DCS GUIDE
AH-64D APACHE BLOCK II

By Chuck
Last Updated: 7/09/2024

DISCLAIMER

This document has been created for recreational purposes only. Do not use for training or real life flying.

The author of this document has never had access to restricted or classified documentation on the AH-64D. The author has never had access to OEM (Original Equipment Manufacturer) data related to the AH-64D, its armament systems nor its defensive systems. All the information within this document is taken from public documentation (i.e. AH-64D Early Access Manual by Eagle Dynamics) and non-official tutorials (player-made videos on Youtube).

The procedures listed in this document are deliberately simplified for gameplay purposes due to the limitations of the DCS World simulation environment and the limitations of the DCS AH-64D module by Eagle Dynamics.

This document is merely a free, personal project that is used for entertainment. This document is not meant nor designed to teach someone to fly a real AH-64.

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Special thanks to Paul "Goldwolf" Whittingham for creating the guide icons.

Helicopters are some of the most fascinating machines ever made. Ever since Eagle Dynamics first released the Ka-50 Black Shark back in 2008, DCS rotary-wing virtual pilots have been unofficially branded as a special kind of insane.

Is it about taming some mechanical beast that constantly tries to kill you? Or is it to show off your flying skills in order to rub it in the fighter jocks' face? Or maybe you're just made of something weird and unnatural? There is a certain madness about it, but don't let that discourage you. Whatever your reason may be to want to try out helicopters, know this: it's a ridiculous amount of fun.

The Apache will test your abilities in many ways. The learning curve is brutal if you try to do everything at once. At first, you may feel like learning its different systems is like drinking water from a fire hydrant. It's a complex piece of aviation technology, but it is strangely very simple to operate once you understand the basics behind it. The key to mastering the DCS AH-64D is to "start small" with simple tasks and eventually go through more complex tasks once you are comfortable with basic procedures. If something looks too complicated, break it down into more manageable chunks of information. The AH-64 is an incredibly capable attack helicopter and it has many, many tools at your disposal. Thankfully, many systems are managed by either your buddy in the other seat or the "George AI", an artificial intelligence that can operate weapons, sensors, or even fly the helicopter for you.

An Apache is only effective if its crewmembers work well together... Otherwise, it's nothing more than a juicy target for the enemy. The best way to experience this DCS module is to find a buddy and operate your ship in multicrew. This will teach you what works, what doesn't, and most importantly, it will force you to communicate. Try out both the pilot and co-pilot/gunner seat; this will naturally give you a much better understanding of how to work with your fellow crew.

Once you start employing the more advanced capabilities of the AH-64, you will be amazed to see how deadly it can be. Left unchecked, a single pair of AH-64s can cause complete mayhem; the flexible 30 mm gun, Hellfire missiles and rockets can be used with high-precision sensors like the TADS (Target Acquisition & Designation Sight), allowing for some remarkable accuracy.

You will be flying one of the most manoeuverable, survivable, and heavily armed rotary-winged aircraft on the modern battlefield. This isn't your average whirly peashooter… you are armed with a stopping power that was meant to obliterate entire columns of Soviet tanks.

NOTHING IS MORE POWERFUL THAN LOVE…

EXCEPT AN APACHE ATTACK HELICOPTER.

The **Boeing AH-64 Apache** is an American twin-turboshaft attack helicopter with a tandem cockpit for a crew of two.

Following the cancellation of the AH-56 Cheyenne in 1972, in favor of projects like the U.S. Air Force A-10 Thunderbolt II and the Marine Corps AV-8A Harrier, the United States Army sought an aircraft to fill an anti-armor attack role that would still be under Army command. The 1948 Key West Agreement forbade the Army from owning combat fixed-wing aircraft. The Army wanted an aircraft better than the AH-1 Cobra in firepower, performance and range. It would have the manoeuverability for terrain following nap-of-the-earth (NOE) flying. To this end, the U.S. Army issued a Request For Proposals (RFP) for the Advanced Attack Helicopter (AAH) program on 15 November 1972. As a sign of the importance of this project, in September 1973 the Army designated its five most important projects as the "Big Five", with the AAH included.

Proposals were submitted by Bell, Boeing Vertol/Grumman team, Hughes, Lockheed, and Sikorsky. The Apache initially began as the Model 77 (designated YAH-64A) developed by Hughes Helicopters. In July 1973, the U.S. Department of Defense selected finalists Bell and Hughes Aircraft's Toolco Aircraft Division (later Hughes Helicopters). This began the phase 1 of the competition. Each company built prototype helicopters and went through a flight test program. Hughes' Model 77/YAH-64A prototype first flew on 30 September 1975, while Bell's Model 409/YAH-63A prototype first flew on 1 October 1975. After evaluating the test results, the Army selected Hughes' YAH-64A over Bell's YAH-63A in 1976. Reasons for selecting the YAH-64A included its more damage tolerant four-blade main rotor and the instability of the YAH-63's tricycle landing gear arrangement. The AH-64A then entered phase 2 of the AAH program under which three pre-production AH-64s would be built, additionally, the two YAH-64A flight prototypes and the ground test unit were upgraded to the same standard.

Hughes Helicopters YAH-64 prototype, 74-22248
(Vertical Flight Society)

YAH-64A prototype in 1982 during a Demonstration Flight
(Public Domain)

During phase 2 of the AAH program, weapons and sensor systems were integrated and tested, including the laser-guided AGM-114 Hellfire missile. Development of the Hellfire missile had begun in 1974, originally known by the name of AGM-114 Helicopter Launched, Fire and Forget Missile ('Hellfire' being a shortened acronym), for the purpose of arming helicopter platforms with an effective anti-tank missile. The AH-64 was later approved full production in 1982.

After purchasing Hughes Helicopters in 1984, McDonnell Douglas continued AH-64 production and development. The helicopter was introduced to U.S. Army service in April 1986. The advanced AH-64D Apache Longbow was delivered to the Army in March 1997. Production has been continued by Boeing Defense, Space & Security, with over 2,400 AH-64s being produced by 2020.

The AH-64A first saw combat in 1989 as part of Operation Just Cause, the US invasion of Panama. In 1991, two teams of AH-64As from the 101st Airborne Division and U.S. Air Force MH-53 Pave Low helicopters struck the first targets in Iraq during the first hours of Operation Desert Storm. Guided by the precision GPS navigation units on board the MH-53's across the featureless desert, the teams of AH-64's approached two separate Early Warning Radar sites along the border between Saudi Arabia and Iraq. Flying radio silent, each AH-64 aircrew acquired their assigned targets through their Forward-Looking Infrared (FLIR) sensors. With a single radio call, the attack commenced with an onslaught of Hellfire missiles, followed by rockets and 30mm fire. Within minutes, the radar sites were disabled, and hundreds of coalition aircraft streamed through the gap in radar coverage to begin the air campaign against the Iraqi military.

Following Operation Desert Storm, McDonnell-Douglas (which had since acquired Hughes) proposed the AH-64B upgrade, which would incorporate a modernized cockpit and fire control system as well as new rotor blades. The program was approved and funded by Congress but was canceled merely a year later in favor of the AH-64D proposal, which promised a much more ambitious upgrade to the aircraft.

Along with building new D models, the U.S. Army also awarded McDonnell-Douglas a $1.9 billion contract to upgrade existing AH-64As to Ds. Starting in August of 1997, Boeing has since upgraded all U.S. Army AH-64A's to D models. In all, 2,400 AH-64's have been produced since 1975; over a thousand of them AH-64D's.

The U.S. Army is the primary operator of the AH-64. It has also become the primary attack helicopter of multiple nations, including Greece, Japan, Israel, the Netherlands, Singapore, and the United Arab Emirates. It has been built under license in the United Kingdom as the AgustaWestland Apache. American AH-64s have served in conflicts in Panama, the Persian Gulf, Kosovo, Afghanistan, and Iraq. Israel used the Apache in its military conflicts in Lebanon and the Gaza Strip. British and Dutch Apaches have seen deployments in wars in Afghanistan and Iraq.

The AH-64 Apache has a four-blade main rotor and a four-blade tail rotor. The crew sits in tandem, with the pilot sitting behind and above the co-pilot/gunner. Both crew members are capable of flying the aircraft and performing methods of weapon engagements independently.

The AH-64 is powered by two General Electric T700 turboshaft engines with high-mounted exhausts on either side of the fuselage. Various models of engines have been used on the Apache; those in British service use engines from Rolls-Royce. In 2004, General Electric Aviation began producing more powerful T700-GE-701D engines, rated at 2,000 shp (1,500 kW) for AH-64Ds.

The crew compartment has shielding between the cockpits, such that at least one crew member can survive hits. The compartment and the rotor blades are designed to sustain a hit from 23 mm rounds. The airframe includes some 2,500 lbs of protection and has a self-sealing fuel system to protect against ballistic projectiles.

Critical system relays and wiring are installed in opposing areas, permitting redundancy within the avionics in the case of computer failure or damage. Each processor group is composed of two individual computers: one primary and one backup. If the primary processor fails or is damaged from weapons fire, the backup processor immediately takes over the required computing tasks.

One of the revolutionary features of the Apache was its helmet mounted display, the Integrated Helmet and Display Sighting System (IHADSS); among its capabilities, either the pilot or gunner can slave the helicopter's 30 mm automatic M230 Chain Gun to their helmet, making the gun track head movements to point where they look. The M230E1 can be alternatively fixed to a locked forward firing position, or controlled via the Target Acquisition and Designation System (TADS). On more modern AH-64s, the TADS/PNVS has been replaced by Lockheed Martin's Arrowhead (MTADS) targeting system.

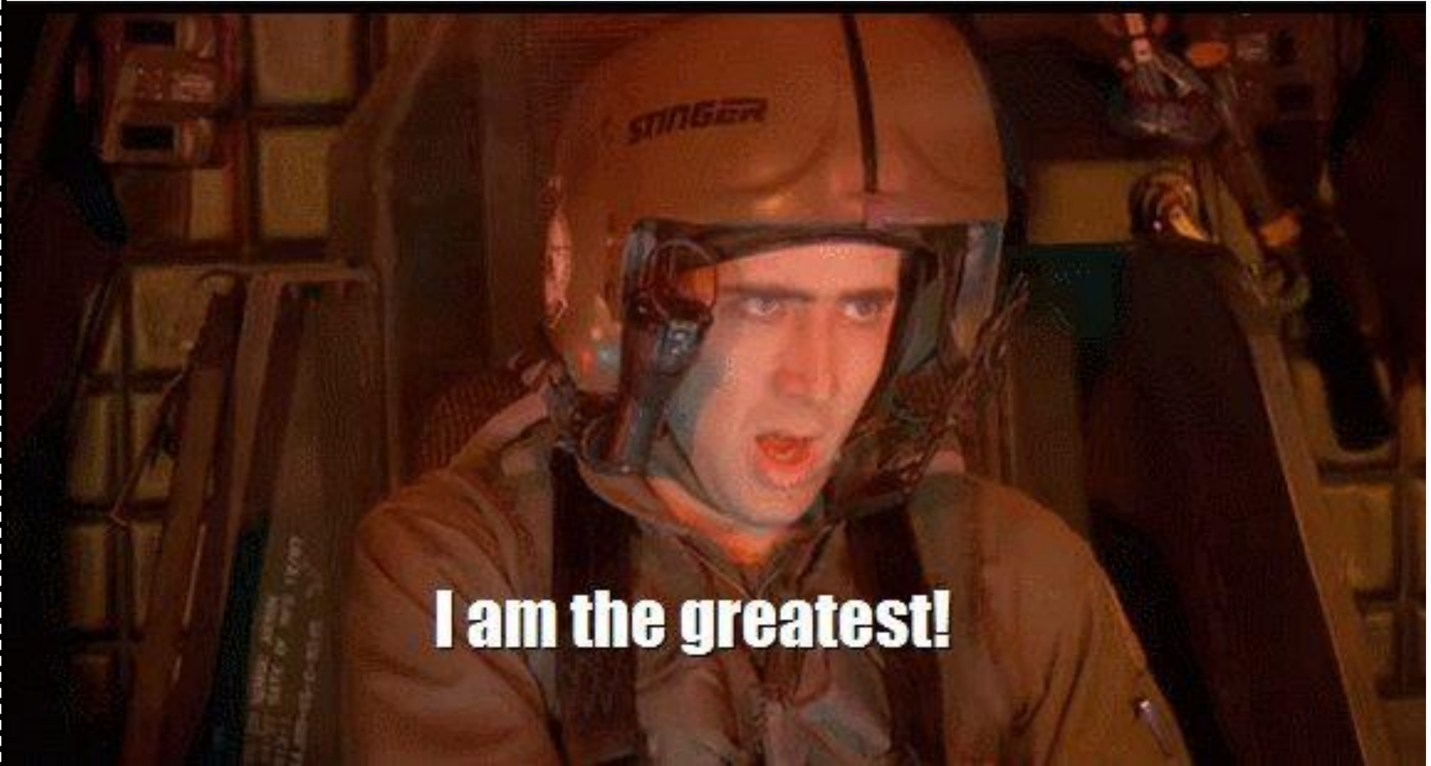
The AN/APG-78 “Longbow” is a millimeter-wave fire-control radar (FCR) target acquisition system. In addition to the FCR, the Radar Frequency Interferometer (RFI) is housed in a dome located above the main rotor. The radome's raised position enables target detection while the helicopter is behind obstacles (e.g. terrain, trees or buildings). A radio modem integrated with the sensor suite allows data to be shared with ground units and other AH-64s, allowing them to fire on targets detected by a single helicopter. Longbow-equipped Apaches can locate up to 256 targets simultaneously within 8 km.

While fighter pilots have “Top Gun”, helicopter pilots are not so lucky; they have “Fire Birds”.

Fire Birds is a 1990 American military action film directed by David Green and produced by William Badalato, Keith Barish and Arnold Kopelson. The film stars Nicolas Cage, Tommy Lee Jones and Sean Young… and it is hard to know whether the movie is bad or really, really bad. However, like many disastrous movies of the time, it’s still worth a watch and has some decent flying sequences.

Extensive aerial stunt sequences were coordinated with the National Guard of the United States, the United States Army and the United States Air Force. Between technical advisers, stuntmen, and pilots, over 100 personnel were directly involved in the production aspects of the film. AH-64 Apache, UH-60 Blackhawk, AH-1 Cobra, MD Helicopters MD 500 and OH-58 Kiowa rotorcraft, as well as Saab 35 Draken aircraft were employed during filming.

Technical assistance from McDonnell Douglas service representatives was also utilized during production. The helicopter training aerial stunt sequences were designed by Richard T. Stevens (who also coordinated visuals for the film “Top Gun”). Scenes from the movie, also features as static shots from MicroProse Gunship 2000 computer game.

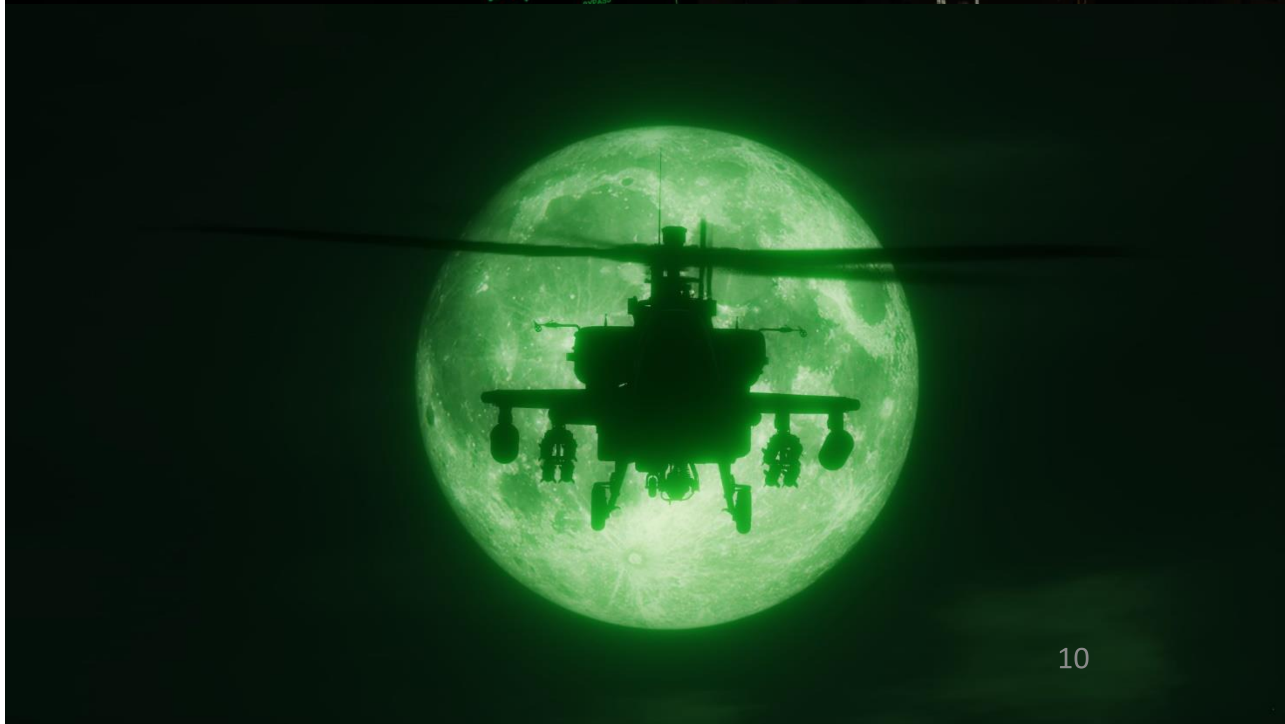


The AH-64 was designed to perform in front-line environments, and to operate at night or day and during adverse weather conditions. Various sensors and onboard avionics allows the Apache to perform in these conditions; such systems include the Target Acquisition and Designation System, Pilot Night Vision System (TADS/PNVS), passive infrared countermeasures, GPS, and the IHADSS. This suite of sensors allows the AH-64 to operate at night remarkably easily when compared to other aircraft/helicopters.

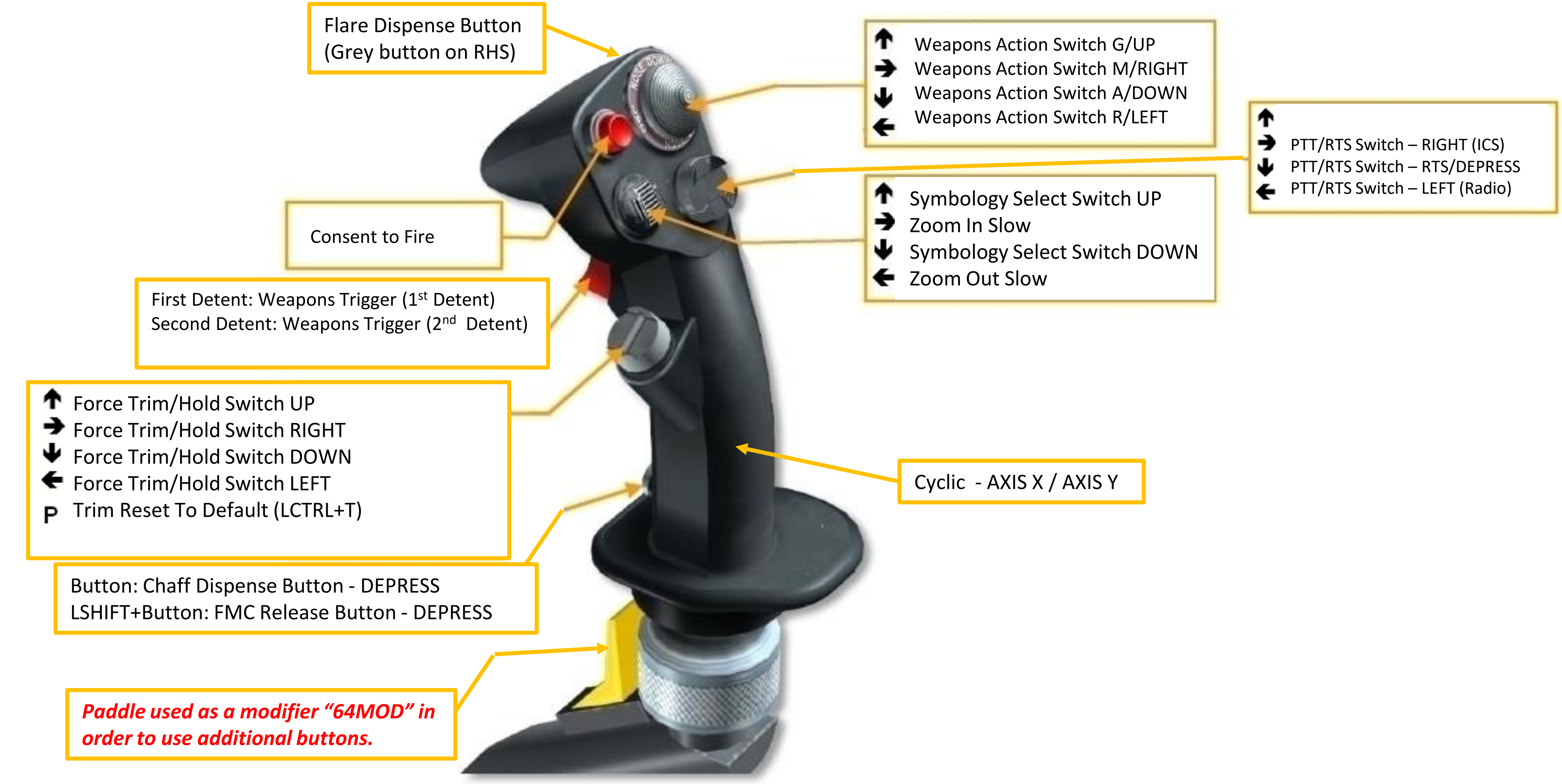
The DCS AH-64D is something truly special. It is a labor of love by Eagle Dynamics and it really shows. An excruciating amount of effort was put into this module, from the sound design to the beautifully modelled cockpit. You have the quintessential attack helicopter of the modern battlefield at your command. Mastering it will require a long time, a lot of effort and countless hours of practice.

If you ever feel discouraged or overwhelmed by the sheer amount of information I'm trying to shove down your throat… always remember that you could share that fall into a bottomless pit of despair with a friend.

Enjoy your read!



Pilot Controls



+ TOE BRAKES (MAPPED ON PEDALS)

Pilot Controls

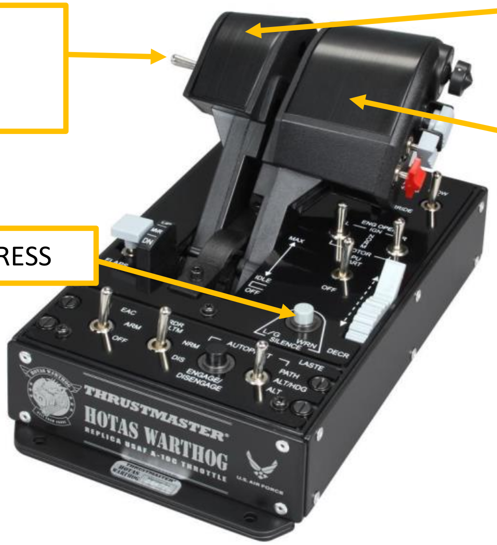
Paddle used as a modifier "64MOD" in order to use additional buttons.

➔ FCR Scan Switch – C (Continuous)
🡐 FCR Scan Switch – S (Single)

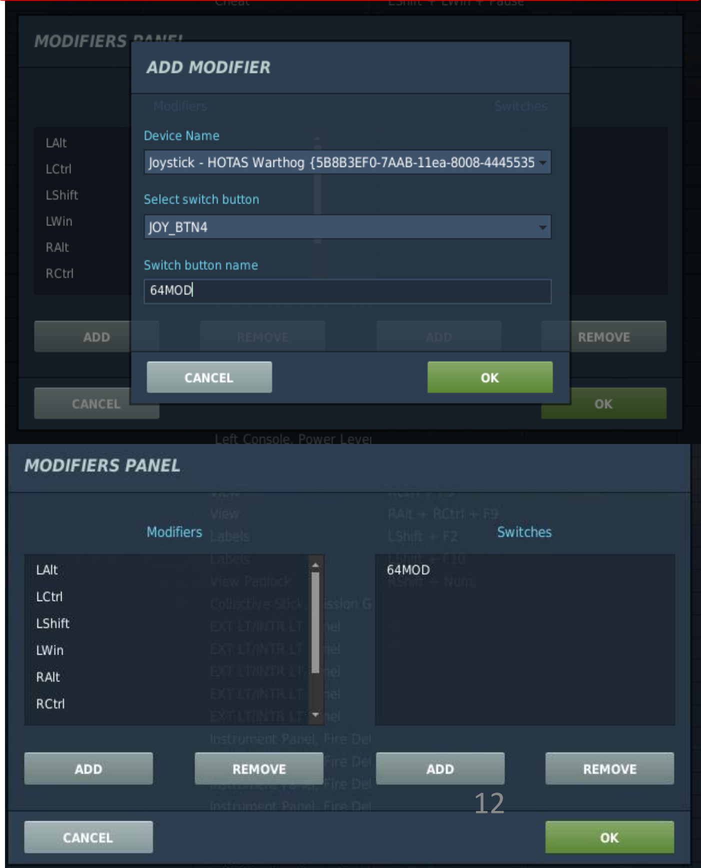
Tail Wheel Lock/Unlock Button - DEPRESS

Power Levers (Both) - AXIS

Collective - AXIS



IMPORTANT NOTE: Red controls in this page use the "Paddle Lever" modifier that we named "64MOD".

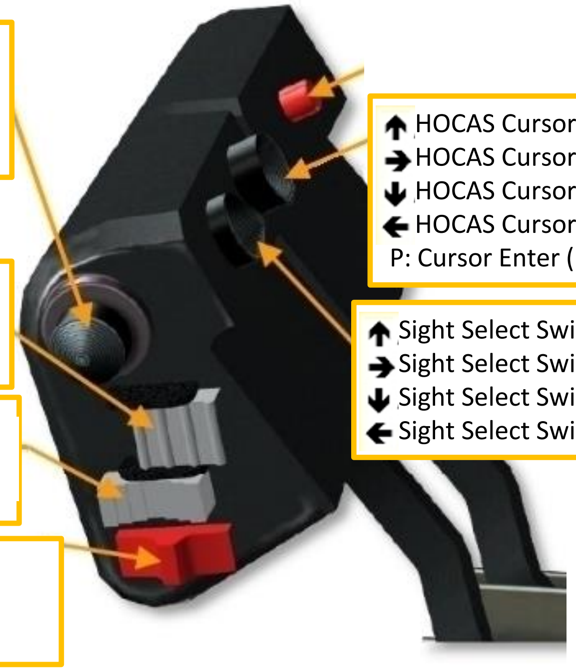


🡑 FCR Scan Size Switch – UP
➔ FCR Scan Size Switch – RIGHT
🡓 FCR Scan Size Switch– DOWN
🡐 FCR Scan Size Switch– LEFT

➔ Missile Advance Switch - DEPRESS
🡐 Cued Search Switch – DEPRESS

➔ Boresight/Polarity Switch – PLRT
🡐

➔ NVS Select Switch - TADS
🡐 NVS Select Switch - PNVS



🡑 HOCAS Cursor Control – Y Axis
➔ HOCAS Cursor Control – X Axis
🡓 HOCAS Cursor Control – Y Axis
🡐 HOCAS Cursor Control – X Axis
P: Cursor Enter (Depress)

🡑 Sight Select Switch – UP
➔ Sight Select Switch – RIGHT
🡓 Sight Select Switch – DOWN
🡐 Sight Select Switch – LEFT

🡑 FCR Mode Switch – UP
➔ FCR Mode Switch – RIGHT
🡓 FCR Mode Switch – DOWN
🡐 FCR Mode Switch – LEFT
(With "64MOD" Modifier)

Pilot Controls

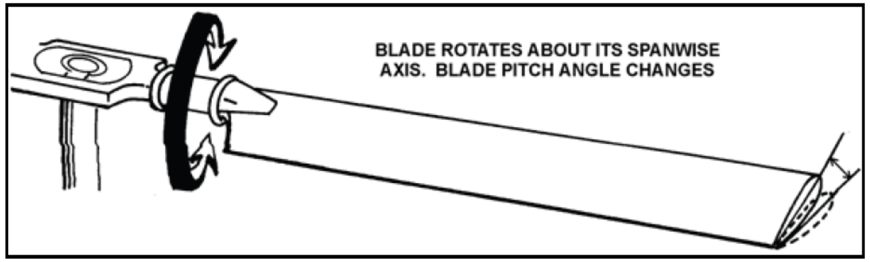


Figure 1-17. Feathering

BIND THE FOLLOWING AXES:

AH-64D PILOT MENU:

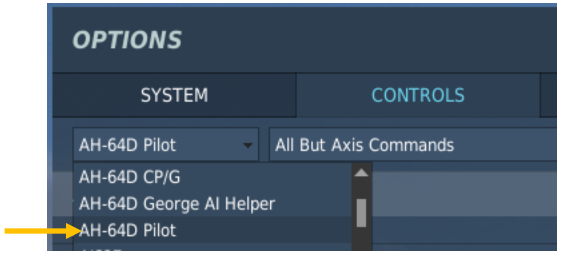
- CYCLIC PITCH (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 90, CURVATURE AT 15)
- CYCLIC ROLL (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 90, CURVATURE AT 15)
- RUDDER/ANTI-TORQUE (DEADZONE AT 10, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- COLLECTIVE (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- POWER LEVERS (BOTH) – CONTROLS ENGINE RPM

NOTES ABOUT CONTROLS

If you are more familiar with airplanes than helicopters, you might not be quite familiar with a “collective” and a “cyclic”. In a prop aircraft, you generally set your engine to a given RPM by changing the propeller’s pitch, and you throttle up and down to change your thrust. Anti-torque pedals are used to change the orientation of your vertical stab.

In a helicopter, it’s the opposite. You set your throttle (or, more accurately in our case, the Power Levers) to a given setting, and you change your thrust with your **collective**, which changes the pitch of your rotor/propeller’s blades. Anti-torque pedals are used to modify your tail rotor’s propeller pitch: the amount of lateral thrust generated by your rotor is in direct relationship with the horizontal/lateral orientation of your helicopter. The **cyclic**, on the other hand, is used just like a regular stick on a plane. The cyclic modifies the orientation of swashplates, to which are attached push rods that define the orientation of the rotor.

In very simple terms, you could say that the collective is used like a throttle on a plane, the power levers are used like a RPM setter on a plane, and the cyclic is used like a joystick on a plane.



Co-Pilot/Gunner Controls

Flare Dispense Button
(Grey button on RHS)
(With "64MOD" Modifier)

RHG Sight Slave Button
(Grey button on RHS)

↑
→ PTT/RTS Switch – RIGHT (ICS)
↓ PTT/RTS Switch – RTS/DEPRESS
← PTT/RTS Switch – LEFT (Radio)
(With "64MOD" Modifier)

↑ LHG Weapon Action (WAS) Switch – G/UP
→ LHG Weapon Action (WAS) Switch – M/RIGHT
↓ LHG Weapon Action (WAS) Switch – A/DOWN
← LHG Weapon Action (WAS) Switch – R/LEFT

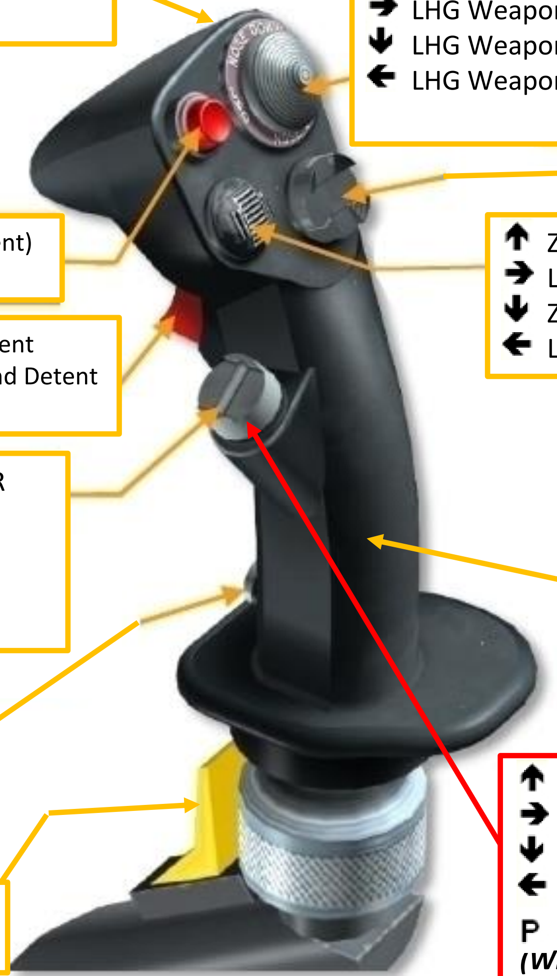
↑ RHG Manual Tracker (MAN TRK) Switch - UP
→ RHG Manual Tracker (MAN TRK) Switch - RIGHT
↓ RHG Manual Tracker (MAN TRK) Switch - DOWN
← RHG Manual Tracker (MAN TRK) Switch - LEFT

Second Detent: Weapons Trigger (2nd Detent)

↑ ZOOM IN SLOW
→ LHG Image Auto-Track – IAT (FWD)
↓ ZOOM OUT SLOW
← LHG Image Auto-Track – OFS (AFT)

↑ LHG TADS FOV Switch– Z (Zoom)
→ LHG TADS FOV Switch– W (Wide)
↓ LHG TADS FOV Switch– M (Medium)
← LHG TADS FOV Switch– N (Narrow)
(With "64MOD" Modifier)

First Detent: RHG LRFD Trigger – First Detent
Second Detent: RHG LRFD Trigger – Second Detent



↑ LHG Store/Update Switch – STORE/CENTER
→ RHG MTT Promote Switch – FWD
↓ LHG Store/Update Switch – UPDT/CENTER
← RHG MTT Promote Switch – AFT
P

Cyclic - AXIS X / AXIS Y

LHG Linear Motion Compensator (LMC) Button

Button: Chaff Dispense Button - DEPRESS
(With "64MOD" Modifier)

Paddle used as a modifier "64MOD" in order to use additional buttons.

↑ Force Trim/Hold Switch UP
→ Force Trim/Hold Switch RIGHT
↓ Force Trim/Hold Switch DOWN
← Force Trim/Hold Switch LEFT
P Trim Reset To Default (LCTRL+T)
(With "64MOD" Modifier)

AH-64D APACHE

PART 2 – CONTROLS SETUP

Co-Pilot/Gunner Controls

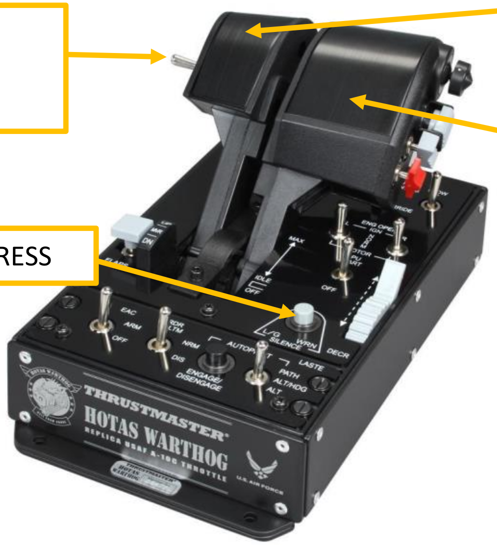
Paddle used as a modifier "64MOD" in order to use additional buttons.

- → FCR Scan Switch – C (Continuous)
- ← FCR Scan Switch – S (Single)

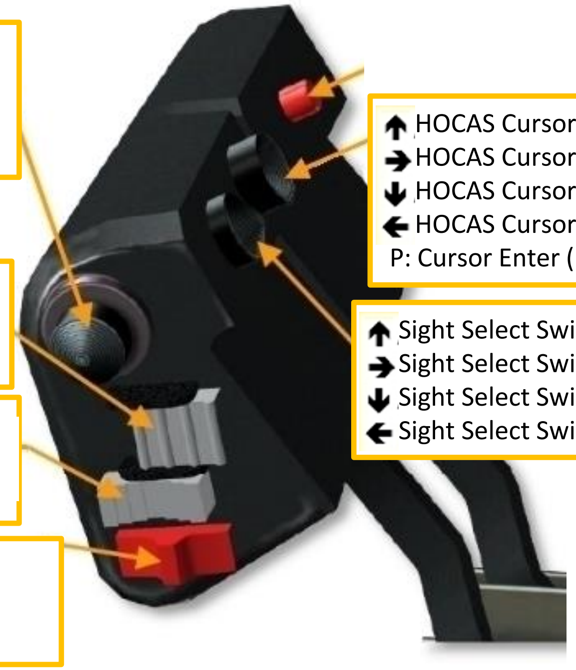
Power Levers (Both) - AXIS

Collective - AXIS

Tail Wheel Lock/Unlock Button - DEPRESS



IMPORTANT NOTE: Red controls in this page use the "Paddle Lever" modifier that we named "64MOD".



- ↑ FCR Scan Size Switch – UP
- → FCR Scan Size Switch – RIGHT
- ↓ FCR Scan Size Switch – DOWN
- ← FCR Scan Size Switch – LEFT

- → Missile Advance Switch - DEPRESS
- ← Cued Search Switch – DEPRESS

- → Boresight/Polarity Switch – PLRT
- ←

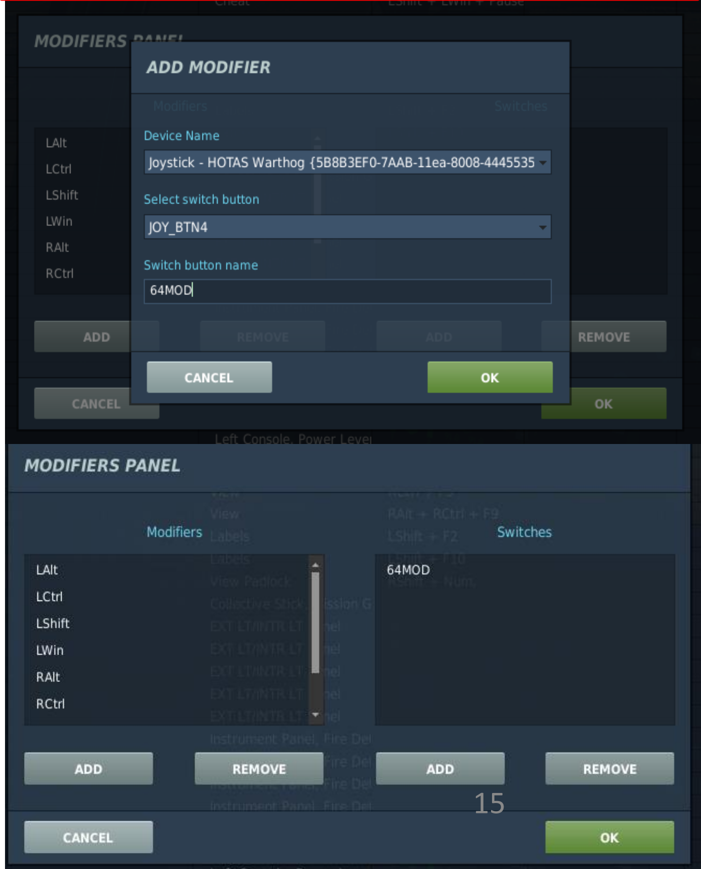
- → NVS Select Switch - TADS
- ← NVS Select Switch - PNVS

- ↑ HOCAS Cursor Control – Y Axis
- → HOCAS Cursor Control – X Axis
- ↓ HOCAS Cursor Control – Y Axis
- ← HOCAS Cursor Control – X Axis
- P: Cursor Enter (Depress)

- ↑ Sight Select Switch – UP
- → Sight Select Switch – RIGHT
- ↓ Sight Select Switch – DOWN
- ← Sight Select Switch – LEFT

- ↑ FCR Mode Switch – UP
- → FCR Mode Switch – RIGHT
- ↓ FCR Mode Switch – DOWN
- ← FCR Mode Switch – LEFT

(With "64MOD" Modifier)

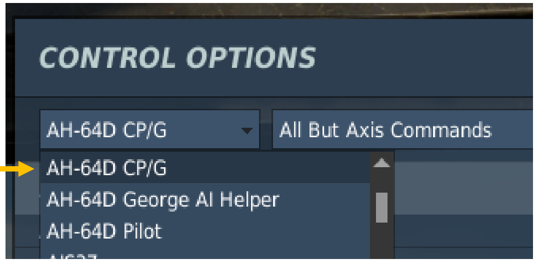


Co-Pilot/Gunner Controls

BIND THE FOLLOWING AXES:

AH-64D COPILOT-GUNNER MENU:

- CYCLIC PITCH (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 90, CURVATURE AT 15)
- CYCLIC ROLL (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 90, CURVATURE AT 15)
- RUDDER/ANTI-TORQUE (DEADZONE AT 10, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- COLLECTIVE (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- POWER LEVERS (BOTH) – CONTROLS ENGINE RPM

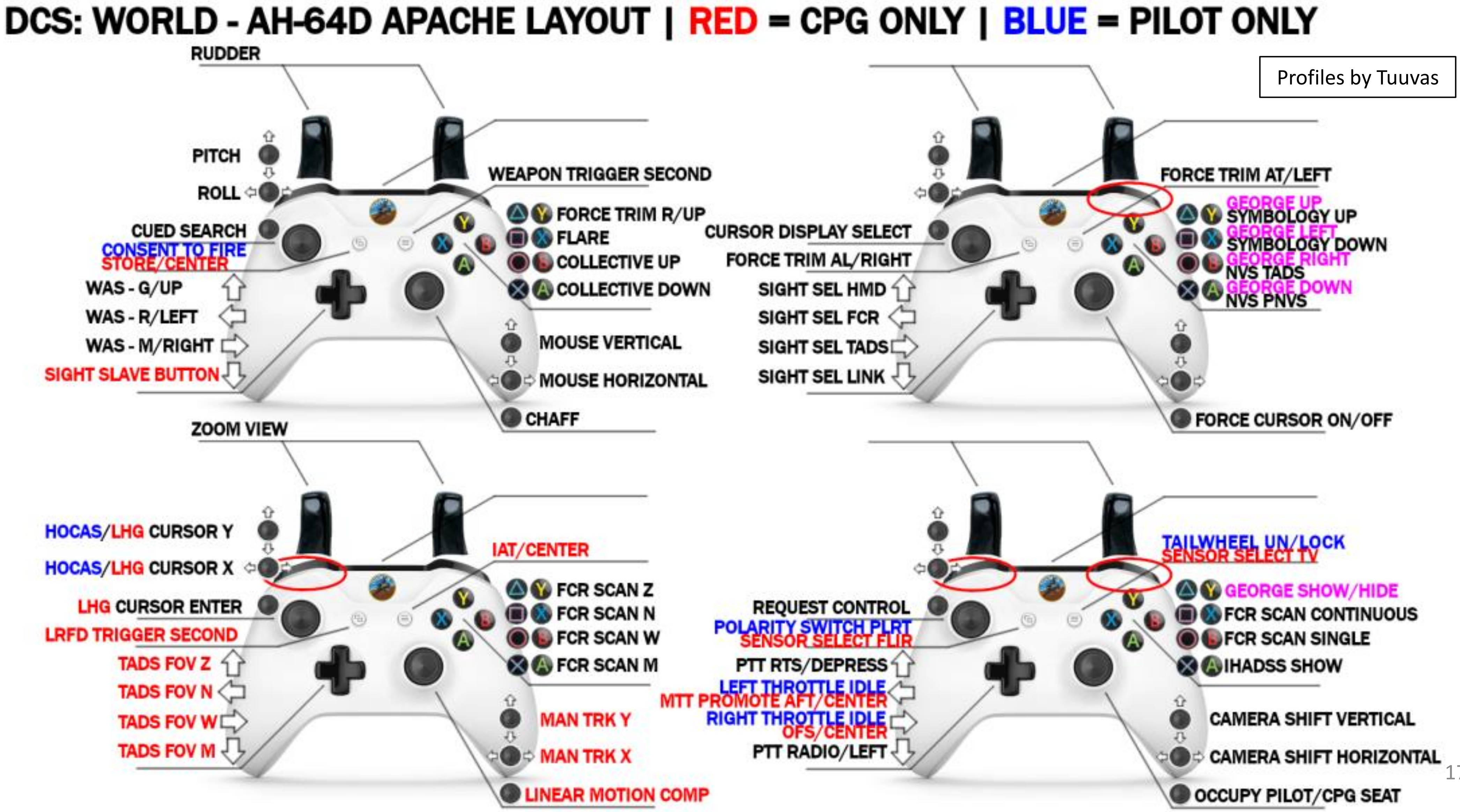


BINDINGS FOR GAMING CONTROLLERS

The AH-64D has LOTS of controls (especially when considering the fact that there are switches on the cyclic, collective, and both TEDAC grips), which can require some bindings being set on additional devices. If you happen to have a X-Box or a Playstation controller, you can easily map most of the controls on it.

Here are a few AH-64 controller profiles created by the amazing **Tuuvas** (Blessed be His Name).

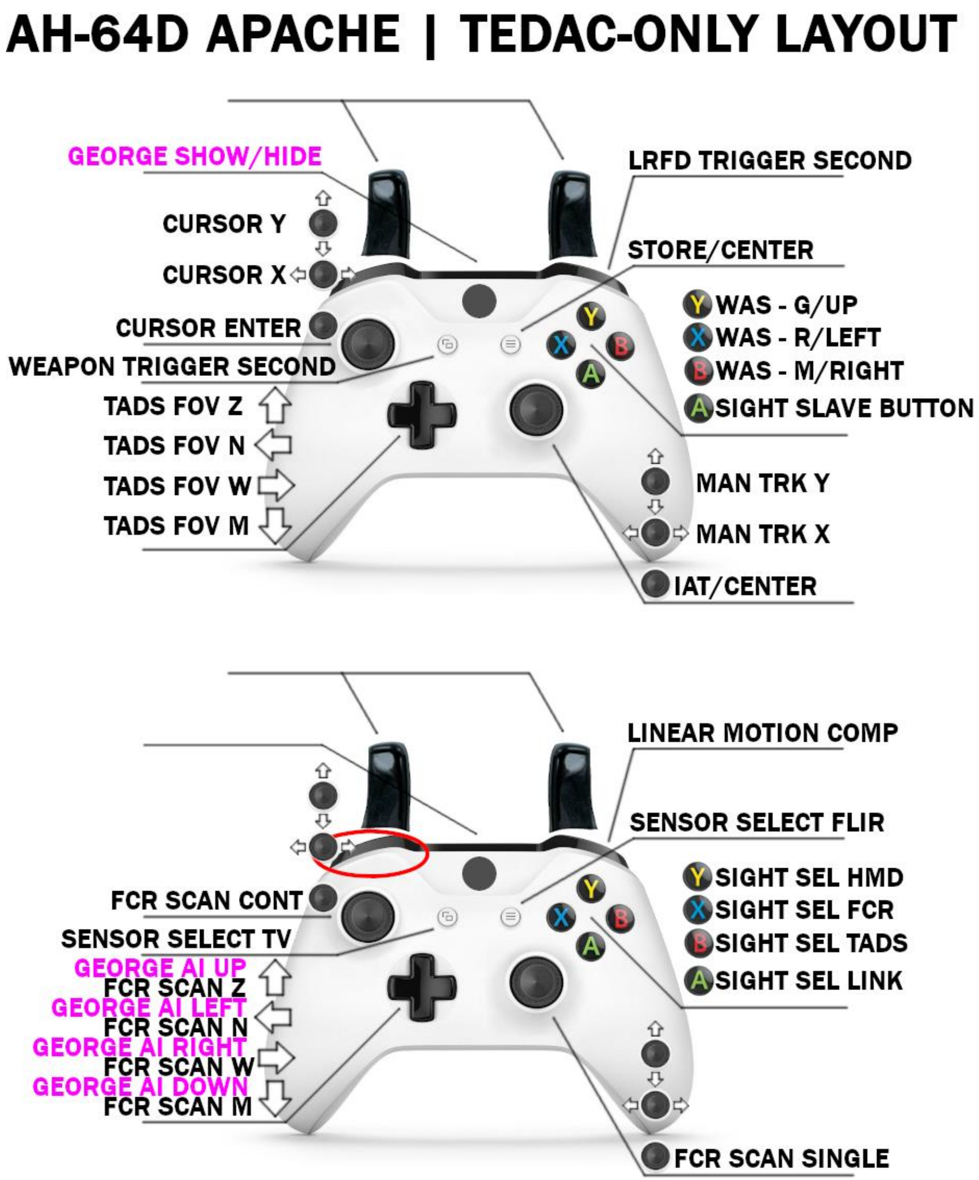
Profiles by Tuuvas

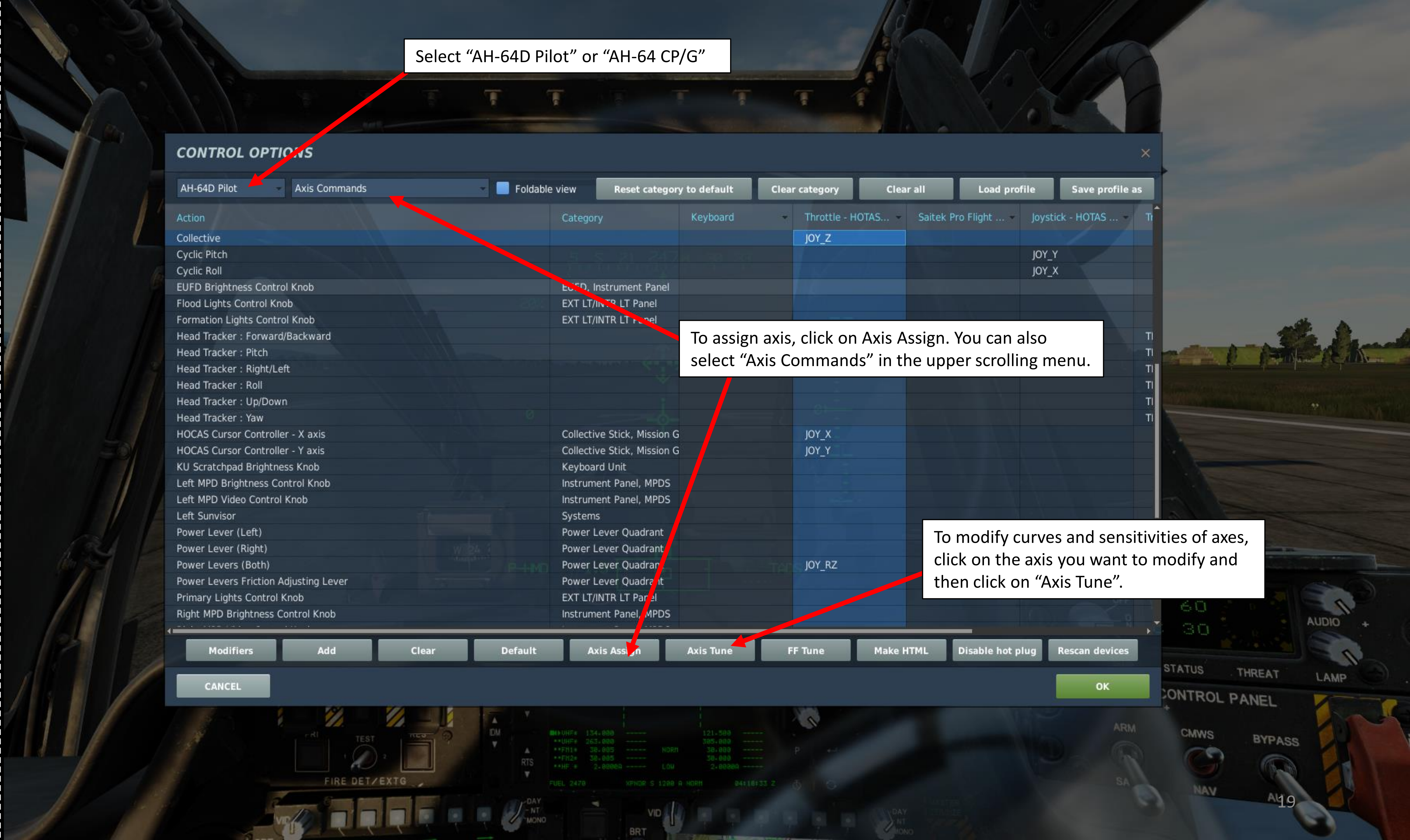


BINDINGS FOR GAMING CONTROLLERS

For the Co-Pilot/Gunner, mapping all TEDAC (Target Acquisition and Designation Sight Electronic Display and Control) functions on gaming controllers is a smart way to have a cyclic and collective setup similar to the pilot’s.

Profiles by Tuuvas





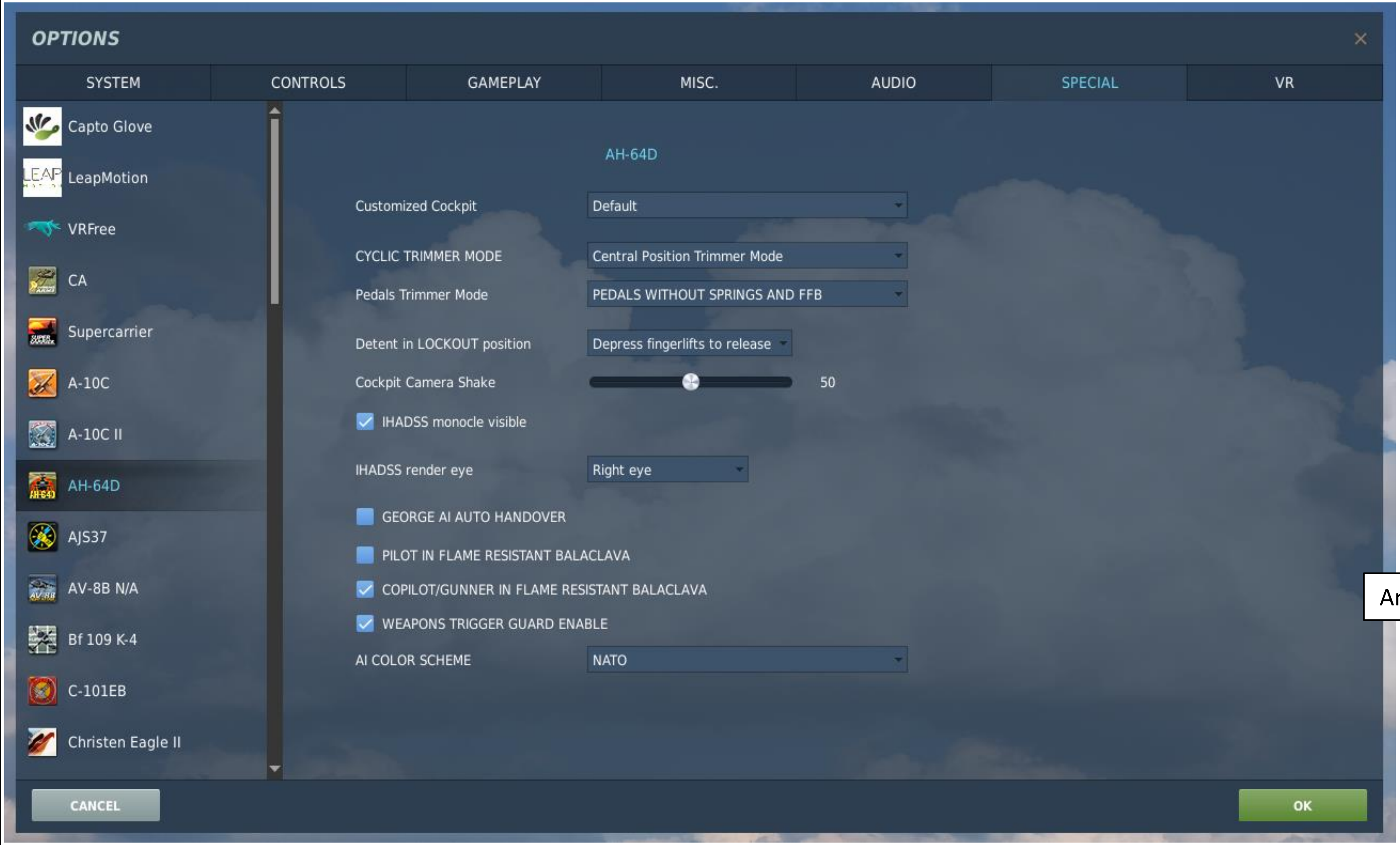
Select "AH-64D Pilot" or "AH-64 CP/G"

To assign axis, click on Axis Assign. You can also select "Axis Commands" in the upper scrolling menu.

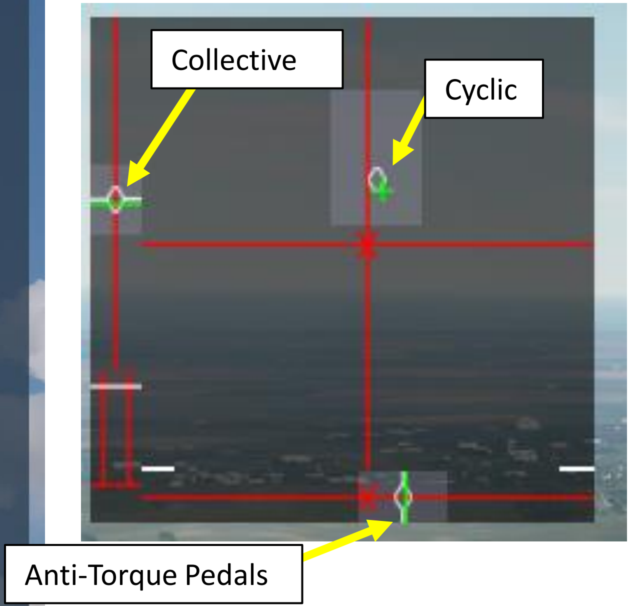
To modify curves and sensitivities of axes, click on the axis you want to modify and then click on "Axis Tune".

CONTROLS FOR CREW & INTERFACE MANAGEMENT

- SET PILOT SEAT — SWITCHES TO PILOT SEAT ("1" BY DEFAULT)
- SET OPERATOR (COPILOT) SEAT — SWITCHES TO COPILOT (OPERATOR) SEAT ("2" BY DEFAULT)
- SHOW CONTROLS INDICATOR — TOGGLE CONTROL INDICATOR INTERFACE (RCTRL+ENTER)
- IHADSS ON/OFF — TOGGLE IHADSS (INTEGRATED HELMET AND DISPLAY SIGHTING SYETEM) MONOCLE ON/OFF



You can toggle the Controls Indicator with the "RCTRL+ENTER" binding.

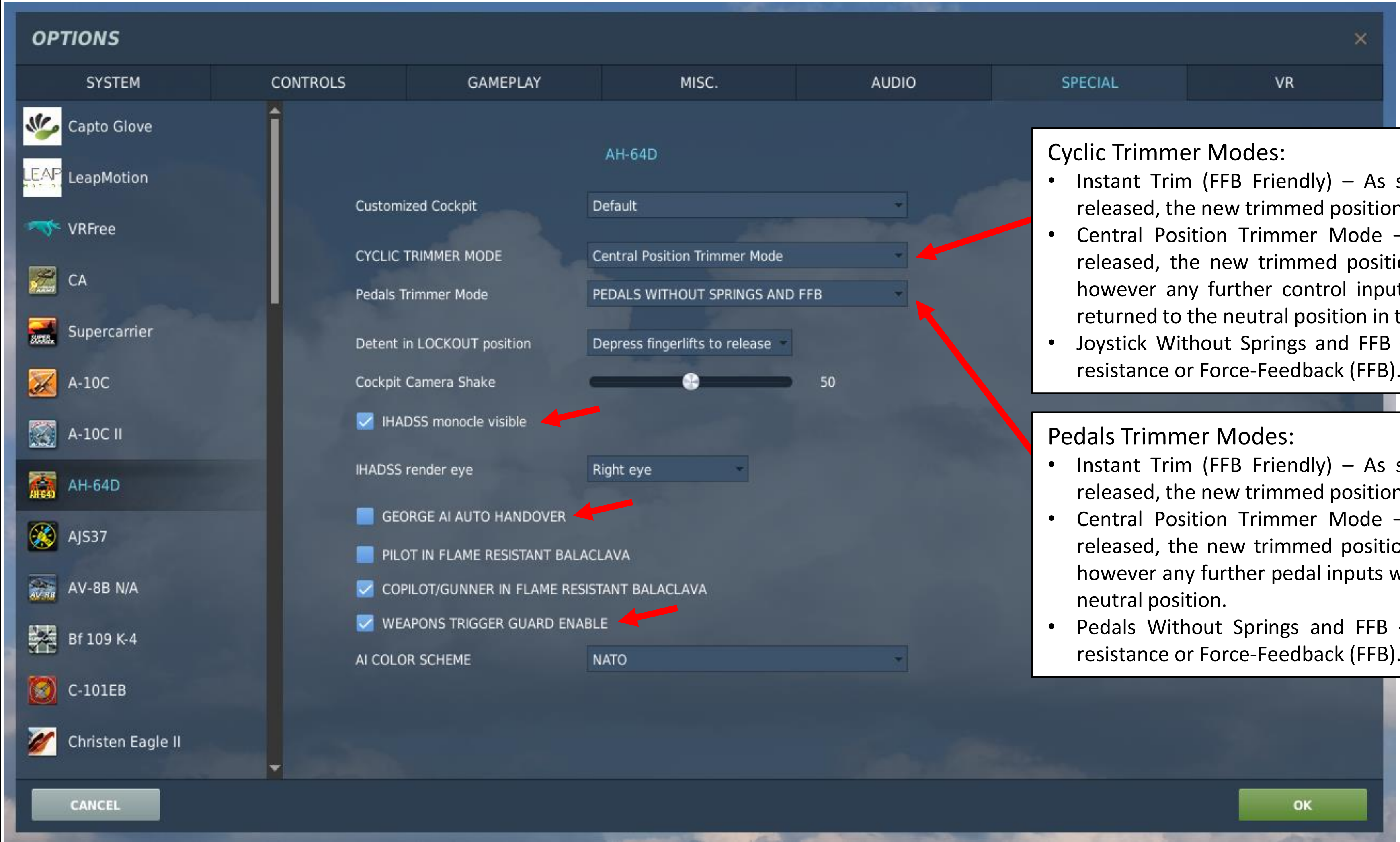


CONTROLS FOR CREW & INTERFACE MANAGEMENT

In the “Special” tab, I set up the options as follows:

- Cyclic Trimmer Mode: Central Position Trimmer Mode
- Pedals Trimmer Mode: Pedals without Springs and FFB (Force Feedback)
- IHADSS Monocle Visible: Ticked (Selected, ON)
- George AI Auto Handover: Unticked (Not Selected, OFF)
- Weapons Trigger Guard Enable: Up to your personal preference.

These options should be set based on what kind of hardware devices you are using.



Cyclic Trimmer Modes:

- Instant Trim (FFB Friendly) – As soon as the Force Trim Release button (trimmer) is released, the new trimmed position of the player’s stick will be applied immediately.
- Central Position Trimmer Mode – After the Force Trim Release button (trimmer) is released, the new trimmed position of the player’s stick will be applied immediately; however any further control inputs will only be applied in each axis after the stick is returned to the neutral position in that axis (pitch and roll are read separately).
- Joystick Without Springs and FFB – This option is used for joysticks lacking any spring resistance or Force-Feedback (FFB).

Pedals Trimmer Modes:

- Instant Trim (FFB Friendly) – As soon as the Force Trim Release button (trimmer) is released, the new trimmed position of the player’s pedals will be applied immediately.
- Central Position Trimmer Mode – After the Force Trim Release button (trimmer) is released, the new trimmed position of the player’s pedals will be applied immediately; however any further pedal inputs will only be applied after the pedals are returned to the neutral position.
- Pedals Without Springs and FFB – This option is used for pedals lacking any spring resistance or Force-Feedback (FFB).


CMWS CONTROL PANEL
OFF
ON
TEST
AUDIO
PWR
STATUS
THREAT
LAMP
ARM
SAFE
CMWS
BYPASS
ENG 1
APU
ENG 2
TEST
FIRE DET/EXTG
P-HMD
FXD

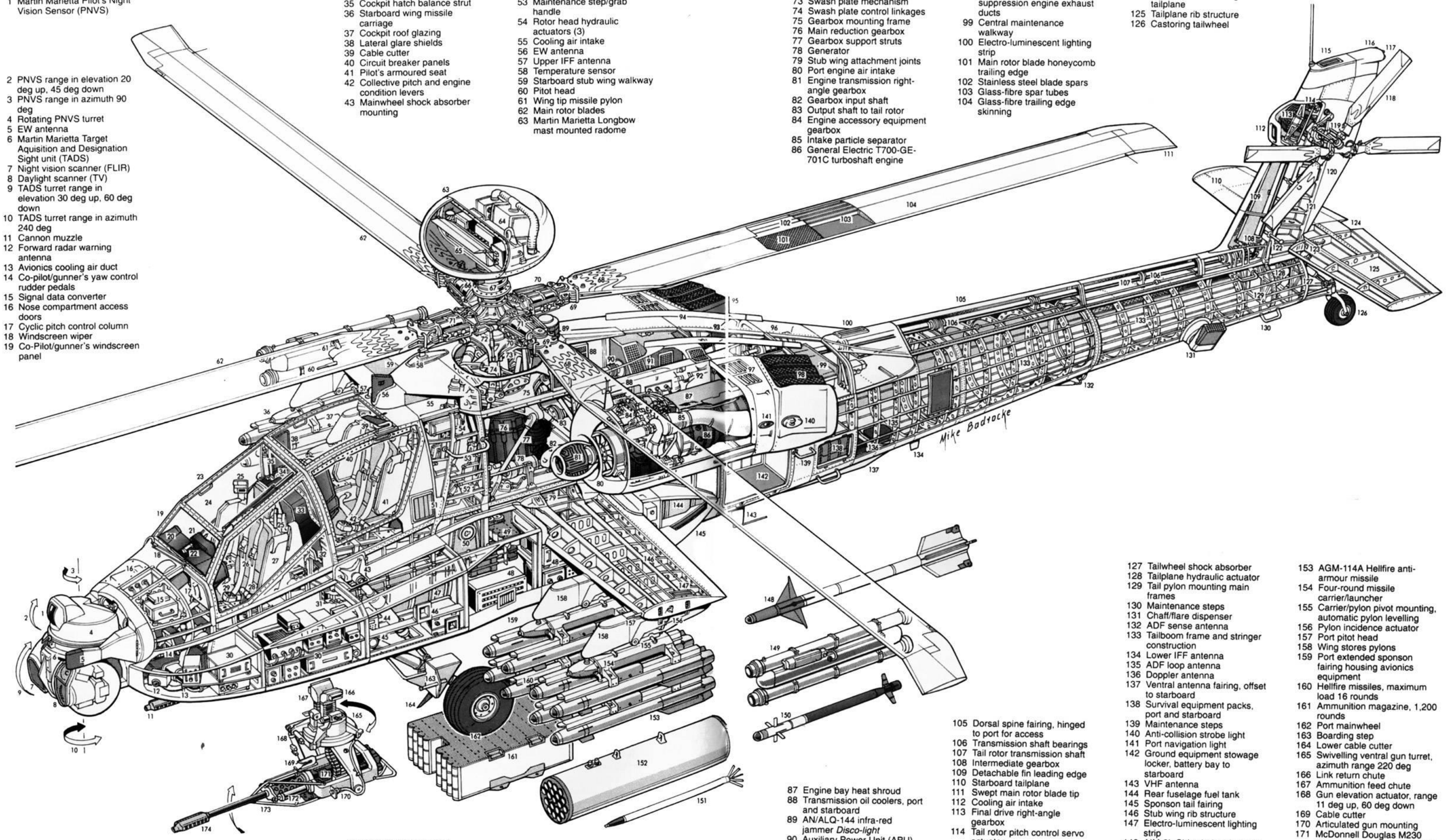
SEAT SELECTION CONTROLS

- Pilot: 1
- Co-Pilot/Gunner (CPG): 2

Tip: Pilot body can be toggled on/off by pressing “RSHIFT+P”

McDonnell Douglas AH-64D Longbow Apache, cutaway drawing key

1 Martin Marietta Pilot's Night Vision Sensor (PNVS)
2 PNVS range in elevation 20 deg up, 45 deg down
3 PNVS range in azimuth 90 deg
4 Rotating PNVS turret
5 EW antenna
6 Martin Marietta Target Aquisition and Designation Sight unit (TADS)
7 Night vision scanner (FLIR)
8 Daylight scanner (TV)
9 TADS turret range in elevation 30 deg up, 60 deg down
10 TADS turret range in azimuth 240 deg
11 Cannon muzzle
12 Forward radar warning antenna
13 Avionics cooling air duct
14 Co-pilot/gunner's yaw control rudder pedals
15 Signal data converter
16 Nose compartment access doors
17 Cyclic pitch control column
18 Windscreen wiper
19 Co-Pilot/gunner's windscreen panel
20 Instrument panel shroud
21 Sight viewer
22 Boresight reticule
23 Starboard side cockpit hatches
24 Pilot's windscreen panel
25 Head position sensors, helmet mounted sight system
26 Safety harness
27 Co-Pilot/gunner's armoured seat
28 Engine condition levers
29 Collective pitch control lever
30 Avionics equipment racks
31 Link return chute, ammunition feed to starboard
32 Pilot's yaw control rudder pedals
33 Pilot's instrument console
34 Armoured screen between cockpits
35 Cockpit hatch balance strut
36 Starboard wing missile carriage
37 Cockpit roof glazing
38 Lateral glare shields
39 Cable cutter
40 Circuit breaker panels
41 Pilot's armoured seat
42 Collective pitch and engine condition levers
43 Mainwheel shock absorber mounting
44 Shock absorber strut
45 Mainwheel leg pivot mounting
46 Boarding step
47 Forward fire retardant foam filled, crashproof fuel tank, total fuel capacity 1,422 lit (313 Imp gal)
48 Avionics equipment racks
49 Central ammunition bay
50 Position of fuel filler on starboard side
51 Cockpit air vent
52 Control system mechanical linkages
53 Maintenance step/grab handle
54 Rotor head hydraulic actuators (3)
55 Cooling air intake
56 EW antenna
57 Upper IFF antenna
58 Temperature sensor
59 Starboard stub wing walkway
60 Pitot head
61 Wing tip missile pylon
62 Main rotor blades
63 Martin Marietta Longbow mast mounted radome
64 Radome avionics
65 Articulated radar scanner
66 RFI antenna
67 Radome rotating mounting
68 Laminated blade root reinforcings
69 Blade root attachment joints
70 Dual friction lead-lag dampers
71 Bearingless articulated hubs
72 Blade pitch control link
73 Swash plate mechanism
74 Swash plate control linkages
75 Gearbox mounting frame
76 Main reduction gearbox
77 Gearbox support struts
78 Generator
79 Stub wing attachment joints
80 Port engine air intake
81 Engine transmission right-angle gearbox
82 Gearbox input shaft
83 Output shaft to tail rotor
84 Engine accessory equipment gearbox
85 Intake particle separator
86 General Electric T700-GE-701C turboshaft engine
87 Engine bay heat shroud
88 Transmission oil coolers, port and starboard
89 AN/ALQ-144 infra-red jammer *Disco-light*
90 Auxiliary Power Unit (APU) output shaft to main gearbox
91 APU housing
92 Port side air conditioning pack
93 APU exhaust
94 Dorsal fairing access panels
95 Starboard engine exhaust ducts
96 Starboard side hydraulics equipment bay
97 Exhaust duct venting air louvres
98 *Black Hole* infra-red suppression engine exhaust ducts
99 Central maintenance walkway
100 Electro-luminescent lighting strip
101 Main rotor blade honeycomb trailing edge
102 Stainless steel blade spars
103 Glass-fibre spar tubes
104 Glass-fibre trailing edge skinning
105 Dorsal spine fairing, hinged to port for access
106 Transmission shaft bearings
107 Tail rotor transmission shaft
108 Intermediate gearbox
109 Detachable fin leading edge
110 Starboard tailplane
111 Swept main rotor blade tip
112 Cooling air intake
113 Final drive right-angle gearbox
114 Tail rotor pitch control servo actuator
115 Electro-luminescent lighting strip
116 Rear radar warning antennae (2)
117 Tail navigation light
118 Dual teetering two-bladed tail rotors, 55 deg separation
119 Blade pitch control linkages
120 Trailing edge VHF antenna
121 Tail pylon spar box structure
122 Pull-out maintenance steps
123 Tailplane pivot mounting
124 One-piece all-moving tailplane
125 Tailplane rib structure
126 Castoring tailwheel



127 Tailwheel shock absorber
128 Tailplane hydraulic actuator
129 Tail pylon mounting main frames
130 Maintenance steps
131 Chaff/flare dispenser
132 ADF sense antenna
133 Tailboom frame and stringer construction
134 Lower IFF antenna
135 ADF loop antenna
136 Doppler antenna
137 Ventral antenna fairing, offset to starboard
138 Survival equipment packs, port and starboard
139 Maintenance steps
140 Anti-collision strobe light
141 Port navigation light
142 Ground equipment stowage locker, battery bay to starboard
143 VHF antenna
144 Rear fuselage fuel tank
145 Sponson tail fairing
146 Stub wing rib structure
147 Electro-luminescent lighting strip
148 AIM-9L Sidewinder air-to-air missile, also representative of Sidearm anti-radiation missile
149 Dual Stinger missile launcher
150 AIM-92A Stinger air-to-air missile
151 7cm (2¾in) folding fin aircraft rocket (FFAR)
152 Nineteen round rocket pack
153 AGM-114A Hellfire anti-armour missile
154 Four-round missile carrier/launcher
155 Carrier/pylon pivot mounting, automatic pylon levelling
156 Pylon incidence actuator
157 Port pitot head
158 Wing stores pylons
159 Port extended sponson fairing housing avionics equipment
160 Hellfire missiles, maximum load 16 rounds
161 Ammunition magazine, 1,200 rounds
162 Port mainwheel
163 Boarding step
164 Lower cable cutter
165 Swivelling ventral gun turret, azimuth range 220 deg
166 Link return chute
167 Ammunition feed chute
168 Gun elevation actuator, range 11 deg up, 60 deg down
169 Cable cutter
170 Articulated gun mounting
171 McDonnell Douglas M230 Chain Gun, 30mm automatic cannon
172 Recoil dampers
173 Cable deflecting framework
174 Cannon muzzle blast suppressor

Pilot Cockpit


Pilot Cockpit
Circuit Breakers

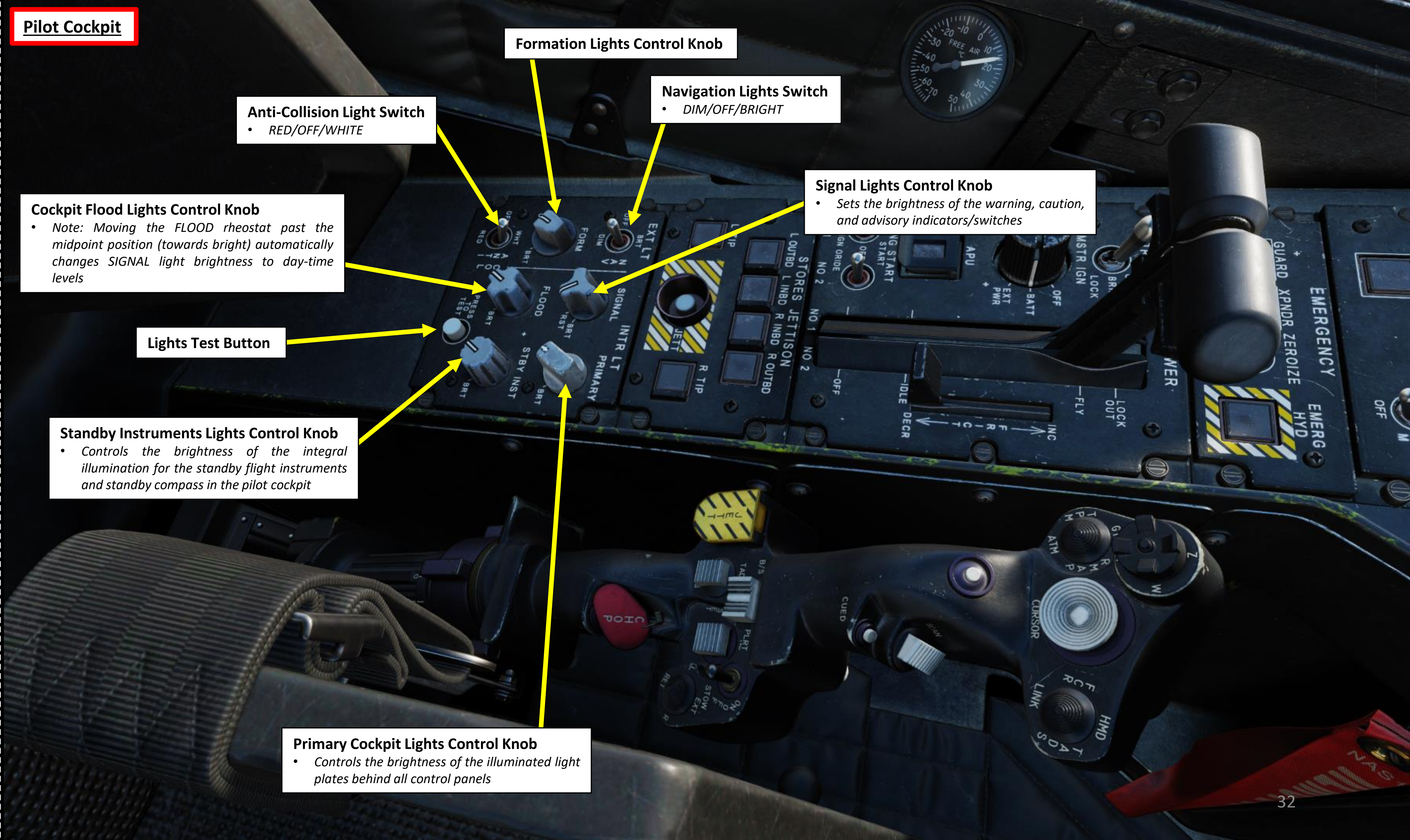

Pilot Cockpit
Air Conditioning Outlets (Gaspers)
IHADSS (Integrated Helmet and Display Sighting System) SSU (Sensor Surveying Unit)
IHADSS (Integrated Helmet and Display Sighting System) SSU (Sensor Surveying Unit)
WARNING
SIT IN SEAT BEFORE ADJUSTING
DO NOT PUT ANYTHING UNDER SEAT


Pilot Cockpit
Cockpit Map Light
Armor Panel

Pilot Cockpit

Pilot Cockpit

Pilot Cockpit



Formation Lights Control Knob

Navigation Lights Switch
- *DIM/OFF/BRIGHT*

Anti-Collision Light Switch
- *RED/OFF/WHITE*

Signal Lights Control Knob
- *Sets the brightness of the warning, caution, and advisory indicators/switches*

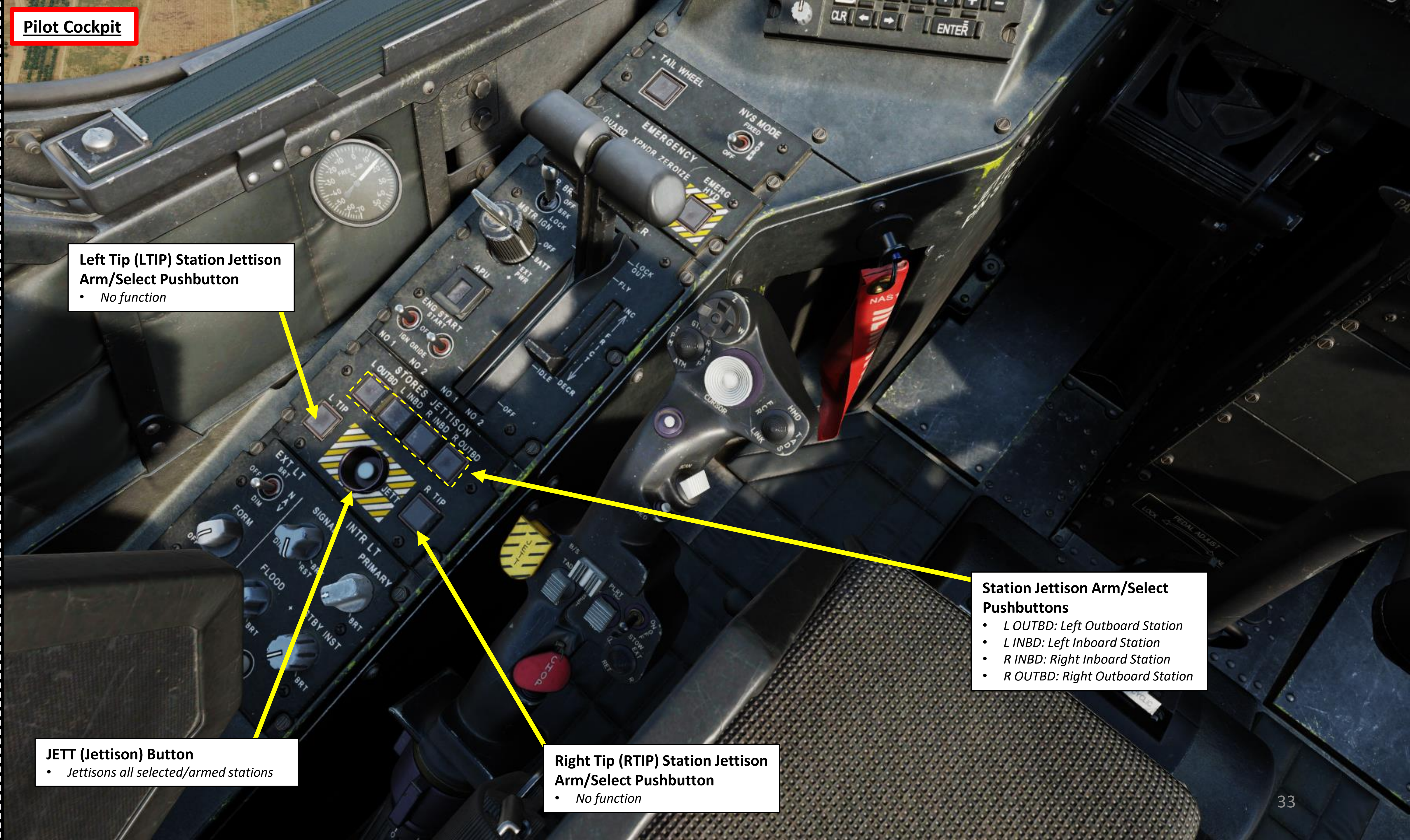
Cockpit Flood Lights Control Knob
- *Note: Moving the FLOOD rheostat past the midpoint position (towards bright) automatically changes SIGNAL light brightness to day-time levels*

Lights Test Button

Standby Instruments Lights Control Knob
- *Controls the brightness of the integral illumination for the standby flight instruments and standby compass in the pilot cockpit*

Primary Cockpit Lights Control Knob
- *Controls the brightness of the illuminated light plates behind all control panels*

Pilot Cockpit



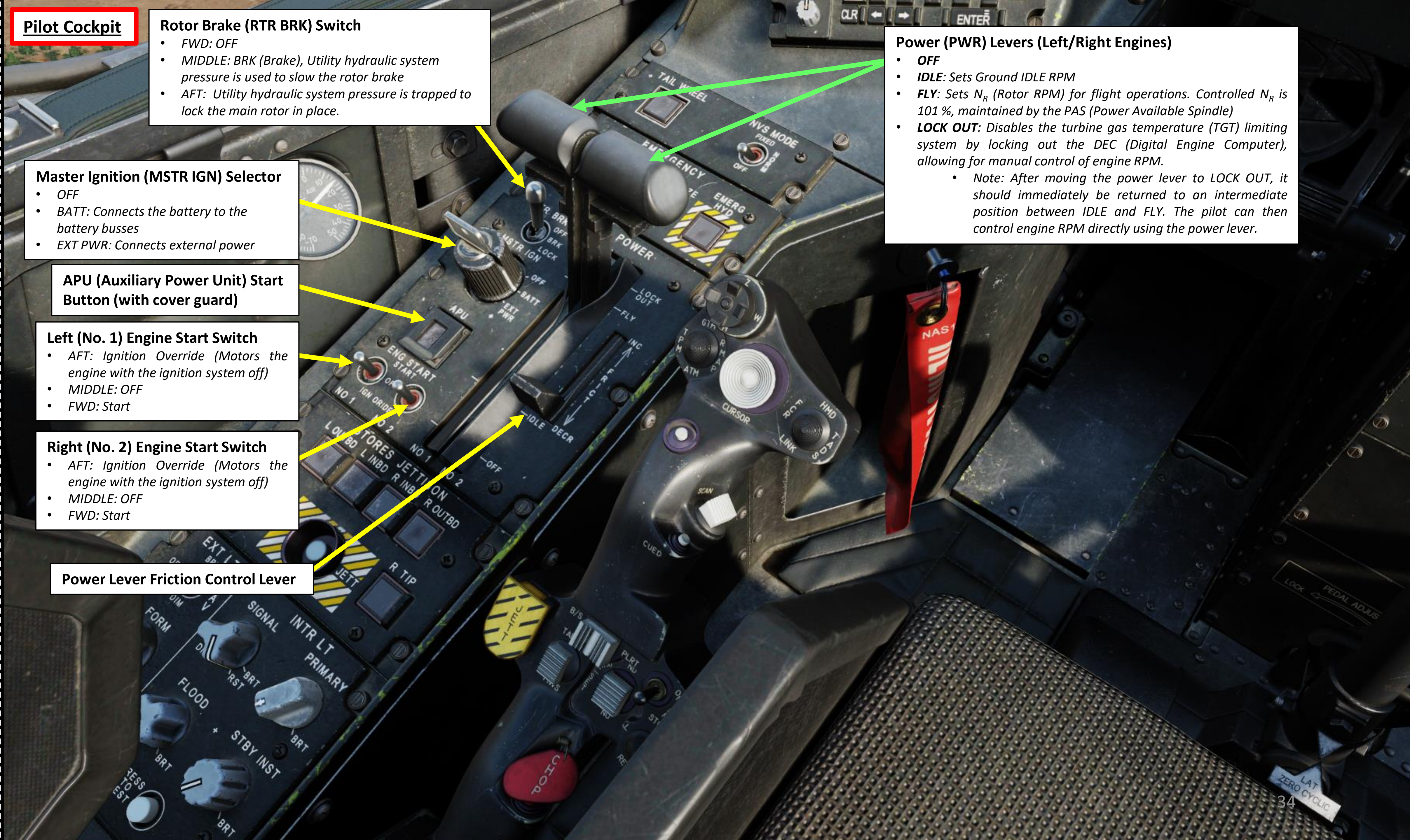
Left Tip (LTIP) Station Jettison Arm/Select Pushbutton
- *No function*

Station Jettison Arm/Select Pushbuttons
- *L OUTBD: Left Outboard Station*
- *L INBD: Left Inboard Station*
- *R INBD: Right Inboard Station*
- *R OUTBD: Right Outboard Station*

JETT (Jettison) Button
- *Jettisons all selected/armed stations*

Right Tip (RTIP) Station Jettison Arm/Select Pushbutton
- *No function*

Pilot Cockpit



Rotor Brake (RTR BRK) Switch
- *FWD: OFF*
- *MIDDLE: BRK (Brake), Utility hydraulic system pressure is used to slow the rotor brake*
- *AFT: Utility hydraulic system pressure is trapped to lock the main rotor in place.*

Master Ignition (MSTR IGN) Selector
- *OFF*
- *BATT: Connects the battery to the battery busses*
- *EXT PWR: Connects external power*

APU (Auxiliary Power Unit) Start Button (with cover guard)

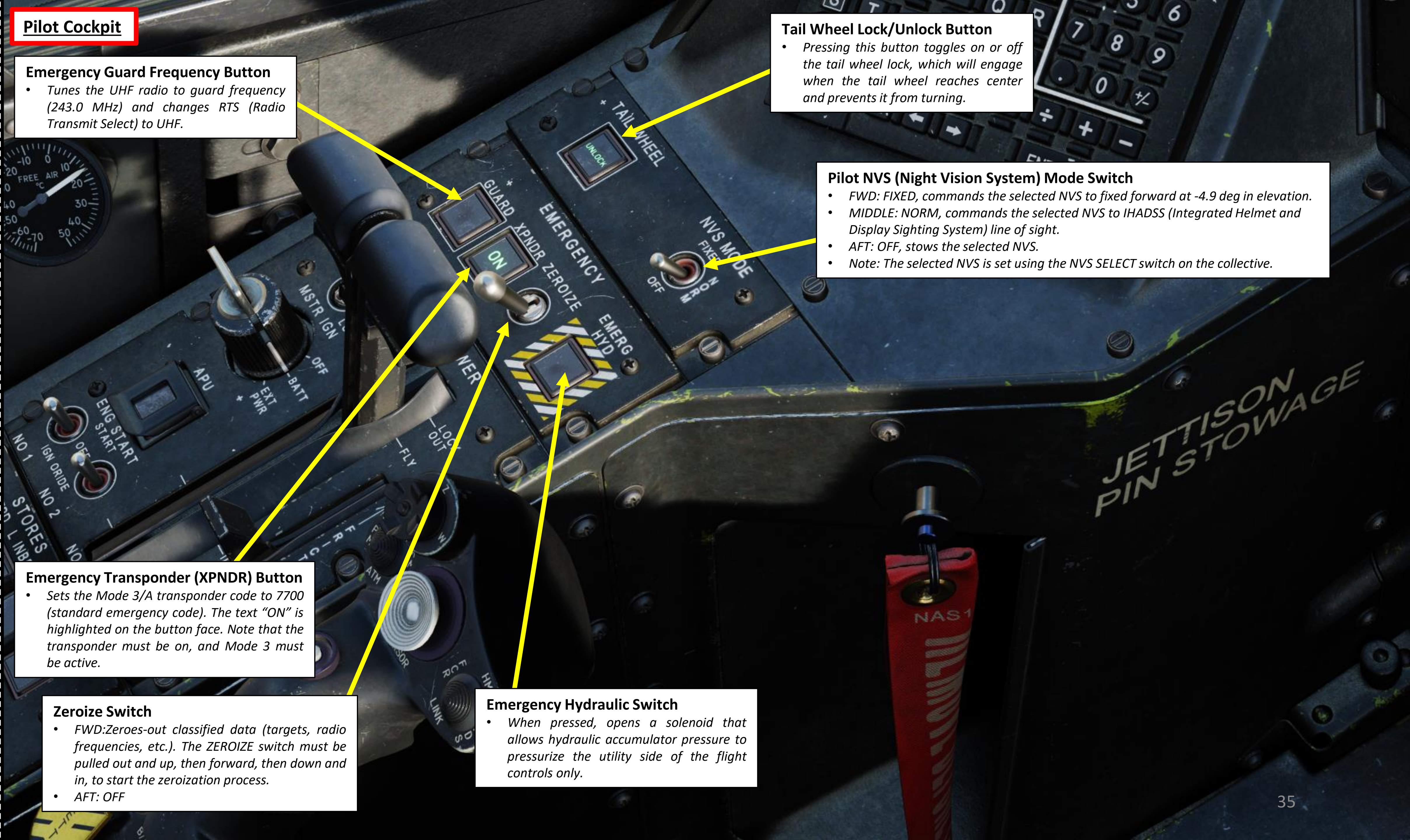
Left (No. 1) Engine Start Switch
- *AFT: Ignition Override (Motors the engine with the ignition system off)*
- *MIDDLE: OFF*
- *FWD: Start*

Right (No. 2) Engine Start Switch
- *AFT: Ignition Override (Motors the engine with the ignition system off)*
- *MIDDLE: OFF*
- *FWD: Start*

Power Lever Friction Control Lever

Power (PWR) Levers (Left/Right Engines)
- ***OFF***
- ***IDLE**: Sets Ground IDLE RPM*
- ***FLY**: Sets N_R (Rotor RPM) for flight operations. Controlled N_R is 101 %, maintained by the PAS (Power Available Spindle)*
- ***LOCK OUT**: Disables the turbine gas temperature (TGT) limiting system by locking out the DEC (Digital Engine Computer), allowing for manual control of engine RPM.*
    - *Note: After moving the power lever to LOCK OUT, it should immediately be returned to an intermediate position between IDLE and FLY. The pilot can then control engine RPM directly using the power lever.*

Pilot Cockpit



Emergency Guard Frequency Button

- *Tunes the UHF radio to guard frequency (243.0 MHz) and changes RTS (Radio Transmit Select) to UHF.*

Tail Wheel Lock/Unlock Button

- *Pressing this button toggles on or off the tail wheel lock, which will engage when the tail wheel reaches center and prevents it from turning.*

Pilot NVS (Night Vision System) Mode Switch

- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*

Emergency Transponder (XPNDR) Button

- *Sets the Mode 3/A transponder code to 7700 (standard emergency code). The text “ON” is highlighted on the button face. Note that the transponder must be on, and Mode 3 must be active.*

Zeroize Switch

- *FWD:Zeroes-out classified data (targets, radio frequencies, etc.). The ZEROIZE switch must be pulled out and up, then forward, then down and in, to start the zeroization process.*
- *AFT: OFF*

Emergency Hydraulic Switch

- *When pressed, opens a solenoid that allows hydraulic accumulator pressure to pressurize the utility side of the flight controls only.*

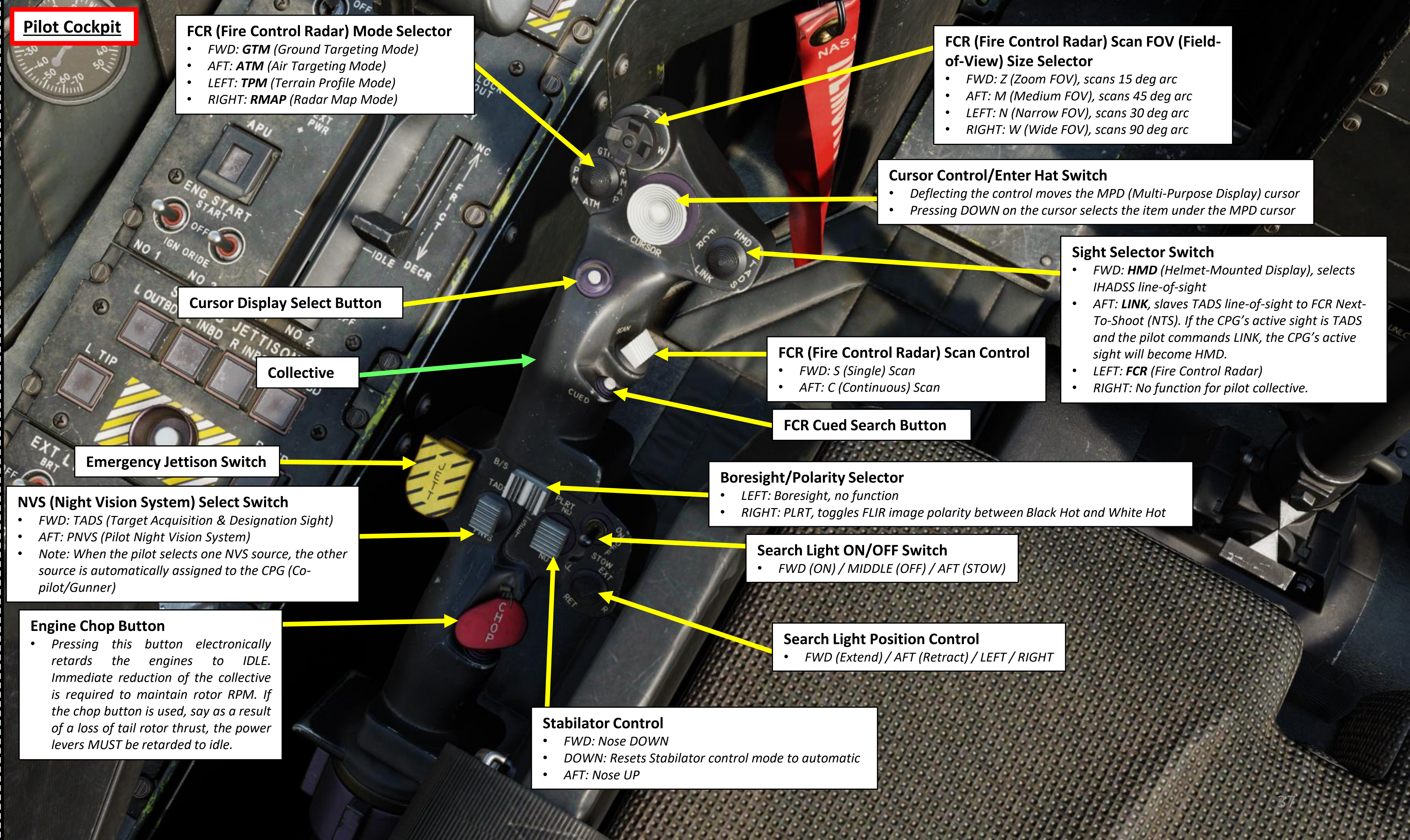
Pilot Cockpit

KU (Keyboard Unit)

- *The Keyboard Unit (KU) allows crewmembers to enter alphanumeric data into MPD (Multi-Purpose Display) fields and do simple arithmetic calculations. It can also be used as a simple scratchpad for notetaking.*

Data Field

Keyboard Unit Brightness Control Knob



Pilot Cockpit

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

Cursor Display Select Button

Collective

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

FCR Cued Search Button

Emergency Jettison Switch

NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

Boresight/Polarity Selector
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

Search Light ON/OFF Switch
- *FWD (ON) / MIDDLE (OFF) / AFT (STOW)*

Engine Chop Button
- *Pressing this button electronically retards the engines to IDLE. Immediate reduction of the collective is required to maintain rotor RPM. If the chop button is used, say as a result of a loss of tail rotor thrust, the power levers MUST be retarded to idle.*

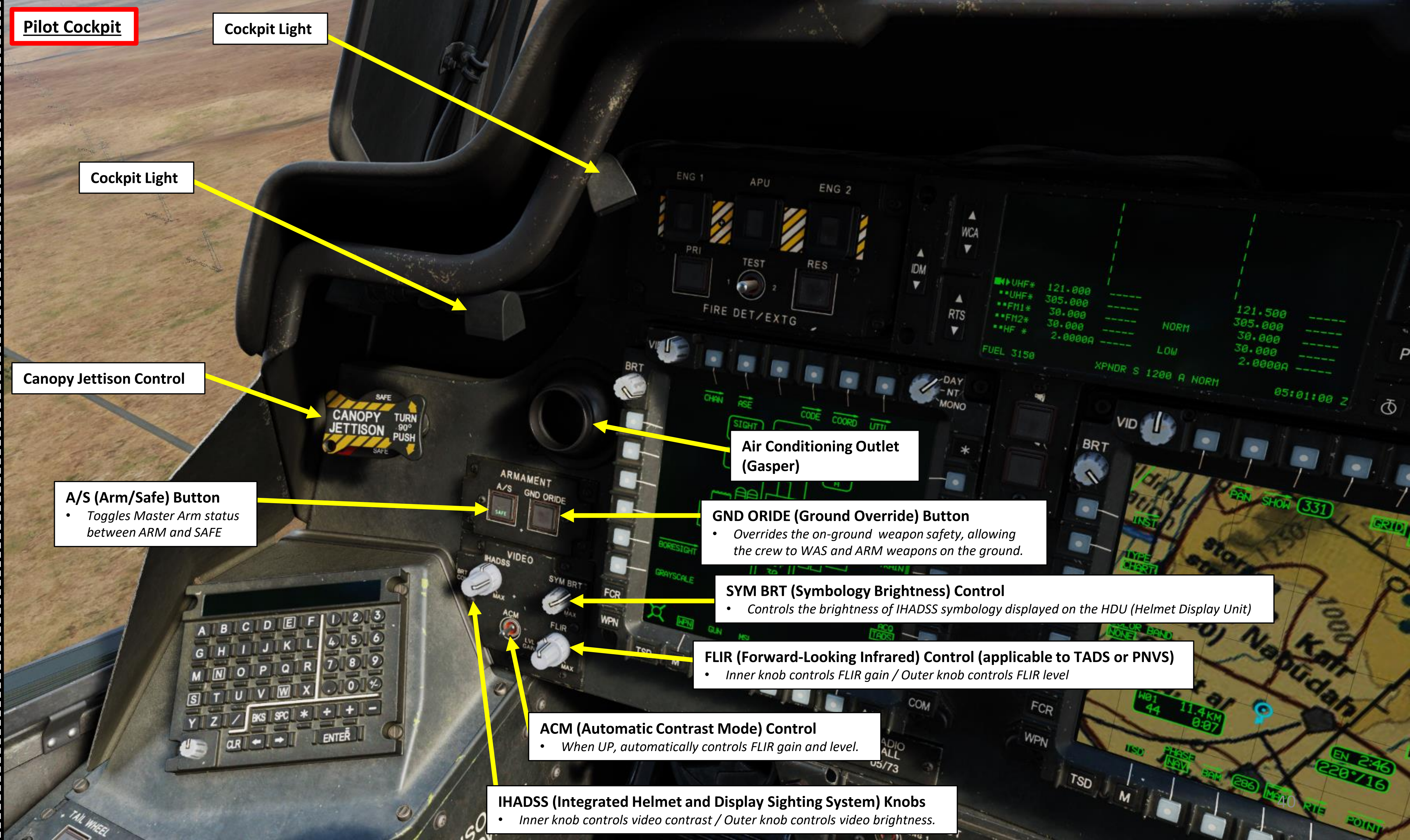
Search Light Position Control
- *FWD (Extend) / AFT (Retract) / LEFT / RIGHT*

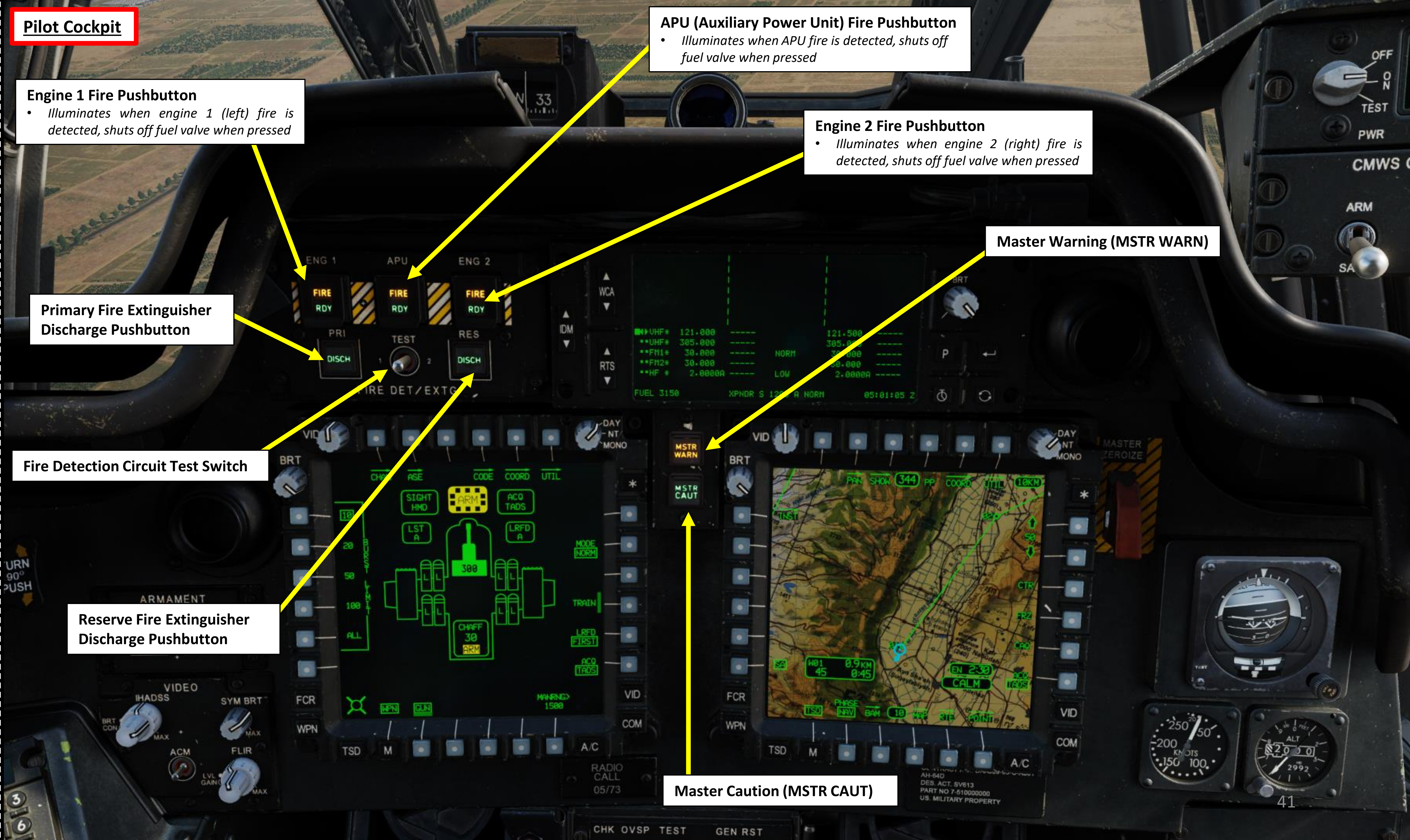
Stabilator Control
- *FWD: Nose DOWN*
- *DOWN: Resets Stabilator control mode to automatic*
- *AFT: Nose UP*

Pilot Cockpit

Pilot Cockpit

Pilot Cockpit



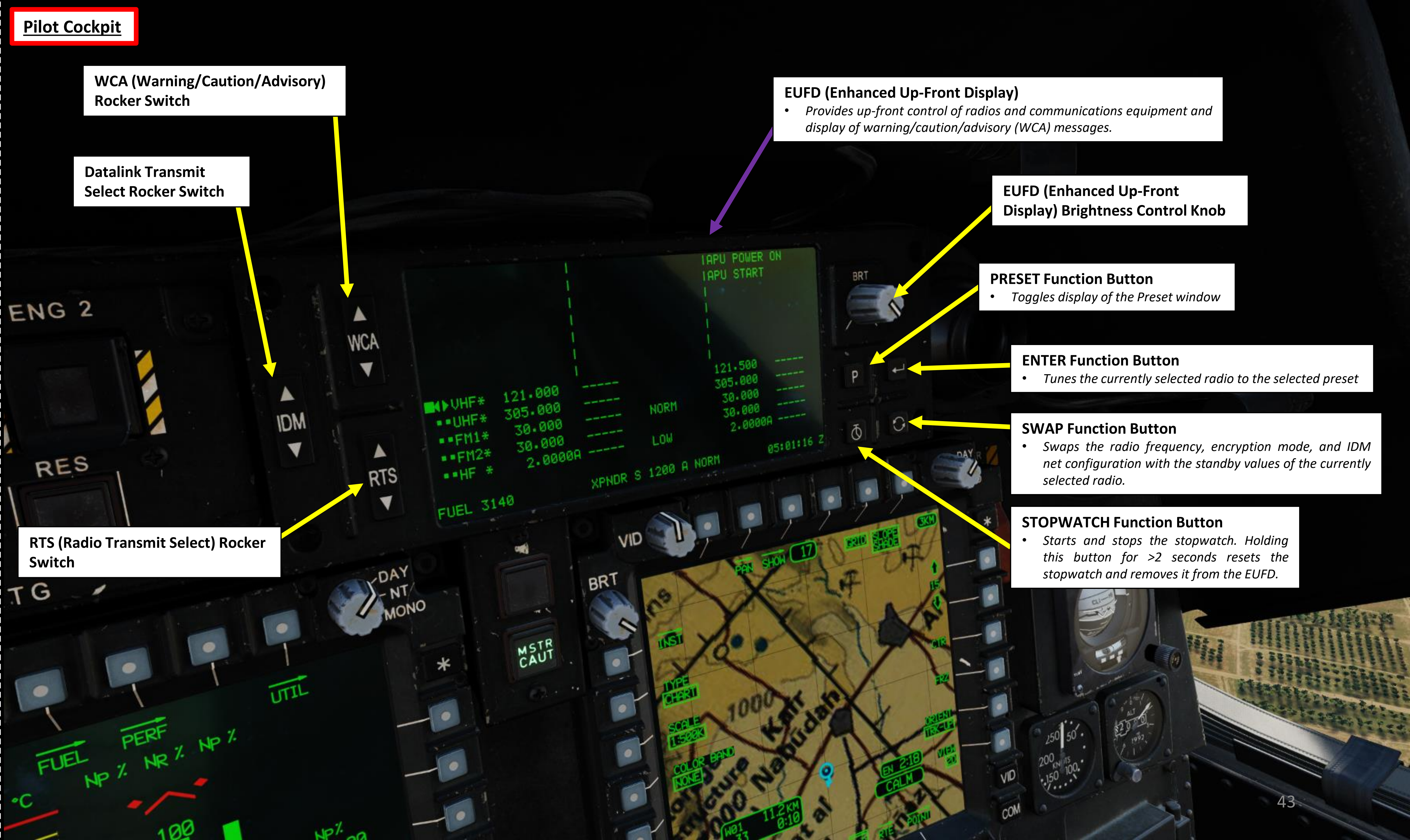

Pilot Cockpit
Engine 1 Fire Pushbutton
• Illuminates when engine 1 (left) fire is detected, shuts off fuel valve when pressed
APU (Auxiliary Power Unit) Fire Pushbutton
• Illuminates when APU fire is detected, shuts off fuel valve when pressed
Engine 2 Fire Pushbutton
• Illuminates when engine 2 (right) fire is detected, shuts off fuel valve when pressed
Master Warning (MSTR WARN)
Primary Fire Extinguisher Discharge Pushbutton
Fire Detection Circuit Test Switch
Reserve Fire Extinguisher Discharge Pushbutton
Master Caution (MSTR CAUT)

Pilot Cockpit

EUFD (Enhanced Up-Front Display)

- *Provides up-front control of radios and communications equipment and display of warning/caution/advisory (WCA) messages.*

Pilot Cockpit



WCA (Warning/Caution/Advisory) Rocker Switch

Datalink Transmit Select Rocker Switch

RTS (Radio Transmit Select) Rocker Switch

EUFD (Enhanced Up-Front Display)
- *Provides up-front control of radios and communications equipment and display of warning/caution/advisory (WCA) messages.*

EUFD (Enhanced Up-Front Display) Brightness Control Knob

PRESET Function Button
- *Toggles display of the Preset window*

ENTER Function Button
- *Tunes the currently selected radio to the selected preset*

SWAP Function Button
- *Swaps the radio frequency, encryption mode, and IDM net configuration with the standby values of the currently selected radio.*

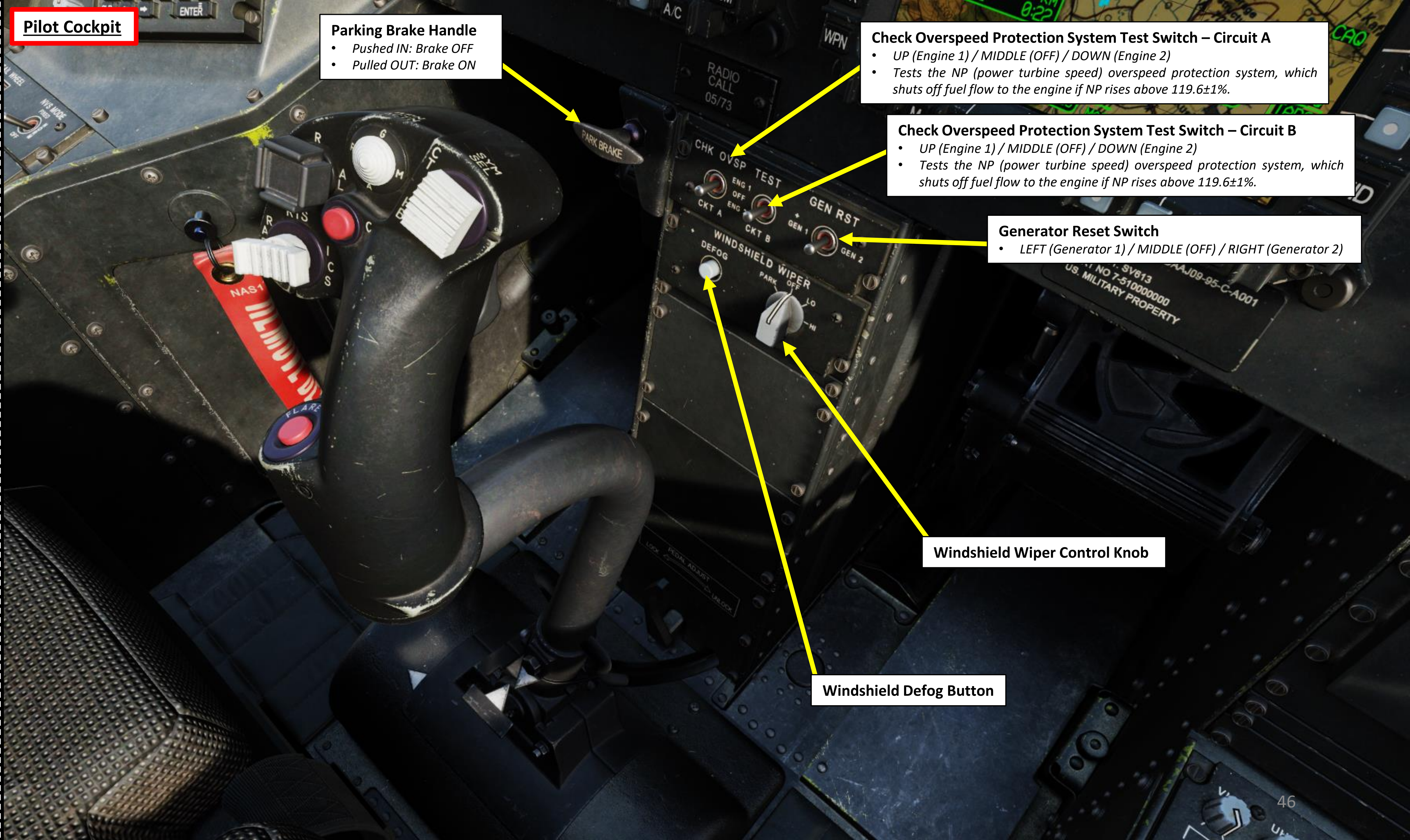
STOPWATCH Function Button
- *Starts and stops the stopwatch. Holding this button for >2 seconds resets the stopwatch and removes it from the EUFD.*

Pilot Cockpit

Master Zeroize Switch
- *Zeroes-out (deletes) classified data.*


Pilot Cockpit
SAI (Standby Attitude Indicator)
Slip & Turn Indicator
SAI Caging Knob
Standby Barometric Altimeter (ft)
Barometric Pressure Setting Readout (in Hg)
Barometric Pressure Setting Knob
Standby Indicated Airspeed (IAS, kts)

Pilot Cockpit



Parking Brake Handle
- *Pushed IN: Brake OFF*
- *Pulled OUT: Brake ON*

Check Overspeed Protection System Test Switch – Circuit A
- *UP (Engine 1) / MIDDLE (OFF) / DOWN (Engine 2)*
- *Tests the NP (power turbine speed) overspeed protection system, which shuts off fuel flow to the engine if NP rises above 119.6±1%.*

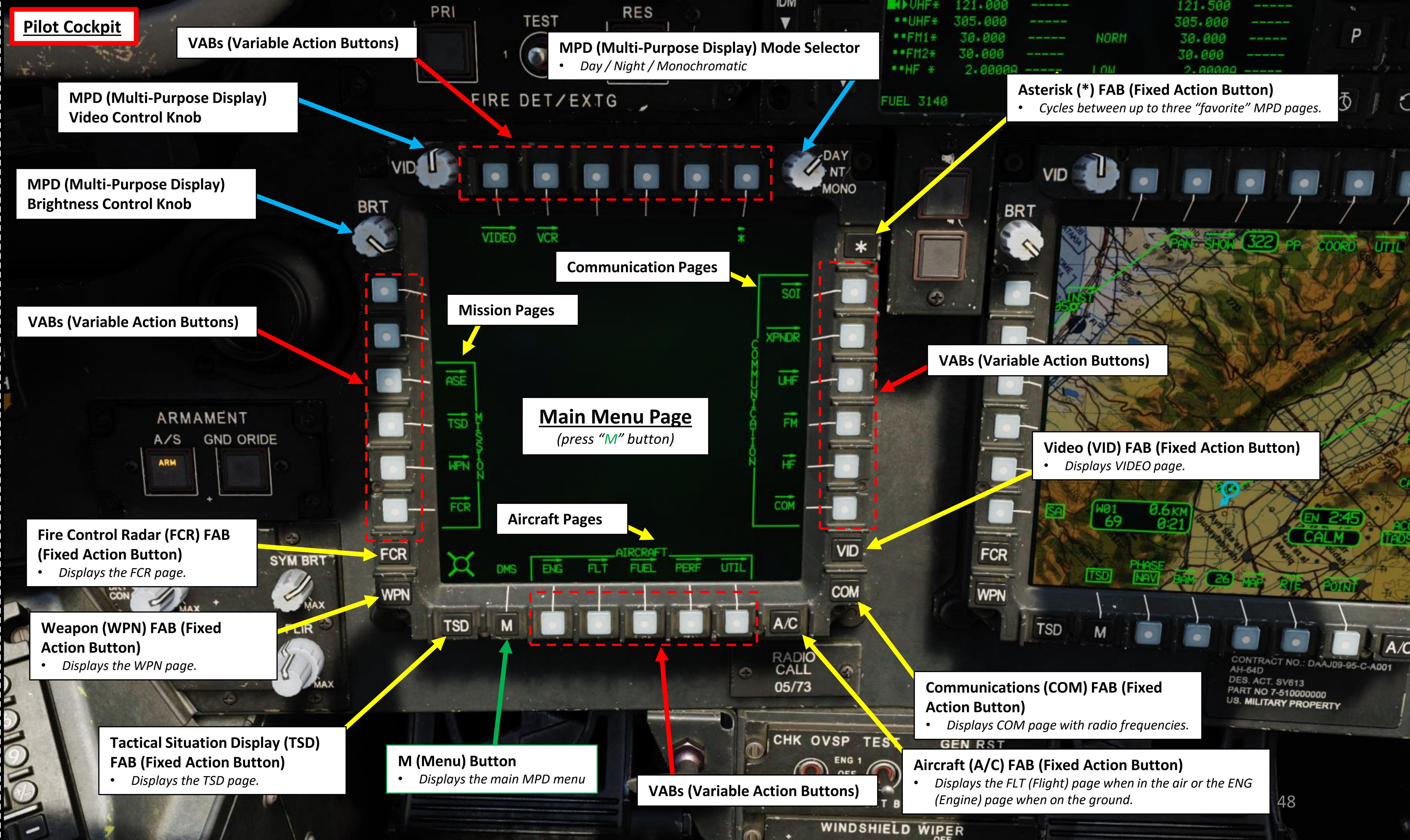
Check Overspeed Protection System Test Switch – Circuit B
- *UP (Engine 1) / MIDDLE (OFF) / DOWN (Engine 2)*
- *Tests the NP (power turbine speed) overspeed protection system, which shuts off fuel flow to the engine if NP rises above 119.6±1%.*

Generator Reset Switch
- *LEFT (Generator 1) / MIDDLE (OFF) / RIGHT (Generator 2)*

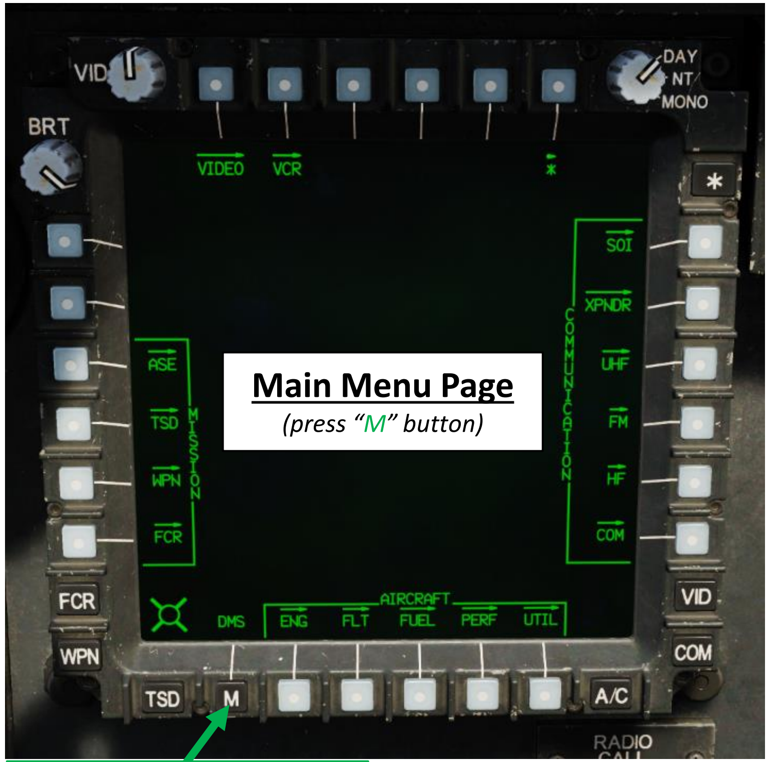
Windshield Wiper Control Knob

Windshield Defog Button


Pilot Cockpit
Magnetic Compass
Boresight Reticle Unit (BRU)
• Used to align/boresight HDU (Helmet Display Unit)
EUFD (Enhanced Up-Front Display)
• Provides up-front control of radios and communications equipment and display of warning/caution/advisory (WCA) messages.
Left MPD (Multi-Purpose Display)
Right MPD (Multi-Purpose Display)


Pilot Cockpit
VABs (Variable Action Buttons)
MPD (Multi-Purpose Display) Mode Selector
• Day / Night / Monochromatic
MPD (Multi-Purpose Display) Video Control Knob
Asterisk (*) FAB (Fixed Action Button)
• Cycles between up to three "favorite" MPD pages.
MPD (Multi-Purpose Display) Brightness Control Knob
Communication Pages
Mission Pages
VABs (Variable Action Buttons)
VABs (Variable Action Buttons)
Main Menu Page
(press "M" button)
Video (VID) FAB (Fixed Action Button)
• Displays VIDEO page.
Aircraft Pages
Fire Control Radar (FCR) FAB (Fixed Action Button)
• Displays the FCR page.
Weapon (WPN) FAB (Fixed Action Button)
• Displays the WPN page.
Communications (COM) FAB (Fixed Action Button)
• Displays COM page with radio frequencies.
Tactical Situation Display (TSD) FAB (Fixed Action Button)
• Displays the TSD page.
M (Menu) Button
• Displays the main MPD menu
VABs (Variable Action Buttons)
Aircraft (A/C) FAB (Fixed Action Button)
• Displays the FLT (Flight) page when in the air or the ENG (Engine) page when on the ground.
PRI
TEST
RES
FIRE DET/EXTG
VID
BRT
DAY
NT
MONO
VIDEO
VCR
ASE
TSD
WPN
FCR
MISSION
SOI
XPNDR
UHF
FM
HF
COM
COMMUNICATION
DMS
ENG
FLT
FUEL
PERF
UTIL
AIRCRAFT
VID
COM
A/C
M
ARMAMENT
A/S
GND ORIDE
ARM
SYM BRT
RADIO CALL
05/73
FUEL 3140
WINDSHIELD WIPER

Pilot Cockpit



M (Menu) Button

- *Displays the main MPD menu*

MPD (Multi-Purpose Display) Pages

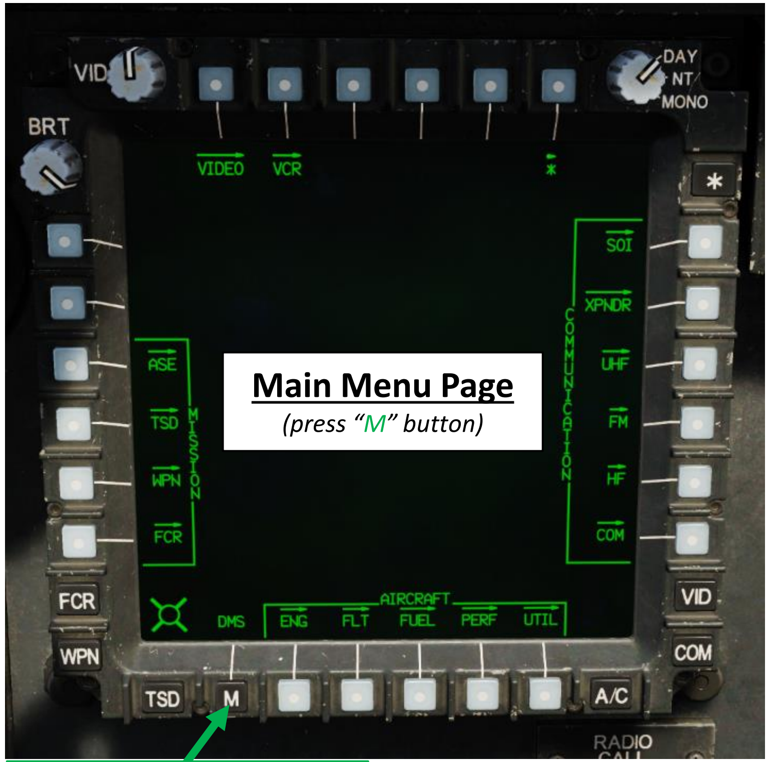
Mission Pages		
ASE: Aircraft Survivability Equipment page. Provides a de-cluttered, azimuth-only display of any radar or laser threats detected by the aircraft defensive systems, and allows the aircrew to manage the survivability equipment onboard the aircraft, such as the RLWR (Radar/Laser Warning Receiver) and chaff dispenser.	**TSD**: Tactical Situation Display page. Shows a top-down overview of the aircraft, battlefield, and surrounding airspace. The TSD is a versatile, full color moving map that allows the aircrew to plot and analyze a wealth of navigational, tactical, and sensor information.	**WPN**: Weapon page. Allows the pilot or CPG to activate weapon systems and configure weapon parameters.
FCR: Fire Control Radar page. Allows configuration and the operation of AN/APG-78 fire control radar.		

Communication Pages		
SOI: Not simulated.	**XPNDR**: Transponder page. Allows configuration of IFF (Identify-Friend-or-Foe) transponder.	**UHF**: UHF Radio page. Allows configuration of ARC-164(V) UHF AM radio.
FM: FM Radio page. Allows configuration of ARC-201D VHF FM1 and FM2 radios.	**HF**: HF Radio page. Allows configuration of ARC-220 HF radio.	**COM**: Communication page. Allows general configuration of radio communications setup.

Notes on MPDs:

- The Multi-Purpose Displays (MPDs) are color liquid crystal displays that allow the pilot and copilot/gunner (CPG) to access different formats. Each format allows the crewmember to view different information or access different functions.
- Pages are selected by either pressing the M (Menu) Button and the VAB (Variable Action Button) next to the desired page or by pressing one of the FABs (Fixed Action Button). There are FABs for the FCR, WPN, TSD, VID, COM and A/C (ENG or FLT) pages, and those can be used to quickly switch between pages.
- The MPDs have a screensaver mode that is armed when the aircraft is on the ground, on external power, with the power levers set to OFF. In this situation, the displays will automatically turn off after 5 minutes with no button presses. Pressing any button will "wake" the MPDs, turning them back on.
- Some pages will automatically appear based on certain events occuring; this MPD logic is called "**autopaging**". The threshold for ASE autopaging can be set independently in each cockpit, while ENG autopaging can be disabled in the CPG cockpit only.
    - The ENG page will display if:
        - A new warning message appears.
        - EMER HYD switch is activated.
        - An engine starter is engaged.
    - The TSD page will display when the RLWR or RFI detects radar or laser energy exceeding the set threshold.
    - The FCR page will display when the sight select is set to FCR.
    - Depressing (Z-axis) on the Symbol Select Switch on the cyclic will select the FLT page.

Pilot Cockpit



Main Menu Page
(press "M" button)

M (Menu) Button
- *Displays the main MPD menu*

MPD (Multi-Purpose Display) Pages

Aircraft Pages		
ENG: Engine page. Displays engine and powertrain data and is formatted based on conditions.	**FLT**: Flight page. Displays basic flight information and allows the aircrew to control various flight settings.	**FUEL**: Fuel page. Displays fuel quantity and distribution, and allows the aircrew to control which tanks feed which engines, or transfer fuel between the forward and aft fuel tanks.
PERF: Performance page. Allows you to configure aircraft performance values and view performance planning data.	**UTIL**: Utility page. Allows the crew to enable or disable aircraft systems.	
Other Pages		
VIDEO: Displays video from aircraft sensors and allows the crewmembers to set video underlays and configure video settings.	**VCR**: Video Cassette Recorder page. Not simulated.	**DMS**: Data Management System page. Allows the aircrew to view system advisories and faults, as well as access further sub-menus for diagnostic and maintenance functions.

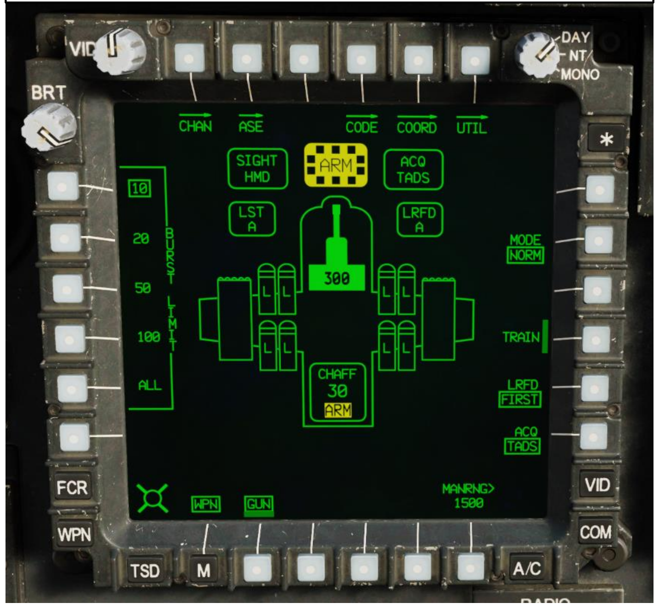
Pilot Cockpit

Mission Pages

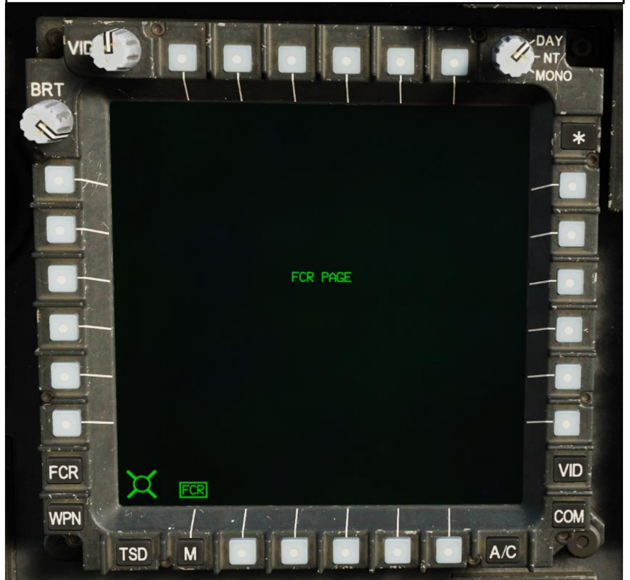
ASE (Aircraft Survivability Equipment) Page

TSD (Tactical Situation Display) Page

WPN (Weapon) Page



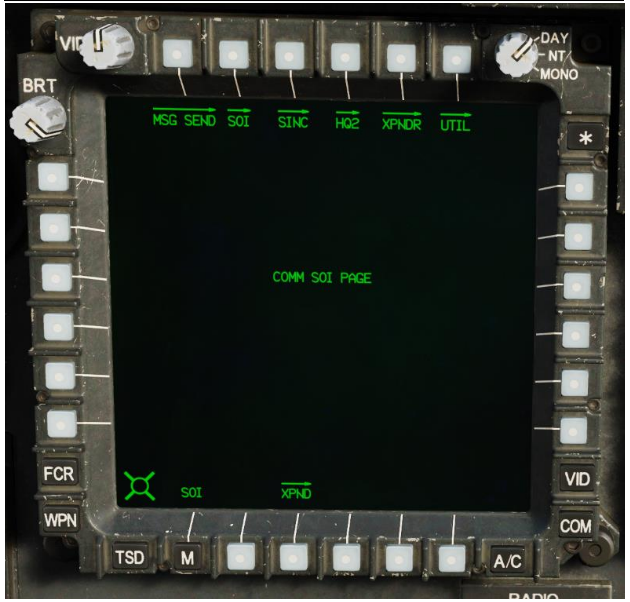
FCR (Fire Control Radar) Page



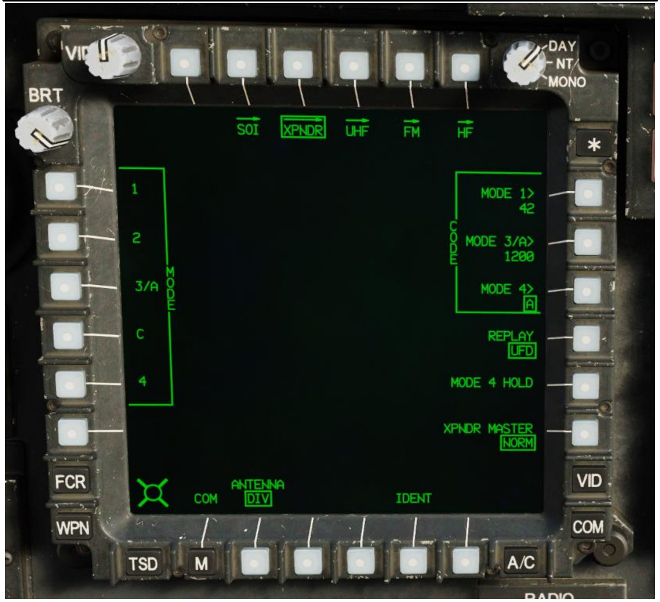
Pilot Cockpit

Communication Pages

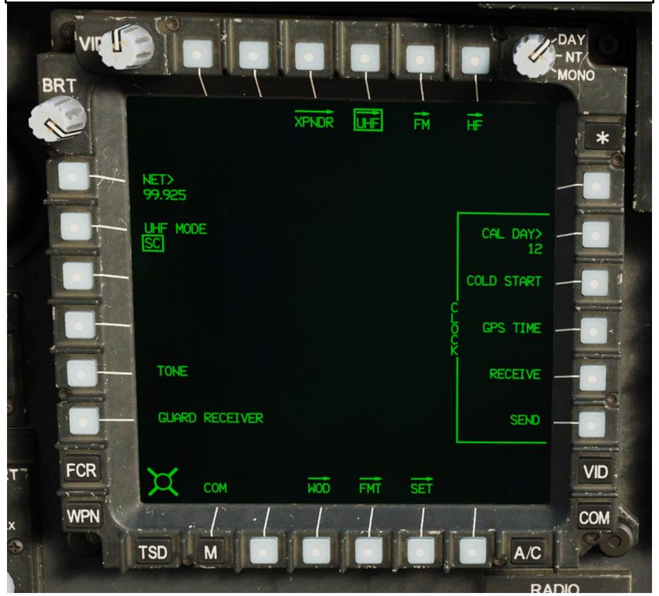
SOI Page



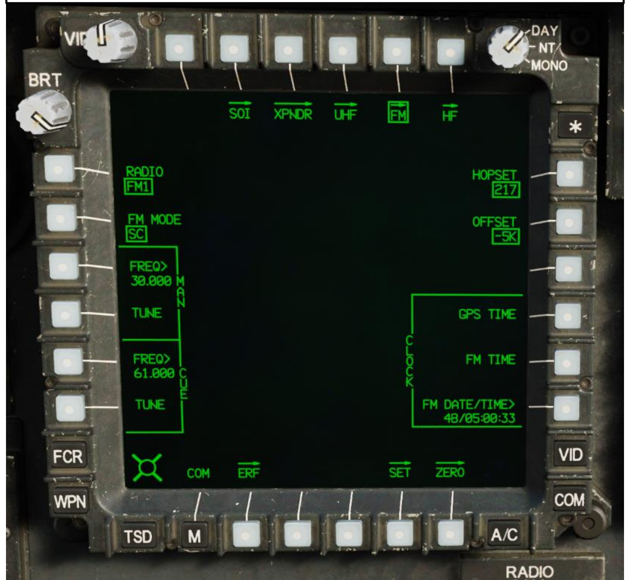
XPNDR (Transponder) Page



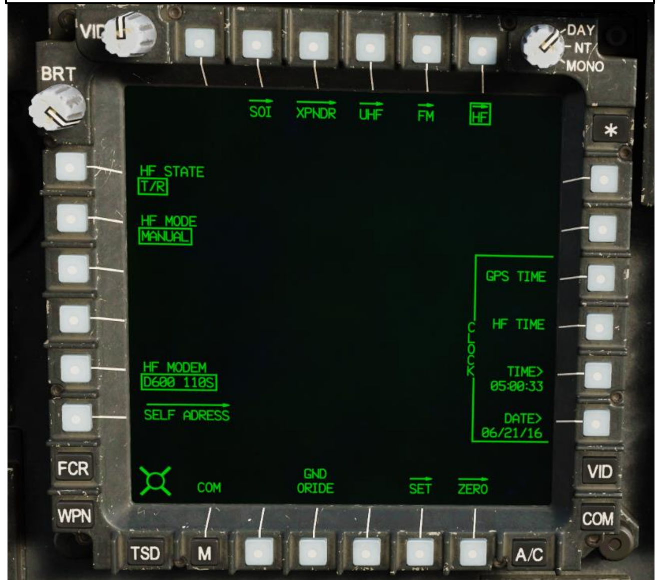
UHF Page



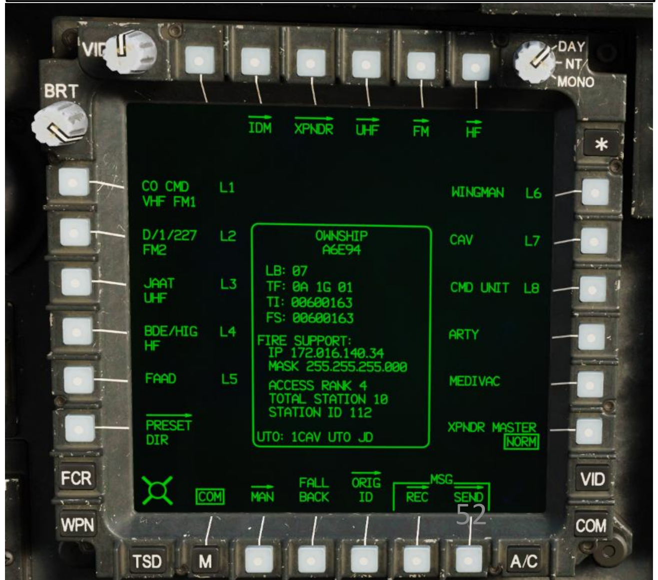
FM Page



HF Page



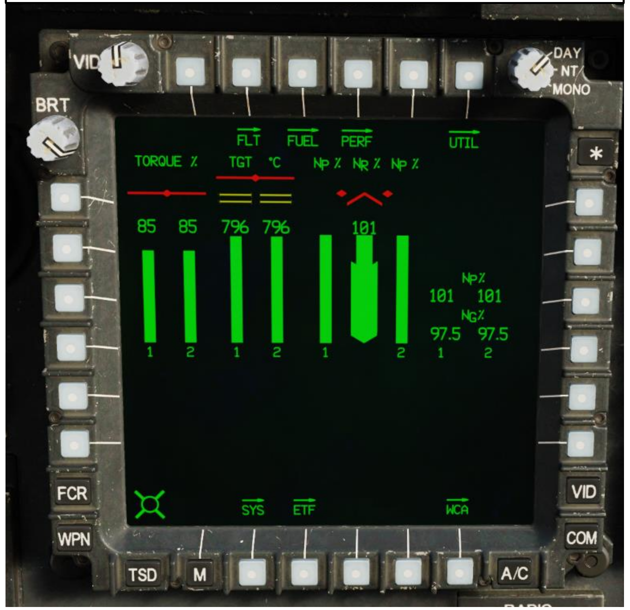
COM (Communication) Page



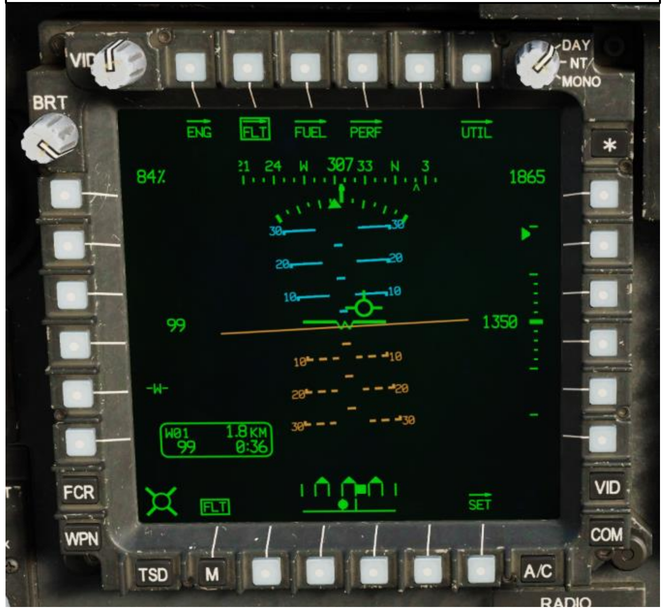
Pilot Cockpit

Aircraft Pages

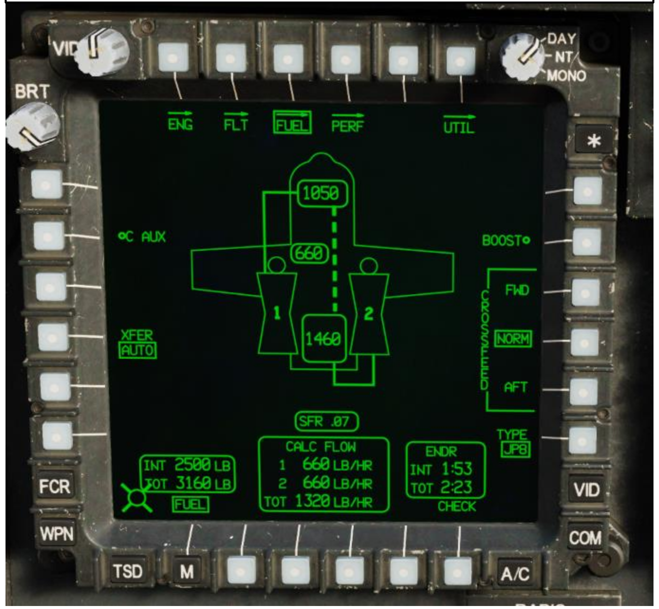
ENG (Engine) Page



FLT (Flight) Page

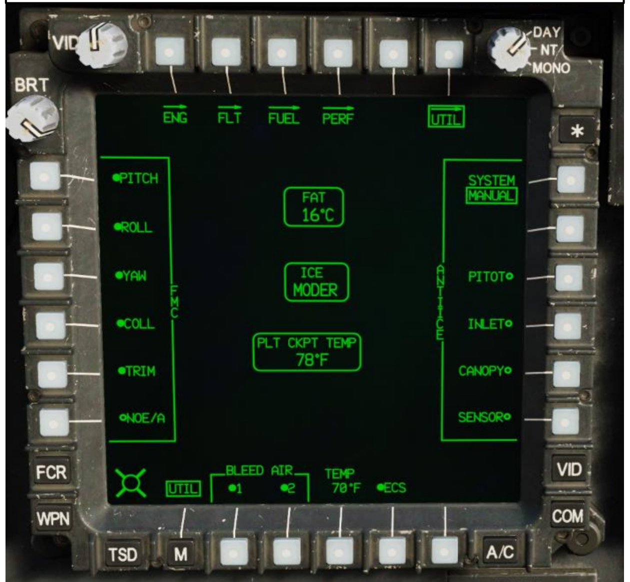


FUEL Page



PERF (Performance) Page

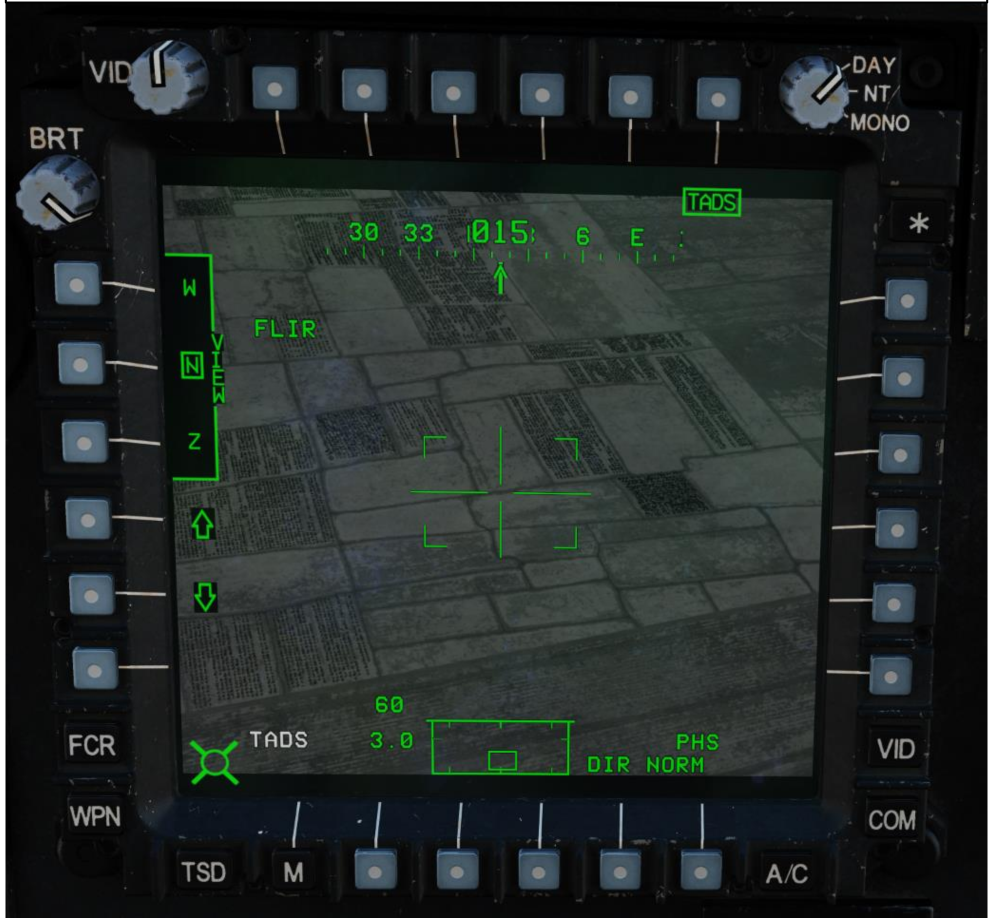
UTIL (Utility) Page



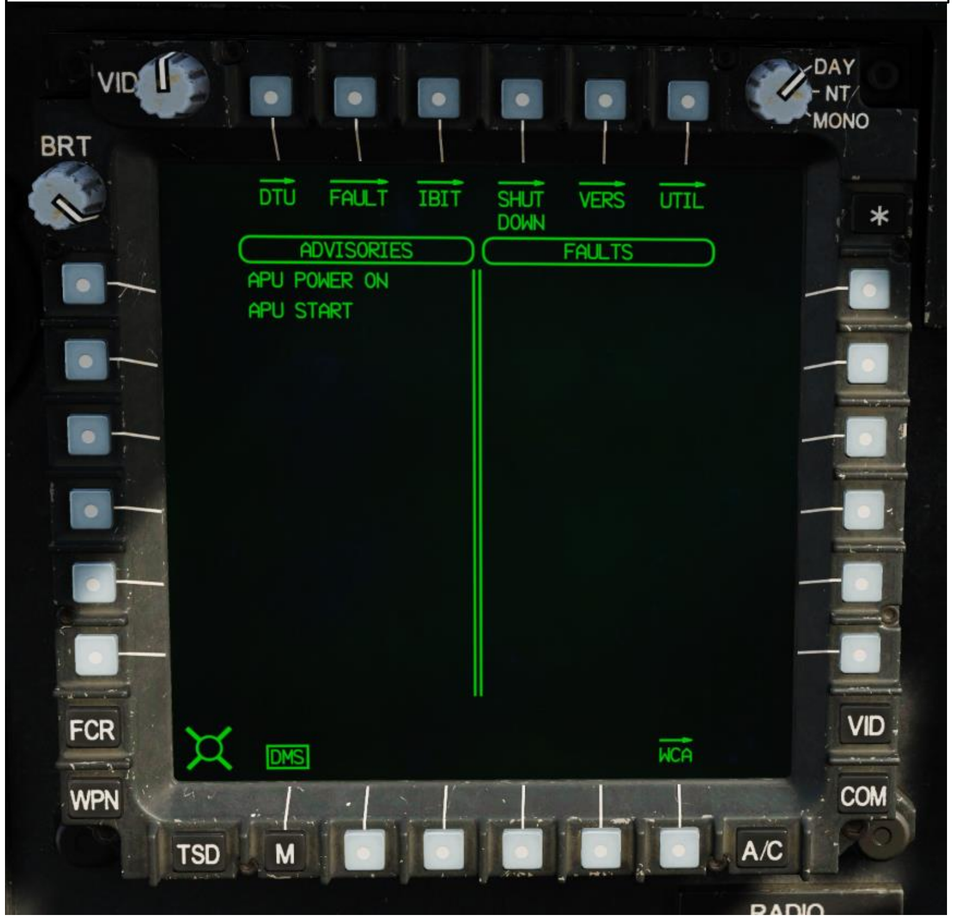
Pilot Cockpit

Other Pages

Video Page

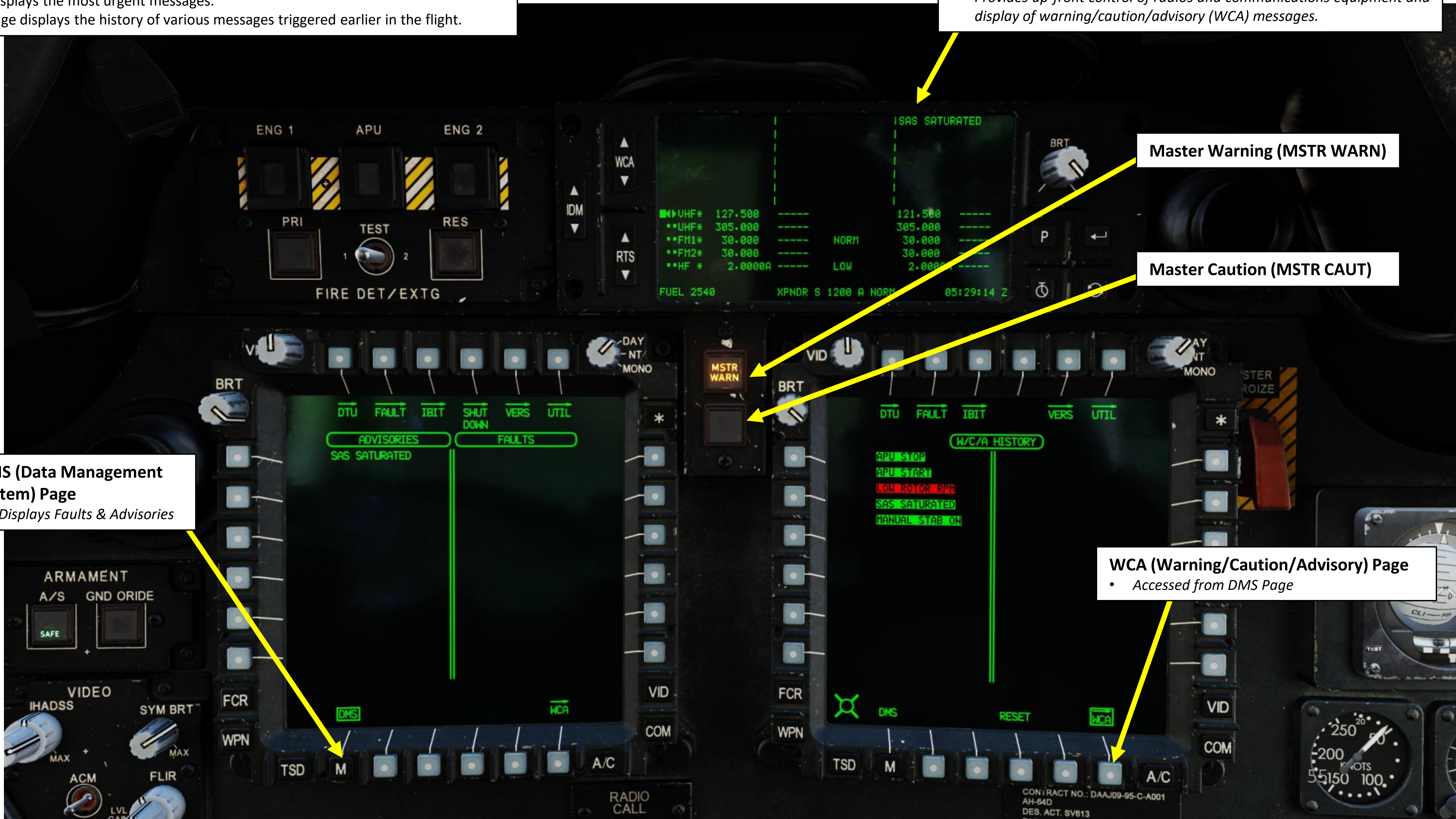


DMS (Data Management System) Page



Pilot Cockpit

Notes on Cautions, Warnings, and Advisories:
- Warnings, Cautions and Advisories are displayed on the EUFD, DMS page and WCA Page.
- The EUFD displays the most urgent messages.
- The WCA page displays the history of various messages triggered earlier in the flight.



EUFD (Enhanced Up-Front Display)
- *Provides up-front control of radios and communications equipment and display of warning/caution/advisory (WCA) messages.*

Master Warning (MSTR WARN)

Master Caution (MSTR CAUT)

DMS (Data Management System) Page
- *Displays Faults & Advisories*

WCA (Warning/Caution/Advisory) Page
- *Accessed from DMS Page*

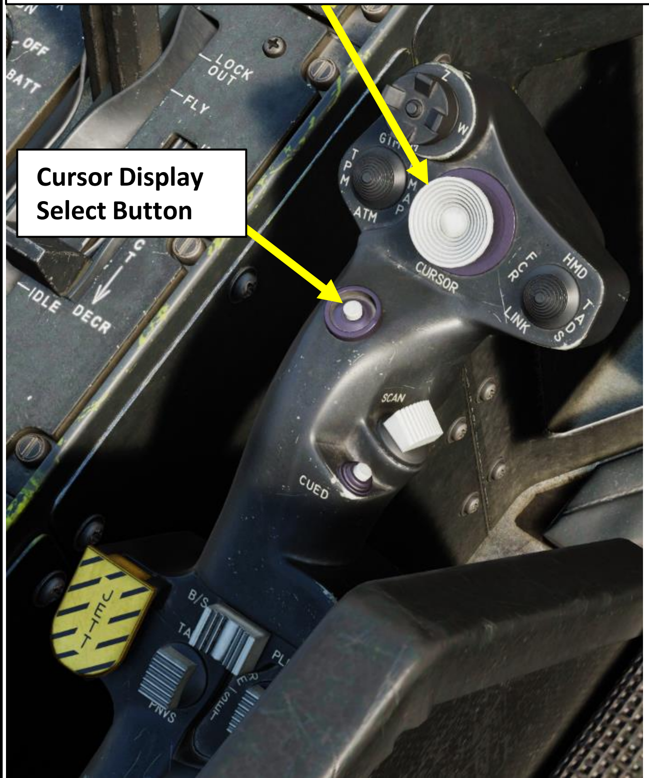
Pilot Cockpit

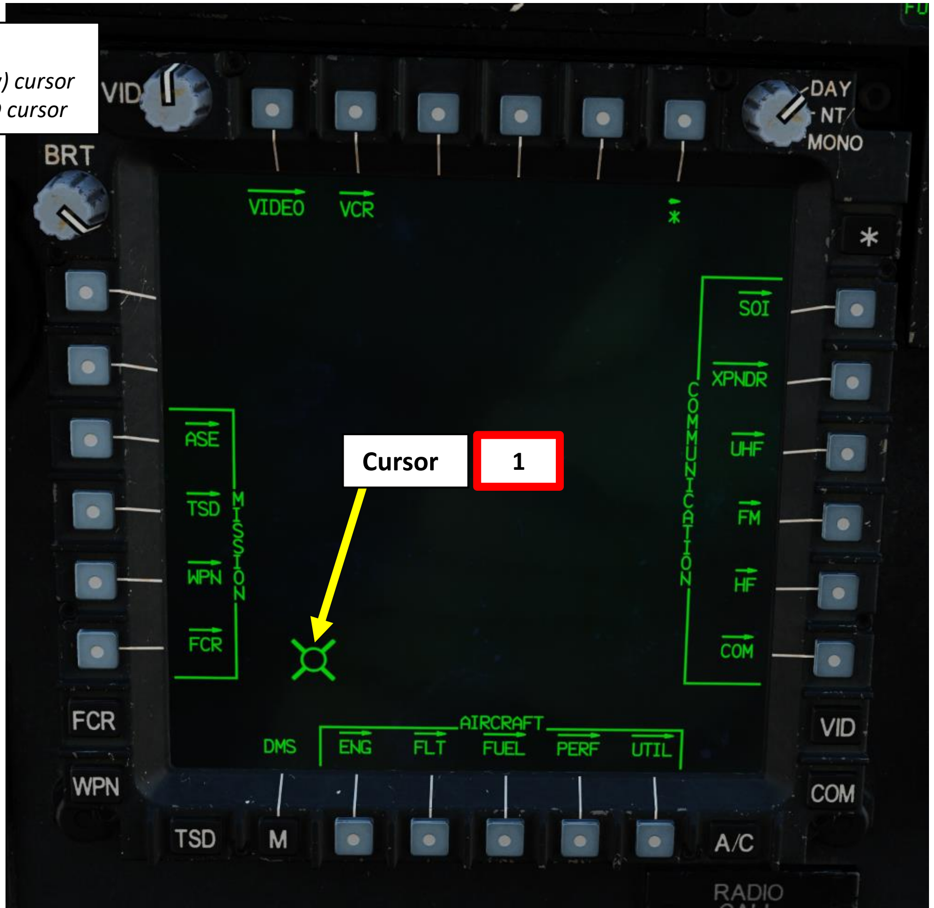
Notes on Cursor Use:

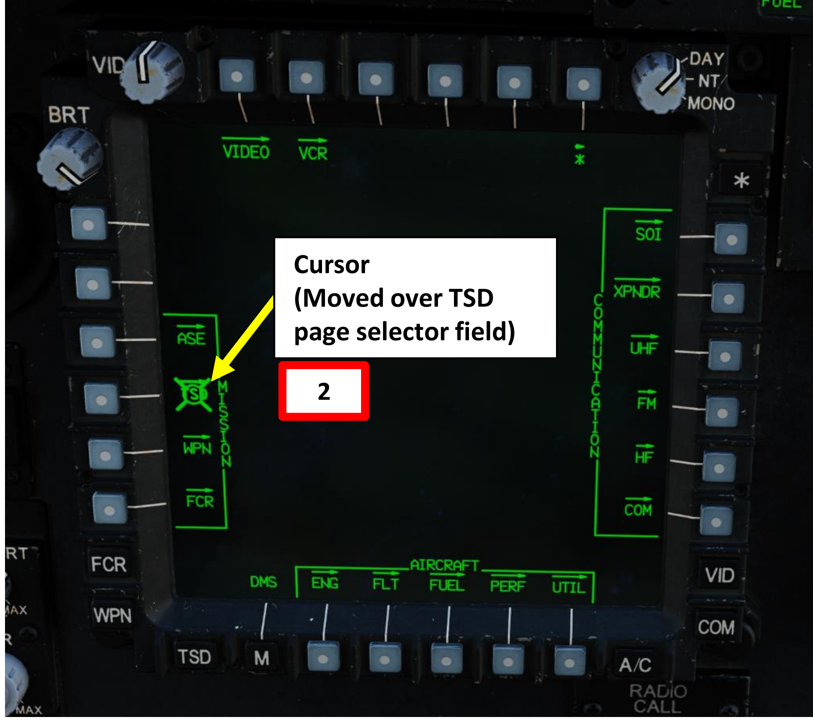
- The Cursor Control/Enter Hat Switch can be used to slew/move a cursor on the MPD (Multi-Purpose Display) pages of the active MPD.
- The cursor can be moved to the opposite display using the Cursor Display Select Button or by moving the Cursor to the edge of one display and "bumping" the Cursor Control/Enter Hat Switch in the direction of the opposite MPD.
- When the Cursor is over a data field, you can select it by pressing DOWN on the Cursor Control/Enter Hat Switch instead of using a VAB (Variable Action Button).
- When FCR (Fire Control Radar) is selected for display on the TDU, the Cursor can be utilized on the TDU. The "bump" method is required for placing the cursor on the TDU in this instance.
    - "TDU" stands for "TEDAC Display Unit".
    - "TEDAC" stands for "TADS Electronic Display & Control".
    - "TADS" stands for "Target Acquisition & Designation Sight"

Cursor Control/Enter Hat Switch

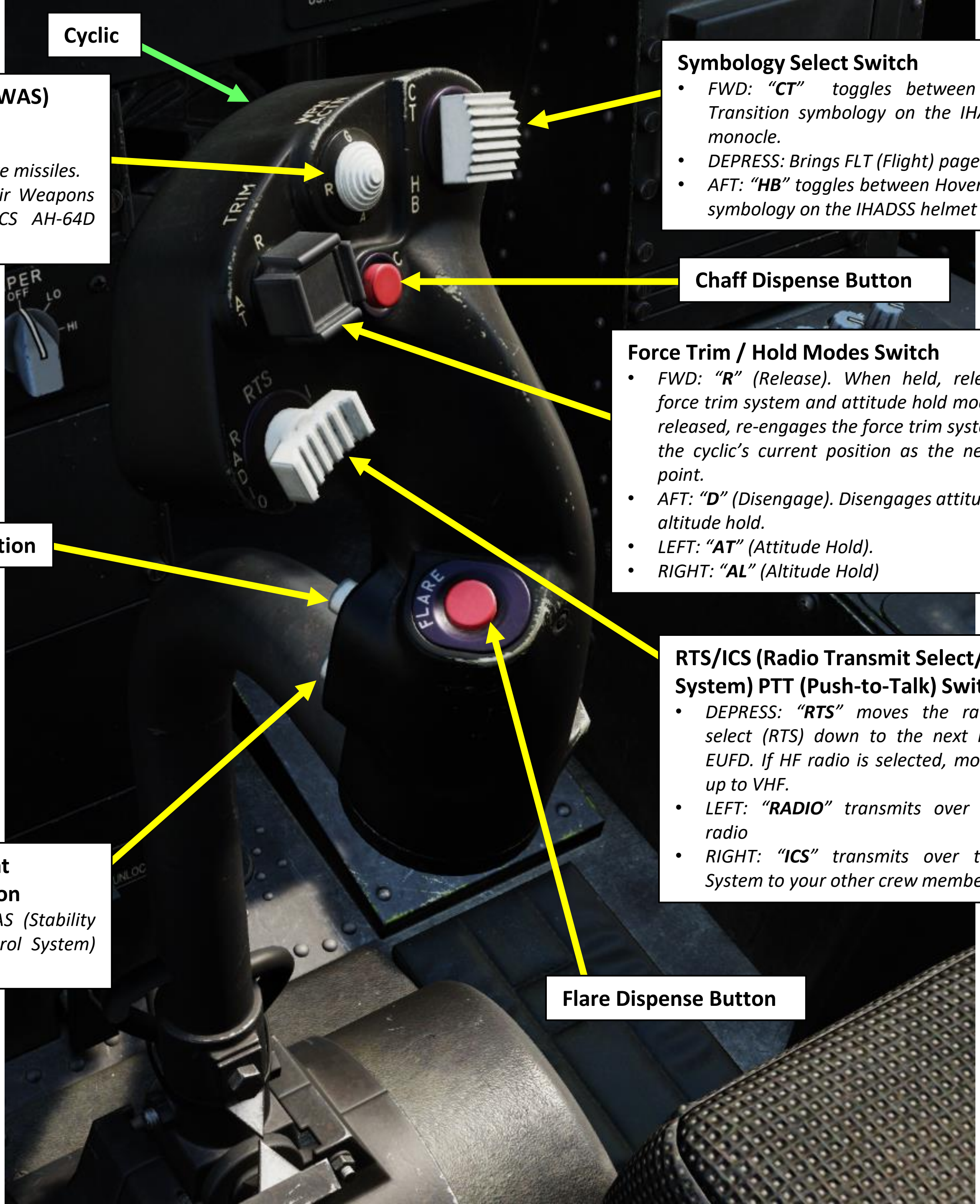
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

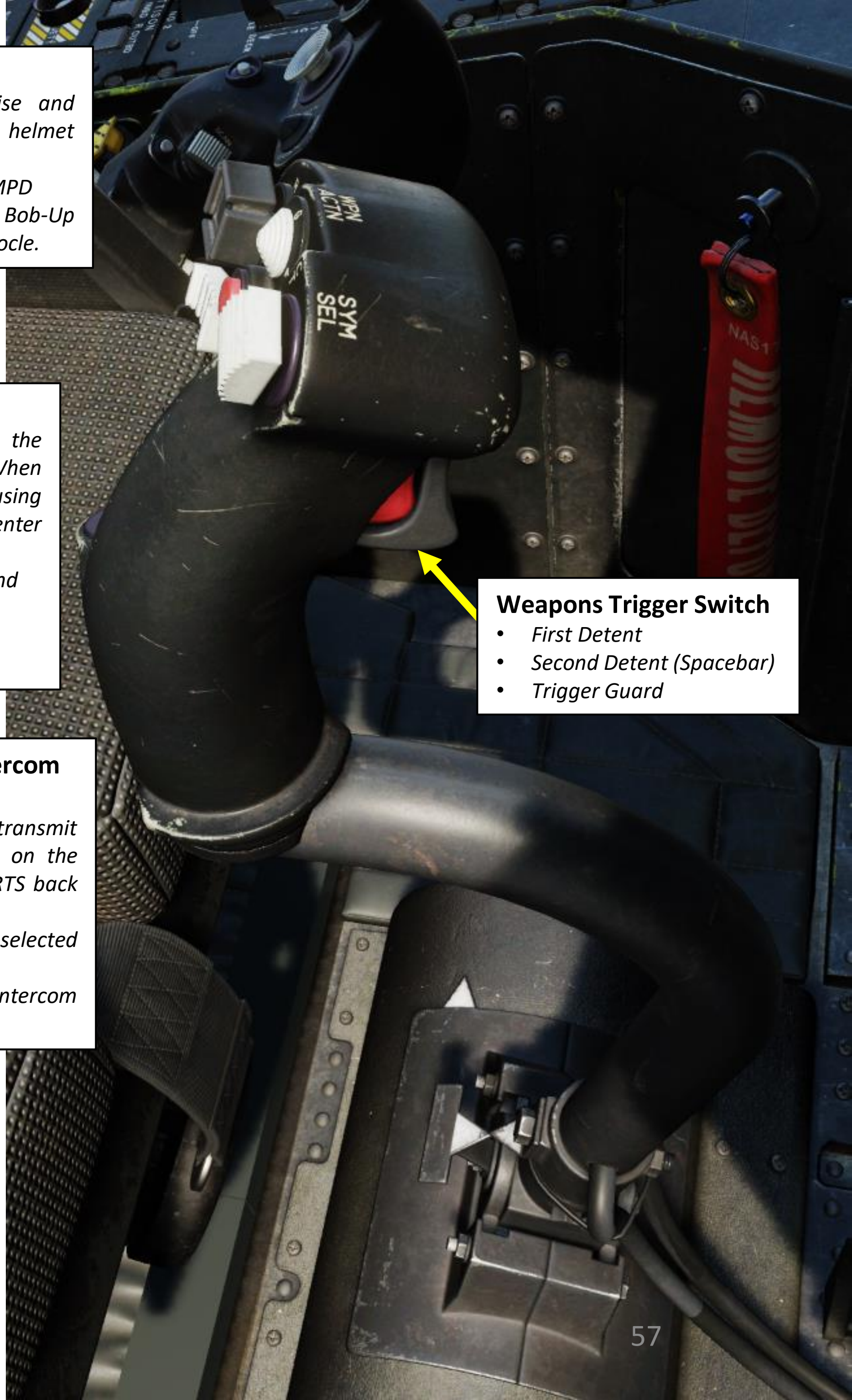






Pilot Cockpit





Cyclic

Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Chaff Dispense Button

Force Trim / Hold Modes Switch
- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*
- *AFT: "**D**" (Disengage). Disengages attitude and altitude hold.*
- *LEFT: "**AT**" (Attitude Hold).*
- *RIGHT: "**AL**" (Altitude Hold)*

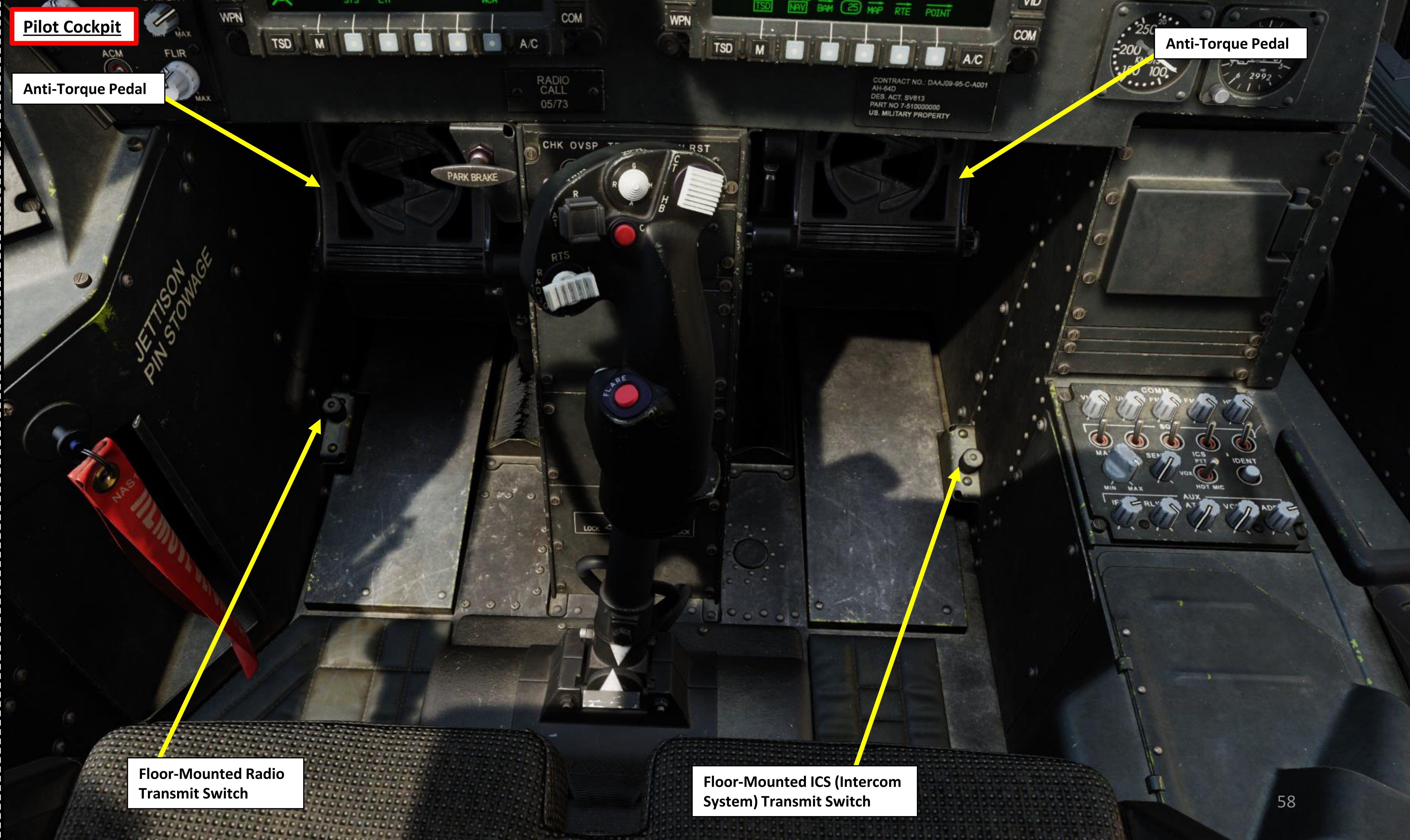
Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

No Function

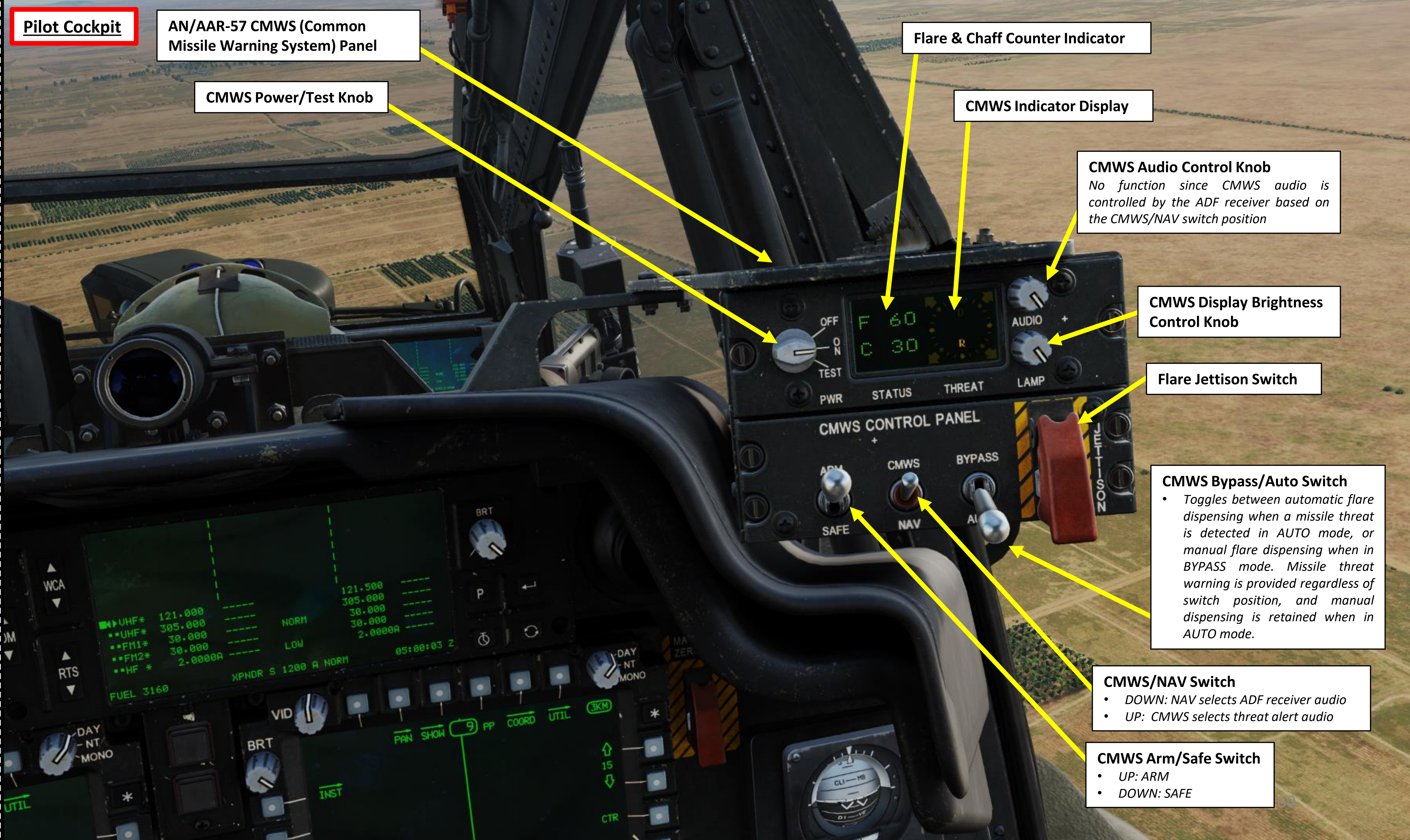
RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch
- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

FMC (Flight Management Computer) Release Button
- *Disengages all FMC SCAS (Stability and Augmentation Control System) channels.*

Flare Dispense Button

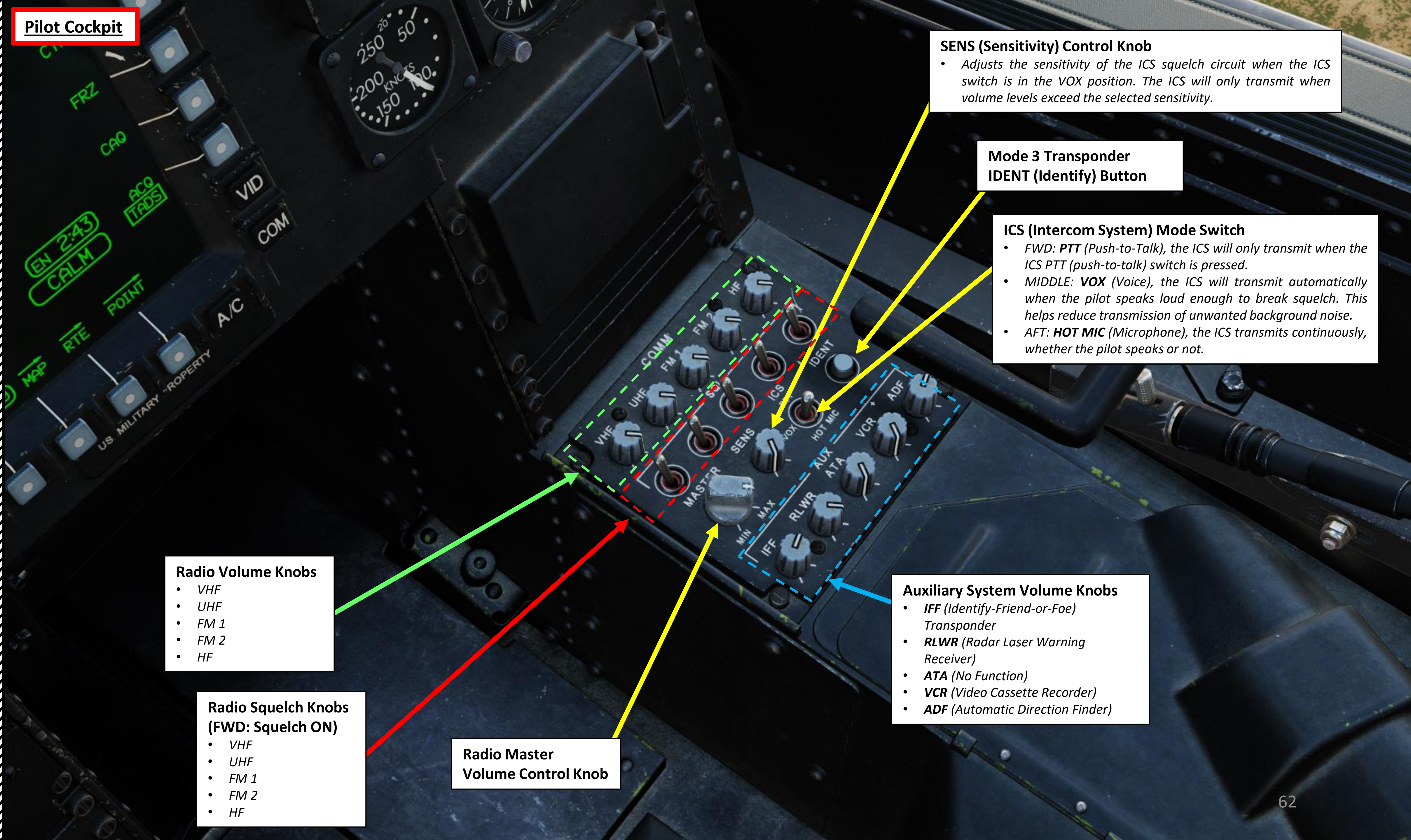

Pilot Cockpit
Anti-Torque Pedal
Anti-Torque Pedal
Floor-Mounted Radio Transmit Switch
Floor-Mounted ICS (Intercom System) Transmit Switch

Pilot Cockpit


Pilot Cockpit
AN/AAR-57 CMWS (Common Missile Warning System) Panel
CMWS Power/Test Knob
Flare & Chaff Counter Indicator
CMWS Indicator Display
CMWS Audio Control Knob
No function since CMWS audio is controlled by the ADF receiver based on the CMWS/NAV switch position
CMWS Display Brightness Control Knob
Flare Jettison Switch
CMWS Bypass/Auto Switch
• Toggles between automatic flare dispensing when a missile threat is detected in AUTO mode, or manual flare dispensing when in BYPASS mode. Missile threat warning is provided regardless of switch position, and manual dispensing is retained when in AUTO mode.
CMWS/NAV Switch
• DOWN: NAV selects ADF receiver audio
• UP: CMWS selects threat alert audio
CMWS Arm/Safe Switch
• UP: ARM
• DOWN: SAFE
CMWS CONTROL PANEL
OFF
ON
TEST
PWR
STATUS
THREAT
AUDIO
LAMP
ARM
SAFE
CMWS
NAV
BYPASS
JETTISON

Pilot Cockpit

Pilot Cockpit



SENS (Sensitivity) Control Knob
- *Adjusts the sensitivity of the ICS squelch circuit when the ICS switch is in the VOX position. The ICS will only transmit when volume levels exceed the selected sensitivity.*

Mode 3 Transponder IDENT (Identify) Button

ICS (Intercom System) Mode Switch
- *FWD: **PTT** (Push-to-Talk), the ICS will only transmit when the ICS PTT (push-to-talk) switch is pressed.*
- *MIDDLE: **VOX** (Voice), the ICS will transmit automatically when the pilot speaks loud enough to break squelch. This helps reduce transmission of unwanted background noise.*
- *AFT: **HOT MIC** (Microphone), the ICS transmits continuously, whether the pilot speaks or not.*

Radio Volume Knobs
- *VHF*
- *UHF*
- *FM 1*
- *FM 2*
- *HF*

Radio Squelch Knobs (FWD: Squelch ON)
- *VHF*
- *UHF*
- *FM 1*
- *FM 2*
- *HF*

Radio Master Volume Control Knob

Auxiliary System Volume Knobs
- ***IFF** (Identify-Friend-or-Foe) Transponder*
- ***RLWR** (Radar Laser Warning Receiver)*
- ***ATA** (No Function)*
- ***VCR** (Video Cassette Recorder)*
- ***ADF** (Automatic Direction Finder)*

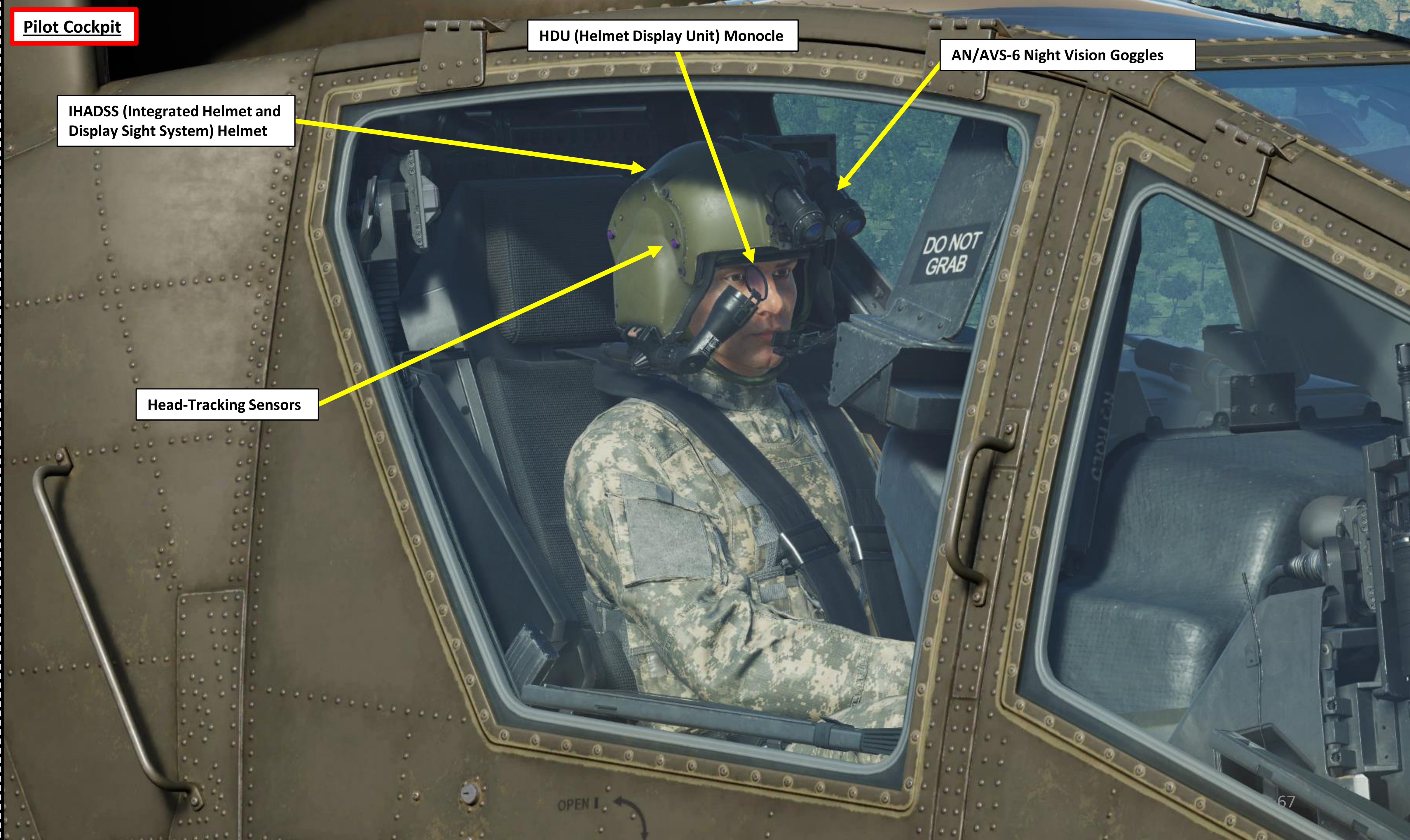
Pilot Cockpit

Pilot Cockpit

Pilot Cockpit

Pilot Cockpit

Pilot Cockpit



Pilot Cockpit

HDU (Helmet Display Unit) Monocle
Displays IHADSS (Integrated Helmet and Display Sight System) Data
- *Use "I" binding to show/hide IHADSS.*

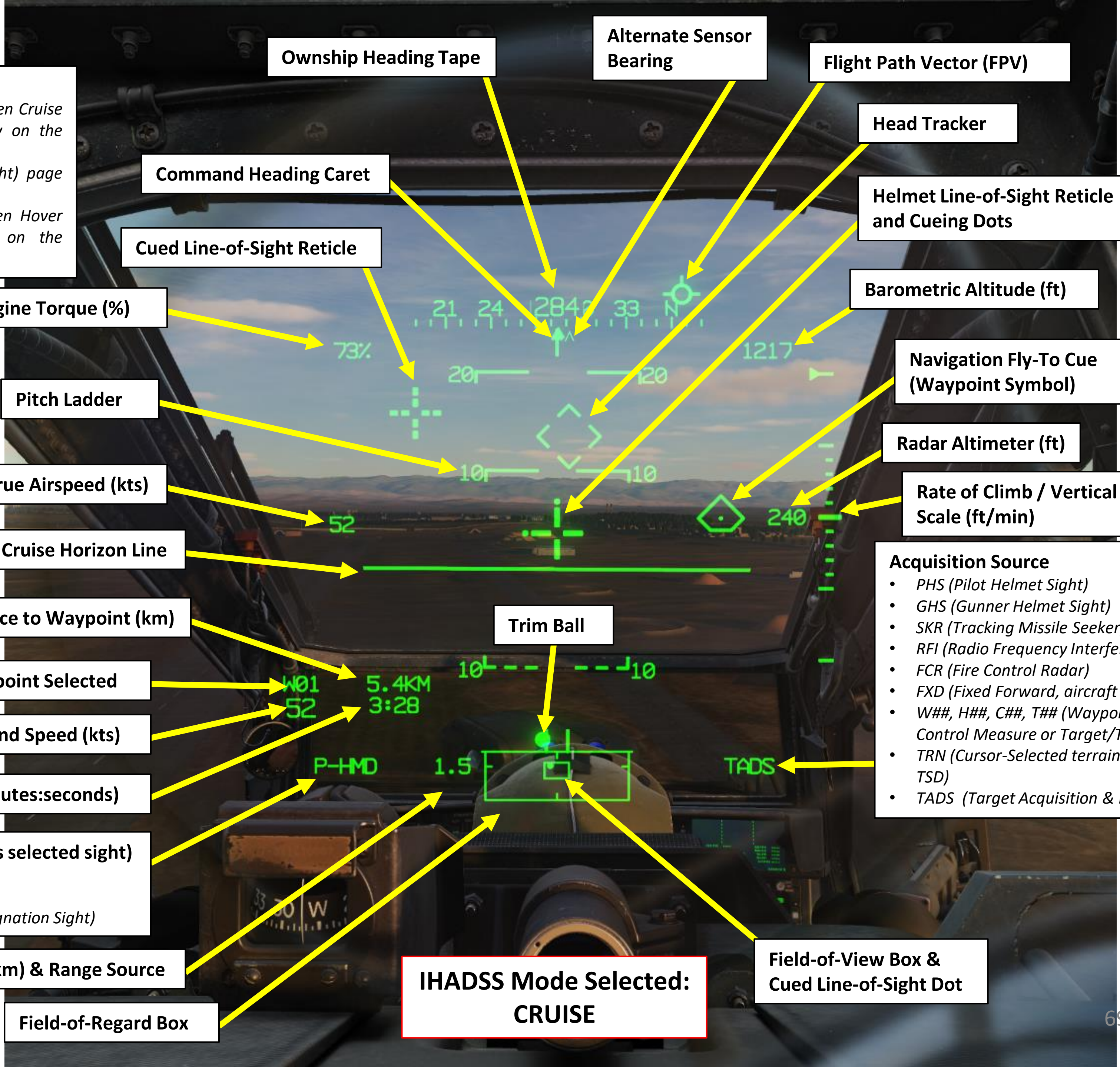
Pilot Cockpit

Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Notes about IHADSS CRUISE Mode:

- This mode is selected by toggling the Symbology Select Switch FWD (toggles between Cruise and Transition modes). CRUISE is typically used for instrument flying in low visibility conditions, but overall it is not very useful during normal flying operations.



Acquisition Source

- *PHS (Pilot Helmet Sight)*
- *GHS (Gunner Helmet Sight)*
- *SKR (Tracking Missile Seeker)*
- *RFI (Radio Frequency Interferometer)*
- *FCR (Fire Control Radar)*
- *FXD (Fixed Forward, aircraft centerline)*
- *W##, H##, C##, T## (Waypoint, Hazard, Control Measure or Target/Threat)*
- *TRN (Cursor-Selected terrain location on the TSD)*
- *TADS (Target Acquisition & Designation Sight)*

Sight Selection (Crewmember's selected sight)

- *HMD (Helmet Display)*
- *FCR (Fire Control Radar)*
- *TADS (Target Acquisition & Designation Sight)*

IHADSS Mode Selected: CRUISE

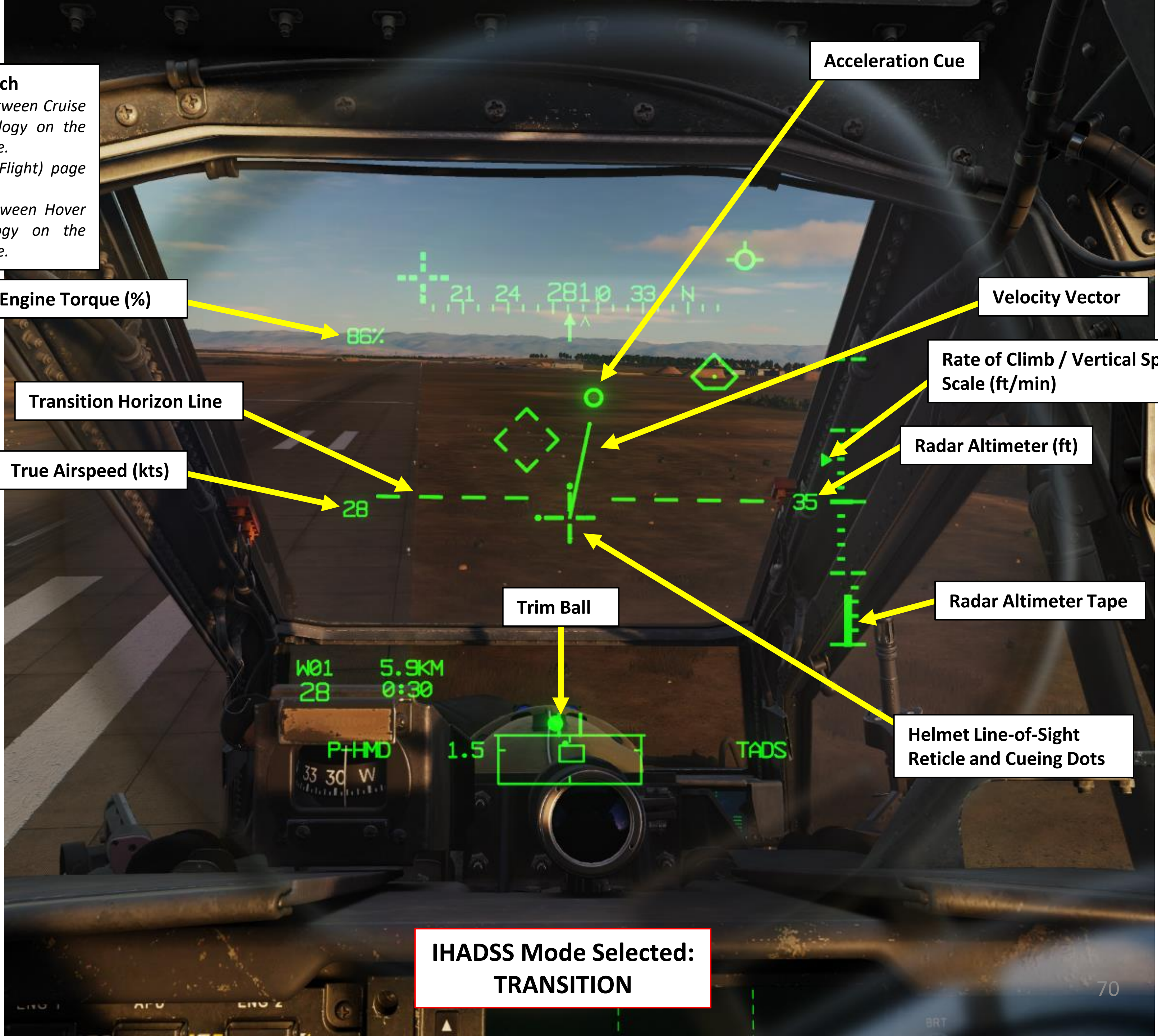
Pilot Cockpit

Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Notes about IHADSS TRANSITION Mode:

- This mode is selected by toggling the Symbology Select Switch FWD (toggles between Cruise and Transition modes). TRANSITION is typically used during most phases of flight unless you want to takeoff, land, or hover.



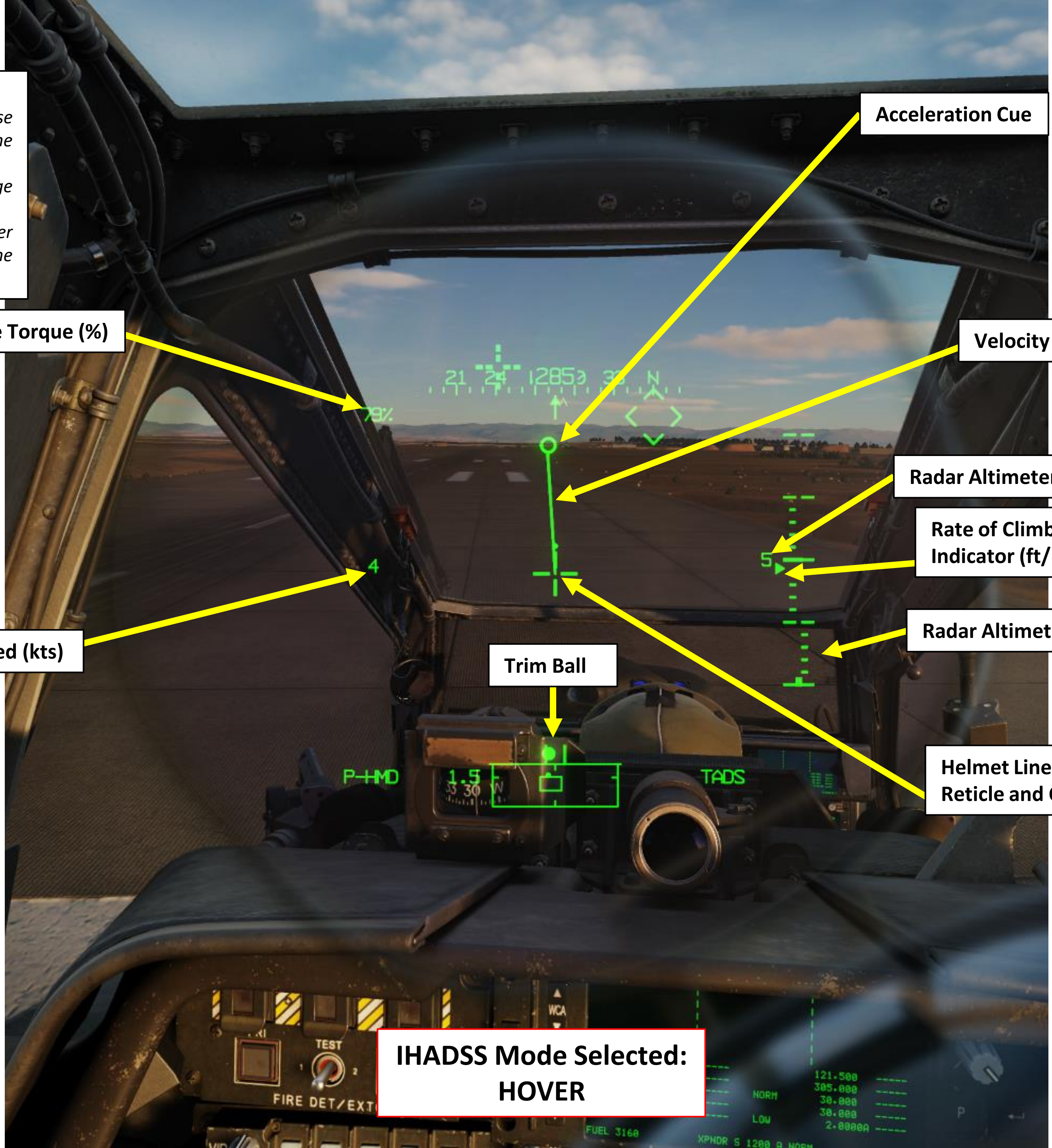
Pilot Cockpit

Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Notes about IHADSS HOVER Mode:

- This mode is selected by toggling the Symbology Select Switch AFT (toggles between Hover and Bob-Up modes). HOVER is typically used whenever you want to bring the helicopter into a hover.



IHADSS Mode Selected: HOVER

Pilot Cockpit

Symbology Select Switch

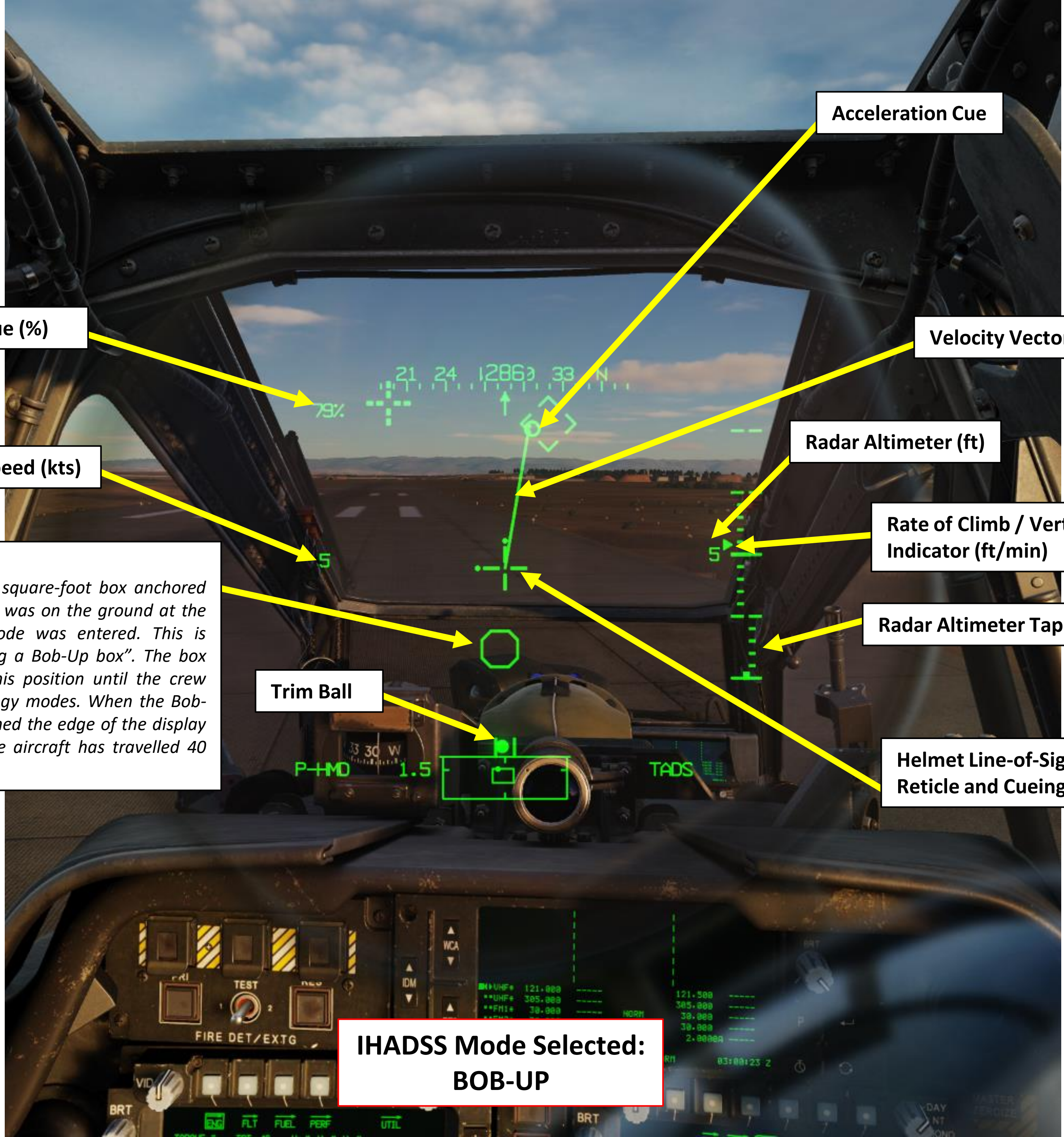
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Notes about IHADSS BOB-UP Mode:

- This mode is selected by toggling the Symbology Select Switch AFT (toggles between Hover and Bob-Up modes). BOB-UP is typically used whenever you want to settle the helicopter into a hover and stay at the current position. The Bob-Up box symbol moves as you drift away from the reference point (bob-up box) set when engaging this mode.

Bob-Up Box

- *Represents a 12 square-foot box anchored to the position it was on the ground at the time Bob-Up mode was entered. This is termed "dropping a Bob-Up box". The box will remain in this position until the crew changes symbology modes. When the Bob-Up box has reached the edge of the display ("saturated"), the aircraft has travelled 40 feet.*



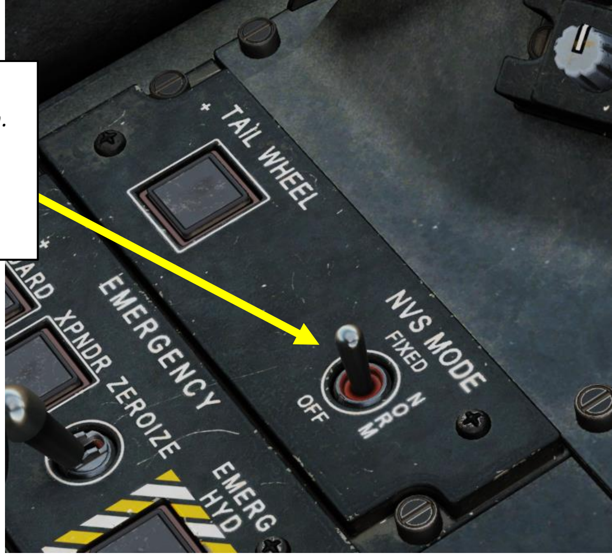
Pilot Cockpit

Pilot Cockpit

PNVS (Pilot Night Vision System) Overlay

Pilot NVS (Night Vision System) Mode Switch

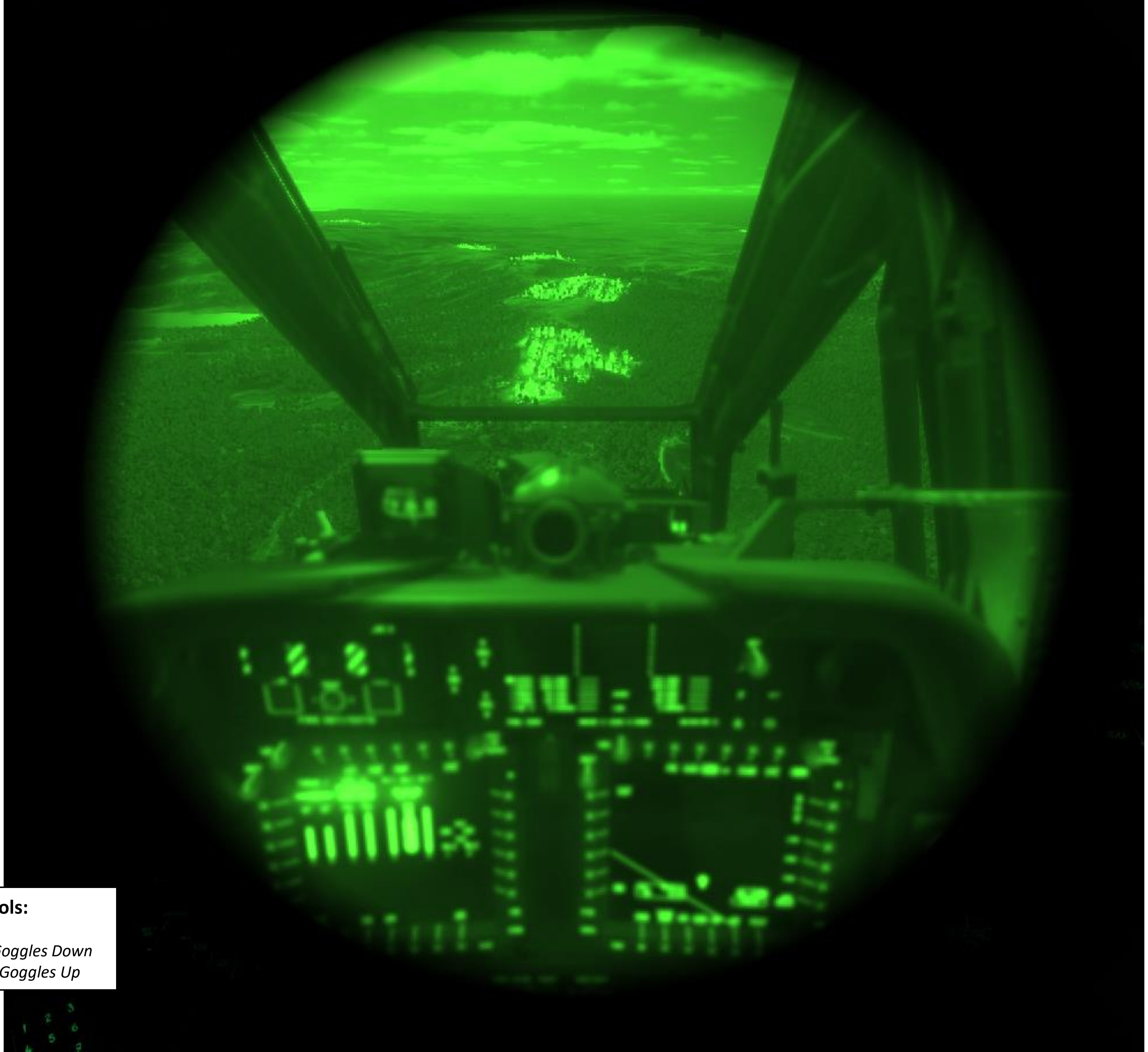
- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*



NVS (Night Vision System) Select Switch

- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

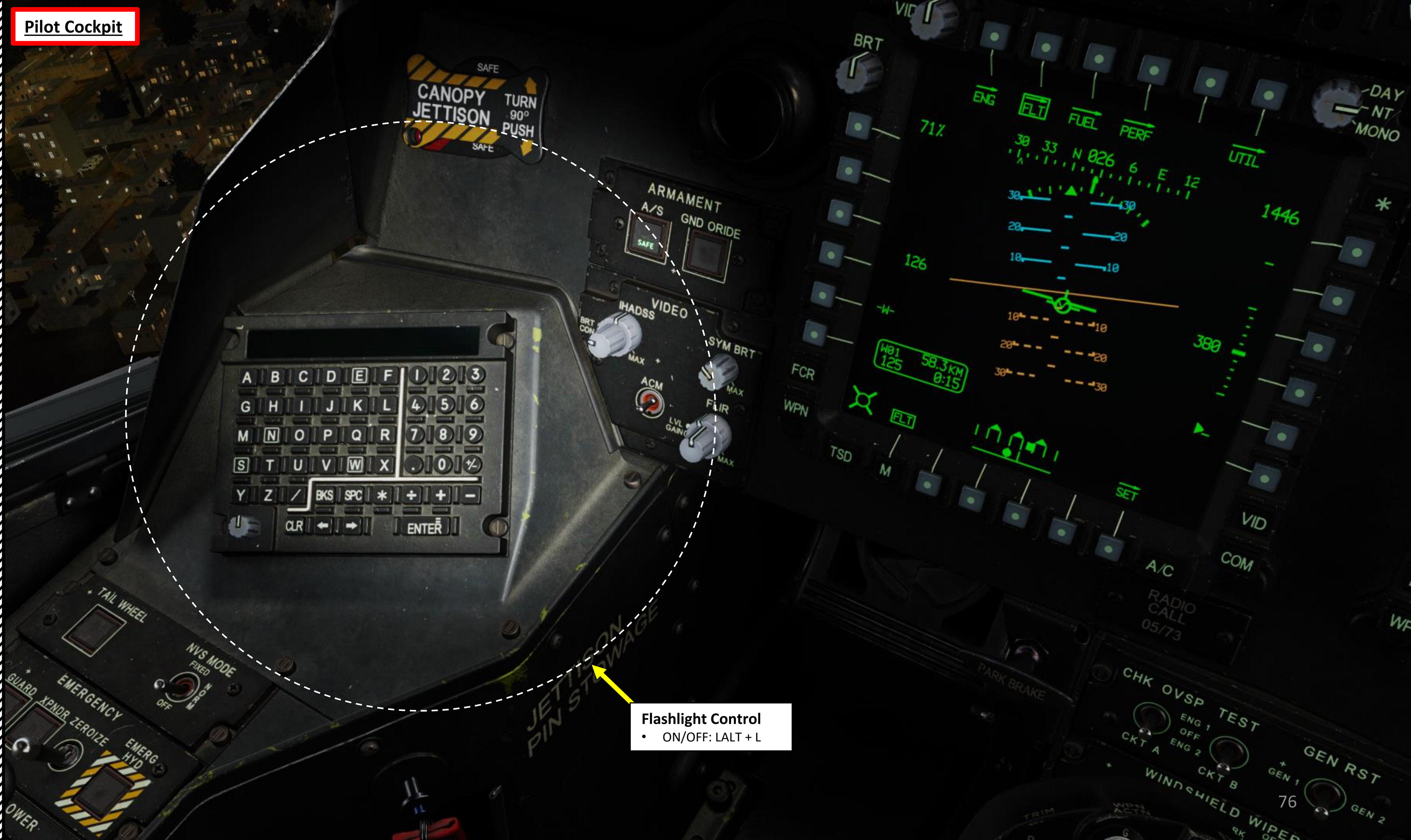
Pilot Cockpit



Night Vision Goggles (NVG) Controls:

- *RSHIFT+H: On/Off*
- *RSHIFT+RALT+H: Gain Night Vision Goggles Down*
- *RSHIFT+RCTRL+H: Gain Night Vision Goggles Up*

Pilot Cockpit



Flashlight Control
- ON/OFF: LALT + L

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

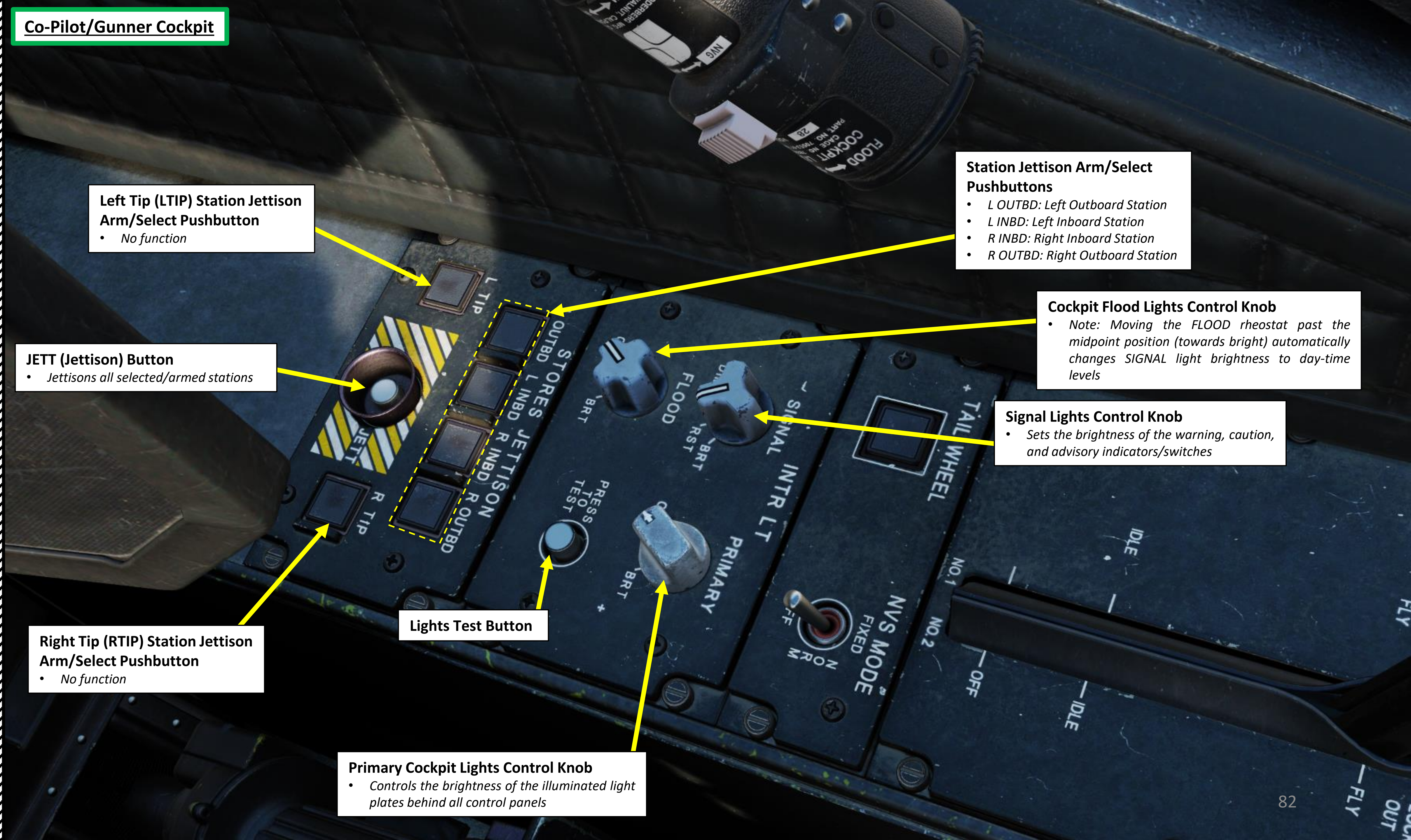
Tip: Co-Pilot/Gunner body can be toggled on/off by pressing “RSHIFT+P”

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit



Left Tip (LTIP) Station Jettison Arm/Select Pushbutton
- *No function*

Station Jettison Arm/Select Pushbuttons
- *L OUTBD: Left Outboard Station*
- *L INBD: Left Inboard Station*
- *R INBD: Right Inboard Station*
- *R OUTBD: Right Outboard Station*

Cockpit Flood Lights Control Knob
- *Note: Moving the FLOOD rheostat past the midpoint position (towards bright) automatically changes SIGNAL light brightness to day-time levels*

JETT (Jettison) Button
- *Jettisons all selected/armed stations*

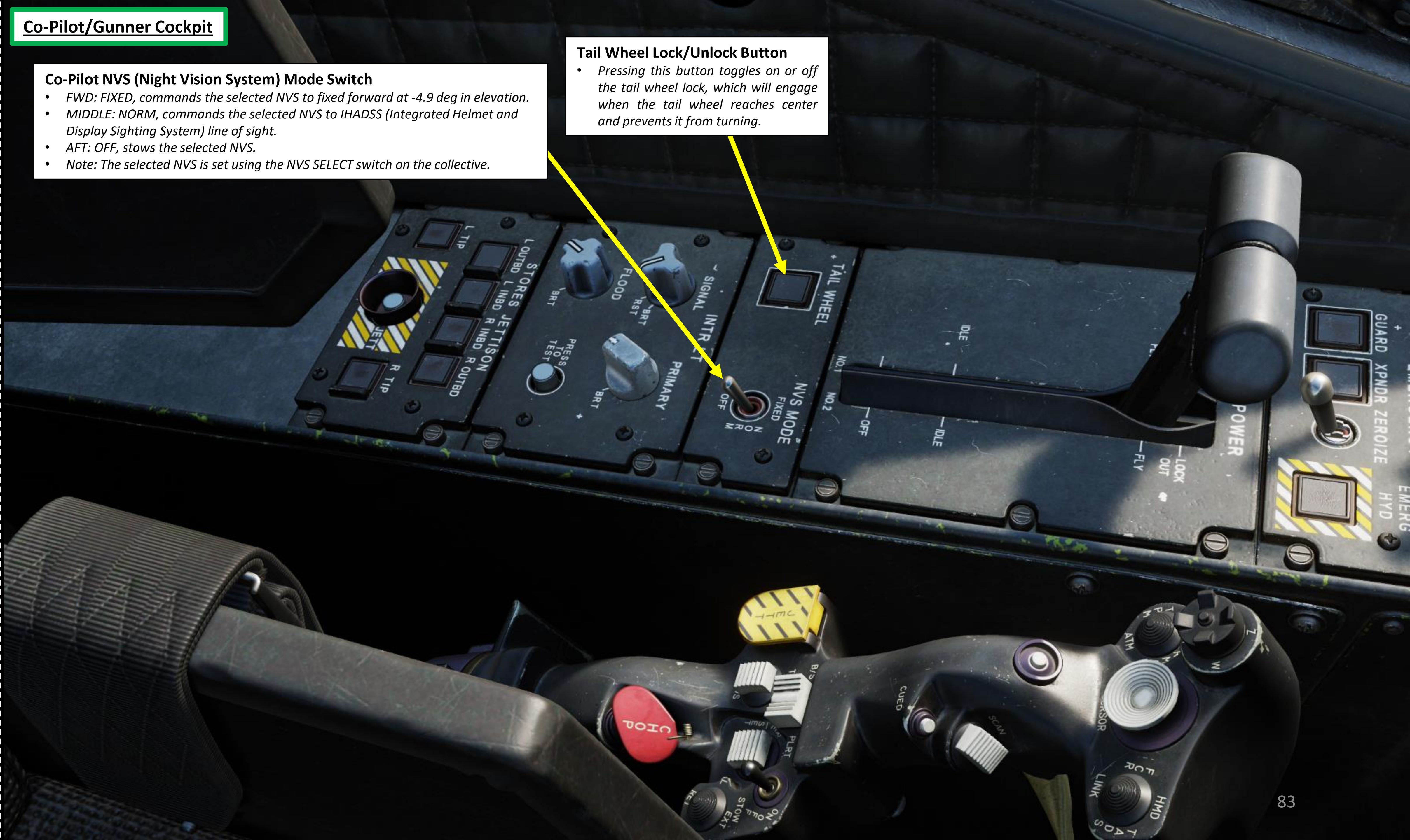
Signal Lights Control Knob
- *Sets the brightness of the warning, caution, and advisory indicators/switches*

Lights Test Button

Right Tip (RTIP) Station Jettison Arm/Select Pushbutton
- *No function*

Primary Cockpit Lights Control Knob
- *Controls the brightness of the illuminated light plates behind all control panels*

Co-Pilot/Gunner Cockpit



Co-Pilot NVS (Night Vision System) Mode Switch

- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*

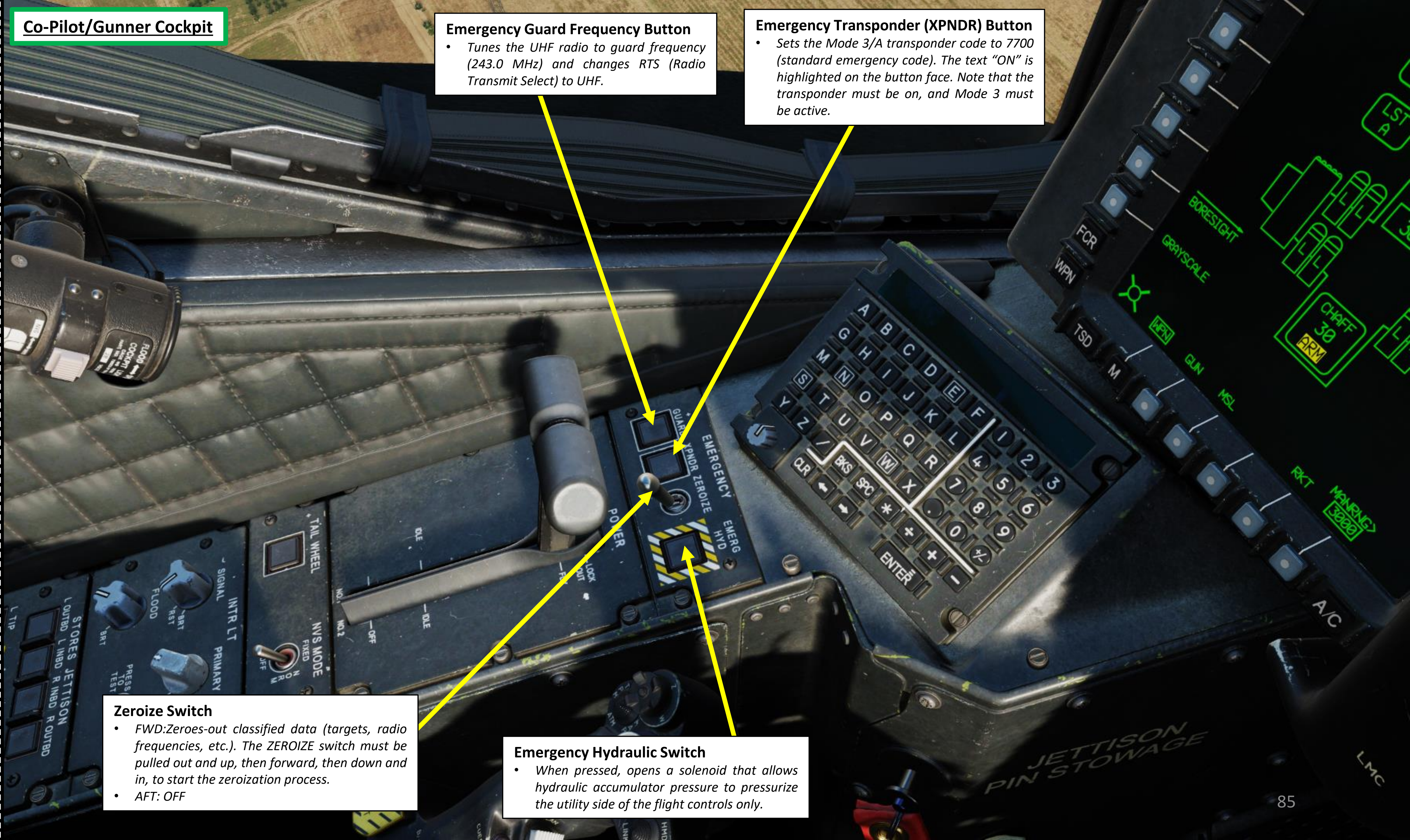
Tail Wheel Lock/Unlock Button

- *Pressing this button toggles on or off the tail wheel lock, which will engage when the tail wheel reaches center and prevents it from turning.*

Co-Pilot/Gunner Cockpit

Power (PWR) Levers (Left/Right Engines)

- ***OFF***
- ***IDLE****: Sets Ground IDLE RPM*
- ***FLY****: Sets N_R (Rotor RPM) for flight operations. Controlled N_R is 101 %, maintained by the PAS (Power Available Spindle)*
- ***LOCK OUT****: Disables the turbine gas temperature (TGT) limiting system by locking out the DEC (Digital Engine Computer), allowing for manual control of engine RPM.*
    - *Note: After moving the power lever to LOCK OUT, it should immediately be returned to an intermediate position between IDLE and FLY. The pilot can then control engine RPM directly using the power lever.*



Co-Pilot/Gunner Cockpit

Emergency Guard Frequency Button

- *Tunes the UHF radio to guard frequency (243.0 MHz) and changes RTS (Radio Transmit Select) to UHF.*

Emergency Transponder (XPNDR) Button

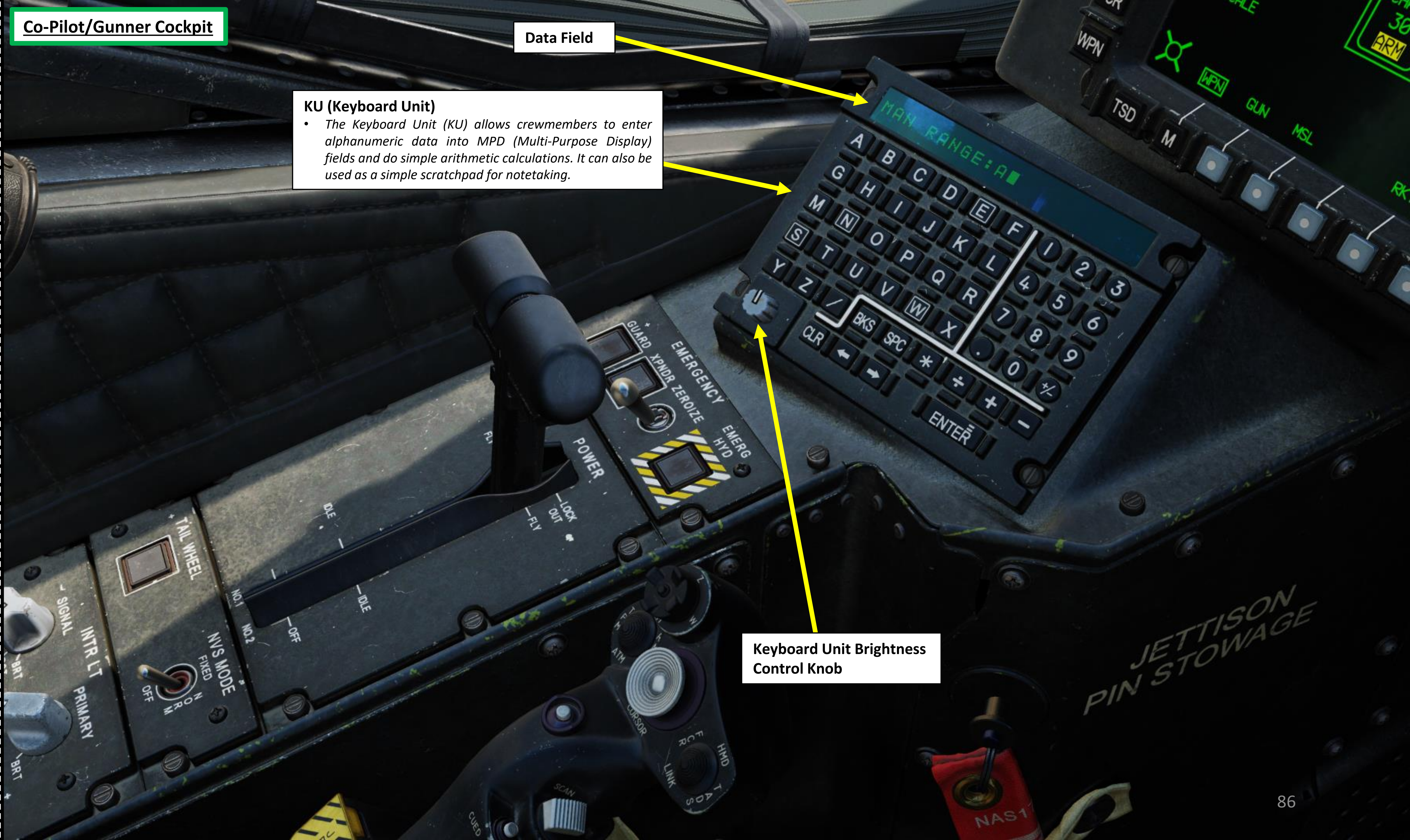
- *Sets the Mode 3/A transponder code to 7700 (standard emergency code). The text "ON" is highlighted on the button face. Note that the transponder must be on, and Mode 3 must be active.*

Zeroize Switch

- *FWD:Zeroes-out classified data (targets, radio frequencies, etc.). The ZEROIZE switch must be pulled out and up, then forward, then down and in, to start the zeroization process.*
- *AFT: OFF*

Emergency Hydraulic Switch

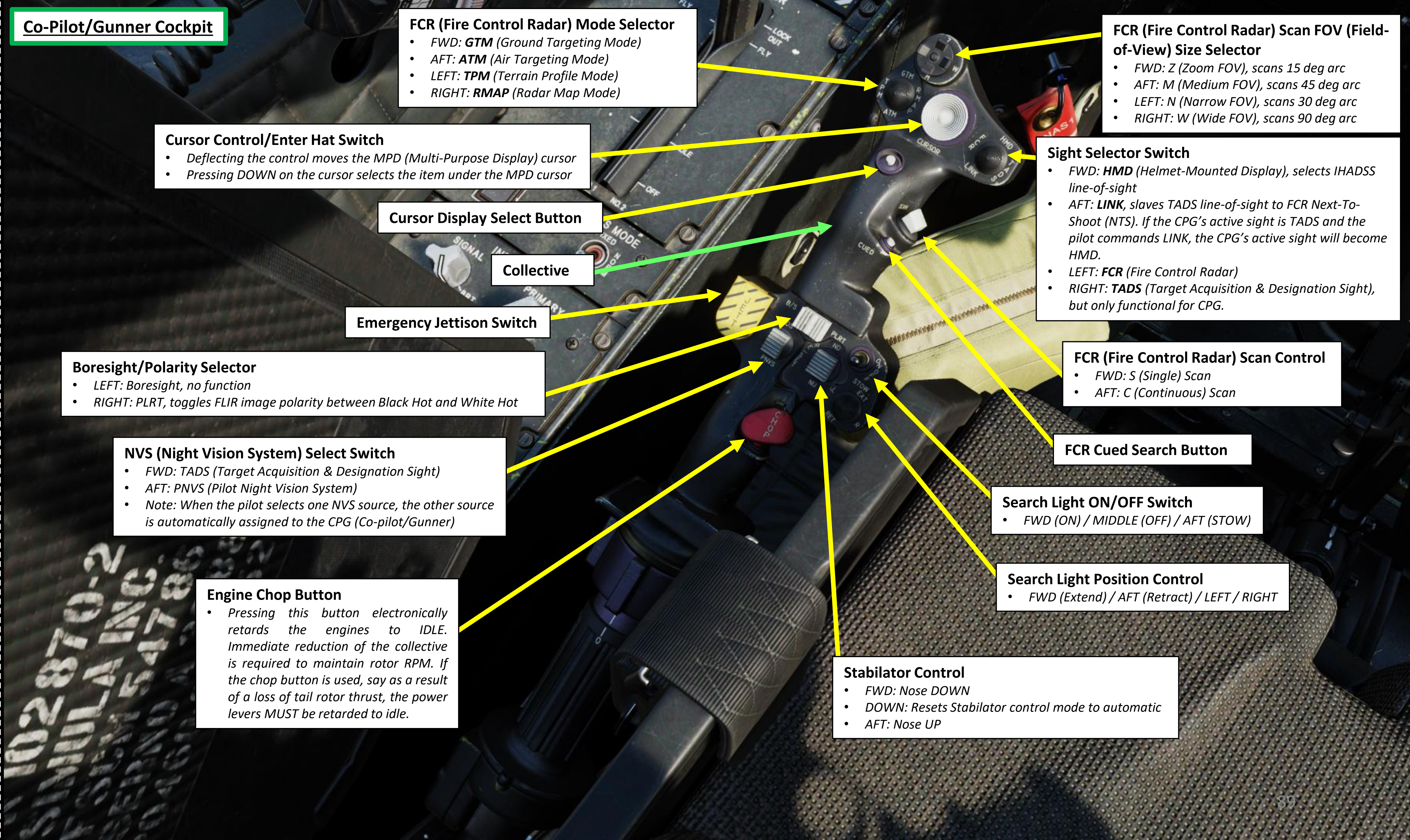
- *When pressed, opens a solenoid that allows hydraulic accumulator pressure to pressurize the utility side of the flight controls only.*


Co-Pilot/Gunner Cockpit
Data Field
KU (Keyboard Unit)
• The Keyboard Unit (KU) allows crewmembers to enter alphanumeric data into MPD (Multi-Purpose Display) fields and do simple arithmetic calculations. It can also be used as a simple scratchpad for notetaking.
Keyboard Unit Brightness Control Knob
MAN RANGE:A
ENTER
CLR
BKS
SPC
EMERGENCY
GUARD
XPNDR ZEROIZE
EMERG HYD
POWER
LOCK OUT
FLY
IDLE
OFF
NO.1
NO.2
TAIL WHEEL
NVS MODE
FIXED
NORM
OFF
INTR LT
PRIMARY
SIGNAL
BRT
JETTISON PIN STOWAGE
TSD
WPN
GUN
MSL

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit



FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

Cursor Display Select Button

Collective

Emergency Jettison Switch

Boresight/Polarity Selector
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

Engine Chop Button
- *Pressing this button electronically retards the engines to IDLE. Immediate reduction of the collective is required to maintain rotor RPM. If the chop button is used, say as a result of a loss of tail rotor thrust, the power levers MUST be retarded to idle.*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

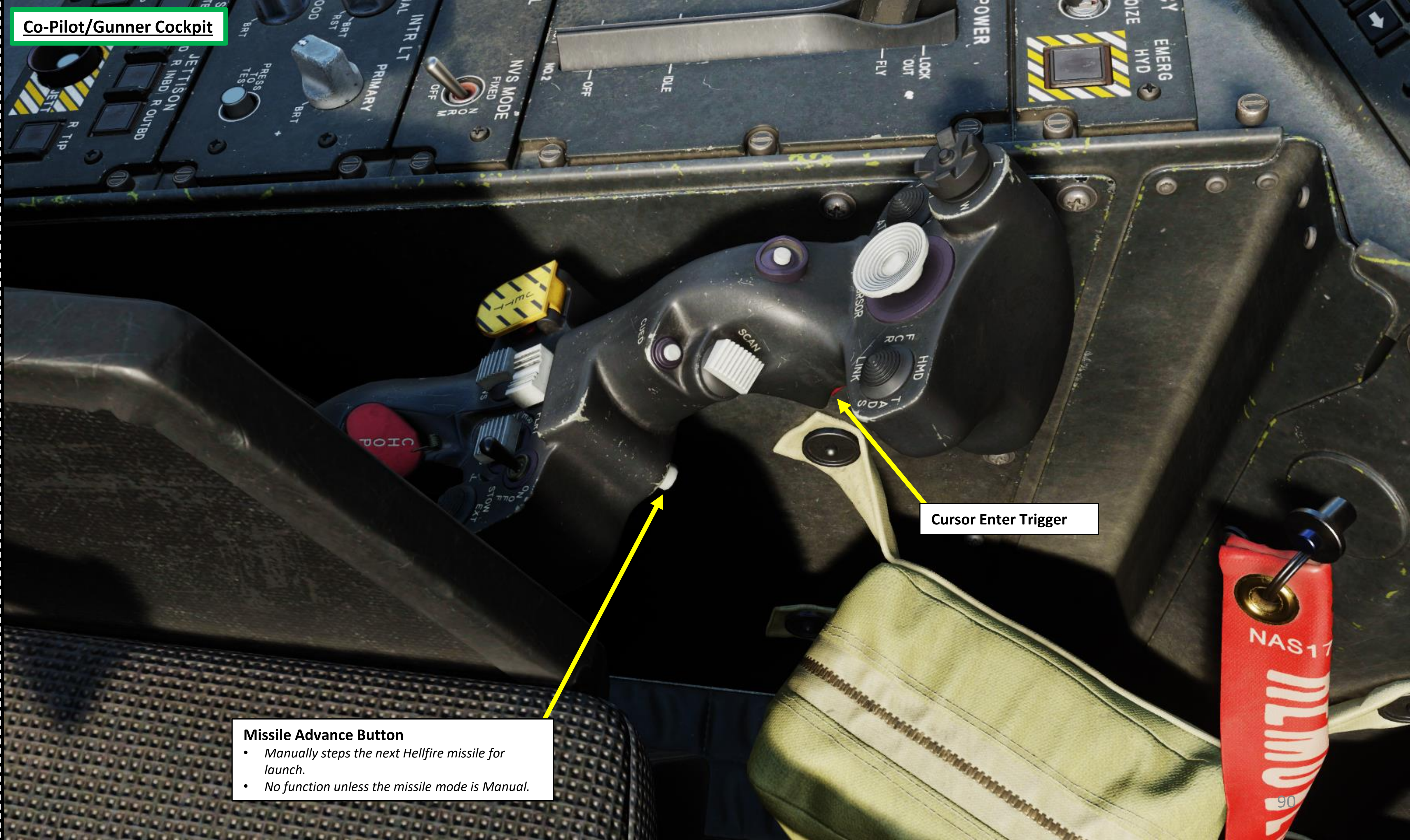
FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

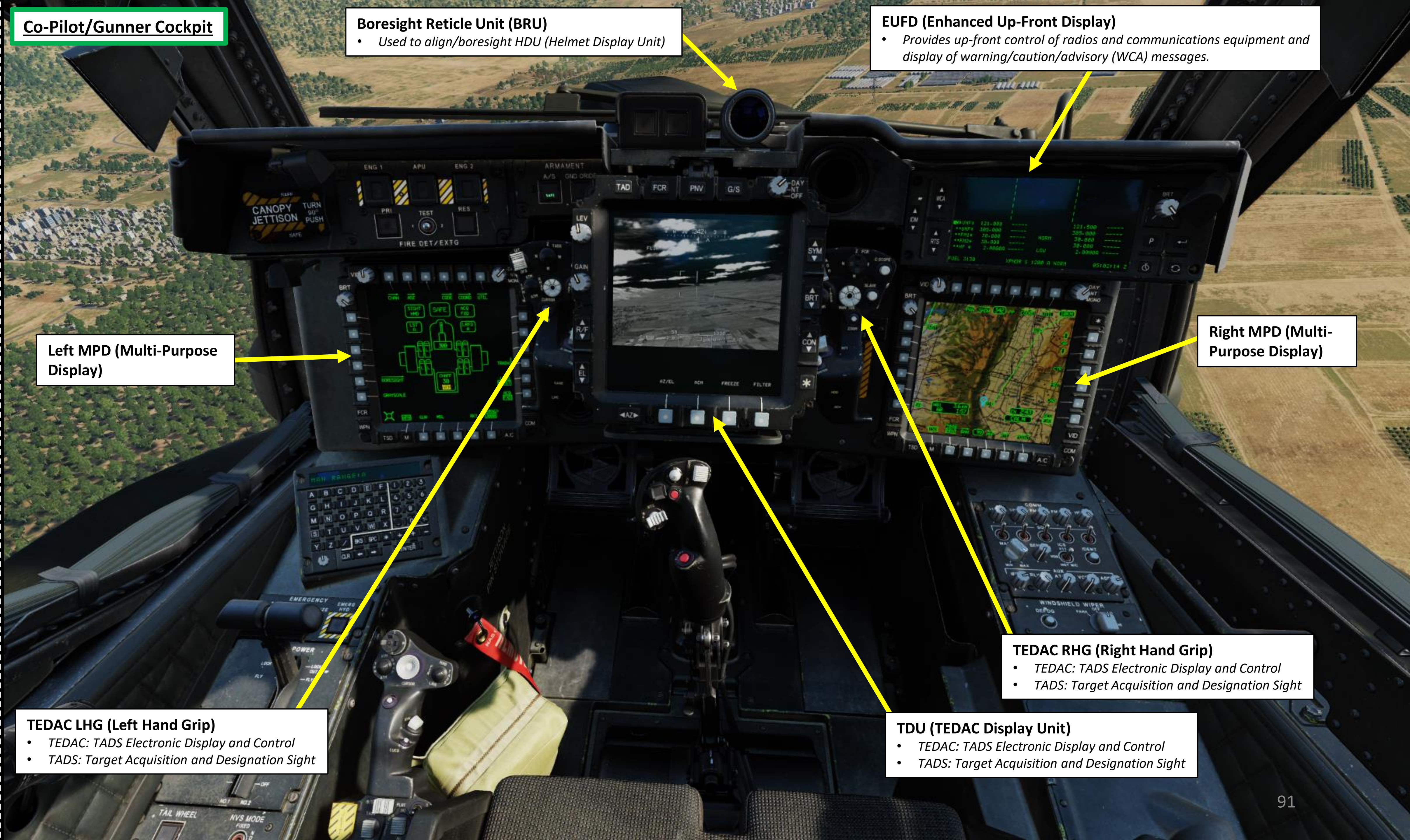
FCR Cued Search Button

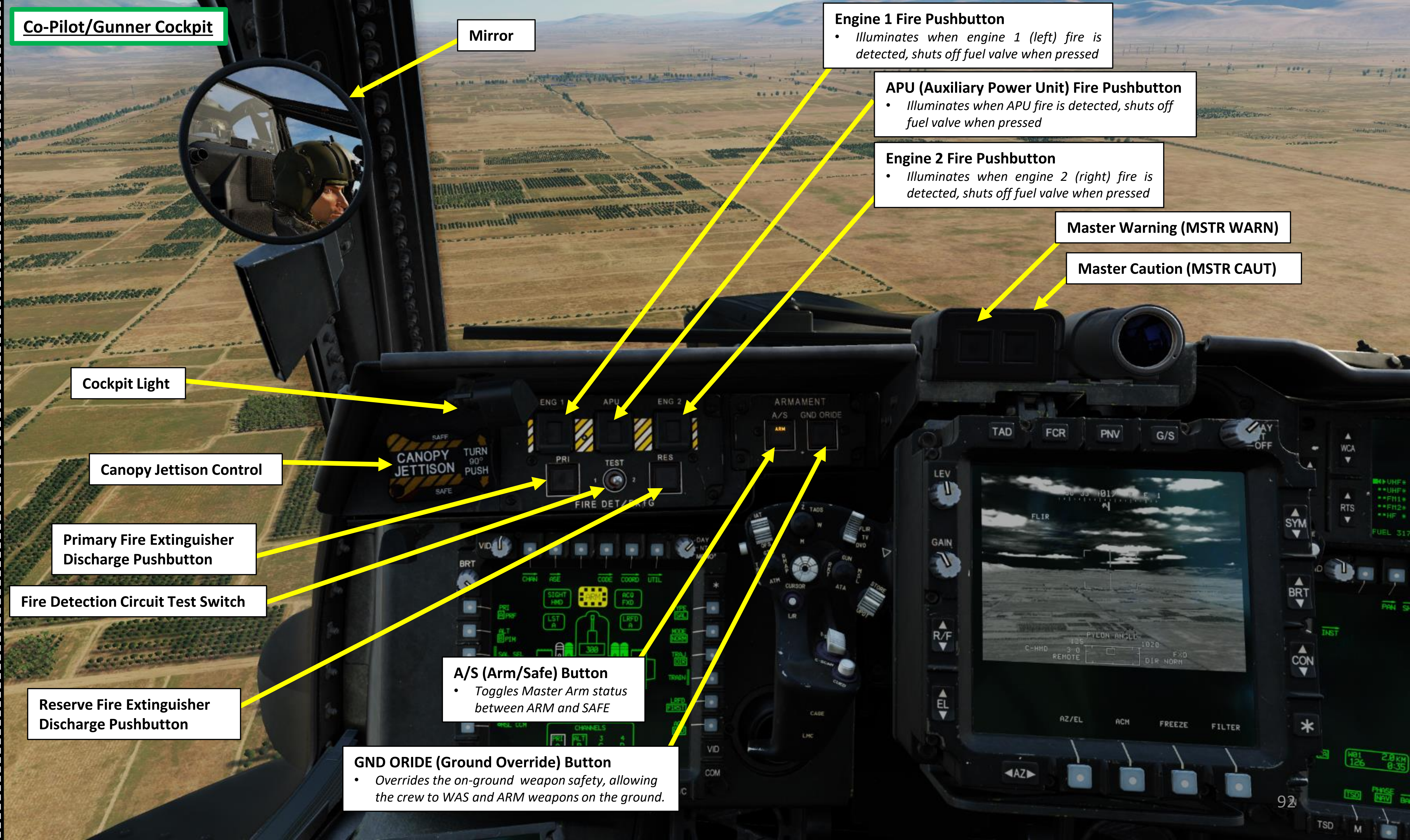
Search Light ON/OFF Switch
- *FWD (ON) / MIDDLE (OFF) / AFT (STOW)*

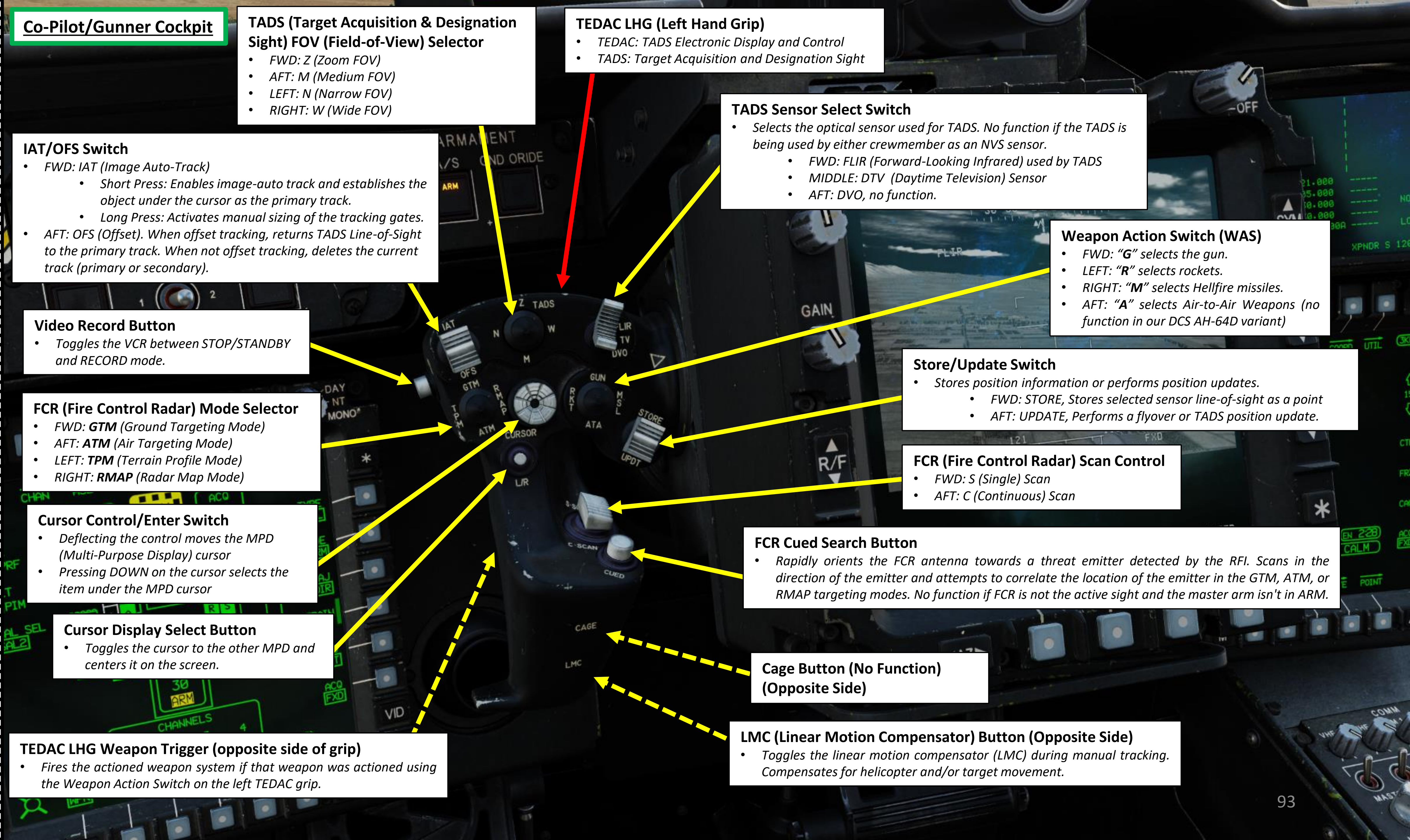
Search Light Position Control
- *FWD (Extend) / AFT (Retract) / LEFT / RIGHT*

Stabilator Control
- *FWD: Nose DOWN*
- *DOWN: Resets Stabilator control mode to automatic*
- *AFT: Nose UP*


Co-Pilot/Gunner Cockpit
Cursor Enter Trigger
Missile Advance Button
• Manually steps the next Hellfire missile for launch.
• No function unless the missile mode is Manual.


Co-Pilot/Gunner Cockpit
Boresight Reticle Unit (BRU)
• Used to align/boresight HDU (Helmet Display Unit)
EUFD (Enhanced Up-Front Display)
• Provides up-front control of radios and communications equipment and display of warning/caution/advisory (WCA) messages.
Left MPD (Multi-Purpose Display)
Right MPD (Multi-Purpose Display)
TEDAC RHG (Right Hand Grip)
• TEDAC: TADS Electronic Display and Control
• TADS: Target Acquisition and Designation Sight
TEDAC LHG (Left Hand Grip)
• TEDAC: TADS Electronic Display and Control
• TADS: Target Acquisition and Designation Sight
TDU (TEDAC Display Unit)
• TEDAC: TADS Electronic Display and Control
• TADS: Target Acquisition and Designation Sight


Co-Pilot/Gunner Cockpit
Mirror
Engine 1 Fire Pushbutton
• Illuminates when engine 1 (left) fire is detected, shuts off fuel valve when pressed
APU (Auxiliary Power Unit) Fire Pushbutton
• Illuminates when APU fire is detected, shuts off fuel valve when pressed
Engine 2 Fire Pushbutton
• Illuminates when engine 2 (right) fire is detected, shuts off fuel valve when pressed
Master Warning (MSTR WARN)
Master Caution (MSTR CAUT)
Cockpit Light
Canopy Jettison Control
Primary Fire Extinguisher Discharge Pushbutton
Fire Detection Circuit Test Switch
Reserve Fire Extinguisher Discharge Pushbutton
A/S (Arm/Safe) Button
• Toggles Master Arm status between ARM and SAFE
GND ORIDE (Ground Override) Button
• Overrides the on-ground weapon safety, allowing the crew to WAS and ARM weapons on the ground.
ENG 1
APU
ENG 2
ARMAMENT
A/S
GND ORIDE
CANOPY JETTISON
TURN 90° PUSH
SAFE
PRI
TEST
RES
FIRE DET/EXTG
TAD
FCR
PNV
G/S
LEV
GAIN
BRT
SYM
CON
AZ/EL
ACM
FREEZE
FILTER



Co-Pilot/Gunner Cockpit

TADS (Target Acquisition & Designation Sight) FOV (Field-of-View) Selector
- *FWD: Z (Zoom FOV)*
- *AFT: M (Medium FOV)*
- *LEFT: N (Narrow FOV)*
- *RIGHT: W (Wide FOV)*

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TADS Sensor Select Switch
- *Selects the optical sensor used for TADS. No function if the TADS is being used by either crewmember as an NVS sensor.*
  - *FWD: FLIR (Forward-Looking Infrared) used by TADS*
  - *MIDDLE: DTV (Daytime Television) Sensor*
  - *AFT: DVO, no function.*

IAT/OFS Switch
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Video Record Button
- *Toggles the VCR between STOP/STANDBY and RECORD mode.*

Store/Update Switch
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

FCR Cued Search Button
- *Rapidly orients the FCR antenna towards a threat emitter detected by the RFI. Scans in the direction of the emitter and attempts to correlate the location of the emitter in the GTM, ATM, or RMAP targeting modes. No function if FCR is not the active sight and the master arm isn't in ARM.*

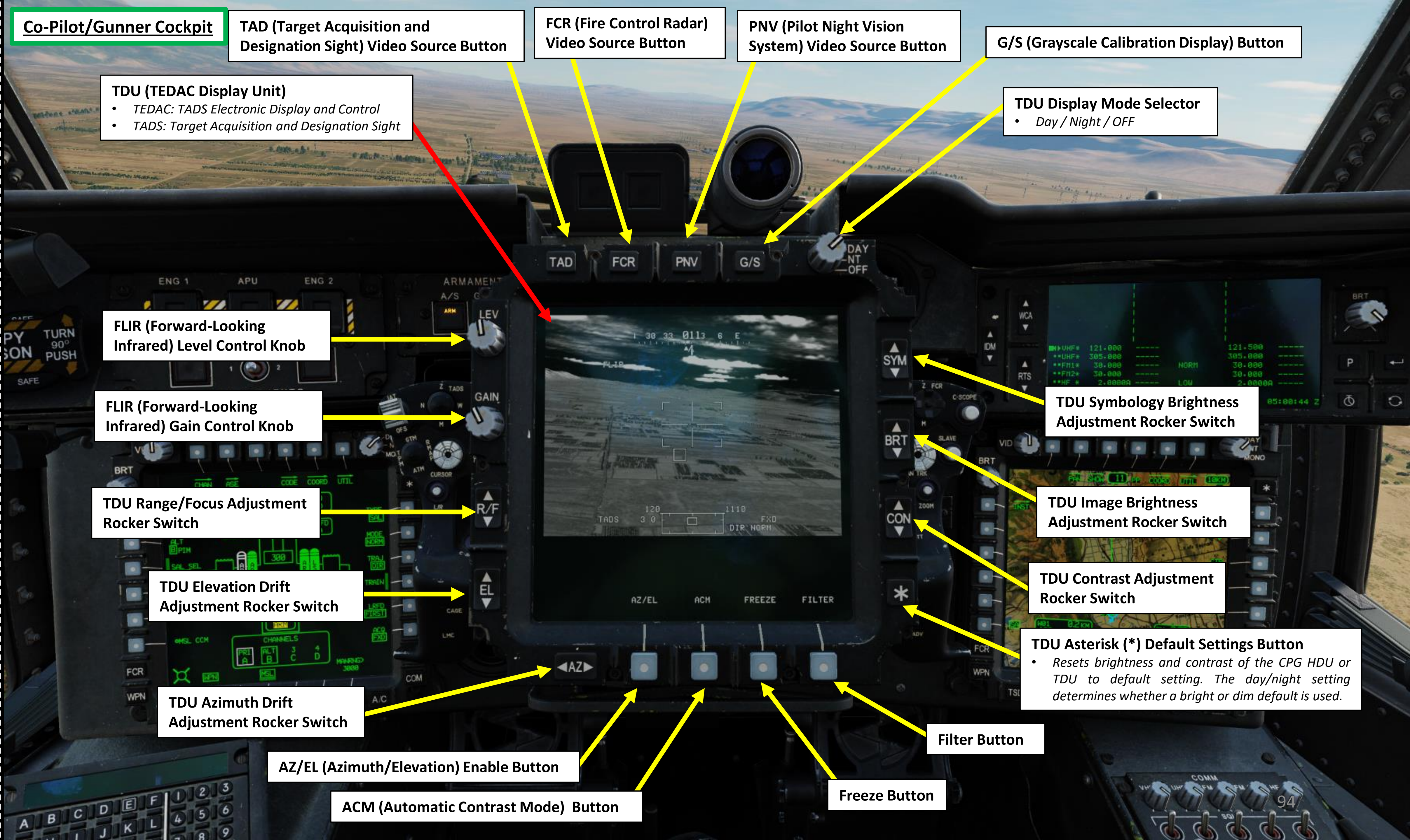
Cursor Display Select Button
- *Toggles the cursor to the other MPD and centers it on the screen.*

Cage Button (No Function) (Opposite Side)

TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

LMC (Linear Motion Compensator) Button (Opposite Side)
- *Toggles the linear motion compensator (LMC) during manual tracking. Compensates for helicopter and/or target movement.*

Co-Pilot/Gunner Cockpit



TAD (Target Acquisition and Designation Sight) Video Source Button

FCR (Fire Control Radar) Video Source Button

PNV (Pilot Night Vision System) Video Source Button

G/S (Grayscale Calibration Display) Button

TDU (TEDAC Display Unit)

- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TDU Display Mode Selector

- *Day / Night / OFF*

FLIR (Forward-Looking Infrared) Level Control Knob

FLIR (Forward-Looking Infrared) Gain Control Knob

TDU Range/Focus Adjustment Rocker Switch

TDU Elevation Drift Adjustment Rocker Switch

TDU Azimuth Drift Adjustment Rocker Switch

AZ/EL (Azimuth/Elevation) Enable Button

ACM (Automatic Contrast Mode) Button

Freeze Button

Filter Button

TDU Symbology Brightness Adjustment Rocker Switch

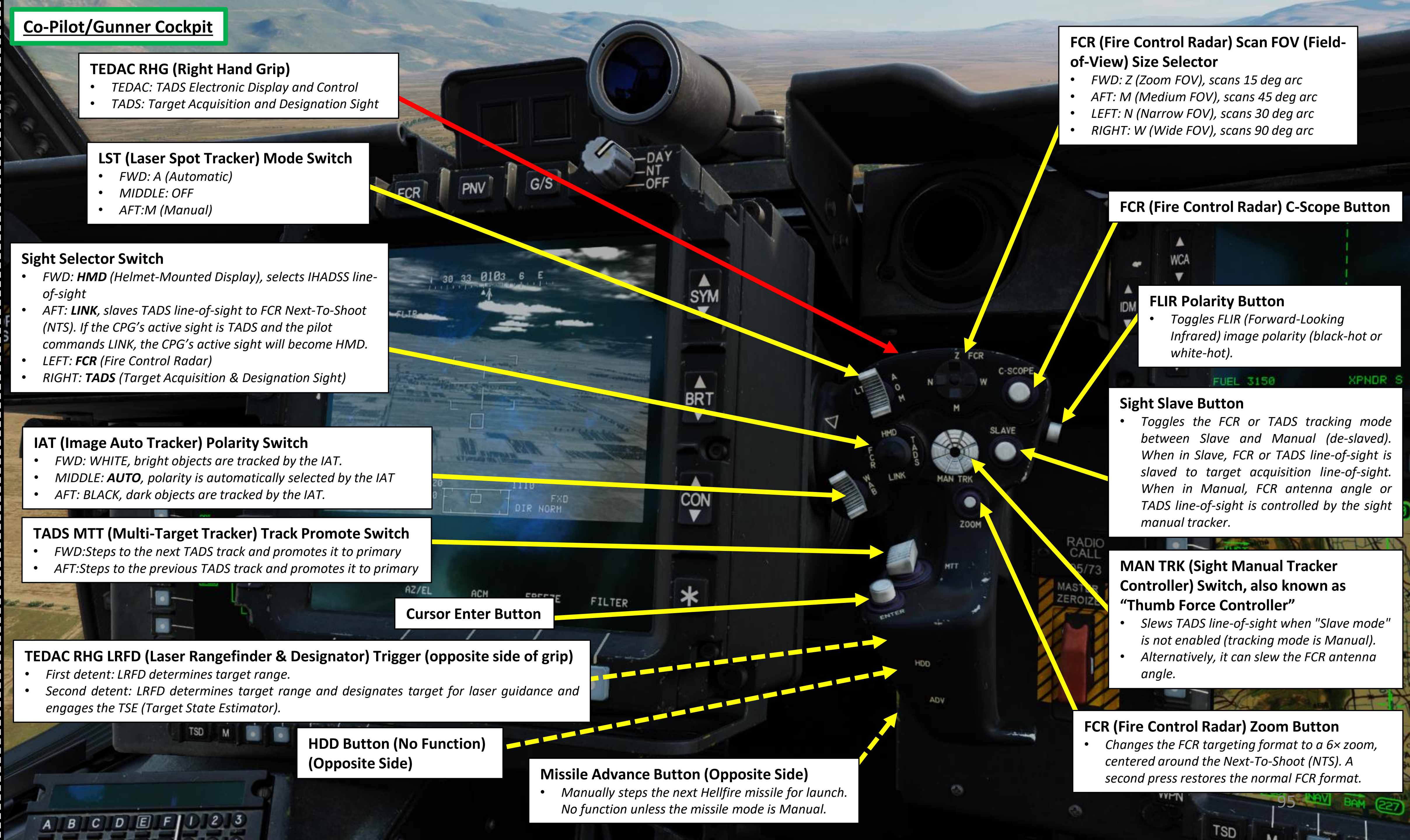
TDU Image Brightness Adjustment Rocker Switch

TDU Contrast Adjustment Rocker Switch

TDU Asterisk (*) Default Settings Button

- *Resets brightness and contrast of the CPG HDU or TDU to default setting. The day/night setting determines whether a bright or dim default is used.*

Co-Pilot/Gunner Cockpit



TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

LST (Laser Spot Tracker) Mode Switch
- *FWD: A (Automatic)*
- *MIDDLE: OFF*
- *AFT:M (Manual)*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

IAT (Image Auto Tracker) Polarity Switch
- *FWD: WHITE, bright objects are tracked by the IAT.*
- *MIDDLE: **AUTO**, polarity is automatically selected by the IAT*
- *AFT: BLACK, dark objects are tracked by the IAT.*

TADS MTT (Multi-Target Tracker) Track Promote Switch
- *FWD:Steps to the next TADS track and promotes it to primary*
- *AFT:Steps to the previous TADS track and promotes it to primary*

Cursor Enter Button

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)
- *First detent: LRFD determines target range.*
- *Second detent: LRFD determines target range and designates target for laser guidance and engages the TSE (Target State Estimator).*

HDD Button (No Function) (Opposite Side)

Missile Advance Button (Opposite Side)
- *Manually steps the next Hellfire missile for launch. No function unless the missile mode is Manual.*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

FCR (Fire Control Radar) C-Scope Button

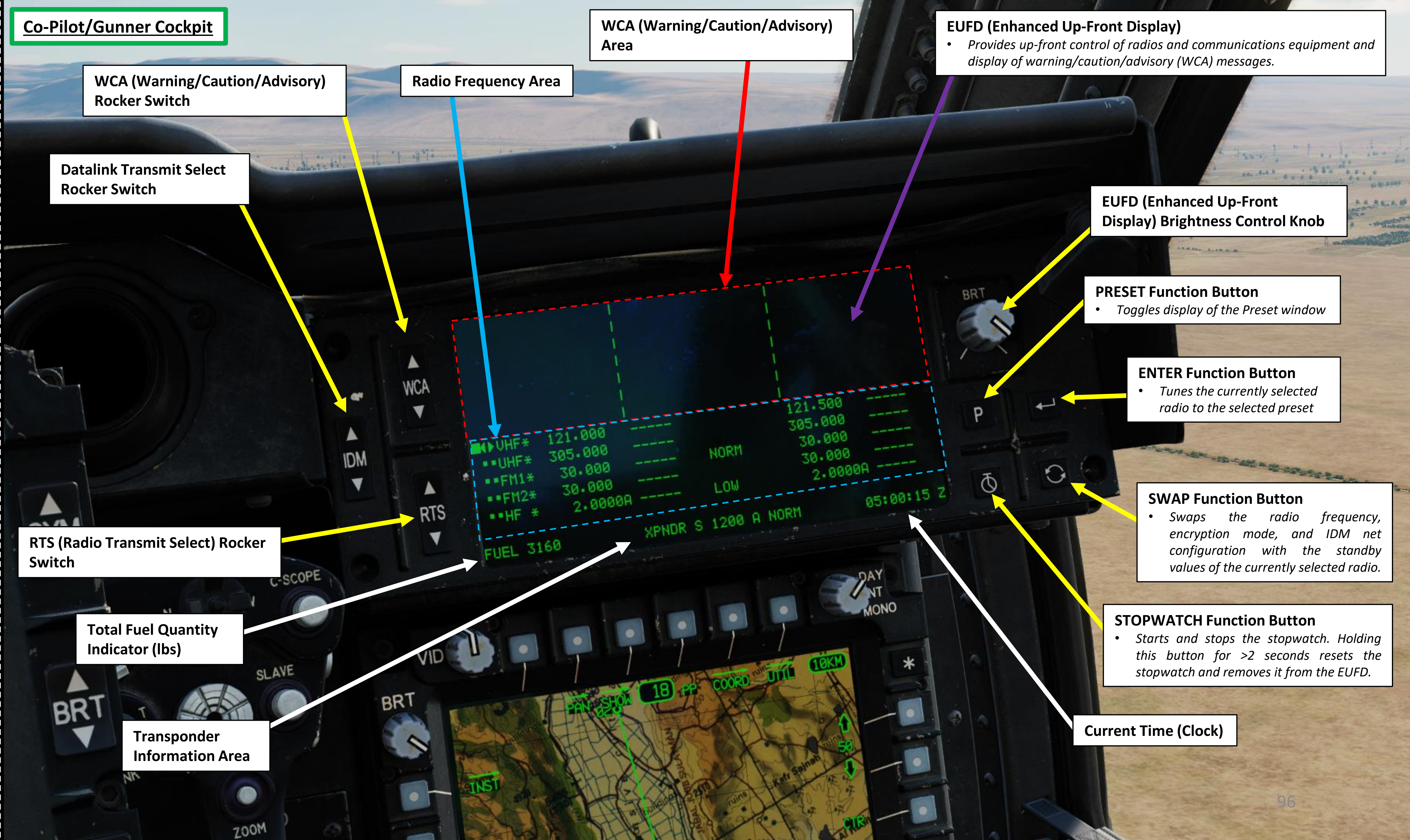
FLIR Polarity Button
- *Toggles FLIR (Forward-Looking Infrared) image polarity (black-hot or white-hot).*

Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"
- *Slews TADS line-of-sight when "Slave mode" is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

FCR (Fire Control Radar) Zoom Button
- *Changes the FCR targeting format to a 6× zoom, centered around the Next-To-Shoot (NTS). A second press restores the normal FCR format.*

Co-Pilot/Gunner Cockpit

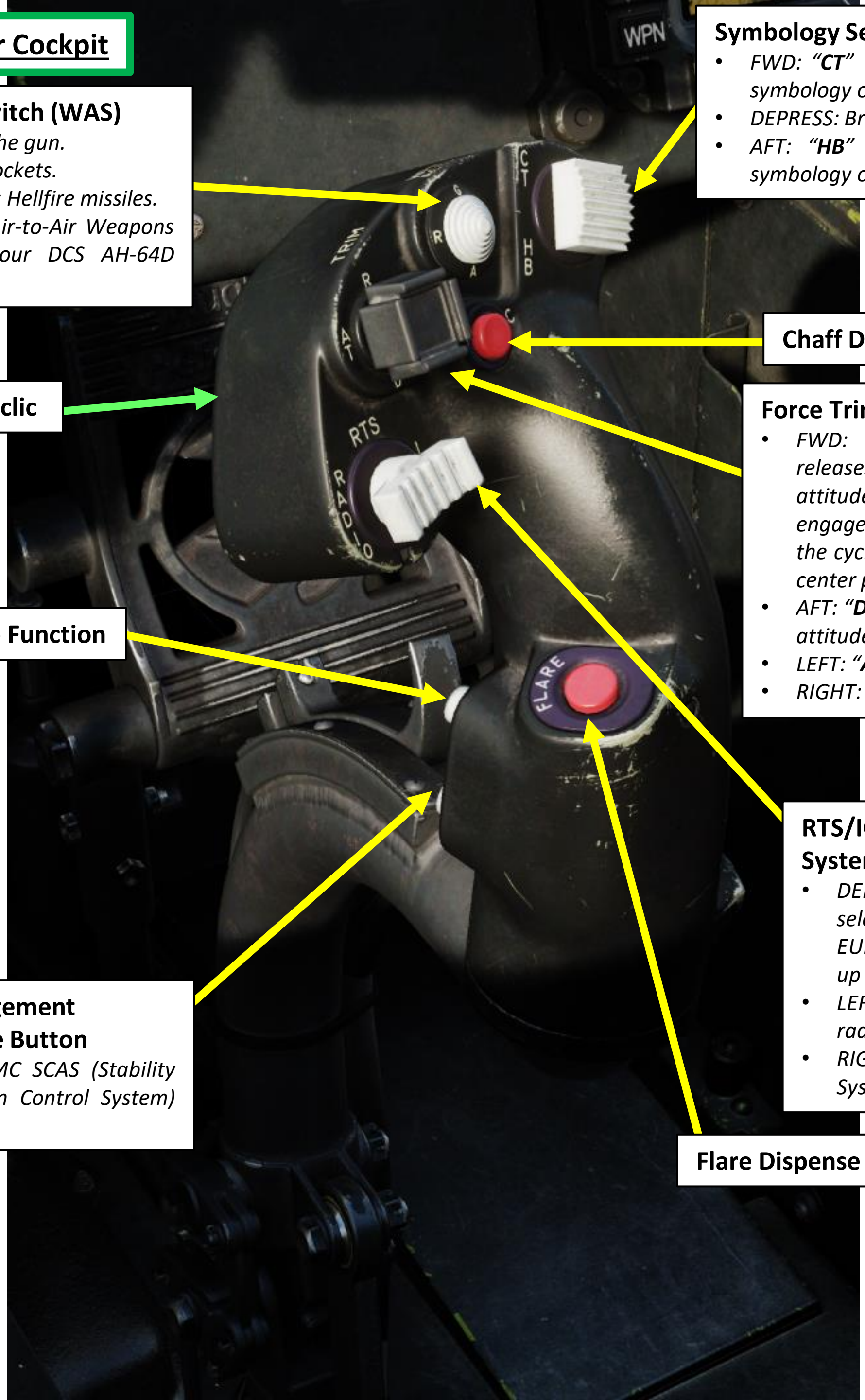


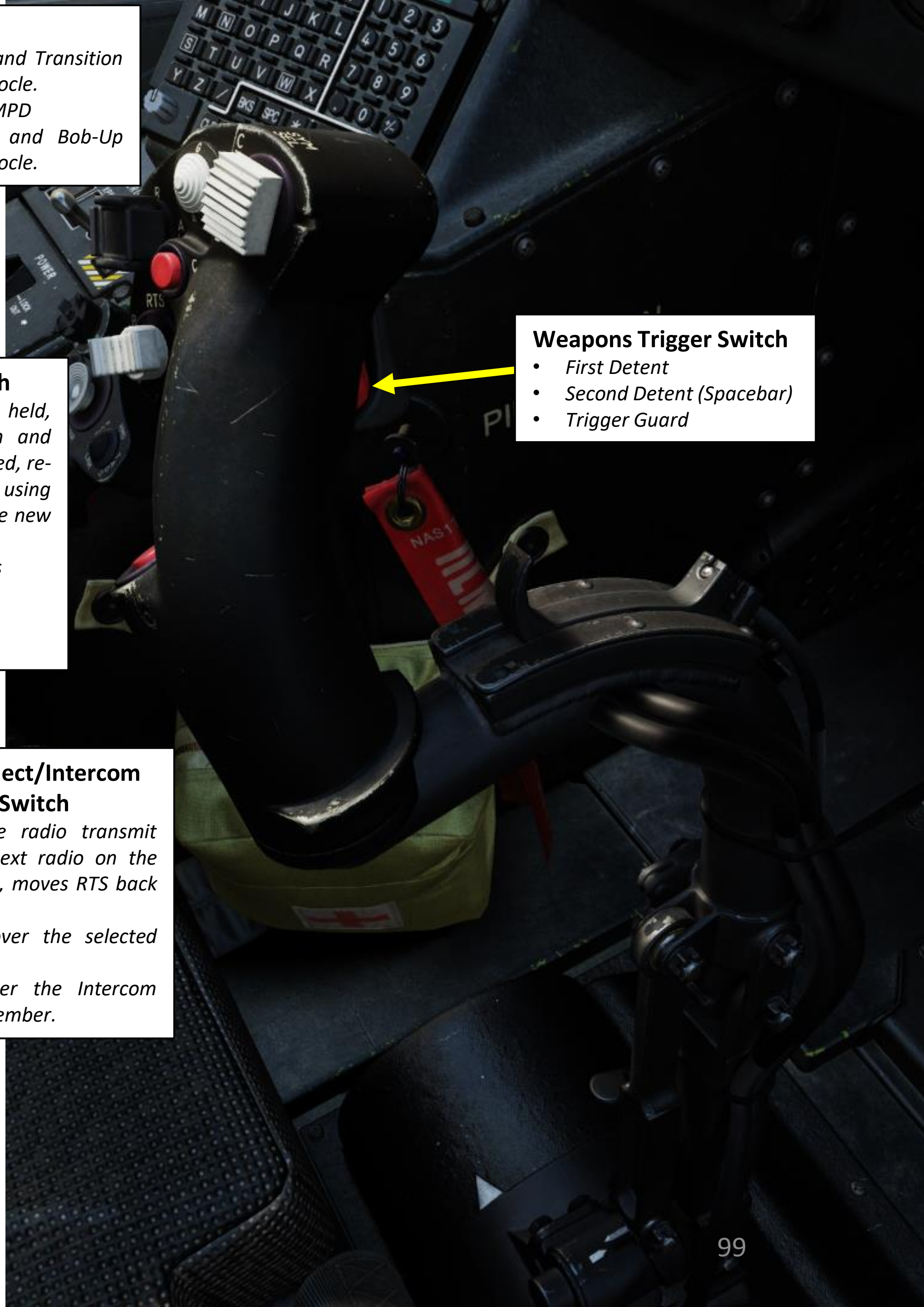
Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Master Zeroize Switch
- *Zeroes-out (deletes) classified data.*

Co-Pilot/Gunner Cockpit





Weapon Action Switch (WAS)

- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Cyclic

No Function

FMC (Flight Management Computer) Release Button

- *Disengages all FMC SCAS (Stability and Augmentation Control System) channels.*

Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Chaff Dispense Button

Force Trim / Hold Modes Switch

- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*
- *AFT: "**D**" (Disengage). Disengages attitude and altitude hold.*
- *LEFT: "**AT**" (Attitude Hold).*
- *RIGHT: "**AL**" (Altitude Hold)*

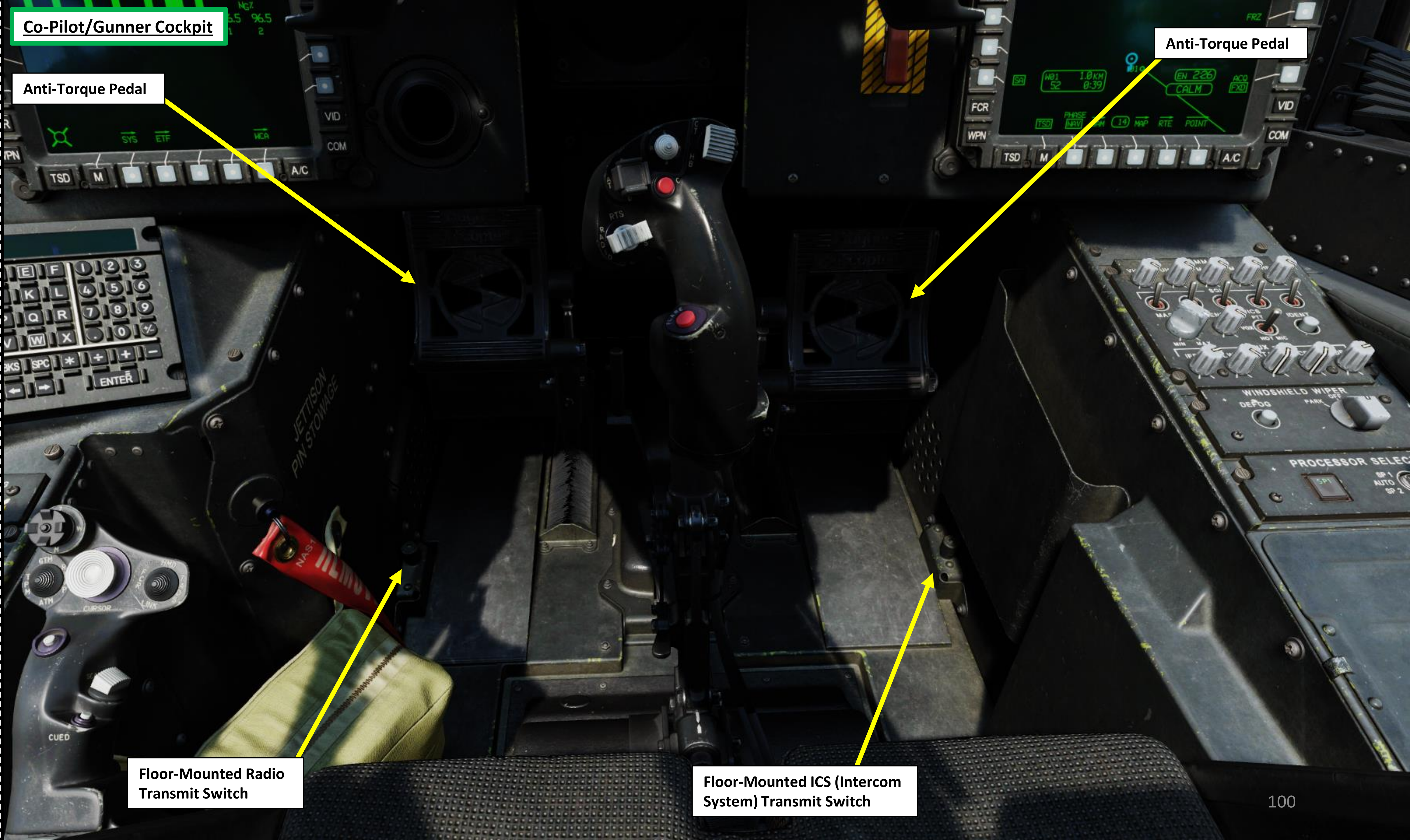
RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch

- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

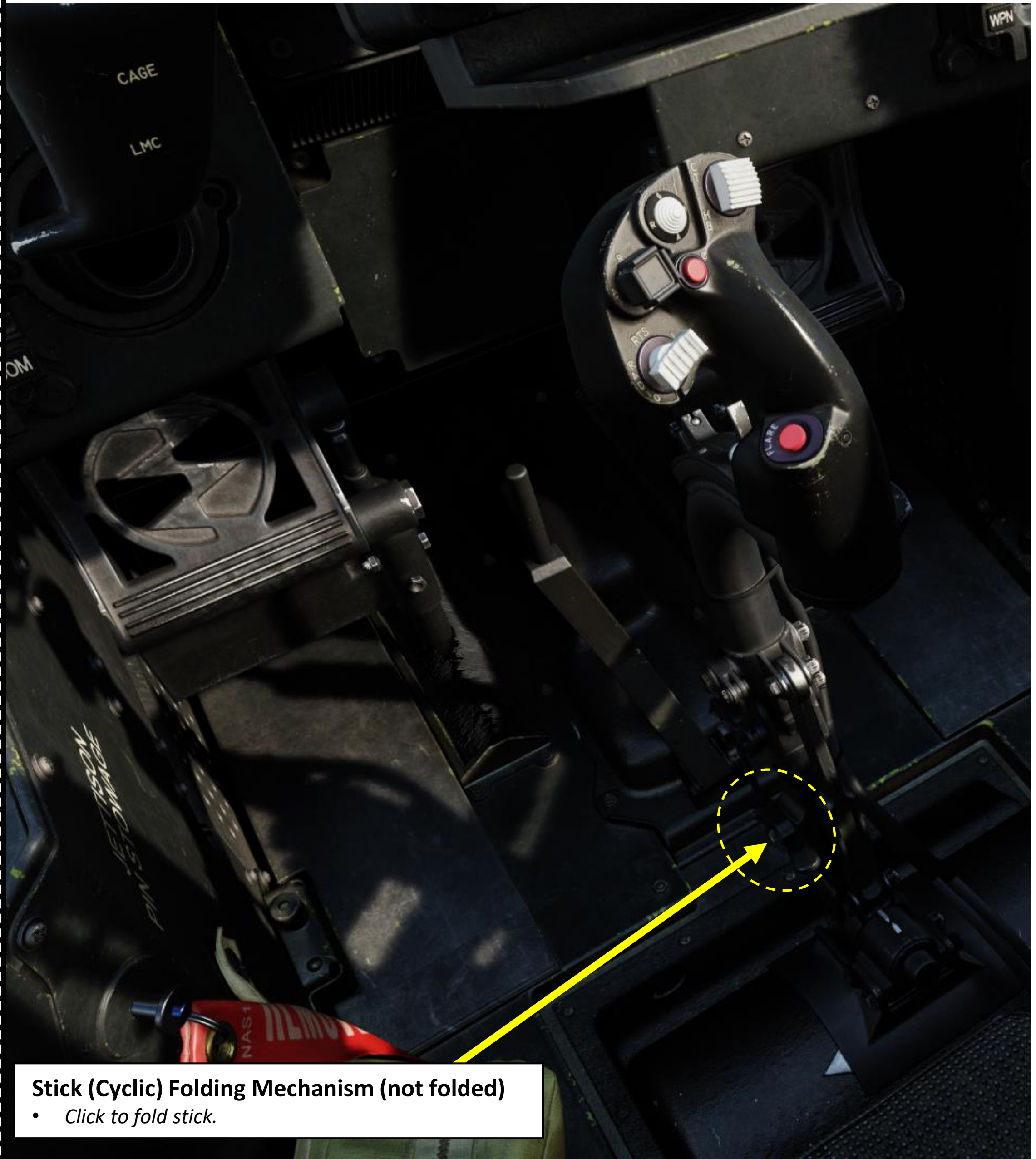
Flare Dispense Button

Weapons Trigger Switch

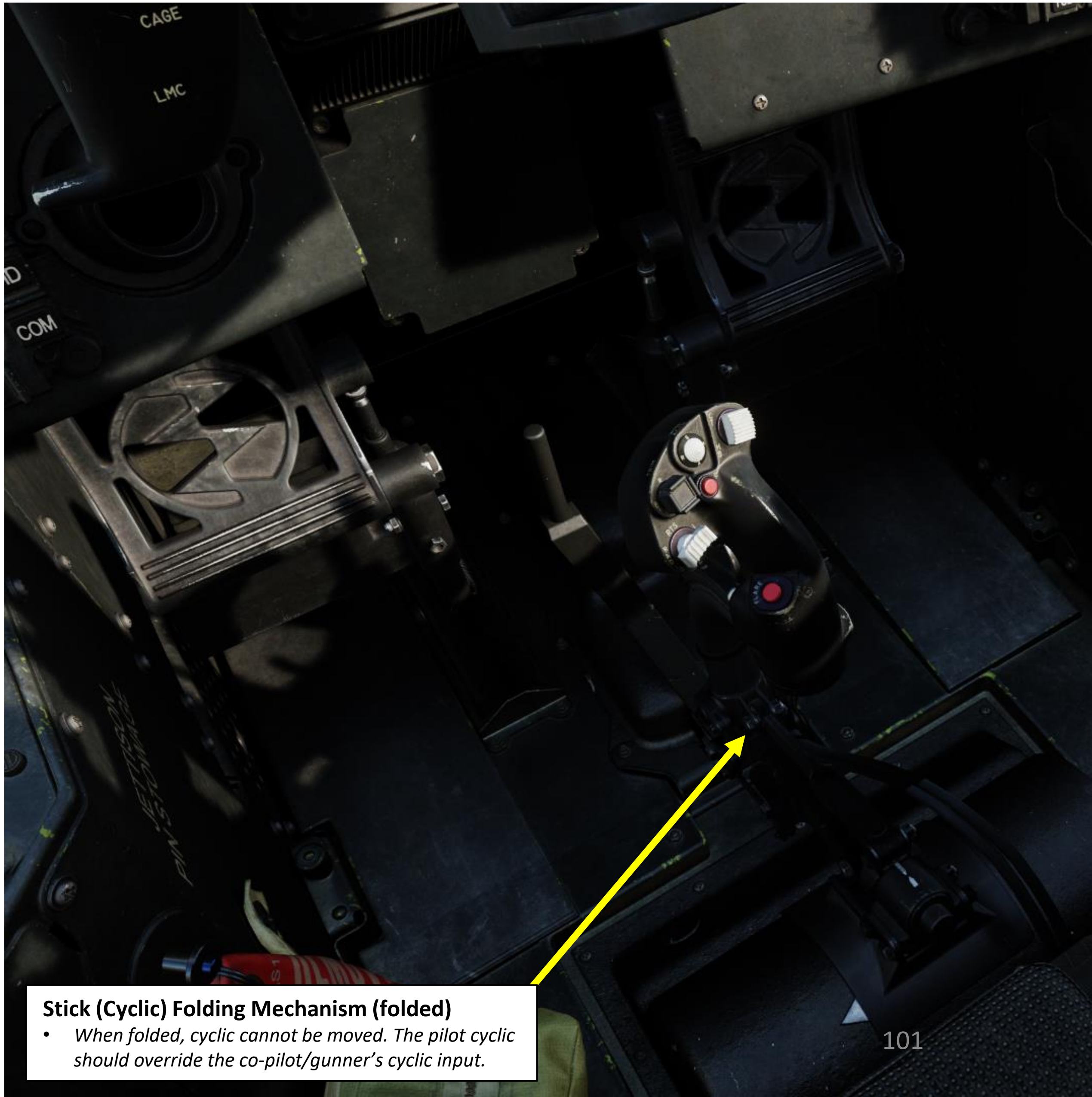
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*


Co-Pilot/Gunner Cockpit
Anti-Torque Pedal
Anti-Torque Pedal
Floor-Mounted Radio Transmit Switch
Floor-Mounted ICS (Intercom System) Transmit Switch

Co-Pilot/Gunner Cockpit

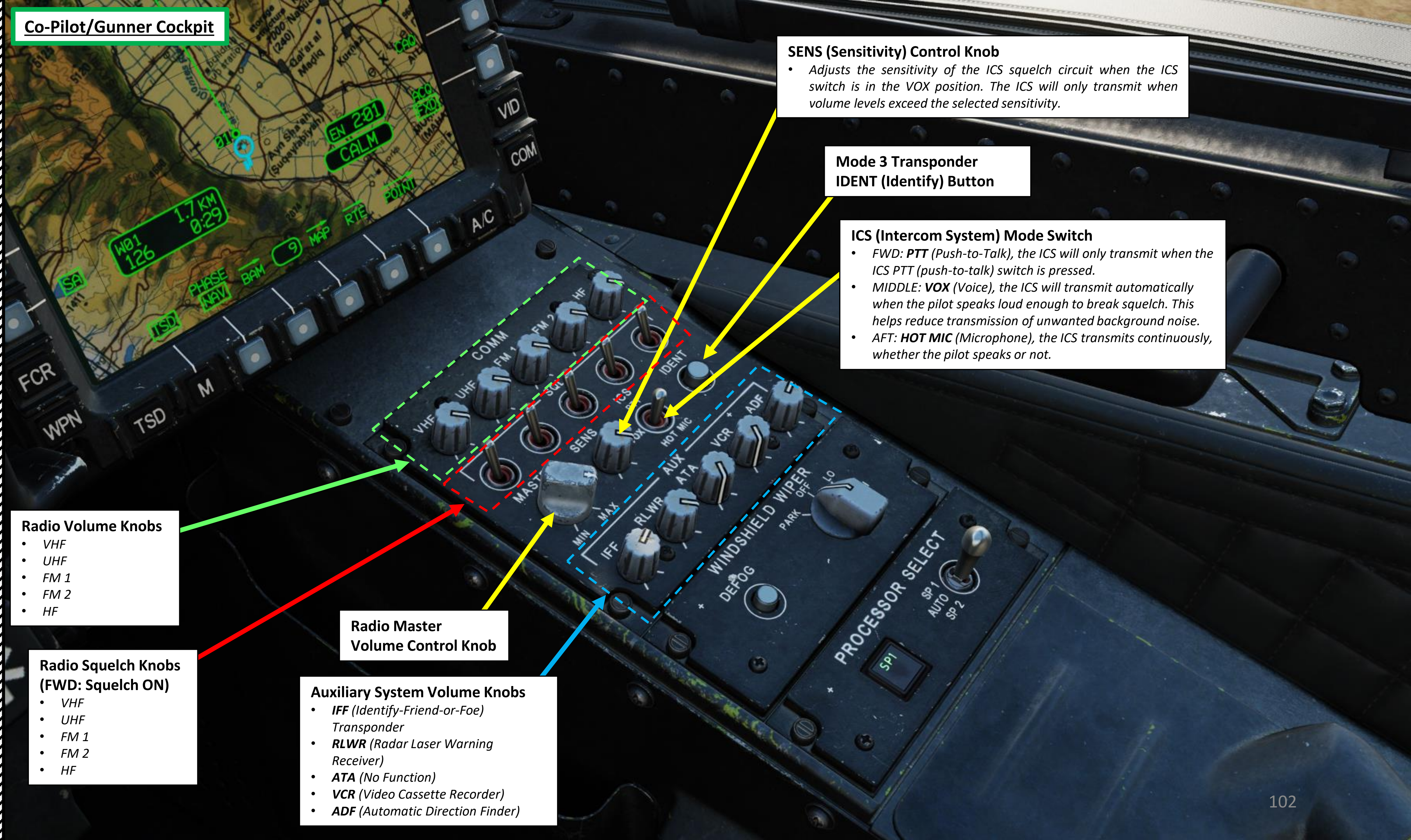


Stick (Cyclic) Folding Mechanism (not folded)
- *Click to fold stick.*



Stick (Cyclic) Folding Mechanism (folded)
- *When folded, cyclic cannot be moved. The pilot cyclic should override the co-pilot/gunner's cyclic input.*

Co-Pilot/Gunner Cockpit



SENS (Sensitivity) Control Knob
- *Adjusts the sensitivity of the ICS squelch circuit when the ICS switch is in the VOX position. The ICS will only transmit when volume levels exceed the selected sensitivity.*

Mode 3 Transponder IDENT (Identify) Button

ICS (Intercom System) Mode Switch
- *FWD: **PTT** (Push-to-Talk), the ICS will only transmit when the ICS PTT (push-to-talk) switch is pressed.*
- *MIDDLE: **VOX** (Voice), the ICS will transmit automatically when the pilot speaks loud enough to break squelch. This helps reduce transmission of unwanted background noise.*
- *AFT: **HOT MIC** (Microphone), the ICS transmits continuously, whether the pilot speaks or not.*

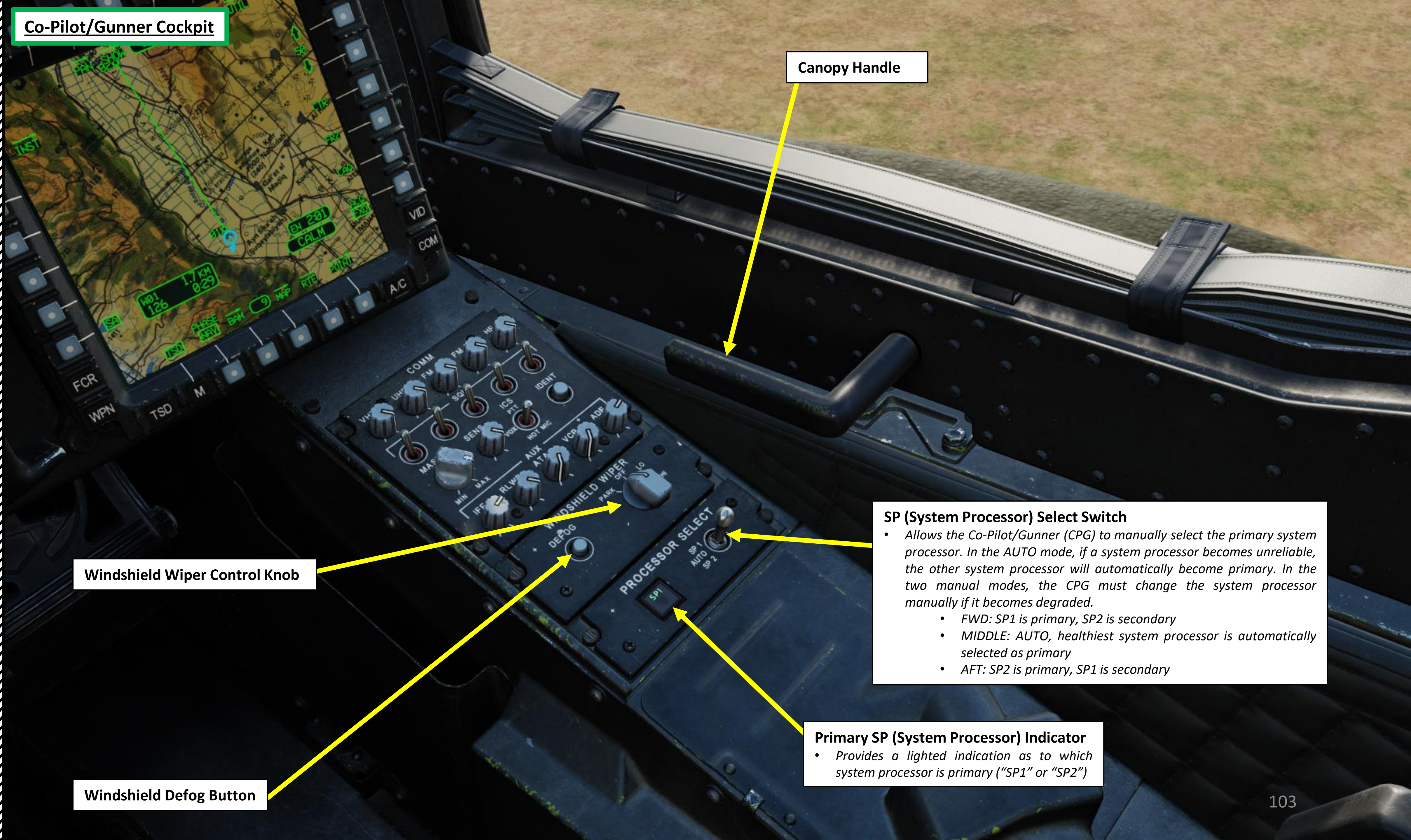
Radio Volume Knobs
- *VHF*
- *UHF*
- *FM 1*
- *FM 2*
- *HF*

Radio Squelch Knobs (FWD: Squelch ON)
- *VHF*
- *UHF*
- *FM 1*
- *FM 2*
- *HF*

Radio Master Volume Control Knob

Auxiliary System Volume Knobs
- ***IFF** (Identify-Friend-or-Foe) Transponder*
- ***RLWR** (Radar Laser Warning Receiver)*
- ***ATA** (No Function)*
- ***VCR** (Video Cassette Recorder)*
- ***ADF** (Automatic Direction Finder)*

Co-Pilot/Gunner Cockpit



Canopy Handle

SP (System Processor) Select Switch

- *Allows the Co-Pilot/Gunner (CPG) to manually select the primary system processor. In the AUTO mode, if a system processor becomes unreliable, the other system processor will automatically become primary. In the two manual modes, the CPG must change the system processor manually if it becomes degraded.*
  - *FWD: SP1 is primary, SP2 is secondary*
  - *MIDDLE: AUTO, healthiest system processor is automatically selected as primary*
  - *AFT: SP2 is primary, SP1 is secondary*

Windshield Wiper Control Knob

Primary SP (System Processor) Indicator

- *Provides a lighted indication as to which system processor is primary ("SP1" or "SP2")*

Windshield Defog Button

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

Co-Pilot/Gunner Cockpit

HDU (Helmet Display Unit) Monocle
Displays IHADSS (Integrated Helmet and Display Sight System) Data
- *Use “I” binding to show/hide IHADSS.*

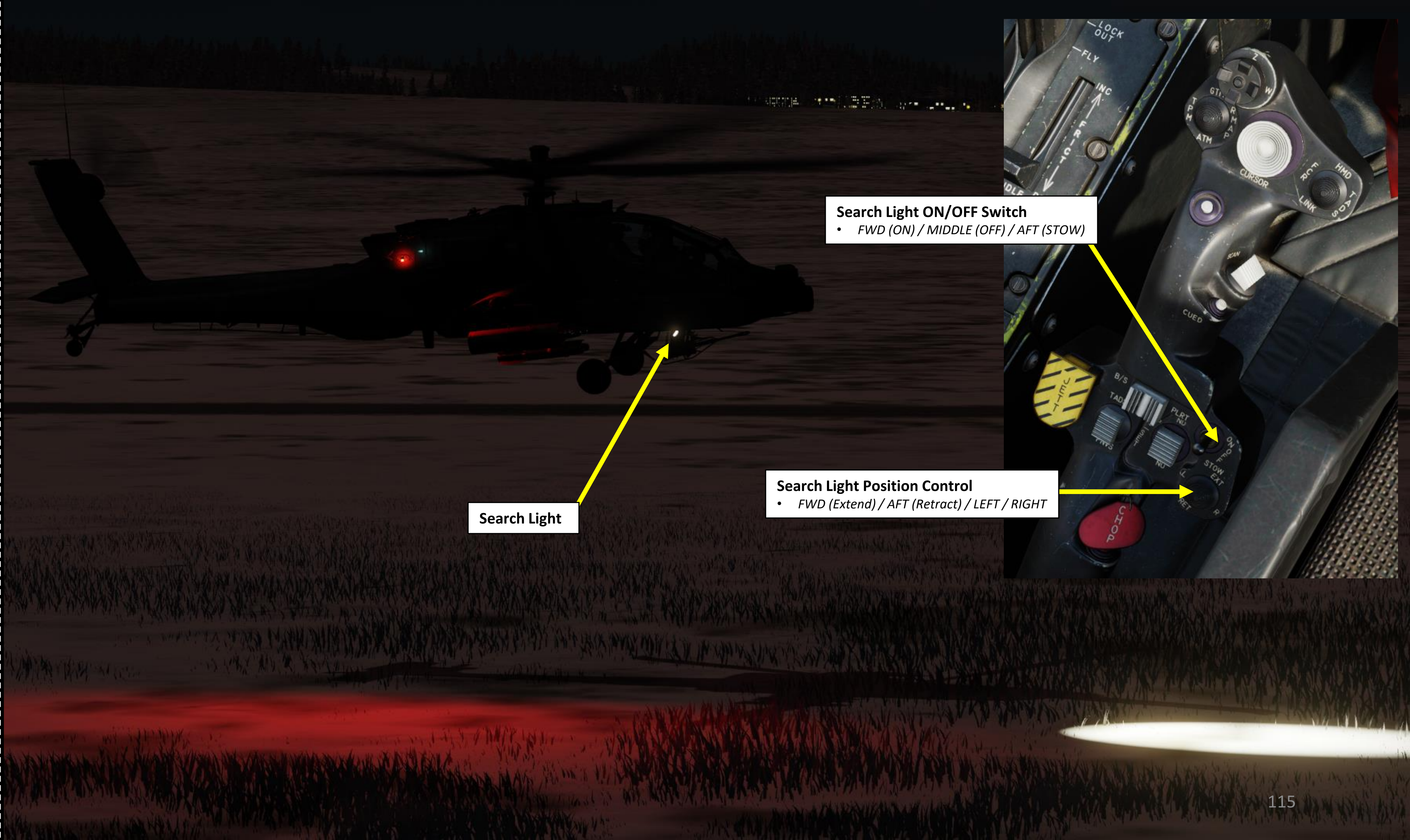
Co-Pilot/Gunner Cockpit

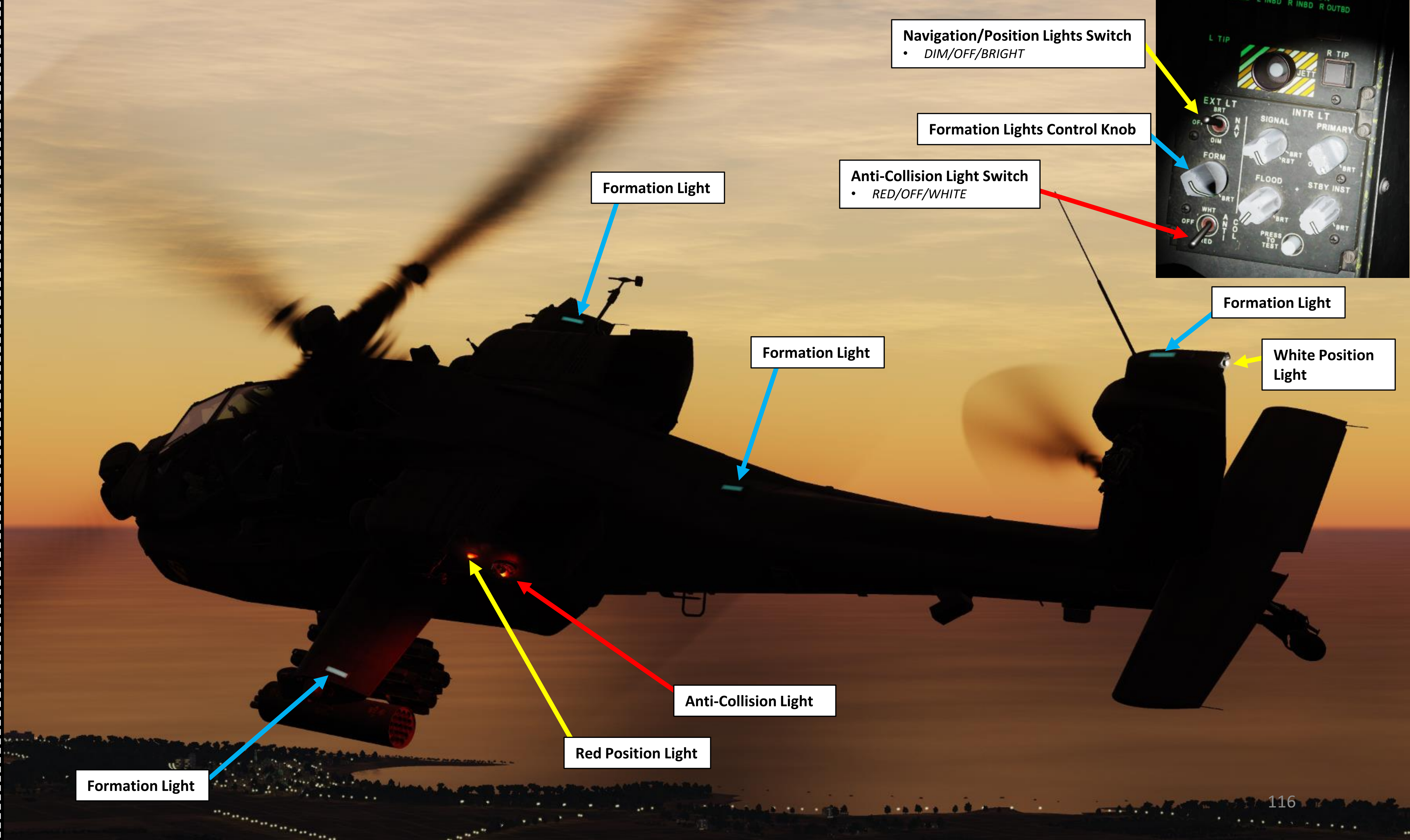

M261 Rocket Launcher
AGM-114 Hellfire Missile
Search Light

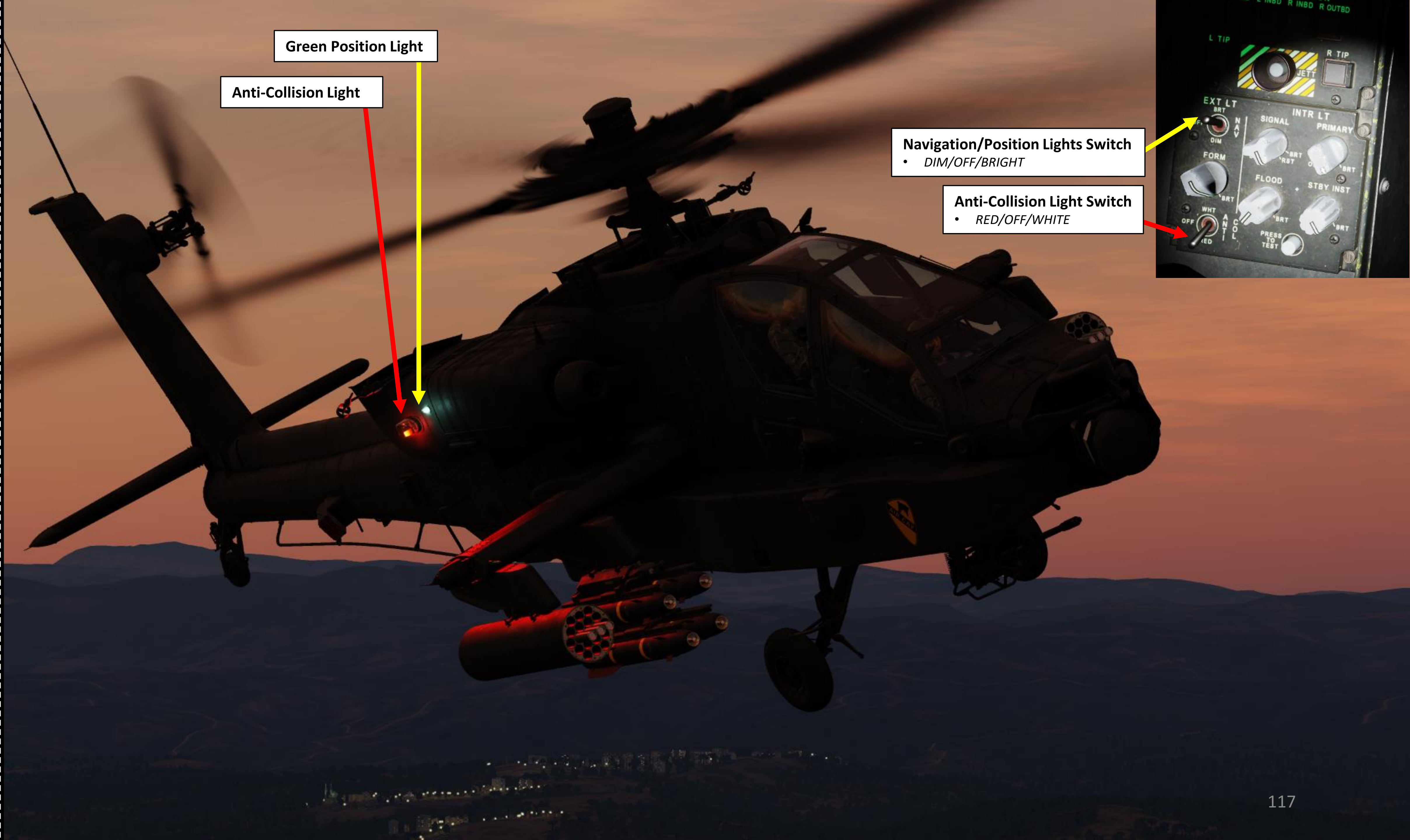

M139 AWS (Area Weapon System)
M230 30 mm Chain-Driven Gun


Flame-Resistant Balaclava
U. S. ARMY AH-64D
U. S. A. SERIAL NO. 0805550


Wipers


Search Light ON/OFF Switch
• FWD (ON) / MIDDLE (OFF) / AFT (STOW)
Search Light Position Control
• FWD (Extend) / AFT (Retract) / LEFT / RIGHT
Search Light


Navigation/Position Lights Switch
• DIM/OFF/BRIGHT
Formation Lights Control Knob
Anti-Collision Light Switch
• RED/OFF/WHITE
Formation Light
Formation Light
Formation Light
White Position Light
Anti-Collision Light
Red Position Light
Formation Light



Navigation/Position Lights Switch
- *DIM/OFF/BRIGHT*

Anti-Collision Light Switch
- *RED/OFF/WHITE*


Tail Rotor
Main Rotor
Stabilator
Tail Wheel
Engine Nose Gearbox
• Provides the 90 degrees (right angle) drive conversion to the main transmission
Main Landing Gear

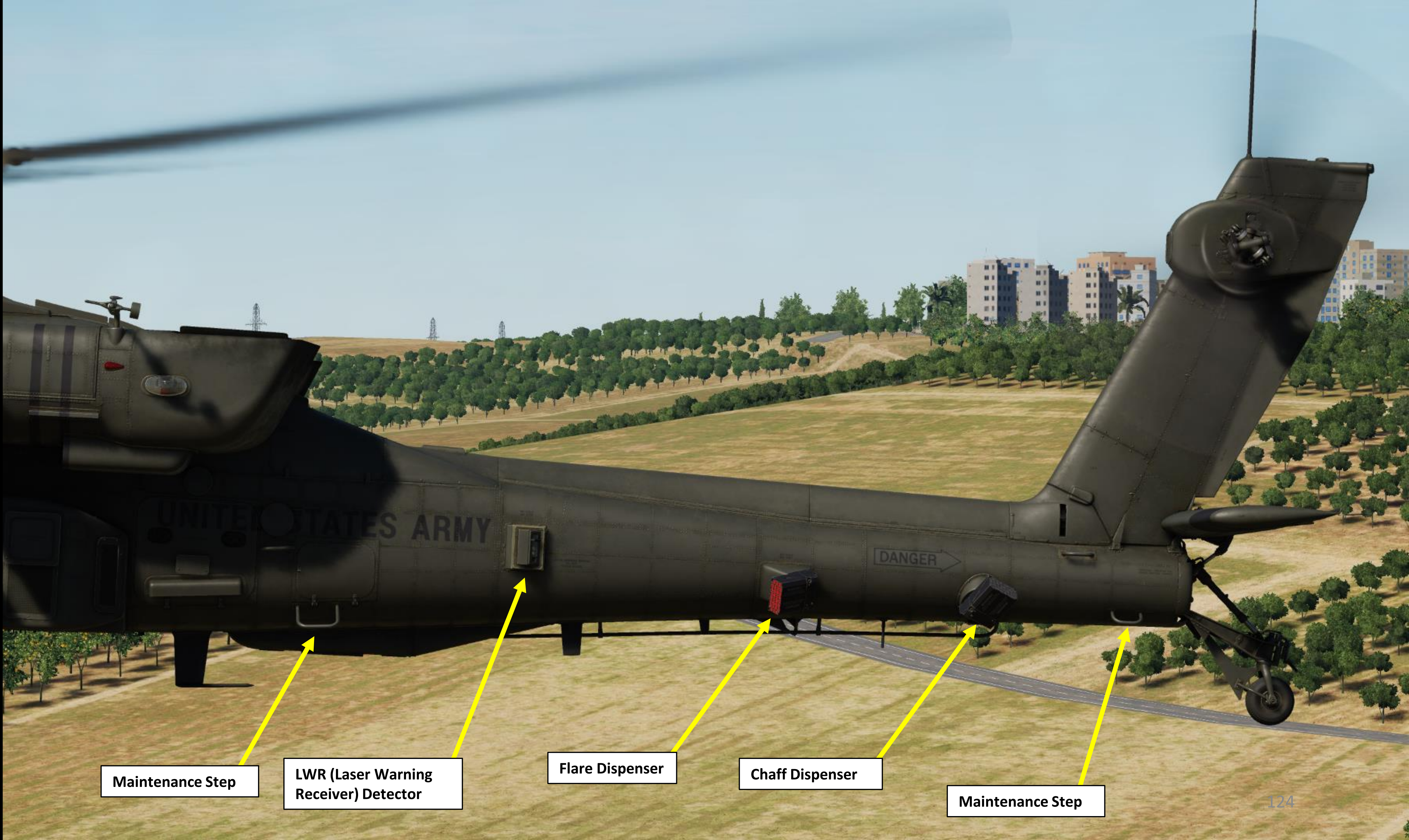

CMWS (Common Missile Warning System) Detector
Engine Exhaust
UNITED STATES ARMY


Temperature Probe
HADS (Helicopter Air Data Sensor) Probe
Temperature Probe
CMWS (Common Missile Warning System) Detector
HADS (Helicopter Air Data Sensor) Probe

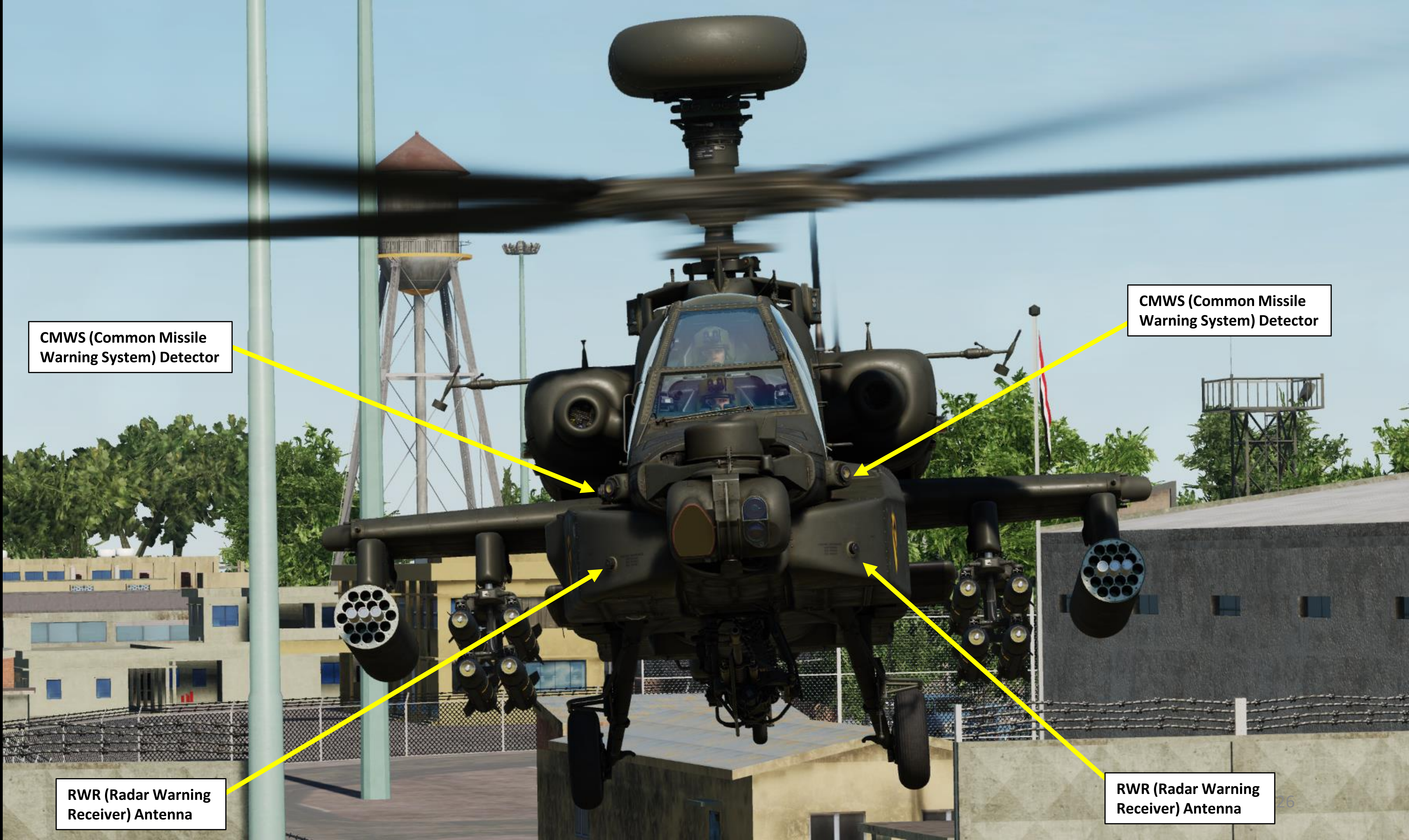

Static Discharge Wick
APU (Auxiliary Power Unit) Exhaust

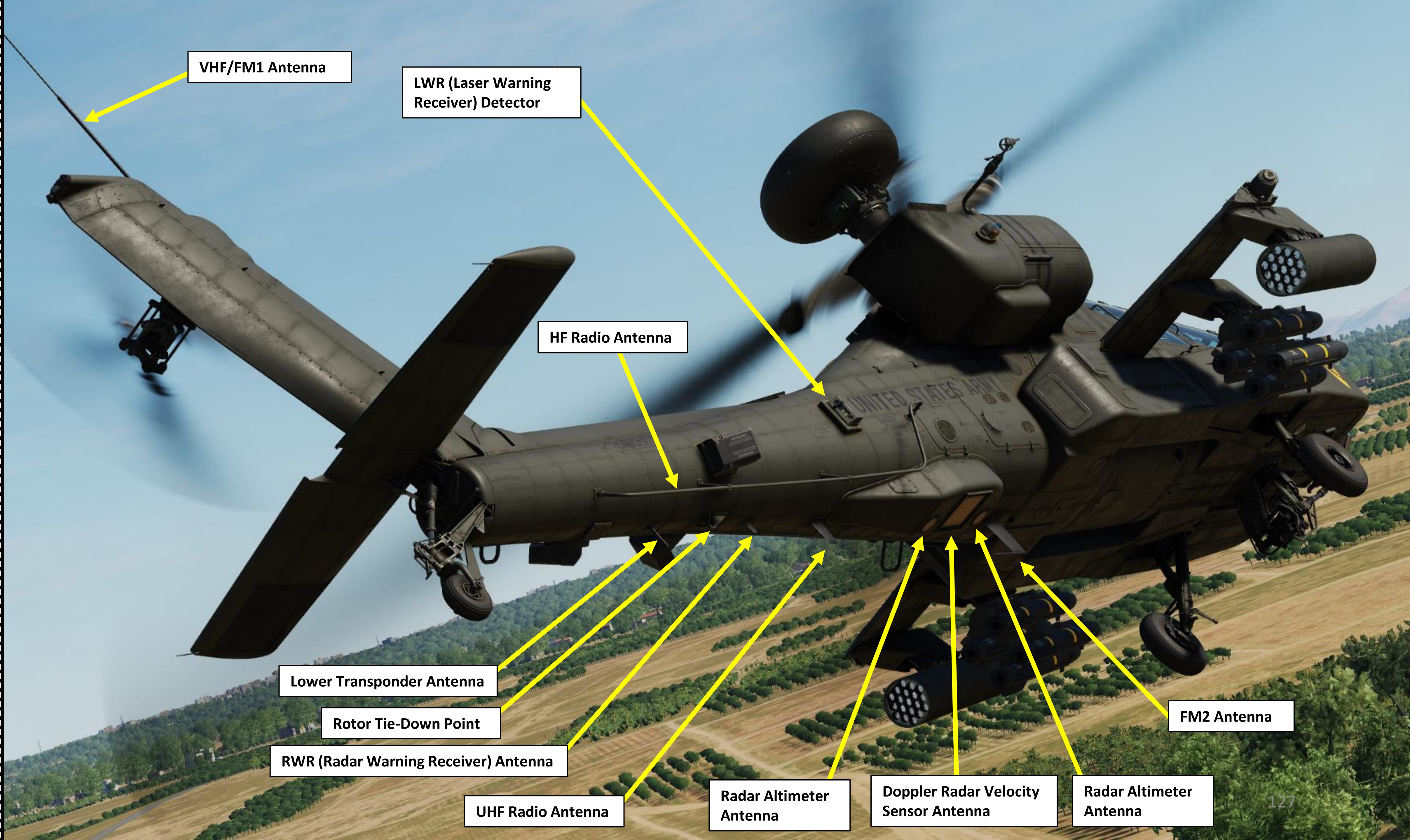

WSPS (Wire Strike Protection System) Cutter
Pitot Probe
WSPS (Wire Strike Protection System) Cutter


WSPS (Wire Strike Protection System) Cutter
Static Port
DO NOT GRAB
AIR CAV

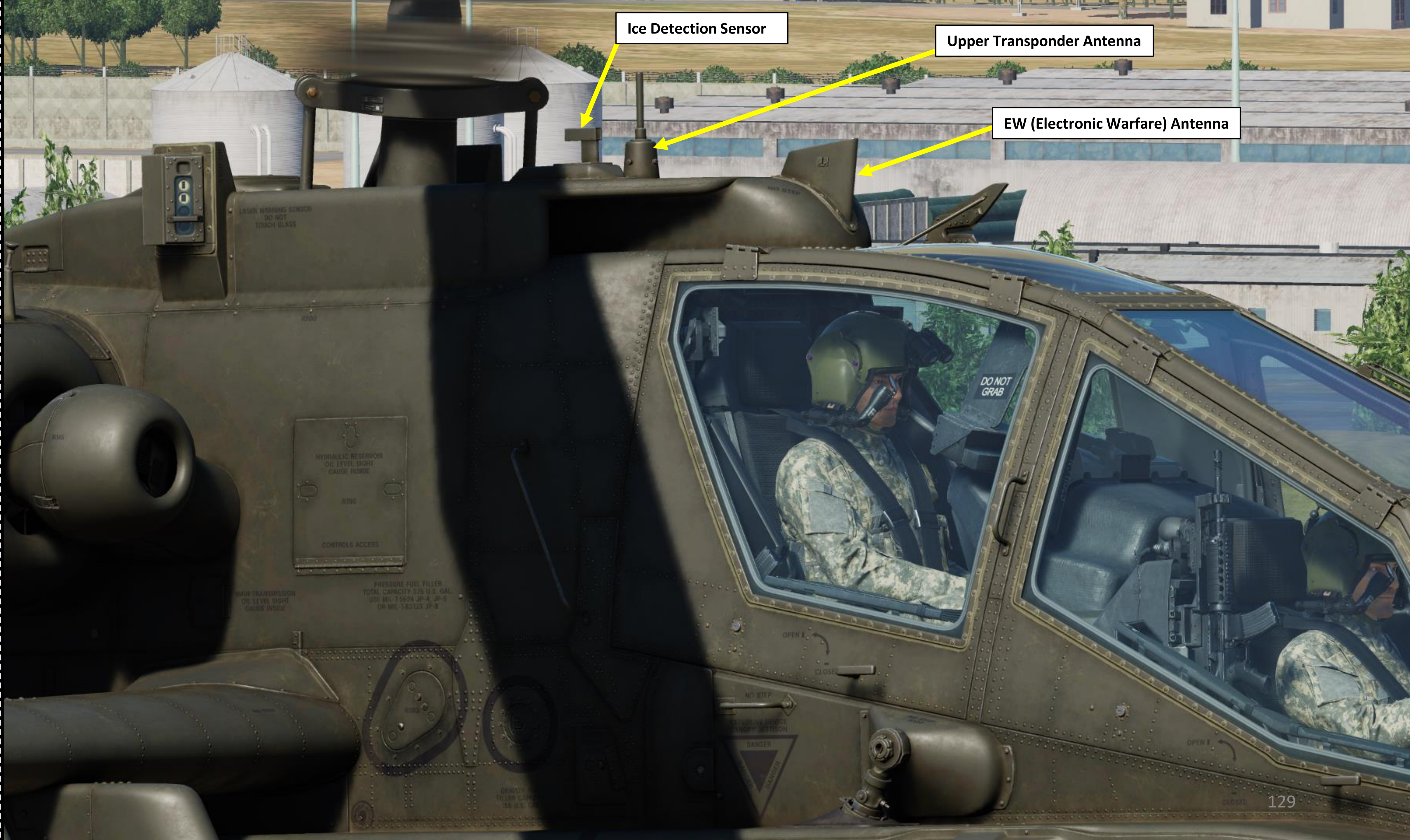

UNITED STATES ARMY
DANGER
Maintenance Step
LWR (Laser Warning Receiver) Detector
Flare Dispenser
Chaff Dispenser
Maintenance Step

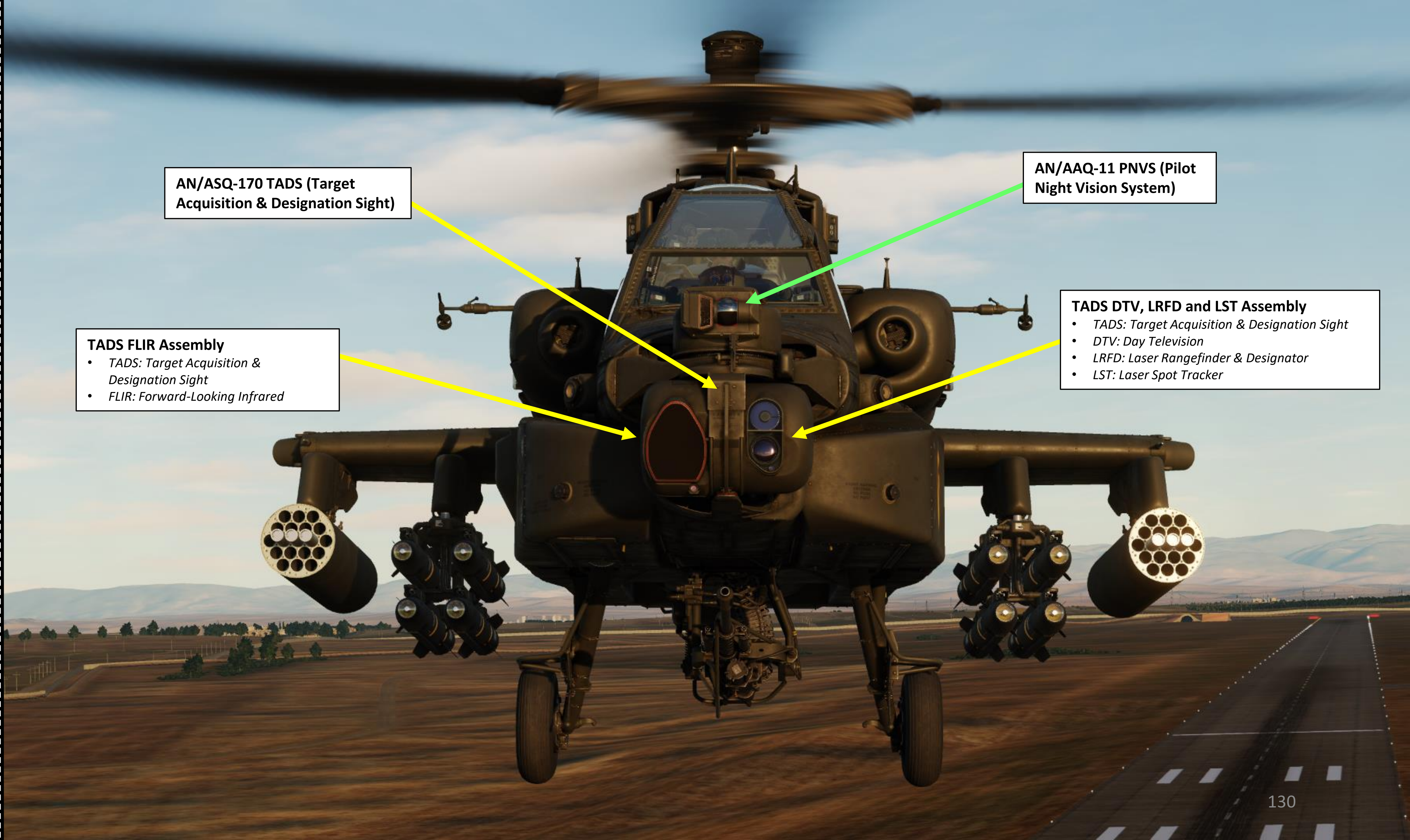

LWR (Laser Warning Receiver) Detector
CMWS (Common Missile Warning System) Detector


CMWS (Common Missile Warning System) Detector
CMWS (Common Missile Warning System) Detector
RWR (Radar Warning Receiver) Antenna
RWR (Radar Warning Receiver) Antenna


VHF/FM1 Antenna
LWR (Laser Warning Receiver) Detector
HF Radio Antenna
Lower Transponder Antenna
Rotor Tie-Down Point
RWR (Radar Warning Receiver) Antenna
UHF Radio Antenna
Radar Altimeter Antenna
Doppler Radar Velocity Sensor Antenna
Radar Altimeter Antenna
FM2 Antenna


RWR (Radar Warning Receiver) Antenna


Ice Detection Sensor
Upper Transponder Antenna
EW (Electronic Warfare) Antenna
LASER WARNING SENSOR DO NOT TOUCH GLASS
HYDRAULIC RESERVOIR OIL LEVEL SIGHT GAUGE INSIDE
CONTROLS ACCESS
DO NOT GRAB
NO STEP


AN/ASQ-170 TADS (Target Acquisition & Designation Sight)
AN/AAQ-11 PNVS (Pilot Night Vision System)
TADS FLIR Assembly
• TADS: Target Acquisition & Designation Sight
• FLIR: Forward-Looking Infrared
TADS DTV, LRFD and LST Assembly
• TADS: Target Acquisition & Designation Sight
• DTV: Day Television
• LRFD: Laser Rangefinder & Designator
• LST: Laser Spot Tracker


AN/APG-78 FCR (Fire Control Radar)


AIR CAV

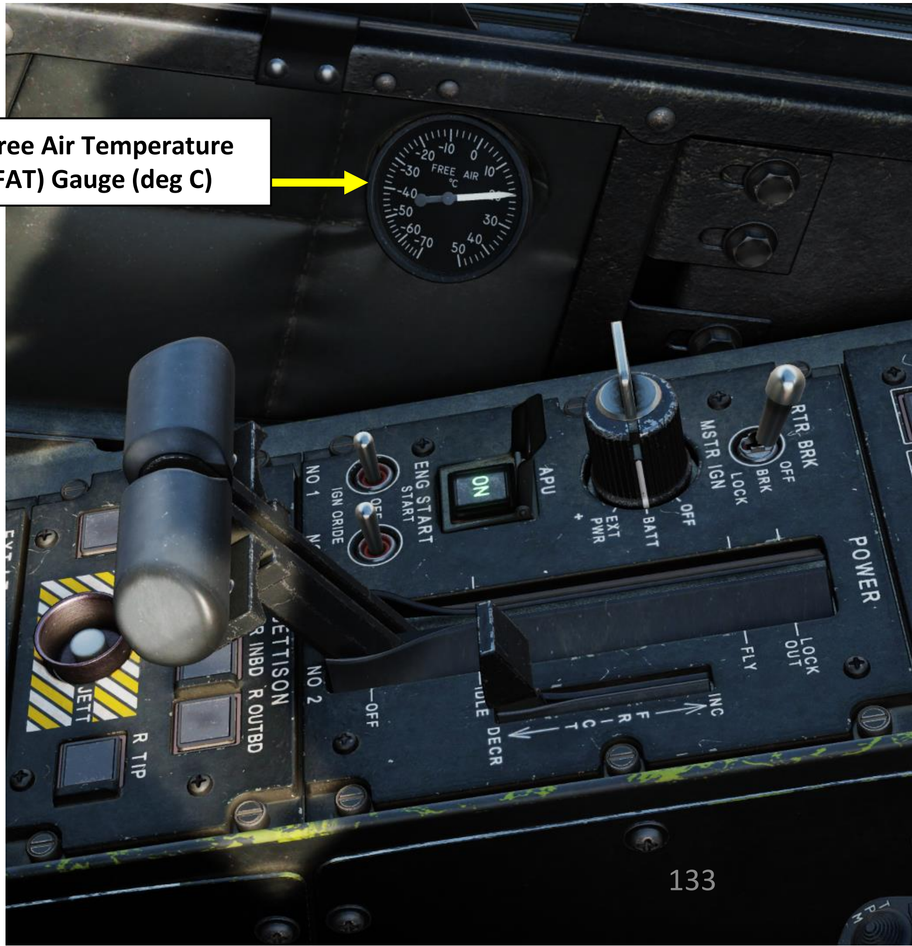
BEFORE FLIGHT

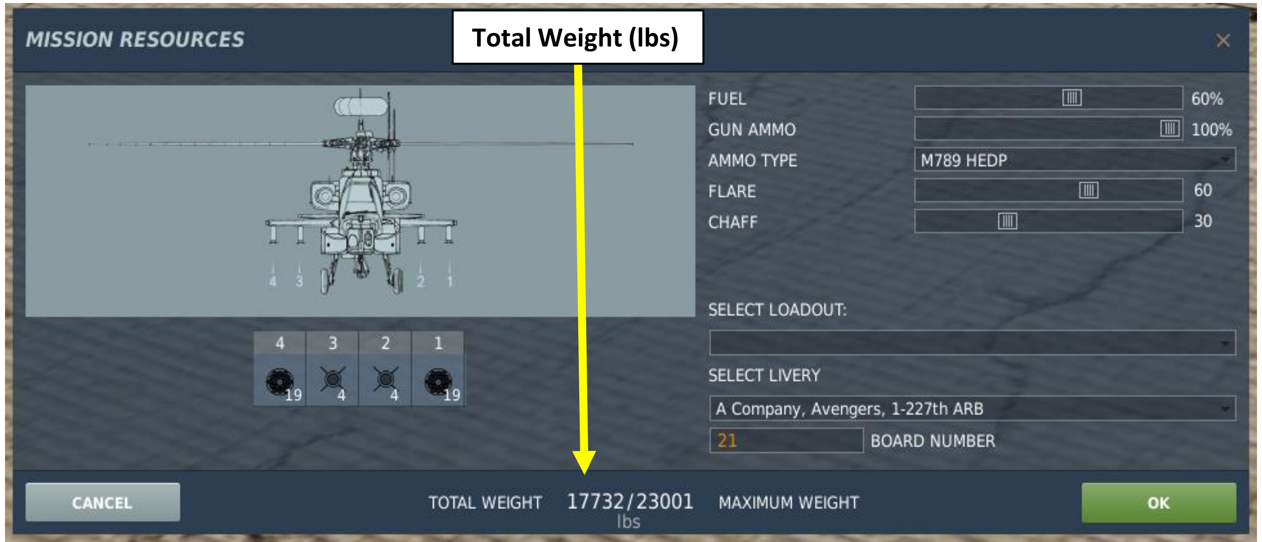
Before flying, it is important to plan ahead. Your allowable weapon and fuel payload will depend on the free air temperature (FAT), the humidity and the pressure-altitude (PA). In DCS, we can neglect the effect of humidity on performance as a simplification. The Pre-Flight planning is a tedious task and a good example is available in my UH-1H Huey guide. I recommend you check this out.

In the meantime, I will simply introduce you the general idea of the parameters you should take into account when flying the AH-64.

We will use three parameters as an example for this section:

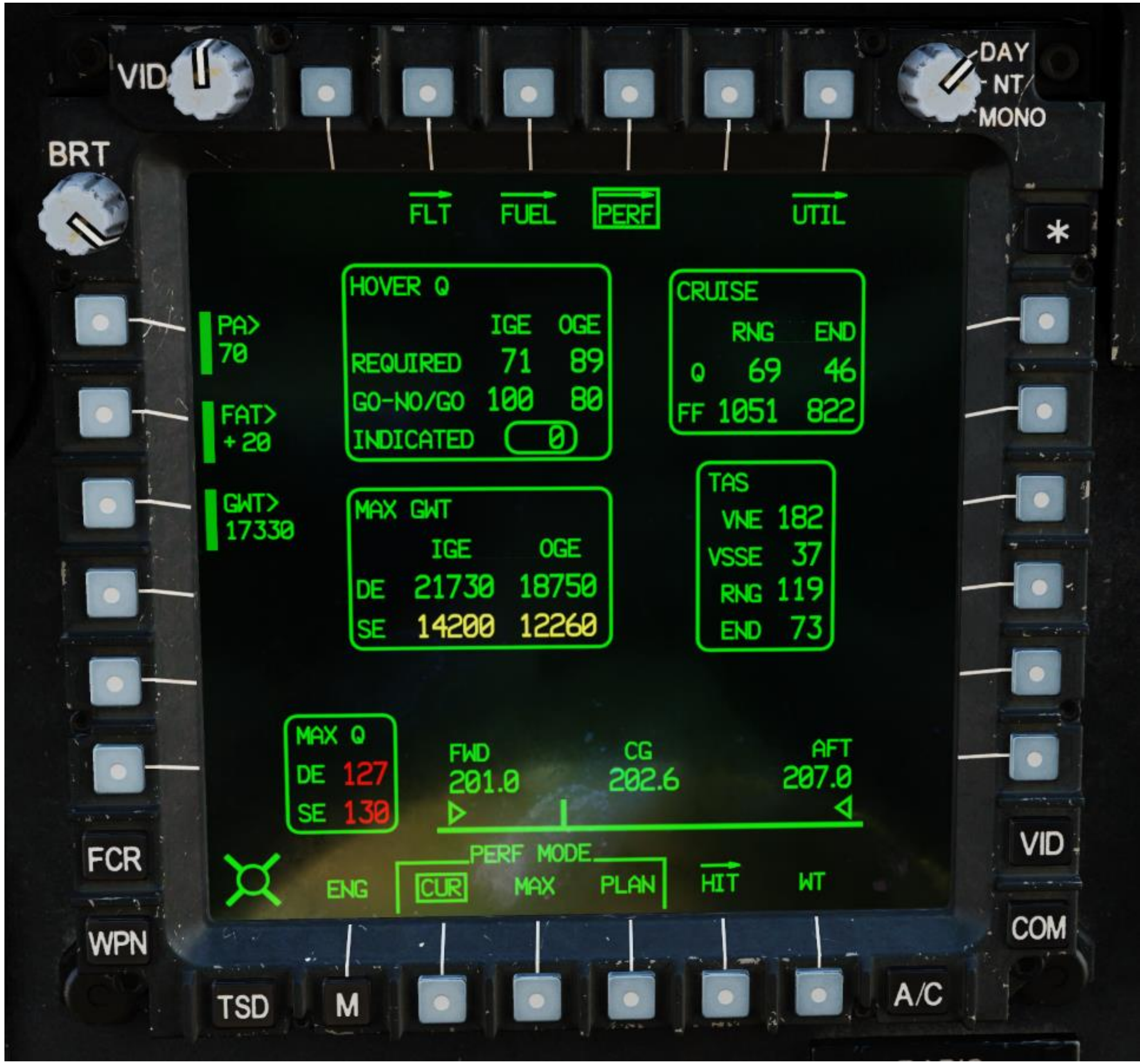
- **Gross Weight (lbs): 17732 lbs**
- **PA (Pressure-Altitude, ft): 71 ft AMSL (Above Mean Sea Level)**
- **FAT (Free Air Temperature): +20 deg C**





PERF PAGE

Maximum takeoff weight for **out of ground effect (OGE)** vertical takeoff (landing) (**OGE** max hover weight) is typically displayed in performance charts. This is also the case for Maximum takeoff weight for **in ground effect (IGE)** vertical takeoff (landing) (**IGE** maximum hover weight). Thankfully, there is a MPD (Multi-Purpose Display) page that calculates these values for you: the PERF (Performance) page.



Additional Notes:

The single most important value on this page is the **Maximum Takeoff Weight OGE and Go-No/Go Torque OGE**. To effectively use these values:

1. You first have to compare your required IGE torque against your indicated torque. So long as these values are within around 1 to 2% of each other, the page can be considered "valid".
2. Next, compare your indicated TQ to your go-no/go torque OGE. If the indicated is less than the go-no/go OGE value, then the helicopter has OGE power, and can perform all maneuvers requiring OGE power (OGE hovers, termination to an OGE hover, altitude over airspeed and continuous angle takeoff, and NOE flight).

For the purposes of DCS, use the Maximum gross weight OGE to load the aircraft for combat. The sum total of all ammunition and fuel loaded on the aircraft **must** remain below this value. As a rule, a minimum 5% power margin should be maintained. Use the rule that **1% of torque = 200 lbs** to achieve this. This means you should subtract 1000 lbs from the max gwt OGE value, for this example, the aircraft should be loaded to no more than 17,290 lbs.

It should be noted that required IGE, go-no/go ige and oge are all calculated and measured at a 5 foot hover height. The required OGE torque is calculated at an 80 foot hover height. Additionally it is important to understand that the aircraft is considered to be OGE when greater than 1 rotor diameter, or 48 feet.

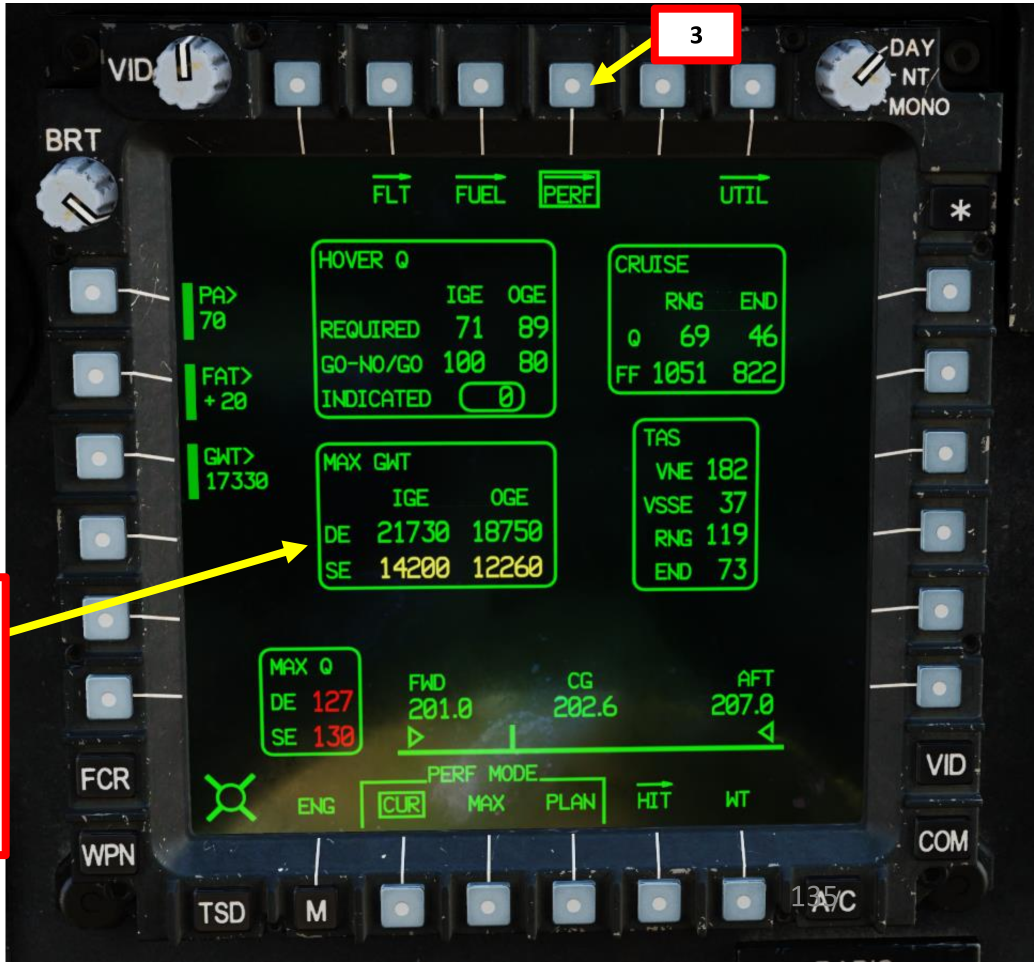
MAXIMUM TAKEOFF WEIGHT

You can access the Max Gross Weight values for OGE and IGE hover by doing the following:

1. Make sure the helicopter MPDs are powered up. This can be done by starting the engines or the APU (Auxiliary Power Unit).
2. Press the A/C (Aircraft) FAB (Fixed Action Button) to display the ENG (Engine) page while helicopter is on the ground.
3. Press the VAB (Variable Action Button) next to PERF to select the Performance page.
   - Alternatively, you can go through the PERF page by using the “M” FAB and select “PERF” with its corresponding VAB.
4. Max Gross Weight for IGE (In Ground Effect) and OGE (Out of Ground Effect) hover is displayed in lbs for the selected Performance mode (CUR, MAX or PLAN) for PA (Pressure-Altitude) and FAT (Free Air Temperature) conditions.
5. “DE” refers to “Dual Engine” operation, while “SE” refers to “Single Engine” operation. SE is also known as “OEI” (One Engine Inoperative).

1
APU (Auxiliary Power Unit) Start Button

2



3

4
Max Gross Weight (GWT) (lbs)

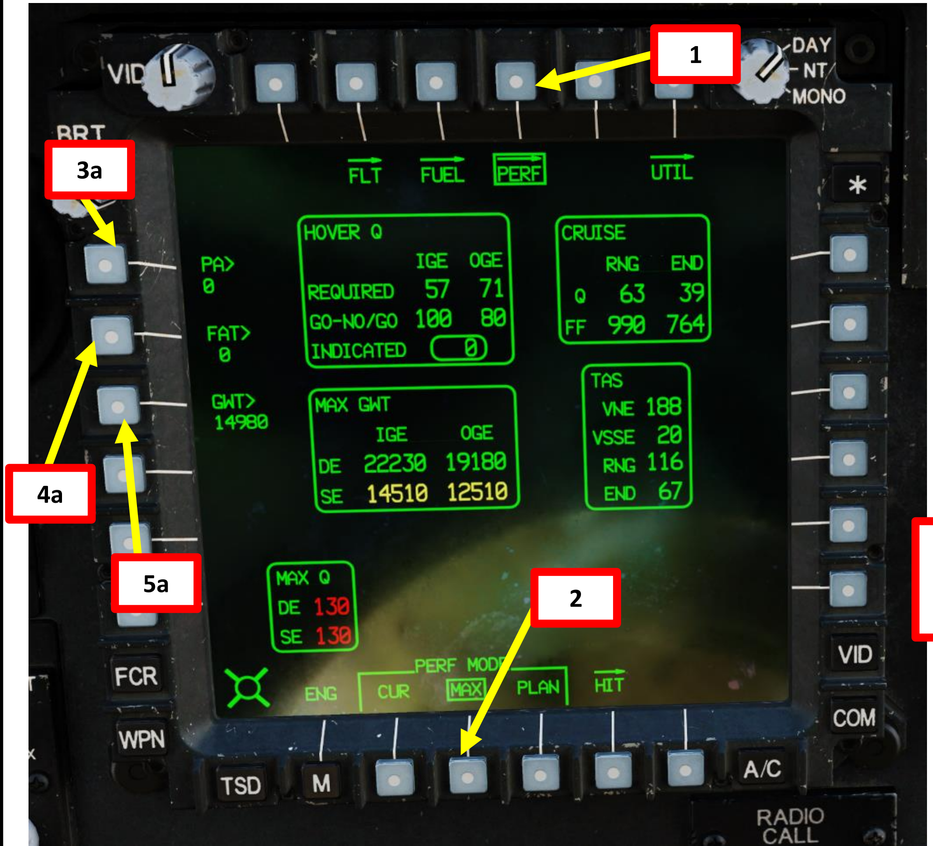
IGE: In Ground Effect
OGE: Out of Ground Effect
DE: Dual Engine
SE: Single Engine

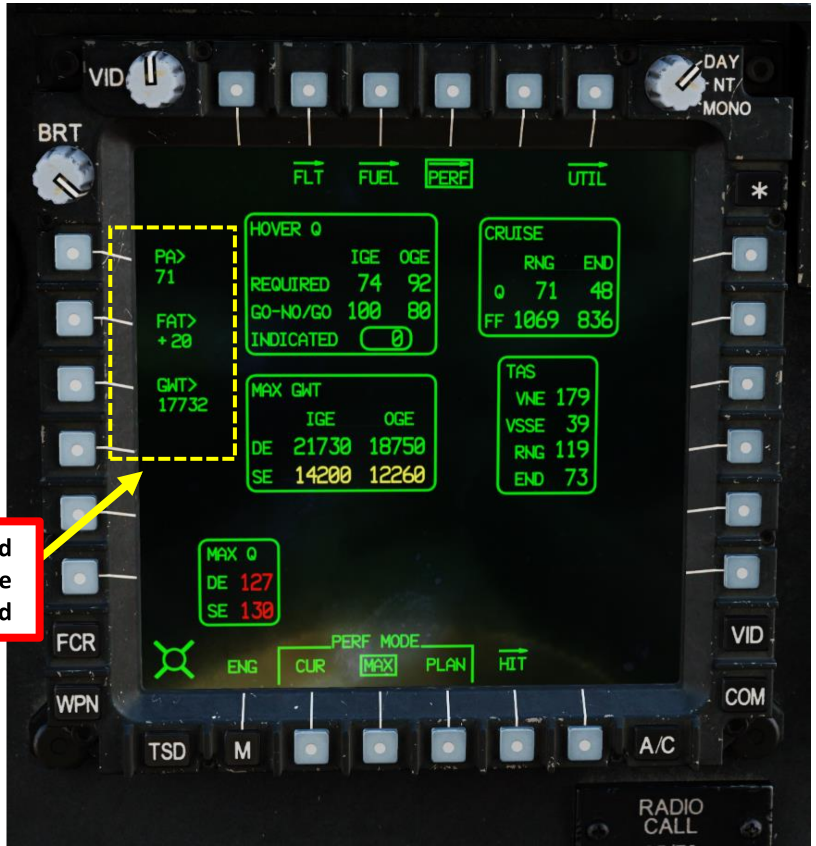
CALCULATING HOVER TORQUE (Q)

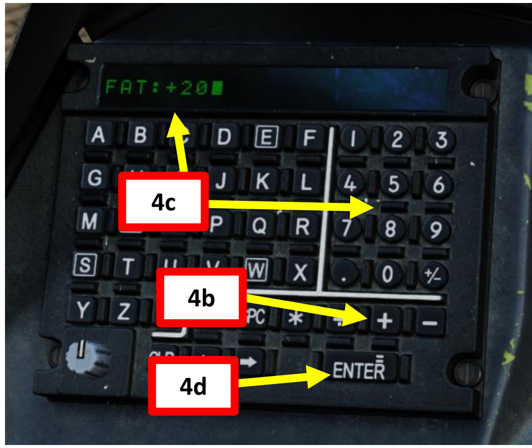
The PERF page can calculate the hover torque (Hover Q) values based on ambient conditions and gross weight. As an example:

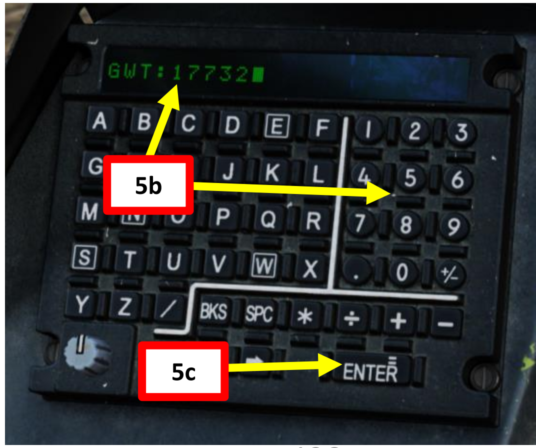
1. Access the PERF page as shown previously.
2. Press VAB (Variable Action Button) next to MAX PERF MODE.
3. Press VAB next to PA (Pressure-Altitude), enter elevation (“**71**” ft) on the KU (Keyboard Unit), then press ENTER on the KU.
4. Press VAB next to FAT (Free Air Temperature), enter ambient temperature (“**+20**” deg C) on the KU (Keyboard Unit), then press ENTER on the KU.
    - Do not forget the + or – sign, otherwise the data entry will be invalid.
5. Press VAB next to GWT (Gross Weight), enter gross weight (“**17732**” lbs) on the KU (Keyboard Unit), then press ENTER on the KU.

Gross Weight (lbs): 17732 lbs
PA (Pressure-Altitude, ft): 71 ft AGL (Above Ground Level)
FAT (Free Air Temperature): +20 deg C



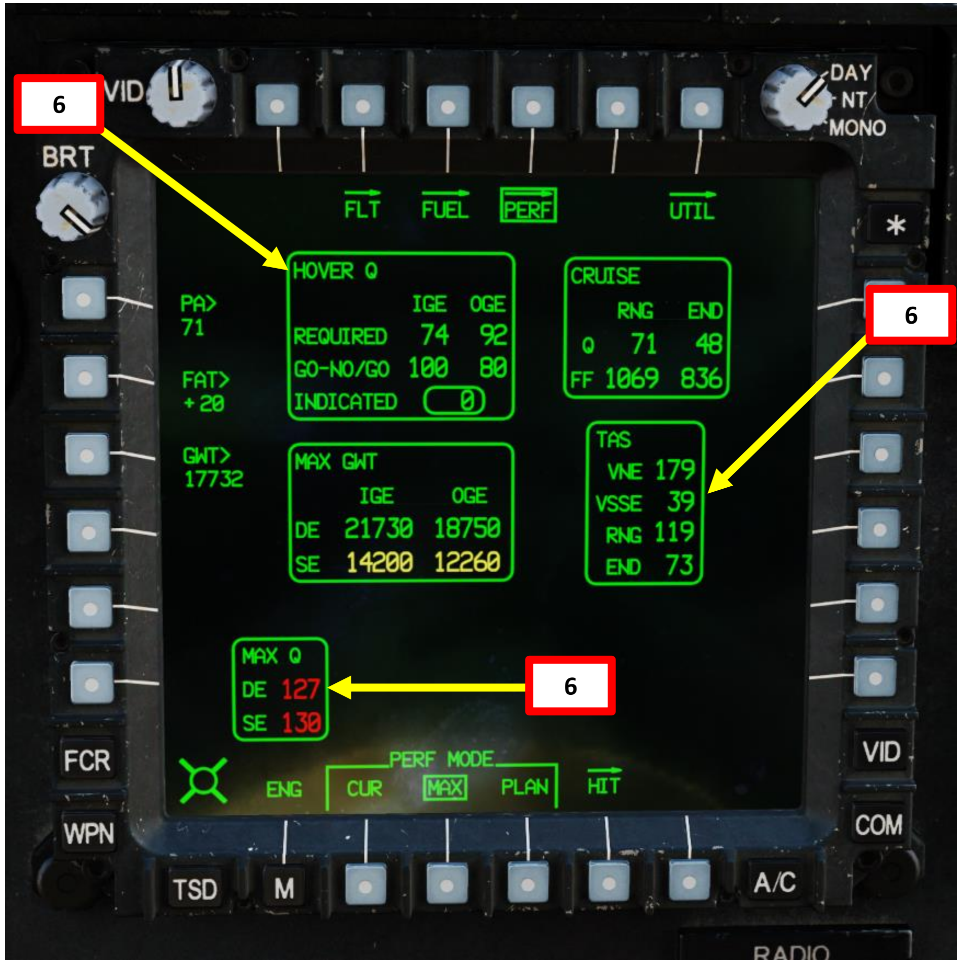






CALCULATING HOVER TORQUE (Q)

6. The following data is computed and is of interest to us:
   - Required Hover Q (Torque, %): Torque needed for IGE (In Ground Effect) and OGE (Out of Ground Effect) conditions
   - GO/NO-GO Hover Q (Torque, %): Provides the crew with a value, calculated at a 5 foot hover height to determine that whether or not the helicopter has OGE hover power. The required TQ IGE/OGE is what tells the crew the required power to hover IGE and OGE.
     - Note: The flight crew can compare indicated torque to go/no-go torque when performing a hover check to determine if they are above maximum gross weight.
   - Indicated Torque (%): combined torque that the engines are presently generating. It is colored green, yellow, or red based on published torque limits.
   - Max DE Q (Torque, %): Displays 10-minute max dual-engine (DE) torque. Value is displayed in yellow if above 100% and red if above 115%.
   - Max SE Q (Torque, %): Displays 2.5-minute maximum single-engine (SE) torque. Value is displayed in yellow if above 110% and red if above 125%.
   - VNE (Do Not Exceed Speed) and VSSE (Safe Single-Engine Speed), in knots (TAS, True Airspeed)
   - RNG: Maximum Range Cruising Speed, in knots
   - END: Maximum Endurance Cruising Speed, in knots

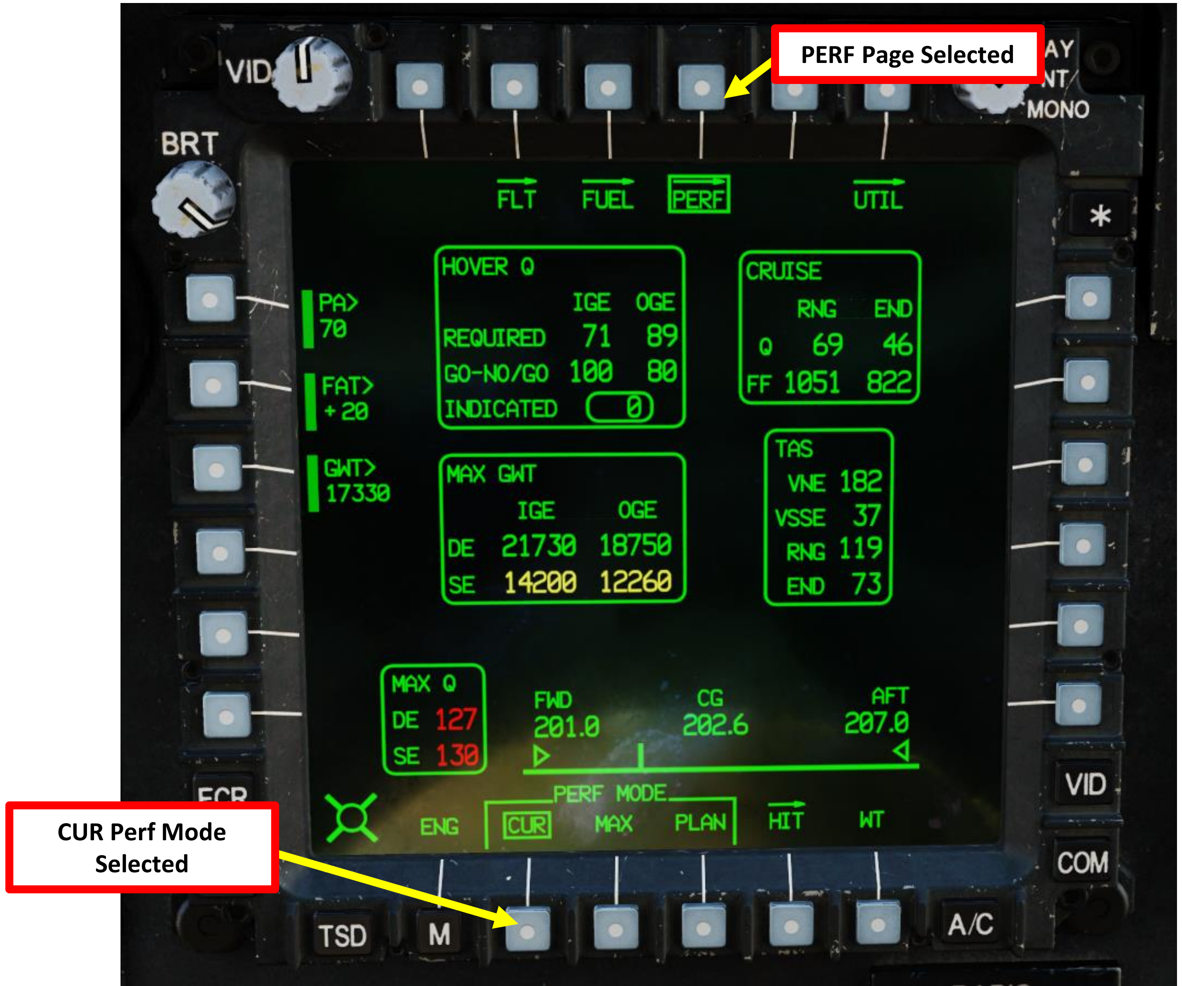


PERF MODES AND WT (WEIGHT) FORMAT

In the PERF page, there are three PERF Modes selectable with the VABs (Variable Action Buttons) which set the conditions for performance calculations:

- **CUR**: Calculates performance using **current** conditions. When selected, the PA, FAT, and GWT values cannot be modified. In CUR mode, the current anti-ice setting (on or off) is used for calculations.
- **MAX**: Performance calculations are made using the values entered for PA, FAT, and GWT.
- **PLAN**: Performance calculations are made using the values loaded from the DTU (Data Transfer Unit). A flight plan can be already set up in a DTC (Data Transfer Cartridge) loaded by the helicopter.

Also, from the PERF page, you can press the VAB (Variable Action Button) next to WT (Weight). This will allow you to modify weight data as required. Your CPG (Co-Pilot/Gunner) had a big breakfast? There’s a modifiable field to take that into consideration for performance calculation.



COLD START PROCEDURE OVERVIEW

- A – Before Start-Up
- B – APU (Auxiliary Power Unit) Start
- C – DMS (Data Management System) Sweep
    - Load DTU (Data Transfer Unit)
    - A/C (Aircraft) Setup
    - ASE (Aircraft Survivability Equipment) Setup
    - TSD (Tactical Situation Display) Setup
    - WPN (Weapon) Setup
    - FCR (Fire Control Radar) Setup
    - COM (Communications) Setup
- D – IHADSS (Integrated Helmet and Display Sighting System) Boresight
- E – Engine Start
- F – After Start-Up

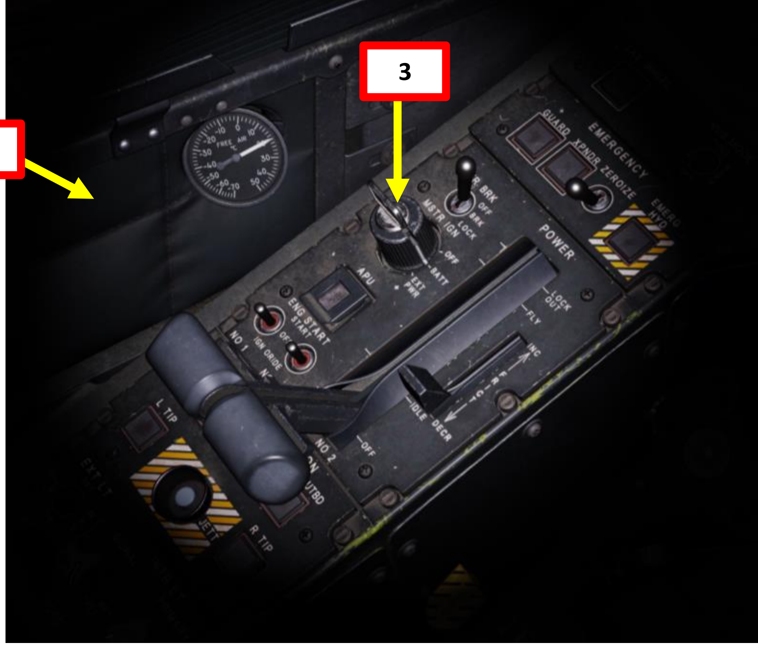
A – BEFORE START-UP

A – BEFORE START-UP

NOTE: Some steps will be omitted to keep the procedure concise and practical. We will assume that your helicopter is in pristine condition and that the ground crew did their job properly.

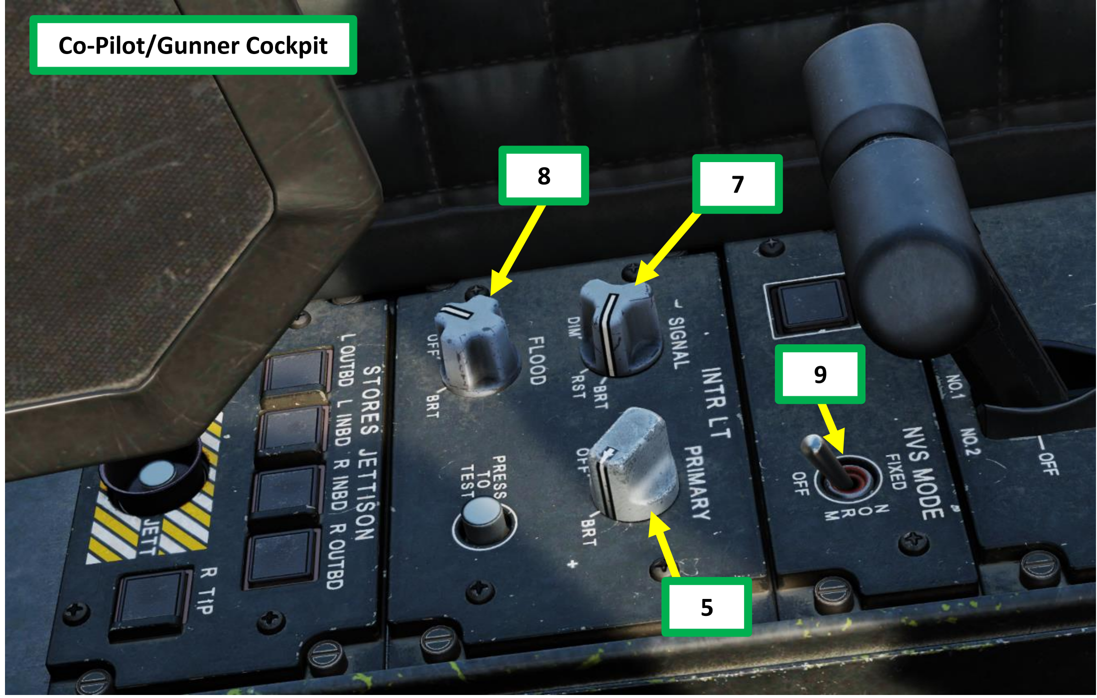
- *Steps preceded by [P] are performed by the Pilot.*
- *Steps preceded by [CPG] are performed by the Co-Pilot Gunner (or the George AI if no player is manning the front cockpit).*
- *Steps preceded by [P+CPG] are performed by both the Pilot* ***and*** *the Co-Pilot Gunner (or the George AI if no player is manning the front cockpit).*
- *Steps preceded by [P/CPG] can be performed by either the Pilot* ***or*** *the Co-Pilot Gunner.*
- *Steps preceded by an asterisk * are* ***optional*** *for an expedited start-up.*

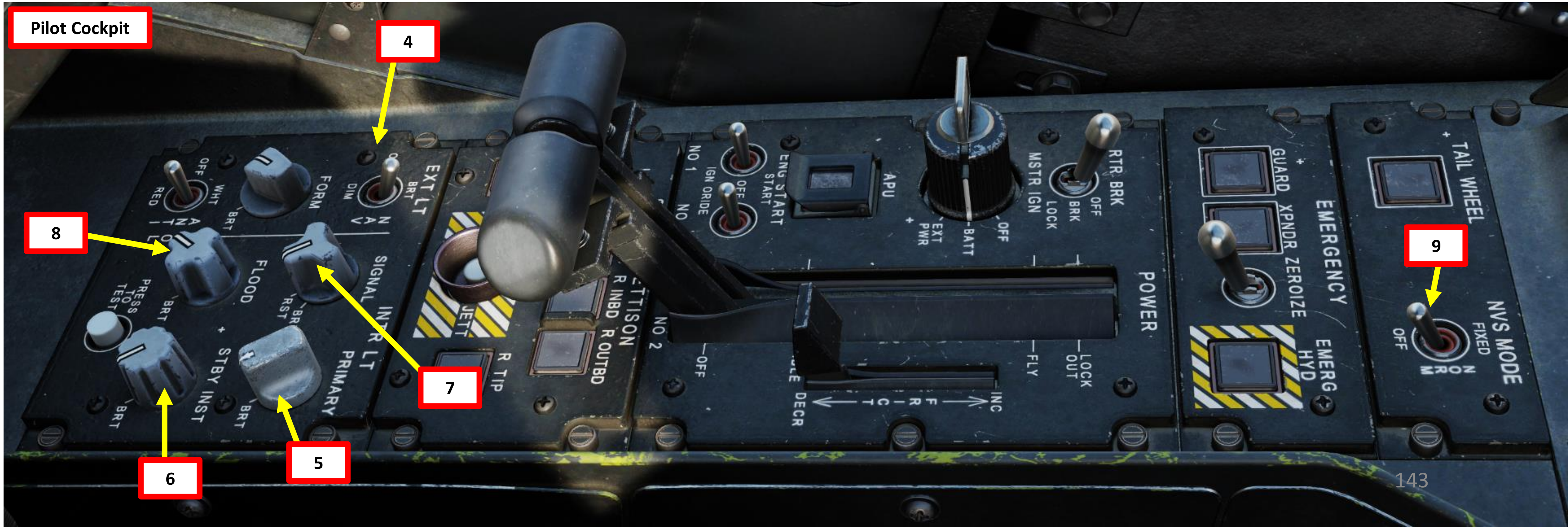
1. *[P+CPG]* If required during night operations, turn on flashlight by using "LALT+L".
2. *[P+CPG]* To view the cockpit more easily, you can remove the IHADSS (Integrated Helmet and Display Sighting System) monocle by pressing "I" ("IHADSS SHOW/HIDE" control).
3. *[P]* Insert Ignition Key and set MSTR IGN (Master Ignition) Selector – BATT (Battery)



A – BEFORE START-UP

4. *[P] Set Navigation Lights Switch – BRIGHT (FWD)
5. [P+CPG] Set Primary Cockpit Lights Control Knob – BRT (Bright)
6. *[P] Set Standby Instruments Lights Control Knob – BRT (Bright)
7. [P+CPG] Set Signal Lights Control Knob – BRT (Bright)
8. *[P+CPG] Set Cockpit Flood Lights Control Knob – As required
9. [P+CPG] Set NVS (Night Vision System) Mode Switch – OFF (AFT)





A – BEFORE START-UP

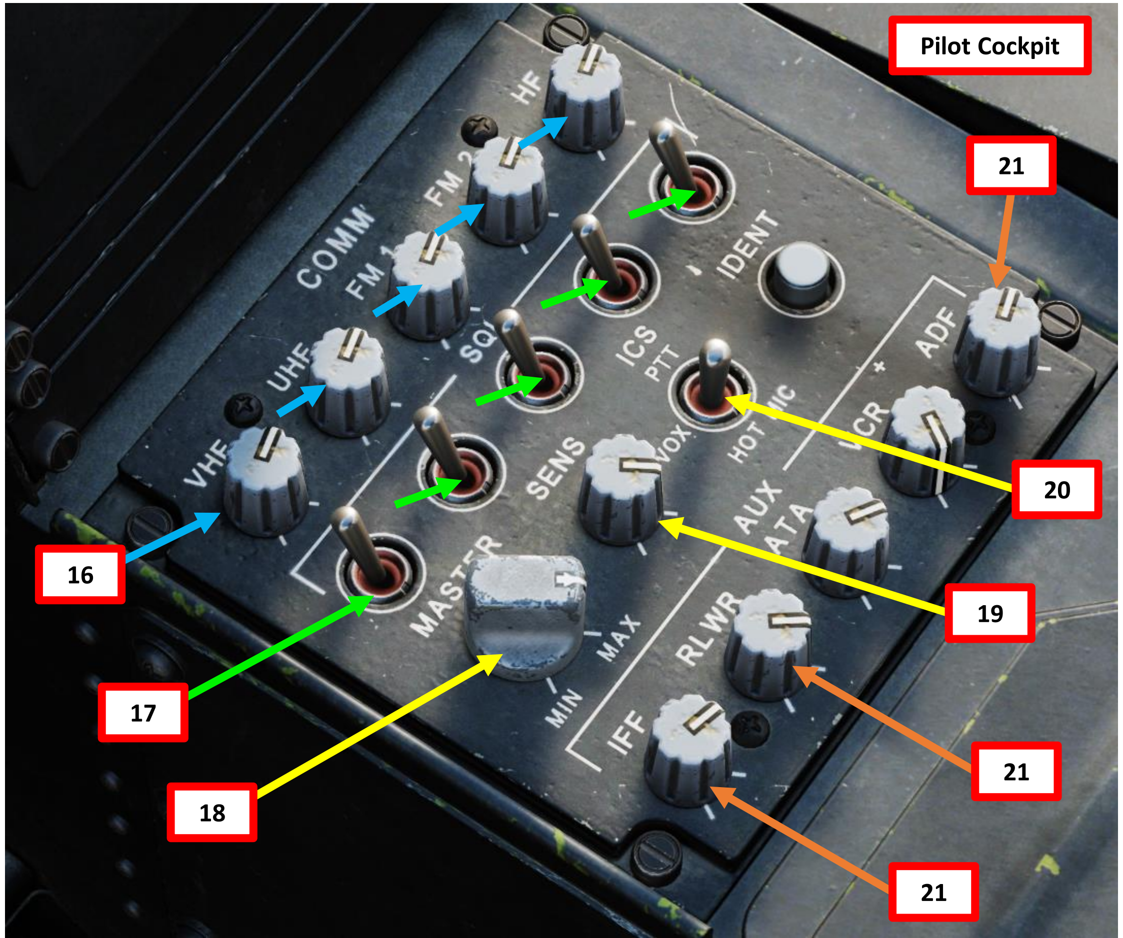
10. [P+CPG] Set KU (Keyboard Unit) Brightness Knob – Bright (Turn Clockwise As Required)
11. [P+CPG] Set MPD (Multi-Purpose Display) Brightness Control (BRT) Knobs – Bright (Turn Clockwise As Required)
12. [P+CPG] Set MPD (Multi-Purpose Display) Video Control (VID) Knobs – Bright (Turn Clockwise As Required)
13. [P+CPG] Set MPD (Multi-Purpose Display) Mode Selector – DAY for day operations, or NT for night operations
14. [P+CPG] Set EUFD (Enhanced Up-Front Display) Brightness Control Knob – Bright (Turn Clockwise As Required)

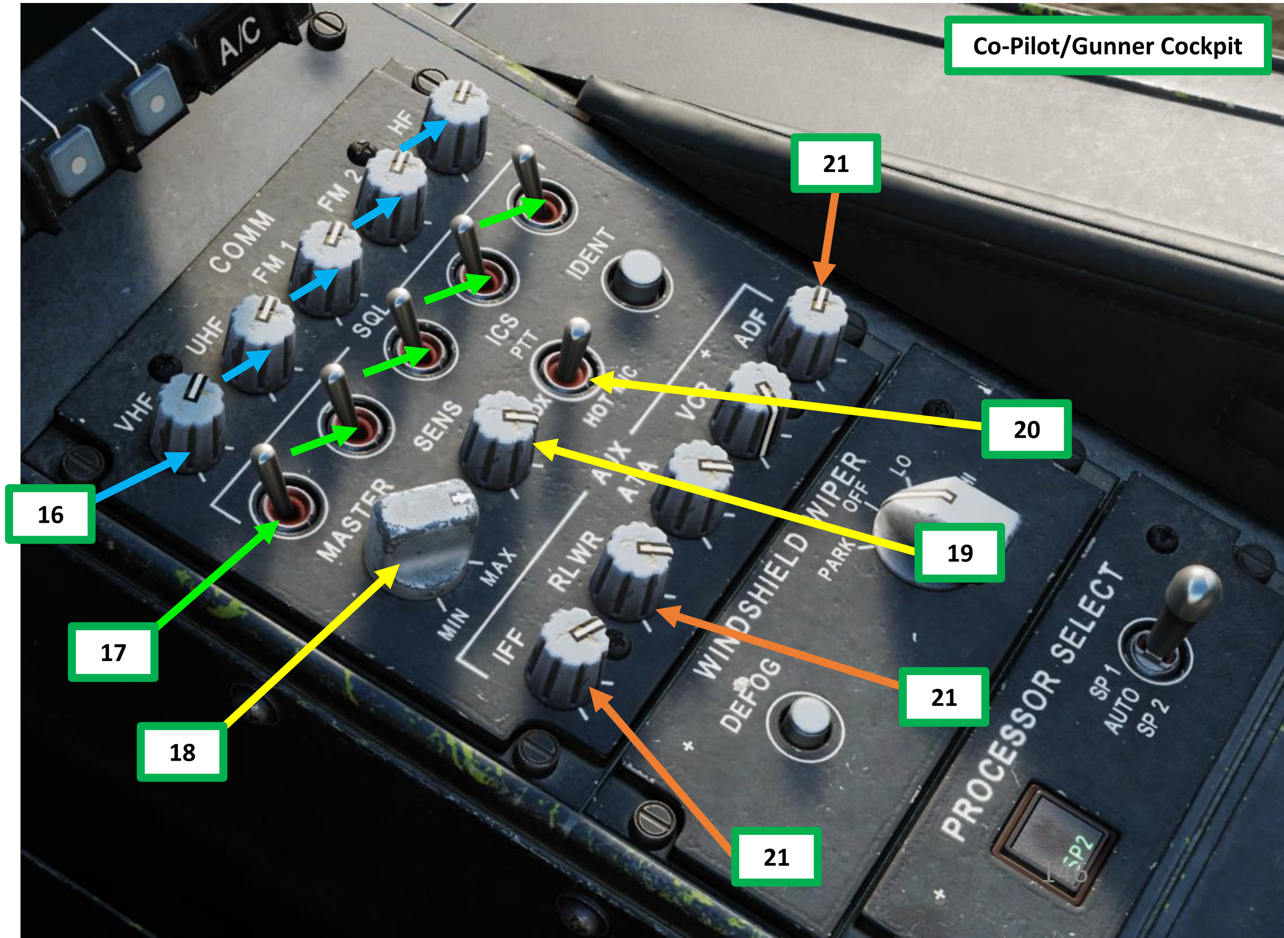
A – BEFORE START-UP

10. *[P+CPG]* Set KU (Keyboard Unit) Brightness Knob – Bright (Turn Clockwise As Required)
11. *[P+CPG]* Set MPD (Multi-Purpose Display) Brightness Control (BRT) Knobs – Bright (Turn Clockwise As Required)
12. *[P+CPG]* Set MPD (Multi-Purpose Display) Video Control (VID) Knobs – Bright (Turn Clockwise As Required)
13. *[P+CPG]* Set MPD (Multi-Purpose Display) Mode Selector – DAY for day operations, or NT for night operations
14. *[P+CPG]* Set EUFD (Enhanced Up-Front Display) Brightness Control Knob – Bright (Turn Clockwise As Required)
15. *[CPG]* Set TDU (TEDAC Display Unit) Mode Selector – DAY for day operations, or NT for night operations

A – BEFORE START-UP

16. *[P+CPG]* Adjust VHF, UHF, FM1, FM2 and HF Radio Volume – As Required (Turn Clockwise)
17. *[P+CPG]* Set VHF, UHF, FM1, FM2 and HF Radio Squelch Switches – FWD (ON) momentarily, then release to center position.
18. *[P+CPG]* Adjust Radio Master Volume Control Knob – As Required (Turn Clockwise towards MAX)
19. *[P+CPG]* Adjust SENS (Sensitivity) Control Knob – As Required (Turn Clockwise)
20. *[P+CPG]* Set ICS (Intercom System) Switch – VOX (MIDDLE).
    - ICS will transmit automatically when the pilot speaks loud enough to break squelch.
21. *[P+CPG]* Adjust IFF (Identify-Friend-or-Foe Transponder), RLWR (Radar Laser Warning Receiver), and ADF (Automatic Direction Finder) Auxiliary Systems Volume – As Required (Turn Clockwise)





A – BEFORE START-UP

22. *[P+CPG] Press the Lights Test Button and confirm all signal lights illuminate properly.

A – BEFORE START-UP

23. *[P/CPG] Hold the Fire Detection Circuit Test Switch – LEFT (Position 1).
24. *[P/CPG] For the duration of the test for the fire detection loop No. 1, confirm the following:
    - MSTR WARN, ENG 1, APU and ENG 2 FIRE buttons illuminate
    - AFT DECK FIRE warning is displayed on the EUFD (Enhanced Up-Front Display)
    - Voice warning system is activated and the aural cues “Aft Deck Fire”, “Engine 1 Fire”, “Engine 2 Fire”, and “APU Fire” are audible.
25. *[P/CPG] Release the Fire Detection Circuit Test Switch (switch springs back to center position) and press the MSTR WARN button to reset the master warning.
26. *[P/CPG] Hold the Fire Detection Circuit Test Switch – RIGHT (Position 2).
27. *[P/CPG] For the duration of the test for the fire detection loop No. 2, confirm the following:
    - MSTR WARN, ENG 1, APU and ENG 2 FIRE buttons illuminate
    - DISCH buttons illuminate
    - AFT DECK FIRE warning is displayed on the EUFD (Enhanced Up-Front Display)
    - Voice warning system is activated and the aural cues “Aft Deck Fire”, “Engine 1 Fire”, “Engine 2 Fire”, and “APU Fire” are audible.
28. *[P/CPG] Release the Fire Detection Circuit Test Switch (switch springs back to center position) and press the MSTR WARN button to reset the master warning.

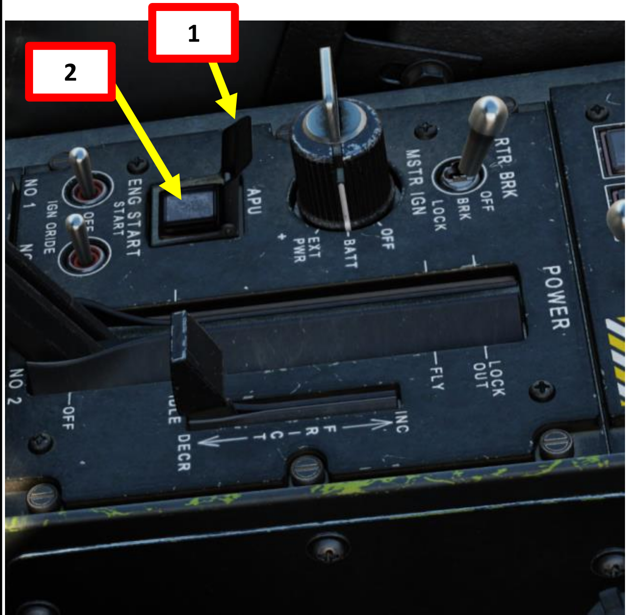
A – BEFORE START-UP

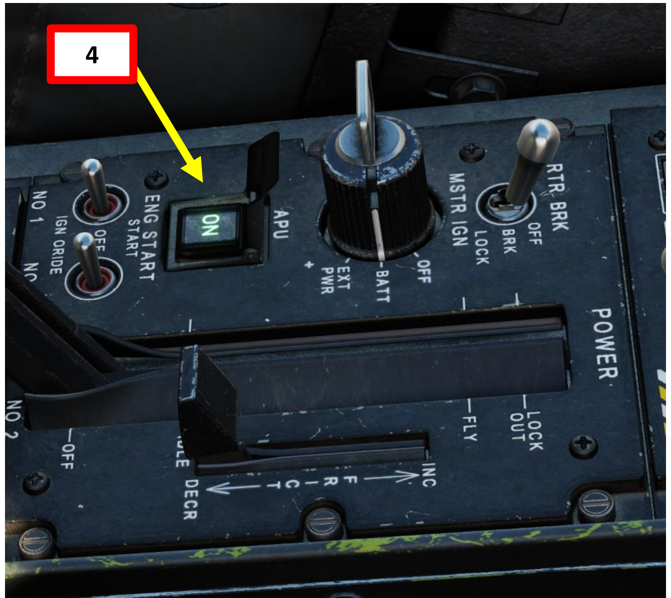
29. *[P+CPG]* Close Cockpit Door using "LCTRL + C" or by clicking on the door handle.

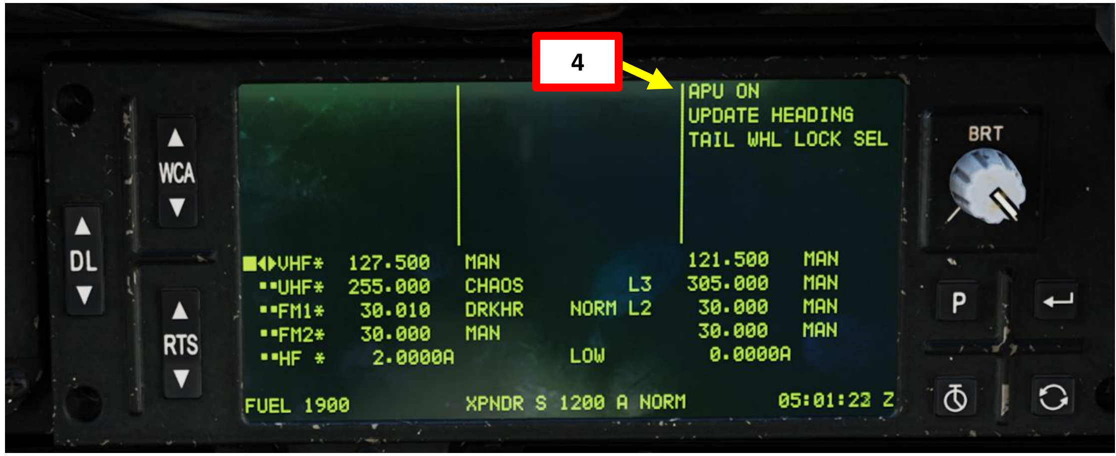
B – APU (AUXILIARY POWER UNIT) START

The APU is primarily used to start the engines without requiring external ground power sources but can be used as an emergency or auxiliary source of electric or hydraulic power.

1. *[P]* Flip the APU Start Button Guard
2. *[P]* Press the APU Start Button for 1 to 2 seconds, then release it.
3. *[P]* During the APU start-up sequence, the following advisories are visible on the EUFD (Enhanced Up-Front Display):
   - APU POWER ON: APU ECU (Electronic Control Unit) has power and APU is not yet ON, meaning that APU RPM has not reached above 95%.
   - APU START: APU start-up sequence is active
   - ACCUM OIL PRES LO: Utility hydraulic accumulator has discharged into the APU start motor
4. *[P]* When the APU start-up sequence is complete:
   - "ON" light illuminates on the APU Start Button
   - On the EUFD, APU POWER ON, APU START and ACCUM OIL PRES LO advisories are extinguished, indicating the utility hydraulic accumulator has recharged.
   - On the EUFD, APU ON advisory is visible

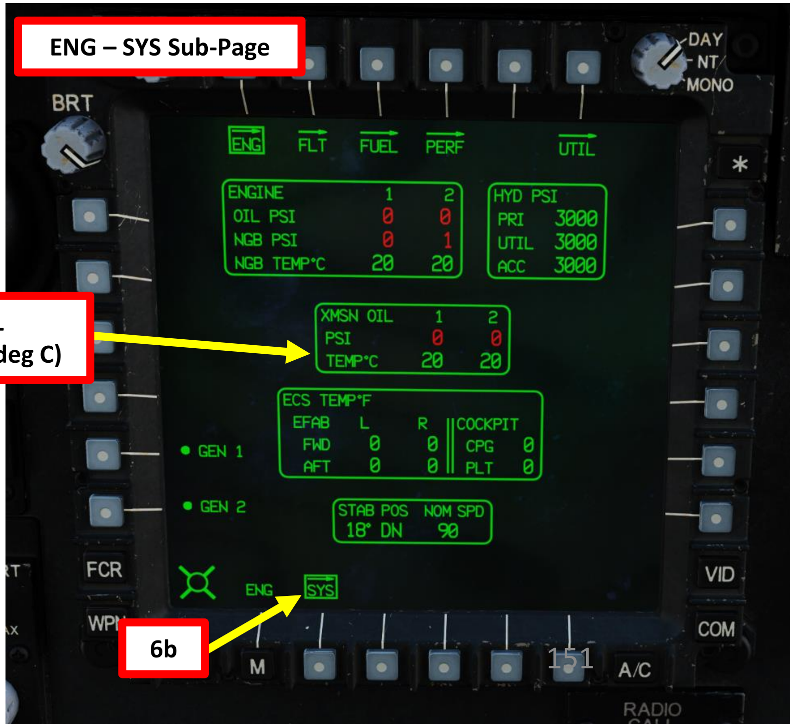






B – APU (AUXILIARY POWER UNIT) START

5. *[P]* Once the APU is started, the APU generator provides power to the MPDs (Multi-Purpose Displays) and other helicopter systems. The ENG page should be visible on the left MPD, while the DMS (Data Management System) DTU (Data Transfer Unit) page should be visible on the right MPD.
6. *[P]* During extended APU operations, monitor the XMSN OIL (transmission oil) temperature on the ENG SYS page (press on the VAB (Variable Action Button) next to SYS on the left MPD). Do not exceed operations on APU power for greater than 5 minutes while at a XMSN OIL temperatures of 120 deg C to 130 deg C. To return to ENG main page, press on VAB next to SYS again.



C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

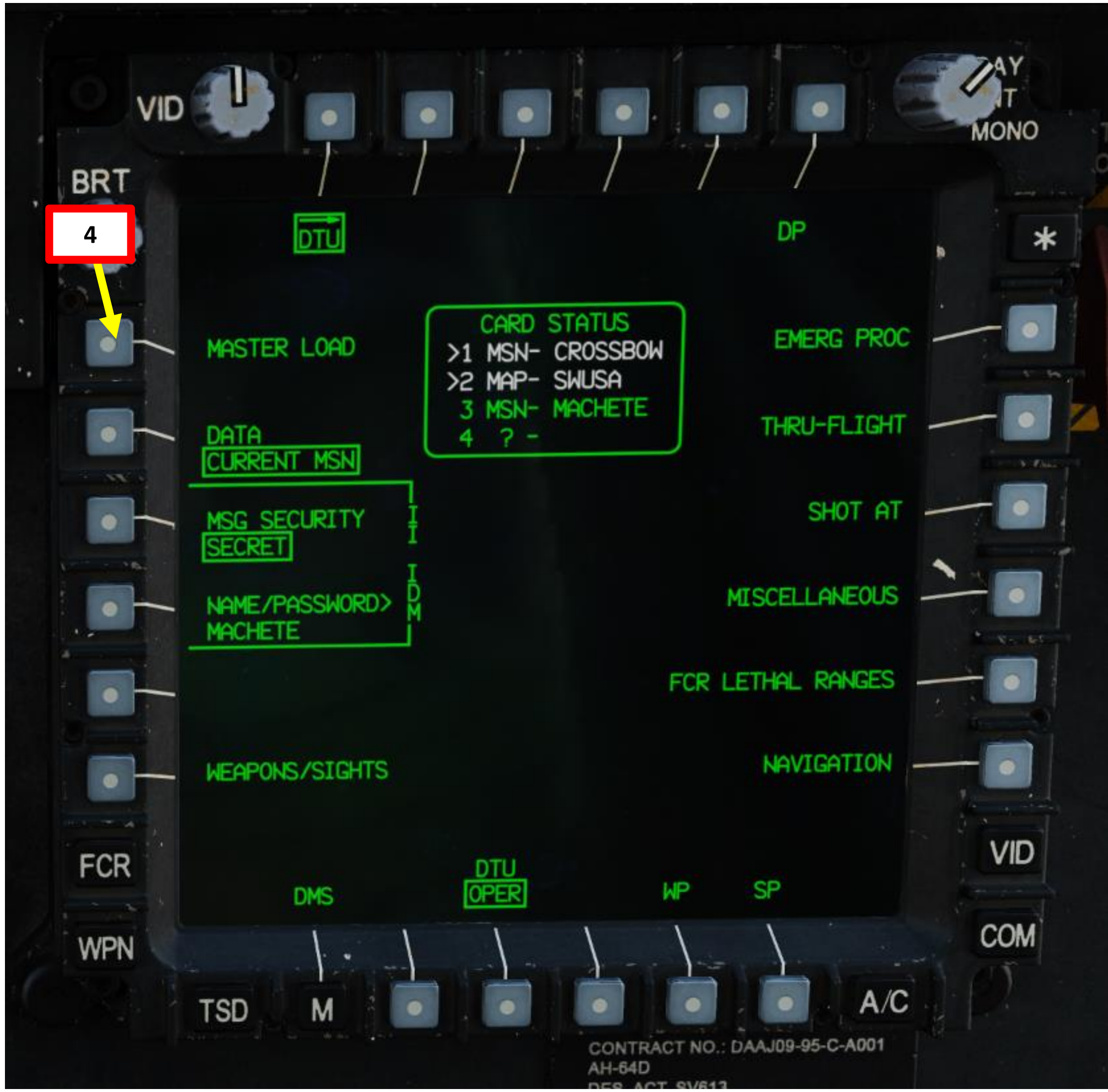
The Data Management System (DMS) sweep is meant to pre-configure aircraft pages for use during flight. These steps can be performed by either the pilot or co-pilot/gunner, or dispatched between both crew members to accelerate the DMS sweep process. As a suggestion:

- The Pilot selects MASTER LOAD, configures COMs, sets up their own TSD and WPN page settings.
- The co-pilot/gunner will handle weapons initialization (i.e. laser codes, Laser Rangefinder/Designator and Laser Spot Tracker setup), their own TSD page settings, perform TADS operational checks.
- Either crewmember can perform the FCR (Fire Control Radar) check.

This version of the DMS sweep is very much abbreviated and based on my personal preference. Feel free to make your own version of it or use other sweeps better suited to your needs.

Load DTU (Data Transfer Unit)

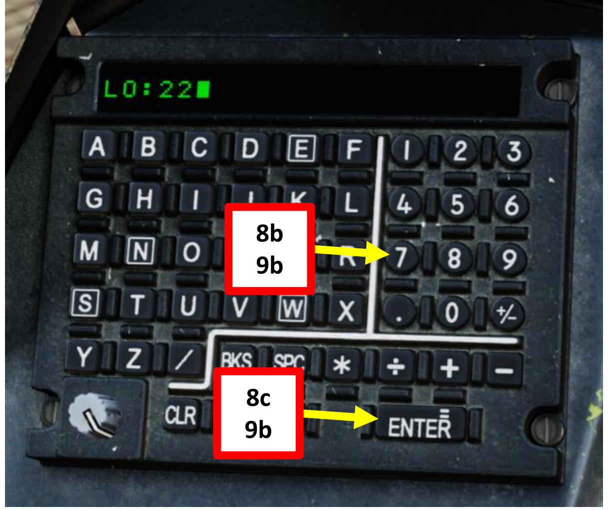
1. *[P/CPG]* The right MPD (Multi-Purpose Display) should already be set to the DMS (Data Management System) DTU (Data Transfer Unit) page once APU is running.
2. **[P/CPG]* Verify the DATA field displays CURRENT MSN (Current Mission).
3. **[P/CPG]* Verify the DTU Mode field displays OPER (Operational).
4. *[P/CPG]* Press the VAB (Variable Action Button) next to MASTER LOAD. The aircraft will then load all content of the DTU cartridge required for the current mission. The loading process can take a minute or two.

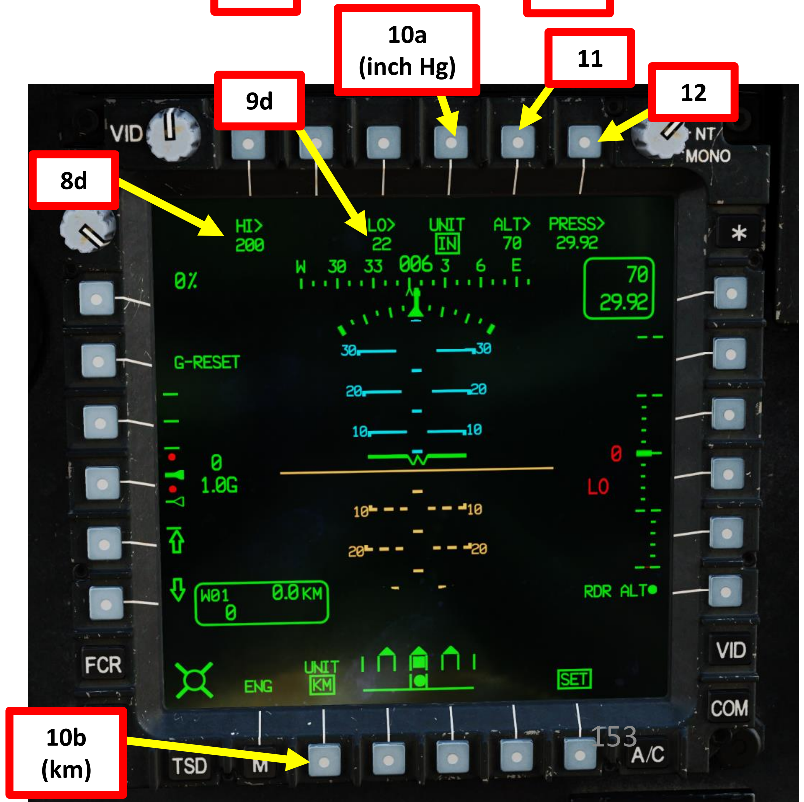


C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

A/C (Aircraft) Setup: FLT Page

5. *[P/CPG]* Press on the M (Menu) Button to access the main MPD menu.
6. *[P/CPG]* Press VAB (Variable Action Button) next to AIRCRAFT – FLT.
7. *[P/CPG]* Press VAB next to SET.
8. **[P/CPG]* If desired, press VAB next to HI, enter the High Altitude Warning value (in feet) on the KU (Keyboard Unit), then press ENTER. I typically use a 200 ft setting.
9. **[P/CPG]* If desired, press VAB next to LO, enter the Low Altitude Warning value (in feet) on the KU (Keyboard Unit), then press ENTER. I typically use a 22 ft setting.
10. **[P/CPG]* If desired, press VAB next to UNIT (next to IN/MB) to toggle between barometric pressure units (inches of mercury or millibars). You can also select distance units displayed using VAB next to UNIT (next to KM/NM).
11. **[P/CPG]* Verify that the ALT (current altitude/elevation) is correct. You can manually change it with the KU if necessary.
12. **[P/CPG]* Verify that the PRESS (barometric pressure setting) is correct. You can manually change it with the KU if necessary.

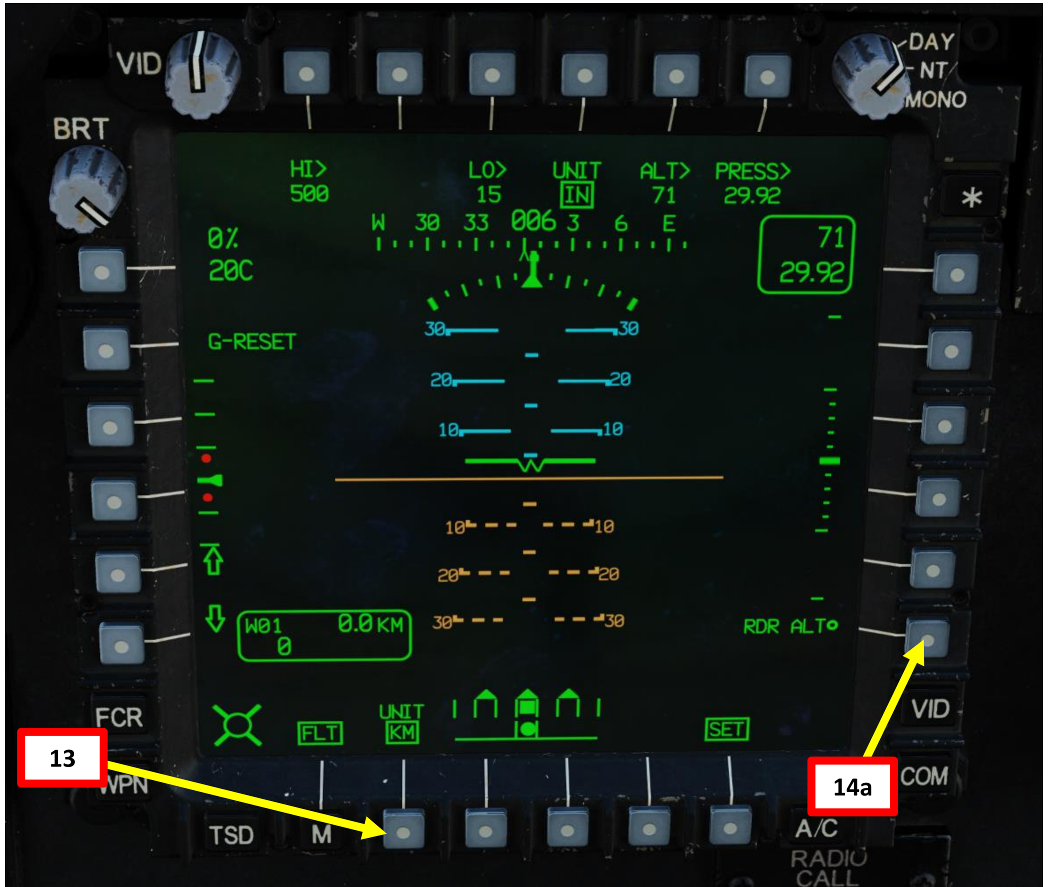


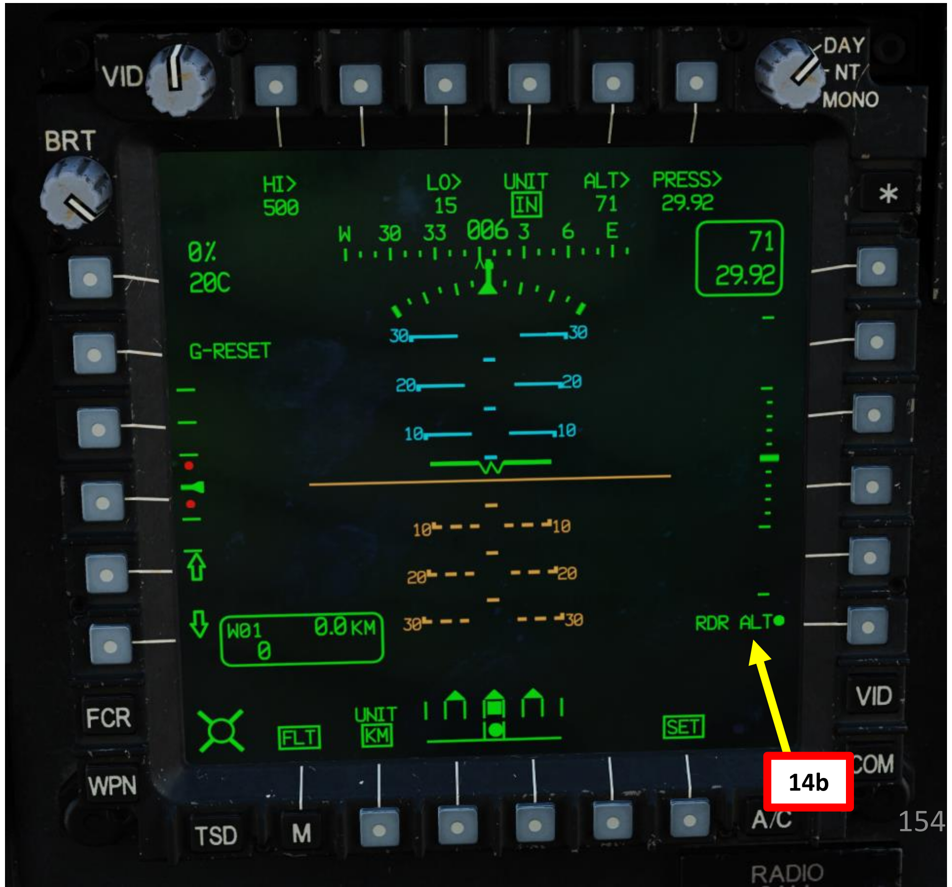


C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

A/C (Aircraft) Setup: FLT Page

13. **[P/CPG]* If desired, press VAB next to UNIT (next to KM/NM) to toggle between distance units (nm or km).
14. *[P/CPG]* Turn on radar altimeter by pressing VAB next to RDR ALT.
    - Hollow circle means OFF. Solid Circle means ON.
15. *[P/CPG]* To exit the FLT SET sub-menu, press VAB (Variable Action Button) next to SET again.

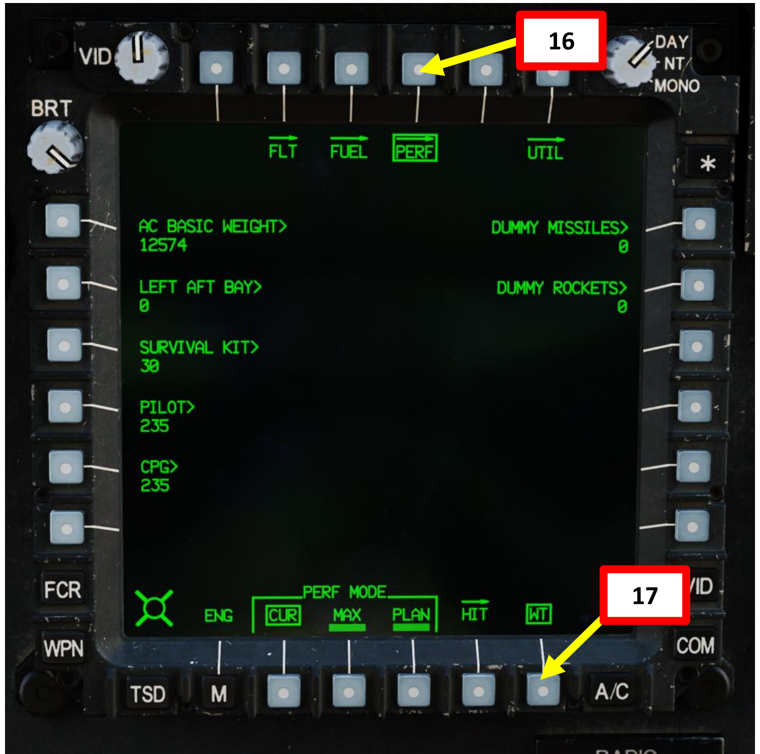


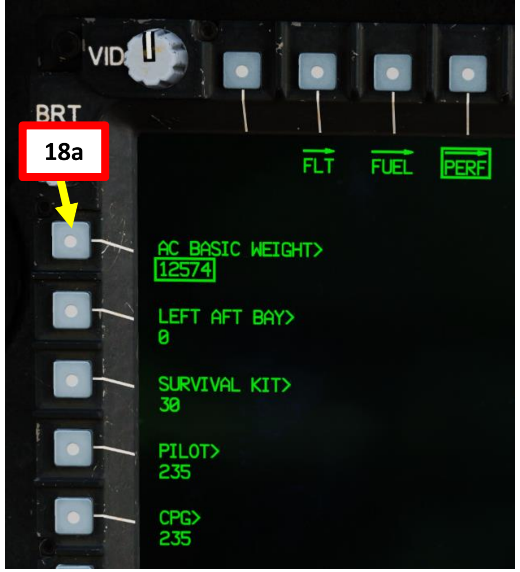


C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

A/C (Aircraft) Setup: PERF Page

16. **[P/CPG]* Press VAB (Variable Action Button) next to PERF.
17. **[P/CPG]* Press VAB next to WT (Weight).
18. **[P/CPG]* If required, update AC BASIC WEIGHT field and other weight fields for LEFT AFT BAY, SURVIVAL KIT, PILOT and CPG (in lbs). We will assume all those fields are correct and leave them as is.
    - To enter a custom Basic Weight:
        a) Press the VAB next to AC BASIC WEIGHT, which is boxed when selected.
        b) Type the BASIC WT (basic empty weight in lbs, which is the weight of the helicopter + all permanently installed equipment, full hydraulic fluid, full oil, and unusable fuel) on the KU (Keyboard Unit).
        c) Press ENTER on the KU.
        d) Type the MOMENT (basic empty moment, which is the weight x arm). Note: The arm value is not available in DCS.
        e) Press ENTER on the KU.

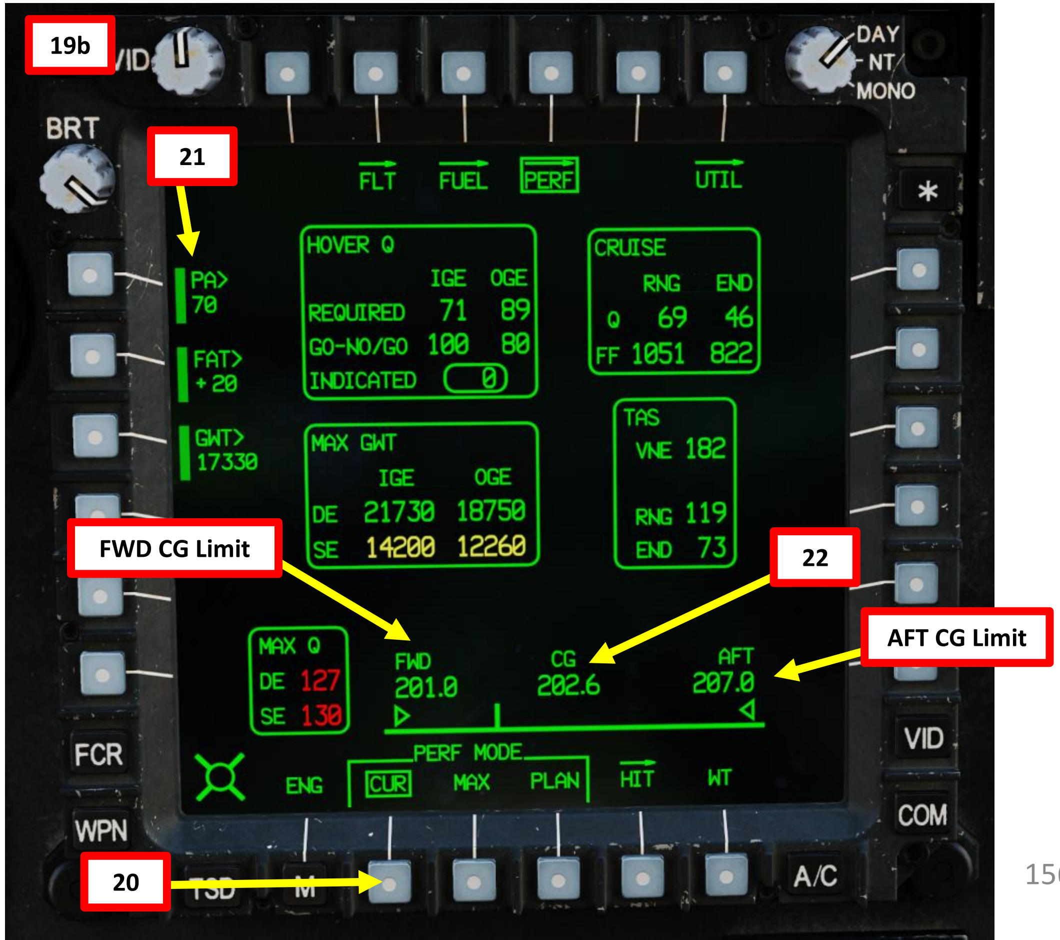




C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

A/C (Aircraft) Setup: PERF Page

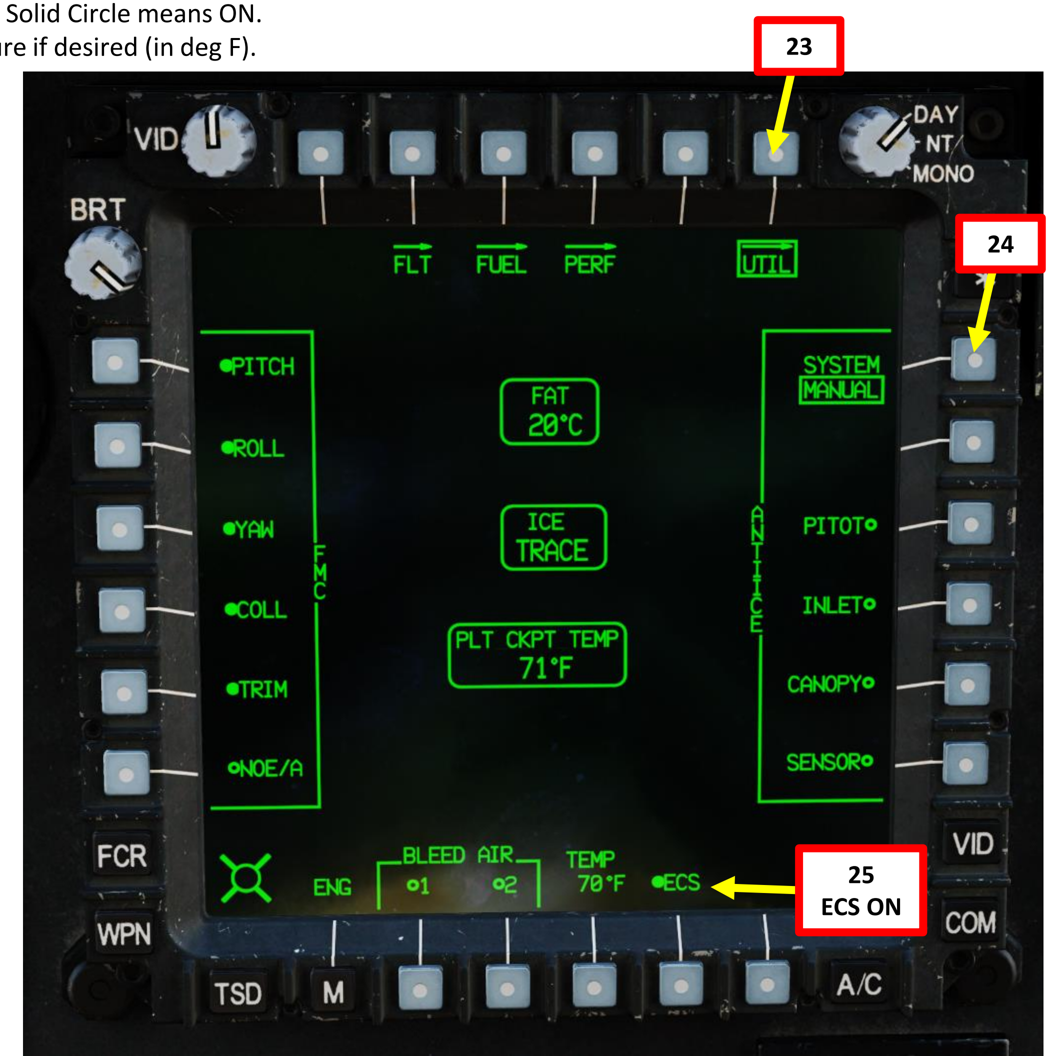
19. *[P/CPG]* Press VAB next to WT (Weight) to return to main PERF page.
20. *[P/CPG]* Verify that PERF Mode selected is CUR (Current).
21. *[P/CPG]* Check PA (Pressure-Altitude, in ft), FAT (Free Air Temperature, in deg C) and GWT (Gross Weight, in lbs). We will assume that they are correct.
22. *[P/CPG]* Ensure aircraft is within CG (Center-of-Gravity) forward and aft limits.



C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

A/C (Aircraft) Setup: UTIL Page

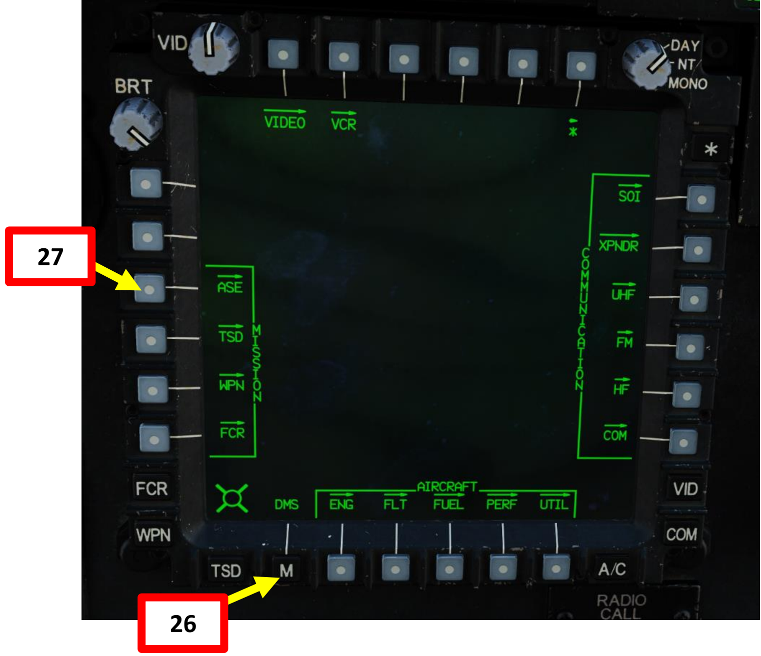
23. *[P/CPG]* Press VAB (Variable Action Button) next to UTIL (Utility).
24. *[P/CPG]* Press VAB next to Anti-Ice System Mode to set MANUAL mode.
    - The reason to leave it in MANUAL is that the pilot is then in control of when they lose 20% of their maximum engine power and not the computer.
25. **[P/CPG]* Check ECS (Environmental Control System) is ON.
    - Hollow circle means OFF. Solid Circle means ON.
    - Adjust cockpit temperature if desired (in deg F).

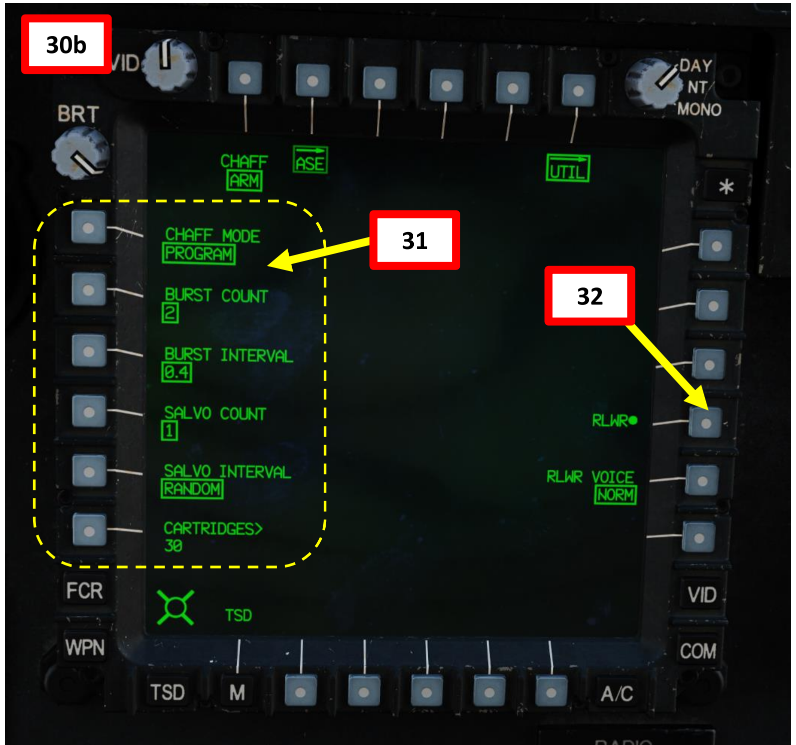


C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

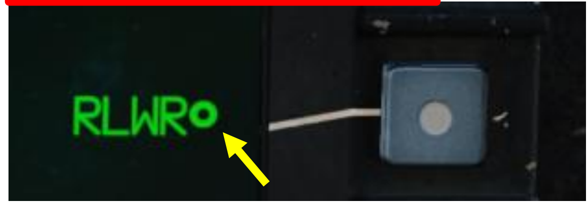
ASE (Aircraft Survivability Equipment) Setup

26. *[P/CPG]* Press on the M (Menu) Button to access the main MPD menu.
27. *[P/CPG]* Press VAB (Variable Action Button) next to MISSION – ASE.
28. *[P/CPG]* Press VAB next to Chaff Arm/Safe Setting to toggle from SAFE to ARM (you must be airborne when doing so since Weight on Wheels sets Chaff to SAFE automatically).
29. **[P/CPG]* Press VAB next to ASE AUTOPAGE Setting to select desired threat level that will result in an Autopage to the TSD (Tactical Situation Display) format. I typically leave it at SEARCH.
    - SEARCH: ASE will Autopage when a search radar is detected.
    - ACQUISITION: ASE will Autopage when a radar acquisition is detected.
    - TRACK: ASE will Autopage when a tracking radar is detected.
    - OFF: ASE will not Autopage.
30. *[P/CPG]* Press VAB next to UTIL.
31. **[P/CPG]* If desired, press VABs next to Chaff Program Settings and KU (Keyboard Unit) to modify your countermeasure programs. I typically leave the default settings as is.
32. *[P/CPG]* Turn on Radar/Laser Warning Receiver by pressing VAB next to RLWR.
    - Hollow circle means OFF. Solid Circle means ON.





Radar/Laser Warning Receiver OFF



Radar/Laser Warning Receiver ON

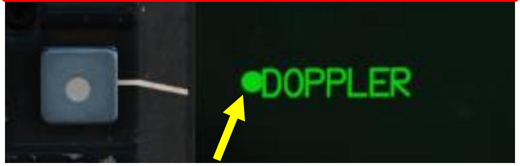
C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

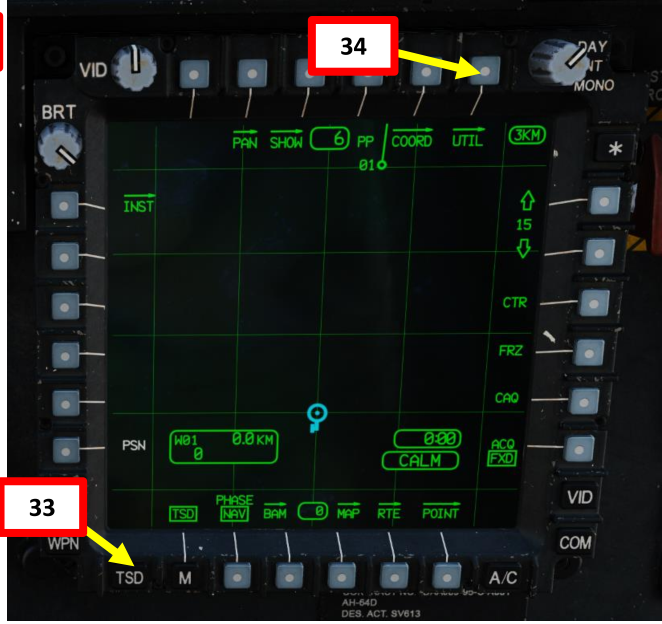
TSD (Tactical Situation Display) Setup

33. *[P/CPG]* Press on the TSD FAB (Fixed Action Button) to access the Tactical Situation Display menu.
34. *[P/CPG]* Press on VAB (Variable Action Button) next to UTIL (Utility).
35. *[P/CPG]* Turn on Doppler Navigation System by pressing VAB next to DOPPLER.
    - Hollow circle means OFF. Solid Circle means ON.
36. *[P/CPG]* While navigation systems alignment is under way, wait until position confidence is at least 95%-probable CEP (Circular Error Probability) for INU1 and INU2 (refer to EGI, the Embedded GPS/Inertial Navigation Units). It should decrease from 0.055 km to an acceptable position confidence (values equal to or smaller than 0.012 km are deemed acceptable in DCS).
37. *[P/CPG]* Once navigation system alignment is complete (it should take roughly 4 to 5 minutes), position confidence data will change from white to green (value smaller than 0.012 km is OK).

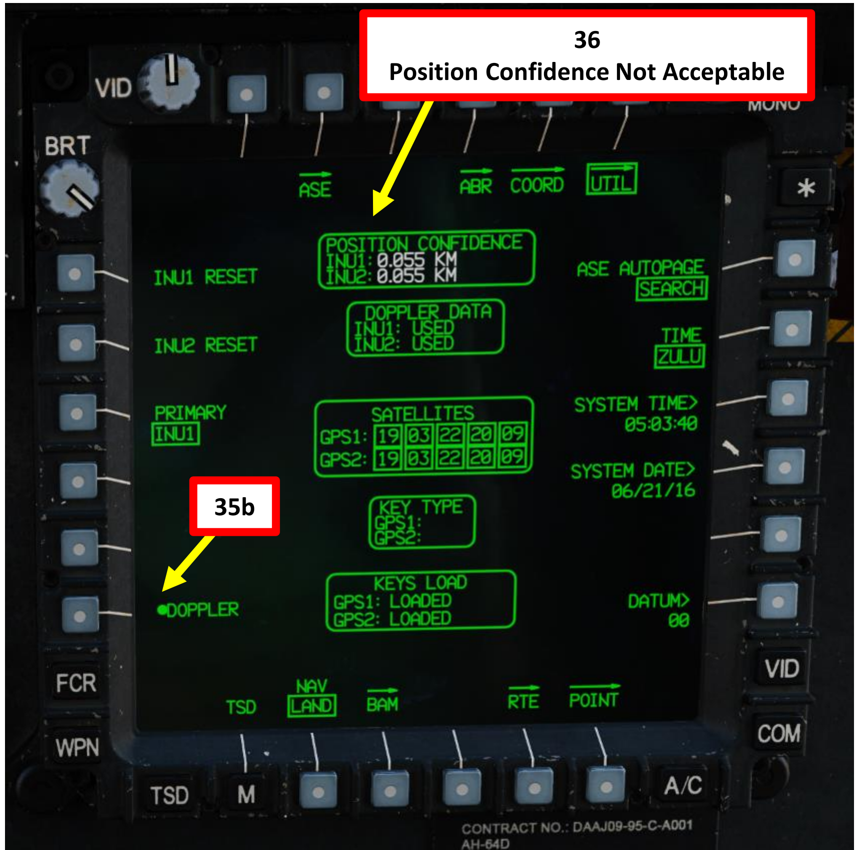
DRVS (Doppler Radar Velocity Sensor) OFF

DRVS (Doppler Radar Velocity Sensor) ON





36
Position Confidence Not Acceptable

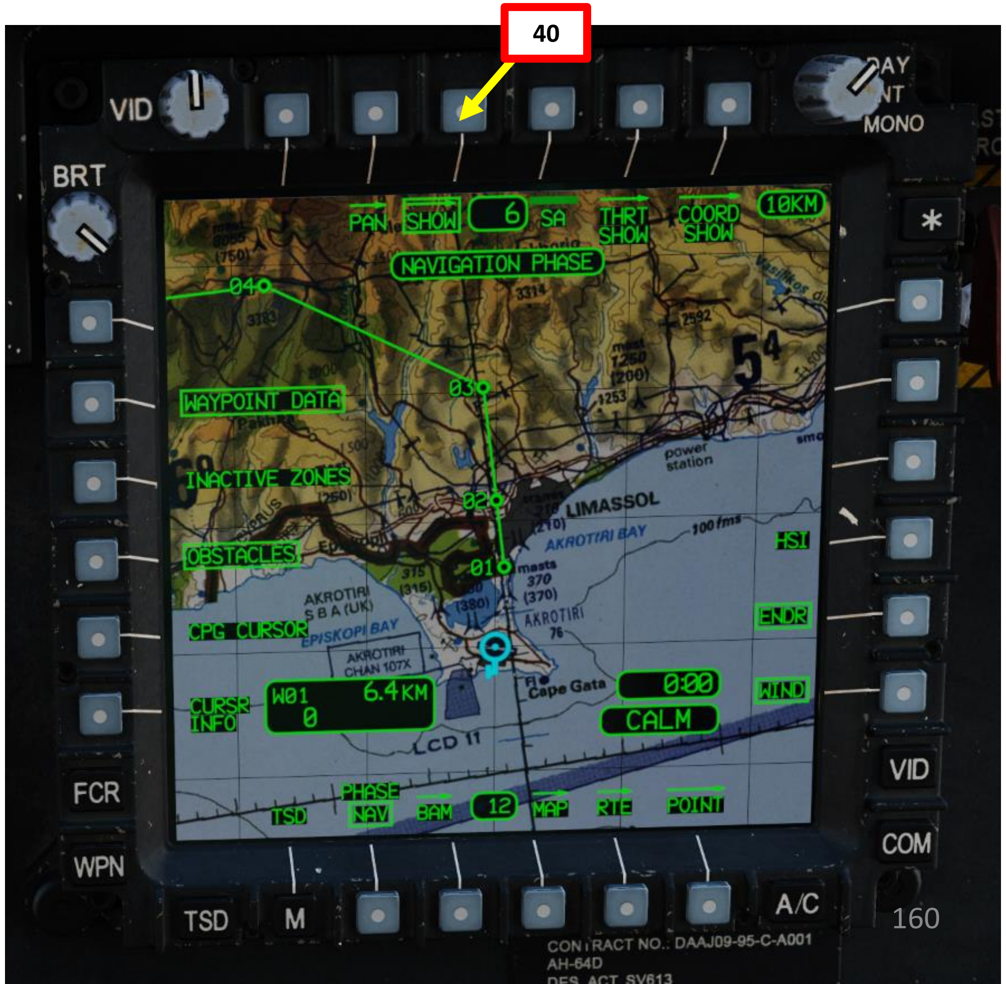


37
Position Confidence Acceptable

C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

TSD (Tactical Situation Display) Setup

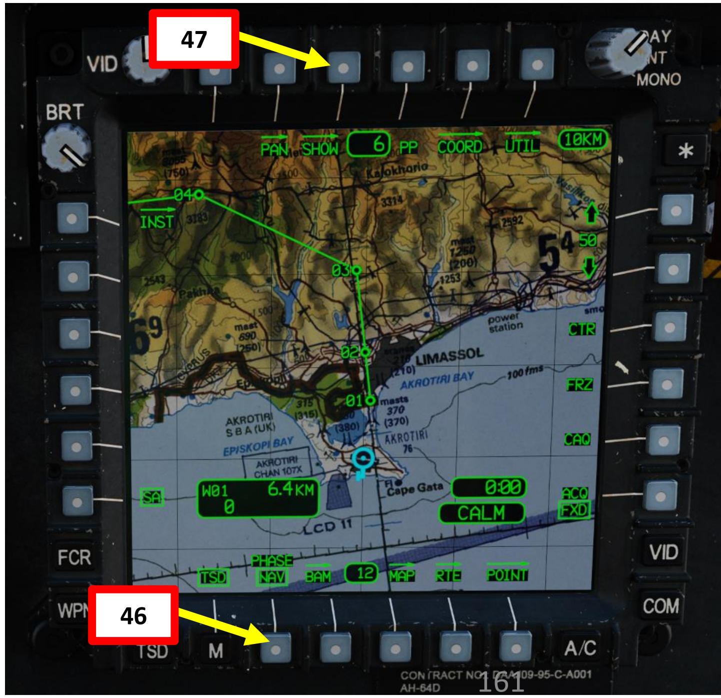
38. *[P/CPG] Press on VAB (Variable Action Button) next to UTIL (Utility) to return to main TSD page.
39. *[P/CPG] Adjust TSD scale using VABs next to the TSD Scale Level Setting.
40. *[P/CPG] Press VAB next to SHOW. The SHOW menu toggles on or off display of different map icons and windows.



C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

TSD (Tactical Situation Display) Setup

41. *[P/CPG]* By default, the NAV (Navigation) Phase is selected.
42. *[P/CPG]* Use VABs (Variable Action Buttons) to select what data is displayed on the TSD in NAV phase.
    - I like to have WAYPOINT DATA, OBSTACLES, CPG CURSOR, ENDR (Endurance Status) and WIND selected.
43. *[P/CPG]* Press VAB next to PHASE to select ATK (Attack) Phase.
44. *[P/CPG]* Use VABs (Variable Action Buttons) to select what data is displayed on the TSD in ATTACK phase.
    - I like to have CURRENT ROUTE, INACTIVE ZONES, FCR TGTS/OBSTACLES, CPG CURSOR, ENDR (Endurance Status) and WIND selected.
45. *[P/CPG]* If desired, use VAB next to THRT SHOW to select which threat types to show. I typically leave it with default settings.
46. *[P/CPG]* Press VAB next to PHASE to return to NAV (Navigation) Phase.
47. *[P/CPG]* Press VAB next to SHOW to return to main TSD page.



C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

TSD (Tactical Situation Display) Setup

48. *[P/CPG]* If desired, set a Control Measure on your starting location. Control Measures are points for depicting friendly and enemy units, airfields, and other graphical control measures for controlling a mission.
    a) On TSD page, press VAB (Variable Action Button) next to POINT.
    b) Press VAB next to ADD
    c) Press VAB next to CM (Control Measure)
    d) Press VAB next to IDENT (Identity). KU (Keyboard Unit) will then display “IDENT:”.
    e) On KU (Keyboard Unit), type “FC”, then press ENTER. “FC” is the Control Measure code for FARP (Forward Arming & Refueling Point) FUEL/AMMO.
    f) KU will display “FREE:” (free text, which has a 3-character limit). Since this is our home base, type “HOM” for “Home”), then press ENTER. This way you have a nice readable bit of text directly above the control measure.
    g) KU will display coordinates for your aircraft’s current position. Press ENTER.
    h) KU will display MSL (Mean Sea Level) altitude of your aircraft’s current position. Press ENTER.

C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

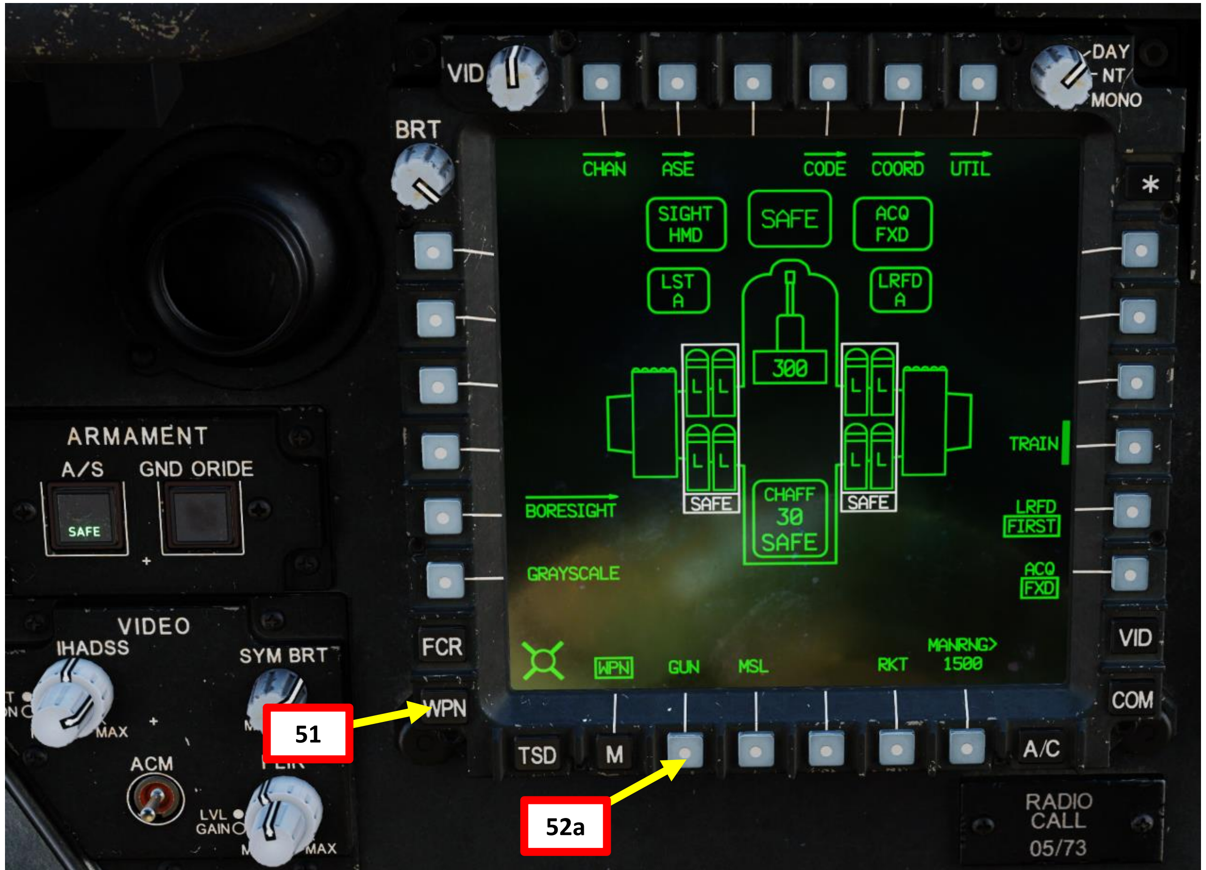
TSD (Tactical Situation Display) Setup

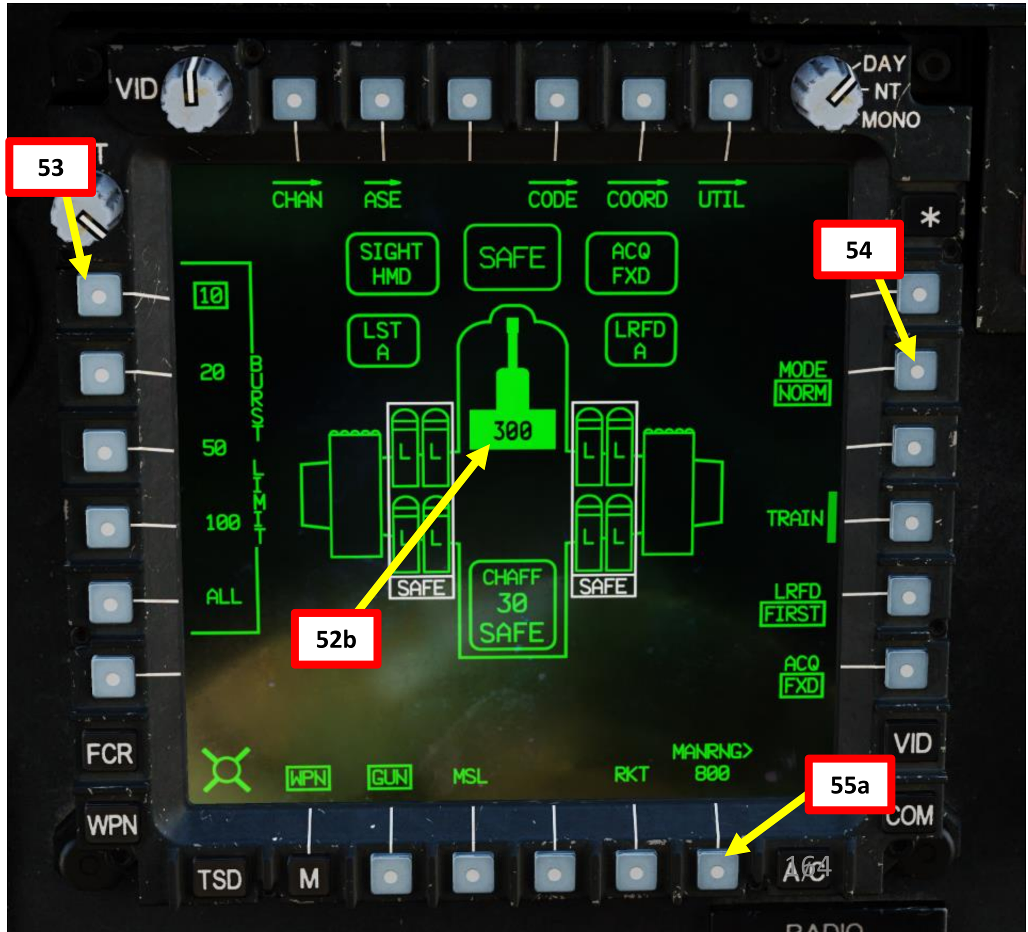
49. **[P/CPG]* Press VAB (Variable Action Button) next to POINT to return to main TSD page.
50. **[P/CPG]* You now have a Control Measure labeled “HOM” (for “Home”) and marked with a FARP icon for you to set as a direct-to when you want to find your way home.
    - If no free text was entered, the Control Measure will be labeled as “C51”.

C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

WPN (Weapon) Setup: Gun

51. *[P/CPG] Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
52. *[P/CPG] Press VAB (Variable Action Button) next to GUN to select the Gun.
53. *[P/CPG] Use VABs to select desired Gun Burst Limit.
54. *[P/CPG] Use VAB next to MODE to select Normal Mode, which means the gun follows IHADSS line-of-sight.
55. *[P/CPG] Press VAB next to MAN RNG, enter desired Gun Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER.
    - I typically use a fixed manual ranging setting of 800 m.
    - If you want to use automatic ranging, enter “A” on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.

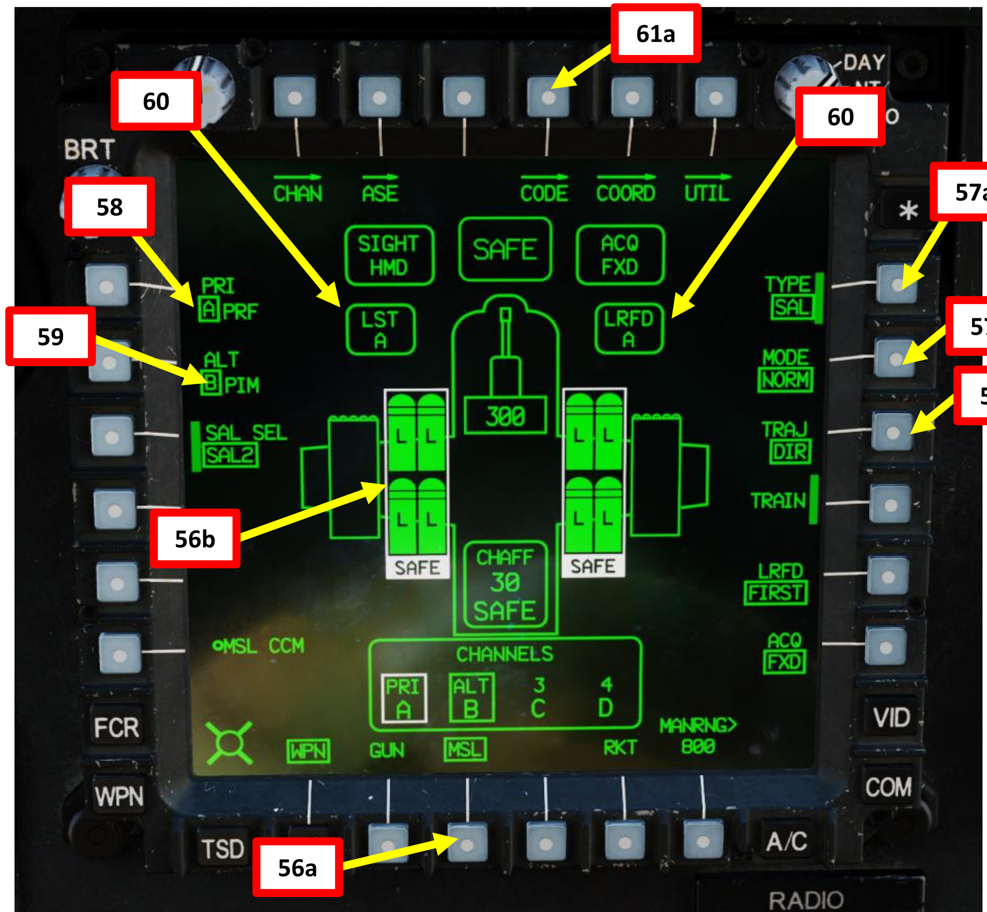


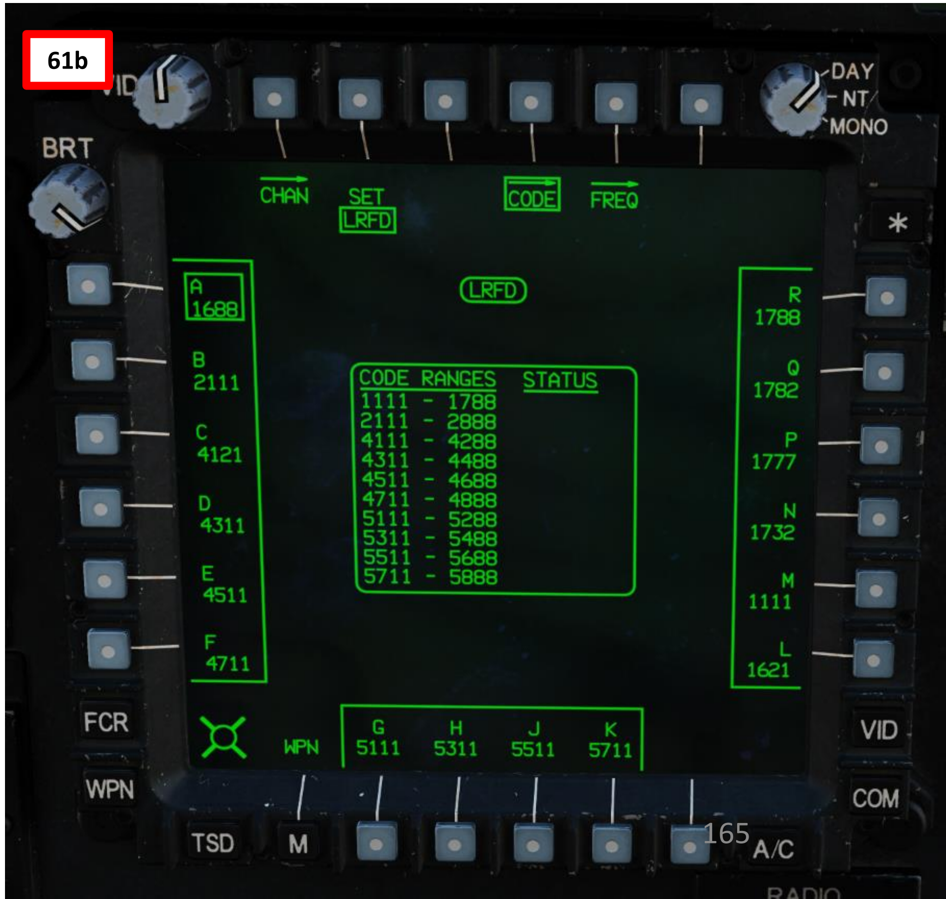


C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

WPN (Weapon) Setup: Missiles

56. *[P/CPG]* Press VAB (Variable Action Button) next to MSL to select Missiles if equipped.
57. *[P/CPG]* By default, Missile type is set to SAL (Semi-Active Laser), Missile mode is set to Normal and Missile trajectory is set to DIR (Direct). Change if required.
58. *[P/CPG]* The PRI setting shows the missile's primary laser code channel is A.
59. *[P/CPG]* The ALT setting shows the missile's alternate laser code channel is B.
60. *[P/CPG]* By default, LST (Laser Spot Tracker) is set to Channel A and LRFD (Laser Rangefinder/Designator) is set to Channel A as well. If you fly with a wingman, it is good practice to set the LST Channel to your wingman's LRFD Channel. As an example, your wingman will designate his targets using LRFD code for Channel B.
61. *[P/CPG]* To change your LST channel code, press VAB (Variable Action Button) next to CODE.

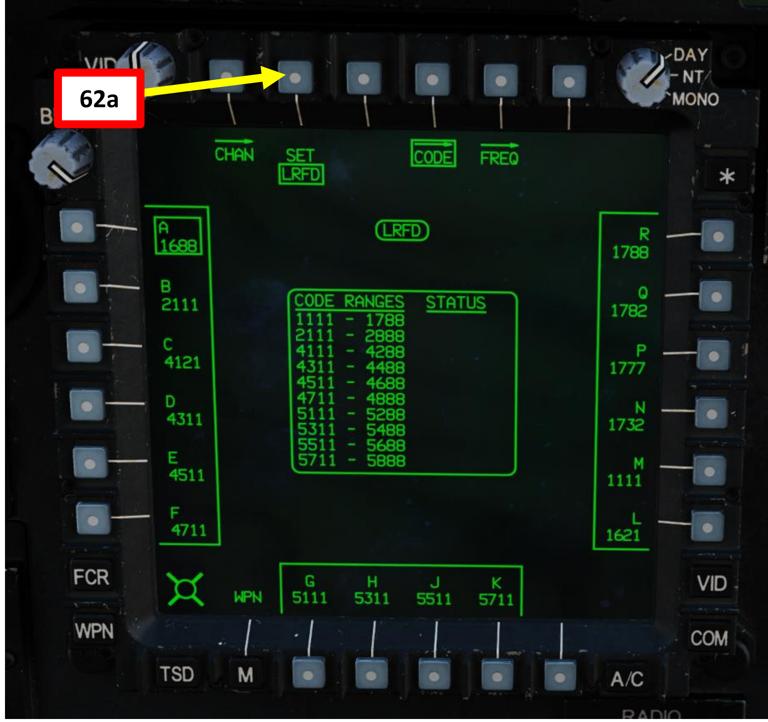


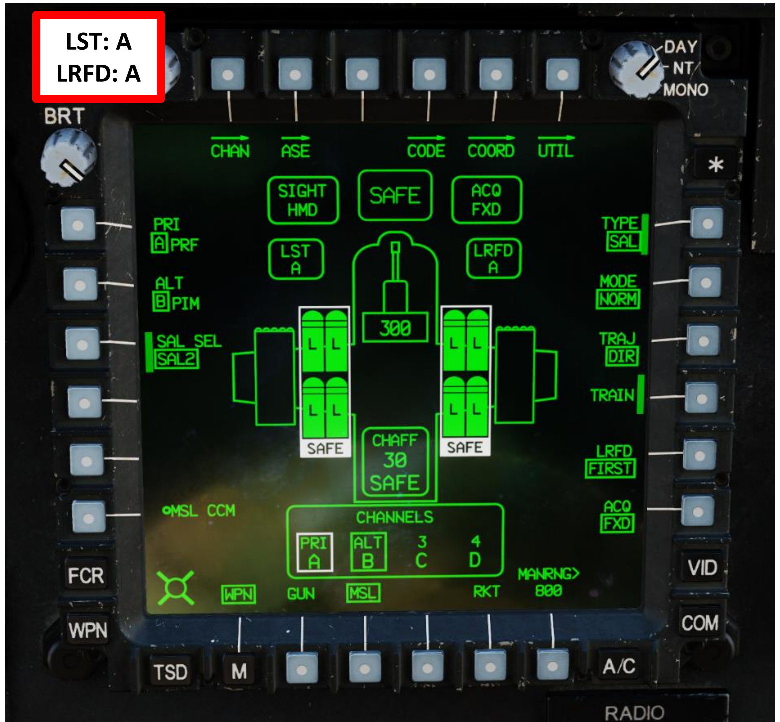


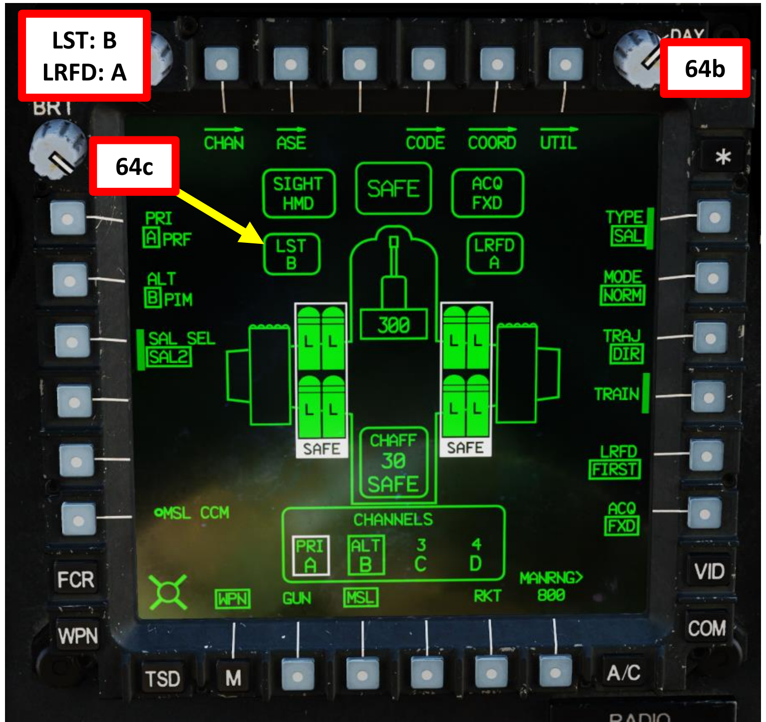
C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

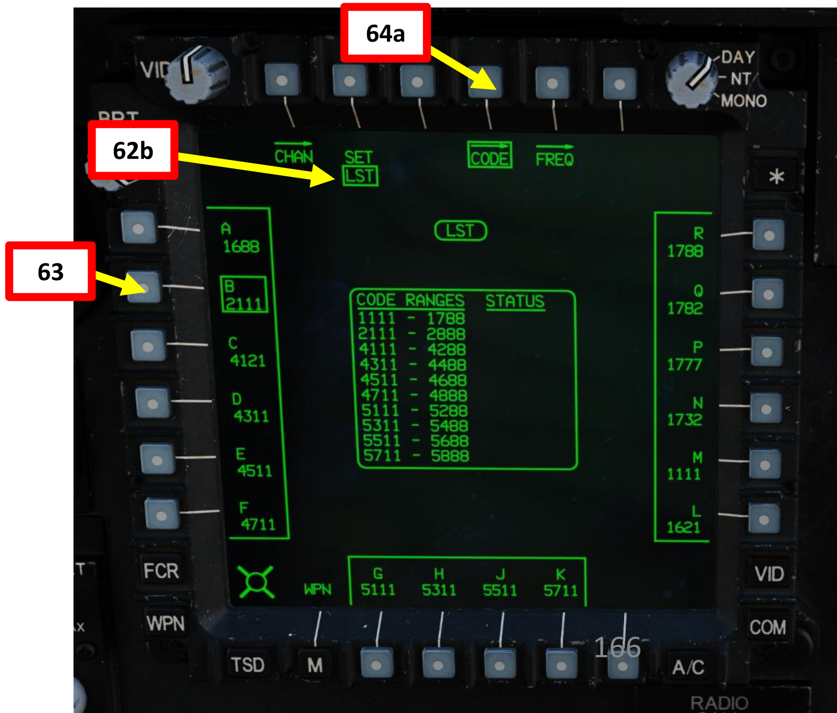
WPN (Weapon) Setup: Missiles

62. *[P/CPG] Press VAB (Variable Action Button) next to SET to switch from LRFD (Laser Rangefinder/Designator) to LST (Laser Spot Tracker) settings.
63. *[P/CPG] Press VAB next to "B" to select Channel B (laser code 2111 by default) for LST.
64. *[P/CPG] Press VAB next to CODE to return to WPN menu. As you can see, the LRFD window shows that you will designate with Laser Channel A (Code 1688) and the LST window shows that you can search for your wingman's laser designation, which is assumed to be Channel B (Code 2111).





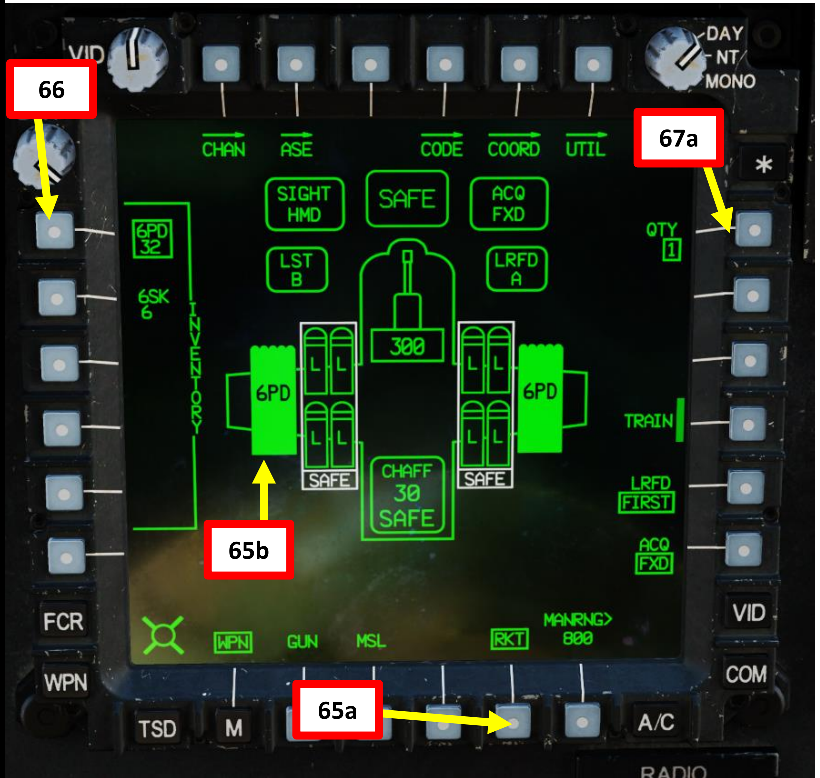


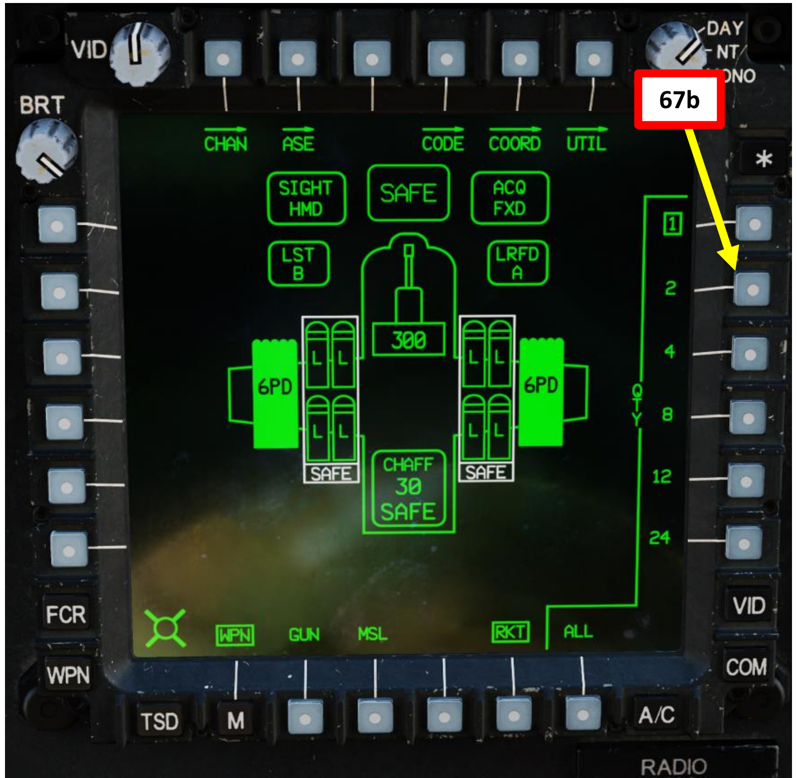


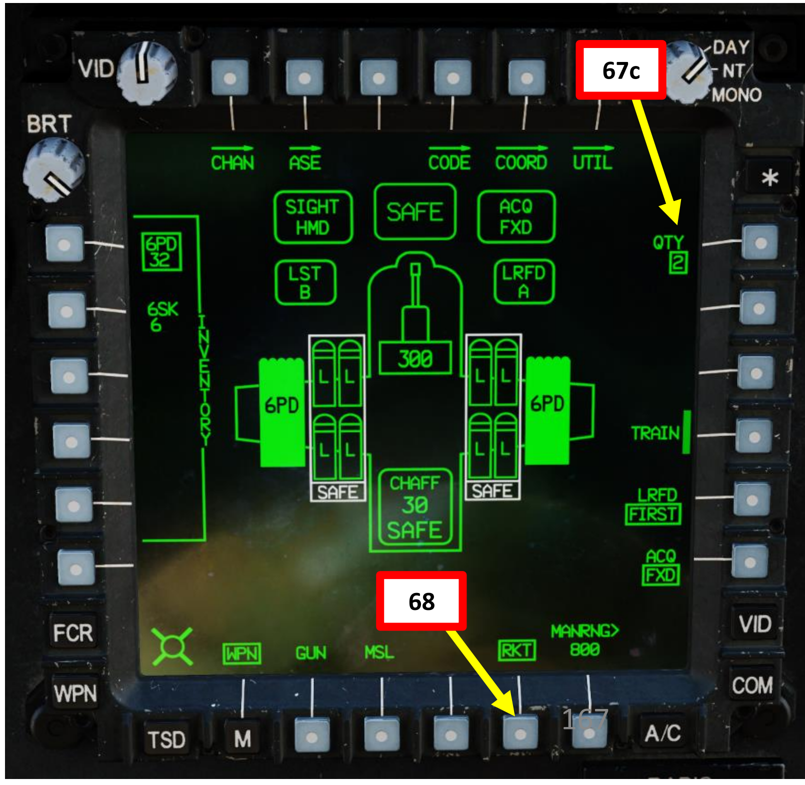
C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

WPN (Weapon) Setup: Rockets

65. *[*P*/*CPG*]* Press VAB (Variable Action Button) next to RKT to select Rocket Pods (if equipped).
66. *[*P*/*CPG*]* Use VABs (Variable Action Button) to select desired rocket types (a single pod can contain multiple rocket types).
67. *[*P*/*CPG*]* Use VAB next to QTY to select the desired number of rockets fired per trigger press.
68. *[*P*/*CPG*]* Press VAB (Variable Action Button) next to RKT to return to main WPN menu.







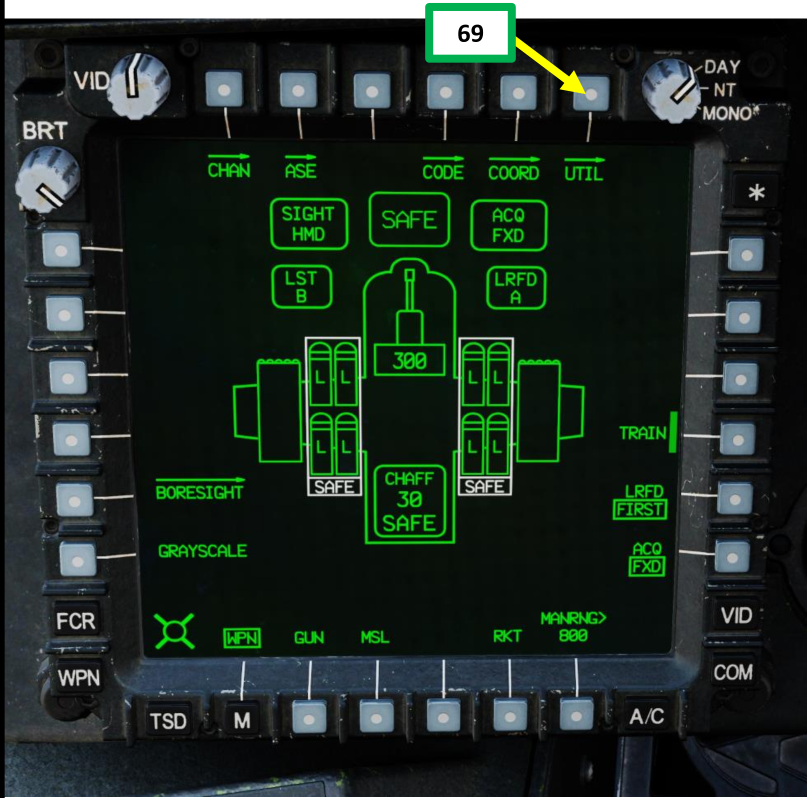
C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

WPN (Weapon) Setup: Laser

69. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
70. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) and laser spot tracker (LST) systems.
    - Hollow circle means OFF. Solid Circle means ON.
    - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
71. *[CPG]* Press VAB next to UTIL to return to main WPN page.

Laser Power OFF

Laser Power ON

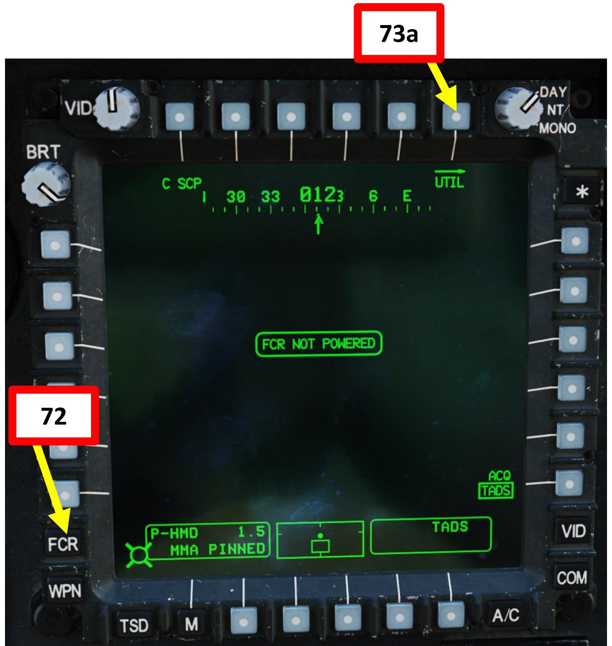


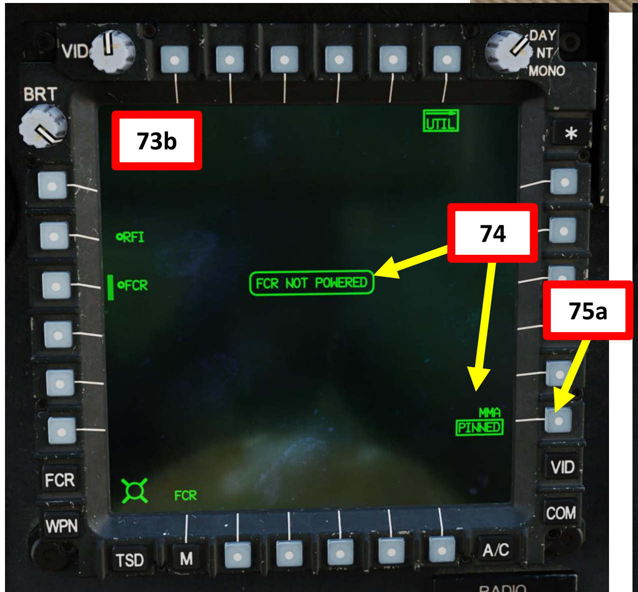
C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

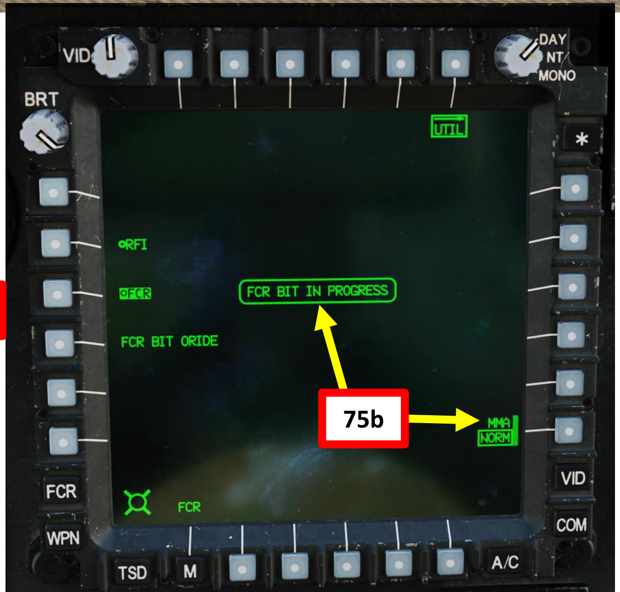
FCR (Fire Control Radar) Setup

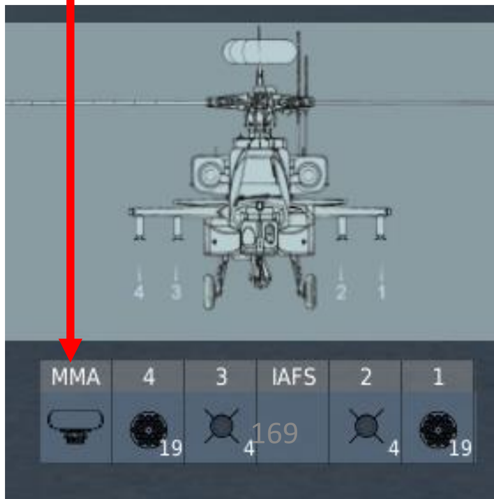
- *Note: these steps are not required if the Fire Control Radar is not installed on your AH-64D.*

72. *[P/CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
73. *[P/CPG]* Press VAB (Variable Action Button) next to UTIL to select Utility page.
    - Note: you can also perform this step by selecting the WPN page first, then selecting UTIL sub-page.
74. *[P/CPG]* FCR NOT POWERED indication should be visible. The state of the Mast-Mounted Assembly (MMA) on the FCR Utility sub-page will be set to PINNED. This is to ensure that the external pin that physically locks the MMA in place is confirmed to be in the unlocked position prior to applying power to the FCR.
75. *[P/CPG]* Press VAB next to MMA – PINNED. This will toggle the Mast-Mounted Assembly from PINNED to NORM and the FCR (Fire Control Radar) and RFI (Radio Frequency Interferometer) will automatically perform their respective power-on sequences.







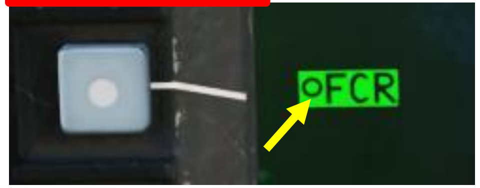


C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

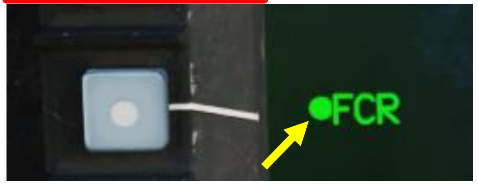
FCR (Fire Control Radar) Setup

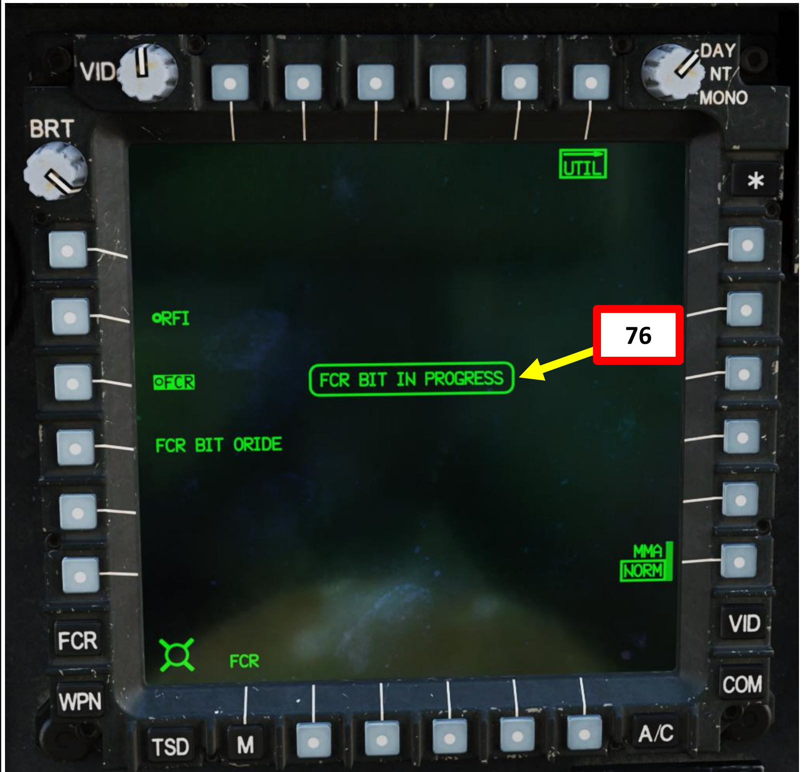
76. *[P/CPG]* During the FCR and RFI power-on sequence, a BIT (Built-In Test) is performed. The BIT lasts approximately 1 minute.
77. *[P/CPG]* Once Built-In Test is complete, the FCR UTIL sub-page will display FCR control parameters and the Fire Control Radar will become available to be selected as a sensor.
    - Hollow circle means OFF. Solid Circle means ON.
78. *[P/CPG]* Take note that the AN/APR-48 RFI may still be powered to provide warning of air defense radar threats independently of FCR operation.
79. **[P/CPG]* If desired, return to FCR main page and check that FCR symbology shows correctly.

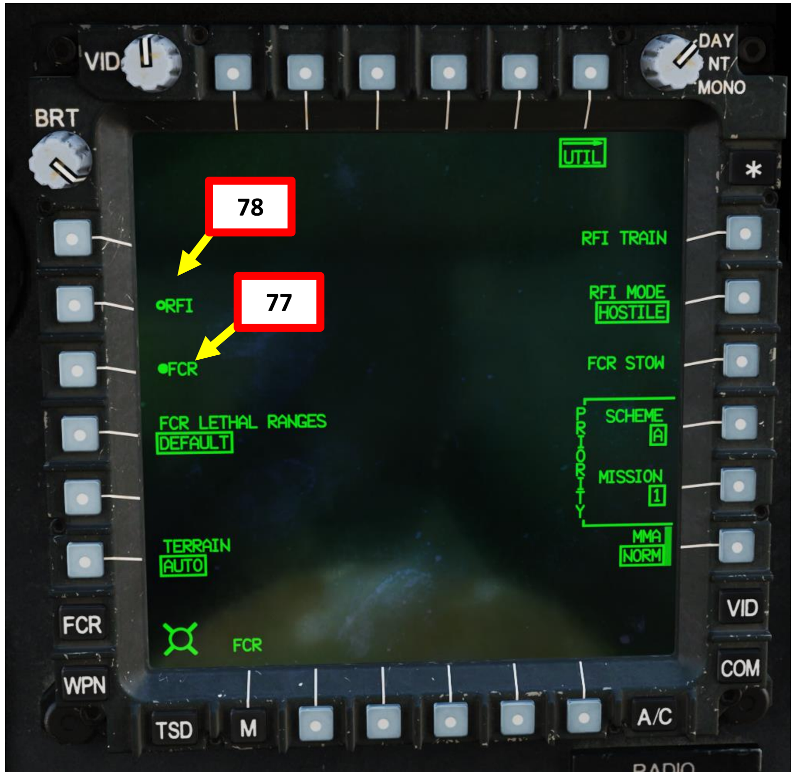
FCR Power OFF



FCR Power ON







C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

COM (Communications) Setup

80. *[P/CPG] Press on the COM FAB (Fixed Action Button) to access the Communications menu.
81. *[P/CPG] Press VAB (Variable Action Button) next to MAN to select the manual radio frequency sub-page.

C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

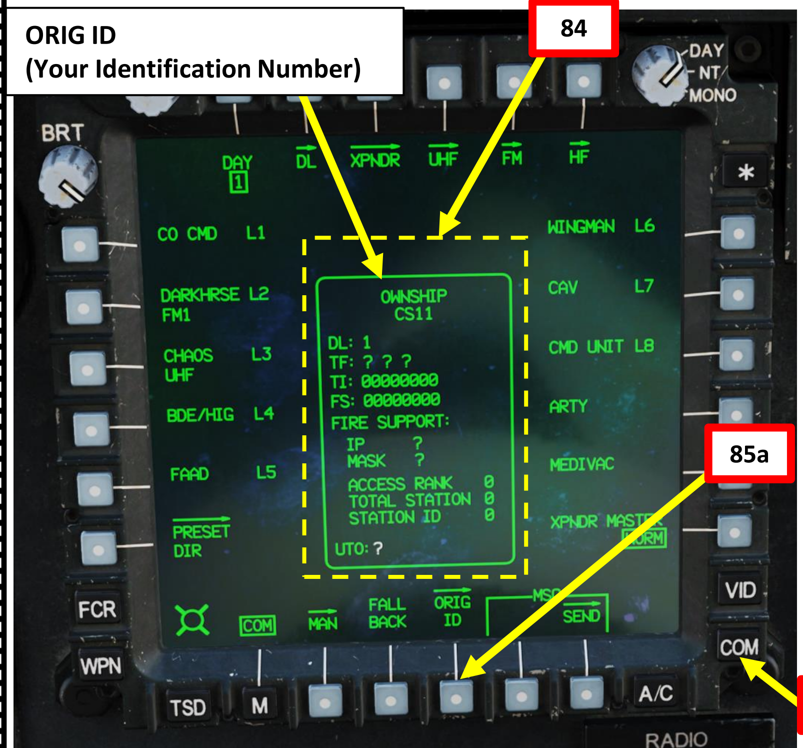
COM (Communications) Setup

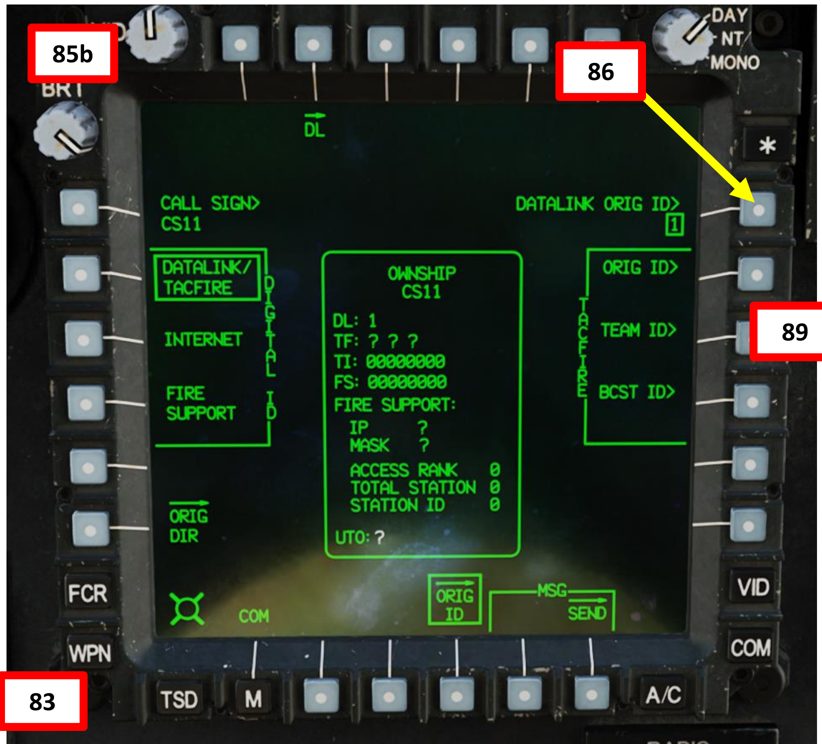
82. *[P/CPG] If you want to change a frequency for a specific radio, press VAB (Variable Action Button) next to the desired radio in the COM – MAN sub-page. Then, enter desired radio frequency (“249.5” as an example) on the KU (Keyboard Unit), then press ENTER. The radio frequency will change on both the COM page and on the EUFD (Enhanced Up-Front Display).

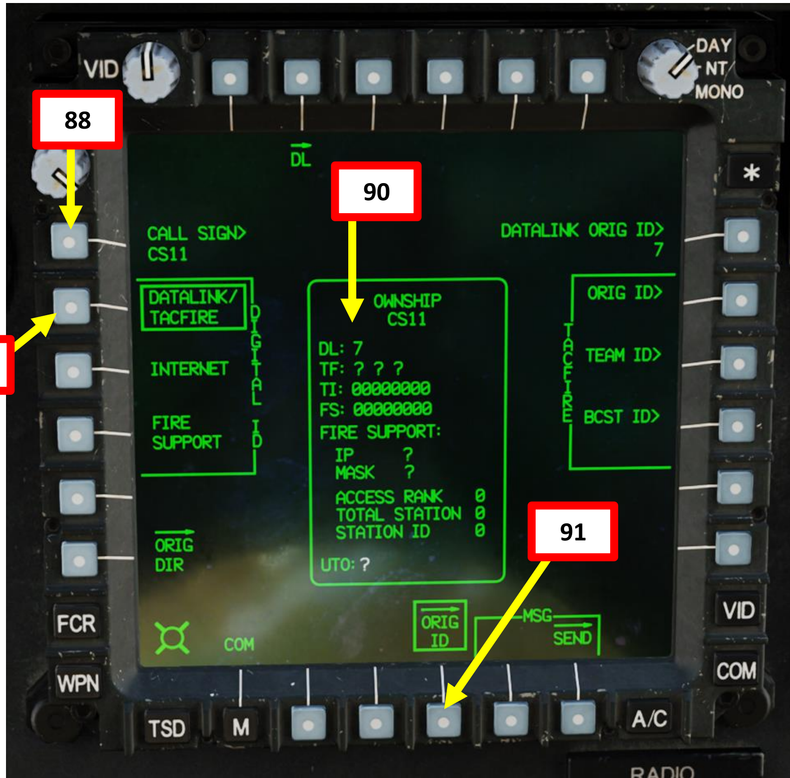
C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

COM (Communications) Setup

83. **[P/CPG]* Press on the COM FAB (Fixed Action Button) to access the Main Communications menu.
84. We will assume the datalink network is already set up correctly, however we need to make sure our Originator ID is set to a value that is not equal to one of our wingmen on the network. We will use Originator ID No. 7.
85. **[P/CPG]* In the OWNSHIP window, we see that our originator ID is set to “1” and our callsign is set to “CS11” (Chaos 1-1).
86. **[P/CPG]* Select ORIG ID sub-page.
87. **[P/CPG]* Select DATALINK ORIG ID (boxed when selected)
88. **[P/CPG]* On the KU (Keyboard Unit), type “7” (desired new originator ID), then press ENTER.
89. **[P/CPG]* You can also modify the Call Sign in a similar fashion (currently set to CS11 for “Chaos 1-1”).
90. **[P/CPG]* Select DATALINK/TACFIRE.
91. **[P/CPG]* On the OWNSHIP window, we see that our originator ID is now set to “7”.
92. **[P/CPG]* Press on the VAB (Variable Action Button) next to ORIG ID to return to the MAIN COM page.







C – DMS (DATA MANAGEMENT SYSTEM) SWEEP

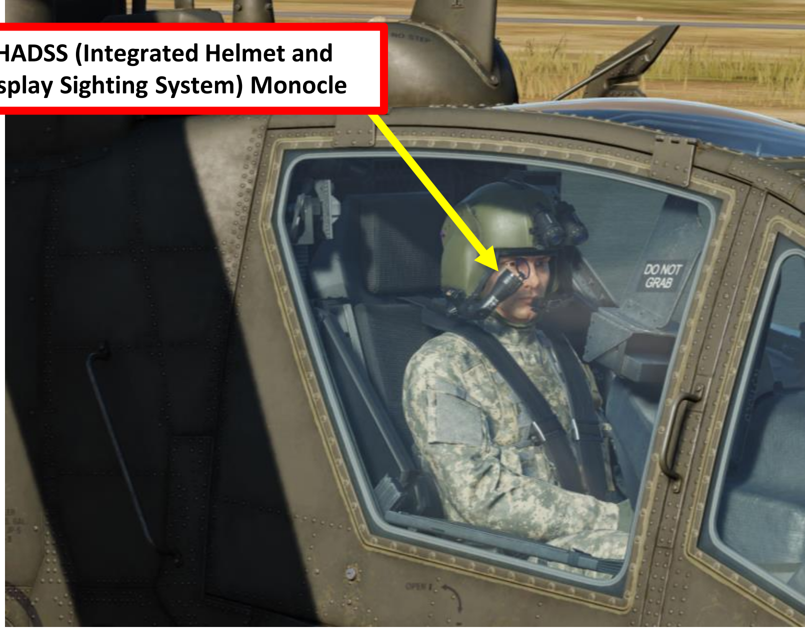
COM (Communications) Setup

93. *[P/CPG] Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L2 (Darkhorse).

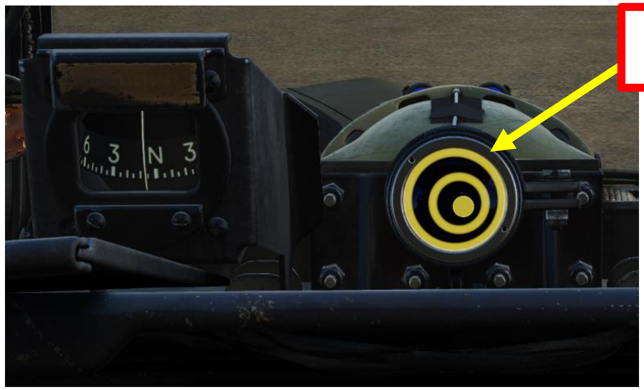
D – IHADSS (Integrated Helmet and Display Sighting System) Boresight

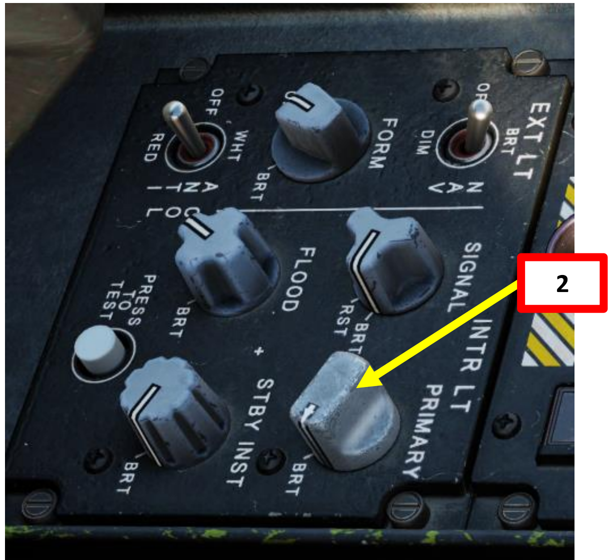
1. *[P+CPG]* Put on the IHADSS (Integrated Helmet and Display Sighting System) monocle by pressing "I" ("IHADSS SHOW/HIDE" control).
2. *[P+CPG]* Make sure the Primary Cockpit Lights Control Knob is set to BRT (Bright). This knob is needed for the boresight alignment symbology on the BRU (Boresight Reticle Unit) to be visible.
3. *[P+CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
4. *[P+CPG]* Press VAB (Variable Action Button) next to BORESIGHT.
5. *[P+CPG]* Press VAB (Variable Action Button) next to IHADSS to activate Boresight Reticle Unit (BRU).

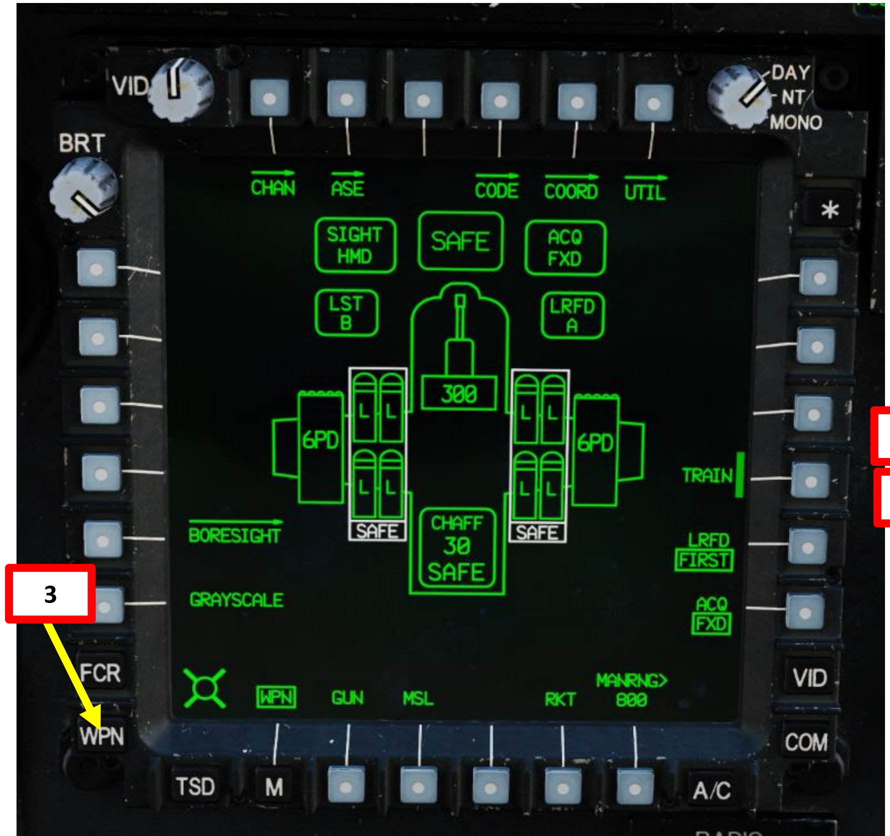
IHADSS (Integrated Helmet and Display Sighting System) Monocle

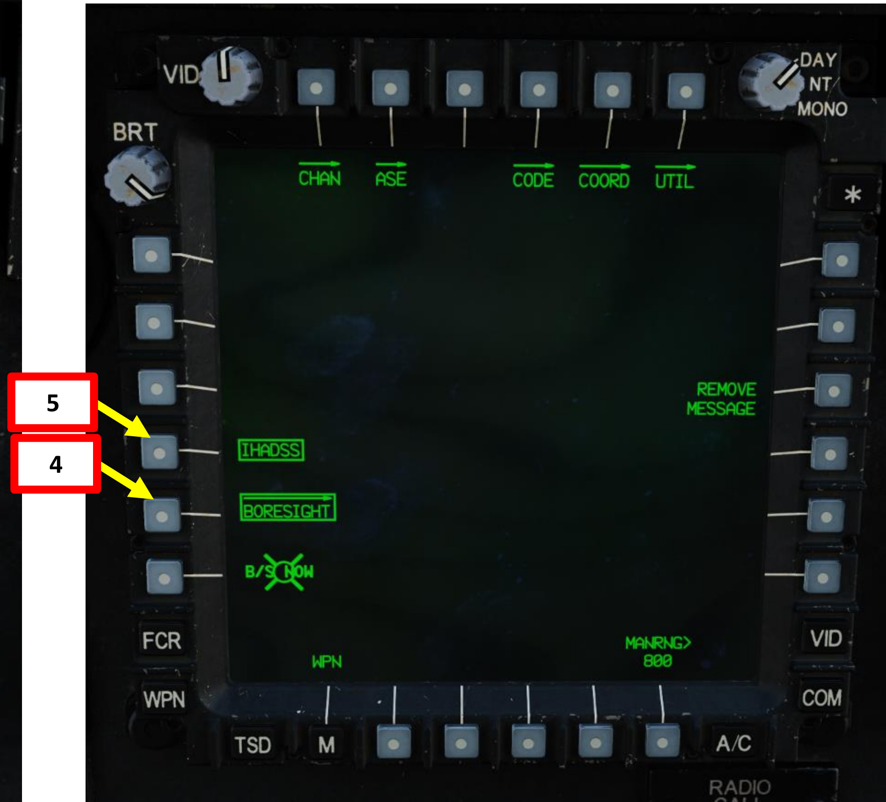


Boresight Reticle Unit (BRU): Bullseye Pattern
Used to align/boresight HDU (Helmet Display Unit)



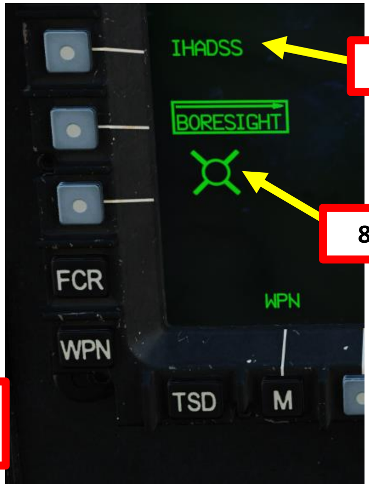


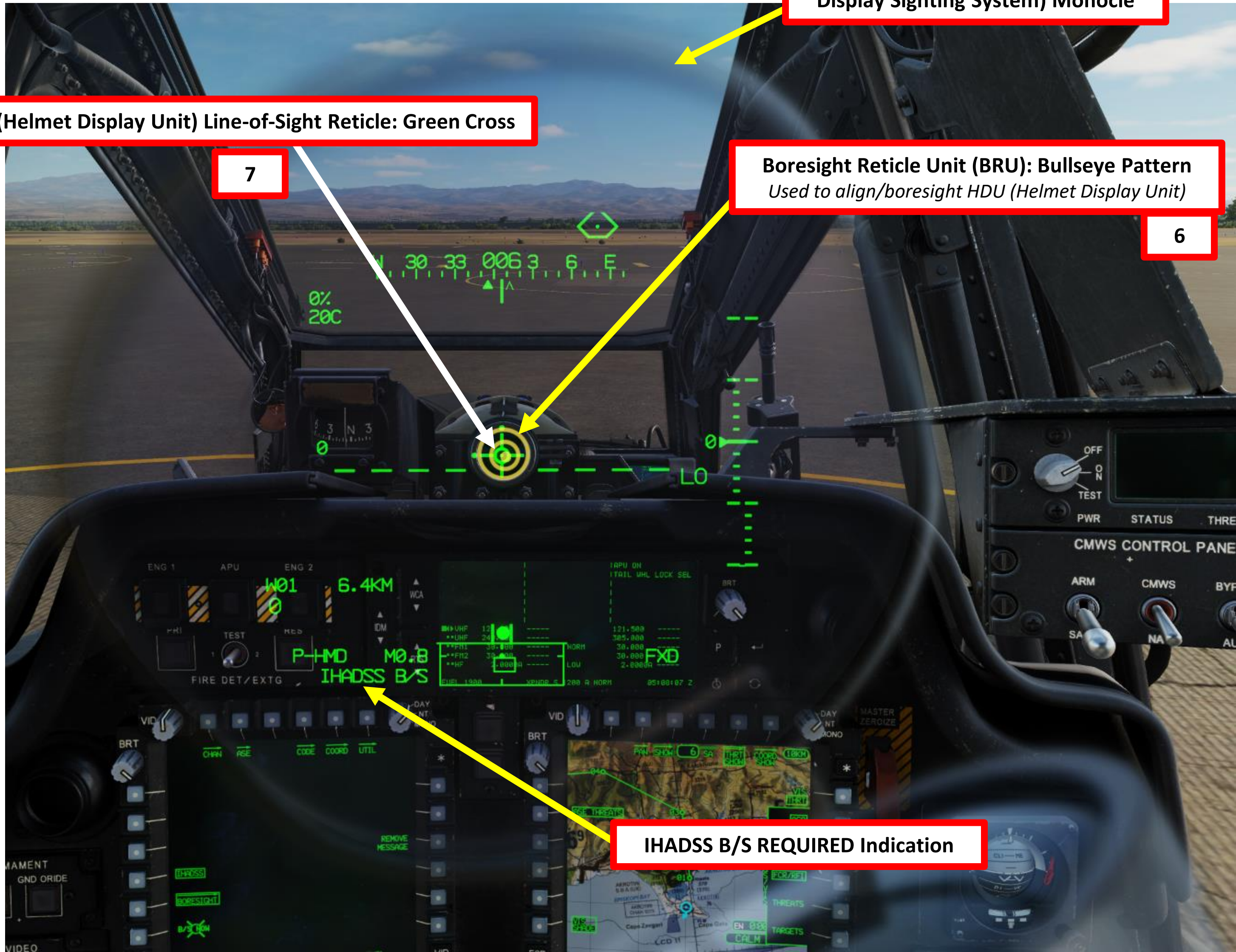




D – IHADSS (Integrated Helmet and Display Sighting System) Boresight

6. *[P+CPG]* Position your head at a natural posture and aim the HDU's (Helmet-Display Unit) line-of-sight reticle at the center of the BRU's (Boresight Reticle Unit) illuminated bullseye pattern (yellow rings). Bullseye pattern rings should be concentric and centered.
7. *[P+CPG]* When the HDU (Helmet Display Unit) is aligned within the bullseye (as shown on picture), press the B/S NOW button. Alternatively, you can Depress the Cursor Control/Enter Hat Switch since the cursor automatically snaps to B/S NOW.
8. *[P+CPG]* If the boresight position is accepted, the BRU bullseye pattern will extinguish, the B/S NOW option will be removed from the MPD page, and the IHADSS button will become un-boxed.





D – IHADSS (Integrated Helmet and Display Sighting System) Boresight

9. [P+CPG] Adjust HDU (Helmet Display Unit) Symbology Brightness – As Required
   - For the pilot, the SYM BRT (Symbology Brightness) Control Knob is used.

SYM BRT (Symbology Brightness) Control

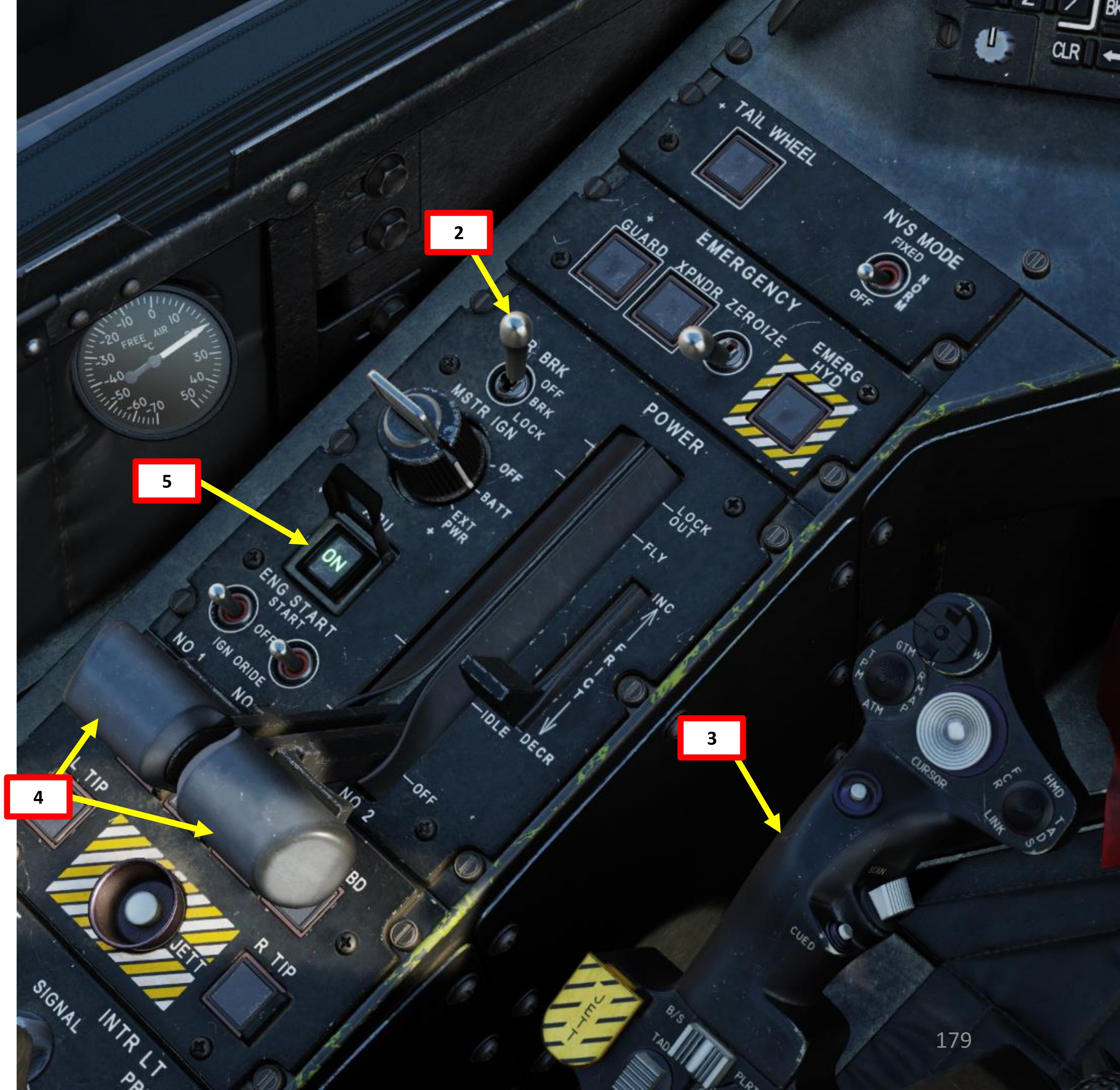
- *Controls the brightness of IHADSS symbology displayed on the HDU (Helmet Display Unit)*

D – IHADSS (Integrated Helmet and Display Sighting System) Boresight

9. *[P+CPG]* Adjust HDU (Helmet Display Unit) Symbology Brightness – As Required
    - For the co-pilot/gunner, the TDU (TEDAC Display Unit) Symbology Brightness Adjustment Rocker Switch is used.
    - The TDU Symbology Brightness control will only work if the TDU Display Mode Selector is set to either DAY or NIGHT.

E – ENGINE START

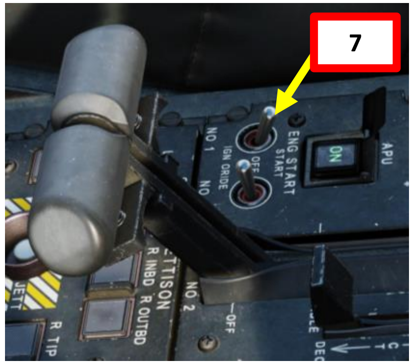
1. *[P] Set Anti-Collision Light Switch:
    - White (FWD) for day operations
    - Red (AFT) for night operations
2. [P] Set RTR BRK (Rotor Brake) Switch – FWD (OFF)
3. [P] Set Collective – Fully DOWN
4. [P] Check that both Power Levers (PWR LVR) are set to OFF (Fully AFT)
    - RALT+END for left PWR LVR
    - RSHIFT+END for right PWR LVR
5. [P] Check that APU (Auxiliary Power Unit) is running. The APU will provide air pressure supply for the engine starters.

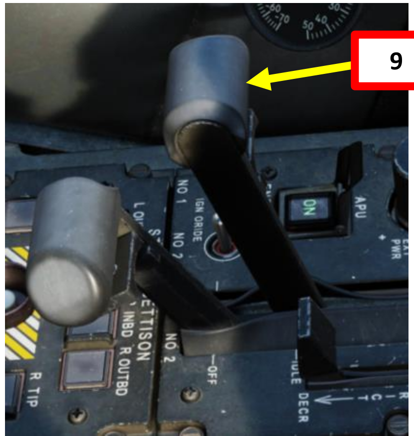


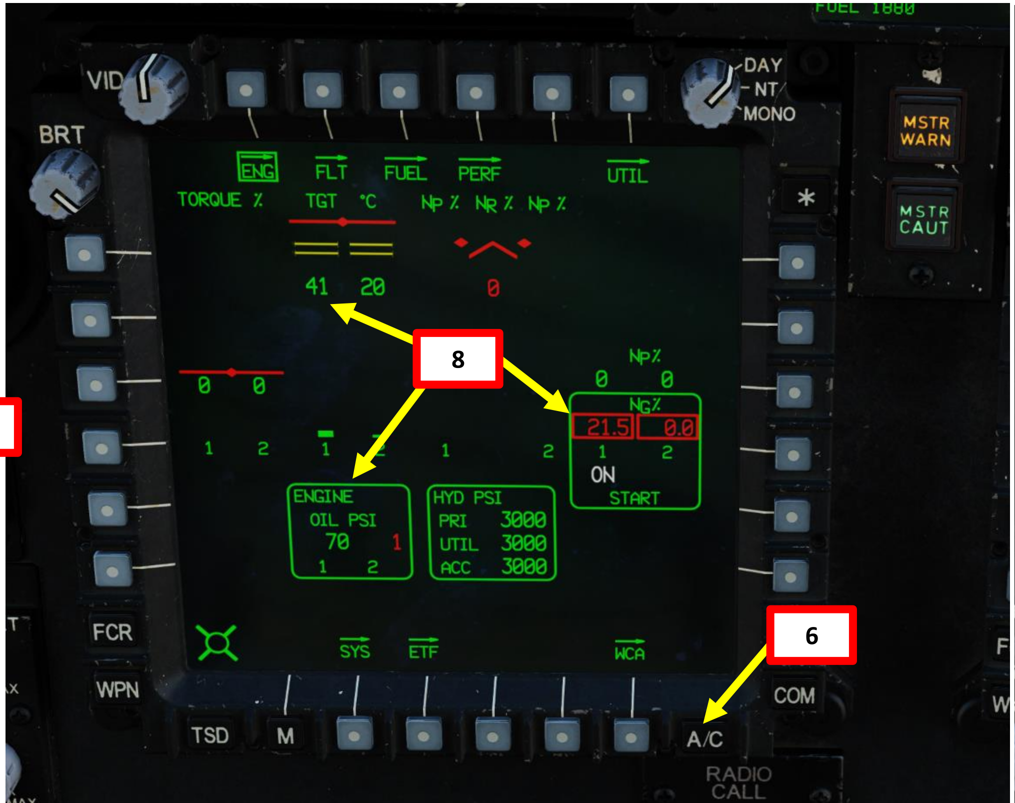
E – ENGINE START

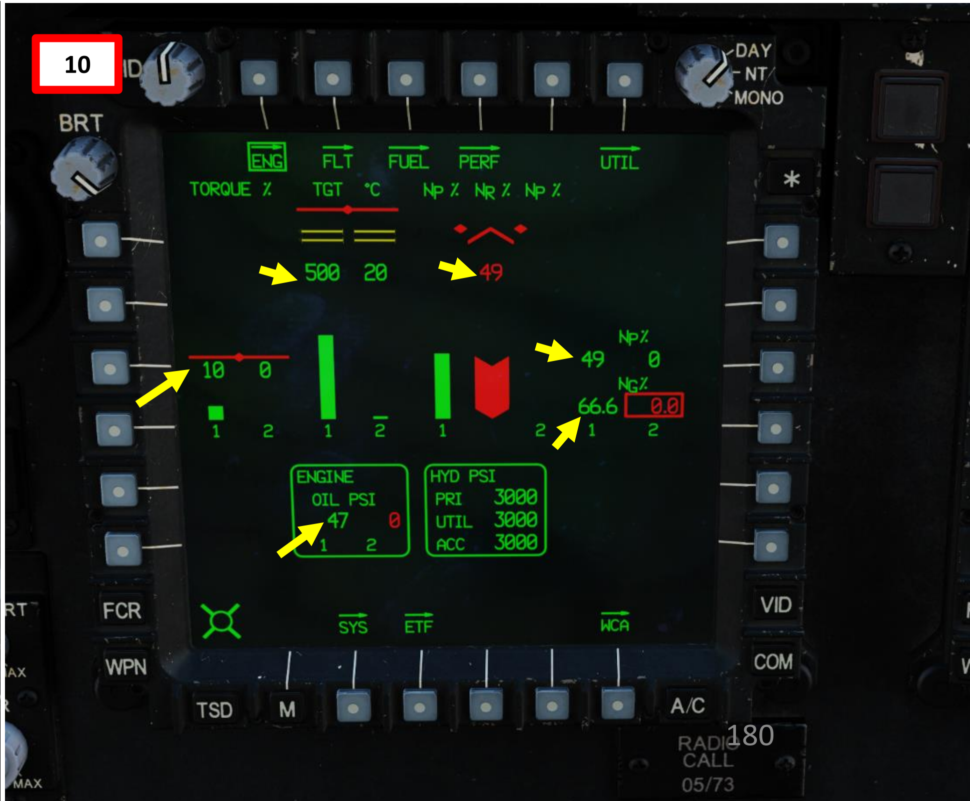
6. *[P]* Select ENG (Engine) page by pressing the A/C FAB (Fixed Action Button).
7. *[P]* Set Left (No. 1) Engine Start Switch to START (FWD) for 1 to 2 seconds, then release switch. Switch will spring back to the OFF (CENTER) position. Monitor EUFD (Enhanced Up-Front Display) for advisories.
8. *[P]* Confirm initiation of left (No. 1) engine start sequence. Confirm:
   a) Increase in NG (Gas Generator Speed, %)
   b) ON START indication on ENG page
   c) Increase in engine oil pressure (psi)
   d) Increase in TGT (Turbine Gas Temperature, deg C)
9. *[P]* Move left PWR LVR (Power Lever) to IDLE (RALT+HOME). Fuel flow will kick in, engine ignition (lightoff) will occur and NG will increase to IDLE power.
10. *[P]* Wait until left engine parameters stabilize to the following:
    - NG (Gas Generator Speed): 66 %
    - NP (Power Turbine Speed) and NR (Main Rotor Speed): 49 %
    - Torque (Q, %): 10 %

Abort Start Conditions:
- During the start if the TGT (Turbine Gas Temperature) appears it will exceed 851°C prior to NG idle speed of 63%
- TGT, NP and ENG OIL PSI do not increase within 45 seconds after moving power lever to idle
- ENG START advisory is removed prior to attaining 52% NG, abort the start by taking the power lever to OFF.







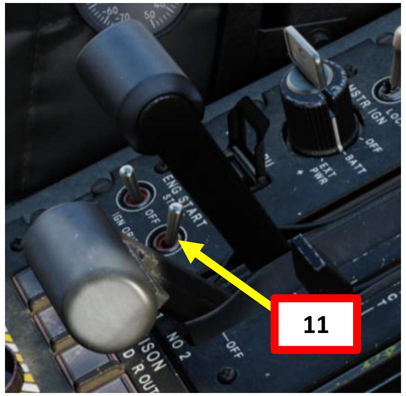


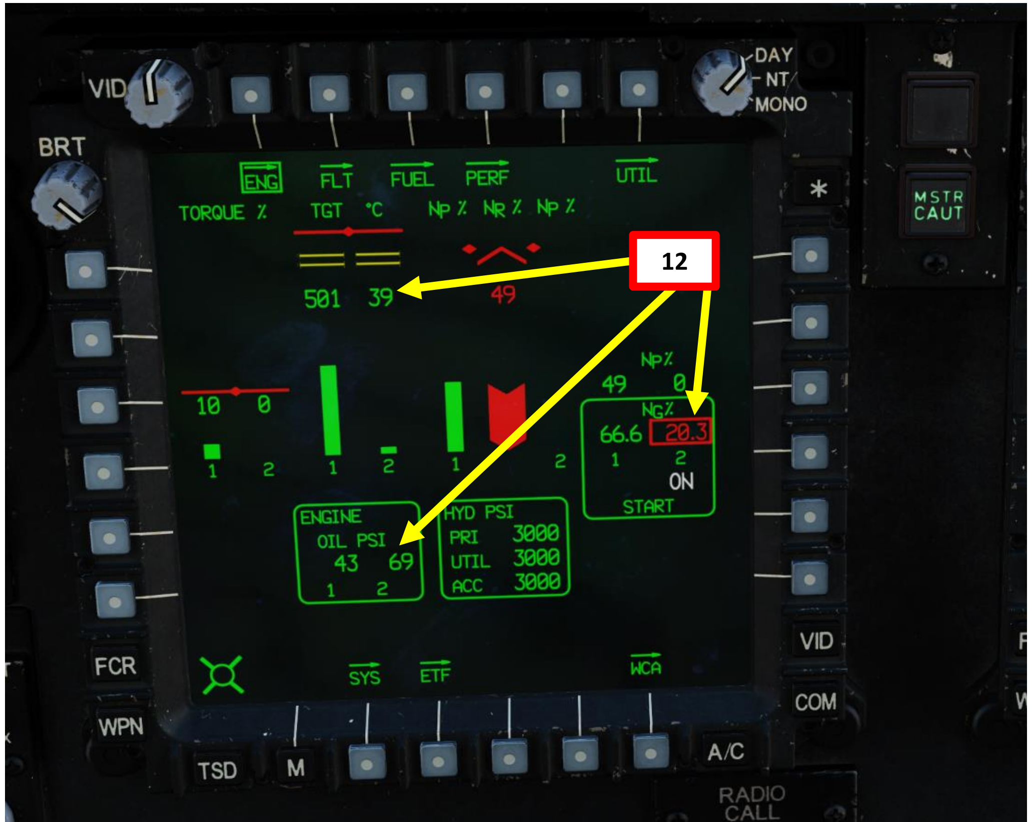
E – ENGINE START

11. *[P]* Set Right (No. 2) Engine Start Switch to START (FWD) for 1 to 2 seconds, then release switch. Switch will spring back to the OFF (CENTER) position. Monitor EUFD (Enhanced Up-Front Display) for advisories.
12. *[P]* Confirm initiation of right (No. 2) engine start sequence. Confirm:
    a) Increase in NG (Gas Generator Speed, %)
    b) ON START indication on ENG page
    c) Increase in engine oil pressure (psi)
    d) Increase in TGT (Turbine Gas Temperature, deg C)
13. *[P]* Move right PWR LVR (Power Lever) to IDLE (RSHIFT+HOME). Fuel flow will kick in, engine ignition (lightoff) will occur and NG will increase to IDLE power.
14. *[P]* Wait until right engine parameters stabilize to the following:
    - NG (Gas Generator Speed): 66 %
    - NP (Power Turbine Speed) and NR (Main Rotor Speed): 58 %
    - Torque (Q, %): 6 % (combined torque shared between both engines)
    - Engine oil pressure: Below 70 psi

Abort Start Conditions:

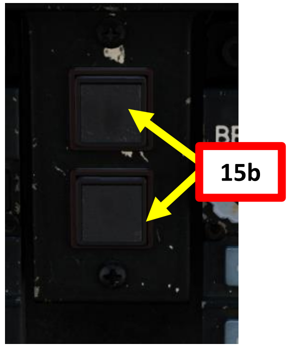
- During the start if the TGT (Turbine Gas Temperature) appears it will exceed 851°C prior to NG idle speed of 63%
- TGT, NP and ENG OIL PSI do not increase within 45 seconds after moving power lever to idle
- ENG START advisory is removed prior to attaining 52% NG, abort the start by taking the power lever to OFF.

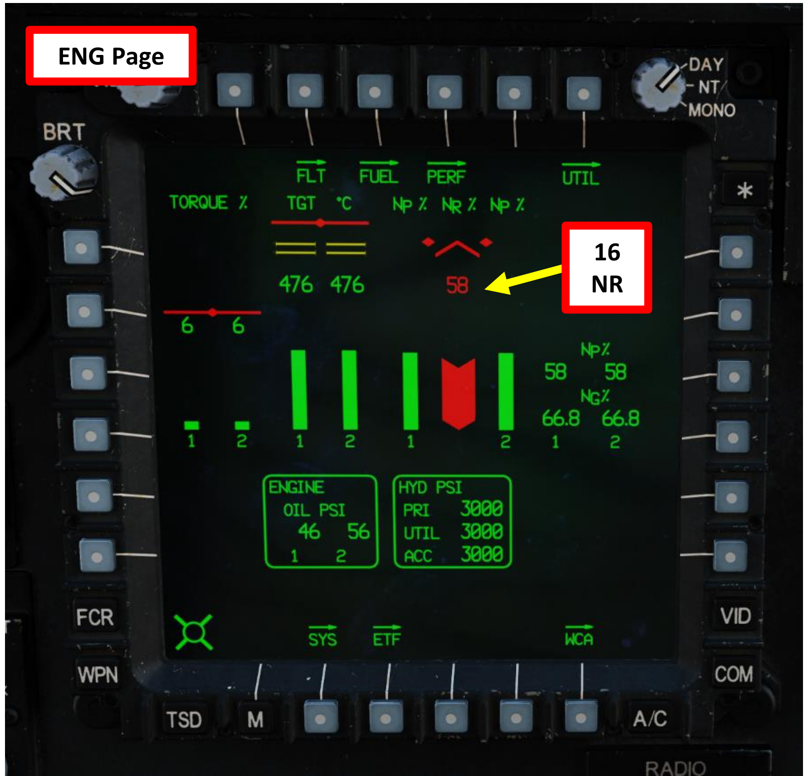


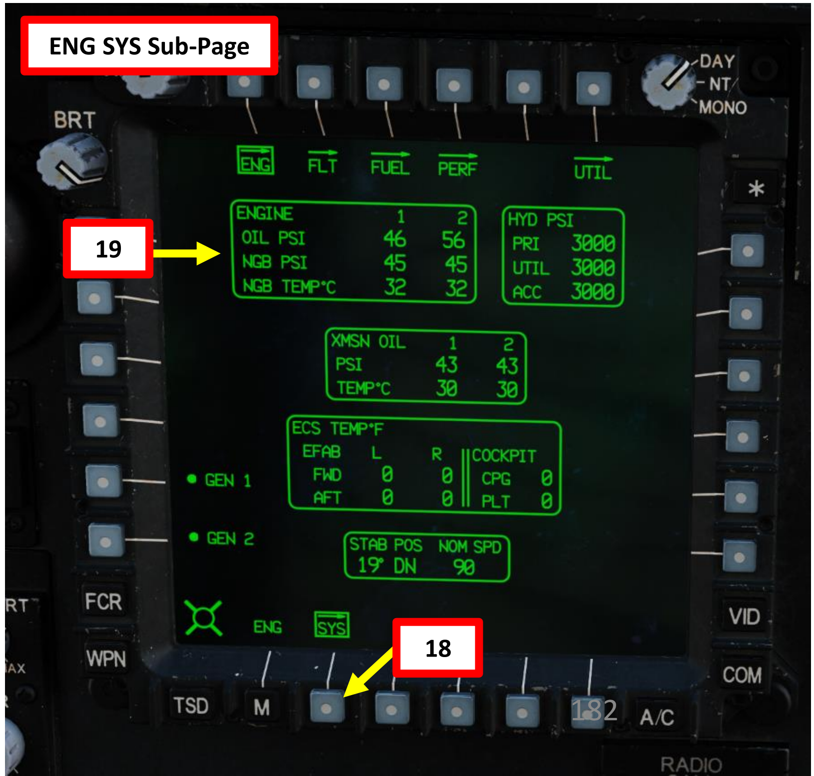


E – ENGINE START

15. *[P]* If required, reset MSTR WARN (Master Warning) and MSTR CAUT (Master Caution) pushbuttons by pressing them.
16. *[P]* Confirm Main Rotor Speed (NR) has increased above 50 % RPM.
17. *[P]* Monitor ENG page for any abnormal engine parameter.
18. *[P]* Monitor ENG SYS sub-page for any abnormal engine parameter by pressing the VAB (Variable Action Button) next to SYS.
19. *[P]* Prior to advancing the power levers to FLY, confirm that both ENG 1 and 2 OIL PSI (Engine Oil Pressure) readouts are less than 70 psi and the NGB TEMP (Nose Gearbox Oil Temperature) readouts are both above 20 deg C. Keep the engine torque below 30% while doing so.

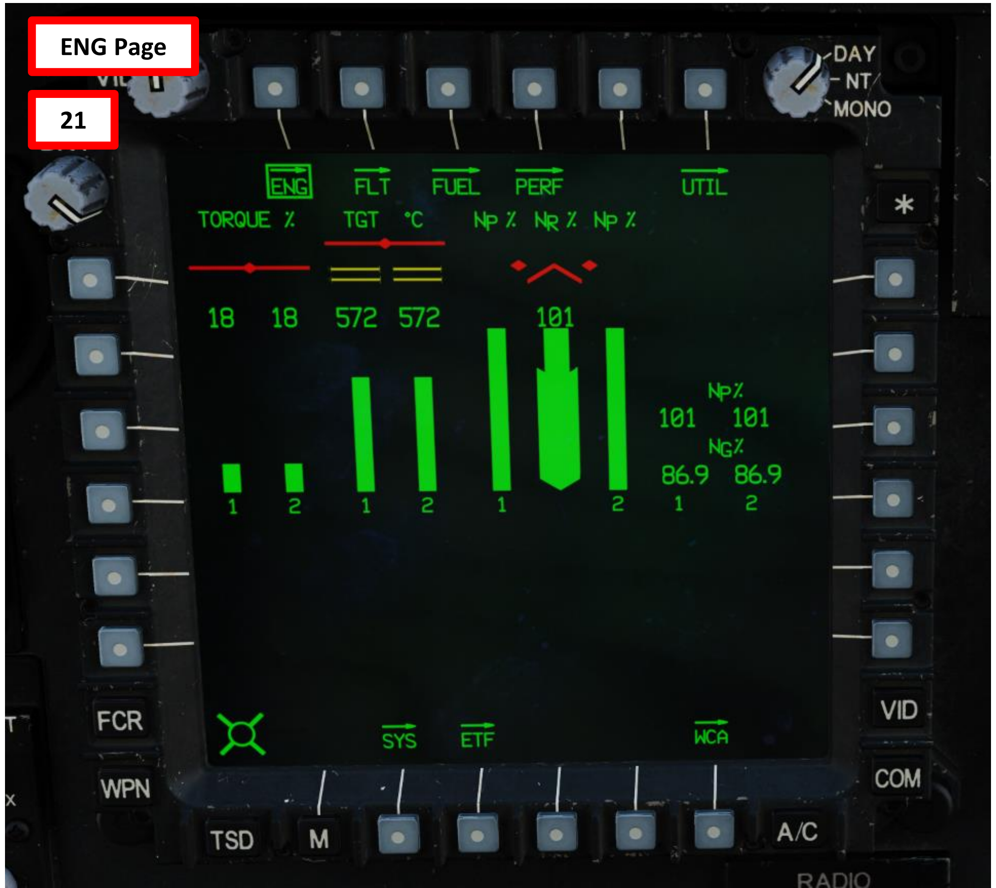






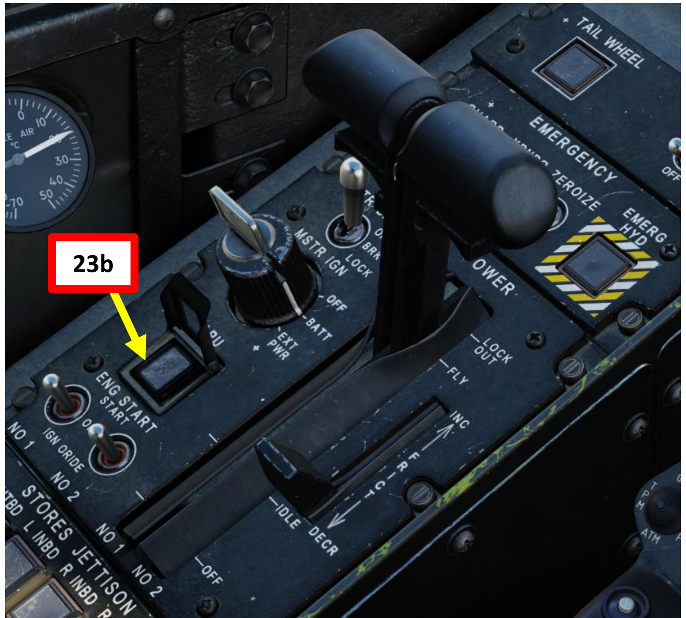
E – ENGINE START

20. [P] Slowly advance both power levers to FLY.
21. [P] Engine parameters should stabilize to the following:
    - NG (Gas Generator Speed): 86 %
    - NP (Power Turbine Speed) and NR (Main Rotor Speed): 101 %
    - Torque (Q, %): 18 %
    - Engine oil pressure: Below 70 psi
22. [P] Confirm LOW ROTOR RPM advisory is not visible on the EUFD (Enhanced Up-Front Display).



E – ENGINE START

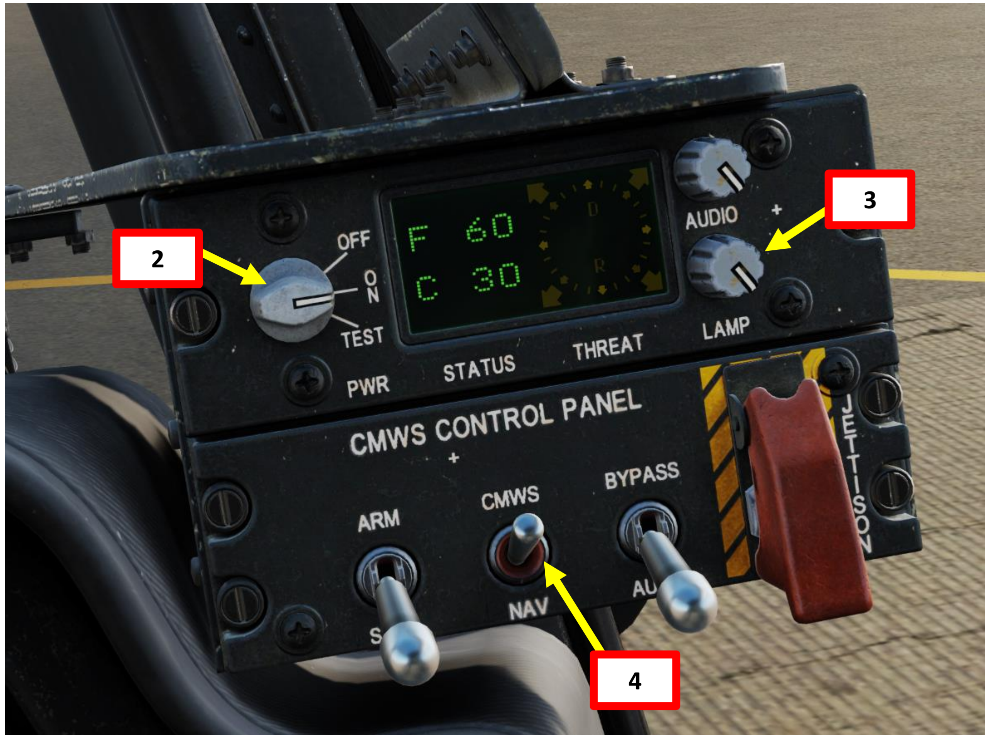
23. *[P]* Press the APU Start Button for 1 to 2 seconds, then release it.
24. *[P]* The APU shutdown sequence will initiate.
25. *[P]* When APU shutdown sequence is complete:
    - “ON” light on the APU Start Button is extinguished
    - On the EUFD, APU ON advisory is extinguished

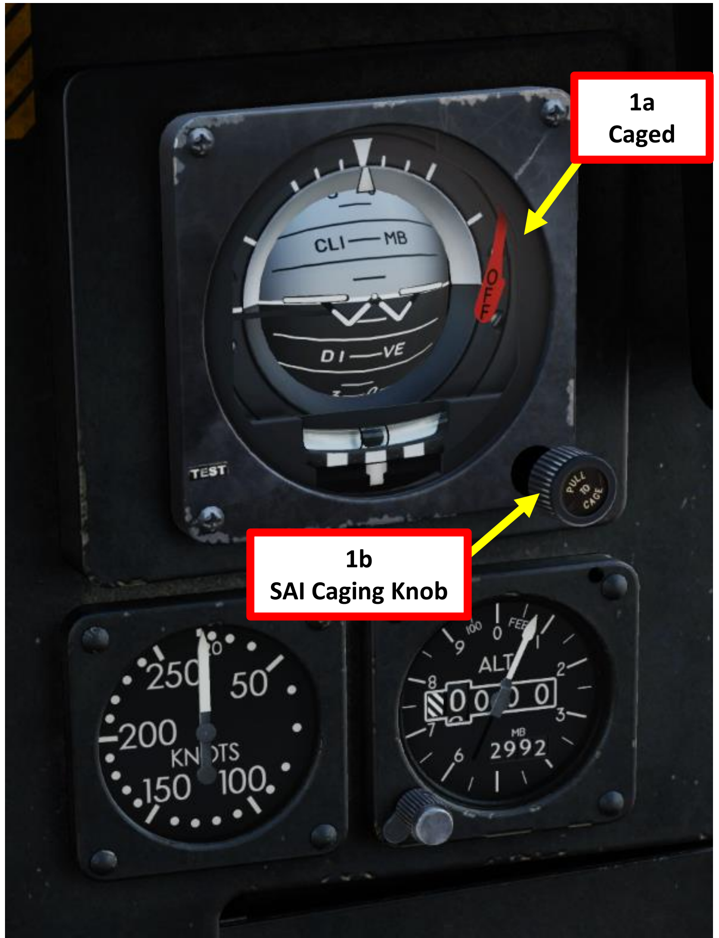


E – ENGINE START

F – AFTER START-UP

1. *[P]* Uncage SAI (Standby Attitude Indicator) by pulling and turning the SAI caging knob. Confirm that red OFF flag disappears.
2. *[P]* Set CMWS (Common Missile Warning System) Power/Test Knob – ON
3. *[P]* Set CMWS Display Brightness Control Knob – As Required
4. *[P]* Set CMWS/NAV Switch – CMWS (UP)

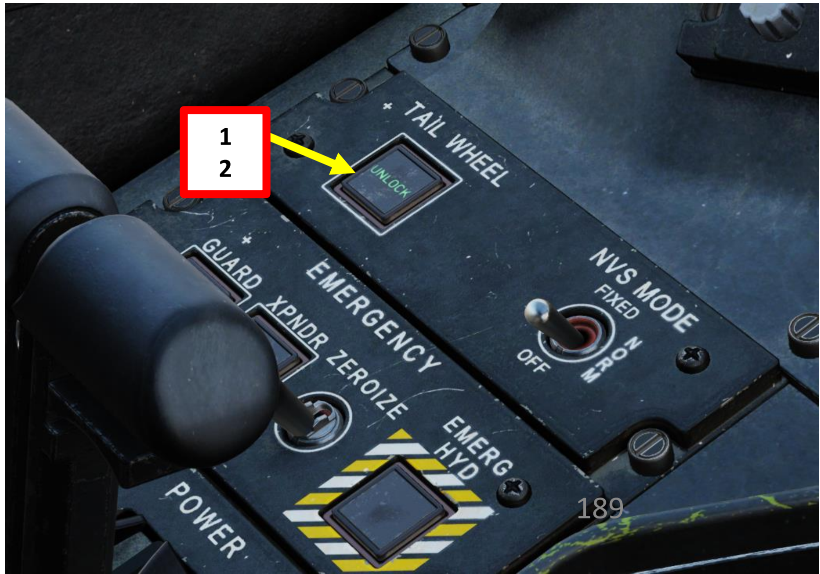





CMWS CONTROL PANEL
PWR
STATUS
THREAT
LAMP
AUDIO
ARM
CMWS
BYPASS
NAV
JETTISON
CANOPY JETTISON
TURN 90° PUSH
SAFE
ARMAMENT
A/S
GND ORIDE
VIDEO
FIRE DET/EXTG
P-HMD
FXD
W01
6.4KM

TAXI

1. *[P/CPG]* Unlock the Tail Wheel by pressing the Tail Wheel Lock/Unlock Button once the helicopter is rolling forward to prevent yaw instability, unless performing an in-place turn.
2. *[P/CPG]* Confirm that UNLOCK light is visible on the button and that “TAIL WHL UNLK SEL” indication is visible on the EUFD (Enhanced Up-Front Display).
3. *[P]* Disengage parking brake and verify it is released (Parking Brake Lever – IN).



TAXI

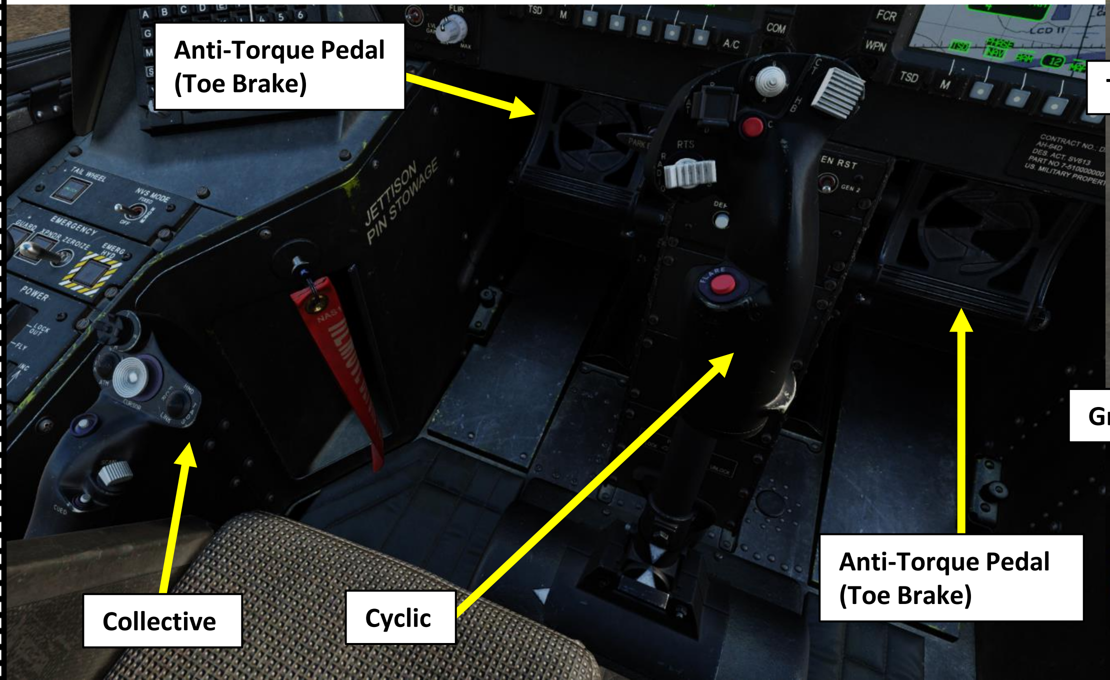
4. *[P]* Select IHADSS (Integrated Helmet and Display Sighting System) Transition Symbology by pressing the Symbology Select Switch FWD ("CT") to toggle between Cruise and Transition symbology on the HDU (Helmet Display Unit). You will recognize Transition mode with the dashed "Transition Horizon Line" on the HDU.
5. *[P]* Raise collective to increase torque between 27 % and 30 %.

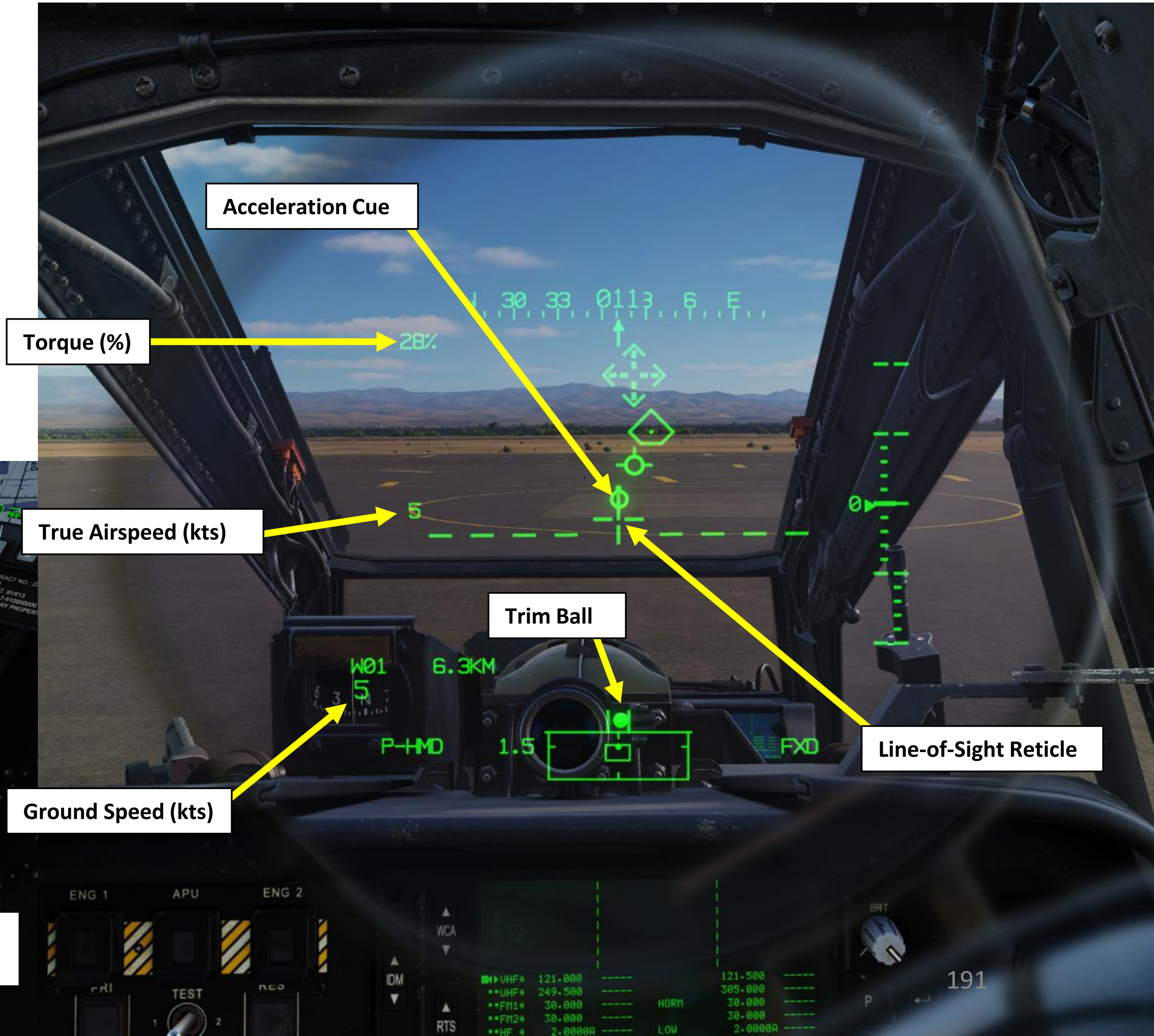
Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

TAXI

6. *[P]* Apply forward cyclic until the acceleration cue is at the tip of the line-of-sight reticle.
7. *[P]* Maintain approximately 5 to 6 knots ground speed.
8. *[P]* Prior to initiating a turn, verify the TAIL WHEEL UNLOCKED light is illuminated and the tailwheel is unlocked. Apply pedal in the direction of turn and maintain a constant rate of turn with pressure/counter pressure on the pedals. Apply cyclic in the direction of the turn to maintain a level horizon line.
9. *[P]* To stop the helicopter, first lock the tailwheel and verify the TAIL WHEEL UNLOCKED light is not illuminated, then apply aft cyclic to center the acceleration cue in the center of the line-of-sight reticle. Reference the trim ball and maintain the trim ball centered with left/right cyclic. When the aircraft has stopped, neutralize the flight controls, and reduce the collective.
10. *[P]* You can apply a small amount of pressure on the toe brakes to come to a full stop.



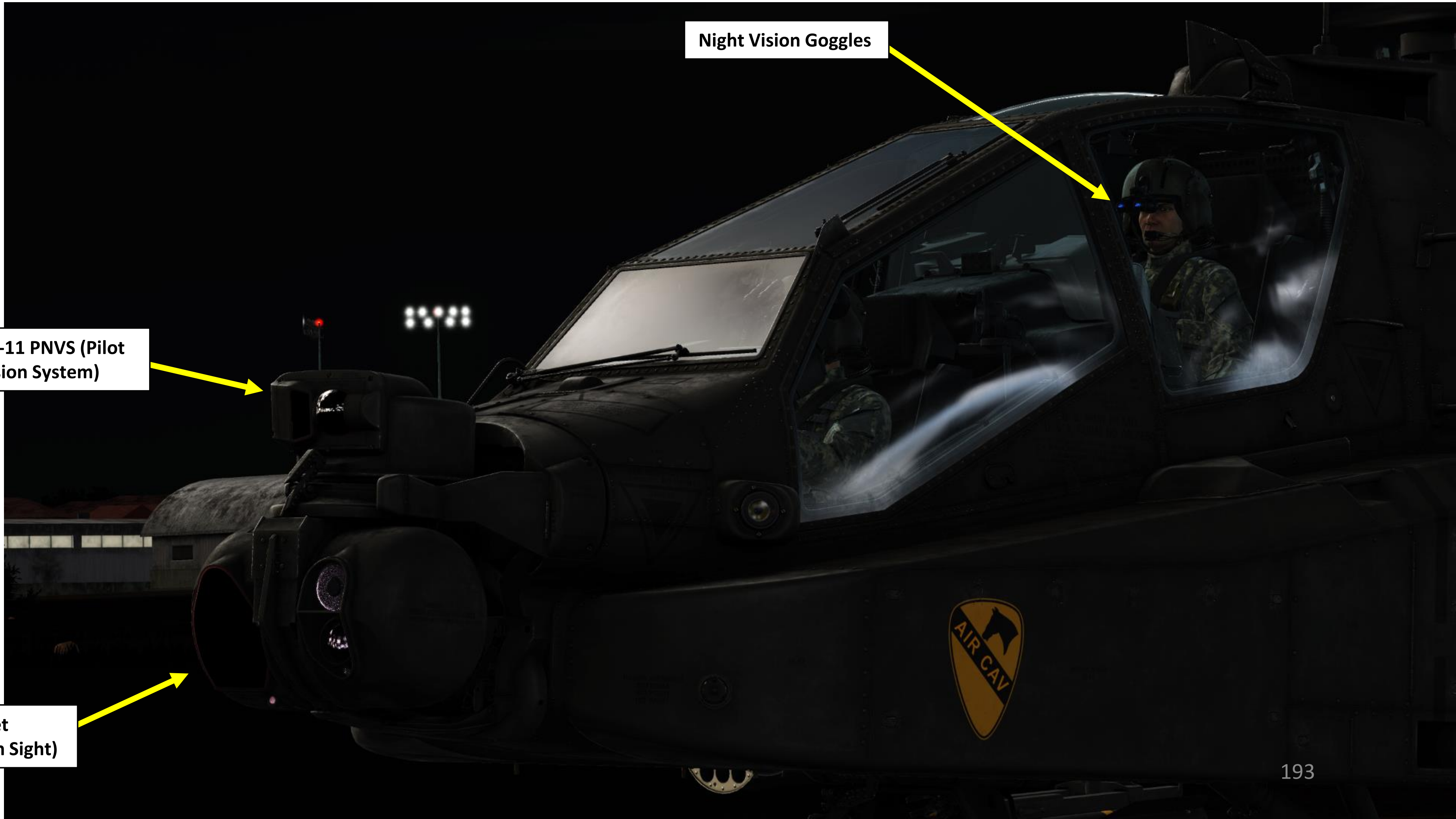


TAXI

NIGHT OPERATION CONSIDERATIONS

The AH-64 is like Batman: it operates best at night. Taxiing in pitch dark can be quite challenging on its own, but the Apache has a few tools to make it easier:

- Night Vision Goggles (NVGs)
- The PNVS (Pilot Night Vision System), which is equipped with its own FLIR sensor
- The TADS (Target Acquisition & Designation Sight), which is equipped with a FLIR (Forward-Looking Infrared) sensor as well. However, the TADS is not really used for taxiing… so we will come back to it in the Sensors & Sights section instead.



NIGHT OPERATION CONSIDERATIONS

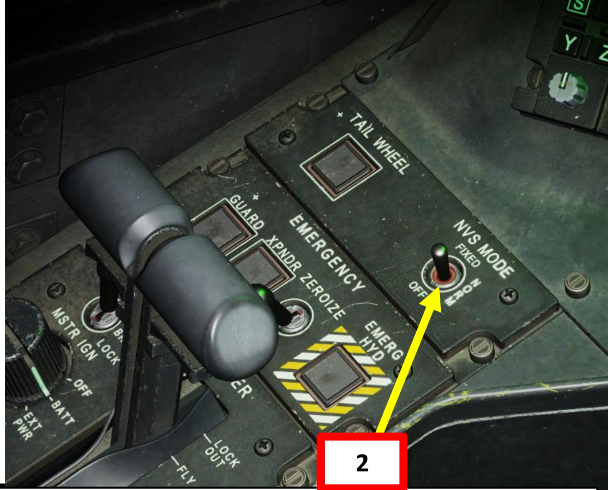
NVGs (Night Vision Goggles) are easy to put on and off but they do not display the symbology provided by the IHADSS monocle.

Night Vision Goggles (NVG) Controls:
- *RSHIFT+H: On/Off*
- *RSHIFT+RALT+H: Gain Night Vision Goggles Down*
- *RSHIFT+RCTRL+H: Gain Night Vision Goggles Up*

NIGHT OPERATION CONSIDERATIONS

You can **use the PNVS (Pilot Night Vision System) FLIR sensor** to see in front of the helicopter during taxi. To do so:

1. Set NVS Select Switch on the collective - AFT (PNVS)
2. Set Pilot NVS Mode Switch to either MIDDLE (NORM, which commands the NVS to follow your helmet line-of-sight) or FWD (FIXED, which commands the NVS to stay at a fixed forward position).
3. The PNVS FLIR overlay will be visible on your IHADSS monocle.
4. If needed, adjust the quality of the FLIR image with the FLIR knobs. The small inner knob adjusts the FLIR LEVEL and the larger outer knob adjusts the FLIR GAIN.
5. If needed, adjust overall image quality for the FLIR using IHADSS knobs. The small inner knob controls the IHADSS BRT (Brightness) and the larger outer knob adjusts the IHADSS CON (Contrast).
6. The FLIR can be operated in either WHOT (white hot) or BHOT (black hot) mode by selecting the collective Boresight/Polarity switch located on the collective.



Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*

Boresight/Polarity Selector 6
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

PNVS (Pilot Night Vision System) Overlay 3

NVS (Night Vision System) Select Switch 1
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

HOVER

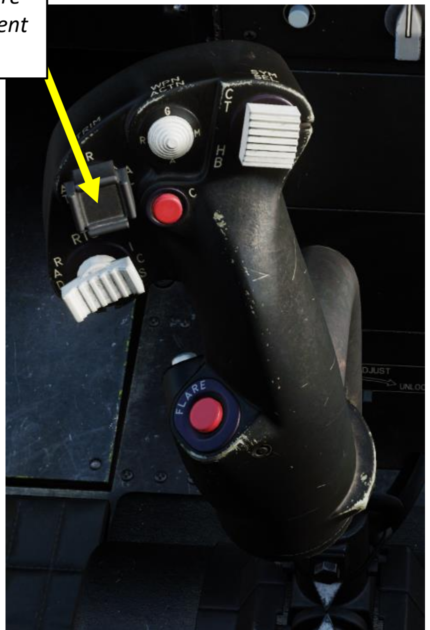
HOVERING FLIGHT BASICS

1. Apply left pedal to stay centered and avoid drifting.
2. Use cyclic to remain straight and level and counter translating tendency (left & aft cyclic input).
3. Raise collective very gently to initiate a hover.
4. Hovering is hard at first. Failure to predict the helicopter's reaction after cyclic input will often result in you dancing the French Cancan for a long time. Think of it like doing plate-spinning: you need to put yourself in a position of equilibrium, so you always need to think one step ahead.
5. Hold the Force Trim switch FWD (on your cyclic) and your stick will remember that "hover" position. Keep in mind that trim works a bit differently from a plane's trimming.
6. Anticipate the rotorcraft's reaction when you trim.

Note: it is important to be able to master hover flight without the HDU (Helmet Display Unit) symbology. The Hover symbology on the HDU is very helpful at night or in low visibility conditions, but during VMC (Visual Meteorological Conditions) it is much easier to hover by looking outside the cockpit rather than focusing on the HDU symbols.

Force Trim / Hold Modes Switch

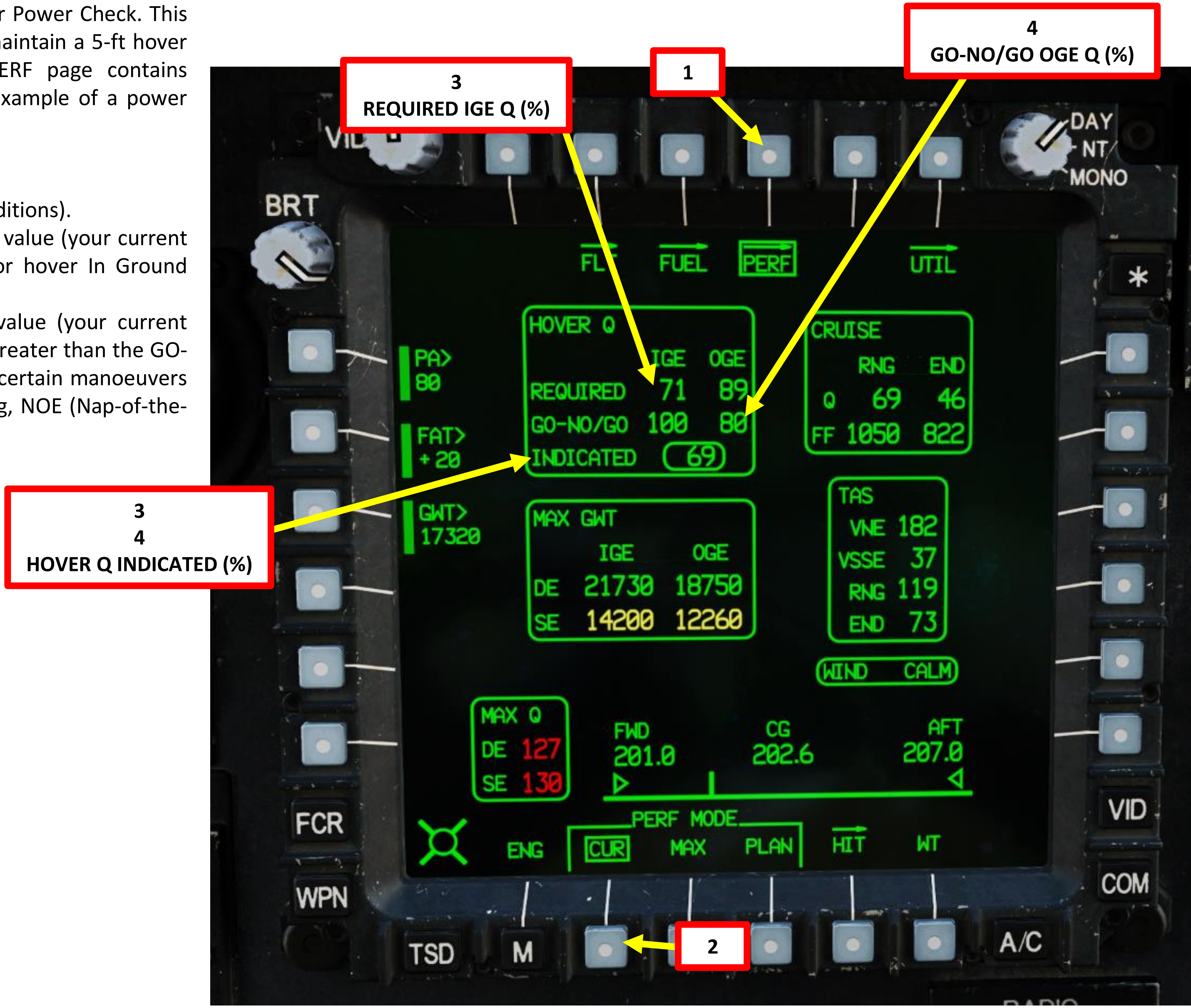
- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*



HOVER POWER CHECK

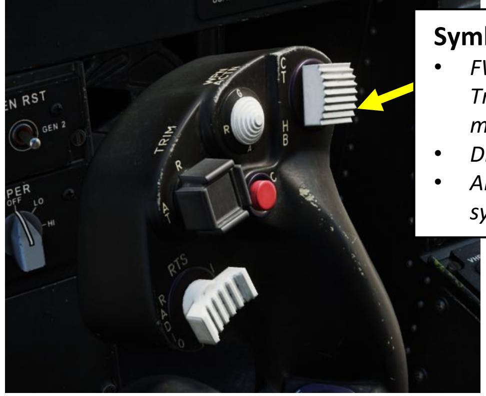
From the A/C – PERF (Aircraft – Performance) page, you can perform a Hover Power Check. This check is basically a verification that your engines provide enough power to maintain a 5-ft hover with a torque that matches the helicopter performance charts. The PERF page contains information that we can use as a comparison. The following steps are an example of a power check.

1. Go in the PERF page (see Section 4 – Mission Planning).
2. Select CUR Performance Mode (Calculates performance using current conditions).
3. While maintaining a 5-ft hover, then verify that the HOVER Q INDICATED value (your current torque) matches the REQUIRED IGE value (Minimum torque needed for hover In Ground Effect).
4. While maintaining a 5-ft hover, verify that the HOVER Q INDICATED value (your current torque) is less than the GO-NO/GO OGE value. If the INDICATED value is greater than the GO-NO/GO OGE value, the aircraft does not have enough power to perform certain manoeuvers that require OGE power (Approach to an OGE hover, Masking/Unmasking, NOE (Nap-of-the-Earth) Flight).



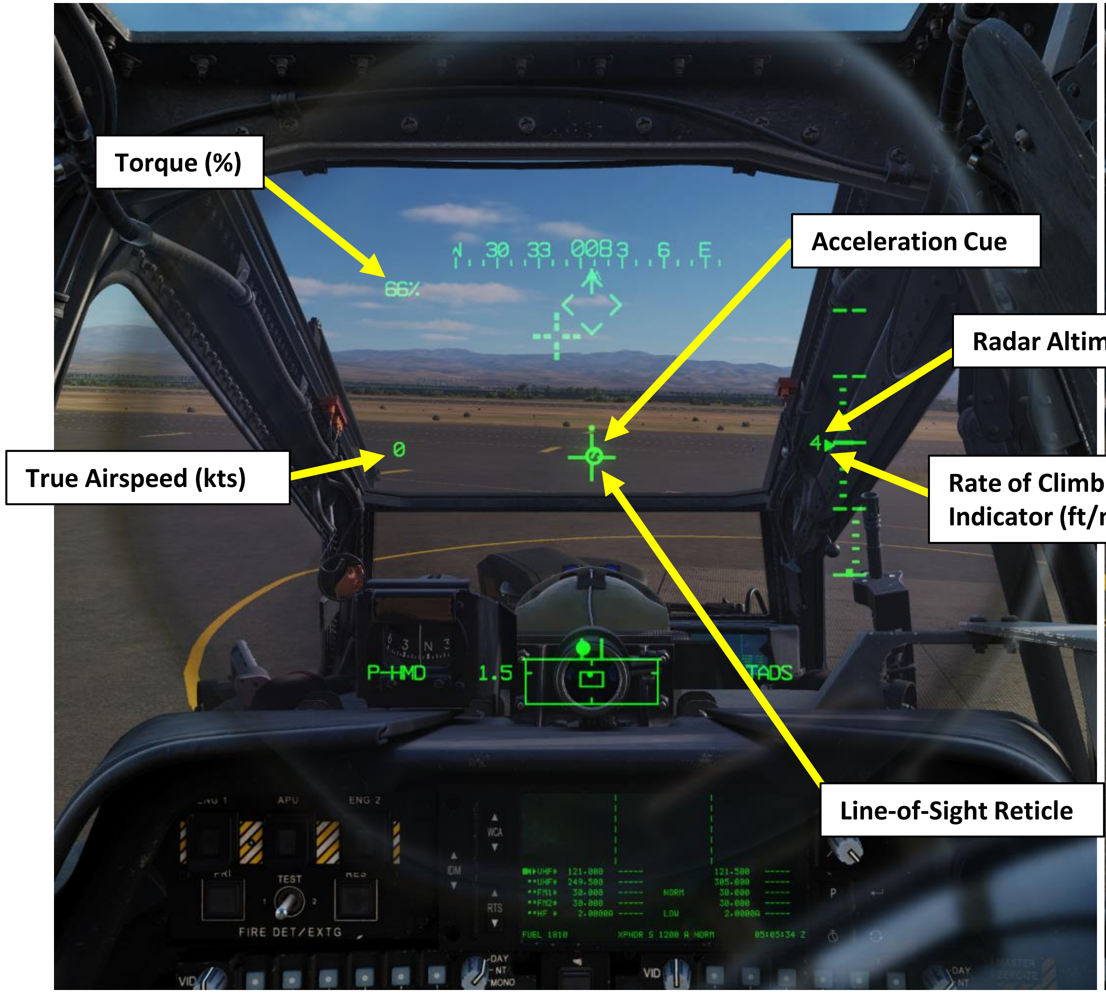
IHADSS HOVER MODE

1. Select IHADSS (Integrated Helmet and Display Sighting System) Hover Symbology by pressing the Symbology Select Switch AFT ("HB") to toggle between Hover and Bob-Up symbology on the HDU (Helmet Display Unit).
2. The Hover Mode symbology is based on the orientation of the Velocity Vector (line) and Acceleration Cue (circle) in relationship to the Line-of-Sight reticle (cross).
    - In simple terms, Hover symbology is basically a top-down view of the direction and speed the aircraft is going.
    - The velocity vector line's length represents ground speed, which will reach maximum saturation at 6 kts. It originates from the center of the line-of-sight reticle, which represents a point approximately at the mast of the helicopter.



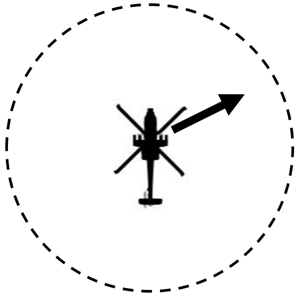
Symbology Select Switch

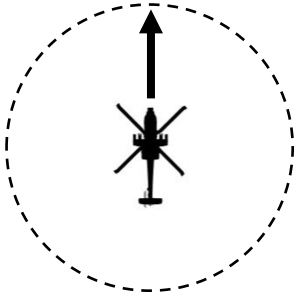
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

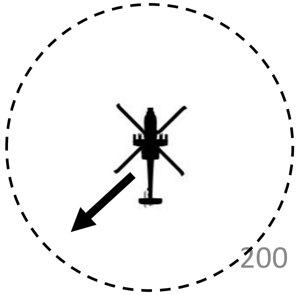


IHADSS HOVER MODE

Here are a few examples to help you have a mental image of how the hover symbology works in practice.

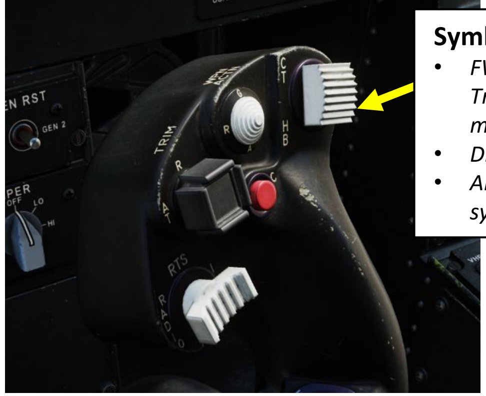


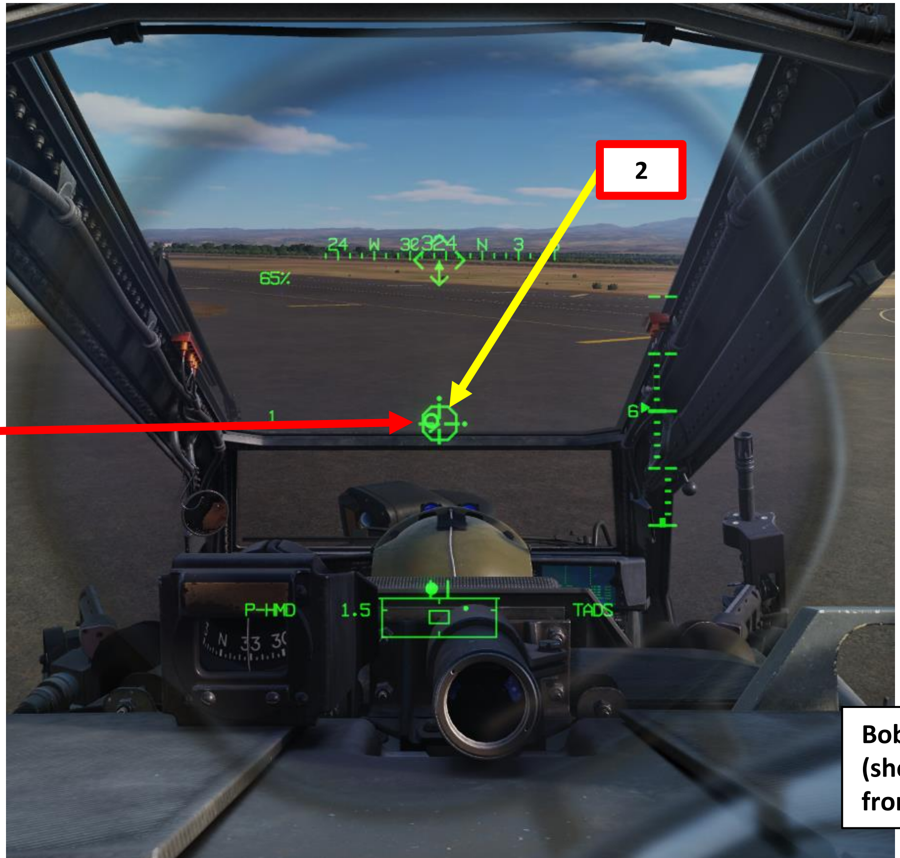


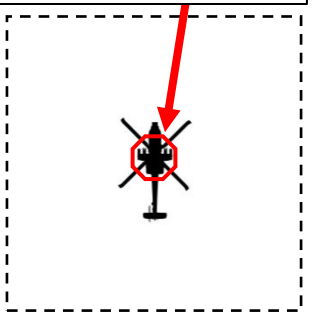


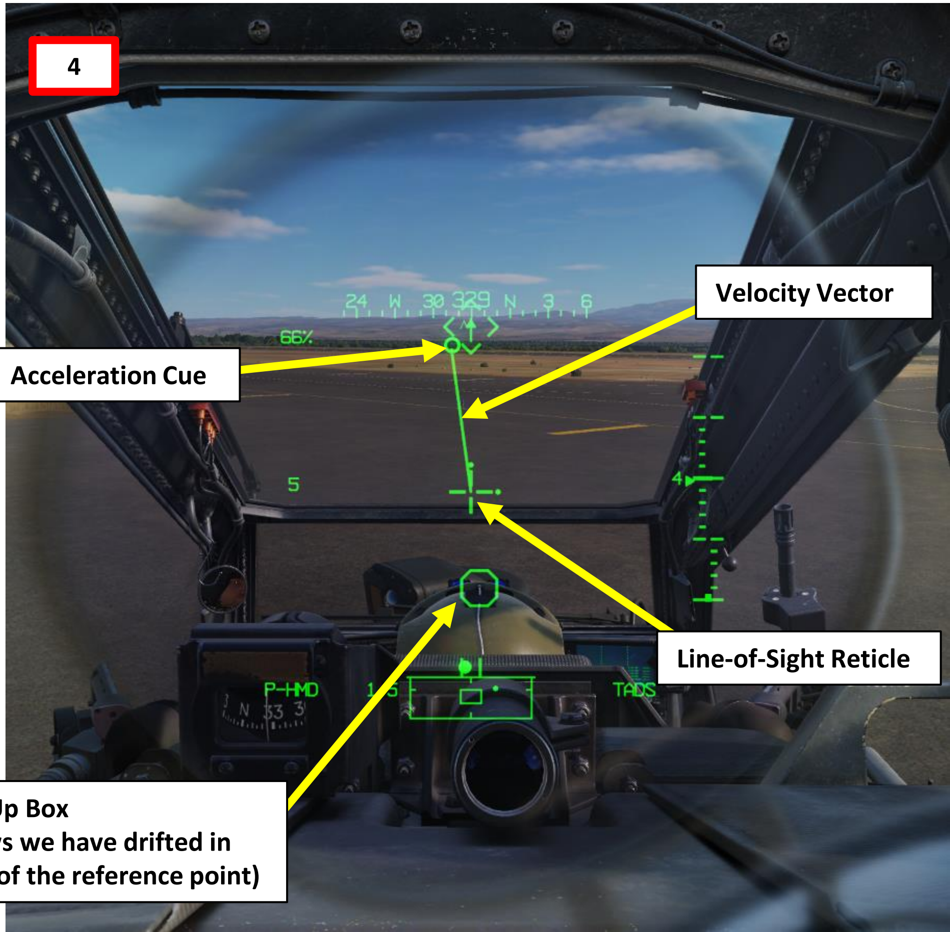
IHADSS HOVER BOB-UP MODE

1. Select IHADSS (Integrated Helmet and Display Sighting System) Bob-Up Symbology by pressing the Symbology Select Switch AFT ("HB") to toggle between Hover and Bob-Up symbology on the HDU (Helmet Display Unit).
2. When Bob-Up mode is engaged, the system will "drop a Bob-Up box". Think of it as if you were dropping an anchor. The box will remain in this position until the crew changes symbology modes. The Bob-Up box represents a 12 square-foot box anchored to the position it was on the ground at the time Bob-Up mode was entered.
3. The symbology in Bob-Up mode is almost identical to the Hover mode symbology with the exception of the Bob-Up box symbol, which represents the location where you initially "dropped" the Bob-up box.
4. The Bob-Up box symbol moves as you drift away from the reference point. You can see the symbology as a top-down view; the line-of-sight reticle represents the position of the aircraft in relationship to the bob-up box when it was first dropped (octagon symbol).
    - Note: The box will remain in this position until the crew changes symbology modes. When the Bob-Up box has reached the edge of the display ("saturated"), the aircraft has travelled 40 ft.



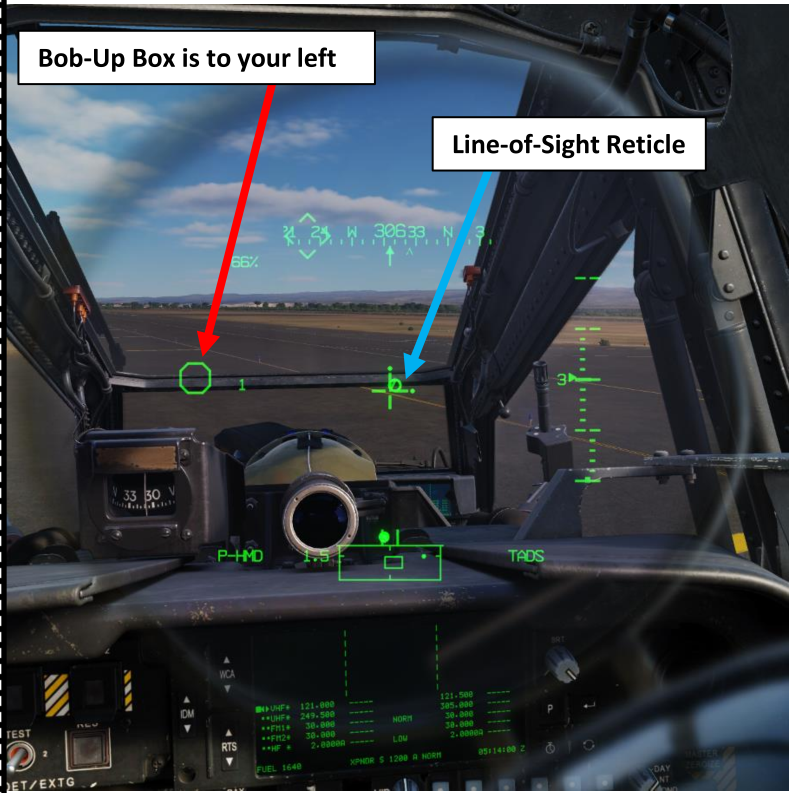


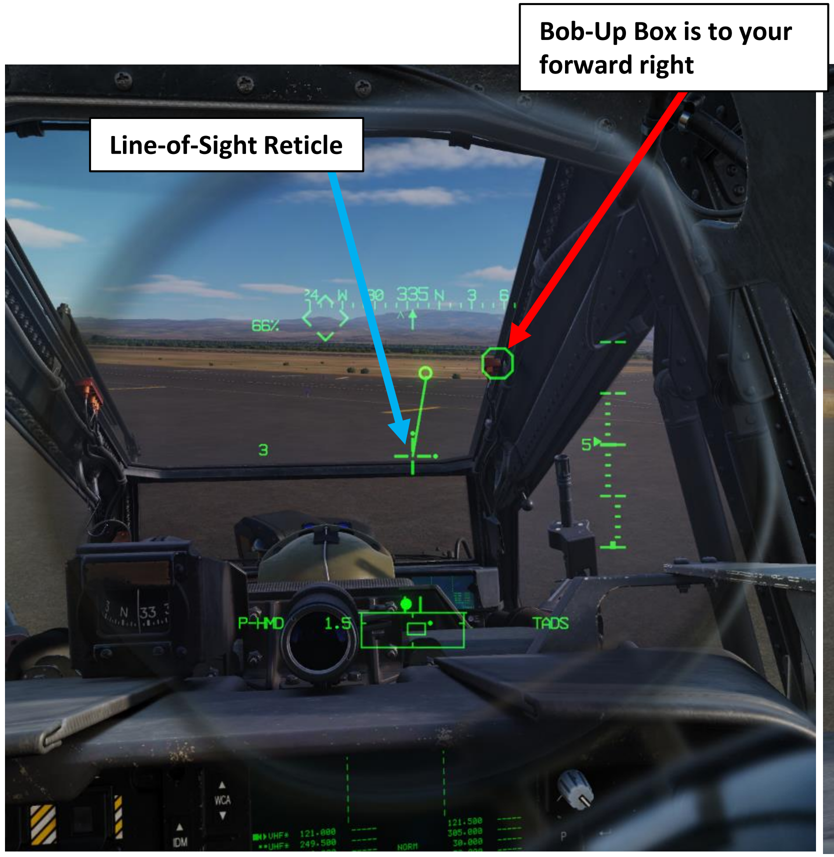


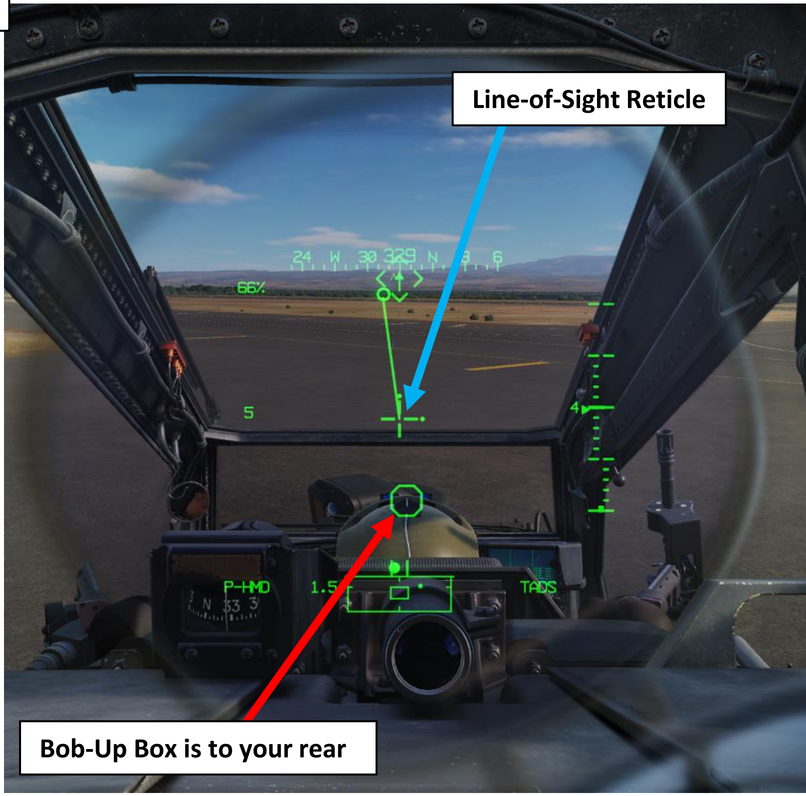


IHADSS HOVER BOB-UP MODE

Here are a few examples to help you have a mental image of how the bob-up symbology works in practice.

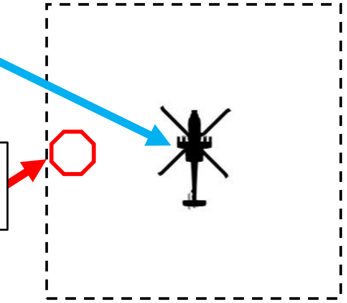






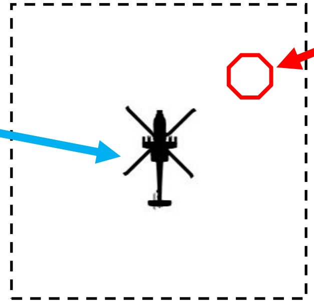
Your Position

Bob-Up Box Drop Reference



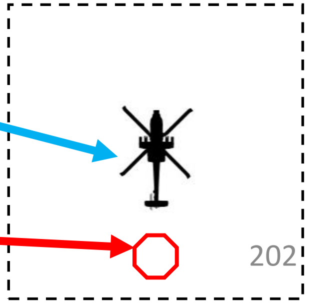
Bob-Up Box Drop Reference

Your Position



Your Position

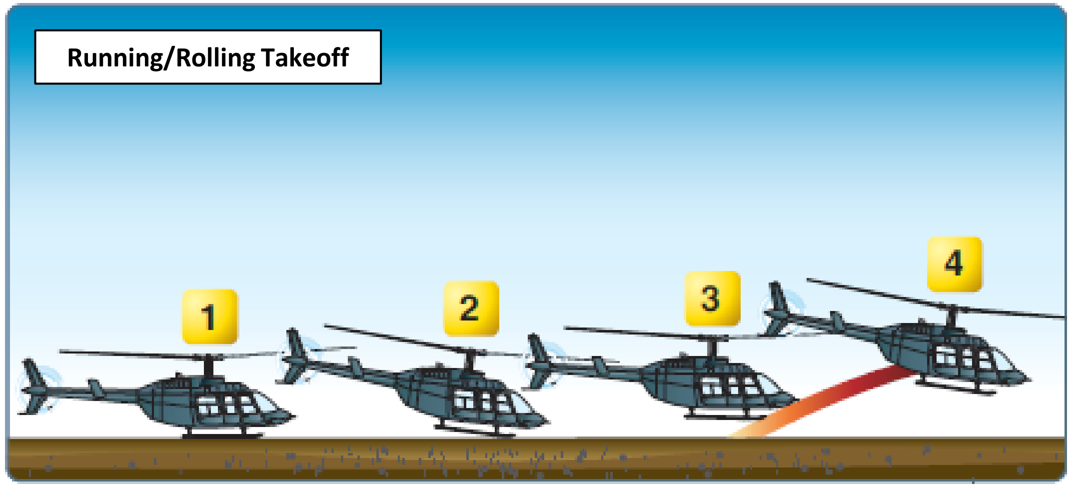
Bob-Up Box Drop Reference



TAKEOFF TYPES OVERVIEW

In the AH-64D, there are four primary types of VMC (Visual Meteorological Conditions) takeoff performed:

- **VMC Normal Takeoff**
    - From a hover, cyclic is pushed forward and collective is increased more than 10 % above hover power (or as necessary to establish the desired climb, 500 ft/min minimum). The climb is performed at 90 kts.
- **VMC Level Acceleration Takeoff**
    - From a hover, cyclic is pushed forward and collective is increased 10 % above hover power (or as necessary to establish the desired climb, 500 ft/min minimum). The climb is performed at 90 kts. This type of takeoff is performed when surface conditions and obstacles permit accelerating the aircraft through VSSE (Velocity for Safe Single Engine operation) prior to initiating a climb. This is done to avoid operating the helicopter in conditions where an engine failure would mean insufficient power is available to recover.
    - This is the preferred takeoff method.
- **VMC Minimum Power Takeoff from the Ground/Hover**
    - The pilot is limited to use only IGE hover power (In Ground Effect) in situations when surface conditions are not suitable for a rolling takeoff. The climb is performed at max rate of climb/endurance airspeed in order to provide the maximum power for climbing.
- **Rolling Takeoff**
    - When the helicopter is IGE power-limited (In Ground Effect) and surface conditions are suited for a rolling takeoff, the pilot is limited to 10 % below hover power (for training) and takes off from the ground by pushing the cyclic power and accelerating until liftoff. The climb is performed at max endurance/rate of climb airspeed to maximum climb ability.



VMC LEVEL ACCELERATION TAKEOFF

1. Line up the helicopter with the direction you will takeoff from. Verify the parking brake lever is released (handle IN).

VMC LEVEL ACCELERATION TAKEOFF

2. Straighten the tailwheel by moving forward while the wheel is unlocked.
3. Lock the tailwheel by pressing the Tail Wheel Lock/Unlock Button. Verify that the tailwheel is locked and the UNLOCK light is extinguished on the button.
4. Select IHADSS (Integrated Helmet and Display Sighting System) Hover Symbology by pressing the Symbology Select Switch AFT ("HB") to toggle between Hover and Bob-Up symbology on the HDU (Helmet Display Unit).
5. Perform a 5-ft stable hover.
6. Select IHADSS (Integrated Helmet and Display Sighting System) Transition Symbology by pressing the Symbology Select Switch FWD ("CT") to toggle between Cruise and Transition symbology on the HDU (Helmet Display Unit). You will recognize Transition mode with the dashed "Transition Horizon Line" on the HDU.
7. Press and hold the force trim release button and apply forward cyclic for a 90-knot climb attitude (wings level) while increasing the collective approximately 10% above hover power (or as necessary to establish the desired climb, 500 ft/min minimum).

Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

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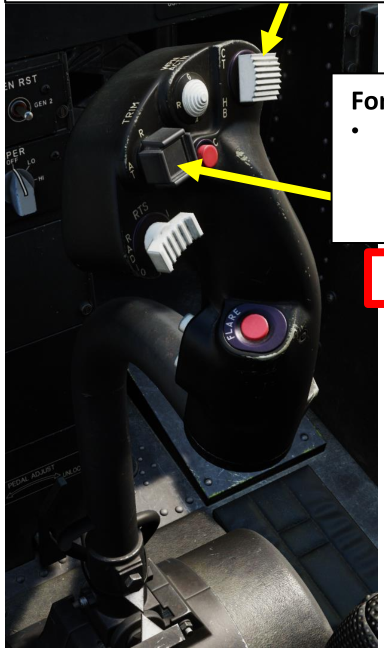
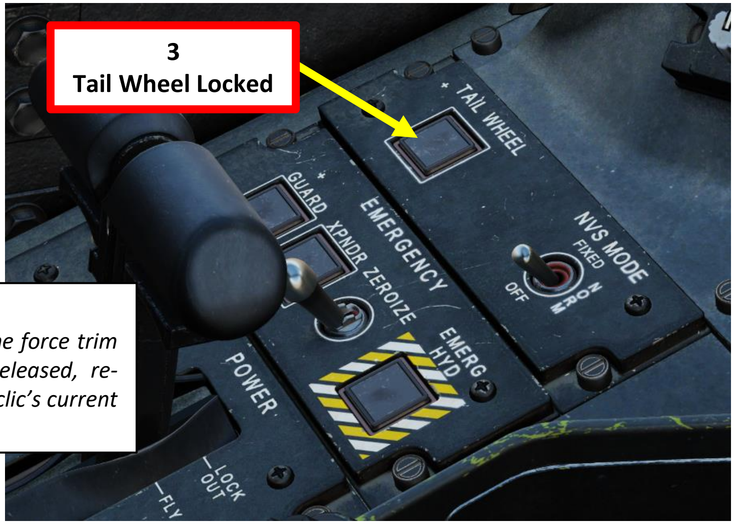
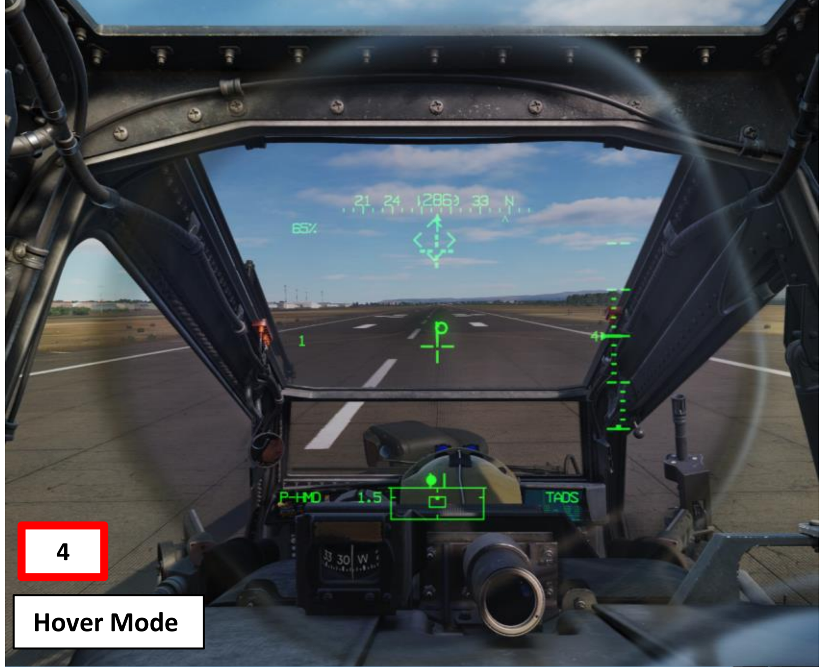


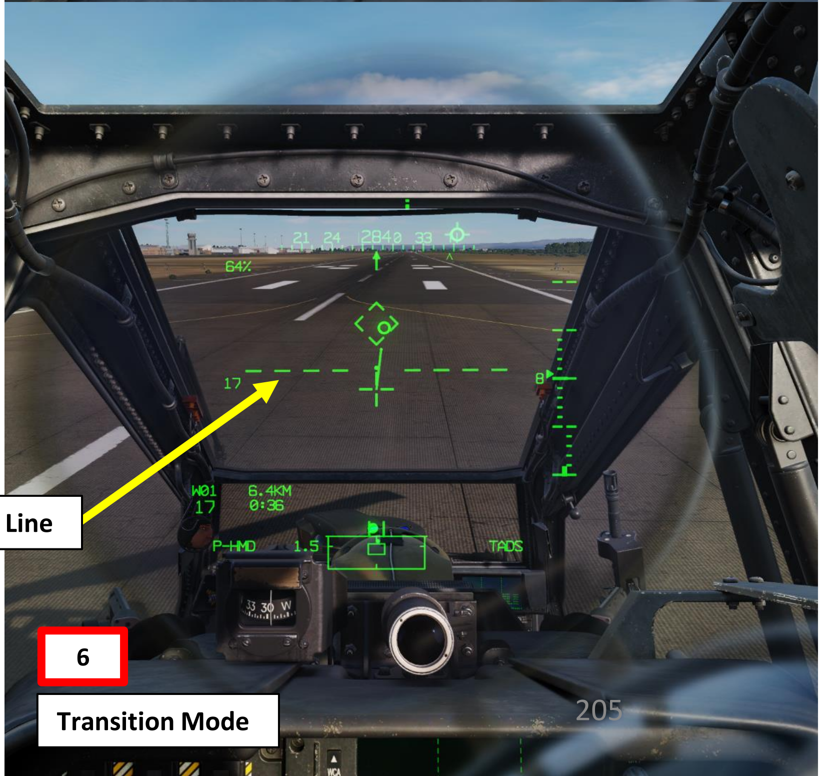
Force Trim / Hold Modes Switch

- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*

7

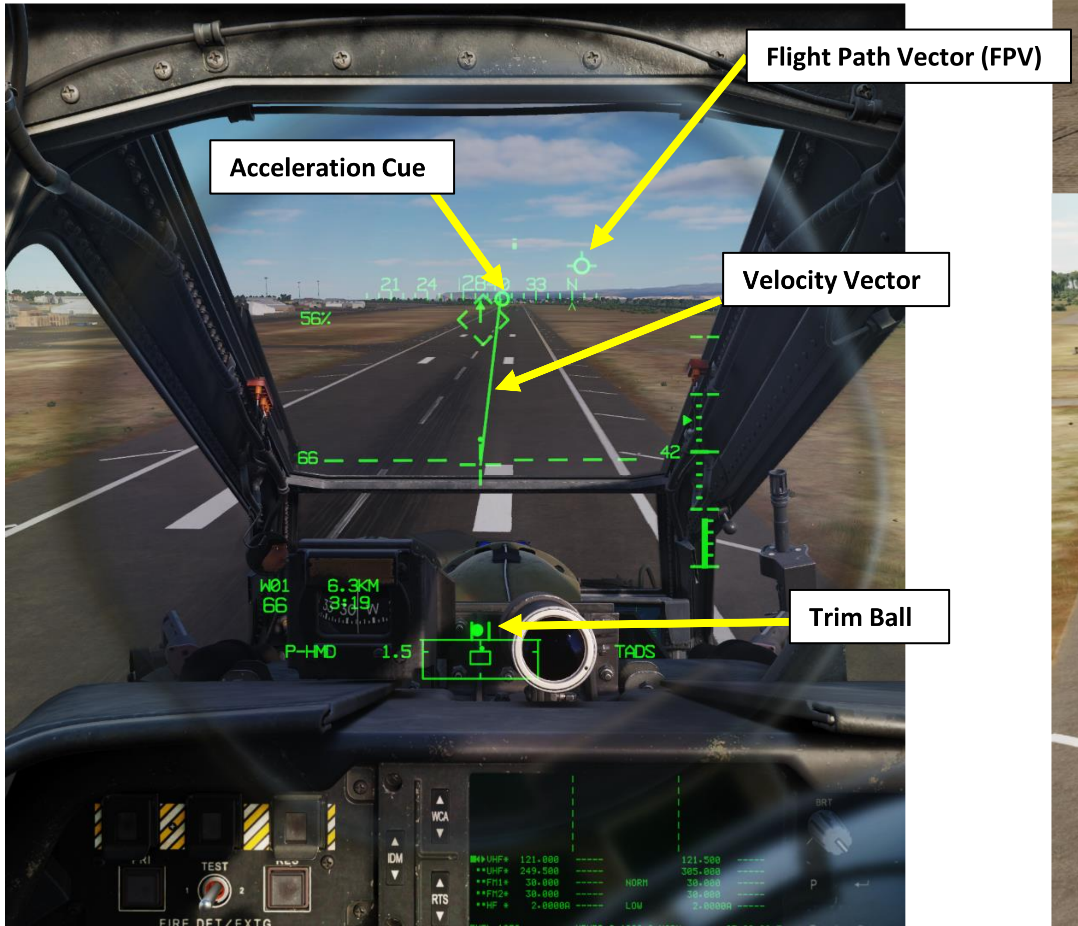






VMC LEVEL ACCELERATION TAKEOFF

8. Release the force trim upon establishing a 90-knot attitude and trim as necessary to maintain a level vertical speed until through VSSE (Velocity Safe Single Engine). Maintain ground track alignment with the pedals and center the trim ball into coordinated flight once clear of all obstacles or 50 ft, whichever occurs first. The velocity vector line should be pointing straight up with your takeoff direction.
9. Continue adjusting the controls as necessary to achieve 50 knots by the time an altitude of 50 ft AGL (Above Ground Level) is reached or as required to clear obstacles. Maintain the flight path vector above any obstacles to assist in ensuring obstacle clearance.
10. Once clear of obstacles, adjust for a 70-knot attitude and 500+ ft/min rate of climb or as desired.



ROLLING TAKEOFF

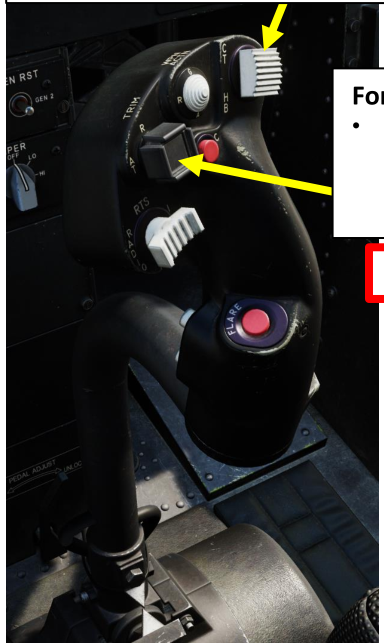
1. Line up the helicopter with the center of the runway. Verify the parking brake lever is released (handle IN).

ROLLING TAKEOFF

2. Straighten the tailwheel by moving forward while the wheel is unlocked.
3. Lock the tailwheel by pressing the Tail Wheel Lock/Unlock Button. Verify that the tailwheel is locked and the UNLOCK light is extinguished on the button.
4. Select IHADSS (Integrated Helmet and Display Sighting System) Transition Symbology by pressing the Symbology Select Switch FWD ("CT") to toggle between Cruise and Transition symbology on the HDU (Helmet Display Unit). You will recognize Transition mode with the dashed "Transition Horizon Line" on the HDU.
5. Press and hold the Force Trim switch FWD (Release) while increasing the collective to 30 % torque.
6. Continue increasing the collective to the simulated power limit (10 % below the torque needed to perform a 5-ft hover check) while simultaneously applying forward cyclic for a 90-knot attitude (wings level), then release the force trim.
7. Helicopter will gradually accelerate until liftoff. Do not allow the nose to go below wings level until the helicopter is off the ground to prevent ground contact with the gun.
8. Use Force Trim switch FWD (Release) as necessary to maintain a level attitude.

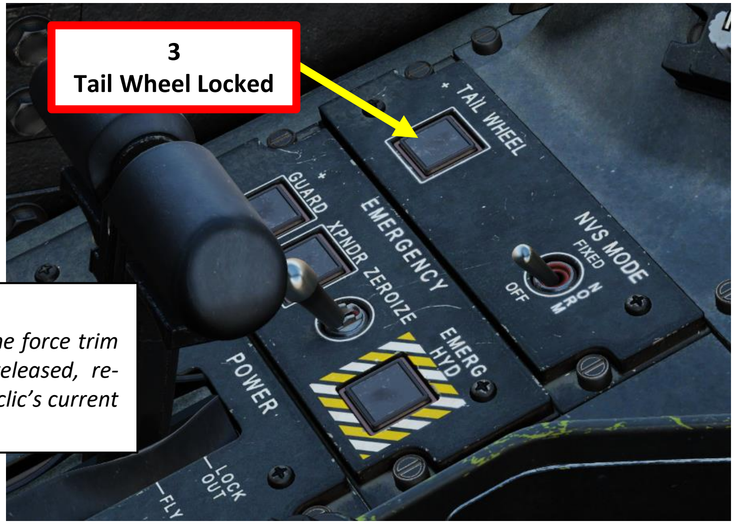
Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

4

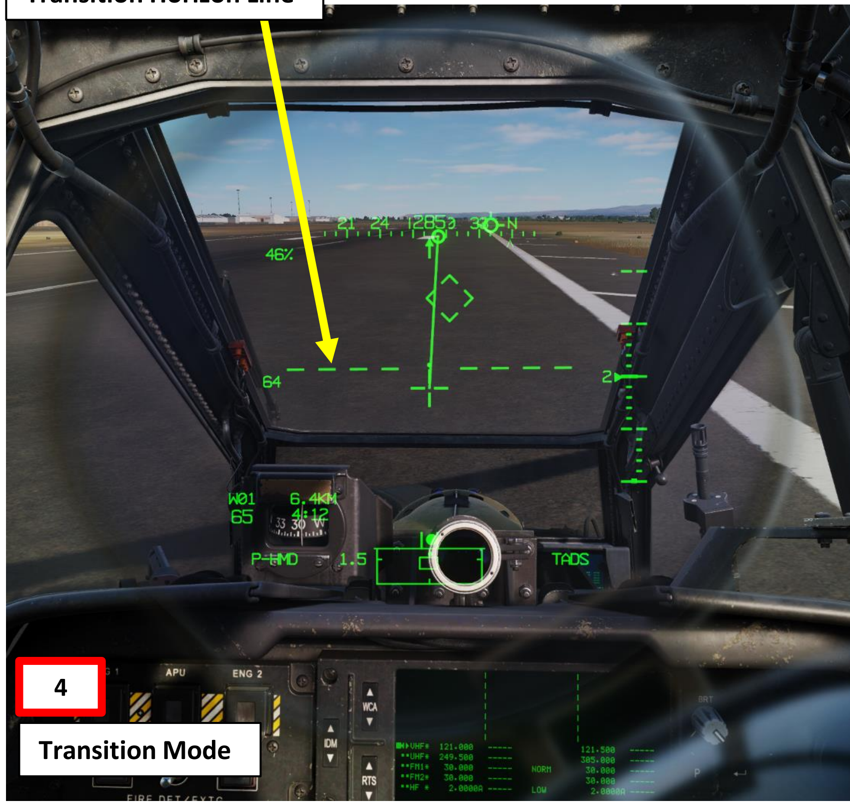


Force Trim / Hold Modes Switch
- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*

7



Transition Horizon Line

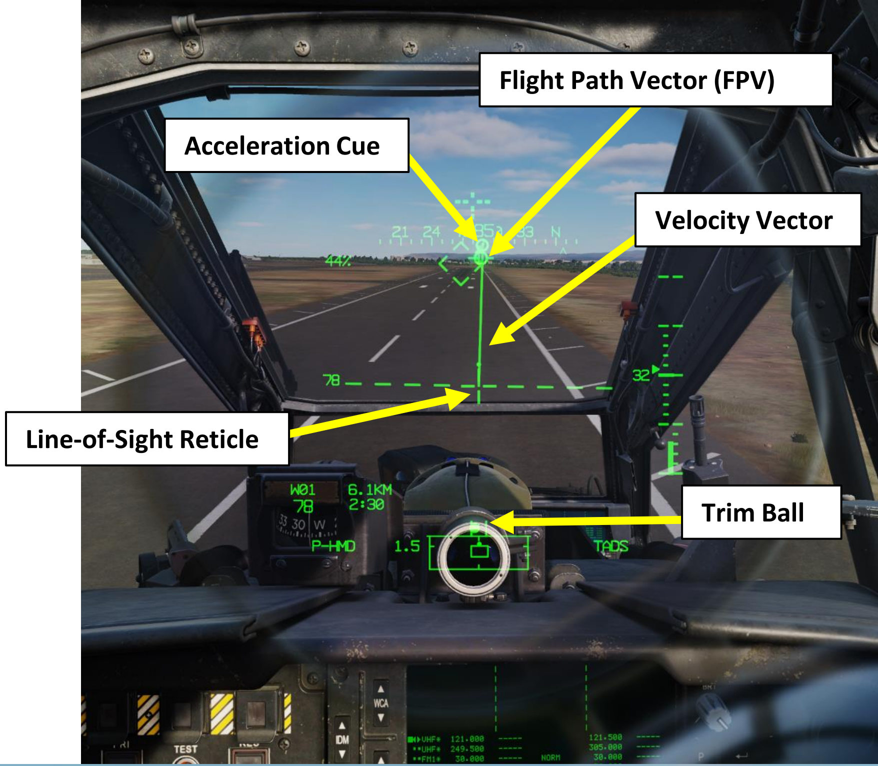


4

Transition Mode

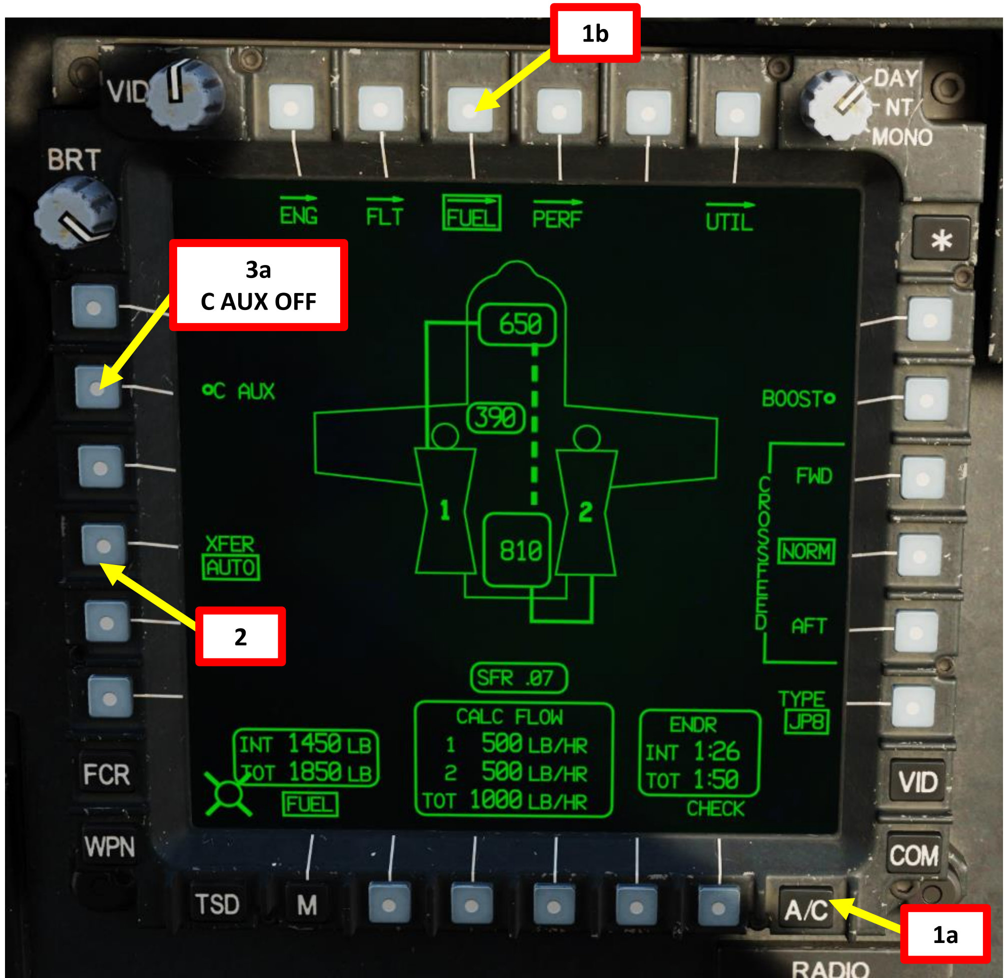
ROLLING TAKEOFF

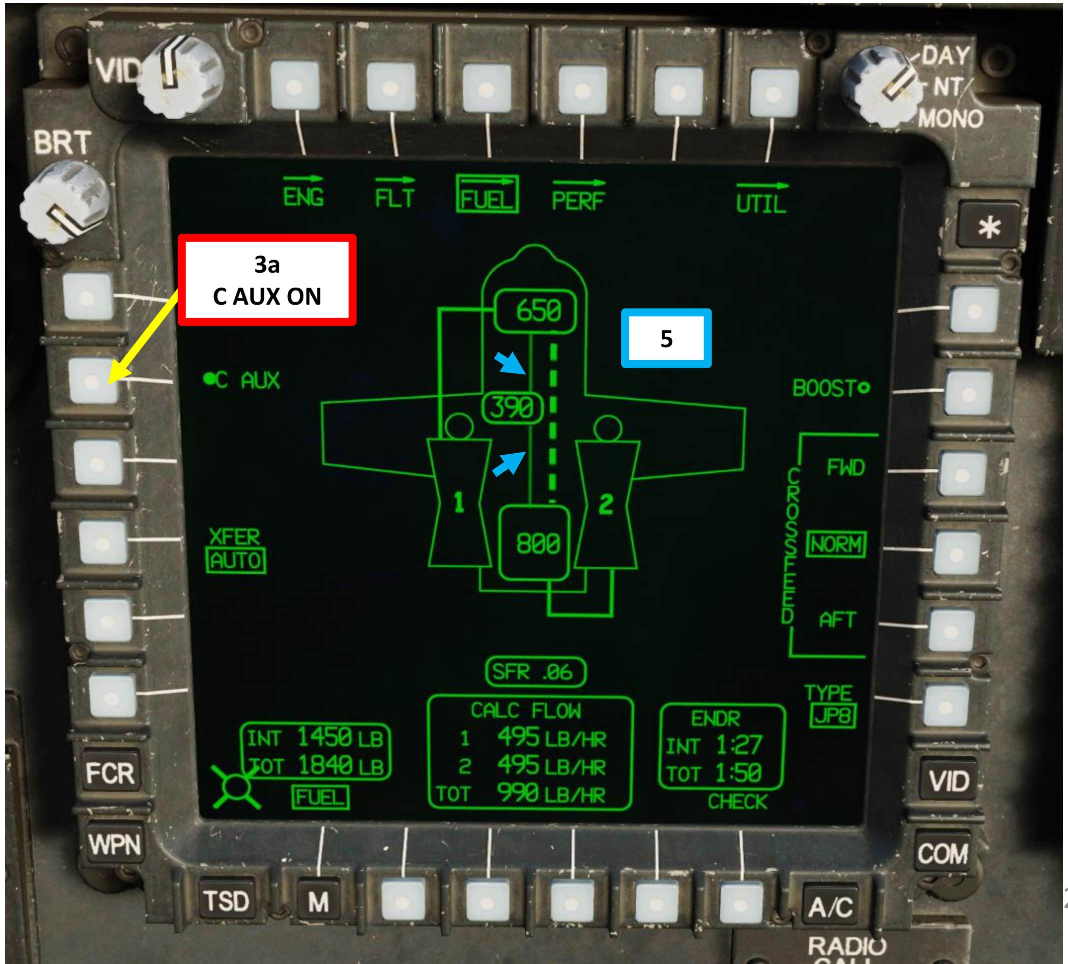
9. Do not allow the nose to drop below wings level until after liftoff to prevent ground contact with the gun. Maintain the velocity vector straight up and down the 12 o'clock post of the line-of-sight reticle with the pedals. The velocity vector line should be pointing straight up as you fly along the runway.
10. As the aircraft lifts off, continue to apply forward cyclic for a level vertical speed while accelerating to achieve 50 knots. Use the pedals to center the trim ball into coordinated flight. Avoid pitch attitudes more than 10 degrees below the horizon to avoid ground contact with the rotor system.
11. As the aircraft approaches 50 knots, adjust for a 70-knot attitude to initiate a climb. Ensure the flight path vector is above the obstacles.
12. Once clear of the obstacles, adjust for a 500+ ft/min rate of climb or as desired. The manoeuver is terminated when a positive rate of climb has been established, the aircraft is clear of obstacles and at or near max endurance/rate-of-climb or desired airspeed.
13. If performing this manoeuver in a power limited environment (high/hot/heavy), it is recommended the pilot use 5% below the maximum dual engine torque available to avoid potentially drooping the rotor.



AFTER TAKEOFF

1. After takeoff, go in the FUEL page.
2. Set XFER (Transfer) Option – AUTO. Fuel will be automatically transferred between the tanks to maintain leveling.
3. If an internal auxiliary fuel tank is installed, the C AUX option is available. In most missions in DCS, the internal auxiliary fuel tank (also nicknamed “Robbie Tank”, referring to “Robertson Fuel Systems”, the company that manufactures the fuel tank) is installed by default. However, fuel transfer from the internal auxiliary tank to the main forward and aft fuel tanks needs to be enabled for fuel transfer to take place.
4. Enable fuel transfer for the internal auxiliary tank by pressing VAB (Variable Action Button) next to C AUX.
   - Hollow circle means OFF. Solid Circle means ON.
5. A solid line will be depicted on the synoptic indicating the transfer.





VMC APPROACH TO A HOVER

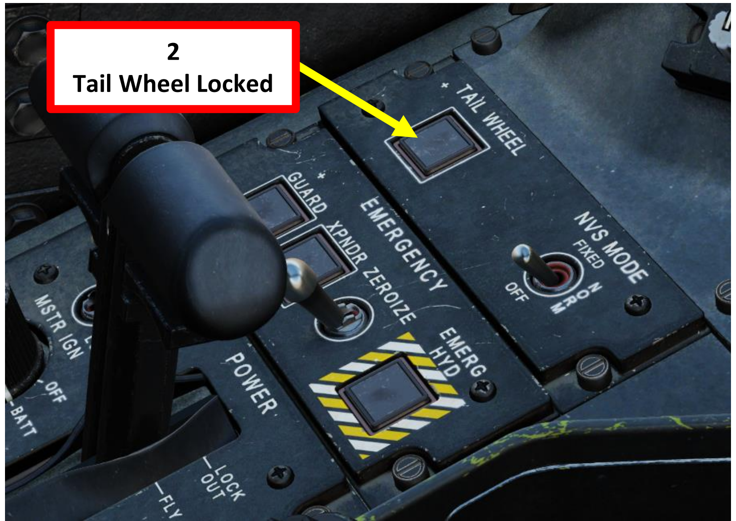
Landing using a VMC (Visual Meteorological Conditions) Approach to a Hover is a technique used when the landing area is small and little space is available to slow down. The approach is performed to stop the helicopter into a hover, then land on a helipad or a FARP (Forward Arming & Refueling Point) landing zone. This landing technique can be difficult (or even impossible) to achieve if you are power-limited (power to maintain a hover is very high due to a heavy configuration, hot day or high altitude) or in case of a single engine failure.

1. Verify the parking brake lever is released (handle IN).
2. Lock the tailwheel by pressing the Tail Wheel Lock/Unlock Button. Verify that the tailwheel is locked and the UNLOCK light is extinguished on the button.
3. Select IHADSS (Integrated Helmet and Display Sighting System) Transition Symbology by pressing the Symbology Select Switch FWD ("CT") to toggle between Cruise and Transition symbology on the HDU (Helmet Display Unit). You will recognize Transition mode with the dashed "Transition Horizon Line" on the HDU.

Symbology Select Switch

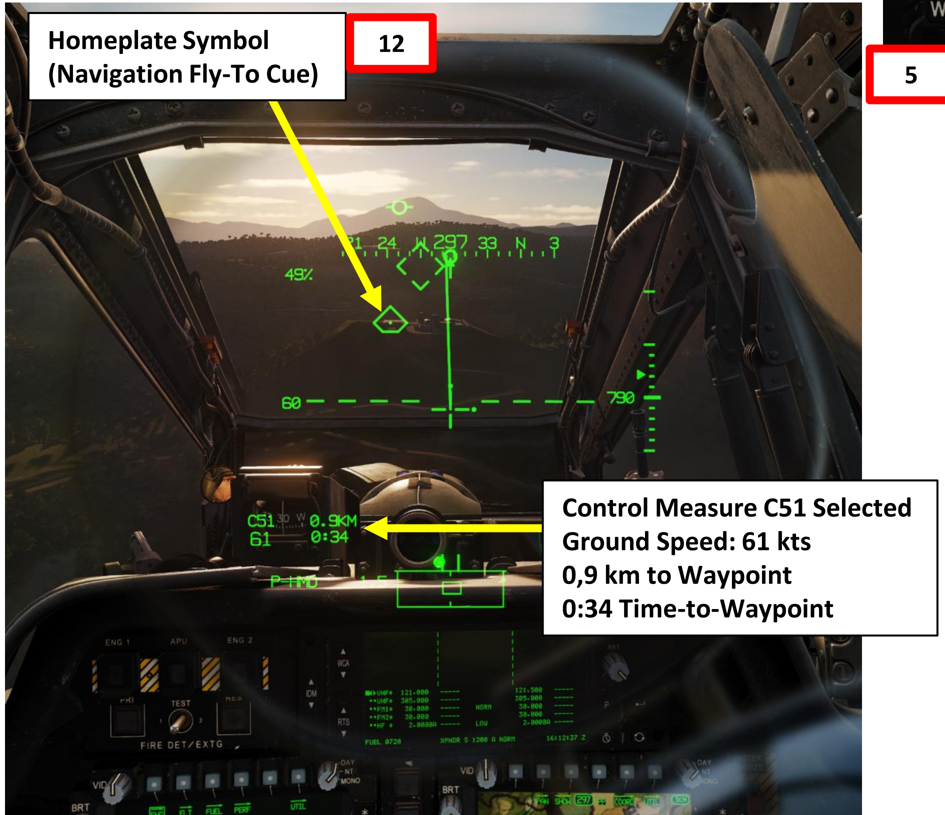
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

3



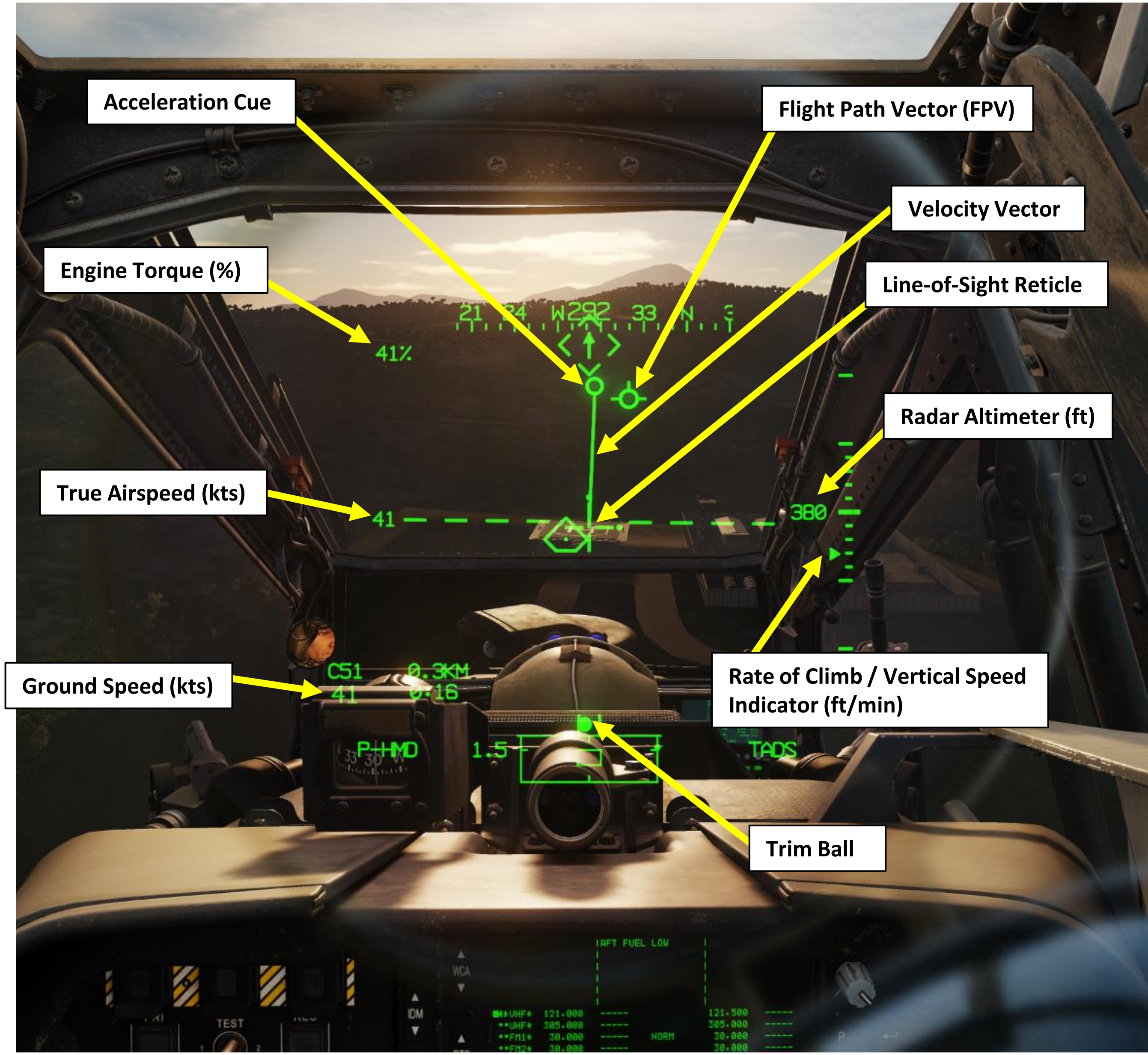
VMC APPROACH TO A HOVER

4. We will assume Control Measure C51 (waypoint set on the Forward Arming & Refueling Point) is already created and located on the landing FARP.
5. Select TSD (Tactical Situation Display) page.
6. Select NAV Phase.
7. Select RTE (Route).
8. Select DIR (Direct To).
9. Select POINT (?).
10. On the KU (Keyboard Unit), enter “C51”, then press ENTER.
11. De-Select RTE (Route).
12. On the HDU (Helmet Display Unit), a “Homeplate” symbol (Navigation Fly-To Cue) will appear on the FARP (Control Measure C51).



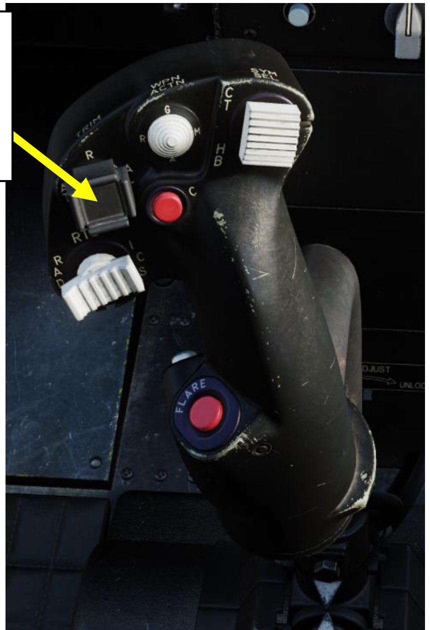
VMC APPROACH TO A HOVER

13. From an altitude and airspeed that affords the best observation of the landing area (like 1000 ft altitude AGL), place the line-of-sight reticle on the intended point of landing.
14. Press and hold Force Trim switch FWD (Release) and reduce the collective approximately 20 % below cruise torque (torque required to maintain level flight at a constant speed).
15. Place the acceleration cue at the 40-knot ground speed position (upper tip of the velocity vector line when ground speed is 40 kts) and adjust the collective for a 500 ft/min or desired rate or descent.
16. Maintain the flight path vector (FPV) slightly above the intended point of landing to prevent “under-arcing” the approach.
17. Control the flight path vector (FPV) vertically with the collective and horizontally with the left/right cyclic.
18. Maintain the acceleration cue behind the tip of the velocity vector to ensure a smooth, consistent deceleration while maintaining a 500 ft/min or desired rate of descent. Prior to descending below the obstacles or 50 ft, keep the trim ball centered.



Force Trim / Hold Modes Switch

- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*



VMC APPROACH TO A HOVER

19. Once below the obstacles or below 50 ft, use the pedals to align the nose with the landing direction. The decision to abort the approach should be made prior to descending below the obstacles.

VMC APPROACH TO A HOVER

20. When the velocity vector is within the line-of-sight reticle, select Hover symbology (Symbology Select Switch AFT to toggle between Hover and Bob-Up modes) and terminate to a 5-foot stationary hover. Use your cyclic to come to a full stop, and raise your collective to “cushion” the sudden drop caused by the loss of translational lift (which is caused by the loss of airspeed).

Symbology Select Switch

- *FWD: “**CT**” toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: “**HB**” toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

20

VMC APPROACH TO A HOVER

21. Once you have come to a full stop in a 5 ft hover, you can slowly reduce collective to safely land on the ground.
22. Neutralize the flight controls and reduce the collective after the aircraft has landed.

VMC APPROACH TO A HOVER

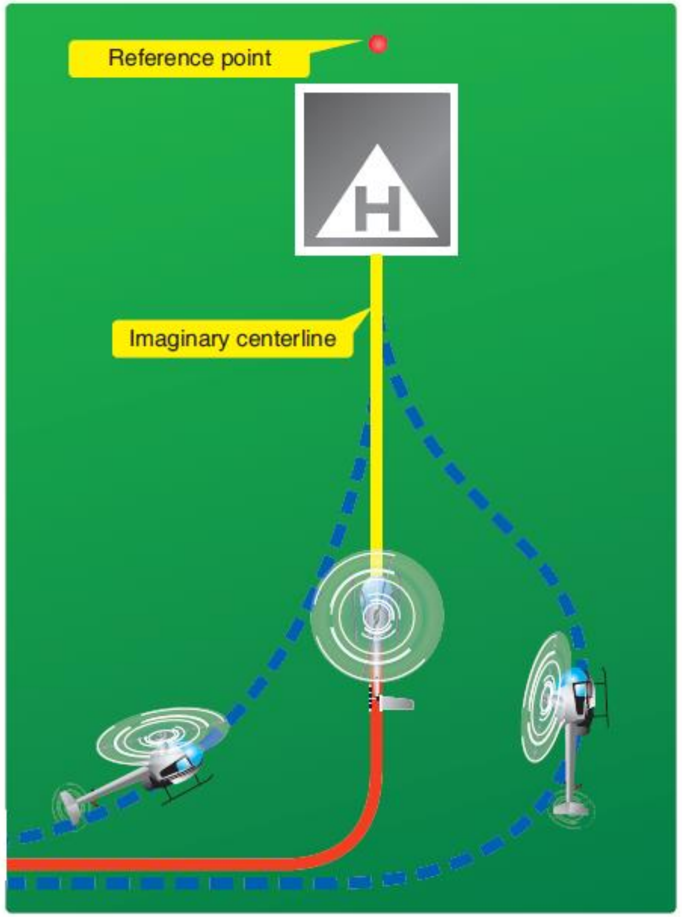
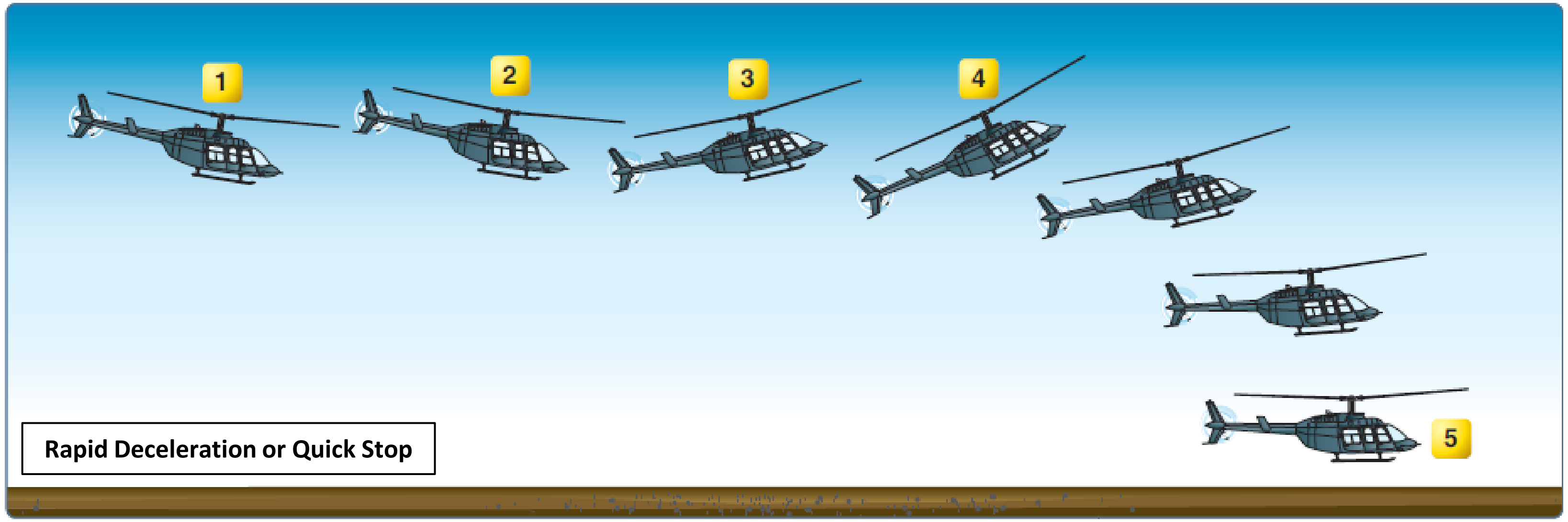
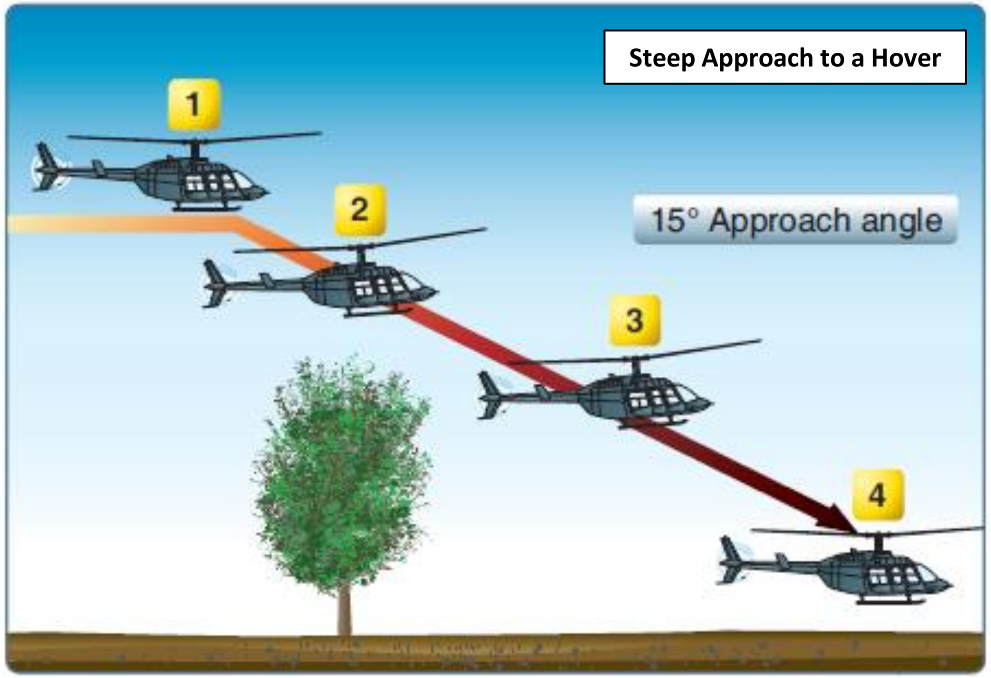


Figure 9-20. *Plan the turn to final so the helicopter rolls out on an imaginary extension of the centerline for the final approach path. This path should neither angle to the landing area, as shown by the helicopter on the left, nor require an S-turn, as shown by the helicopter on the right.*





ROLLING LANDING

Landing using a Rolling Landing technique is used whenever you have enough space to decelerate using a prepared landing surface like a runway and aerobraking. A Rolling Landing is very useful when you are power-limited (power to maintain a hover is very high due to a heavy configuration, hot day or high altitude) or in case of a single engine failure.

1. Verify the parking brake lever is released (handle IN).
2. Lock the tailwheel by pressing the Tail Wheel Lock/Unlock Button. Verify that the tailwheel is locked and the UNLOCK light is extinguished on the button.
3. Select IHADSS (Integrated Helmet and Display Sighting System) Transition Symbology by pressing the Symbology Select Switch FWD ("CT") to toggle between Cruise and Transition symbology on the HDU (Helmet Display Unit). You will recognize Transition mode with the dashed "Transition Horizon Line" on the HDU.

Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

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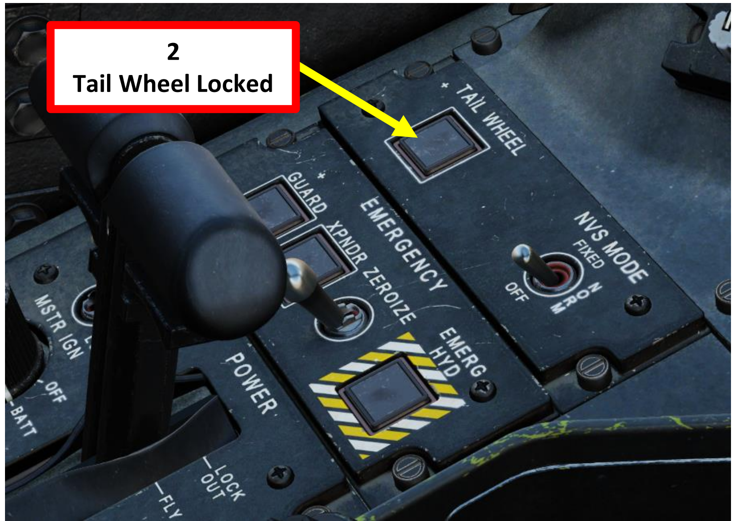
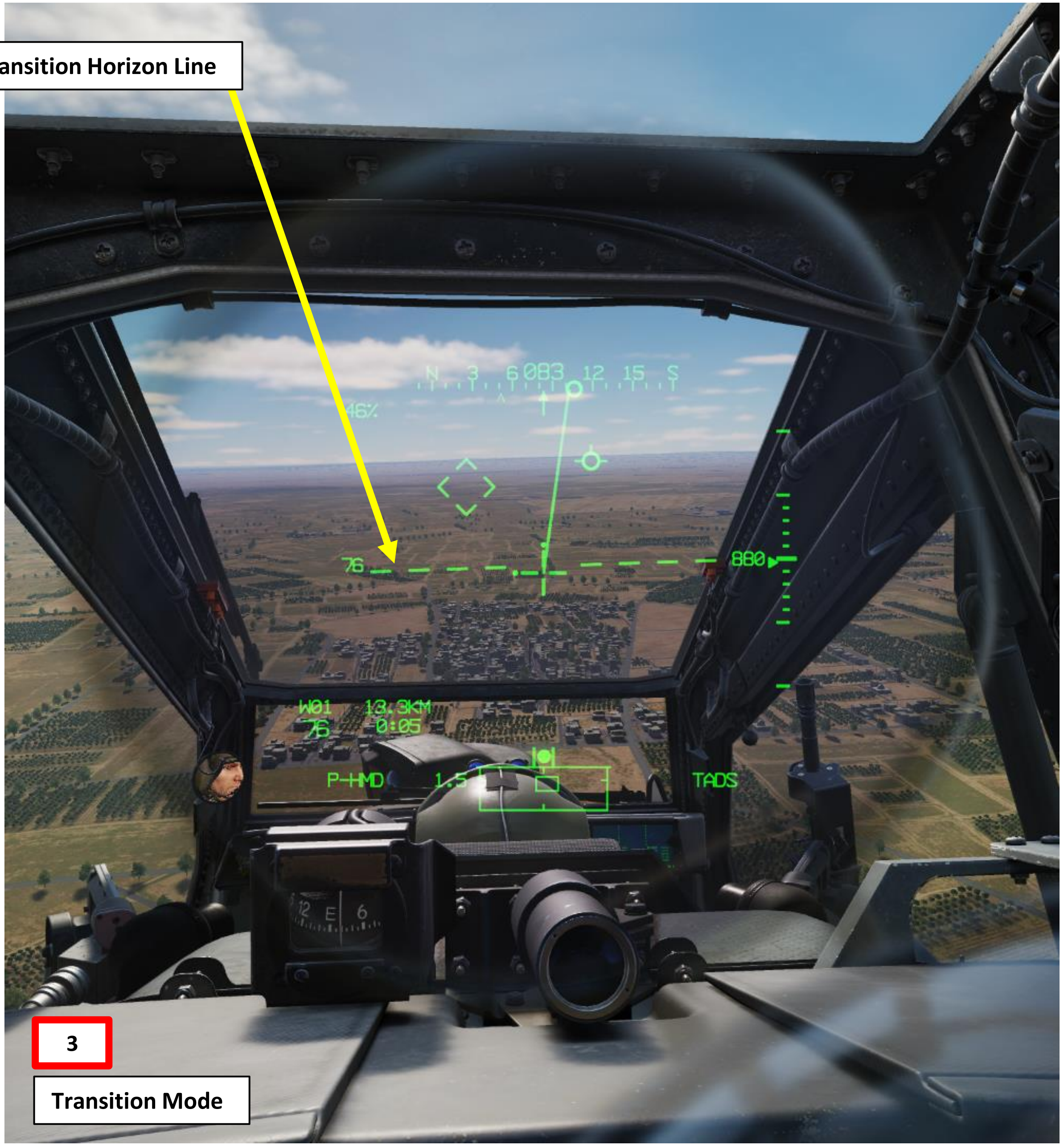
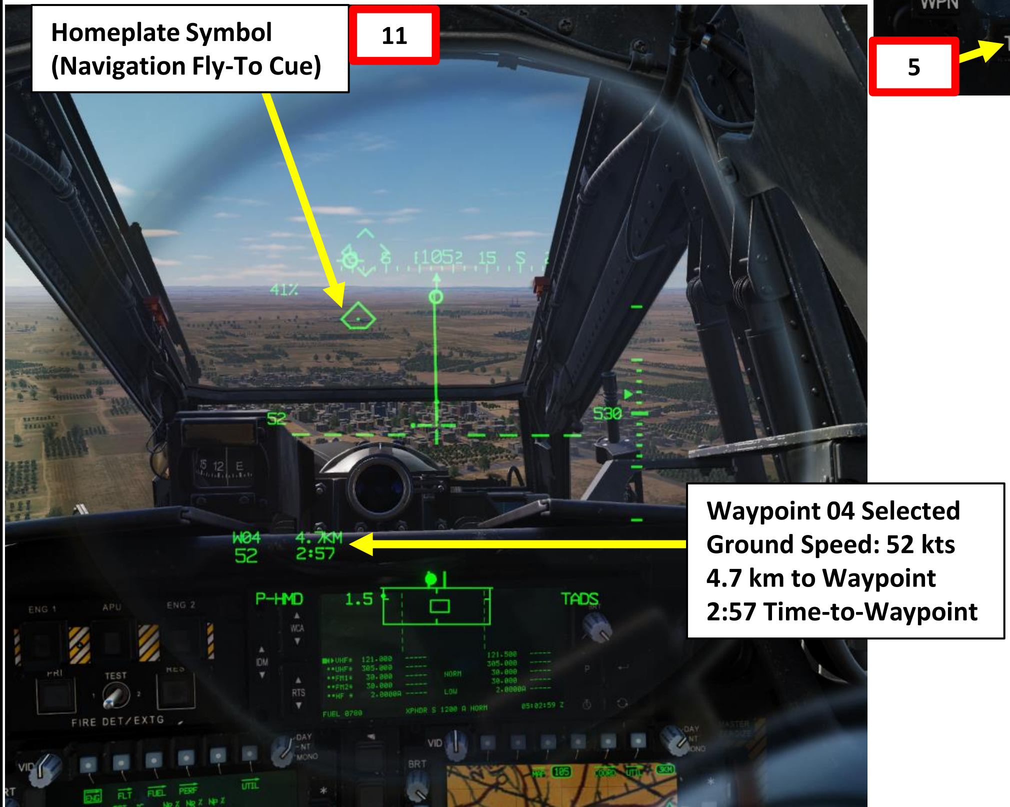




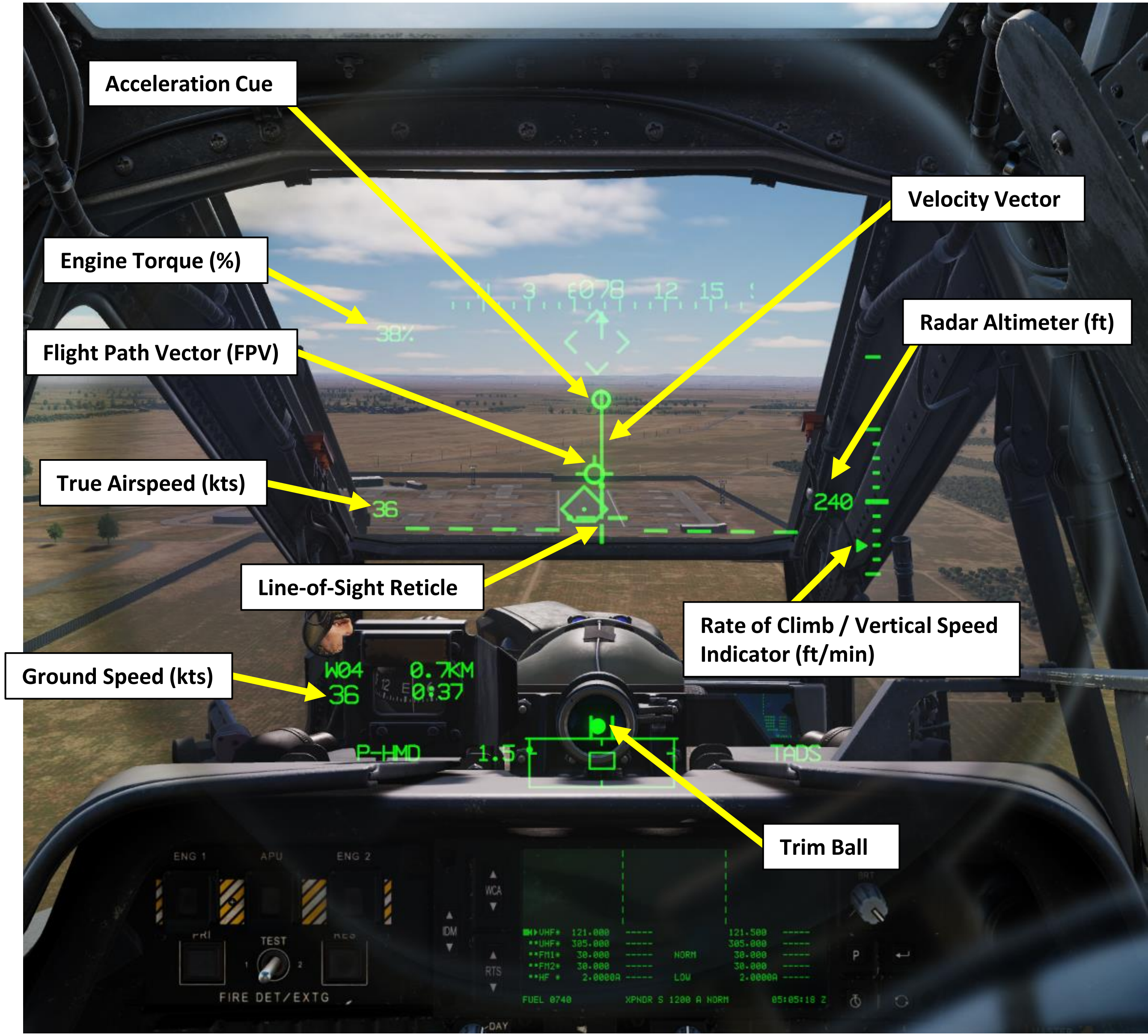
ROLLING LANDING

4. We will assume Waypoint 4 (W04) is located on the landing airport.
5. Select TSD (Tactical Situation Display) page.
6. Select NAV Phase.
7. Select RTE (Route).
8. Select DIR (Direct To).
9. Select WP04.
10. De-Select RTE (Route).
11. On the HDU (Helmet Display Unit), a “Homeplate” symbol (Navigation Fly-To Cue) will appear on the destination airport.

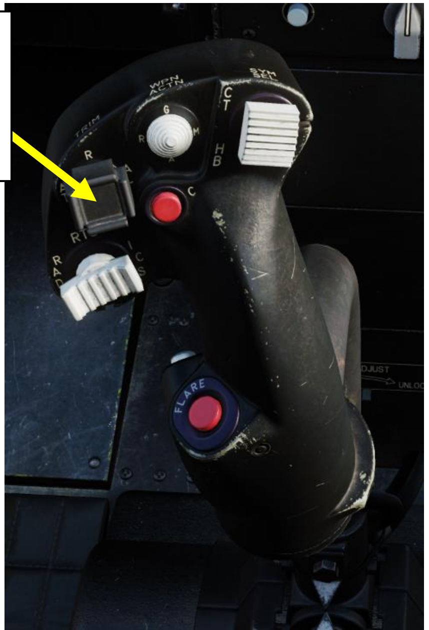


ROLLING LANDING

12. From an altitude and airspeed that affords the best observation of the landing area (like 1000 ft altitude AGL), place the line-of-sight reticle on the intended point of landing.
13. Press and hold the Force Trim switch FWD (Release) and reduce the collective approximately 20% below cruise torque (torque required to maintain level flight at a constant speed).
14. Place the acceleration cue at the 40-knot ground speed position (upper tip of the velocity vector line when ground speed is 40 kts) and adjust the collective for a 300 to 500 ft/min or desired rate of descent.
15. Maintain the flight path vector (FPV) slightly above the intended point of landing to prevent "under-arcing" the approach (coming in too low). Plan to touch down in the first third of the useable landing area.
16. Control the flight path vector (FPV) vertically with the collective and horizontally with the left/right cyclic.
17. Maintain the acceleration cue behind the tip of the velocity vector to ensure a smooth, consistent deceleration while maintaining a 300 to 500 ft/min or desired rate of descent. Prior to descending below the obstacles or 50 ft, keep the trim ball centered.

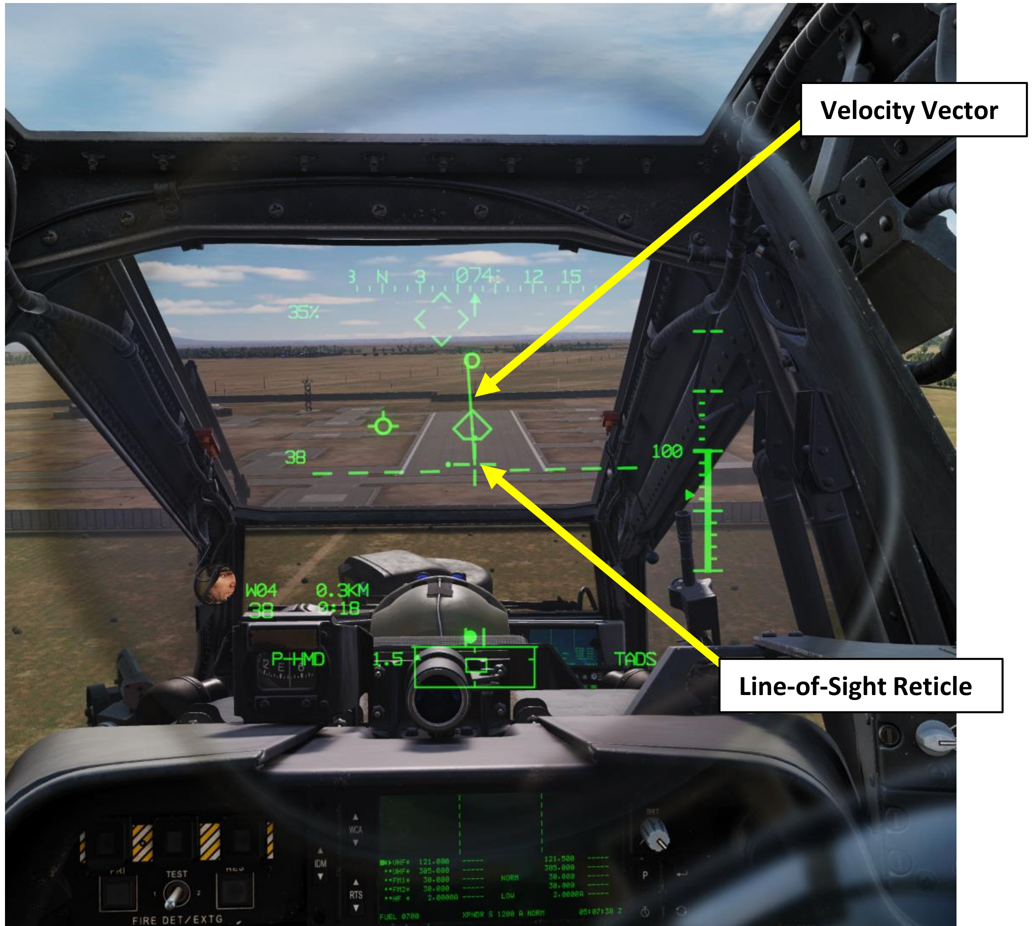


Force Trim / Hold Modes Switch
- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*



ROLLING LANDING

18. Once below the obstacles or below 50 ft, use the pedals to align the nose with the landing direction. Maintain the velocity vector straight up and down the 12 o'clock post of the line-of-sight reticle with the pedals and lateral cyclic.
19. Maintain at or above ETL (Effective Translational Lift, typically between 16-24 kts) or VSDE (Velocity Safe Dual Engine) until touch down, or if single engine maintain at or above VSSE (Velocity Safe Single Engine) until 30 ft.
20. Once the aircraft touches down, reduce the collective slightly to settle the aircraft, then increase the collective to 30% torque with dual engine (60% torque with single engine) or more prior to applying aft cyclic to aerodynamically brake the aircraft.
21. Maintain heading with the pedals and a level attitude with lateral cyclic.



ROLLING LANDING

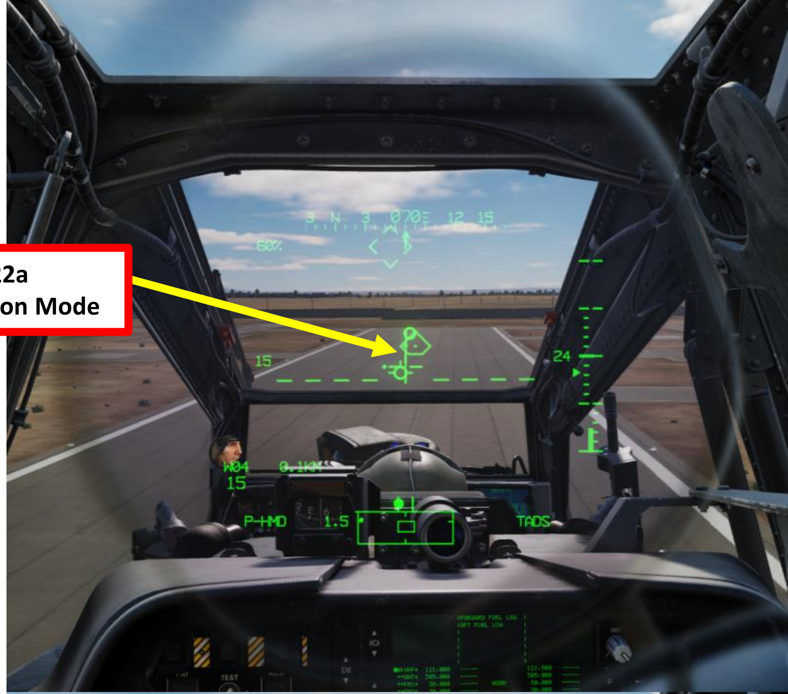
22. When the velocity vector is within the line-of-sight reticle, select Hover symbology (Symbology Select Switch AFT to toggle between Hover and Bob-Up modes) and maintain the acceleration cue in the center of the line-of-sight reticle.
23. Neutralize the flight controls and reduce the collective after the aircraft has stopped. It is permissible to utilize the toe brakes to assist in stopping the aircraft.

Symbology Select Switch

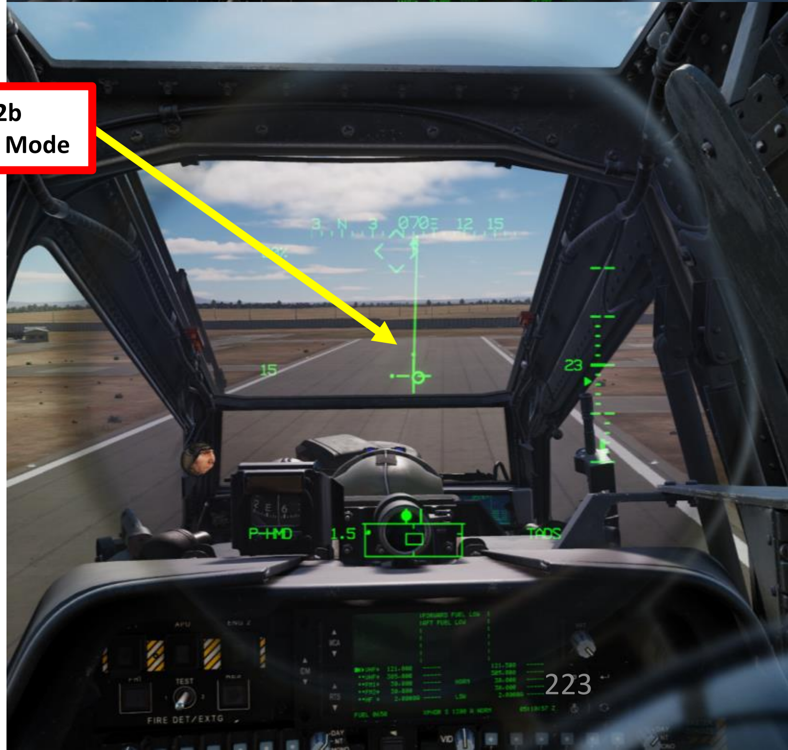
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

22

22a
Transition Mode



22b
Hover Mode



ROLLING LANDING

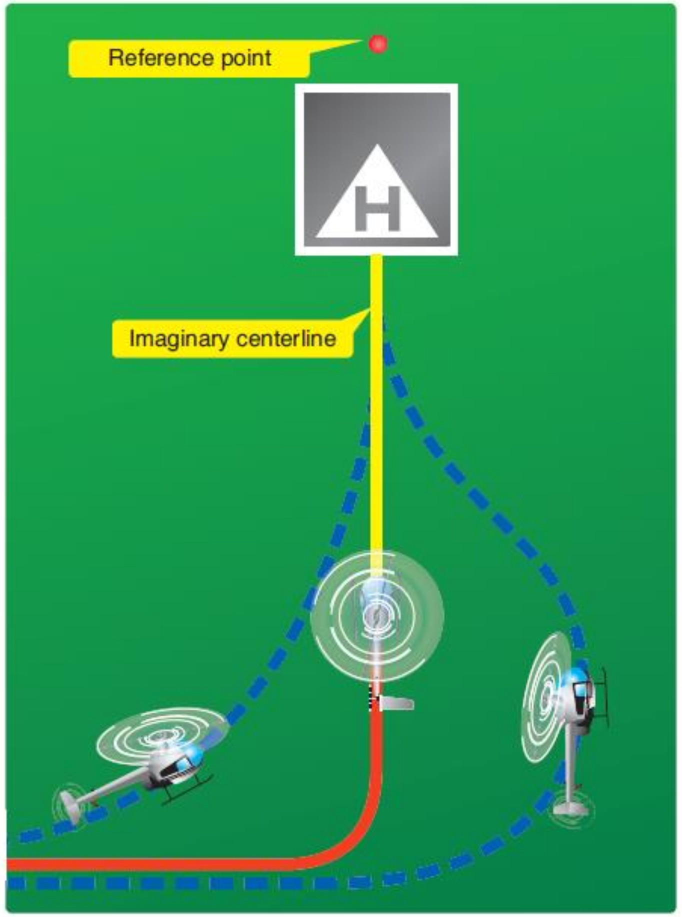
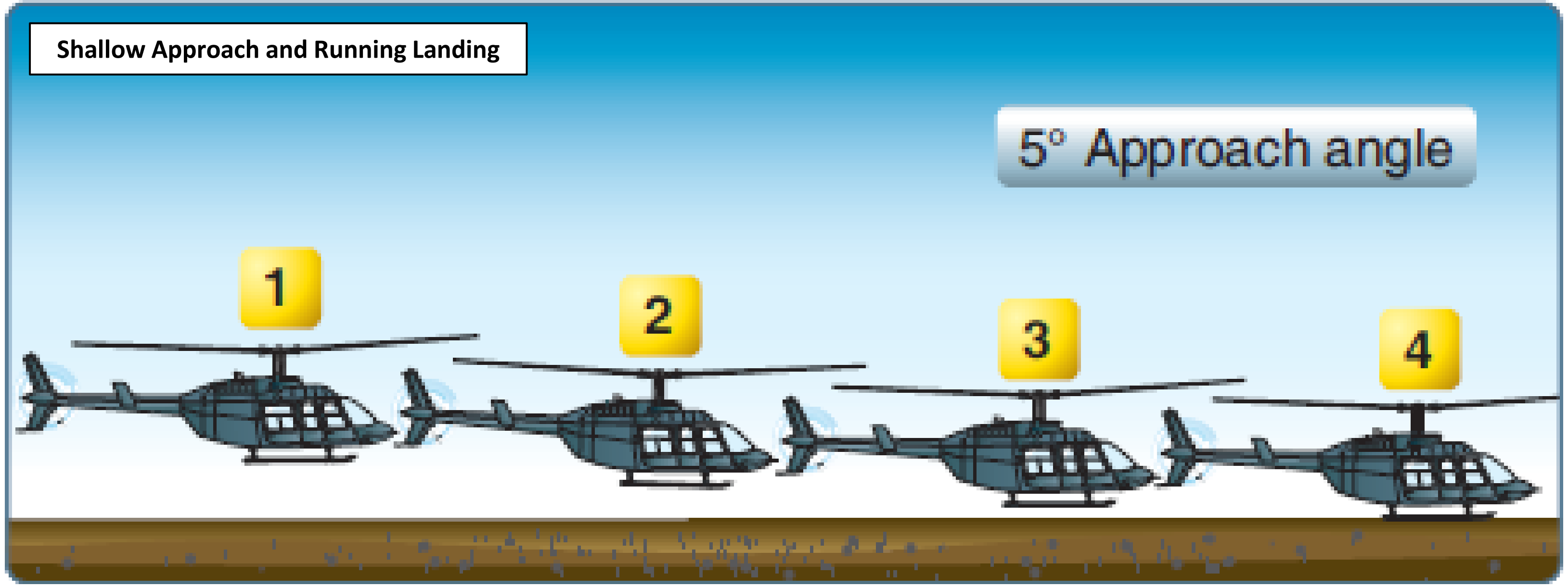


Figure 9-20. *Plan the turn to final so the helicopter rolls out on an imaginary extension of the centerline for the final approach path. This path should neither angle to the landing area, as shown by the helicopter on the left, nor require an S-turn, as shown by the helicopter on the right.*



SECTION SUMMARY

1 – Powerplant
1.1 – General Electric T700-GE-701C Engines

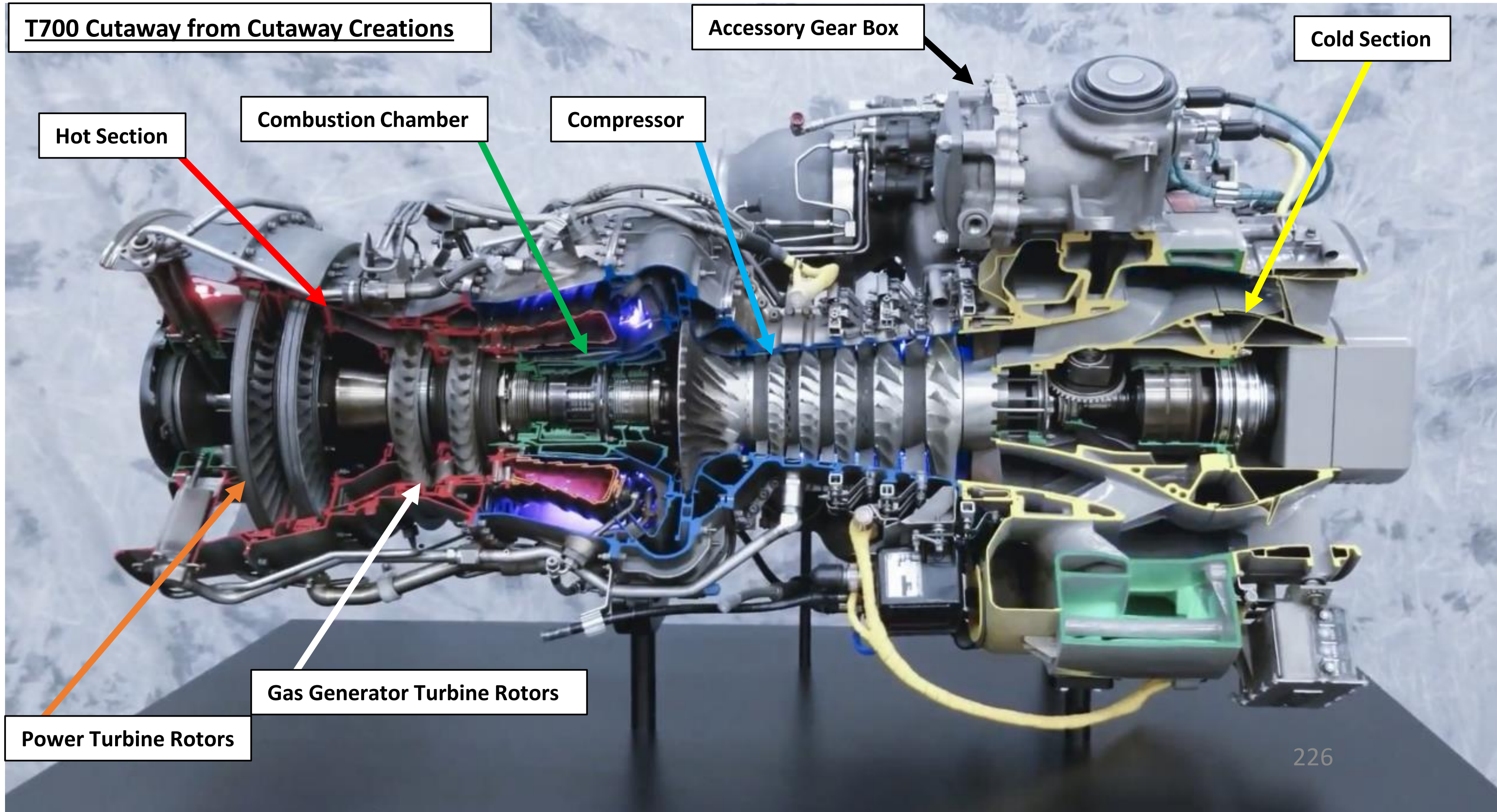
The AH-64D is powered by two General Electric T700-GE-701C turboshaft engines, each generating 1,940 shaft horsepower. The engines are front drive and regulated by a **Digital Electronic Control (DEC)** and **Hydromechanical Unit (HMU)** integral with each engine. Each engine consists of a cold section, hot section, power turbine section, and accessory section.

The **cold section** consists of an inlet particle separator for dust and sand protection, six-stage compressor, variable inlet guide vanes (IGVs), and variable stator vanes. The DEC is mounted to the cold section.

The **hot section** consists of the annular combustor, nozzle assembly and gas generator turbine stages. The gas generator is connected to the cold section's compressor through a central shaft, which rotates the compressor stage to produce self-sustaining engine power.

The **power turbine section** consists of two turbine stages and the exhaust frame. The power turbine shaft rotates within the gas generator compressor shaft and runs the full length of the engine to the front-mounted nose gearbox. The engine turbine gas temperature (TGT) thermocouples are mounted to this stage, just aft of the gas generator stages, along with the engine speed and torque sensors that provide cockpit indications of NP (Power Turbine Speed) and TQ (Torque) respectively.

The **accessory section** includes the HMU, NG (Gas Generator Speed) sensor, engine-driven fuel pump, oil system, and the Air Turbine Starter (ATS). Each engine's nose-mounted reduction gearbox powers the main transmission through an over-running "sprag" clutch that will disengage the engine from the main transmission if the powertrain system is operating at a higher RPM than the engine power turbine.



1 – Powerplant
1.1 – General Electric T700-GE-701C Engines

The **DEC (Digital Electronic Control)** and **HMU (Hydromechanical Unit)** work together to manage each engine, setting power based on the position of the power levers and collective. The power lever position is mechanically transmitted to the HMU via a **Power Available Spindle (PAS)**, and the collective position mechanically via a **Load Demand Spindle (LDS)**.

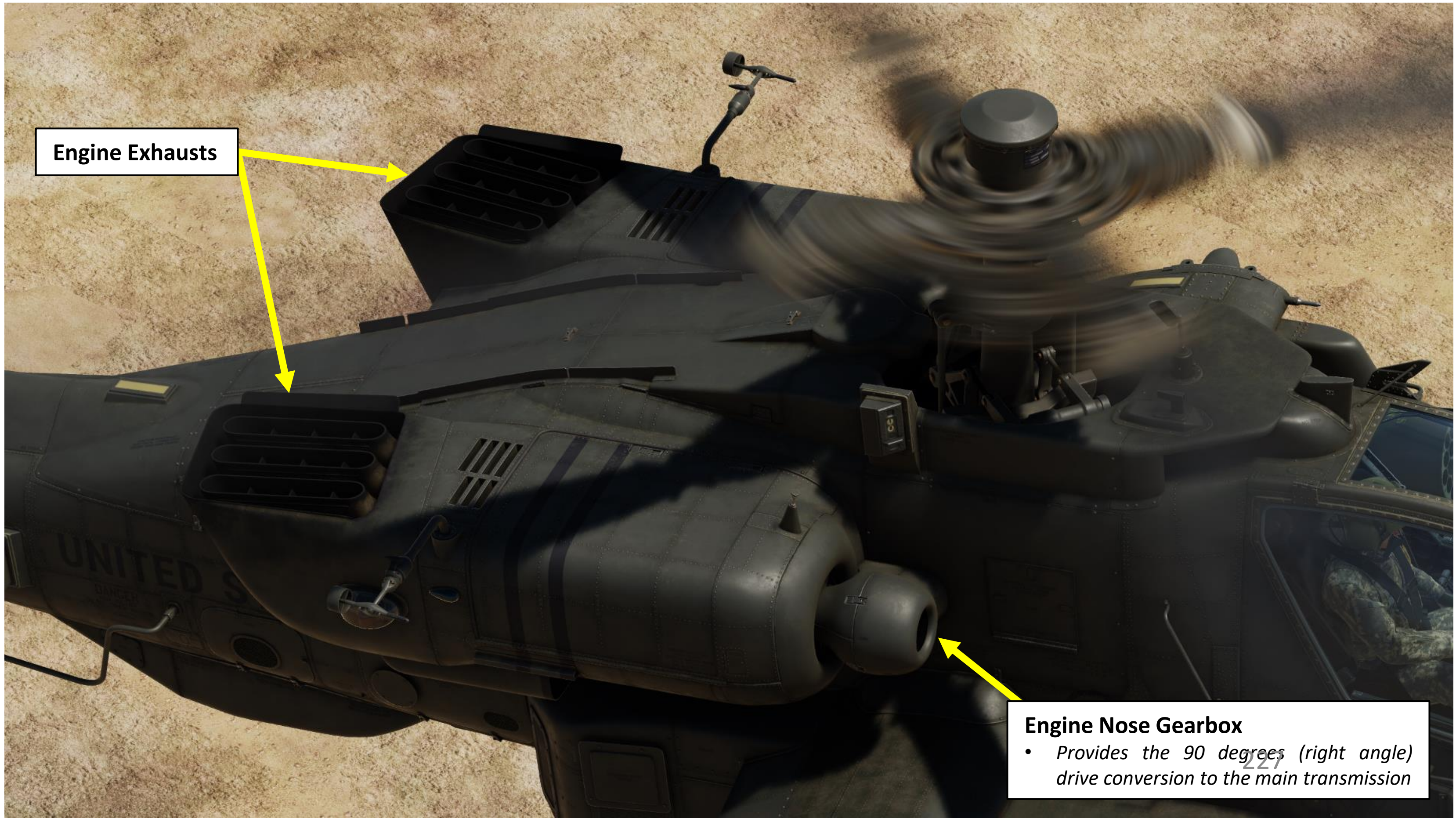
During normal operation, the **HMU**:
- controls fuel flow to the combustor according to the PAS and LDS.
- schedules the inlet guide vanes, controls the anti-ice and start bleed valve
- regulates discharge air pressure and NG (Gas Generator Speed).
- includes a mechanical (fly-weights) NG overspeed protection system that will flame out the engine to prevent an engine overspeed.

During normal operation, the **DEC**:
- coordinates automatic torque load-sharing between the two engines
- monitors NP (Power Turbine Speed), and limits turbine gas temperature (TGT)
- Includes an electrical NP overspeed protection (like the HMU's mechanical NG overspeed protection)

The DEC is normally powered by the engine's alternator but can use aircraft power as a backup. The DEC for each engine can be disabled by placing the engine's power lever into the "lock-out" position momentarily.

The DEC has a contingency power feature that automatically activates during single-engine operations. If an engine fails, the DEC of the opposite engine increases the TGT limiter of the remaining engine automatically.

During high-torque manoeuvers (e.g., left pedal turns with no change in collective position), the DEC's maximum torque rate attenuator (MTRA) will automatically reduce fuel flow to assist in preventing an over-torque when the torque exceeds 100% and the pilot has made no adjustments to the collective (also called an 'uncompensated' maneuver.

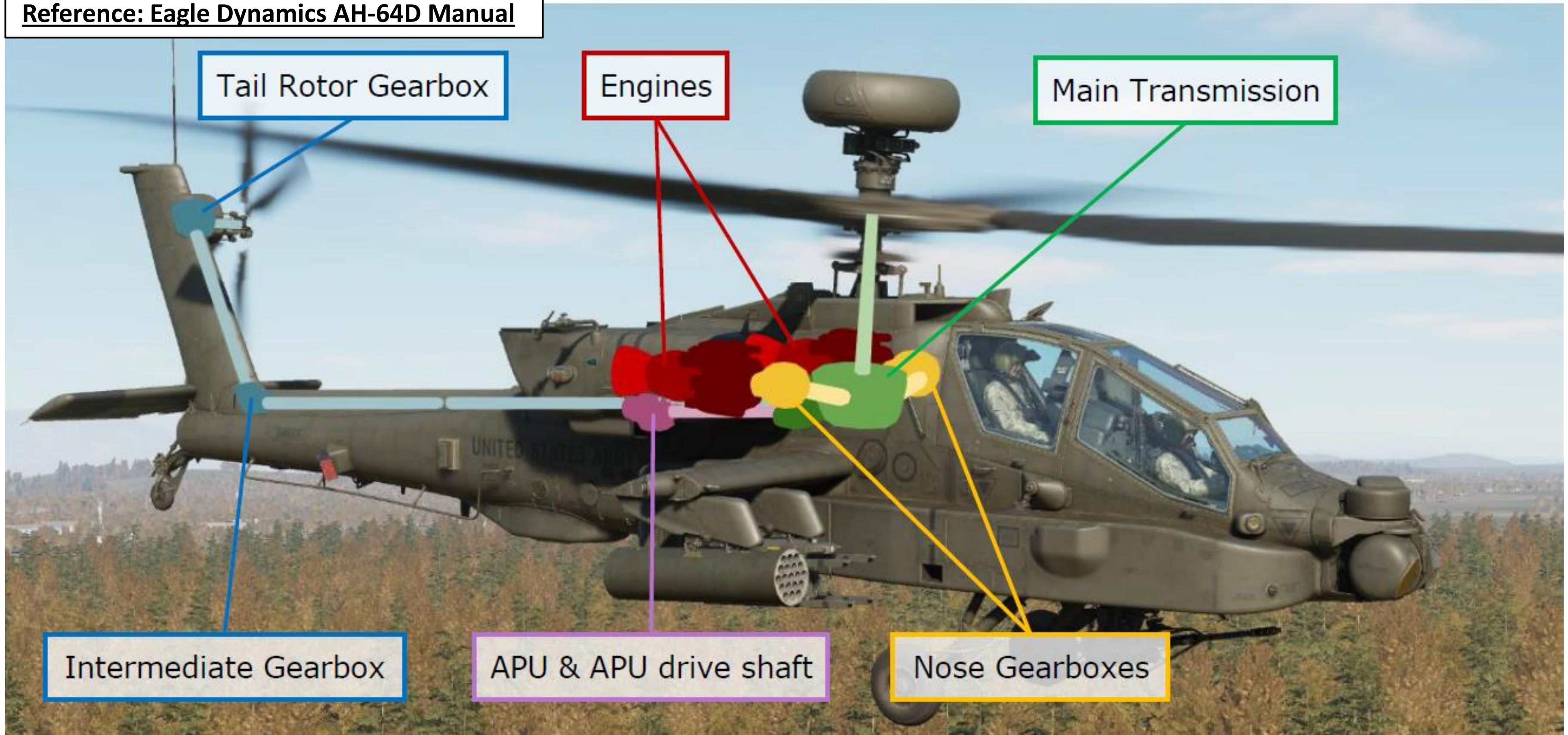


1 – Powerplant
1.1 – General Electric T700-GE-701C Engines

An **accessory gearbox (AGB)** is mounted to the aft side of the main transmission. This gearbox provides mechanical power to the aircraft's two electrical AC generators and two hydraulic pumps, one for the Primary hydraulic system and the other for the Utility hydraulic system. This prevents the loss of generator and hydraulic power during an autorotation when both engines have failed. The **APU (Auxiliary Power Unit)** powers the transmission's accessory gearbox via the APU drive shaft, which provides full electrical power to the aircraft avionics and hydraulic power to the flight controls prior to starting the main engines. The accessory gearbox also includes the rotor brake and the NR (Main Rotor Speed) sensor.

The tail rotor drive system consists of the tail rotor drive shaft, intermediate gearbox, and tail rotor gearbox. The **tail rotor drive shaft (TGB, Tail Rotor Gearbox)** consists of four sections within the tail boom. The sections are connected with flexible couplings and mounted with hanger bearings to accommodate aerodynamic and manoeuvering loads from the tail boom. The **intermediate gearbox (IGB)** is at the base of the vertical stabilizer, and the tail rotor gearbox is at the base of the tail rotor static mast. Both gearboxes reduce the transmission RPM and change the angle of the drive. The main and tail rotor drive shafts are designed to carry torque loads only. Each of these shafts pass through and rotate within a static mast. The main rotor static mast carries all vertical and bending loads, and the tail rotor static mast absorbs all tail rotor loads. This allows the aircraft to perform aggressive or aerobatic manoeuvers while minimizing stresses to the drive train system.

Reference: Eagle Dynamics AH-64D Manual



1 – Powerplant
1.2 – Engine Controls

The **collective** is mechanically connected to the Load Demand Spindle (LDS) and directly controls rotor blade pitch.

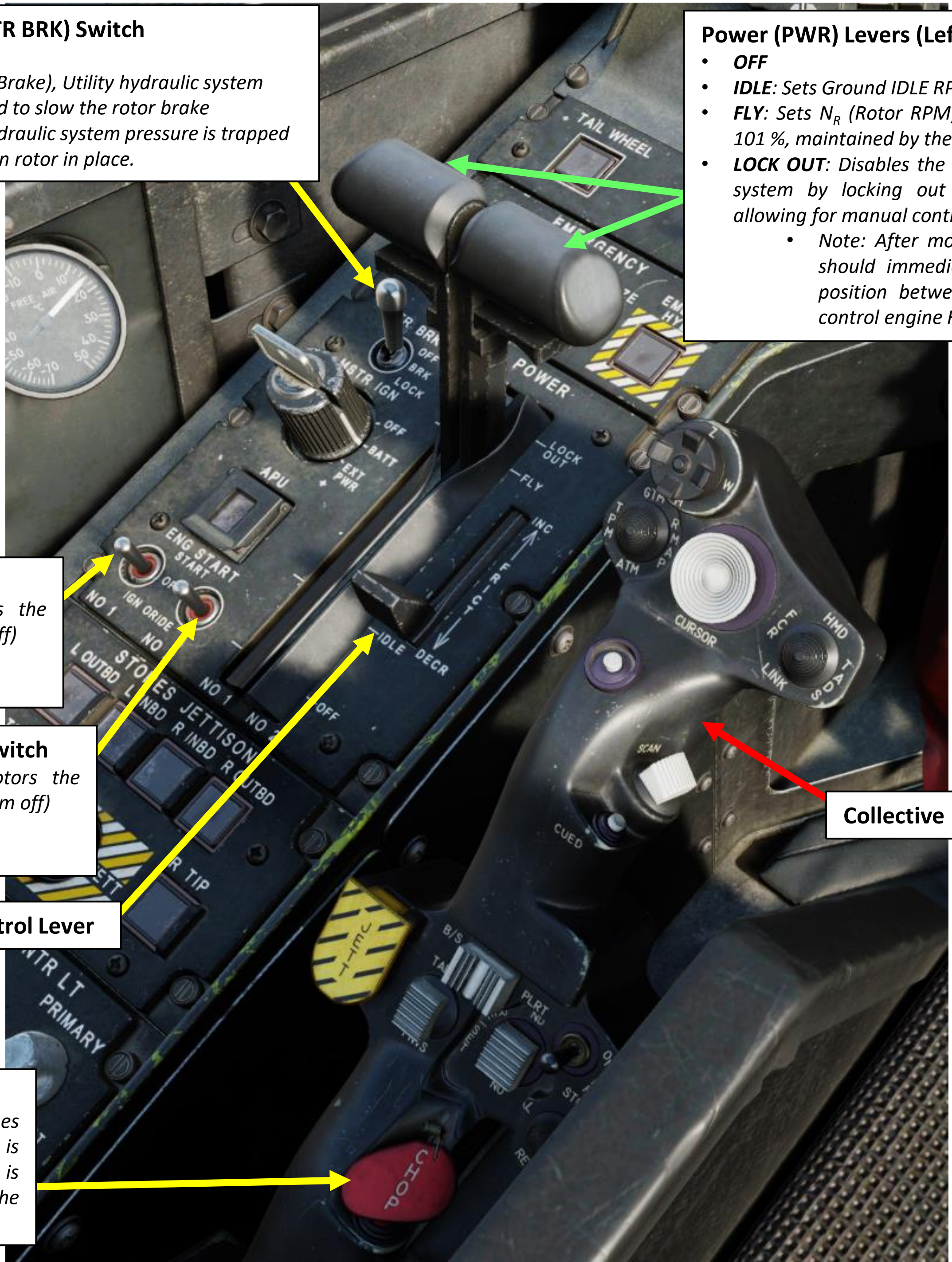
The **Power (PWR) Levers**' position is mechanically transmitted to the HMU (Hydromechanical Unit) via a Power Available Spindle (PAS).

The fuel flow to the engine, as mentioned earlier, is controlled by the Load Demand Spindle and Power Available Spindle. The DEC (Digital Electronic Control) and HMU (Hydromechanical Unit) both work together to manage engine parameters based on the LDS and PAS.

The **rotor brake** is used to slow down the main rotor (when main rotor Nr is below 50%) until it stops moving once the engines have been shut down. Engaging the rotor brake when Nr is above 50% can cause damage to the system.

Rotor Brake (RTR BRK) Switch
- *FWD: OFF*
- *MIDDLE: BRK (Brake), Utility hydraulic system pressure is used to slow the rotor brake*
- *AFT: Utility hydraulic system pressure is trapped to lock the main rotor in place.*

Power (PWR) Levers (Left/Right Engines)
- ***OFF***
- ***IDLE**: Sets Ground IDLE RPM*
- ***FLY**: Sets N_R (Rotor RPM) for flight operations. Controlled N_R is 101 %, maintained by the PAS (Power Available Spindle)*
- ***LOCK OUT**: Disables the turbine gas temperature (TGT) limiting system by locking out the DEC (Digital Engine Computer), allowing for manual control of engine RPM.*
    - *Note: After moving the power lever to LOCK OUT, it should immediately be returned to an intermediate position between IDLE and FLY. The pilot can then control engine RPM directly using the power lever.*



Left (No. 1) Engine Start Switch
- *AFT: Ignition Override (Motors the engine with the ignition system off)*
- *MIDDLE: OFF*
- *FWD: Start*

Right (No. 2) Engine Start Switch
- *AFT: Ignition Override (Motors the engine with the ignition system off)*
- *MIDDLE: OFF*
- *FWD: Start*

Power Lever Friction Control Lever

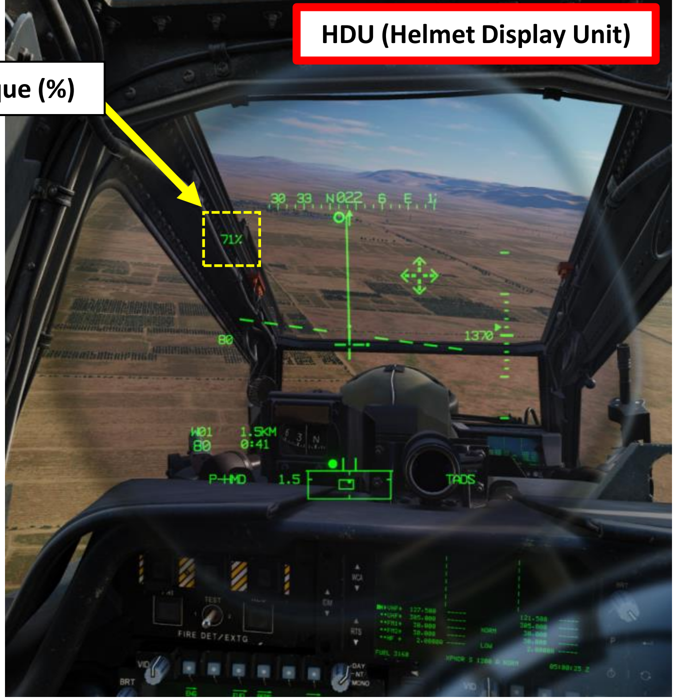
Collective

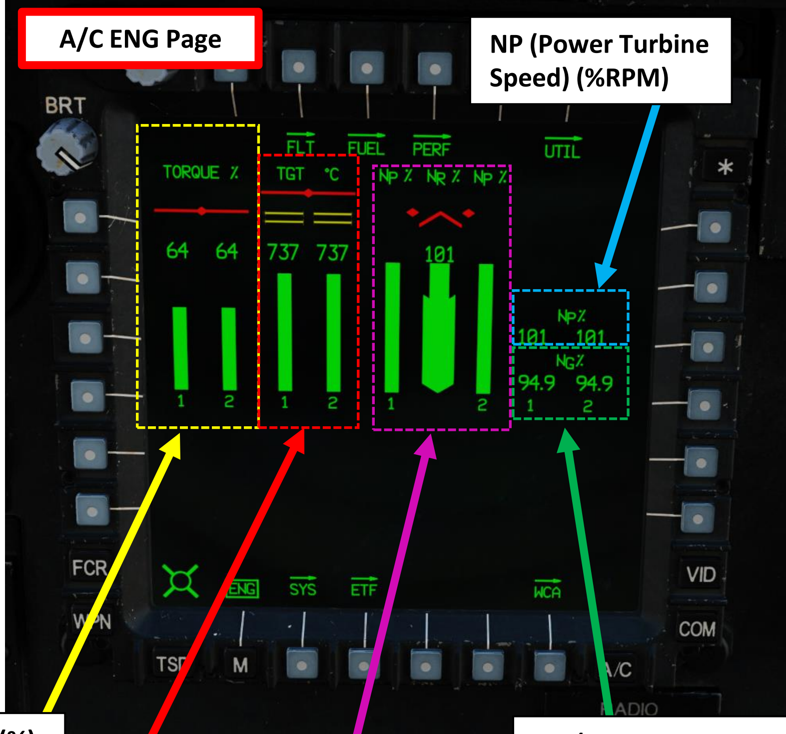
Engine Chop Button
- *Pressing this button electronically retards the engines to IDLE. Immediate reduction of the collective is required to maintain rotor RPM. If the chop button is used, say as a result of a loss of tail rotor thrust, the power levers MUST be retarded to idle.*

1 – Powerplant
1.3 – Engine Indications

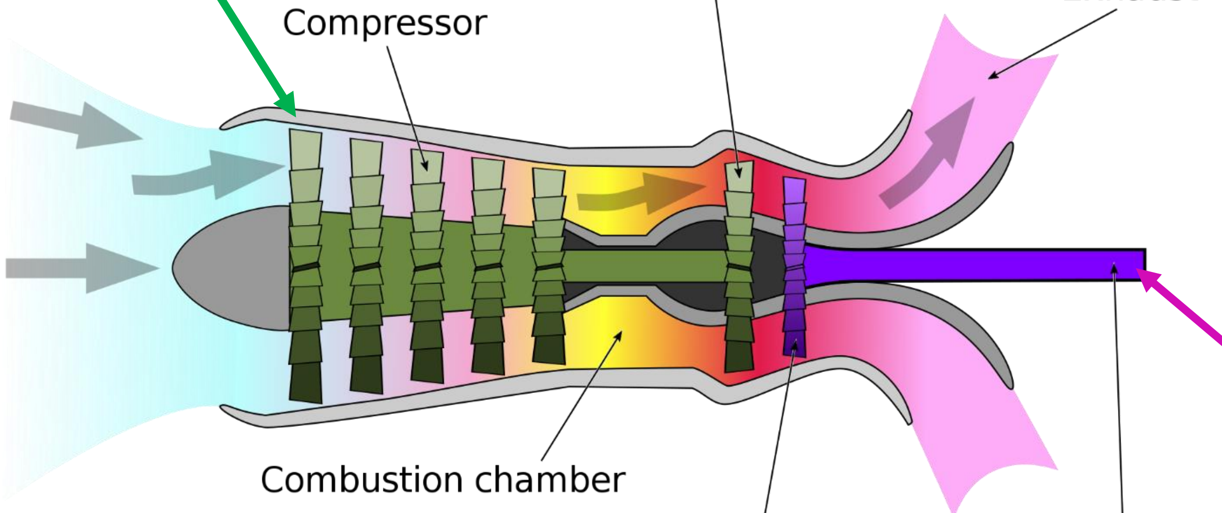
Keep an eye on the following engine parameters ("1" is for left engine, "2" is for right engine):

- **NG** (Gas Generator Speed) – used to monitor health and power setting of the engine.
- **NP** (Power Turbine Speed) / **NR** (Main Rotor Speed) – used to monitor rotor overspeed or underspeed.
- **Torquemeter** – used to define reference power settings for different phases of flight.
- **TGT** (Turbine Gas Temperature) – must be monitored to prevent engine overheat.





NG (Gas Generator / Compressor Rotation Speed in %RPM)



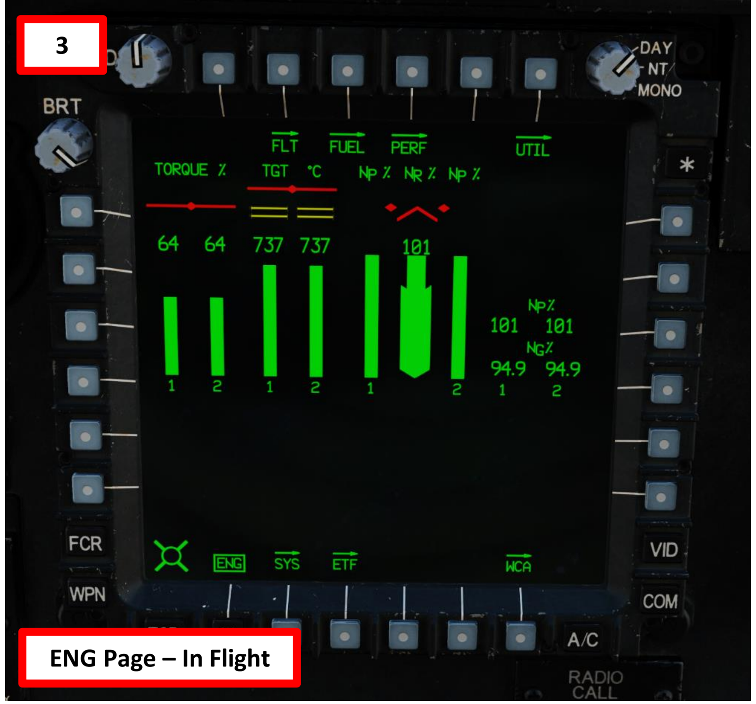
NP (Power Turbine Speed in %RPM)

Incidentally, since the Power Turbine drives the Main Rotor shaft, in normal operation NP is equal to the Main Rotor Speed (**NR**, in %RPM)

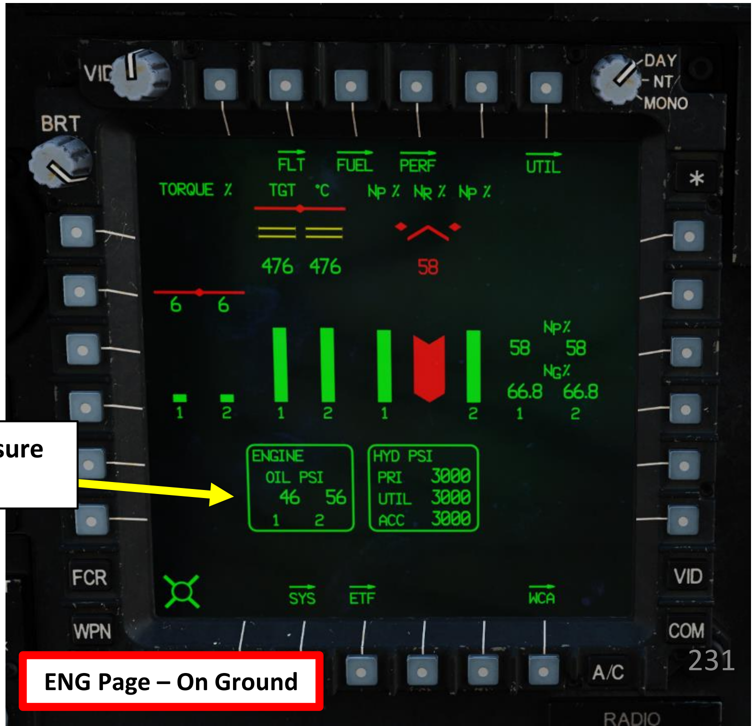
1 – Powerplant
1.3 – Engine Indications

To monitor engine parameters, press A/C FAB (Fixed Action Button), which displays the FLT (Flight) page when in the air or the ENG (Engine) page when on the ground. To consult the ENG page while in the air, simply press the A/C, then press the upper VAB (Variable Action Button) next to “ENG”.

The ENG page format will display additional engine parameters when on ground (“1” is for left engine, “2” is for right engine), such as Engine Oil Pressure and Hydraulic Pressure.

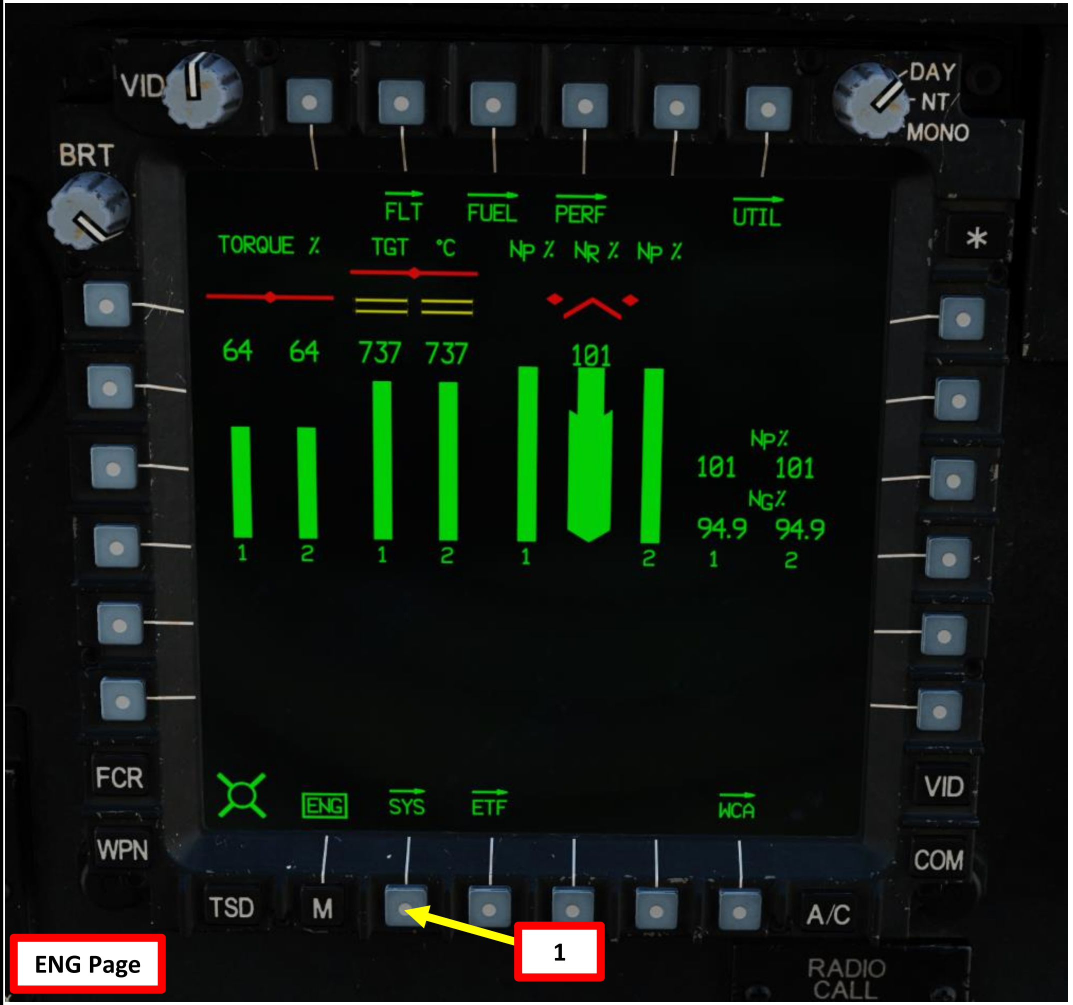


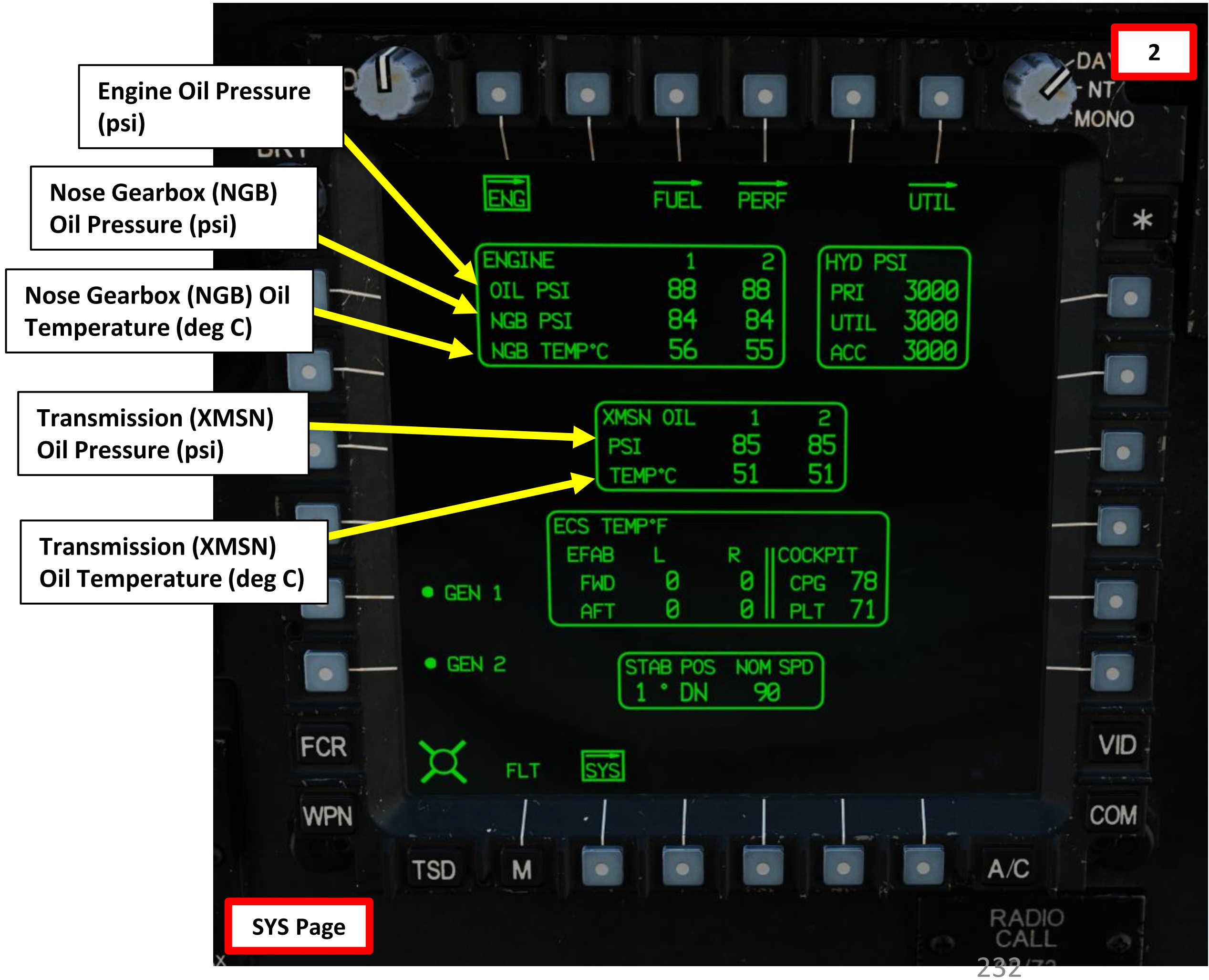
Engine Oil Pressure (psi)



1 – Powerplant
1.3 – Engine Indications

Additional engine parameters are visible from the SYS (System) page. From the ENG page, press bottom VAB (Variable Action Button) next to “SYS”.





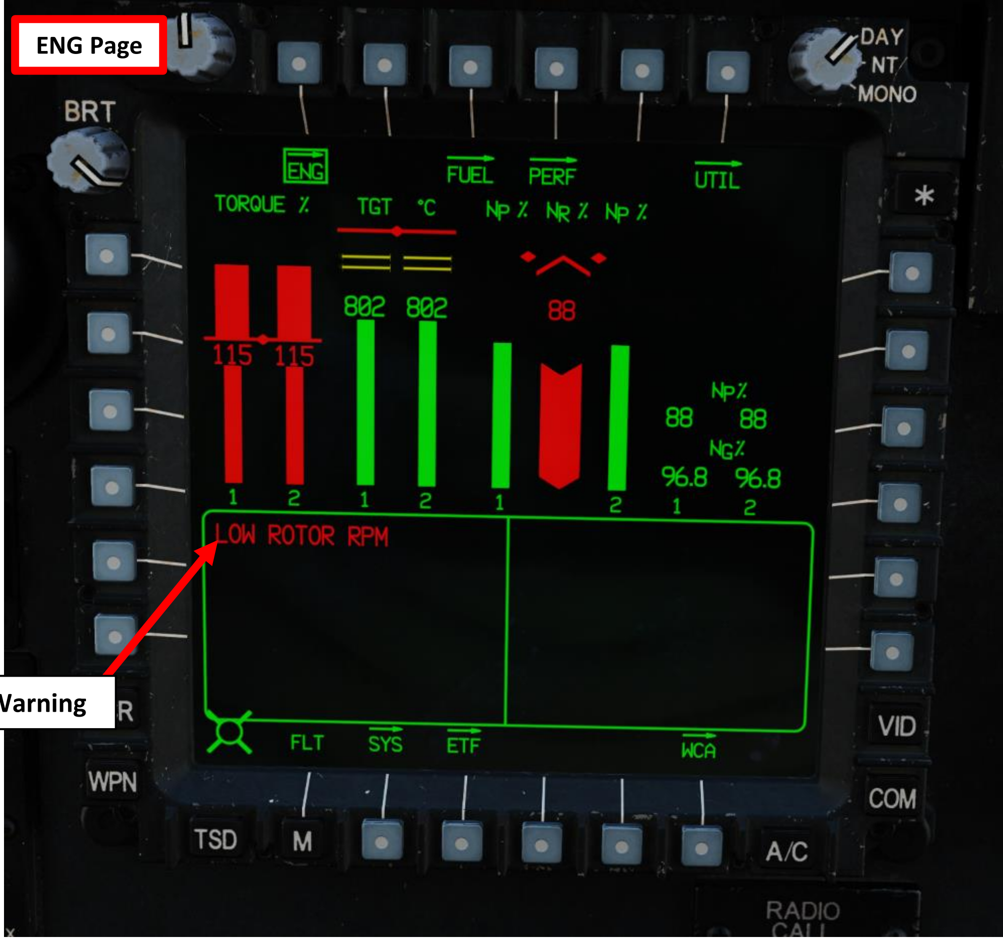
1 – Powerplant
1.4 – Engine Operation Limits

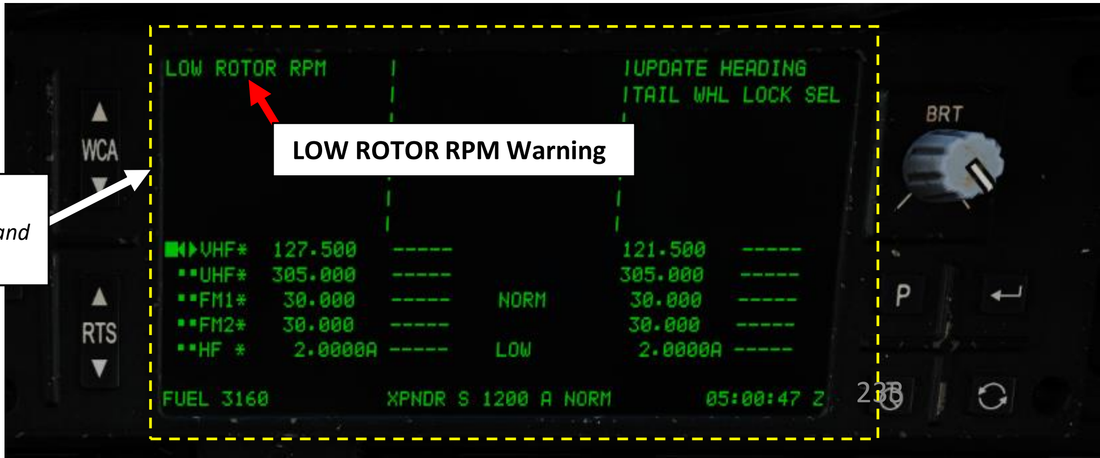
Torque:
- 2.5-Minute Single-Engine Contingency Range if NR >90%: 111 to 122% **(yellow)**
- 6-Second Dual-engine Transient Operating Range if NR >90%: 101 to 115% **(yellow)**
- 6-Second Single-engine Transient Operating Range if NR >90%: 123 to 125% **(yellow)**
- Red maximum limit is dynamic **(red)**
    - If NR is <50%, TQ redline is 30%.
    - If NR is <90%, TQ redline is 70%.
    - If NR is >90% in AEO (All Engines Operating) conditions, TQ redline is 115%
    - If NR is >90% in OEI (One Engine Operating) conditions, TQ redline is 125%

NP (Power Turbine Speed):
- Intermediate Operating Range **(yellow)**: 106 to 121 %
- Overspeed **(red)**: At or above 121 %

NG (Gas Generator Speed):
- Intermediate Operating Range **(yellow)**: 102.3 to 105.1 %
- Underspeed **(red)**: At or below 63.1 %
- Overspeed **(red)**: At or above 105.1 %

NR (Main Rotor Speed):
- Intermediate Operating Range **(yellow)**: 106 to 111 %
- Underspeed **(red)**: At or below 95 %, displays LOW ROTOR RPM Warning
- Overspeed **(red)**: At or above 110 %, displays HIGH ROTOR RPM Warning



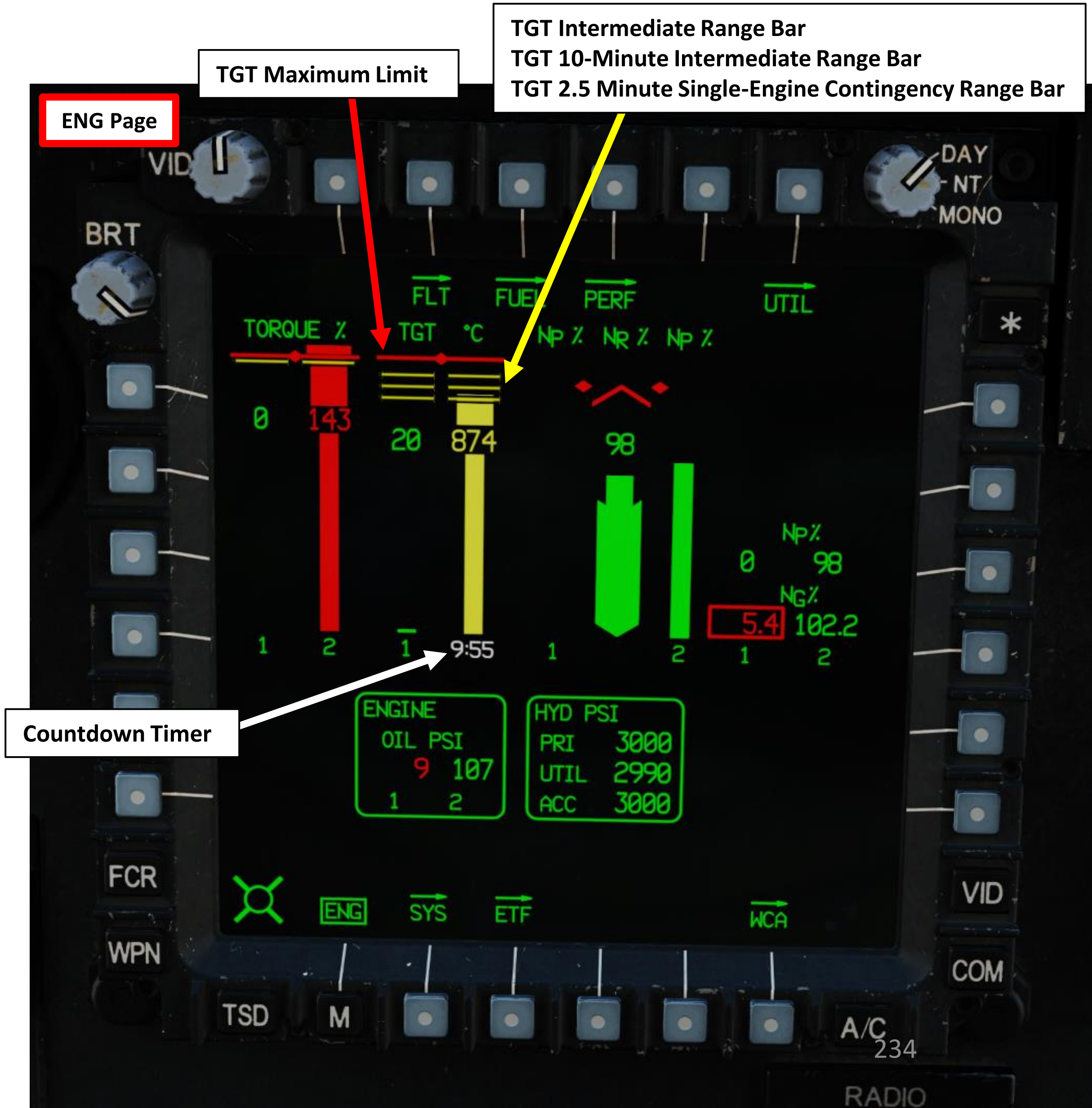


EUFD (Enhanced Up-Front Display)
- *Provides up-front control of radios and communications equipment and display of warning/caution/advisory (WCA) messages.*

1 – Powerplant
1.4 – Engine Operation Limits

TGT (Turbine Gas Temperature):

- TGT Limiter (AOE, All Engines Operating): 867 deg C
- TGT Limiter (OEI, One Engine Operating): 896 deg C
- If either engine's TQ indicates <51%, the other engine's TGT limiter is increased to 896 °C, allowing the healthy engine to operate in a single-engine contingency mode.
- Intermediate Operating Range **(yellow)**: 811 to 870 deg C
- 10-Minute Intermediate Operating Range **(yellow)**: 871 to 878 deg C
- 2.5-Minute Single-Engine Contingency Range **(yellow)**: 879 to 896 deg C
- 12-Second Transient Range: 897 to 949 deg C
- Maximum limit **(red)**: 949 deg C



1 – Powerplant
1.4 – Engine Operation Limits

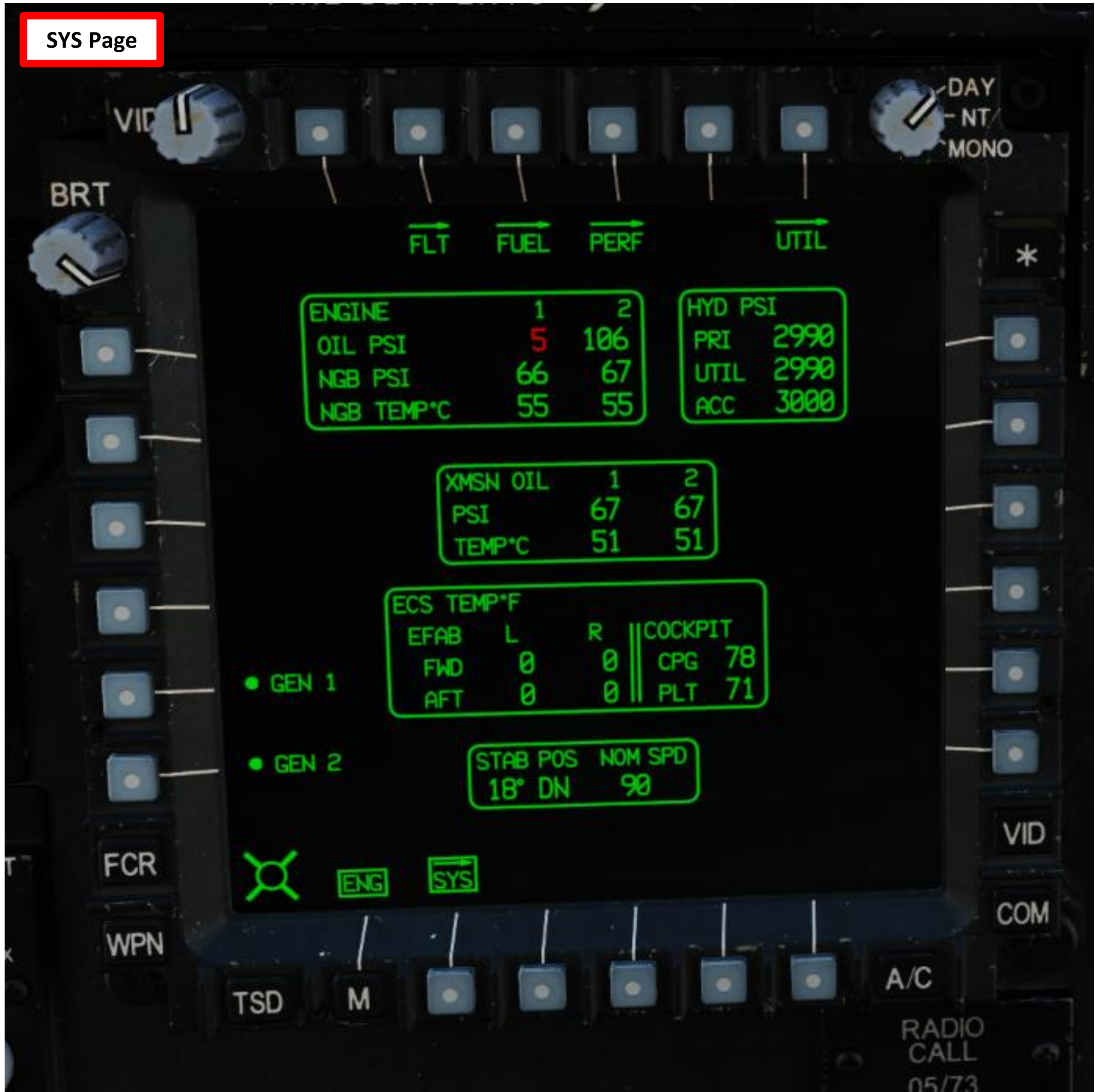
Engine Oil Pressure:
- Maximum allowable: 120 psi **(red)**
- Minimum allowable: 23 psi **(red)**

Nose Gearbox (NGB) Oil Pressure:
- Minimum allowable: 30 psi **(red)**

Nose Gearbox (NGB) Oil Temperature:
- Maximum allowable: 134 deg C **(red)**

Transmission (XMSN) Oil Pressure:
- Minimum allowable: 30 psi **(red)**

Transmission (XMSN) Oil Temperature):
- Maximum allowable: 134 deg C **(red)**



2 – APU (Auxiliary Power Unit)

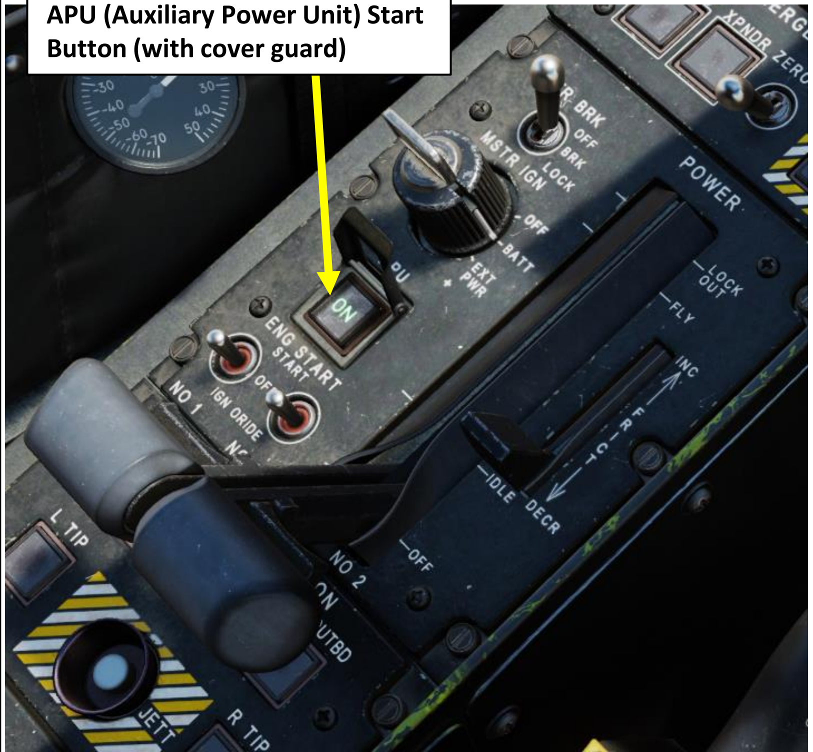
The APU (Auxiliary Power Unit) is a self-contained turbine engine that can power the accessory section of the main transmission to generate electric and hydraulic power, as well as pressurized air, without the need for engine power. The APU is primarily used to start the engines without requiring external ground power sources but can be used as an auxiliary source of electric or hydraulic power. The APU is started or stopped by pressing the **APU Start Button** on the engine control panel.

The APU draws fuel from the aft fuel cell only and consumes approximately 175 pounds per hour when active. The APU is automatically monitored by an Electronic Control Unit (ECU), which detects overspeed and overcurrent anomalies, as well as abnormal oil pressure. The ECU will automatically shut down the APU when an anomaly is detected. The ECU also controls the power takeoff (PTO) clutch engagement to the accessory section of the main transmission.

APU POWER ON Indication
- APU ECU (Electronic Control Unit) has power and APU is not yet ON, meaning that APU RPM has not reached above 95%.

APU START Indication
- APU start sequence is active

APU ON Indication
- APU is running with a RPM above 95 %

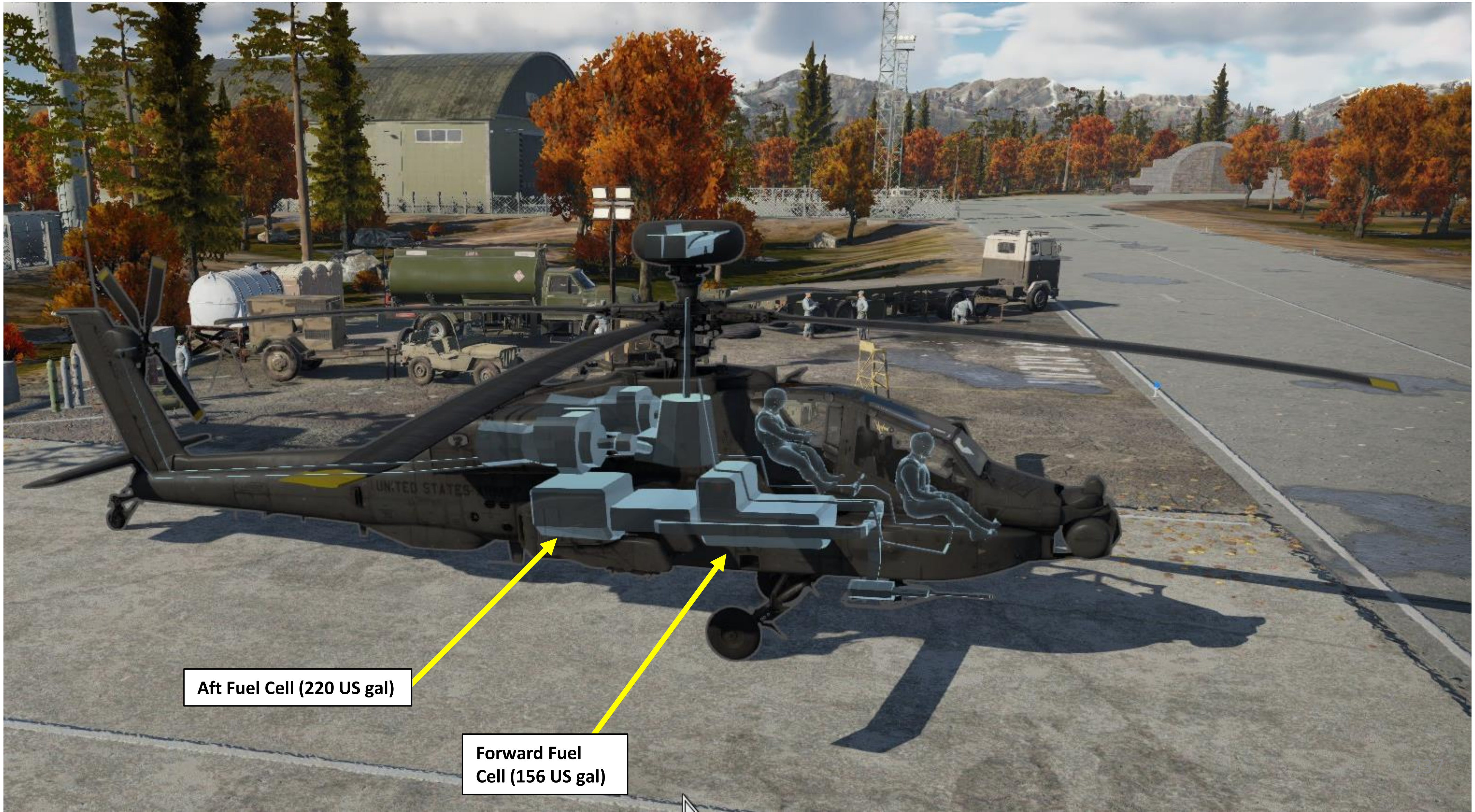


APU (Auxiliary Power Unit) Start Button (with cover guard)

APU (Auxiliary Power Unit) Exhaust

3 – Fuel System
3.1 – Fuel System Overview

The AH-64D includes two internal self-sealing, crash-resistant fuel cells. The forward fuel cell holds up to 156 gallons, and the aft fuel cell holds up to 220 gallons. Fuel is normally balanced between the two cells automatically.



3 – Fuel System

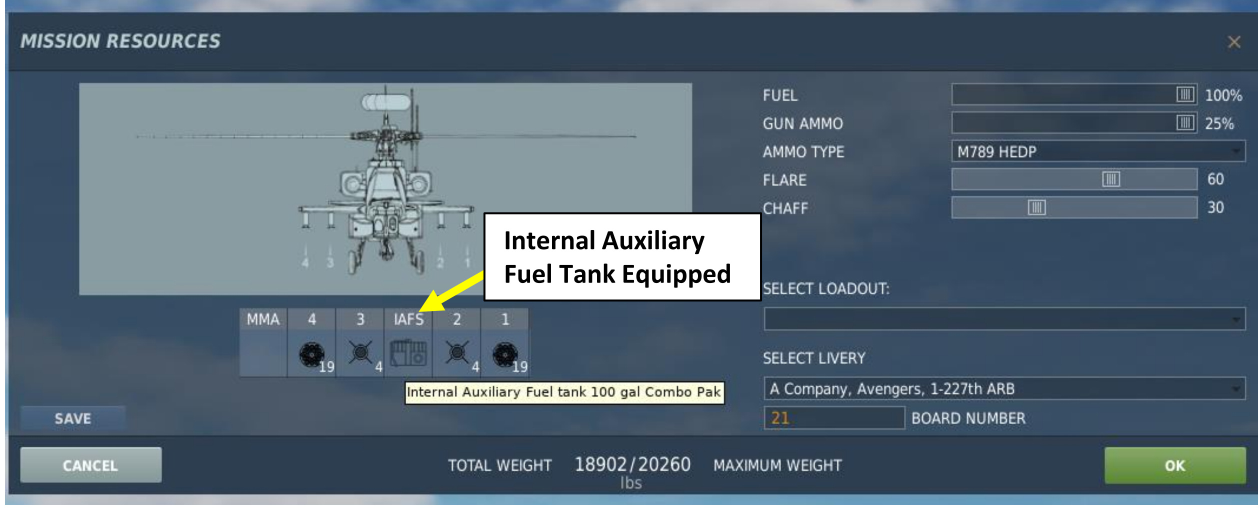
3.1 – Fuel System Overview

A 230-gallon external fuel tank can be mounted on each of the four stub wing pylons. The external fuel tank mounted under the left inboard pylon feeds the forward fuel cell, and external fuel tank mounted under the right inboard pylon feeds the aft fuel cell. If an additional two fuel tanks are mounted under the outboard pylons, the outboard external fuel tanks feed fuel to the inboard-mounted external fuel tanks.

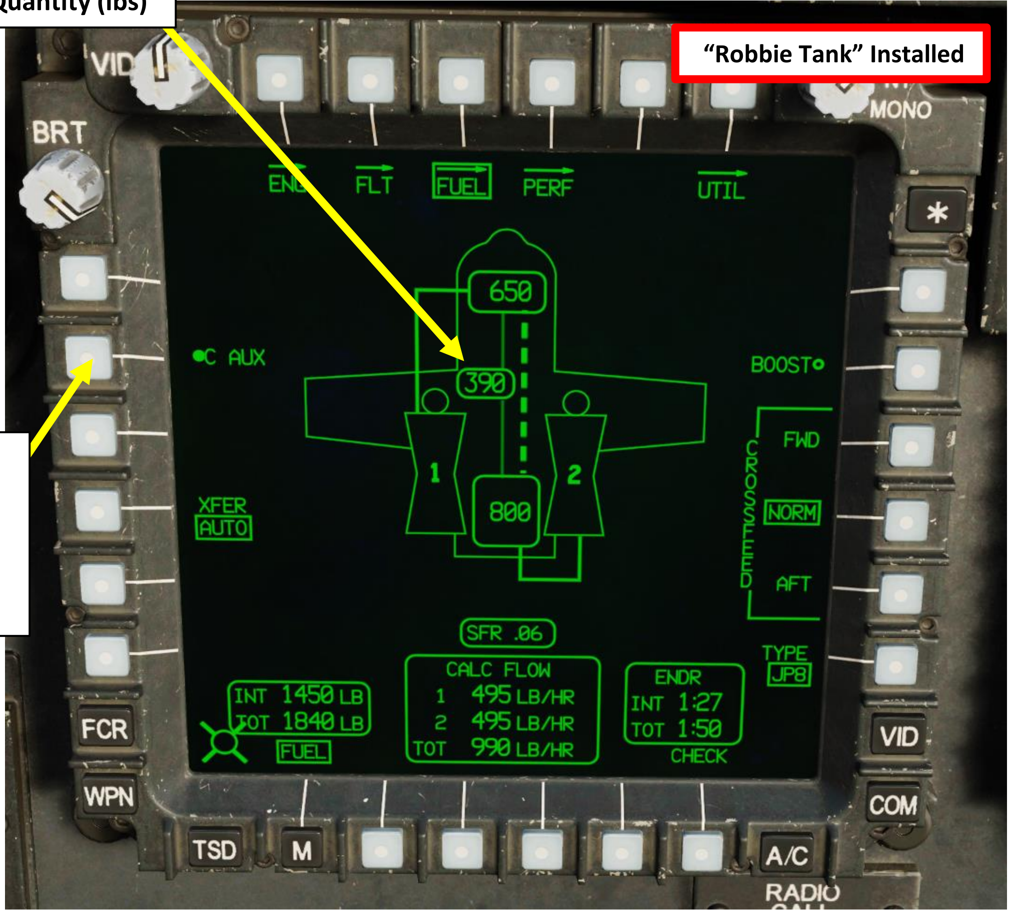
3 – Fuel System
3.1 – Fuel System Overview

An **Internal Auxiliary Fuel System (IAFS)** can be installed into the ammunition bay, storing 98 gallons at the expense of reducing the 1200 round ammunition capacity to 300 rounds.

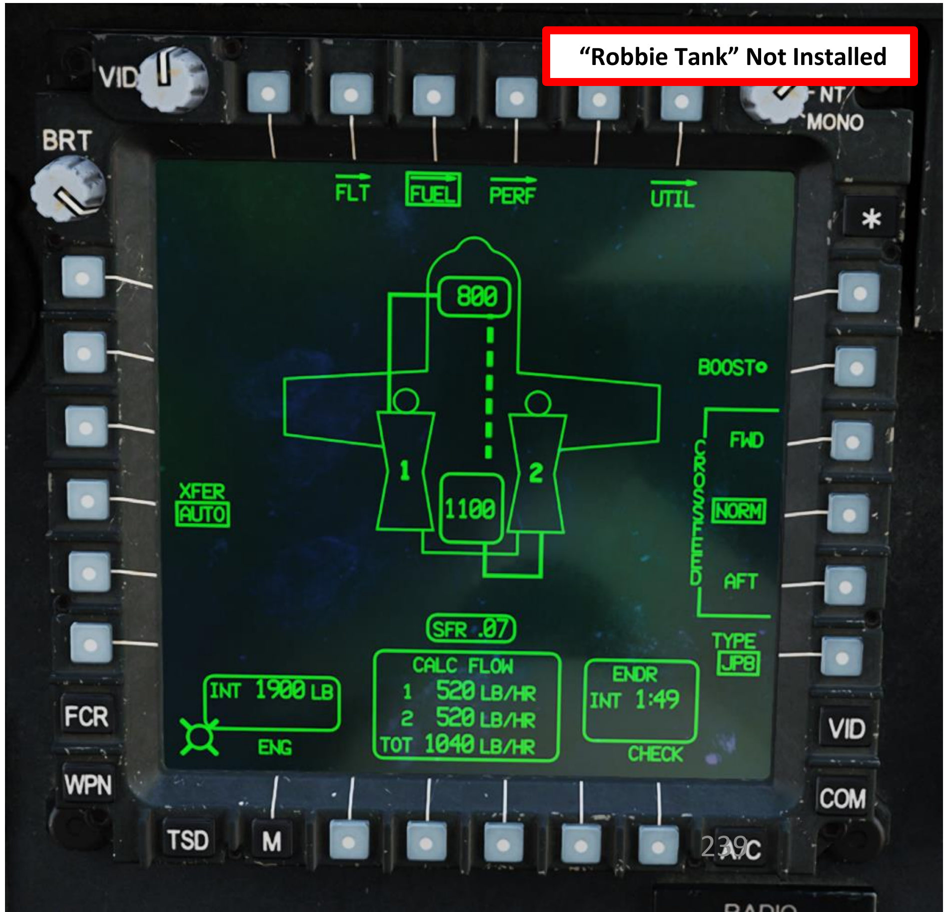
In most missions in DCS, the internal auxiliary fuel tank (also nicknamed "Robbie Tank", referring to "Robertson Fuel Systems", the company that manufactures the fuel tank) is installed by default. It can be removed in the Ground Crew Menu.



Auxiliary Fuel Tank ("Robbie Tank") Quantity (lbs)

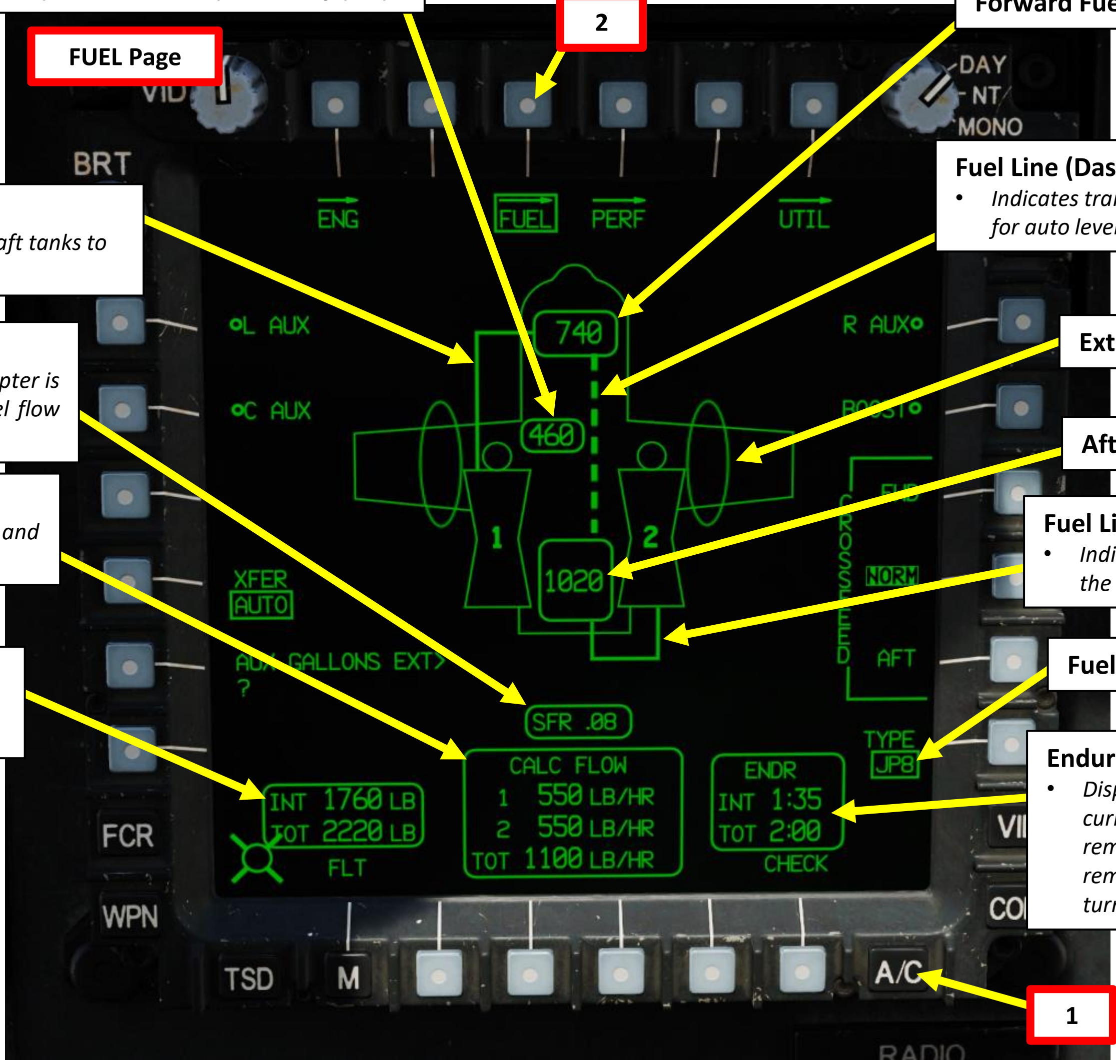


Center Auxiliary Tank (IAFS, Internal Auxiliary Fuel System) Control
- Solid Circle, fuel transfer ON: transfers center auxiliary tank fuel (IAFS) to the forward and aft fuel tank
- Hollow Circle, fuel transfer OFF



3 – Fuel System
3.2 – Fuel Indications

Fuel indications are displayed on the EUFD (Enhanced Up-Front Display) and A/C FUEL page.



Auxiliary Fuel Tank ("Robbie Tank") Quantity (lbs)

Forward Fuel Tank Quantity (lbs)

Fuel Line (Solid)
- *Indicates the flow of fuel from the forward and aft tanks to the #1 and #2 engines, respectively*

Fuel Line (Dashed)
- *Indicates transfer between the forward and aft fuel tanks for auto leveling*

SFR (Specific Fuel Range)
- *Displayed above the fuel flow window when the helicopter is moving. SFR is equal to ground speed divided by fuel flow and is used to determine best economy power setting.*

External Fuel Tank

Aft Fuel Tank Quantity (lbs)

Fuel Flow Calculation (lbs/hour)
- *Displays the fuel flow (in pounds per hour) to engines #1 and #2, and the total fuel flow.*

Fuel Line (Solid)
- *Indicates the flow of fuel from the forward and aft tanks to the #1 and #2 engines, respectively*

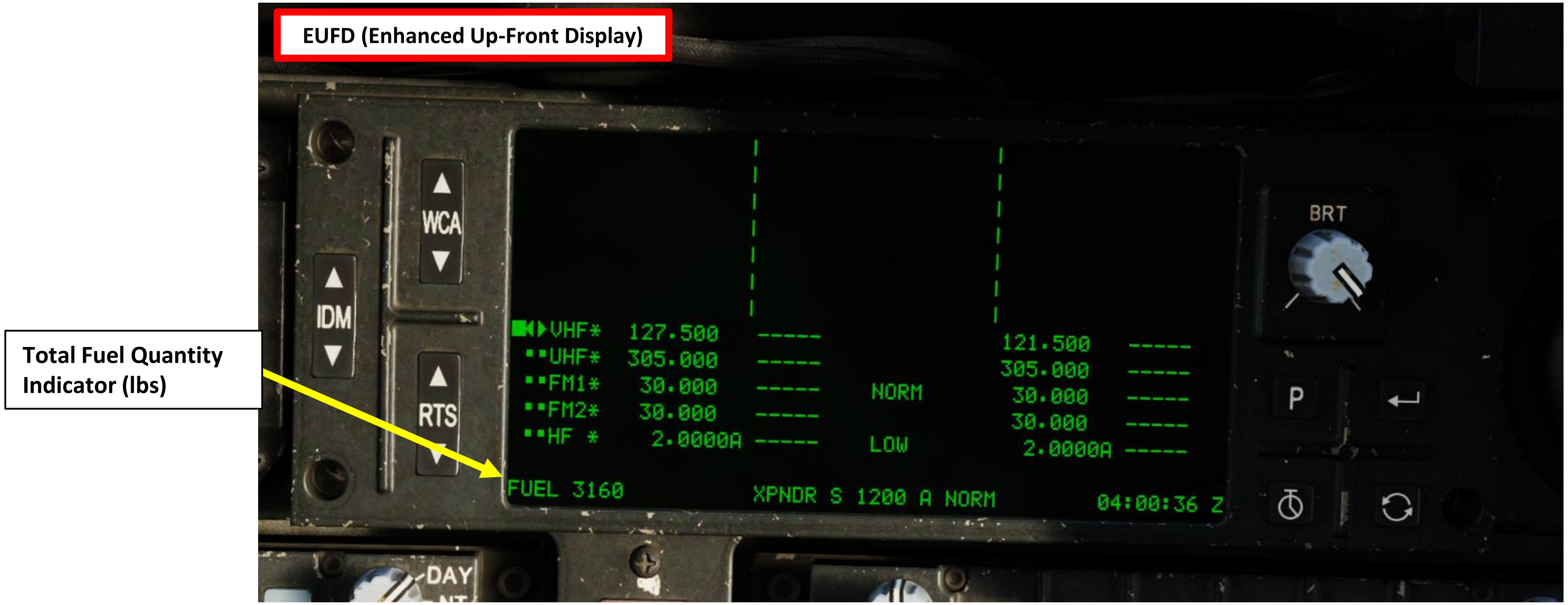
Fuel Type

Fuel Totalizer Indicator
- *INT: Internal Fuel Quantity (lbs)*
- *TOT: Total Fuel Quantity (lbs)*

Endurance (Hours:Minutes)
- *Displays the remaining time until fuel is exhausted based on current fuel flow. If external tanks are installed, displays the remaining time until internal fuel is exhausted, and the remaining time until all fuel is exhausted. Time remaining turns white when 20 minutes or fewer remain.*

3 – Fuel System
3.2 – Fuel Indications

Fuel indications are displayed on the EUFD (Enhanced Up-Front Display) and A/C FUEL page.



3 – Fuel System
3.3 – Fuel Controls

Fuel Transfer

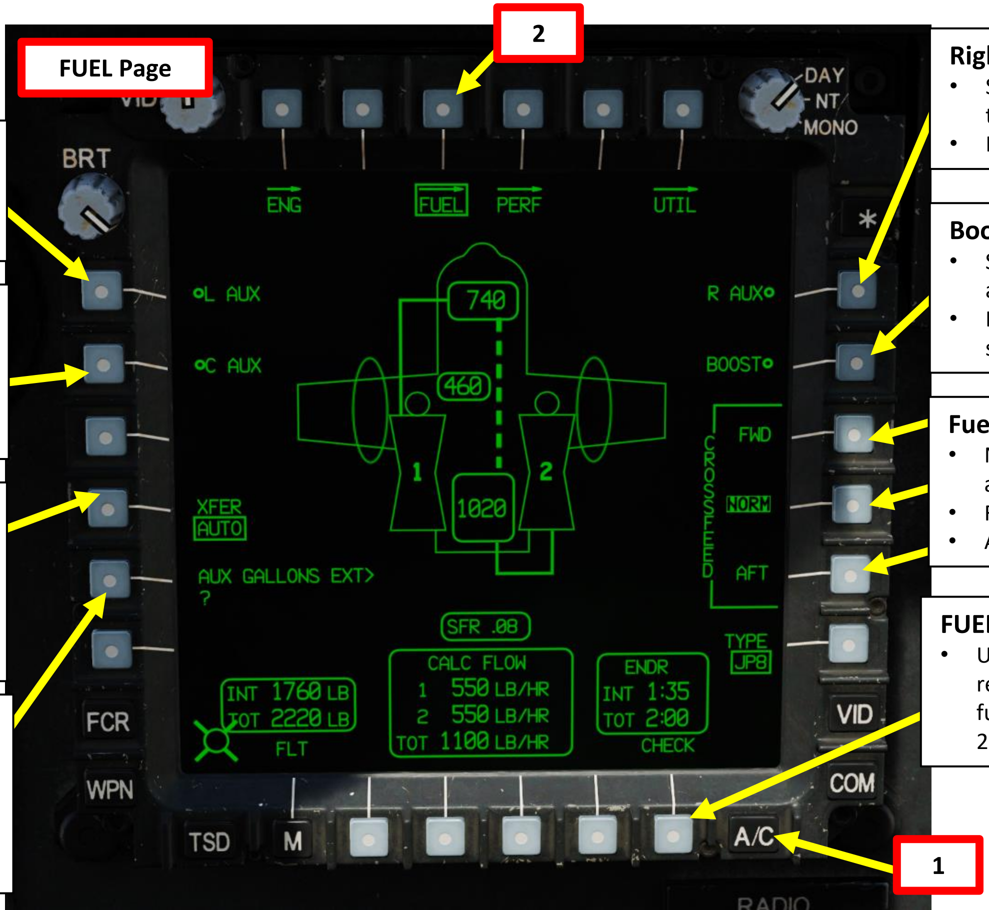
- Fuel is transferred between the forward and aft cells using IPAS (Integrated Pressurized Air System) air pressure. Transfer is normally automatic but can be manually controlled by the aircrew.
- Fuel transfer from the IAFS or external tanks is one-way only. Transfer from the external tanks to the internal cells is pneumatic, and an electric fuel pump transfers fuel from the IAFS to the internal cells. If fuel is being transferred between the forward and aft fuel cells, any fuel transfer from external or internal fuel systems will be paused.
- Normally, the forward cell feeds engine 1 and the aft cell feeds engine 2.
- The aircrew can control crossfeed modes, where both engines feed from one fuel cell, as necessary in abnormal circumstances.
- IPAS air provides power to the fuel boost pump located in the aft fuel cell. During start the crossfeed is commanded ON and the fuel boost pump is commanded ON when the crossfeed has finished rotating aft. This boost pump can also be manually turned on during an emergency or operations in extreme cold temperatures.
- The APU has its own electric boost pump that also draws from the aft cell.

Left Auxiliary Tank (External Tank) Control
- Solid Circle, fuel transfer ON: transfers left auxiliary tank fuel to the forward and aft fuel tank
- Hollow Circle, fuel transfer OFF

Center Auxiliary Tank (IAFS, Internal Auxiliary Fuel System) Control
- Solid Circle, fuel transfer ON: transfers center auxiliary tank fuel (IAFS) to the forward and aft fuel tank
- Hollow Circle, fuel transfer OFF

Fuel Transfer Selection Control
- AUTO: Fuel is automatically transferred between the tanks to maintain leveling
- FWD: Fuel is transferred from the aft tank to the forward tank.
- AFT: Fuel is transferred from the forward tank to the aft tank
- OFF: Fuel is not transferred and no auto-leveling occurs

External Auxiliary Fuel (External Tank) Input Control
- The 230-gallon external auxiliary fuel tanks lack fuel quantity sensing probes. If external auxiliary tanks are installed, the aircrew must input the amount of fuel in the external auxiliary tanks using this button.
- The internal auxiliary tank has a fuel quantity probe which provides automatic fuel quantity indication.



Right Auxiliary Tank (External Tank) Control
- Solid Circle, fuel transfer ON: transfers right auxiliary tank fuel to the forward and aft fuel tank
- Hollow Circle, fuel transfer OFF

Boost Pump Control
- Solid Circle, boost pump ON: crossfeed mode is automatically set to AFT
- Hollow Circle, boost pump OFF, mode is automatically set to NORM.

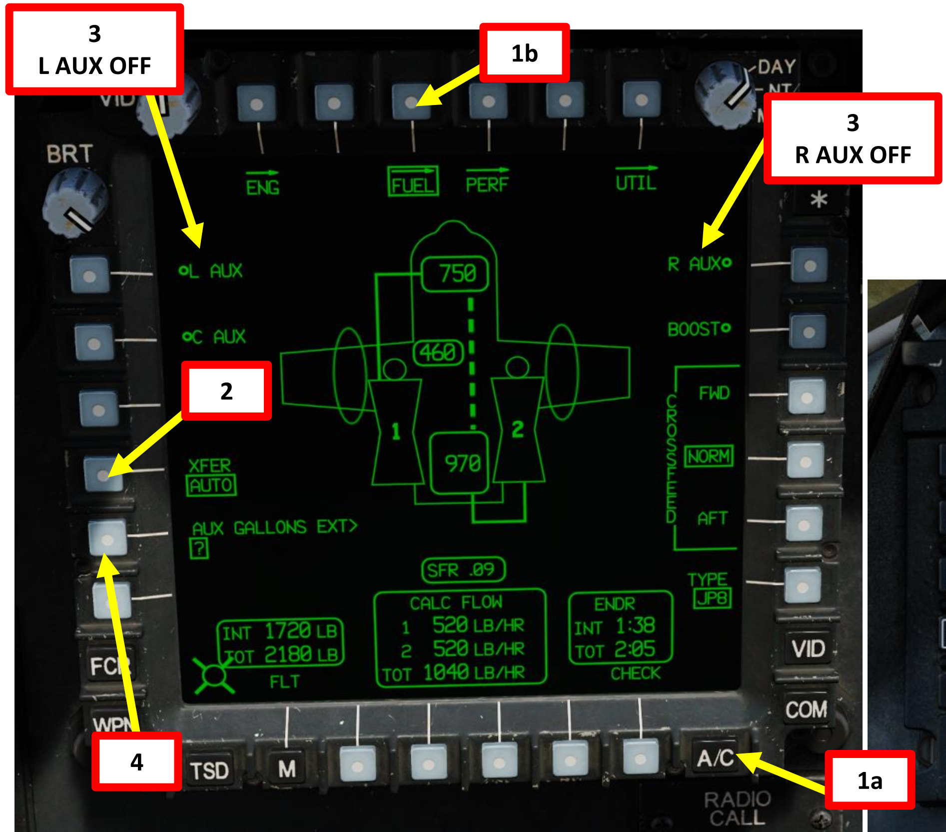
Fuel Crossfeed Selection Controls
- NORM. Engine #1 feeds from the forward tank, and engine #2 feeds from the aft tank.
- FWD. Both engines feed from the forward tank.
- AFT. Both engines feed from the aft tank.

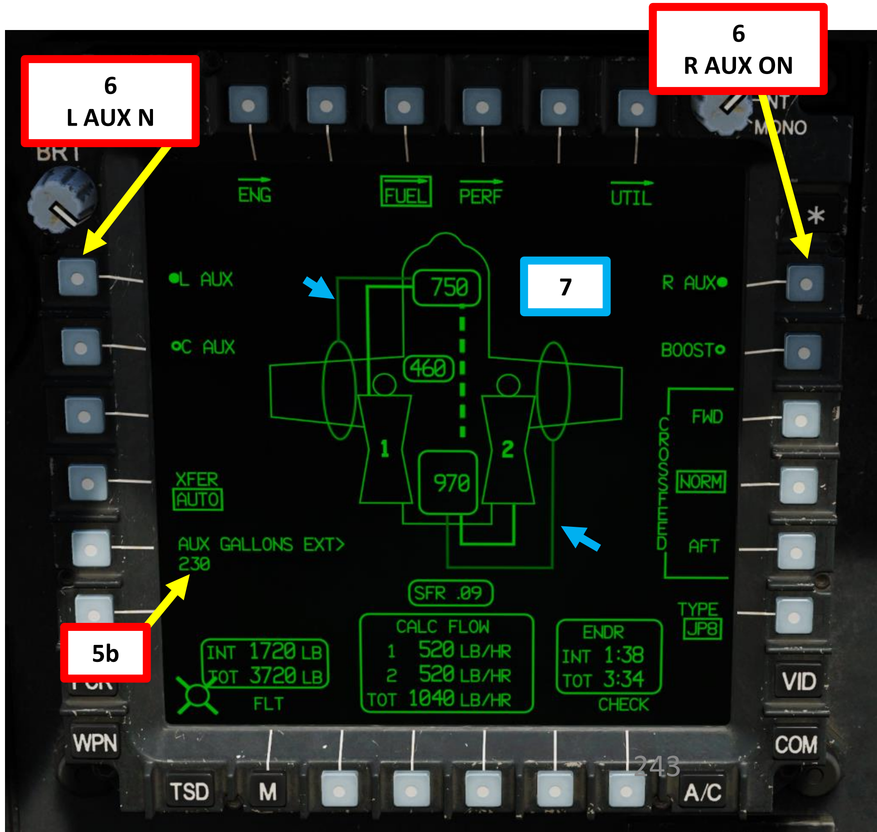
FUEL CHECK Format Selector
- Use this feature to calculate time until entering IFR reserve (30 minutes), VFR reserve (20 minutes), and fuel burnout. Pressing CHECK displays options for 15-, 20-, and 30-minute checks

3 – Fuel System
3.3 – Fuel Controls

External Fuel Tanks Operation

1. Go in the FUEL page.
2. Set XFER (Transfer) Option – AUTO. Fuel will be automatically transferred between the tanks to maintain leveling.
3. If an external auxiliary fuel tank is installed, the L/R AUX options are available. However, fuel transfer from the external auxiliary tank to the main forward and aft fuel tanks needs to be enabled for fuel transfer to take place.
4. The 230-gallon external auxiliary fuel tanks lack fuel quantity sensing probes. If external auxiliary tanks are installed, the aircrew must input the amount of fuel in the external auxiliary tanks using this button. Press the VAB (Variable Action Button) next to « AUX GALLONS EXT ? »
5. On the KU (Keyboard Unit), enter the fuel quantity of external fuel tanks (230 US Gal), then press ENTER.
6. Enable fuel transfer for the external auxiliary tank by pressing VAB (Variable Action Button) next to L AUX and R AUX.
   - Hollow circle means OFF. Solid Circle means ON.
7. A solid line will be depicted on the synoptic indicating the transfer.

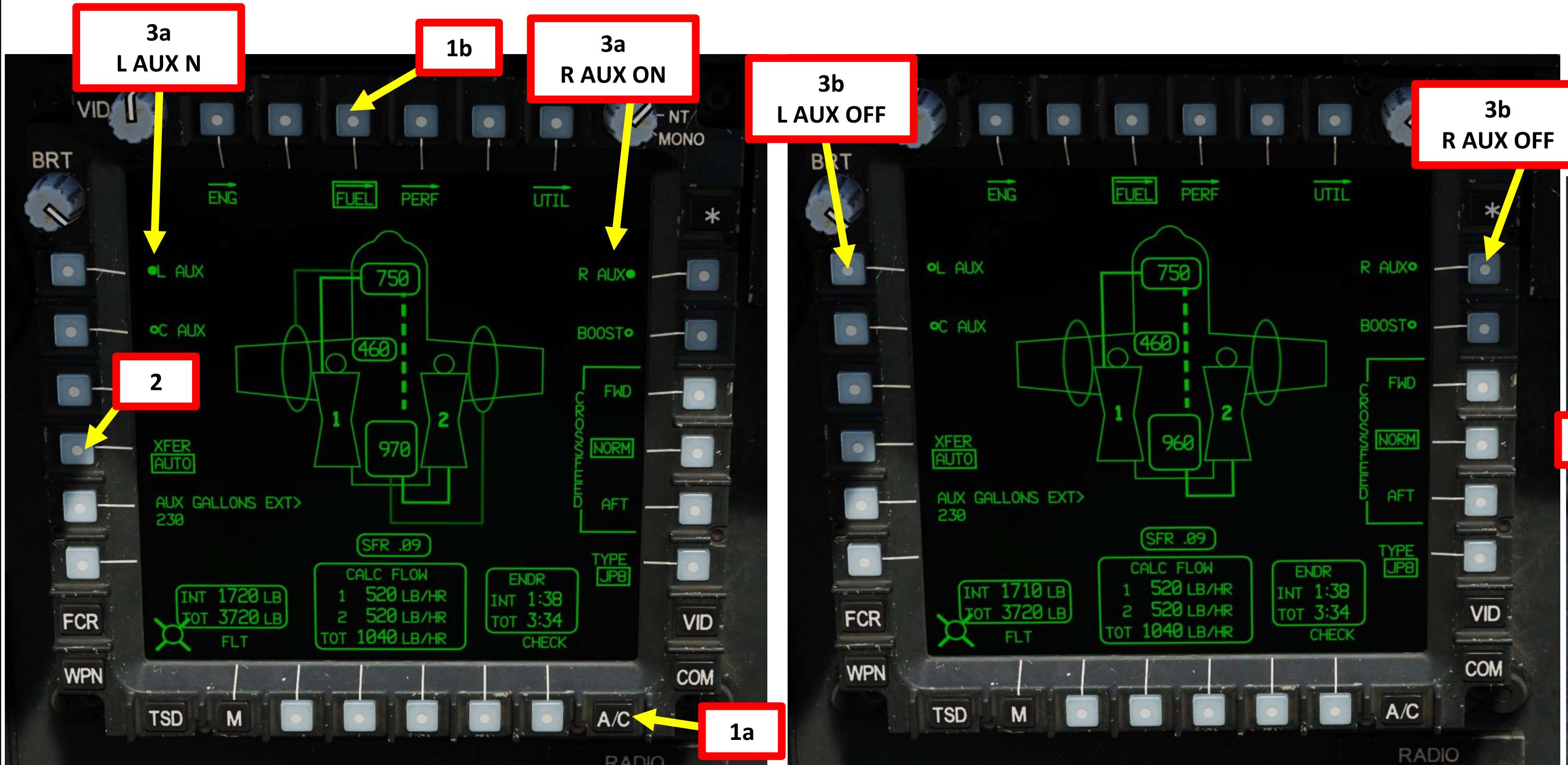


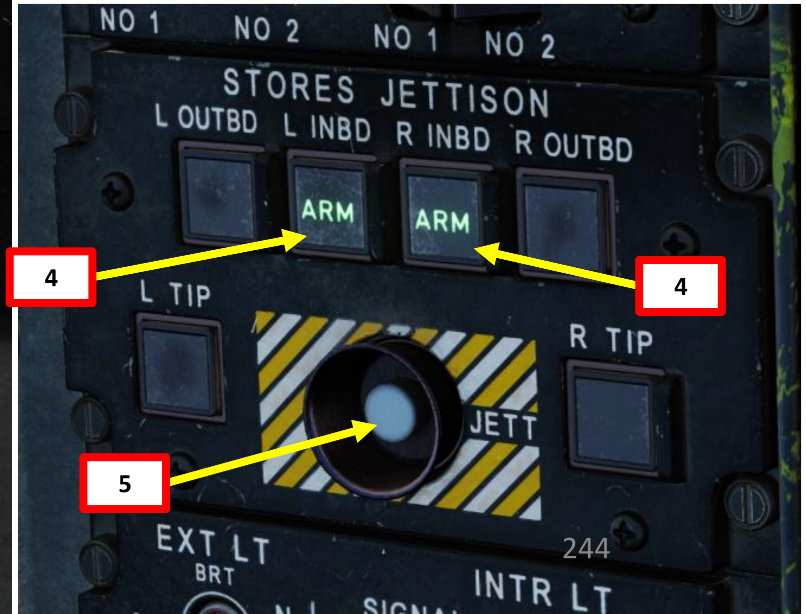


3 – Fuel System
3.3 – Fuel Controls

External Fuel Tanks Jettison

1. Go in the FUEL page.
2. Set XFER (Transfer) Option – AUTO. Fuel will be automatically transferred between the tanks to maintain leveling.
3. Disable fuel transfer for the external auxiliary tank by pressing VAB (Variable Action Button) next to L AUX and R AUX.
    - Hollow circle means OFF. Solid Circle means ON.
4. Press the desired Station Jettison Arm/Select Pushbutton of the station you have external tanks installed on.
5. Press the JETT (Jettison) Button.

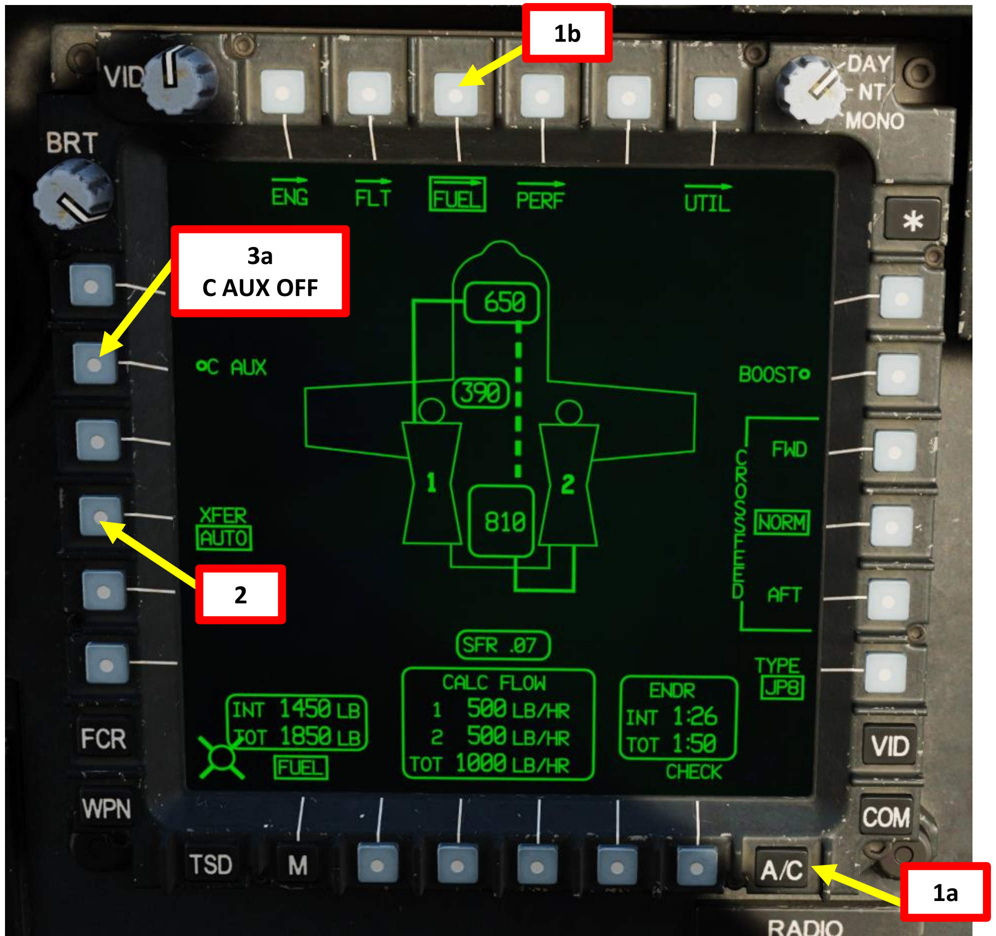


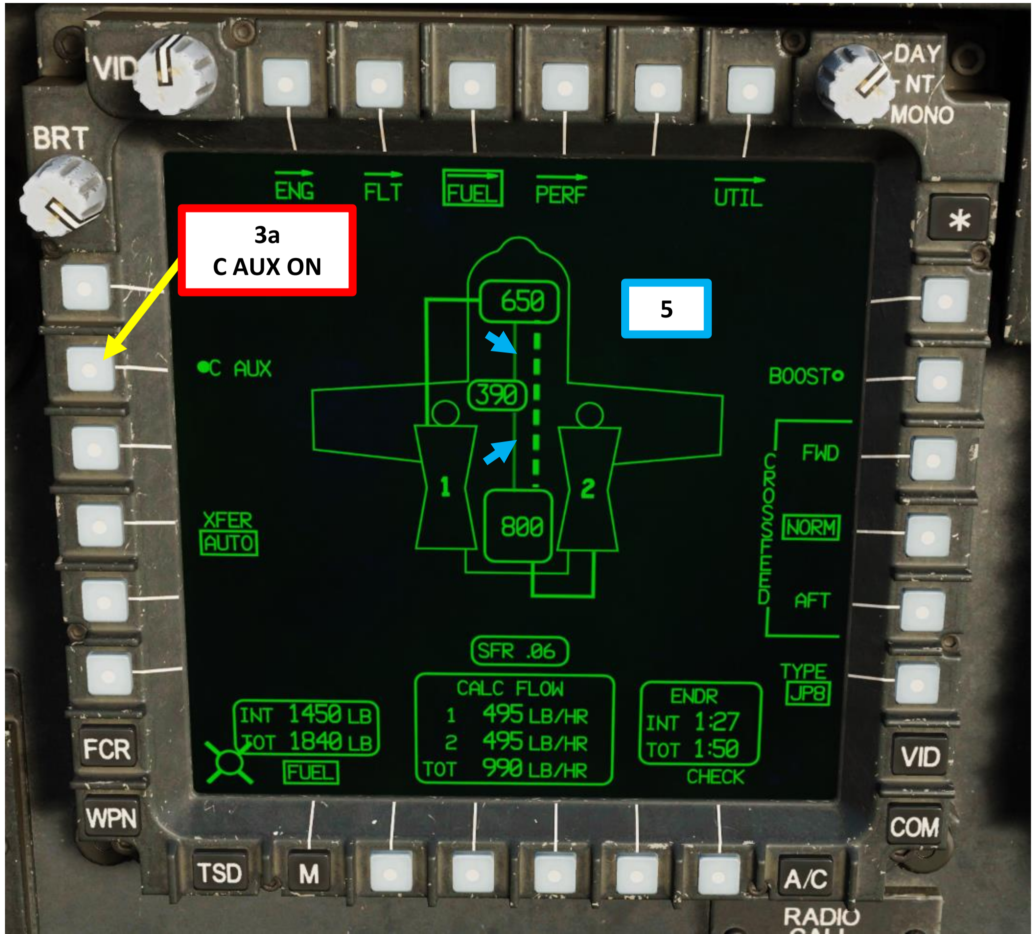


3 – Fuel System
3.3 – Fuel Controls

Internal Auxiliary Fuel System (IAFS, or "Robbie Tank") Operation

1. Go in the FUEL page.
2. Set XFER (Transfer) Option – AUTO. Fuel will be automatically transferred between the tanks to maintain leveling.
3. If an internal auxiliary fuel tank is installed, the C AUX option is available. However, fuel transfer from the internal auxiliary tank to the main forward and aft fuel tanks needs to be enabled for fuel transfer to take place.
4. Enable fuel transfer for the internal auxiliary tank by pressing VAB (Variable Action Button) next to C AUX.
    - Hollow circle means OFF. Solid Circle means ON.
5. A solid line will be depicted on the synoptic indicating the transfer.



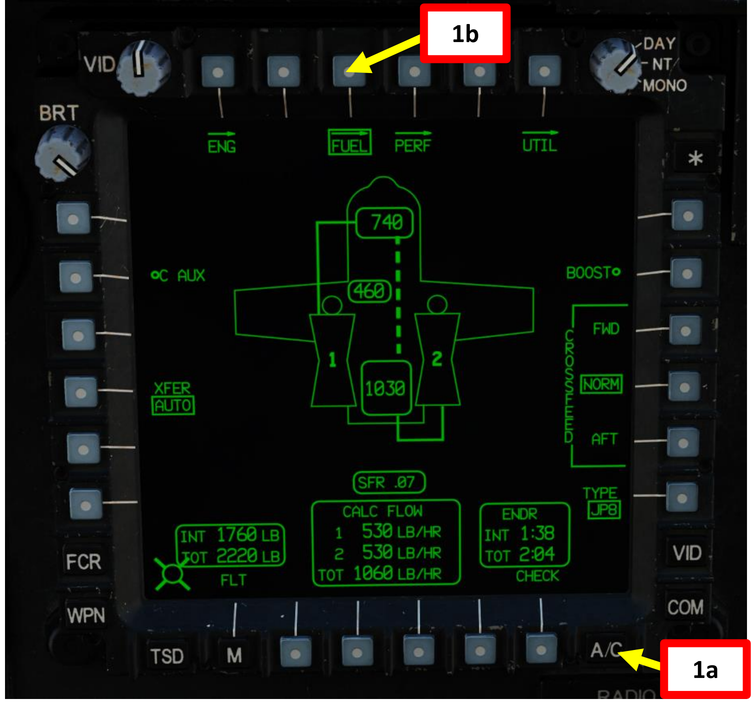


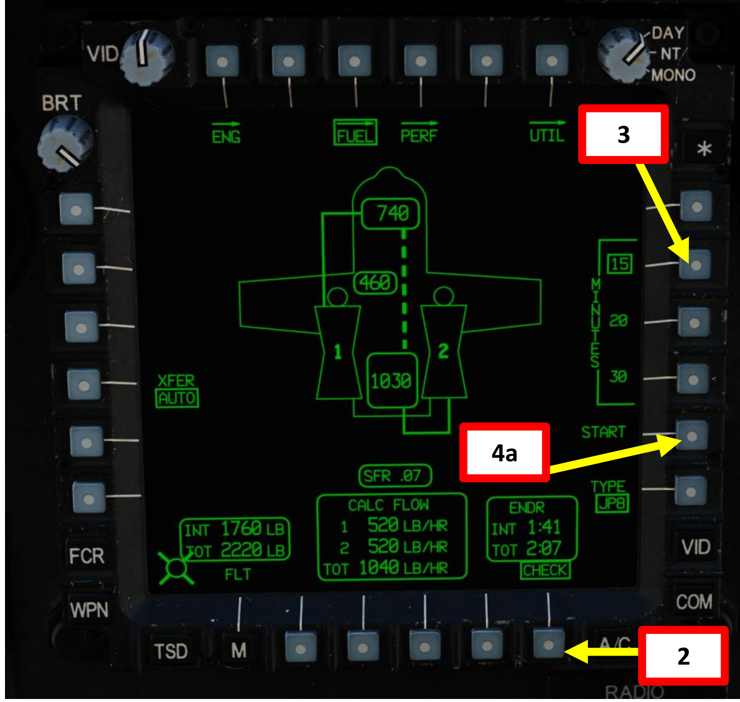
3 – Fuel System
3.3 – Fuel Controls

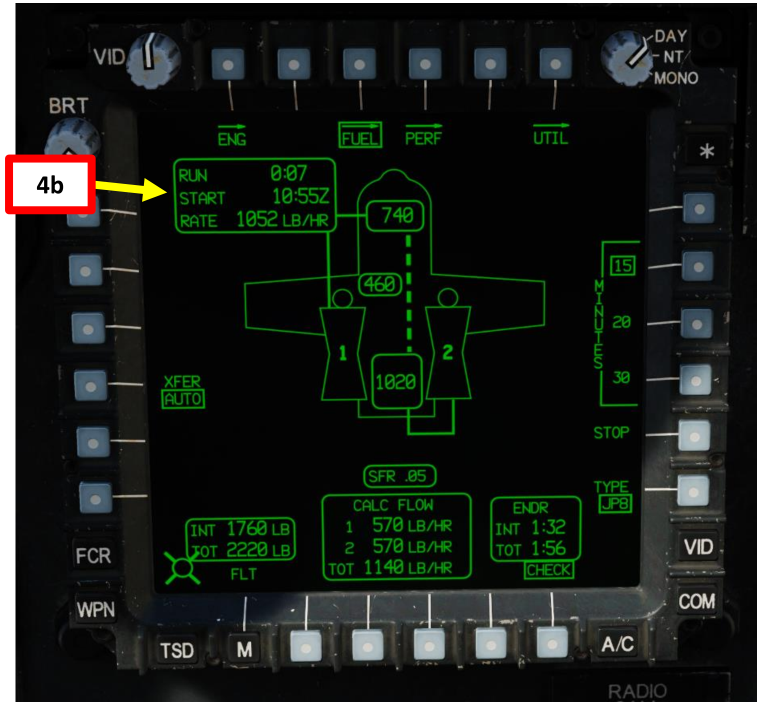
FUEL CHECK Feature

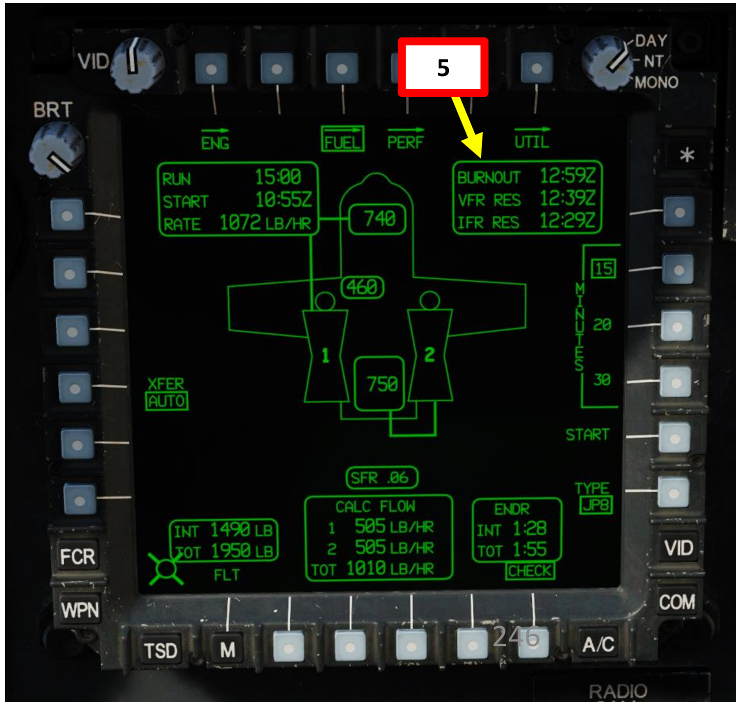
The “Fuel Check” feature is used to calculate time until entering IFR (Instrument Flight Rules) reserve (30 minutes), VFR (Visual Flight Rules) reserve (20 minutes), and fuel burnout.

To perform a fuel check:
1. Go in the FUEL page.
2. Press VAB (Variable Action Button) next to CHECK
3. Press VAB next to the desired option (15 minutes, 20 minutes or 30 minutes) for the check duration. We will select 15 minutes as an example.
4. Press VAB next to START to begin the fuel check, during which the average fuel flow is determined.
5. After the timer has expired, the burnout and reserve times are displayed.
    - **BURNOUT**: Time displayed in zulu time (or local time, as set on the TSD > UTIL page) at which the helicopter will run out of fuel.
    - **VFR RES** (Visual Flight Rules Reserve): Time displayed in zulu time (or local time, as set on the TSD > UTIL page) at which the fuel state in the helicopter will be just enough fuel to fly to your first landing point and then still have 20 minutes of fuel remaining at a normal cruise speed.
    - **IFR RES** (Instrument Flight Rules Reserve): Time displayed in zulu time (or local time, as set on the TSD > UTIL page) at which the fuel state in the helicopter will be just enough fuel to fly to your first landing point and then still have 30 minutes of fuel remaining at a normal cruise speed.









3 – Fuel System
3.4 – Fuel Planning

Bingo Fuel Calculation Example:

- *100 minutes for time of flight with a fuel flow of 1000 lbs/hour gives a Bingo Fuel of 1666 lbs, which is the minimum fuel quantity required to get back to base*

Useful Formulas

The KU (Keyboard Unit) can be used to calculate rapidly certain parameters such as Bingo Fuel, Objective Time, Specific Fuel Range Factor and Flight Range.

- *Note: *, ÷, + and – keys are used as operators, and ENTER is used as the equal sign.*

- **Bingo Fuel (lbs)** = (Time of Flight ÷ 60) × Fuel Flow
- **Objective Time (mins)** = ([Total Fuel – Bingo Fuel] ÷ Fuel Flow) × 60
- **Specific Fuel Range (SFR) Factor** = Ground Speed ÷ Fuel Flow
- **Flight Range (nm)** = SFR × Total Fuel

Objective Time (mins)

- *With a total fuel of 1850 lbs, a Bingo Fuel of 1666 lbs and a fuel flow of 1000 lbs/hour, we get an Objective Time of about 11 minutes.*

SFR (Specific Fuel Range)

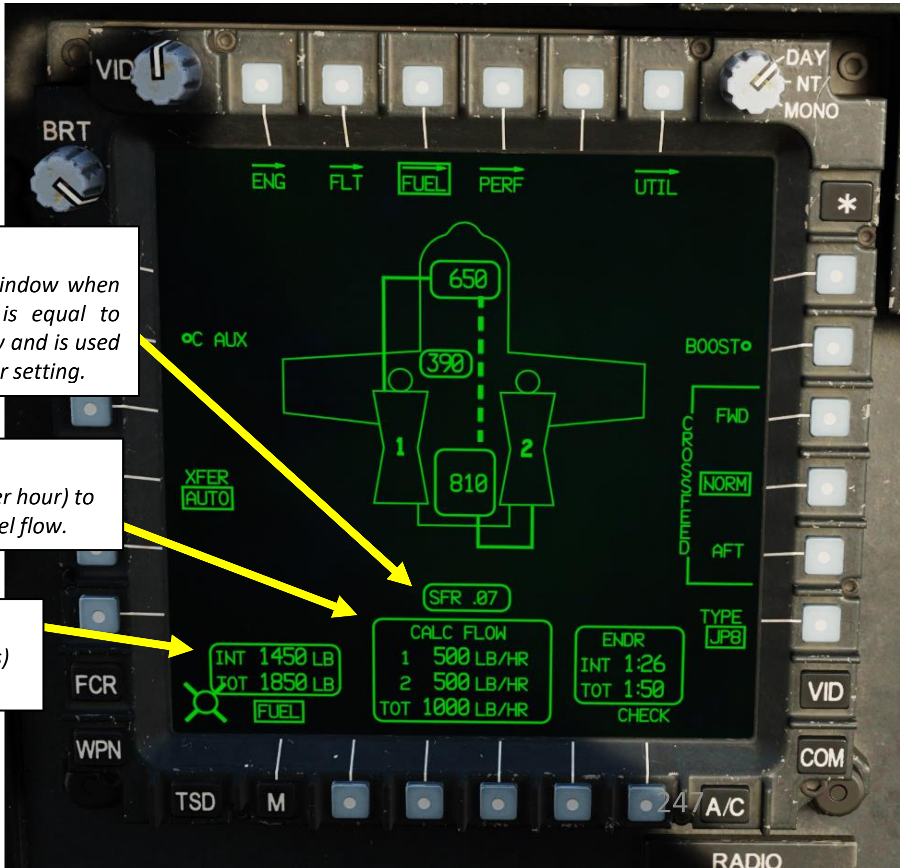
- *Displayed above the fuel flow window when the helicopter is moving. SFR is equal to ground speed divided by fuel flow and is used to determine best economy power setting.*

Fuel Flow Calculation (lbs/hour)

- *Displays the fuel flow (in pounds per hour) to engines #1 and #2, and the total fuel flow.*

Fuel Totalizer Indicator

- *INT: Internal Fuel Quantity (lbs)*
- *TOT: Total Fuel Quantity (lbs)*



4 – Hydraulic System

The AH-64D has two independent hydraulic systems: the primary hydraulic system and the utility hydraulic system.

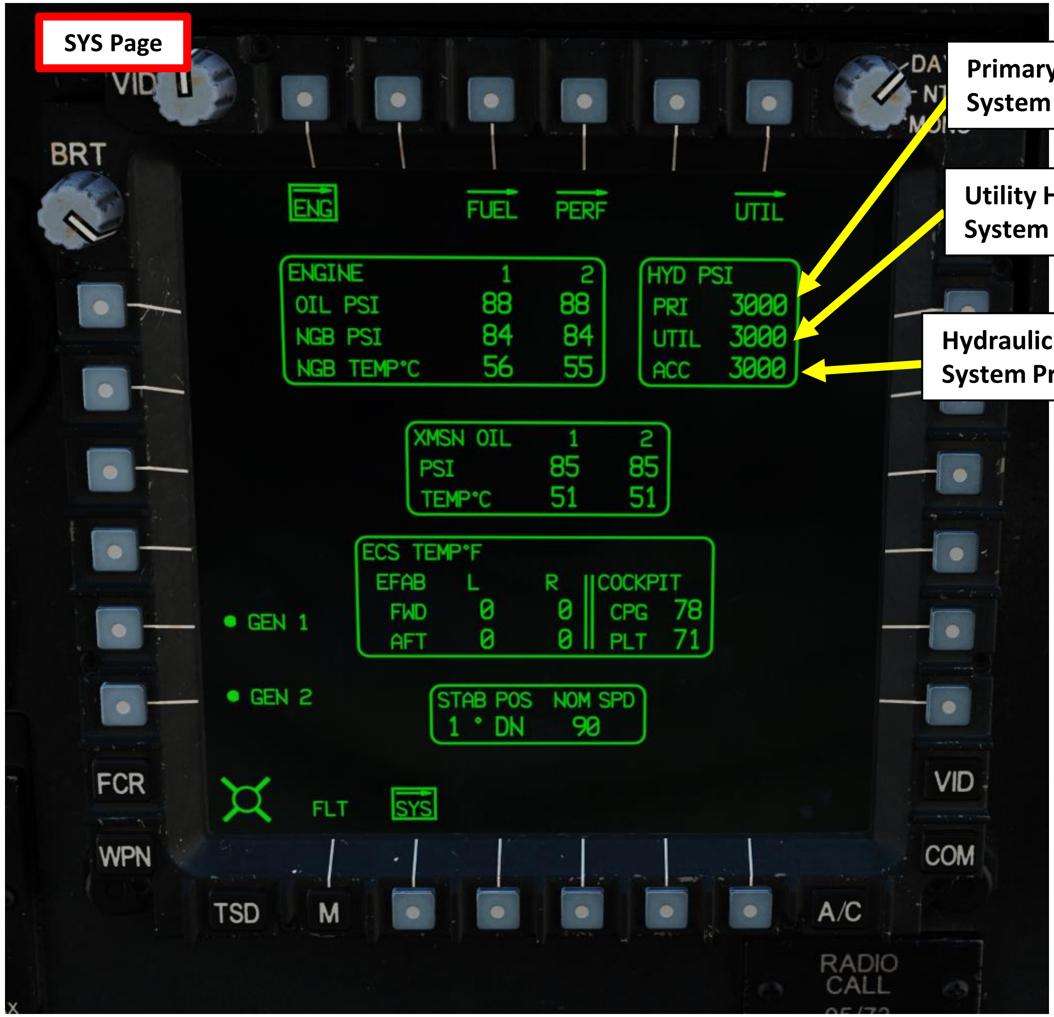
The **Primary** system exclusively powers the hydraulic flight control system via the FMC (Flight Management Computer). It's powered by the main transmission and has a total capacity of six pints with a one-pint reservoir.

The **Utility** system is a secondary source of hydraulic power for the flight controls (bypassing the FMC). The utility system is powered by the main transmission. Because of the higher loads placed on the utility system, it has a higher-volume manifold and larger reservoir. The utility system powers all other hydraulic systems:

- Rotor brake
- Area Weapon System (gun) turret drive
- Ammunition handling system
- APU start motor
- Tailwheel unlock actuator
- External stores elevation actuators.

The utility system charges a 3,000-psi **hydraulic accumulator**. The hydraulic accumulator is used to:

- Provide hydraulic damping during gun fire
- Provide hydraulic power to the rotor brake
- Provide hydraulic power to the APU starter
- Temporarily power the flight controls via the utility system in an emergency



5 – Electrical System

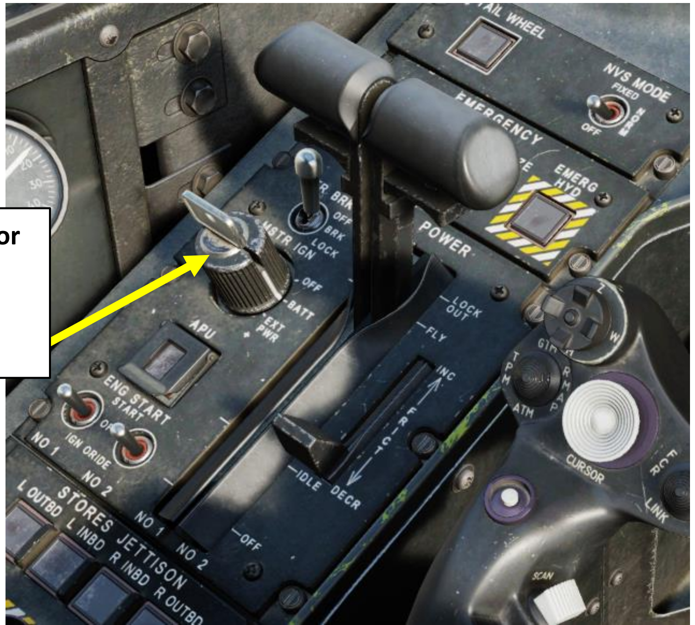
Electrical aircraft power is managed by the **Electrical Power Management System (EPMS)**. The EPMS is a fully redundant and automatic power system consisting of a distributor for battery, AC, and DC power. Power is distributed by four AC busses, four DC busses, four battery busses, and a battery hot bus. Each bus and power consumer is protected by a resettable circuit breaker.

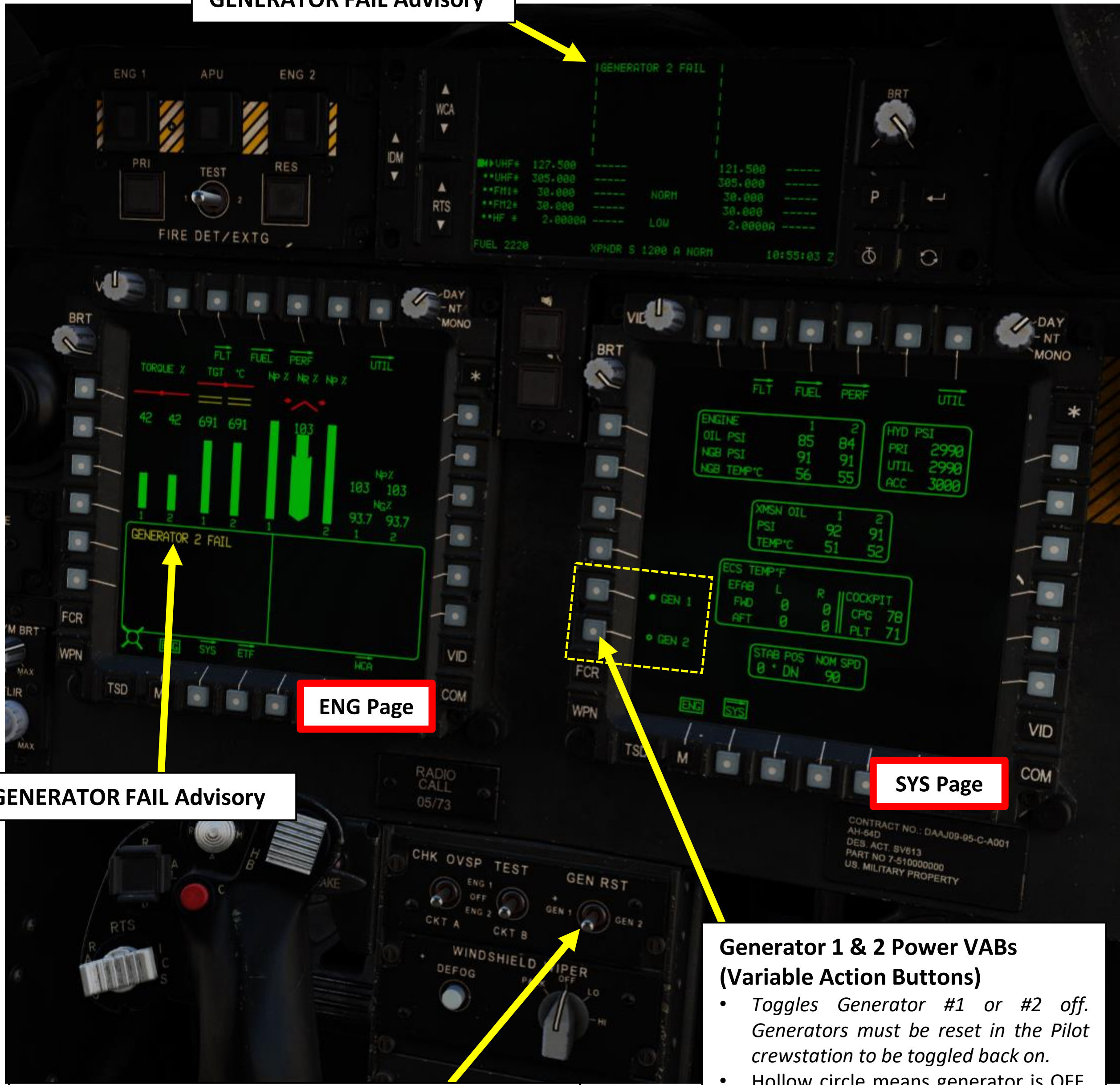
The 24-volt battery can provide power for normal flight loads for up to 12 minutes, assuming at least an 80% charge.

AC power is provided by two brushless, air-cooled generators. Each generator outputs 45 kVA three-phase four-wire power at 115 or 200 volts and 400 Hz. Each generator has its own Generator Control Unit (GCU). A single generator is capable of handling full flight loads without shedding. The generators are mounted to the transmission accessory gearbox.

DC power is provided by two Transformer-Rectifier Units (TRUs), each providing 28 volts and 350 amps of DC power. Like the generators, a single TRU can provide sufficient power for full flight loads without shedding.

An external power receptacle can provide DC and AC power for all systems from an AGPU (Aircraft Ground Power Unit).

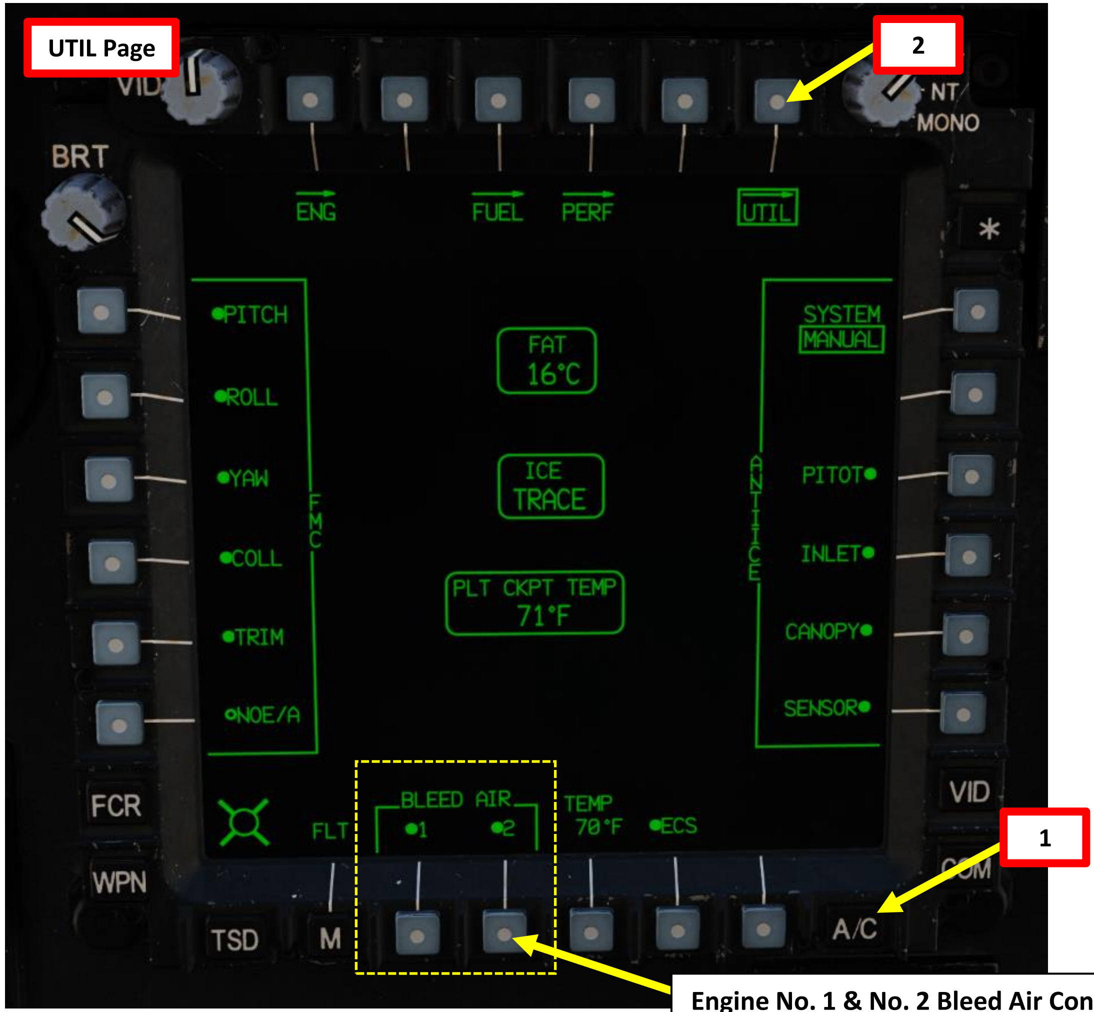




6 – Pneumatic Systems
6.1 – Integrated Pressurized Air System (IPAS)

The IPAS (Integrated Pressurized Air System) provides pressurized air to aircraft pneumatic systems. Bleed air is drawn from two ports: a high-pressure port is exclusively used to pressurize the hydraulic systems, and a low-pressure port is used by all other consumers. Low-pressure air is used by the engine air turbine starters, fuel boost and transfer pumps, anti-ice system, ice detection probe, nitrogen inerting unit, vapor cycle cooling system, and environmental control system.

IPAS bleed air can be provided by one or both engines, the APU, or an external source such as an AGPU (Aircraft Ground Power Unit).



Engine No. 1 & No. 2 Bleed Air Control VABs (Variable Action Buttons)
- *Enables or disables bleed air from engine #1 or #2.*
- Hollow circle means bleed air is OFF. Solid Circle means bleed air is ON.

6 – Pneumatic Systems
6.2 – Environmental Control System (ECS)

The ECS (Environmental Control System) provides crewmember comfort through ventilation, heating, and air conditioning. Ventilation is provided by Pilot and Co-Pilot/Gunner gaspers (air conditioning outlets), which can be opened to admit outside air into the cockpit. The ECS also powers ventilation fans that provide forced air exchange between the cockpits and for avionics cooling. Cockpit heating and windshield defogging are both provided by regulated bleed air from the IPAS (Integrated Pressurized Air System).

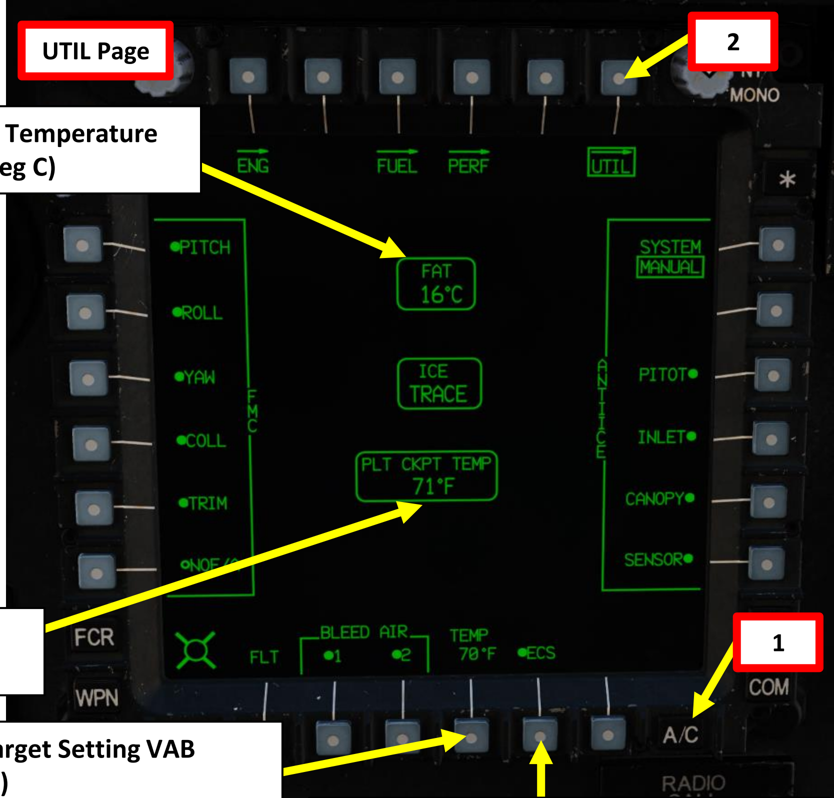
Air conditioning is provided from two independent vapor cycle cooling systems. One system provides cooled air for the Pilot and aft sections of each Extended Forward Avionics Bay (EFAB); the other system provides cooled air for the CPG, the TADS & PNVS turrets, and the forward sections of each EFAB. A digital control unit (DCU) manages the flow of cooled air for each system. In the event of a failure of one of the ECS systems, the DCU of the functioning system will automatically open an interconnect valve between the two cockpits. The ventilation fans in the failed cockpit will stop, and the functional cockpit's ventilation fans will force cooled air into both cockpits.

6 – Pneumatic Systems
6.2 – Environmental Control System (ECS)

ECS controls are available in the A/C UTIL page and on the Windshield Control Panel.

To set a cockpit temperature:

a) Make sure the ECS Power VAB (Variable Action Button) is ON (solid)
b) Press Cockpit Temperature Target Setting VAB
c) On KU (Keyboard Unit), enter target temperature in Fahrenheit, then press ENTER.



UTIL Page

2

Free Air Temperature (FAT) (deg C)

Cockpit Temperature (deg F)

1

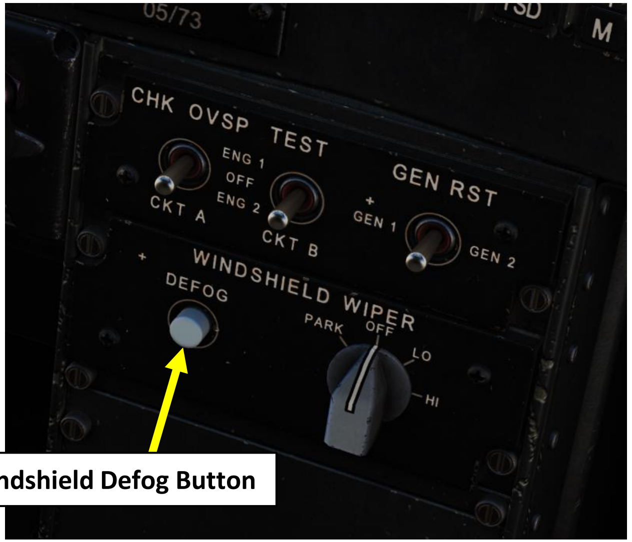
b

Cockpit Temperature Target Setting VAB (Variable Action Button)
- Sets the desired crew station temperature using the KU (Keyboard Unit). Each crewmember can set their own temperature in deg Fahrenheit.
- Example: 70 deg F = 21 deg C

ECS Power VAB (Variable Action Button)
- Powers ECS system ON or OFF.
- Hollow circle means bleed air is OFF. Solid Circle means bleed air is ON.
- When powered off, the ECS will not regulate cockpit or EFAB temperature.

a

Free Air Temperature (FAT) Gauge (deg C)



Windshield Defog Button

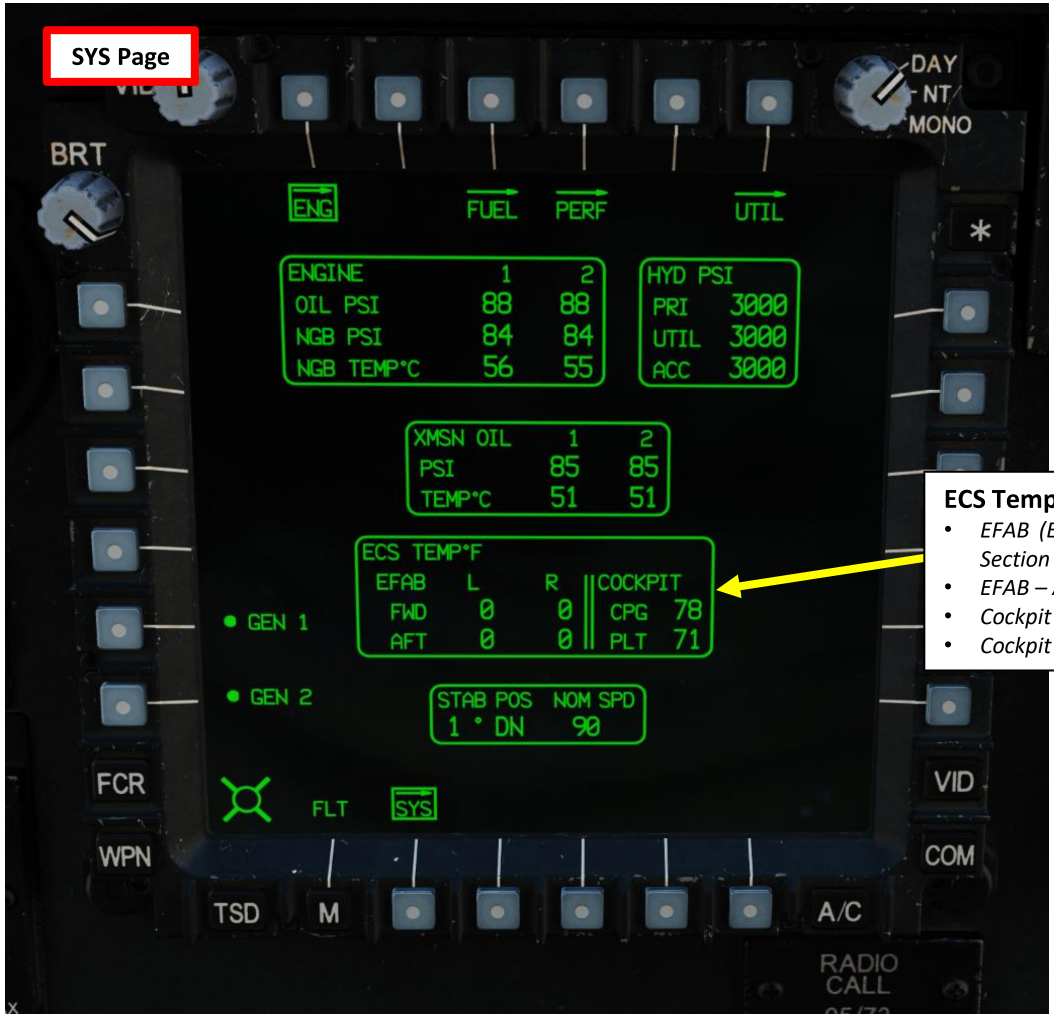
c

c

c

6 – Pneumatic Systems
6.2 – Environmental Control System (ECS)

ECS temperature indications are available in the A/C SYS page.

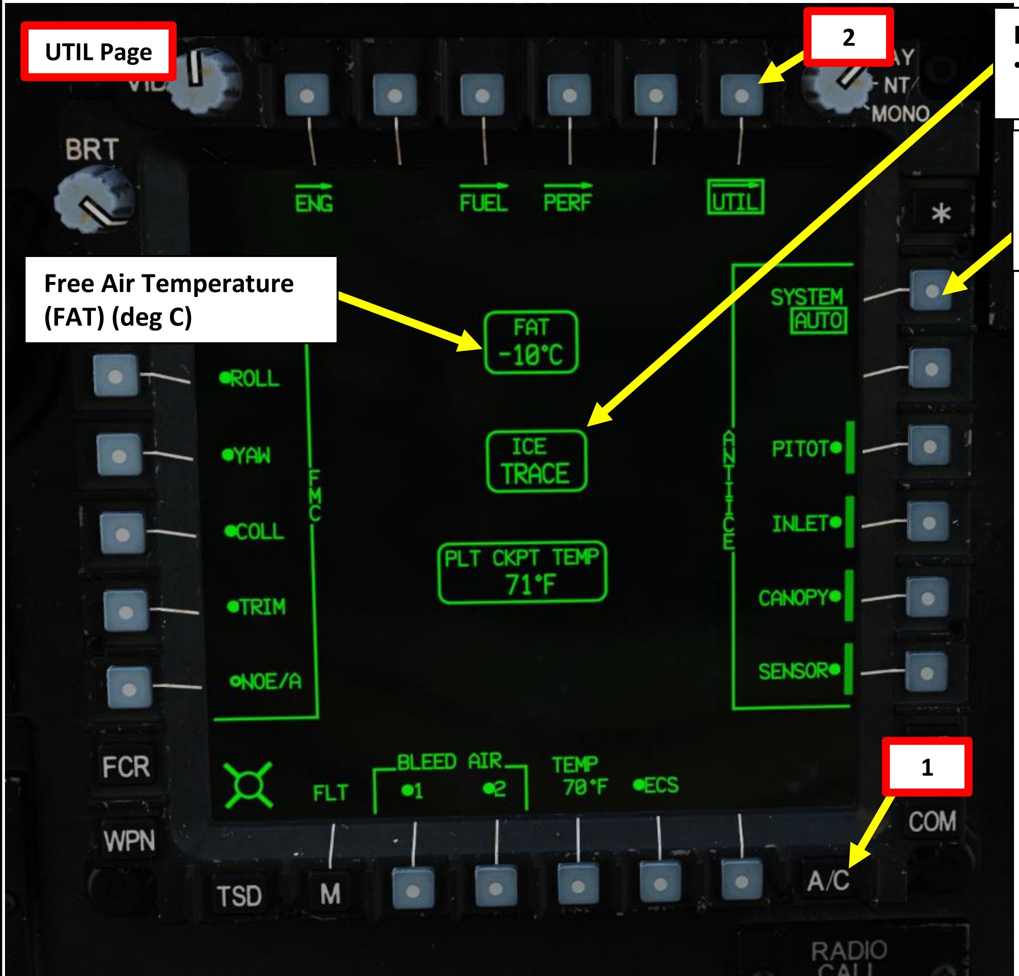


ECS Temperatures (deg F)
- *EFAB (Extended Forward Avionics Bay) – Forward Section*
- *EFAB – Aft Section*
- *Cockpit CPG (Co-Pilot Gunner)*
- *Cockpit PLT (Pilot)*

7 – Anti-Ice System

7.1 – Ice Detection System

Ice detection is provided by an aspirating ice detection probe, powered by pneumatic air from the IPAS (Integrated Pressurized Air System). The ice detection probe activates whenever free air temperature drops to 5° C or below.



Ice Detector Status

- *Displays level of ice accumulation sensed by the ice detection probe.*

Anti-Ice System Control Mode Selector

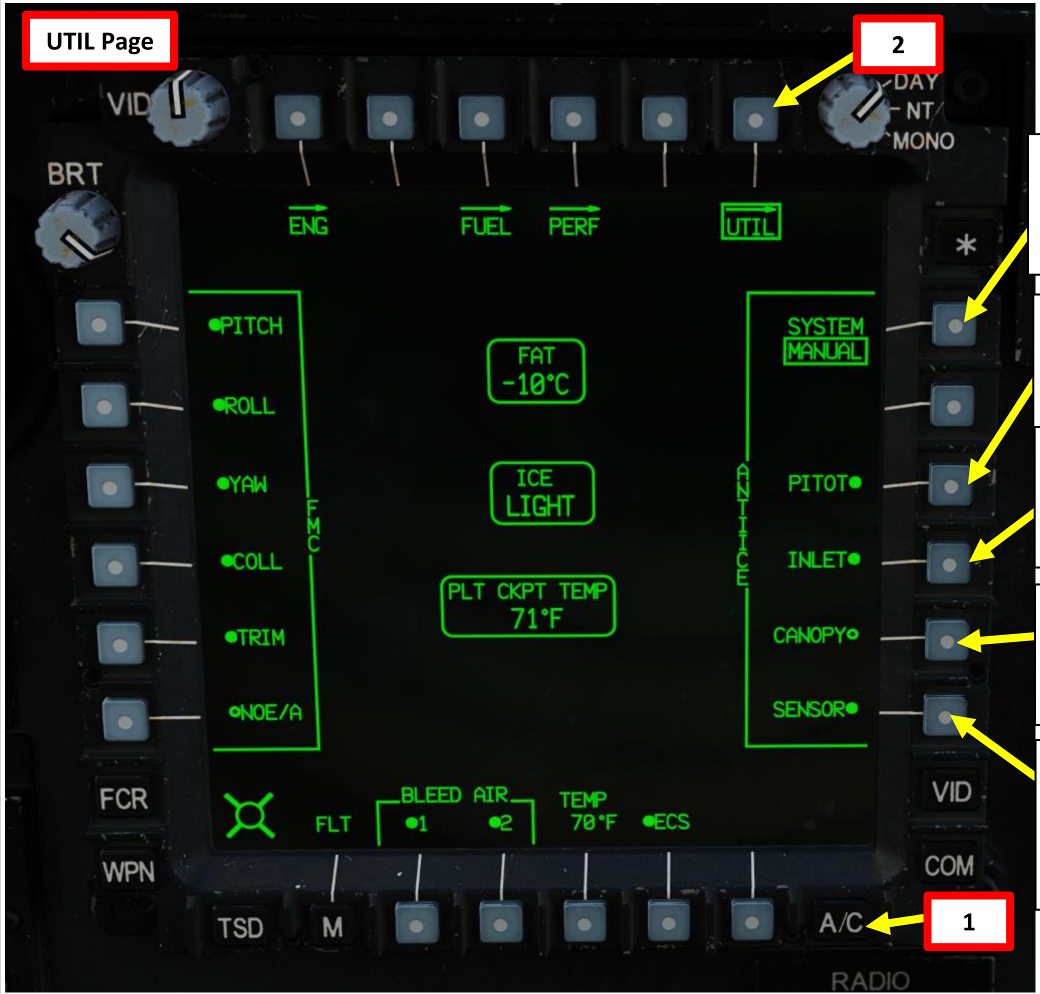
- *MANUAL: Anti-Ice equipment is manually turned ON or OFF with their respective VAB (Variable Action Button)*
- *AUTO: Anti-Ice equipment is automatically turned ON or OFF based on ice detection*

7 – Anti-Ice System
7.2 – Ice Protection System Controls

Ice protection is provided by engine inlet anti-ice from main engine bleed air, electrical heat to the pitot and helicopter air data system (HADS) sensors, electric sensor aperture anti-ice, and electrically heated canopies.

- When in AUTO mode, anti-ice system controls are enabled automatically when ice is detected by the ice detect probe. When ice is no longer detected, they can be disabled manually by the aircrew; they are not disabled automatically.
- In MANUAL mode, the aircrew must enable and disable the anti-icing systems manually depending on the presence of ice.

The anti-Ice system controls are available in the A/C UTIL sub-page.



Anti-Ice System Control Mode Selector
- *MANUAL: Anti-Ice equipment is manually turned ON or OFF with their respective VAB (Variable Action Button)*
- *AUTO: Anti-Ice equipment is automatically turned ON or OFF based on ice detection*

Pitot Anti-Ice Selector
- *Solid circle: ON, enables electrical pitot and HADS (Helicopter Air Data Sensor) heat.*
- *Hollow circle: OFF*

Inlet Anti-Ice Selector
- *Solid circle: ON, enables bleed air heat for the engine and inlet fairings, and electrical heating for nose gearbox fairings.*
- *Hollow circle: OFF*

Canopy Anti-Ice Selector
- *Solid circle: ON, enables electrical heating elements embedded in the middle forward windshields for the pilot and co-pilot/gunner stations.*
- *Hollow circle: OFF*

Sensor Anti-Ice Selector
- *Solid circle: ON, enables electrical heating of the turret shrouds, boresight, and sensor windows for the TADS/PNVS.*
- *Hollow circle: OFF*

Note: Sensor anti-ice is automatically disabled and « barriered » while on the ground.

8 – Fire Protection System

Engine fire detection is provided by two optical flame detectors in each engine compartment, and two in the APU (Auxiliary Power Unit) compartment. Two nitrogen fire bottles provide fire suppression. The bottles, labeled PRI (primary) and RES (reserve), can be discharged into either engine or the APU.

Three pneumatic fire/overheat detectors are located in the aft deck area. A transmission aft deck fire warning is provided by crewstation voice message, flashing master warning pushbutton, EUFD (Enhanced Up-Front Display) and MPD (Multi-Purpose Display) warning messages. There is **no extinguishing agent for the aft deck area**.

APU (Auxiliary Power Unit) Fire Pushbutton
- *Illuminates when APU fire is detected, shuts off fuel valve when pressed*

Engine 1 Fire Pushbutton
- *Illuminates when engine 1 (left) fire is detected, shuts off fuel valve when pressed*

Engine 2 Fire Pushbutton
- *Illuminates when engine 2 (right) fire is detected, shuts off fuel valve when pressed*

Primary Fire Extinguisher Discharge Pushbutton

Reserve Fire Extinguisher Discharge Pushbutton

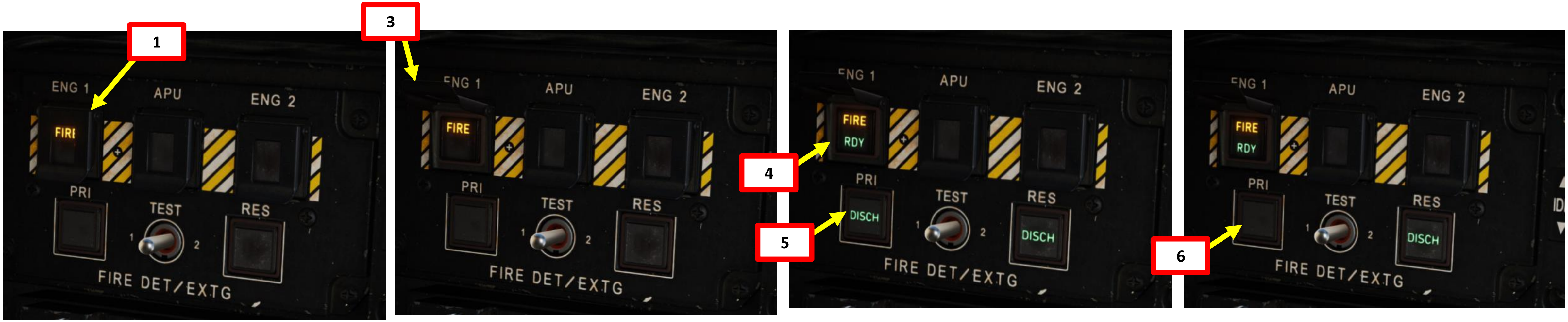
Fire Detection Circuit Test Switch

Engine Fire Warning

8 – Fire Protection System

Engine Fire Emergency Procedure

1. When a fire is detected, the FIRE push-light of the affected engine (or APU) will illuminate.
2. Configure aircraft controls (cyclic and collective) for single-engine operation.
3. Flip the illuminated FIRE push-light guard UP.
4. Press the FIRE push-light of the affected engine (or APU). This will arm the fire extinguishing system, **shut off fuel flow to the indicated engine (or APU)**, shut off bleed air from the indicated engine (or APU), close the cooling louvers to the indicated engine, turn off the voice warning message, and turn off the master warning light.
5. When the fire extinguishing system is armed, the RDY light will illuminate.
6. Press the illuminated PRI DISCH (Primary Discharge) pushbutton to discharge the primary fire extinguishing agent bottle and extinguish the DISCH light.
    - Alternatively, pressing the RES DISCH (Reserve Discharge) pushbutton will discharge the reserve fire extinguishing agent bottle and extinguish the DISCH light.
7. The FIRE light will extinguish once fire is extinguished.
8. Press the same FIRE pushbutton a second time (in the same crew station) to reverse the functions listed in step 3) and disarm the fire extinguishing system.



INTRODUCTION

The AH-64 has one of the most interesting aerodynamic models in DCS. We will look at some aerodynamic concepts to help you understand why the helicopter behaves the way it does. Don’t worry, I’ll keep it short and simple. The following principles are simply what you MUST understand as an Apache pilot if you want to fly worth a darn.

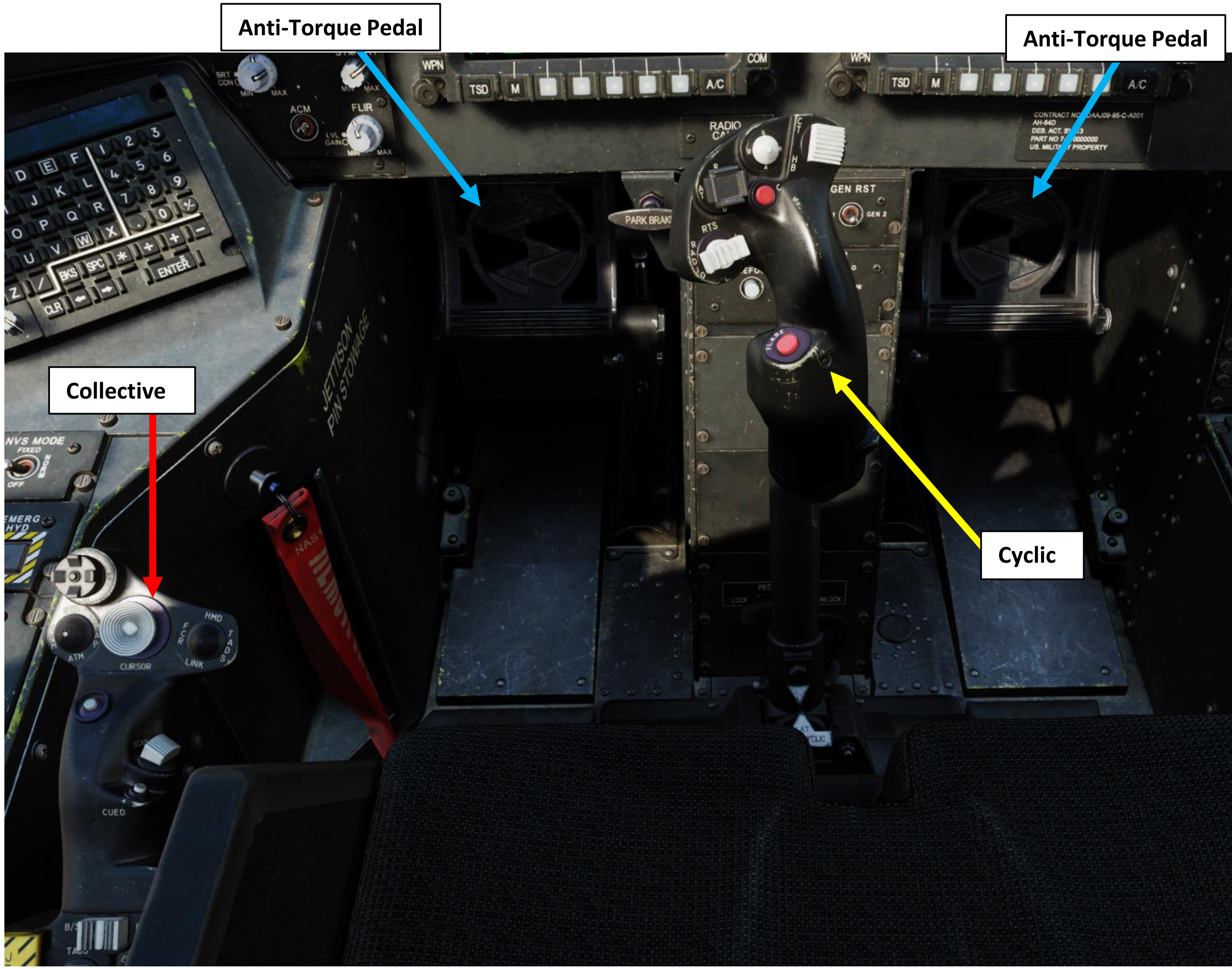
FLIGHT CONTROLS

The AH-64D flight controls are hydromechanical, consisting of mechanical linkages between the flight controls and control surfaces, augmented by transmission-driven hydraulic power. The flight controls are conventional and consist of a cyclic, collective, and anti-torque pedals. Complete controls are provided for both pilot and co-pilot/gunner.
The system includes the following:

- **Cyclic system**:
    - Moving the cyclic (stick) in any direction will produce a corresponding movement of the helicopter which is a result of a change in the plane of rotation of the main rotor. The cyclic is mechanically connected to a swashplate on the rotor mast, which tilts the main rotor.

- **Collective control system**:
    - The amount of lever movement determines the angle of attack and lift developed by the main rotor, and results in ascent or descent of the helicopter: When the lever is in the full down position, the main rotor is at minimum pitch. When the lever is in the full up position, the main rotor is at maximum pitch. The collective is mechanically connected to the Load Demand Spindle (LDS) and directly controls rotor blade pitch.

- **Anti-Torque pedals**:
    - Moving the pedals allow you to turn the helicopter left or right in the yaw axis. The anti-torque pedals control tail rotor blade pitch.



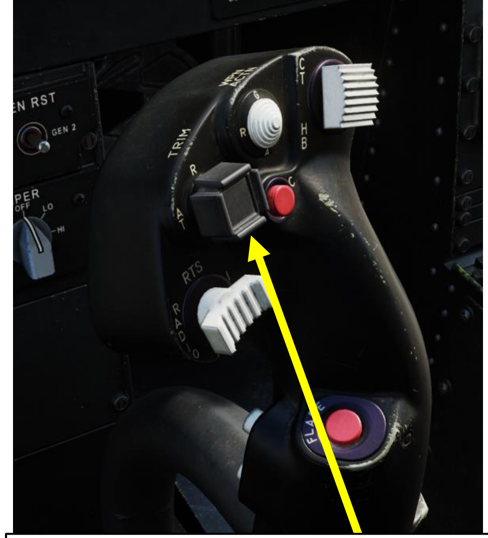
FLIGHT CONTROLS

Source: Eagle Dynamics AH-64D Manual

- **Tail Rotor system**:
  - The tail rotor control system is operated by pilot/copilot anti-torque pedals. Pushing an anti-torque pedal will change the pitch of the tail rotor blades, resulting in directional control.

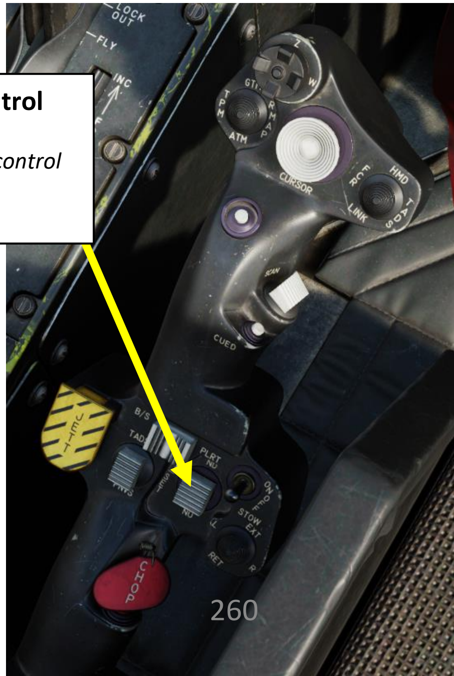
- **Force Trim system**:
  - Force centering devices are incorporated in the cyclic controls and directional pedal controls. The lateral and longitudinal force trim springs and magnetic solenoids engage and disengage the force trim. These devices furnish a force gradient or "feel" to the cyclic control stick and anti-torque pedals. A Force Trim / Hold Modes switch on the cyclic disengages the force trim system, allowing the cyclic to move freely without resistance. When re-engaged, the force trim springs hold the cyclic in its current position and provide an increasing force gradient as the cyclic is deflected away from this center point.

- **Horizontal Stabilator**:
  - The AH-64D has an articulating horizontal stabilator controlled by an electric actuator. The horizontal stabilator improves pitch angle control and improves over-the-nose visibility at low airspeeds.
    - In **automatic mode**, the FMC (Flight Management Computer) schedules the horizontal stabilator position according to collective position, airspeed, and pitch rate. In nap of the earth (NOE)/approach mode, the horizontal stabilator is driven to the 25 deg trailing edge down position when below 80 knots, to further improve over-the-nose visibility.
    - In **manual mode**, the Pilot controls stabilator position with a switch on the collective.



Force Trim / Hold Modes Switch
- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*
- *AFT: "**D**" (Disengage). Disengages attitude and altitude hold.*
- *LEFT: "**AT**" (Attitude Hold).*
- *RIGHT: "**AL**" (Altitude Hold)*

Horizontal Stabilator Control
- *FWD: Nose DOWN*
- *DOWN: Resets Stabilator control mode to automatic*
- *AFT: Nose UP*



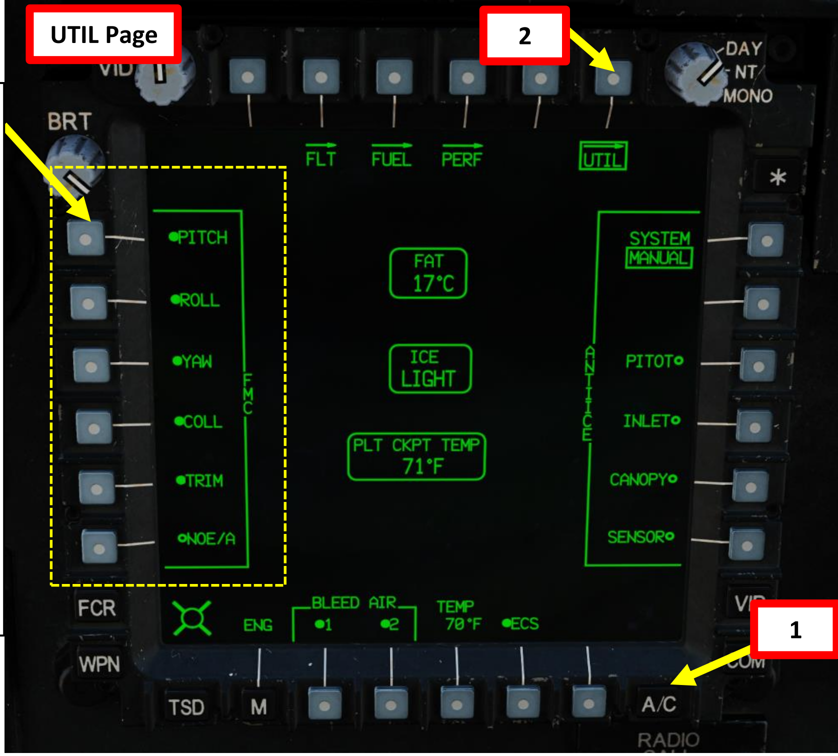
FLIGHT CONTROLS

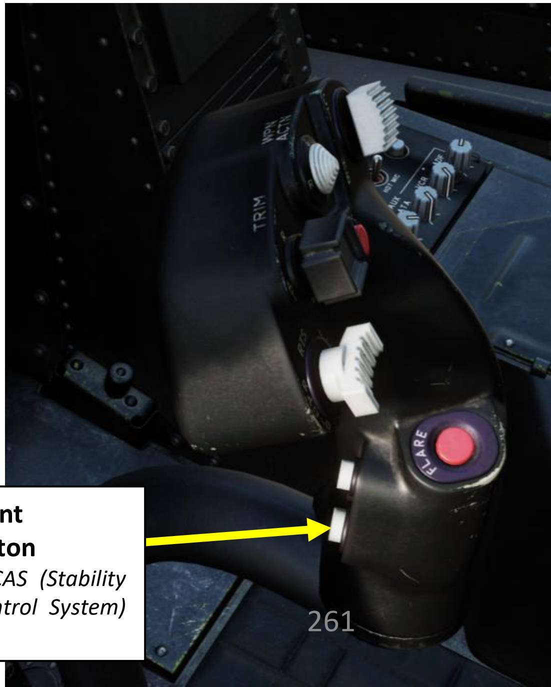
- **SCAS (Stability and Control Augmentation System)**
    - The Hydraulic augmentation is provided by the Stability and Control Augmentation System (SCAS), which consists of electro-hydraulic actuators controlled by the **Flight Management Computer (FMC)**. The FMC provides rate damping to smooth flight control inputs and command augmentation. It also provides limited attitude and altitude hold capability for hands-off flying. We will go in more detail about these hold modes in the Aircraft Control Systems section. The command augmentation system provides consistent control feel across the full range of helicopter airspeeds.

Source: Eagle Dynamics AH-64D Manual

FMC Controls (in UTIL page) VABs (Variable Action Buttons)

- ***PITCH***: *SCAS dampens longitudinal (pitch) rates and can command longitudinal cyclic in command mode.*
- ***ROLL***: *SCAS dampens lateral (roll) rates and can command lateral cyclic in command mode.*
- ***YAW***: *SCAS dampens directional (yaw) rates and provide heading hold and turn coordination.*
- ***COLL***: *SCAS can command collective application in command mode.*
- ***TRIM***: *Toggles the force trim magnetic brakes on the cyclic and anti-torque pedals.*
- ***NOE/A***: *Activates FMC (Flight Management Computer) nap-of-the-earth/approach mode. In NOE/approach mode, the horizontal stabilator is commanded to 25 deg trailing edge down when airspeed is below 80 kts. This provides better over-the-nose visibility for low-altitude flying.*





FMC (Flight Management Computer) Release Button

- *Disengages all FMC SCAS (Stability and Augmentation Control System) channels.*

FLIGHT CONTROLS

Source: Eagle Dynamics AH-64D Manual

- **BUCS (Back-Up Control System)**
    - The BUCS is a single-channel, four-axis, non-redundant electric fly-by-wire (FBW) system. The FBW system is designed to replicate the feel of the hydromechanical controls but does not replicate SCAS functionality. BUCS can only be active for the Pilot or the CPG station.
    - Normally, the Pilot and Co-Pilot/Gunner flight controls are mechanically linked. The mechanical linkages are protected by shear pins and mis-track sensors to prevent a control jam or severance from affecting both sets of flight controls.
    - If the flight controls are decoupled by the shear pin, or a mis-track is otherwise sensed, the Back-Up Control System is automatically activated.
    - Either the Pilot or the Co-Pilot/Gunner can transfer BUCS control to their station if necessary, depending on the nature and location of the jam or severance within the flight controls.
    - The "BUCS Select Trigger" under the CPG collective manually switches the Back-Up Control System (BUCS) control priority to the CPG cockpit controls. Be aware that this process is non-reversible.

BUCS Select Trigger (CPG Only)

Co-Pilot/Gunner Collective, Bottom View

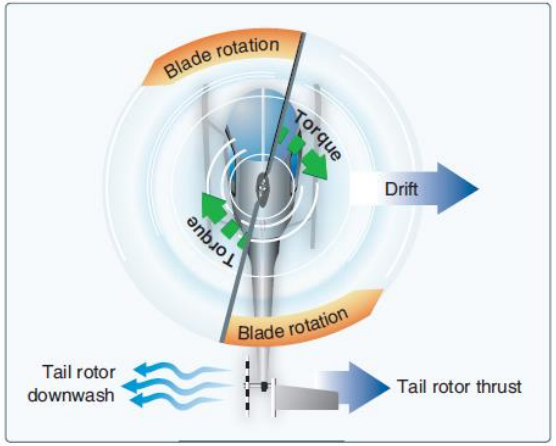
FORCES: TORQUE, TRANSLATIONAL & VERTICAL LIFT

IN A NUTSHELL…

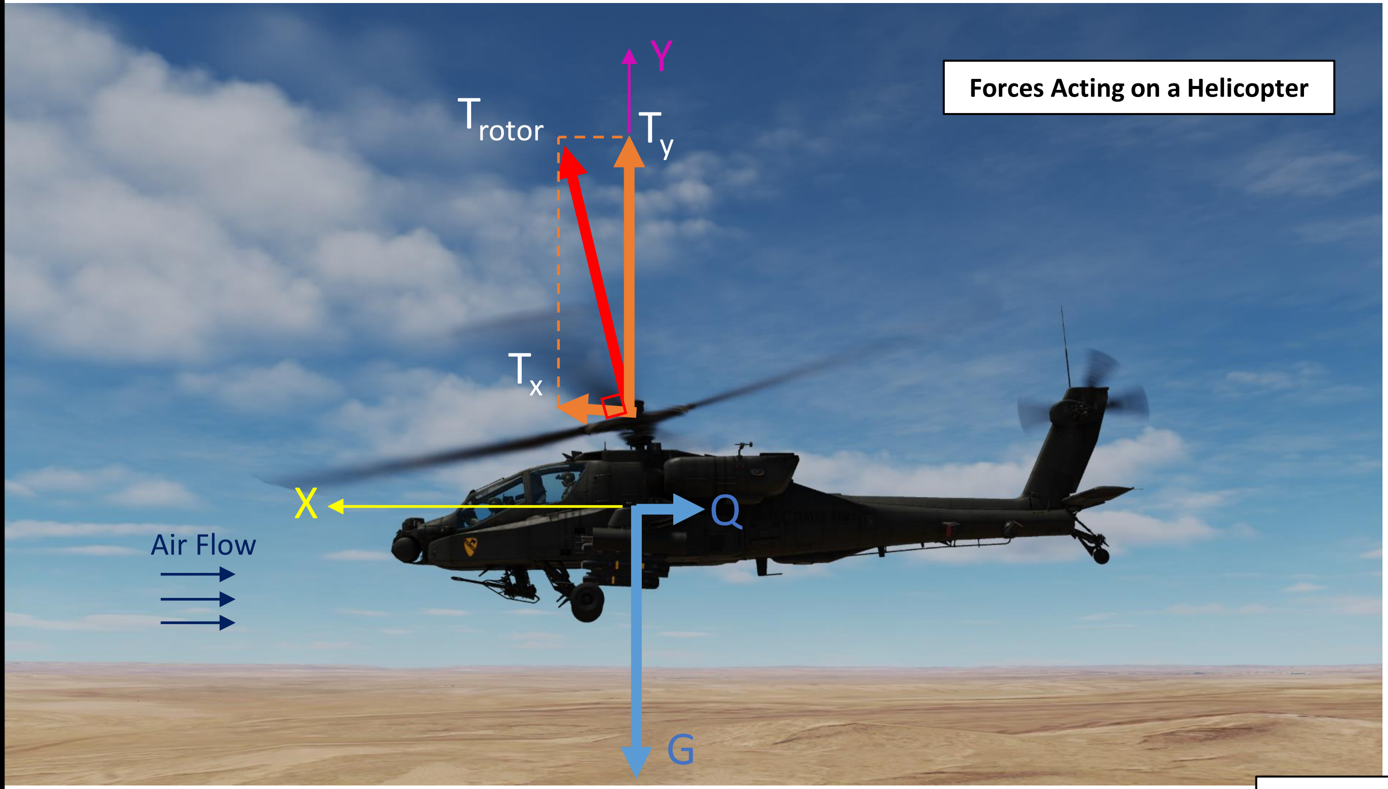
In a hover, you will most likely generate vertical lift only since the lift vector is pointing upwards. However, if you push your nose down and gain horizontal speed, you will notice that you will generate much more lift as you gain speed. This is called "**Translational Lift**": your blades gain much more lift efficiency as you accelerate.

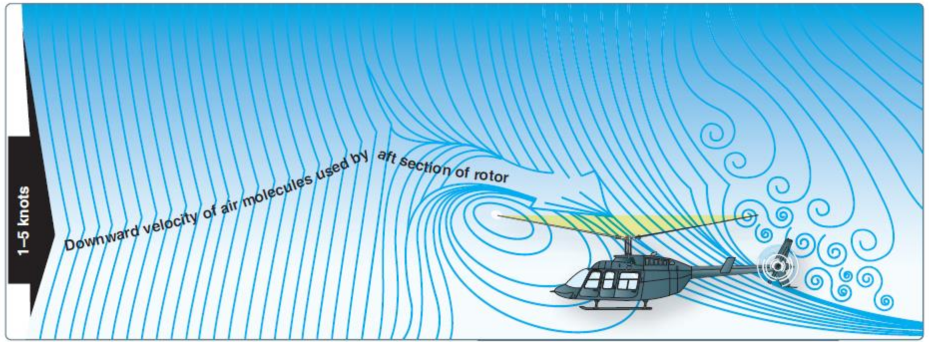
You might also wonder why you need to apply left pedal when you are hovering. This is simply to counter the **torque** created by the main rotor blades' rotation in the yaw axis. In a prop airplane, the torque will force you to use pedal on takeoff to stay straight. The same principle applies for a helicopter, but in a different axis.

Translating tendency is a right lateral movement of the helicopter that is a combination of tail rotor thrust and main rotor torque; translating tendency is countered with left cyclic.

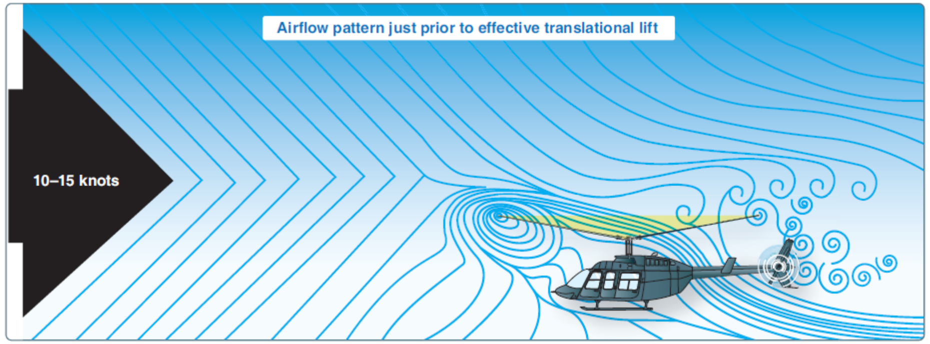


A tail rotor is designed to produce thrust in a direction opposite torque. The thrust produced by the tail rotor is sufficient to move the helicopter laterally.





The airflow pattern for 1-5 knots of forward airspeed. Note how the downwind vortex is beginning to dissipate and induced flow down through the rear of the rotor system is more horizontal.



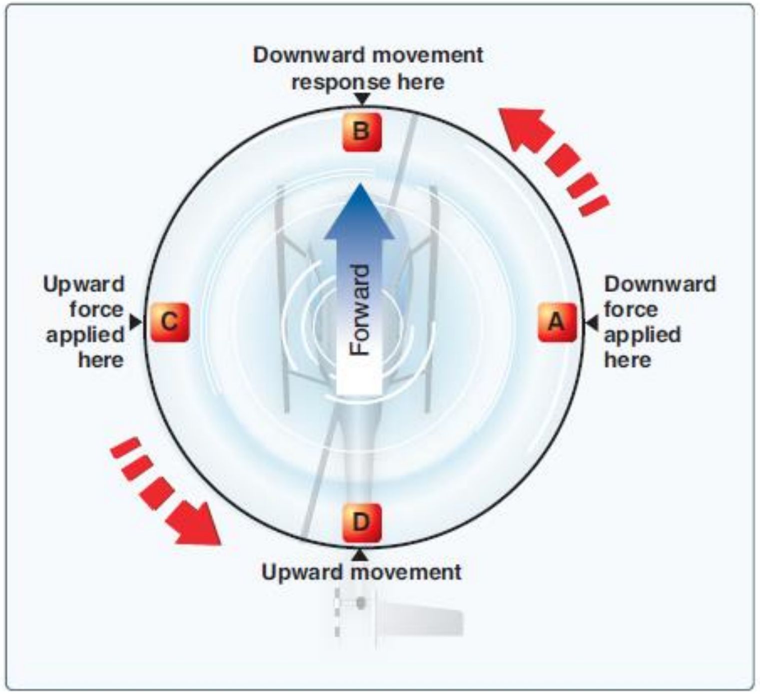
The airflow pattern for 10-15 knots. At this increased airspeed, the airflow continues to become more horizontal. The leading edge of the downwash pattern is being overrun and is well back under the nose of the helicopter.

GYROSCOPIC PRECESSION

IN A NUTSHELL…

The spinning main rotor of a helicopter acts like a gyroscope. What we call "**gyroscopic precession**" is the resultant action or deflection of a spinning object when a force is applied to this object. This action occurs 90 degrees in the direction of rotation from the point where the force is applied, like on a rotating blade.

Now, what does this mean and why should you care about such mumbo jumbo? This means that if you want to push your nose down, you push your cyclic forward. What happens in reality is that pilot control input is mechanically offset 90 degrees "later", as shown on the pictures below.



Gyroscopic Precession

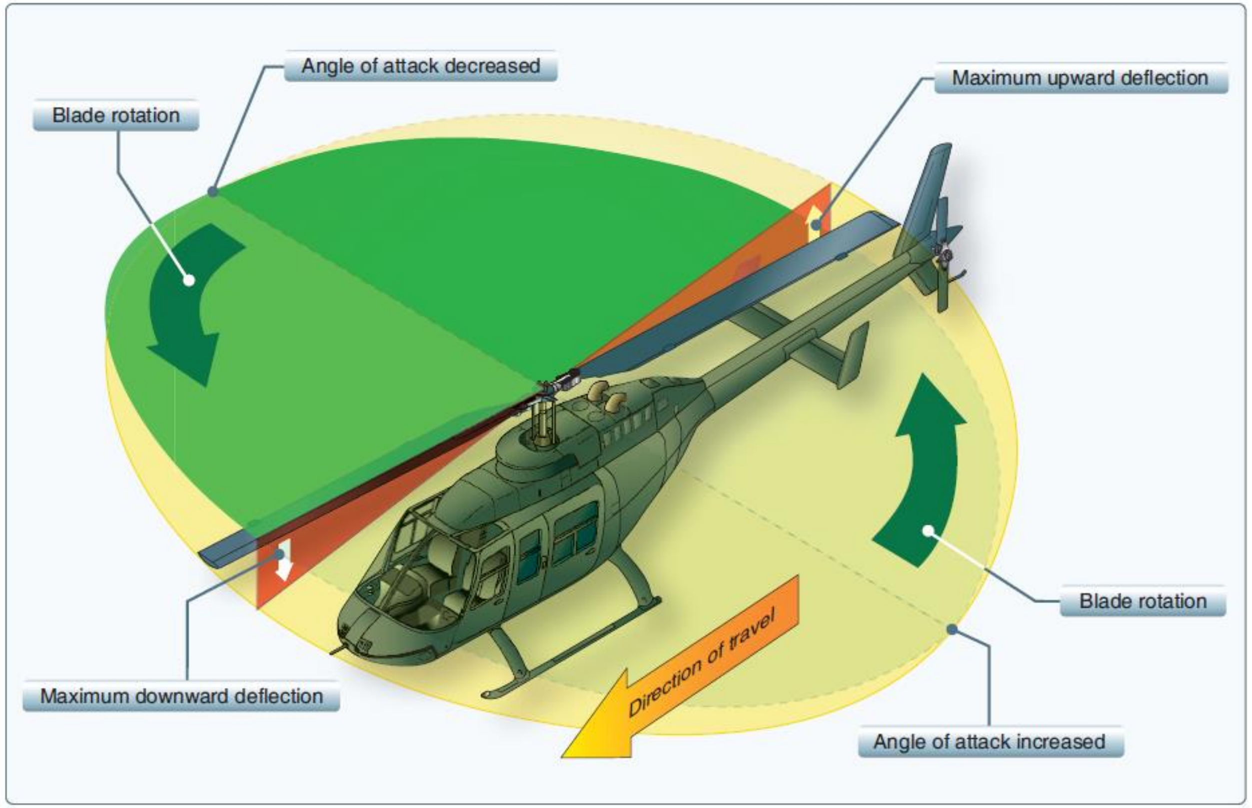


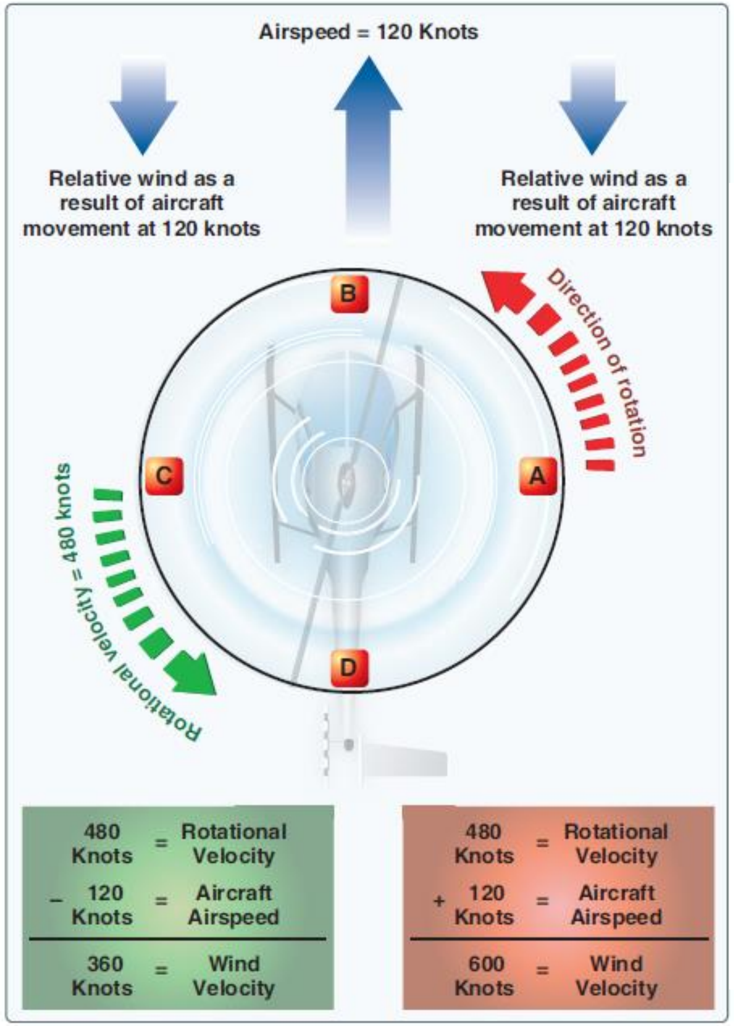
Figure 2-29. *As each blade passes the 90° position on the left in a counterclockwise main rotor blade rotation, the maximum increase in angle of incidence occurs. As each blade passes the 90° position to the right, the maximum decrease in angle of incidence occurs. Maximum deflection takes place 90° later—maximum upward deflection at the rear and maximum downward deflection at the front—and the tip-path plane tips forward.*

RETREATING BLADE STALL & DISSYMMETRY OF LIFT

In forward flight, the relative airflow through the main rotor disk is different on the advancing and retreating side. The relative airflow over the advancing side is higher due to the forward speed of the helicopter, while the relative airflow on the retreating side is lower. This dissymmetry of lift increases as forward speed increases. To generate the same amount of lift across the rotor disk, the advancing blade flaps up while the retreating blade flaps down. This causes the AOA to decrease on the advancing blade, which reduces lift, and increase on the retreating blade, which increases lift.

At some point as the forward speed increases, the low blade speed on the retreating blade, and its high AOA cause a stall and loss of lift. Retreating blade stall is a major factor in limiting a helicopter's never-exceed speed (VNE) and its development can be felt by a low frequency vibration, pitching up of the nose, and a roll in the direction of the retreating blade. High weight, low rotor rpm, high density altitude, turbulence and/or steep, abrupt turns are all conducive to retreating blade stall at high forward airspeeds. As altitude is increased, higher blade angles are required to maintain lift at a given airspeed.

Thus, retreating blade stall is encountered at a lower forward airspeed at altitude. Most manufacturers publish charts and graphs showing a VNE decrease with altitude.

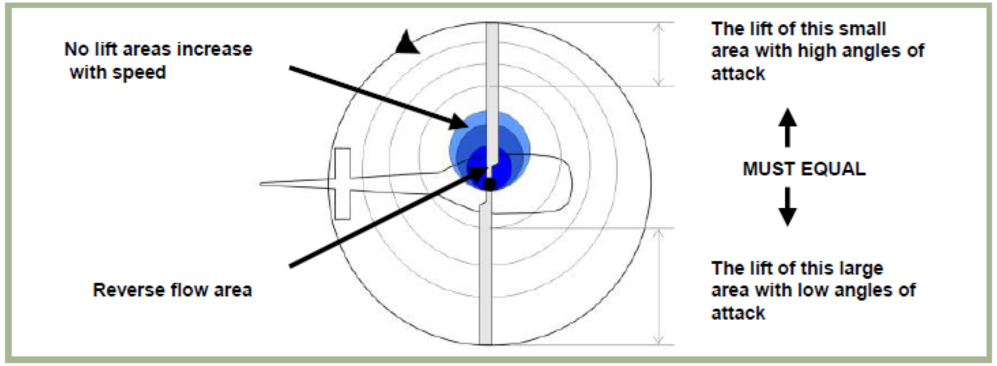


Airflow in forward flight

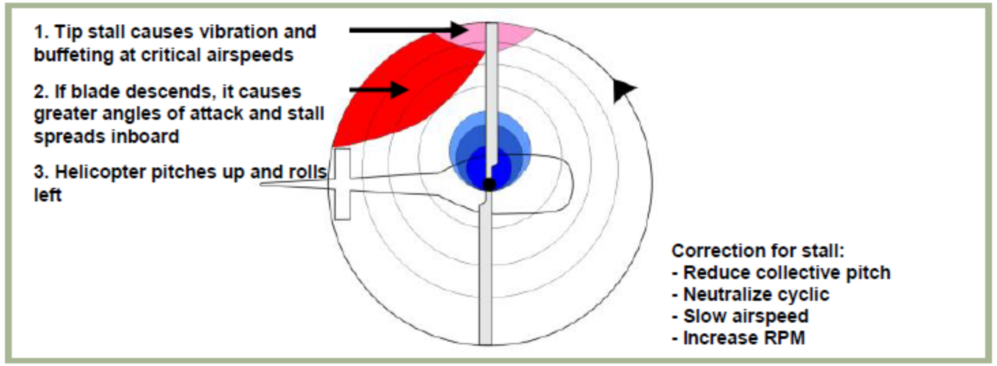
IN A NUTSHELL…

Did you ever wonder why your helicopter can never stay straight when you center your cyclic stick? The reason why you always need to hold your stick to your left and towards you is because the lift generated by your rotor blade is not equal everywhere on your blades. Therefore, the lift profile is **not symmetric.** "Lift dissymmetry" is just other fancy ways to refer to this phenomenon.

"Retreating Blade Stall" is a major factor in limiting a helicopter's maximum forward airspeed. Just as the stall of a fixed wing aircraft wing limits the low-airspeed flight envelope, the stall of a rotor blade limits the high-speed potential of a helicopter.



Normal Cruise Lift Pattern



Lift Pattern at Critical Airspeed

OGE VS IGE: UNDERSTANDING GROUND EFFECT

Ground effect is the increased efficiency of the rotor system caused by interference of the airflow when near the ground. The air pressure or density is increased, which acts to decrease the downward velocity of air. Ground effect permits relative wind to be more horizontal, lift vector to be more vertical, and induced drag to be reduced.

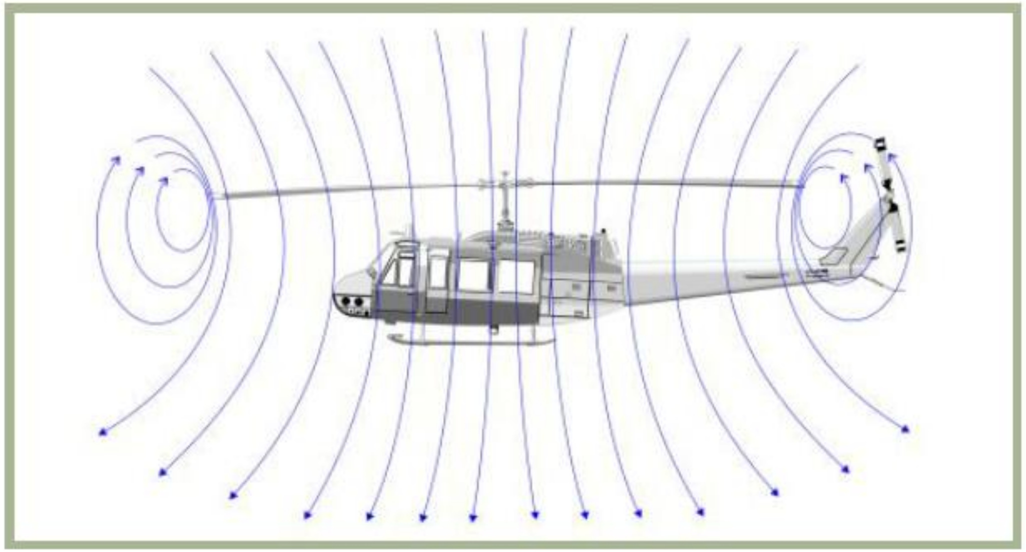
These conditions allow the rotor system to be more efficient. Maximum ground effect is achieved when hovering over smooth hard surfaces. When hovering over surfaces as tall grass, trees, bushes, rough terrain, and water, maximum ground effect is reduced. Rotor efficiency is increased by ground effect to a height of about one rotor diameter (measured from the ground to the rotor disk) for most helicopters. Since the induced flow velocities are decreased, the AOA is increased, which requires a reduced blade pitch angle and a reduction in induced drag. This reduces the power required to hover IGE.

The benefit of placing the helicopter near the ground is lost above IGE altitude, which is what we call OGE: Out of Ground Effect.

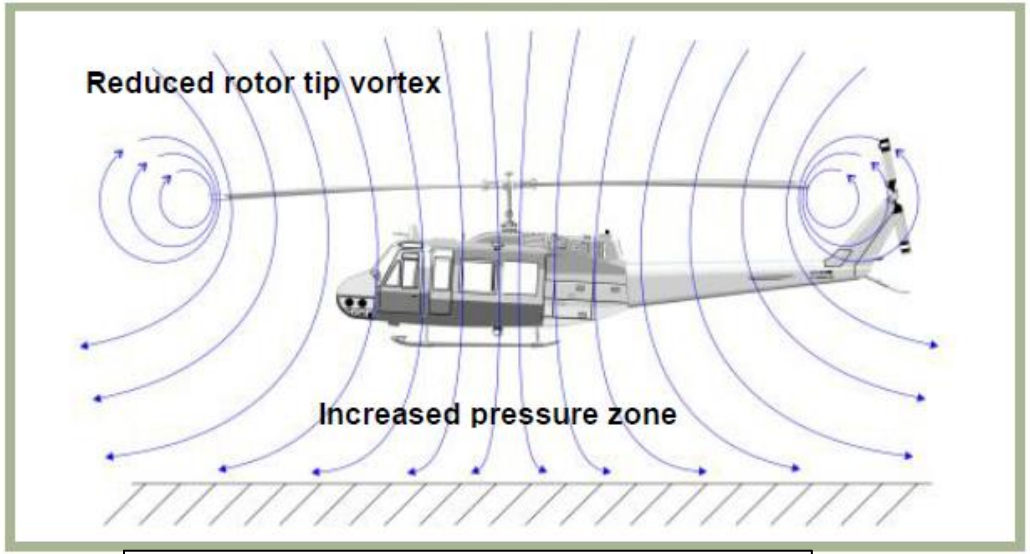
IN A NUTSHELL…

Ground Effect is what gives you additional lift when you are flying close to the ground. A hover, for instance, is much easier to maintain close to the ground torque-wise since ground effect is nullified at higher altitudes.

Ground effect is specially important on missions where you need to fly NOE (Nap-Of-Earth, where even lawnmowers dare not set foot).



Airflow when Out of Ground Effect (OGE)
(UH-1H)



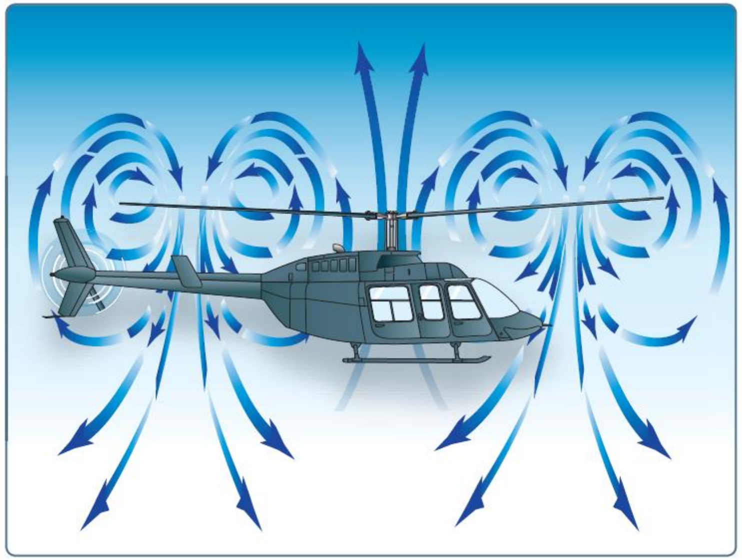
Airflow when In Ground Effect (IGE)
(UH-1H)

VORTEX RING STATE (VRS)

Vortex ring state describes an aerodynamic condition in which a helicopter may be in a vertical descent with 20 percent up to maximum power applied, and little or no climb performance. The term “settling with power” comes from the fact that the helicopter keeps settling even though full engine power is applied.

In a normal out-of-ground-effect (OGE) hover, the helicopter is able to remain stationary by propelling a large mass of air down through the main rotor. Some of the air is recirculated near the tips of the blades, curling up from the bottom of the rotor system and rejoining the air entering the rotor from the top. This phenomenon is common to all airfoils and is known as tip vortices. Tip vortices generate drag and degrade airfoil efficiency. As long as the tip vortices are small, their only effect is a small loss in rotor efficiency. However, when the helicopter begins to descend vertically, it settles into its own downwash, which greatly enlarges the tip vortices. In this vortex ring state, most of the power developed by the engine is wasted in circulating the air in a doughnut pattern around the rotor.

A fully developed vortex ring state is characterized by an unstable condition in which the helicopter experiences uncommanded pitch and roll oscillations, has little or no collective authority, and achieves a descent rate that may approach 6,000 feet per minute (fpm) if allowed to develop.



Vortex Ring State

WHY SHOULD YOU CARE?

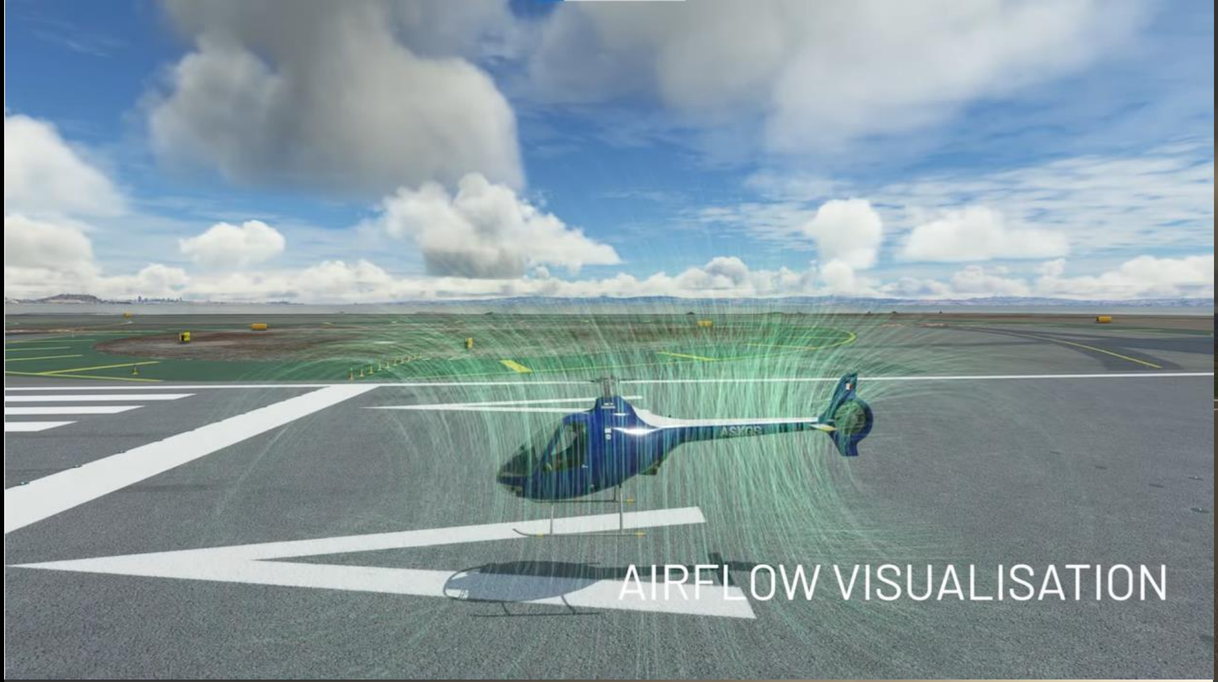
One of the biggest issues new pilots have is that they do not understand what VRS is, what it does, why it happens and how to counter it. In simple terms, if your **airspeed is below the ETL (Effective Translational Lift) speed of 16-24 kts** (which is the speed at which VRS usually occurs), you will experience a sudden loss of lift that will cause you to drop like a rock. VRS also occurs in situations where you have a **descent rate of 300 ft/min or greater**. More often than not, VRS happens when you are trapped in a column of disrupted air created by your own rotor blades, and this (unfortunately) often occurs at the most critical part of flight: on **LANDING.**

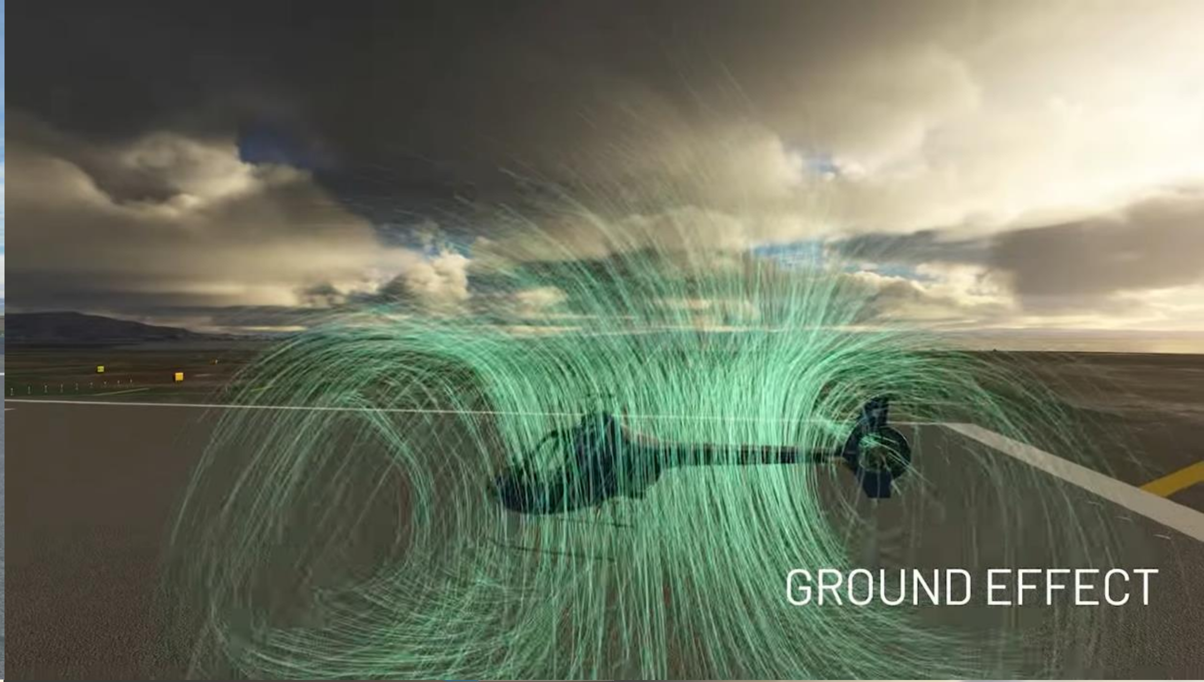
Oh, now I’ve got your attention? Good. One of the biggest problems Peter Pilots experience is to land their chopper. Even in real life, there are many pilots who do what we call a “hard landing” because they did not anticipate correctly the sudden loss of lift caused by VRS. A hard landing is when you impact the ground at a vertical speed that is too great, which causes structural damage to the landing gear, and possibly other structural components. The helicopter is not a total loss, but it will require extensive inspection and repairs, which costs time, money, and temporarily deprives the operator from one of its main sources of income.

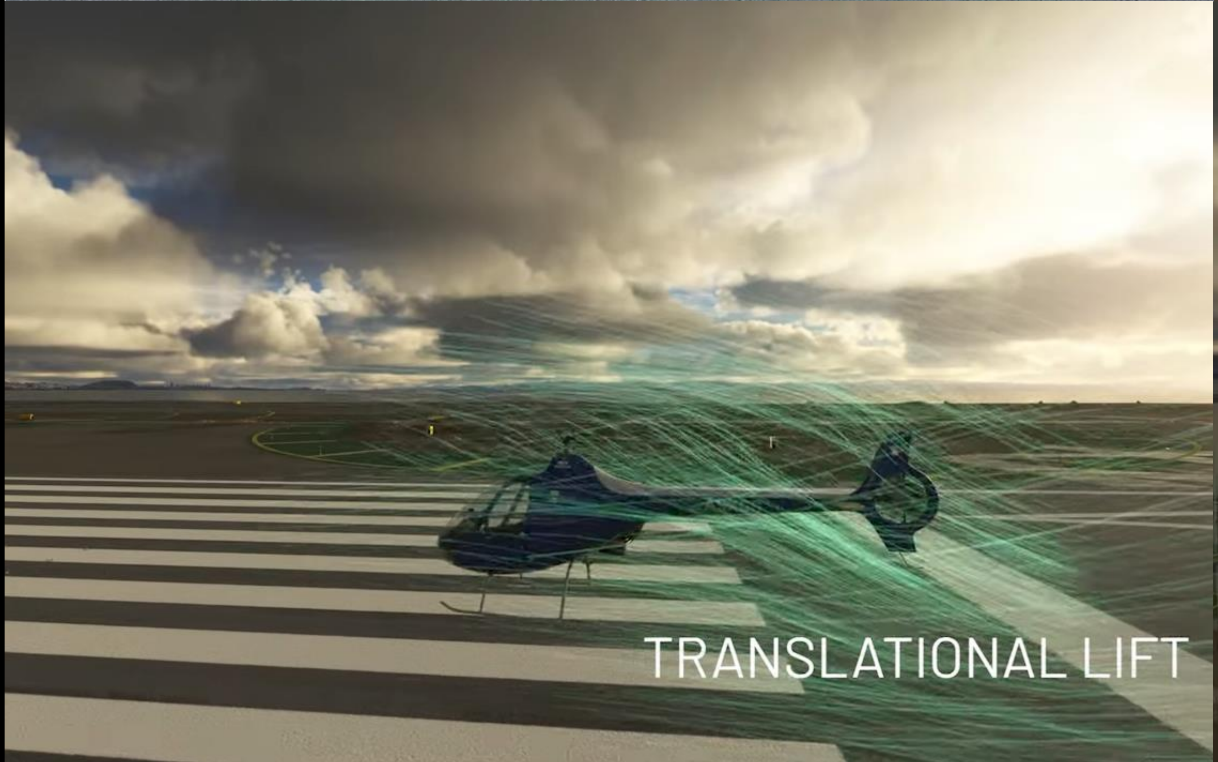
Countering VRS is easy if you pay attention to your airspeed and descent rate. Once you enter VRS, raising the collective (which is instinctively what someone would do) will do nothing at best, or aggravate the situation at worst. To reduce the descent rate, you need to get out of that column of disrupted air. You counter VRS by pointing the nose down (or in any direction) to pick up some speed and get away from these nasty vortices.
Note: Many pilots confuse VRS with the inertia of your machine. If you come in too fast and raise your collective too slowly, it is to be expected that you will crash.

VRS: VERIFY DESCENT RATE & SPEED

VRS Video by Matt Wagner: https://youtu.be/np5dpEXcmNU


AIRFLOW VISUALISATION

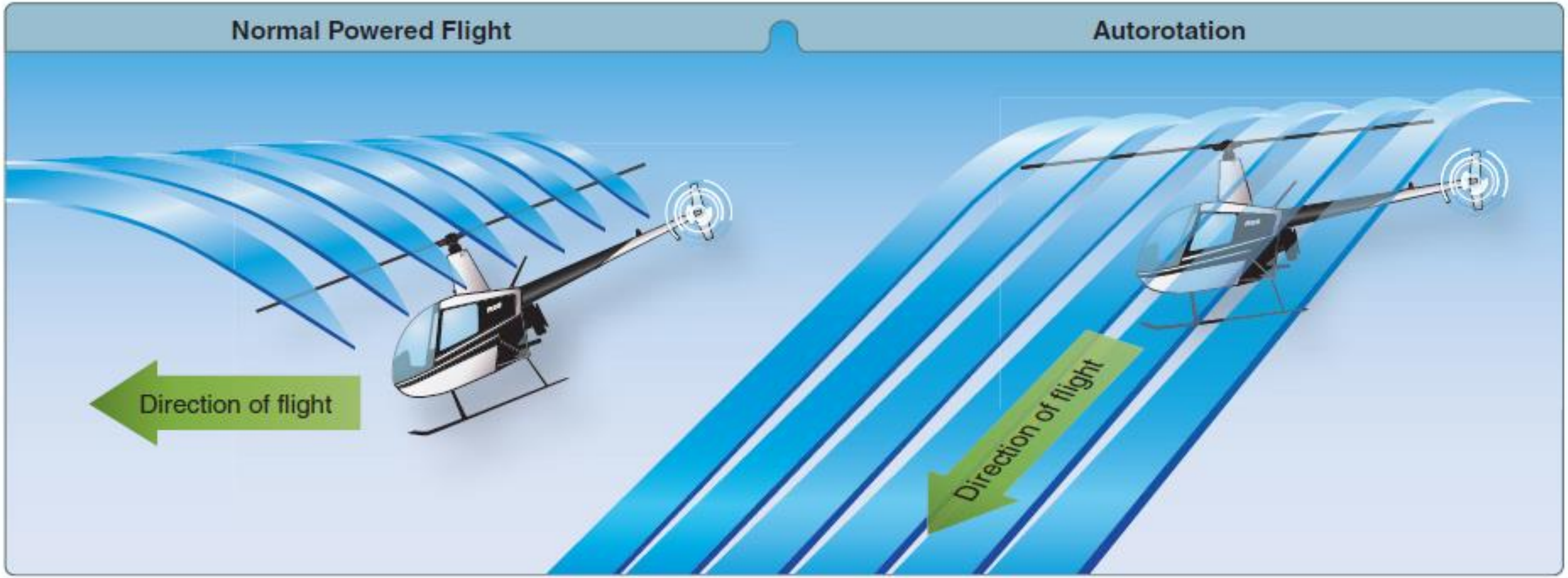

GROUND EFFECT


TRANSLATIONAL LIFT


RING VORTEX

AUTOROTATION

Autorotation is a flight state where your engine is disengaged from the rotor system and rotor blades are driven solely by the upward flow of air through the rotor. It can be caused by engine malfunction or engine failure, tail rotor failure or a sudden loss of tail rotor effectiveness.



During an autorotation, the upward flow of relative wind permits the main rotor blades to rotate at their normal speed. In effect, the blades are "gliding" in their rotational plane.

AH-64D APACHE

PART 10 – AUTOROTATION

AUTOROTATION – CORRECTIVE ACTIONS

WHY SHOULD YOU WANT TO SIMULATE AUTOROTATION?

Real life does not come with a “re-spawn” button. Life is imperfect: there is always a chance that you could lose engine power for a million reasons. In the world of DCS, odds are that you will be sent on dangerous (read: SUICIDAL) missions. There are very high chances that you will be fired upon. With so much crap flying in the air, you are bound to get zinged by something. This is why if you enter in an autorotation state, you MUST know what you do.

HOW TO SIMULATE AUTOROTATION

Autorotation can be simulated if you reduce one of your power levers to IDLE. Train yourself to deal with autorotation and you will be surprised to see how much better your flying will become.

AUTOROTATION RECOVERY EXAMPLE:

1. Find a good place to land first and make sure you are at 1500 ft or more.
2. Jettison weapons installed on pylons.
3. Simulate engine loss of power by reducing a Power Lever to IDLE.
4. Use TRIM RESET TO DEFAULT binding (LCTRL+T). This “simulator feature” allows the cyclic to be reset to its center position.
5. Apply right anti-torque pedal to center the helicopter, lower collective and pull up cyclic to compensate for sudden RPM loss: make sure the power turbine of the “live” engine reaches 101% N_P RPM.
6. Adjust cyclic for a constant descent between **77 kts (minimum rate of descent airspeed)** and **107 kts (maximum glide distance airspeed)**. In autorotation, as airspeed increases **above 70 – 80 kts**, the **rate of descent and glide distance increase significantly**. **Below 70 kts**, the **rate of descent will also increase but glide distance decreases**.
7. Maintain 101 % Main Rotor (N_R) RPM and 77-107 kts airspeed. **Maximum autorotation airspeed is 145 kts**.
8. *RECOVERY MODE: TOUCHDOWN* (no power, continue descent and land)
   a) Once condition at step 7) is respected , continue descent and do not touch power levers.
   b) At 75 to 125 ft AGL, apply aft cyclic to level out and decelerate. Descent rate should be around 300-500 ft/min.
   c) At 15 ft AGL, start flaring and raise collective with decision to cushion the landing: not too fast, not too slow.Keep in mind that you have wheels, not skids. This will be very helpful on landing. Tap your brake pedals to slow down once you are on the ground.

Here is a video demonstration of a touchdown autorotation recovery by “Eagle 7”.
LINK: https://youtu.be/fOsnba4-Hv8

Power (PWR) Levers (Left/Right Engines)
- ***OFF***
- ***IDLE***: *Sets Ground IDLE RPM*
- ***FLY***: *Sets N_R (Rotor RPM) for flight operations. Controlled N_R is 101 %, maintained by the PAS (Power Available Spindle)*
- ***LOCK OUT***: *Disables the turbine gas temperature (TGT) limiting system by locking out the DEC (Digital Engine Computer), allowing for manual control of engine RPM.*
  - *Note: After moving the power lever to LOCK OUT, it should immediately be returned to an intermediate position between IDLE and FLY. The pilot can then control engine RPM directly using the power lever.*

AIRCRAFT SPEEDS & SPECIFICATIONS

From the PERF (Performance) page, the following data is computed:

- HOVER Q:
  - Required Hover Q (Torque, %): Minimum torque needed for IGE (In Ground Effect) and OGE (Out of Ground Effect) conditions
  - GO/NO-GO Hover Q (Torque, %): Minimum torque needed to maintain a 5-ft hover at maximum gross weight.
    - Note: The flight crew can compare indicated torque to go/no-go torque when performing a hover check to determine if they are above maximum gross weight.
  - Indicated Torque (%): combined torque that the engines are presently generating. It is colored green, yellow, or red based on published torque limits.

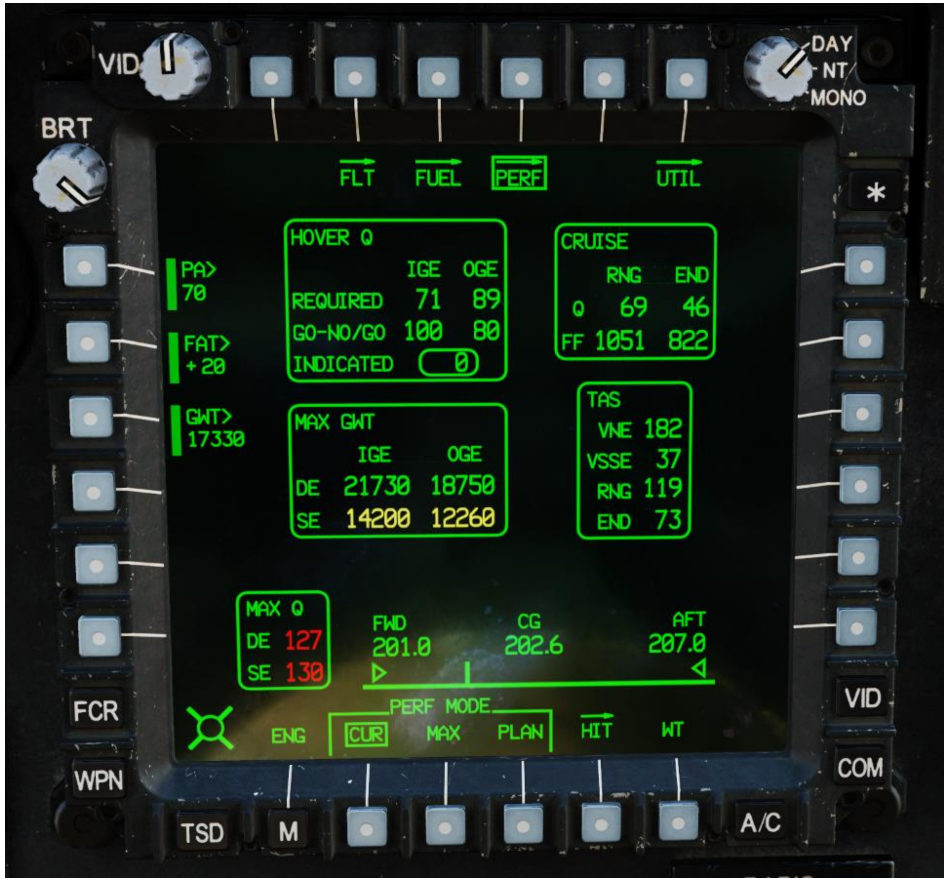
- CRUISE:
  - Q RNG/END: Maximum-range (RNG) or maximum-endurance (END) torque value (in percent).
  - FF RNG/END: Maximum-range (RNG) or maximum-endurance (END) fuel flow value (in pounds per hour).

- MAX GWT:
  - DE IGE/OGE: Maximum Gross Weight for maximum dual-engine (DE) operation In-Ground Effect (IGE) or Out of Ground Effect (OGE)
  - SE IGE/OGE: Maximum Gross Weight for 2.5-minute maximum single-engine (SE) operation In-Ground Effect (IGE) or Out of Ground Effect (OGE)

- TAS:
  - VNE (Do Not Exceed Speed), in knots (TAS, True Airspeed)
  - VSSE (Safe Single-Engine Speed), in knots (TAS, True Airspeed)
  - RNG: Maximum Range Cruising Speed, in knots (TAS, True Airspeed)
  - END: Maximum Endurance Cruising Speed, in knots (TAS, True Airspeed)

- MAX Q:
  - Max DE Q (Torque, %): Displays 10-minute max dual-engine (DE) torque. Value is displayed in yellow if above 100% and red if above 115%.
  - Max SE Q (Torque, %): Displays 2.5-minute maximum single-engine (SE) torque. Value is displayed in yellow if above 110% and red if above 125%.

- CG LIMITS:
  - CG Status: Displays the forward and aft center of gravity limits and the current center of gravity (in inches).



AIRSPEED & MANOEUVERING LIMITS

- V_{NE} (Never Exceed Speed): Determined as a function of weight, altitude and temperature (see PERF page).
- Maximum Airspeed for Autorotation: 145 kts
- Maximum Rearward/Sideward Flight Speed: 45 kts (for all gross weights)
- Maximum Airspeed for Searchlight Extension: 90 kts.
- Maximum Airspeed with Symmetrically Loaded External Fuel Tanks (2 or 4) installed: 130 kts
- Maximum Airspeed for Stores Jettison: 130 kts
- Maximum Airspeed for External Tanks Jettison: 100 kts

- Intentional manoeuvers beyond attitude +/- 30 deg in pitch or +/- 60 deg in roll are prohibited.
- Avoid large pedal step inputs in arresting right hovering/low speed yawing turns greater than 60 deg/sec.
- Do not complete a landing on terrain which produces a pitch attitude change from a hover greater than 7 deg nose up or 12 deg nose down or a roll attitude greater than 10 deg.
- Do not exceed 2 Gs when flying with external fuel tanks.

COMBAT EMPLOYMENT

The basic building block of any attack helicopter unit is an **Air Weapons Team** (**AWT** or simply “team”) of two AH-64’s under the control of an **Air Mission Commander (AMC)**, which is typically the most experienced Pilot-in-Command (PC) in the flight. The AMC’s responsibilities include:

- Ensuring success of the team’s mission
- Managing the movement and manoeuver of the team
- Weapons release authority for the team

Source: Eagle Dynamics AH-64D Manual

In the general sense, manoeuverability is the primary consideration for the Air Weapons Team. Here are a few **guidelines**:

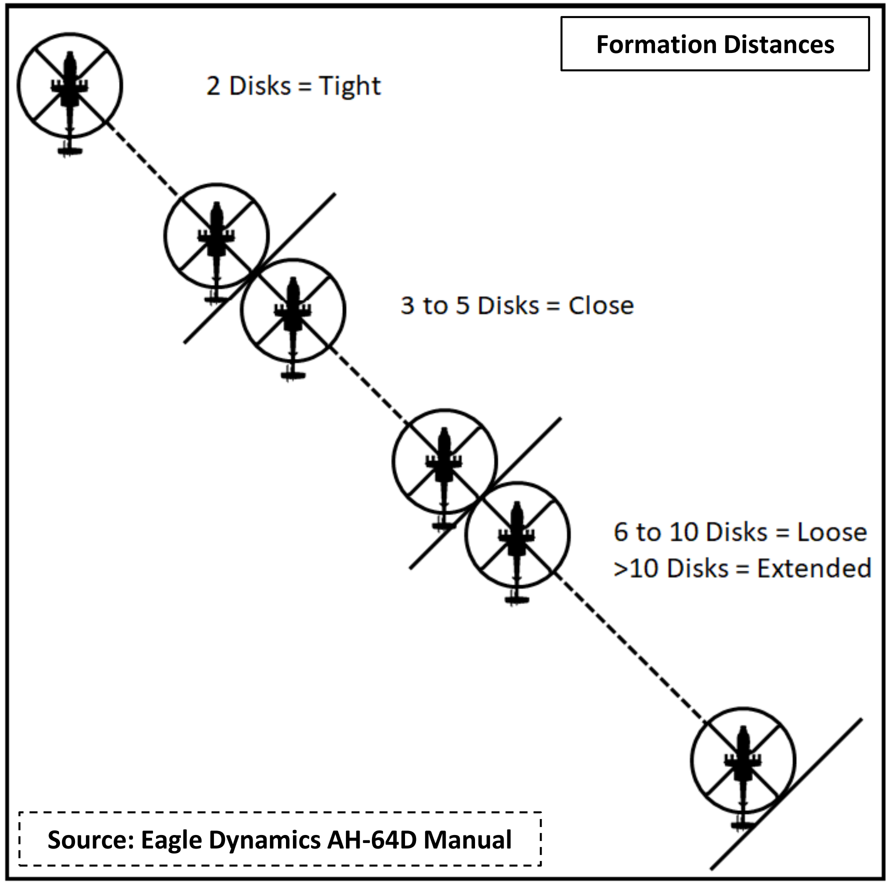
- The “Lead” should manoeuver in predictable ways for the “Wing” to facilitate formation cohesion.
- The Wing should never inhibit the Lead’s ability to manoeuver and should always be able to provide suppressive fire for Lead.
- Distance between helicopters can vary based on terrain, proximity to the ground, illumination/visibility, and expected or known enemy threats. Typical distances range from 3 to 5 rotor discs up to a kilometer or more. Distances are typically greater when over open terrain, whereas distances between aircraft will be less when operating in restrictive terrain (like valleys or urban areas).

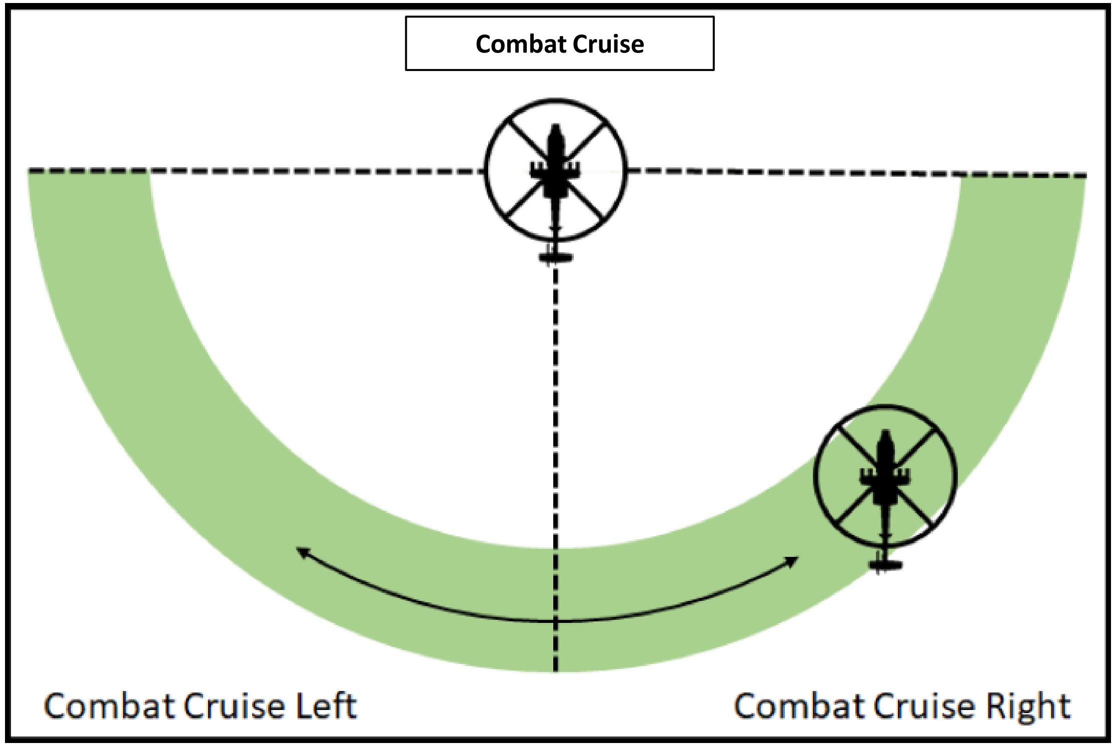
COMBAT EMPLOYMENT

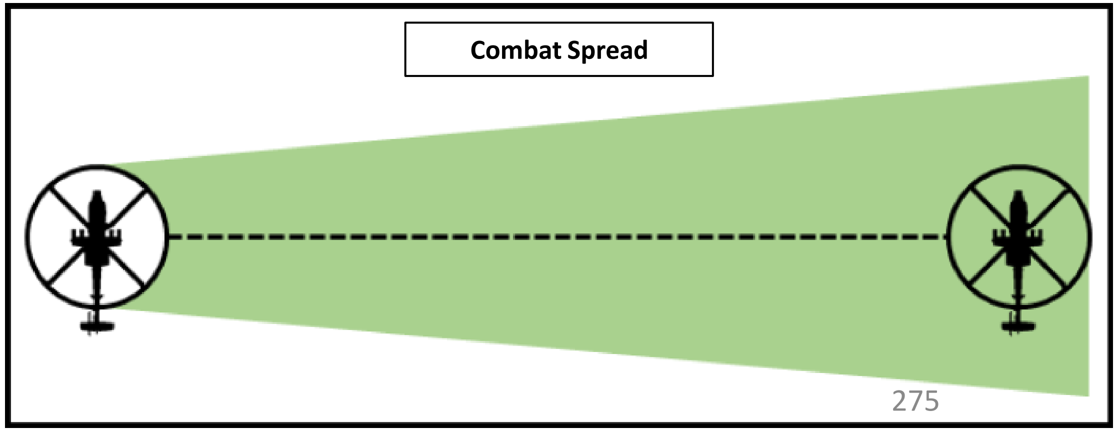
Combat Cruise is the standard formation for AWT employment. It is generally more useful at very low altitudes and provides the most flexibility for the flight while minimizing predictability. The Wing's position aims to provide support to the Lead if unexpected enemy units are encountered.

Combat Spread is meant to maximize forward firepower with overlapping sensor fields-of-view and weapons coverage, but at the expense of ease of manoeuverability and team flexibility. Combat Spread requires a high degree of scanning and coordination between pilots in each aircraft, particularly at night due to NVS (Night Vision Sensor) limitations. Distance between aircraft should be based on manoeuvering room, visibility, terrain, and expected enemy contact.

Source: Eagle Dynamics AH-64D Manual







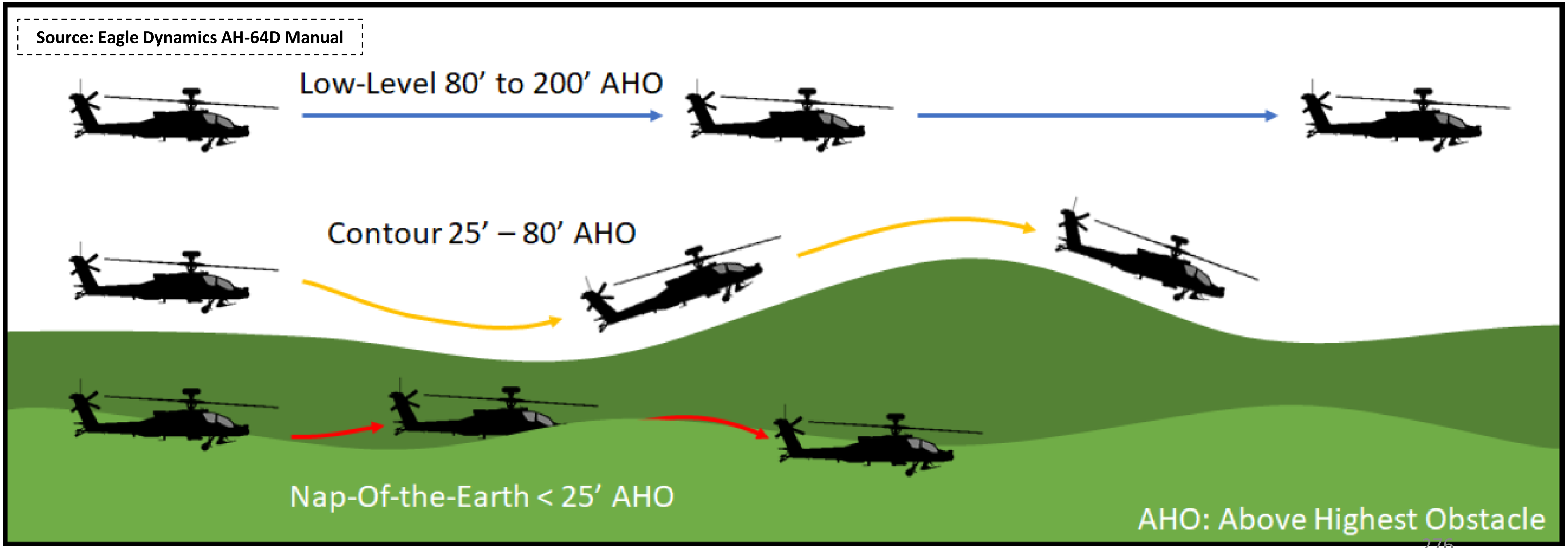
COMBAT EMPLOYMENT

The purpose of terrain flight and the associated modes of flight is to deny enemy forces the ability to acquire, track and engage the aircraft. Terrain flight requires constant scanning to locate and avoid obstacles, particularly at night. The modes of terrain flight are defined as:

- **Nap-of-the-earth (NOE) flight** is as close to the earth's surface as vegetation and obstacles permit, typically up to 25 feet above the highest obstacle (AHO). Crews will typically perform "Bounding Overwatch" movement, where one aircraft provides cover while the other aircraft moves. This mode of flight requires good training and a lot of concentration in order to avoid colliding with obstacles.

- **Contour flight** is at low altitude conforming to the contours of the earth, typically between 25 to 80 feet AHO. Crews will typically perform "Traveling Overwatch" movement and utilize Combat Cruise as their formation.

- **Low-level flight** is at constant altitude and airspeed, typically between 80 to 200 feet AHO. Crews typically perform "Travelling" movement to rapidly transit from one place to another. Keep in mind that this method provides the least amount of security for unexpected enemy encounters.

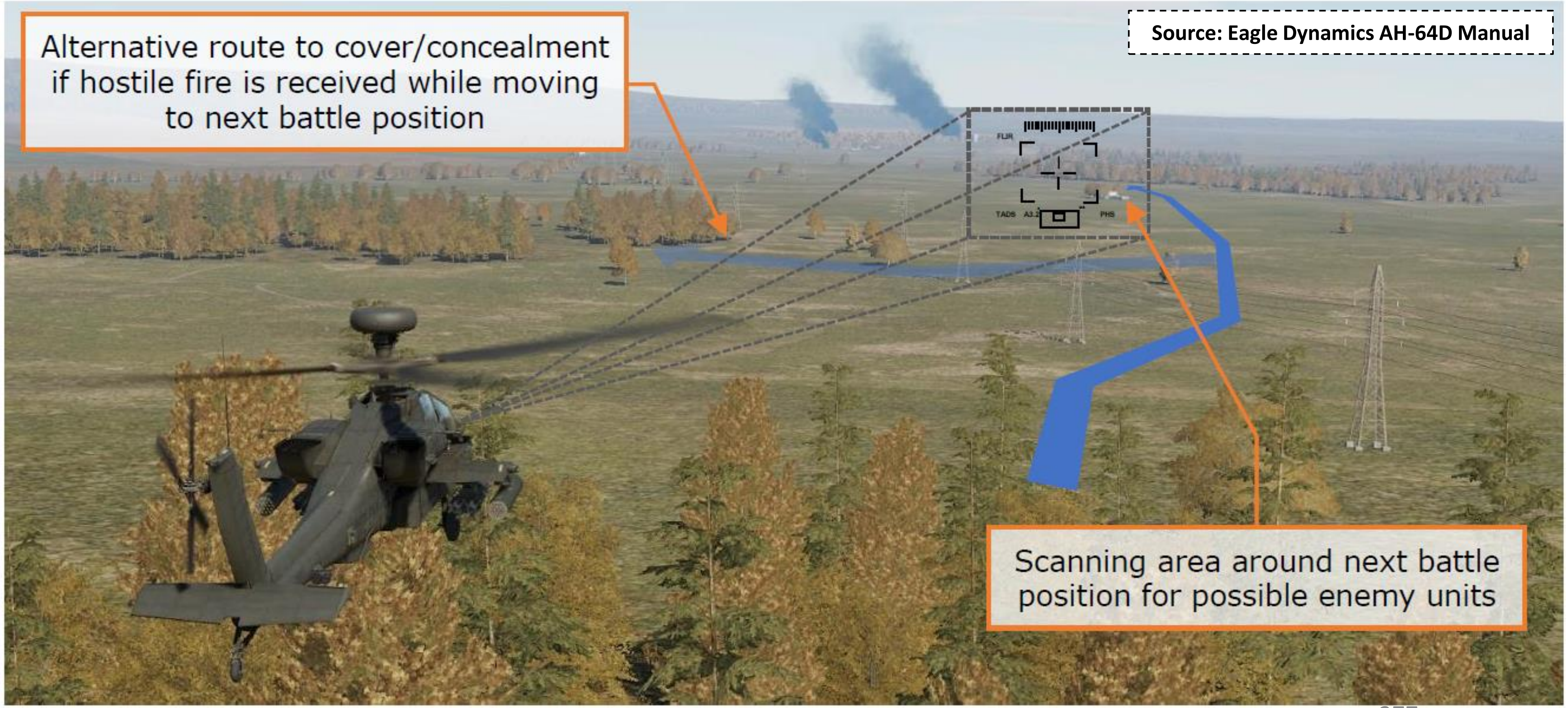


Terrain Flight Modes

COMBAT EMPLOYMENT

Planning is an essential aspect of flying the AH-64. Even before climbing into the cockpit, air routes, terrain, suspected/known enemy positions, enemy weapon systems, and even the weather, should all be evaluated to understand how each factor will affect the aircrew's ability to operate. Terrain allows you to mask your position and movements from the enemy. Blindly bounding from one position to the next without performing reconnaissance of the route to that next position, and any potential fields of observation or fire, is a good way to catch lead in the face.

Whenever possible, an attack helicopter aircrew should always choose a **Battle Position** (BP, a defensive location oriented on a likely enemy avenue of approach) that places the enemy within the maximum effective range of their weapons, while remaining outside the maximum effective range of the enemy's range (standoff). When standoff cannot be maintained due to changes on the battlefield, the aircrew can utilize its mobility to rapidly re-position the attack helicopter to regain and maintain that standoff for as long as possible. This maximizes the attack helicopter's effectiveness against the enemy, while minimizing the enemy's ability to engage it.



Reconnaissance next to BP (Battle Position) with alternative sources of cover

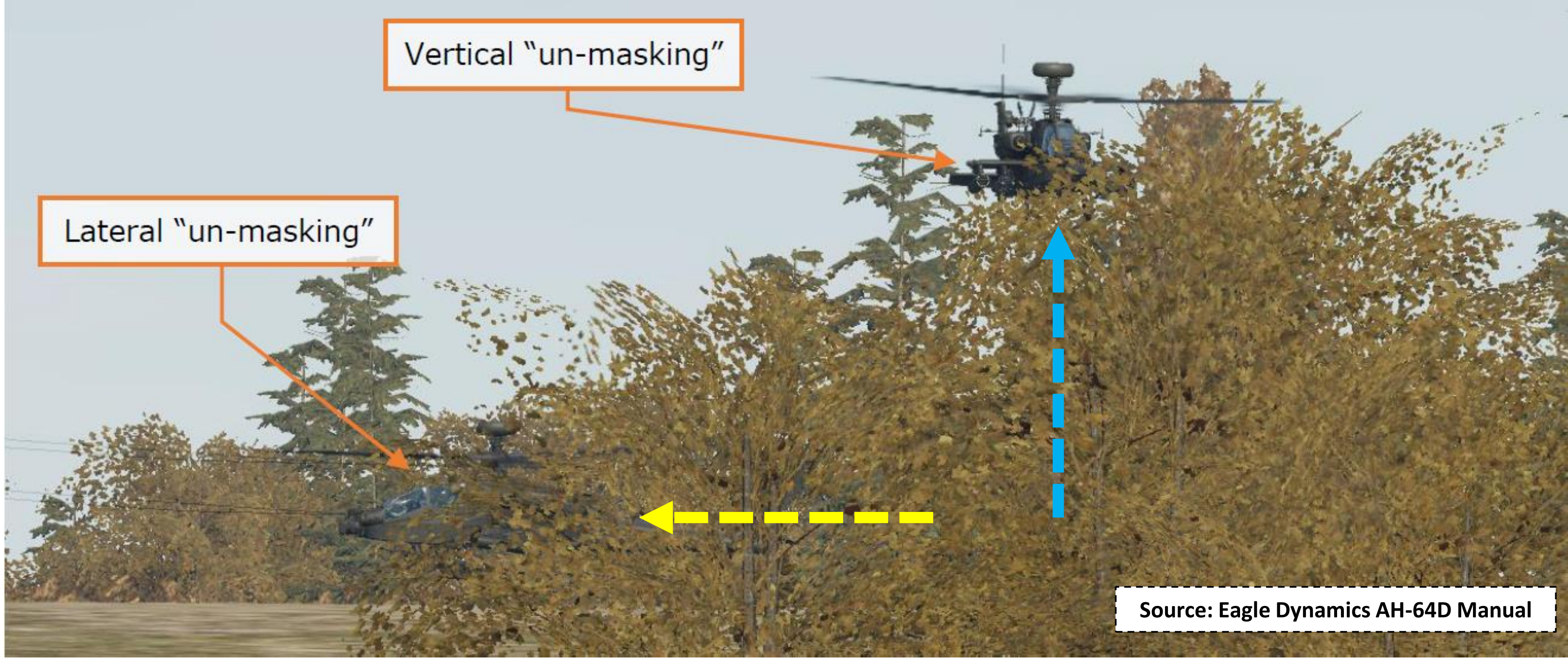
COMBAT EMPLOYMENT

Attack helicopters should use cover and concealment whenever possible (known as "masking"), bounding from one battle position to the next to minimize exposure to enemy fire. The best practice is to remain undetected for as long as possible until ready to attack. To perform sensor scans of the battlefield or engage enemy targets with their weapon systems, attack helicopters must "un-mask" from behind cover/concealment.

Depending on the nature of the cover/concealment and the tactical situation, attack helicopters can un-mask vertically or laterally (from the side) to expose their sensors or weapon systems while keeping an escape route available if things go pear-shaped.

When an attack is initiated, the enemy should be engaged within the shortest amount of time possible before re-masking and relocating to a different battle position.

Weapon fire reveals your presence to the enemy, just as a sniper reveals his position by firing on the enemy. This is why constantly relocating is crucial to ensure your survival.



Un-masking from behind cover

QUICK TIPS

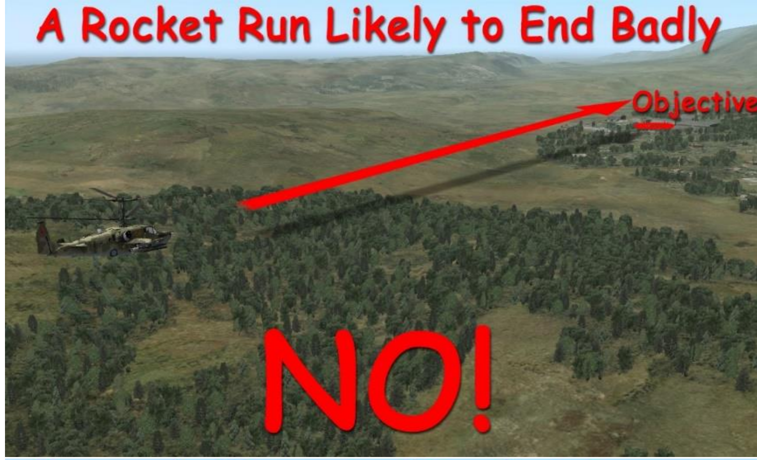
I recommend the "10 RULES TO LIVE BY: **DCS Black Shark Tactics Primer"** by Realandsimulatedwars. It's an oldie but a goldie; these concepts are explained for the Ka-50 Black Shark, but most of them are also very much applicable to the AH-64 as well.

Link: http://realandsimulatedwars.yolasite.com/dcs-black-shark-tactics-primer.php

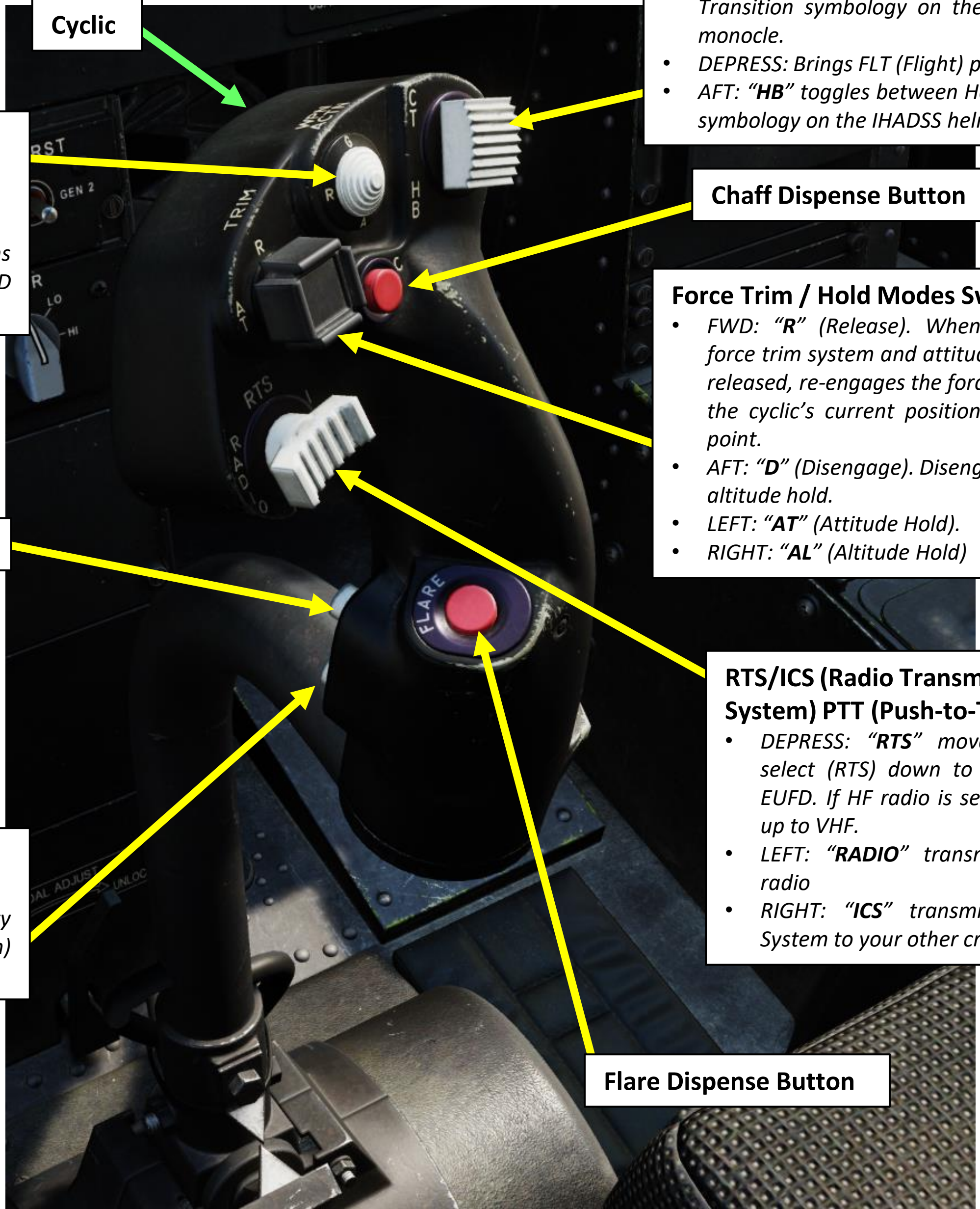
- **Rule #1: Never fly over the objective**
- **Rule #2: Fire munitions from their maximum range**
- **Rule #3: Avoid the "Dead Man's Zone"**
- **Rule #4: New Area = DANGER ZONE!**
- **Rule #5: There is no such thing as too much reconnaissance**
- **Rule #6: Identify your targets**
- **Rule #7: Preserve ammunition**
- **Rule #8: Know the operational situation**
- **Rule #9: Attack the enemy from your maximum munition range and on its flanks**
- **Rule #10: Lack of patience will kill you**

There are other great resources such as **KriegSimulation's "Nap-of-the-Earth" article**
http://kriegsimulation.blogspot.ca/2009/10/dcs-black-shark-nap-of-earth-noe-flying.html

Robdcamp's forum thread on SIMHQ is also enlightening to help you survive AAA threats:
http://simhq.com/forum/ubbthreads.php/topics/2915432/Guide_to_Surving_MANPADS_AAA_a.html#Post2915432



HOCAS (HANDS-ON COLLECTIVE AND STICK)
CYCLIC



Cyclic

Symbology Select Switch
- *FWD: “**CT**” toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: “**HB**” toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

Weapon Action Switch (WAS)
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Chaff Dispense Button

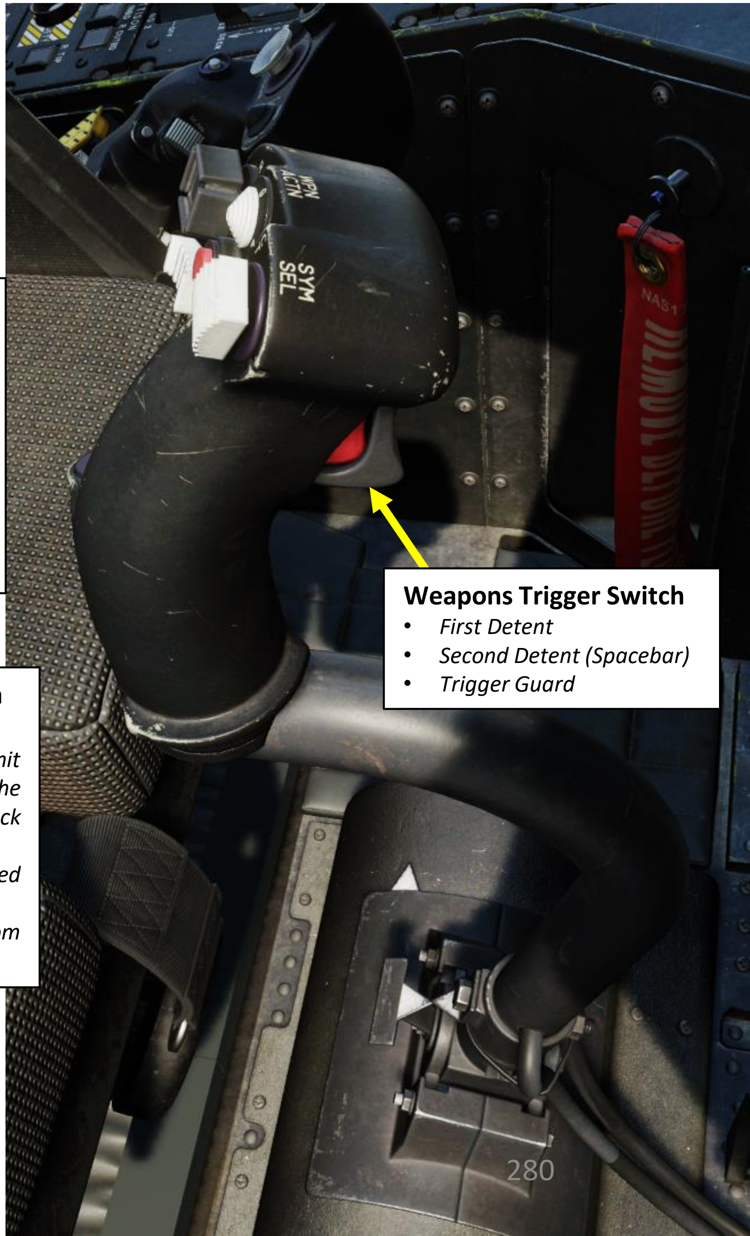
Force Trim / Hold Modes Switch
- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*
- *AFT: “**D**” (Disengage). Disengages attitude and altitude hold.*
- *LEFT: “**AT**” (Attitude Hold).*
- *RIGHT: “**AL**” (Altitude Hold)*

No Function

RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch
- *DEPRESS: “**RTS**” moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: “**RADIO**” transmits over the selected radio*
- *RIGHT: “**ICS**” transmits over the Intercom System to your other crew member.*

FMC (Flight Management Computer) Release Button
- *Disengages all FMC SCAS (Stability and Augmentation Control System) channels.*

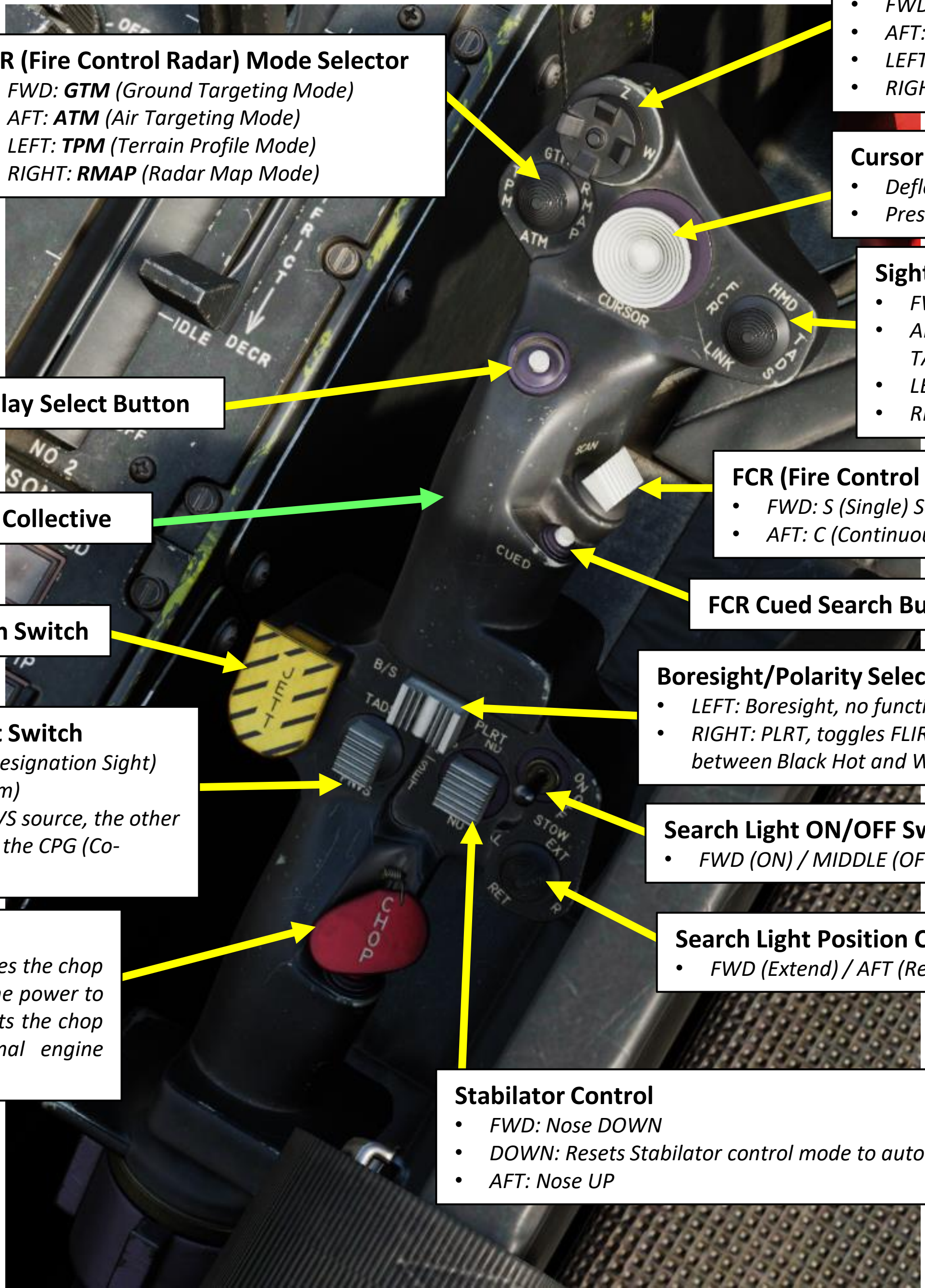
Flare Dispense Button



Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

HOCAS (HANDS-ON COLLECTIVE AND STICK)

COLLECTIVE



FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

Cursor Display Select Button

Collective

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

FCR Cued Search Button

Emergency Jettison Switch

Boresight/Polarity Selector
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

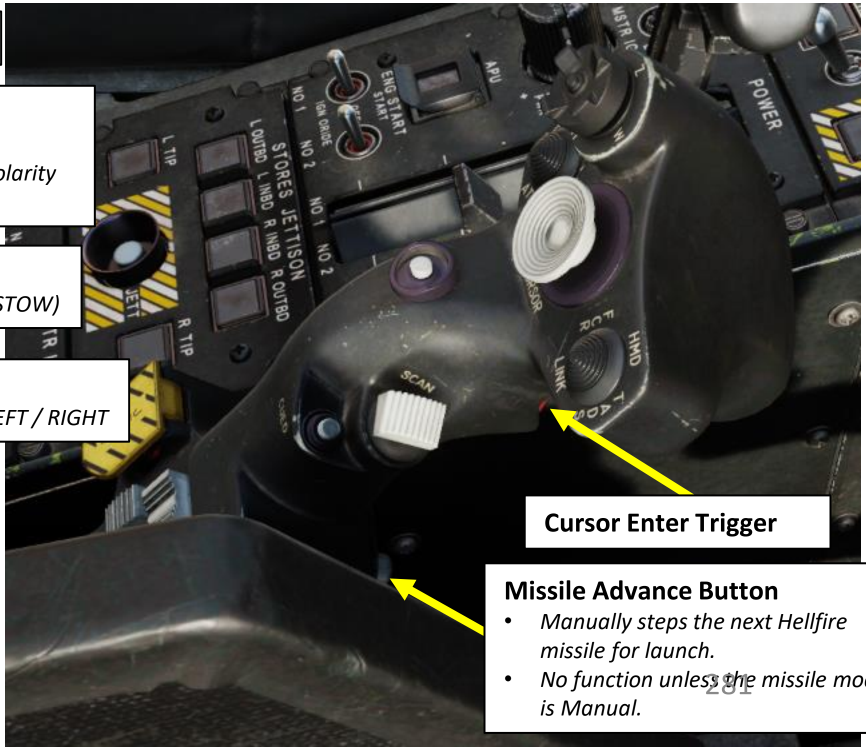
NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

Search Light ON/OFF Switch
- *FWD (ON) / MIDDLE (OFF) / AFT (STOW)*

Engine Chop Button
- *Pressing this button activates the chop circuit, which reduces engine power to IDLE. Pressing it again resets the chop circuit and restores normal engine power.*

Search Light Position Control
- *FWD (Extend) / AFT (Retract) / LEFT / RIGHT*

Stabilator Control
- *FWD: Nose DOWN*
- *DOWN: Resets Stabilator control mode to automatic*
- *AFT: Nose UP*



Cursor Enter Trigger

Missile Advance Button
- *Manually steps the next Hellfire missile for launch.*
- *No function unless the missile mode is Manual.*

TEDAC (TADS ELECTRONIC DISPLAY AND CONTROL) LEFT HAND GRIP

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TADS (Target Acquisition & Designation Sight) FOV (Field-of-View) Selector
- *FWD: Z (Zoom FOV)*
- *AFT: M (Medium FOV)*
- *LEFT: N (Narrow FOV)*
- *RIGHT: W (Wide FOV)*

TADS Sensor Select Switch
- *Selects the optical sensor used for TADS. No function if the TADS is being used by either crewmember as an NVS sensor.*
  - *FWD: FLIR (Forward-Looking Infrared) used by TADS*
  - *MIDDLE: DTV (Daytime Television) Sensor*
  - *AFT: DVO, no function.*

IAT/OFS Switch
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

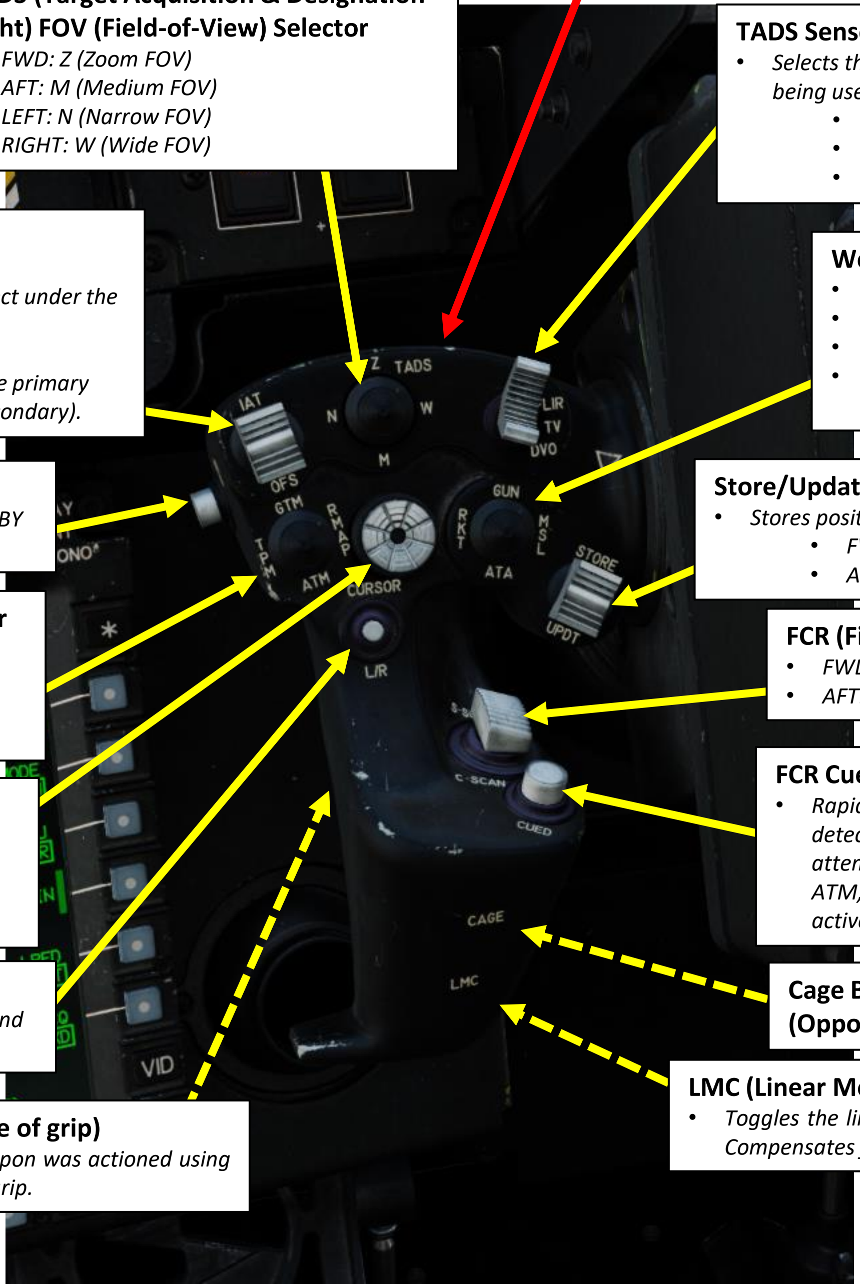
Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Video Record Button
- *Toggles the VCR between STOP/STANDBY and RECORD mode.*

Store/Update Switch
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*



Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

FCR Cued Search Button
- *Rapidly orients the FCR antenna towards a threat emitter detected by the RFI. Scans in the direction of the emitter and attempts to correlate the location of the emitter in the GTM, ATM, or RMAP targeting modes. No function if FCR is not the active sight and the master arm isn't in ARM.*

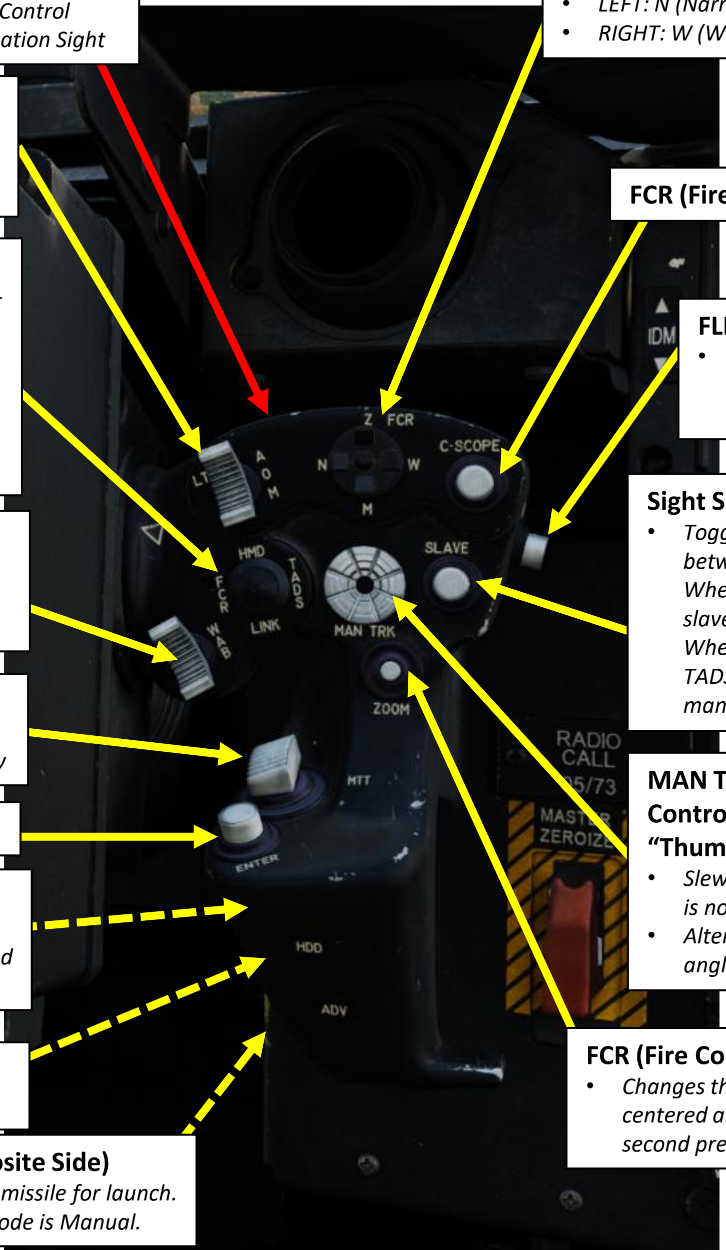
Cursor Display Select Button
- *Toggles the cursor to the other MPD and centers it on the screen.*

Cage Button (No Function) (Opposite Side)

TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

LMC (Linear Motion Compensator) Button (Opposite Side)
- *Toggles the linear motion compensator (LMC) during manual tracking. Compensates for helicopter and/or target movement.*

TEDAC (TADS ELECTRONIC DISPLAY AND CONTROL) RIGHT HAND GRIP



TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

LST (Laser Spot Tracker) Mode Switch
- *FWD: A (Automatic)*
- *MIDDLE: OFF*
- *AFT:M (Manual)*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

IAT (Image Auto Tracker) Polarity Switch
- *FWD: WHITE, bright objects are tracked by the IAT.*
- *MIDDLE: **AUTO**, polarity is automatically selected by the IAT*
- *AFT: BLACK, dark objects are tracked by the IAT.*

TADS MTT (Multi-Target Tracker) Track Promote Switch
- *FWD:Steps to the next TADS track and promotes it to primary*
- *AFT:Steps to the previous TADS track and promotes it to primary*

Cursor Enter Button

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)
- *First detent: LRFD determines target range.*
- *Second detent: LRFD determines target range and designates target for laser guidance and engages the TSE (Target State Estimator).*

HDD Button (No Function) (Opposite Side)

Missile Advance Button (Opposite Side)
- *Manually steps the next Hellfire missile for launch. No function unless the missile mode is Manual.*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

FCR (Fire Control Radar) C-Scope Button

FLIR Polarity Button
- *Toggles FLIR (Forward-Looking Infrared) image polarity (black-hot or white-hot).*

Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"
- *Slews TADS line-of-sight when "Slave mode" is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

FCR (Fire Control Radar) Zoom Button
- *Changes the FCR targeting format to a 6× zoom, centered around the Next-To-Shoot (NTS). A second press restores the normal FCR format.*


TAD
FCR
PNV
G/S
LEV
GAIN
R/F
EL
AZ
SYM
RES
ENTER
CLR

SECTION SUMMARY

SECTION SUMMARY

- **6 – AN/APR-48A RFI (Radio Frequency Interferometer)**

1 – INTRODUCTION
1.1 – Sensors & Sights Overview

The AH-64 is equipped with an impressive variety of sights and sensors. The main sensors are:

- The **AN/ASQ-170 TADS** (Target Acquisition & Designation Sight), which has the ability to locate, track, and laser designate targets day and night, and in bad weather conditions.
- The **AN/AAQ-11 PNVS** (Pilot Night Vision System), which provides day- and night-capable infrared vision.
- The **AN/APG-78 FCR** (Fire Control Radar), which is an air-to-ground and air-to-air radar with the capability to locate and independently track up to 128 surface targets.
- The **AGM-114K Hellfire Missile Seeker**, which has its own ability to detect and track laser-designated targets.
- The **AN/APR-48A RFI** (Radio Frequency Interferometer), which provides coverage identification and direction of radar emitters.

1 – INTRODUCTION
1.1 – Sensors & Sights Overview

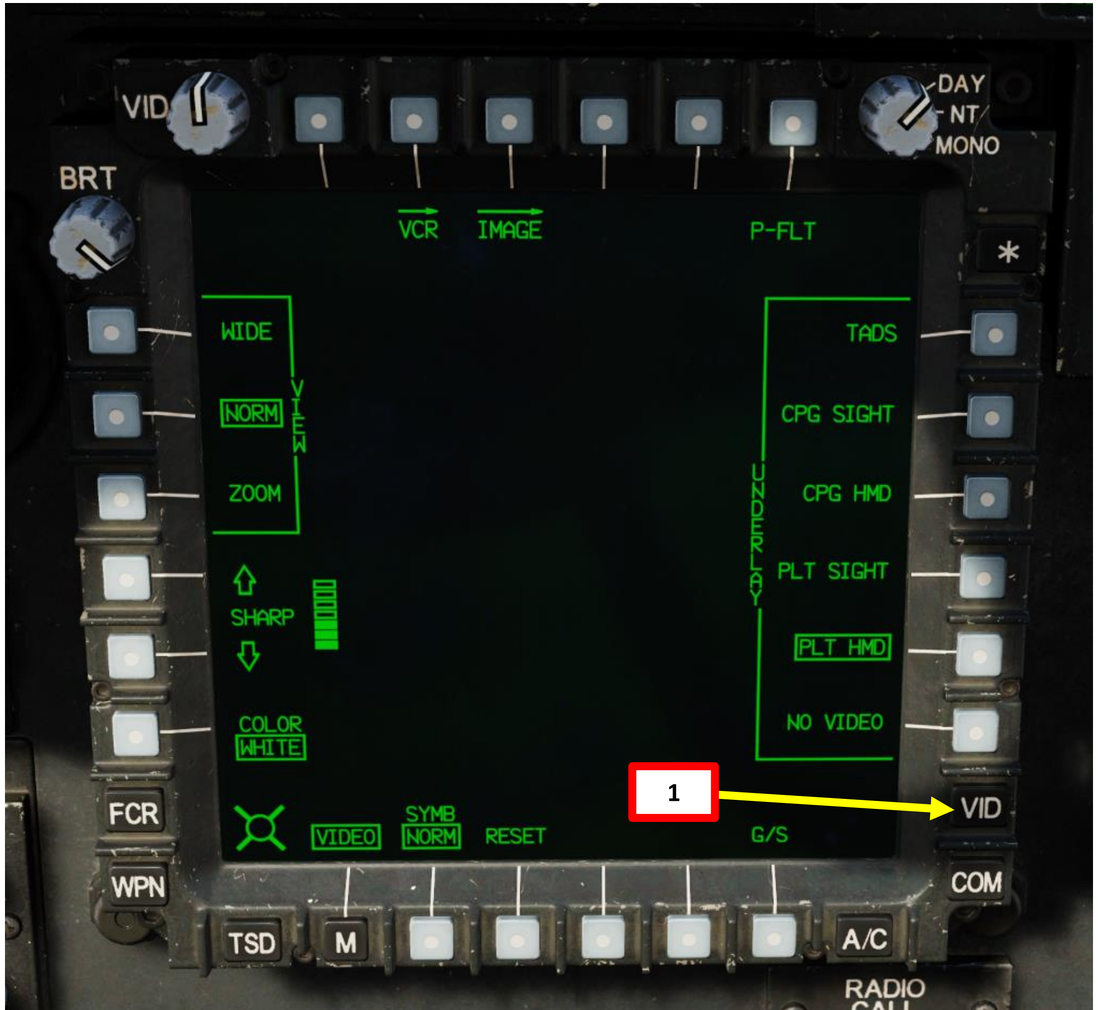
The **TDU** (TEDAC Display Unit) displays the TADS (Target Acquisition & Designation Sight) video feed. The TDU can also be used to interface with the FCR (Fire Control Radar) and the PNVS (Pilot Night Vision System).

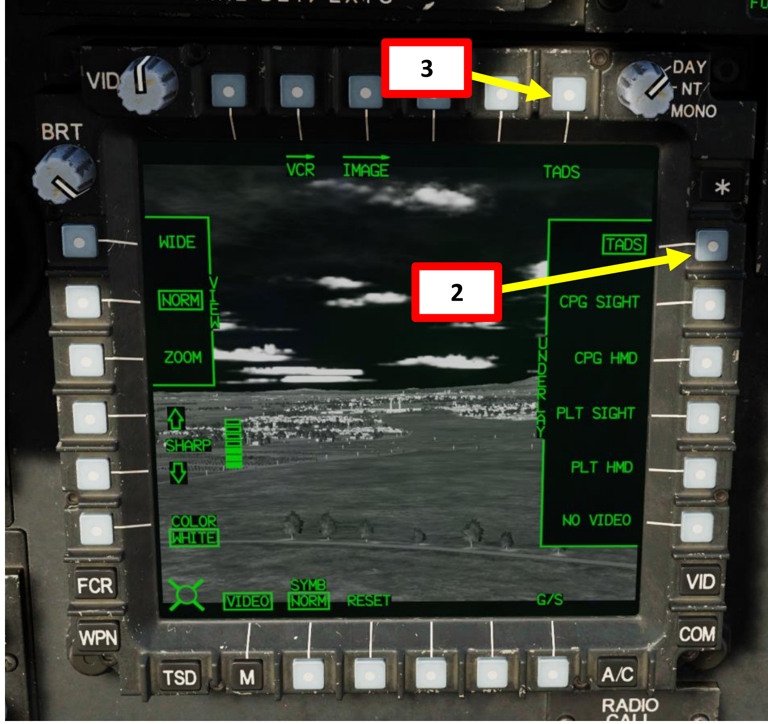
TDU (TEDAC Display Unit)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

1 – INTRODUCTION
1.1 – Sensors & Sights Overview

MPDs (Multi-Purpose Displays) can show video from aircraft sensors and allows the crewmembers to set video underlays and configure video settings. This is useful for the pilot to use the **VIDEO page** as a repeater.

In this example, the pilot selects the TADS feed on the VIDEO page.





1 – INTRODUCTION
1.1 – Sensors & Sights Overview

The primary sensor and sighting system for the AH-64 is the **IHADSS** (Integrated Helmet and Display Sighting System). The IHADSS displays sensor, targeting, and aircraft information in the crewmember's line-of-sight on the **HDU** (Helmet Display Unit) monocle, helping the crewmembers to locate and track targets and maintain situational awareness. The HDU symbology format changes depending on its display mode, which is controlled by the crew.

1 – INTRODUCTION
1.1 – Sensors & Sights Overview

The IHADSS (Integrated Helmet and Display Sighting System) HDU (Helmet Display Unit) is also capable of overlaying calibrated video data from Forward-Looking Infrared (FLIR) or Day Television (DTV) sensors. The video data can come from the TADS (Target Acquisition & Designation Sight) or the PNVS (Pilot Night Vision System) depending on what video source is selected.

PNVS (Pilot Night Vision System) Overlay on Pilot HDU (Helmet Display Unit)

TADS Overlay on Co-Pilot/Gunner HDU (Helmet Display Unit)

TADS Feed on TDU (TEDAC Display Unit)

1 – INTRODUCTION
1.2 – Sight Selection

The principle of “Sight Selection” in the AH-64 can be simplified as: what am I using to aim with?

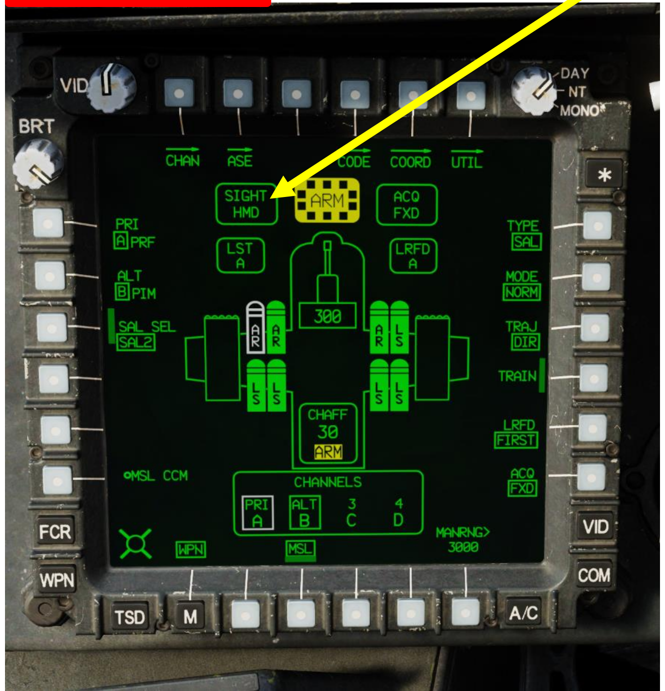
Controlling which sight is selected is fairly straightforward: there are **Sight Select** switches on both the pilot and co-pilot **collective**, but there is also a **Sight Select switch** on the **TEDAC Right Hand Grip** that can be used exclusively by the co-pilot.

1 – INTRODUCTION
1.2 – Sight Selection

The indication of which sight is selected can be found in:
- The Weapon Page
- The TDU (TADS Display Unit)
- On both the pilot and the co-pilot/gunner HDU (Helmet Display Unit) monocle.

Sight Selection (Crewmember's selected sight)
- *HMD (Helmet Display)*
- *FCR (Fire Control Radar)*
- *TADS (Target Acquisition & Designation Sight)*

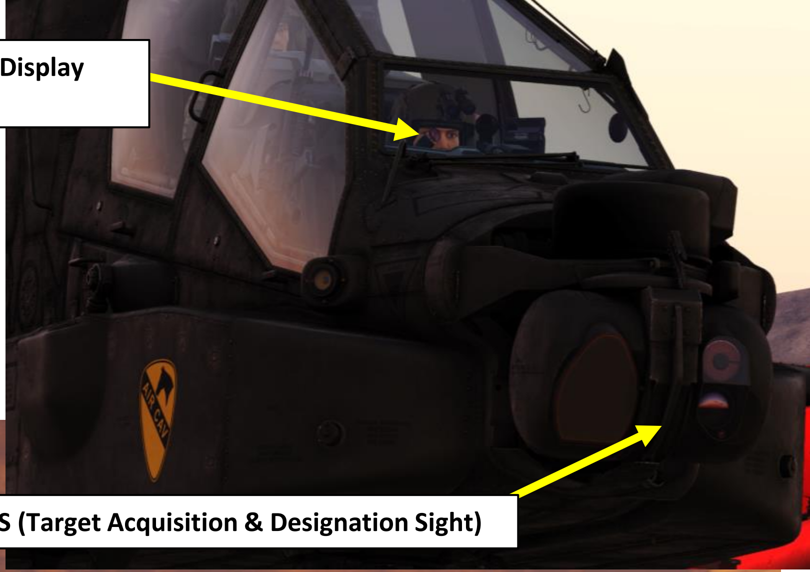
Weapon MPD Page

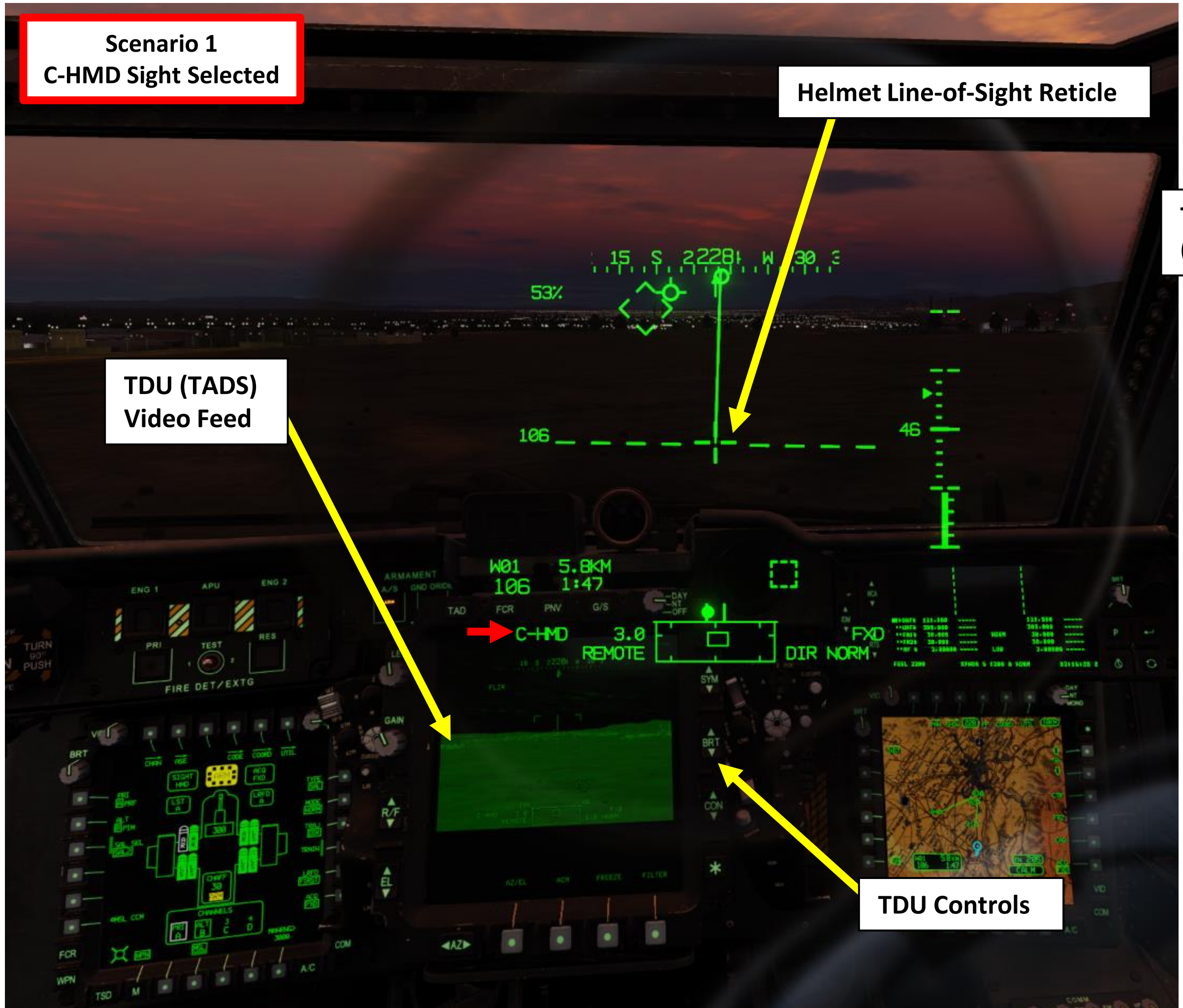


1 – INTRODUCTION
1.2 – Sight Selection

Here are two scenarios to illustrate how sight selection works. More practical examples will be shown in the Weapons section.

- Scenario 1: **C-HMD (Co-Pilot Helmet Display) Sight is selected**. This means that the helmet is used as the primary sight. Incidentally, TDU (TEDAC Display Unit) controls for Symbology will only affect the HDU (Helmet Display Unit).
- Scenario 2: **TADS is selected as a sight**. This means that the TADS is used as the primary sight, which will overlay the TADS FLIR on the co-pilot's HDU (Helmet Display Unit). Your monocle will look "through" the TADS, and TDU controls will affect the TADS.

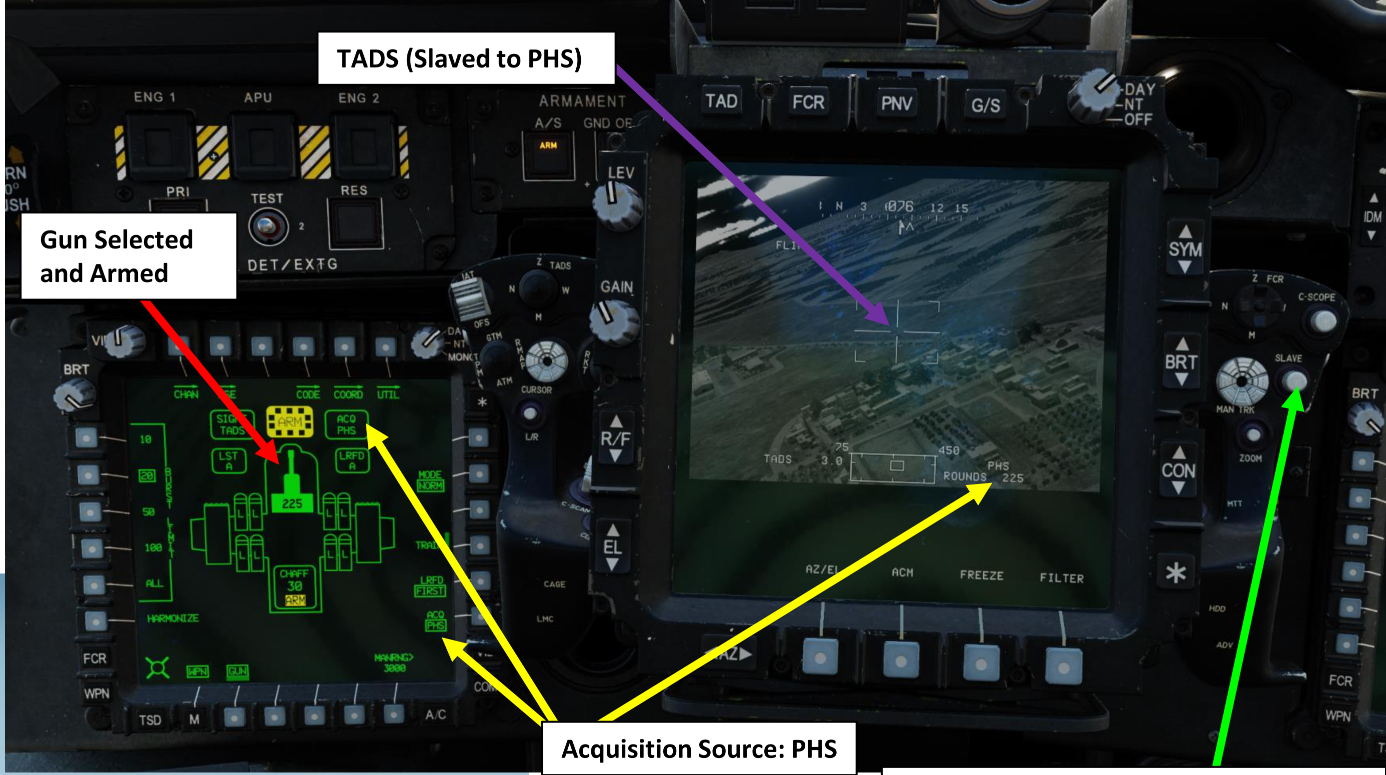


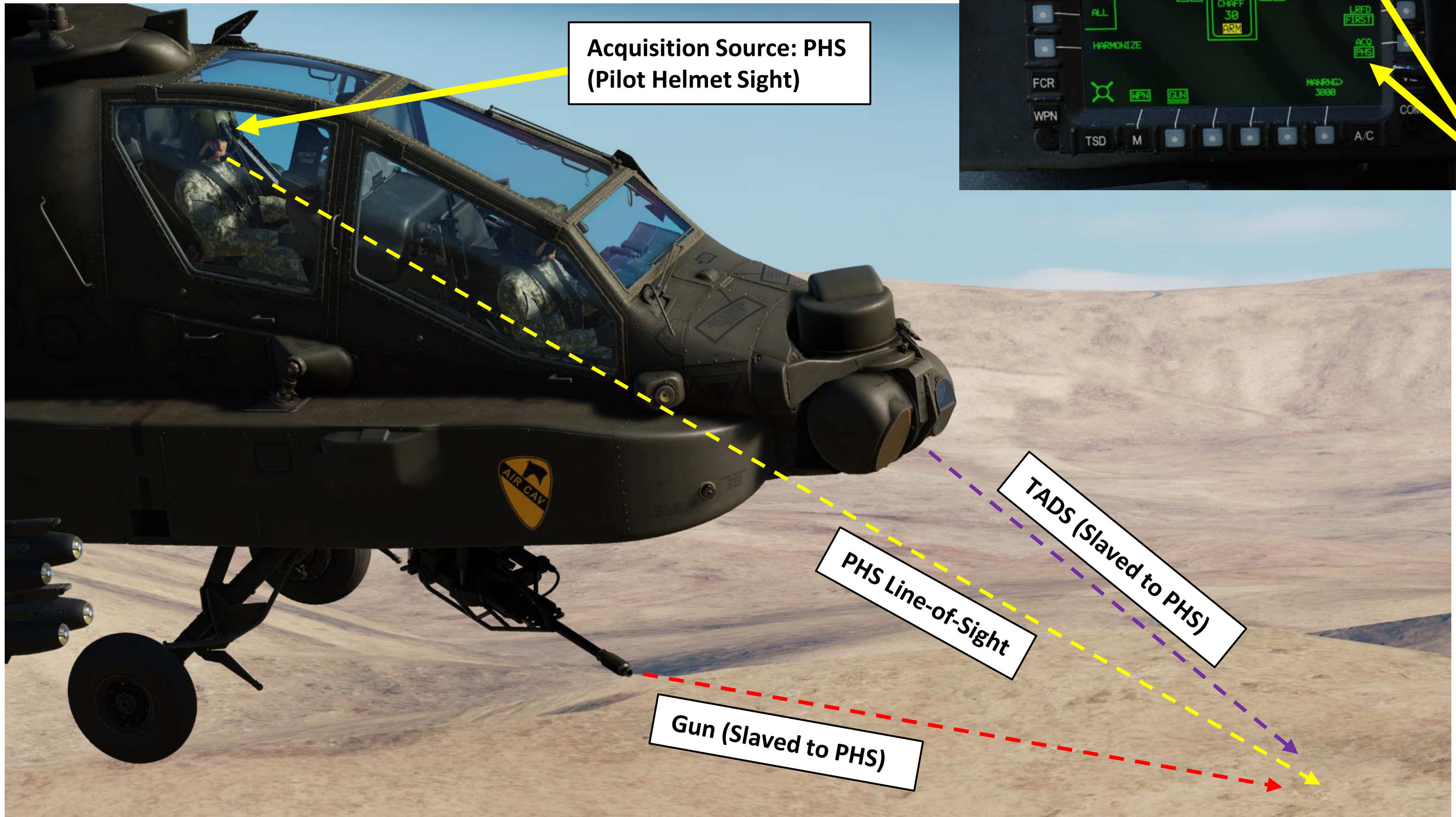


1 – INTRODUCTION
1.3 – Acquisition Sources

The principle of an “Acquisition Source” in the AH-64 can be simplified as: what am I acquiring my target from? An acquisition source is used to slave or cue the selected sight to a line-of-sight or point on the ground. Acquisition sources allow either the pilot or co-pilot/gunner to slave onboard sensors to them. As an example, you could be using a stored target or a waypoint as an acquisition source, which can be used by the TADS to maintain visibility over a fixed point of interest in space.

In the example below, the PHS (Pilot Helmet Sight) has been selected as an acquisition source and the co-pilot pressed the Sight Slave button to “snap” the TADS sensor to the pilot helmet’s line-of-sight.





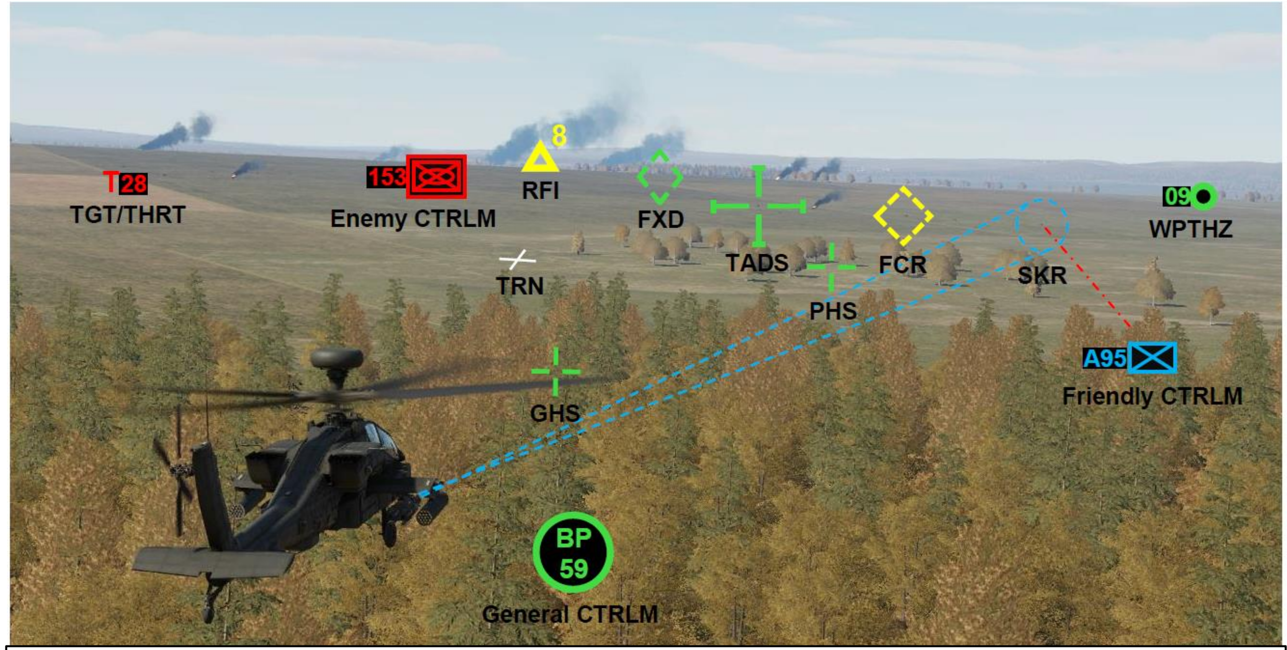
Sight Slave Button

- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

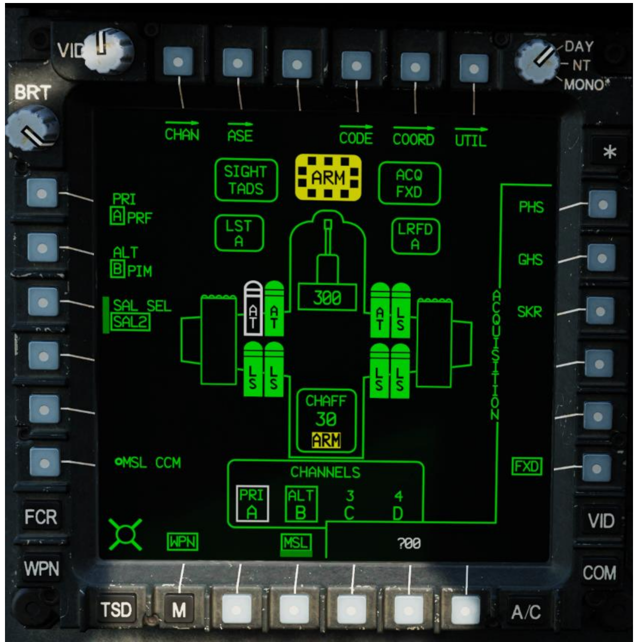
1 – INTRODUCTION
1.3 – Acquisition Sources

Each crewmember has the ability to select and receive cueing information from the following selectable Acquisition sources:

- **PHS (Pilot Helmet Sight):** Useful when the pilot has found a target and the co-pilot/gunner wants to slave the TADS to where the pilot helmet's line-of-sight.
- **GHS (Gunner Helmet Sight):** Useful when the co-pilot/gunner has found a target visually and wants to slave the TADS to his helmet's line-of-sight.
- **SKR (Tracking Missile Seeker):** Useful when the Hellfire missile's seeker has spotted a laser from another laser designator (like another AH-64 or a JTAC) and the gunner wants to slave sensors to the location where the missile seeker is looking. This is a "primitive" form of LST (Laser Spot Tracker).
- **FXD (Fixed):** Useful when you want to quickly "boresight" sensors and weapons in the forward position, which is fixed 0 deg in azimuth and elevation with the aircraft centerline.
- **Waypoint/Target (W##, H##, C##, T##):** Useful when co-pilot/gunner wants to slave the TADS to specific coordinates stored in a Waypoint, Hazard, Control Measure or Target/Threat. ## refers to the number of the point.
- **CAQ/TRN (Cursor Acquisition/Terrain):** Useful when you want to slave sensors to a specific terrain location on the TSD (Tactical Situation Display) page, which is done by using the cursor controls on either the pilot or co-pilot's Cursor Control on the collective or on the co-pilot's TEDAC Left Hand Grip.
- **RFI (Radio Frequency Interferometer):** Not yet implemented.



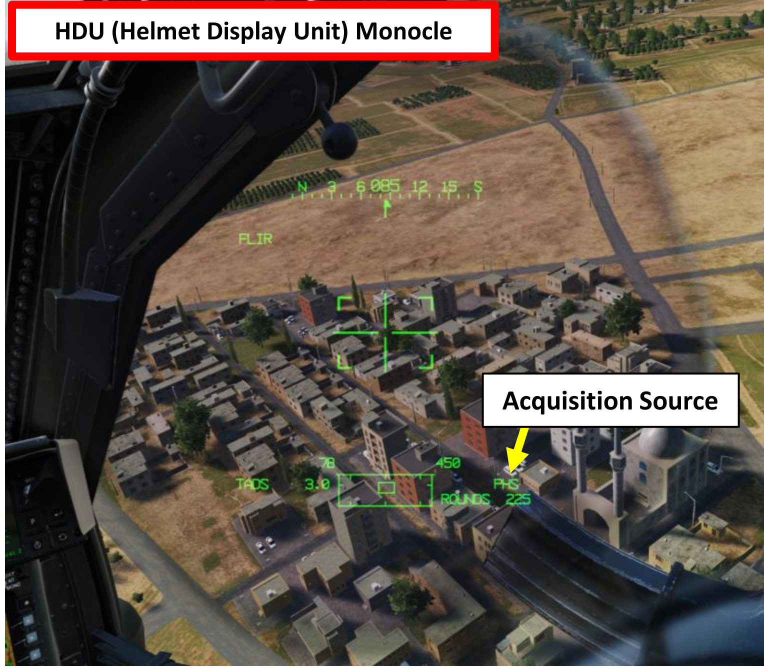
Acquisition Sources on the Battlefield (Source: Eagle Dynamics Manual)



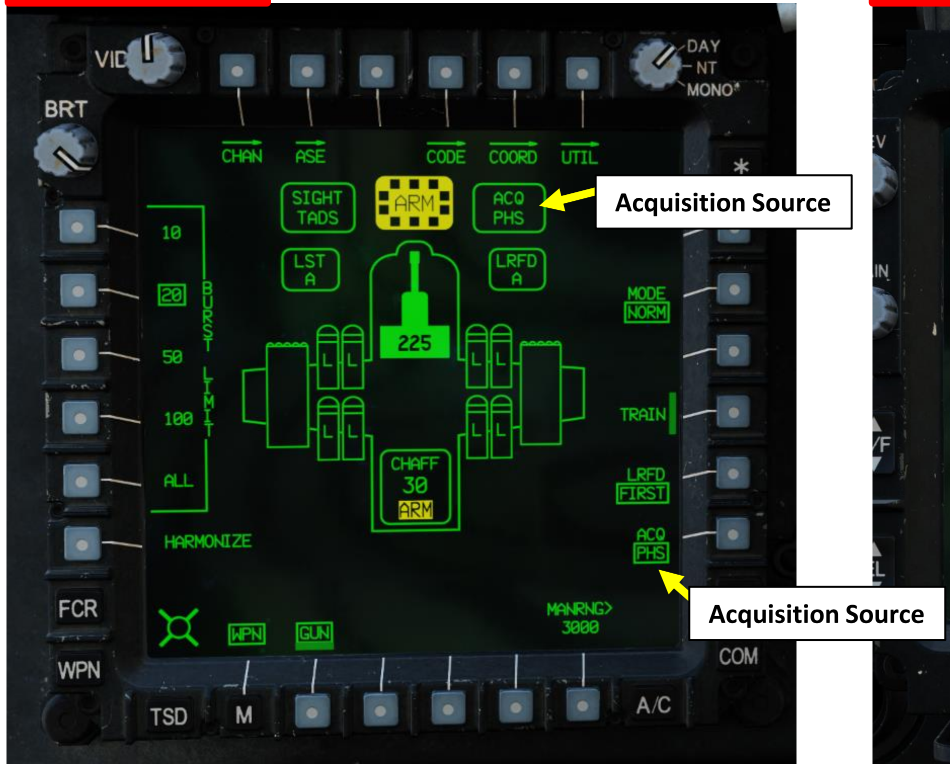
1 – INTRODUCTION
1.3 – Acquisition Sources

The selected acquisition source is displayed on:

- The Weapon page
- The TDU (TEDAC Display Unit)
- The TSD (Tactical Situation Display) page
- The HDU (Helmet Display Unit) monocle

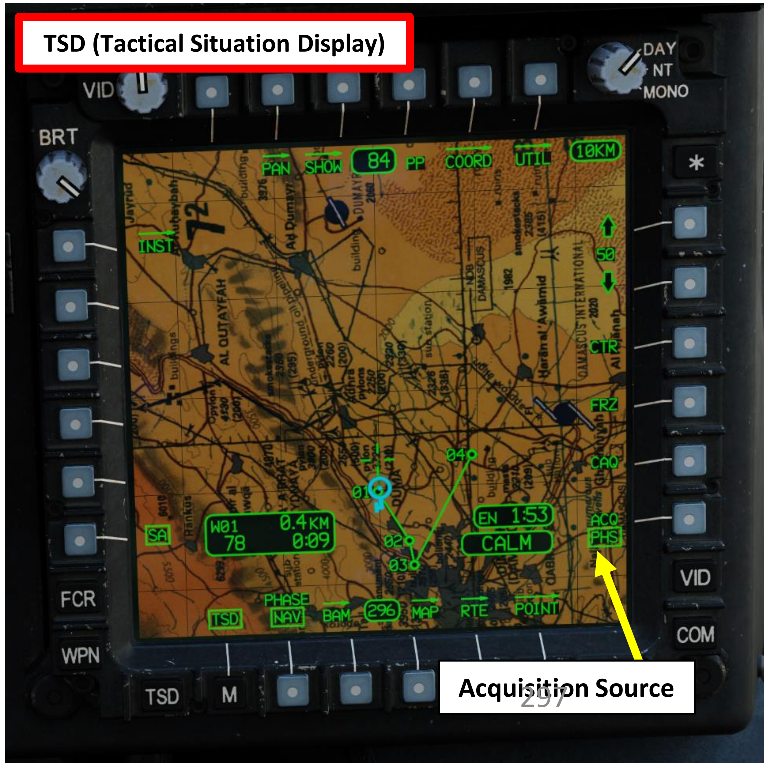


Weapon MPD Page



TDU (TADS Display Unit)

TSD (Tactical Situation Display)



1 – INTRODUCTION
1.3 – Acquisition Sources

To change acquisition source:

1. Go through either the Weapon or TSD (Tactical Situation Display) page.
2. Press on the VAB (Variable Action Button) next to ACQ.
3. Select VAB next to desired acquisition source.
4. And… That's it! The process is a bit clunky when you keep having to switch back and forth between acquisition sources, but it is what it is.
5. If you want to slave sensors to the selected acquisition source, the co-pilot gunner has to press the Sight Slave button on the TEDAC Right Hand Grip.

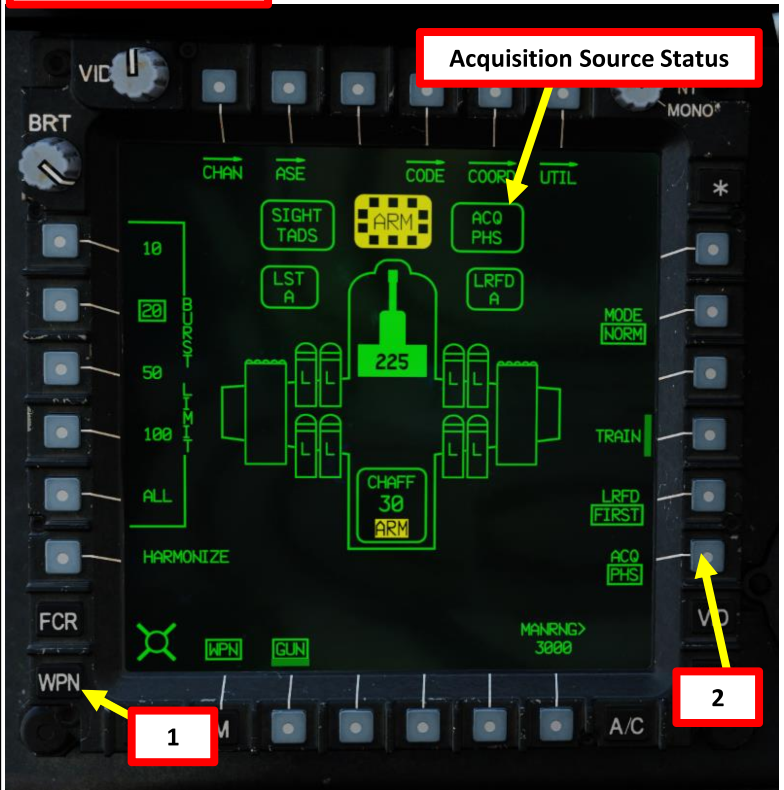
TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

5

Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

Weapon MPD Page

Acquisition Source Status



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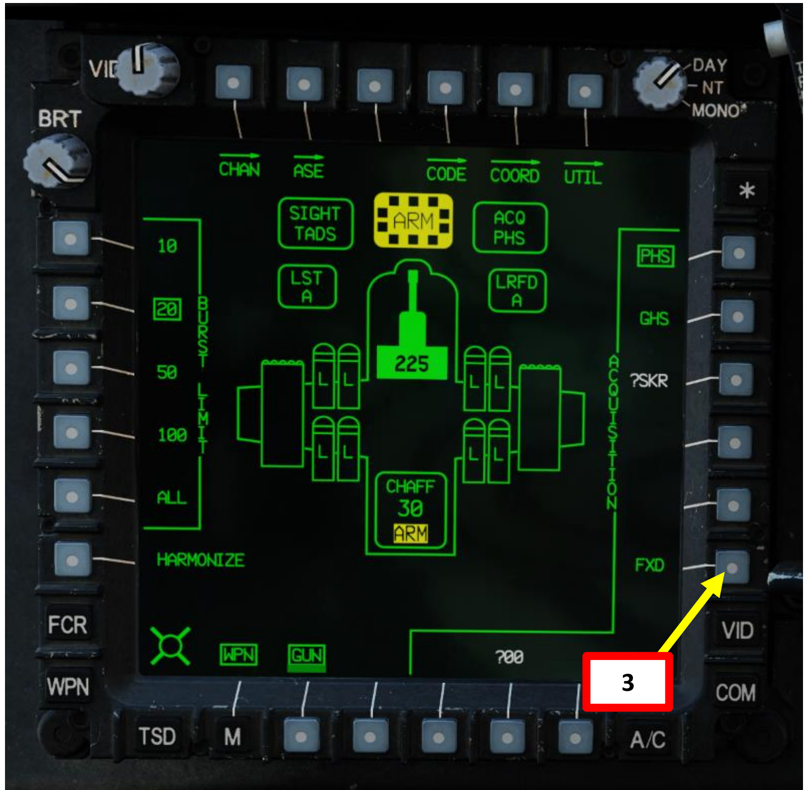

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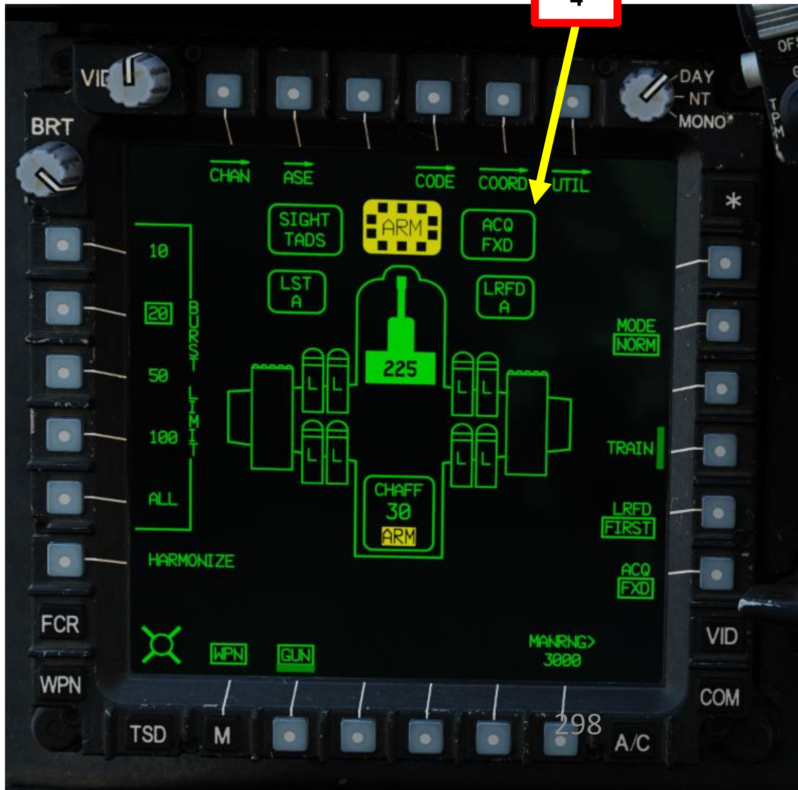


4

1 – INTRODUCTION
1.4 – Powering Up Sensors

Sensors can be powered on by accessing the WPN (Weapon) page from the Co-Pilot/Gunner seat, then selecting the "UTIL" sub-menu. From the UTIL sub-menu, you can press the VABs (Variable Action Buttons) next to:

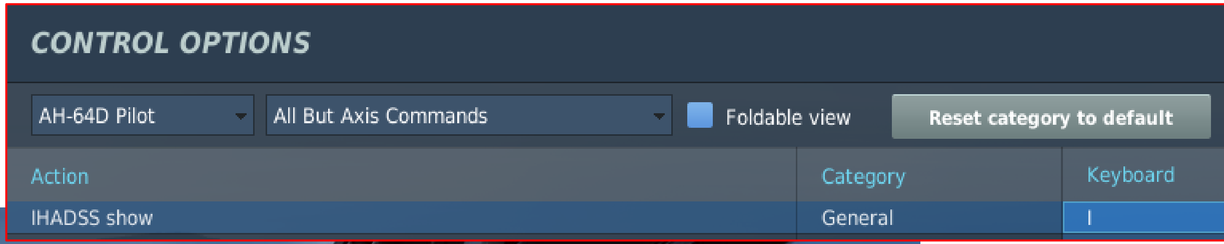
- **IHADSS** (Integrated Helmet and Display Sighting System)
- **RFI** (Radio Frequency Interferometer)
- **FCR** (Fire Control Radar)
- **TADS** (Target Acquisition & Designation Sight)
- **FLIR** (TADS Forward-Looking Infrared)
- **LASER** (Radar/Laser Warning Receiver)

- Additional Note: Hollow circle means OFF. Solid Circle means ON.

2 – HMD (HELMET-MOUNTED DISPLAY)

2.1 – IHADSS (Integrated Helmet & Display Sighting System) Components

The IHADSS (Integrated Helmet and Display Sighting System) allows the crewmembers to view flight and navigation information, sensor video, targeting information, and weapon status. The **IHADSS can be toggled ON/OFF using the "IHADSS Show" binding, which is "i" by default.**

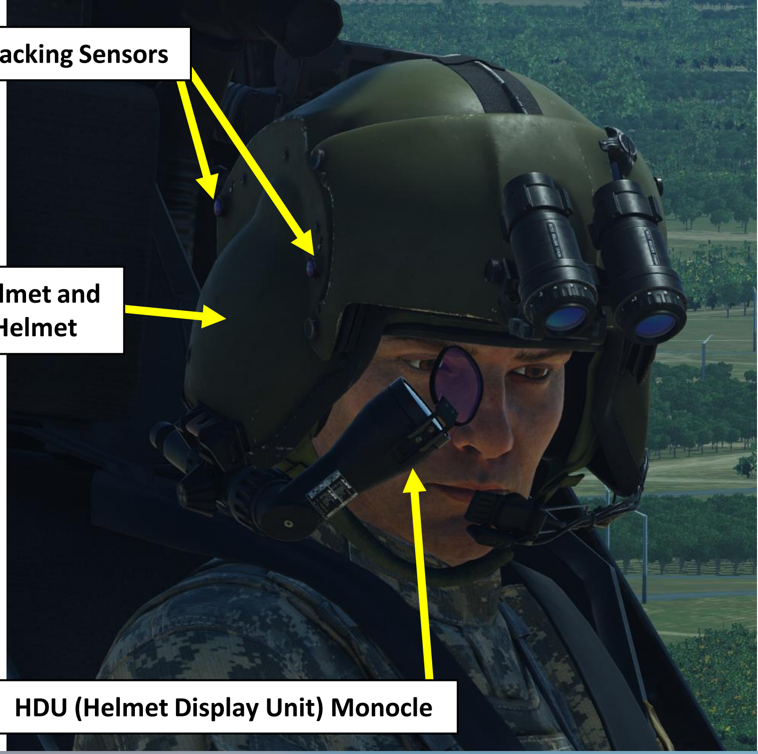


HDU (Helmet Display Unit) Monocle
Displays IHADSS (Integrated Helmet and Display Sight System) Data
- *Use "I" binding to show/hide IHADSS.*

2 – HMD (HELMET-MOUNTED DISPLAY)
2.1 – IHADSS (Integrated Helmet & Display Sighting System) Components

The IHADSS consists of the Helmet Display Unit (HDU), a small, collimated display placed in front of the crewmember's right eye (on a rotatable arm); the Sensor Surveying Units (SSU) and Integrated Helmet Unit (IHU), a series of sensors in the cockpit that determine crewmember head position and line-of-sight; the Boresight Reticle Units (BRU), which establishes sensor boresight; and avionics systems that can slave sensor and weapon systems to the IHADSS line of sight.

The IHADSS also allows each crewmember to independently cue weapons and sensors using their head movements and is integral in performing flight operations at night. The pilot is presented with a Flight symbology format within the Helmet Display Unit (HDU). The co-pilot/gunner is either presented with Flight symbology format or Weapon symbology format within the HDU, depending on sight selection.

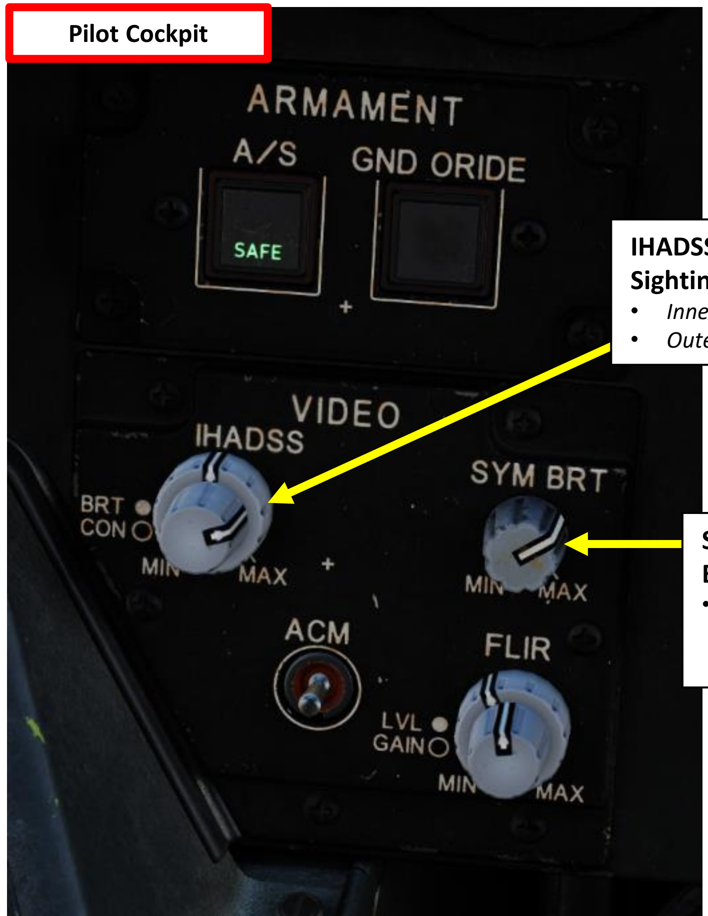


2 – HMD (HELMET-MOUNTED DISPLAY)
2.1 – IHADSS (Integrated Helmet & Display Sighting System) Components

For the **pilot**, the SYM BRT Control knob is used to adjust the HDU symbology's brightness. The IHADSS Button's inner and outer knobs controls video contrast and brightness.

The IHADSS is aligned using the BRU (Boresight Reticle Unit) and the Weapon Page.

Pilot Cockpit



IHADSS (Integrated Helmet and Display Sighting System) Knobs
- *Inner knob controls video contrast*
- *Outer knob controls video brightness.*

SYM BRT (Symbology Brightness) Control
- *Controls the brightness of IHADSS symbology displayed on the HDU (Helmet Display Unit)*

Pilot Cockpit

Boresight Reticle Unit (BRU)
- *Used to align/boresight HDU (Helmet Display Unit)*

2 – HMD (HELMET-MOUNTED DISPLAY)

2.1 – IHADSS (Integrated Helmet & Display Sighting System) Components

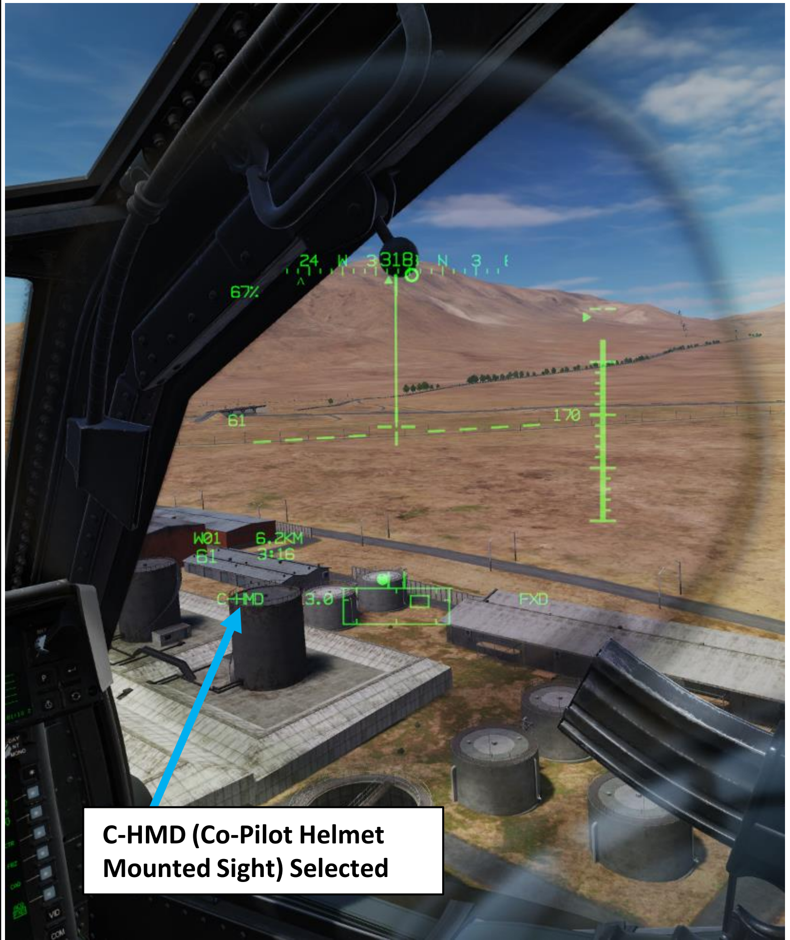
For the **co-pilot/gunner**, the TDU (TEDAC Display Unit) Symbology Brightness Adjustment Rocker Switch is used to adjust the HDU brightness.

- The TDU Symbology Brightness control will only work if the TDU Display Mode Selector is set to either DAY or NIGHT.
- Another subtlety when using the TDU Symbology Brightness Adjustment Rocker Switch is that you should make sure the Sight Selector Switch has been pressed FWD on the collective to select the Helmet-Mounted display as the sight.

The IHADSS is aligned using the BRU (Boresight Reticle Unit) and the Weapon Page, just like in the pilot cockpit.

Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*



C-HMD (Co-Pilot Helmet Mounted Sight) Selected

Co-Pilot/Gunner Cockpit

Boresight Reticle Unit (BRU)

- *Used to align/boresight HDU (Helmet Display Unit)*

TDU Display Mode Selector

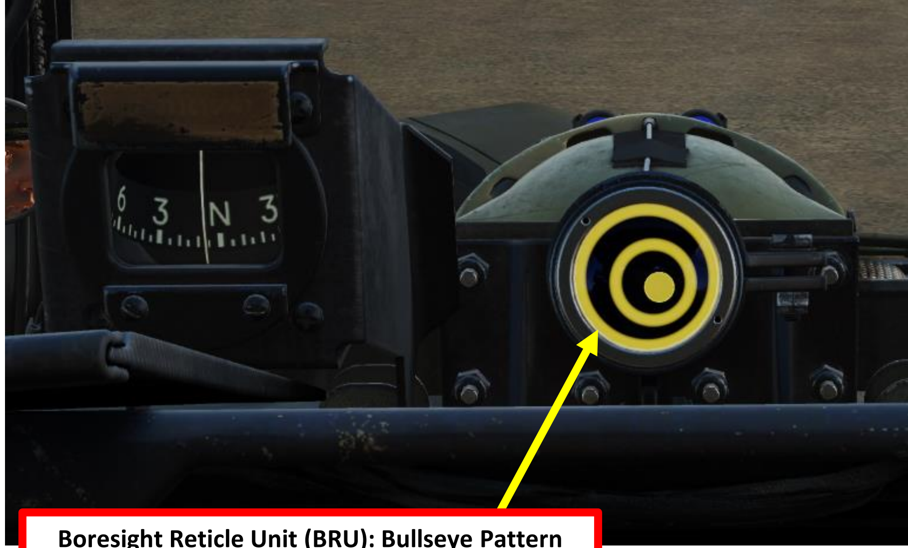
- *Day / Night / OFF*

TDU Symbology Brightness Adjustment Rocker Switch

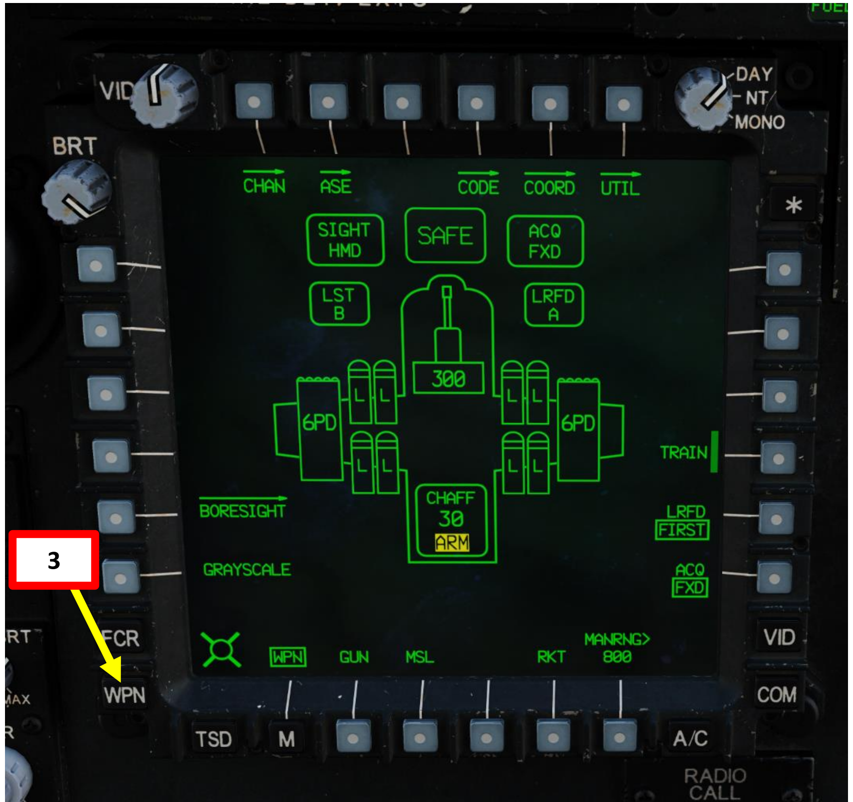
2 – HMD (HELMET-MOUNTED DISPLAY)
2.2 – IHADSS (Integrated Helmet & Display Sighting System) Boresight

During the aircraft's start-up procedure, the IHADSS for each crew station must be "boresighted" to provide the aircraft systems with accurate azimuth and elevation position data of each crewmember's helmet.

1. Put on the IHADSS (Integrated Helmet and Display Sighting System) monocle by pressing "I" ("IHADSS SHOW/HIDE" control).
2. Make sure the Primary Cockpit Lights Control Knob is set to BRT (Bright). This knob is needed for the boresight alignment symbology on the BRU (Boresight Reticle Unit) to be visible.
3. Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
4. Press VAB (Variable Action Button) next to BORESIGHT.
5. Press VAB (Variable Action Button) next to IHADSS to activate Boresight Reticle Unit (BRU).

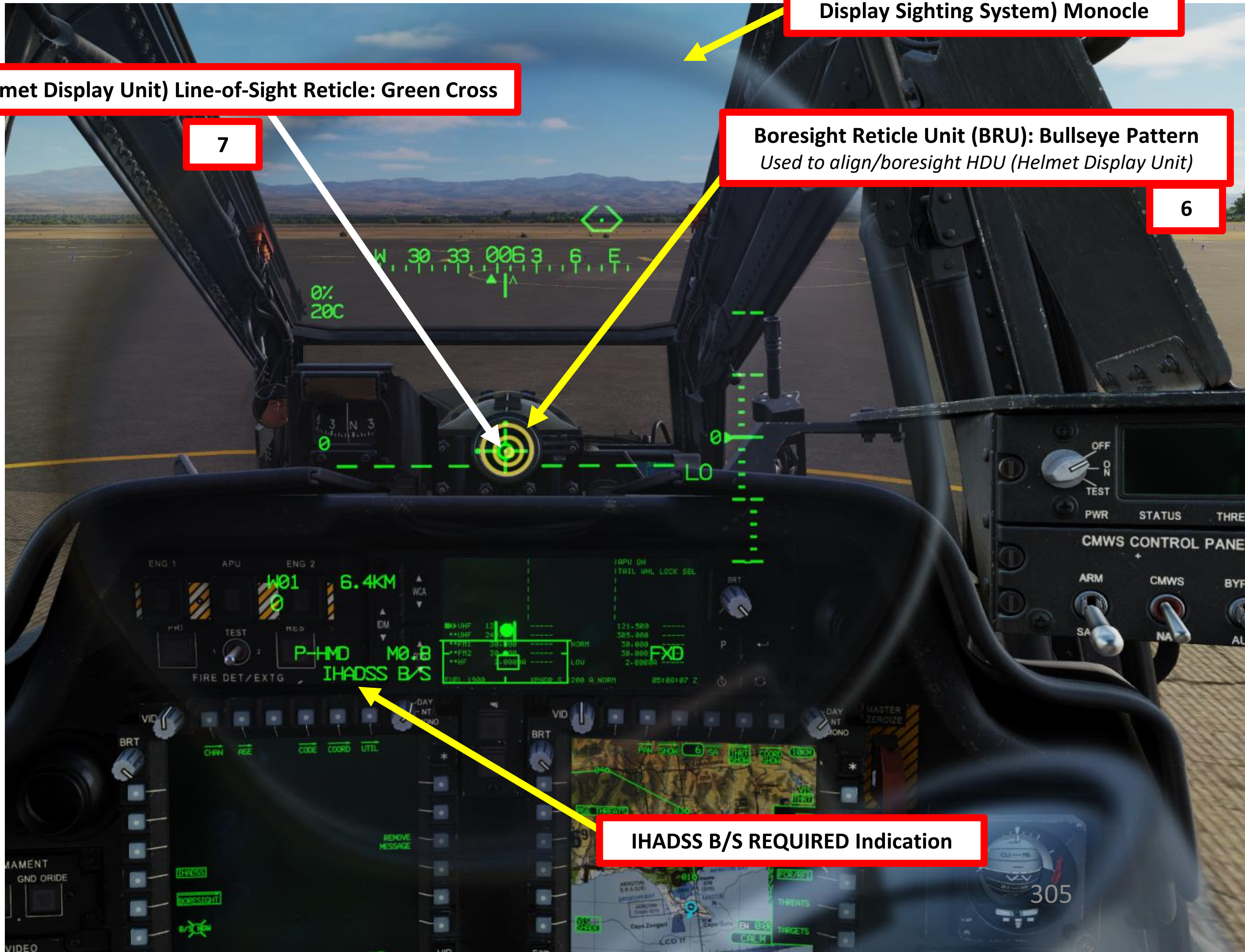


Boresight Reticle Unit (BRU): Bullseye Pattern
Used to align/boresight HDU (Helmet Display Unit)



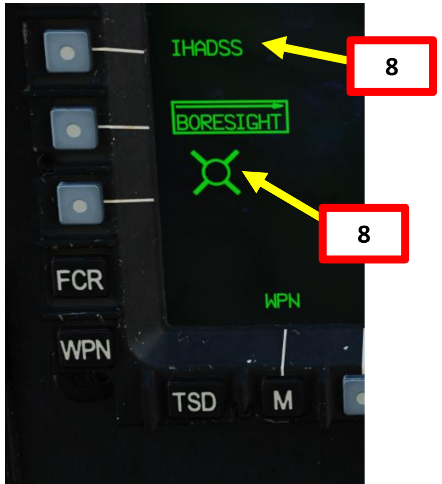
2 – HMD (HELMET-MOUNTED DISPLAY)
2.2 – IHADSS (Integrated Helmet & Display Sighting System) Boresight

6. Position your head at a natural posture and aim the HDU's (Helmet-Display Unit) line-of-sight reticle at the center of the BRU's (Boresight Reticle Unit) illuminated bullseye pattern (yellow rings). Bullseye pattern rings should be concentric and centered.
7. When the HDU (Helmet Display Unit) is aligned within the bullseye (as shown on picture), press the B/S NOW button. Alternatively, you can Depress the Cursor Control/Enter Hat Switch since the cursor automatically snaps to B/S NOW.



2 – HMD (HELMET-MOUNTED DISPLAY)
2.2 – IHADSS (Integrated Helmet & Display Sighting System) Boresight

8. If the boresight position is accepted, the BRU bullseye pattern will extinguish, the B/S NOW option will be removed from the MPD page, and the IHADSS button will become un-boxed.



2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

IHADSS symbology can change based on which IHADSS Mode is selected. IHADSS mode selected is done with the Symbology Select Switch. The Symbology Select Switch toggles between Cruise and Transition each FWD press, and it also toggles between Hover and Bob-Up each AFT press. You can select four distinct modes:

- **Cruise** Mode
- **Transition** Mode
- **Hover** Mode
- **Bob-Up** Mode

Transition Mode is typically used during normal flight, while Hover Mode is better suited when flying in, well, a hover (d'uh). There is no specific indication to tell you which mode is selected... You will have to recognize the mode based on what information is available on the HDU.

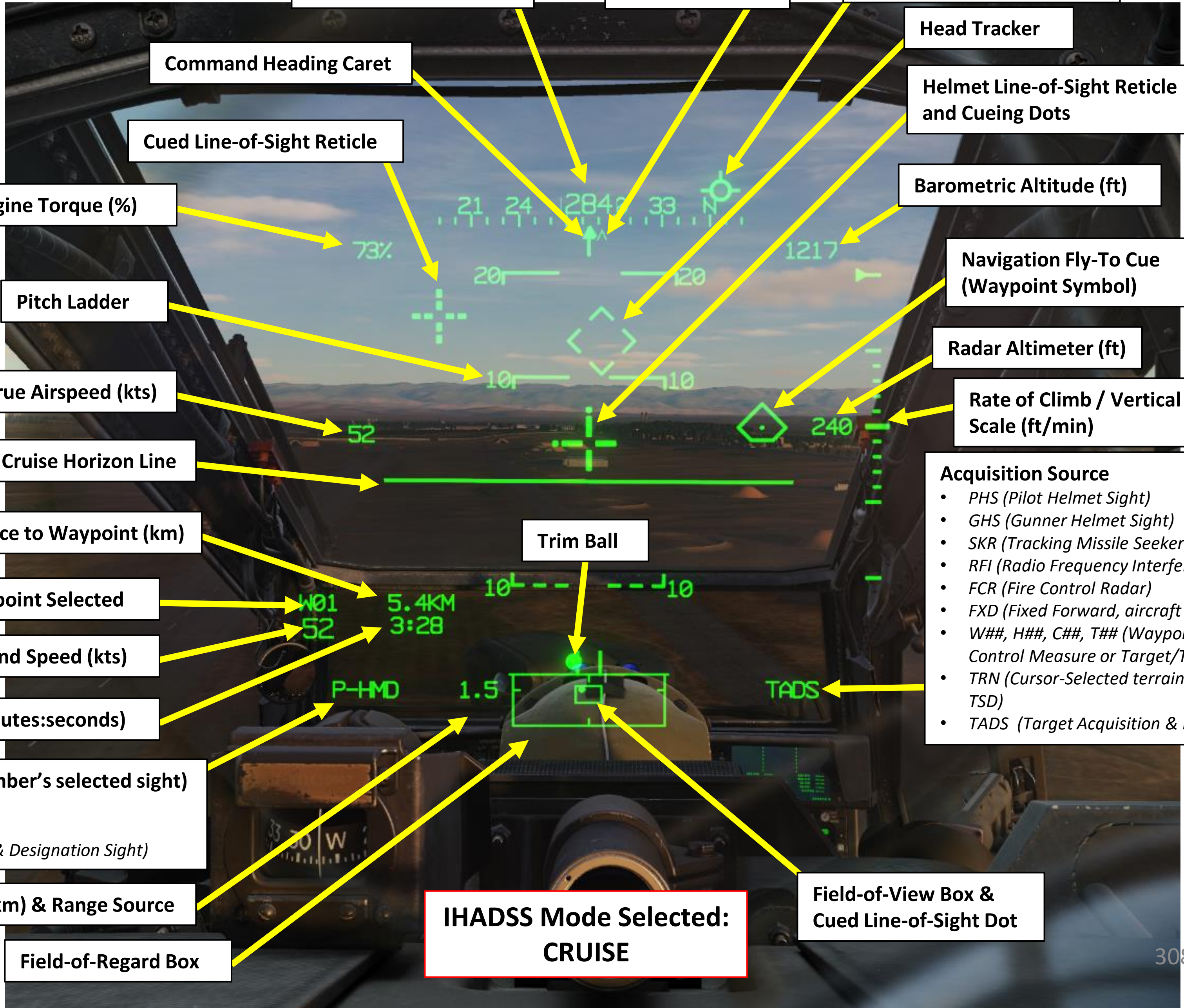
Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

Cruise Mode is selected by toggling the Symbology Select Switch FWD (toggles between Cruise and Transition modes).

CRUISE is typically used for instrument flying in low visibility conditions, but overall it is not very useful during normal flying operations. CRUISE can also be useful to see your MSL (Mean Sea Level) altitude when you need to know your flight level since TRANSITION mode does not show that.

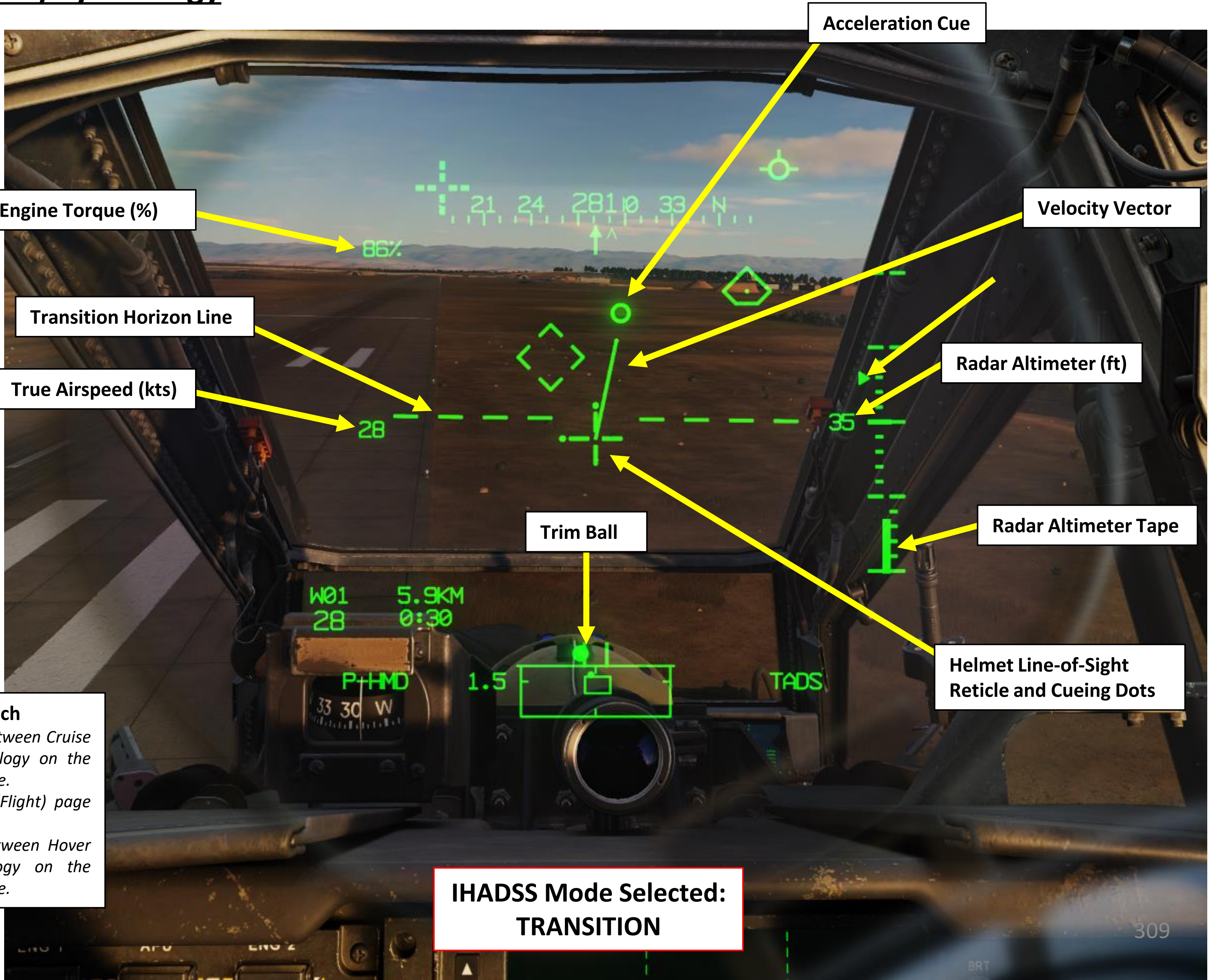
Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

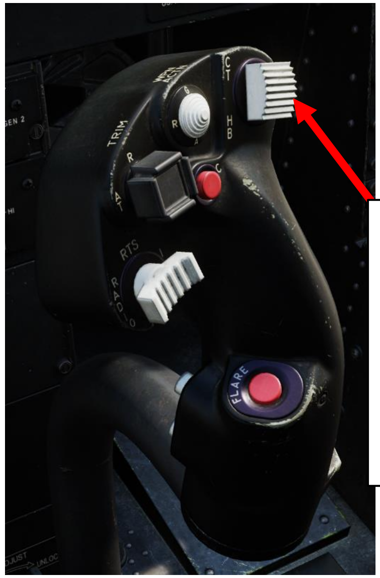


2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

Transition Mode is selected by toggling the Symbology Select Switch FWD (toggles between Cruise and Transition modes).

TRANSITION is typically used during most phases of flight unless you want to takeoff, land, or hover.



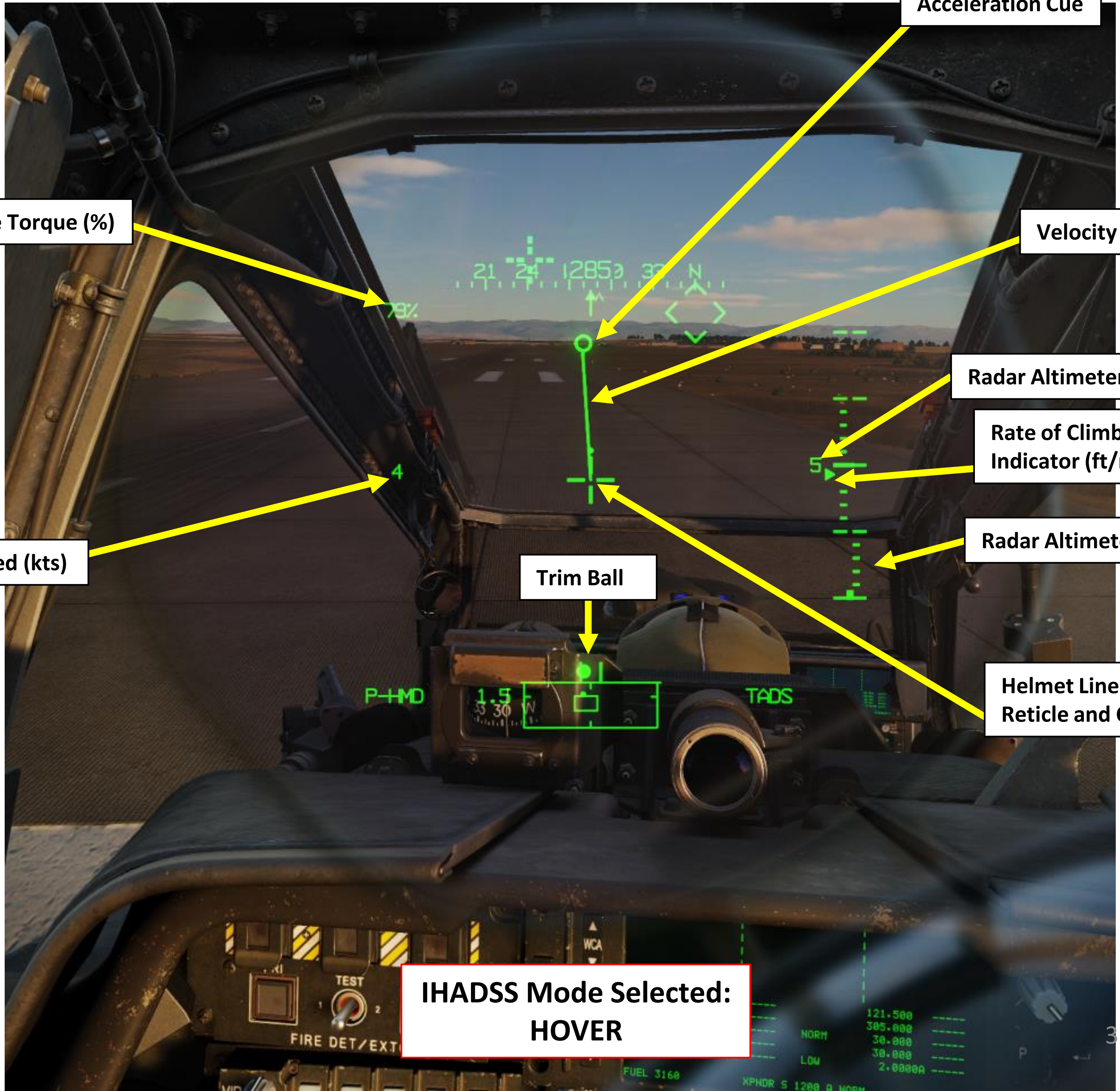


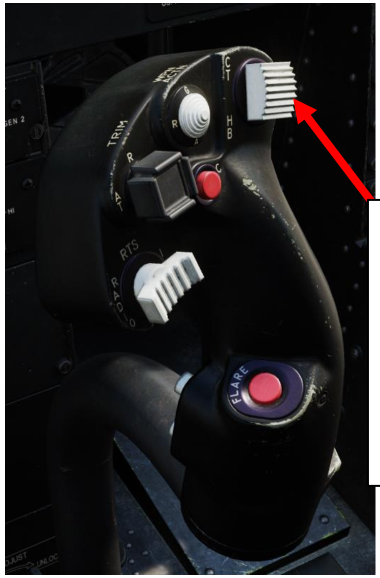
Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

Hover Mode is selected by toggling the Symbology Select Switch AFT (toggles between Hover and Bob-Up modes).

HOVER is typically used whenever you want to bring the helicopter into a hover.





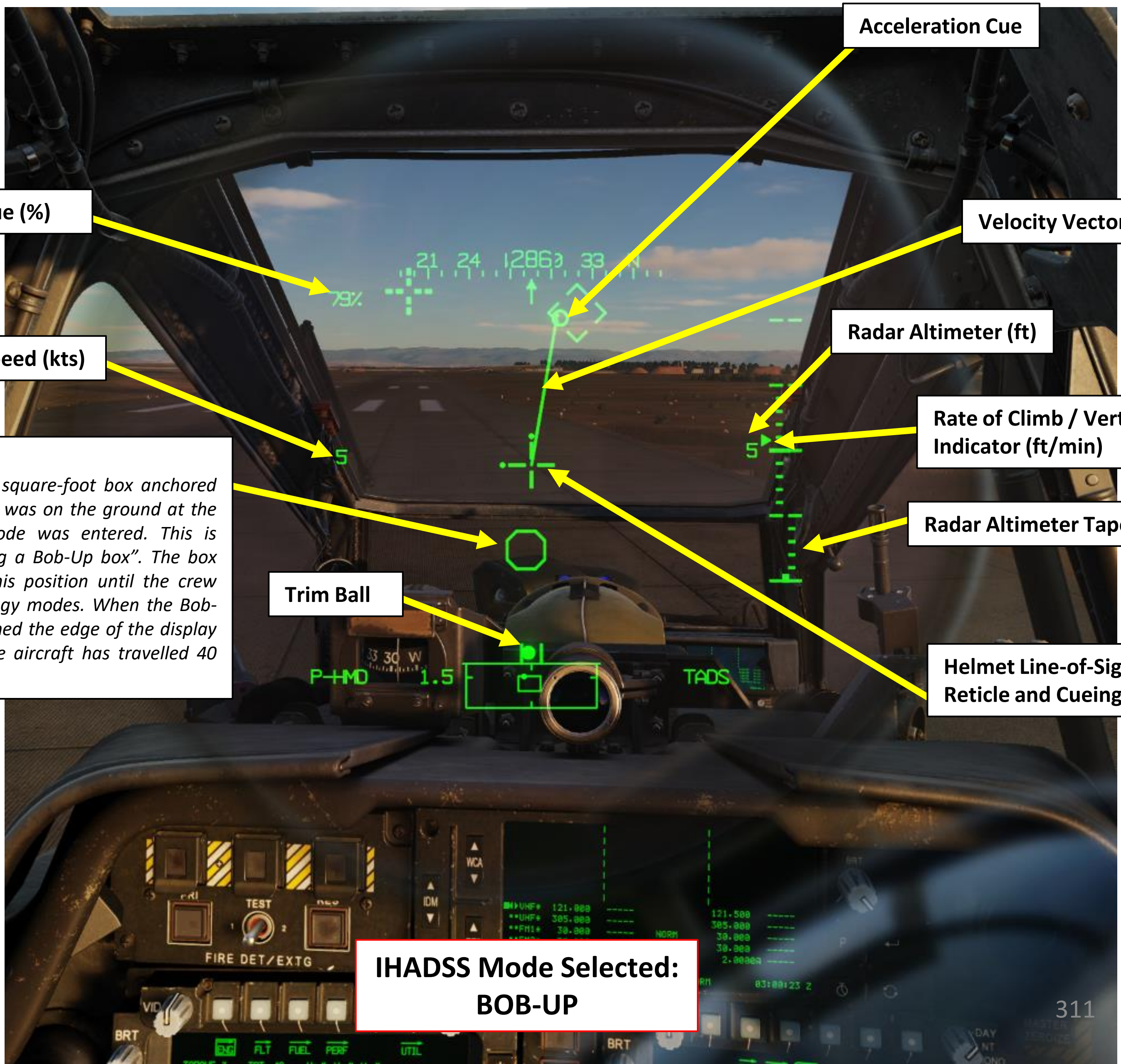
Symbology Select Switch

- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

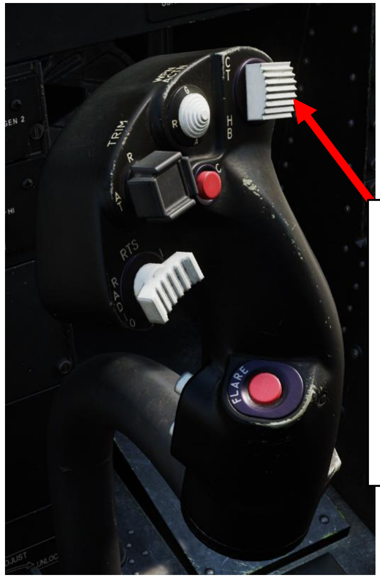
2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

Bob-Up Mode is selected by toggling the Symbology Select Switch AFT (toggles between Hover and Bob-Up modes).

BOB-UP is typically used whenever you want to settle the helicopter into a hover and stay at the current position. The Bob-Up box symbol moves as you drift away from the reference point (bob-up box) set when engaging this mode.



Bob-Up Box
- *Represents a 12 square-foot box anchored to the position it was on the ground at the time Bob-Up mode was entered. This is termed "dropping a Bob-Up box". The box will remain in this position until the crew changes symbology modes. When the Bob-Up box has reached the edge of the display ("saturated"), the aircraft has travelled 40 feet.*



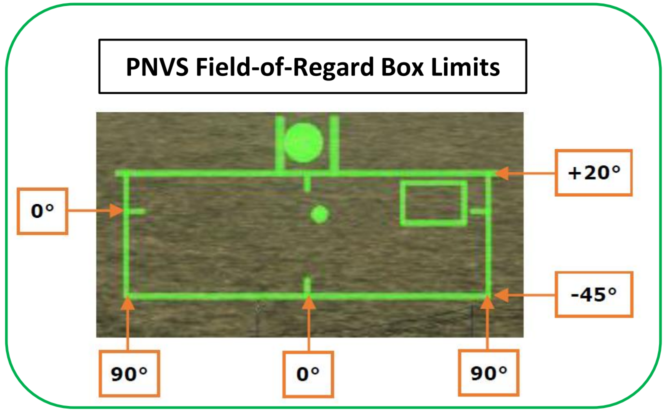
Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

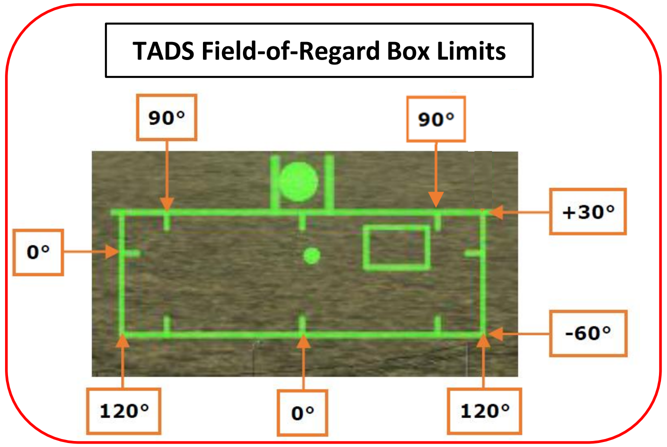
2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

The **High Action Display (HAD)** displays symbology used mainly for targeting and weapon employment. It also provides additional information such as the selected sight and selected acquisition source.

The **Field-of-View (FOV) Box** indicates the relative position of the PNVS (Pilot Night Vision System) or TADS (Target Acquisition & Designation Sight) field-of-view (30 deg x 40 deg) within the Field-of-Regard Box.

The **Field-of-Regard (FOR) Box** indicates azimuth limits for the current sensor selected. Tick mark around the edges of the FOR box assist in marking the sensor limits for each sensor.





2 – HMD (HELMET-MOUNTED DISPLAY)
2.3 – HDU (Helmet Display Unit) Symbology

The **Helmet Line-of-Sight Reticle** provides a fixed reference for aircraft pitch attitude and for weapon aiming. The reticle flashes when:

- The line-of-sight is invalid, or;
- When the NVS (Night Vision System) switch is set to NORM and TADS/PNVS sensors are at their slew limits.

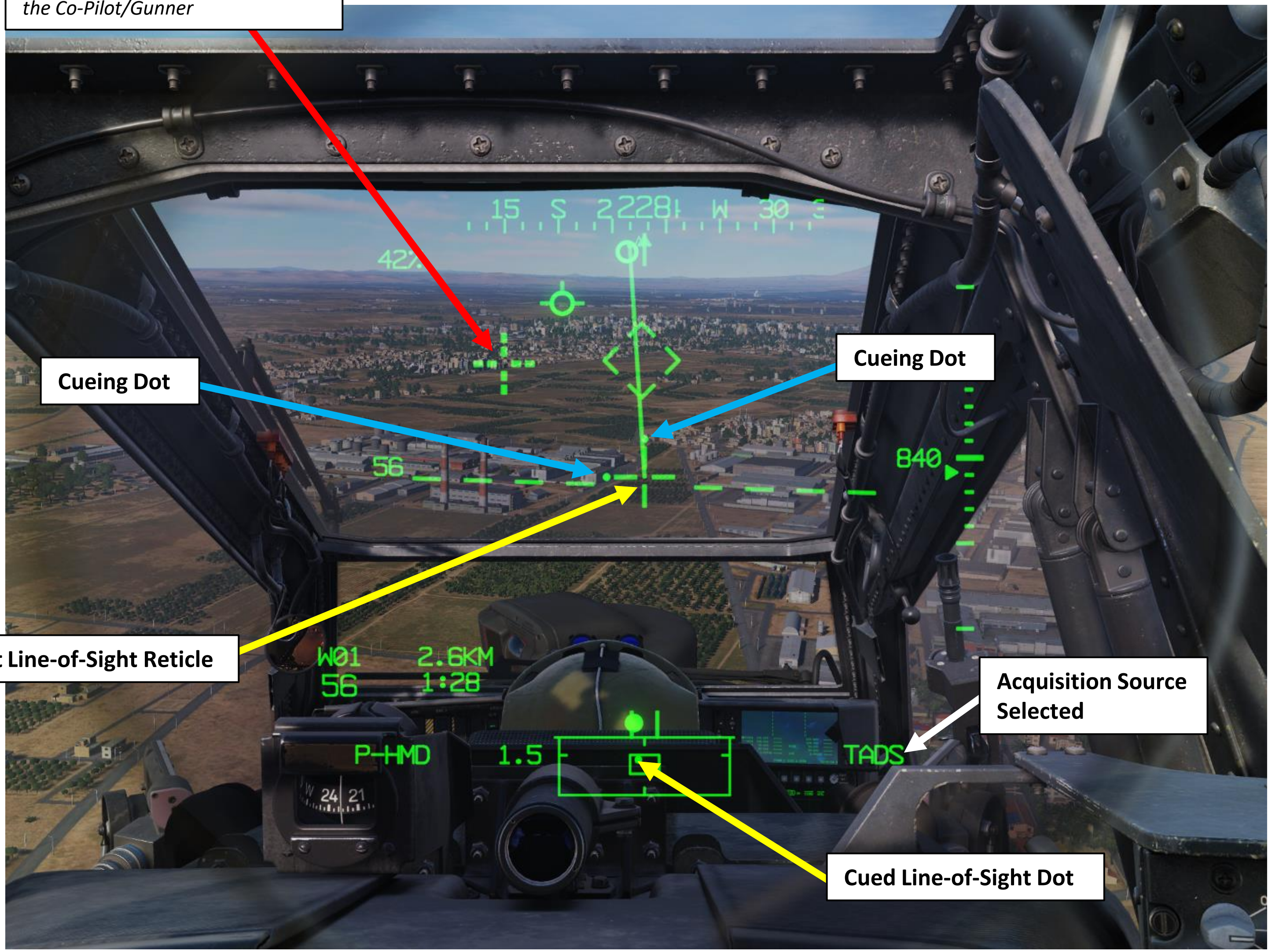
The **Cued Line-of-Sight Reticle** is a representation of the location of the acquisition source (target designated with the TADS, a waypoint, etc.). It appears when the selected acquisition source is located within the HDU field-of-view.

The **Cueing Dots** indicate the quadrant direction of the selected acquisition source in relationship to the crewmember's Helmet Line-of-Sight Reticle.

- As an example, a cueing dot to the left with a cueing dot above the Helmet Line-of-Sight Reticle means the selected acquisition source (which is represented by the Cued Line-of-Sight Reticle in our case) is to the top left, as shown in this screenshot.

The **Cued Line-of-Sight Dot** indicates the relative azimuth and elevation of the selected acquisition source within the field-of-regard box.

Cued Line-of-Sight Reticle
Target selected with the TADS by the Co-Pilot/Gunner



Cueing Dot

Cueing Dot

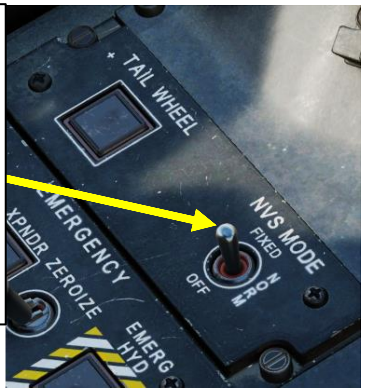
Helmet Line-of-Sight Reticle

Acquisition Source Selected

Cued Line-of-Sight Dot

Pilot NVS (Night Vision System) Mode Switch

- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*



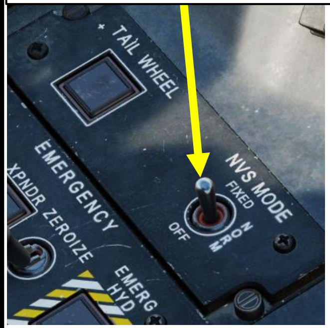
2 – HMD (HELMET-MOUNTED DISPLAY)
2.4 – TADS & PNVS Integration

The HDU (Helmet Display Unit) can overlay calibrated video data from Forward-Looking Infrared (FLIR) or Day Television (DTV) sensors. The video data can come from the TADS (Target Acquisition & Designation Sight) or the PNVS (Pilot Night Vision System) depending on what video source is selected. Keep in mind that the PNVS and the TADS are two independent sensors.

From the Pilot Seat:
- When the Pilot NVS (Night Vision System) switch is set to NORM (Middle position), the PNVS overlay is displayed by default.
- When the Pilot NVS switch is set to OFF (Aft position), the TADS or PNVS overlay is removed.
- You can switch between PNVS and TADS overlay using the NVS Select Switch FWD (TADS) or AFT (PNVS) on the collective.

PNVS (Pilot Night Vision System) Overlay on Pilot HDU (Helmet Display Unit)

Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*

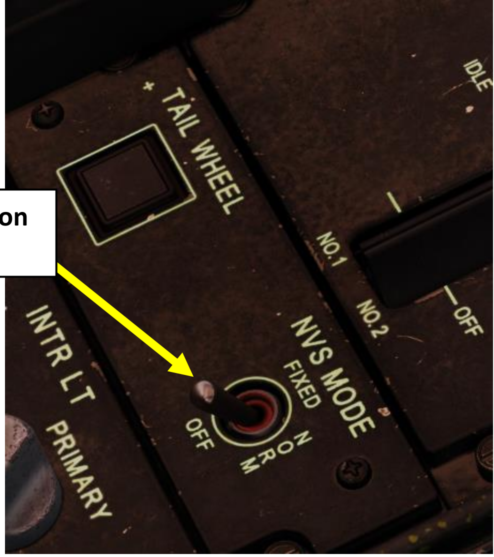


NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

2 – HMD (HELMET-MOUNTED DISPLAY)
2.4 – TADS & PNVS Integration

From the Co-Pilot/Gunner Seat:

- To display TADS video overlay:
    a) Set the Co-Pilot NVS (Night Vision System) switch to OFF (Aft position).
    b) Set the Sight Select Switch to RIGHT (TADS) on the collective.
- To display PNVS video overlay:
    a) Set the Co-Pilot NVS (Night Vision System) switch to NORM (Middle position).
    b) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display) on the collective.
    c) Set the Co-Pilot NVS Select switch to PNVS (AFT)



Co-Pilot NVS (Night Vision System) Mode Switch

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: TADS (Target Acquisition & Designation Sight), but only functional for CPG collective.*

NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

PNVS (Pilot Night Vision System) Overlay on Co-Pilot HDU (Helmet Display Unit)

TADS (Target Acquisition & Designation Sight) Overlay on Co-Pilot HDU (Helmet Display Unit)

2 – HMD (HELMET-MOUNTED DISPLAY)
2.4 – TADS & PNVS Integration

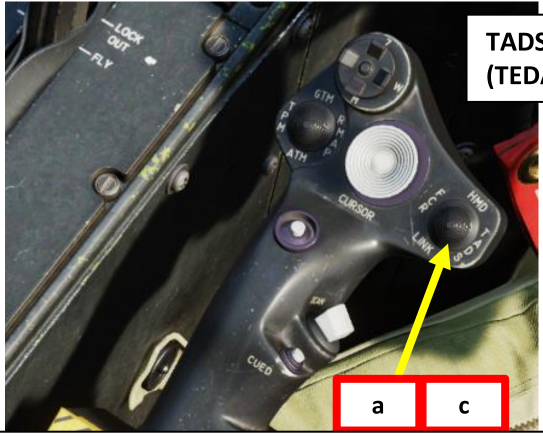
From the Co-Pilot/Gunner Seat:

- When the TADS is selected with the Sight Select Switch to RIGHT, the overlay on the HDU may be annoying, especially when operating in day conditions where you would prefer using the TDU (TEDAC Display Unit).

2 – HMD (HELMET-MOUNTED DISPLAY)
2.4 – TADS & PNVS Integration

From the Co-Pilot/Gunner Seat:

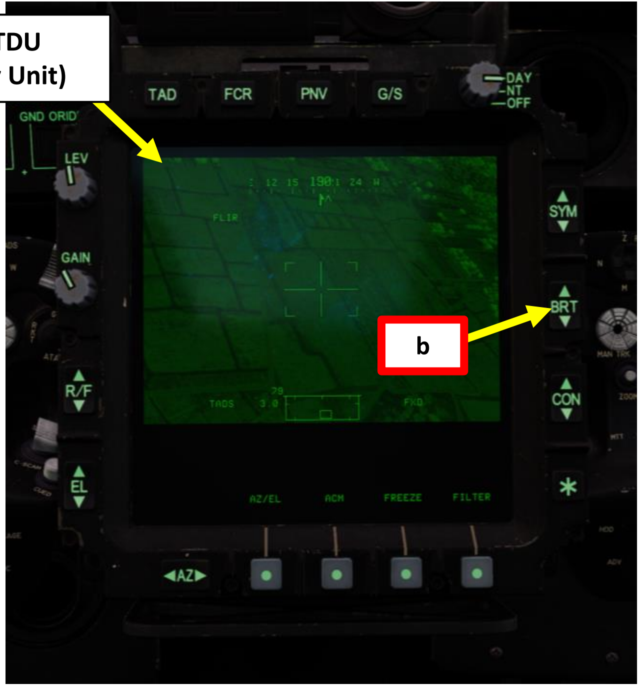
- To remove the TADS overlay from the HDU, there are two methods to do so:
  - Method 1: Flip away the HDU using the "IHADSS Show" binding, which is "i" by default.
  - Method 2: Reduce the TADS Overlay brightness
    - a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "C-HMD".
    - b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
    - c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.



Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*

TADS Feed on TDU (TEDAC Display Unit)



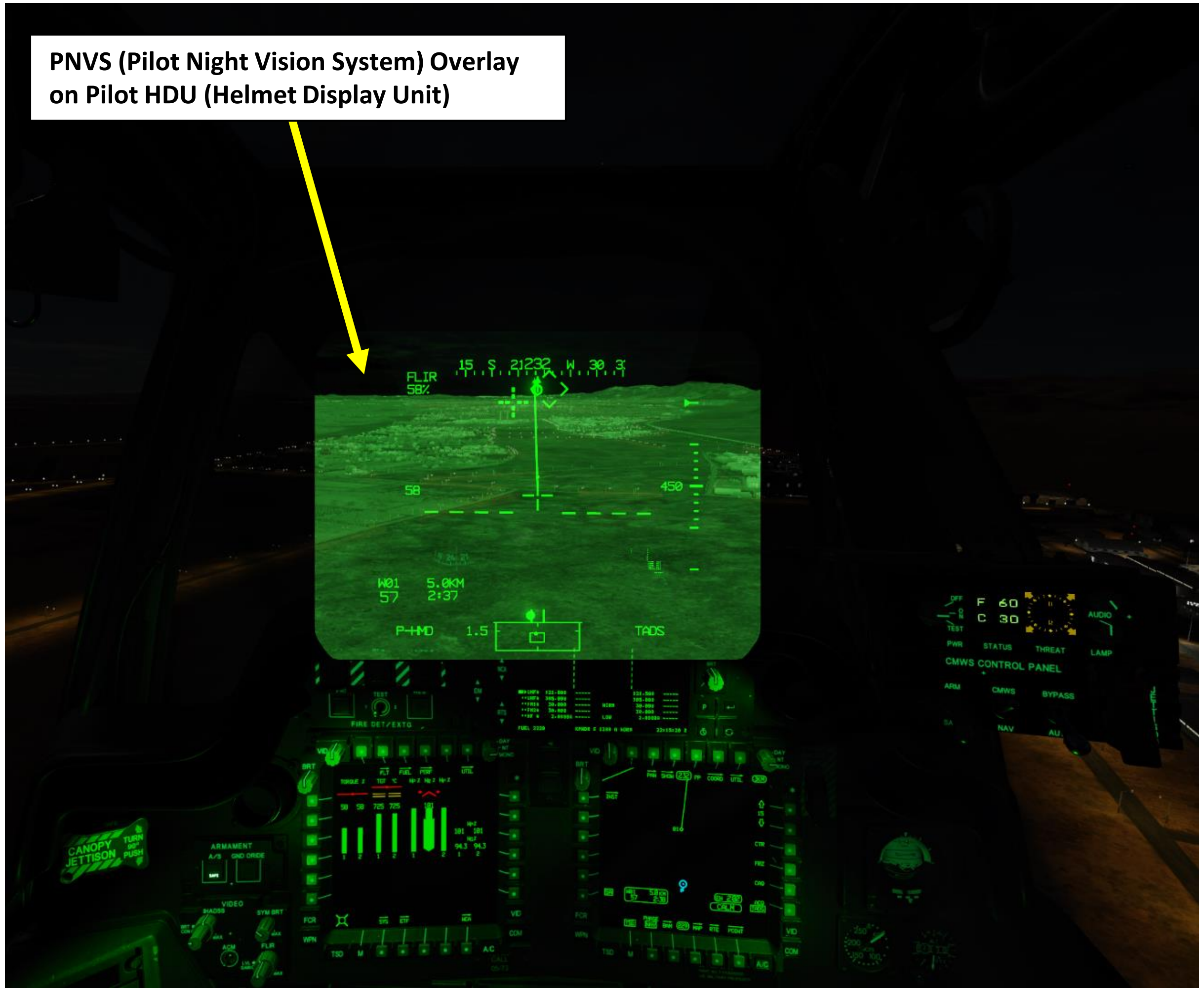
TADS Overlay on Co-Pilot/Gunner HDU (Helmet Display Unit)

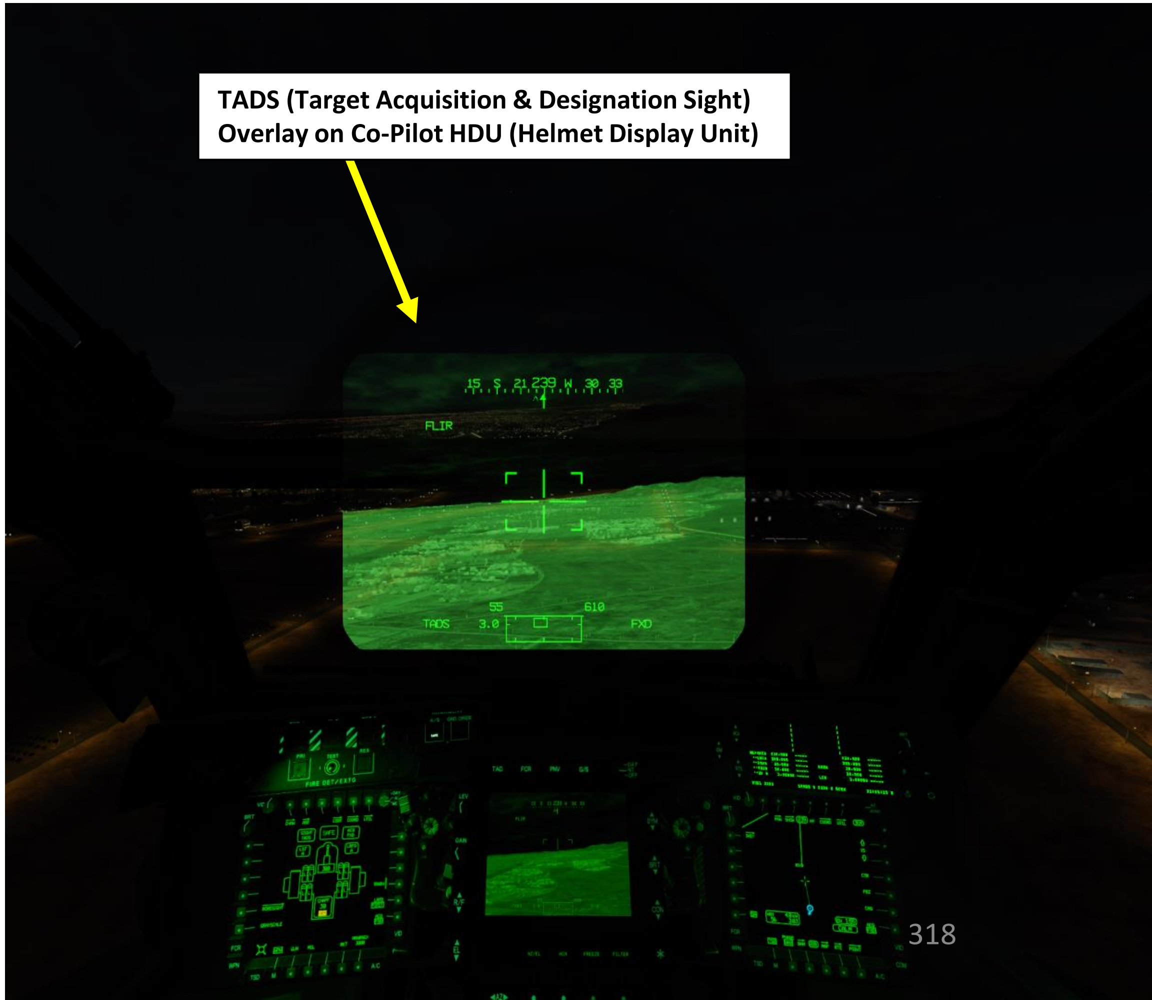
2 – HMD (HELMET-MOUNTED DISPLAY)

2.4 – TADS & PNVS Integration

General Notes:

- Keep in mind that in most cases, the pilot will want the PNVS overlay on his own HDU while the co-pilot will want the TADS overlay on his own HDU.
- TADS and PNVS video overlay can only be displayed on **one** HDU (Helmet Display Unit) at a time. This means that if the pilot selects TADS feed on his HDU, the Co-Pilot/Gunner will lose it from his own HDU if he has it selected. The same goes for the PNVS; if the Co-Pilot/Gunner selects it, the pilot will lose the ability to use it. Always warn the other crew member if you want to switch between sensors on your HDU monocle in order to avoid confusion.





2 – HMD (HELMET-MOUNTED DISPLAY)
2.5 – Target Storing with HMD

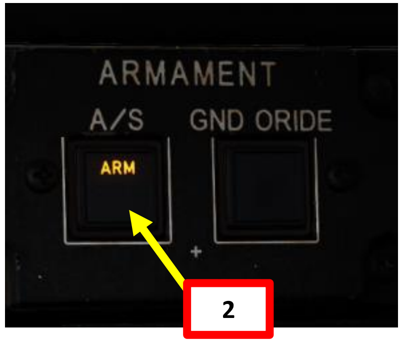
Click Here for the Navigation Section

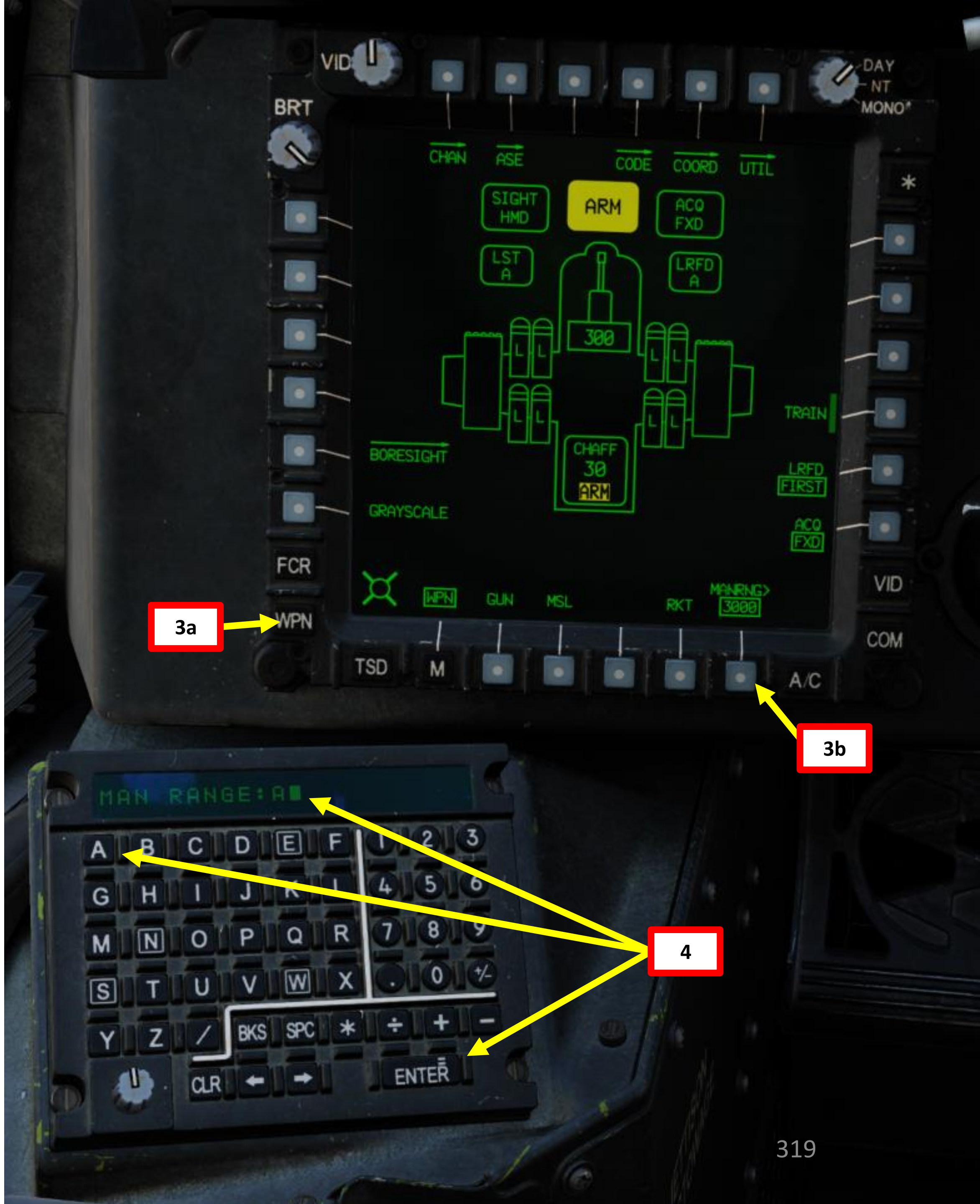
How to Store a Point (HMD, Automatic Range)

The Co-Pilot/Gunner can "store" a point set on a target within its range. Using automatically computed ranging is one of the less accurate methods compared to laser ranging. Here is a tutorial on how to store a target using automatic ranging.

1. [CPG] Set the Sight Select Switch to FWD (HMD) on the collective. Performing this action will select the TADS and display the "C-HMD" (Co-Pilot Helmet-Mounted Display) indication on the lower left of the HDU (Helmet Display Unit).
2. [P/CPG] Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. [CPG] On the WPN page, press VAB (Variable Action Button) next to MAN RNG to select ranging parameter/option.
4. [CPG] Type "A" on the KU (Keyboard Unit), then press ENTER on the KU. This will select automatic ranging.

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*





2 – HMD (HELMET-MOUNTED DISPLAY)
2.5 – Target Storing with HMD

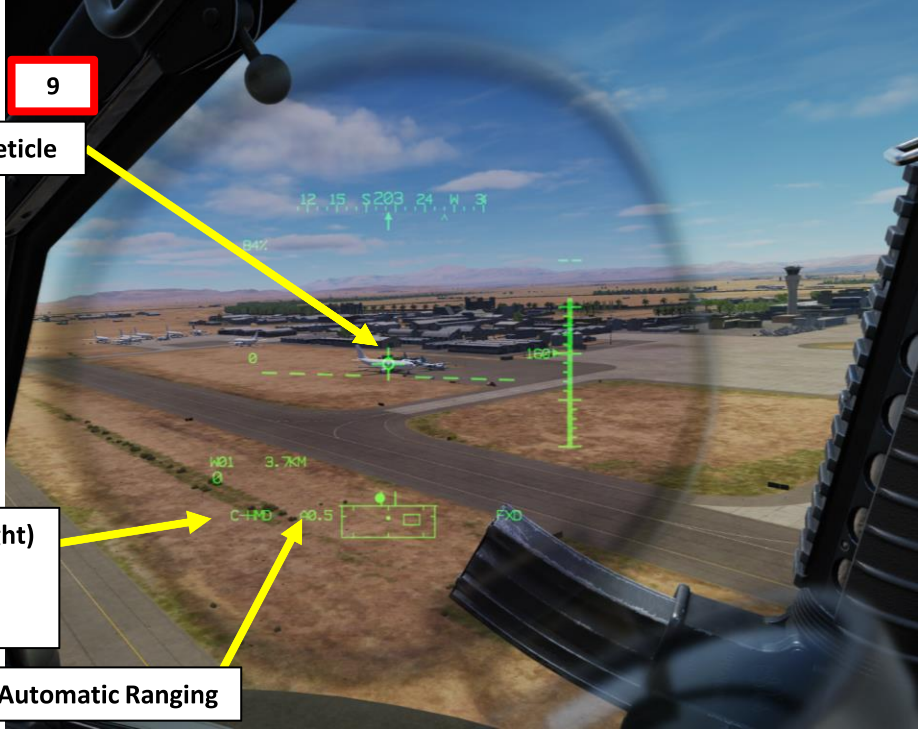
How to Store a Point (HMD, Automatic Range)

5. *[CPG]* Select Press on the TSD FAB (Fixed Action Button) to access the Tactical Situation Display menu.
6. *[CPG]* Press on VAB (Variable Action Button) next to POINT.
7. *[CPG]* Press on VAB next to STO (Store).
8. *[CPG]* Press on VAB next to TYPE to toggle between either WP (Waypoint) or TG (Target). We will select TG to store target coordinate data.

2 – HMD (HELMET-MOUNTED DISPLAY)
2.5 – Target Storing with HMD

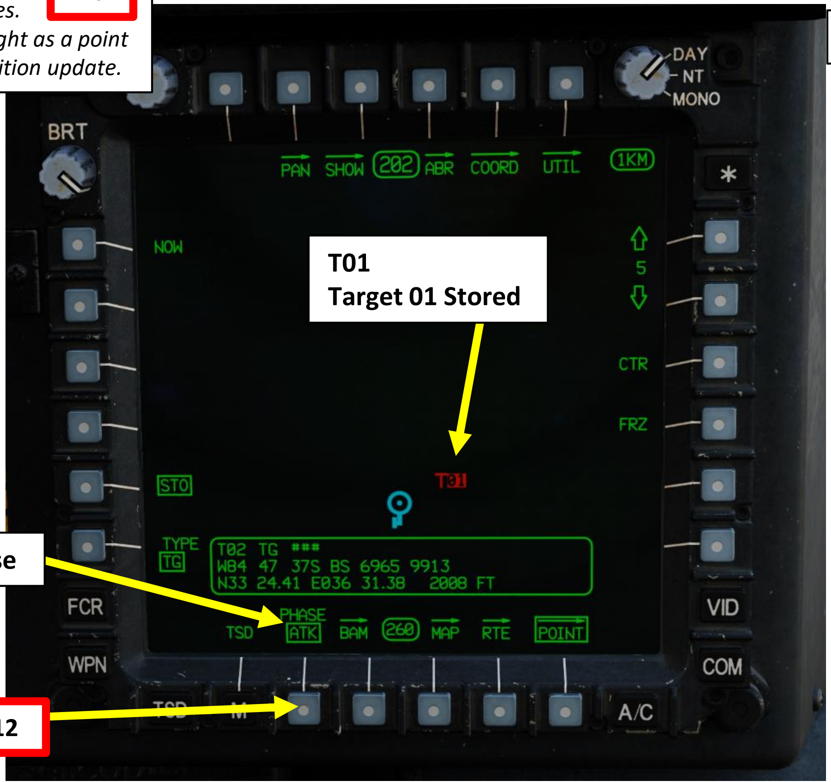
How to Store a Point (HMD, Automatic Range)

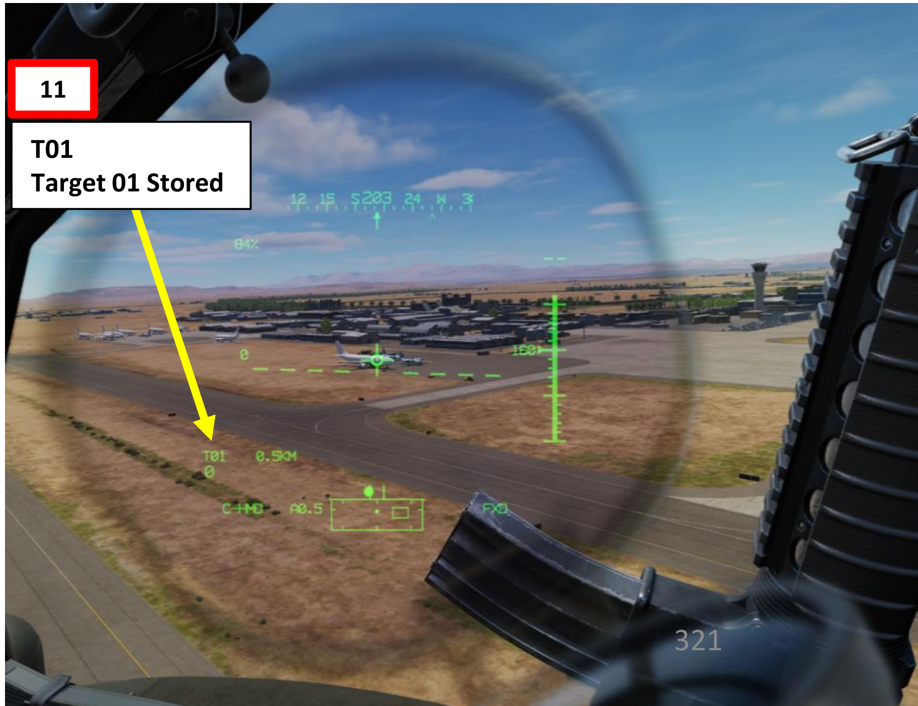
9. *[CPG]* Place the Helmet Line-of-Sight Reticle on the target you want to store as a target point.
10. *[CPG]* Press the TEDAC Left Hand Grip Store/Update Switch FWD (STORE) to store the TADS line-of-sight as a target point.
11. *[CPG]* A "T" followed by the Target Point number will be displayed on the HDU (Helmet Display Unit). As an example, "T01" indicates that Target Point 01 coordinates have been stored.
12. *[CPG]* On the TSD (Tactical Situation Display) page, selecting the ATK (Attack) Phase allows you to display stored target points. This is useful when multiple targets are saved and you want to quickly figure out where they are in relationship to you.



Sight Selection (Crewmember's selected sight)
- *HMD (Helmet Display)*
- *FCR (Fire Control Radar)*
- *TADS (Target Acquisition & Designation Sight)*

Store/Update Switch **10**
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.1 – Introduction

The AN/ASQ-170 TADS (Target Acquisition & Designation Sight) has the ability to locate, track, and laser designate targets day and night, and in bad weather conditions. It consists of both FLIR (Forward-Looking Infrared) and Day TV (DTV) video systems, a laser rangefinder/designator (LRF/D), and a laser spot tracker (LST).

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.2 – Display

In the AH-64D, the CPG's (Co-Pilot/Gunner) uses the TDU (TEDAC Display Unit) to display the TADS (Target Acquisition & Designation Sight) video feed. The TDU can also be used to interface with the FCR (Fire Control Radar) and the PNVS (Pilot Night Vision System).

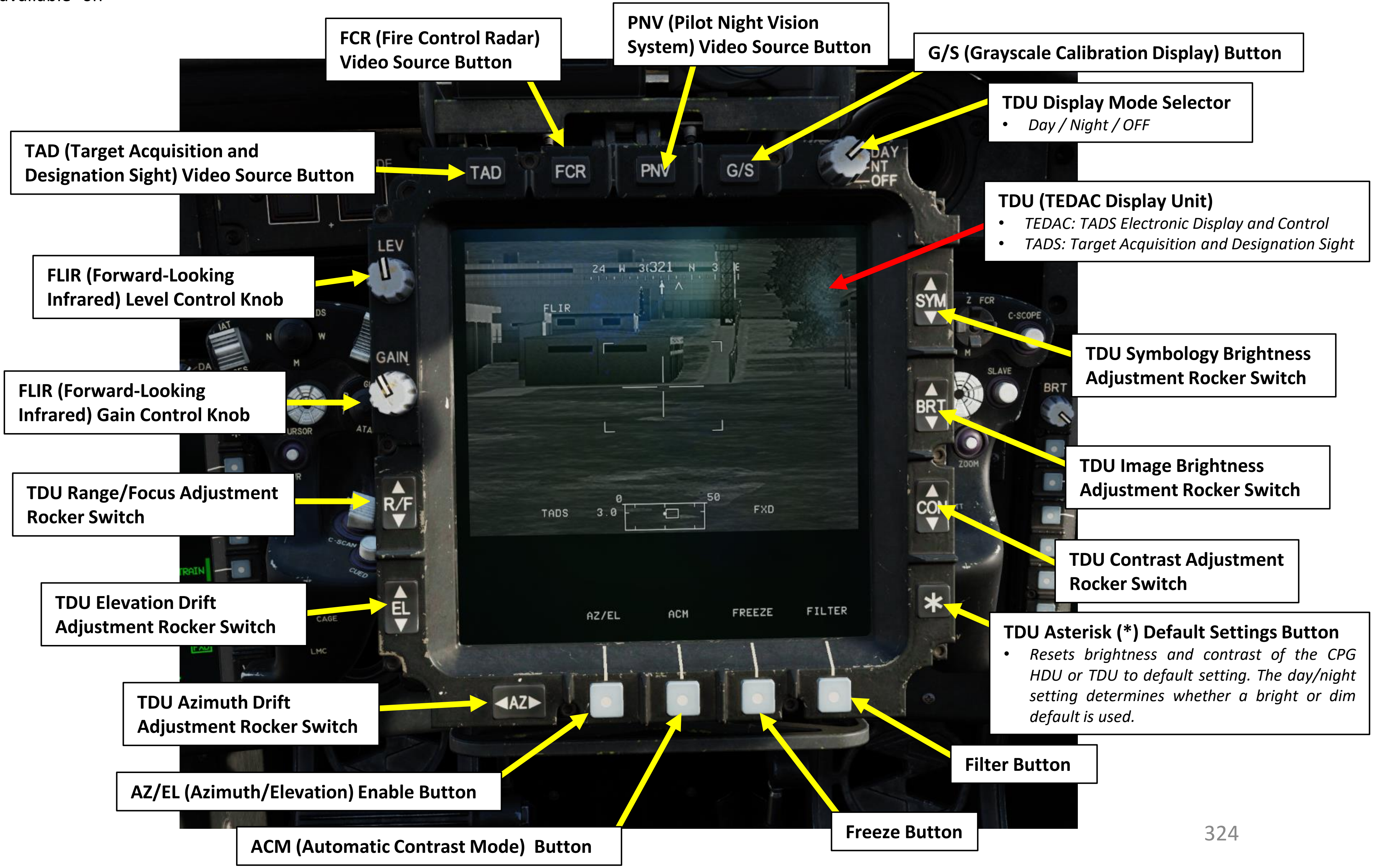
TDU (TEDAC Display Unit)

- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.2 – Display

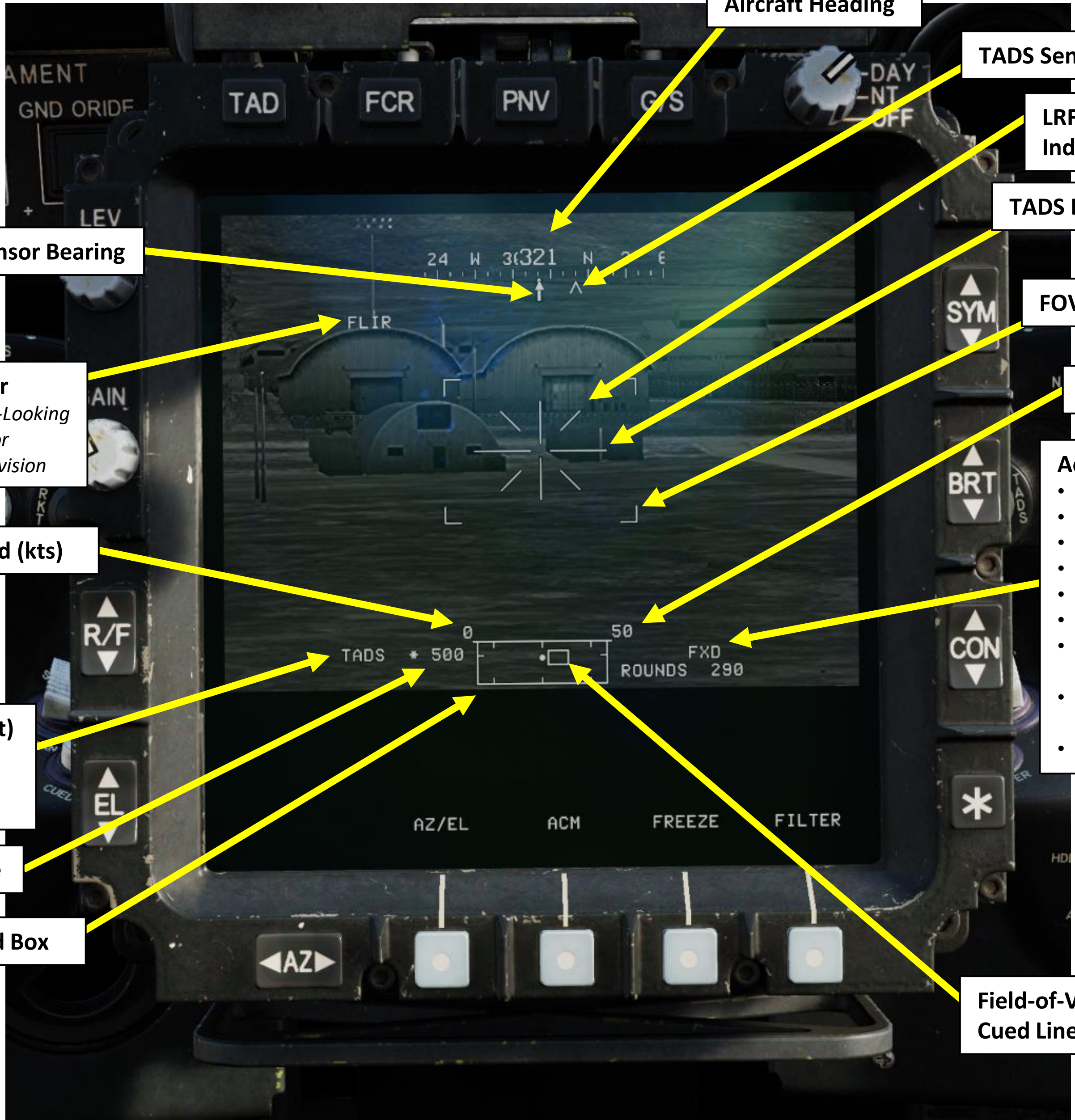
Various TDU image controls are available on buttons surrounding the display.



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.2 – Display

Here is a quick overview of the TDU symbology. Take note that the information displayed changes depending on what weapon and delivery mode is selected.



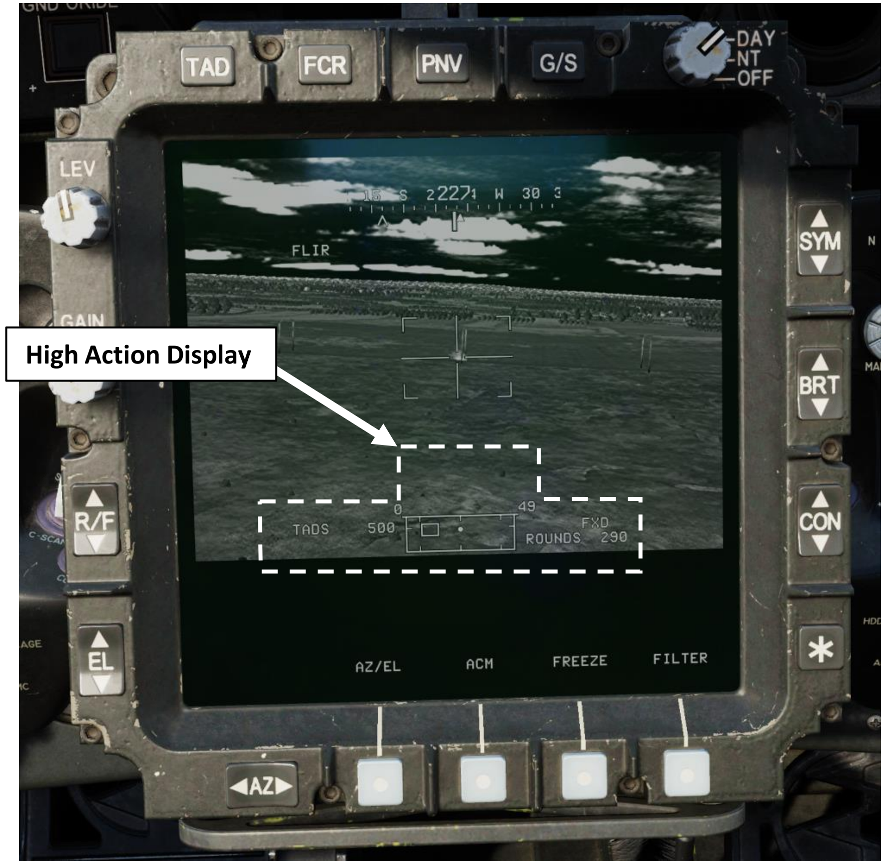
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

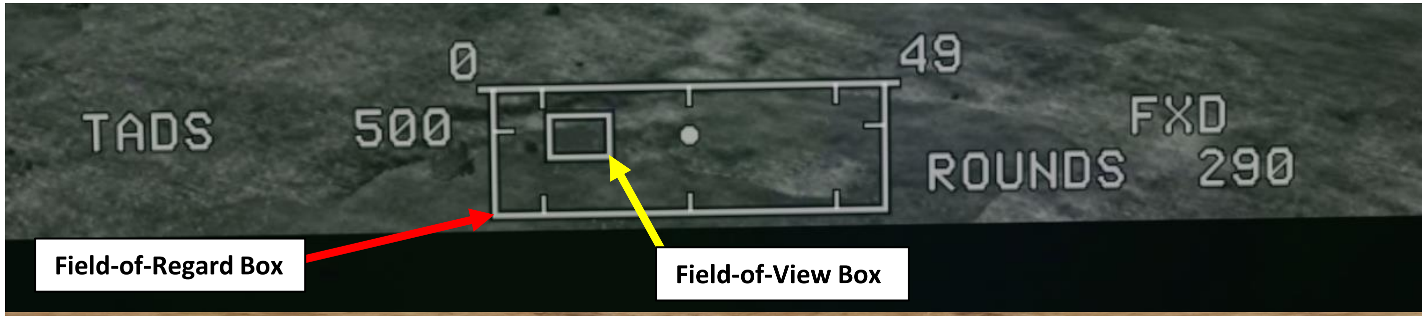
3.2 – Display

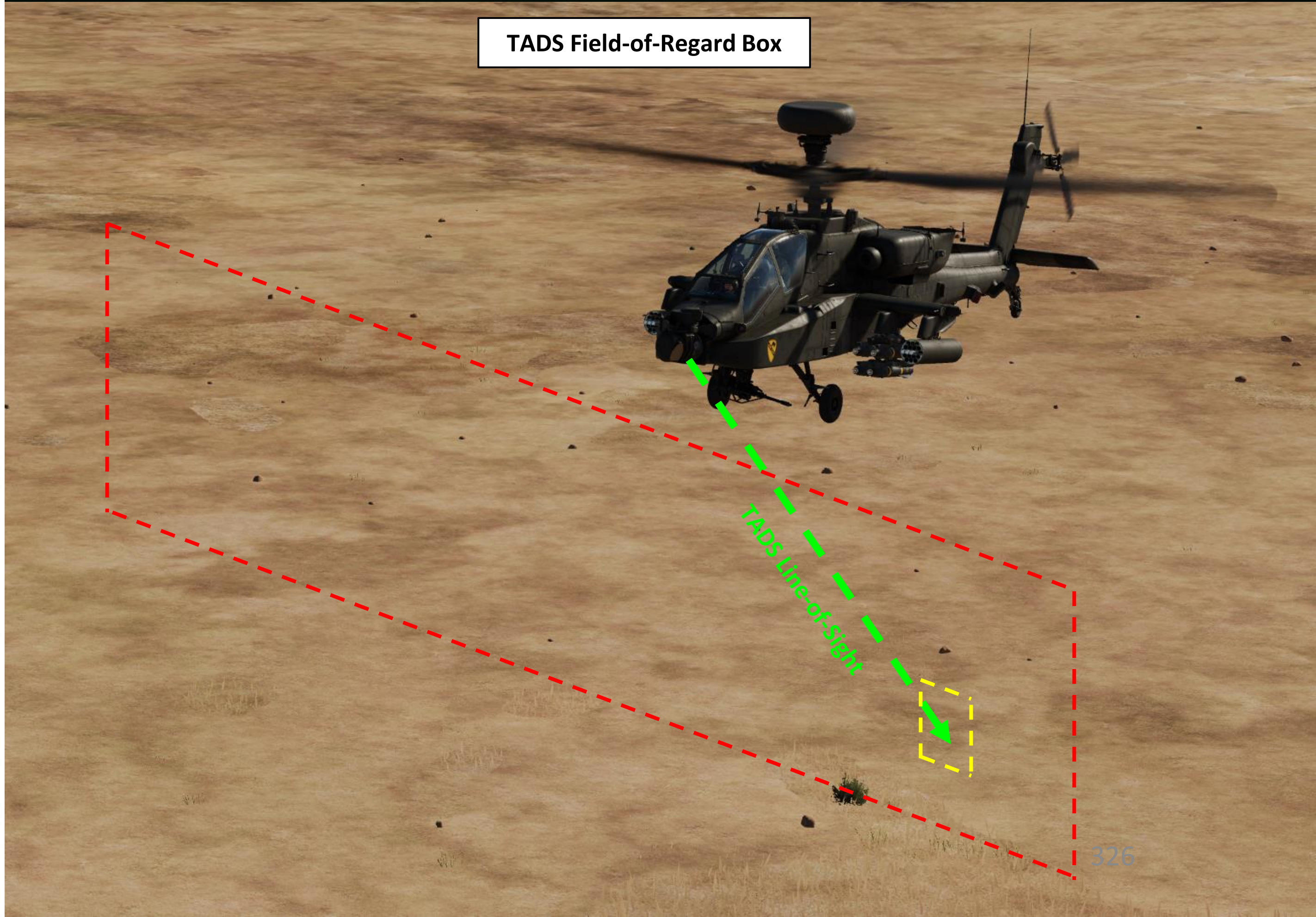
The **High Action Display (HAD)** shows symbology used mainly for targeting and weapon employment. It also provides additional information such as the selected sight and selected acquisition source.

The **Field-of-View (FOV) Box** indicates the relative position of TADS (Target Acquisition & Designation Sight) field-of-view (30 deg x 40 deg) within the Field-of-Regard Box.

The **Field-of-Regard (FOR) Box** indicates azimuth limits for the current sensor selected. Tick mark around the edges of the FOR box assist in marking the sensor limits for each sensor.

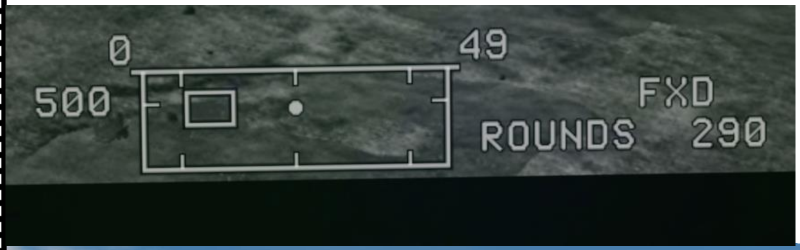




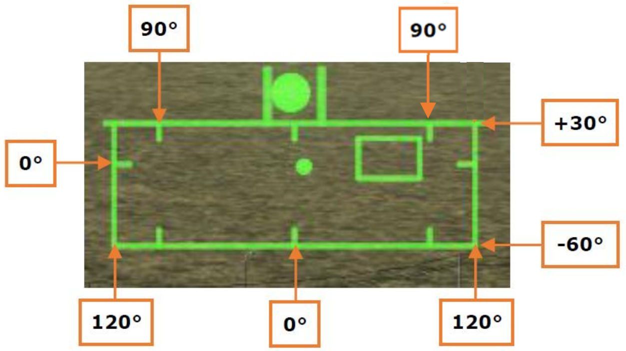


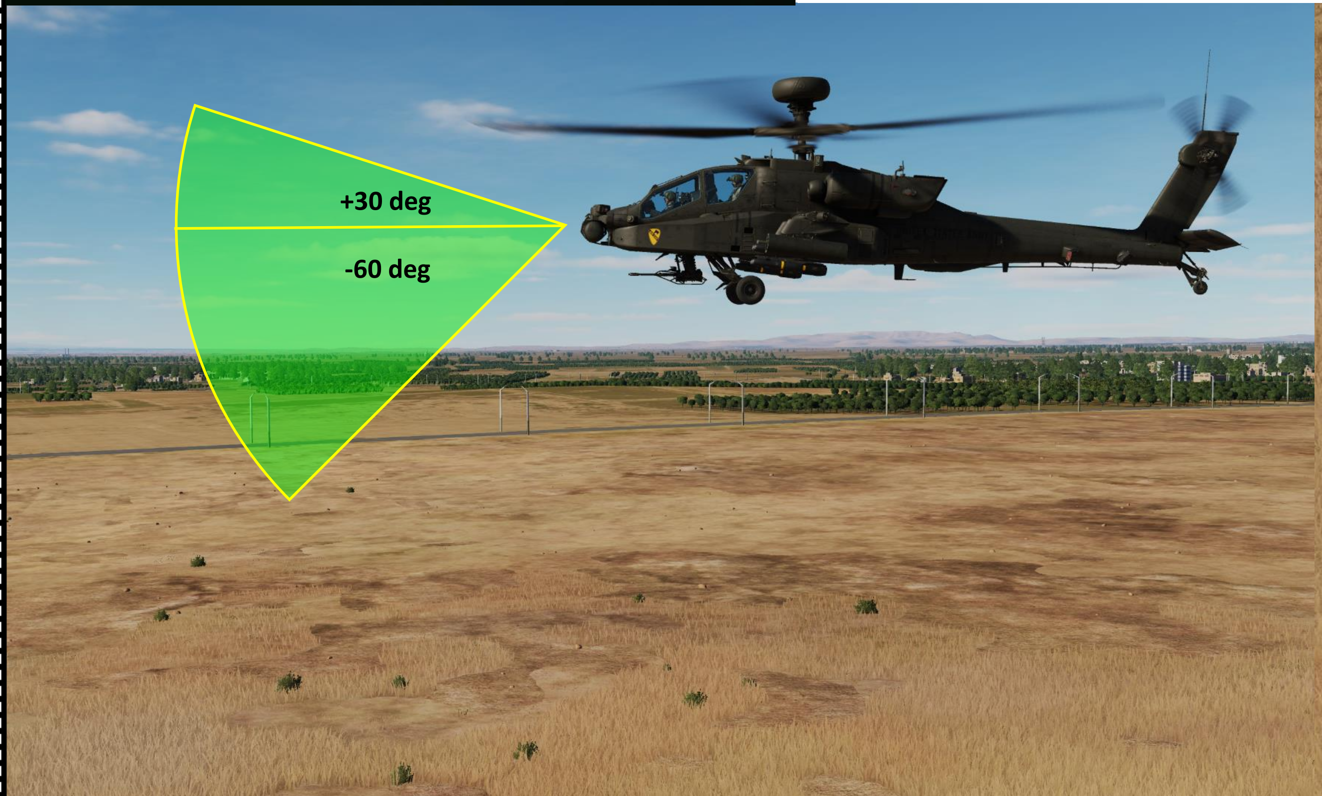
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.2 – Display

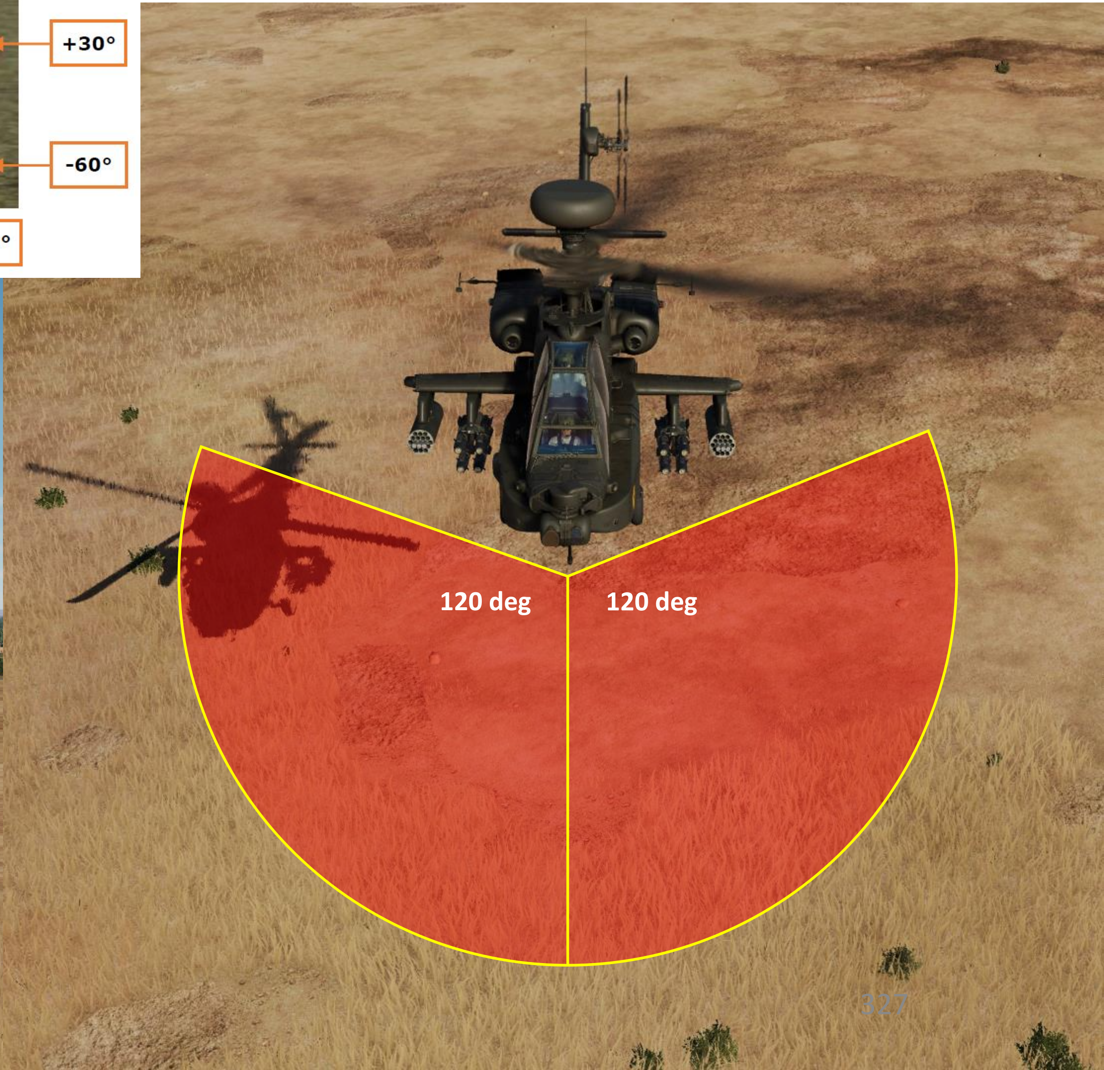
TADS Limitations (displayed on Field-of-Regard Box)
- Elevation range of motion: + 30 deg to -60 deg
- Azimuth range of motion: +/- 120 deg
- Slew rate: 60 deg/sec



TADS Field-of-Regard Box Limits







3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.2 – Display

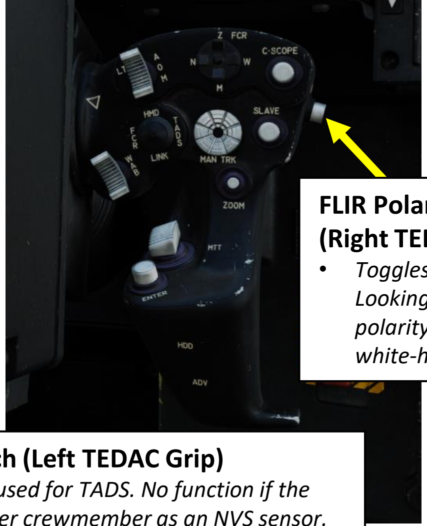
DTV (Daytime TV) is selected with the TADS Sensor Select Switch set to MIDDLE (DTV), which is located on the left TEDAC grip.

FLIR (Forward-Looking Infrared) is selected with the TADS Sensor Select Switch set to FWD (FLIR), which is located on the left TEDAC grip.

- FLIR Polarity can be toggled between **BHOT** (Black Hot) and **WHOT** (White Hot) by using either:
    - The Boresight/Polarity Selector on the collective or;
    - The FLIR Polarity Button on the right TEDAC grip.

Boresight/Polarity Selector
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

TADS Sensor Select Switch (Left TEDAC Grip)
- *Selects the optical sensor used for TADS. No function if the TADS is being used by either crewmember as an NVS sensor.*
    - *FWD: FLIR (Forward-Looking Infrared) used by TADS*
    - *MIDDLE: DTV (Daytime Television) Sensor*
    - *AFT: DVO, no function.*



FLIR Polarity Button (Right TEDAC Grip)
- *Toggles FLIR (Forward-Looking Infrared) image polarity (black-hot or white-hot).*

WHOT (White Hot) FLIR Polarity
Zoom levels: Wide, Medium, Narrow, & Zoom

BHOT (Black Hot) FLIR Polarity
Zoom levels: Wide, Medium, Narrow, & Zoom

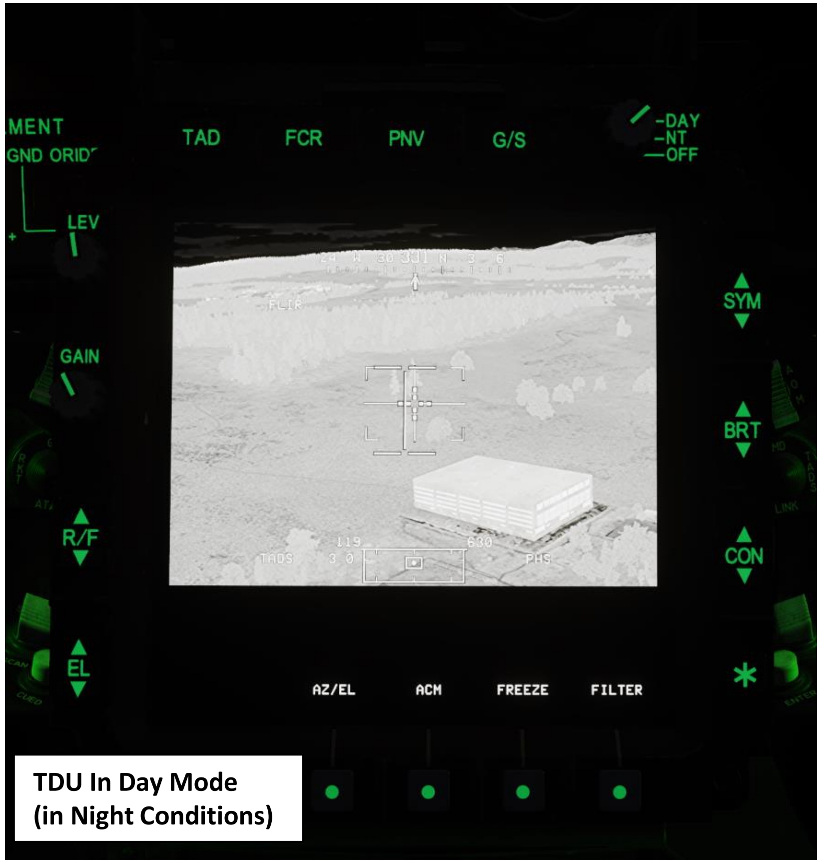
DTV (Day Television)
Zoom levels: Wide, Narrow, & Zoom

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.2 – Display

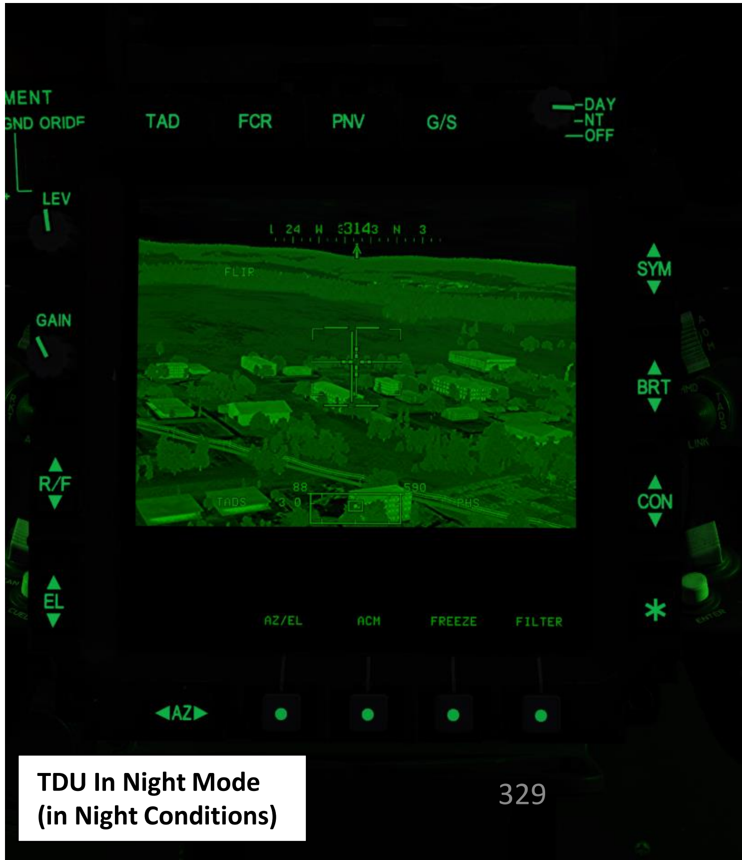
Depending on whether you are operating during the day or at night, I recommend you set the **TDU Display Mode selector** accordingly. It can make your life much easier and provide better visibility on the TDU (TADS Display Unit).

TDU Display Mode Selector
- *Day / Night / OFF*

TDU In Day Mode
(in Daylight Conditions)



TDU In Day Mode
(in Night Conditions)



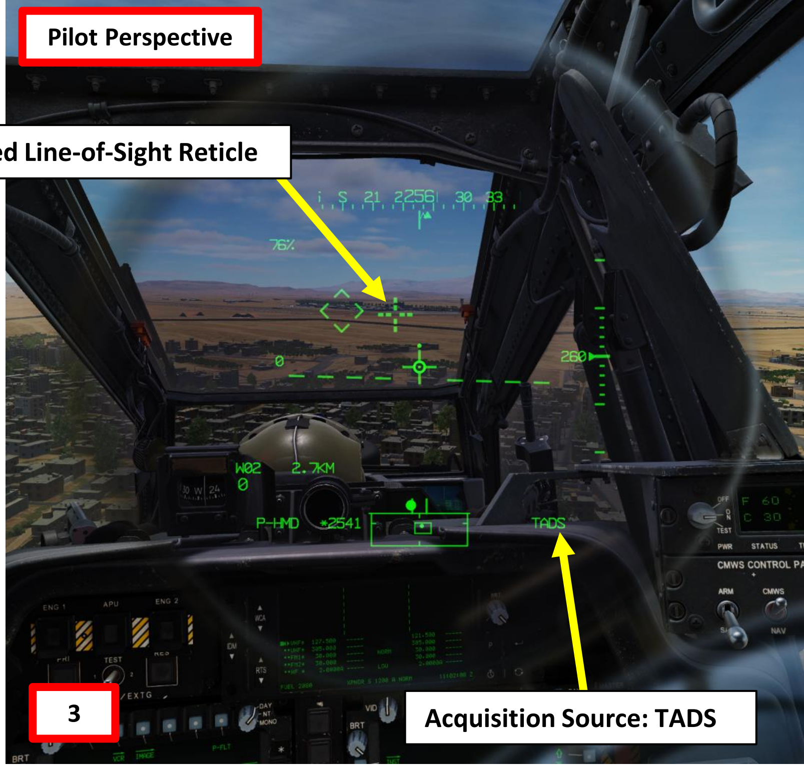
TDU In Night Mode
(in Night Conditions)

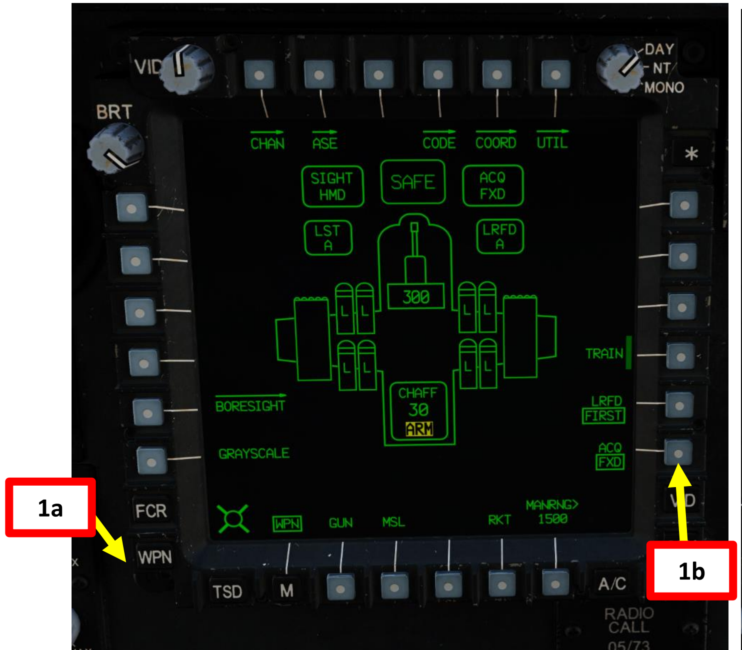
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.2 – Display

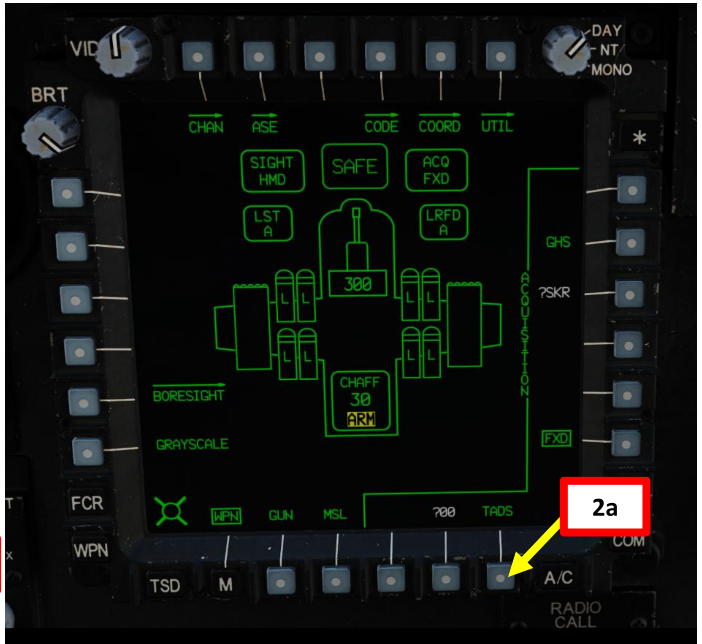
Notes for the Pilot: On your IHADSS HDU (Helmet Display Unit), the Cued Line-of-Sight Reticle represents where the TADS is looking ***if your acquisition (ACQ) source is set to the TADS***. If another acquisition source is selected, the Cued Line-of-Sight Reticle will be pointing to this other acquisition source instead of the TADS.

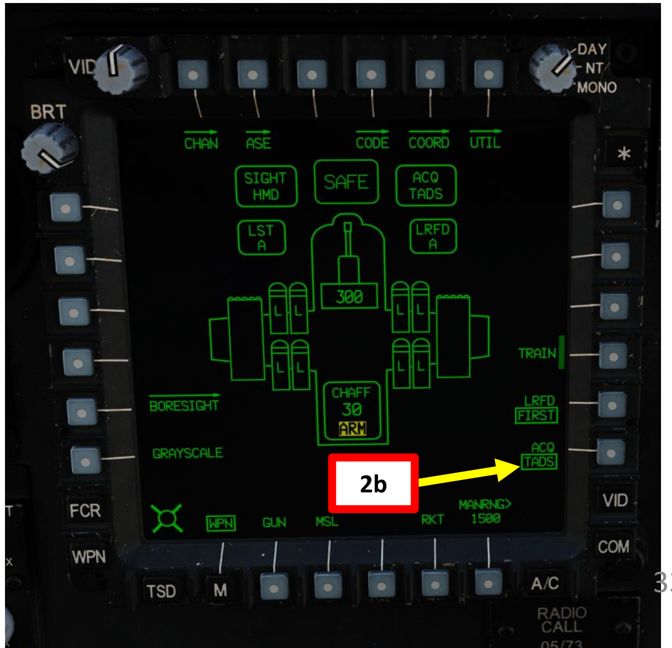
To set the TADS as the ACQ (acquisition) source:

1. *[P]* From the WPN or TSD page, press VAB (Variable Action Button) next to ACQ (Acquisition Source).
2. *[P]* Press VAB next to “TADS”. Your current acquisition source will then be the TADS.
3. *[P]* The Cued Line-of-Sight Reticle on the HDU will then be where the TADS is looking since the ACQ source is set to “TADS”.









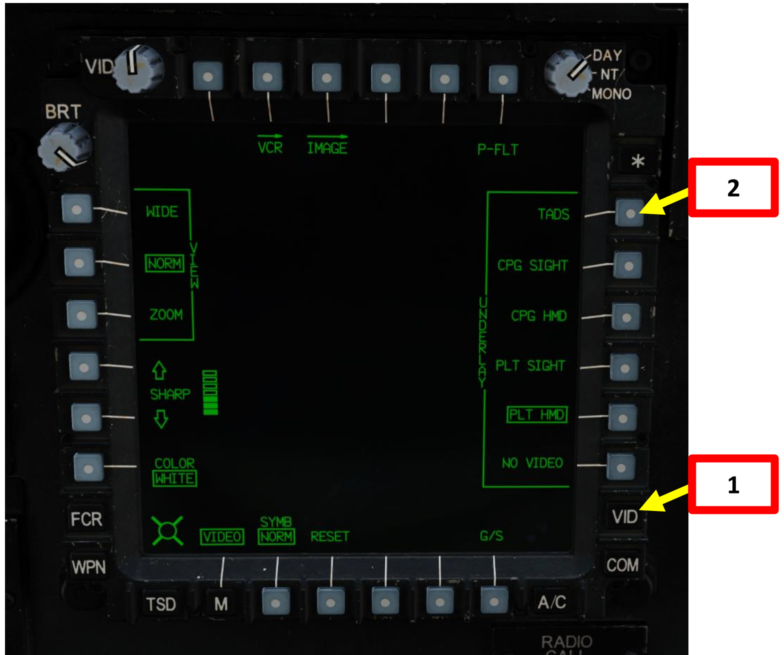
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

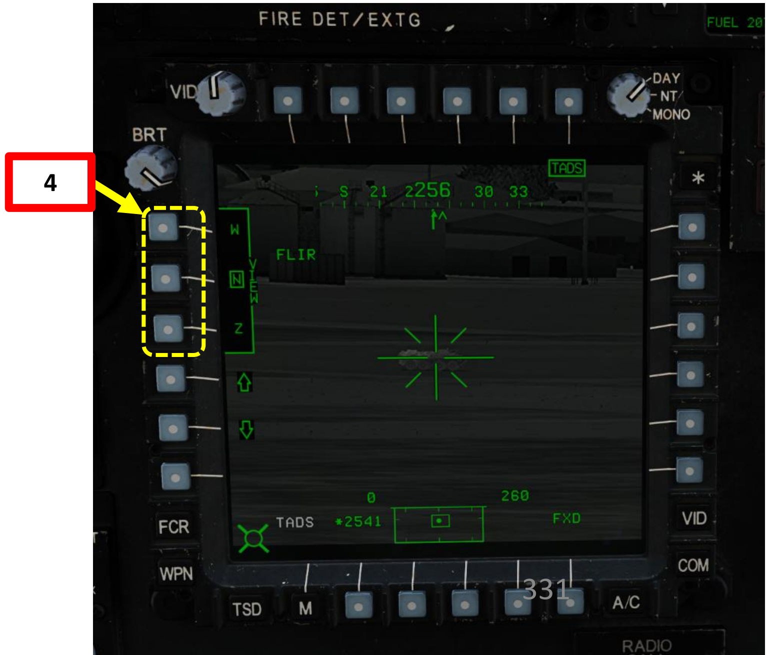
3.2 – Display

Notes for the Pilot: You can also look at the TADS video feed, but you cannot slew the TADS by yourself; that's the Co-Pilot/Gunner's job.

To see the TADS feed:

1. *[P]* Press on the VID FAB (Fixed Action Button) to access the Video menu
2. *[P]* Press VAB (Variable Action Button) next to TADS to select TADS feed underlay.
3. *[P]* Press VAB next to VID option to collapse underlay options.
4. *[P]* Zoom settings can be selected via the W, N and Z VABs to the left.

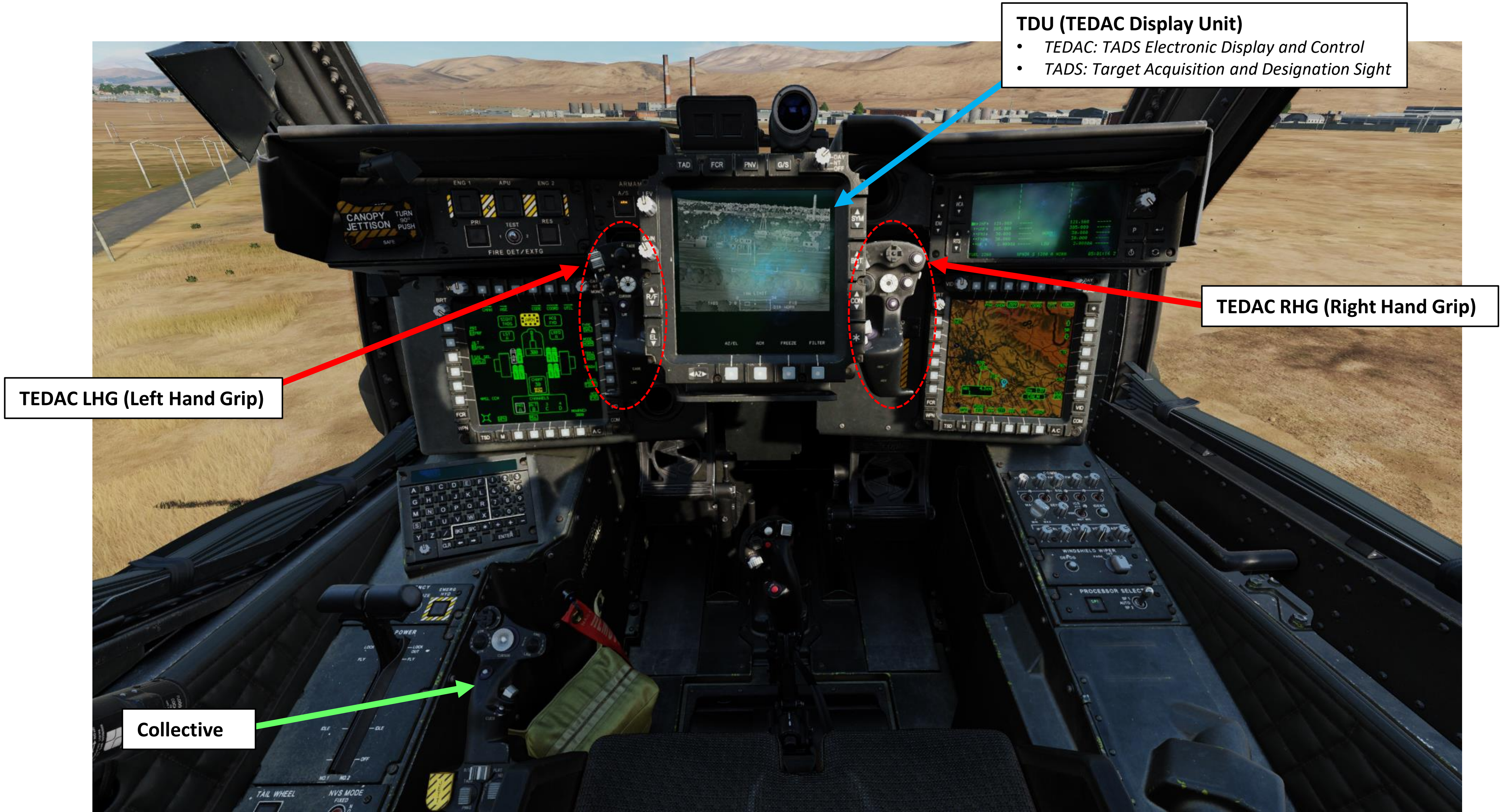




3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.3 – Controls (Overview)

The TADS is mainly controlled by the CPG (Co-Pilot/Gunner).

- The main controls are located on the **Left and Right TEDAC grips**.
- Display-related settings are available on the **TDU** (TEDAC Display Unit).
- Some TADS functions are also duplicated on the **collective** as well.



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.3 – Controls (TEDAC Left Hand Grip)

Here is an overview of the TADS controls on the left TEDAC grip.

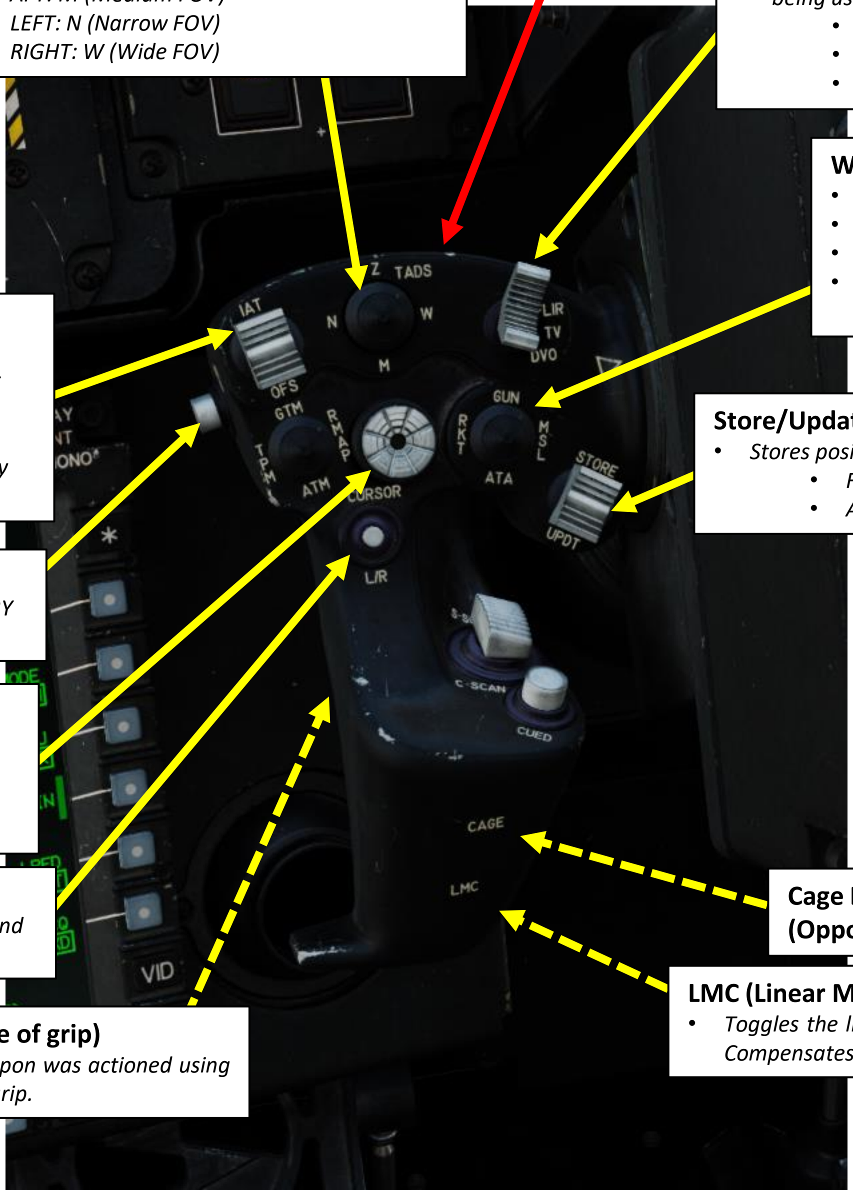
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TADS (Target Acquisition & Designation Sight) FOV (Field-of-View) Selector
- *FWD: Z (Zoom FOV)*
- *AFT: M (Medium FOV)*
- *LEFT: N (Narrow FOV)*
- *RIGHT: W (Wide FOV)*

TADS Sensor Select Switch
- *Selects the optical sensor used for TADS. No function if the TADS is being used by either crewmember as an NVS sensor.*
  - *FWD: FLIR (Forward-Looking Infrared) used by TADS*
  - *MIDDLE: DTV (Daytime Television) Sensor*
  - *AFT: DVO, no function.*

Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

IAT/OFS Switch
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*



Store/Update Switch
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

Video Record Button
- *Toggles the VCR between STOP/STANDBY and RECORD mode.*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

Cursor Display Select Button
- *Toggles the cursor to the other MPD and centers it on the screen.*

Cage Button (No Function) (Opposite Side)

TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

LMC (Linear Motion Compensator) Button (Opposite Side)
- *Toggles the linear motion compensator (LMC) during manual tracking. Compensates for helicopter and/or target movement.*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.3 – Controls (TEDAC Right Hand Grip)

Here is an overview of the TADS controls on the right TEDAC grip.

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

LST (Laser Spot Tracker) Mode Switch
- *FWD: A (Automatic)*
- *MIDDLE: OFF*
- *AFT:M (Manual)*

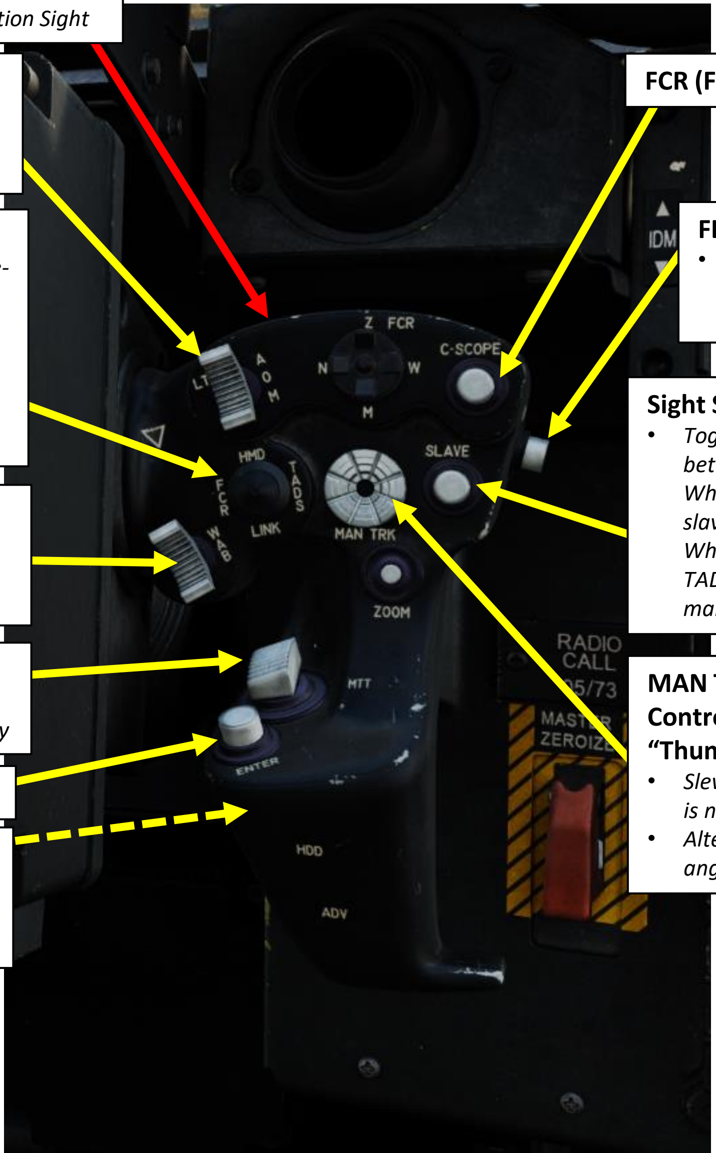
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

IAT (Image Auto Tracker) Polarity Switch
- *FWD: WHITE, bright objects are tracked by the IAT.*
- *MIDDLE: **AUTO**, polarity is automatically selected by the IAT*
- *AFT: BLACK, dark objects are tracked by the IAT.*

TADS MTT (Multi-Target Tracker) Track Promote Switch
- *FWD:Steps to the next TADS track and promotes it to primary*
- *AFT:Steps to the previous TADS track and promotes it to primary*

Cursor Enter Button

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)
- *First detent: LRFD determines target range.*
- *Second detent: LRFD determines target range and designates target for laser guidance and engages the TSE (Target State Estimator).*



FCR (Fire Control Radar) C-Scope Button

FLIR Polarity Button
- *Toggles FLIR (Forward-Looking Infrared) image polarity (black-hot or white-hot).*

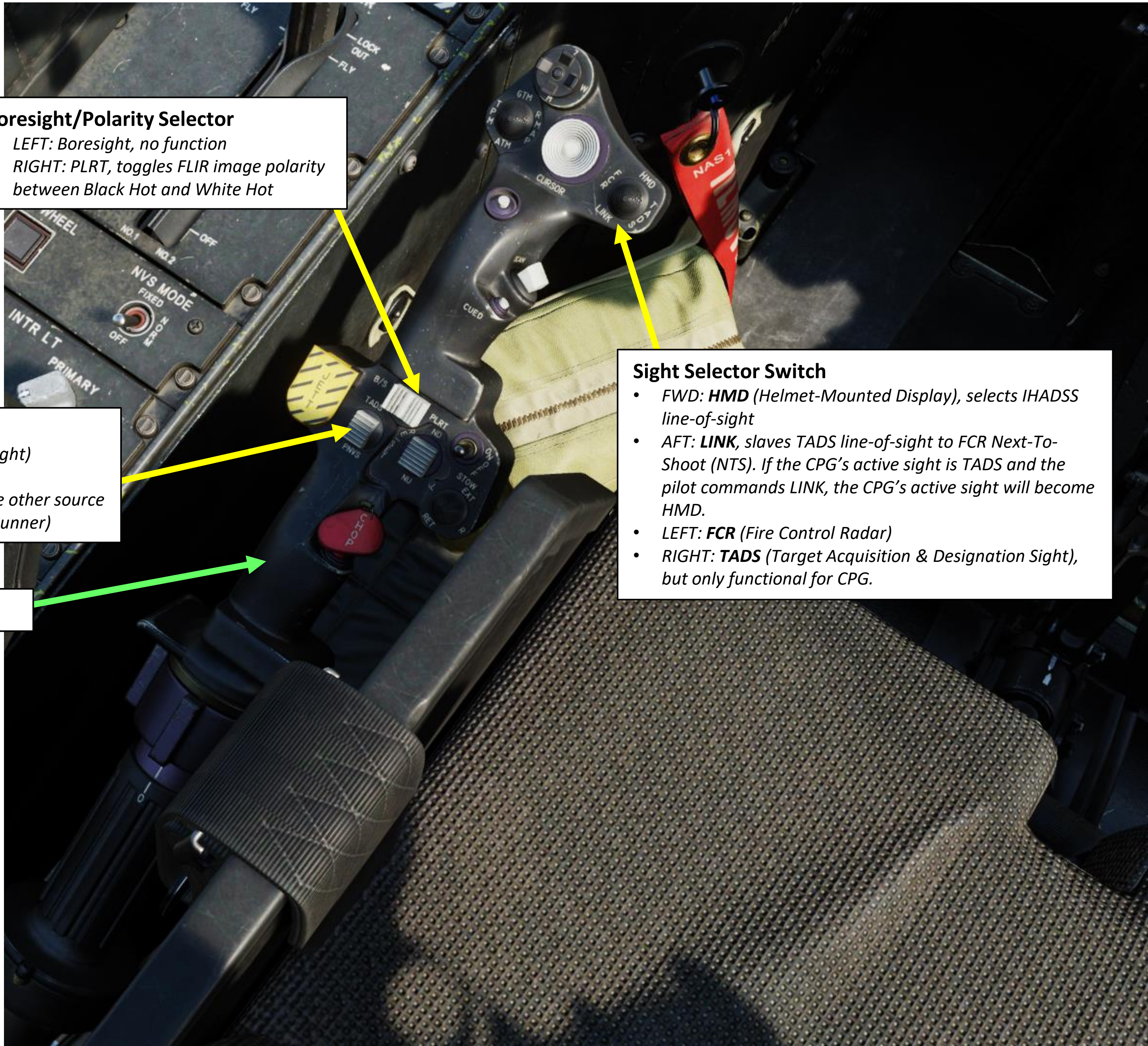
Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"
- *Slews TADS line-of-sight when "Slave mode" is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.3 – Controls (Collective)

Here is an overview of the TADS controls on the collective.



Boresight/Polarity Selector

- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

NVS (Night Vision System) Select Switch

- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

Collective

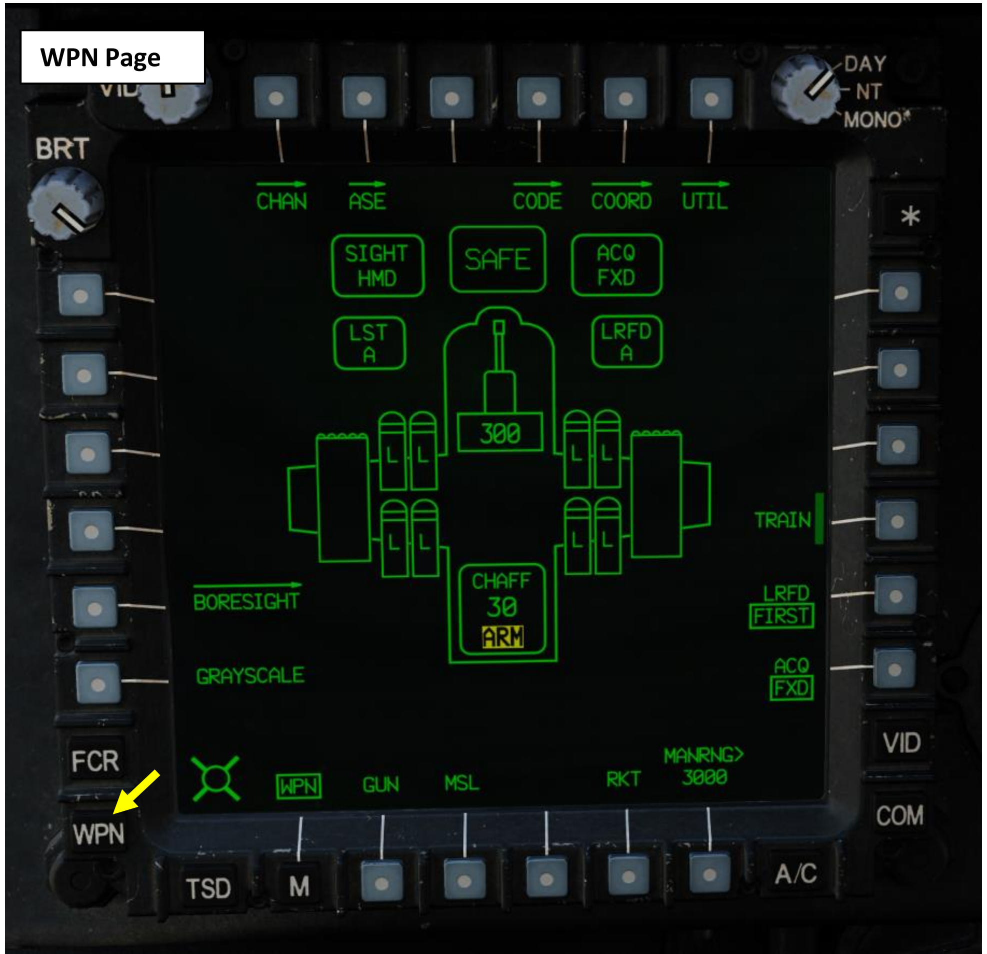
Sight Selector Switch

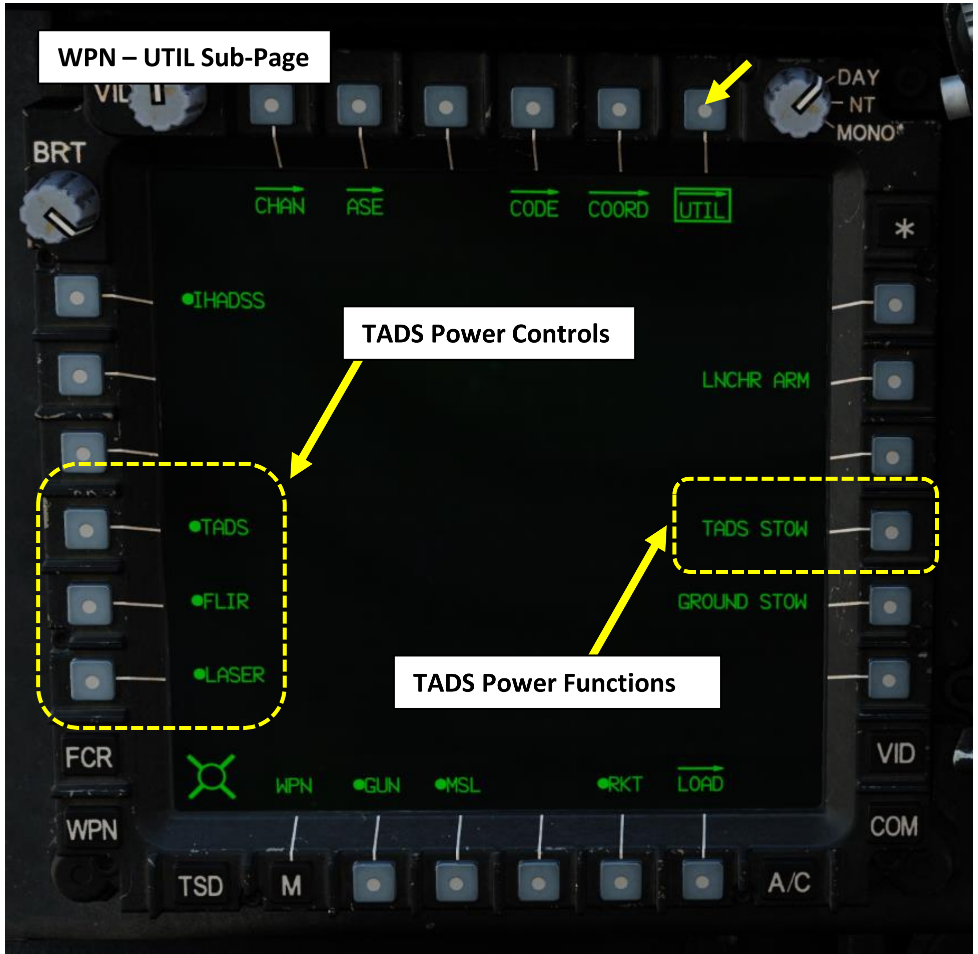
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.3 – Controls (WPN – UTIL Sub-Page)

Take note that selecting the WPN page, then the UTIL sub-page allows you to access TADS power options and functions such as:

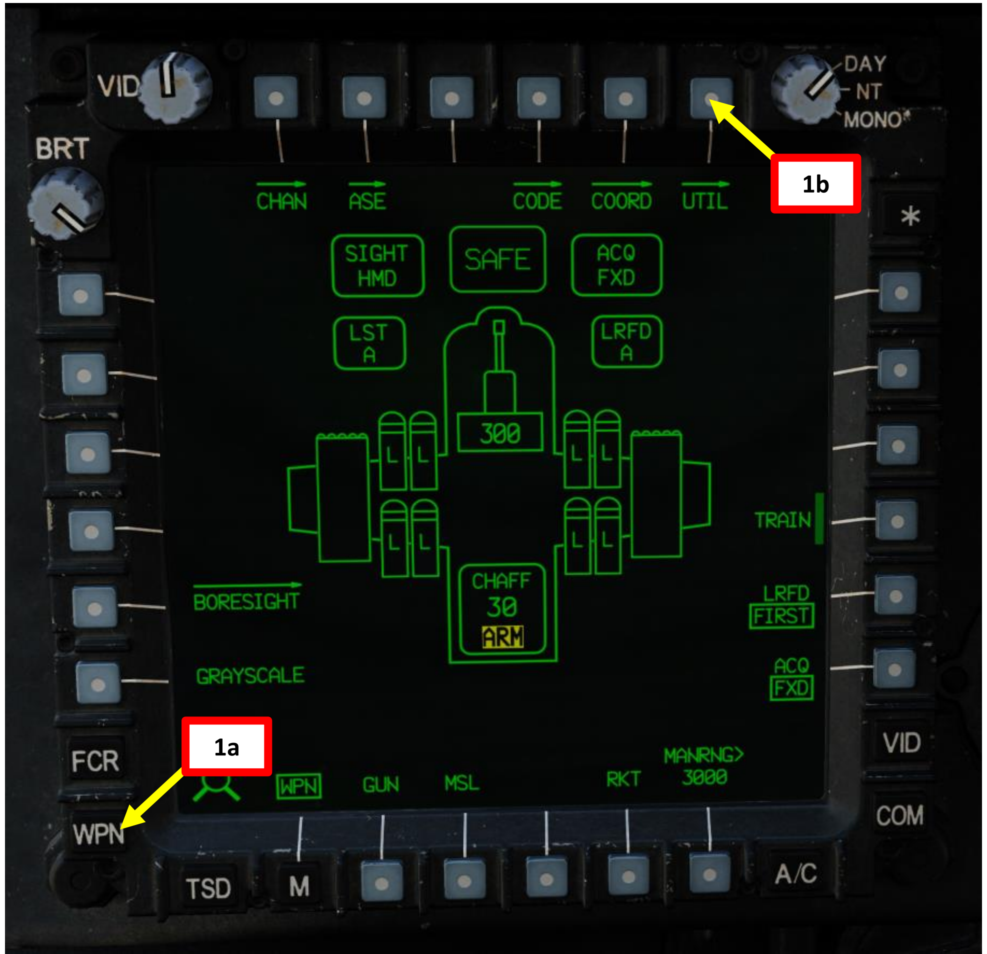
- **TADS**: Powers the TADS on/off. TADS is normally powered on automatically one minute after aircraft power-on.
- **FLIR**: Powers the TADS FLIR on/off. The FLIR is normally powered on automatically one minute after aircraft power-on.
- **LASER**: Powers the TADS LRFD on/off.
- **TADS STOW**: Stows the TADS turret, facing 180° aft.

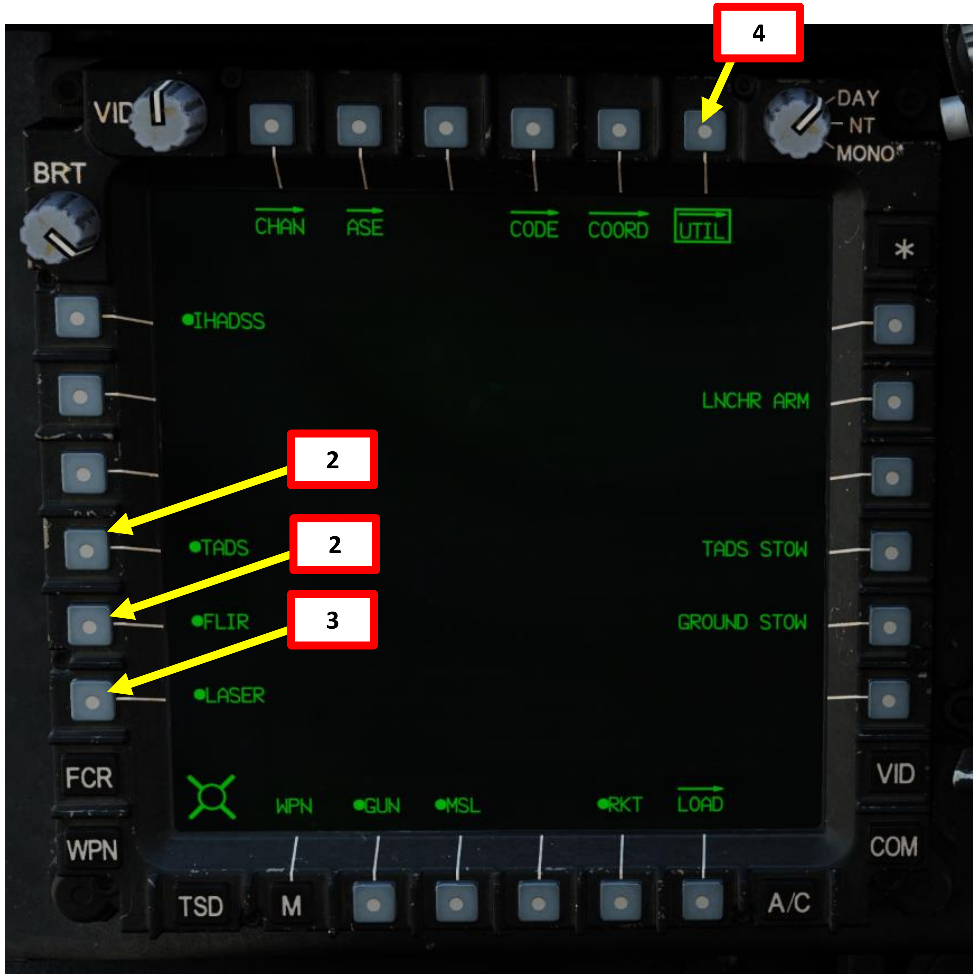




3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.4 – Laser Range Finder & Designator (LRFD)

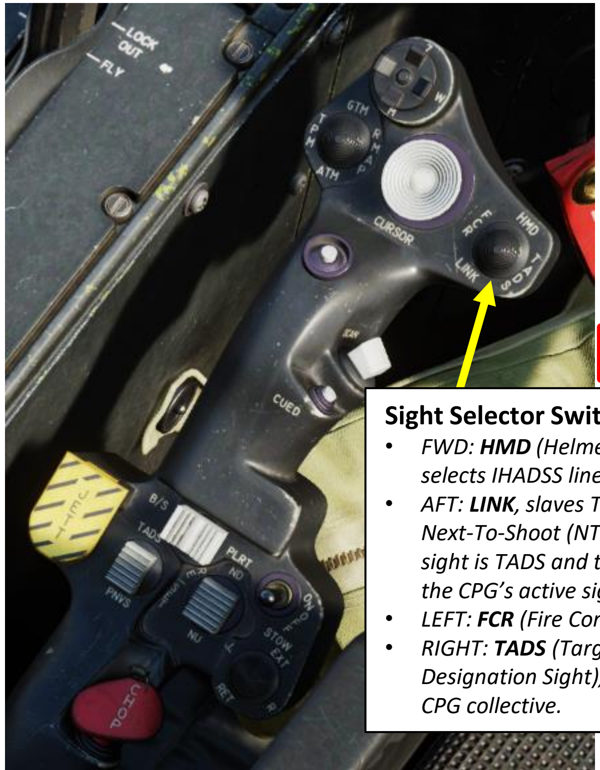
1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
   - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
   - Hollow circle means OFF. Solid Circle means ON.
   - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.4 – Laser Range Finder & Designator (LRFD)

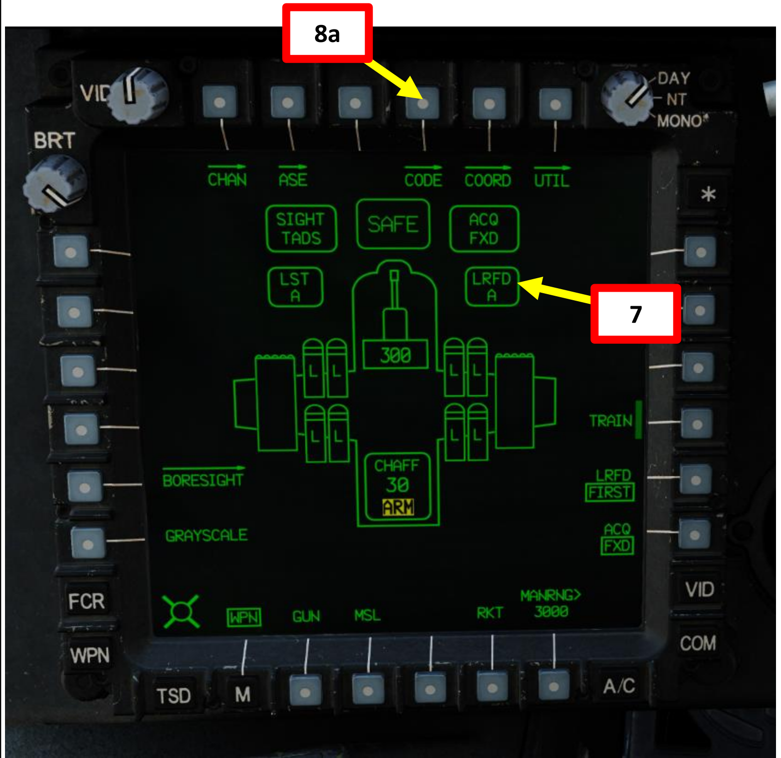
5. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
6. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the "IHADSS Show" binding, which is "i" by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "C-HMD".
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

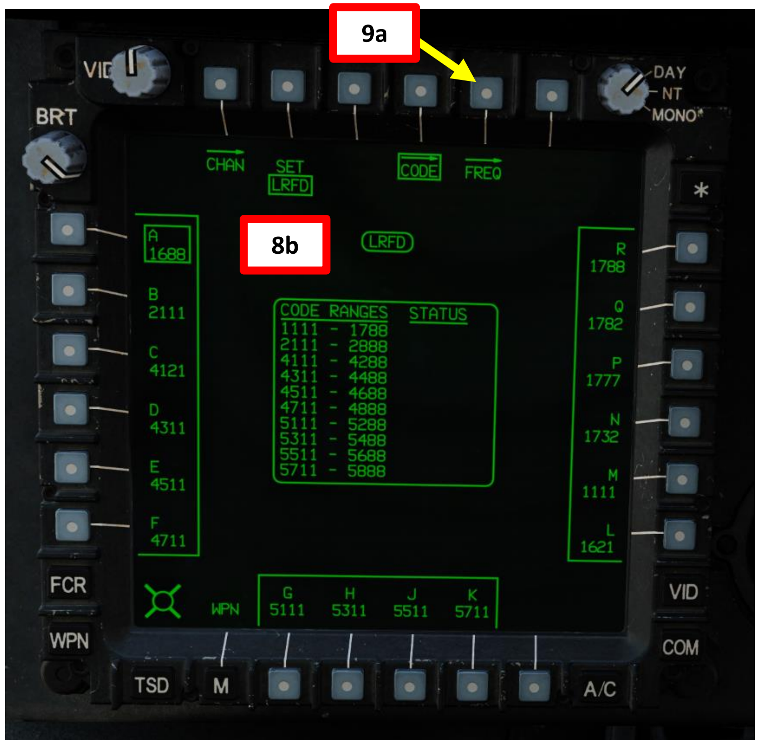


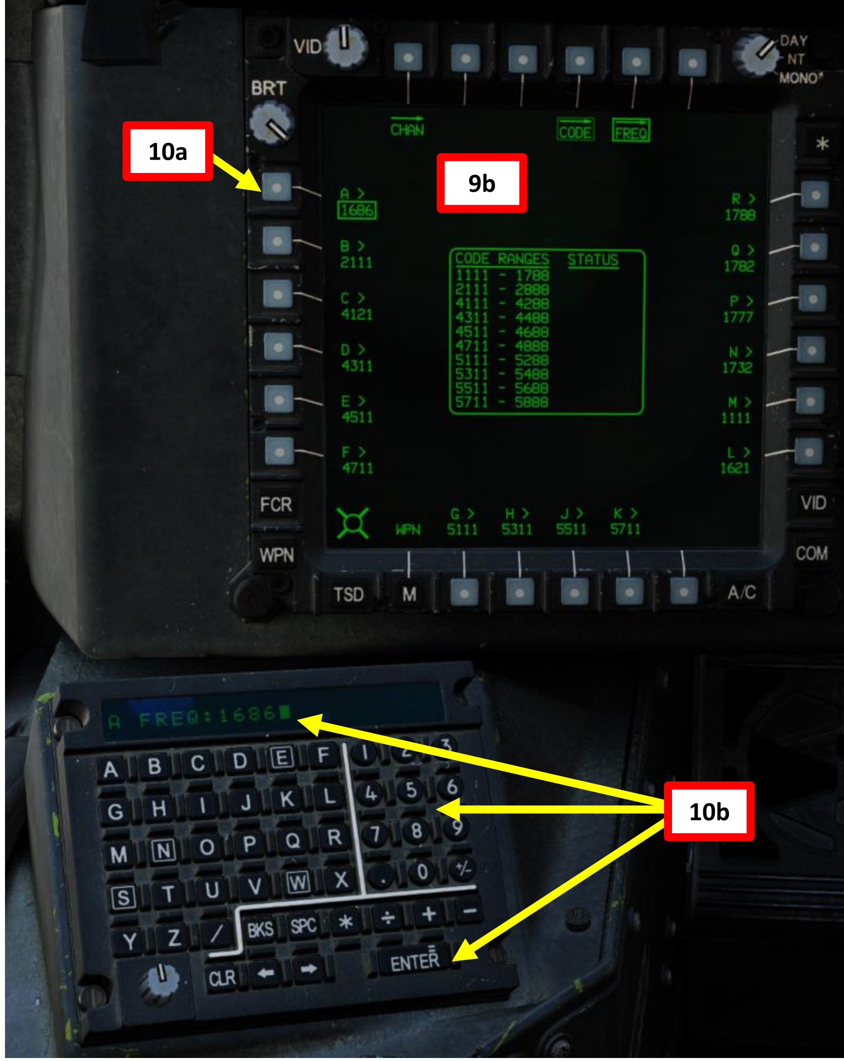
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*

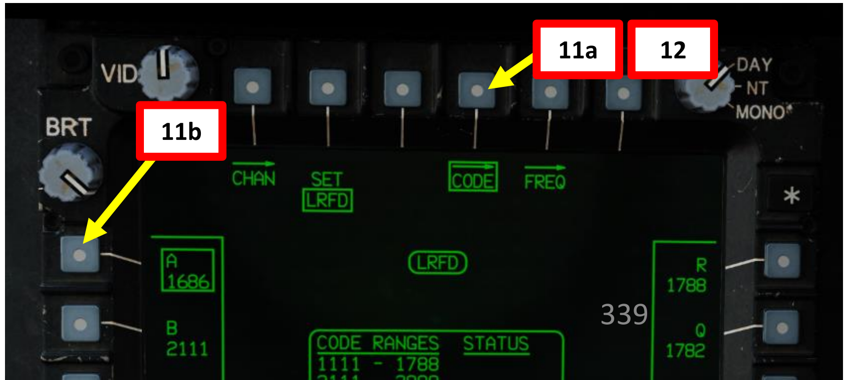
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.4 – Laser Range Finder & Designator (LRFD)

7. *[CPG]* By default, the LRFD (Laser Rangefinder/Designator) is set to Channel A. From the WPN (Weapon) page, any laser channel and its associated code can be selected and changed as desired.
   - In this example, we will select **Channel A** and change it to a **designation laser code of 1686** instead of the default laser code of 1688.
8. *[CPG]* To change your LRFD channel code, press VAB (Variable Action Button) next to CODE.
9. *[CPG]* Press VAB next to FREQ to select the laser frequency page.
10. *[CPG]* Press VAB next to Channel A, type the desired laser code of 1686 on the KU (Keyboard Unit), then press ENTER on the KU. Channel A will then have a laser code of 1686.
11. *[CPG]* To select the LRFD channel you will designate with, press VAB next to CODE, then press VAB next to Channel A to make it the active laser channel/code.
12. *[CPG]* Press VAB next to CODE to return to WPN menu.





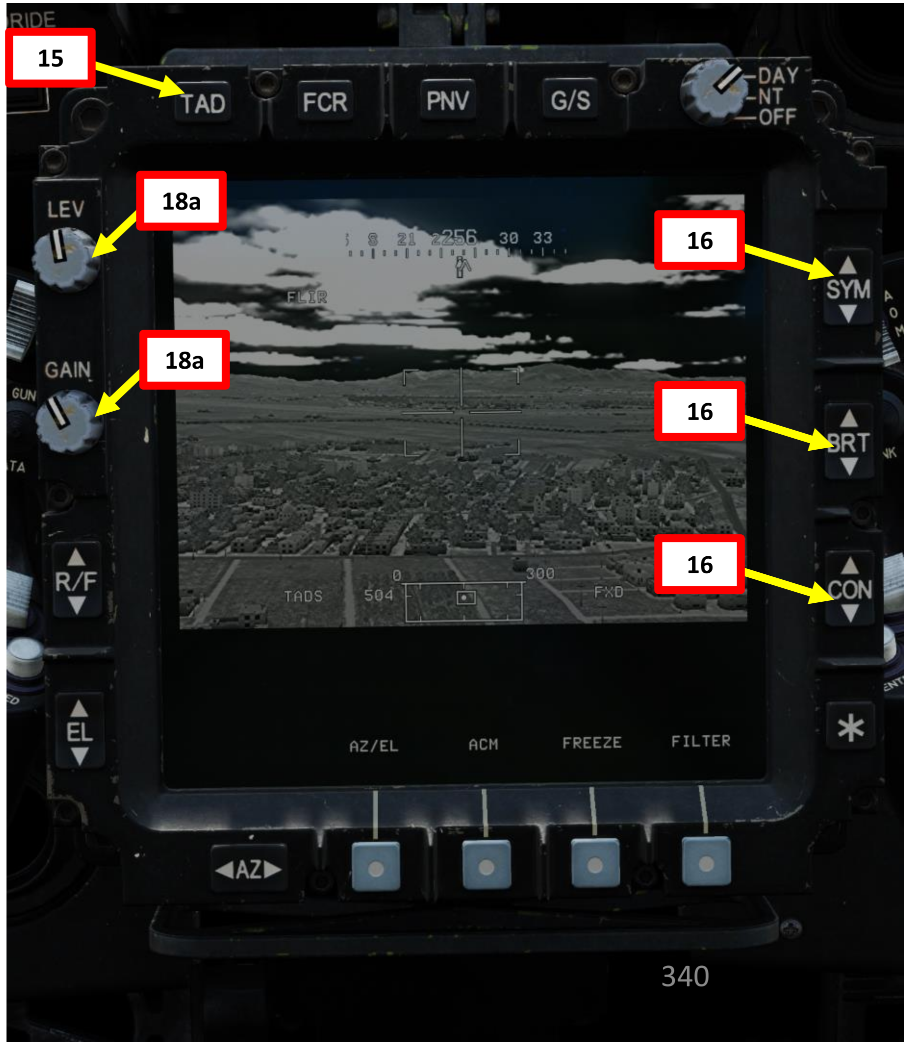




3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.4 – Laser Range Finder & Designator (LRFD)

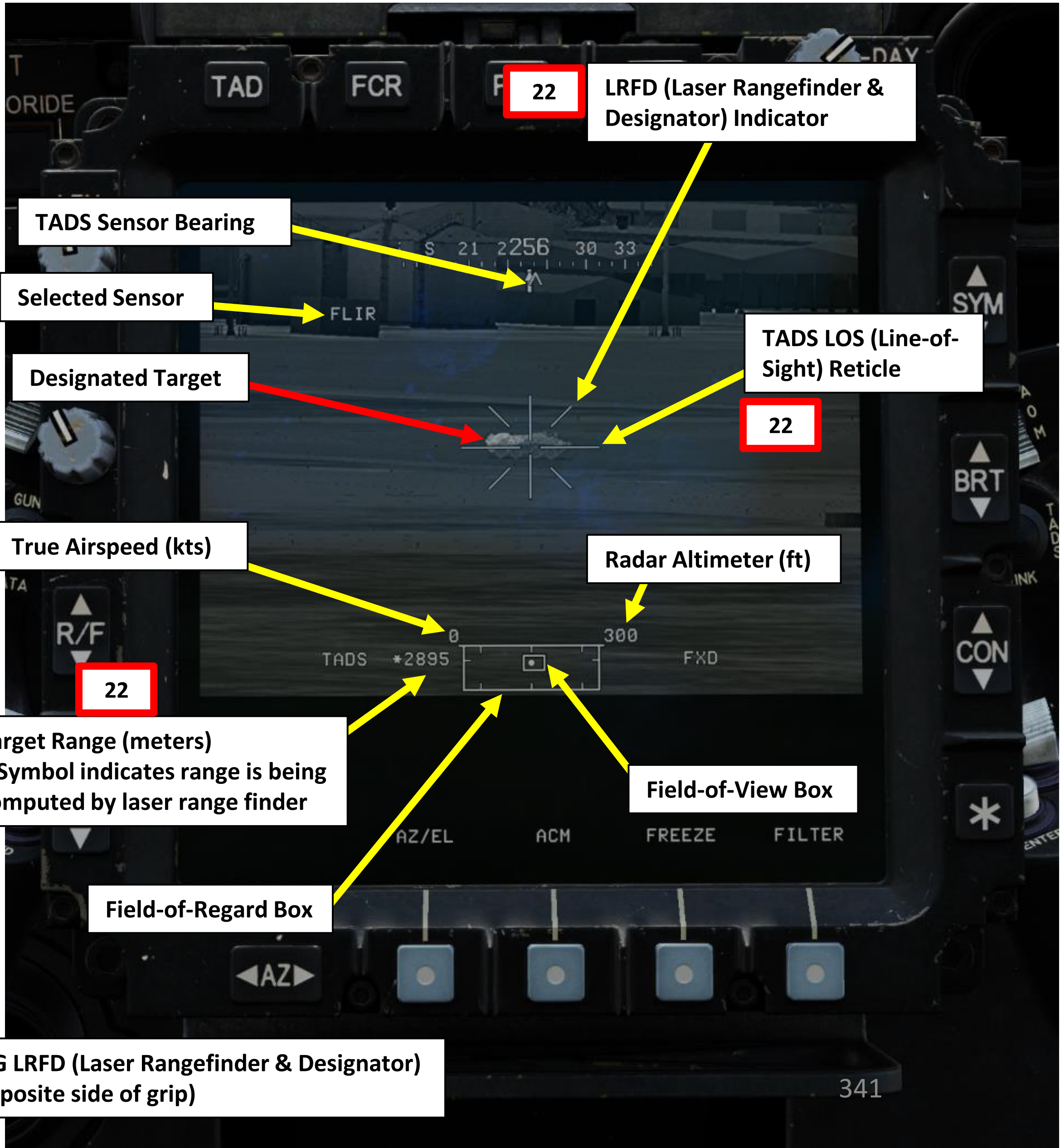
13. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
14. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
15. *[CPG]* Select TADS video feed source by pressing the TAD button.
16. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
17. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
18. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.4 – Laser Range Finder & Designator (LRFD)

19. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
20. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller".
21. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
22. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.4 – Laser Range Finder & Designator (LRFD)

The TSD (Tactical Situation Display) page displays the TADS line-of-sight. Pressing the TEDAC Right Hand Grip LRFD Trigger (First Detent) to lase updates the TADS line-of-sight line position. The line-of-sight line is white when lasing and green when not lasing.

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.4 – Laser Range Finder & Designator (LRFD)

Notes for the CPG: In situations where you need to be looking somewhere else than the TDU (TEDAC Display Unit), keep in mind that having the TADS feed overlayed on the IHADSS HDU (Helmet Display Unit) is very useful, especially if you need to keep track of an existing target while looking for other targets.

Notes for the Pilot: On your IHADSS HDU (Helmet Display Unit), the Cued Line-of-Sight Reticle represents where the TADS is looking if your ACQ source is the TADS.

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

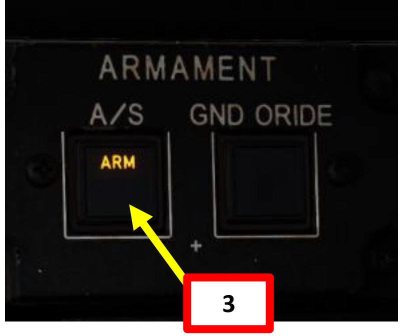
3.5 – Target Storing with TADS

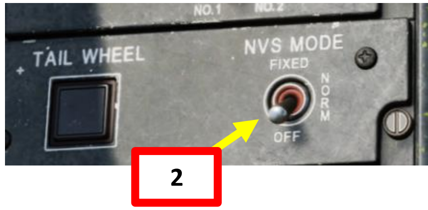
Click Here for the Navigation Section

How to Store a Point (TADS, Laser Range)

The Co-Pilot/Gunner can "store" a point set on a target within its range. Using a laser for ranging is one of the more accurate methods. Here is a tutorial on how to store a target using laser ranging.

1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
    - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON. Also check that Co-Pilot NVS (Night Vision System) Mode Switch is OFF (AFT).
3. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
4. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller".
5. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.





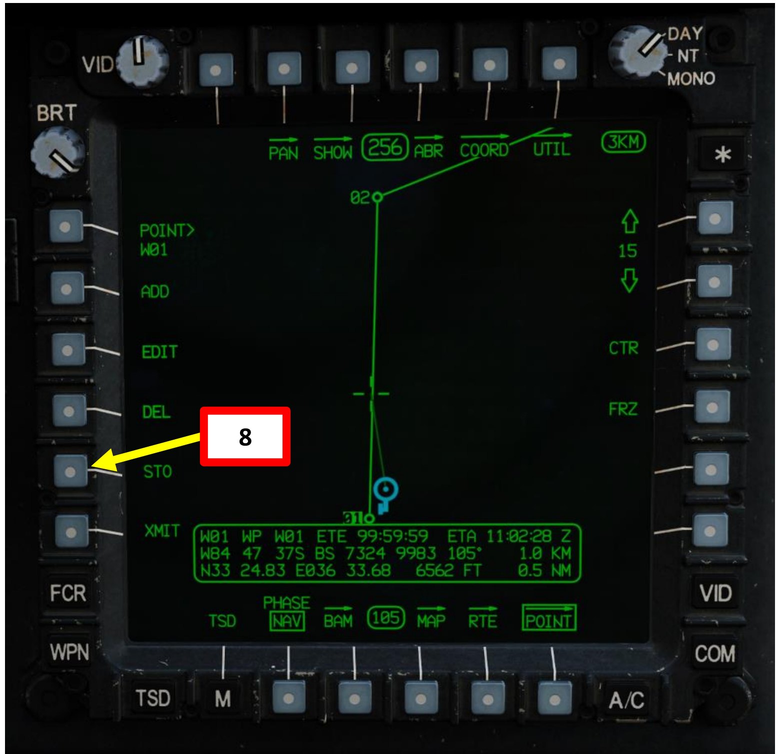
Sight Selector Switch

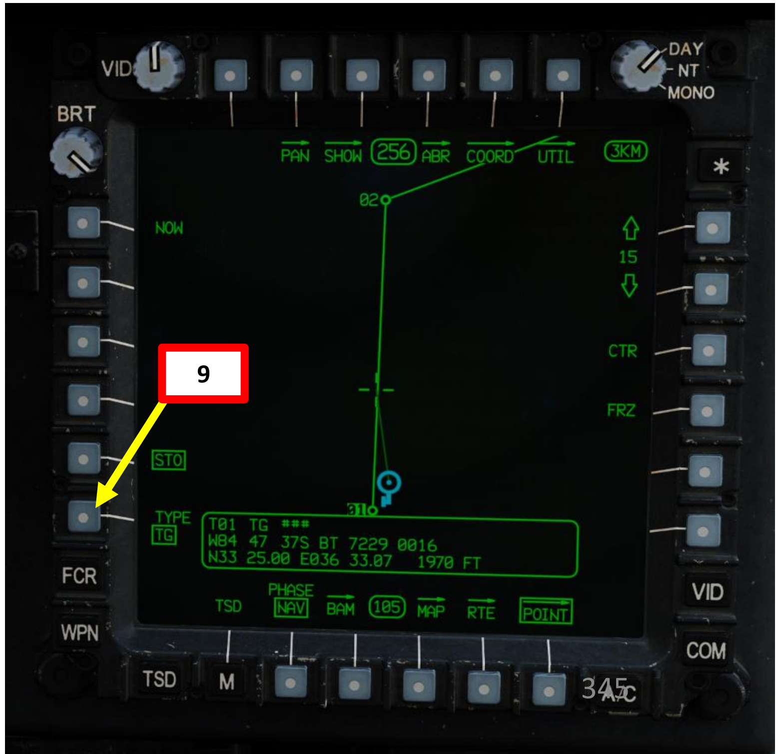
- *FWD:* ***HMD*** *(Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT:* ***LINK****, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT:* ***FCR*** *(Fire Control Radar)*
- *RIGHT:* ***TADS*** *(Target Acquisition & Designation Sight), but only functional for CPG collective.*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.5 – Target Storing with TADS

How to Store a Point (TADS, Laser Range)

6. *[CPG]* Select Press on the TSD FAB (Fixed Action Button) to access the Tactical Situation Display menu.
7. *[CPG]* Press on VAB (Variable Action Button) next to POINT.
8. *[CPG]* Press on VAB next to STO (Store).
9. *[CPG]* Press on VAB next to TYPE to toggle between either WP (Waypoint) or TG (Target). We will select TG to store target coordinate data.





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.5 – Target Storing with TADS

How to Store a Point (TADS, Laser Range)

10. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
11. *[CPG]* Press the TEDAC Left Hand Grip Store/Update Switch FWD (STORE) to store the TADS line-of-sight as a target point.
12. *[CPG]* A "T" followed by the Target Point number will be displayed on the TDU (TADS Display Unit). As an example, "T01" indicates that Target Point 01 coordinates have been stored.
    - The Co-Pilot can then call out to the pilot something like "BMP stored target 01" to let him know what has been spotted and stored in which target point.

Store/Update Switch **11a**
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

10a
TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)

LRFD (Laser Rangefinder & Designator) Indicator
10b
Designated Target
TADS LOS (Line-of-Sight) Reticle

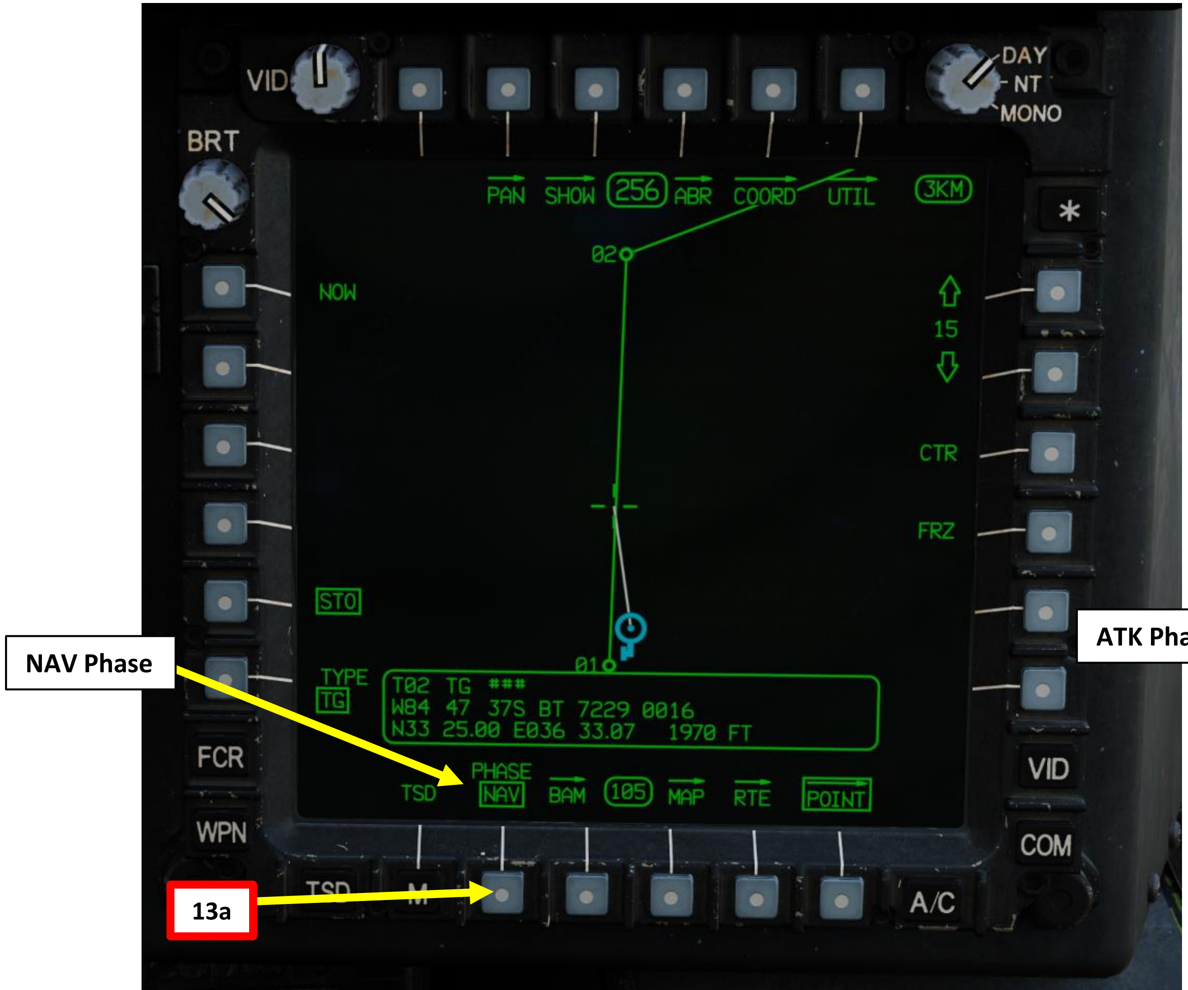
11b
T01
Target 01 Stored

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.5 – Target Storing with TADS

How to Store a Point (TADS, Laser Range)

13. *[CPG]* On the TSD (Tactical Situation Display) page, selecting the ATK (Attack) Phase allows you to display stored target points. This is useful when multiple targets are saved and you want to quickly figure out where they are in relationship to you.



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

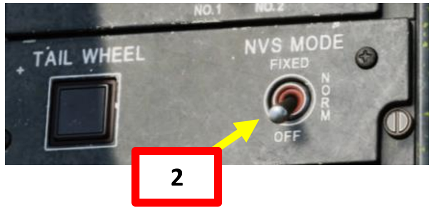
3.5 – Target Storing with TADS

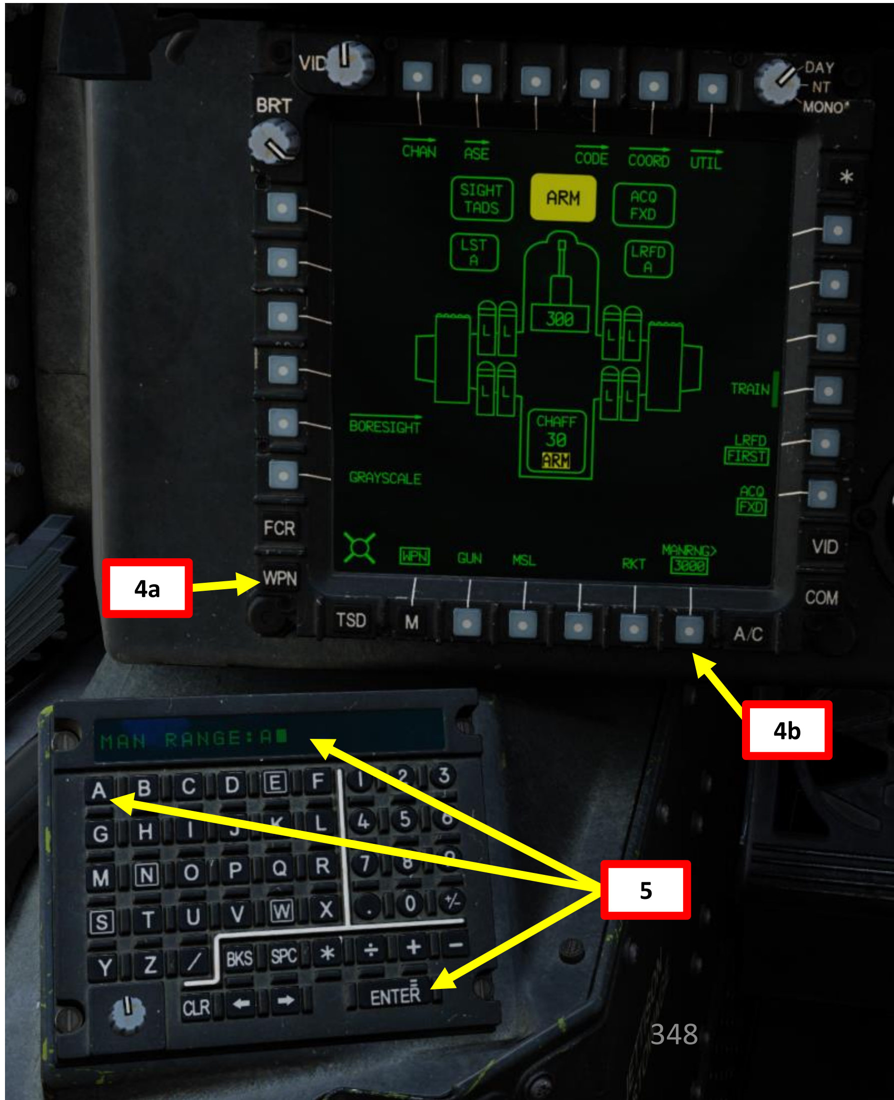
Click Here for the Navigation Section

How to Store a Point (TADS, Automatic Range)

The Co-Pilot/Gunner can "store" a point set on a target within its range. Using automatically computed ranging is one of the less accurate methods compared to laser ranging. Here is a tutorial on how to store a target using automatic ranging.

1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
   - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON. Also check that Co-Pilot NVS (Night Vision System) Mode Switch is OFF (AFT).
3. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
4. *[CPG]* On the WPN page, press VAB (Variable Action Button) next to MAN RNG to select ranging parameter/option.
5. *[CPG]* Type "A" on the KU (Keyboard Unit), then press ENTER on the KU. This will select automatic ranging.





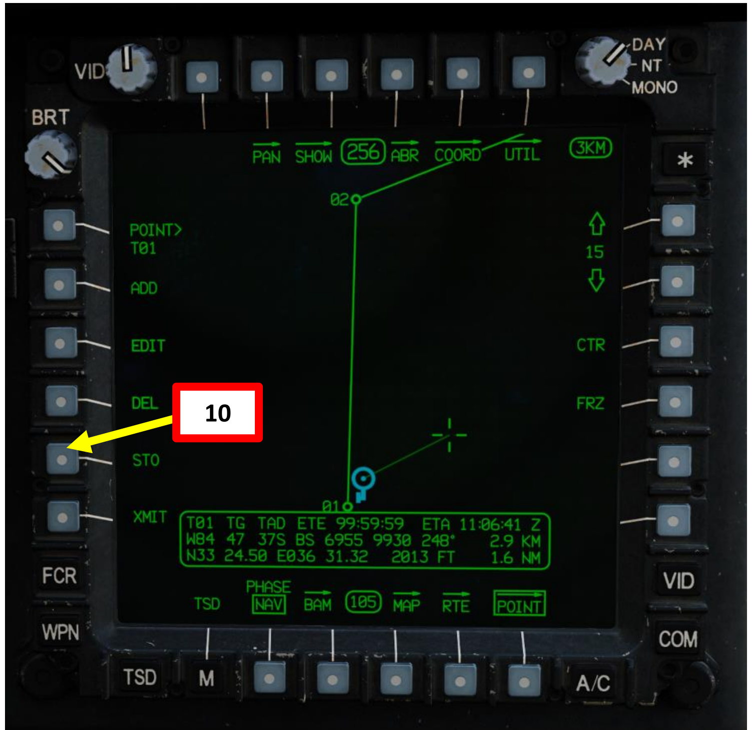
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.5 – Target Storing with TADS

How to Store a Point (TADS, Automatic Range)

6. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller".
7. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
8. *[CPG]* Select Press on the TSD FAB (Fixed Action Button) to access the Tactical Situation Display menu.
9. *[CPG]* Press on VAB (Variable Action Button) next to POINT.
10. *[CPG]* Press on VAB next to STO (Store).
11. *[CPG]* Press on VAB next to TYPE to toggle between either WP (Waypoint) or TG (Target). We will select TG to store target coordinate data.

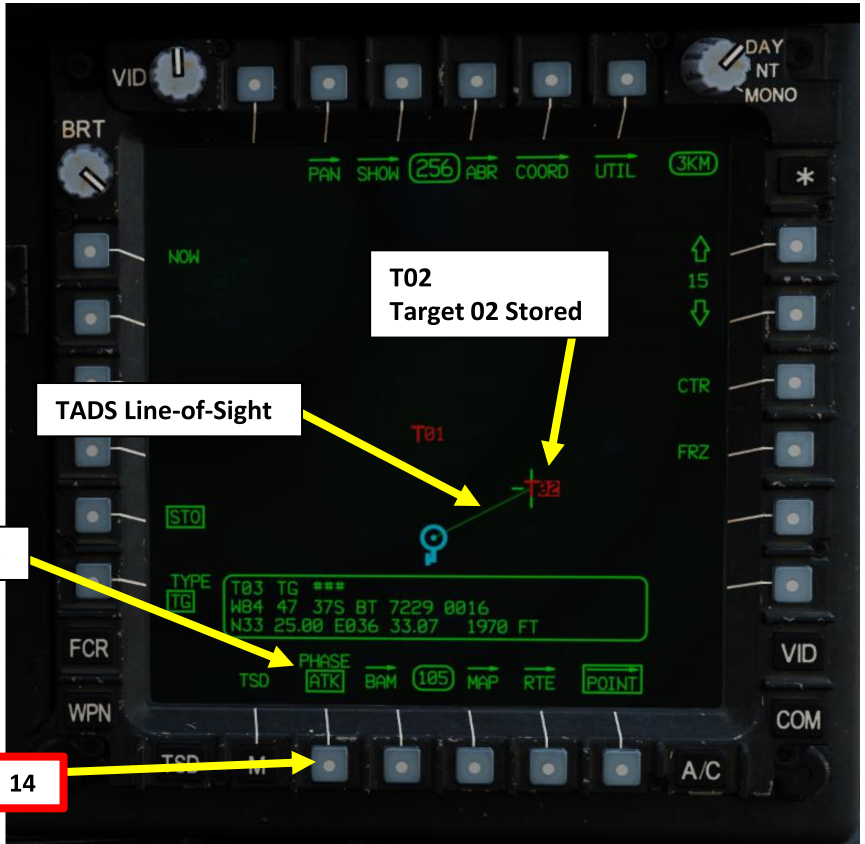


3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.5 – Target Storing with TADS

How to Store a Point (TADS, Automatic Range)

12. [CPG] Press the TEDAC Left Hand Grip Store/Update Switch FWD (STORE) to store the TADS line-of-sight as a target point.
13. [CPG] A "T" followed by the Target Point number will be displayed on the TDU (TADS Display Unit). As an example, "T02" indicates that Target Point 02 coordinates have been stored.
    - The Co-Pilot can then call out to the pilot something like "BMP stored target 02" to let him know what has been spotted and stored in which target point.
14. [CPG] On the TSD (Tactical Situation Display) page, selecting the ATK (Attack) Phase allows you to display stored target points. This is useful when multiple targets are saved and you want to quickly figure out where they are in relationship to you.

Store/Update Switch 12
- *Stores position information or performs position updates.*
    - *FWD: STORE, Stores selected sensor line-of-sight as a point*
    - *AFT: UPDATE, Performs a flyover or TADS position update.*



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

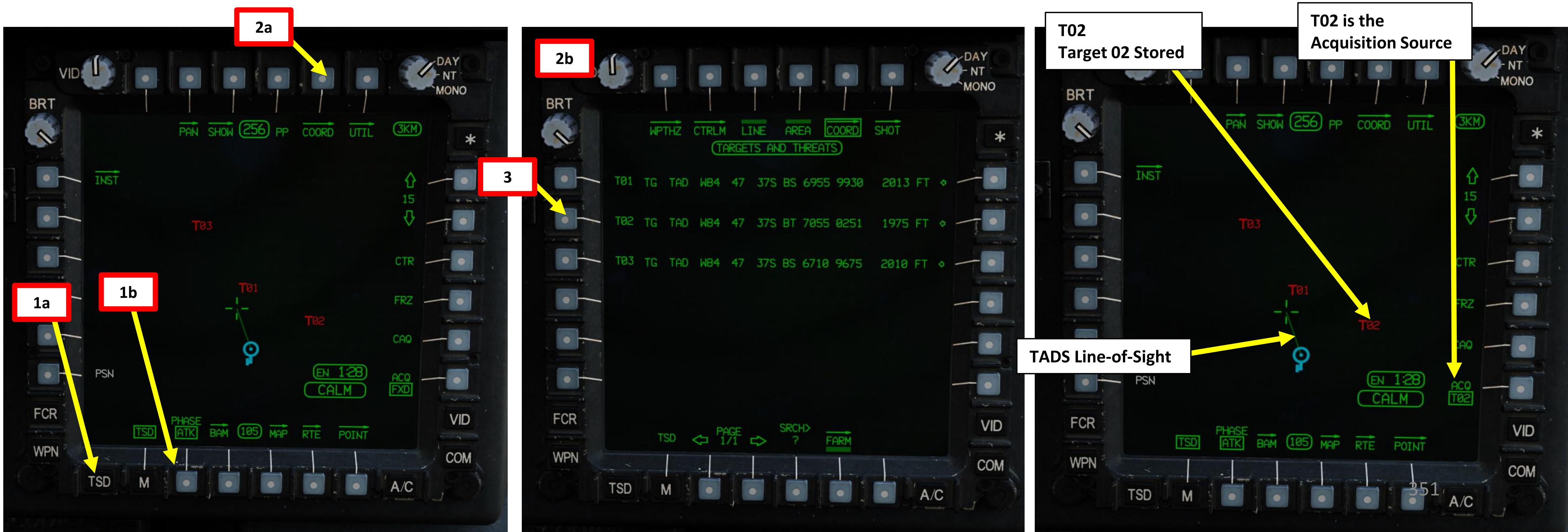
3.5 – Target Storing with TADS

Click Here for the Navigation Section

How to Slave TADS to a Stored Point (COORD Page Method)

The useful aspect of stored point is that the TADS can be "slaved" to it, meaning that it will "snap" on its coordinates and keep tracking its position in a "ground-stabilized" manner. In this example, we have three existing target points T01, T02 and T03. We will slave the TADS to Target Point T02 and use the COORD page to select T02 as the acquisition source.

1. *[CPG]* On the TSD (Tactical Situation Display) page, select ATK (Attack) Phase. This will allow you to see existing target points on the TSD.
2. *[CPG]* Press on VAB (Variable Action Button) next to COORD (Coordinates).
3. *[CPG]* Press on VAB next to T02 to select Target Point 2.
4. *[CPG]* Target Point T02 is now the acquisition source, which we will need to slave the TADS to.



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.5 – Target Storing with TADS

How to Slave TADS to a Stored Point (COORD Page Method)

5. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is Target Point T02 in this case.
6. *[CPG]* The TADS will keep tracking the target point, which means that MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input will not be able to move the TADS line-of-sight.
7. *[CPG]* If desired, on TEDAC Right Hand Grip, press the Sight Slave Button to “de-slave” the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input to make adjustments to the TADS line-of-sight.

TADS Reticle Slaved

TADS Reticle De-Slaved

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.5 – Target Storing with TADS

Click Here for the Navigation Section

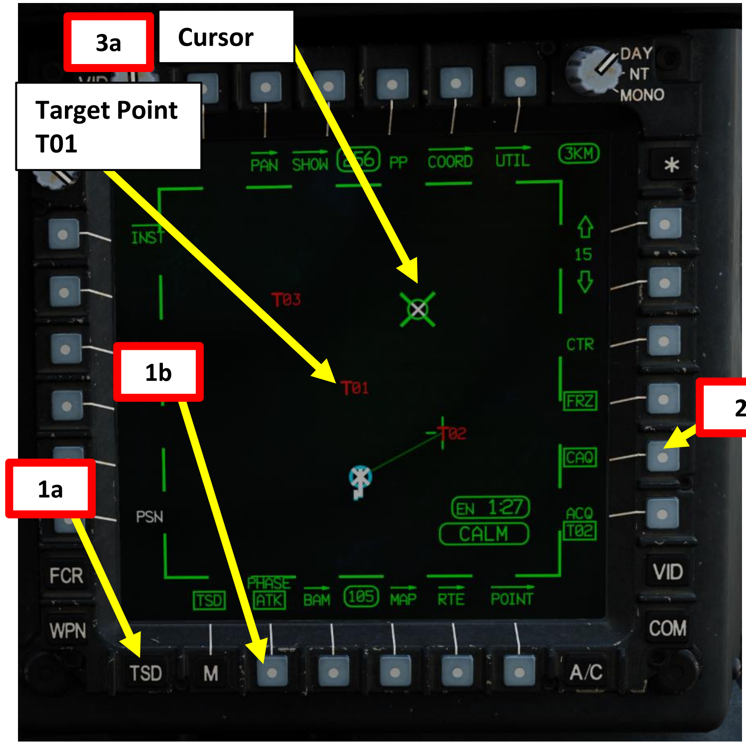
How to Slave TADS to a Stored Point (Cursor Acquisition Method)

In this example, we have three existing target points T01, T02 and T03. We will slave the TADS to Target Point T01 and use the CAQ (Cursor Acquisition) method with the TSD (Tactical Situation Display) page to select T01 as the acquisition source.

1. *[CPG]* On the TSD (Tactical Situation Display) page, select ATK (Attack) Phase. This will allow you to see existing target points on the TSD.
2. *[CPG]* Press on VAB (Variable Action Button) next to CAQ (Cursor Acquisition).
3. *[CPG]* Move the MPD (Multi-Purpose Display) Cursor on the desired target symbol (T01 is our case) using the Cursor Control Hat Switch on the collective or on the TEDAC Right Hand Grip.
4. *[CPG]* Once cursor is over Target T01, depress the Cursor Control/Enter Hat Switch. This will select the target point as the acquisition source.

Cursor Control/Enter Hat Switch

- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

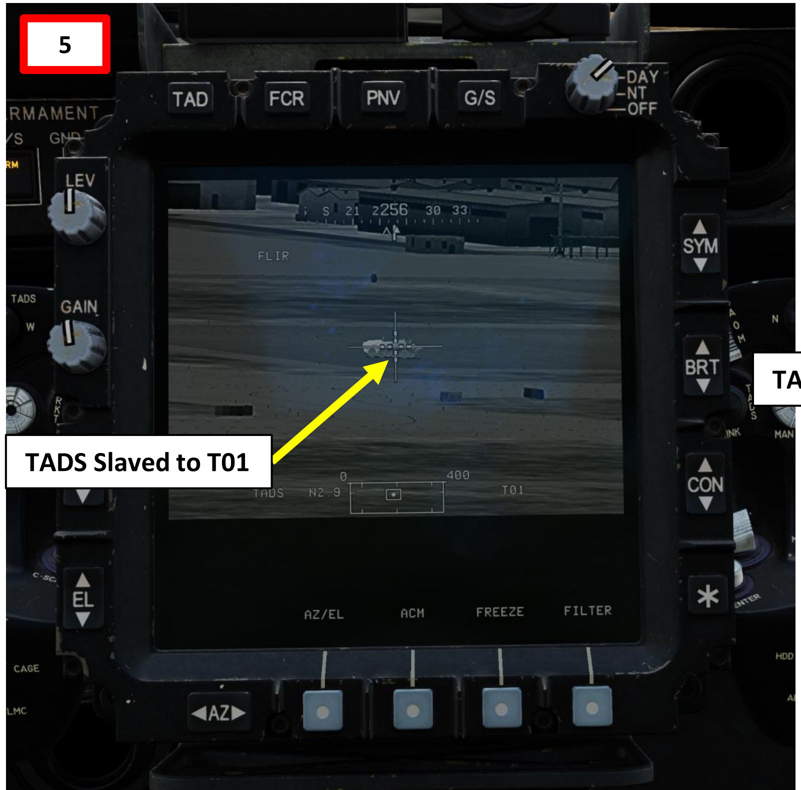
3.5 – Target Storing with TADS

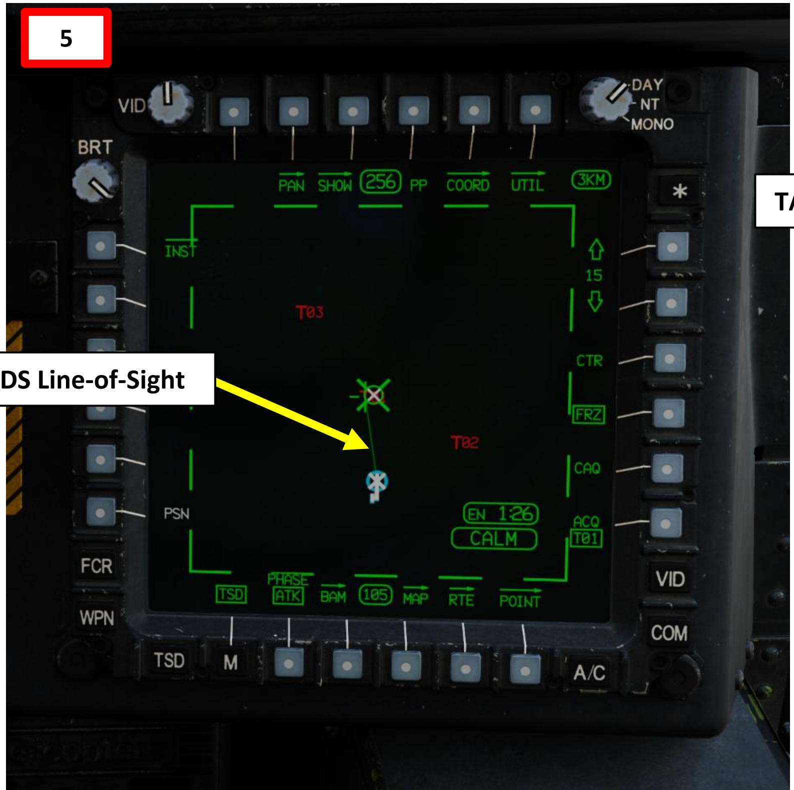
How to Slave TADS to a Stored Point (Cursor Acquisition Method)

5. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is Target Point T01 in this case.
6. *[CPG]* The TADS will keep tracking the target point, which means that MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input will not be able to move the TADS line-of-sight.
7. *[CPG]* If desired, on TEDAC Right Hand Grip, press the Sight Slave Button to “de-slave” the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input to make adjustments to the TADS line-of-sight.

TADS Reticle Slaved

TADS Reticle De-Slaved





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.6 – Linear Motion Compensator (LMC) & Target State Estimator (TSE)

What if a target is not sitting perfectly still? Vehicles could be moving, or the helicopter itself could be manoeuvering around a target, causing the TADS to drift away from the target. Thankfully, the Apache has a feature called **LMC (Linear Motion Compensator)**, which is a toggleable slew logic within the TADS that **allows the co-pilot/gunner to adjust and maintain continuous (linear speed) turret slew rates** instead of using raw MAN TRK (Sight Manual Tracker Controller Switch, also known as "Thumb Force Controller) controller inputs. In other words, LMC helps you track a target by compensating for helicopter movement and/or target movement and is meant to reduce co-pilot/gunner's workload. Take note that the LMC slew rate gains are reduced when fields-of-view of higher magnification are selected by the co-pilot/gunner to aid in targeting stabilization.

The LMC can be used in conjunction with **TSE (Target State Estimator), which provides lead-angle compensation when employing the gun or rockets**. Basically, if you have LMC engaged and the reticle's speed matches the target's speed, the cannon can automatically apply some lead to make sure the rounds hit where the target is going to be while taking into account its current speed and direction. TSE is engaged by pulling the LRFD (Laser Rangefinder & Designator) trigger to the second detent.

General guidance with regards to the laser are:

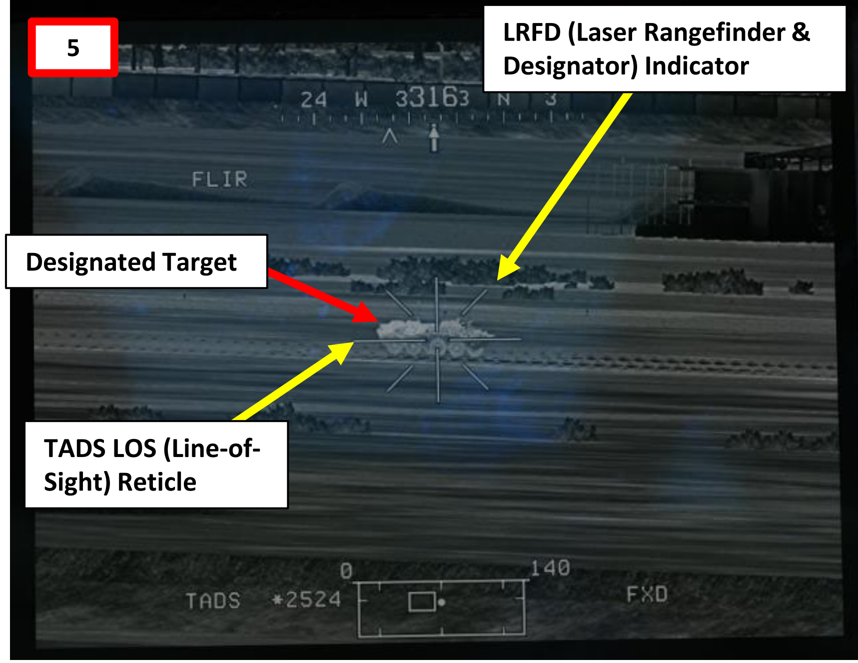
- If neither the target nor the aircraft is moving use first detent ranging
- Otherwise, use continuous second detent designation (with LRFD Trigger) to employ the TSE.

LMC & TSE Example by Matt Wagner: https://youtu.be/eQEuD_qQGGs

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.6 – Linear Motion Compensator (LMC) & Target State Estimator (TSE)

Example of use of LMC with a moving vehicle

1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
4. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight on the target using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller".
5. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target to obtain ranging information.
   - First detent held: LRFD determines the target range
   - Second detent held: LRFD determines target range and designates target for laser guidance.
6. *[CPG]* On TEDAC Left Hand Grip, press LMC (Linear Motion Compensator) Button to engage LMC.



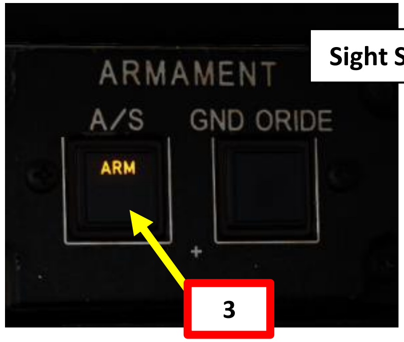
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*

TEDAC RHG (Right Hand Grip)

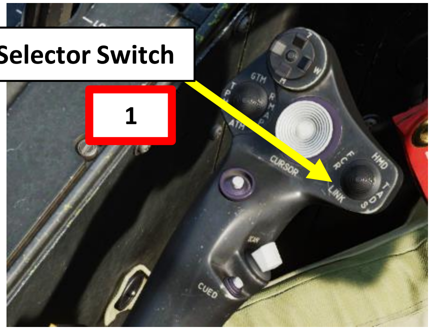
MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller" 4
- *Slews TADS line-of-sight when TADS LOS when Slave is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip) 5

LMC (Linear Motion Compensator) Button (Opposite Side) 6
- *Toggles the linear motion compensator (LMC) during manual tracking. Compensates for helicopter and/or target movement.*



Sight Selector Switch



Target Lased & Designated LMC OFF

LMC ON (Reticle moves with constant rate)

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.6 – Linear Motion Compensator (LMC) & Target State Estimator (TSE)

Example of use of LMC with a moving vehicle

7. *[CPG]* Once LMC is engaged, use the MAN TRK (Sight Manual Tracker Controller) Switch to gradually increase reticle slewing rate until the reticle's speed matches the moving vehicle's speed.
    - LMC can also be used the other way around; if the vehicle is static and the helicopter is manoeuvering around it, the reticle slewing rate can be adjusted in a similar fashion to keep the reticle "fixed" on the vehicle.
8. *[CPG]* Once the reticle is following the vehicle, you can squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to the second detent to engage TSE (Target State Estimator). If you have selected the cannon or rockets, the TSE will automatically apply some lead to make sure the rounds hit where the target is going to be while taking into account its current speed and direction.
9. *[CPG]* On TEDAC Left Hand Grip, press LMC (Linear Motion Compensator) Button again to disengage LMC.

TEDAC LHG (Left Hand Grip)

9 LMC (Linear Motion Compensator) Button (Opposite Side)

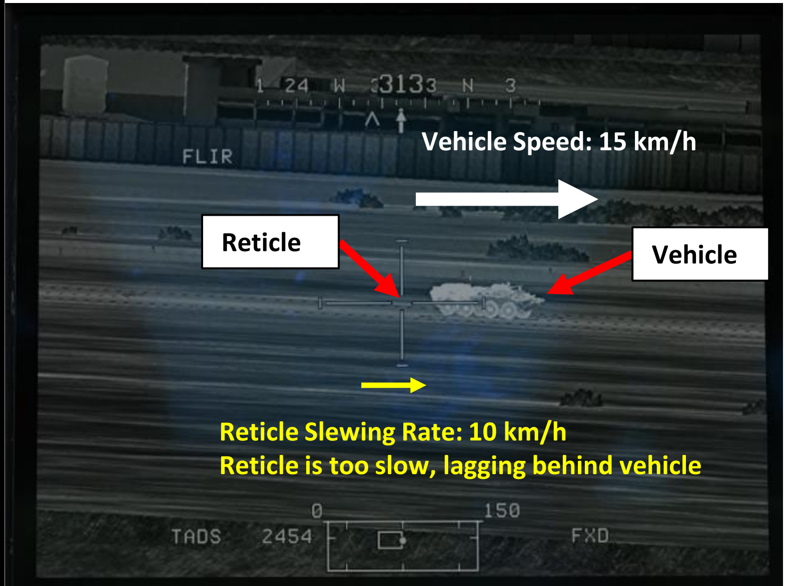
TEDAC RHG (Right Hand Grip)

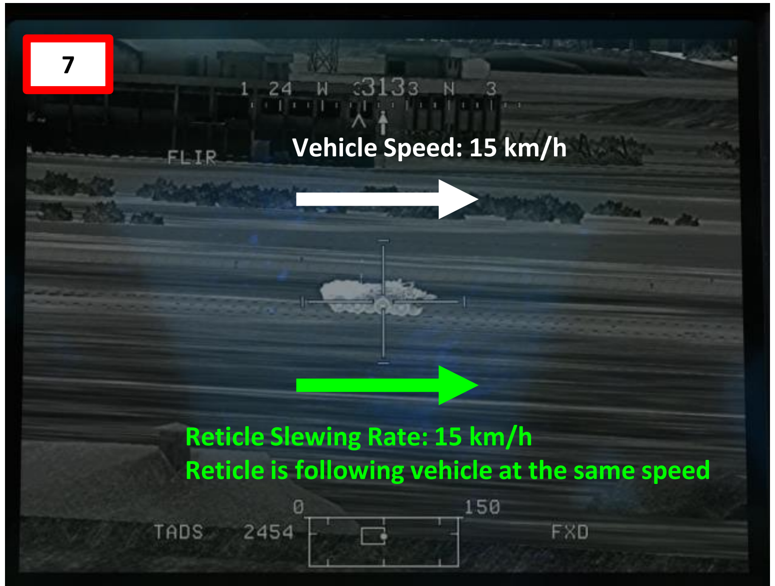
MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"

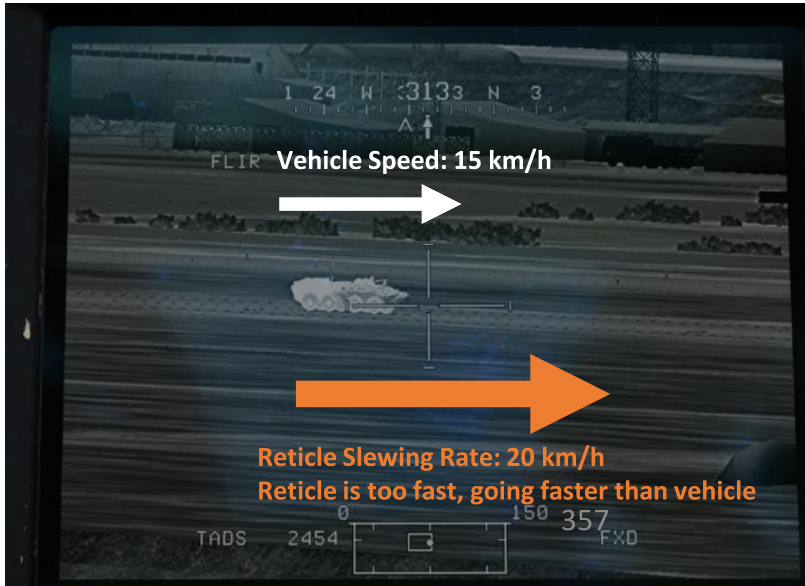
7

8

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)







3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.7 – Image Auto Tracker (IAT)

Tracking a moving target through the TADS is usually done with the Linear Motion Compensator (LMC). However, using LMC effectively can take a lot of practice, and it can be quite difficult to use if you do not have a controller with a good mini stick.

Image Auto Tracker (IAT) mode will make target tracking much easier since the **TADS (Target Acquisition & Designation Sight) uses image contrast to control turret slew**. IAT can be used with either the FLIR or Day TV cameras. IAT is employed in a similar fashion to "point track" designation with the LITENING targeting pod for the DCS A-10C, F/A-18C or F-16C pilots. When a target is tracked with IAT mode, you can also designate and lase the tracked target as seen previously in the "Linear Motion Compensator (LMC) & Target State Estimator (TSE)" section.

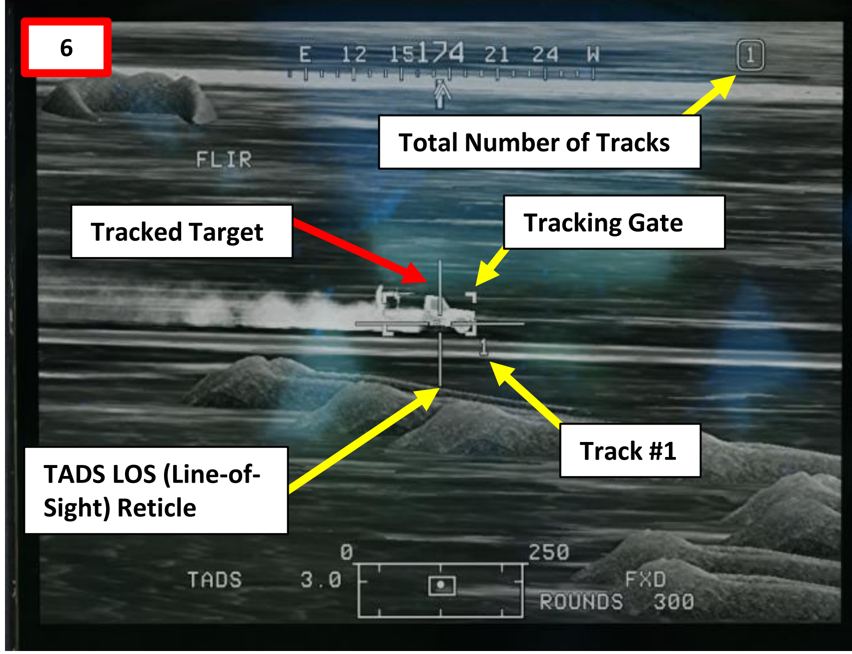
Note: Image Auto Tracker has a sub-mode called Multi-Target Tracker (MTT), which will be explained in the next section.

Image Auto Tracker Example by Matt Wagner: https://youtu.be/dG2fRltdpaw

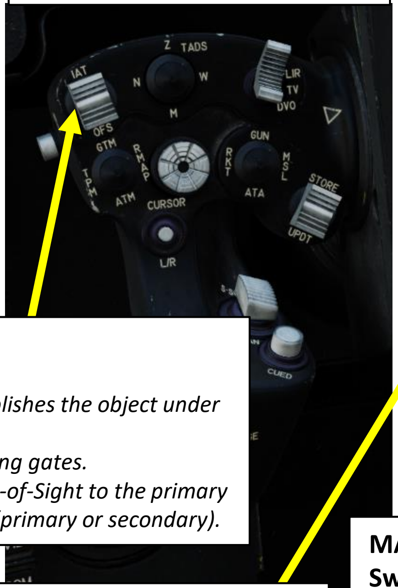
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.7 – Image Auto Tracker (IAT)

Example of use of IAT with a moving vehicle

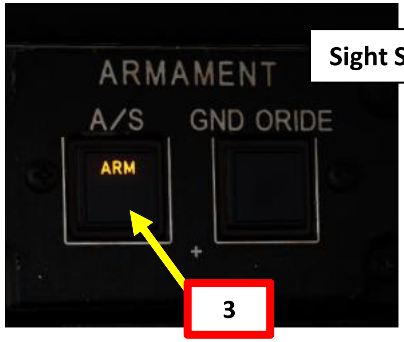
1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
4. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight on the target using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller".
5. *[CPG]* On TEDAC Right Hand Grip, set IAT Polarity Switch as desired. We will leave it to the AUTO (Middle) position.
6. *[CPG]* On TEDAC Left Hand Grip, press IAT/OFS Switch FWD (short press) to engage Image Auto-Track. The TADS line-of-sight will follow the moving target based on contrast. A tracking gate and track number will appear next to the target.

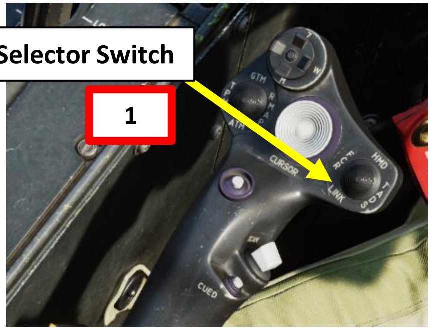


TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*



TEDAC RHG (Right Hand Grip)





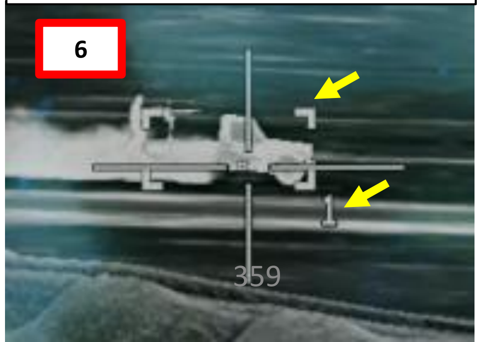
IAT/OFS Switch (6)
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

IAT (Image Auto Tracker) Polarity Switch (4)
- *FWD: **WHITE**, bright objects are tracked by the IAT.*
- *MIDDLE: **AUTO**, polarity is automatically selected by the IAT*
- *AFT: **BLACK**, dark objects are tracked by the IAT.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller" (4)
- *Slews TADS line-of-sight when TADS LOS when Slave is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

IAT not tracking target yet (Reticle does not move)

IAT tracks target (Reticle moves with target)



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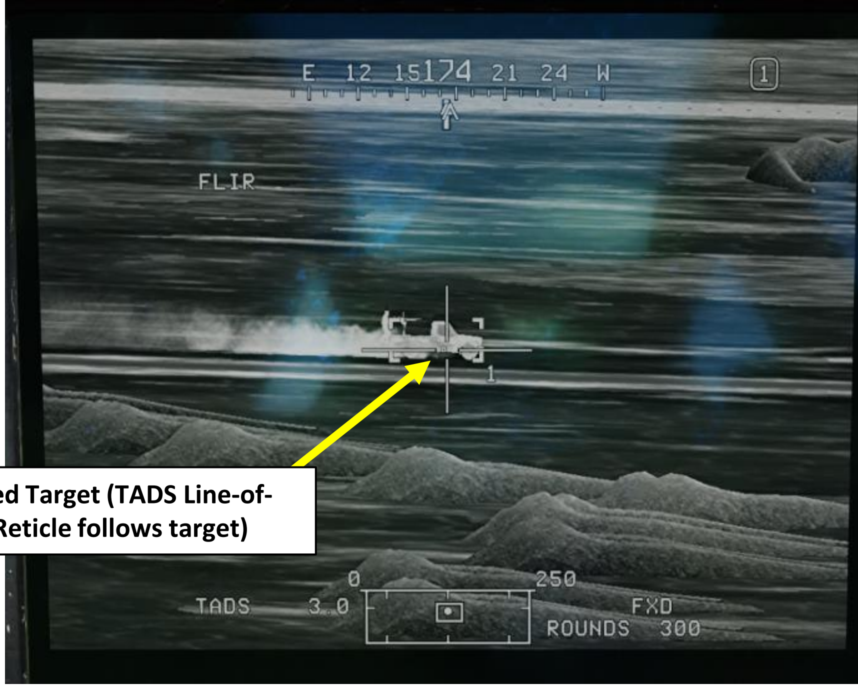
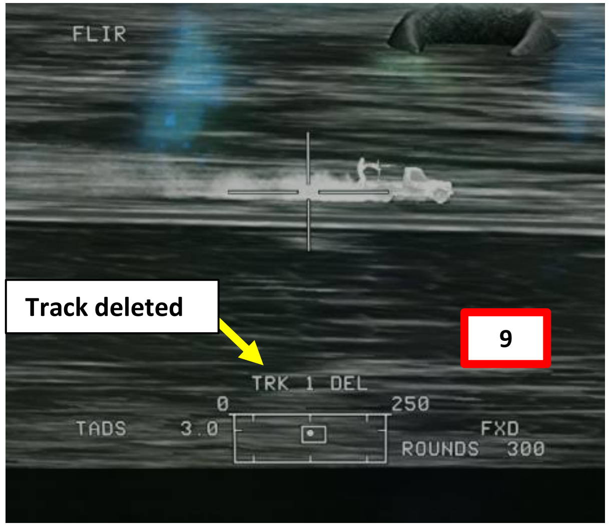
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.7 – Image Auto Tracker (IAT)

7. [CPG] If desired, you can slew TADS Line-of-Sight reticle away from the target using the MAN TRK (Sight Manual Tracker Controller) Switch. When the target is out of the TADS line-of-sight (this is called “offset tracking”), a line with the track number indicates its position relative to the TADS line-of-sight reticle.
8. [CPG] On TEDAC Left Hand Grip, press IAT/OFS Switch AFT (Offset) to return the TADS line-of-sight reticle to the primary track. The tracking gates will re-appear and the reticle will resume following the primary track again.
9. [CPG] Pressing the IAT/OFS Switch AFT a second time when there is no offset tracking will delete the current track, displaying the “TRK 1 DEL” in a case where tracked target #1 is deleted.



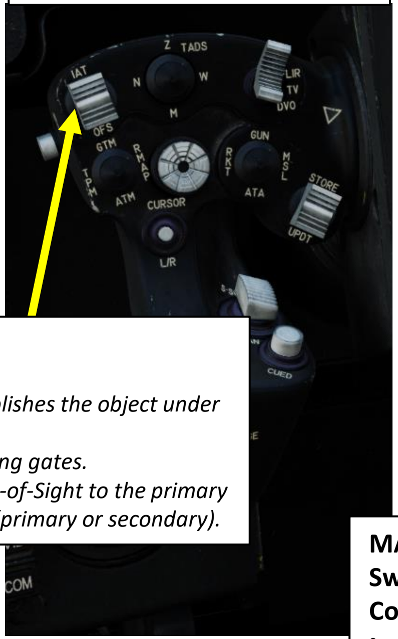
Tracked Target (TADS Line-of-Sight Reticle follows target)



Track deleted

9

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*

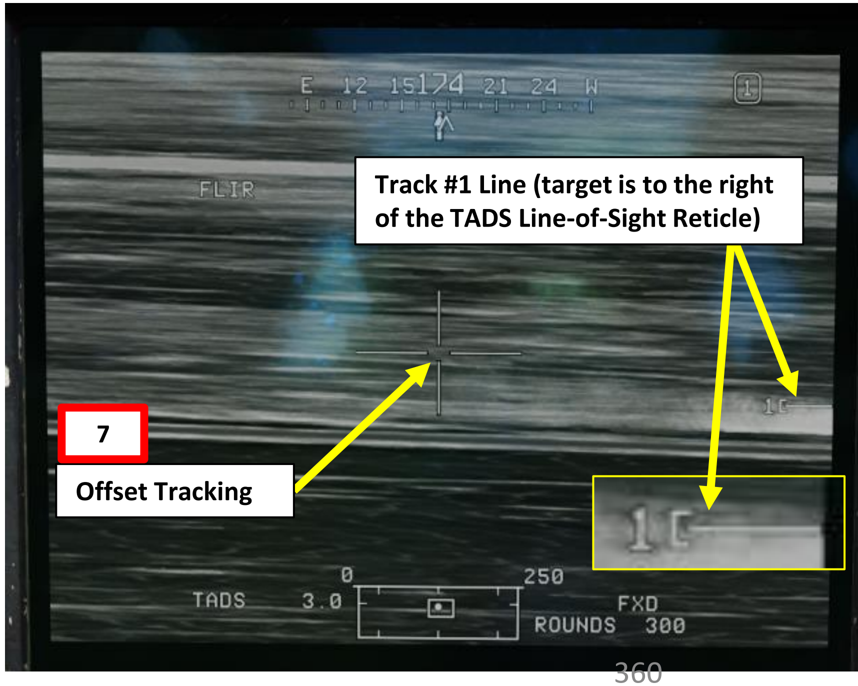


TEDAC RHG (Right Hand Grip)

IAT/OFS Switch 8 9
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”
- *Slews TADS line-of-sight when TADS LOS when Slave is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

7



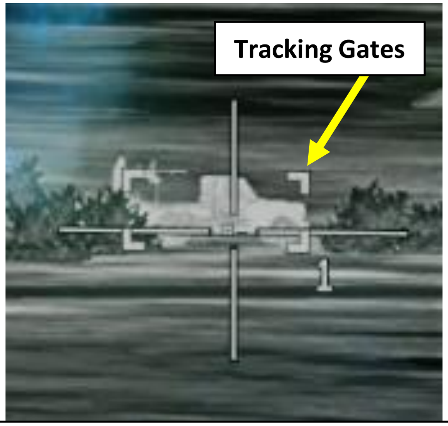
Track #1 Line (target is to the right of the TADS Line-of-Sight Reticle)

7

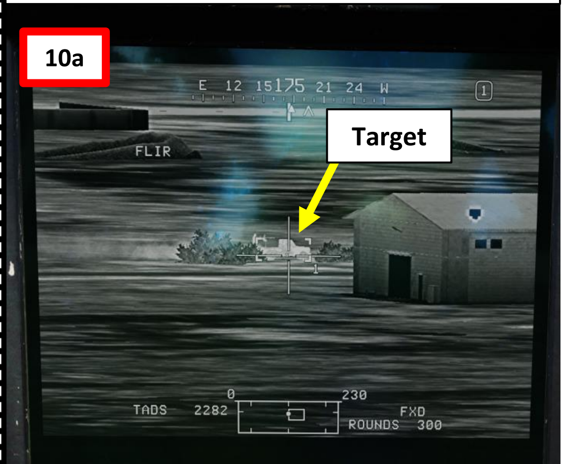
Offset Tracking

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.7 – Image Auto Tracker (IAT)

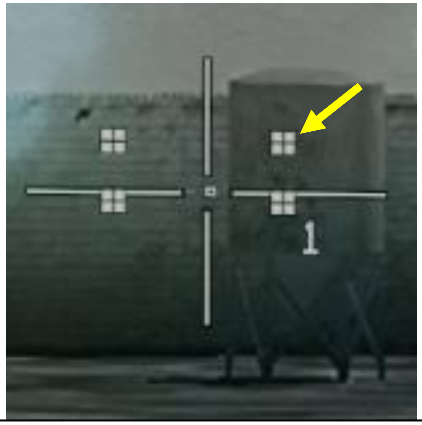
10. *[CPG]* If a track is obscured (i.e. a target is moving behind a building, losing contrast in the process), the tracking gates will sequentially:
    a) Display “tracking gates”, following the target contrast as long as it is not obstructed.
    b) Display “inertial indicators”, shown as four rectangles. The tracking gates will still move at the same speed the target was last being tracked.
    c) Display “low confidence indicators”, shown as sixteen smaller rectangles.
    d) Lose track of the target, indicated by the message “TRK 1 DROP” in a case where tracked target #1 is dropped by the Image Auto Tracker.



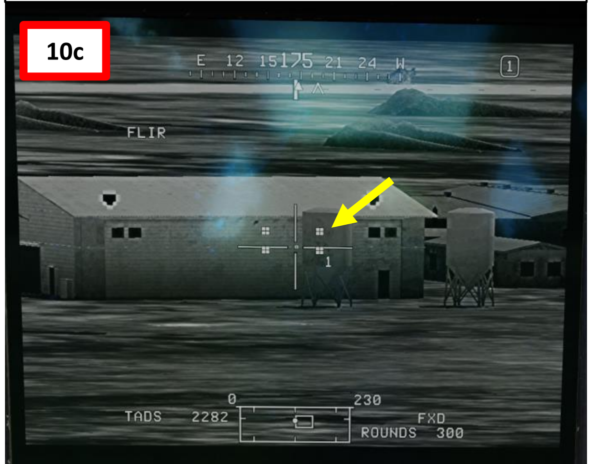
Target Tracked (Target Visible)

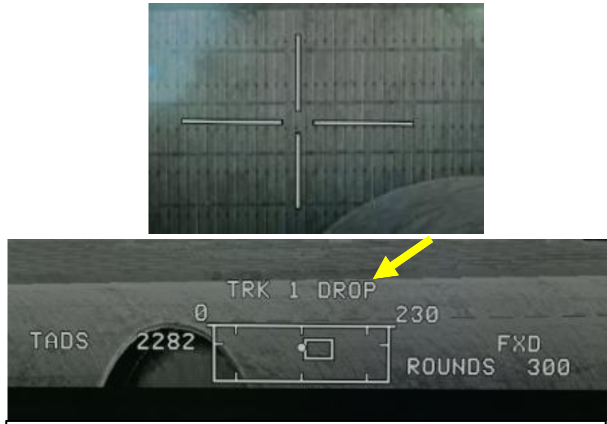


Inertial Indicators (Target Obscured)



Low Confidence Indicators (Target Obscured)





Track Dropped (Target Obscured)

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.8 – Multi-Target Tracker (MTT)

Image Auto Tracker (IAT) allows you to track a single target… but you can also track multiple targets at once! **Multi-Target Tracker (MTT) mode** is an IAT sub-mode that allows you to track multiple moving targets **using image contrast to control turret slew.**

The tracking process in MTT is almost identical to IAT. However, there are useful additional functions available with the TADS MTT Track Promote Switch that allow you to step between tracked targets.

Up to **three targets can be tracked simultaneously**: a **primary** track, and two **secondary** tracks.

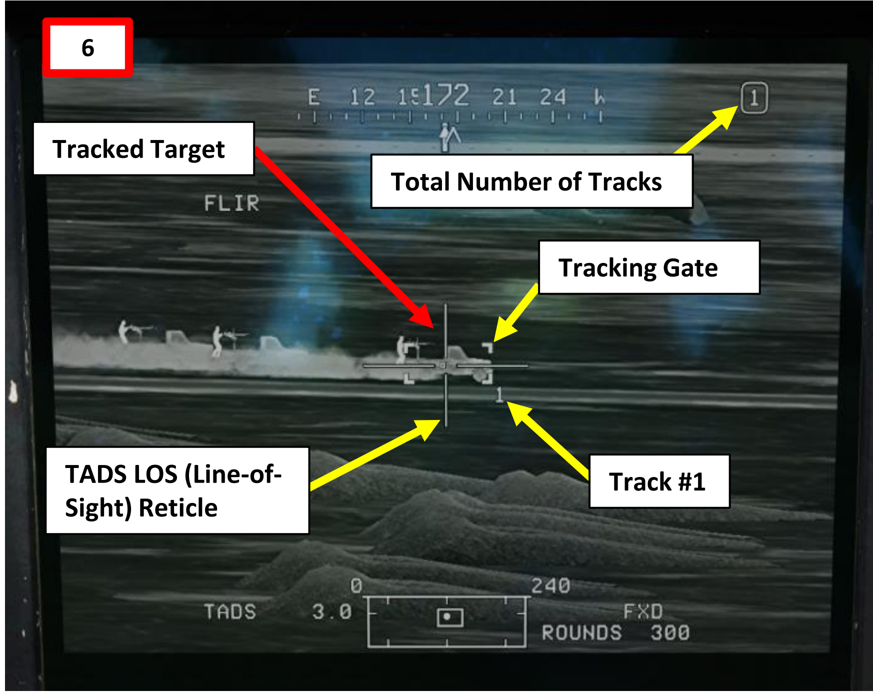
TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TADS MTT (Multi-Target Tracker) Track Promote Switch
- *FWD:Steps to the next TADS track and promotes it to primary*
- *AFT:Steps to the previous TADS track and promotes it to primary*

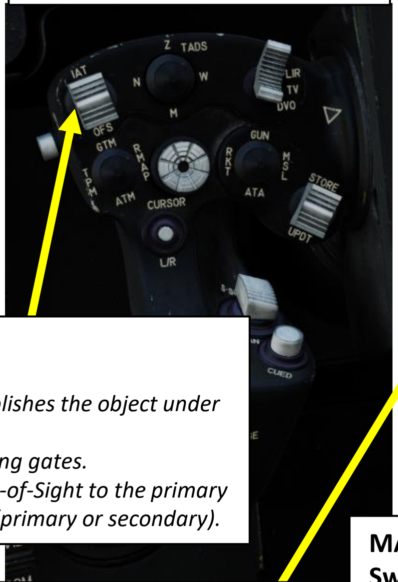
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.8 – Multi-Target Tracker (MTT)

Example of use of IAT with multiple moving vehicles

1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
4. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight on the target using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
5. *[CPG]* On TEDAC Right Hand Grip, set IAT Polarity Switch as desired. We will leave it to the AUTO (Middle) position.
6. *[CPG]* On TEDAC Left Hand Grip, press IAT/OFS Switch FWD (short press) to engage Image Auto-Track. The TADS line-of-sight will follow the moving target based on contrast. A tracking gate and track number will appear next to the target.



TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*

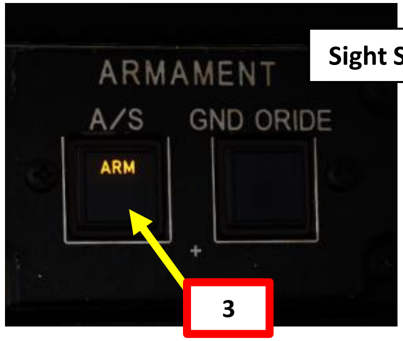


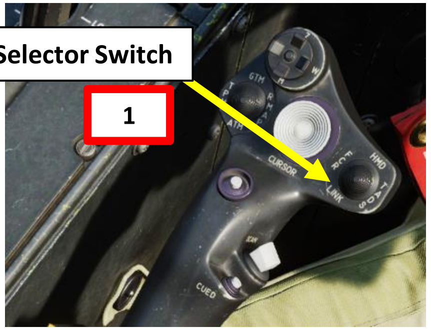
TEDAC RHG (Right Hand Grip)

IAT/OFS Switch 6
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

4 **IAT (Image Auto Tracker) Polarity Switch**
- *FWD: **WHITE**, bright objects are tracked by the IAT.*
- *MIDDLE: **AUTO**, polarity is automatically selected by the IAT*
- *AFT: **BLACK**, dark objects are tracked by the IAT.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller” 4
- *Slews TADS line-of-sight when TADS LOS when Slave is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.8 – Multi-Target Tracker (MTT)

7. *[CPG]* To track a second target, slew TADS Line-of-Sight reticle on the second target using the MAN TRK (Sight Manual Tracker Controller) Switch.
8. *[CPG]* On TEDAC Left Hand Grip, press IAT/OFS Switch FWD (short press) to engage Image Auto-Track on the second target. A tracking gate and track number "2" will appear next to the target, becoming the new primary target.
9. *[CPG]* Target #1 will remain tracked as well. A numbered flag indicates it has become a secondary target.
10. *[CPG]* Repeat previous steps to track a third target. Target #3 will become the new primary target, while targets #1 and #2 will become secondary targets.
11. *[CPG]* A maximum of three targets can be tracked simultaneously.
12. *[CPG]* Just like with IAT for a single target, pressing the TEDAC Left Hand Grip IAT/OFS Switch AFT (Offset) returns the TADS line-of-sight reticle to the primary track.
13. *[CPG]* To step between tracks, press the TADS MTT Track Promote Switch FWD or AFT to cycle between targets.

IAT/OFS Switch 8 12

- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

TEDAC LHG (Left Hand Grip)

- *TEDAC: TADS Electronic Display and Control*

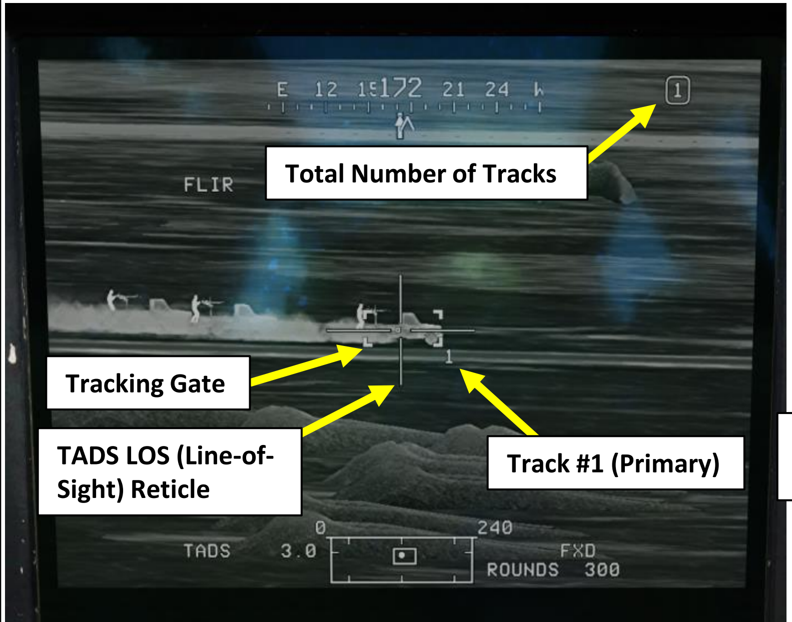
TEDAC RHG (Right Hand Grip)

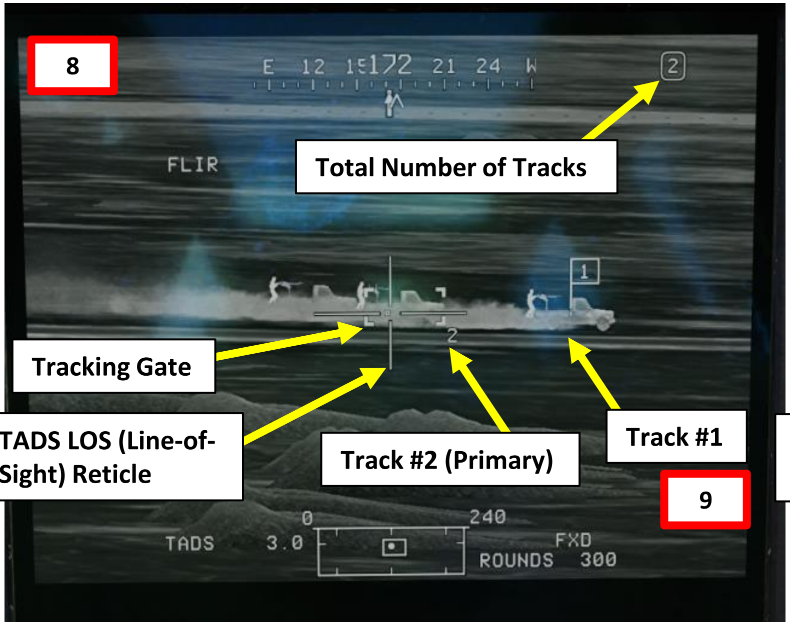
13 **TADS MTT (Multi-Target Tracker) Track Promote Switch**

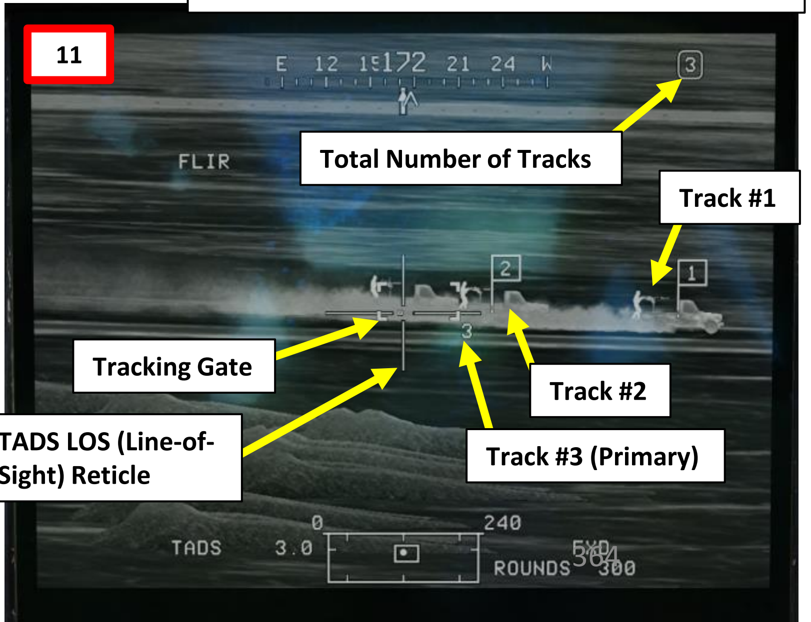
- *FWD:Steps to the next TADS track and promotes it to primary*
- *AFT:Steps to the previous TADS track and promotes it to primary*

7 **MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"**

- *Slews TADS line-of-sight when TADS LOS when Slave is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*





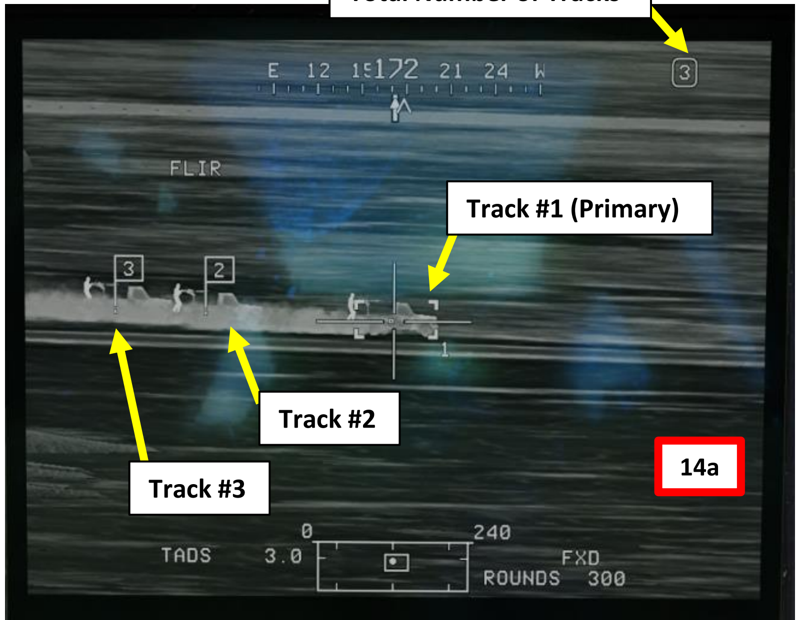


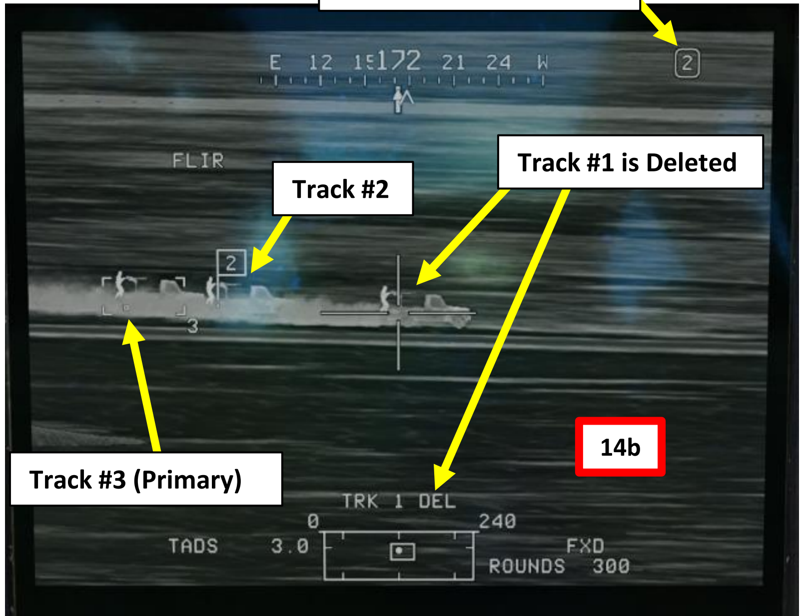
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.8 – Multi-Target Tracker (MTT)

14. *[CPG]* Pressing the IAT/OFS Switch AFT SHORT when there is no offset tracking will delete the currently selected primary track, displaying the "TRK 1 DEL" in a case where tracked target #1 is deleted. In this example, deleting track #1 will make track #3 the primary track.
15. *[CPG]* Pressing the IAT/OFS Switch AFT LONG will delete all tracks, displaying the "ALL TRKS DEL".

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*

IAT/OFS Switch 14 15
- *FWD: IAT (Image Auto-Track)*
  - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
  - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*





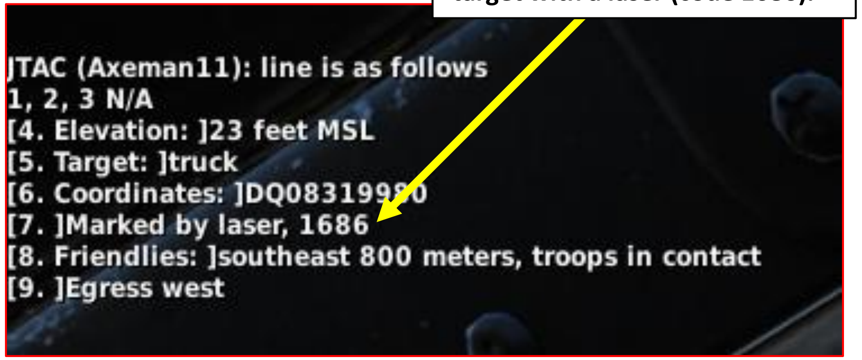
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.9 – Laser Spot Tracker (LST)

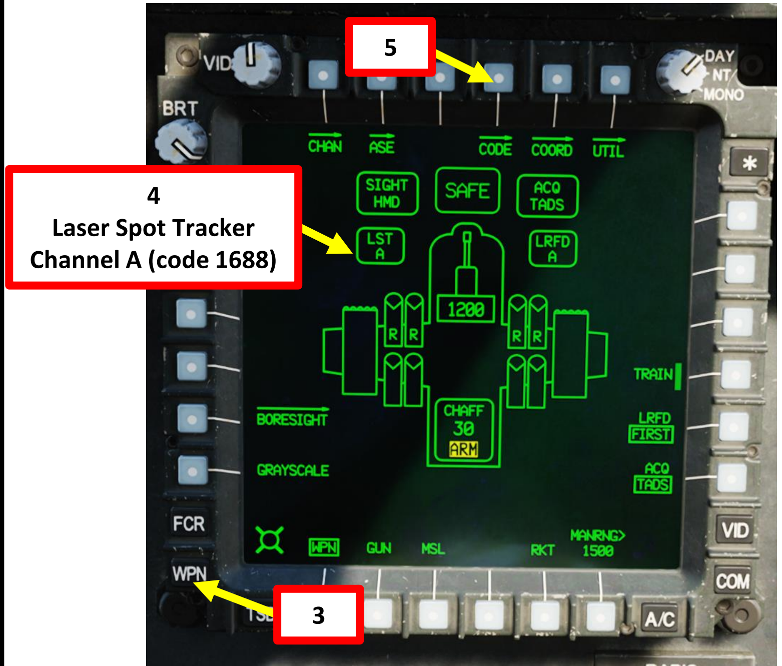
LST (Laser Spot Tracker) mode allows you to spot and track a laser designation from someone else. Laser Spot Tracker code is associated to the TADS (Target Acquisition & Designation Sight) laser detector. This allows the TADS sensor to slave its line-of-sight to a laser designator like a JTAC or another AH-64.

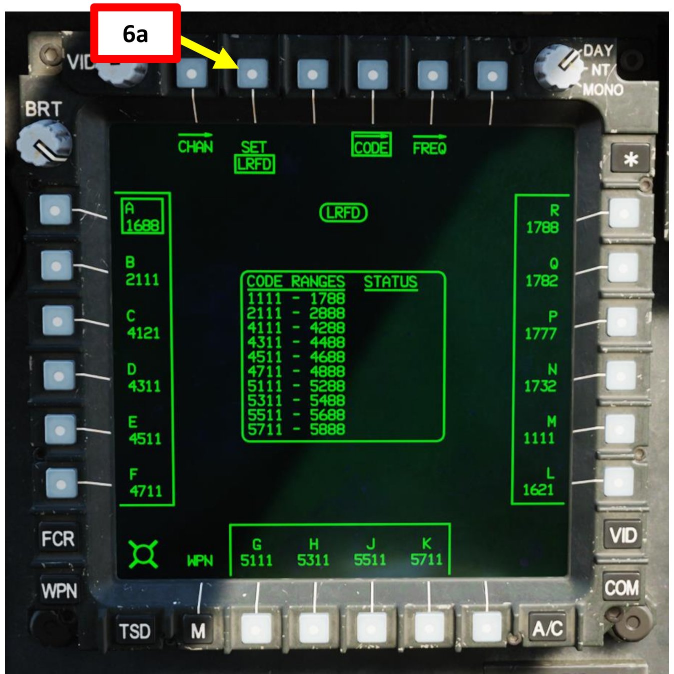
To track a laser using LST:

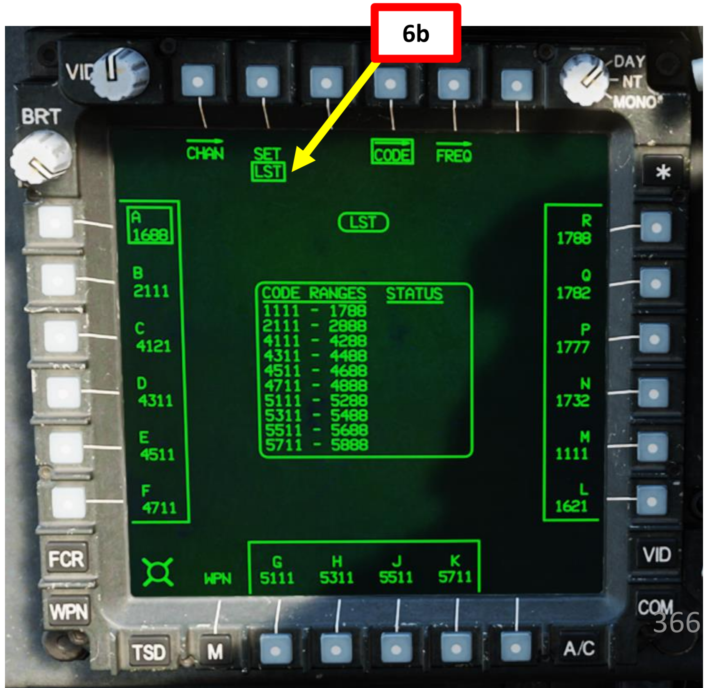
1. Find out what the laser code use by the friendly is (in our case, the friendly JTAC uses code 1688). Make sure the friendly asset is lasing the target before attempting to track it.
2. *[CPG]* Power up TADS
3. *[P/CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
4. *[P/CPG]* By default, LST (Laser Spot Tracker) is set to Channel A and LRFD (Laser Rangefinder/Designator) is set to Channel A as well.
    - In this example, we will select **Channel C** and change it to a **laser spot tracker code of 1686** instead of the default laser code of 4121.
5. *[P/CPG]* Toggle channel code by pressing VAB (Variable Action Button) next to CODE.
6. *[P/CPG]* Press VAB (Variable Action Button) next to SET to switch from LRFD (Laser Rangefinder/Designator) to LST (Laser Spot Tracker) settings.

Example of a JTAC designating a target with a laser (code 1686).



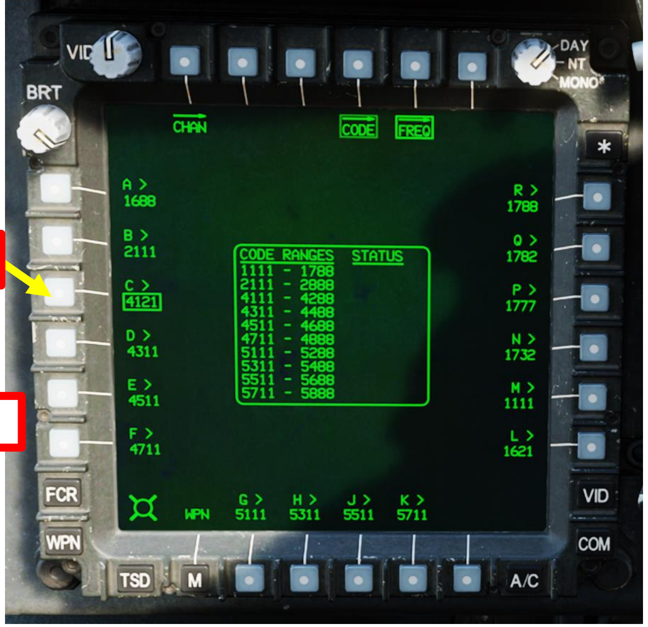


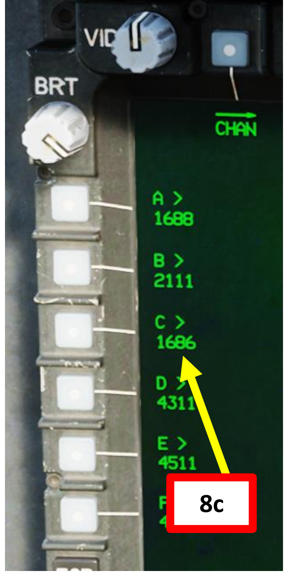


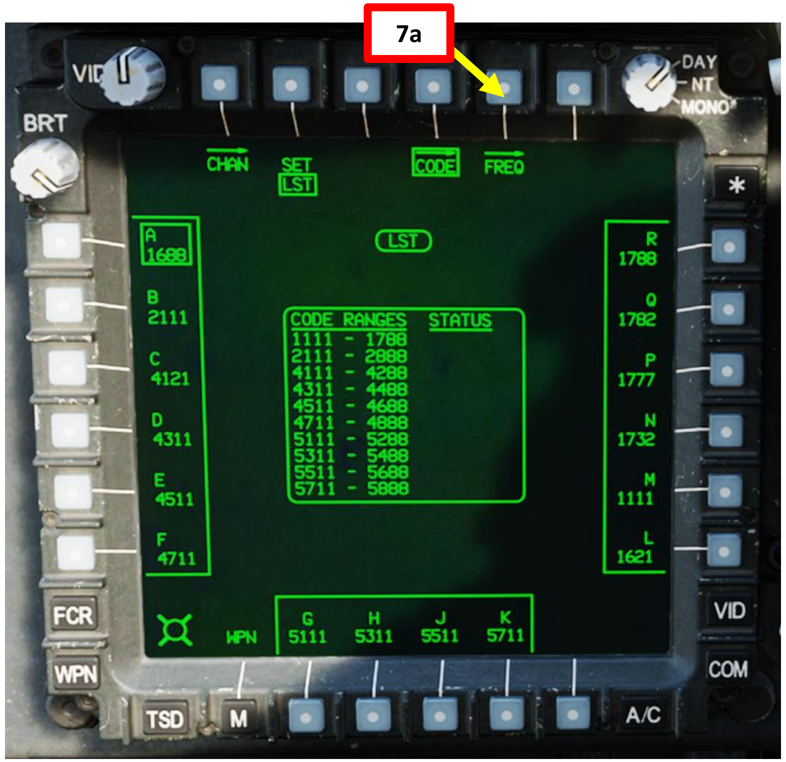


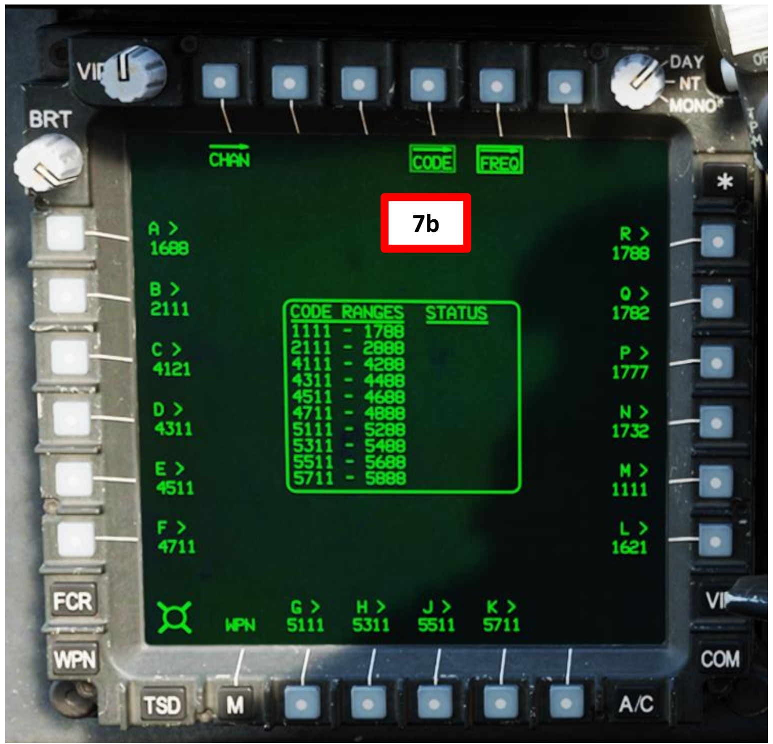
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.9 – Laser Spot Tracker (LST)

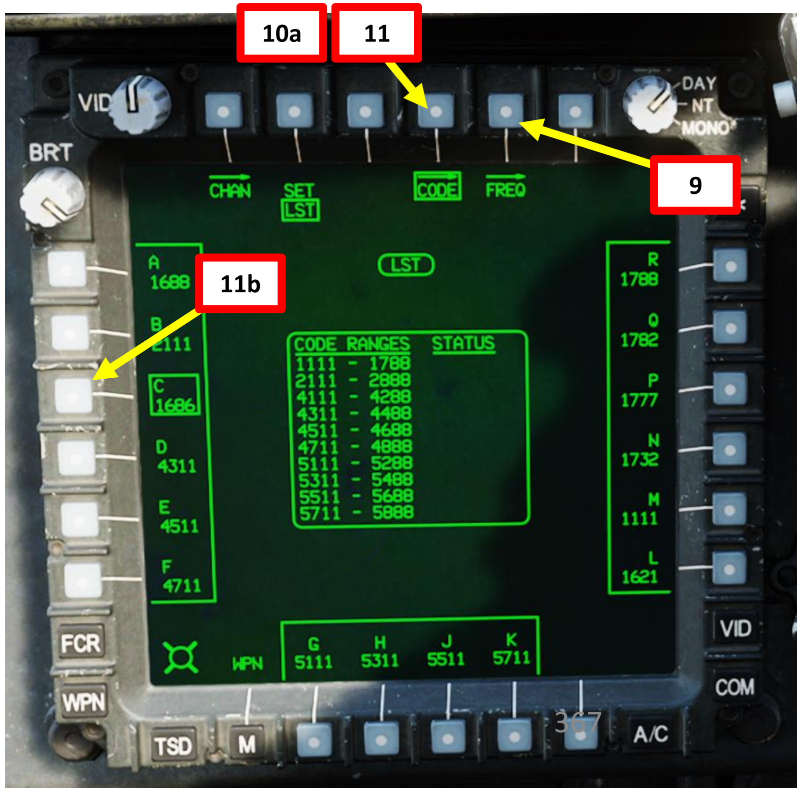
7. [P/CPG] Press VAB next to FREQ to select the laser frequency page.
8. [P/CPG] Press VAB next to Channel C, type the desired laser code of 1686 on the KU (Keyboard Unit), then press ENTER on the KU. Channel C will then have a laser code of 1686.
9. [P/CPG] Exit laser frequency page by pressing VAB next to FREQ.
10. [P/CPG] To select the LST channel you will spot the laser with, press VAB next to CODE, then press VAB next to Channel C to make it the active laser channel/code.
11. [P/CPG] Press VAB next to CODE to return to WPN menu.





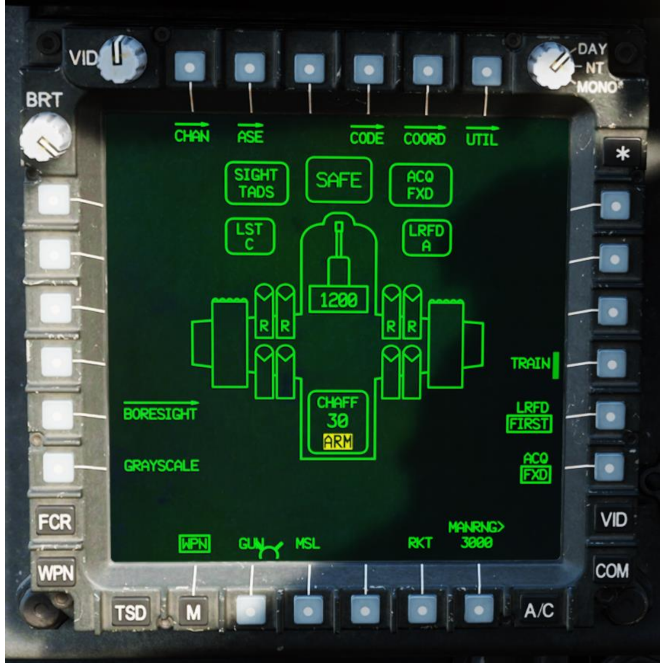






3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.9 – Laser Spot Tracker (LST)

12. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
13. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
14. *[P]* Fly the helicopter in the approximate direction where the target (and laser designator) is expected to be.



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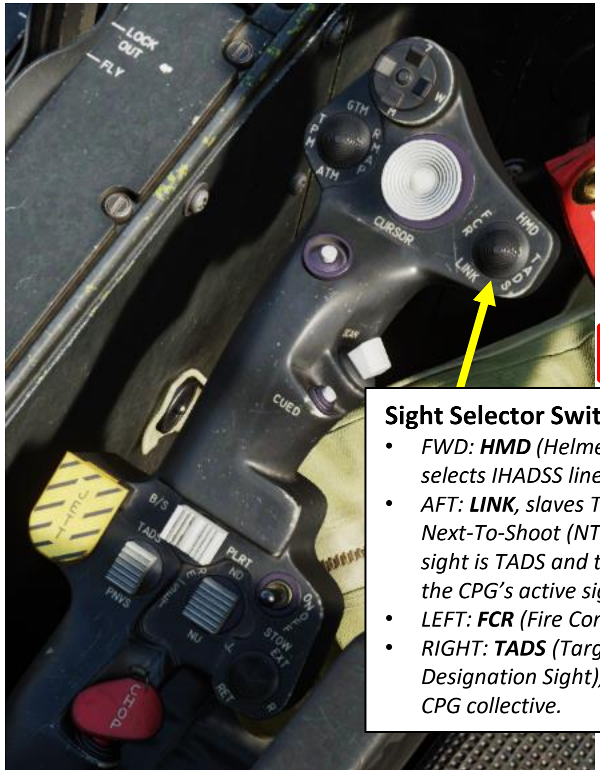


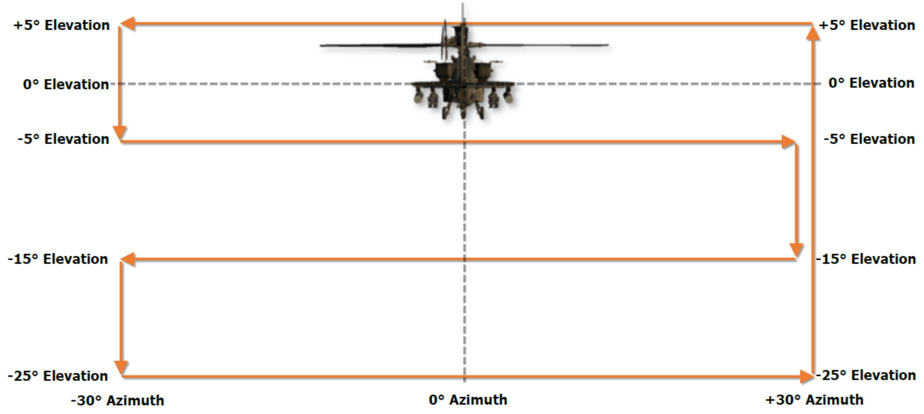
12

Sight Selector Switch
- FWD: ***HMD*** *(Helmet-Mounted Display), selects IHADSS line-of-sight*
- AFT: ***LINK****, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- LEFT: ***FCR*** *(Fire Control Radar)*
- RIGHT: ***TADS*** *(Target Acquisition & Designation Sight), but only functional for CPG collective.*

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.9 – Laser Spot Tracker (LST)

15. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight near the approximate location of the target using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
16. *[CPG]* Command Laser Spot Track
    - To use Automatic Mode, set LST Mode Switch FWD (Automatic). the TADS will enter a continuous, 4-bar azimuth/elevation scan pattern until a laser designation matching the PRF (Pulse Repetition Frequency) code assigned to the LST is detected, or the LST is disabled.
    - To use Manual Mode, set LST Mode Switch AFT (Manual). The MAN TRK Switch will control where the laser spot tracker is searching.
17. *[CPG]* Once a matching laser designation is detected, the TADS will slew to and track the laser designation.
    - Note: When the LST is employed, the Multi-Target Tracker will continue to perform automatic tracking of the primary and secondary tracks if the respective tracks remain within the optical field-of-view of the TADS sensor. However, if the tracks are forced outside the TADS field-of-view while LST operations are being performed, the tracks will enter inertial track, and may eventually be dropped.
18. *[CPG]* To cancel Laser Spot Tracking, set LST Mode Switch to MIDDLE position (OFF).

LST 4-bar Automatic Scan Pattern



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.1 – PHS (Pilot Helmet Sight) Slaving

Note: A crewmember can never select their current sight to also be their current acquisition source. For example, the co-pilot/gunner cannot select TADS as their sight and their acquisition source at the same time, because you can't slave the TADS to the TADS (it is already looking where it is currently looking).

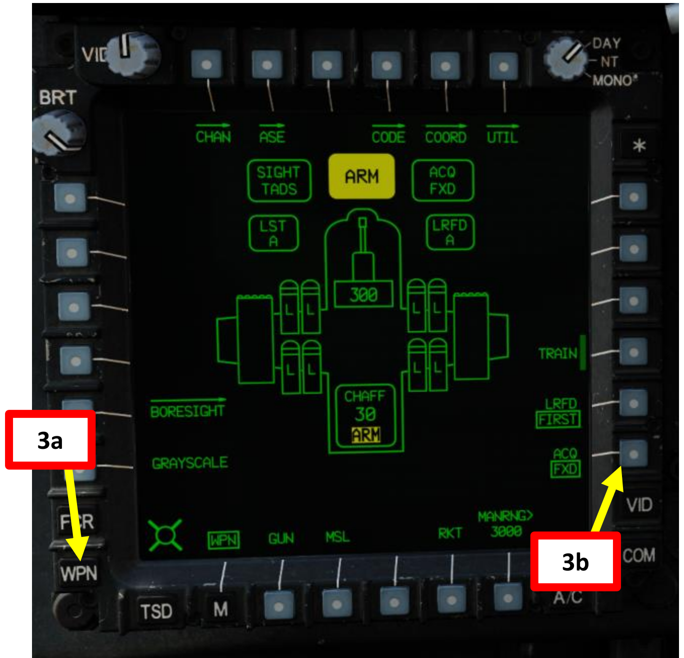
PHS (Pilot Helmet Sight) slaving is mainly used by the co-pilot/gunner (CPG) in a situation where:

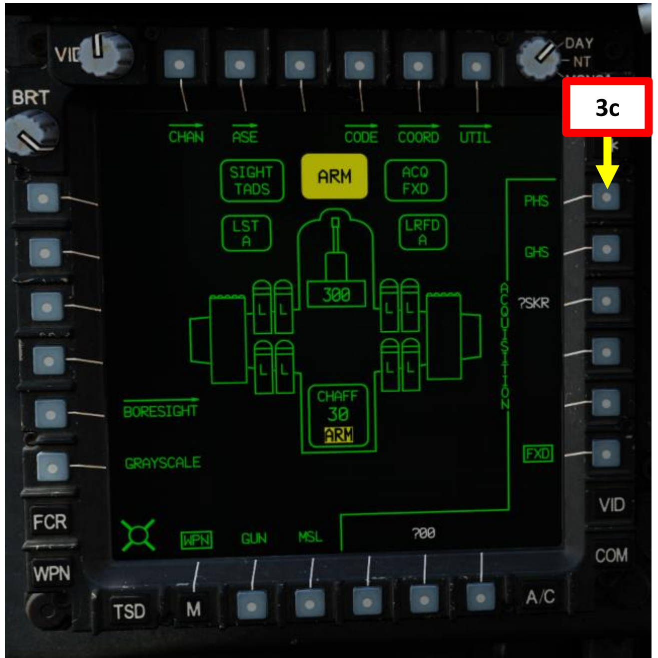
- *The pilot's helmet is looking at a target of interest*
- *The CPG wants to slave the TADS to the pilot helmet's line-of-sight in order to have better visibility and to eventually attack this target.*

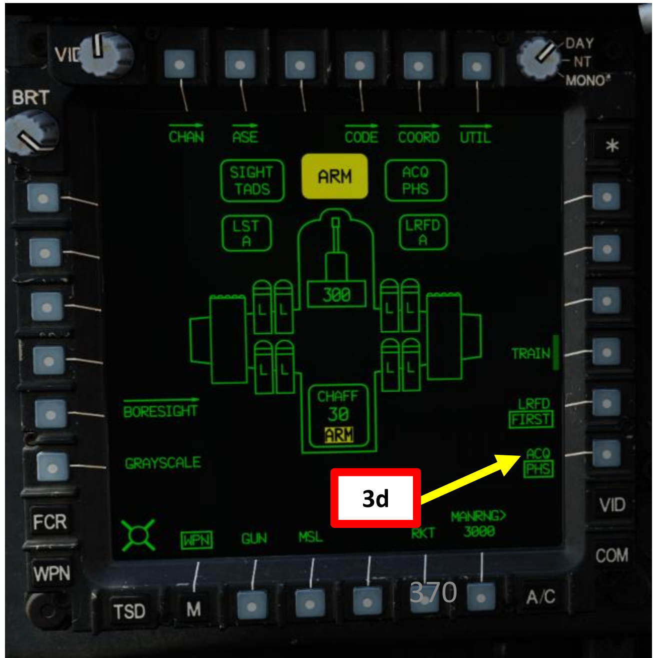
1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
    - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[CPG]* From the WPN or TSD page, press VAB (Variable Action Button) next to ACQ (Acquisition Source). Then, press VAB next to "PHS" (Pilot Helmet Sight). Your current acquisition source will then be the pilot's helmet sight.

Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*







3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.1 – PHS (Pilot Helmet Sight) Slaving

4. *[P]* Move helmet to place the helmet line-of-sight reticle on a target of opportunity.
5. *[P]* Call out to the co-pilot/gunner: “Target, my line-of-sight.”
    - This will tell the co-pilot/gunner that he needs to change his acquisition source to the PHS (Pilot Helmet Sight) in order to slave the helicopter’s sensors to it.

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

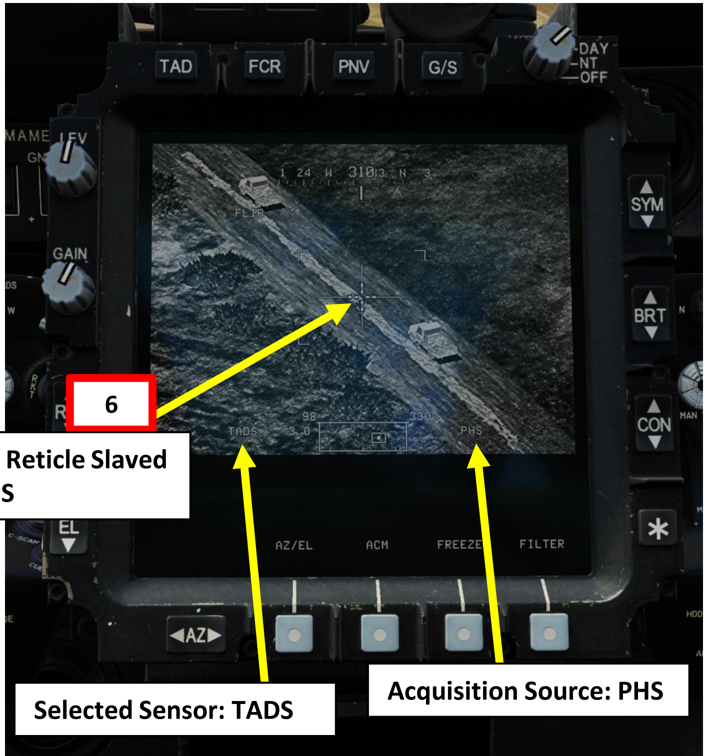
3.10 – Target Slaving to Acquisition Sources

3.10.1 – PHS (Pilot Helmet Sight) Slaving

6. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is the Pilot Helmet Sight (PHS) in this case.
    - The Co-Pilot/Gunner can then call out “slaved” to the Pilot to tell him that the TADS is slaved to the acquisition source.
    - The Pilot should keep his helmet line-of-sight reticle pointed on the target since the TADS will follow it as long as the TADS is slaved to it.
    - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input will not be able to move the TADS line-of-sight.
7. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to “de-slave” the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input to make adjustments to the TADS line-of-sight if required.
    - The Co-Pilot/Gunner can then call out “de-slaved” to the Pilot to tell him that the TADS is not slaved to an acquisition source (his helmet) and is free to move.

TADS Reticle Slaved

TADS Reticle De-Slaved



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.10 – Target Slaving to Acquisition Sources
3.10.1 – PHS (Pilot Helmet Sight) Slaving

Note: here is an example of a "flow" to use Pilot Helmet Sight slaving:

- Pilot spots target, places helmet reticle on target, then calls out "Target, my line-of-sight".
- Co-Pilot/Gunner selects acquisition source to PHS, slaves TADS to acquisition source, then calls out "slaved" to remind the pilot that the TADS is slaved to his helmet reticle.
- When TADS reticle is roughly on target, Co-Pilot/Gunner de-slaves TADS, calls out "de-slaved" to tell the pilot that he can start looking elsewhere. Target can then be lased, designated, and stored.

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.2 – GHS (Gunner Helmet Sight) Slaving

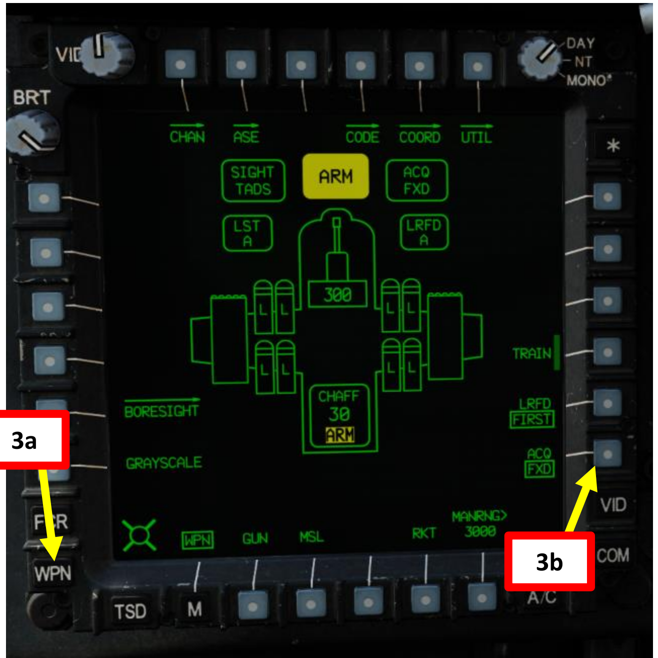
GHS (Gunner Helmet Sight) slaving is mainly used by the co-pilot/gunner (CPG) in a situation where:

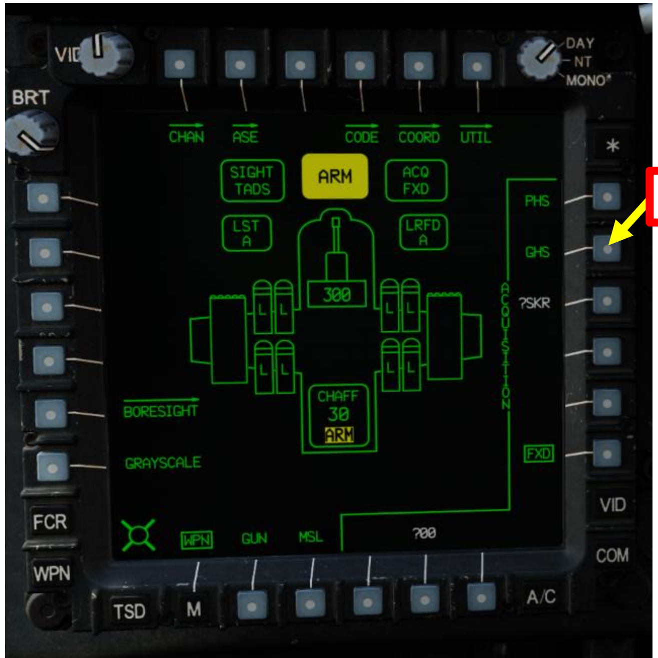
- *The co-pilot's helmet is looking at a target of interest*
- *The CPG wants to slave the TADS to his own helmet's line-of-sight in order to have better visibility and to eventually attack this target.*

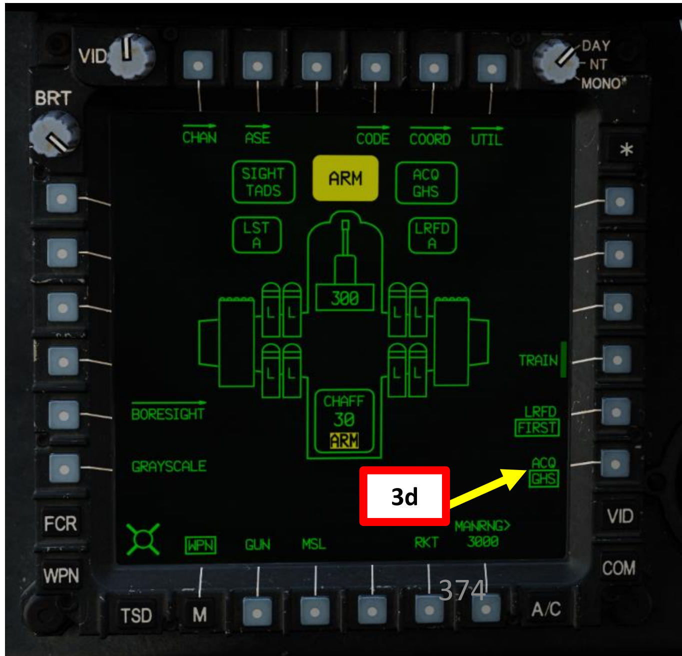
1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
    - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[CPG]* From the WPN or TSD page, press VAB (Variable Action Button) next to ACQ (Acquisition Source). Then, press VAB next to "GHS" (Gunner Helmet Sight). Your current acquisition source will then be your (the gunner's) helmet sight.

Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*





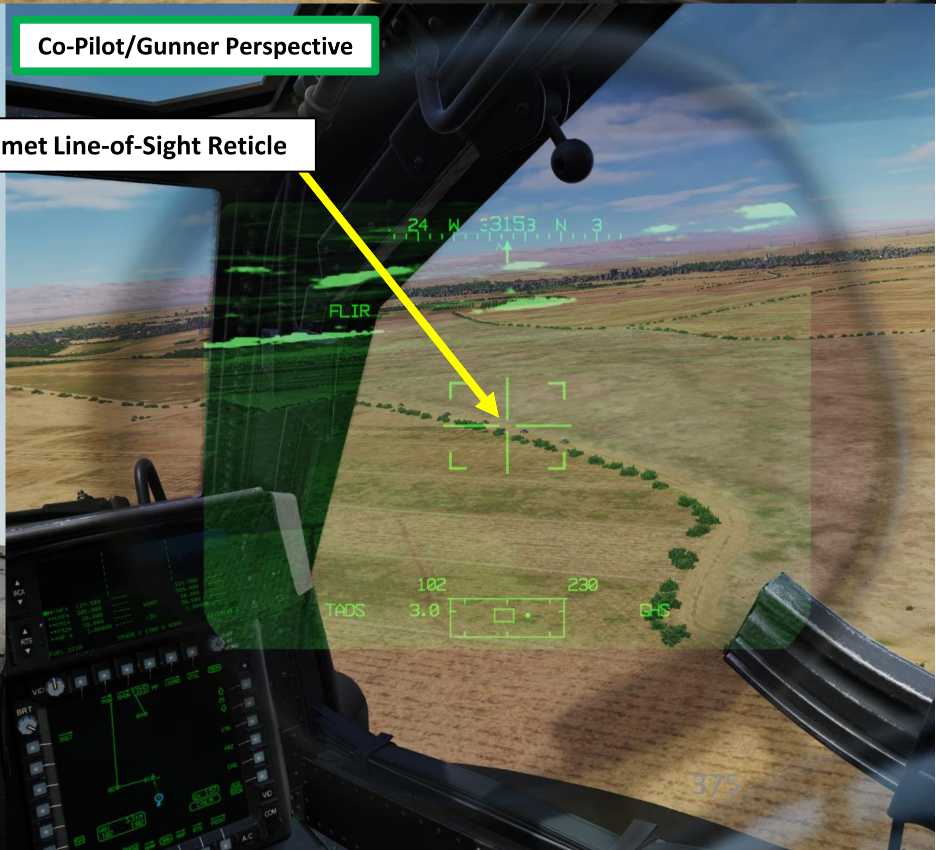


3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.2 – GHS (Gunner Helmet Sight) Slaving

4. *[CPG]* Move helmet to place the helmet line-of-sight reticle on a target of opportunity.

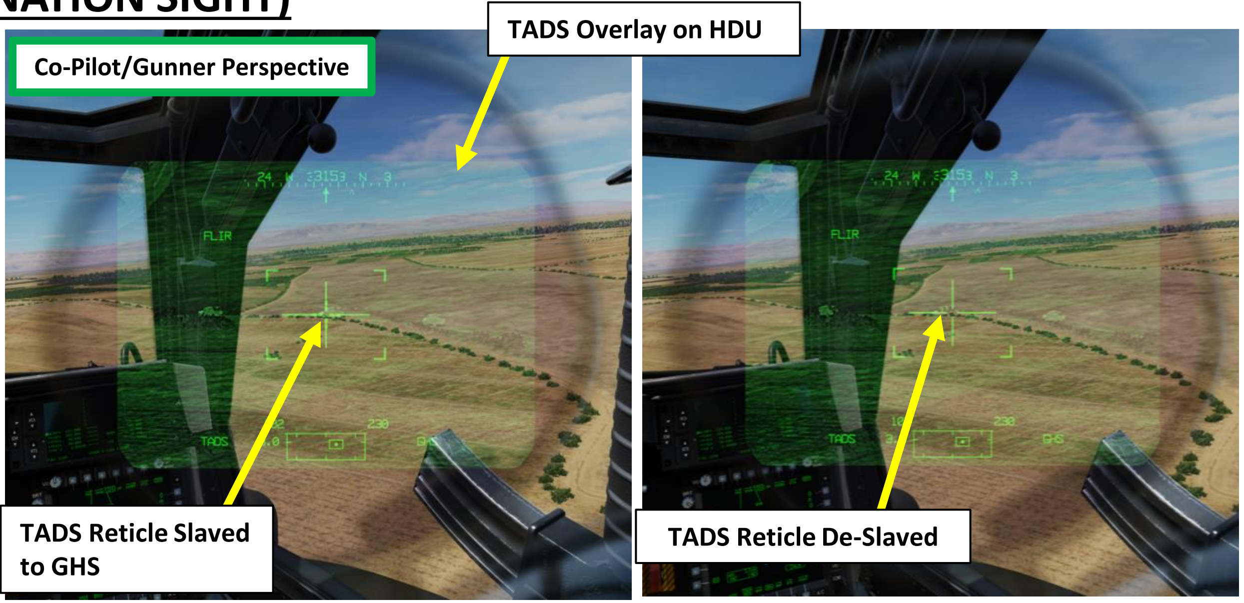


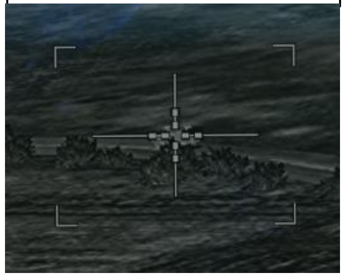
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

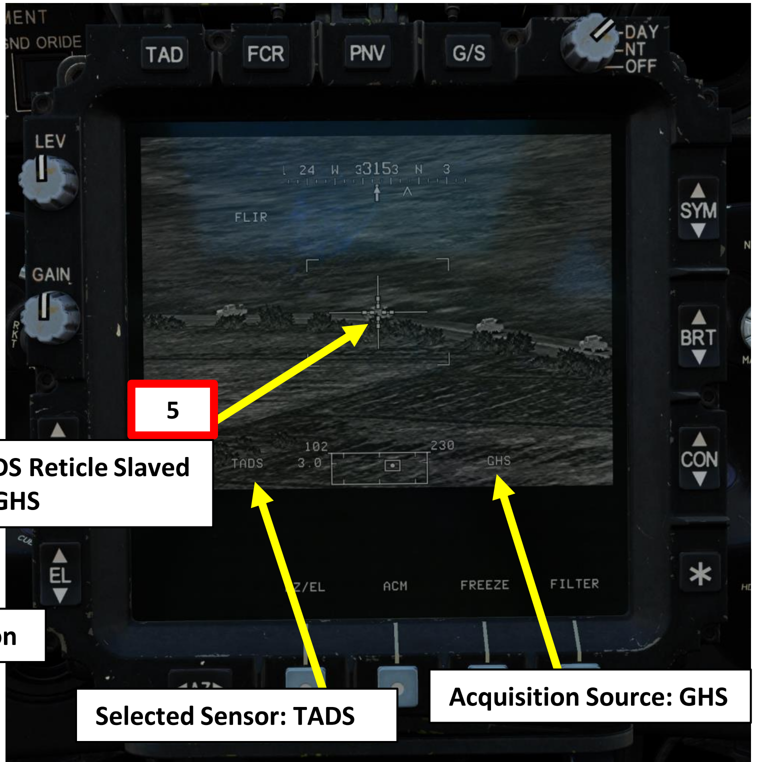
3.10 – Target Slaving to Acquisition Sources

3.10.2 – GHS (Gunner Helmet Sight) Slaving

5. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is the Gunner Helmet Sight (GHS) in this case.
    - The Co-Pilot/Gunner should keep his helmet line-of-sight reticle pointed on the target since the TADS will follow it as long as the TADS is slaved to it.
    - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input will not be able to move the TADS line-of-sight.
    - Using the TADS overlay on the HDU (Helmet Display Unit) is quite useful here.
6. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to “de-slave” the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input to make adjustments to the TADS line-of-sight if required.







3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.2 – GHS (Gunner Helmet Sight) Slaving

Note: here is an example of a “flow” to use Gunner Helmet Sight slaving:

- Co-Pilot/Gunner selects acquisition source to GHS, slaves TADS to acquisition source.
- When TADS reticle is roughly on target, Co-Pilot/Gunner de-slaves TADS. Target can then be lased, designated, and stored.

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

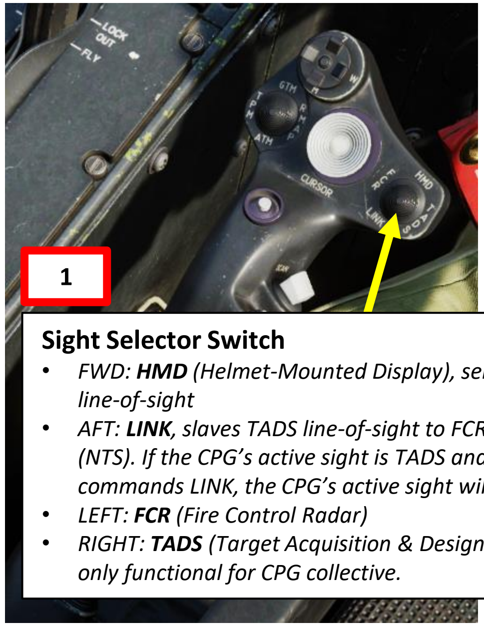
3.10 – Target Slaving to Acquisition Sources

3.10.3 – SKR (Tracking Missile Seeker) Slaving

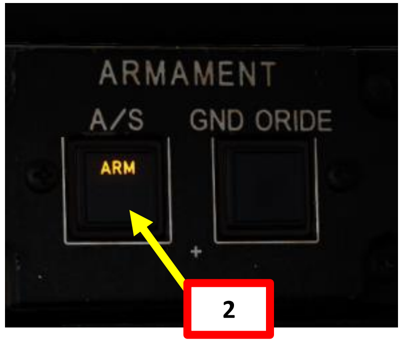
SKR (Tracking Missile Seeker) slaving is mainly used by the co-pilot/gunner (CPG) in a situation where the Hellfire missile's seeker has spotted a laser from another laser designator (like another AH-64 or a JTAC) and the gunner wants to slave sensors to the location where the missile seeker is looking. This is a "primitive" form of LST (Laser Spot Tracker).

Note: Using the SKR acquisition source is different from the LST (Laser Spot Tracker) of the TADS. The missile seeker head has a narrower laser detection field-of-view. In this example, another AH-64 Apache is lasing a target for us.

1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
    - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
4. *[CPG]* On TEDAC Right Hand Grip, press WAS (Weapon Action Switch) RIGHT to select missiles.



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*



TEDAC LHG (Left Hand Grip) Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

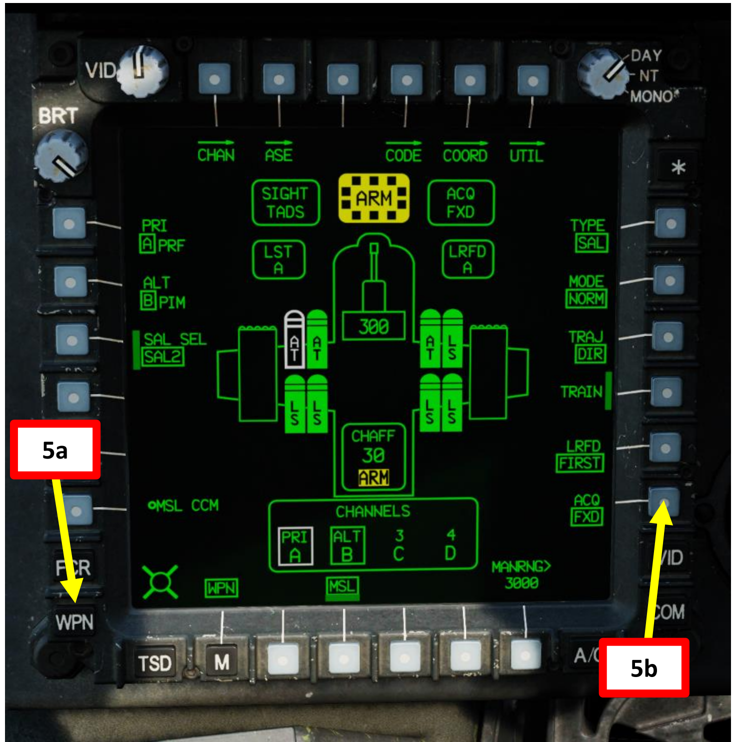
Hellfire Missile Seeker Head

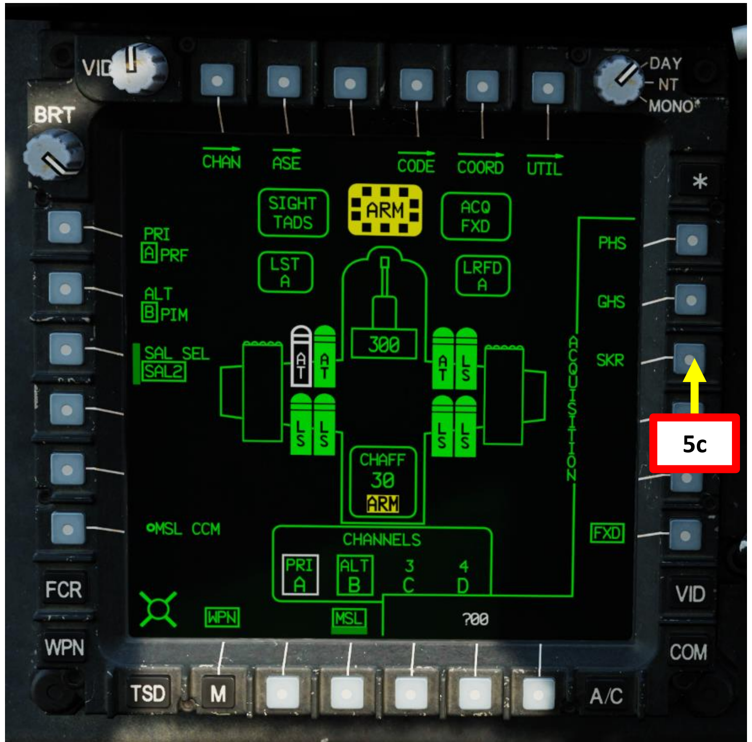
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

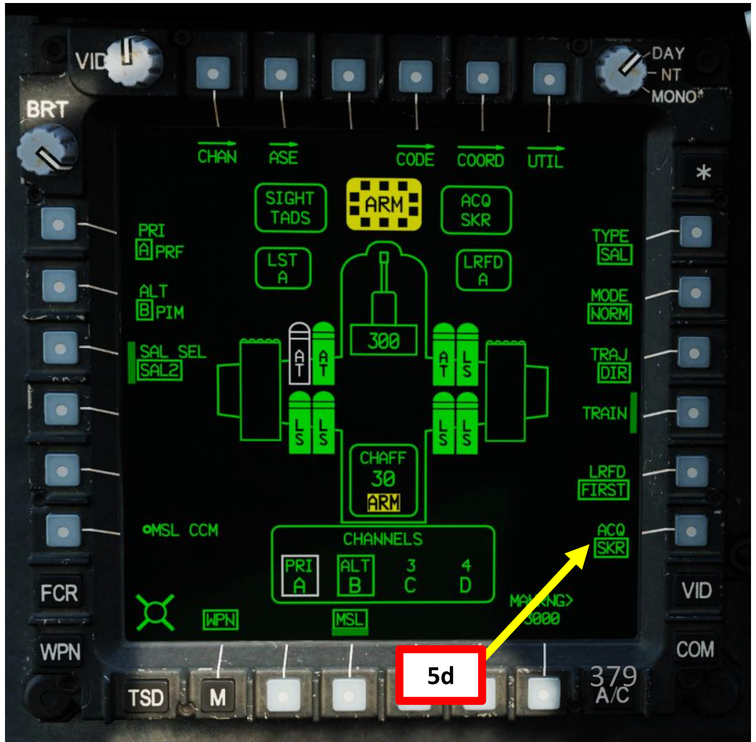
3.10 – Target Slaving to Acquisition Sources

3.10.3 – SKR (Tracking Missile Seeker) Slaving

5. *[CPG]* From the WPN or TSD page, press VAB (Variable Action Button) next to ACQ (Acquisition Source). Then, press VAB next to "SKR" (Seeker). Your current acquisition source will then be the Hellfire missile's seeker head (and, indirectly, the location of a target being laser designated if the laser is spotted).
6. *[P]* Fly the helicopter roughly in the direction of the laser-designated target. The missile seeker has a narrow field-of-view to detect the laser.







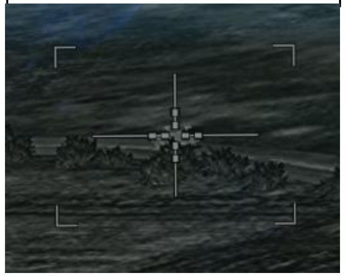
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.3 – SKR (Tracking Missile Seeker) Slaving

7. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then be slaved to the location of the missile seeker track of a laser (if the missile seeker "spots" the laser).
    - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input will not be able to move the TADS line-of-sight.
8. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to "de-slave" the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input to make adjustments to the TADS line-of-sight if required.

TADS Reticle Slaved



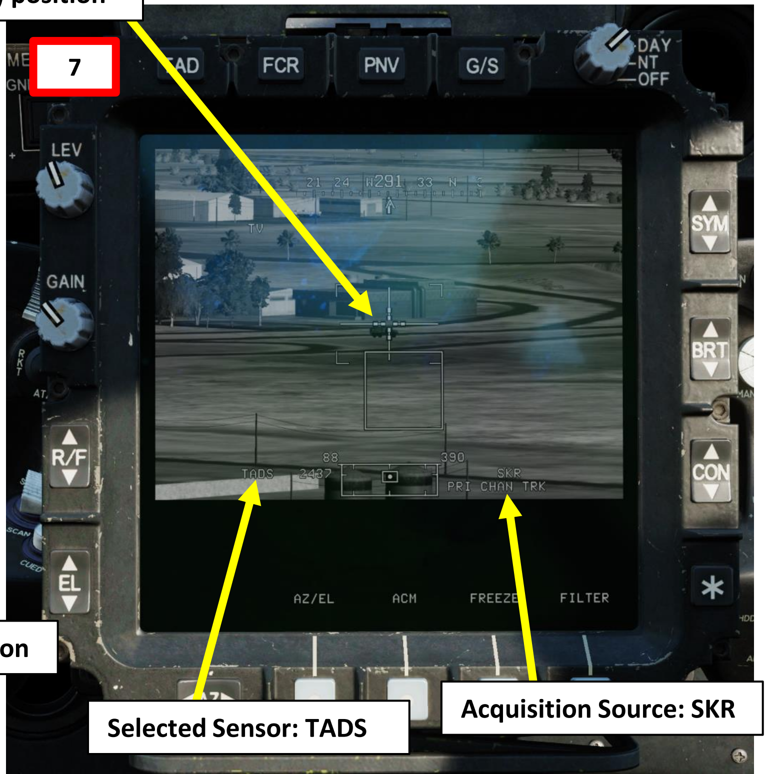
TADS Reticle De-Slaved

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"

Sight Slave Button

7 8

TADS Reticle Slaved to Fixed (FXD) position



7

Selected Sensor: TADS

Acquisition Source: SKR

TADS Reticle De-Slaved

8

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.3 – SKR (Tracking Missile Seeker) Slaving

The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight.

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

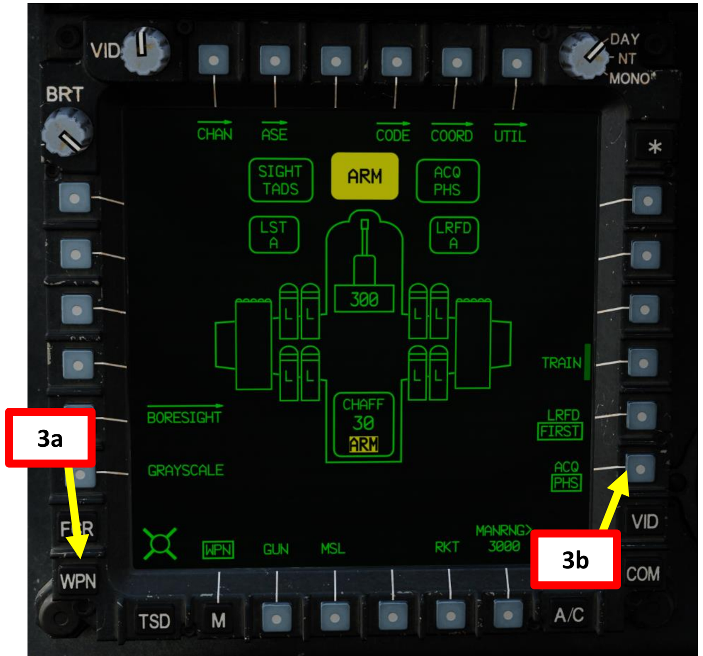
3.10.4 – FXD (Fixed) Slaving

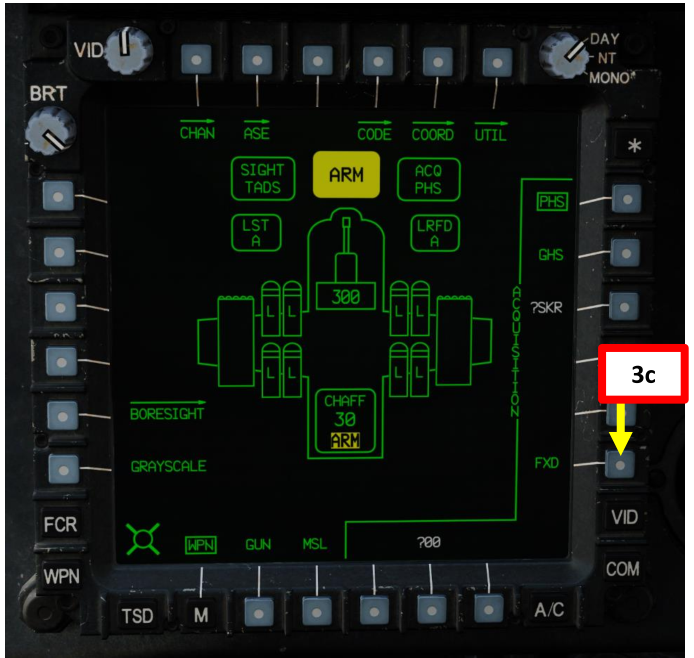
FXD (Fixed) slaving is useful when you want to quickly "boresight" sensors and weapons in the forward position, which is fixed 0 deg in azimuth and elevation with the aircraft centerline.

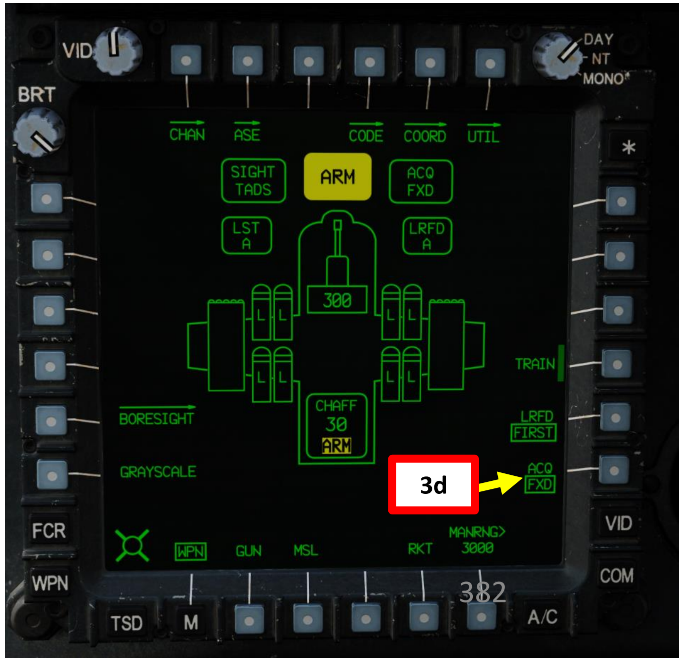
1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
   - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[CPG]* From the WPN or TSD page, press VAB (Variable Action Button) next to ACQ (Acquisition Source). Then, press VAB next to "FXD" (Fixed). Your current acquisition source will then be the "fixed" (boresighted) position.

Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*







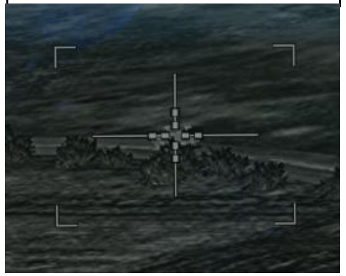
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

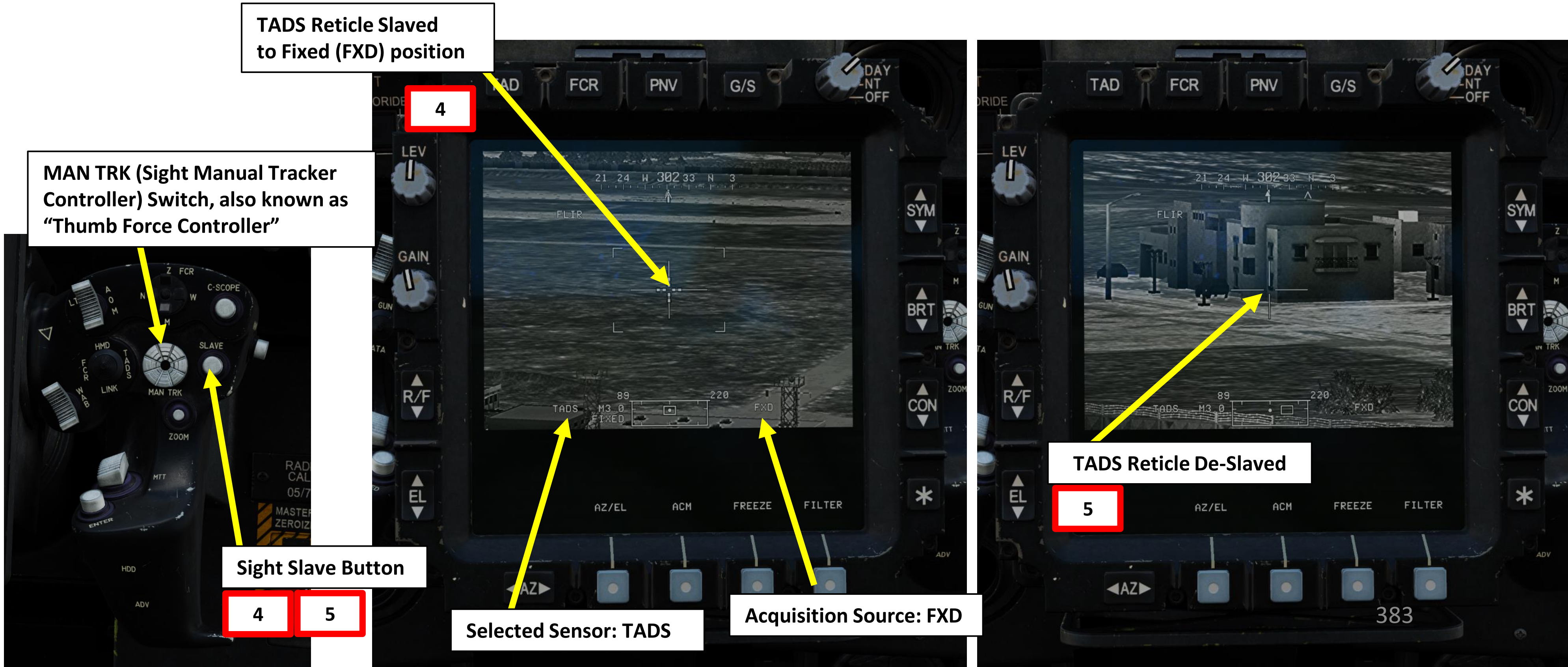
3.10.4 – FXD (Fixed) Slaving

4. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then "boresight" the TADS in the forward position, which is fixed 0 deg in azimuth and elevation with the aircraft centerline.
   - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input will not be able to move the TADS line-of-sight.
5. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to "de-slave" the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input to make adjustments to the TADS line-of-sight if required.

TADS Reticle Slaved



TADS Reticle De-Slaved



3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.4 – FXD (Fixed) Slaving

FXD slaving can be seen as a “boresight” function that is helpful when you want to quickly “slave” everything back to the front of the helicopter.

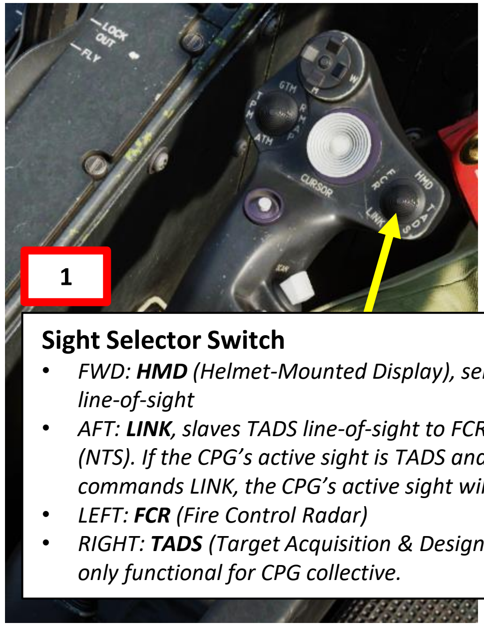
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.5 – Waypoint/Target Slaving

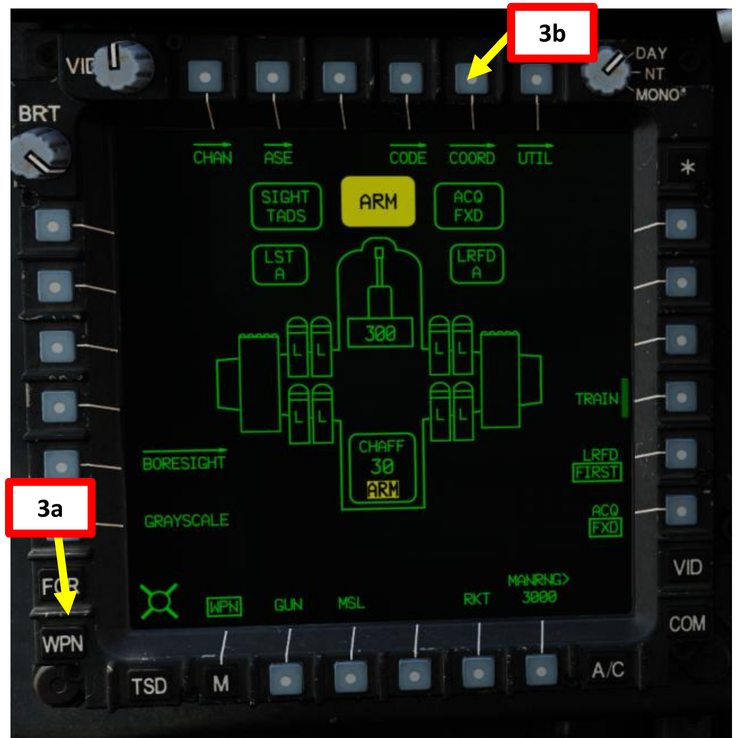
Waypoint/Target (W##, H##, C##, T##) slaving is useful when co-pilot/gunner wants to slave the TADS to specific coordinates stored in a Waypoint, Hazard, Control Measure or Target/Threat. ## refers to the number of the point.

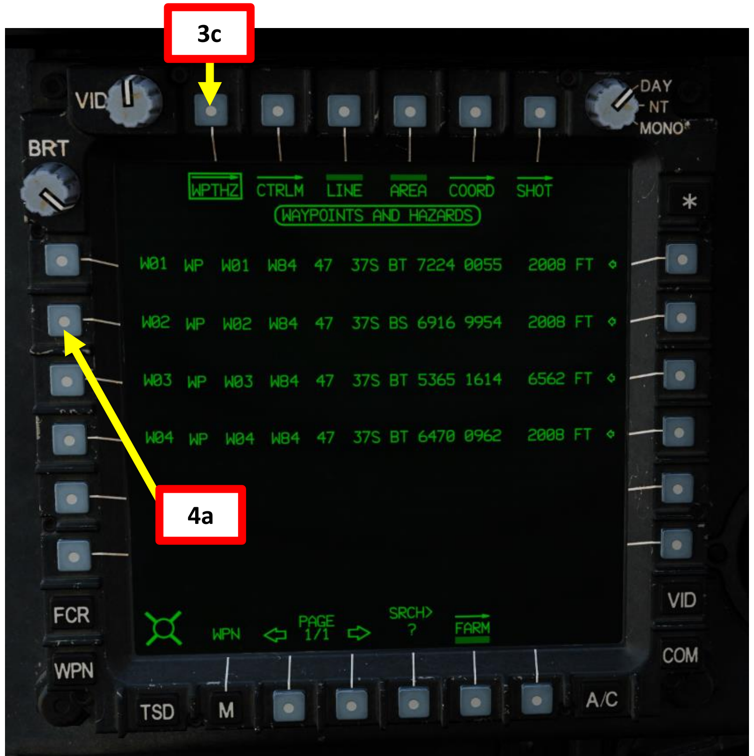
1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
    - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[CPG]* From the WPN or TSD page, press VAB (Variable Action Button) next to COORD (Coordinates). Then, press VAB next to the relevant waypoint/target category, which is WPTHZ since we want to select a waypoint (WPTHZ for Waypoints and Hazards, CTRLM for Control Measures).
    - If targets are already stored, entering the COORD page will display existing TARGETS AND THREATS (T01, T02, etc.)
4. *[CPG]* Press VAB next to desired waypoint you want to use as an acquisition source; we will select Waypoint W02.

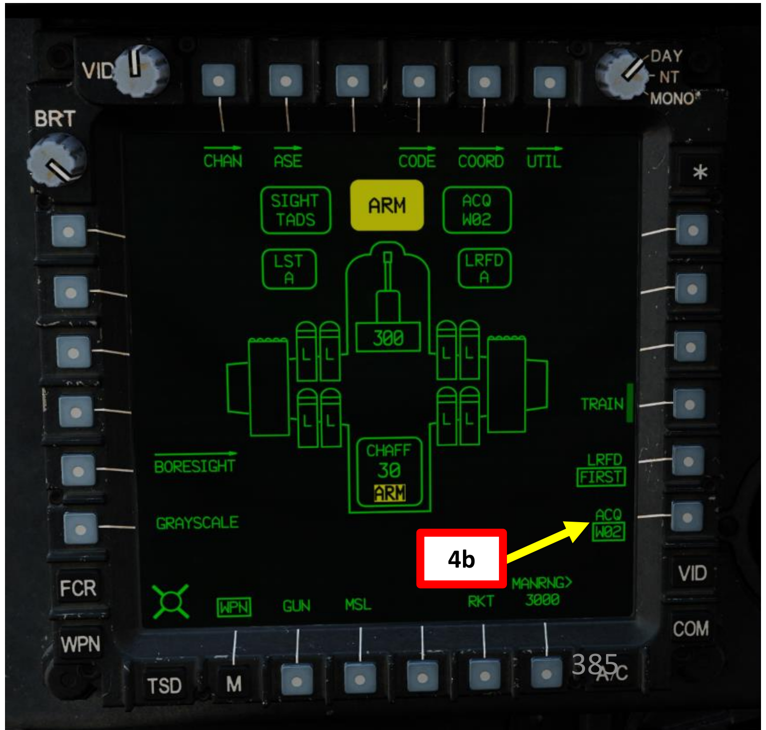


Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*





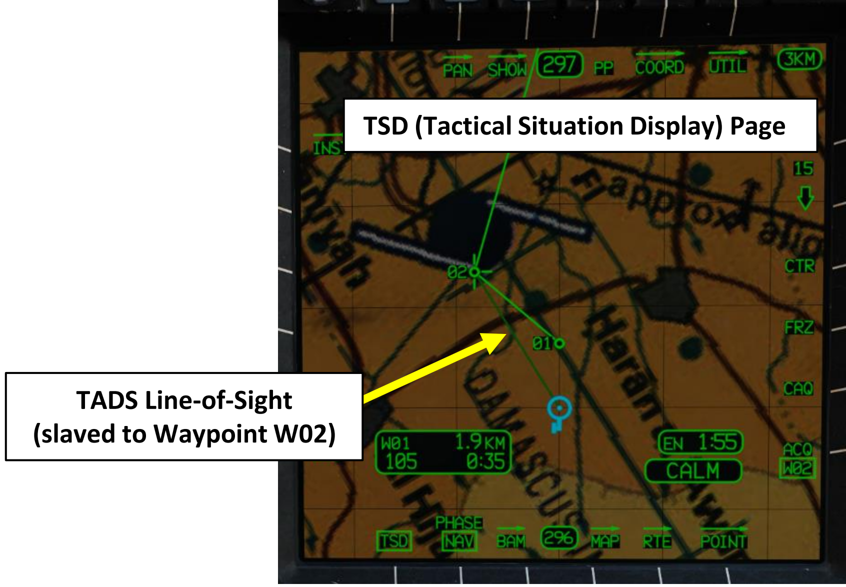


3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

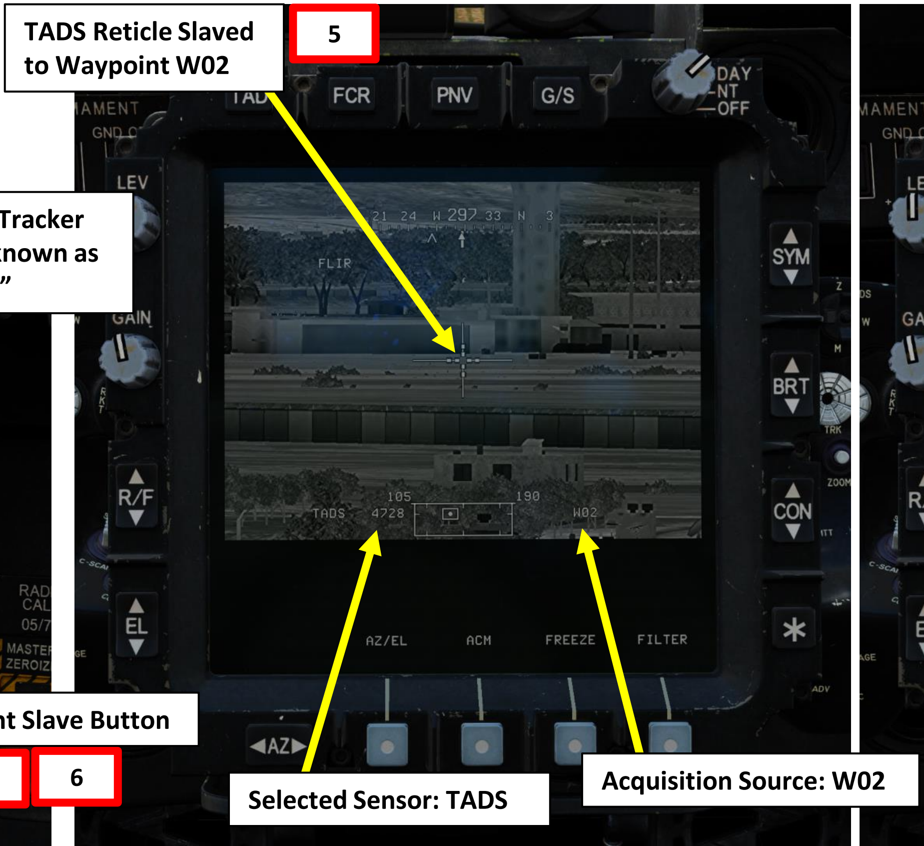
3.10.5 – Waypoint/Target Slaving

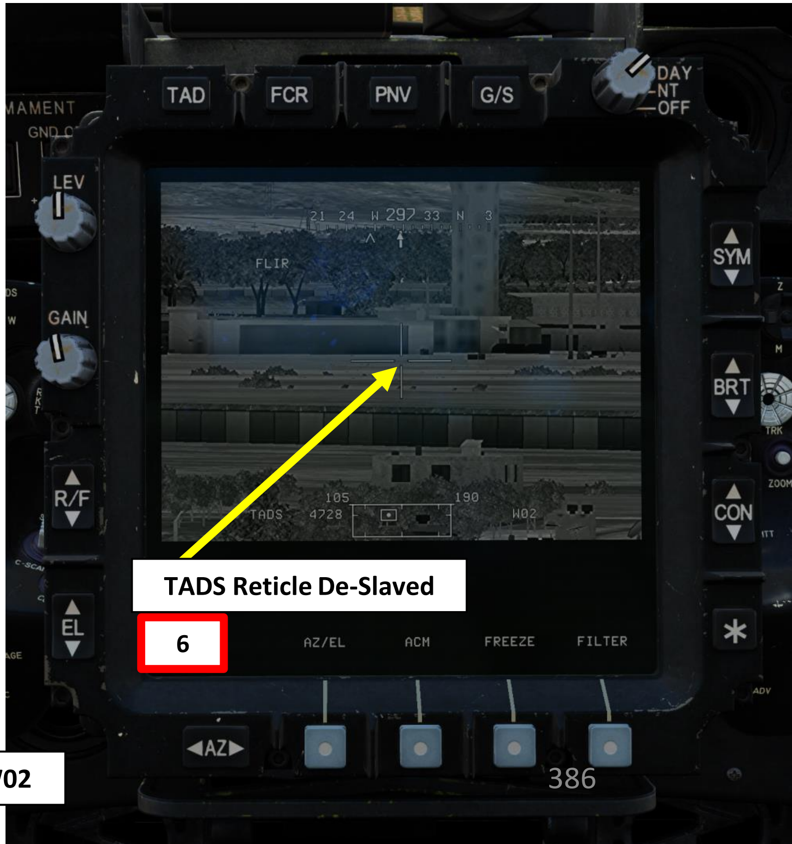
5. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then slave the TADS to the selected waypoint (W02).
    - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input will not be able to move the TADS line-of-sight.
6. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to “de-slave” the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input to make adjustments to the TADS line-of-sight if required.



TADS Reticle Slaved

TADS Reticle De-Slaved





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.6 – CAQ/TRN (Cursor Acquisition/Terrain) Slaving

Cursor Acquisition and Terrain Acquisition are useful features when you want to slave sensors to a specific waypoint/target symbol or terrain location on the TSD (Tactical Situation Display) page, which is done by using the cursor controls on either the pilot or co-pilot's Cursor Control on the collective or on the co-pilot's TEDAC Left Hand Grip.

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG collective.*

1. *[CPG]* Set the Sight Select Switch to RIGHT (TADS) on the collective. Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
   - Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, use any procedure from section 2.4 (TADS & PNVS Integration).
2. *[CPG]* Verify that TADS, FLIR and LASER are powered from the WPN – UTIL (Weapon Utility) page. Hollow circle means OFF, solid circle means ON.
3. *[P/CPG]* On the TSD (Tactical Situation Display) page, select NAV (Navigation) Phase or ATK (Attack) Phase. NAV will display navigation waypoints and flight plan, while ATK will display target points. In this tutorial, the selected phase is not important since we will use Cursor Acquisition on the terrain map displayed on the TSD.
4. *[P/CPG]* Press on VAB (Variable Action Button) next to CAQ (Cursor Acquisition).

TSD – NAV Phase

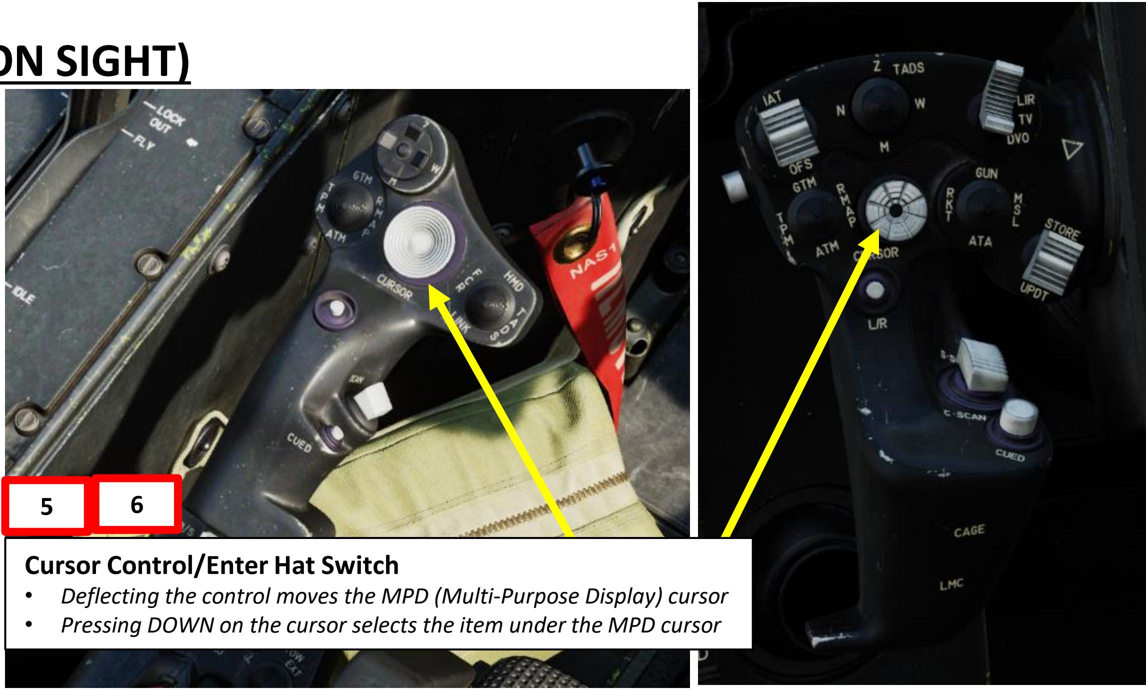
TSD – ATK Phase

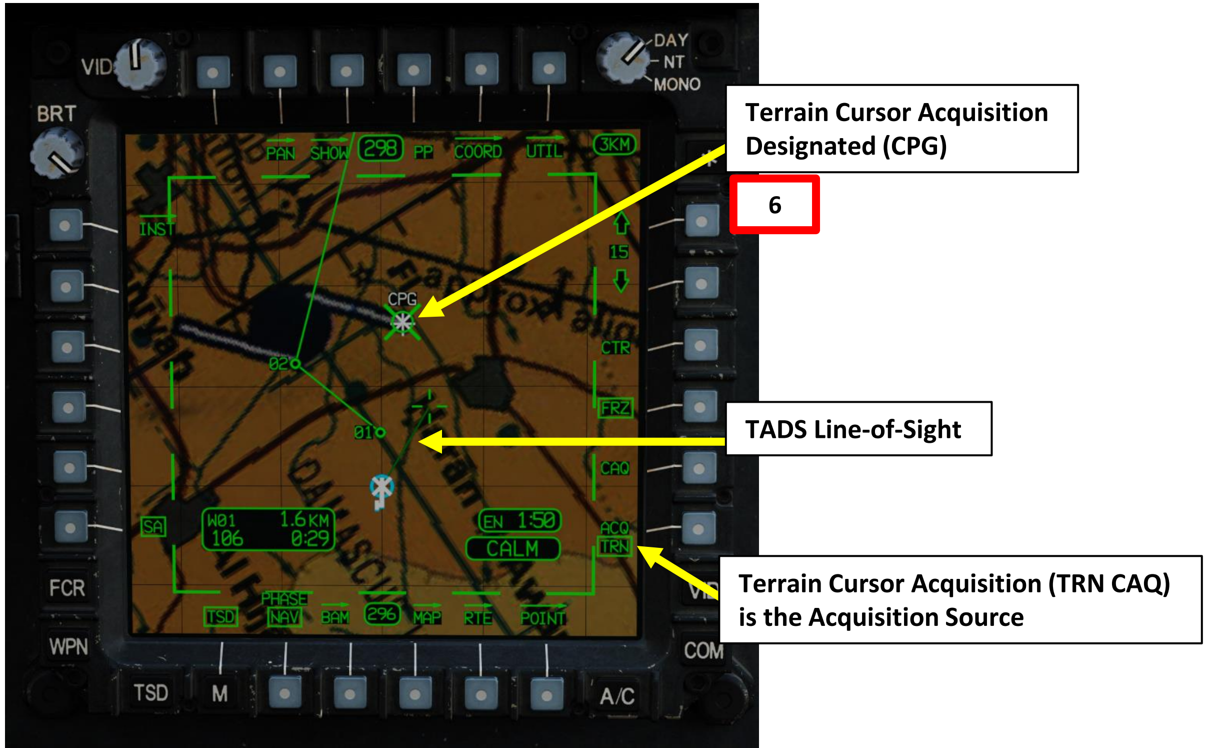
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.6 – CAQ/TRN (Cursor Acquisition/Terrain) Slaving

5. *[P/CPG]* Move the MPD (Multi-Purpose Display) Cursor using the Cursor Control Hat Switch on the collective or on the TEDAC Right Hand Grip. Cursor can be moved on either:
    - A target symbol (i.e. T01)
    - A navigation symbol (i.e. W02)
    - A specific location on the TSD map
6. *[P/CPG]* Once cursor is over desired location on the TSD, depress the Cursor Control/Enter Hat Switch. This will select this location as the acquisition source.
    - Since we set the cursor on a terrain feature of the TSD map as the co-pilot/gunner, the "CPG" white cross symbol will appear on the TSD to show that this point has been selected as the terrain acquisition point (TRN).





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

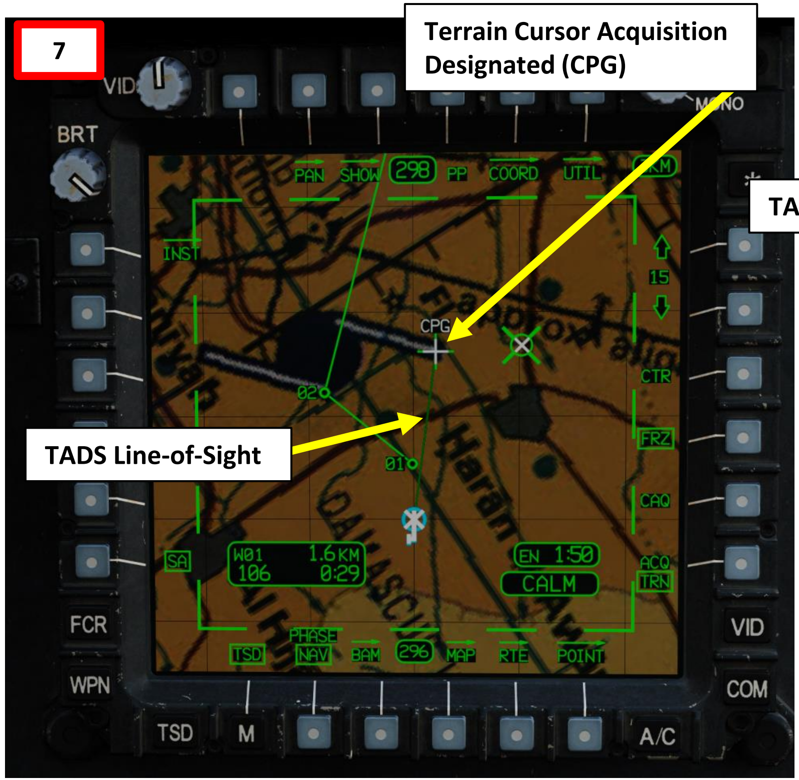
3.10 – Target Slaving to Acquisition Sources

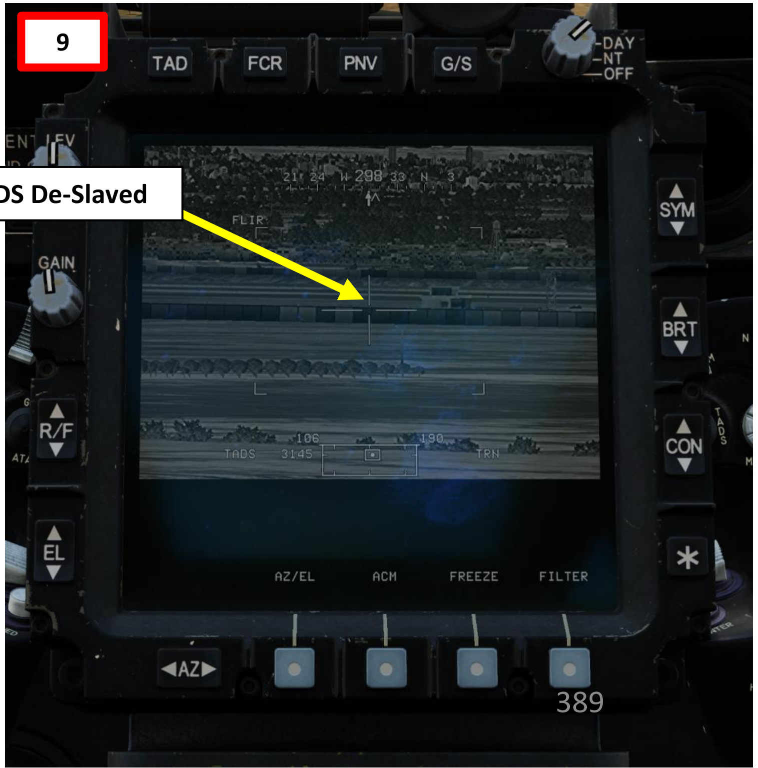
3.10.6 – CAQ/TRN (Cursor Acquisition/Terrain) Slaving

7. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is the TSD cursor designated on the map terrain (TRN) in this case.
8. *[CPG]* The TADS will keep tracking the terrain point, which means that MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input will not be able to move the TADS line-of-sight.
9. *[CPG]* If desired, on TEDAC Right Hand Grip, press the Sight Slave Button to "de-slave" the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input to make adjustments to the TADS line-of-sight.

TADS Reticle Slaved

TADS Reticle De-Slaved





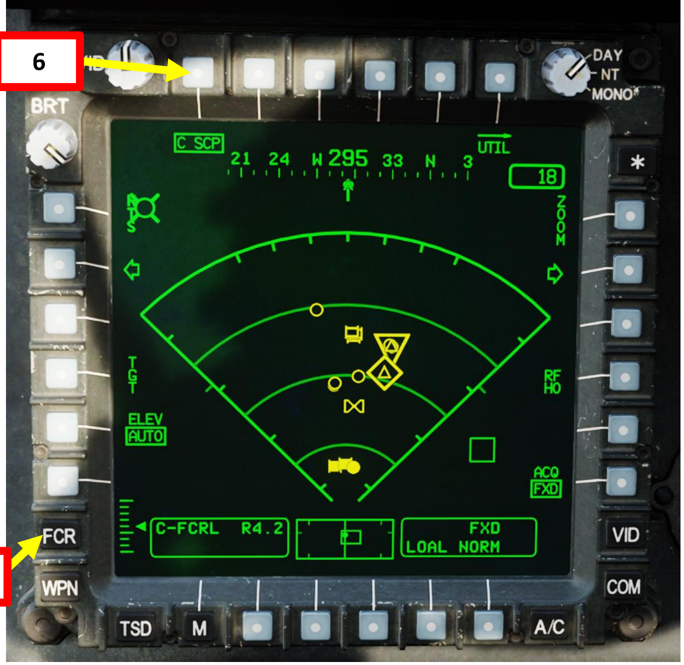
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.7 – FCR (Fire Control Radar) Slaving

FCR slaving is very useful when you want to slave the TADS to a specific target detected by the Fire Control Radar.

1. Power up the TADS & FCR.
2. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
4. *[CPG]* Set Sight Selector Switch – LEFT (FCR)
5. *[CPG]* Set FCR Mode Selector – FWD (GTM)
6. *[CPG]* Enable (box) C-SCP (C-Scope) if desired. This will display FCR Symbology on the Helmet-Mounted Display and TDU (TADS Display Unit).
7. *[CPG]* Use FCR Scan Control Switch to perform a scan.
   - Switch FWD: Single Scan
   - Switch AFT: Continuous Scan



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

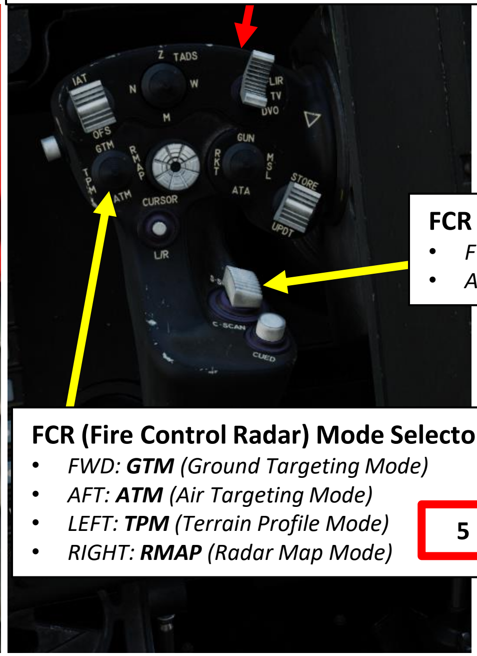
4

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

5

Collective

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



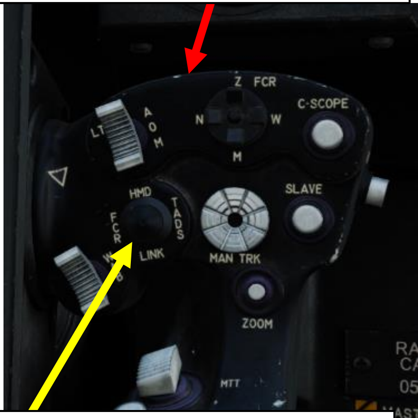
FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

7

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

5

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

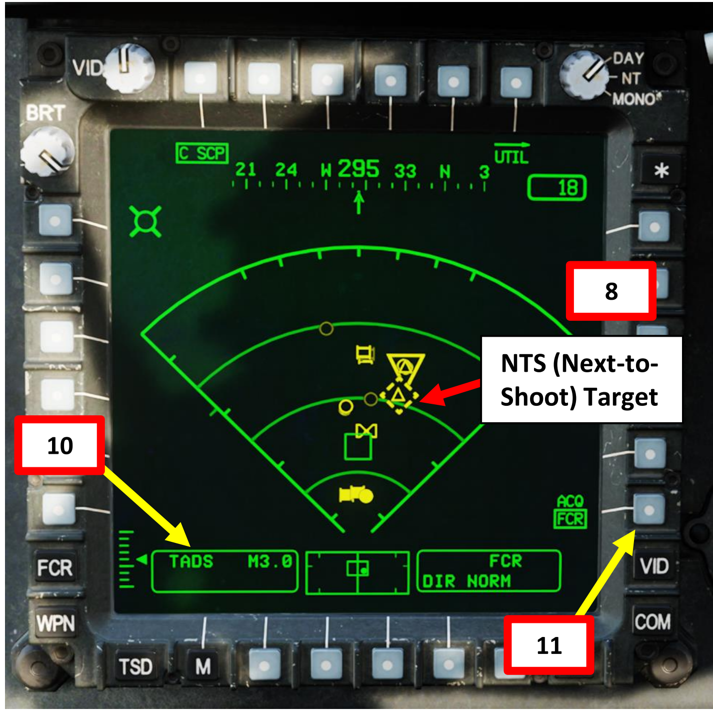
4

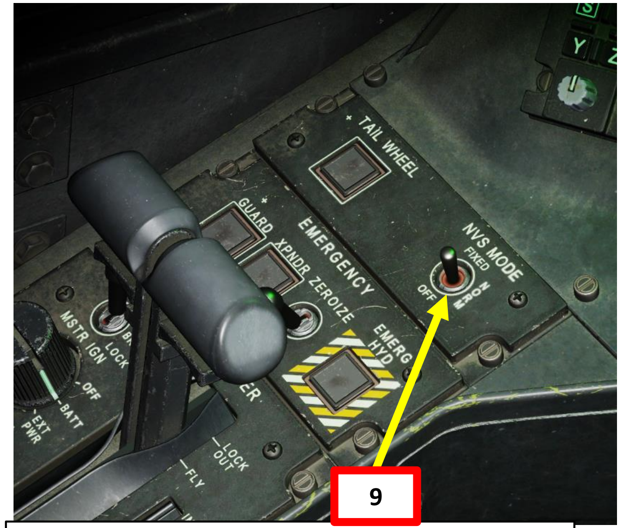
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.7 – FCR (Fire Control Radar) Slaving

8. *[CPG]* Targets are automatically detected, classified and prioritized by the FCR. The NTS (Next-to-Shoot) Target and ANTS (Alternate Next-to-Shoot) Target are automatically determined as priority targets. **We will assume the NTS we obtained is the target we want to slave the TADS to** in order to better identify it.
9. *[CPG]* Either crewmember's NVS Mode switch must be set to NORM or FIXED with TADS as the selected NVS sensor.
10. *[CPG]* Set Sight Selector Switch – RIGHT (TADS).
11. *[CPG]* Press VAB (Variable Action Button) next to ACQ (Acquisition Source). Then, press VAB next to "FCR" (Fire Control Radar). Your current acquisition source will then be the Fire Control Radar.





Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED*
- *MIDDLE: NORM*
- *AFT: OFF*

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

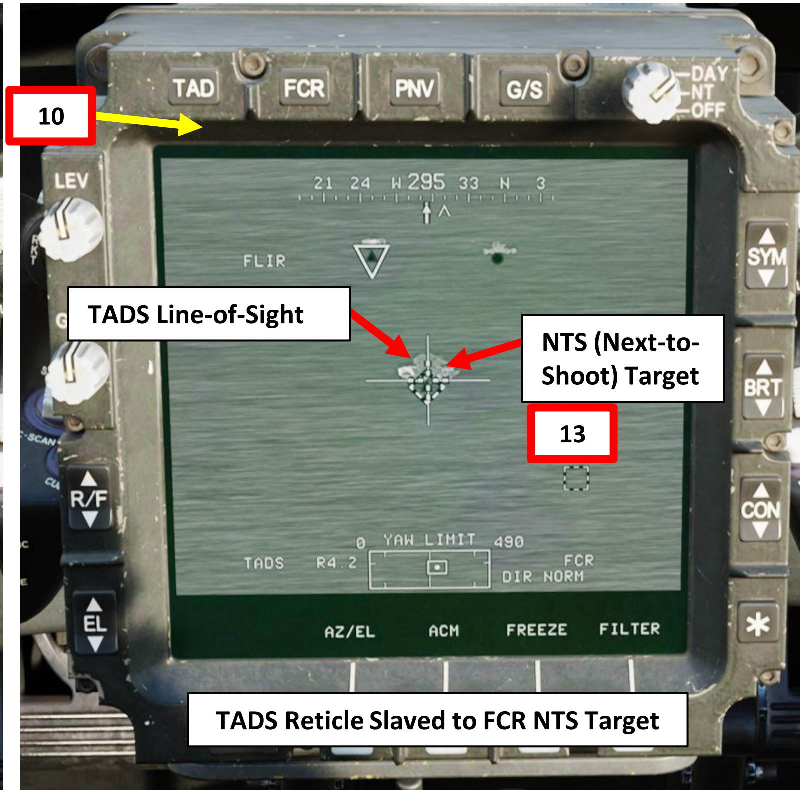
10

3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

3.10 – Target Slaving to Acquisition Sources

3.10.7 – FCR (Fire Control Radar) Slaving

12. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is the FCR NTS (Next-to-Shoot) Target in this case.
13. *[CPG]* The TADS will slew towards the NTS (Next-to-Shoot) Target designated by the FCR.
    - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input will not be able to move the TADS line-of-sight.
14. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to “de-slave” the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or “Thumb Force Controller”) input to make adjustments to the TADS line-of-sight if required.

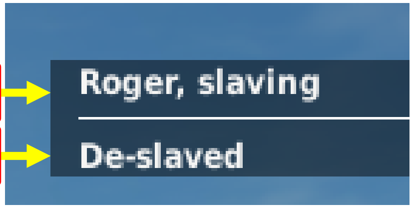


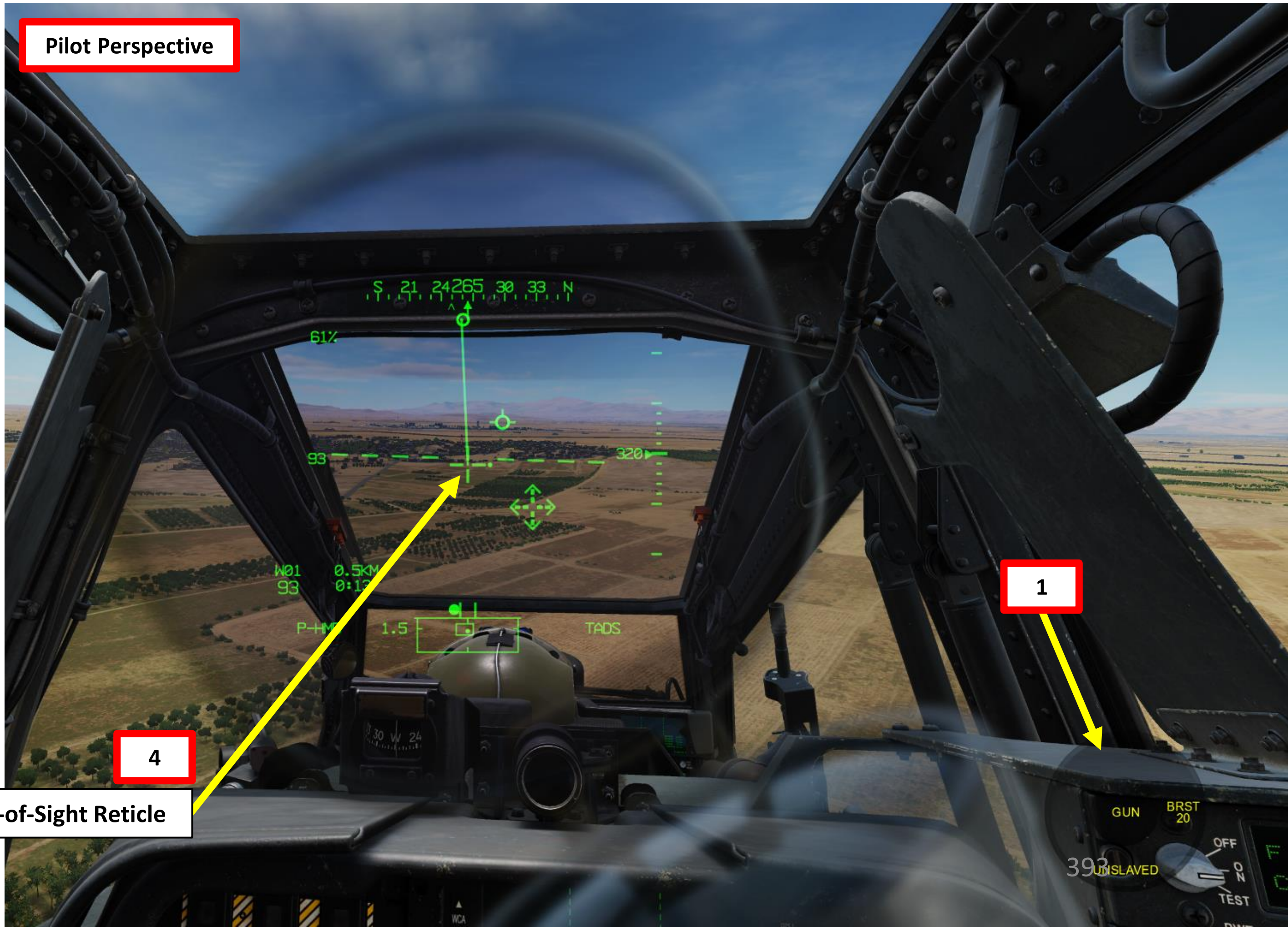
3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)

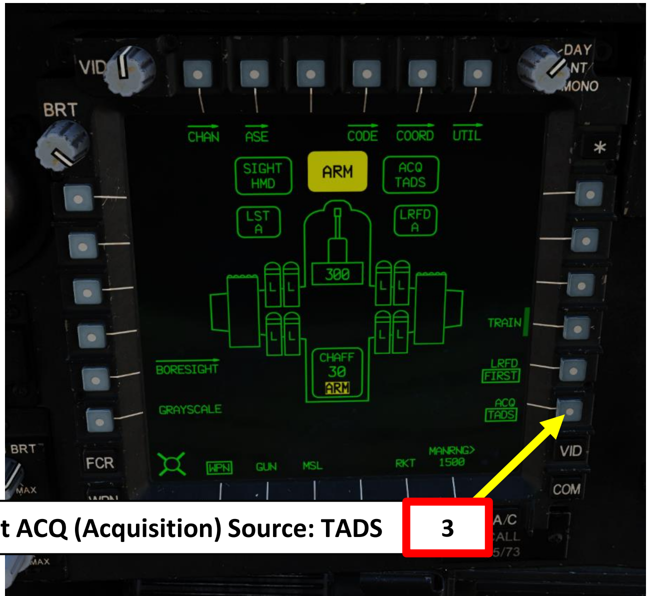
3.11 – Using George AI

You can use the “George” AI to use the TADS to find, store and designate/lase targets. Here is a brief overview of how to make “George” use the TADS.

1. *[P]* Show the George Menu by using « LCTRL+V ».
2. *[P]* The pilot’s HDU (Helmet Display Unit) reticle is used as a Designation Reticle to point an area where “George” can identify and track targets.
3. *[P]* From the WPN (Weapon) page, set the Pilot Acquisition Source to TADS. Then, fly towards the target and ensure the the helicopter attitude remains stable.
4. *[P]* Move your head (HDU Reticle / Designation Reticle) near the area you want the Co-Pilot/Gunner to search for targets, then press « W » SHORT (less than 0.5 sec).
5. *[CPG]* George will select the acquisition source to PHS (Pilot Helmet Sight), then slave the TADS to the acquisition source, then call out “slaving” to remind the pilot that the TADS is slaved to his helmet reticle.
6. *[CPG]* When George has set the TADS reticle is roughly on the area pointed at by the pilot’s HDU reticle, George will de-slave the TADS, call out “de-slaved” to tell the pilot that he can start looking elsewhere. Target can then be spotted, designated, lased and stored by him.

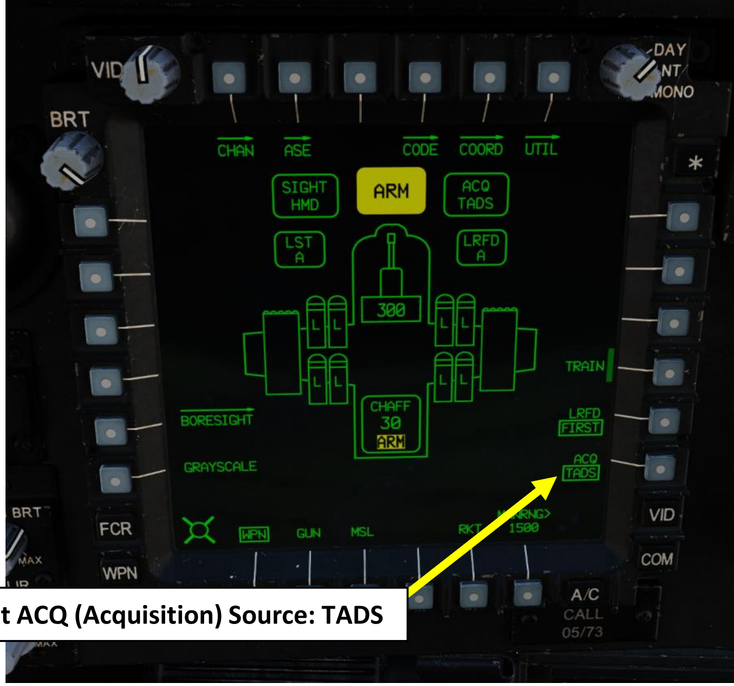


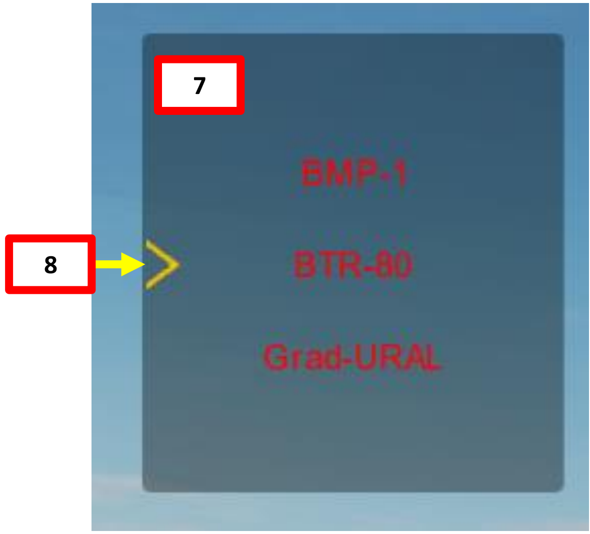




3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.11 – Using George AI

7. *[CPG]* George will then start scanning for targets in the designated area. When targets are found, a menu with a list of targets appears.
8. *[P]* Cycle through the target list using « W » SHORT (UP) or « S » SHORT (DOWN) until desired target is selected by the > symbol.
9. *[P]* Press « D » SHORT (RIGHT) to select target.
    - Note: Pressing "S" SHORT (DOWN) undesignates George's target.
10. *[CPG]* George will then designate, lase and store the target with the TADS, calling out "lased and stored" in the process.
11. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.





3 – AN/ASQ-170 TADS (TARGET ACQUISITION & DESIGNATION SIGHT)
3.12 – Targeting Methods

There are different methods to operate the TADS when flying a mission. Here are two “flows” that are generally used by DCS players.

- The first method is very straightforward since it is a “find and destroy target” kind of approach.
- The second method is a bit more complicated but allows you to have a much better picture of the battlefield. It also allows you to easily switch between stored targets.

Method 1 (Direct):

1. Find target with the TADS
2. Designate and lase target with TEDAC Right Hand Grip LRFD Trigger
3. Perform attack and release weapons on target

Method 2 (Target Storing):

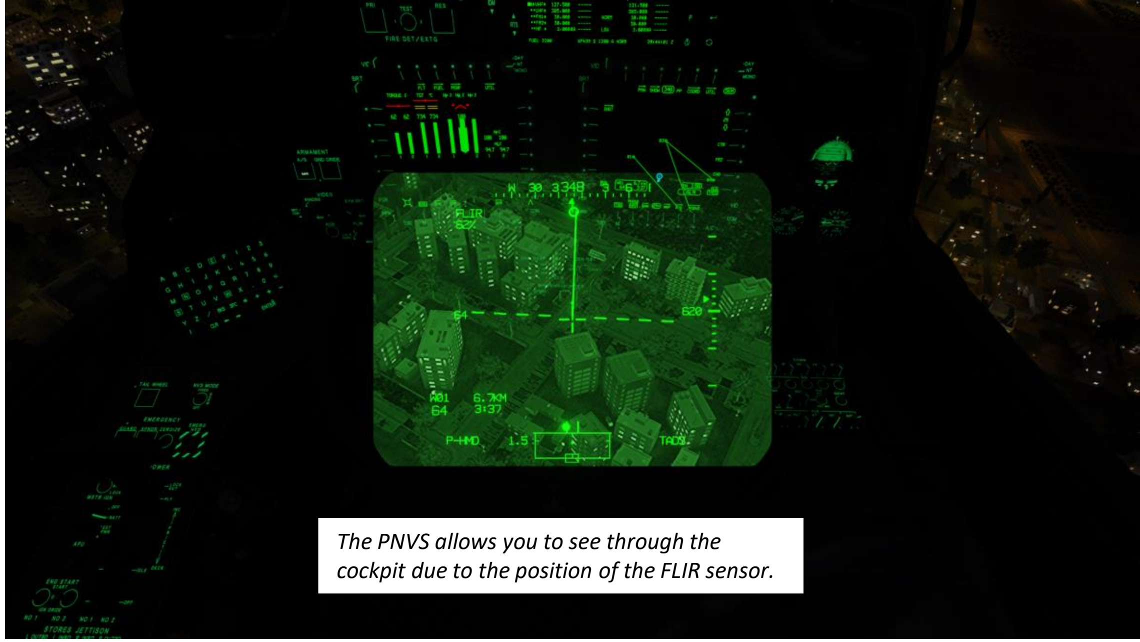
1. Find target with the TADS
2. Designate and lase target with TEDAC Right Hand Grip LRFD Trigger
3. Store target with the TEDAC Left Hand Grip Store/Update Switch FWD (STORE)
4. Find other targets and repeat steps 1 through 3
5. Make the target of your choice the acquisition source via the COORD menu of the TSD (Tactical Situation Display) page
6. Slave TADS to desired Target Point (i.e. T01).
7. Perform attack and release weapons on target
8. De-slave TADS
9. Select another target as the acquisition source via the COORD menu of the TSD (Tactical Situation Display) page
10. Repeat steps 6 through 8.

4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)

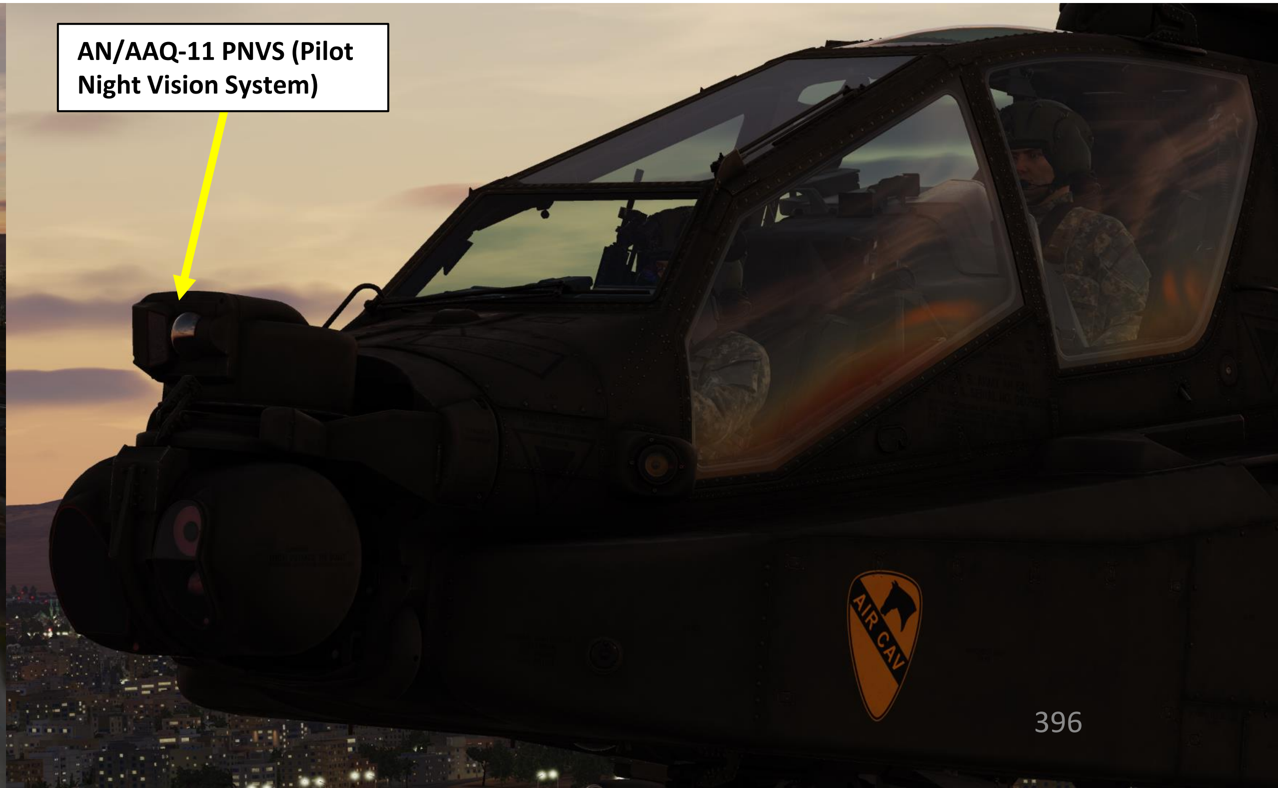
4.1 – Introduction

The AN/AAQ-11 PNVS (Pilot Night Vision System) is a FLIR-only (Forward-Looking Infrared) steerable turret that is designed to aid the Pilot in the back seat to fly under total darkness. While it provides day- and night-capable infrared vision, the PNVS is mainly used for night operations. Either crewmember can select either the PNVS.

The PNVS is not a sight per se; it **cannot be used to perform targeting or aim any weapon systems**. It is simply a sensor that allows either crew member to have better night visibility and to "see through" the cockpit. Seeing through the helicopter is incredibly useful when flying at night, especially in situations where you fly close to the ground and need to avoid collisions with buildings, trees or other obstacles.



The PNVS allows you to see through the cockpit due to the position of the FLIR sensor.



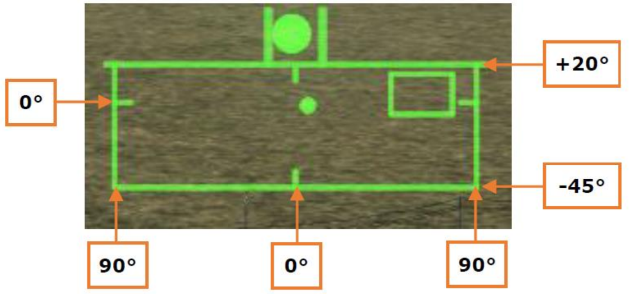
4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)

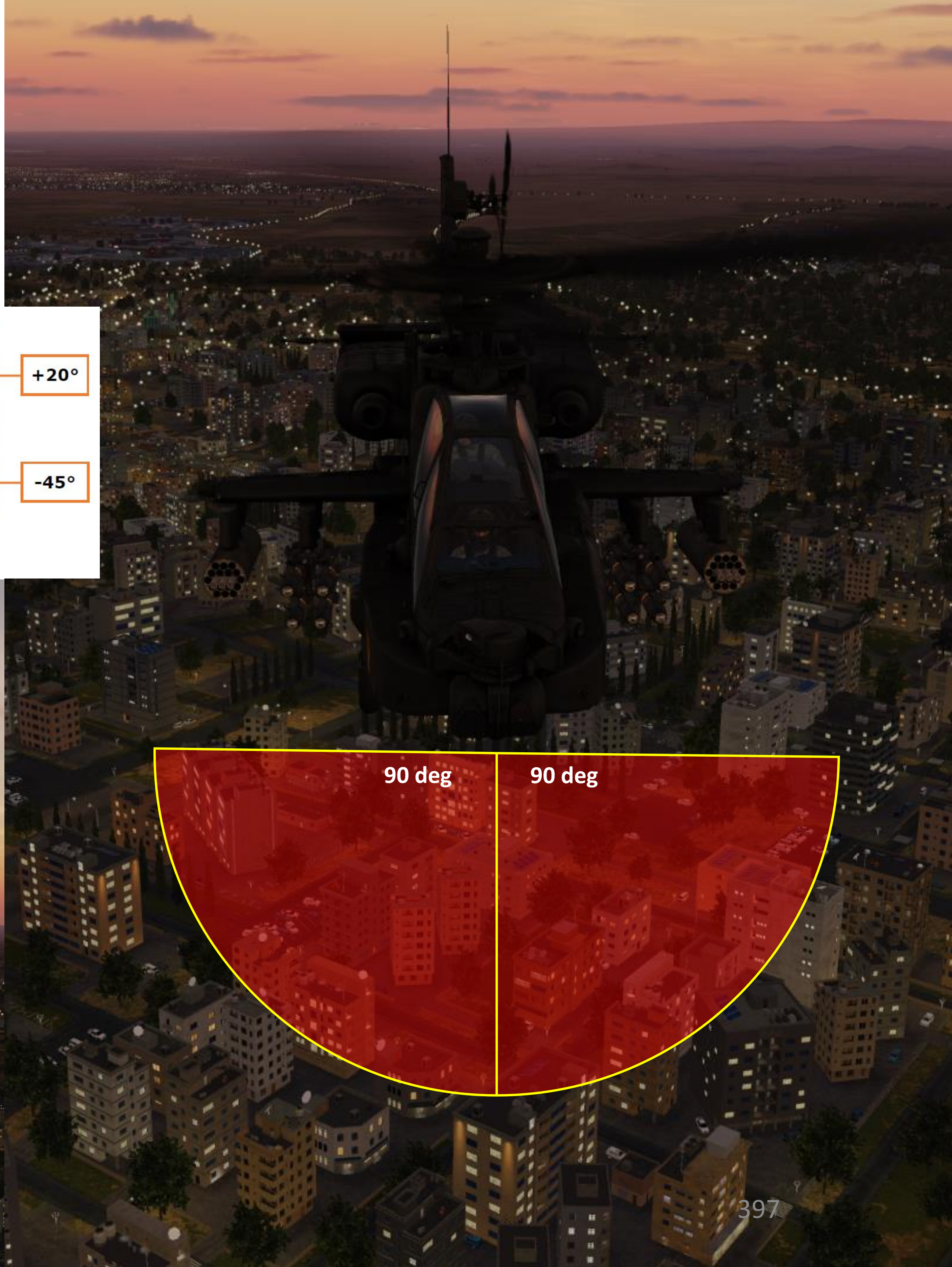
4.1 – Introduction

PNVS Limitations (displayed on Field-of-Regard Box)

- Elevation range of motion: + 20 deg to -45 deg
- Azimuth range of motion: +/- 90 deg
- Slew rate: 120 deg/sec

PNVS Field-of-Regard Box Limits

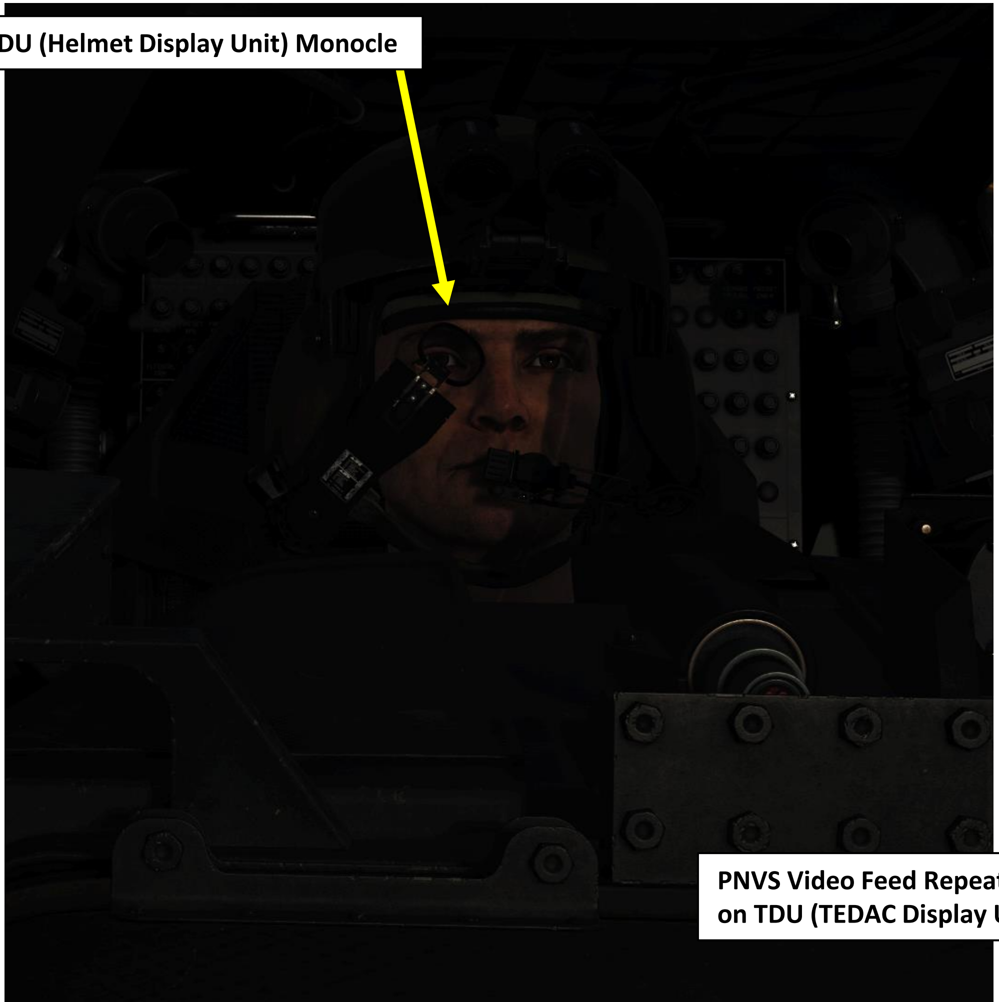


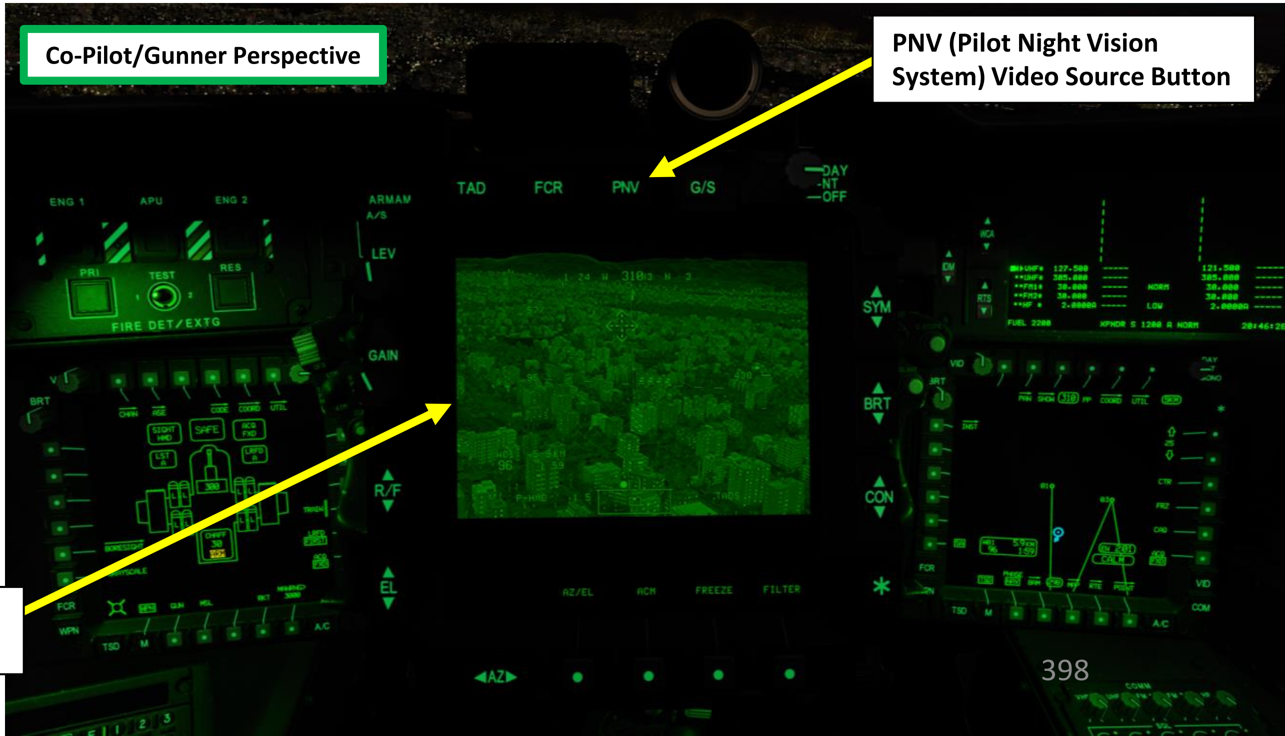


4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)
4.2 – Symbology

The PNVS video feed is displayed on the HDU (Helmet Display Unit) monocle and its symbology is pretty much identical to IHADSS (Integrated Helmet and Display Sight System) symbology in terms of information.

PNVS symbology can also be repeated on the TDU (TEDAC Display Unit) in the co-pilot/gunner's cockpit. The co-pilot can monitor PNVS feed by pressing the "PNV Video Source Button".



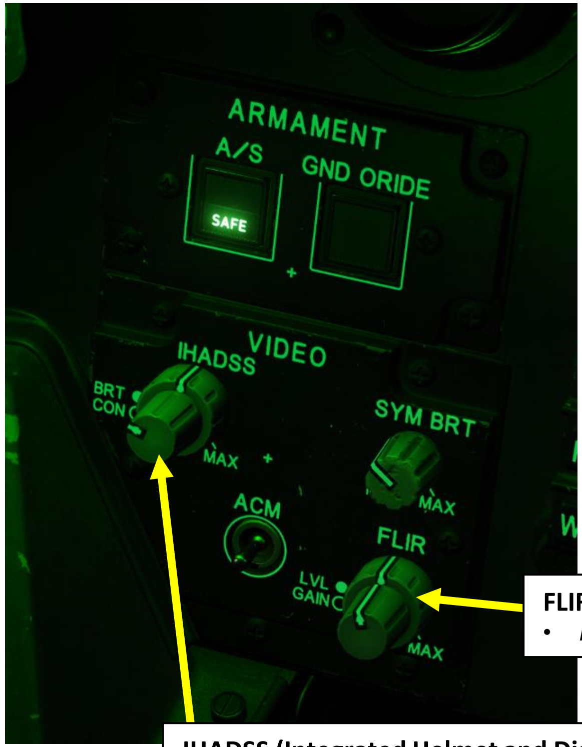


4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)
4.3 – Controls

Pilot Controls

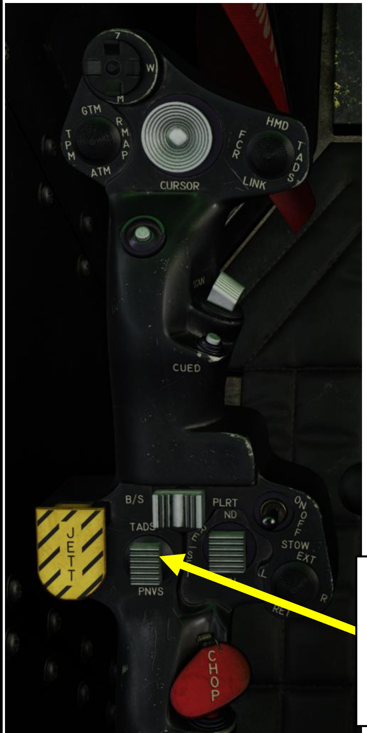
The PNVS is used primarily by the pilot and its controls are mainly located on the collective, left panel, IHADSS VIDEO and FLIR VIDEO knobs.

Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*



FLIR (Forward-Looking Infrared) Control (applicable to TADS or PNVS)
- *Inner knob controls FLIR gain / Outer knob controls FLIR level*

IHADSS (Integrated Helmet and Display Sighting System) Knobs
- *Inner knob controls video contrast / Outer knob controls video brightness.*



NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

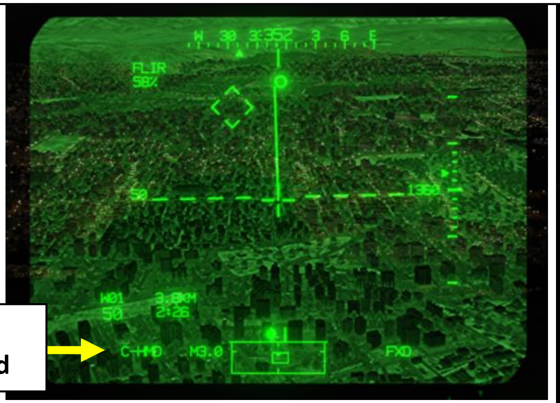
4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)
4.3 – Controls

Co-Pilot/Gunner Controls

While the PNVS is mainly used by the pilot, the co-pilot/gunner can also use it if desired. However, keep in mind that PNVS video overlay can only be displayed on **one** HDU (Helmet Display Unit) at a time. **From the CPG seat, PNVS brightness, contrast and gain controls are located on the TDU (TEDAC Display Unit)**. However, for these controls to work on the PNVS overlay, the following two conditions need to be met:

1. Set the Co-Pilot NVS (Night Vision System) switch to NORM (Middle position).
2. Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display) on the collective.

Co-Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*

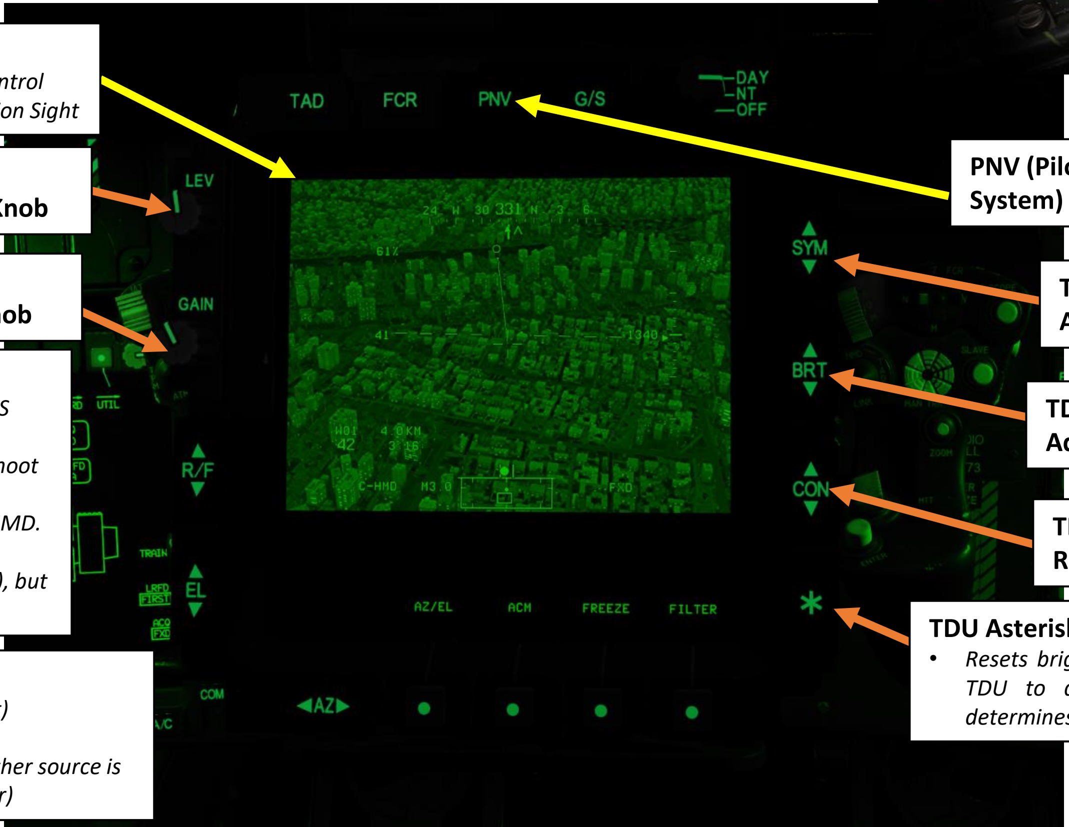


C-HMD (Co-Pilot Helmet-Mounted Display) Sight Selected

TDU (TEDAC Display Unit)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FLIR (Forward-Looking Infrared) Level Control Knob

FLIR (Forward-Looking Infrared) Gain Control Knob



PNV (Pilot Night Vision System) Video Source Button

TDU Symbology Brightness Adjustment Rocker Switch

TDU Image Brightness Adjustment Rocker Switch

TDU Contrast Adjustment Rocker Switch

TDU Asterisk (*) Default Settings Button
- *Resets brightness and contrast of the CPG HDU or TDU to default setting. The day/night setting determines whether a bright or dim default is used.*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

NVS (Night Vision System) Select Switch
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)

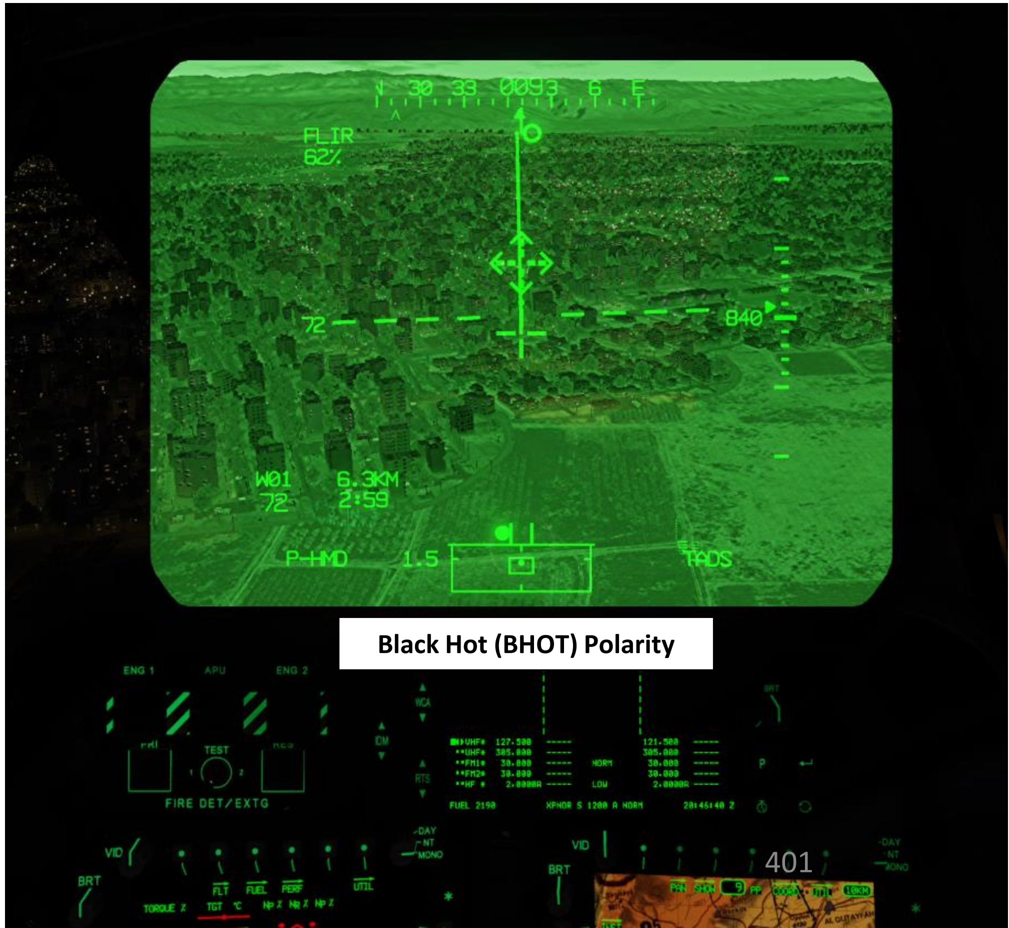
4.3 – Controls

PNVS Polarity Control (applicable to both Pilot and Co-Pilot/Gunner)

BHOT (Black Hot) or WHOT (White Hot) FLIR polarity can be toggled by the **Boresight/Polarity Selector Switch** being set to the **RIGHT** position on the collective.

Boresight/Polarity Selector
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*

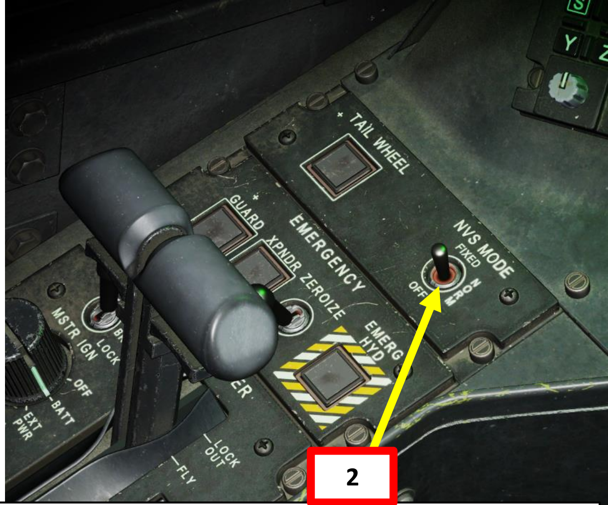
White Hot (WHOT) Polarity



Black Hot (BHOT) Polarity

4 – AN/AAQ-11 PNVS (PILOT NIGHT VISION SYSTEM)
4.4 – Tutorial

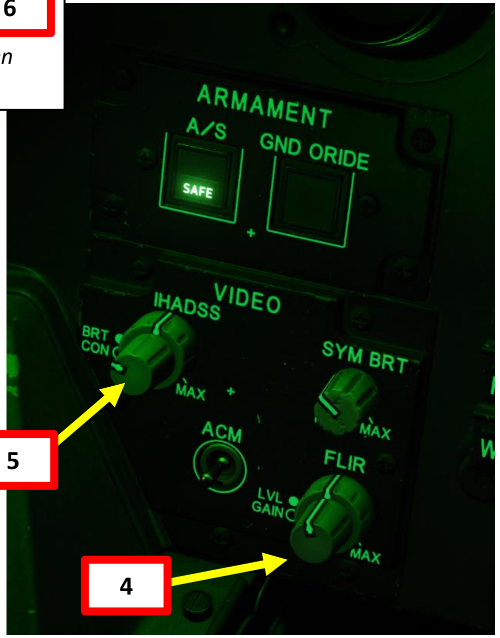
1. Set NVS Select Switch on the collective - AFT (PNVS)
2. Set Pilot NVS Mode Switch to either MIDDLE (NORM, which commands the NVS to follow your helmet line-of-sight) or FWD (FIXED, which commands the NVS to stay at a fixed forward position).
3. The PNVS FLIR overlay will be visible on your IHADSS monocle.
4. If needed, adjust the quality of the FLIR image with the FLIR knobs. The small inner knob adjusts the FLIR LEVEL and the larger outer knob adjusts the FLIR GAIN.
5. If needed, adjust overall image quality for the FLIR using IHADSS knobs. The small inner knob controls the IHADSS BRT (Brightness) and the larger outer knob adjusts the IHADSS CON (Contrast).
6. The FLIR can be operated in either WHOT (white hot) or BHOT (black hot) mode by selecting the collective Boresight/Polarity switch located on the collective.
7. To turn OFF the PNVS, set Pilot NVS Mode Switch to AFT (OFF).



2

Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED, commands the selected NVS to fixed forward at -4.9 deg in elevation.*
- *MIDDLE: NORM, commands the selected NVS to IHADSS (Integrated Helmet and Display Sighting System) line of sight.*
- *AFT: OFF, stows the selected NVS.*
- *Note: The selected NVS is set using the NVS SELECT switch on the collective.*

Boresight/Polarity Selector
6
- *LEFT: Boresight, no function*
- *RIGHT: PLRT, toggles FLIR image polarity between Black Hot and White Hot*



5

4

PNVS (Pilot Night Vision System) Overlay
3

NVS (Night Vision System) Select Switch
1
- *FWD: TADS (Target Acquisition & Designation Sight)*
- *AFT: PNVS (Pilot Night Vision System)*
- *Note: When the pilot selects one NVS source, the other source is automatically assigned to the CPG (Co-pilot/Gunner)*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.1 – What is the FCR?

The AN/APG-78 is a short-range fire control radar system that utilizes a radar antenna shrouded within an aerodynamic radome atop the AH-64D's rotor mast. The APG-78 FCR was designed for anti-armor missions and can detect moving vehicles, but it is also capable of detecting stationary targets as well as low-flying aircraft. As the FCR is a sight just like the HMD (Helmet-Mounted Display) and the TADS (Target Acquisition & Designation Sight), the FCR can be used to employ the gun, rockets and missiles. However, it is not capable of providing guidance to the AGM-114K laser-guided missiles and can only provide target data to the AGM-114L radar-guided missile variants.

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.1 – Introduction
5.1.1 – What is the FCR?

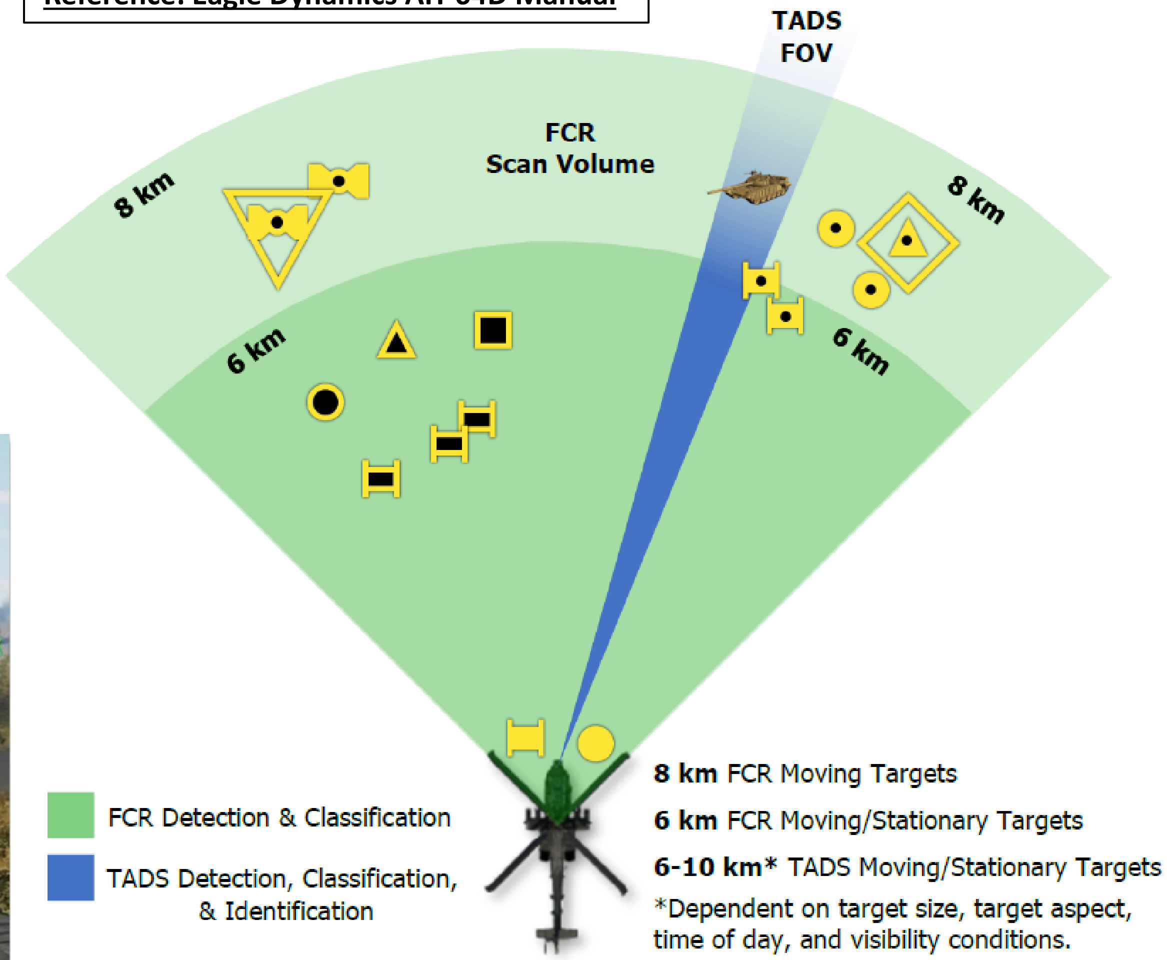
What is the FCR used for though?

The FCR cannot recognize specific vehicle types or equipment on the battlefield, nor identify whether targets are friend or foe. However, the wide area search capability of the FCR allows the crew to direct the optical sensors of the TADS. Alternatively, during periods of limited visibility, the FCR C-Scope function can directly aid the Co-Pilot/Gunner to acquire targets within the TADS (Target Acquisition & Designation Sight) field-of-view by performing a narrow scan along the same line-of-sight and overlaying virtual target symbols within the TADS sensor video.

The key advantage in using the FCR for initial detection and classification of targets is its ability to scan 50 square kilometers of the battlefield within seconds, while simultaneously performing an initial classification of each target of military interest that is detected within the FCR scan volume. Performing the same task while using optical sensors would require a significantly longer period of time and would be further constrained by the narrow aperture of the optical sensors themselves, the relative size and aspect angle of each target, the time of day, and visibility conditions.

Reference: Eagle Dynamics AH-64D Manual

Reference: Eagle Dynamics AH-64D Manual



Detection, Classification & Identification of Targets

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.2 – Displays

Fire Control Radar symbology can be displayed on the FCR page, which is shown by pressing the FCR Button on either MPD (Multi-Purpose Display) or the TDU (TEDAC Display Unit). There is also an overlay for FCR symbology on the TSD when the ATK (ATTACK) Phase is selected.

FCR Page
Left MPD (Multi-Purpose Display)

FCR Page
TDU (TEDAC Display Unit)

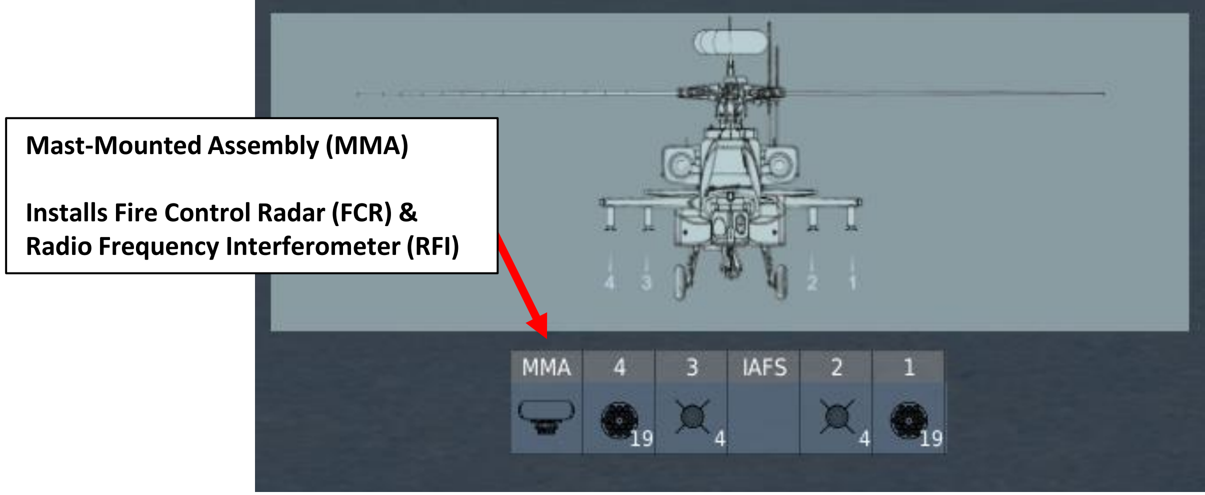
FCR Overlay on TSD (Tactical Situation Display) Page
Right MPD (Multi-Purpose Display)

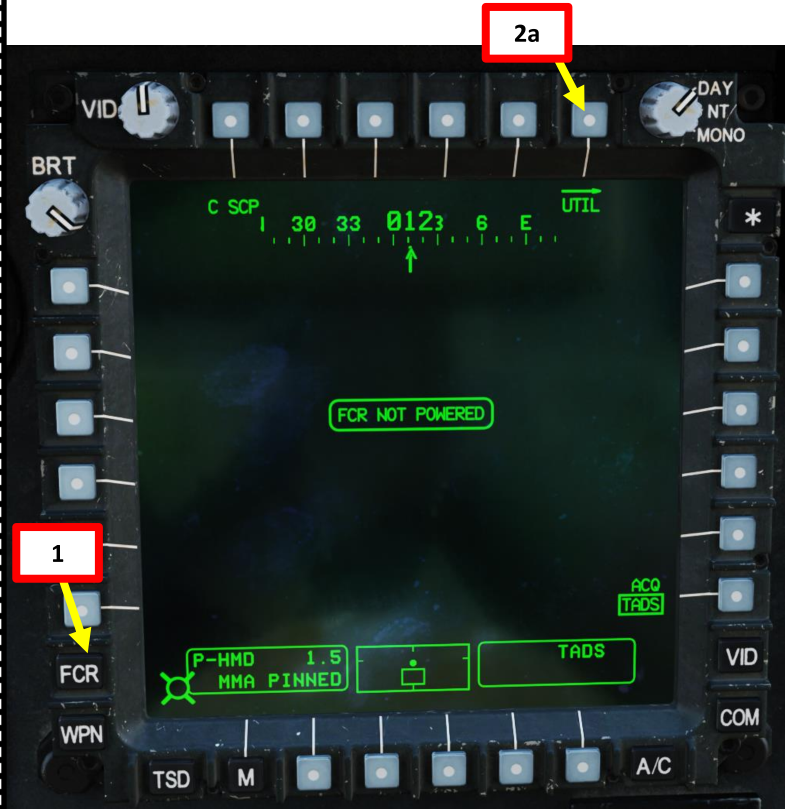
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

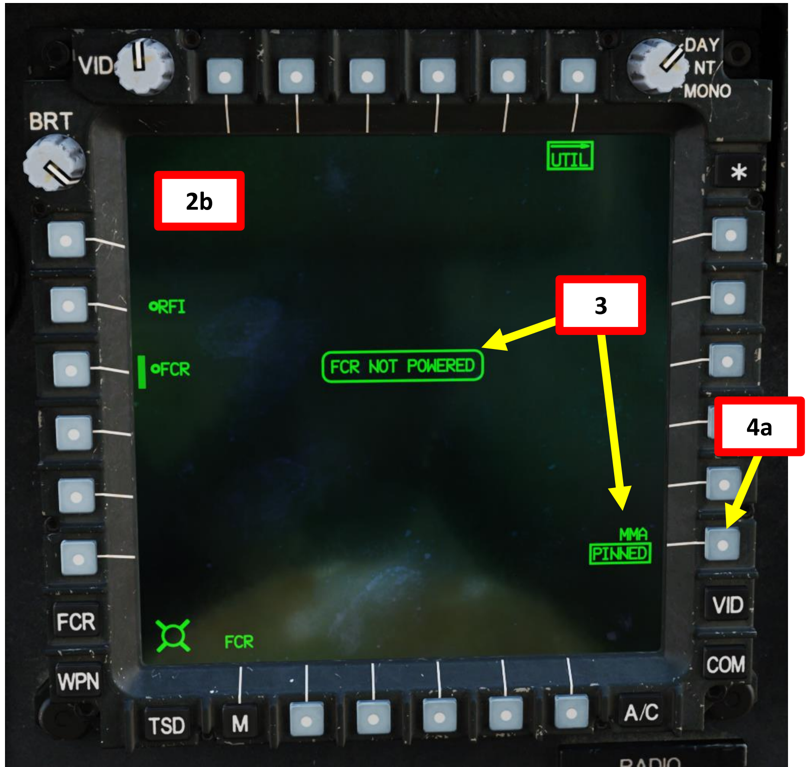
5.1 – Introduction

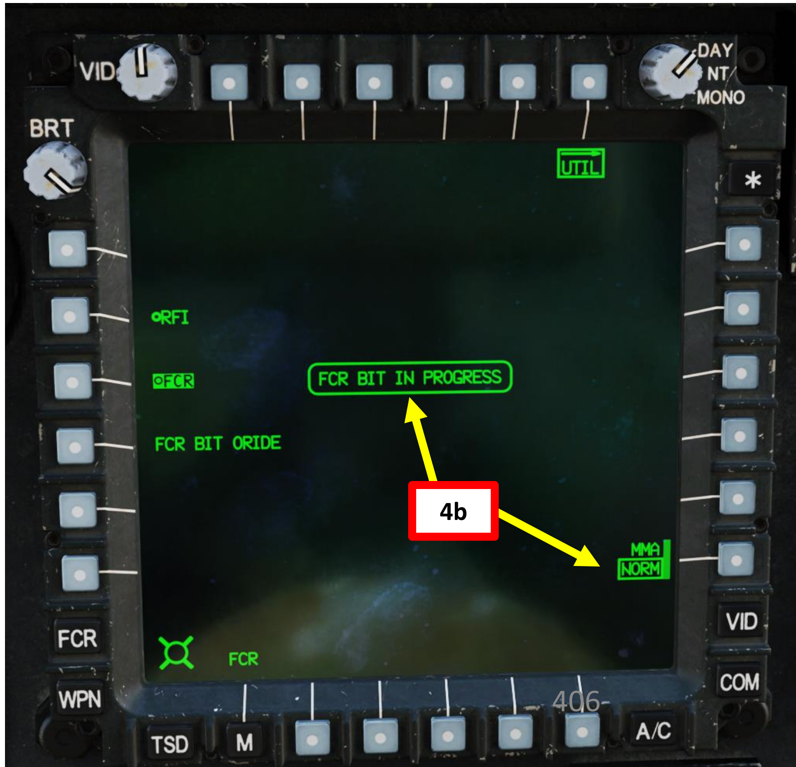
5.1.3 – Power-Up Sequence Procedure

1. Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
2. Press VAB (Variable Action Button) next to UTIL to select Utility page.
   - Note: you can also perform this step by selecting the WPN page first, then selecting UTIL sub-page.
3. FCR NOT POWERED indication should be visible. The state of the Mast-Mounted Assembly (MMA) on the FCR Utility sub-page will be set to PINNED. This is to ensure that the external pin that physically locks the MMA in place is confirmed to be in the unlocked position prior to applying power to the FCR.
4. Press VAB next to MMA – PINNED. This will toggle the Mast-Mounted Assembly from PINNED to NORM and the FCR (Fire Control Radar) and RFI (Radio Frequency Interferometer) will automatically perform their respective power-on sequences.









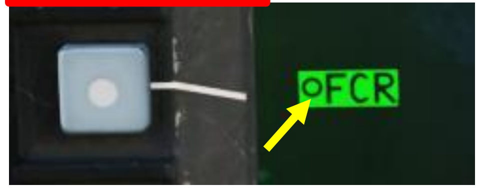
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

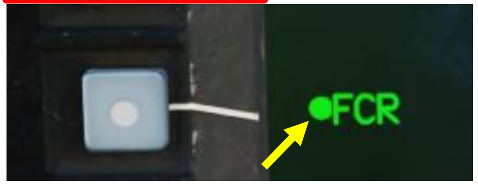
5.1.3 – Power-Up Sequence Procedure

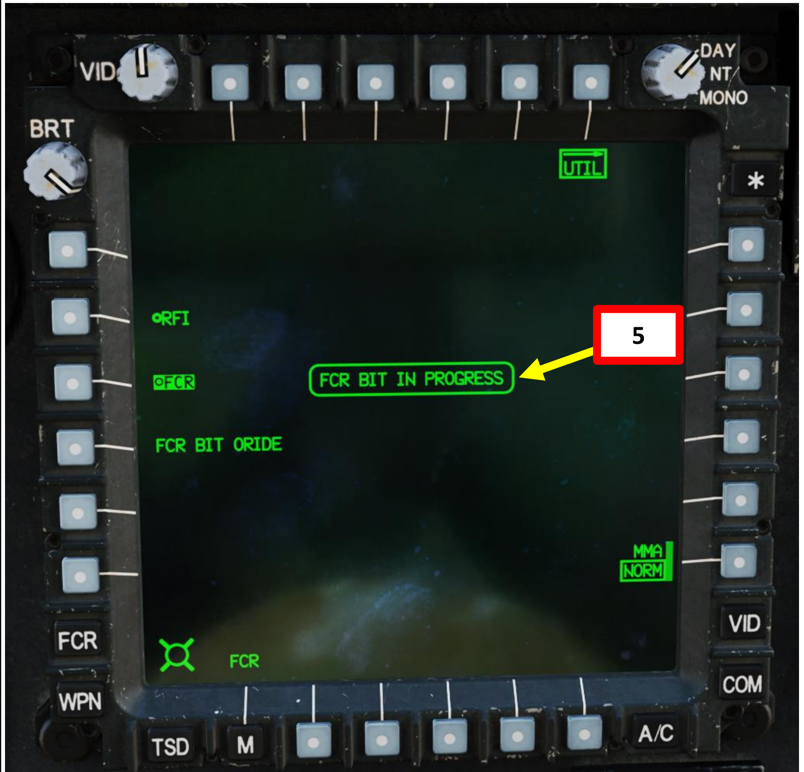
5. During the FCR and RFI power-on sequence, a BIT (Built-In Test) is performed. The BIT lasts approximately 1 minute.
6. Once Built-In Test is complete, the FCR UTIL sub-page will display FCR control parameters and the Fire Control Radar will become available to be selected as a sensor.
    - Hollow circle means OFF. Solid Circle means ON.
7. Take note that the AN/APR-48 RFI may still be powered to provide warning of air defense radar threats independently of FCR operation.
8. If desired, return to FCR main page and check that FCR symbology shows correctly.

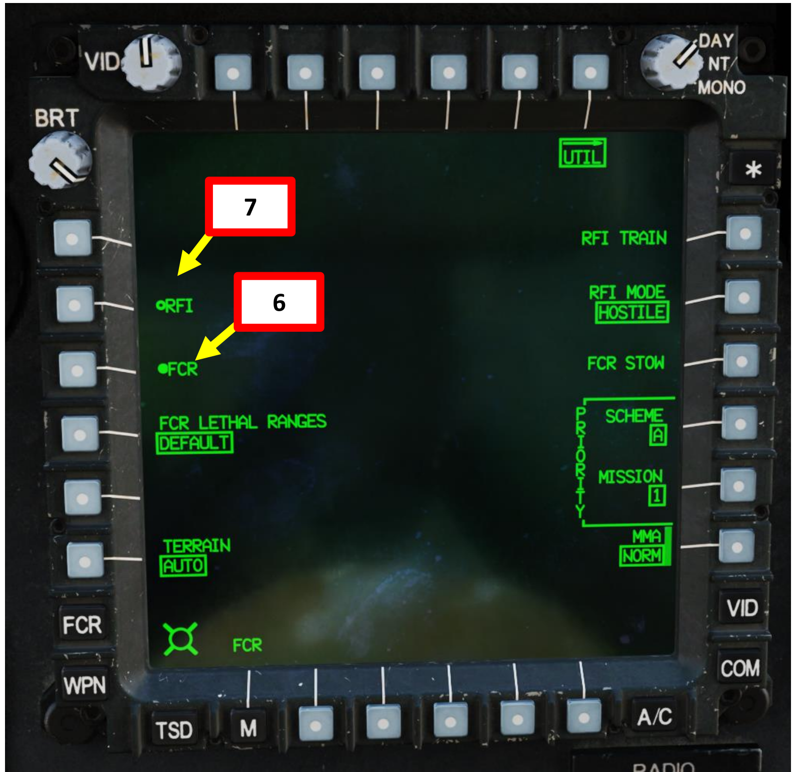
FCR Power OFF



FCR Power ON







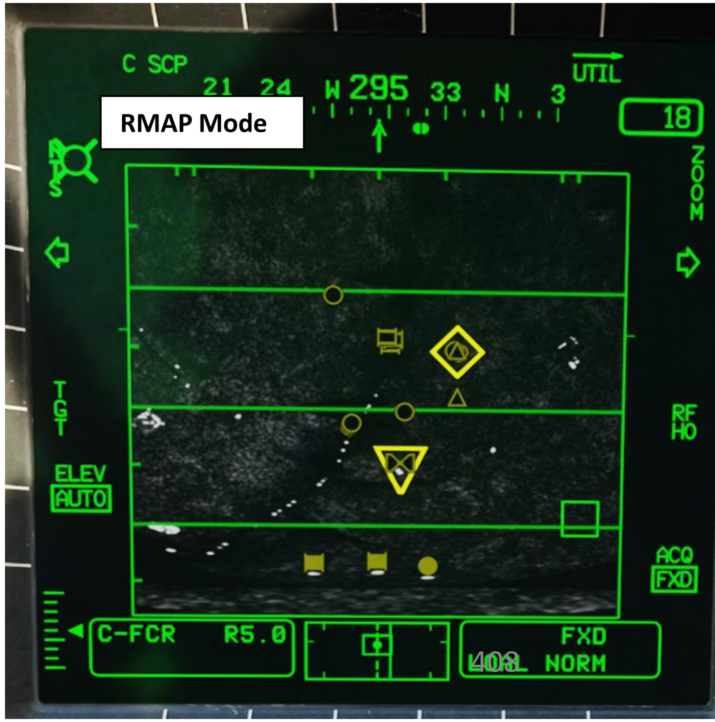
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.4 – FCR Modes Overview

The FCR may be used for targeting, reconnaissance, or low-level obstacle avoidance using one of four modes. These modes are selected with the FCR Mode Selector on the collective or TEDAC Left Hand Grip.

- **Ground Targeting Mode (GTM):** The FCR scans a 90° sector of the battlefield, processes ground and low-flying air targets to a range of 8 km, and displays targets in a PPI (Plan Position Indicator) format.
- **Radar Map Mode (RMAP):** The FCR scans a 90° sector of the battlefield, processes ground and low-flying air targets to a range of 8 km, and displays targets over a radar-generated surface map in a B-scope format.
- **Air Targeting Mode (ATM):** The FCR scans 360° over the battlefield, processes air targets to a range of 8 km, and displays targets in a PPI format.
- **Terrain Profile Mode (TPM):** The FCR scans a 180° or 90° sector of the terrain directly in front of the aircraft to a range of 2.5 km, and displays terrain obstructions and obstacles in a PPI format.



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.5 – Radar Scanning

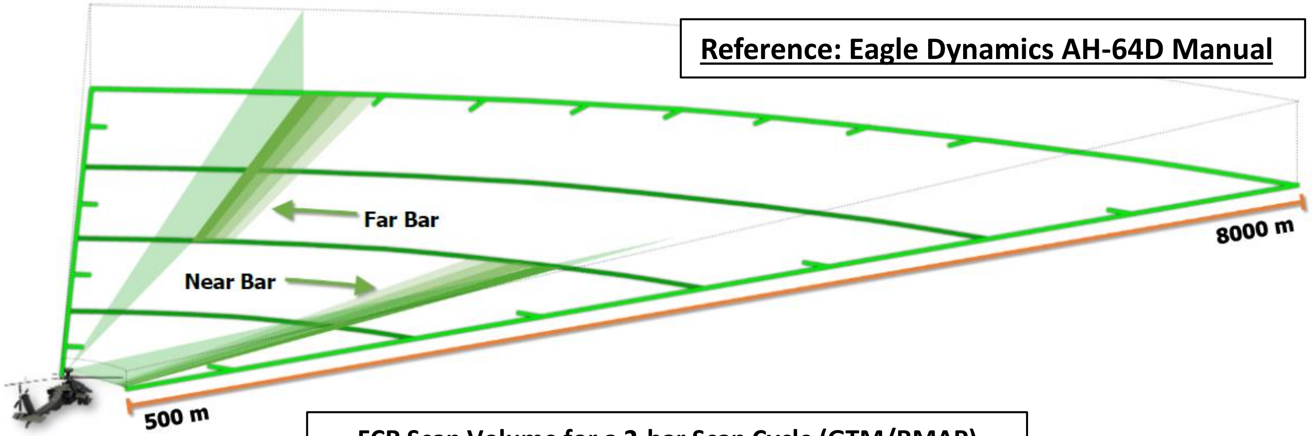
The FCR operates in two scan modes:

- **S-SCAN (Single Scanburst)**
  - Multiple scans of the FCR scan volume are performed when the selected sight is the FCR (**Sight Selector Switch LEFT to FCR**) and the **FCR Scan Control switch is momentarily pressed FWD to S-SCAN position**.
  - The FCR will only transmit for the duration of a single scanburst and then automatically cease scanning.
  - The number of scan cycles performed within a single scanburst is dependent on the selected scan size, which is selected with the **FCR Scan FOV (Field-of-View) Size Selector**.
    - **M (Medium FOV):** 2 scans are performed within a single scanburst.
    - **N (Narrow FOV):** 3 scans are performed within a single scanburst.
    - **W (Wide FOV):** 2 scans are performed within a single scanburst.
    - **Z (Zoom FOV):** 4 scans are performed within a single scanburst.

- **C-SCAN (Continuous Scanburst)**
  - Multiple and continuous scans of the FCR scan volume are performed when the selected sight is the FCR (**Sight Selector Switch LEFT to FCR**) and the **FCR Scan Control switch is momentarily pressed AFT to the C-SCAN position**.
  - The FCR will continuously transmit within the selected scan volume until the FCR Scan Control switch is momentarily pressed to either position to cease scanning, or the crewmember selects a different sight.

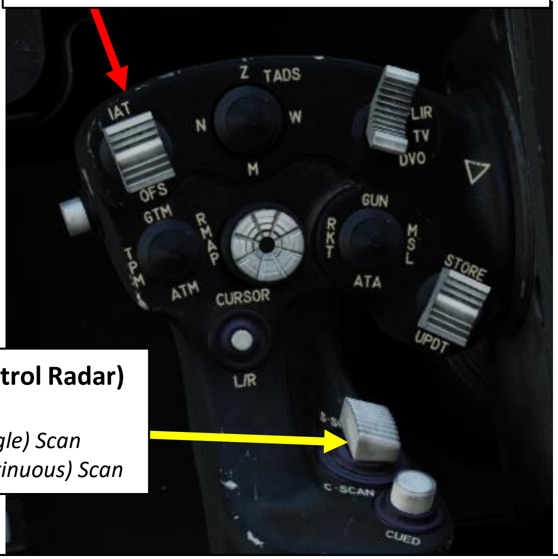
Note: **Single scanbursts** are best used in GTM, RMAP, or ATM when performing target acquisition or engagements. **Continuous scanbursts** are best used when performing continuous surveillance across a wide sector of the battlespace, such as using ATM to perform overwatch of the local airspace; or when using TPM to assist in avoiding obstacles and terrain while navigating at low altitude during times of darkness or low-visibility conditions.

Reference: Eagle Dynamics AH-64D Manual



FCR Scan Volume for a 2-bar Scan Cycle (GTM/RMAP)

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.1 – Introduction
5.1.5 – Radar Scanning

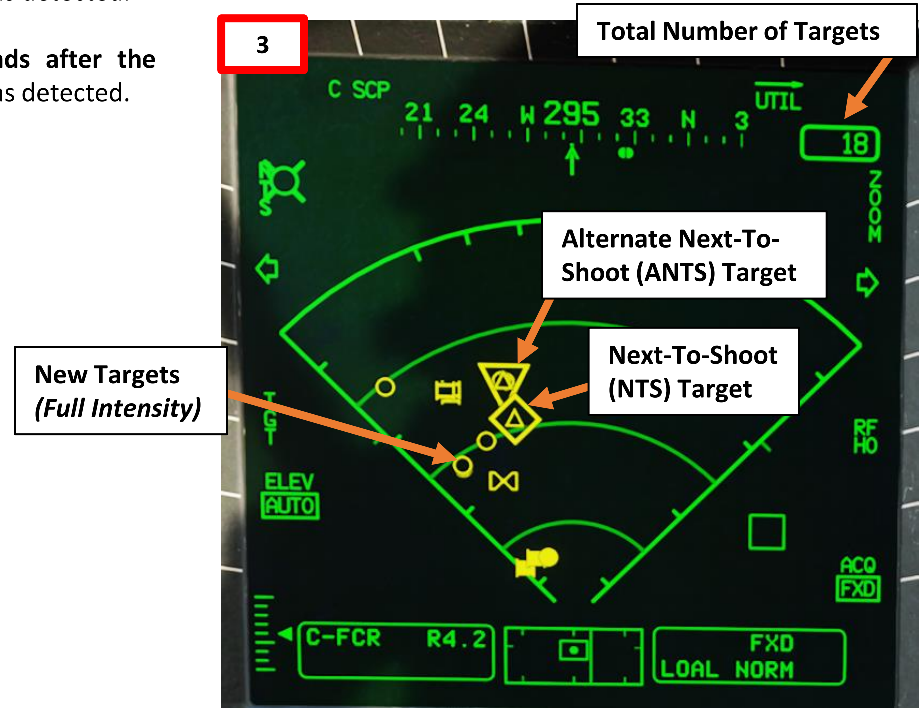
Here is an example of a single scanburst. The radar first scans the close range sector (500-1500 m), then the long-range sector (1500-8000 m).

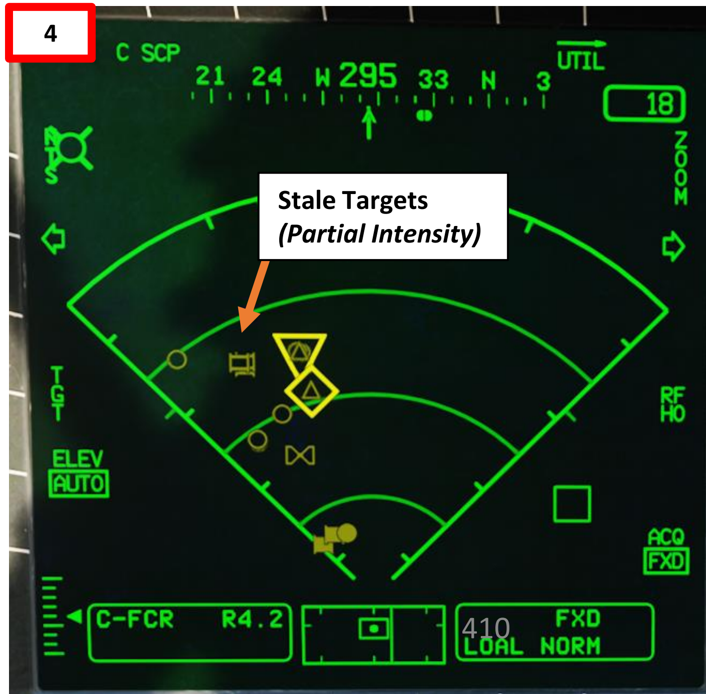
When set to GTM, RMAP, or ATM, the FCR page displays the 16 highest priority targets that have been detected by the FCR, any of which may be designated for engagement.

At the completion of the first scan cycle within the scanburst, or if the first scan is aborted for any reason, the **Next-To-Shoot (NTS)** and **Alternate Next-To-Shoot (ANTS) targets** are designated as the first and second priority targets, respectively. The NTS target will be surrounded by a diamond symbol and the ANTS will be surrounded by an inverted triangle symbol.

Moving target symbols will become **stale 5 seconds after the completion of the most recent scan** in which the target was detected.

Stationary target symbols will become **stale 30 seconds after the completion of the most recent scan** in which the target was detected.





5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.5 – Radar Scanning

Field-of-View settings are controlled with the **FCR Scan FOV Size Selector.**

Wide Field-of-View

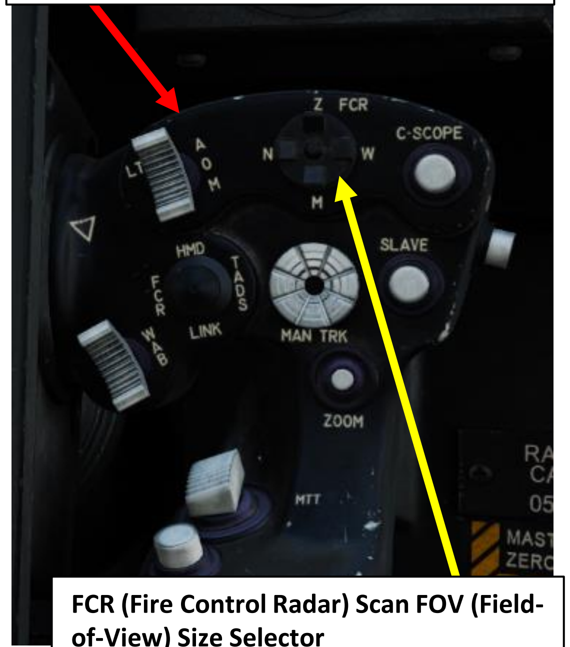
Medium Field-of-View

Narrow Field-of-View

Zoom Field-of-View

TEDAC RHG (Right Hand Grip)

- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector

- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.6 – Target Detection, Classification & Prioritization

When searching for ground targets, the fire control radar can scan an area that covers up to 50 square kilometers. Within a busy area of operations, this means a multitude of potential targets of varying levels of importance and priority.

The FCR automates the target acquisition process by detecting, classifying, and prioritizing up to 256 targets within seconds of initiating a scan using a single button push by either crewmember. The FCR will scan the selected area of the battlefield, compare any radar signatures it detects with a library of vehicles and aircraft, assign the appropriate target type to each processed target, and then present the 16 highest priority targets to the crew as a "shoot list", based on the parameters for prioritization the crew has selected.

Although the FCR may be used for autonomous targeting, it is most effective when combined with the other sensors and data onboard the AH-64D. The automated detection and classification process allows the crew to highlight areas of the battlefield for subsequent observation through the TADS for the purposes of target identification. This is particularly useful in avoiding fratricide ("friendly fire") when operating along the Forward Edge of the Battle Area (FEBA).

This sub-section breaks down the target detection, classification & prioritization process in order to help you better understand how the FCR answers this modern age question: Who's who?

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.6 – Target Detection, Classification & Prioritization

1 – How Targets are Detected

Throughout each scan cycle within a scanburst, radar signatures within the FCR scan volume are determined to be targets of military interest.

2 – How Targets are Classified

Once a target of military interest is detected, the radar signature is compared to a library of known target types. However, the FCR is not capable of recognizing the target (T-72 or M1A2), nor is it able to identify the coalition affiliation of the target (friend or foe).

The target is then classified as one of the following six types:

I. Tracked Vehicles (T-72, M1A2 Abrams, etc.)
II. Wheeled Vehicle (BTR-80, Bradley, Humvee, etc.)
III. Air Defense Vehicle (ZSU-23-4, Rapier, etc.)
IV. Helicopter (Ka-50, AH-64, etc.)
V. Fixed-Wing Aircraft (Su-25, A-10, etc.)
VI. Unknown (Any target that cannot be classified).

Target Symbology Table

TARGET TYPE	MOVING (500-8000 METERS)	STATIONARY (500-1500 METERS)	STATIONARY (1500-8000 METERS)
TRACKED VEHICLE			
WHEELED VEHICLE			
AIR DEFENSE VEHICLE			
UNKNOWN			
HELICOPTER			
FIXED-WING			

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.1 – Introduction
5.1.6 – Target Detection, Classification & Prioritization

3 – How Targets are Prioritized

Once targets are classified by type, they are ranked according to a series of prioritization parameters, some of which are fixed within the avionics, others may be adjusted by the crewmembers from within the cockpit. As the targets are ranked, the 16 targets that are ranked at the top of the list are displayed as the "high priority targets" on the FCR and TSD pages, the next 240 ranked targets are displayed on the TSD (when set to ATK phase) as "low priority targets", and any remaining targets ranked below 256 are not shown at all.

Targets are prioritized based on their positions within activated PFZ's (Priority Fire Zone) or NFZ's (No Fire Zone), the selected Priority Scheme, target classification, and range from the ownship.

The automated target prioritization process consists of 5 parameters and is performed continuously as the FCR scans the battlespace; with target symbol positions updated, added, or removed on each subsequent scan as the High Priority Target List is updated. The first three parameters may be selected by the aircrew, but the last two parameters are fixed within the FCR software.

Priority Target List

PFZ	1	Air Defense Vehicle
PFZ	2	Tracked Vehicle
PFZ	3	Tracked Vehicle
PFZ	4	Tracked Vehicle
PFZ	5	Wheeled Vehicle
PFZ	6	Unknown
High Priority Targets	7	Air Defense Vehicle
High Priority Targets	8	Helicopter
High Priority Targets	9	Helicopter
High Priority Targets	10	Tracked Vehicle
High Priority Targets	11	Tracked Vehicle
High Priority Targets	12	Tracked Vehicle
High Priority Targets	13	Wheeled Vehicle
High Priority Targets	14	Wheeled Vehicle
High Priority Targets	15	Unknown
High Priority Targets	16	Unknown
Low Priority Targets	17	Unknown
Low Priority Targets	18	Unknown
Low Priority Targets	19	Unknown

FCR Scan Cycle: Target Prioritization Process

1 – Active NFZ (No Fire Zone)
- *Any targets within the geographical boundaries of an active NFZ are removed from the prioritization ranking.*

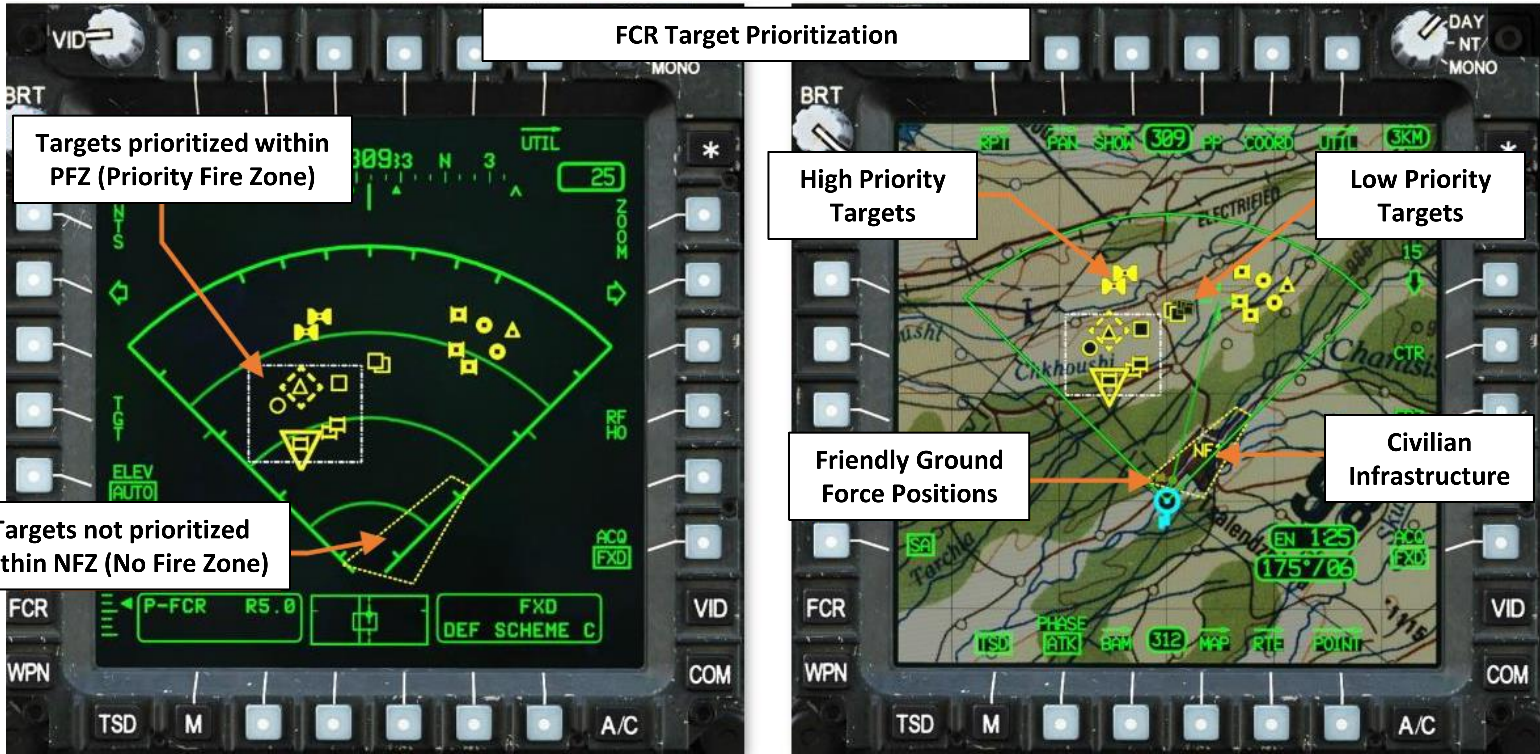
2 – Active PFZ (Priority Fire Zone)
- *Any targets within the geographical boundaries of an active PFZ are ranked above all targets outside of the PFZ.*

3 – Priority Scheme
- *Targets are further ranked in accordance with the selected priority scheme on the FCR Utility sub-page.*
  - Scheme A: Stationary ground targets and airborne targets are prioritized over moving ground targets.
  - Scheme B: Stationary ground targets will be prioritized over moving round targets or airborne targets.
  - Scheme C: Moving ground targets and airborne targets will be prioritized over stationary ground targets.

4 – Target Classification
- *Targets are further ranked by target classification (tracked vehicle, wheeled vehicle, etc.).*

5 – Target Proximity
- *Target are further ranked by distance to ownship*

FCR Target Prioritization



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.1 – Introduction

5.1.6 – Target Detection, Classification & Prioritization

3 – How Targets are Prioritized

At the completion of the first scan cycle within the scanburst, or if the first scan is aborted for any reason, the **Next-To-Shoot (NTS)** and **Alternate Next-To-Shoot (ANTS) targets** are designated as the first and second priority targets respectively.

The MPD **cursor** may also be used to **manually designate the NTS target** on the FCR page. However, when an NTS target is manually designated in this manner, that target is placed at the top of the High Priority Target List, with every other target shifting down the list as necessary. If a different target is manually designated as NTS by the MPD cursor, that target is then placed at the top of the High Priority Target List, and the previous target that had been manually designated as NTS is returned to its previous ranking as necessary.

Next-To-Shoot (NTS) Target

- *When the first scan within a scanburst is completed, the NTS target symbol is set to the target the FCR has classified as the highest priority; however, the crewmember may manually designate the NTS target using the NTS Select button or by selecting a target symbol on the FCR page with the MPD cursor.*
- *The NTS diamond is dashed unless all three of the following conditions are met:*
  1. *The FCR is the selected sight within the crewstation*
  2. *A weapon is actioned (WAS'ed) within the crew station in which the FCR is the selected sight*
  3. *The A/S (Arm/Safe) Button is set to ARM.*

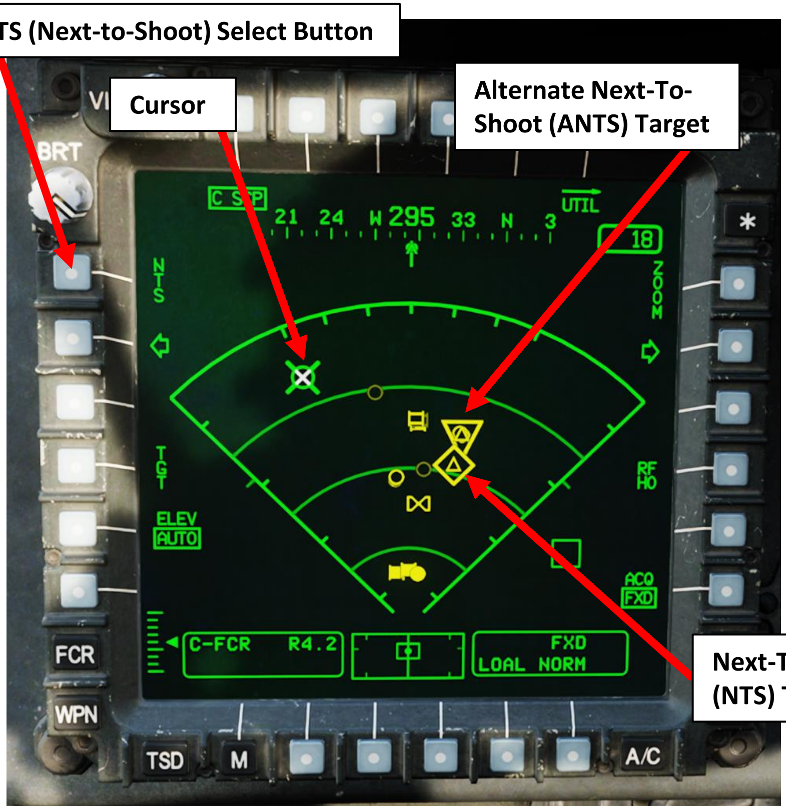
Alternate Next-To-Shoot (ANTS) Target

- *Indicates the FCR target that will become Next-To-Shoot (NTS) if the NTS Select button is pressed or an RF missile is fired at the current NTS target.*

NTS (Next-to-Shoot) Select Button

Cursor

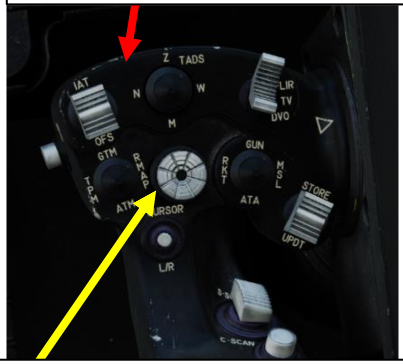
Alternate Next-To-Shoot (ANTS) Target



Next-To-Shoot (NTS) Target

TEDAC LHG (Left Hand Grip)

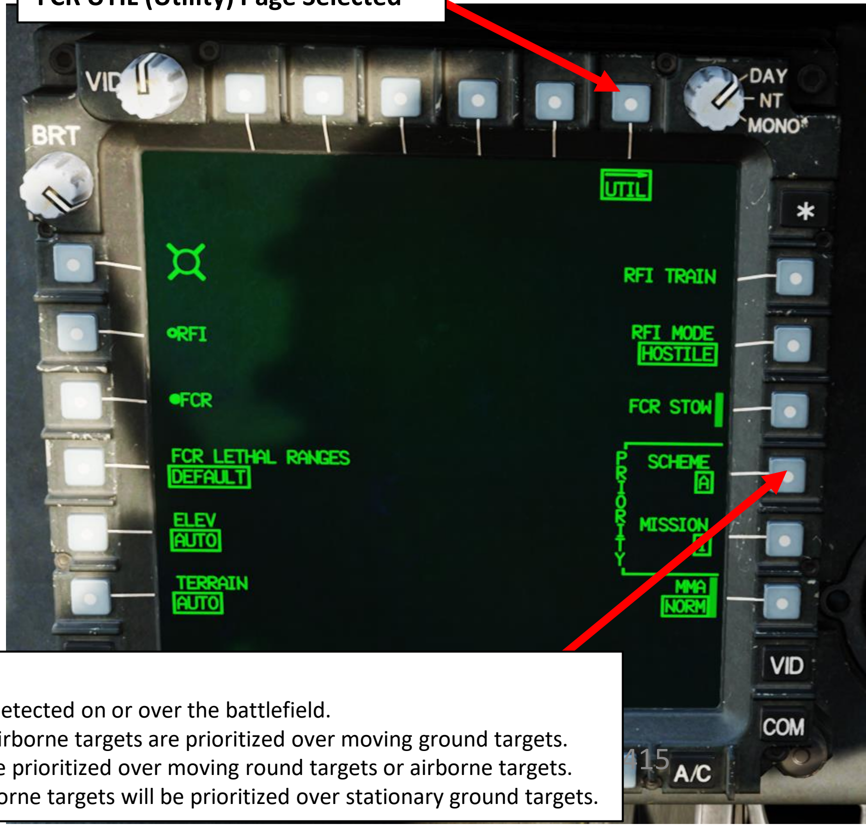
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



Cursor Control/Enter Switch

- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

FCR UTIL (Utility) Page Selected



Priority Scheme Selector

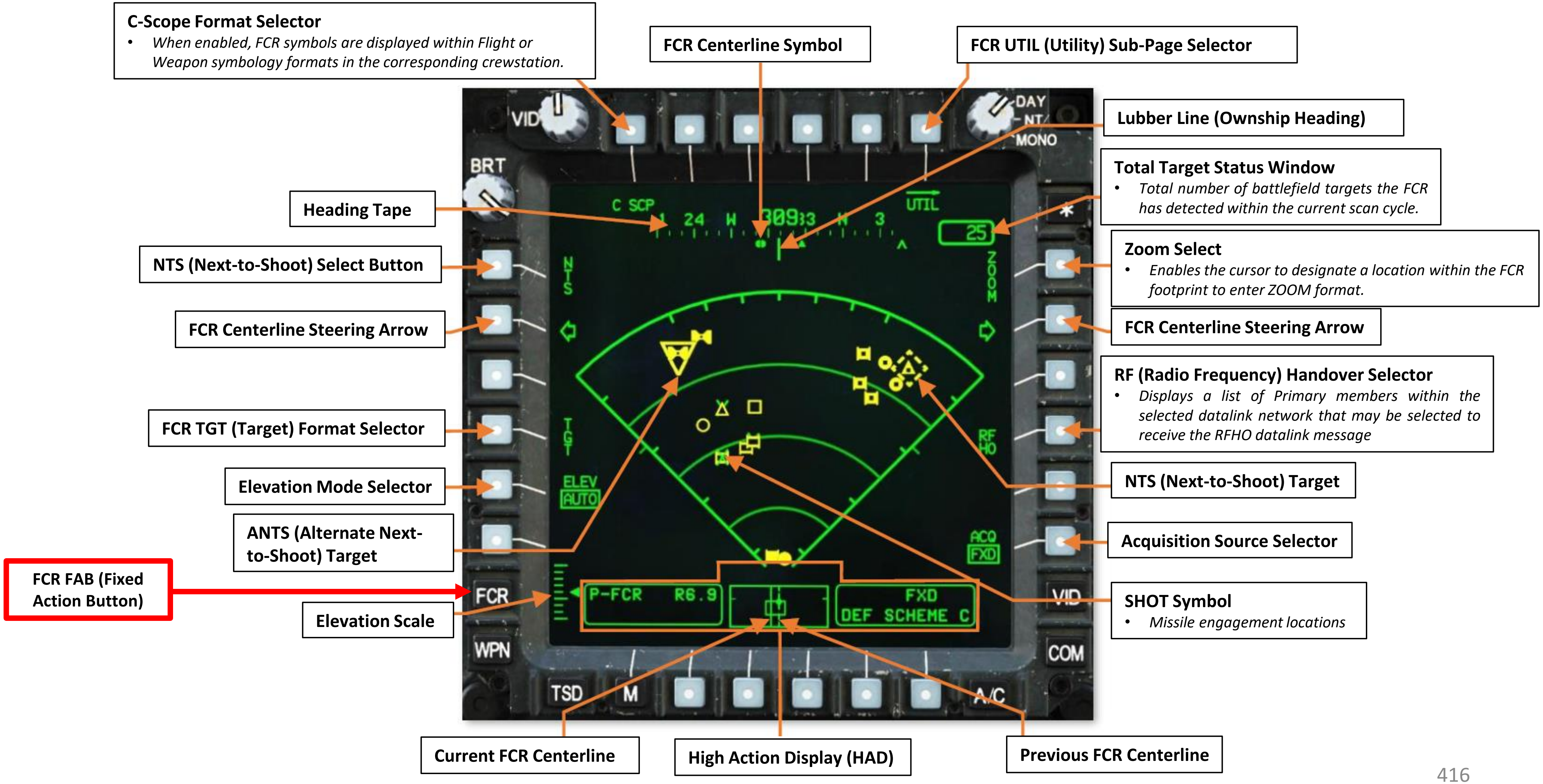
- Selects how the FCR will prioritize targets detected on or over the battlefield.
- Scheme A: Stationary ground targets and airborne targets are prioritized over moving ground targets.
- Scheme B: Stationary ground targets will be prioritized over moving round targets or airborne targets.
- Scheme C: Moving ground targets and airborne targets will be prioritized over stationary ground targets.

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.2 – Symbology

5.2.1 – FCR Page

The FCR page is selected by pressing the **FCR FAB (Fixed Action Button).**



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.2 – Symbology

5.2.1 – FCR Page

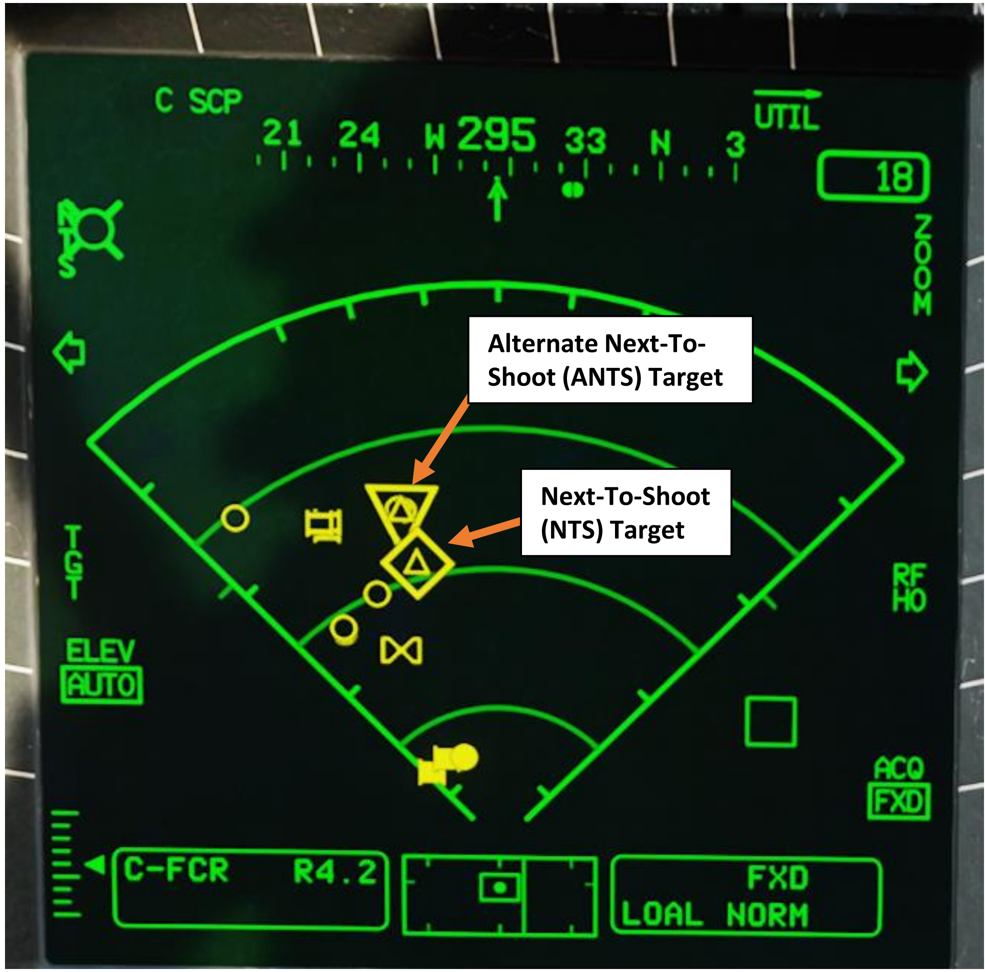
Here is an overview of the target types displayed on the FCR page.

Next-To-Shoot (NTS) Target

- *When the first scan within a scanburst is completed, the NTS target symbol is set to the target the FCR has classified as the highest priority; however, the crewmember may manually designate the NTS target using the NTS Select button or by selecting a target symbol on the FCR page with the MPD cursor.*
- *The NTS diamond is dashed unless all three of the following conditions are met:*
    1. *The FCR is the selected sight within the crewstation*
    2. *A weapon is actioned (WAS'ed) within the crew station in which the FCR is the selected sight*
    3. *The A/S (Arm/Safe) Button is set to ARM.*

Alternate Next-To-Shoot (ANTS) Target

- *Indicates the FCR target that will become Next-To-Shoot (NTS) if the NTS Select button is pressed or an RF missile is fired at the current NTS target.*



Target Symbology Table

TARGET TYPE	MOVING (500-8000 METERS)	STATIONARY (500-1500 METERS)	STATIONARY (1500-8000 METERS)
TRACKED VEHICLE			
WHEELED VEHICLE			
AIR DEFENSE VEHICLE			
UNKNOWN			
HELICOPTER			
FIXED-WING			

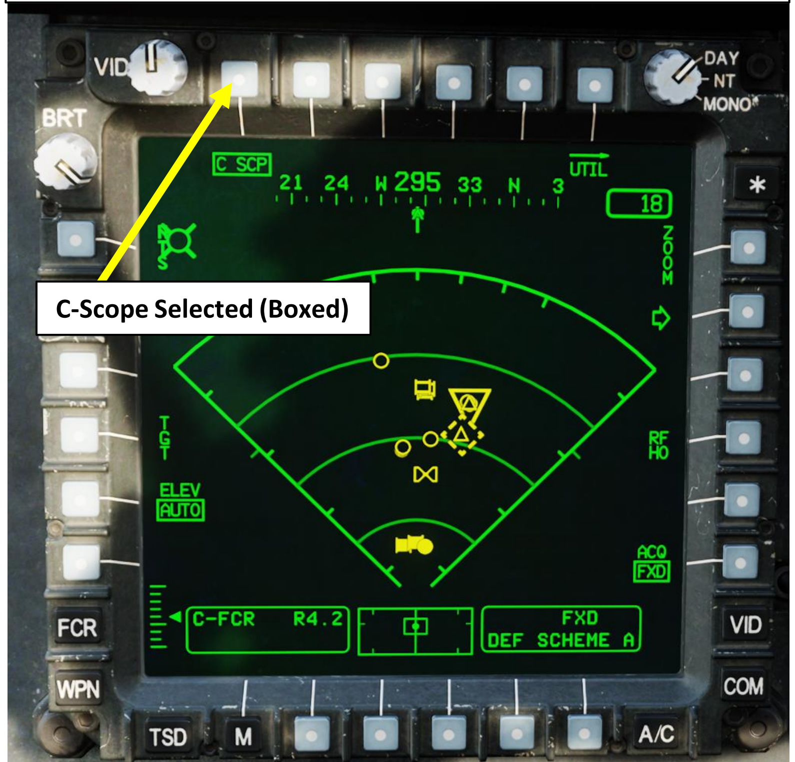
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.2 – Symbology
5.2.2 – C-Scope Format

If the **C-Scope Button** is pressed (either from the **FCR page C-SCP Button** or with the **TEDAC RHG C-Scope Button**), the FCR symbology overlay will be visible on the TADS and IHADSS.

C-Scope increases the aircrew's situational awareness by fusing FCR target data with TADS sensor video and allowing either crewmember to see a virtual representation of battlefield targets through their helmet displays. This capability is particularly useful when receiving FCR target data through the datalink from a FCR-equipped AH-64, in which target locations may be viewed while still masked behind terrain, allowing the receiving aircrew to easily gain situational awareness of the battlefield before unmasking their own aircraft from behind cover.

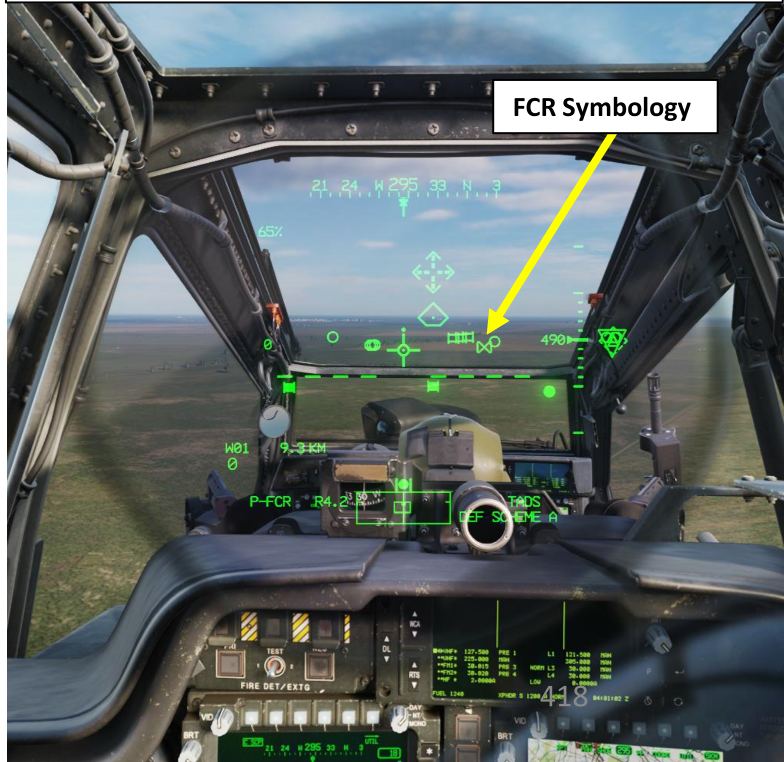
TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR Page
Left MPD (Multi-Purpose Display)



TADS Page
TDU (TEDAC Display Unit)

FCR Overlay on IHADSS (Integrated Helmet and Display Sighting System)



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

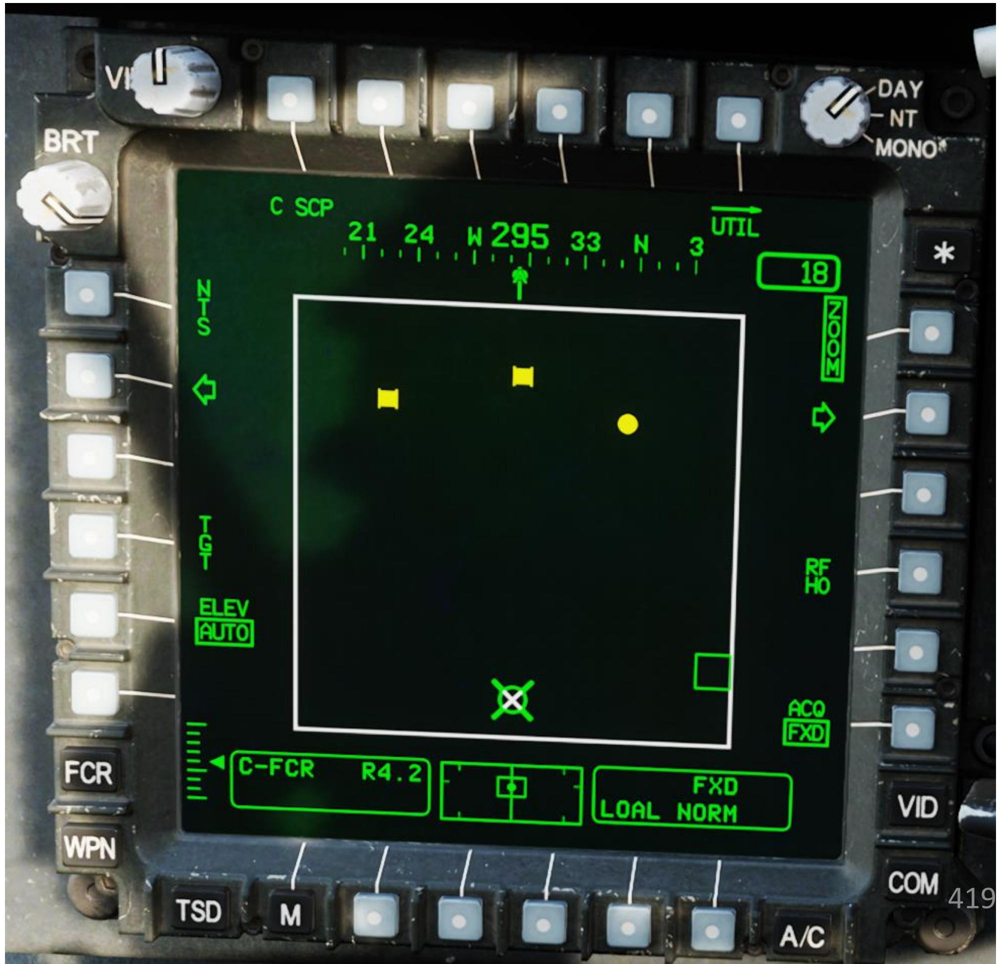
5.2 – Symbology

5.2.3 – Zoom Format

The FCR page may be expanded within a designated sector of the FCR footprint by using the ZOOM function, which displays a closer, more detailed view of FCR target symbols located within a small area. When enabled, the selected area within the FCR footprint is enlarged by a 6:1 ratio.

When ZOOM is pressed, the MPD Zoom cursor is displayed, which represents the relative area of the FCR footprint that will be expanded. Once the MPD Zoom cursor is placed over the desired location, Cursor-Enter may be pressed to enter the FCR ZOOM format. The ZOOM button may be subsequently de-selected to exit the FCR ZOOM format.

If an FCR scan is initiated while ZOOM is enabled, the FCR page will exit ZOOM format for the duration of the scan and will re-enter ZOOM format when the FCR scan is completed.



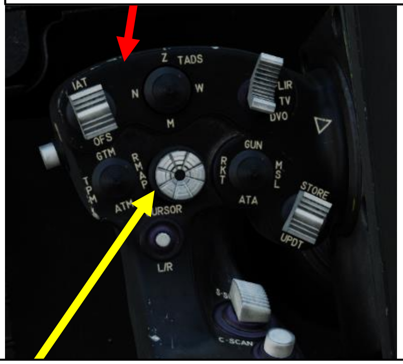
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.2 – Symbology
5.2.3 – Zoom Format

On the FCR page, the ZOOM format may be accessed in either crewstation by:

1. Moving the cursor on the desired area you want to zoom with the Cursor Control Switch (either on the TEDAC Left Hand Grip or on the Collective)
2. Pressing the ZOOM button on the FCR page.
3. Pressing DOWN on the Cursor Switch (ENTER).
4. You can exit Zoom Format by pressing ZOOM button on the FCR page.

Alternatively, the CPG may directly enter the FCR ZOOM format by pressing the **ZOOM button on the TEDAC Right Handgrip**. However, this method of entering ZOOM format of the FCR page bypasses the selection of the enlarged area using the MPD Cursor, and the ZOOM format will be centered on the current Next-To-Shoot (NTS) target.

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



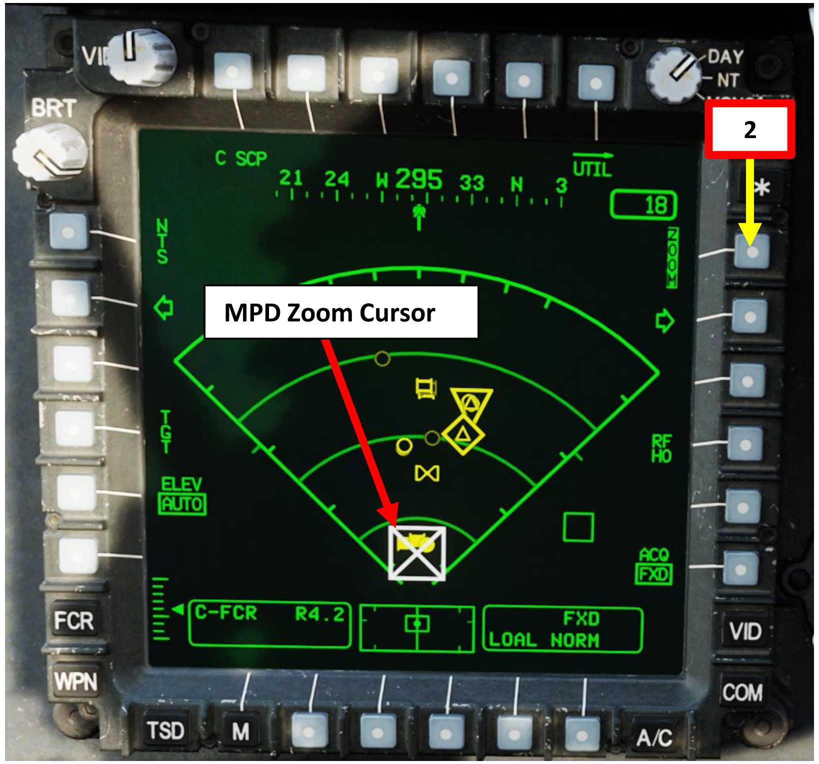
Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

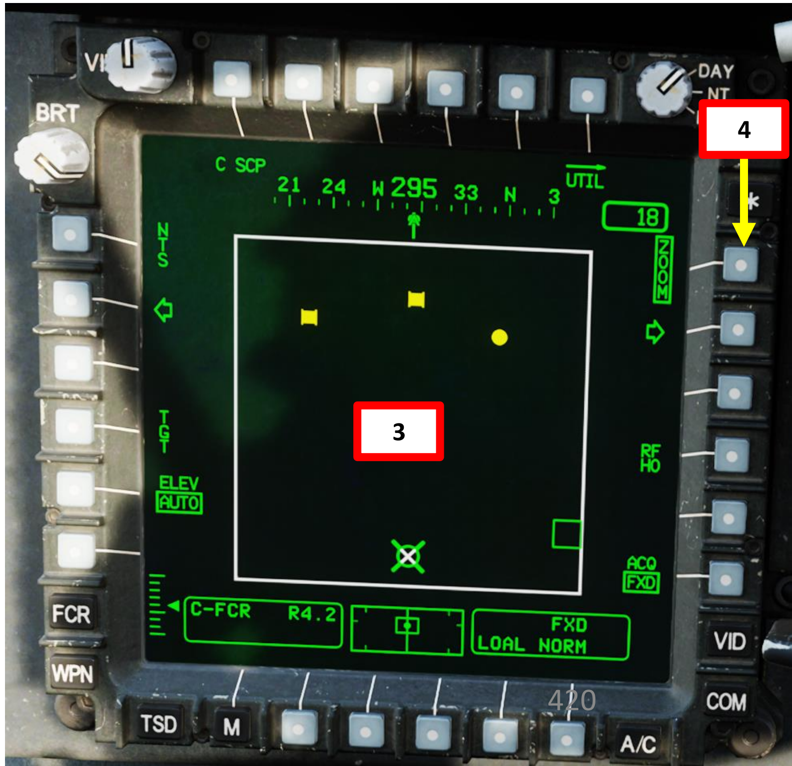
1
3

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Zoom Button
- *Changes the FCR targeting format to a 6× zoom, centered around the Next-To-Shoot (NTS). A second press restores the normal FCR format.*

2





5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.2 – Symbology
5.2.4 – Target Format

Pressing the **TGT button on the FCR page** displays the FCR page in Target format. The TGT format of the FCR page allows either crewmember to store FCR target locations as Target points within the TGT/THRT partition of the navigation database.

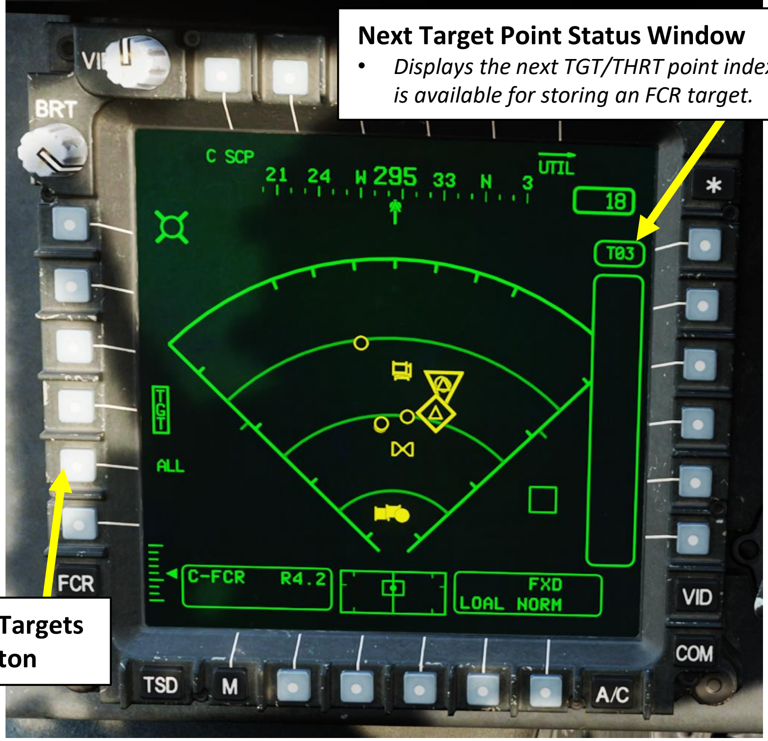
When pressing the **Store All Targets Button (ALL)**, all FCR targets displayed on the FCR page will be stored as Target (TG) points in TGT/THRT point indexes that are not already occupied with point data. **See example below.**

- *Note: If ALL is selected or any FCR target symbol is cursor-selected while the FCR TGT format is displayed, the ALL option is removed.*

Target Format can be exited by pressing on the **TGT button** again.

TGT (Target) Format Selector

1



Next Target Point Status Window

- *Displays the next TGT/THRT point index that is available for storing an FCR target.*

2 **Store All Targets (ALL) Button**

3 **Stored Target Points Status Window**

- *Displays the TGT/THRT point indexes of each Target point that has been stored from the FCR TGT format.*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.2 – Symbology
5.2.4 – Target Format

To store a target when the TGT format is displayed:

1. On FCR page, select TGT Format
2. Move the cursor on the desired target symbol with the Cursor Control Switch (either on the TEDAC Left Hand Grip or on the Collective)
3. Press DOWN on the Cursor Switch (ENTER).
4. Cursor-selecting an FCR target symbol on the FCR page will store a Target (TG) point at that FCR target's location.

- Alternatively, the CPG may store the current Next-To-Shoot (NTS) target as a Target (TG) point without entering the FCR TGT format by pressing the **Store/Update switch** to the STORE (FWD) position on the TEDAC Left Handgrip while the FCR is the CPG's selected sight.

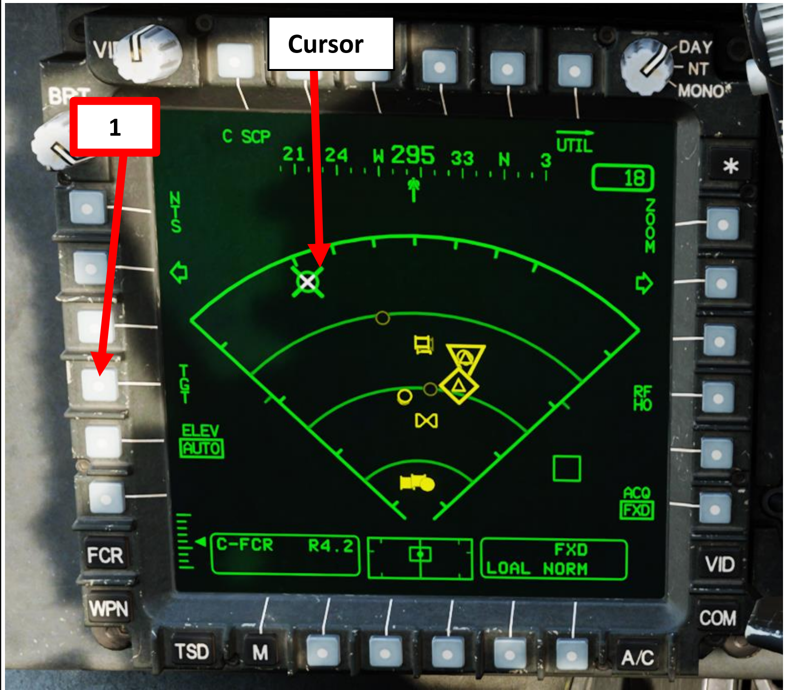
Note: If point indexes T01 through T49 within the TGT/THRT partition are already occupied with point data, Target points can no longer be stored from the FCR TGT format.

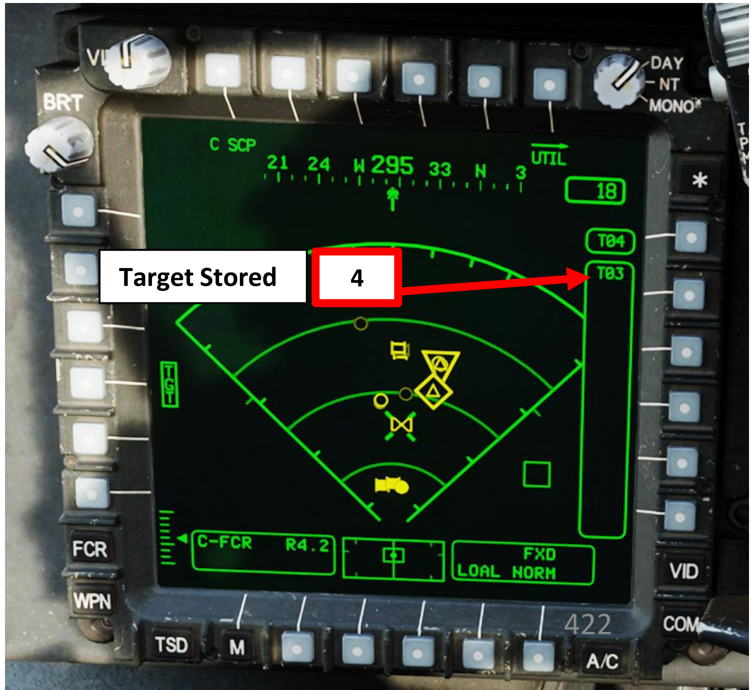
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Store/Update Switch
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

2
3



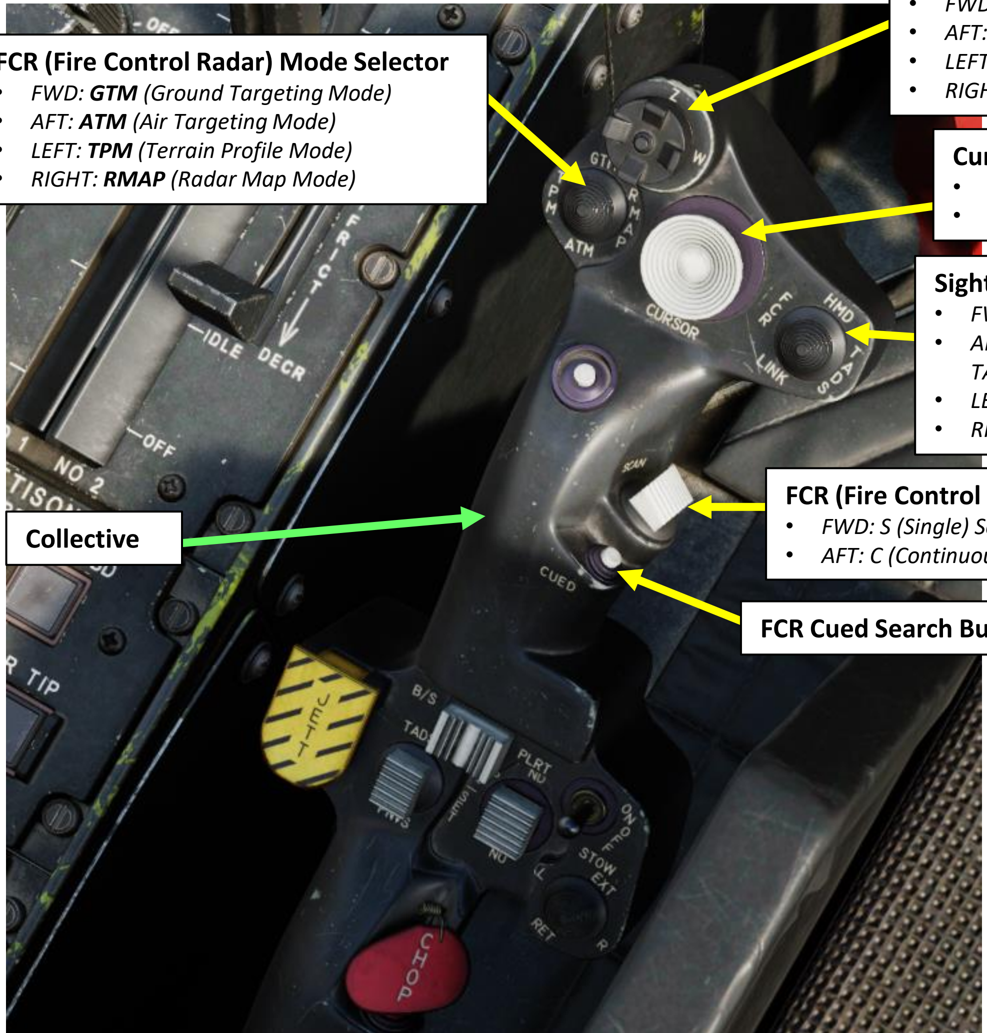


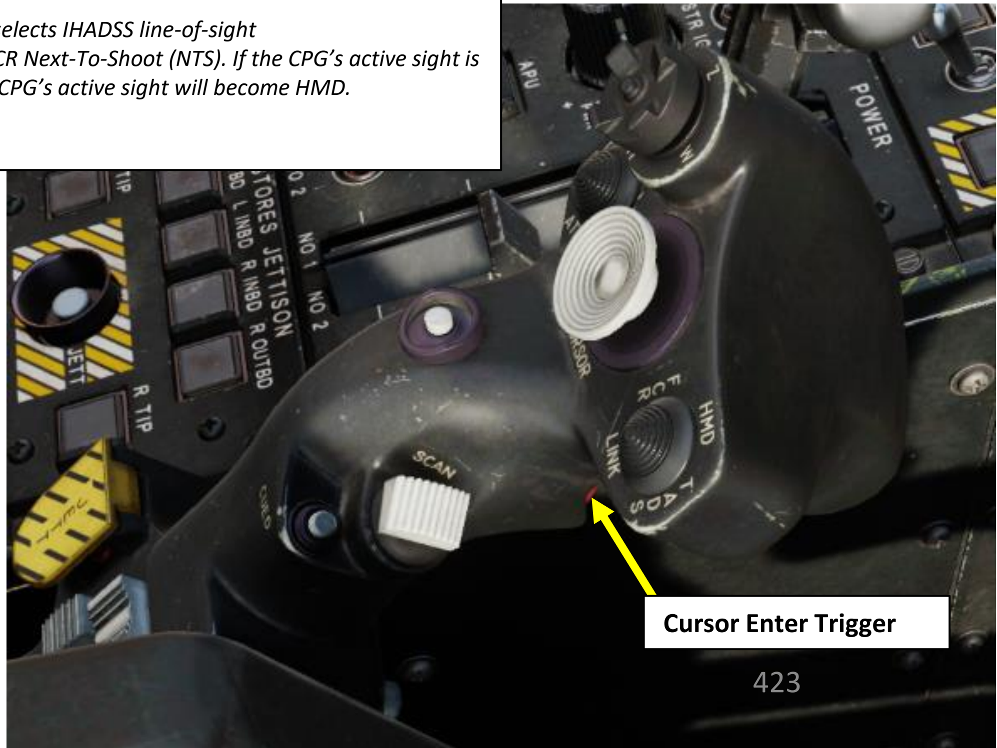
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.3 – Controls

5.3.1 – Collective Controls

Take note that the Pilot and Co-Pilot/Gunner **collective controls are identical**, which means that both crew members can control the FCR.

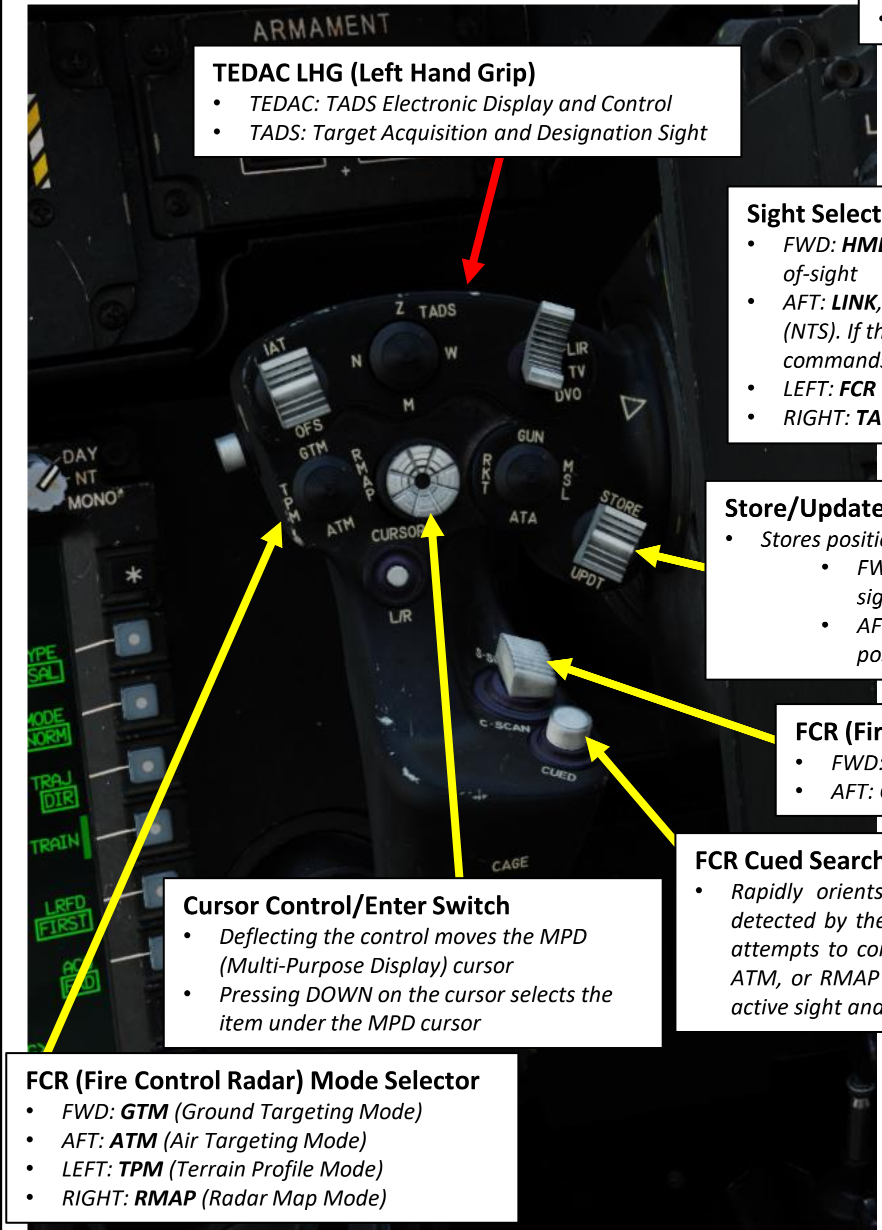




5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.3 – Controls

5.3.2 – TEDAC Controls



TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

FCR (Fire Control Radar) C-Scope Button

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

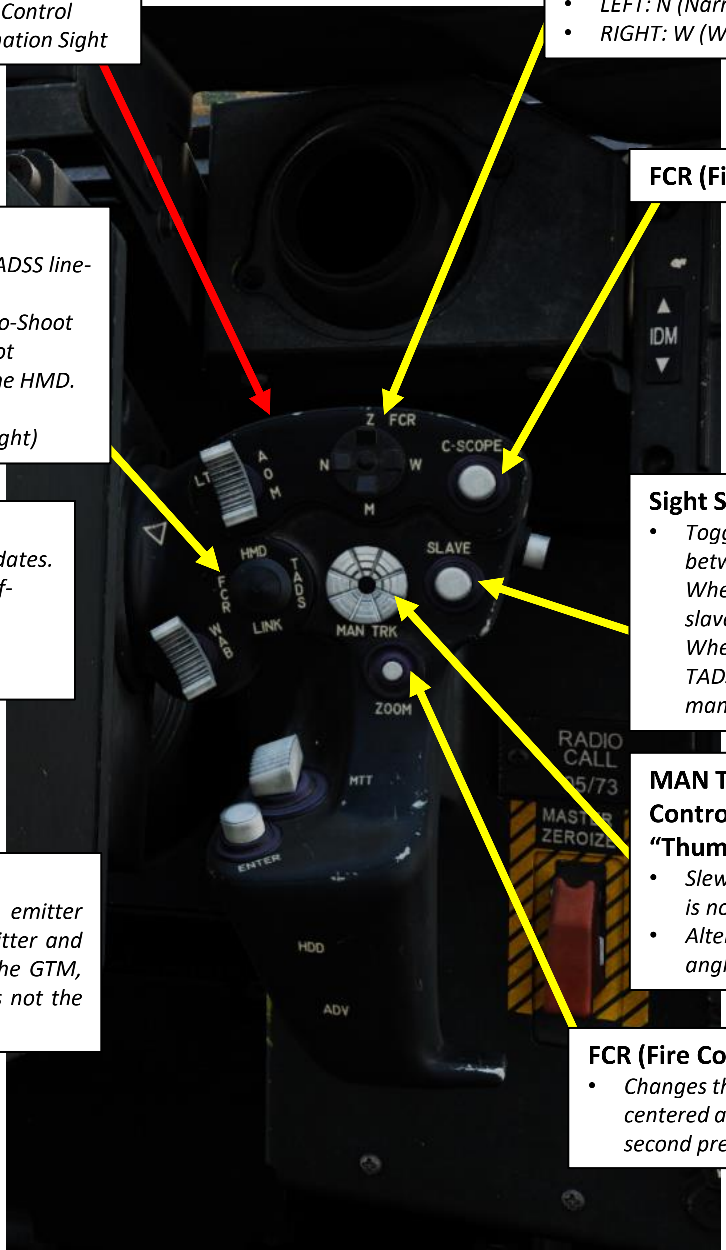
Store/Update Switch
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

FCR Cued Search Button
- *Rapidly orients the FCR antenna towards a threat emitter detected by the RFI. Scans in the direction of the emitter and attempts to correlate the location of the emitter in the GTM, ATM, or RMAP targeting modes. No function if FCR is not the active sight and the master arm isn't in ARM.*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*



Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"
- *Slews TADS line-of-sight when "Slave mode" is not enabled (tracking mode is Manual).*
- *Alternatively, it can slew the FCR antenna angle.*

FCR (Fire Control Radar) Zoom Button
- *Changes the FCR targeting format to a 6× zoom, centered around the Next-To-Shoot (NTS). A second press restores the normal FCR format.*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

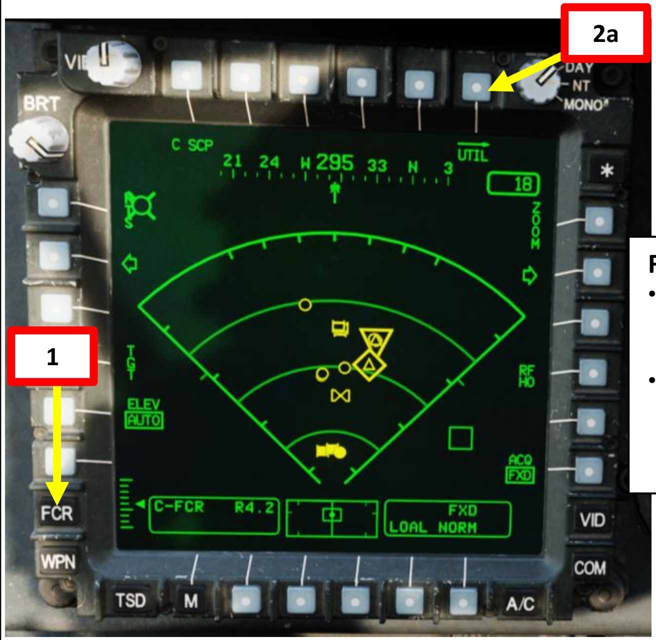
5.3 – Controls

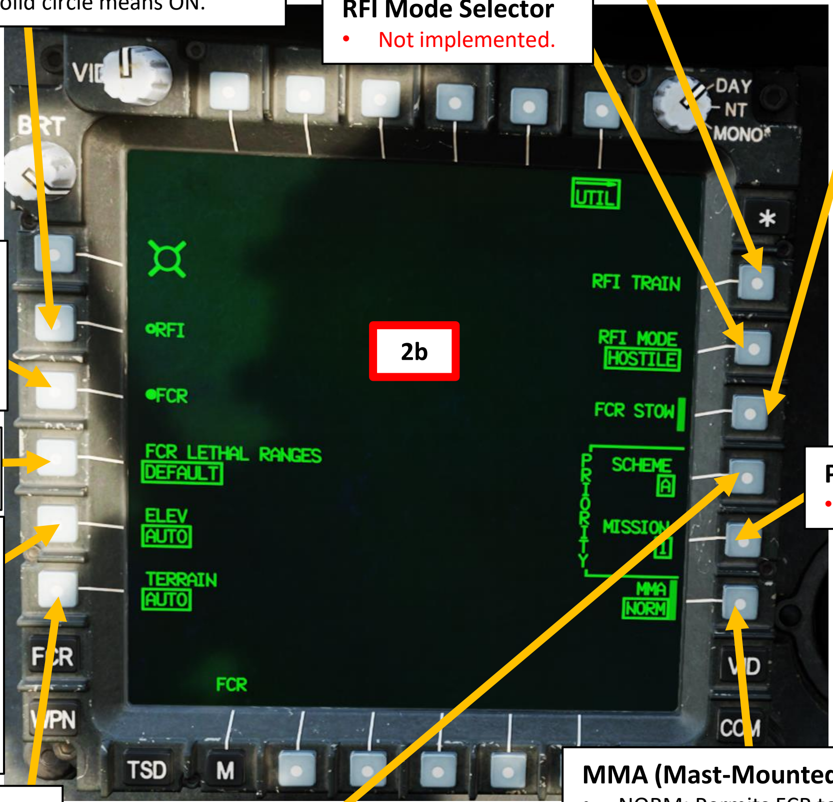
5.3.3 – FCR UTIL (Utility) Page

The UTIL sub-page allows either crewmember to toggle power to the **FCR (Fire Control Radar)** or **RFI (Radio Frequency Interferometer)** systems, adjust the settings of the mast-mounted radome and/or radar antenna elevation, or change the parameters for target prioritization.

To access the UTIL page:

1. Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
2. Press VAB (Variable Action Button) next to UTIL to select Utility page.





FCR Stow Control
- Manually commands the FCR radome to the stow position, rotating the mast-mounted assembly 180 deg towards the rear.
- *If either crewmember selects FCR as their sight, this option is unavailable for selection ("barriered").*

RFI Training Mode Selector
- Not implemented.

RFI Power Control
- Hollow circle means OFF
- Solid circle means ON.

RFI Mode Selector
- Not implemented.

FCR Power Control
- Hollow circle means OFF
- Solid circle means ON.
- *Note: FCR power will be inhibited if the MMA (Mast-Mounted Assembly) State is set to PINNED.*

FCR Lethal Range Setting
- Not implemented.

FCR Elevation Mode
- **AUTO**: FCR antenna automatically adjusts its elevation based on the altitude above terrain as measured by the radar altimeter. Use when operating over flat terrain.
- **MAN**: FCR antenna may be manually adjusted with arrow buttons displayed on the FCR page or using the MAN TRK controller on the TEDAC Right Hand Grip. Use when operating over terrain that varies in elevation.

Priority Mission Selector
- Not implemented.

FCR Terrain Setting
- Auto Mode: Configures terrain processing settings for rejecting false targets and ground clutter.

MMA (Mast-Mounted Assembly) State Selector
- NORM: Permits FCR to be powered, MMA may be rotated.
- PINNED: Inhibits the FCR from being powered, MMA cannot rotate.
- Note: When toggling MMA state from PINNED to NORM, the FCR and RFI will be initialized automatically.

Priority Scheme Selector
- Selects how the FCR will prioritize targets detected on or over the battlefield.
- Scheme A: Stationary ground targets and airborne targets are prioritized over moving ground targets.
- Scheme B: Stationary ground targets will be prioritized over moving round targets or airborne targets.
- Scheme C: Moving ground targets and airborne targets will be prioritized over stationary ground targets.

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.3 – Controls

5.3.4 – Radar Azimuth & Elevation Control

Azimuth Controls (Pilot)

When the FCR Sensor is selected by the pilot's **Sight Selector Switch LEFT (FCR)**, the FCR Centerline is automatically slaved to the Pilot's Acquisition Source. The pilot may steer the FCR centerline by either:

- Method 1 – **Changing the Acquisition Source** using the ACQ Button on the FCR page.
  - If using **FXD**: FCR centerline is fixed forward.
  - If using **PHS**: FCR centerline is slaved to the Pilot's helmet's line-of-sight, allowing the pilot to look in the direction of the desired scan direction and initiate a scanburst.
  - If using **TRN**: FCR centerline is slaved to a fixed geographical location on the TSD (Tactical Situation Display).
- Method 2 – Using the **FCR Centerline Steering Arrows** on the FCR page.

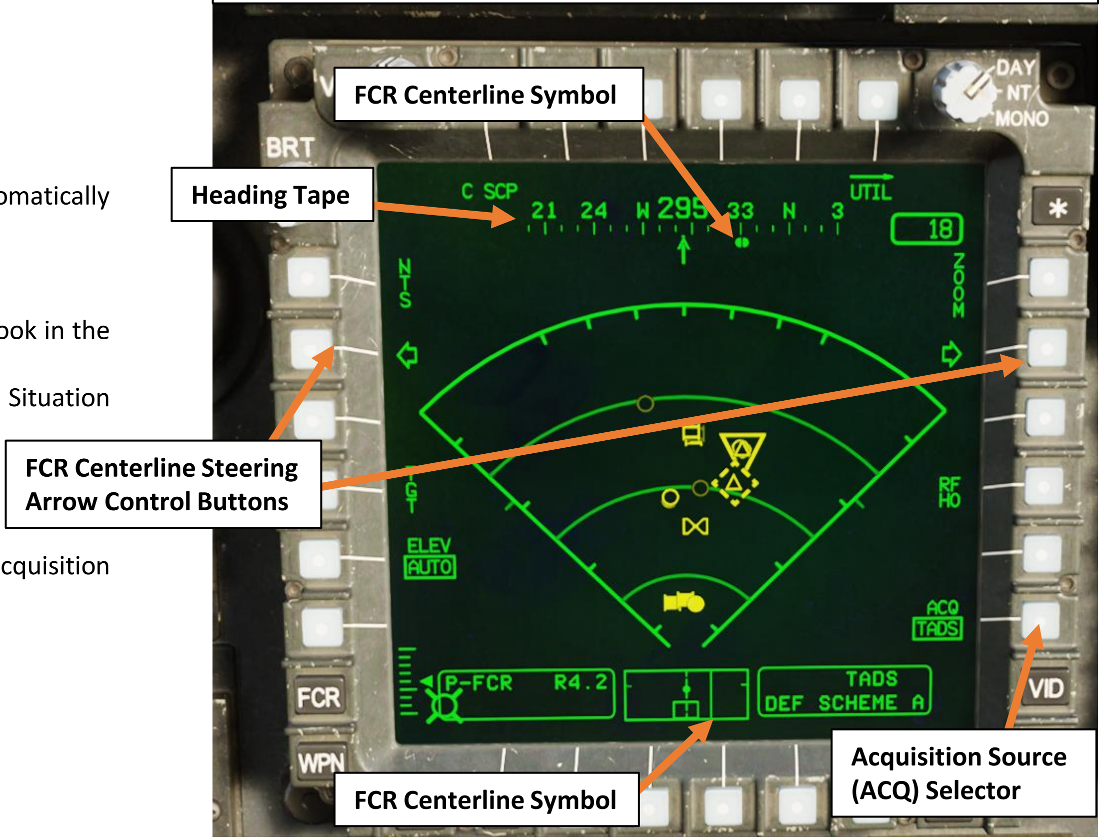
Note: The Pilot **may re-slave the FCR to an acquisition source** using either:

- Method A – **Selecting any acquisition source** from the **ACQ Selection Menu**, even if the current acquisition source is re-selected.
- Method B – **Selecting HMD as the Sight** using the pilot's **Sight Selector Switch FWD (HMD).**

Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

FCR Page
Left MPD (Multi-Purpose Display)



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.3 – Controls

5.3.4 – Radar Azimuth & Elevation Control

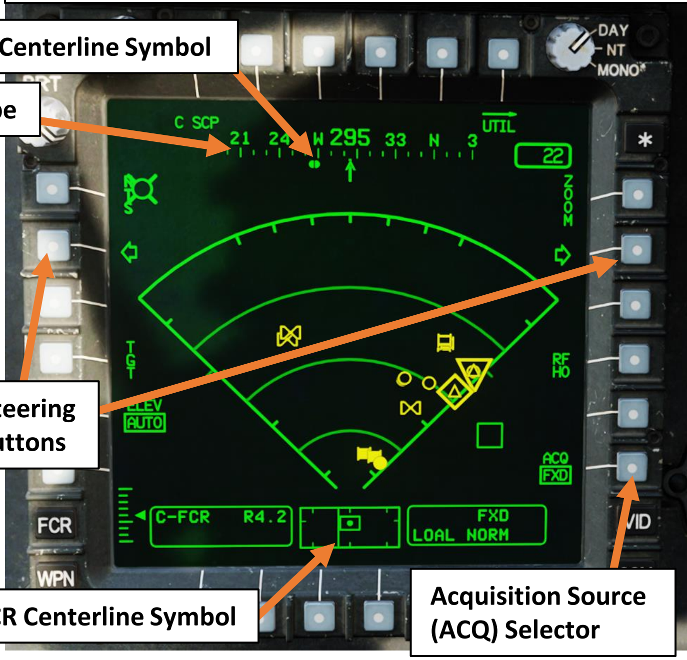
Azimuth Controls (CPG)

When the FCR Sensor is selected by the CPG's **Sight Selector Switch LEFT (FCR)**, the CPG may steer the FCR centerline by either:

- Method 1 – **Changing the Acquisition Source** using the ACQ Button on the FCR page.
    - If using **FXD**: FCR centerline is fixed forward.
    - If using **PHS**: FCR centerline is slaved to the Pilot's helmet's line-of-sight, allowing the pilot to look in the direction of the desired scan direction and initiate a scanburst.
    - If using **GHS**: FCR centerline is slaved to the CPG's helmet's line-of-sight, allowing the CPG to look in the direction of the desired scan direction and initiate a scanburst.
    - If using **TRN**: FCR centerline is slaved to a fixed geographical location on the TSD (Tactical Situation Display).
- Method 2 – Using the **FCR Centerline Steering Arrows** on the FCR page.
- Method 3 – Using the **Sight Manual Tracker (MAN TRK) Switch** if the FCR is de-slaved from the CPG's acquisition source.

Note: The CPG **may re-slave the FCR to an acquisition source** using the **Sight Slave Button**.

FCR Page
Left MPD (Multi-Purpose Display)



FCR Centerline Symbol

Heading Tape

FCR Centerline Steering Arrow Control Buttons

FCR Centerline Symbol

Acquisition Source (ACQ) Selector

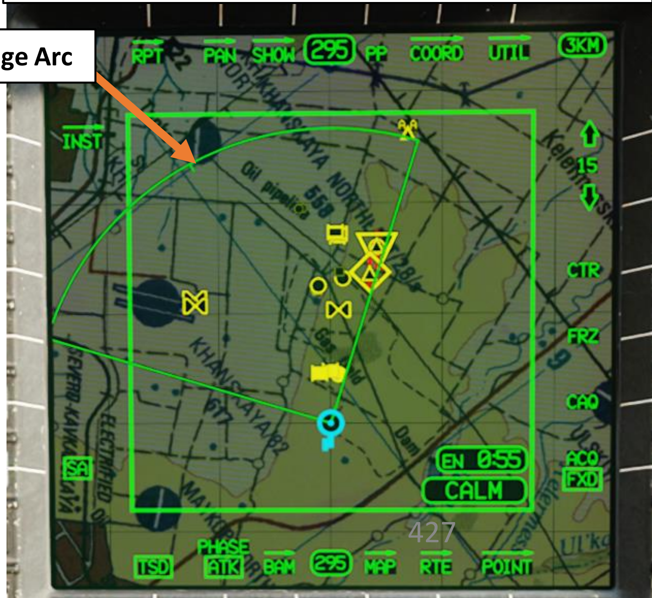
TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

Sight Slave Button

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"

FCR Overlay on TSD (Tactical Situation Display) Page
Right MPD (Multi-Purpose Display)



FCR Coverage Arc

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.3 – Controls

5.3.4 – Radar Azimuth & Elevation Control

Elevation Controls (Automatic)

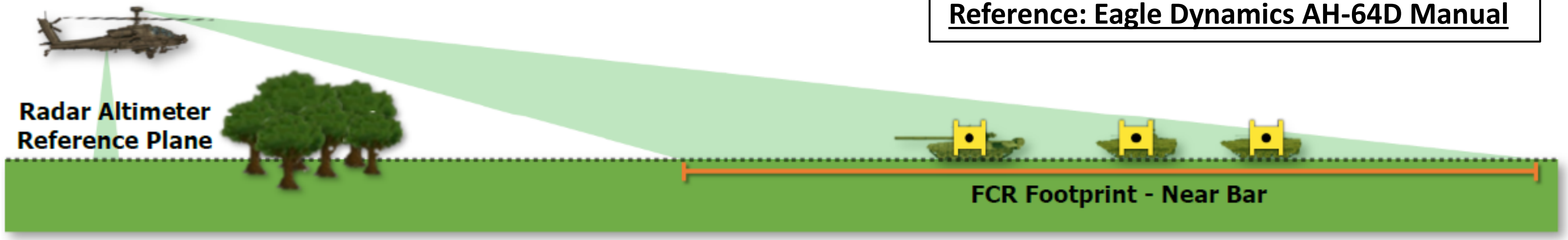
The FCR antenna is stabilized in elevation, which allows the radar beam to remain within the intended FCR scan volume at aircraft attitudes of +20 deg to -15 deg in pitch or +/-20 deg in roll without a degradation in scan quality. However, depending on a multitude of factors including aircraft altitude above the terrain, some portions of the FCR scan volume may not be reached by the radar beam.

To reduce crew workload when using the FCR in GTM or RMAP mode, the FCR elevation control defaults to an automatic mode, based on the current altitude above ground level (AGL) as measured by the radar altimeter. The automatic elevation mode adjusts the antenna elevation to maintain the 2-bar scan pattern between a range of 500 and 8000 m, but this may not be possible at higher altitudes.

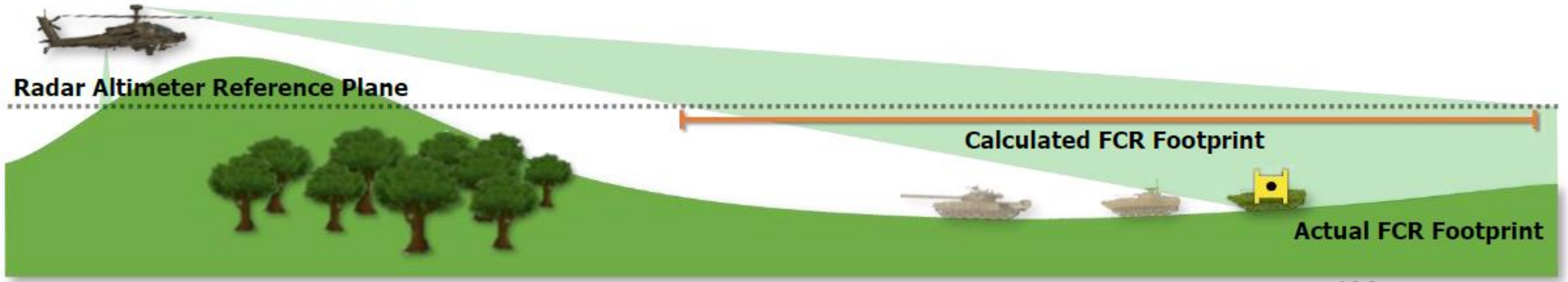
It is important to note that the accuracy of the automatic elevation mode is predicated on the assumption that the intended FCR footprint is at the same elevation as the terrain directly below the aircraft. As this may not always be the case, using the **automatic elevation mode should only be performed in areas with minimal terrain relief**, such as open plains. Automatic elevation mode should not be used when operating over mountains or rolling hills.

FCR Page
Left MPD (Multi-Purpose Display)

Reference: Eagle Dynamics AH-64D Manual



FCR Automatic Elevation (Flat Terrain)



FCR Automatic Elevation (Terrain Elevation Difference)

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.3 – Controls

5.3.4 – Radar Azimuth & Elevation Control

Elevation Controls (Manual)

The FCR elevation control mode may be toggled between automatic (AUTO) and manual (MAN) from the **FCR Utility sub-page** when the FCR is the selected sight and set to GTM or RMAP modes.

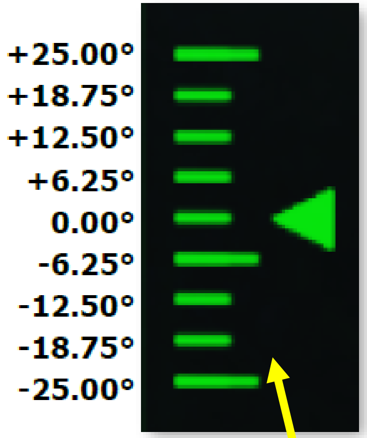
When set to AUTO, the **ELEV control mode option** is displayed on the FCR page as a shortcut to quickly revert to manual elevation control.

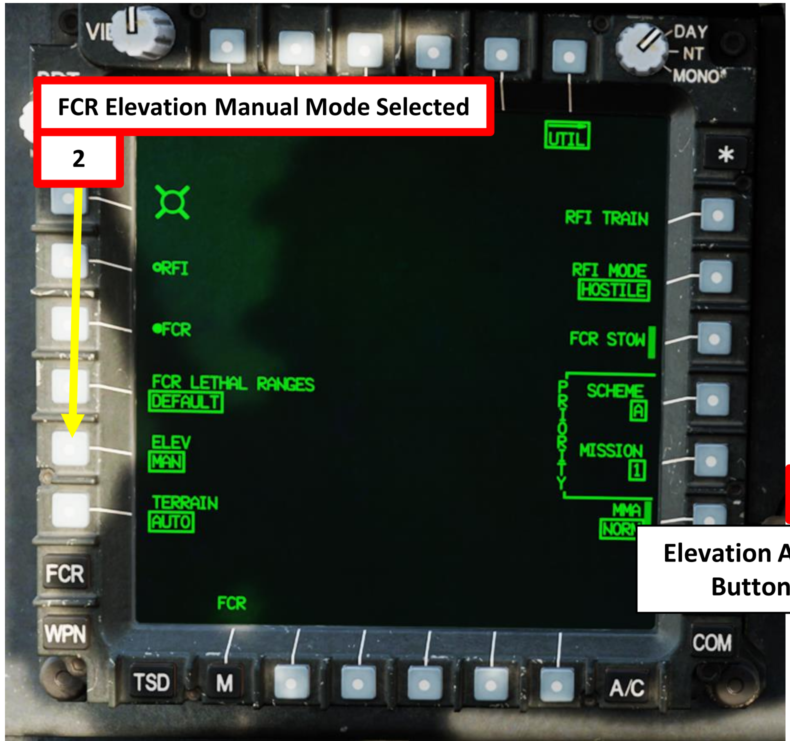
When set to MAN (see example below), you can change elevation manually via the **Elevation Arrow Buttons** or the **Sight Manual Tracker (MAN TRK)** on the CPG's TEDAC Left Handgrip.

The **Elevation Scale** is displayed on the main FCR page corresponding with the current antenna elevation setting. The Elevation Scale does not indicate the mechanical position of the elevation servo, but rather the elevation of the FCR scan volume relative to the horizontal plane.

TEDAC RHG (Right Hand Grip)

- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*





5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

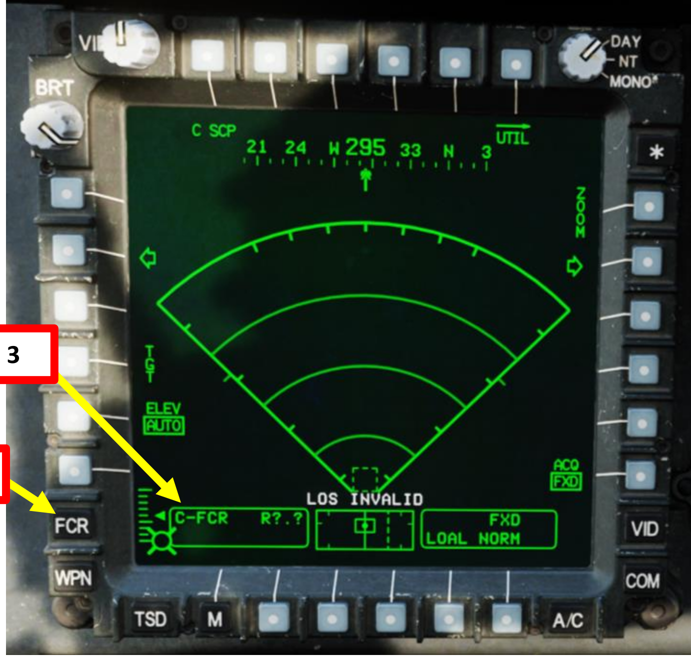
5.4 – FCR Modes

5.4.1 – GTM (Ground Targeting Mode)

GTM (Ground Targeting Mode) is used to detect and classify ground vehicles and low-flying aircraft. When the FCR is scanning in GTM, the FCR centerline will be stabilized in azimuth, independently of the aircraft heading, as indicated by the FCR Centerline Symbol along the bottom of the Heading Tape. GTM is the default FCR mode upon power-up.

To enter and use GTM Mode:

1. Power up the FCR as shown previously.
2. *[P/CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
3. *[P/CPG]* Set Sight Selector Switch – LEFT (FCR)
4. *[P/CPG]* Set FCR Mode Selector – FWD (GTM)



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

3

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

Collective

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

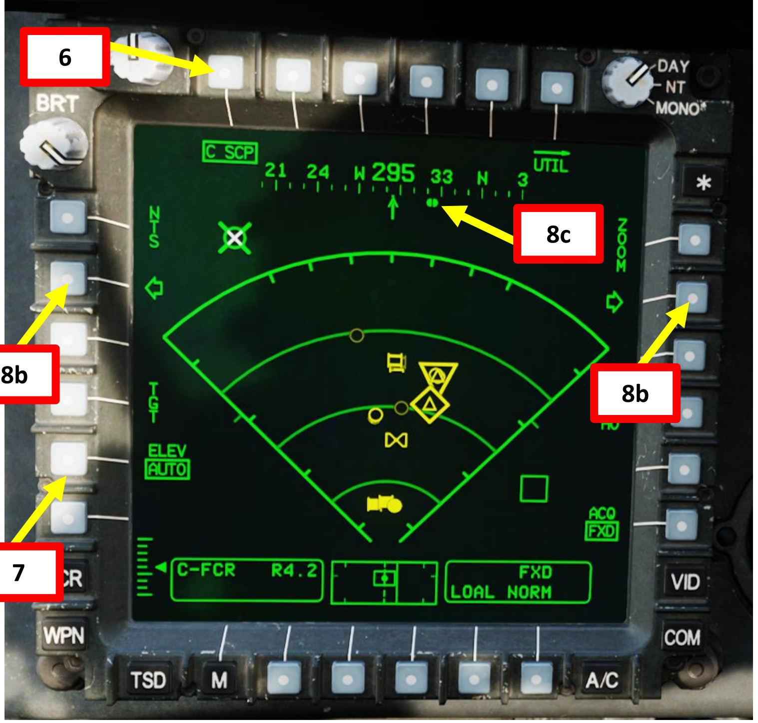
3

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

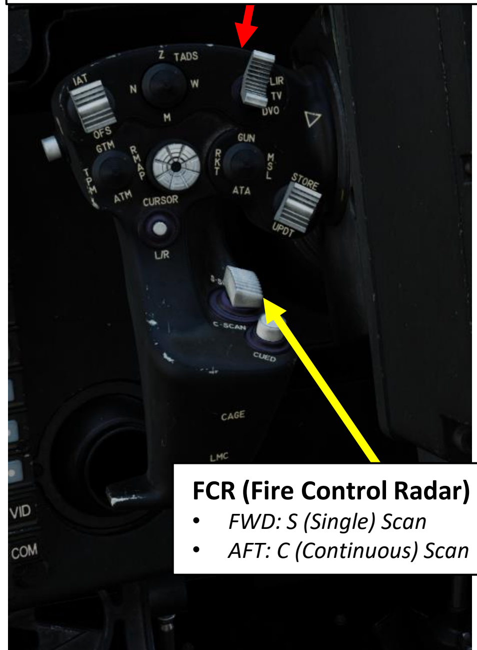
5.4 – FCR Modes

5.4.1 – GTM (Ground Targeting Mode)

5. *[P/CPG]* If desired, enable TSD ATK (Tactical Situation Display Attack) mode in order to display FCR symbology on the TSD page.
6. *[P/CPG]* Enable (box) C-SCP (C-Scope) if desired. This will display FCR Symbology on the Helmet-Mounted Display and TDU (TADS Display Unit).
7. *[P/CPG]* Set FCR Elevation – As desired. We will leave it to AUTO.
8. Adjust FCR Azimuth as desired by either:
    a) *[CPG]* Using the Sight Manual Tracker (MAN TRK) Switch if the FCR is de-slaved from the CPG's acquisition source, or;
    b) *[P/CPG]* Using the FCR Centerline Steering Arrows on the FCR page.
9. *[P/CPG]* Set FCR Scan Field-of-View – As desired.
10. *[P/CPG]* Use FCR Scan Control Switch to perform a scan.
    - Switch FWD: Single Scan
    - Switch AFT: Continuous Scan



TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

10

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

9

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

Sight Slave Button

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"

8a

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.4 – FCR Modes

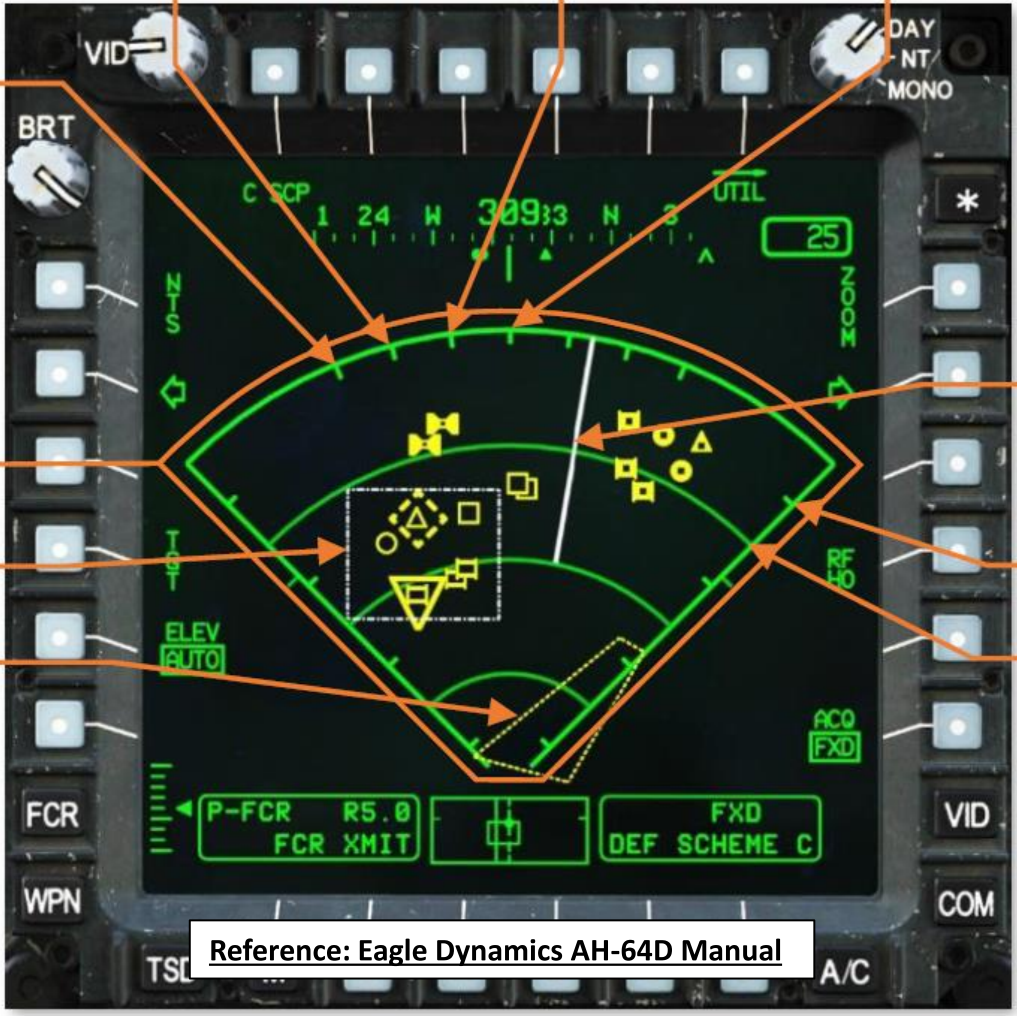
5.4.1 – GTM (Ground Targeting Mode)

Narrow Scan Size Marks

Zoom Scan Size Marks

FCR Centerline

Medium Scan Size Marks



Scan Wiper

- Displays the position of the FCR antenna within the FCR scan sector when performing a scan. The FCR Scan Wiper will be displayed in White when performing a single scanburst or displayed in Green when performing a continuous scanburst.

FCR Footprint

- The entire FCR Footprint represents the size of the FCR scan sector if the FCR Scan Size switch were pressed right to the "W" position. A Wide scan size will encompass a 90° sector of the battlefield, 45° to either side of the FCR Centerline, to a maximum range of 8 kilometers.

Range Marks

- Indicates the distance from the ownship on either side of the FCR scan sector in 2-km increments, at 1 km, 3 km, 5 km, and 7 km.

Activated PFZ (Priority Fire Zone)

Activated NFZ (No Fire Zone)

Range Arcs

- Indicates the distance from the ownship within the FCR scan sector in 2-km increments, at 2 km, 4 km, and 6 km.

Reference: Eagle Dynamics AH-64D Manual

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

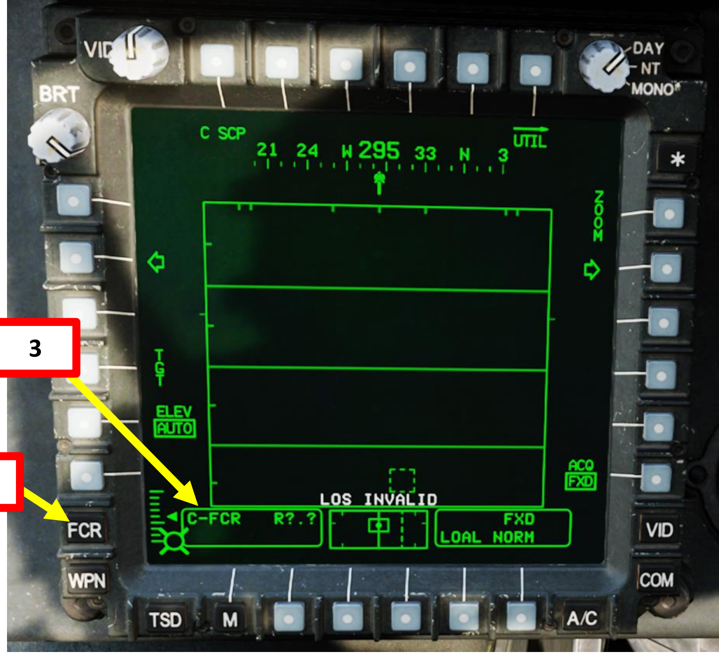
5.4 – FCR Modes

5.4.2 – RMAP (Radar Map Mode)

RMAP (Radar Map) mode is used to detect and classify ground vehicles and low-flying aircraft, which are displayed in a B-Scope (PPI, Plan Position Indicator) format along with a radar-generated terrain map underlaid below the FCR target symbols. When the FCR is scanning in RMAP, the FCR centerline will be stabilized in azimuth, independently of the aircraft heading. The FCR-generated terrain map displayed in RMAP mode allows the crew to identify significant terrain features or radar-reflective man-made infrastructure that may not be readily visible to the naked eye or optical sensors.

To enter and use RMAP Mode:

1. Power up the FCR as shown previously.
2. *[P/CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
3. *[P/CPG]* Set Sight Selector Switch – LEFT (FCR)
4. *[P/CPG]* Set FCR Mode Selector – RIGHT (RMAP)



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

3

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

Collective

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

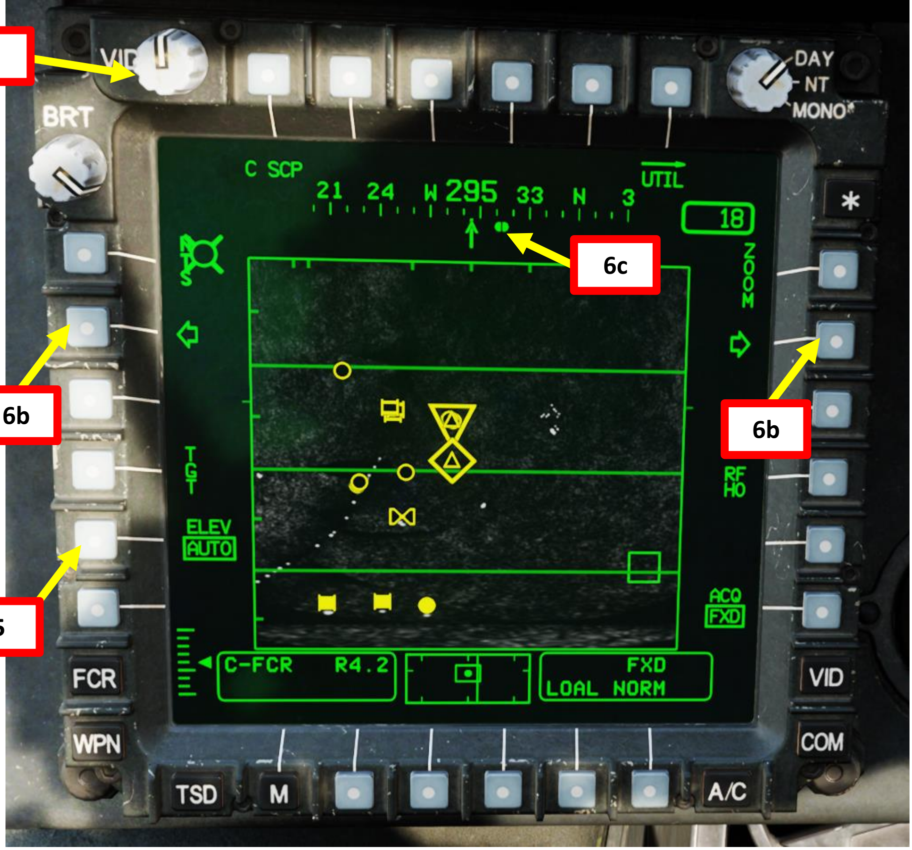
3

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

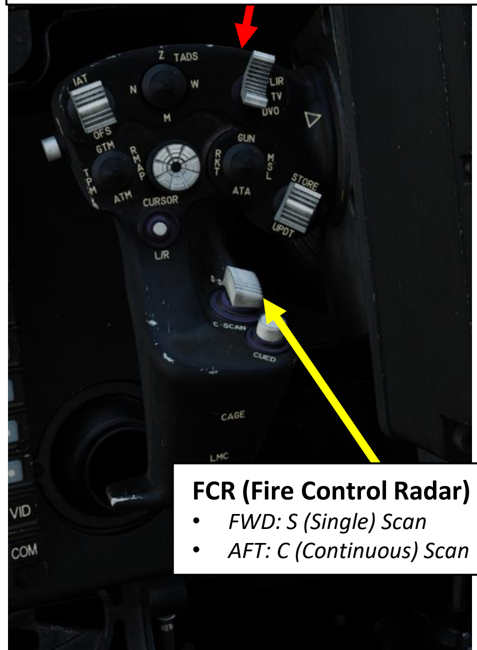
5.4 – FCR Modes

5.4.2 – RMAP (Radar Map Mode)

5. [P/CPG] Set FCR Elevation – As desired. We will leave it to AUTO.
6. Adjust FCR Azimuth as desired by either:
   a) [CPG] Using the Sight Manual Tracker (MAN TRK) Switch if the FCR is de-slaved from the CPG's acquisition source, or;
   b) [P/CPG] Using the FCR Centerline Steering Arrows on the FCR page.
7. [P/CPG] Set FCR Scan Field-of-View – As desired.
8. [P/CPG] Use FCR Scan Control Switch to perform a scan.
   - Switch FWD: Single Scan
   - Switch AFT: Continuous Scan
9. [P/CPG] The brightness of the terrain video underlay may be adjusted independently of the primary symbology displayed on the MPD using the VID knob.
10. [P/CPG] The FCR-generated terrain map displayed in RMAP mode allows the crew to identify significant terrain features or radar-reflective man-made infrastructure that may not be readily visible to the naked eye or optical sensors.



TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

8

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

7

Sight Slave Button

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"

6a

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.4 – FCR Modes

5.4.2 – RMAP (Radar Map Mode)

Note 1: Re-selecting RMAP using the FCR mode switch on the Collective Mission Grip or the TEDAC Left Handgrip when the FCR mode is already set to RMAP will toggle the terrain video underlay on the FCR page. The RMAP terrain video will take priority over any video underlay that has been selected on the VID page. If the RMAP terrain video is disabled, the video underlay selected on the VID page will be displayed.

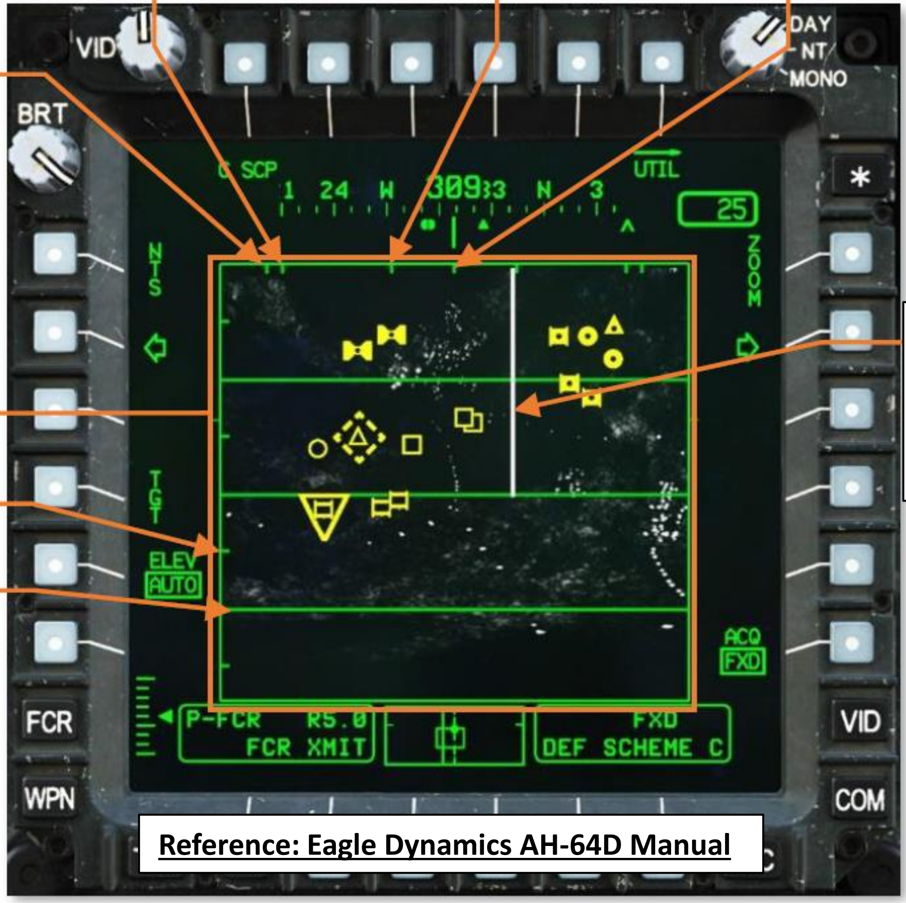
Note 2: RMAP mode is interchangeable with GTM, in that a scanburst performed in one mode may be viewed in the format of the other after the scanburst is complete. When the FCR mode is set to RMAP, activated Fire Zones (PFZ's and NFZ's) are not displayed on the FCR page.

Narrow Scan Size Marks

Zoom Scan Size Marks

FCR Centerline

Medium Scan Size Marks



FCR Footprint
- The entire FCR Footprint represents the size of the FCR scan sector if the FCR Scan Size switch were pressed right to the "W" position. A Wide scan size will encompass a 90° sector of the battlefield, 45° to either side of the FCR Centerline, to a maximum range of 8 kilometers.

Range Marks
- Indicates the distance from the ownship on either side of the FCR scan sector in 2-km increments, at 1 km, 3 km, 5 km, and 7 km.

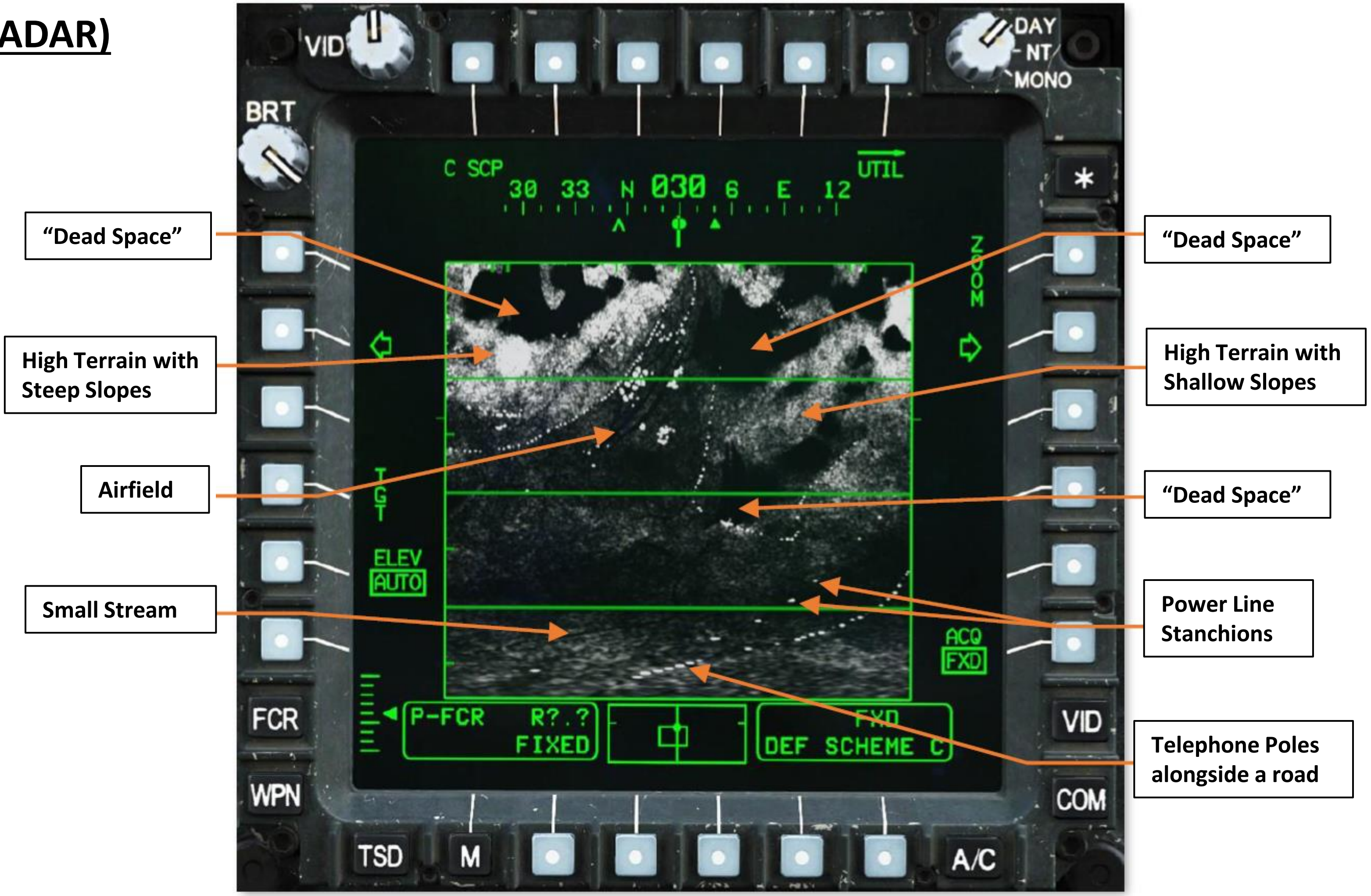
Range Lines
- Indicates the distance from the ownship within the FCR scan sector in 2-km increments, at 2 km, 4 km, and 6 km.

Scan Wiper
- Displays the position of the FCR antenna within the FCR scan sector when performing a scan. The FCR Scan Wiper will be displayed in White when performing a single scanburst or displayed in Green when performing a continuous scanburst.

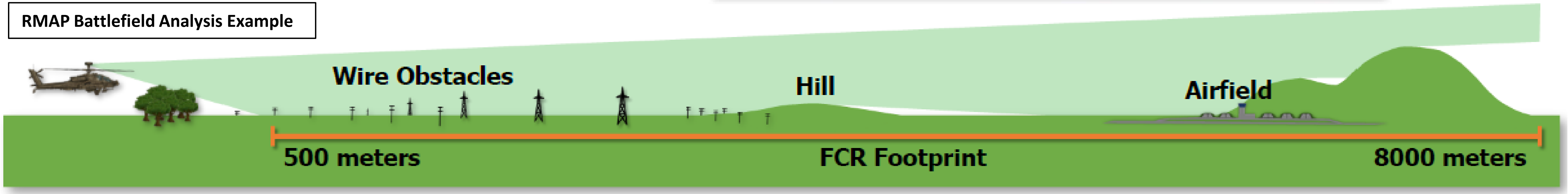
Reference: Eagle Dynamics AH-64D Manual

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.4 – FCR Modes
5.4.2 – RMAP (Radar Map Mode)

Note 3: Areas of terrain that are not visible to the radar, known as "dead space", will be shaded black like a shadow cast across the terrain. Depending on the amount of intelligence the crew has received prior to the mission regarding the location of enemy positions, these areas should be regarded as potentially unknown enemy positions.



RMAP Battlefield Analysis Example



Reference: Eagle Dynamics AH-64D Manual

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.4 – FCR Modes

5.4.3 – ATM (Air Targeting Mode)

Mode not implemented yet.

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.4 – FCR Modes

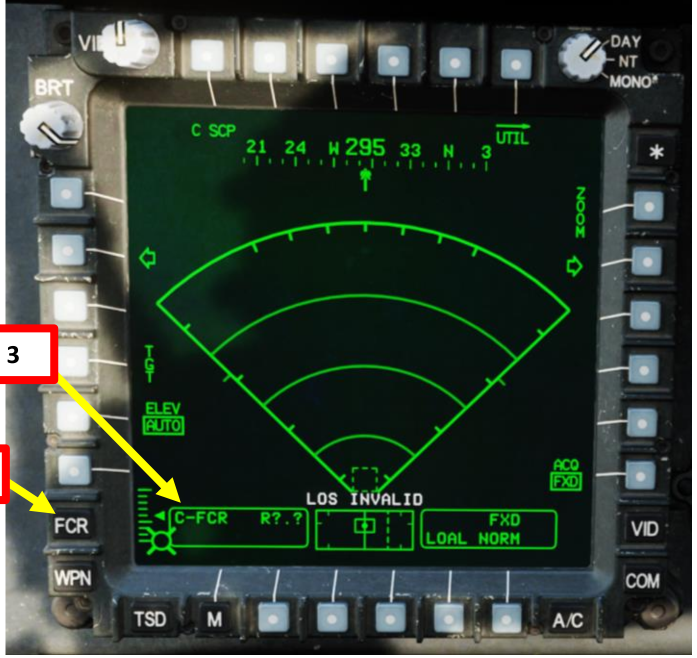
5.4.4 – TPM (Terrain Profile Mode)

Mode not implemented yet.

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.5 – How to: Target Acquisition, Ranging & Storing using FCR

1. Power up the FCR as shown previously.
2. *[P/CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
3. *[P/CPG]* Set Sight Selector Switch – LEFT (FCR)
4. *[P/CPG]* Set FCR Mode Selector – FWD (GTM)



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

3

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

Collective

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

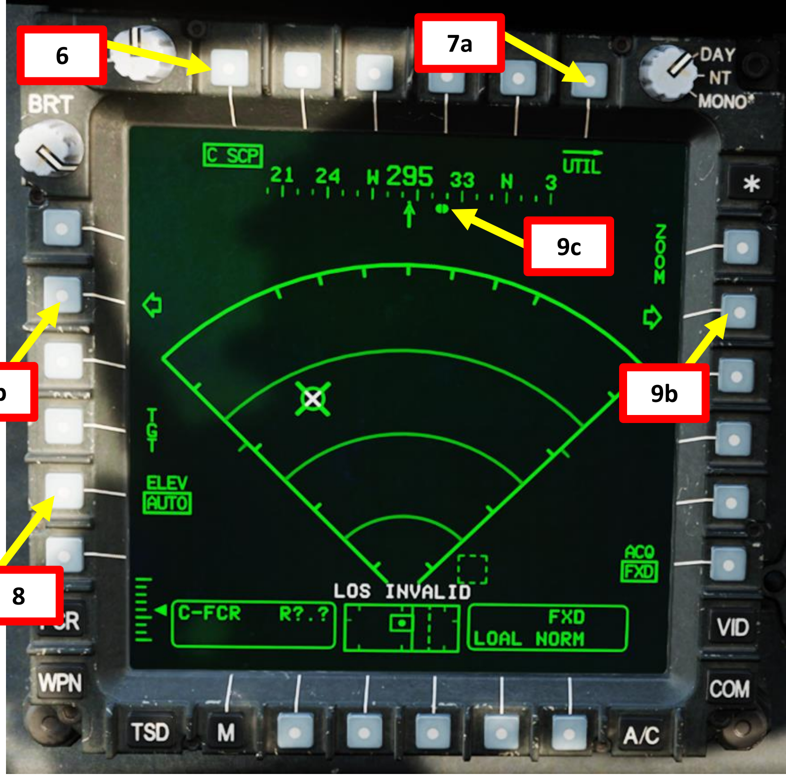
4

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

3

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.5 – How to: Target Acquisition, Ranging & Storing using FCR



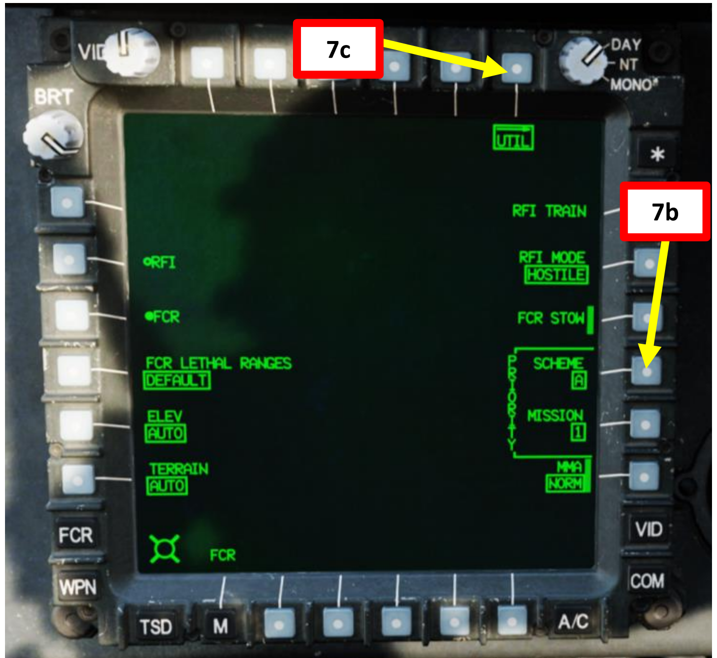
5. [P/CPG] If desired, enable TSD ATK (Tactical Situation Display Attack) mode in order to display FCR symbology on the TSD page.
6. [P/CPG] Enable (box) C-SCP (C-Scope) if desired. This will display FCR Symbology on the Helmet-Mounted Display and TDU (TADS Display Unit).
7. [P/CPG] From the FCR UTIL (Utility) page, select desired Priority Scheme.
    - Scheme A: Stationary ground targets and airborne targets are prioritized over moving ground targets.
    - Scheme B: Stationary ground targets will be prioritized over moving round targets or airborne targets.
    - Scheme C: Moving ground targets and airborne targets will be prioritized over stationary ground targets.
8. [P/CPG] Set FCR Elevation – As desired. We will leave it to AUTO.
9. Adjust FCR Azimuth as desired by either:
    a) [CPG] Using the Sight Manual Tracker (MAN TRK) Switch if the FCR is de-slaved from the CPG's acquisition source, or;
    b) [P/CPG] Using the FCR Centerline Steering Arrows on the FCR page.
10. [P/CPG] Set FCR Scan Field-of-View – As desired.

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

Sight Slave Button

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"



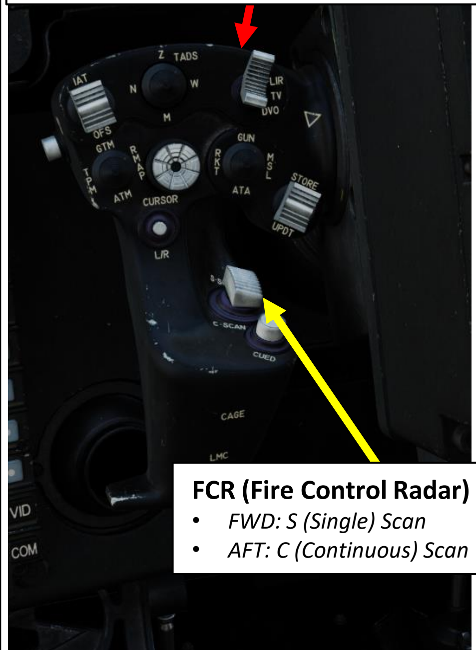
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.5 – How to: Target Acquisition, Ranging & Storing using FCR

11. *[P/CPG] If the target is already detected using another sensor onboard the aircraft and you want to reduce the time necessary to bring the FCR towards the intended FCR scan area, select desired acquisition source and slave the fire control radar to it. In this example, we will leave ACQ to FXD (Fixed).
    - Note: Setting another sensor as the acquisition source and enabling the SLAVE function increases the efficiency of target acquisition using an FCR scanburst; especially when using narrow scan sizes.
12. [P/CPG] Use FCR Scan Control Switch to perform a scan.
    - Switch FWD: Single Scan
    - Switch AFT: Continuous Scan
13. [P/CPG] Targets are automatically detected, classified and prioritized by the FCR. The NTS (Next-to-Shoot) Target and ANTS (Alternate Next-to-Shoot) Target are automatically determined as priority targets.
14. [P/CPG] When the FCR is being utilized as the selected sight, only one range source is available, which is a range computed by the fire control radar (nm). The Radar range displayed within the crewmember's High Action Display will always reflect the slant range to the current Next-To-Shoot (NTS) target as selected on the FCR page.

Acquisition Source **11**
- *PHS (Pilot Helmet Sight)*
- *GHS (Gunner Helmet Sight)*
- *SKR (Tracking Missile Seeker)*
- *RFI (Radio Frequency Interferometer)*
- *FXD (Fixed Forward, aircraft centerline)*
- *W##, H##, C##, T## (Waypoint, Hazard, Control Measure or Target/Threat)*
- *TRN (Cursor-Selected terrain location on the TSD)*
- *TADS (Target Acquisition & Designation Sight)*

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



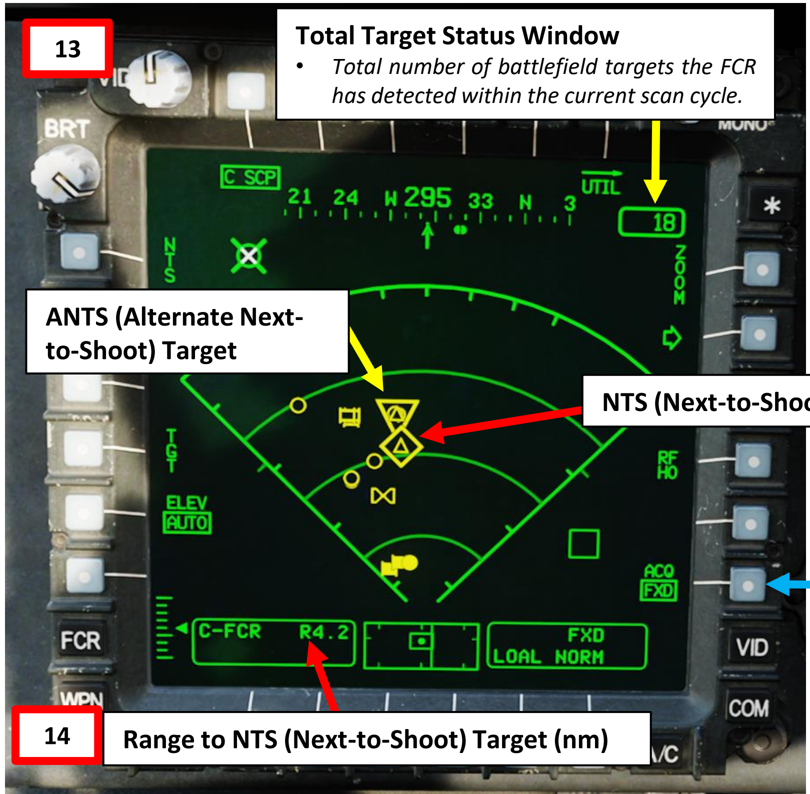
FCR (Fire Control Radar) Scan Control **12**
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Slave Button **11**

13

Total Target Status Window
- *Total number of battlefield targets the FCR has detected within the current scan cycle.*



ANTS (Alternate Next-to-Shoot) Target

NTS (Next-to-Shoot) Target

14 **Range to NTS (Next-to-Shoot) Target (nm)**

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.5 – How to: Target Acquisition, Ranging & Storing using FCR

To store a target:

15. *[P/CPG]* On FCR page, select TGT Format
16. *[P/CPG]* Move the cursor on the desired target symbol with the Cursor Control Switch (either on the TEDAC Left Hand Grip or on the Collective)
17. *[P/CPG]* Press DOWN on the Cursor Switch (ENTER).
18. *[P/CPG]* Cursor-selecting an FCR target symbol on the FCR page will store a Target (TG) point at that FCR target's location.
19. *[P/CPG]* On FCR page, exit TGT Format

- *[CPG]* Alternatively, the CPG may store the current Next-To-Shoot (NTS) target as a Target (TG) point without entering the FCR TGT format by pressing the **Store/Update switch** to the STORE (FWD) position on the TEDAC Left Handgrip while the FCR is the CPG's selected sight.

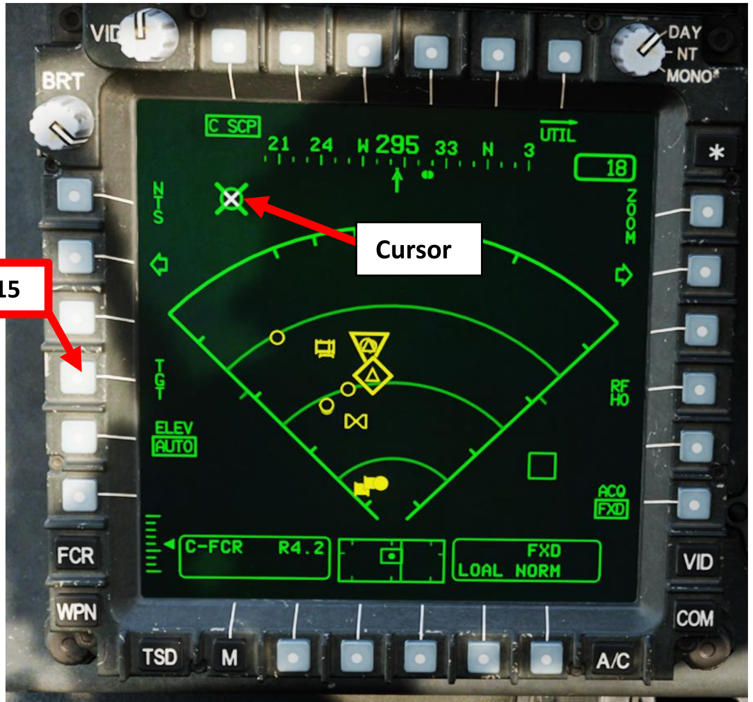
Note: If point indexes T01 through T49 within the TGT/THRT partition are already occupied with point data, Target points can no longer be stored from the FCR TGT format.

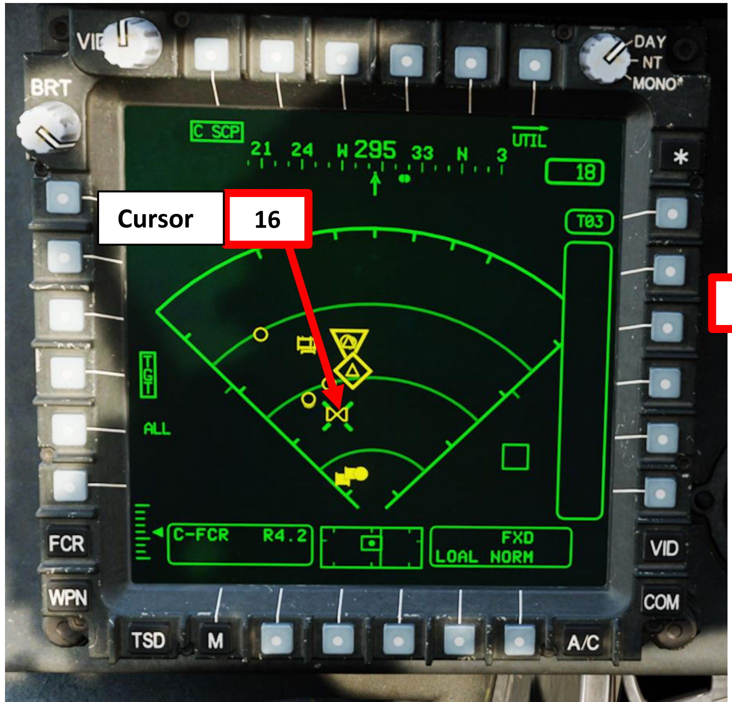
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

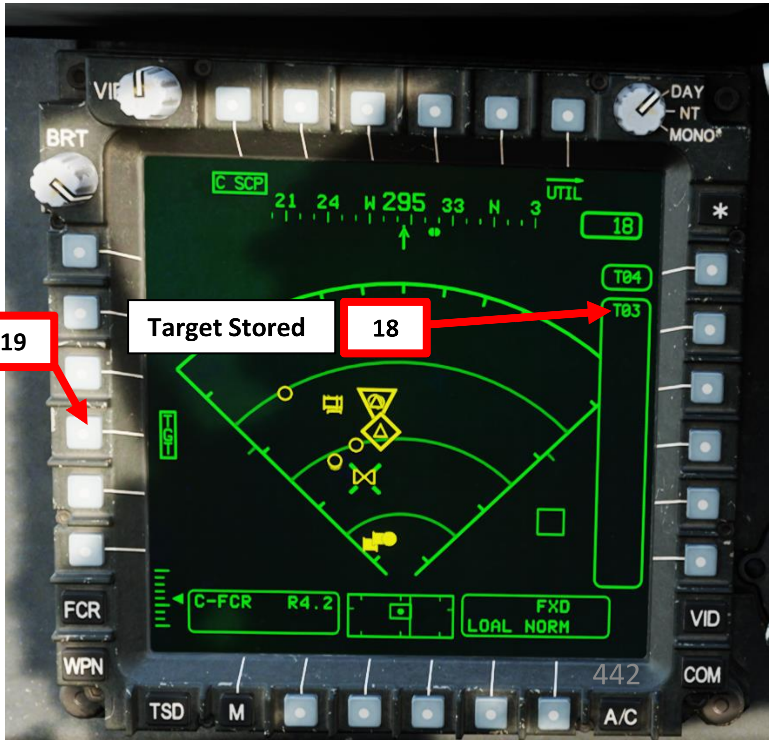
Store/Update Switch
- *Stores position information or performs position updates.*
  - *FWD: STORE, Stores selected sensor line-of-sight as a point*
  - *AFT: UPDATE, Performs a flyover or TADS position update.*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

16
17







5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.5 – How to: Target Acquisition, Ranging & Storing using FCR

To manually designate the NTS (Next-to-Shoot) Target:

20. *[P/CPG]* Move the cursor on the desired target symbol with the Cursor Control Switch (either on the TEDAC Left Hand Grip or on the Collective)
21. *[P/CPG]* Press DOWN on the Cursor Switch (ENTER).
22. *[P/CPG]* Cursor-selecting an FCR target symbol on the FCR page will set this new target as the Next-to-Shoot (NTS) Target. That target is then placed at the top of the High Priority Target List, and the previous target that had been manually designated as NTS is returned to its previous ranking.

- Alternatively, The NTS (Next-to-Shoot) and ANTS (Alternate Next-to-Shoot) may be manually sequenced by **pressing the NTS Select button on the FCR page**. Each time this button is pressed, the NTS and ANTS designations will sequence to the next targets on the High Priority Target List.

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

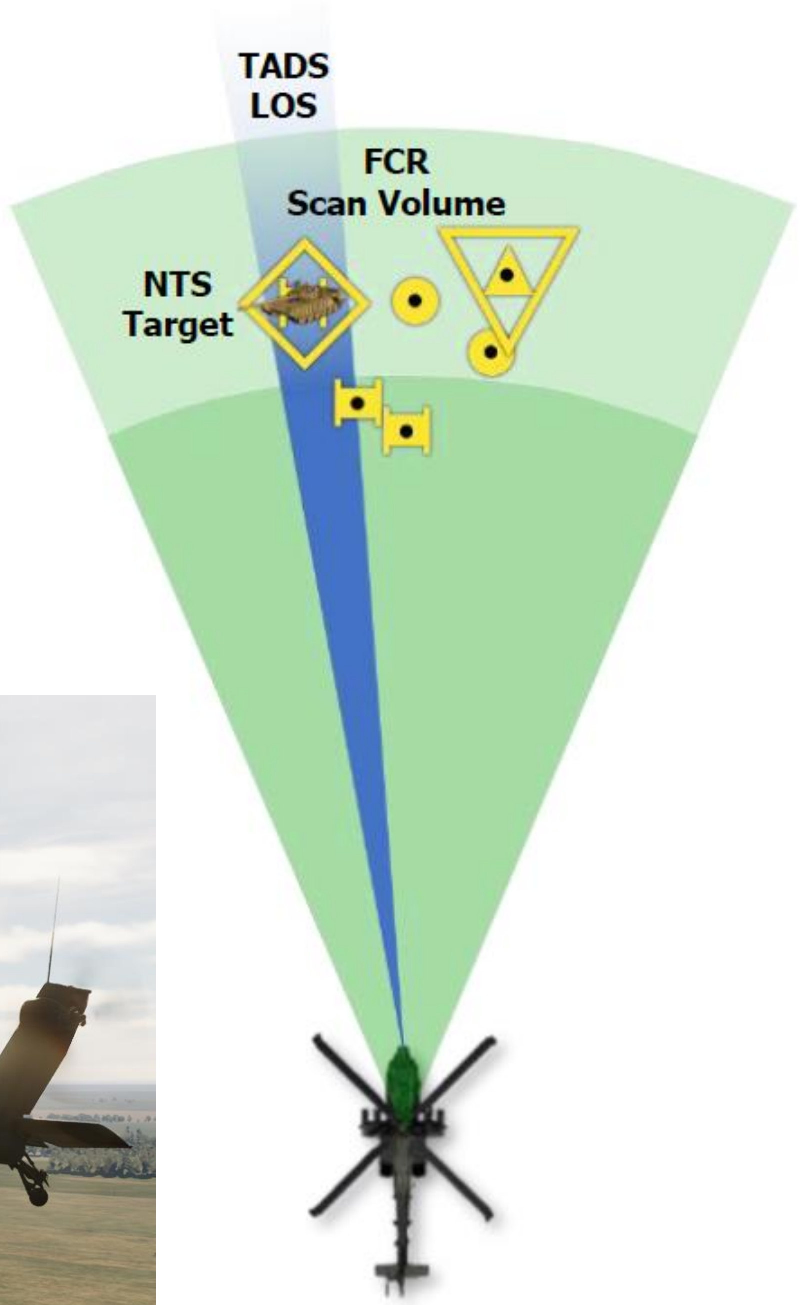
20
21

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

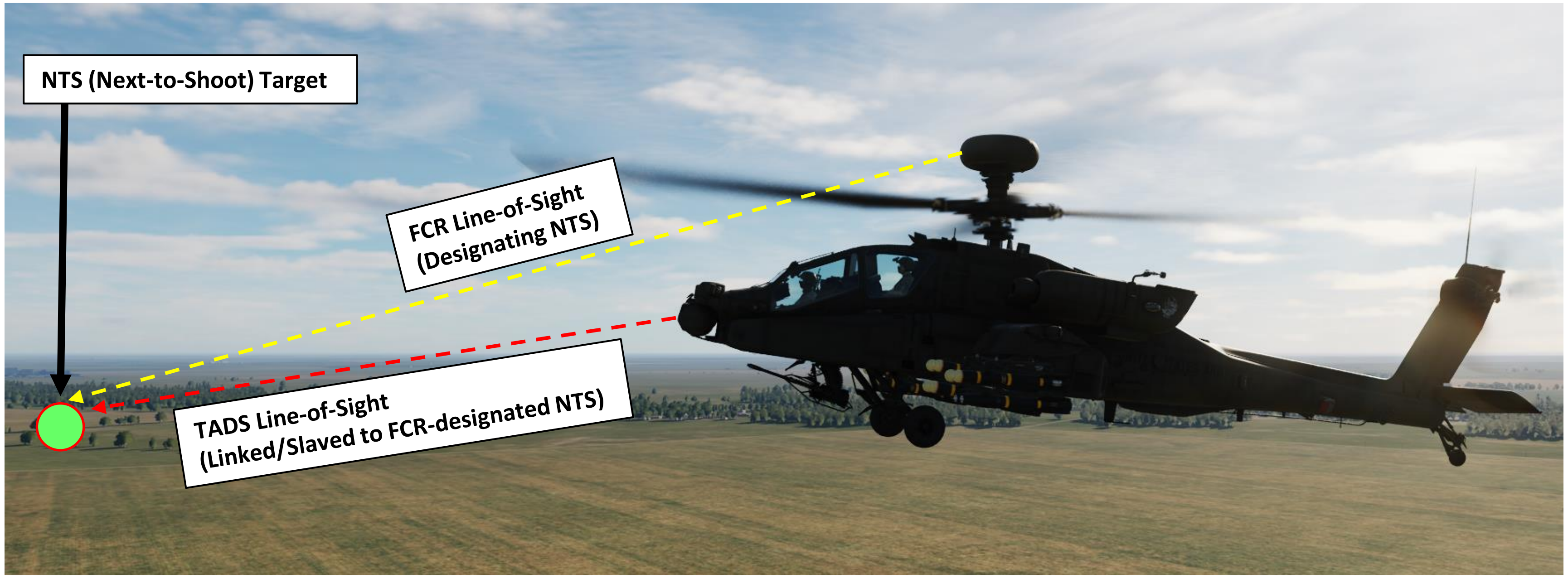
5.6 – Linking Sights

5.6.1 – Linking TADS to FCR-Designated Target (NTS, Next-To-Shoot)

The FCR by itself is not sufficient to properly identify a target; you should always verify that what you have selected as the NTS (Next-To-Shoot) Target is what you really want to throw expensive radar-guided missiles at. In order to visually confirm what a target really is, it is possible to slave/link the TADS (Target Acquisition & Designation Sight) to your FCR NTS.



TADS Linked to FCR NTS Target



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.1 – Linking TADS to FCR-Designated Target (NTS, Next-To-Shoot)

In this example, the CPG will link the TADS to the FCR NTS Target:

1. Power up the TADS & FCR.
2. *[CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
3. *[CPG]* Set Sight Selector Switch – LEFT (FCR)
4. *[CPG]* Set FCR Mode Selector – FWD (GTM)
5. *[CPG]* Enable (box) C-SCP (C-Scope) if desired. This will display FCR Symbology on the Helmet-Mounted Display and TDU (TADS Display Unit).
6. *[CPG]* Use FCR Scan Control Switch to perform a scan.
    - Switch FWD: Single Scan
    - Switch AFT: Continuous Scan

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

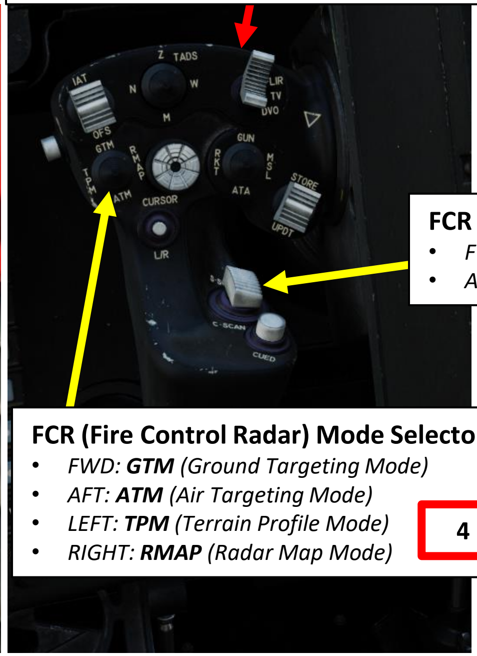
3

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

Collective

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



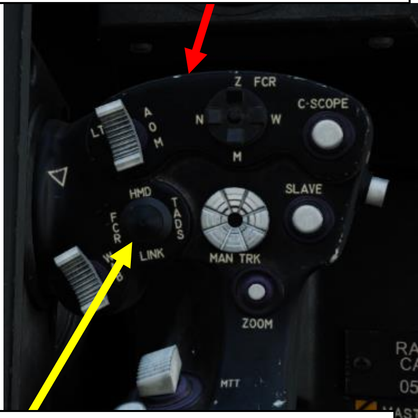
FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

6

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

4

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

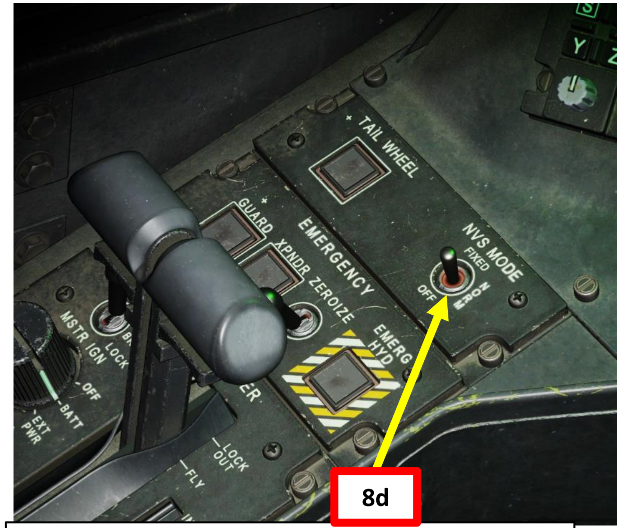
3

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.1 – Linking TADS to FCR-Designated Target (NTS, Next-To-Shoot)

7. *[CPG]* Targets are automatically detected, classified and prioritized by the FCR. The NTS (Next-to-Shoot) Target and ANTS (Alternate Next-to-Shoot) Target are automatically determined as priority targets. We will assume the NTS we obtained is the target we want to link the TADS to in order to better identify it.
8. *[CPG]* Prior to linking the TADS to the FCR, verify that all the following conditions are met:
   a) A NTS target has been designated by the FCR.
   b) Your selected sight is not the HMD (Helmet-Mounted Display).
   c) Your acquisition source is not set to TADS.
   d) Either crewmember's NVS Mode switch is set to NORM or FIXED with TADS as the selected NVS sensor.
9. *[CPG]* Set Sight Selector Switch – AFT (LINK)
10. *[CPG]* The TADS will slew towards the NTS (Next-to-Shoot) Target designated by the FCR.

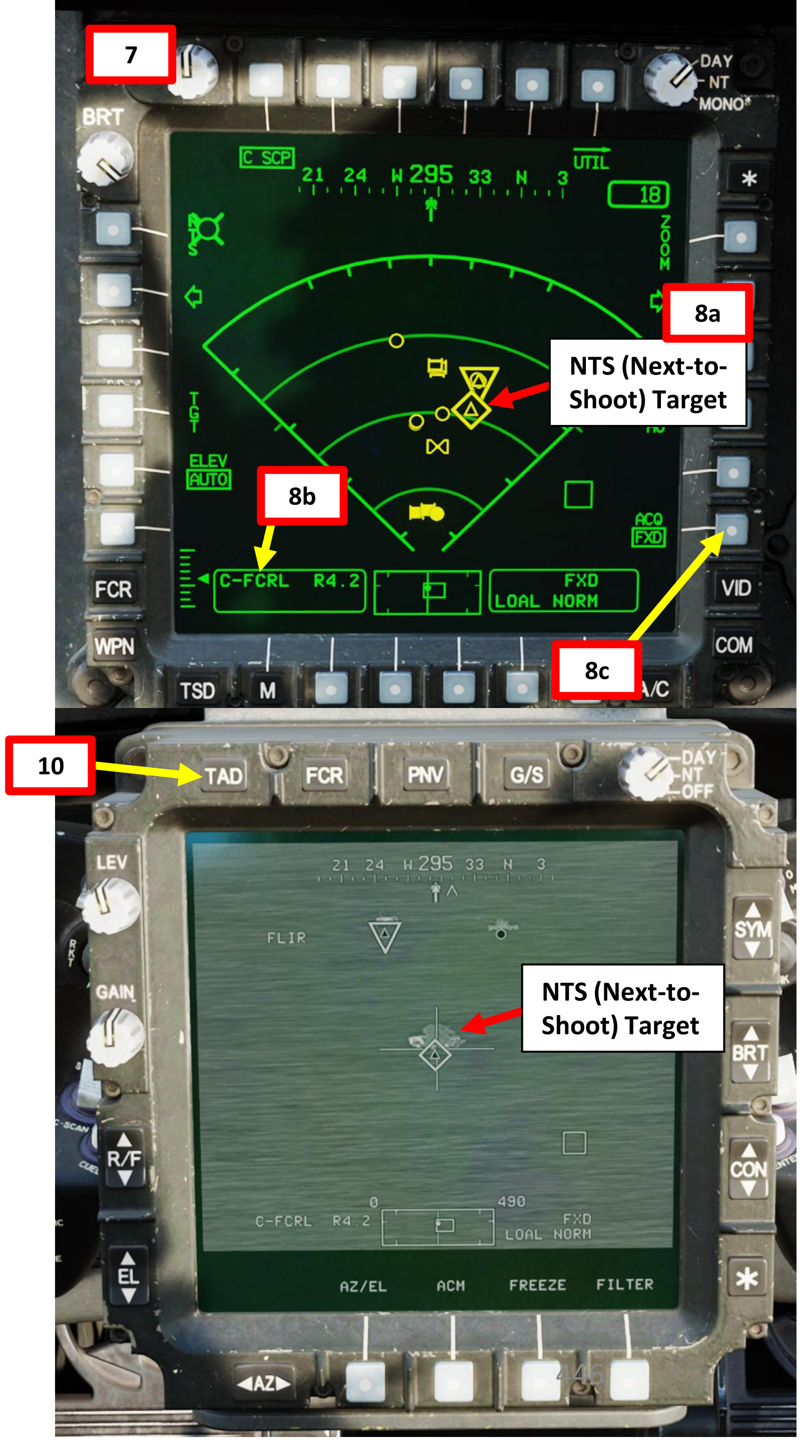


Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED*
- *MIDDLE: NORM*
- *AFT: OFF*

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

9

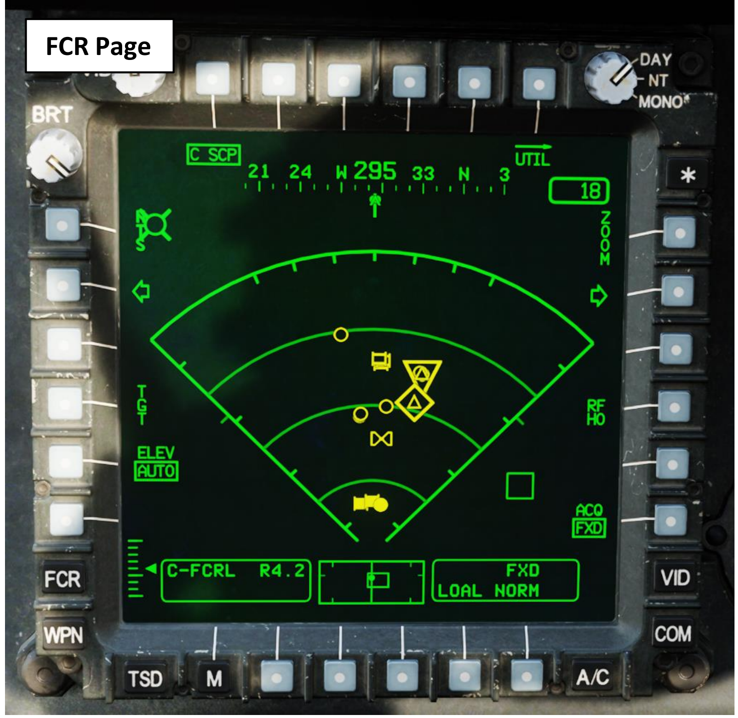


5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

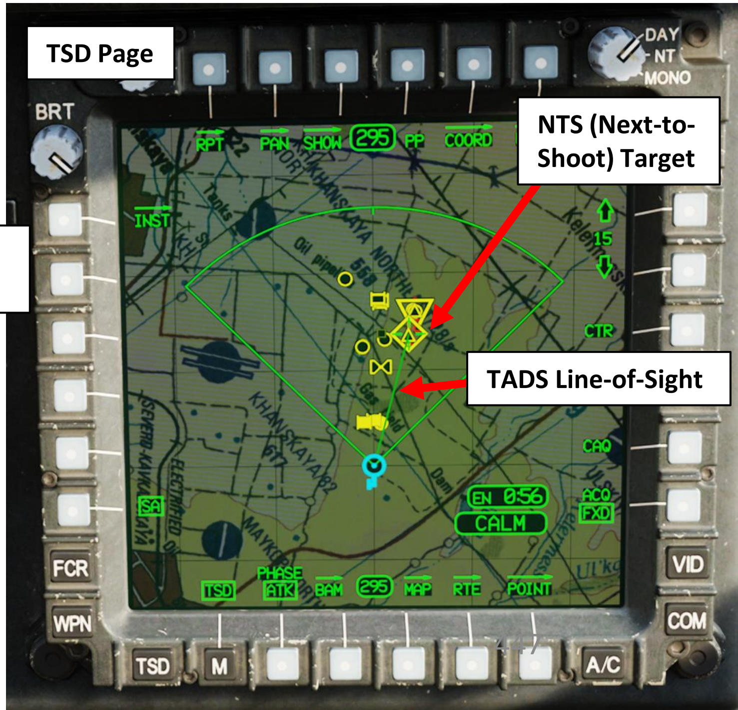
5.6 – Linking Sights

5.6.1 – Linking TADS to FCR-Designated Target (NTS, Next-To-Shoot)

11. *[CPG]* If the TADS is already linked to the FCR and a new scanburst is commanded, the TADS will remain linked but will return to the fixed forward position until a new NTS target is designated.
12. *[CPG]* When the TADS is linked to the FCR, the TADS will default to a Medium FOV (field-of-view) if the selected sensor is FLIR, or Wide FOV if the selected sensor is DTV. If the aircraft and/or target are moving, this helps ensure the CPG is able to visually acquire the target within the TADS video, and subsequently stabilize the TADS on target, before the target exits the selected sensor's FOV.
13. *[CPG]* When linked to the FCR NTS target, the TADS laser rangefinder/designator (LRFD) will be inhibited from firing and the Laser Spot Track (LST) and Image Auto-Track (IAT) functions will be overridden and disabled. However, the TADS will still attempt to maintain any tracks that remain within its optical field-of-view while linked to the FCR.
14. *[CPG]* After the TADS line-of-sight has been linked to the FCR NTS target, the CPG may press the Sight Slave button on the TEDAC Right Handgrip, which will de-slave the TADS and enable the Sight Manual Tracker, allowing the CPG to manually slew the TADS as normal.



TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.1 – Linking TADS to FCR-Designated Target (NTS, Next-To-Shoot)

15. *[CPG]* The following TADS controls on the TEDAC handgrips will remain operational in the CPG crewstation while the TADS is linked to the FCR.
    - TADS Sensor Select Switch
    - TADS Field-of-View Select Switch
    - IAT/OFS Switch
    - LMC (Linear Motion Compensator) Button
    - FLIR Polarity Button
    - Sight Slave Button.
16. *[CPG]* If any of the following criteria are met within the crewstation that selected LINK, LINK will be disabled and the TADS will return to the fixed forward position.
    - The crewmember re-selects LINK while the TADS is already linked to the FCR NTS target.
    - The crewmember selects HMD as the sight.
    - The crewmember selects a different acquisition source.

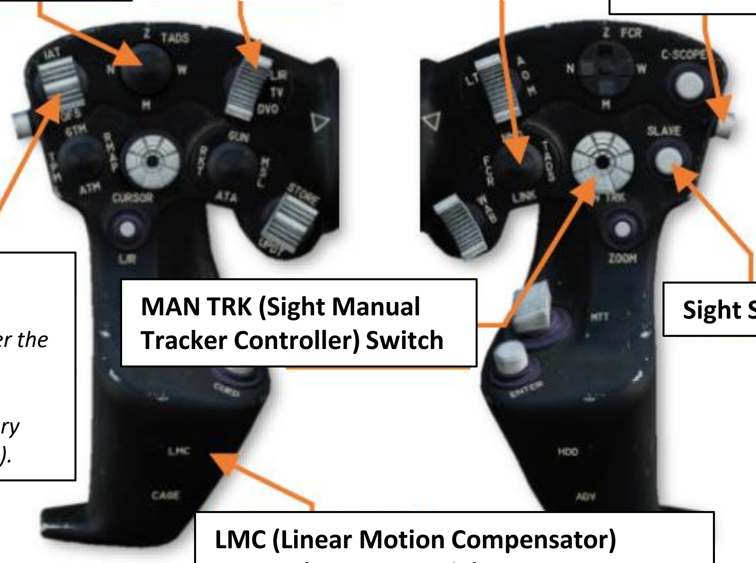
    Note: Alternatively, the CPG may press the Sight Select switch to the TADS position to disable LINK and take control of the TADS as the selected sight to independently track, lase, and engage targets as necessary.

TADS Sensor Select Switch
- *Selects the optical sensor used for TADS. No function if the TADS is being used by either crewmember as an NVS sensor.*
    - *FWD: FLIR (Forward-Looking Infrared) used by TADS*
    - *MIDDLE: DTV (Daytime Television) Sensor*
    - *AFT: DVO, no function.*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

TADS (Target Acquisition & Designation Sight) FOV (Field-of-View) Selector
- *FWD: Z (Zoom FOV)*
- *AFT: M (Medium FOV)*
- *LEFT: N (Narrow FOV)*
- *RIGHT: W (Wide FOV)*

FLIR Polarity Button
- *Toggles FLIR (Forward-Looking Infrared) image polarity (black-hot or white-hot).*



IAT/OFS Switch
- *FWD: IAT (Image Auto-Track)*
    - *Short Press: Enables image-auto track and establishes the object under the cursor as the primary track.*
    - *Long Press: Activates manual sizing of the tracking gates.*
- *AFT: OFS (Offset). When offset tracking, returns TADS Line-of-Sight to the primary track. When not offset tracking, deletes the current track (primary or secondary).*

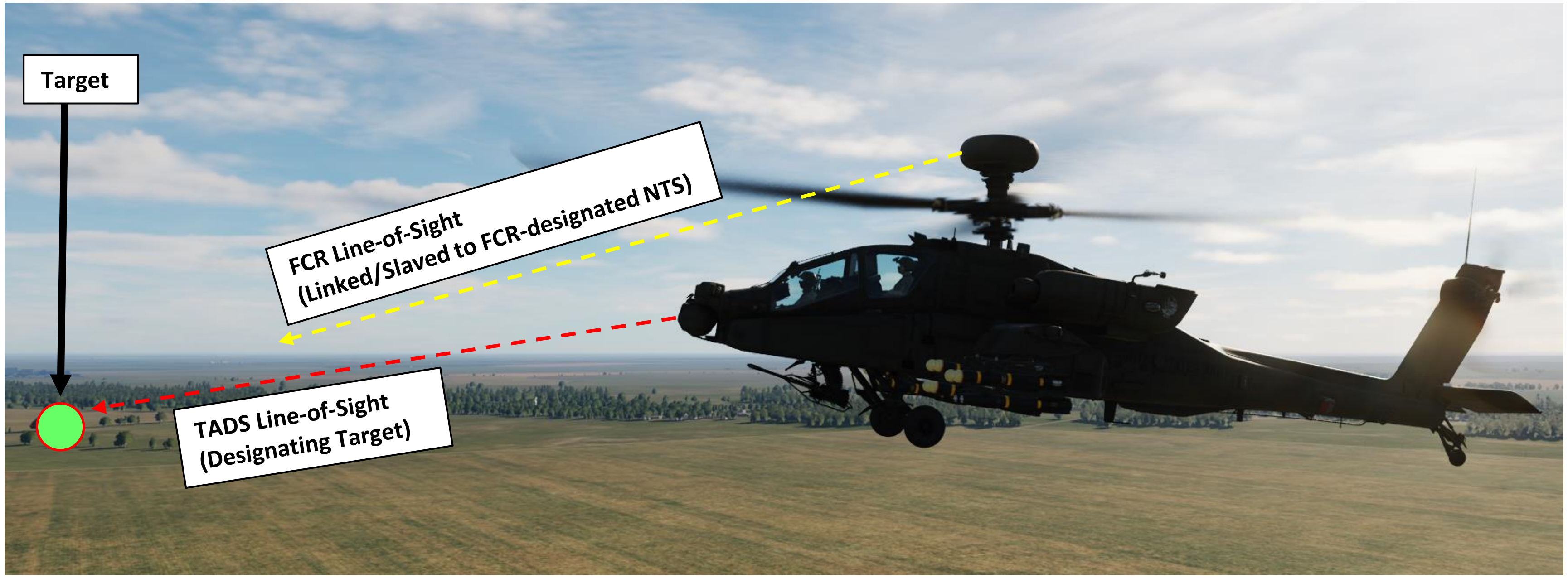
MAN TRK (Sight Manual Tracker Controller) Switch

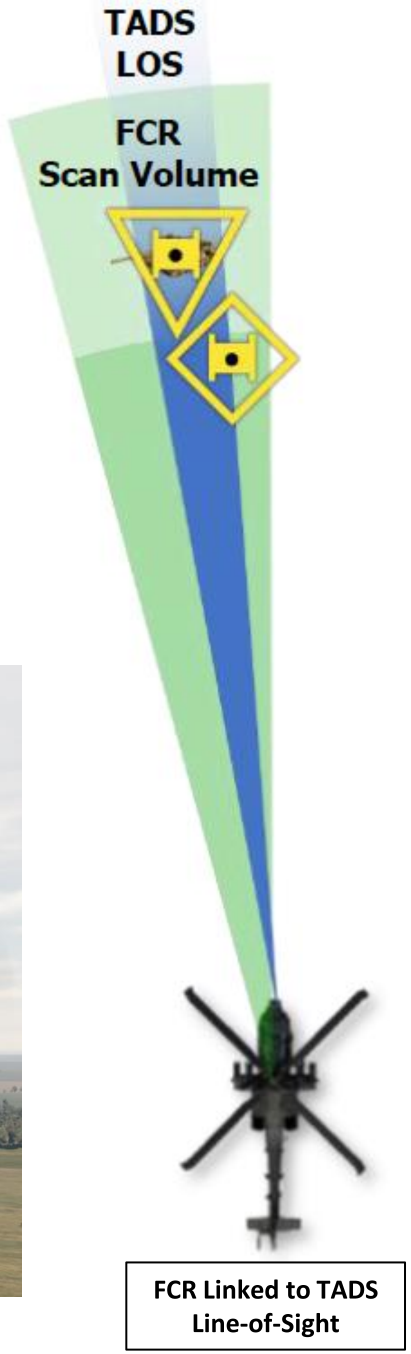
Sight Slave Button

LMC (Linear Motion Compensator) Button (Opposite Side)
- *Toggles the linear motion compensator (LMC) during manual tracking. Compensates for helicopter and/or target movement.*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.6 – Linking Sights
5.6.2 – Linking FCR to TADS Line-of-Sight

When a target is designated with the TADS (Target Acquisition & Designation Sight), it is possible to direct FCR scan volume to the area near the designated target. This allows the crew to have a more accurate picture of the whole battlefield.





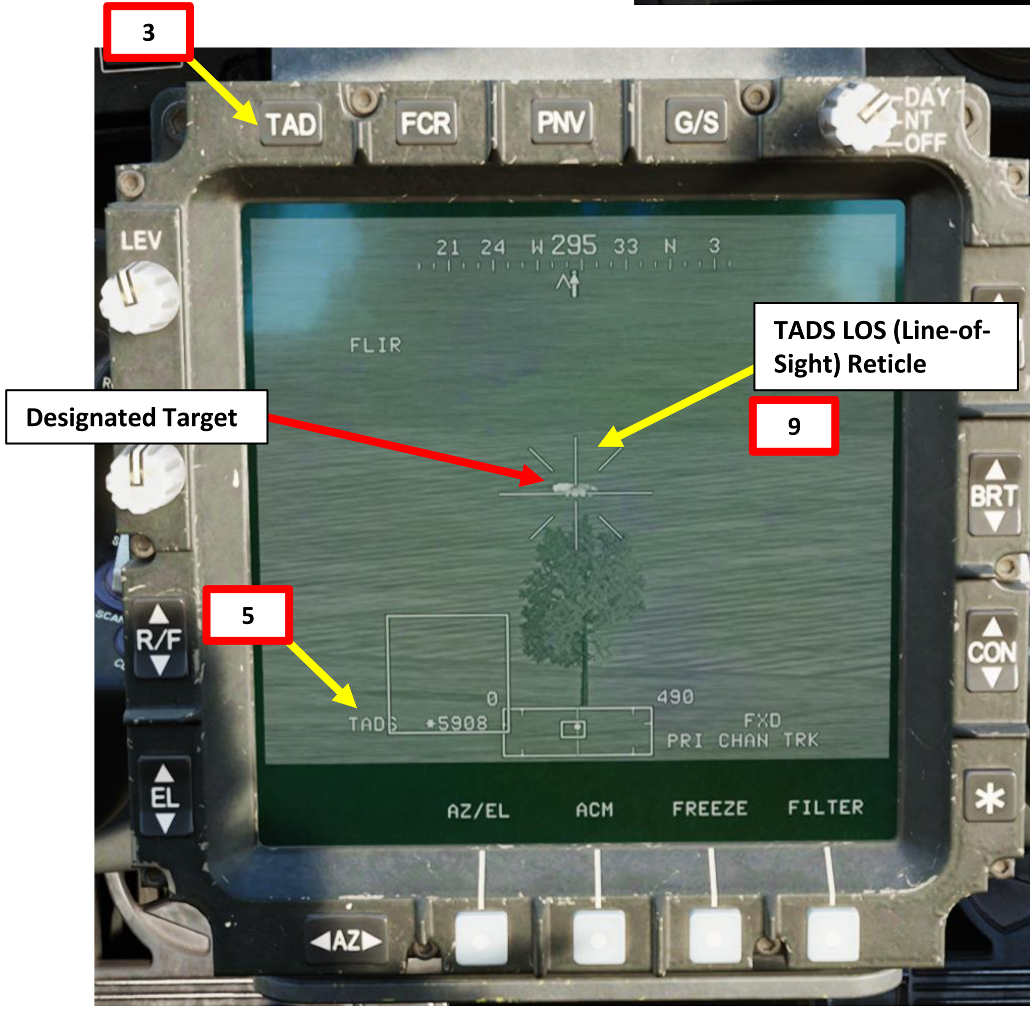
5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.2 – Linking FCR to TADS Line-of-Sight

In this example, the CPG will link the FCR scan volume to the TADS Line-of-Sight:

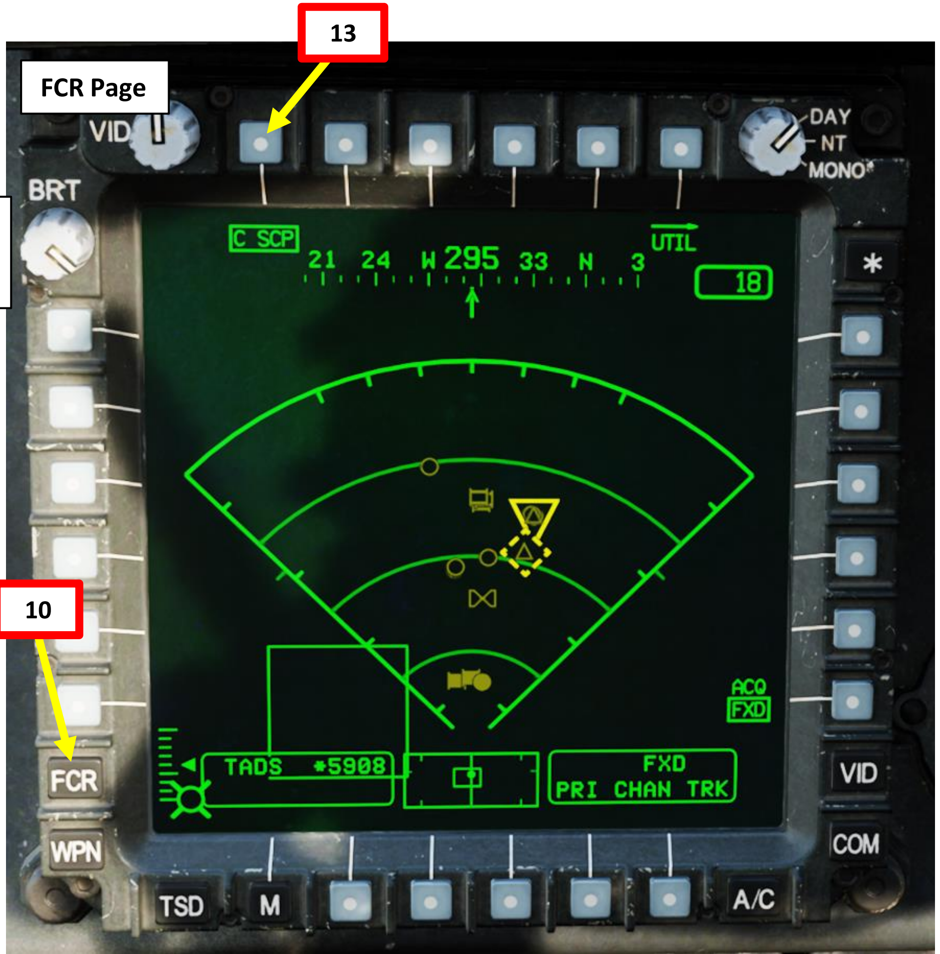
1. Power up the TADS & FCR.
2. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[CPG]* Select TADS video feed source by pressing the TAD button.
4. *[CPG]* Set Sight Selector Switch – RIGHT (TADS)
5. *[CPG]* Confirm the selected sight is the TADS.
6. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
7. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
8. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
9. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
   - First detent held: LRFD determines the target range
   - Second detent held: LRFD determines target range and designates target for laser guidance.



TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)
5.6 – Linking Sights
5.6.2 – Linking FCR to TADS Line-of-Sight

10. *[CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
11. *[P/CPG]* If desired, enable TSD ATK (Tactical Situation Display Attack) mode in order to display FCR symbology on the TSD page.
12. *[CPG]* Set FCR Mode Selector – FWD (GTM)
13. *[CPG]* Enable (box) C-SCP (C-Scope) if desired. This will display FCR Symbology on the Helmet-Mounted Display and TDU (TADS Display Unit).



5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.2 – Linking FCR to TADS Line-of-Sight

14. *[CPG]* Prior to linking the FCR to the TADS, verify that all the following conditions are met:
    a) Your selected sight is not the HMD (Helmet-Mounted Display).
    b) Your acquisition source is not set to FCR.
    c) Either crewmember's NVS Mode switch is set to NORM or FIXED with TADS as the selected NVS sensor.

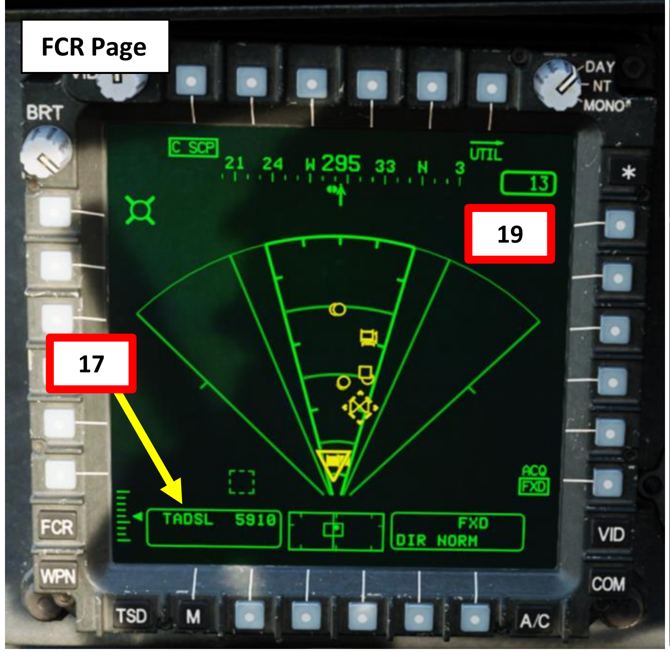
Pilot NVS (Night Vision System) Mode Switch
- *FWD: FIXED*
- *MIDDLE: NORM*
- *AFT: OFF*

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.2 – Linking FCR to TADS Line-of-Sight

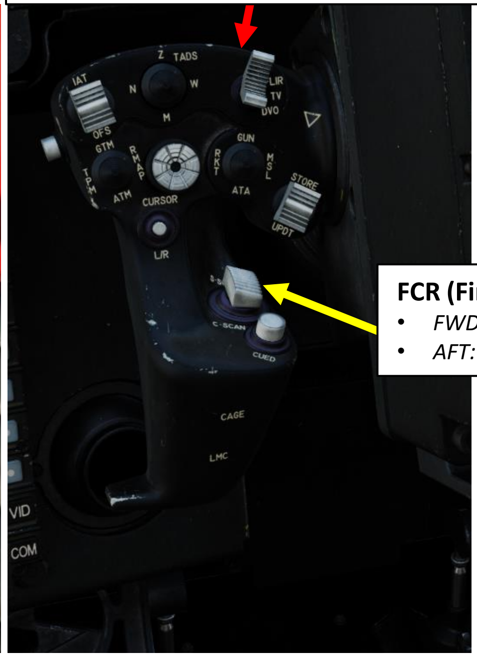
15. *[CPG]* Set Sight Selector Switch – AFT (LINK)
16. *[CPG]* Set FCR Scan Field-of-View – NARROW (LEFT) or ZOOM (FWD).
17. *[CPG]* The FCR centerline will be linked to the azimuth of the TADS line-of-sight (LOS). "TADSL" will be displayed in the Sight Select Status field of the High Action Display in the CPG crewstation.
18. *[CPG]* Use FCR Scan Control Switch to perform a scan.
    - Switch FWD: Single Scan
    - Switch AFT: Continuous Scan
19. *[CPG]* Targets are automatically detected, classified and prioritized by the FCR. The NTS (Next-to-Shoot) Target and ANTS (Alternate Next-to-Shoot) Target are automatically determined as priority targets.



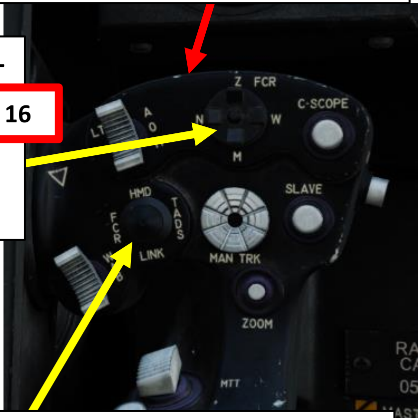
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

15

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

16

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

18

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

15

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.2 – Linking FCR to TADS Line-of-Sight

20. *[CPG]* If necessary, the CPG may perform more FCR scans while it is still linked to the TADS, allowing the crew to detect and acquire additional targets along the azimuth of the TADS line-of-sight, or to hand off a target acquired within the TADS field-of-view to the FCR for engagement. However, such procedures are most effective when C-Scope has been enabled to allow the CPG to correlate the FCR target symbols with those seen within the TADS sensor video.

5 – AN/APG-78 FCR (FIRE CONTROL RADAR)

5.6 – Linking Sights

5.6.2 – Linking FCR to TADS Line-of-Sight

21. *[CPG]* The following TADS controls on the TEDAC handgrips will remain operational in the CPG crewstation while the FCR is linked to the TADS.
    - FCR Mode Selector
    - FCR Scan Field-of-View Size Selector
    - FCR Scan Size Select Switch
    - FCR Zoom Button
22. *[CPG]* If any of the following criteria are met within the crewstation that selected LINK, LINK will be disabled and the FCR will return to the fixed forward position.
    - The CPG re-selects LINK while the FCR is already linked to the TADS line-of-sight.
    - The CPG selects HMD as the sight.
    - The CPG selects a different acquisition source.

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

FCR (Fire Control Radar) C-Scope Button

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

FCR (Fire Control Radar) Scan Control
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

FCR (Fire Control Radar) Zoom Button
- *Changes the FCR targeting format to a 6× zoom, centered around the Next-To-Shoot (NTS). A second press restores the normal FCR format.*

6 – AN/APR-48A RFI (RADIO FREQUENCY INTERFEROMETER)

Not Implemented Yet

SECTION SUMMARY

1 – INTRODUCTION
1.1 – Armament Introduction

The AH-64 may seem like a complicated weapon platform at first, but its operation is relatively simple. Here are a few things to remember:

- The main duty of the pilot is to fly the helicopter towards the target, manage countermeasure programs and perform attack profiles.
- The main duty of the Co-Pilot/Gunner (CPG) is to power up and operate sensors (like the TADS, or Target Acquisition and Designation Sight), designate and store targets, and operate guided weapons like the Hellfire missile.
- Weapon Master Arm control is available in both the pilot and co-pilot/gunner cockpits, which means either crew member can launch weapons. Keep in mind that ultimately, target designation with the TADS is the Co-Pilot's job.
- In case the pilot is incapacitated, it is possible for the co-pilot/gunner to fly the helicopter and to employ unguided weapons.
- The key to operate the AH-64 successfully is efficient communication between both crew members.

1 – INTRODUCTION
1.2 – Armament Overview

The AH-64 has three primary weapons at its disposal:

- The M139 **Area Weapon System (AWS)**, which has a hydraulically steered M230 30 mm chain-driven gun
- The M261 **Aerial Rocket Sub-System (ARS)**
- The **Longbow Hellfire Modular Missile System (LBHMMS)**, which allows employment of the AGM-114 Hellfire Missile

1 – INTRODUCTION
1.2 – Armament Overview

CANNON	
NAME	DESCRIPTION
M139 AWS (Area Weapon System) M230 30 mm Chain-Driven Gun	30 mm flexible chain-driven gun (300 rounds if Internal Auxiliary Fuel System (IAFS) or « Robbie Tank » is installed, 1200 rounds if IAFS is not installed). Ammunition available: • **M789 HEDP** (High Explosive Dual Purpose) • **M788 TP** (Target Practice) rounds.

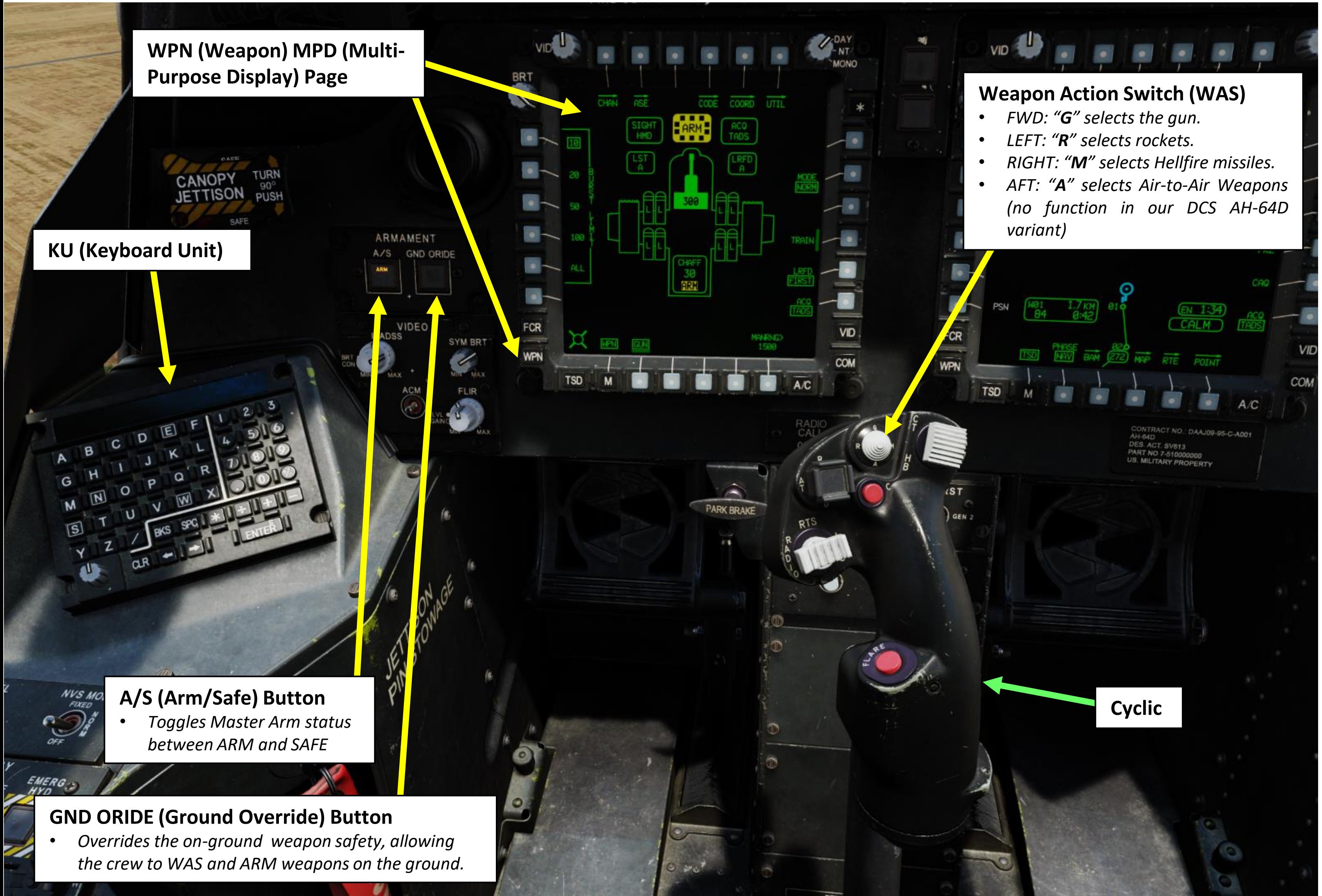
ROCKETS	
NAME	DESCRIPTION
M261 ARS (Aerial Rocket Sub-System) Hydra 70 Rockets (2.75 in / 70 mm)	19 x Hydra 70 (2.75 in / 70 mm) Rockets Rocket types available: • **M151 HE**: « 10-pounder » high explosive, good against lightly armored and soft targets, comes with both M423 point-detonating (PD) and M433 resistance-capacitance (RC) programmable delay fuzes. • **M156**: White Phosphorus, nicknamed « Willy Pete »), used for target marking, comes with M423 PD (Point-Detonating) fuze • **M229 HE**: « 17-pounder » high explosive aerial artillery, comes with both M423 point-detonating (PD) and M433 resistance-capacitance (RC) programmable delay fuzes • **M257 IL**: Illumination rockets • **M259**: White Phosphorus, nicknamed « Willy Pete », used for smoke screen concealment, comes with M439 variable time delay fuze • **M261 MPSM**: Multi-purpose sub-munition, used against lightly- to medium-armored vehicles and soft targets, comes with an M439 variable time delay fuze for an airburst just prior to the target. • **M264**: Red Phosphorus, used for smoke screen, comes with M439 variable time delay fuze • **M274 TP-SM « blue spear »**: training rocket that produce a brief smoke signature for target practice. • **M282 MPP**: Multi-purpose penetrator, used against lightly armored vehicles and bunkers, comes with a modified M423 fuze providing a fixed delay for penetration effects.

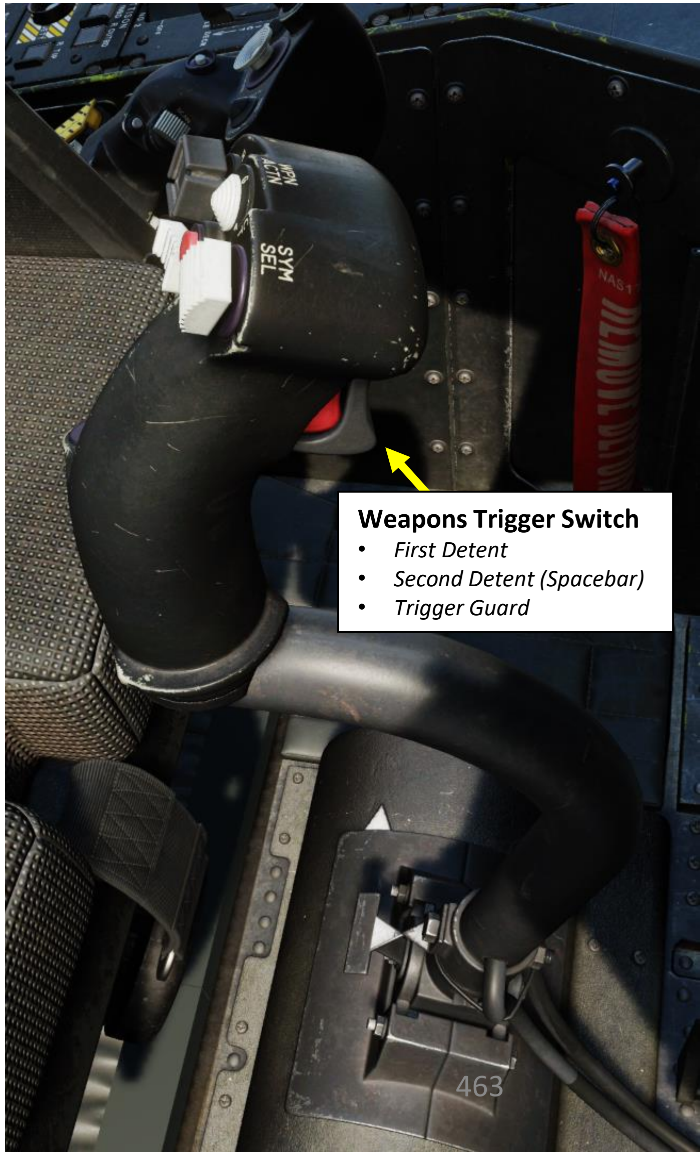
1 – INTRODUCTION
1.2 – Armament Overview

AIR-TO-GROUND MISSILES	
NAME	DESCRIPTION
AGM-114K (Laser-Guided)	Semi-active laser-homing anti-ground and anti-armor missile, with a 20 lbs high-explosive anti-tank (HEAT) warhead, which includes a tandem shaped-charge for defeating reactive armor. The missile can be laser-guided by the copilot-gunner looking with the TADS LRFD (Laser Range-Finder/Designator) or another laser designator. • Note: The M299 four-rail missile launcher can fire all variants of the Hellfire missile.
AGM-114L (Radar-Guided)	Active radar-guided, anti-ground and anti-armor missile, with a 20 lbs high-explosive anti-tank (HEAT) warhead, which includes a tandem shaped-charge for defeating reactive armor. This variant is a fire-and-forget weapon. • Note: The M299 four-rail missile launcher can fire all variants of the Hellfire missile.

1 – INTRODUCTION
1.3 – Weapon Interface (Pilot)

The pilot uses the **WPN MPD page** to configure weapons, and the **KU (Keyboard Unit)** is used to input certain parameters. The **WAS (Weapon Action Switch)** on the **cyclic** is used for weapon selection. Weapon release is performed with the **Weapons Trigger Switch**, which has two stages and a trigger guard. The **A/S (Arm/Safe) Button** is used as a "Master Arm".





1 – INTRODUCTION
1.3 – Weapon Interface (Pilot)

Sight selection is performed with the **Sight Selector Switch** on the **collective**. In certain situations, the **IHADSS** (Integrated Helmet and Display Sighting System) Monocle can be used to aim weapons with.

The **High Action Display (HAD)** displays symbology used mainly for targeting and weapon employment. It also provides additional information such as the selected sight and selected acquisition source.

Collective

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

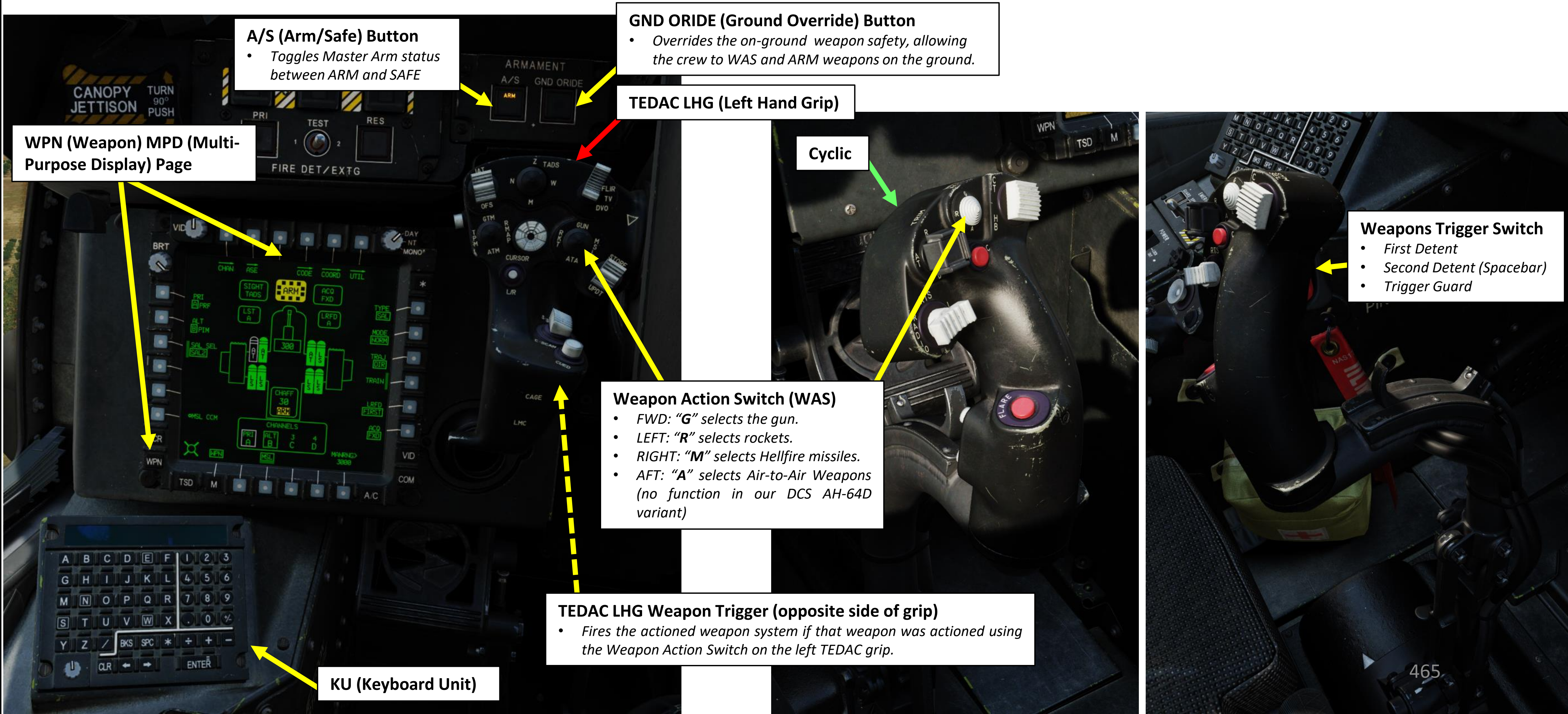
IHADSS (Integrated Helmet and Display Sighting System) Monocle

High Action Display

1 – INTRODUCTION

1.4 – Weapon Interface (Co-Pilot/Gunner)

The co-pilot uses the **WPN MPD page** to configure weapons, and the **KU (Keyboard Unit)** is used to input certain parameters. The **WAS (Weapon Action Switch)** on the **cyclic** is used for weapon selection, but there is also a WAS selector on the **TEDAC Left Hand Grip**. Weapon release is performed with the **Weapons Trigger Switch**, which has two stages and a trigger guard (available on both the **cyclic** and **TEDAC Left Hand Grip**). The **A/S (Arm/Safe) Button** is used as a “Master Arm”.



1 – INTRODUCTION
1.4 – Weapon Interface (Co-Pilot/Gunner)

The **TADS** (Target Acquisition and Designation Sight) is the main sensor of the AH-64 and is controlled by the CPG (Co-Pilot/Gunner). The main controls for the TADS are located on the **Left and Right TEDAC grips,** including weapon controls as well. Some TADS functions are also duplicated on the collective as well.

TDU (TEDAC Display Unit)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

TEDAC RHG (Right Hand Grip)

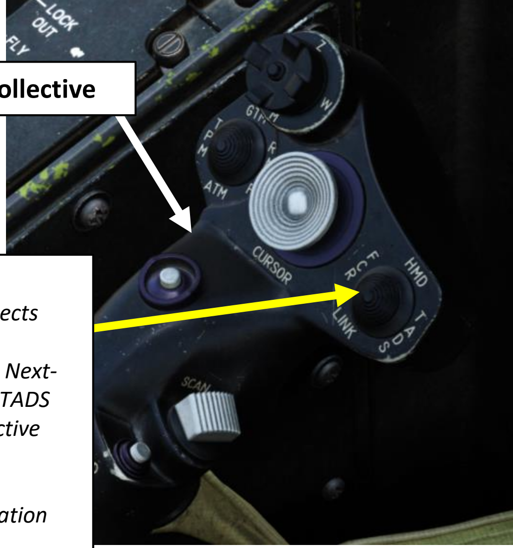
TEDAC LHG (Left Hand Grip)

1 – INTRODUCTION
1.4 – Weapon Interface (Co-Pilot/Gunner)

Sight selection is performed with the **Sight Selector Switch** on the **collective**, but there is also a Sight selector switch on the **TEDAC Right Hand Grip**.

In certain situations, the **IHADSS** (Integrated Helmet and Display Sighting System) Monocle can be used to aim weapons with.

TEDAC RHG (Right Hand Grip)



Collective

Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

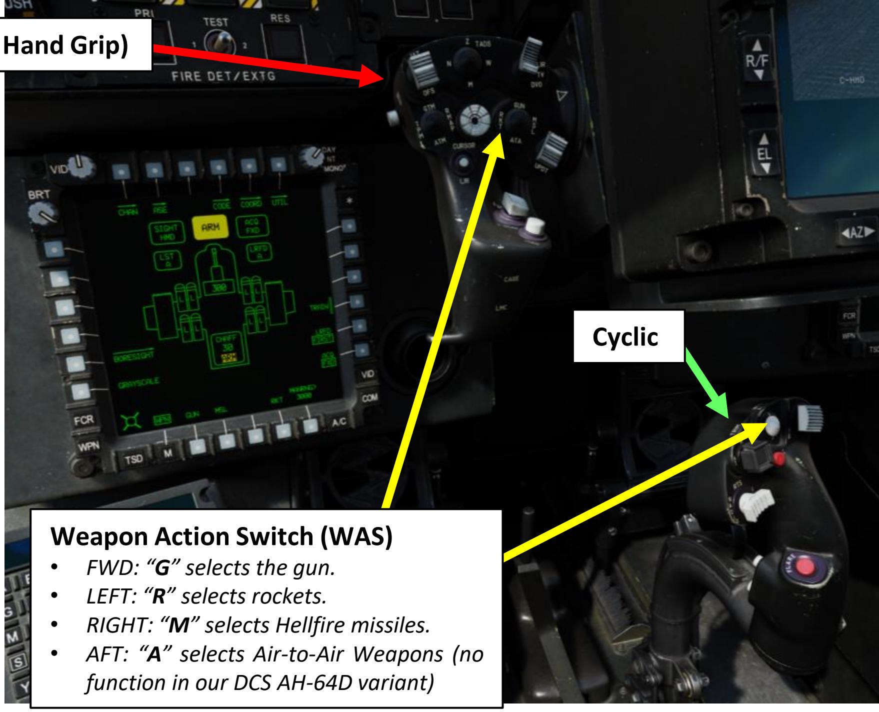
IHADSS (Integrated Helmet and Display Sighting System) Monocle

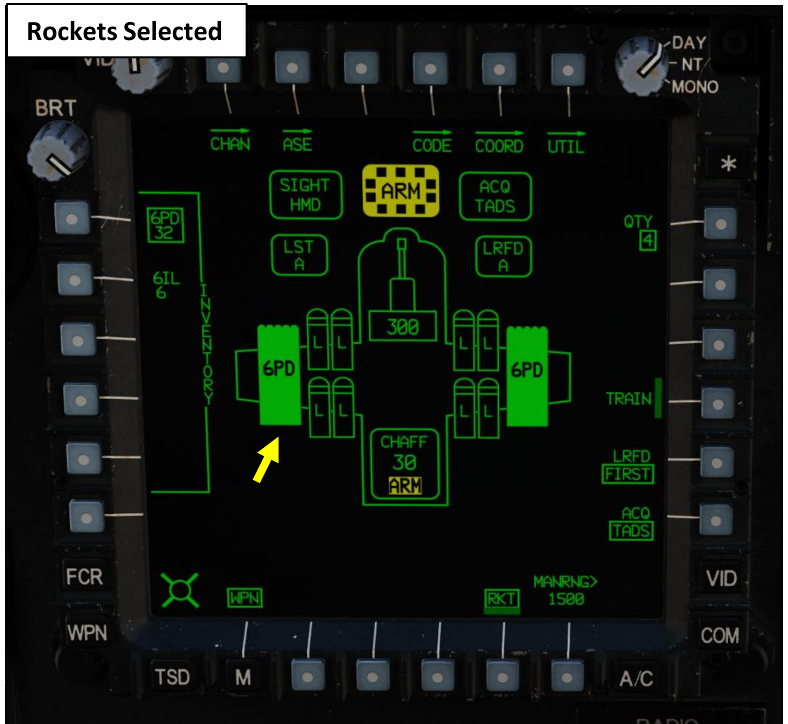
1 – INTRODUCTION
1.5 – WASing Weapons & Trigger Guard

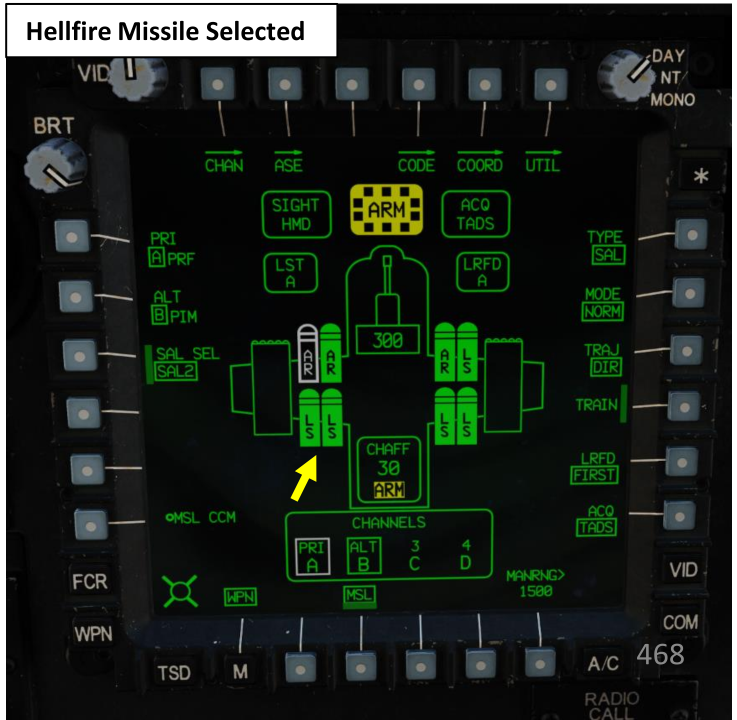
The state of the WPN (Weapon) MPD (Multi-Purpose Display) page changes based on what weapon is selected with the Weapon Action Switch, which is nicknamed “WAS” (pronounced “wahz” or “woz”). When hearing “WASing Gun” or “WASing Rockets” or “WASing Hellfire”, this basically means that the Weapon Action Switch is being actioned to select a specific weapon.

Take note that the Weapon Action Switches (WAS) on the **pilot and co-pilot/gunner cyclics** override each other. The co-pilot/gunner has an additional Weapon Action Switch on the **TEDAC Left Hand Grip.**

Very important:
- If the co-pilot/gunner (CPG) uses the **TEDAC LHG WAS, only the CPG’s TEDAC LHG trigger will be active**.
- If the CPG uses the **cyclic WAS, only the CPG’s cyclic trigger will be active**.



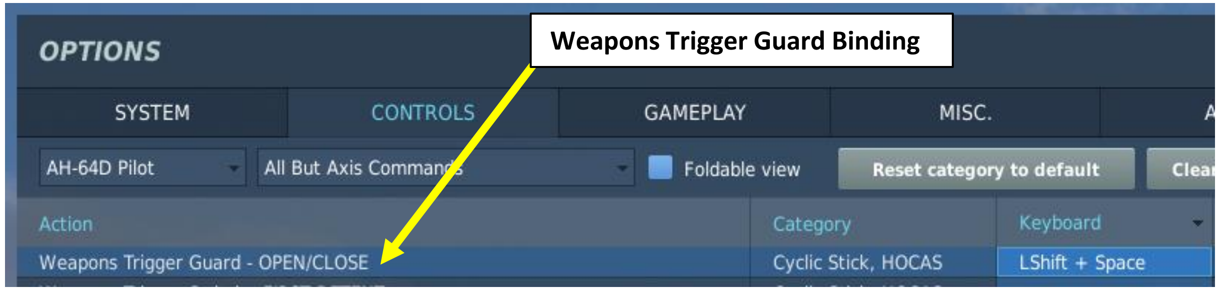


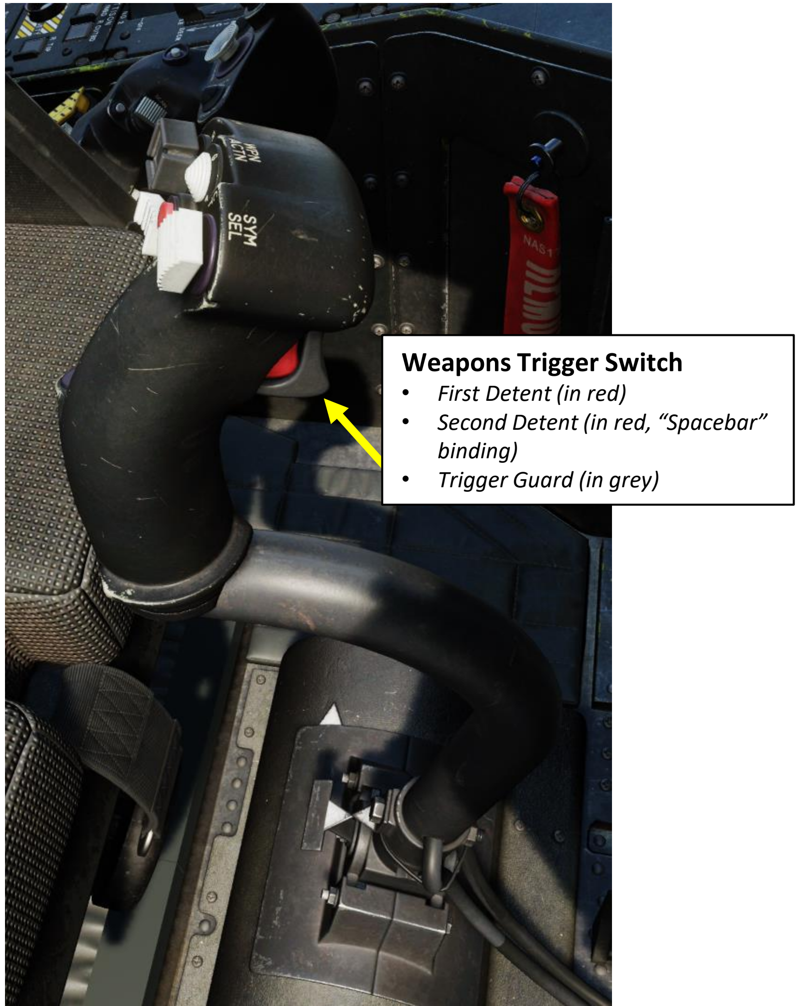


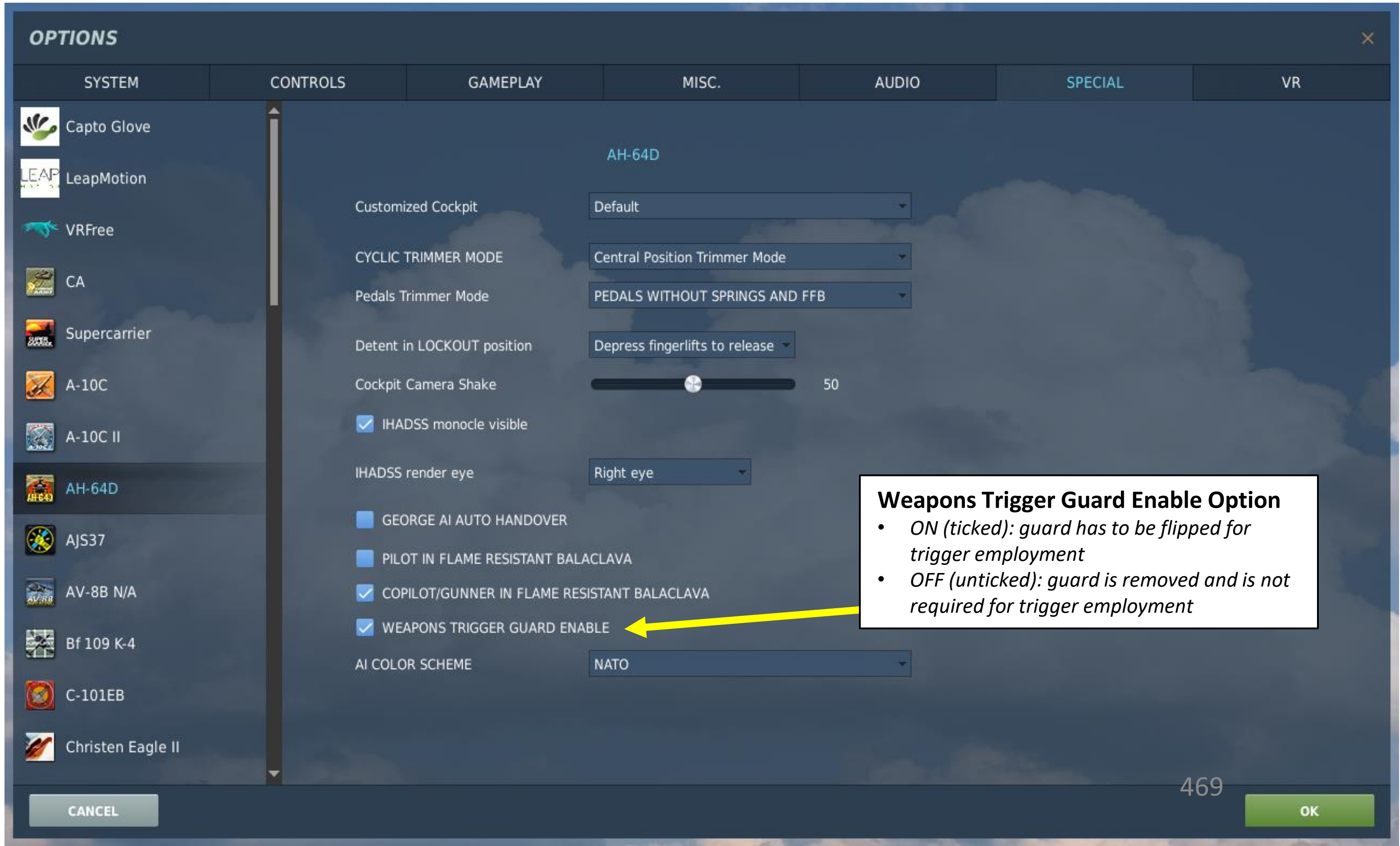
1 – INTRODUCTION
1.5 – WASing Weapons & Trigger Guard

The cyclic **Weapons Trigger Switch has a guard** that has to be flipped before pressing the trigger. I recommend mapping “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”. *Yes, I am well aware of the irony of this last sentence.*

Take note that there is a Special Option that allows you to disable the need to flip the trigger guard.







1 – INTRODUCTION
1.6 – Weapon Delivery Techniques

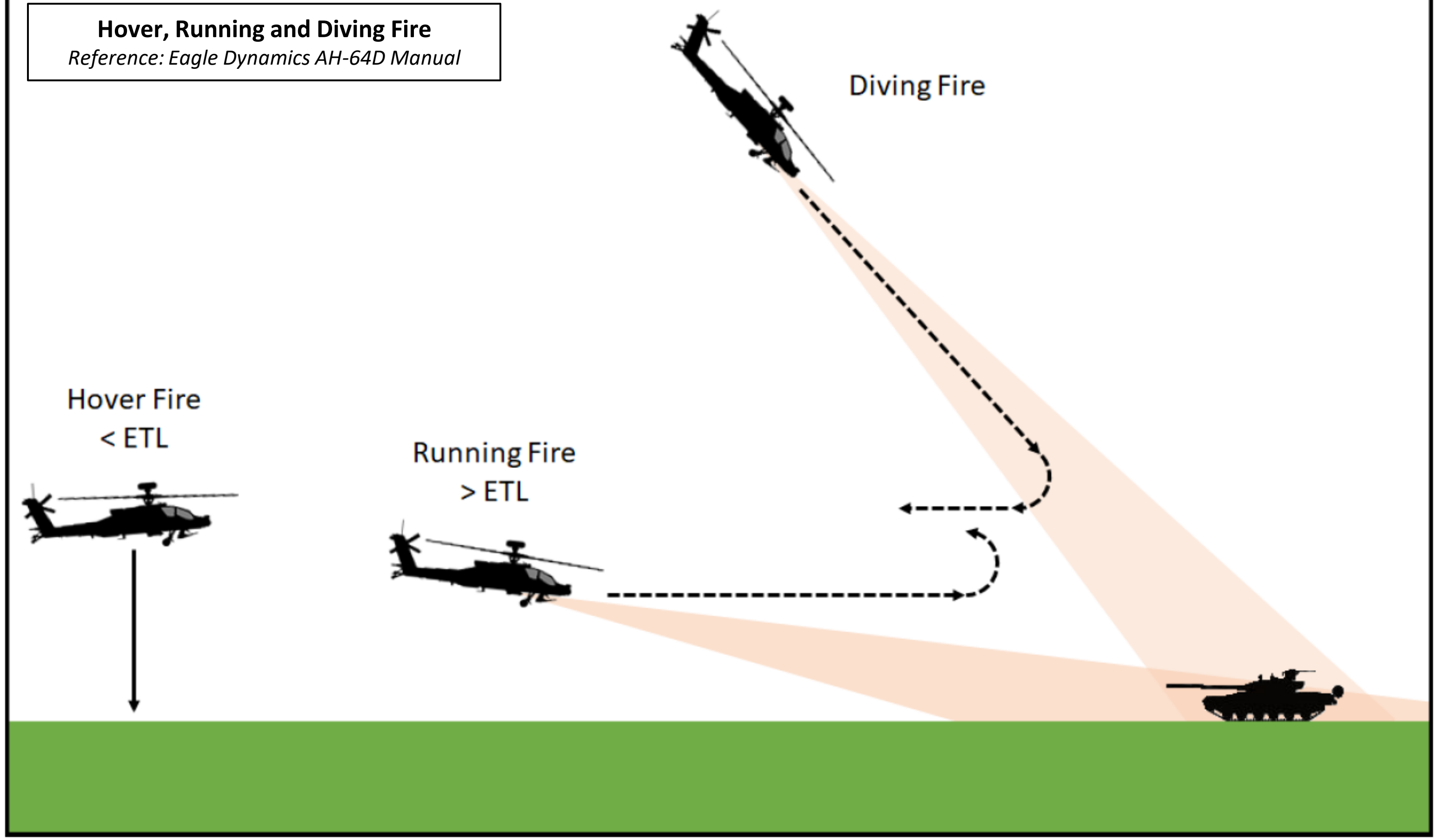
There are three main techniques for weapons delivery:

- **Hover Fire:** technique conducted at speeds less than effective translational lift (ETL, roughly 16-24 knots airspeed) and may be either moving or stationary.

- **Running Fire:** technique conducted at speeds greater than ETL (15-24 kts). Forward airspeed adds stability to the helicopter and increases the delivery accuracy of unguided weapon systems, particularly rockets.

- **Diving Fire:** engagement conducted in a diving profile, typically between -10° to -30° pitch attitudes. Airspeed and altitude will be determined by the expected threat level from enemy defenses and desired weapons effects, with a steeper dive providing a smaller "beaten zone" and improved accuracy. However, a steep dive will also require more altitude for recovery. Diving fire may be performed from low altitude with a climb or "bump" from behind cover or from level flight at high altitude.

Hover, Running and Diving Fire
Reference: Eagle Dynamics AH-64D Manual



2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN
2.1 – Introduction

The M230 30 mm automatic chain-driven gun mounted on the underside of the helicopter is a component of the M139 Area Weapon System (AWS).
Keep in mind that this weapon is mainly used for soft targets for suppressing an area… and therefore does not have the precision of a laser beam.

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

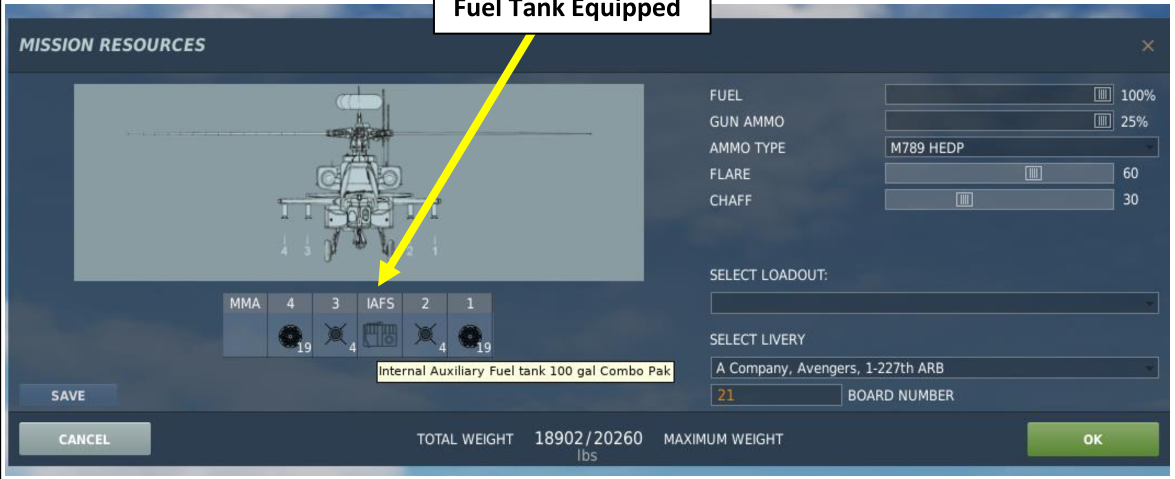
2.1 – Introduction

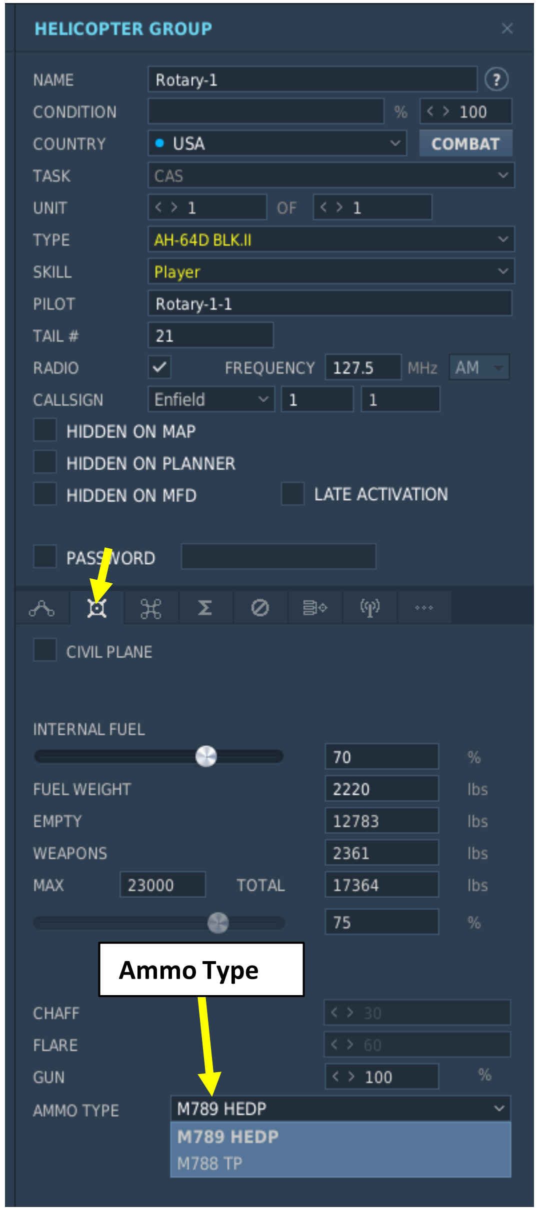
Ammunition

The M230 fires 30x113 millimeter link-less, tracer-less ammunition, consisting of either **M789 High Explosive Dual Purpose (HEDP) rounds** for tactical operations or **M788 Target Practice rounds** for non-combat use. The M789 has a light armor penetrating capability as well as a bursting fragmentation effect for anti-material and anti-personnel use. Ammunition type can be selected via the Mission Editor.

The M230 has a magazine of 1200 rounds and fires up to 625 rounds per minute. When the Internal **Auxiliary Fuel System (IAFS, also nicknamed "Robbie Tank")** is installed, **magazine size is reduced to 300 rounds**.

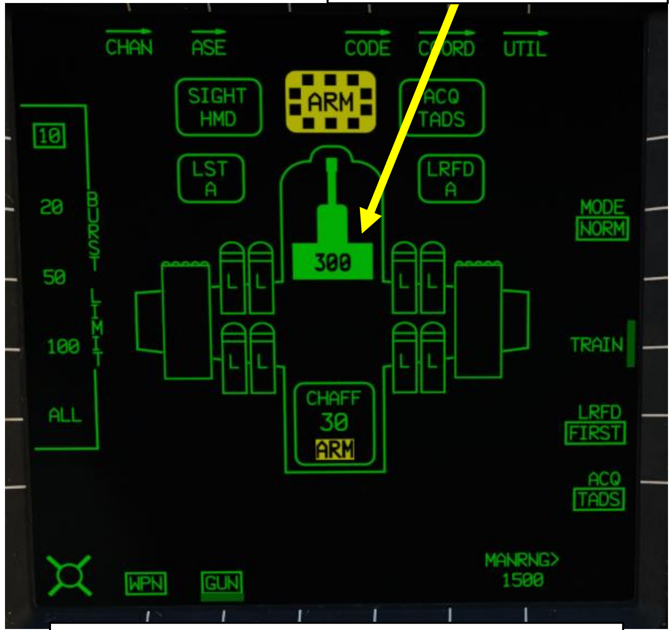
Internal Auxiliary Fuel Tank Equipped



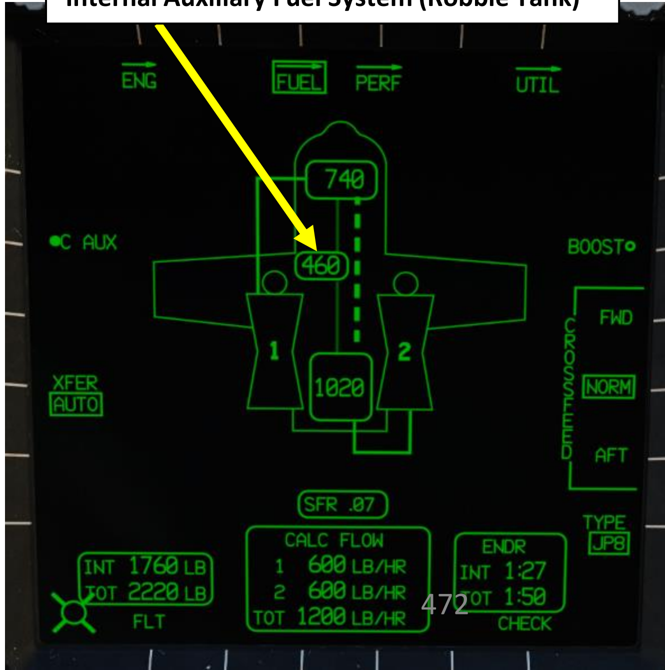


Ammo Type

WPN Page
Gun Ammunition Counter



A/C FUEL Page
Internal Auxiliary Fuel System (Robbie Tank)

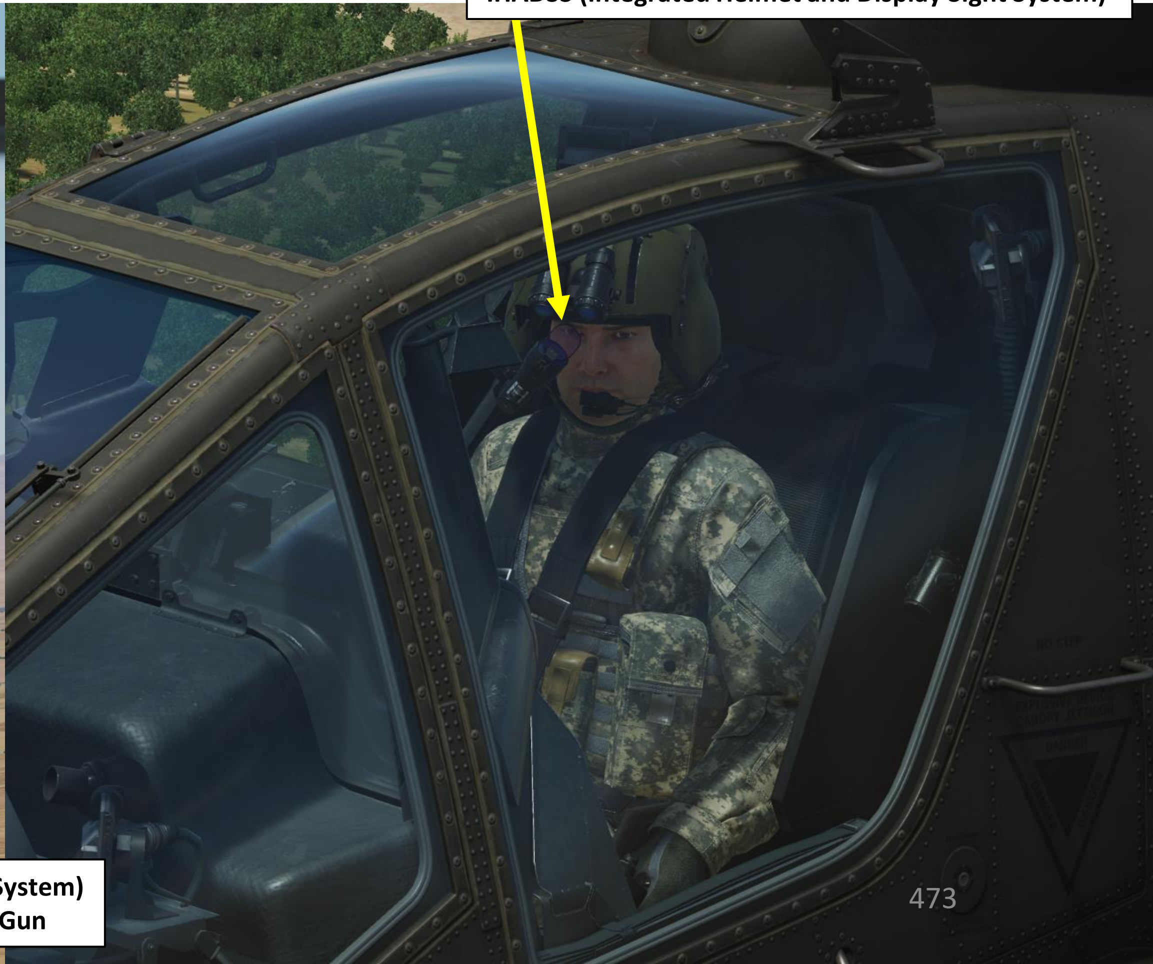


2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.1 – Introduction

Gun Aiming

The gun is mounted on a hydraulically steered turret that can be slaved to either the TADS (Target Acquisition & Designation Sight) line-of-sight or IHADSS (Integrated Helmet and Display Sighting System) line-of-sight, or fixed to a forward-firing position.

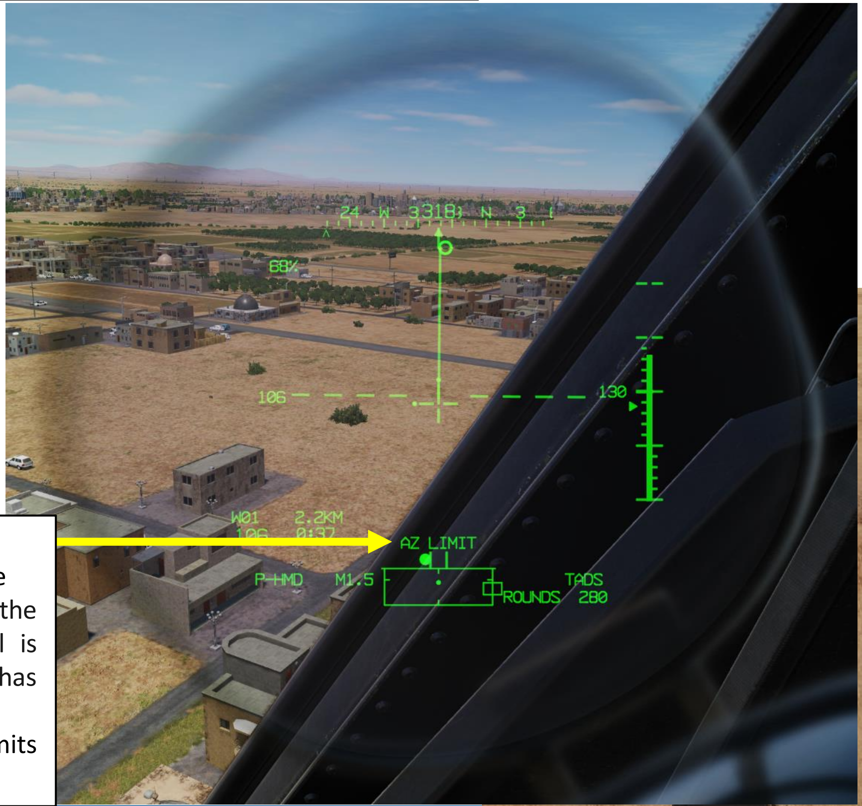


2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.1 – Introduction

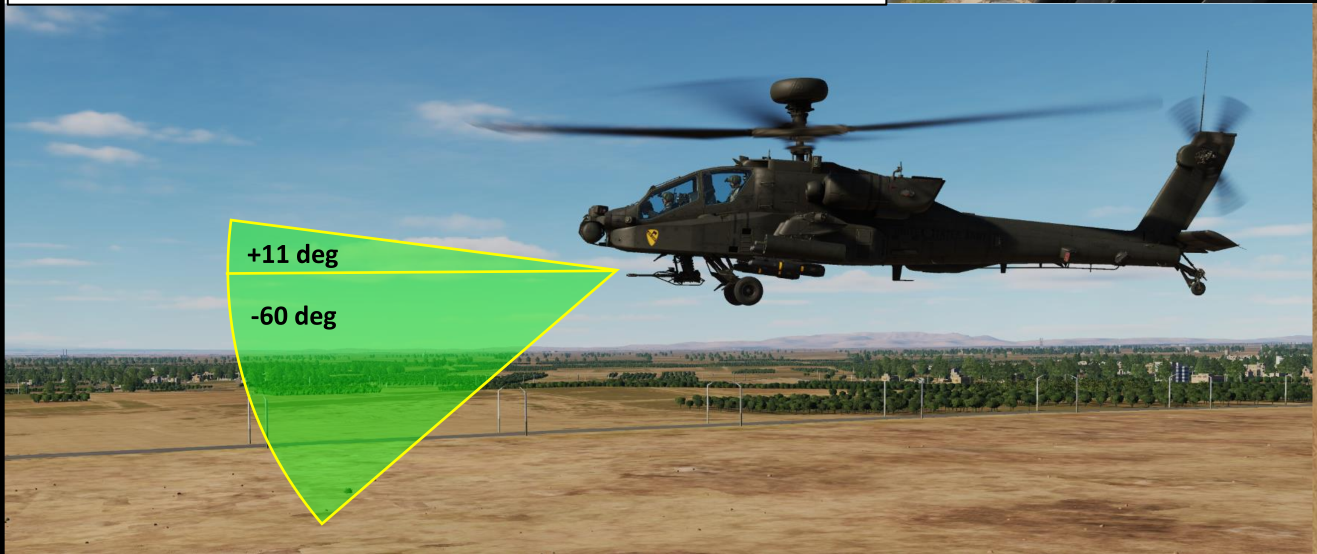
Gun Turret Limitations

- Elevation range of motion: + 11 deg to -60 deg
- Azimuth range of motion: +/- 86 deg



Gun Limit Indication

- **BAL LIMIT:** Sight is aimed beyond the gun's maximum ballistic range
- **COINCIDENCE:** Lack of convergence between the point at which the sight is being directed and the point at which the gun barrel is directed. Usually appears while the gun turret is still moving and it has not yet synced up with the sight.
- **EL LIMIT:** Sight is aimed too high or too low for the gun elevation limits
- **AZ LIMIT:** Sight is aimed beyond the gun azimuth limits



2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.1 – Introduction

Ranging Considerations

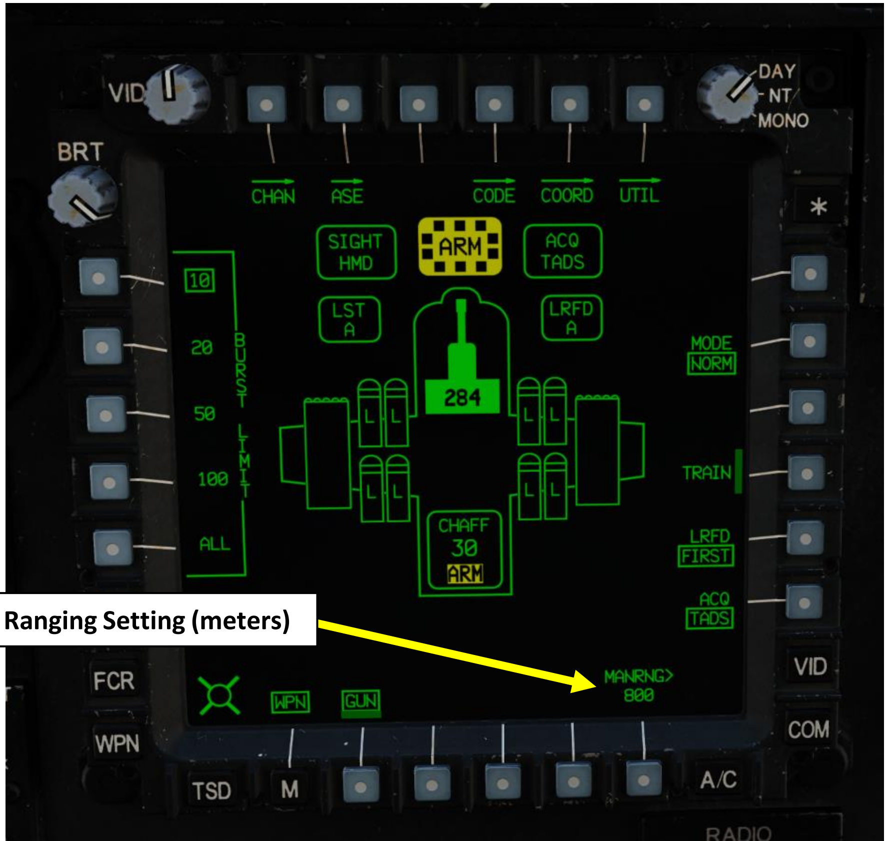
The M230 gun is designed to be used as a close-in weapon when employed by the aircrew's helmet sights. Range source can be either set to manual (fixed range set through the WPN page) or automatic.

When the **HMD (Helmet-Mounted Display) is selected as the sight and the gun is selected** with the WAS (Weapon Action Switch), the range source is **automatically reverted to the Manual Range setting** (set on the WPN page). Why? Because this prevents any unintended ranging value from being used when hasty close-in firing is needed. As an example, a NAV range to a target could potentially make the gun attempt to elevate for a ballistic solution that does not match where the HMD sight is looking.

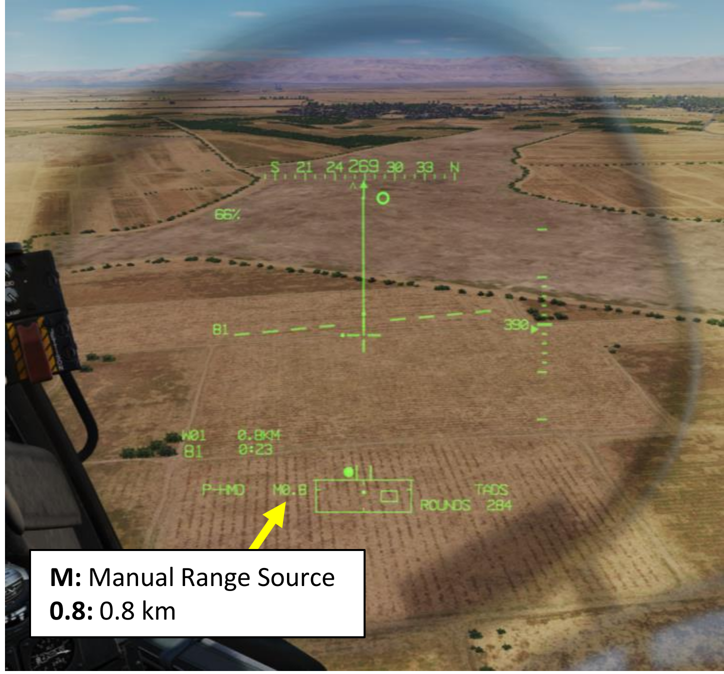
Take note that you can still use a different range source like Automatic or NAV after the gun is WASed (selected).

Weapon Action Switch (WAS)

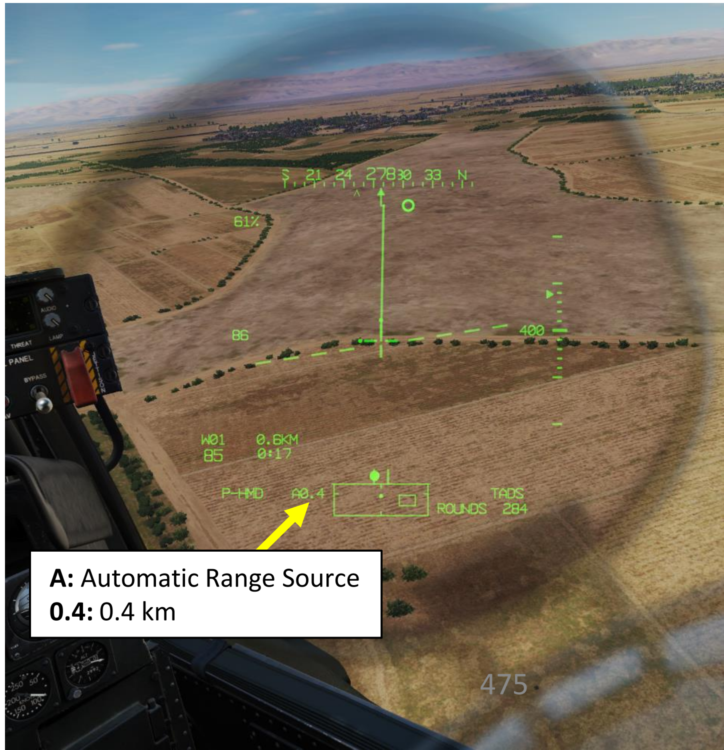
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*



WPN Page Ranging Setting (meters)



M: Manual Range Source
0.8: 0.8 km



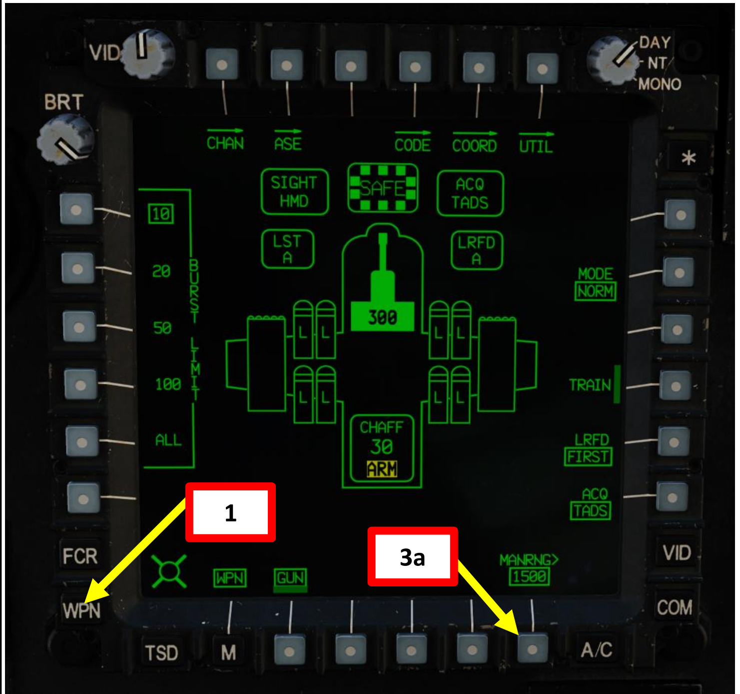
A: Automatic Range Source
0.4: 0.4 km

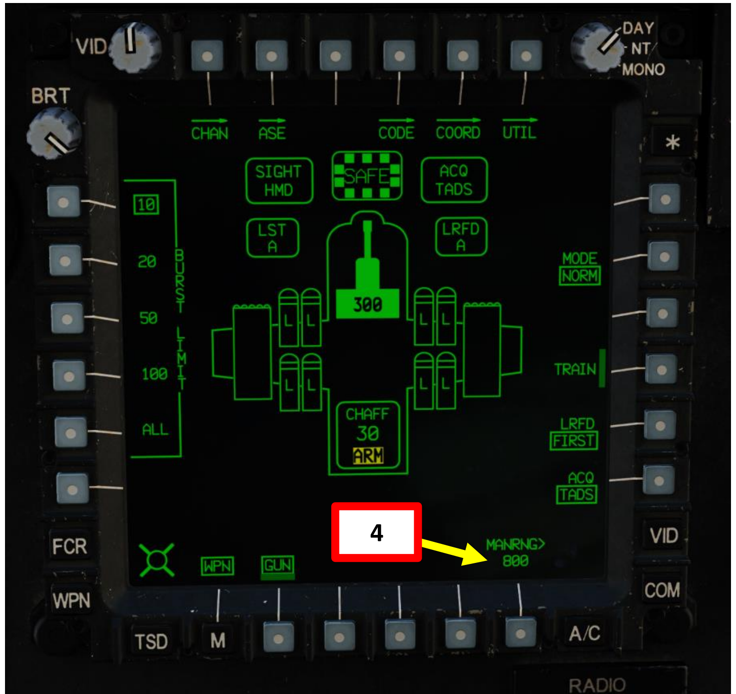
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.1 – Introduction

Setting Manual Range Source

1. *[P/CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
2. *[P/CPG]* Press WAS (Weapon Action Switch) UP to select the Gun.
3. *[P/CPG]* Press VAB next to MAN RNG, enter desired Gun Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER.
   - I typically use a fixed manual ranging setting of 800 m.
4. *[P/CPG]* New Gun Ranging Distance Parameter is visible on the WPN page and HMD (Helmet-Mounted Display). The Distance is preceded by "M" for "Manual".



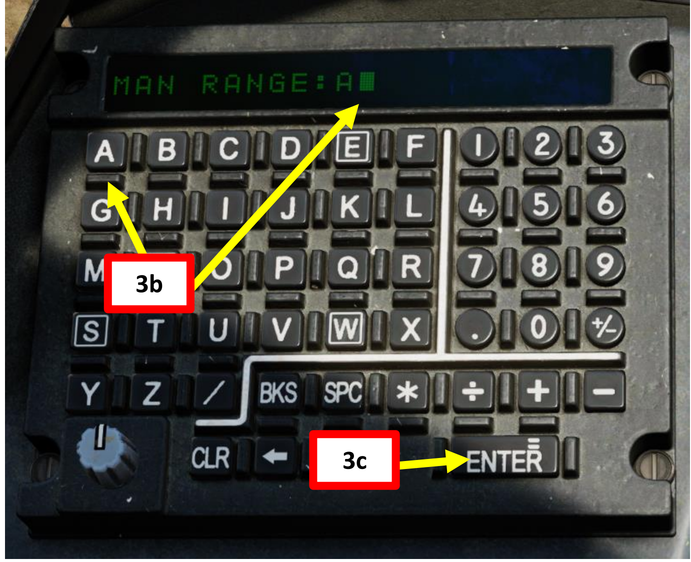


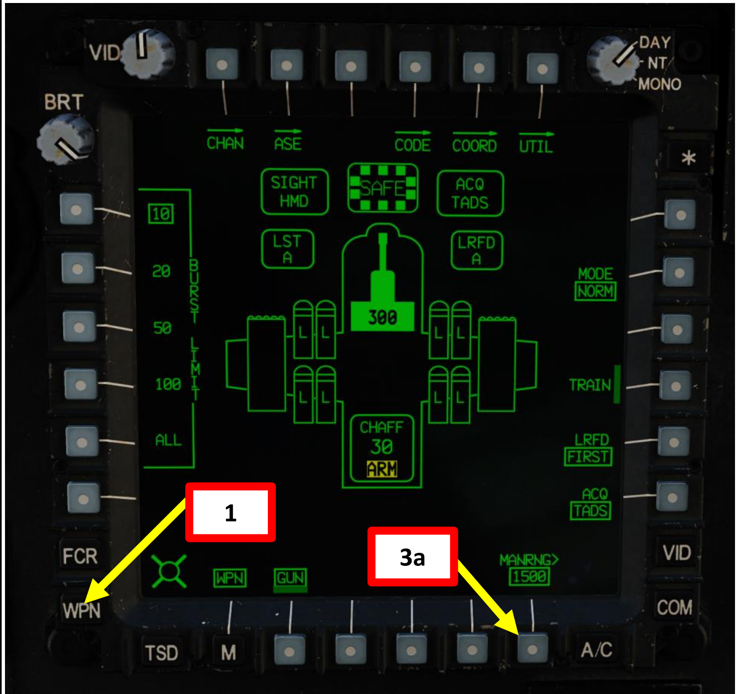
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

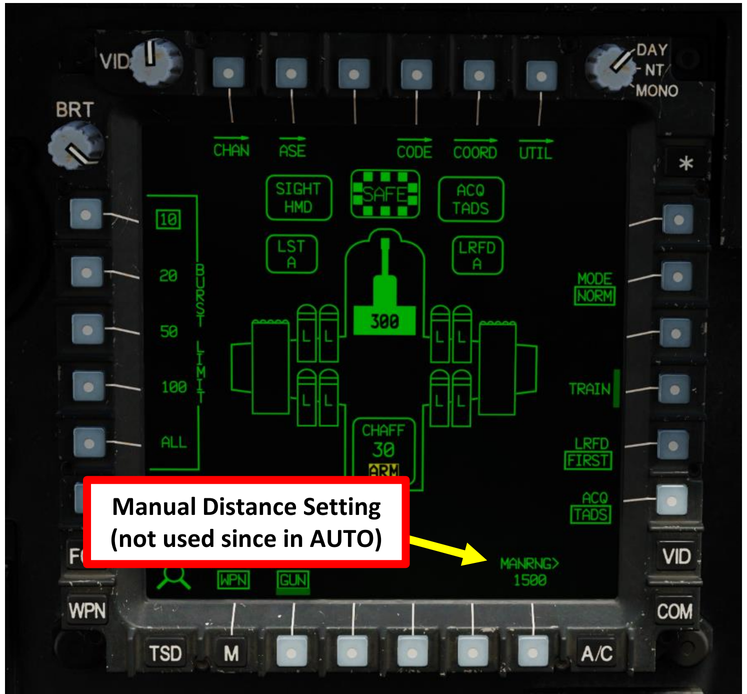
2.1 – Introduction

Setting Automatic Range Source

1. [P/CPG] Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
2. [P/CPG] Press WAS (Weapon Action Switch) UP to select the Gun.
3. [P/CPG] Press VAB next to MAN RNG, enter "A" on the KU (Keyboard Unit), then press ENTER.
   - Keep in mind that the radar altimeter must be on in order to use automatic ranging.
4. [P/CPG] Gun Ranging Distance Parameter is visible on HMD (Helmet-Mounted Display). The Distance is preceded by "A" for "Automatic".







2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.2 – Gun Operation by Pilot

2.2.1 – NORM Mode with HMD (Helmet-Mounted Display)

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "P-HMD".
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Press WAS (Weapon Action Switch) UP to select the Gun.
   - The range source will automatically change to a Manual range (MANRNG) based on the range value set on the WPN page.
4. *[P]* Flip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the "Weapons Trigger Guard – OPEN/CLOSE" to a binding easy to remember like "LSHIFT+SPACEBAR".
   - This step is not required if the "Weapons Trigger Guard Enable Special Option" is disabled (unticked).

2

1b

3b

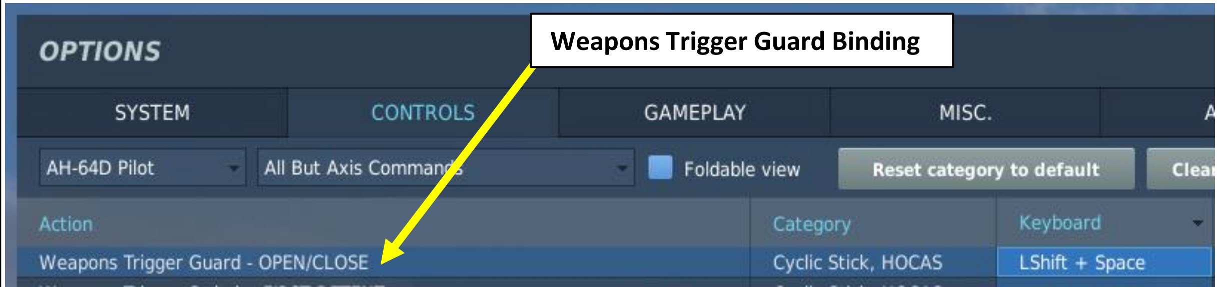
1a

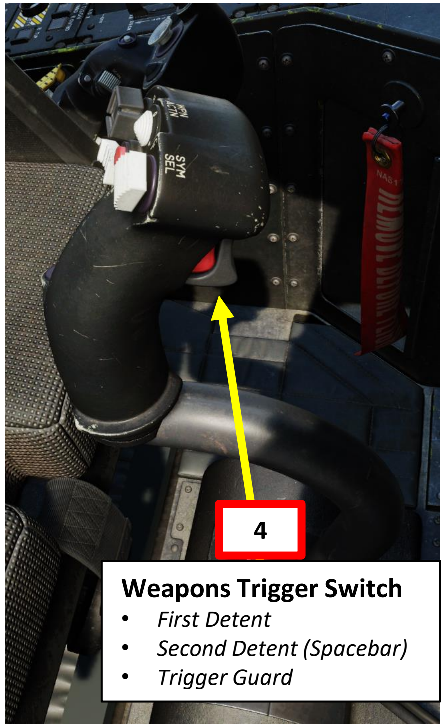
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

3a

Weapons Trigger Guard Binding





4

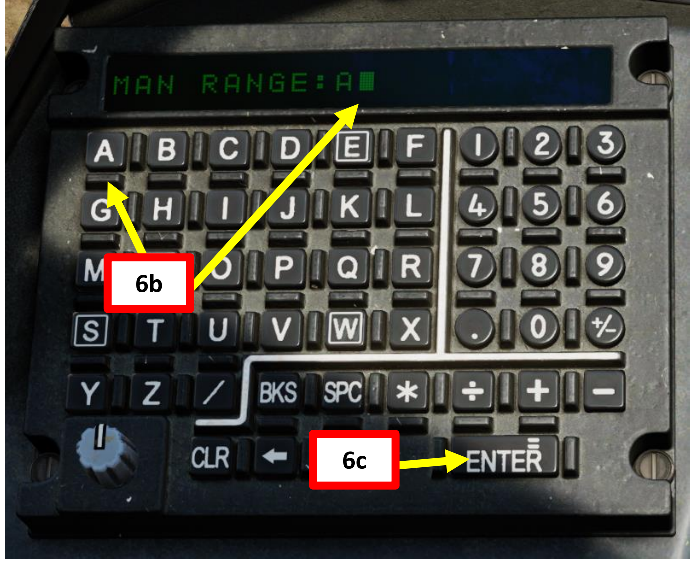
Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

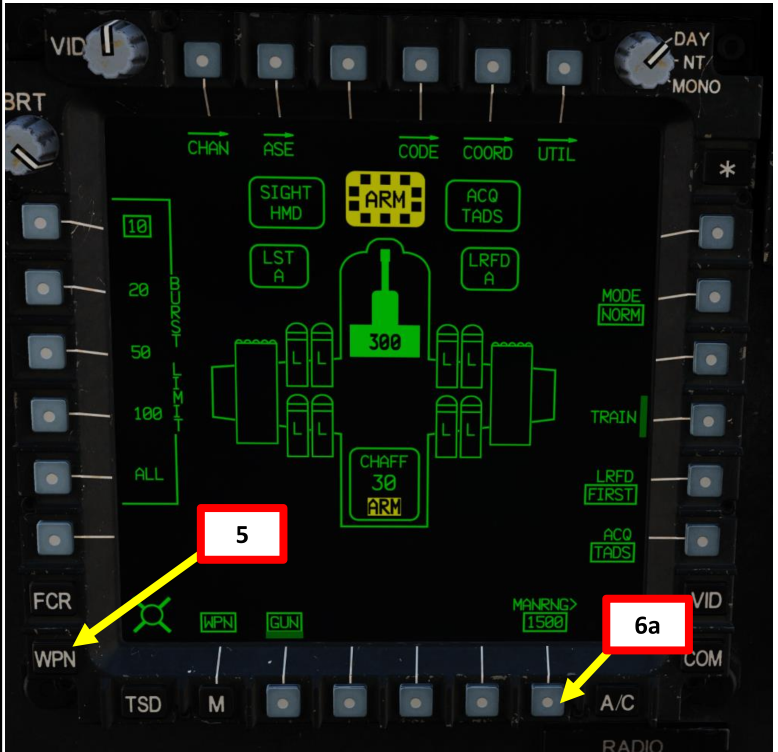
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

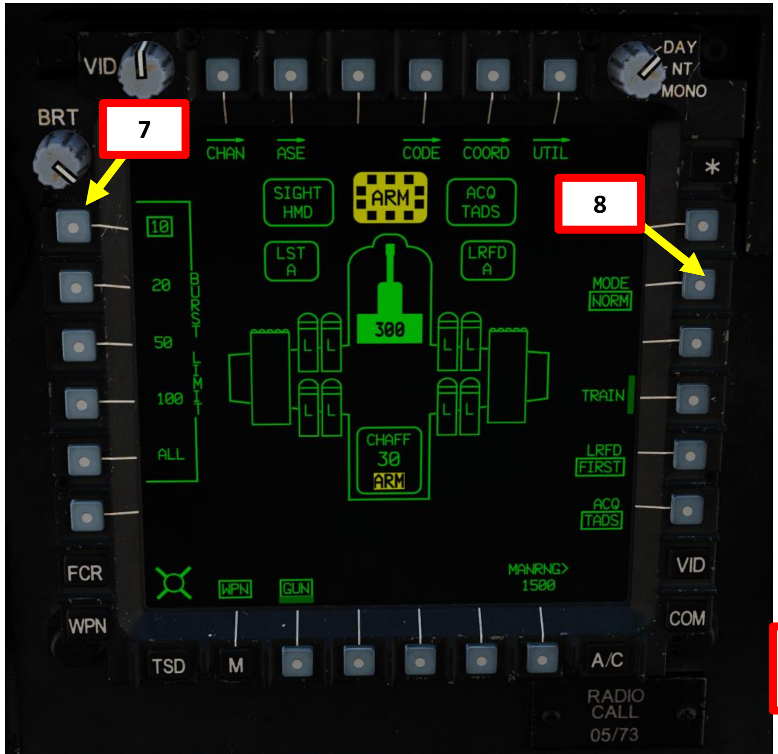
2.2 – Gun Operation by Pilot

2.2.1 – NORM Mode with HMD (Helmet-Mounted Display)

5. *[P]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[P]* Press VAB (Variable Action Button) next to MAN RNG, enter desired Gun Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
   - For manual ranging, a setting of 800 m is recommended.
   - For automatic ranging, enter "A" on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.
7. *[P]* Press VAB next to desired BURST LIMIT setting. We will select 10 rounds per burst.
8. *[P]* Press VAB next to MODE to select NORM.





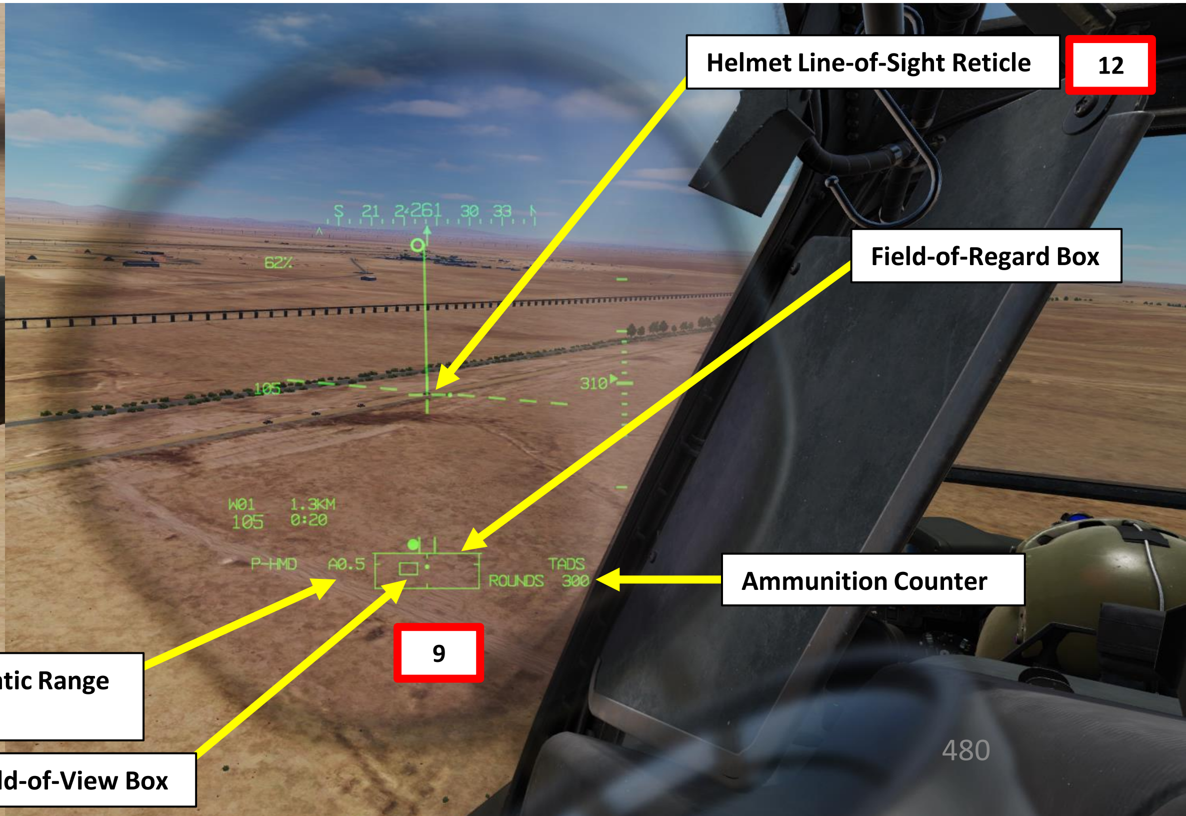


2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.2 – Gun Operation by Pilot

2.2.1 – NORM Mode with HMD (Helmet-Mounted Display)

9. *[P]* Verify no COINCIDENCE, AZ LIMIT, EL LIMIT or BAL LIMIT messages are displayed in the High Action Display.
10. *[P]* Move your head to keep the Helmet Line-of-Sight Reticle on the target. The gun turret will follow the reticle and compensate for range.
11. *[P]* The maximum supported software ballistic range of the gun is 4200 m, but as a personal preference, I typically like to get within a range to target between 500 m and 1800 m.
12. *[P]* Fire the gun by squeezing the Weapons Trigger Second Detent ("Spacebar" binding) on the cyclic.



2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.2 – Gun Operation by Pilot

2.2.1 – NORM Mode with HMD (Helmet-Mounted Display)

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.2 – Gun Operation by Pilot

2.2.2 – FIXED Mode

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "P-HMD".
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Press WAS (Weapon Action Switch) UP to select the Gun.
    - The range source will automatically change to a Manual range (MANRNG) based on the range value set on the WPN page. However, **this will not affect the range compensation for the gun**.
4. *[P]* Flip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
    - Set the "Weapons Trigger Guard – OPEN/CLOSE" to a binding easy to remember like "LSHIFT+SPACEBAR".
    - This step is not required if the "Weapons Trigger Guard Enable Special Option" is disabled (unticked).

2

1b

3b

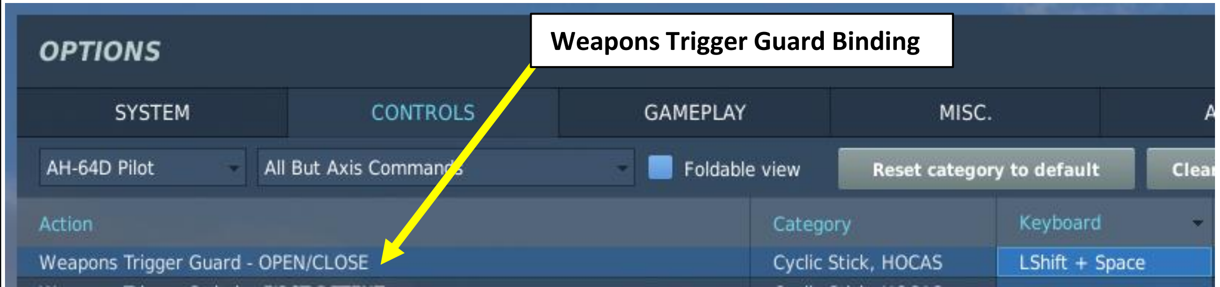
Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

3a

1a

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

Weapons Trigger Guard Binding



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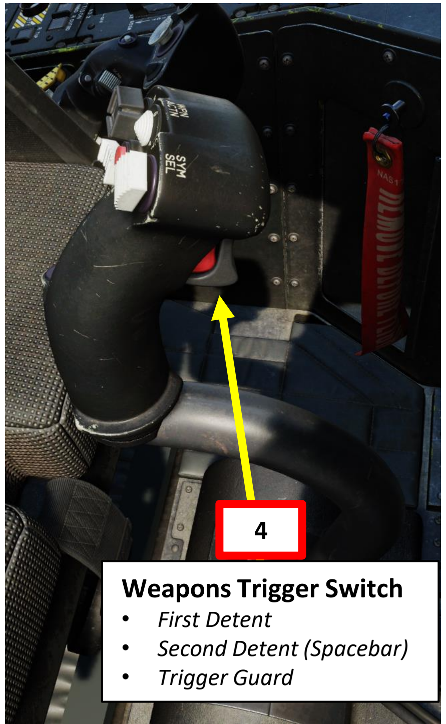


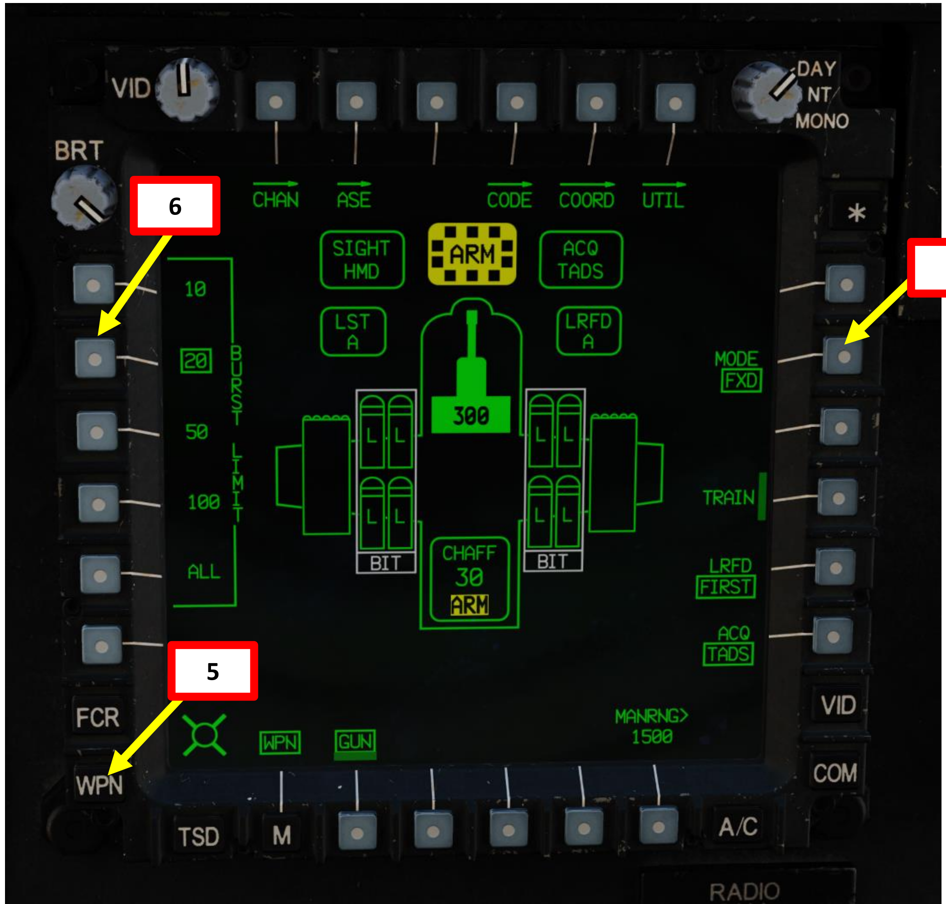
Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.2 – Gun Operation by Pilot

2.2.2 – FIXED Mode

5. *[P]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[P]* Press VAB (Variable Action Button) next to desired BURST LIMIT setting. We will select 20 rounds per burst.
7. *[P]* Press VAB next to MODE to select FXD (Fixed).
8. *[P]* When employing the gun in Fixed mode with the Helmet-Mounted Display, the gun is fixed forward at a ballistic solution of 1575 meters. The Fixed Gun Reticle represents the virtual location in front of the aircraft that coincides with the 1575-meter ballistic solution.



2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.2 – Gun Operation by Pilot

2.2.2 – FIXED Mode

9. *[P]* Manoeuver the helicopter to aim the Fixed Gun Reticle at the target.
10. *[P]* Fire the gun by squeezing the Weapons Trigger Second Detent (“Spacebar” binding) on the cyclic.
11. *[P]* Observe round impacts and adjust aim as required if further attacks are needed.

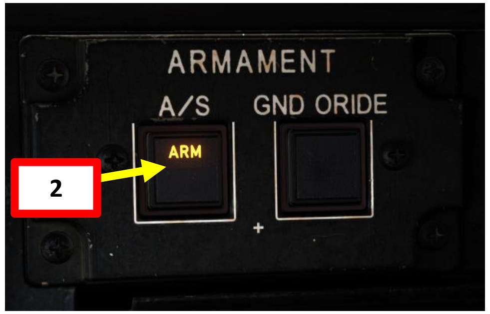
10
Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.1 – NORM Mode with HMD (Helmet-Mounted Display)

1. *[CPG]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “C-HMD”.
2. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) UP to select the Gun.
   - The range source will automatically change to a Manual range (MANRNG) based on the range value set on the WPN page.
4. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
   - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).

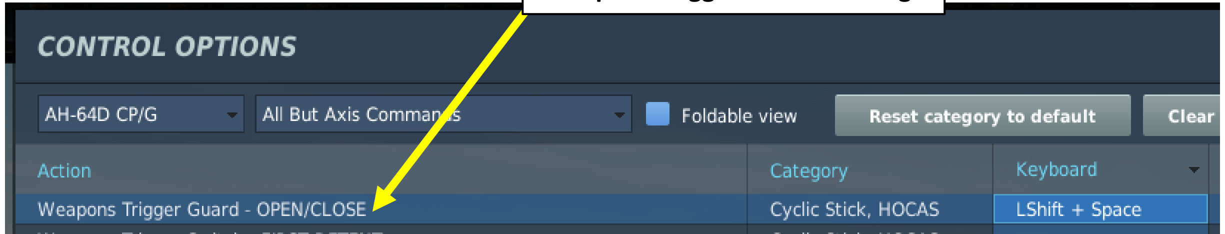


Weapon Action Switch (WAS) 3a
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

4

Weapons Trigger Guard Binding



1a

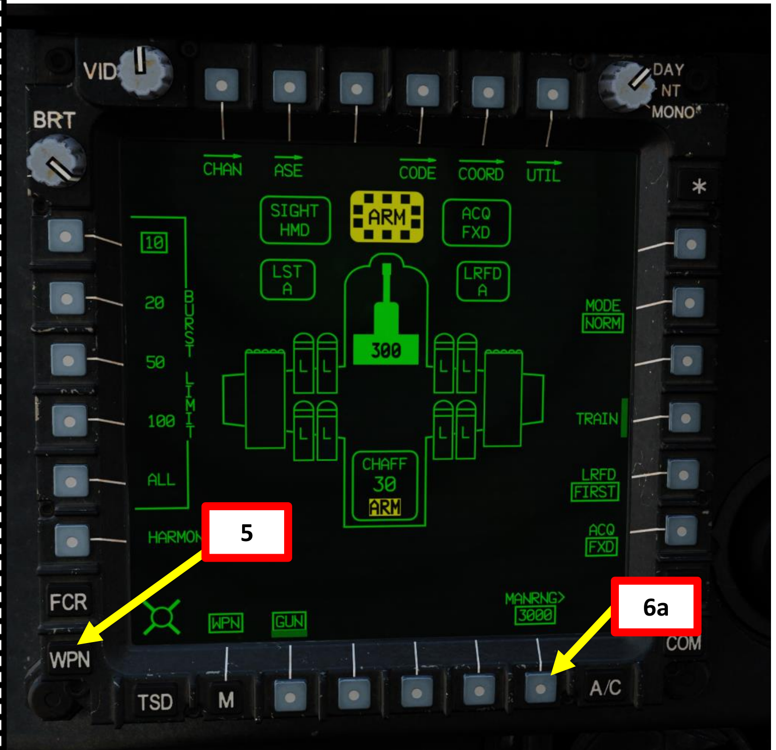
TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

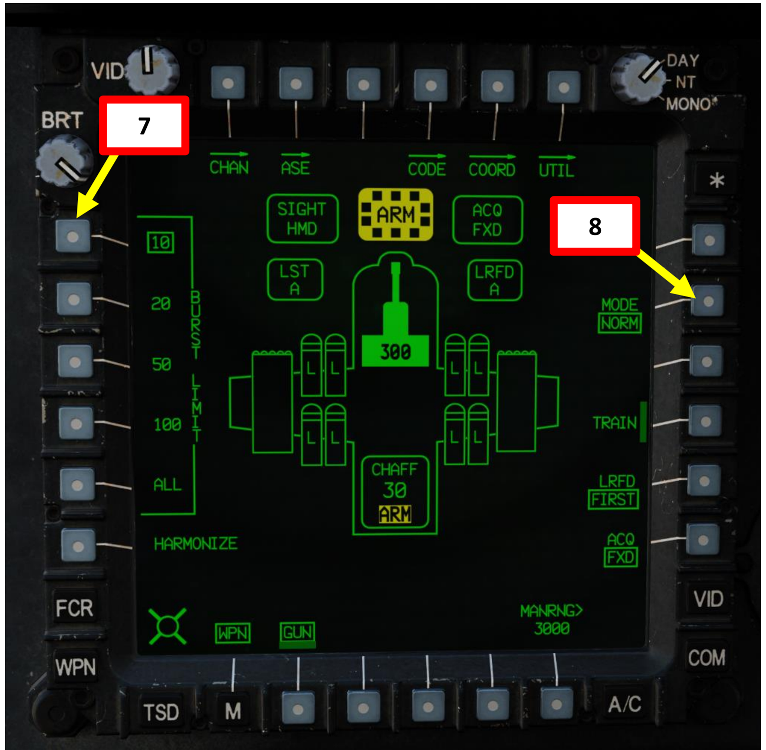
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.1 – NORM Mode with HMD (Helmet-Mounted Display)

5. *[CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[CPG]* Press VAB (Variable Action Button) next to MAN RNG, enter desired Gun Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
    - For manual ranging, a setting of 800 m is recommended.
    - For automatic ranging, enter "A" on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.
7. *[CPG]* Press VAB next to desired BURST LIMIT setting. We will select 10 rounds per burst.
8. *[CPG]* Press VAB next to MODE to select NORM.





2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

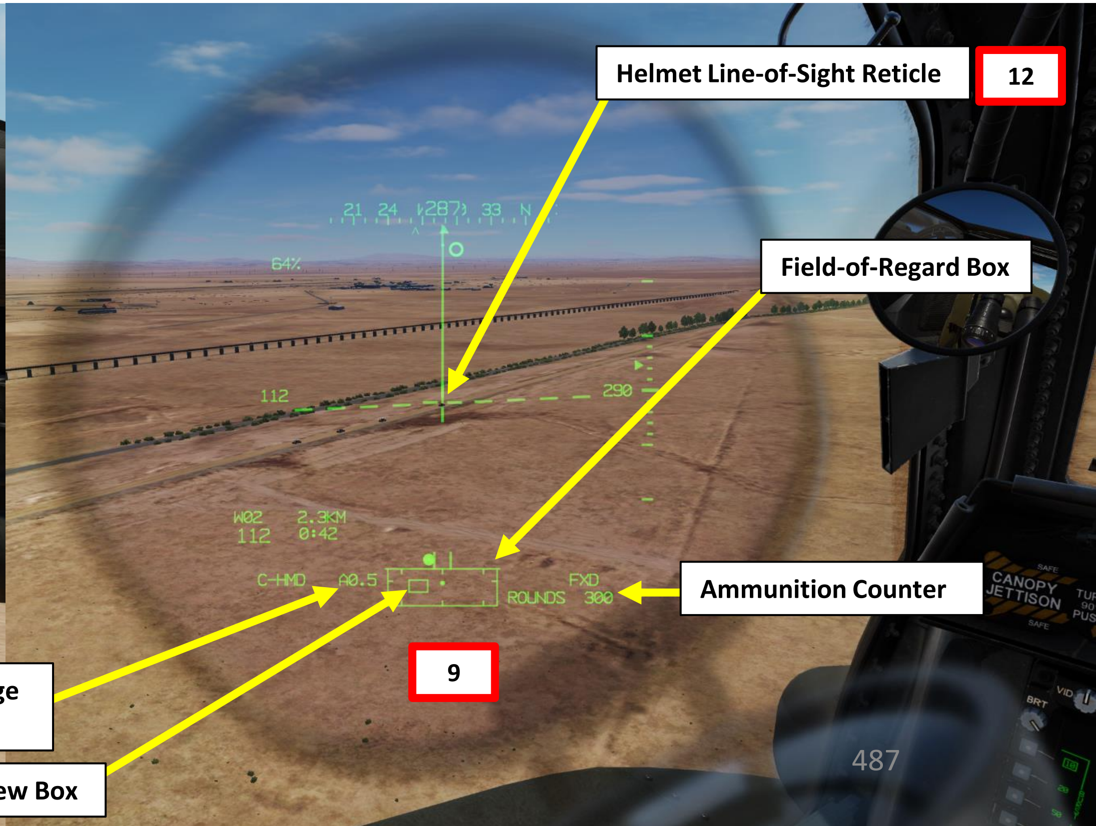
2.3.1 – NORM Mode with HMD (Helmet-Mounted Display)

9. *[CPG]* Verify no COINCIDENCE, AZ LIMIT, EL LIMIT or BAL LIMIT messages are displayed in the High Action Display.
10. *[CPG]* Move your head to keep the Helmet Line-of-Sight Reticle on the target. The gun turret will follow the reticle and compensate for range.
11. *[CPG]* The maximum supported software ballistic range of the gun is 4200 m, but as a personal preference, I typically like to get within a range to target between 500 m and 1800 m.
12. *[CPG]* Fire the gun by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.

11

TEDAC LHG Weapon Trigger (opposite side of grip)

- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*



2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

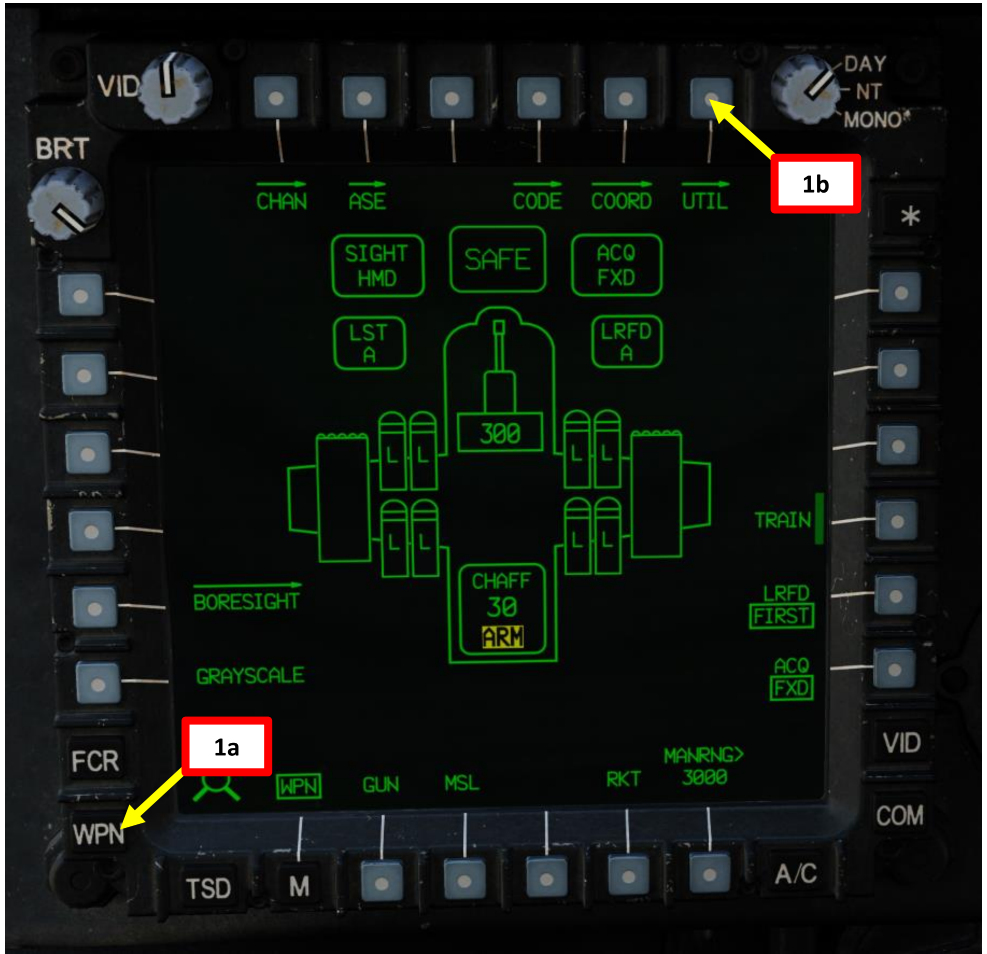
2.3.1 – NORM Mode with HMD (Helmet-Mounted Display)

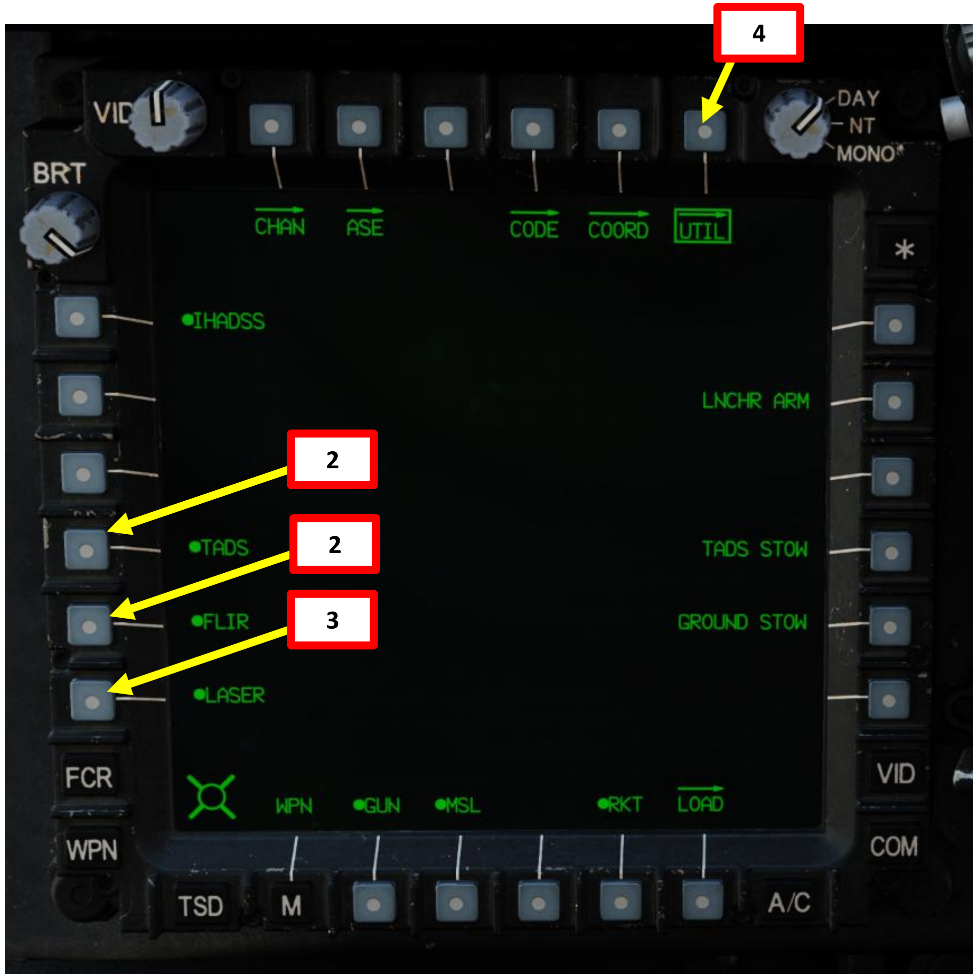
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
   - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
   - Hollow circle means OFF. Solid Circle means ON.
   - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

5. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
6. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the “IHADSS Show” binding, which is “i” by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “C-HMD”.
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

5a

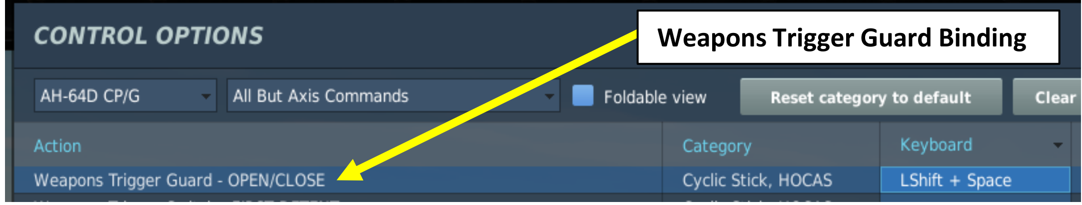
TEDAC RHG Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

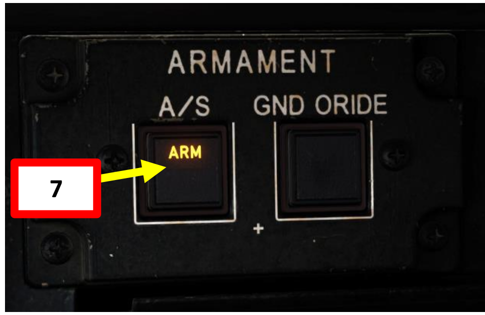
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

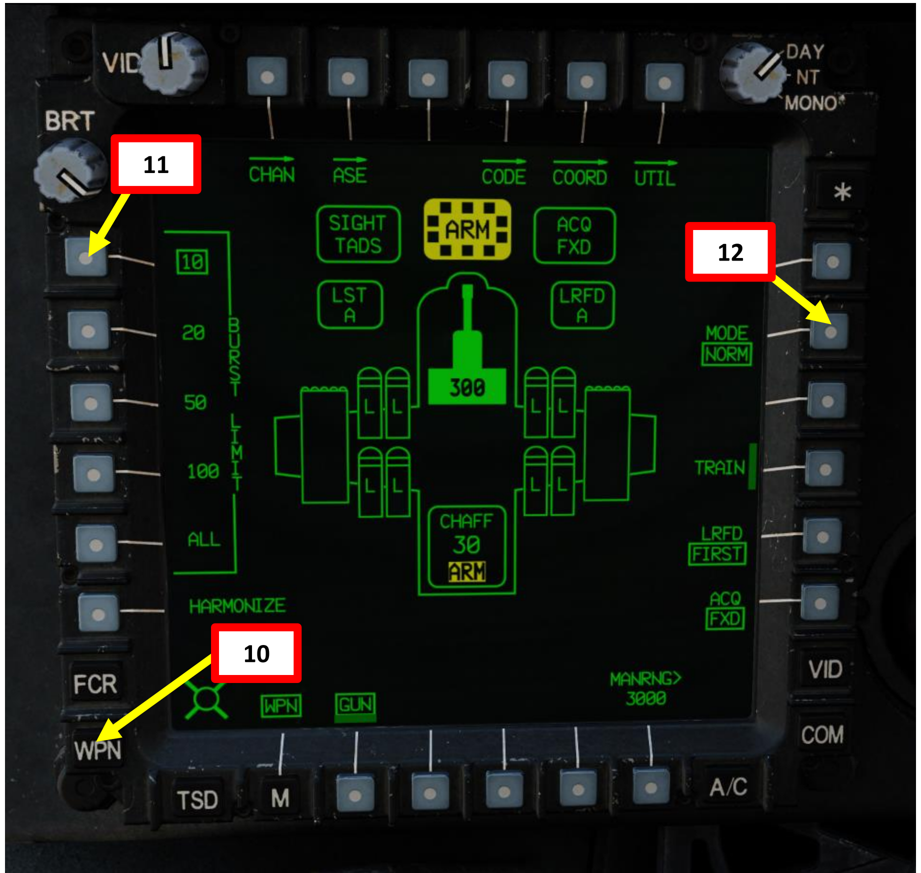
2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)



7. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
8. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) UP to select the Gun.
9. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the "Weapons Trigger Guard – OPEN/CLOSE" to a binding easy to remember like "LSHIFT+SPACEBAR".
   - This step is not required if the "Weapons Trigger Guard Enable Special Option" is disabled (unticked).
10. *[CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
11. *[CPG]* Press VAB (Variable Action Button) next to desired BURST LIMIT setting. We will select 10 rounds per burst.
12. *[CPG]* Press VAB next to MODE to select NORM.





Weapon Action Switch (WAS)

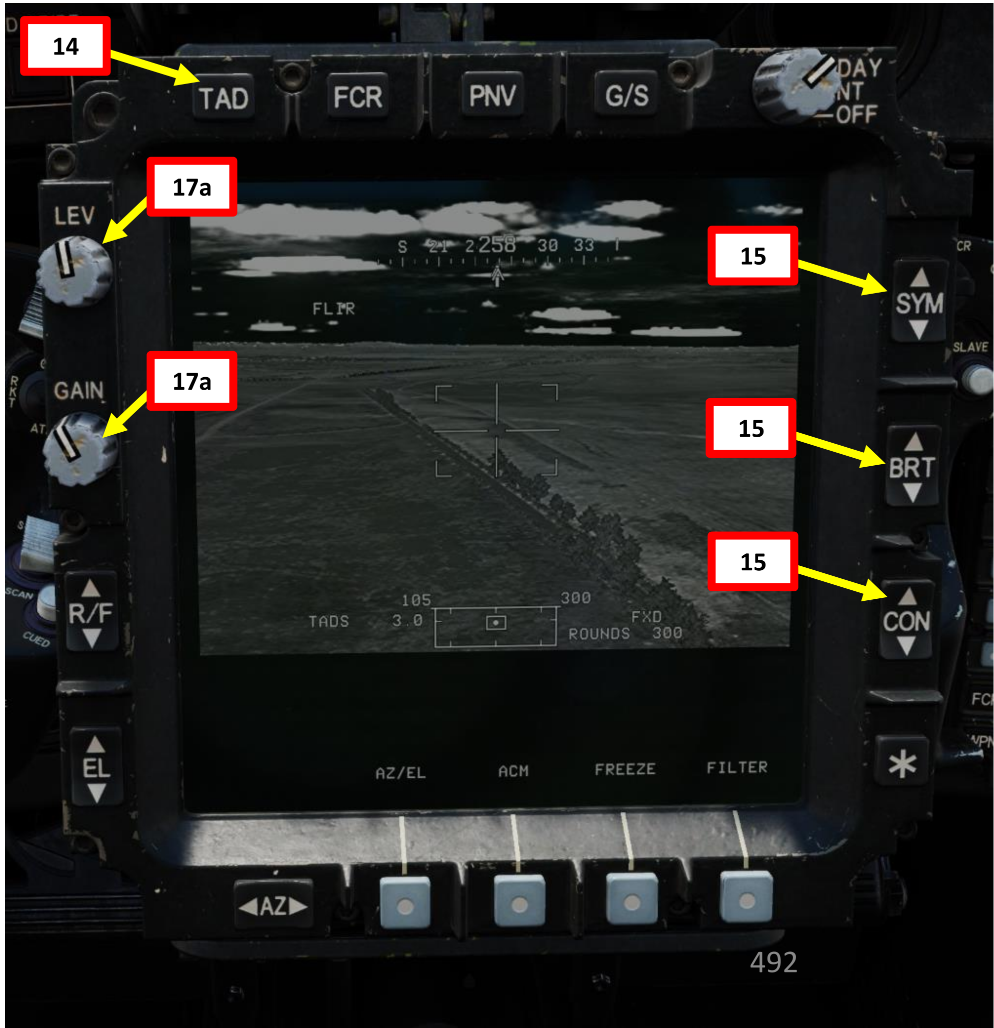
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

TEDAC LHG Weapon Trigger (opposite side of grip)

- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN
2.3 – Gun Operation by Co-Pilot/Gunner
2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

13. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
14. *[CPG]* Select TADS video feed source by pressing the TAD button.
15. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
16. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
17. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.

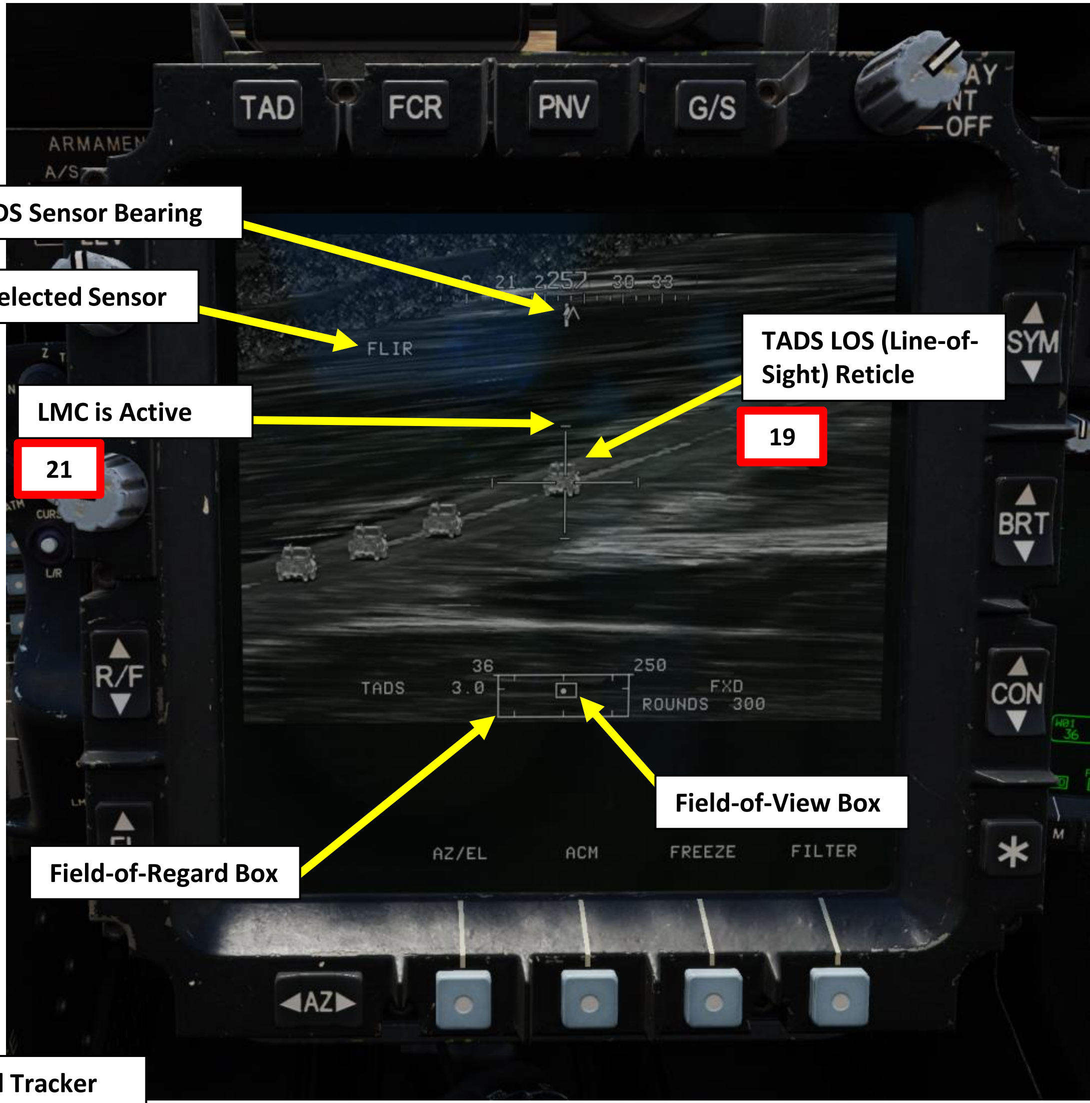


2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

18. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
19. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
20. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
21. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).



2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

22. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will automatically apply some lead to make sure the gun rounds hit where the target is going to be while taking into account its current speed and direction.
23. *[CPG]* The maximum supported software ballistic range of the gun is 4200 m, but as a personal preference, I typically like to get within a range to target between 500 m and 1800 m.
24. *[CPG]* Fire the gun by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.
25. *[CPG]* If target is destroyed and LMC (Linear Motion Compensator) has been engaged, on TEDAC Left Hand Grip, press LMC Button again to disengage LMC.

TEDAC LHG (Left Hand Grip)

24

TEDAC LHG Weapon Trigger (opposite side of grip)

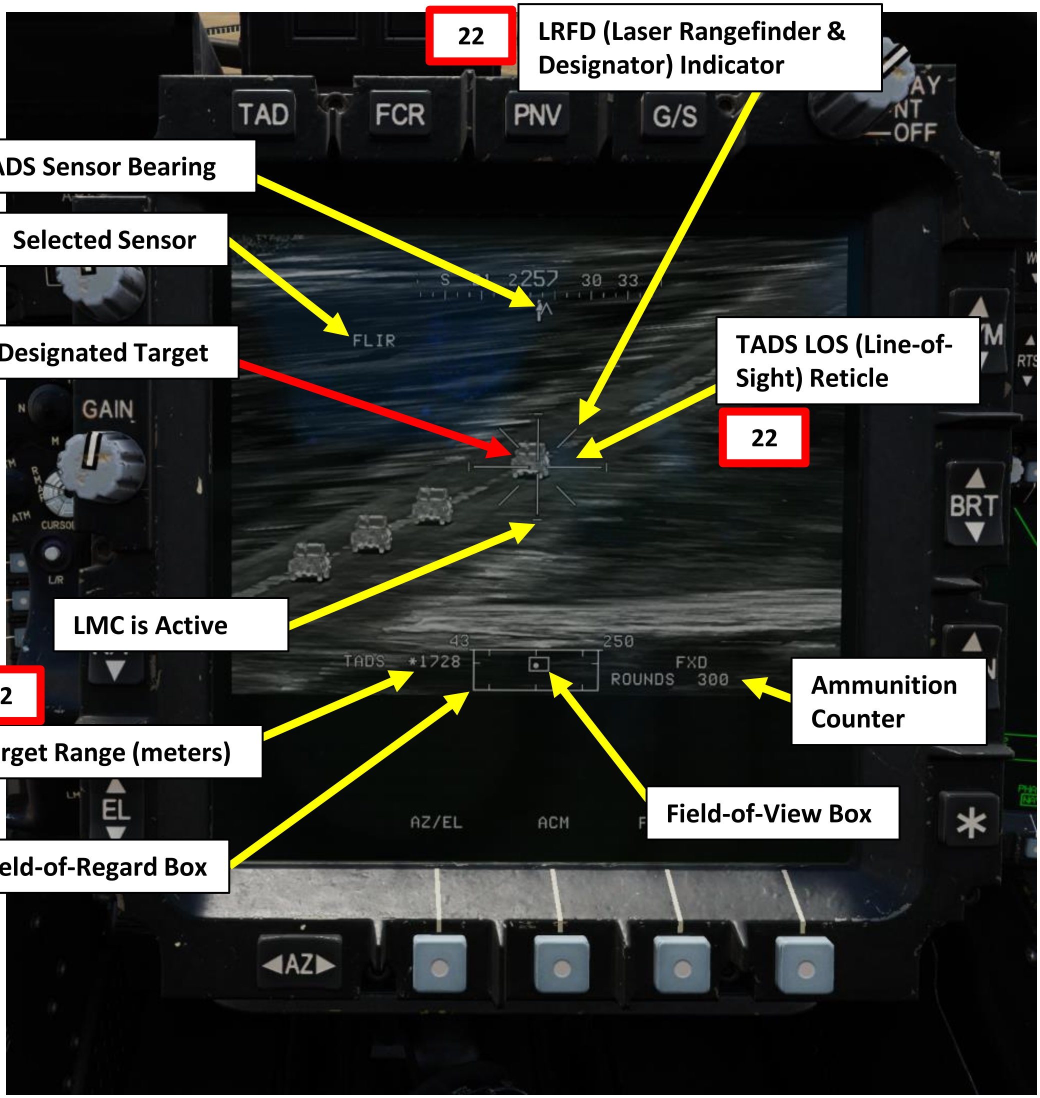
LMC (Linear Motion Compensator) Button (Opposite Side)

25

TEDAC RHG (Right Hand Grip)

22

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)



22

LRFD (Laser Rangefinder & Designator) Indicator

TADS Sensor Bearing

Selected Sensor

Designated Target

TADS LOS (Line-of-Sight) Reticle

22

LMC is Active

22

Target Range (meters)

Ammunition Counter

Field-of-View Box

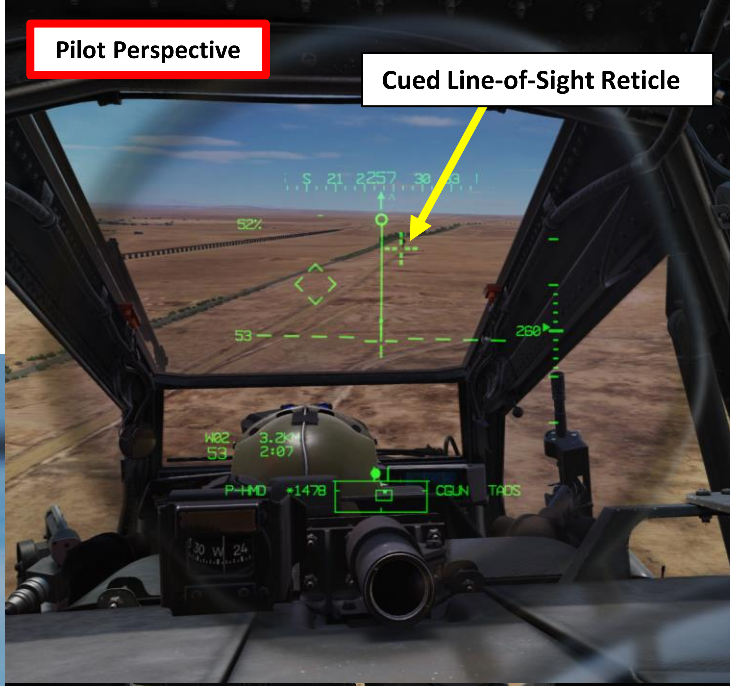
Field-of-Regard Box

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

Note for the pilot if operating in multicrew: On the pilot's IHADSS HDU (Helmet Display Unit), the Cued Line-of-Sight Reticle represents where the TADS is looking if your ACQ (acquisition) source is the TADS.



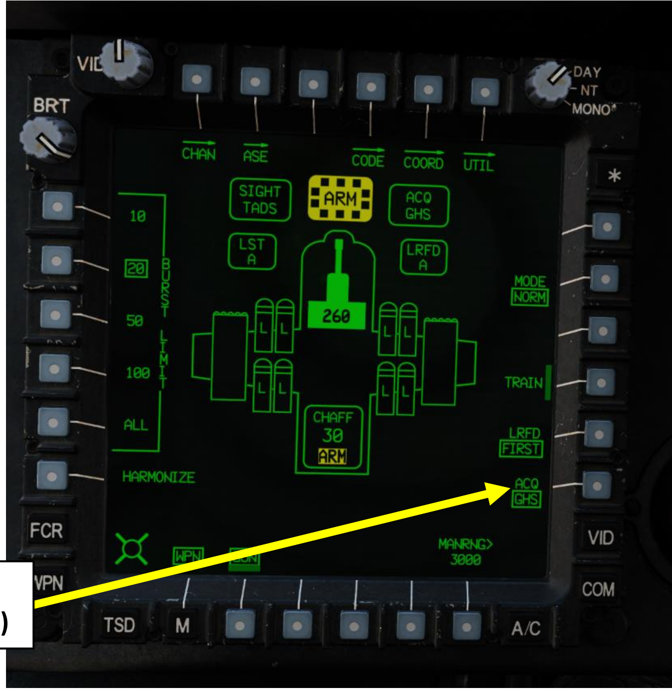
2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.3 – Gun Operation by Co-Pilot/Gunner

2.3.2 – NORM Mode with TADS (Target Acquisition and Designation Sight)

Notes for the CPG: In situations where a target of opportunity is spotted visually by either crew member, it is good practice for the co-pilot/gunner to select either his helmet (GHS, Gunner Helmet Sight) or the pilot's helmet (PHS, Pilot Helmet Sight), then press the Sight Slave Button to slave the TADS to the helmet's line-of-sight reticle.

Once the TADS line-of-sight is on the target, pressing the Sight Slave Button a second time will de-slave the TADS and allow the co-pilot/gunner to make fine adjustments from the TADS display directly using the MAN TRK (Sight Manual Tracker Controller) Switch.



Acquisition Source: GHS (Gunner Helmet Sight)

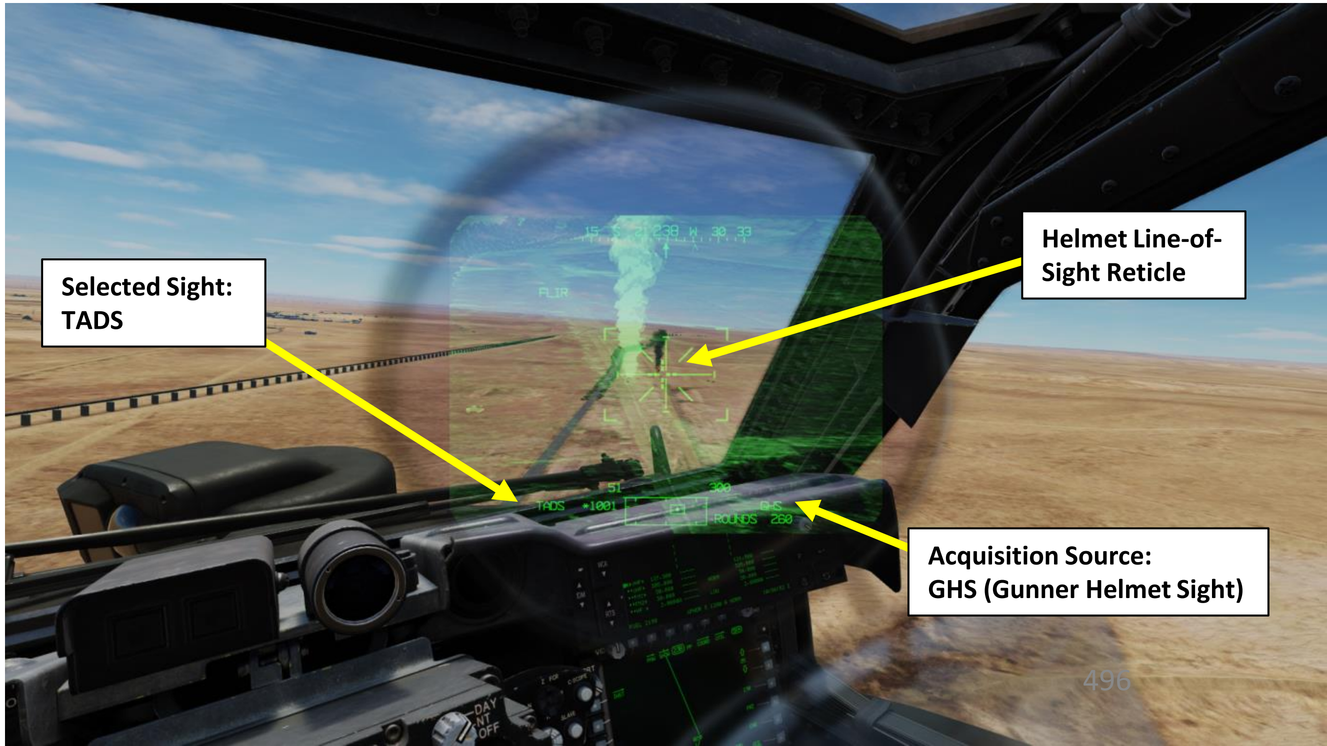
TEDAC RHG (Right Hand Grip)

- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Slave Button

- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"



Selected Sight: TADS

Helmet Line-of-Sight Reticle

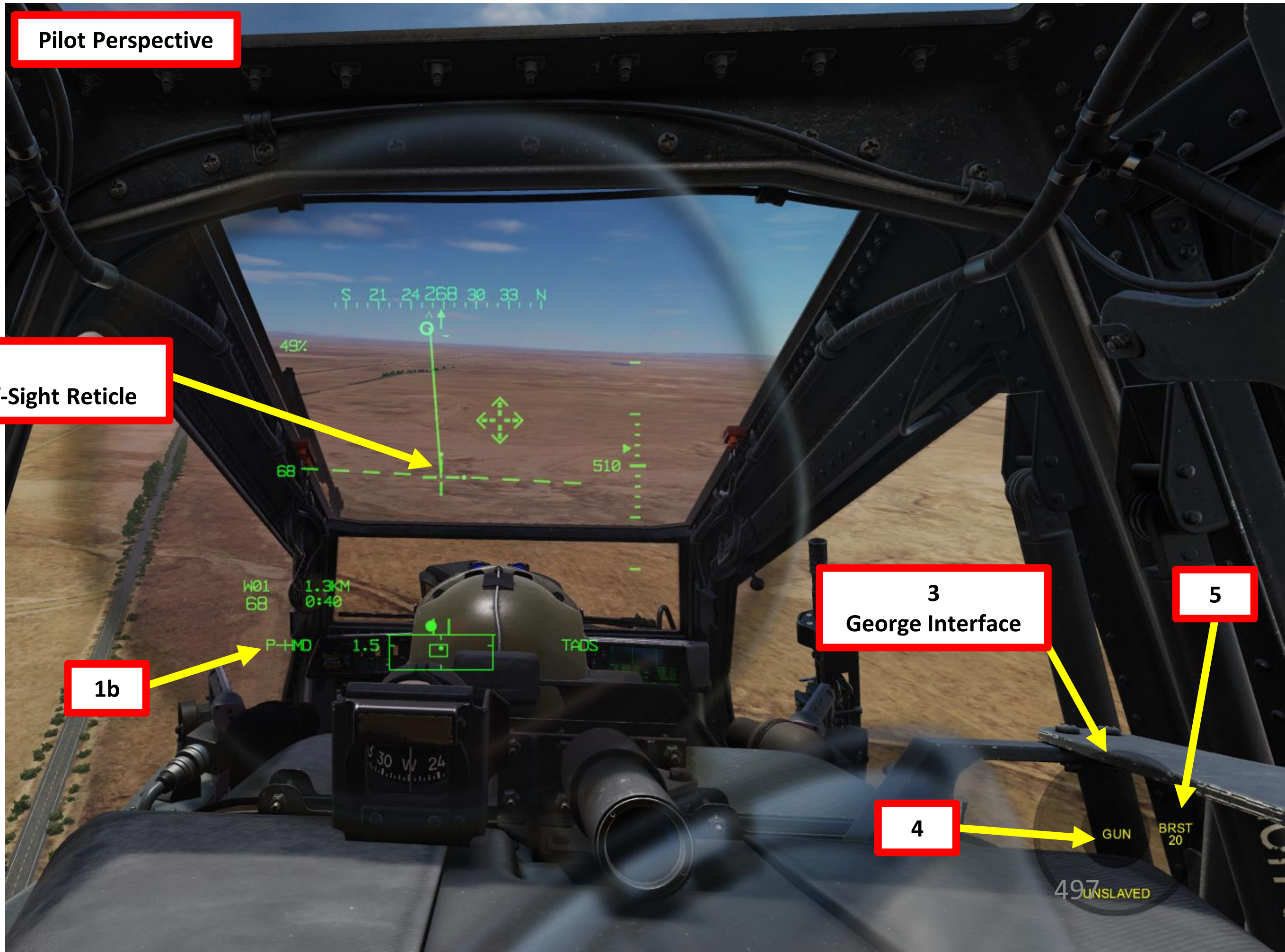
Acquisition Source: GHS (Gunner Helmet Sight)

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.4 – Gun Operation by George AI as Co-Pilot/Gunner

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “P-HMD”.
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Show the George Menu by using « LCTRL+V ».
4. *[P]* Press « A » SHORT (LEFT) for less than 0.5 sec to cycle between weapons until GUN is selected.
5. *[P]* Press « D » SHORT (RIGHT) for less than 0.5 sec to cycle between gun burst settings. We will select 20 rounds per burst.
6. *[P]* The George Menu changes color depending on the active rules of engagement (ROE):
   - Yellow: Weapons hold
   - Green: Weapons free
7. *[P]* Confirm that the George Menu color is yellow. If it is green (weapons free), press « W » LONG (UP) for more than 0.5 sec to set ROE back to weapons hold.
8. *[P]* The pilot’s HDU (Helmet Display Unit) reticle is used as a Designation Reticle to point an area where “George” can identify and track targets.

2



1a

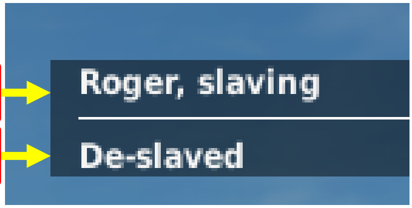
Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

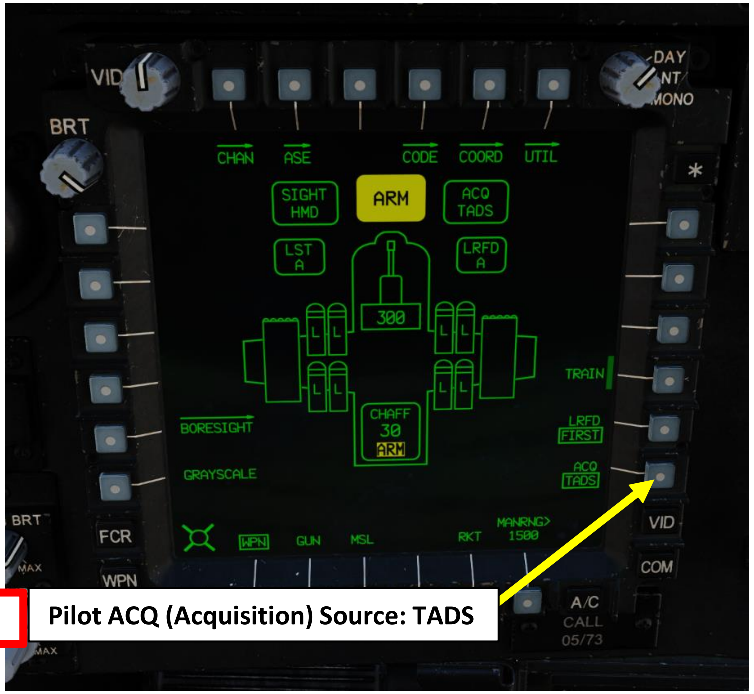
2.4 – Gun Operation by George AI as Co-Pilot/Gunner

9. *[P]* From the WPN (Weapon) page, set the Pilot Acquisition Source to TADS. Then, fly towards the target and ensure the the helicopter attitude remains stable.
10. *[P]* Move your head (HDU Reticle / Designation Reticle) near the area you want the Co-Pilot/Gunner to search for targets, then press « W » SHORT (less than 0.5 sec).
11. *[CPG]* George will select the acquisition source to PHS (Pilot Helmet Sight), then slave the TADS to the acquisition source, then call out "slaving" to remind the pilot that the TADS is slaved to his helmet reticle.
12. *[CPG]* When George has set the TADS reticle is roughly on the area pointed at by the pilot's HDU reticle, George will de-slave the TADS, call out "de-slaved" to tell the pilot that he can start looking elsewhere. Target can then be spotted, designated, lased and stored by him.



11

12



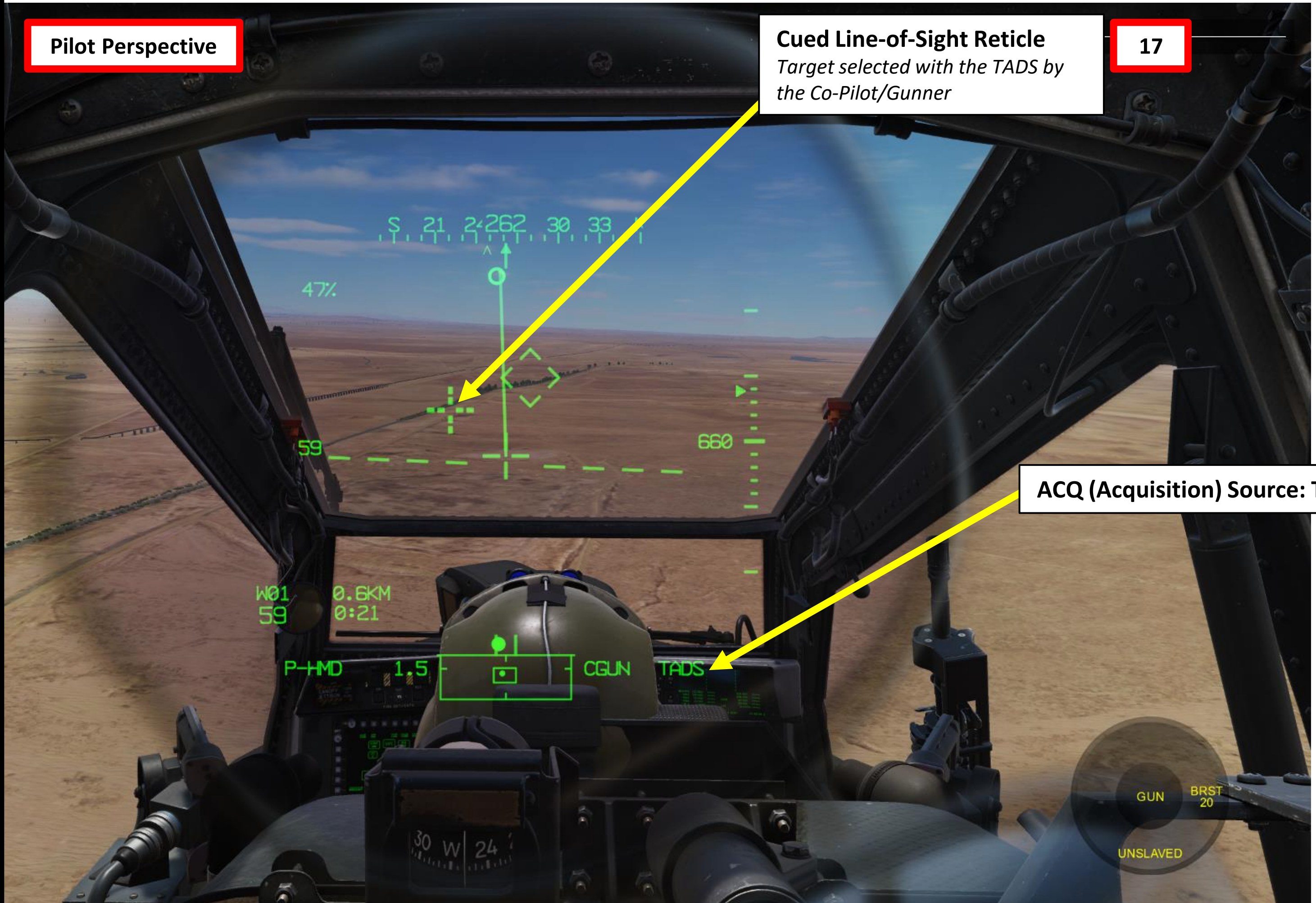
9 Pilot ACQ (Acquisition) Source: TADS

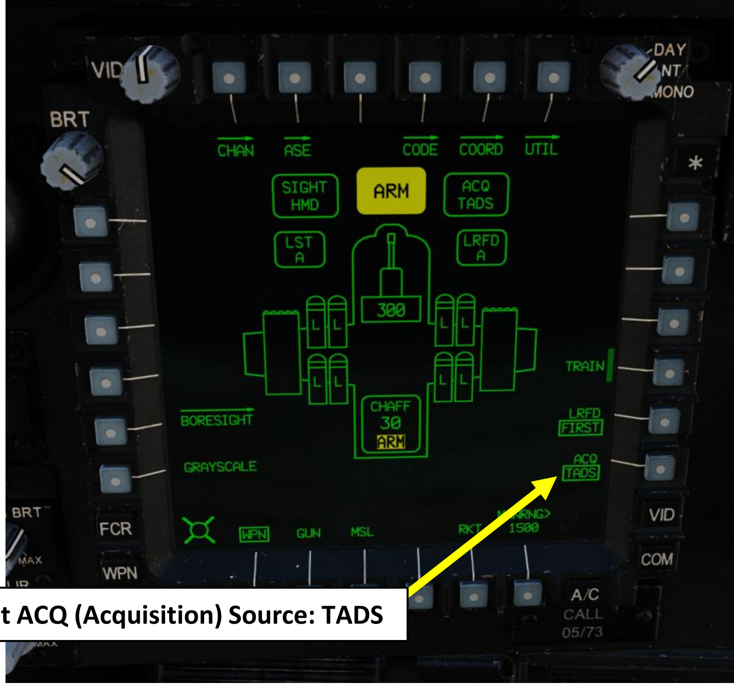
Pilot Perspective

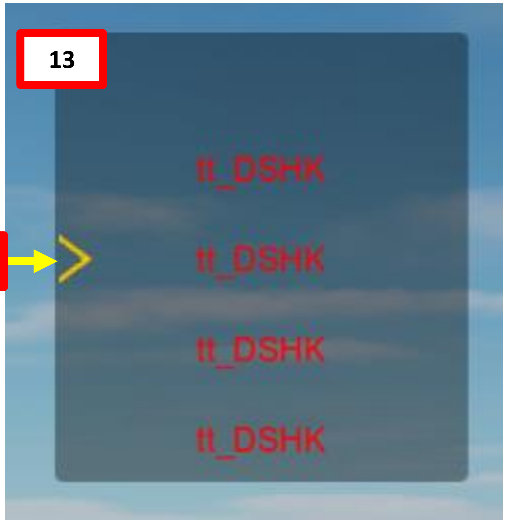
10 Helmet Line-of-Sight Reticle

2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN
2.4 – Gun Operation by George AI as Co-Pilot/Gunner

13. *[CPG]* George will then start scanning for targets in the designated area. When targets are found, a menu with a list of targets appears.
14. *[P]* Cycle through the target list using « W » SHORT (UP) or « S » SHORT (DOWN) until desired target is selected by the > symbol.
15. *[P]* Press « D » SHORT (RIGHT) to select target.
    - Note: Pressing "S" SHORT (DOWN) undesignates George's target.
16. *[CPG]* George will then designate, lase and store the target with the TADS, calling out "lased and stored" in the process.
17. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.





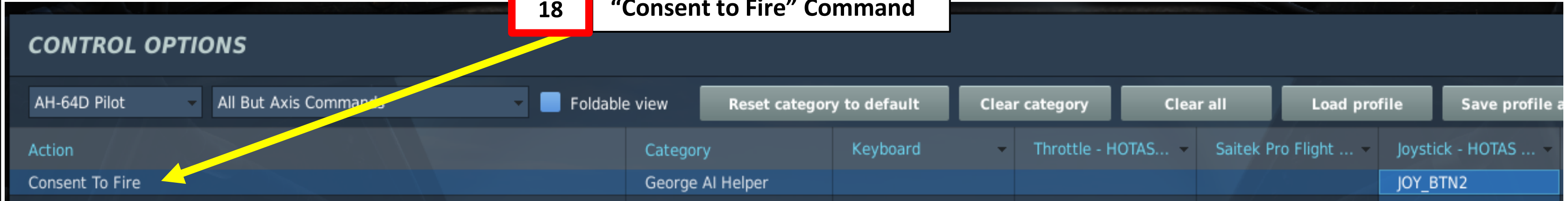


2 – M139 AWS (AREA WEAPON SYSTEM) / M230 30 MM GUN

2.4 – Gun Operation by George AI as Co-Pilot/Gunner

18. [P] Use the « Consent To Fire » command to order George to fire on the selected target.
    - Alternatively, you could press « W » LONG (more than 0.5 sec) to set ROE to weapons free. The George Menu will then switch to green (weapons free).
19. [CPG] George will then fire on the target with the burst setting selected previously.
20. [P] If you want George to stop engaging the target, press “S” SHORT (DOWN) to undesignate George’s target.
21. [P] You can hide the George Menu by using « LCTRL+V ».

18 “Consent to Fire” Command



19a

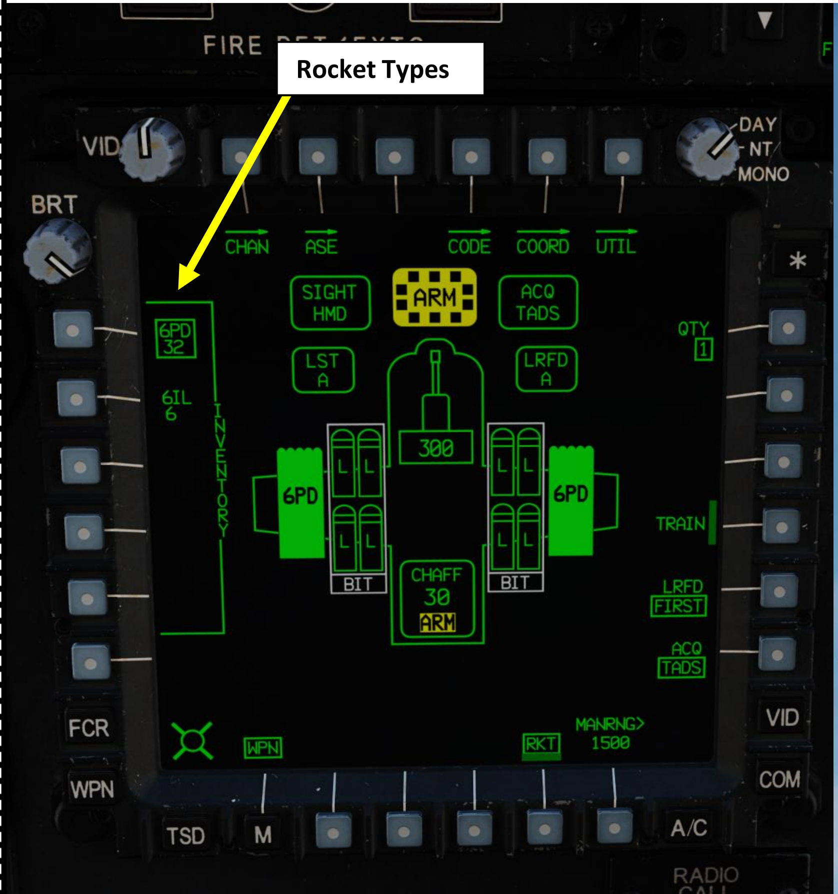
19b

3 – UNGUIDED AERIAL ROCKETS
3.1 – Introduction

The Aerial Rocket Sub-system (ARS) consists of M261 lightweight rocket launchers, capable of firing 2.75-inch folding fin aerial rockets (FFARs), primarily variants of the Hydra-70 rocket. The M261 has 19 rocket tubes, and can be loaded on all four pylons, for a maximum of 76 rockets. Each M261 rocket launcher is "zoned", allowing for carriage of up to three different rocket types with one pair of launchers mounted, or up to five rocket types with two pairs of rocket launchers mounted. Each tube provides individual firing and fusing circuits.

The interesting feature of the ARS system is its integration with articulated hardpoints; this allows any crew member to aim with the HMD (Helmet-Mounted Display) Line-of-Sight Reticle, and the articulated hardpoint will move to control rocket elevation (but not in azimuth) to ensure the rocket lands on the aimpoint when fired. Of course, this takes into account that pylon articulation elevation limits are respected and that the helicopter is positioned correctly and flies at an adequate attitude.

Rocket Types			
Label	**Motor**	**Fuzing**	**Warhead**
6PD	Mk. 66	Point Detonation	High Explosive
6RC	Mk. 66	Penetration	High Explosive
6MP	Mk. 66	Time Delay	Multipurpose Submunition
6IL	Mk. 66	Time Delay	Illumination
6SK	Mk. 66	Time Delay	Smoke
6FL	Mk. 66	Time Delay	Flechette



3 – UNGUIDED AERIAL ROCKETS

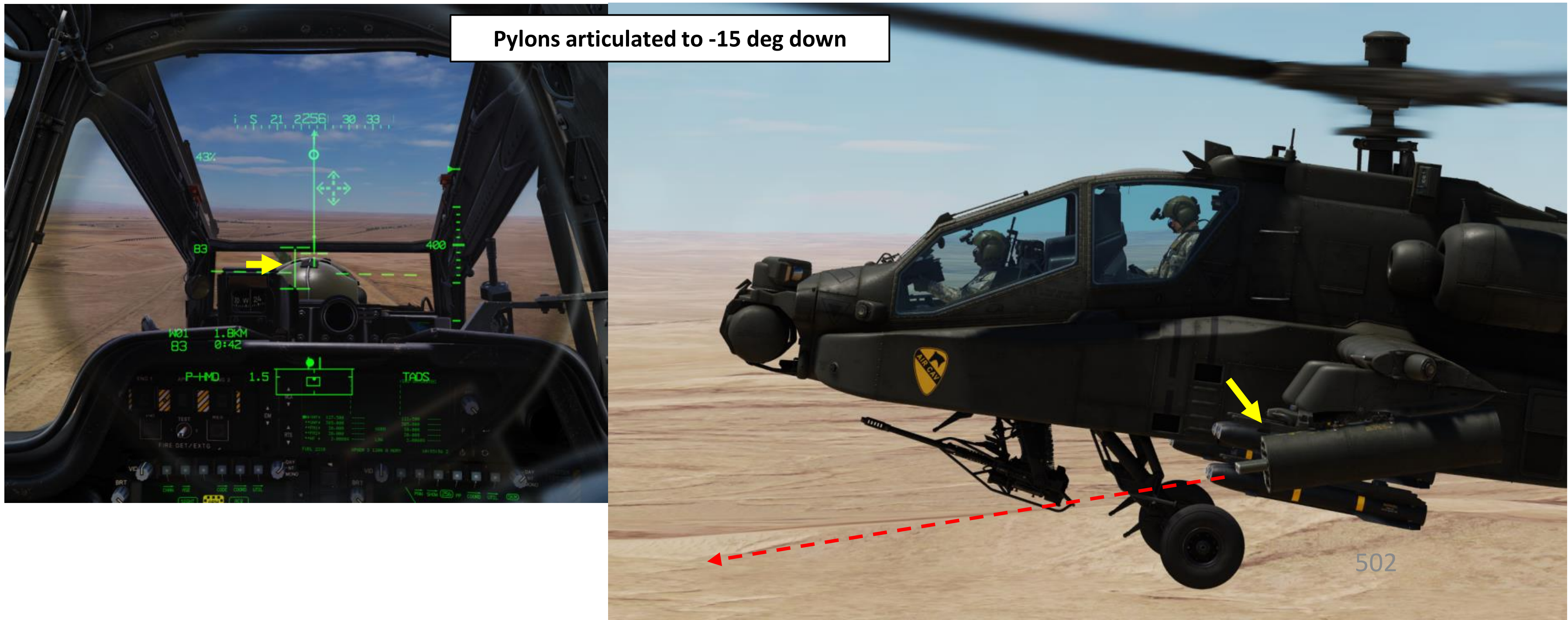
3.1 – Introduction

Articulated Hardpoint Limits

The Aerial Rocket Sub-system provides the AH-64 with a direct and indirect fire capability akin to a light rocket artillery battery. Each hardpoint is capable of articulating between +4 deg to -15 deg in elevation.

"PYLON LIMIT" Message is visible if pylon limits are exceeded

Pylons articulated to +4 deg up

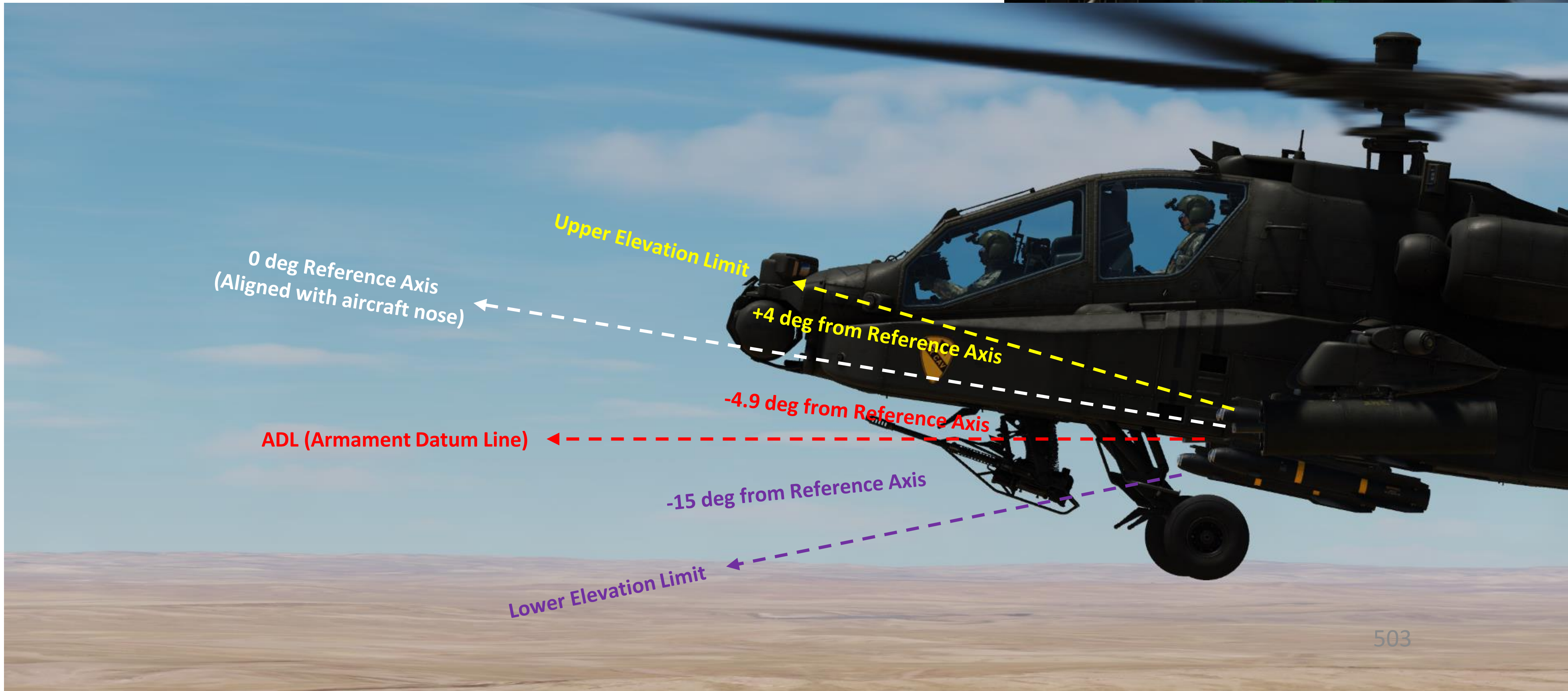


Pylons articulated to -15 deg down

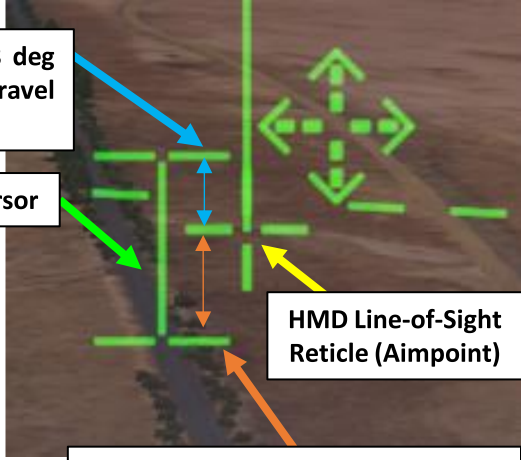
3 – UNGUIDED AERIAL ROCKETS
3.1 – Introduction

Aircraft Datum Line (ADL)

The Aircraft Datum Line (ADL) is a line that is drawn straight out from the nose at -4.9 deg elevation and is represented by the Head Tracker symbol within the Helmet-Mounted Display flight symbology. In a stable hover with no winds, the ADL will be level with the horizon and is typically at an approximate mid-point between the upper and lower articulation limits of the pylons.



3 – UNGUIDED AERIAL ROCKETS
3.1 – Introduction

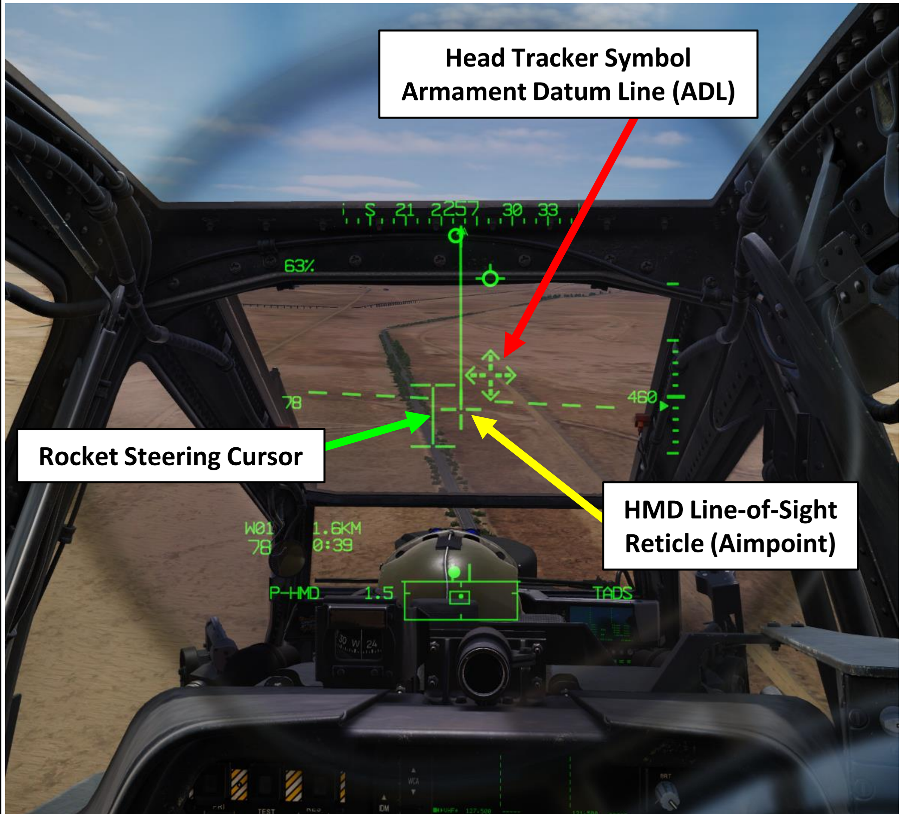


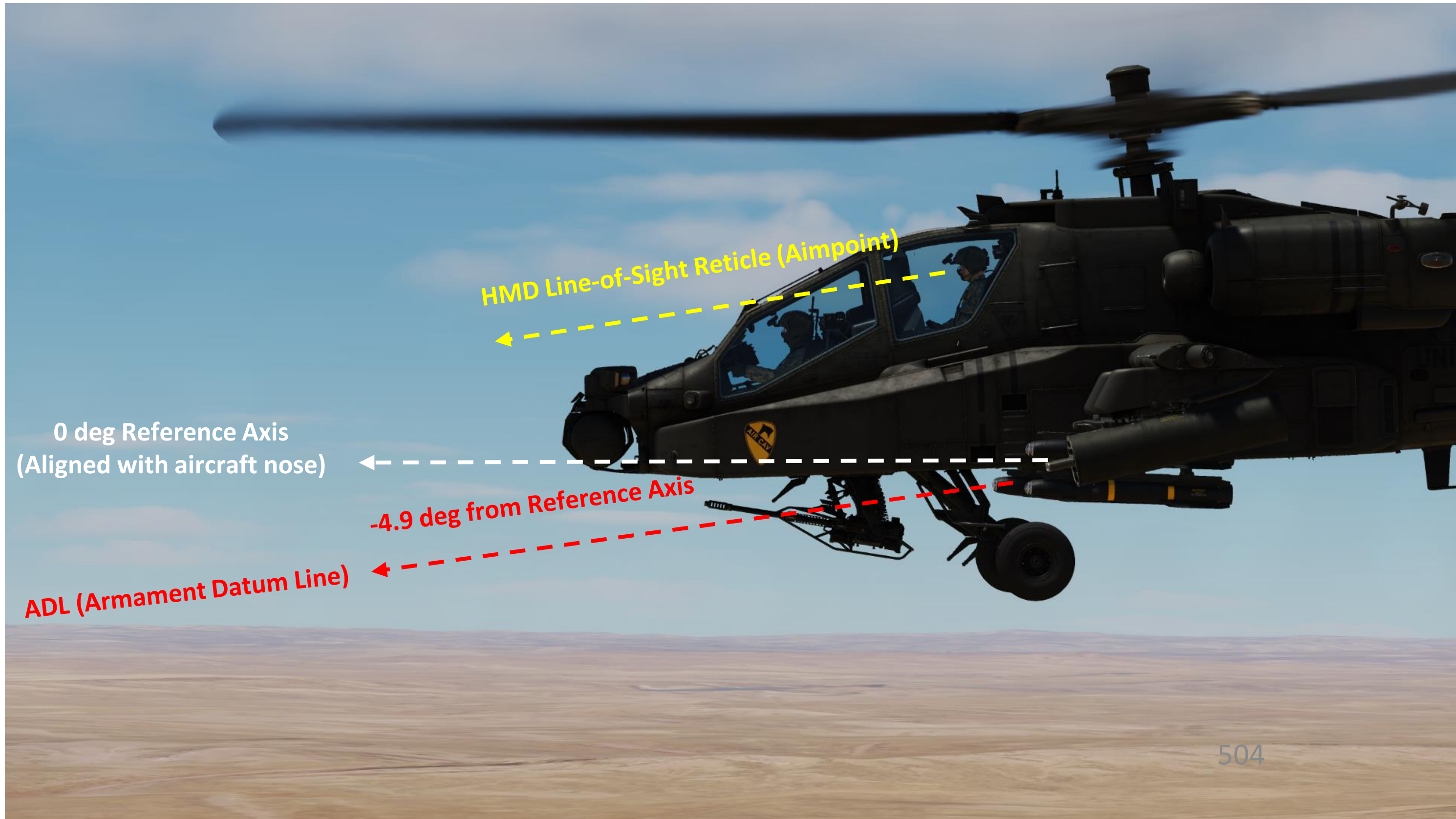
Rocket Steering Cursor

The Rocket Steering Cursor is a steering/manoeuver cue that indicates the direction to turn the aircraft (by either cyclic or pedal inputs) and the required pitch angle of the aircraft to place the calculated ballistic solution within the articulation limits of the pylons. In other words, the Rocket Steering Cursor represents the required position in azimuth and elevation the ADL (Armament Datum Line) of the aircraft needs to be placed relative to the aimpoint to keep the ballistic solution within the pylon articulation range.

When the HMD (Helmet-Mounted Display) is the crewmember's selected sight, the Line-of-Sight reticle is used to designate the target location. In this situation, you can consider the HMD Line-of-Sight as the aimpoint reference. This is done regardless of wherever the crewmember is looking, and the ballistic solution is updated continuously as the crewmember looks around. There are also cases where other sensors are used to designate the aimpoint reference.

The remaining factors that influence where the Rocket Steering Cursor is placed are the range to the target and the relative winds and air mass as calculated by the High Integrated Air Data Computer (HIADC).



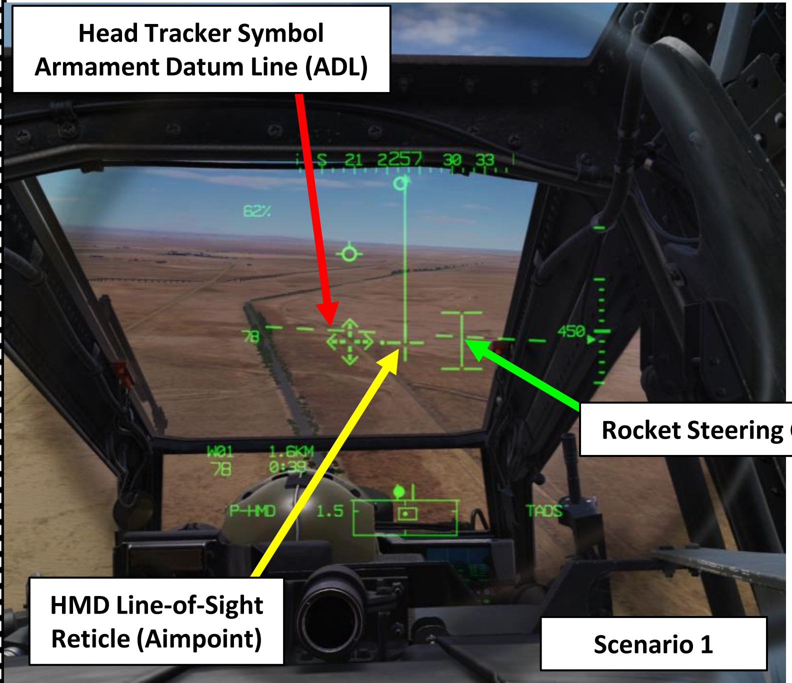


3 – UNGUIDED AERIAL ROCKETS

3.1 – Introduction

Rocket Steering Cursor

- Scenario 1: Rocket Steering Cursor indicates to turn right since HMD Line-of-Sight (aimpoint) is to the right of the ADL.
- Scenario 2: Rocket Steering Cursor, HMD Line-of-Sight (aimpoint) and ADL are lined up. Rockets will land on HMD Line-of-Sight.
- Scenario 3: Rocket Steering Cursor indicates to turn left since HMD Line-of-Sight (aimpoint) is to the left of the ADL.
- Scenario 4: Rocket Steering Cursor is dashed and indicates that HMD Line-of-Sight (aimpoint) is out of the pylon articulation range.

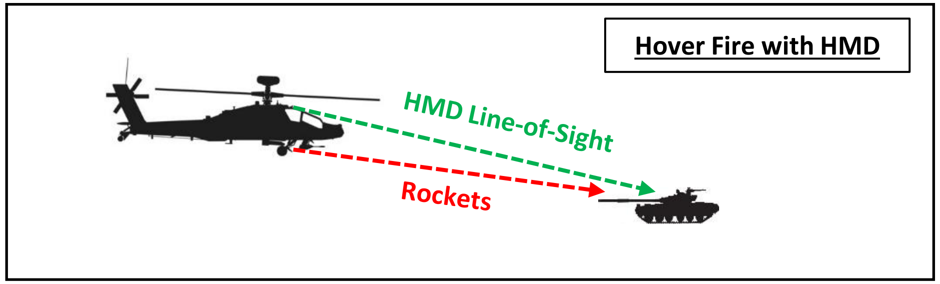


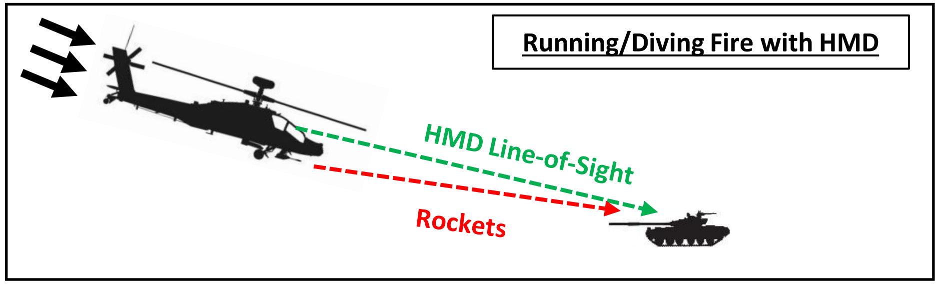
3 – UNGUIDED AERIAL ROCKETS
3.1 – Introduction

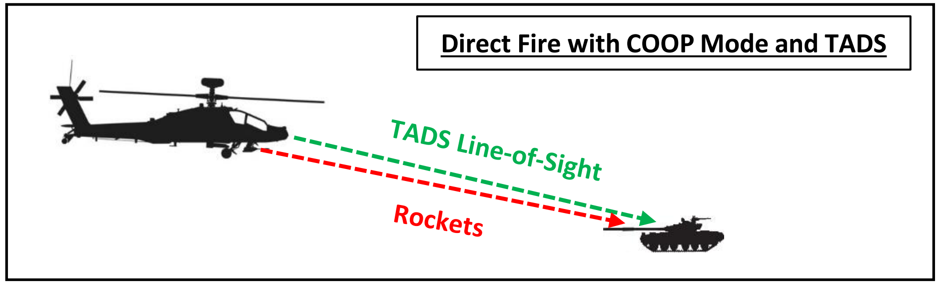
Engagement Methods

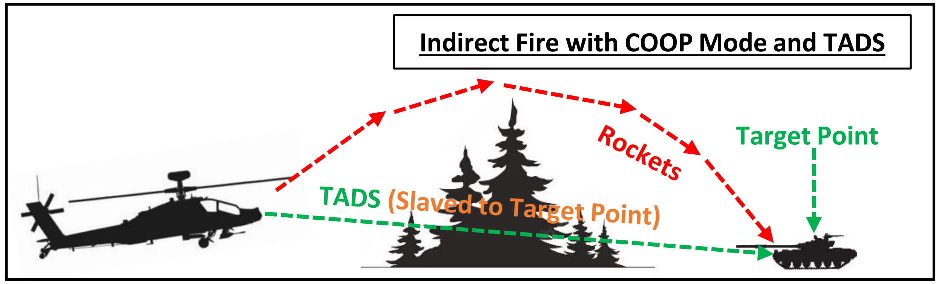
There are four primary methods of using rockets in the AH-64:

- **Hover Fire with Helmet-Mounted Display (HMD):** This method has the pilot fly in a hover and use the HMD Line-of-Sight reticle to aim with. Steering commands are provided by the Rocket Steering Cursor to align the helicopter with the aimpoint (HMD Line-of-Sight).
- **Running/Diving Fire with Helmet-Mounted Display (HMD):** This method has the pilot perform a running/diving attack and use the HMD Line-of-Sight reticle to aim with. Steering commands are provided by the Rocket Steering Cursor to align the helicopter with the aimpoint (HMD Line-of-Sight).
- **Direct Fire with COOP Mode and TADS:** COOP Mode implies that both the pilot and co-pilot/gunner have selected rockets and work in cooperation to designate and fire rockets on the target. The co-pilot/gunner's job is to use the TADS (Target Acquisition & Designation Sight) to designate the target. The pilot's job is to steer the helicopter using the Rocket Steering Cursor as a steering cue and fire rockets. Direct fire means that there is a clear line-of-sight between the TADS and the target.
- **Indirect Fire with COOP Mode and TADS:** COOP Mode implies that both the pilot and co-pilot/gunner have selected rockets and work in cooperation to designate and fire rockets on the target. The co-pilot/gunner's job is to use the TADS (Target Acquisition & Designation Sight) to designate the target. The pilot's job is to steer the helicopter using the Rocket Steering Cursor as a steering cue and fire rockets. Indirect fire means that there is not necessarily any line-of-sight between the TADS and the target; slaving the TADS to a waypoint or a target point is the preferred procedure for this method.







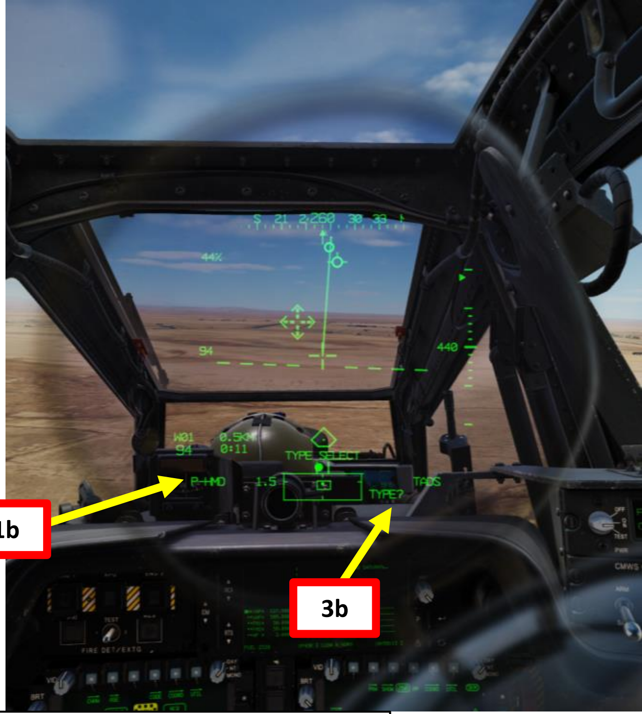


3 – UNGUIDED AERIAL ROCKETS

3.2 – Rocket Operation by Pilot

3.2.1 – Hover Fire with HMD (Helmet-Mounted Display)

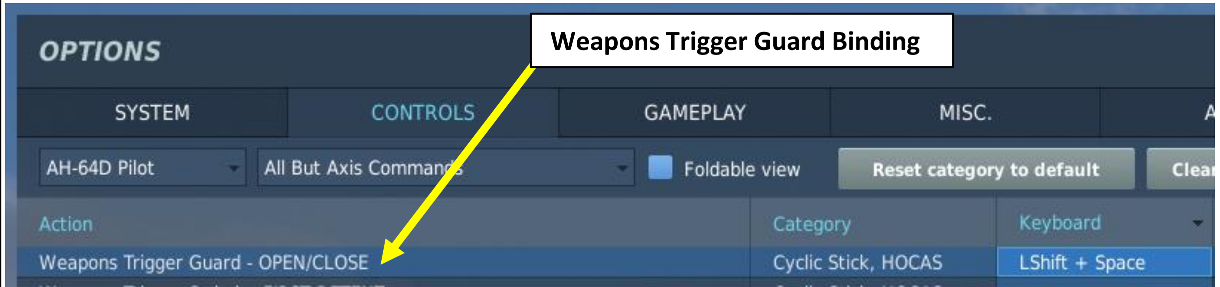
1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "P-HMD".
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Press WAS (Weapon Action Switch) LEFT to select the Rockets.
    - "TYPE?" indication means that we have not selected a rocket type yet.
4. *[P]* Flip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
    - Set the "Weapons Trigger Guard – OPEN/CLOSE" to a binding easy to remember like "LSHIFT+SPACEBAR".
    - This step is not required if the "Weapons Trigger Guard Enable Special Option" is disabled (unticked).

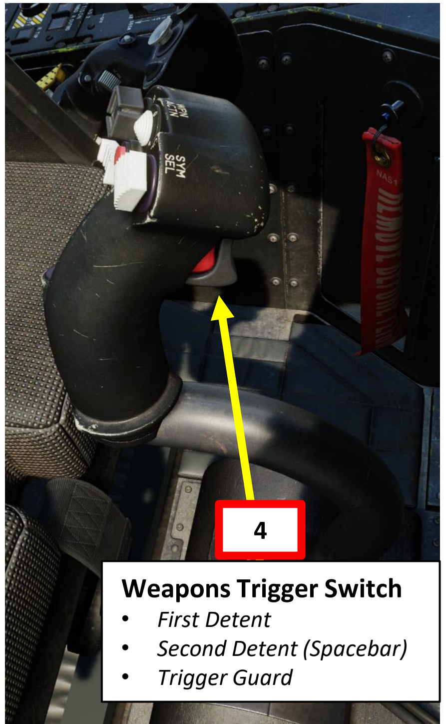


1a

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

Weapons Trigger Guard Binding





Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

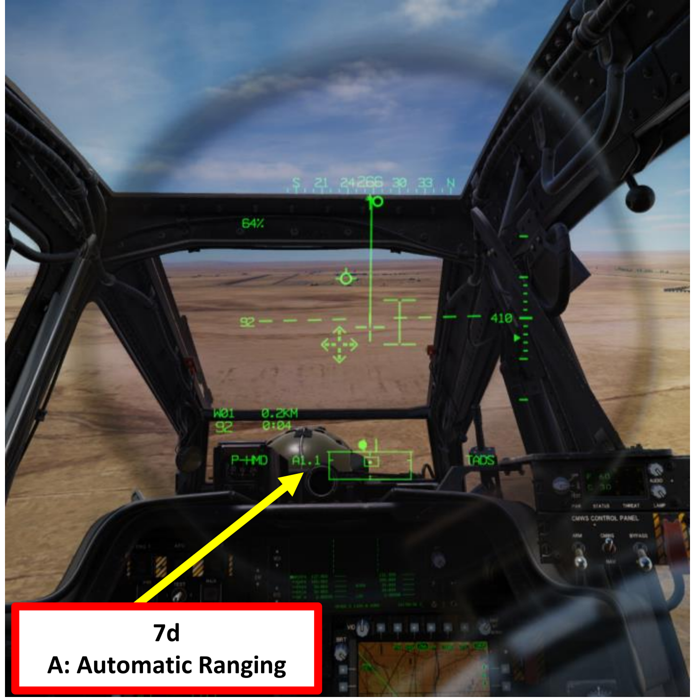
Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

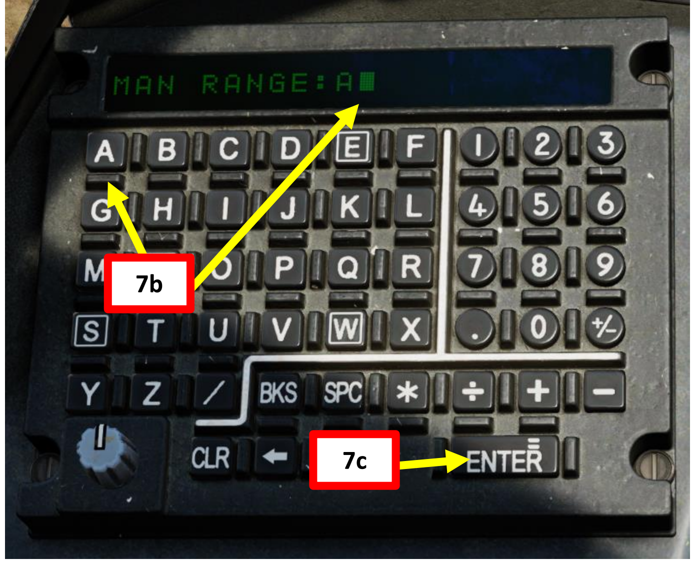
3 – UNGUIDED AERIAL ROCKETS

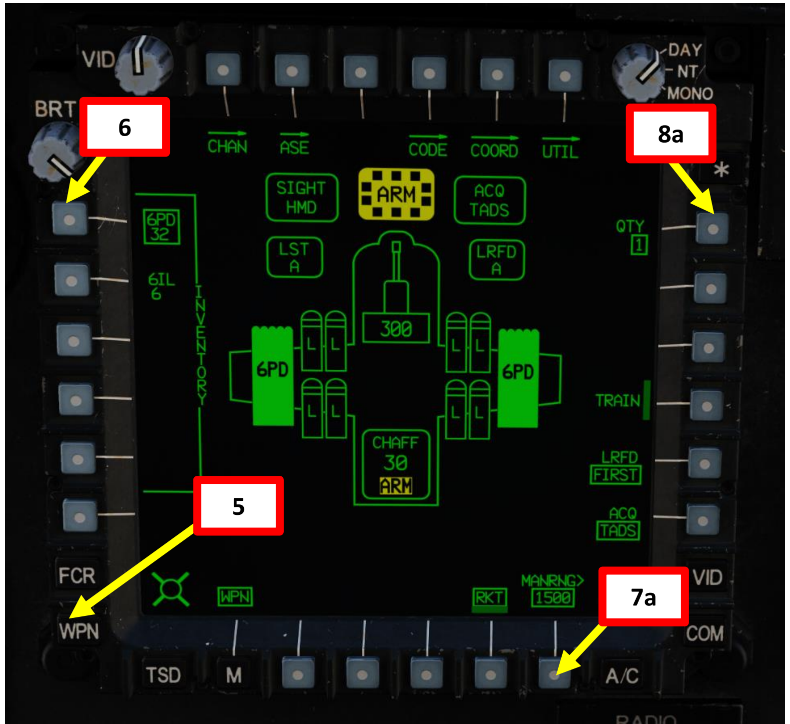
3.2 – Rocket Operation by Pilot

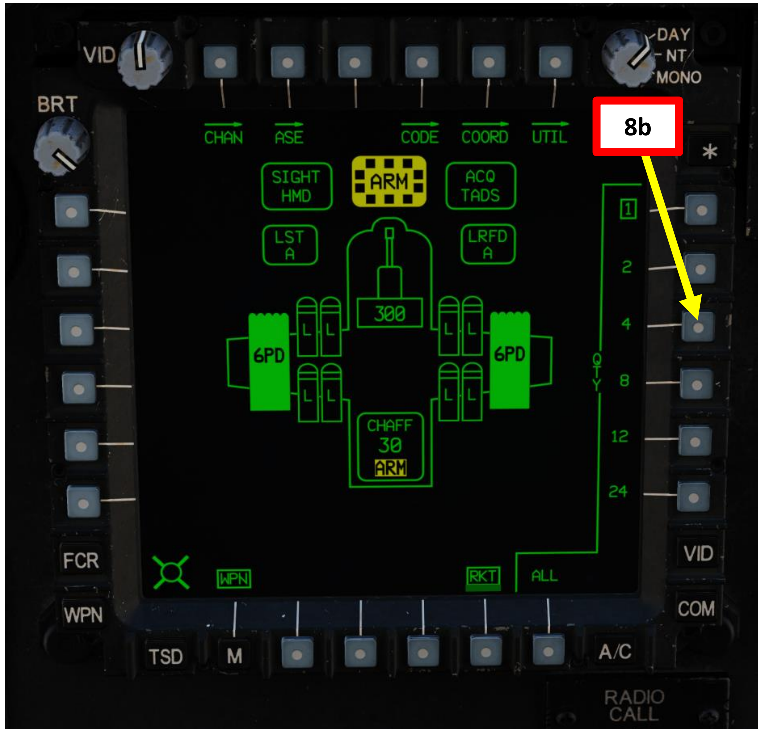
3.2.1 – Hover Fire with HMD (Helmet-Mounted Display)

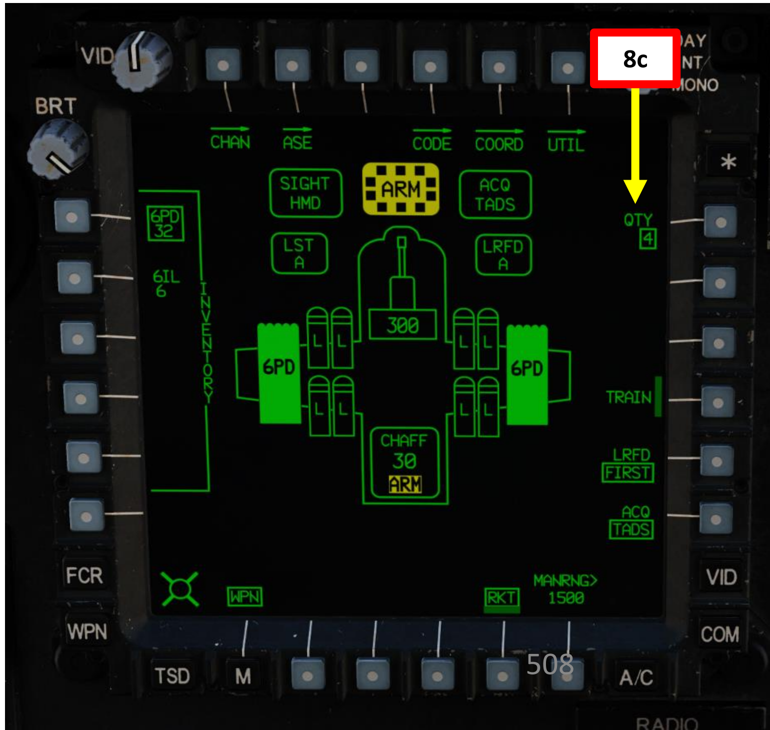
5. *[P]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[P]* Press on the VAB (Variable Action Button) next to the rocket type you want to select. We will select type “6PD”, which is a high explosive warhead with point detonation fuzing. The rocket counter is below the type data field.
7. *[P]* Press VAB next to MAN RNG, enter desired Rocket Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
   - For automatic ranging, enter “A” on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.
8. *[P]* Press VAB next to desired Salvo Quantity setting. We will select 4 rockets per salvo.









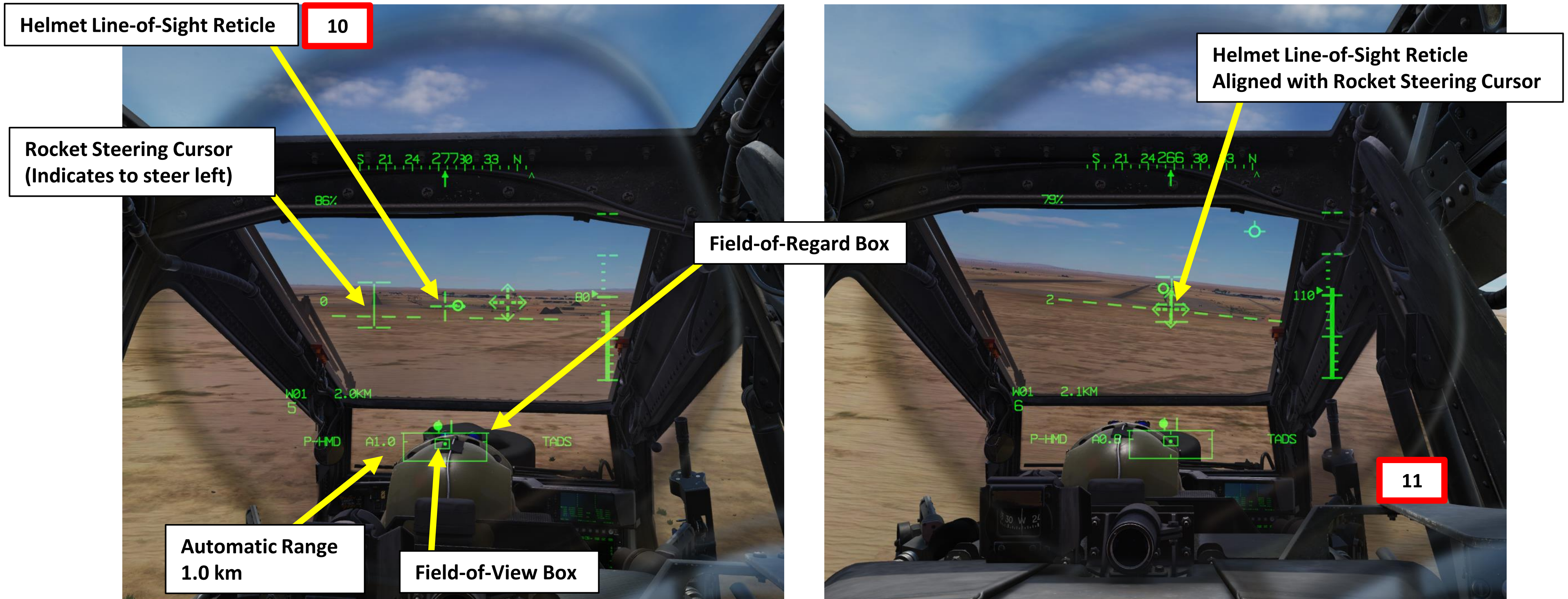


3 – UNGUIDED AERIAL ROCKETS

3.2 – Rocket Operation by Pilot

3.2.1 – Hover Fire with HMD (Helmet-Mounted Display)

9. *[P]* Bring the helicopter into a stable hover.
10. *[P]* Move your head to keep the Helmet Line-of-Sight Reticle on the target.
11. *[P]* Use pedal inputs to turn the helicopter in the direction of the Rocket Steering Cursor ***while maintaining the HMD Line-of-Sight reticle on the target***.
12. *[P]* When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle, stop turning and stabilize the helicopter attitude and heading.
13. *[P]* The articulated hardpoints will move to control rocket elevation (but not in azimuth) to ensure the rocket lands on the aimpoint (in this case, the HMD Line-of-Sight) when fired.
14. *[P]* Verify no weapon inhibit messages (i.e. PYLON LIMITS) are displayed in the High Action Display.

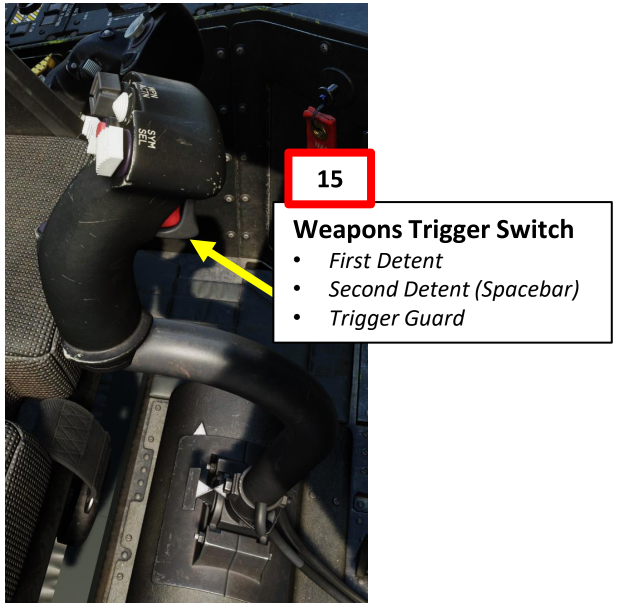


3 – UNGUIDED AERIAL ROCKETS

3.2 – Rocket Operation by Pilot

3.2.1 – Hover Fire with HMD (Helmet-Mounted Display)

15. [P] Fire rockets by squeezing the Weapons Trigger Second Detent ("Spacebar" binding) on the cyclic.



3 – UNGUIDED AERIAL ROCKETS

3.2 – Rocket Operation by Pilot

3.2.2 – Running/Diving Fire with HMD (Helmet-Mounted Display)

1. [P] Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “P-HMD”.
2. [P] Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. [P] Press WAS (Weapon Action Switch) LEFT to select the Rockets.
   - “TYPE?” indication means that we have not selected a rocket type yet.
4. [P] Flip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
   - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).

2

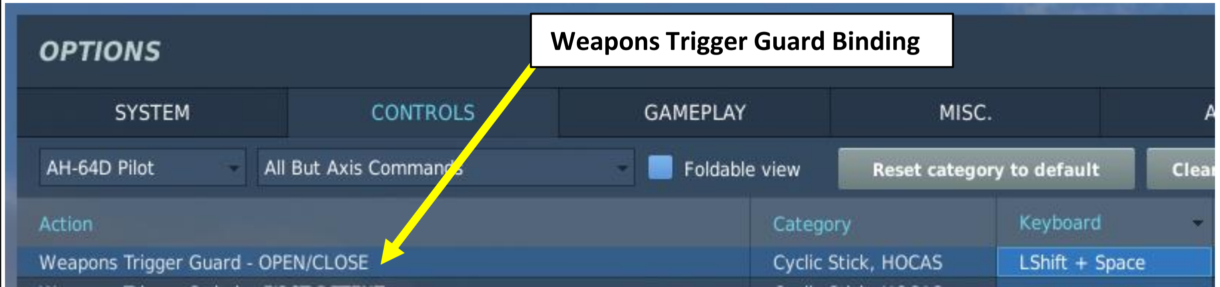
1b

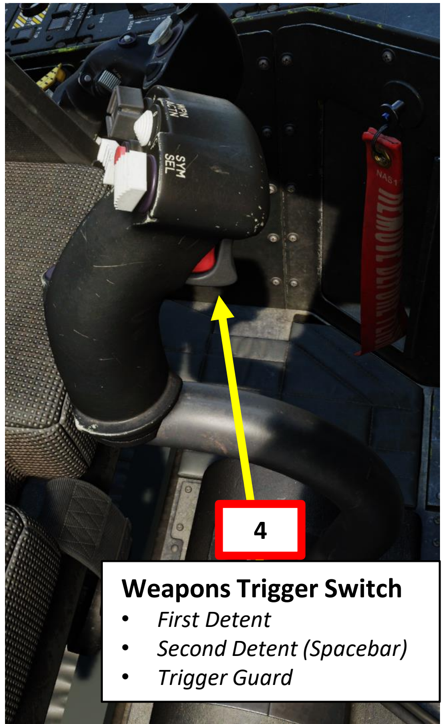
3b

1a

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

Weapons Trigger Guard Binding





4

Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

Weapon Action Switch (WAS)
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

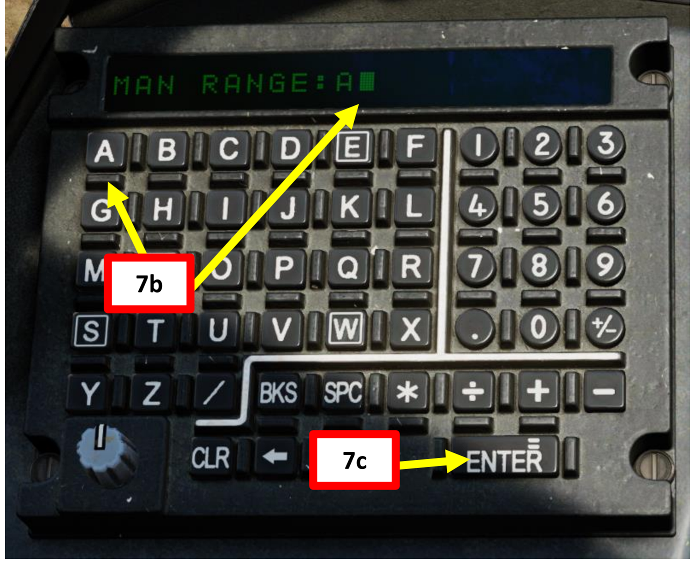
3a

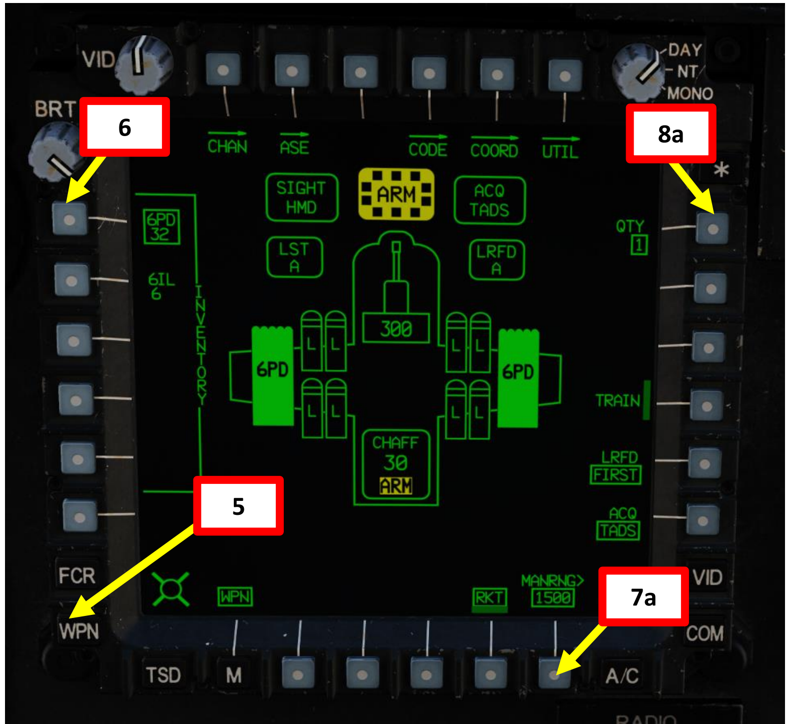
3 – UNGUIDED AERIAL ROCKETS

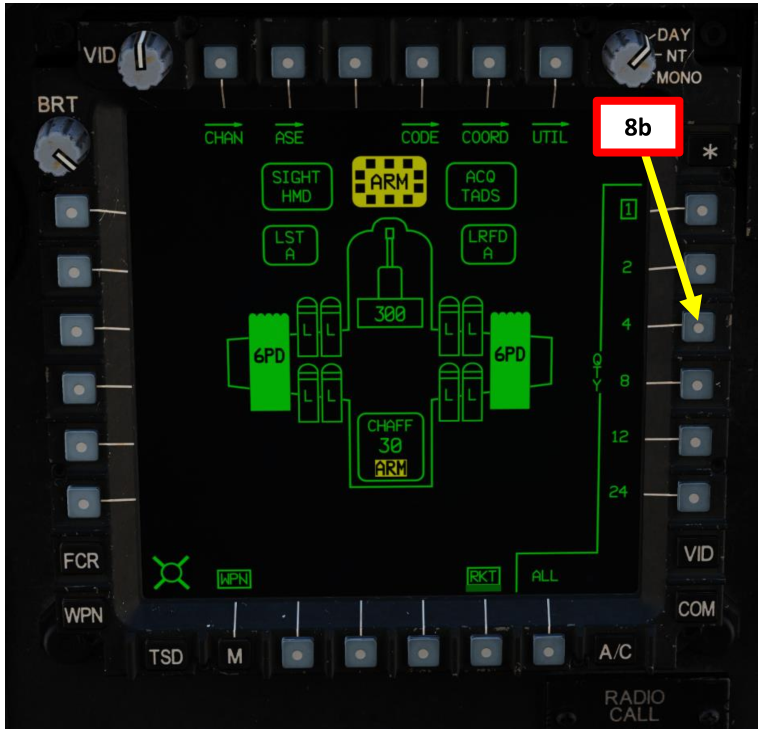
3.2 – Rocket Operation by Pilot

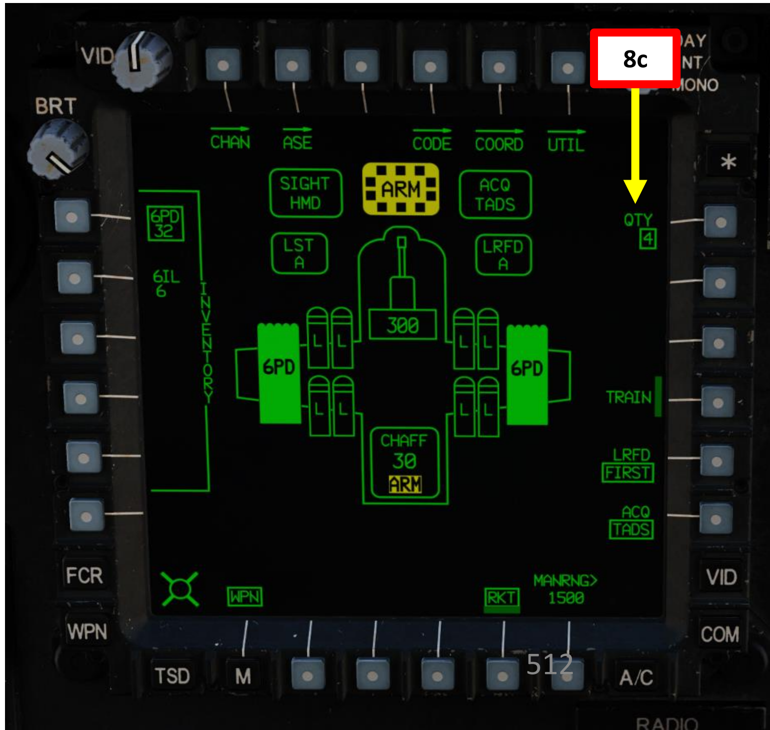
3.2.2 – Running/Diving Fire with HMD (Helmet-Mounted Display)

5. *[P]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[P]* Press on the VAB (Variable Action Button) next to the rocket type you want to select. We will select type “6PD”, which is a high explosive warhead with point detonation fuzing. The rocket counter is below the type data field.
7. *[P]* Press VAB next to MAN RNG, enter desired Rocket Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
    - For automatic ranging, enter “A” on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.
8. *[P]* Press VAB next to desired Salvo Quantity setting. We will select 4 rockets per salvo.







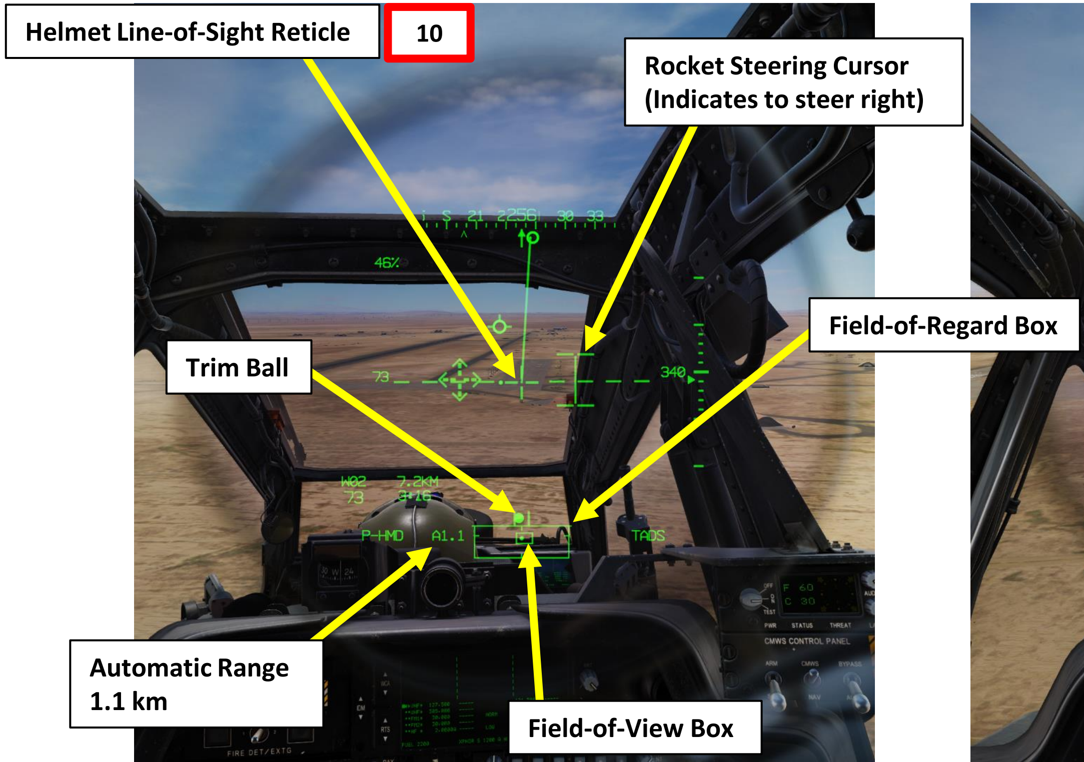


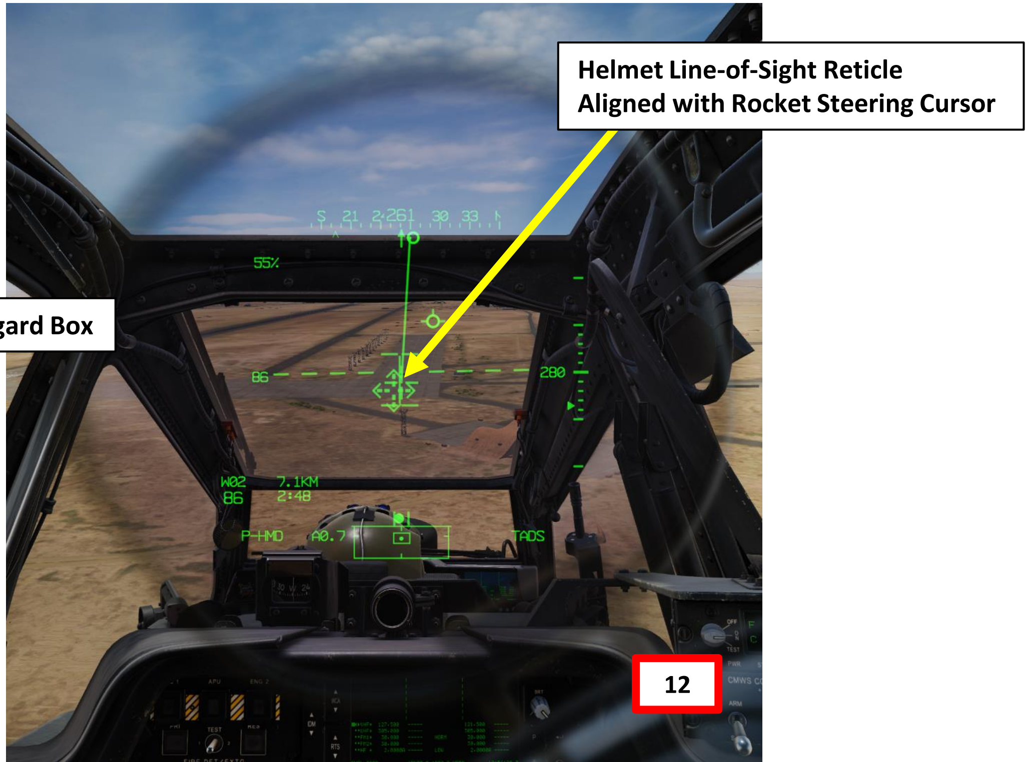
3 – UNGUIDED AERIAL ROCKETS

3.2 – Rocket Operation by Pilot

3.2.2 – Running/Diving Fire with HMD (Helmet-Mounted Display)

9. *[P]* Spot the target visually start flying towards it.
10. *[P]* Move your head to keep the Helmet Line-of-Sight Reticle on the target.
11. *[P]* Use cyclic roll inputs to turn the aircraft in the direction of the Rocket Steering Cursor ***while maintaining the HMD Line-of-Sight reticle on the target***.
12. *[P]* When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle in the lateral axis, stop turning and stabilize the helicopter attitude and heading with cyclic inputs. Maintain the trim ball centered with the pedals.
    - If performing a dive, use cyclic to adjust the pitch attitude of the helicopter and maintain applied power setting with the collective.
13. *[P]* The articulated hardpoints will move to control rocket elevation (but not in azimuth) to ensure the rocket lands on the aimpoint (in this case, the HMD Line-of-Sight) when fired.





3 – UNGUIDED AERIAL ROCKETS

3.2 – Rocket Operation by Pilot

3.2.2 – Running/Diving Fire with HMD (Helmet-Mounted Display)

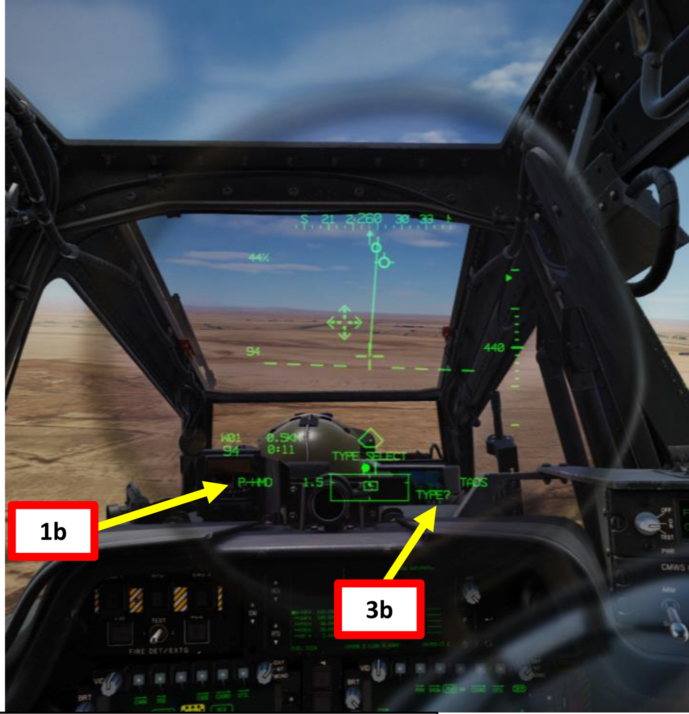
14. *[P]* Verify no weapon inhibit messages (i.e. PYLON LIMITS) are displayed in the High Action Display.
15. *[P]* Fire rockets by squeezing the Weapons Trigger Second Detent (“Spacebar” binding) on the cyclic.

3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

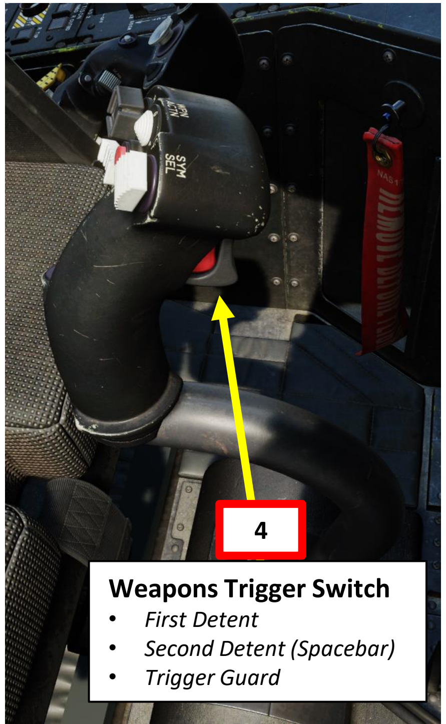
3.3.1 – Direct Fire with COOP Mode & TADS

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “P-HMD”.
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Press WAS (Weapon Action Switch) LEFT to select the Rockets.
   - “TYPE?” indication means that we have not selected a rocket type yet.
4. *[P]* Flip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
   - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).



1a

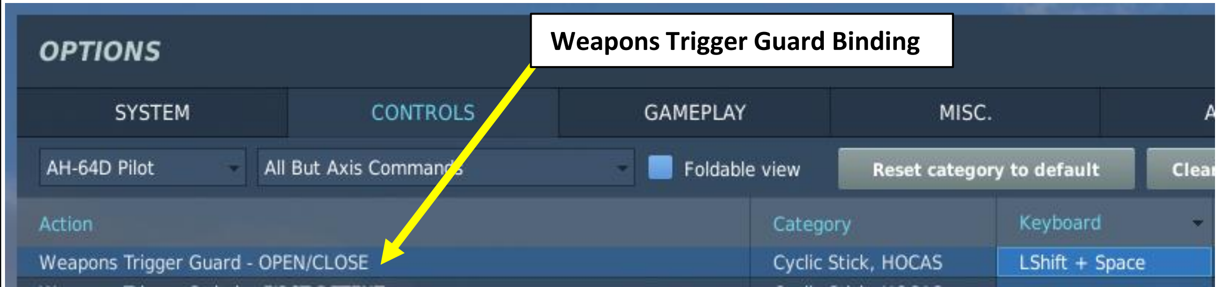
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*



Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

Weapon Action Switch (WAS)
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Weapons Trigger Guard Binding

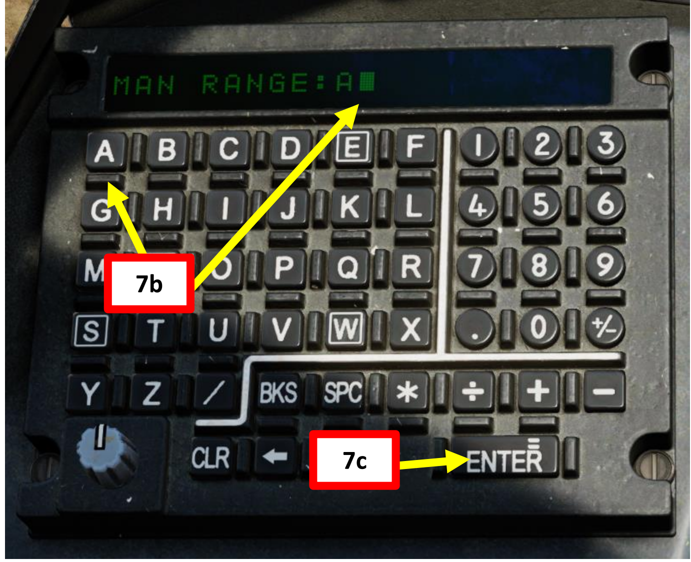


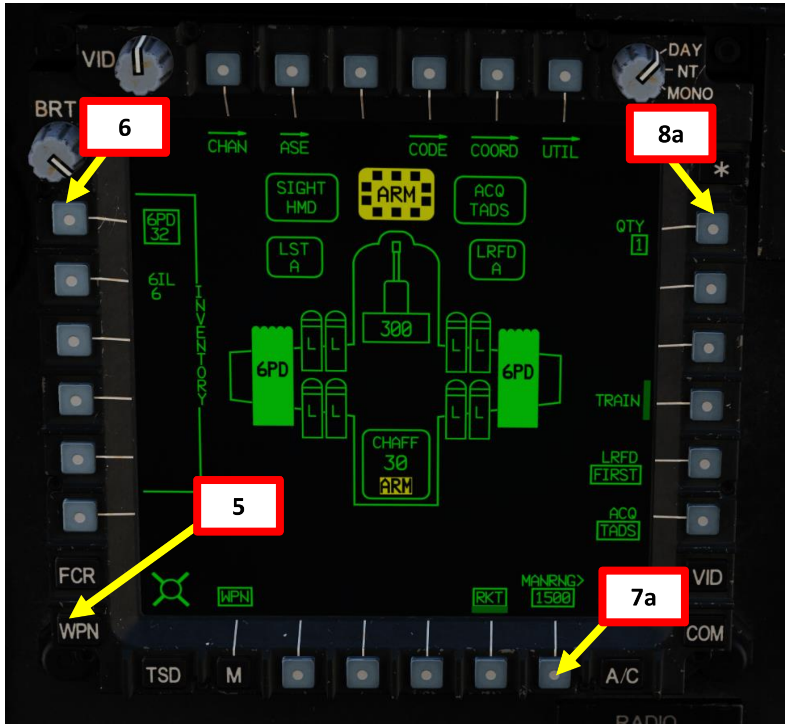
3 – UNGUIDED AERIAL ROCKETS

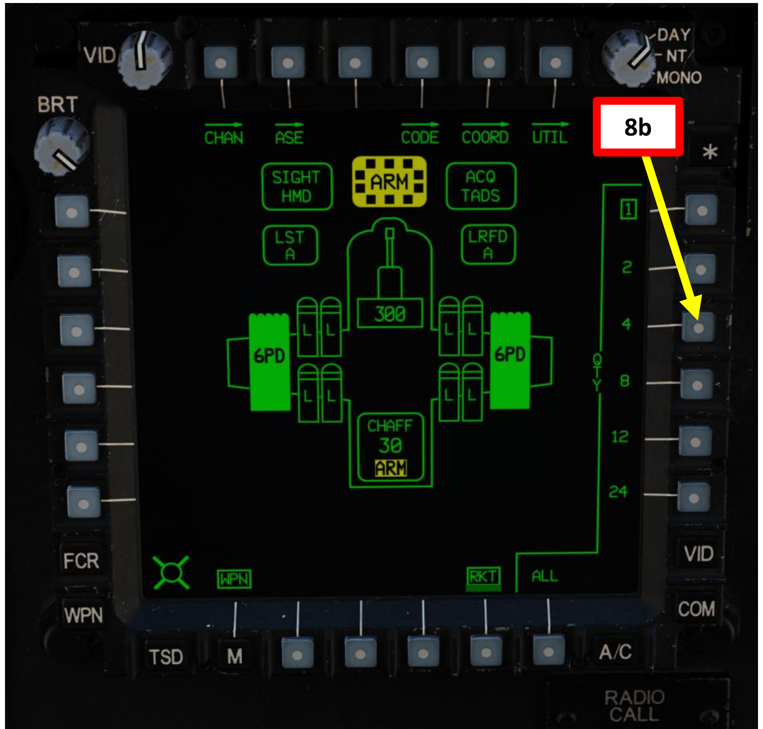
3.3 – Rocket Operation by Multicrew

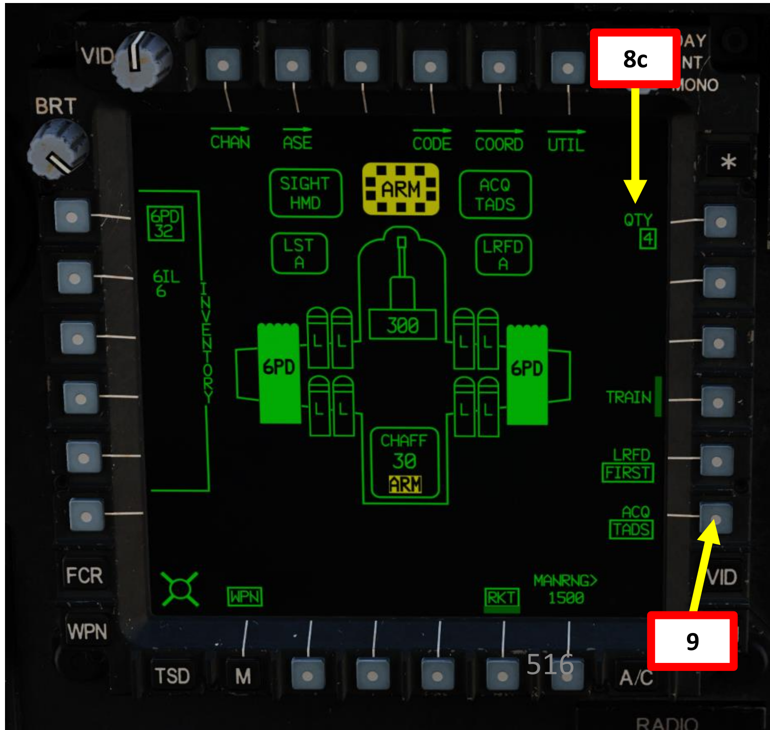
3.3.1 – Direct Fire with COOP Mode & TADS

5. *[P]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[P]* Press on the VAB (Variable Action Button) next to the rocket type you want to select. We will select type "6PD", which is a high explosive warhead with point detonation fuzing. The rocket counter is below the type data field.
7. *[P]* Press VAB next to MAN RNG, enter desired Rocket Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
   - For automatic ranging, enter "A" on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.
8. *[P]* Press VAB next to desired Salvo Quantity setting. We will select 4 rockets per salvo.
9. *[P]* Press VAB next to ACQ and select TADS. This will ensure you are using the Co-Pilot/Gunner's Target Acquisition & Designation Sight as your acquisition source.







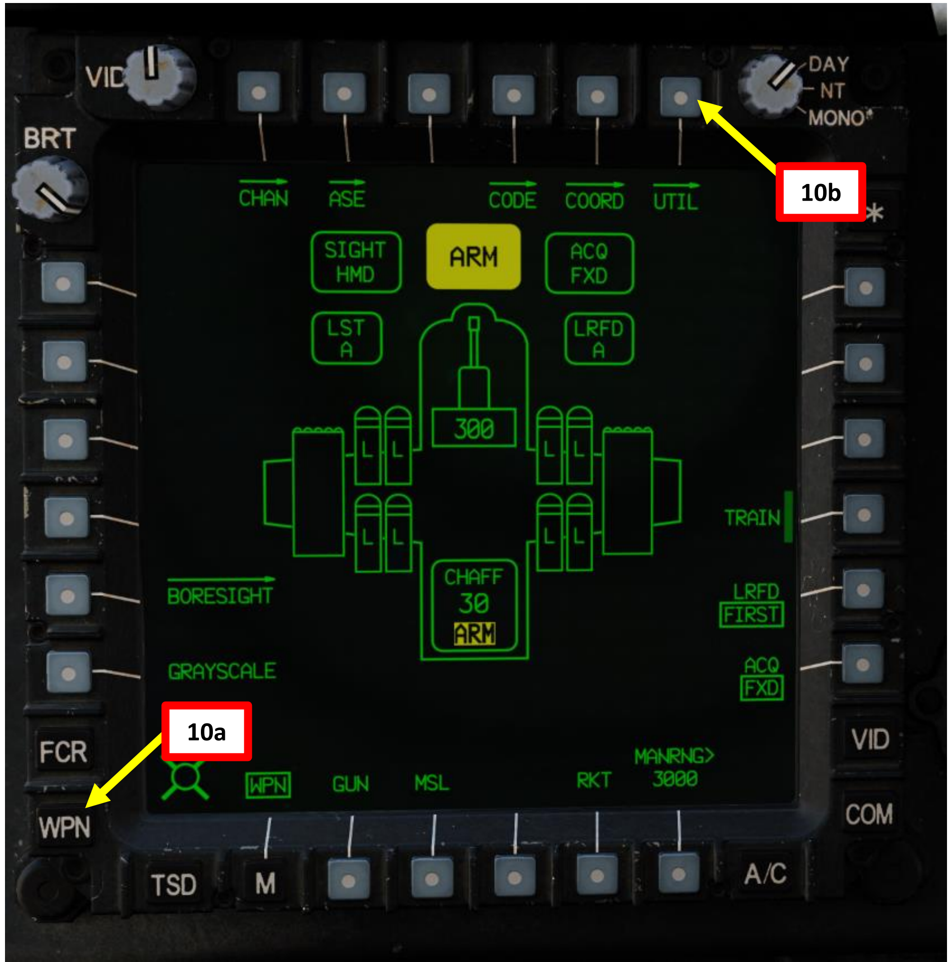


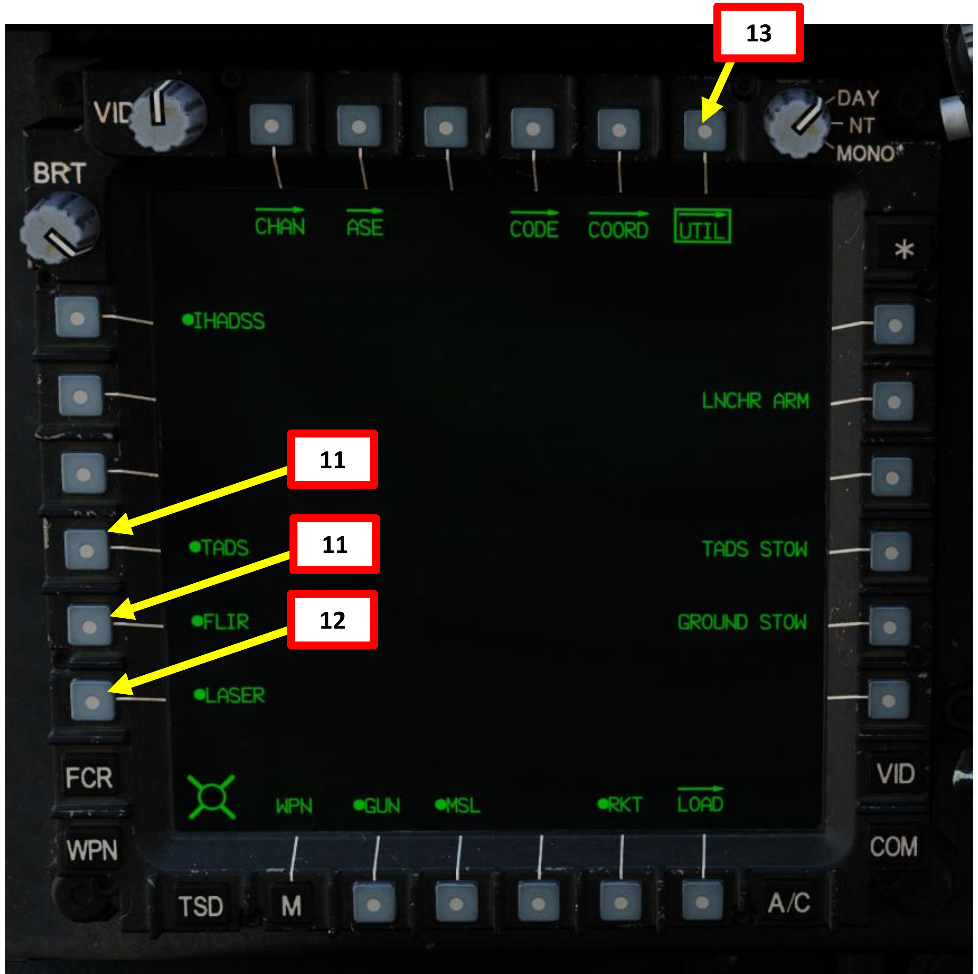
3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

10. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
11. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
    - Hollow circle means OFF. Solid Circle means ON.
12. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
    - Hollow circle means OFF. Solid Circle means ON.
    - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
13. *[CPG]* Press VAB next to UTIL to return to main WPN page.



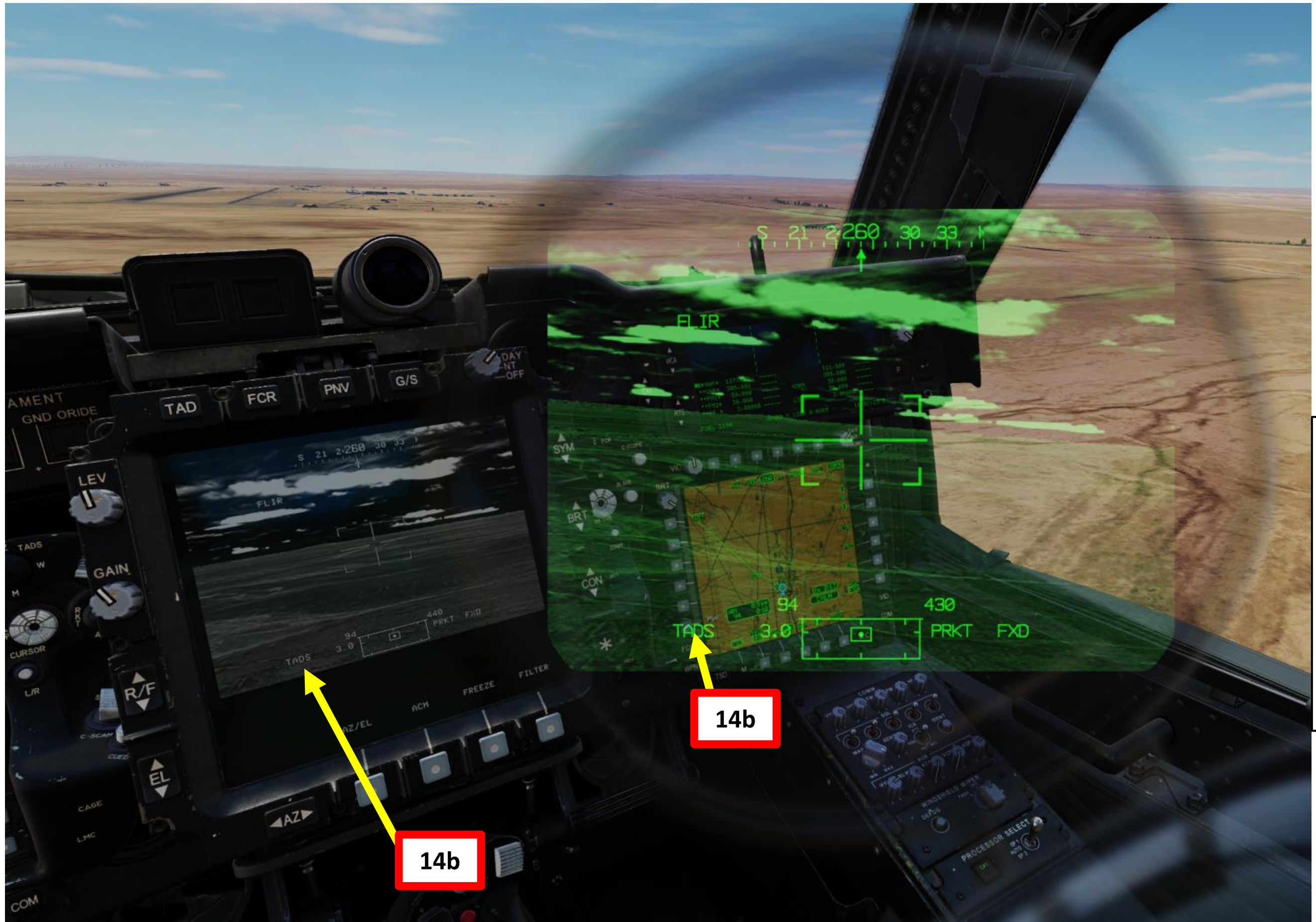


3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

14. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
15. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the “IHADSS Show” binding, which is “i” by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “C-HMD”.
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.



14a

TEDAC RHG Sight Selector Switch

- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

3 – UNGUIDED AERIAL ROCKETS

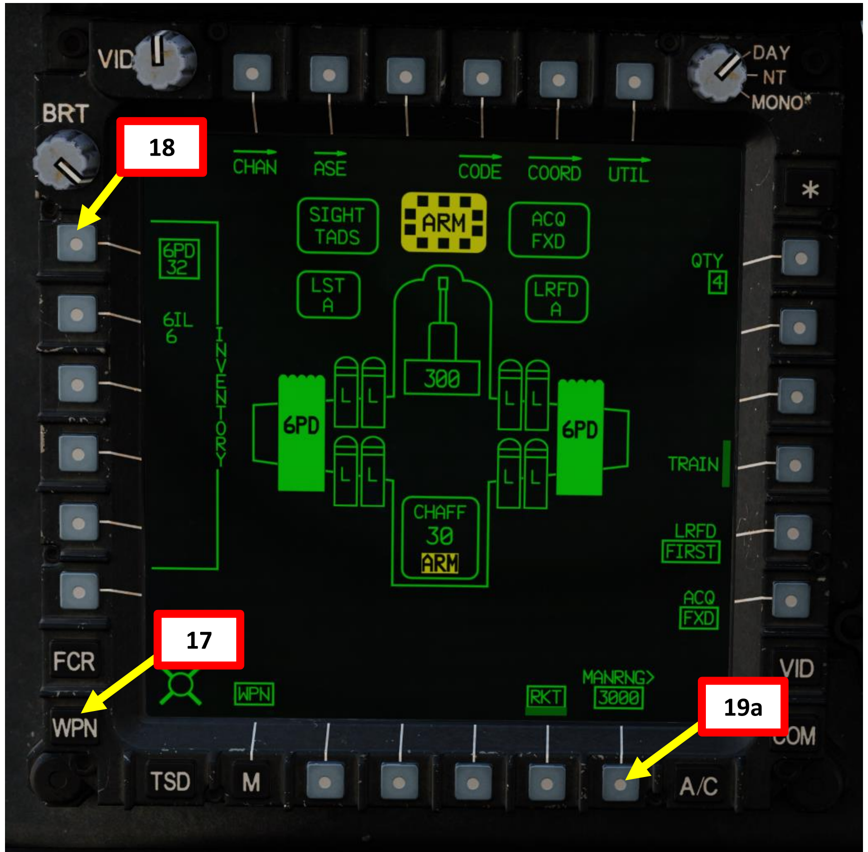
3.3 – Rocket Operation by Multicrew

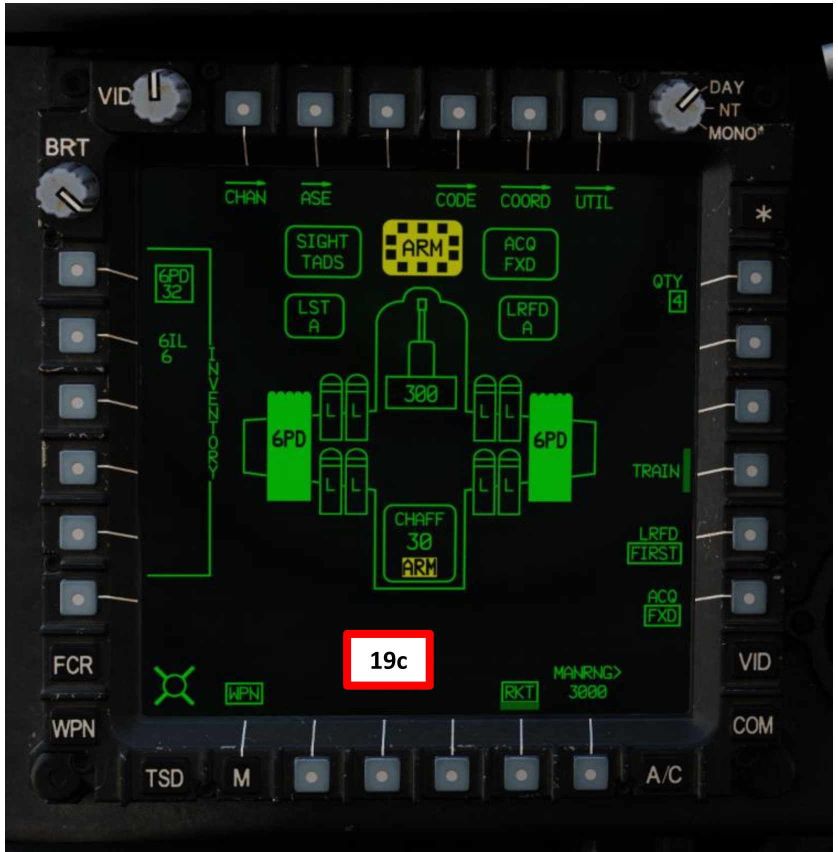
3.3.1 – Direct Fire with COOP Mode & TADS

16. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) LEFT to select the Rockets.
17. *[CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
18. *[CPG]* Press on the VAB (Variable Action Button) next to the rocket type you want to select. We will select type "6PD", which is a high explosive warhead with point detonation fuzing. The rocket counter is below the type data field.
19. *[CPG]* Press VAB next to MAN RNG, enter desired Rocket Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
    - For automatic ranging, enter "A" on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.

Weapon Action Switch (WAS)

- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*





3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

20. When both the pilot and co-pilot/gunner have selected rockets, the "COOP" indication appears, meaning that rockets are used in "cooperation" mode and need both the pilot and co-pilot/gunner to work together to aim/designate and fire.

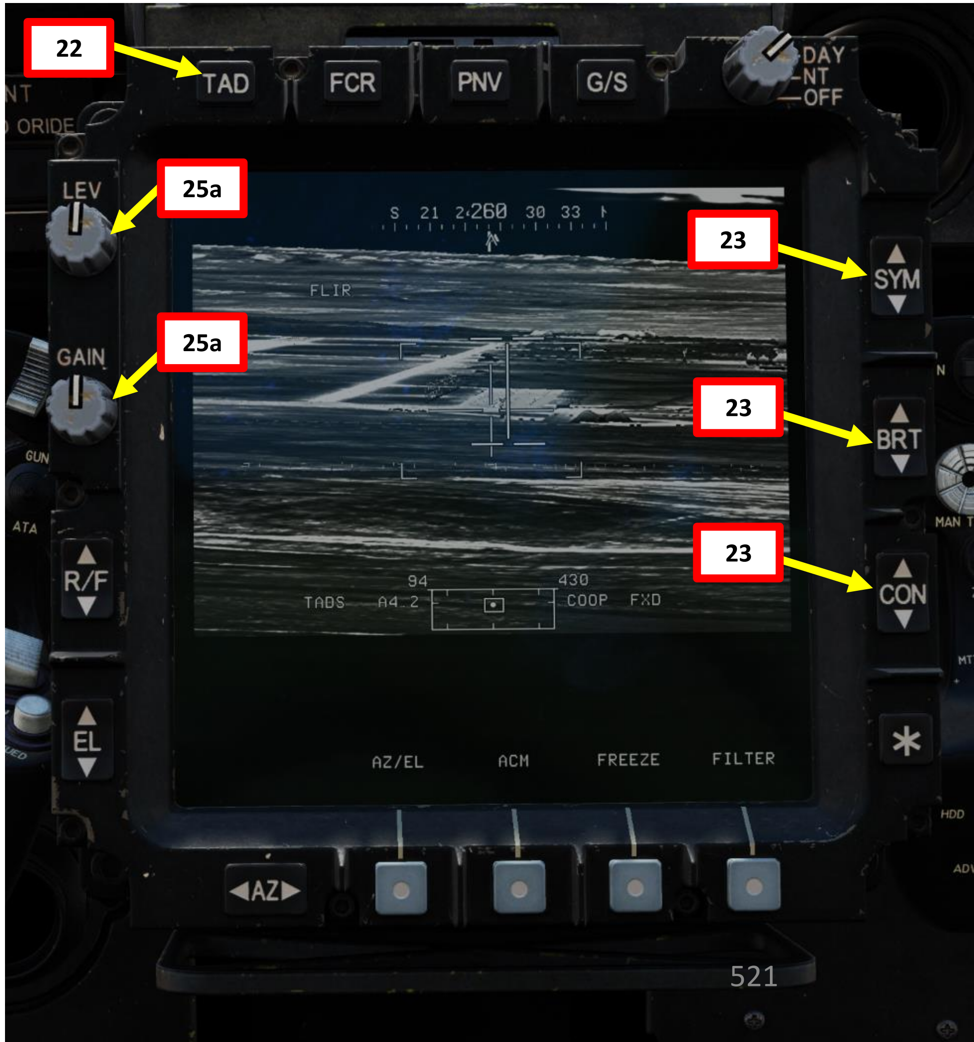
3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

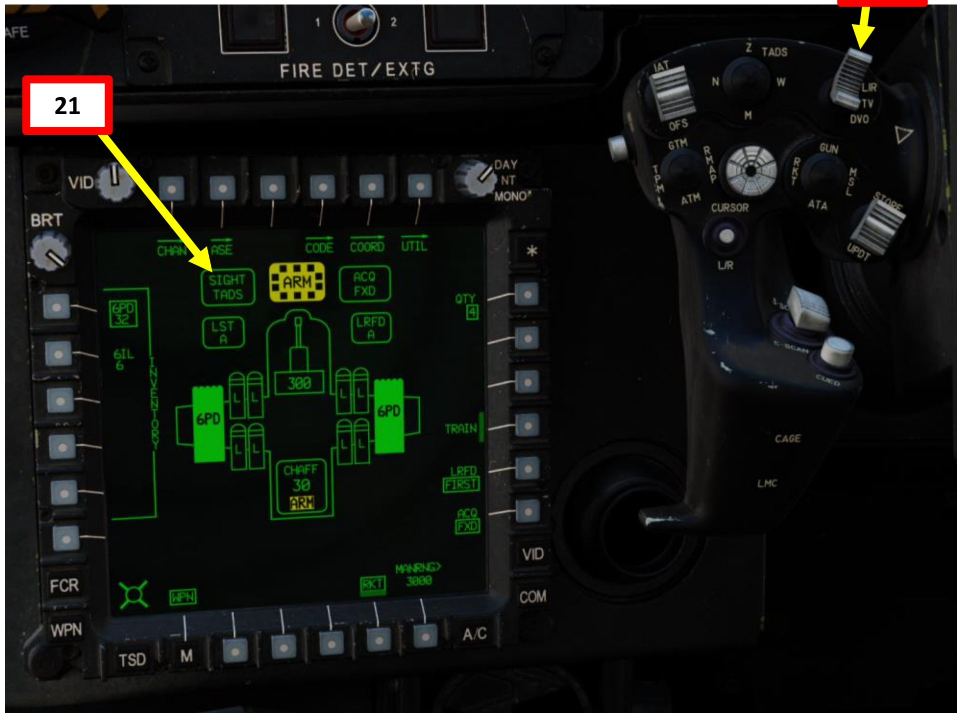
3.3.1 – Direct Fire with COOP Mode & TADS

21. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
22. *[CPG]* Select TADS video feed source by pressing the TAD button.
23. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
24. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
25. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.

Boresight/Polarity Selector
25b



24
21



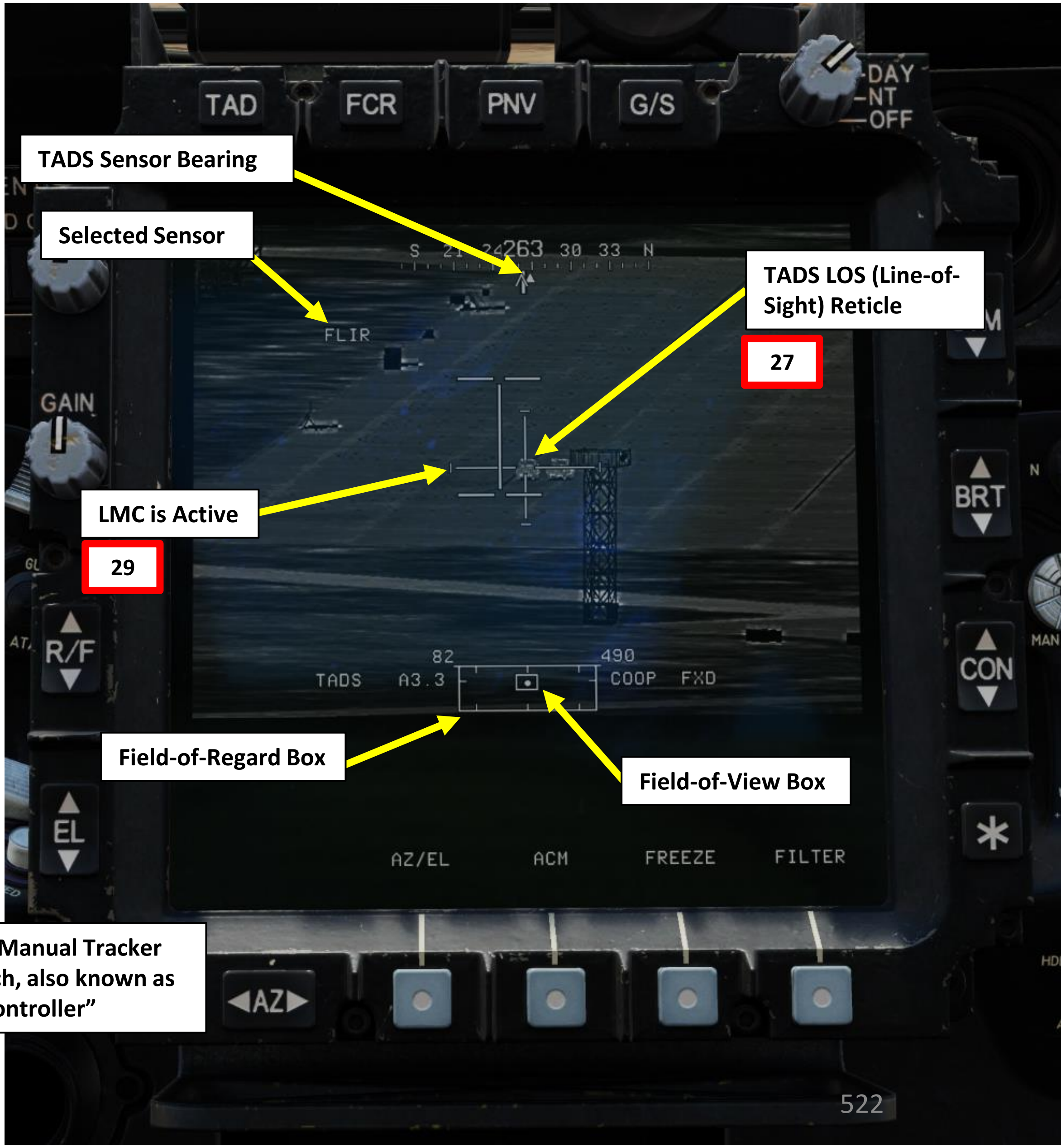
25b
FLIR Polarity Button

3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

26. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
27. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
28. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
29. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).

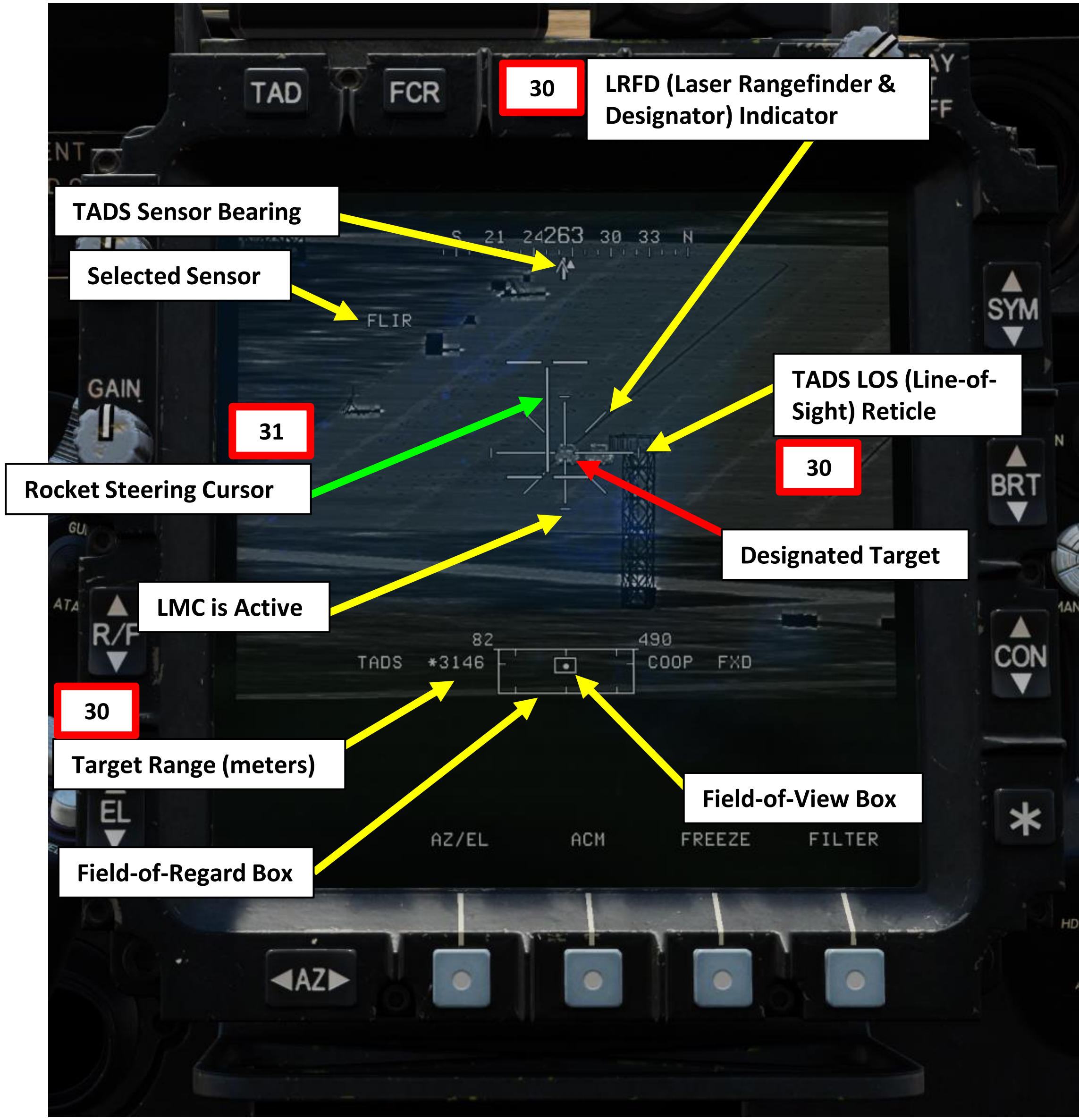


3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

30. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will automatically apply some lead to make sure the rockets hit where the target is going to be while taking into account its current speed and direction.
31. *[CPG]* Instruct the Pilot to align the aircraft with the Rocket Steering Cursor and fire using the phrase "Match and Shoot".

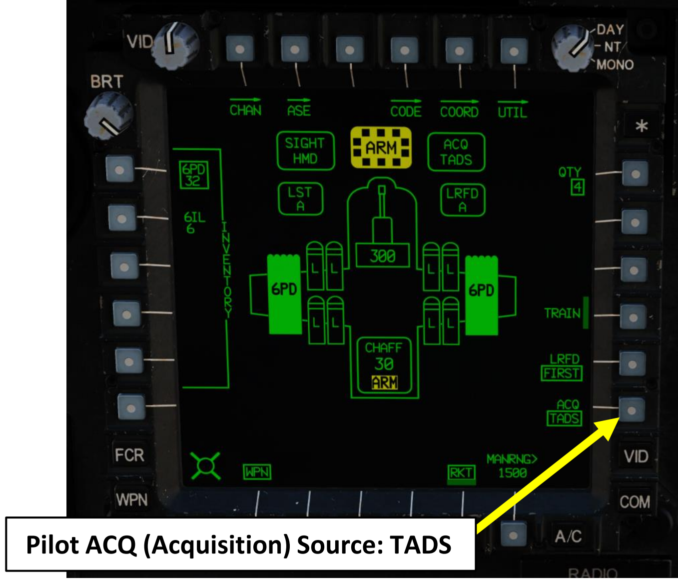


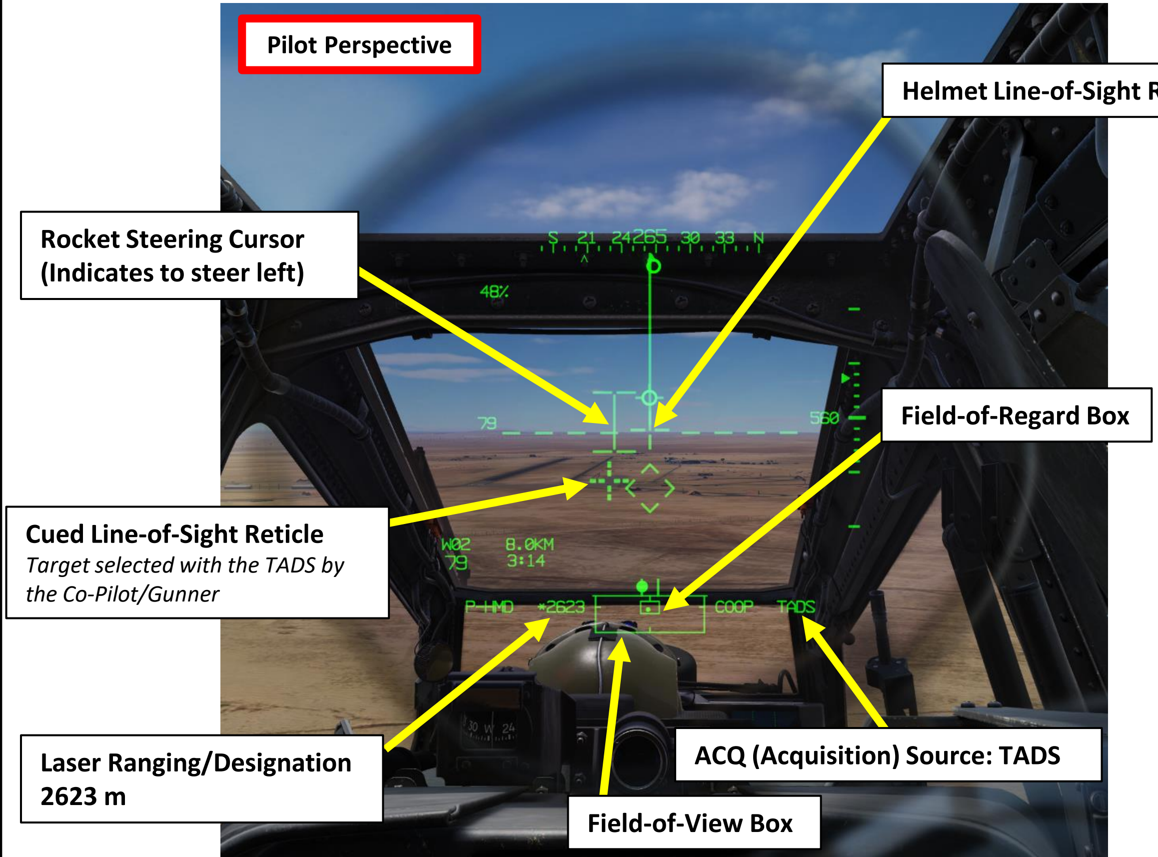
3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

32. *[P]* When pilot is told “Match and Shoot” by the co-pilot/gunner, steer the helicopter in the direction of the Rocket Steering Cursor to “match” (align) the helicopter properly with the target designated by the co-pilot/gunner by using the HMD LOS (Helmet-Mounted Display Line-of-Sight) Reticle and the Rocket Steering Cursor.
    - **If in a hover**, use pedal inputs to turn the aircraft in the direction of the Rocket Steering Cursor. When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle, stop turning and stabilize the aircraft attitude and heading.
    - **If flying with forward airspeed above ETL** (Effective Translational Lift, which is typically between 16-24 kts), use cyclic roll inputs to turn the aircraft in the direction of the Rocket Steering Cursor. When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle in the vertical axis, stop turning and stabilize the aircraft attitude and heading with cyclic. Maintain the trim ball centered with the pedals.
33. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.





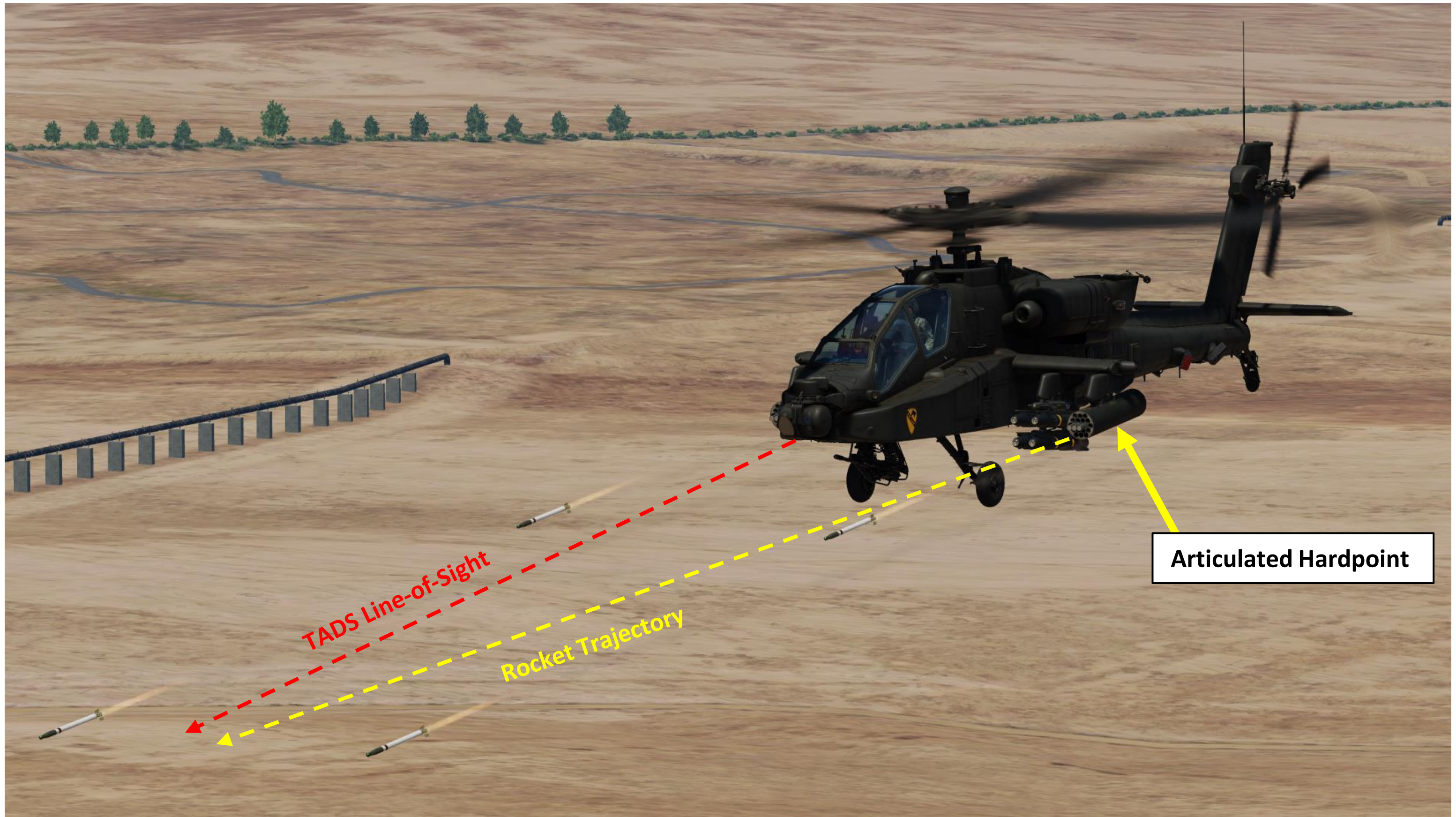
3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

34. *[P]* The articulated hardpoints will move to control rocket elevation (but not in azimuth) to ensure the rocket lands on the aimpoint (in this case, the TADS Line-of-Sight) when fired.
35. *[P]* Verify no weapon inhibit messages (i.e. PYLON LIMITS) are displayed in the High Action Display.
36. *[P]* Fire rockets by squeezing the Weapons Trigger Second Detent ("Spacebar" binding) on the cyclic.

Helmet Line-of-Sight Reticle
Aligned with Rocket Steering Cursor



Articulated Hardpoint

36

Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

37. Once rockets are fired, a TOF (Time-of-Flight) indication in seconds is displayed until rocket impact.
38. *[CPG]* After rockets are fired, the co-pilot/gunner should be "sensing", meaning he decreases the TADS field-of-view (FOV) one level (with TEDAC Left Hand Grip TADS FOV (Field-of-View) Selector) to observe for rocket impacts. Make required adjustments to aimpoint and repeat rocket salvo with the pilot as necessary until target effects are achieved.

TADS (Target Acquisition & Designation Sight) FOV (Field-of-View) Selector

- *FWD: Z (Zoom FOV)*
- *AFT: M (Medium FOV)*
- *LEFT: N (Narrow FOV)*
- *RIGHT: W (Wide FOV)*

Co-Pilot/Gunner Perspective

3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.1 – Direct Fire with COOP Mode & TADS

3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

Indirect rocket fire can be performed either using a diving attack or from a hover; the AH-64 can be employed as mobile aerial rocket artillery.

Here is a flow I like to use to perform indirect fire using Rocket COOP mode:

Co-Pilot/Gunner finds, lases, designates and stores target with the TADS

↓

Co-Pilot/Gunner selects stored target (Target Point)

↓

Co-Pilot/Gunner slaves TADS to Target Point (NAV Ranging)

↓

Pilot and Co-Pilot/Gunner both select rockets

↓

Pilot selects TADS as ACQ (Acquisition Source)

↓

Pilot “matches and shoots” target by using Rocket Steering Cursor

3 – UNGUIDED AERIAL ROCKETS

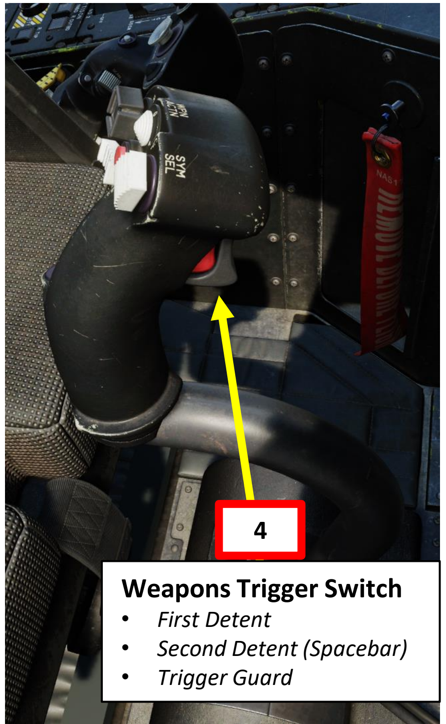
3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "P-HMD".
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Press WAS (Weapon Action Switch) LEFT to select the Rockets.
   - "TYPE?" indication means that we have not selected a rocket type yet.
4. *[P]* Flip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the "Weapons Trigger Guard – OPEN/CLOSE" to a binding easy to remember like "LSHIFT+SPACEBAR".
   - This step is not required if the "Weapons Trigger Guard Enable Special Option" is disabled (unticked).

1a

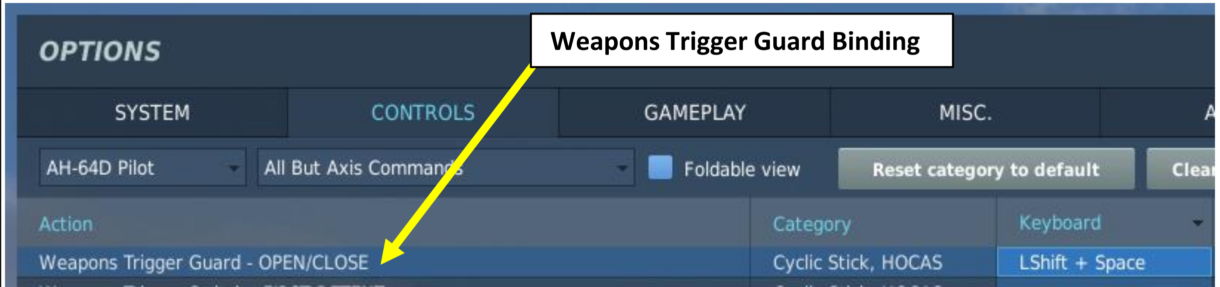
Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*



Weapons Trigger Switch
- *First Detent*
- *Second Detent (Spacebar)*
- *Trigger Guard*

Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

Weapons Trigger Guard Binding

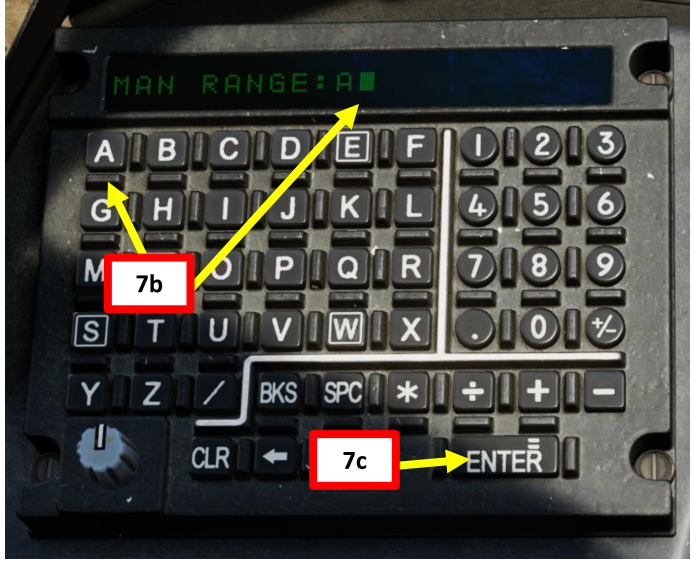


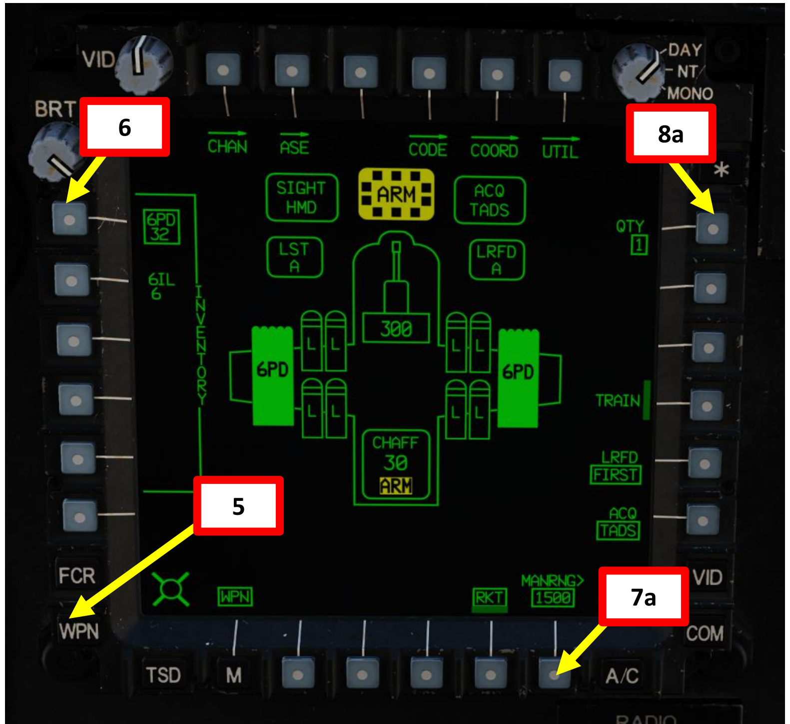
3 – UNGUIDED AERIAL ROCKETS

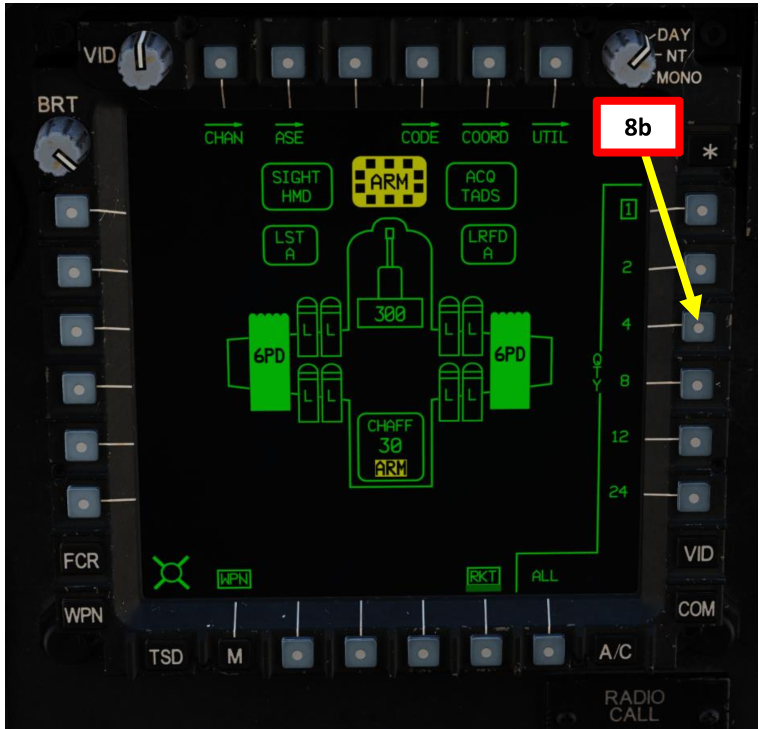
3.3 – Rocket Operation by Multicrew

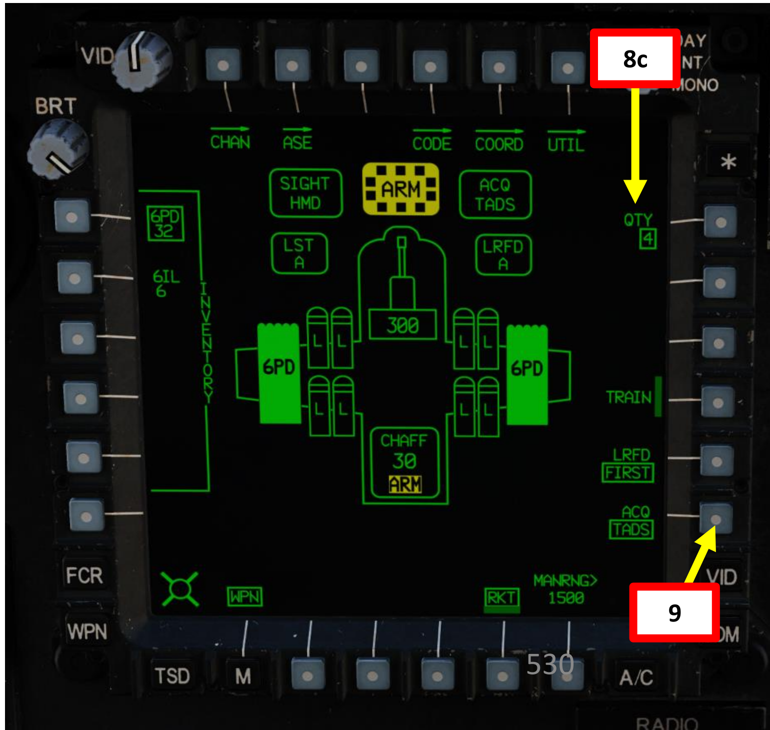
3.3.2 – Indirect Fire with COOP Mode & TADS

5. *[P]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
6. *[P]* Press on the VAB (Variable Action Button) next to the rocket type you want to select. We will select type "6PD", which is a high explosive warhead with point detonation fuzing. The rocket counter is below the type data field.
7. *[P]* Press VAB next to MAN RNG, enter desired Rocket Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
    - For automatic ranging, enter "A" on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.
8. *[P]* Press VAB next to desired Salvo Quantity setting. We will select 4 rockets per salvo.
9. *[P]* Press VAB next to ACQ and select TADS. This will ensure you are using the Co-Pilot/Gunner's Target Acquisition & Designation Sight as your acquisition source.



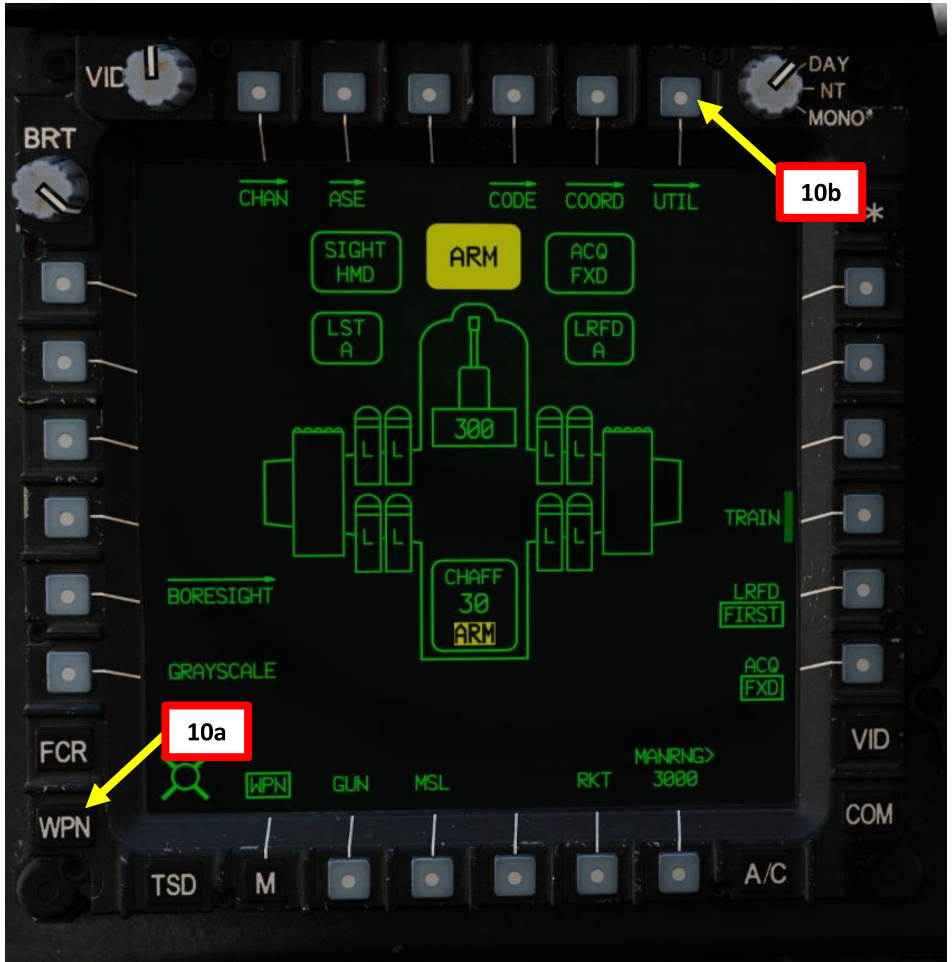


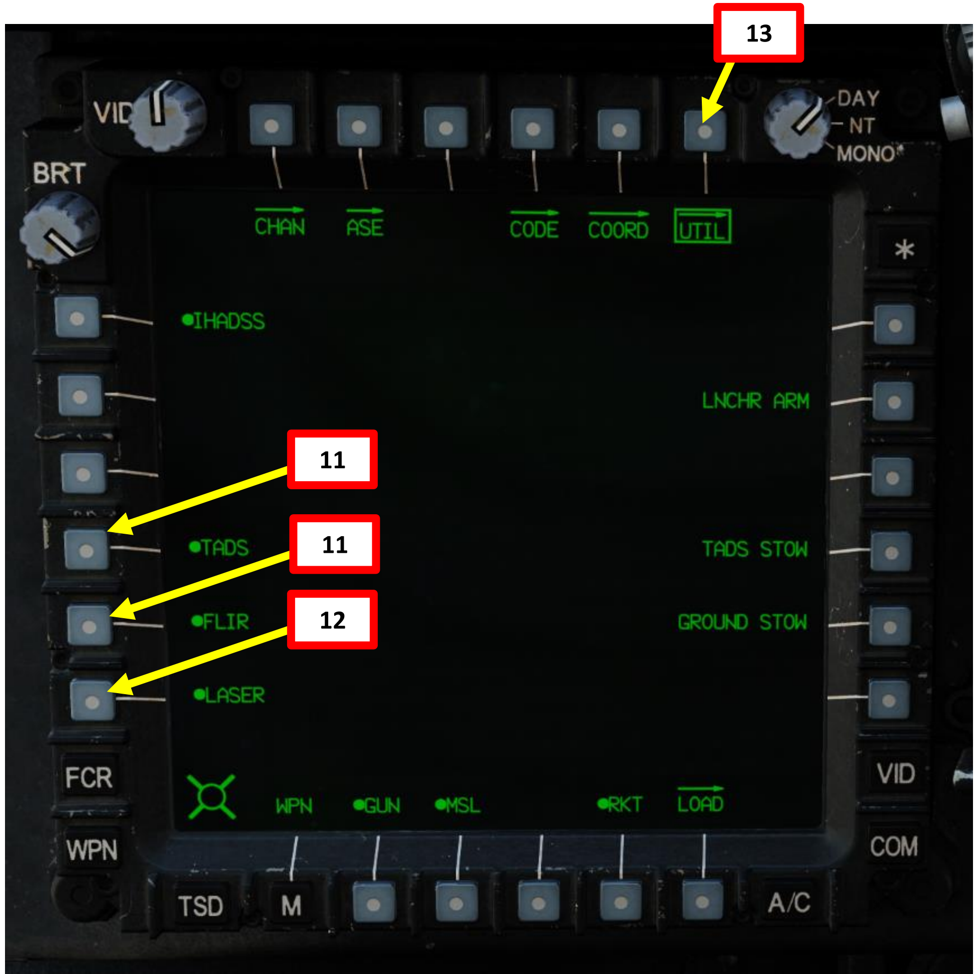




3 – UNGUIDED AERIAL ROCKETS
3.3 – Rocket Operation by Multicrew
3.3.2 – Indirect Fire with COOP Mode & TADS

10. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
11. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
    - Hollow circle means OFF. Solid Circle means ON.
12. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
    - Hollow circle means OFF. Solid Circle means ON.
    - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
13. *[CPG]* Press VAB next to UTIL to return to main WPN page.



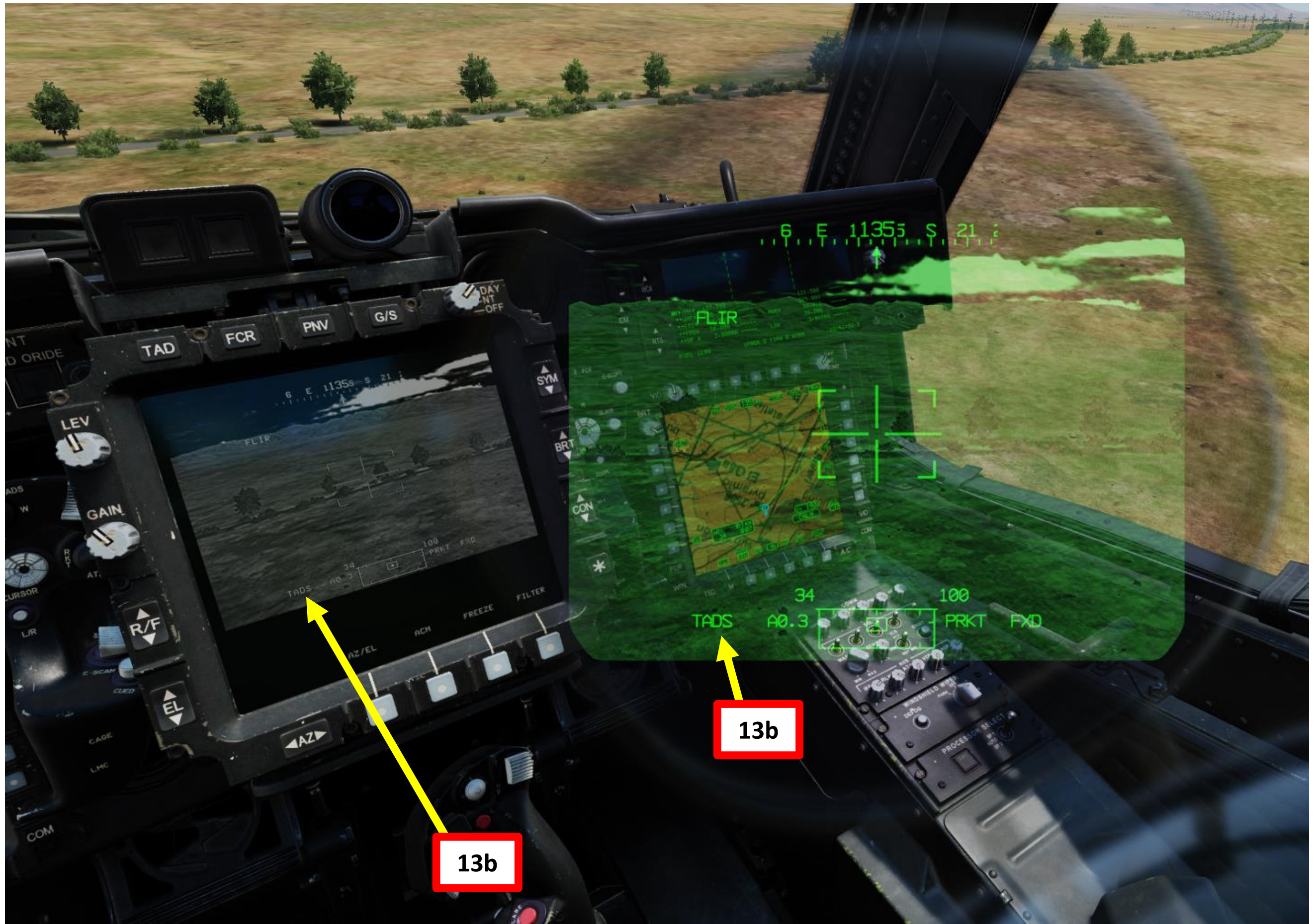


3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

14. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
15. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the "IHADSS Show" binding, which is "i" by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "C-HMD".
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.



TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: TADS (Target Acquisition & Designation Sight), but only functional for CPG.*

13a

3 – UNGUIDED AERIAL ROCKETS

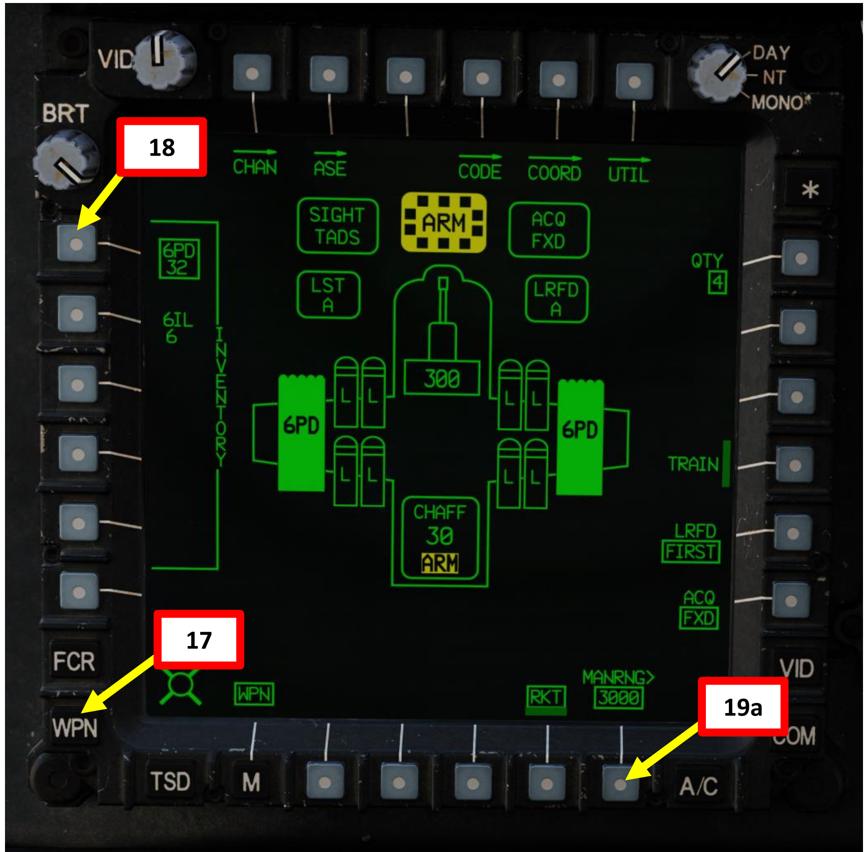
3.3 – Rocket Operation by Multicrew

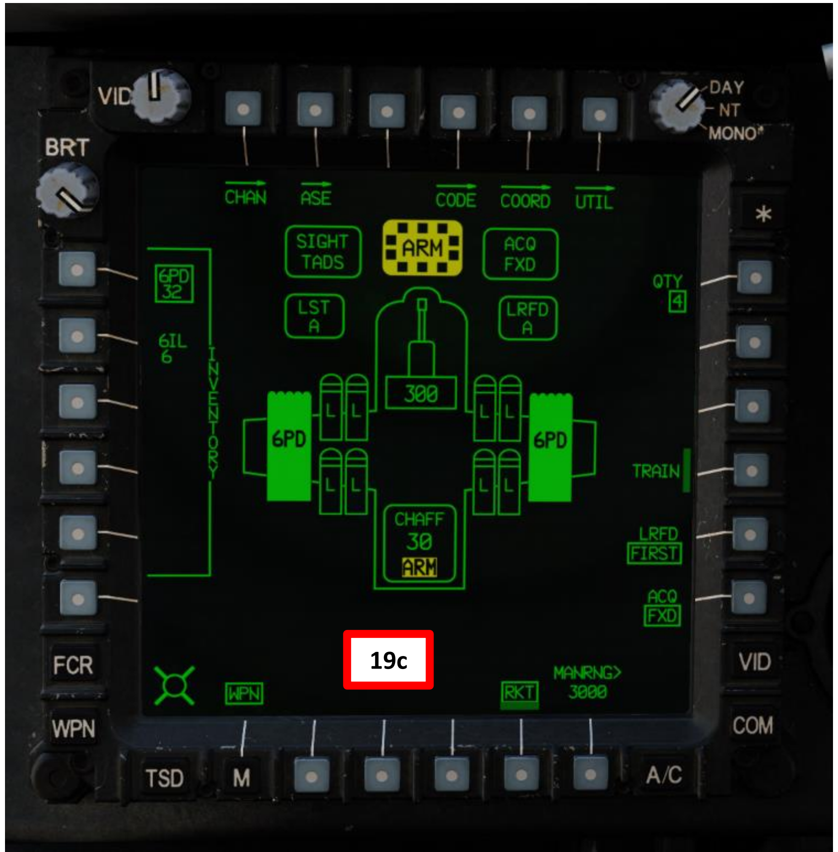
3.3.2 – Indirect Fire with COOP Mode & TADS

16. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) LEFT to select the Rockets.
17. *[CPG]* Press on the WPN FAB (Fixed Action Button) to access the Weapon menu.
18. *[CPG]* Press on the VAB (Variable Action Button) next to the rocket type you want to select. We will select type "6PD", which is a high explosive warhead with point detonation fuzing. The rocket counter is below the type data field.
19. *[CPG]* Press VAB next to MAN RNG, enter desired Rocket Ranging Distance Parameter (in meters) on the KU (Keyboard Unit), then press ENTER. In this case, we will use automatic ranging.
    - For automatic ranging, enter "A" on the KU, then press ENTER instead. Keep in mind that the radar altimeter must be on in order to use automatic ranging.

Weapon Action Switch (WAS)

- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*



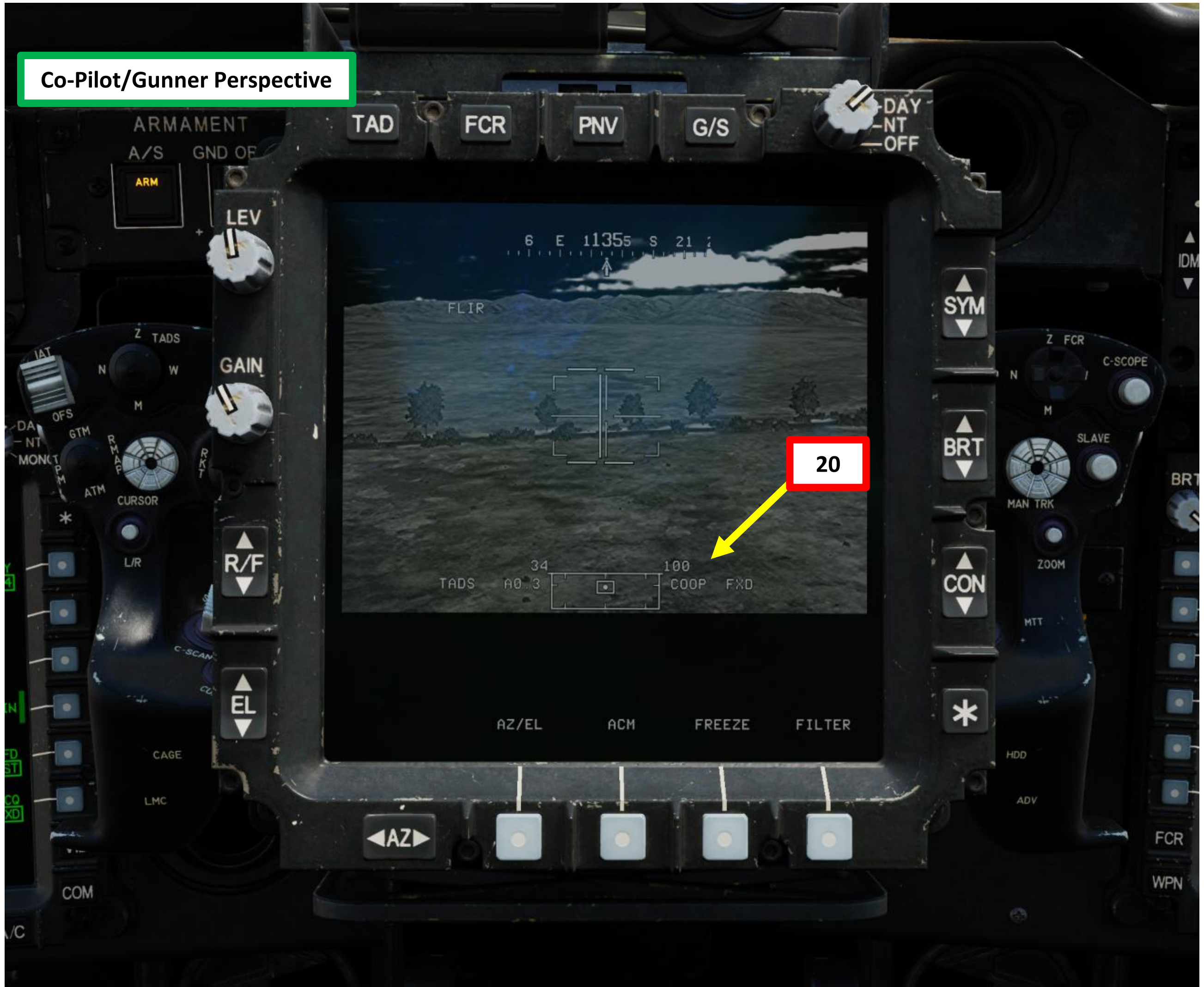


3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

20. When both the pilot and co-pilot/gunner have selected rockets, the “COOP” indication appears, meaning that rockets are used in “cooperation” mode and need both the pilot and co-pilot/gunner to work together to aim/designate and fire.

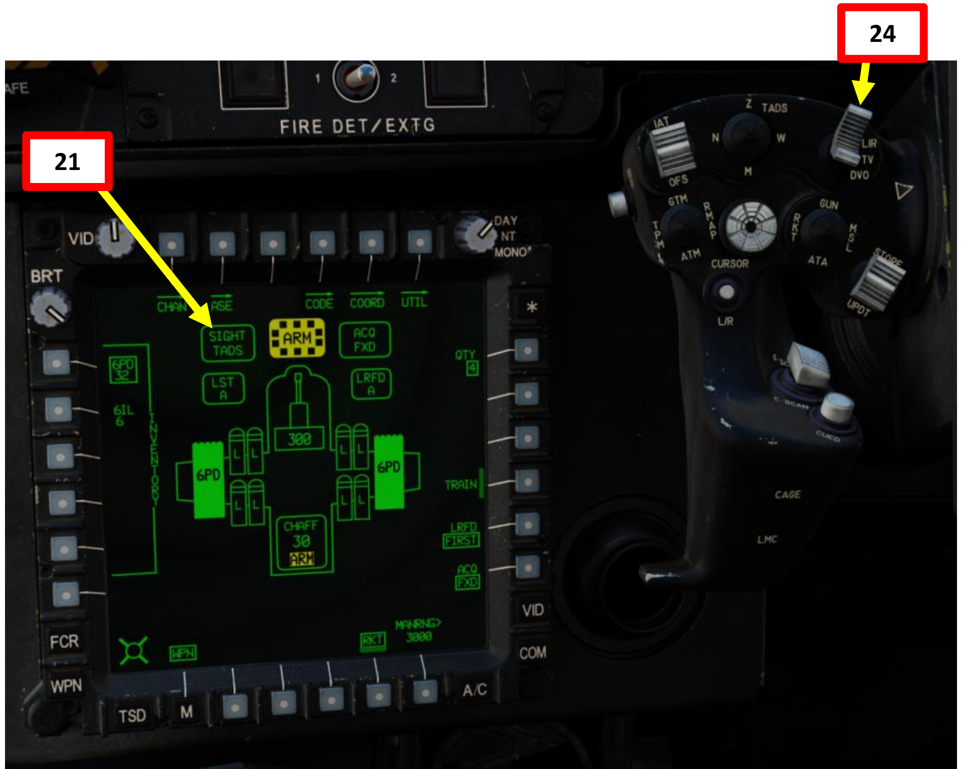


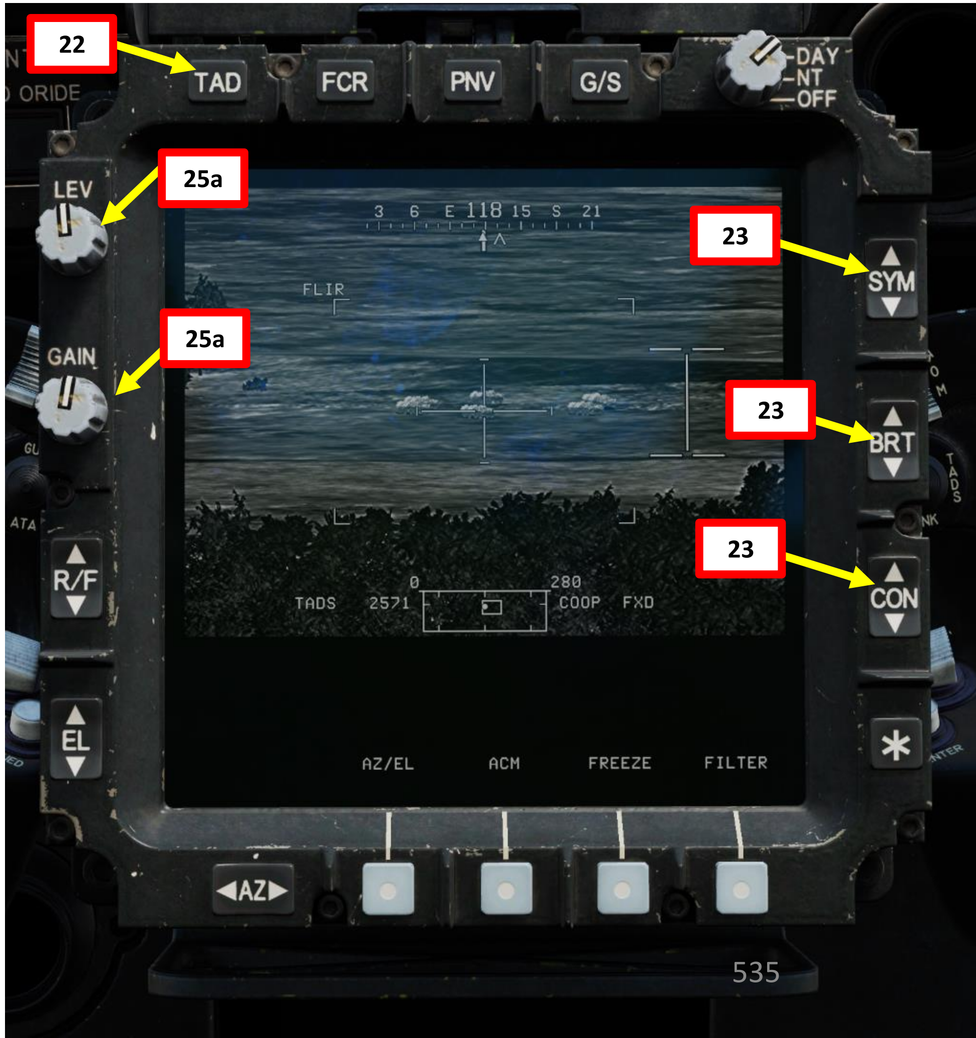
3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

21. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
22. *[CPG]* Select TADS video feed source by pressing the TAD button.
23. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
24. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
25. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.



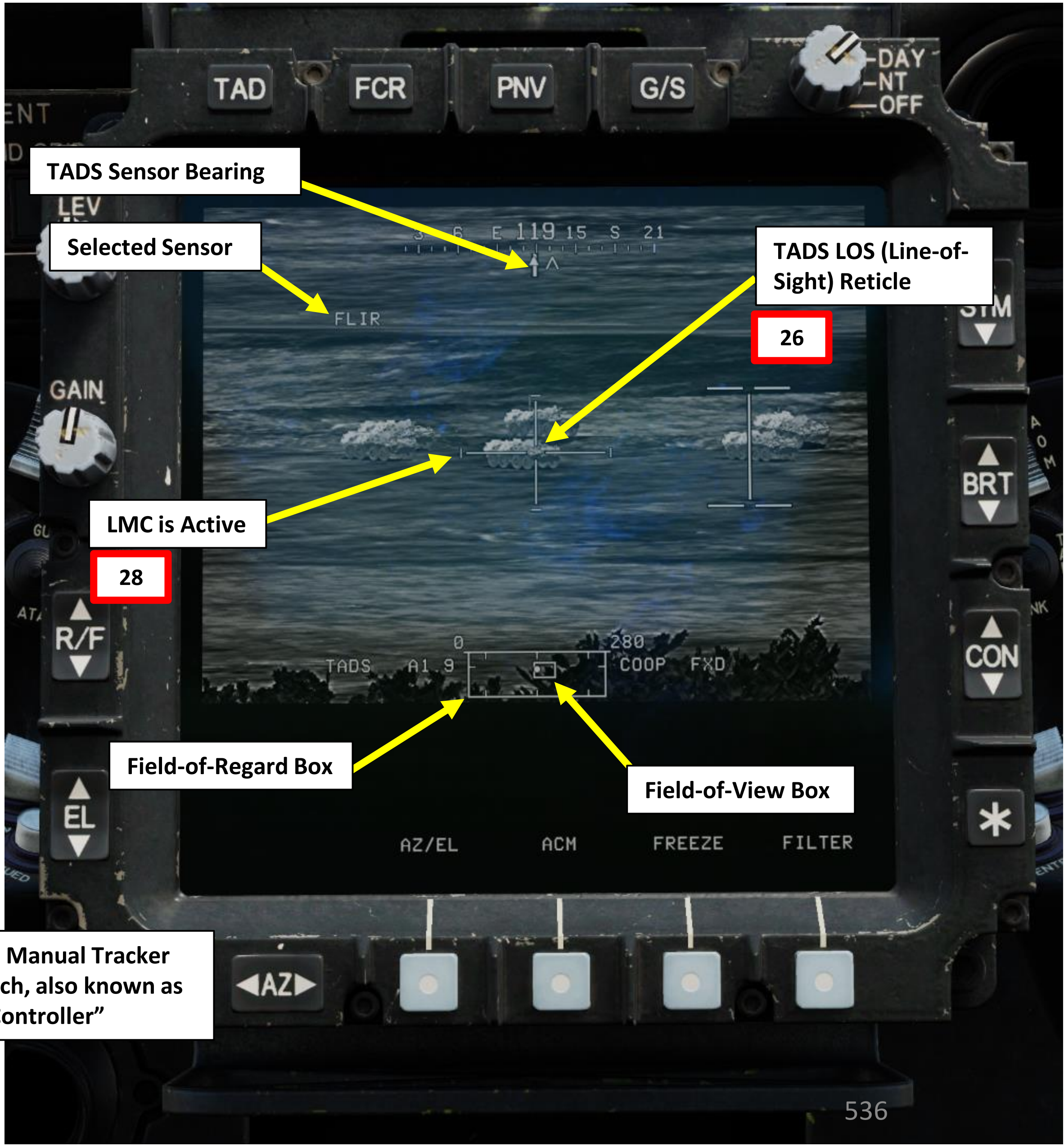


3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

25. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
26. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller".
27. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
28. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).



3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

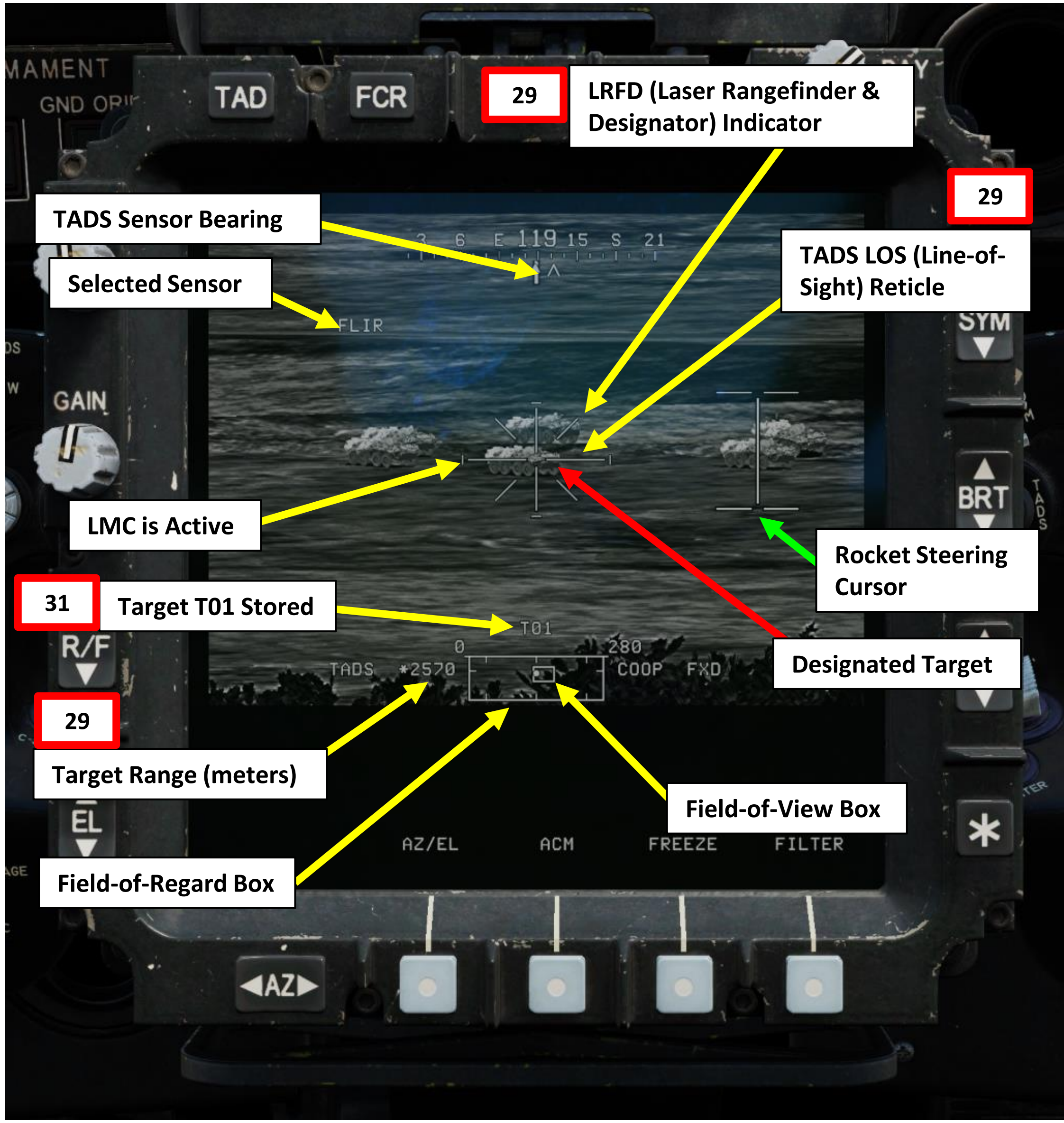
29. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will automatically apply some lead to make sure the rockets hit where the target is going to be while taking into account its current speed and direction.
30. *[CPG]* Press the TEDAC Left Hand Grip Store/Update Switch FWD (STORE) to store the TADS line-of-sight as a target point.
31. *[CPG]* A "T" followed by the Target Point number will be displayed on the TDU (TADS Display Unit). As an example, "T01" indicates that Target Point 01 coordinates have been stored.
    - The Co-Pilot can then call out to the pilot something like "BMP stored target 01" to let him know what has been spotted and stored in which target point.

Store/Update Switch 30
- *Stores position information or performs position updates.*
    - *FWD: STORE, Stores selected sensor line-of-sight as a point*
    - *AFT: UPDATE, Performs a flyover or TADS position update.*

TEDAC LHG (Left Hand Grip)

TEDAC RHG (Right Hand Grip)

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)



3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

32. *[CPG]* On the TSD (Tactical Situation Display) page, select ATK (Attack) Phase. This will allow you to see existing target points on the TSD.
33. *[CPG]* Press on VAB (Variable Action Button) next to COORD (Coordinates).
34. *[CPG]* Press on VAB next to T01 to select Target Point 1.
35. *[CPG]* Target Point T01 is now the acquisition source, which we will need to slave the TADS to.

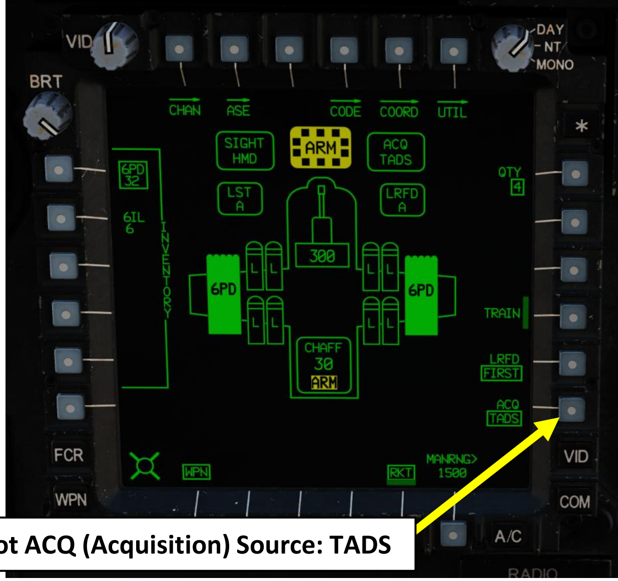
3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

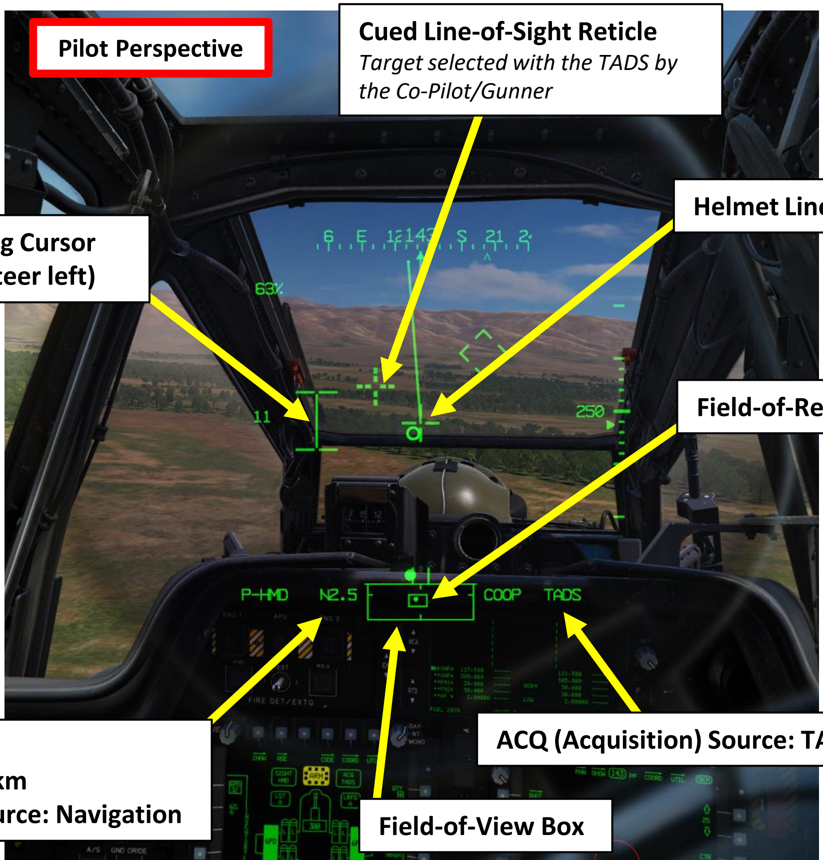
3.3.2 – Indirect Fire with COOP Mode & TADS

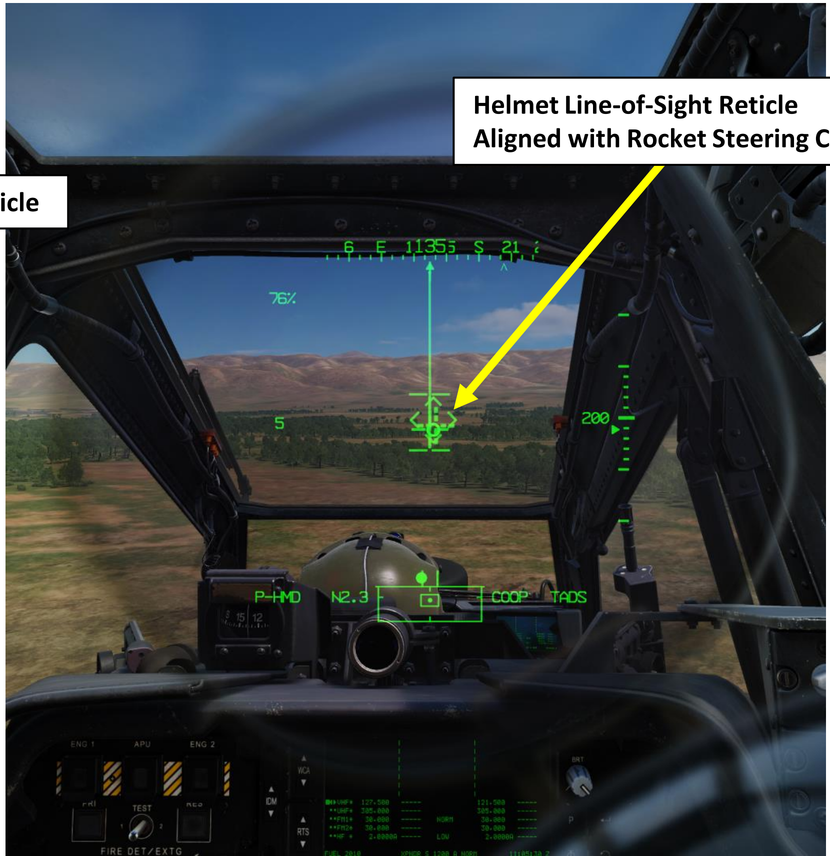
36. *CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is Target Point T01 in this case. Even if you lose line-of-sight with the target, the TADS will still remember the coordinates of the stored target.
    - Note: alternatively, you could also use the Cursor Acquisition method to slave the TADS to a target point.
37. *CPG]* Verify that Range Source is set to NAV (Navigation). Range indication should be preceded by "N", which means that the range is computed from the target point coordinates.
38. *[CPG]* Instruct the Pilot to align the aircraft with the Rocket Steering Cursor and fire using the phrase "Match and Shoot".

3 – UNGUIDED AERIAL ROCKETS
3.3 – Rocket Operation by Multicrew
3.3.2 – Indirect Fire with COOP Mode & TADS



39. *[P]* When pilot is told “Match and Shoot” by the co-pilot/gunner, steer the helicopter in the direction of the Rocket Steering Cursor to “match” (align) the helicopter properly with the target designated by the co-pilot/gunner by using the HMD LOS (Helmet-Mounted Display Line-of-Sight) Reticle and the Rocket Steering Cursor.
    - **If in a hover**, use pedal inputs to turn the aircraft in the direction of the Rocket Steering Cursor. When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle, stop turning and stabilize the aircraft attitude and heading.
    - **If flying with forward airspeed above ETL** (Effective Translational Lift, which is typically between 16-24 kts), use cyclic roll inputs to turn the aircraft in the direction of the Rocket Steering Cursor. When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle in the vertical axis, stop turning and stabilize the aircraft attitude and heading with cyclic. Maintain the trim ball centered with the pedals.
40. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.



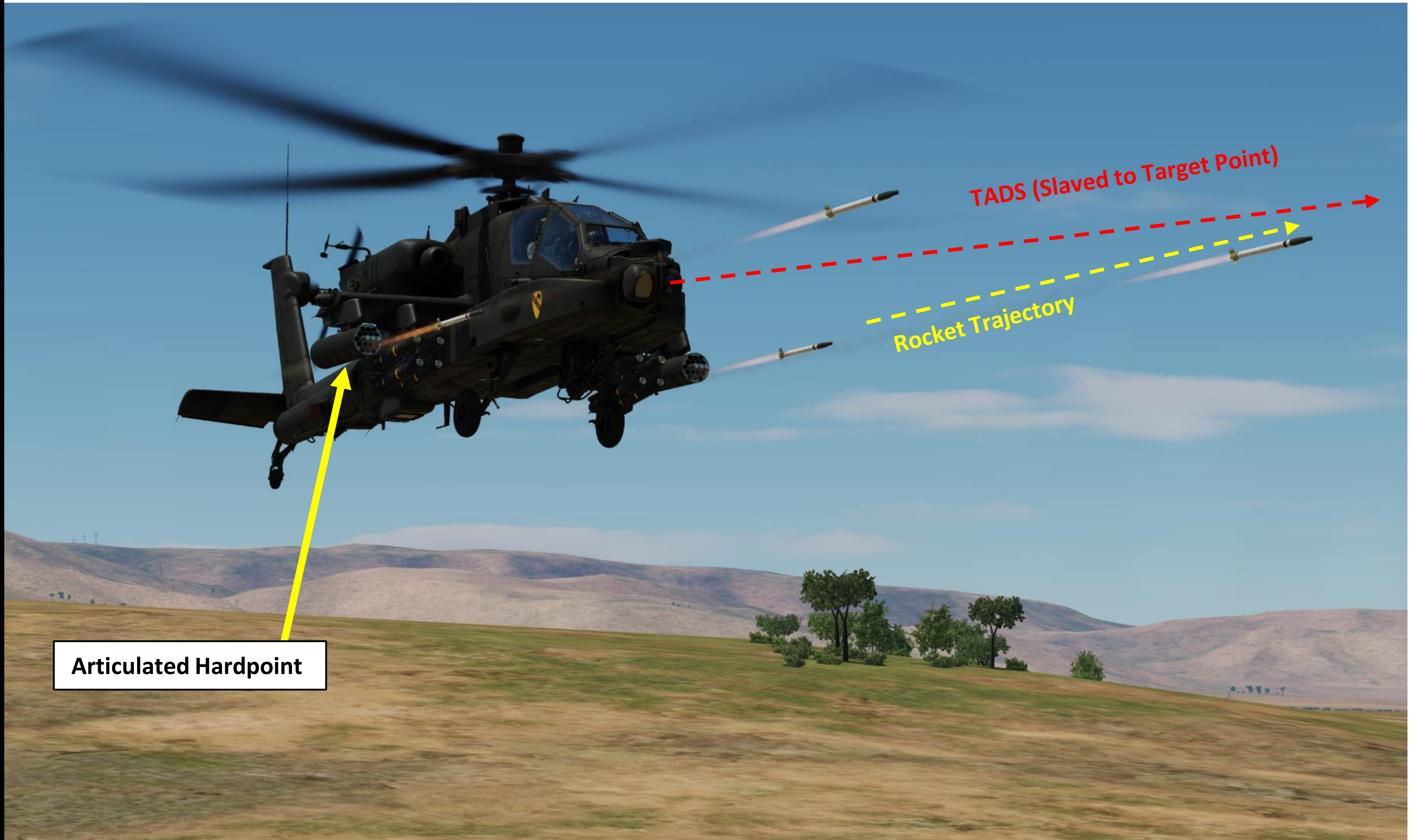


3 – UNGUIDED AERIAL ROCKETS

3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

41. *[P]* The articulated hardpoints will move to control rocket elevation (but not in azimuth) to ensure the rocket lands on the aimpoint (in this case, the TADS Line-of-Sight) when fired.
42. *[P]* Verify no weapon inhibit messages (i.e. PYLON LIMITS) are displayed in the High Action Display.
43. *[P]* Fire rockets by squeezing the Weapons Trigger Second Detent ("Spacebar" binding) on the cyclic.



3 – UNGUIDED AERIAL ROCKETS

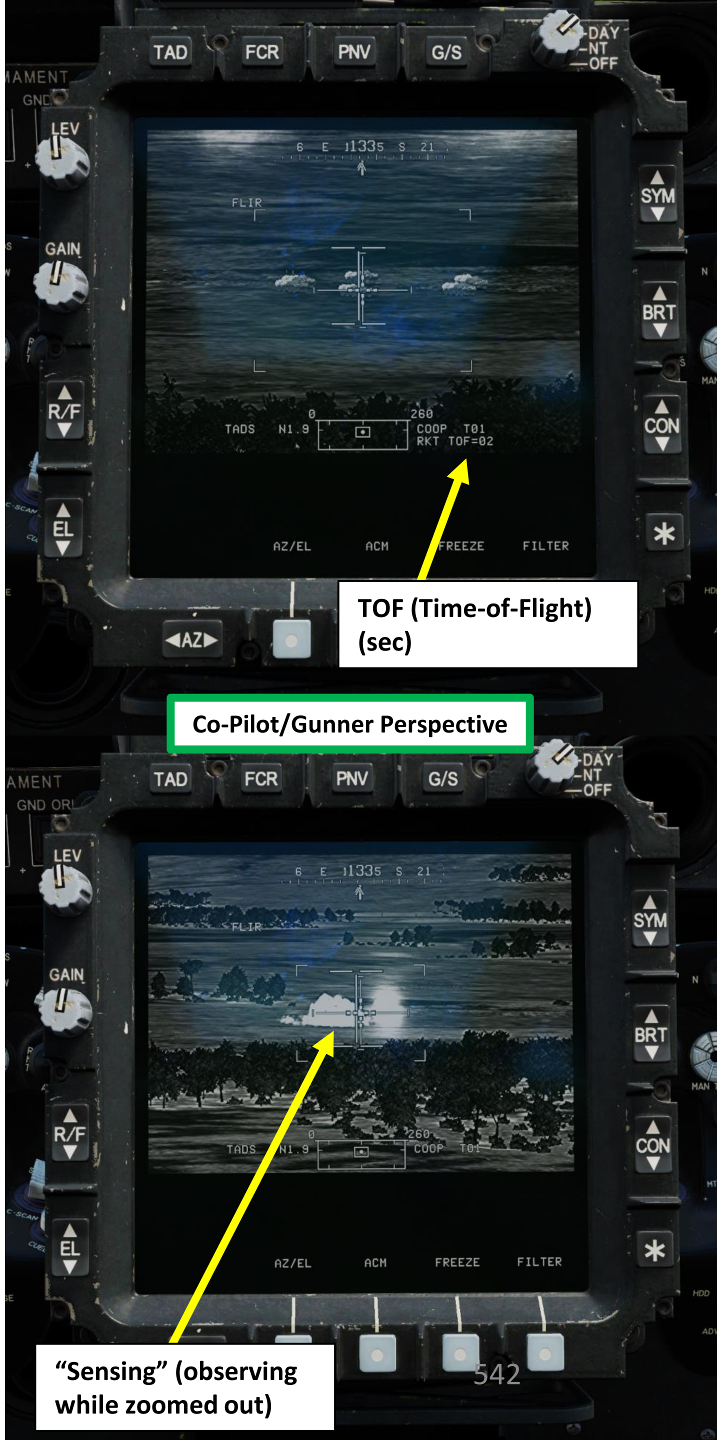
3.3 – Rocket Operation by Multicrew

3.3.2 – Indirect Fire with COOP Mode & TADS

44. Once rockets are fired, a TOF (Time-of-Flight) indication in seconds is displayed until rocket impact.
45. *[CPG]* After rockets are fired, the co-pilot/gunner should be "sensing", meaning he decreases the TADS field-of-view (FOV) one level (with TEDAC Left Hand Grip TADS FOV (Field-of-View) Selector) to observe for rocket impacts. Make required adjustments to aimpoint and repeat rocket salvo with the pilot as necessary until target effects are achieved.

TADS (Target Acquisition & Designation Sight) FOV (Field-of-View) Selector

- *FWD: Z (Zoom FOV)*
- *AFT: M (Medium FOV)*
- *LEFT: N (Narrow FOV)*
- *RIGHT: W (Wide FOV)*



3 – UNGUIDED AERIAL ROCKETS
3.3 – Rocket Operation by Multicrew
3.3.2 – Indirect Fire with COOP Mode & TADS



3 – UNGUIDED AERIAL ROCKETS
3.4 – Rocket Operation by George AI as Co-Pilot/Gunner

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "P-HMD".
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Show the George Menu by using « LCTRL+V ».
4. *[P]* Press « A » SHORT (LEFT) for less than 0.5 sec to cycle between weapons until RKTS (Rockets) are selected.
5. *[P]* Press « A » LONG (LEFT) for more than 0.5 sec to cycle between rocket types. We will select HE (High Explosive) rockets.
6. *[P]* Press « D » SHORT (RIGHT) for less than 0.5 sec to cycle between rocket salvo quantity settings. We will select 4 rockets per salvo.
7. *[P]* The George Menu changes color depending on the active rules of engagement (ROE):
   - Yellow: Weapons hold
   - Green: Weapons free
8. *[P]* Confirm that the George Menu color is yellow. If it is green (weapons free), press « W » LONG (UP) for more than 0.5 sec to set ROE back to weapons hold.
9. *[P]* The pilot's HDU (Helmet Display Unit) reticle is used as a Designation Reticle to point an area where "George" can identify and track targets.

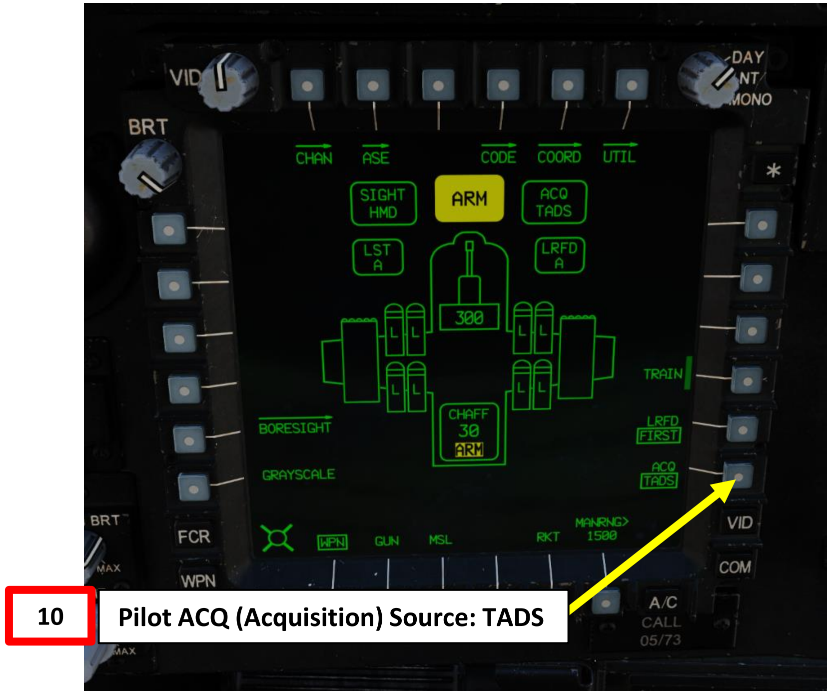
2

1a

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

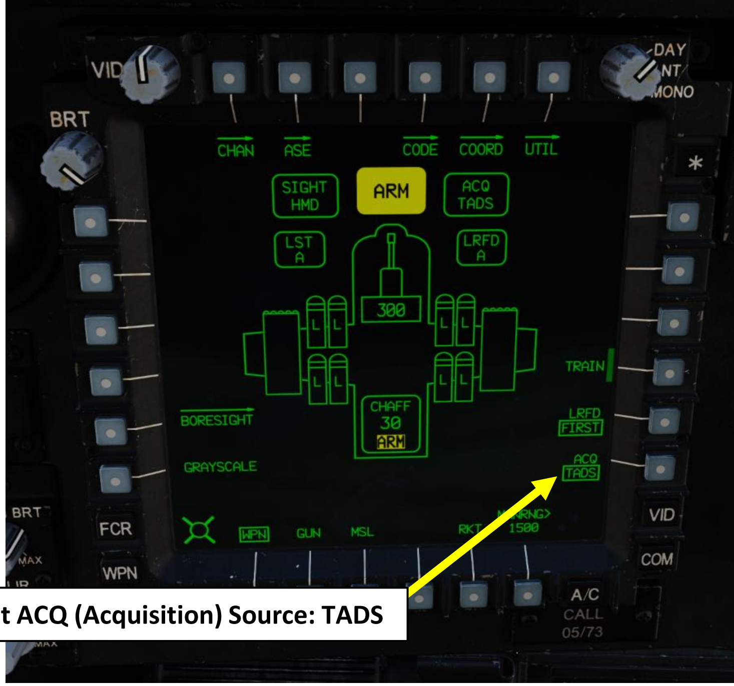
3 – UNGUIDED AERIAL ROCKETS
3.4 – Rocket Operation by George AI as Co-Pilot/Gunner

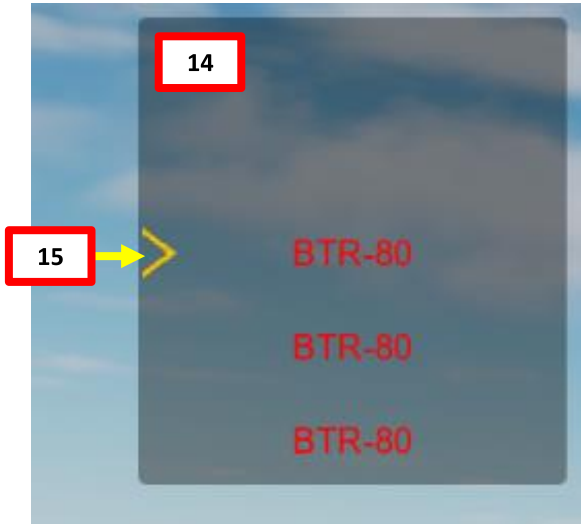
10. *[P]* From the WPN (Weapon) page, set the Pilot Acquisition Source to TADS. Then, fly towards the target and ensure the the helicopter attitude remains stable.
11. *[P]* Move your head (HDU Reticle / Designation Reticle) near the area you want the Co-Pilot/Gunner to search for targets, then press « W » SHORT (less than 0.5 sec).
12. *[CPG]* George will select the acquisition source to PHS (Pilot Helmet Sight), then slave the TADS to the acquisition source, then call out “slaving” to remind the pilot that the TADS is slaved to his helmet reticle.
13. *[CPG]* When George has set the TADS reticle is roughly on the area pointed at by the pilot’s HDU reticle, George will de-slave the TADS, call out “de-slaved” to tell the pilot that he can start looking elsewhere. Target can then be spotted, designated, lased and stored by him.



3 – UNGUIDED AERIAL ROCKETS
3.4 – Rocket Operation by George AI as Co-Pilot/Gunner

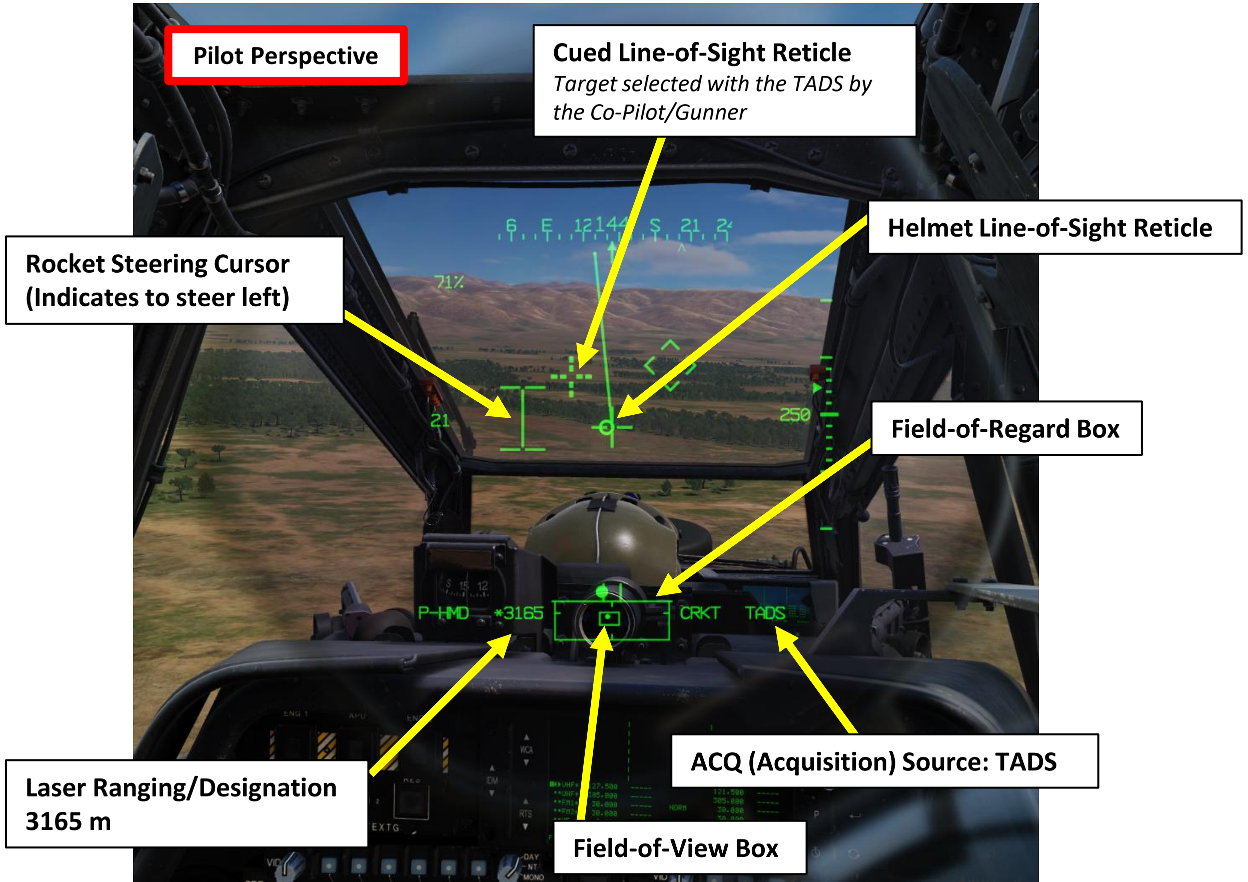
14. [CPG] George will then start scanning for targets in the designated area. When targets are found, a menu with a list of targets appears.
15. [P] Cycle through the target list using « W » SHORT (UP) or « S » SHORT (DOWN) until desired target is selected by the > symbol.
16. [P] Press « D » SHORT (RIGHT) to select target.
    - Note: Pressing "S" SHORT (DOWN) undesignates George's target.
17. [CPG] George will then designate, lase and store the target with the TADS, calling out "lased and stored" in the process.
18. [P] The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.





3 – UNGUIDED AERIAL ROCKETS
3.4 – Rocket Operation by George AI as Co-Pilot/Gunner

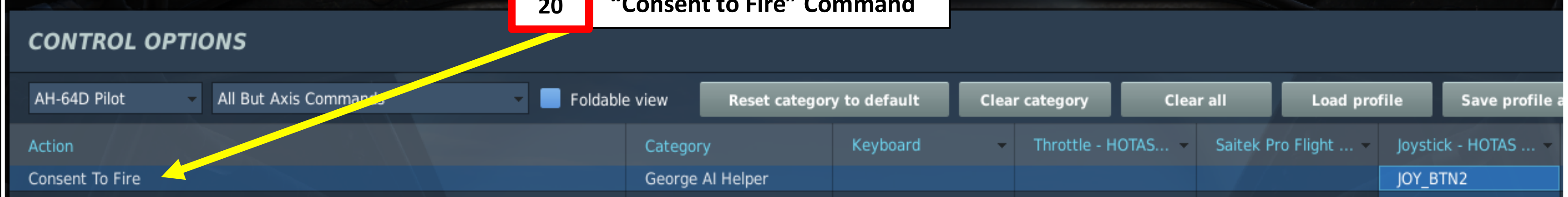
19. *[P]* Steer the helicopter in the direction of the Rocket Steering Cursor to "match" (align) the helicopter properly with the target designated by the co-pilot/gunner by using the HMD LOS (Helmet-Mounted Display Line-of-Sight) Reticle and the Rocket Steering Cursor.
    - **If in a hover**, use pedal inputs to turn the aircraft in the direction of the Rocket Steering Cursor. When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle, stop turning and stabilize the aircraft attitude and heading.
    - **If flying with forward airspeed above ETL** (Effective Translational Lift, which is typically between 16-24 kts), use cyclic roll inputs to turn the aircraft in the direction of the Rocket Steering Cursor. When Rocket Steering Cursor is aligned with the HMD Line-of-Sight reticle in the vertical axis, stop turning and stabilize the aircraft attitude and heading with cyclic. Maintain the trim ball centered with the pedals.



3 – UNGUIDED AERIAL ROCKETS
3.4 – Rocket Operation by George AI as Co-Pilot/Gunner

20. *[P]* Use the « Consent To Fire » command to order George to fire on the selected target.
    - Alternatively, you could press « W » LONG (more than 0.5 sec) to set ROE to weapons free. The George Menu will then switch to green (weapons free).
21. *[CPG]* George will then fire rockets on the target by himself when you have a good firing solution (HMD LOS (Helmet-Mounted Display Line-of-Sight) Reticle and the Rocket Steering Cursor are lined up).
22. *[P]* If you want George to stop engaging the target, press "S" SHORT (DOWN) to undesignate George's target.
23. *[P]* You can hide the George Menu by using « LCTRL+V ».

20
"Consent to Fire" Command



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3 – UNGUIDED AERIAL ROCKETS

3.4 – Rocket Operation by George AI as Co-Pilot/Gunner

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

The AGM-114 Hellfire air-to-ground missile was primarily designed as a “tank killer” weapon. It was originally developed under the name ”Heliborne Laser Fire-and-Forget Missile”, which led to the colloquial name "Hellfire" ultimately becoming the missile's formal name.

Our variant of the Apache comes with the AGM-114K “Kilo” and AGM-114L “Lima” Hellfires. The “Kilo” Hellfire is a semi-active laser-guided (SAL) variant, while the “Lima” Hellfire (sometimes referred as the “Longbow Hellfire”) has an active radar frequency seeker (RF) that is guided by the AN/APG-78 Fire Control Radar.

AGM-114K Hellfire

AGM-114L Hellfire

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Longbow Hellfire Modular Missile System (LBHMMS)

The Longbow Hellfire Modular Missile System (LBHMMS) provides precision fire capability against point targets at long range. The LBHMMS includes the M299 missile launcher rack, but it is also integrated with the AN/APG-78 FCR (Fire Control Radar) and the AN/ASQ-170 TADS (Target Acquisition & Designation Sight).

The “Longbow” system is basically a software communication architecture built around a network (commonly referred as “tactical internet”) that enables aircraft to transmit data (targets, waypoints, text messaging, etc.) between themselves. Targets acquired can be shared across the Longbow Net to other helicopters, even those that are not equipped with a radar.

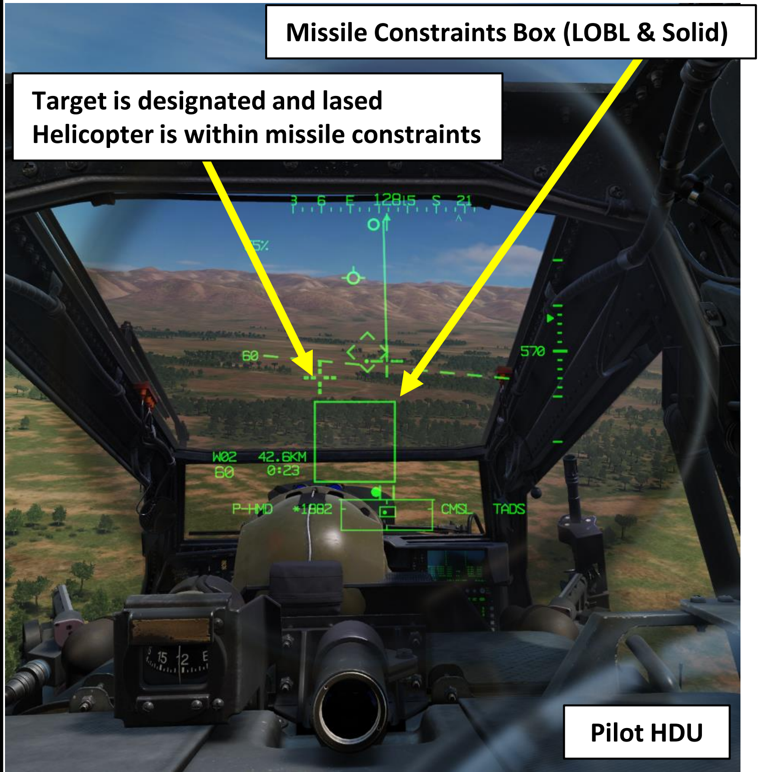
4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

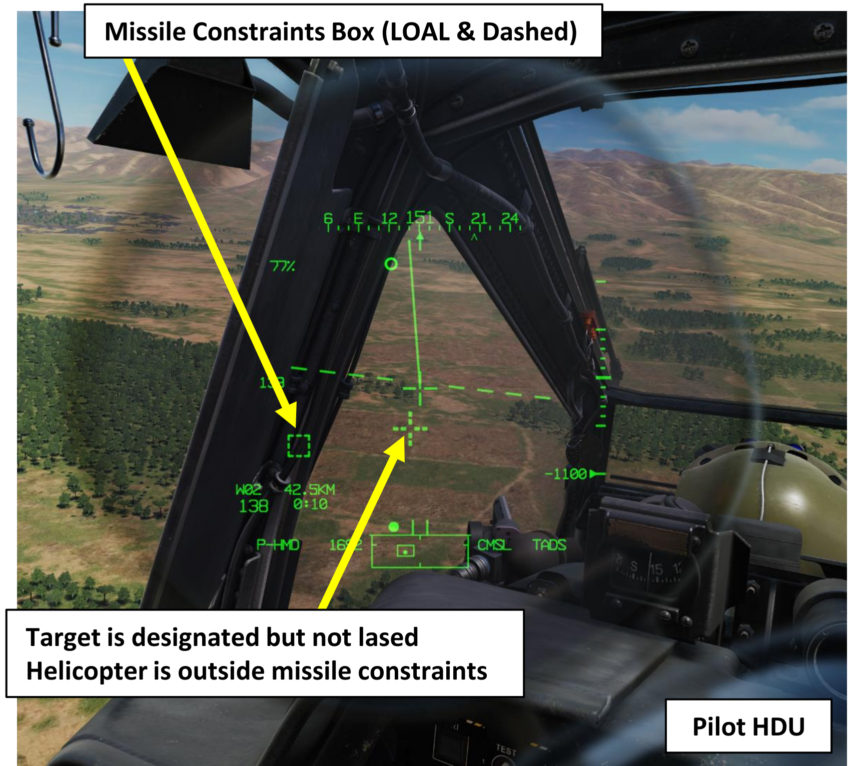
Missile Constraints Box

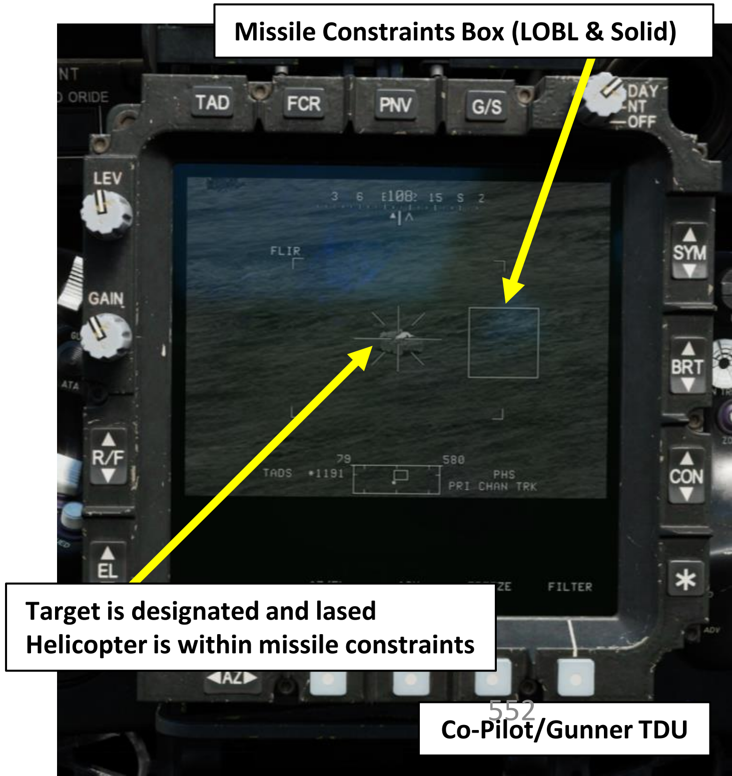
When selecting the Hellfire, the “Missile Constraints Box” is used to assist in successful launch and destruction of ground targets. This box is visible on the HDU (Helmet Display Unit) monocle and on the TDU (TEDAC Display Unit) as well. The location of the constraints box is used to indicate the position of the missile seeker itself relative to the missile datum line (0° in azimuth and elevation from the missile body). Keep in mind that the constraints box location does not correspond with a real-world location “out-the-window”. Box sizes indicate how far the aircraft nose can be offset from the target while still allowing a successful engagement.

The constraints box is displayed in two sizes, and these boxes can be either dashed or solid:

- **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as “LOAL box” (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
- **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as “LOBL box” (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
- **Dashed format**: missile not in constraints and/or not ready to fire
- **Solid format**: missile within constraints and ready to fire







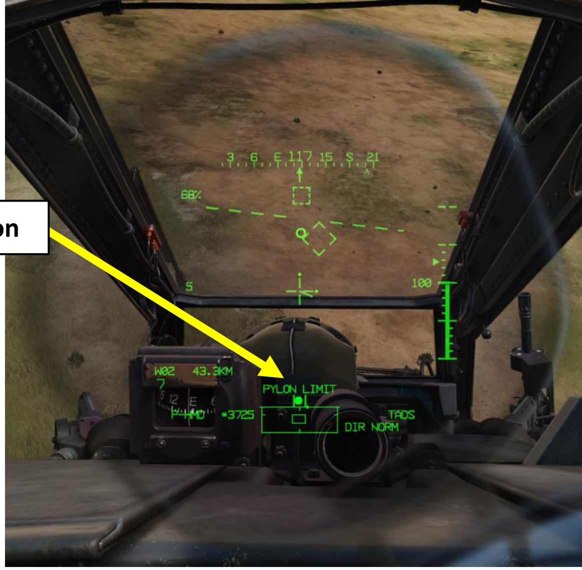
4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

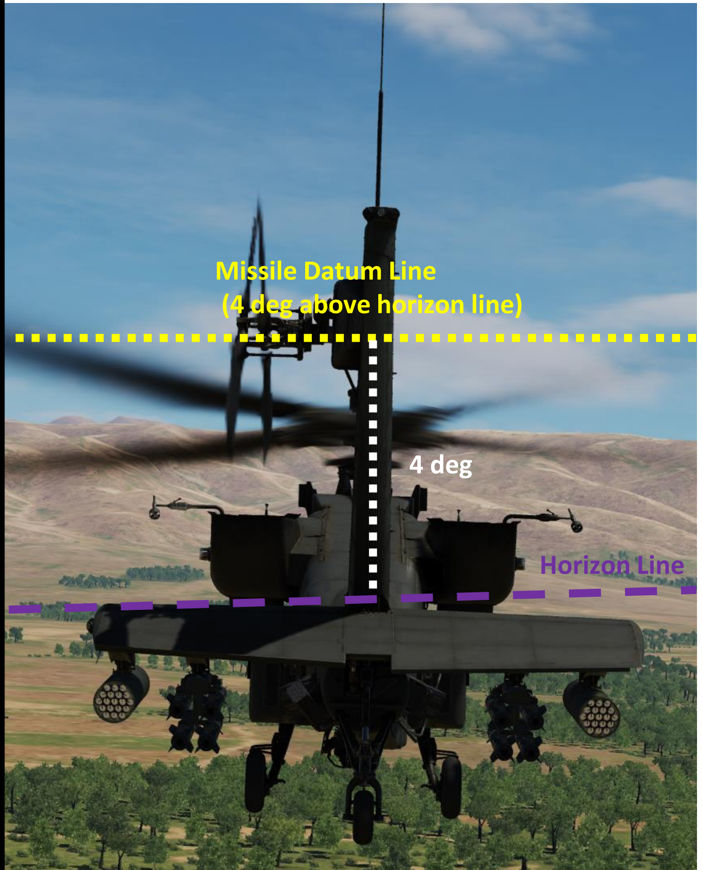
Missile Constraints Box

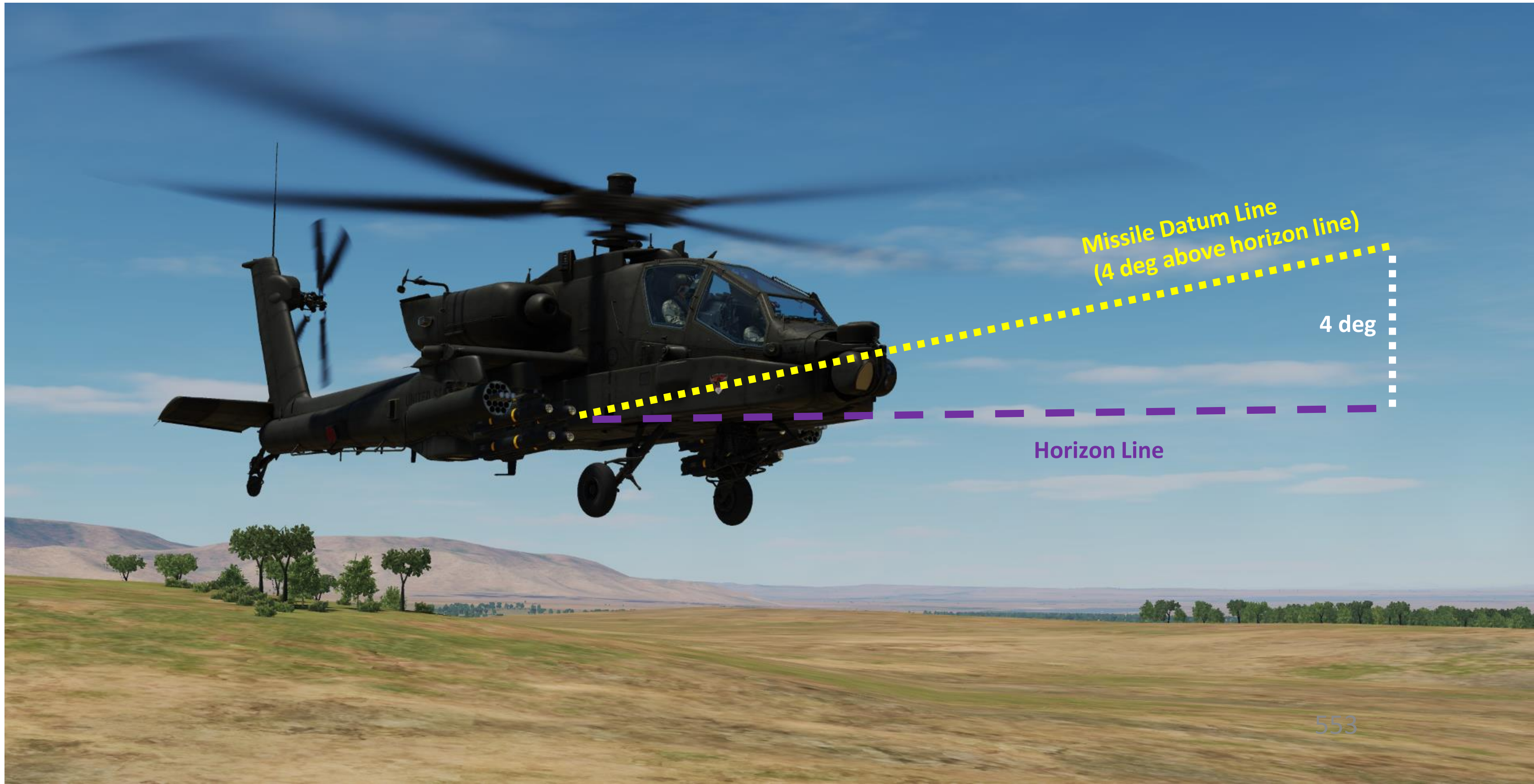
When the missiles are actioned with SAL (Semi-Active Laser) as the selected missile type, all pylons with a Hellfire missile launcher (and has SAL missiles loaded on its launcher rails) will be commanded to articulate and maintain +4 deg above the horizon. This command is performed independently of aircraft attitude.

- If the missile launchers cannot articulate to within 10 deg of this commanded angle due to articulation limits, a PYLON LIMIT message is visible to the crewmember that has actioned the missiles. In practice, this translates into an allowable aircraft pitch attitude of -10 deg to +29 deg before a PYLON LIMIT message is triggered.

Note: The missiles can still be fired with a pull of the weapon trigger to the 2nd detent. However, this will not guarantee that the missile will hit the target if the pylons cannot articulate properly.





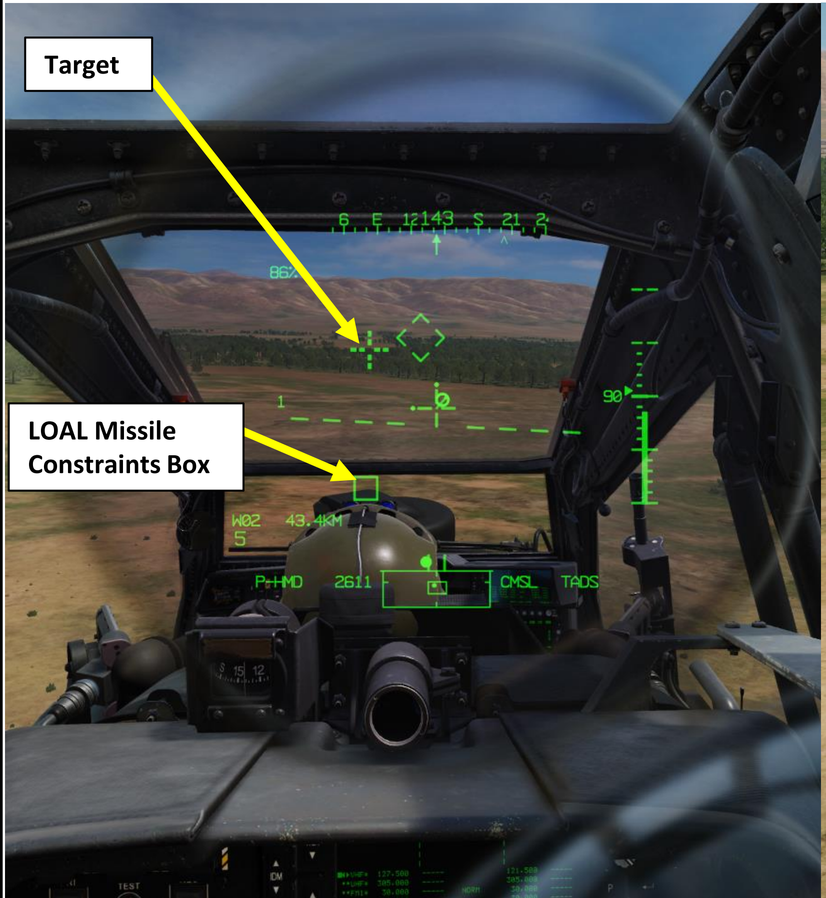


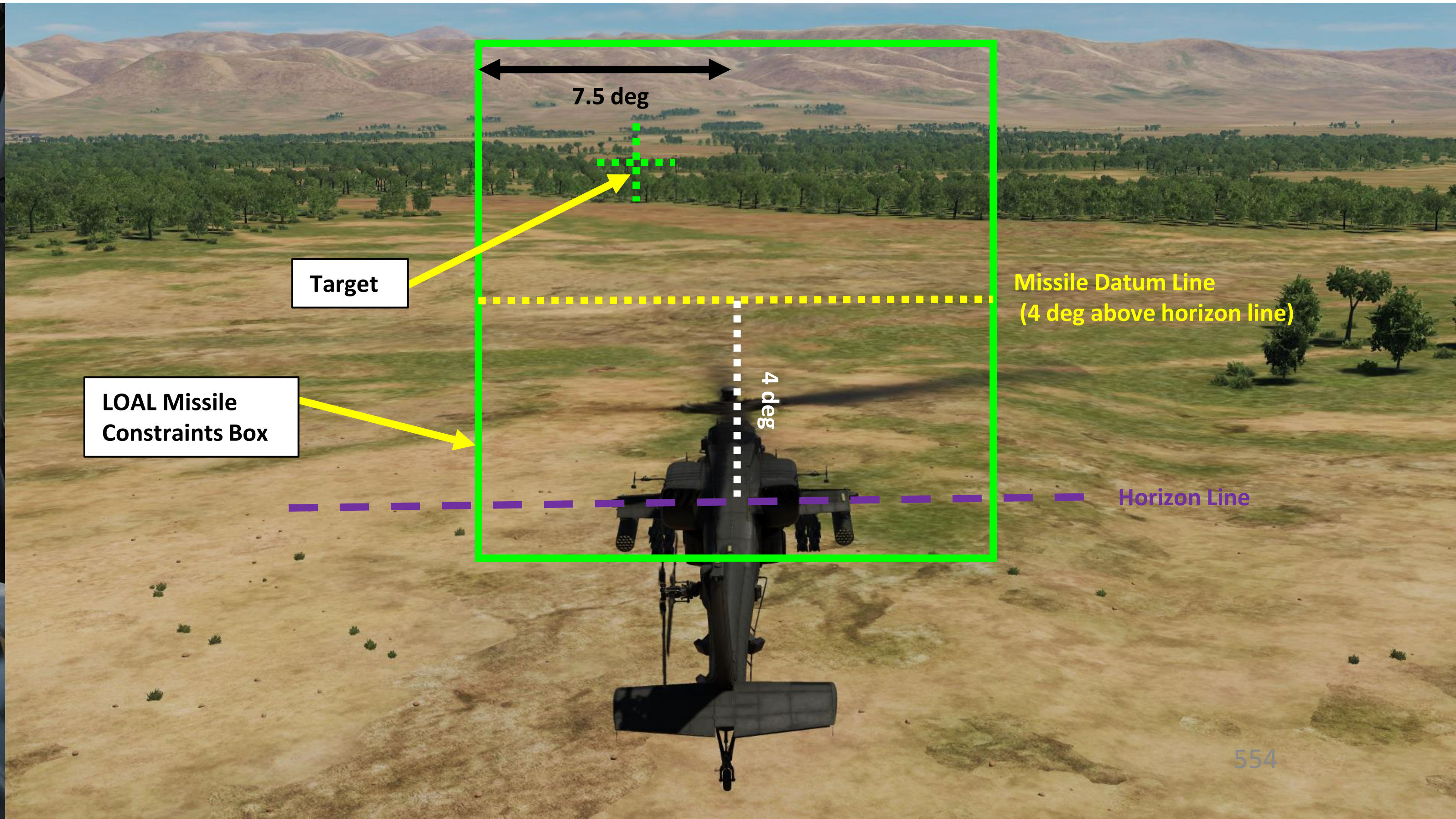
4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Missile Constraints Box

The **LOAL (Lock-On After Launch) missile constraints box** indicates a maximum allowable offset angle at launch of 7.5 deg from the missile datum line.

- If the aircraft manoeuvers to an extent that the source of the constraints box shifts outside of this 7.5 deg offset angle, the constraints box will switch to a dashed LOAL box.



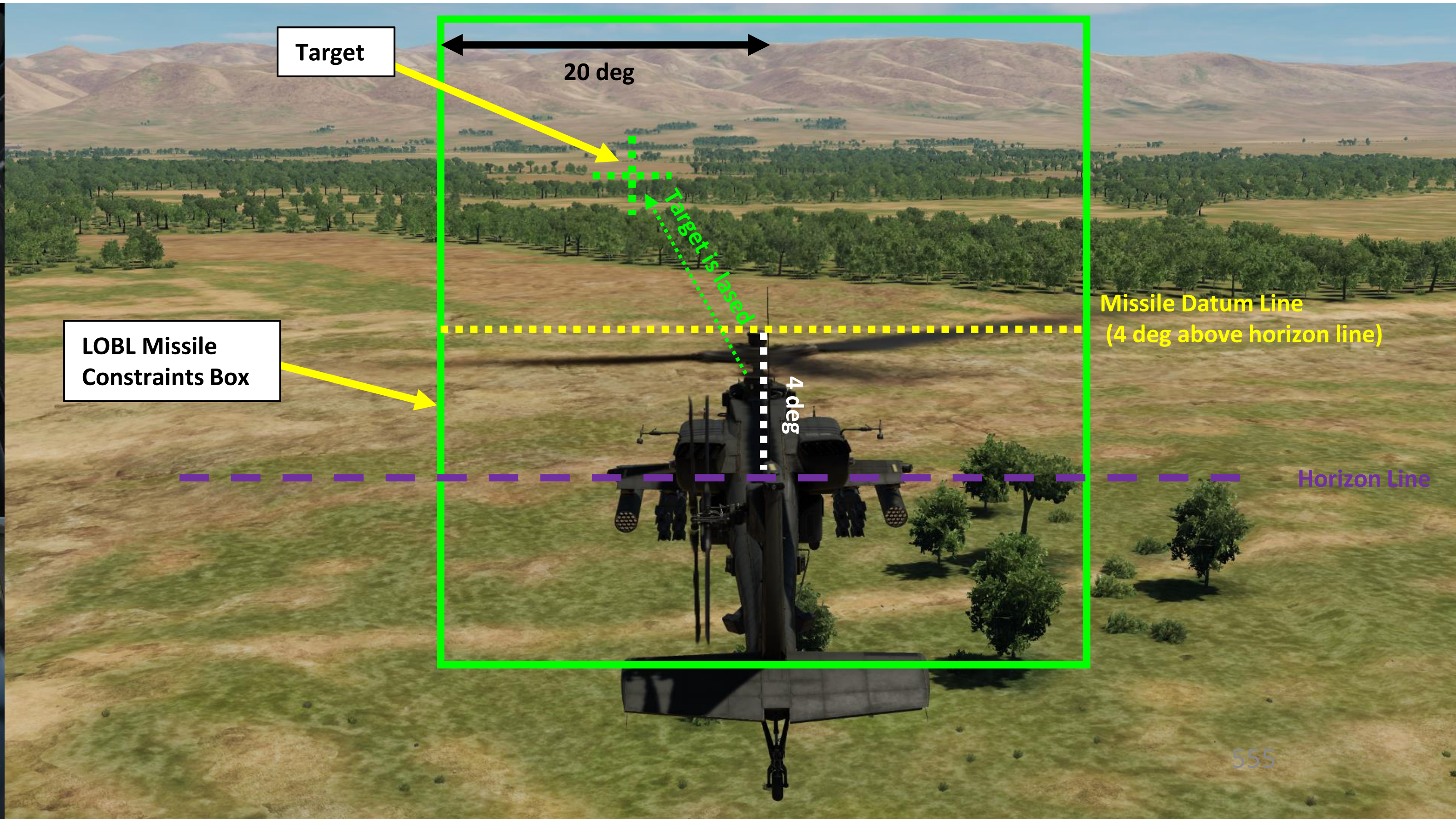


4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Missile Constraints Box

The **LOBL (Lock-On Before Launch) missile constraints box** indicates a maximum allowable offset angle at launch of 20 deg from the missile datum line.

- If the missile detects and tracks a matching laser designation within this range, the LOAL box will automatically switch to a larger LOBL box, which will indicate the increased allowable offset angle of the missile seeker.
- If the aircraft manoeuvers to an extent the laser designation shifts outside of this 20 deg offset angle, the constraints box will switch to a dashed LOBL box.
- If the laser designation is no longer tracked by the missile seeker, the constraints box will revert to LOAL and will be driven by the selected LOAL trajectory.



4 – AGM-114 HELLFIRE MISSILE

4.1 – Introduction

WPN Page & Missile Settings (AGM-114K, Semi-Active Laser)

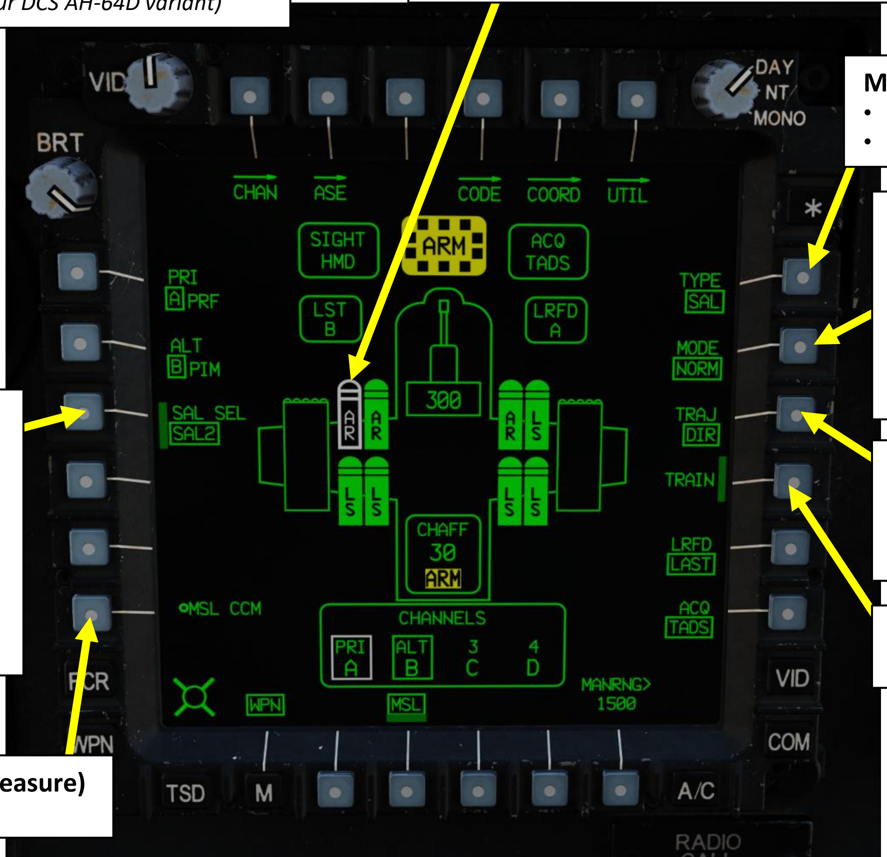
When Hellfire missiles are selected Weapon Action Switch (WAS) set to the RIGHT position, the WPN (Weapon) page display the following information.

This format is visible when the SAL (Semi-Active Laser) missile type such as the AGM-114K is selected.

Weapon Action Switch (WAS)
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

SAL (Semi-Active Laser) Missile Type Selector
- *SAL 1. Selects Hellfire I missiles for firing. Hellfire I missiles are only capable of tracking PRF codes.*
- *SAL 2. Selects Hellfire II missiles for firing. Hellfire II missiles can track both PRF and PIM codes.*
- *AUTO. Automatically selects Hellfire I or II missiles. If a PIM code is set, only Hellfire II missiles will be selected. If a PRF code is set, Hellfire II (SAL 2) missiles will be prioritized over Hellfire I missiles.*

MSL CCM (Missile Counter-Measure)
- *Not Simulated*



Missile Icons

AGM-114K Semi-Active Laser Missile Codes:
- *LS: Missile **S**tandby, not set to a laser code*
- *AR: Missile **R**eady, seeker is in scanning for laser matching "**A**" code. "BR" would scan for laser matching "B" code, and so on.*
- *AT: Missile seeker in **T**rack mode, detecting laser matching "**A**" code. "BT" would track and detect laser matching "B" code, and so on.*

AGM-114L Radio Frequency Missile Codes:
- *S: Missile is powered but not yet aligned (**S**tandby).*
- *OT: Missile **o**ver-**t**emperature is detected.*
- *R: Missile **r**eady to receive target.*
- *T: Missile seeker in **t**rack mode.*

AGM-114K/L Common Codes:
- *NA: Missile **n**ot **a**vailable.*
- *MU: **M**issile in on an **u**nlatched launcher.*
- *SF: Missile launcher **s**tation is **f**ailed.*
- *MF: **M**issile has **f**ailed BIT (Built-In Test).*
- *MH: **M**issile **h**angfire has been detected.*
- *MA: **M**issile launch has been **a**borted.*

Missile Type
- *SAL: Semi-Active Laser (AGM-114K)*
- *RF: Radio Frequency (AGM-114L)*

Missile Mode
- *NORM: Normal, all selected missiles will be guided using the priority laser channel*
- *RIPL: Ripple, selected missiles will be guided alternately between the priority and alternate laser channel for each successive launch*
- *MAN: Manual, a single missile will be launched and guided using the priority laser channel. The Manual Advance button on the collective or TEDAC must be used to ready the next missile between launches.*

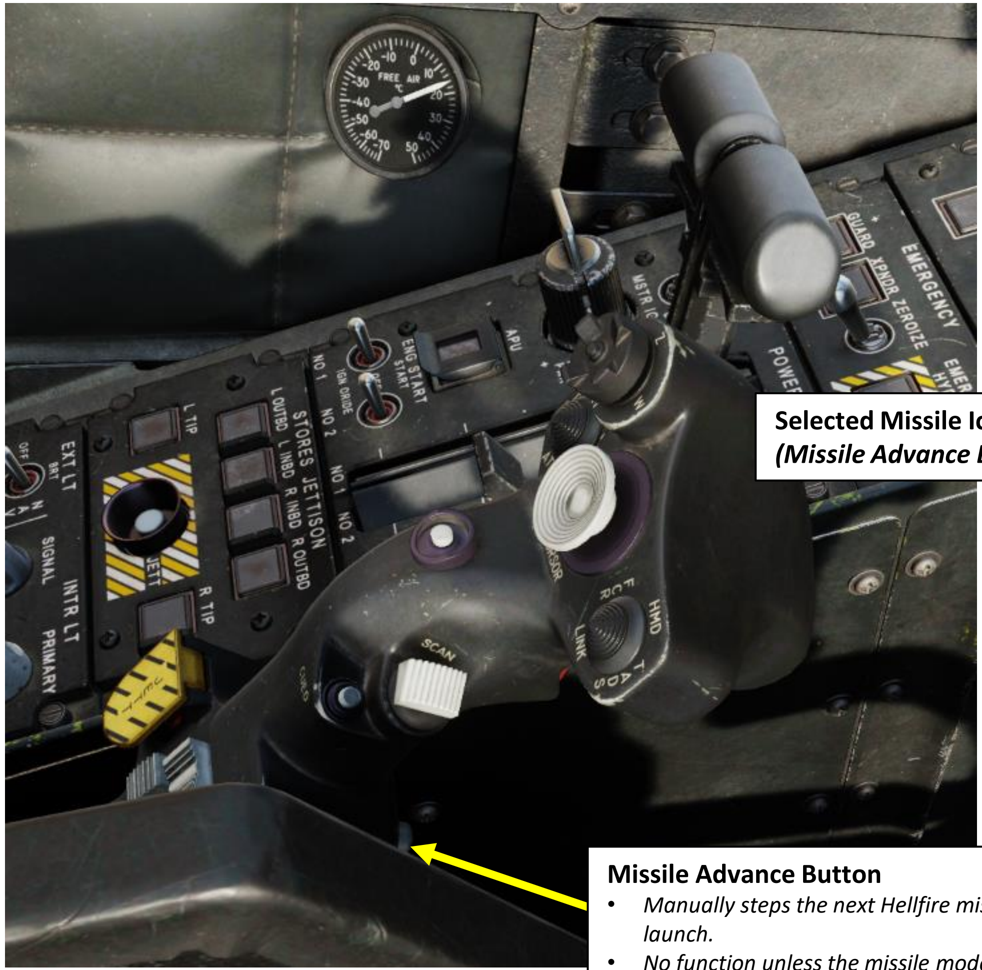
Missile Trajectory
- *DIR: Direct, missile will fly directly to the target with minimal loft.*
- *LO: Low, missile will fly a low-altitude loft to the target*
- *HI: High, missile will fly a high-altitude loft to the target*

Training Mode Selector
- *Used for synthetic weapons engagement for training.*

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

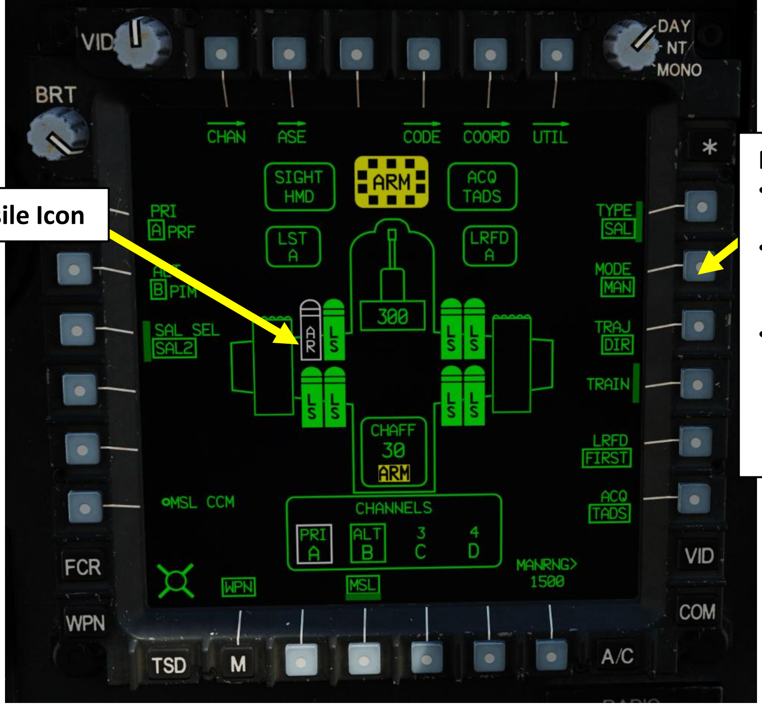
WPN Page & Missile Settings (AGM-114K, Semi-Active Laser)

When missile mode is in MANUAL, using the Missile Advance Button steps the next Hellfire missile for launch. If the missile mode is not in MANUAL, the Missile Advance Button has no function.



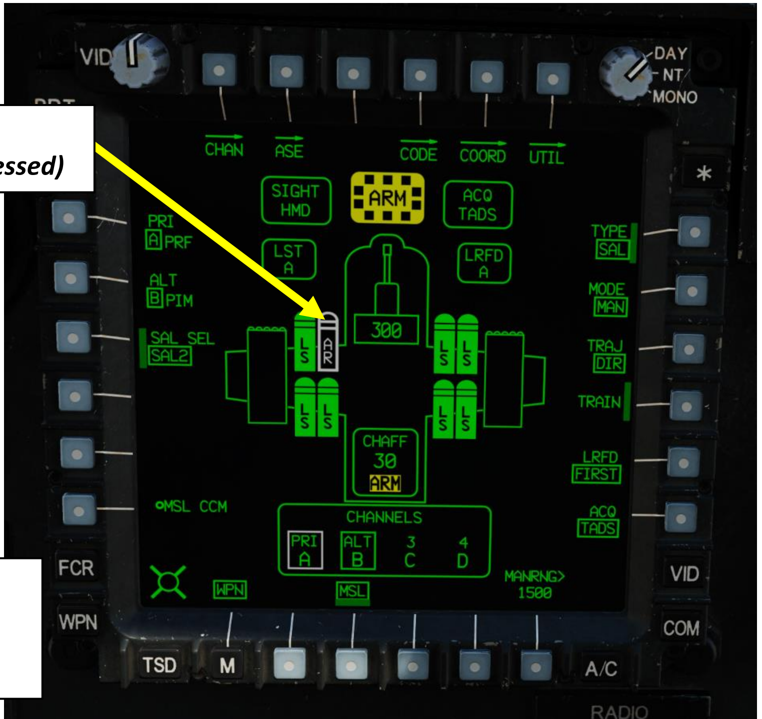
Missile Advance Button
- *Manually steps the next Hellfire missile for launch.*
- *No function unless the missile mode is Manual.*

Selected Missile Icon



Missile Mode
- *NORM: Normal, all selected missiles will be guided using the priority laser channel*
- *RIPL: Ripple, selected missiles will be guided alternately between the priority and alternate laser channel for each successive launch*
- *MAN: Manual, a single missile will be launched and guided using the priority laser channel. The Manual Advance button on the collective or TEDAC must be used to ready the next missile between launches.*

Selected Missile Icon
(Missile Advance Button Pressed)



4 – AGM-114 HELLFIRE MISSILE

4.1 – Introduction

WPN Page & Missile Settings (AGM-114K, Semi-Active Laser)

Missile Channel (CHAN) Sub-Page Selector
- *Assigns laser codes to each of the four SAL (Semi-Active Laser) missile channels*

Laser Code Sub-Page Selector
- *Assigns laser codes to the TADS Laser Rangefinder/Designator (LRFD) and Laser Spot Tracker (LST)*

TADS LST (Laser Spot Tracker) Selected Laser Preset Code

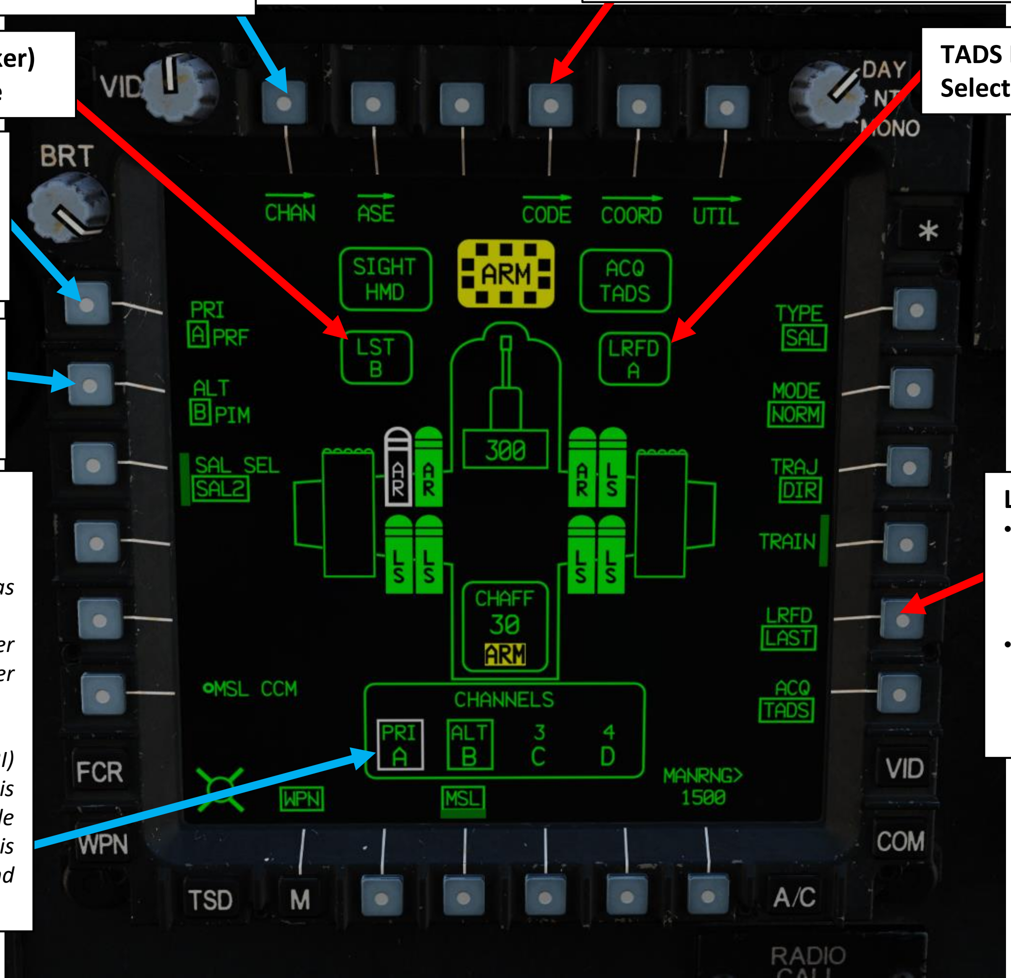
TADS LRFD (Laser Rangefinder/Designator) Selected Laser Preset Code

Missile Priority Channel Selector
- *Designates the priority missile channel (laser code preset).*
- *When a laser code is selected, PIM (Pulse Interval Modulation) or PRF (Pulse Repetition Frequency) is displayed next to the code indicating the type of laser code.*

Missile Alternate Channel Selector
- *Designates the alternate missile channel (laser code preset).*
- *Alternate missile channel cannot be chosen until a priority missile channel is chosen.*

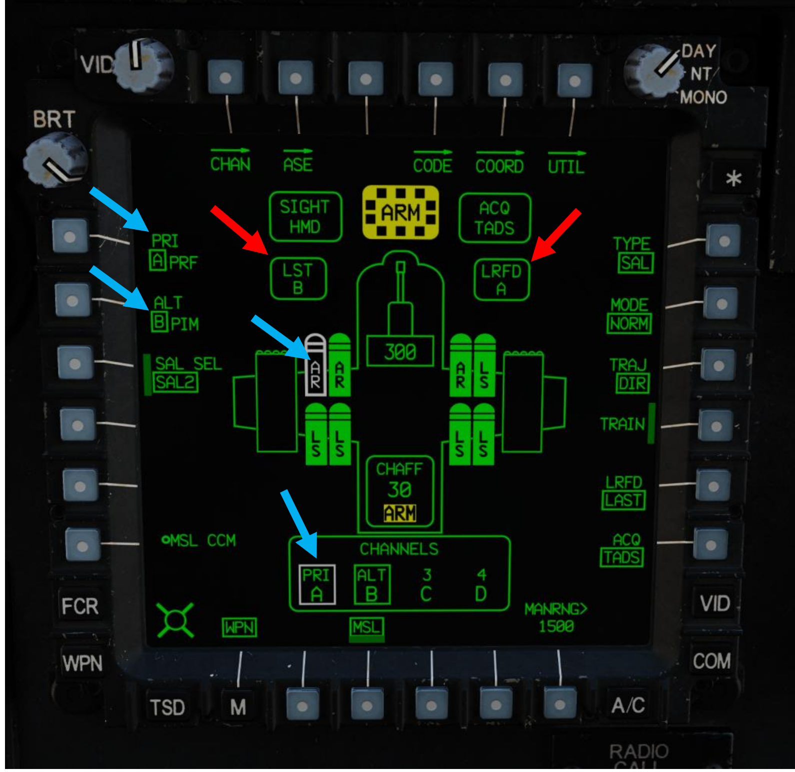
Missile Channel Laser Code Assignations
- *PRI: Missile Primary Channel*
- *ALT: Missile Alternate Channel*
- *1 / 2 / 3 / 4: Missile Channel (replaced by PRI or ALT if set as Primary or Alternate Channel)*
- *A / B / C / D / E / F / G / H / J / K / R / Q / P / N / M / L: Laser Code presets. As an example, preset code "A" can be set to laser code "1688".*

- *In this example, Missile Channel 1 is set as the primary (PRI) missile channel, to which a laser preset code A (1688) is assigned. Missile Channel 2 is set as the alternate (ALT) missile missile channel, to which a laser preset code B (2111) is assigned. Missile Channel 3 has a laser preset code C (4121) and Missile Channel 4 has a lser preset code D (4311).*



LRFD (Laser Rangefinder/Designator) Mode Selector
- *FIRST: The beginning portion of a sequence of rangefinder pulses will be used to determine target range. As an example, lasing through foliage in FIRST mode would determine the range based on what the laser "hit" first.*
- *LAST: The ending portion of a sequence of rangefinder pulses will be used to determine target range. As an example, lasing through foliage in LAST mode would determine the range based on what the laser "hit" last, so whatever is behind the foliage.*

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction



Missile Channels & Laser Codes

It is easy to confuse all these "codes" listed in the WPN page. Here is a quick reminder:

- Each semi-active laser Hellfire missile has four "**channels**".
  - Each channel can have a different laser code associated with it, which the missile seeker can home onto.
  - Laser code presets can be modified manually.
  - Having missile channels you can quickly change is useful when multiple laser designators are operating together, allowing missiles to home on specific lasers (assuming no conflicting codes are being used simultaneously).
- **LST** (Laser Spot Tracker) code is associated to the TADS (Target Acquisition & Designation Sight) laser detector. This allows the TADS sensor to slave its line-of-sight to a laser designator like a JTAC or another AH-64.
- **LRFD** (Laser Rangefinder/Designator) code is associated to the TADS laser designator. This allows you to guide a Hellfire by yourself or to designate a target for other flight members.

AN/ASQ-170 TADS DTV, LRFD and LST Assembly
- *TADS: Target Acquisition & Designation Sight*
- *DTV: Day Television*
- *LRFD: Laser Rangefinder & Designator*
- *LST: Laser Spot Tracker*

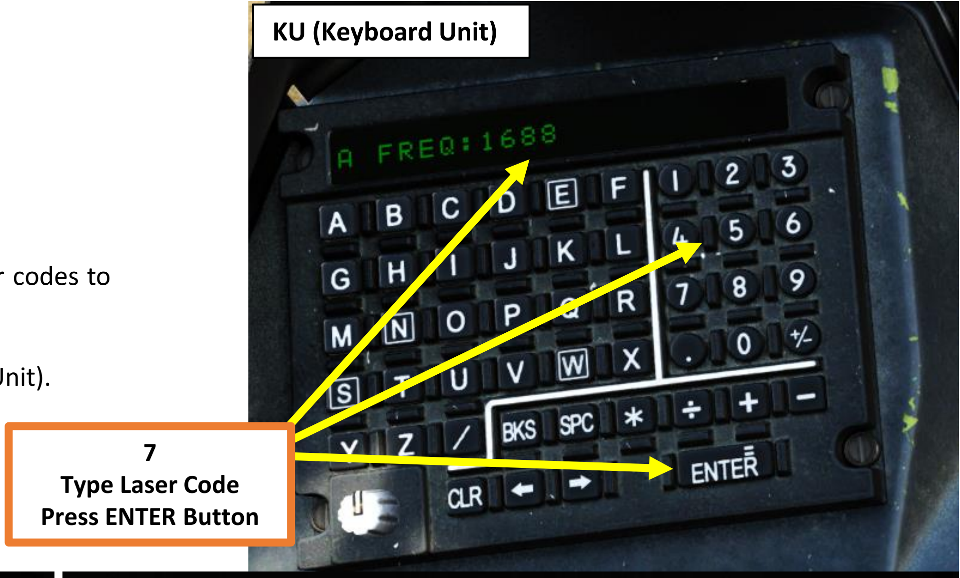
Missile Channel 1 (set as Priority Channel)	Missile Channel 2 (set as Alternate Channel)	Missile Channel 3	Missile Channel 4
Laser Preset Code: A (1688)	Laser Preset Code: B (2111)	Laser Preset Code: C (4121)	Laser Preset Code: D (4311)

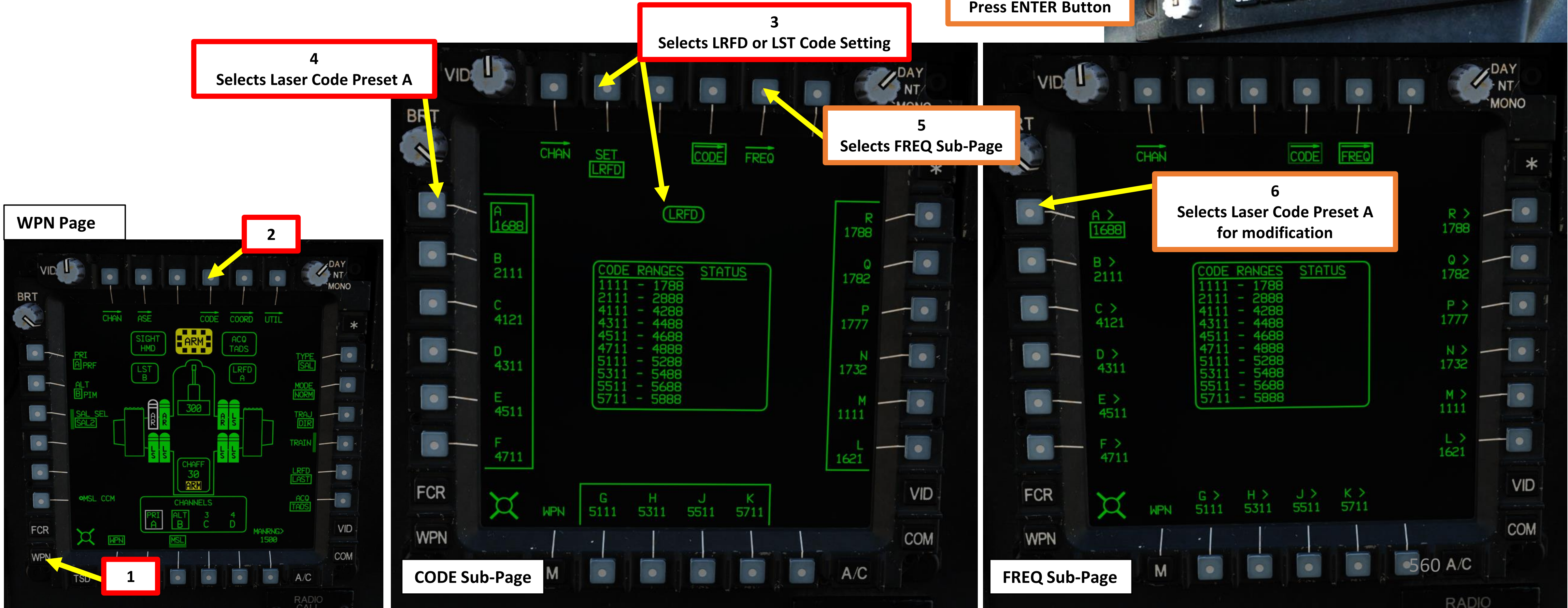
4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Laser Code Sub-Page (AGM-114K, Semi-Active Laser)

The Laser CODE sub-page (accessed by pressing the VAB (Variable Action Button) next to CODE) is used to assign laser codes to the TADS Laser Rangefinder/Designator (LRFD) and Laser Spot Tracker (LST).

Laser preset codes can be modified manually by accessing the FREQ (Frequency) sub-page and using the KU (Keyboard Unit).

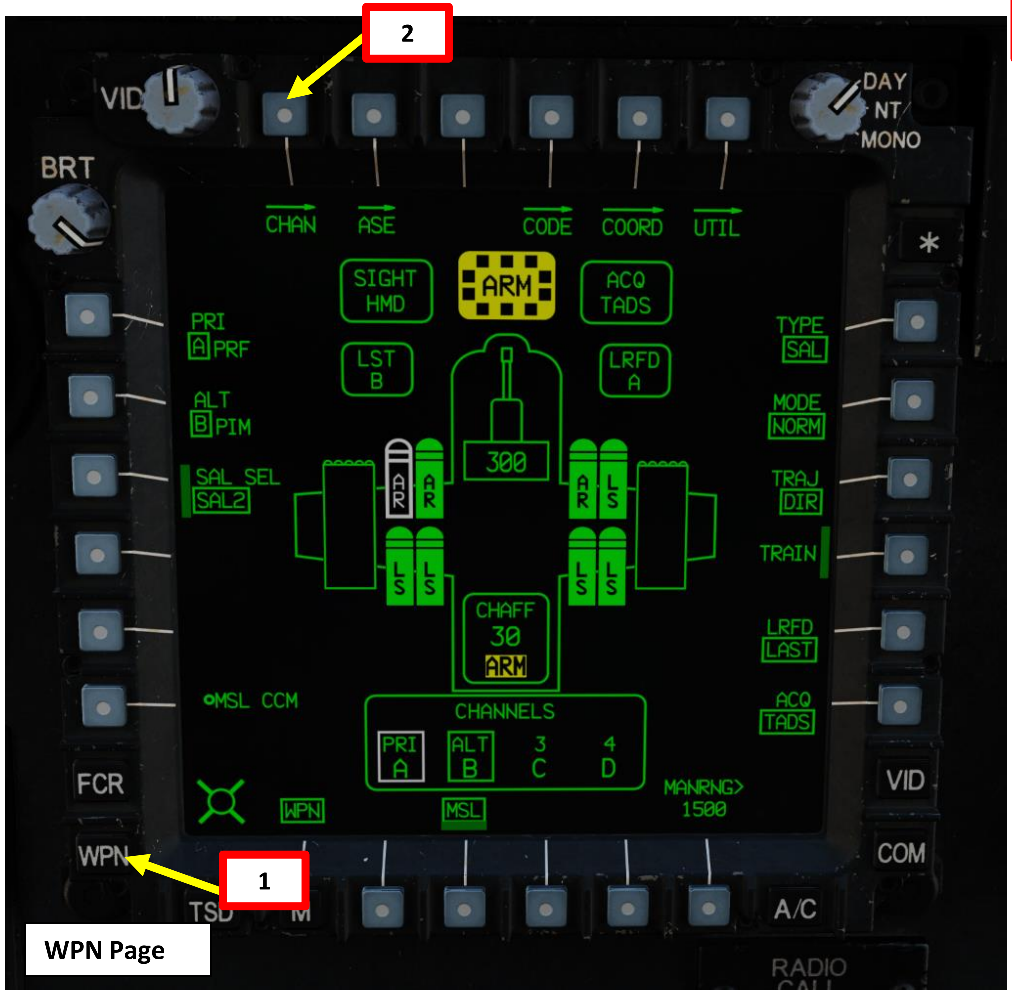




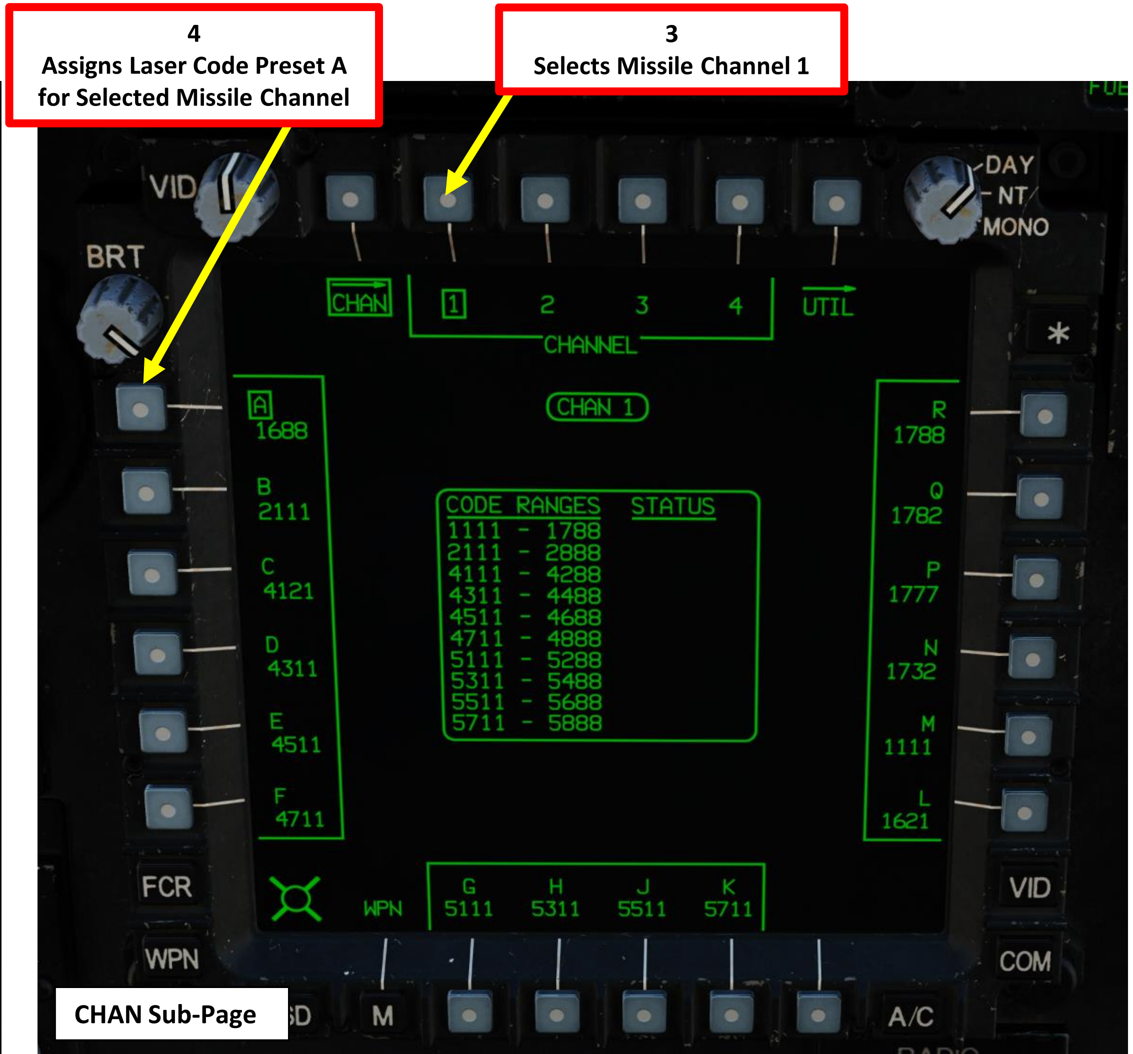
4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Missile Channel (CHAN) Sub-Page (AGM-114K, Semi-Active Laser)

The Missile Channel (CHAN) sub-page (accessed by pressing the VAB (Variable Action Button) next to CHAN) is used to assign laser codes to Hellfire missile seekers. Each seeker can memorize up to four “channels”, which can have different laser preset codes associated with them.



WPN Page



CHAN Sub-Page

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

WPN Page & Missile Settings (AGM-114L, Radio Frequency)

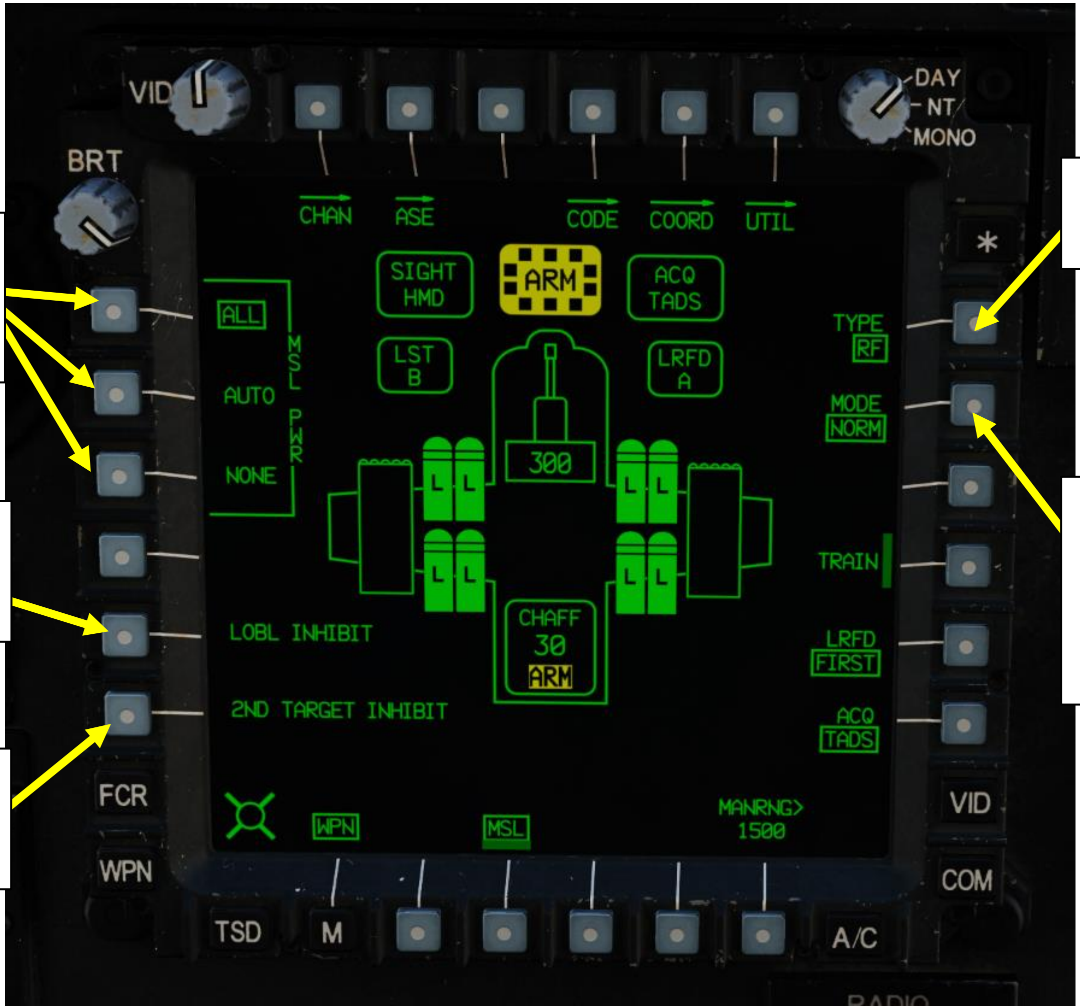
When Hellfire missiles are selected by pressing the Weapon Action Switch (WAS) to the RIGHT position, the WPN (Weapon) page displays the following information.

This format is visible when the RF (Radio Frequency) missile type such as the AGM-114L is selected.

Missile Power Mode Selector
- *ALL: All missiles are powered on continuously*
- *AUTO: Automatic, between zero and four missiles are powered on automatically, depending on total missile inventory.*
- *NONE: All missiles are powered off.*

LOBL (Lock-On Before Launch) Inhibit Option
- *Inhibits the missile's RF (radio frequency) transmitter from transmitting. This will prevent the missile from attempting to track a selected target while still on the rail.*

Secondary Target Inhibit Option
- *Inhibits secondary target information from being handed over to the missile from the FCR (Fire Control Radar). Only applicable during stationary target engagements.*



Missile Type
- *SAL: Semi-Active Laser (AGM-114K)*
- *RF: Radio Frequency (AGM-114L)*

Missile Mode
- *NORM: Normal, the weapons system will power on the missiles automatically according to the MSL PWR selection.*
- *MAN: Manual, a single missile will be powered on when it is selected using the Manual Advance button on the collective or TEDAC.*

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Engagement Types (AGM-114K)

The AH-64 can use the Hellfire missile in a number of different engagement methods.

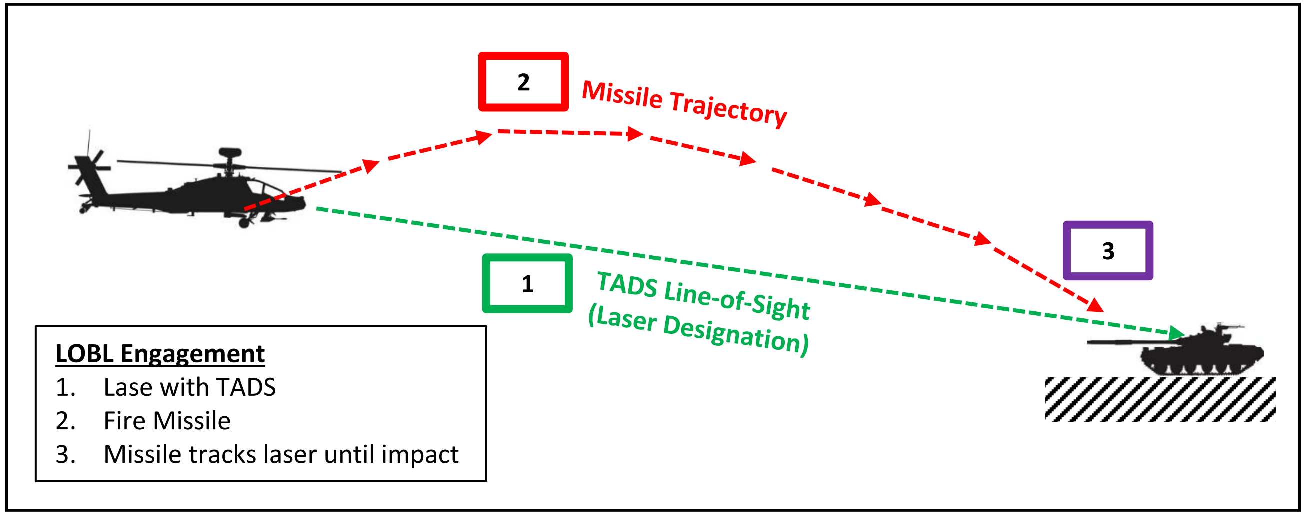
LOBL (Lock-On Before Launch)

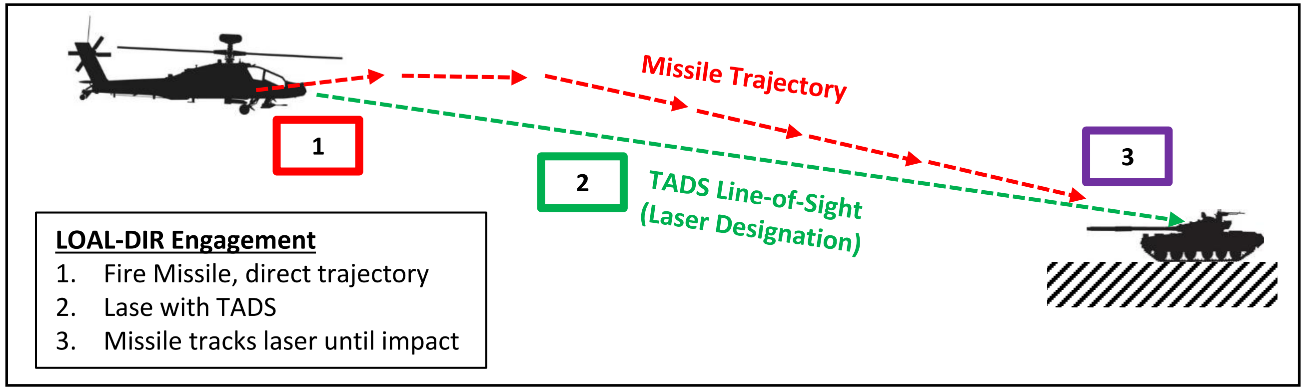
The Co-Pilot/Gunner lases a target using the TADS LRFD (Laser Rangefinder/Designator) first, then fires the missile. The missile then tracks the laser until impact.

LOAL-DIR (Lock-On After Launch – Direct Trajectory)

The Co-Pilot/Gunner fires the missile first, then lases a target using the TADS LRFD (Laser Rangefinder/Designator). Laser designation can also be performed by another AH-64 or a JTAC. The missile's seeker is slaved to the TADS or HMD Line-of-Sight reticle (depending on selected sight of the crewmember). This method is useful in cases where you want to minimize the amount of time being exposed or use the terrain to mask your attack, like in pop-up attacks.

- Note: The most common reason for firing a missile in LOAL-Direct instead of LOBL is backscatter. Backscatter can exist when an obscurant (such as dust, smoke or fire, which can interfere with the laser beam) is between the aircraft and target, and/or the angle between the TADS Line-of-Sight reticle and missile seeker differ by greater than 2 deg. When this 2 deg difference is detected by the aircraft, a "BACKSCATTER" message will be presented to the CPG, which will prevent the missile from being launched, regardless of which weapon trigger detent is used.





4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Engagement Types (AGM-114K)

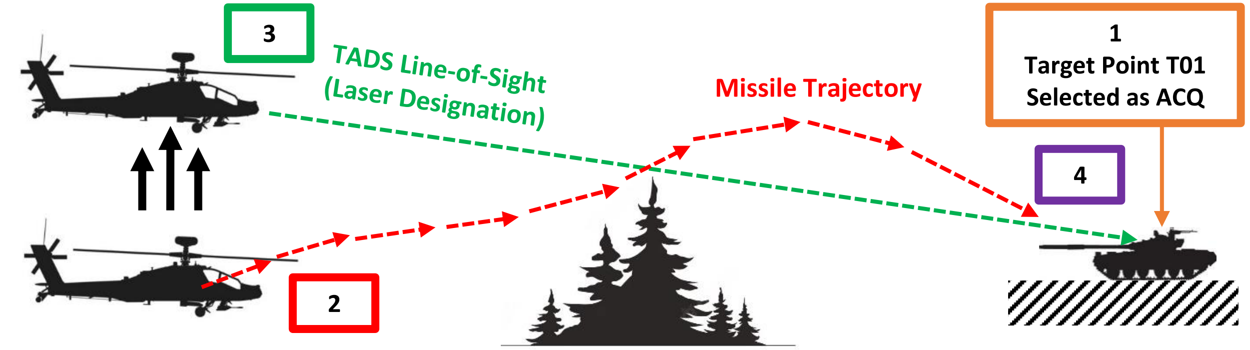
LOAL-LO (Lock-On After Launch – Low Trajectory)

The Co-Pilot/Gunner fires the missile first. The missile will initially perform a shallow climb to clear a low obstacle in front of the aircraft. The pilot can then pop-up from behind cover, and the CPG can lase the target using the TADS LRFD (Laser Rangefinder/Designator). Lasing can also be performed by other laser designators (a friendly AH-64, OH-58, JTAC, etc.). This method is used for long-range missile engagement, with a trajectory mode optimized to allow the AH-64 to fire its missiles from behind cover at maximum stand-off range, and then un-mask to designate for the missile's final moments of flight.

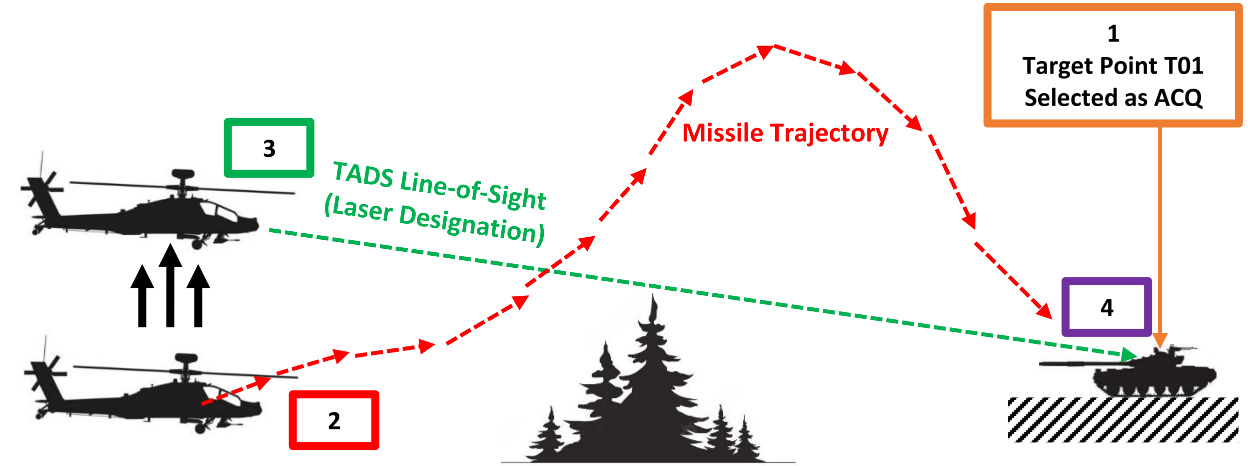
LOAL-HI (Lock-On After Launch – High Trajectory)

The Co-Pilot/Gunner fires the missile first. The missile will initially perform a steep climb to clear a high obstacle in front of the aircraft. The pop-up attack and laser designation can then be performed similarly to the LOAL-LO engagement method.

- Note applicable to both LOAL-LO and LOAL-HI: When LO or HI is the selected LOAL trajectory, the missile's seeker will be caged forward, regardless of the selected sight. The most recent TSD (Tactical Situation Display) point selected (i.e. Target Point T01 as an example) as an acquisition source drives the missile constraints box. Regardless of the selected sight's LOS angle, the constraints box will remain driven off the offset angle of the point residing within the ACQ (Acquisition Source) menu when the LOAL trajectory is set to LO or HI.



LOAL-LO Engagement
1. Target Point selected as ACQ (Acquisition Source) by you
2. Fire Missile, low trajectory
3. Lase with TADS
4. Missile tracks laser until impact



LOAL-HI Engagement
1. Target Point selected as ACQ (Acquisition Source) by you
2. Fire Missile, high trajectory
3. Lase with TADS
4. Missile tracks laser until impact

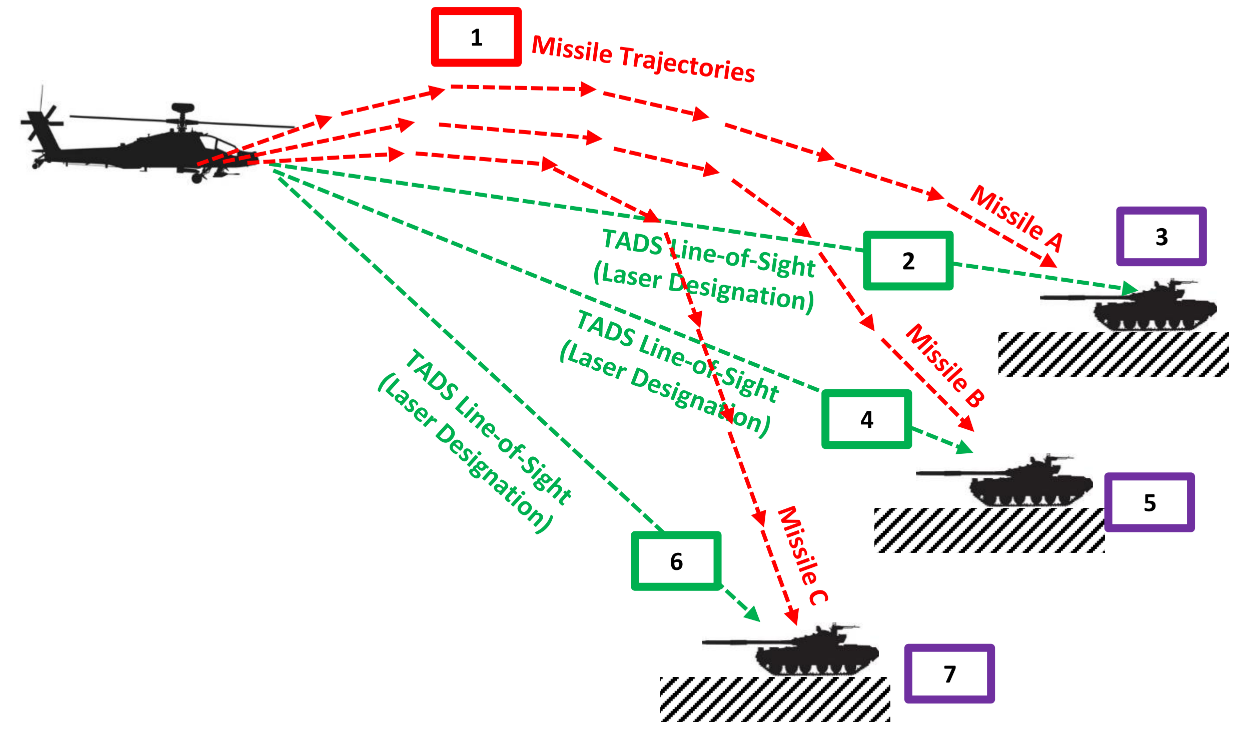
4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Engagement Types (AGM-114K)

Rapid Fire

“Rapid Fire” is defined as multiple missiles launched while being guided by the same laser designation code at the same time, with the laser designation shifting to the next target after each subsequent missile impact. It can be performed in either LOAL or LOBL launch modes. This rapid engagement method of engaging multiple targets within relatively close proximity with on-board laser designation is useful when attacking vehicle columns.

The sequence goes as follows:
- Missiles are fired in quick succession.
- As each missile is launched, the aircraft systems will calculate the missile time-of-flight (TOF) based on the range value displayed in the High Action Display and monitor the elapsed time for each missile that is calculated to be in flight.
- 8 seconds after a missile is launched, “FIRE MSLS” will be displayed momentarily in the High Action Display as a cue to the co-pilot/gunner to fire the next missile in sequence. The “HF TOF=##” with the least remaining time to impact will always be displayed before others in the flight queue.
- When the lowest TOF reaches 12 seconds prior to impact, “LASE 1 TRGT” is displayed to cue the CPG to start designating the target if not already doing so. When the lowest TOF reaches 0, the next TOF counter in sequence is displayed until it too reaches 12 seconds prior to impact, in which case “LASE 2 TRGT” is displayed, and so on.



Rapid Fire Engagement
1. Missiles A, B and C fired in quick succession
2. Target 1 lased with TADS
3. Missile A tracks laser until impact
4. Target 2 lased with TADS
5. Missile B tracks laser until impact
6. Target 3 lased with TADS
7. Missile C tracks laser until impact

4 – AGM-114 HELLFIRE MISSILE
4.1 – Introduction

Engagement Types (AGM-114K)

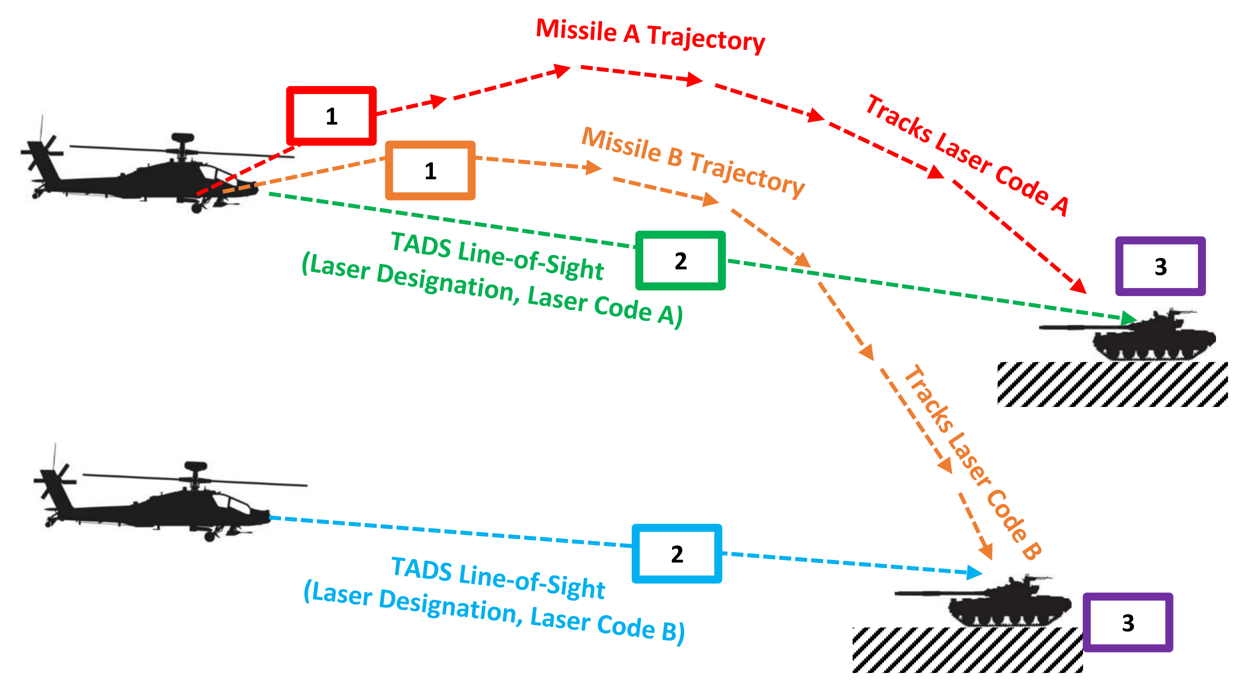
Ripple Fire

Ripple Fire is defined as multiple missiles launched while being guided by two unique laser designation codes at the same time, with each missile launch alternating between two assigned laser designation codes. It can be performed in either LOAL or LOBL launch modes, and the launching aircraft may provide one of the two sources of laser designation or neither of them. This rapid engagement method of engaging multiple targets simultaneously with different laser codes is useful when attacking vehicle columns.

The primary consideration when engaging targets using Ripple Fire is ensuring that **each subsequent missile is launched in the direction of the laser designation that matches it's assigned laser code**, especially if launching in LOAL mode at two target locations that are laterally separated by a significant distance.

RIPL mode provides automatic missile management, coding three missiles to the Priority missile channel and another three to the Alternate missile channel. With every missile launch, the **Priority and Alternate channels are automatically swapped**, so that **missiles are launched sequentially for each missile channel in an alternating sequence**.

RIPL mode also provides two additional Weapon Status messages to provide an indication to the crew when missiles are tracking a laser code matching the Alternate channel ("ALT CHAN TRK") or if missiles are tracking laser codes matching both the Priority and Alternate channels ("2 CHAN TRACK").



Ripple Fire Engagement

1. Missile A (Priority Channel set to preset laser code A) and Missile B (Alternate Channel set to preset laser code B) are fired in quick succession
2. Targets 1 and 2 are both lased simultaneously by two different designators with two different laser codes
    - Target 1 lased with TADS with laser code A. Designator is you.
    - Target 2 lased with TADS with laser code B. Designator is your wingman.
3. Missile A tracks laser code A until impact / Missile B tracks laser code B until impact

4 – AGM-114 HELLFIRE MISSILE

4.1 – Introduction

Engagement Types (AGM-114K)

Remote Fire

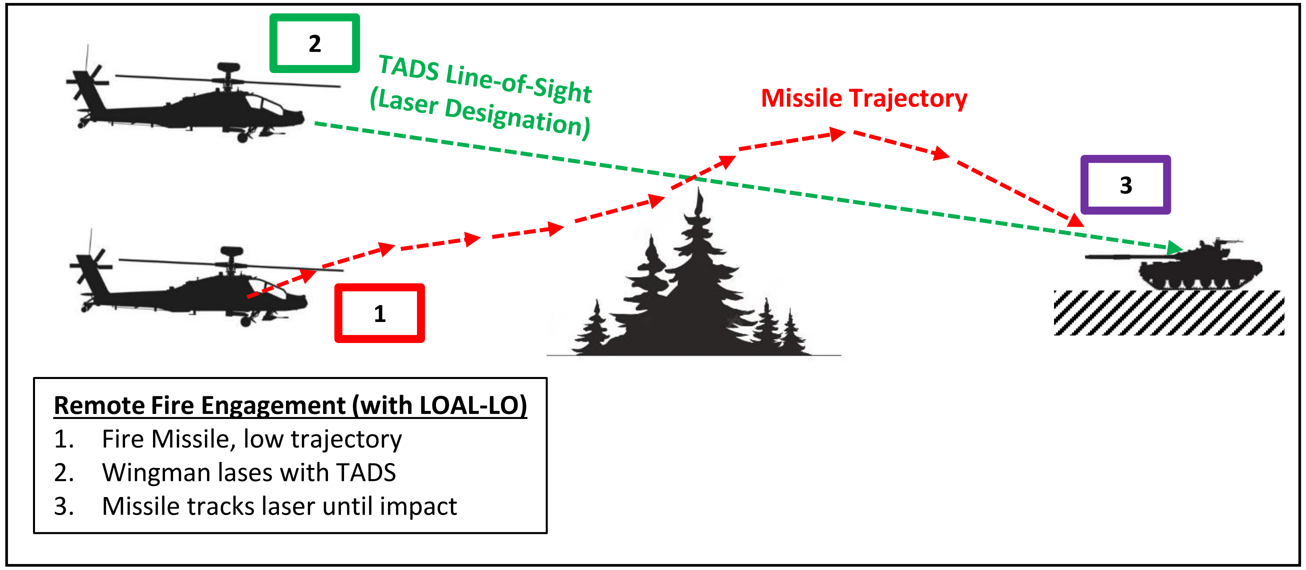
A “Remote” Hellfire engagement is conducted when another aircraft or ground element (JTAC) provides laser designation for the aircraft launching the missile. The designating aircraft informs the firing aircraft what code they will use to designate the target, and the firing aircraft sets that code as their Priority missile channel.

When conducting a Remote engagement, the firing aircraft will typically fire from behind cover. A LOAL-LO or LOAL-HI trajectory is recommended depending on the height of the obstacle in front of the aircraft.

Prior to conducting a Remote engagement, the designating element should pass the MGRS (Military Grid Reference System) or Latitude/Longitude coordinates location for the target, along with their laser code/frequency. The aircrew in the firing aircraft will input the target location as a point on the TSD (Tactical Situation Display), set that point as their acquisition source, and then re-orient and/or re-position the aircraft as necessary to launch the missile.

While the pilot is re-positioning the aircraft, the co-pilot/gunner will then set their PRI channel to the designator’s laser code and select the desired LOAL trajectory. Once the missile is properly configured for launch, and the Pilot has placed the aircraft into proper launch constraints, the aircrew of the firing aircraft will notify the designating element they are ready to fire and then coordinate for the designation as appropriate.

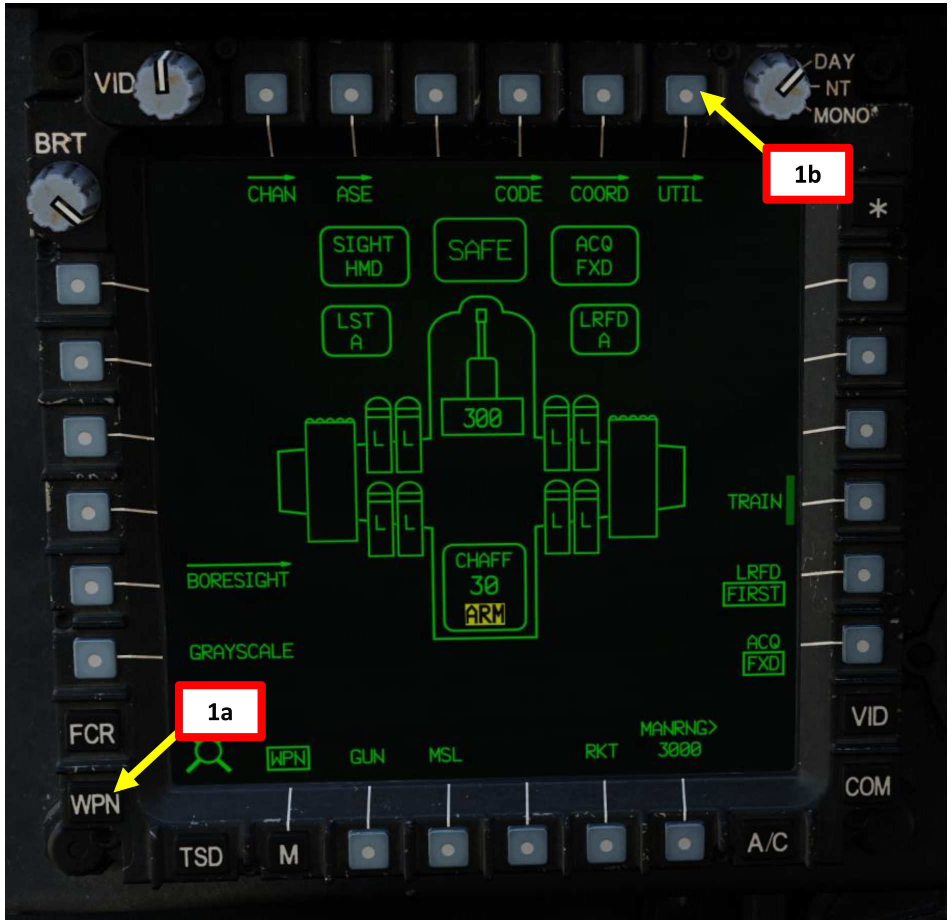
As with other Hellfire engagements, “MSL LAUNCH”, “FIRE MSLS”, “HF TOF=##” and “LASE # TRGT” messages are displayed in the same sequence following the same logic. However, when a missile is launched on a laser code that does not match the launching aircraft’s LRFD (Laser Rangefinder/Designator), the aircrew is presented with these messages in the Sight Status field of the HAD instead of the Weapon Status field. This allows the aircrew to engage other targets with missiles autonomously while the Remote missile is still in flight, monitor the times-of-flight of each missile separately, and provide cueing to the designating element of when laser guidance is required prior to impact if not already coordinated.

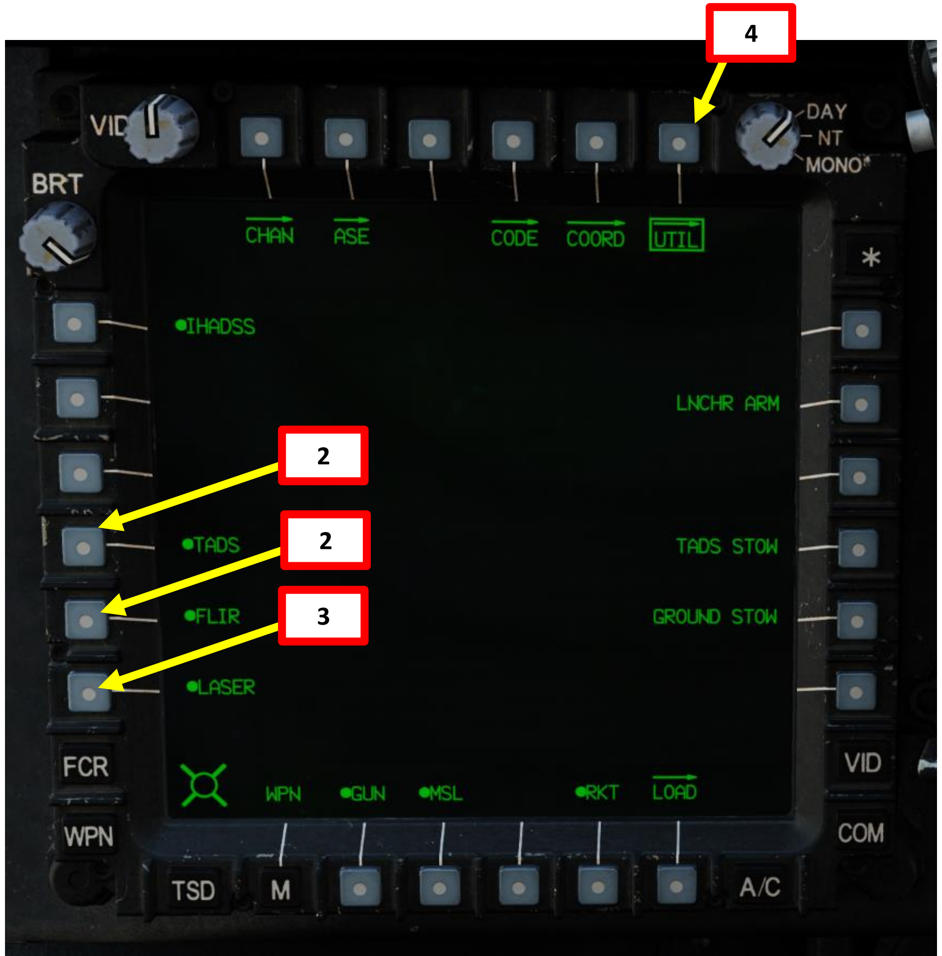


Note: When the PRI (Priority) channel and LRFD (Laser Rangefinder/Designator) codes differ, a “REMOTE” message will be displayed in the HAD (High Action Display) Sight Status field, alerting the gunner to the fact that the missile is not coded to match their current LRFD code.

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

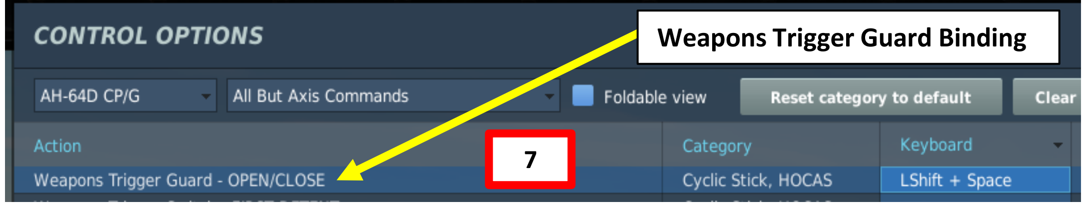
1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
   - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
   - Hollow circle means OFF. Solid Circle means ON.
   - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





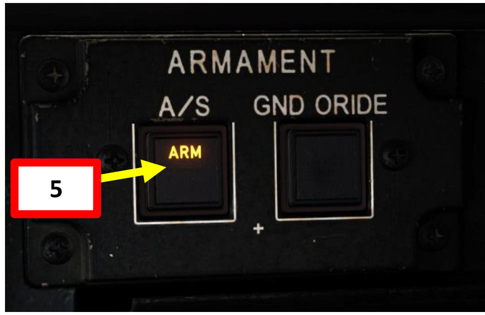
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

5. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
6. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
7. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
    - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
    - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).
8. *[CPG]* Set Missile Type to SAL (Semi-Active Laser).
9. *[CPG]* Set Missile mode to NORMAL.
10. *[CPG]* Set Missile trajectory to DIR (Direct).
11. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Mode Selector – As required. I typically set it to LAST.



Weapons Trigger Guard Binding

7



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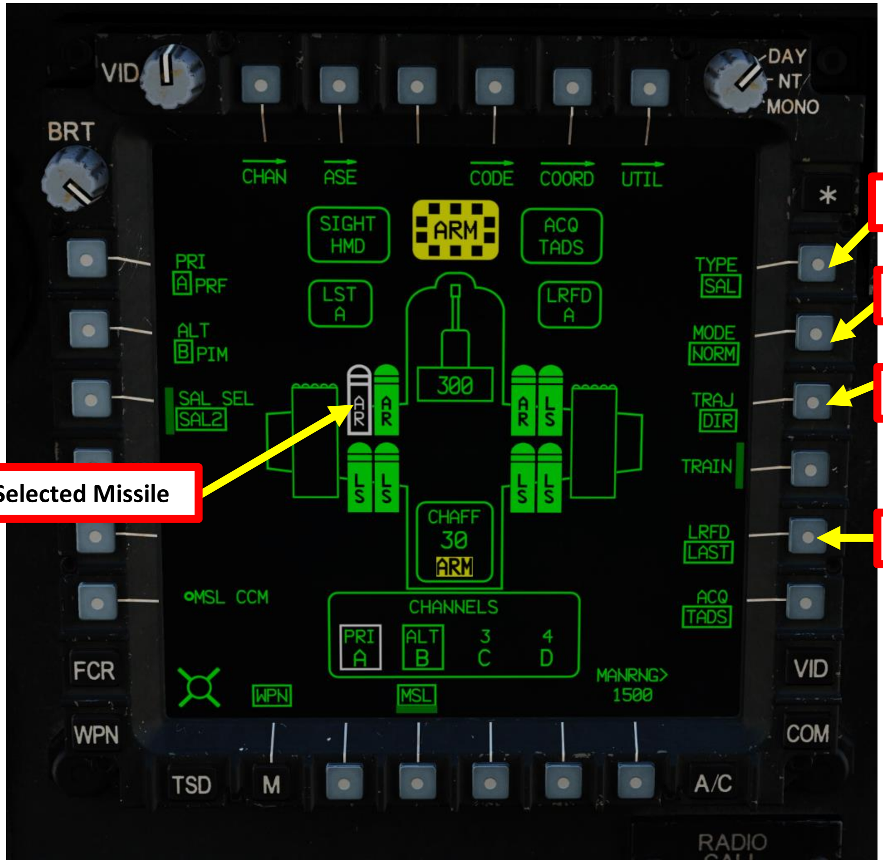
Weapon Action Switch (WAS) 6
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*



Selected Missile

8

9

10

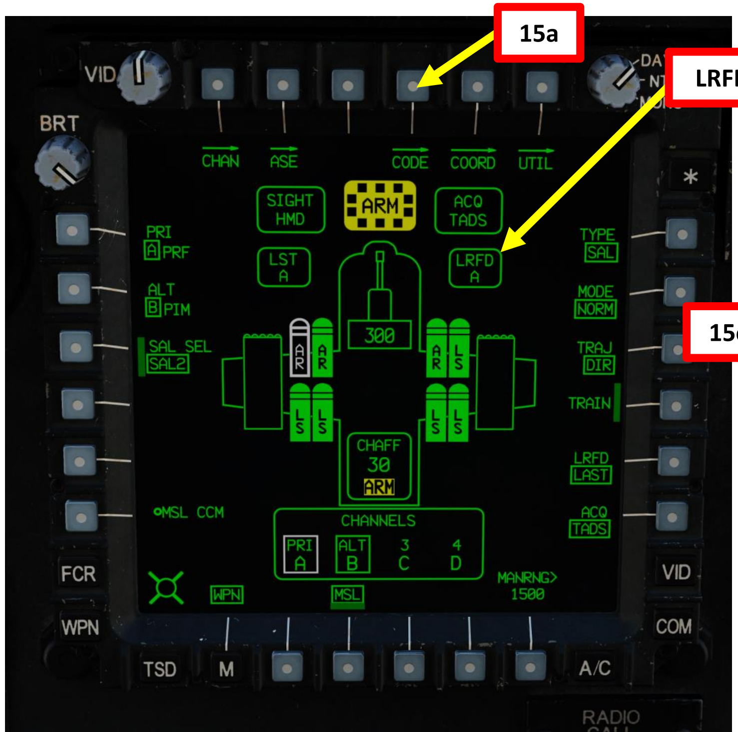
11

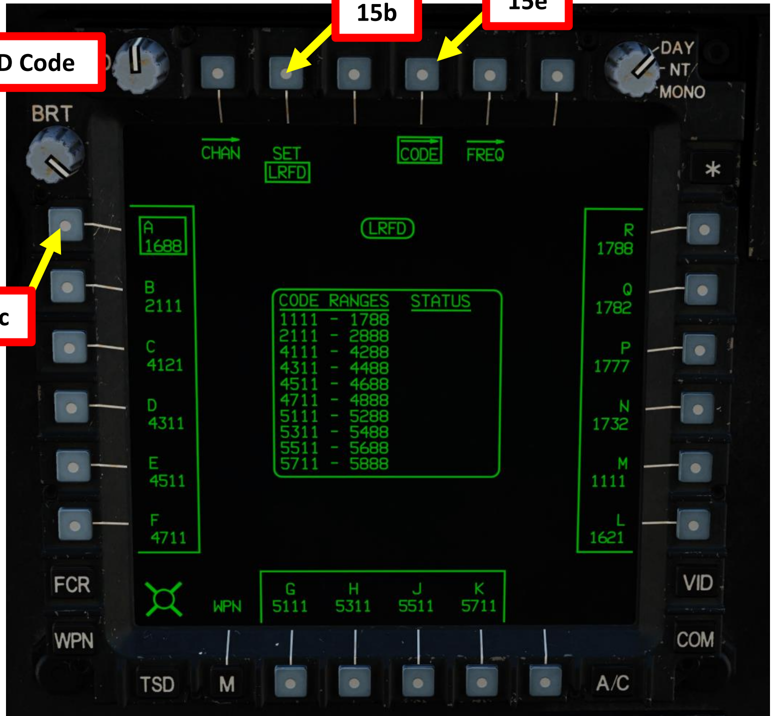
TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

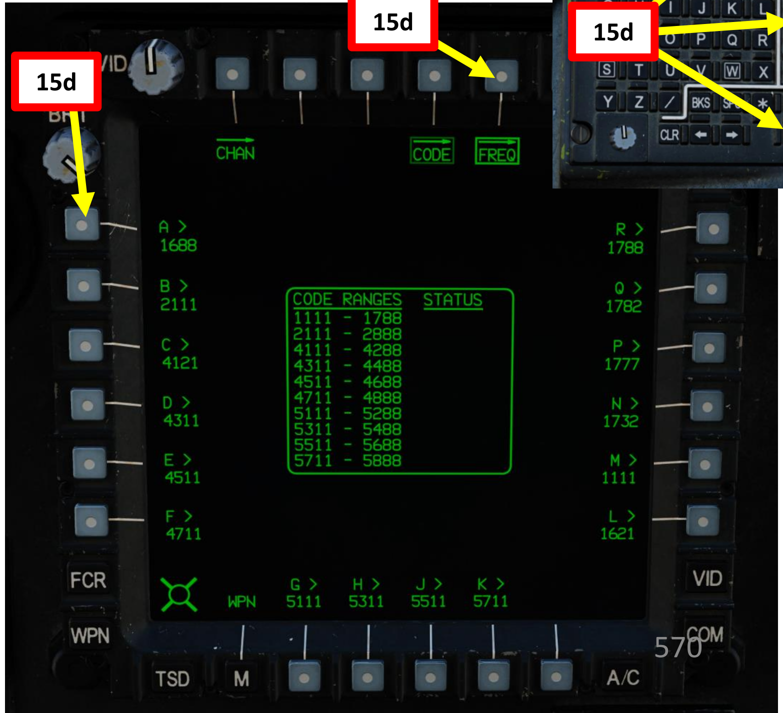
7

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

12. In this tutorial, we will designate the target with the LRFD (Laser Rangefinder & Designator) of the TADS (Target Acquisition & Designation Sight); its designation laser code is set to preset A (1688).
13. Missile Channel 1 is set as the Priority (PRI) Channel with a laser code set to preset A (1688).
14. Missile Channel 2 is set as the Alternate (ALT) Channel with a laser code set to preset B (2111) in case a wingman designates a target for you and you want the missile seeker to track your wingman's laser.
15. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Laser code to preset A. To change your LRFD laser code:
    a) Press VAB (Variable Action Button) next to CODE
    b) Select LRFD using VAB next to SET LRFD/LST to toggle between LRFD and LST.
    c) Select preset laser code A using appropriate VAB.
    d) If you want to change the laser code associated with preset code A, press VAB next to FREQ (Frequency), press VAB next to preset code "A", type the code on the KU (Keyboard Unit), then press ENTER on the KU.
    e) Exit CODE sub-page by pressing VAB next to CODE







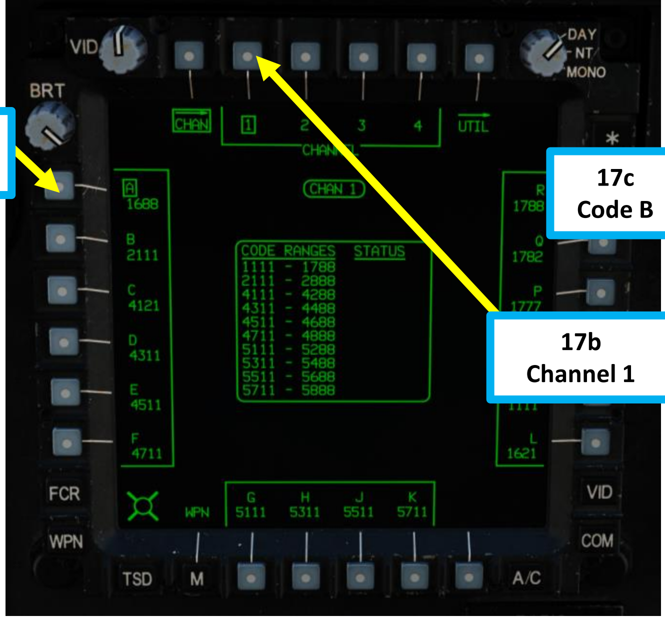
4 – AGM-114 HELLFIRE MISSILE

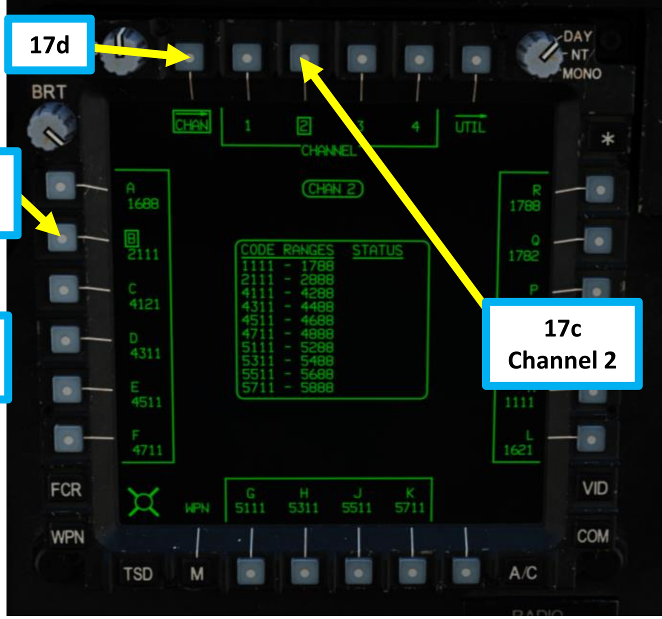
4.2 – Laser-Guided Hellfire (AGM-114K)

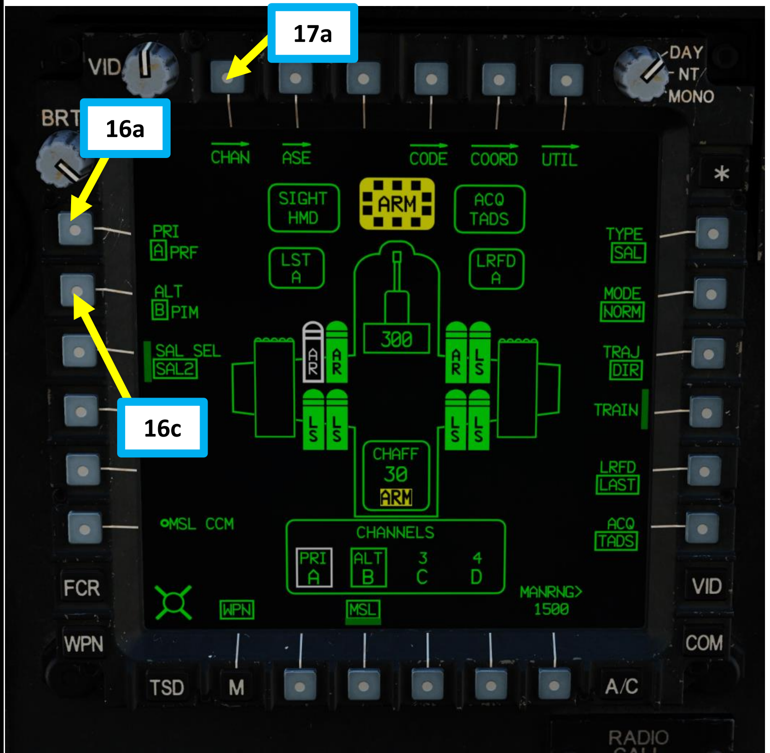
4.2.1 – Missile Operation by Multicrew

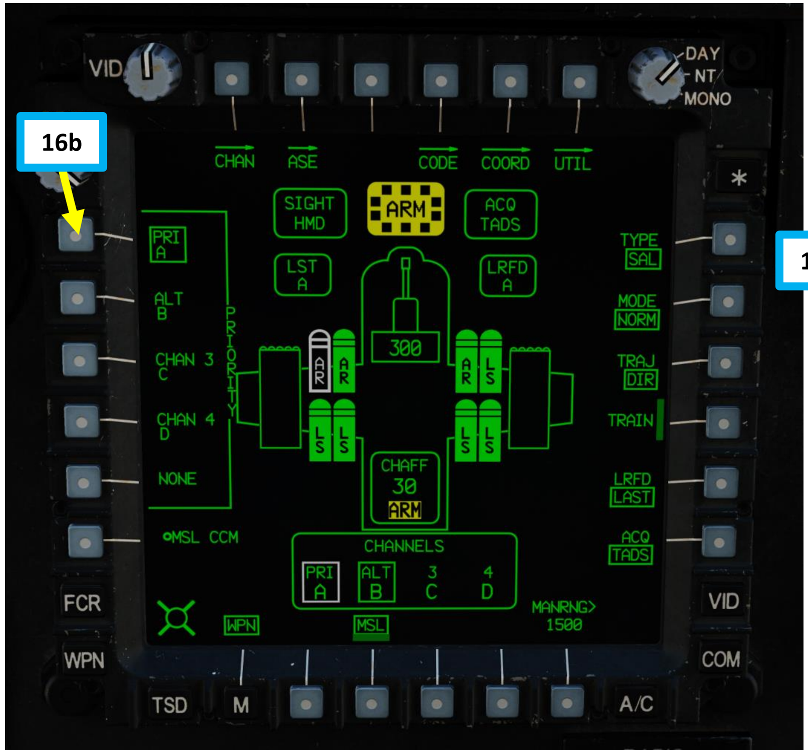
4.2.1.1 – LOBL (Lock-On Before Launch)

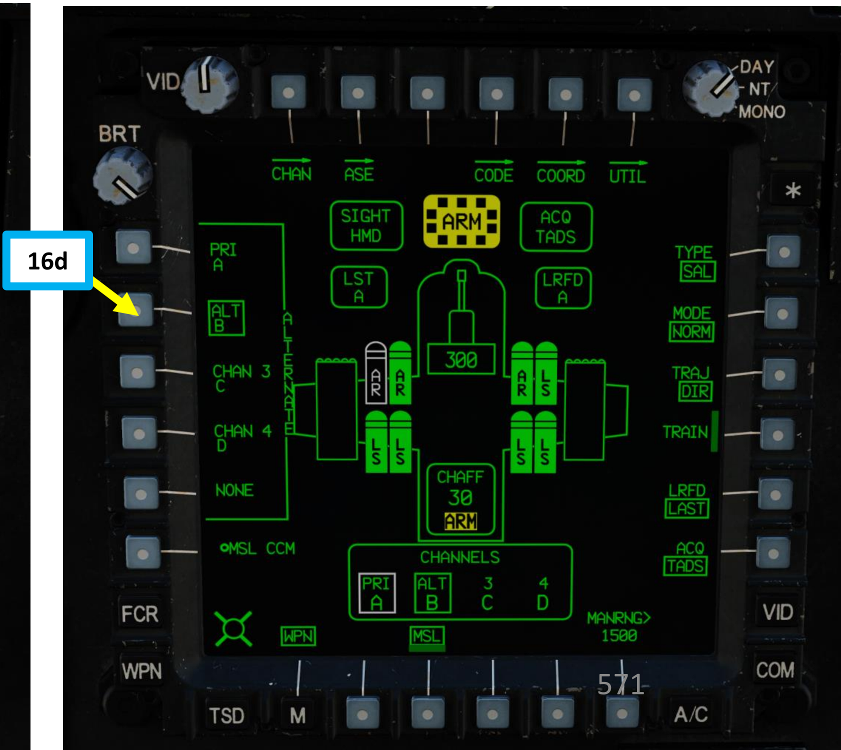
16. *[CPG]* Set Missile Priority Channel to Channel 1 and set Missile Alternate Channel to Channel 2.
    a) Press VAB (Variable Action Button) next to PRI (Priority)
    b) Press VAB next to A.
    c) Press VAB next to ALT (Alternate)
    d) Press VAB next to B.
17. *[CPG]* Set Missile Channel 1 (set to Priority) to laser preset code A (1688) and set Missile Channel 2 (set to Alternate) to laser preset code B (2111).
    a) Press VAB next to CHAN (Channel)
    b) Press VAB next to Channel 1, then press VAB next to laser preset code A
    c) Press VAB next to Channel 2, then press VAB next to laser preset code B
    d) Exit CHAN sub-page by pressing VAB next to CHAN





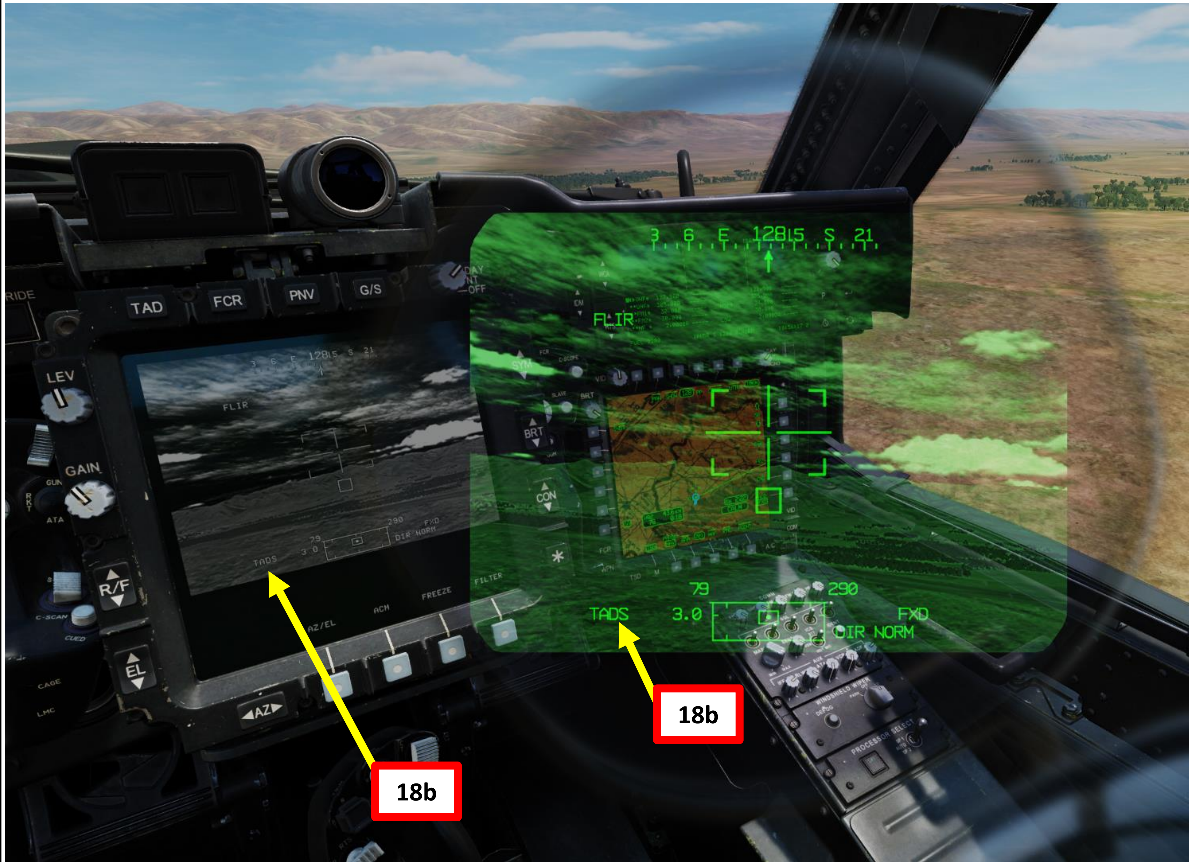






4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

18. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
19. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the "IHADSS Show" binding, which is "i" by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "C-HMD".
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

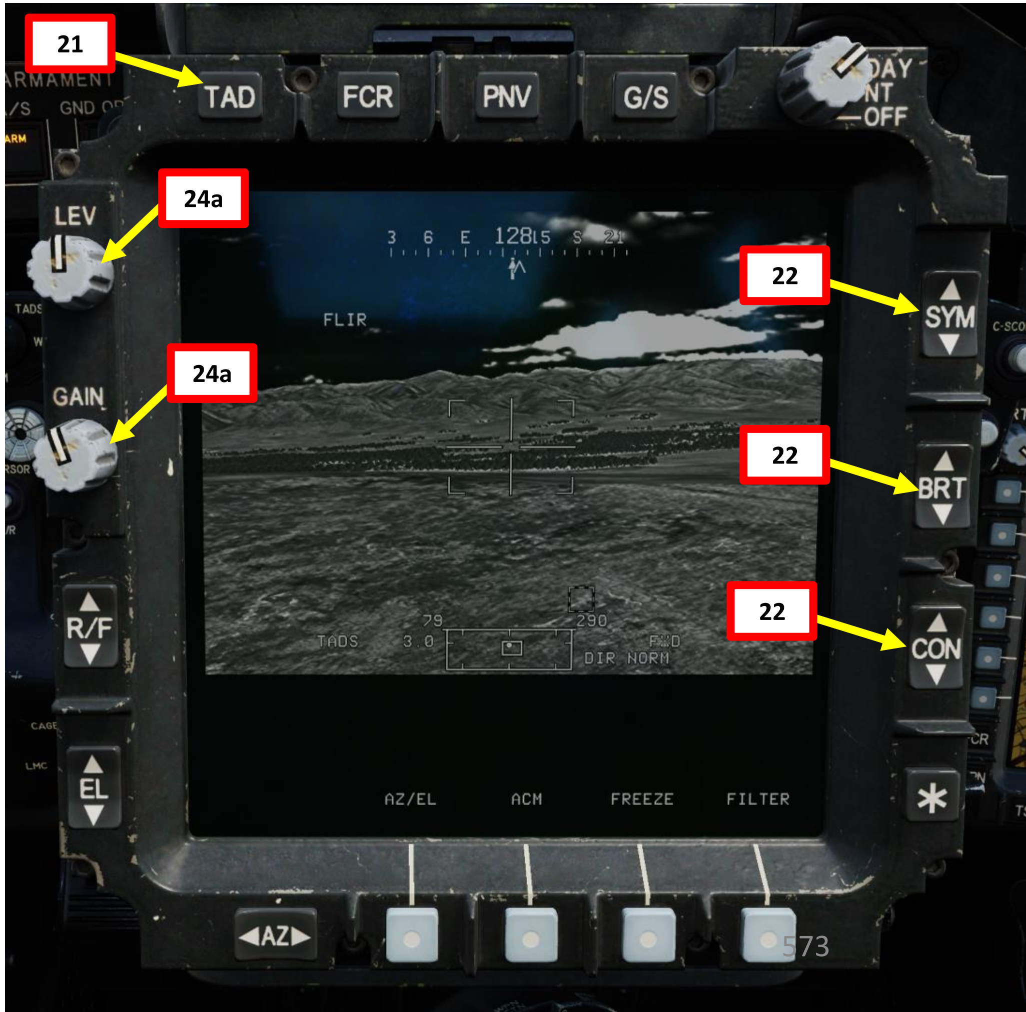


18a

TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

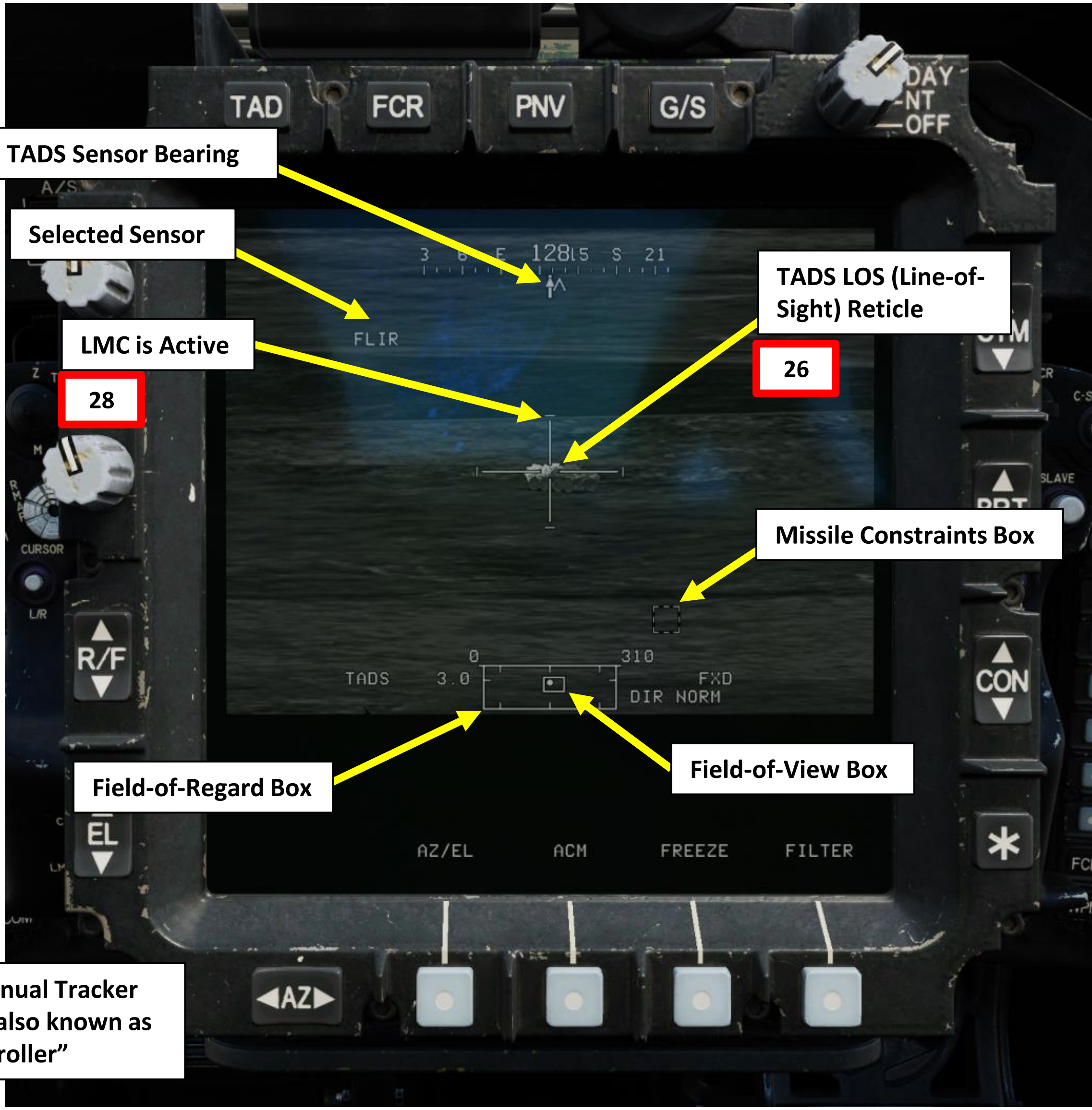
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

20. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
21. *[CPG]* Select TADS video feed source by pressing the TAD button.
22. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
23. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
24. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.



4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

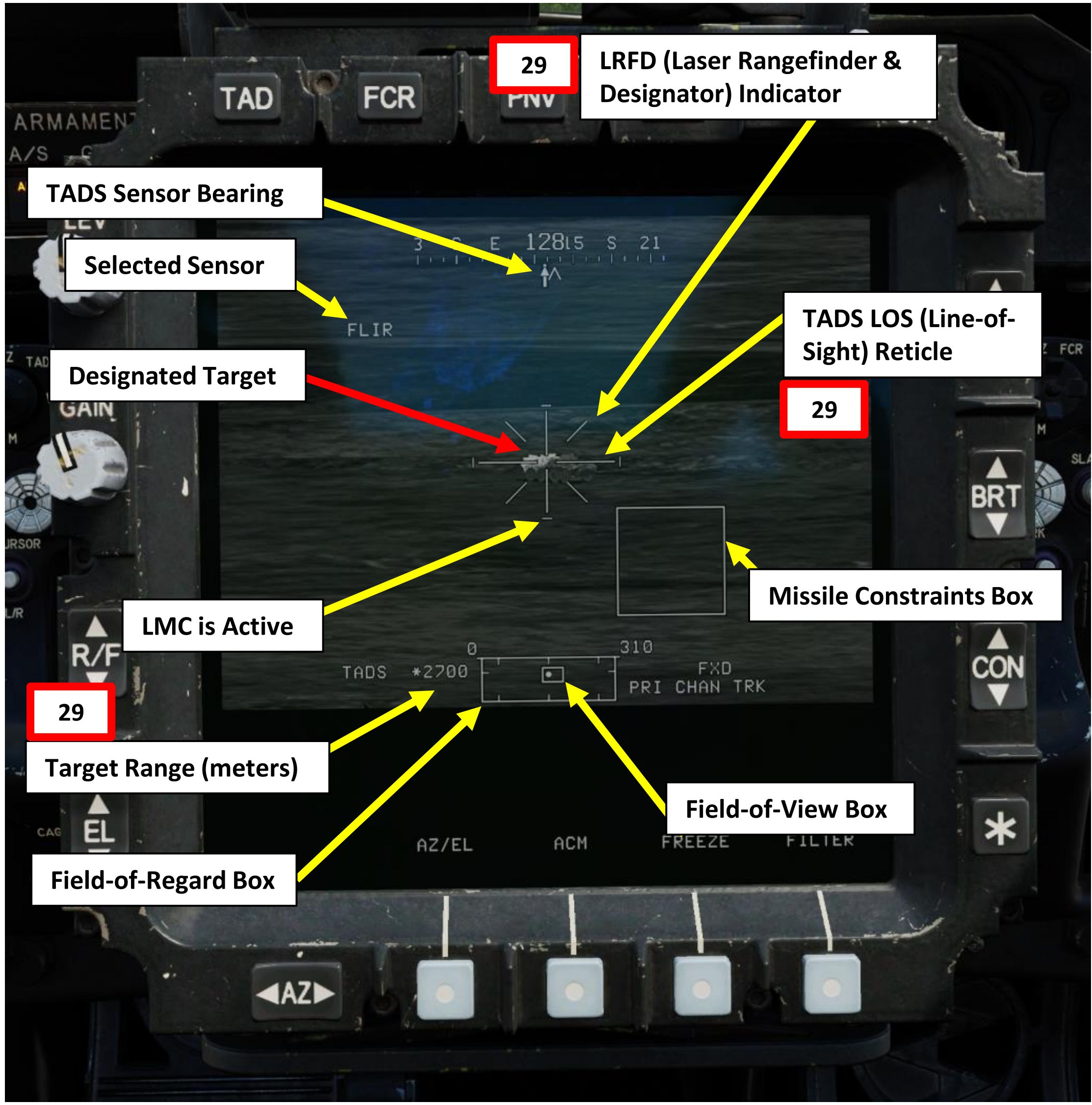
25. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
26. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
27. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
28. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).



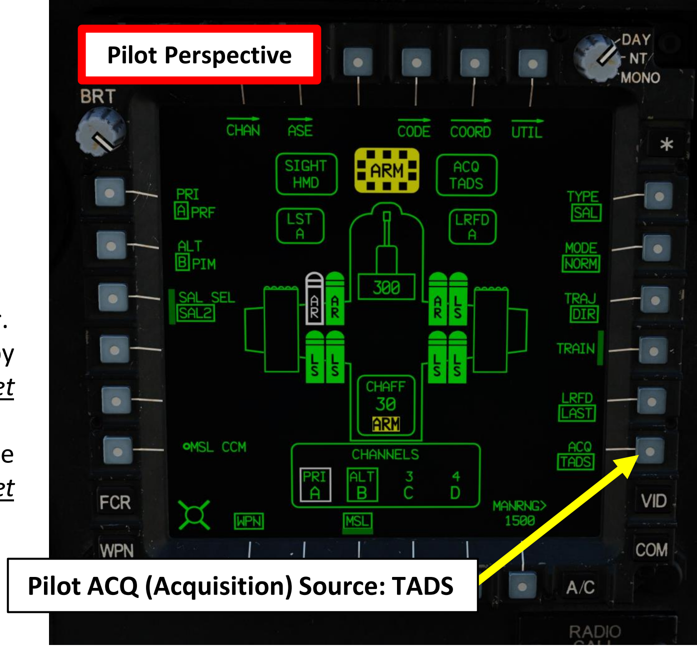
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

29. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will help you track the target more easily.
30. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase "Constraints".

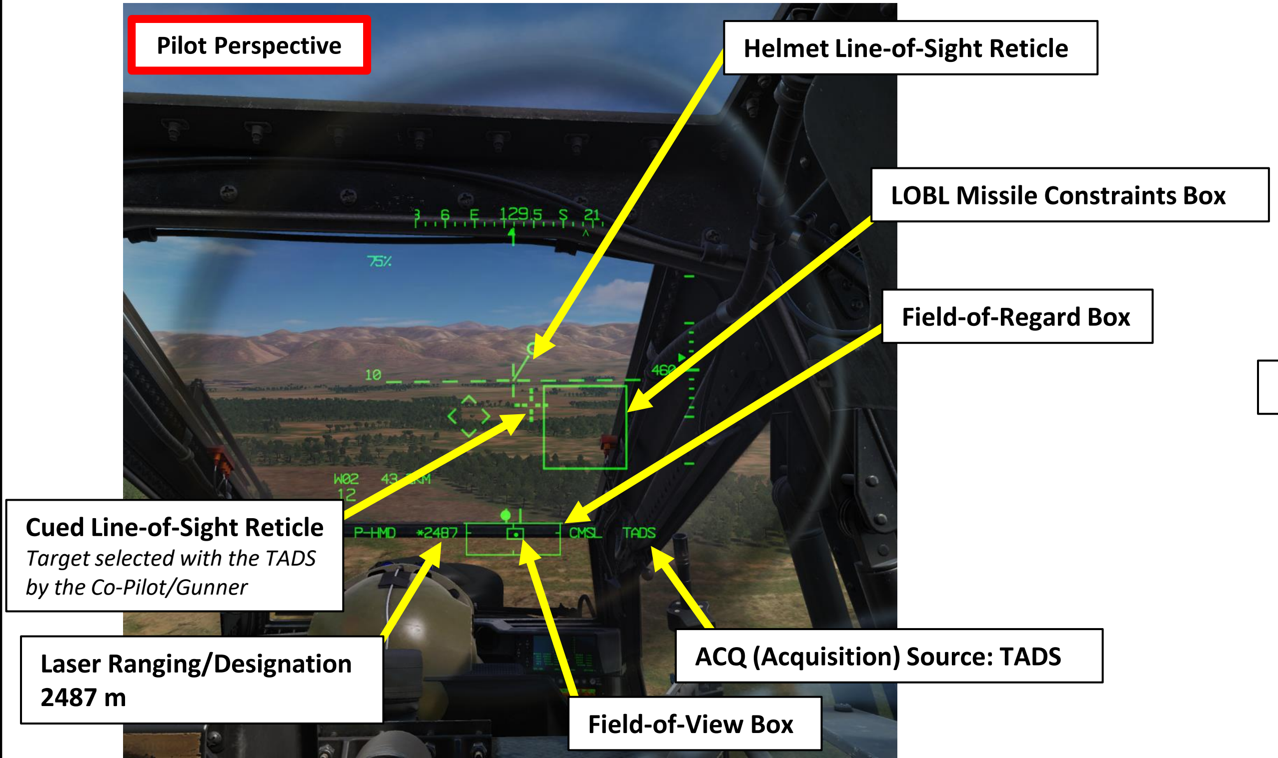
TEDAC RHG (Right Hand Grip)



4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)



31. *[P]* When pilot is told "Constraints" by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box, which should be big (LOBL box) and solid since the target is being actively lased by the co-pilot/gunner.
    - **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as "LOAL box" (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
    - **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as "LOBL box" (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire
32. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.



4 – AGM-114 HELLFIRE MISSILE

4.2 – Laser-Guided Hellfire (AGM-114K)

4.2.1 – Missile Operation by Multicrew

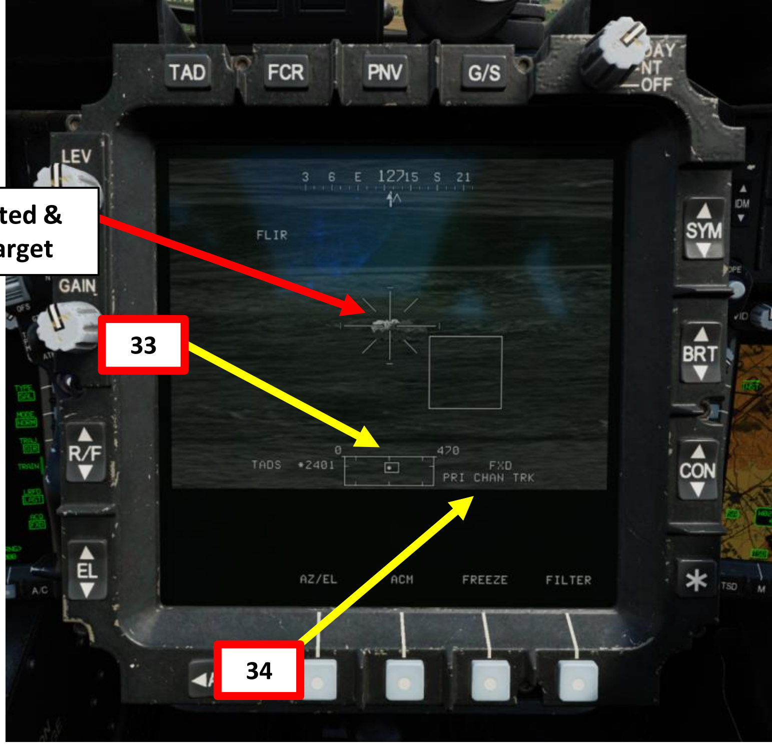
4.2.1.1 – LOBL (Lock-On Before Launch)

33. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
34. *[CPG]* Verify PRI CHAN TRK is displayed in the High Action Display. This means the missile is tracking the priority channel.
35. *[CPG]* While target is being lased with the TEDAC Right Hand Grip LRFD Trigger, fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.

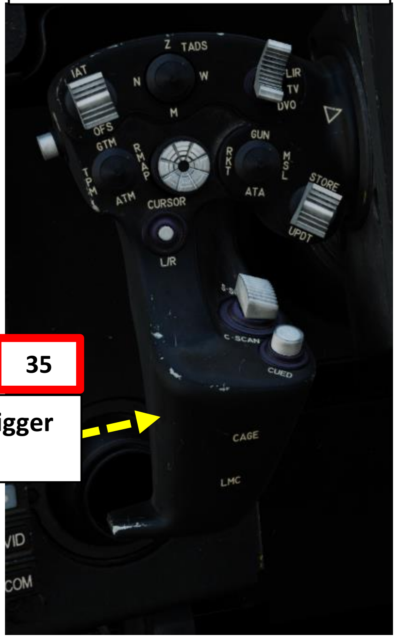
Designated & Lased Target

33

34



TEDAC LHG (Left Hand Grip)



TEDAC RHG (Right Hand Grip)

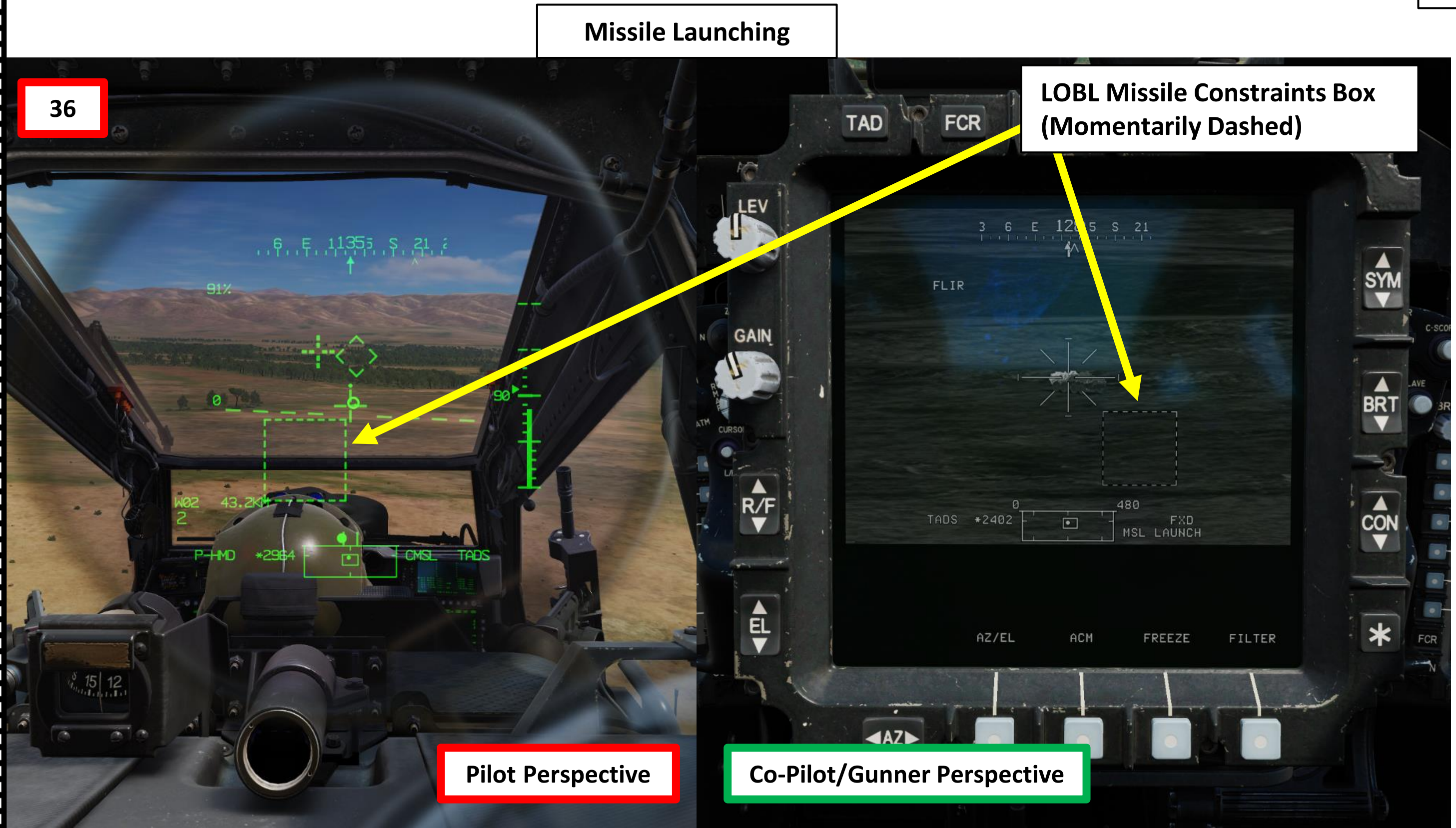
35

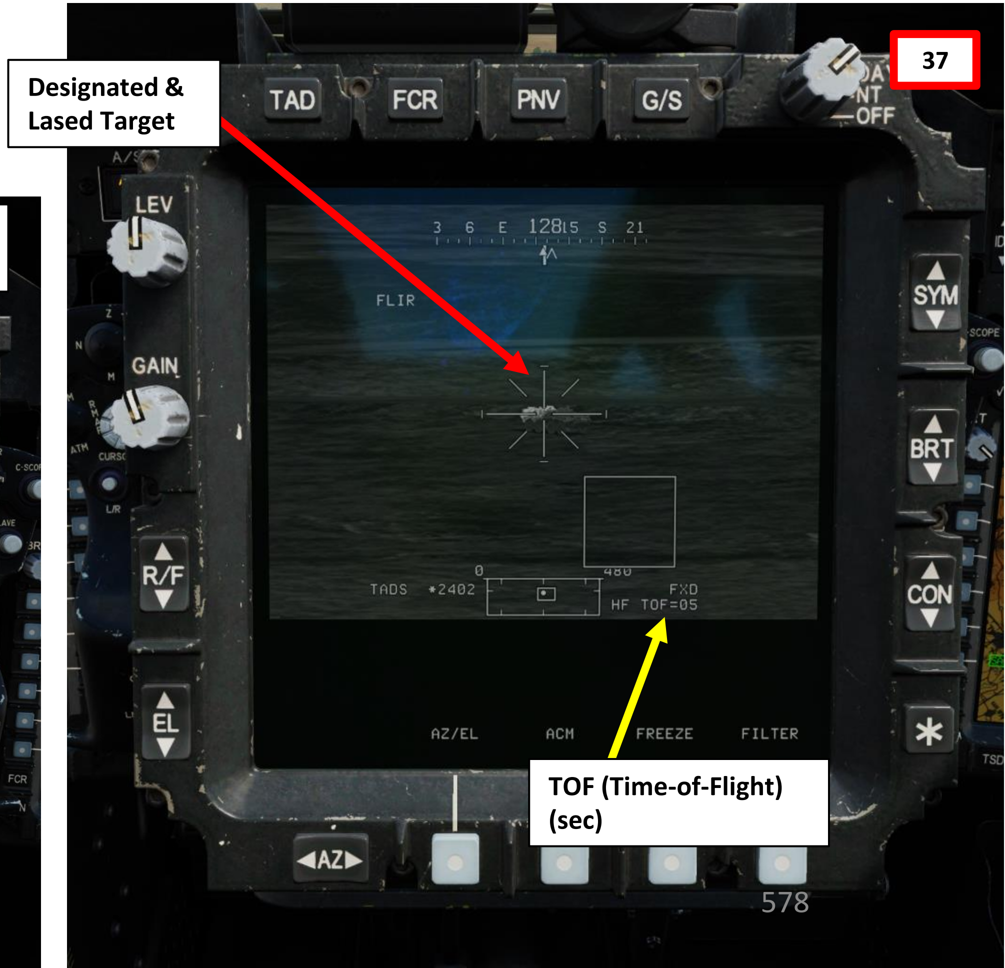
TEDAC LHG Weapon Trigger (opposite side of grip)

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

36. *[CPG]* The missile will track the laser until impact. Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected) and a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.
37. *[CPG]* Ensure continuous laser designation is provided on the intended target for the duration of the missile flight time until impact is observed.





4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

38. *[CPG]* If target is destroyed and LMC (Linear Motion Compensator) has been engaged, on TEDAC Left Hand Grip, press LMC Button again to disengage LMC.

TEDAC LHG (Left Hand Grip)

LMC (Linear Motion Compensator) Button (Opposite Side)

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.1 – LOBL (Lock-On Before Launch)

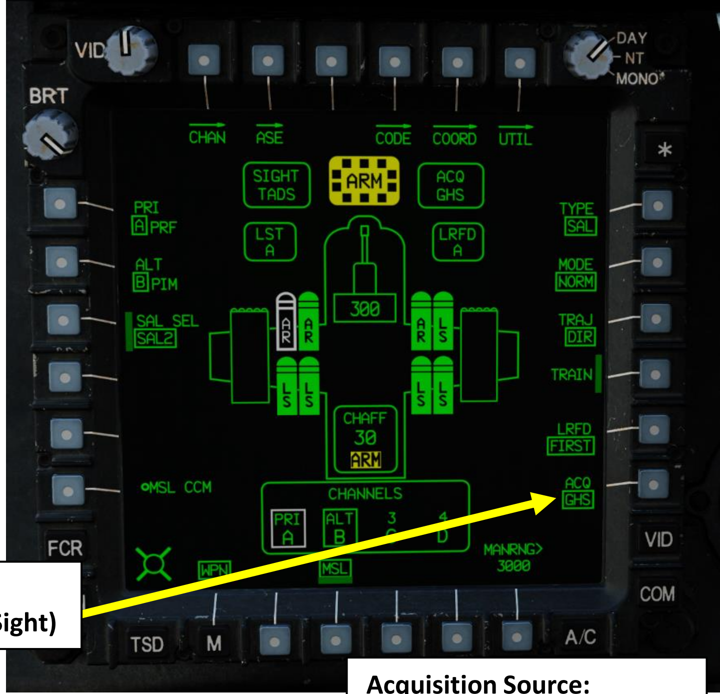
Notes for the CPG: In situations where a target of opportunity is spotted visually by either crew member, it is good practice for the co-pilot/gunner to select either his helmet (GHS, Gunner Helmet Sight) or the pilot's helmet (PHS, Pilot Helmet Sight), then press the Sight Slave Button to slave the TADS to the helmet's line-of-sight reticle.

Once the TADS line-of-sight is on the target, pressing the Sight Slave Button a second time will de-slave the TADS and allow the co-pilot/gunner to make fine adjustments from the TADS display directly using the MAN TRK (Sight Manual Tracker Controller) Switch.

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"



Acquisition Source: GHS (Gunner Helmet Sight)

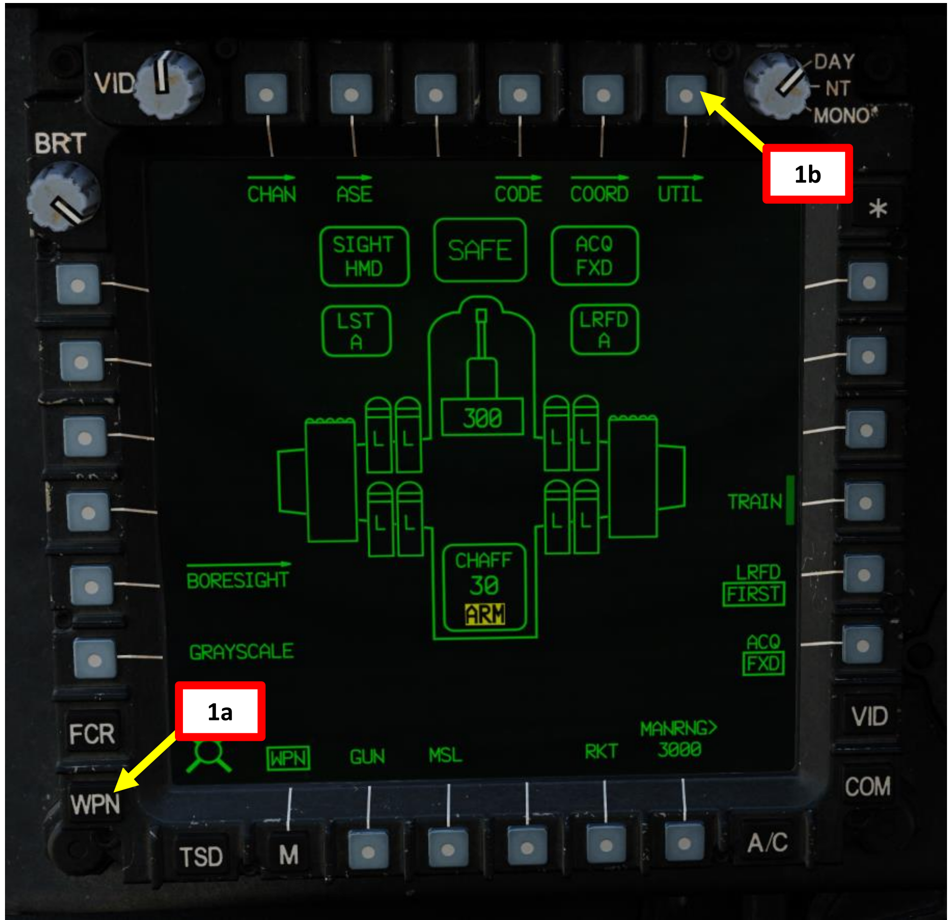
Acquisition Source: GHS (Gunner Helmet Sight)

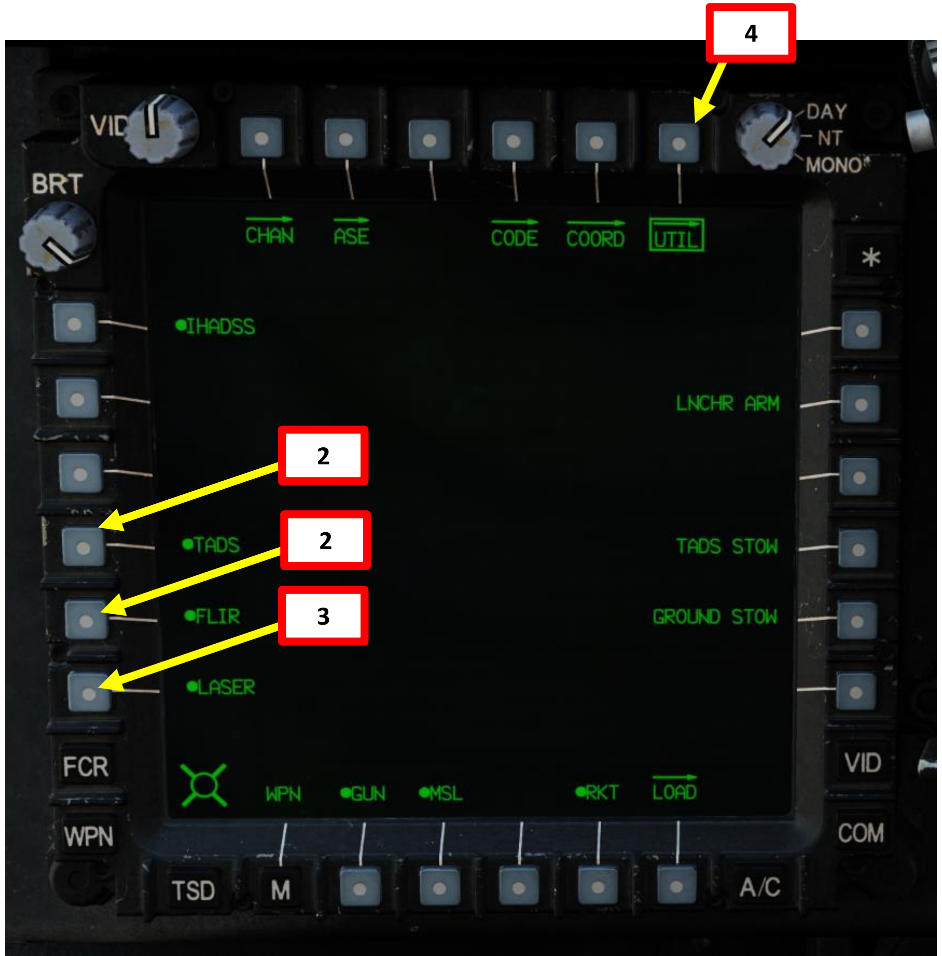
Helmet Line-of-Sight Reticle

Selected Sight: TADS

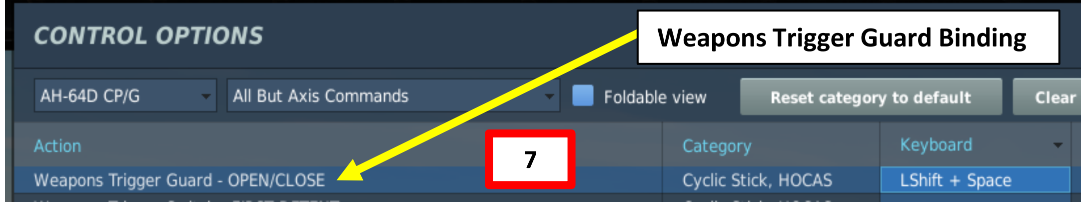
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
   - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
   - Hollow circle means OFF. Solid Circle means ON.
   - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.

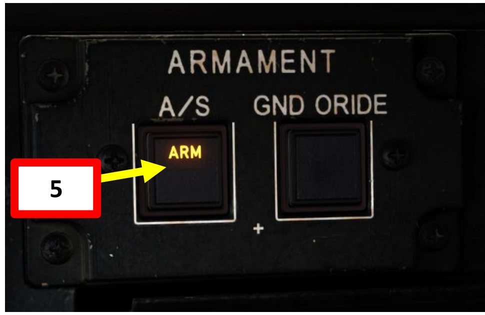


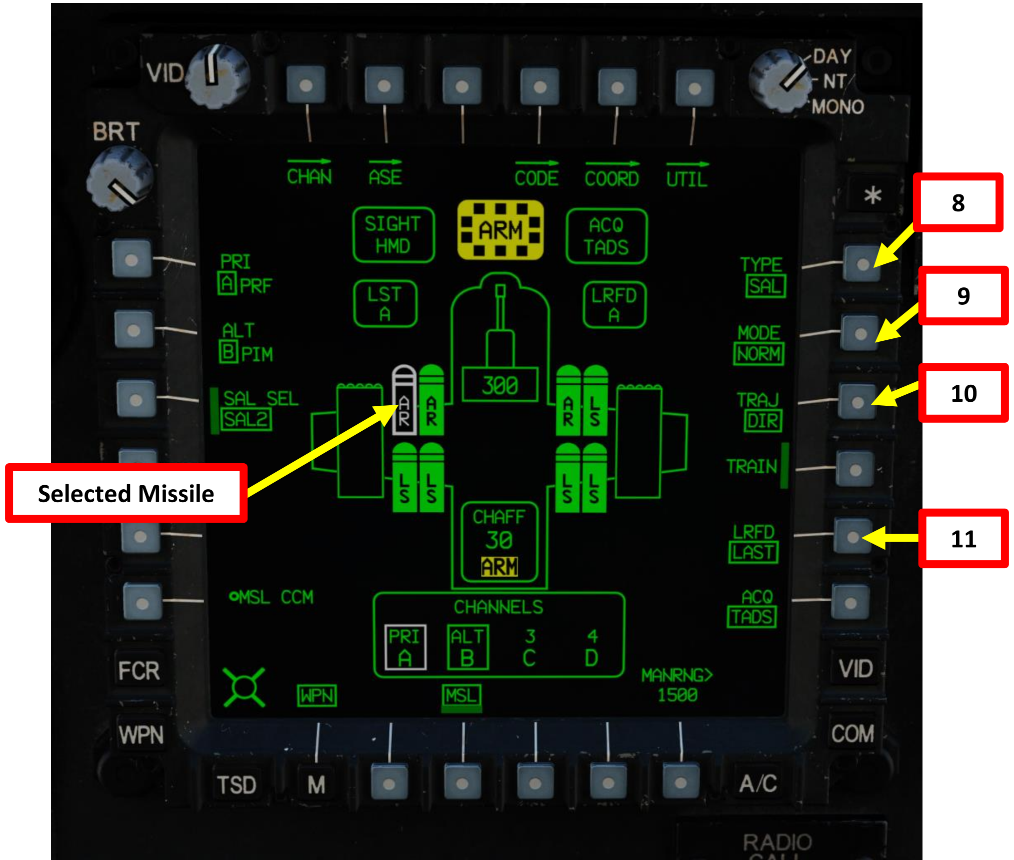


4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)



5. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
6. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
7. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
   - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).
8. *[CPG]* Set Missile Type to SAL (Semi-Active Laser).
9. *[CPG]* Set Missile mode to NORMAL.
10. *[CPG]* Set Missile trajectory to DIR (Direct).
11. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Mode Selector – As required. I typically set it to LAST.





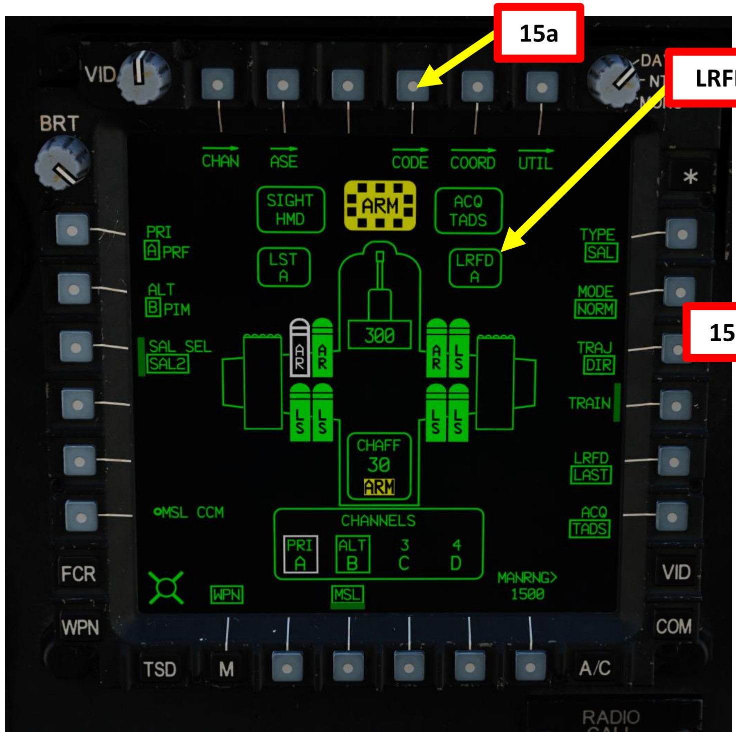
Weapon Action Switch (WAS) 6
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

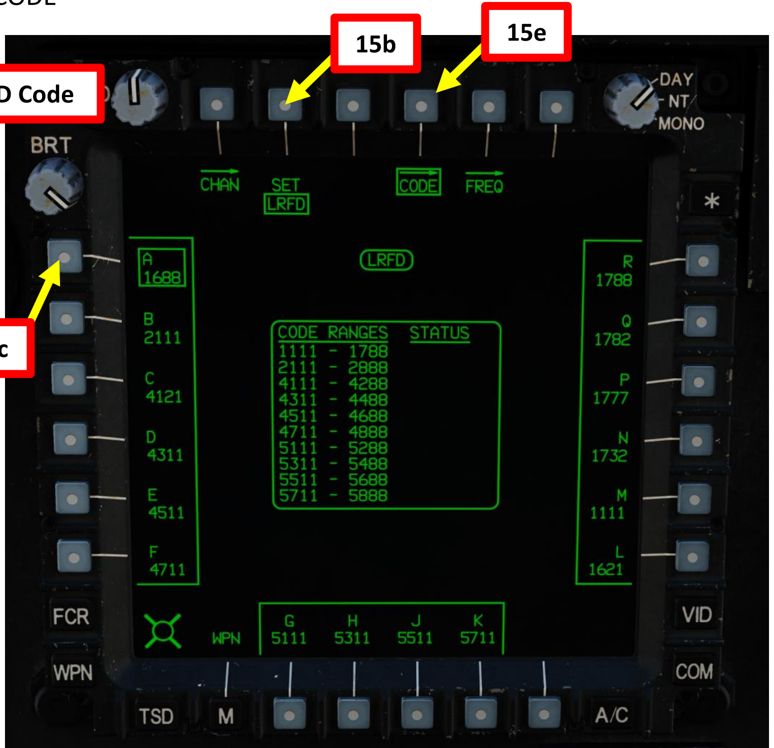
TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

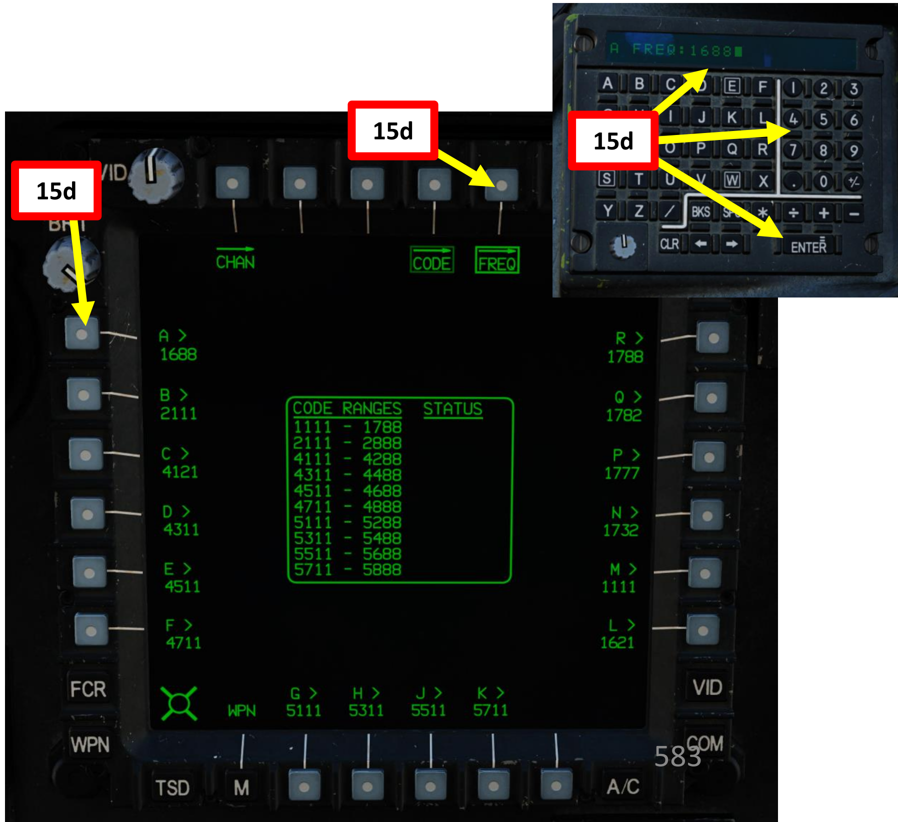
7

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

12. In this tutorial, we will designate the target with the LRFD (Laser Rangefinder & Designator) of the TADS (Target Acquisition & Designation Sight); its designation laser code is set to preset A (1688).
13. Missile Channel 1 is set as the Priority (PRI) Channel with a laser code set to preset A (1688).
14. Missile Channel 2 is set as the Alternate (ALT) Channel with a laser code set to preset B (2111) in case a wingman designates a target for you and you want the missile seeker to track your wingman's laser.
15. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Laser code to preset A. To change your LRFD laser code:
    a) Press VAB (Variable Action Button) next to CODE
    b) Select LRFD using VAB next to SET LRFD/LST to toggle between LRFD and LST.
    c) Select preset laser code A using appropriate VAB.
    d) If you want to change the laser code associated with preset code A, press VAB next to FREQ (Frequency), press VAB next to preset code "A", type the code on the KU (Keyboard Unit), then press ENTER on the KU.
    e) Exit CODE sub-page by pressing VAB next to CODE







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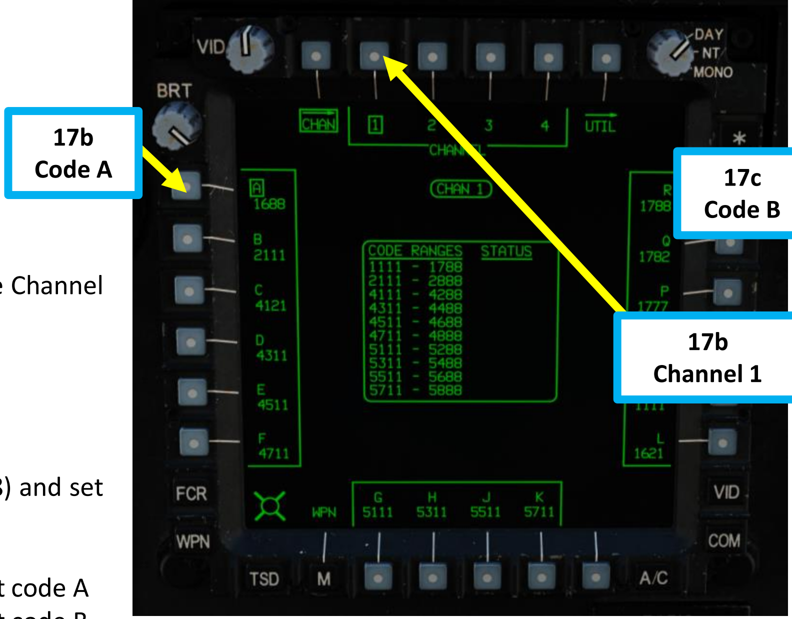
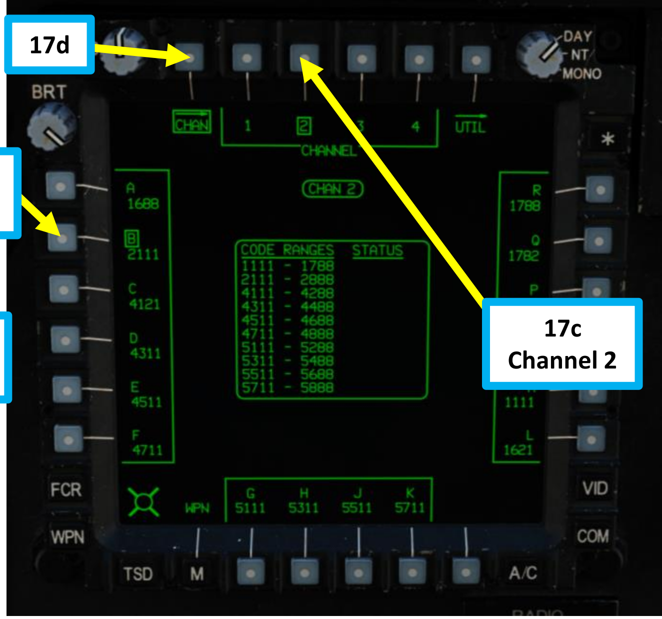
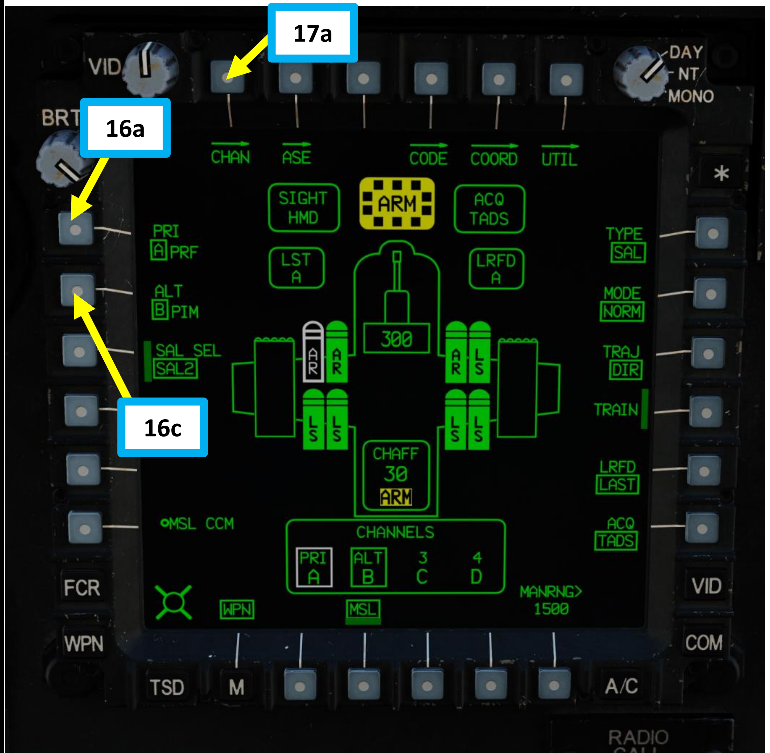
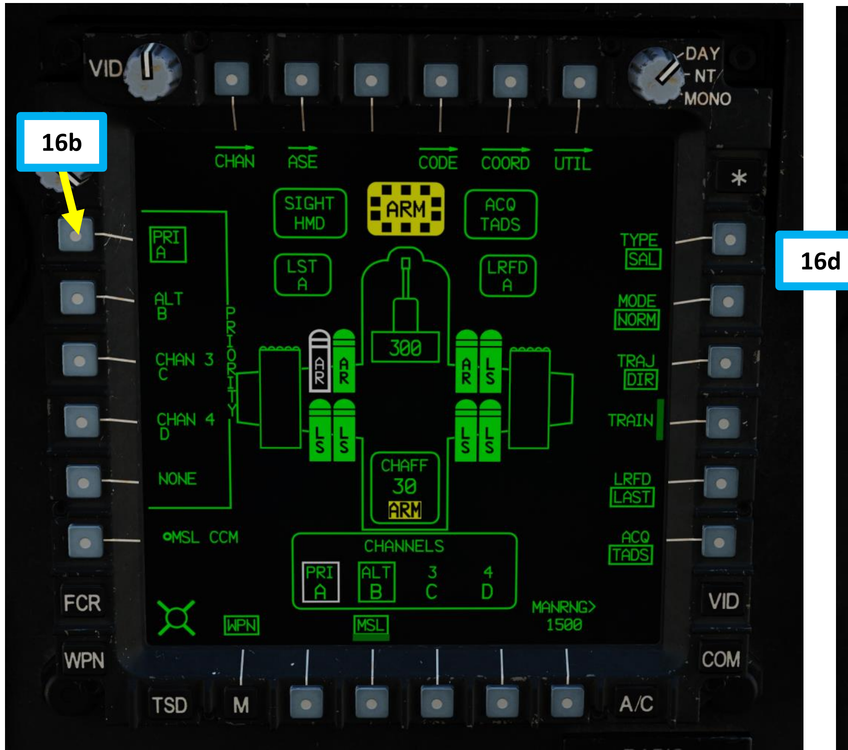
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

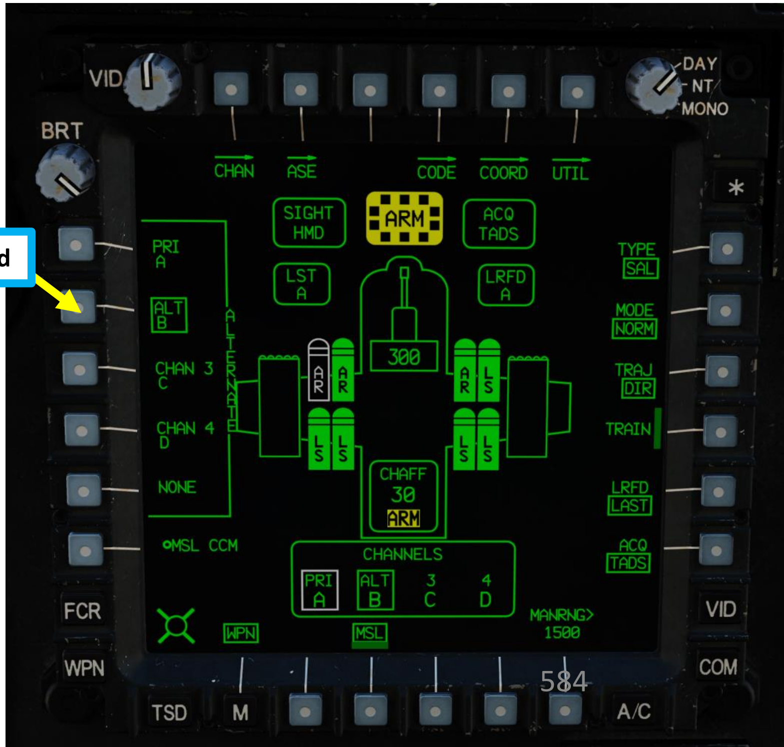
16. *[CPG]* Set Missile Priority Channel to Channel 1 and set Missile Alternate Channel to Channel 2.
    a) Press VAB (Variable Action Button) next to PRI (Priority)
    b) Press VAB next to A.
    c) Press VAB next to ALT (Alternate)
    d) Press VAB next to B.
17. *[CPG]* Set Missile Channel 1 (set to Priority) to laser preset code A (1688) and set Missile Channel 2 (set to Alternate) to laser preset code B (2111).
    a) Press VAB next to CHAN (Channel)
    b) Press VAB next to Channel 1, then press VAB next to laser preset code A
    c) Press VAB next to Channel 2, then press VAB next to laser preset code B
    d) Exit CHAN sub-page by pressing VAB next to CHAN











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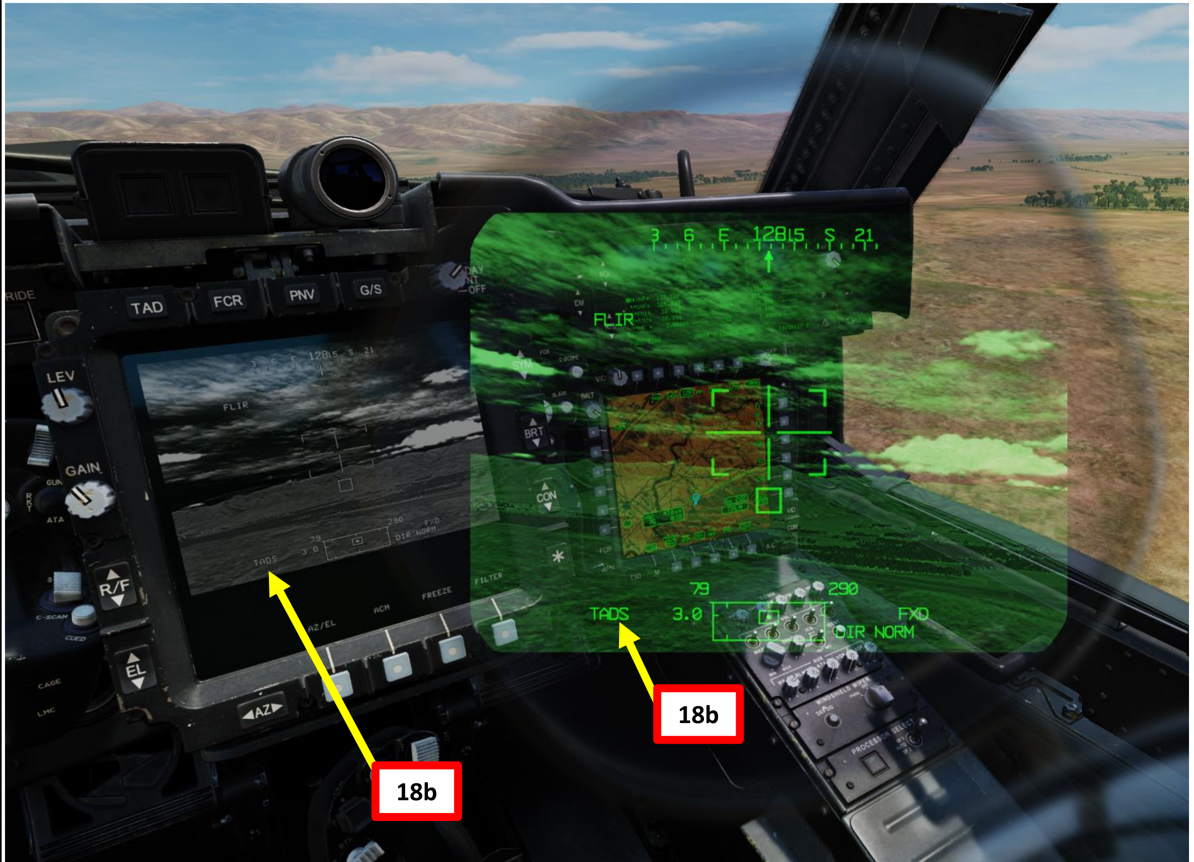
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

18. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
19. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the "IHADSS Show" binding, which is "i" by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "C-HMD".
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

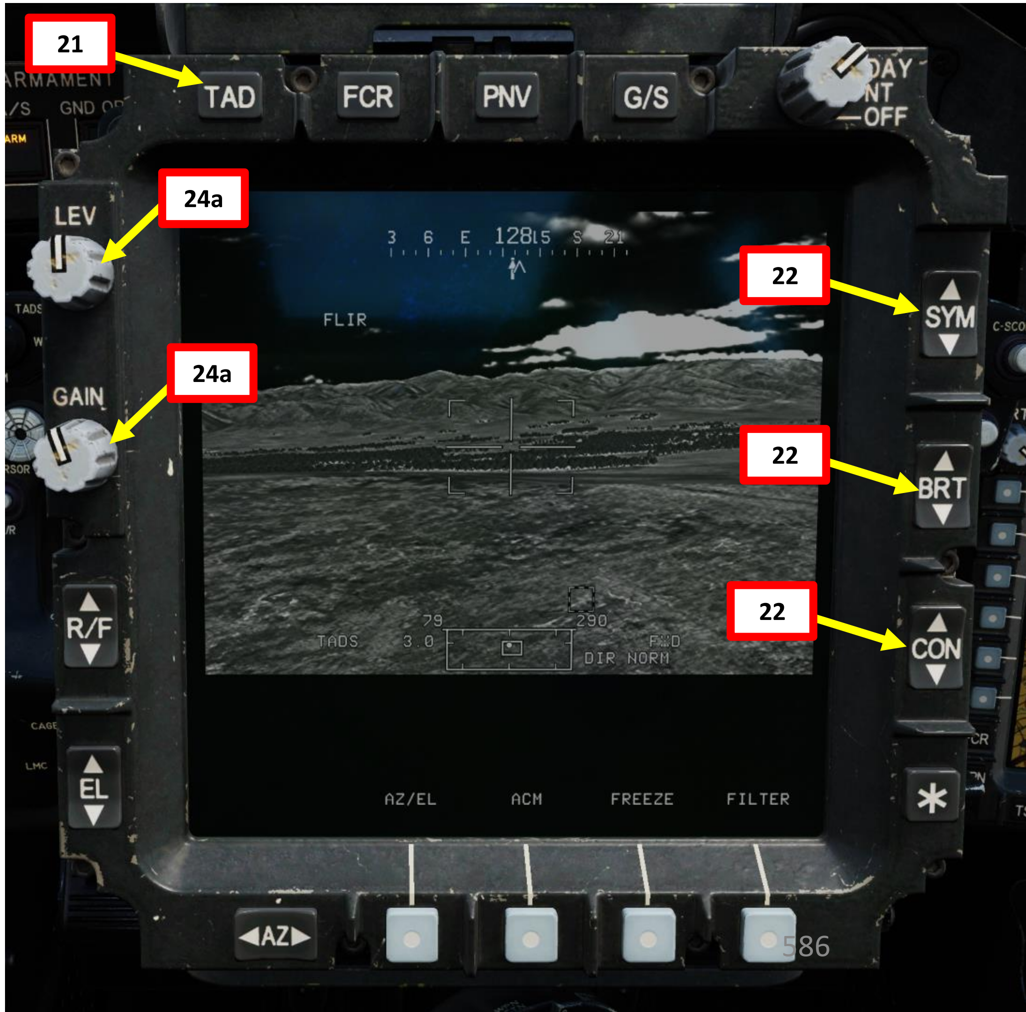


18a

TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

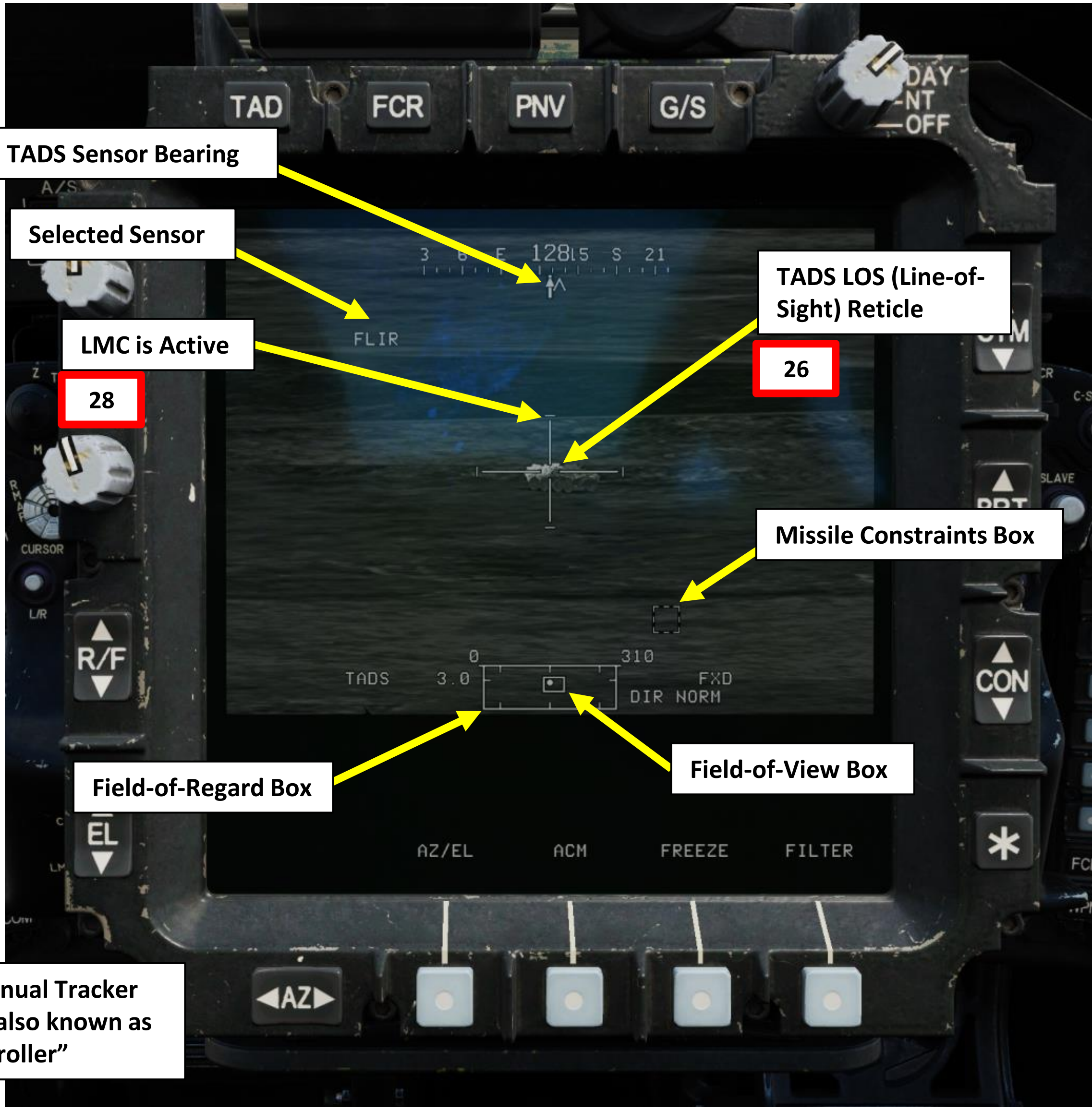
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

20. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
21. *[CPG]* Select TADS video feed source by pressing the TAD button.
22. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
23. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
24. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.



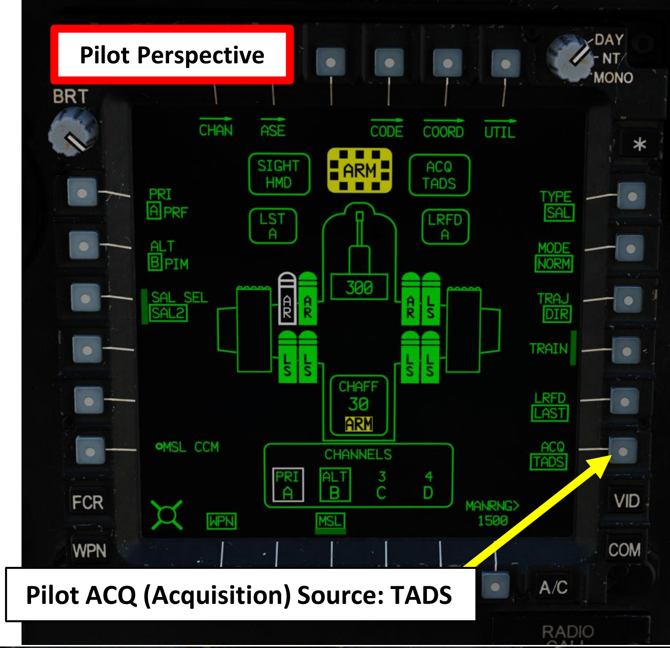
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

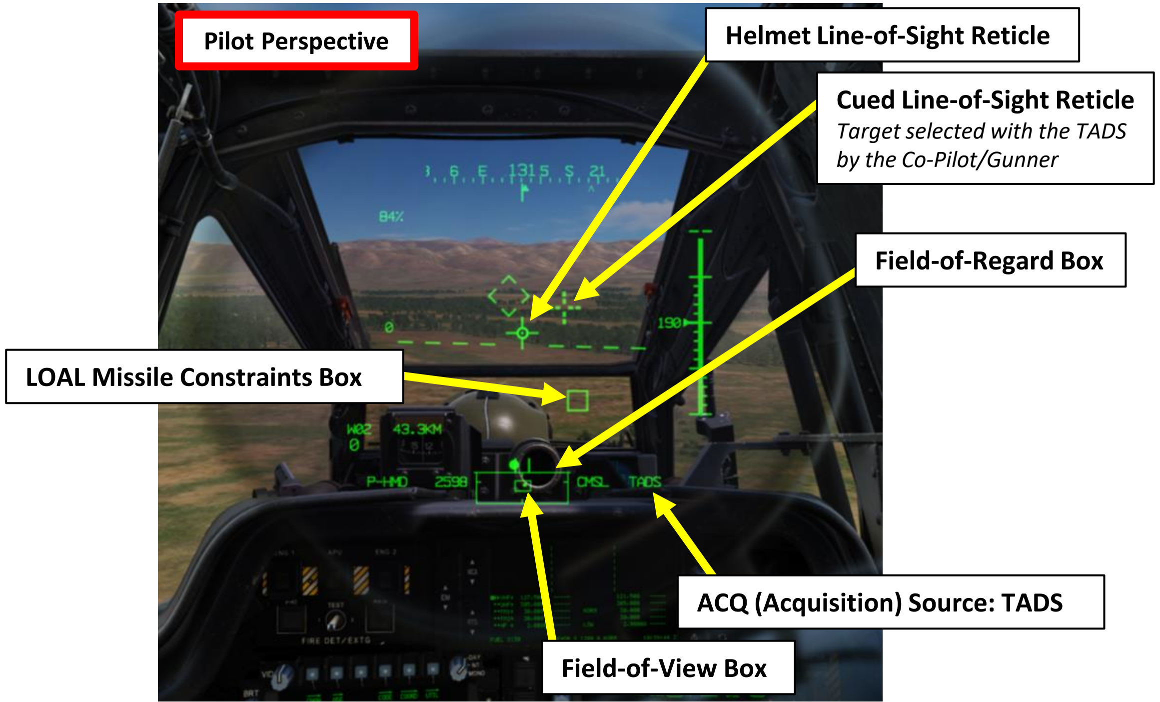
25. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
26. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
27. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
28. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).

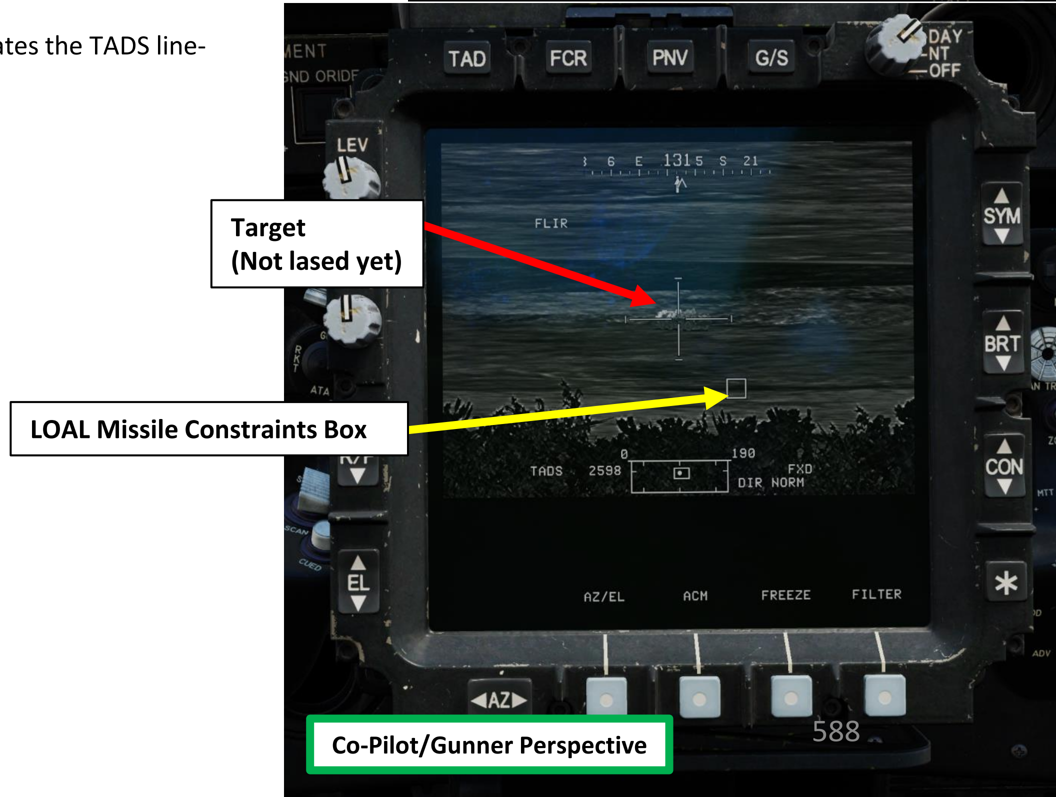


4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

29. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase "Constraints".
30. *[P]* When pilot is told "Constraints" by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box, which should be small (LOAL box) and solid since the target is not being actively lased by the co-pilot/gunner yet.
    - **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as "LOAL box" (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
    - **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as "LOBL box" (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire
31. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.







4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
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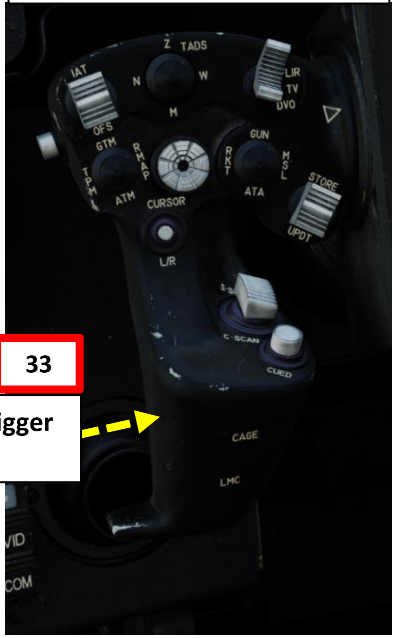
32. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
33. *[CPG]* Fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.
34. *[CPG]* Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected)

TEDAC LHG (Left Hand Grip)



33

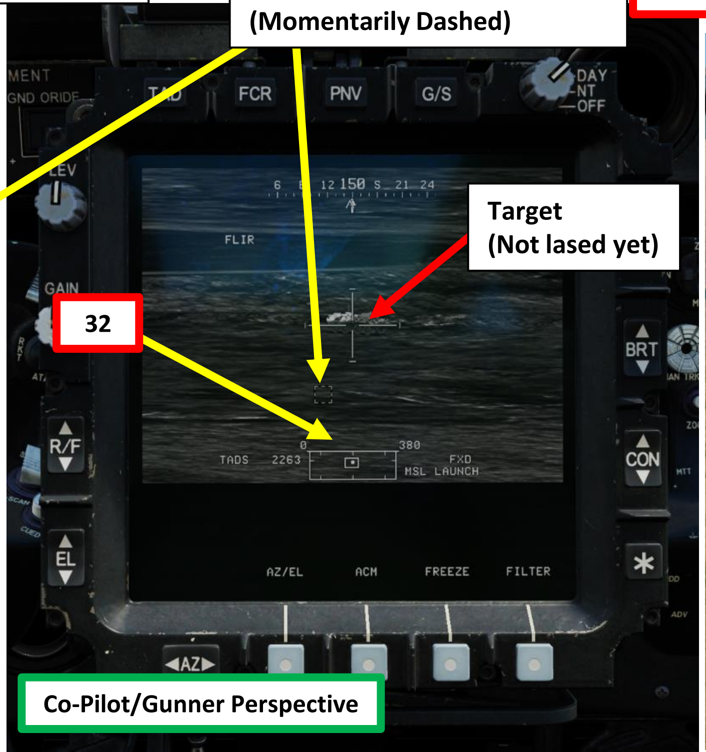
TEDAC LHG Weapon Trigger
(opposite side of grip)

Missile Launching

LOAL Missile Constraints Box
(Momentarily Dashed)

34

Pilot Perspective



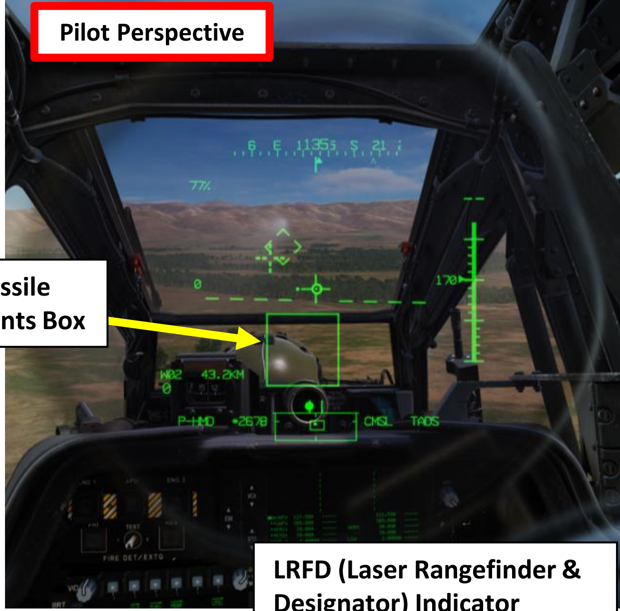
Target
(Not lased yet)

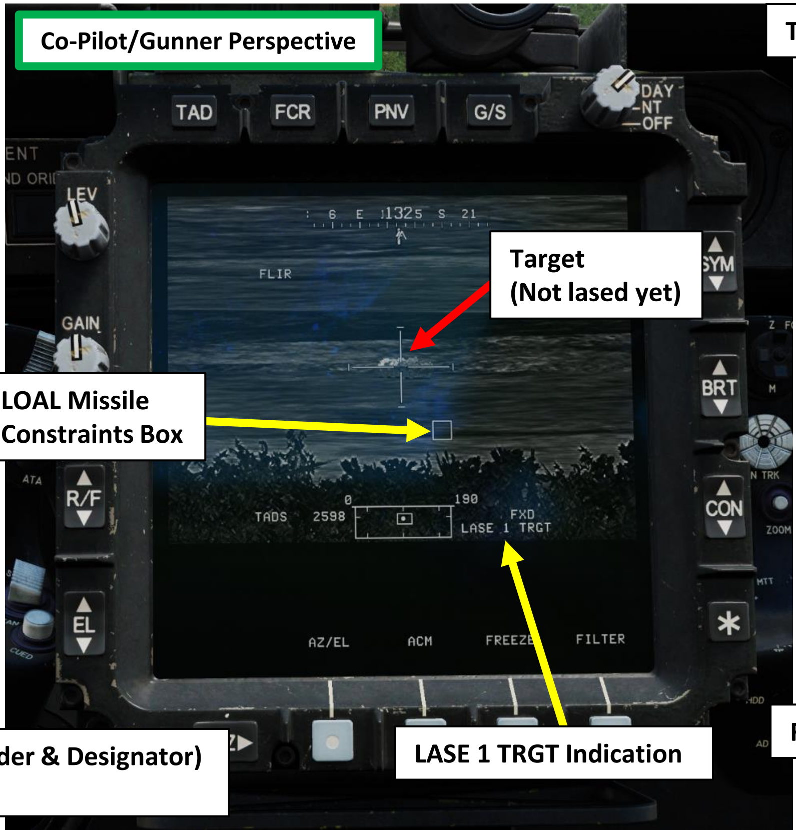
32

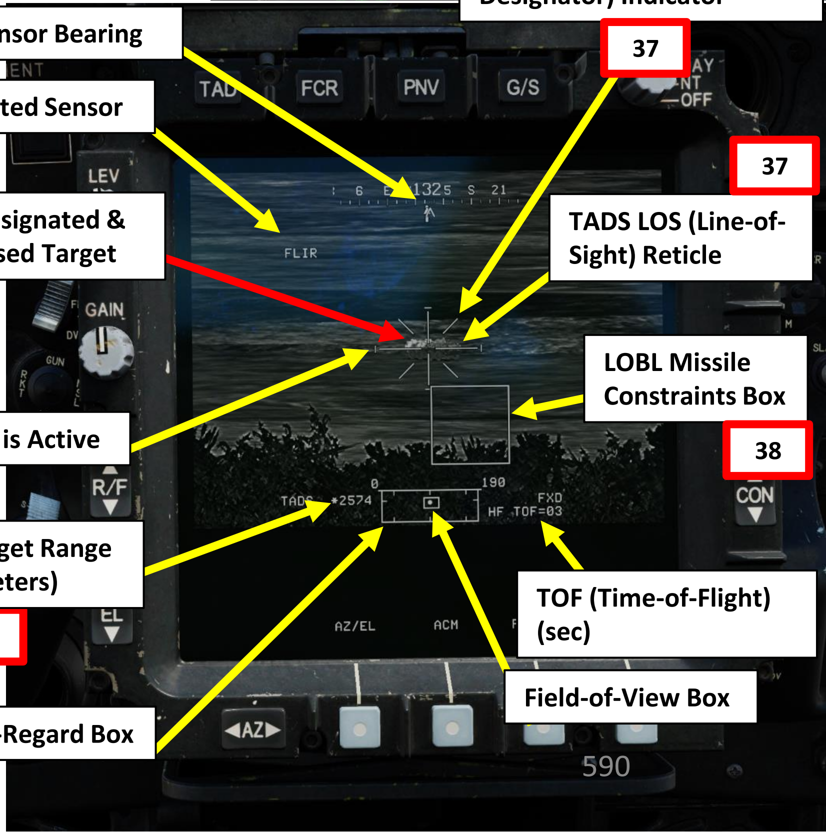
Co-Pilot/Gunner Perspective

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.2 – LOAL-DIR (Lock-On After Launch – Direct)

35. *[CPG]* Once missile has been launched, a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.
36. *[CPG]* The “LASE 1 TRGT” indication appears when the co-pilot/gunner needs to lase the target (about 10 sec before missile impact).
37. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will help you track the target more easily.
38. *[CPG]* Once missile is tracking the laser, the Missile Constraints Box will switch from LOAL (small box) to LOBL (big box). The missile will track the laser until impact.
39. *[CPG]* Ensure continuous laser designation is provided on the intended target for the duration of the missile flight time until impact is observed.







4 – AGM-114 HELLFIRE MISSILE
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4.2.1 – Missile Operation by Multicrew
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40. *[CPG]* If target is destroyed and LMC (Linear Motion Compensator) has been engaged, on TEDAC Left Hand Grip, press LMC Button again to disengage LMC.

TEDAC LHG (Left Hand Grip)

LMC (Linear Motion Compensator) Button (Opposite Side)

4 – AGM-114 HELLFIRE MISSILE
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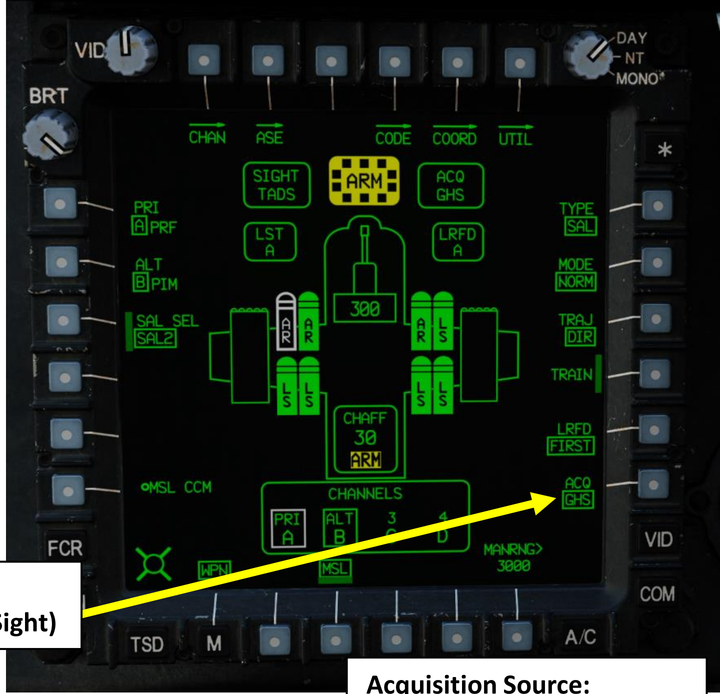
Notes for the CPG: In situations where a target of opportunity is spotted visually by either crew member, it is good practice for the co-pilot/gunner to select either his helmet (GHS, Gunner Helmet Sight) or the pilot's helmet (PHS, Pilot Helmet Sight), then press the Sight Slave Button to slave the TADS to the helmet's line-of-sight reticle.

Once the TADS line-of-sight is on the target, pressing the Sight Slave Button a second time will de-slave the TADS and allow the co-pilot/gunner to make fine adjustments from the TADS display directly using the MAN TRK (Sight Manual Tracker Controller) Switch.

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Slave Button
- *Toggles the FCR or TADS tracking mode between Slave and Manual (de-slaved). When in Slave, FCR or TADS line-of-sight is slaved to target acquisition line-of-sight. When in Manual, FCR antenna angle or TADS line-of-sight is controlled by the sight manual tracker.*

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"



Acquisition Source: GHS (Gunner Helmet Sight)

Acquisition Source: GHS (Gunner Helmet Sight)

Helmet Line-of-Sight Reticle

Selected Sight: TADS

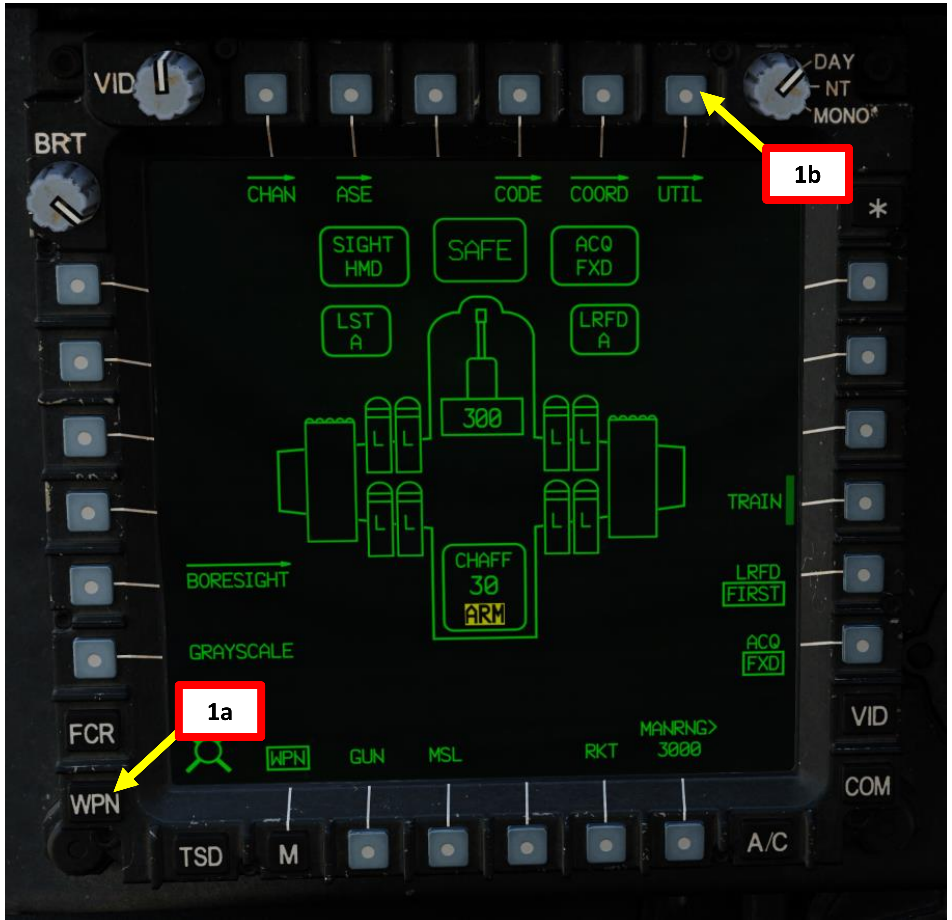
4 – AGM-114 HELLFIRE MISSILE

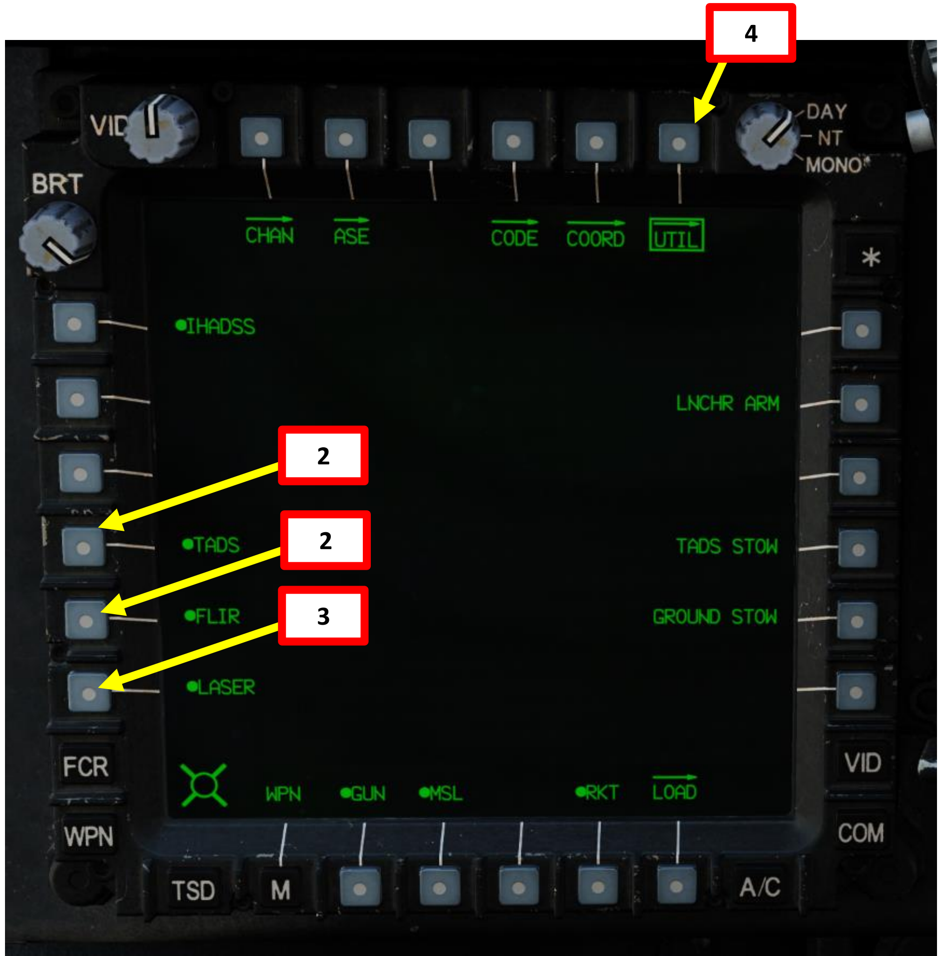
4.2 – Laser-Guided Hellfire (AGM-114K)

4.2.1 – Missile Operation by Multicrew

4.2.1.3 – LOAL-LO / LOAL-HI (Lock-On After Launch – Low/High)

1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
    - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
    - Hollow circle means OFF. Solid Circle means ON.
    - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





4 – AGM-114 HELLFIRE MISSILE
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4.2.1 – Missile Operation by Multicrew
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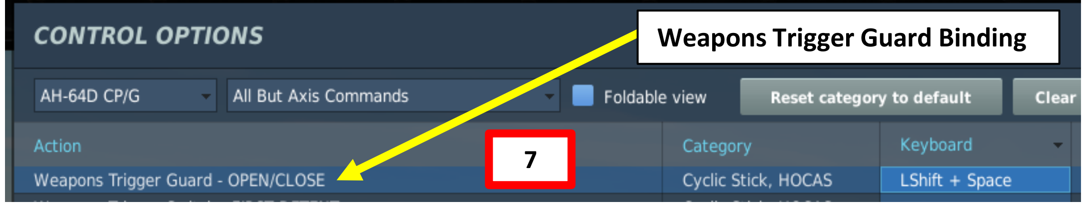
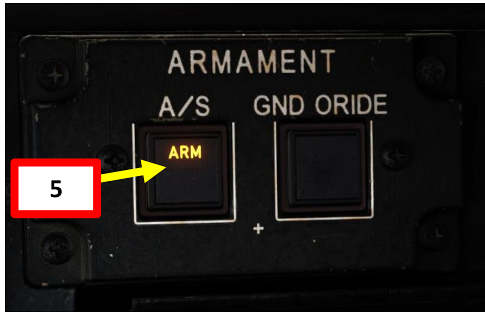
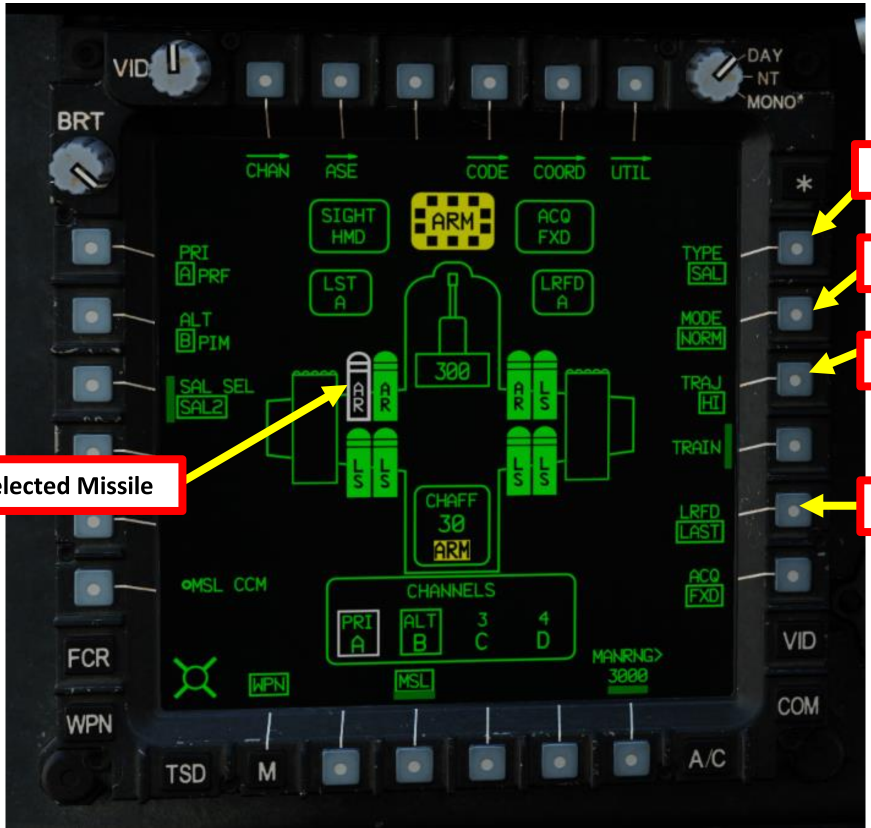
5. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
6. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
7. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
    - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
    - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).
8. *[CPG]* Set Missile Type to SAL (Semi-Active Laser).
9. *[CPG]* Set Missile mode to NORMAL.
10. *[CPG]* Set Missile trajectory to HI (High) or LO (Low) depending on the desired missile lofting trajectory. In this example, we will select HI.
11. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Mode Selector – As required. I typically set it to LAST.





Weapon Action Switch (WAS) 6
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*



TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
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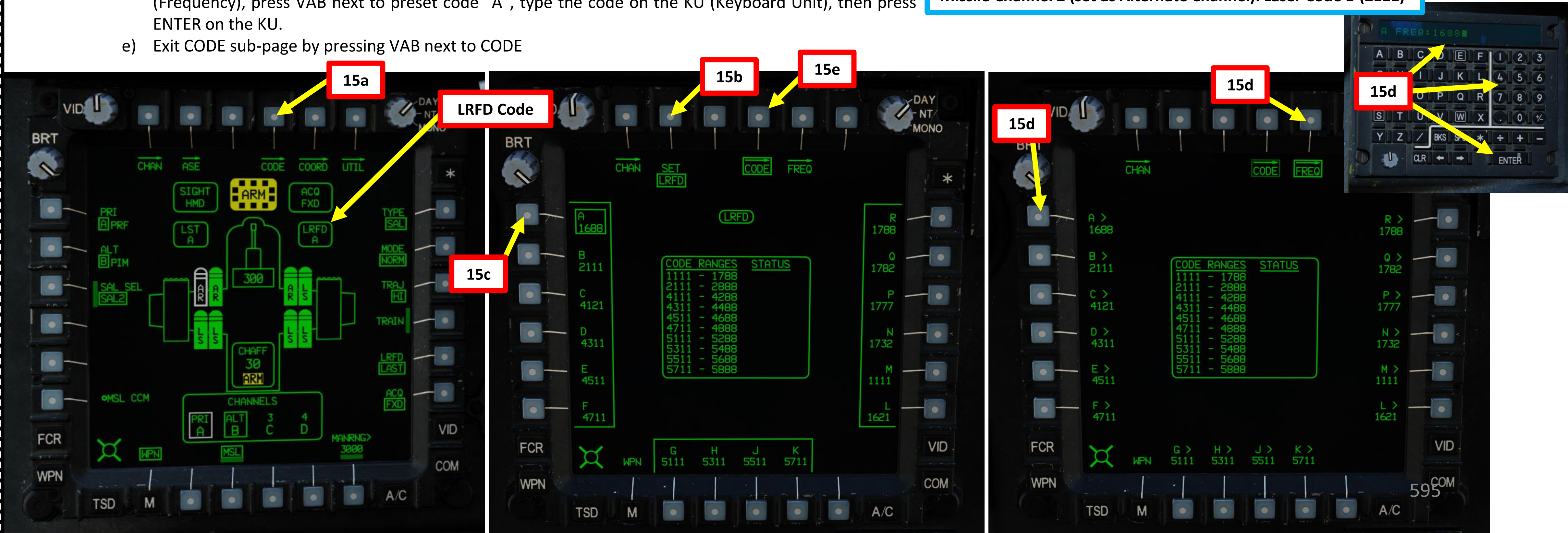
12. In this tutorial, we will designate the target with the LRFD (Laser Rangefinder & Designator) of the TADS (Target Acquisition & Designation Sight); its designation laser code is set to preset A (1688).
13. Missile Channel 1 is set as the Priority (PRI) Channel with a laser code set to preset A (1688).
14. Missile Channel 2 is set as the Alternate (ALT) Channel with a laser code set to preset B (2111) in case a wingman designates a target for you and you want the missile seeker to track your wingman's laser.
15. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Laser code to preset A. To change your LRFD laser code:
    a) Press VAB (Variable Action Button) next to CODE
    b) Select LRFD using VAB next to SET LRFD/LST to toggle between LRFD and LST.
    c) Select preset laser code A using appropriate VAB.
    d) If you want to change the laser code associated with preset code A, press VAB next to FREQ (Frequency), press VAB next to preset code "A", type the code on the KU (Keyboard Unit), then press ENTER on the KU.
    e) Exit CODE sub-page by pressing VAB next to CODE



4 – AGM-114 HELLFIRE MISSILE
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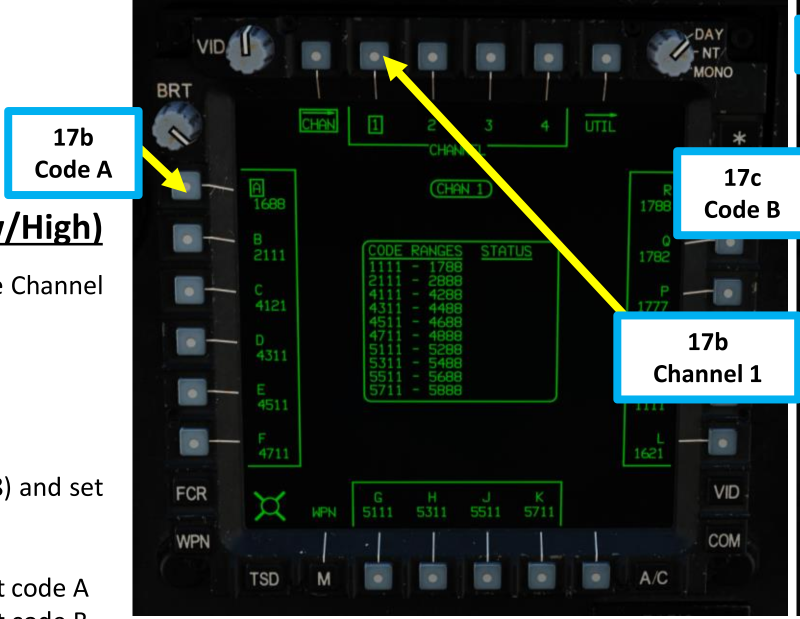
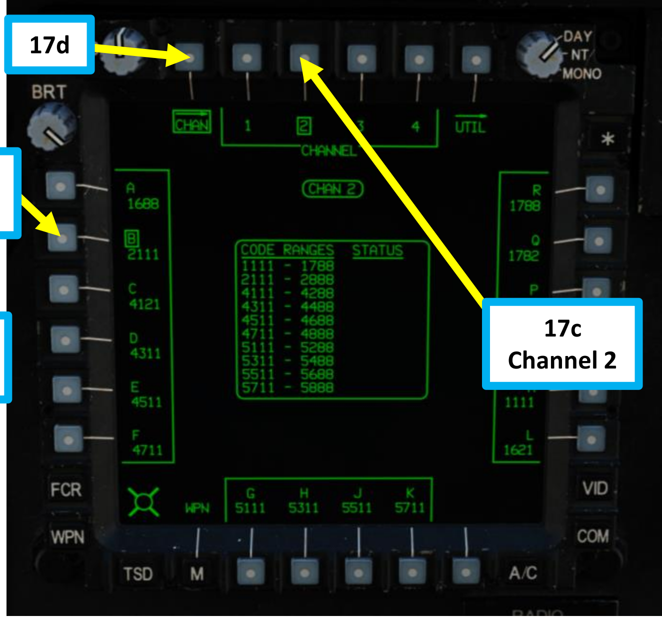
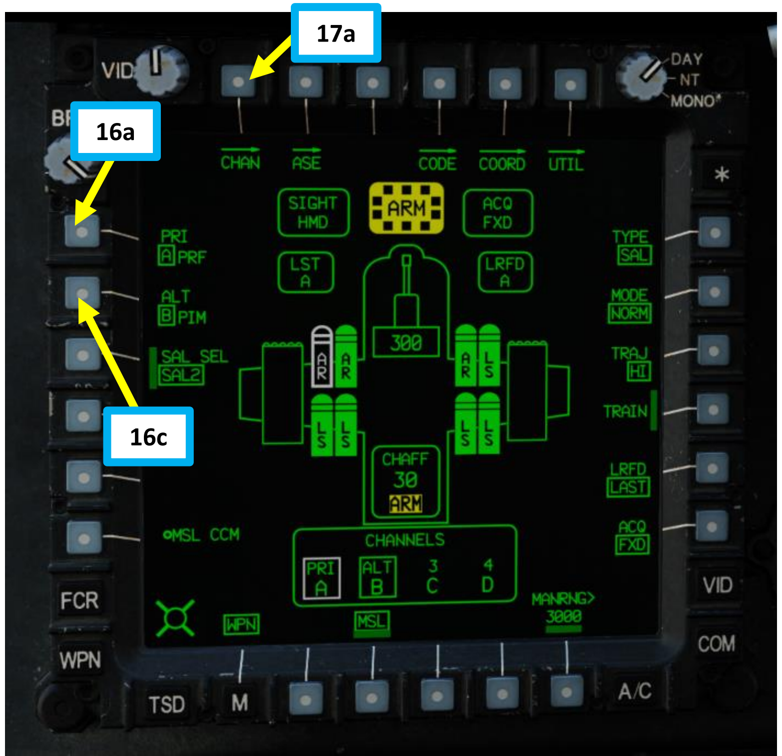
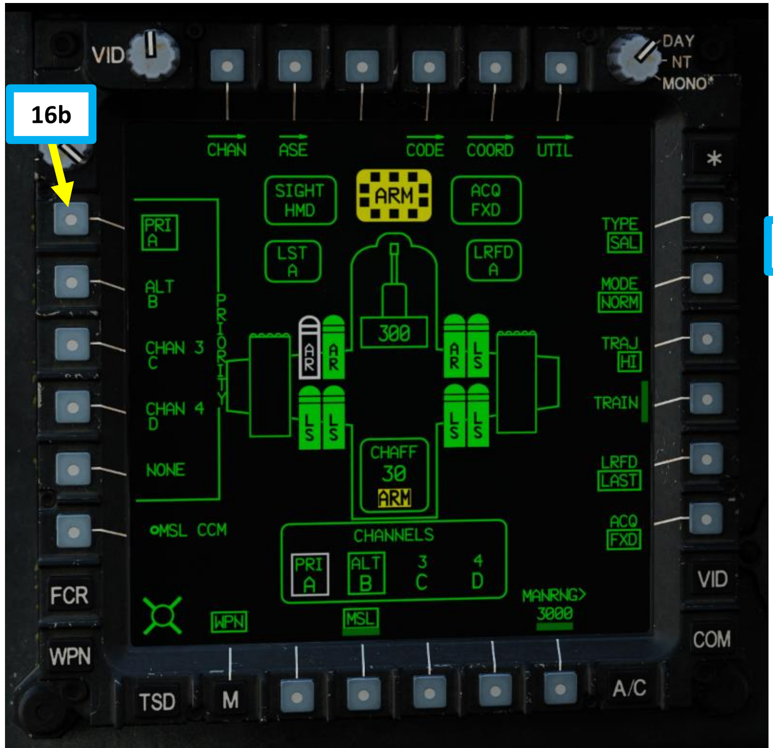
4.2.1 – Missile Operation by Multicrew
4.2.1.3 – LOAL-LO / LOAL-HI (Lock-On After Launch – Low/High)

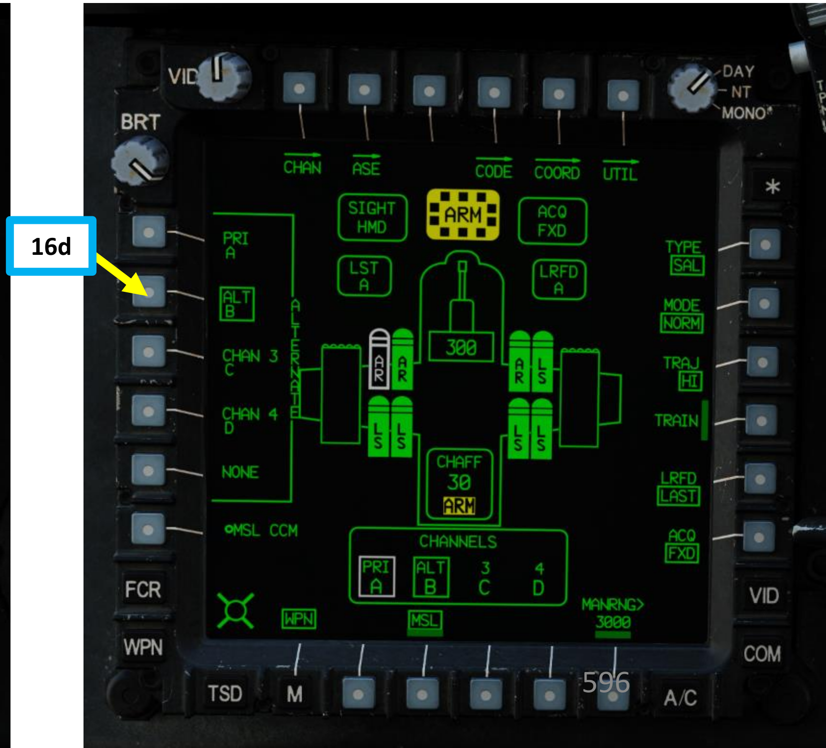
16. *[CPG]* Set Missile Priority Channel to Channel 1 and set Missile Alternate Channel to Channel 2.
    a) Press VAB (Variable Action Button) next to PRI (Priority)
    b) Press VAB next to A.
    c) Press VAB next to ALT (Alternate)
    d) Press VAB next to B.
17. *[CPG]* Set Missile Channel 1 (set to Priority) to laser preset code A (1688) and set Missile Channel 2 (set to Alternate) to laser preset code B (2111).
    a) Press VAB next to CHAN (Channel)
    b) Press VAB next to Channel 1, then press VAB next to laser preset code A
    c) Press VAB next to Channel 2, then press VAB next to laser preset code B
    d) Exit CHAN sub-page by pressing VAB next to CHAN











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18. [CPG] Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
19. [CPG] Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the “IHADSS Show” binding, which is “i” by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “C-HMD”.
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

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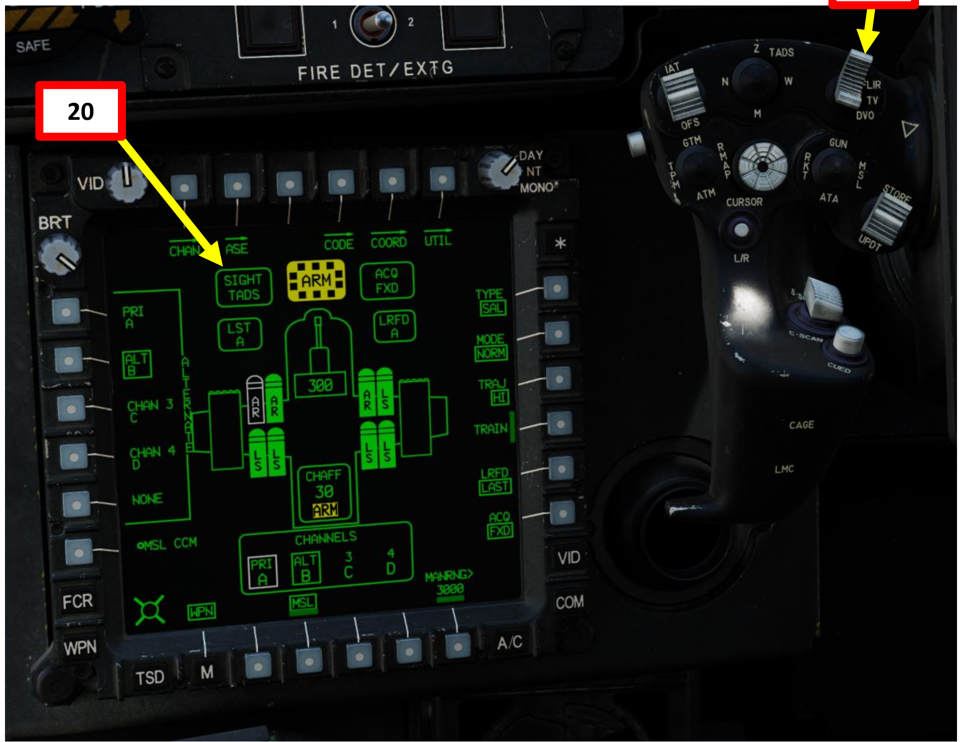
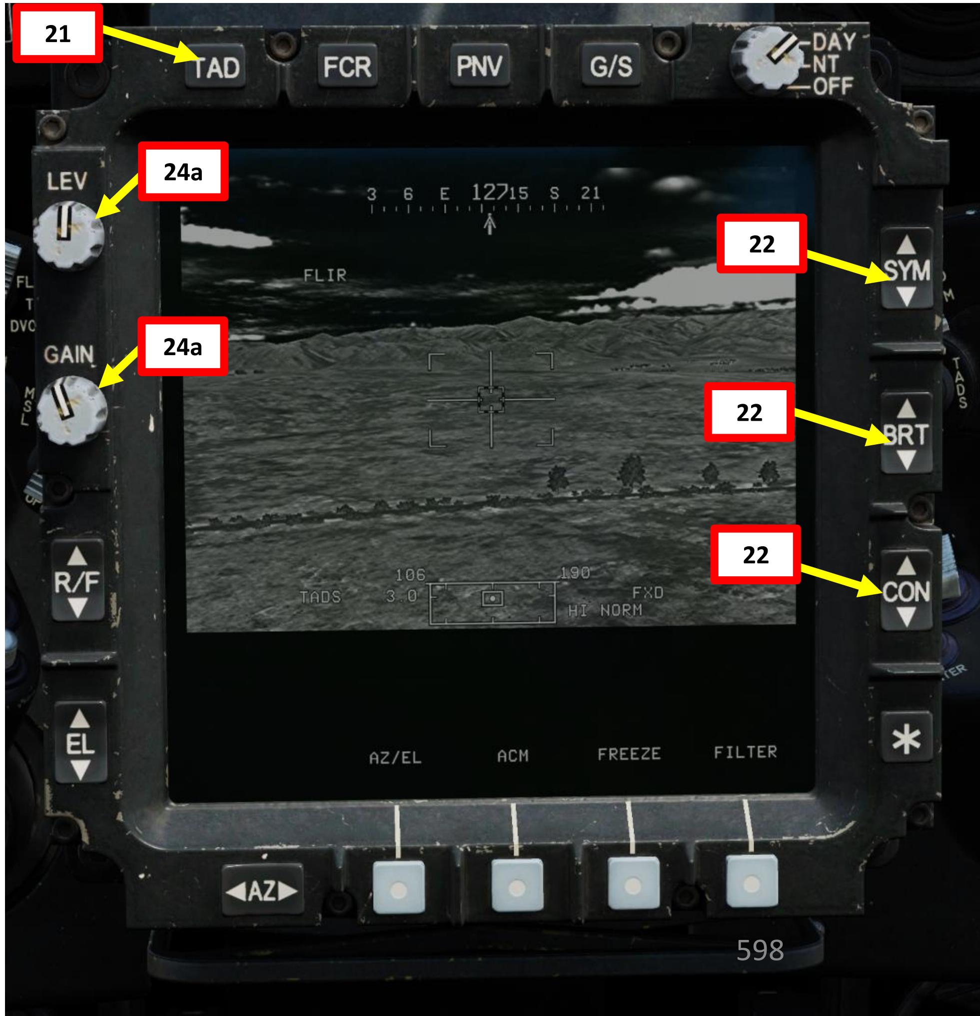
20. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
21. *[CPG]* Select TADS video feed source by pressing the TAD button.
22. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
23. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
24. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.





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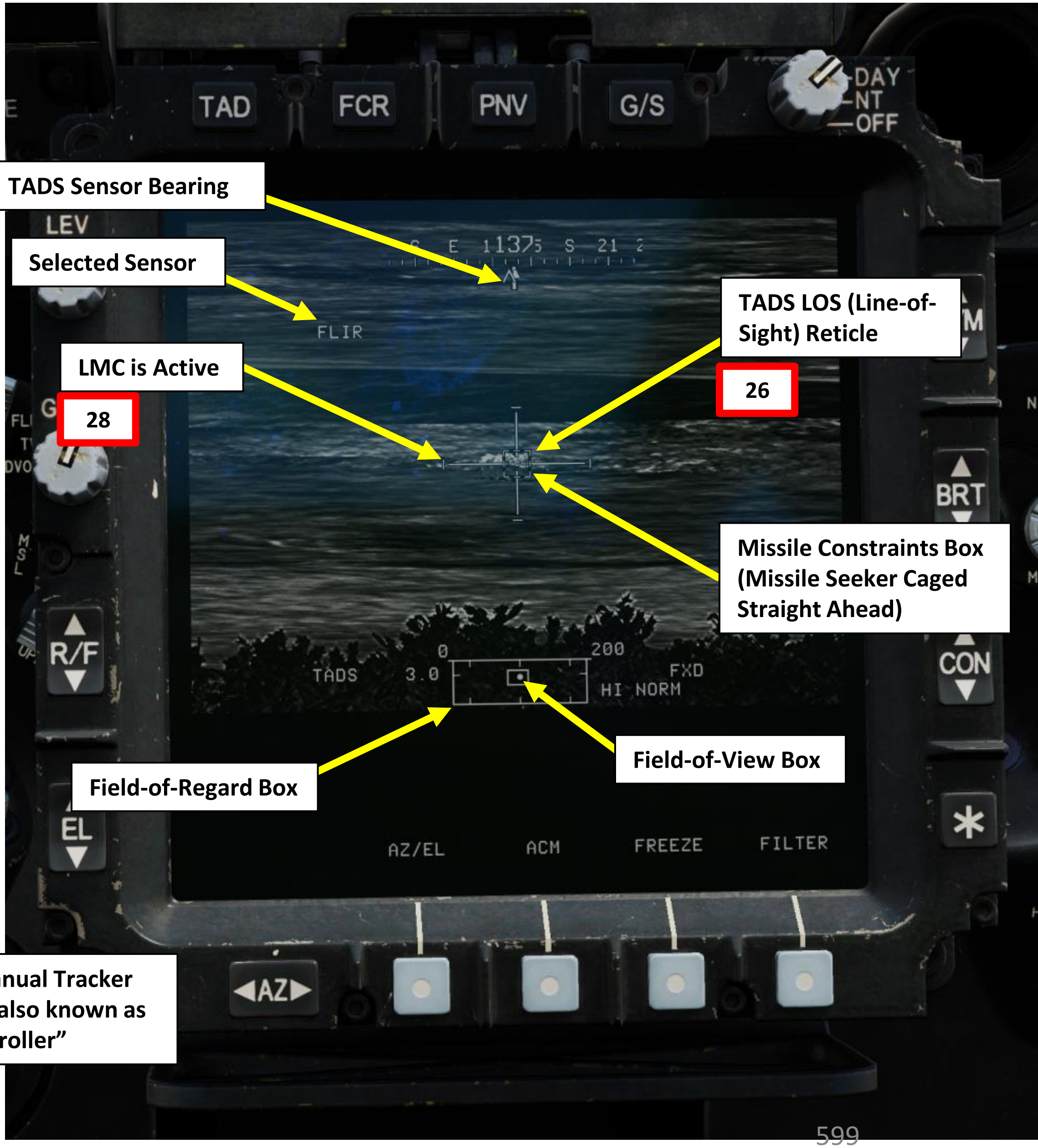
25. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
26. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
27. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
28. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).



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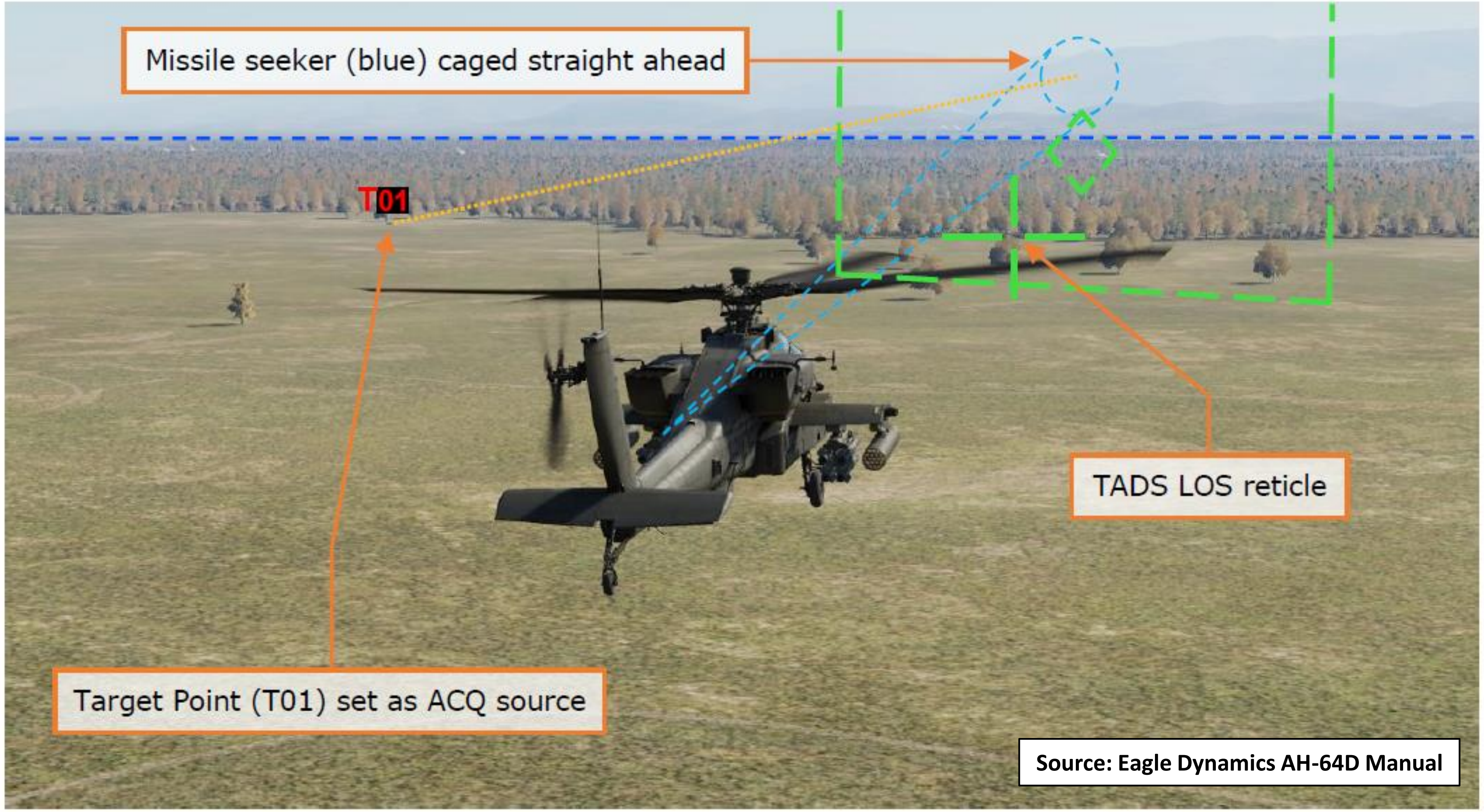
4.2.1.3 – LOAL-LO / LOAL-HI (Lock-On After Launch – Low/High)

29. *[CPG]* In order to use the LOAL-HI or LOAL-LO mode, we need to select a navigation point or target point as an acquisition source (ACQ) that is placed roughly on the target. This target point is necessary since the TADS (Target Acquisition & Designation Sight) must be slaved to it.
    - For simplification purposes, we will assume there is no target point programmed, in which case we will create a target point with the TADS.
    - Note: the Missile Constraints Box is dashed and frozen in the center of the Line-of-Sight reticle until a point is selected.



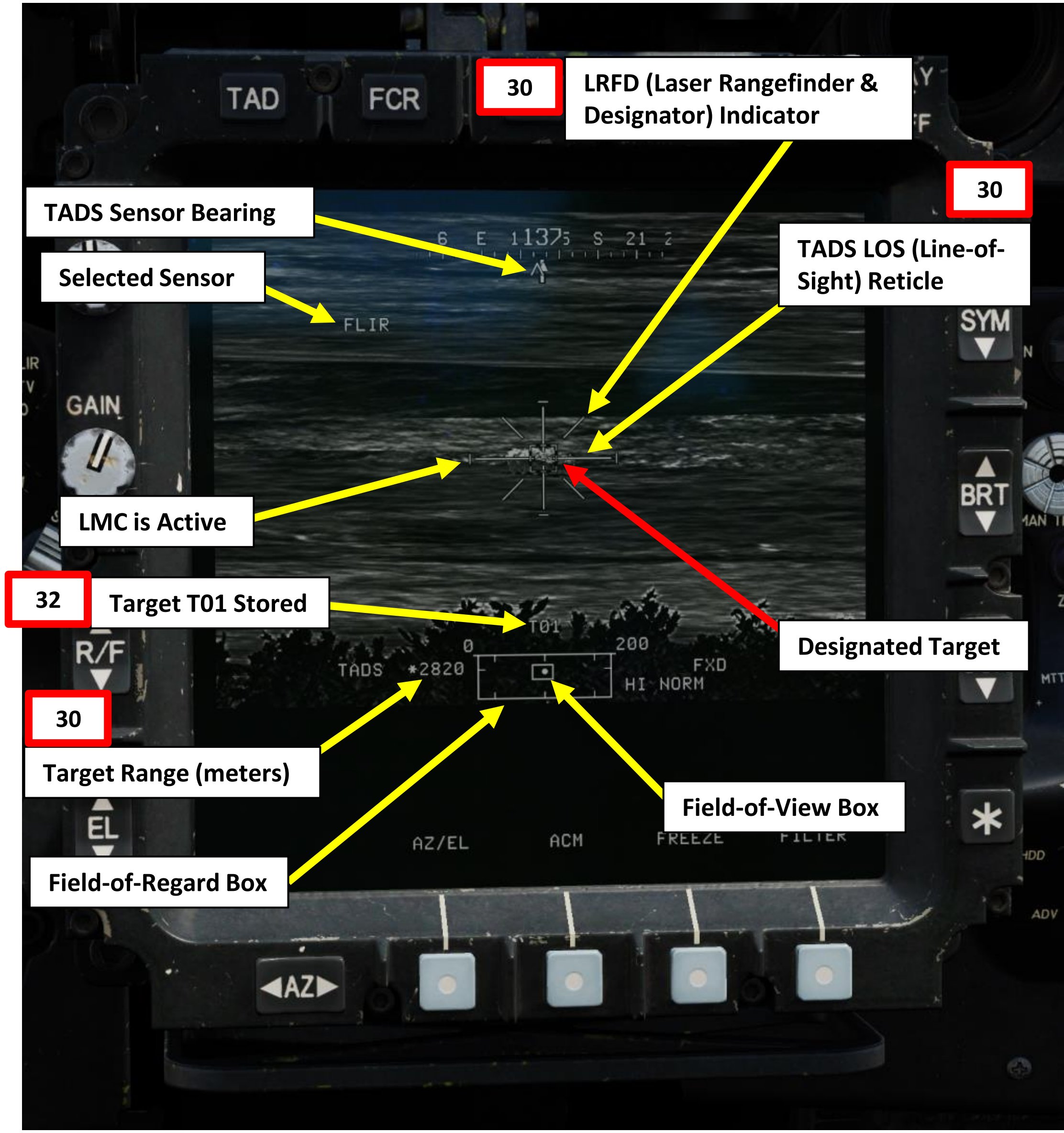
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.3 – LOAL-LO / LOAL-HI (Lock-On After Launch – Low/High)

30. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will automatically apply some lead to make sure the rockets hit where the target is going to be while taking into account its current speed and direction.
31. *[CPG]* Press the TEDAC Left Hand Grip Store/Update Switch FWD (STORE) to store the TADS line-of-sight as a target point.
32. *[CPG]* A “T” followed by the Target Point number will be displayed on the TDU (TADS Display Unit). As an example, “T01” indicates that Target Point 01 coordinates have been stored.
    - The Co-Pilot can then call out to the pilot something like “BMP stored target 01” to let him know what has been spotted and stored in which target point.

Store/Update Switch 31
- *Stores position information or performs position updates.*
    - *FWD: STORE, Stores selected sensor line-of-sight as a point*
    - *AFT: UPDATE, Performs a flyover or TADS position update.*

TEDAC LHG (Left Hand Grip)

TEDAC RHG (Right Hand Grip)



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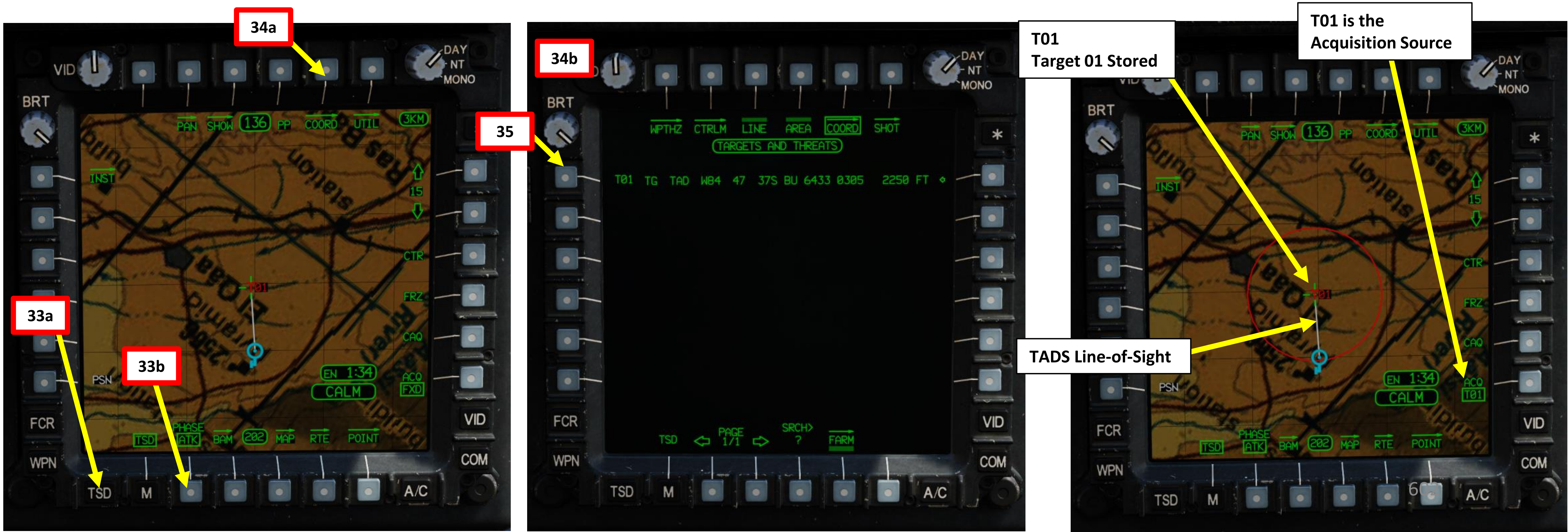
33. *[CPG]* On the TSD (Tactical Situation Display) page, select ATK (Attack) Phase. This will allow you to see existing target points on the TSD.
34. *[CPG]* Press on VAB (Variable Action Button) next to COORD (Coordinates).
35. *[CPG]* Press on VAB next to T01 to select Target Point 1.
36. *[CPG]* Target Point T01 is now the acquisition source, which we will need to slave the TADS to.



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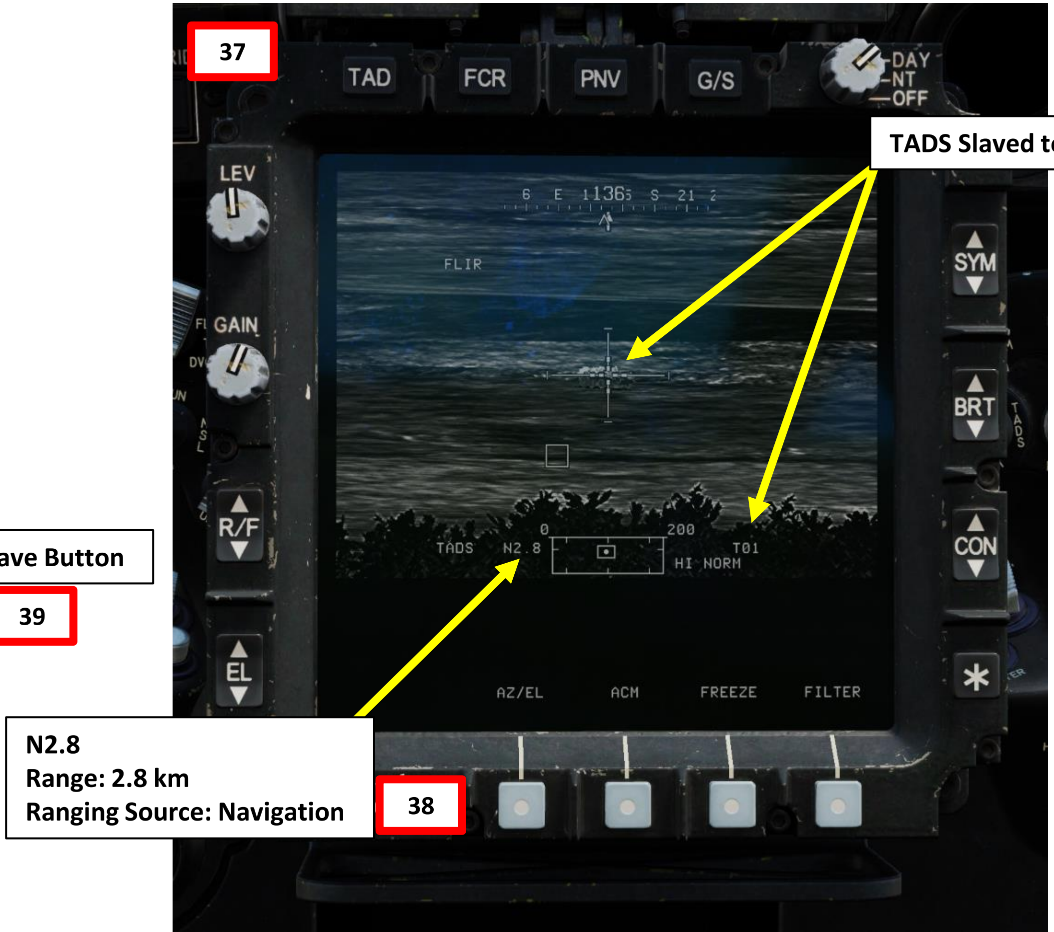
37. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then lock on the selected acquisition source, which is Target Point T01 in this case. Even if you lose line-of-sight with the target, the TADS will still remember the coordinates of the stored target.
    - Note: alternatively, you could also use the Cursor Acquisition method to slave the TADS to a target point.
38. *[CPG]* Verify that Range Source is set to NAV (Navigation). Range indication should be preceded by "N", which means that the range is computed from the target point coordinates.
39. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to switch to manual track. This will allow you to make smaller adjustments if necessary.



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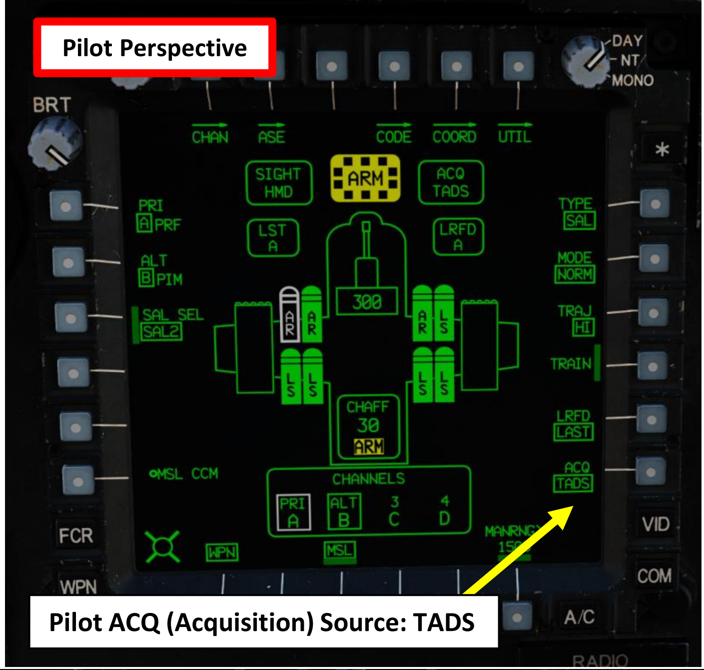
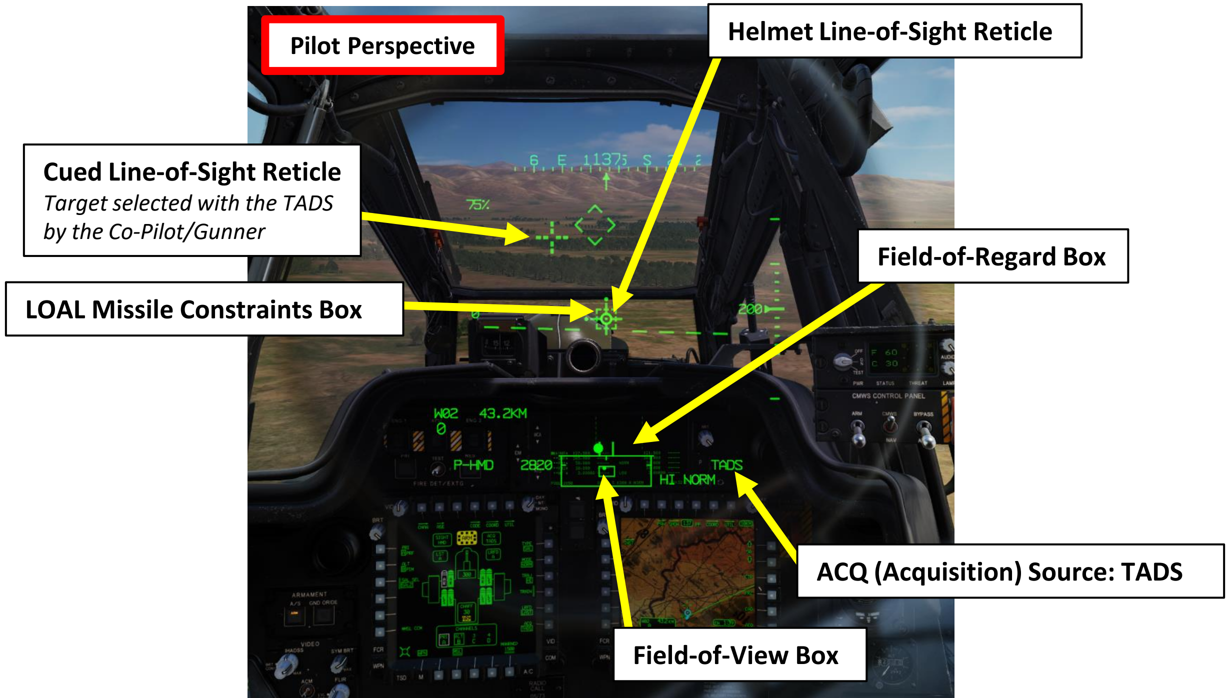
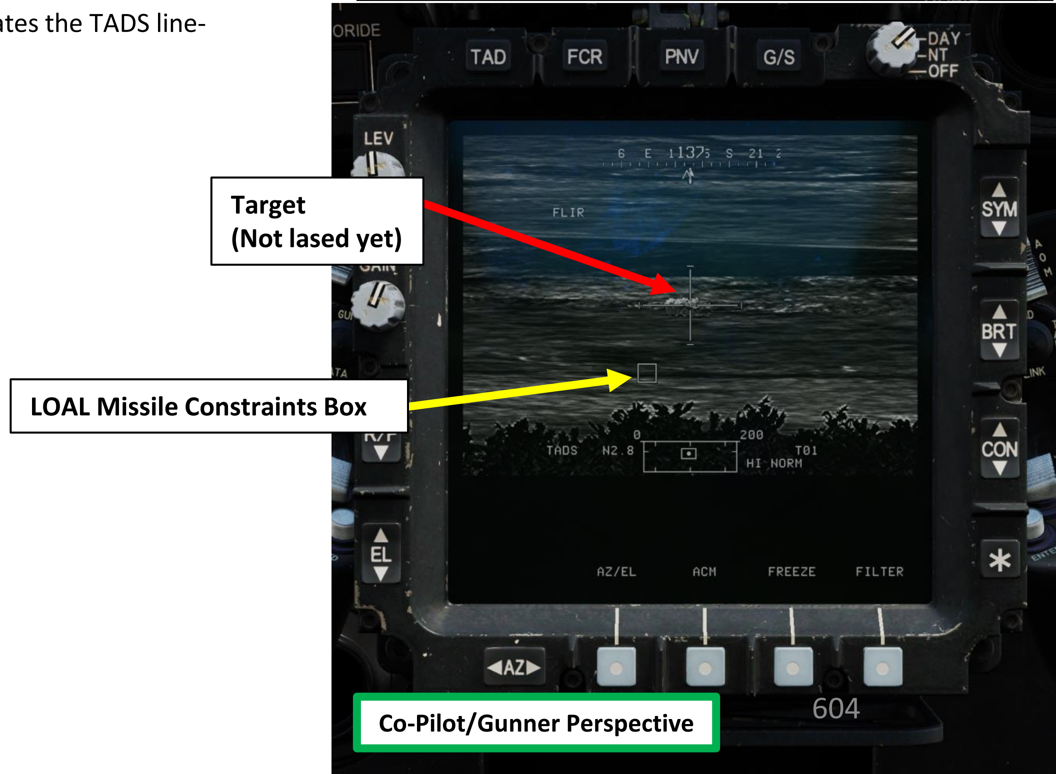
40. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase “Constraints”.
41. *[P]* When pilot is told “Constraints” by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box, which should be small (LOAL box) and solid since the target is not being actively lased by the co-pilot/gunner yet.
    - **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as “LOAL box” (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
    - **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as “LOBL box” (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire
42. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.







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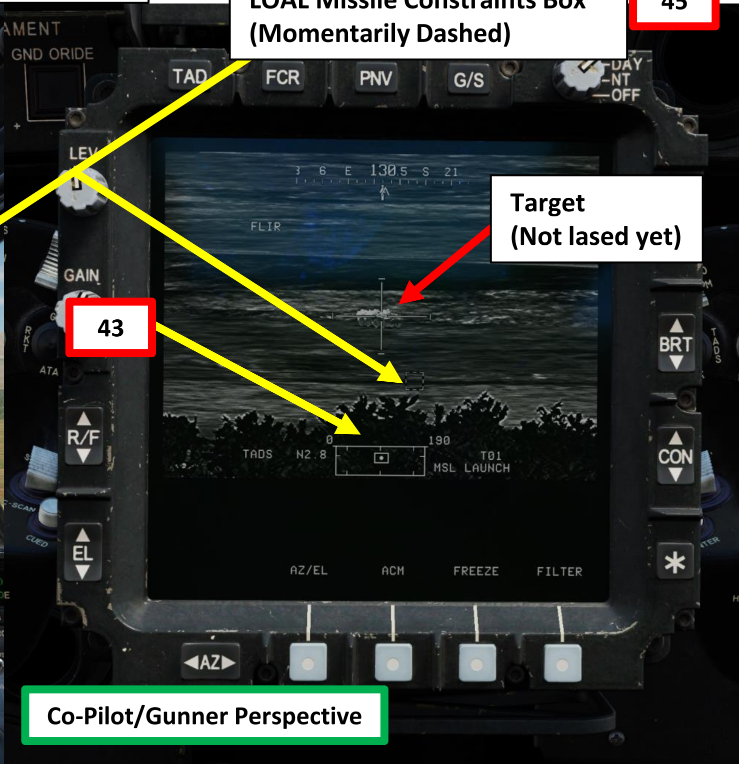
43. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
44. *[CPG]* Fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent. The missile will loft and follow the selected trajectory (High or Low profile, as selected).
45. *[CPG]* Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected)

Missile Launching

Pilot Perspective



LOAL Missile Constraints Box (Momentarily Dashed)

45

Target (Not lased yet)

43

Co-Pilot/Gunner Perspective

TEDAC LHG (Left Hand Grip)

44

TEDAC LHG Weapon Trigger (opposite side of grip)

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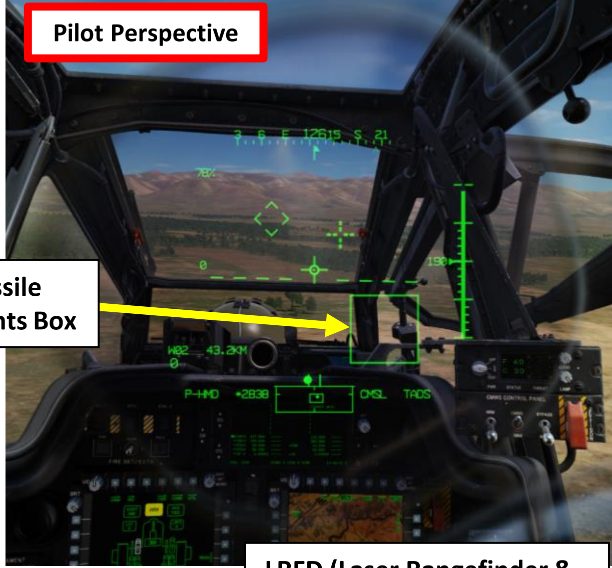
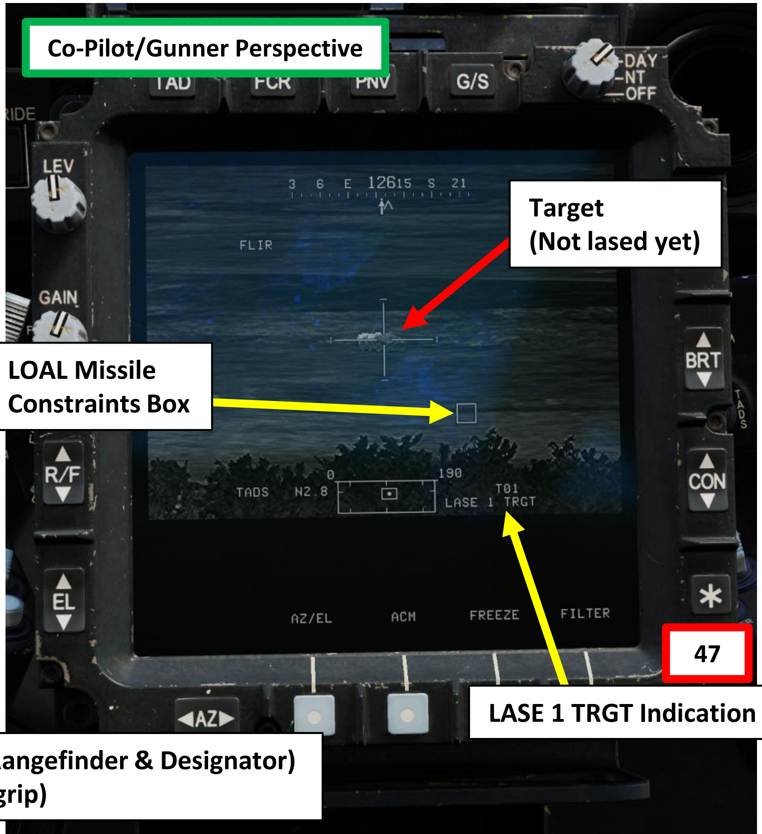
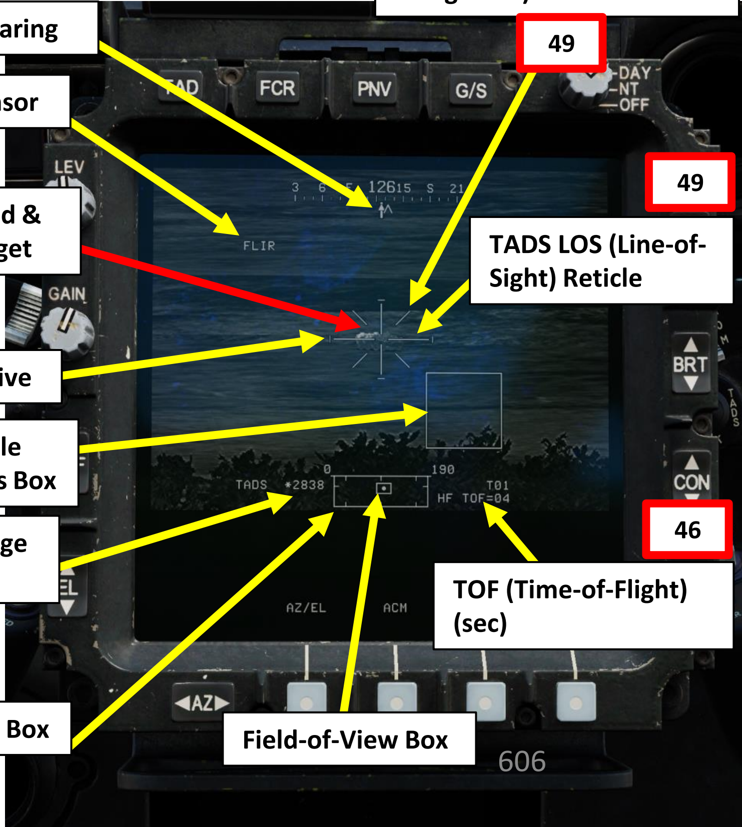
46. *[CPG]* Once missile has been launched, a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.
47. *[CPG]* The “LASE 1 TRGT” indication appears when the co-pilot/gunner needs to lase the target (about 10 sec before missile impact).
48. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will help you track the target more easily.
49. *[CPG]* Once missile is tracking the laser, the Missile Constraints Box will switch from LOAL (small box) to LOBL (big box). The missile will track the laser until impact.
50. *[CPG]* Ensure continuous laser designation is provided on the intended target for the duration of the missile flight time until impact is observed.







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51. *[CPG]* If target is destroyed and LMC (Linear Motion Compensator) has been engaged, on TEDAC Left Hand Grip, press LMC Button again to disengage LMC.

- **Important Note**: if using a HI or LO trajectory, take into account that the missile needs enough distance to perform its lofting profile… firing a missile too close to the target may result in the missile flying too high and not being able to detect the laser designator.

4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.4 – Operating with a JTAC/AFAC
4.2.1.4.1 – Introduction to JTAC, FAC & AFAC

The JTAC (Joint Terminal Attack Controller), also known as a FAC (Forward Air Controller), is the radio operator that finds targets for you and requests air strikes. The JTAC calls in air support from jets, helicopter gunships and armed drones. He is the main line of communication between the grunts on the ground and yourself. An AFAC is an Airborne Forward Air Controller, which has a similar role but that is airborne. This function can be performed by other helicopter pilots flying the AH-64 or the OH-58 Kiowa Warrior… or by drones like the MQ-1A Predator.

In DCS, JTACs can send you target coordinates and visually identify/mark the target with an infrared (IR) pointer, which can only be spotted with night vision goggles (NVGs). JTACs can also designate a target with a laser, which can be tracked either by the TADS LST (Laser Spot Tracker) or with the Hellfire missile's seeker directly acting as an acquisition source.

FAC (Forward Air Controller)

MQ-1A Predator Drone AFAC

OH-58D Kiowa Warrior AFAC

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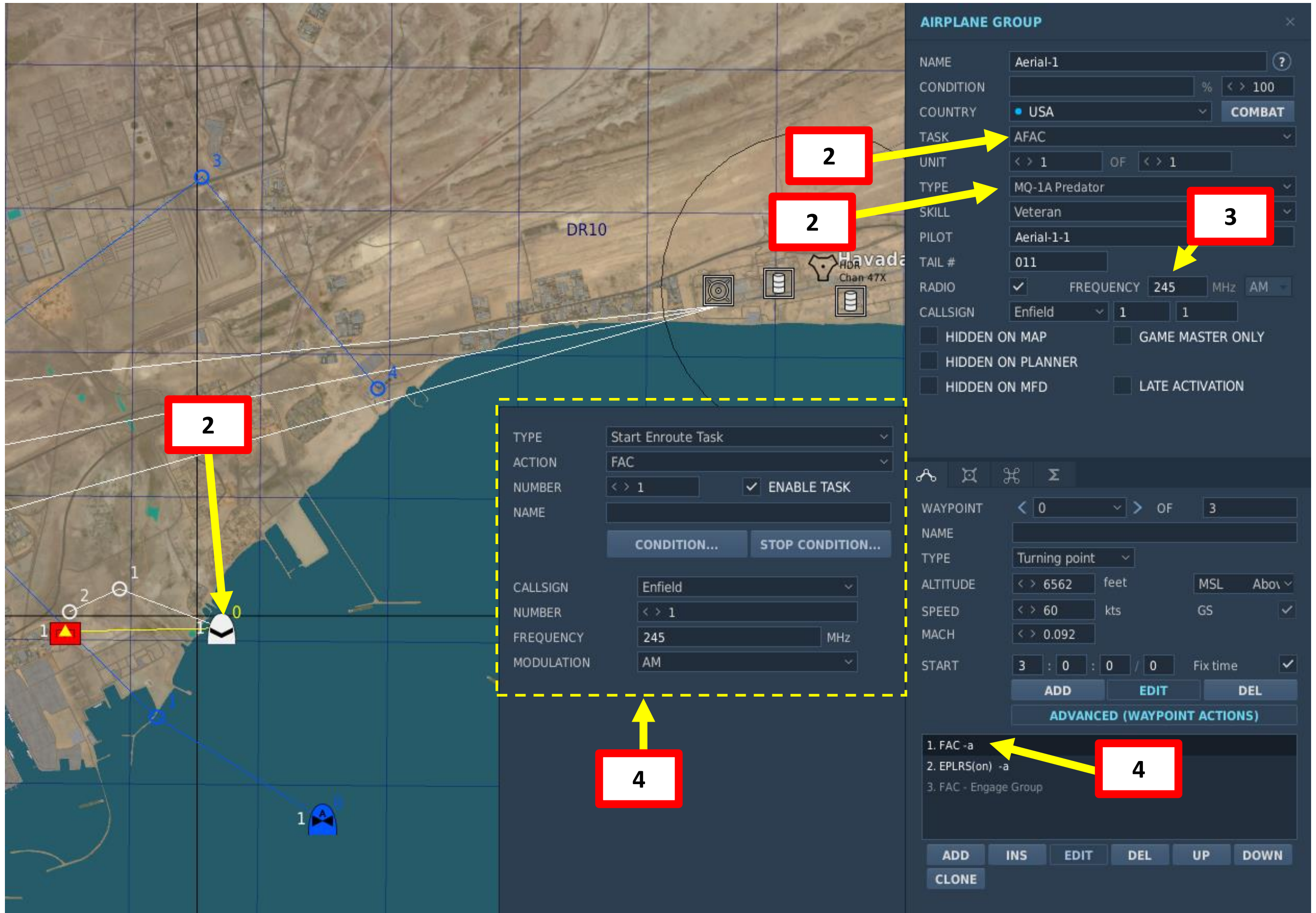
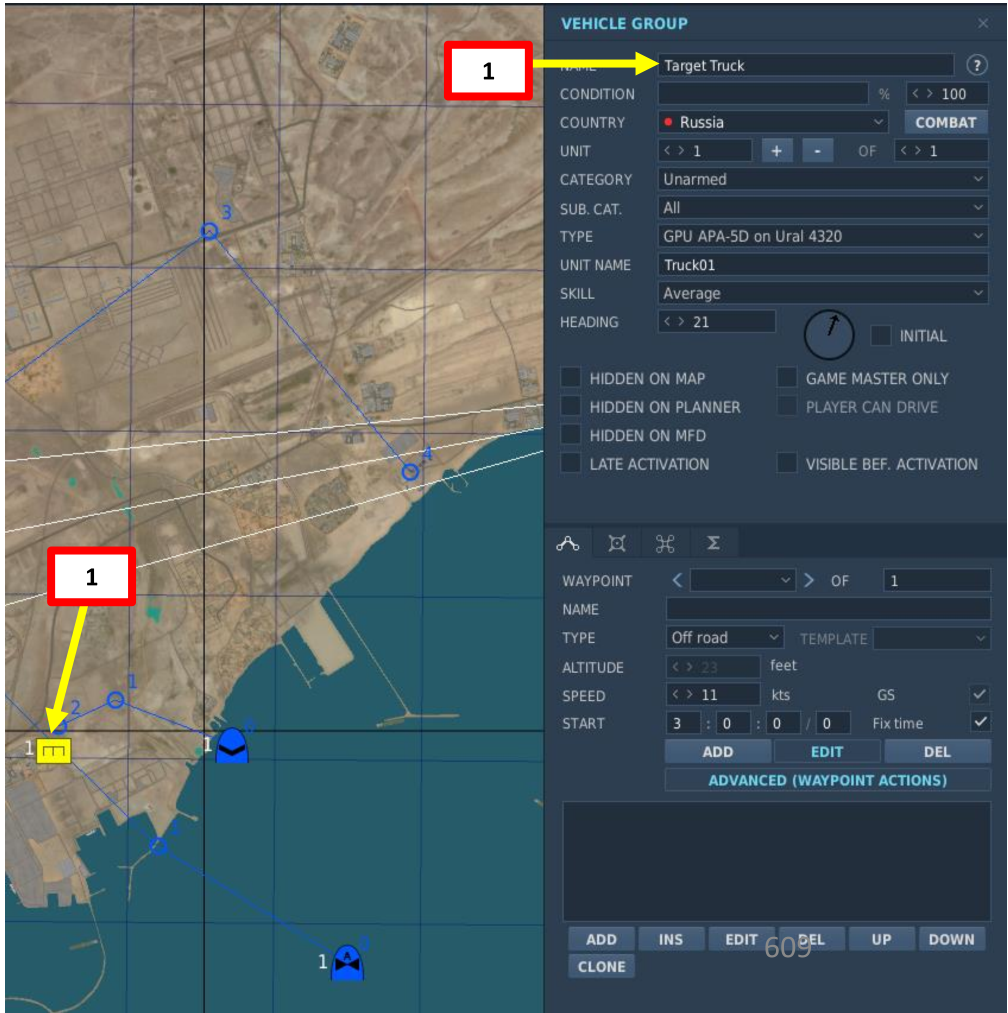
4.2.1.4.1 – Introduction to JTAC, FAC & AFAC

Setting up a JTAC or a FAC through the mission editor requires a few important steps:

1. Create a target with a valid group name. In this example, we named it "Target Truck".
2. Create a unit for the JTAC/FAC (I typically use a MQ-1A Predator Drone with the AFAC Task or a ATGM HMMWV (Air-to-Ground Missile High Mobility Multipurpose Wheeled Vehicle, or "Humvee").
3. Give the JTAC/FAC unit a valid radio frequency you can communicate on (i.e. 245.00 MHz AM).
4. Give a "Start Enroute Task" Advanced Waypoint Action set to "FAC", with the radio frequency previously set.





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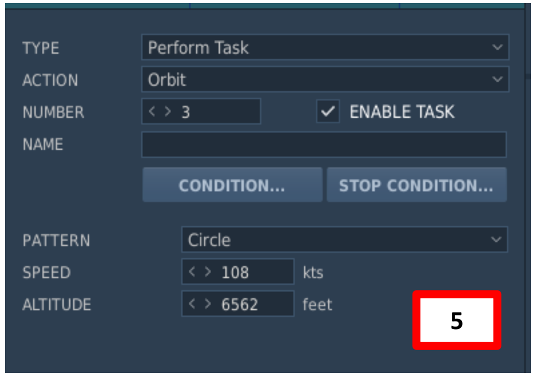
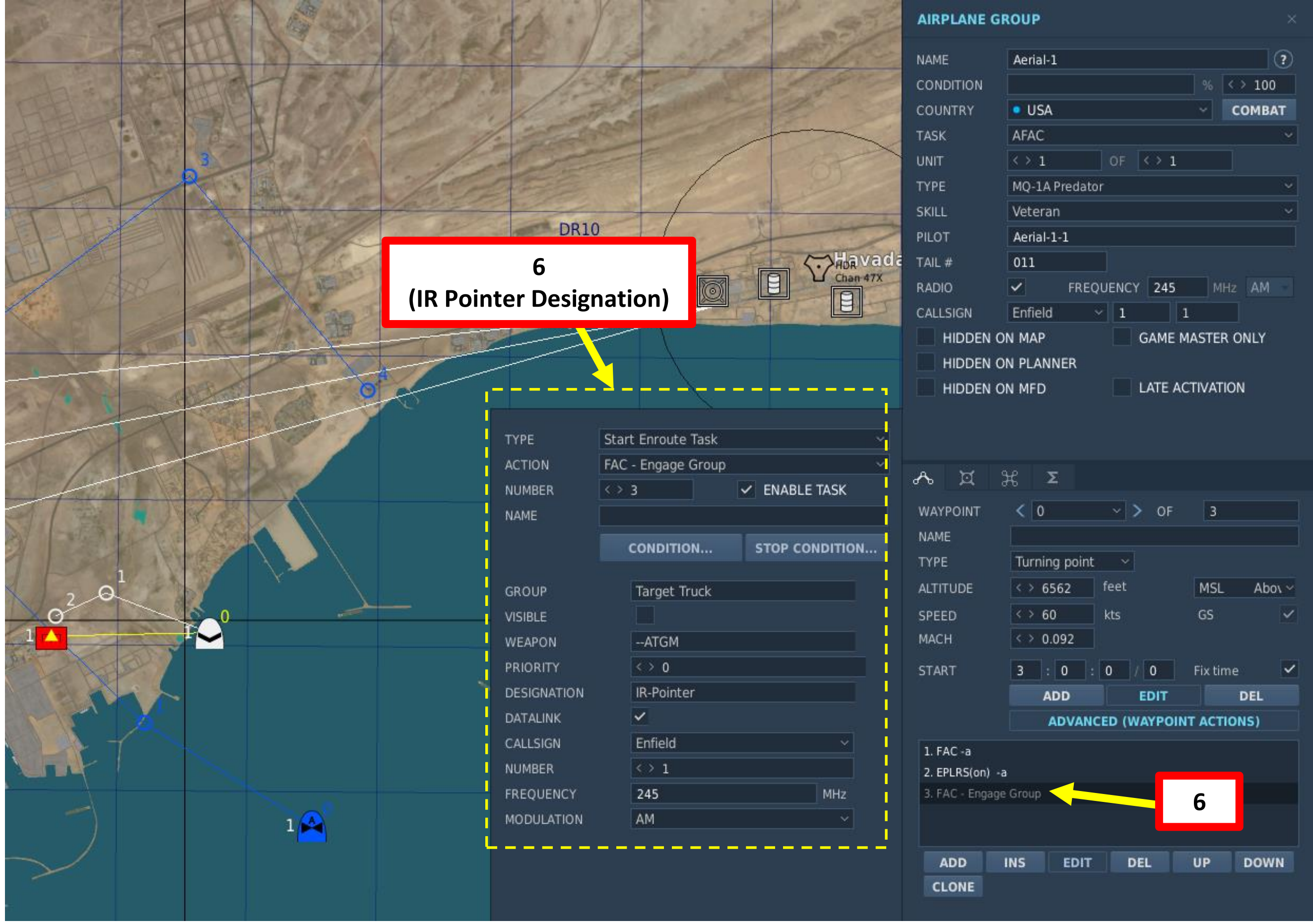
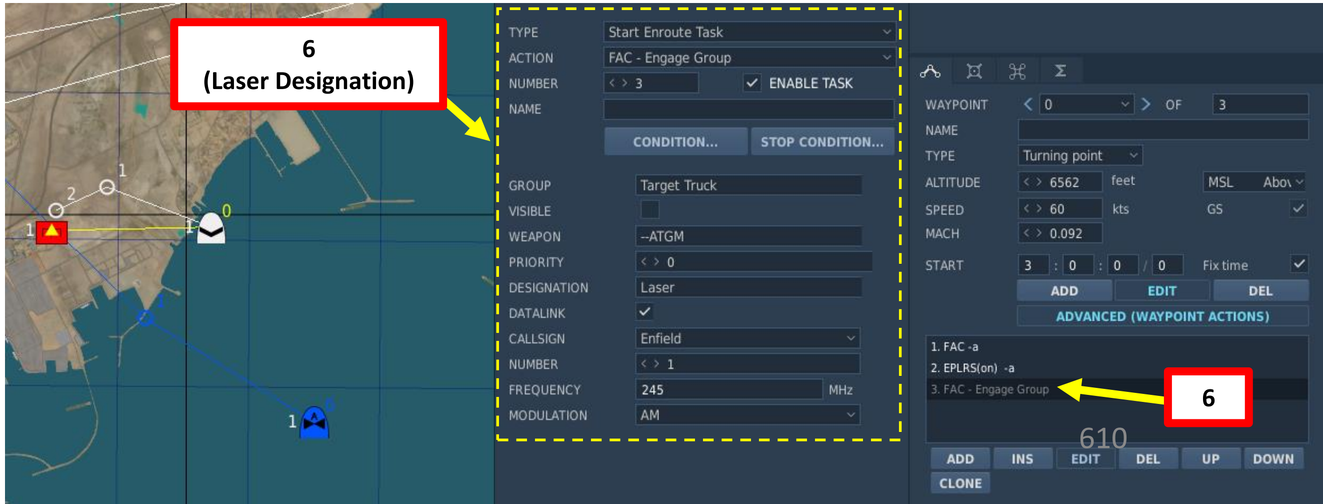
5. If using an Airborne Forward Air Controller (AFAC), I suggest you give a “Perform Task” Advanced Waypoint Action set to “Orbit”. This will allow the drone to orbit over the target and provide continuous support.
6. Give a “Start Enroute Task” Advanced Waypoint Action set to “FAC – Engage Group”.
    a) Select the “Target Truck” group name we created previously.
    b) Set Weapon to “ATGM”
    c) Set “IR Pointer” designation is used if you want to receive coordinates and have the JTAC use an infrared pointer to visually show you the target location (only visible with NVGs, Night Vision Goggles). Alternatively, you can set “Laser” designation







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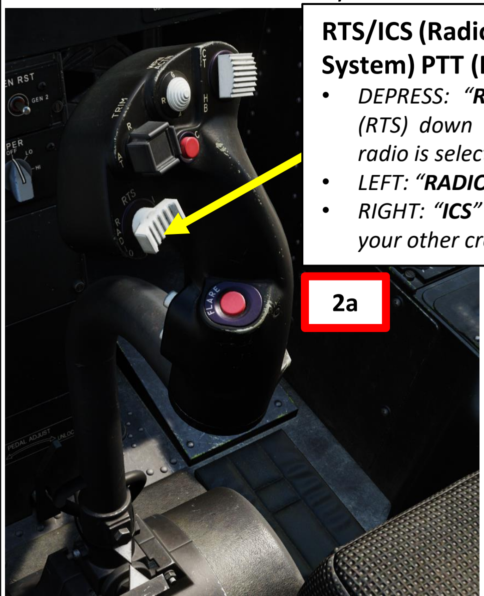
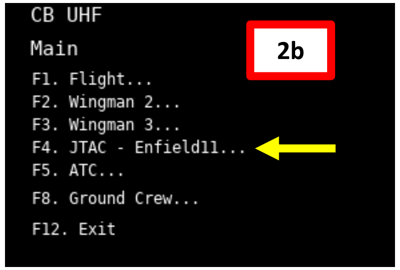
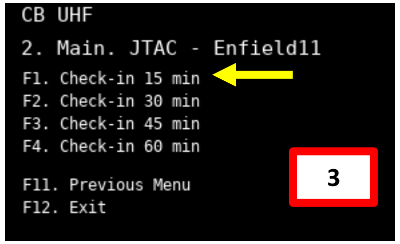
A – Contact JTAC

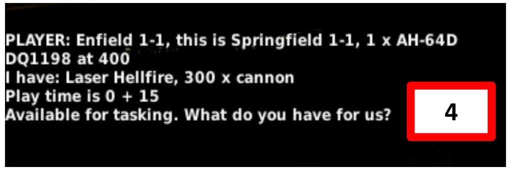
1. Set required JTAC frequency with radio (ARC-164(V) UHF AM in this example). Frequency is set to 245.00 MHz AM).
2. Depress PTT/RTS (Push-to-Talk Radio Transmit Select) Switch to select desired radio (ARC-164(V) UHF AM). Communicate on UHF AM radio with PTT/RTS LEFT and select JTAC – Enfield11 (F4) in radio menu.
3. Select "CHECK-IN 15 MIN" (F1)
4. You will contact the JTAC and give him your altitude and ordnance available, plus your time available on station.
5. JTAC will answer "Type 2 in effect" and ask you when you are ready to receive a 9-line.
6. Select "READY TO COPY" (F1) to receive 9-line.
7. The JTAC will give you the 9-line and ask you when you are ready for remarks.
8. Select "READY TO COPY REMARKS" (F1)
9. JTAC will give you remarks.
10. Select "9-LINE READBACK" to repeat the information you have been given and confirm it with the JTAC.
11. JTAC will confirm your readback, send you a JTAC transmission and clear you to engage target.

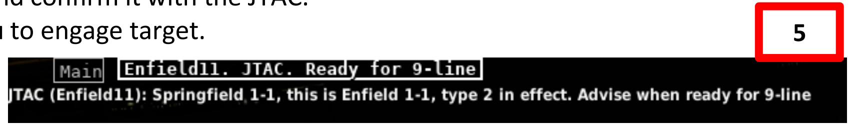


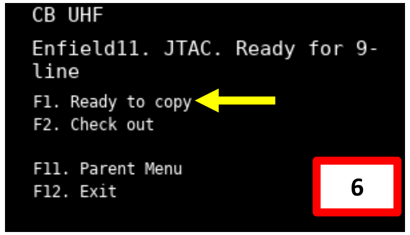
RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch
- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

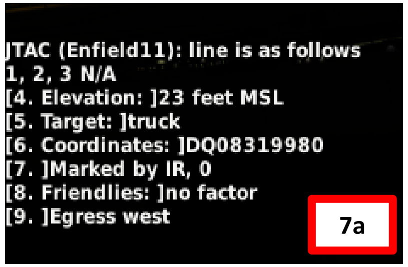


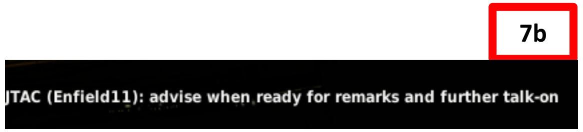


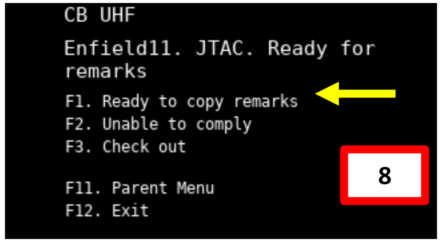


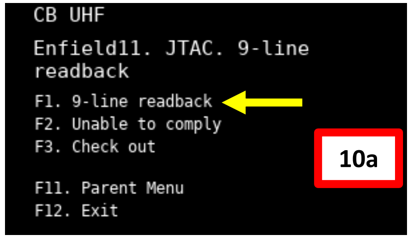












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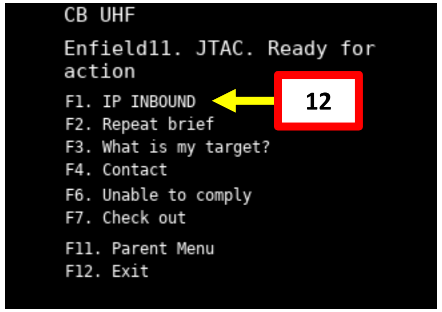
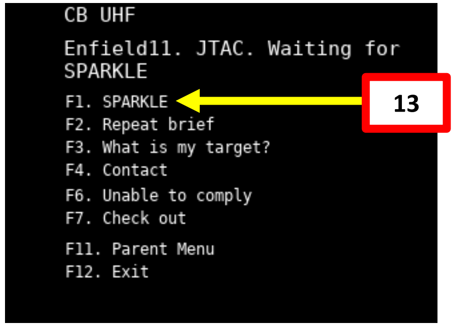
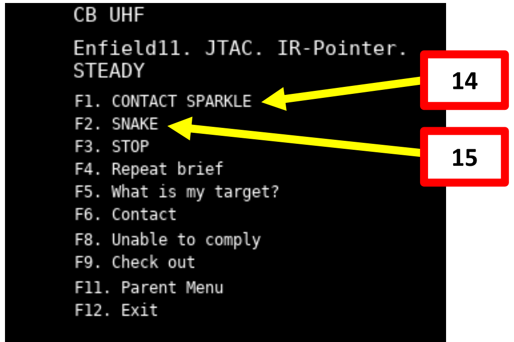
4.2.1.4.2 – Using Coordinates + IR Pointer

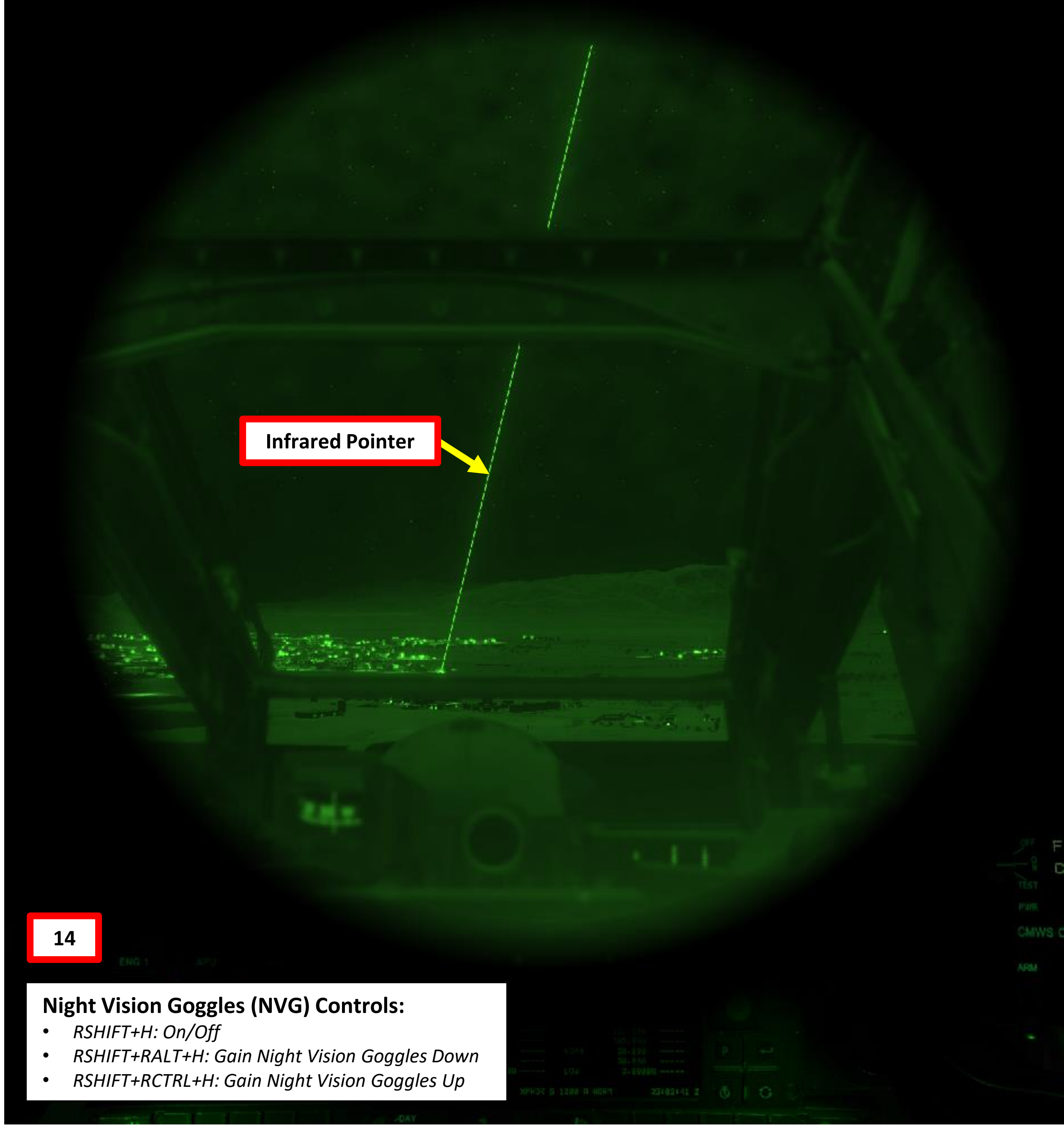
A – Contact JTAC

12. The JTAC will request you to report to the IP (Initial Point). Use F1 (IP INBOUND) when reaching the IP and you are ready to perform the attack.
13. If desired, use F1 to request "Sparkle", which means you are requesting target marking by IR (Infrared) pointer.
14. To have the JTAC start using his IR pointer, use F1 to call out "Contact Sparkle". A steady IR pointer will paint the target, which is only visible when equipping NVGs (Night Vision Goggles). Use RSHIFT+H to put on NVGs.
15. Calling out "Snake" using F2 will make the JTAC oscillate the IR pointer around the target to facilitate spotting the IR pointer.









Night Vision Goggles (NVG) Controls:
- *RSHIFT+H: On/Off*
- *RSHIFT+RALT+H: Gain Night Vision Goggles Down*
- *RSHIFT+RCTRL+H: Gain Night Vision Goggles Up*

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A – Contact JTAC

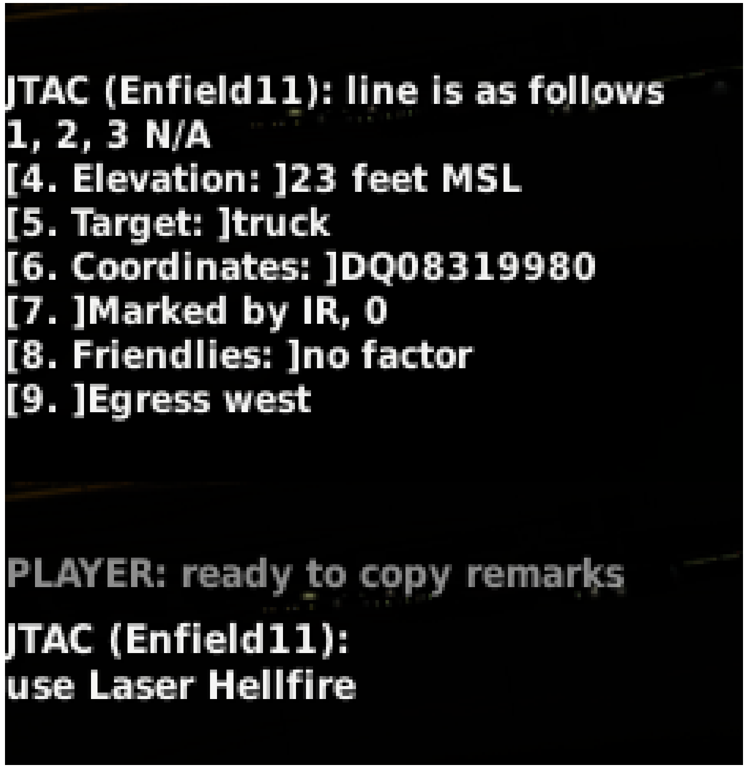
What is a CAS (Close Air Support) 9-line and why is it important? The goal of a 9-line is to provide you as much information as concisely as possible.

9-line

Line 1: IP/BP – Initial Point/Battle Position (N/A in our case)
Line 2: Heading from the IP to the Target (N/A in our case)
Line 3: Distance from the IP/BP to target (N/A in our case)
Line 4: Target elevation – 23 feet above Mean Sea Level (MSL)
Line 5: Target description: Truck.
Line 6: Target location: Grid coordinates of target (UTM coordinates DQ08319980)
Line 7: Target Mark Type: Marked by IR (Infrared) pointer
Line 8: Location of Friendlies: No friendlies on the ground nearby, no factor
Line 9: Egress semi-cardinal direction when departing from target: West

Remarks

Remarks generally include information about troops in contact or danger close, SEAD support in effect, hazards, weather or other threats. In our case, the JTAC wants us to use a Laser Hellfire.



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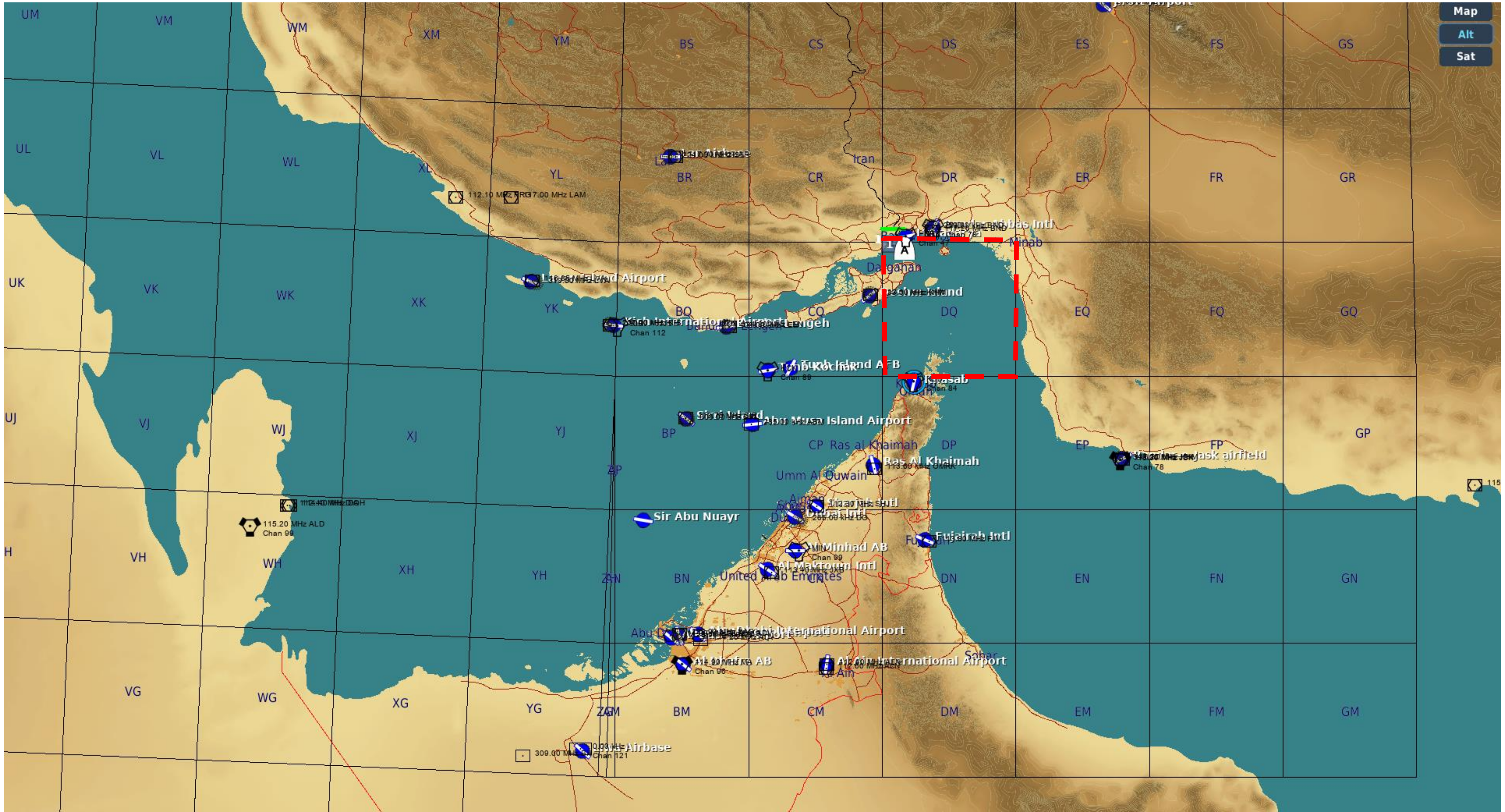
B – Enter Target Coordinates in a Waypoint

The target coordinates given to us by the JTAC, which are given in “UTM” (Universal Transverse Mercator) format.



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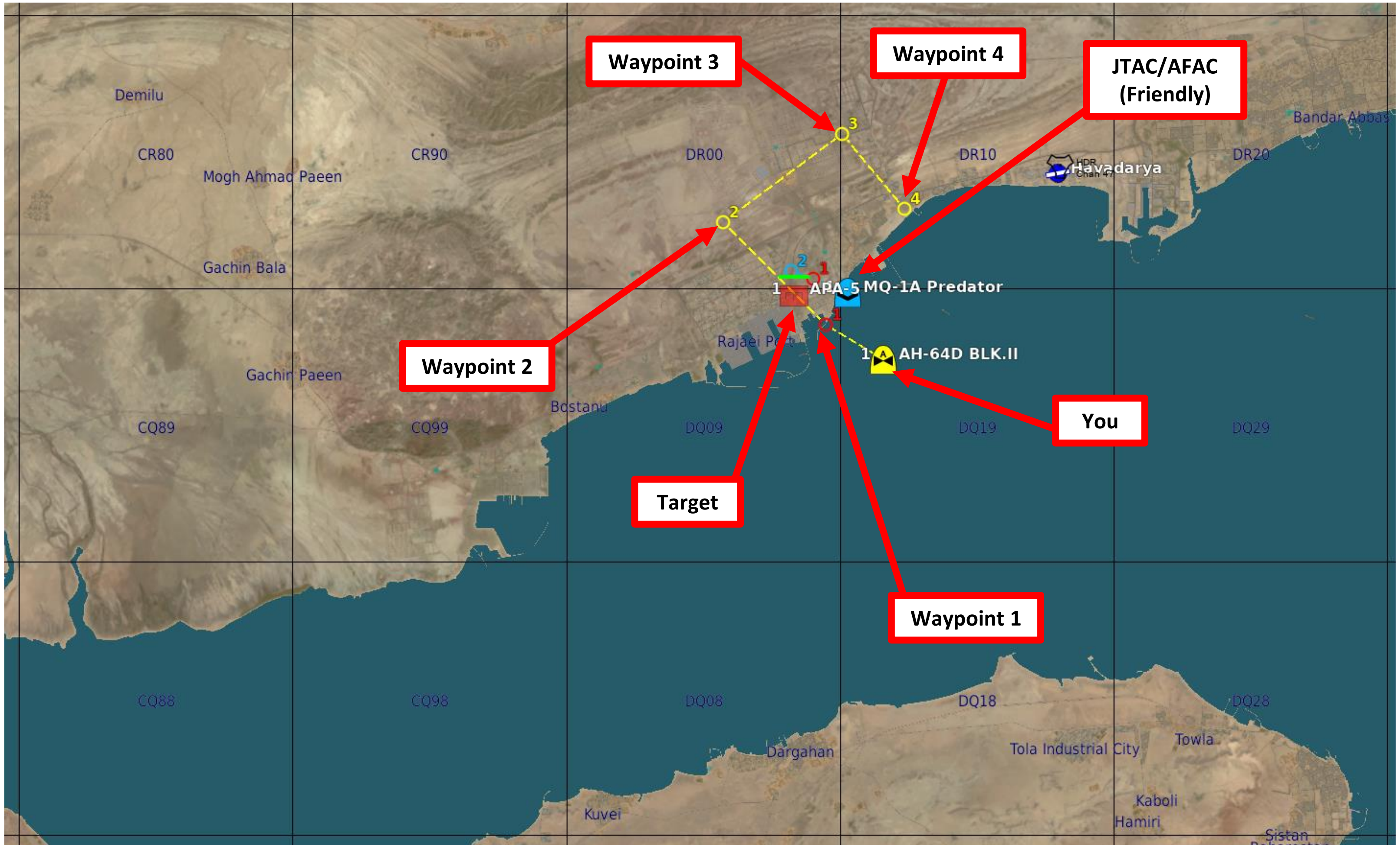
B – Enter Target Coordinates in a Waypoint

We have currently 4 existing waypoints. We will create a 5th waypoint with the target in "UTM" (Universal Transverse Mercator) format. The UTM coordinates of the target are **DQ08319980**.



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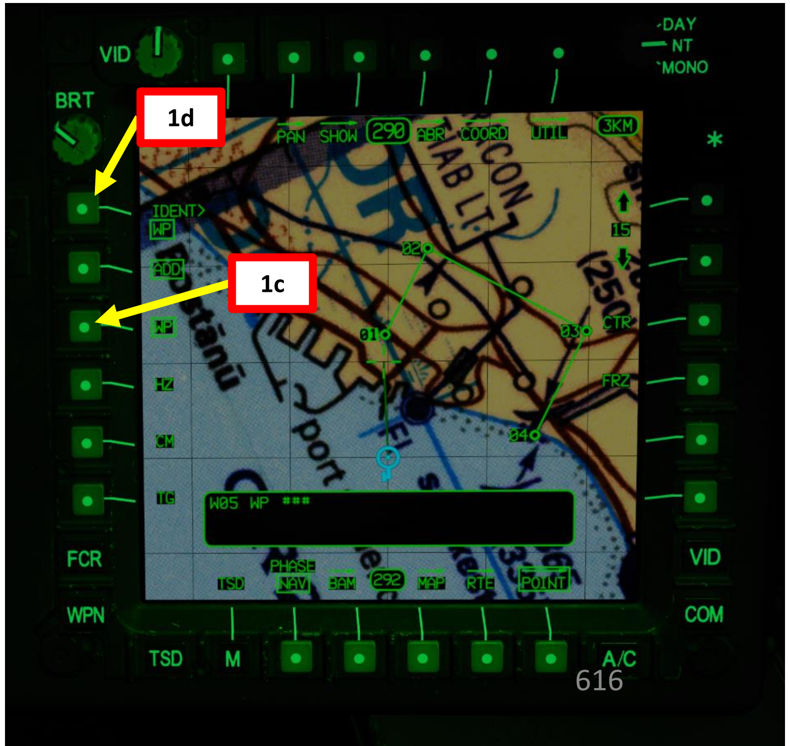
B – Enter Target Coordinates in a Waypoint

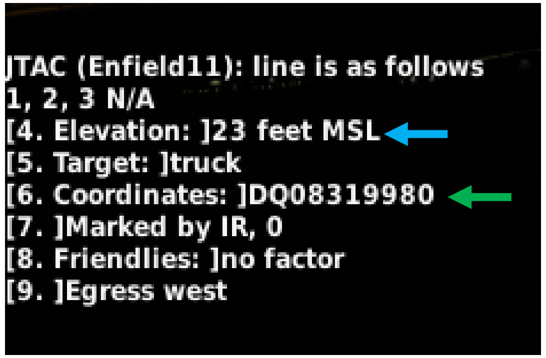
1. *[P/CPG]* Enter target coordinates in a navigation waypoint.
    a) On TSD page, press VAB (Variable Action Button) next to POINT.
    b) Press VAB next to ADD
    c) Press VAB next to WP (Waypoint)
    d) Press VAB next to IDENT (Identity). KU (Keyboard Unit) will then display “IDENT:”.

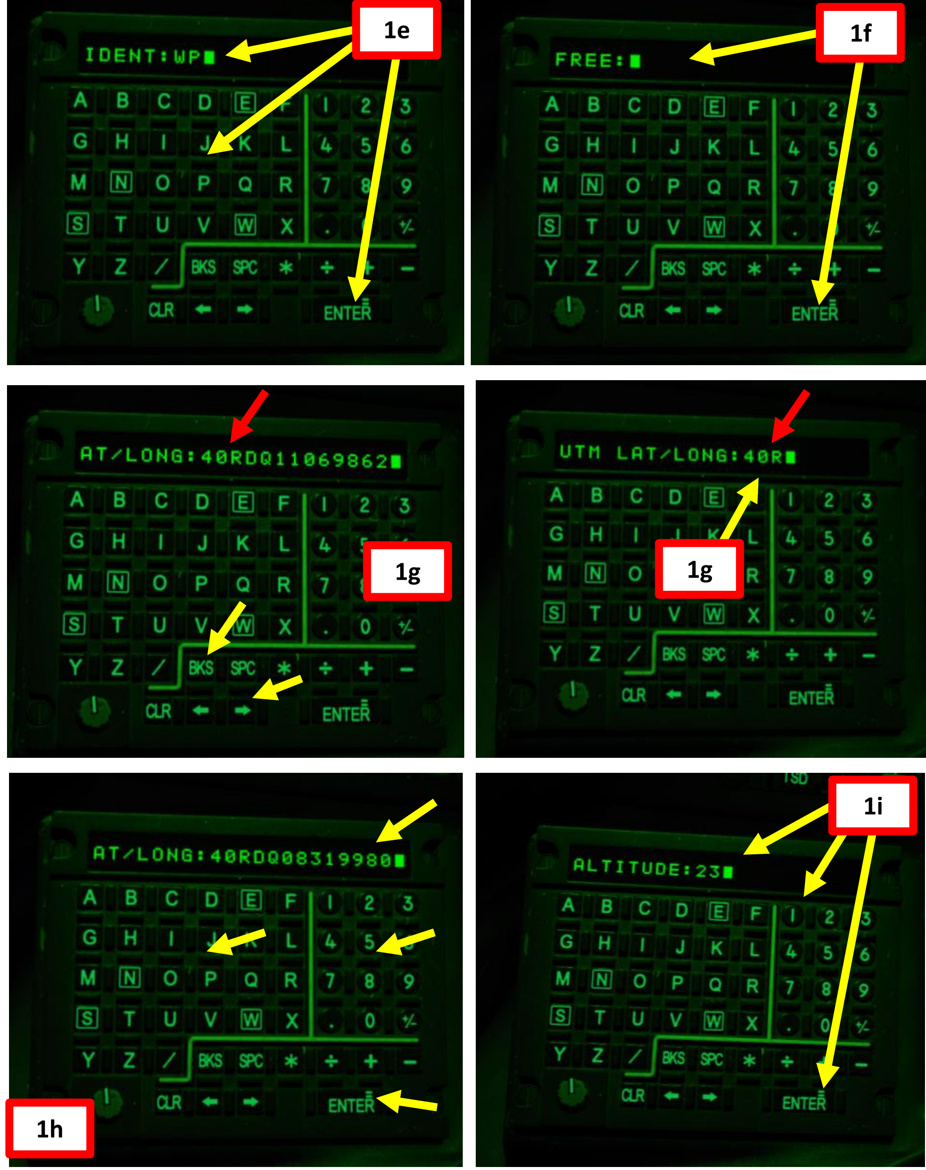


4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.4 – Operating with a JTAC/AFAC
4.2.1.4.2 – Using Coordinates + IR Pointer

B – Enter Target Coordinates in a Waypoint

1. *[P/CPG]* Enter target coordinates in a navigation waypoint.
    e) On KU (Keyboard Unit), type “WP”, then press ENTER. “WP” stands for “Waypoint”.
    f) KU will display “FREE:”. Press ENTER since no free text is required.
    g) KU will display current aircraft coordinates (**40R**DQ11069862), which need to be changed. Press RIGHT ARROW button repeatedly until cursor reaches the end of the coordinates format, then press BKS (Backspace) button repeatedly until coordinate field only has its first three digits (**40R** in our case).
    h) The target’s MGRS coordinates given by the JTAC are as follows: **DQ08319980**. More accurately, the actual coordinates are **40RDQ08319980** (remember the first three digits shown initially on the KU). Type coordinates **40RDQ08319980** on the KU, then press ENTER.
    i) The target’s elevation given by the JTAC was **23** ft MSL (Mean Sea Level). Type target elevation (**23**) in feet, then press ENTER.





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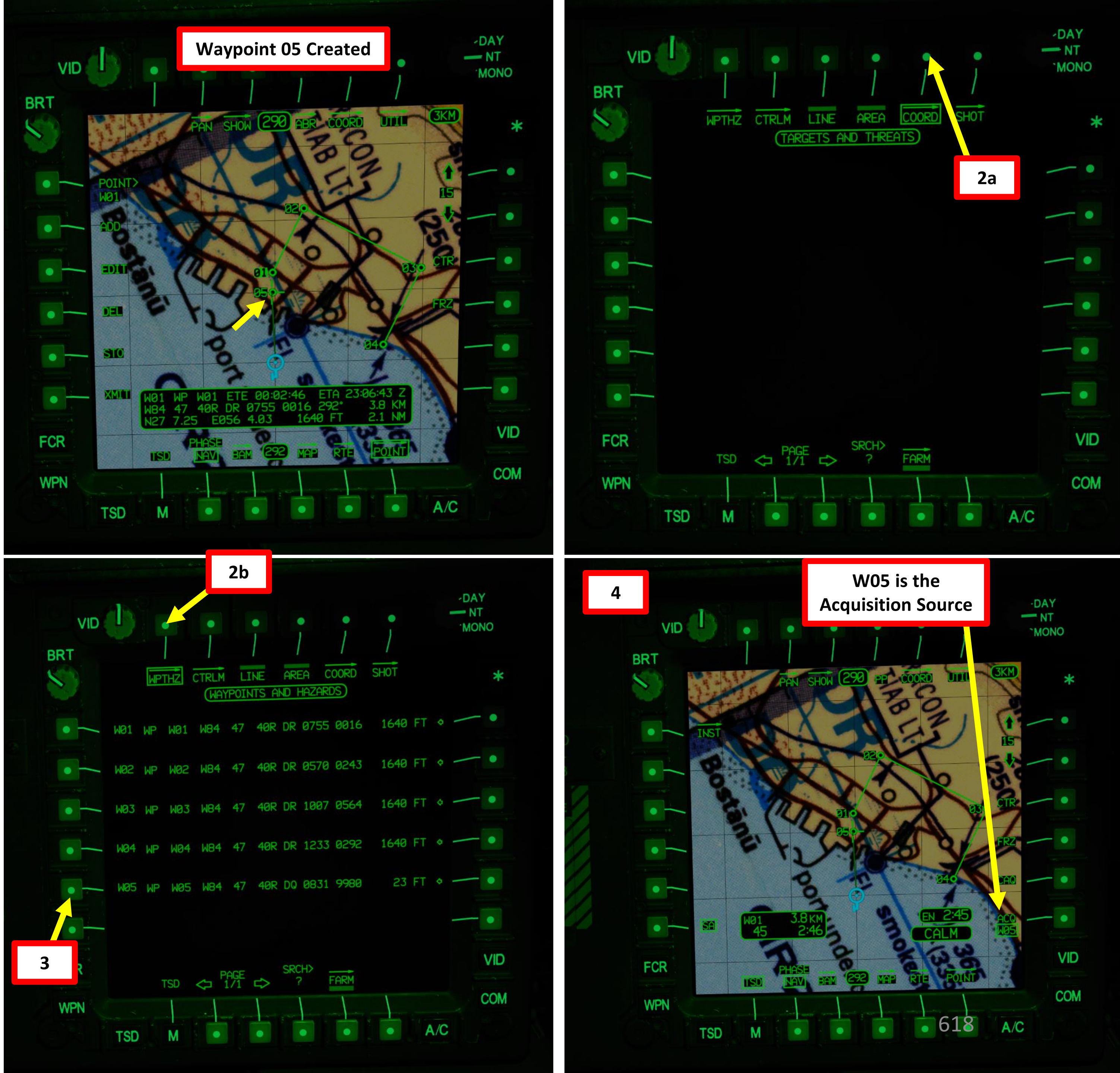
B – Enter Target Coordinates in a Waypoint

2. *[CPG]* From the WPN or TSD page, press VAB (Variable Action Button) next to COORD (Coordinates). Then, press VAB next to the relevant waypoint/target category, which is WPTHZ since we want to select a waypoint (WPTHZ for Waypoints and Hazards, CTRLM for Control Measures).
   - If targets are already stored, entering the COORD page will display existing TARGETS AND THREATS (T01, T02, etc.)
3. *[CPG]* Press VAB next to desired waypoint you want to use as an acquisition source; we will select Waypoint W05.
4. *[CPG]* Waypoint 05 will come the acquisition source, which the TADS (Target Acquisition & Designation Sight) can slave to.



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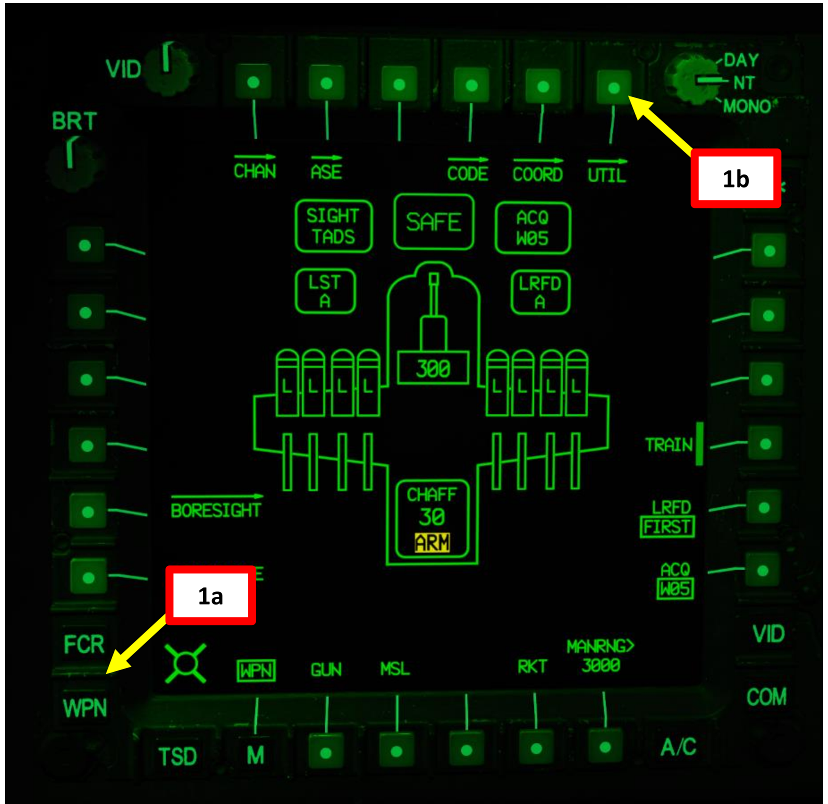
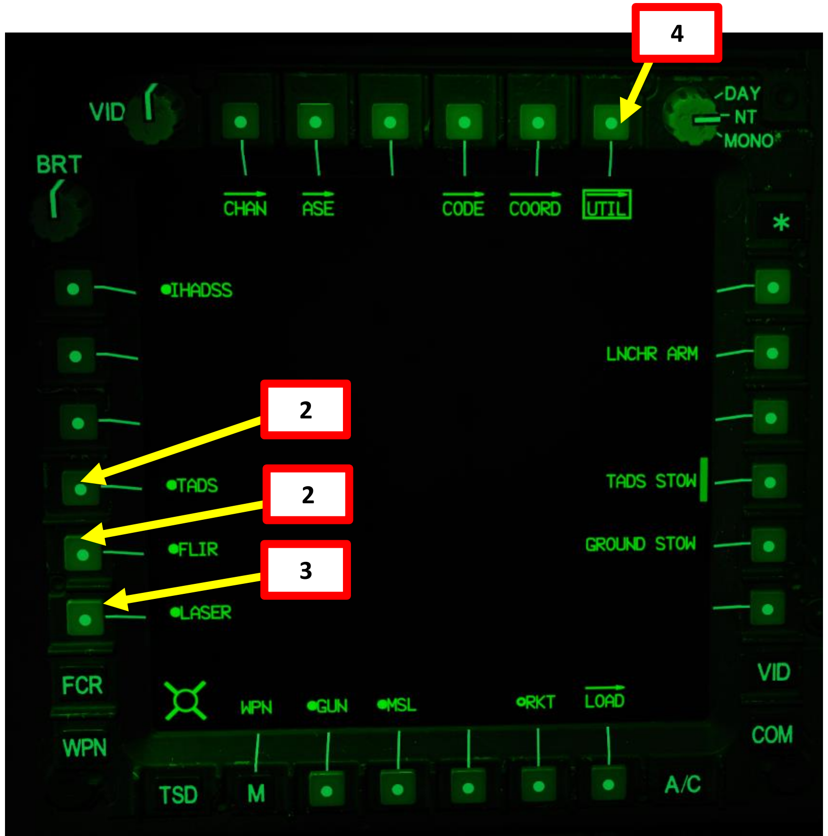
C – Missile & TADS Setup

1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
    - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
    - Hollow circle means OFF. Solid Circle means ON.
    - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





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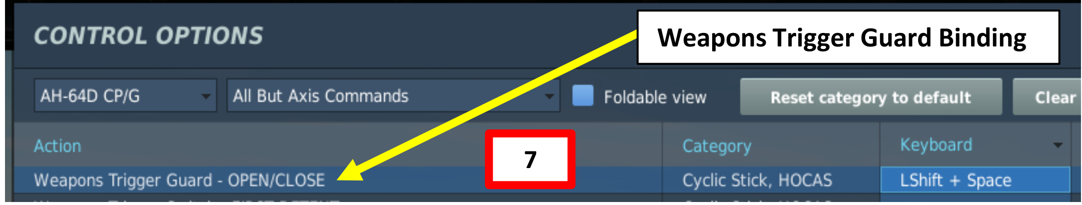
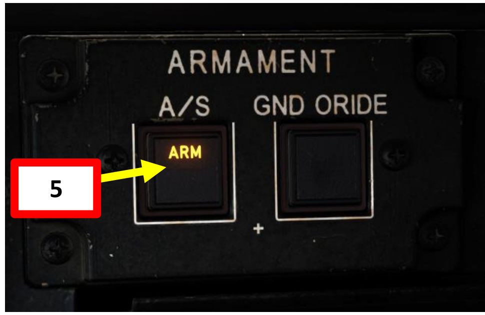
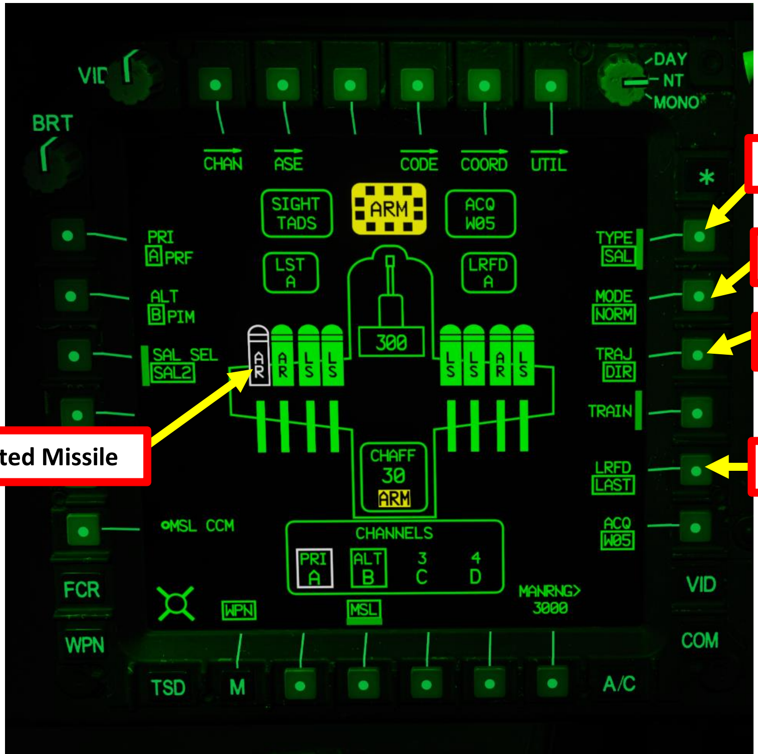
C – Missile & TADS Setup

5. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
6. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
7. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the "Weapons Trigger Guard – OPEN/CLOSE" to a binding easy to remember like "LSHIFT+SPACEBAR".
   - This step is not required if the "Weapons Trigger Guard Enable Special Option" is disabled (unticked).
8. *[CPG]* Set Missile Type to SAL (Semi-Active Laser).
9. *[CPG]* Set Missile mode to NORMAL.
10. *[CPG]* Set Missile trajectory to DIR (Direct).
11. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Mode Selector – As required. I typically set it to LAST.





Weapon Action Switch (WAS) 6
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*



TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

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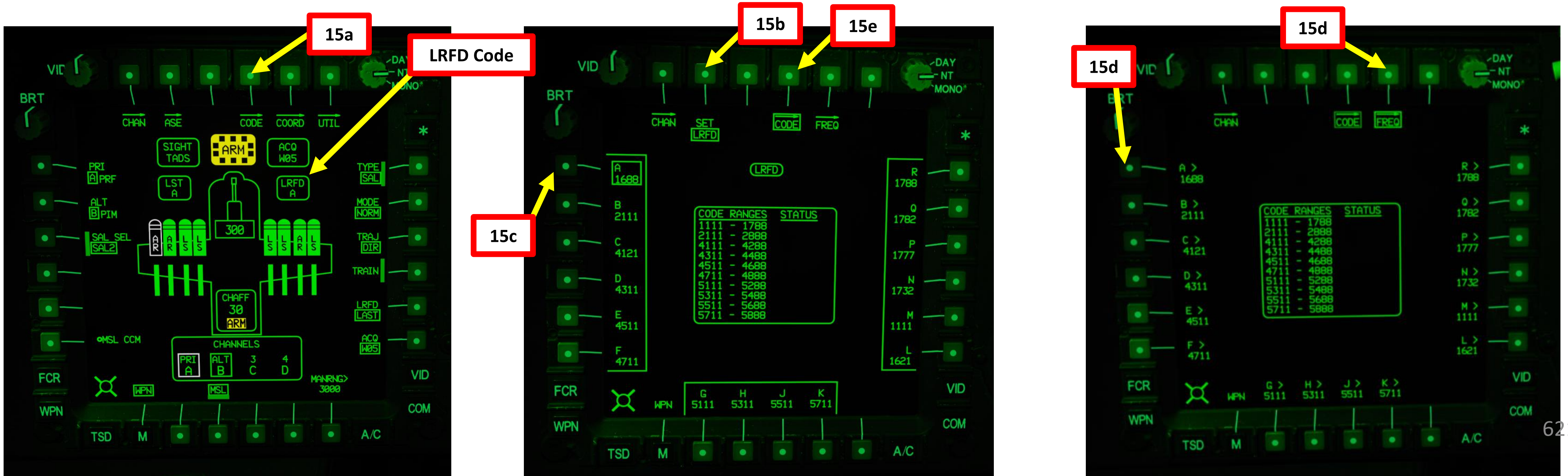
C – Missile & TADS Setup

12. In this tutorial, we will designate the target with the LRFD (Laser Rangefinder & Designator) of the TADS (Target Acquisition & Designation Sight); its designation laser code is set to preset A (1688).
13. Missile Channel 1 is set as the Priority (PRI) Channel with a laser code set to preset A (1688).
14. Missile Channel 2 is set as the Alternate (ALT) Channel with a laser code set to preset B (2111) in case a wingman designates a target for you and you want the missile seeker to track your wingman's laser.
15. *[CPG]* Set LRFD (Laser Rangefinder/Designator) Laser code to preset A. To change your LRFD laser code:
    a) Press VAB (Variable Action Button) next to CODE
    b) Select LRFD using VAB next to SET LRFD/LST to toggle between LRFD and LST.
    c) Select preset laser code A using appropriate VAB.
    d) If you want to change the laser code associated with preset code A, press VAB next to FREQ (Frequency), press VAB next to preset code "A", type the code on the KU (Keyboard Unit), then press ENTER on the KU.
    e) Exit CODE sub-page by pressing VAB next to CODE



4 – AGM-114 HELLFIRE MISSILE
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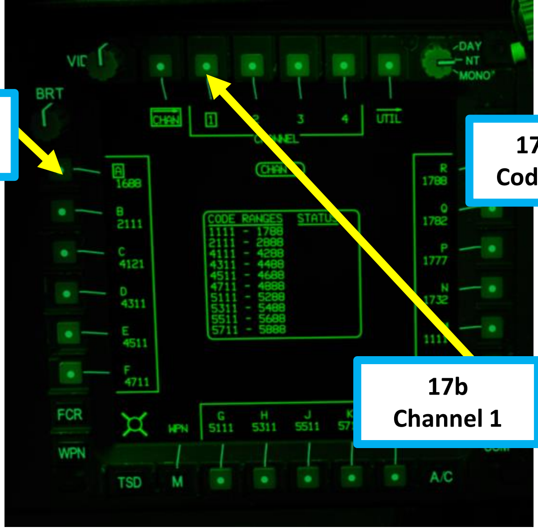
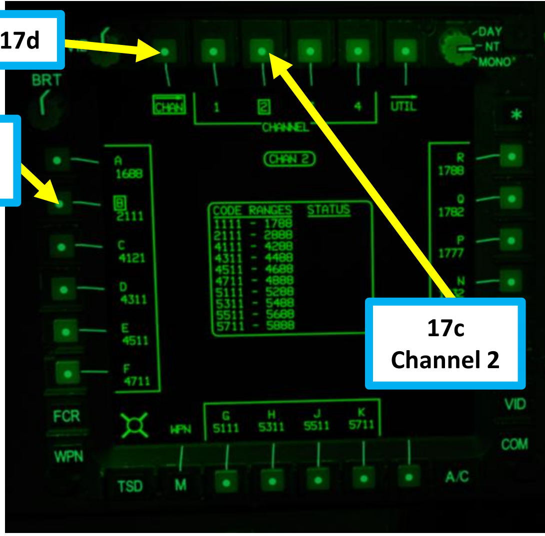
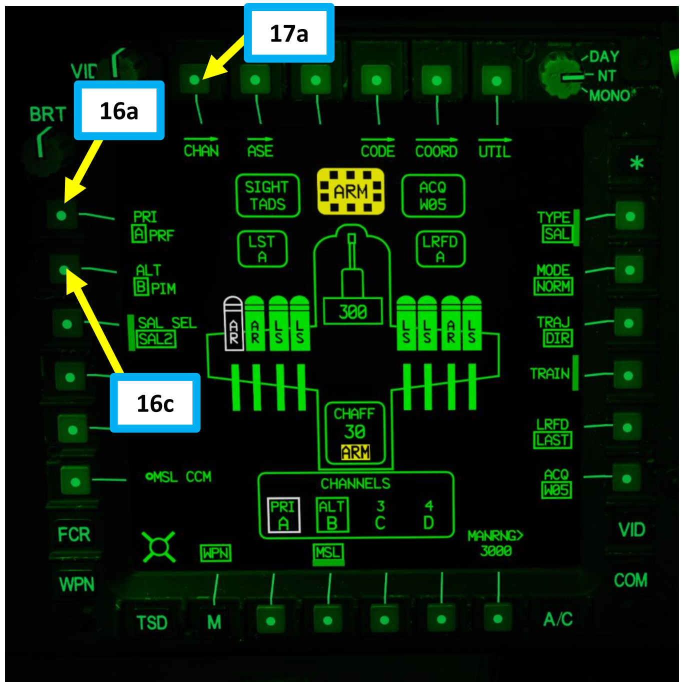
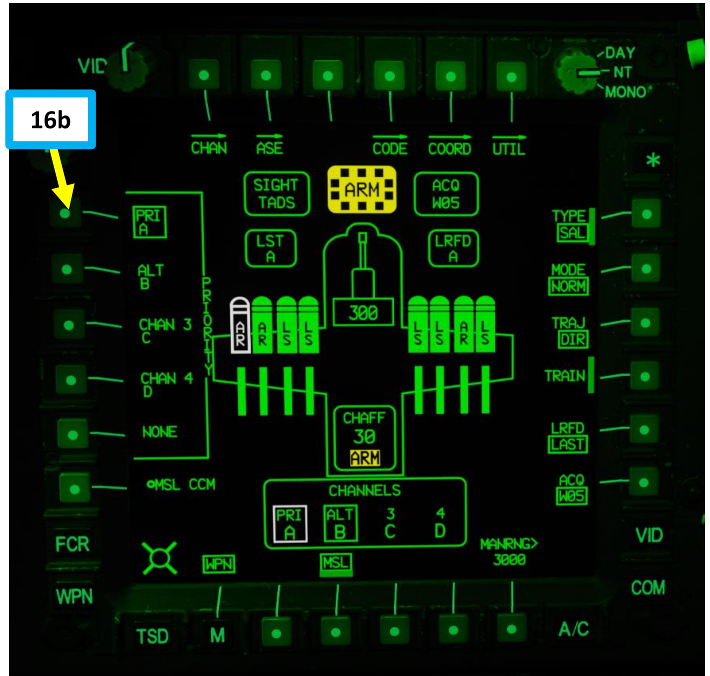
C – Missile & TADS Setup

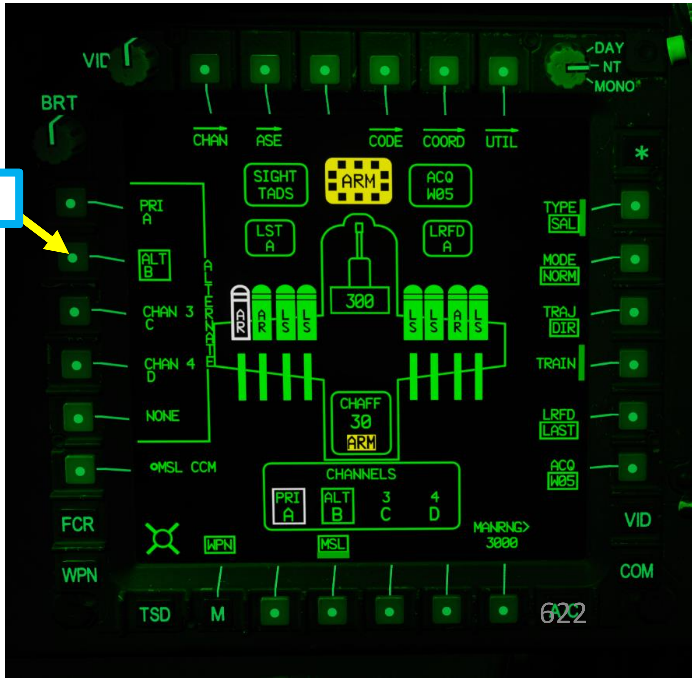
16. *[CPG]* Set Missile Priority Channel to Channel 1 and set Missile Alternate Channel to Channel 2.
    a) Press VAB (Variable Action Button) next to PRI (Priority)
    b) Press VAB next to A.
    c) Press VAB next to ALT (Alternate)
    d) Press VAB next to B.
17. *[CPG]* Set Missile Channel 1 (set to Priority) to laser preset code A (1688) and set Missile Channel 2 (set to Alternate) to laser preset code B (2111).
    a) Press VAB next to CHAN (Channel)
    b) Press VAB next to Channel 1, then press VAB next to laser preset code A
    c) Press VAB next to Channel 2, then press VAB next to laser preset code B
    d) Exit CHAN sub-page by pressing VAB next to CHAN











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C – Missile & TADS Setup

18. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
19. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the “IHADSS Show” binding, which is “i” by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “C-HMD”.
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

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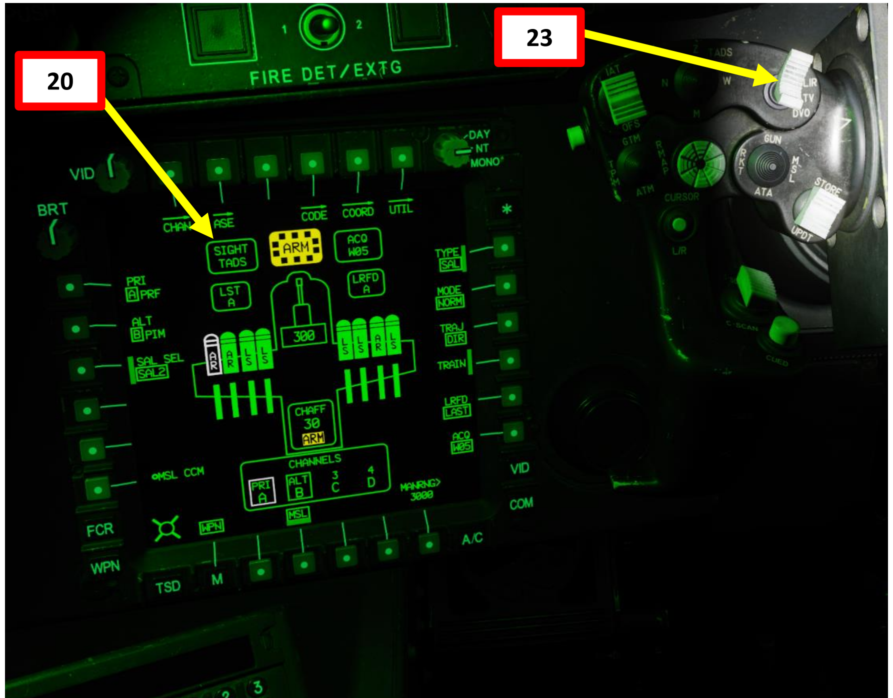
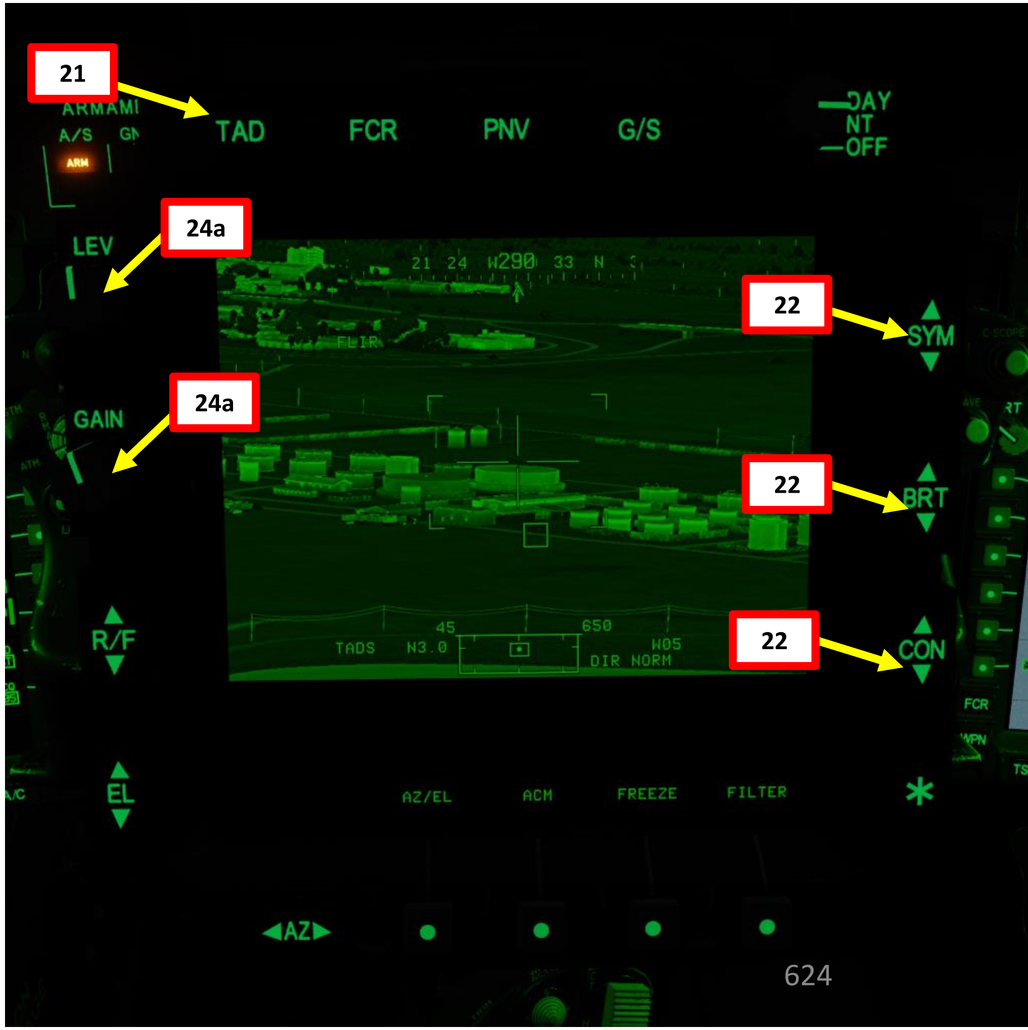
C – Missile & TADS Setup

20. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
21. *[CPG]* Select TADS video feed source by pressing the TAD button.
22. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
23. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
24. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.





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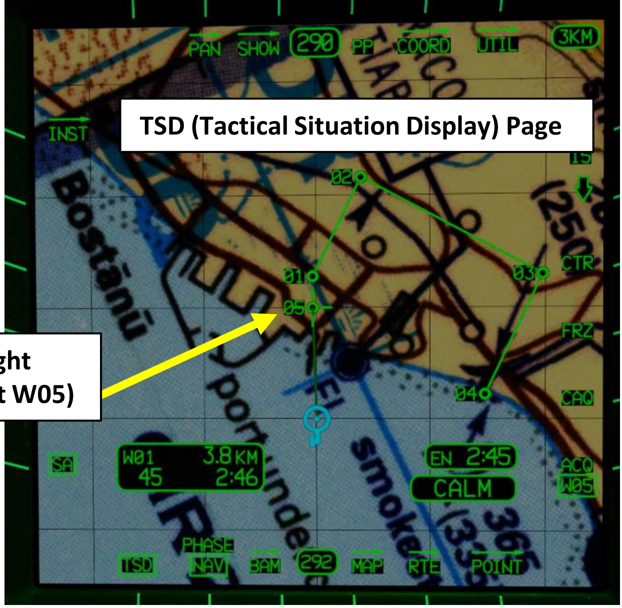
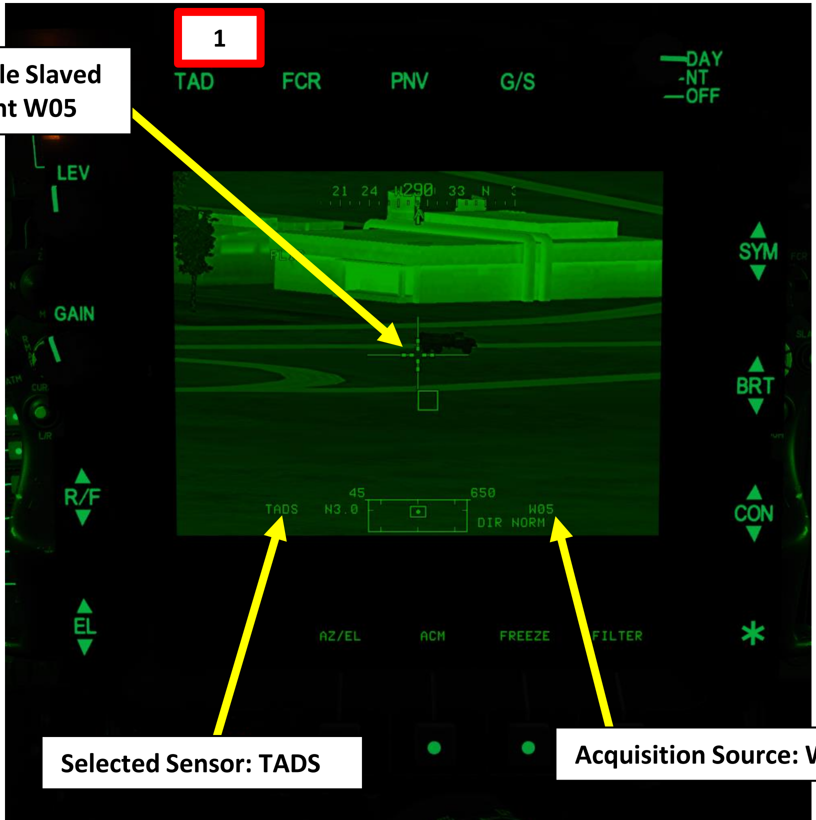
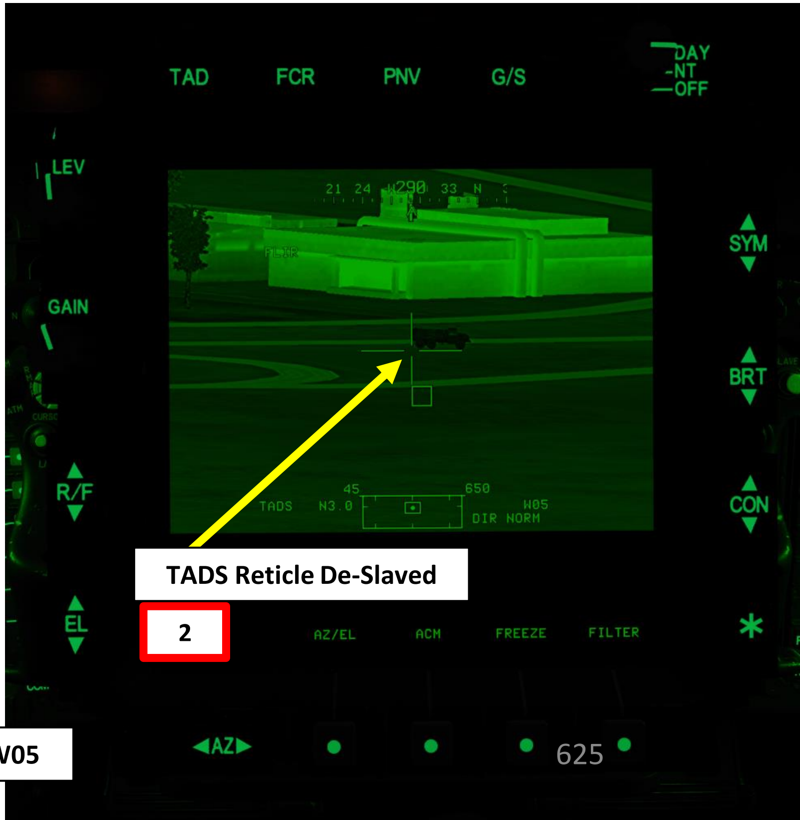
D – Slave TADS to Waypoint and Designate Target

1. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then slave the TADS to the selected waypoint (W02).
    - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input will not be able to move the TADS line-of-sight.
2. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to "de-slave" the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input to make adjustments to the TADS line-of-sight if required.







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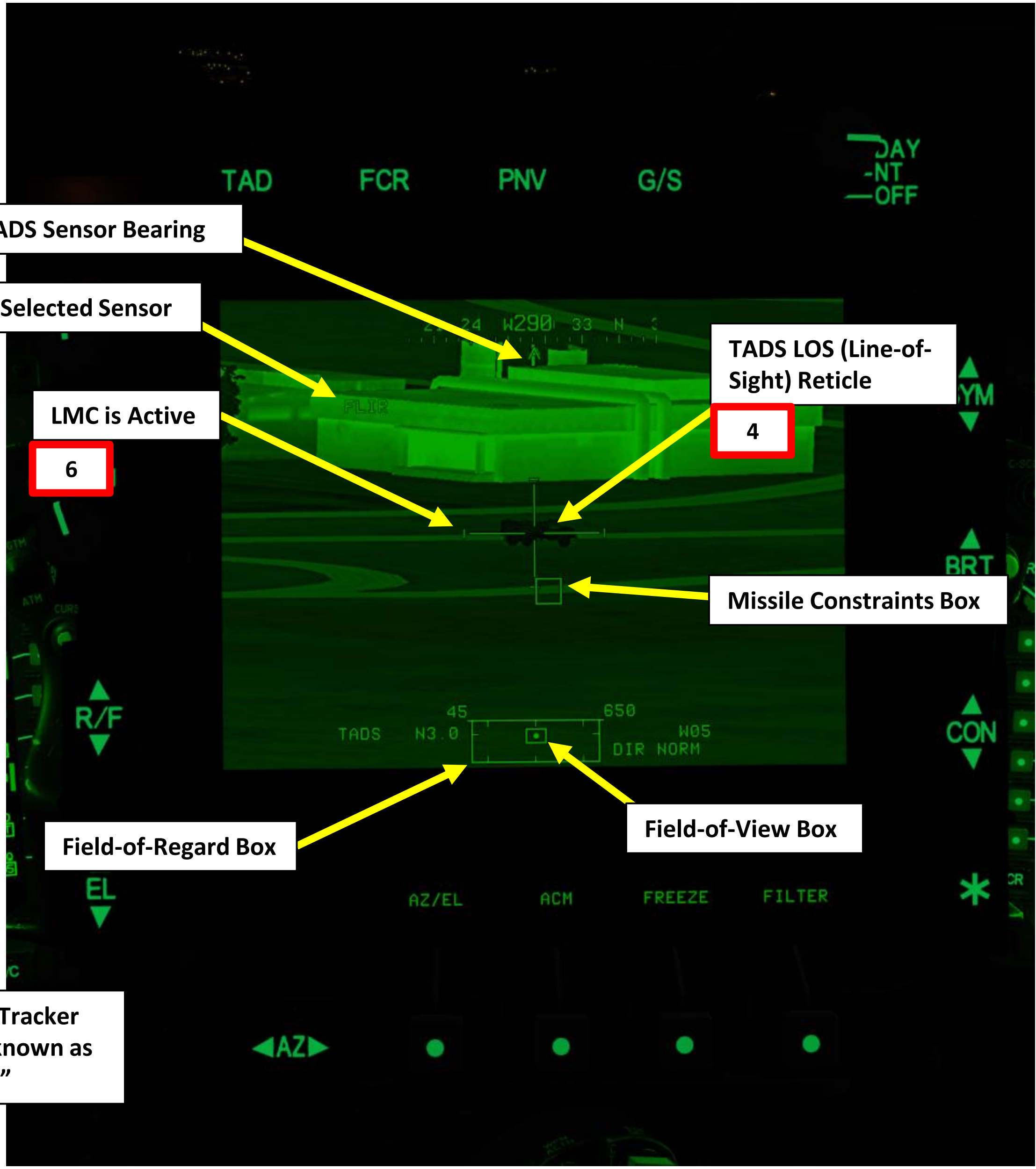
D – Slave TADS to Waypoint and Designate Target

3. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
4. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
5. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
6. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).



4 – AGM-114 HELLFIRE MISSILE

4.2 – Laser-Guided Hellfire (AGM-114K)

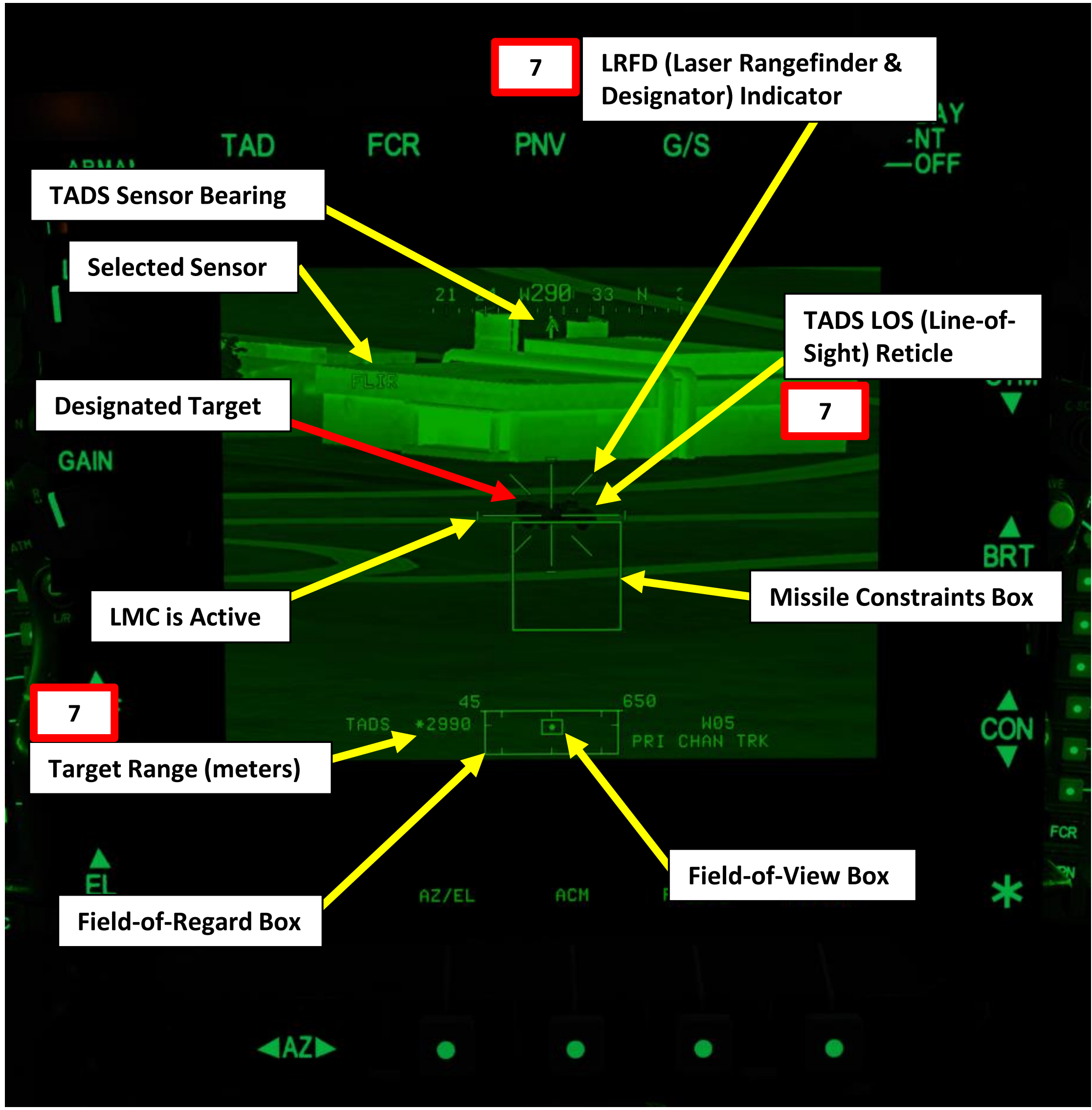
4.2.1 – Missile Operation by Multicrew

4.2.1.4 – Operating with a JTAC/AFAC

4.2.1.4.2 – Using Coordinates + IR Pointer

D – Slave TADS to Waypoint and Designate Target

7. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will help you track the target more easily.
8. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase "Constraints".



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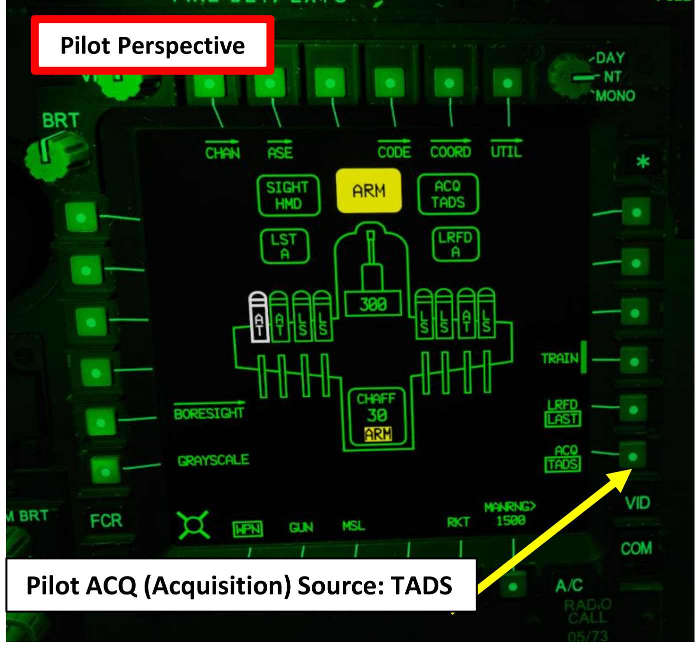
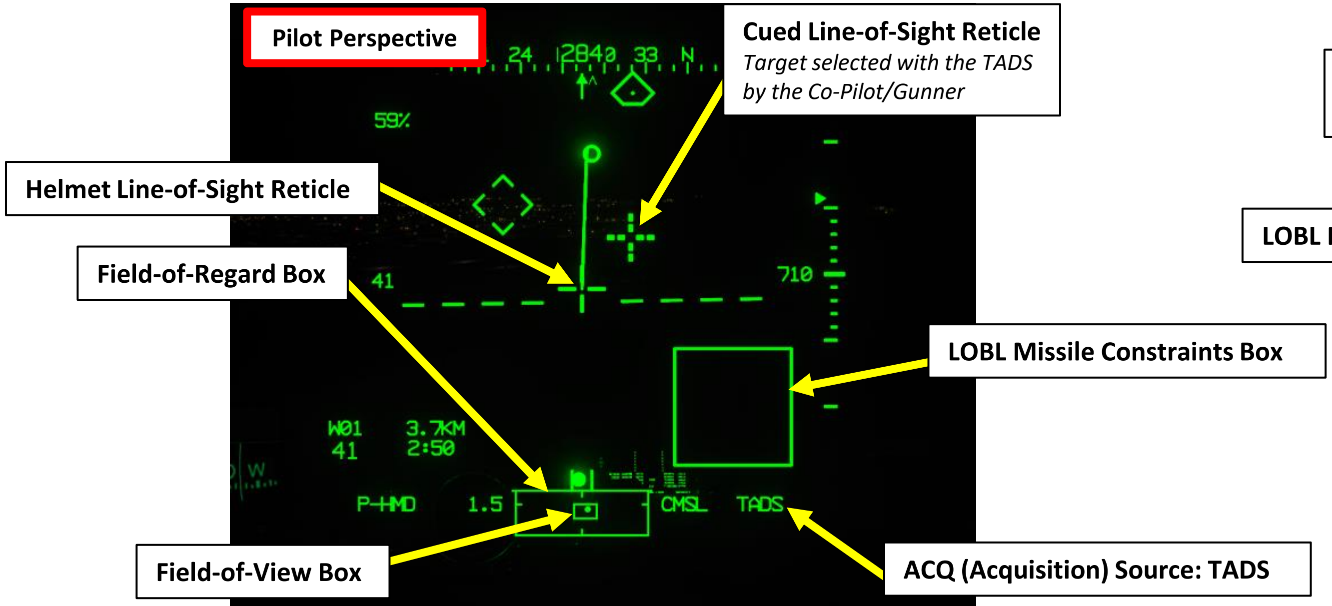
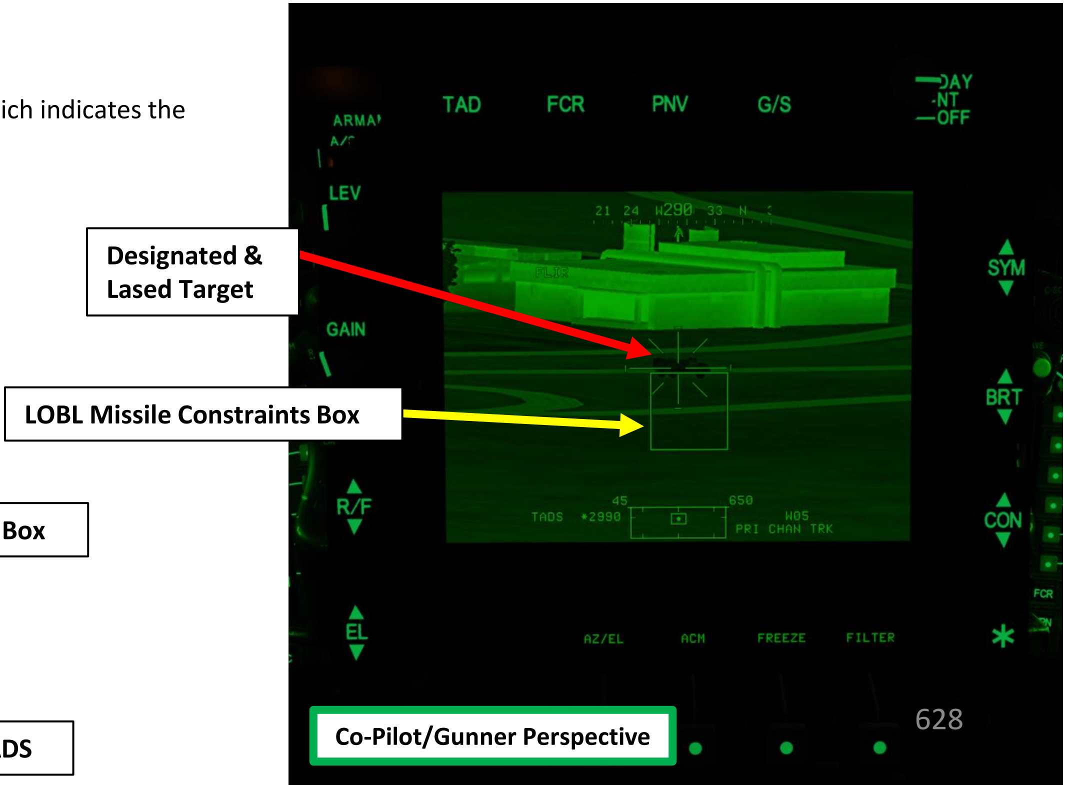
E – Perform Attack

1. *[P]* When pilot is told "Constraints" by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box, which should be big (LOBL box) and solid since the target is being actively lased by the co-pilot/gunner.
    - **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as "LOAL box" (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
    - **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as "LOBL box" (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire
2. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.







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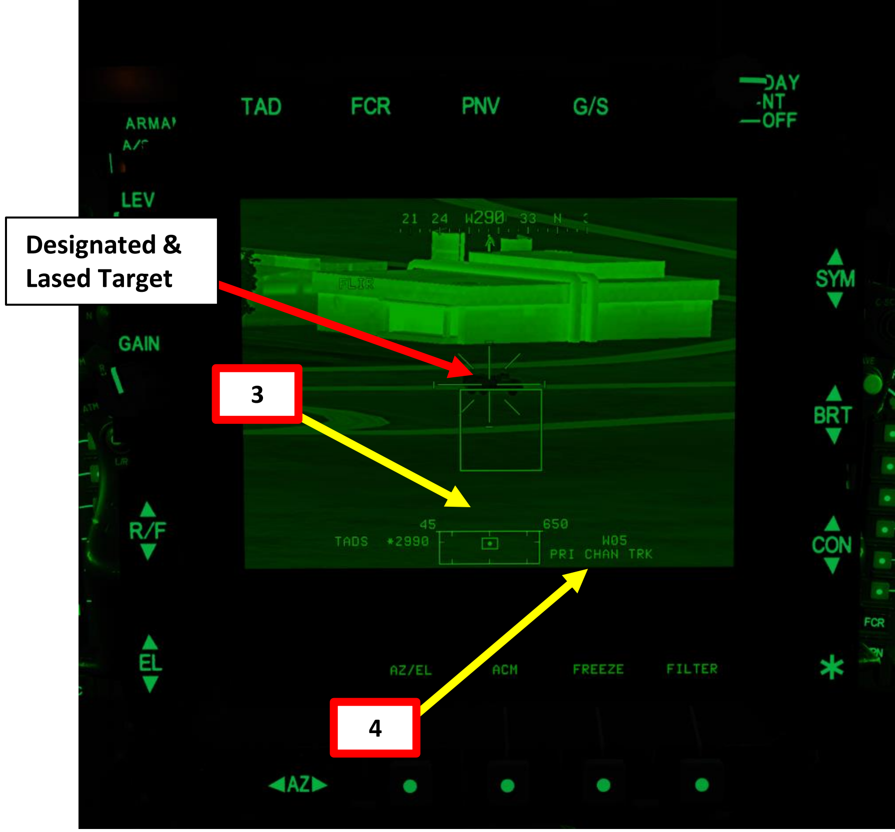
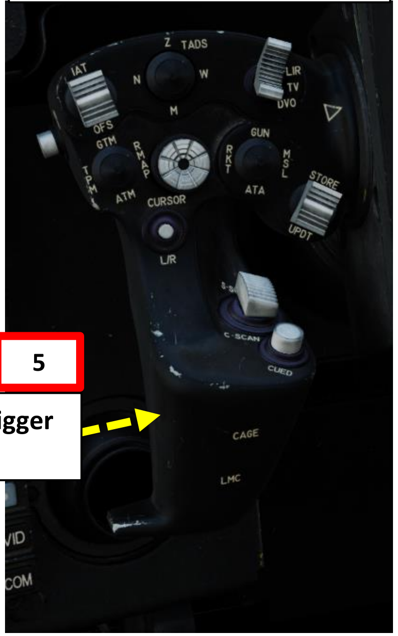
E – Perform Attack

3. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
4. *[CPG]* Verify PRI CHAN TRK is displayed in the High Action Display. This means the missile is tracking the priority channel.
5. *[CPG]* While target is being lased with the TEDAC Right Hand Grip LRFD Trigger, fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.



TEDAC LHG (Left Hand Grip)



5

TEDAC LHG Weapon Trigger (opposite side of grip)

TEDAC RHG (Right Hand Grip)

TEDAC RHG LRFD (Laser Rangefinder & Designator) Trigger (opposite side of grip)

4 – AGM-114 HELLFIRE MISSILE
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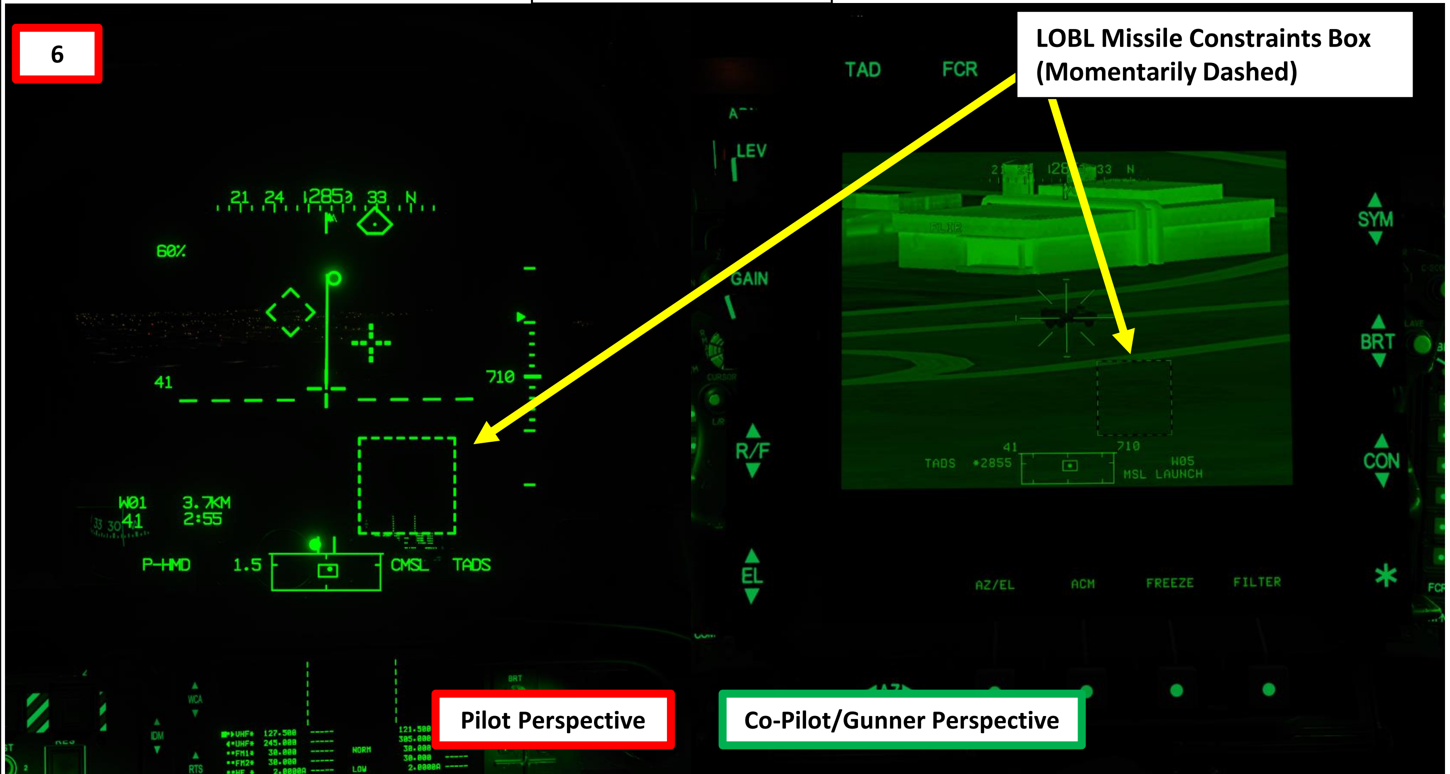
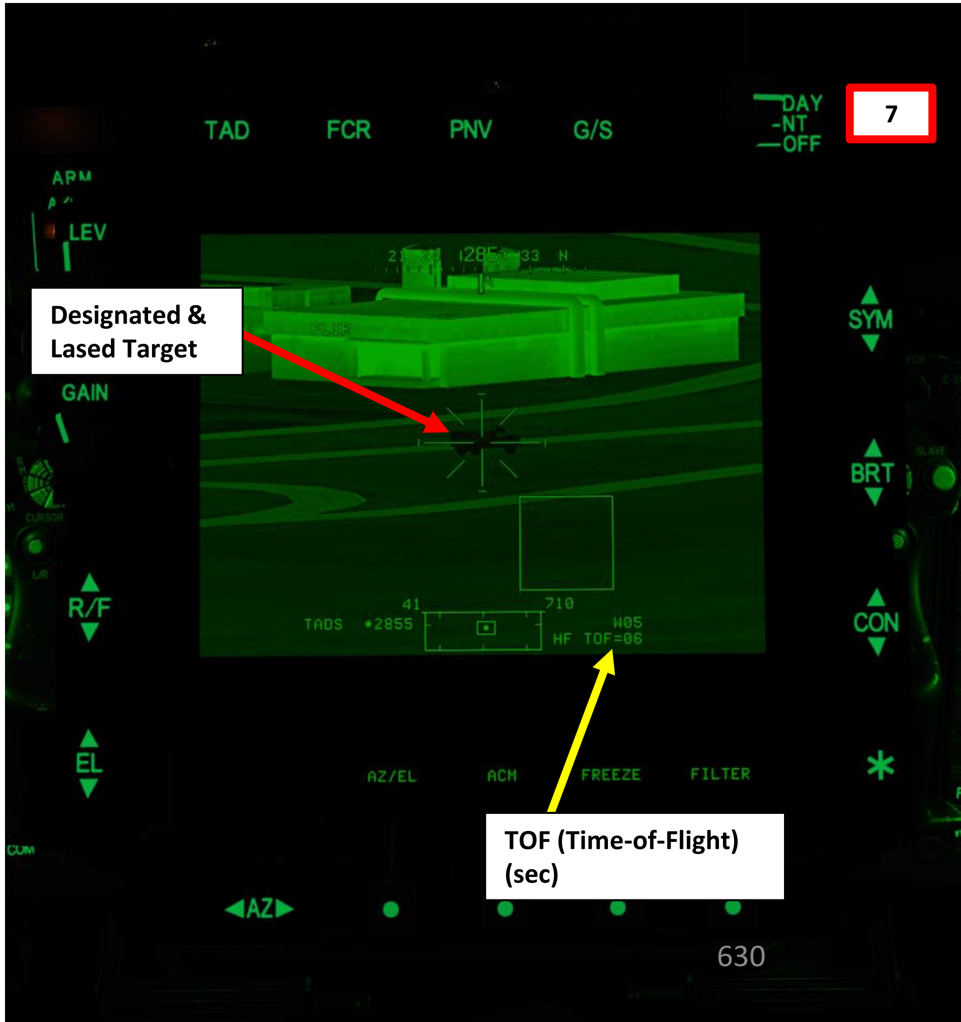
E – Perform Attack

6. *[CPG]* The missile will track the laser until impact. Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected) and a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.
7. *[CPG]* Ensure continuous laser designation is provided on the intended target for the duration of the missile flight time until impact is observed.

Missile Launching





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E – Perform Attack

8. *[CPG]* If target is destroyed and LMC (Linear Motion Compensator) has been engaged, on TEDAC Left Hand Grip, press LMC Button again to disengage LMC.

TEDAC LHG (Left Hand Grip)

LMC (Linear Motion Compensator) Button (Opposite Side)

4 – AGM-114 HELLFIRE MISSILE
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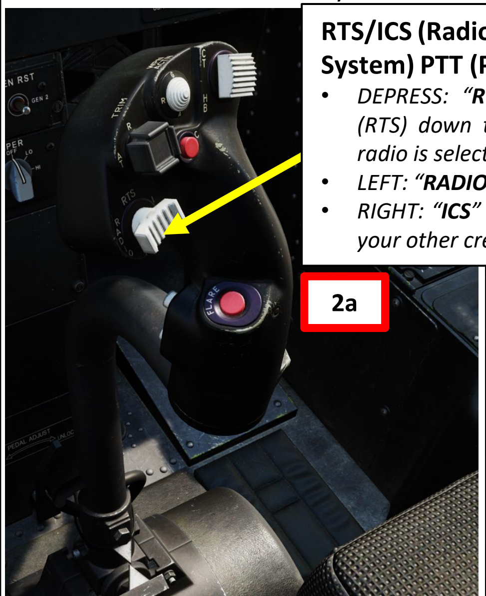
4.2.1.4.3 – Using Laser Designation

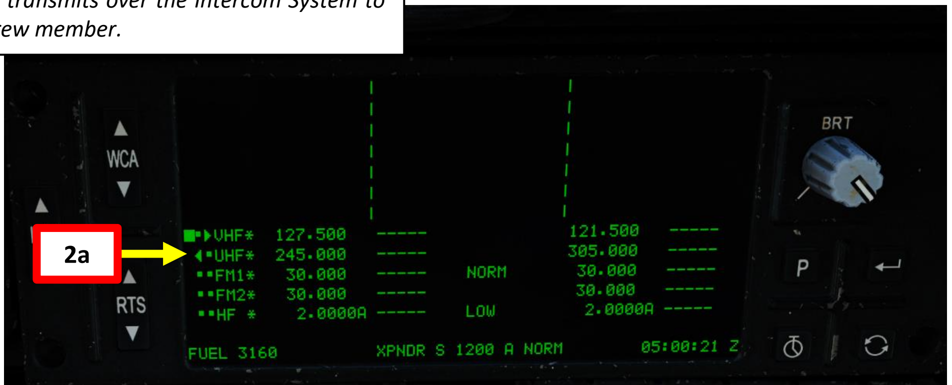
A – Contact JTAC

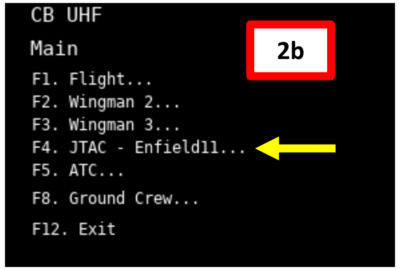
1. Set required JTAC frequency with radio (ARC-164(V) UHF AM in this example). Frequency is set to 245.00 MHz AM).
2. Depress PTT/RTS (Push-to-Talk Radio Transmit Select) Switch to select desired radio (ARC-164(V) UHF AM). Communicate on UHF AM radio with PTT/RTS LEFT and select JTAC – Enfield11 (F4) in radio menu.
3. Select "CHECK-IN 15 MIN" (F1)
4. You will contact the JTAC and give him your altitude and ordnance available, plus your time available on station.
5. JTAC will answer "Type 2 in effect" and ask you when you are ready to receive a 9-line.
6. Select "READY TO COPY" (F1) to receive 9-line.
7. The JTAC will give you the 9-line and ask you when you are ready for remarks.
8. Select "READY TO COPY REMARKS" (F1)
9. JTAC will give you remarks.
10. Select "9-LINE READBACK" to repeat the information you have been given and confirm it with the JTAC.
11. JTAC will confirm your readback, send you a JTAC transmission and clear you to engage target.

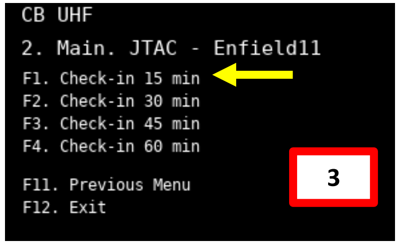


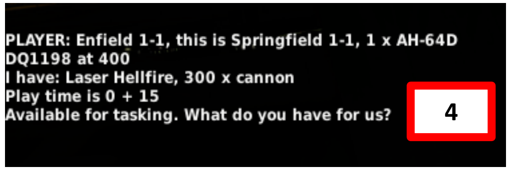
RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch

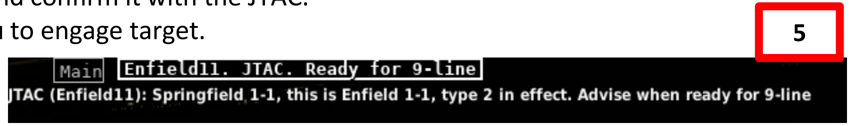
- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

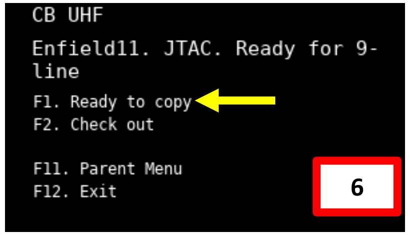


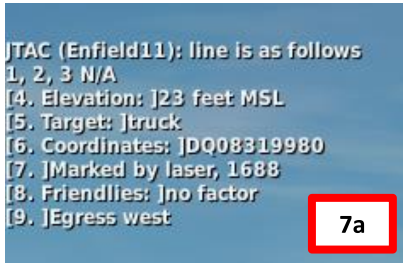


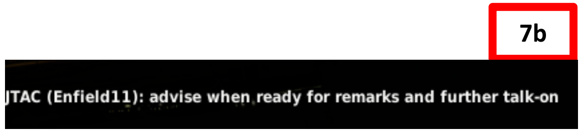


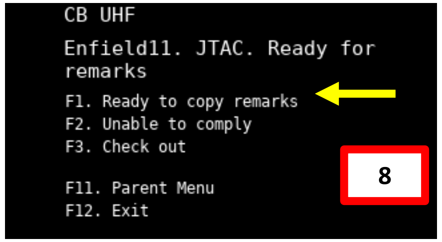


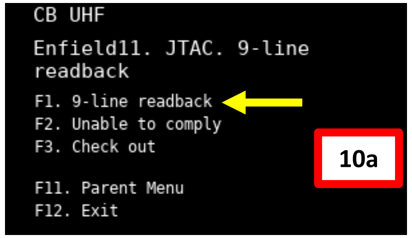








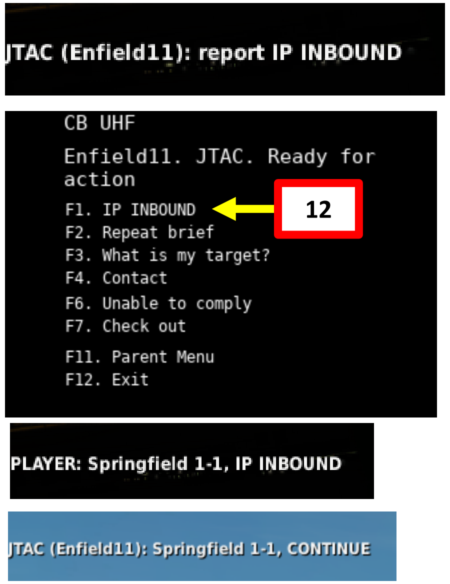




4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.1 – Missile Operation by Multicrew
4.2.1.4 – Operating with a JTAC/AFAC
4.2.1.4.3 – Using Laser Designation

A – Contact JTAC

12. The JTAC will request you to report to the IP (Initial Point). Use F1 (IP INBOUND) when reaching the IP and you are ready to perform the attack.
13. Use F1 (LASER ON) to request the JTAC to lase target.
14. The JTAC will start lasing the target.



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A – Contact JTAC

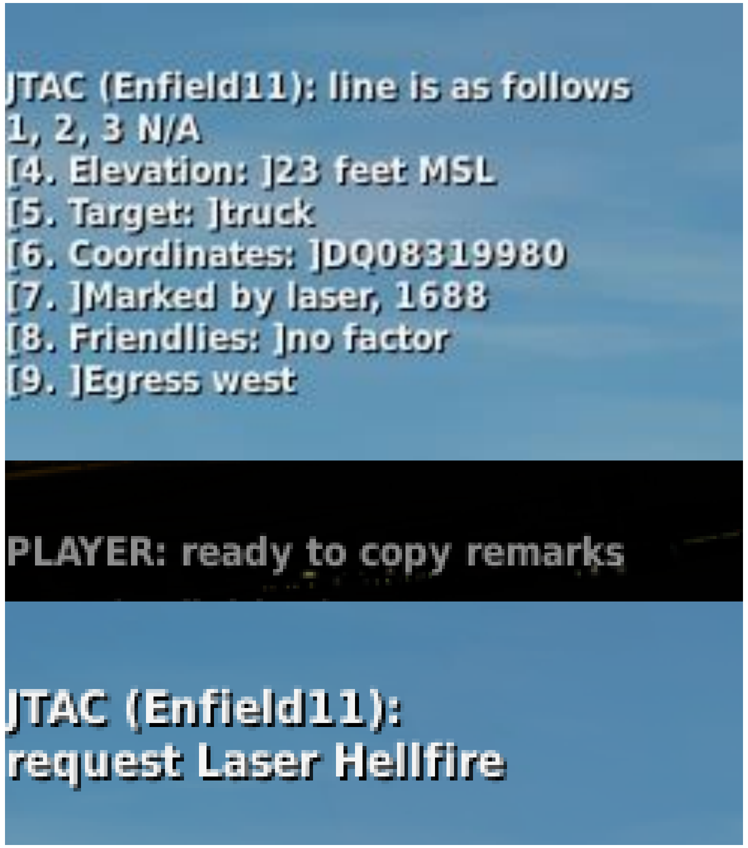
What is a CAS (Close Air Support) 9-line and why is it important? The goal of a 9-line is to provide you as much information as concisely as possible.

9-line

Line 1: IP/BP – Initial Point/Battle Position (N/A in our case)
Line 2: Heading from the IP to the Target (N/A in our case)
Line 3: Distance from the IP/BP to target (N/A in our case)
Line 4: Target elevation – 23 feet above Mean Sea Level (MSL)
Line 5: Target description: Truck.
Line 6: Target location: Grid coordinates of target (UTM coordinates DQ08319980)
Line 7: Target Mark Type: Marked by laser with a laser code of 1688
Line 8: Location of Friendlies: No friendlies on the ground nearby, no factor
Line 9: Egress semi-cardinal direction when departing from target: West

Remarks

Remarks generally include information about troops in contact or danger close, SEAD support in effect, hazards, weather or other threats. In our case, the JTAC wants us to use a Laser Hellfire.



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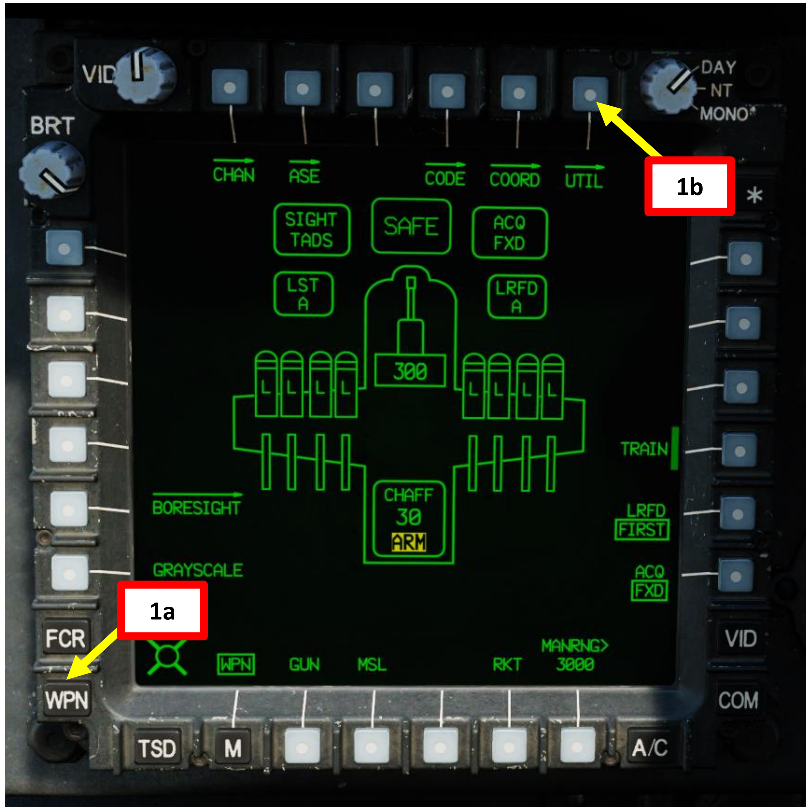
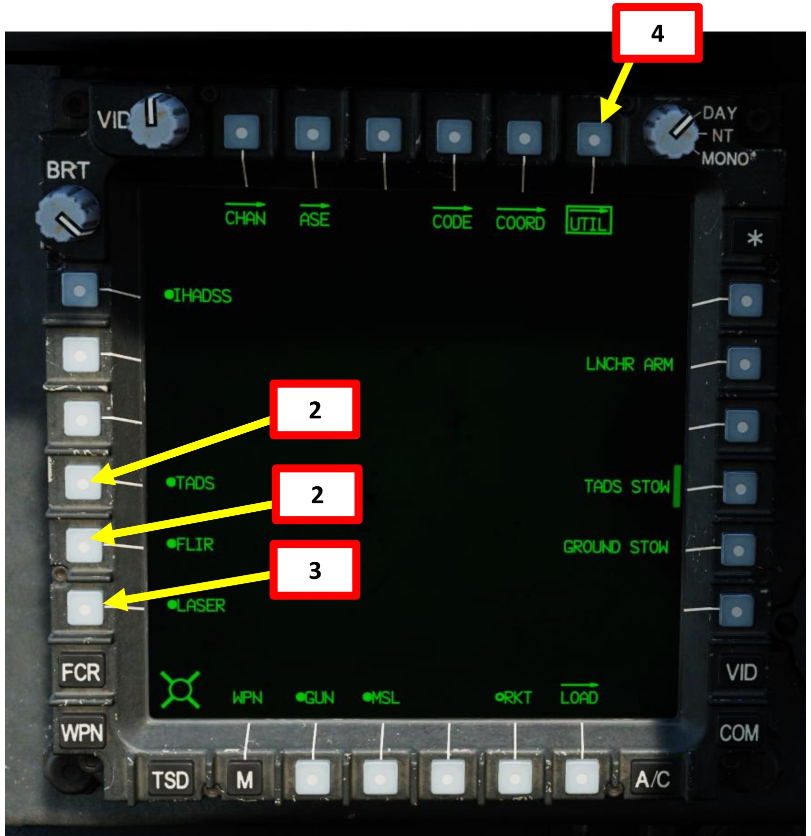
B – Missile & TADS Setup

1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
   - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
   - Hollow circle means OFF. Solid Circle means ON.
   - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





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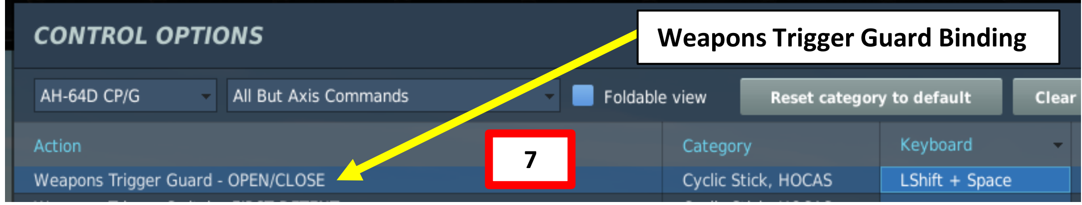
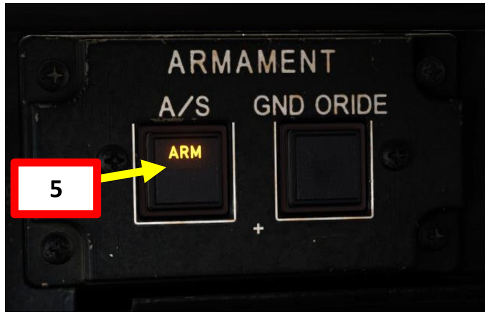
B – Missile & TADS Setup

5. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
6. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
7. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
   - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).
8. *[CPG]* Set Missile Type to SAL (Semi-Active Laser).
9. *[CPG]* Set Missile mode to NORMAL.
10. *[CPG]* Set Missile trajectory to DIR (Direct).
11. *[CPG]* Set Acquisition Source to SKR (Tracking Missile Seeker).



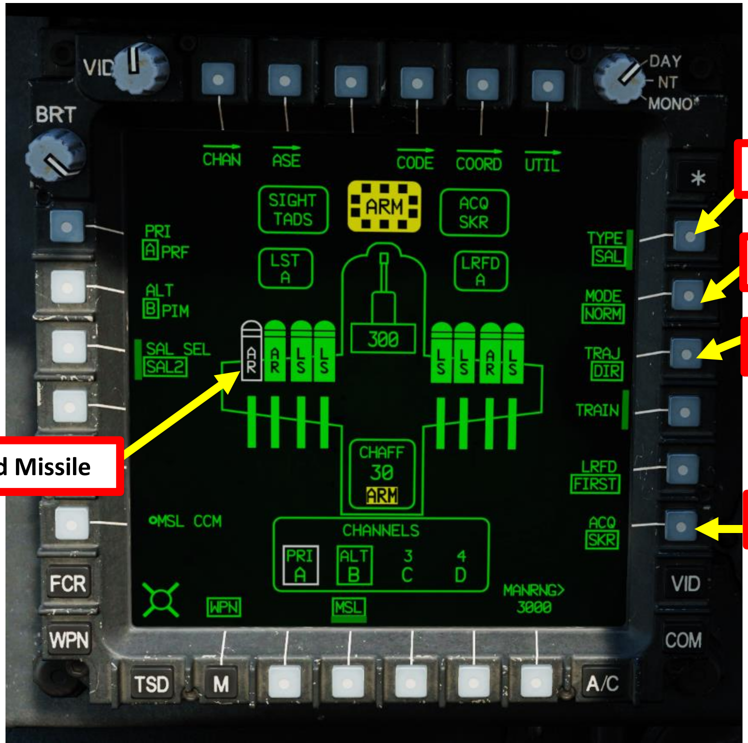


Weapon Action Switch (WAS) 6

- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

TEDAC LHG Weapon Trigger (opposite side of grip)

- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*



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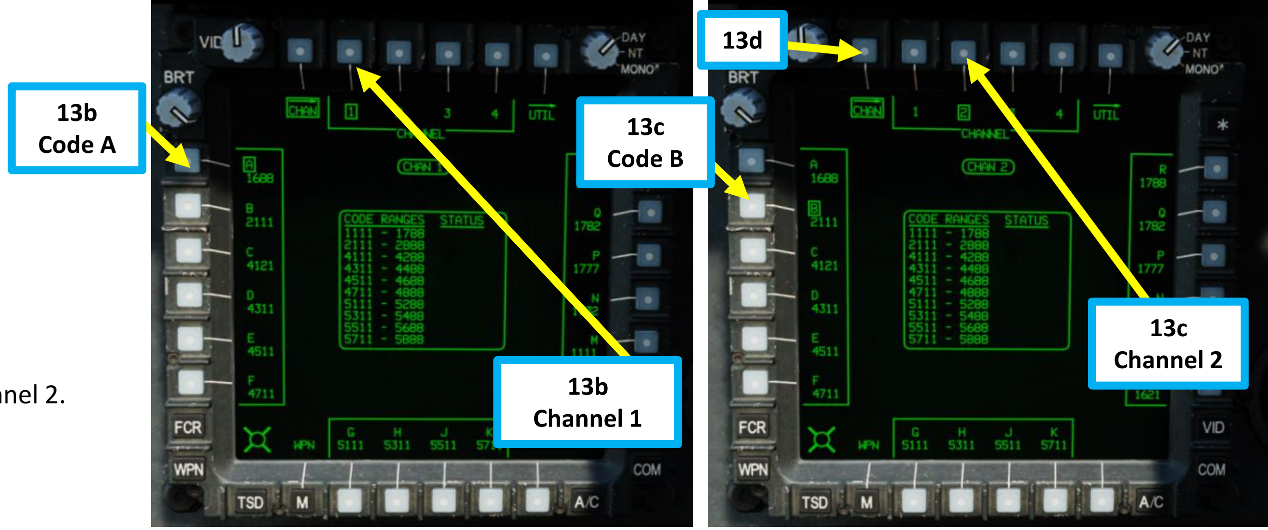
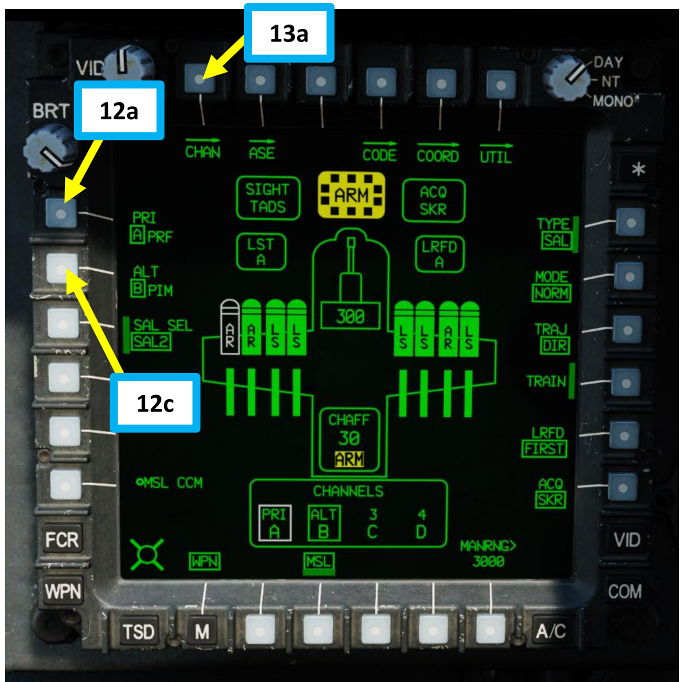
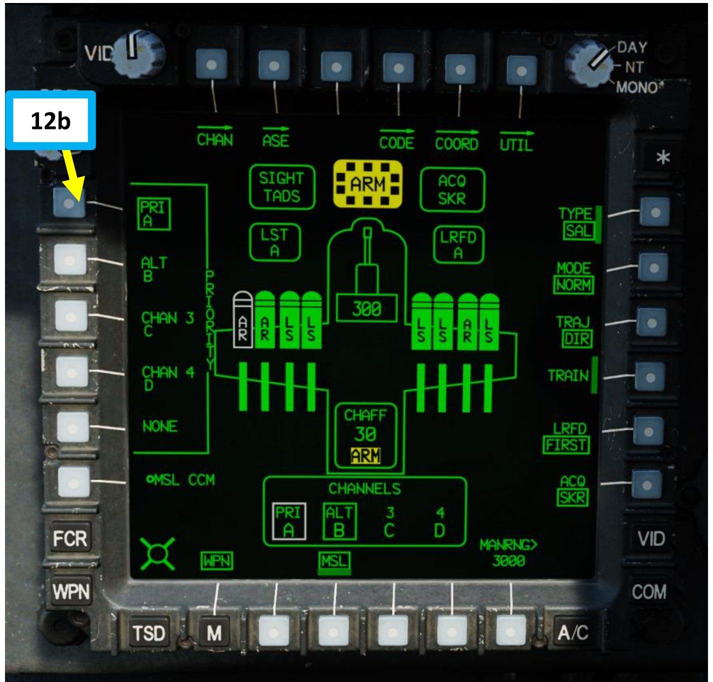
B – Missile & TADS Setup



12. *[CPG]* Set Missile Priority Channel to Channel 1 and set Missile Alternate Channel to Channel 2.
    a) Press VAB (Variable Action Button) next to PRI (Priority)
    b) Press VAB next to A.
    c) Press VAB next to ALT (Alternate)
    d) Press VAB next to B.
13. *[CPG]* Set Missile Channel 1 (set to Priority) to laser preset code A (1688) and set Missile Channel 2 (set to Alternate) to laser preset code B (2111).
    a) Press VAB next to CHAN (Channel)
    b) Press VAB next to Channel 1, then press VAB next to laser preset code A
    c) Press VAB next to Channel 2, then press VAB next to laser preset code B
    d) Exit CHAN sub-page by pressing VAB next to CHAN





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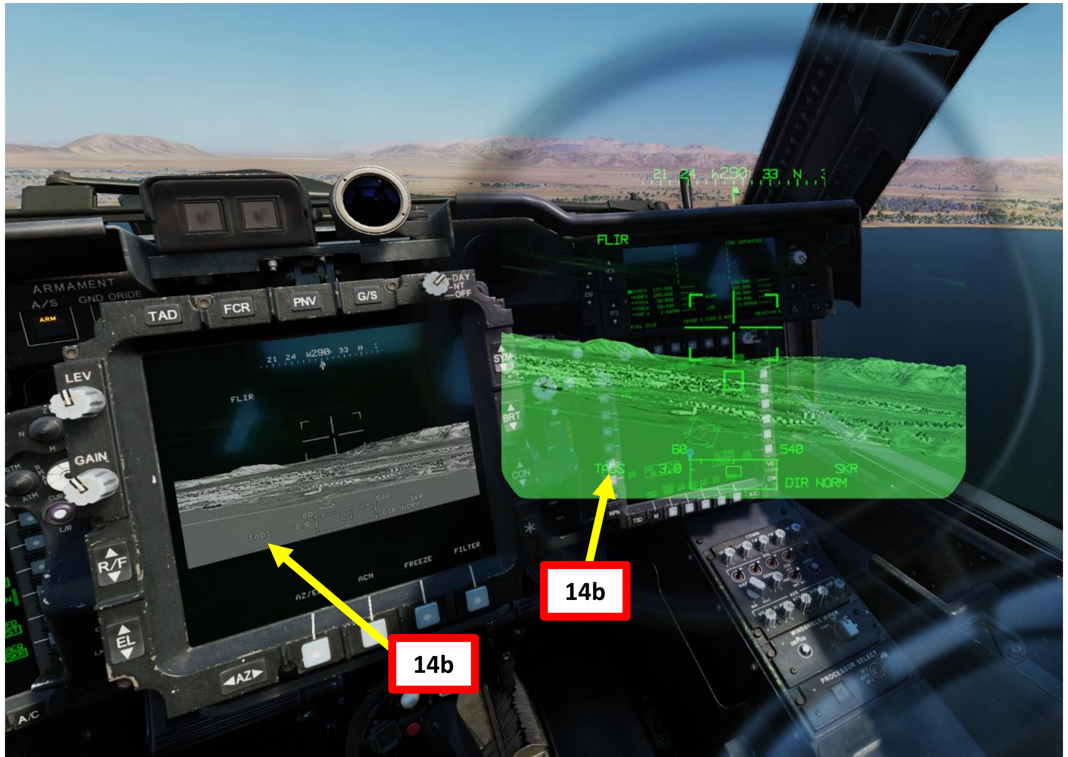
B – Missile & TADS Setup

14. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the “TADS” indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
15. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the “IHADSS Show” binding, which is “i” by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “C-HMD”.
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.



14a

TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

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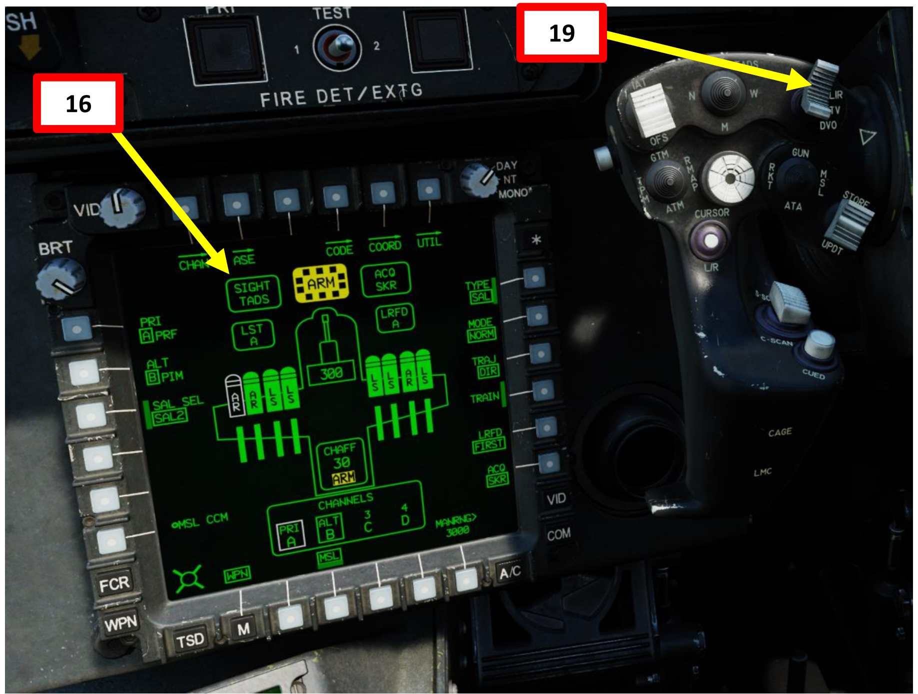
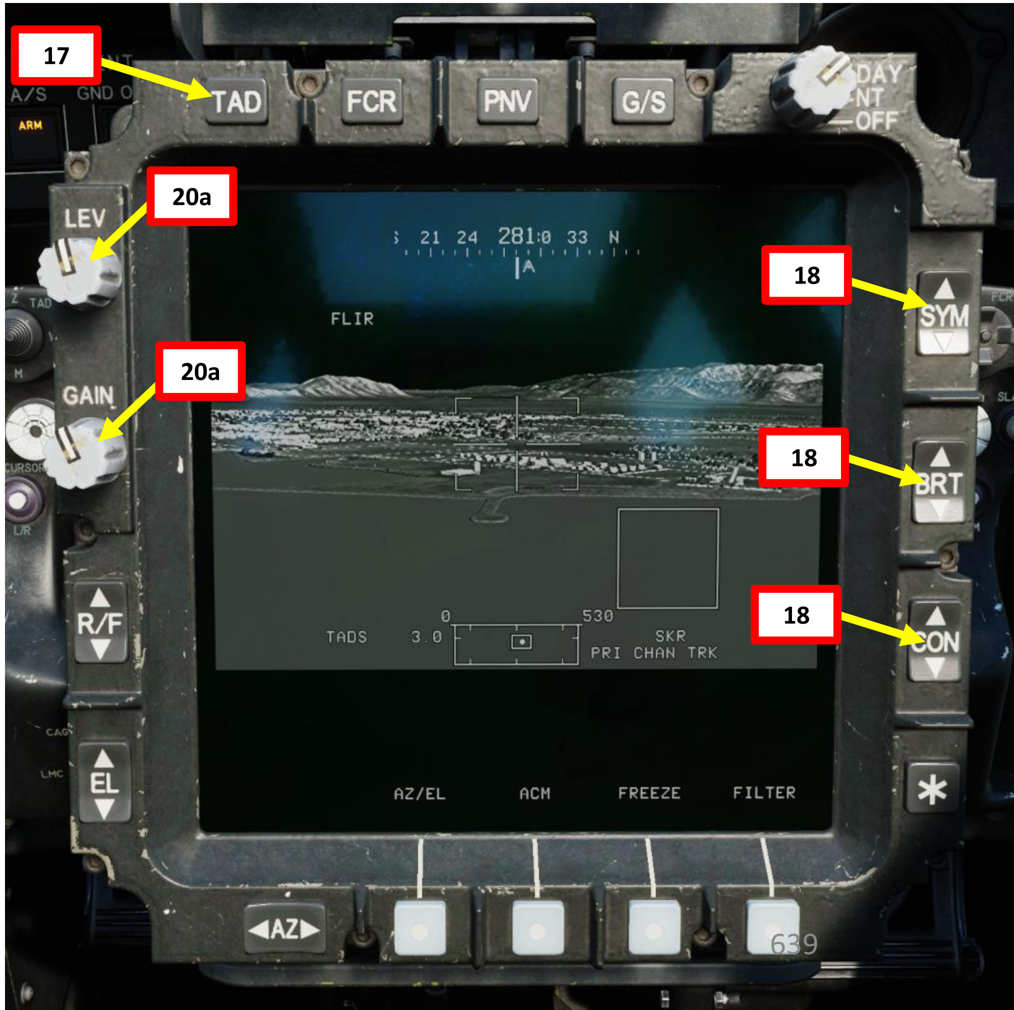
B – Missile & TADS Setup

16. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
17. *[CPG]* Select TADS video feed source by pressing the TAD button.
18. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
19. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
20. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.





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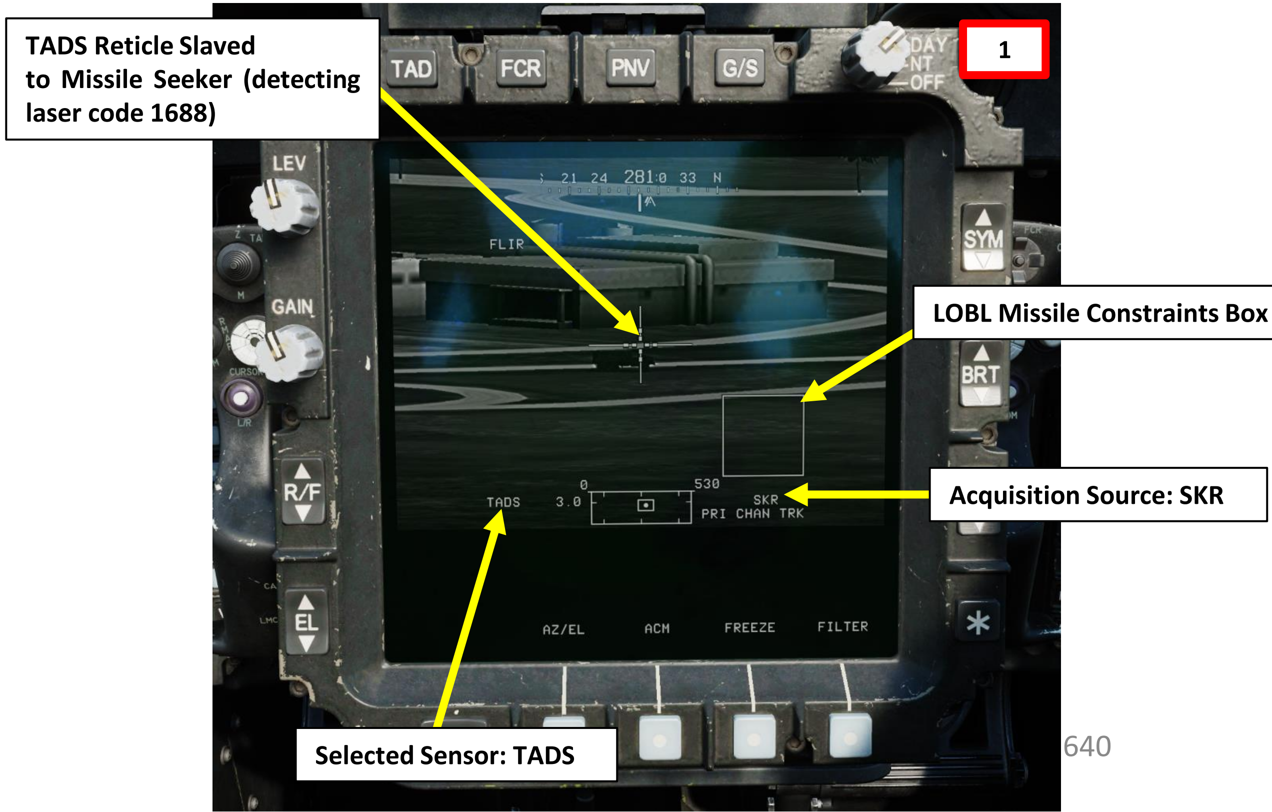
C – Slave TADS to Missile Seeker Acquisition Source

1. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button. The TADS will then be slaved to the location of the missile seeker track of a laser (if the missile seeker "spots" the laser).
   - While TADS is slaved, MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input will not be able to move the TADS line-of-sight.
2. *[CPG]* On TEDAC Right Hand Grip, press the Sight Slave Button again to "de-slave" the TADS from the target point acquisition source. This will allow you to use MAN TRK switch (Sight Manual Tracker Controller, or "Thumb Force Controller") input to make adjustments to the TADS line-of-sight if required.
3. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
4. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase "Constraints".



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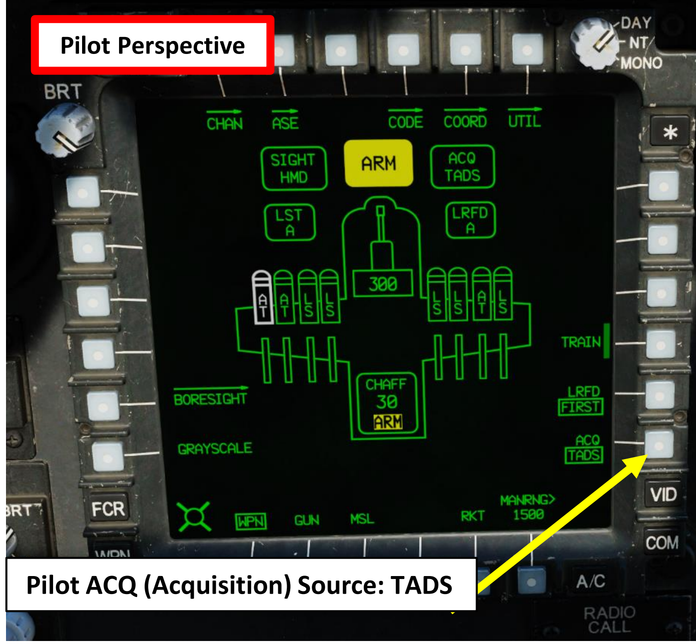
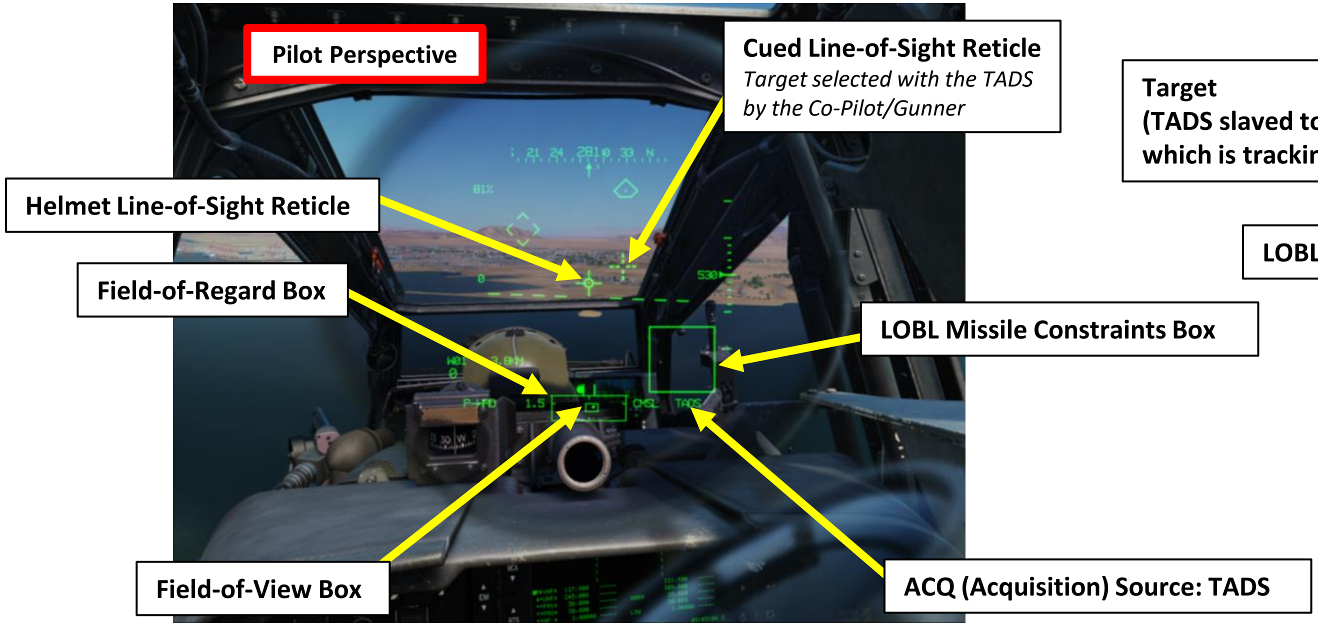
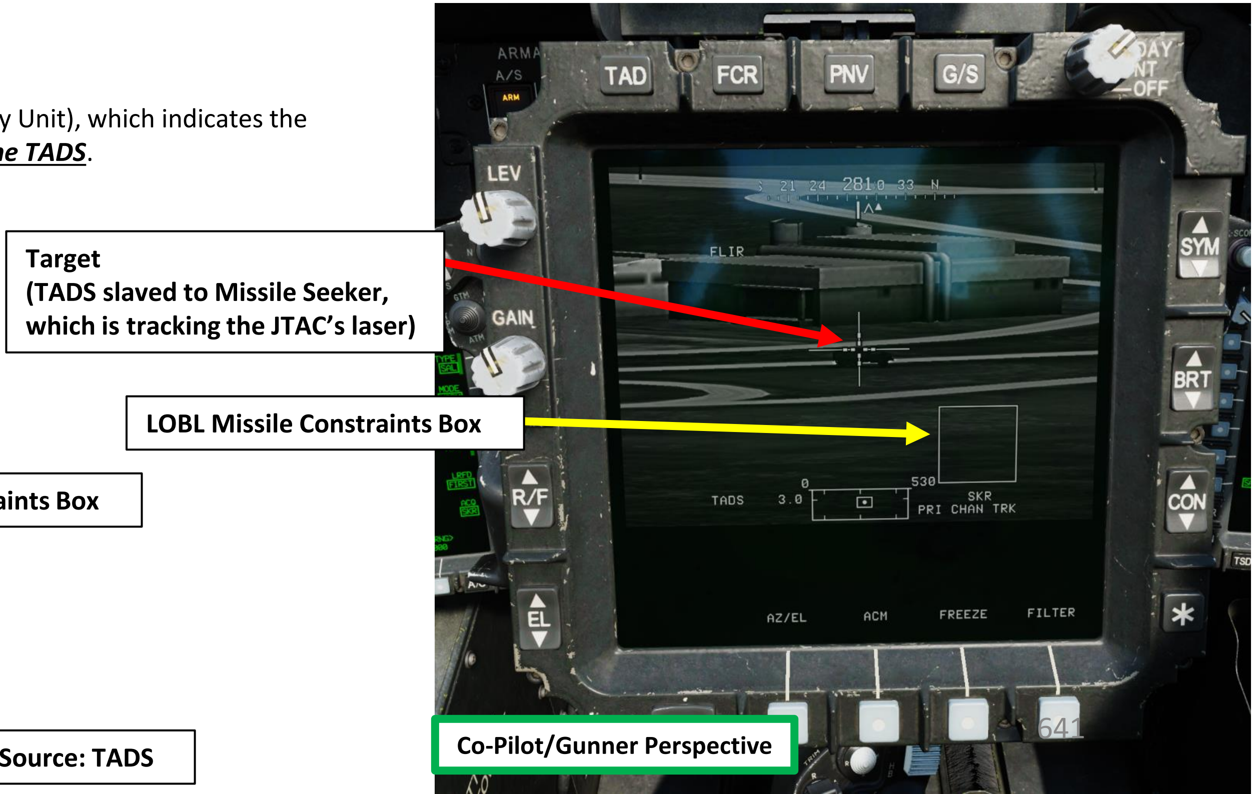
D – Perform Attack

1. *[P]* When pilot is told "Constraints" by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box, which should be big (LOBL box) and solid since the target is being actively lased by the JTAC.
    - **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as "LOAL box" (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
    - **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as "LOBL box" (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire
2. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.







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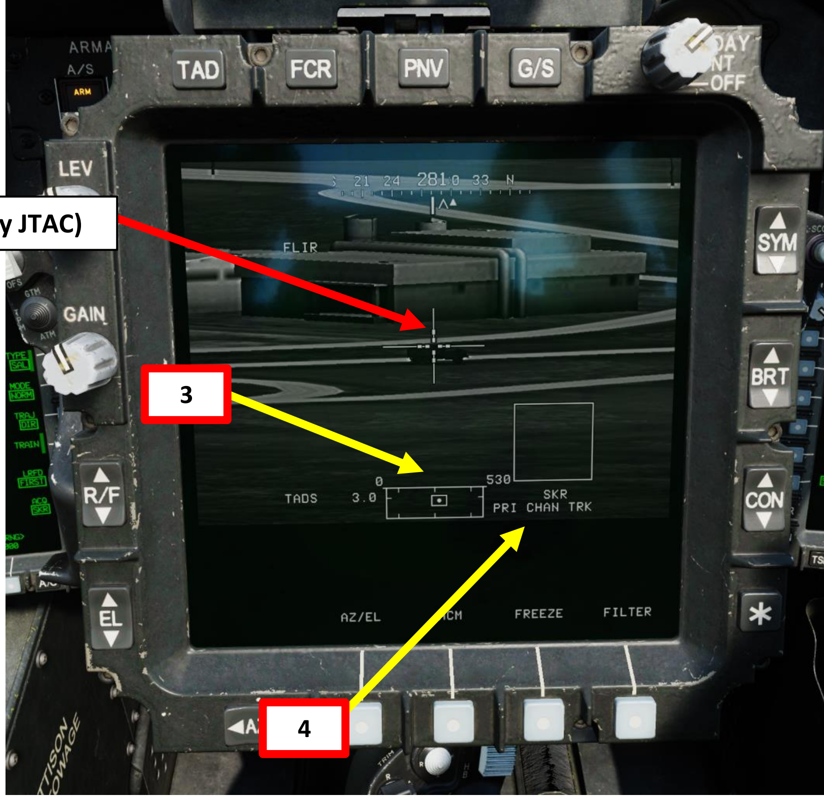
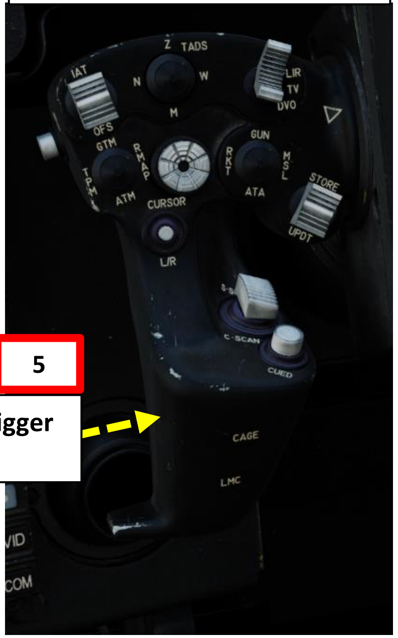
D – Perform Attack

3. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
4. *[CPG]* Verify PRI CHAN TRK is displayed in the High Action Display. This means the missile is tracking the priority channel.
5. *[CPG]* While target is being lased with the TEDAC Right Hand Grip LRFD Trigger, fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.

Target (lased by JTAC)



TEDAC LHG (Left Hand Grip)



TEDAC LHG Weapon Trigger (opposite side of grip)

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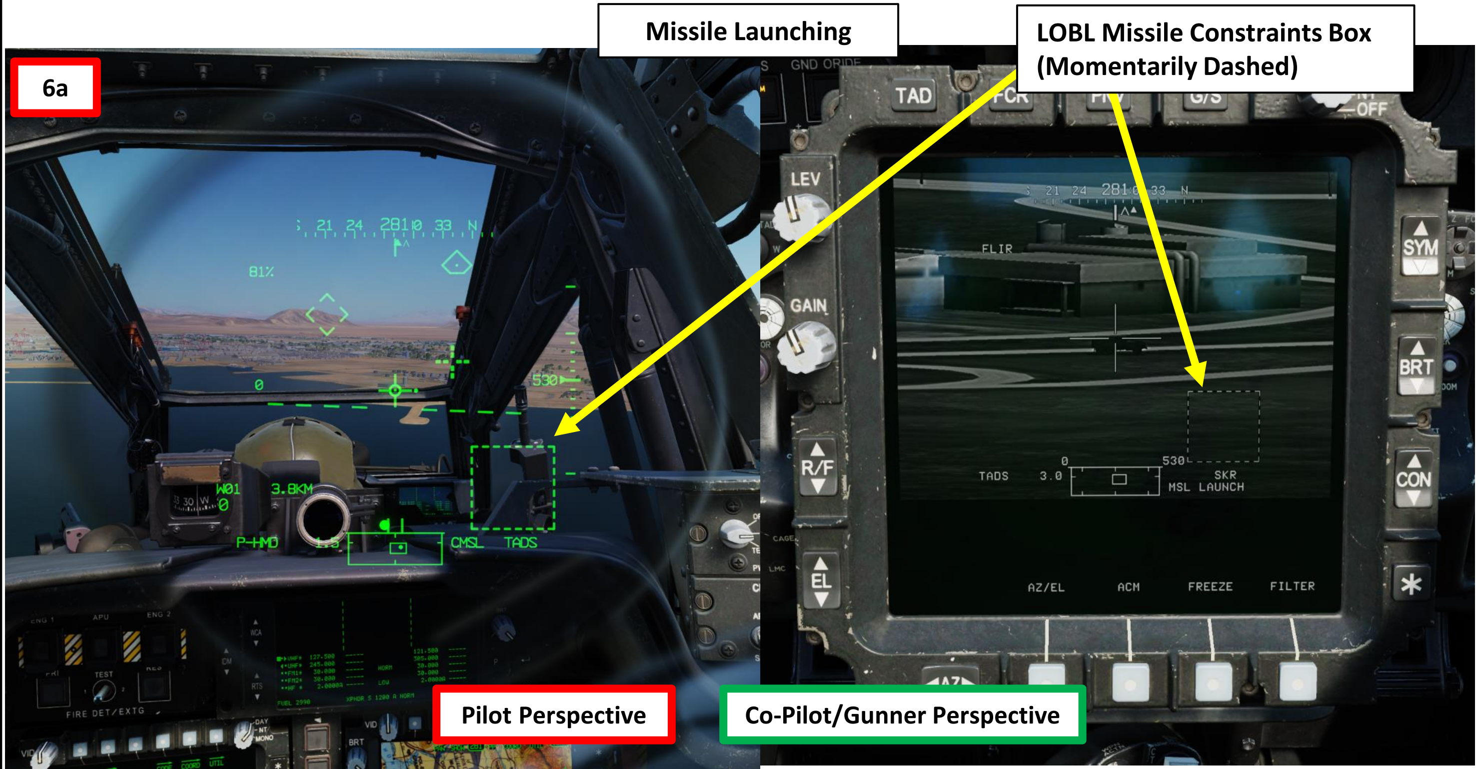
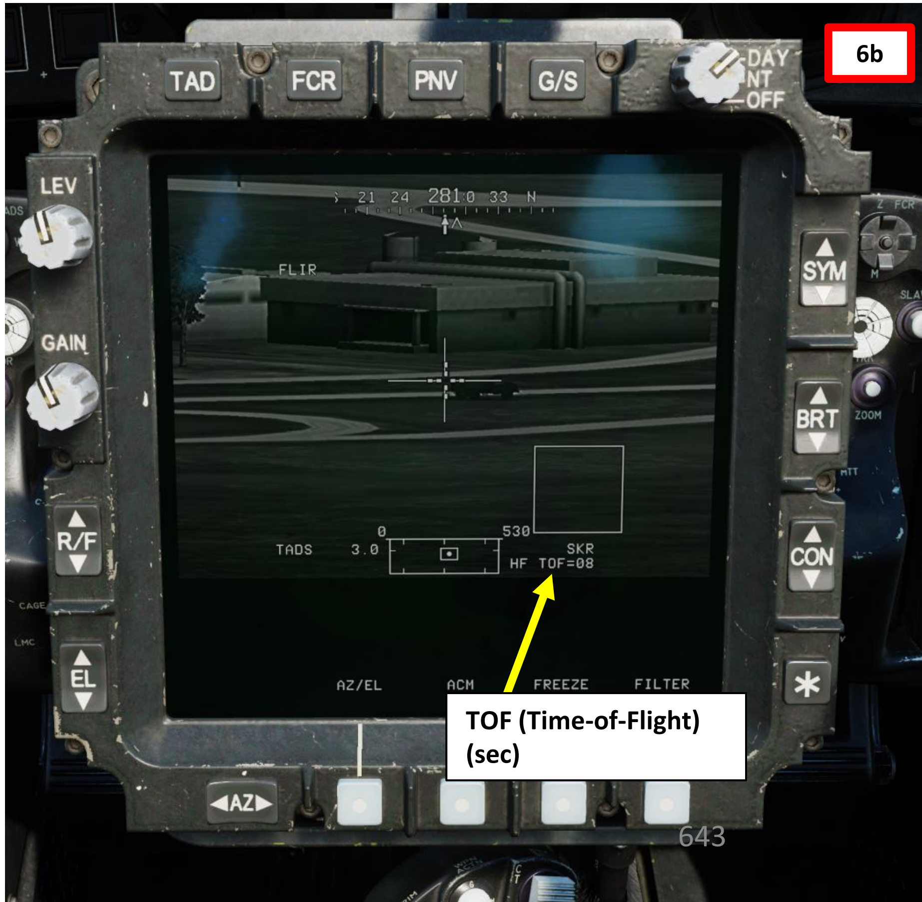
D – Perform Attack

6. *[CPG]* The missile will track the JTAC's laser until impact. Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected) and a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.





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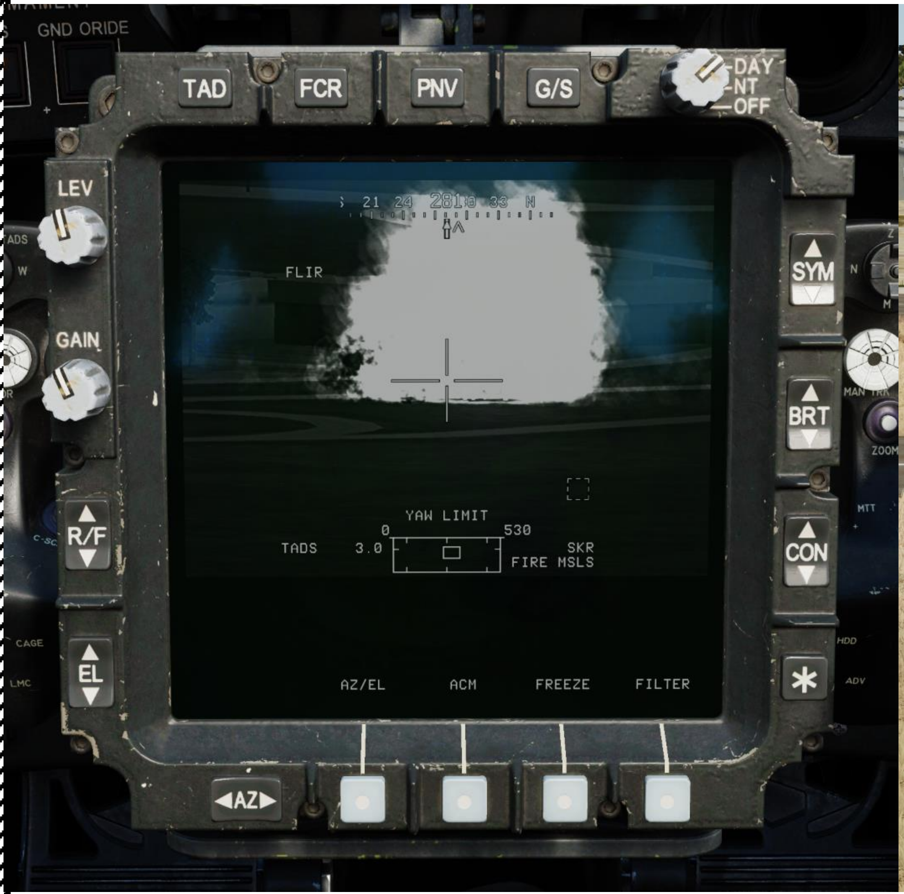
D – Perform Attack



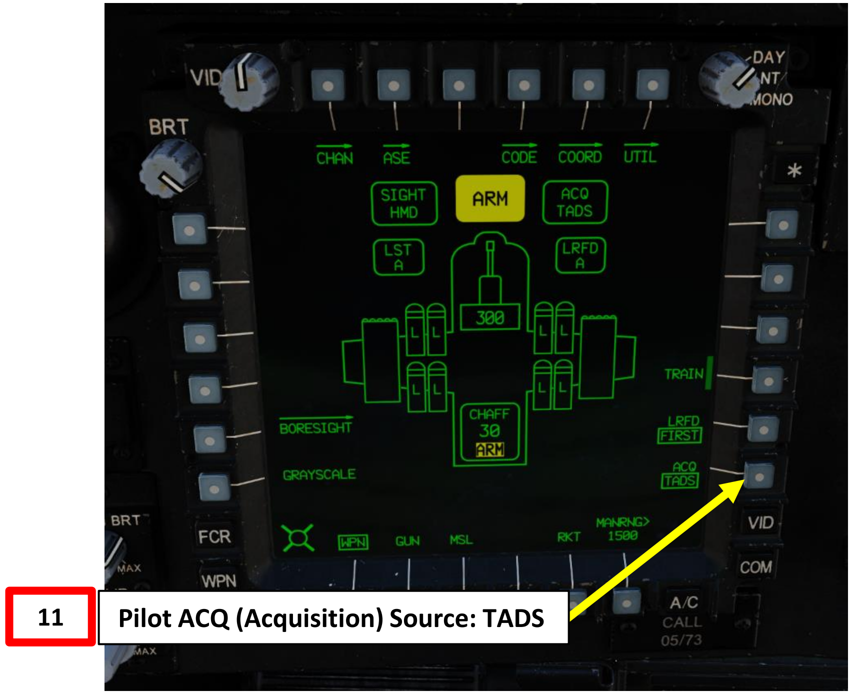
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner

1. *[P]* Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display “P-HMD”.
2. *[P]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
3. *[P]* Show the George Menu by using « LCTRL+V ».
4. *[P]* Press « A » SHORT (LEFT) for less than 0.5 sec to cycle between weapons until HELLFIRE (Missiles) are selected.
5. *[P]* Press « A » LONG (LEFT) for more than 0.5 sec to cycle between missile types. We will select SAL2 (Semi-Active Laser) missiles.
6. *[P]* Press « D » SHORT (RIGHT) for less than 0.5 sec to cycle between missile modes. Select either LOBL (Lock-On Before Launch) or LOAL (Lock-On After Launch) for semi-active laser missiles. We will select LOBL.
7. *[P]* Press « D » LONG (RIGHT) for more than 0.5 sec to cycle between missile trajectories/profiles. Since we selected LOBL previously, we will leave the trajectory at TRAJ DIR.
    - LOBL (Lock-On Before Launch) mode only has TRAJ DIR.
    - LOAL (Lock-On After Launch) mode has either TRAJ DIR (Direct), TRAJ LO (Low) or TRAJ HI (High).
8. *[P]* The George Menu changes color depending on the active rules of engagement (ROE):
    - Yellow: Weapons hold
    - Green: Weapons free
9. *[P]* Confirm that the George Menu color is yellow. If it is green (weapons free), press « W » LONG (UP) for more than 0.5 sec to set ROE back to weapons hold.
10. *[P]* The pilot’s HDU (Helmet Display Unit) reticle is used as a Designation Reticle to point an area where “George” can identify and track targets.

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG’s active sight is TADS and the pilot commands LINK, the CPG’s active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: No function for pilot collective.*

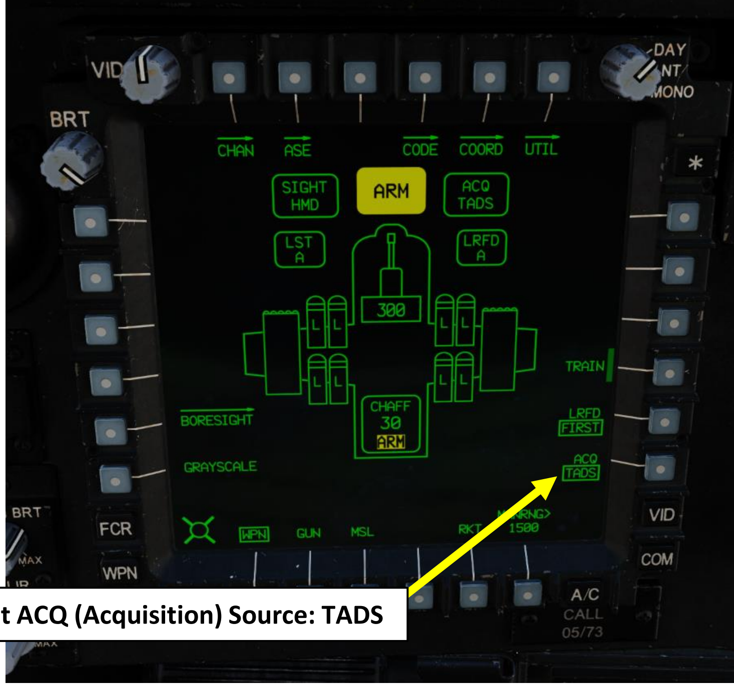
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner

11. *[P]* From the WPN (Weapon) page, set the Pilot Acquisition Source to TADS. Then, fly towards the target and ensure the the helicopter attitude remains stable.
12. *[P]* Move your head (HDU Reticle / Designation Reticle) near the area you want the Co-Pilot/Gunner to search for targets, then press « W » SHORT (less than 0.5 sec).
13. *[CPG]* George will select the acquisition source to PHS (Pilot Helmet Sight), then slave the TADS to the acquisition source, then call out “slaving” to remind the pilot that the TADS is slaved to his helmet reticle.
14. *[CPG]* When George has set the TADS reticle is roughly on the area pointed at by the pilot’s HDU reticle, George will de-slave the TADS, call out “de-slaved” to tell the pilot that he can start looking elsewhere. Target can then be spotted, designated, lased and stored by him.



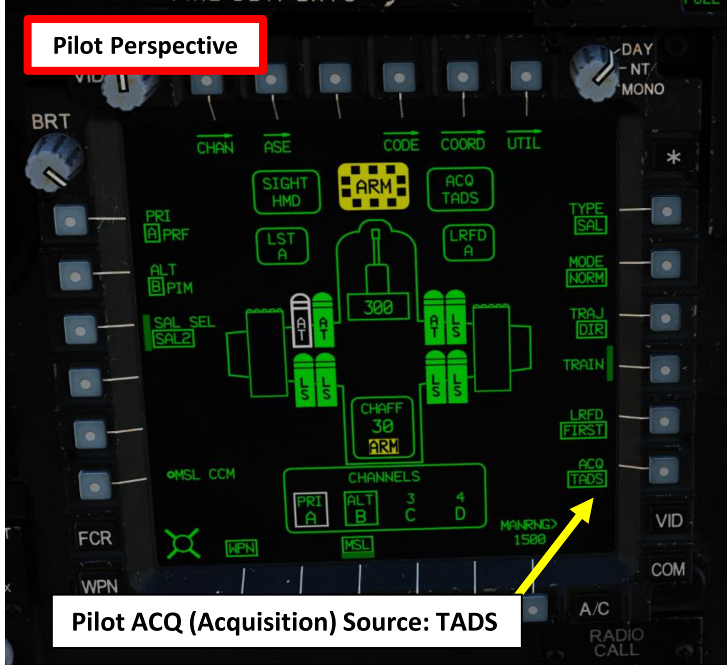
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner

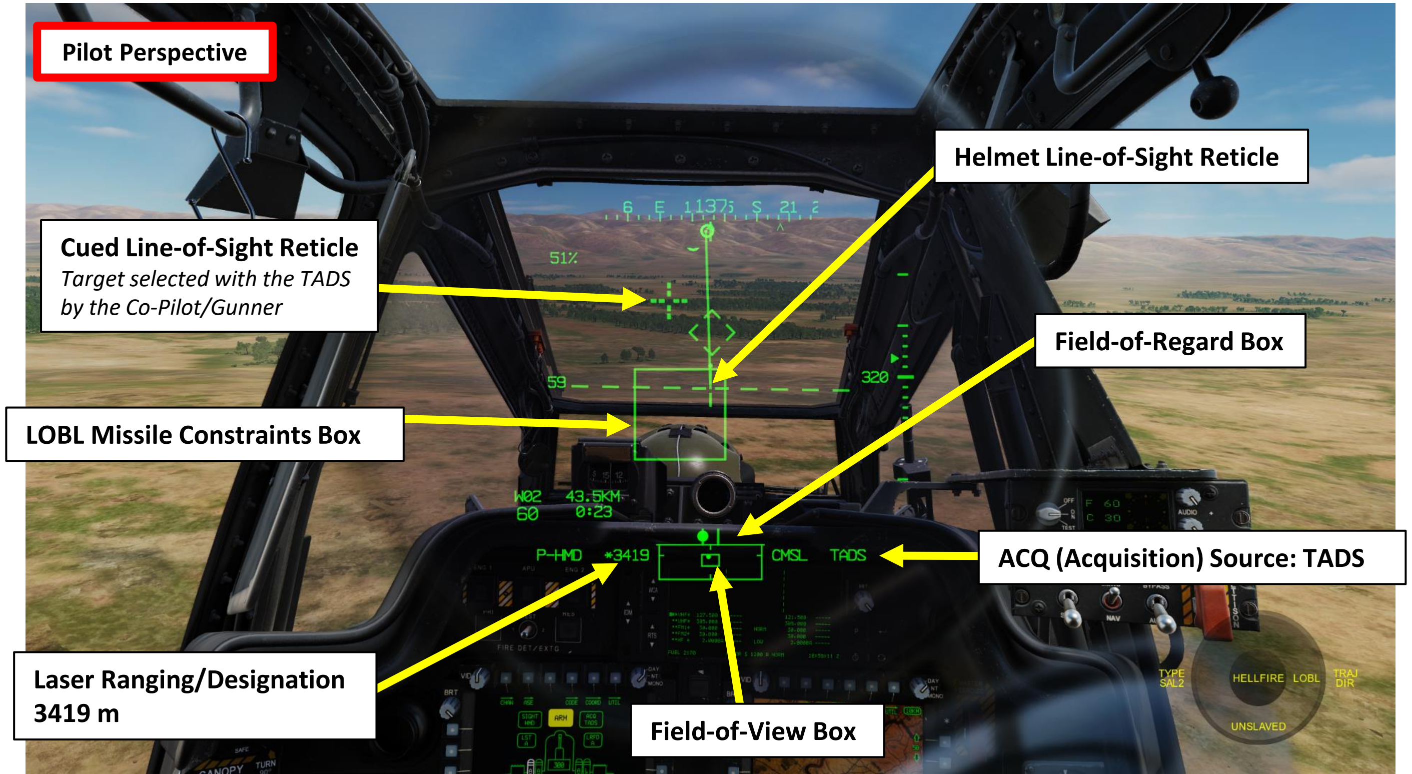
15. *[CPG]* George will then start scanning for targets in the designated area. When targets are found, a menu with a list of targets appears.
16. *[P]* Cycle through the target list using « W » SHORT (UP) or « S » SHORT (DOWN) until desired target is selected by the > symbol.
17. *[P]* Press « D » SHORT (RIGHT) to select target.
    - Note: Pressing "S" SHORT (DOWN) undesignates George's target.
18. *[CPG]* George will then designate, lase (if required) and store the target with the TADS, calling out "lased and stored" in the process.
19. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.



4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner

20. *[P]* Align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box, which should be big (LOBL box) and solid since the target is being actively lased by the co-pilot/gunner.
    - **Small (LOAL) box**: Missile seeker is not detecting laser energy with a frequency that matches the laser frequency assigned to it by the aircraft. Referred as "LOAL box" (Lock-On After Launch) since this box is visible in situations when the *laser designates the target AFTER firing the missile*.
    - **Big (LOBL) box**: Missile seeker is detecting and tracking a laser designation that matches the laser frequency assigned to it by the aircraft. Referred as "LOBL box" (Lock-On Before Launch) since this box is visible in situations when the *laser designates the target BEFORE firing the missile*.
    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire
21. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.



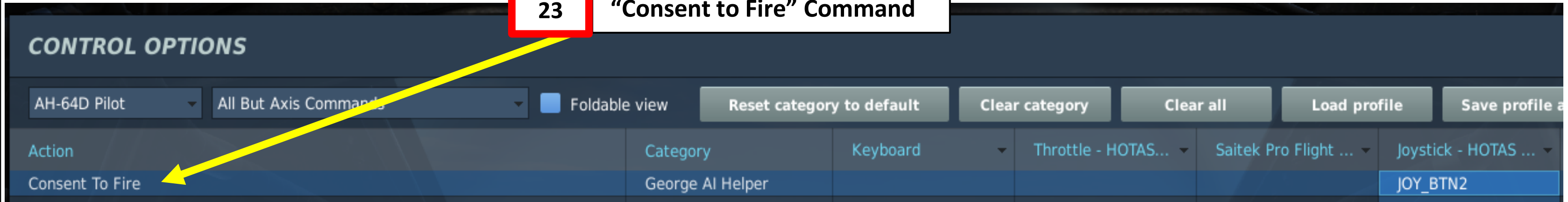


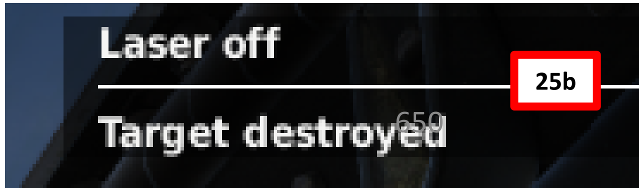
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner

22. [P] Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.

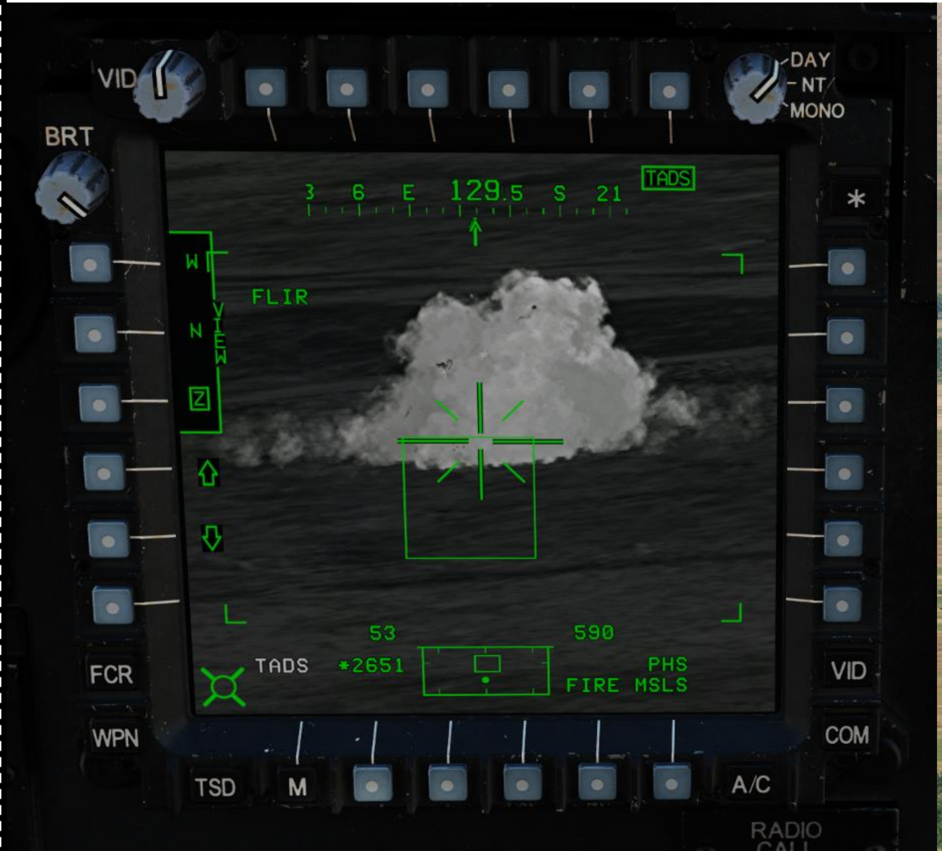
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner

23. *[P]* Use the « Consent To Fire » command to order George to fire on the selected target.
    - Alternatively, you could press « W » LONG (more than 0.5 sec) to set ROE to weapons free. The George Menu will then switch to green (weapons free).
24. *[CPG]* George will then fire the missile on the target by himself when you have a good firing solution (Missile Constraints Box).
25. *[P]* Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected).
26. *[P]* If you want George to stop engaging the target, press “S” SHORT (DOWN) to undesignate George’s target.
27. *[P]* You can hide the George Menu by using « LCTRL+V ».



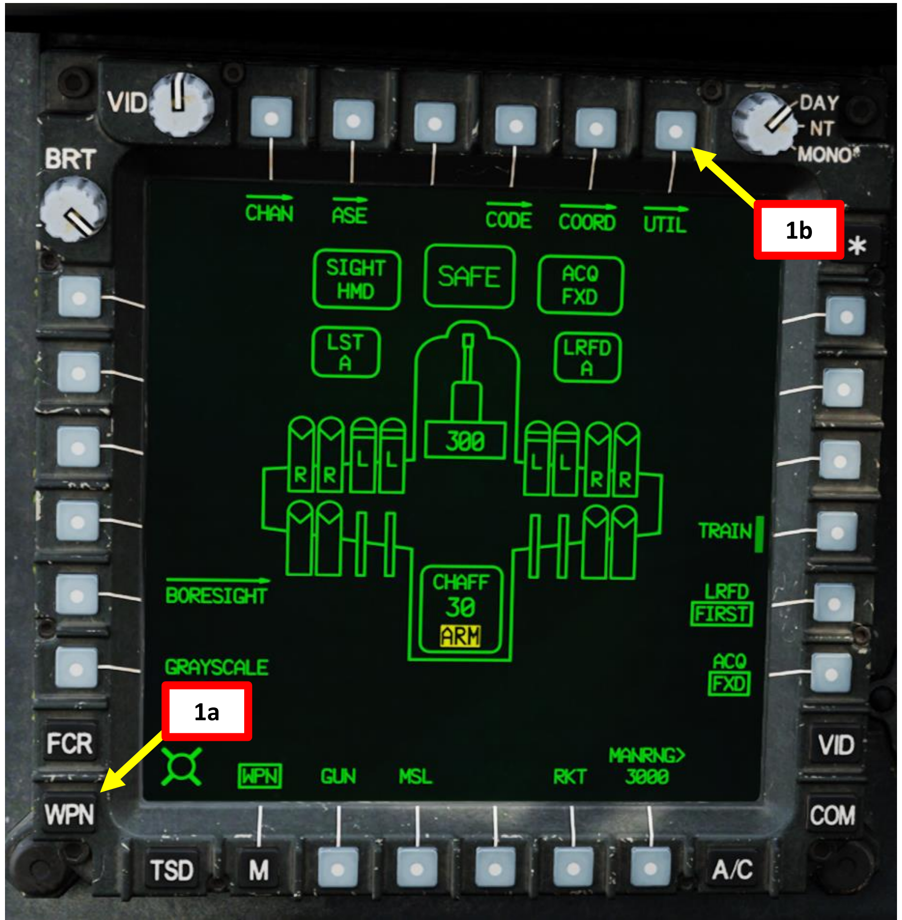


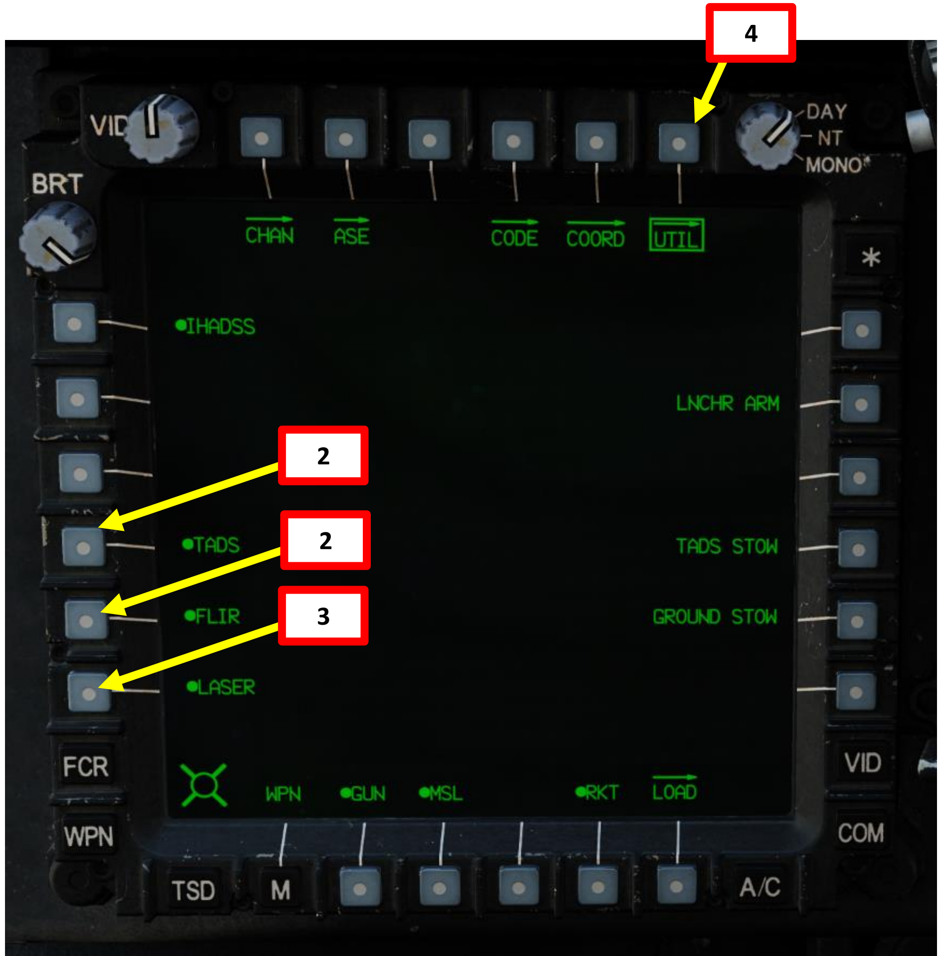
4 – AGM-114 HELLFIRE MISSILE
4.2 – Laser-Guided Hellfire (AGM-114K)
4.2.2 – Missile Operation by George AI as Co-Pilot/Gunner



4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS and FLIR to power on the TADS and FLIR systems.
    - Hollow circle means OFF. Solid Circle means ON.
3. *[CPG]* Press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system.
    - Hollow circle means OFF. Solid Circle means ON.
    - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Press VAB next to UTIL to return to main WPN page.





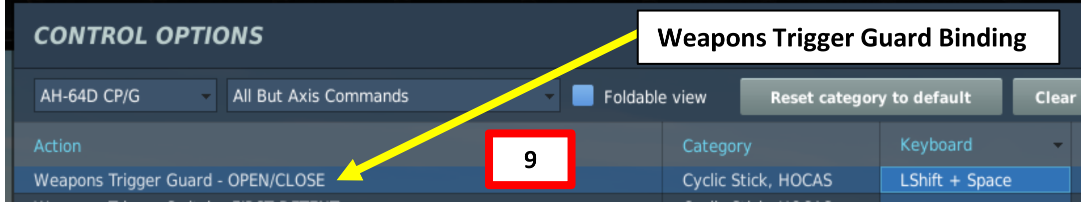
4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

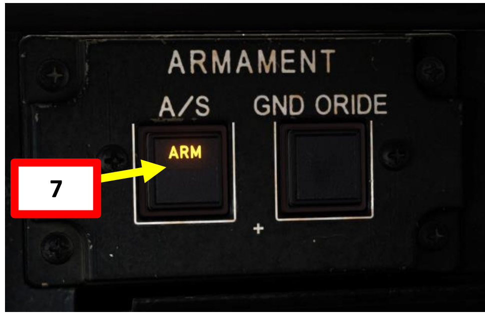
5. *[CPG]* Set the Sight Select Switch to RIGHT (TADS). Performing this action will select the TADS and display the "TADS" indication on the lower left of the TDU (TEDAC Display Unit) and HDU (Helmet Display Unit).
6. *[CPG]* Once the TADS becomes the selected sight, the TADS overlay will be visible on the HDU. If you want to remove the TADS overlay from the HDU, you can use one of these two methods:
    - Method 1: Flip away the HDU using the "IHADSS Show" binding, which is "i" by default.
    - Method 2: Reduce the TADS Overlay brightness
        a) Set the Sight Select Switch to FWD (HMD, Helmet-Mounted Display). The HDU sight selected should display "C-HMD".
        b) Press the TDU Image Brightness Adjustment Rocker Switch DOWN a few times to bring the brightness all the way down.
        c) Set the Sight Select Switch to RIGHT (TADS) on the collective. The TADS overlay should not be visible.

TEDAC RHG Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight), but only functional for CPG.*

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

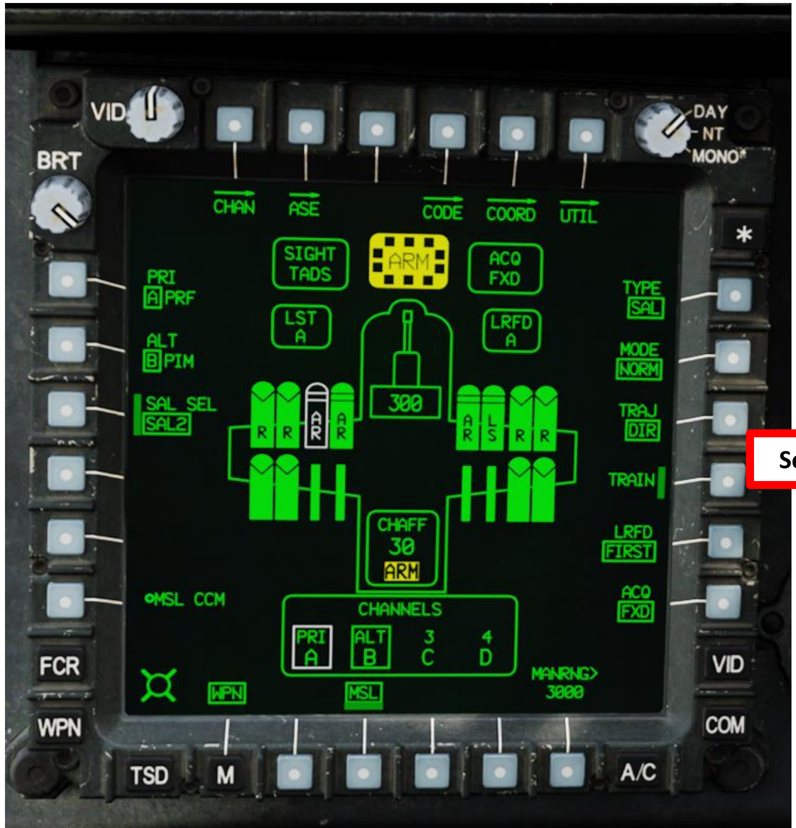
7. *[CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
8. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
9. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
   - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
   - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).
10. *[CPG]* Set Missile Type to RF (Radio Frequency).
11. *[CPG]* Set Missile mode to NORMAL.
12. *[CPG]* Set Missile Power Mode to AUTO.
13. *[CPG]* Set Missile LBL (Lock-On Before Launch) Inhibit – OFF (Un-boxed).

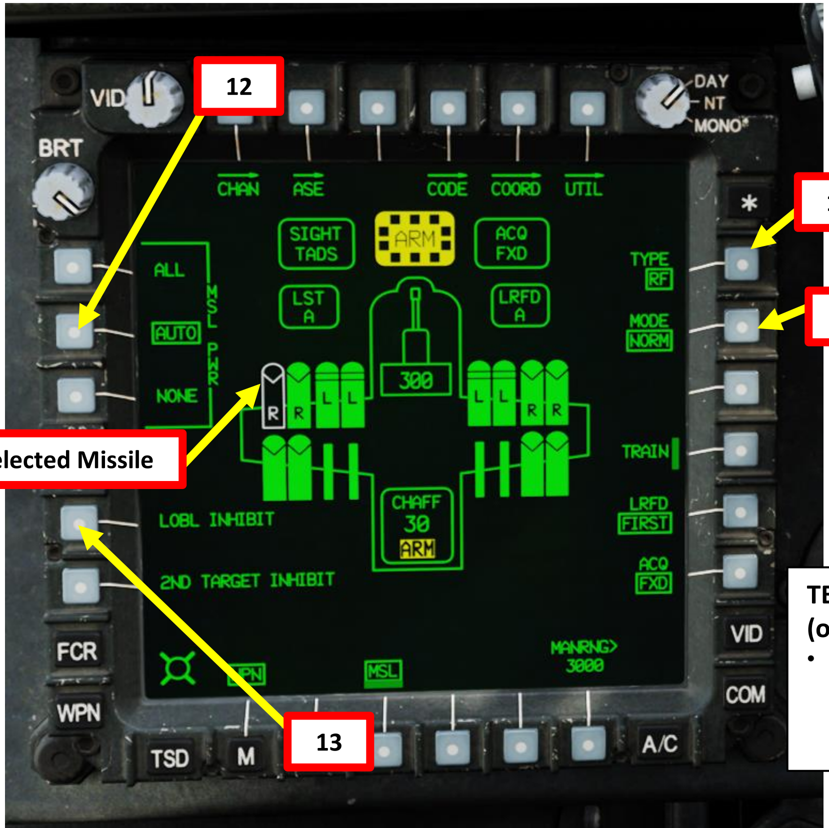




Weapon Action Switch (WAS) 8

- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*



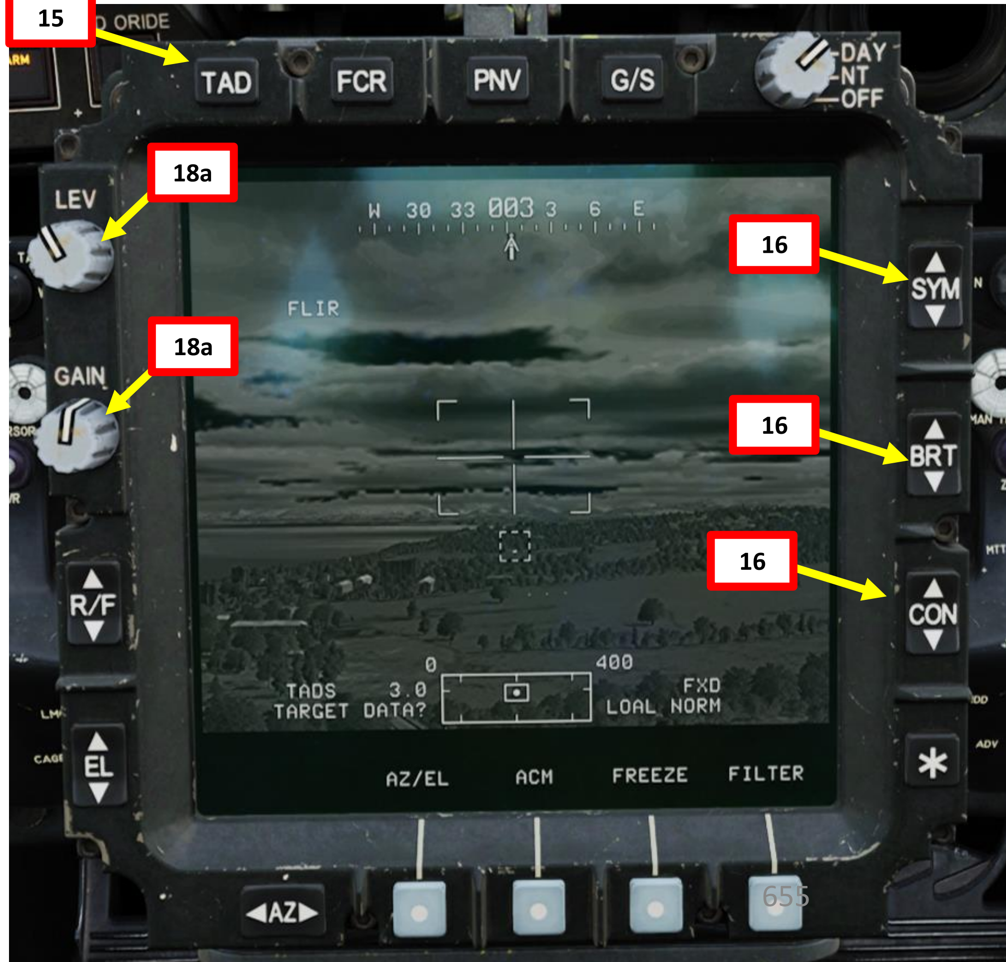


TEDAC LHG Weapon Trigger (opposite side of grip)

- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

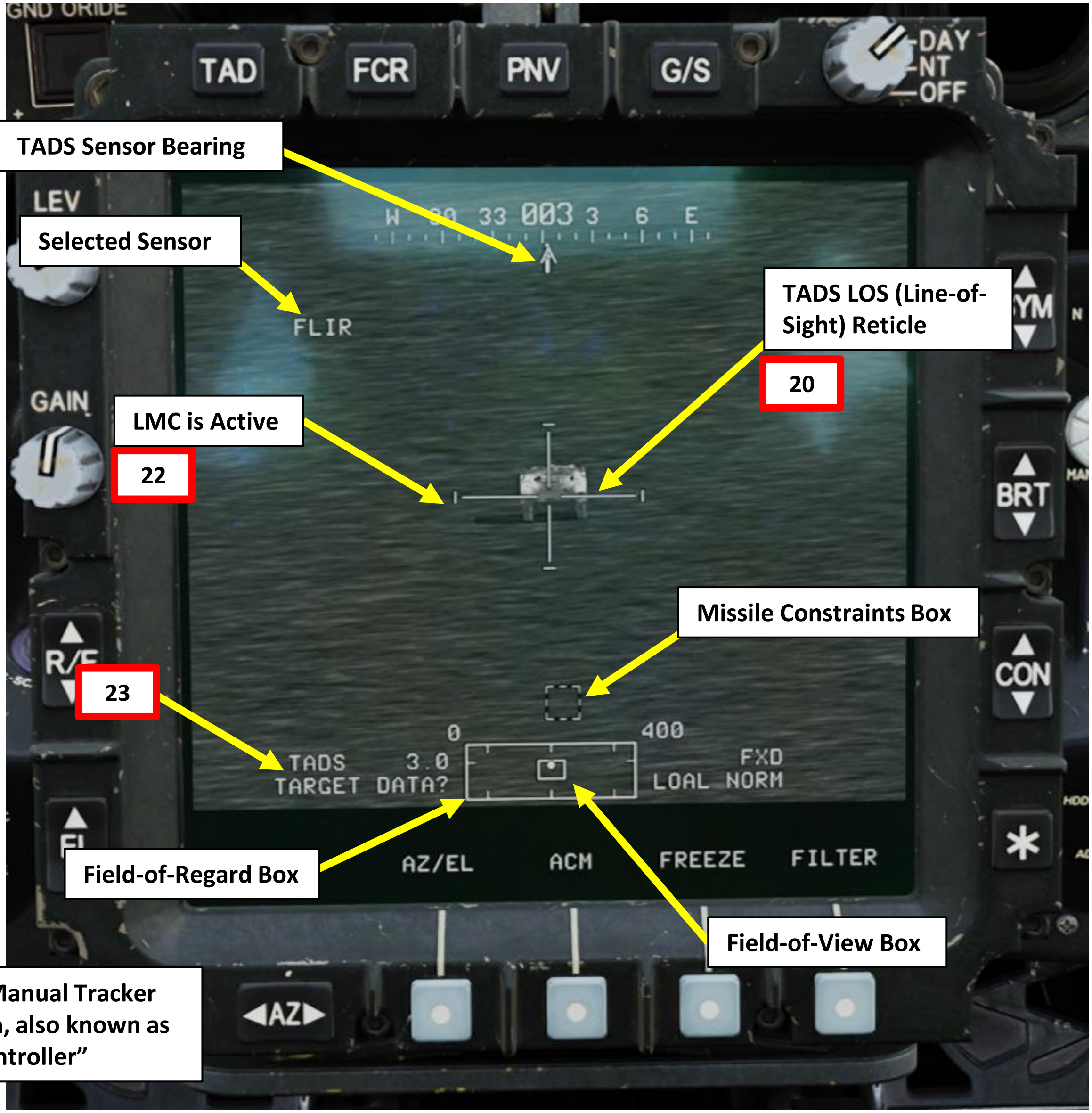
4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

14. *[CPG]* Confirm the selected sight is the TADS via the WPN page.
15. *[CPG]* Select TADS video feed source by pressing the TAD button.
16. *[CPG]* Adjust TDU (TADS Display Unit) Symbology Brightness (SYM), Image Brightness (BRT), Contrast (CON) – As Required.
17. *[CPG]* On TEDAC Left Hand Grip, set TADS Sensor Select Switch to either FLIR (FWD) for TADS infrared imagery or to DTV (MIDDLE) for Day TV.
18. *[CPG]* If FLIR is selected:
    a) Adjust FLIR Level and Gain – As Required.
    b) Toggle FLIR polarity using TEDAC Right Hand Grip FLIR Polarity Button or Collective Boresight/Polarity Selector RIGHT (PLRT) – As Desired.



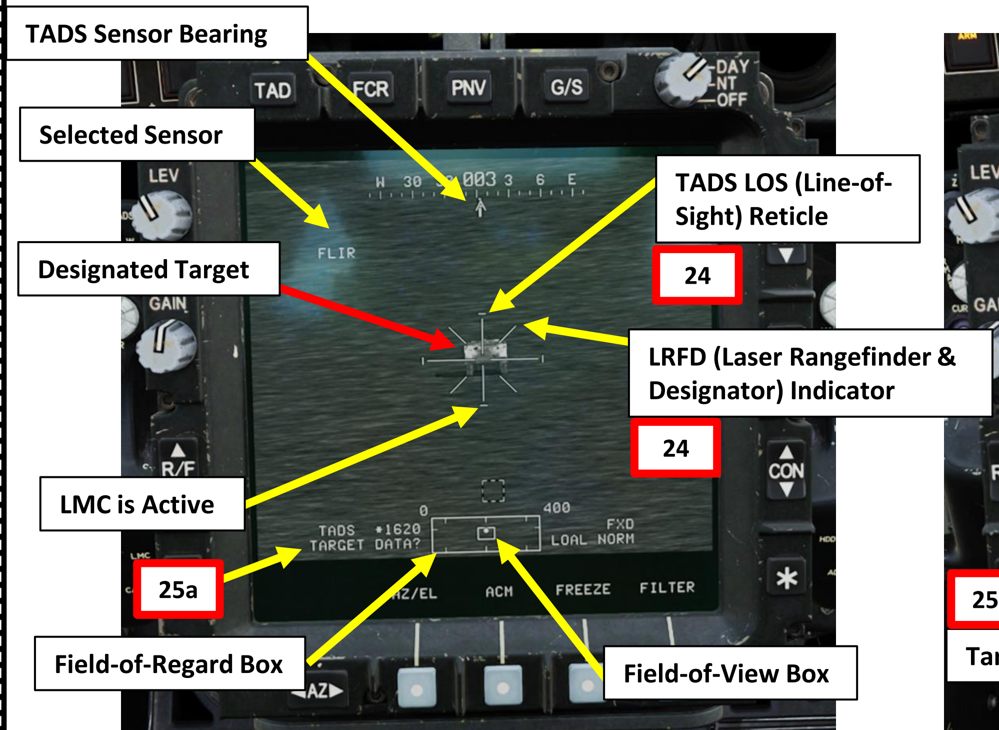
4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

19. *[CPG]* On TEDAC Left Hand Grip, set TADS FOV (Field-of-View) Selector – As Desired (Zoom, Medium, Narrow or Wide)
20. *[CPG]* On TEDAC Right Hand Grip, slew TADS Line-of-Sight using the MAN TRK (Sight Manual Tracker Controller) Switch, also known as “Thumb Force Controller”.
21. *[CPG]* While using the MAN TRK Switch, the TADS is not ground-stabilized. You may need to make constant adjustments to keep the Reticle on the target.
22. *[CPG]* If the target or the helicopter is moving, on TEDAC Left Hand Grip, press LMC Button to engage the Linear Motion Compensator. The TADS Line-of-Sight Reticle will become much easier to manage since it will compensate for helicopter and/or target movement. LMC also enables the Target State Estimator (TSE).
23. *[CPG]* The “TADS TARGET DATA?” indication means that the AGM-114L missile’s guidance system has no target location memorized through its own active radar seeker yet.



4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

24. *[CPG]* Squeeze and hold the TEDAC Right Hand Grip LRFD Trigger to lase and designate the target.
    - First detent held: LRFD (Laser Range Finder & Designator) determines the target range
    - Second detent held: LRFD determines target range and designates target for laser guidance.
        - If LMC (Linear Motion Compensator) is active, squeezing and holding the TEDAC Right Hand Grip LRFD Trigger to the second detent engages TSE (Target State Estimator). TSE will help you track the target more easily.
25. *[CPG]* Keep the TEDAC Right Hand Grip LRFD Trigger squeezed until the “TADS TARGET DATA?” indication disappears and a valid range is visible. This means the missile now has enough position data about the target to properly home on its location.
26. *[CPG]* Unlike the AGM-114K laser-guided missile, the AGM-114L radar-guided missile does not track the laser designator; it uses the target location determined by the TADS and its laser ranging as a reference and uses its own active radar seeker to home on the target.
27. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase “Constraints”.



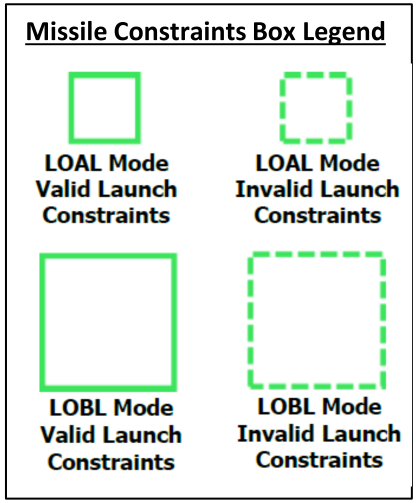
4 – AGM-114 HELLFIRE MISSILE

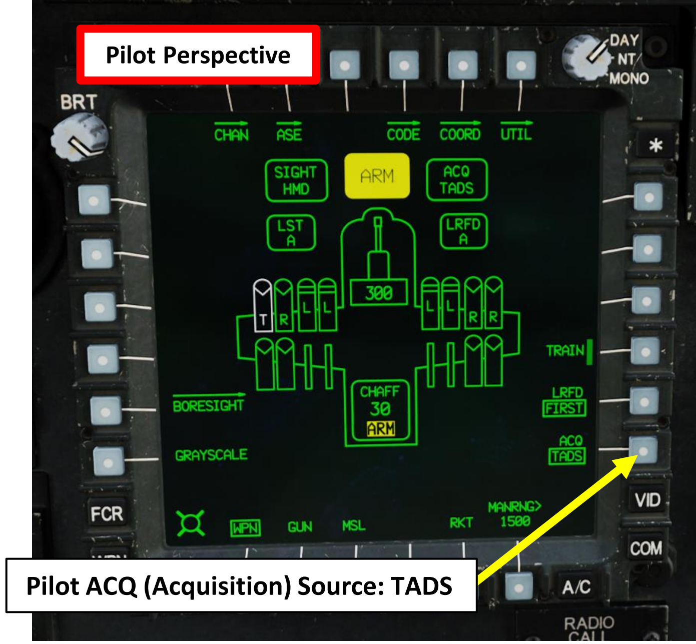
4.3 – Radar-Guided Hellfire (AGM-114L)

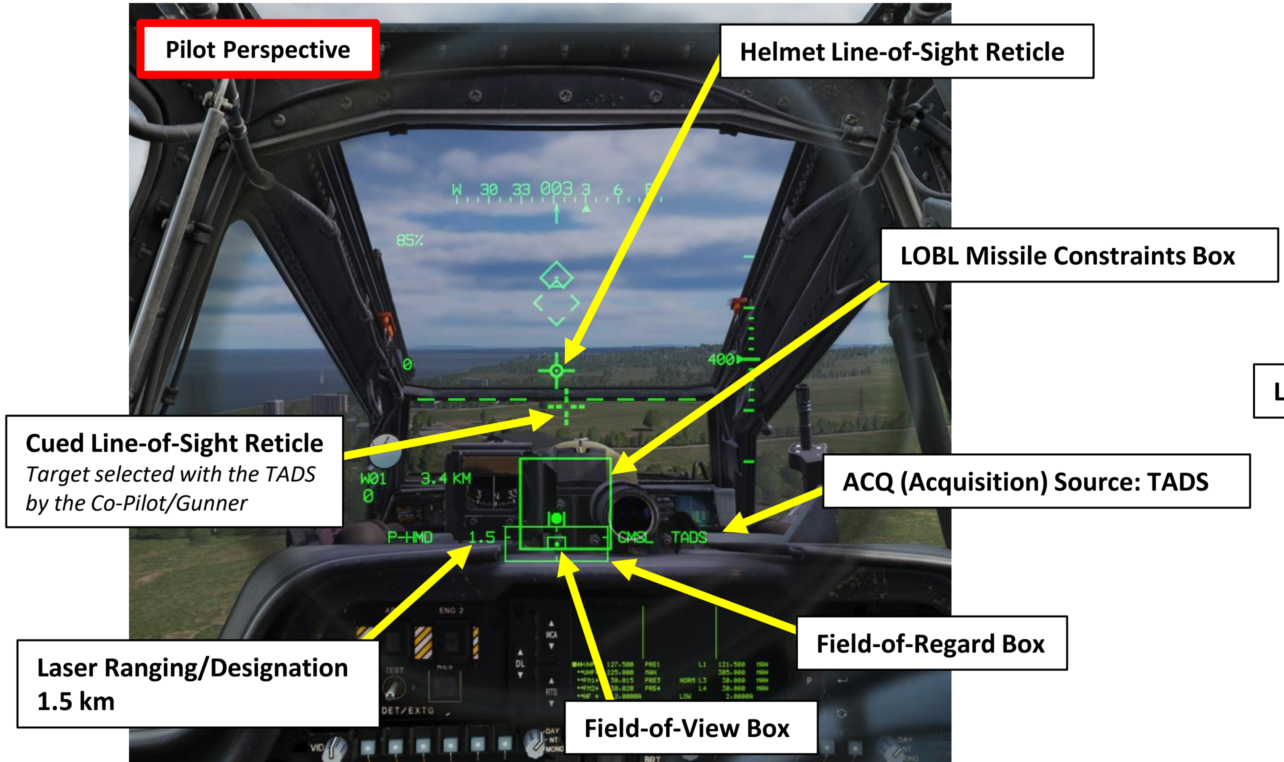
4.3.1 – Missile Operation by Multicrew

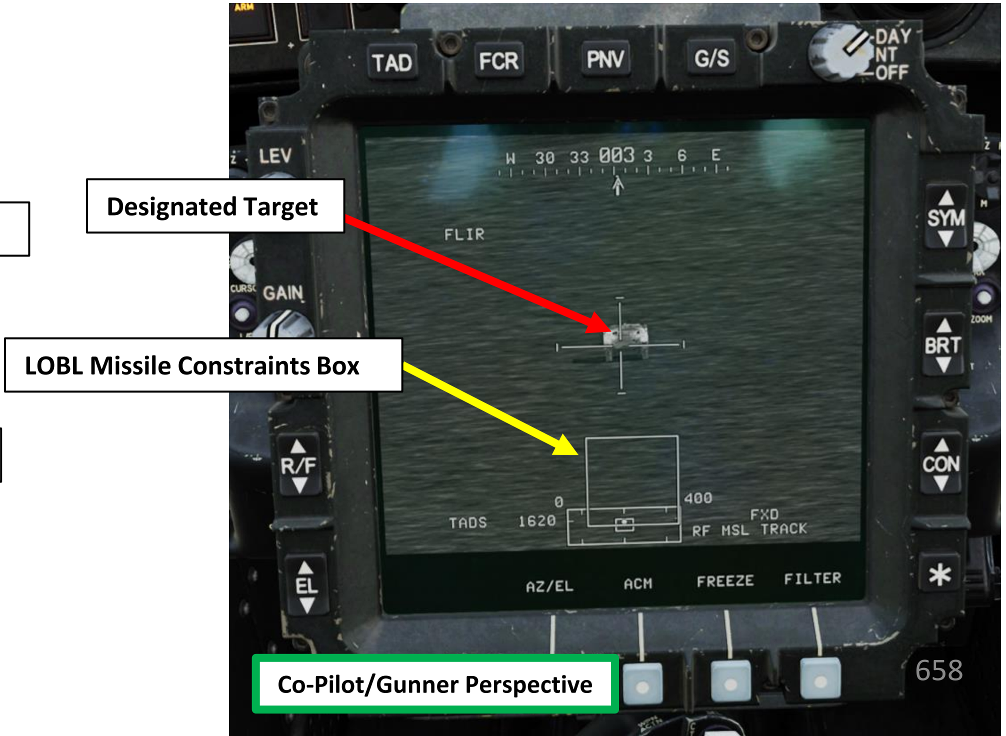
4.3.1.1 – Without FCR (Fire Control Radar)

28. *[P]* When pilot is told "Constraints" by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box.
    - Note: Just as in the case of the AGM-114K, the AGM-114L may be employed in either a Lock-On-Before-Launch (**LOBL**) mode or a Lock-On-After-Launch (**LOAL**) mode. However, the electronics within the AGM-114L missile itself performs an automatic determination of which mode it should utilize, based on the nature of the target handover it receives. The aircrew does not have any direct control over which mode the missile defaults to.
29. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.









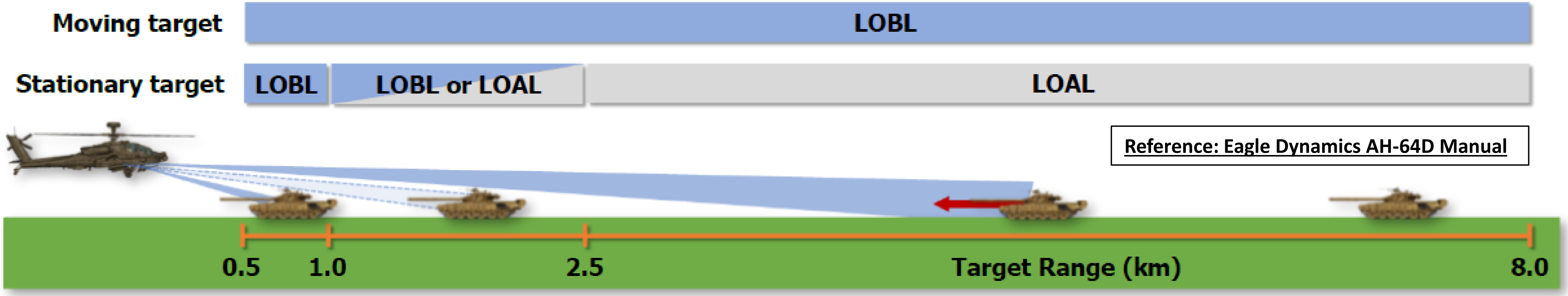
4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

30. *[P/CPG]* Important Note: Once a target has been “memorized” by the missile, subsequent designation will not erase the initial target coordinates memorized. In order to “reset” the missile and erase the memorized target, press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT once to de-action the missile, then RIGHT a second time to re-select Missiles.

31. **LOAL vs LOBL Selection Logic**
Unlike the laser-seeking AGM-114K missile variants, the AGM-114L missile performs its own determination of which launch mode (LOBL or LOAL) is optimal for target acquisition, based on the nature of the target handover it receives.
    - **Lock-On After Launch (LOAL) small box**: Missile will activate its onboard radar seeker after launch and scan the vicinity of the target location in an attempt to acquire and track its target.
        - Selected if the target is stationary and greater than 2.5 km in range.
        - Selected if the target is stationary and between 1 and 2.5 km in range and LOBL mode is unsuccessful.
    - **Lock-On Before Launch (LOBL) big box**: Missile will immediately activate its onboard radar seeker and scan the vicinity of the target location in an attempt to acquire and track its target.
        - Selected if the target is stationary but less than 1 km in range and there is insufficient time to acquire the target after launch.
        - Selected if the target is stationary and between 1 and 2.5 km in range and there may be insufficient time to acquire the target after launch
        - Selected if the target is moving at any range.

    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire

Weapon Action Switch (WAS) 30
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

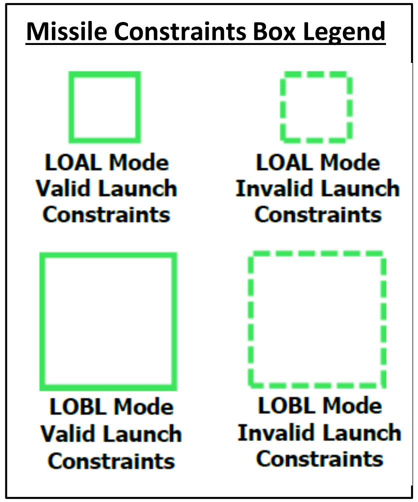


Reference: Eagle Dynamics AH-64D Manual

LOBL & LOAL Selection Logic

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

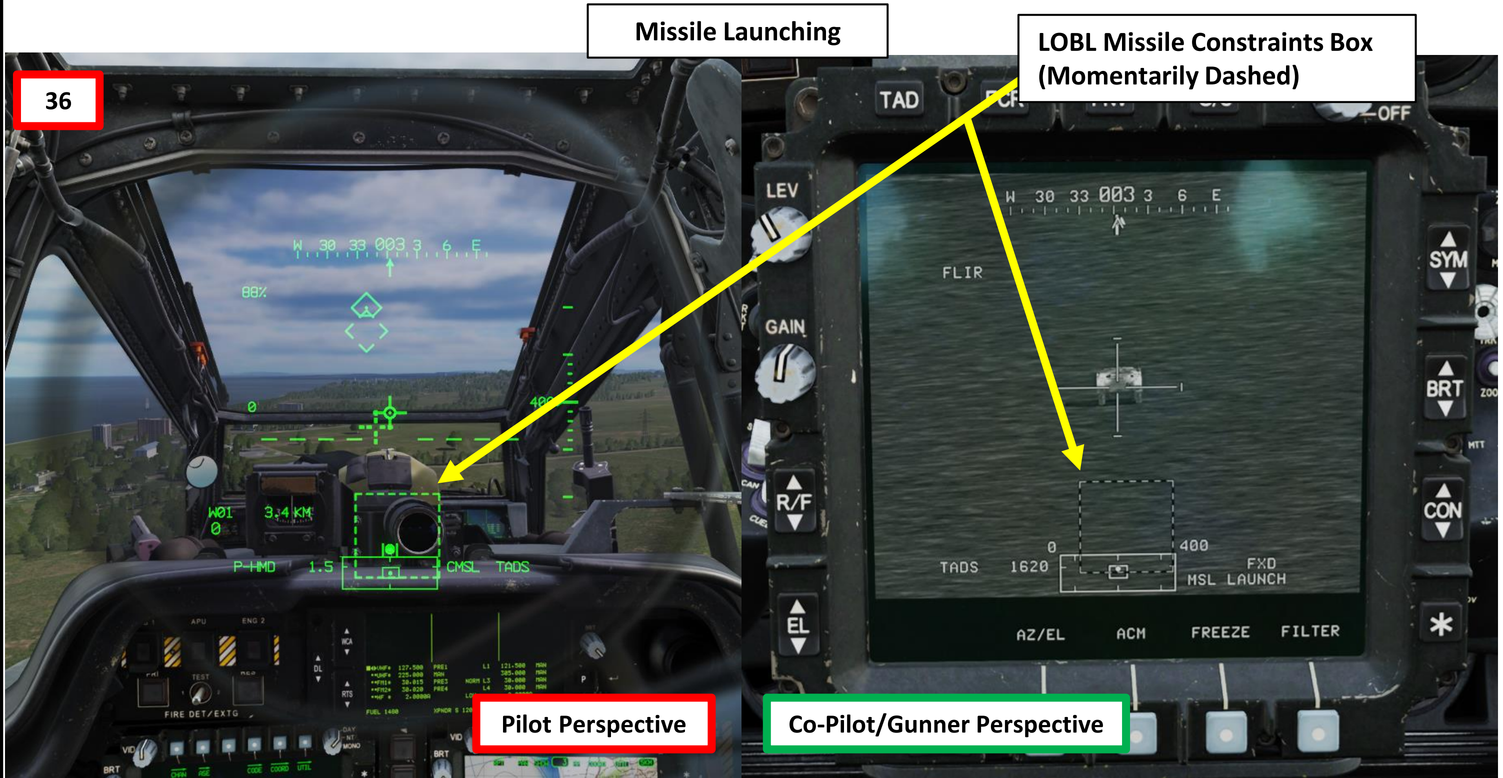
32. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
33. *[CPG]* If the missile is outside acceptable launch constraints or any Weapon Inhibit messages are displayed within the High Action Display, the Missile Constraints Box will be displayed as Invalid (dashed).
    - **LOBL Constraints (< 1 km):** Missile seeker line-of-sight is offset ≤ 5 deg from the Missile Datum Line
    - **LOBL Constraints (≥ 1 km):** Missile seeker line-of-sight is offset ≤ 20 deg from the Missile Datum Line
    - **LOAL Constraints (≥ 1 km):** Missile seeker line-of-sight to the target is offset ≤ 20 deg from the Missile Datum Line
34. *[CPG]* Verify RF MSL TRACK is displayed in the High Action Display. This means the missile is tracking the target.
35. *[CPG]* Fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.



TEDAC LHG (Left Hand Grip)

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

36. *[CPG]* The missile will home on the target; fire and forget. Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected) and a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.



4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.1 – Without FCR (Fire Control Radar)

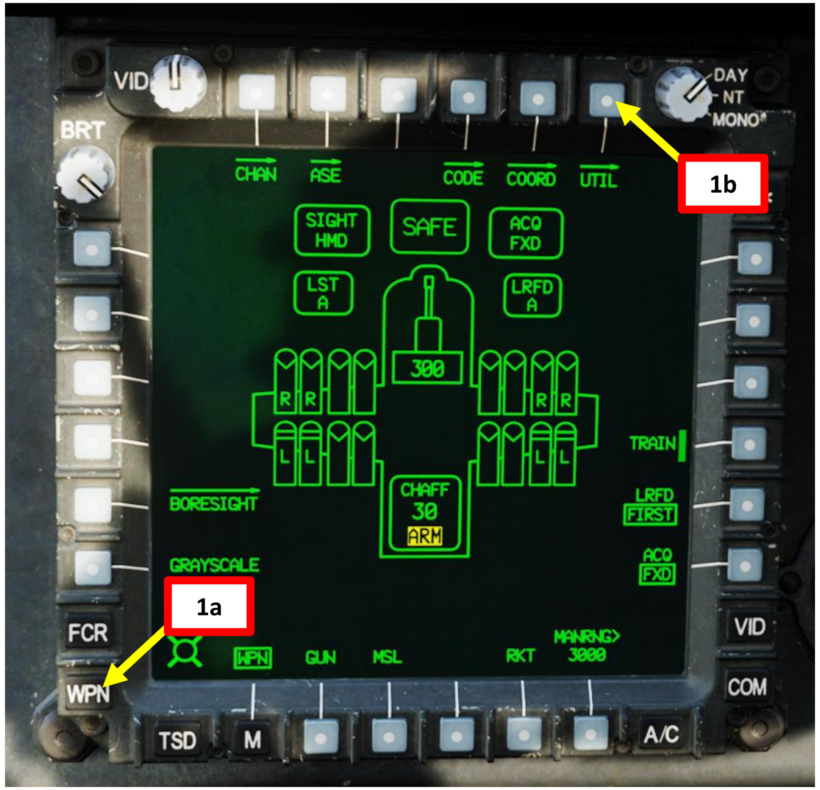
37. *[CPG]* If target is destroyed and LMC (Linear Motion Compensator) has been engaged, on TEDAC Left Hand Grip, press LMC Button again to disengage LMC.

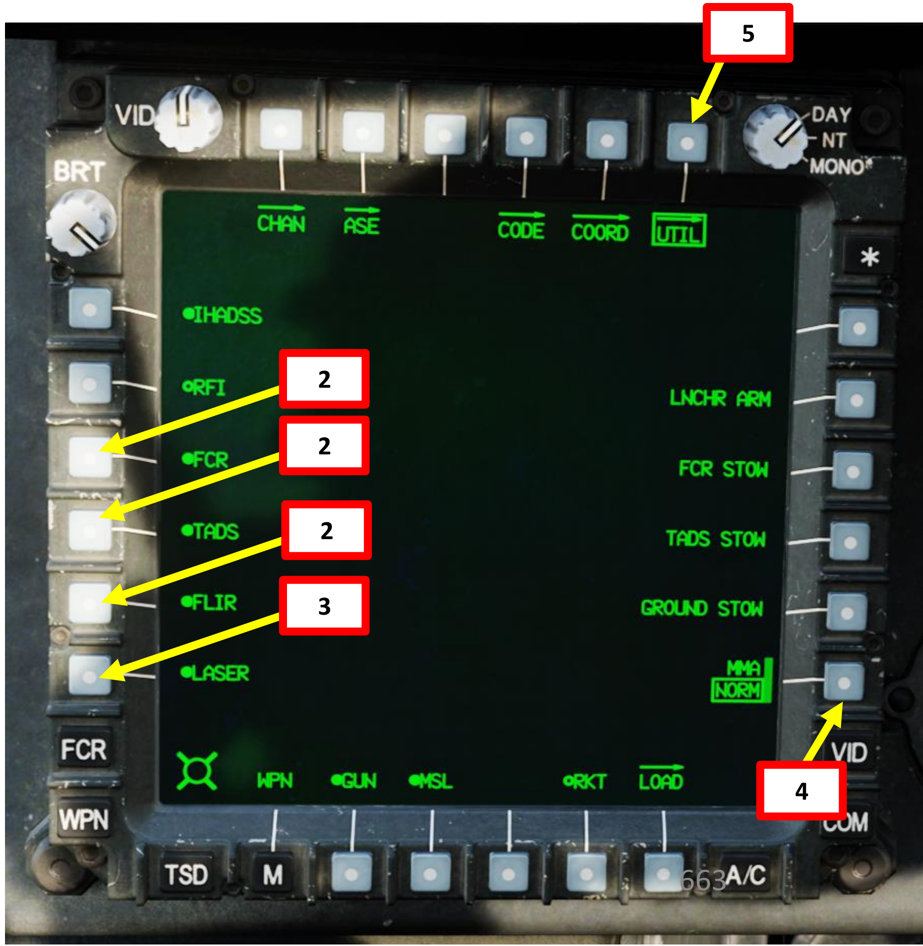
TEDAC LHG (Left Hand Grip)

LMC (Linear Motion Compensator) Button (Opposite Side)

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

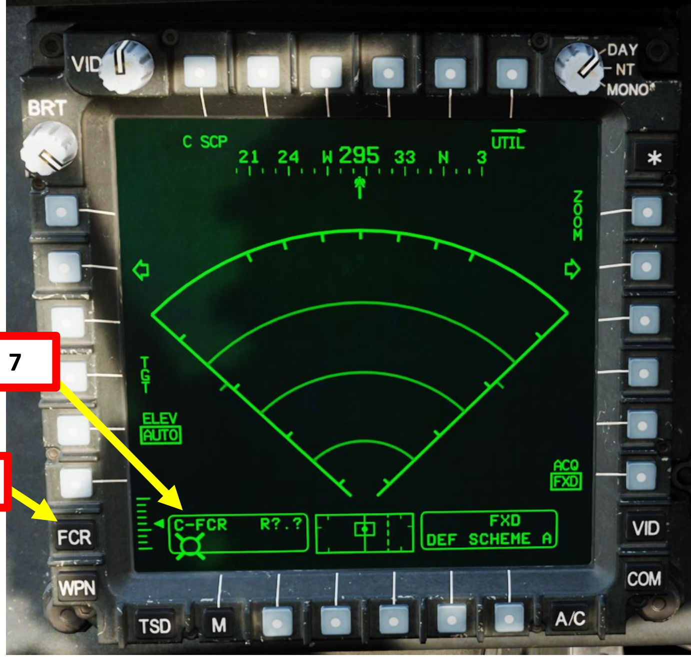
1. *[CPG]* From the WPN page, press VAB (Variable Action Button) next to UTIL to select Weapon Utility page.
2. *[CPG]* If required, press VABs next to TADS, FLIR and FCR to power on the TADS, FLIR and Fire Control Radar systems.
   - Hollow circle means OFF. Solid Circle means ON.
3. **[CPG]* If desired, press VAB next to LASER to power on the laser rangefinder/designator (LRFD) system. Take note that we will not need it in this tutorial since we will only use the FCR to provide targeting data.
   - Hollow circle means OFF. Solid Circle means ON.
   - Note: powering up the laser can only be performed by the Co-Pilot/Gunner.
4. *[CPG]* Once FCR BIT (Built-In Test) is complete, press VAB next to MMA – PINNED.
   - This will toggle the Mast-Mounted Assembly from PINNED to NORM and the FCR (Fire Control Radar) will automatically perform a power-on sequence.
5. *[CPG]* Press VAB next to UTIL to return to main WPN page.





4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

6. *[P/CPG]* Press on the FCR FAB (Fixed Action Button) to access the Fire Control Radar menu.
7. *[P/CPG]* Set Sight Selector Switch – LEFT (FCR)
8. *[P/CPG]* Set FCR Mode Selector – FWD (GTM)



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6

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

7

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

8

Collective

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Mode Selector
- *FWD: **GTM** (Ground Targeting Mode)*
- *AFT: **ATM** (Air Targeting Mode)*
- *LEFT: **TPM** (Terrain Profile Mode)*
- *RIGHT: **RMAP** (Radar Map Mode)*

8

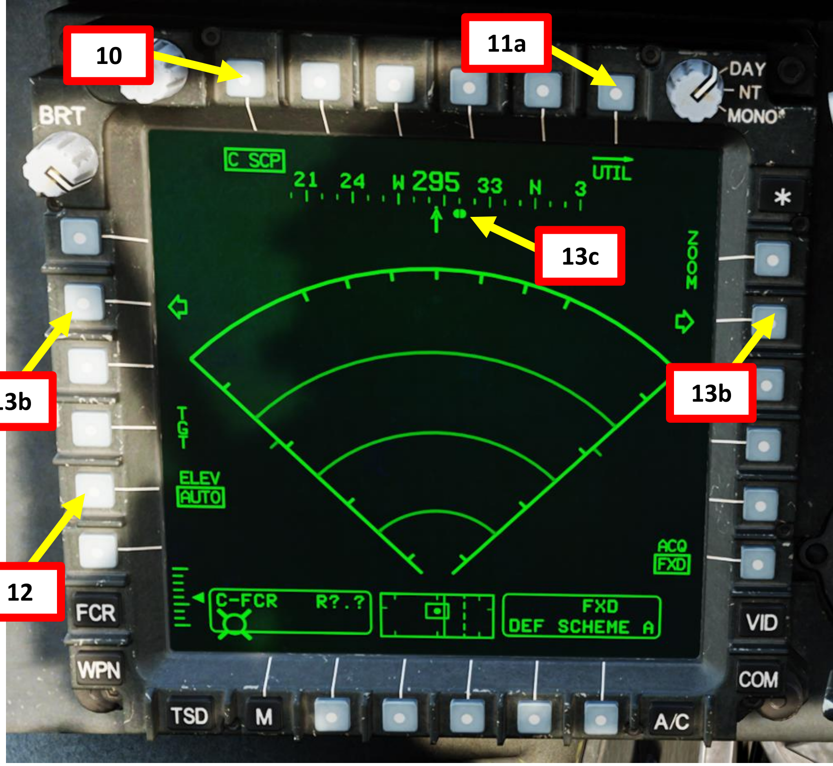
TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

7

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

9. *[P/CPG]* If desired, enable TSD ATK (Tactical Situation Display Attack) mode in order to display FCR symbology on the TSD page.
10. *[P/CPG]* Enable (box) C-SCP (C-Scope) if desired. This will display FCR Symbology on the Helmet-Mounted Display and TDU (TADS Display Unit).
11. *[P/CPG]* From the FCR UTIL (Utility) page, select desired Priority Scheme.
    - Scheme A: Stationary ground targets and airborne targets are prioritized over moving ground targets.
    - Scheme B: Stationary ground targets will be prioritized over moving round targets or airborne targets.
    - Scheme C: Moving ground targets and airborne targets will be prioritized over stationary ground targets.
12. *[P/CPG]* Set FCR Elevation – As desired. We will leave it to AUTO.
13. Adjust FCR Azimuth as desired by either:
    - *a)* *[CPG]* Using the Sight Manual Tracker (MAN TRK) Switch if the FCR is de-slaved from the CPG's acquisition source, or;
    - *b)* *[P/CPG]* Using the FCR Centerline Steering Arrows on the FCR page.
14. *[P/CPG]* Set FCR Scan Field-of-View – As desired.

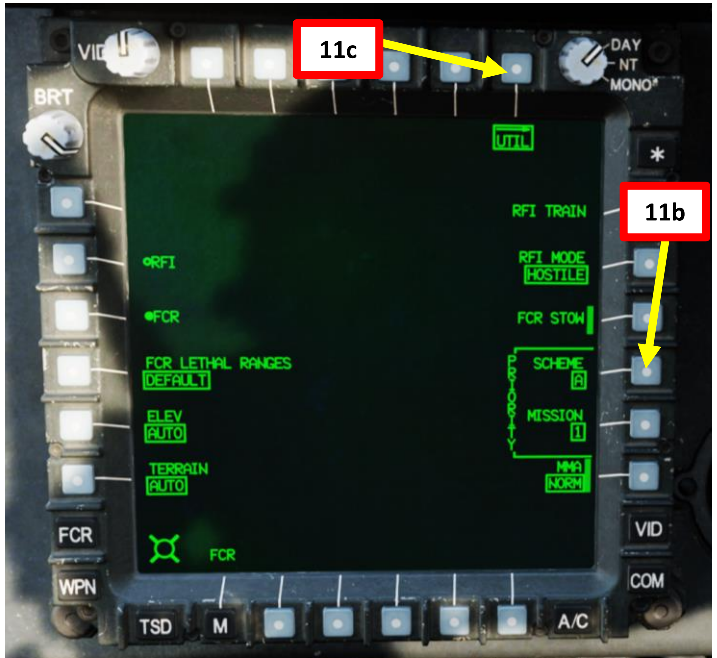


TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

FCR (Fire Control Radar) Scan FOV (Field-of-View) Size Selector
- *FWD: Z (Zoom FOV), scans 15 deg arc*
- *AFT: M (Medium FOV), scans 45 deg arc*
- *LEFT: N (Narrow FOV), scans 30 deg arc*
- *RIGHT: W (Wide FOV), scans 90 deg arc*

Sight Slave Button

MAN TRK (Sight Manual Tracker Controller) Switch, also known as "Thumb Force Controller"

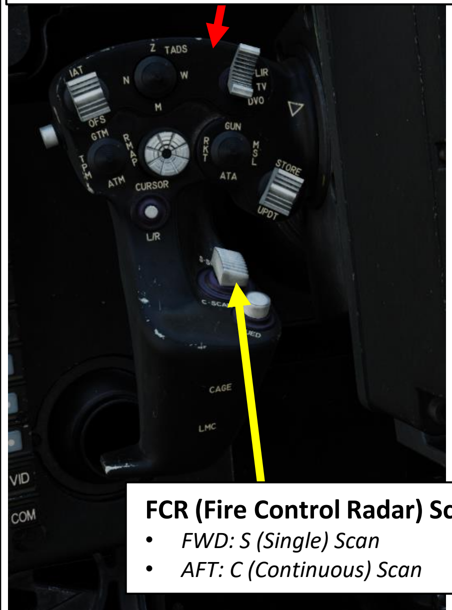


4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

15. *[P/CPG] If the target is already detected using another sensor onboard the aircraft and you want to reduce the time necessary to bring the FCR towards the intended FCR scan area, select desired acquisition source and slave the fire control radar to it. In this example, we will leave ACQ to FXD (Fixed).
    - Note: Setting another sensor as the acquisition source and enabling the SLAVE function increases the efficiency of target acquisition using an FCR scanburst; especially when using narrow scan sizes.
16. [P/CPG] Use FCR Scan Control Switch to perform a scan.
    - Switch FWD: Single Scan
    - Switch AFT: Continuous Scan
17. [P/CPG] Targets are automatically detected, classified and prioritized by the FCR. The NTS (Next-to-Shoot) Target and ANTS (Alternate Next-to-Shoot) Target are automatically determined as priority targets.
18. [P/CPG] When the FCR is being utilized as the selected sight, only one range source is available, which is a range computed by the fire control radar (nm). The Radar range displayed within the crewmember's High Action Display will always reflect the slant range to the current Next-To-Shoot (NTS) target as selected on the FCR page.

Acquisition Source 15
- *PHS (Pilot Helmet Sight)*
- *GHS (Gunner Helmet Sight)*
- *SKR (Tracking Missile Seeker)*
- *RFI (Radio Frequency Interferometer)*
- *FXD (Fixed Forward, aircraft centerline)*
- *W##, H##, C##, T## (Waypoint, Hazard, Control Measure or Target/Threat)*
- *TRN (Cursor-Selected terrain location on the TSD)*
- *TADS (Target Acquisition & Designation Sight)*

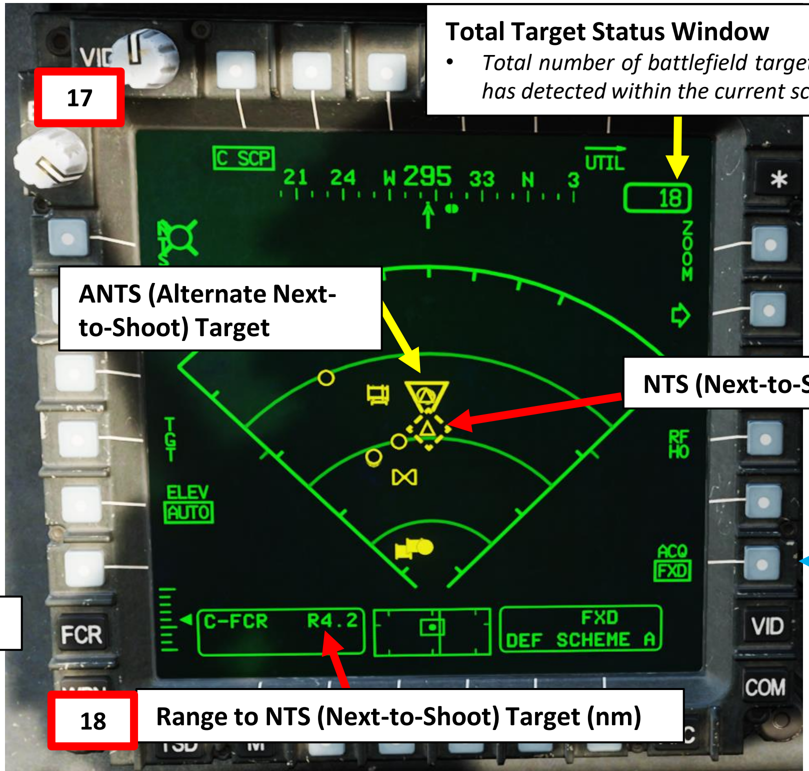
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*



FCR (Fire Control Radar) Scan Control 16
- *FWD: S (Single) Scan*
- *AFT: C (Continuous) Scan*

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Slave Button 11



17

Total Target Status Window
- *Total number of battlefield targets the FCR has detected within the current scan cycle.*

ANTS (Alternate Next-to-Shoot) Target

NTS (Next-to-Shoot) Target

18 **Range to NTS (Next-to-Shoot) Target (nm)**

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

If you want to manually designate the NTS (Next-to-Shoot) Target:

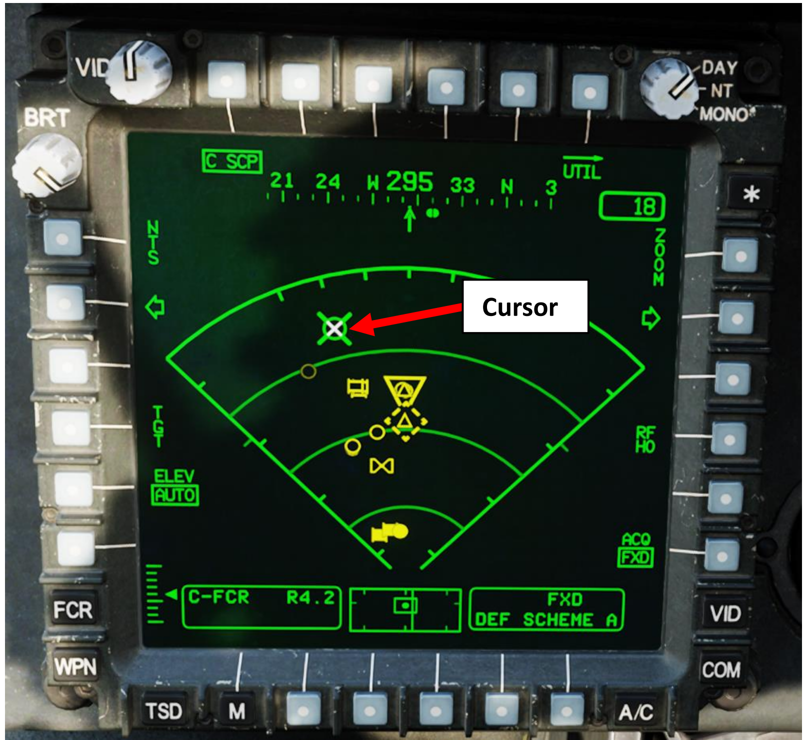
19. *[P/CPG] Move the cursor on the desired target symbol with the Cursor Control Switch (either on the TEDAC Left Hand Grip or on the Collective)
20. *[P/CPG] Press DOWN on the Cursor Switch (ENTER).
21. *[P/CPG] Cursor-selecting an FCR target symbol on the FCR page will set this new target as the Next-to-Shoot (NTS) Target. That target is then placed at the top of the High Priority Target List, and the previous target that had been manually designated as NTS is returned to its previous ranking.

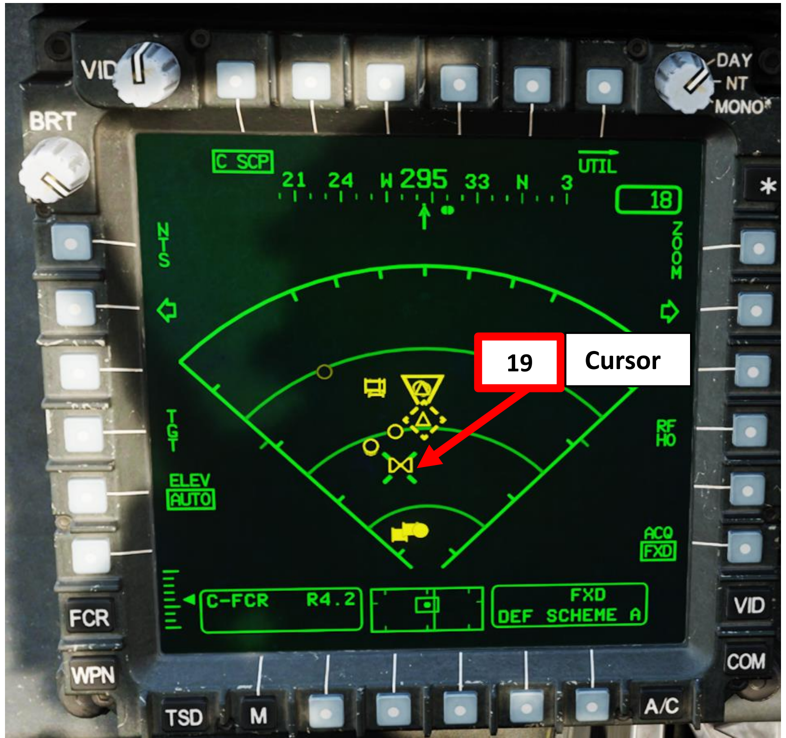
- Alternatively, The NTS (Next-to-Shoot) and ANTS (Alternate Next-to-Shoot) may be manually sequenced by **pressing the NTS Select button on the FCR page**. Each time this button is pressed, the NTS and ANTS designations will sequence to the next targets on the High Priority Target List.

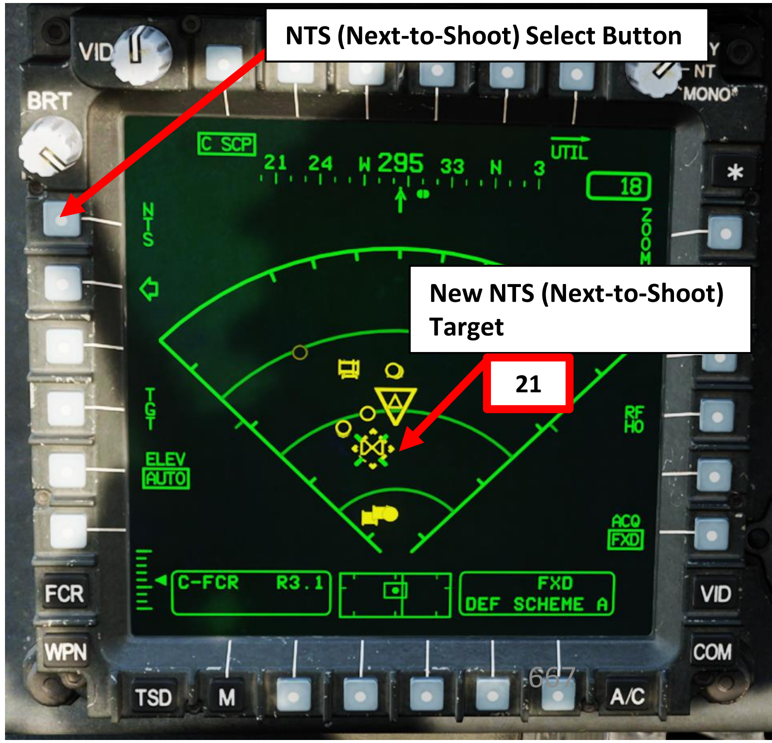
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

19
20

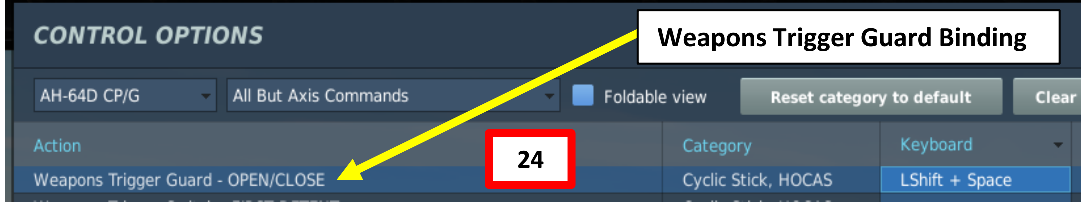


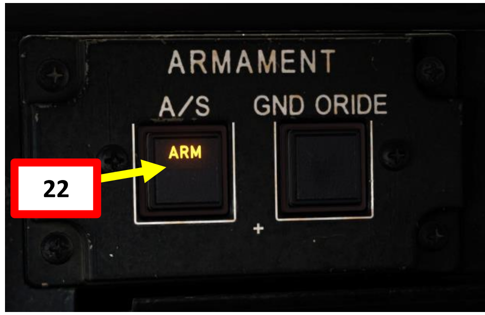


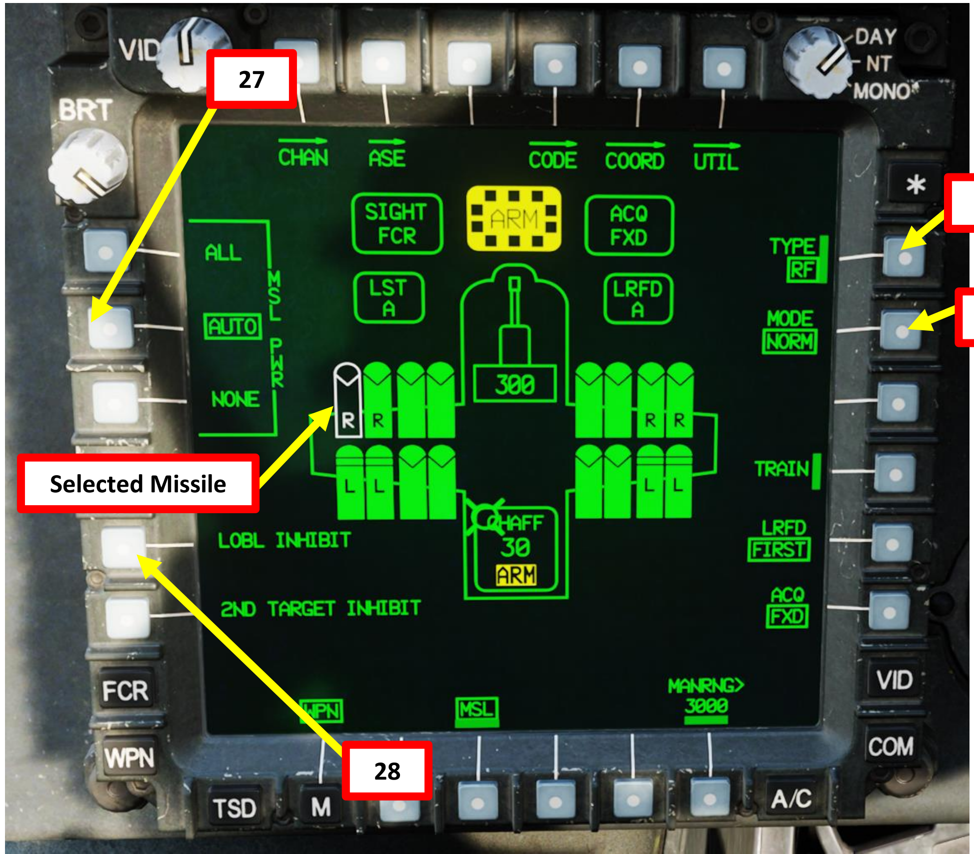


4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

22. *[P/CPG]* Press A/S (Arm/Safe) Pushbutton to set Master Arm ON (ARM).
23. *[CPG]* Press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT to select Missiles.
24. *[CPG]* Flip TEDAC Left Hand Grip Weapons Trigger Switch Guard – UP (Safety OFF/OPEN).
    - Set the “Weapons Trigger Guard – OPEN/CLOSE” to a binding easy to remember like “LSHIFT+SPACEBAR”.
    - This step is not required if the “Weapons Trigger Guard Enable Special Option” is disabled (unticked).
25. *[CPG]* Verify Missile Type is set to RF (Radio Frequency).
26. *[CPG]* Set Missile mode to NORMAL.
27. *[CPG]* Set Missile Power Mode to AUTO.
28. *[CPG]* Set Missile LBL (Lock-On Before Launch) Inhibit – OFF (Un-boxed).







Weapon Action Switch (WAS) 23
- *FWD: “**G**” selects the gun.*
- *LEFT: “**R**” selects rockets.*
- *RIGHT: “**M**” selects Hellfire missiles.*
- *AFT: “**A**” selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

TEDAC LHG Weapon Trigger (opposite side of grip)
- *Fires the actioned weapon system if that weapon was actioned using the Weapon Action Switch on the left TEDAC grip.*

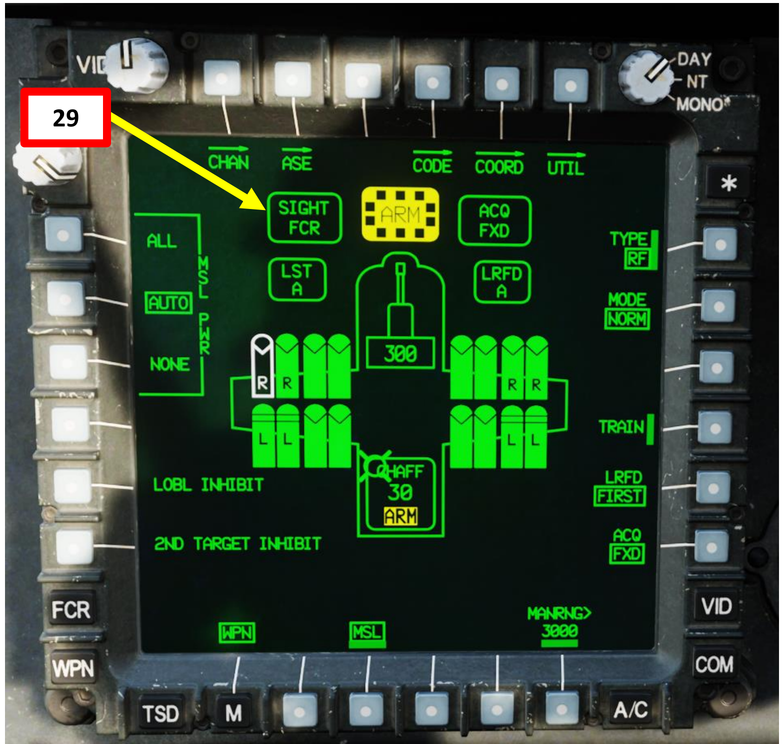
4 – AGM-114 HELLFIRE MISSILE

4.3 – Radar-Guided Hellfire (AGM-114L)

4.3.1 – Missile Operation by Multicrew

4.3.1.2 – With FCR (Fire Control Radar)

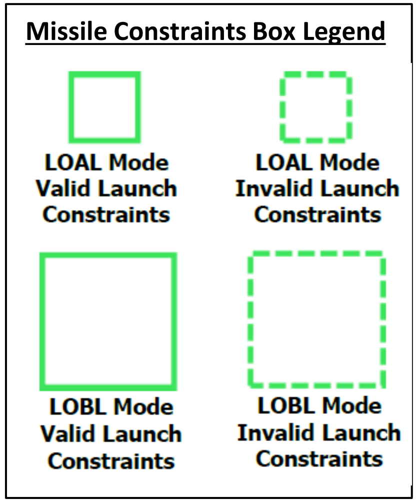
29. *[CPG]* Confirm the selected sight is the FCR.
30. *[CPG]* If desired, you can monitor the TADS video feed by pressing the TAD button or the FCR page by pressing the FCR button.
31. *[CPG]* The NTS (Next-to-Shoot) Target is automatically being located and ranged by the Fire Control Radar. This information is fed to the missile. This means the missile now has enough position data about the target to properly home on its location.
32. *[CPG]* Unlike the AGM-114K laser-guided missile, the AGM-114L radar-guided missile does not track a laser designator; it uses the target location determined by the FCR as a reference and uses its own active radar seeker to home on the target.
33. *[CPG]* Instruct the Pilot to align the aircraft within missile launch constraints using the phrase "Constraints".



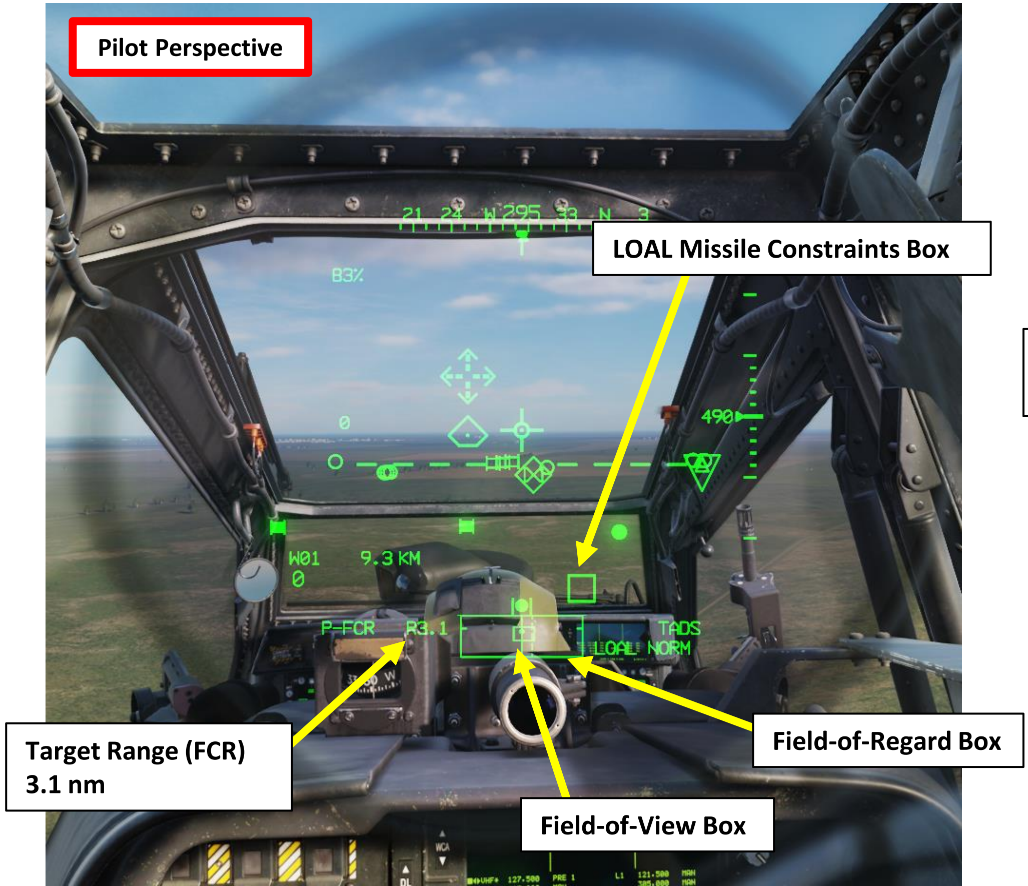
FCR Page on TDU (TADS Display Unit) 30

TADS Feed on TDU (TADS Display Unit) 30

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)



34. *[P]* When pilot is told "Constraints" by the co-pilot/gunner, align the helicopter properly with the target designated by the co-pilot/gunner by using the Missile Constraints Box.
    - Note: Just as in the case of the AGM-114K, the AGM-114L may be employed in either a Lock-On-Before-Launch (**LOBL**) mode or a Lock-On-After-Launch (**LOAL**) mode. However, the electronics within the AGM-114L missile itself performs an automatic determination of which mode it should utilize, based on the nature of the target handover it receives. The aircrew does not have any direct control over which mode the missile defaults to.



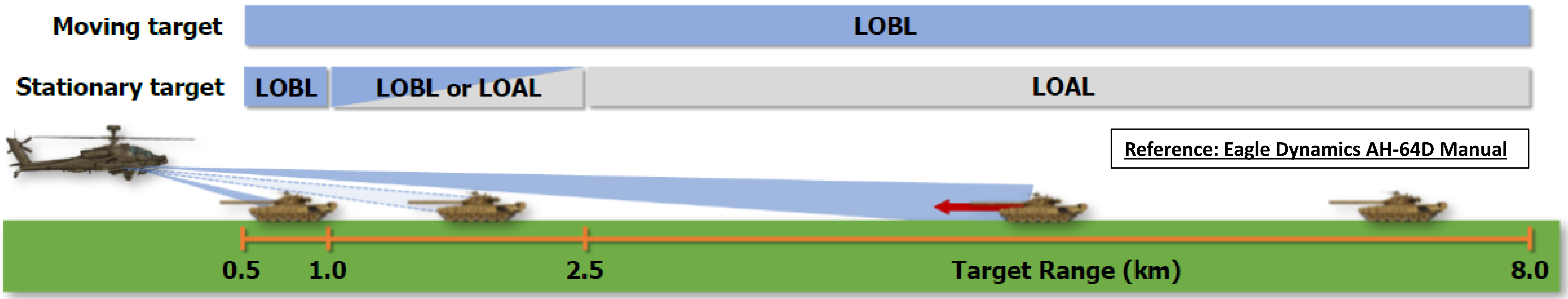
4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

35. *[P/CPG]* Important Note: Once a target has been "memorized" by the missile, subsequent designation will not erase the initial target coordinates memorized. In order to "reset" the missile and erase the memorized target, press TEDAC Left Hand Grip WAS (Weapon Action Switch) RIGHT once to de-action the missile, then RIGHT a second time to re-select Missiles.

36. LOAL vs LOBL Selection Logic
Unlike the laser-seeking AGM-114K missile variants, the AGM-114L missile performs its own determination of which launch mode (LOBL or LOAL) is optimal for target acquisition, based on the nature of the target handover it receives.
    - **Lock-On After Launch (LOAL) small box**: Missile will activate its onboard radar seeker after launch and scan the vicinity of the target location in an attempt to acquire and track its target.
        - Selected if the target is stationary and greater than 2.5 km in range.
        - Selected if the target is stationary and between 1 and 2.5 km in range and LOBL mode is unsuccessful.
    - **Lock-On Before Launch (LOBL) big box**: Missile will immediately activate its onboard radar seeker and scan the vicinity of the target location in an attempt to acquire and track its target.
        - Selected if the target is stationary but less than 1 km in range and there is insufficient time to acquire the target after launch.
        - Selected if the target is stationary and between 1 and 2.5 km in range and there may be insufficient time to acquire the target after launch
        - Selected if the target is moving at any range.

    - **Dashed format**: missile not in constraints and/or not ready to fire
    - **Solid format**: missile within constraints and ready to fire

Weapon Action Switch (WAS) 35
- *FWD: "**G**" selects the gun.*
- *LEFT: "**R**" selects rockets.*
- *RIGHT: "**M**" selects Hellfire missiles.*
- *AFT: "**A**" selects Air-to-Air Weapons (no function in our DCS AH-64D variant)*

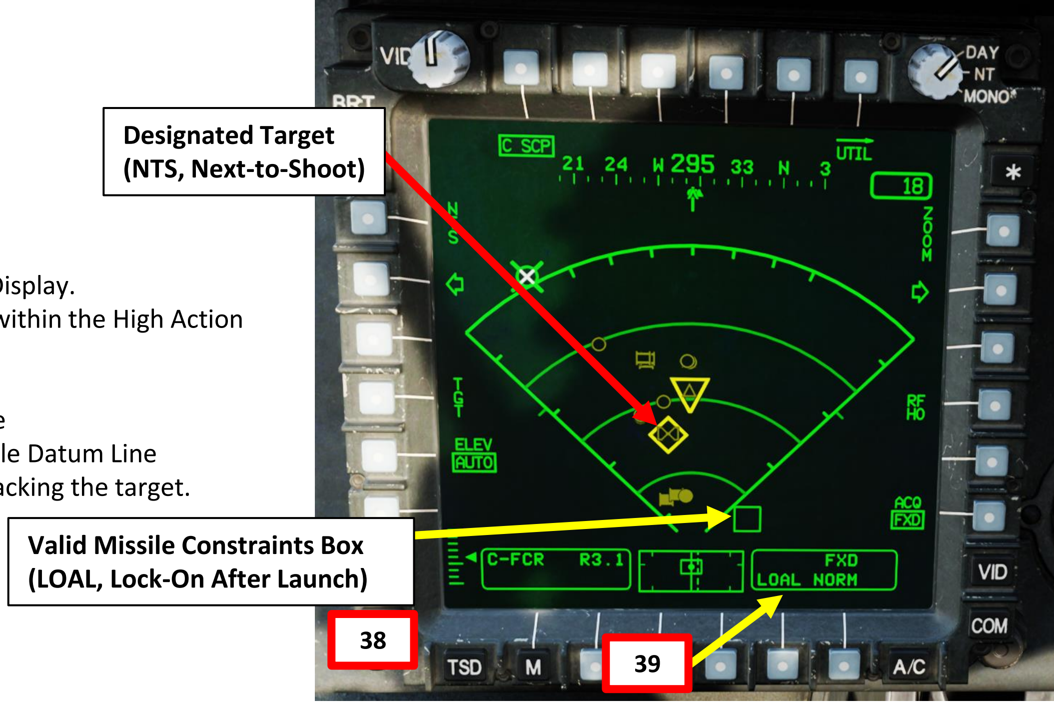


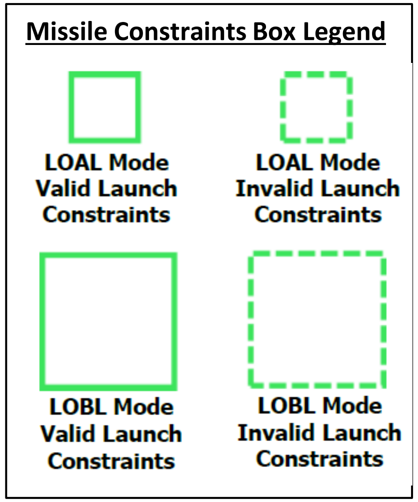
Reference: Eagle Dynamics AH-64D Manual

LOBL & LOAL Selection Logic

4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

37. *[CPG]* Verify no weapon inhibit messages (i.e. SKR LIMIT, YAW LIMIT, etc.) are displayed in the High Action Display.
38. *[CPG]* If the missile is outside acceptable launch constraints or any Weapon Inhibit messages are displayed within the High Action Display, the Missile Constraints Box will be displayed as Invalid (dashed).
    - **LOBL Constraints (< 1 km):** Missile seeker line-of-sight is offset ≤ 5 deg from the Missile Datum Line
    - **LOBL Constraints (≥ 1 km):** Missile seeker line-of-sight is offset ≤ 20 deg from the Missile Datum Line
    - **LOAL Constraints (≥ 1 km):** Missile seeker line-of-sight to the target is offset ≤ 20 deg from the Missile Datum Line
39. *[CPG]* Verify LOAL NORM or LOBL NORM is displayed in the High Action Display. This means the missile is tracking the target.
40. *[CPG]* Fire missile by squeezing the TEDAC Left Hand Grip Weapons Trigger Second Detent.



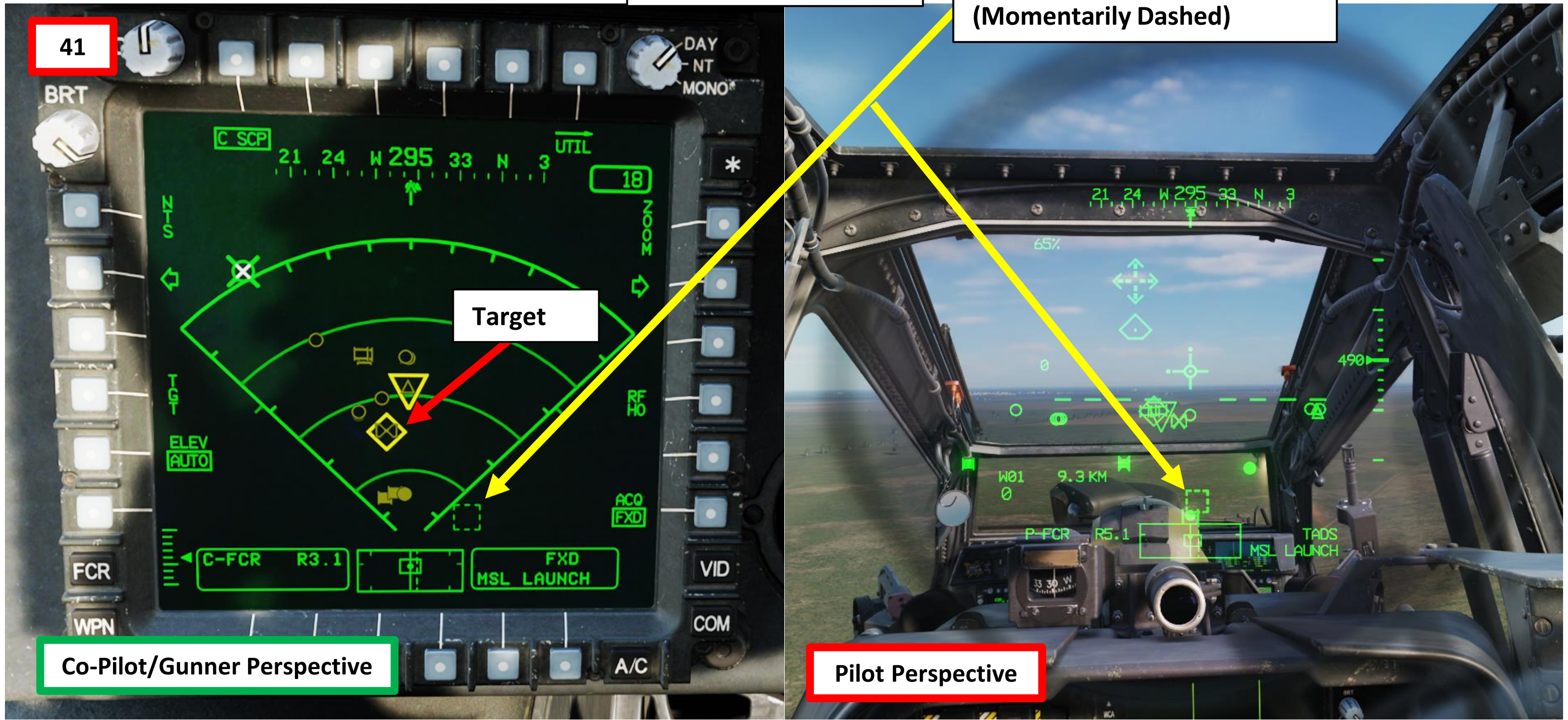


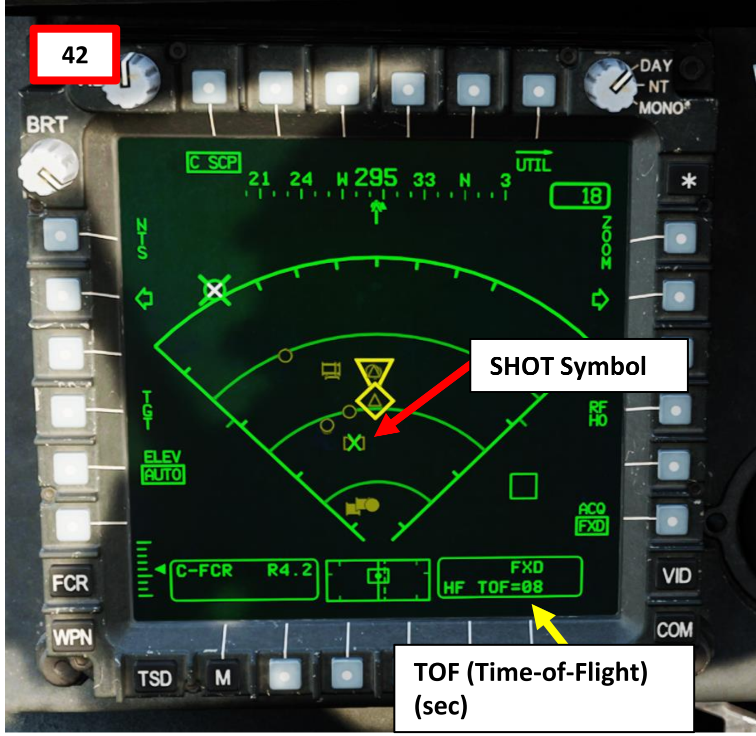
4 – AGM-114 HELLFIRE MISSILE
4.3 – Radar-Guided Hellfire (AGM-114L)
4.3.1 – Missile Operation by Multicrew
4.3.1.2 – With FCR (Fire Control Radar)

41. *[CPG]* The missile will home on the target; fire and forget. Once the missile is fired, the Missile Constraints Box will momentarily become dashed (this is normal since the next missile is automatically selected) and a TOF (Time-of-Flight) indication in seconds is displayed until missile impact.
42. *[CPG]* A SHOT symbol will appear where the missile has been fired at.

Missile Launching

LOAL Missile Constraints Box (Momentarily Dashed)





4 – AGM-114 HELLFIRE MISSILE

4.3 – Radar-Guided Hellfire (AGM-114L)

4.3.1 – Missile Operation by Multicrew

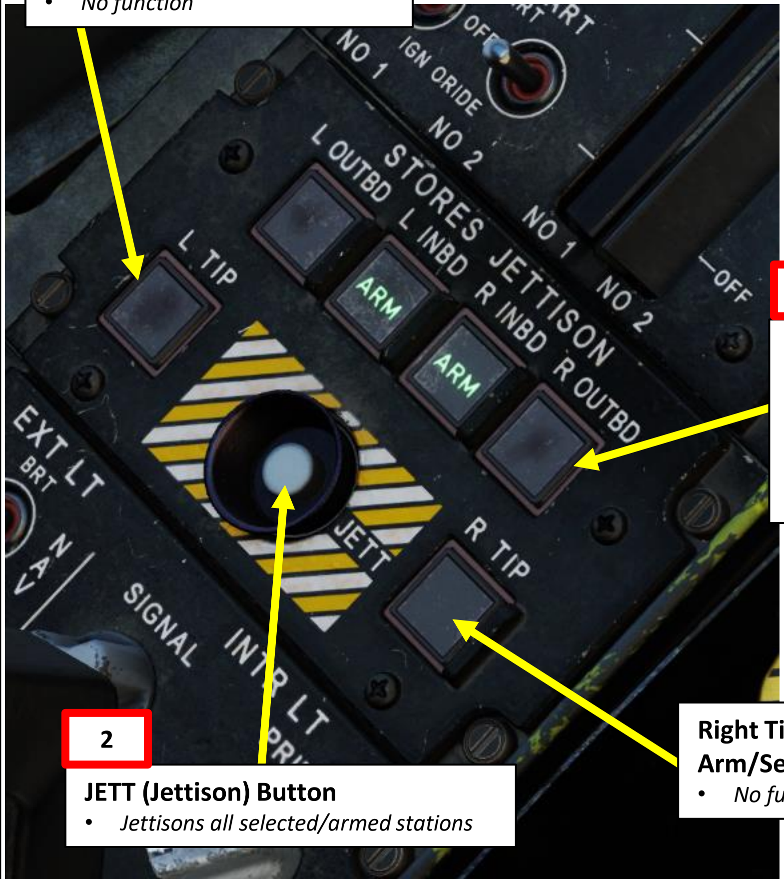
4.3.1.2 – With FCR (Fire Control Radar)

5 – ORDNANCE JETTISON
5.1 – Selective Stores Jettison

If you want to jettison specific stores:

1. Press the desired Station Jettison Arm/Select Pushbutton of the station you want to jettison.
2. Press the JETT (Jettison) Button.

Left Tip (LTIP) Station Jettison Arm/Select Pushbutton
- *No function*



1

Station Jettison Arm/Select Pushbuttons
- *L OUTBD: Left Outboard Station*
- *L INBD: Left Inboard Station*
- *R INBD: Right Inboard Station*
- *R OUTBD: Right Outboard Station*

Right Tip (RTIP) Station Jettison Arm/Select Pushbutton
- *No function*

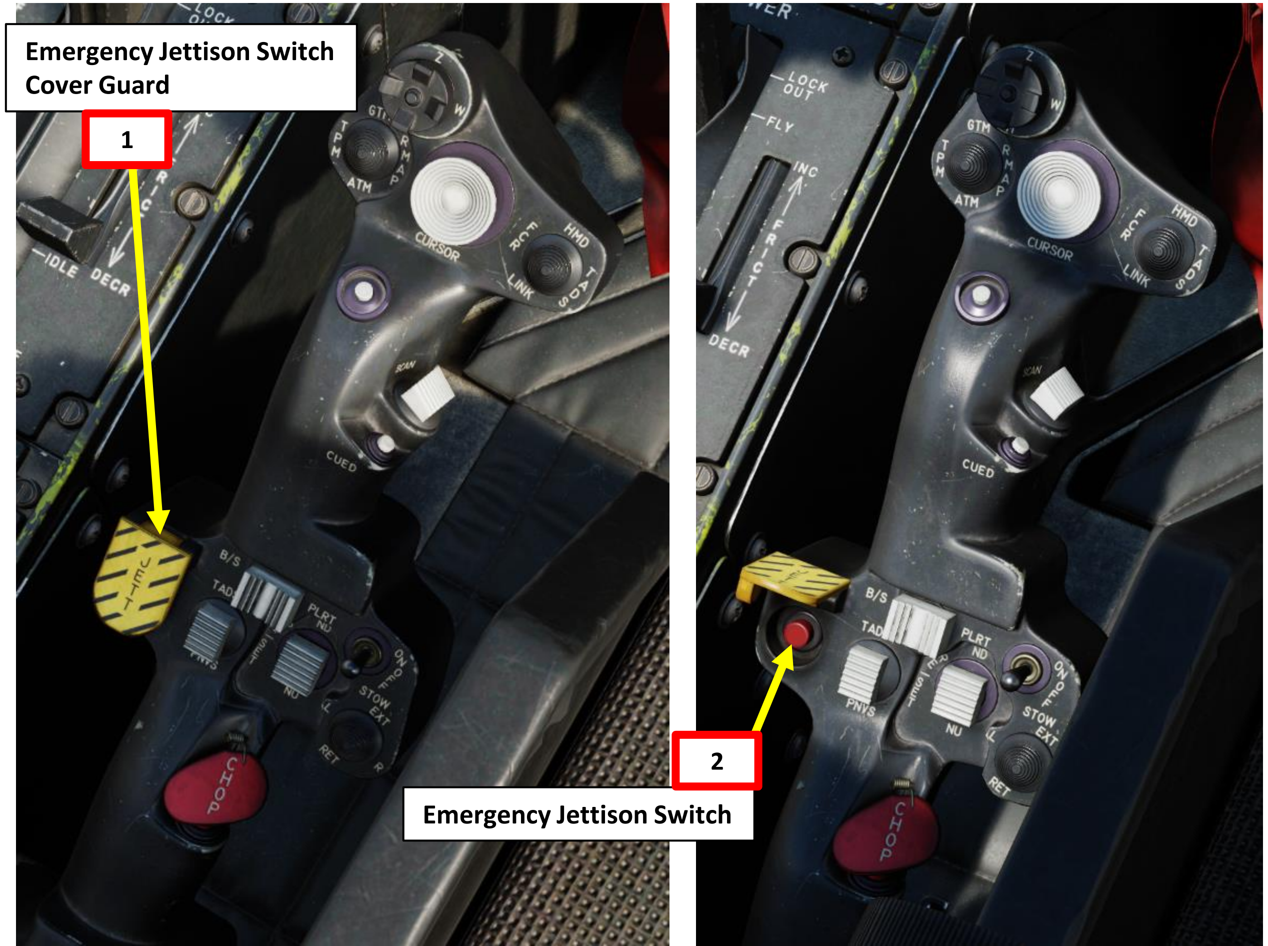
2

JETT (Jettison) Button
- *Jettisons all selected/armed stations*

5 – ORDNANCE JETTISON
5.2 – Emergency Stores Jettison

If you want to jettison all stores at once:

1. Flip the Emergency Jettison Switch Cover Guard
2. Press the Emergency Jettison Switch

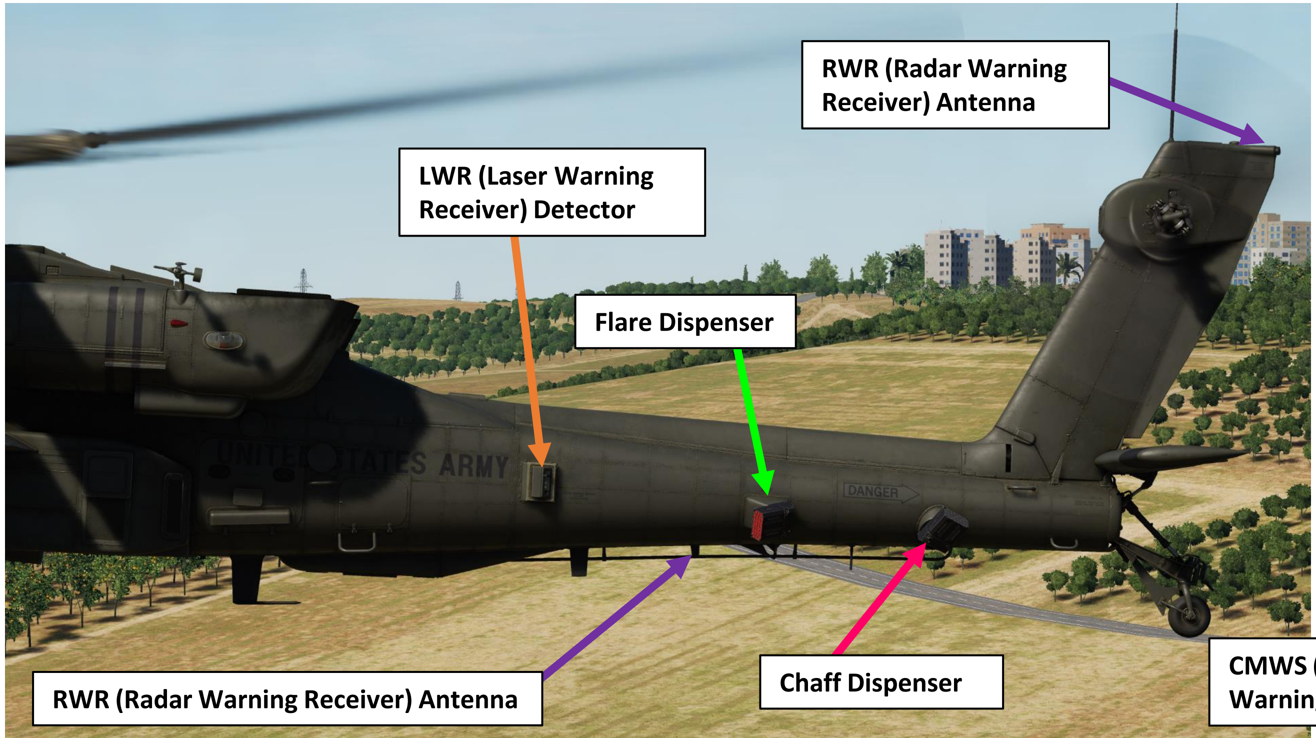


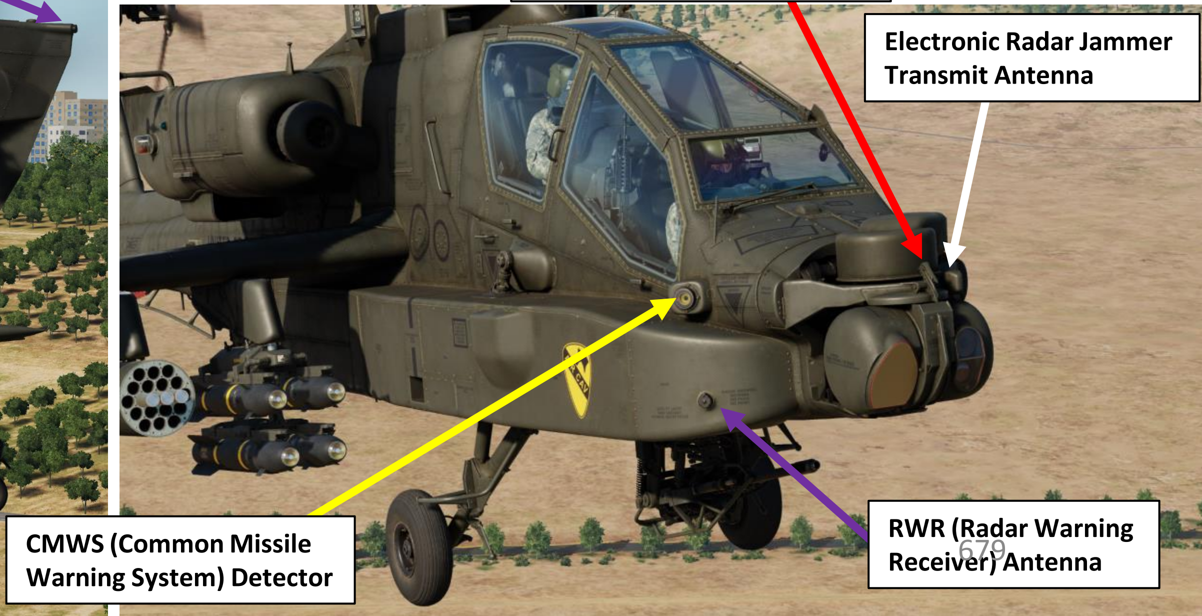
SECTION SUMMARY

1 – Introduction to ASE (Aircraft Survivability Equipment)

The AH-64D is equipped with ASE (Aircraft Survivability Equipment, pronounced “ace”), which is a suite of active and passive systems to ensure, well, the survival of the aircraft. The main components of ASE are:

- WSPS (Wire Strike Protection System): a system of wire cutting blades to cut through power lines.
- AN/APR-39A(V)4 Radar Signal Detecting Set: also referred as the RWR (Radar Warning Receiver), this system provides detection of threat radar emitters.
- AN/AVR-2A Laser Signal Detecting Set: this system provides detection of threat laser emissions, which are often used by tanks or helicopters when ranging a target.
- Common Missile Warning System (CMWS): provides detection of threat missiles.
- Chaff & Flare Countermeasures Dispensers: provides chaff and flare decoys to defeat incoming missiles.
- AN/ALQ-136(V)5 Electronic Radar Jammer: provides radar jamming capabilities.

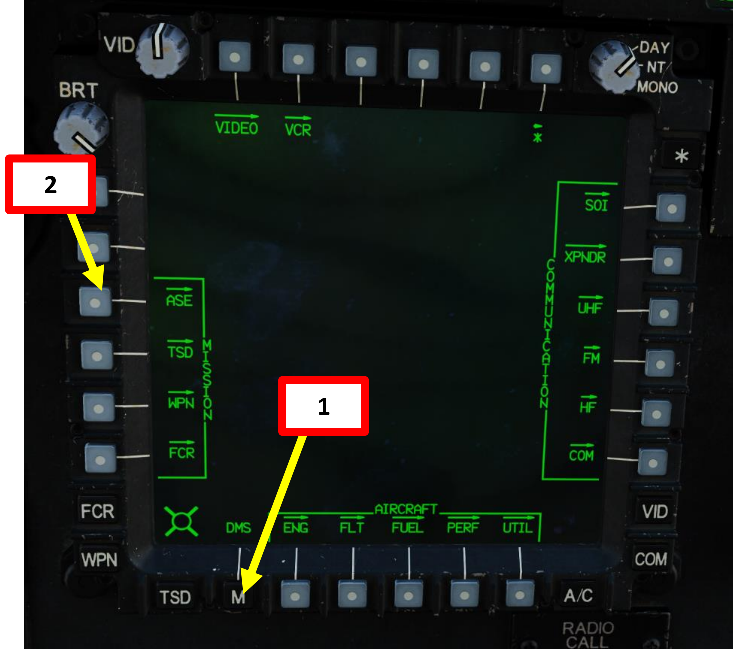


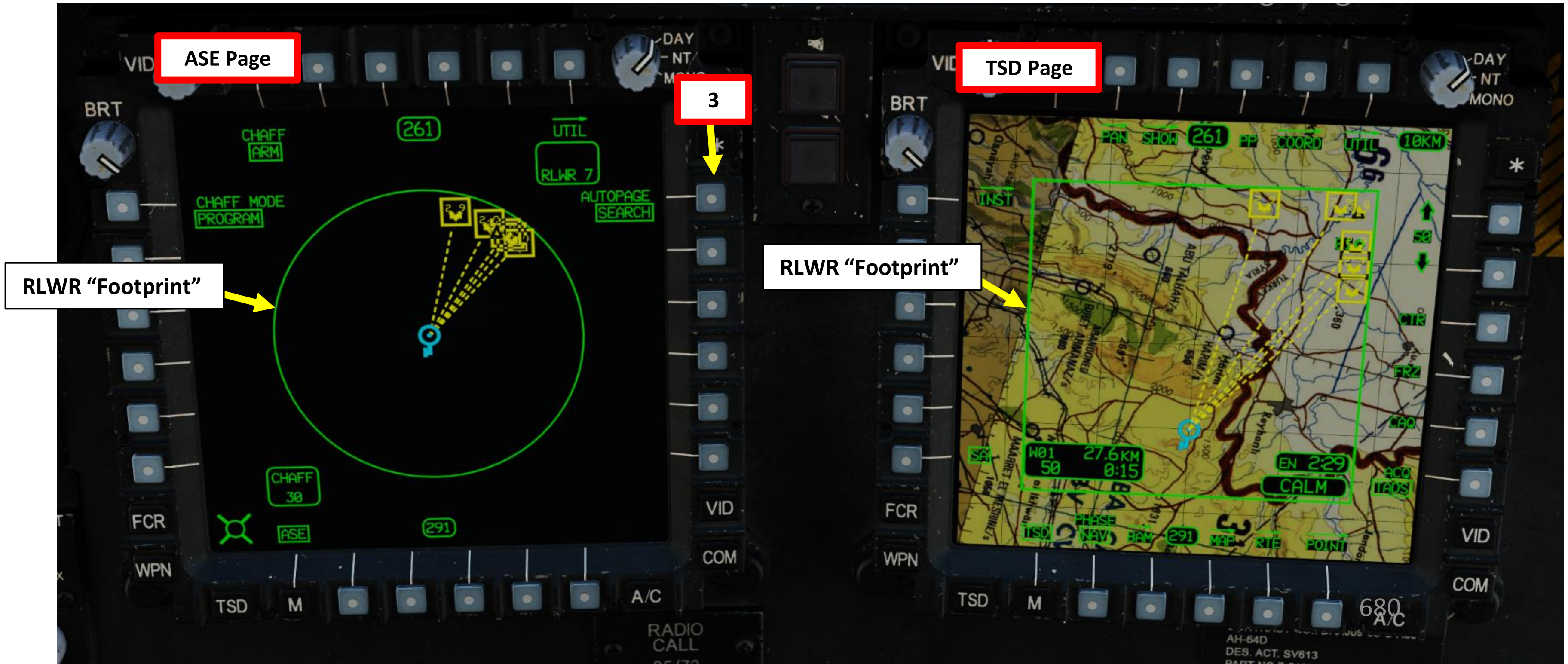


1 – Introduction to ASE (Aircraft Survivability Equipment)

The MPD (Multi-Purpose Display) TSD (Tactical Situation Display) and ASE (Aircraft Survivability Equipment) pages provide a singular "footprint" for the combined indications of the RLWR (Radar/Laser Warning Receiver) and RFI (Radio Frequency Interferometer) if equipped with an FCR (Fire Control Radar) mast-mounted assembly. The ASE page can be accessed in the following manner:

1. Press on the M (Menu) Button to access the main MPD menu.
2. Press VAB (Variable Action Button) next to MISSION – ASE.
3. Press VAB next to ASE AUTOPAGE Setting to select desired threat level that will result in an "Autopage" (automatic display of the ASE symbology) to the ASE and TSD (Tactical Situation Display) format. I typically leave it at SEARCH.
    - SEARCH: ASE will Autopage when a search radar is detected.
    - ACQUISITION: ASE will Autopage when a radar acquisition is detected.
    - TRACK: ASE will Autopage when a tracking radar is detected.
    - OFF: ASE will not Autopage.





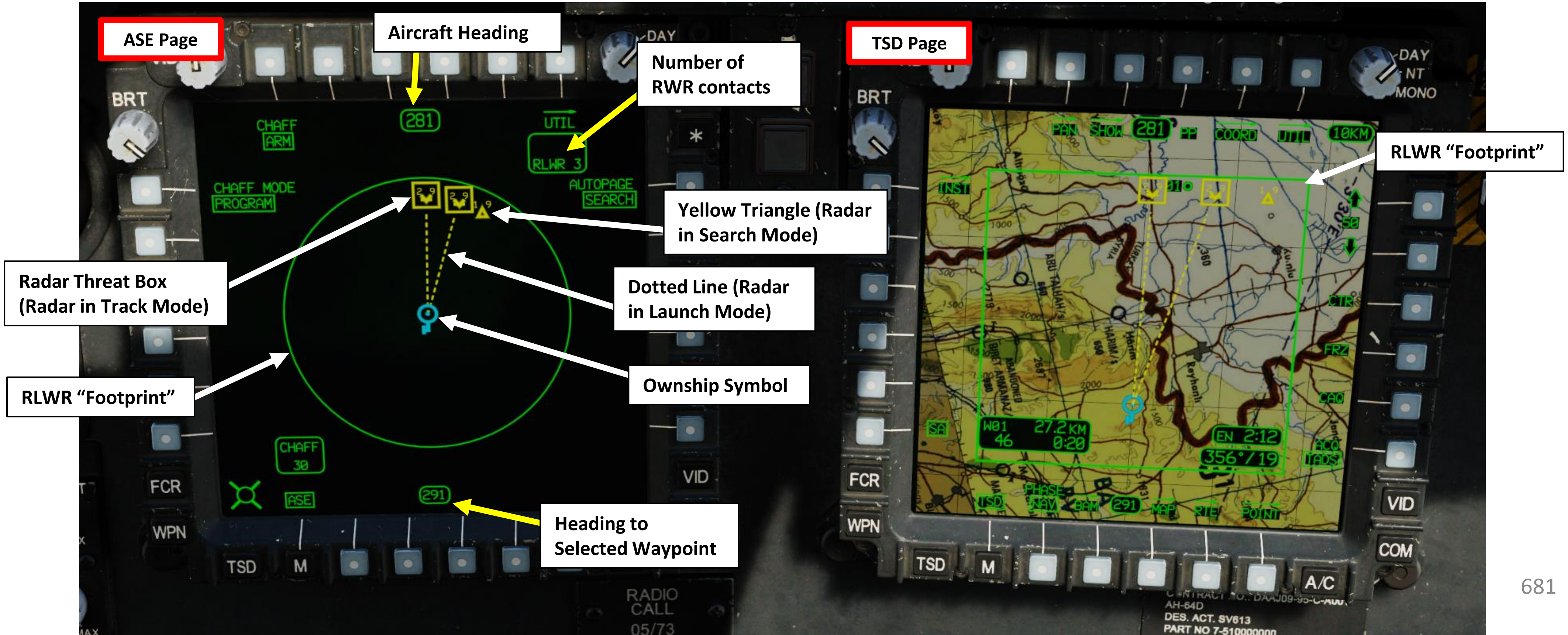
2 – AN/APR-39A(V)4 Radar Signal Detecting Set

Radar Warning Receiver (RWR) Symbology

The AN/APR-39A(V)4 provides detection of threat radar emissions. The system uses a series of external antennas to passively detect and identify radar signals and display them to the crew on the MPD TSD and ASE pages. The display is an azimuth-only top-down display with no range information. The type of threat symbol is displayed within the inside of the RLWR (Radar/Laser Warning Receiver) "footprint". The nature of the threat is indicated by the type of icon and its label, and the severity of the threat is indicated by additional formatting placed around the symbol. Symbol formatting is as follows:

- Search Mode: Radar threat is displayed as a **yellow triangle icon** with a one- or two-digit label identifier.
- Track Mode: **Radar threat icon** is displayed with a **box placed around the icon** and a dotted line leading to the Ownship.
- Launch Mode: Radar threat is displayed with a **flashing box** placed around the icon and a **flashing dotted line** leading to the Ownship (blue symbol).
- New Threat: A new radar threat is displayed as a **bolded yellow triangle for 3 seconds**.
- Threat no longer detected: A radar threat that is no longer detected will be displayed in **partial intensity yellow for 10 seconds** before being removed from the RLWR "footprint".

An aural warning will give you the type of radar, its mode (search, track, launch) and relative bearing from you (in o' clock).



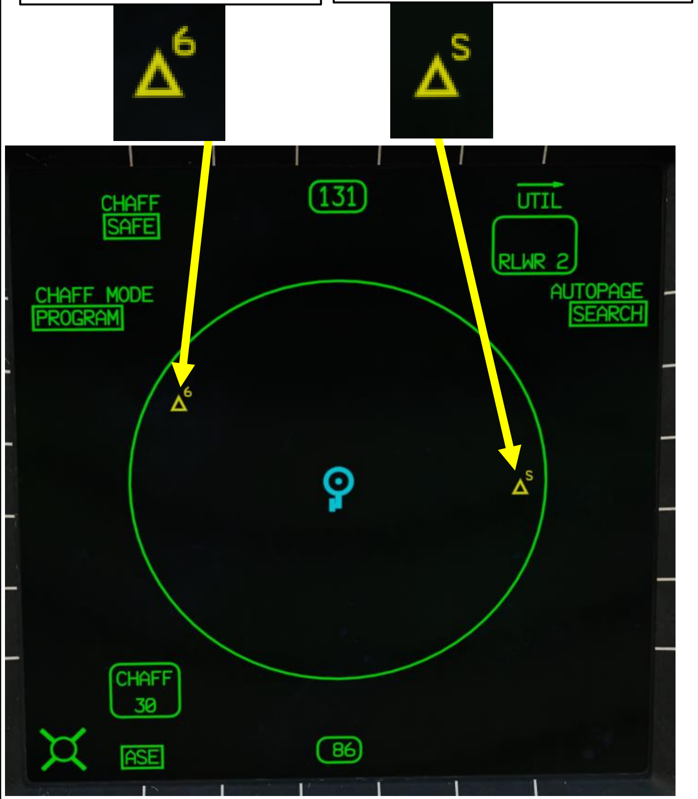
2 – AN/APR-39A(V)4 Radar Signal Detecting Set

Radar Warning Receiver (RWR) Symbology

AH-64D Threat Data Sheet by Mediocre_Chaos
Source: https://www.digitalcombatsimulator.com/en/files/3321336/

6: SA-6 SAM (Surface-to-Air Missile) System

S: "Flat Face" Search Radar



SAM / AAA THREATS (KM RANGE)			ASE / RWR Codes			AH-64D
GROUND						
SYSTEMS						
2	CH	52 / ++	SA-2	Guideline	S-75	R
3	CH	24 / ++	SA-3	Goa	S-125	R
5	CH	135 / ++	SA-5	Gammon	S-200	R
6	CH	41 / 26	SA-6	Gainful	Kub	R
7	EV	19 / 18	HQ-7			O
8	CH	17 / 16	SA-8	Gecko	Osa	R/O
10	CH	85 / ++	SA-10	Grumble	S-300	R
11	CH	43 / ++	SA-11	Gadfly	Buk	R
13	FL	09 / 12	SA-13	Gopher	Strela	IR
15	CH	17 / 20	SA-15	Gauntlet	Tor	R
19	EV	09 / 12	SA-19 (2S6)	Grison	Tunguska	O
A	EV	04 / 10	Gepard			R
	EV	04 / 05	M163	Vulcan		R
	EV	04 / 07	ZSU-23-4	Shilka		R
HK	CH	46 / ++	Hawk			R
NS	CH	11 / 35	NASAMS AIM-120C			R
		11 / 30	NASAMS AIM-120B			R
P	CH	89 / ++	Patriot			R
RO	CH	11 / 20	Roland			R
RA	EV	13 / 10	Rapier			O
MANPADS						
	FL	4.6 / 12	SA-18	Grouse	Igla	IR
	FL	4.6 / 12	SA-24	Grinch	Igla-S	IR
	FL	3.7 / 07	FIM-92	Stinger		IR
ATGM						
BMP	EV	05 / --	AT-5	Spandrel	9M113 Konkurs	W
T80/90	EV	05 / --	AT-11	Sniper	9M119M Refleks	L

COUNTERMEASURES: CH - CHAFF FL - FLARES
EV - EVASIVE MANEUVERING (OPTICAL SAM / AAA)
10 / 22 - MAX LAUNCH RANGE, km / ALTITUDE x 1000 ft AGL
++ THE MISSILE CAN REACH ABOVE 50,000 ft
GUIDANCE: R - RADAR O - OPTICAL IR - INFRA RED L - LASER W - WIRE

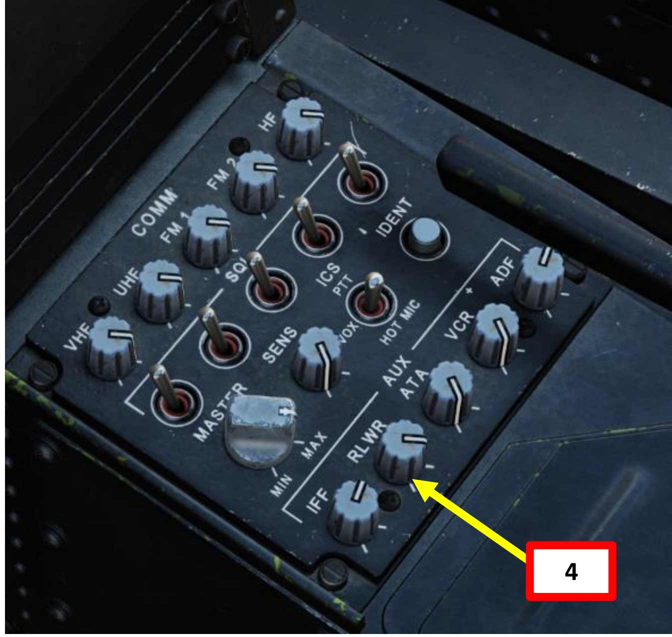
SAM / AAA THREATS (NM RANGE)			ASE / RWR Codes			AH-64D
GROUND						
SYSTEMS						
2	CH	28 / ++	SA-2	Guideline	S-75	R
3	CH	13 / ++	SA-3	Goa	S-125	R
5	CH	73 / ++	SA-5	Gammon	S-200	R
6	CH	22 / 26	SA-6	Gainful	Kub	R
7	EV	10 / 18	HQ-7			O
8	CH	09 / 16	SA-8	Gecko	Osa	R/O
10	CH	46 / ++	SA-10	Grumble	S-300	R
11	CH	23 / ++	SA-11	Gadfly	Buk	R
13	FL	05 / 12	SA-13	Gopher	Strela	IR
15	CH	09 / 20	SA-15	Gauntlet	Tor	R
19	EV	05 / 12	SA-19 (2S6)	Grison	Tunguska	O
A	EV	02 / 10	Gepard			R
	EV	02 / 05	M163	Vulcan		R
	EV	02 / 07	ZSU-23-4	Shilka		R
HK	CH	25 / ++	Hawk			R
NS	CH	06 / 35	NASAMS AIM-120C			R
		06 / 30	NASAMS AIM-120B			R
P	CH	48 / ++	Patriot			R
RO	CH	06 / 20	Roland			R
RA	EV	07 / 10	Rapier			O
MANPADS						
	FL	2.5 / 12	SA-18	Grouse	Igla	IR
	FL	2.5 / 12	SA-24	Grinch	Igla-S	IR
	FL	2.0 / 07	FIM-92	Stinger		IR
ATGM						
BMP	EV	2.6998 / --	AT-5	Spandrel	9M113 Konkurs	W
T80/90	EV	2.6998 / --	AT-11	Sniper	9M119M Refleks	L

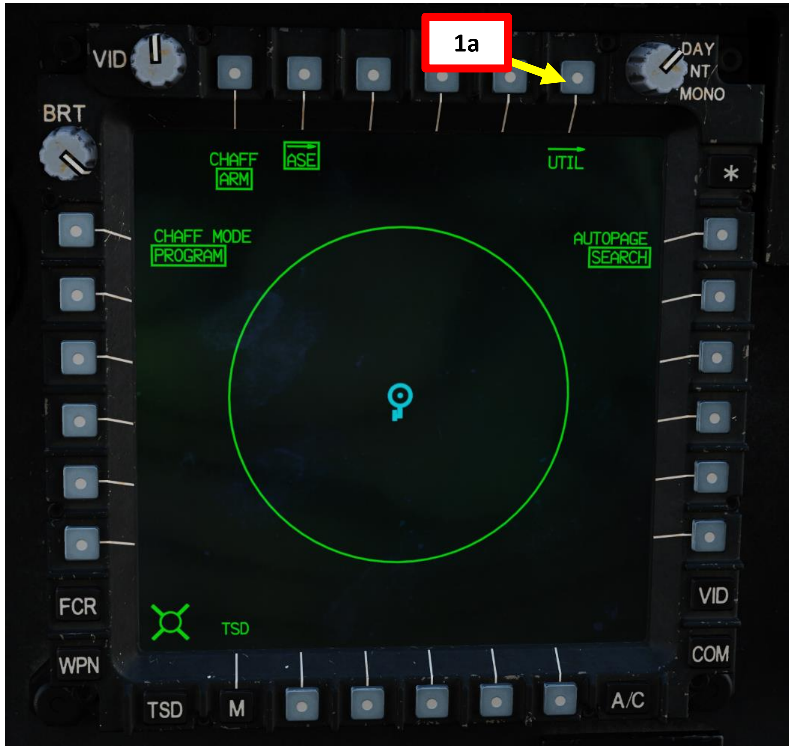
COUNTERMEASURES: CH - CHAFF FL - FLARES
EV - EVASIVE MANEUVERING (OPTICAL SAM / AAA)
10 / 22 - MAX LAUNCH RANGE, NM / ALTITUDE x 1000 ft AGL
++ THE MISSILE CAN REACH ABOVE 50,000 ft
GUIDANCE: R - RADAR O - OPTICAL IR - INFRA RED L - LASER W - WIRE

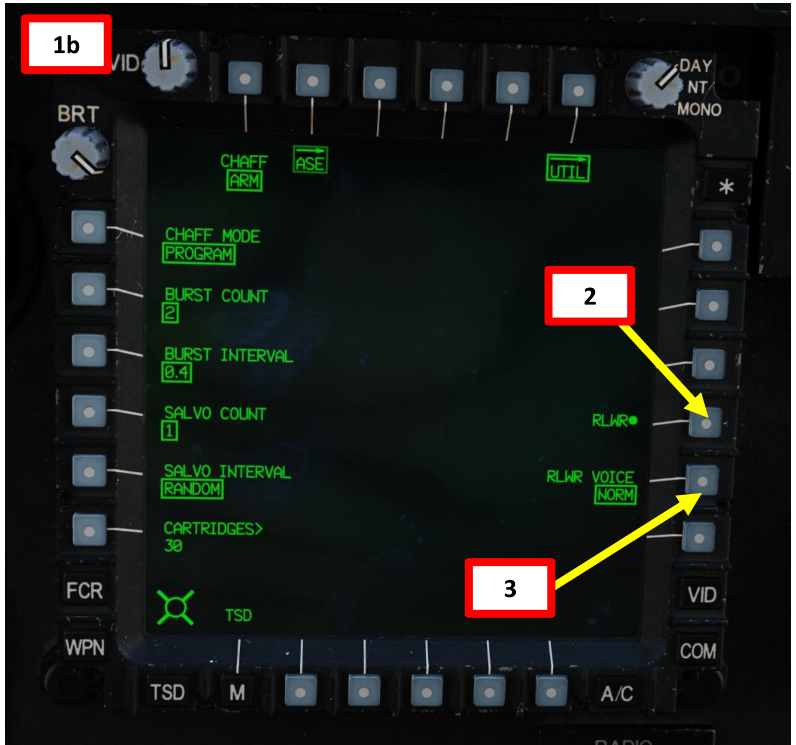
2 – AN/APR-39A(V)4 Radar Signal Detecting Set

How to Power Up the Radar Signal Detecting Set / Radar Warning Receiver (RWR)

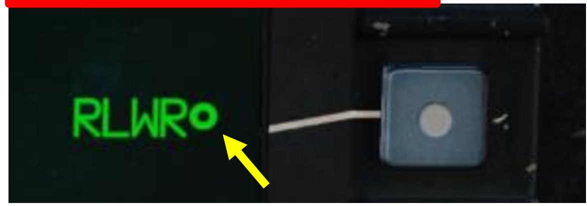
1. From the ASE page, press VAB next to UTIL.
2. Turn on Radar/Laser Warning Receiver by pressing VAB next to RLWR.
   - Hollow circle means OFF. Solid Circle means ON.
3. Set Radar Warning Receiver Audio/Voice Mode – as desired
   - NORM: Normal voice warnings for radar emitters
   - TERSE: Voice warnings are less frequent
4. Adjust RWR volume with the RLWR Auxiliary System Volume Knob







Radar/Laser Warning Receiver OFF



Radar/Laser Warning Receiver ON

3 – AN/AVR-2A Laser Signal Detecting Set

The AN/AVR-2A provides detection of threat laser emissions by using a series of external detectors to passively detect and classify laser sources. It can detect laser threats from 360 degrees around aircraft, just like the Radar Warning Receiver.

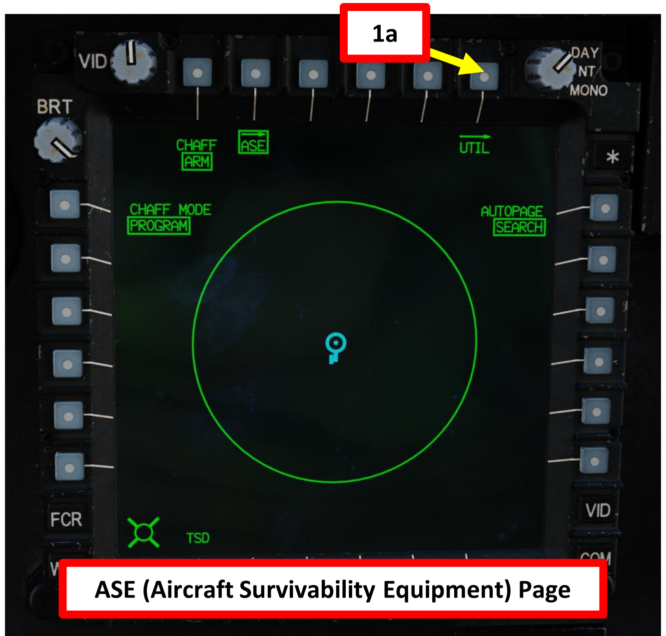
Note: The Laser Signal Detecting Set is powered and controlled from the ASE UTIL page in the exact same manner as the Radar Signal Detecting Set / Radar Warning Receiver (RWR).
See steps 1 through 4 below for power-up sequence.

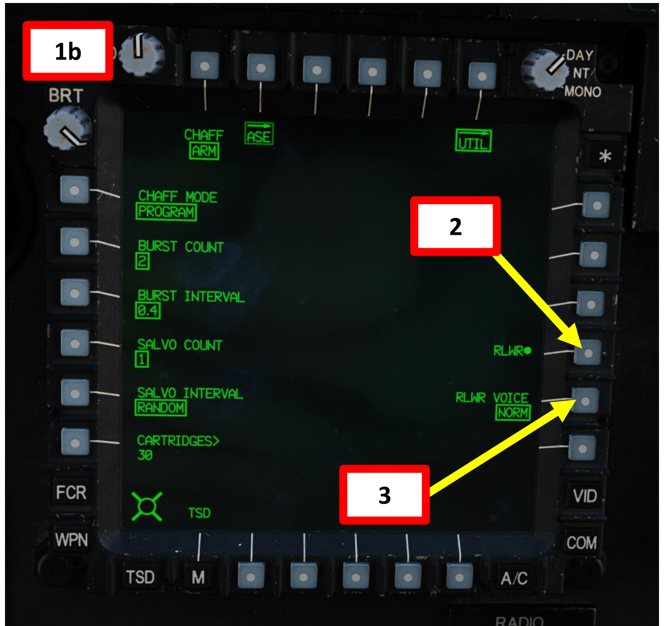
Symbology is displayed on both the ASE (Aircraft Survivability Equipment) page and the TSD (Tactical Situation Display) page.

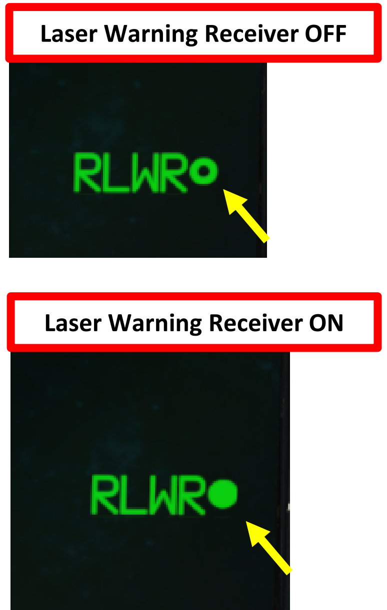
When a laser strikes the laser warning sensors, the laser is categorized as either:
- A **laser rangefinder** (like a tank using a laser to determine the proper range to shoot at you); or
- A **laser designator** (like a tank using a laser to designate you as a target for missile guidance); or
- A **beam-riding guidance system** (like a Ka-50 attack helicopter firing a Vikhr beam-riding missile at you).

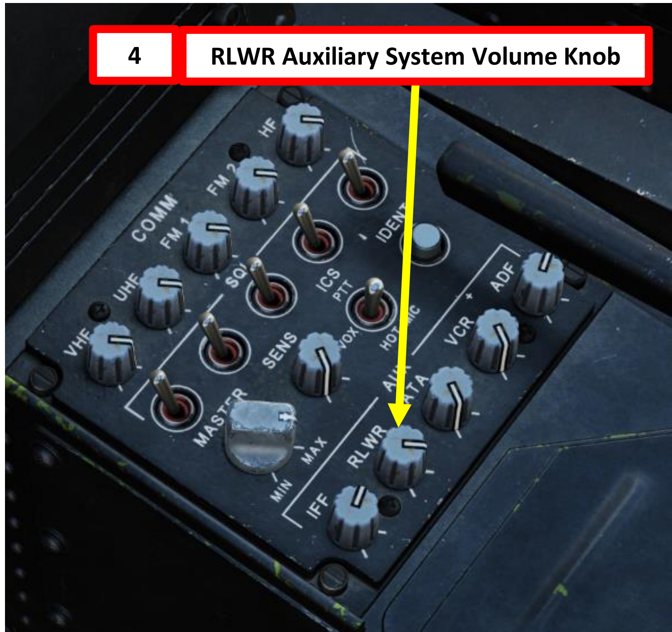
The laser warning system is integrated with the radar warning receiver as the combined “RLWR”, or “Radar/Laser Warning System”. Laser threats are displayed as “snowflake” symbols along with the radar symbols on both the TSD page and on the ASE page. When a laser threat is displayed, audio alerts will also warn the crew of the laser threat type and direction, just like the radar warning receiver.

Since the RLWR is limited to just 7 symbols of the highest priority threats, the **laser threats are prioritized along with the radar threats so that the most critical threats are displayed to the crew**. This means that if a tank is lasing the aircraft with just a rangefinder while several radar threats are locked on to the ownship or launching missiles at it, the rangefinder may not be displayed if the number of higher priority threats is 7 or more.









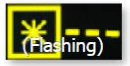
3 – AN/AVR-2A Laser Signal Detecting Set

In this first example, a tank is using its laser range finder to fire its machinegun. The tank is in front of us to our right (front-right quadrant). The **information displayed is in azimuth only; no range information is available.** The general rule of thumb when seeing/hearing a laser warning is to perform evasive actions and pop flares. A missile will head your way soon after.

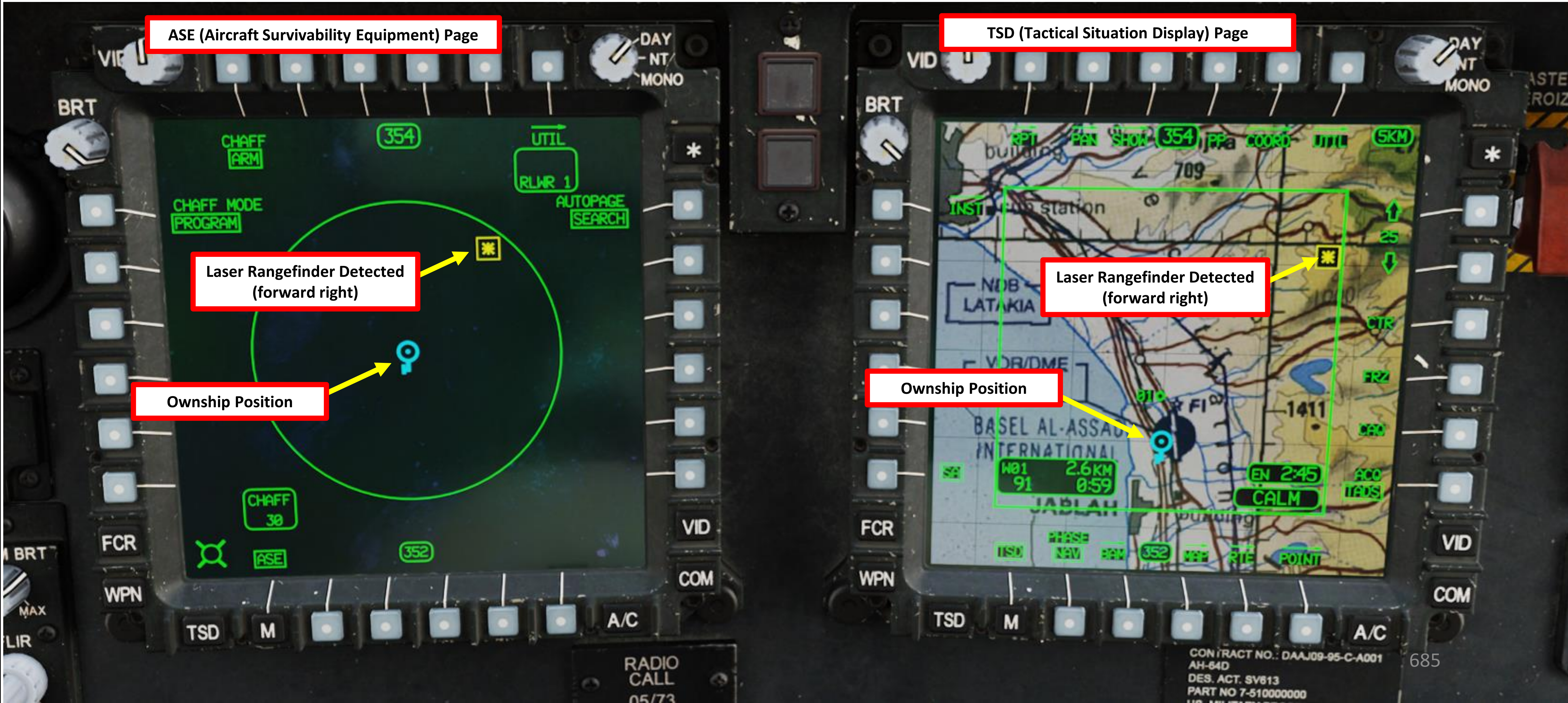
ASE/TSD Laser Symbology


Laser Rangefinder

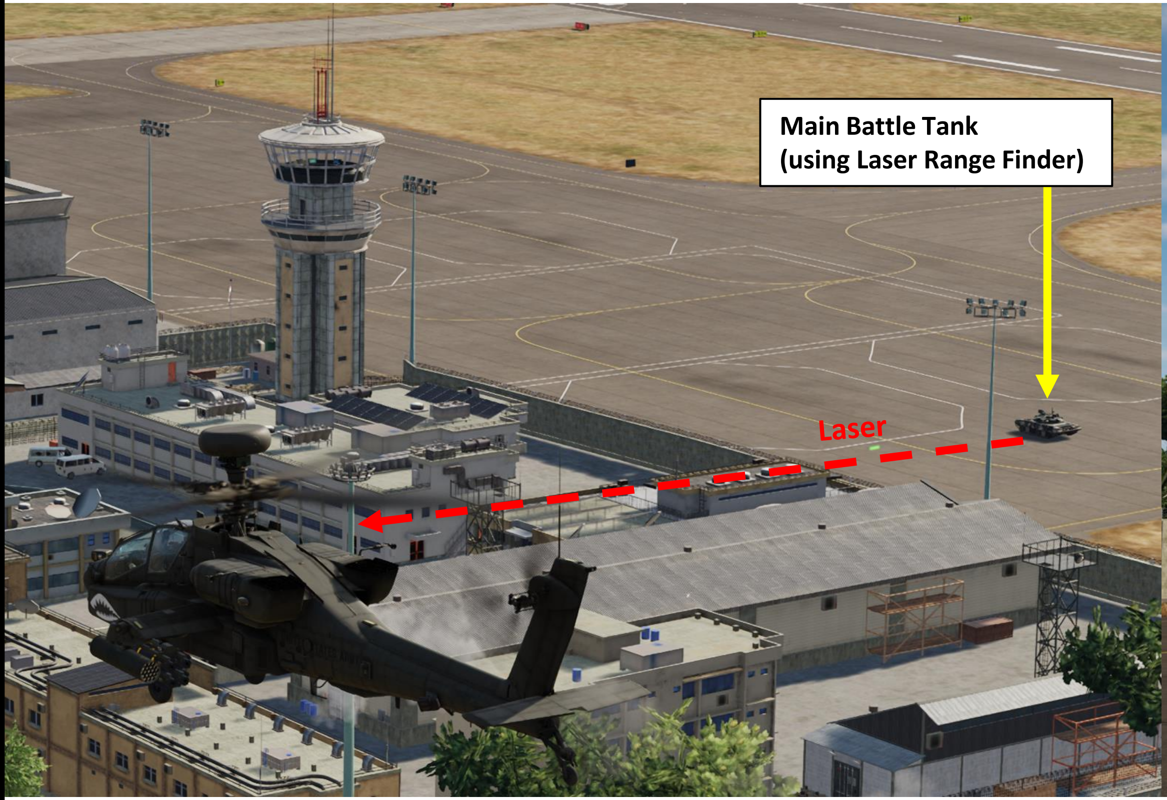

Laser Designator



Beam-Riding Guidance System



3 – AN/AVR-2A Laser Signal Detecting Set



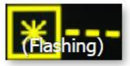
3 – AN/AVR-2A Laser Signal Detecting Set

In this second example, a Ka-50 is using a beam-riding Vikhr missile in your direction from your front left quadrant. The snowflake symbol does not blink when you are being designated by a laser, but a blinking snowflake means the beam-riding missile is heading towards you.

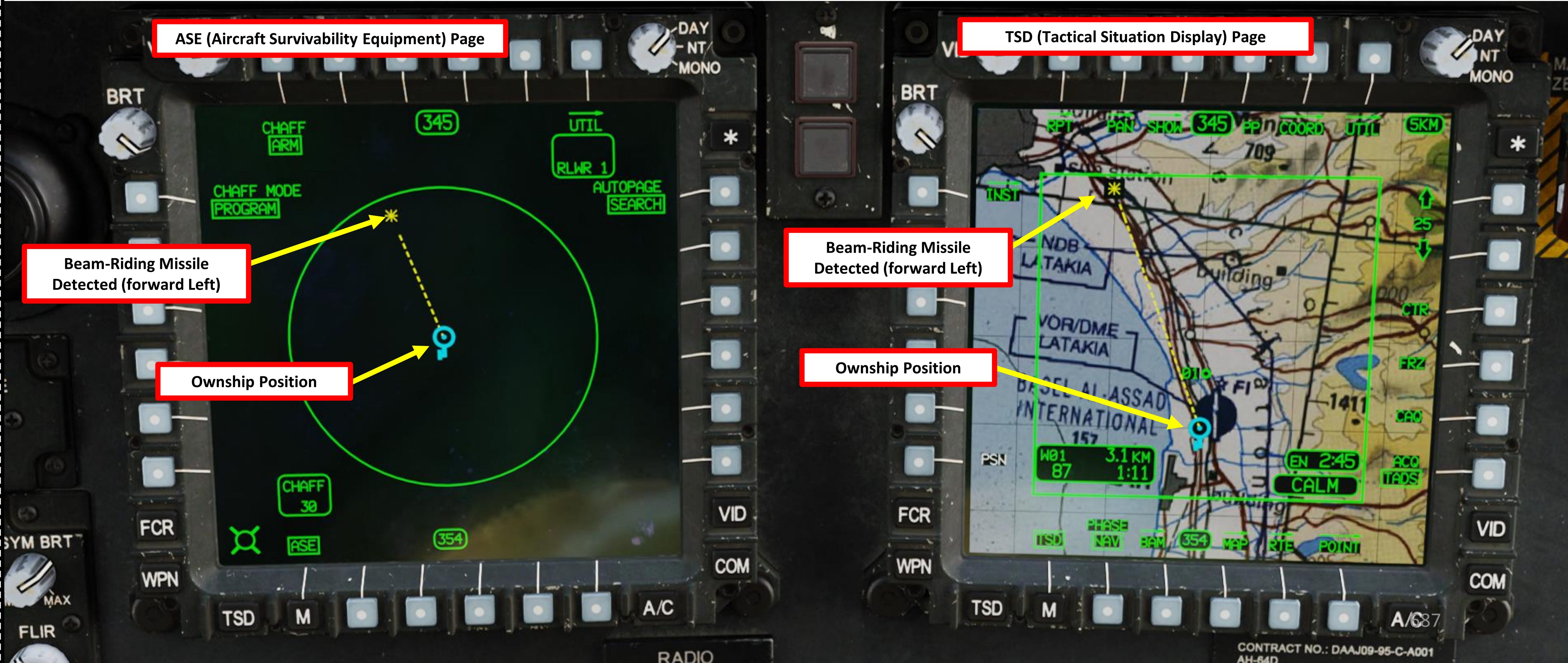
ASE/TSD Laser Symbology


Laser Rangefinder

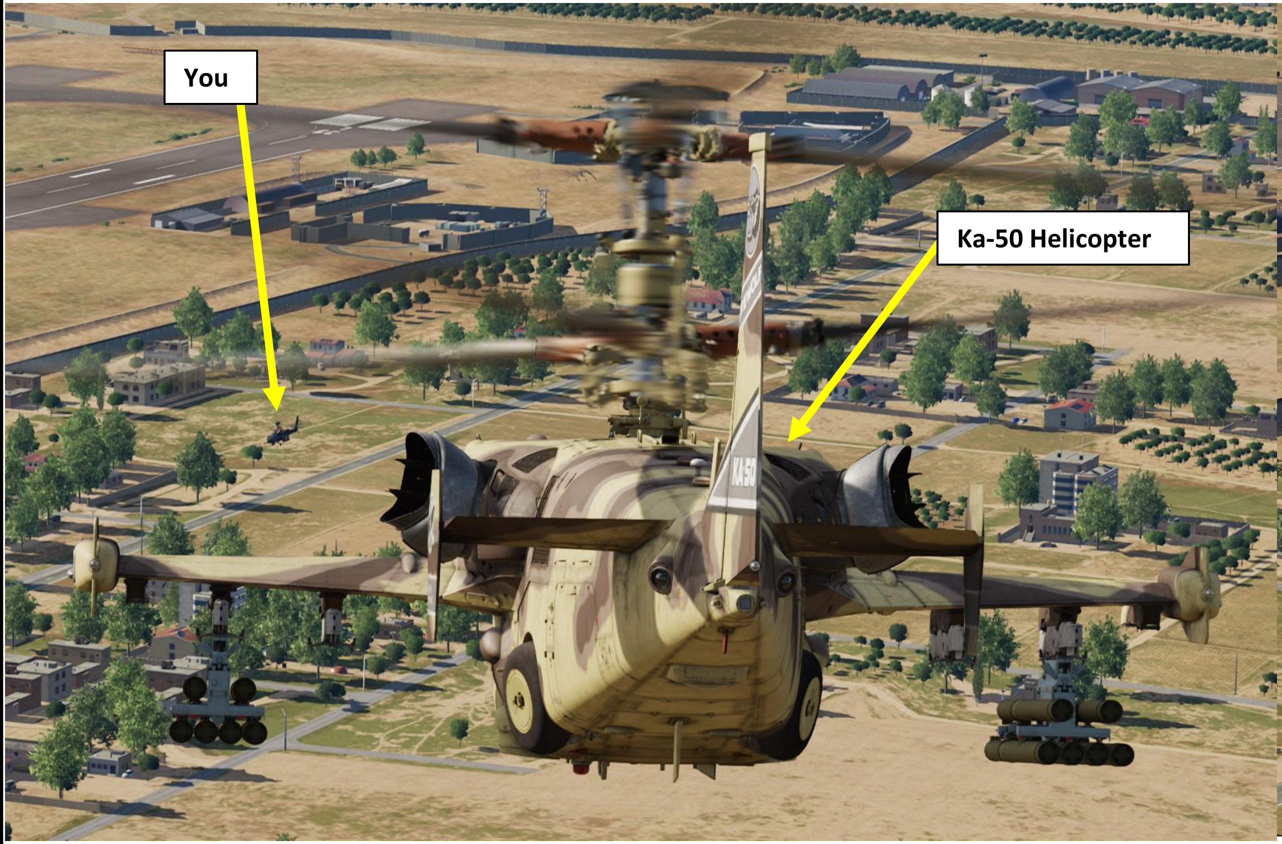

Laser Designator

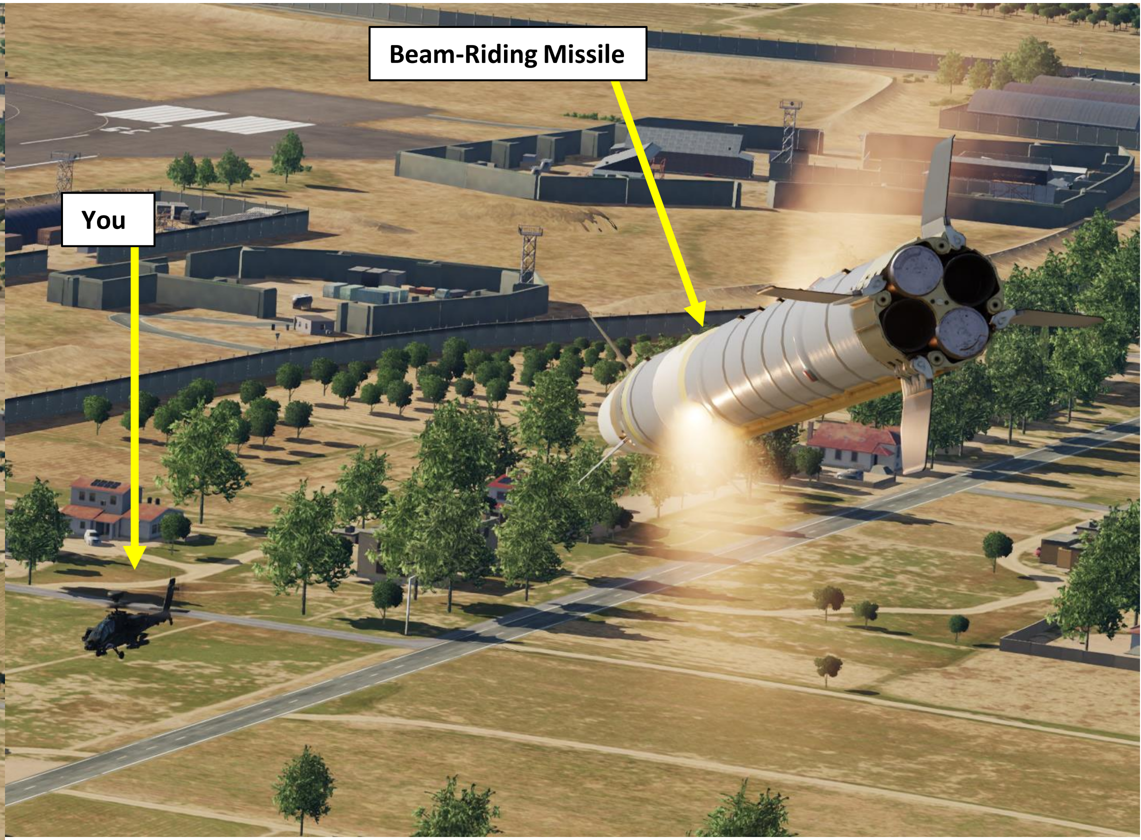


Beam-Riding Guidance System



3 – AN/AVR-2A Laser Signal Detecting Set

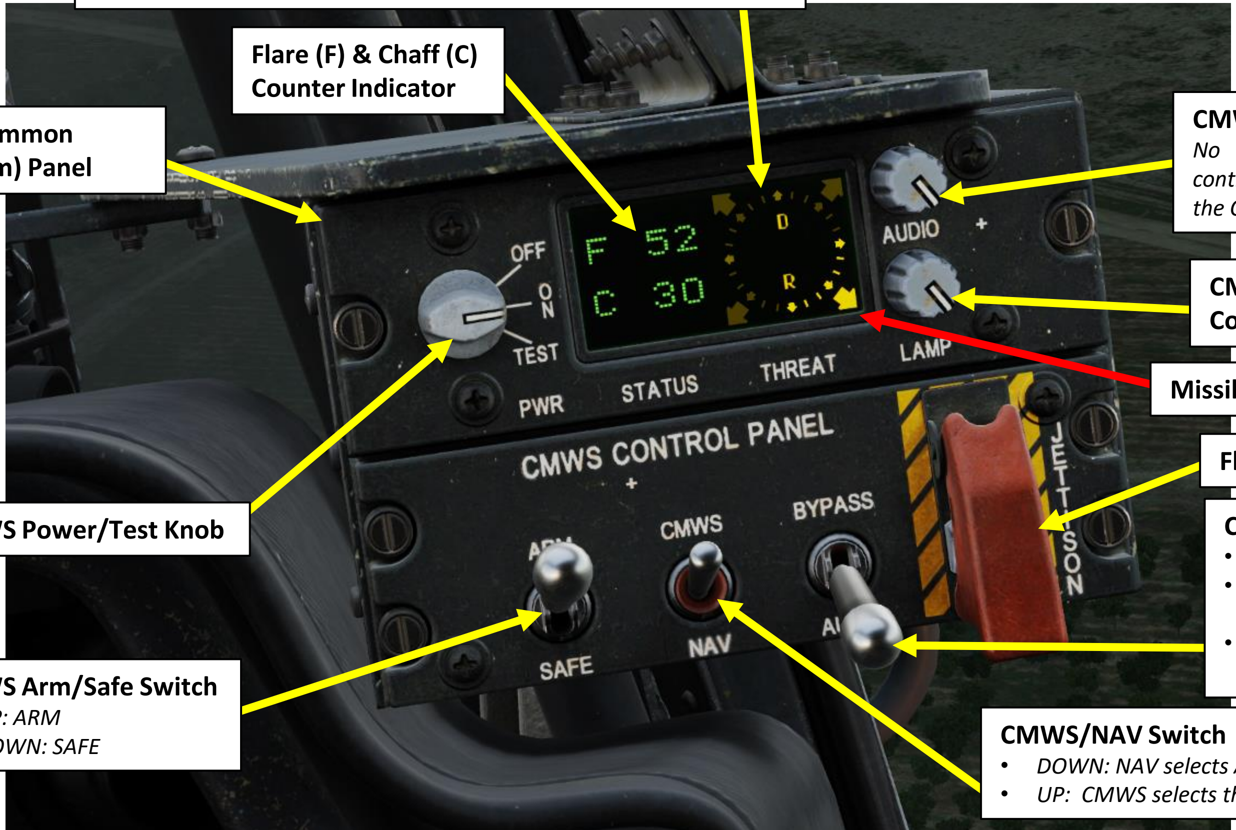




4 – AN/AAR-57 Common Missile Warning System (CMWS)

The AN/AAR-57 provides detection of threat missiles via a series of external detectors to passively detect missiles after launch. Keep in mind that it does not detect whether missiles are launched from friendly units or not. The system displays the threat direction to the Pilot via the Control Indicator, along with an associated audio alert to the crew. The AAR-57 is also capable of initiating automatic dispensing of flares without crew interaction, but still retains a manual flare dispense capability via the cyclic-mounted FLARE buttons in both crew stations.

Consult quadrant arrows on the CMWS Indicator Display to see missile launches. In the example below, a missile is being launched from our rear right.

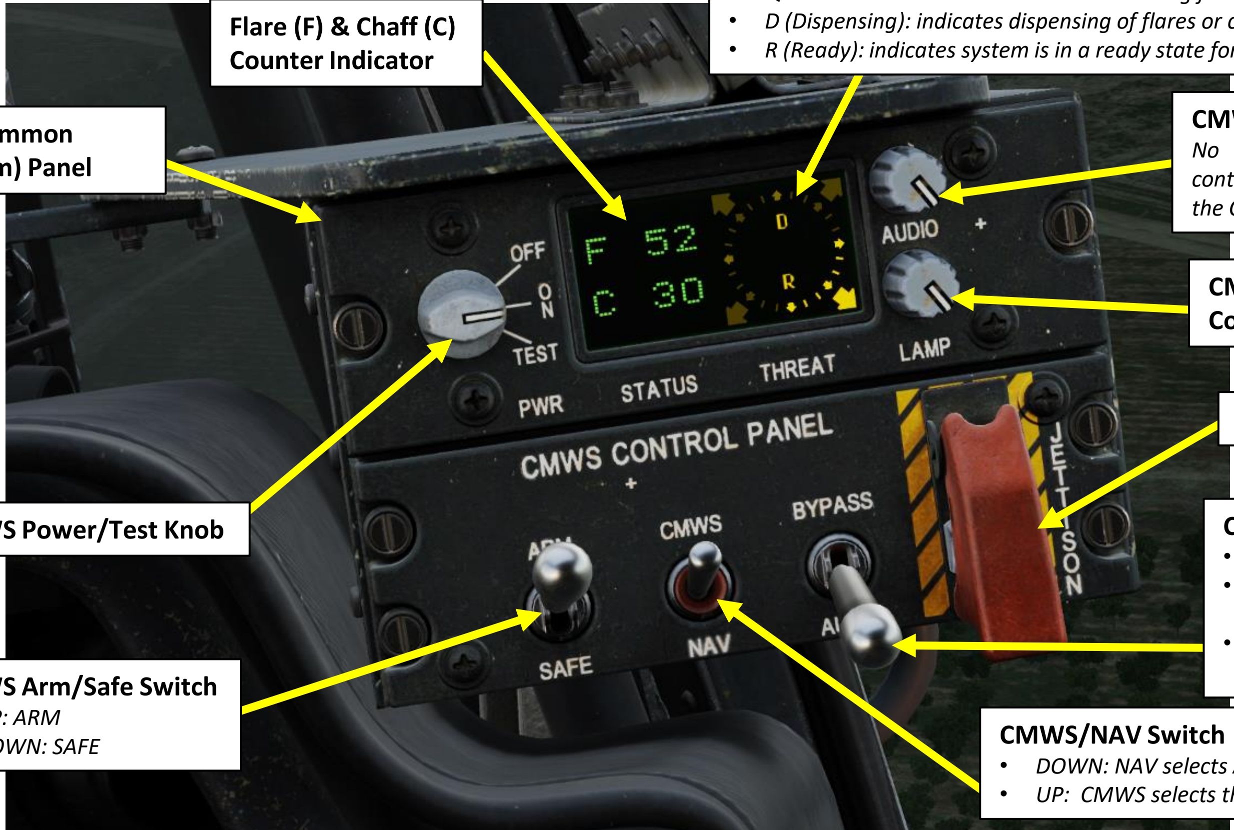


4 – AN/AAR-57 Common Missile Warning System (CMWS)

To use the CMWS:

1. *[P]* Set CMWS (Common Missile Warning System) Power/Test Knob – ON
2. *[P]* Set CMWS Display Brightness Control Knob – As Required
3. *[P]* Set CMWS/NAV Switch – CMWS (UP)
4. *[P]* Set CMWS Bypass/Auto Switch – As desired. I suggest BYPASS since AUTO mode can waste a lot of flares needlessly.
5. *[P]* Adjust Missile Warning System volume with the ADF Auxiliary System Volume Knob; the AAR-57 CMWS uses the ADF (Automatic Direction Finder) audio channel to provide audio alerts to the crew.
   - Note: While providing threat audio, the crew will be unable to tune and identify navaids using the ADF receiver.
6. *[P]* Set the CMWS Arm/Safe Switch – ARM (UP)
7. *[P]* Consult the CMWS Indicator Display to see where missiles are being launched in relationship to you. You will also receive audio threat warnings.

5 **ADF Auxiliary System Volume Knob**



7 **CMWS Indicator Display**
- *Quadrant Arrow: Direction missile is coming from*
- *D (Dispensing): indicates dispensing of flares or chaff is in progress*
- *R (Ready): indicates system is in a ready state for flare dispensing*

Flare (F) & Chaff (C) Counter Indicator

AN/AAR-57 CMWS (Common Missile Warning System) Panel

CMWS Audio Control Knob
No function since CMWS audio is controlled by the ADF receiver based on the CMWS/NAV switch position

CMWS Display Brightness Control Knob 2

Flare Jettison Switch

1 **CMWS Power/Test Knob**

CMWS Bypass/Auto Switch 4
- *UP: BYPASS, manual flare dispensing*
- *DOWN: AUTO, automatic flare dispensing when a missile threat is detected*
- *Note: Missile threat warning is provided regardless of switch position, and manual dispensing is retained when in AUTO mode.*

6 **CMWS Arm/Safe Switch**
- *UP: ARM*
- *DOWN: SAFE*

CMWS/NAV Switch 3
- *DOWN: NAV selects ADF receiver audio*
- *UP: CMWS selects threat alert audio*

5 – Countermeasures
5.1 - Introduction

Countermeasures are very simple to use. You have three countermeasure types at your disposal: flares, chaff and an ECM (Electronic Countermeasure) jammer. We will explore together what is used against what, and how.

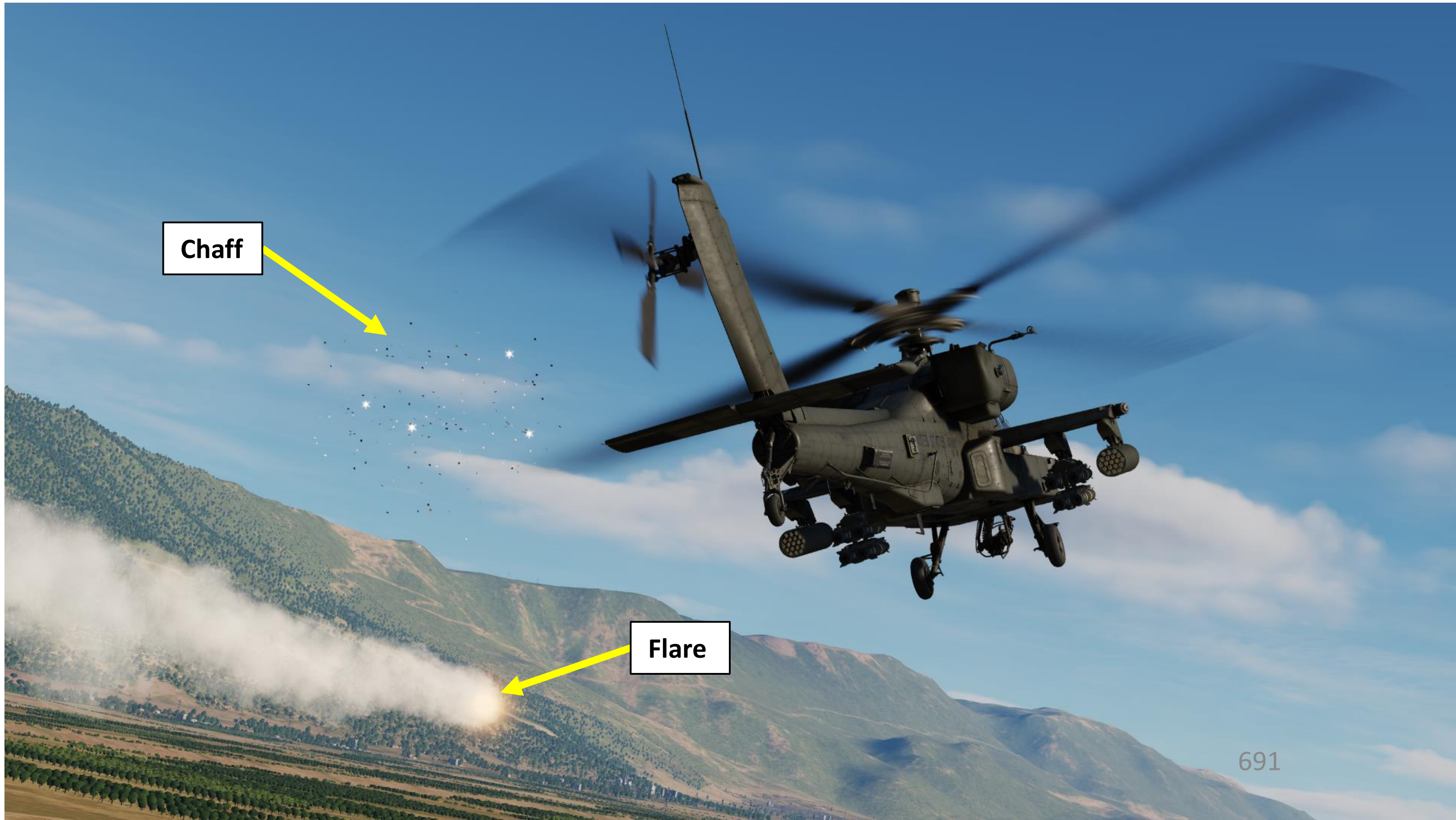
Missiles can generally track you using 2 things: radar signature (radar waves are sent on you and you reflect them, which is called a “radar signature”) and heat signature (like the exhaust of your engines). Countermeasures will only be effective against the kind of weapon it was meant to counter; a heat-seeking missile will not care if you deploy electronic countermeasures against it since it tracks heat, not radar signatures. This is why it is important to know what is attacking you in order to counter it properly. This is what the **RLWR** (Radar/Laser Warning Receiver) is for: to help you know what is firing at you so you can take the adequate action to counter it. The AH-64D has a **CMWS** (Common Missile Warning System), so you can know when a missile has been launched.

Flares are used against missiles that track heat (infrared or IR) signatures. Instead of going for the heat signature generated by your engines, a missile will go for a hotter heat source like flares.

Chaff is a form of “passive” jamming. Passive (reflected) jamming is when a deceptive object or device reflects radar waves. Chaff is simply a bundle of small pieces of metal foil with reflective coating, which creates clusters of radar signatures that prevent a radar to get a solid lock on the aircraft itself.

The **AN/ALQ-136(V) electronic radar jammer** is a form of “continuous” jamming, also called “active” or “transmitted” jamming. This device transmits its own synchronized radar waves back at your enemy’s radar receiver to simulate erroneous radar wave returns. Simply put, active jamming will try to drown a radar in white noise.

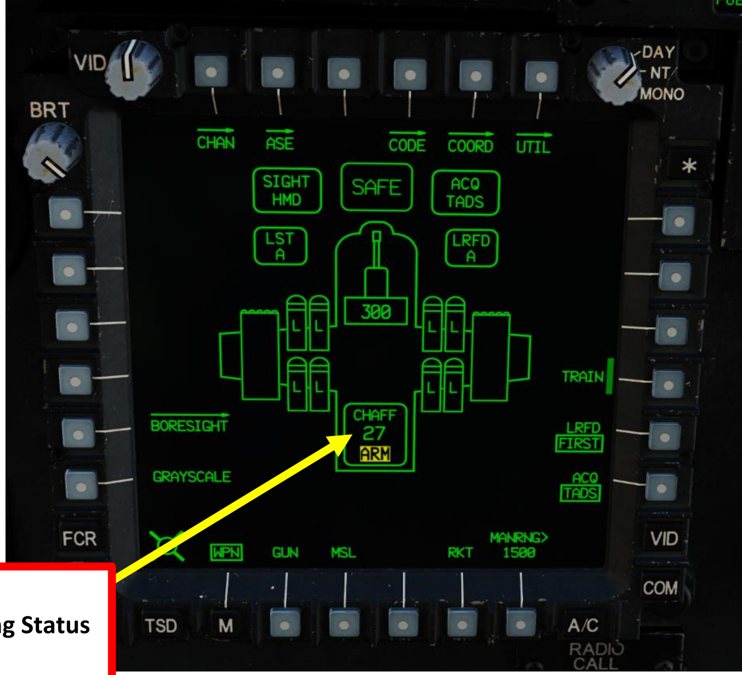
In order to use these three forms of countermeasures, you can use “countermeasure programs”, routines that will deploy a number of flares/chaff for a number of cycles at a given interval.

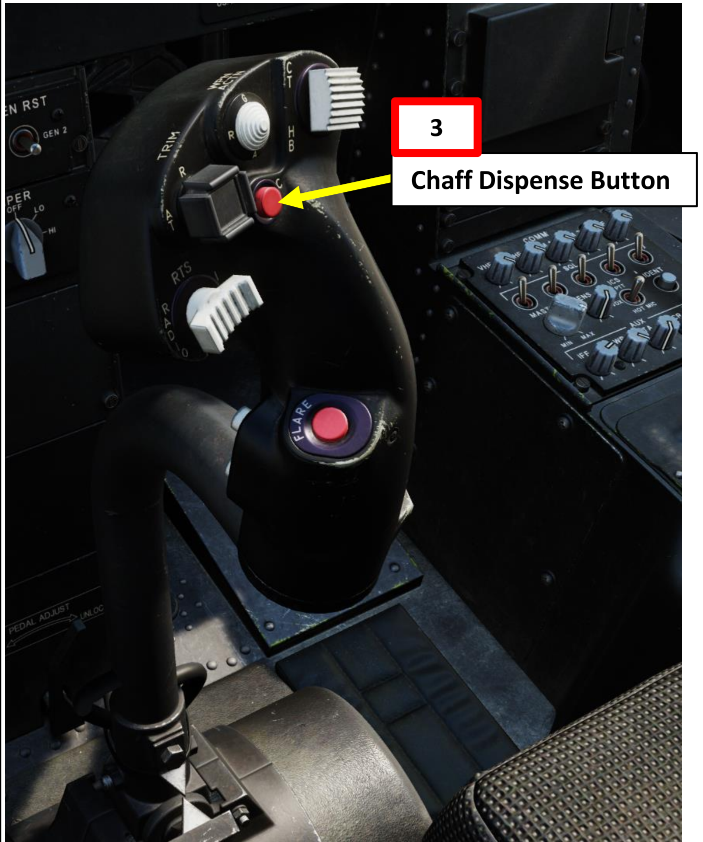


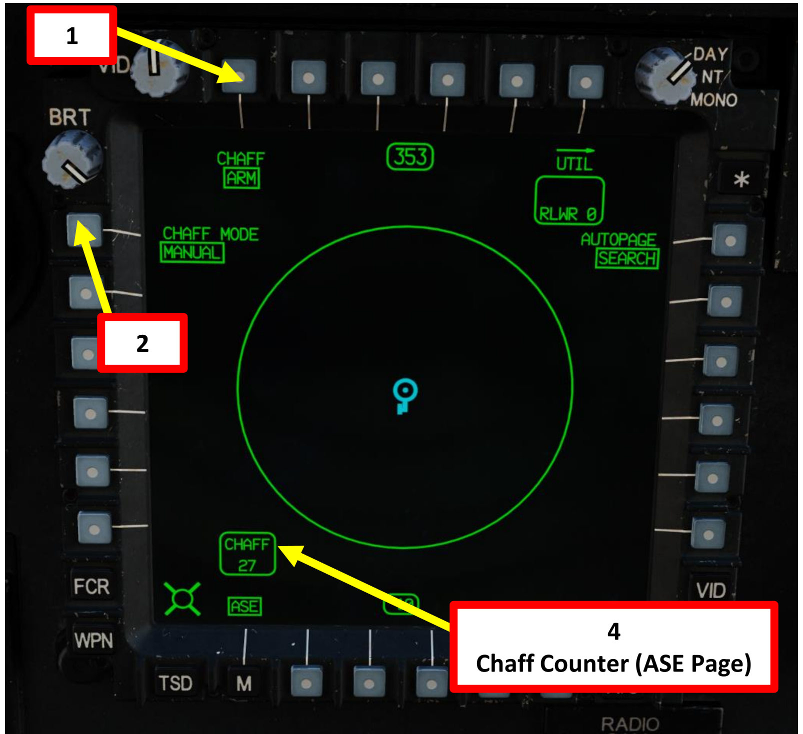
5 – Countermeasures
5.2 - Chaff

Manual Chaff Dispensing

1. *[P/CPG]* From the ASE (Aircraft Survivability Equipment) page, use VAB (Variable Action Button) next to "CHAFF" field to arm chaff.
2. *[P/CPG]* Use VAB next to "CHAFF MODE" to set the release mode to MANUAL.
3. *[P/CPG]* Press the Chaff Dispense Button on the cyclic to dispense a single chaff.
4. *[P/CPG]* Chaff counters are available on the ASE page (for both Pilot and Co-Pilot/Gunner), WPN page (for both Pilot and Co-Pilot/Gunner), and on the CMWS (Common Missile Warning System) panel (Pilot only)



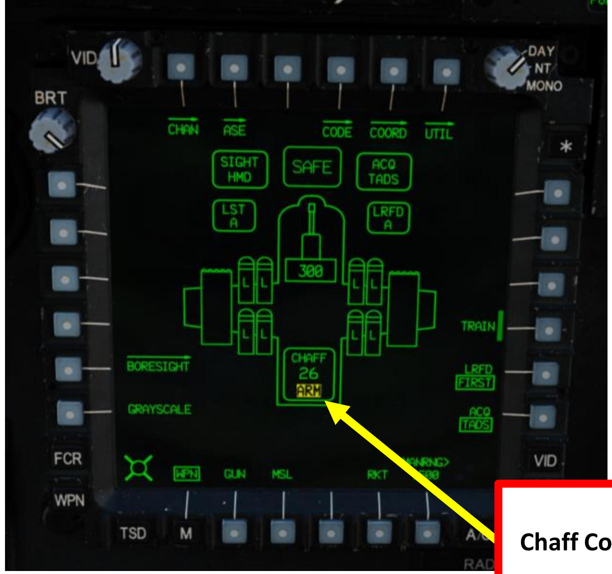


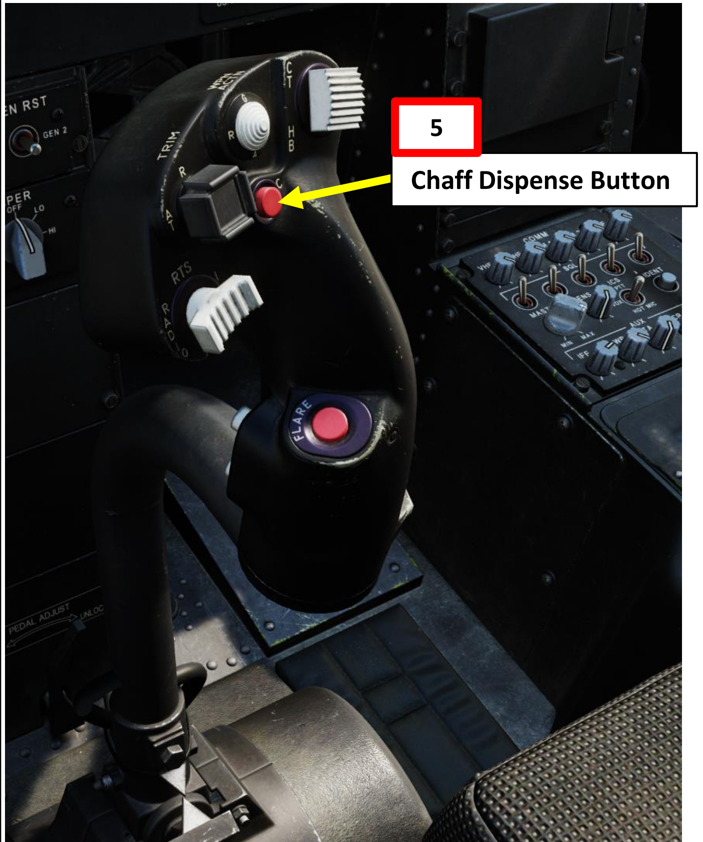


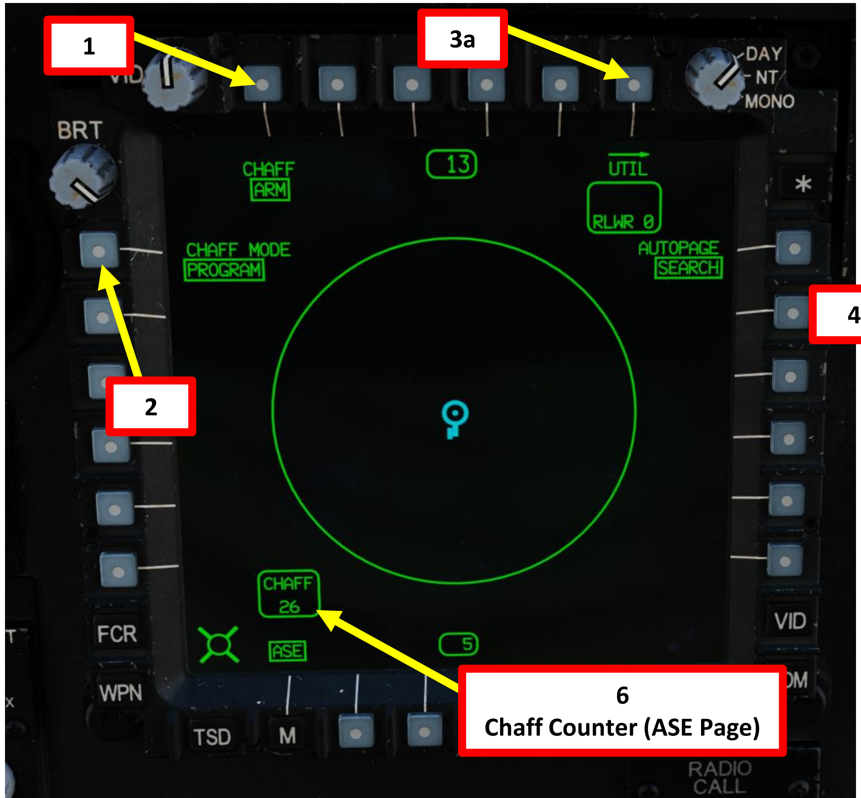
5 – Countermeasures
5.2 - Chaff

Programmed Chaff Dispensing

1. *[P/CPG]* From the ASE (Aircraft Survivability Equipment) page, use VAB (Variable Action Button) next to "CHAFF" field to arm chaff.
2. *[P/CPG]* Use VAB next to "CHAFF MODE" to set the release mode to PROGRAM.
3. *[P/CPG]* Use VAB next to "UTIL" to enter the ASE Utility sub-page.
4. *[P/CPG]* Use associated VABs to set Burst Counter (chaff per burst), Burst Interval (time in sec between bursts), Salvo Count (number of salvoes) and Salvo Interval (time in sec between salvoes).
5. *[P/CPG]* Press the Chaff Dispense Button on the cyclic to dispense chaff as programmed.
6. *[P/CPG]* Chaff counters are available on the ASE page (for both Pilot and Co-Pilot/Gunner), WPN page (for both Pilot and Co-Pilot/Gunner), and on the CMWS (Common Missile Warning System) panel (Pilot only)







5 – Countermeasures
5.2 - Chaff

Chaff DIspensers

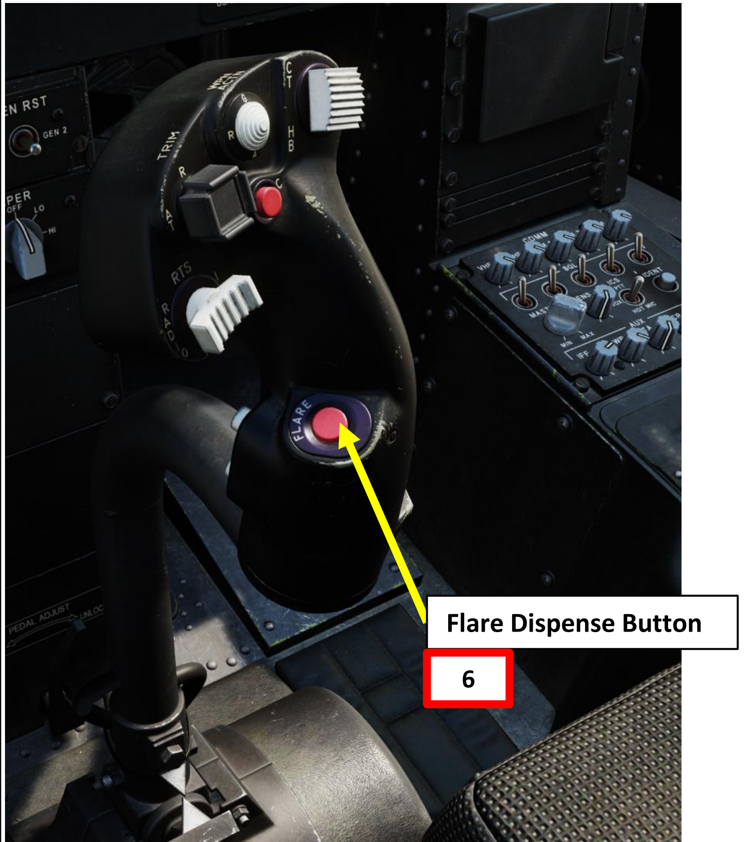
The M-141 chaff dispenser is mounted on the left side of the tail boom and can hold 30 chaff cartridges.

Take note that chaff cannot be armed and launched while on the ground.

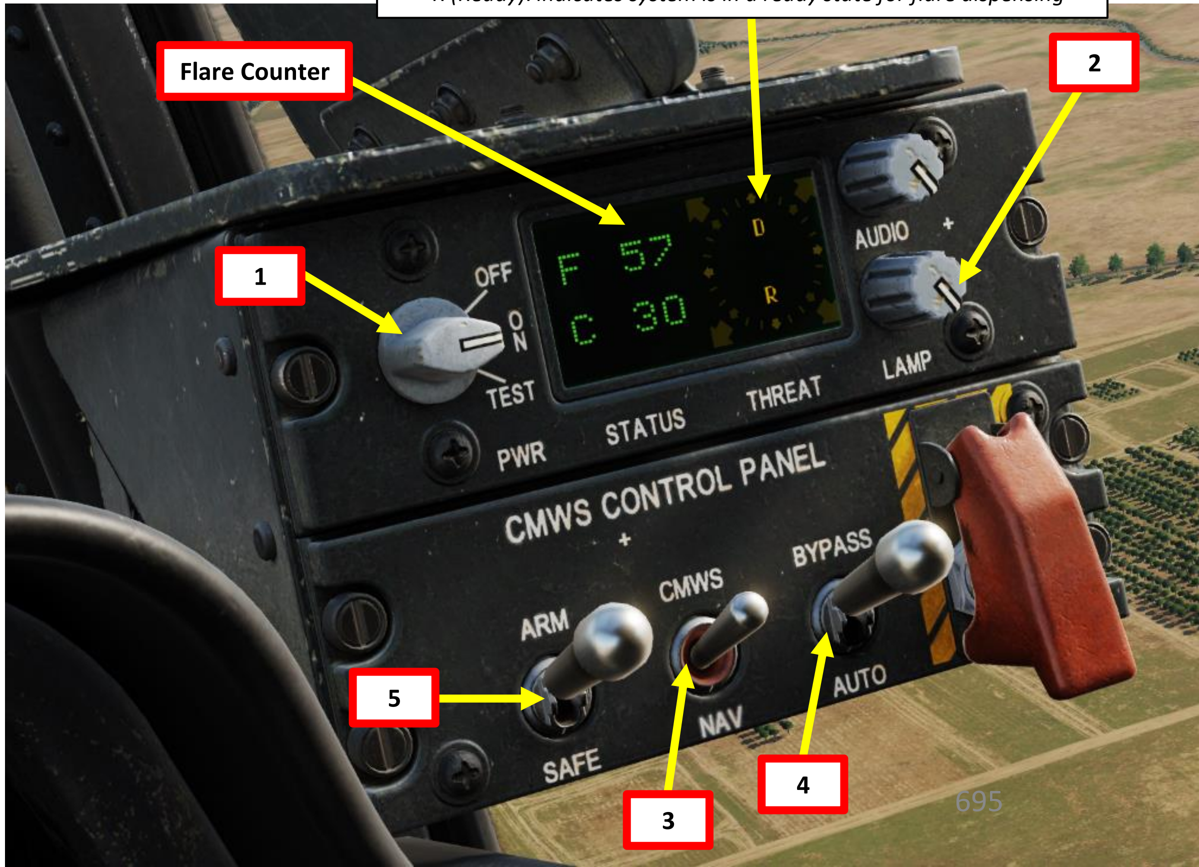
5 – Countermeasures
5.3 - Flares

Flare Dispensing in BYPASS Mode

1. *[P]* Set CMWS (Common Missile Warning System) Power/Test Knob – ON
2. *[P]* Set CMWS Display Brightness Control Knob – As Required
3. *[P]* Set CMWS/NAV Switch – CMWS (UP)
4. *[P]* Set CMWS Bypass/Auto Switch – BYPASS.
5. *[P]* Set the CMWS Arm/Safe Switch – ARM (UP)
6. *[P]* Press the Flare Dispense Button to dispense the flare program.
   - Keep in mind that flares will **not** automatically be dispensed with the preset flare program. Bypass mode ensures that you have full control over the release of flares.



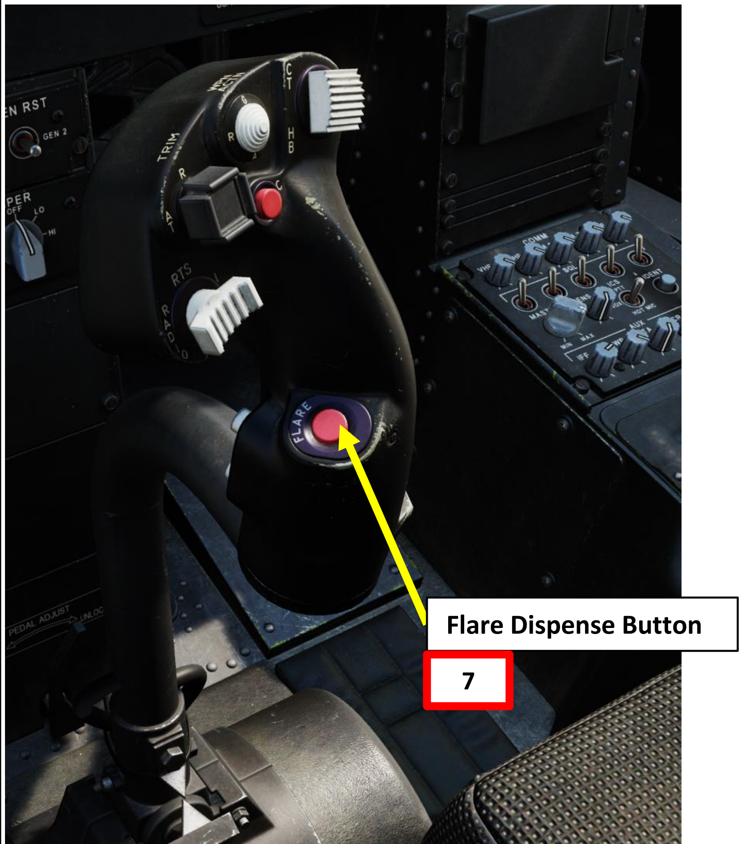
CMWS Indicator Display
- *D (Dispensing): indicates dispensing of flares or chaff is in progress*
- *R (Ready): indicates system is in a ready state for flare dispensing*



5 – Countermeasures
5.3 - Flares

Flare Dispensing in AUTO Mode

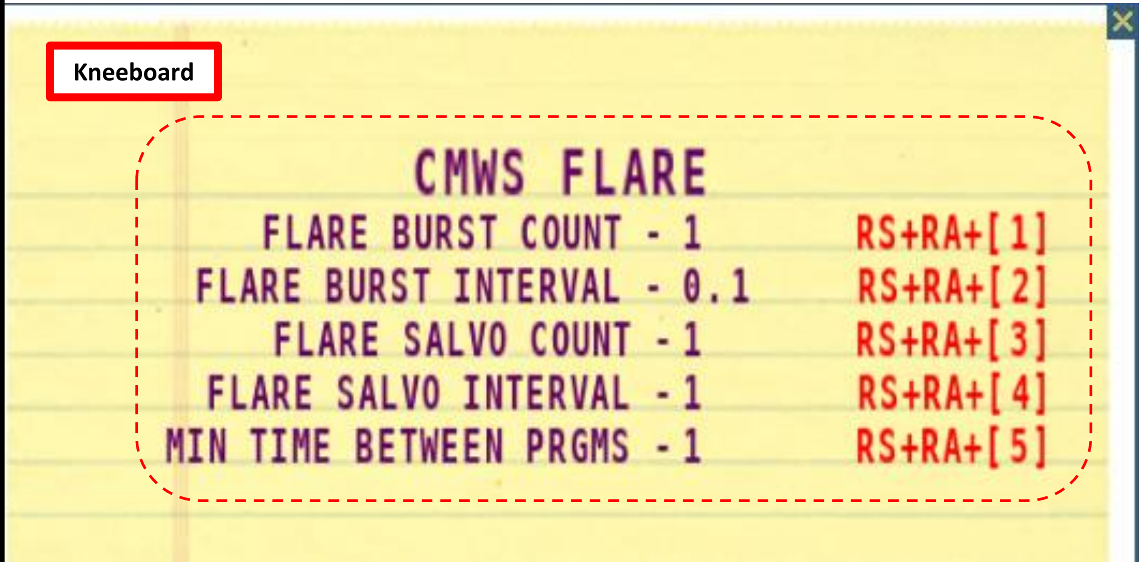
1. *[P]* Set CMWS (Common Missile Warning System) Power/Test Knob – ON
2. *[P]* Set CMWS Display Brightness Control Knob – As Required
3. *[P]* Set CMWS/NAV Switch – CMWS (UP)
4. *[P]* Set CMWS Bypass/Auto Switch – AUTO.
5. *[P]* Set the CMWS Arm/Safe Switch – ARM (UP)
6. *[P]* In AUTO mode, flares will still automatically be dispensed with the preset flare program (set on ground with engines OFF or via the Mission Editor).
7. *[P]* If desired, press the Flare Dispense Button to dispense the flare program "manually".

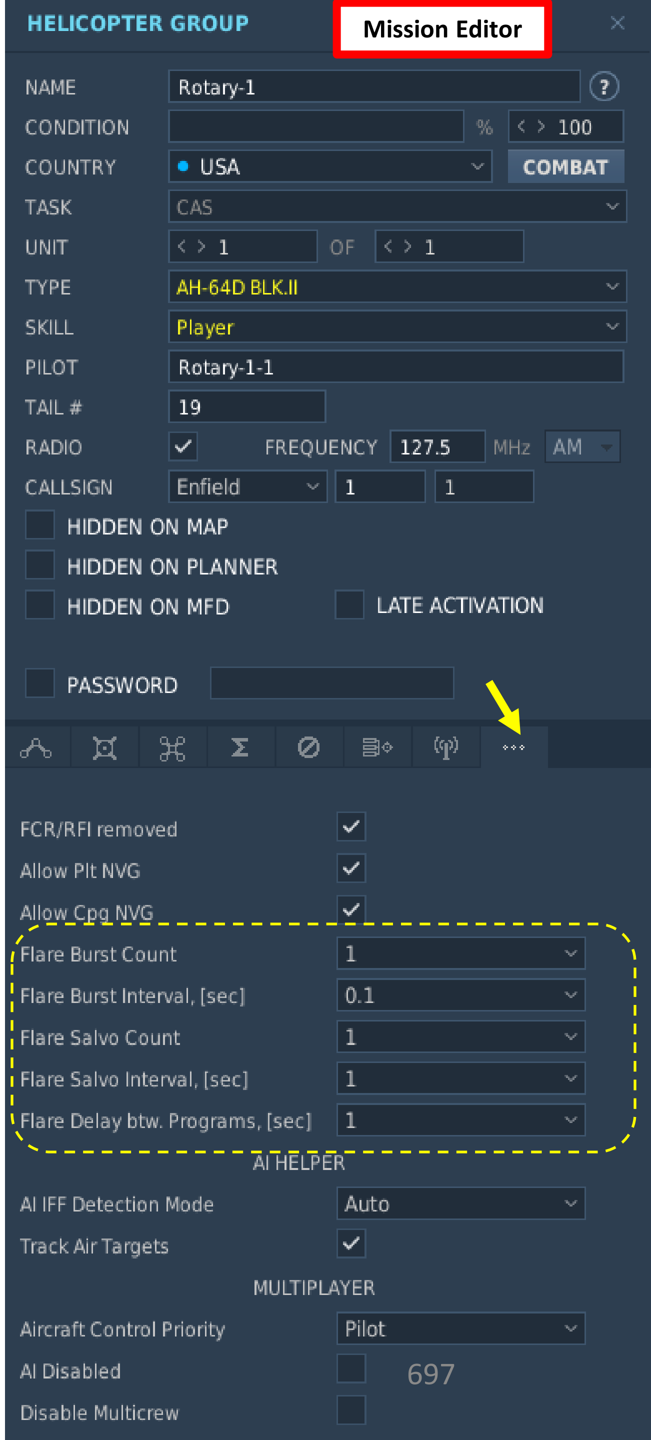


5 – Countermeasures
5.3 - Flares

Flare Program Setup

1. Flares utilize a pre-set flare program, and which can only be modified when on the ground or from within the Mission Editor.
2. To modify flare program while in-mission, make sure the helicopter is on the ground and that the engines are OFF.
3. Display kneeboard using "RSHIFT+K" and cycle through pages using "[" and "]" to find the "CMWS FLARE" page.
4. Commands to modify the flare program settings are listed on the kneeboard:
    - Burst Counter (flares per burst): "RSHIFT+RALT+1"
    - Burst Interval (time in sec between bursts): "RSHIFT+RALT+2"
    - Salvo Count (number of salvoes): "RSHIFT+RALT+3"
    - Salvo Interval (time in sec between salvoes): "RSHIFT+RALT+4"
    - Flare Delay between Programs (in sec): "RSHIFT+RALT+5"





5 – Countermeasures
5.3 - Flares

Flare Jettison

Jettisoning flares is used in case of a forced landing since they are a fire hazard.

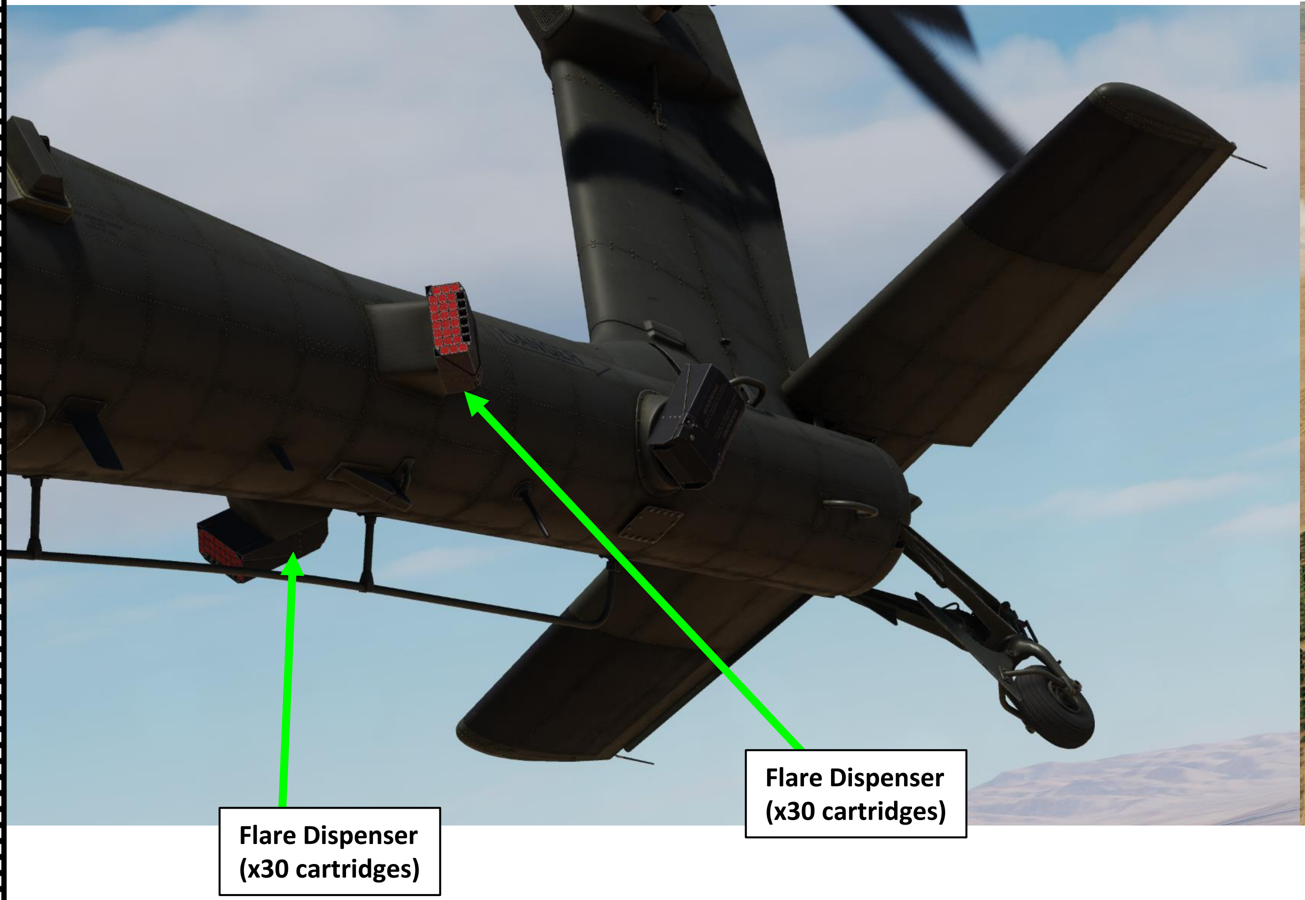
1. *[P]* Set CMWS (Common Missile Warning System) Power/Test Knob – ON
2. *[P]* Set the CMWS Arm/Safe Switch – ARM (UP)
3. *[P]* Flip the Flare Jettison Cover up, then switch the JETTISON switch UP to jettison flares.

5 – Countermeasures
5.3 - Flares

Flare Dispensers

A pair of Improved Countermeasures Dispensers (ICMD) are mounted on opposing sides of the tail boom and can hold 30 flare cartridges each.

Take note that flares cannot be armed and launched while on the ground.



5 – Countermeasures
5.4 – AN/ALQ-136(V)5 Electronic Radar Jammer

The Electronic Radar Jammer is not implemented yet.

SECTION SUMMARY

- **1 – Introduction to Datalink**
  - 1.1 – SMDL (Secure Modem Datalink)
  - 1.2 – Components Breakdown
  - 1.3 – Datalink Capabilities

- **2 – Datalink Network Setup via COM Page**
  - 2.1 – Setting up your own ORIG ID (Originator Identification)
  - 2.2 – Radio Setup for a Datalink Network
  - 2.3 – How to Add a Member to a Network
  - 2.4 – How to Remove a Member from a Network

- **3 – Datalink Functions**
  - 3.1 – Sending/Receiving Messages
    - 3.1.1 – Free Text
    - 3.1.2 – MPS (Mission Planning System) Text
  - 3.2 – Sending/Receiving Mission Files
  - 3.3 – Sending/Receiving Individual TSD (Tactical Situation Display) Points
  - 3.4 – Tactical Reports
    - 3.4.1 – Present Position (PP) Reports
    - 3.4.2 – Target (TGT) Reports
    - 3.4.3 – BDA (Battle Damage Assessment) Reports
    - 3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports
  - 3.5 – BAM (Battle Area Management) Functions
    - 3.5.1 – Sending Fire Zones
    - 3.5.2 – Receiving Fire Zones
  - 3.6 – Radar Target Handover (RFHO)
    - 3.6.1 – Introduction to RF (Radio Frequency) Handover
    - 3.6.2 – Sending RF (Radio Frequency) Handover
    - 3.6.3 – Receiving RF (Radio Frequency) Handover

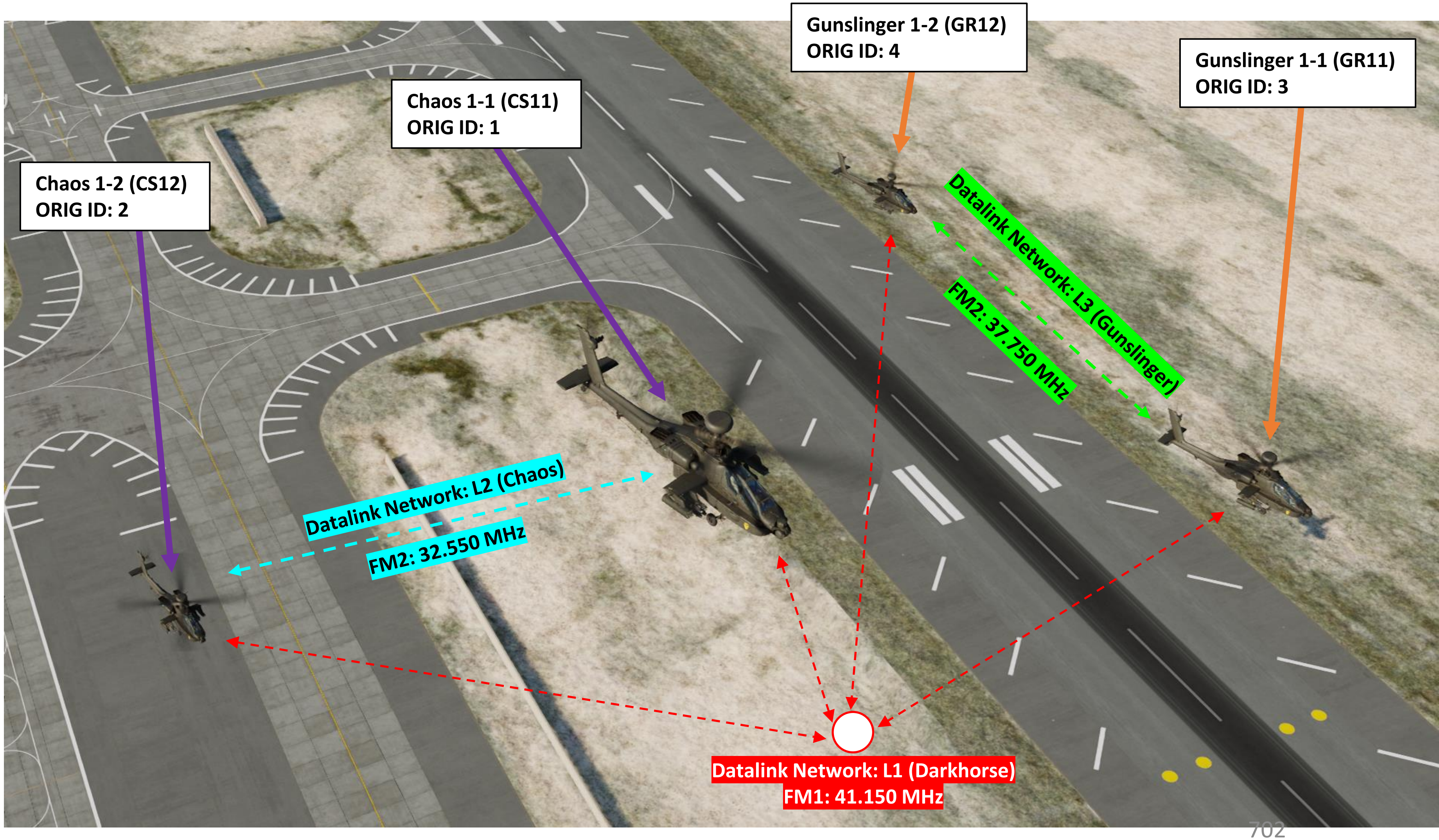
1 – INTRODUCTION TO DATALINK
1.1 – SMDL (Secure Modem Datalink)

The AH-64D utilizes a secure, modem-based datalink (SMDL) to send and receive targeting data, tactical reports, text messages, and mission files amongst other AH-64D's within the team. The modem traffic is relayed as discrete microbursts of data across the helicopters' radios, which allows multiple datalink networks to be tuned simultaneously; one network across each radio. Datalink messages may be transmitted between AH-64D Team members and Primary members within a datalink network.

Each network may consist of 16 network members, containing 15 subscribers in addition to the ownship. Any of the 15 subscribers may be set as a Team member, a Primary member, or both; however, a maximum of 7 subscribers within each network may be designated as a Primary member. The designation of a subscriber as Team or Primary determines the type of data messages the member may receive from the ownship.

Team members receive **text messages** and **mission files**. These messages coordinate team actions and movements and distribute mission updates across the entire team of AH-64D's on a datalink network.

Primary members receive **tactical reports, targeting data, fires distribution**, and individual TSD (Tactical Situation Display) **points**. These messages coordinate tactical actions of individual companies and platoons of AH-64D's.



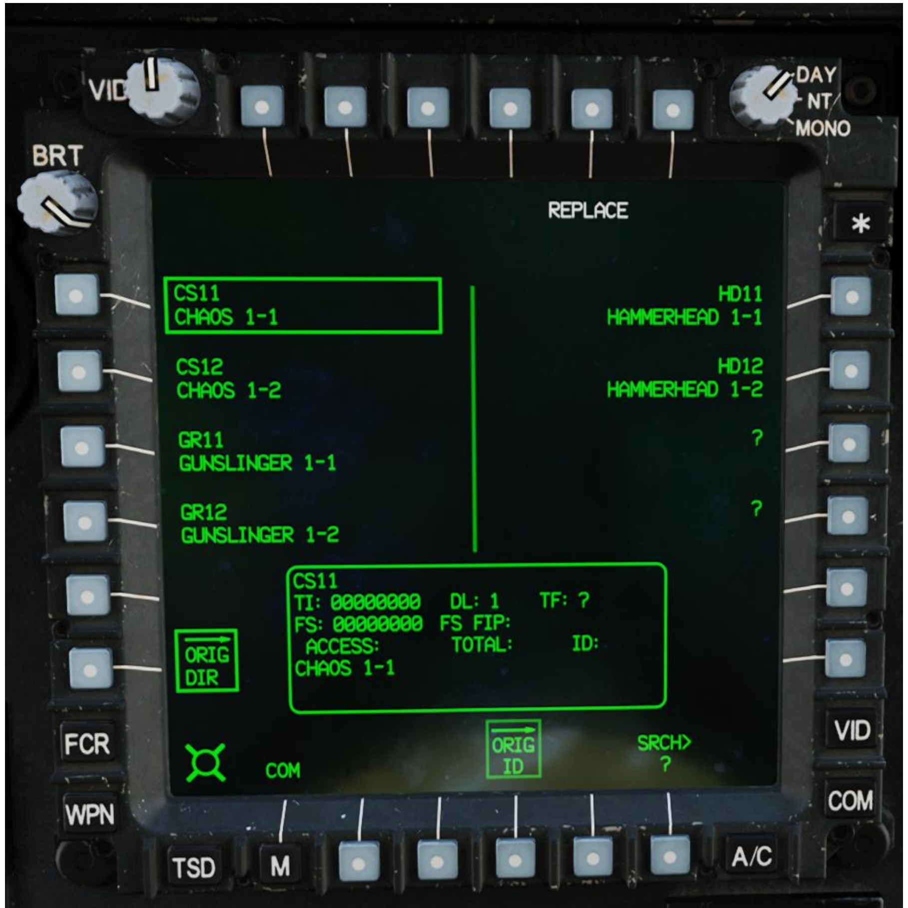
1 – INTRODUCTION TO DATALINK
1.1 – SMDL (Secure Modem Datalink)

General Concepts: Originator ID and Callsign

Originator ID: The originator ID (Identification) will be how the datalink modems of other AH-64D's within the mission will recognize the aircraft when sending or receiving datalink messages. The alphanumeric character ranges that are valid for entry are 0-39 (with no leading zeros), A-Z, 1A-1Z, 2A-2Z, and 3A-3I.

- Note: Each network member, to include the ownship, must have a unique ID number.

Ownship Callsign: This data field will determine how the aircraft is annotated within the cockpit of other AH-64D's within the mission when sending or receiving datalink messages. A minimum of 3 and a maximum of 5 alphanumeric characters may be entered.

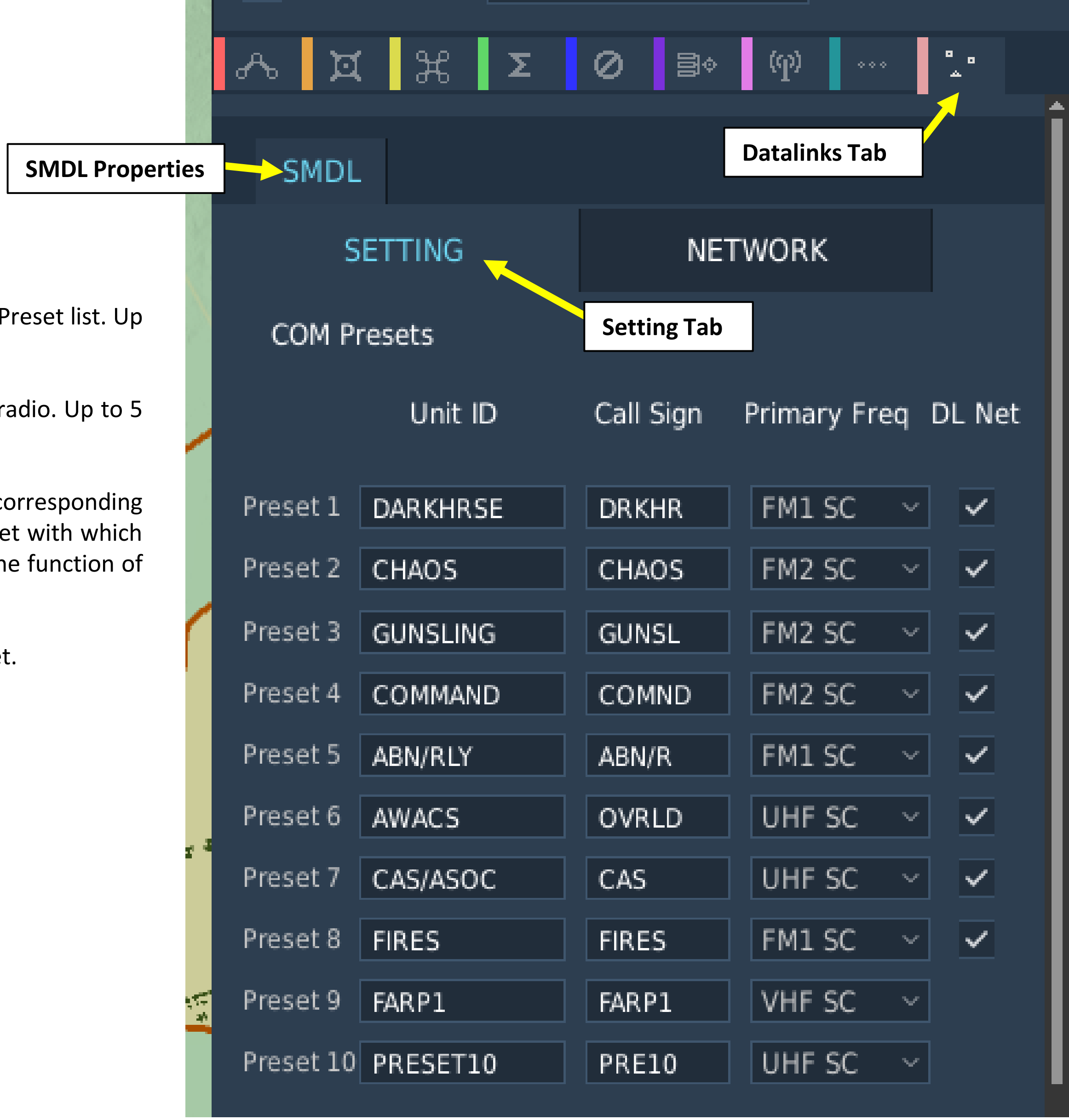


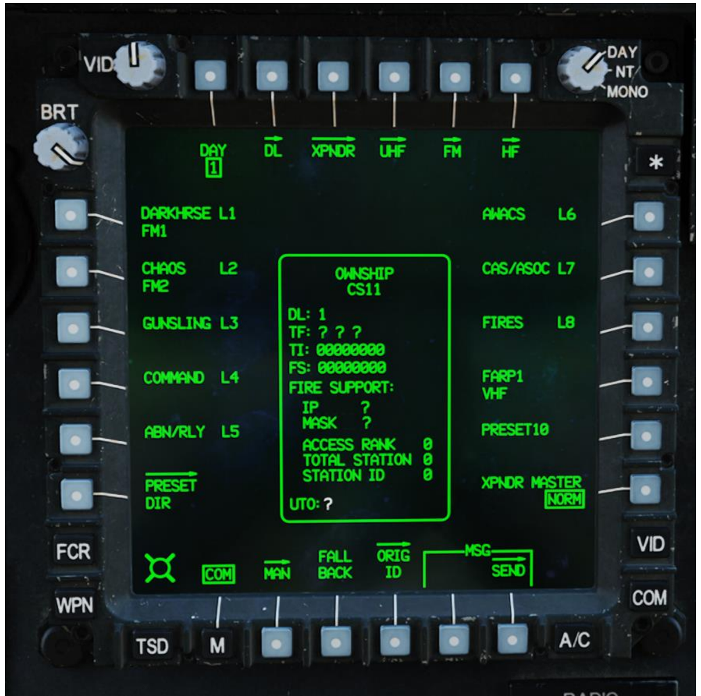
1 – INTRODUCTION TO DATALINK
1.1 – SMDL (Secure Modem Datalink)

Mission Editor: Setting Tab

The Setting Tab is used to configure details of each preset channel on the COM page.

- **Unit ID**: This data field determines how the preset is displayed on the COM page and on the EUFD Preset list. Up to 8 alphanumeric characters may be entered.
- **Call Sign**: This data field determines how the preset is displayed on the EUFD when assigned to a radio. Up to 5 alphanumeric characters may be entered.
- **Primary Freq**: Displays options for designating a primary frequency and radio for the preset. The corresponding entries on the COM Preset format will be displayed in white to highlight the intended radio and net with which the preset is intended to be utilized during the mission. The primary designation does not affect the function of any radio equipment or how the preset is assigned to a specific radio.
- **DL Net**: When checked, DATALINK protocols will be enabled on the MODEM sub-page for the preset.



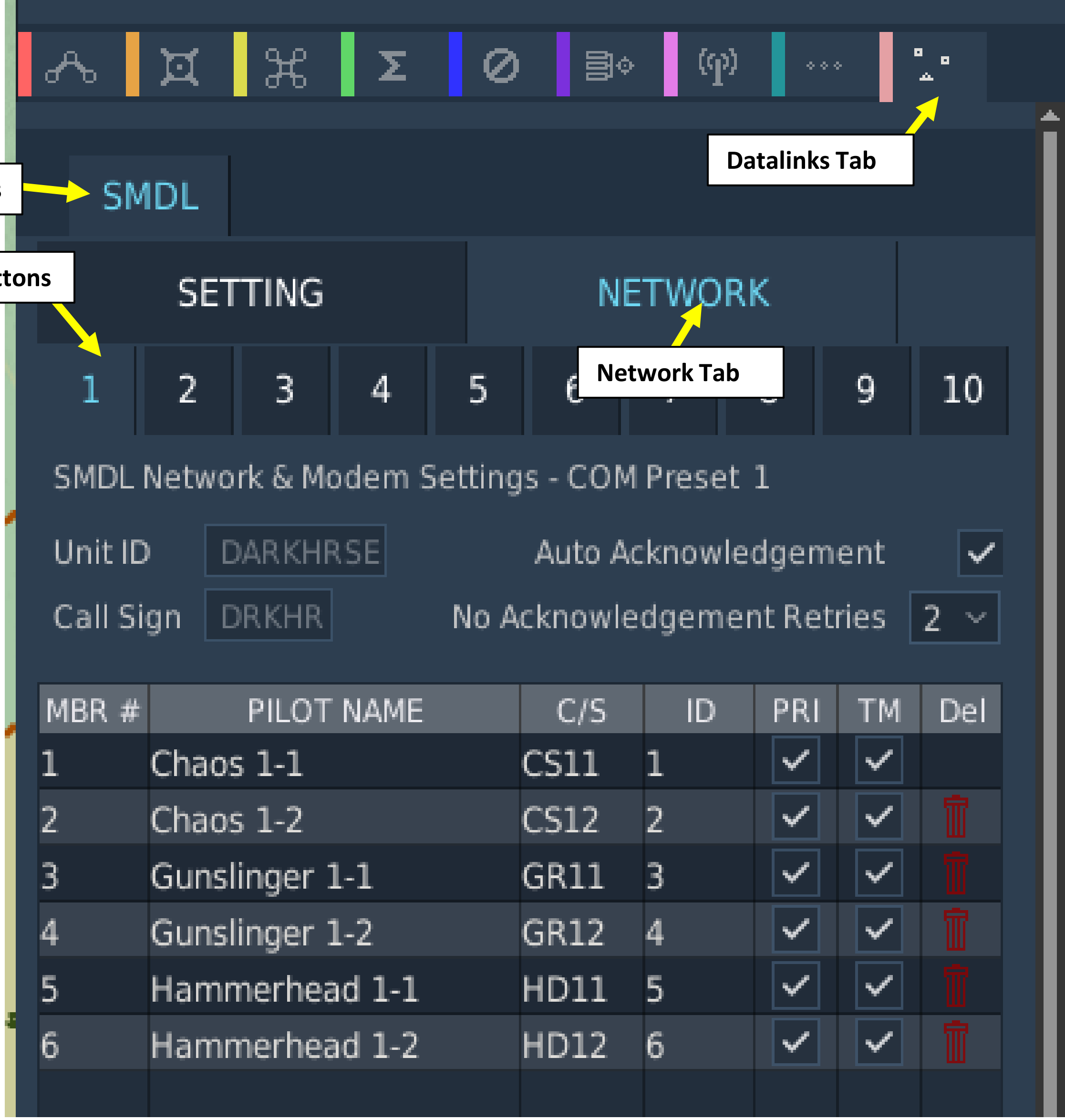


1 – INTRODUCTION TO DATALINK
1.1 – SMDL (Secure Modem Datalink)

Mission Editor: Network Tab

The Network Tab is used to set up configure datalink network settings.

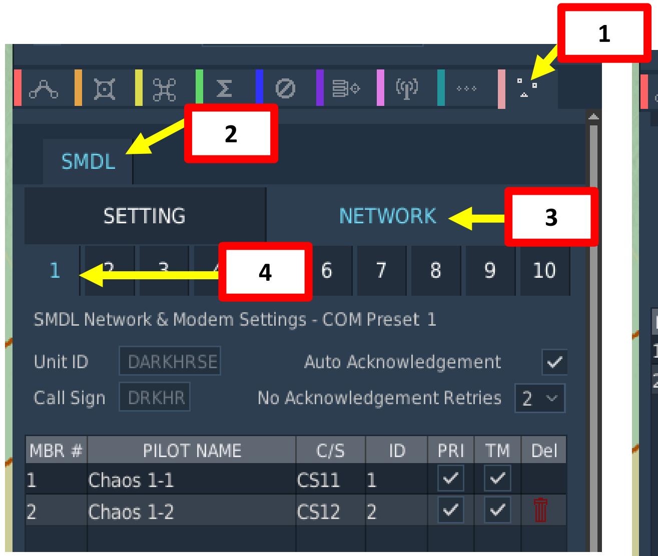
- **Preset Buttons (1-10):** Selects the corresponding preset with which to edit the network and modem settings in the table below.
- **Auto Acknowledgement**: When checked, automatic acknowledgements will be transmitted by the modem when a digital message is received across the datalink network associated with this preset.
- **No Acknowledgement Retries**: Selects the number of subsequent attempts the modem should transmit digital messages if an acknowledgement of reception is not received across the datalink network associated with this preset.
- **MBR #:** Displays the index of each network member associated with this preset. A maximum of 16 members may be present within each network. The ownship will always occupy the first entry; entries 2-16 will correspond with network subscribers.
- **PILOT NAME**: Displays the name of each network member, which corresponds to how their entries will be annotated within the ORIG DIR and MBR DIR sub-pages.
- **C/S**: Displays the Callsign of each network member.
- **ID**: Displays the subscriber ID (Identification Number) of each network member.
- **PRI**: When checked, the member will be designated as a Primary member within the datalink network associated with this preset. A **maximum of 8 Primary members** may be present within each network, with the ownship always included as the first entry.
- **TM**: When checked, the member will be designated as a Team member within the datalink network associated with this preset. A **maximum of 16 Team members** may be present within each network, with the ownship always included as the first entry.

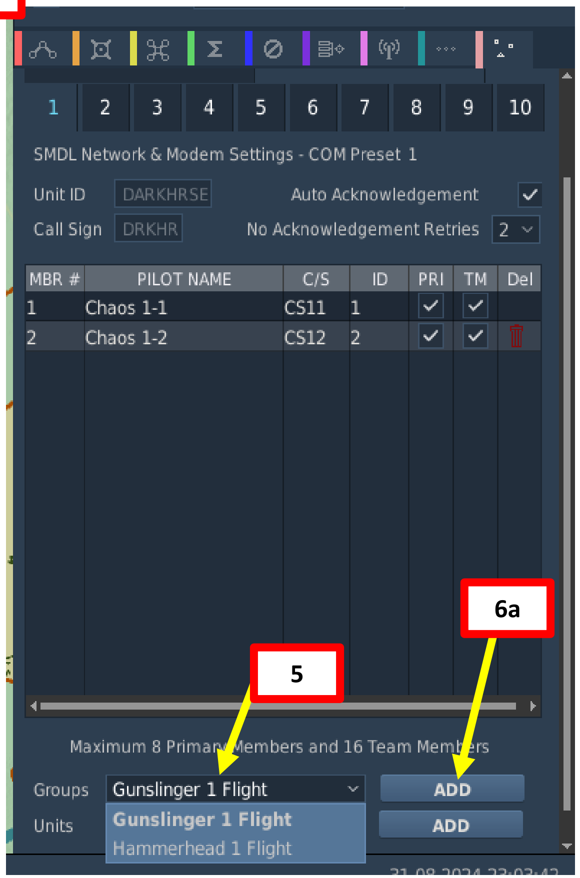


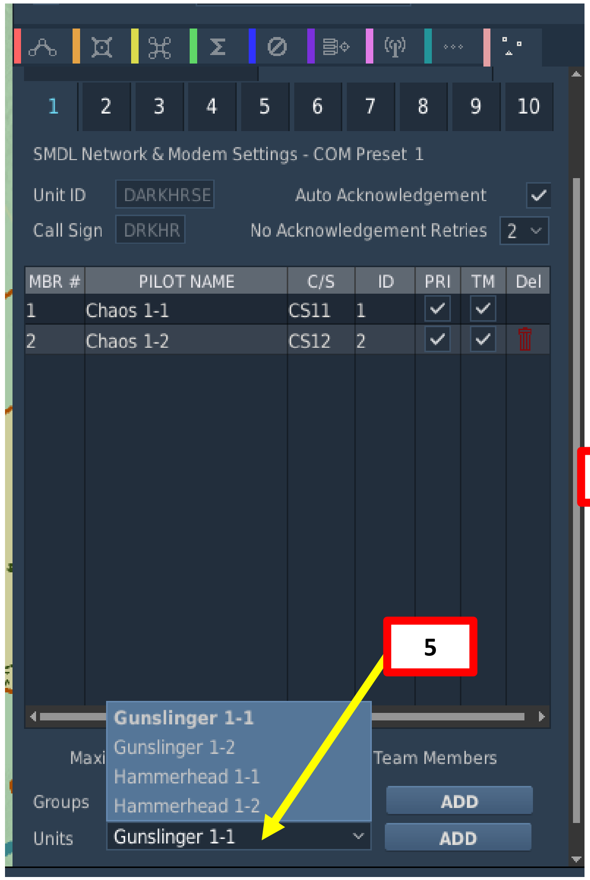
1 – INTRODUCTION TO DATALINK
1.1 – SMDL (Secure Modem Datalink)

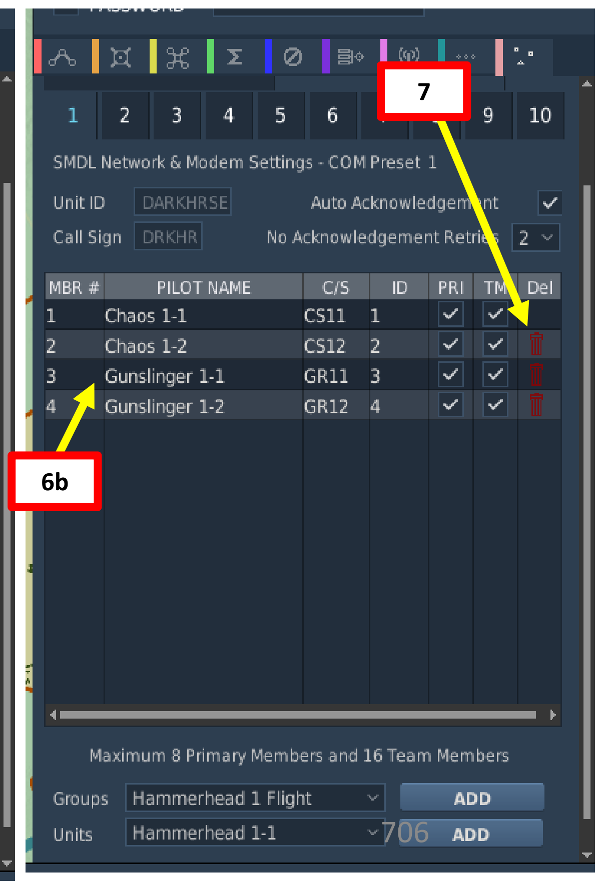
Mission Editor: Adding a Member to the Network

1. Select Datalinks Tab
2. Select SMDL menu
3. Select Network Tab
4. Select desired COM Preset Channel reserved for Datalink network. We will choose Preset 1, which is the channel for “Darkhorse”.
5. You can select either a single unit or an entire group of units to add to the network. Take note that you may need to scroll down a bit further to see this menu.
6. Select ADD on the desired unit/group you want to add.
7. Units can be removed using the DEL (Delete) button.









1 – INTRODUCTION TO DATALINK
1.1 – SMDL (Secure Modem Datalink)

Network Example

In this example, we have **Chaos** Flight and **Gunslinger** Flight, which form together the **Darkhorse** team.

Datalink Network L1 (DARKHORSE, Preset 1) on FM1 Radio is set for data exchange between all four members of the team.

Datalink Network L2 (CHAOS, Preset 2) on FM2 Radio Channel 2 is set for data exchange between members of Chaos Flight only.

Datalink Network L3 (GUNSLINGER, Preset 3) on FM3 Radio Channel 3 is set for data exchange between members of Gunslinger Flight only.

Darkhorse

Chaos Flight 1

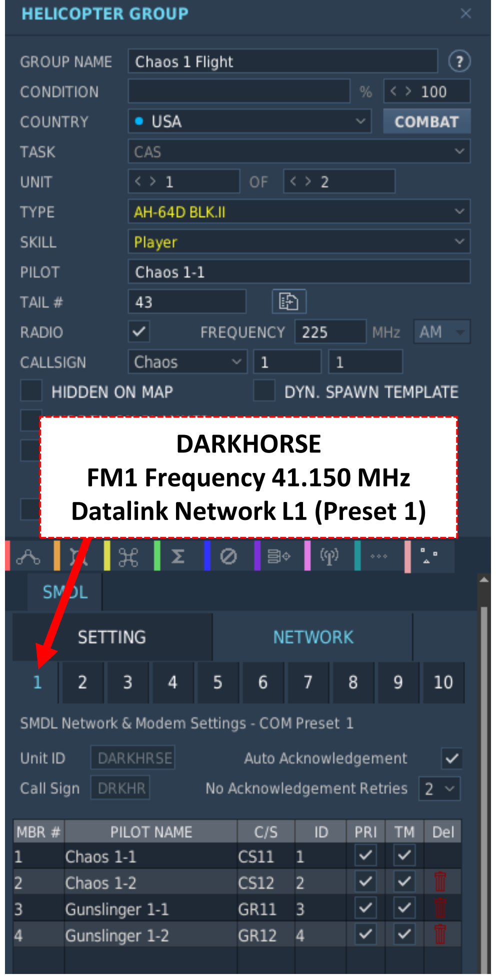
Chaos 1-1 (AH-64D)
Flight 1 / Member 1
Originator ID: 1
Callsign: CS11
Primary (PRI)
Team Member (TM)

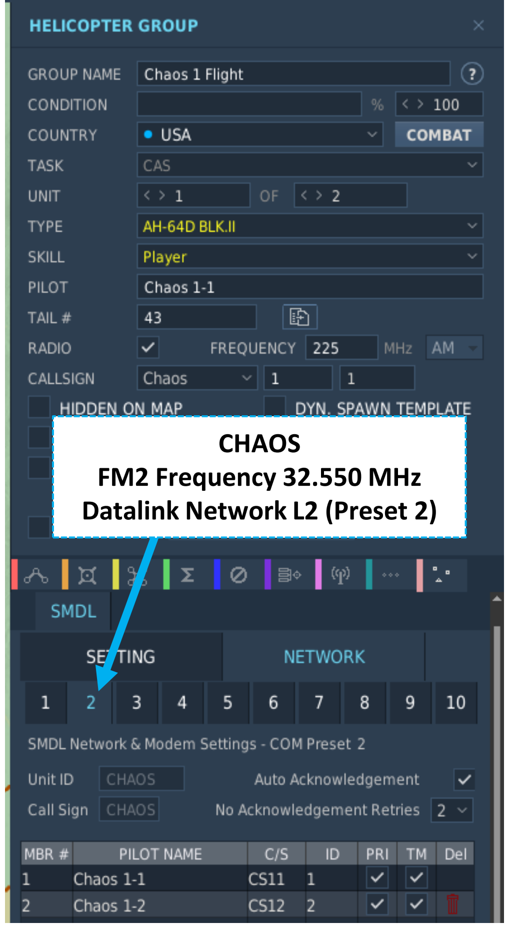
Chaos 1-2 (AH-64D)
Flight 1 / Member 2
Originator ID: 2
Callsign: CS12
Primary (PRI)
Team Member (TM)

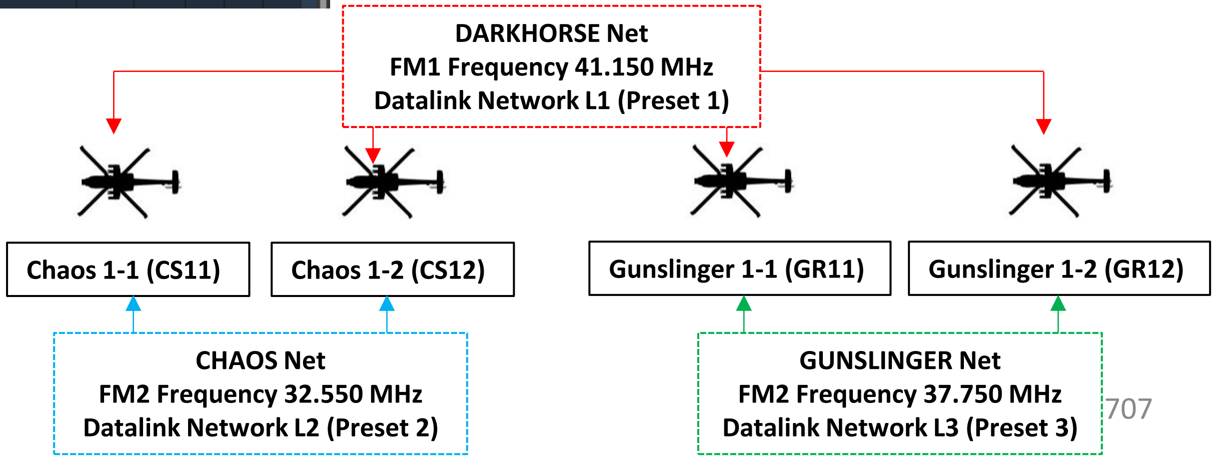
Gunslinger Flight 1

Gunslinger 1-1 (AH-64D)
Flight 1 / Member 1
Originator ID: 3
Callsign: GR11
Primary (PRI)
Team Member (TM)

Gunslinger 1-2 (AH-64D)
Flight 1 / Member 2
Originator ID: 4
Callsign: GR12
Primary (PRI)
Team Member (TM)







1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown

The crew uses datalink functionalities via four main components: the EUFD (Enhanced Up-Front Display), KU (Keyboard Unit), COM (Communications) page and TSD (Tactical Situation Display) page.

EUFD (Enhanced Up-Front Display)

TSD (Tactical Situation Display) Page

COM (Communications) Page

KU (Keyboard Unit)

- *The Keyboard Unit (KU) allows crewmembers to enter alphanumeric data into MPD (Multi-Purpose Display) fields and do simple arithmetic calculations. It can also be used as a simple scratchpad for notetaking.*

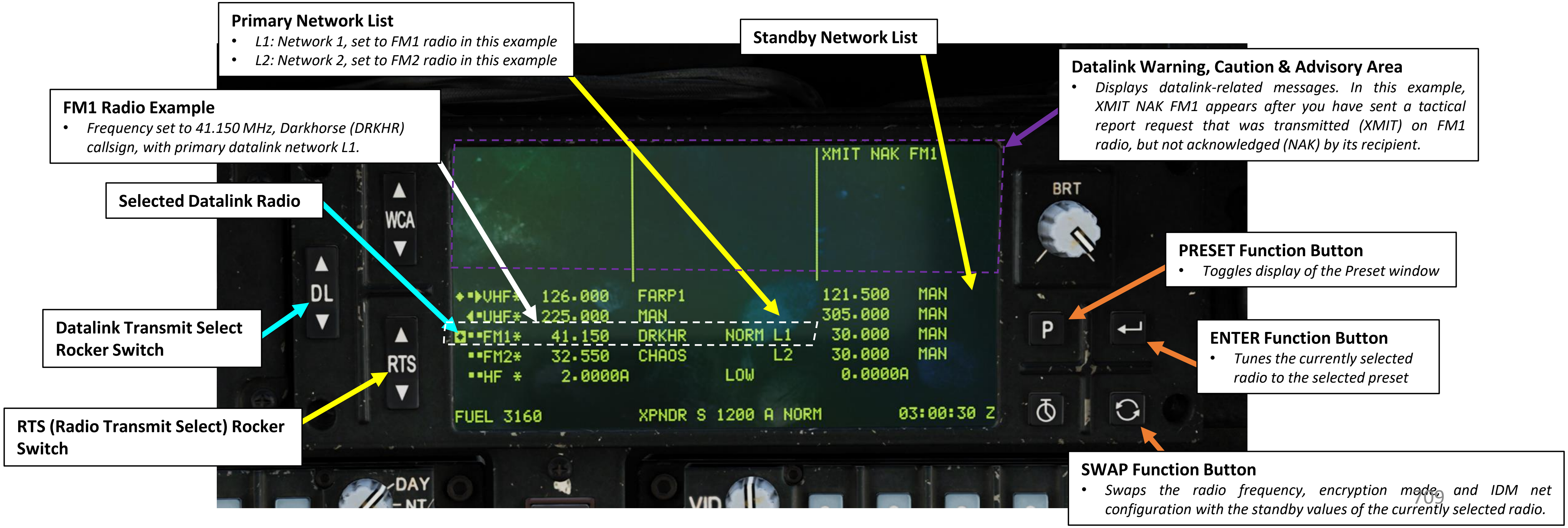
1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – EUFD

The **Enhanced Up-Front Display (EUFD)** provides the aircrew with a consolidated location for viewing the current configuration and datalink settings of each radio. The modem can receive datalink messages from the VHF, UHF, FM1, and FM2 radios simultaneously, but each crewmember may only transmit datalink messages across a single radio at any given time.

The radio through which each crewmember transmits datalink messages is independent from the radio the crewmember has selected for voice transmissions. The **Datalink Transmit Select** rocker is used to select a radio for datalink transmissions while the **Radio Transmit Select** rocker is used to select a radio for voice transmissions. The **Primary Network List** displays which radios are configured to transmit and receive datalink messages, and to which datalink network the radio has been tuned.

The **Standby Network List** displays which datalink networks are associated with the radio presets residing in the standby slots for each radio. When considering the standby slots of each radio, the number of networks that may be readily accessible at any given time is as follows:

- 8 datalink networks (two for each radio) may be loaded into the VHF, UHF, FM1, and FM2 radios.
- 4 datalink networks (one for each radio) may be tuned and monitored for data communications.
- 2 datalink networks (one for each crewmember) may be selected to transmit data communications, independently of the radios selected by each crewmember for transmitting voice communications.

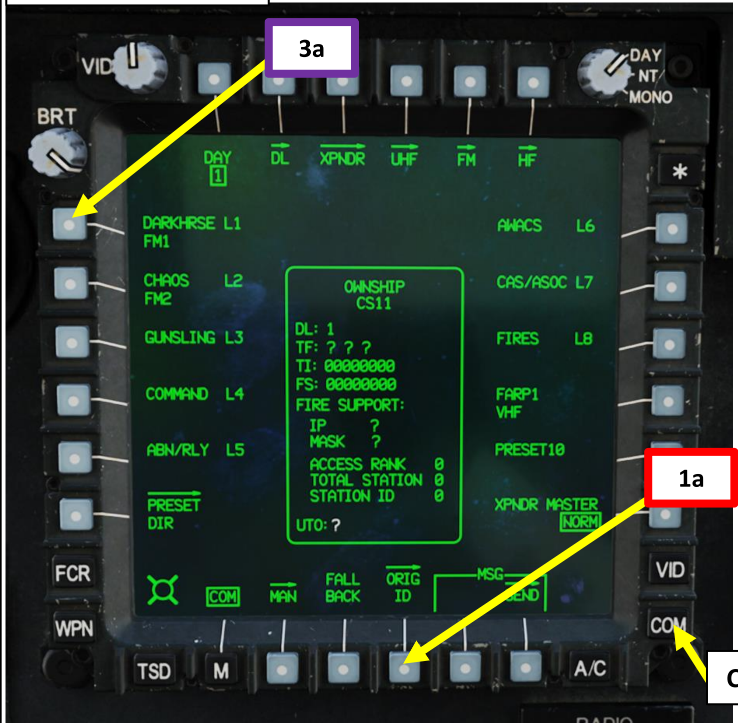


1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – COM

The **COM (Communications) page** is used for setting up datalink network, members and many other datalink-related functions. Here is how to access those various sub-pages:

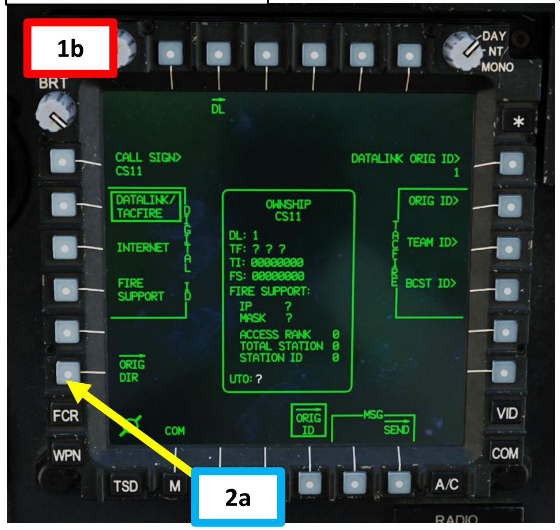
1. **ORIG ID (COM Originator Identification) sub-page**
2. **ORIG DIR (COM Originator Directory) sub-page**
3. **NET (COM Network) sub-page**
4. **MBR DIR (COM Member Directory) sub-page**
5. **MODEM sub-page**

Main COM Page

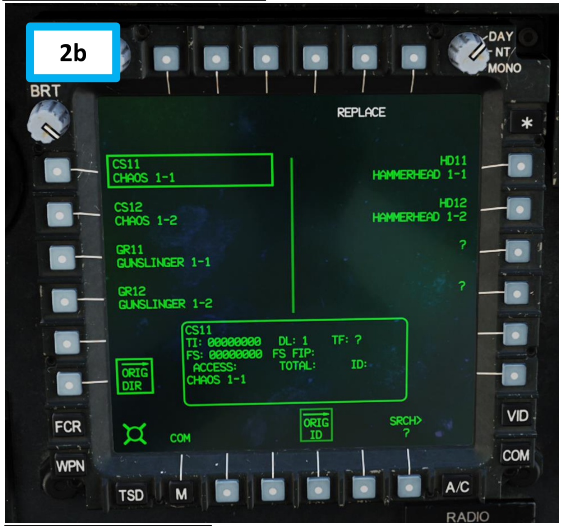


COM Page Selector

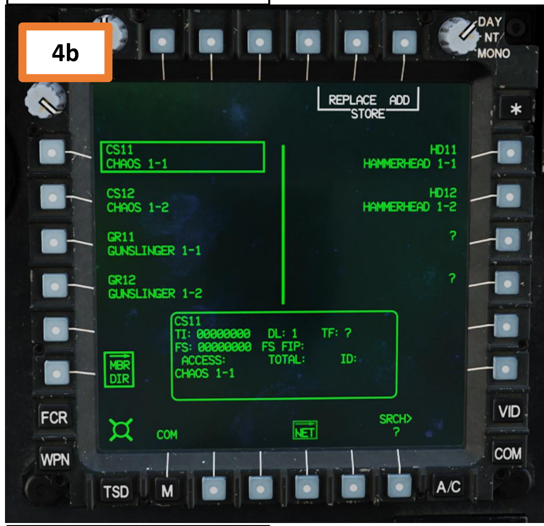
ORIG ID Sub-Page

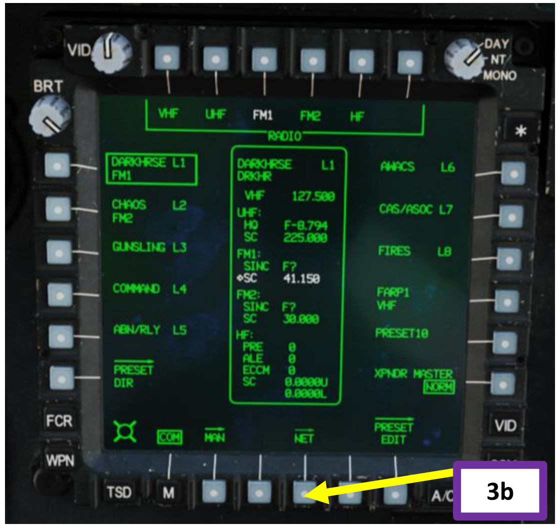


ORIG DIR Sub-Page

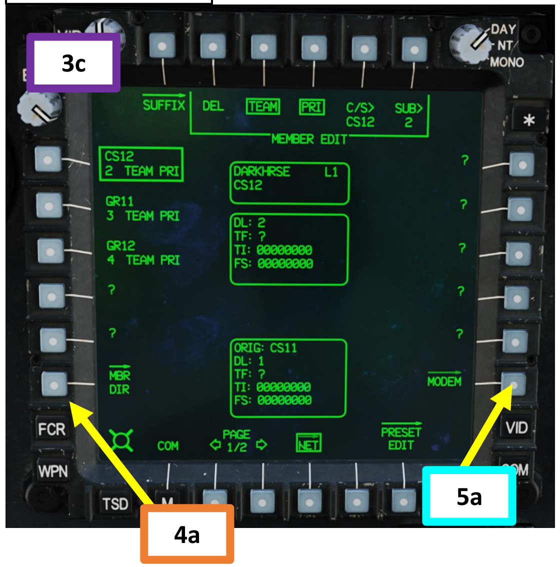


MBR DIR Sub-Page





NET Sub-Page



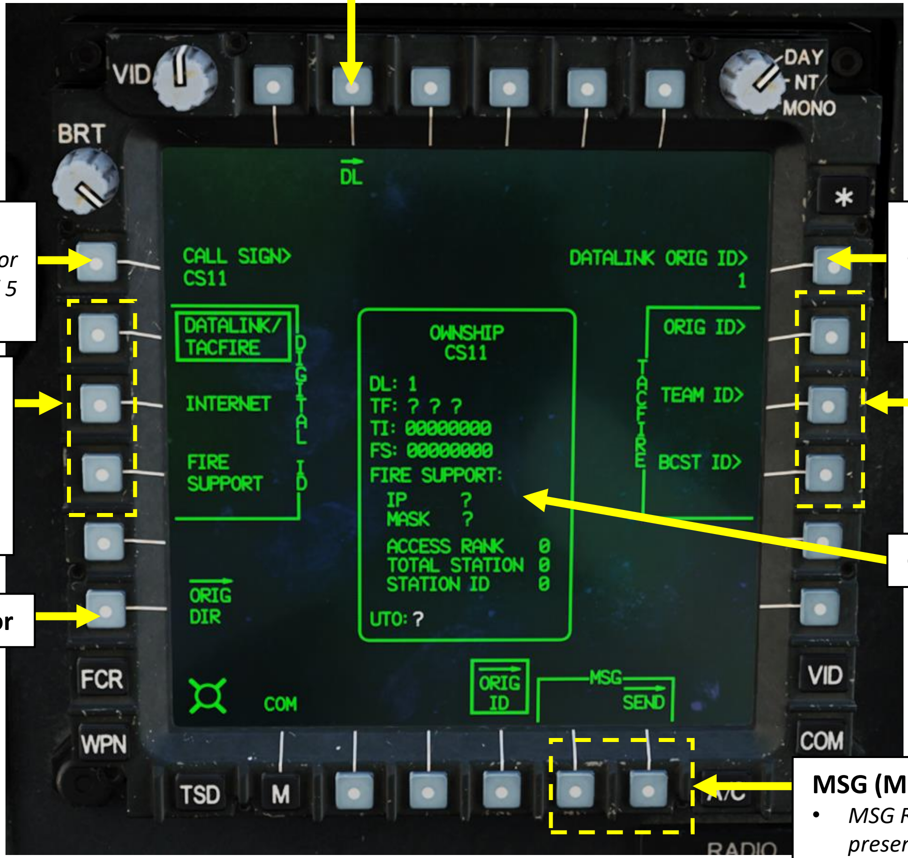
MODEM Sub-Page

1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – COM

Here is an overview of various sub-pages and their primary use.

1. **ORIG ID (COM Originator Identification) sub-page**: allows crewmembers to review or modify the ownship's identification settings for sending and receiving traffic across the datalink network(s).
    - Accessed from Main COM page → ORIG ID Button

DL (Datalink) Sub-Page Selector



Ownship Callsign
- *Activates the KU (Keyboard Unit) for inputting the originator callsign for the ownship. A minimum of 3 and a maximum of 5 alphanumeric characters may be entered.*

Digital ID Select
- *Selects a page format for configuring digital ID settings for each type of protocol*
    - *DATALINK/TACFIRE Protocol*
    - *INTERNET Protocol*
    - *FIRE SUPPORT Protocol*

ORIG DIR Sub-Page Selector

Datalink Originator ID
- *Activates the KU (Keyboard Unit) for inputting the originator identification (ID) number which identifies the ownship on the datalink network.*

TACFIRE ID Settings
- *Not Implemented.*

Ownship Status Window

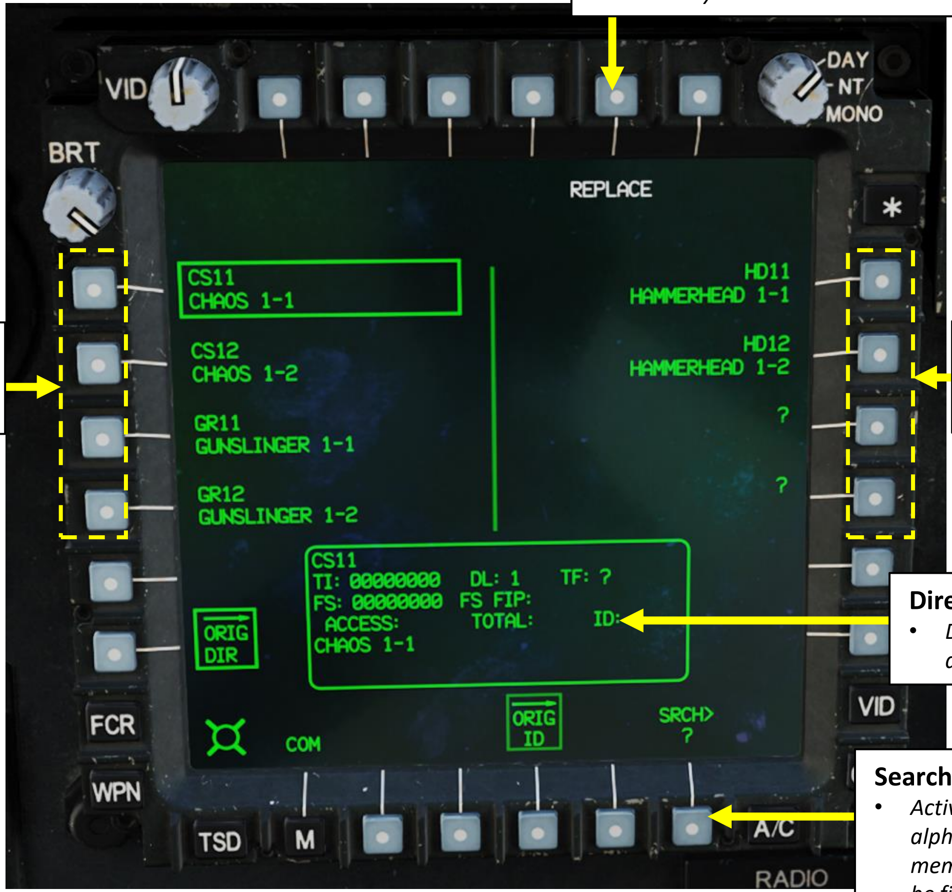
MSG (Message)Sub-Pages
- *MSG REC:Displays the Message Receive sub-page. If no messages are present on the receive list, this sub-page option will not be displayed.*
- *MSG SEND: Displays the Message Send sub-page.*

1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – COM

Here is an overview of various sub-pages and their primary use.

2. **ORIG DIR (COM Originator Directory) sub-page**: allows crewmembers to set their ownship identification settings to a pre-planned network member entry.
    - Accessed from Main COM page → ORIG ID Button → ORIG DIR Button

Replace Ownship
- *Replaces the ownship's digital ID settings with those of the directory member that has been selected for review.*



Directory Members
- *Selects a directory member for review within the Directory Member status window.*

Directory Members
- *Selects a directory member for review within the Directory Member status window.*

Directory Member Status Window
- *Displays the callsign and digital ID settings of the selected directory member.*

Search Directory
- *Activates the KU (Keyboard Unit) for inputting alphanumeric characters to search for a specific member within the directory. Displayed members will be filtered accordingly based on the results.*

1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – COM

Here is an overview of various sub-pages and their primary use.

3. **NET (COM Network) sub-page**: allows crewmembers to review or modify the callsign and identification settings of each member within the datalink network of the selected preset.
    - Accessed from Main COM page → Selecting a Network Member → NET Button

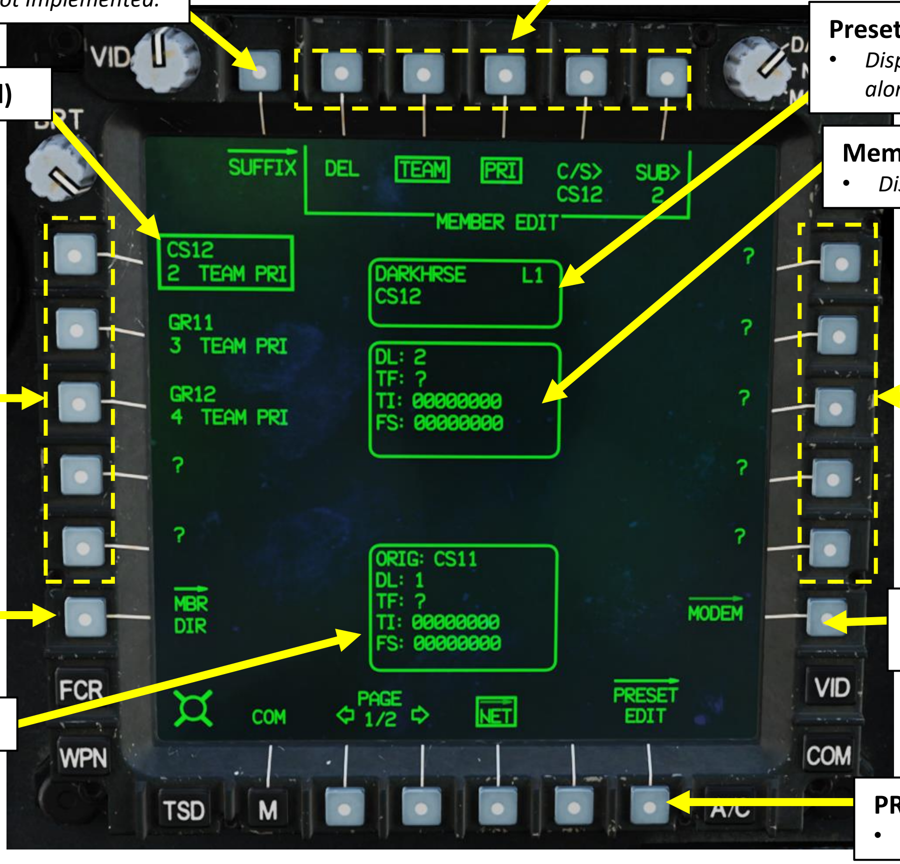
MEMBER EDIT
- *Displays options for editing the digital ID settings of the selected network member.*
- *DEL: Deletes network member from preset.*
- *TEAM: Designates network member as a Team Member.*
- *PRI: Designates network member as a Primary Member.*
- *C/S: Activates KU (Keyboard Unit) for inputting the network callsign of the member.*
- *SUB: Activates KU (Keyboard Unit) for inputting the subscriber identification (ID) number, which identifies the member on the datalink network.*

SUFFIX Sub-Page
- *Not Implemented.*

Selected Network Member (Boxed)

Preset Status Window
- *Displays the unit ID and modem protocol of the preset network, along with the callsign of the selected network member.*

Member Status Window
- *Displays the digital ID settings of the selected network member*



Network Members
- *Selects a network member for review within the Member Status Window*

Network Members
- *Selects a network member for review within the Member Status Window*

MBR DIR Sub-Page Selector
- *Displays the Member Directory sub-page.*

Ownship Status Window

MODEM Sub-Page Selector
- *Displays the MODEM sub-page.*

PRESET EDIT Sub-Page Selector
- *Displays the Preset Edit sub-page.*

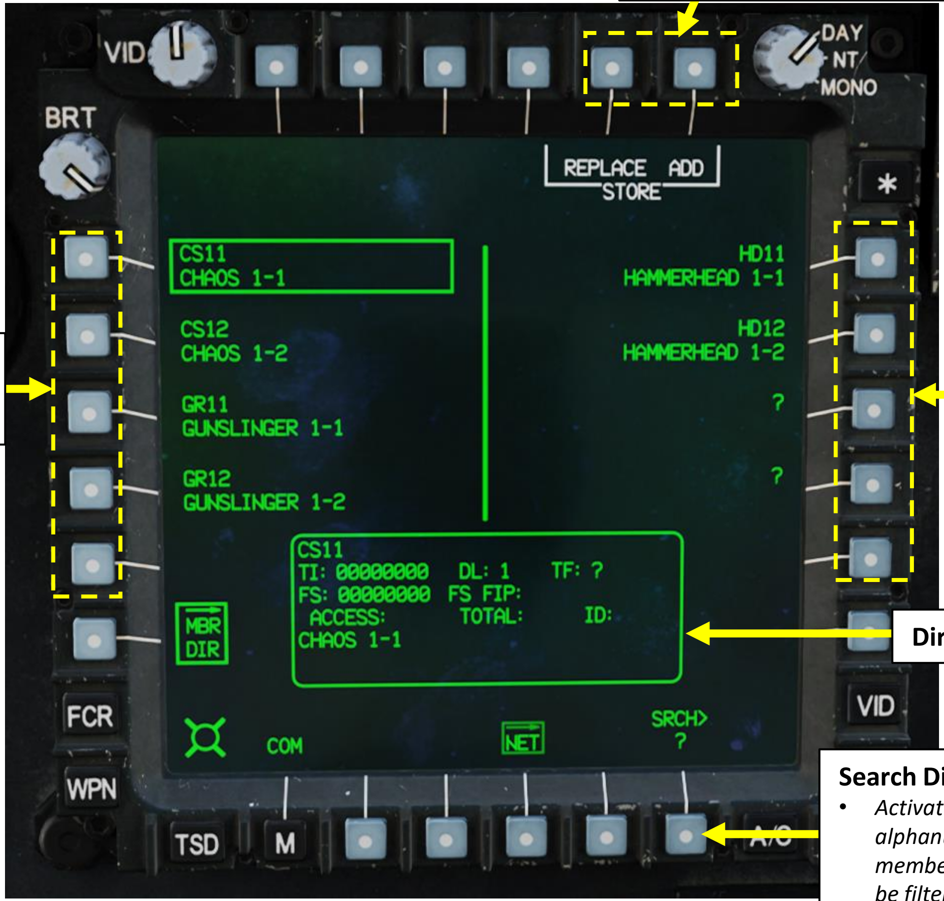
1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – COM

Here is an overview of various sub-pages and their primary use.

4. **MBR DIR (COM Member Directory) sub-page:** allows crewmembers to add new members to the network or replace existing member entries in the network member list.
    - Accessed from Main COM page → Selecting a Network Member → NET Button → MBR DIR Button

STORE METHOD
- *Inserts selected directory member into the selected datalink network.*
- *STORE – REPLACE: Displays the REPLACE format of the Member Directory sub-page.*
- *STORE – ADD: Adds the selected directory member into the first network entry is that is available. If the datalink network already contains 15 network members, this option will be disabled and "barriered" unless an existing network member is deleted from the selected datalink network.*

Directory Members
- *Selects a directory member for review within the Directory Member Status Window*



Directory Members
- *Selects a directory member for review within the Directory Member Status Window*

Directory Member Status Window

Search Directory
- *Activates the KU (Keyboard Unit) for inputting alphanumeric characters to search for a specific member within the directory. Displayed members will be filtered accordingly based on the results.*

1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – COM

Here is an overview of various sub-pages and their primary use.

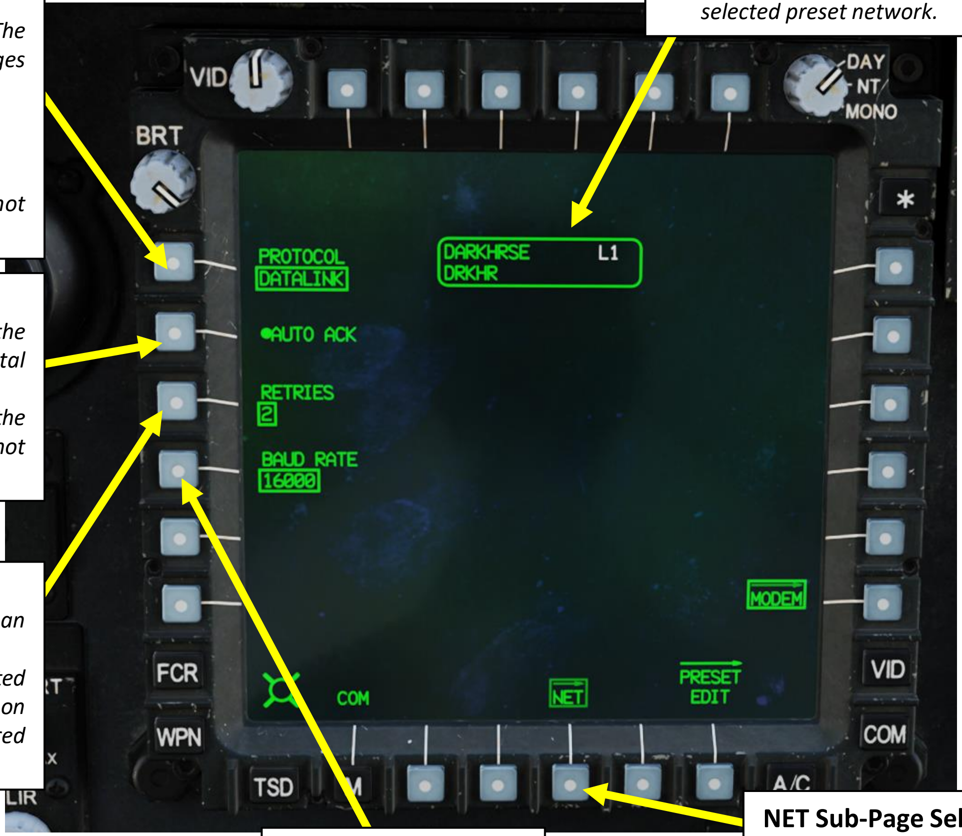
5. **MODEM sub-page:** allows crewmembers to configure the settings the modem will utilize when sending or receiving data through any radios tuned to the selected preset.
    - Accessed from Main COM page → Selecting a Network Member → NET Button → MODEM Button

Modem Protocol
- *Selects the type of protocol the modem will utilize for the selected preset.*
- *DATALINK: protocol digital messages may be sent using any radio tuned to the selected preset. The modem will monitor any radios tuned to the selected preset for incoming digital messages compatible with AH-64D-only DATALINK protocols.*
- *TACFIRE: Not implemented.*
- *INTERNET: Not implemented.*
- *FIRE SUPPORT: Not implemented.*
- *NONE: Radios tuned to the selected preset cannot send digital messages. The modem will not monitor any radios tuned to the selected preset.*

Modem Automatic Acknowledgement
- *Enables/disables automatic acknowledgements by the modem. If a digital message is received, the modem will transmit a discrete acknowledgement to the originator ID of the sender that the digital message has been received by the ownship.*
- *When a request for data is transmitted to a network subscriber, an “acknowledgement” from the subscriber’s modem only confirms the request for data was received. An acknowledgement does not contain the requested data, which is transmitted within a “reply”.*

Modem Retries
- *Selects the number of subsequent attempts the modem should transmit digital messages if an acknowledgement of reception is not received from any intended message recipients.*
- *If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.*

Preset Status Window
- *Displays the unit ID, callsign, and modem protocol of the selected preset network.*



Modem Baud Rate
- *Not Implemented.*

NET Sub-Page Selector
- *Displays the NET (Network) Sub-Page.*

1 – INTRODUCTION TO DATALINK
1.2 – Components Breakdown – TSD

The TSD (Tactical Situation Display) page allows you to send, request and receive tactical reports. TSD points and fire zones can also be sent and received.

Tactical Report Selectors
- *BDA: Battle Damage Assessment*
- *TGT: Fire Control Radar Target*
- *PP: Present Position*
- *FARM: Fuel, Ammo, Rockets & Missiles*
- *SIT: Not Implemented.*
- *SPOT: Not Implemented*

Tactical Reports Page Selector

Main TSD Page

TSD Page Selector

TSD Point Page Selector

Tactical Reports Page

TSD Point Page

XMIT (Transmit) Function

1 – INTRODUCTION TO DATALINK
1.3 – Datalink Capabilities

Each network may consist of 16 network members, containing 15 subscribers in addition to the ownship. Any of the 15 subscribers may be set as a Team member, a Primary member, or both; however, a maximum of 7 subscribers within each network may be designated as a Primary member. The designation of a subscriber as Team or Primary determines the type of data messages the member may receive from the ownship.

Team members receive **text messages** and **mission files**. These messages coordinate team actions and movements and distribute mission updates across the entire team of AH-64D's on a datalink network.

Primary members receive **tactical reports, targeting data, fires distribution**, and individual TSD (Tactical Situation Display) **points**. These messages coordinate tactical actions of individual companies and platoons of AH-64D's.

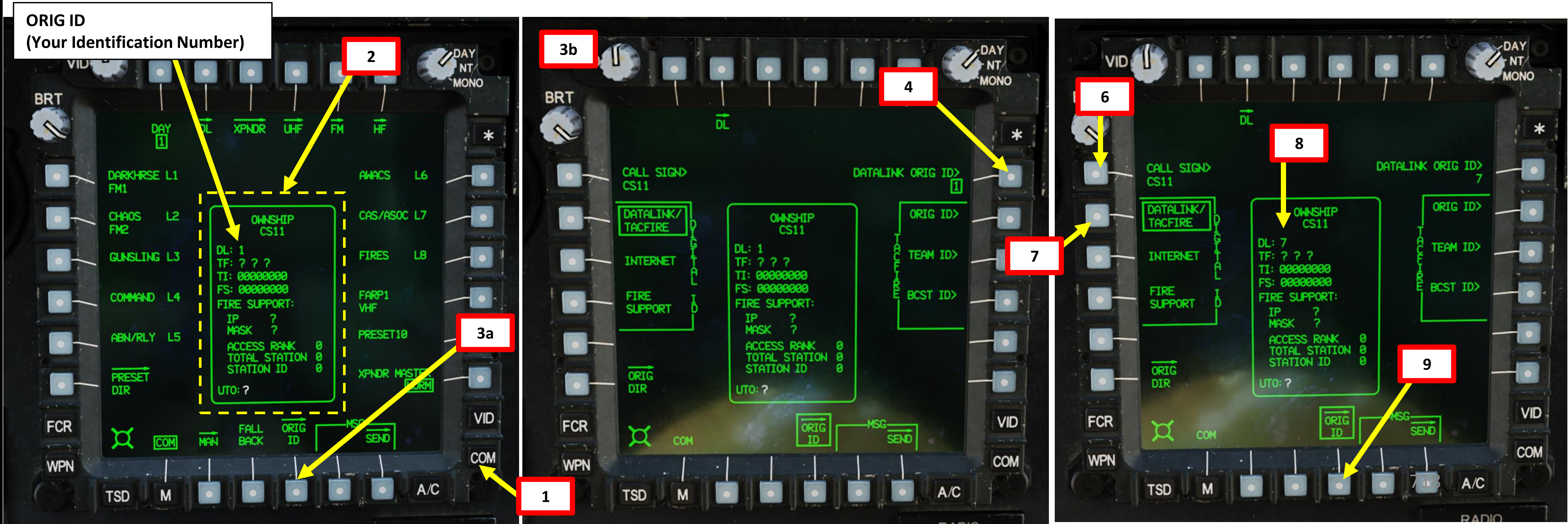
Team Member Capabilities:
- Send/Receive TEXT messages
- Send/Receive CURRENT MISSION (Mission Files)
- Send/Receive Mission 1 or Mission 2 files residing on the Data Transfer Cartridge (DTC)

Primary Member Capabilities:
- All capabilities of Team Members
- Send/Receive BDA (Battle Damage Assessment) tactical reports
- Send/Receive TGT (Fire Control Radar Target) tactical reports
- Send/Receive PP (Present Position) tactical reports
- Send/Receive FARM (Fuel, Ammo, Rockets, Missiles) tactical reports
- Send/Receive PFZ/NFZ (Primary Fire Zone/No Fire Zone)
- Send/Receive POINTS (individual points stored in the Tactical Situation Display database)
- Send/Receive RFHO (Radio Frequency Handover), which are targets detected by the fire control radar

2 – DATALINK NETWORK SETUP VIA COM PAGE
2.1 – Setting up your own ORIG ID (Originator Identification)

Within a single network, each member must have a unique originator identification number. In this example, we want to modify our Originator Identification from « 1 » to « 7 ».

1. Select COM page
2. All presets are listed in the MAIN COM page. In the OWNSHIP window, we see that our originator ID is set to "1" and our callsign is set to "CS11" (Chaos 1-1).
3. Select ORIG ID sub-page.
4. Select DATALINK ORIG ID (boxed when selected)
5. On the KU (Keyboard Unit), type "7" (desired new originator ID), then press ENTER.
6. You can also modify the Call Sign in a similar fashion (currently set to CS11 for "Chaos 1-1").
7. Select DATALINK/TACFIRE.
8. On the OWNSHIP window, we see that our originator ID is now set to "7".
9. Press on the VAB (Variable Action Button) next to ORIG ID to return to the MAIN COM page.

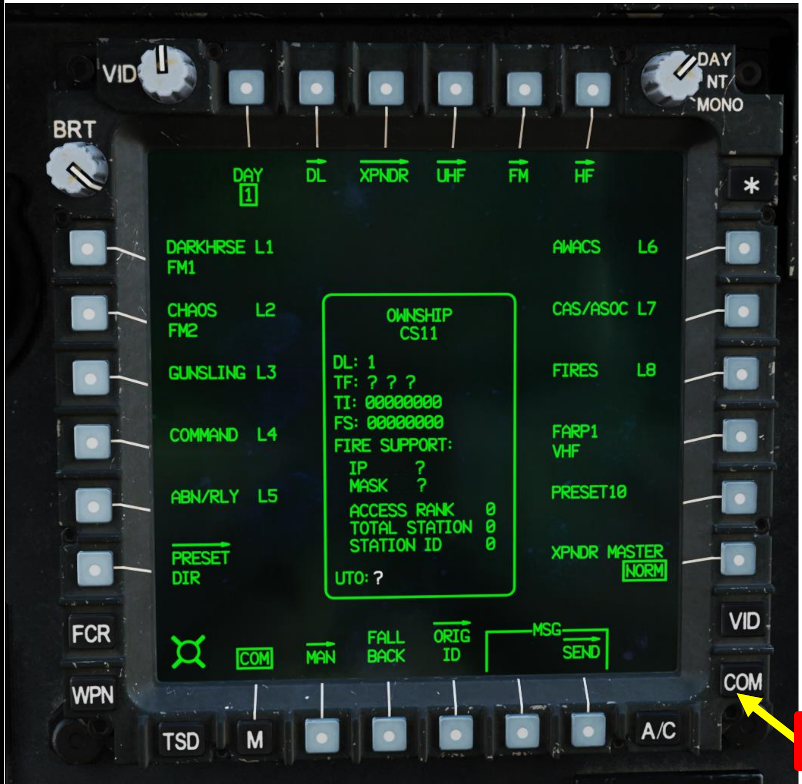


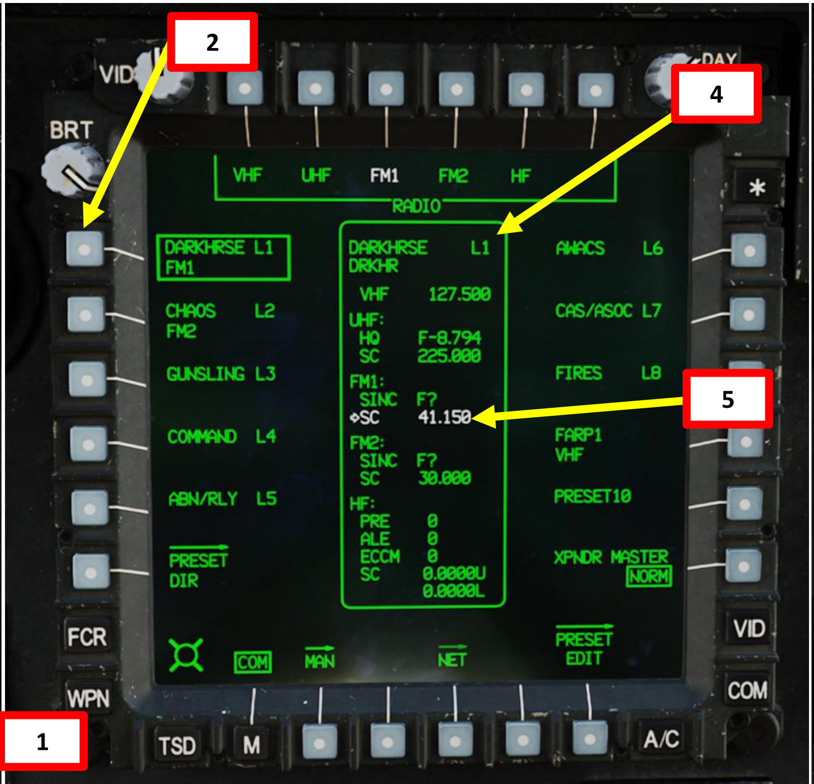
2 – DATALINK NETWORK SETUP VIA COM PAGE
2.2 – Radio Setup for a Datalink Network

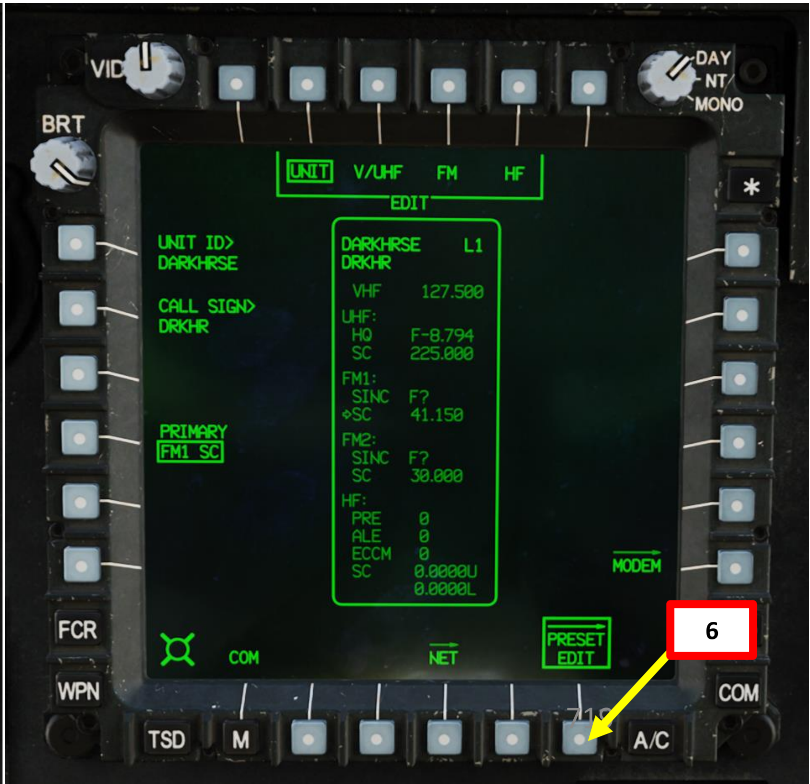
Each datalink network can be modified; from the COM page, you can change the callsign, radio and radio frequency used to transmit/receive data on. There are 10 preset channels labelled « L1 » through « L10 ».

In this example, we will modify Preset Channel L1 (**Callsign Darkhorse, FM1 radio, 41.150 MHz**) and change it with a new callsign (**Hammer**), radio (**VHF1 Single Channel**) and frequency (**128.500 MHz**).

1. Select COM page
2. All presets are listed in the MAIN COM page.
3. Select desired Datalink Preset Network. We will select Preset Network L1 (Darkhorse).
4. In the RADIO window, we see that Datalink Preset Network L1 is set to a FM1 as its primary radio with a frequency of 41.150 MHz.
5. The radio listed in white indicates which radio is selected for this network (FM1 in this case).
6. Select PRESET EDIT.



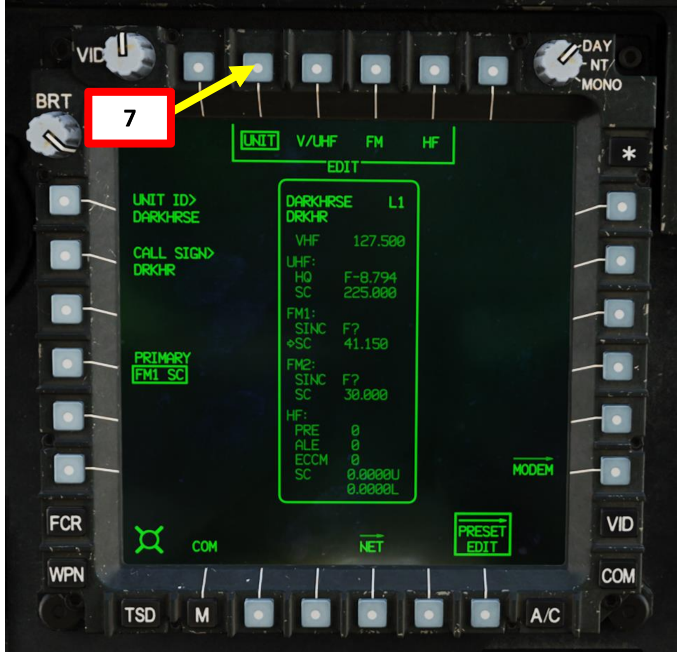


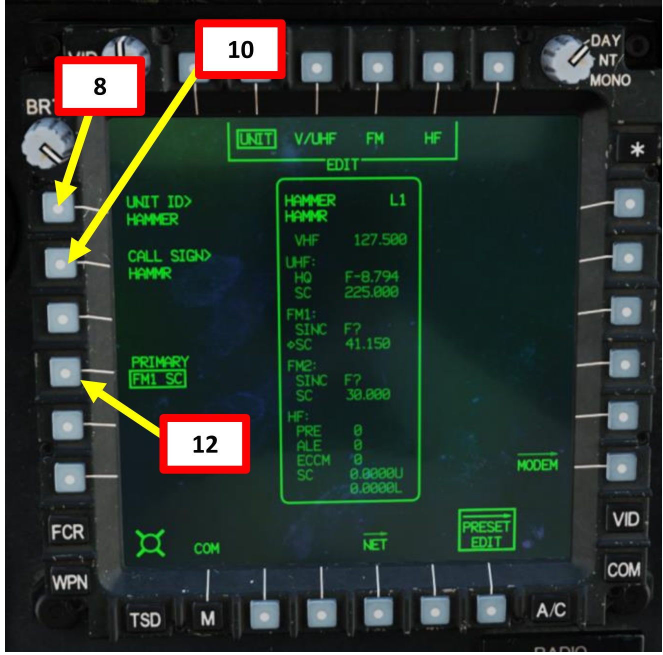


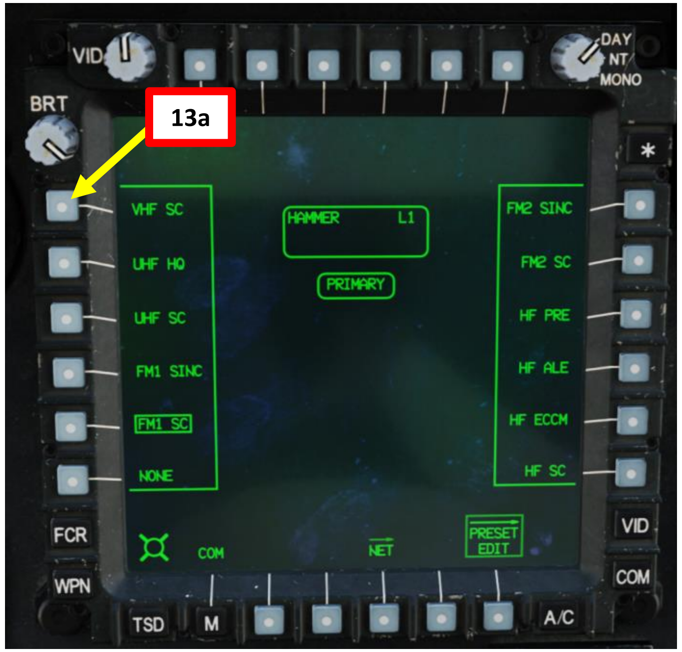
2 – DATALINK NETWORK SETUP VIA COM PAGE
2.2 – Radio Setup for a Datalink Network

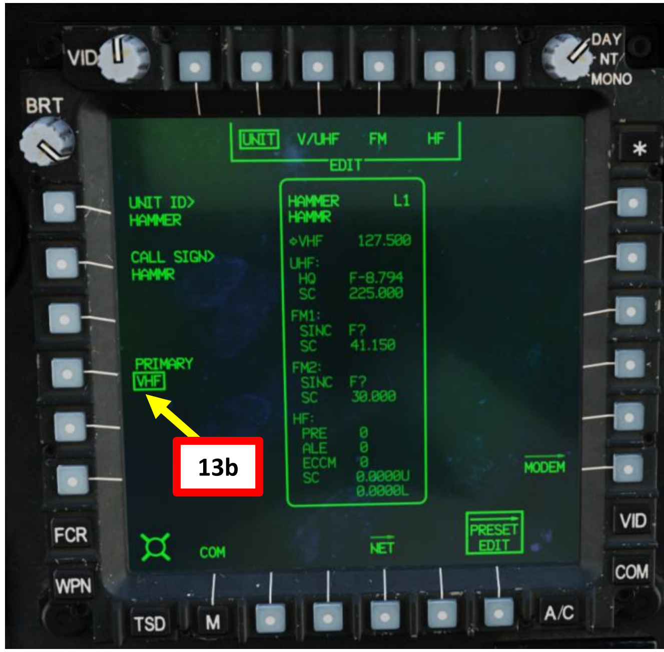
New Preset Channel L1: Callsign **Hammer**, **VHF1 Single Channel radio** with frequency **128.500 MHz**.

7. Select UNIT.
8. Select UNIT ID (boxed when selected)
9. On the KU (Keyboard Unit), type desired unit name (HAMMER), then press ENTER.
10. Select CALL SIGN (boxed when selected)
11. On the KU (Keyboard Unit), type desired callsign (HAMMR), then press ENTER.
12. Select PRIMARY RADIO.
13. Select VHF SC (Single Channel)





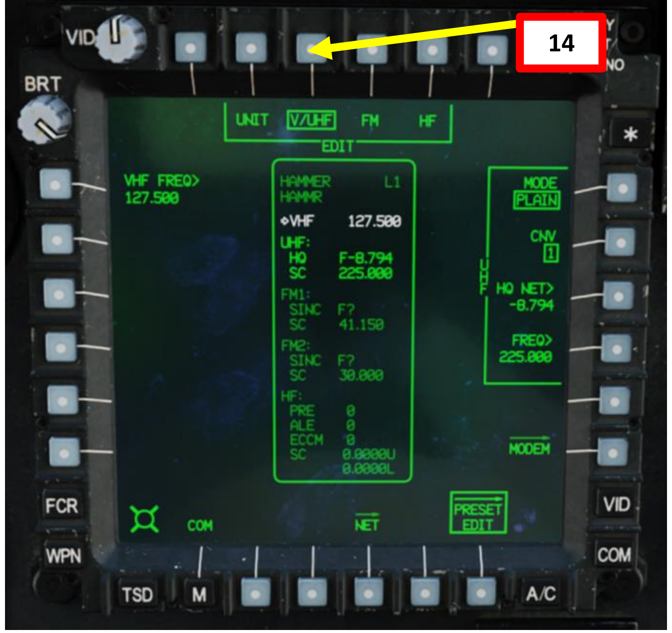


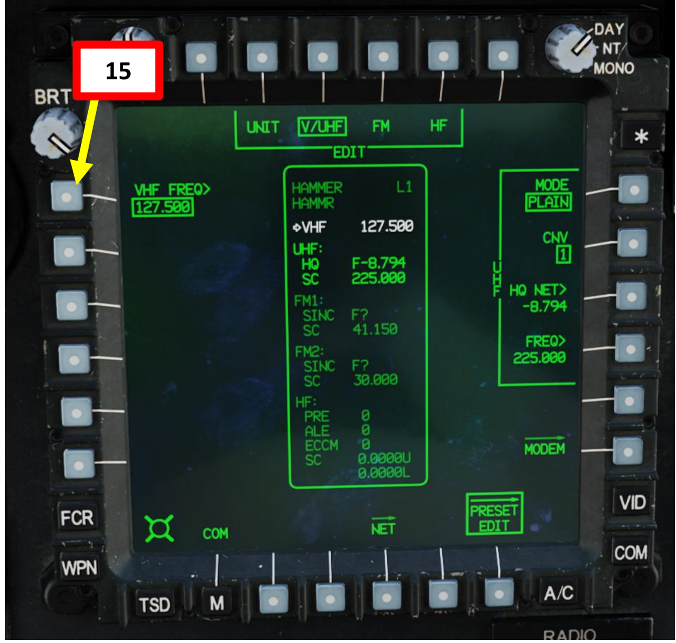


2 – DATALINK NETWORK SETUP VIA COM PAGE
2.2 – Radio Setup for a Datalink Network

New Preset Channel L1: Callsign **Hammer**, **VHF1 Single Channel radio** with frequency **128.500 MHz**.

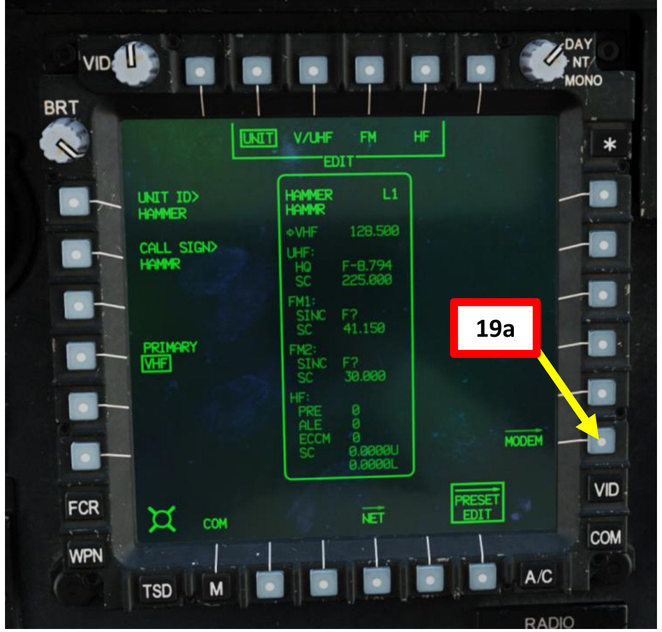
14. Select V/UHF EDIT
15. Select VHF FREQ (boxed when selected)
16. On the KU (Keyboard Unit), type desired frequency (128.500), then press ENTER.
17. Confirm that VHF field is updated correctly and is displayed in white (indicates VHF1 is set as the primary radio for Datalink Network L1).
18. Return to UNIT and check that network window information is updated as well.

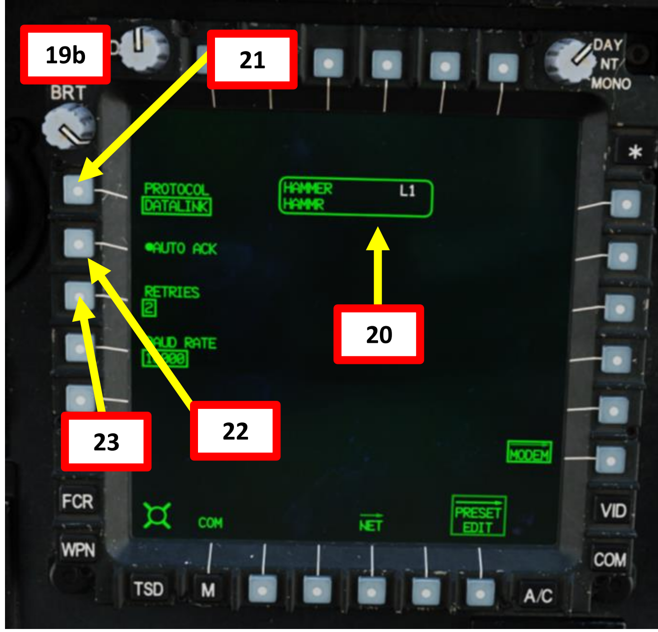


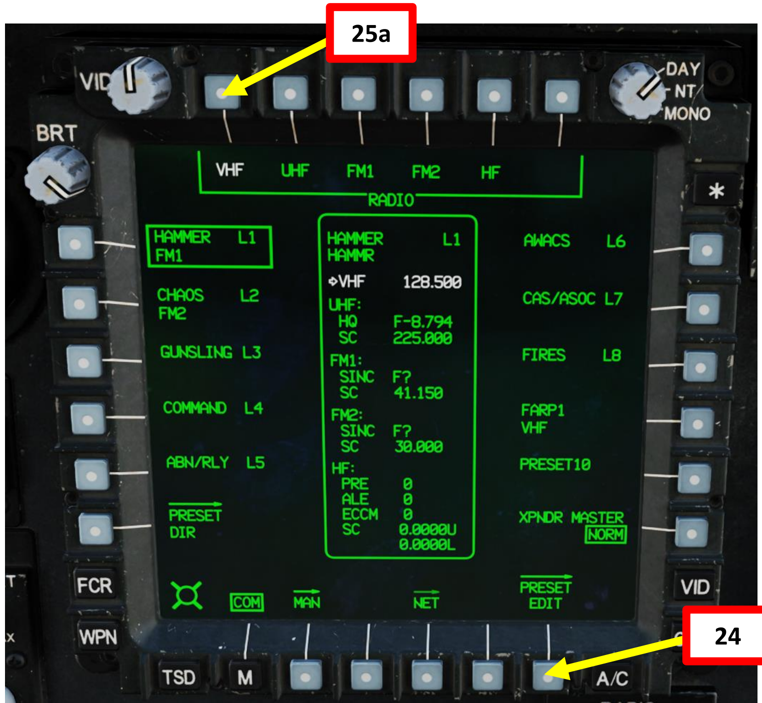


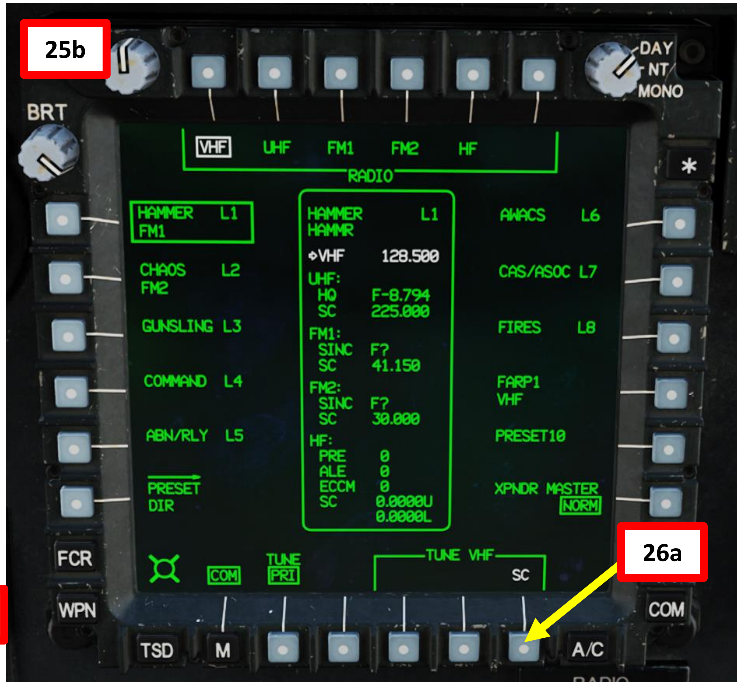
2 – DATALINK NETWORK SETUP VIA COM PAGE
2.2 – Radio Setup for a Datalink Network

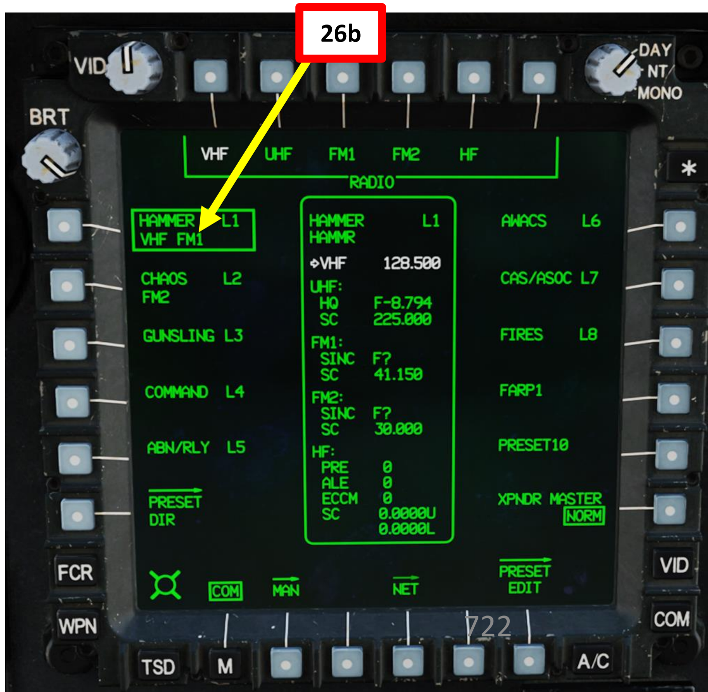
19. Select MODEM sub-page.
20. Verify network window displays the correct callsign (Hammer) and preset channel (network L1).
21. Set PROTOCOL – DATALINK.
22. Set AUTO ACK – ENABLED (solid).
    - *Enables/disables automatic acknowledgements by the modem. If a digital message is received, the modem will transmit a discrete acknowledgement to the originator ID of the sender that the digital message has been received by the ownship.*
23. Set RETRIES – As desired.
    - *Selects the number of subsequent attempts the modem should transmit digital messages if an acknowledgement of reception is not received from any intended message recipients.*
24. Exit PRESET EDIT menu.
25. Select VHF.
26. Select SC (Single Channel).









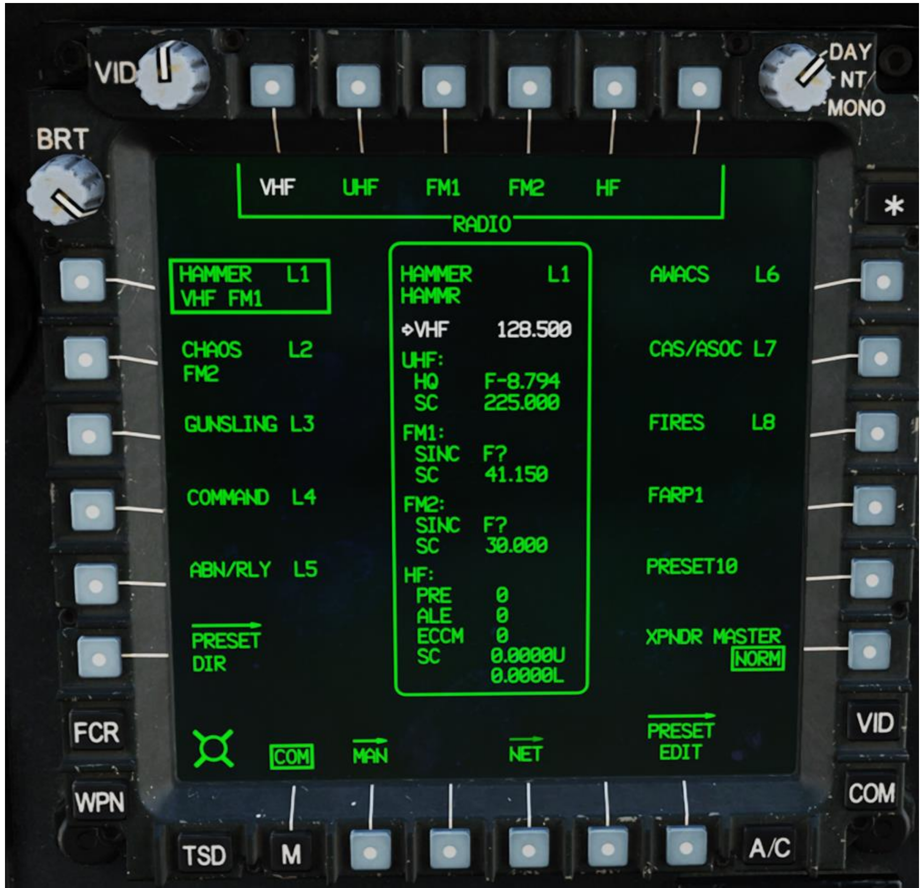


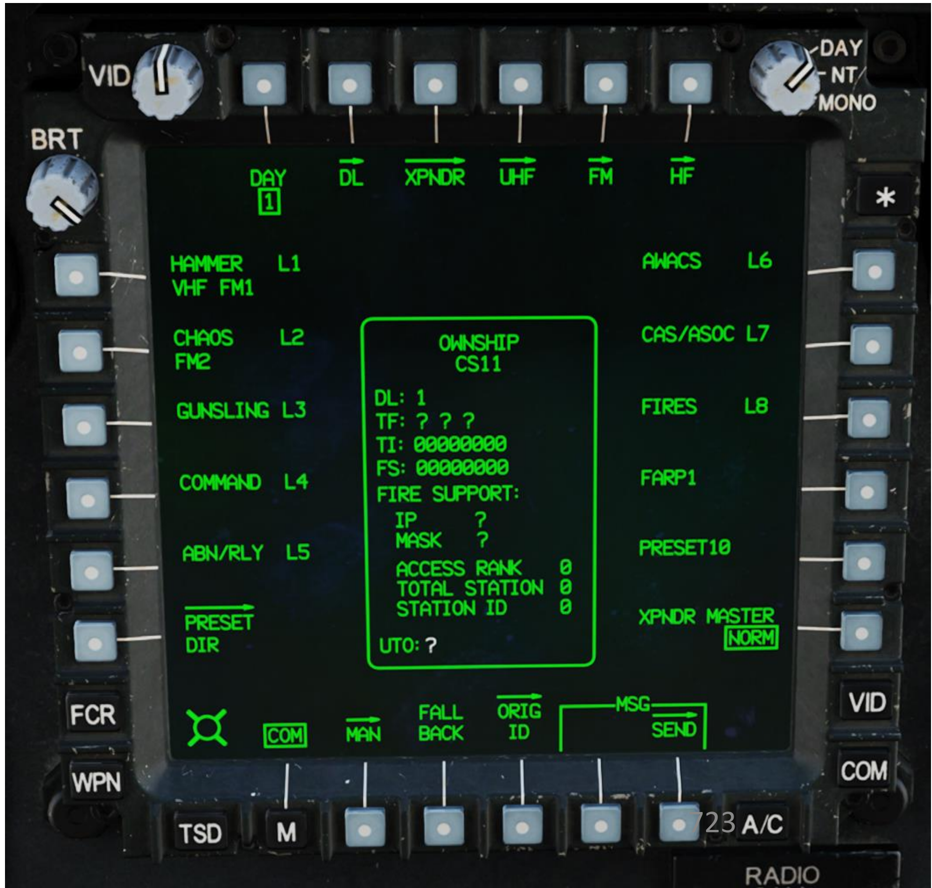
2 – DATALINK NETWORK SETUP VIA COM PAGE

2.2 – Radio Setup for a Datalink Network

27. Use Datalink Transmit Select Rocker Switch to set the Datalink Radio to VHF.
28. And that's it! Your datalink network is now up and running. You may now add members to it.

27a Datalink Transmit Select Rocker Switch

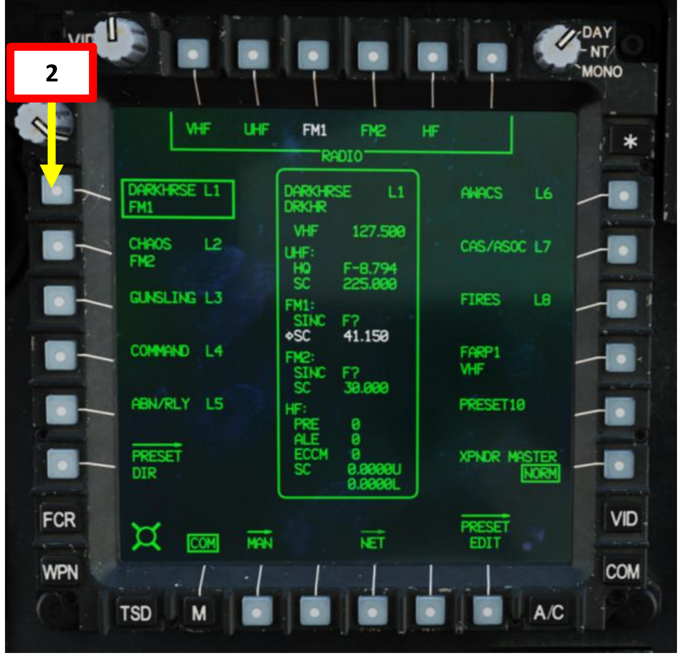


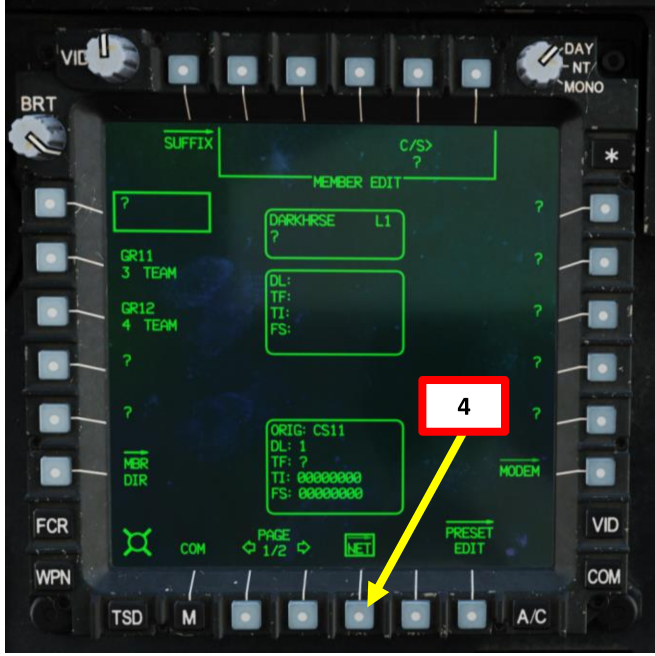


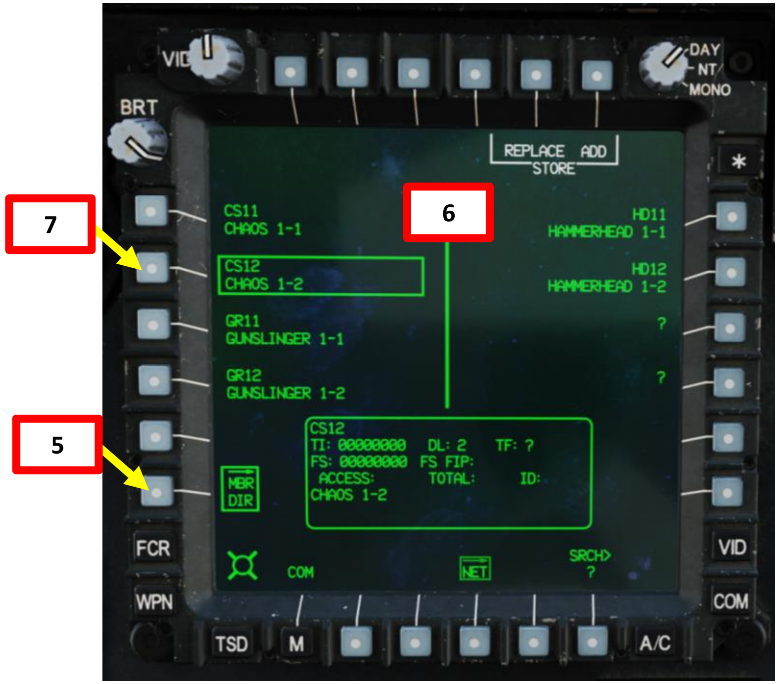
2 – DATALINK NETWORK SETUP VIA COM PAGE
2.3 – How to Add a Member to a Network

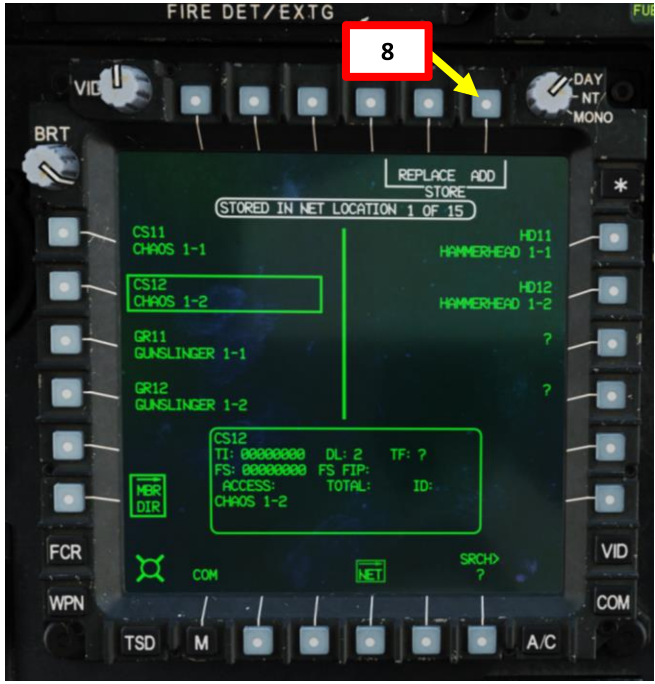
In this example, we will add a new member to Preset Channel L1 (**Callsign Darkhorse, FM1 radio, 41.150 MHz**). This new Primary Member is Chaos 1-2.

1. Select COM page
2. All presets are listed in the MAIN COM page.
3. Select desired Datalink Preset Network. We will select Preset Network L1 (Darkhorse).
4. Select NET
5. Select MBR DIR (Member Directory) Sub-Page.
6. We now have a list of all the potential aircraft we can add to the preset network L1 (Darkhorse).
7. Select the Member slot for Chaos 1-2 (boxed when selected)
8. Select ADD.







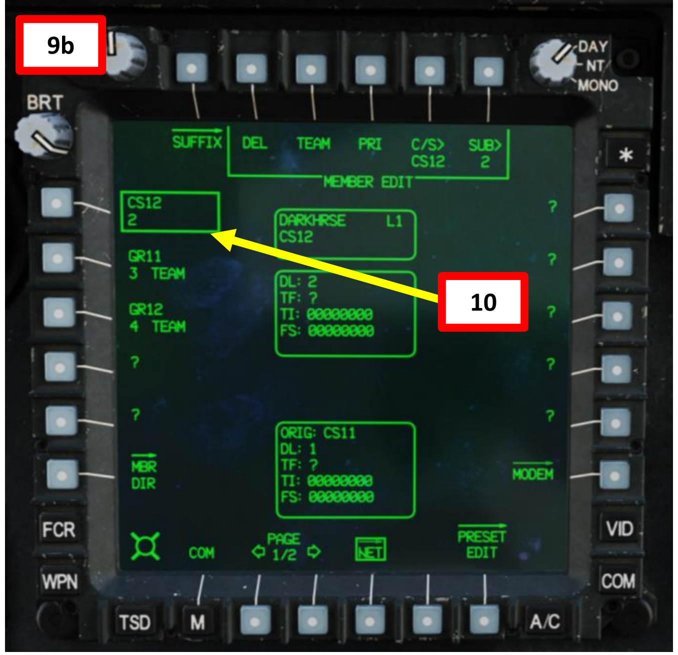


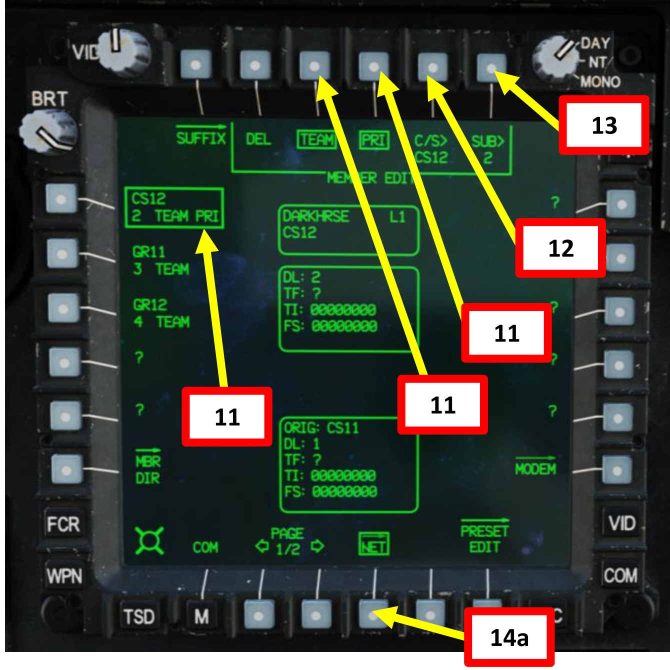
2 – DATALINK NETWORK SETUP VIA COM PAGE

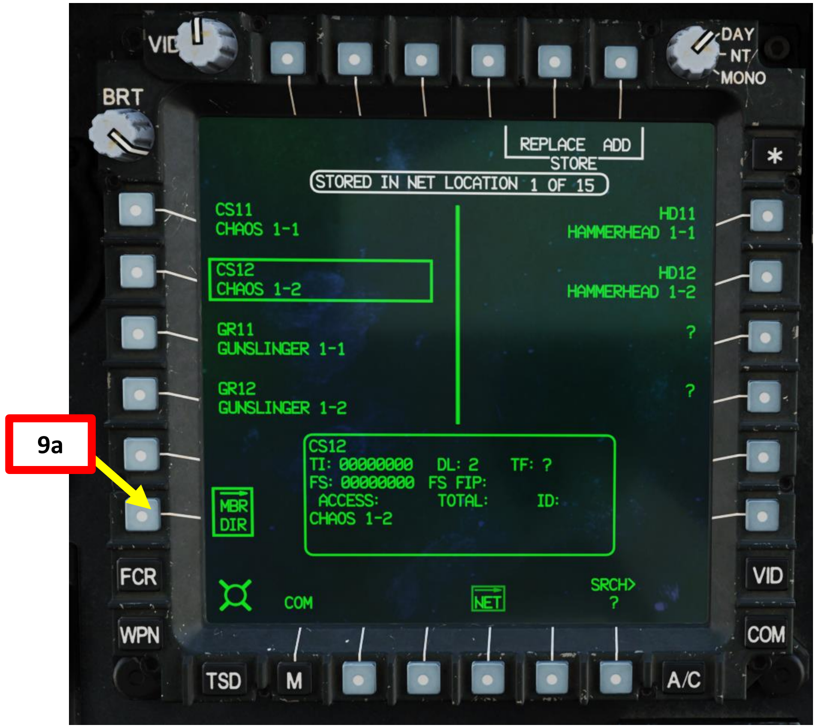
2.3 – How to Add a Member to a Network

In this example, we will add a new member to Preset Channel L1 (**Callsign Darkhorse, FM1 radio, 41.150 MHz**). This new Primary Member is Chaos 1-2.

9. Exit MBR DIR (Member Directory) Sub-Page.
10. You will now see Chaos 1-2 (CS12) in the list of members in the network.
11. Assign a TEAM and/or PRIMARY role to the member by using the TEAM and PRI buttons.
12. If desired, you can edit the member's callsign by selecting C/S (Callsign), typing on the KU (Keyboard Unit) the desired callsign, then pressing ENTER.
13. If desired, you can edit the member's subscriber ID by selecting SUB (Subscriber), typing on the KU (Keyboard Unit) the desired subscriber ID number, then pressing ENTER.
14. Exit NET Sub-Page.
15. And that's it! Chaos 1-2 is now part of preset network L1 (Darkhorse).



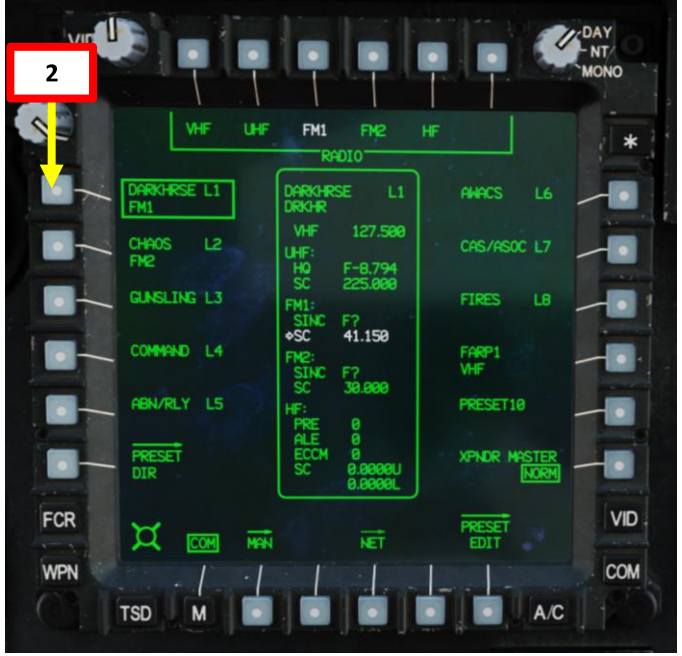


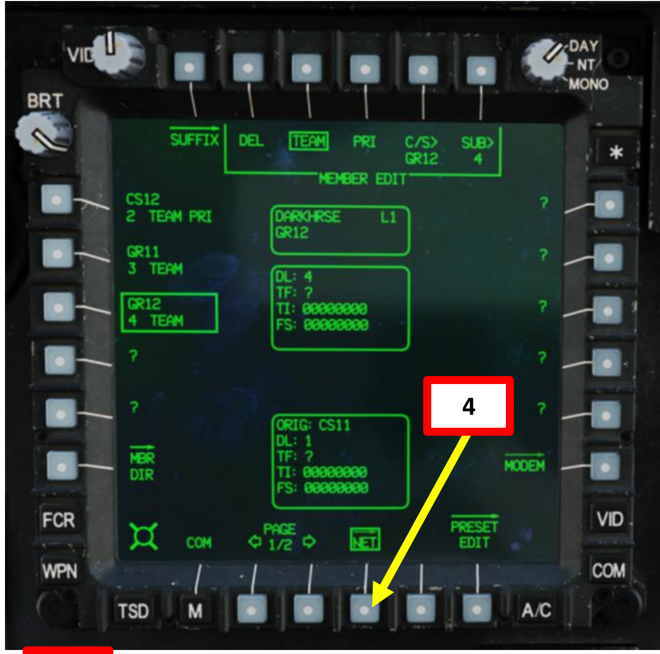


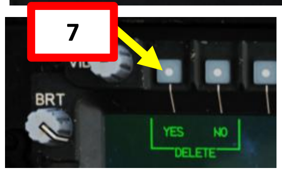
2 – DATALINK NETWORK SETUP VIA COM PAGE
2.4 – How to Remove a Member from a Network

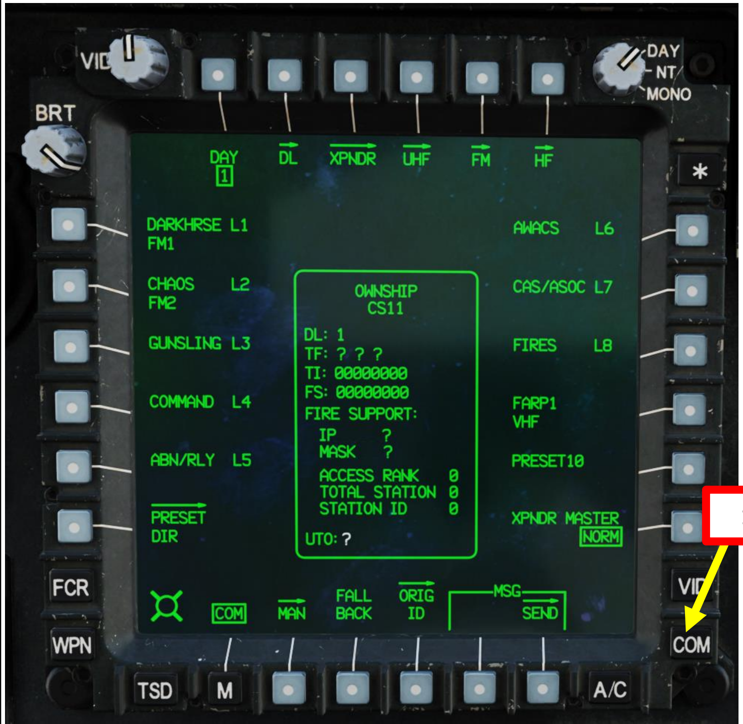
In this example, we will remove a member from Preset Channel L1 (**Callsign Darkhorse, FM1 radio, 41.150 MHz**). This soon-to-be-removed Primary Member is Gunslinger 1-2 (GR12).

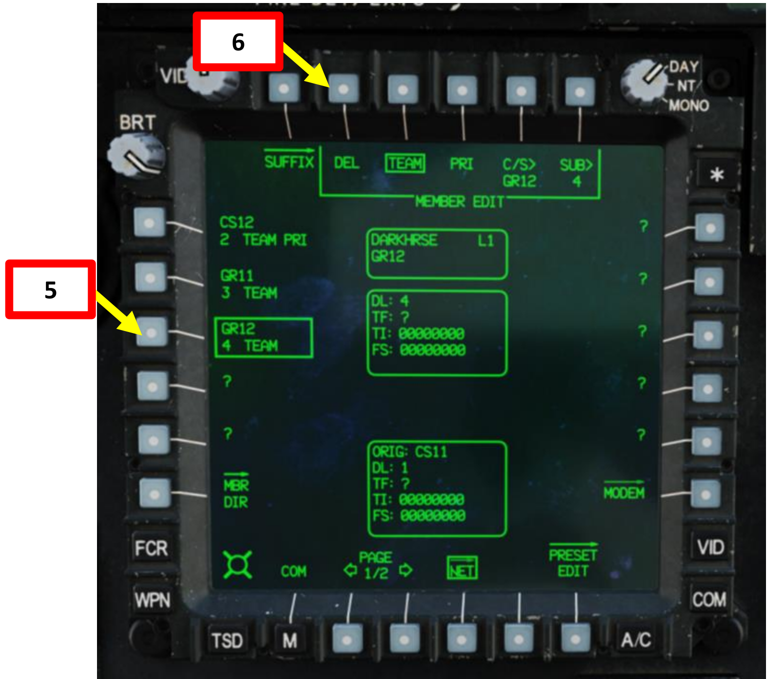
1. Select COM page
2. All presets are listed in the MAIN COM page.
3. Select desired Datalink Preset Network. We will select Preset Network L1 (Darkhorse).
4. Select NET
5. Select the Member slot for Gunslinger 1-2 (boxed when selected)
6. Select DEL (Delete).
7. Select YES.
8. Gunslinger 1-2 is now removed from preset network L1 (Darkhorse).

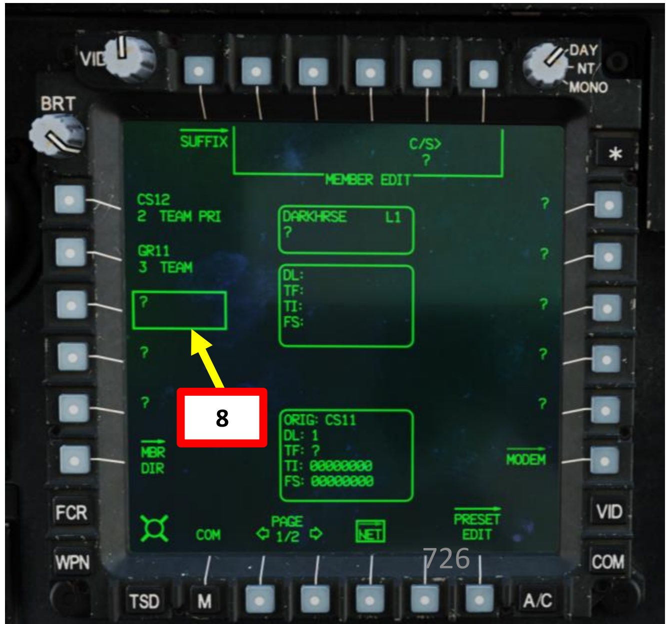












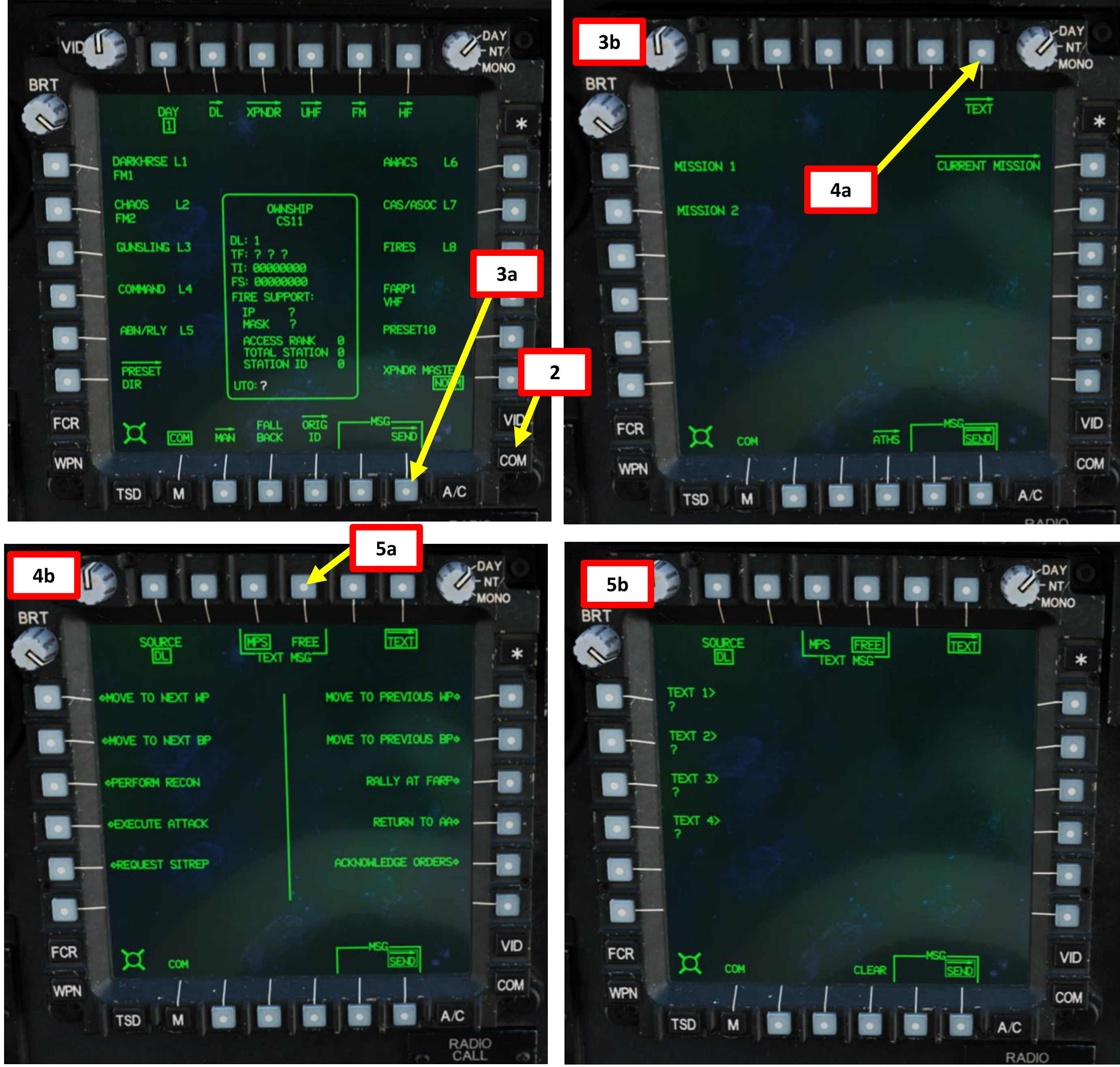
3 – DATALINK FUNCTIONS

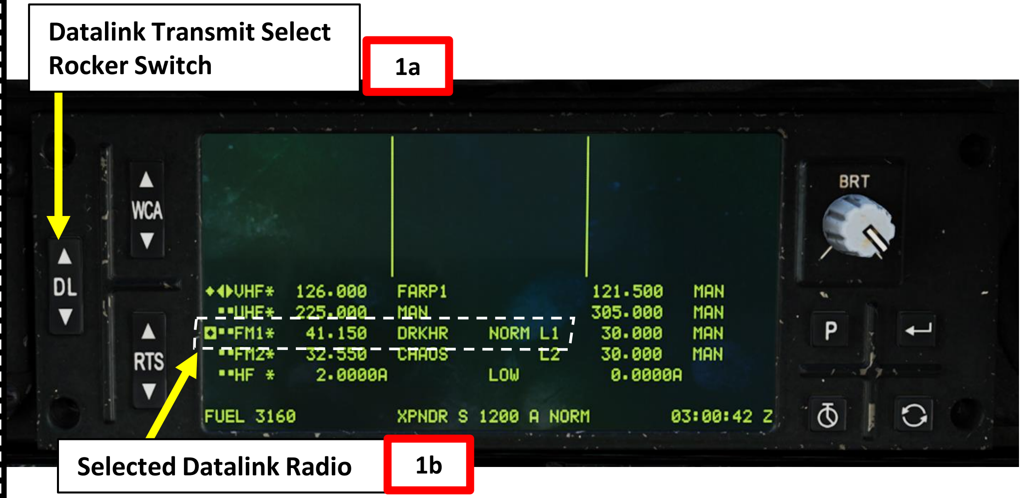
3.1 – Sending/Receiving Messages

3.1.1 – Free Text

To send a free text message to a wingman:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select COM page
3. Select SEND MSG (Send Message)
4. Select TEXT
5. Select FREE

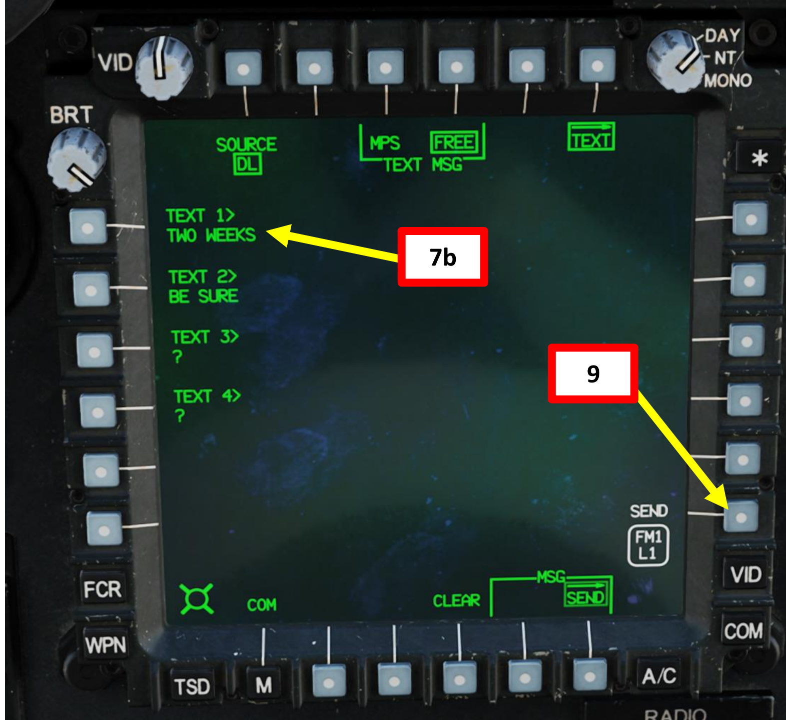


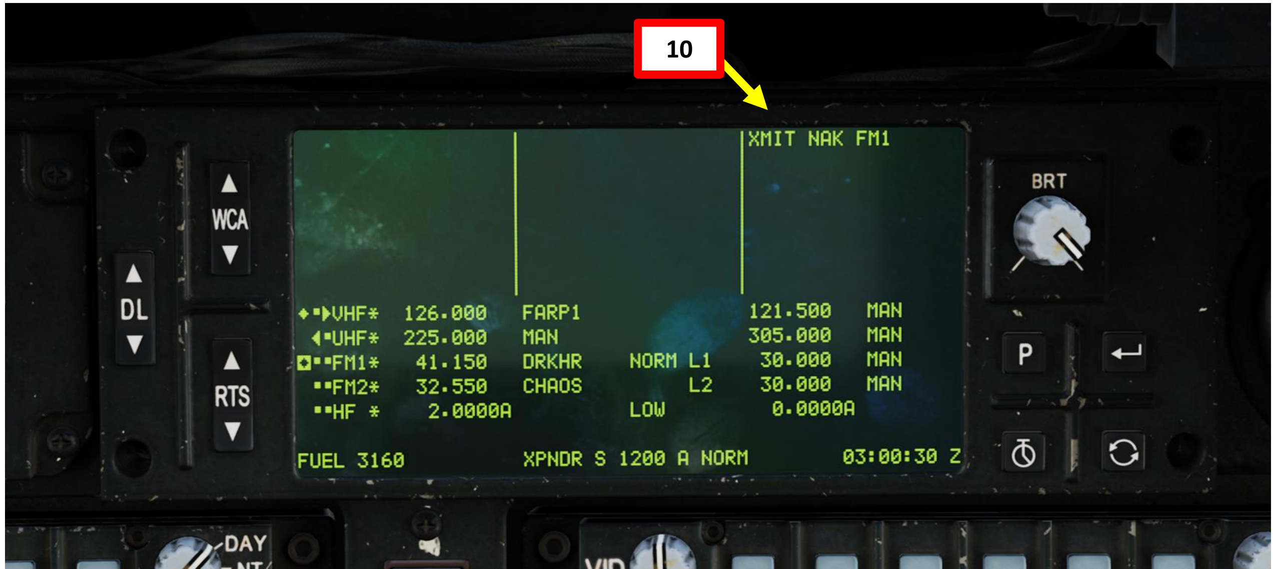


3 – DATALINK FUNCTIONS
3.1 – Sending/Receiving Messages
3.1.1 – Free Text

To send a free text message to a wingman:

6. Select Text Line 1
7. On the KU (Keyboard Unit), type desired message, then press ENTER.
8. Repeat previous steps for other text lines if needed.
9. Press SEND to transmit on the datalink network L1.
10. If an acknowledgement is not received from all intended recipients following the number of selected retries, a "XMIT NAK" (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.





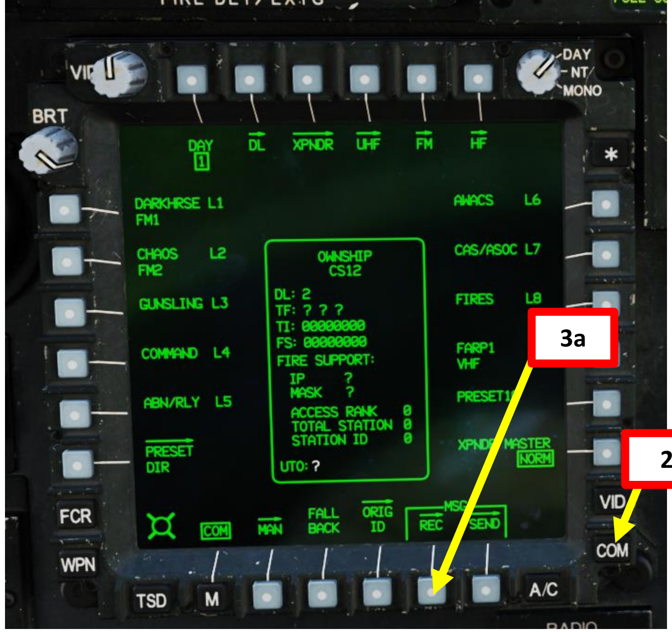
3 – DATALINK FUNCTIONS

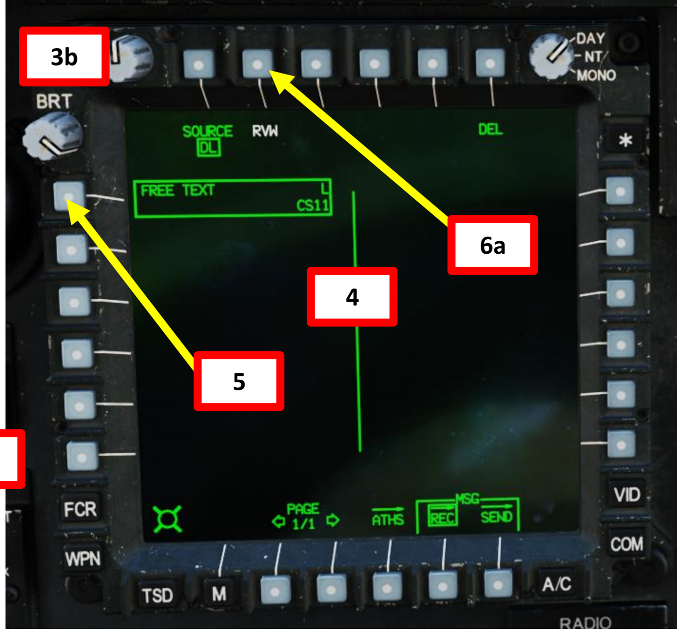
3.1 – Sending/Receiving Messages

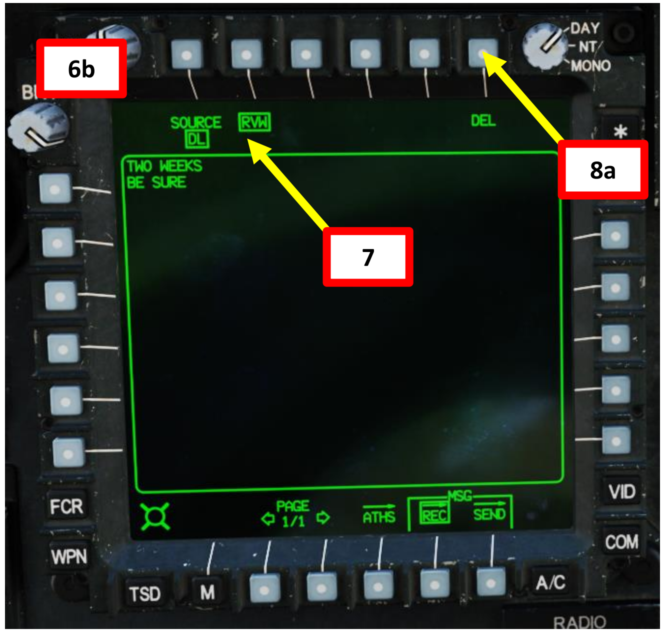
3.1.1 – Free Text

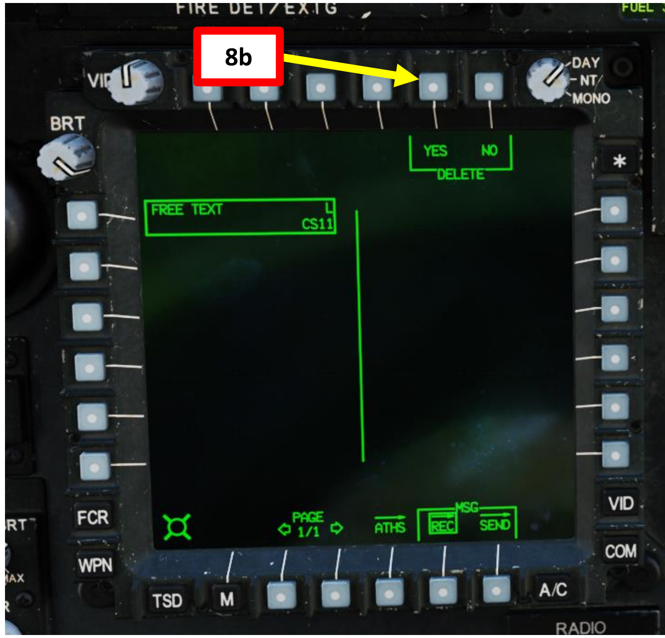
When receiving a free text message from a wingman:

1. When a text message or mission file has been received through the datalink, the EUFD will display a "DL MESSAGE" advisory, prompting the aircrew to access the MSG REC sub-page to review (or store) the received datalink message.
2. Select COM page
3. Select REC MSG (Receive Message)
4. All received messages will be visible.
5. Select message by pressing the relevant VAB (Variable Action Button)
6. Select RVM (Review Message). This will display the Review format when a text message is selected from the message list. The RVM option will be displayed in white if the selected text message has not been reviewed by either crewmember.
7. Once the text message has been reviewed, the option will be displayed in green.
8. If you want to delete the message, press DEL (Delete), then select YES.









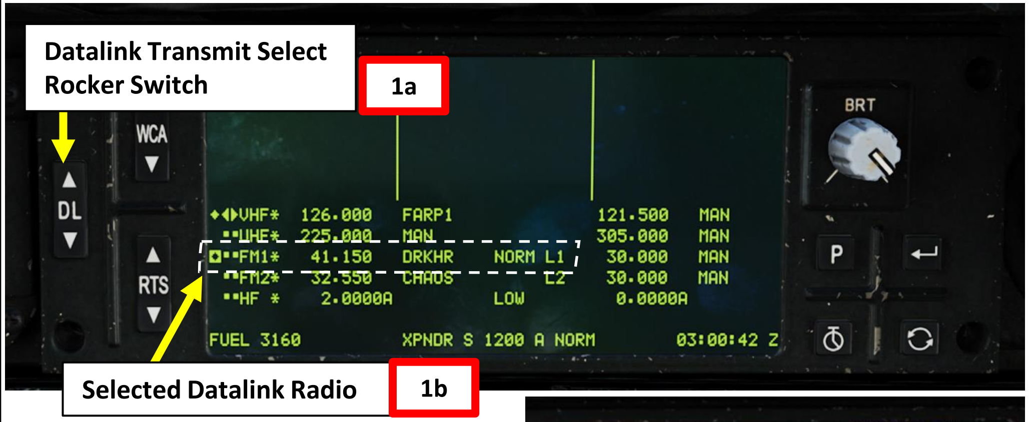
3 – DATALINK FUNCTIONS

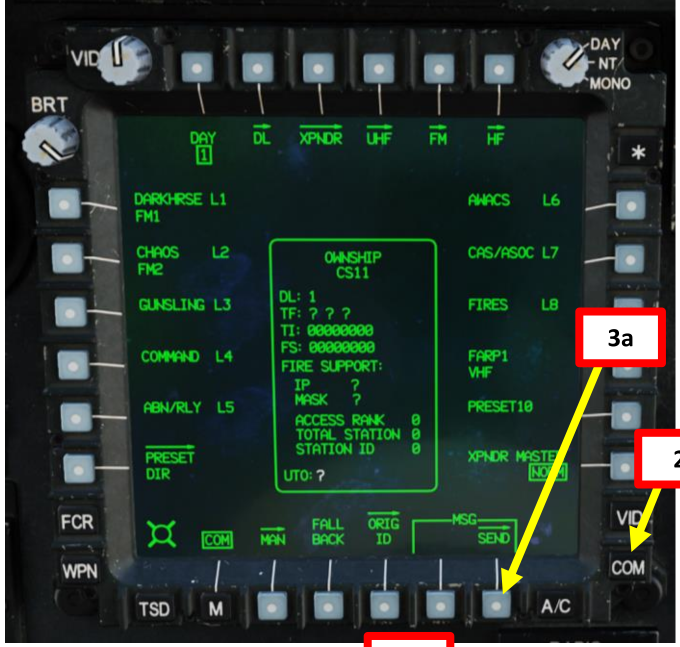
3.1 – Sending/Receiving Messages

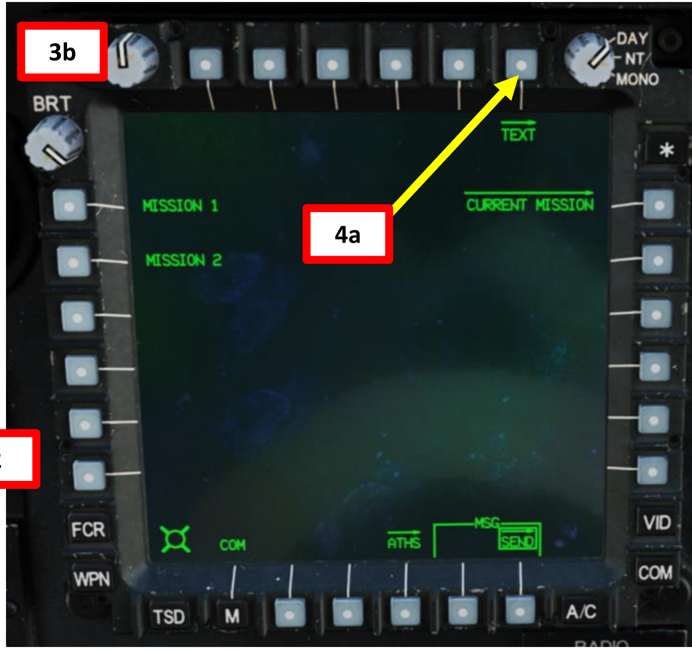
3.1.2 – MPS (Mission Planning System) Text

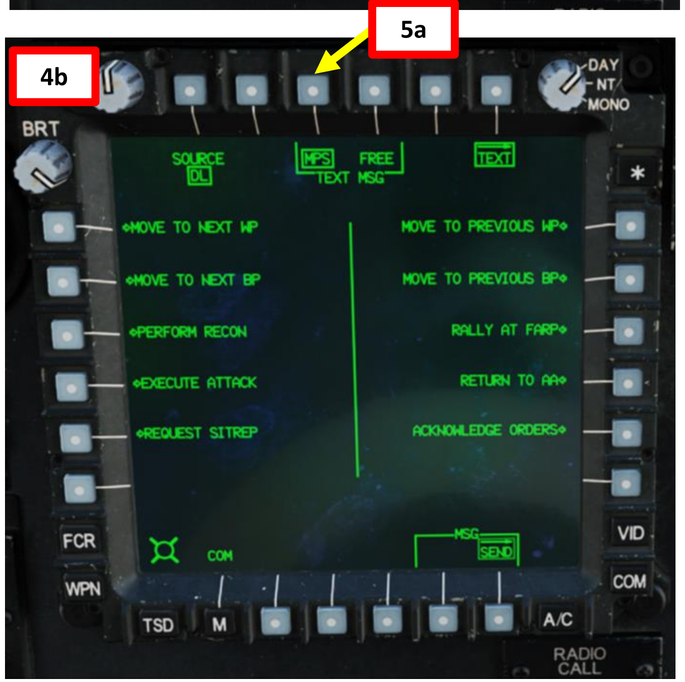
To send a MPS text message to a wingman:

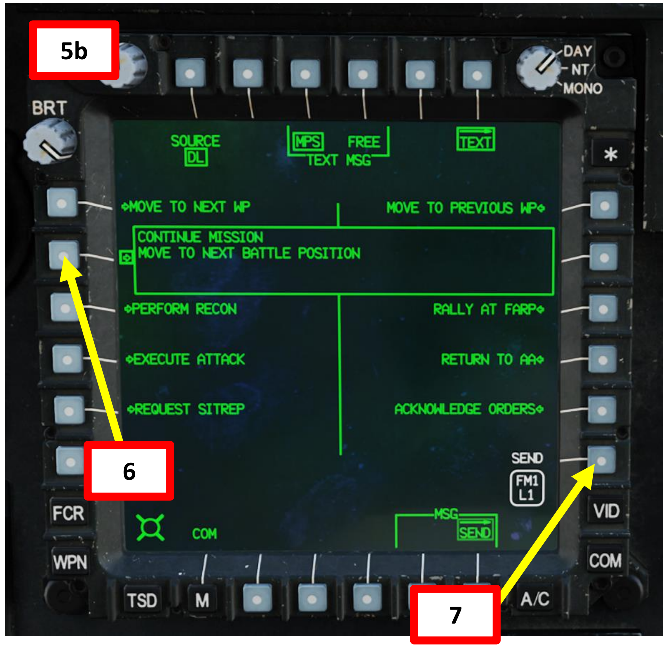
1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select COM page
3. Select SEND MSG (Send Message)
4. Select TEXT
5. Select MPS. This displays a few preset instructions for you to choose from.
6. Select desired preset message/instruction. We will select MOVE TO THE NEXT BP in order to request the wingman to move to the next battle position.
7. Press SEND to transmit on the datalink network L1.
8. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.











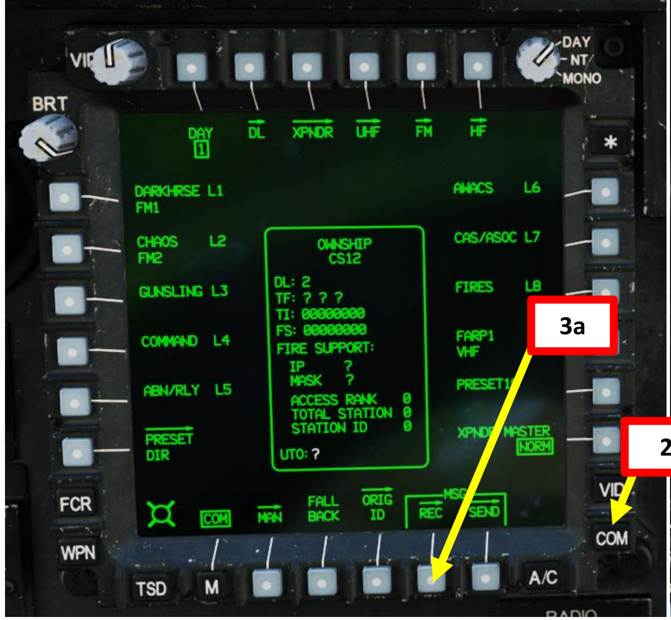
3 – DATALINK FUNCTIONS

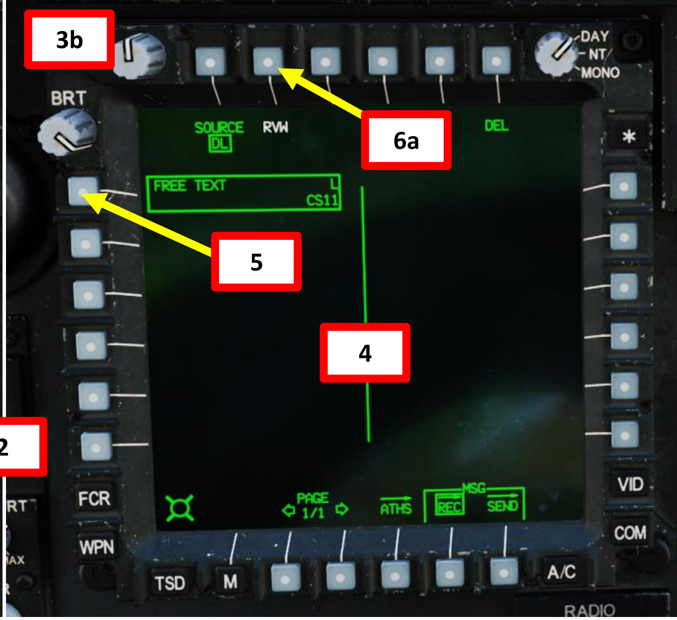
3.1 – Sending/Receiving Messages

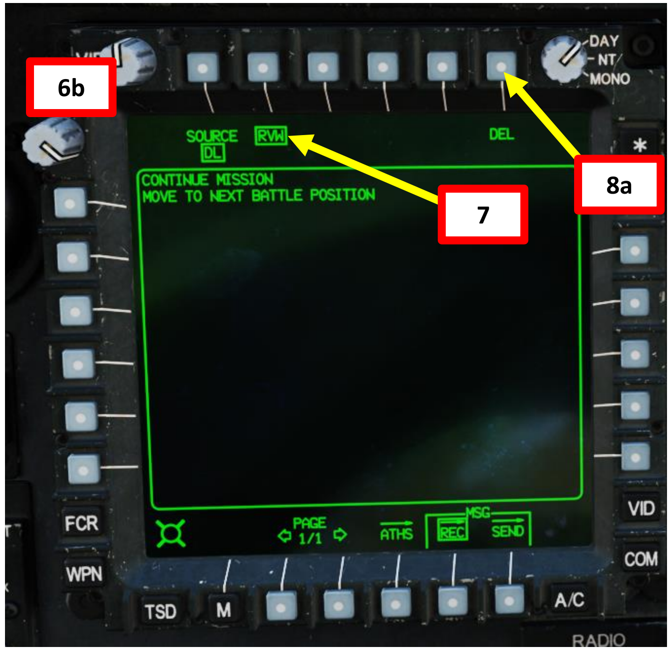
3.1.2 – MPS (Mission Planning System) Text

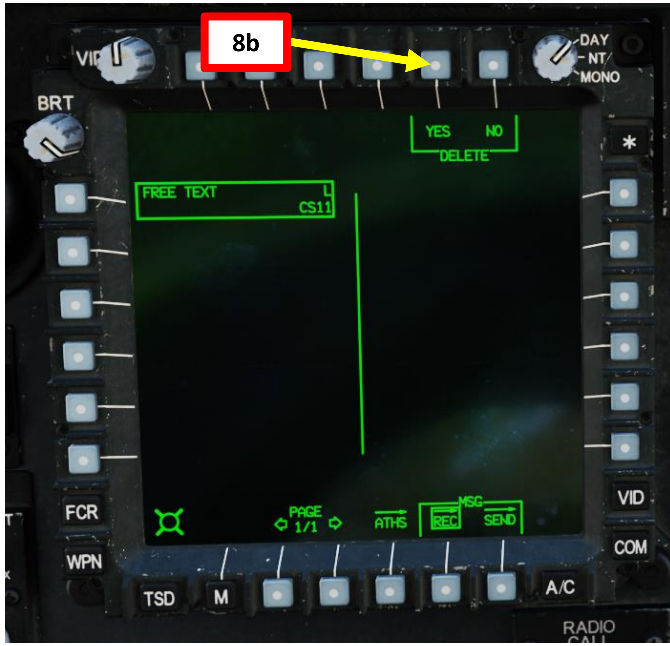
When receiving a MPS text message from a wingman:

1. When a text message or mission file has been received through the datalink, the EUFD will display a "DL MESSAGE" advisory, prompting the aircrew to access the MSG REC sub-page to review (or store) the received datalink message.
2. Select COM page
3. Select REC MSG (Receive Message)
4. All received messages will be visible.
5. Select message by pressing the relevant VAB (Variable Action Button)
6. Select RVM (Review Message). This will display the Review format when a text message is selected from the message list. The RVM option will be displayed in white if the selected text message has not been reviewed by either crewmember.
7. Once the text message has been reviewed, the option will be displayed in green.
8. If you want to delete the message, press DEL (Delete), then select YES.









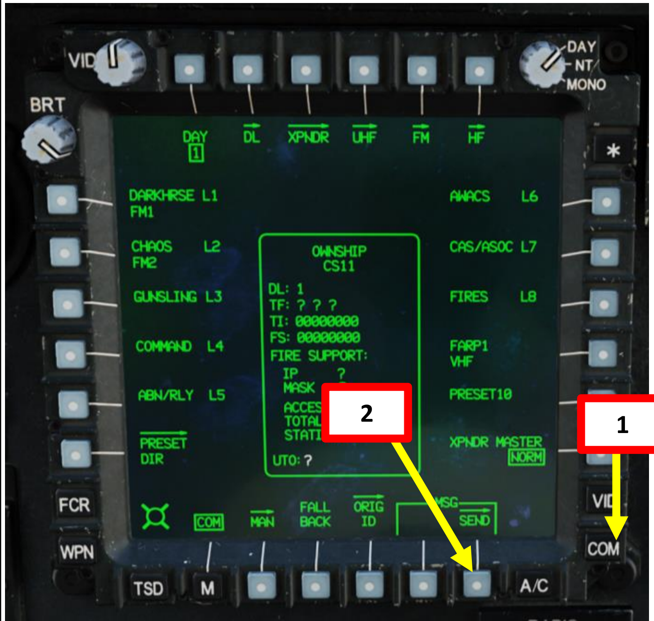
3 – DATALINK FUNCTIONS
3.2 – Sending/Receiving Mission Files

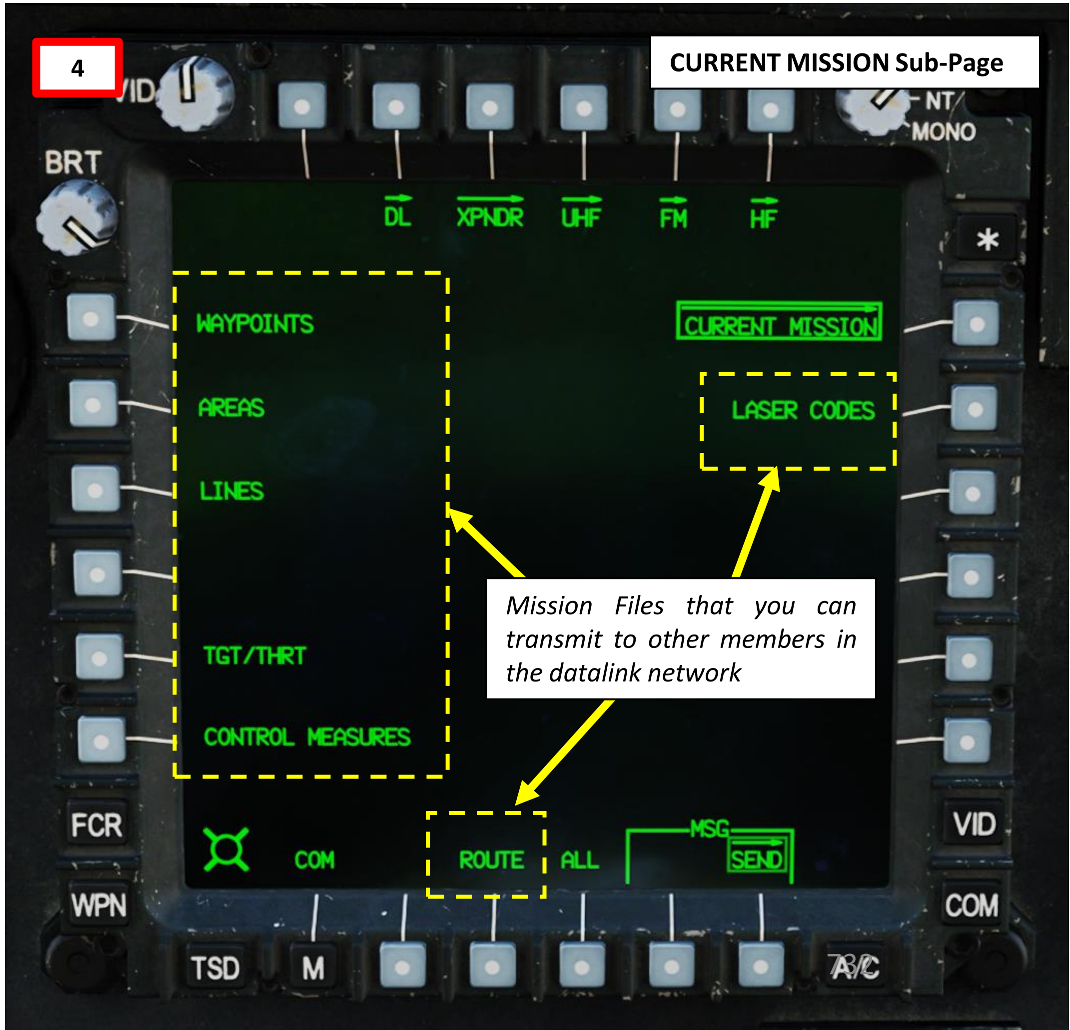
Mission files may be sent from the aircraft database across the datalink network, which will overwrite the corresponding mission file when stored in the receiving aircraft. Each mission file may be individually selected for transmission, or the entire mission database may be selected for transmission.

The CURRENT MISSION sub-page transmits mission files from the aircraft memory across the datalink network. When stored, the mission files onboard the receiving aircraft will be replaced with the received mission file. This allows commanders or team leaders to synchronize information displayed on the TSD of each AH-64D as changes in mission occur in real-time. This may also be used to update the TSD database of subsequent teams entering the battlespace from those already on-station performing reconnaissance or conducting a "battle handover".

Mission files include the following:

- Waypoints/Hazards (W01 to W50)
- Areas (Not Implemented)
- Lines (Not Implemented)
- Target/Threats (TGT/THRT)
- Control Measures (C51 to C99)
- Laser Codes
- Routes

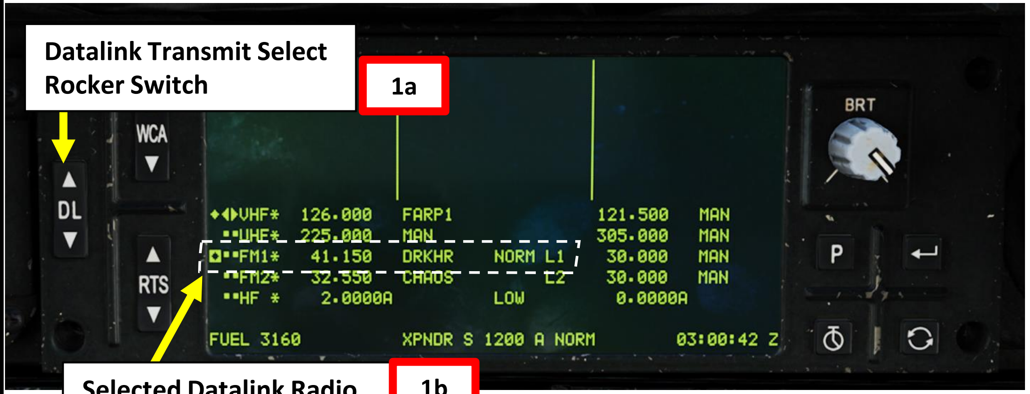


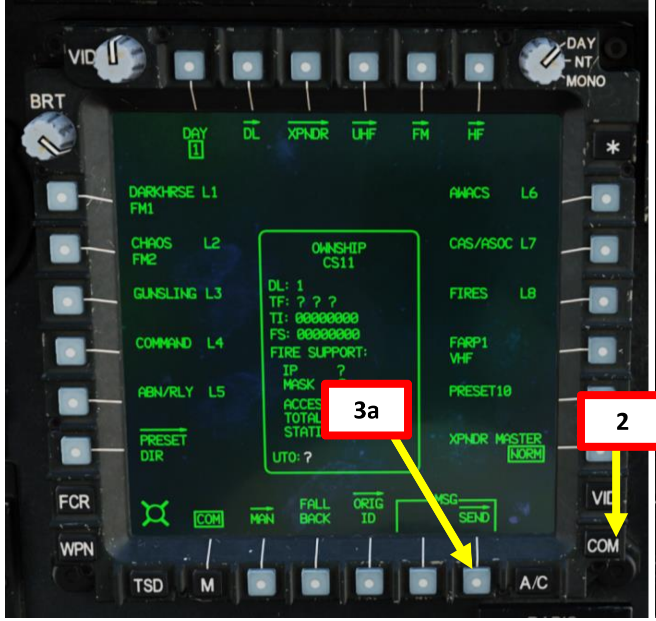


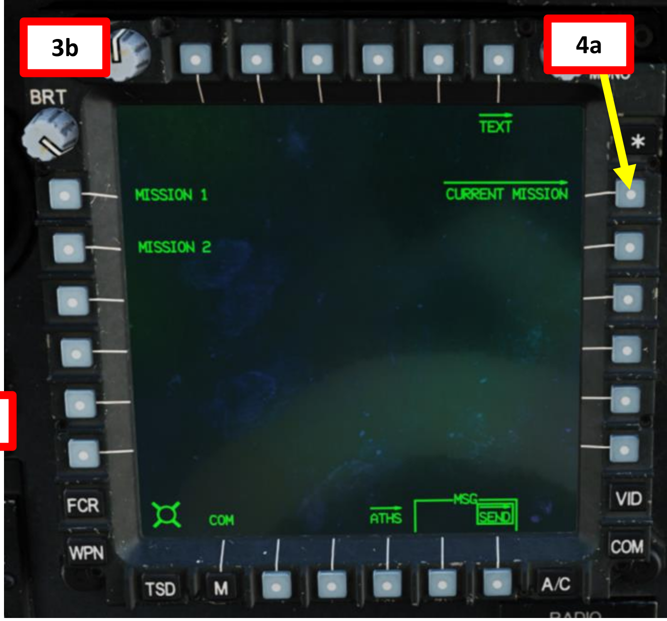
3 – DATALINK FUNCTIONS
3.2 – Sending/Receiving Mission Files

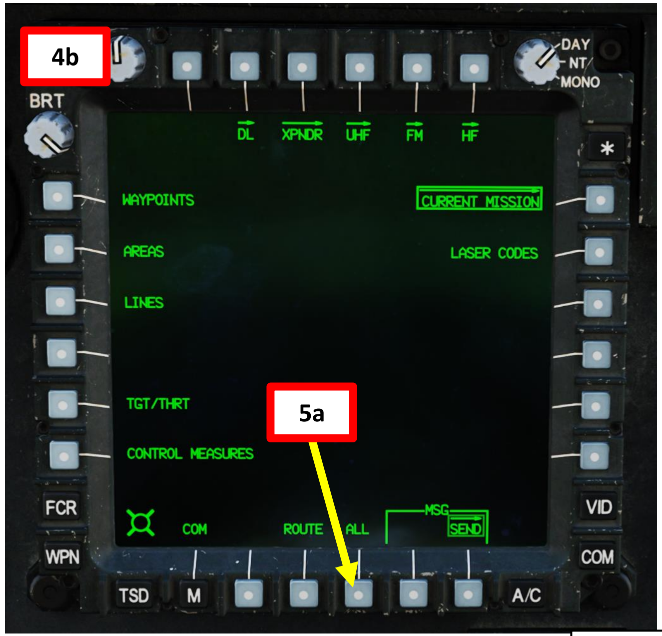
To send a Mission File to a wingman:

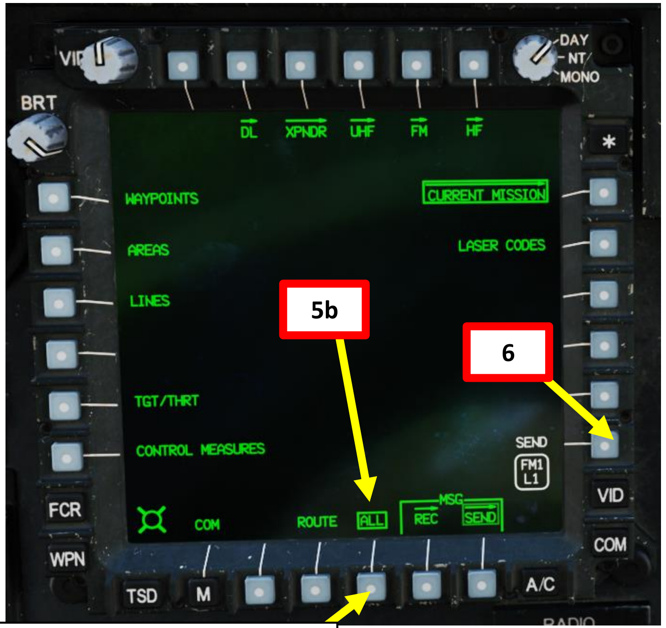
1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select COM page
3. Select SEND MSG (Send Message)
4. Select CURRENT MISSION
5. Select which Mission File type you want to send. In our case, we want to send ALL mission files (waypoints, targets/threats, control measures, laser codes, routes).
6. Press SEND to transmit on the datalink network L1.
7. The selected mission files will be transmitted to **all team members (TEAM and PRIMARY)** on the network.
8. The recipients will be able to either store these mission files (which will override their own in the process) or simply review them.
9. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.









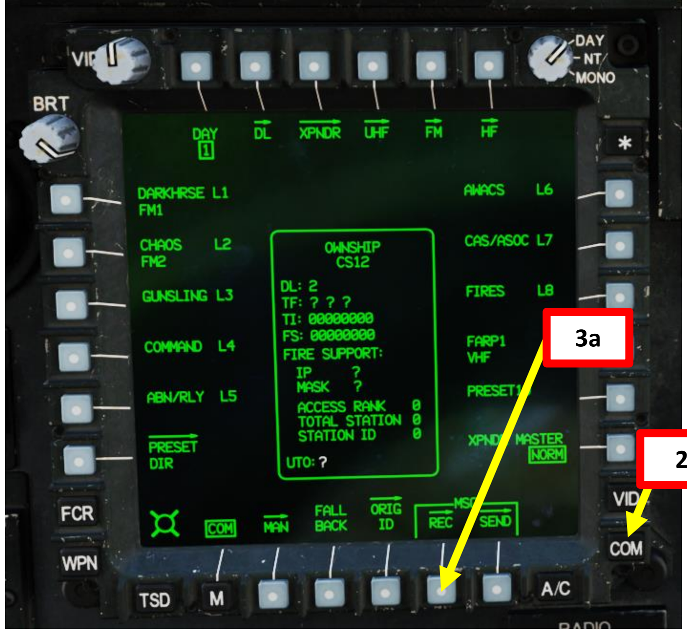


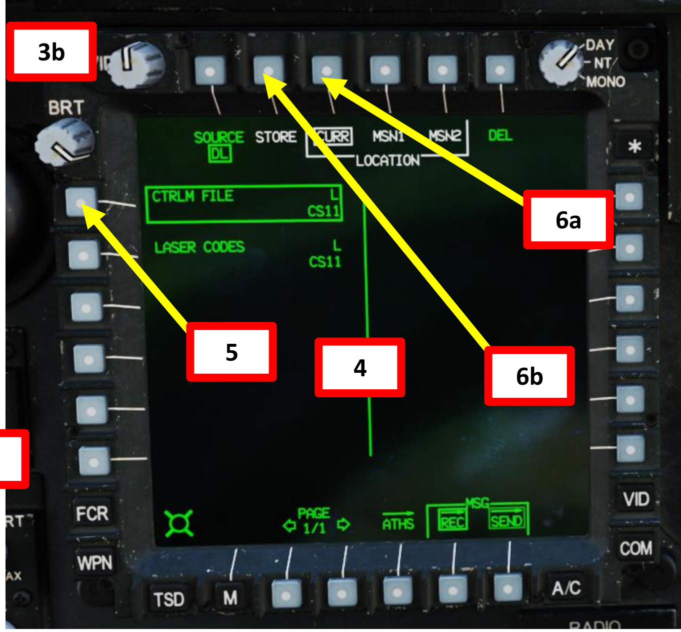
ALL: Use if you want to transmit all Mission Files at once

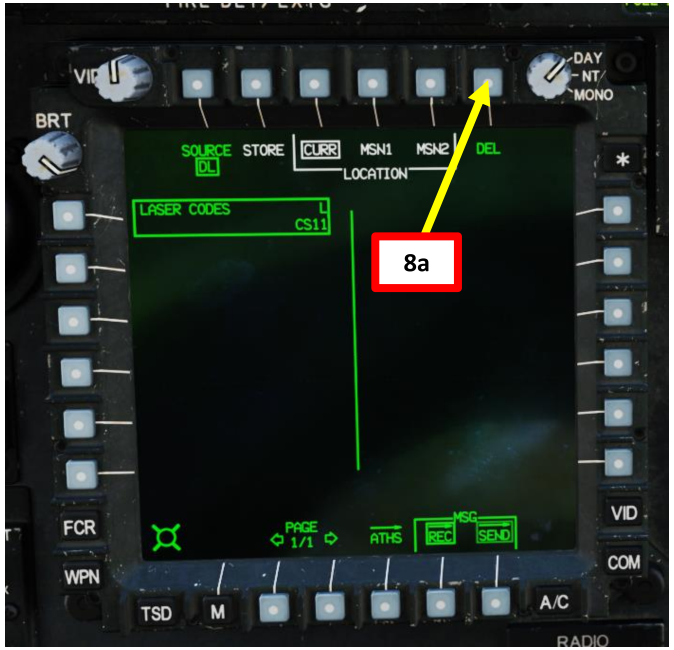
3 – DATALINK FUNCTIONS
3.2 – Sending/Receiving Mission Files

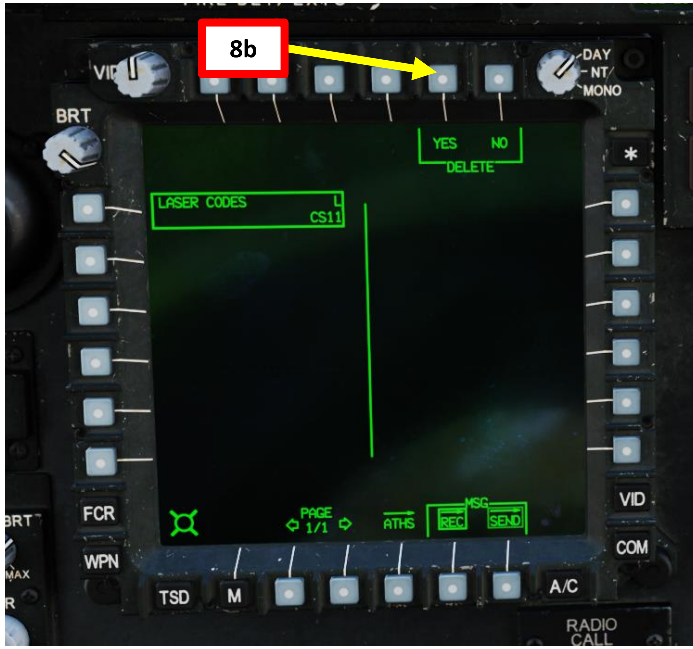
When receiving a Mission File from a wingman:

1. When a mission file has been received through the datalink, the EUFD will display a “DL MESSAGE” advisory, prompting the aircrew to access the MSG REC sub-page to review (or store) the received datalink message.
2. Select COM page
3. Select REC MSG (Receive Message)
4. All received mission files will be visible.
5. Select desired mission file by pressing the relevant VAB (Variable Action Button)
6. If you want to store this mission file and override your own database in the process:
    a) Select CURR (Current Mission)
    b) Select STORE
7. In this example, we received a CTRLM (Control Measures) and laser codes. Storing this data means that **all** our control measures will be replaced by the ones sent by the sender.
    - **Be very careful about storing mission files; accidentally wiping out a carefully crafted flight plan may not be a decision you want to take lightly.**
8. If you want to discard this data, press DEL (Delete), then select YES.





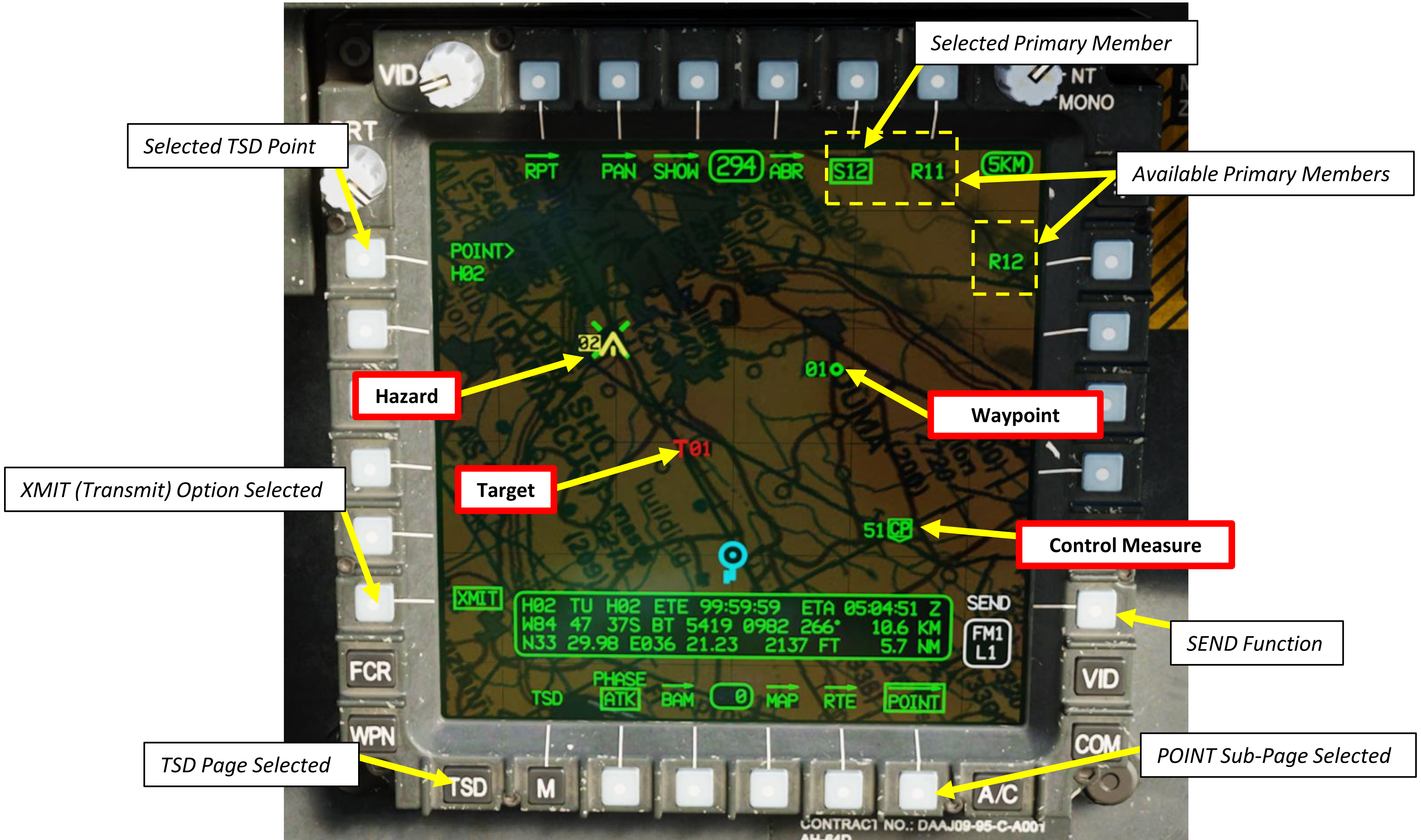




3 – DATALINK FUNCTIONS
3.3 – Sending/Receiving Individual TSD (Tactical Situation Display) Points

Any point (Waypoint, Hazard, Control Measure, or Target/Threat) residing within the TSD (Tactical Situation Display) database may be transmitted across the datalink network. However, unlike mission files which are transmitted to all Team members within the datalink network, TSD points may **only be transmitted to selected Primary members**. This facilitates target handovers between individual aircraft by sending Target points, it allows team leaders to develop hasty control measures during the mission, and permits a more limited transfer of TSD points to specific aircraft in lieu of sending an entire file to all Team members.

By default, no Primary members are selected to receive a point transmission; each Primary member must be selected as a method of confirming which subscribers should receive the selected point.



3 – DATALINK FUNCTIONS

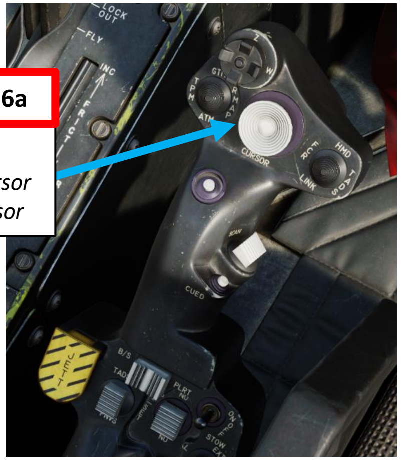
3.3 – Sending/Receiving Individual TSD (Tactical Situation Display) Points

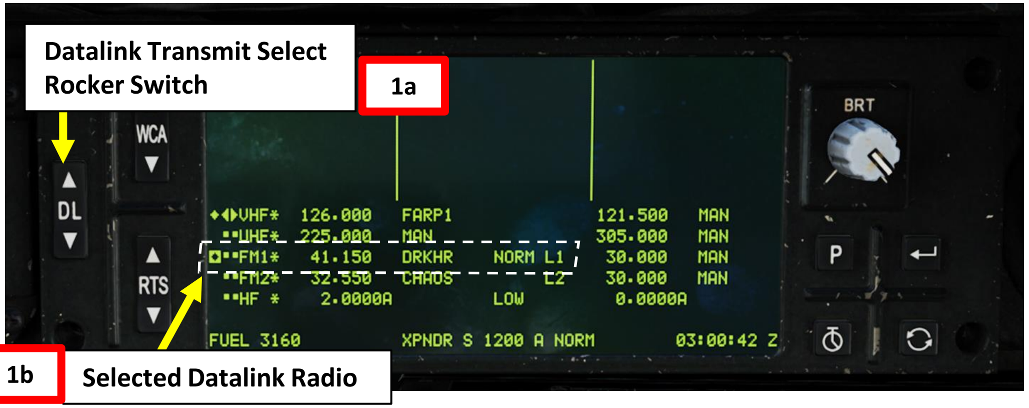
To send a Point to a wingman:

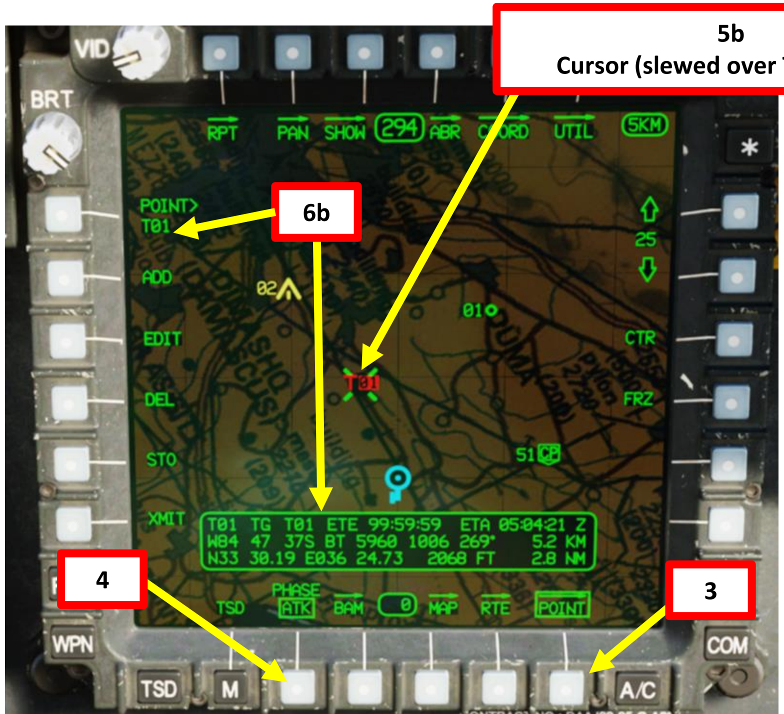
1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select TSD (Tactical Situation Display) page
3. Select POINT sub-page
4. If selecting a Target Point, select ATK (Attack) Phase. If selecting any other point type, you can remain on NAV (Navigation) Phase. Since we want to select Target T01, we will use ATK.
5. Move Cursor over desired symbol on the TSD
6. Press “Cursor Enter” to select desired symbol and display the Review Status Window.
7. Select XMIT (Transmit)

Cursor Control/Enter Hat Switch

- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*







3 – DATALINK FUNCTIONS
3.3 – Sending/Receiving Individual TSD (Tactical Situation Display) Points

To send a Point to a wingman:

8. Select which primary members you want to transmit the point to (boxed when selected). We will choose Chaos 1-2 (S12) and Gunslinger 1-1 (R11).
    - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, “CS12” (Chaos 1-2) would displayed as “S12” within the Primary member list on the TSD page. “GR11” (Gunslinger 1-1) would be displayed as “R11”.
9. Press SEND to transmit point data on the datalink network L1 to Chaos 1-2 and Gunslinger 1-1.
10. The recipients will be able to store this point if desired or discard it.
11. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.

COM Page
NET Sub-Page

3 – DATALINK FUNCTIONS

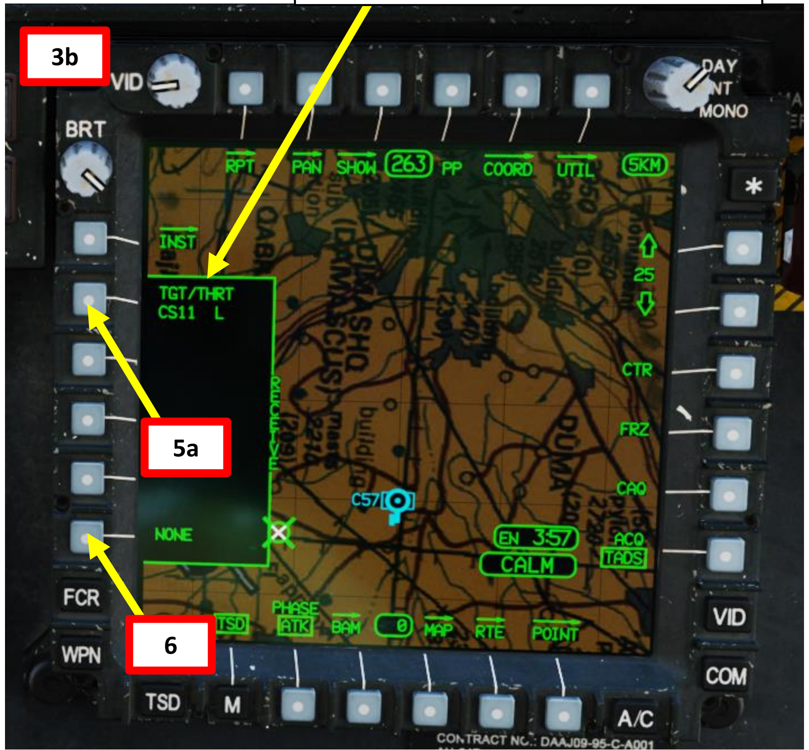
3.3 – Sending/Receiving Individual TSD (Tactical Situation Display) Points

When receiving a Point from a wingman:

1. When a TSD point has been received through the datalink, the EUFD will display a TGT/THRT (Target/Threat), CTRLM (Control Measure) or WPT/HZD (Waypoint/Hazard) advisory based on what point type is received.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent points received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the data type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this point in your own database, select desired received point by pressing the relevant VAB (Variable Action Button). The point data will then be stored in your database.
6. If you do not want to store the point, select NONE.

4

Target/Threat (TGT/THRT) from Chaos 1-1 (CS11) on Network L1

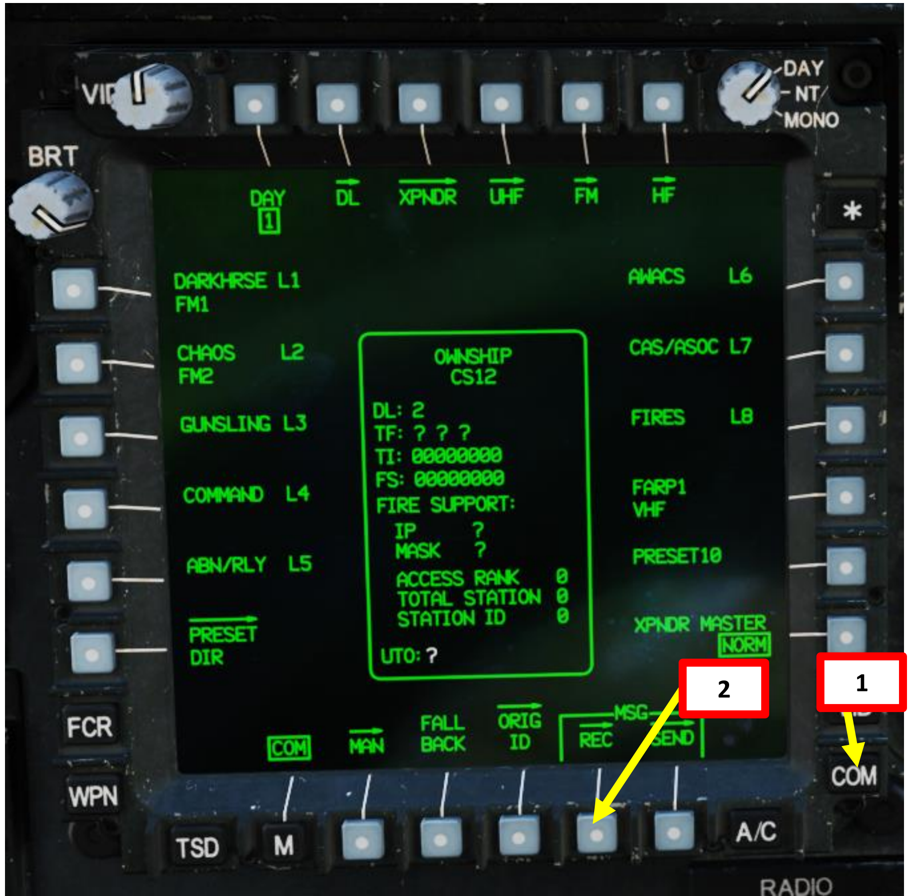


3 – DATALINK FUNCTIONS
3.3 – Sending/Receiving Individual TSD (Tactical Situation Display) Points

When receiving a Point from a wingman:

Alternatively, you can also store the TGT/THRT point by performing the following steps:

1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired TGT/THRT file by pressing the relevant VAB (Variable Action Button)
4. Select CURR (Current Mission)
5. Select STORE

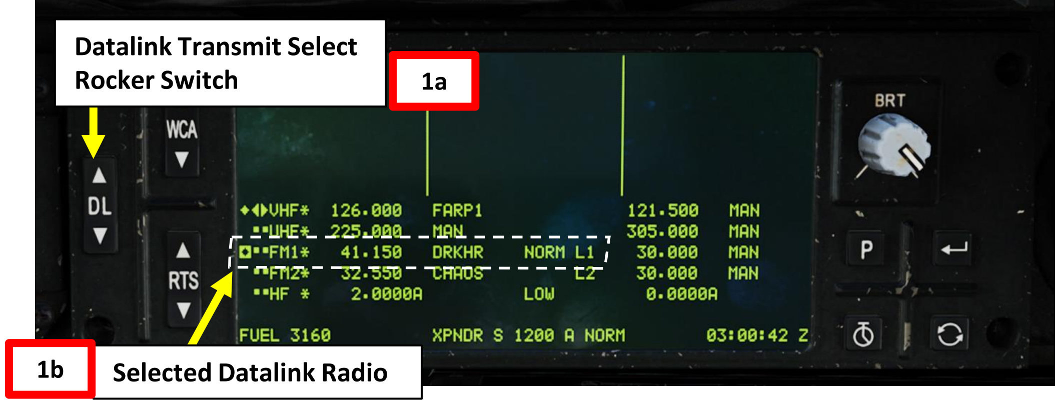


3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

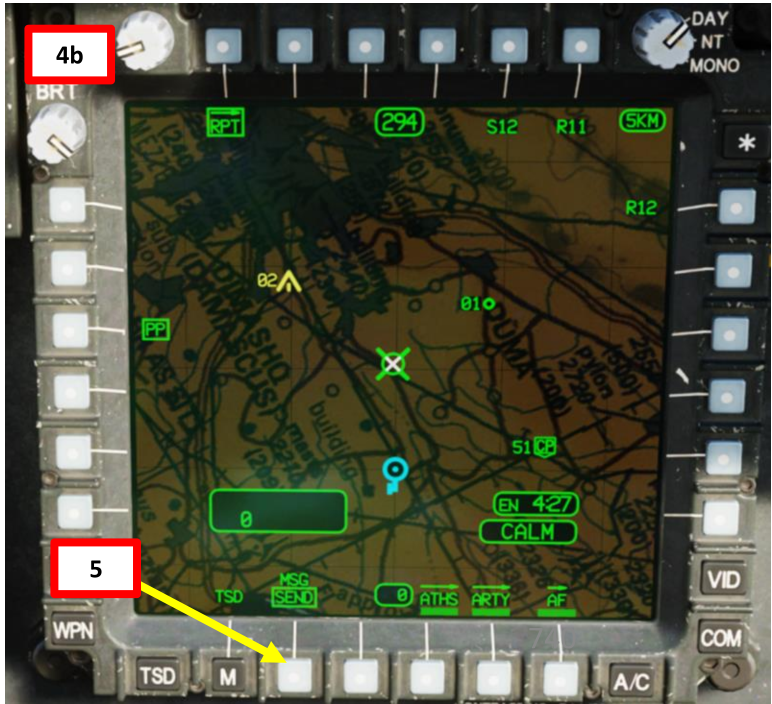
3.4.1 – Present Position (PP) Reports

It is possible to send or request Present Position (PP) Tactical Reports. PP reports transmit the ownship's present position to other AH-64D's, which will be displayed as Datalink Subscriber control measure symbols on the TSD within the receiving aircraft. Each unique present position report is stored as C93 through C99 within the TSD database, allowing a maximum of 7 present position points to be displayed at any given time. Present Position reports are only transmitted on demand. These points are static in nature and are not automatically updated as each AH-64D within the datalink network moves across the battlefield.



To send a PP Tactical Report to a wingman:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select TSD (Tactical Situation Display) page
3. Select RPT (Reports) sub-page
4. Select PP (Present Position) Report Type.
5. Select SEND MSG (Send Message).



3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.1 – Present Position (PP) Reports

To send a PP Tactical Report to a wingman:

6. Select which primary members you want to transmit the tactical report to (boxed when selected). We will choose Chaos 1-2 (S12).
   - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, “CS12” (Chaos 1-2) would displayed as “S12” within the Primary member list on the TSD page. “GR11” (Gunslinger 1-1) would be displayed as “R11”.
7. Press SEND to transmit tactical report on the datalink network L1 to Chaos 1-2.
8. The recipients will be able to store this report if desired or discard it.
9. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.

To request a PP Tactical Report from a wingman:

10. The procedure is pretty much the same as the previous steps, but instead of selecting SEND MSG, you must select RQST MSG (Request Message) and press SEND.
11. Your wingman will automatically send the requested report provided the AUTO REPLY function is selected on the RPT (Reports) sub-page.

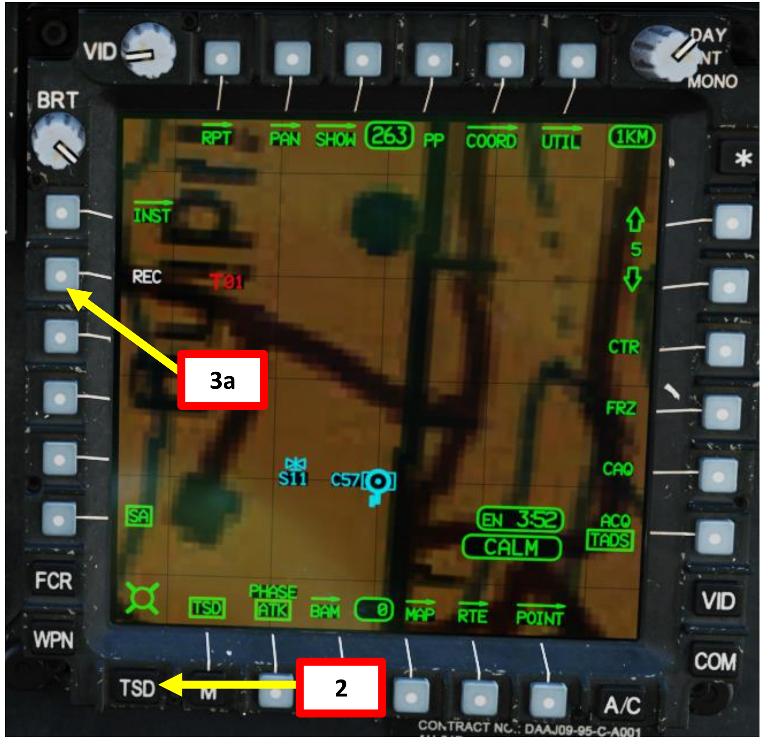
3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

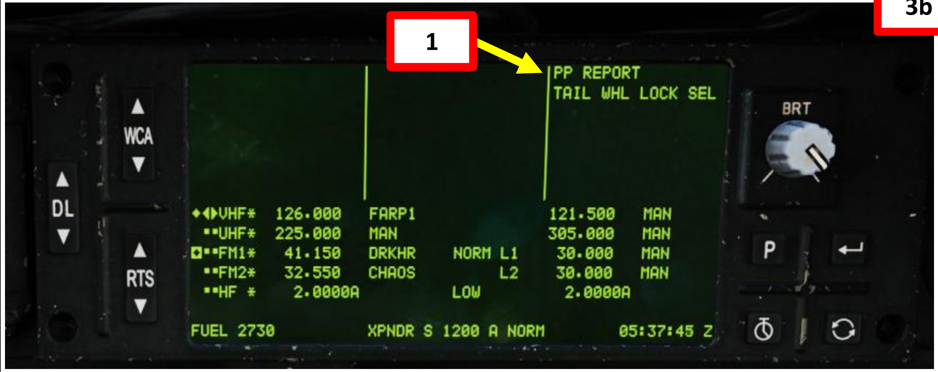
3.4.1 – Present Position (PP) Reports

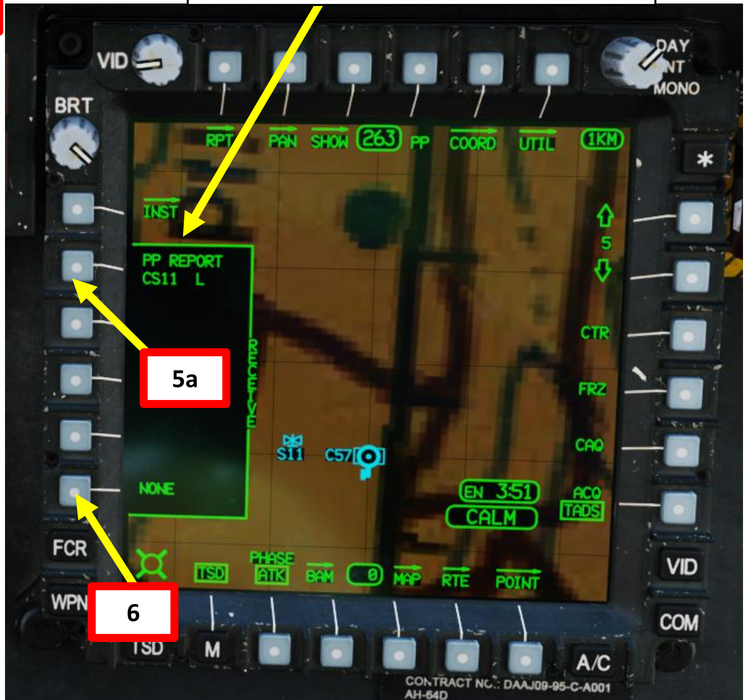
When receiving a PP Report from a wingman:

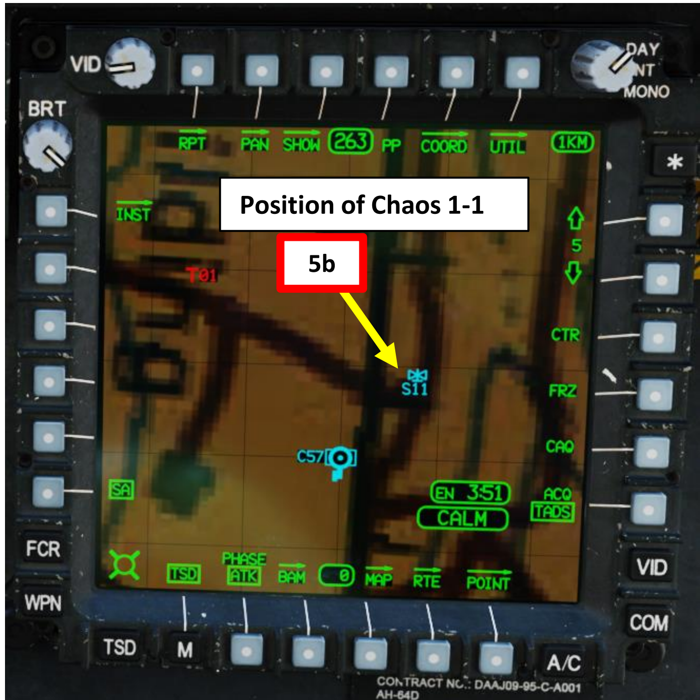
1. When a PP report has been received through the datalink, the EUFD will display a PP REPORT advisory.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent reports received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the report type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this report in your own database, select desired received report by pressing the relevant VAB (Variable Action Button). The report data will then be stored in your database. Take note that the present position you will have is static and will not move; this is merely the position of the sender at the time of transmission.
6. If you do not want to store the report, select NONE.



4
Present Position Report (PP) from Chaos 1-1 (CS11) on Network L1





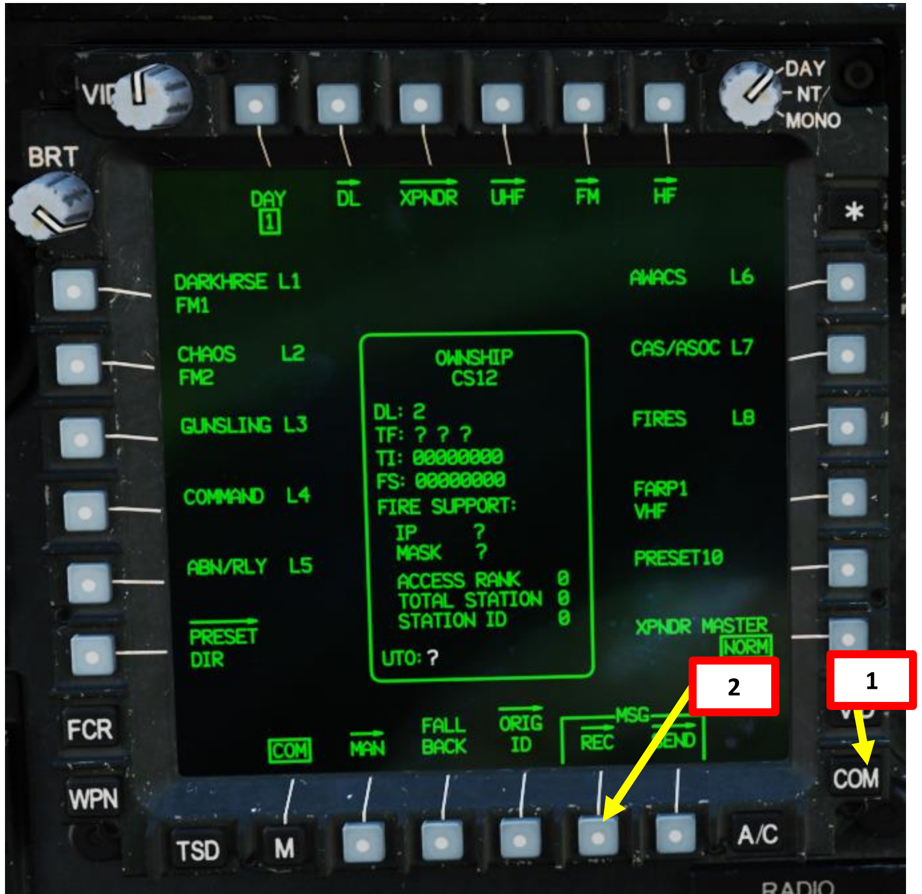


3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.1 – Present Position (PP) Reports

When receiving a PP Report from a wingman:

Alternatively, you can also store the Present Position report by performing the following steps:

1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired present position file by pressing the relevant VAB (Variable Action Button)
4. Select STORE

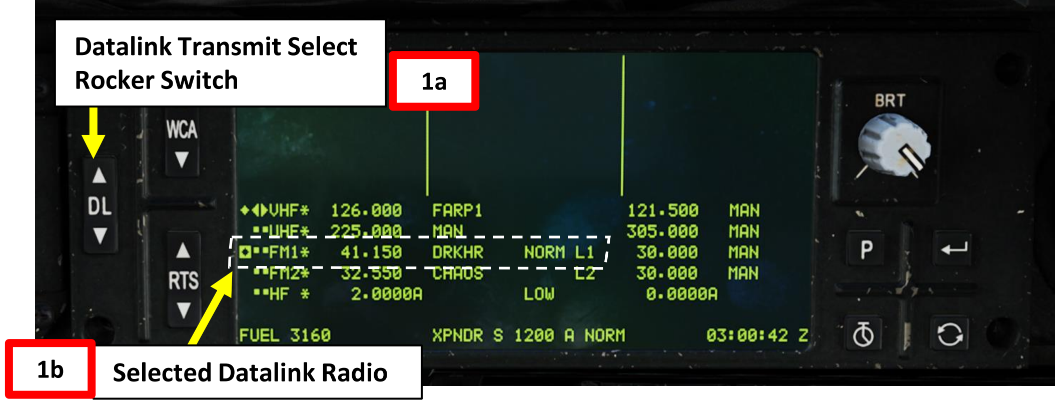


3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

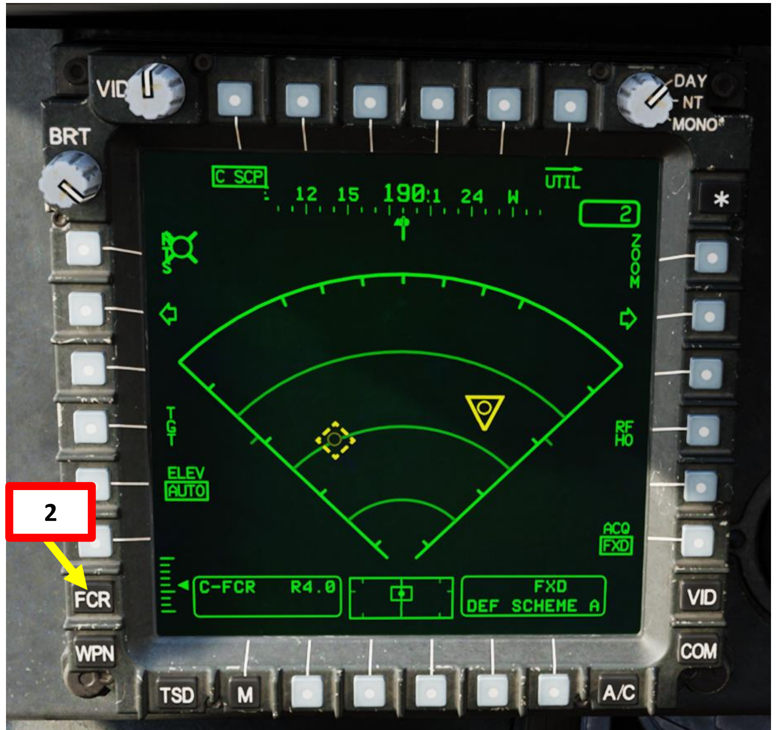
3.4.2 – Target (TGT) Reports

It is possible to send or request Target (TGT) Tactical Reports. TGT reports distribute FCR (Fire Control Radar) target data to other AH-64D's. TGT reports may contain individually-selected FCR targets, high-priority FCR targets, or all FCR targets which includes high-priority and low-priority targets.



To send a TGT Tactical Report to a wingman:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Make sure you have stored targets by performing a scan with the FCR (Fire Control Radar),
3. Select TSD (Tactical Situation Display) page
4. Select RPT (Reports) sub-page



3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

3.4.2 – Target (TGT) Reports

To send a TGT Tactical Report to a wingman:

5. Select TGT (Target) Report Type.
6. Select ALL (All FCR Targets, which includes the 16 high-priority targets and all low-priority targets) or PRI (16 High-Priority FCR Targets) – As desired.
7. Select which primary members you want to transmit the tactical report to (boxed when selected). We will choose Chaos 1-2 (S12).
   - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, “CS12” (Chaos 1-2) would displayed as “S12” within the Primary member list on the TSD page. “GR11” (Gunslinger 1-1) would be displayed as “R11”.
8. Press SEND to transmit tactical report on the datalink network L1 to Chaos 1-2.
9. The recipients will be able to store this report if desired or discard it.
10. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.

3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

3.4.2 – Target (TGT) Reports

To send a TGT Tactical Report to a wingman:

11. The MPD cursor may be used to individually select FCR targets for transmission within the TGT report. If any FCR target is cursor-selected on the TSD while the TGT report format is displayed, that FCR target will be included within the FCR target report. Cursor-selecting any FCR target in this manner will de-select the ALL and PRI options, since a custom TGT report has been started using cursor-selected targets. Subsequently selecting ALL or PRI will erase the custom TGT report.
    - Note: There are no indications as to which FCR targets have been cursor-selected for a custom TGT report.

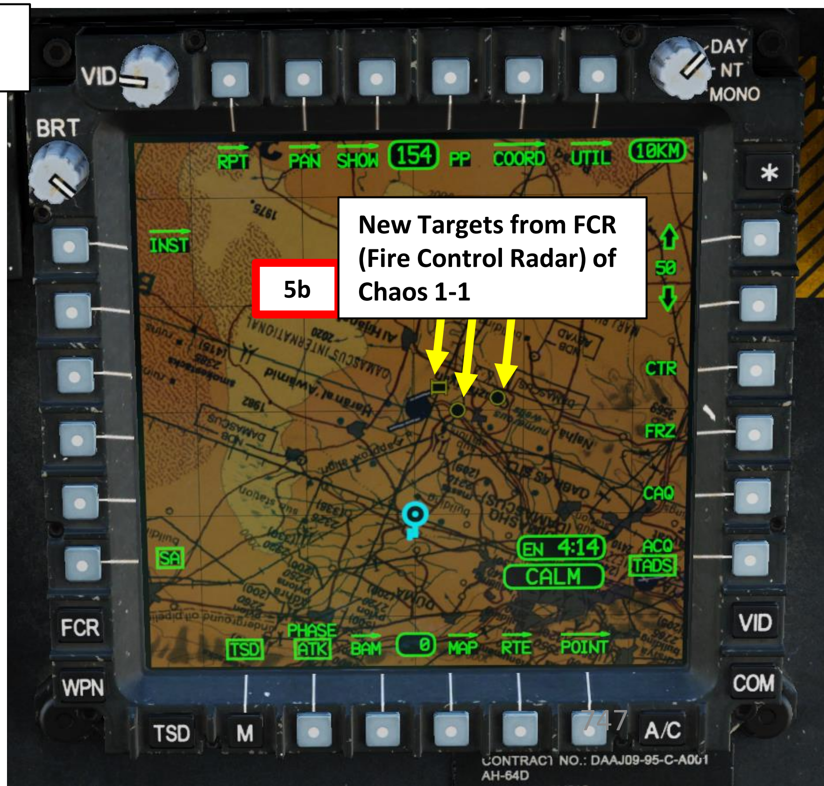
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.2 – Target (TGT) Reports

When receiving a TGT Report from a wingman:

1. When a TGT report has been received through the datalink, the EUFD will display a FCR TGT REPORT advisory.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent reports received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the report type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this report in your own database, select desired received report by pressing the relevant VAB (Variable Action Button). The report data will then be stored in your database.
6. If you do not want to store the report, select NONE.



3 – DATALINK FUNCTIONS

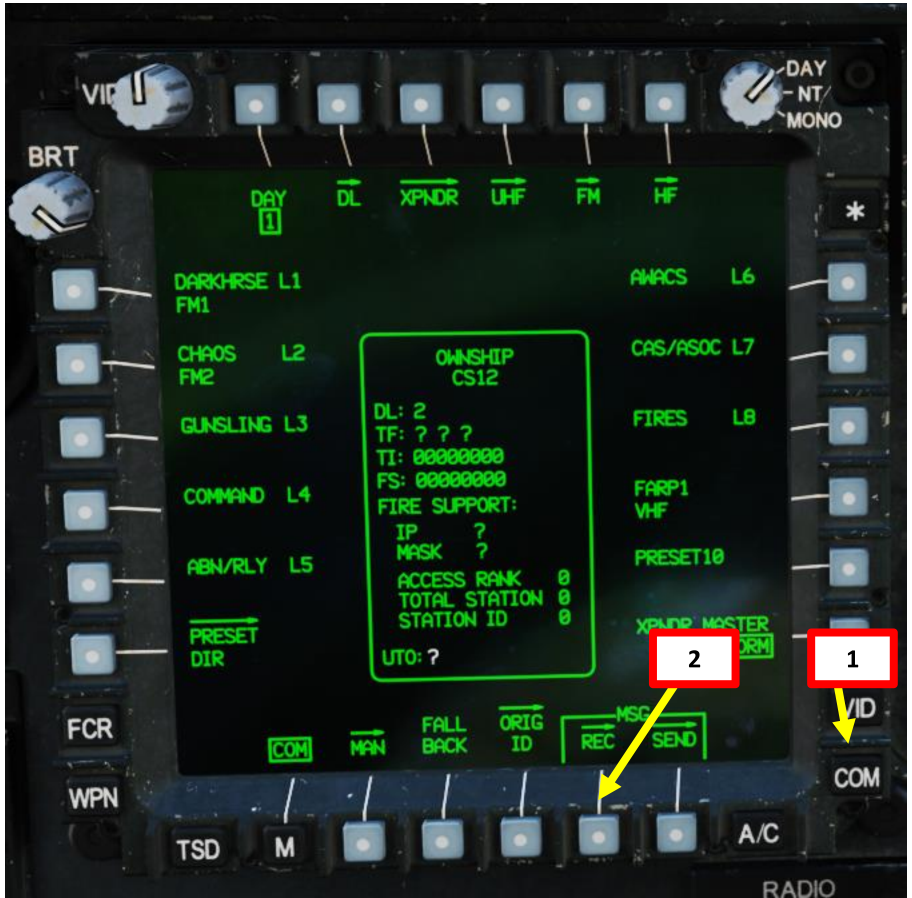
3.4 – Tactical Reports

3.4.2 – Target (TGT) Reports

When receiving a TGT Report from a wingman:

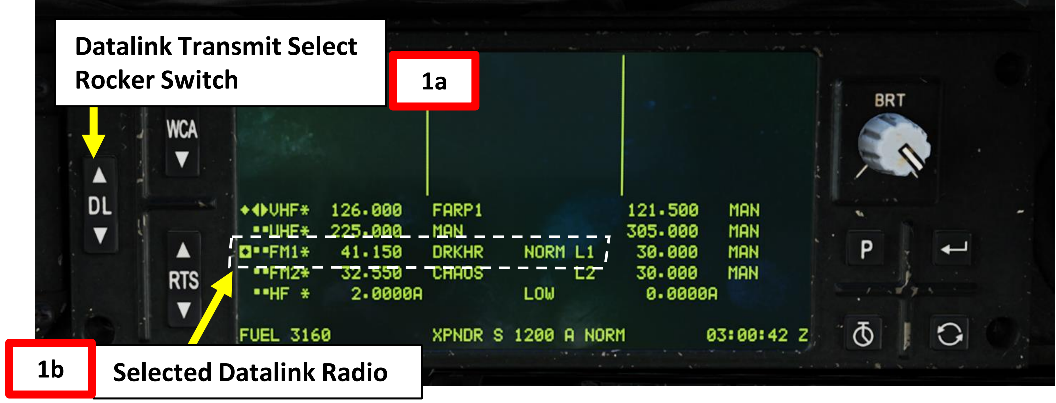
Alternatively, you can also store the target report by performing the following steps:

1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired FCR TGT RPT file by pressing the relevant VAB (Variable Action Button)
4. Select STORE



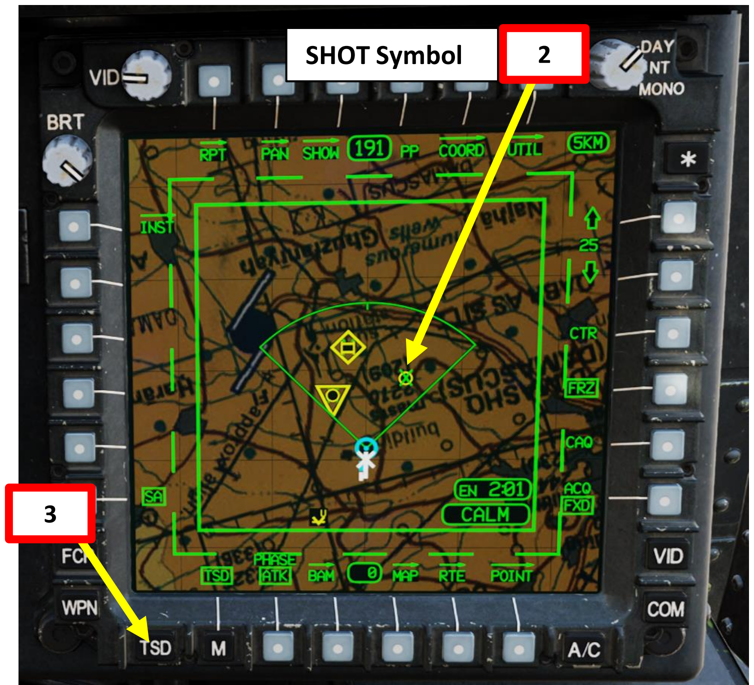
3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.3 – BDA (Battle Damage Assessment) Reports

It is possible to send or request Battle Damage Assessment (BDA) Tactical Reports. BDA reports transmit the SHOT file stored within the onboard database, which stores the details of each missile engagement performed by the ownship. The BDA report can also forward SHOT files that have already been received from other AH-64D's via the datalink.



To send or request a BDA Tactical Report to a wingman:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Ensure you have shot a few missiles beforehand; this will populate the SHOT database. SHOT symbols should be visible on the FCR and TSD pages.
3. Select TSD (Tactical Situation Display) page
4. Select RPT (Reports) sub-page
5. Select BDA (Battle Damage Assessment) Report Type.
6. Select SEND MSG (Send Message).
7. Select OWN (Ownship SHOT Files) or ALL (All SHOT Files) – As desired.



3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

3.4.3 – BDA (Battle Damage Assessment) Reports

To send a BDA Tactical Report to a wingman:

8. Select which primary members you want to transmit the tactical report to (boxed when selected). We will choose Chaos 1-2 (S12).
   - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, "CS12" (Chaos 1-2) would displayed as "S12" within the Primary member list on the TSD page. "GR11" (Gunslinger 1-1) would be displayed as "R11".
9. Press SEND to transmit tactical report on the datalink network L1 to Chaos 1-2.
10. The recipients will be able to store this report if desired or discard it.
11. If an acknowledgement is not received from all intended recipients following the number of selected retries, a "XMIT NAK" (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.

To request a BDA Tactical Report from a wingman:

12. The procedure is pretty much the same as the previous steps, but instead of selecting SEND MSG, you must select RQST MSG (Request Message) and press SEND.
13. Your wingman will automatically send the requested report provided the AUTO REPLY function is selected on the RPT (Reports) sub-page.

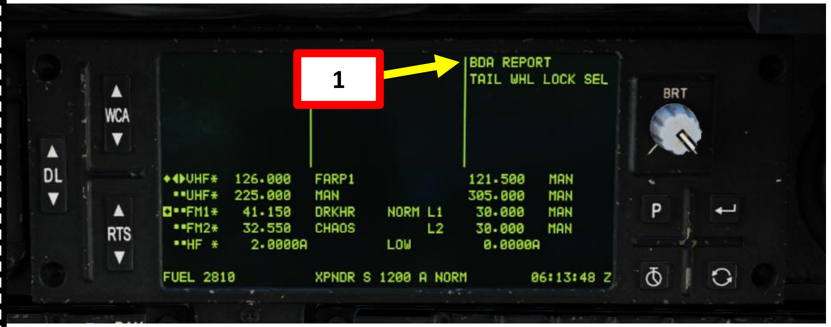
3 – DATALINK FUNCTIONS

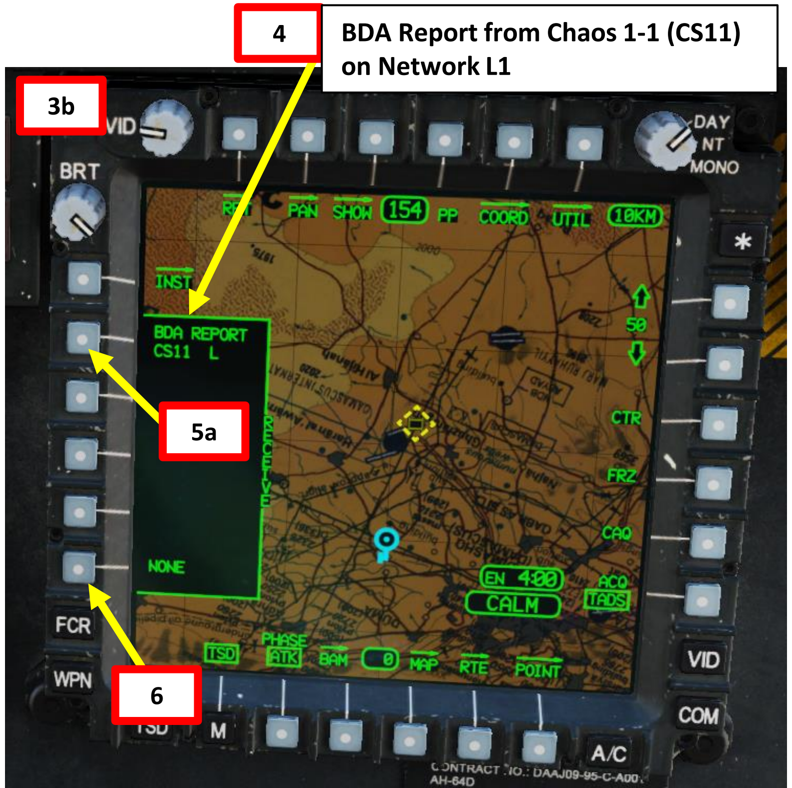
3.4 – Tactical Reports

3.4.3 – BDA (Battle Damage Assessment) Reports

When receiving a BDA Report from a wingman:

1. When a BDA report has been received through the datalink, the EUFD will display a BDA REPORT advisory.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent reports received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the report type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this report in your own database, select desired received report by pressing the relevant VAB (Variable Action Button). The report data will then be stored in your database.
6. If you do not want to store the report, select NONE.





3 – DATALINK FUNCTIONS

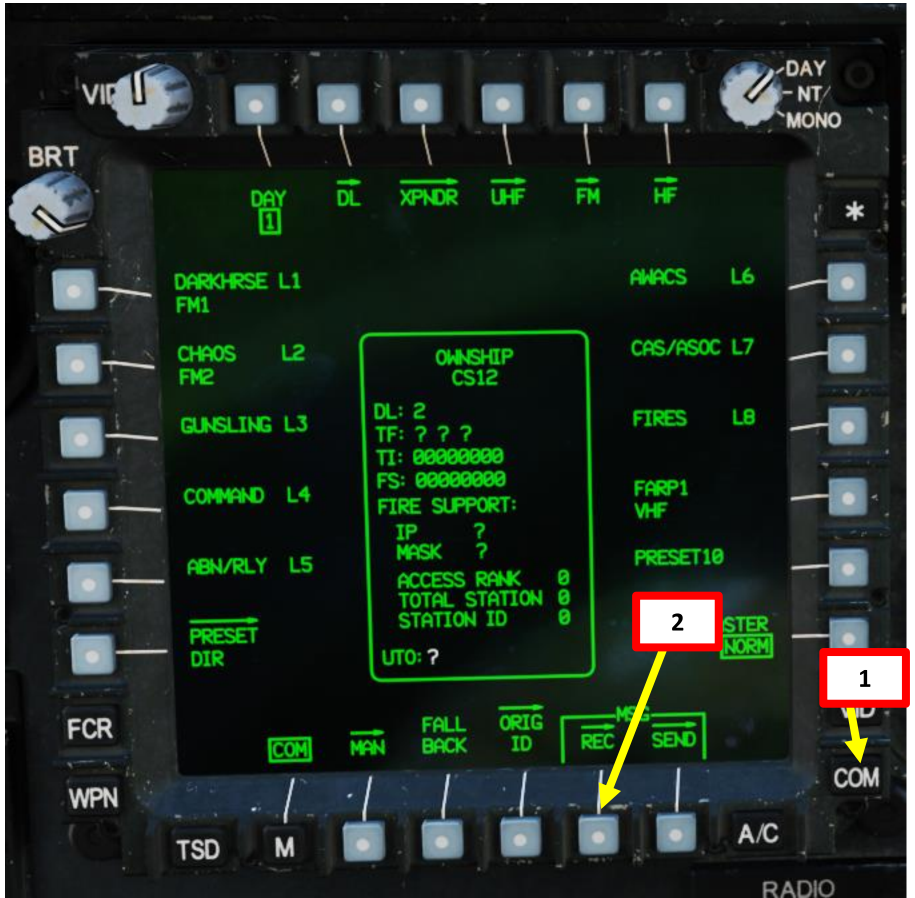
3.4 – Tactical Reports

3.4.3 – BDA (Battle Damage Assessment) Reports

When receiving a BDA Report from a wingman:

Alternatively, you can also store the BDA report by performing the following steps:

1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired BDA REPORT file by pressing the relevant VAB (Variable Action Button)
4. Select STORE



3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.3 – BDA (Battle Damage Assessment) Reports

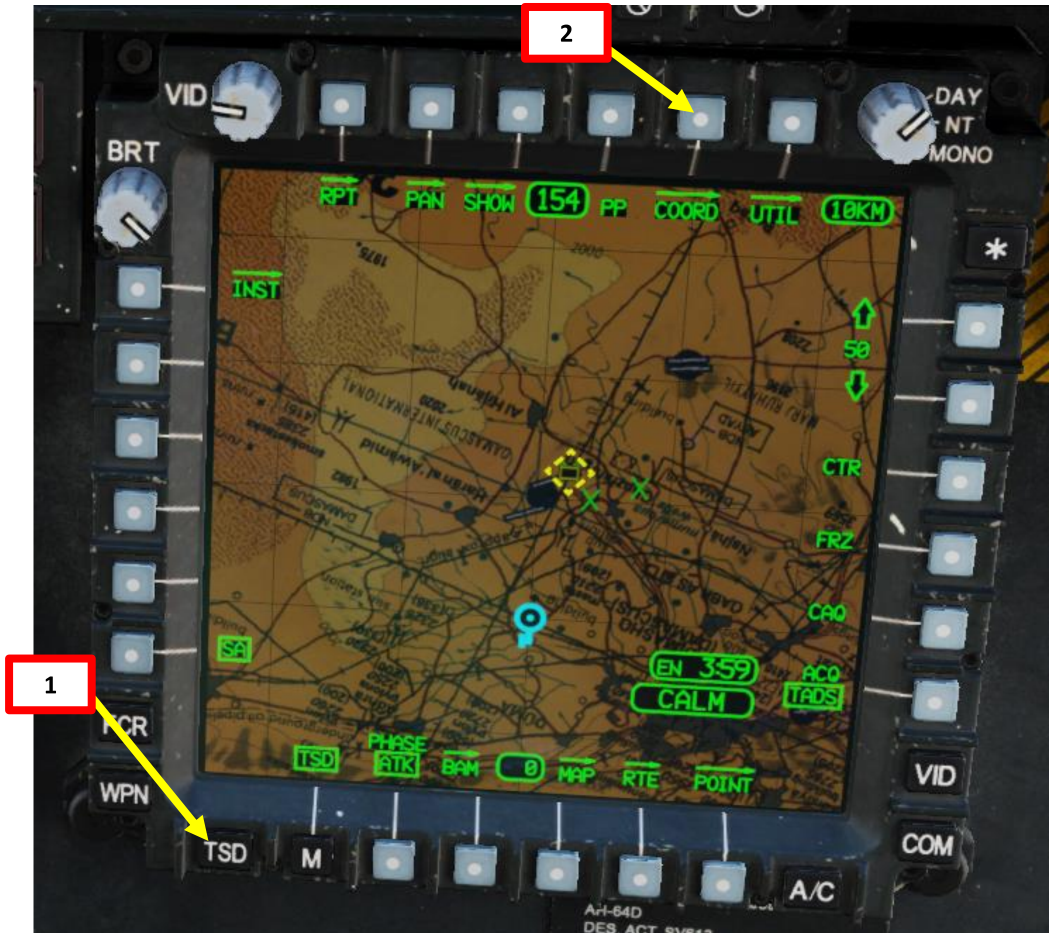
To review a BDA Tactical Report from a wingman:

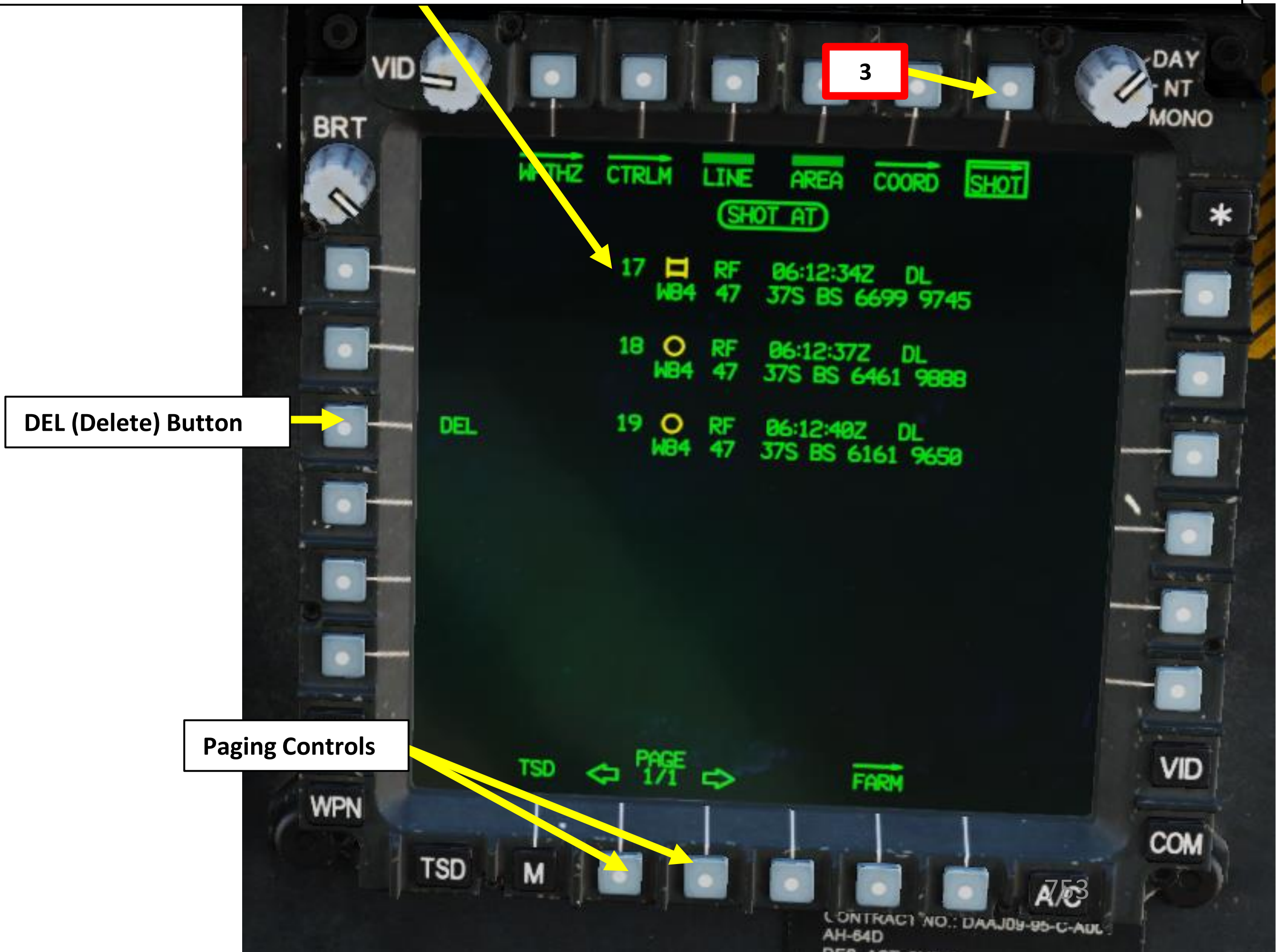
1. Select TSD (Tactical Situation Display) page.
2. Select COORD (Coordinates) sub-page.
3. Select SHOT.
4. Consult Missile Engagement Data fields as desired.

4

Missile Engagement Data

- ***Shot Index***: *The index for each ownship missile engagement is numbered 1 through 16. Any SHOT files that are extracted from BDA reports received via the datalink will be stored in indexes 17-128, allowing a total of 16 missile engagements from 7 other AH-64D's within the network.*
- ***Target Classification***: *If a RF missile engagement is conducted against an FCR-detected target, the corresponding FCR target symbol will be displayed next to the Shot index. If an RF missile engagement is conducted using the TADS to generate target data, an "Unknown" (square) target symbol will be displayed. All SAL missile engagements will be displayed with an "Unknown" (square) target symbol.*
- ***Missile Type***: *"RF" will be displayed when an AGM-114L missile is employed, or "SAL" when an AGM-114K missile is employed.*
- ***Time of Engagement***. *The missile engagement is recorded at the moment that launch is commanded.*
- ***Ownship (OWN)/Datalink (DL):*** *"OWN" will be displayed for missile engagements 1-16. "DL" will be displayed for missile engagements 17-128 that have been received over the datalink network.*
- ***Location of Engagement***: *The MGRS coordinates of the target, to include the Earth Datum and Datum Code, are displayed based on the location of the target handover data when employing an RF missile, or the line-of-sight and range source of the selected sight at the moment of launch when employing a SAL missile.*



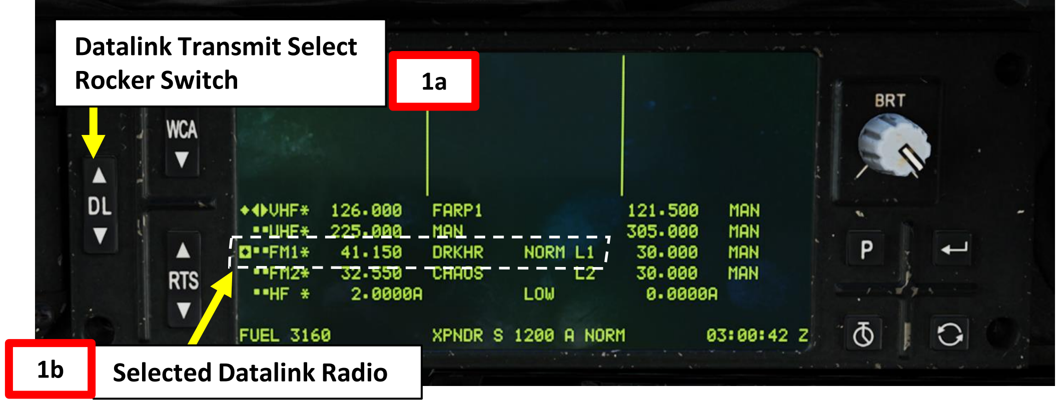


3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

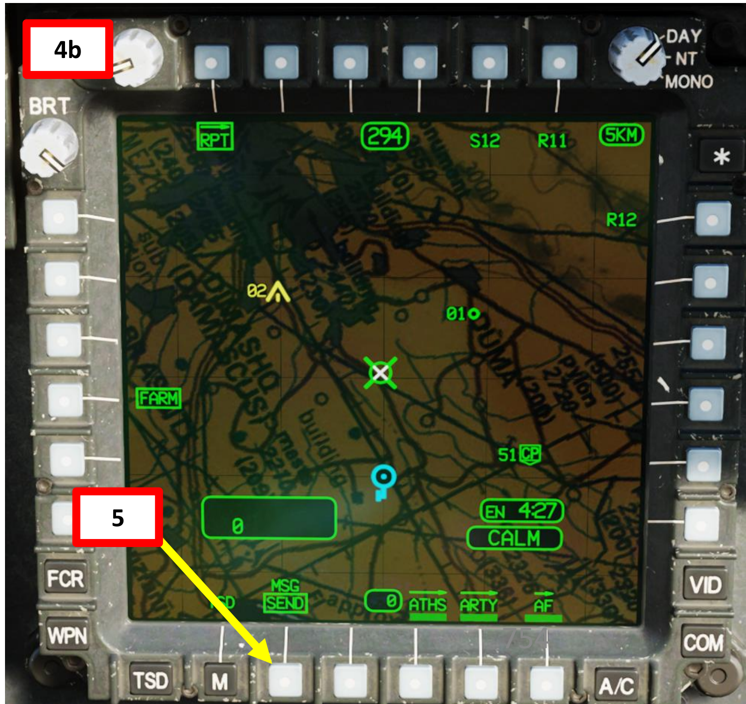
3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports

It is possible to send or request Fuel/Ammo/Rockets/Missiles (FARM) Tactical Reports. FARM reports transmit the fuel state, munitions inventory, and the quantity of expendable countermeasures remaining onboard the aircraft. The FARM report also includes the present position and MSL altitude (above mean sea level) of the originating aircraft, and the time at which the data was transmitted.



To send a FARM Tactical Report to a wingman:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select TSD (Tactical Situation Display) page
3. Select RPT (Reports) sub-page
4. Select FARM (Fuel/Ammo/Rockets/Missiles) Report Type.
5. Select SEND MSG (Send Message).



3 – DATALINK FUNCTIONS

3.4 – Tactical Reports

3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports

To send a FARM Tactical Report to a wingman:

6. Select which primary members you want to transmit the tactical report to (boxed when selected). We will choose Chaos 1-2 (S12).
   - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, “CS12” (Chaos 1-2) would displayed as “S12” within the Primary member list on the TSD page. “GR11” (Gunslinger 1-1) would be displayed as “R11”.
7. Press SEND to transmit tactical report on the datalink network L1 to Chaos 1-2.
8. The recipients will be able to store this report if desired or discard it.
9. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.

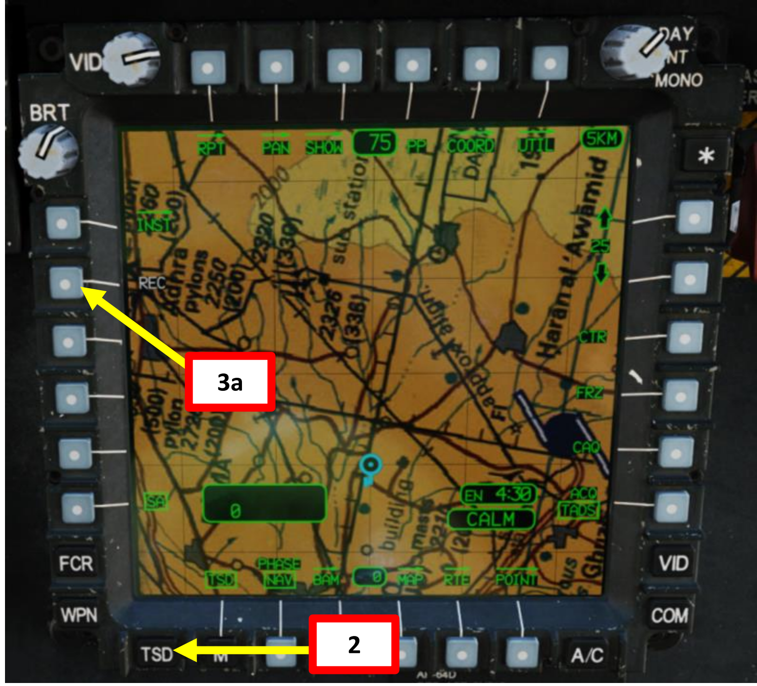
To request a FARM Tactical Report from a wingman:

10. The procedure is pretty much the same as the previous steps, but instead of selecting SEND MSG, you must select RQST MSG (Request Message) and press SEND.
11. Your wingman will automatically send the requested report provided the AUTO REPLY function is selected on the RPT (Reports) sub-page.

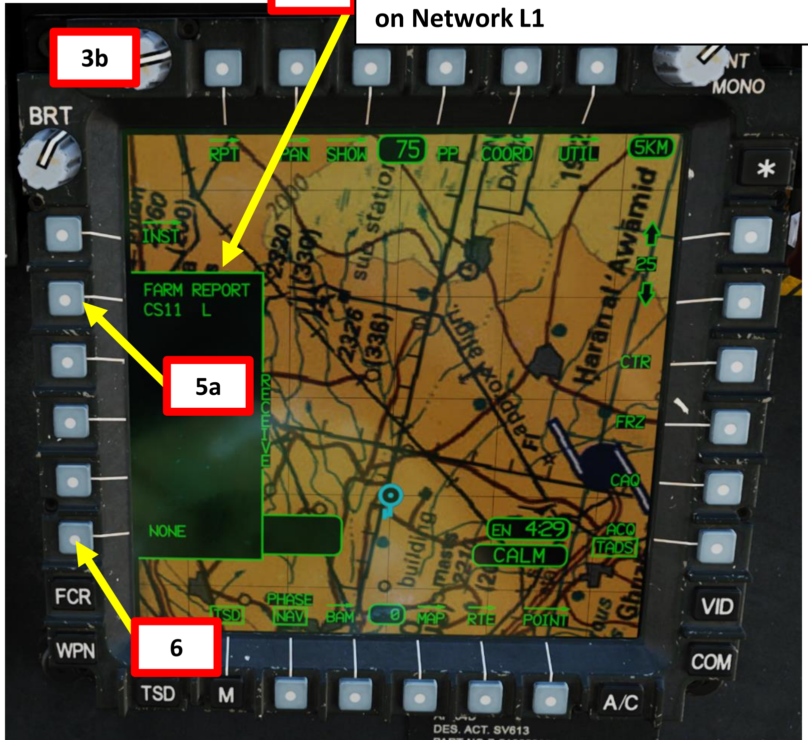
3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports

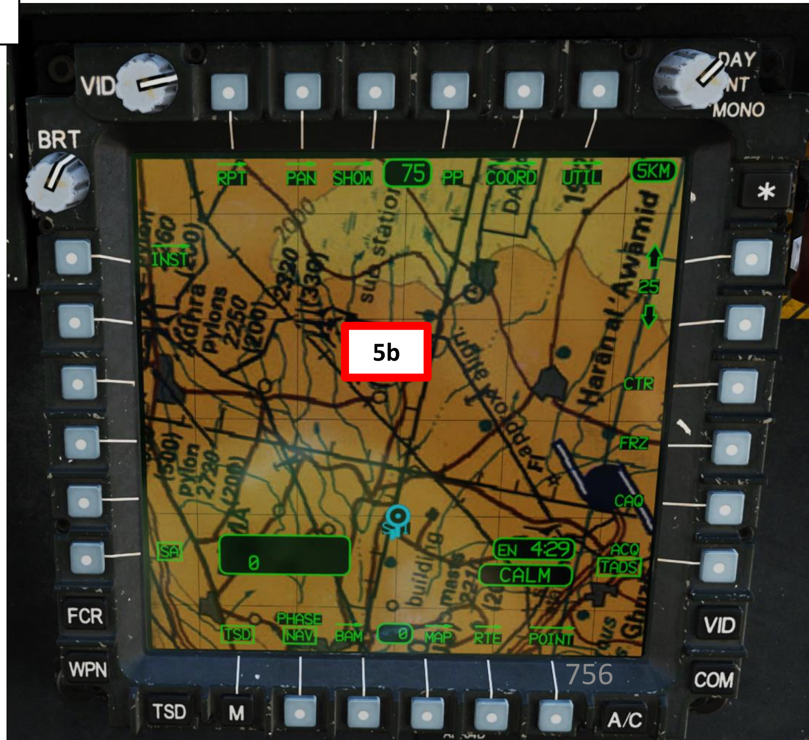
When receiving a FARM Report from a wingman:

1. When a FARM report has been received through the datalink, the EUFD will display a FARM REPORT advisory.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent reports received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the report type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this report in your own database, select desired received report by pressing the relevant VAB (Variable Action Button). The report data will then be stored in your database.
6. If you do not want to store the report, select NONE.



4
FARM Report from Chaos 1-1 (CS11) on Network L1



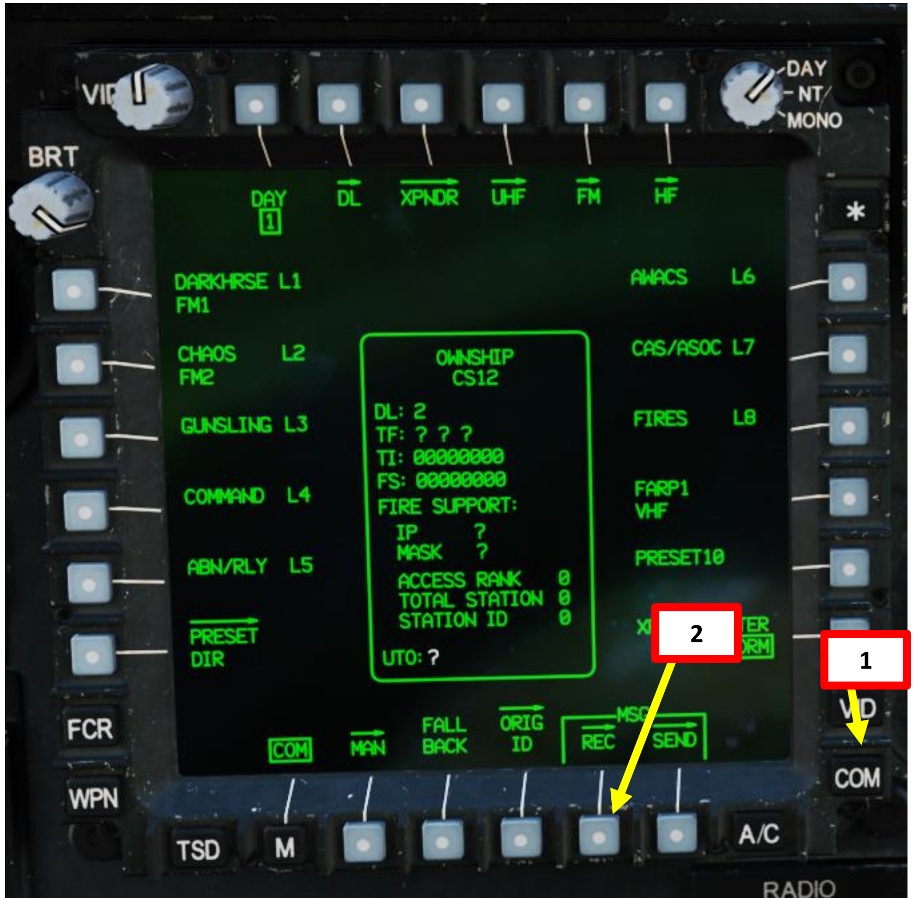


3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports

When receiving a FARM Report from a wingman:

Alternatively, you can also store the FARM report by performing the following steps:

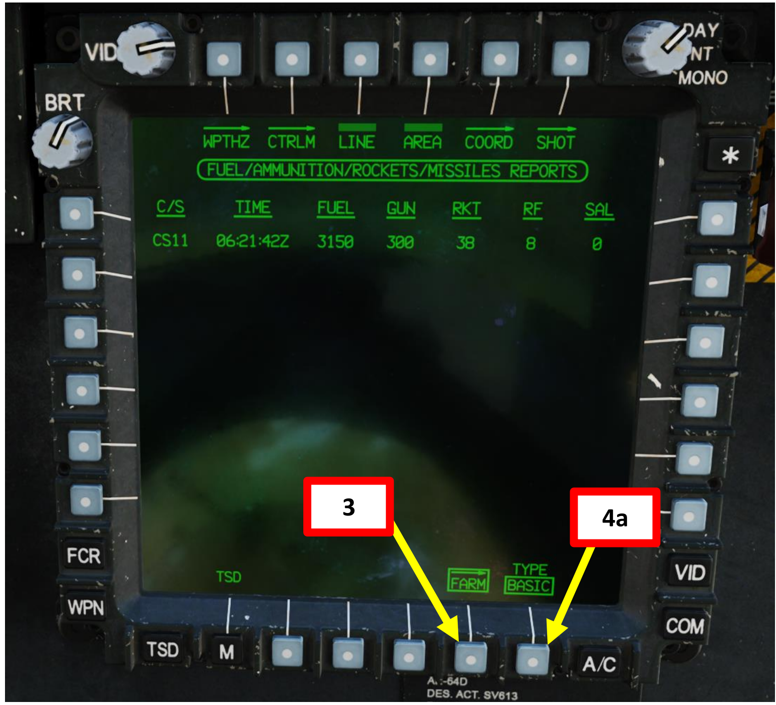
1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired FARM REPORT file by pressing the relevant VAB (Variable Action Button)
4. Select STORE

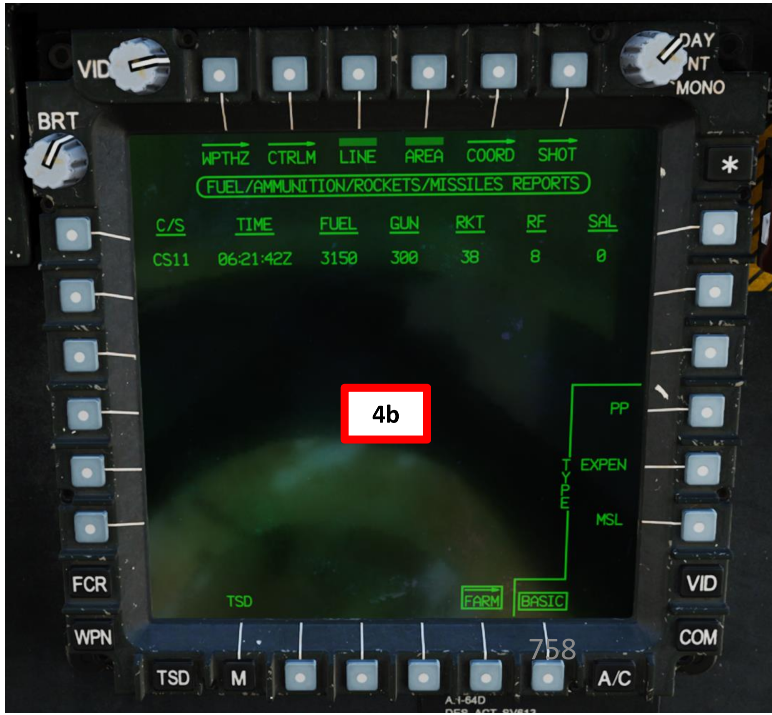


3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports

To review a FARM Tactical Report from a wingman:

1. Select TSD (Tactical Situation Display) page.
2. Select COORD (Coordinates) sub-page.
3. Select FARM.
4. Select TYPE.

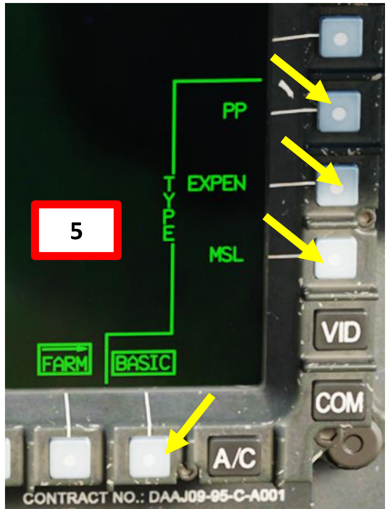


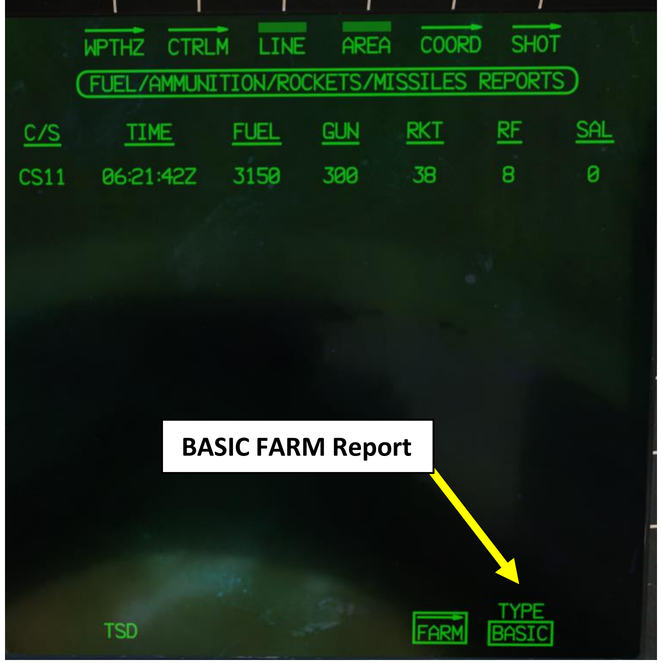


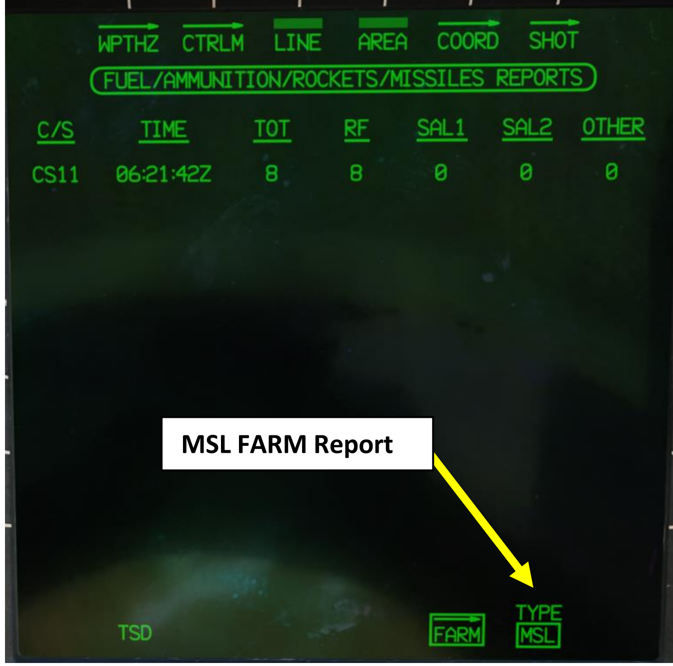
3 – DATALINK FUNCTIONS
3.4 – Tactical Reports
3.4.4 – FARM (Fuel Ammo Rockets Missiles) Reports

To review a FARM Tactical Report from a wingman:

5. Select desired FARM Report Type.
    - **BASIC**: displays the datalink subscriber's callsign, the time the report was received, the total fuel onboard (lbs.), remaining rounds of 30mm ammunition, remaining rockets onboard (of any type), and the remaining missiles onboard, separated between RF and SAL variants.
    - **MSL (Missiles):** displays the datalink subscriber's callsign, the time the report was received, and the remaining missiles onboard, separated between RF, SAL1, SAL2, and Other missile variants. Only RF (AGM-114L) and SAL2 (AGM-114K) are simulated within DCS: AH-64D.
    - **EXPEN (Expendables):** displays the datalink subscriber's callsign, the time the report was received, and the remaining expendable countermeasures onboard, separated between Flare, Chaff, and Other. Only flares and chaff are simulated within DCS: AH-64D.
    - **PP (Present Position):** displays the datalink subscriber's callsign, the time the report was received, the subscriber's present position in both MGRS and Latitude/Longitude coordinate formats, and the subscriber's altitude in feet above mean sea level (MSL).



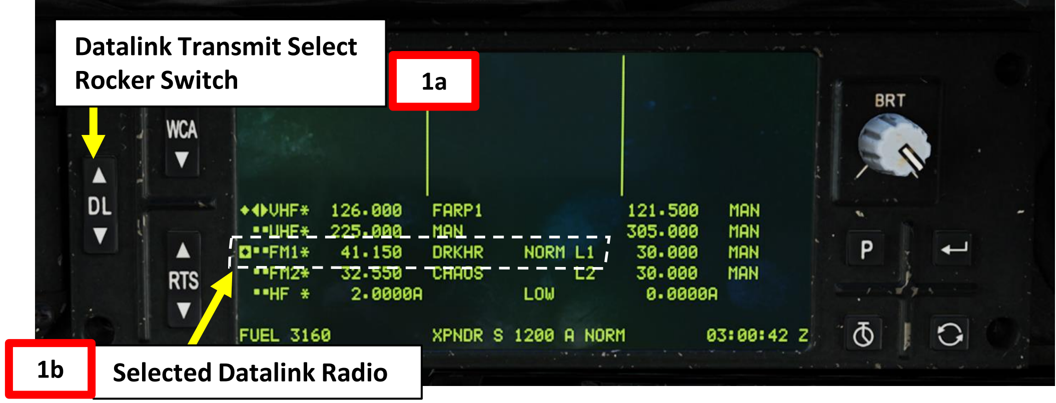


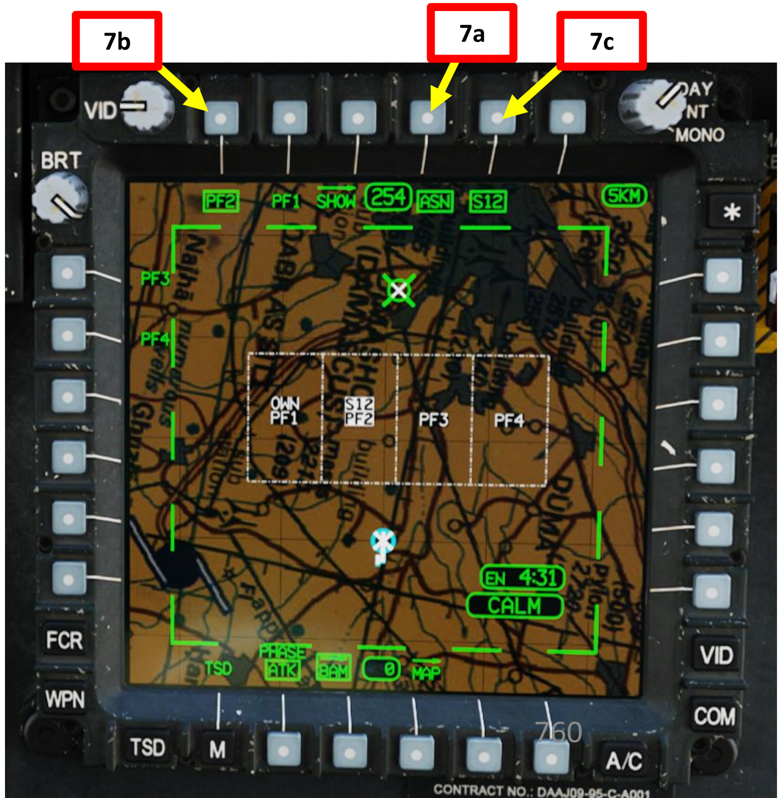


3 – DATALINK FUNCTIONS
3.5 – BAM (Battle Area Management) Functions
3.5.1 – Sending Fire Zones

To send a Fire Zone to a wingman:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Select TSD (Tactical Situation Display) page
3. Select ATK (Attack) Phase
4. Select BAM (Battle Area Management) sub-page
5. Make sure the fire zone you want to send has already been created.
6. Select PF (Priority Fire Zone) or NF (No Fire Zone) as desired. We will select PF in order to send our priority fire zones.
7. Assign fire zones to wingman using the ASN (Assign) Format. We will assign PF2 (Priority Fire Zone 2) to Chaos 1-2 (S12).





3 – DATALINK FUNCTIONS

3.5 – BAM (Battle Area Management) Functions

3.5.1 – Sending Fire Zones

To send a Fire Zone to a wingman:

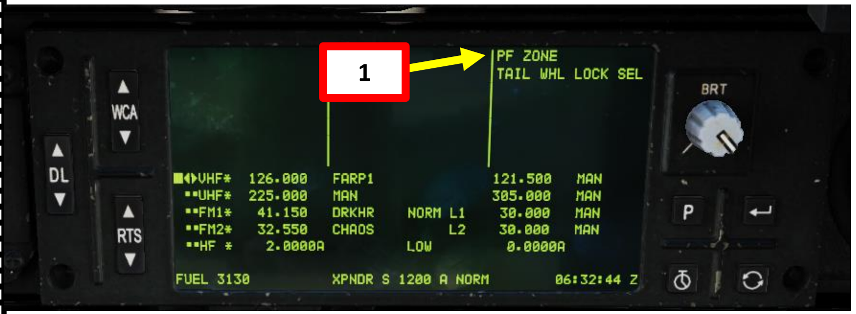
8. Exit ASN (Assign) Format.
9. Select which primary members you want to transmit the fire zone to (boxed when selected). We will choose Chaos 1-2 (S12).
    - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, “CS12” (Chaos 1-2) would displayed as “S12” within the Primary member list on the TSD page. “GR11” (Gunslinger 1-1) would be displayed as “R11”.
10. Press SEND to transmit fire zone on the datalink network L1 to Chaos 1-2.
11. The recipients will be able to store this fire zone if desired or discard it.
12. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.

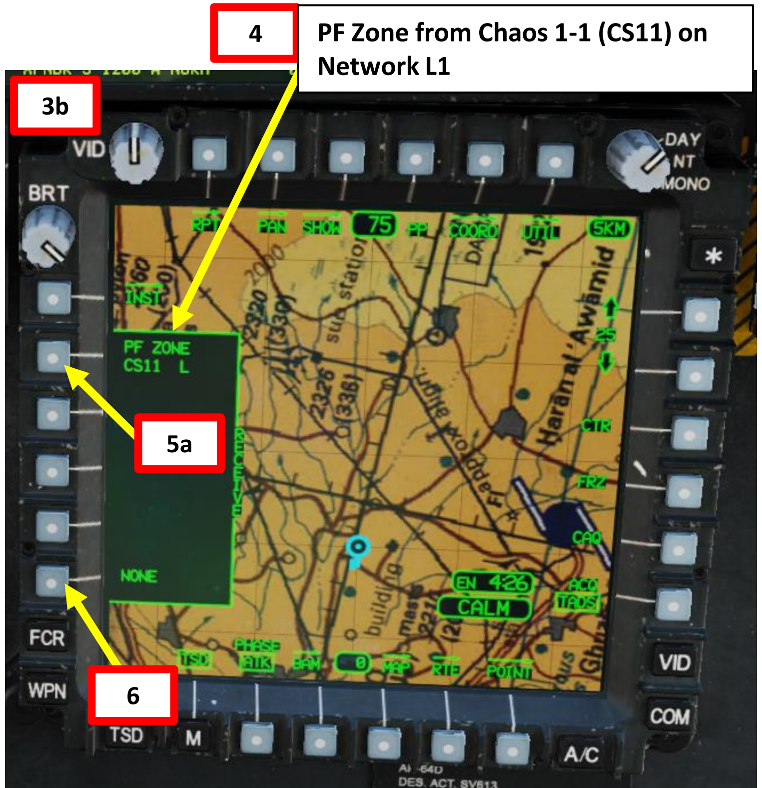
3 – DATALINK FUNCTIONS

3.5 – BAM (Battle Area Management) Functions

3.5.2 – Receiving Fire Zones

1. When a Fire Zone has been received through the datalink, the EUFD will display a PF ZONE (Priority Fire Zone) or NF ZONE (No Fire Zone) advisory based on what type of fire zone has been sent.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent reports received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the report type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this fire zone in your own database, select desired received fire zone report by pressing the relevant VAB (Variable Action Button). The fire zone data will then be stored in your database and override your own fire zones.
6. If you do not want to store the fire zone, select NONE.





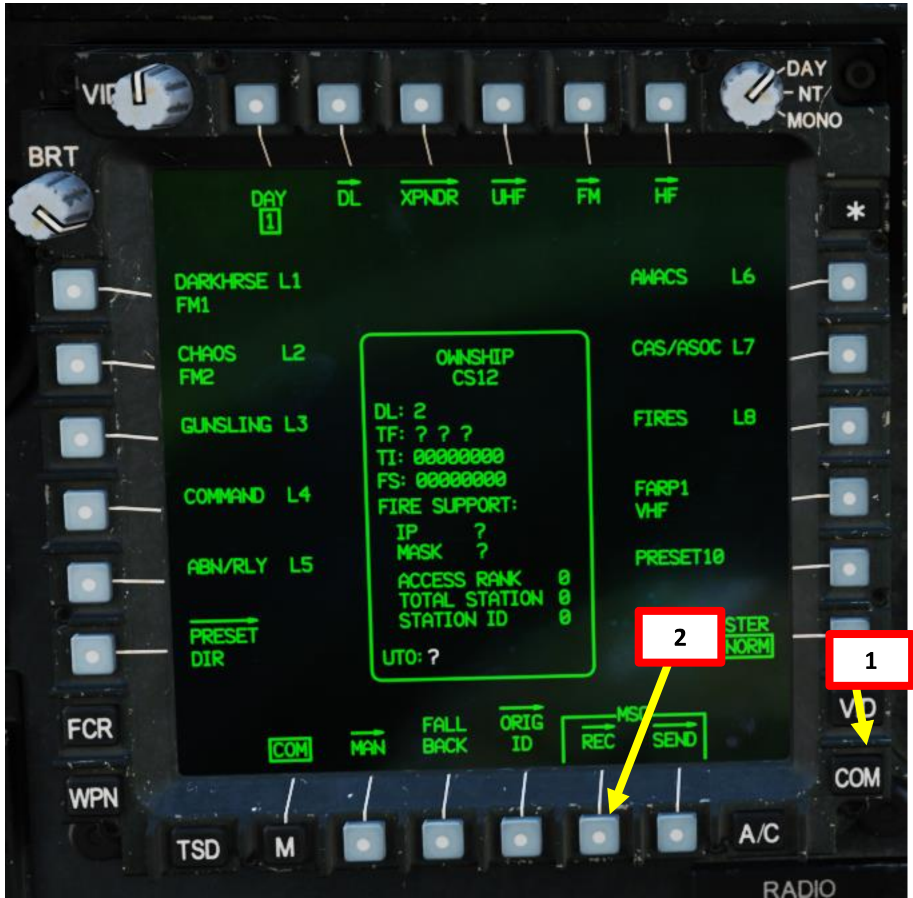
3 – DATALINK FUNCTIONS

3.5 – BAM (Battle Area Management) Functions

3.5.2 – Receiving Fire Zones

Alternatively, you can also store the Fire Zone by performing the following steps:

1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired PF ZONE file by pressing the relevant VAB (Variable Action Button)
4. Select CURR (Current Mission)
5. Select STORE



3 – DATALINK FUNCTIONS

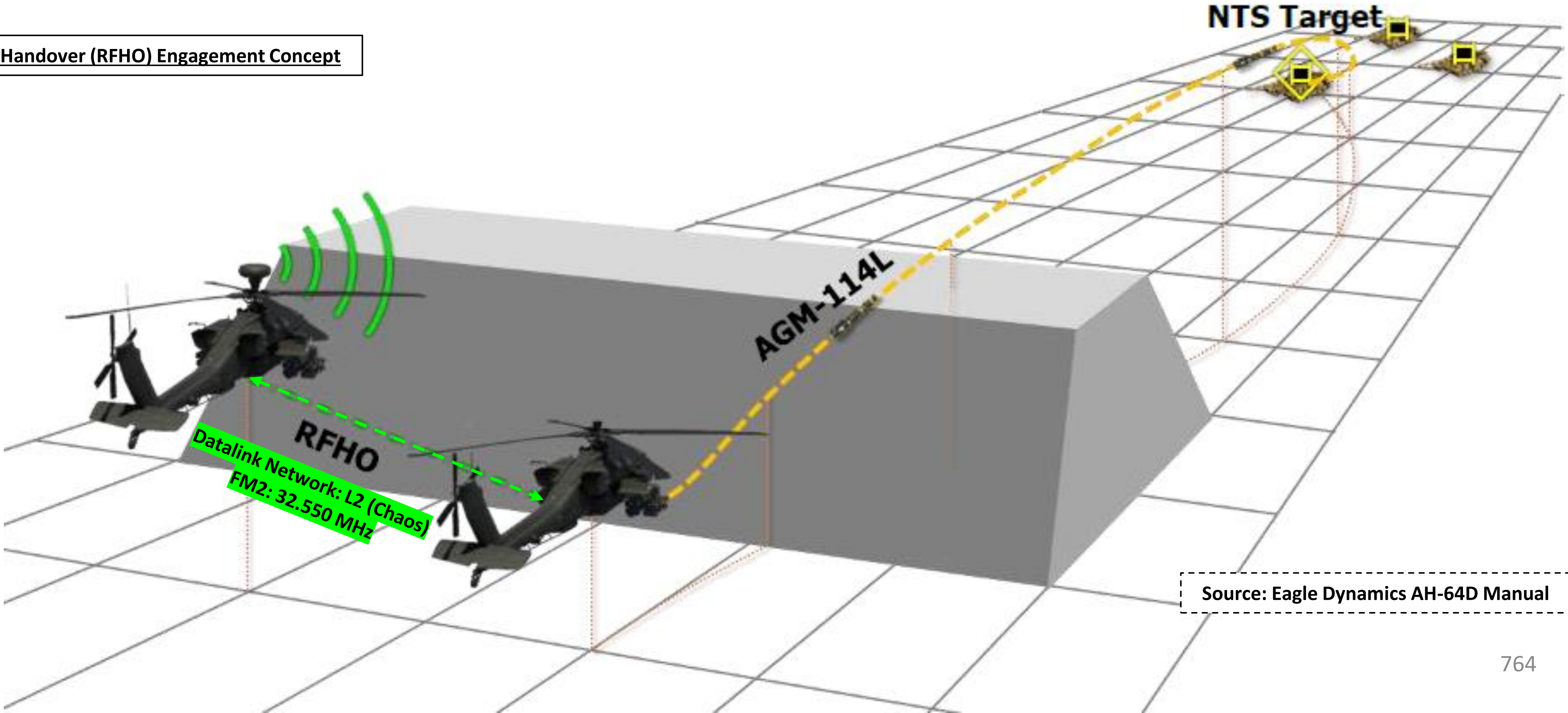
3.6 – Radar Target Handover (RFHO)

3.6.1 – Introduction to RF (Radio Frequency) Handover

Radar-generated targets detected by an AH-64D equipped with a FCR (Fire Control Radar) may be transmitted to other AH-64Ds across the datalink network. Unlike FCR TGT Report datalink messages, which only provide situational awareness or aid in target acquisition using the receiving aircraft's own sensors, RF Handover (RFHO) datalink messages may be used for direct targeting by AGM-114L radar-guided missiles without the receiving aircraft acquiring the target.

RFHO datalink messages may be sent to any AH-64D Primary member(s) within the selected datalink network, allowing the receiving aircraft to engage the FCR target with RF missiles, rockets, or 30mm gunfire, **regardless of whether the receiving aircraft is equipped with an FCR themselves**. This means that a team of AH-64s could technically only need one fire control radar to find targets and dispatch them (or "hand them over") to other wingmen on the datalink network. However, if received by an AH-64D that is equipped with an FCR, the RFHO data will replace any target data generated by the receiving aircraft's own FCR.

RF Handover (RFHO) Engagement Concept

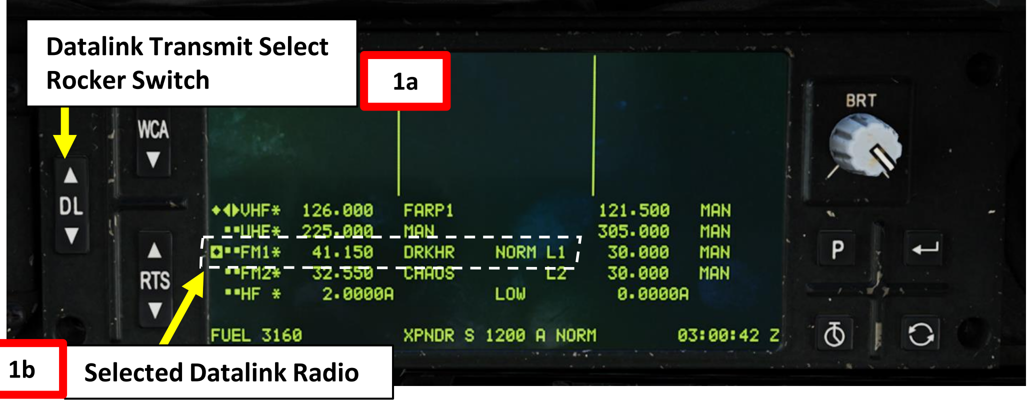


Source: Eagle Dynamics AH-64D Manual

3 – DATALINK FUNCTIONS
3.6 – Radar Target Handover (RFHO)
3.6.2 – Sending RF (Radio Frequency) Handover

To send a target to a wingman via RFHO:

1. Select desired Datalink Preset Network by using Datalink Transmit Select Rocker Switch. We will select Preset Network L1 (Darkhorse).
2. Set Sight Selector Switch – LEFT (FCR)
3. Select FCR (Fire Control Radar) page
4. Make sure you have stored targets by performing a scan with the FCR (Fire Control Radar).



Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

2

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Sight Selector Switch
- *FWD: **HMD** (Helmet-Mounted Display), selects IHADSS line-of-sight*
- *AFT: **LINK**, slaves TADS line-of-sight to FCR Next-To-Shoot (NTS). If the CPG's active sight is TADS and the pilot commands LINK, the CPG's active sight will become HMD.*
- *LEFT: **FCR** (Fire Control Radar)*
- *RIGHT: **TADS** (Target Acquisition & Designation Sight)*

2

3 – DATALINK FUNCTIONS
3.6 – Radar Target Handover (RFHO)
3.6.2 – Sending RF (Radio Frequency) Handover

To send a target to a wingman via RFHO:

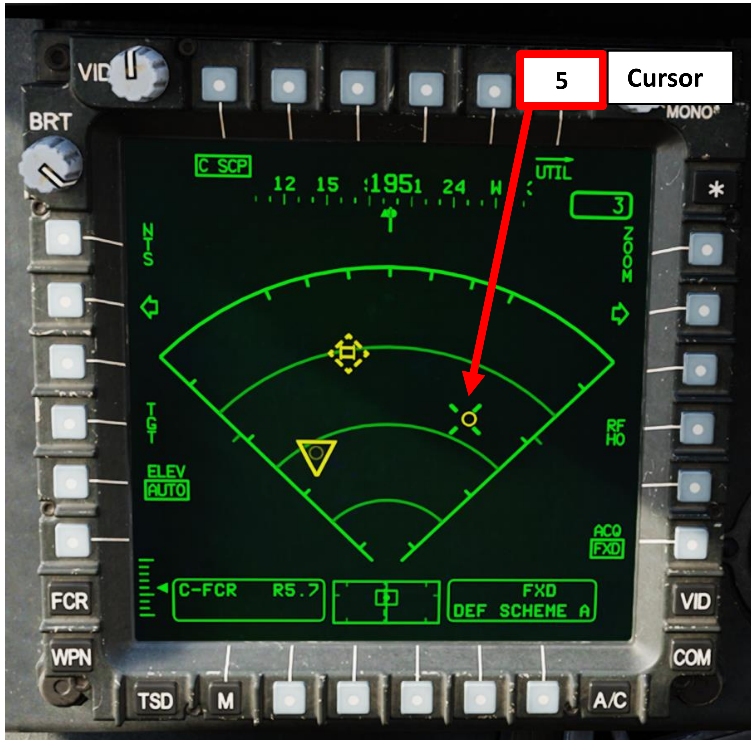
5. Move the cursor on the desired target symbol with the Cursor Control Switch (either on the TEDAC Left Hand Grip or on the Collective)
6. Press DOWN on the Cursor Switch (ENTER).
7. Cursor-selecting an FCR target symbol on the FCR page will set this new target as the Next-to-Shoot (NTS) Target. That target is then placed at the top of the High Priority Target List, and the previous target that had been manually designated as NTS is returned to its previous ranking.

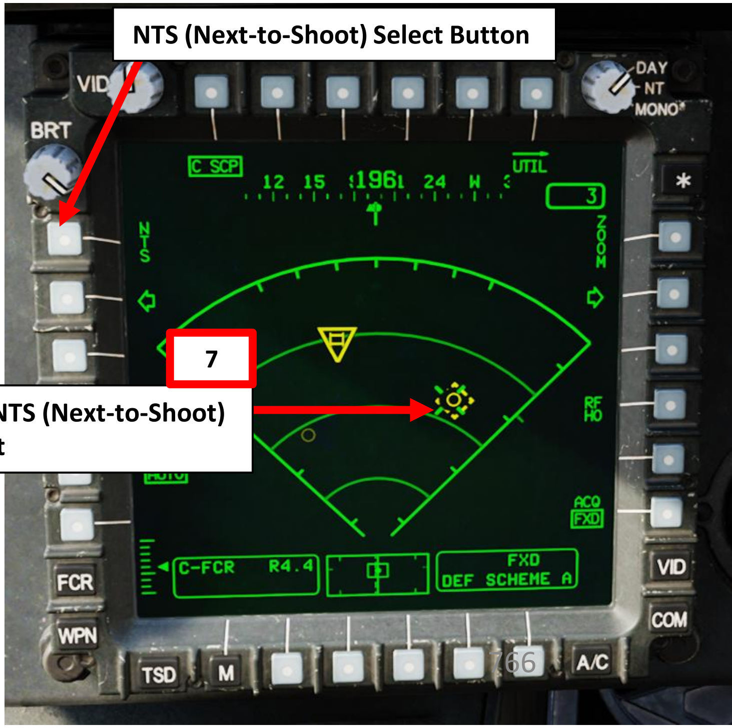
TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

5

6

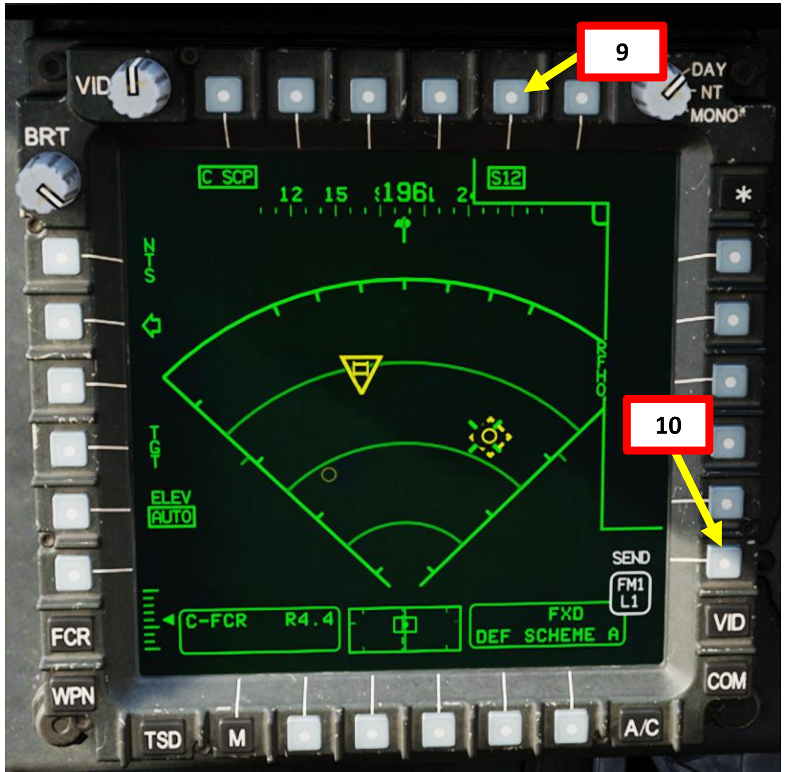




3 – DATALINK FUNCTIONS
3.6 – Radar Target Handover (RFHO)
3.6.2 – Sending RF (Radio Frequency) Handover

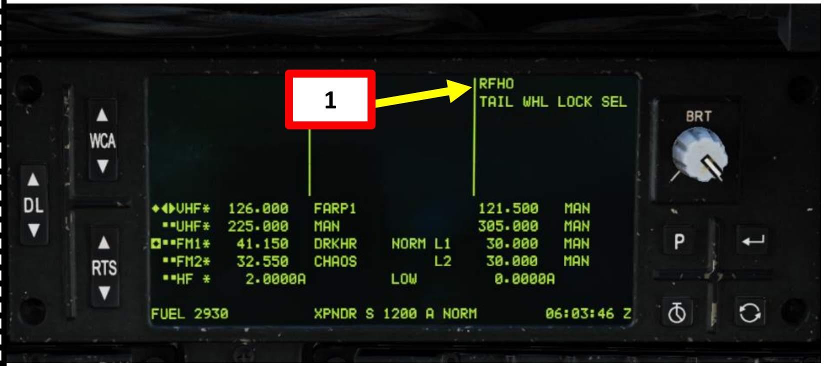
To send a target to a wingman via RFHO:

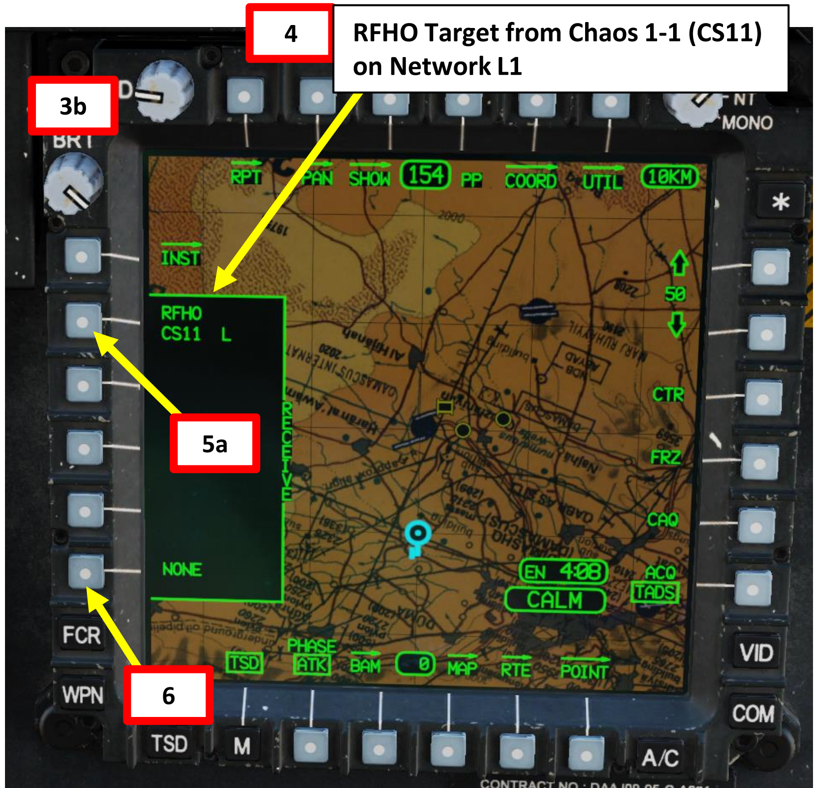
8. Select RFHO (Radio Frequency Handover).
9. Select which primary members you want to transmit the target to (boxed when selected). We will choose Chaos 1-2 (S12).
    - Important note: Each entry within the list is generated from the Callsigns of Primary members as displayed on the NET sub-page, **truncated to the last three alphanumeric characters**. For example, “CS12” (Chaos 1-2) would displayed as “S12” within the Primary member list on the TSD page. “GR11” (Gunslinger 1-1) would be displayed as “R11”.
10. Press SEND to transmit target on the datalink network L1 to Chaos 1-2.
11. The designated NTS (Next-to-Shoot) Target will then revert to its initial priority since this target is “handed over” your wingman. You will regain your previous NTS (Next-to-Shoot) Target.
12. The recipients will be able to store this target if desired or discard it.
13. If an acknowledgement is not received from all intended recipients following the number of selected retries, a “XMIT NAK” (No acknowledgement to transmission) advisory message will be displayed on the EUFD, indicating which radio through which the modem failed to receive all required acknowledgements.



3 – DATALINK FUNCTIONS
3.6 – Radar Target Handover (RFHO)
3.6.3 – Receiving RF (Radio Frequency) Handover

1. When a RFHO target has been received through the datalink, the EUFD will display a RFHO advisory.
2. Select TSD page.
3. Select REC (Receive) to open the TSD Receive List.
4. The four most recent reports received via Datalink that have not yet been stored (excluding Mission Files and Text Messages) will be displayed. Each entry includes the report type, the originator callsign of the sender and the datalink modem protocol through which it was received.
5. If you want to store this RFHO in your own database, select desired received report by pressing the relevant VAB (Variable Action Button). The target will then be stored in your database and become your new NTS (Next-to-Shoot), which you can engage with the AGM-114L missile as shown in the Weapons section.
6. If you do not want to store the RFHO target, select NONE.

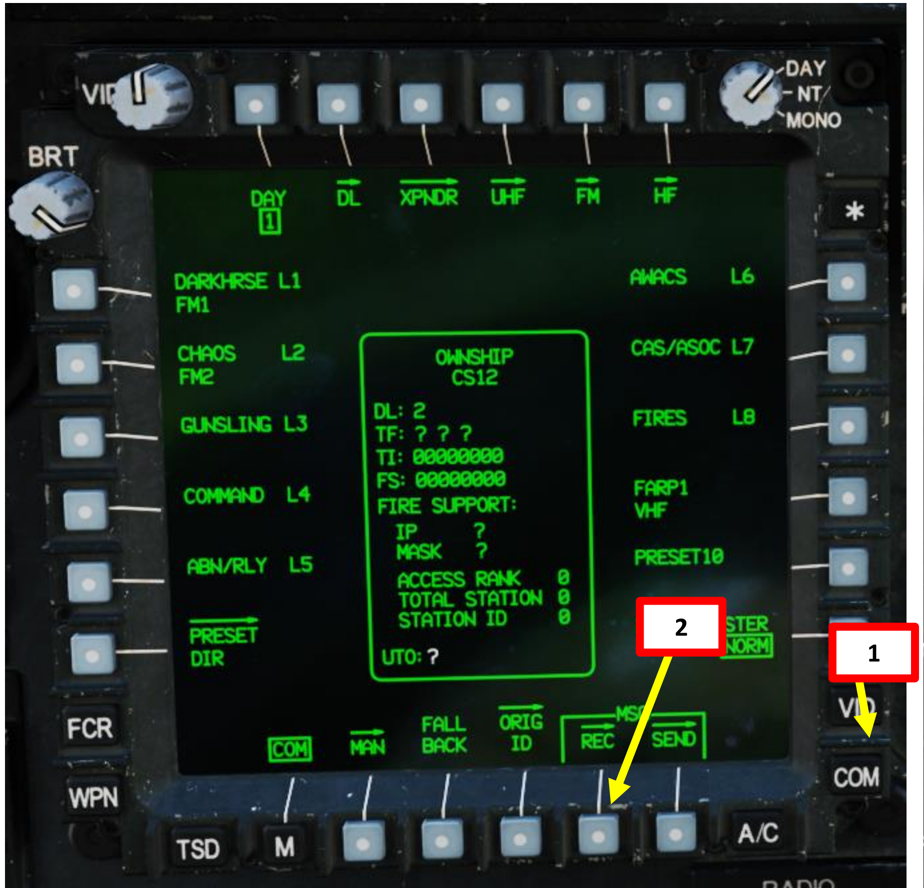


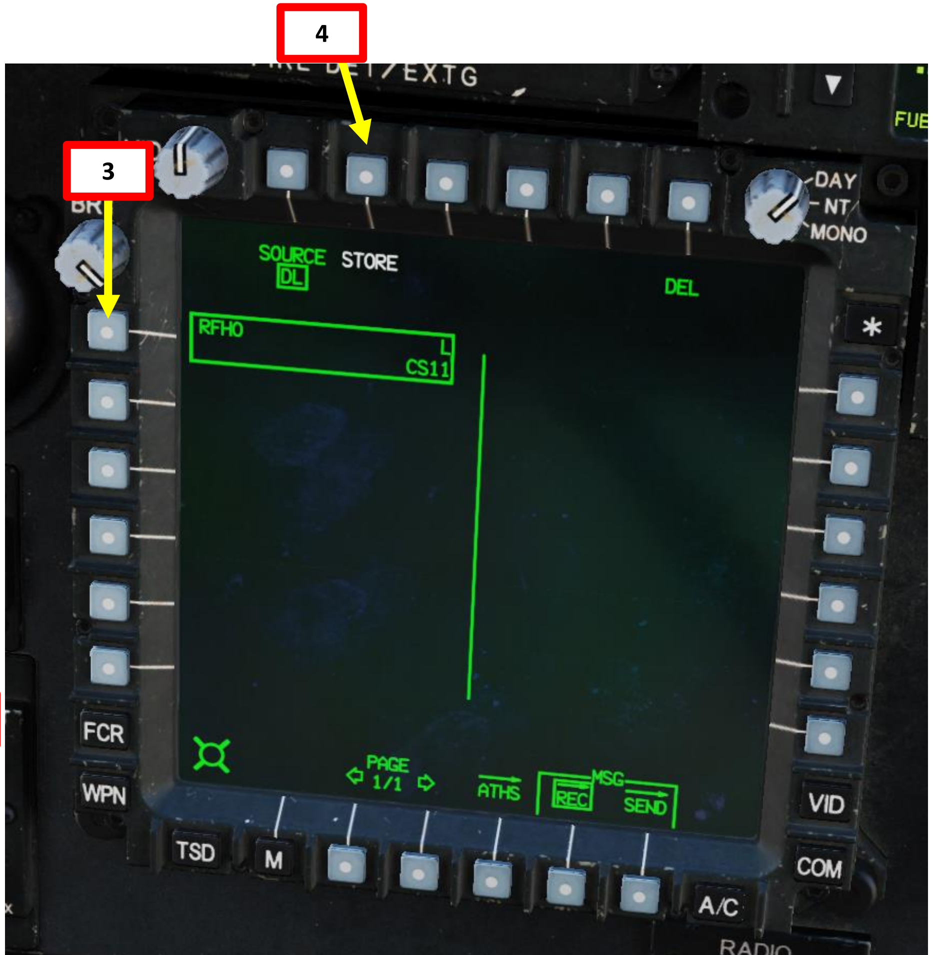


3 – DATALINK FUNCTIONS
3.6 – Radar Target Handover (RFHO)
3.6.3 – Receiving RF (Radio Frequency) Handover

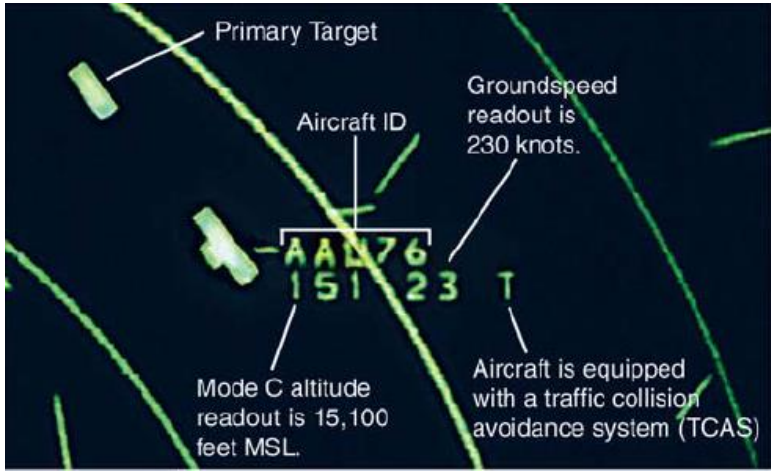
Alternatively, you can also store the RFHO target by performing the following steps:

1. Select COM page
2. Select REC MSG (Receive Message)
3. Select desired RFHO file by pressing the relevant VAB (Variable Action Button)
4. Select STORE





IFF (IDENTIFY-FRIEND-OR-FOE) INTRODUCTION



An IFF (Identify-Friend-or-Foe) system usually consists of an **INTERROGATOR** component and a **TRANSPONDER** component.

The **interrogator** component broadcasts an interrogation signal with a specific “code” (pulse frequency).

A **transponder** equipped on another aircraft will receive the interrogation signal and broadcast a reply signal with its own “code” (pulse frequency) as well. The information sent from this reply signal will vary based on the transponder mode selected.

Your own aircraft transponder will then see if the interrogation code and reply codes match, which in some cases can be used to determine whether the other aircraft is a friendly contact. The nature of the information determined will vary based on the transponder mode.

Take note that **the AH-64D has no interrogator**, therefore you cannot send interrogation signals to other aircraft to see whether they are friendly or not. However, you do have a transponder, which is very important. If you set an incorrect transponder code, friendly contacts may not be able to identify you as a friendly, which can be a big problem.

IFF MODES

In its simplest form, a IFF "Mode" or interrogation type is generally determined by pulse spacing between two or more interrogation pulses. Various modes exist from Mode 1 to 5 for military use, to Mode A, C, and Mode S for civilian use. The takeaway from this table should be:

- **Mode 4 is the preferred mode in a combat** scenario because it is highly secure (encrypted). Encrypted interrogation codes cannot be detected by an enemy transponder, and your transponder will not broadcast a reply signal to the other team.
- **Mode 4 invalid/lack of reply cannot guarantee that an aircraft is hostile**, but a **valid reply is a guarantee of a friendly contact** (within DCS)
- **Modes 1, 2, and 3 are not secure to use** since any other aircraft from the opposing team could find what your Interrogator code is and set his transponder to it, fooling you into thinking he is a friendly contact. These modes also easily give away your position since every time your transponder broadcasts an answer, this signal can be intercepted by an enemy transponder, which can send your position to other enemy fighters via datalink.

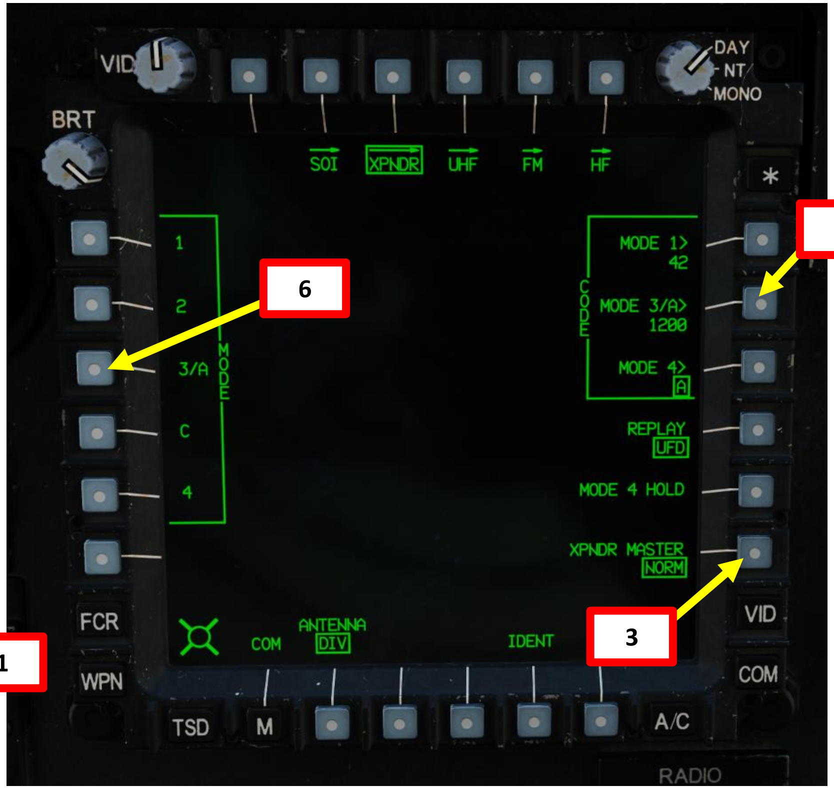
Military Interrogation Mode	Civilian Interrogation Mode	Description
1		Provides 2-digit 5-bit mission code
2		Provides 4-digit octal unit code (set on ground for fighters, can be changed in flight by transport aircraft)
3	A	Provides a 4-digit octal identification code for the aircraft, set in the cockpit but assigned by the air traffic controller. Mode 3/A is often combined with Mode C to provide altitude information as well.
	C	Provides the aircraft's pressure altitude and is usually combined with Mode 3/A to provide a combination of a 4-digit octal code and altitude as Mode 3 A/C, often referred to as Mode A and C
4		Provides a 3-pulse reply, delay is based on the encrypted challenge
5		Provides a cryptographically secured version of Mode S and ADS-B GPS position
S		Mode S (Select) is designed to help avoiding overinterrogation of the transponder (having many radars in busy areas) and to allow automatic collision avoidance. Mode S transponders are compatible with Mode A and Mode C Secondary Surveillance Radar (SSR) systems. This is the type of transponder that is used for TCAS or ACAS II (Airborne Collision Avoidance System) functions

SETTING UP THE APX-118(V) TRANSPONDER

The APX-118(V) transponder is capable of responding to interrogations in Mode 1, Mode 3/A, and Mode C formats. The APX-118(V) can also reply to encrypted Mode 4 interrogations. **Take note that IFF is not implemented yet.**

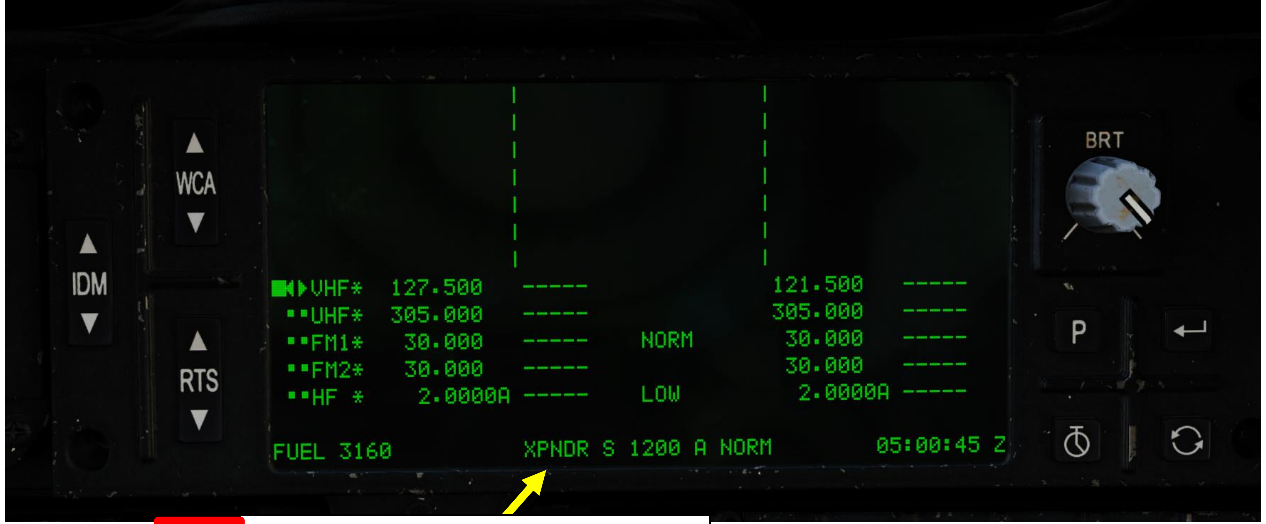
As an example, let's say that the mission briefing needs us to set the IFF transponder to **Mode 3A with a code of 1200**.

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to XPNDR (Transponder).
3. Press on VAB next to XPNDR MASTER to select NORM (Normal) Mode.
4. Press on VAB next to CODE MODE 3/A.
5. On KU (Keyboard Unit), enter the transponder code, then press ENTER.
6. Press on VAB next to MODE 3/A.



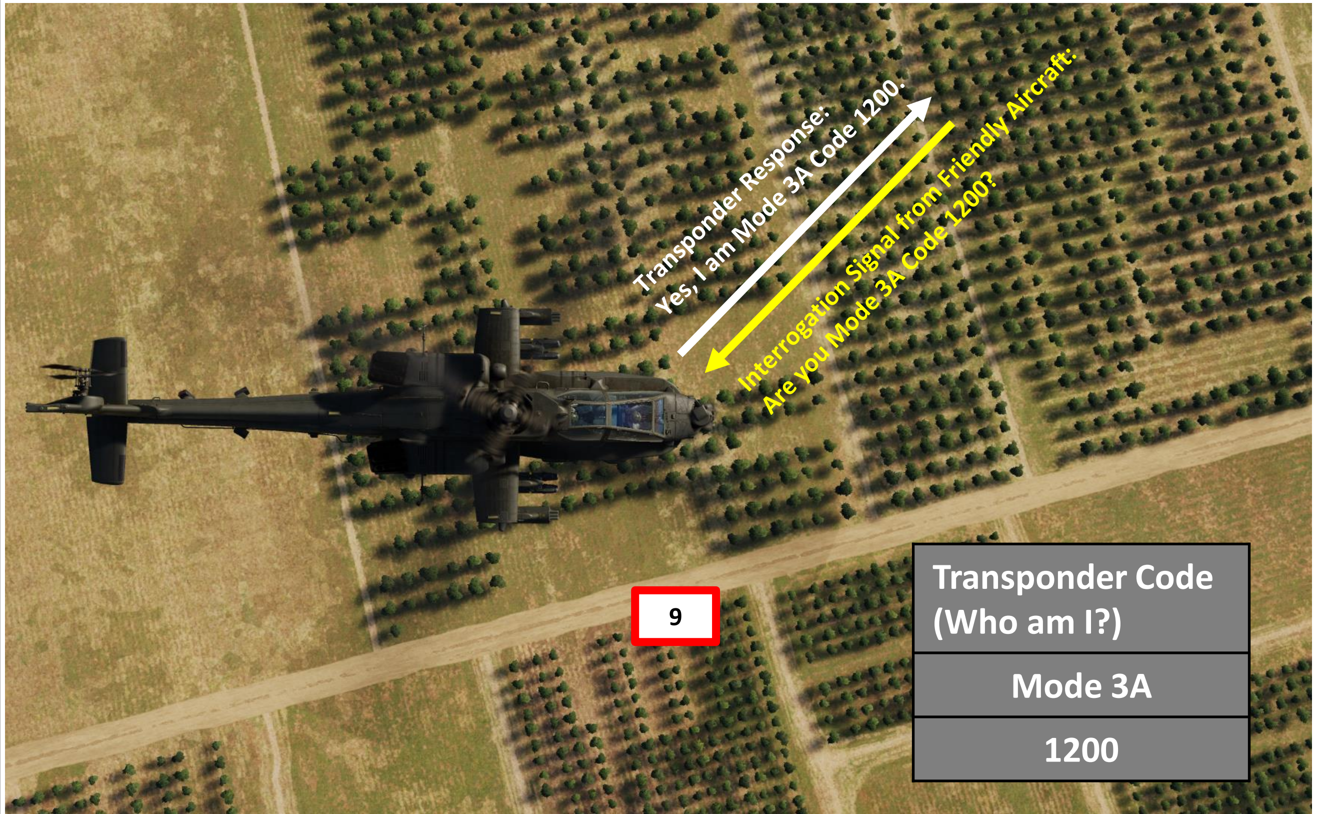
SETTING UP THE APX-118(V) TRANSPONDER

7. Transponder information should be visible on the EUFD (Enhanced Up-Front Display).
8. Adjust the IFF tone volume as desired.
9. If you are interrogated with mode 3A with a code set to 1200, the transponder will then send a response signal (reply) to the interrogator with the transponder code you entered previously.
10. If the tower wants to know your position, they are likely to send you a specific IFF mode and code, then ask you to "*Identify*". This requires you to press the IDENT button, which will allow the tower to know where you are from your transponder's identification signal/transmission.



7

Transponder Information Area
- Mode 3/A "Squawk Code": 1200
- Master Mode: NORM (Normal)



10

Mode 3 Transponder IDENT (Identify) Button

8

APX-118(V) TRANSPONDER EMERGENCY MODE

Pressing the Emergency Transponder (XPNDR) Button sets the Mode 3/A transponder code to 7700 (standard emergency code). The text “ON” is highlighted on the button face. Note that the transponder must be on, and Mode 3 must be active.

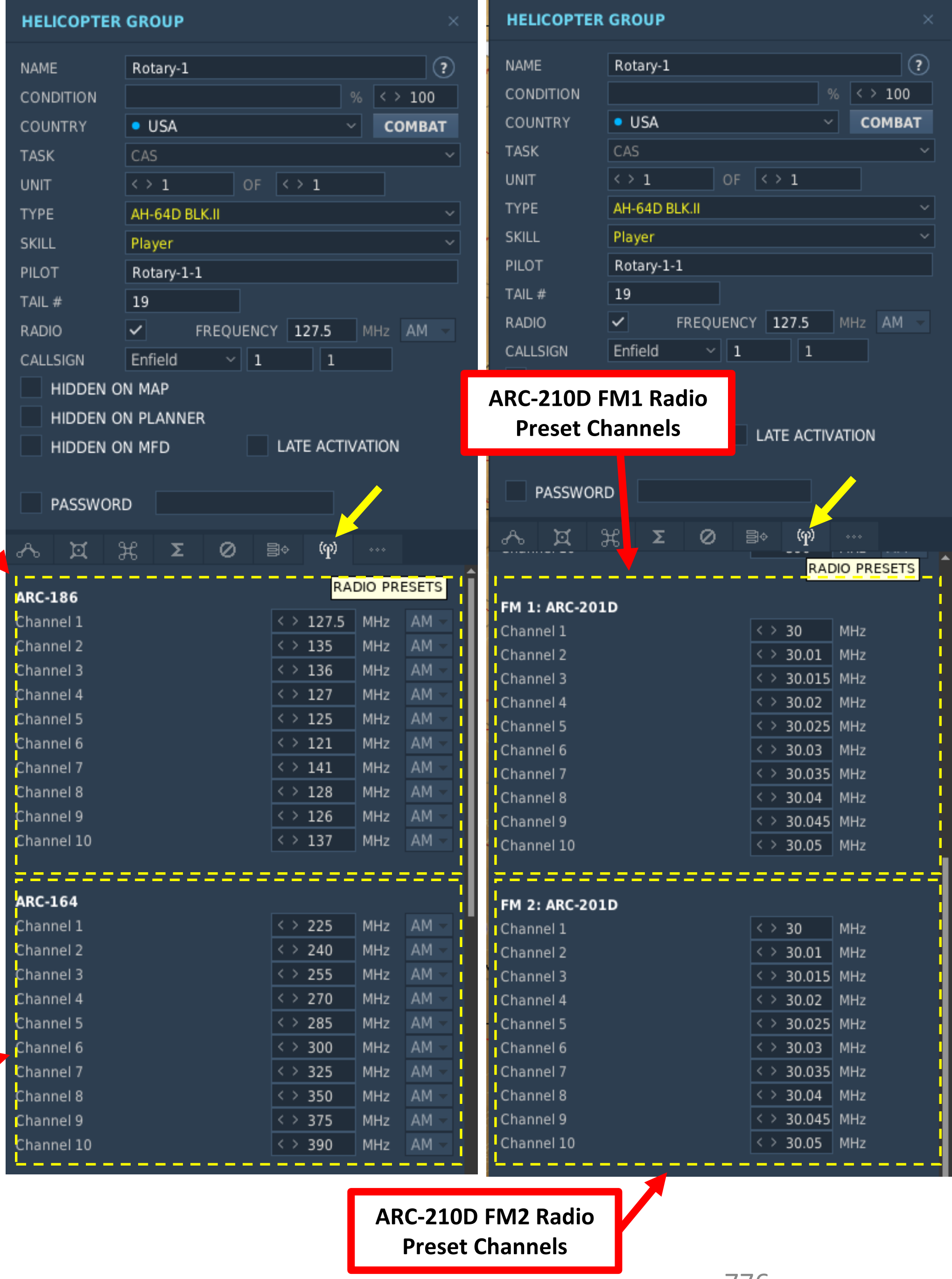
SECTION SUMMARY

1 – RADIO COMMUNICATIONS OVERVIEW

Communicating in the AH-64 can be done with the following equipment:

- **ARC-186(V) VHF-AM radio**: used for communicating with Air Traffic Control (ATC).
    - ARC-186 radio is **not encrypted/secure**.
    - ARC-186 radio has 10 preset channels that can be modified manually.
    - Frequency Range:
        - 108.00 to 115.975 MHz
        - 116.00 to 151.975 MHz
- **ARC-164(V) UHF-AM radio**: used for communicating with ATC, other aircraft, or ground forces.
    - ARC-164 radio has the ability to communicate on HAVE QUICK frequency-hopping nets and can be connected to a KY-58 module for **secure** communications.
    - ARC-164 radio has 10 preset channels that can be modified manually.
    - Frequency range:
        - 225.00 to 399.975 MHz
        - Guard receiver frequency tuned to 243.0 MHz
- **ARC-201D SINCGARS (Single Channel Ground and Airborne Radio System) VHF-FM1 and VHF-FM2 radio sets**: provide two-way line-of-sight communications over VHF-FM frequencies.
    - Both ARC-201D radios have embedded **secure** communications capability and can communicate on frequency-hopping nets.
    - ARC-210D radios both have 10 preset channels each, which can be modified manually.
    - Frequency range:
        - 30.000 to 87.975 MHz
- **ARC-220 HF radio**: used for two-way, non-line-of-sight (NLOS) and over-the-horizon (OTH) communications over shortwave frequencies.
    - ARC-220 radio has an embedded modem for sending and receiving data transmissions, can operate using frequency-hopping nets, and can be connected to a KY-100 module for **secure** communications capability. The ARC-220 is also capable of communications using Automatic Link Establishment (ALE) multi-channel nets to decrease crew workload and increase communications reliability.
    - Frequency range:
        - 2.0000 to 29.9999 MHz
- **ICS (Intercom System):** used to communicate between crew members.

- Note 1: All radios are connected to the battery bus and can be used prior to engine start.
- Note 2: The AH-64D includes a MD-1295A Improved Data Modem (IDM) that can transmit and receive TACFIRE (Tactical Fire Direction System) and Longbow AFAPD (Air Force Applications Program Development) messages over any radio. It can also utilize either FM radio for Fire Support artillery messages
    - **These features are not simulated yet.**



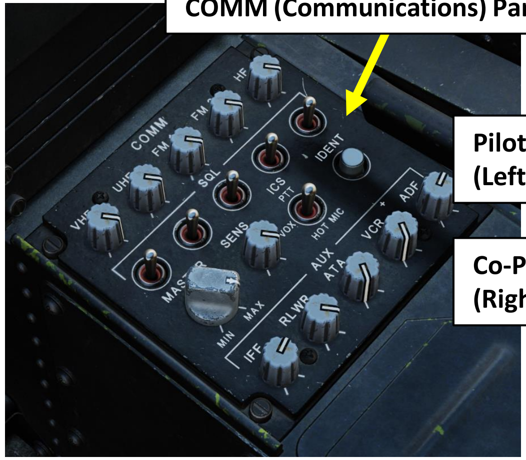
1 – RADIO COMMUNICATIONS OVERVIEW

1 – RADIO COMMUNICATIONS OVERVIEW

In practice, radio communications are primarily performed with the RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch on the cyclic. The EUFD (Enhanced Up-Front Display) panel allows you to monitor which frequencies are selected;

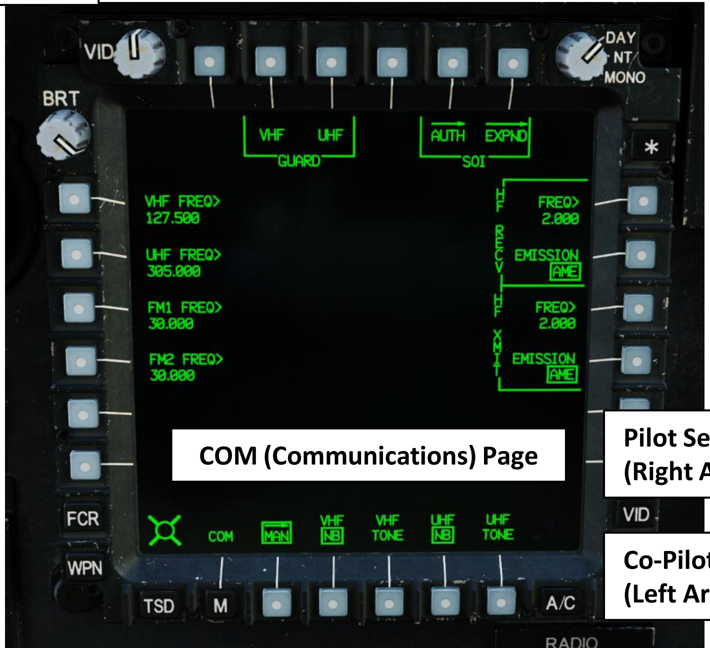
- The left arrow represents your selected radio
- The right arrow represents the other crew member's selected radio

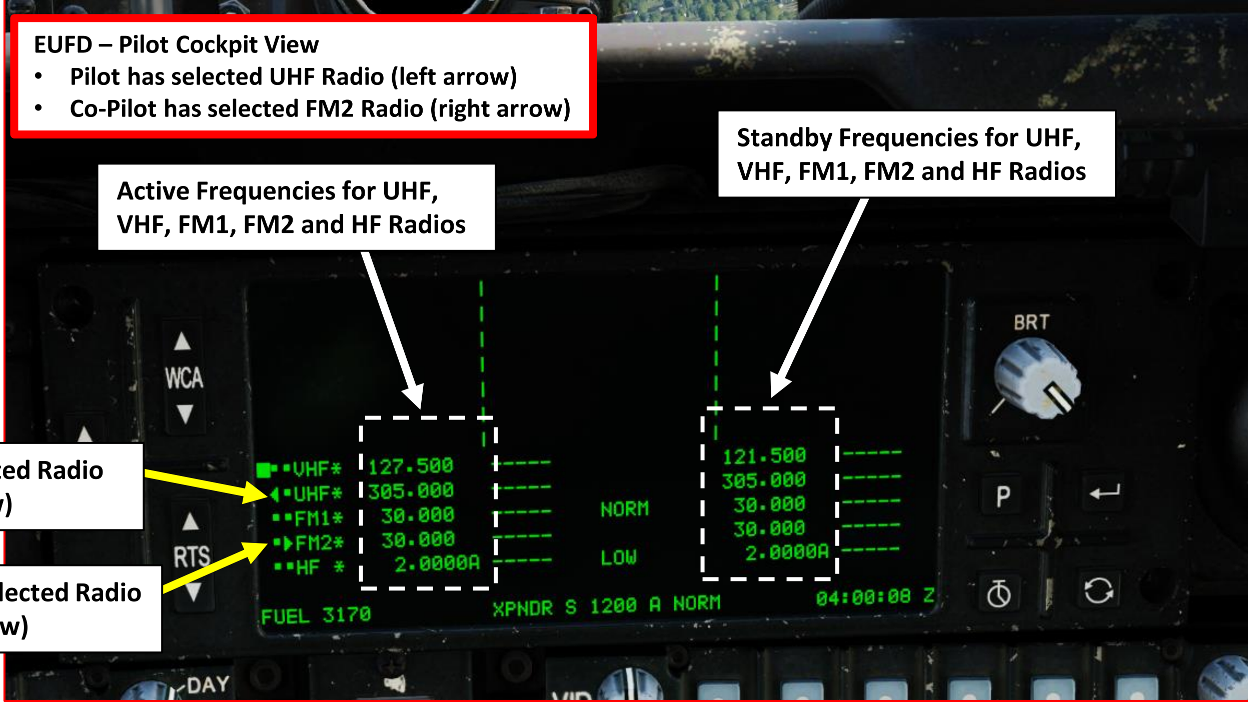
Other radio tools are available on the COMM panel and the COM MPD (Multi-Purpose Display) page.



RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch

- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*



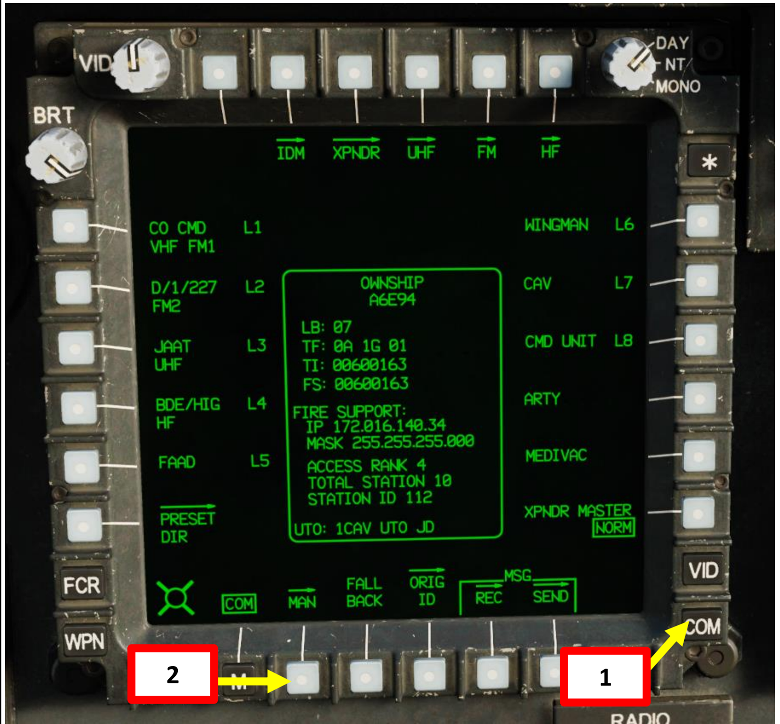


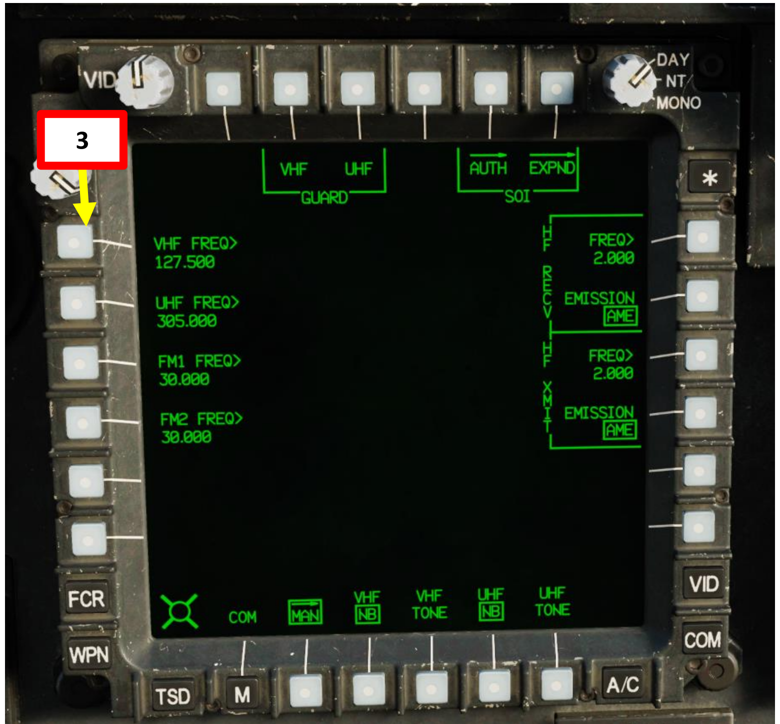
2 – ARC-186(V) VHF-AM RADIO
2.1 – Manual Frequency Tuning with COM Page

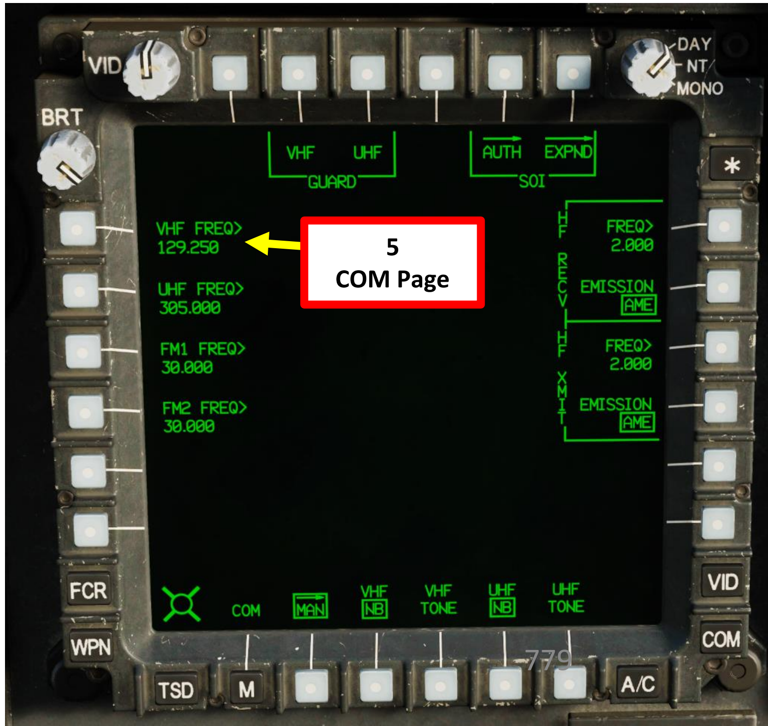
To manually tune a VHF-AM frequency via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to MAN (Manual).
3. Press on VAB next to VHF FREQ.
4. On KU (Keyboard Unit), enter the desired radio frequency (as an example “129.250”, then press ENTER.
5. The new active frequency will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).

Frequency Range:
- 108.00 to 115.975 MHz
- 116.00 to 151.975 MHz



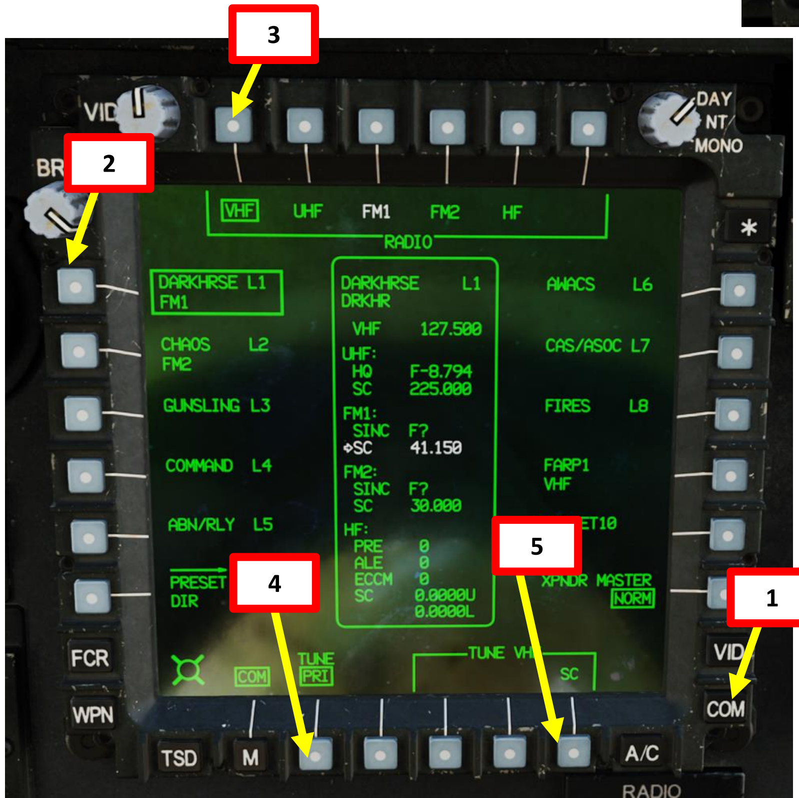


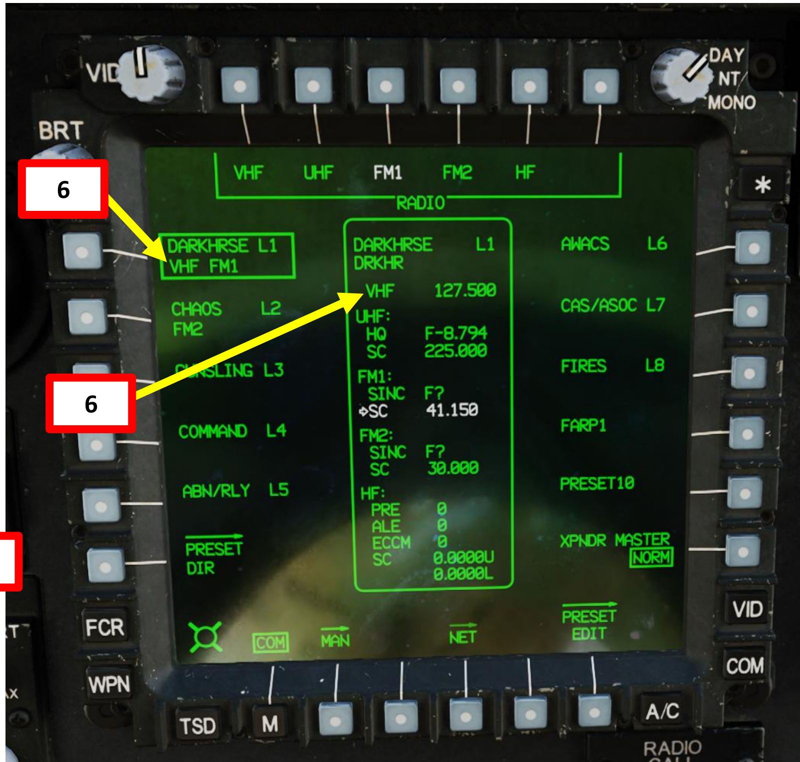


2 – ARC-186(V) VHF-AM RADIO
2.2 – Preset Frequency Tuning with COM Page

To select a preset VHF-AM channel via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to desired preset channel.
3. Press on VAB next to VHF RADIO.
4. Select TUNE Mode – PRI (Primary).
5. Set TUNE Selection – SC (Single Channel).
6. The new active preset channel will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).
7. Use the RTS (Ratio Transmit Select) Rocker to select VHF radio for transmission.

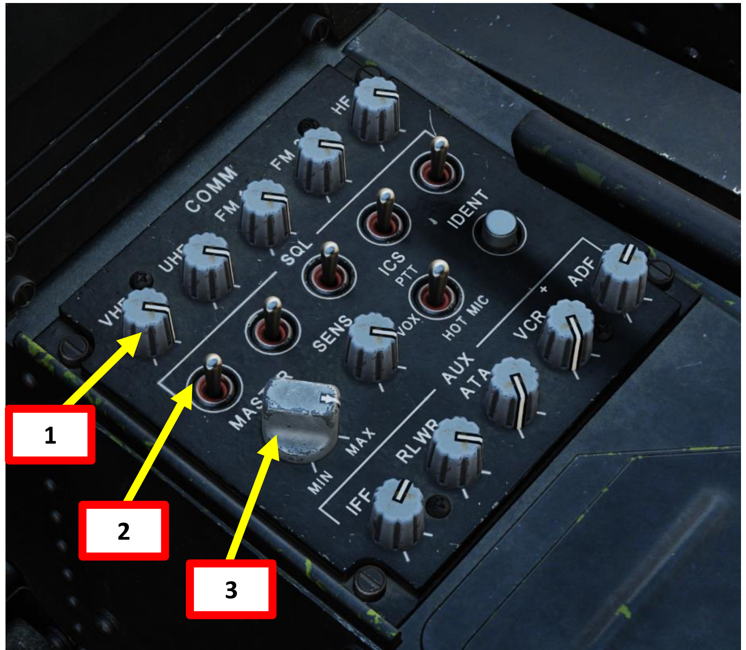


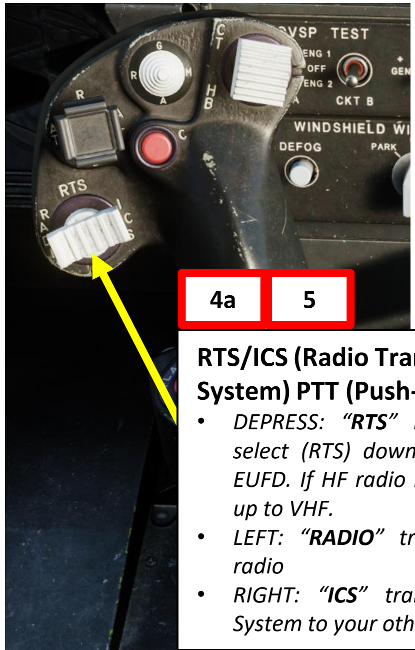


2 – ARC-186(V) VHF-AM RADIO
2.3 – Radio Transmission

To transmit on a manual VHF-AM frequency:

1. Adjust VHF Radio Volume – As Required
2. Set VHF Radio Squelch Switch FWD momentarily (ON).
3. Adjust Radio Master Volume Control Knob – As Required.
4. Depress the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch to move Left Selection Arrow DOWN on the EUFD (Enhanced Up-Front Display). Depress PTT/RTS until the Left Selection Arrow is next to the active VHF frequency indication.
   - Alternatively, you can use the RTS (Radio Transmit Select) Rocker Switch on the EUFD panel.
5. To transmit, press the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch LEFT (RALT + \) to transmit on the selected radio and frequency.
   - Alternatively, there is a Floor-Mounted Radio Transmit Switch behind the left anti-torque pedal. It allows the non-flying crewmember to transmit on their selected radio without interfering with the flight controls.





RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch

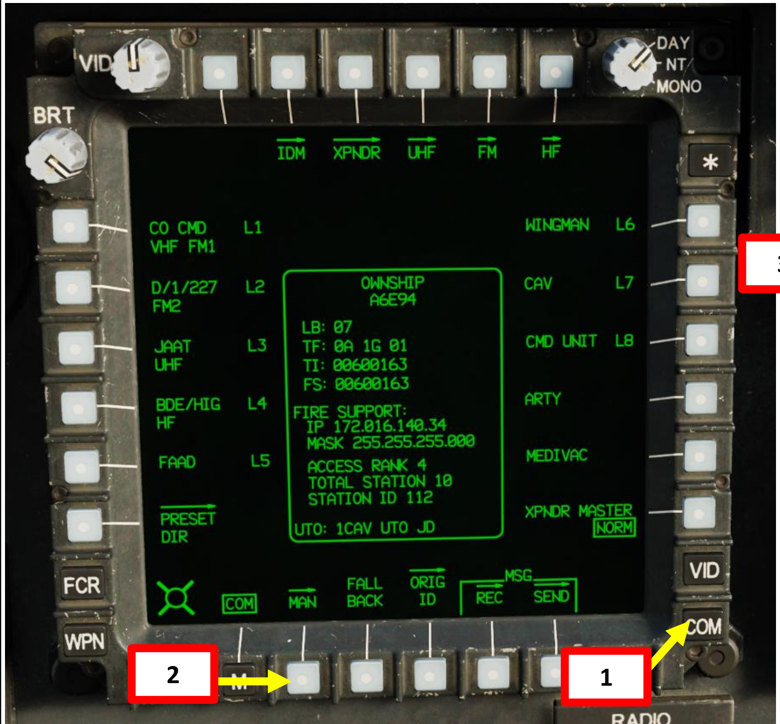
- *DEPRESS: “**RTS**” moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: “**RADIO**” transmits over the selected radio*
- *RIGHT: “**ICS**” transmits over the Intercom System to your other crew member.*

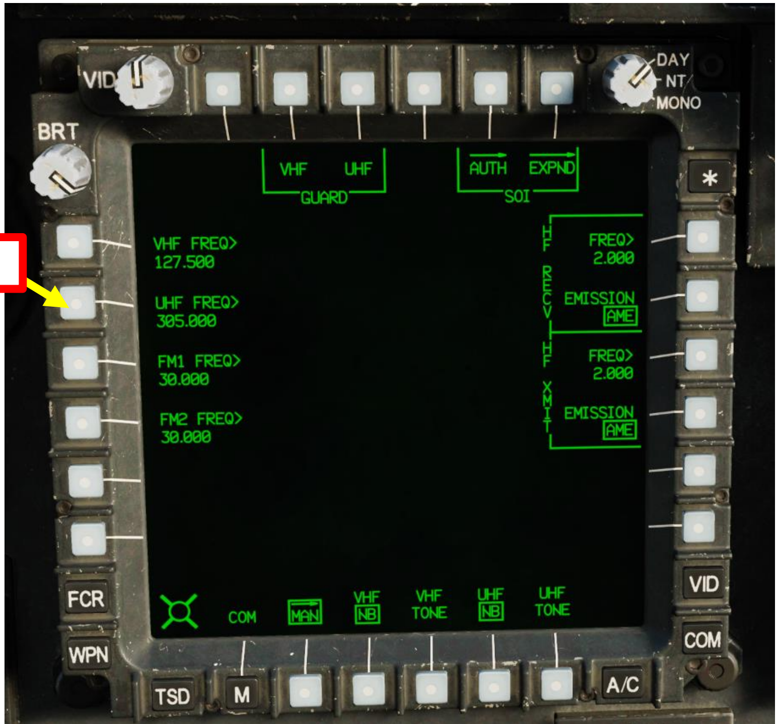
3 – ARC-164(V) UHF-AM RADIO
3.1 – Manual Frequency Tuning with COM Page

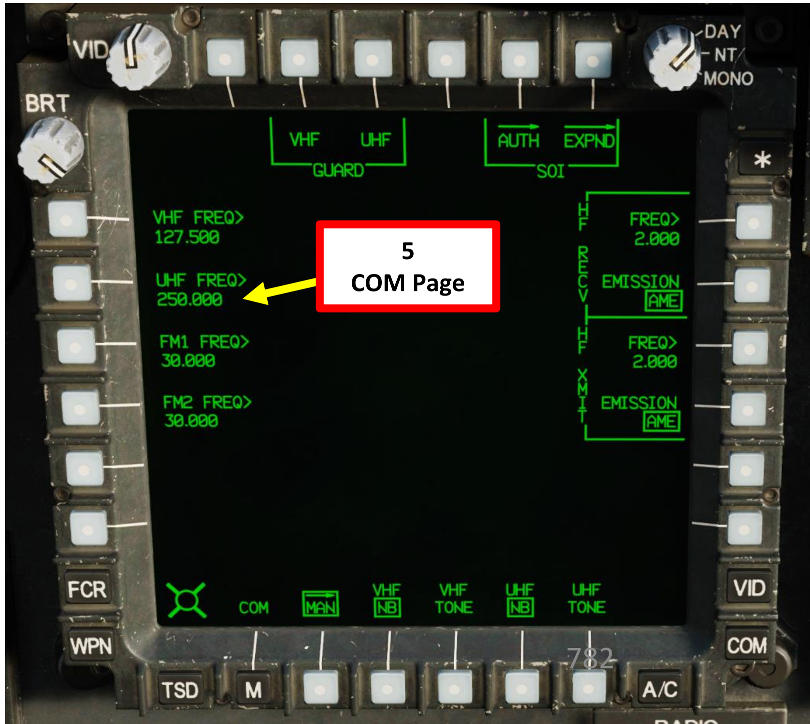
To manually tune a UHF-AM frequency via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to MAN (Manual).
3. Press on VAB next to UHF FREQ.
4. On KU (Keyboard Unit), enter the desired radio frequency (as an example "250.000", then press ENTER.
5. The new active frequency will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).

Frequency Range:
- 225.00 to 399.975 MHz



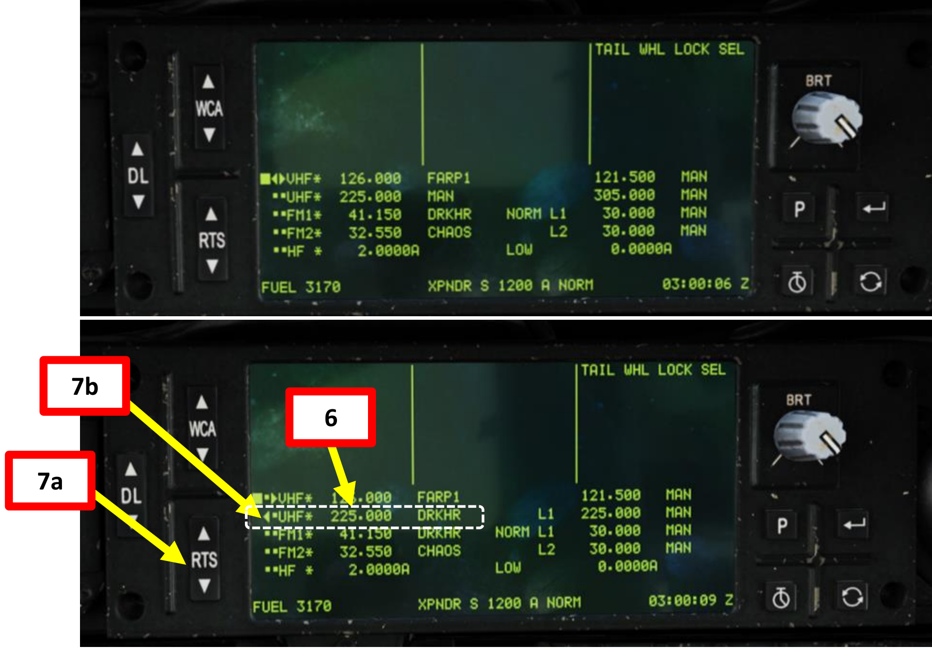


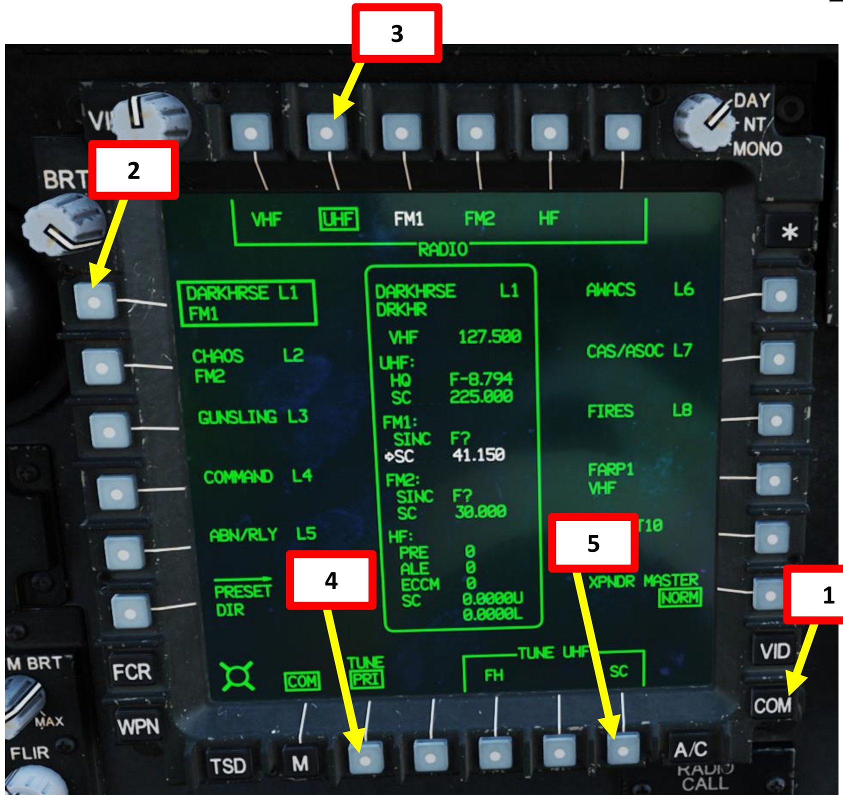


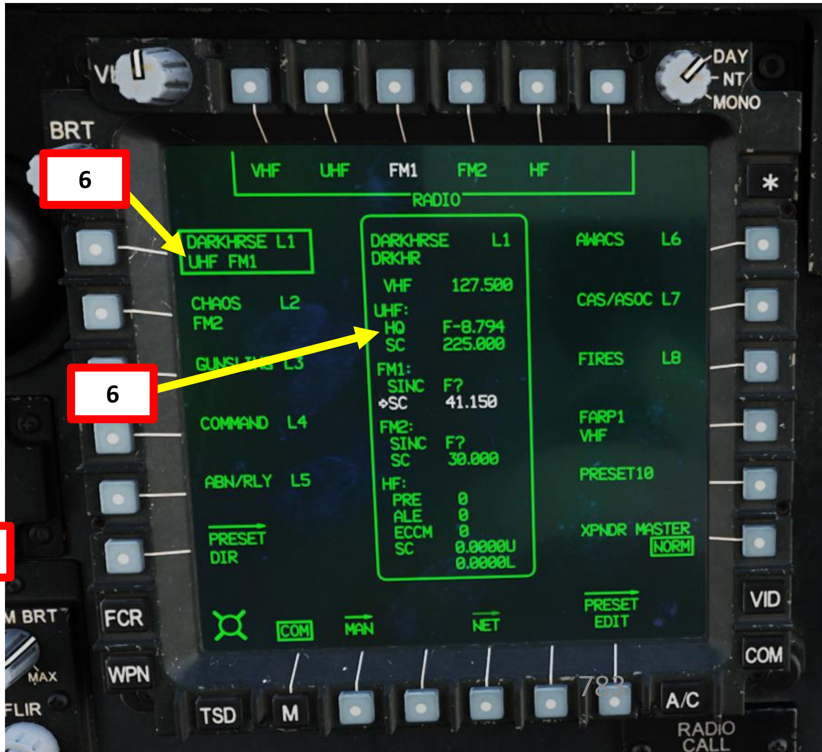
3 – ARC-164(V) UHF-AM RADIO
3.2 – Preset Frequency Tuning with COM Page

To select a preset UHF-AM channel via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to desired preset channel.
3. Press on VAB next to UHF RADIO.
4. Select TUNE Mode – PRI (Primary).
5. Set TUNE Selection – SC (Single Channel).
6. The new active preset channel will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).
7. Use the RTS (Ratio Transmit Select) Rocker to select UHF radio for transmission.



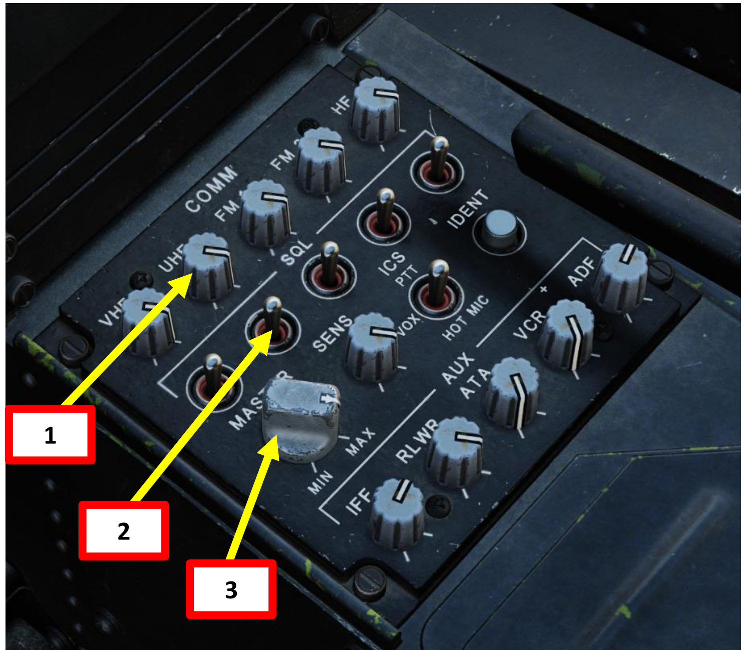


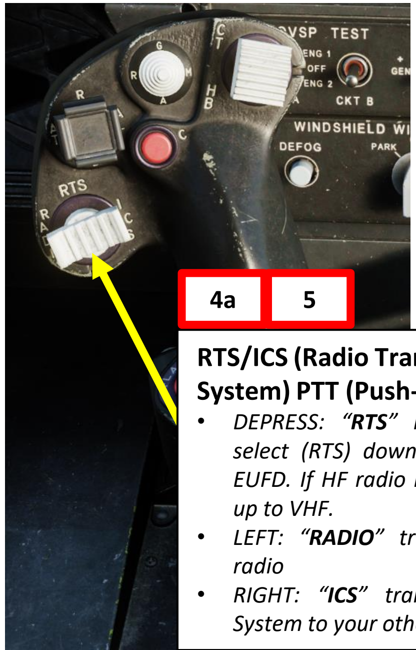


3 – ARC-164(V) UHF-AM RADIO
3.3 – Radio Transmission

To transmit on a manual UHF-AM frequency:

1. Adjust UHF Radio Volume – As Required
2. Set UHF Radio Squelch Switch FWD momentarily (ON).
3. Adjust Radio Master Volume Control Knob – As Required.
4. Depress the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch to move Left Selection Arrow DOWN on the EUFD (Enhanced Up-Front Display). Depress PTT/RTS until the Left Selection Arrow is next to the active UHF frequency indication.
   - Alternatively, you can use the RTS (Radio Transmit Select) Rocker Switch on the EUFD panel.
5. To transmit, press the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch LEFT (RALT + \) to transmit on the selected radio and frequency.
   - Alternatively, there is a Floor-Mounted Radio Transmit Switch behind the left anti-torque pedal. It allows the non-flying crewmember to transmit on their selected radio without interfering with the flight controls.





RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch

- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

4 – ARC-210D SINCGARS VHF-FM RADIOS (FM1 & FM2)

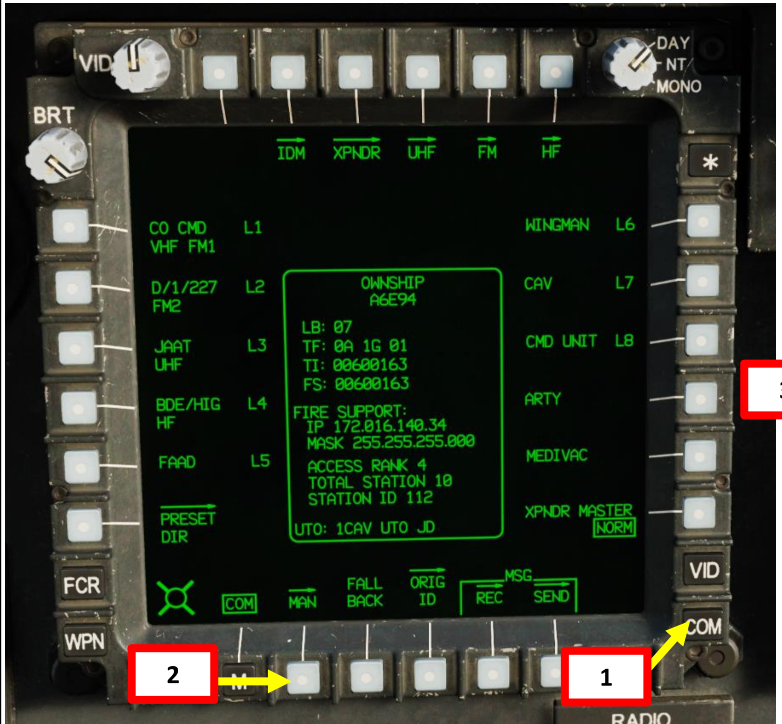
4.1 – Manual Frequency Tuning with COM Page

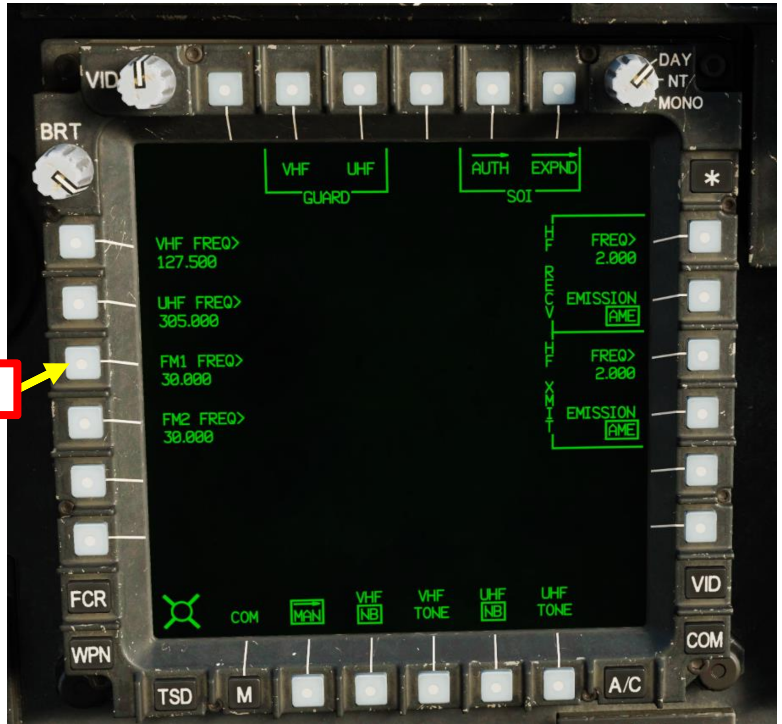
To manually tune a VHF-FM frequency via the COM page:

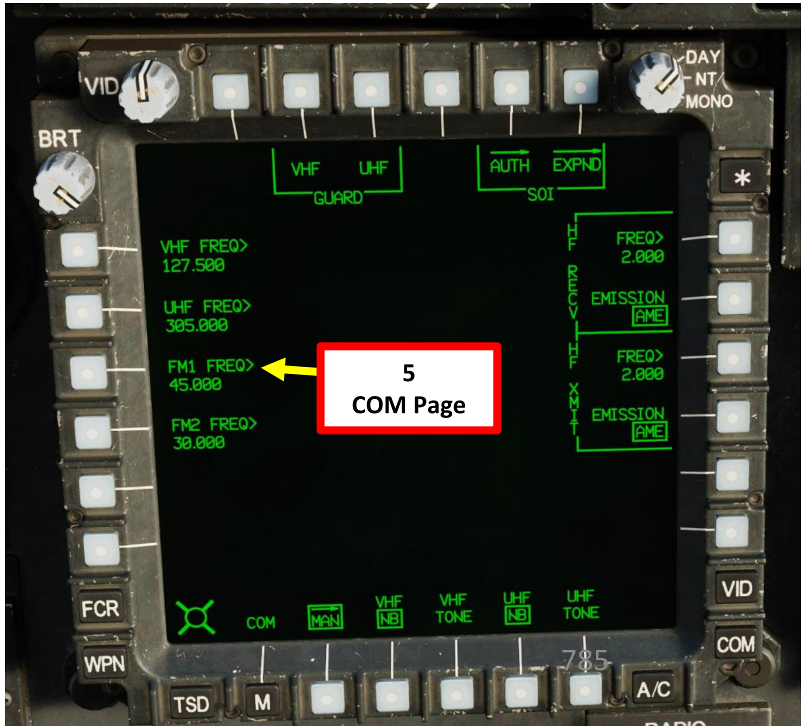
1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to MAN (Manual).
3. Press on VAB next to FM1 FREQ for the FM1 radio (or FM2 FREQ for the FM2 radio).
4. On KU (Keyboard Unit), enter the desired radio frequency (as an example "45.000", then press ENTER.
5. The new active frequency will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).

Frequency Range:

- 30.000 to 87.975 MHz



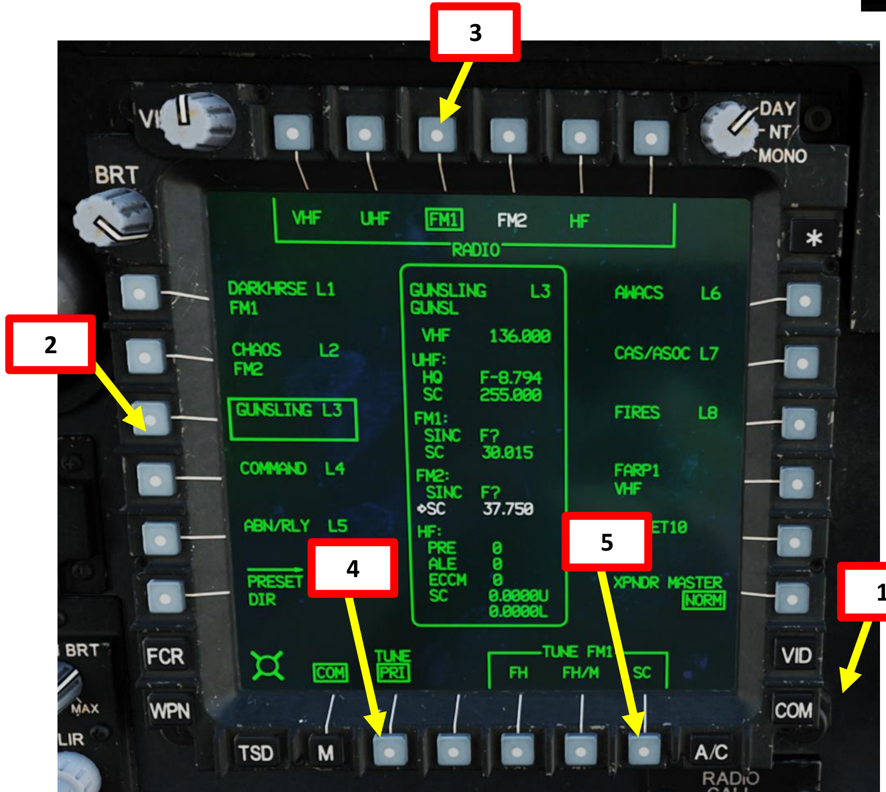


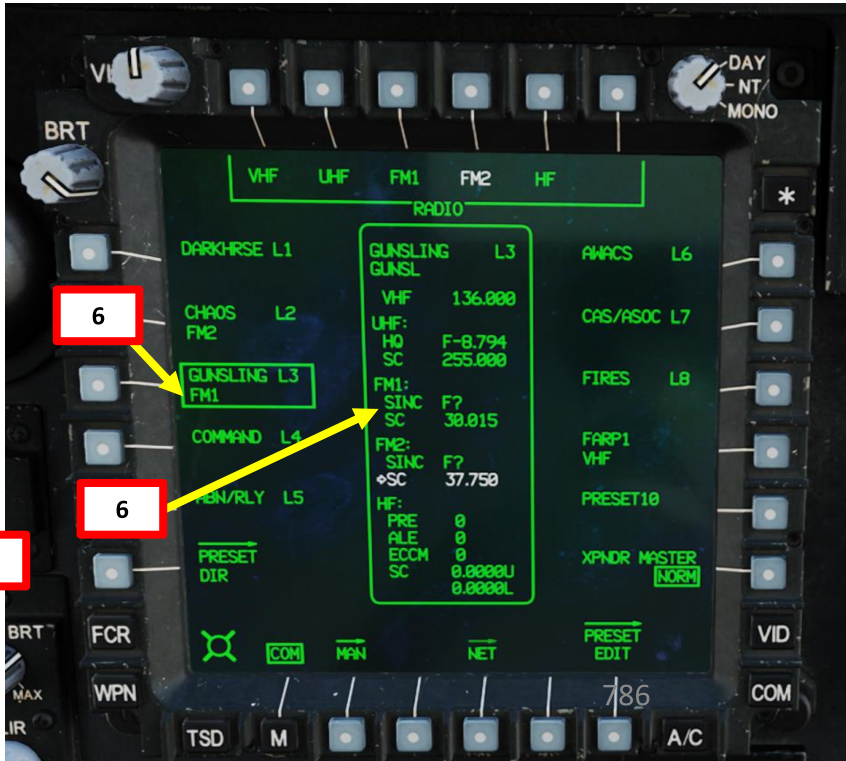


4 – ARC-210D SINCGARS VHF-FM RADIOS (FM1 & FM2)
4.2 – Preset Frequency Tuning with COM Page

To select a preset FM1 channel via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to desired preset channel.
3. Press on VAB next to FM1 RADIO.
4. Select TUNE Mode – PRI (Primary).
5. Set TUNE Selection – SC (Single Channel).
6. The new active preset channel will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).
7. Use the RTS (Ratio Transmit Select) Rocker to select FM1 radio for transmission.

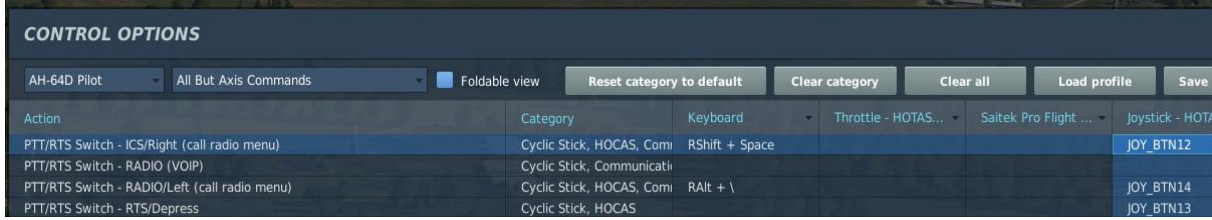




4 – ARC-210D SINCGARS VHF-FM RADIOS (FM1 & FM2)
4.3 – Radio Transmission

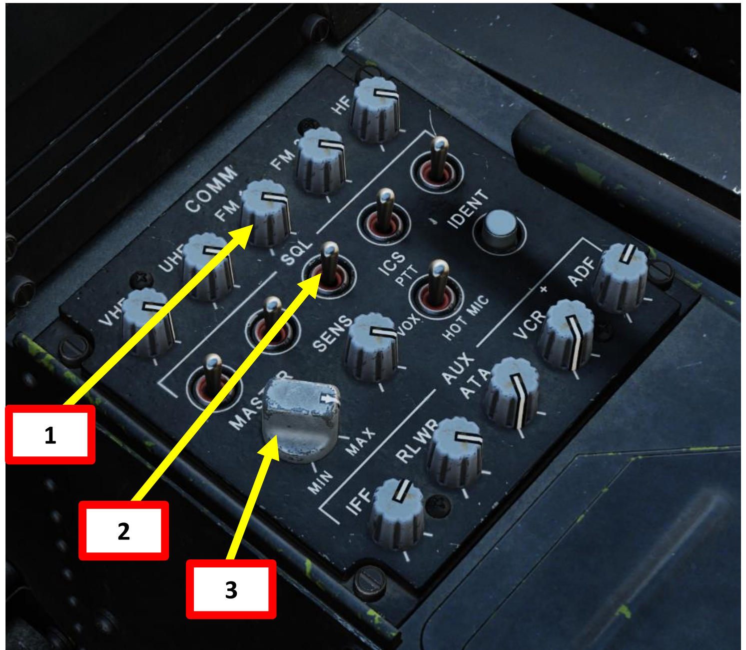
To transmit on a manual FM frequency with the ARC-210D FM1 radio:

1. Adjust FM1 Radio Volume – As Required
2. Set FM1 Radio Squelch Switch FWD momentarily (ON).
3. Adjust Radio Master Volume Control Knob – As Required.
4. Depress the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch to move Left Selection Arrow DOWN on the EUFD (Enhanced Up-Front Display). Depress PTT/RTS until the Left Selection Arrow is next to the active FM1 frequency indication.
   - Alternatively, you can use the RTS (Radio Transmit Select) Rocker Switch on the EUFD panel.
5. To transmit, press the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch LEFT (RALT + \) to transmit on the selected radio and frequency.
   - Alternatively, there is a Floor-Mounted Radio Transmit Switch behind the left anti-torque pedal. It allows the non-flying crewmember to transmit on their selected radio without interfering with the flight controls.

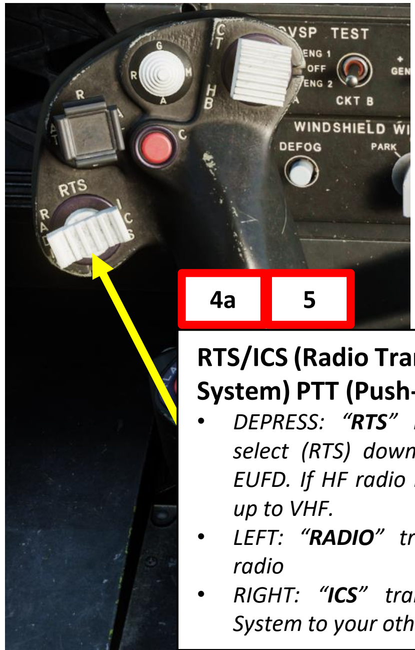


4b
Selection Arrow (left)

4a
RTS (Radio Transmit Select) Rocker Switch



1
2
3



4a
5

RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch

- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

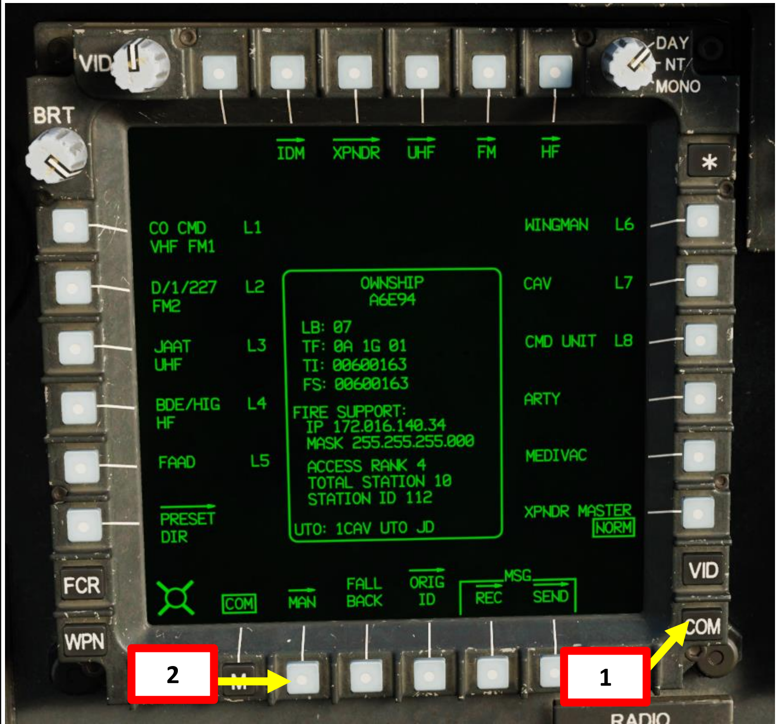
5
Floor-Mounted Radio Transmit Switch

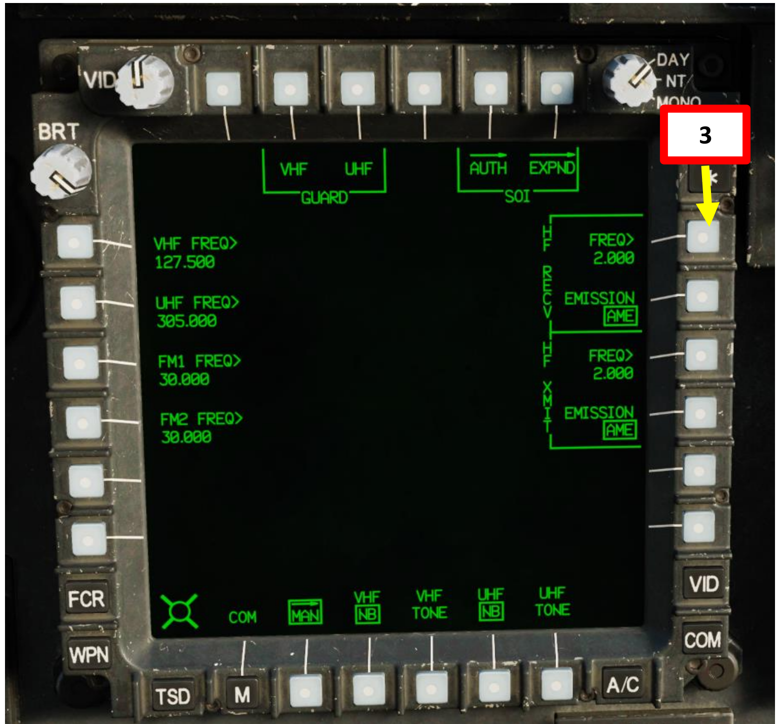
5 – ARC-220 HF RADIO
5.1 – Manual Frequency Tuning with COM Page

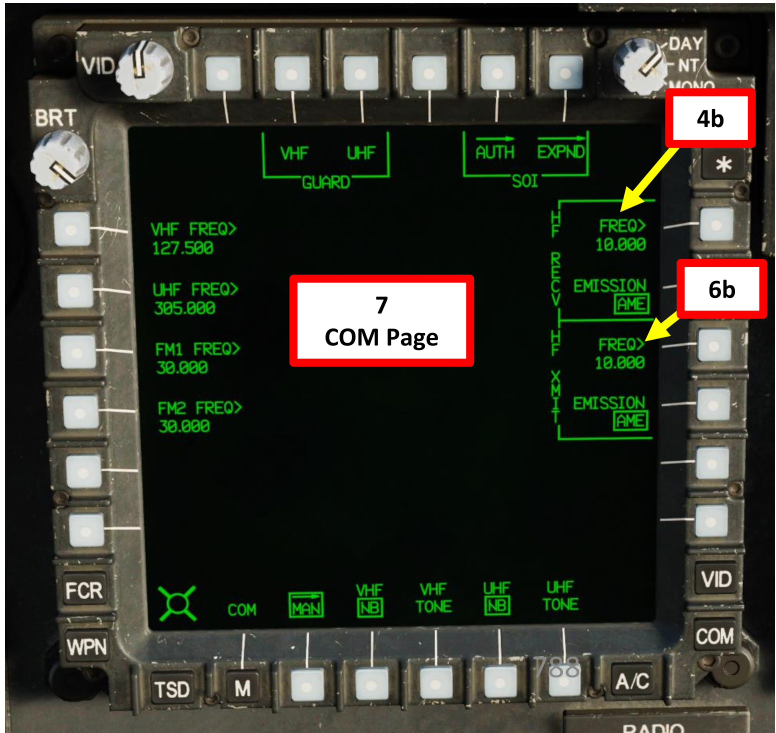
To manually tune a HF frequency via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to MAN (Manual).
3. Press on VAB next to HF RECV FREQ.
4. On KU (Keyboard Unit), enter the desired radio receiver frequency (as an example “10.0000”, then press ENTER.
5. If the HF XMIT FREQ field is not set properly, press on VAB next to HF XMIT FREQ.
6. Then, on KU (Keyboard Unit), enter the desired radio transmitter frequency (as an example “10.0000”, then press ENTER.
7. The new active frequency will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).

Frequency Range:
- 2.0000 to 29.9999 MHz



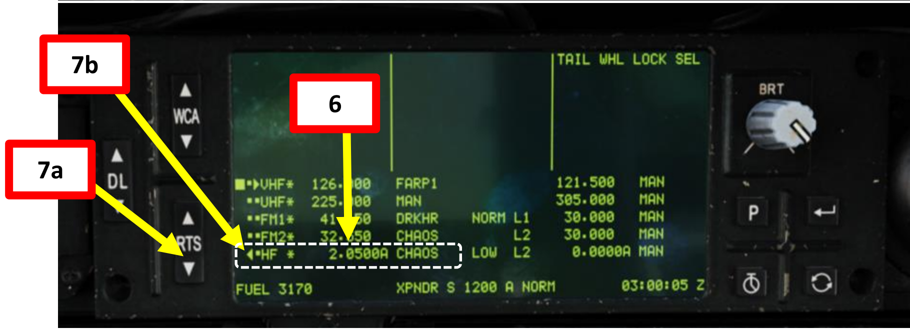


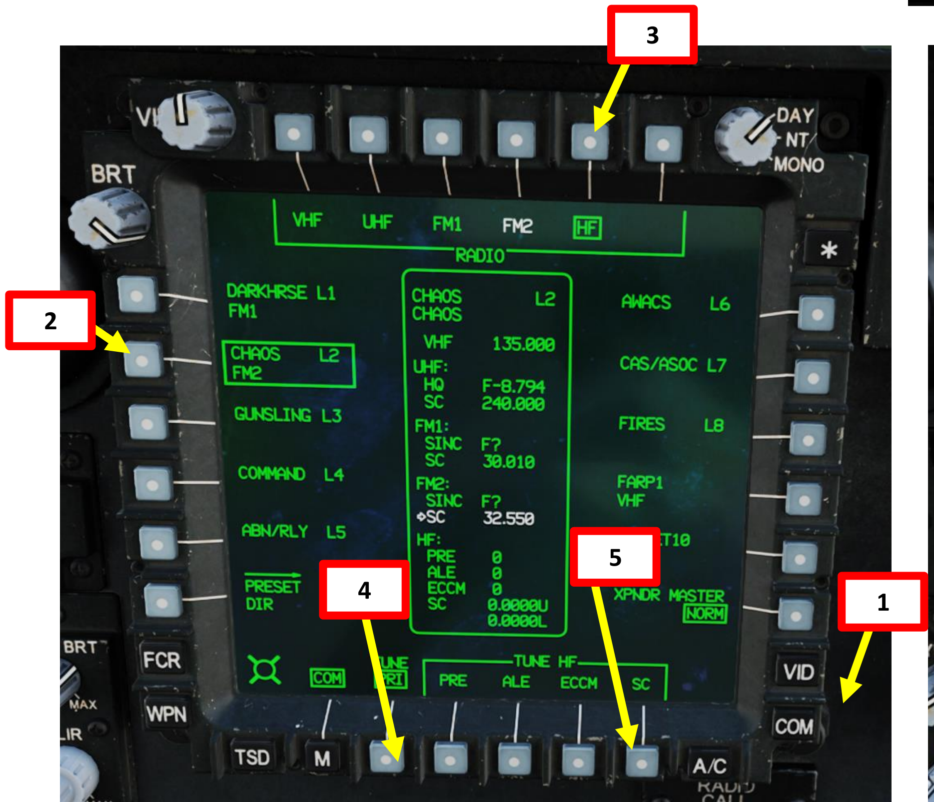


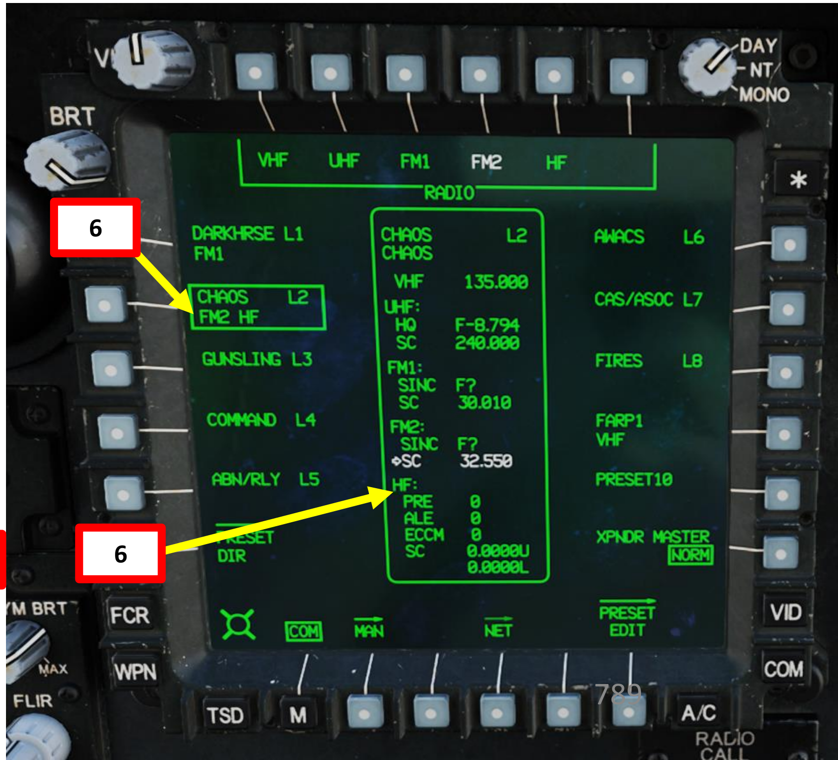
5 – ARC-220 HF RADIO
5.2 – Preset Frequency Tuning with COM Page

To select a preset HF channel via the COM page:

1. Press on the COM FAB (Fixed Action Button) to access the Communications menu.
2. Press on VAB (Variable Action Button) next to desired preset channel.
3. Press on VAB next to HF RADIO.
4. Select TUNE Mode – PRI (Primary).
5. Set TUNE Selection – SC (Single Channel).
6. The new active preset channel will be visible on the COM page and on the EUFD (Enhanced Up-Front Display).
7. Use the RTS (Ratio Transmit Select) Rocker to select HF radio for transmission.



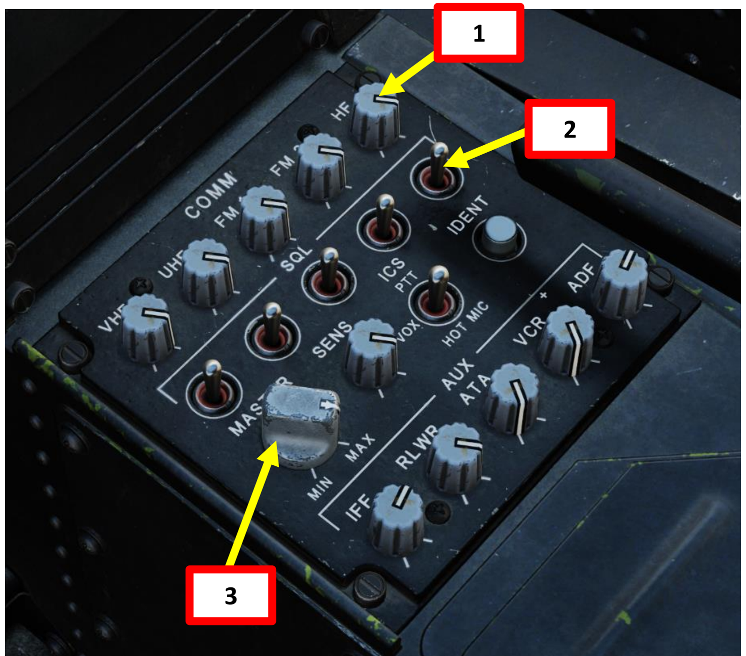


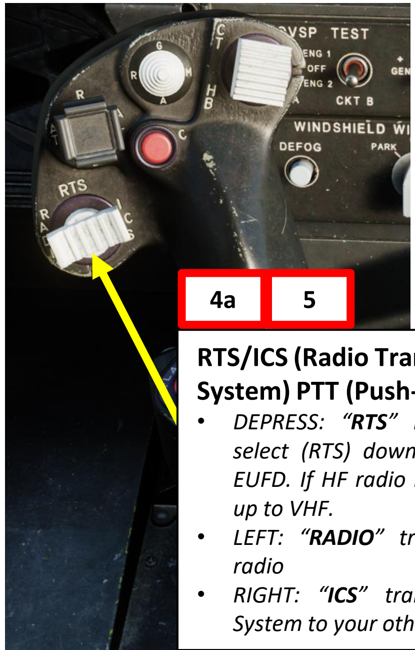


5 – ARC-220 HF RADIO
5.3 – Radio Transmission

To transmit on a manual HF frequency:

1. Adjust HF Radio Volume – As Required
2. Set HF Radio Squelch Switch FWD momentarily (ON).
3. Adjust Radio Master Volume Control Knob – As Required.
4. Depress the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch to move Left Selection Arrow DOWN on the EUFD (Enhanced Up-Front Display). Depress PTT/RTS until the Left Selection Arrow is next to the active HF frequency indication.
    - Alternatively, you can use the RTS (Radio Transmit Select) Rocker Switch on the EUFD panel.
5. To transmit, press the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch LEFT (RALT + \) to transmit on the selected radio and frequency.
    - Alternatively, there is a Floor-Mounted Radio Transmit Switch behind the left anti-torque pedal. It allows the non-flying crewmember to transmit on their selected radio without interfering with the flight controls.



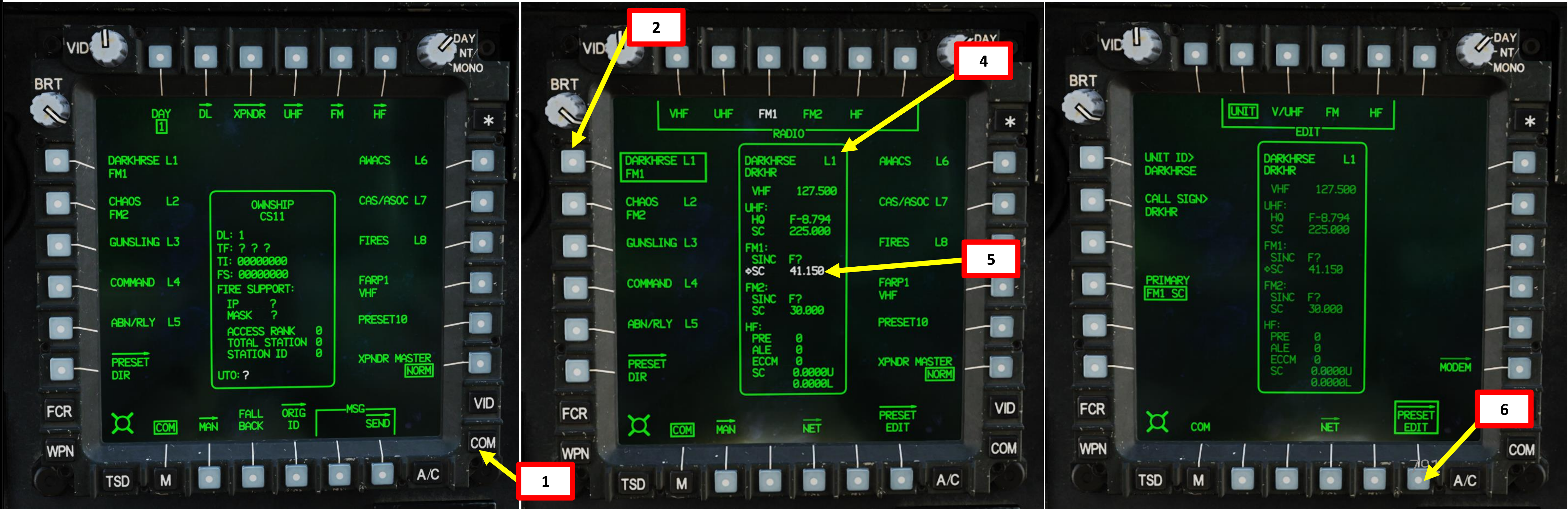


6 – HOW TO EDIT A PRESET CHANNEL
Changing Preset Channel 1 to HAMMER – VHF1 128.500 MHz

Each preset channel can be modified; from the COM page, you can change the callsign, radio and radio frequency used to transmit/receive on.

In this example, we will modify Preset Channel 1 (**Callsign Darkhorse, FM1 radio, 41.150 MHz**) and change it with a new callsign (**Hammer**), radio (**VHF1 Single Channel**) and frequency (**128.500 MHz**).

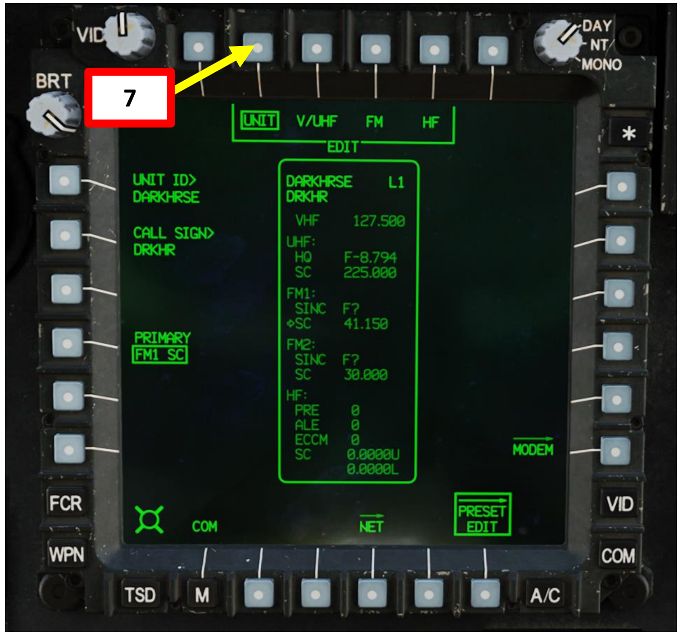
1. Select COM page
2. All presets are listed in the MAIN COM page.
3. Select desired Preset Channel. We will select Preset Channel 1 (Darkhorse).
4. In the RADIO window, we see that Preset Channel 1 is set to a FM1 as its primary radio with a frequency of 41.150 MHz.
5. The radio listed in white indicates which radio is selected for this Preset Channel (FM1 in this case).
6. Select PRESET EDIT.

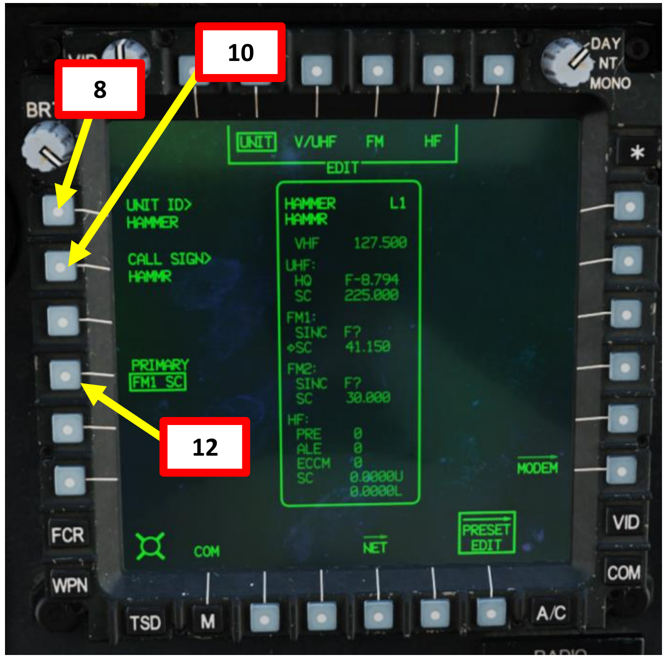


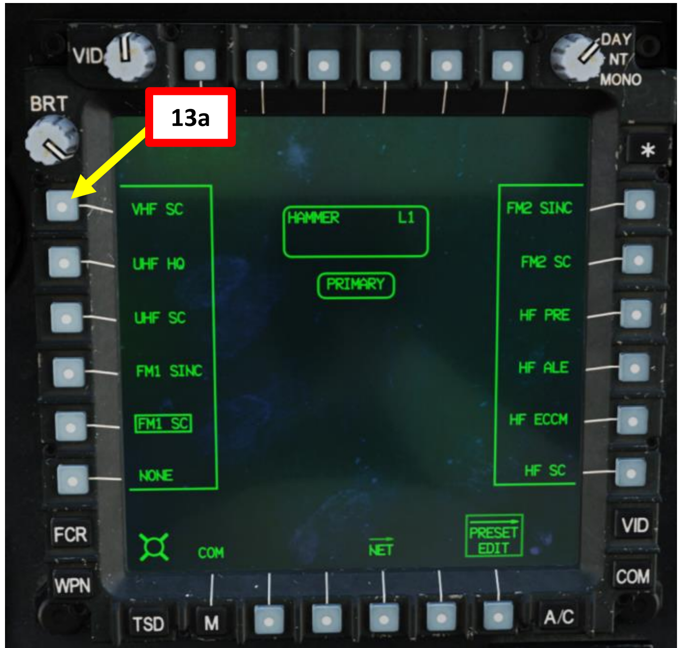
6 – HOW TO EDIT A PRESET CHANNEL
Changing Preset Channel 1 to HAMMER – VHF1 128.500 MHz

New Preset Channel 1: Callsign **Hammer**, **VHF1 Single Channel radio** with frequency **128.500 MHz**.

7. Select UNIT.
8. Select UNIT ID (boxed when selected)
9. On the KU (Keyboard Unit), type desired unit name (HAMMER), then press ENTER.
10. Select CALL SIGN (boxed when selected)
11. On the KU (Keyboard Unit), type desired callsign (HAMMR), then press ENTER.
12. Select PRIMARY RADIO.
13. Select VHF SC (Single Channel)



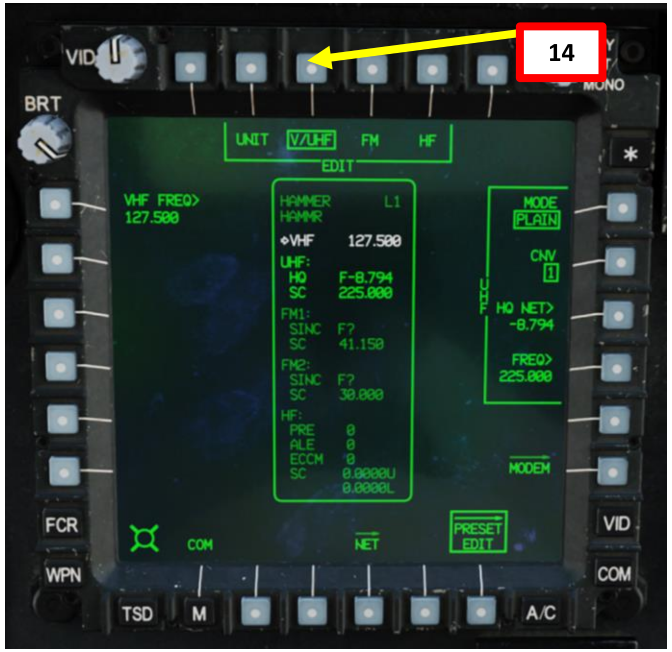


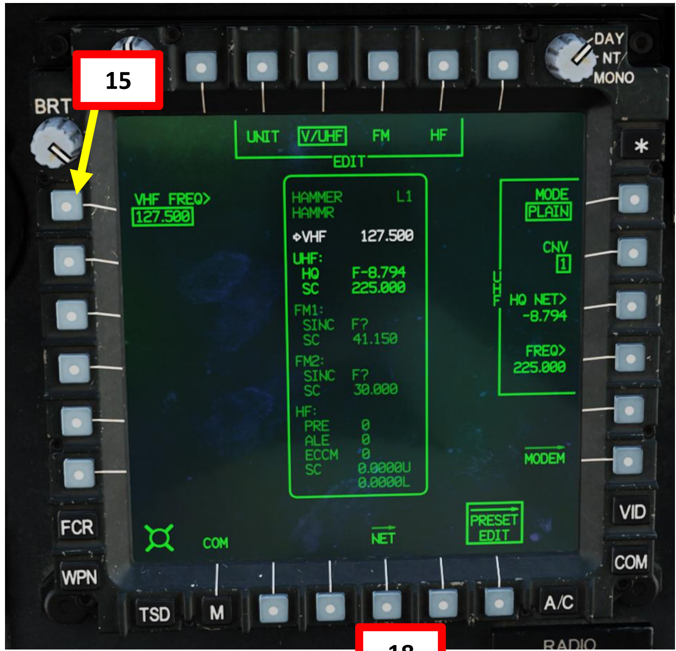


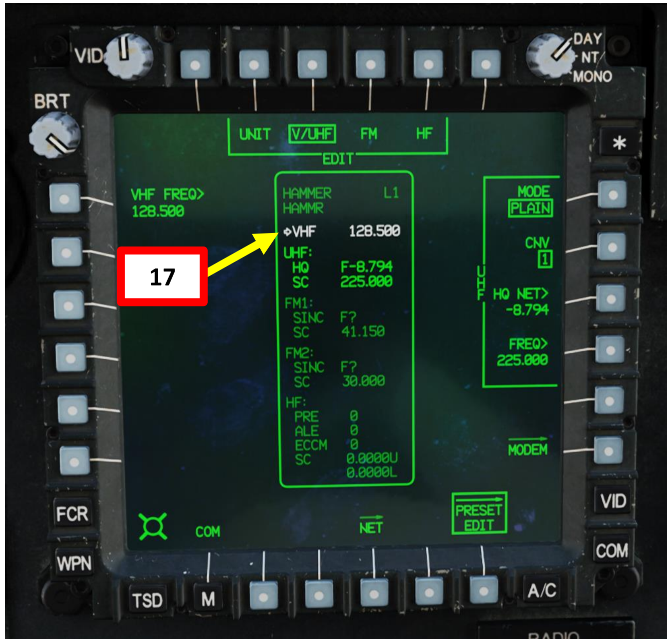
6 – HOW TO EDIT A PRESET CHANNEL
Changing Preset Channel 1 to HAMMER – VHF1 128.500 MHz

New Preset Channel 1: Callsign **Hammer**, **VHF1 Single Channel radio** with frequency **128.500 MHz**.

14. Select V/UHF EDIT
15. Select VHF FREQ (boxed when selected)
16. On the KU (Keyboard Unit), type desired frequency (128.500), then press ENTER.
17. Confirm that VHF field is updated correctly and is displayed in white (indicates VHF1 is set as the primary radio for Preset Channel 1).
18. Return to UNIT and check that network window information is updated as well.

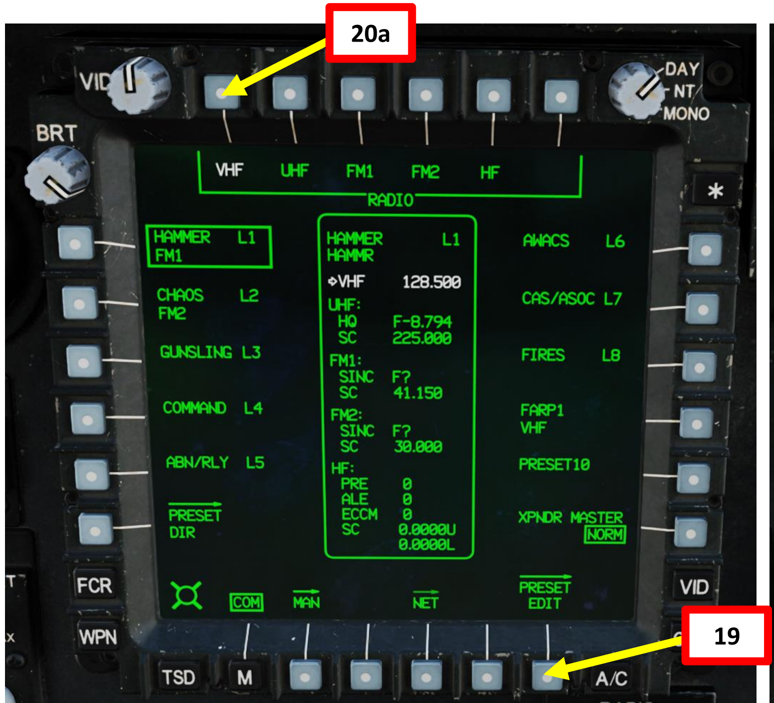


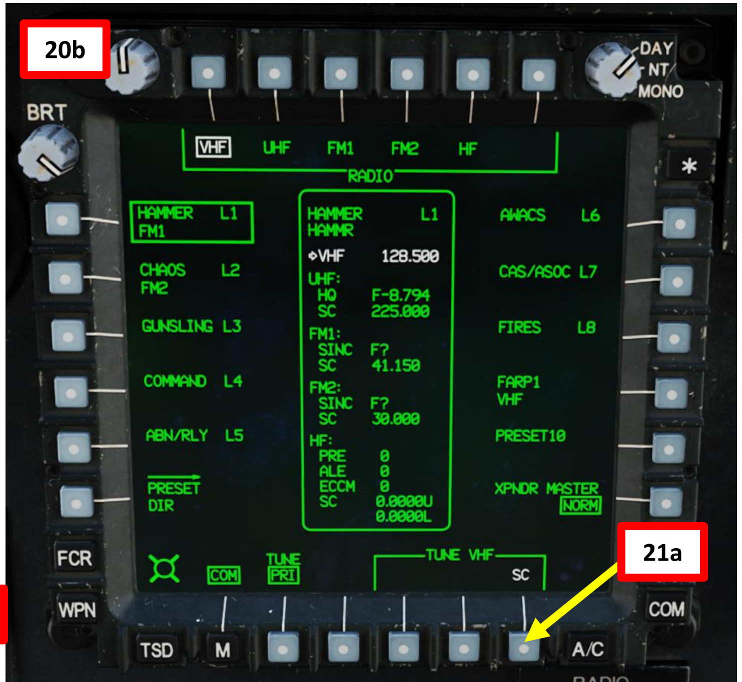




6 – HOW TO EDIT A PRESET CHANNEL
Changing Preset Channel 1 to HAMMER – VHF1 128.500 MHz

19. Exit PRESET EDIT menu.
20. Select VHF.
21. Select SC (Single Channel).
22. And that's it! Preset Channel 1 is now set to: Callsign **Hammer**, **VHF1 Single Channel radio** with frequency **128.500 MHz**.





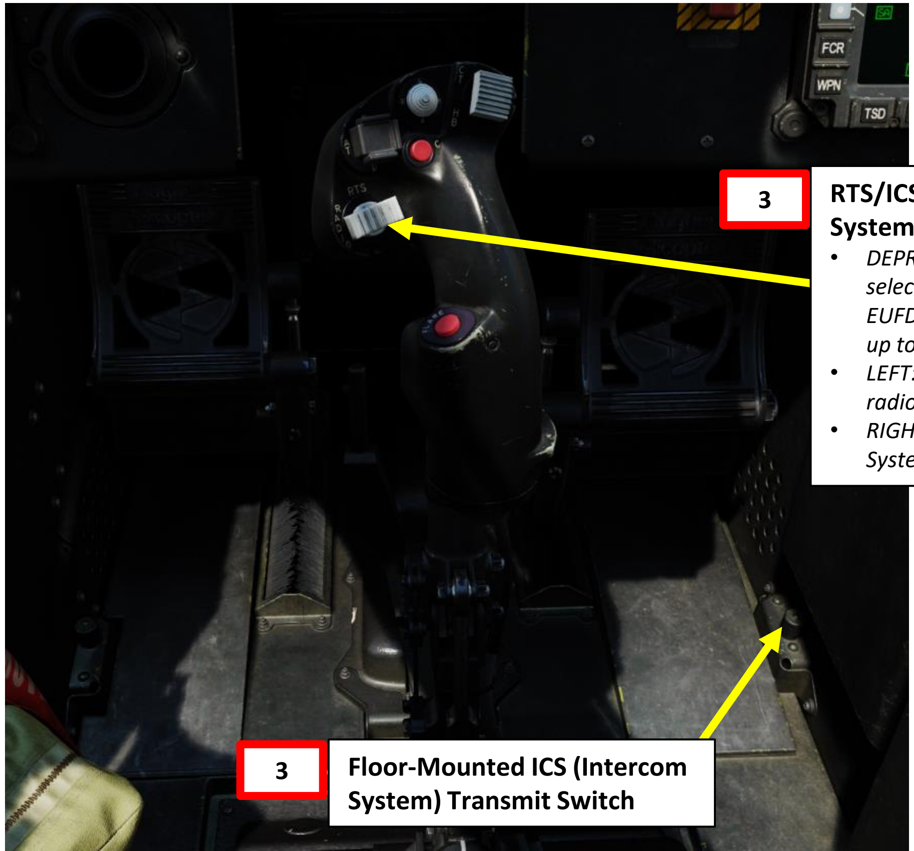
7 – ICS (INTERCOM SYSTEM)

To communicate on the intercom:

1. Set ICS (Intercom System) Mode Switch – As required.
2. Adjust SENS (Sensitivity) Control Knob – As required.
3. To transmit, press the PTT/RTS (Push-to-Talk/Radio Transmit Select) Switch RIGHT (RSHIFT + SPACEBAR) to transmit on the Intercom.
    - Alternatively, there is a Floor-Mounted ICS Transmit Switch behind the right anti-torque pedal. It allows the non-flying crewmember to transmit on the intercom system without interfering with the flight controls.

ICS (Intercom System) Mode Switch
- *FWD: **PTT** (Push-to-Talk), the ICS will only transmit when the ICS PTT (push-to-talk) switch is pressed.*
- *MIDDLE: **VOX** (Voice), the ICS will transmit automatically when the pilot speaks loud enough to break squelch. This helps reduce transmission of unwanted background noise.*
- *AFT: **HOT MIC** (Microphone), the ICS transmits continuously, whether the pilot speaks or not.*

SENS (Sensitivity) Control Knob
- *Adjusts the sensitivity of the ICS squelch circuit when the ICS switch is in the VOX position. The ICS will only transmit when volume levels exceed the selected sensitivity.*



3

RTS/ICS (Radio Transmit Select/Intercom System) PTT (Push-to-Talk) Switch
- *DEPRESS: "**RTS**" moves the radio transmit select (RTS) down to the next radio on the EUFD. If HF radio is selected, moves RTS back up to VHF.*
- *LEFT: "**RADIO**" transmits over the selected radio*
- *RIGHT: "**ICS**" transmits over the Intercom System to your other crew member.*

3

Floor-Mounted ICS (Intercom System) Transmit Switch

1

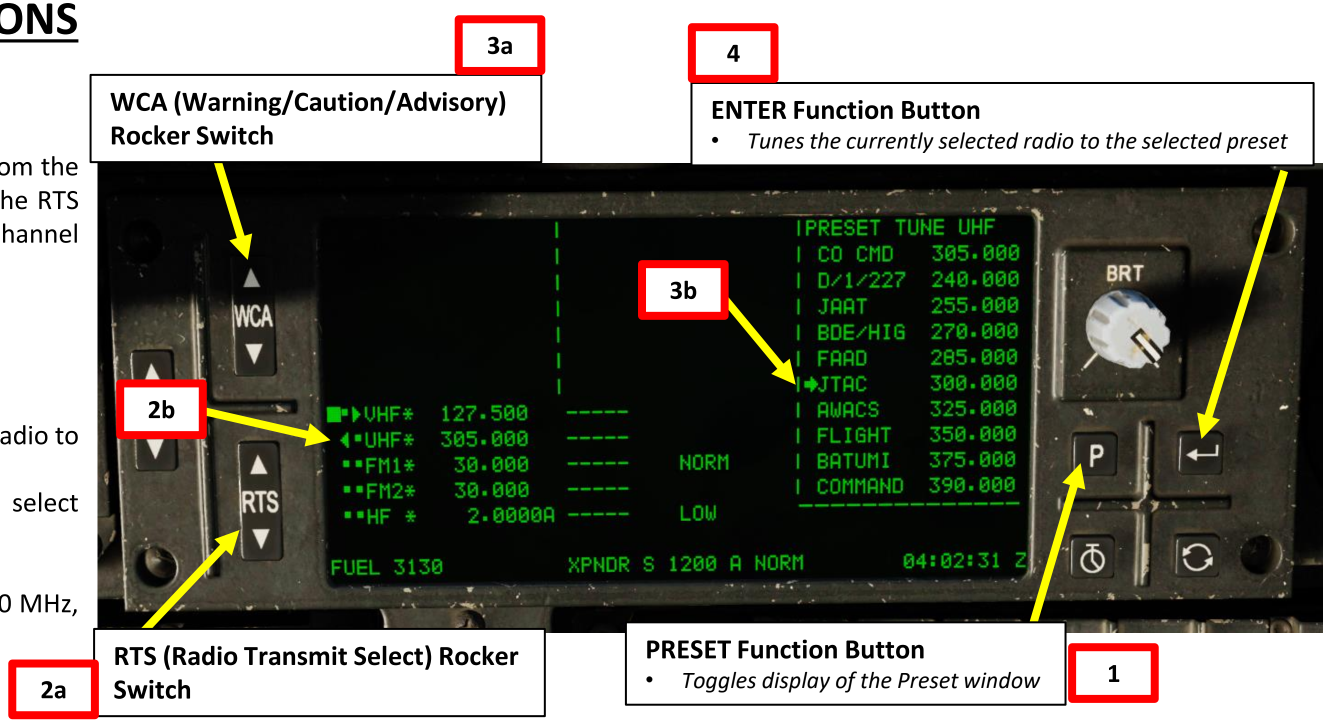
2

8 – EUFD (ENHANCED UP-FRONT DISPLAY) FUNCTIONS
8.1 – PRESET FREQUENCY TUNING

The EUFD's Preset list can be displayed at any time to access the 10 preset networks from the top-level COM page. The Preset list will only display preset frequencies for the radio the RTS (Radio Transmit Select) switch is set to and is only capable of tuning single-channel frequencies.

To tune a frequency via the EUFD Preset function:

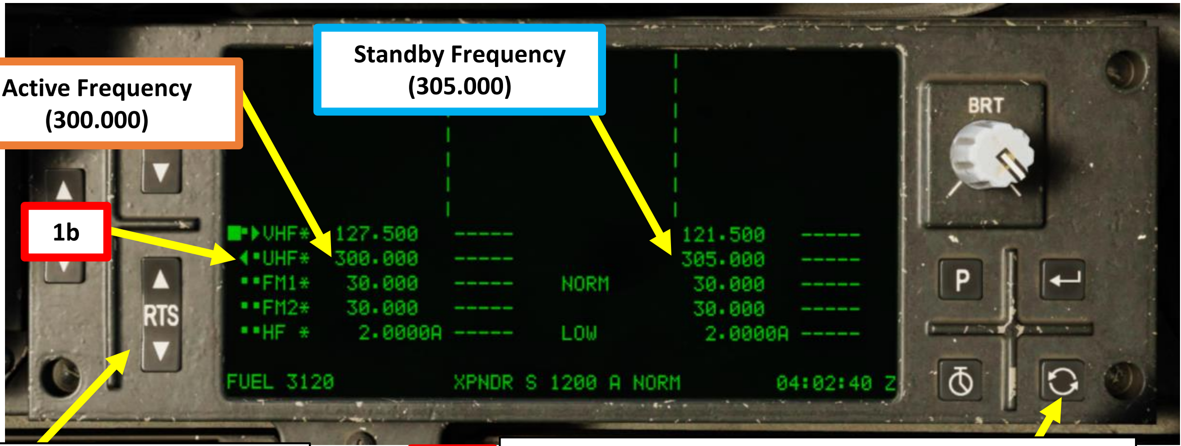
1. Press the Preset Button
2. Use the RTS (Radio Transmit Select) Rocker Switch on the EUFD panel to select the radio to tune. The left selection arrow indicates which radio is selected.
3. Use the WCA (Warning/Caution/Advisory) Rocker Switch on the EUFD panel to select frequency from the preset list.
4. Press ENTER Button on the EUFD panel.
5. In this example, we have selected the UHF Radio with the preset frequency 300.000 MHz, which is for the JTAC.



8 – EUFD (ENHANCED UP-FRONT DISPLAY) FUNCTIONS
8.2 – FREQUENCY SWAP

The “swap” button which swaps the currently selected radio’s primary frequency/settings with that radio’s standby frequency/settings.

1. Use the RTS (Radio Transmit Select) Rocker Switch on the EUFD panel to select the radio to tune. The left selection arrow indicates which radio is selected.
2. Press the SWAP Function Button to swap the active and standby frequencies for the selected radio.

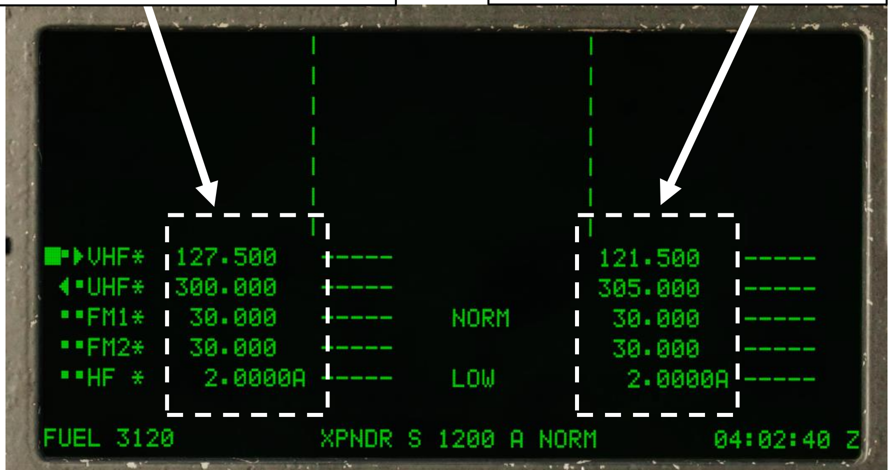


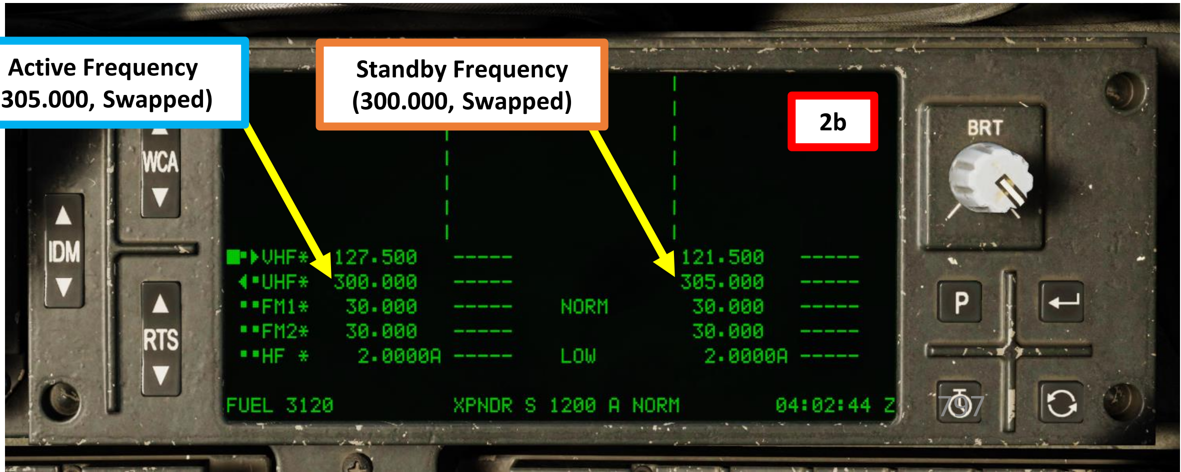
1a RTS (Radio Transmit Select) Rocker Switch

2a **SWAP Function Button**
- *Swaps the radio frequency, encryption mode, and IDM net configuration with the standby values of the currently selected radio.*

Active Frequencies for UHF, VHF, FM1, FM2 and HF Radios

Standby Frequencies for UHF, VHF, FM1, FM2 and HF Radios





SECTION SUMMARY

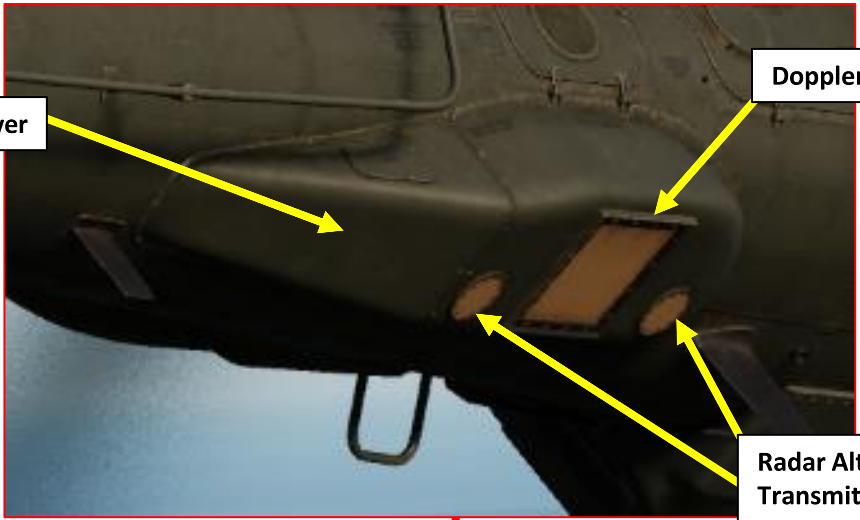
1 – Navigation Introduction
1.1 – Introduction

Navigation in the AH-64 is mostly done through the TSD (Tactical Situation Display), HDU (Helmet Display Unit), and FLT (Flight) A/C (Aircraft) page. The Standby Magnetic Compass can also be used as a backup. The Apache uses a variety of navigation methods to direct you to mission locations. Depending on the mission or stage in the mission, you may use different navigation sources.

1 – Navigation Introduction
1.1 – Introduction

The Apache's navigation system consists of the following components:

- 2 x Embedded GPS (Global Positioning System) Inertial Navigation Systems (EGI)
- AN/ASN-157 Doppler Radar Velocity Sensor (DRVS)
- Helicopter Air Data System (HADS), which consists of a network of air pressure probes
- Radar Altimeter
- Automatic Direction Finder (ADF)
- High Integrated Air Data Computer (HIADC)
- Flight Management Computer (FMC)



AH-64D APACHE

PART 19 – NAVIGATION

1 – Navigation Introduction
1.2 – Navigation System Interfaces

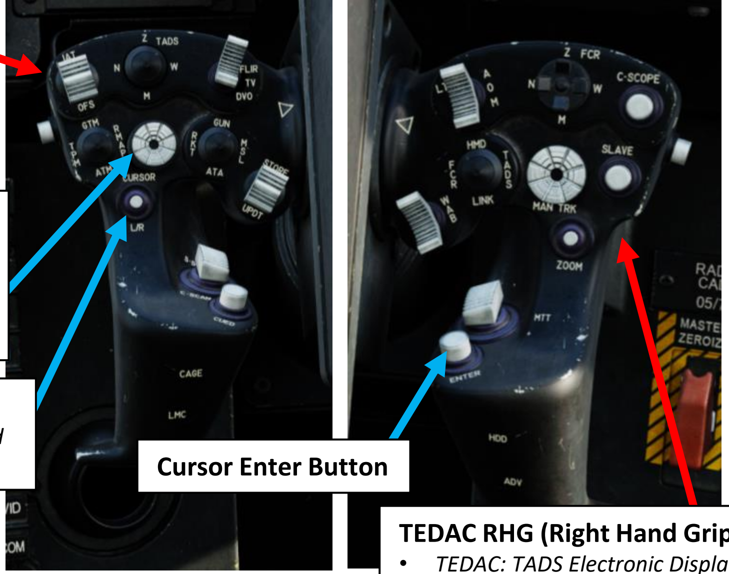
Navigation systems are controlled through the following interfaces:

- **TSD** (Tactical Situation Display) page Variable Action Buttons, which allow you to configure navigation systems and navigation aids
- **KU** (Keyboard Unit), which allows you to enter navigation data
- **Cursor controls** on the collective
    - Note: Cursor controls are also duplicated for the Co-Pilot/Gunner on the left and right TEDAC grips

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

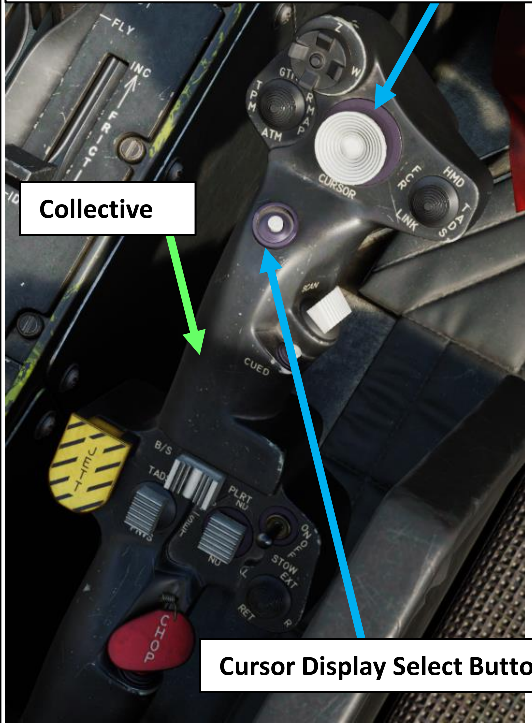
Cursor Display Select Button
- *Toggles the cursor to the other MPD and centers it on the screen.*



Cursor Enter Button

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*



Collective

Cursor Display Select Button

KU (Keyboard Unit)
- *The Keyboard Unit (KU) allows crewmembers to enter alphanumeric data into MPD (Multi-Purpose Display) fields and do simple arithmetic calculations. It can also be used as a simple scratchpad for notetaking.*

Cursor

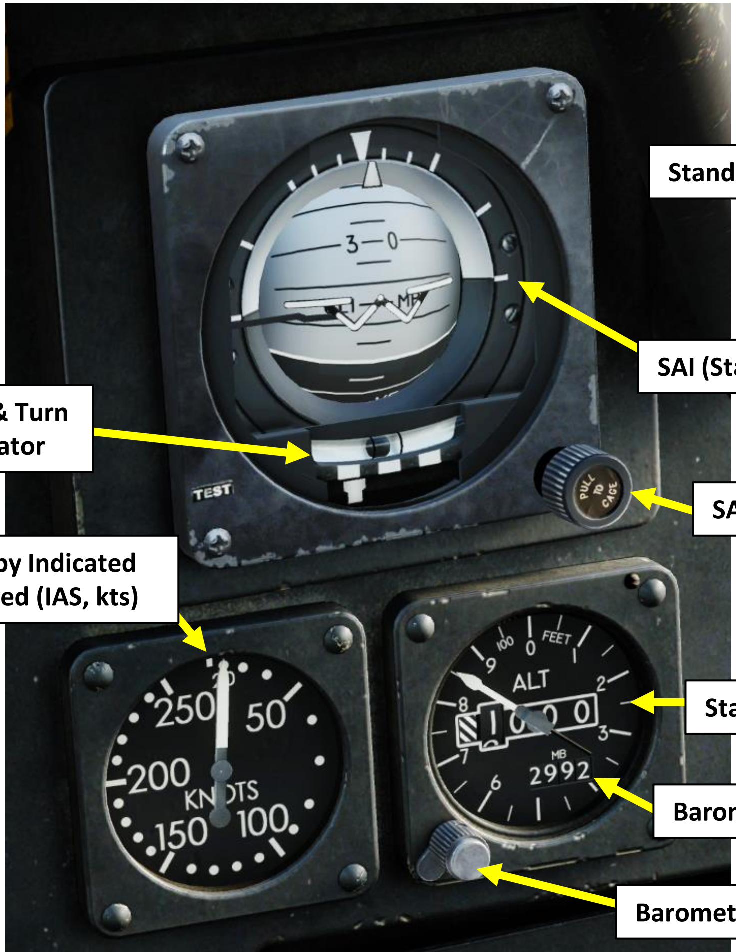
TSD (Tactical Situation Display) Page

1 – Navigation Introduction
1.2 – Navigation System Interfaces

The HDU (Helmet Display Unit) displays navigation symbology as well as the TSD.

The FLT A/C page has a SET option sub-menu that allows you to configure various navigation parameters and units.

Standby indications for attitude, barometric altitude and airspeed are used as a back-up.



Standby Magnetic Compass

HDU (Helmet Display Unit) Monocle
Displays IHADSS (Integrated Helmet and Display Sight System) Data
- *Use "I" binding to show/hide IHADSS.*

SAI (Standby Attitude Indicator)

Slip & Turn Indicator

SAI Caging Knob

Standby Indicated Airspeed (IAS, kts)

Standby Barometric Altimeter (ft)

Barometric Pressure Setting Readout (in Hg)

Barometric Pressure Setting Knob

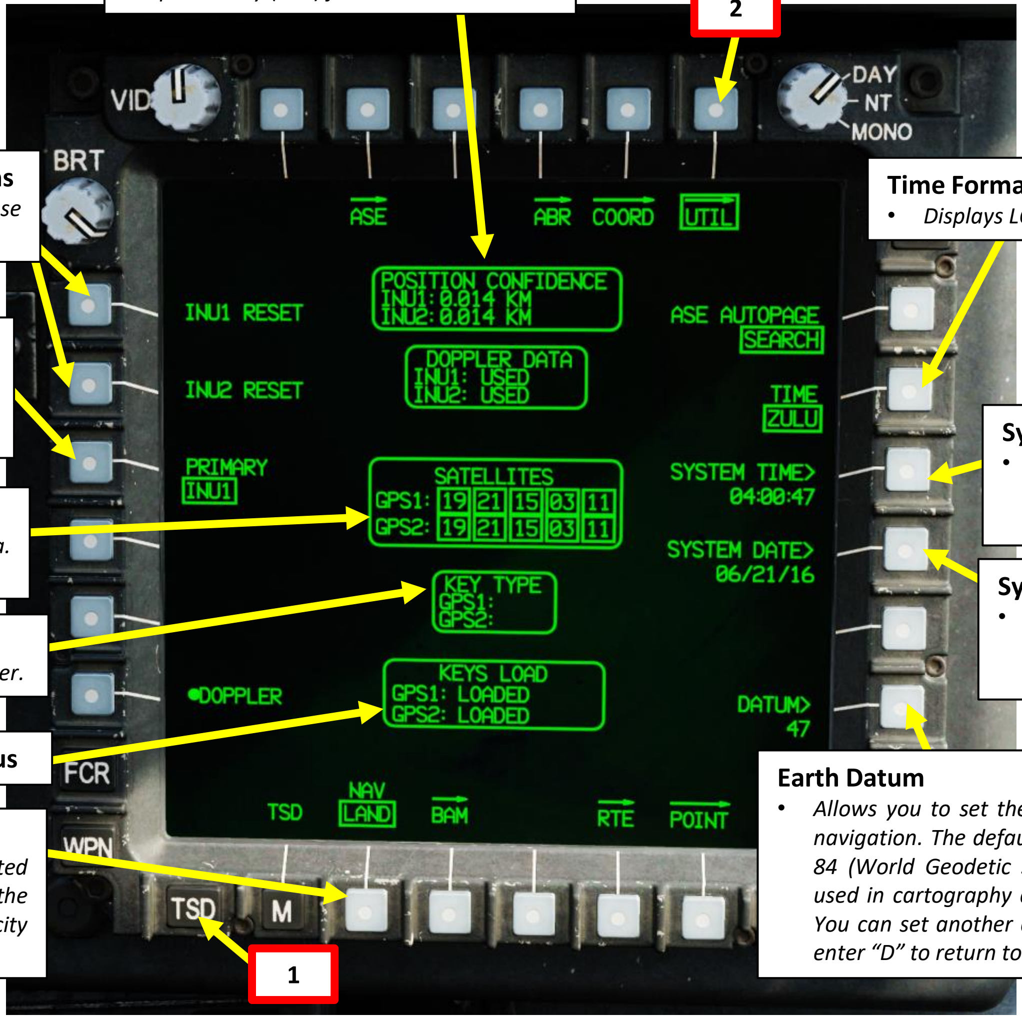
FLT (Flight) A/C (Aircraft) Page

FLT (Flight) A/C (Aircraft) Page SET Options

1 – Navigation Introduction
1.3 – EGI (Embedded GPS/Inertial Navigation Unit)

Two EGIs (Embedded GPS/Inertial Navigation Unit) allow the aircraft to know its current position. Each EGI consists of a five-channel encrypted GPS (Global Positioning System) receiver that provides position updates to a ring laser gyro (RLG) inertial navigation unit (INU). The two EGIs are labeled INU1 and INU2, and the navigation system will select between them automatically as primary and backup.

To access EGI data, you can access the TSD (Tactical Situation Display) – UTIL sub-page.



Position Confidence Indication
- *Displays the 95%-probable circular error probability (CEP) for INU1 and INU2.*

INU (Inertial Navigation Unit) Reset Buttons
- *Resets either INU1 or INU2 when pressed. For use when INU data becomes invalid or unreliable.*

Primary INU (Inertial Navigation Unit) Buttons
- *Toggles between INU1 and INU2 as primary. Normally set automatically by the system. Button is barriered if the other INU is detected to be unreliable or in a reset state.*

Satellite Status
- *Displays the GPS satellites visible to the GPS antenna. Satellites that the EGI's are using are boxed.*

GPS Key Type
- *Type of GPS key loaded into each GPS receiver.*

GPS Key Status

Navigation Mode
- *Toggles between LAND and SEA. During start-up, the selected mode will control the method of EGI alignment. In flight, the selected mode changes the weighting of the Doppler velocity data to provide the best navigational accuracy.*

Time Format
- *Displays LOCAL or ZULU (UTC) time.*

System Time
- *Allows you to change the system time with the KU (Keyboard Unit)*

System Date
- *Allows you to change the system date with the KU (Keyboard Unit)*

Earth Datum
- *Allows you to set the geodetic system use for navigation. The default is "47", meaning WGS-84 (World Geodetic System 1984, a standard used in cartography and satellite navigation) . You can set another datum by ABR page ID or enter "D" to return to the default datum.*

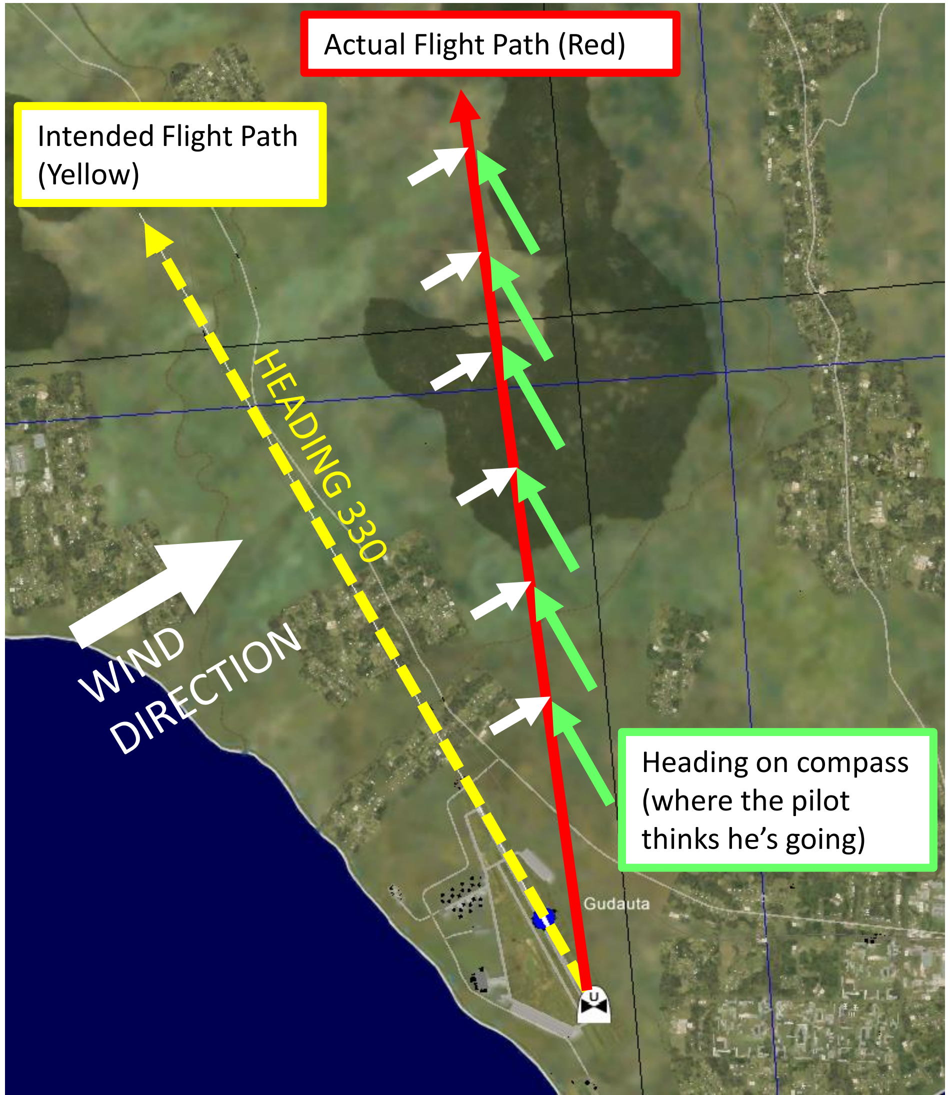
1 – Navigation Introduction
1.4 – AN/ASN-157 Doppler Radar Velocity Sensor (DRVS)

Old generation aircraft traditionally navigate using a magnetic compass and a directional gyro. A needle points somewhere, and by staying the course they expect to arrive to their destination. However, real life is not so simple. Wind can have a dramatic effect on navigation, especially on long-distance flights. If a pilot follows a certain heading and wind is pushing him sideways, he can start drifting and be completely off course. The compass will tell him that he is going in a certain direction (and in a certain sense, he is facing a direction that is parallel to the direction he intends to take) but in reality he will be drifting away.

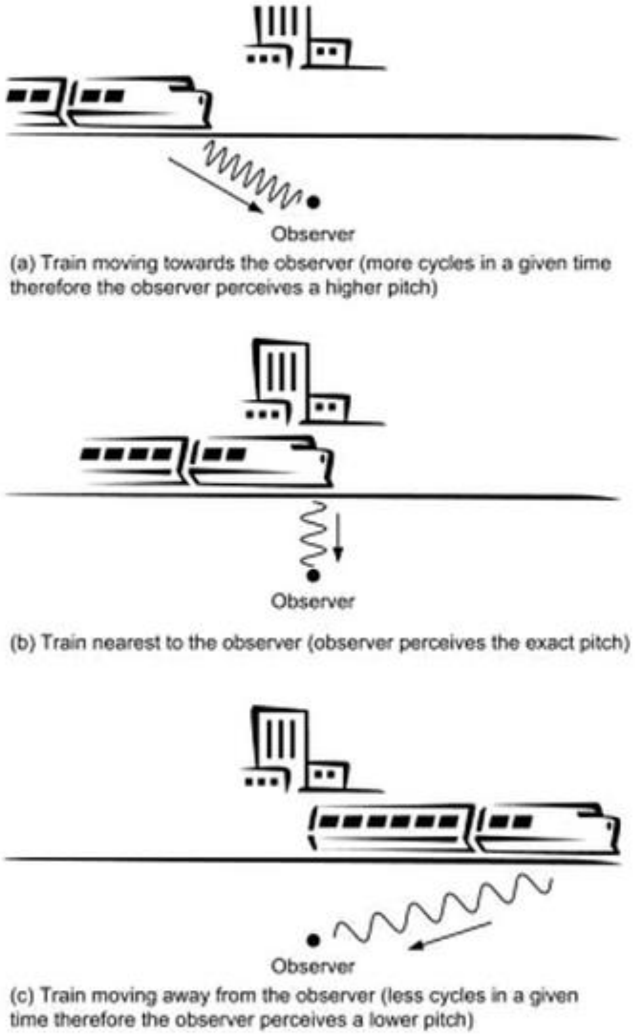
This is why Doppler navigation systems were conceived: it allowed the pilot to fly to a certain heading and detect whether or not the wind is pushing him off course.

The Doppler effect is probably that boring phenomenon you heard about in high school and didn't care about at the time. Basically, the Doppler effect is the reason why airplane fly-bys in airshows are so awesome to listen to: a moving object (like a plane) is emitting waves (like sound waves) that are received by an observer (you), and the frequency of this wave (like the sound pitch) will change the closer or farther the aircraft comes to you.

A Doppler system installed on the AH-64 transmits and receives waves, and a computer calculates your ground speed and drift angle. It also gives a more responsive approximation of your vertical speed, which is very useful to know if you are sinking too quickly during precision approaches. Pretty cool, eh?



The Doppler Effect



1 – Navigation Introduction
1.4 – AN/ASN-157 Doppler Radar Velocity Sensor (DRVS)

The AN/ASN-157 Doppler Radar Velocity Sensor (DRVS) uses the Doppler radar to determine aircraft ground speed. This figure is used as a velocity-aiding source for the EGI (Embedded GPS/Inertial Navigation Unit).

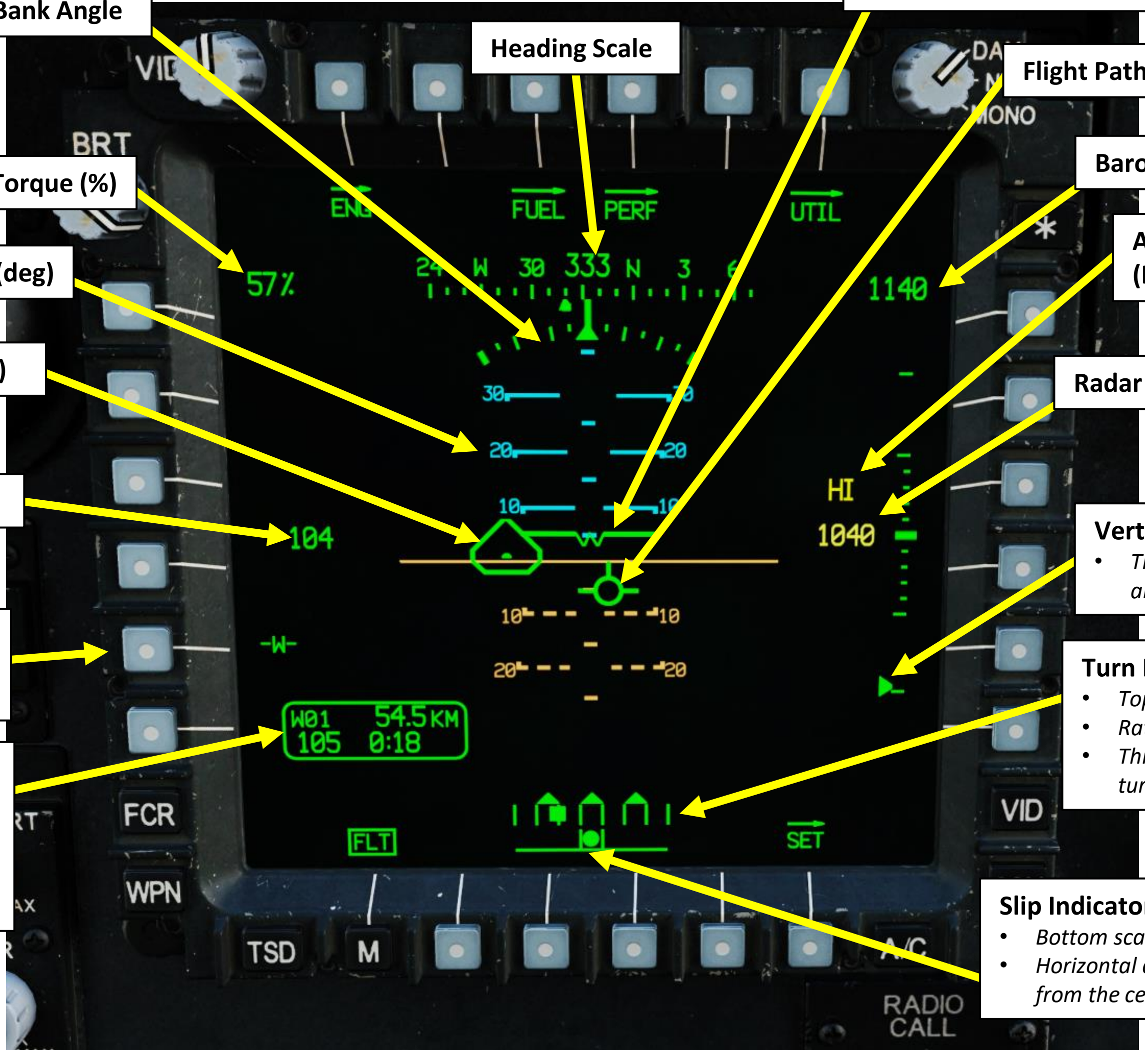
To access Doppler data, you can access the TSD (Tactical Situation Display) – UTIL sub-page. You can turn on or off the doppler radar from there using the "DOPPLER" Variable Action Button.

Doppler Data
- *USED: INU is using Doppler-aided navigation*
- *REJECTED: INU is not using Doppler-aided navigation*
- *MEMORY: Doppler-aided navigation is in dead-reckoning mode.*

Doppler Navigation System Power
- *Hollow circle means OFF. Solid Circle means ON.*

1 – Navigation Introduction
1.5 – FLT (Flight) Page

The FLT (Flight) page displays basic flight information and allows the aircrew to control various flight settings.



Waterline Symbol
- *Indicates nose position and is a central reference for the pitch ladder. The symbol can be biased (adjusted upward or downward from its normal position) by using the FLT SET page. When the waterline is biased, it appears filled in rather than hollow.*

Bank Angle

Heading Scale

Flight Path Vector (FPV)

Torque (%)

Barometric Altitude (ft)

Aircraft Pitch Scale (deg)

Altitude High/Low (HI/LO) Warning

Navigation Fly-To Cue (Waypoint Symbol)

Radar Altimeter (ft)

True Airspeed (kts)

Vertical Speed (ft/min)
- *Tick marks for every 100 feet per minute to ±500 fpm, and then another tick mark is drawn at ±1000 fpm.*

Waterline Bias Toggle Button
- *Toggles on or off the waterline bias. "BIAS" is displayed below "-W-" when bias is applied.*

Turn Rate Indicator
- *Top scale of this symbol indicates aircraft rate of turn.*
- *Rate of turn is shown as a solid square.*
- *Three "doghouses" indicate level (no turn) and standard rate turns to the left or right.*

Waypoint Data
- **W01: Waypoint Name**
- **105: Ground Speed (kts)**
- **54.5 KM: Distance to Waypoint**
- **0:18: Time to Waypoint (minutes:seconds)**

Slip Indicator
- *Bottom scale of this symbol indicates horizontal acceleration.*
- *Horizontal acceleration is shown as a deflection of the oval from the center position.*

1 – Navigation Introduction
1.5 – FLT (Flight) Page

From the FLT page, you can use the SET button to access additional options such as:

- High and Low Altitude Alerts
- G-Meter Reset
- Waterline Bias Setting
- Altimeter Setting
- Distance Units
- Radar Altimeter Power

High Altitude Alert (ft)
- *Toggles editing of the high-altitude alert, which is done via the KU (Keyboard Unit). When above this altitude, the word "HI" will appear in yellow next to the altimeter. Disabled if set to zero.*

Low Altitude Alert (ft)
- *Toggles editing of the low-altitude alert, which is done via the KU (Keyboard Unit). When below this altitude, the word "LO" will appear in red next to the altimeter, and an "altitude low" audio alert will sound.*

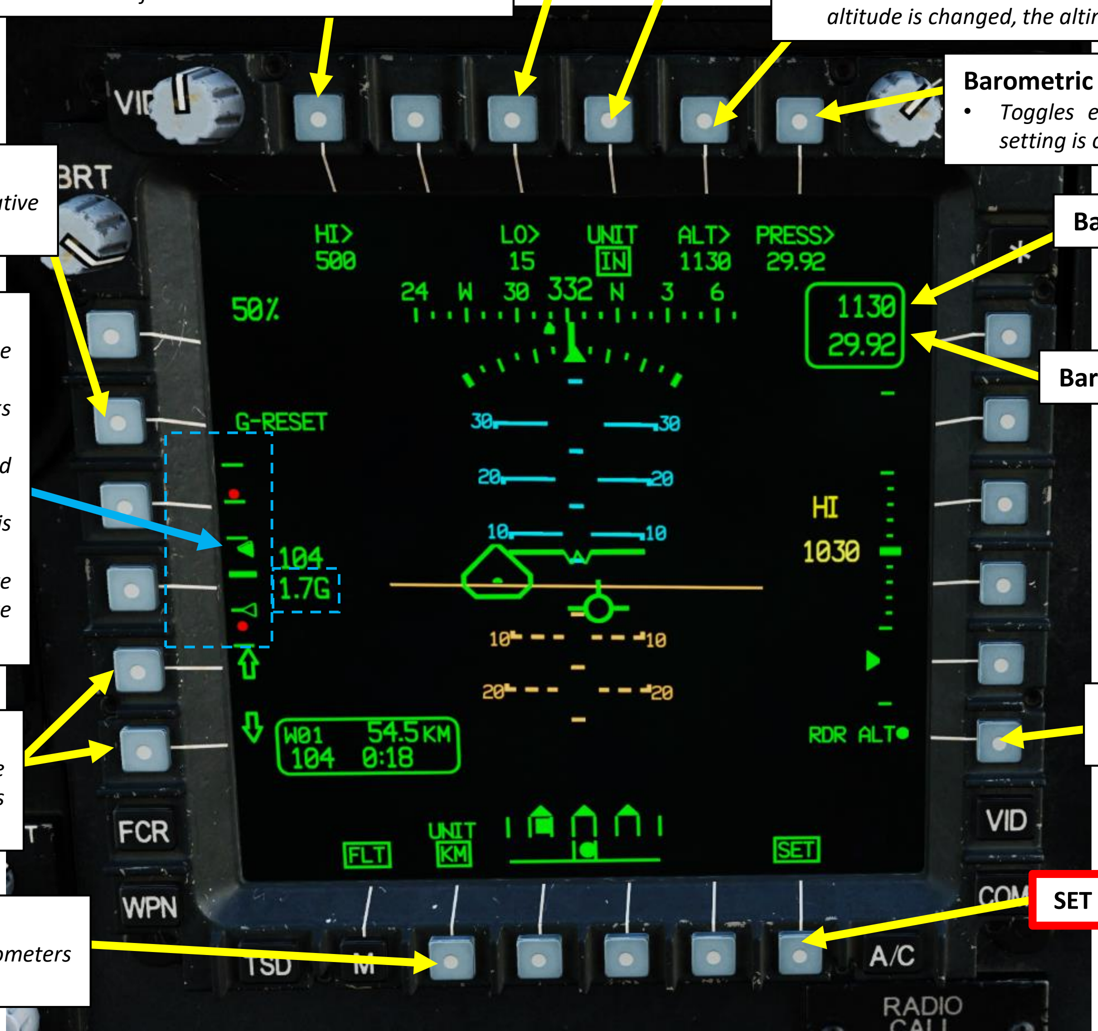
Altimeter Setting Unit Selector
- *Toggles barometric pressure setting between inches of mercury (IN) and millibars (MB).*

Barometric Altitude (ft)
- *Toggles editing of current barometric altitude. When the barometric altitude is changed, the altimeter setting is changed accordingly.*

Barometric Pressure Setting (in Hg or mbar)
- *Toggles editing of current sea-level pressure. When the altimeter setting is changed, the barometric altitude is changed accordingly.*

G-Reset Button
- *Pressing this button resets the positive and negative accelerometer telltales to 1 g.*

Accelerometer (G)
- *Displays current load factor (in g) graphically on the vertical scale.*
- *A major tick mark indicates 1 g, with minor tick marks every additional g, for a range of +4 to -1 g.*
- *Small red circles indicate maximum positive and negative load factor.*
- *Solid green triangle indicates current load factor and is displayed in red if a limit is exceeded.*
- *Hollow green triangles are positive and negative telltales, which indicate maximum positive and negative g experienced during this flight.*



Barometric Altitude (ft)

Barometric Pressure Setting (in Hg or mbar)

Radar Altimeter (RDR ALT) Power Button
- *Hollow circle means OFF. Solid Circle means ON.*

Waterline Bias Set Buttons
- *Biases the waterline symbol up or down in pitch 1 degree for every button press. "BIAS" is displayed if a bias is applied. Up to 10° of up or down bias can be applied.*

Distance Unit Selector
- *Toggles distance units displayed between kilometers (KM) and nautical miles (NM).*

SET Option Selected

2 – TSD (Tactical Situation Display)
2.1 – Overview

The TSD (Tactical Situation Display) page is one of the most important navigation tools at your disposal. The TSD shows a top-down overview of the aircraft, battlefield, and surrounding airspace. It contains a very versatile, colored moving map that allows the aircrew to plot and analyze navigational, tactical, and sensor information.

The TSD can be used to designate landmark points with a slewable cursor.

The TSD page is accessed by pressing the TSD FAB (Fixed Action Button).

TSD Page Selected

2 – TSD (Tactical Situation Display)
2.2 – Moving Map

Symbology

By default, a moving map is visible on the TSD. It contains basic navigation information.

PP (Present Position) Option
- *This option displays the aircraft position in:*
- *MGRS (Military Grid Reference System) coordinates (upper row)*
- *Latitude and longitude coordinates (lower row, left)*
- *Elevation (lower row, right)*

SHOW Sub-Page
- *Allows you to select which symbols are shown on the map*

PAN Sub-Page
- *Allows you to move and rotate the map independently of the Ownship location*

Grid Width

Map Scale
- *Scale value is displayed in kilometers or nautical miles.*
- *Available scale levels are: 400 km (216 NM), 150 km (81 nm), 100 km (54 nm), 75 km (40.5 nm), 50 km (27 nm), 25 km (13.5 nm), 15 km (8.1 nm), 10 km (5.4 nm), 5 km (2.7 nm), 2 km (1.1 nm), and 1 km (0.5 nm).*

INST (Instruments) Sub-Page
- *Configures the TSD for radio navigation while operating in low-visibility conditions. The page provides necessary controls for setting a heading bug, manually tuning an NDB (Non-Directional Beacon) frequency, testing the ADF (Automatic Direction Finder) system, and an independent timer.*

Map Scale Increase/Decrease Selectors
- *Changes the scale level of the map.*
- *Holding the button will continuously zoom the map in or out.*

Aircraft Heading

Cursor

Navigation Symbology (Waypoint)

Ownship

CTR (Center) Function
- *Toggles between centering the display on the Ownship, or de-centering with the Ownship placed towards the bottom third of the display.*

FRZ (Freeze) Function
- *Freezes the map display. The map and Ownship will not move, but the data blocks will continue to update.*

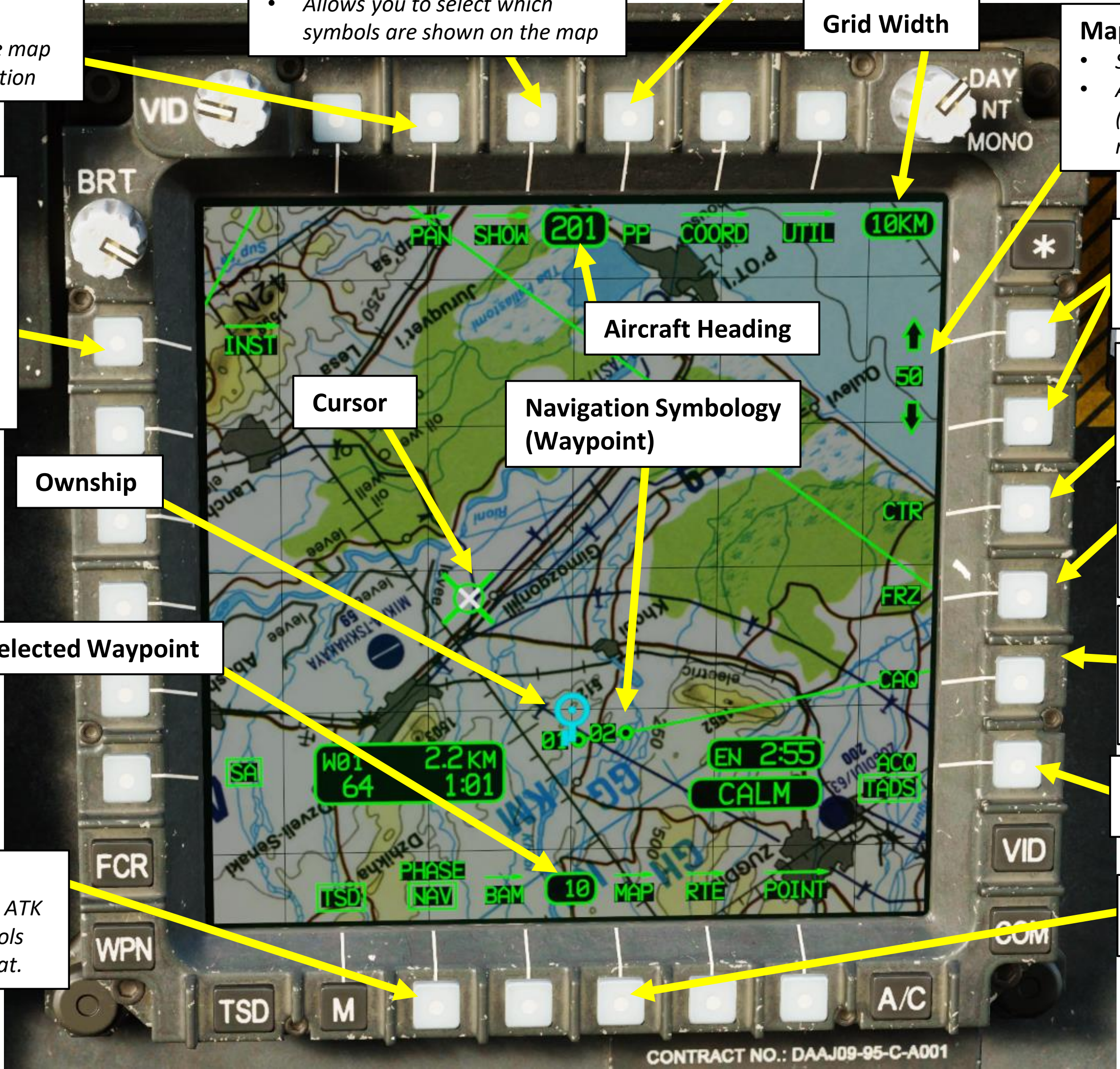
Heading to Selected Waypoint

CAQ (Cursor Acquisition) Function
- *Freezes the display and allows the crewmember to designate a symbol or a terrain point for use as an acquisition source.*

ACQ (Acquisition Source) Selector
- *Selects the acquisition source for the active sight*

Phase Selection Option
- *Toggles between NAV (Navigation) and ATK (Attack) phases. The active phase controls what information is shown on the format.*

MAP Sub-Page Selector
- *Controls Moving Map Options*



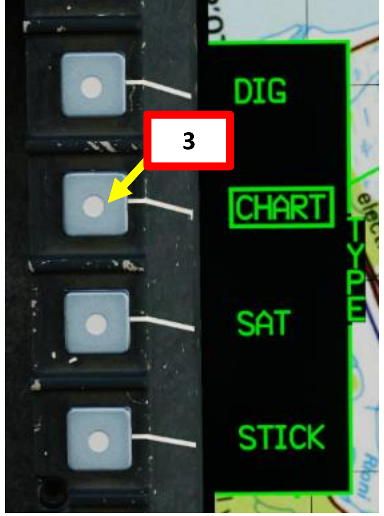
2 – TSD (Tactical Situation Display)
2.2 – Moving Map

Map Types

You can access Map Options by using the VAB (Variable Action Button) next to MAP.

From the MAP sub-page, you can select four different Moving Map formats:

- **DIG**: underlays a relief map generated by the digital terrain elevation database (DTED).
- **CHART**: underlays a tactical navigation chart.
- **SAT**: underlays satellite-based imagery.
- **STICK**: underlays only the coordinate grid.



Map Type Selector
- *Configures map type to either DIG, CHART, SAT or STICK.*

Grid Display Option
- *Toggles display of the coordinate grid. When displayed, the grid size is displayed in the upper right corner.*

Map Orientation Option
- ***HDG-UP**. The map is oriented such that aircraft heading is upwards.*
- ***TRK-UP**. The map is oriented such that aircraft ground track is upwards.*
- ***N-UP**. The map is oriented such that true north is upwards.*

Map 2D/3D View Option

MAP Sub-Page Selected

2 – TSD (Tactical Situation Display)
2.2 – Moving Map

Map Types

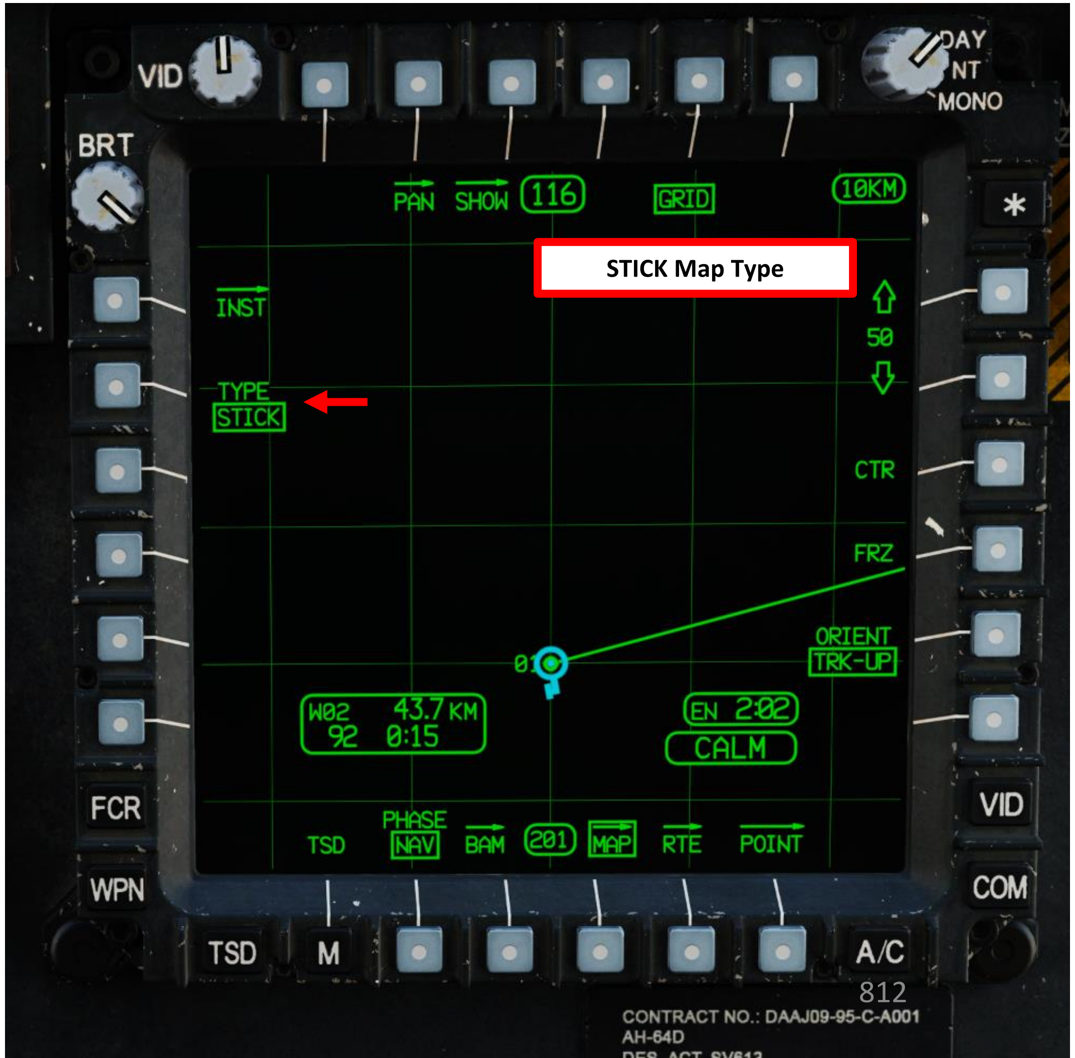
Chart Scale Selector
- *Selects the chart scale to use. Options are 1:12.5K, 1:50K, 1:100K, 1:250K, 1:500K, 1:1M, 1:2M, and 1:5M. Chart rasters may not be available for all scales.*

Chart Color Bands Selector
- ***A/C**: Terrain is shaded based on aircraft altitude. Terrain that rises above the current altitude is shaded red, and terrain within 50 feet of the current altitude is shaded in yellow.*
- ***ELEV**: Terrain is shaded from green to brown based on its MSL elevation. If the MPD is in MONO (monochromatic mode), shading will be from green to black.*
- ***NONE**: No coloring is applied*

2 – TSD (Tactical Situation Display)
2.2 – Moving Map

Map Types

Satellite Resolution Level Selector
- *Sets the resolution level of the satellite imagery to display.*



2 – TSD (Tactical Situation Display)
2.2 – Moving Map

Map Types

HIGHEST ELEVATION

LOWEST ELEVATION

ELEV Shading Legend

Chart Scale Selector

- *Selects the chart scale to use. Options are 1:12.5K, 1:50K, 1:100K, 1:250K, 1:500K, 1:1M, 1:2M, and 1:5M. Chart rasters may not be available for all scales.*

DIG Color Bands Selector

- ***A/C****: Terrain is shaded based on aircraft altitude. Terrain that rises above the current altitude is shaded red, and terrain within 50 feet of the current altitude is shaded in yellow.*
- ***ELEV****: Terrain is shaded from green to brown based on its MSL elevation. If the MPD is in MONO (monochromatic mode), shading will be from green to black.*
- ***NONE****: No coloring is applied*

Contours Selector

- *Toggles display of terrain contour lines at regular elevation intervals. Options are NONE (no contours) and 50-, 100-, 200-, 500-, and 1000-foot intervals.*

FFD (Foundation Feature Data) Selector

FFD includes roads, airports, forests, and other man-made and natural features.

- ***None****: No FFD is displayed.*
- ***Area****: Shape-type FFD is displayed. This includes forests, marshes, sand, rock, snow/ice, industrial areas, political boundaries, airports, railroads, towers, water structures, buildings, urban areas, and bodies of water.*
- ***Line****: Vector-type FFD is displayed. This includes fords/ferries, trees, roads, paths, pipes, cliffs, gullies, political boundaries, runways, towers, buildings, bridges, fences/barriers, and bodies of water.*

2 – TSD (Tactical Situation Display)
2.2 – Moving Map

PAN Functions

Pressing the PAN button enters PAN sub-page, where you can move and rotate the map independently of the Ownship location. When in PAN sub-page, the TSD page is frozen, indicated by a thick dashed border displayed around the "TSD footprint".

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

Pan Map Heading Selectors
- *Pressing the left or right arrows rotates the map in 1° increments, or 40° per second when pressed and held. Pressing HDG> allows a heading value to be entered via the KU (Keyboard Unit).*

PAN Sub-Page Selected

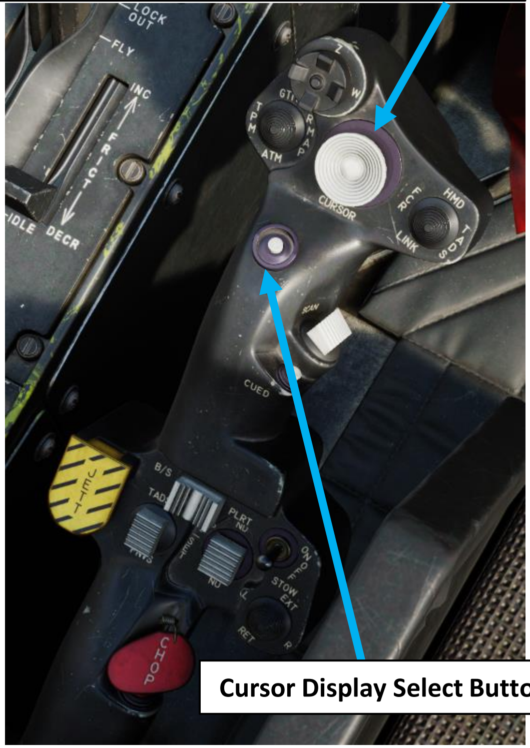
Pan-to-Point Selector
- *Pressing this button allows entry of a point (for example, a target point T01) using the KU (Keyboard Unit). After entry, the map will pan to this point.*

Pan-to-Route-Point Selector
- *When using Route Pan, the point labels displayed adjacent* **RTE⬆** *and* **RTE⬇** *indicate the next and previous points in the route sequence respectively. Pressing the* **RTE⬆** *and* **RTE⬇** *buttons pans the map to that point.*

Route Pan Selectors
- *Pressing and holding* **RTE⬆** *and* **RTE⬇** *(adjacent the arrows), smoothly scrolls the view to the next or previous points while held.*

Pan Mode Selector
- *Toggles the pan mode between CURSR (Cursor Control pans map) and NORM (Cursor Control controls on-screen cursor) pan modes.*

Ownship



Cursor Display Select Button

Last Pan Selector
- *Resets the map to the previous pan location*

2 – TSD (Tactical Situation Display)
2.3 – Display

PP (Present Position) Option
- *This option displays the aircraft position in:*
- *MGRS (Military Grid Reference System) coordinates (upper row)*
- *Latitude and longitude coordinates (lower row, left)*
- *Elevation (lower row, right)*

COORDINATES Sub-Page Selector
- *Displays coordinates for various navigation points & targets*

SHOW Sub-Page
- *Allows you to select which symbols are shown on the map*

UTILITY Sub-Page Selector
- *Controls TSD Utility Options*

PAN Sub-Page
- *Allows you to move and rotate the map independently of the Ownship location*

Grid Width

Map Scale
- *Scale value is displayed in kilometers or nautical miles.*
- *Available scale levels are: 400 km (216 NM), 150 km (81 nm), 100 km (54 nm), 75 km (40.5 nm), 50 km (27 nm), 25 km (13.5 nm), 15 km (8.1 nm), 10 km (5.4 nm), 5 km (2.7 nm), 2 km (1.1 nm), and 1 km (0.5 nm).*

INST (Instruments) Sub-Page
- *Configures the TSD for radio navigation while operating in low-visibility conditions. The page provides necessary controls for setting a heading bug, manually tuning an NDB (Non-Directional Beacon) frequency, testing the ADF (Automatic Direction Finder) system, and an independent timer.*

Aircraft Heading

Map Scale Increase/Decrease Selectors
- *Changes the scale level of the map.*
- *Holding the button will continuously zoom the map in or out.*

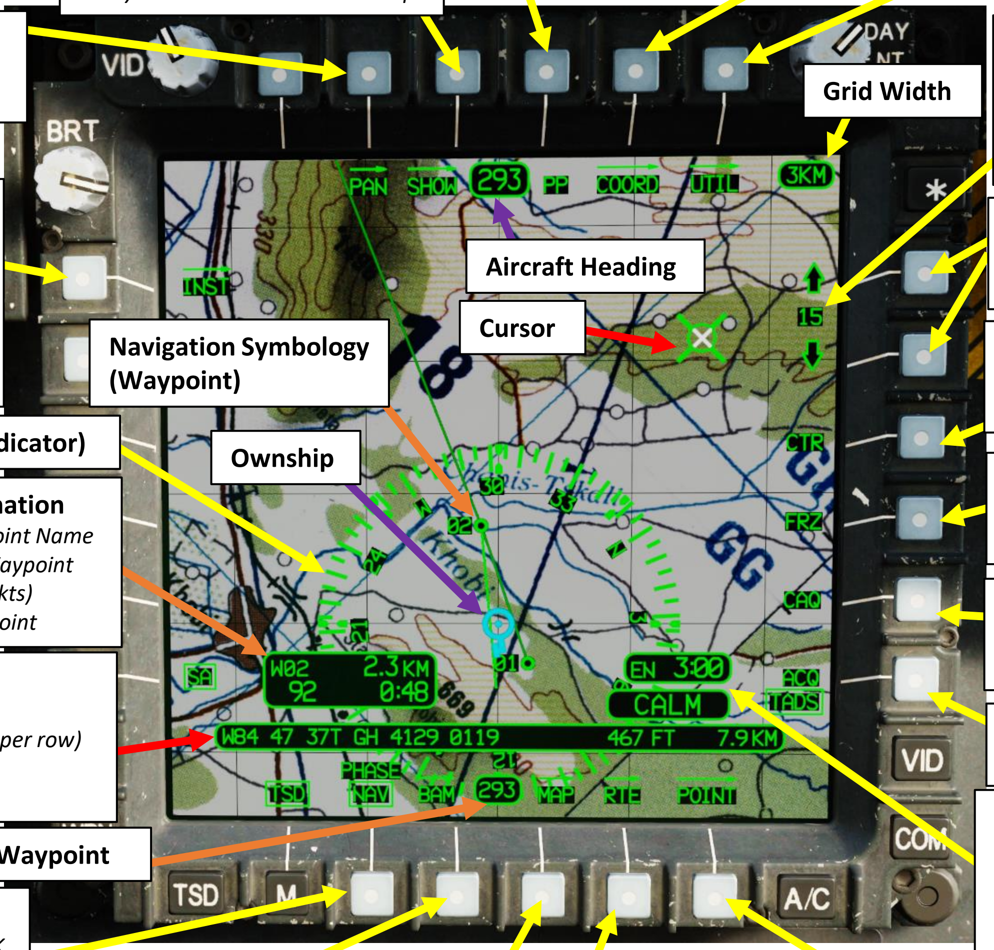
Cursor

Navigation Symbology (Waypoint)

CTR (Center) Function
- *Toggles between centering the display on the Ownship, or de-centering with the Ownship placed towards the bottom third of the display.*

HSI (Horizontal Situation Indicator)

Ownship



FRZ (Freeze) Function
- *Freezes the map display. The map and Ownship will not move, but the data blocks will continue to update.*

Selected Waypoint Information
- *Upper Left: Selected Waypoint Name*
- *Upper Right: Distance to Waypoint*
- *Lower Left: Ground Speed (kts)*
- *Lower Right: Time to Waypoint*

CAQ (Cursor Acquisition) Function
- *Freezes the display and allows the crewmember to designate a symbol or a terrain point for use as an acquisition source.*

Cursor Information

This option displays the cursor position in:
- *MGRS (Military Grid Reference System) coordinates (upper row)*
- *Elevation (ft)*
- *Distance from cursor to ownship (km)*

ACQ (Acquisition Source) Selector
- *Selects the acquisition source for the active sight*

Heading to Selected Waypoint

Endurance & Wind Information
- *Upper Row: Displays the total endurance time available based on remaining fuel in all internal and external tanks.*
- *Lower Row: Displays the winds as computed by the aircraft Air Data System (ADS). "CALM" is displayed when wind speed is less than 5 knots. When NR is less than 50% and wind speed is greater than 45 knots, wind speed is displayed in yellow.*

Phase Selection Option
- *Toggles between NAV (Navigation) and ATK (Attack) phases. The active phase controls what information is shown on the format.*

BAM (Battle Area Management) Sub-Page Selector
- *Allows the crewmembers to create Priority Fire Zones (PFZ) and No-Fire Zones (NFZ) and assign them to wingmen.*

MAP Sub-Page Selector
- *Controls Moving Map Options*

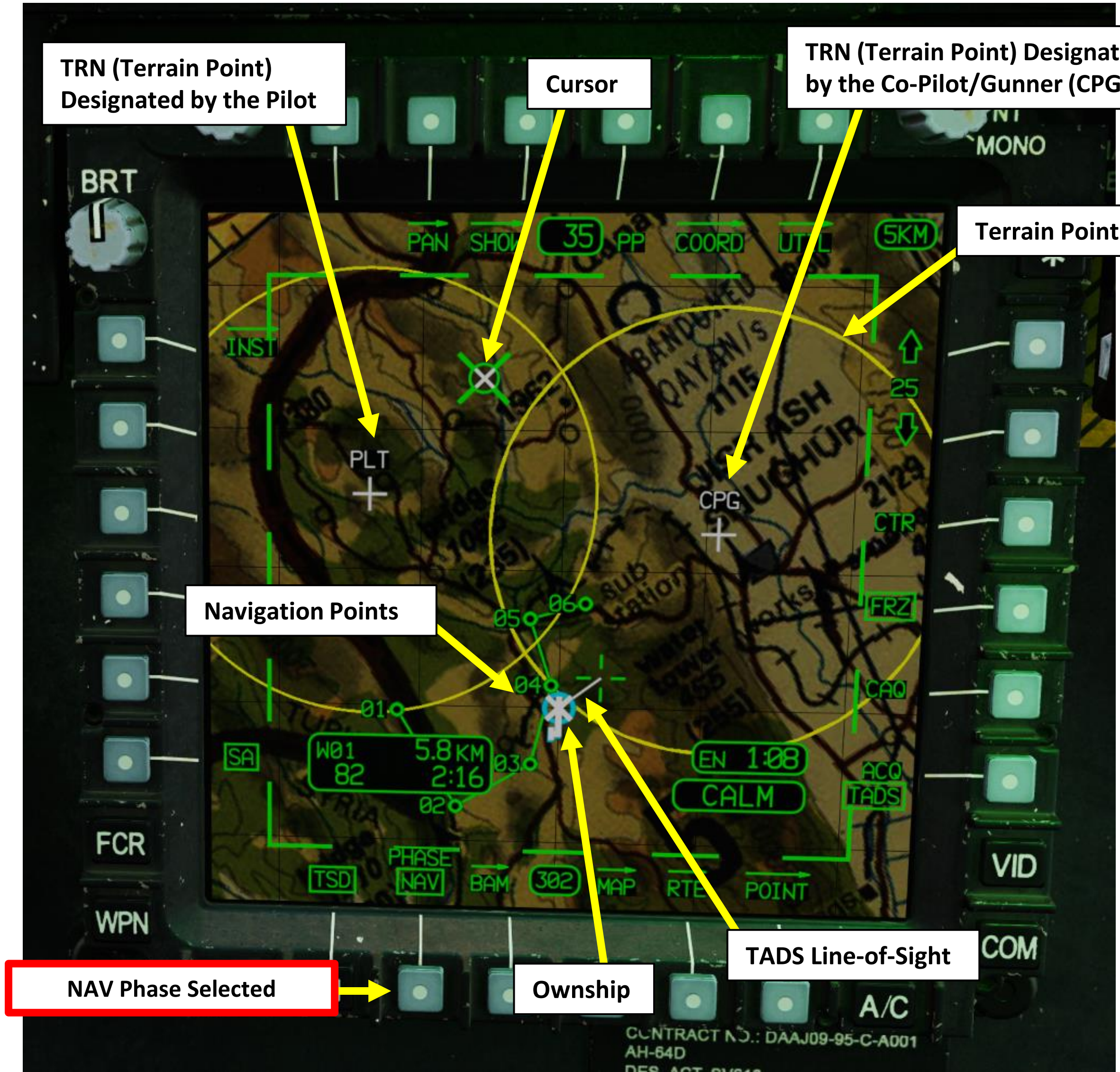
ROUTE (RTE) Sub-Page Selector
- *Used to combine points into routes*

POINT Sub-Page Selector
- *Used to create, edit, and delete stored points, as well as transmit them to other flight members*

2 – TSD (Tactical Situation Display)
2.4 – Symbology

TSD Symbology can display any navigation point type, sensor line-of-sight, threat rings and other symbols related to waypoints, hazards, control measures or targets/threats. NAVIGATION and ATTACK Phases will filter symbology based on what is needed in specific mission phases.

- Note: symbology related to waypoints/hazards, control measures and targets/threats will be shown in their respective section.



2 – TSD (Tactical Situation Display)
2.4 – Symbology

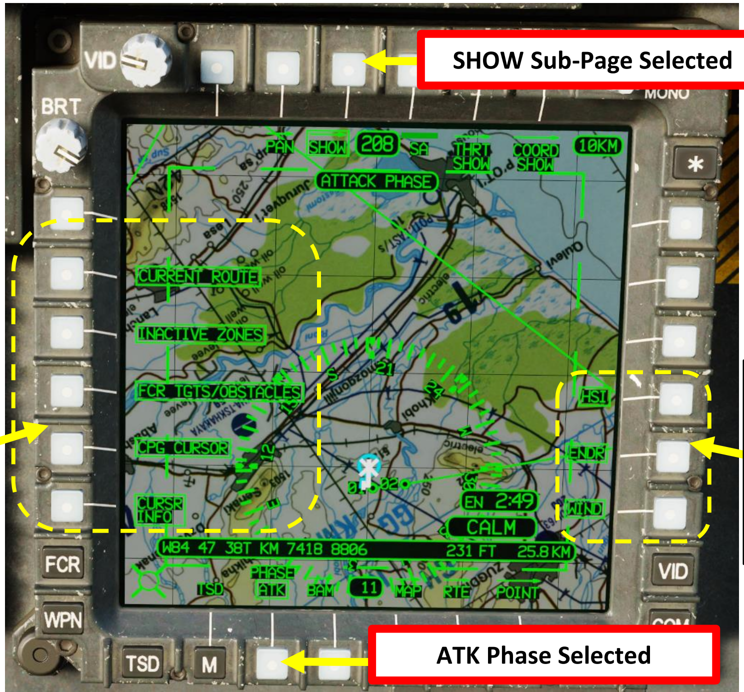
SHOW Functions

The SHOW menu toggles on or off display of different map icons and windows. It displays different options depending on whether the current phase is NAV or ATK (selectable using “Phase Selector” button).

Shown Data Selectors (boxed = displayed)
- *Waypoint Data*
- *Inactive Zones*
- *Obstacles*
- *CPG (Co-Pilot/Gunner Cursor)*
- *Cursor Information*

Shown Data Selectors (boxed = displayed)
- *HSI (Horizontal Situation Indicator)*
- *ENDR (Endurance) Data*
- *Wind Status*

Shown Data Selectors (boxed = displayed)
- *Current Route*
- *Inactive Zones*
- *FCR (Fire Control Radar) TGTS (Targets) / Obstacles*
- *CPG (Co-Pilot/Gunner Cursor)*
- *Cursor Information*



Shown Data Selectors (boxed = displayed)
- *HSI (Horizontal Situation Indicator)*
- *ENDR (Endurance) Data*
- *Wind Status*

2 – TSD (Tactical Situation Display)
2.4 – Symbology

SHOW Functions

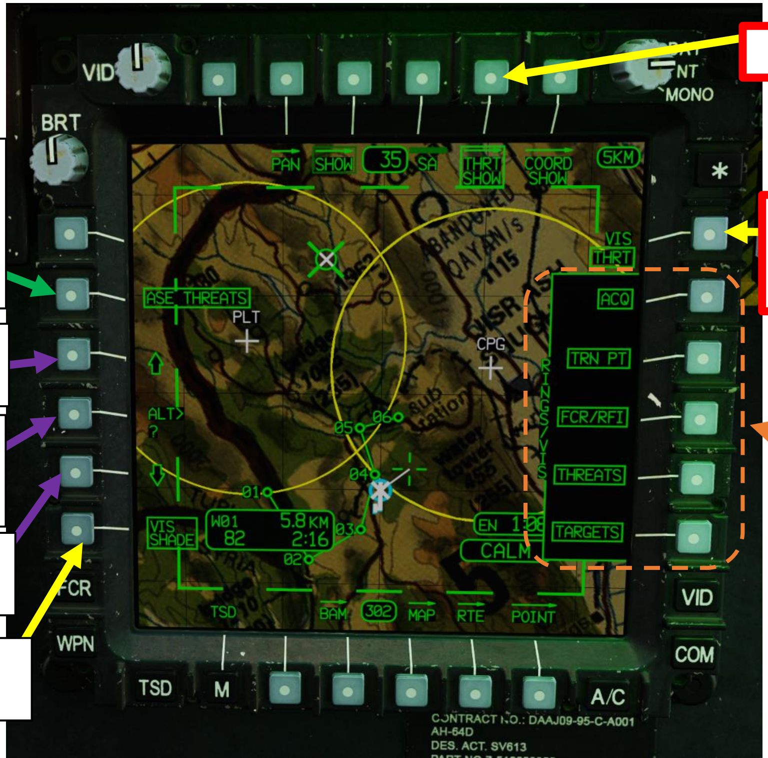
Once SHOW is selected:

- Select **THRT SHOW** to control display of the "ASE footprint" (Aircraft Survivability Equipment), lethality rings of targets and threats, and their intervisibility (line-of-sight) status. Options can change based on which intervisibility source is selected (OWN or THRT).

THRT SHOW Sub-Page Selected

Intervisibility Source Selected: OWN (Ownship)
- *Shaded areas represent the Ownship's line-of-sight at its current altitude.*

Intervisibility/Rings Toggle Selectors (boxed = displayed)
- *OWN: ownship (your aircraft)*
- *TRN PT: Pilot and Co-Pilot/Gunner Terrain Points*
- *GHOST: The ghostship when TSD is frozen or in PAN mode.*



THRT SHOW Sub-Page Selected

Intervisibility Source Selected: THRT (Threat)
- *Shaded areas represent areas where this aircraft will be detectable by a threat at its current altitude.*

Intervisibility/Rings Toggle Selectors (boxed = displayed)
- *ACQ: Current ACQ source if a point (W##, H##, C##, T##).*
- *TRN PT: Pilot and CPG terrain points. (T55 or T56)*
- *FCR/RFI: FCR (Fire Control Radar) targets that have been merged with RFI-detected threats.*
- *THREATS: Threats (T##).*
- *TARGETS: Targets (T##).*

ASE THREATS Selector (boxed = displayed)
- *Toggles display of RFI/RLWR (Radio Frequency Interferometer/Radar Laser Warning Receiver) detected threats around "ASE footprint". If toggled off, the ASE Autopage setting will override this option and display ASE Threats on the TSD when the ASE Autopage threshold is reached or exceeded.*

Terrain Point Altitude Increment Button
- *Increases terrain point altitude by 5 ft*

Terrain Point Altitude Selector
- *Allows changing selected terrain point altitude with the KU (Keyboard Unit). Option only appears if TRN POINT shading is active.*

Terrain Point Altitude Decrement Button
- *Decreases terrain point altitude by 5 ft*

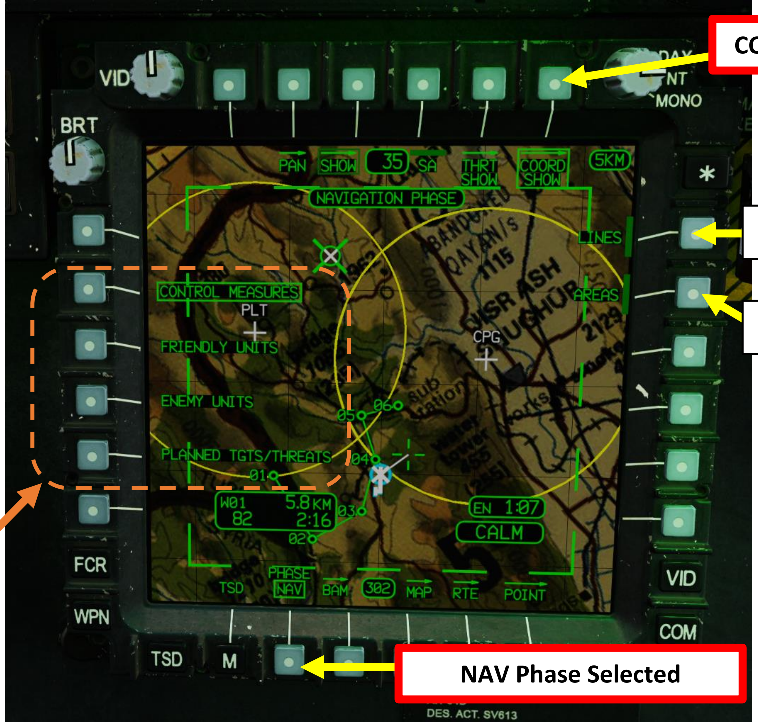
Intervisibility Shading Selector (boxed = displayed)
- *Toggles display of line-of-sight shading for the selected threat types.*

2 – TSD (Tactical Situation Display)
2.4 – Symbology

SHOW Functions

Once SHOW is selected:
- Select **COORD SHOW** to control display of points within the database. These options can be set differently between the NAV and ATK phases.

Shown Data Selectors (boxed = displayed)
- *Control Measures*
- *Friendly Units*
- *Enemy Units*
- *Planned Targets/Threats*

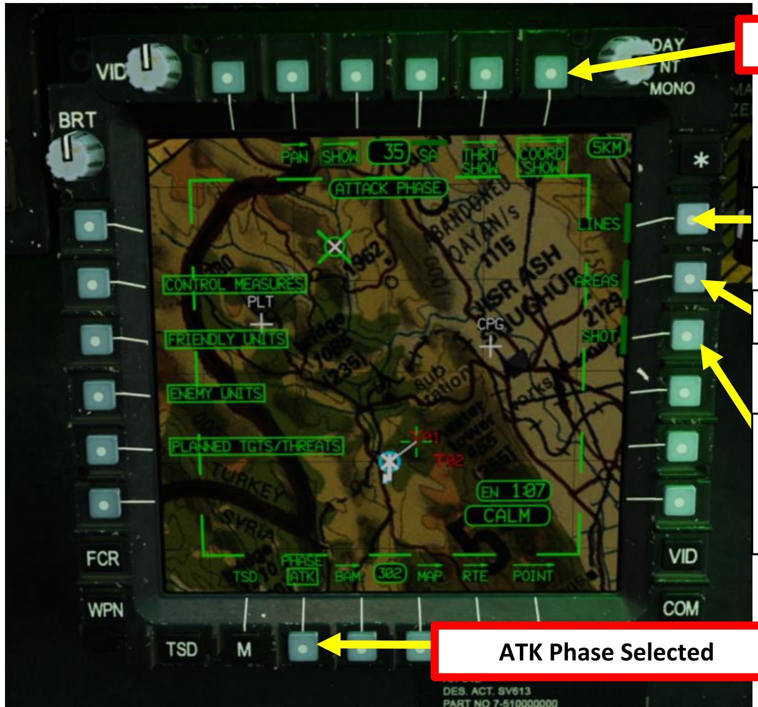


COORD SHOW Sub-Page Selected

Pre-Planned Lines Display Selector

Pre-Planned Areas Display Selector

NAV Phase Selected



COORD SHOW Sub-Page Selected

Pre-Planned Lines Display Selector

Pre-Planned Areas Display Selector

"Shot-At" Display Selector
- *Toggles display of Shot-At indications. Shot-At indications are generated when Hellfire missiles are employed against a target.*

ATK Phase Selected

2 – TSD (Tactical Situation Display)
2.5 – Controls

The TSD is primarily controlled with the following components:

- **TSD** (Tactical Situation Display) page **Variable Action Buttons**
- **KU** (Keyboard Unit), which allows you to enter navigation data
- **Cursor controls** on the collective and TEDAC grips.
    - The Cursor Control/Enter Hat Switch can be used to slew/move a cursor on the MPD (Multi-Purpose Display) pages on the active MPD.
    - The cursor can be moved to the opposite display using the Cursor Display Select Button or by moving the Cursor to the edge of one display and “bumping” the Cursor Control/Enter Hat Switch in the direction of the opposite MPD.
    - When the Cursor is over a data field, you can select it by pressing DOWN on the Cursor Control/Enter Hat Switch instead of using a VAB (Variable Action Button).
    - The CAQ (Cursor Acquisition) Option on the TSD allows you to use the cursor to select symbols and slave sensors to it.

TEDAC LHG (Left Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

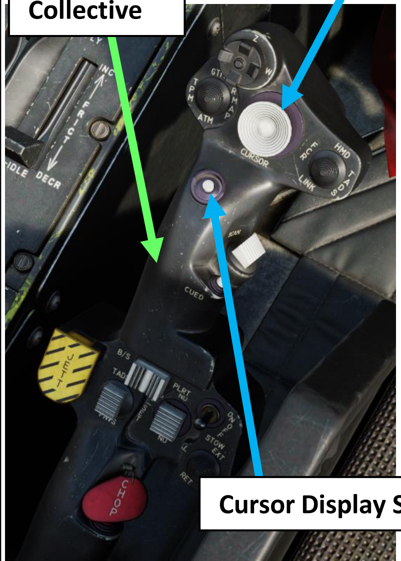
Cursor Display Select Button
- *Toggles the cursor to the other MPD and centers it on the screen.*

Cursor Enter Button

TEDAC RHG (Right Hand Grip)
- *TEDAC: TADS Electronic Display and Control*
- *TADS: Target Acquisition and Designation Sight*

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

Collective



Cursor Display Select Button

KU (Keyboard Unit)
- *The Keyboard Unit (KU) allows crewmembers to enter alphanumeric data into MPD (Multi-Purpose Display) fields and do simple arithmetic calculations. It can also be used as a simple scratchpad for notetaking.*

CAQ (Cursor Acquisition) Function

Cursor

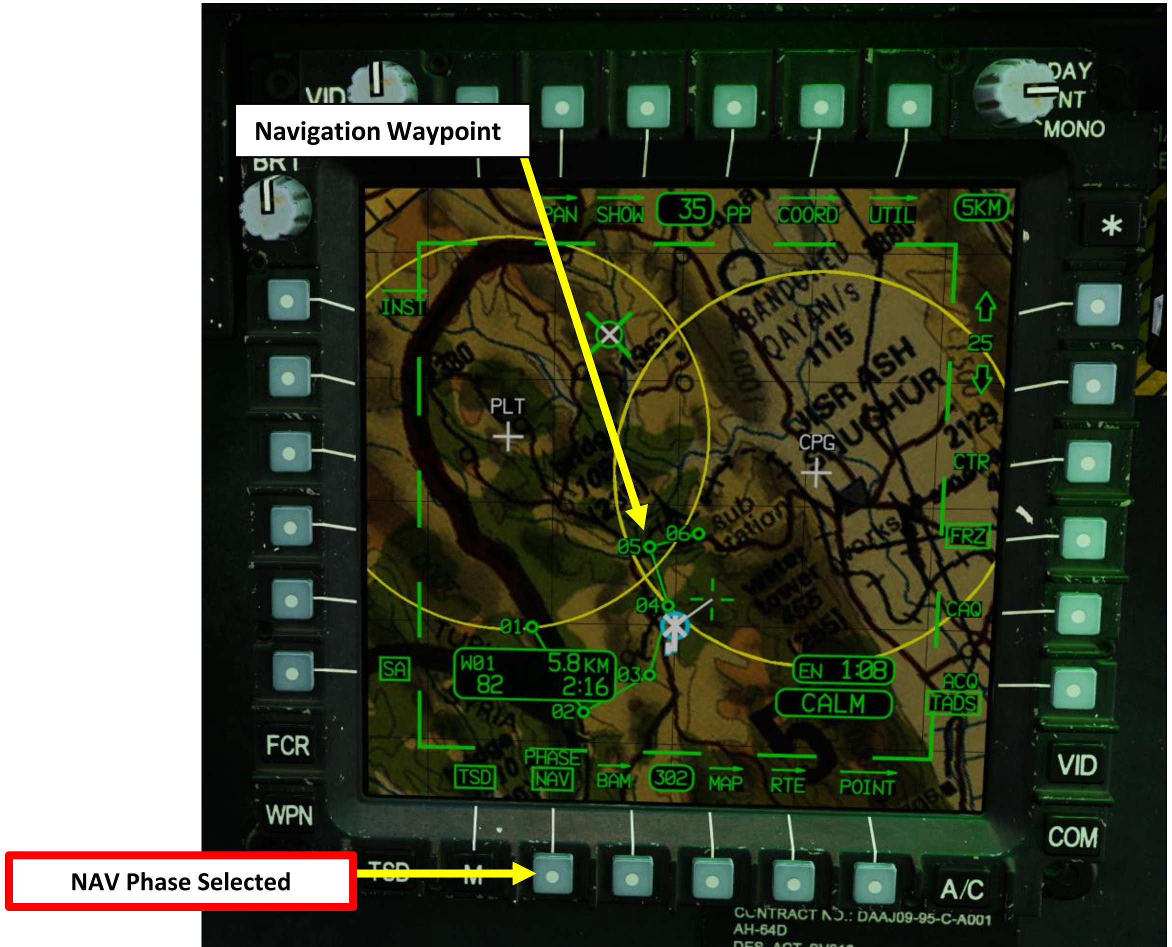
TSD (Tactical Situation Display) Page

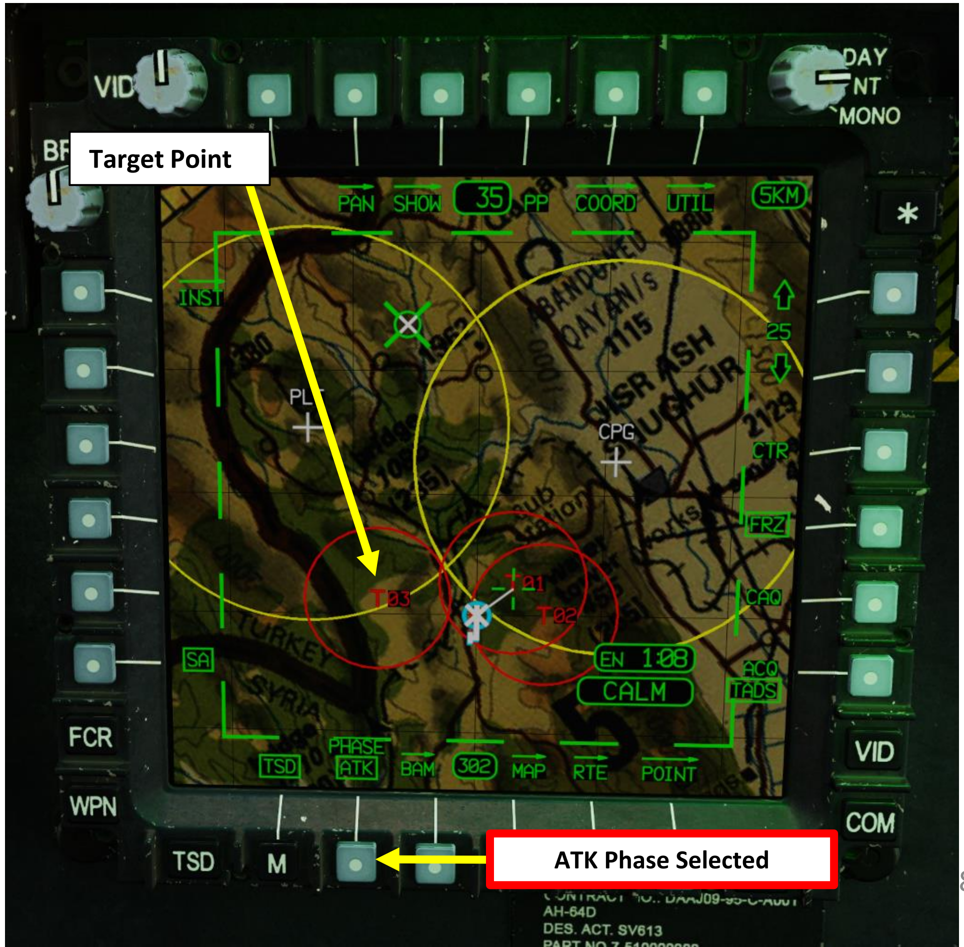
2 – TSD (Tactical Situation Display)
2.6 – Navigation & Attack Phases

When using the TSD, it is important to use the appropriate phase using the NAV/ATK Phase selector.

- **NAV (Navigation) Phase** shows navigation-related symbology and information windows. This phase is relevant when flying to or away from the area of operations. This phase does not display threats or target points.

- **ATK (Attack) Phase** shows symbology related to threats and targets. This symbology is more useful when employing sensors and weapons to attack targets of opportunity. You would typically want to use this phase when entering the area of operations.





2 – TSD (Tactical Situation Display)
2.7 – BAM (Battle Area Management) Sub-Page

The BAM (Battle Area Management) sub-page allows the crewmembers to create Priority Fire Zones and No-Fire Zones and assign them to wingmen. When the BAM sub-page is displayed, the map freezes. Assigning such zones between flight members can dramatically increase the efficiency of the unit and facilitate communications when performing complex operations.

A **Priority Fire Zone (PFZ)** is a zone where a target is expected to be. When operating with multiple ships, you can assign a PFZ to each wingman to facilitate dispatching tasks and targets.

- Up to 8 Priority Fire Zones can be created, one of which is active at a time.

A **No-Fire Zone (NFZ)** is a zone where there could be friendly elements or civilian infrastructures. Obviously, you are expected to NOT employ any ordnance in this zone.

- Up to 8 No-Fire Zones (NFZ) can be created, any number of which can be active at the same time.

PFZs and NFZs affect prioritization of FCR (Fire Control Radar) targets. Targets detected in a PFZ are prioritized higher, whereas targets detected in an NFZ are de-prioritized.

2 – TSD (Tactical Situation Display)
2.7 – BAM (Battle Area Management) Sub-Page

You can access the BAM sub-page from the TSD page.

To create a PFZ:
1. From TSD page, select BAM Sub-Page
2. Select PF Fire Zone Type ("PF" for Priority Fire Zone)
3. Select desired drawing method
4. If using the AUTO or MAN drawing method:
   a) Select draw shape ("LN" for lines or "BX" for box)
   b) Select desired number of zones (#Z)
5. If using the TRP (Target Reference Point) drawing method, select desired TRP KM Size.

TRP KM Size
- *When using the TRP drawing method, allows the crewmember to select the size of the fire zone. Pressing the button toggles between 1, 2, and 3 km2.*

Drawing Method Selector
- ***AUTO** (Automatic): The crewmember uses the cursor to designate the two opposite corners of a rectangle.*
  - *If Draw Shape is set to BX, after selecting the second corner, the area within the rectangle is automatically divided up into equally spaced fire zones.*
  - *If Draw Shape is set to LN, after selecting the fourth point, the area within the polygon is automatically divided up into equally spaced fire zones, oriented parallel to the first line drawn.*
- ***MAN** (Manual): The crewmember uses the cursor to draw a single PFZ, which becomes Priority Fire Zone 1. The crewmember repeats this process for each of the remaining Priority Fire Zones, based on the #Z (Number of Zones) value selected.*
- ***TRP** (Target Reference Point): The crewmember designates a target reference point using the cursor. The area around the TRP is automatically divided up into 4 Priority Fire Zones, by quadrant.*

Fire Zone Type Selector
- *PF: Priority Fire Zone*
- *NF: No-Fire Zone*

Fire Zone Activation Selector
- *Used to activate a PFZ. Permits selection of NONE or one of 8 PFZs. Select the Priority Fire Zone to be active which will collapse the menu. Fire zone activations are transmitted to wingmen over IDM using the SEND button.*

Delete Zones Selector
- *Deletes all Priority Fire Zones*

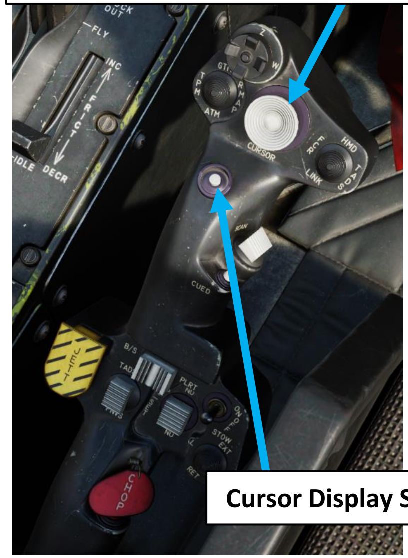
#Z (Number of Zones) Selector
- *Selects the number of zones that will be created when drawing PFZs. The area drawn will be divided up into that number of zones.*

Draw Shape Selector
- *BX (Box): Allows the crewmember to select to opposite corners of a box for a PFZ/NFZ.*
- *LN (Line): Allows the crewmember to draw a quadrilateral polygon for a PFZ/NFZ shape by selecting four corners in a clockwise or counterclockwise order.*

BAM (Battle Area Management) Sub-Page Selector

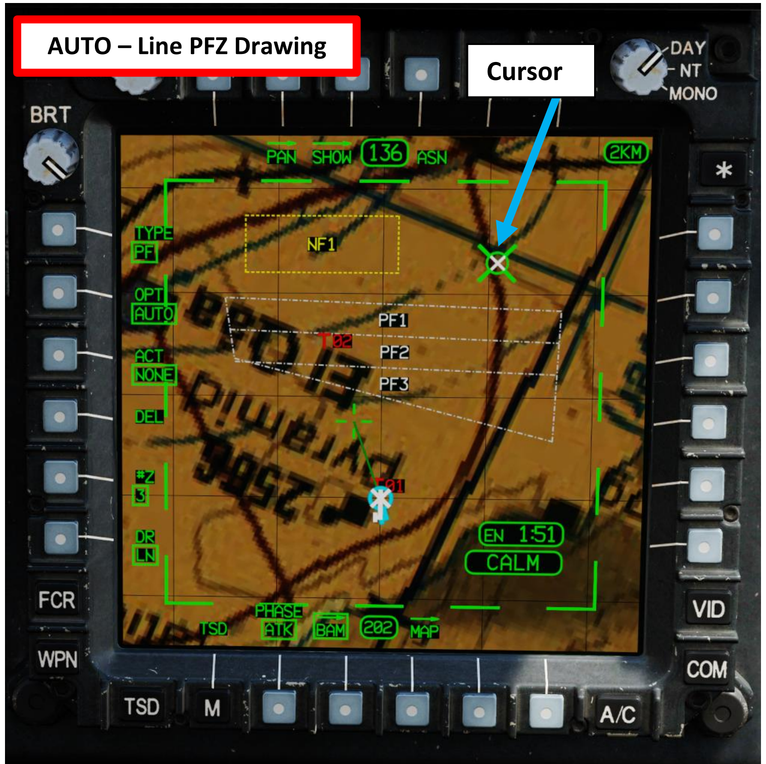
2 – TSD (Tactical Situation Display)
2.7 – BAM (Battle Area Management) Sub-Page

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*



To create a PFZ:

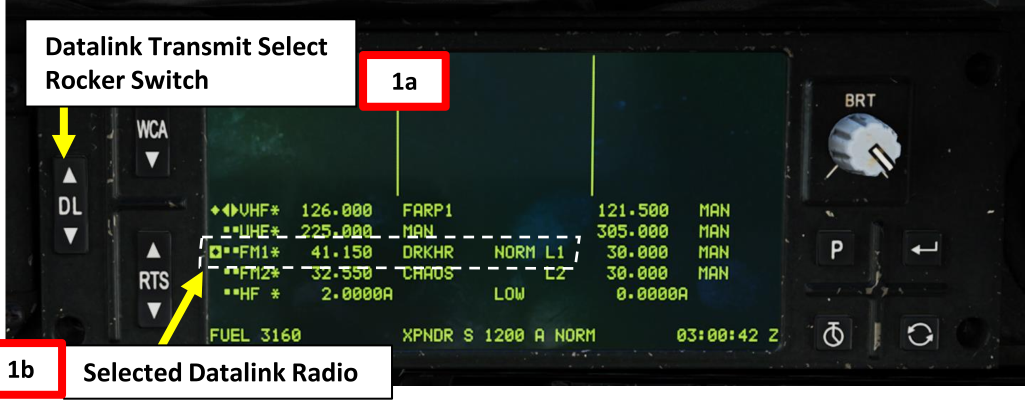
6. Draw selected zone using the selected drawing method
   - ***AUTO*** *(Automatic): The crewmember uses the cursor to designate (with Cursor Control and Cursor Enter) the two opposite corners of a rectangle.*
     - *If Draw Shape is set to BX, after selecting the second corner, the area within the rectangle is automatically divided up into equally spaced fire zones.*
     - *If Draw Shape is set to LN, after selecting the fourth point, the area within the polygon is automatically divided up into equally spaced fire zones, oriented parallel to the first line drawn.*
   - ***MAN*** *(Manual): The crewmember uses the cursor (with Cursor Control and Cursor Enter) to draw a single PFZ, which becomes Priority Fire Zone 1. The crewmember repeats this process for each of the remaining Priority Fire Zones, based on the #Z (Number of Zones) value selected.*
   - ***TRP*** *(Target Reference Point): The crewmember designates a target reference point using the cursor (with Cursor Control and Cursor Enter). The area around the TRP is automatically divided up into 4 Priority Fire Zones, by quadrant.*



2 – TSD (Tactical Situation Display)
2.7 – BAM (Battle Area Management) Sub-Page

Assigning Priority Fire Zones

Pressing the ASN (Assign) Format Selector allows you to assign Priority Fire Zones to flight members (or to you, using Ownship Select). Take note that members need to be on the same datalink network.



Datalink Transmit Select Rocker Switch

1a

1b

Selected Datalink Radio

PF1 (Priority Fire Zone 1) Selected for Assignation

5

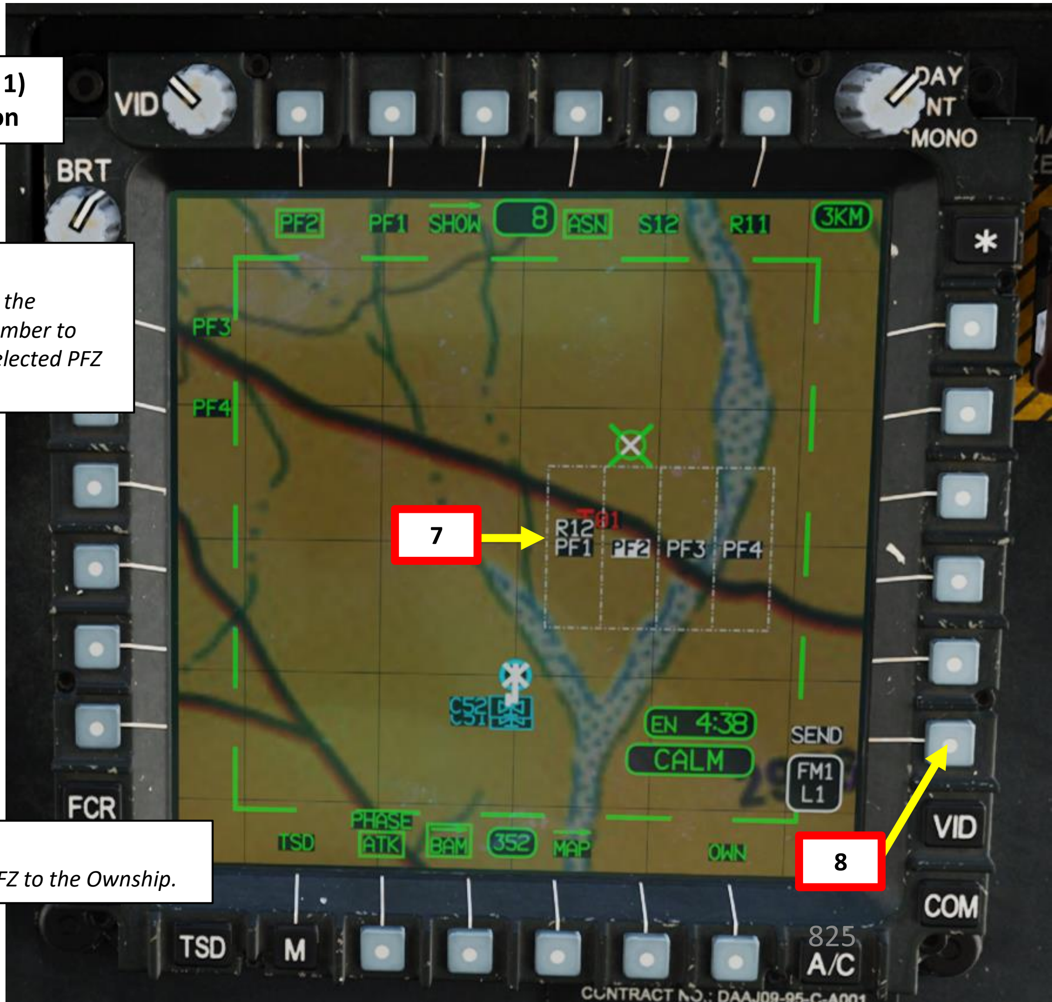
ASN (Assign) Format Selected

4

3

BAM (Battle Area Management) Sub-Page Selector

2



PF1 (Priority Fire Zone 1) Selected for Assignation

Member Select

- *Press a button next to the displayed network member to assign the currently selected PFZ to that member.*

6

6

Ownship Select

- *Assigns the selected PFZ to the Ownship.*

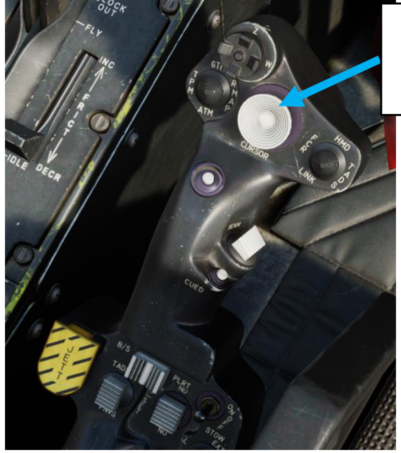
7

8

2 – TSD (Tactical Situation Display)
2.7 – BAM (Battle Area Management) Sub-Page

To create a NFZ:

1. From TSD page, select BAM Sub-Page
2. Select NF Fire Zone Type ("NF" for No-Fire Zone)
3. Select desired Activation Mode
4. Select desired NFZ to draw using the NFZ Selector menu
5. Select draw shape ("LN" for lines or "BX" for box)
6. Draw selected zone using the Cursor Control & Cursor Enter.



Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

NFZ Selector Menu

Activation Mode Selector
- *SINGLE. Only one NFZ is active at a time. The ACT button activates the selected NFZ, and if different NFZ is already active, deactivates it.*
- *MULTI. Multiple NFZs can be active at a time. The ACT button toggles the selected NFZ active or inactive.*

NF1 (No-Fire Zone 1)
Box Drawing

Fire Zone Type Selector
- *PF: Priority Fire Zone*
- *NF: No-Fire Zone*

NFZ Selector
- *Used to select which NFZ is being drawn*

Fire Zone Activation Selector
- *Used to activate a NFZ. Permits selection of NONE or one of 8 NFZs. Select the Priority Fire Zone to be active which will collapse the menu. Fire zone activations are transmitted to wingmen over IDM using the SEND button.*

Delete Zones Selector
- *Deletes selected No-Fire Zone*

Draw Shape Selector
- *BX (Box): Allows the crewmember to select to opposite corners of a box for a PFZ/NFZ.*
- *LN (Line): Allows the crewmember to draw a quadrilateral polygon for a PFZ/NFZ shape by selecting four corners in a clockwise or counterclockwise order.*

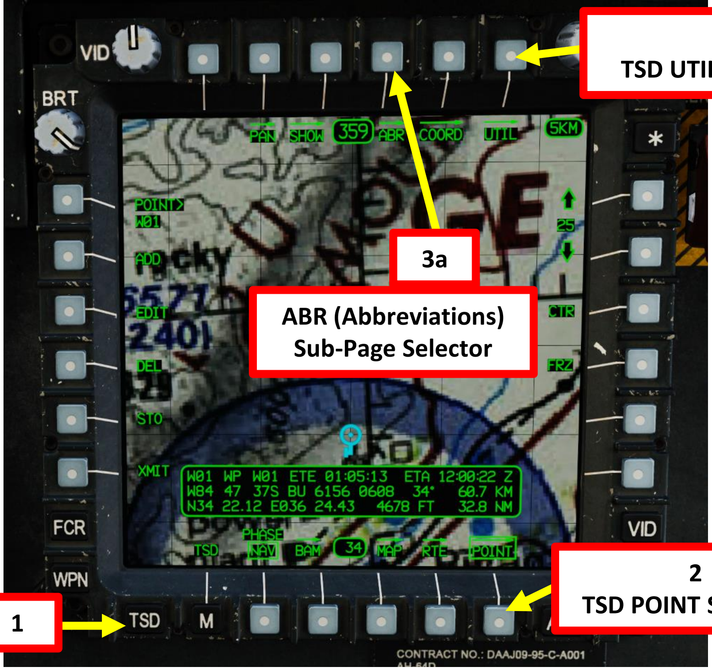
BAM (Battle Area Management)
Sub-Page Selector

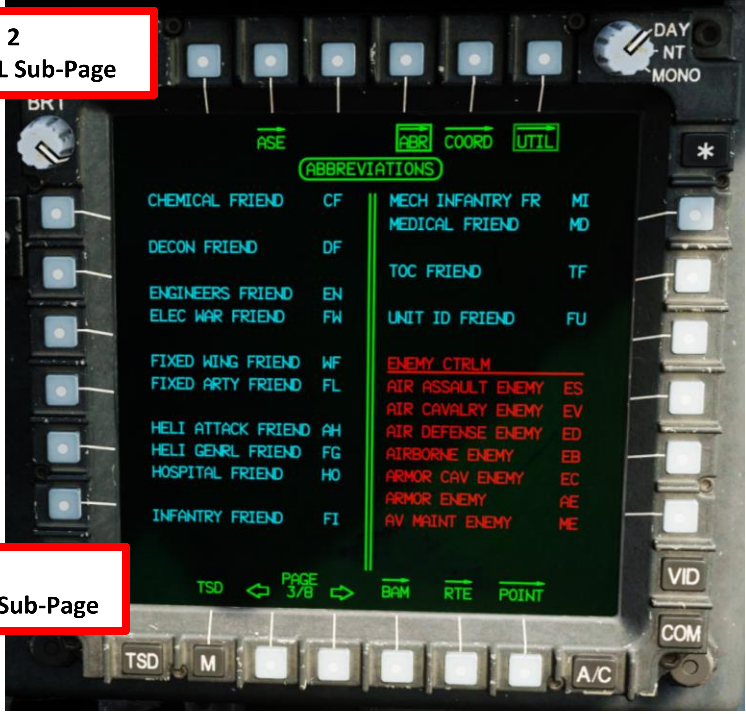
NF1 (No-Fire Zone 2)
Line Drawing
Active

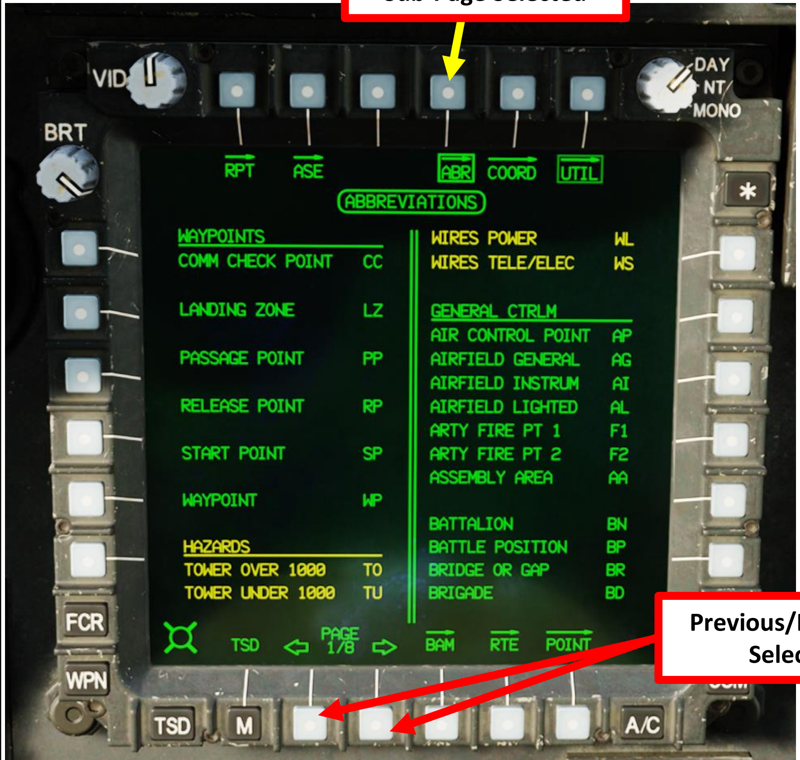
2 – TSD (Tactical Situation Display)
2.8 – ABR (Abbreviations) Sub-Page

From either the TSD POINT or TSD UTIL sub-pages, you can access the ABR (Abbreviations) sub-page. This allows you to search for IDENT (Identifier) codes for specific types of points on the TSD. These points will be explored in the next section.

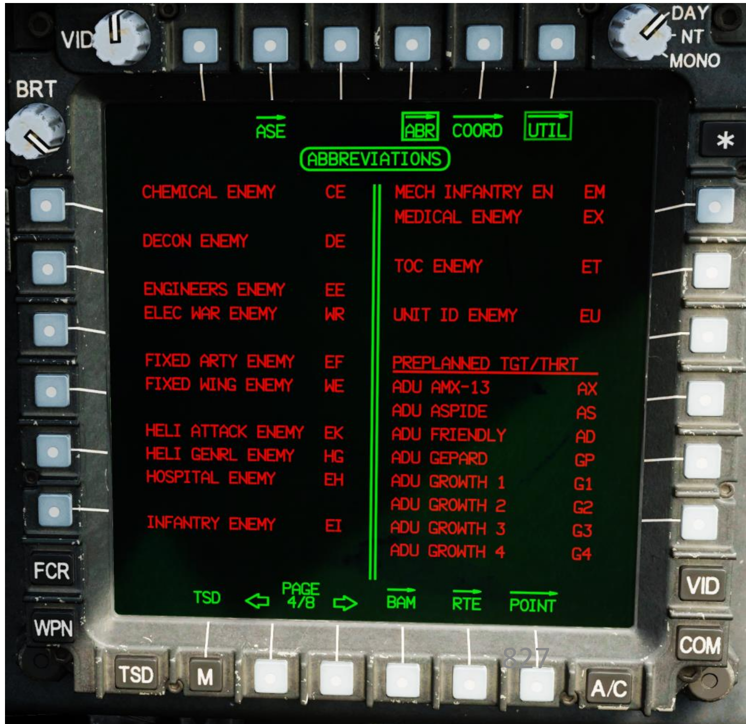
The main use of this page is that it can be useful when manually entering points during a mission.





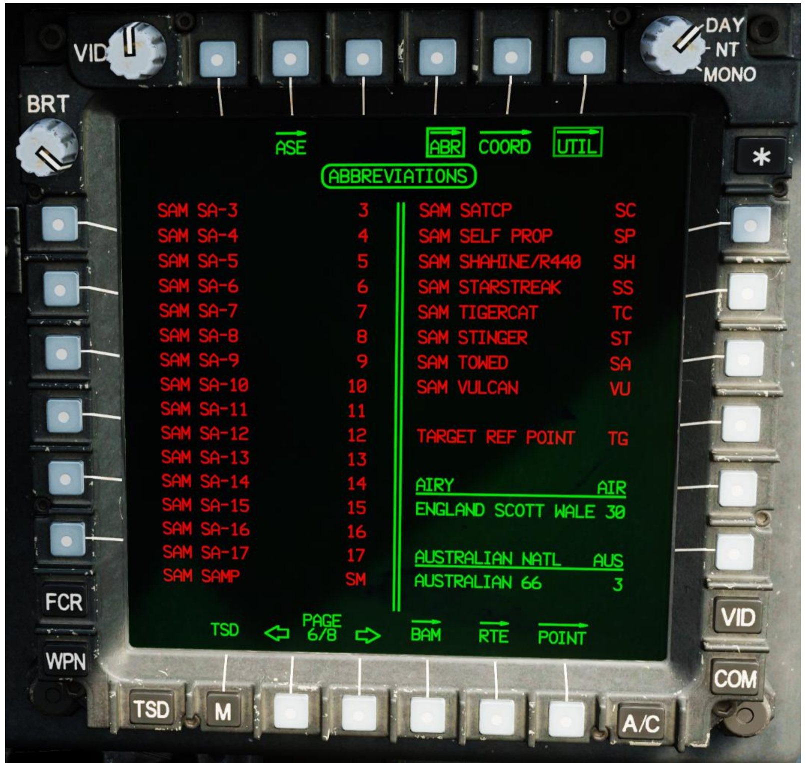


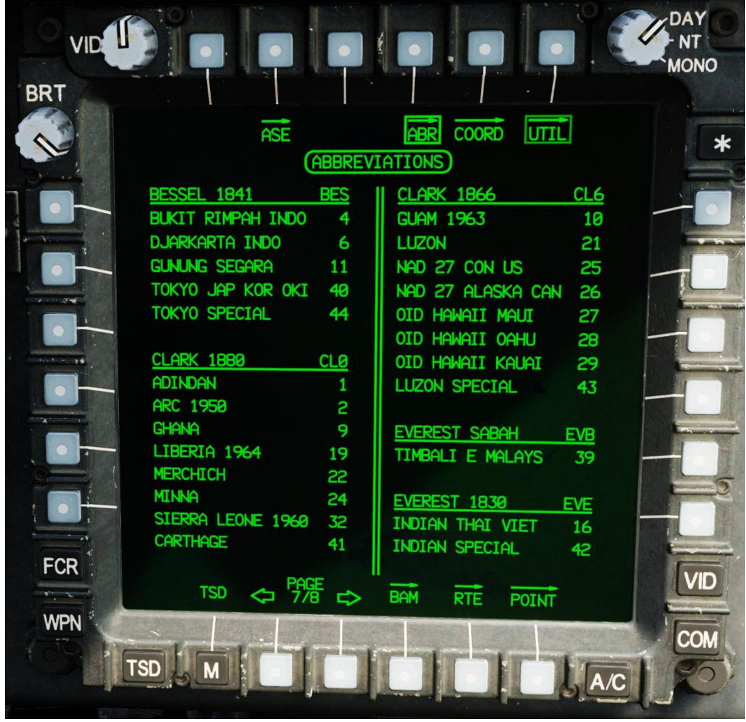
Previous/Next Page Selectors



2 – TSD (Tactical Situation Display)
2.8 – ABR (Abbreviations) Sub-Page

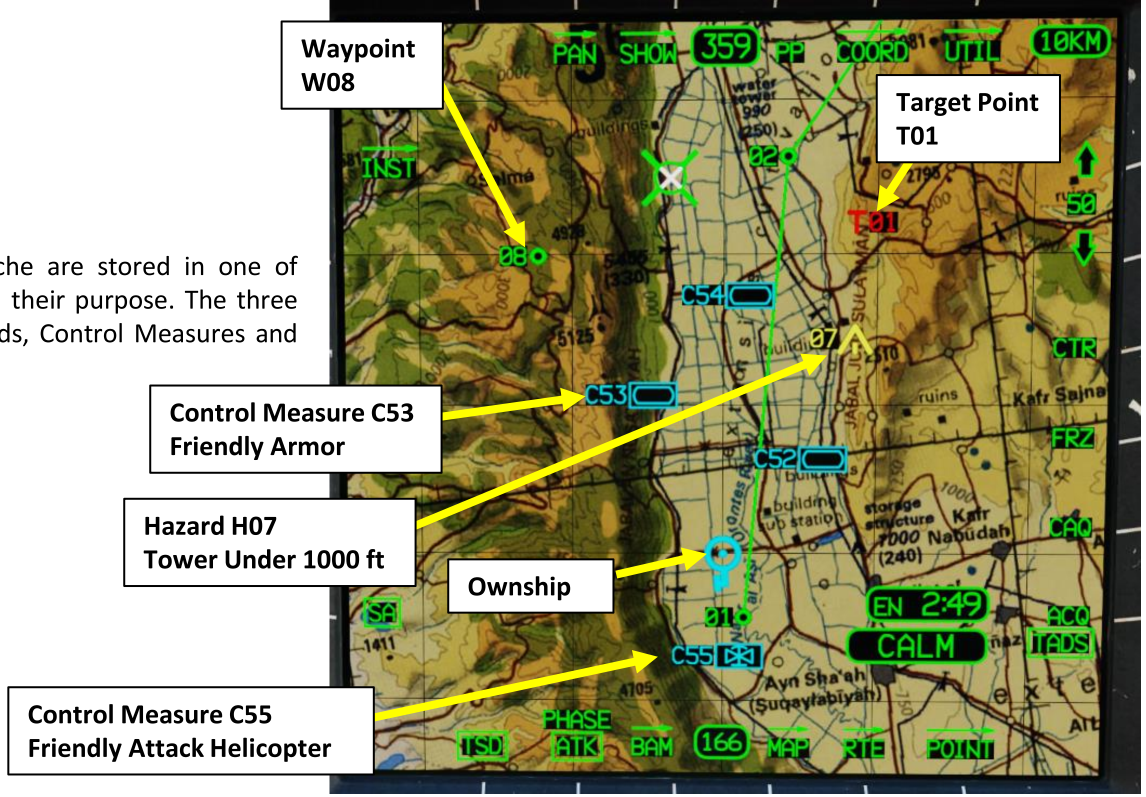
There are up to eight pages worth of IDENT codes. Use them well!





3 – Points
3.1 – Point Types
3.1.1 – Overview

Navigation points in the Apache are stored in one of three partitions, depending on their purpose. The three partitions are Waypoint/Hazards, Control Measures and Target/Threats.



Navigation Point Database Partitions

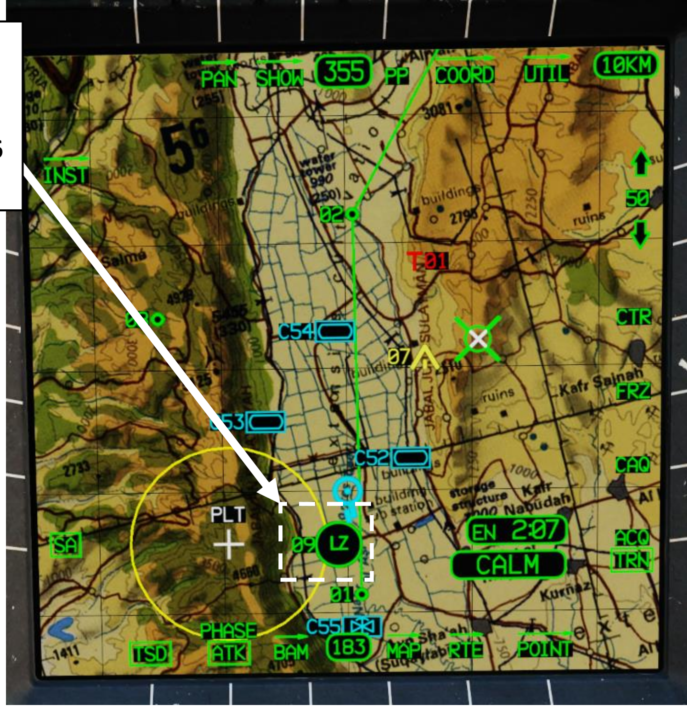
WPTHZ	CTRLM	TGT/THRT	TRN
• Waypoints • Hazards	• General Control Measures • Friendly Control Measures • Enemy Control Measures	• Targets • Threats	• Terrain Point Targets
Points 1 through 50	Points 51 through 99 • Points 93 through 99 store Present Position Reports	Points 100 through 149 • Referred as "T01" through "T50"	Points 150 through 155 (referred as "T51" through "T56")
Used for depicting Generic Waypoints, Communications Checkpoints, route Start and Release Points, and Hazards such as towers or wires.	Used for depicting friendly and enemy units, airfields, and other graphical control measures for “controlling” a mission. • Note: anything stored in points 93 through 99 will be overwritten when a present position is received from another aircraft.	Used for depicting targets and threats. Threat icons can display threat rings.	Used for storing additional TSD file locations such as the PLT (Pilot) and CPG (Co-Pilot/Gunner) TRN (Terrain) points. • Note: Cannot be added/edited with the KU (Keyboard Unit) since these database files reside within aircraft memory.

3 – Points
3.1 – Point Types
3.1.1 – Overview

There are four main components of information associated with each point within the aircraft database:

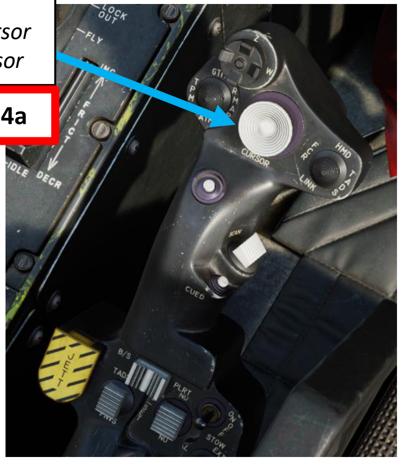
- **IDENT**: Identifier, a unique letter code specific to a point type.
    - Example: 1 a Communications Checkpoint (CC) identifier is a Waypoint/Hazard, and therefore cannot be used if the selected point type is a Control Measure
    - Example 2: a Checkpoint (CP) identifier is a Control Measure, which cannot be used if the selected point type is a Waypoint/Hazard.
- **FREE**: Free text, consists of up to three alphanumeric characters that can be added for additional information to the crewmembers.
    - For most points, these free text characters are only visible when reviewing a point on the COORD page, or when the Review Status window is displayed on the POINT or RTE sub-pages
    - Some types of Control Measures will display their free text information directly on the TSD. These types of points can be useful in providing additional information of the nature of that location, even if the icon itself doesn’t align with the terrain or situation.
    - In other cases, it may be more useful to have a specific point type placed on the TSD to provide context to the crew at a quick glance.
    - Any time a custom free text is not entered by the crew, the free text defaults to the point type and number within the database (i.e., “W01”, “H09”, “C51”, “T05” etc.).
- **UTM LAT/LONG**: Universal Transverse Mercator Latitude/Longitude coordinates.
    - The location of each point is stored using MGRS coordinates (labeled as UTM in the cockpit) or Latitude/Longitude in Degrees, Minutes, Minute-Decimals format (DD°MM.MMM).
    - Regardless of the method of entry, both coordinate formats can be viewed in the Review Status window or on the COORD page.
- **ALTITUDE**: elevation above mean sea level.
    - The altitude of each point is referenced from mean sea level (MSL) in feet.
    - Any time a custom altitude is not entered by the crew, the altitude defaults to the elevation of the terrain at the point’s location using Digital Terrain Elevation Data loaded into the aircraft database.

Waypoint W09
- **Ident: LZ (Landing Zone)**
- **Free Text: FAL (Falcon)**
- **UTM LAT/LONG: 37S BV 5373 2656**
- **Altitude: 529 ft**



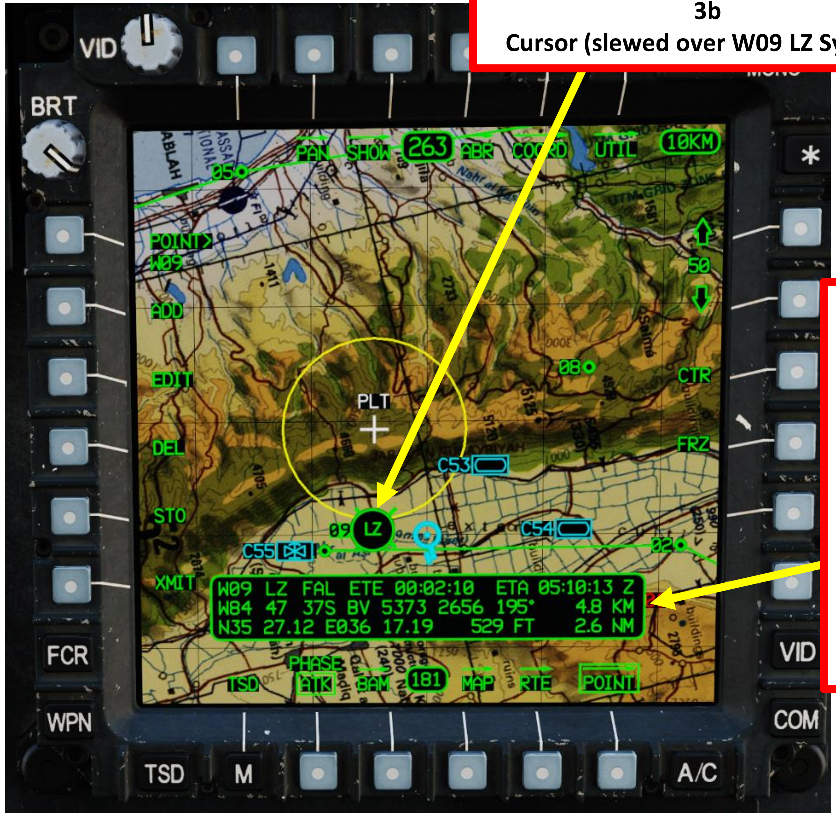
3 – Points
3.1 – Point Types
3.1.1 – Overview

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*



When a point is selected on the TSD while the POINT or RTE sub-pages are displayed, the point's label will be displayed in inverse video, and the Review Status window will be displayed showing additional information. Any point may be selected as a Direct-To for the purposes of navigation, or as the Acquisition source for the purposes of targeting.

A quick way of selecting a point (and display the Review Status Window) can be done by:
1. Select TSD page
2. Select POINT sub-page
3. Move Cursor over desired symbol on the TSD
4. Press "Cursor Enter" to select desired symbol and display the Review Status Window.



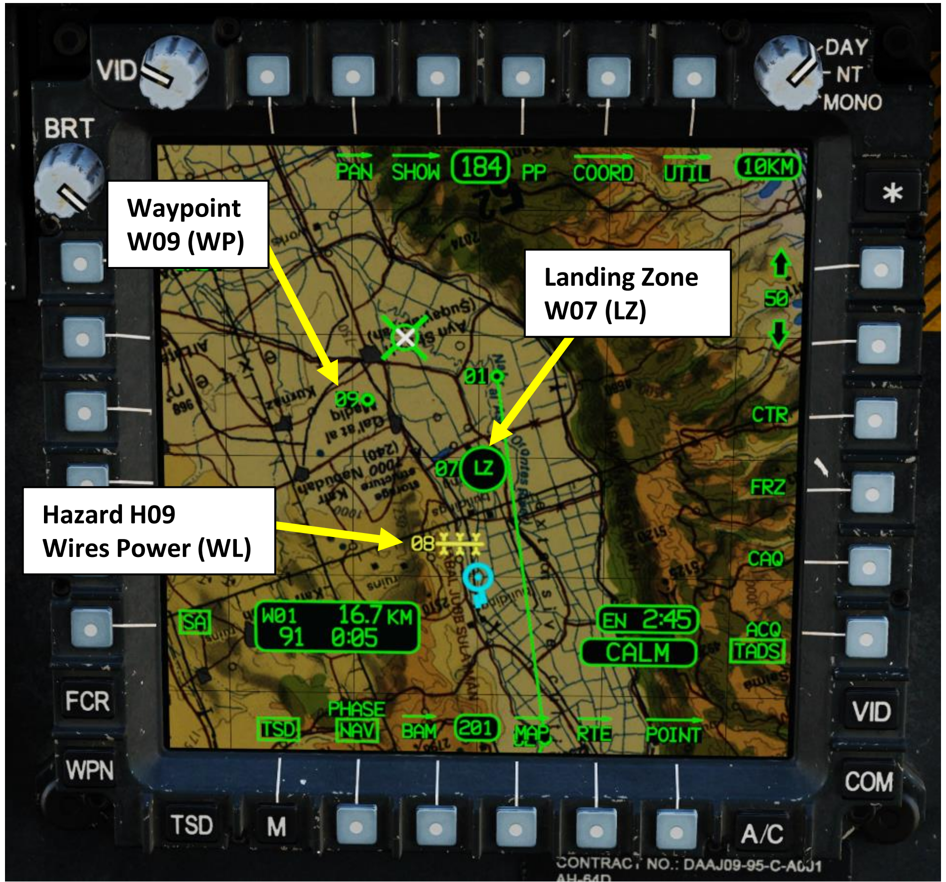
4b
Review Status Window
- W09: Waypoint 09
- LZ: Identifier (Landing Zone)
- FAL: Free Text Characters (LZ Falcon)
- ETE: Estimated time enroute to the point
- ETA: Estimated time of arrival at the point
- W04 47 37S BV 5373 2656: MGRS/UTM Coordinates
- 195: Heading to point
- 4.8 KM / 2.6 NM: Distance to Go
- N35 27.12 E036 17.19: Latitude / Longitude Coordinates
- 529 FT: Point Altitude (Above Mean Sea Level)

3 – Points
3.1 – Point Types
3.1.2 – WPTHZ (Waypoints/Hazards)

Waypoint/Hazards include graphics for depicting Generic Waypoints, Communications Checkpoints, route Start and Release Points, and Hazards such as towers or wires. Hazards are depicted in yellow. It is important to note that hazards are always perpendicular to the flight path of the aircraft on the TSD and do not depict the actual direction of the hazard, but its general location only.

- When creating a waypoint (WP) with the “Cursor Drop” method, the default point dropped at the cursor location is a Waypoint (WP).
- When creating a hazard (HZ) with the “Cursor Drop” method, the default point dropped at the cursor location is a Tower Under 1000 ft (TU).

Important Note:
Waypoint and Hazard data can be accessed from the COORD page in the WPTHZ sub-menu. Data can be expanded by using the VABs (Variable Action Button) to the right. Left VABs select a waypoint as an acquisition source.



COORD Page
WPTHZ Sub-Menu

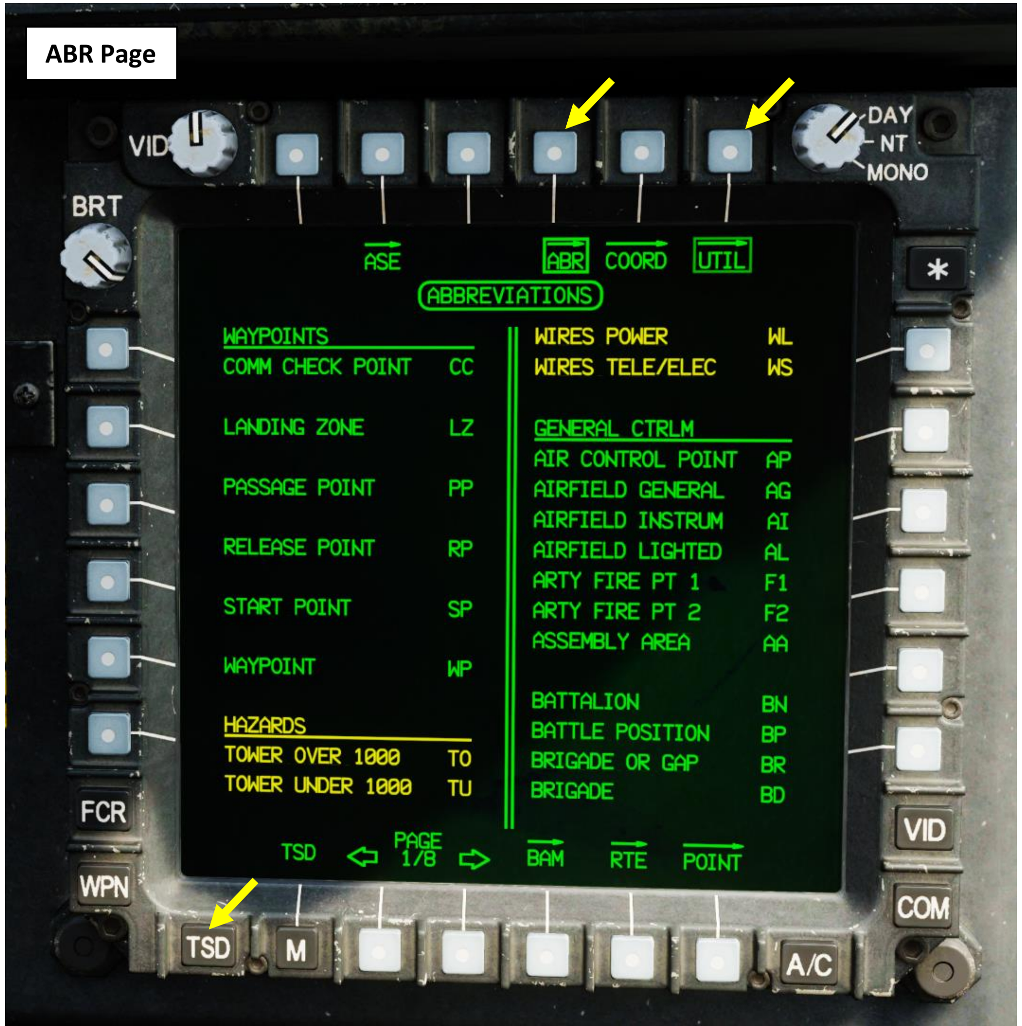
Left VABs select waypoint as an acquisition source.

Source: Eagle Dynamics AH-64D Manual

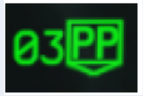
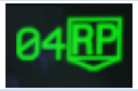
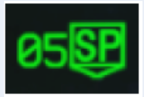
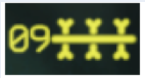
3 – Points
3.1 – Point Types
3.1.2 – WPTHZ (Waypoints/Hazards)

A complete list can be found on the TSD Abbreviation (ABR) page. This page is accessed by selecting either the TSD POINT or TSD UTIL sub-pages.

ABR Page



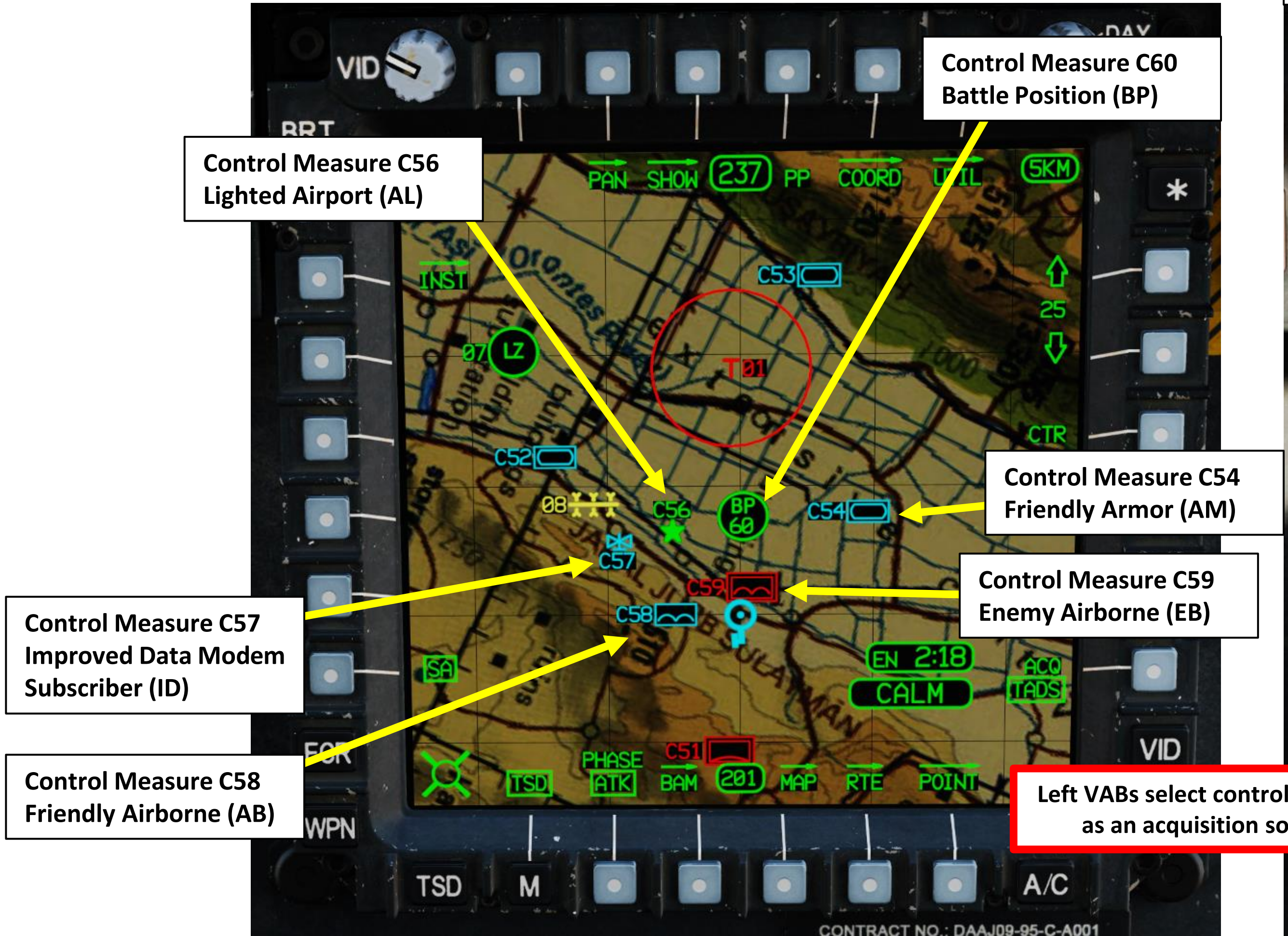
Waypoints/Hazards TSD Symbols

Symbol	Identifier	Point Name
	**CC**	Communications Check Point
	**LZ**	Landing Zone
	**PP**	Passage Point
	**RP**	Release Point
	**SP**	Start Point
	**WP**	Waypoint
	**TO**	Tower over 1000 ft
	**TU**	Tower under 1000 ft
	**WL**	Wires Power
	**WS**	Wires Telephone/Electric

3 – Points
3.1 – Point Types
3.1.3 – CTRLM (Control Measures)

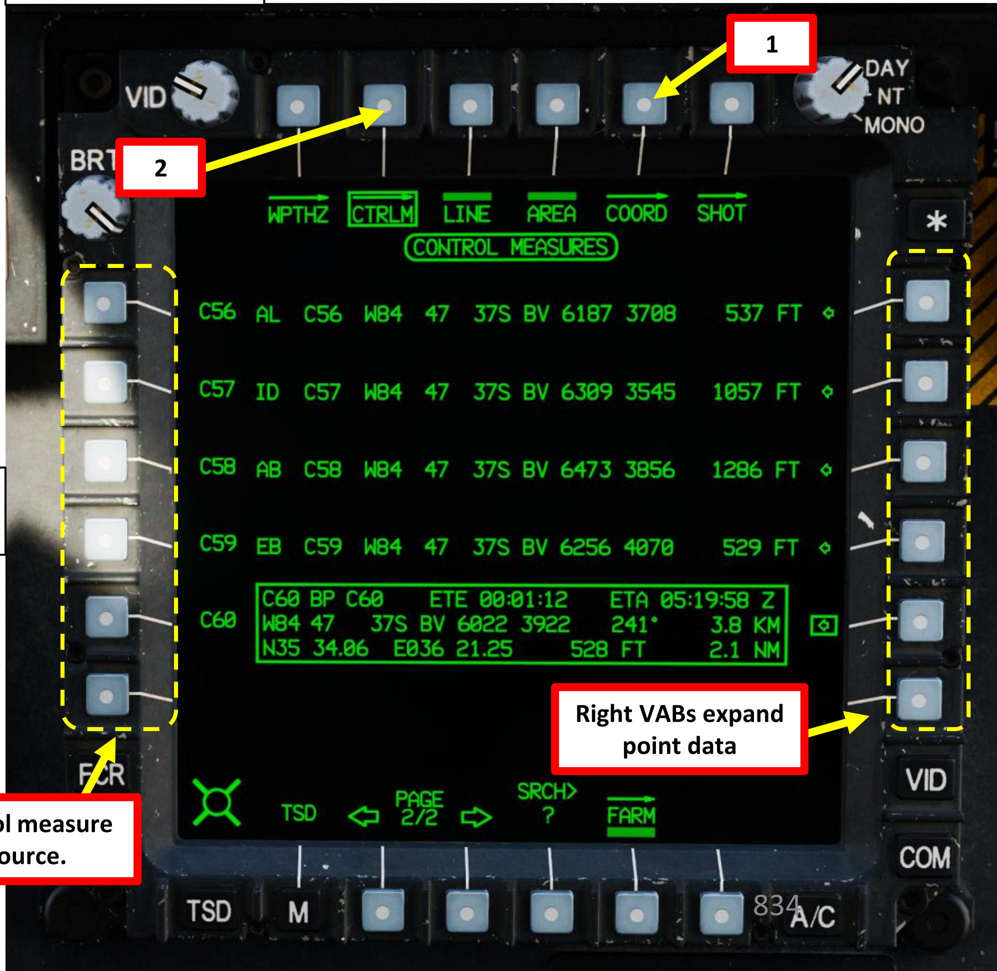
Control measures include graphics for depicting Friendly and Enemy Units, Forward Arming and Refueling Points (FARPS), Battle Positions and others.

- When creating a control measure with the "Cursor Drop" method, the default point dropped at the cursor location is a Checkpoint (CP).



Important Note:
Control Measure data can be accessed from the COORD page in the CTRLM sub-menu. Data can be expanded by using the VABs (Variable Action Button) to the right. Left VABs select a control measure as an acquisition source.

COORD Page
CTRLM Sub-Menu

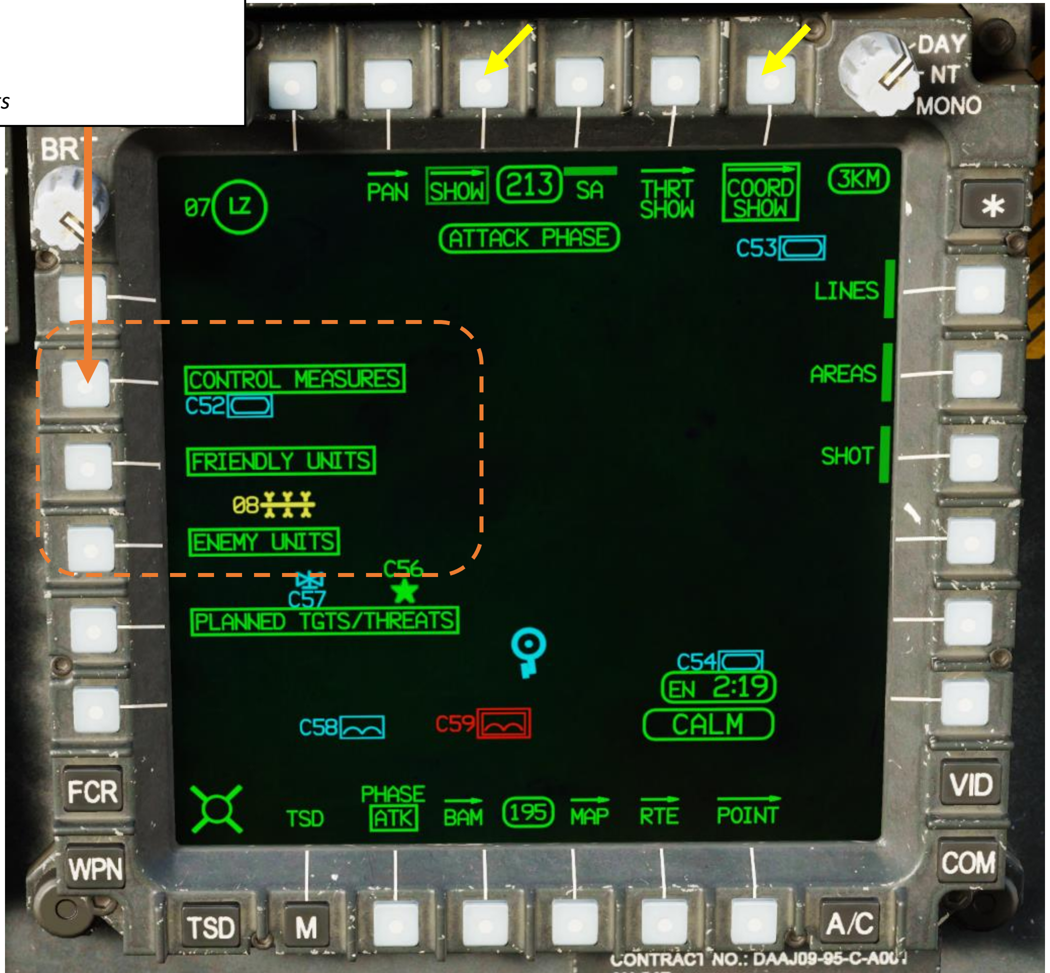


3 – Points
3.1 – Point Types
3.1.3 – CTRLM (Control Measures)

In the COORD SHOW sub-page, you can toggle control measure symbology visibility options.

A complete list can be found on the TSD Abbreviation (ABR) page. This page is accessed by selecting either the TSD POINT or TSD UTIL sub-pages.

Shown Data Selectors (boxed = displayed)
- *Control Measures*
- *Friendly Units*
- *Enemy Units*
- *Planned Targets/Threats*

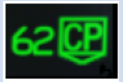
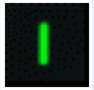
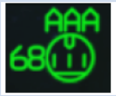


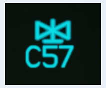
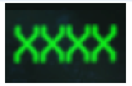
ABR Page

3 – Points
3.1 – Point Types
3.1.3 – CTRLM (Control Measures)

Source: Eagle Dynamics AH-64D Manual

Control Measures TSD Symbols		
Symbol	Identifier	Point Name
	AP	Air Control Point
	AG	Airfield General
	AI	Airfield Instrument
	AL	Lighted Airport
	F1	Artillery Firing Point 1
	F2	Artillery Firing Point 2
	AA	Assembly Area
	BN	Battalion
	BP	Battle Position
	BR	Bridge or Gap

Control Measures TSD Symbols		
Symbol	Identifier	Point Name
	BD	Brigade
	CP	Checkpoint
	CO	Company
	CR	Corps
	DI	Division
	FF	FARP (Forward Arming Refueling Point) Fuel Only
	FM	FARP (Forward Arming Refueling Point) Ammo Only
	FC	FARP (Forward Arming Refueling Point) Fuel & Ammo
	FA	Forward Assembly Area
	GL	Ground Light/Small Town

Control Measures TSD Symbols		
Symbol	Identifier	Point Name
	HA	Holding Area
	NB	NBC (Nuclear, Biological, Chemical) Area
	ID	IDM (Improved Data Modem) Subscriber
	BE	NDB (Non-Directional Beacon) Symbol
	RH	Railhead Point
	GP	Regiment or Group
	US	United States Army

3 – Points
3.1 – Point Types
3.1.3 – CTRLM (Control Measures)

Source: Eagle Dynamics AH-64D Manual

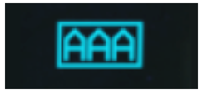
Friendly Control Measures TSD Symbols

Symbol	Identifier	Point Name
	AD	Friendly Air Defense
	AS	Friendly Air Assault
	AV	Friendly Air Cavalry
	AB	Friendly Airborne
	AM	Friendly Armor
	CA	Friendly Armored Cavalry
	MA	Friendly Aviation Maintenance
	CF	Friendly Chemical
	DF	Friendly Decontamination
	EN	Friendly Engineers

Friendly Control Measures TSD Symbols

Symbol	Identifier	Point Name
	FW	Friendly Electronic Warfare
	WF	Friendly Fixed Wing
	FL	Friendly Field Artillery
	AH	Friendly Attack Helicopter
	FG	Friendly Helicopter, General
	HO	Friendly Hospital
	FI	Friendly Infantry
	MI	Friendly Mechanized Infantry
	MD	Friendly Medical
	TF	Friendly Tactical Operations Center

Friendly Control Measures TSD Symbols

Symbol	Identifier	Point Name
	FU	Friendly Unit

3 – Points
3.1 – Point Types
3.1.3 – CTRLM (Control Measures)

Source: Eagle Dynamics AH-64D Manual

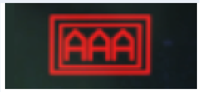
Enemy Control Measures TSD Symbols

Symbol	Identifier	Point Name
	ED	Enemy Air Defense
	ES	Enemy Air Assault
	EV	Enemy Air Cavalry
	EB	Enemy Airborne
	AE	Enemy Armor
	EC	Enemy Armored Cavalry
	ME	Enemy Aviation Maintenance
	CE	Enemy Chemical
	DE	Enemy Decontamination
	EE	Enemy Engineers

Enemy Control Measures TSD Symbols

Symbol	Identifier	Point Name
	WR	Enemy Electronic Warfare
	WE	Enemy Fixed Wing
	EF	Enemy Field Artillery
	EK	Enemy Attack Helicopter
	HG	Enemy Helicopter, General
	EH	Enemy Hospital
	EI	Enemy Infantry
	EM	Enemy Mechanized Infantry
	EX	Enemy Medical
	ET	Enemy Tactical Operations Center

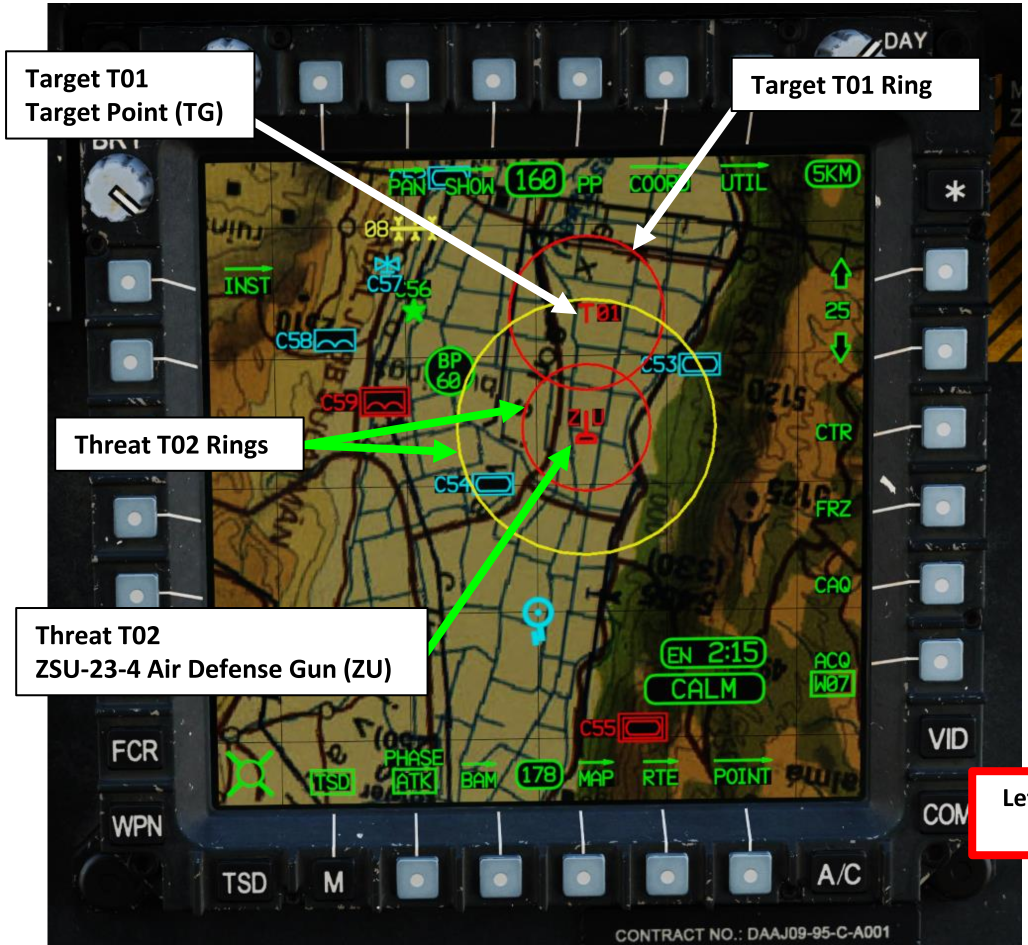
Enemy Control Measures TSD Symbols

Symbol	Identifier	Point Name
	EU	Enemy Unit

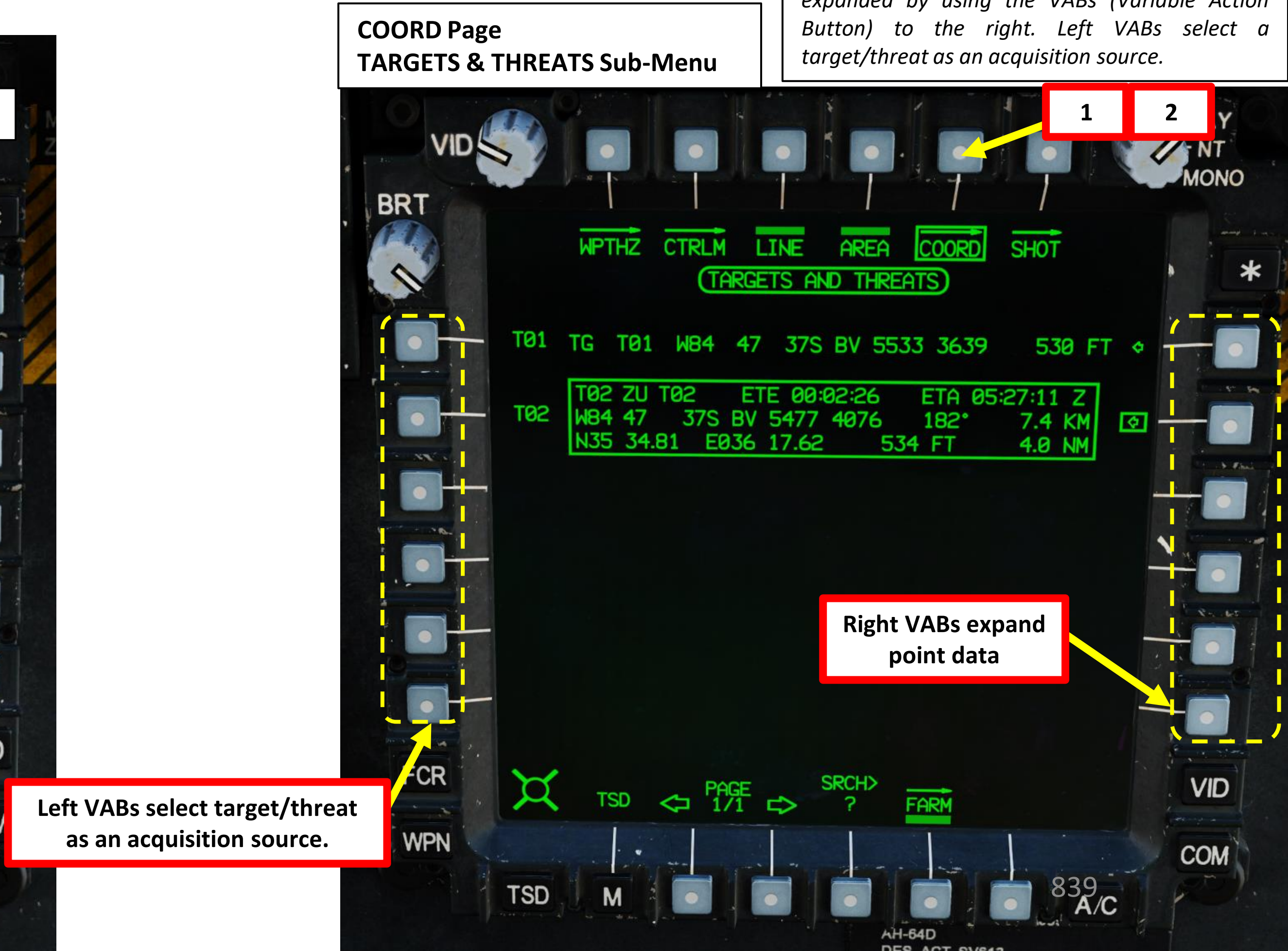
3 – Points
3.1 – Point Types
3.1.4 – TGT/THRT (Targets/Threats)

Targets/Threats include graphics for depicting the location of Targets found during the conduct of a mission or for depicting the location of known or templated threat systems. When a point is entered as a Threat, it can display a threat ring on the TSD. Threat rings are toggleable on the THRT SHOW sub-page on the TSD.

- When creating a target/threat with the “Cursor Drop” method, the default point dropped at the cursor location is a Target Point (TG).



Important Note:
Target and threat data can be accessed from the COORD page sub-menu (press the COORD VAB twice to access this sub-page). Data can be expanded by using the VABs (Variable Action Button) to the right. Left VABs select a target/threat as an acquisition source.

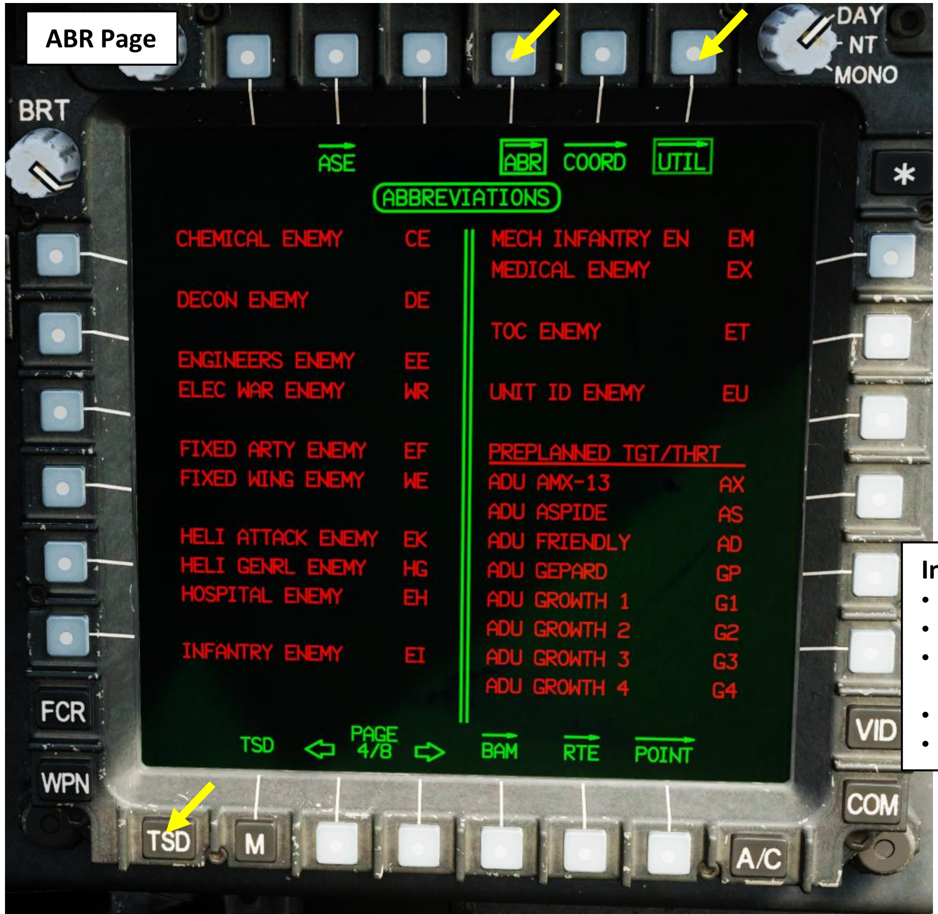


3 – Points
3.1 – Point Types
3.1.4 – TGT/THRT (Targets/Threats)

In the COORD SHOW sub-page, you can toggle target/threat symbology visibility options.

In the THRT SHOW sub-page, you can toggle target/threat ring symbology visibility options.

A complete list can be found on the TSD Abbreviation (ABR) page. This page is accessed by selecting either the TSD POINT or TSD UTIL sub-pages.



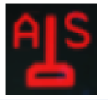
Shown Data Selectors (boxed = displayed)
- *Control Measures*
- *Friendly Units*
- *Enemy Units*
- *Planned Targets/Threats*

Intervisibility/Rings Toggle Selectors (boxed = displayed)
- *ACQ: Current ACQ source if a point (W##, H##, C##, T##).*
- *TRN PT: Pilot and CPG terrain points. (T55 or T56)*
- *FCR/RFI: FCR (Fire Control Radar) targets that have been merged with RFI-detected threats.*
- *THREATS: Threats (T##).*
- *TARGETS: Targets (T##).*

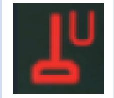
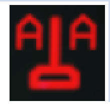
3 – Points
3.1 – Point Types
3.1.4 – TGT/THRT (Targets/Threats)

Source: Eagle Dynamics AH-64D Manual

Targets/Threats TSD Symbols

Symbol	Identifier	Point Name
	TG	Target Point
	AX	AMX-13 Air Defense Gun
	AS	Aspide SAM System
	AD	Friendly Air Defense Gun
	GP	Gepard Air Defense Gun
	G1	Growth 1
	G2	Growth 2
	G3	Growth 3
	G4	Growth 4
	SD	Spada SAM System

Targets/Threats TSD Symbols

Symbol	Identifier	Point Name
	83	M1983 Air Defense Gun
	U	Unknown Air Defense Unit
	S6	2S6 / SA-19 Air Defense Unit
	AA	Air Defense Gun
	GU	Generic Air Defense Unit
	MK	Marksman Air Defense Gun
	SB	Sabre Air Defense Gun
	GS	Self-Propelled Air Defense Gun
	GT	Towed Air Defense Gun
	ZU	ZSU-23-4 Air Defense Gun

Targets/Threats TSD Symbols

Symbol	Identifier	Point Name
	NV	Naval Air Defense System
	SR	Battlefield Surveillance Radar
	TR	Target Acquisition Radar
	70	RBS-70 SAM System
	BP	Blowpipe SAM System
	BH	Bloodhound SAM System
	CH	Chapparal SAM System
	CT	Crotale SAM System
	C2	CSA-2/1/X SAM System
	HK	Hawk SAM System

3 – Points
3.1 – Point Types
3.1.4 – TGT/THRT (Targets/Threats)

Source: Eagle Dynamics AH-64D Manual

Targets/Threats TSD Symbols

Symbol	Identifier	Point Name
	**JA**	Javelin SAM System
	**PT**	Patriot SAM System
	**RE**	Redeye SAM System
	**RA**	Rapier SAM System
	**RO**	Roland SAM System
	**1**	SA-1 SAM System
	**2**	SA-2 SAM System
	**3**	SA-3 SAM System
	**4**	SA-4 SAM System
	**5**	SA-5 SAM System

Targets/Threats TSD Symbols

Symbol	Identifier	Point Name
	**6**	SA-6 SAM System
	**7**	SA-7 SAM System
	**8**	SA-8 SAM System
	**9**	SA-9 SAM System
	**10**	SA-10 SAM System
	**11**	SA-11 SAM System
	**12**	SA-12 SAM System
	**13**	SA-13 SAM System
	**14**	SA-14 SAM System
	**15**	SA-15 SAM System

Targets/Threats TSD Symbols

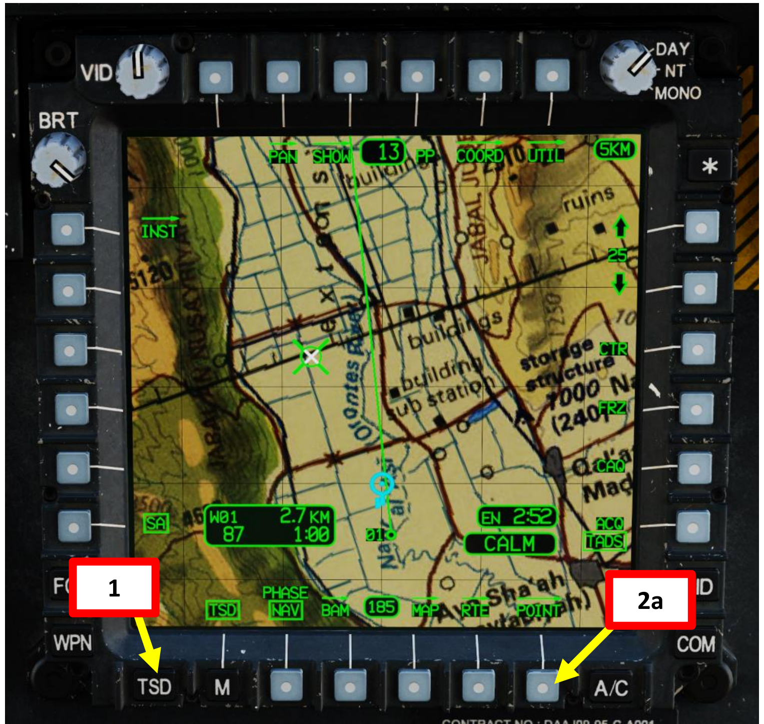
Symbol	Identifier	Point Name
	**16**	SA-16 SAM System
	**17**	SA-17 SAM System
	**SM**	SAMP SAM System
	**SC**	SATCP SAM System
	**SP**	Self-Propelled SAM System
	**SH**	Shahine/R440- SAM System
	**SS**	Starstreak SAM System
	**TC**	Tigercat SAM System
	**ST**	Stinger SAM System
	**SA**	Towed SAM System
	**VU**	Vulcan Air Defense Gun

3 – Points
3.2 – Adding a Point
3.2.1 – Using “Cursor Drop”

You can add a point by using the cursor to designate a location on the TSD (Tactical Situation Display).

To create a point using the “cursor drop” method:

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press POINT VAB (Variable Action Button).
3. Press ADD VAB.
4. Select the type of point you want to add. In this example, we will select a Control Measure (CM).
   - WP: Waypoint
   - HZ: Hazard
   - CM: Control Measure
   - TG: Target/Threat



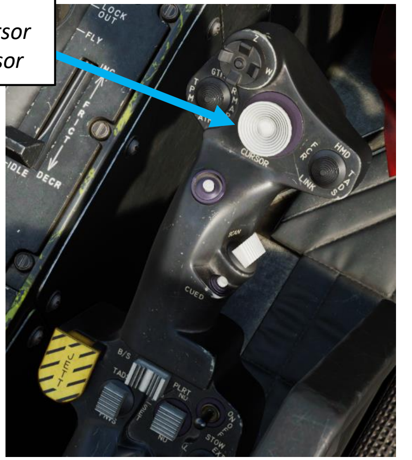
3 – Points
3.2 – Adding a Point
3.2.1 – Using "Cursor Drop"

To create a point using the "cursor drop" method:

5. When the "cursor drop" method is used to add a point, default points are dropped at the cursor location based on what point type is selected:
   - Selecting WP (Waypoint) will drop a Waypoint (WP) by default
   - Selecting HZ (Hazard) will drop a Tower Under 1000' (TU) by default
   - Selecting CM (Control Measure) will drop a Checkpoint (CP) by default
   - Selecting TG (Target/Threat) will drop a Target Point (TG) by default
6. Move Cursor over desired location of the selected point.
7. Press "Cursor Enter" to create desired point at the cursor location.
8. Once point is created, the Review Status Window will display point information.
9. Exit the point ADD sub-menu by pressing the POINT VAB again.

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

6 7



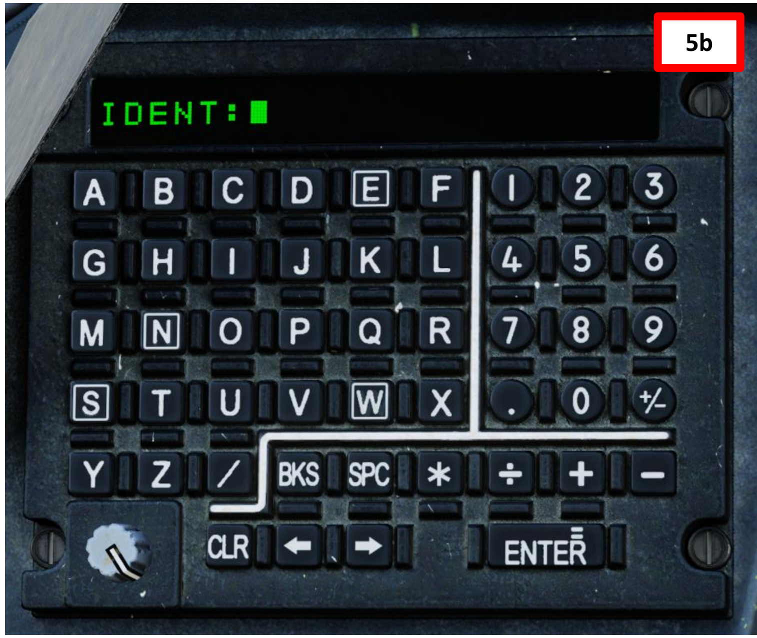
8
Review Status Window
- **C56: Control Measure 56**
- **CP: Identifier (Checkpoint, CP)**
- **C56 (right of CP): Free Text Characters (C56 is auto-generated)**
- **ETE: Estimated time enroute to the point**
- **ETA: Estimated time of arrival at the point**
- **W04 47 37S BV 5869 2650: MGRS/UTM Coordinates**
- **60: Heading to point**
- **4.2 KM / 2.3 NM: Distance to Go**
- **N35 27.17 E036 20.47: Latitude / Longitude Coordinates**
- **529 FT: Point Altitude (Above Mean Sea Level)**

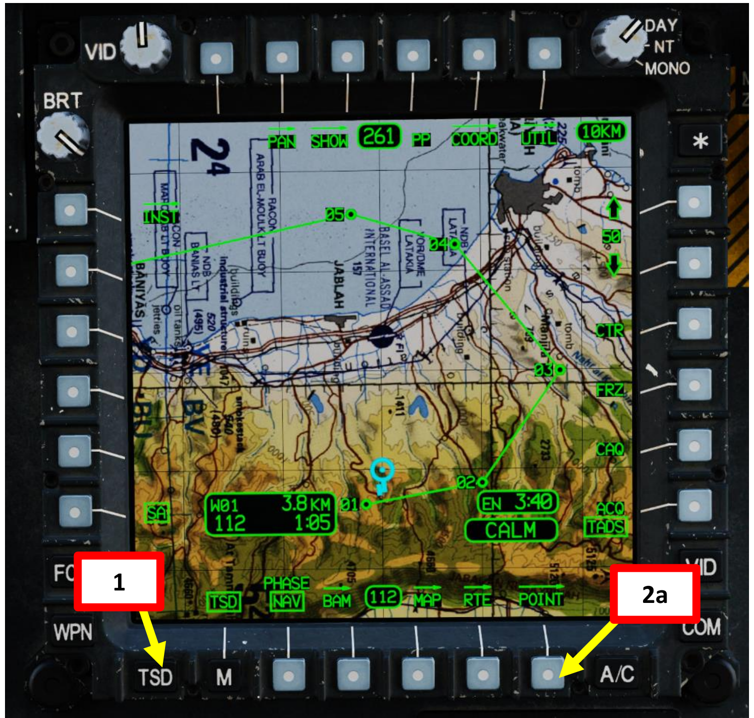
3 – Points
3.2 – Adding a Point
3.2.2 – Using Coordinates with KU (Keyboard Unit)

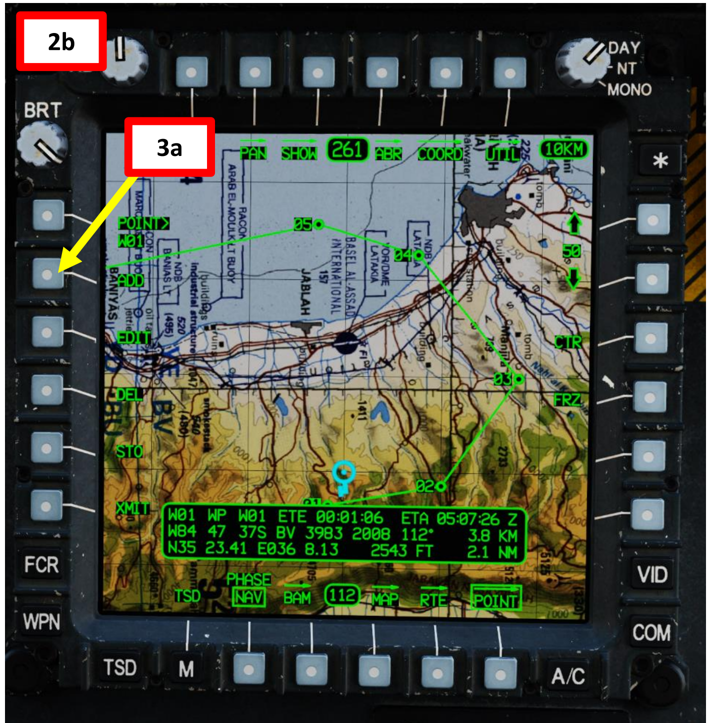
You can add a point by using the KU (Keyboard Unit) to input coordinates and elevation.

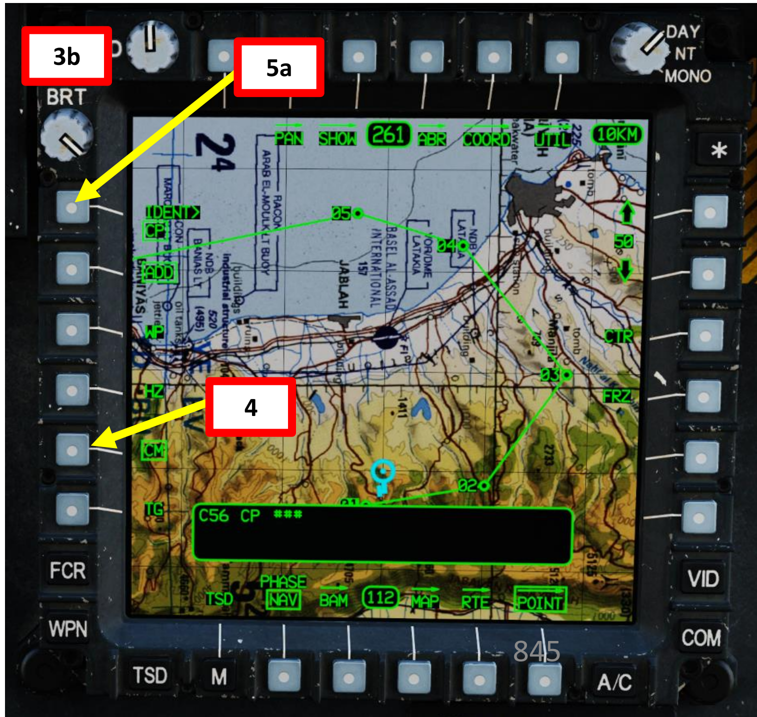
To create a point using the "KU" method:

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press POINT VAB (Variable Action Button).
3. Press ADD VAB.
4. Select the type of point you want to add. In this example, we will select a Control Measure (CM) since we want to add the Bassel Al Assad airport as a Control Measure (CM) of "Airfield General" type (Ident: AG).
    - WP: Waypoint
    - HZ: Hazard
    - CM: Control Measure
    - TG: Target/Threat
5. Press IDENT (Identity) VAB. KU (Keyboard Unit) will then display "IDENT:".









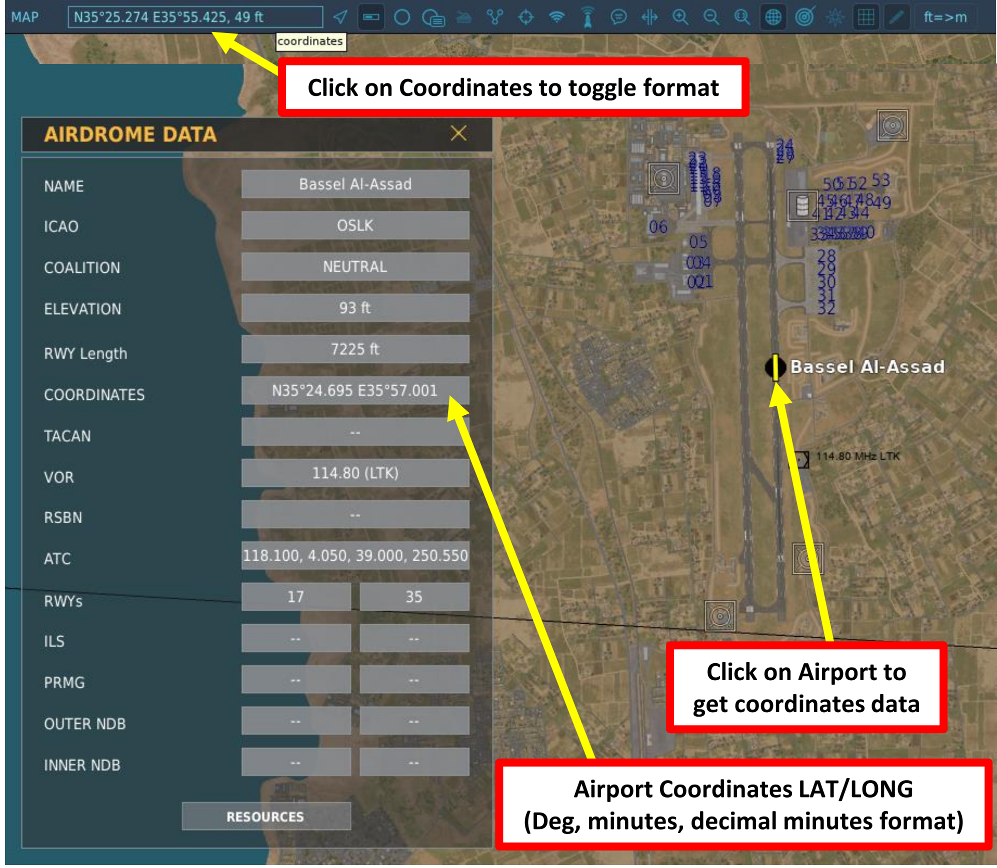
3 – Points
3.2 – Adding a Point
3.2.2 – Using Coordinates with KU (Keyboard Unit)

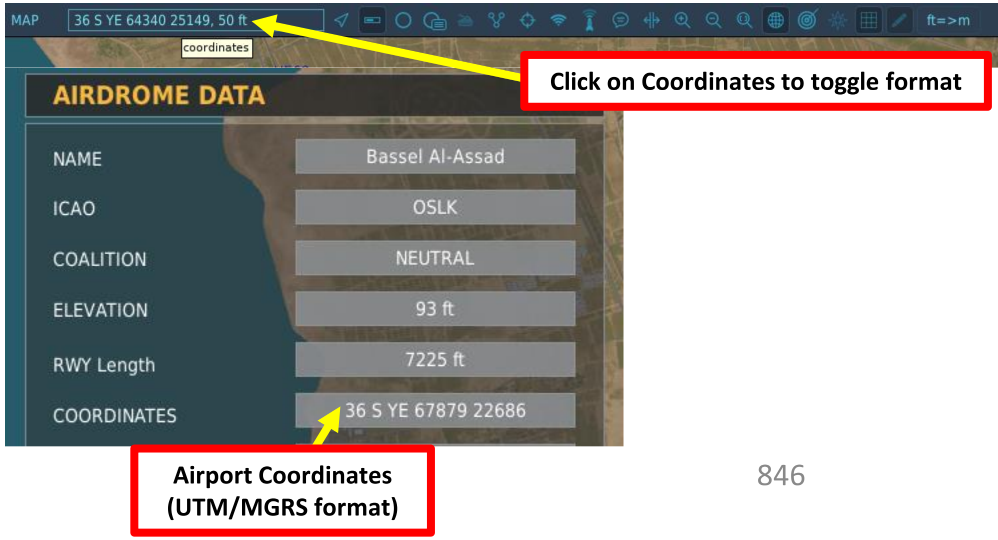
To create a point using the "KU" method:

We want to add a Control Measure (CM) on the Bassel Al Assad Airport. You can consult the ABR (Abbreviations) page to get the appropriate IDENT code for an Airfield General.

- IDENT: **AG** (Airfield General)
- FREE (Free Text): **BAS** (three letters maximum)
- LATITUDE/LONGITUDE: **35°24.69' North 035°57.00' East (Deg, minutes, decimal minutes)**
- MGRS/UTM Coordinates: **36 S YE 6787 2268**
- ELEV: **Elevation 93 ft**

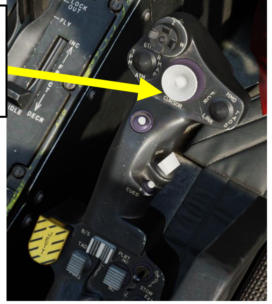
6. On KU (Keyboard Unit), type "AG", then press ENTER. "AG" is the Control Measure IDENT code for AIRFIELD GENERAL Control Measure.
7. KU will display "FREE:". On KU, type "BAS", then press ENTER. "BAS" is a free text we can use to refer to the Bassel Al Assad airport.
   - Alternatively, you can leave the field empty and just press ENTER since free text is not mandatory.

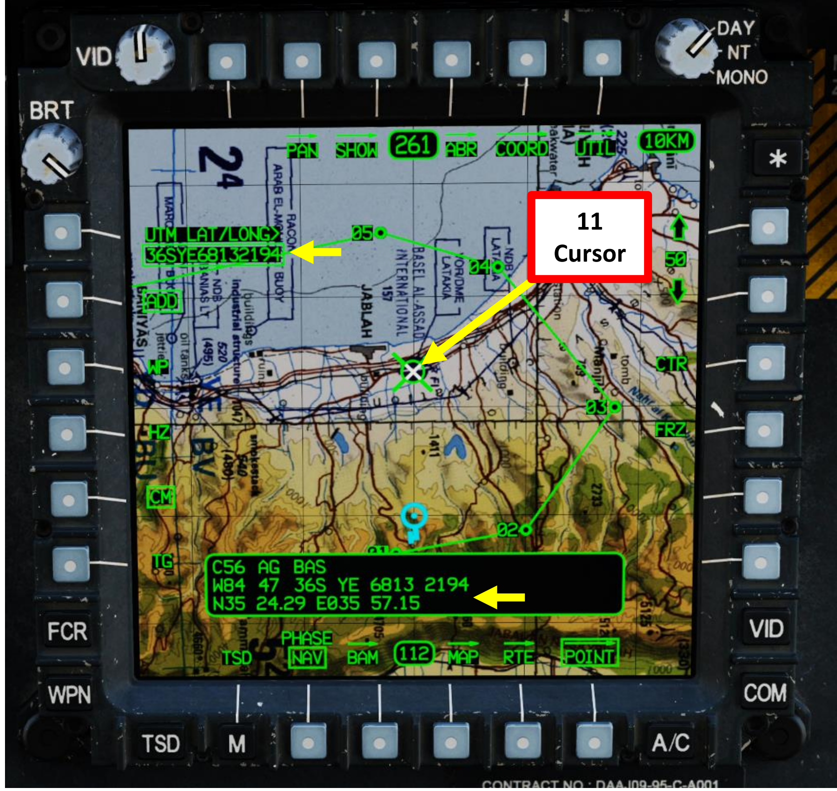




3 – Points
3.2 – Adding a Point
3.2.2 – Using Coordinates with KU (Keyboard Unit)

11
Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*





11
Cursor

To create a point using the "KU" method:

We want to add a Control Measure (CM) on the Bassel Al Assad Airport. You can consult the ABR (Abbreviations) page to get the appropriate IDENT code for an Airfield General.

- IDENT: **AG** (Airfield General)
- FREE (Free Text): **BAS** (three letters maximum)
- LATITUDE/LONGITUDE: **35°24.69' North 035°57.00' East (Deg, minutes, decimal minutes)**
- MGRS/UTM Coordinates: **36 S YE 6787 2268**
- ELEV: **Elevation 93 ft**

8. By default, then KU will display coordinates for your aircraft's current position.
9. Use CLR (Clear) on the KU to delete the current coordinates.
10. On the KU, enter coordinates either in LAT/LONG (Latitude/Longitude) or in MGRS/UTM (Military Grid Reference System/Universal Transverse Mercator) format, then press ENTER.
    - LATITUDE/LONGITUDE Coordinates: **35°24.69' North 035°57.00' East (Deg, minutes, decimal minutes)**
        - **Input format: "N352569E0355700"**
    - MGRS/UTM Coordinates: **36 S YE 6787 2268**
        - **Input format: "36SYE67872268"**
11. Alternatively to the previous step, it is possible to move the Cursor over desired airport, then press "Cursor Enter" to save the coordinates. It is also possible to type the name of an existing waypoint (i.e. "W01" for Waypoint 01) to copy the coordinates on the KU, then press ENTER.
12. KU will display MSL (Mean Sea Level) altitude at the selected coordinates. Modify if required, using CLR and the keypad. If altitude is correct **(93 ft)**, press ENTER.

8

9

10
MGRS/UTM Format

10
LAT/LONG Format

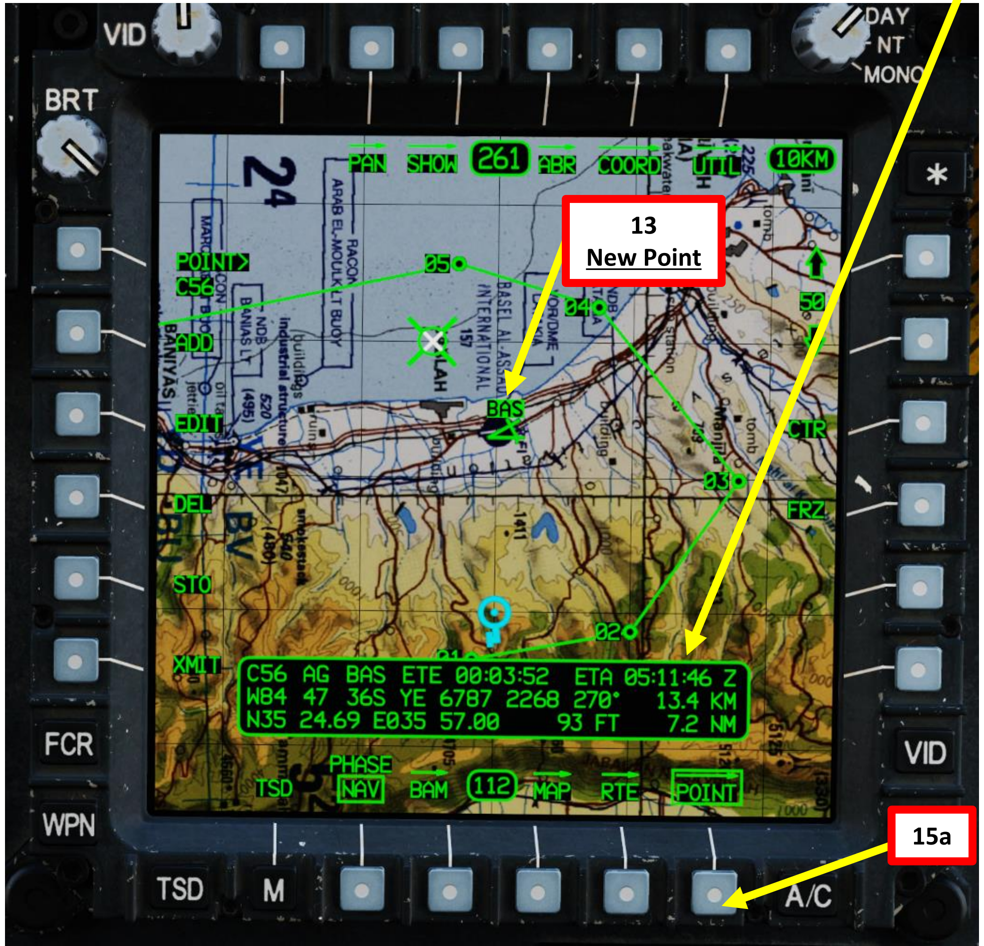
12
Altitude/ Elevation (ft)

3 – Points
3.2 – Adding a Point
3.2.2 – Using Coordinates with KU (Keyboard Unit)

To create a point using the "KU" method:

13. And that's it! A brand new point is created.
14. Once point is created, the Review Status Window will display point information.
15. Exit the point ADD sub-menu by pressing the POINT VAB again.

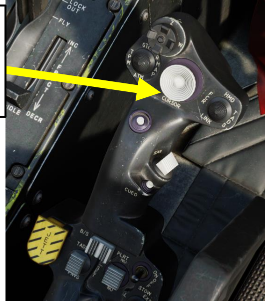
14
Review Status Window
- C56: Control Measure 56
- AG: Identifier (Airfield General, AG)
- BAS: Free Text Characters (stands for "Bassel Al Assad Airport")
- ETE: Estimated time enroute to the point
- ETA: Estimated time of arrival at the point
- W04 47 36S YE 6787 2268: MGRS/UTM Coordinates
- 270: Heading to point
- 13.4 KM / 7.2 NM: Distance to Go
- N35 24.69 E035 57.00: Latitude / Longitude Coordinates
- 93 FT: Point Altitude (Above Mean Sea Level)

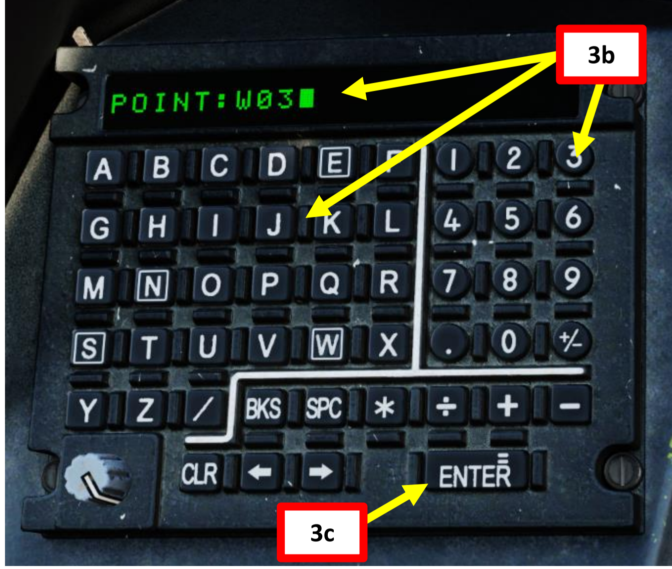


3 – Points
3.3 – Editing a Point

4a **Cursor Control/Enter Hat Switch**

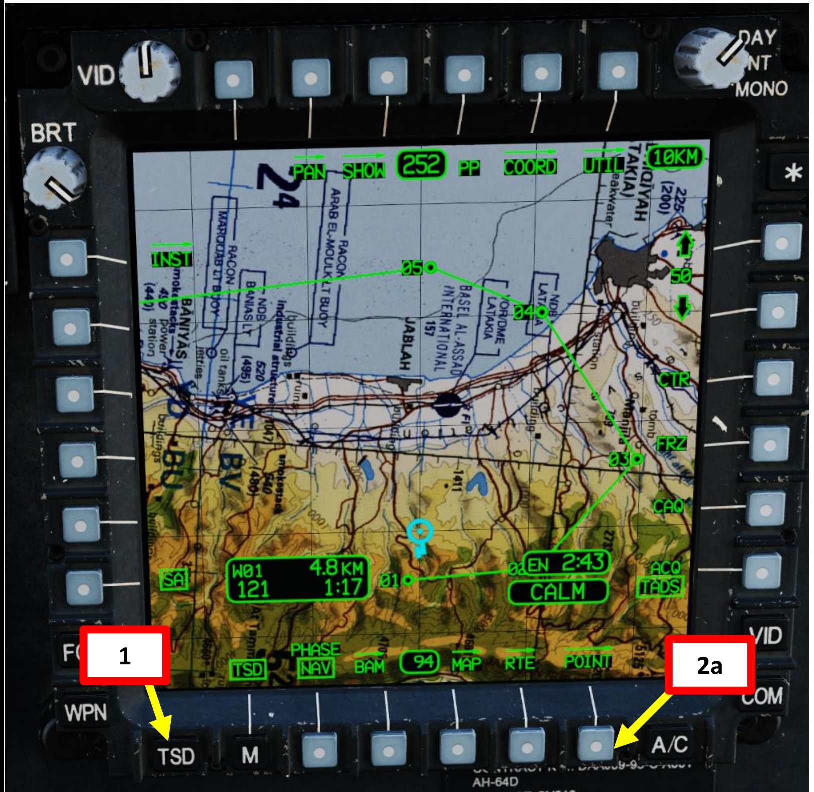
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

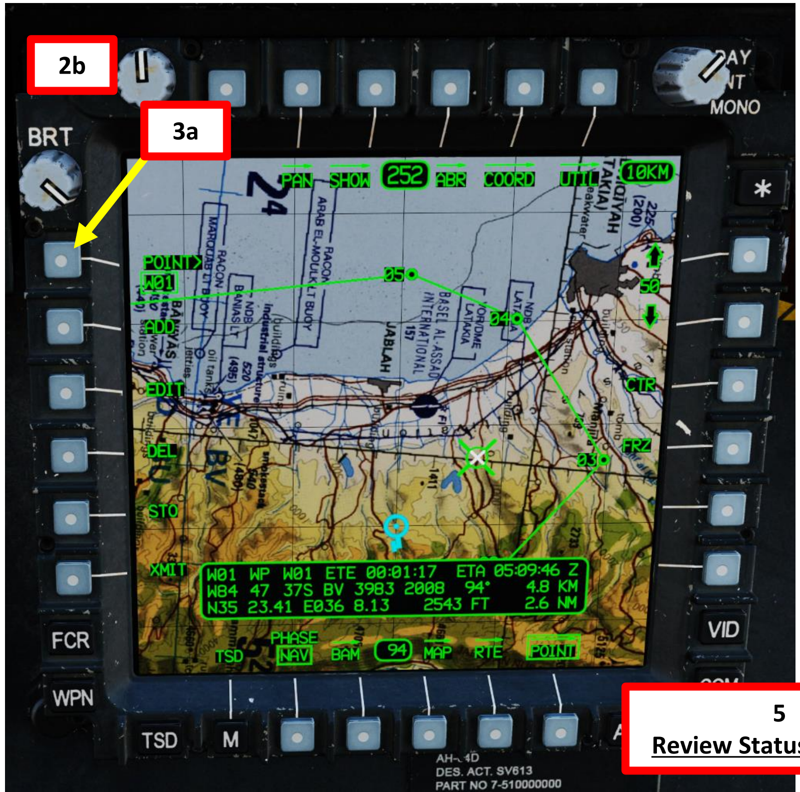


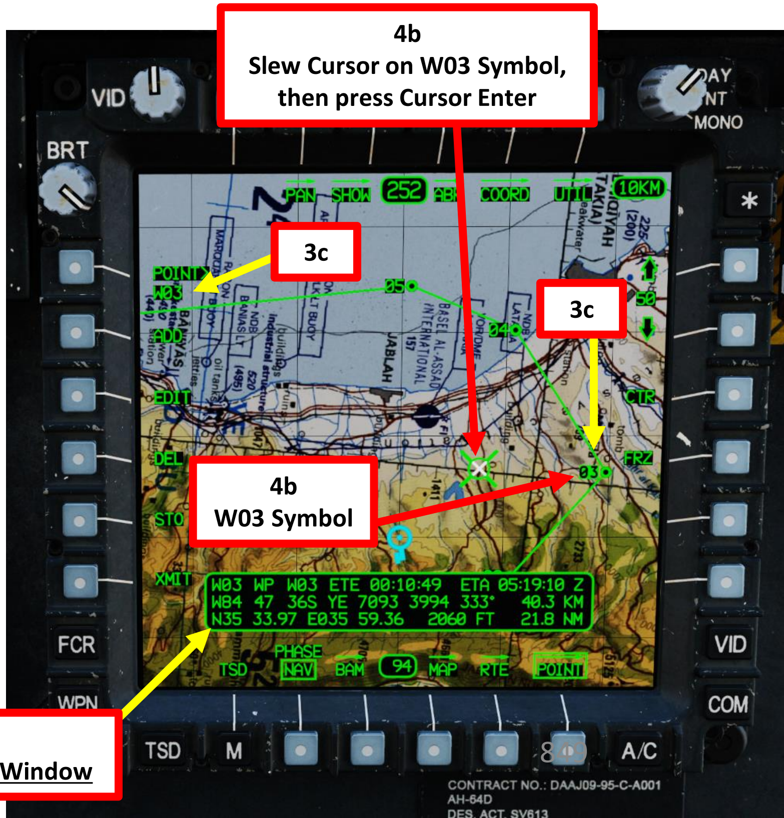


To edit a point:

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press POINT VAB (Variable Action Button).
3. Select the point you want to edit. In this example, we will select Waypoint 03.
   a) Press POINT> VAB
   b) Type the point number you want to edit (i.e., "W03" for Waypoint 03, "H09" for Hazard 09, "C51" for Control Measure 51, "T05" for Target 05, etc.)
   c) Press ENTER on the KU.
4. ***Alternatively to the previous step***, it is also possible to move the Cursor over desired point, then press "Cursor Enter" to select it.
5. Once Waypoint 03 symbol is selected, the Review Status Window will display point information.



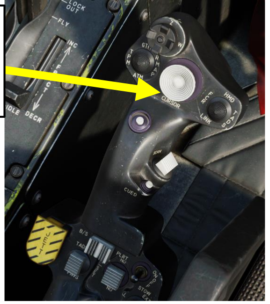


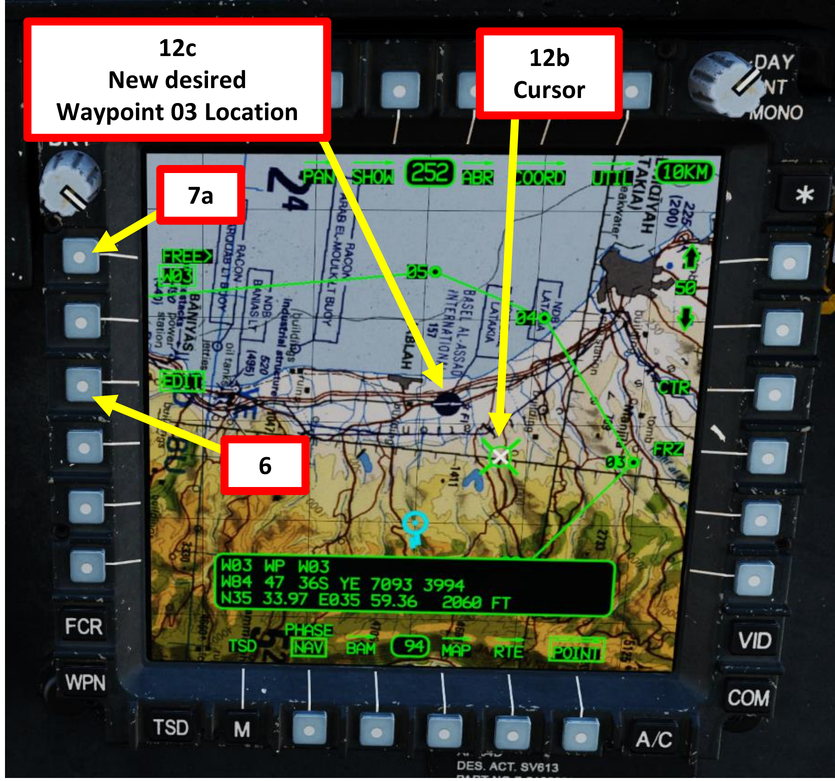


3 – Points
3.3 – Editing a Point

12a

Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*





6. Press EDIT VAB (Variable Action Button).
7. Press FREE VAB, type desired free text on the KU (Keyboard Unit) for a maximum of three characters, then press ENTER.
   - Note: If the existing free text is desired, simply press ENTER without a different free text entry.
8. By default, then KU will display coordinates for your aircraft's current position.
   - Note: If the existing location is desired, simply press Enter without a different location entry.
9. In this example, we will edit the waypoint coordinates to place them on the Bassel Al Assad airport.
10. Use CLR (Clear) on the KU to delete the current coordinates.
11. On the KU, enter the new coordinates either in LAT/LONG (Latitude/Longitude) or in MGRS/UTM (Military Grid Reference System/Universal Transverse Mercator) format, then press ENTER.
    - LATITUDE/LONGITUDE Coordinates: **35°24.69' North 035°57.00' East (Deg, minutes, decimal minutes)**
      - **Input format: "N352569E0355700"**
    - MGRS/UTM Coordinates: **36 S YE 6787 2268**
      - **Input format: "36SYE67872268"**
12. Alternatively to the previous step, it is possible to move the Cursor over desired location, then press "Cursor Enter" to save the coordinates. It is also possible to type the name of an existing waypoint (i.e. "W01" for Waypoint 01) to copy the coordinates on the KU, then press ENTER.
13. KU will display MSL (Mean Sea Level) altitude at the previous coordinates. Use CLR (Clear) on the KU to delete the current elevation, then type the elevation of the airport (93 ft), then press ENTER.

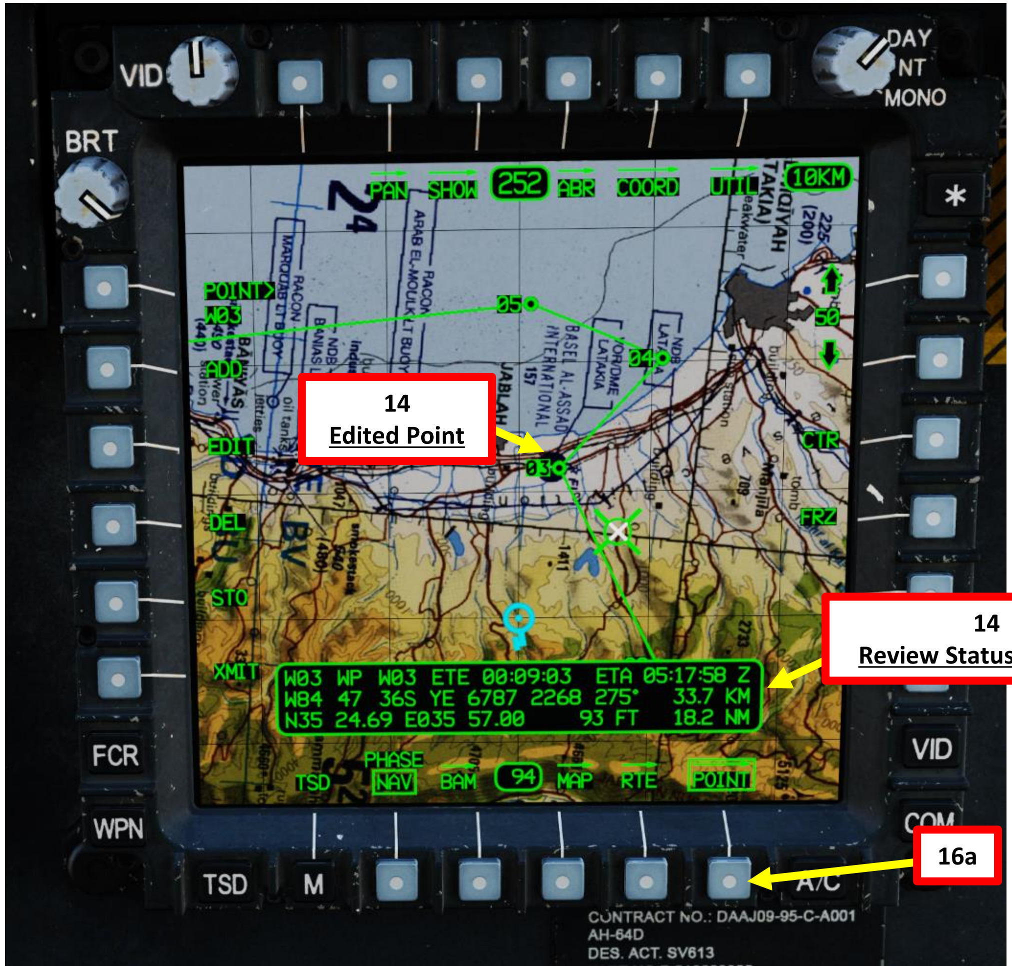
11
MGRS/UTM Format

11
LAT/LONG Format

13
Altitude/ Elevation (ft)

3 – Points
3.3 – Editing a Point

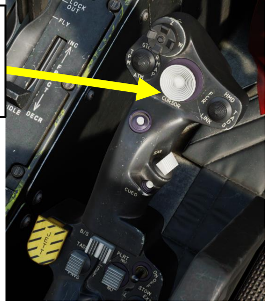
14. And that's it! You have just edited Waypoint 03 with new coordinates and elevation.
15. Once the point is edited, the Review Status Window will display point information.
16. Exit the point ADD sub-menu by pressing the POINT VAB again.

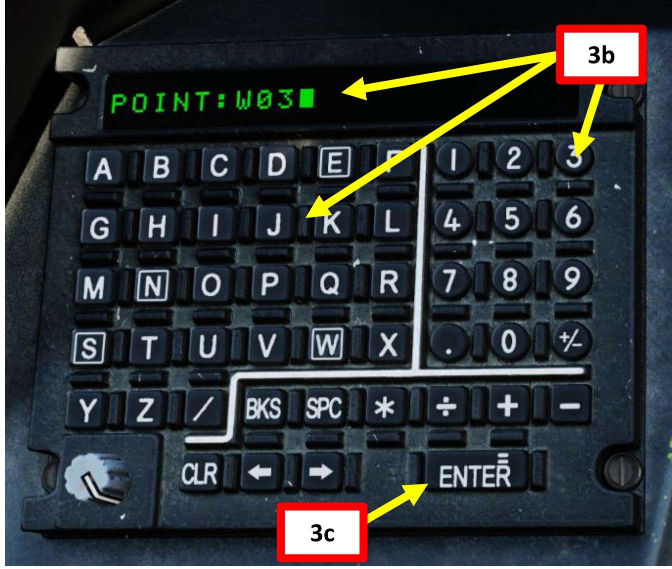


3 – Points
3.4 – Deleting a Point

4a

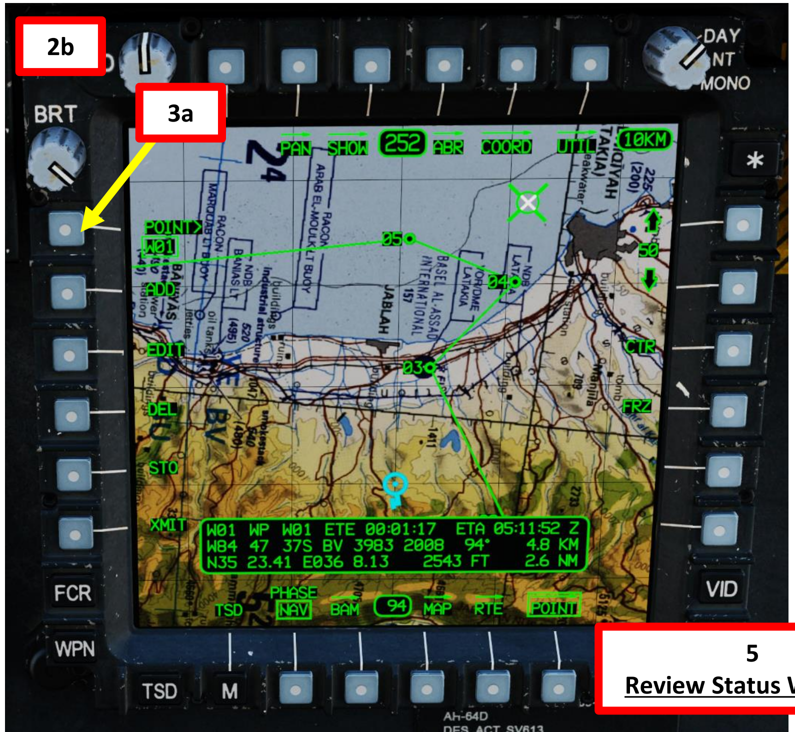
Cursor Control/Enter Hat Switch
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

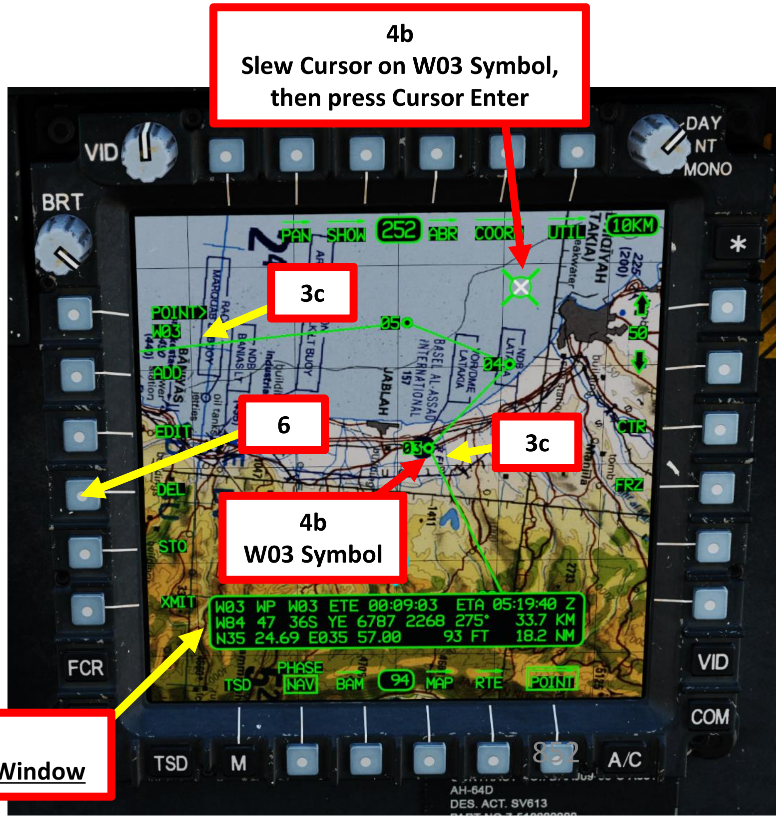




To delete a point:

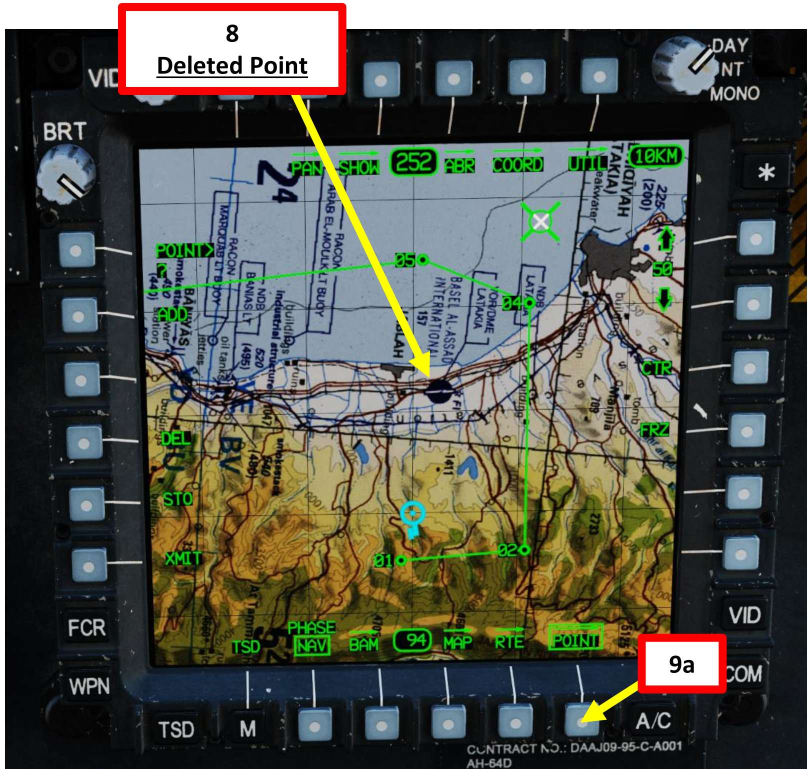
1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press POINT VAB (Variable Action Button).
3. Select the point you want to edit. In this example, we will select Waypoint 03.
   a) Press POINT> VAB
   b) Type the point number you want to edit (i.e., "W03" for Waypoint 03, "H09" for Hazard 09, "C51" for Control Measure 51, "T05" for Target 05, etc.)
   c) Press ENTER on the KU.
4. ***Alternatively to the previous step***, it is also possible to move the Cursor over desired point, then press "Cursor Enter" to select it.
5. Once Waypoint 03 symbol is selected, the Review Status Window will display point information.
6. Press DEL (Delete) VAB (Variable Action Button).





3 – Points
3.4 – Deleting a Point

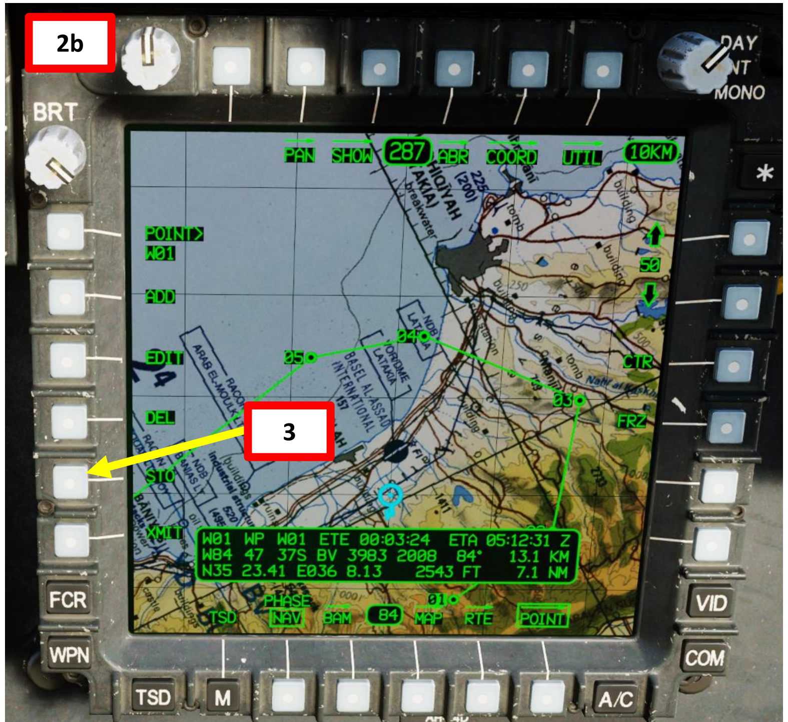
7. Confirm deletion by pressing the YES VAB.
8. And that's it! You have just deleted Waypoint 03.
9. Exit the point ADD sub-menu by pressing the POINT VAB again.



3 – Points
3.5 – Storing a Point
3.5.1 – Flyover Point

To store a point at the current aircraft position (Flyover Point):

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press POINT VAB (Variable Action Button).
3. Press STO (Store) VAB.
4. Select desired point type by toggling the TYPE VAB.
   - WP will store the point as a Waypoint
   - TG will store the point as a Target Point
5. Press NOW VAB to store current aircraft coordinates and altitude.



3 – Points
3.5 – Storing a Point
3.5.1 – Flyover Point

6. And that's it! You have just created a Flyover Point (Waypoint W07 in our case). The flyover point will have "FLY" for free text.
7. After storing the point, the Review Status window will automatically advance to the next empty point number.
8. Exit the point ADD sub-menu by pressing the POINT VAB again.

3 – Points
3.5 – Storing a Point
3.5.2 – Co-Pilot/Gunner Line-of-Sight

The Co-Pilot/Gunner can utilize any range source to store a point using either his TADS (Target Acquisition & Designation Sight) or HMD (Helmet-Mounted Display) Line-of-Sight. Using a more accurate range source such as a laser while sight-selected TADS will provide more precision when trying to store a location. Less accurate methods include using the HMD as the sight or using an Automatic range or an estimated Manual range. Most of these tutorials are already available in PART 13 – SENSORS & SIGHTS.

How to Store a Point (HMD, Automatic Range)

How to Store a Point (TADS, Laser Range)

How to Store a Point (TADS, Automatic Range)

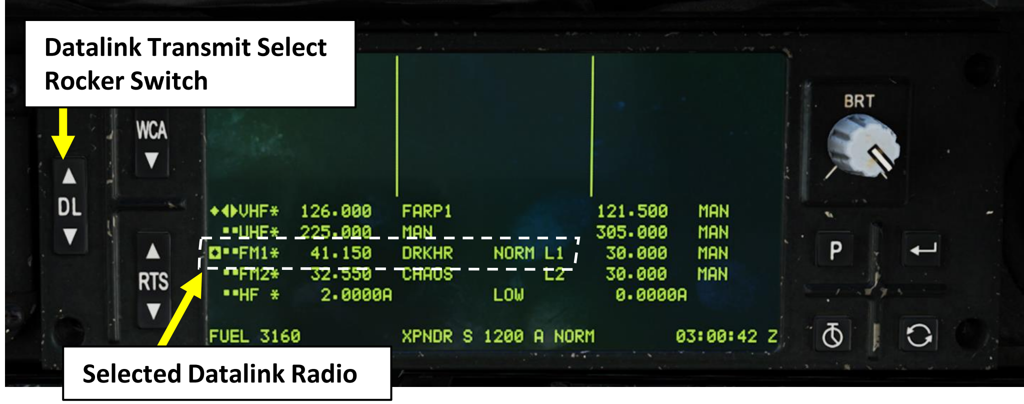
How to Slave TADS to a Stored Point (COORD Page Method)

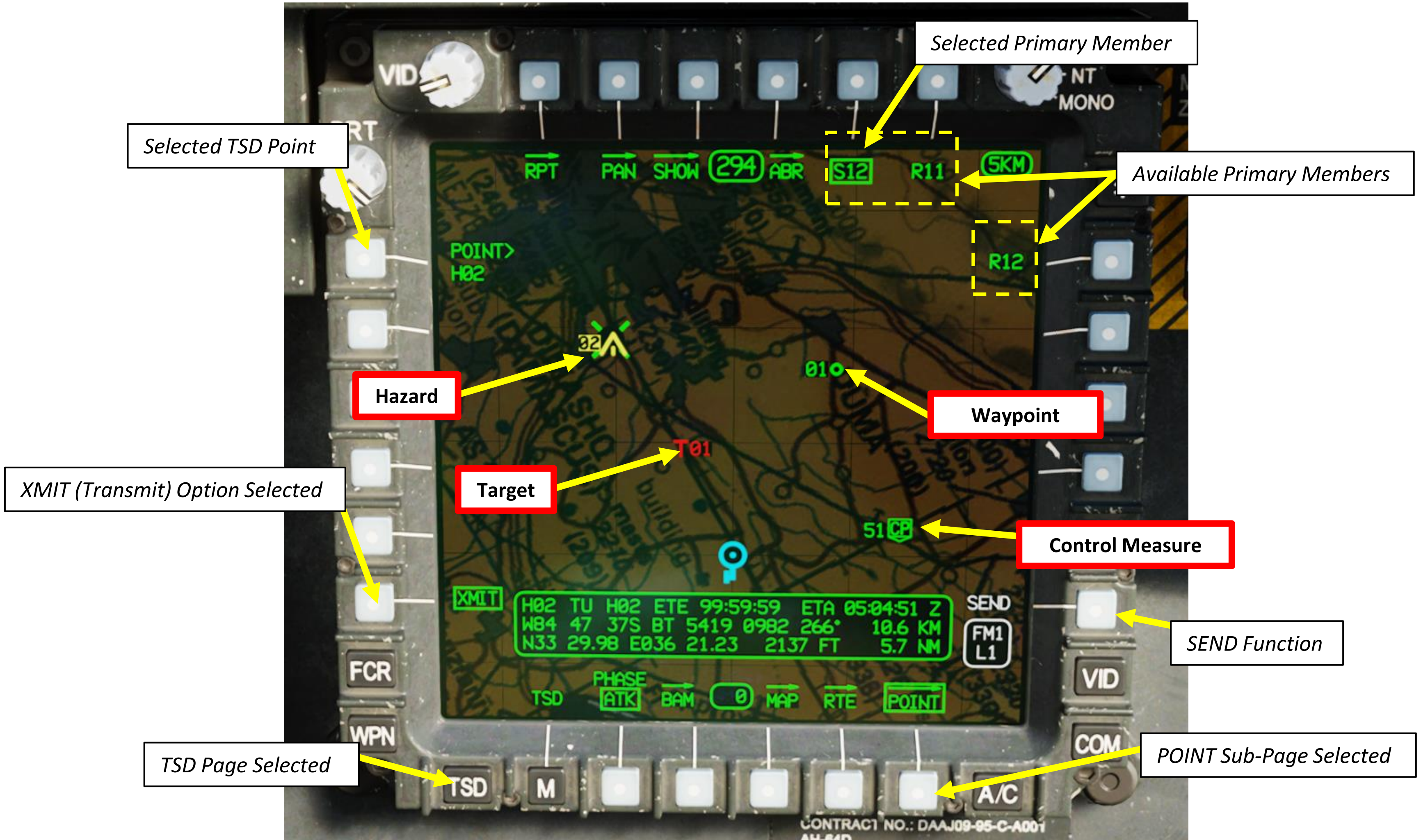
How to Slave TADS to a Stored Point (Cursor Acquisition Method)

3 – Points
3.6 – Transmitting a Point

Any point (Waypoint, Hazard, Control Measure, or Target/Threat) residing within the TSD (Tactical Situation Display) database may be transmitted across the datalink network.

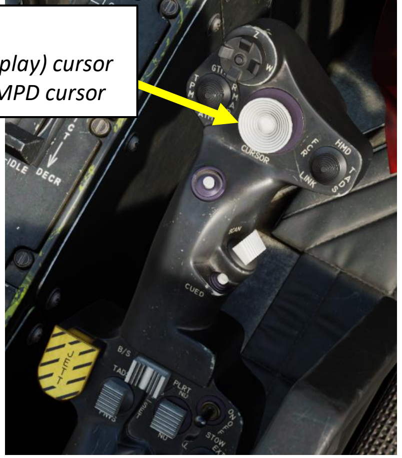
Please consult Part 16 (Datalink) – Section 3.3 (Datalink Functions – Sending/Receiving Individual TSD Points) for more information about datalink-related procedures for point transmission.

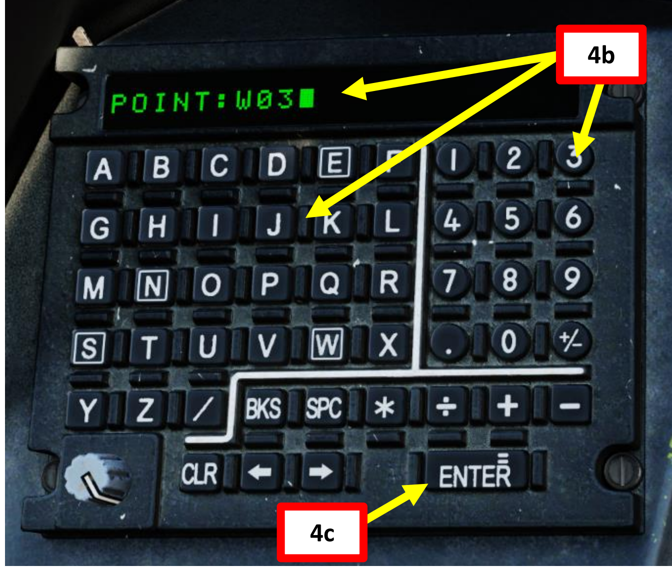




3 – Points
3.7 – Navigating to a Point

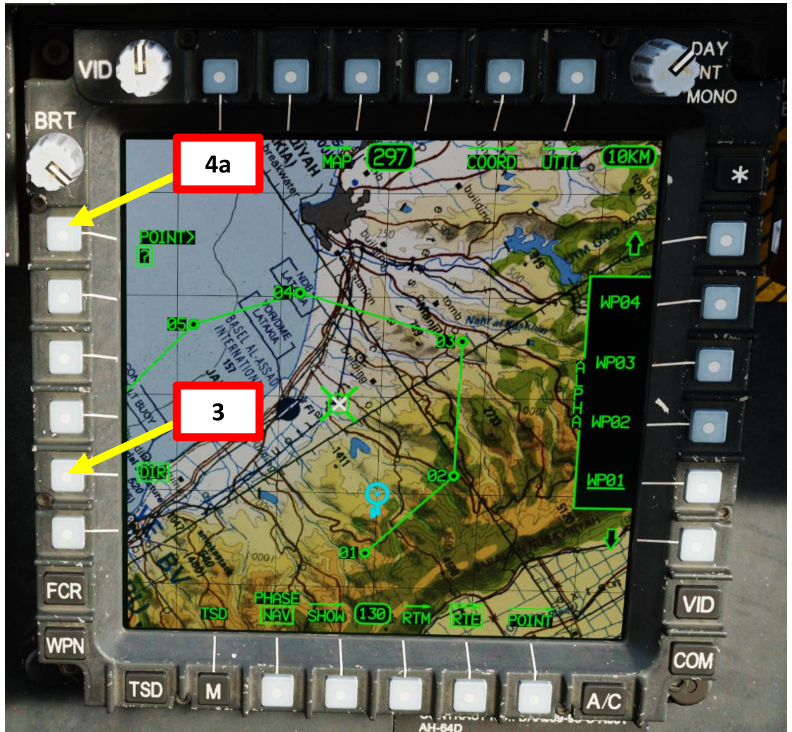
5a **Cursor Control/Enter Hat Switch**
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*





To navigate to a point using the Direct-To Line:

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. Press DIR (Direct-To) VAB (Variable Action Button).
4. Select the point you want to navigate to. In this example, we will select Waypoint 03.
    a) Press POINT> VAB
    b) Type the point number you want to edit (i.e., "W03" for Waypoint 03, "H09" for Hazard 09, "C51" for Control Measure 51, "T05" for Target 05, etc.)
    c) Press ENTER on the KU.
5. ***Alternatively to the previous step***, it is also possible to move the Cursor over the desired point, then press "Cursor Enter" to select it.



5b
W03 Symbol

5b
Slew Cursor on W03 Symbol, then press Cursor Enter

3 – Points
3.7 – Navigating to a Point

6. When waypoint is selected as a DIRECT-TO, a straight line is drawn from the Ownship to the selected point. This line does not follow the aircraft, but rather represents the original course plotted from the aircraft's position at the moment the Direct-To was entered. The current route will be displayed in partial-intensity green while a Direct-To course is active.
    - Note 1: If a point is selected as the Direct-To, and that point is part of the current route, after arriving at that point the route will sequence normally, starting with the first time that point appears in the route sequence. When this happens, the Direct-To line is removed and the route returns to full-intensity green.
    - Note 2: If a point is selected as the Direct-To, and that point is not part of the current route, after arriving at that point, the current Navigation Fly-To Cue and Waypoint Status window will remain at that point, unless a new Direct-To point is selected or a different route is selected on the Route Menu (RTM) page.
7. Select the Variable Action Button next to "WP03" will display additional navigation data.
8. Pressing VAB next to RTE (Route) again will return to the default TSD page.

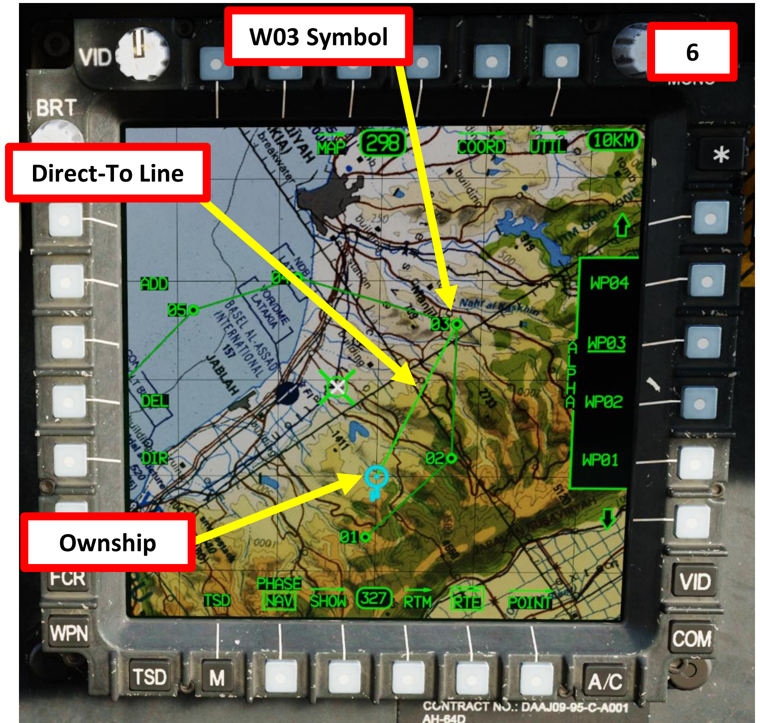
Endurance & Wind Information
- *Upper Row: Displays the total endurance time available based on remaining fuel in all internal and external tanks.*
- *Lower Row: Displays the winds as computed by the aircraft Air Data System (ADS). "CALM" is displayed when wind speed is less than 5 knots. When NR is less than 50% and wind speed is greater than 45 knots, wind speed is displayed in yellow.*

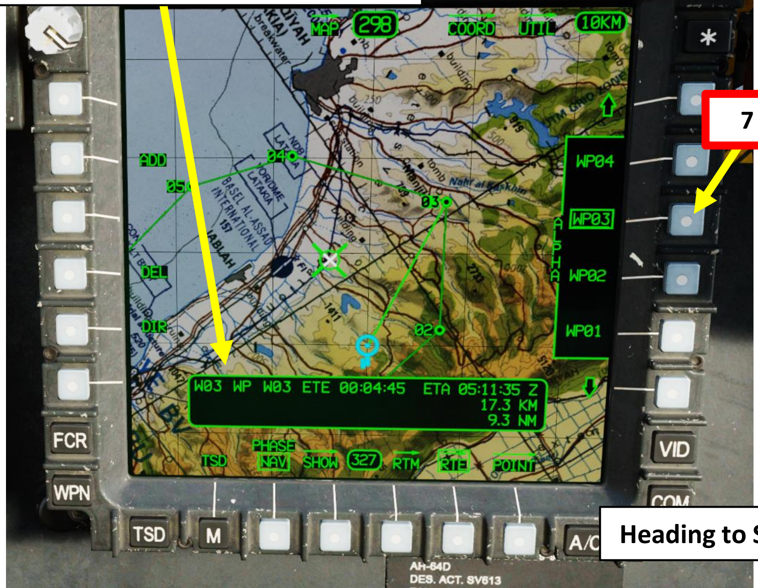
Selected Waypoint Information
- *W03: Selected Waypoint Name*
- *WP: Identifier (Waypoint)*
- *W03: Free Text*
- *ETE: Estimated time enroute to the point*
- *ETA: Estimated time of arrival*
- *17.3 KM: Distance to Waypoint (km)*
- *9.3 NM: Distance to Waypoint (nm)*

Selected Waypoint Information
- *Upper Left: Selected Waypoint Name*
- *Upper Right: Distance to Waypoint*
- *Lower Left: Ground Speed (kts)*
- *Lower Right: Time to Waypoint*

Navigation Symbology (Waypoint)

Aircraft Heading

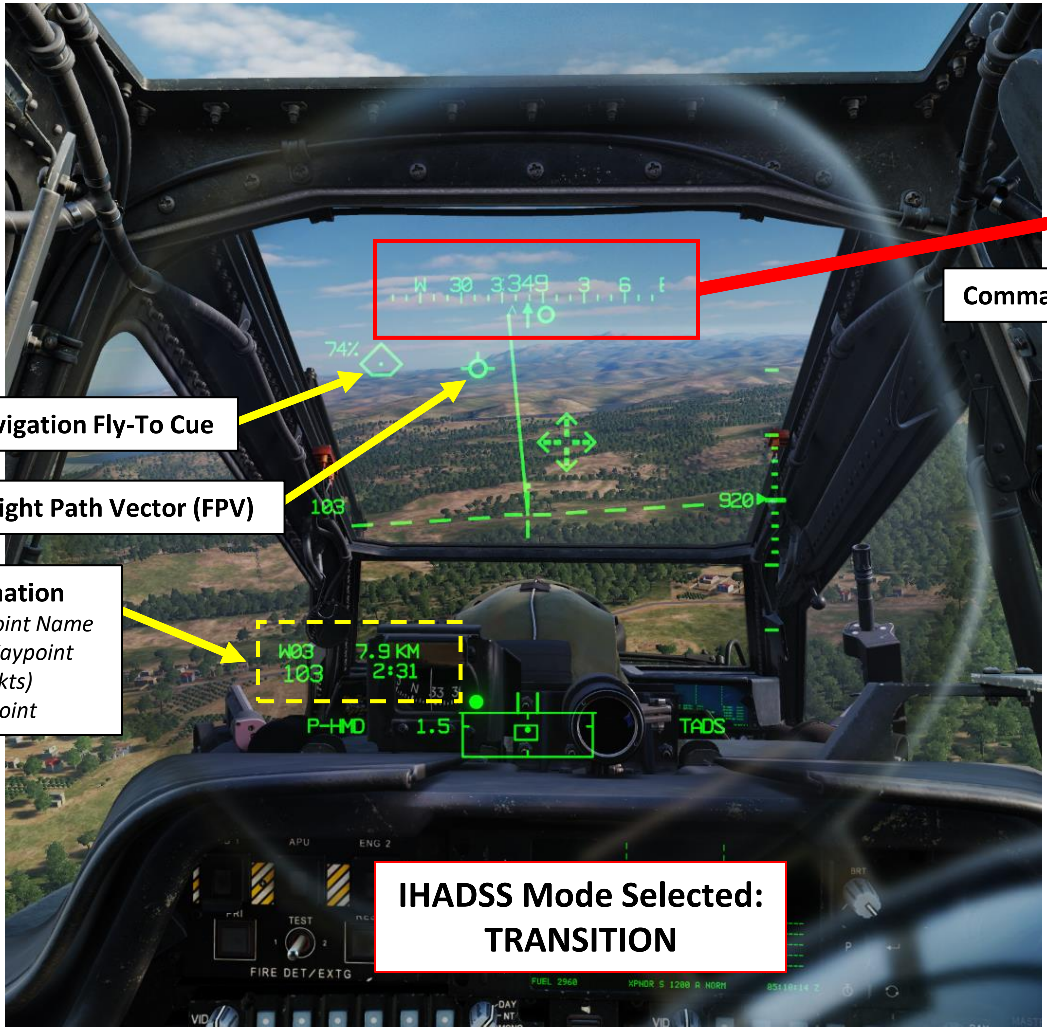




Heading to Selected Waypoint

3 – Points
3.7 – Navigating to a Point

9. Once a Direct-To point has been selected by the crew, first turn in the direction of the Command Heading Chevron on the HDU (Helmet Display Unit).
10. When the Navigation Fly-To Cue appears within the HDU field of view, place the FPV (Flight Path Vector) over the top of, or inside, the Navigation Fly-To Cue.
11. When not navigating to the current Navigation Fly-To Cue (such as performing traffic pattern flight), the HDU Transition symbology can be used to assist in correcting for winds. With the aircraft in coordinated flight with the trim ball centered (termed "in trim"), the crew can place the desired ground track between the Velocity Vector and the Heading Tape's Lubber Line to correct for winds. Using this technique, the Pilot can determine where to adjust the heading of the aircraft to ensure that the aircraft's actual track across the ground coincides with the desired course, even without a Navigation Direct-To Cue to reference with the Flight Path Vector.

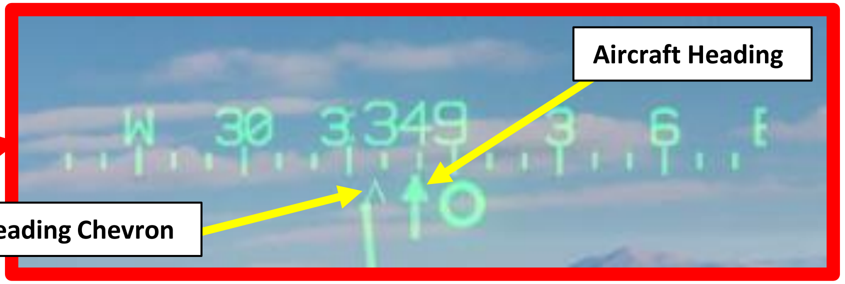


Navigation Fly-To Cue

Flight Path Vector (FPV)

Selected Waypoint Information
- *Upper Left: Selected Waypoint Name*
- *Upper Right: Distance to Waypoint*
- *Lower Left: Ground Speed (kts)*
- *Lower Right: Time to Waypoint*

IHADSS Mode Selected: TRANSITION



Aircraft Heading

Command Heading Chevron

Symbology Select Switch
- *FWD: "**CT**" toggles between Cruise and Transition symbology on the IHADSS helmet monocle.*
- *DEPRESS: Brings FLT (Flight) page on MPD*
- *AFT: "**HB**" toggles between Hover and Bob-Up symbology on the IHADSS helmet monocle.*

4 – Navigation Routes
4.1 – Creating a Route

The aircraft can store 10 unique routes, each consisting of up to 100 points. Separate routes can be selected from the TSD Route (RTE) page, Route Menu (RTM) sub-page. Routes can be built using **Waypoint/Hazards and Control Measures only**. Targets/Threats **cannot** be added to a route.

Routes typically consist of a **Start Point (SP)** and end with a **Release Point (RP)**. When planning a mission, it is useful to have multiple ingress and egress routes to and from the objective area. Routes should not be considered a flight plan, but rather an avenue to reach the objective area, reposition to different sectors of the battlefield, or method to control multiple flights of aircraft. As such, most route points do not need to be directly overflown.

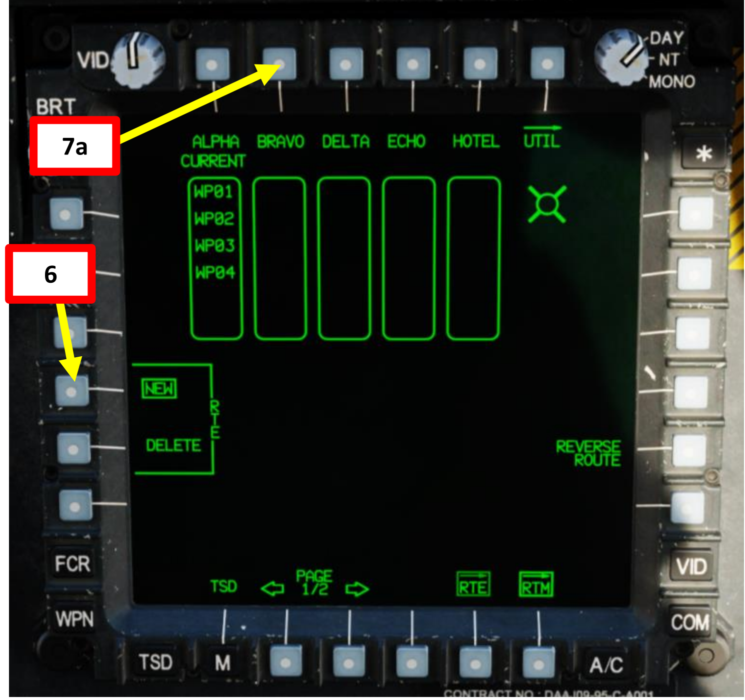
Routes can be composed of any number of points, depending on how the aircrews intend to perform their mission.
As an example, a basic route generally includes:
- A Start Point (W05, SP),
- A Communications Checkpoint (W06, CC),
- A standard Waypoint (W07),
- And a Release Point (W08, RP).

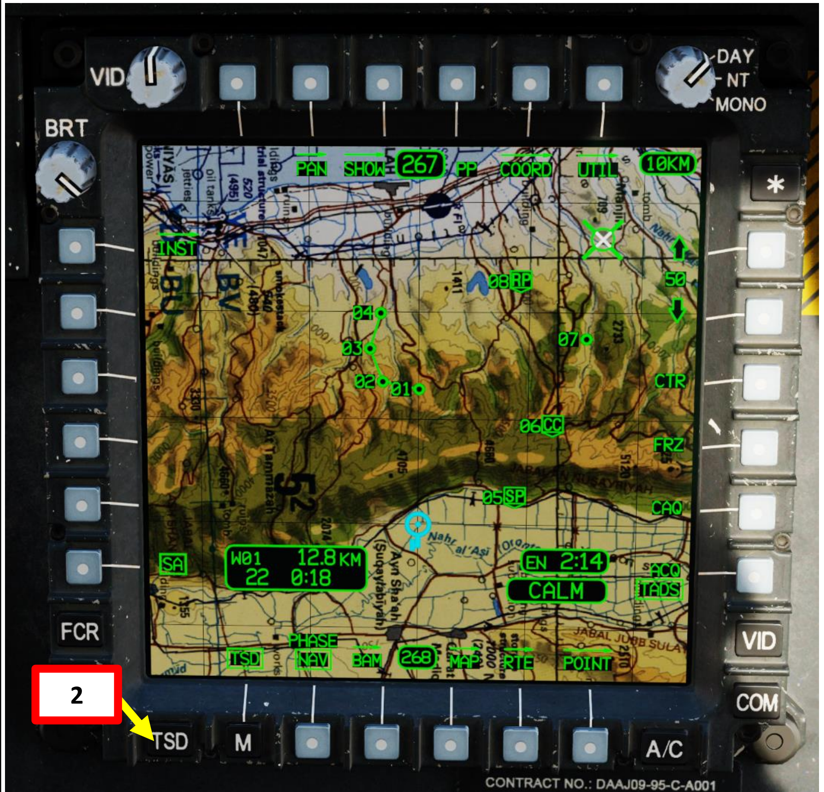
Currently it is only possible to generate one route in the Mission Editor; all other routes on the Route Menu (RTM) page will be empty of any points. However, these other routes can be edited by adding points during the mission. To build a new route using the Route page, the points that are to be used for the route will need to be added prior, using the POINT page as shown previously.

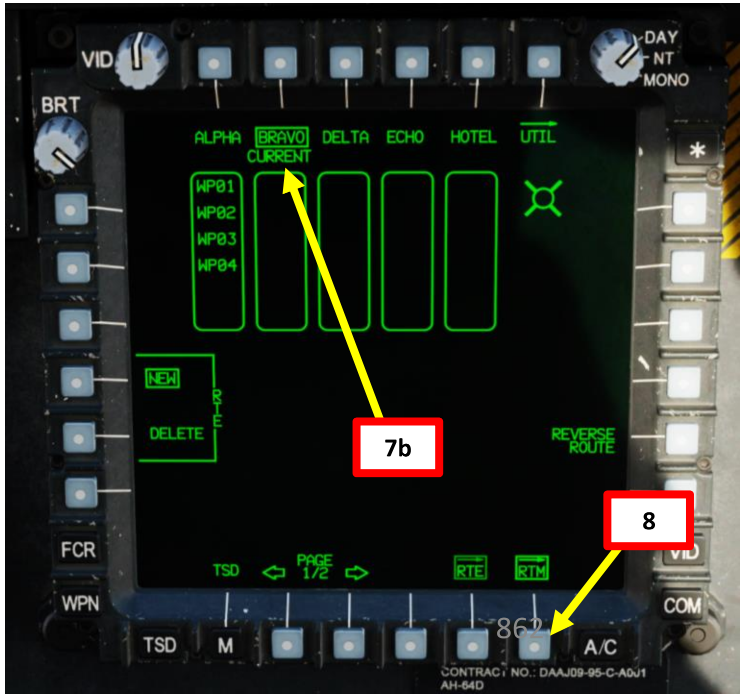
4 – Navigation Routes
4.1 – Creating a Route

To create a new route:

1. We will assume that all required waypoints, hazards and control measures required to create the new route are already created.
2. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
3. Press RTE (Route) VAB (Variable Action Button).
4. By default, Route ALPHA is already selected. This route is created from waypoints already created in the Mission Editor. In this tutorial, we want to create a new Route BRAVO.
5. Select RTM (Route Menu).
6. Select NEW RTE (New Route).
7. Select BRAVO to create the new BRAVO Route and set it as the current/active route.
8. Select RTM (Route Menu) to return to the RTE (Route) page.



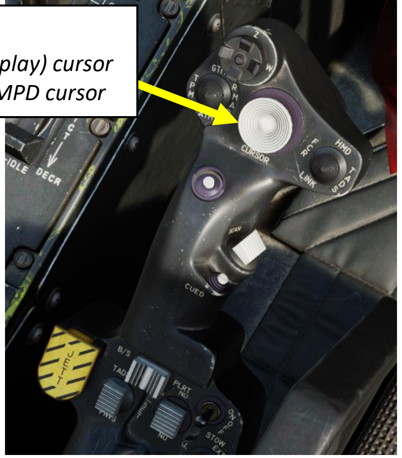


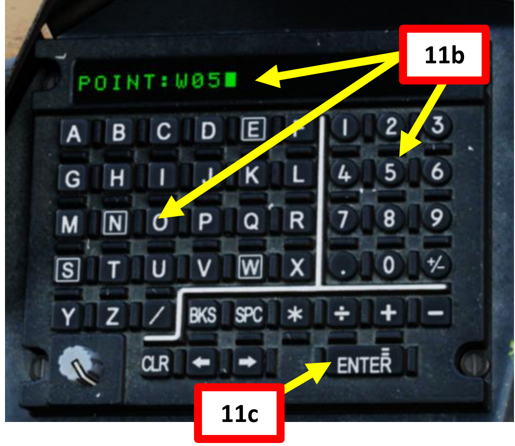


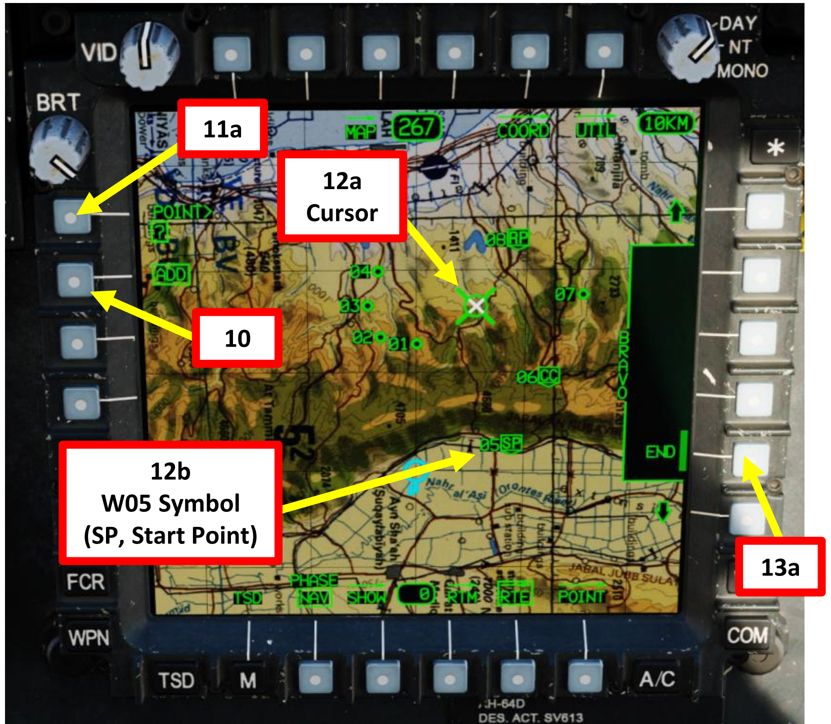
4 – Navigation Routes
4.1 – Creating a Route

9. We will add Waypoint 05 (SP, Start Point) as the first point of the route.
10. Press ADD VAB (Variable Action Button).
11. Select the point you want to add to the route. we will select Waypoint 05 (SP, Start Point).
    a) Press POINT> VAB
    b) Type the point number you want to add to the route (i.e., “W05” for Waypoint 05, “H09” for Hazard 09, “C51” for Control Measure 51, etc.). We will add “W05”.
    c) Press ENTER on the KU.
12. ***Alternatively to the previous step***, it is also possible to move the Cursor over point W05, then press “Cursor Enter” to select it.
13. Press “END” VAB to place the W05 point at the start of the route. The “END” identifier will move to the following position within the route sequence.

12a **Cursor Control/Enter Hat Switch**
- *Deflecting the control moves the MPD (Multi-Purpose Display) cursor*
- *Pressing DOWN on the cursor selects the item under the MPD cursor*

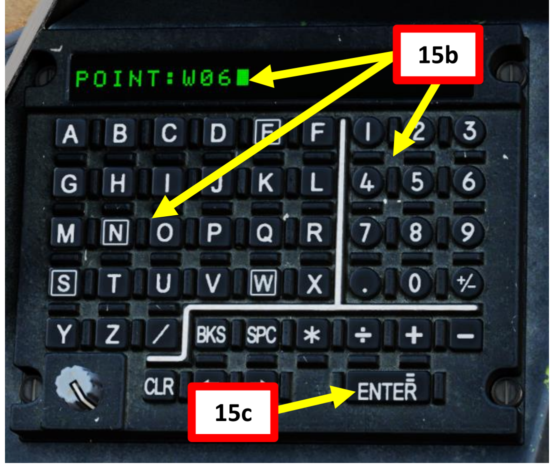


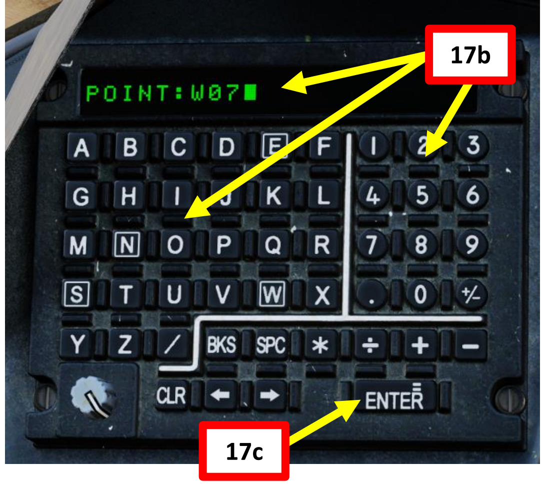


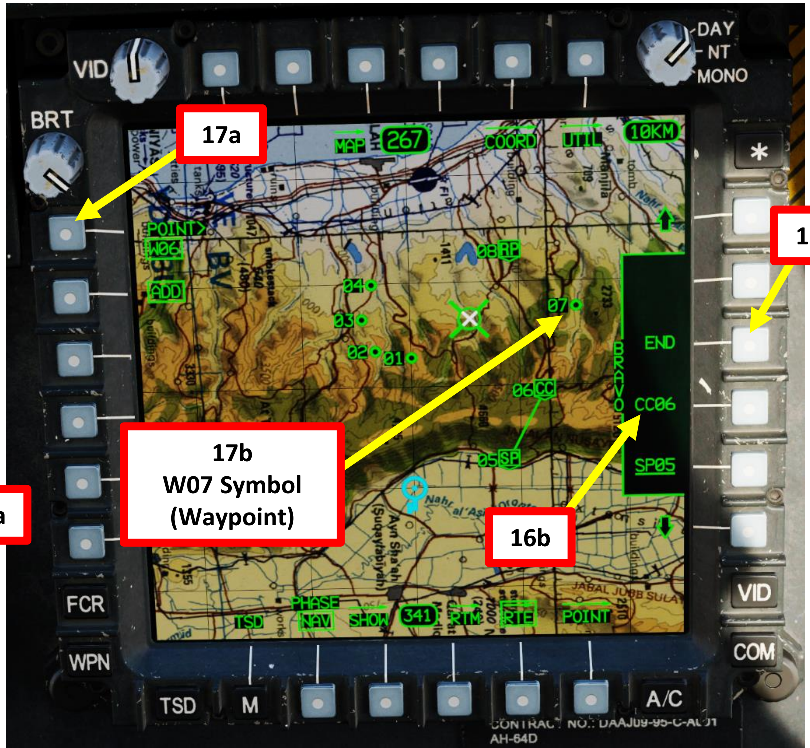


4 – Navigation Routes
4.1 – Creating a Route

14. We will repeat the three previous steps to add the remaining points W06 (CC, Communications Checkpoint), W07 (Waypoint 07), and W08 (RP, Release Point).
15. Select W06 (CC, Communications Checkpoint) using either the Keyboard Unit method or the Cursor method.
    a) Press POINT> VAB.
    b) Type the “W06”.
    c) Press ENTER on the KU.
16. Press “END” VAB to place the W06/CC06 point after W05 (SP, Start Point) at the end of the route.
17. Select W07 (Waypoint) using either the Keyboard Unit method or the Cursor method.
    a) Press POINT> VAB.
    b) Type the “W07”.
    c) Press ENTER on the KU.
18. Press “END” VAB to place the W07 point after W06 (CC, Communications Checkpoint) at the end of the route.

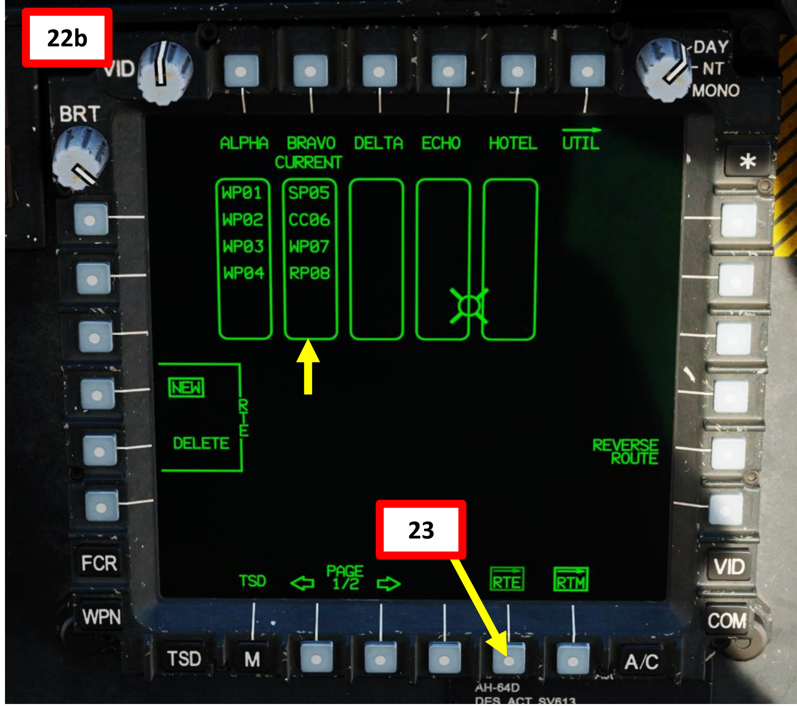


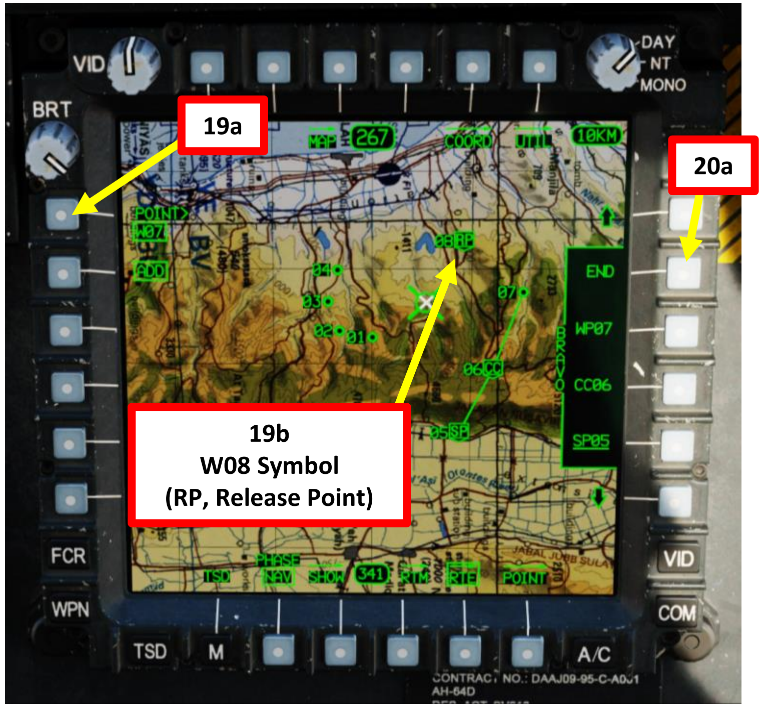


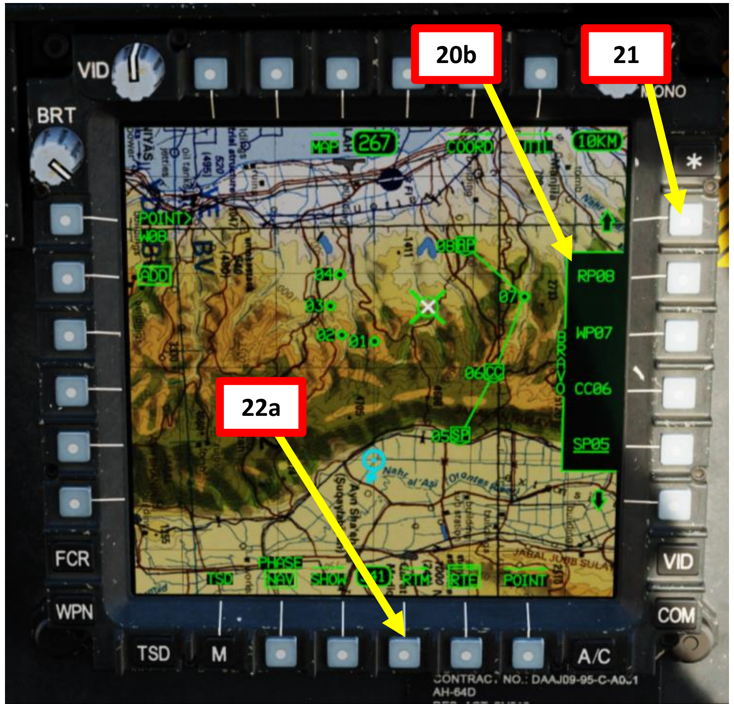


4 – Navigation Routes
4.1 – Creating a Route

19. Select W08 (RP, Release Point) using either the Keyboard Unit method or the Cursor method.
    a) Press POINT> VAB.
    b) Type the “W08”.
    c) Press ENTER on the KU.
20. Press “END” VAB to place the W08/RP08 point after W07 (Waypoint) at the end of the route.
21. If you want to add subsequent points but you do not see the END VAB, you can scroll to the END of the route using the UP ARROW VAB.
22. When you are done adding points to the route, you can check the route from the RTM (Route Menu).
23. To exit RTE (Route) page, press RTE VAB.
24. And that’s it! You just created Route BRAVO and populated it with:
    - W05 (SP, Start Point)
    - W06 (CC, Communications Checkpoint)
    - W07 (Waypoint 07)
    - W08 (RP, Release Point).



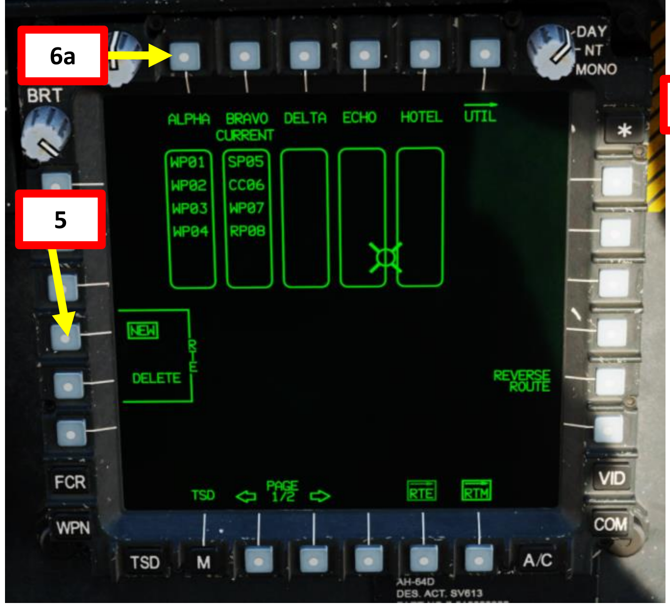


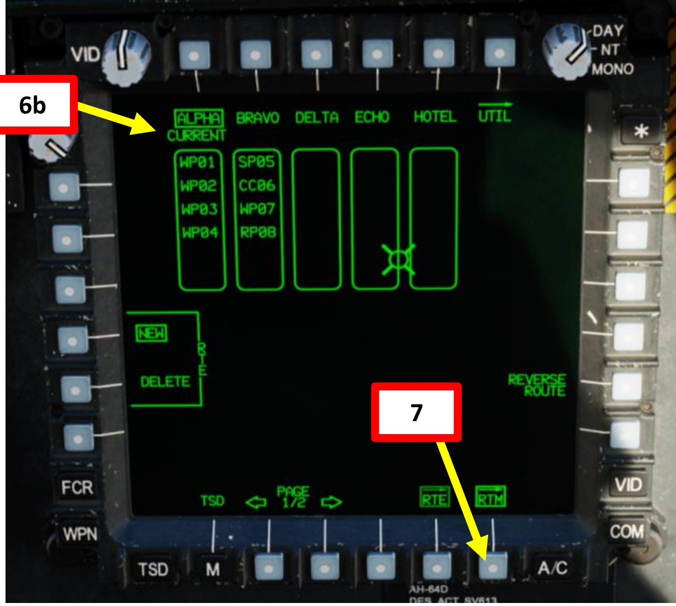


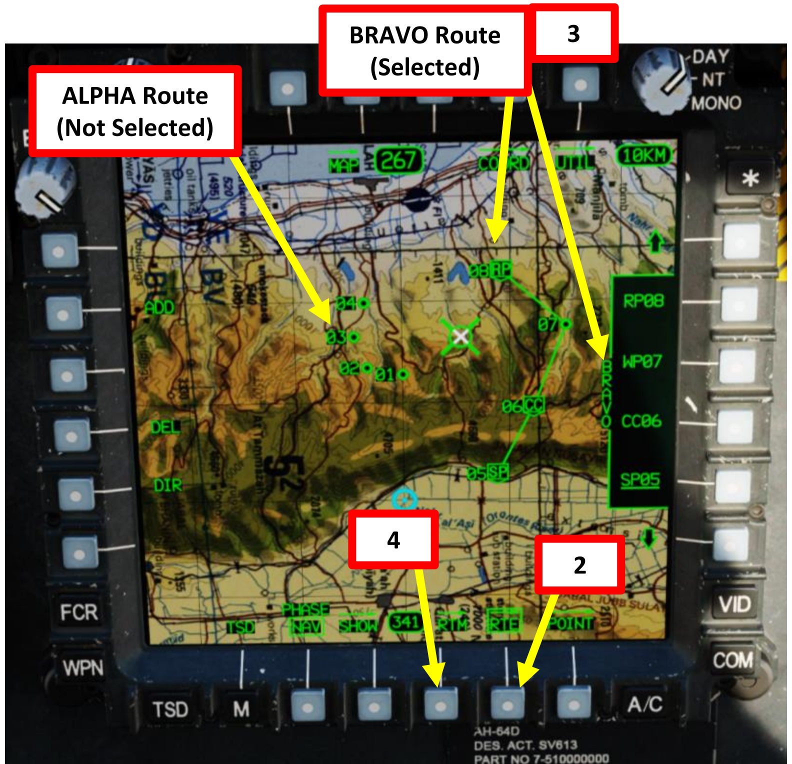
4 – Navigation Routes
4.2 – Selecting a Route

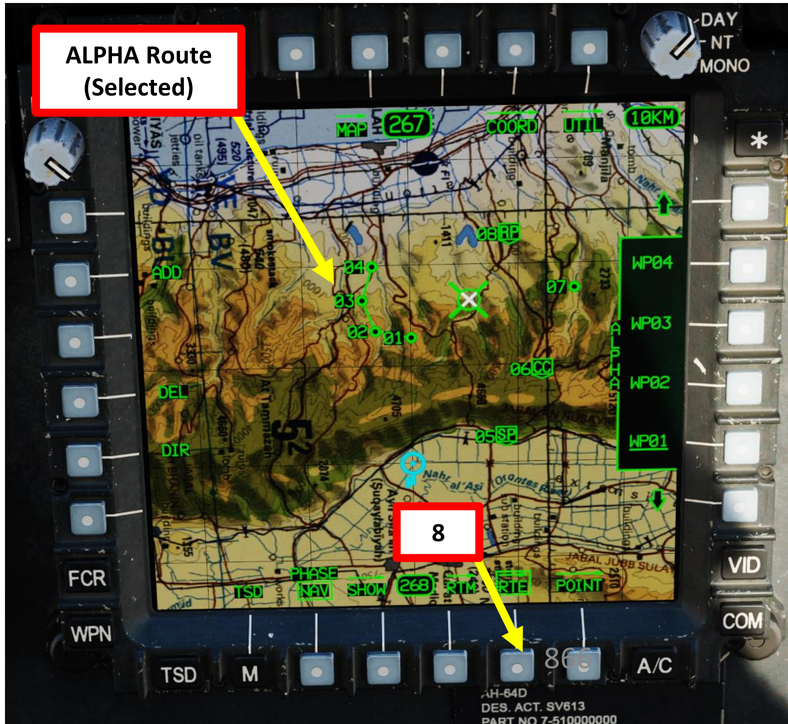
In the previous tutorial, we created and selected Route BRAVO as our current route. What if we want to select Route ALPHA instead?

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. In this example, Route BRAVO is already selected. We want to select Route ALPHA.
4. Select RTM (Route Menu).
5. Select NEW RTE (New Route).
6. Select ALPHA to set it as the current/active route.
7. Select RTM (Route Menu) to return to the RTE (Route) page.
8. To exit RTE (Route) page, press RTE VAB.









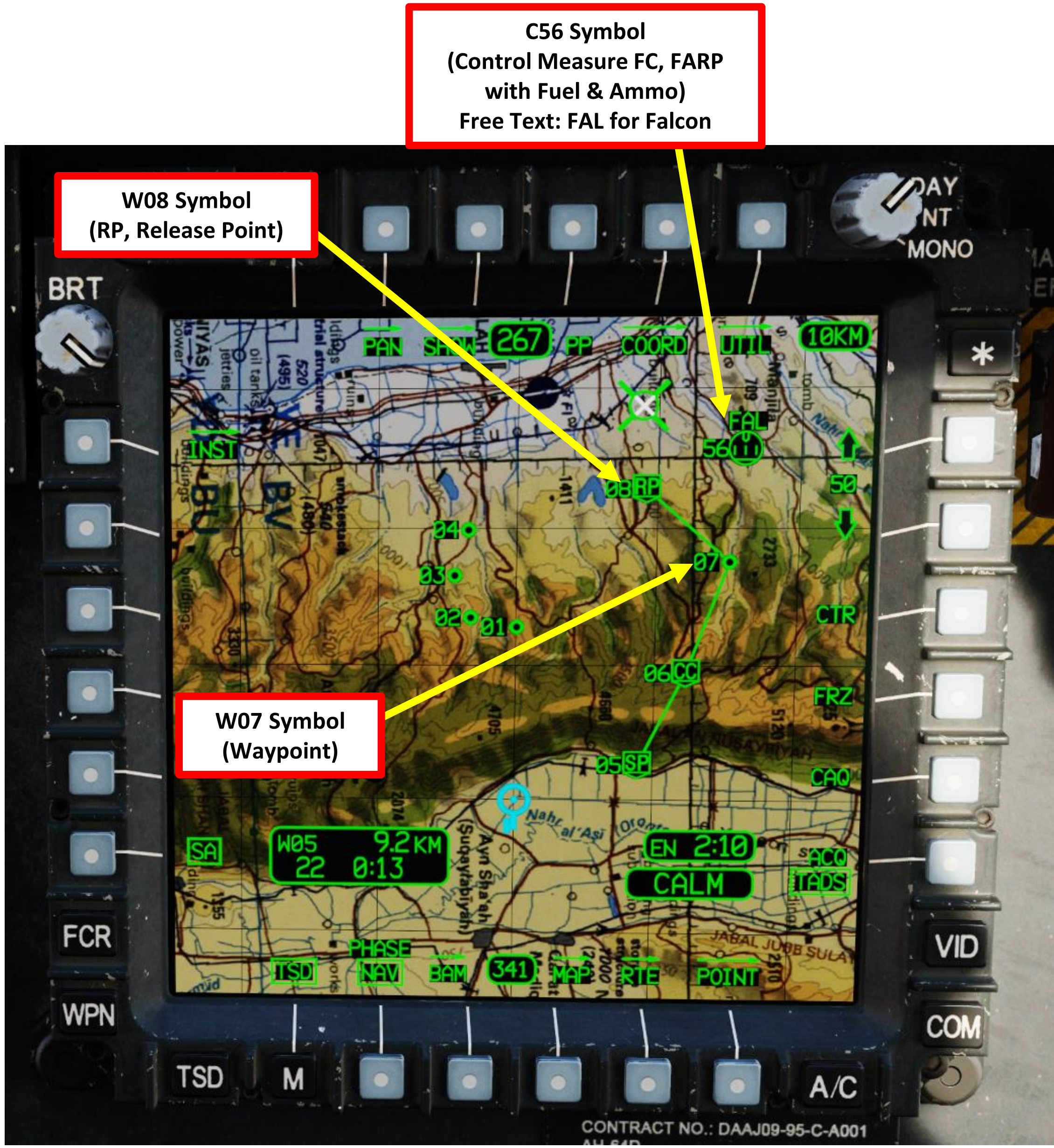
4 – Navigation Routes
4.3 – Editing a Route

In this example, we have Route BRAVO, which consists of the following points:

- Start Point (W05, SP)
- Communications Checkpoint (W06, CC)
- Waypoint (W07)
- Release Point (W08, RP)

We want to edit Route BRAVO by adding Control Measure C56 to the route, more precisely between Waypoint W07 and Release Point W08/RP08.

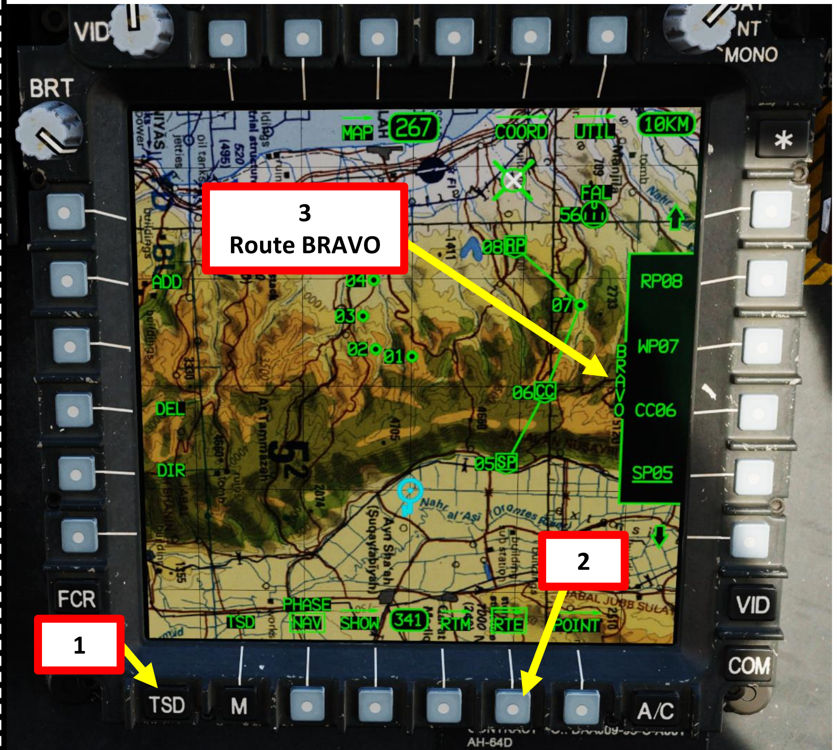
- C56 is a FARP (Forward Arming Refueling Point) Fuel & Ammo. Its IDENT is “FC” and it has a Free Text “FAL” for “Falcon”.

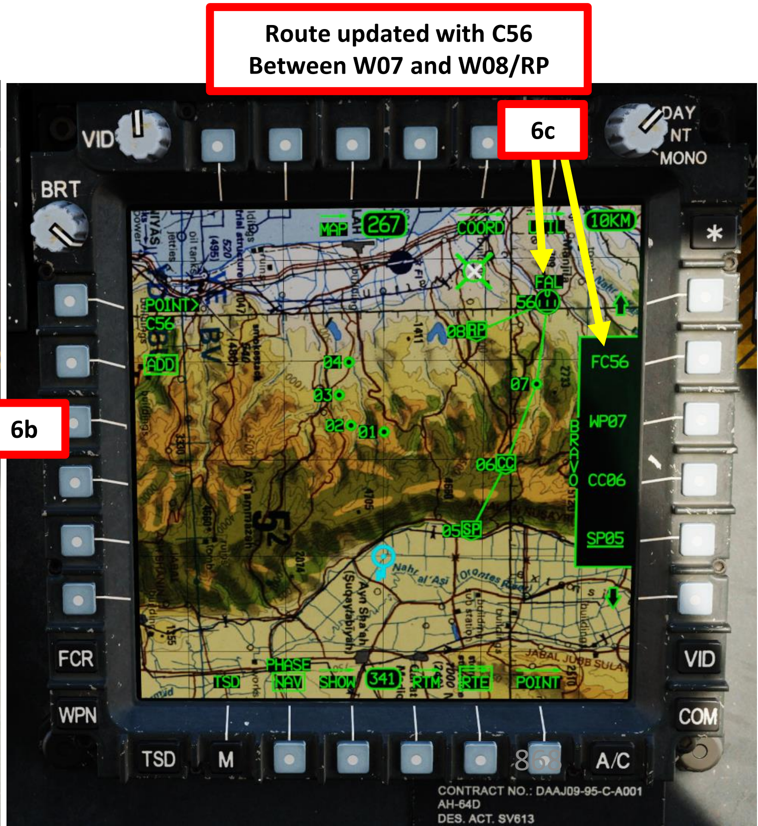


4 – Navigation Routes
4.3 – Editing a Route

How to Add a Point to a Route

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. Make sure Route BRAVO is already selected.
4. Press ADD VAB.
5. Select Control Measure C56 (FC, FARP with Fuel & Ammo) using either the Keyboard Unit method or the Cursor method.
    a) Press POINT> VAB.
    b) Type the "C56".
    c) Press ENTER on the KU.
6. To insert point C56 between W07 and W08/RP, press UP ARROW VAB until W08/RP is visible in the BRAVO Route menu. Then, press VAB next to RP08 to insert C56/FC56 before RP08. The point that is located at that position within the route sequence (RP08) will move to the following position, and all points that follow will move accordingly.
7. And there we go, C56 was inserted after W07 and before W08/RP.



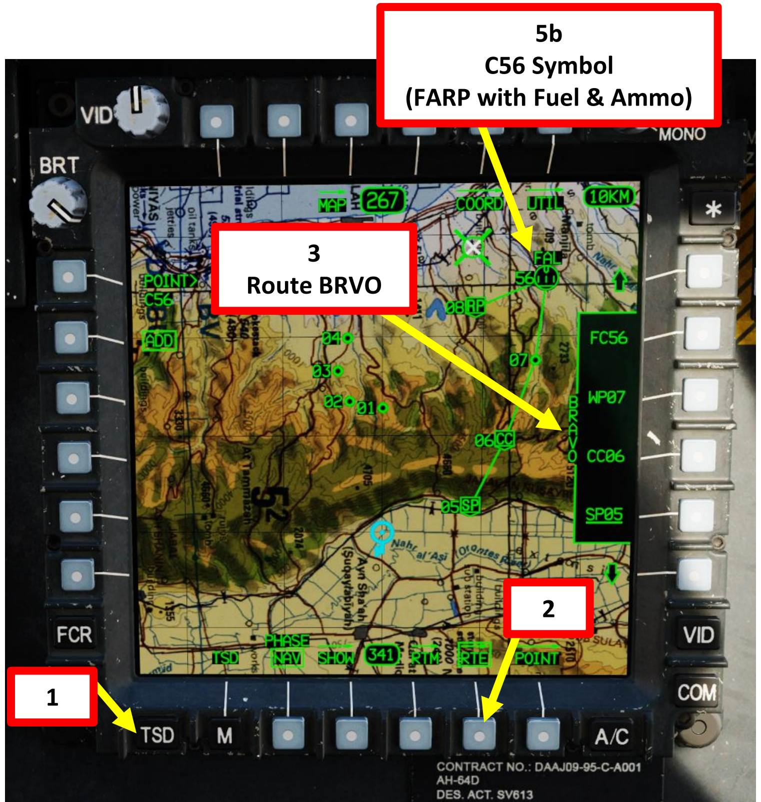


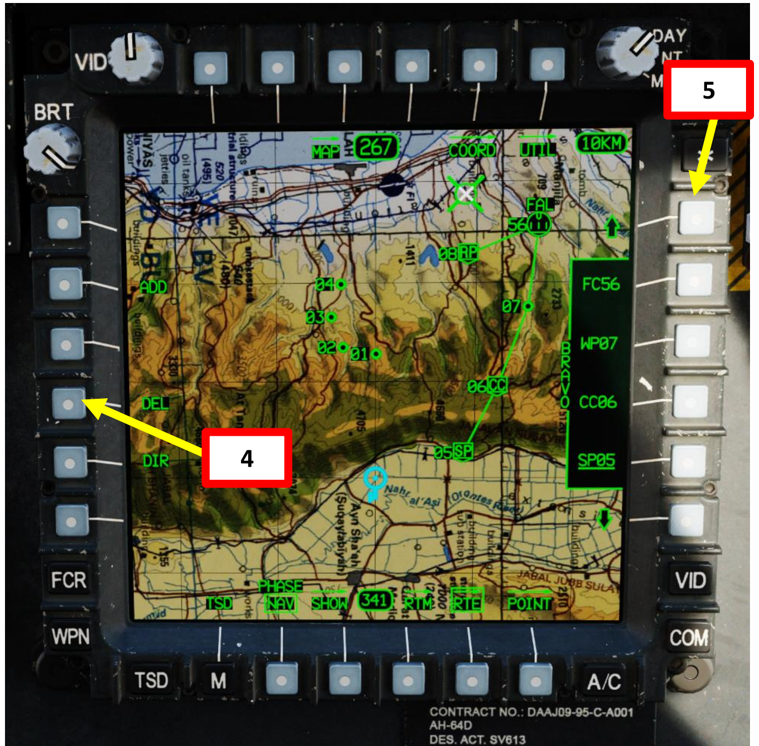
4 – Navigation Routes
4.3 – Editing a Route

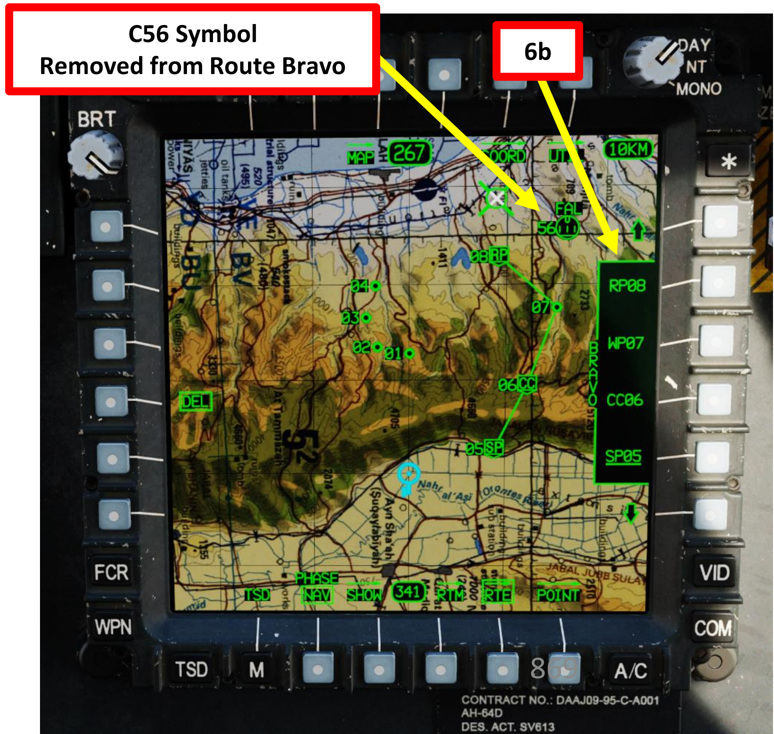
How to Remove a Point from a Route

In this example, we will delete Control Measure C56 from Route BRAVO.

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. Make sure Route BRAVO is already selected.
4. Press DEL (Delete) VAB
    - If ADD is already selected (boxed), de-select it first.
5. Press UP ARROW VAB until C56/FC56 is visible in the BRAVO Route menu.
6. Press VAB next to FC56 to remove C56/FC56 from Route BRAVO. This will not delete the Control Measure itself from the navigation database; it will merely remove it from the route only.



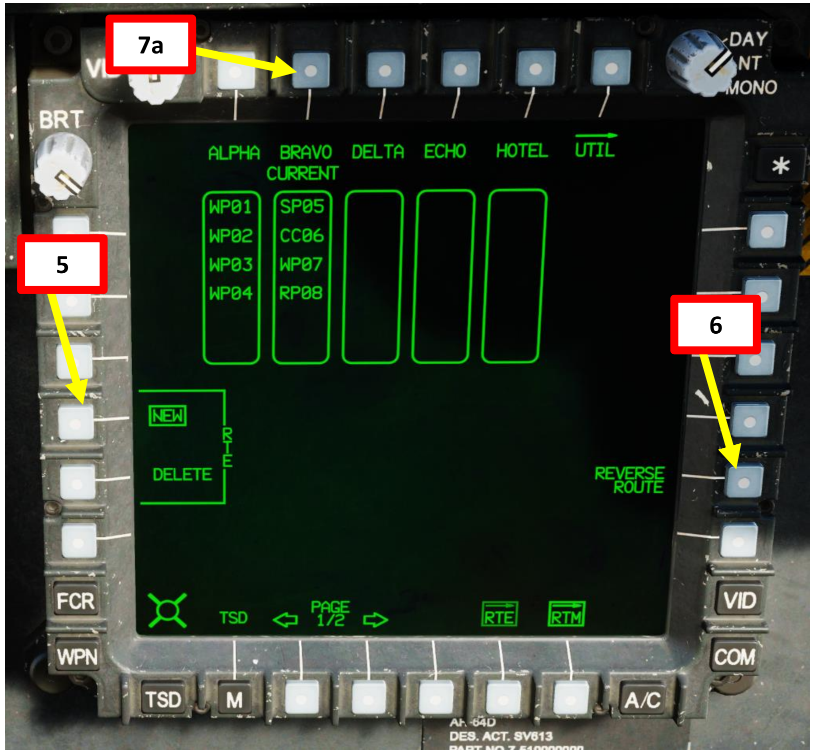


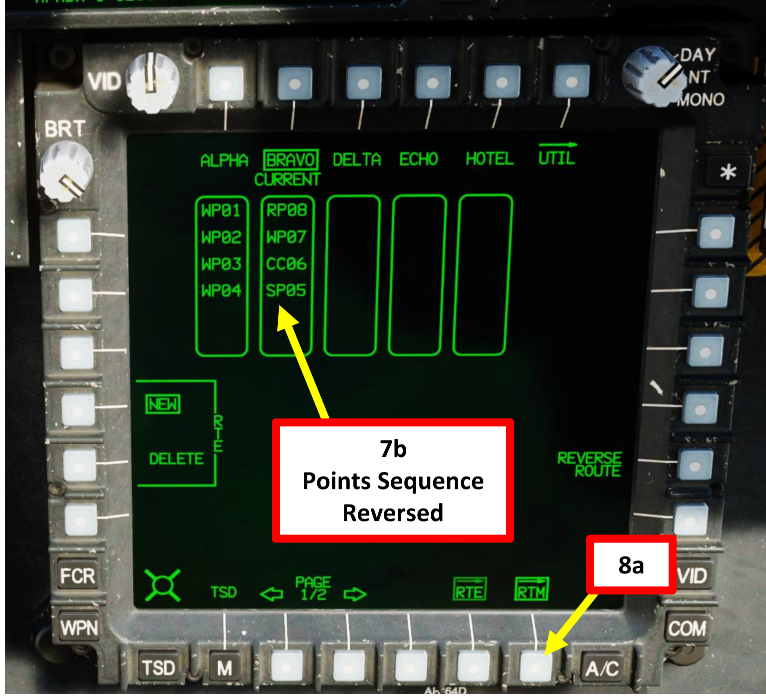


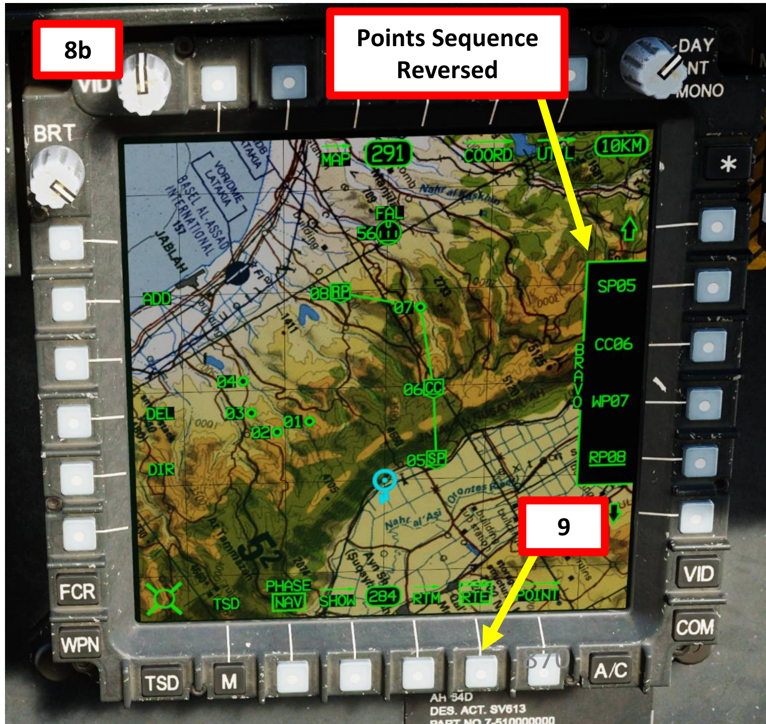
4 – Navigation Routes
4.4 – Reversing a Route

In a previous tutorial, we created Route BRAVO. What if we want to **reverse the points in the route** in order to backtrack a route?

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. In this example, Route BRAVO is already selected.
4. Select RTM (Route Menu).
5. Select NEW RTE (New Route).
6. Select REVERSE ROUTE.
7. Select BRAVO to reverse the points in this specific route. The first point SP05 (Start Point) will become the last, the last point (RP08, Release Point) will become the first in the sequence. All other points in-between will be re-ordered in reverse in a similar fashion.
8. Select RTM (Route Menu) to return to the RTE (Route) page.
9. To exit RTE (Route) page, press RTE VAB.



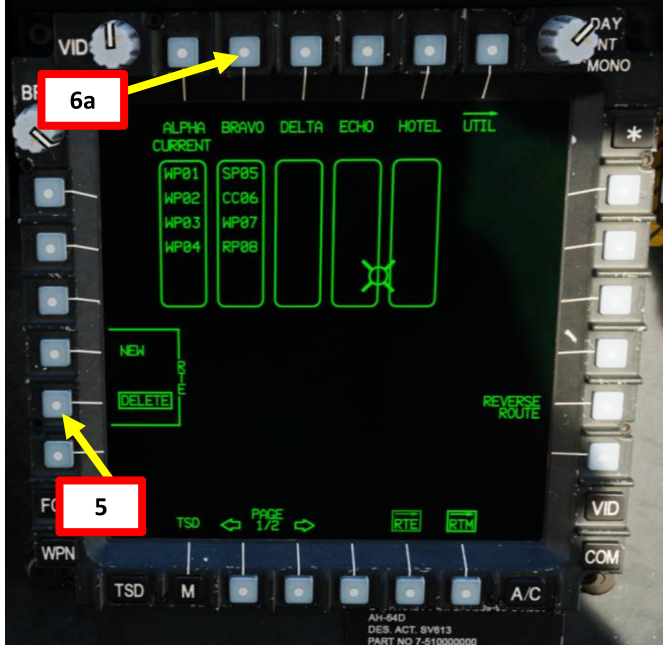


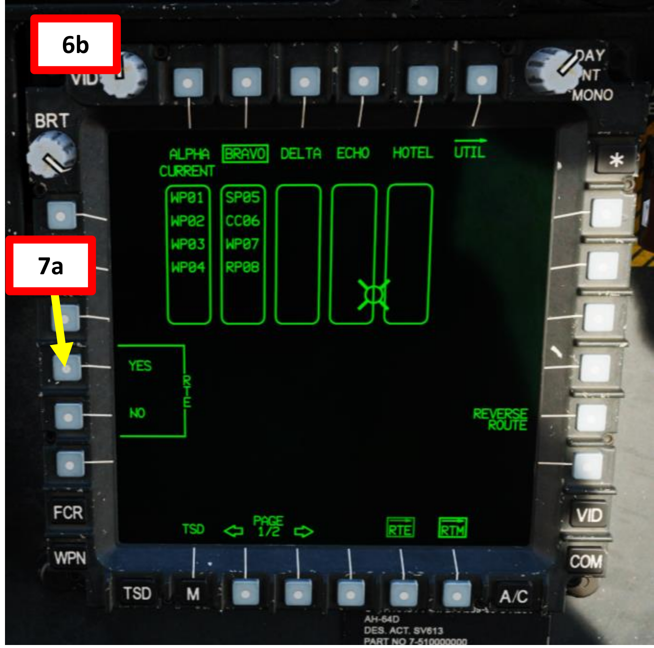


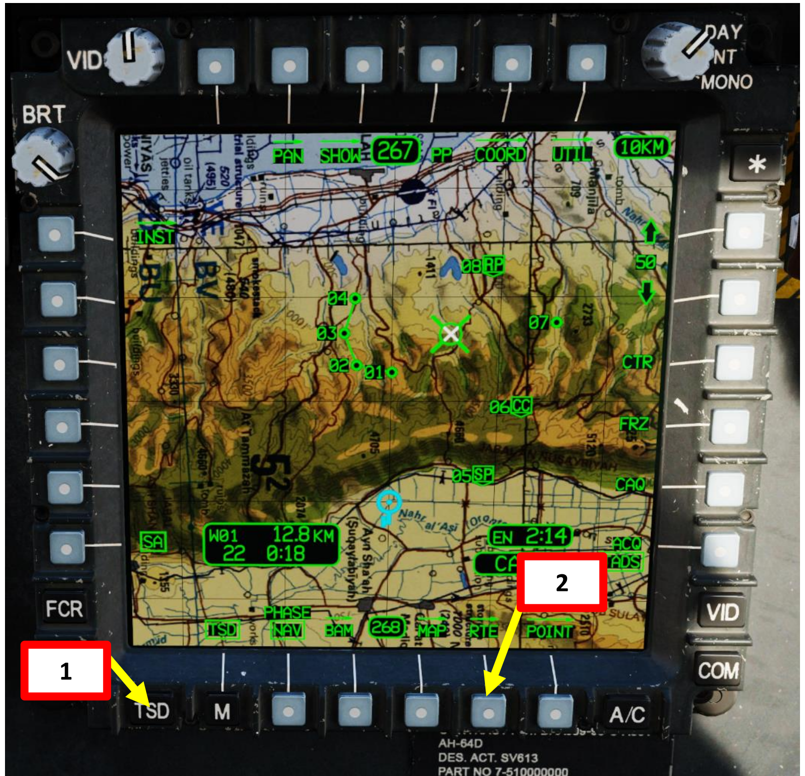
4 – Navigation Routes
4.5 – Deleting a Route

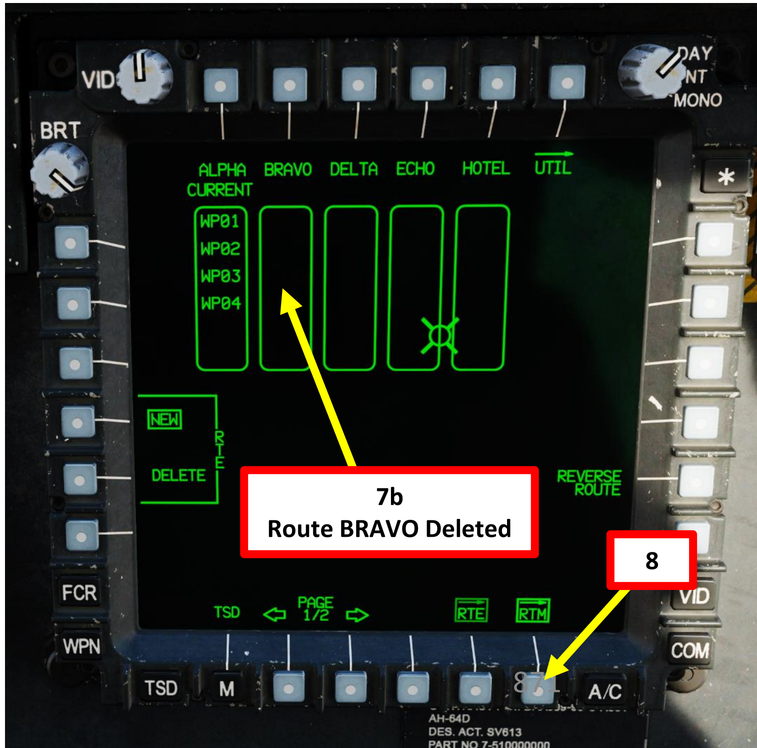
In a previous tutorial, we created Route BRAVO. What if we want to **delete** it?

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. In this example, Route ALPHA is already selected.
4. Select RTM (Route Menu).
5. Select DELETE RTE (Delete Route).
6. Select BRAVO.
7. Select YES to confirm deletion.
8. Select RTM (Route Menu) to return to the RTE (Route) page.
9. To exit RTE (Route) page, press RTE VAB.







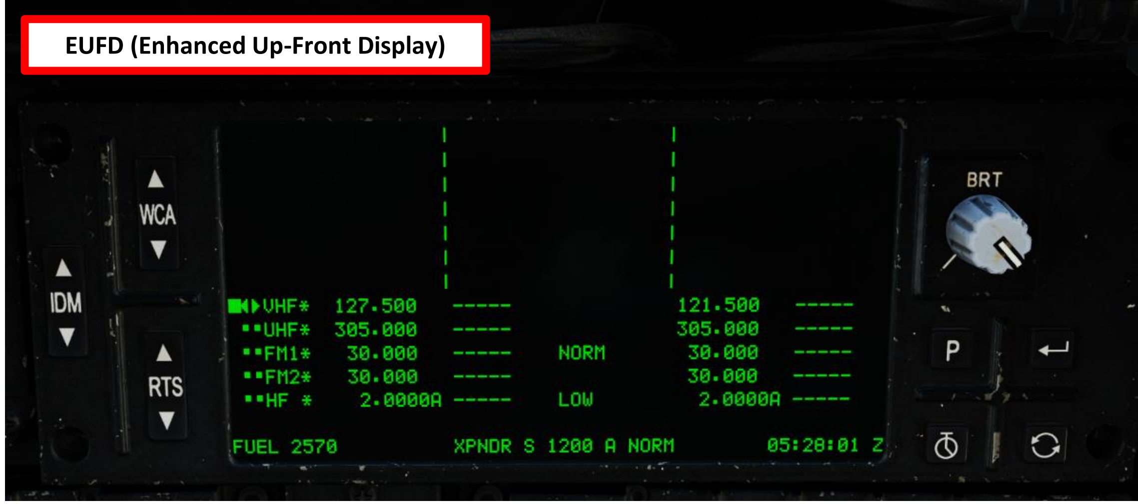


4 – Navigation Routes
4.6 – Route Navigation & Point Sequencing

Navigating through a route is fairly straightforward. The **selected point is underlined** in the RTE (Route) menu. When the aircraft overflies this point, the navigation system will automatically switch to the next waypoint in the sequence for the selected route.

Pressing on a VAB next to a point in the Route Menu, the point will become boxed and additional information for the waypoint is displayed such as distance, ETE (Estimated time enroute to the point) or ETA (Estimated time of arrival).

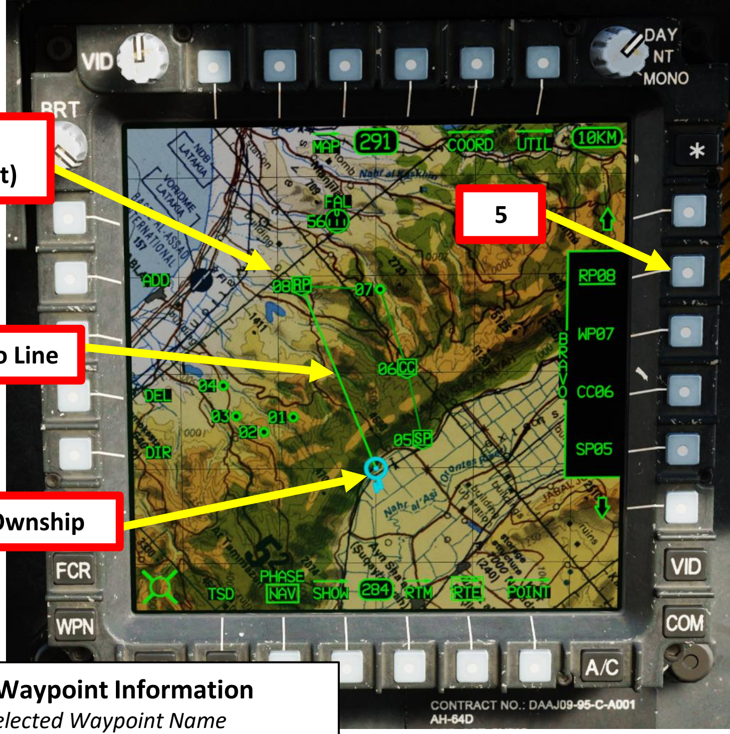
If a TSD is not displayed on either MPD, a "WAYPOINT APPROACH" advisory will be displayed on the EUFD to alert the crewmember of an impending turn to the next route point. This advisory will display when the estimated time enroute (ETE) to that route point at the current ground speed is 60 seconds. When passing the route point, even if the aircraft does not directly overfly it, the next route point is automatically set as the new destination and "WAYPOINT PASSAGE" is displayed on the EUFD for 90 seconds.



4 – Navigation Routes
4.6 – Route Navigation & Point Sequencing

If you want to select a specific waypoint in the route, you can do a Direct-To.

1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press RTE (Route) VAB (Variable Action Button).
3. Make sure desired route is selected.
4. Press DIR (Direct-To) VAB.
5. Press VAB next to the point you want to select (W08/RP08 in this example).
6. When the point is selected as a DIRECT-TO, a straight line is drawn from the Ownship to the selected point. This line does not follow the aircraft, but rather represents the original course plotted from the aircraft's position at the moment the Direct-To was entered. The current route will be displayed in partial-intensity green while a Direct-To course is active.
7. If desired, press one more time the VAB next to the W08/RP08 to box it and display additional information.



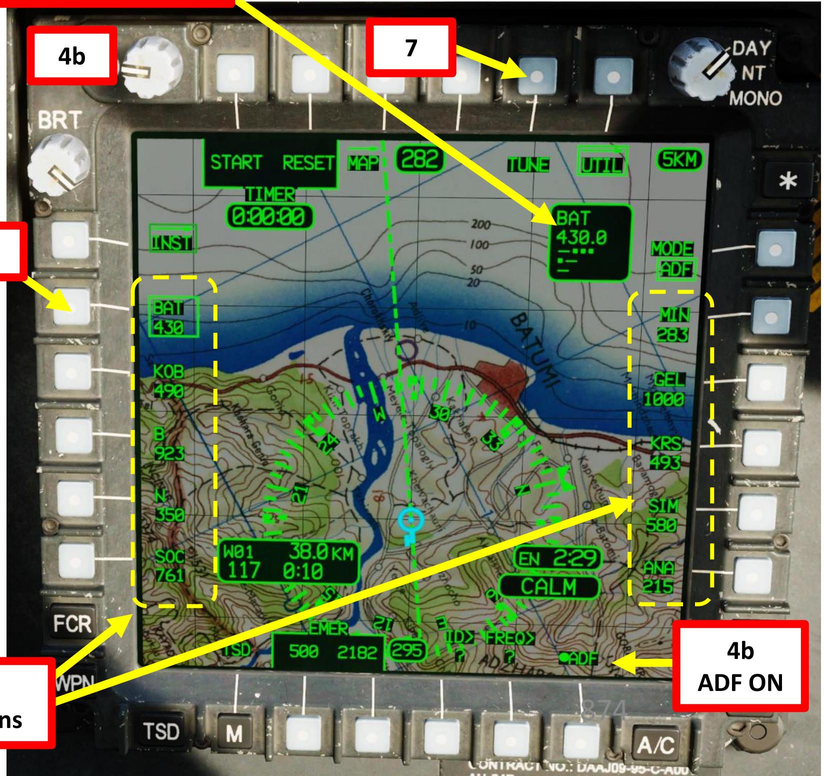
Selected Waypoint Information
- *W08: Selected Waypoint Name*
- *WP: Identifier (Waypoint)*
- *W08: Free Text*
- *ETE: Estimated time enroute to the point*
- *ETA: Estimated time of arrival*
- *20.4 KM: Distance to Waypoint (km)*
- *11.0 NM: Distance to Waypoint (nm)*

5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.1 – NDB Tuning to a Preset Frequency

In this example, we will tune the ADF to a preset station.

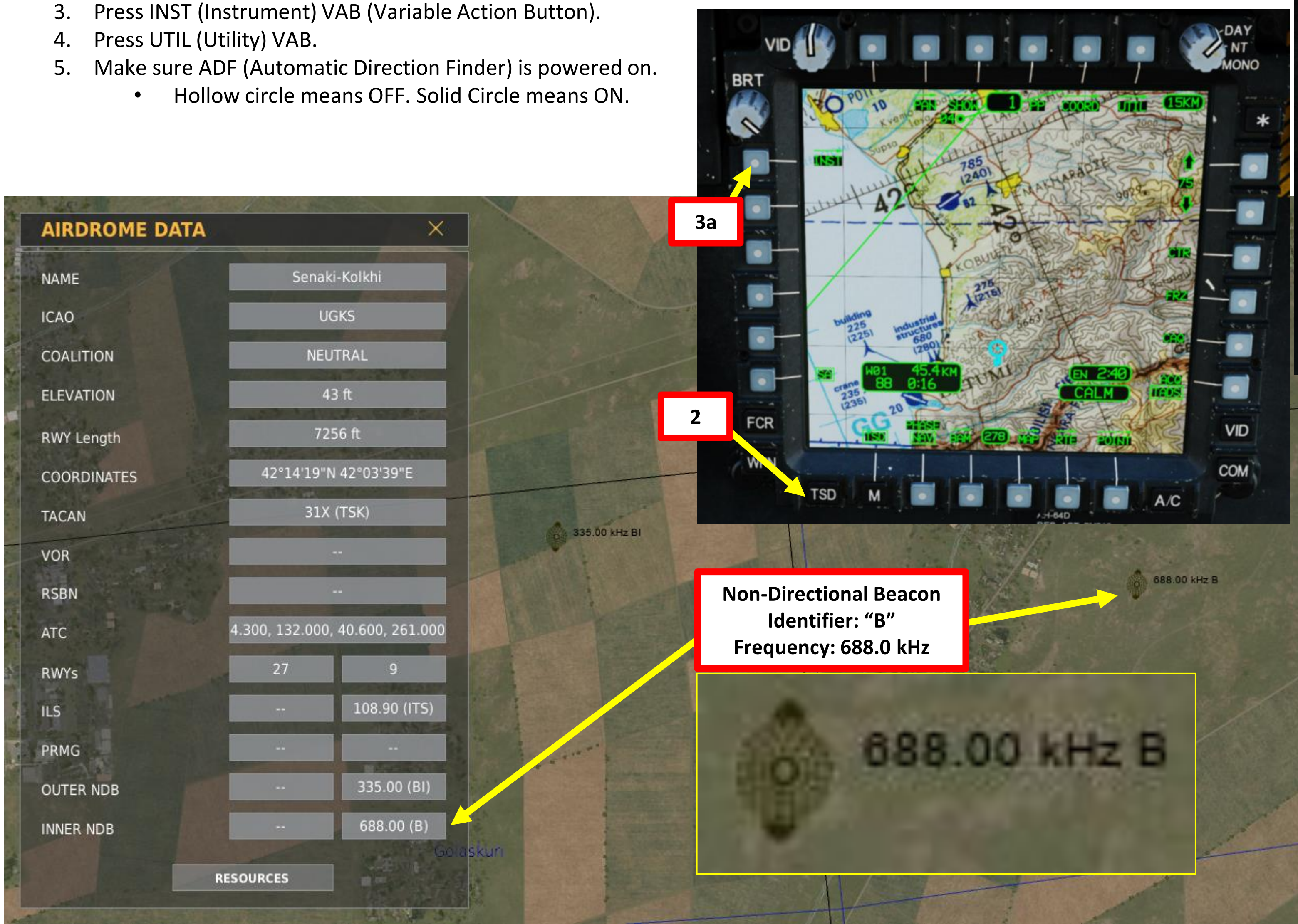
1. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
2. Press INST (Instrument) VAB (Variable Action Button).
3. Press UTIL (Utility) VAB.
4. Press ADF (Automatic Direction Finder) VAB.
    - Hollow circle means OFF. Solid Circle means ON.
5. Ten preset channels are listed with their name (identifier) and associated frequency.
6. Select desired preset channel. We will select preset channel BAT, which is the NDB station at Batumi (430.00 kHz).
7. Press TUNE VAB.
8. And that's it! You have now tuned the ADF to station BAT (430.00 kHz).
9. Press UTIL VAB to return to the INST TSD sub-page.

Selected ADF Station Information
Name (BAT)
Frequency (430.0 kHz)
Morse Code



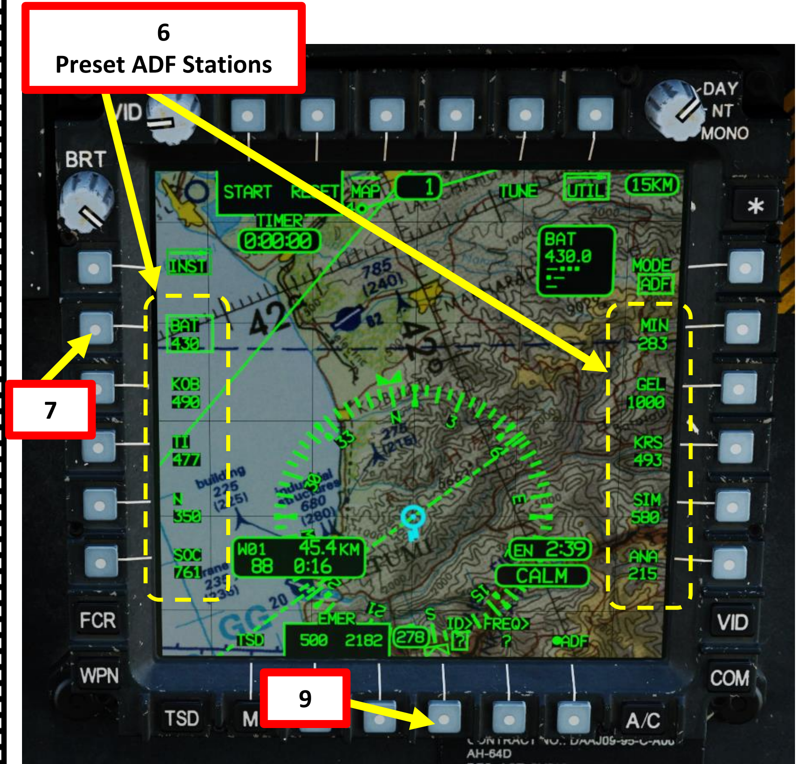
5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.2 – Editing a Preset Frequency

1. We want to edit a preset frequency to a NDB (Non-Direction Beacon) station named "B" (identifier), which has a frequency of 688.0 kHz. This information is available from the F10 map by clicking on the Senaki-Kolkhi airport.
2. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
3. Press INST (Instrument) VAB (Variable Action Button).
4. Press UTIL (Utility) VAB.
5. Make sure ADF (Automatic Direction Finder) is powered on.
    - Hollow circle means OFF. Solid Circle means ON.



5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.2 – Editing a Preset Frequency

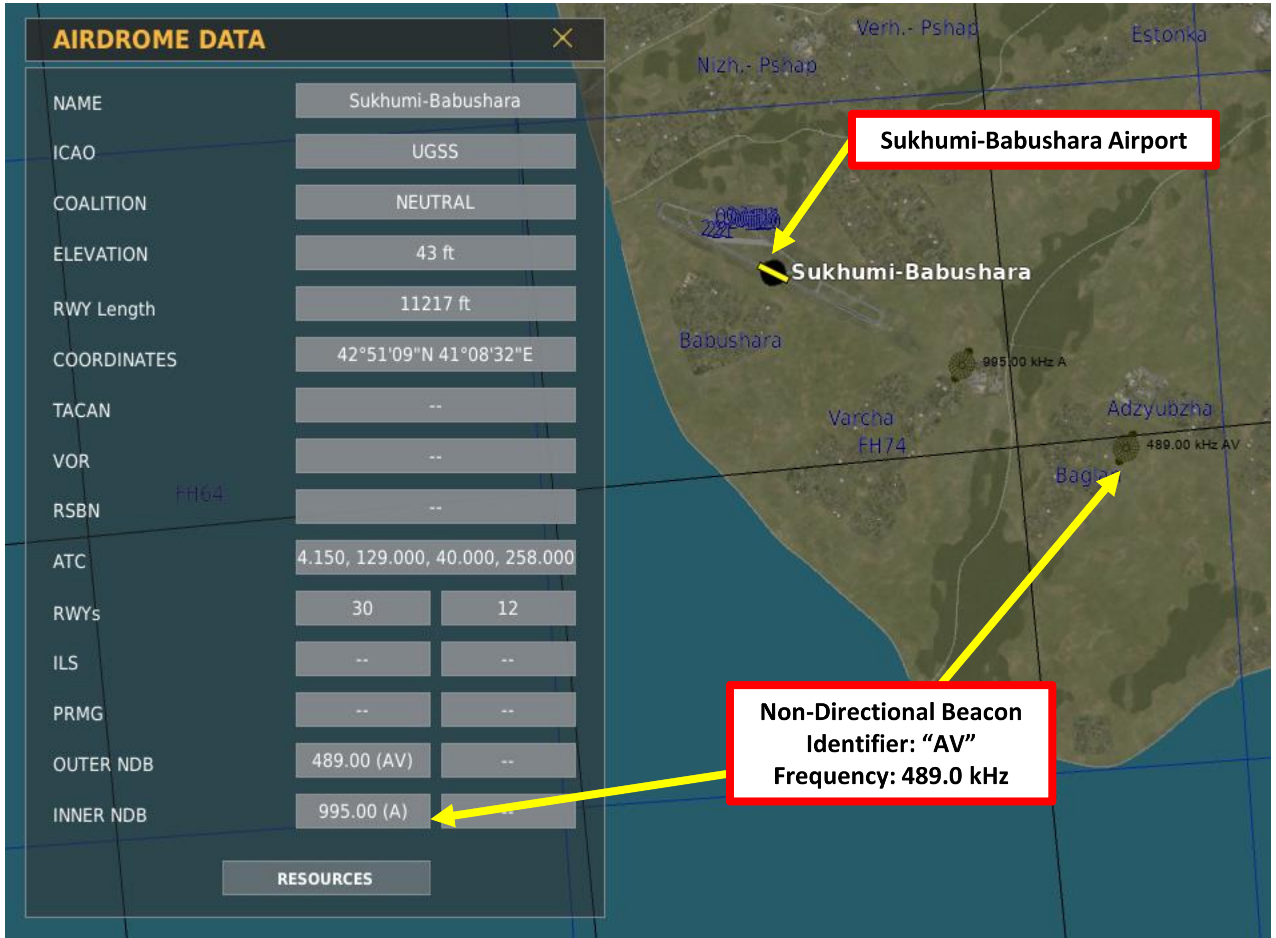
6. Ten preset channels are listed with their name (identifier) and associated frequency.
7. Select the preset channel that you want to edit. We will select preset channel BAT, then change its identifier and frequency.
8. We want to add NDB (Non-Direction Beacon) station “B”, which has a frequency of 688.0 kHz.
9. Select ID>.
10. On the KU (Keyboard Unit), select and enter identifier (“B” in this case), then press ENTER.
11. Select FREQ>.
12. On the KU, select and enter frequency (“688.0” in this case), then press ENTER.
13. And that’s it! The selected preset channel is now set to NDB “B” with a frequency of 688.0 kHz.



5 – AN/ARN-149 ADF (Automatic Direction Finder)

5.3 – NDB Tuning to a Manual Frequency

1. We want to enter a manual frequency to a NDB (Non-Direction Beacon) station named “AV” (identifier), which has a frequency of 489.0 kHz. This information is available from the F10 map by clicking on the Sukhumi-Babushara airport.
2. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
3. Press INST (Instrument) VAB (Variable Action Button).
4. From UTIL page, make sure ADF (Automatic Direction Finder) is powered on. Then, return to INST page by pressing VAB next to UTIL again.
    - Hollow circle means OFF. Solid Circle means ON.



5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.3 – NDB Tuning to a Manual Frequency

5. Select FREQ>.
6. On the KU (Keyboard Unit), select and enter frequency (“489.0” in this case), then press ENTER.
7. And that’s it! The selected manual frequency is now set to NDB “AV” with a frequency of 489.0 kHz.

5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.4 – NDB Navigation

In this tutorial, we want to navigate to a NDB (Non-Direction Beacon) next to Batumi Airport. The NDB station is called LU and has a frequency of 430.00 kHz. To better visualize the location of the NDB, I have manually added a Control Measure representing the NDB on the TSD (Tactical Situation Display).

- **Important note**: The ADF antenna can determine a coarse azimuth to an AM radio signal within the **range of 100 and 2199.5 kHz.**

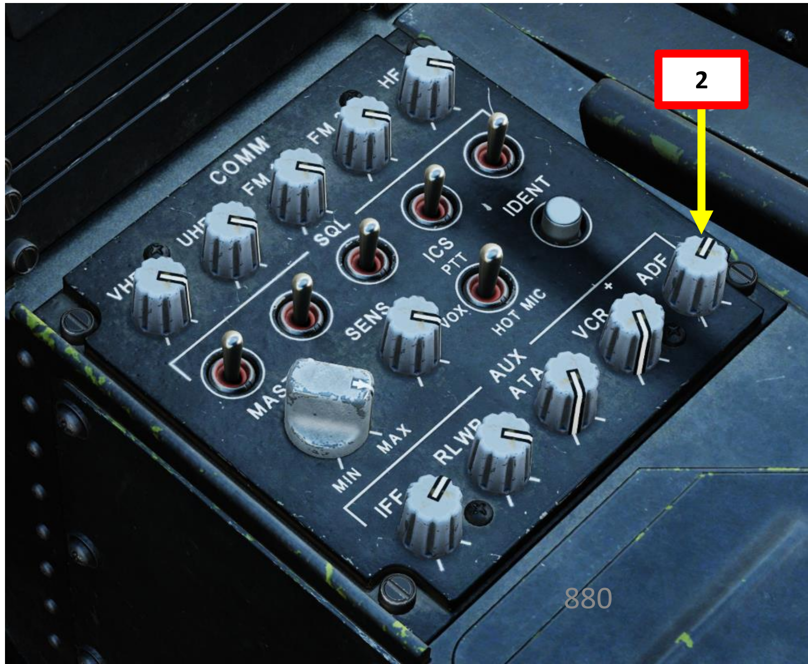
Control Measure C51
IDENT: BE (NDB Station)
Free Text: LU (NDB name)

5 – AN/ARN-149 ADF (Automatic Direction Finder)

5.4 – NDB Navigation

1. Set CMWS/NAV Switch – NAV (DOWN).
   - As a post-production modification to the AH-64D, the AAR-57 Common Missile Warning System (CMWS) uses the ADF audio channel to provide audio alerts to the crew. As such, the ADF audio volume knob in each crewstation is utilized to control CMWS threat warning audio volume separately from the RLWR audio volume. While providing threat audio, the crew will be unable to tune and identify navaids using the ADF receiver. The CMWS/NAV switch is used to switch between ADF receiver audio when in the NAV position and CMWS threat alert audio when in the CMWS position.
   - In this case, we want to use NAV.
2. Adjust the ADF tone volume as desired.
3. Press TSD (Tactical Situation Display) FAB (Fixed Action Button).
4. Press MAP VAB (Variable Action Button), and set the ORIENT option to TRK-UP.
5. Press MAP VAB again to return to the main TSD page.

1 **CMWS/NAV Switch**
- *DOWN: NAV selects ADF receiver audio*
- *UP: CMWS selects threat alert audio*



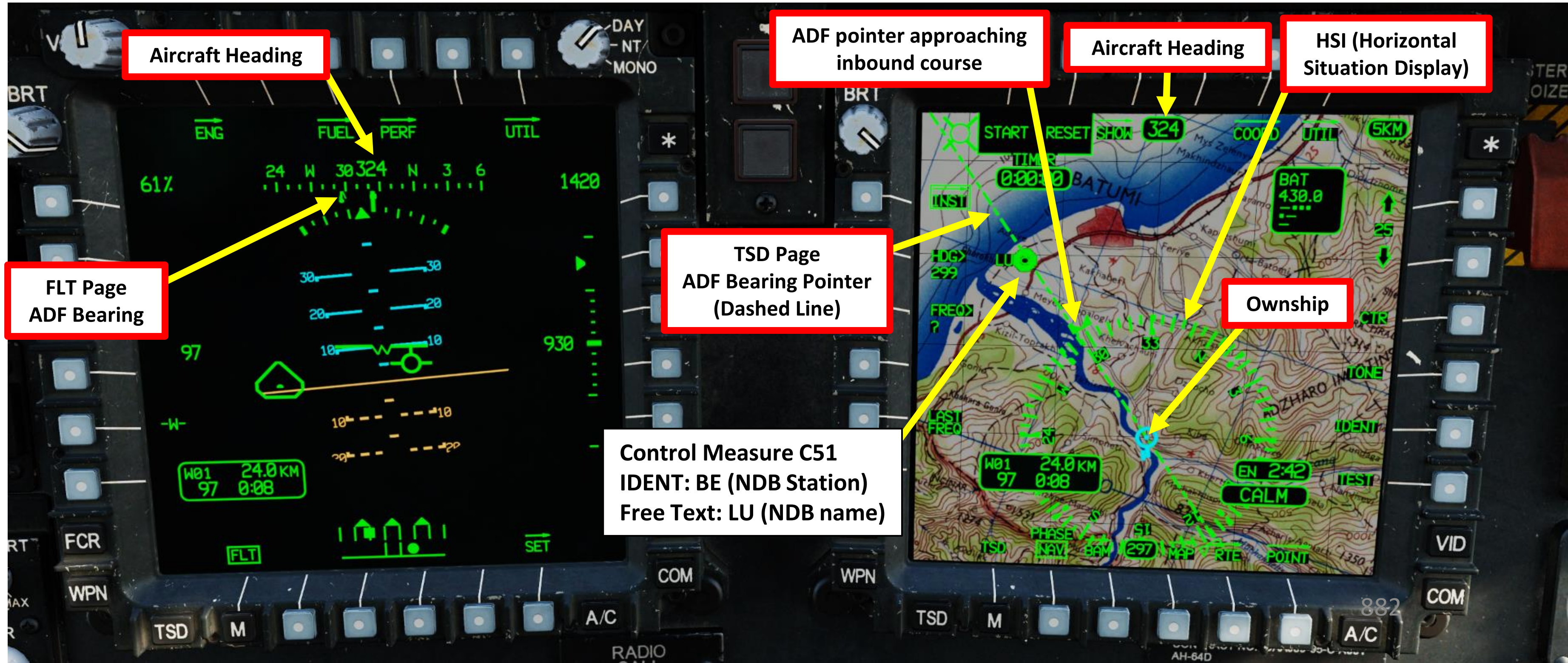
5 – AN/ARN-149 ADF (Automatic Direction Finder)

5.4 – NDB Navigation

6. Press INST (Instrument) VAB (Variable Action Button).
7. Press UTIL (Utility) VAB.
8. Press ADF (Automatic Direction Finder) VAB to power on the ADF system..
    - Hollow circle means OFF. Solid Circle means ON.
9. In this case, we already have a preset channel set to the Batumi LU NDB (430.00 kHz). We will select preset channel BAT.
10. Press TUNE VAB.
11. Press UTIL (Utility) VAB to return to INST page.
12. If you want to approach the NDB from a certain direction (as an example, the runway heading of 299 Magnetic):
    a) Press VAB next to HDG>
    b) On the KU (Keyboard Unit), enter desired inbound heading (299), then press ENTER.

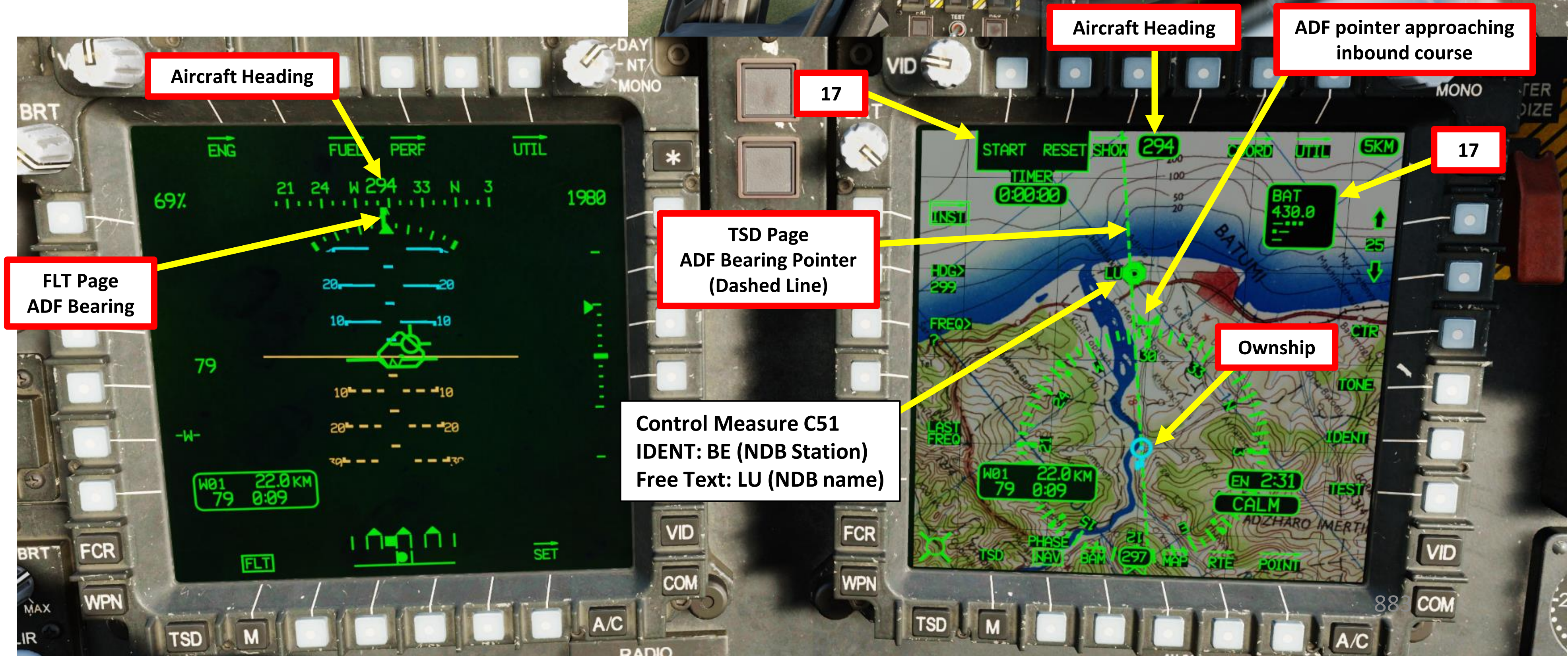
5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.4 – NDB Navigation

13. Once the NDB station signal is received, you should start hearing its morse code being broadcasted continuously. You can use HDU (Helmet Display Unit), FLT (Flight) page and TSD (Tactical Situation Indicator) symbology to determine the bearing of the NDB station.
14. When the ADF Bearing Pointer swings to the direction of a received NDB signal, the crew turns toward the azimuth indicated by the Bearing Pointer and aligns it with the 12 o'clock of the TSD. The aircraft is now tracking toward the NDB.
15. It's important to note that when the TSD is in Track-up orientation, the HSI (Horizontal Situation Indicator) and the Ownship will "twist" in response to crosswinds and the Current Heading at the top center of the TSD indicates the current aircraft heading, not the heading of the TSD. The TSD moving map will remain oriented to the actual ground track of the aircraft.



5 – AN/ARN-149 ADF (Automatic Direction Finder)
5.4 – NDB Navigation

16. When you are tracking the NDB, the Bearing Pointer should be aligned with the 12 o'clock of the TSD.
17. Additional controls for ADF navigation are provided such as a dedicated timer that is crewstation independent and an NDB status window that aids in identifying the selected Non-Directional Beacon the ADF is currently tuned to.



PART 20 – AIRCRAFT CONTROL SYSTEMS

SECTION SUMMARY

1 – AIRCRAFT CONTROL SYSTEMS OVERVIEW

Source: Eagle Dynamics AH-64D Manual

Here is an overview of different systems involved in providing the helicopter with some level of control automation.

FMC (Flight Management Computer)

The AH-64D incorporates a Flight Management Computer (FMC) that can electronically command movement to the flight control servo-actuators for reduced pilot workload and accurate weapons delivery. The FMC also provides stabilator scheduling based on collective position and longitudinal calibrated airspeed; and Back-Up Control System (BUCS) functionality in case of jams or severances within the cockpit flight controls.

The FMC's three primary functions regarding aircraft control are Stability Augmentation, Command Augmentation, and Hold mode functionality.

The Stability and Command Augmentation Systems (SCAS) are always active within each individual FMC channel. **Each FMC channel can be toggled on or off via the A/C UTIL page**; or **all FMC channels can be immediately commanded off using the FMC Release "pinkie" button** on the cyclic grip in either crewstation.

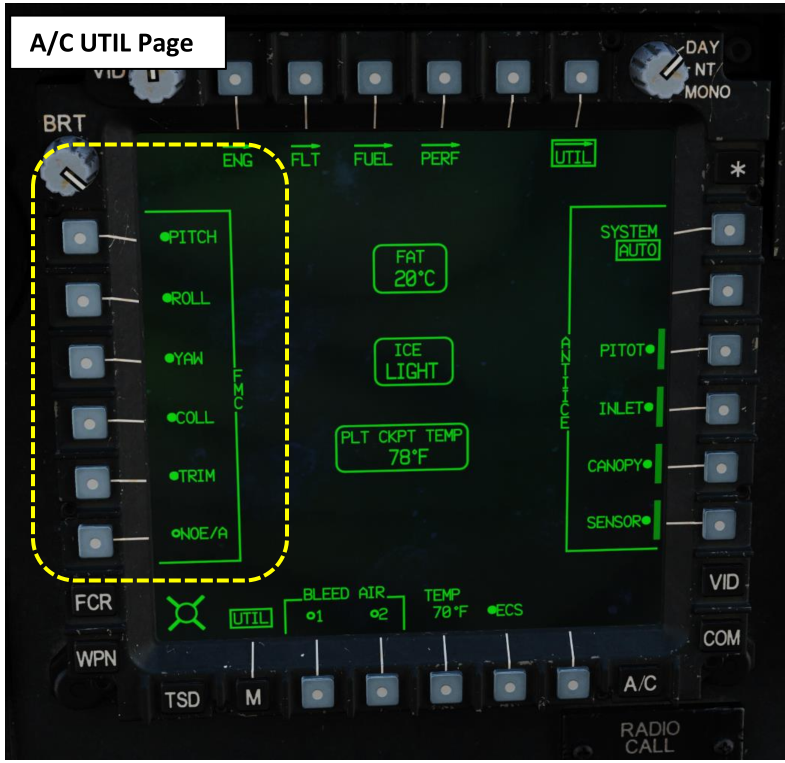
The cyclic, collective, and pedals in each cockpit utilize a series of sensors called Linear Variable Differential Transducers (LVDT) to sense the position and movement of each flight control and relay these movements to the FMC. These movements are used by the FMC to process SCAS commands to the flight controls during normal operations, or to provide full "fly-by-wire" flight control functions during an emergency when in BUCS mode.

Each FMC channel corresponds to an individual hydromechanical servo-actuator that manipulates the main or tail rotor swashplate assemblies; and each of these servo-actuators includes an electronically commanded hydraulic valve. This valve can be commanded by the FMC to initiate movement of the servo-actuator control linkage to the swashplate independently of, or in conjunction with, direct mechanical inputs from the flight controls in each cockpit. The component within each servo-actuator that initiates these control movements is called the "SAS sleeve", and each possesses a limited range of motion to provide SCAS and hold mode functionality (±10% authority in all axes except the pitch axis, which is +20% and -10% authority).

The FMC commands the flight control servo-actuators based on the following:

- Flight control inputs as reported through the Linear Variable Differential Transducers (LVDT).
- Aircraft rate information from the EGI's (Embedded GPS/Inertial Navigation System)
- Helicopter Air Data System (HADS)
- Radar Altimeter
- Pitot and Static Port pressure sensors

The FMC can only command movement to the servo-actuators using the Primary hydraulic system; therefore, if the Primary hydraulic system fails or loses pressure, the aircraft can still be flown using the Utility hydraulic system, but without the stability and augmentation the FMC provides, nor will hold modes or BUCS be available.



FMC (Flight Management Computer) Release Button

- *Disengages all FMC SCAS (Stability and Augmentation Control System) channels.*

1 – AIRCRAFT CONTROL SYSTEMS OVERVIEW

SAS (Stability Augmentation System)

Source: Eagle Dynamics AH-64D Manual

The Stability Augmentation System (SAS) function of the FMC (Flight Management Computer) provides a stable aircraft for reduced pilot workload and increased weapons delivery accuracy. SAS is active in each FMC control axis that is enabled via the A/C UTIL page. SAS inputs are limited by the authority of the SAS sleeves within each flight control servo-actuator (±10% authority in all axes except the pitch axis, which is +20% and -10% authority).

When necessary, the FMC commands movement of the SAS sleeves within the applicable flight control servo-actuator(s) to provide the following:

- Yaw rate damping. When accelerating, yaw rate damping will be present until ground speed is ≥ 40 knots. When decelerating from ground speeds ≥ 40 knots, yaw rate damping won't return until ground speed is ≤ 30 knots.
- Lateral (roll) and Longitudinal (pitch) rate damping at all airspeeds.
- Atmospheric upset damping.

Rate damping minimizes attitude oscillations within the respective pitch, roll and yaw axes, but will not prevent attitude drift from the force trimmed positions of the flight controls. Atmospheric upset damping reduces the effect of atmospheric disturbances (such as turbulence) from affecting the aircraft's flight path.
The EGI inertial measurements provide airframe movements/rates to the FMC, which compares the EGI (Embedded GPS/Inertial Navigation System) data to the flight control LVDTs. If there are no changes in the flight control positions, the FMC commands the respective servo-actuator(s) SAS sleeves to counter the un-commanded movements.

1 – AIRCRAFT CONTROL SYSTEMS OVERVIEW

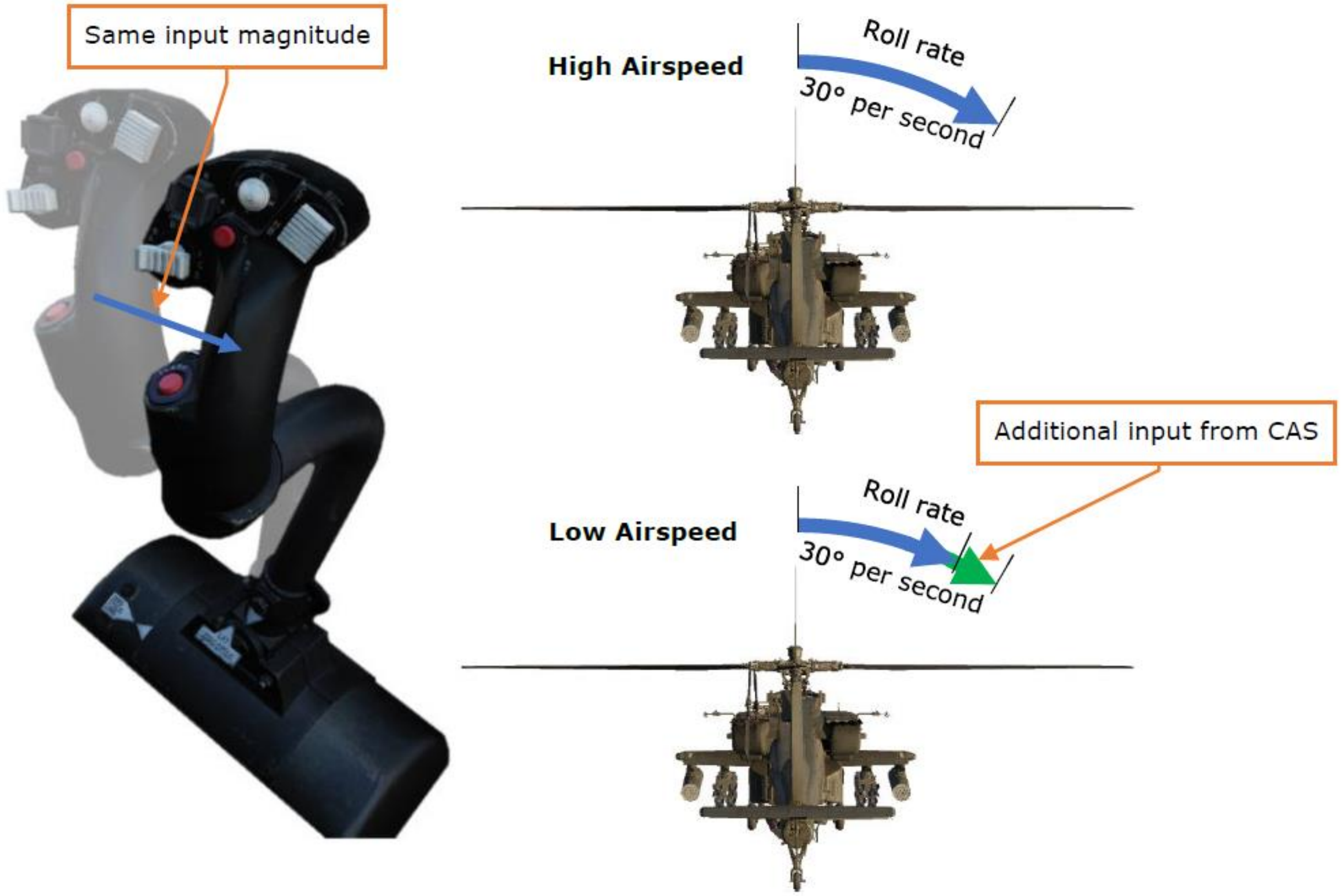
CAS (Command Augmentation System)

The Command Augmentation System (CAS) function of the FMC provides an immediate and uniform aircraft response at all longitudinal airspeeds. CAS is active in each FMC (Flight Management Computer) control axis that is enabled via the A/C UTIL page. CAS input limitations are the same as SAS (Stability Augmentation System, ±10% authority in all axes except the pitch axis, which is +20% and -10% authority).

When a control input is made, the FMC detects the flight control movement in the respective LVDT axis (or axes) and will command movement of the SAS sleeve within the applicable flight control servo-actuator(s). This provides a "power steering" response to remove the lag effect of mechanical inputs into the flight control servo-actuators. At lower longitudinal airspeeds, the amount of CAS input is proportionally increased to ensure the aircraft handling remains consistent with flight at higher airspeeds.

CAS is disabled in the FMC Yaw channel when the aircraft is on the ground (determined by the weight-on-wheels or "squat" switch). This prevents over-steering during ground taxi.

Source: Eagle Dynamics AH-64D Manual



Command Augmentation at Different Speeds

2 – FORCE TRIM

Source: Eagle Dynamics AH-64D Manual

Mounted to the cyclic grip in each crewstation is a "Force Trim/Hold Mode" 4-way switch. When this 4-way switch is pressed to the forward "Release" position, the force trim magnetic brakes on the cyclic and pedals are released. Pressing this 4-way switch to this position is analogous to pressing the "force trim interrupt" button in other helicopters.

The force trim release switch in the AH-64D serves three purposes in flight:

1. Provides a method to disengage the magnetic brakes of the force trim system on the cyclic and pedals.
2. Used to temporarily disengage any active hold modes that are currently engaged and, if necessary, allows the SAS (Stability Augmentation System) sleeves to re-center in all axes.
3. Used to set new reference values of pitch, roll, heading, sideslip, velocity, or position to the FMC (Flight Management Computer), depending on what Attitude hold modes/sub-modes are activated at any given time.

- When the **Force Trim/Hold Mode switch is pressed to the left "AT" position**, Attitude Hold is toggled on/off, and will enter one of three sub-modes based on current ground speed (see Attitude Hold for more information).
- When the **Force Trim/Hold Mode switch is pressed to the right "AL" position**, Altitude Hold is toggled on/off, and will enter one of two sub-modes based on current ground speed and altitude above ground level (see Altitude Hold for more information).
- When the **Force Trim/Hold Mode switch is pressed to the aft "Disengage" position**, Attitude Hold and Altitude Hold modes will be toggled off.
- Any time the **force trim release switch (Force Trim/Hold switch pressed forward)** is pressed, Attitude Hold (if activated) and Heading Hold (always active) will be temporarily disengaged. When the force trim release switch is no longer pressed, these hold modes will attempt to re-engage and "capture" new reference values to hold, based on the sub-mode within which they are operating.
- The **"Trim – RESET to default" control binding** is a *simulated* function that can be used to artificially reset cyclic/pedal trim magnetic brakes.

Even if the force trim release switch is not pressed, a "breakout" value within each flight control axis of the cyclic and pedals allows the pilot to "fly through" certain hold modes/sub-modes. These breakout values do not deactivate the hold modes altogether but will temporarily disengage their function and no longer hold the commanded reference value(s) until the conditions for re-engagement are met.

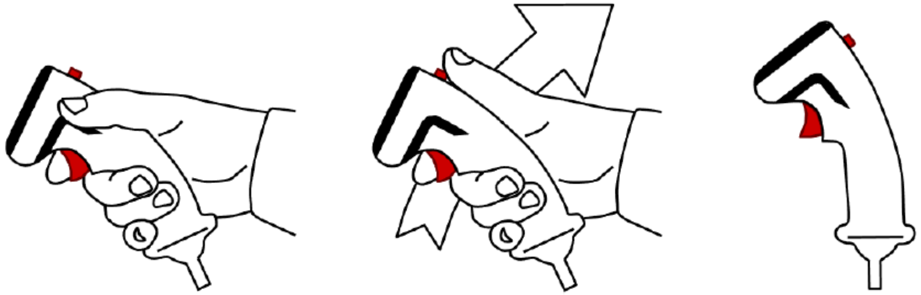
Force Trim / Hold Modes Switch

- *FWD: "**R**" (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic's current position as the new center point.*
- *AFT: "**D**" (Disengage). Disengages attitude and altitude hold.*
- *LEFT: "**AT**" (Attitude Hold).*
- *RIGHT: "**AL**" (Altitude Hold)*

Trimming Procedure

Most helicopters are rarely flown with either the cyclic or the pedals in the neutral position. Many helicopters feature a "force trim" system to reduce pilot workload. Such systems produce a force gradient which maintains the position of the cyclic (and pedals in some cases) using springs or magnetic brakes.

- *To trim the controls in their current position, press and release the "Trimmer" button (Force Trim Switch FWD), then immediately return the stick and pedals to their neutral positions.*



3 – HOLD MODES
3.1 – HOLD MODES OVERVIEW

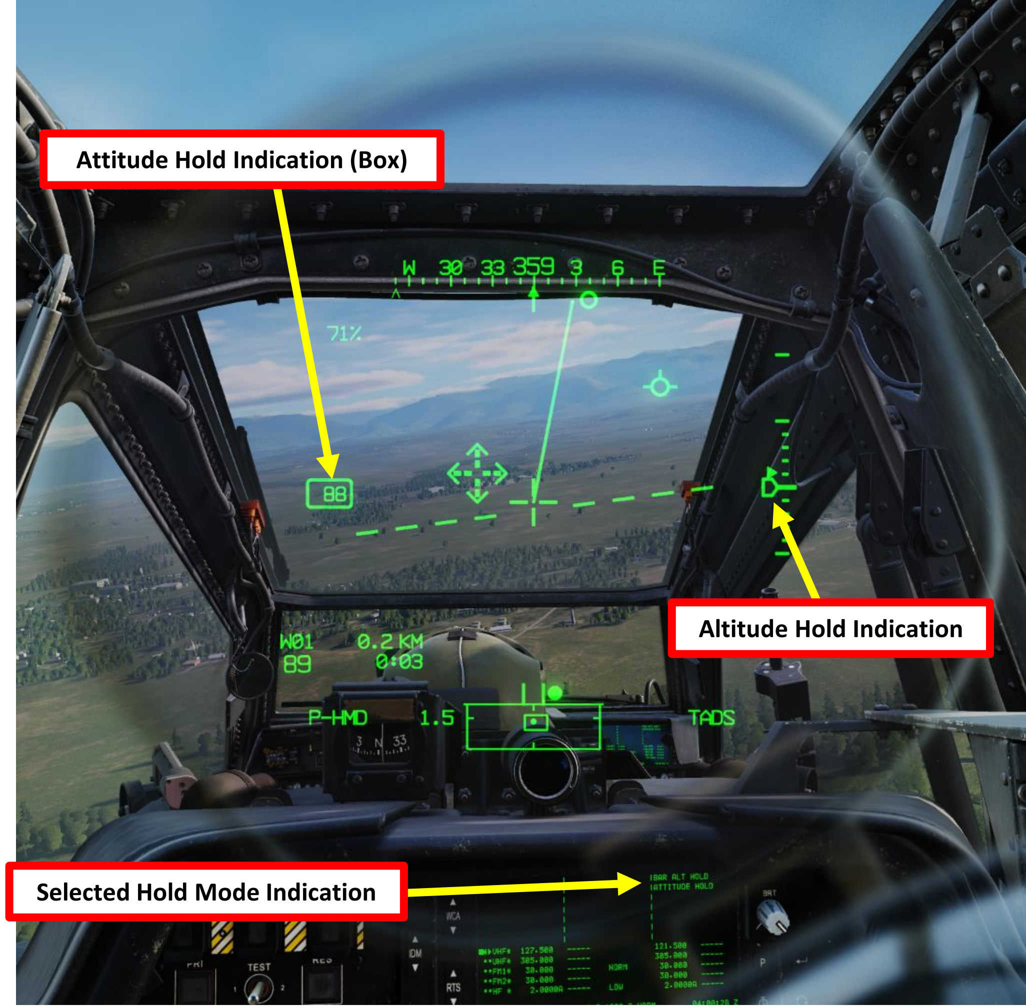
Here is an overview of different “hold modes”. We will explore them in more detail in the next section.

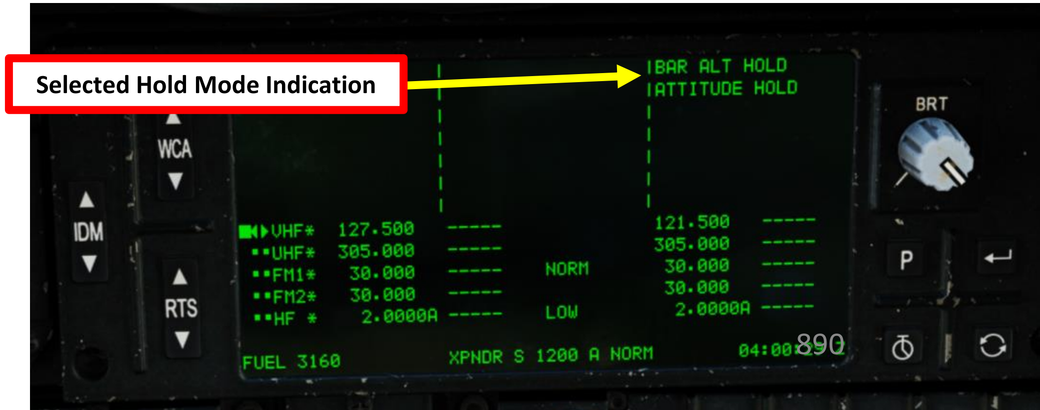
The hold modes are designed to provide limited hands-off flight and decrease pilot workload. Like the SAS (Stability Augmentation System) and CAS (Command Augmentation System) functions of the FMC (Flight Management Computer), the hold modes utilize the same SAS sleeves within the servo-actuators to affect the aircraft flight controls. As such, they are subject to the same limited control authorities (±10% in roll, yaw and collective; +20% and -10% in pitch) and are not autopilot functions.

To best utilize the FMC hold mode functionality, the pilot should first fly the aircraft to a stable, force trimmed state. Once the aircraft is set at the desired flight condition, engage the desired hold mode(s).

- FMC Yaw Channel Modes
    - **Heading Hold** Sub-Mode: the helicopter maintains its current heading.
    - **Turn Coordination** Sub-Mode: the helicopter maintains the sideslip angle.
- FMC Pitch & Roll Channel Modes
    - **Attitude Hold** Sub-Mode: the helicopter holds its current pitch and roll attitude.
    - **Position Hold** Sub-Mode: the helicopter holds its current position in a hover.
    - **Velocity Hold** Sub-Mode: the helicopter maintains its current airspeed.
- FMC Collective Channel Modes
    - **Radar Altitude Hold** Sub-Mode: the helicopter maintains its current altitude, which is computed from the radar altimeter. This mode will take into account changes in terrain elevation.
    - **Barometric Altitude Hold** Sub-Mode: the helicopter maintains its current altitude, which is computed from air pressure sensors. This mode will not take into account changes in terrain elevation.

Take note that Attitude/Position Hold and Radar/Barometric Altitude Modes can be combined together.



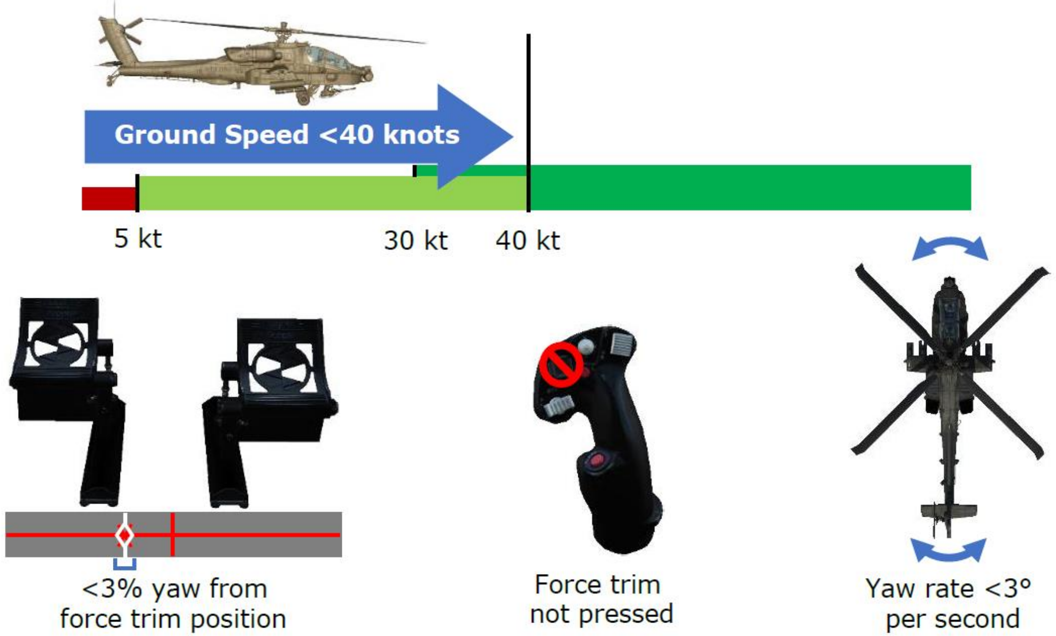


3 – HOLD MODES
3.2 – FMC YAW CHANNEL MODES
3.2.1 – HEADING HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

1. **If Attitude Hold (any sub-mode) is off**, Heading Hold is engaged automatically when all of the following conditions are true:
    - One second has elapsed since Heading Hold was disengaged
    - The helicopter is off the weight-on-wheels ("squat") switch
    - Ground speed <40 knots
    - Pedal displacement <3% in yaw axis from the force trim reference position
    - Force trim release switch is not pressed
    - Yaw rate <3° per second
2. Heading Hold assists the pilot in maintaining the magnetic heading reference.
3. If the Force Trim / Hold Modes Switch is pressed FWD ("R", for "Release"), Heading Hold is disengaged, and the FMC Yaw channel will only provide command augmentation and rate damping. When the pilot stops pressing the force trim release switch, the FMC will update the Heading Hold reference to the current magnetic heading.

Heading Hold Engagement (Attitude Hold OFF)

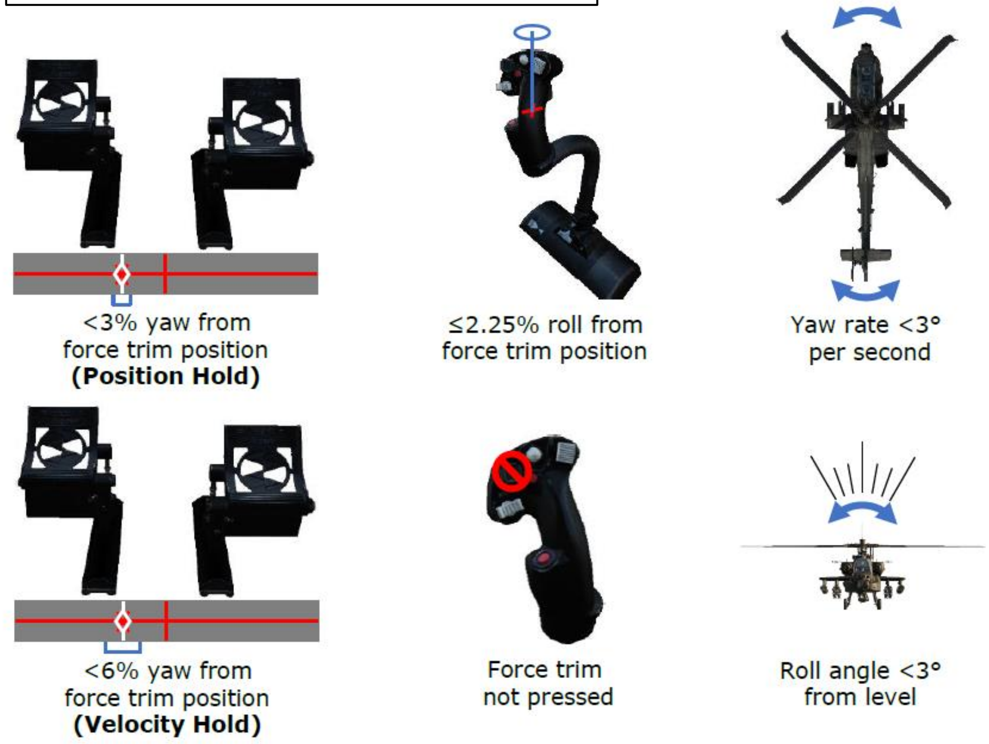


3 – HOLD MODES
3.2 – FMC YAW CHANNEL MODES
3.2.1 – HEADING HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

1. **If Attitude Hold (in Position or Velocity sub-mode) is on**, Heading Hold is engaged automatically when all of the following conditions are true:
    - Pedal displacement <3% in yaw axis from the force trim reference position in Position Hold sub-mode or <6% in yaw axis from the force trim reference position in Velocity Hold sub-mode
    - Cyclic displacement ≤2.25% in roll axis from the force trim position
    - Yaw rate <3° per second
    - Roll (bank) angle is <3° from level attitude
    - Force trim is not pressed
2. Heading Hold assists the pilot in maintaining the magnetic heading reference.
3. If the Force Trim / Hold Modes Switch is pressed FWD (“R”, for “Release”), Heading Hold is disengaged, and the FMC Yaw channel will only provide command augmentation and rate damping. When the pilot stops pressing the force trim release switch, the FMC will update the Heading Hold reference to the current magnetic heading.

Heading Hold Engagement (Attitude Hold ON)

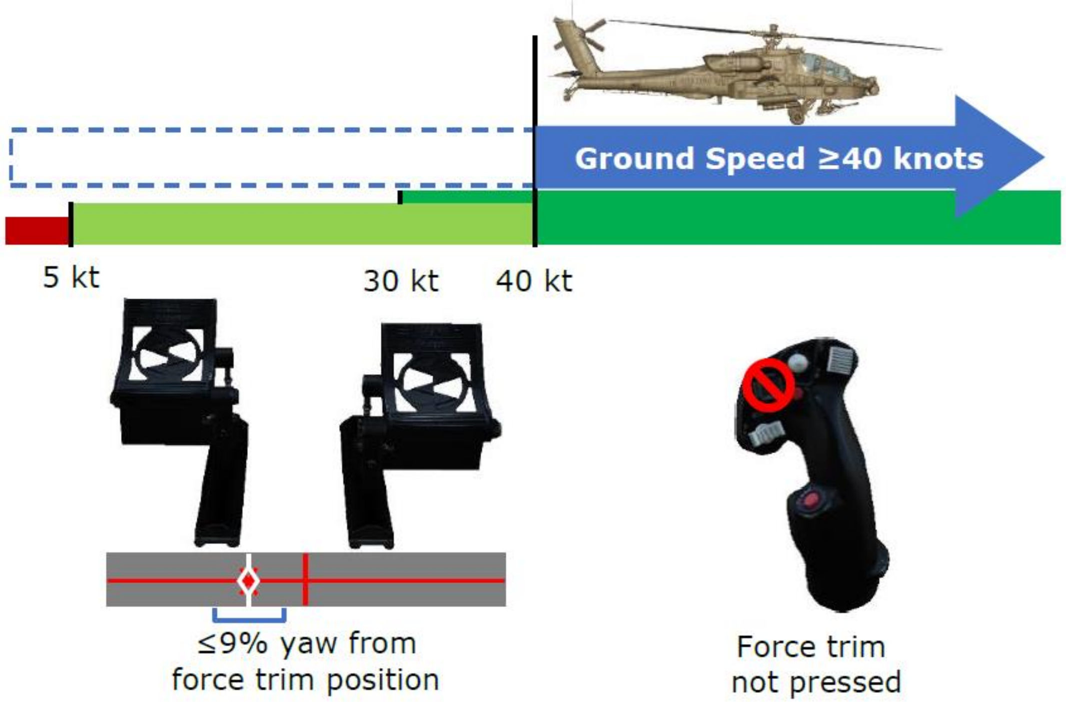


3 – HOLD MODES
3.2 – FMC YAW CHANNEL MODES
3.2.2 – TURN COORDINATION SUB-MODE

Source: Eagle Dynamics AH-64D Manual

1. **If Attitude Hold is off**, Turn Coordination is engaged automatically when all of the following conditions are true:
    - Ground speed ≥40 knots
    - Pedal displacement ≤9% in yaw axis from the force trim reference position
    - Force trim is not pressed
2. Turn Coordination sub-mode assists the pilot in maintaining the sideslip angle, and is a function of roll attitude, airspeed, and sideslip. Sideslip angle is a derived quantity based on inertial velocity as opposed to air data. This method of determining sideslip angle provides more stable and reliable sideslip information than can be obtained from an air data sensor.
3. If the Force Trim / Hold Modes Switch is pressed FWD (“R”, for “Release”), Turn Coordination is disengaged, and the FMC Yaw channel will only provide command augmentation and rate damping. When the pilot stops pressing the force trim release switch, the FMC will update the Turn Coordination sideslip angle reference to the current trim ball position.

Turn Coordination Engagement (Attitude Hold OFF)

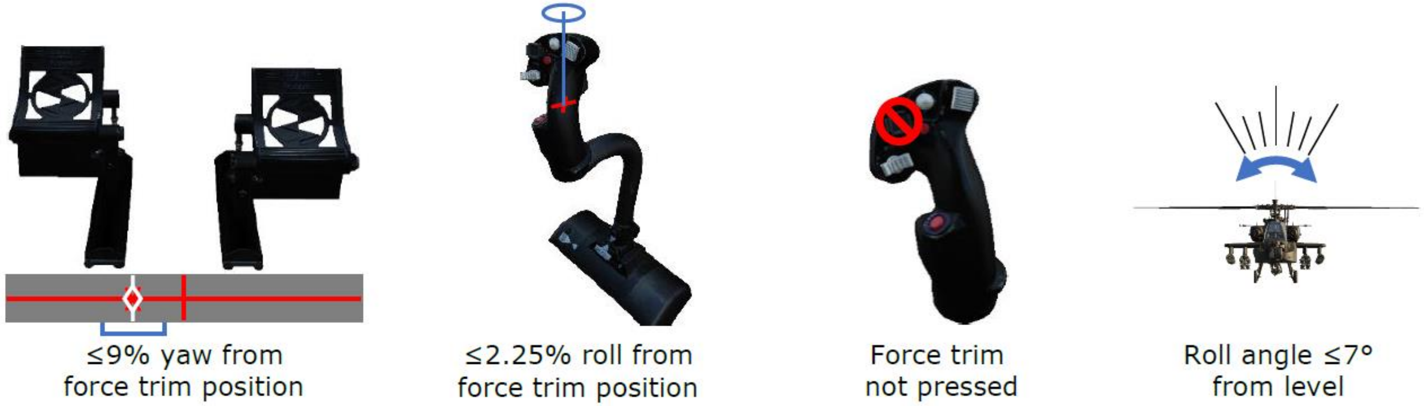


3 – HOLD MODES
3.2 – FMC YAW CHANNEL MODES
3.2.2 – TURN COORDINATION SUB-MODE

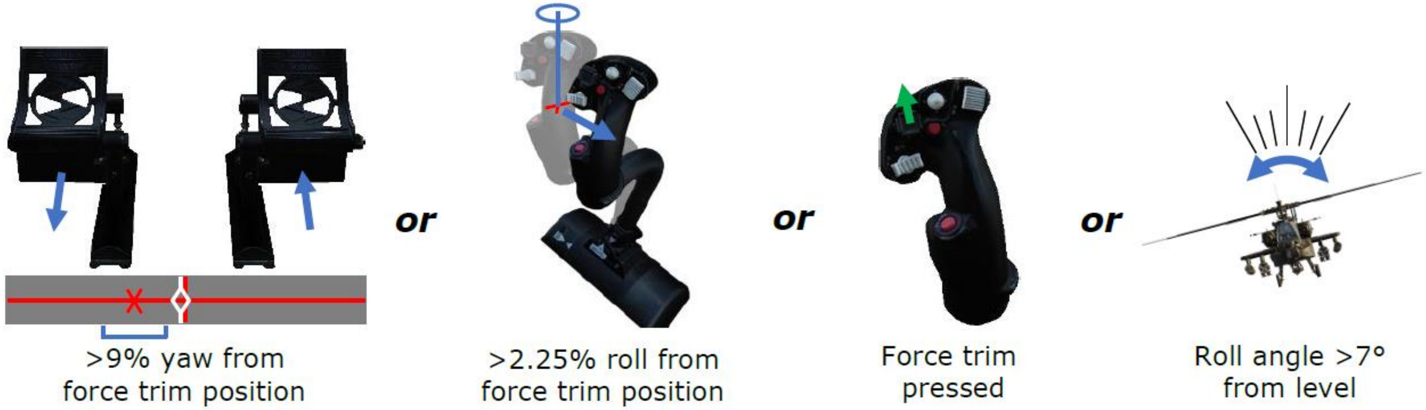
Source: Eagle Dynamics AH-64D Manual

4. **If Attitude Hold is on with ground speed ≥40 knots, Turn Coordination will switch to Heading Hold automatically** when all of the following conditions are true:
    - Pedal displacement ≤9% in yaw axis from the force trim reference position
    - Cyclic displacement ≤2.25% in roll axis from the force trim position
    - Roll (bank) angle is ≤7° from level attitude
    - Force trim is not pressed
5. **If Attitude Hold is on with ground speed ≥40 knots, Heading Hold will revert to Turn Coordination automatically** if any of the following conditions are true:
    - Pedal displacement >9% in yaw axis from the force trim reference position
    - Cyclic displacement >2.25% in roll axis from the force trim position
    - Roll (bank) angle is >7° from level attitude
    - Force Trim is pressed

Turn Coordination changes to Heading Hold (Attitude Hold ON) 4



Heading Hold Reverts to Turn Coordination (Attitude Hold ON) 5



3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES

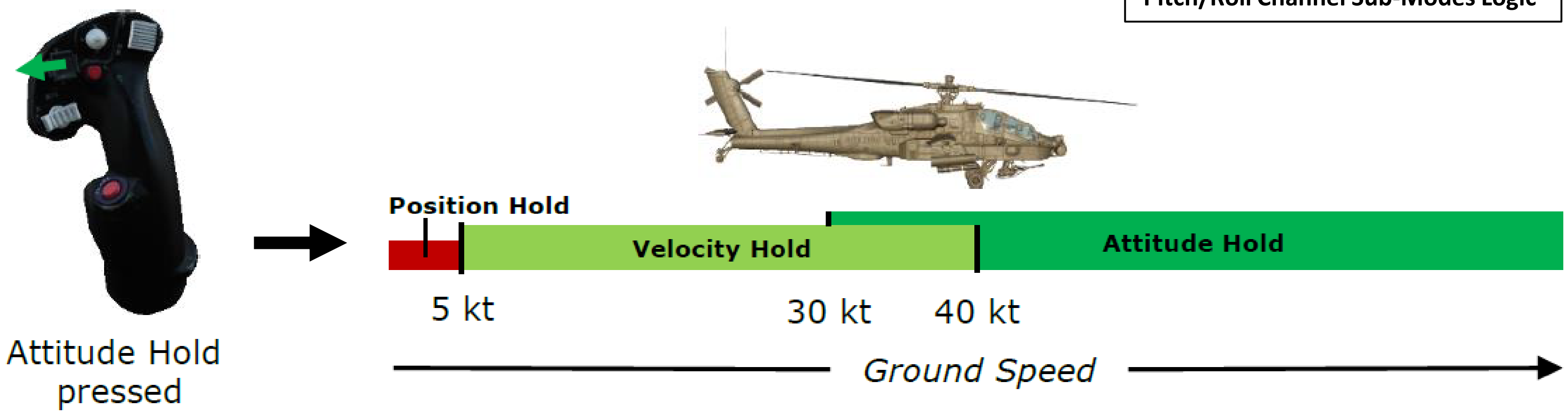
Source: Eagle Dynamics AH-64D Manual

The FMC Pitch and Roll channels operate with Attitude Hold and two additional sub-modes: Position Hold and Velocity Hold. Only one of these three sub-modes can be activated at any given time, only when the Attitude Hold is activated using the Force Trim/Hold Mode switch when pressed to the Left/AT position, and only when the FMC Pitch and Roll channels are turned on. Condition-based logic will determine which sub-mode the Pitch/Roll channels are using, and whether that sub-mode is engaged or disengaged from affecting the flight control servo-actuators at any given time.

The condition that determines which Attitude Hold sub-mode the Pitch/Roll channels operate within is the helicopter's ground speed:

- If the ground speed is **≤5 knots, Position Hold** sub-mode is activated.
- If the ground speed is **>5 knots but <40 knots, Velocity Hold** sub-mode is activated.
- If ground speed is **≥40 knots, Attitude Hold** sub-mode will be activated.

Pitch/Roll Channel Sub-Modes Logic



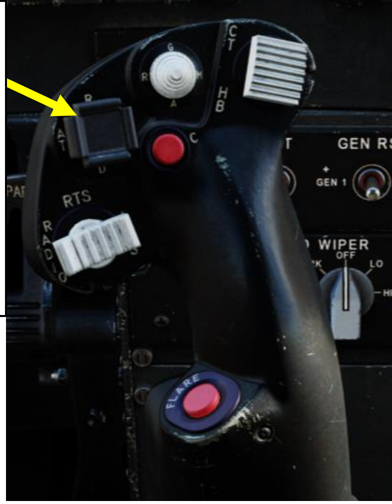
3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES
3.3.1 – ATTITUDE HOLD SUB-MODE

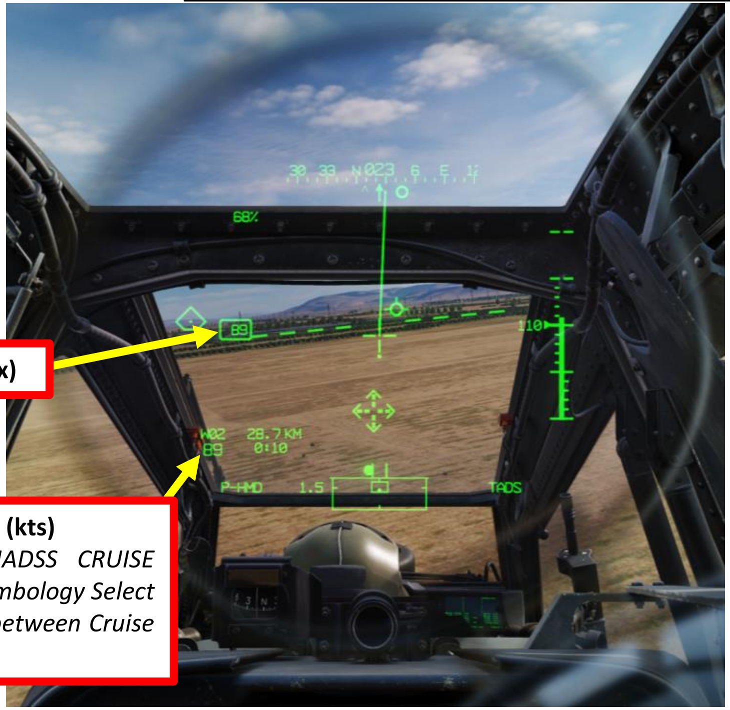
Source: Eagle Dynamics AH-64D Manual

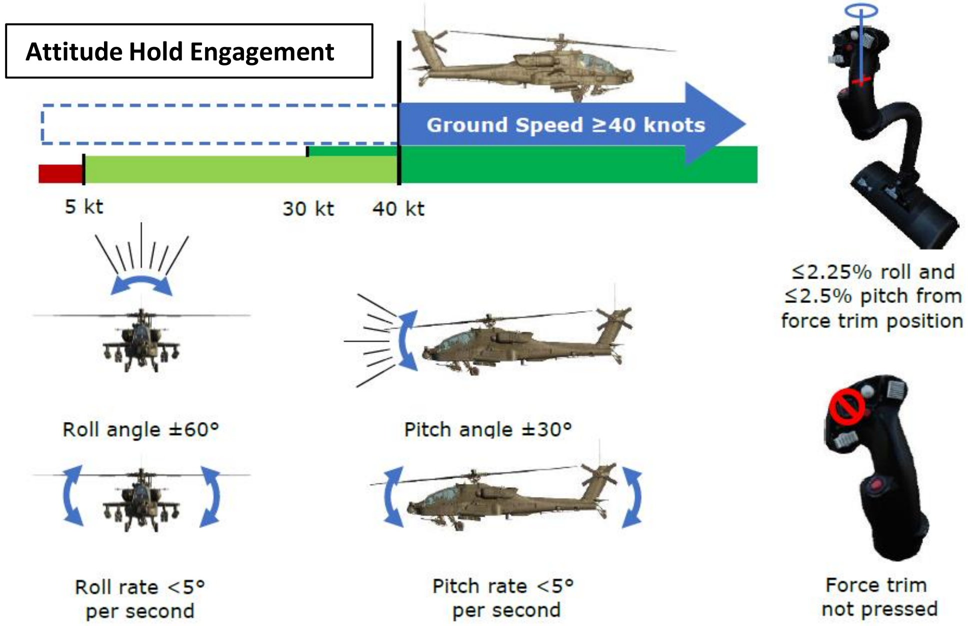
1. To enter Attitude Hold, fly at 40 kts (ground speed) or faster, then press Force Trim / Hold Modes Switch LEFT (“AT”, for “Attitude Hold”).
2. Attitude Hold will only be engaged when all the following conditions are true:
   - Ground speed ≥40 knots
   - Cyclic displacement ≤2.25% in roll and ≤2.5% in pitch from the force trim reference position
   - Roll attitude <±60° and Pitch attitude <±30°
   - Pitch and Roll rates <5° per second
   - Force trim is not pressed
3. When Attitude Hold is engaged, the FMC (Flight Management Computer) will use rates and attitudes provided by the EGI (Embedded GPS/Inertial Navigation System) to maintain a pitch and roll attitude.

Force Trim / Hold Modes Switch

- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*
- *AFT: “**D**” (Disengage). Disengages attitude and altitude hold.*
- *LEFT: “**AT**” (Attitude Hold).*
- *RIGHT: “**AL**” (Altitude Hold)*







3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES
3.3.1 – ATTITUDE HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

4. Attitude Hold will not counter cyclic inputs by the pilot if the cyclic is displaced beyond its “breakout” threshold. If the pilot displaces the cyclic >2.5% in pitch or >2.25% in roll from the force trim reference position without pressing the force trim release switch, the Attitude Hold mode will disengage in one or both of the Pitch and Roll axes and will not attempt to counter the pilot inputs into the flight control servo-actuators but will continue to provide CAS and SAS functionality. Once the cyclic has been returned to within 2.5% in pitch and 2.25% in roll from the force trim reference position (“breakout” threshold), Attitude Hold sub-mode will re-engage.
5. To **establish new pitch and/or roll reference values**, the pilot can simply press and hold the force trim release switch, fly the helicopter to the desired attitude, and then stop pressing the force trim release switch.
6. You can disengage Attitude Hold by pressing the Force Trim / Hold Modes Switch LEFT (“AT”, for “Attitude Hold”).

3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES
3.3.2 – POSITION HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

1. To enter Position Hold, slow down to 5 kts (ground speed) or slower, then press Force Trim / Hold Modes Switch LEFT (“AT”, for “Attitude Hold”).
2. Position Hold will only be engaged when all the following conditions are true:
   - Ground speed <5 knots
   - Cyclic displacement ≤2.25% in roll and ≤2.5% in pitch from the force trim reference position
   - Roll attitude <±60° and Pitch attitude <±30°
   - Pitch and Roll rates <5° per second
   - Force trim is not pressed
3. When Position Hold is engaged, the FMC (Flight Management Computer) will use velocities provided by the EGI (Embedded GPS/Inertial Navigation System) to approximate and maintain its position. You can think of it as a “hover” mode.

Force Trim / Hold Modes Switch

- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*
- *AFT: “**D**” (Disengage). Disengages attitude and altitude hold.*
- *LEFT: “**AT**” (Attitude Hold).*
- *RIGHT: “**AL**” (Altitude Hold)*

1

Attitude Hold Indication (Box)

Ground Speed (kts)
(only displayed in IHADSS CRUISE Mode, selected with Symbology Select Switch FWD to toggle between Cruise and Transition)

Selected Hold Mode Indication

3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES
3.3.2 – POSITION HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

4. If the pilot displaces the cyclic without pressing the force trim release switch, the FMC (Flight Management Computer) will command SAS (Stability Augmentation System) sleeve inputs into the Pitch and Roll servo-actuators to counter the cyclic inputs to maintain the aircraft's position over the reference location. The SAS sleeves within the respective servo-actuators will continue to counter the pilot inputs until the SAS sleeve becomes "saturated" at their maximum authority.
5. To **re-position the helicopter and set a new position reference**, the pilot should press and hold the force trim release switch, translate the helicopter to the desired location, and then stop pressing the force trim release switch.
    - Note 1: Pressing the force trim release switch will not deactivate the Position Hold but it will disengage any FMC inputs from attempting to maintain the helicopter hover over the referenced position until the force trim release switch is no longer pressed, and the new reference position is "captured" by the FMC.
    - Note 2: If the pilot accelerates the aircraft above 5 knots ground speed, Velocity Hold sub-mode will be entered.
    - Note 3: Since Position Hold is only engaged when ground speed is ≤5 knots while the force trim release switch is not pressed, Heading Hold will also be active in the FMC Yaw axis while operating in this sub-mode. However, if the pedals are displaced ≥3% from the force trim reference position, Heading Hold will disengage.
6. You can disengage Position Hold by pressing the Force Trim / Hold Modes Switch LEFT ("AT", for "Attitude Hold").

3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES
3.3.3 – VELOCITY HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

1. To enter Velocity Hold, fly between 5 kts to 40 kts (ground speed), then press Force Trim / Hold Modes Switch LEFT (“AT”, for “Attitude Hold”).
2. Position Hold will only be engaged when all the following conditions are true:
    - Ground speed >5 knots but <40 knots
    - Cyclic displacement ≤2.25% in roll and ≤2.5% in pitch from the force trim reference position
    - Roll attitude <±60° and Pitch attitude <±30°
    - Pitch and Roll rates <5° per second
    - Force trim is not pressed
3. When Velocity Hold is engaged, the FMC (Flight Management Computer) will use inertial velocities provided by the EGI (Embedded GPS/Inertial Navigation System) to maintain a 2-dimensional velocity and in the horizontal plane.

Force Trim / Hold Modes Switch

- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*
- *AFT: “**D**” (Disengage). Disengages attitude and altitude hold.*
- *LEFT: “**AT**” (Attitude Hold).*
- *RIGHT: “**AL**” (Altitude Hold)*

1

Attitude Hold Indication (Box)

Ground Speed (kts)
(only displayed in IHADSS CRUISE Mode, selected with Symbology Select Switch FWD to toggle between Cruise and Transition)

Selected Hold Mode Indication

3 – HOLD MODES
3.3 – FMC PITCH & ROLL CHANNEL MODES
3.3.3 – VELOCITY HOLD SUB-MODE

Source: Eagle Dynamics AH-64D Manual

4. If the pilot displaces the cyclic without pressing the force trim release switch while Velocity Hold is engaged, the FMC (Flight Management Computer) will command SAS (Stability Augmentation System) sleeve inputs into the Pitch and Roll servo-actuators to counter the cyclic inputs to maintain the aircraft's velocity and vector. The SAS sleeves within the respective servo-actuators will continue to counter the pilot inputs until the SAS sleeve becomes "saturated" at their maximum authority.
5. To **establish a new velocity and/or vector reference**, the pilot needs to press and hold the force trim release switch, adjust the flight controls to attain the desired velocity and vector, and then stop pressing the force trim release switch.
    - Note 1: Pressing the force trim release switch will not deactivate the Velocity Hold but it will disengage any FMC inputs from attempting to maintain the helicopter velocities until the force trim release switch is no longer pressed and the new reference velocities are "captured" by the FMC.
    - Note 2: If the pilot accelerates the aircraft to 40 knots ground speed or greater, Attitude Hold sub-mode will be entered.
    - Note 3: If the pilot decelerates the aircraft to 5 knots ground speed or slower, Position Hold sub-mode will be entered.
    - Note 4: Since Velocity Hold is only engaged when ground speed is >5 knots and <40 knots while the force trim release switch is not pressed, Heading Hold will also be active in the FMC Yaw axis while operating in this sub-mode. However, if pedals are displaced ≥6% from the force trim reference position, Heading Hold will disengage
6. You can disengage Velocity Hold by pressing the Force Trim / Hold Modes Switch LEFT ("AT", for "Attitude Hold").

3 – HOLD MODES
3.4 – FMC COLLECTIVE CHANNEL MODES
3.4.1 – RADAR ALTITUDE HOLD SUB-MODE

1. To enter Radar Altitude Hold, press Force Trim / Hold Modes Switch RIGHT (“AL”, for “Altitude Hold”).
2. Radar Altitude Hold can only be activated when all of the following conditions are true:
    - Ground speed <40 knots
    - Altitude is ≤1,428 feet above ground level (AGL)
    - Vertical velocity is ≤100 feet per minute
    - The radar altimeter is powered on and operational (power status is toggled on the A/C – FLT page in the SET sub-menu).
3. The aircraft controls will maintain the radar altitude set when the mode was engaged.
    - Note: Radar Altitude Hold is not a terrain following mode. It provides distance from the ground directly below the aircraft and does not provide any approaching terrain variation information.

Force Trim / Hold Modes Switch

- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*
- *AFT: “**D**” (Disengage). Disengages attitude and altitude hold.*
- *LEFT: “**AT**” (Attitude Hold).*
- *RIGHT: “**AL**” (Altitude Hold)*

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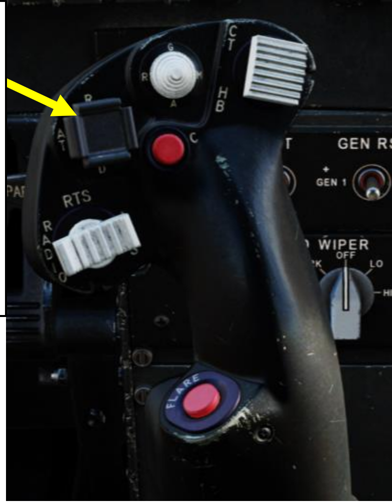
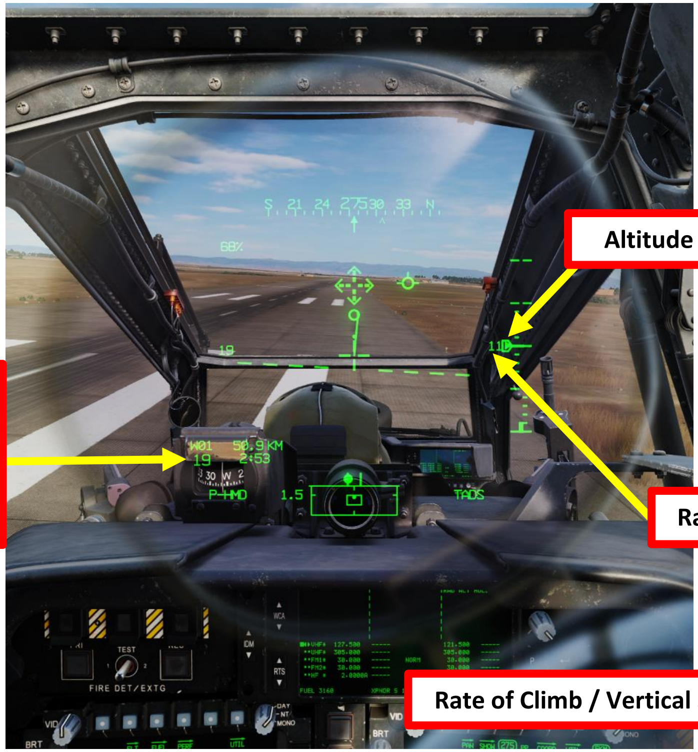




Altitude Hold Indication

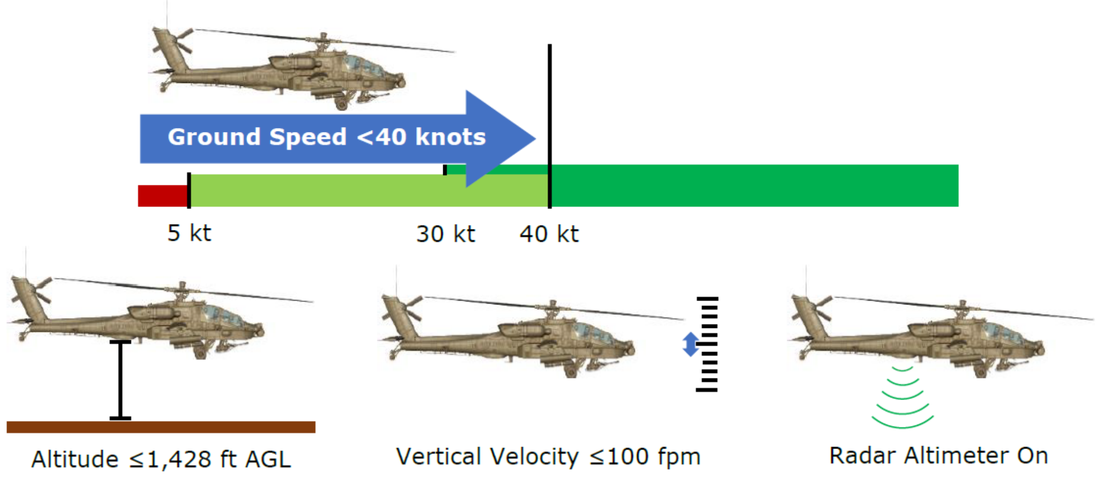
Radar Altimeter (ft)

Rate of Climb / Vertical Speed Scale (ft/min)

Ground Speed (kts)
(only displayed in IHADSS CRUISE Mode, selected with Symbology Select Switch FWD to toggle between Cruise and Transition)

Radar Altitude Hold Activation Conditions

Source: Eagle Dynamics AH-64D Manual



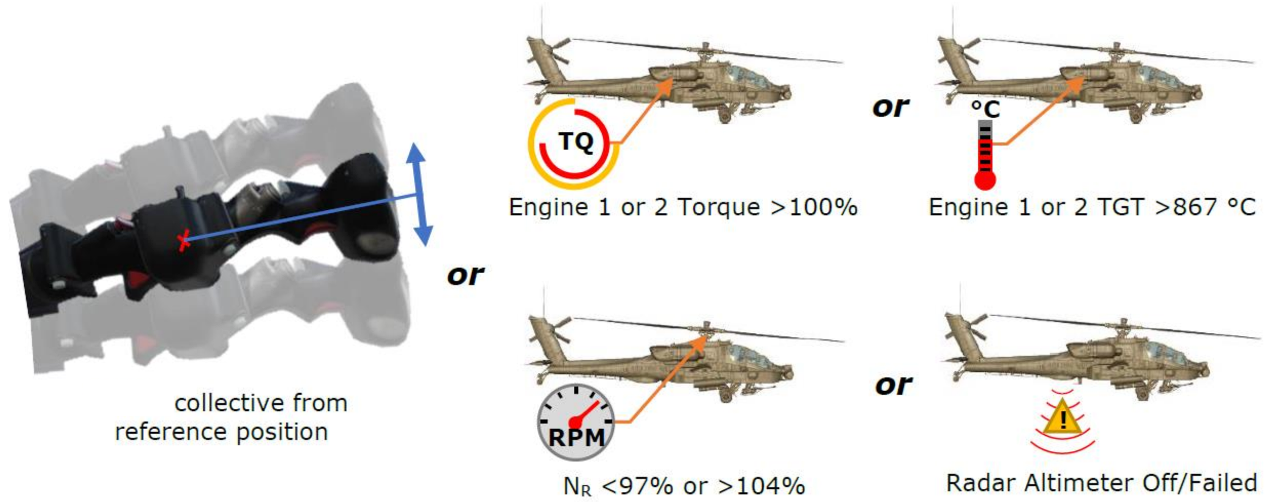
Selected Hold Mode Indication

3 – HOLD MODES
3.4 – FMC COLLECTIVE CHANNEL MODES
3.4.1 – RADAR ALTITUDE HOLD SUB-MODE

4. Radar Altitude Hold is automatically deactivated when any of the following conditions are true:
   - Pilot displaces the collective from the reference position (collective position at the time Radar Altitude Hold mode is activated)
   - Either engine torque (TQ) >100%
   - Either engine Turbine Gas Temperature (TGT) >867° C
   - Rotor speed (NR) is <97% or >104%
   - The radar altimeter is turned off or has failed
5. You can disengage Radar Altitude Hold by pressing the Force Trim / Hold Modes Switch RIGHT (“AL”, for “Altitude Hold”).

Radar Altitude Hold Deactivation Conditions

Source: Eagle Dynamics AH-64D Manual

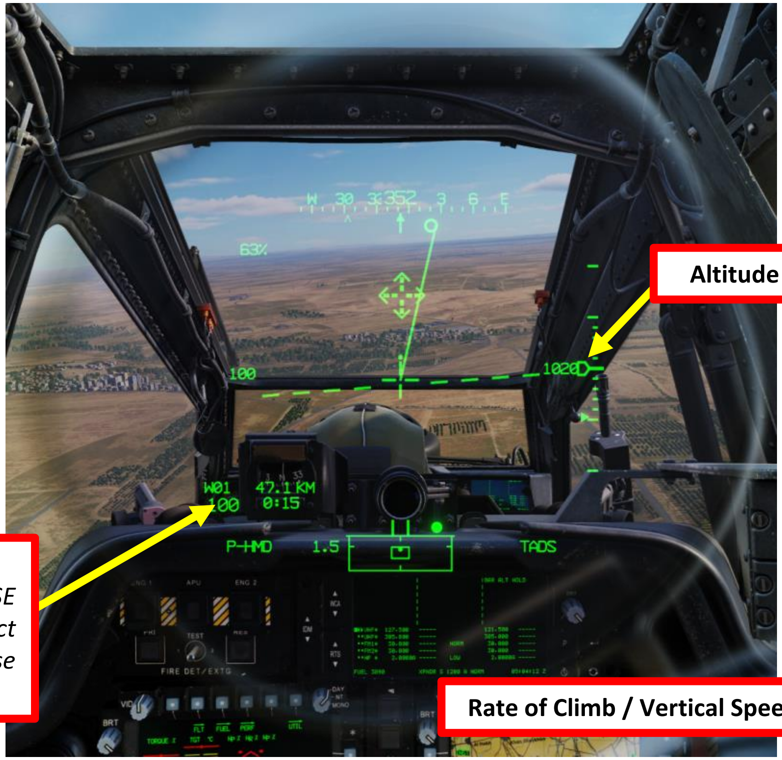


3 – HOLD MODES
3.4 – FMC COLLECTIVE CHANNEL MODES
3.4.2 – BAROMETRIC ALTITUDE HOLD SUB-MODE

1. To enter Barometric Altitude Hold, press Force Trim / Hold Modes Switch RIGHT (“AL”, for “Altitude Hold”).
2. Barometric Altitude Hold can only be activated when both of the following conditions are true:
   a) If conditions for Radar Altitude Hold sub-mode activation cannot be met
   b) Vertical velocity is within the limits below as determined by aircraft ground speed:
      - If ground speed ≤5 knots, vertical velocity is ≤100 feet per minute
      - If ground speed is >5 knots but <40 knots, vertical velocity is ≤200 feet per minute
      - From 40 to 160 knots ground speed, the vertical velocity rate limit increases linearly from ±200 feet per minute at 40 knots to ±400 feet per minute at 160 knots. (Example: at 100 knots ground speed, the vertical velocity rate limit must be ≤300 feet per minute)
3. The aircraft controls will maintain the barometric altitude set when the mode was engaged.
   - Barometric altitude is not based on ground elevation directly below the aircraft. It is your job to monitor terrain height and make sure the helicopter does not collide with it.

Force Trim / Hold Modes Switch
- *FWD: “**R**” (Release). When held, releases the force trim system and attitude hold mode. When released, re-engages the force trim system, using the cyclic’s current position as the new center point.*
- *AFT: “**D**” (Disengage). Disengages attitude and altitude hold.*
- *LEFT: “**AT**” (Attitude Hold).*
- *RIGHT: “**AL**” (Altitude Hold)*

1



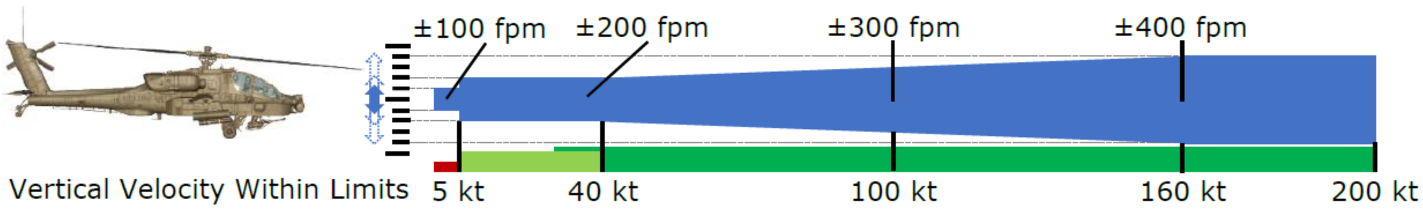
Altitude Hold Indication

Ground Speed (kts)
(only displayed in IHADSS CRUISE Mode, selected with Symbology Select Switch FWD to toggle between Cruise and Transition)

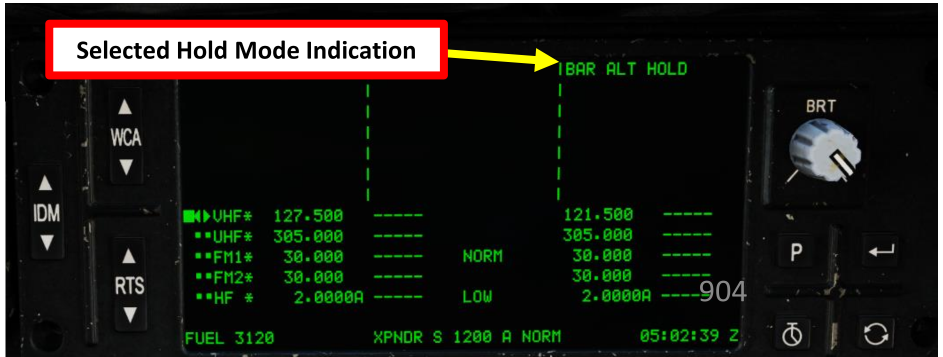
Rate of Climb / Vertical Speed Scale (ft/min)

Barometric Altitude Hold Activation Conditions

Source: Eagle Dynamics AH-64D Manual



Selected Hold Mode Indication

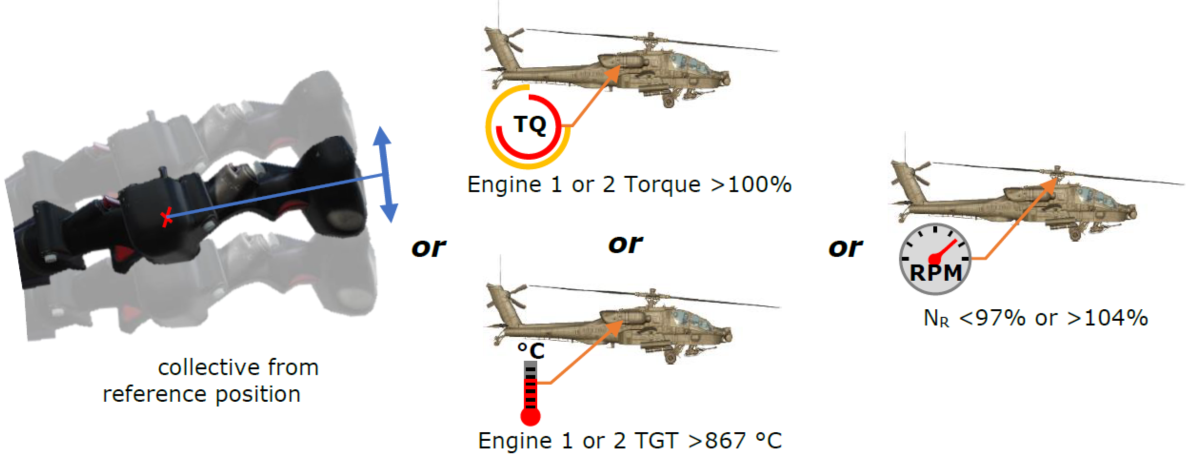


3 – HOLD MODES
3.4 – FMC COLLECTIVE CHANNEL MODES
3.4.2 – BAROMETRIC ALTITUDE HOLD SUB-MODE

4. Barometric Altitude Hold is automatically deactivated when any of the following conditions are true:
    - Pilot displaces the collective from the reference position (collective position at the time Barometric Altitude Hold mode is activated)
    - Either engine torque (TQ) >100%
    - Either engine Turbine Gas Temperature (TGT) >867° C
    - Rotor speed (NR) is <97% or >104%
5. You can disengage Barometric Altitude Hold by pressing the Force Trim / Hold Modes Switch RIGHT (“AL”, for “Altitude Hold”).

Barometric Altitude Hold Deactivation Conditions

Source: Eagle Dynamics AH-64D Manual



4 – SAS (STABILITY AUGMENTATION SYSTEM) SATURATION

As the SAS (Stability Augmentation System) sleeve within each servo-actuator possess limited authority to affect the flight controls (±10% authority in all axes except the pitch axis, which is +20% and -10% authority), when a hold mode is engaged and the FMC has commanded the SAS sleeve to the limit of its allowable movement, the SAS sleeve is “saturated”.

If the saturation condition persists, the FMC will begin to lose its ability to maintain the reference values of pitch, roll, heading, sideslip, velocity, or position. Depending on which hold sub-mode is engaged, the flight control audio tone will sound over each crewmember’s ICS (Intercom System) and the “SAS SATURATED” advisory will be displayed on the EUFD (Enhanced Up-Front Display).

The flight control audio tone will sound with an associated EUFD advisory when the criteria listed below is met for each respective sub-mode:

- If in **Attitude Hold** sub-mode, the “SAS SATURATED” advisory and flight control audio tone will be presented to the crew after 90 seconds of continuous saturation within the Pitch, Roll or Collective axes and 10 seconds of continuous saturation within the Yaw axis.
- If in **Velocity Hold** sub-mode, the “SAS SATURATED” advisory and flight control audio tone will be presented to the crew after 2 seconds of continuous saturation within the Pitch, Roll or Collective axes and 7 seconds of continuous saturation within the Yaw axis.
- If in **Position Hold** sub-mode, the “SAS SATURATED” advisory and flight control audio tone will be presented to the crew after 1 second of continuous saturation within the Pitch, Roll or Collective axes and 5 seconds of continuous saturation within the Yaw axis.
- If in **Position Hold** sub-mode, the “HOVER DRIFT” advisory and flight control audio tone will be presented to the crew if the aircraft drifts greater than 48 feet (one rotor diameter) from the reference position.

When the pilot presses the force trim release switch (which interrupts any hold modes that are active in the FMC (Flight Management Computer) Pitch, Roll and/or Yaw channels) the SAS sleeves within each servo-actuator (except Collective) will return to center within 3 to 5 seconds. While the SAS sleeve is moving to center, it will continue to provide augmentation and rate damping. Therefore, performing aggressive or rapid control inputs can delay the re-centering of the SAS sleeve to the longer duration of 5 seconds.

During sideward flight or hovering flight with high crosswinds without the force trim being pressed, a “SAS SATURATED” advisory and flight control audio tone may be presented to the crew. Under these conditions, the relative wind from sideward flight or high crosswinds will apply force to the vertical tail, creating a weathervane effect in which the nose will turn into the wind. The FMC will attempt to compensate for this weathervane effect while in Heading Hold sub-mode, which may result in saturation of the SAS sleeve within the Yaw axis.

Source: Eagle Dynamics AH-64D Manual

THE CREW

Make no mistake: operating the AH-64 requires **two** crewmembers.

The effectiveness of a crew is not necessarily a function of how well the pilot flies or how proficient a co-pilot/gunner is with sensors and weapons… it is how well they both work together. The Apache is a complex machine, and one of its main challenges is managing your workload in a way that avoids task saturation. You will recognize "task saturation" as a moment when you have too much to do with too little time, tools or resources to do it. Basically… you are overwhelmed and you can end up "freezing", being unable to make effective decisions.

This is why it is very important for a crew to:
1. Define who does what and when (cockpit responsibilities)
2. Delegate tasks when necessary in order to keep each crewmember's workload manageable
3. Communicate clearly, efficiently and avoiding unnecessary distractions. Be concise.
4. Practice target acquisition procedures and sensor slaving
5. When engaging targets, discuss the game plan beforehand so that both crewmembers are on the same page.
6. Share relevant information between crewmembers (location of friendly/enemy units, calling out hazards such as power lines, etc.)
7. Have two sets of eyes looking around instead of one

All of these things are easy to understand in theory, but practice is essential in order to see what works and what does not. Each crew is different, and your AH-64 will only be as good as how you operate with your buddy as a team. This is why training in low-stress environments is of prime importance when learning the AH-64. It's one thing to learn how to use every system… it's another to figure out how to use the right tools for the job as efficiently as possible and live to tell the tale.

Casmo illustrates these points very well in his "Crew Coordination Techniques" for the Mi-24.

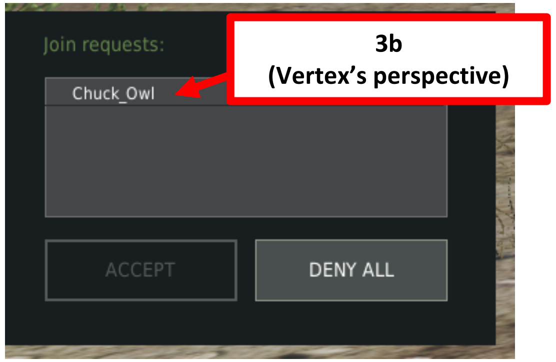
AH-64D APACHE

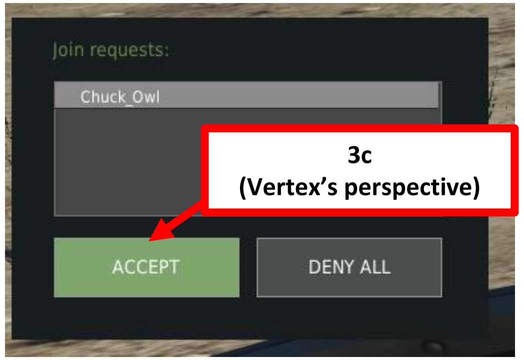
PART 21 – MULTICREW

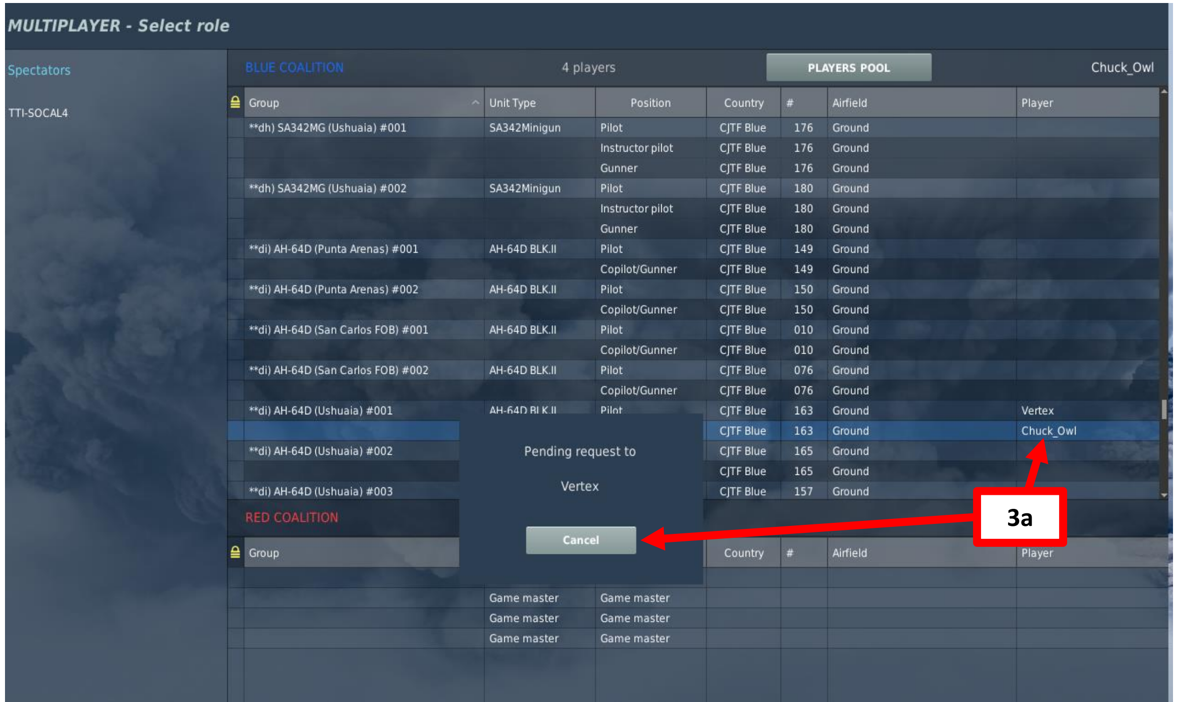
MULTICREW TUTORIAL

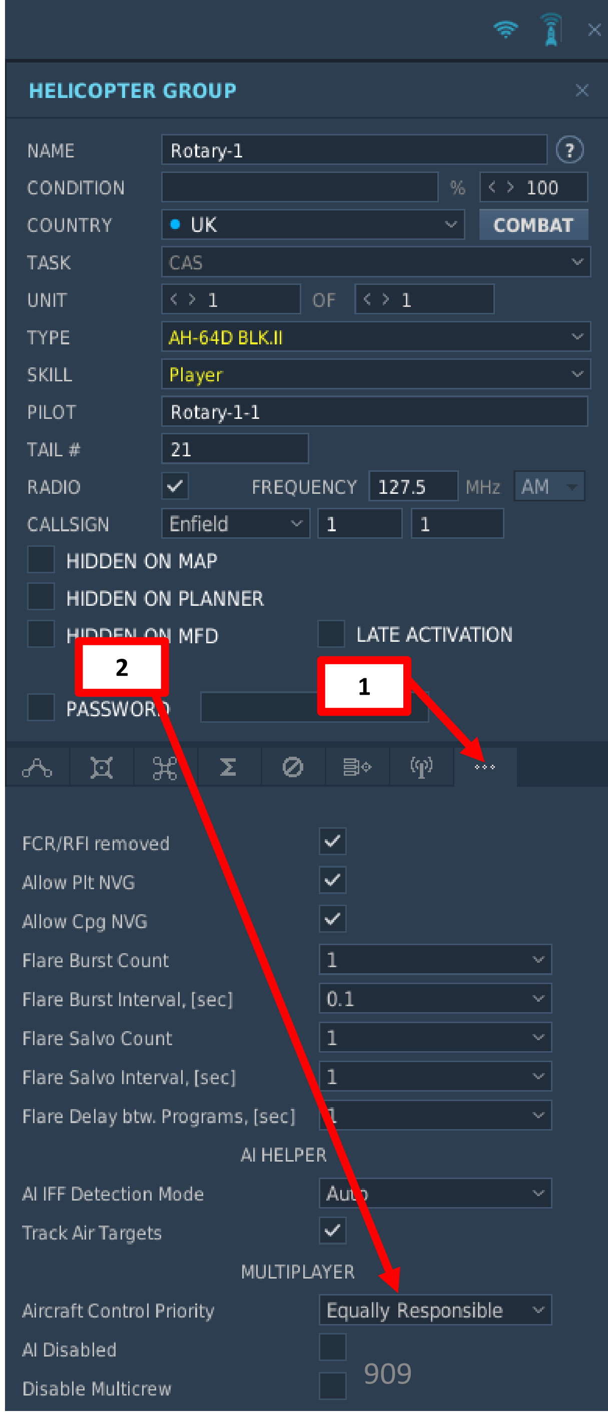
The AH-64 can be flown by two players in multiplayer. However, you need to go in the Mission Editor and make sure the AH-64 is set up in the following manner:

1. Select AH-64D Unit and go in “Additional Properties for Aircraft” menu
2. Set “Aircraft Control Priority” to “Equally Responsible”
3. When spawning in multiplayer in any seat, the pilot will receive a request to let you take control of the other seat.



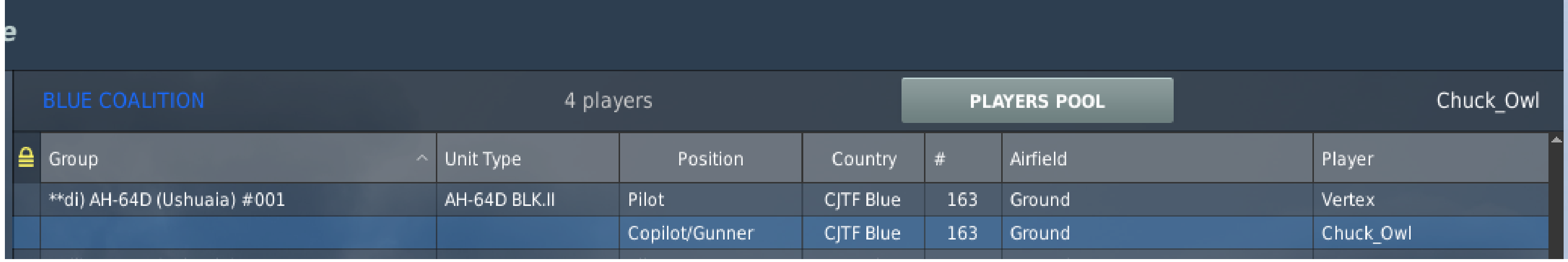


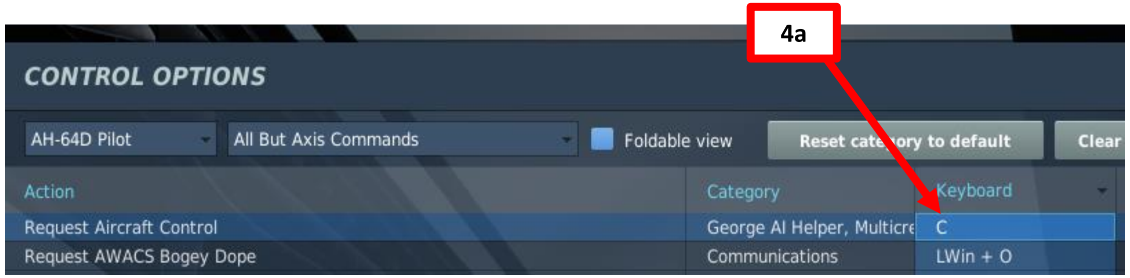




MULTICREW TUTORIAL

4. Once you are spawned, you can take control of the aircraft by pressing the "Request Aircraft Control" binding ("C" key). The other crew member you are taking controls from must accept.



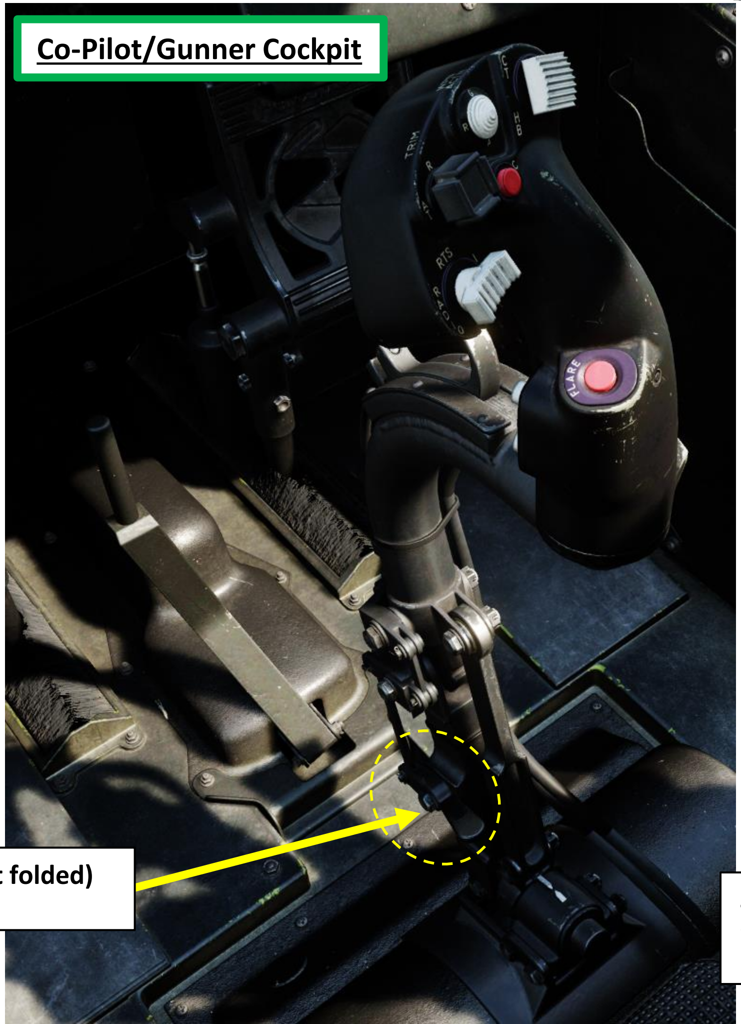


MULTICREW

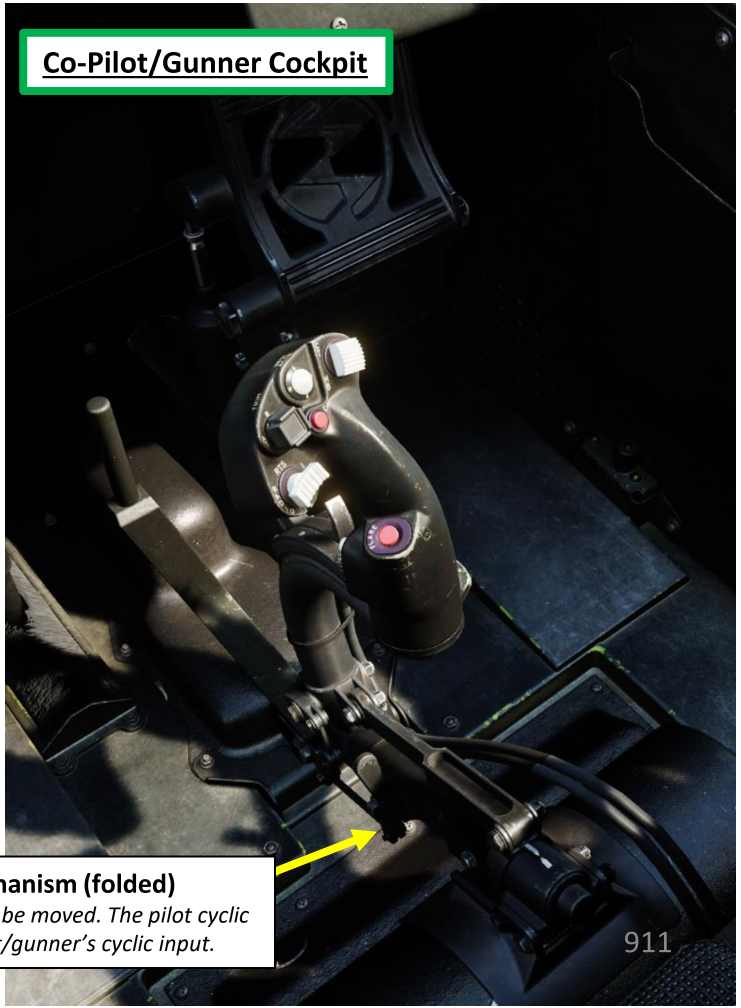
How To Engage/Disengage Co-Pilot Controls

In the real helicopter, the Pilot and Co-Pilot/Gunner's flight controls are mechanically linked together. The Co-Pilot/Gunner's cyclic can be folded down to prevent interference when not flying the aircraft.

In DCS, the **Pilot or Co-Pilot can take over controls by pressing « C » (Request Aircraft Control).**



Stick (Cyclic) Folding Mechanism (not folded)
- *Click to fold stick.*



Stick (Cyclic) Folding Mechanism (folded)
- *When folded, cyclic cannot be moved. The pilot cyclic should override the co-pilot/gunner's cyclic input.*

MULTICREW

CREW RESPONSIBILITIES

Note: Items in **bold** can be performed by both the Pilot and Co-Pilot/Gunner

Take note that this is not an exhaustive list of all crew responsibilities.

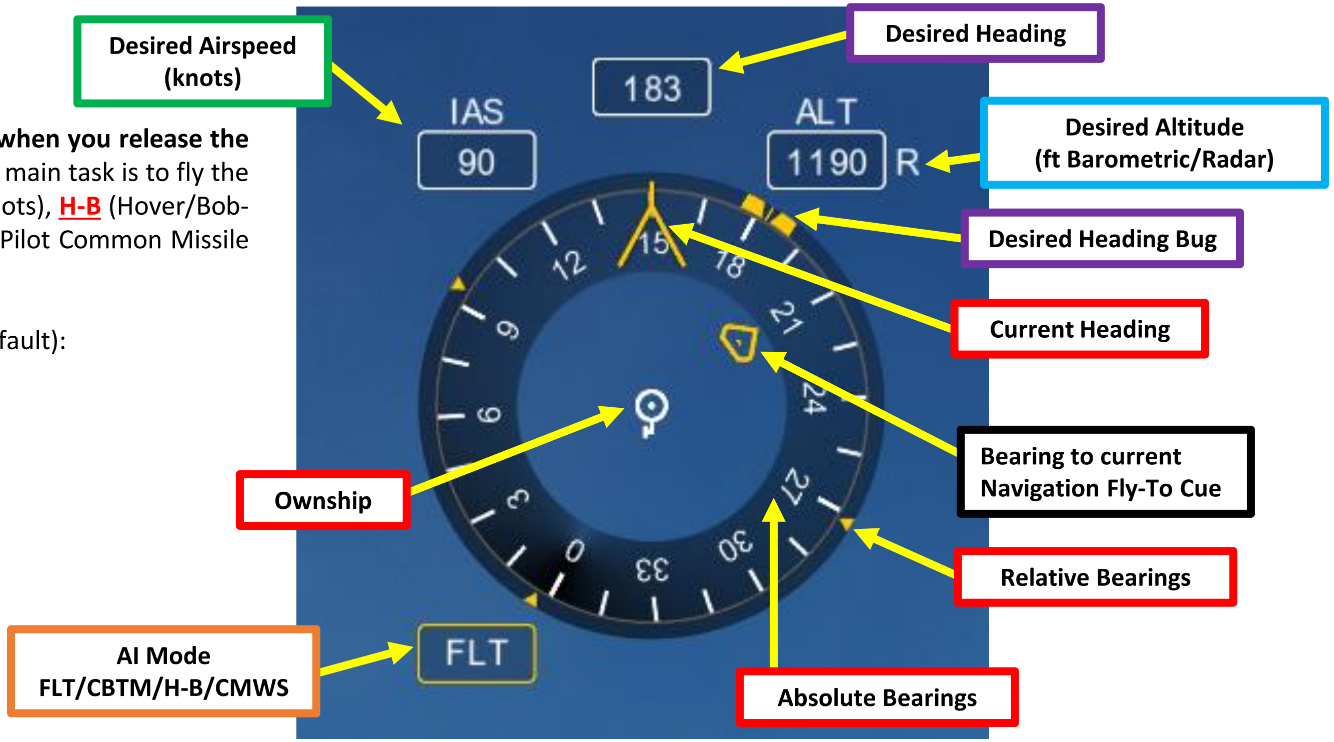
Pilot		Co-Pilot/Gunner	
Weapon Selection & Release	**Flight Controls (Cyclic, Collective, Anti-Torque Pedals)**	**Weapon Selection & Release**	**Flight Controls (Cyclic, Collective, Anti-Torque Pedals)**
Weapon Selection	**Radio Communications**	**Weapon Selection**	**Radio Communications**
Acquisition Source Selection	**Anti-Ice System Management**	**Acquisition Source Selection**	**Anti-Ice System Management**
Aircraft Control Hold Modes	**Fire Protection System Management**	**Aircraft Control Hold Modes**	**Fire Protection System Management**
Hydraulic Systems Management	**Fuel System Management**	**Hydraulic Systems Management**	**Fuel System Management**
External Lights Control	**Electrical Systems Management**	**External Lights Control**	**Electrical Systems Management**
Engine Power (PWR) Lever Control	**External Lights**	**Engine Power (PWR) Lever Control**	**External Lights**
Navigation Systems	**IHADSS Controls**	**Navigation Systems**	**IHADSS Controls**
Cabin Pressurization / Air Conditioning Management	**Chaff & Flare Countermeasure Dispensing Controls**	**Cabin Pressurization / Air Conditioning Management**	**Chaff & Flare Countermeasure Dispensing Controls**
FCR (Fire Control Radar) Controls	**ASE (Aircraft Survivability Equipment) Controls**	**FCR (Fire Control Radar) Controls**	**ASE (Aircraft Survivability Equipment) Controls**
Engine Start/Shutdown	PNVS (Pilot Night Vision System) (can also be used by CPG, but primarily used by pilot)	TADS (Target Acquisition & Designation) Controls (TDU + TEDAC Grips)	Laser Rangefinder/Designator (LRFD) and Laser Spot Tracker (LST) Systems Management
APU (Auxiliary Power Unit) Start	CMWS (Common Missile Warning System) Controls (+ arming switch for flare dispensing)		
Rotor Brake	Generator Reset Controls		

"GEORGE" AI AS THE PILOT – FLT MODE

When the player is in the Co-Pilot/Gunner's seat, George takes over the Pilot's seat **when you release the controls by using the "C" (Request Aircraft Control) binding.** In this mode, George's main task is to fly the helicopter and can fly in three modes: FLT (Normal Flight, if aircraft flies above 30 knots), H-B (Hover/Bob-Up Flight, if aircraft flies below 30 knots), or CBTM (Combat Manoeuvers). CMWS (Pilot Common Missile Warning System Settings) is also available for CMWS setup.

Here is a breakdown of George's CPG functions in ***FLT Mode*** (AI mode selected by default):

- **LCTRL+V:** Toggle AI Menu ON/OFF
- **W: AI Menu UP**
- **A: AI Menu LEFT**
- **S: AI Menu DOWN**
- **D: AI Menu RIGHT**
- **C:** Request Aircraft Control



- **UP (W) SHORT**: **Increases** desired **speed** in the IAS window. After a short delay, George will accelerate the helicopter to the new speed.
- **UP (W) LONG**: **Increases** the desired **altitude** in the ALT window. After button is released, George will increase the helicopter's altitude. If set to <1420 feet, George will hold the radar altitude. If set ≥1420 feet, George will hold the barometric altitude.

- **LEFT (A) SHORT**: Changes AI Menu mode to CBTM (Combat) or CMWS (Common Missile Warning System).
- **LEFT (A) LONG**: Moves desired **heading** bug **left**. After button is released, commands George to turn the helicopter to the new heading.

FLT Mode

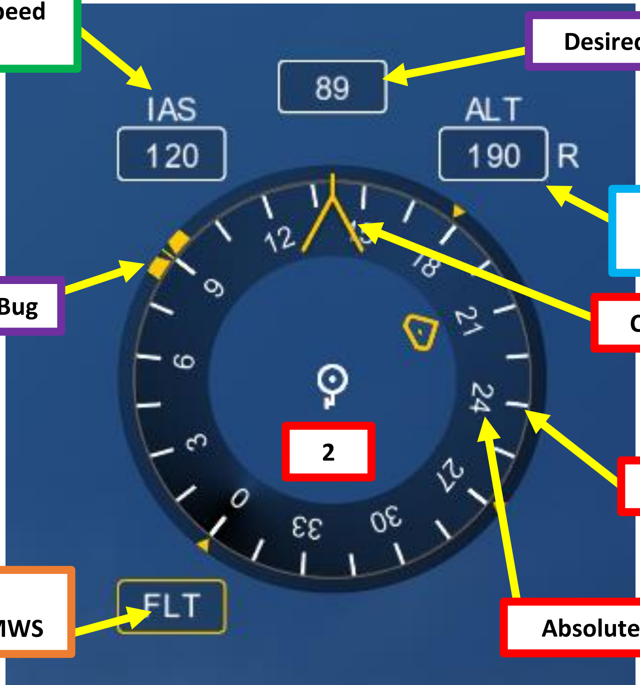
- **RIGHT (D) SHORT**: Activates **head-tracking steering**. You can look in the direction you wish George to fly, then press Right (D) Short to turn in that direction.
- **RIGHT (D) LONG**: Moves desired **heading** bug **right**. After button is released, commands George to turn the helicopter to the new heading.

- **DOWN (S) SHORT**: **Decreases** desired **speed** in the IAS window. After a short delay, George will accelerate the helicopter to the new speed. H-B (Hover/Bob-Up) mode is activated if speed decreases below 30 knots.
- **DOWN (S) LONG**: **Decreases** the desired **altitude** in the ALT window. After button is released, George will decrease the helicopter's altitude. If set to <1420 feet, George will hold the radar altitude. If set ≥1420 feet, George will hold the barometric altitude.

"GEORGE" AI AS THE PILOT – FLT MODE

You can "point and designate" a destination for the Pilot to fly to. Here is a brief example of how George is used in FLT mode.

1. *[CPG]* Release Controls using "C",
2. *[CPG]* Show the George Menu by using « LCTRL+V ». This command will display a horizontal situation indicator that can be used to give commands to George (acting as Pilot).
3. *[CPG]* If CBTM AI Mode is selected, select FLT (Flight) AI Mode with « A » Short. Otherwise, leave AI Mode to FLT.
4. *[CPG]* Set desired Airspeed by using « W » SHORT (Increase) or « S » SHORT (Decrease).
5. *[CPG]* Set desired Entry Altitude by using « W » LONG (Increase) or « S » LONG (Decrease).
6. *[CPG]* Move your head to look in the direction you want to turn (you can use the Helmet Line-of-Sight Reticle as a reference, but this isn't mandatory; the direction you are looking at alone is sufficient).
7. *[CPG]* Press « D » SHORT to request George to steer helicopter towards the target.
   - Alternatively, you can set desired heading using « A » LONG (Heading Bug Left) or « D » LONG (Heading Bug Right).

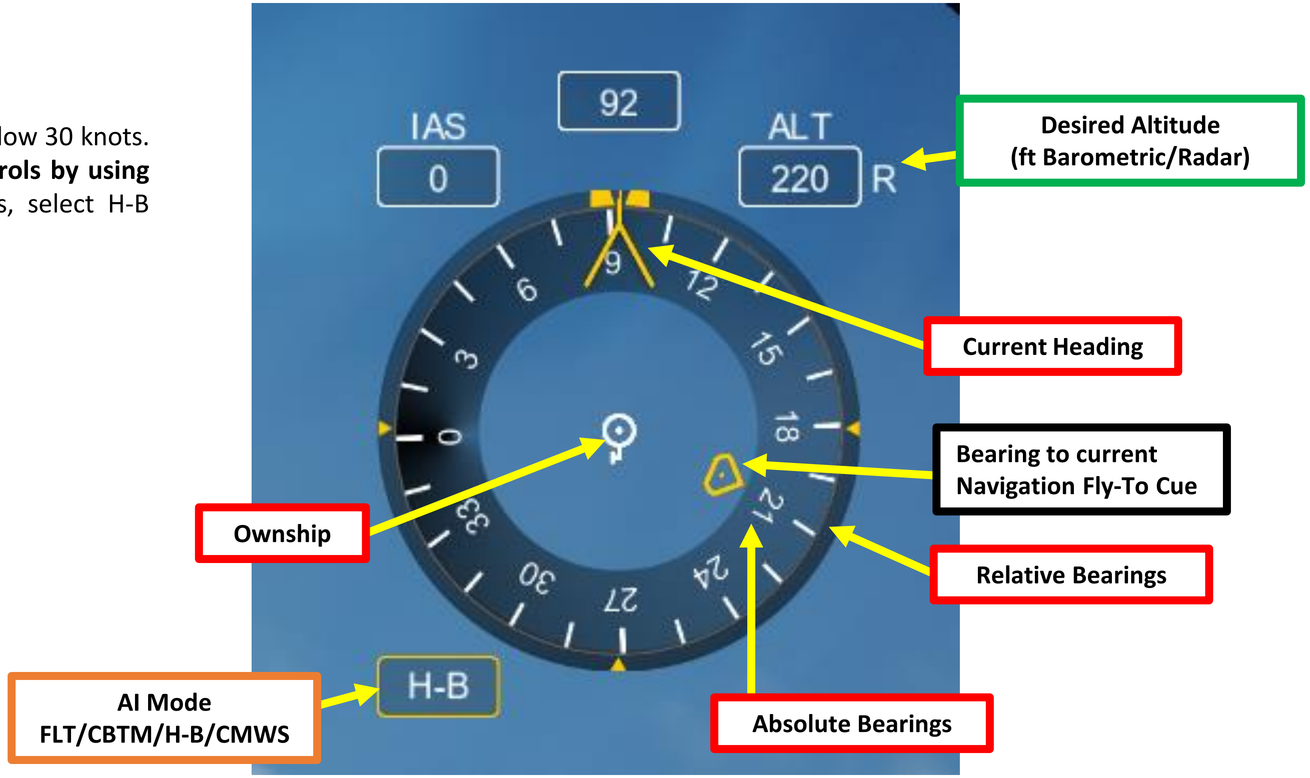


"GEORGE" AI AS THE PILOT – H-B MODE

In order to have the **H-B** (Hover/Bob-Up Flight) mode available, the aircraft must fly below 30 knots. Setting aircraft airspeed can be requested from the FLT Mode. First **release the controls by using the "C" (Request Aircraft Control) binding,** then once airspeed is below 30 knots, select H-B (Hover/Bob-Up Flight) AI Mode with « A » Short.

Here is a breakdown of George's CPG functions in ***H-B Mode*** :

- **LCTRL+V:** Toggle AI Menu ON/OFF
- **W: AI Menu UP**
- **A: AI Menu LEFT**
- **S: AI Menu DOWN**
- **D: AI Menu RIGHT**
- **C:** Request Aircraft Control



- **UP (W) SHORT**: George **increases radar altitude** by 10 feet.
- **UP (W) LONG**: George translates the helicopter **forward** while the button is held.

- **LEFT (A) SHORT**: Changes AI Menu mode to CBTM (Combat) or CMWS (Common Missile Warning System).
- **LEFT (A) LONG**: George translates the helicopter **leftward** while the button is held.

H-B Mode

- **RIGHT (D) SHORT**: Activates **head-tracking steering**. You can look in the direction you wish George to fly, then press Right (D) Short again to turn in that direction.
- **RIGHT (D) LONG**: George translates the helicopter **rightward** while the button is held.

- **DOWN (S) SHORT**: George **decreases radar altitude** by 10 feet.
- **DOWN (S) LONG**: George translates the helicopter **backward** while the button is held.

"GEORGE" AI AS THE PILOT – CBTM MODE

Here is a breakdown of George's CPG functions in ***CBTM Mode*** (AI mode selected by pressing "A" SHORT):

- **LCTRL+V:** Toggle AI Menu ON/OFF
- **W: AI Menu UP**
- **A: AI Menu LEFT**
- **S: AI Menu DOWN**
- **D: AI Menu RIGHT**
- **C:** Request Aircraft Control

The CBTM mode is primarily used to ask the Pilot to perform an attack run on a target in order to have a valid missile firing solution. The symbology is very similar to the one used in FLT mode, but the AI flies the helicopter more "aggressively". First **release the controls by using the "C" (Request Aircraft Control) binding,** then select CBTM (Combat Manoeuvers) AI Mode with « A » Short.

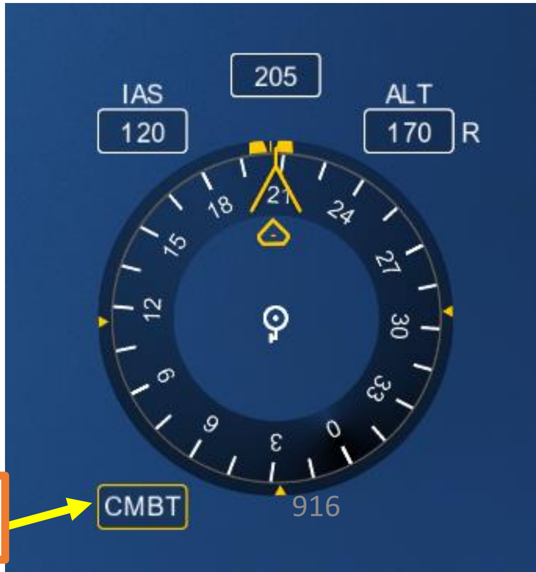
- **UP (W) SHORT**: Commands George to turn the aircraft to the heading of the TADS Line-of-Sight reticle. Good for starting an attack run, bringing the helicopter into Hellfire launch constraints, or aligning the Rocket Steering Cursor.
- **UP (W) LONG**: No Function.

- **LEFT (A) SHORT**: Changes AI Menu mode to FLT (Flight) or CMWS (Common Missile Warning System).
- **LEFT (A) LONG**: Commands George to perform a 90° turn to the left to defend or more quickly re-attack.

CBTM Mode

- **RIGHT (D) SHORT**: Commands George to fly a direct path to the current Navigation Direct-To Cue. If the point is part of a route, George will continue along that route in sequence. If the point is not part of a route, or is the final point in the route, George will come to a hover at that location.
- **RIGHT (D) LONG**: Commands George to perform a 90° turn to the right to defend or more quickly re-attack.

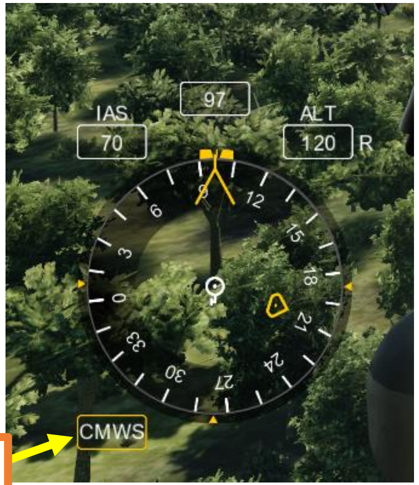
- **DOWN (S) SHORT**: No Function
- **DOWN (S) LONG**: Commands George to perform a 180 deg combat evasion turn. Intended to be used following an attack run or for evasive action.



"GEORGE" AI AS THE PILOT – CMWS MODE

When George is in the ***CMWS*** (Pilot Common Missile Warning System Settings) Mode, it is possible to make him select a the position of two switches on the CMWS Control Panel. To make the George CMWS interface appear, **press "A" (AI Menu LEFT) to toggle between AI modes until CMWS is selected**. Here is a breakdown of George's CPG functions in ***CMWS Mode***.

- **W: AI Menu UP**
  - **SHORT PRESS:** Toggles CMWS between ARM and SAFE.
  - **LONG PRESS:** No Function.
- **A: AI Menu LEFT:**
  - **SHORT PRESS:** Changes AI Menu mode to FLT (Flight), or H-B (Hover/Bob-Up) depending on airspeed or CBTM (Combat Manoeuvers).
- **S: AI Menu DOWN:**
  - **SHORT PRESS:** Toggles CMWS between AUTO and BYPASS.
  - **LONG PRESS:** No Function.
- **D: AI Menu RIGHT:**
  - **SHORT PRESS:** No Function.
  - **LONG PRESS:** No Function.



AI Mode
FLT/CBTM/H-B/CMWS

CMWS Arm/Safe Setting
- **Yellow Symbology: Armed**
- **Green Symbology: Safe**

CMWS Bypass/Auto Setting

Co-Pilot/Gunner Cockpit View

CMWS Bypass/Auto Switch
- *Toggles between automatic flare dispensing when a missile threat is detected in AUTO mode, or manual flare dispensing when in BYPASS mode. Missile threat warning is provided regardless of switch position, and manual dispensing is retained when in AUTO mode.*

Pilot Cockpit View

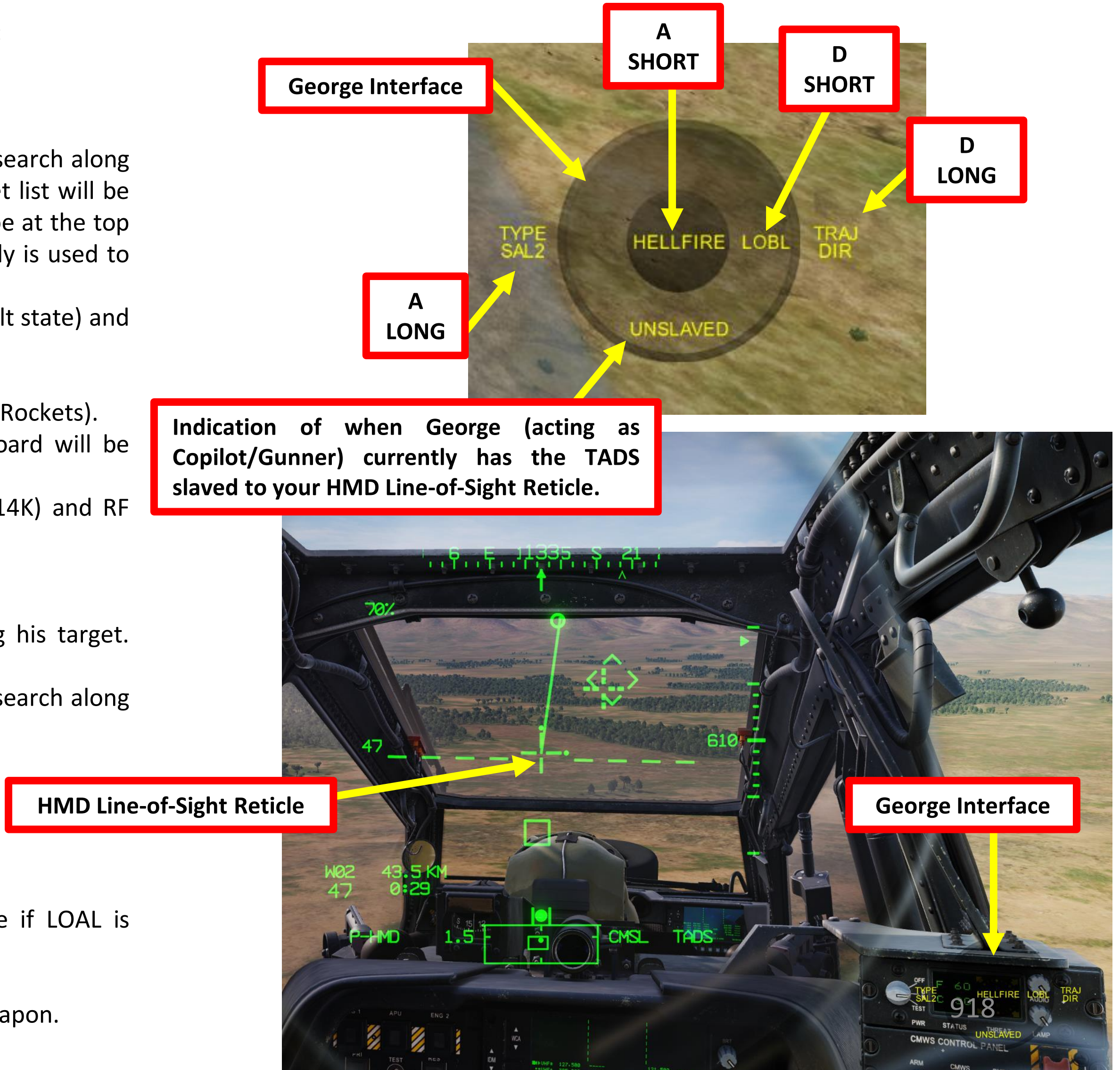
CMWS Arm/Safe Switch
- *UP: ARM*
- *DOWN: SAFE*

"GEORGE" AI AS THE CO-PILOT/GUNNER

When the player is in the Pilot's seat, George takes over the Co-Pilot/Gunner seat. In this mode, George's main task is to set up, acquire targets with the TADS and employ weapons (including the gun, rockets and missiles). George can also give various callouts including target ranging.

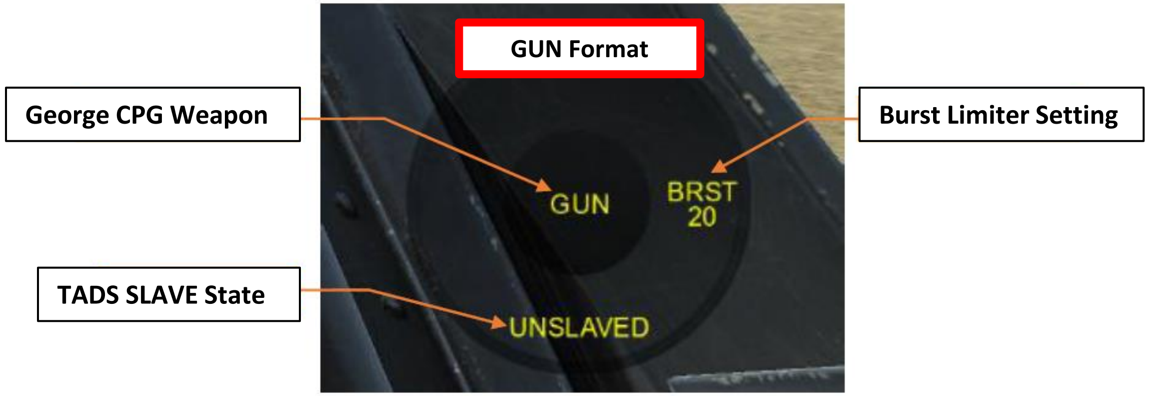
Here is a breakdown of George's CPG functions in ***Target Designation/Weapon Control Mode***:

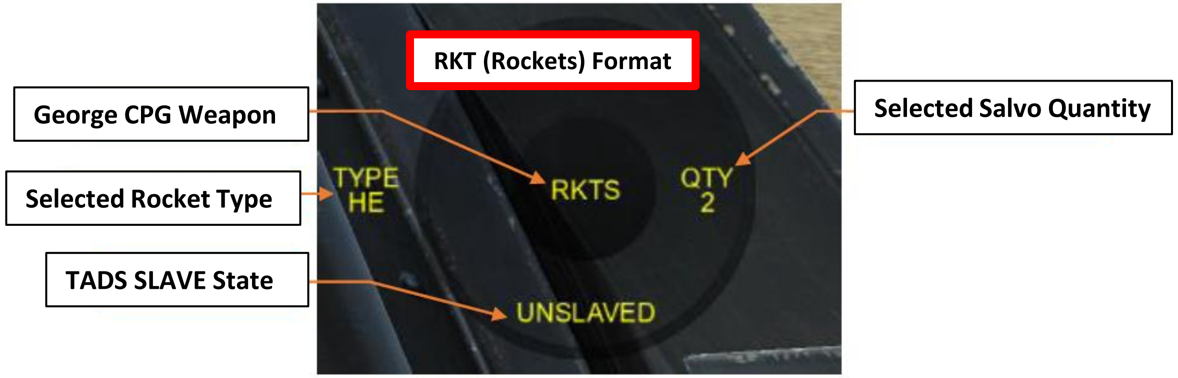
- **LCTRL+V:** Toggle AI Menu ON/OFF
- **W: AI Menu UP**
  - **SHORT PRESS:** Commands George to slave TADS to PHS (Pilot Helmet Sight) and search along designated line of sight for targets. If George finds more than one target, a target list will be displayed. Target in list will be ordered by threat (meaning air defense units will be at the top of the list even if they are not in the center of the designated area). This basically is used to "designate" a search area for the AI.
  - **LONG PRESS:** Toggles between rules of engagement (ROE); Weapons Hold (default state) and Weapons Free (George fires by himself without input from the Pilot).
- **A: AI Menu LEFT:**
  - **SHORT PRESS:** Cycles CPG (Co-Pilot/Gunner) weapon GUN-MSL-RKT (Gun-Missiles-Rockets).
  - **LONG PRESS**: Toggles TYPE setting. Only missile and rocket types loaded onboard will be shown in the interface.
    - If MSL selected, toggles TYPE between SAL (Semi-Active Laser, AGM-114K) and RF (Radio Frequency, AGM114L).
    - If RKT selected, cycles TYPE of HE-ILL-MPP-SMK.
- **S: AI Menu DOWN:**
  - **SHORT PRESS:** Commands George to cease laser designation and stop tracking his target. George will slave TADS to a fixed forward position.
  - **LONG PRESS**: If George has already found a target, commands George to repeat search along the current TADS line-of-sight.
- **D: AI Menu RIGHT:**
  - **SHORT PRESS:** Cycles weapon settings.
    - If MSL selected, toggles between LOBL and LOAL.
    - If RKT selected, cycles QTY of 1-2-4-8-12-24-ALL.
    - If GUN selected, cycles BURST of 10-20-50-100-ALL.
  - **LONG PRESS**: If MSL selected, cycles TRAJ or DIR-LO-HI setting. Only available if LOAL is selected.
- **C:** Request Aircraft Control
- **Consent to Fire Binding**: Orders George to engage the selected target with the selected weapon.

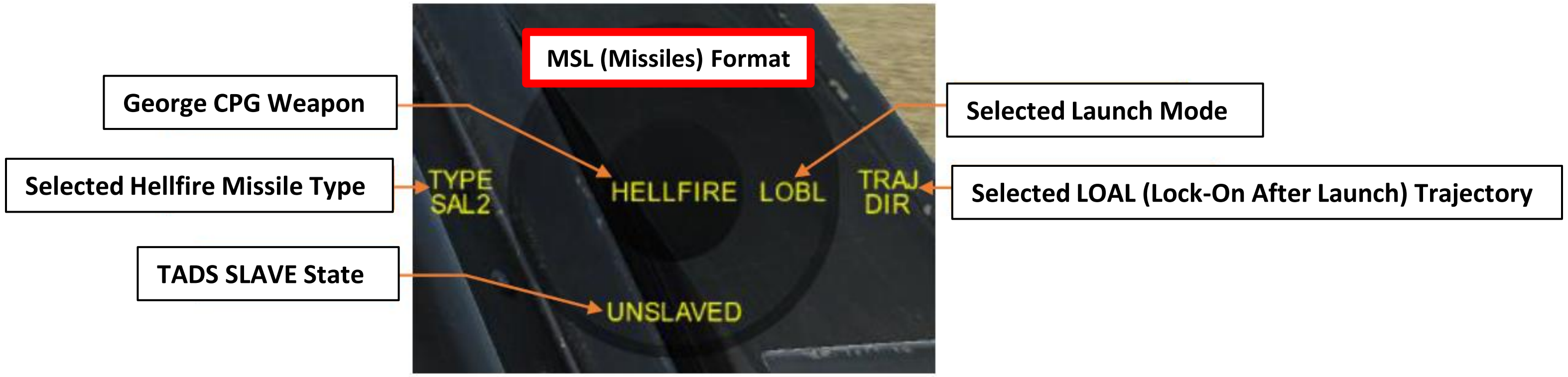


"GEORGE" AI AS THE CO-PILOT/GUNNER

George's CPG functions in ***Target Designation/Weapon Control Mode:***







"GEORGE" AI AS THE CO-PILOT/GUNNER

The on-screen interface outline changes color depending on the active rules of engagement (ROE) setting for George:

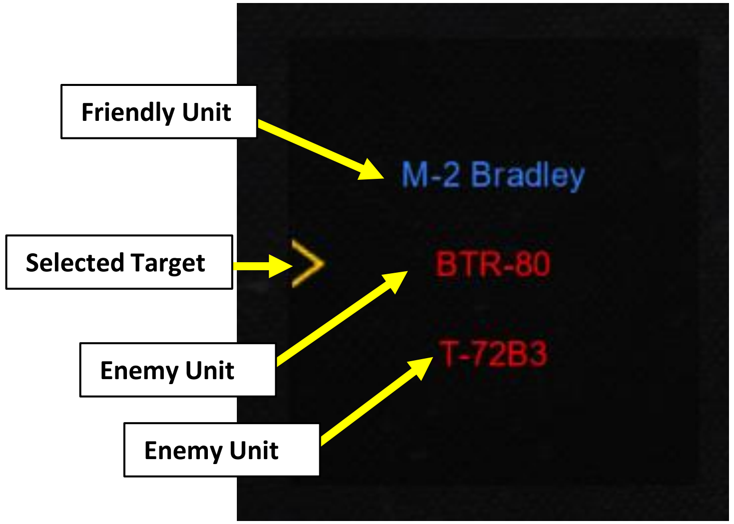
- **Yellow**: Weapons Hold, George will wait for your « Consent to Fire » command before firing weapons.
- **Green**: Weapons Free, George will fire weapons at targets at will.

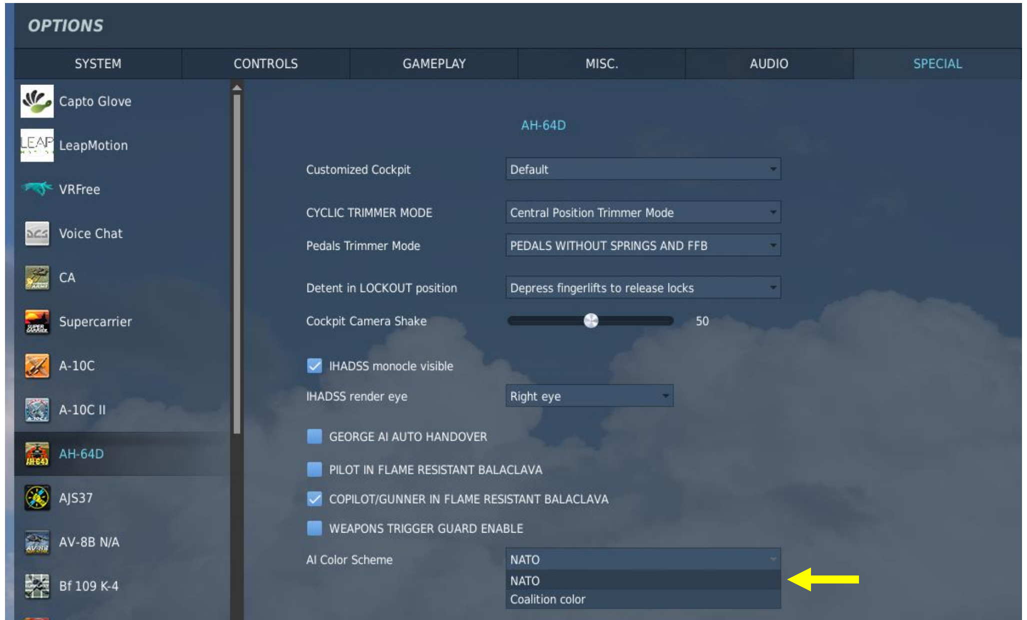
"GEORGE" AI AS THE CO-PILOT/GUNNER

Once George has searched an area and found some targets, a list of available targets appears. Here is a breakdown of George's CPG functions in ***Target List Mode***.

- **W: AI Menu UP**
  - **SHORT PRESS:** Moves target selection list UP.
  - **LONG PRESS:** Commands George to increase sensor magnification to the next field-of-view.
- **A: AI Menu LEFT**
  - **SHORT PRESS:** Cancels target list selection
  - **LONG PRESS**: Displays default list, excludes friendlies if enemy or unknown contacts are in.
- **S: AI Menu DOWN:**
  - **SHORT PRESS:** Moves target selection list DOWN.
  - **LONG PRESS**: Commands George to decrease sensor magnification to the previous field-of-view.
- **D: AI Menu RIGHT:**
  - **SHORT PRESS:** Selects target next to **> symbol**.
  - **LONG PRESS**: Displays all contacts, including friendlies.

Take note that the color scheme of targets can be set in the Special Options tab.

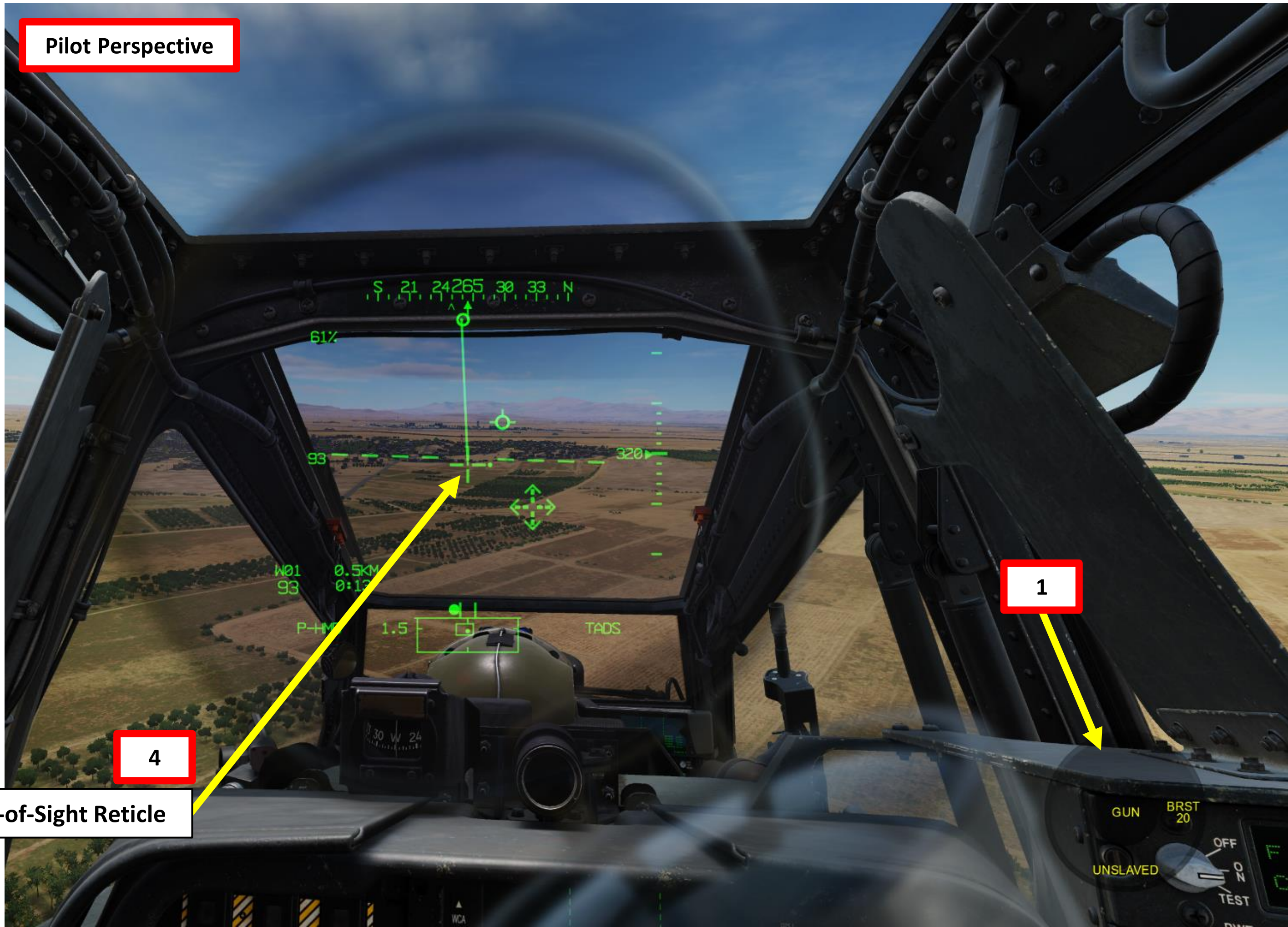


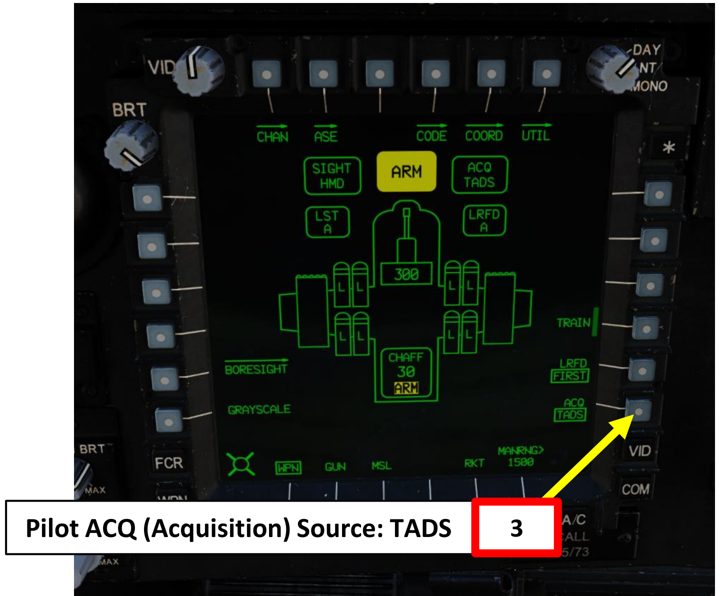


"GEORGE" AI AS THE CO-PILOT/GUNNER

Here is a quick demo on how to designate select a target from a list (assuming all weapons are set up and selected properly):

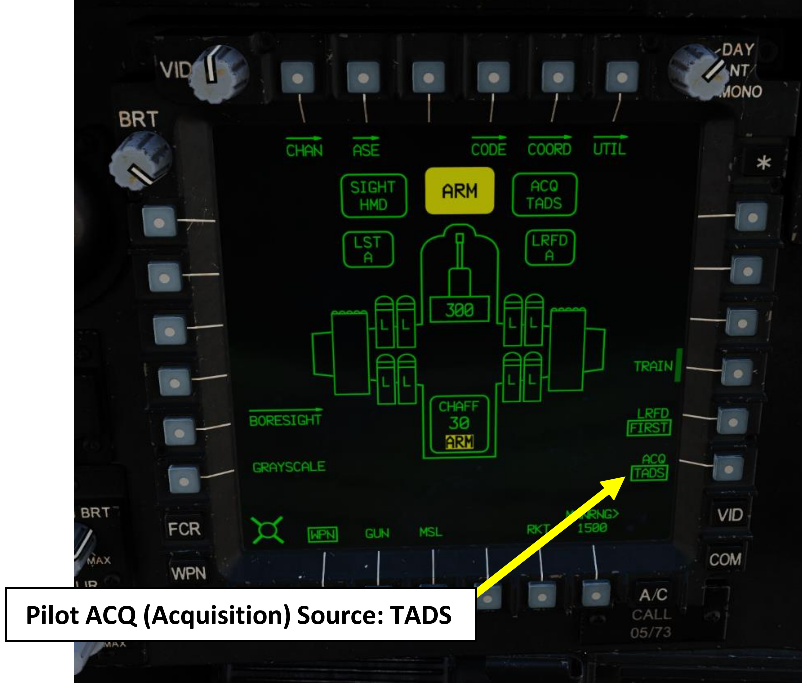
1. *[P]* Show the George Menu by using « LCTRL+V ».
2. *[P]* The pilot's HDU (Helmet Display Unit) reticle is used as a Designation Reticle to point an area where "George" can identify and track targets.
3. *[P]* From the WPN (Weapon) page, set the Pilot Acquisition Source to TADS. Then, fly towards the target and ensure the the helicopter attitude remains stable.
4. *[P]* Move your head (HDU Reticle / Designation Reticle) near the area you want the Co-Pilot/Gunner to search for targets, then press « W » SHORT (less than 0.5 sec).
5. *[CPG]* George will select the acquisition source to PHS (Pilot Helmet Sight), then slave the TADS to the acquisition source, then call out "slaving" to remind the pilot that the TADS is slaved to his helmet reticle.
6. *[CPG]* When George has set the TADS reticle is roughly on the area pointed at by the pilot's HDU reticle, George will de-slave the TADS, call out "de-slaved" to tell the pilot that he can start looking elsewhere. Target can then be spotted, designated, lased and stored by him.

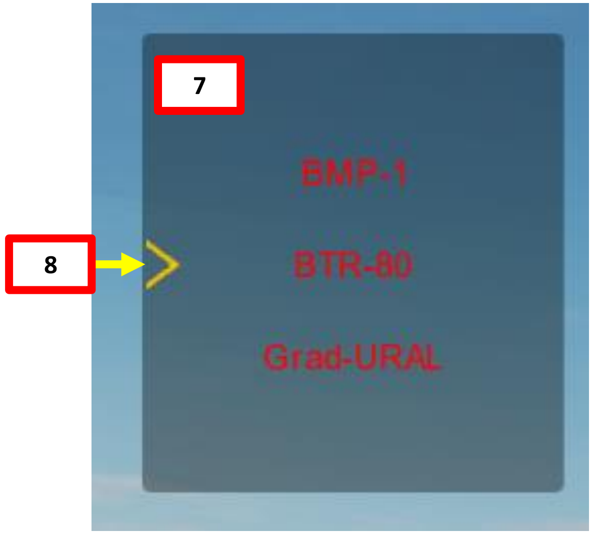




"GEORGE" AI AS THE CO-PILOT/GUNNER

7. *[CPG]* George will then start scanning for targets in the designated area. When targets are found, a menu with a list of targets appears.
8. *[P]* Cycle through the target list using « W » SHORT (UP) or « S » SHORT (DOWN) until desired target is selected by the **>** symbol.
9. *[P]* Press « D » SHORT (RIGHT) to select target.
   - Note: Pressing “S” SHORT (DOWN) undesignates George’s target.
10. *[CPG]* George will then designate, lase and store the target with the TADS, calling out “lased and stored” in the process.
11. *[P]* The pilot should be able to see a cued line-of-sight reticle on his HDU (Helmet Display Unit), which indicates the TADS line-of-sight and the designated target ***if your acquisition (ACQ) source is set to the TADS***.





"GEORGE" AI AS THE CO-PILOT/GUNNER

For a full demonstration of George employment for target designation, consult the Weapon Employment tutorials:

Gun Operation by George AI as Co-Pilot/Gunner

Rocket Operation by George AI as Co-Pilot/Gunner

Missile Operation by George AI as Co-Pilot/Gunner

RESOURCES

DCS AH-64D Quick Start Manual (English versions)

Matt “Wags” Wagner Tutorials (Youtube)
https://www.youtube.com/playlist?list=PLer9oF4AanvF7CTss44TU4aDOxb5A9Jic

Casmo’s AH-64D Tutorials (Youtube)
https://www.youtube.com/playlist?list=PLNtUtkZqN36l4Tj9tvQxPxwSVC4mBjB7l

Eagle 7 AH-64D Tutorials (Youtube)
https://www.youtube.com/@eagle7117/videos

DCS AH-64 Apache Guide – Game Pressure
https://guides.gamepressure.com/digital-combat-simulator-ah-64d/

Apache: Inside the Cockpit of the World's Most Deadly Fighting Machine – Book by Ed Macy

Hellfire – Book by Ed Macy

Fire Birds (because helicopter pilots need terrible movies too)

THANK YOU TO ALL MY PATRONS

Creating these guides is no easy task, and I would like to take the time to properly thank every single one of my Patreon supporters. The following people have donated a very generous amount to help me keep supporting existing guides and work on new projects as well:

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