DCS GUIDE

F-16CM VIPER BLOCK 50

BY CHUCK

LAST UPDATED: 17/04/2025

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 F-16C. The author has never had access to OEM (Original Equipment Manufacturer) data related to the F-16C, its armament systems nor its defensive systems. All the information within this document is taken from public documentation (i.e. F-16 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 F-16C 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 F-16.

TABLE OF CONTENTS

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

The **F-16C Fighting Falcon** (also nicknamed "Viper" by its pilots) is a supersonic, single-engine, multi-role combat aircraft developed by General Dynamics for the United States Air Force (USAF). Designed as an air superiority day fighter, it evolved into a successful all-weather multirole aircraft. Over 4,600 aircraft have been built since production was approved in 1976.

Experiences in the Vietnam War revealed the need for air superiority fighters and better air-to-air training for fighter pilots. From this need originated the Lightweight Fighter (LWF) program. This program was a United States Air Force technology evaluation program initiated in the late 1960s by a group of officers and defense analysts known as the "Fighter Mafia". It was spurred by then-Major John Boyd's 'energy-maneuverability' (E-M) theory, which indicated that excessive weight would have severely debilitating consequences on the maneuverability of an aircraft. Boyd's design called for a light-weight fighter with a high thrust-to-weight ratio, high maneuverability, and a gross weight of less than 20,000 lbs; half that of its counterpart, the McDonnell Douglas F-15 Eagle.

In 1972, the Air Staff selected General Dynamics' Model 401 and Northrop's P-600 for the prototype development and testing phase. General Dynamics and Northrop were awarded contracts worth $37.9 million and $39.8 million to produce the YF-16 and YF-17, respectively, with first flights of both prototypes planned for early 1974. Late in the program, in 1974, with the promise of European sales, the Air Force changed the program name to Air Combat Fighter (ACF), and committed to purchasing 650 models of the YF-16, adopted as the F-16 Fighting Falcon. The YF-17, on the other hand, would eventually become the F/A-18 Hornet.

YF-16 aircraft and a YF-17 aircraft, side-by-side, by Air Force Camera Operator: R.L. House (1972)
Reference: https://en.wikipedia.org/wiki/Lightweight_Fighter_program

Increased interest turned the LWF into a serious acquisition program. North Atlantic Treaty Organization (NATO) allies Belgium, Denmark, the Netherlands, and Norway were seeking to replace their F-104G Starfighter fighter-bombers. In early 1974, they reached an agreement with the U.S. that if the USAF ordered the LWF winner, they would consider ordering it as well. The USAF also needed to replace its F-105 Thunderchief and F-4 Phantom II fighter-bombers. The U.S. Congress sought greater commonality in fighter procurements by the Air Force and Navy, and in August 1974 redirected Navy funds to a new Navy Air Combat Fighter (NACF) program that would be a navalized fighter-bomber variant of the LWF.

The four NATO allies had formed the "Multinational Fighter Program Group" (MFPG) and pressed for a U.S. decision by December 1974; thus, the USAF accelerated testing. To reflect this serious intent to procure a new fighter-bomber, the LWF program was rolled into a new Air Combat Fighter (ACF) competition.

The ACF would not be a pure fighter, but multi-role, and Schlesinger made it clear that any ACF order would be in addition to the F-15, which extinguished opposition to the LWF. ACF also raised the stakes for GD and Northrop because it brought in competitors intent on securing what was touted at the time as "the arms deal of the century". These were Dassault-Breguet's proposed Mirage F1M-53, the Anglo-French SEPECAT Jaguar, and the proposed Saab 37E "Eurofighter". Northrop offered the P-530 Cobra, which was similar to the YF-17.

The Jaguar and Cobra were dropped by the MFPG early on, leaving two European and the two U.S. candidates. On 11 September 1974, the U.S. Air Force confirmed plans to order the winning ACF design to equip five tactical fighter wings. Though computer modeling predicted a close contest, the YF-16 proved significantly quicker going from one maneuver to the next, and was the unanimous choice of those pilots that flew both aircraft.

On 13 January 1975, the YF-16 was announced as the winner of the ACF competition. The chief reasons given were the YF-16's lower operating costs, greater range, and maneuver performance that was "significantly better" than that of the YF-17, especially at supersonic speeds. Another advantage of the YF-16 – unlike the YF-17 – was its use of the Pratt & Whitney F100 turbofan engine, the same powerplant used by the F-15; such commonality would lower the cost of engines for both programs. Secretary McLucas announced that the USAF planned to order at least 650, possibly up to 1,400 production F-16s.

The Fighting Falcon's key features include a frameless bubble canopy for better visibility, side-mounted control stick to ease control while maneuvering, an ejection seat reclined 30 degrees from vertical to reduce the effect of g-forces on the pilot, and use of a relaxed static stability/fly-by-wire flight control system which helps to make it an agile aircraft. The F-16 was the first fighter aircraft purpose-built to pull 9-g maneuvers and can reach a maximum speed of over Mach 2. Although the LWF program called for a structural life of 4,000 flight hours, capable of achieving 7.33 g with 80% internal fuel; General Dynamics' engineers decided to design the F-16's airframe life for 8,000 hours and for 9-g maneuvers on full internal fuel. This proved advantageous when the aircraft's mission changed from solely air-to-air combat to multi-role operations.

One change made during production was augmented pitch control to avoid deep stall conditions at high angles of attack. The stall issue had been raised during development, but had originally been discounted. Model tests of the YF-16 conducted by the Langley Research Center revealed a potential problem, but no other laboratory was able to duplicate it. YF-16 flight tests were not sufficient to expose the issue; later flight testing on the FSD (Full-Scale Development) aircraft demonstrated there was a real concern. In response, the area of the horizontal stabilizer were increased by 25% on the Block 15 aircraft in 1981 and later retrofitted to earlier aircraft. In addition, a manual override switch to disable the horizontal stabilizer flight limiter was prominently placed on the control console, allowing the pilot to regain control of the horizontal stabilizers (which the flight limiters otherwise lock in place) and recover. Besides reducing the risk of deep stalls, the larger horizontal tail also improved stability and permitted faster takeoff rotation.

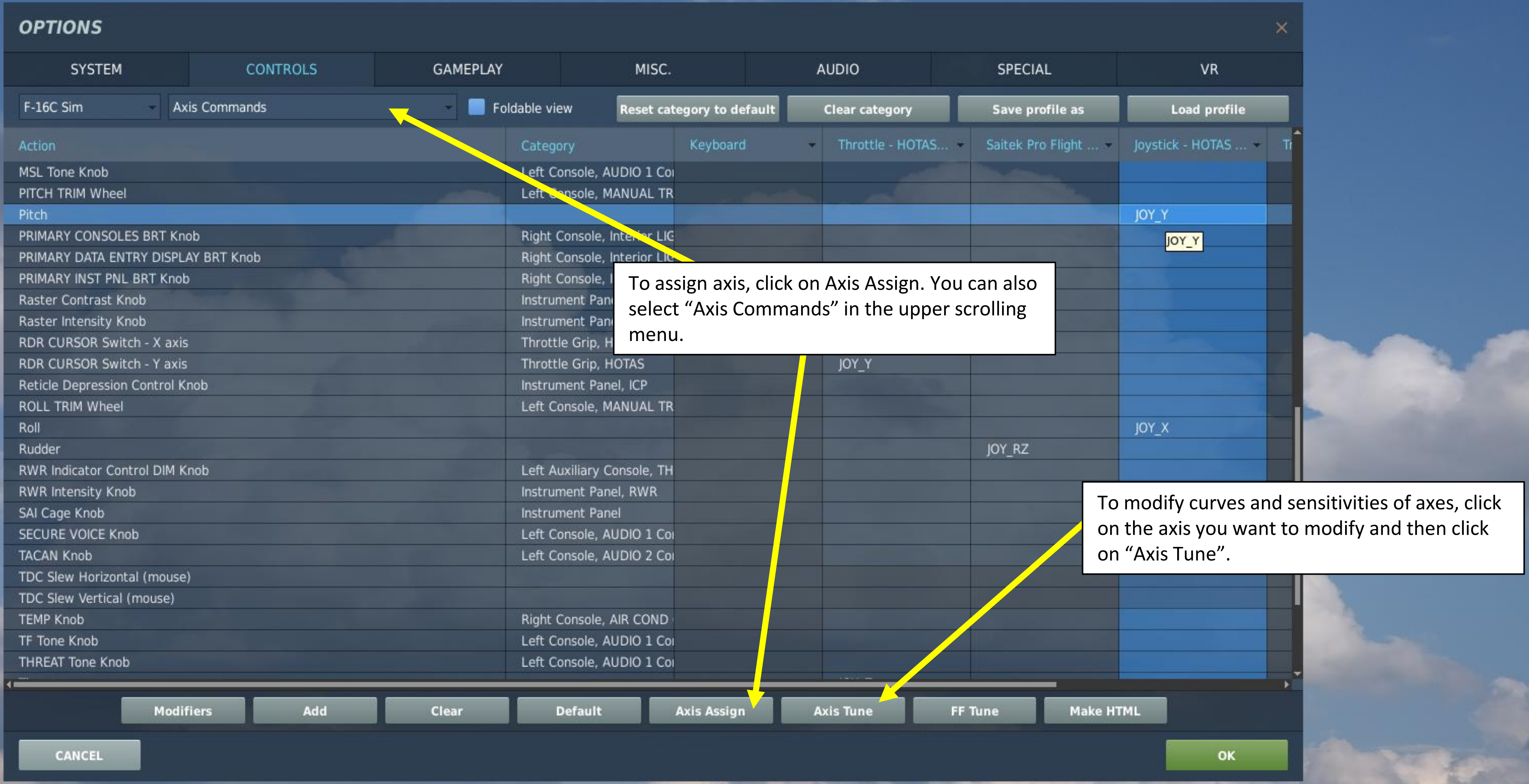
In the 1980s, the Multinational Staged Improvement Program (MSIP) was conducted to evolve the F-16's capabilities, mitigate risks during technology development, and ensure the aircraft's worth. The program upgraded the F-16 in three stages. The MSIP process permitted the quick introduction of new capabilities, at lower costs and with reduced risks compared to traditional independent upgrade programs. In 2012, the USAF had allocated $2.8 billion to upgrade 350 F-16s while waiting for the F-35 to enter service. One key upgrade has been an auto-GCAS (Ground collision avoidance system) to reduce instances of controlled flight into terrain. Onboard power and cooling capacities limit the scope of upgrades, which often involve the addition of more power-hungry avionics.

Equipment-wise, early F-16s could be armed with up to six AIM-9 Sidewinder heat-seeking short-range air-to-air missiles (AAM) by employing rail launchers on each wingtip, as well as radar guided AIM-7 Sparrow medium-range AAMs in a weapons mix. More recent versions support the AIM-120 AMRAAM and replaced the AIM-7. The aircraft can carry various other AAMs, a wide variety of air-to-ground missiles, rockets or bombs; electronic countermeasures (ECM), navigation, targeting or weapons pods; and fuel tanks on 9 hardpoints – six under the wings, two on wingtips, and one under the fuselage. Two other locations under the fuselage are available for sensor or radar pods. The F-16 carries a 20 mm M61A1 Vulcan cannon for close range aerial combat and strafing.

At the time, the Thrust-to-Weight ratio of the Viper was nothing short of revolutionary. Check out this 1975 takeoff comparison between a F-16A and the F-4 Phantom in the Netherlands: https://youtu.be/eyWqKT-AG9A?t=46

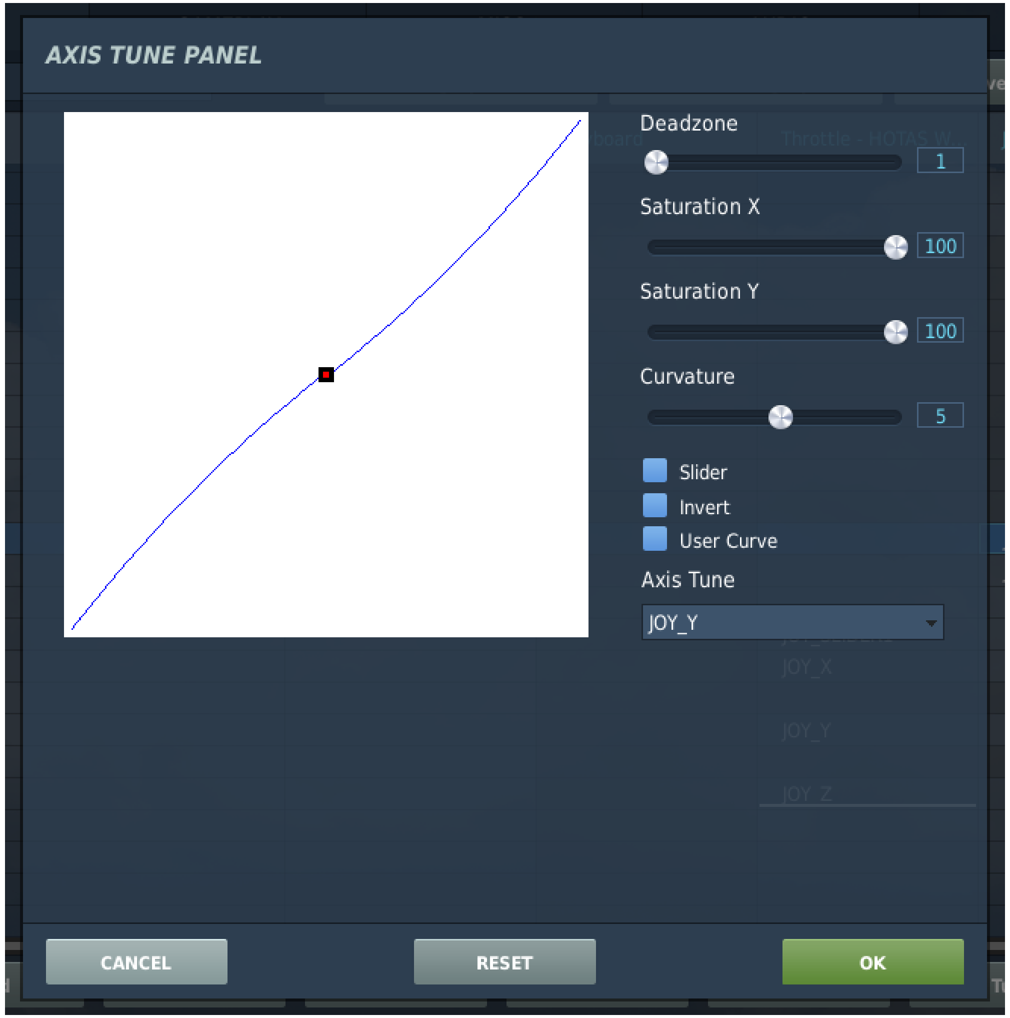
F-16s have participated in numerous conflicts, most of them in the Middle East. The Viper is one of the most successful export fighters ever built and has been operated by various air forces around the world including the United States, Israel, South Korea, Pakistan, Taiwan, Greece, Netherlands, Belgium, Denmark, Norway, Italy, Poland, Portugal, Oman, Bahrain, Iraq, United Arab Emirates, Turkey, Egypt, Jordan, Romania, Slovakia, Indonesia, Singapore, Thailand, Morocco, Venezuela, and Chile. Its popularity among operators is certainly not a sheer coincidence.

Note: In your controls, make sure you check your "Trim" controls since the default version of the game has your trim hat set to changing your view rather than trim the aircraft. Since most of you are probably equipped with a TRACKIR already, I suggest you make sure the Trim Hat Switch is set up properly.



Bind the following axes:

- PITCH (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 5)
- ROLL (DEADZONE AT 1, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 5)
- RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- THRUST – CONTROLS ENGINE RPM
- RDR CURSOR SWITCH – X & Y AXIS
- ANT ELEV Knob
- WHEEL BRAKE LEFT / RIGHT



WHAT YOU NEED MAPPED

NWS A/R DISC MSL STEP Button (hidden grey button on right hand side)

WPN REL Button

Camera/Gun Trigger (Two Detents)

↑ Countermeasures Management Sw - FWD
→ Countermeasures Management Sw – RIGHT
↓ Countermeasures Management Sw – AFT
← Chaff/Flare Dispense Button (Slap Switch)
P

Expand/FOV Button

Paddle Switch - Depress

↑ Trim Switch – Nose DOWN
→ Trim Switch – Right Wing DOWN
↓ Trim Switch – Nose UP
← Trim Switch – Left Wing DOWN

↑ DMS UP
→ DMS RIGHT
↓ DMS DOWN
← DMS LEFT

↑ TMS UP
→ TMS RIGHT
↓ TMS DOWN
← TMS LEFT

Zoom In Slow: L_Shift+TMS UP
Zoom Out Slow: L_Shift+TMS DOWN

+ TOE BRAKES (MAPPED ON PEDALS)

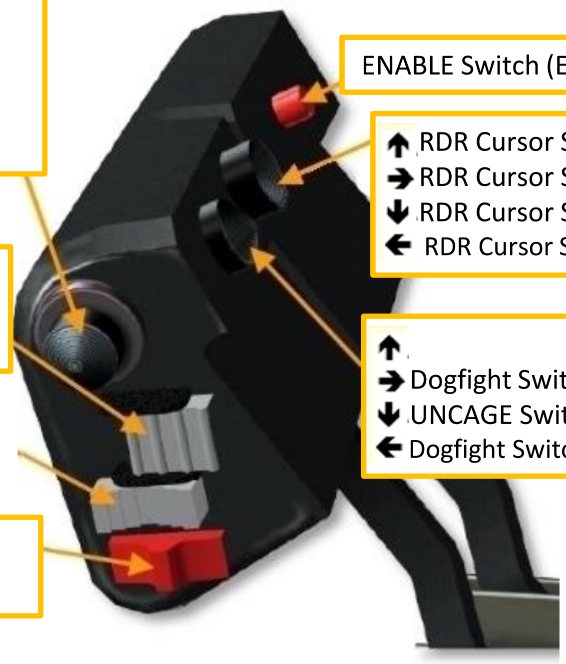
WHAT YOU NEED MAPPED

🡡 Transmit Switch - UHF
🡢 Transmit Switch – IFF IN
🡣 Transmit Switch - VHF
🡠 Transmit Switch – IFF OUT
P

🡠 SPD BRK Switch – AFT/Extend

🡢 SPD BRK Switch – FWD/Retract

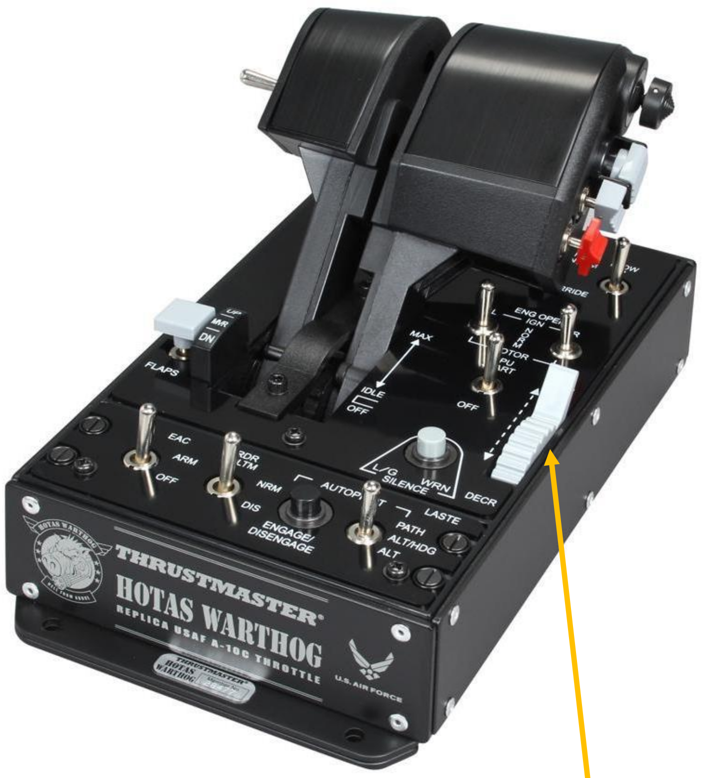
🡠 MAN RNG Knob – CCW (Zoom Out)
🡢 MAN RNG Knob – CW (Zoom In)



ENABLE Switch (Enter)

🡡 RDR Cursor Switch – Y Axis
🡢 RDR Cursor Switch – X Axis
🡣 RDR Cursor Switch – Y Axis
🡠 RDR Cursor Switch – X Axis

🡡
🡢 Dogfight Switch – MISSILE OVERRIDE/CENTER
🡣 UNCAGE Switch
🡠 Dogfight Switch – DOGFIGHT/CENTER

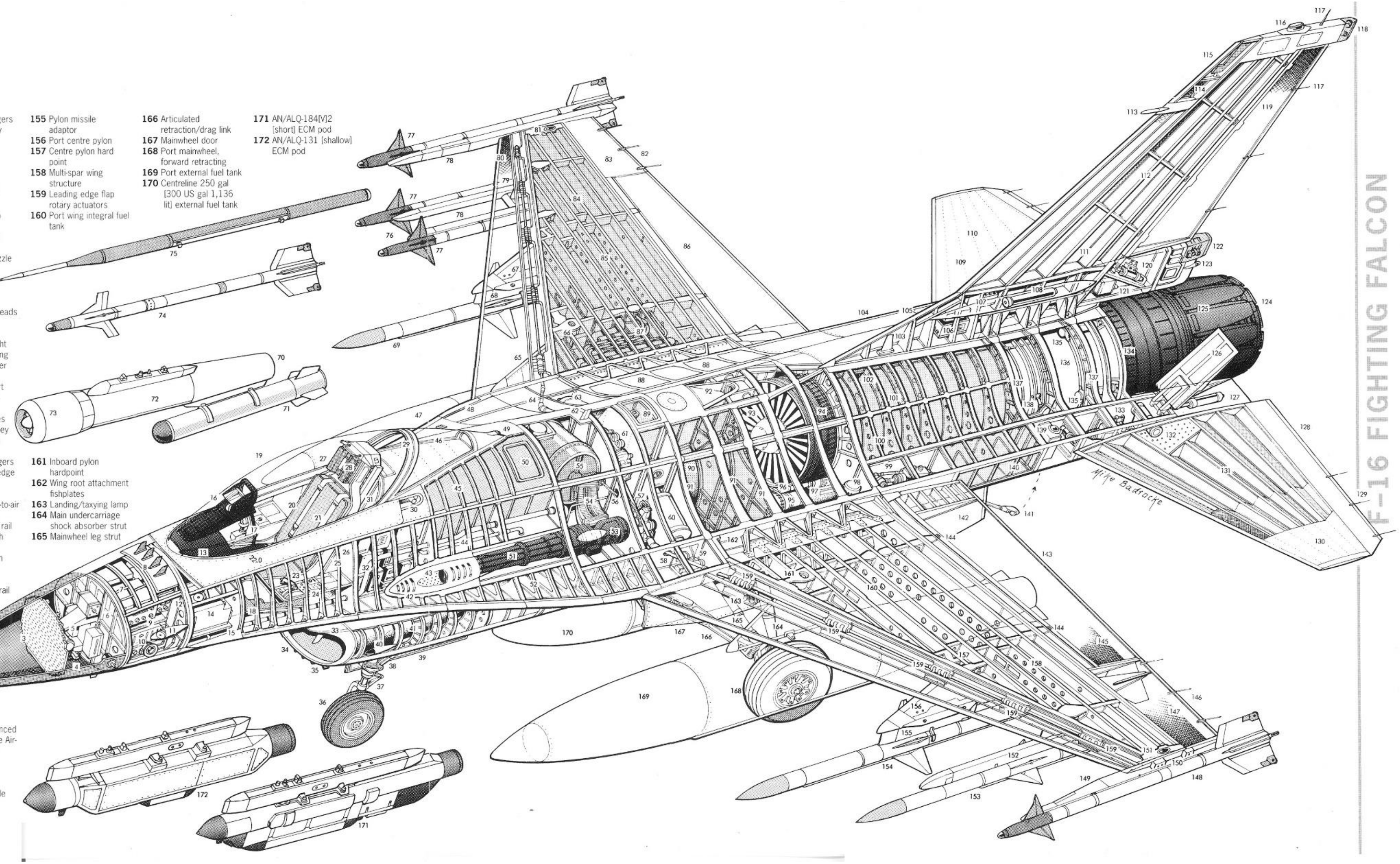


ANT ELEV Knob (Radar Antenna Elevation)

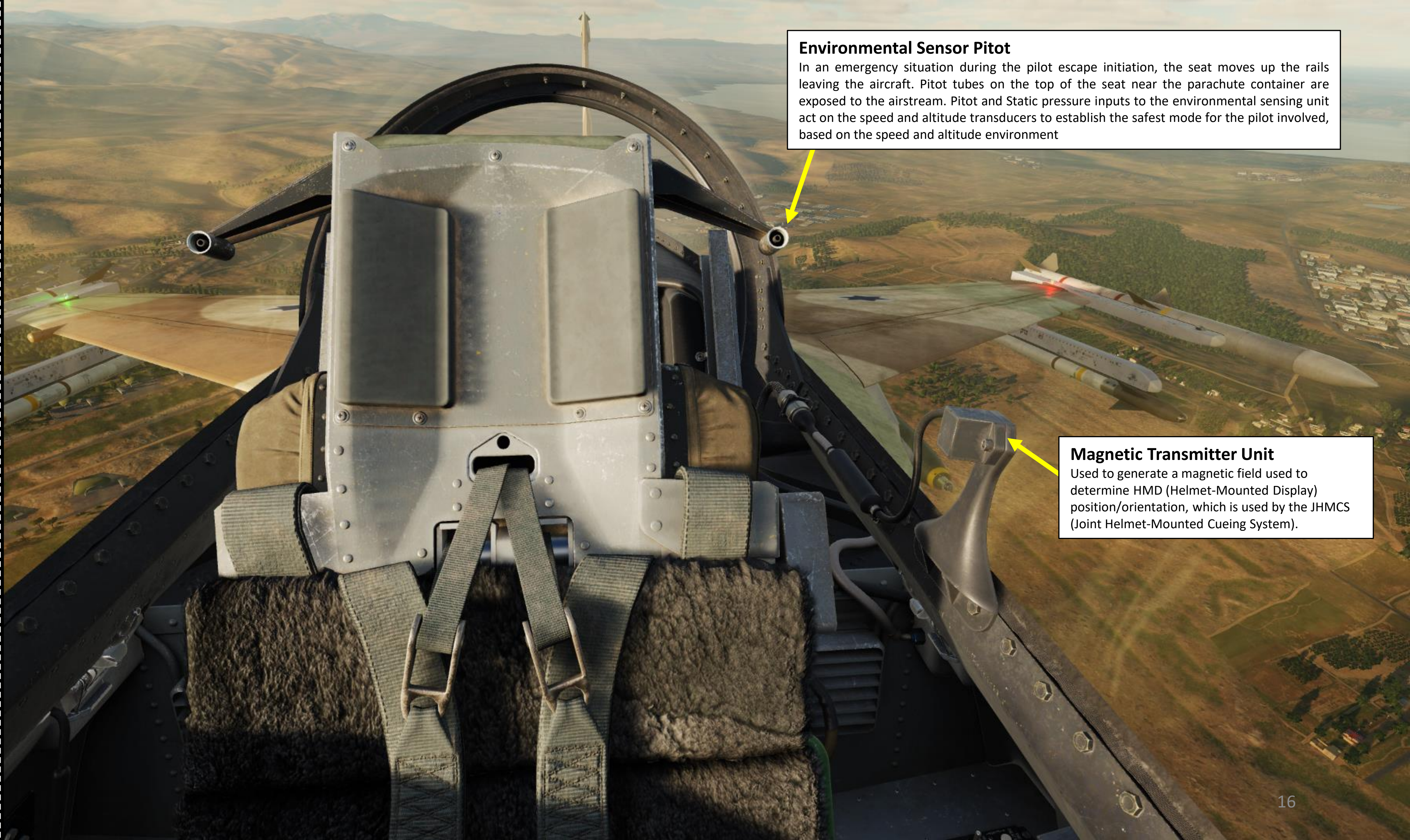

COM 1
COM 2
IFF
LIST
A-A
A-G
UHF 305.00 STPT 2
VHF 127.00 15:43:37
M 4 1337 T 1X
DRIFT C/O
WARN RESET
FUEL FLOW
27200
PEDAL ADJ

Lockheed Martin F-16ADF

1 Pitot head
2 Glass-fibre radome
3 Planar radar scanner
4 ILS glideslope antenna
5 Scanner drive unit
6 Radar mounting bulkhead
7 Forward avionics equipment bay
8 Upper IFF antenna array
9 Westinghouse AN/APG-66 digital pulse doppler radar equipment module
10 Night identification light
11 Radar warning antenna
12 Cockpit front pressure bulkhead
13 Instrument panel shroud
14 Weapons system fire control electronics
15 Fuselage forebody strake fairing
16 Wide-angle-raster-video head-up-display [WARHUD]
17 Side stick controller, fly-by-wire control system
18 Cockpit pressure floor
19 Frameless cockpit canopy
20 McDonnell-Douglas ACES II "zero-zero" ejection seat
21 Seat harness
22 Canopy fairing
23 Engine throttle lever
24 Port side console panel
25 Cockpit section close-pitched frame structure
26 Rear pressure bulkhead
27 Ejection seat headrest
28 Seat arming safety lever
29 Cockpit pressure sealing frame
30 Canopy hinge point
31 Ejection seat launch rails
32 Rear avionics equipment bay
33 Boundary layer splitter plate
34 Fixed geometary engine air intake
35 Lower IFF antenna array
36 Aft retracting nosewheel
37 Shock absorber scissor links
38 Retraction strut
39 Nosewheel door
40 Forward position light
41 Intake trunking
42 Cooling air louvres
43 Gun gas suppression muzzle aperture
44 Air system piping
45 Forward fuselage fuel tank, total system capacity 893 gal [1072.5 US gal, 4060 litres]
46 Canopy aft glazing
47 Starboard 308 gal [370 US gal, 1400 lit] external fuel tank
48 Forebody blended wing root
49 Upper position light and flight refuelling floodlight
50 Fuel tank bay access panel
51 Rotary cannon barrels
52 Forebody frame structure
53 M61 Vulcan, 20-mm rotary cannon
54 Ammunition feed and link return chutes
55 Ammunition drum, 51 rounds
56 Ammunition drum flexible drive shaft
57 Hydraulic gun drive motor
58 Leading edge flap control shaft
59 Hydraulic equipment service bay
60 Primary system hydraulic reservoir
61 Leading-edge manoeuvre flap drive motor
62 TACAN antenna
63 No.2 hydraulic system reservoir
64 Leading edge flap control shaft
65 Inboard pylon
66 Pylon hardpoint
67 Wing centre stores pylon
68 Missile launch adaptor
69 AIM-7F/M Sparrow III air-to-air missile
70 A/A 37U-36 Aerial Gunnery Target System [AGTS]
71 TDK-39 towed target container
72 Winch housing and airframe adaptor
73 Air driven turbine housing
74 AIM-9P-2/3 Sidewinder air-to-air missile
75 ACMI data-link pod
76 Twin Sidewinder installation
77 AIM-9M Sidewinder air-to air missiles
78 Missile launch rails
79 Outboard stores pylon
80 Aluminium honey comb leading edge flap structure
81 Starboard navigation light
82 Static dischargers
83 Fixed section of trailing edge
84 Multi-spar wing structure
85 Starboard wing integral fuel tank
86 Starboard flaperon
87 Fuel system piping
88 Access panels
89 Centre fuel tank bay
90 Intake ducting
91 Wing attachment main bulkheads
92 Universal air refuelling receptacle [UARSSI]
93 Engine compressor face
94 Pratt & Whitney F100-PW-100 after burning turbofan engine
95 Jet fuel starter
96 Airframe mounted engine accessory equipment gear box
97 Gearbox drive shaft
98 Ground pressure refuelling connector
99 Flaperon servo actuator
100 Rear fuselage frame construction
101 Rear integral fuel tank
102 Main engine mounting suspension link
103 UHF antenna
104 Starboard side body fairing
105 Fin root fillet
106 HF tuner
107 Anti-collision light power supply
108 Flight control system hydraulic accumulators
109 Starboard tailplane
110 Tailplane panels, interchangeable port and starboard
111 Fin torsion box structure
112 Steel leading edge strip
113 Dynamic pressure sensor
114 Aluminium honeycomb leading edge panel
115 VHF antenna
116 Anti-collision light
117 Static dischargers
118 Tail radar warning antennas
119 Aluminium honeycomb rudder construction
120 Rudder servo actuator
121 Radar warning power supply
122 ECM antenna fairing
123 Tail navigation light
124 Variable area exhaust nozzle
125 Nozzle flaps
126 Split trailing edge airbrake, upper and lower surfaces
127 Airbrake hydraulic jack
128 Port all-moving tailplane
129 Static dischargers
130 Graphite epoxy tailplane skin panels
131 Corrugated aluminium sub-structure
132 Tailplane pivot mounting
133 Tailplane servo actuator
134 Nozzle sealing fairing
135 Fueldraulic nozzle actuators
136 Afterburner tailpipe
137 Rear fuselage bulkheads
138 Rear engine mounting
139 Aft position light
140 Port body fairing
141 Runway arrester hook
142 Ventral fin, port and starboard
143 Port flaperon
144 Flaperon hinges
145 Aluminium honey comb flaperon construction
146 Static dischargers
147 Fixed trailing edge section
148 Port AIM-9M Sidewinder air-to-air missile
149 Missile launch rail
150 Wing tip launch rail fitting
151 Port navigation light
152 Port outer pylon/missile rail
153 AIM-120 Advanced Medium Range Air-to-Air Missile [AMRAAM]
154 Port AIM-7 Sparrow air-to-air missile
155 Pylon missile adaptor
156 Port centre pylon
157 Centre pylon hard point
158 Multi-spar wing structure
159 Leading edge flap rotary actuators
160 Port wing integral fuel tank
161 Inboard pylon hardpoint
162 Wing root attachment fishplates
163 Landing/taxying lamp
164 Main undercarriage shock absorber strut
165 Mainwheel leg strut
166 Articulated retraction/drag link
167 Mainwheel door
168 Port mainwheel, forward retracting
169 Port external fuel tank
170 Centreline 250 gal [300 US gal 1,136 lit] external fuel tank
171 AN/ALQ-184[V]2 [short] ECM pod
172 AN/ALQ-131 [shallow] ECM pod



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

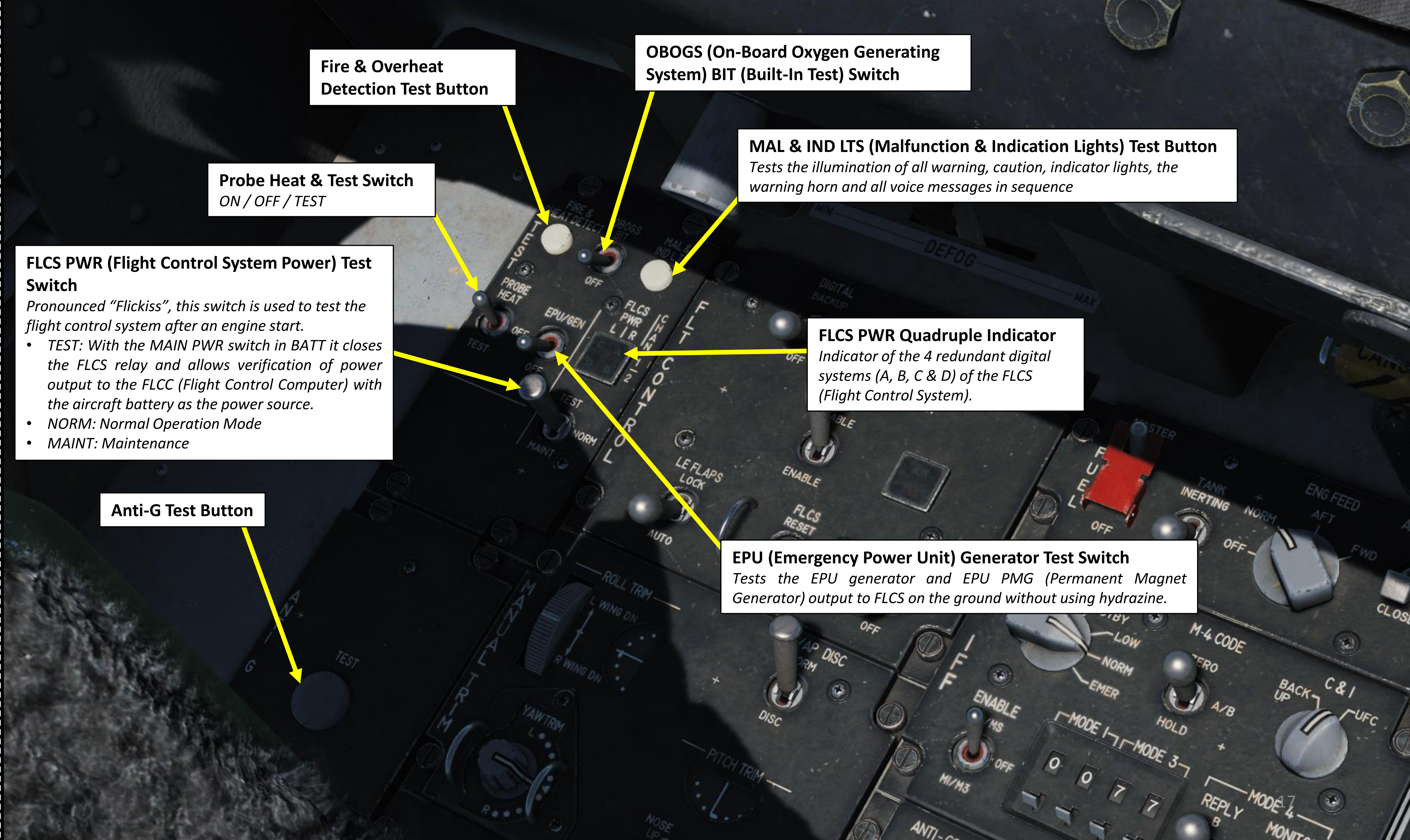


Environmental Sensor Pitot

In an emergency situation during the pilot escape initiation, the seat moves up the rails leaving the aircraft. Pitot tubes on the top of the seat near the parachute container are exposed to the airstream. Pitot and Static pressure inputs to the environmental sensing unit act on the speed and altitude transducers to establish the safest mode for the pilot involved, based on the speed and altitude environment

Magnetic Transmitter Unit

Used to generate a magnetic field used to determine HMD (Helmet-Mounted Display) position/orientation, which is used by the JHMCS (Joint Helmet-Mounted Cueing System).



Fire & Overheat Detection Test Button

OBOGS (On-Board Oxygen Generating System) BIT (Built-In Test) Switch

MAL & IND LTS (Malfunction & Indication Lights) Test Button
Tests the illumination of all warning, caution, indicator lights, the warning horn and all voice messages in sequence

Probe Heat & Test Switch
ON / OFF / TEST

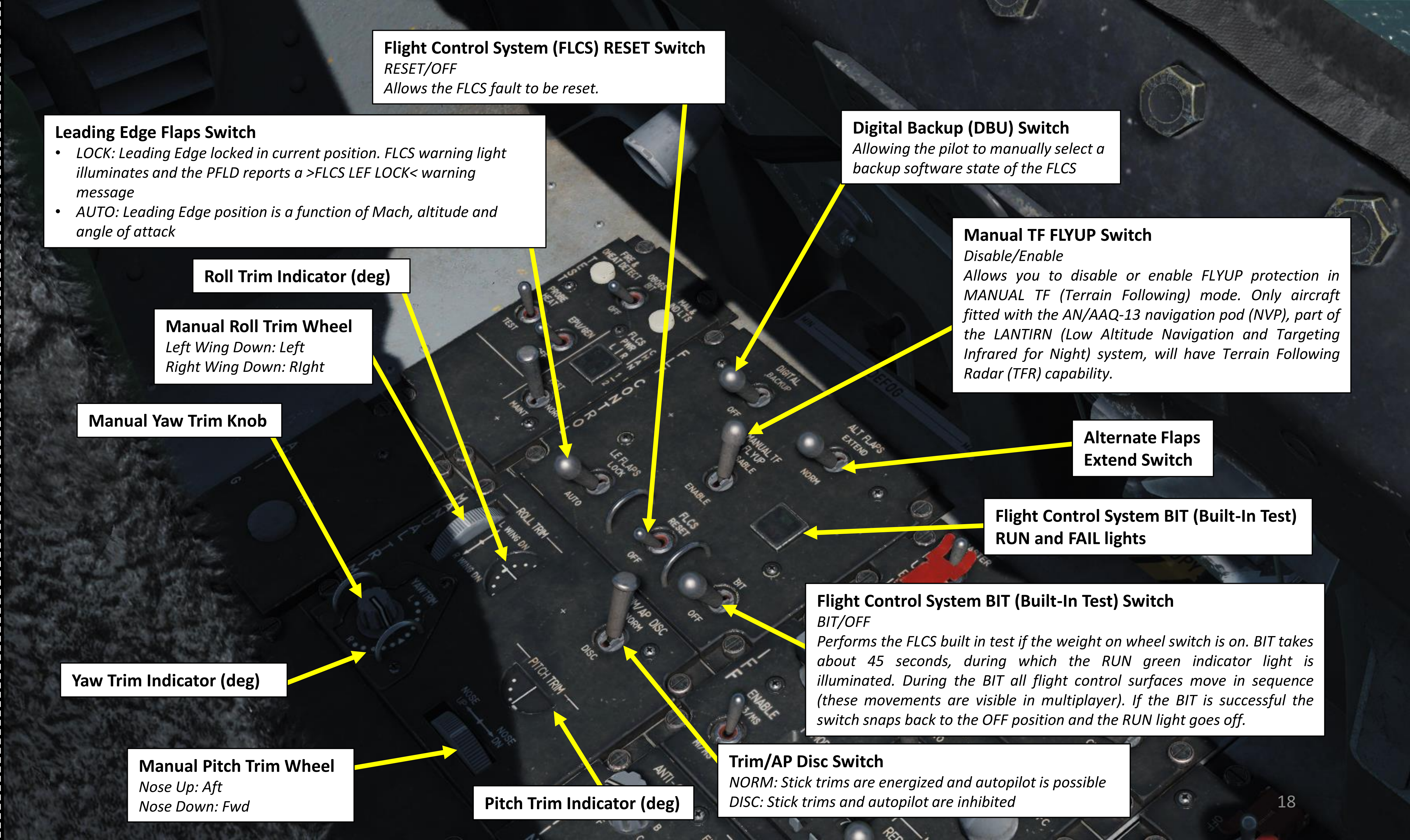
FLCS PWR (Flight Control System Power) Test Switch
Pronounced "Flickiss", this switch is used to test the flight control system after an engine start.

- *TEST: With the MAIN PWR switch in BATT it closes the FLCS relay and allows verification of power output to the FLCC (Flight Control Computer) with the aircraft battery as the power source.*
- *NORM: Normal Operation Mode*
- *MAINT: Maintenance*

FLCS PWR Quadruple Indicator
Indicator of the 4 redundant digital systems (A, B, C & D) of the FLCS (Flight Control System).

Anti-G Test Button

EPU (Emergency Power Unit) Generator Test Switch
Tests the EPU generator and EPU PMG (Permanent Magnet Generator) output to FLCS on the ground without using hydrazine.



Flight Control System (FLCS) RESET Switch
RESET/OFF
Allows the FLCS fault to be reset.

Leading Edge Flaps Switch
- *LOCK: Leading Edge locked in current position. FLCS warning light illuminates and the PFLD reports a >FLCS LEF LOCK< warning message*
- *AUTO: Leading Edge position is a function of Mach, altitude and angle of attack*

Digital Backup (DBU) Switch
Allowing the pilot to manually select a backup software state of the FLCS

Roll Trim Indicator (deg)

Manual Roll Trim Wheel
Left Wing Down: Left
Right Wing Down: RIght

Manual TF FLYUP Switch
Disable/Enable
Allows you to disable or enable FLYUP protection in MANUAL TF (Terrain Following) mode. Only aircraft fitted with the AN/AAQ-13 navigation pod (NVP), part of the LANTIRN (Low Altitude Navigation and Targeting Infrared for Night) system, will have Terrain Following Radar (TFR) capability.

Manual Yaw Trim Knob

Alternate Flaps Extend Switch

Flight Control System BIT (Built-In Test) RUN and FAIL lights

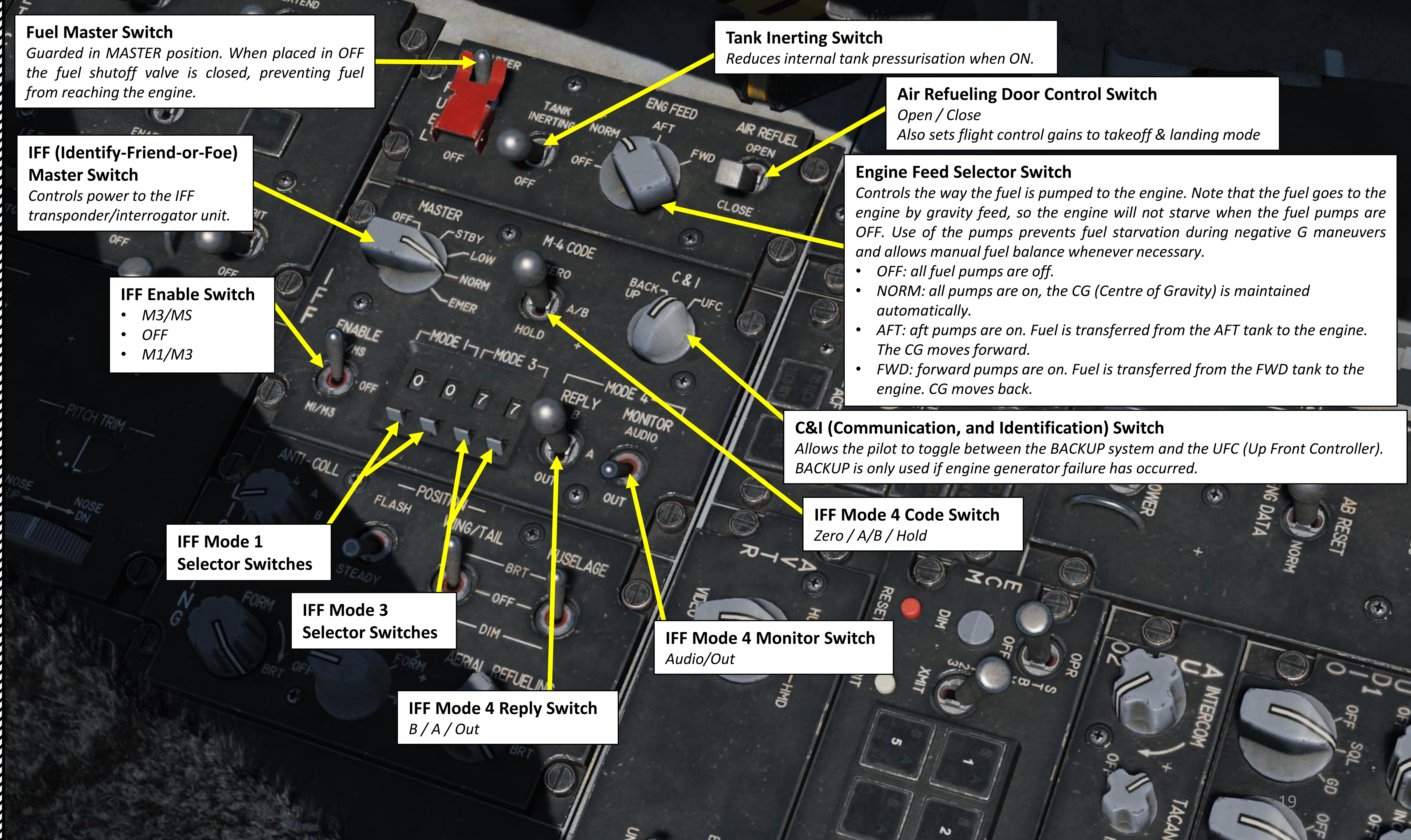
Flight Control System BIT (Built-In Test) Switch
BIT/OFF
Performs the FLCS built in test if the weight on wheel switch is on. BIT takes about 45 seconds, during which the RUN green indicator light is illuminated. During the BIT all flight control surfaces move in sequence (these movements are visible in multiplayer). If the BIT is successful the switch snaps back to the OFF position and the RUN light goes off.

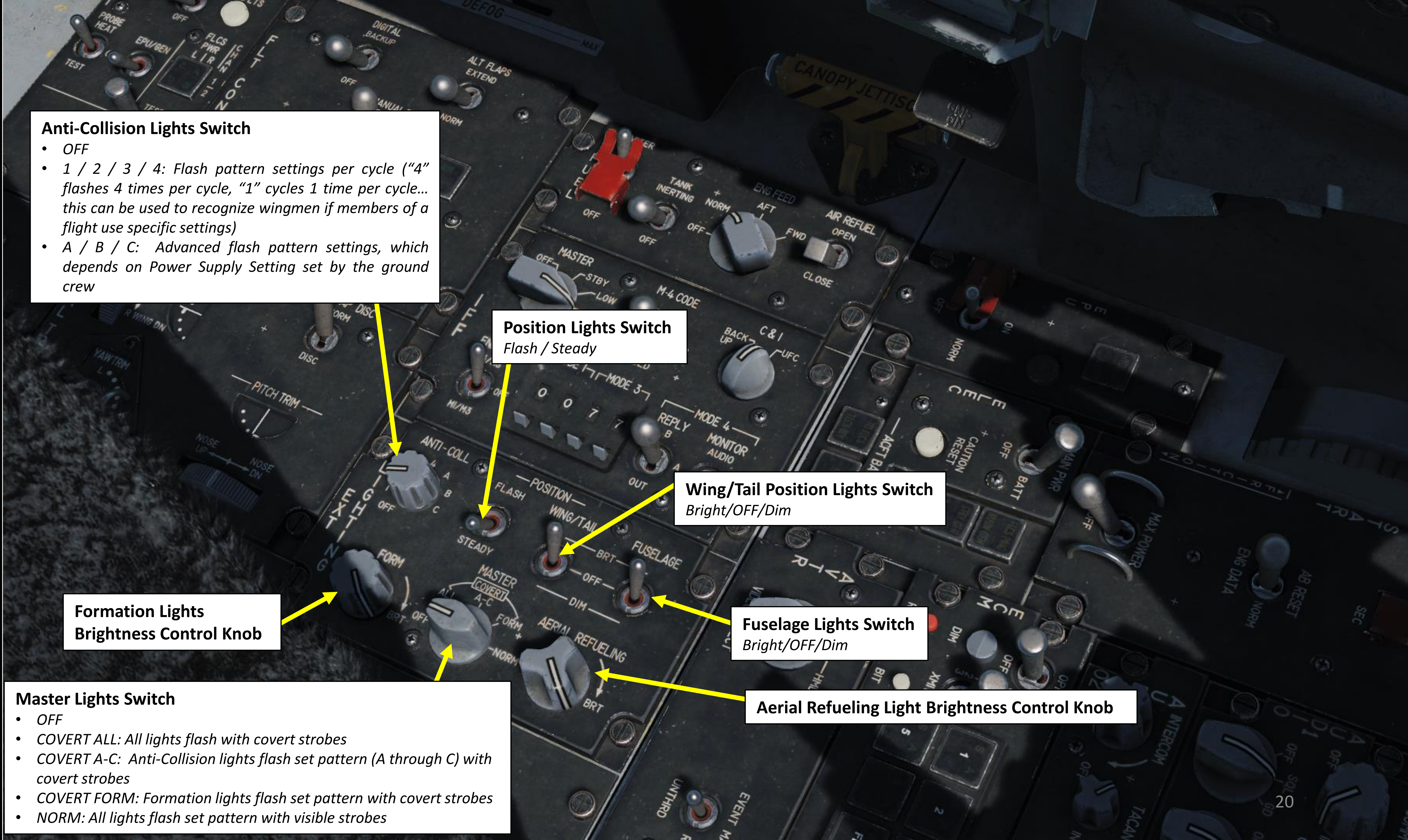
Yaw Trim Indicator (deg)

Manual Pitch Trim Wheel
Nose Up: Aft
Nose Down: Fwd

Pitch Trim Indicator (deg)

Trim/AP Disc Switch
NORM: Stick trims are energized and autopilot is possible
DISC: Stick trims and autopilot are inhibited


Fuel Master Switch
Guarded in MASTER position. When placed in OFF the fuel shutoff valve is closed, preventing fuel from reaching the engine.
Tank Inerting Switch
Reduces internal tank pressurisation when ON.
Air Refueling Door Control Switch
Open / Close
Also sets flight control gains to takeoff & landing mode
IFF (Identify-Friend-or-Foe) Master Switch
Controls power to the IFF transponder/interrogator unit.
Engine Feed Selector Switch
Controls the way the fuel is pumped to the engine. Note that the fuel goes to the engine by gravity feed, so the engine will not starve when the fuel pumps are OFF. Use of the pumps prevents fuel starvation during negative G maneuvers and allows manual fuel balance whenever necessary.
- *OFF: all fuel pumps are off.*
- *NORM: all pumps are on, the CG (Centre of Gravity) is maintained automatically.*
- *AFT: aft pumps are on. Fuel is transferred from the AFT tank to the engine. The CG moves forward.*
- *FWD: forward pumps are on. Fuel is transferred from the FWD tank to the engine. CG moves back.*
IFF Enable Switch
- *M3/MS*
- *OFF*
- *M1/M3*
C&I (Communication, and Identification) Switch
Allows the pilot to toggle between the BACKUP system and the UFC (Up Front Controller). BACKUP is only used if engine generator failure has occurred.
IFF Mode 4 Code Switch
Zero / A/B / Hold
IFF Mode 1 Selector Switches
IFF Mode 3 Selector Switches
IFF Mode 4 Monitor Switch
Audio/Out
IFF Mode 4 Reply Switch
B / A / Out



Anti-Collision Lights Switch
- *OFF*
- *1 / 2 / 3 / 4: Flash pattern settings per cycle ("4" flashes 4 times per cycle, "1" cycles 1 time per cycle… this can be used to recognize wingmen if members of a flight use specific settings)*
- *A / B / C: Advanced flash pattern settings, which depends on Power Supply Setting set by the ground crew*

Position Lights Switch
Flash / Steady

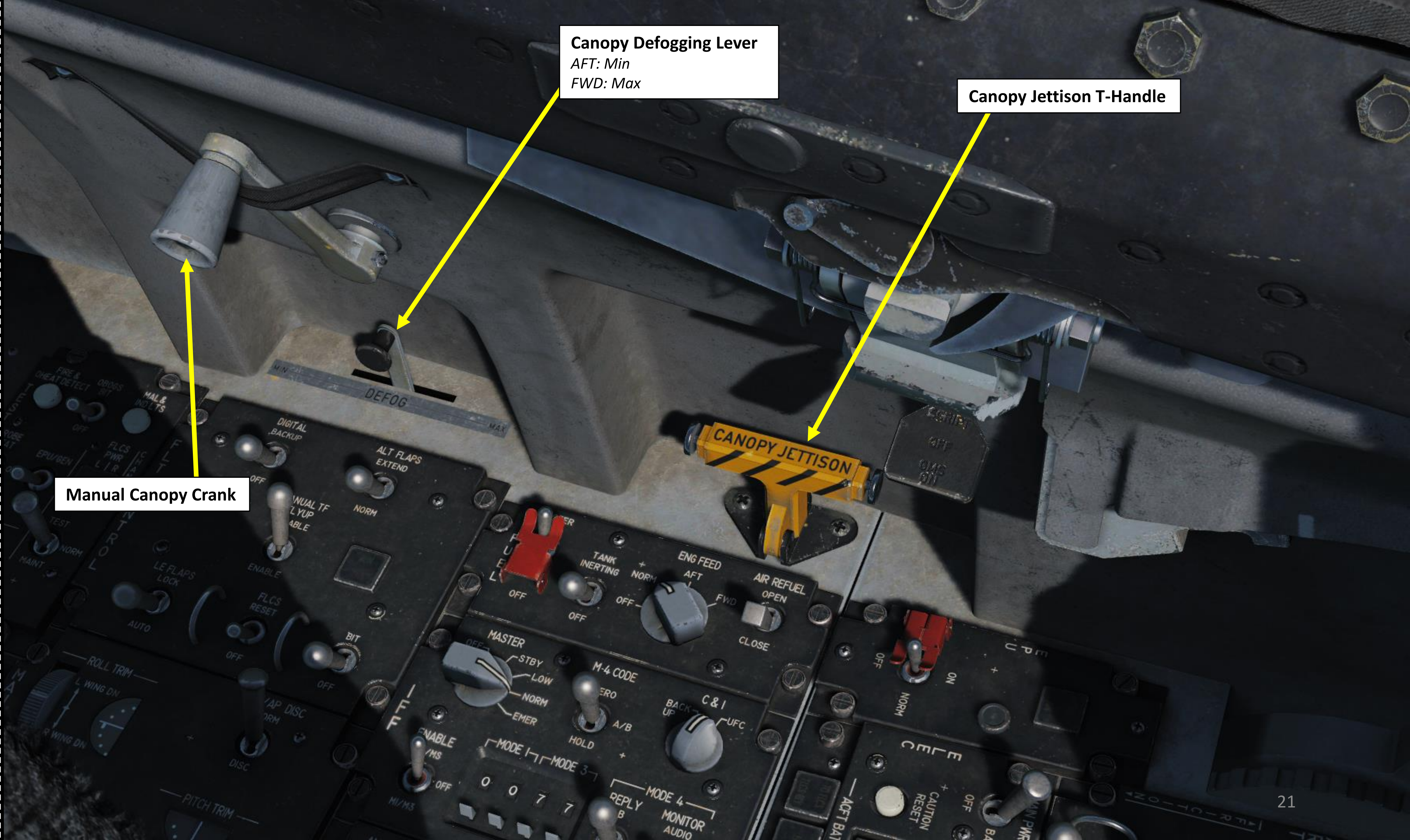
Wing/Tail Position Lights Switch
Bright/OFF/Dim

Formation Lights Brightness Control Knob

Fuselage Lights Switch
Bright/OFF/Dim

Master Lights Switch
- *OFF*
- *COVERT ALL: All lights flash with covert strobes*
- *COVERT A-C: Anti-Collision lights flash set pattern (A through C) with covert strobes*
- *COVERT FORM: Formation lights flash set pattern with covert strobes*
- *NORM: All lights flash set pattern with visible strobes*

Aerial Refueling Light Brightness Control Knob


Canopy Defogging Lever
AFT: Min
FWD: Max
Canopy Jettison T-Handle
Manual Canopy Crank

EPU (Emergency Power Unit) Switch

The EPU is a hydrazine-powered, self-contained unit that can provide emergency hydraulic and electrical power, when just bleed air is not enough, for about 10 to 15 minutes. You would most often use this if you lose your engine, and the EPU would provide power to the hydraulic and electrical systems. In a way, it's like a very limited Auxiliary Power Unit, or APU.

The main requirements for the EPU are that it should be simple, maintenance-free, supply power immediately and consistently for the required time. Use of Hydrazine assures this while requiring careful handling, but it is very toxic and inflammable.

EPU RUN Light

- *Illuminates when the EPU turbine runs within the proper range and the EPU hydraulic pressure is above 2000 psi*

EPU Hydrazine/Air Light

- *AIR light illuminates when the EPU is engaged and running on engine bleed air and not Hydrazine.*
- *HYDRAZINE light illuminates when hydrazine is used to power the turbine.*

Main Power Switch

- *FWD: MAIN (MAIN generator and standby generator provide power to the aircraft systems)*
- *MID: BATT (aircraft battery is connected and the battery bus is powered)*
- *AFT: OFF*

CAUTION Reset Button

Resets an ELEC fault, displayed as the amber ELEC SYS caution light.

TO FLCS (Flight Control System) Indicator

When illuminated, battery power is going to one or more FLCS branches. Basically the battery is powering the FLCS and will deplete fast.

FLCS (Flight Control System) PMG Indicator

- *Illuminates in flight if none of the FLCS branches are receiving power from the FLCS PMG (Permanent Magnet Generator).*
- *Illuminates on ground after 60 seconds of weight-on-wheels if one or more of the FLCS branches aren't receiving power from the FLCS PMG.*

MAIN GEN Indicator

When illuminated, the main generator is not connected to the non-essential AC buses

STBY GEN Indicator

When illuminated, the standby generator power is not available

FLCS RLY (Relay) Indicator

When illuminated, one or more FLCS branches aren't getting adequate voltage (at least 20 Volts) from the battery .

EPU GEN Indicator

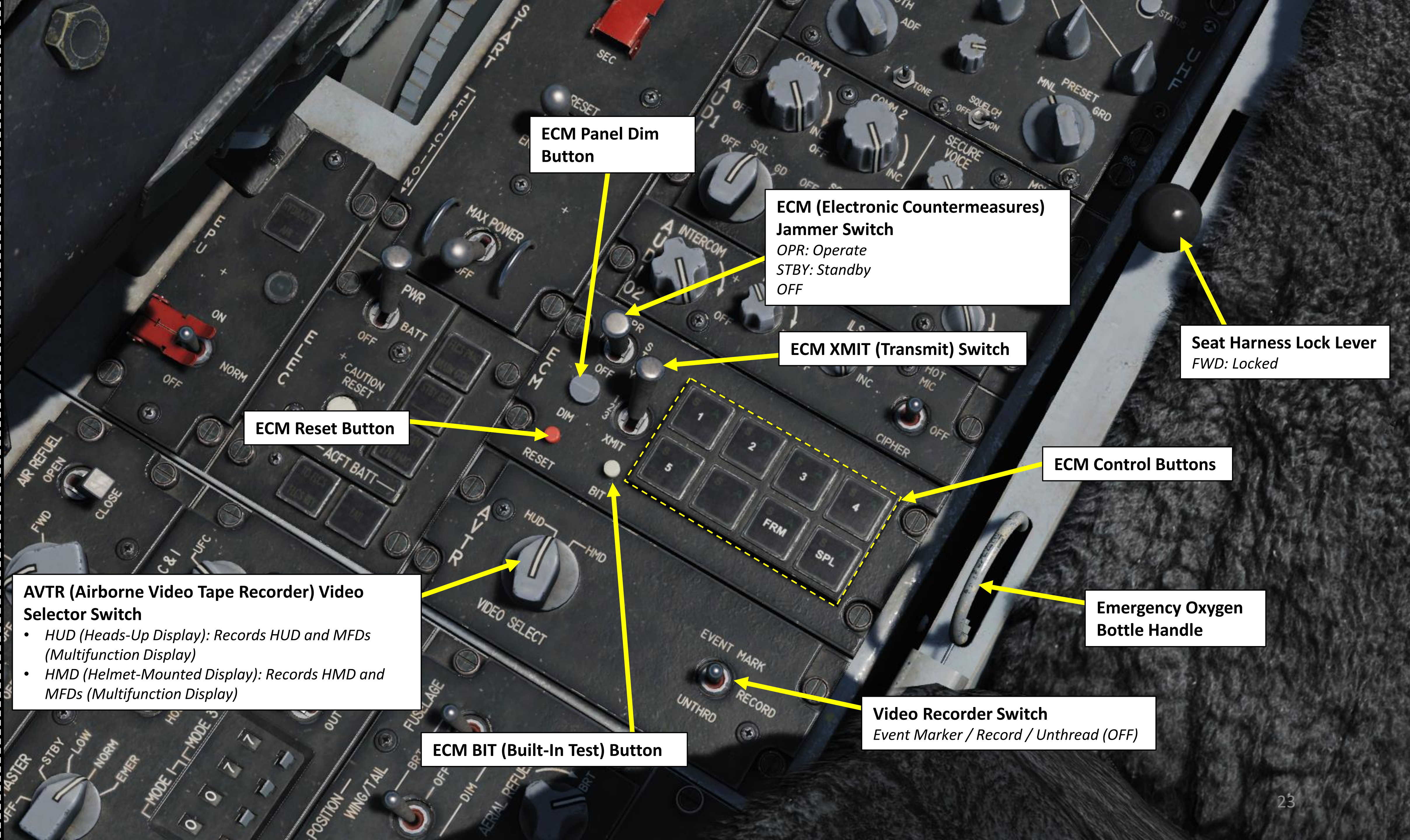
When illuminated, EPU has been commanded ON but the EPU generator is not providing power to the emergency buses. Be aware that the light does not function with the EPU in OFF (Weight On Wheel ON) and the engine running.

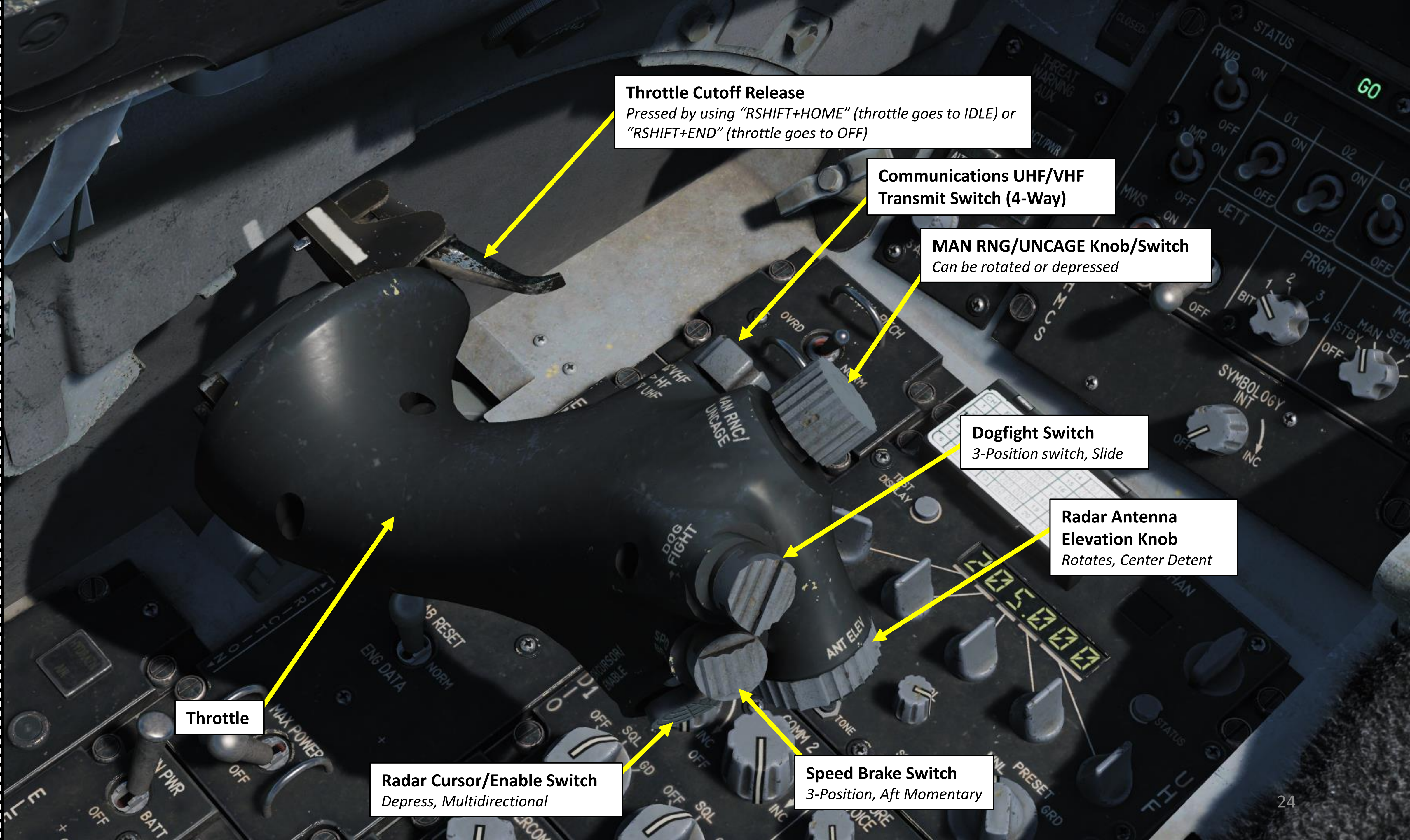
ACFT BATT FAIL Indicator

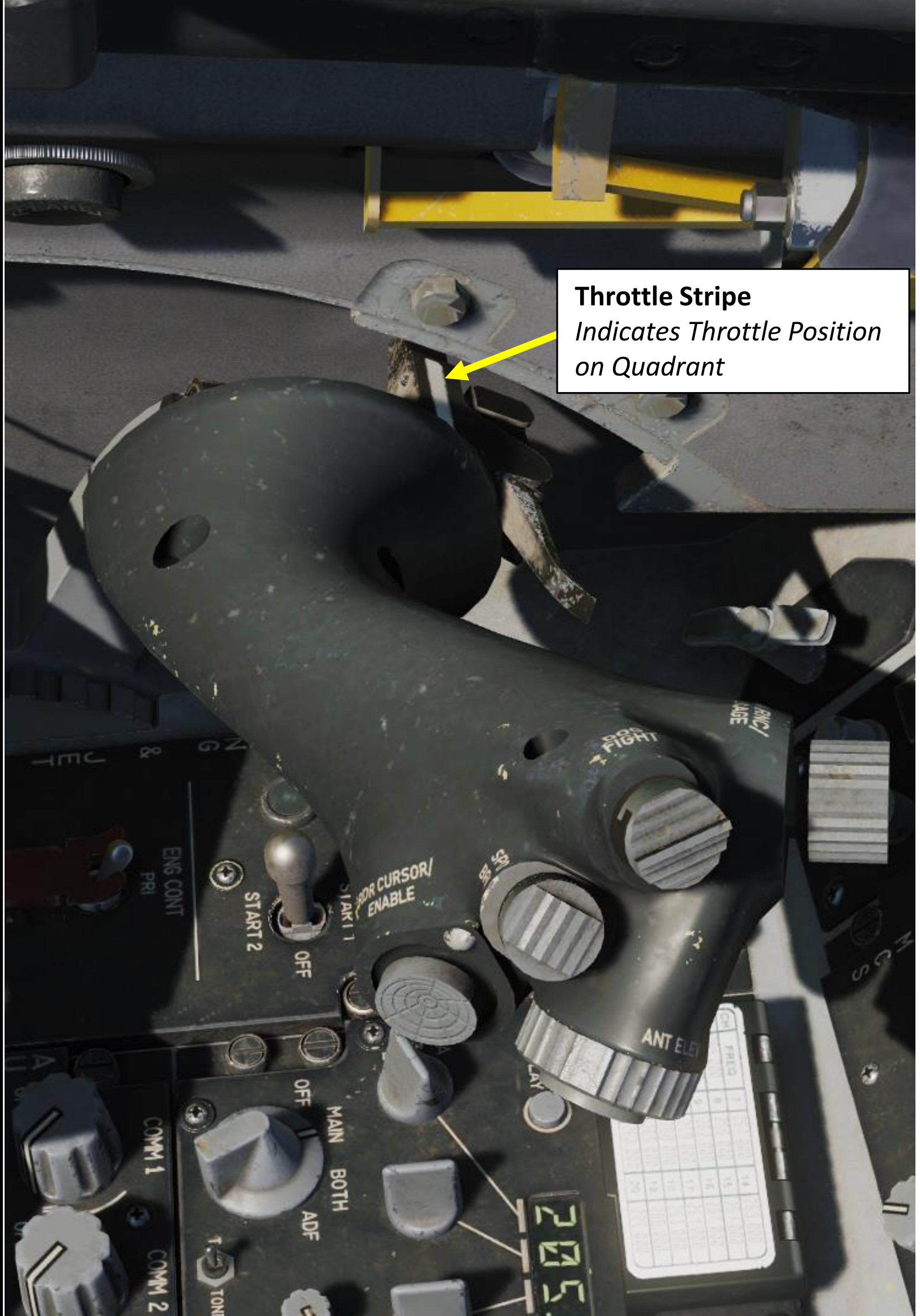
When illuminated, indicates there is less than 20 volts in the battery when airborne or a battery failure occurred on the ground.

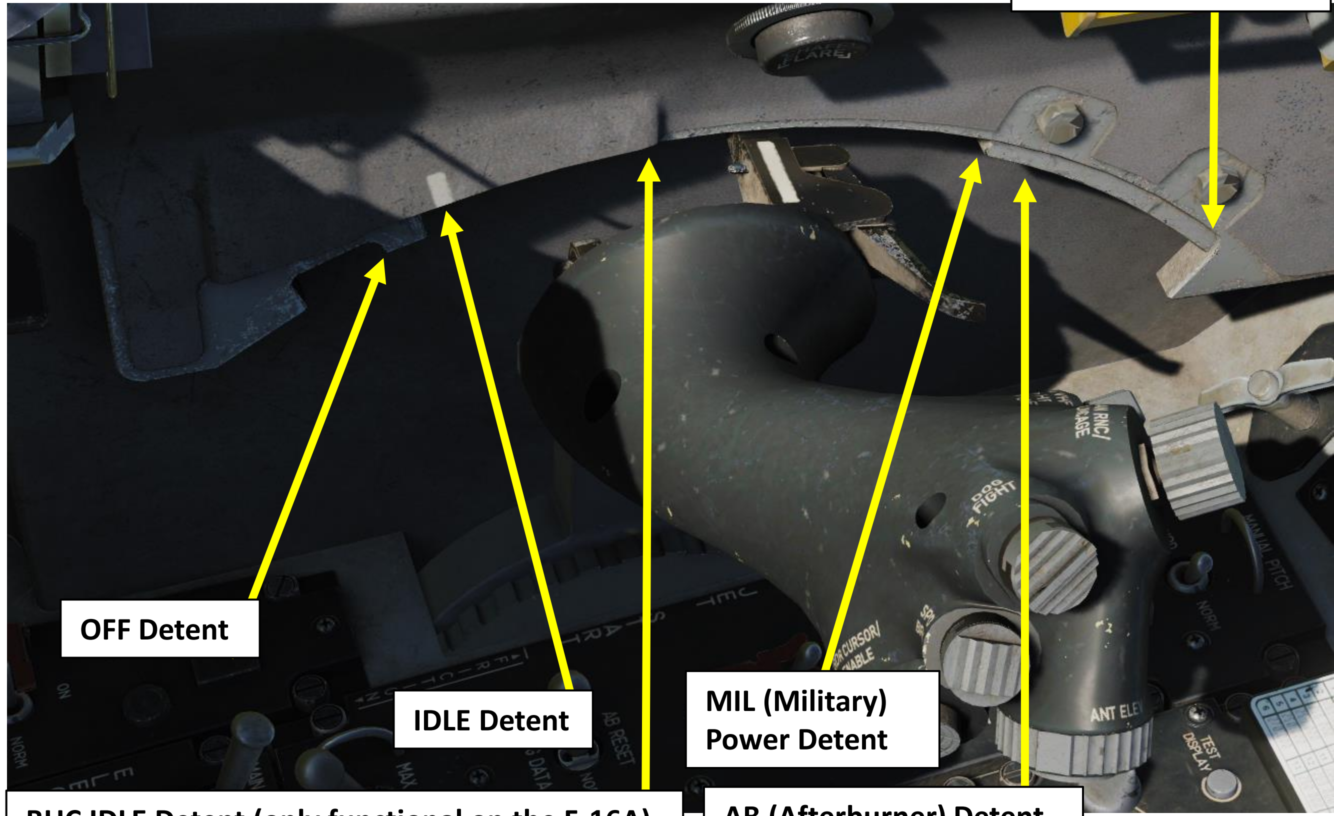
EPU PMG Indicator

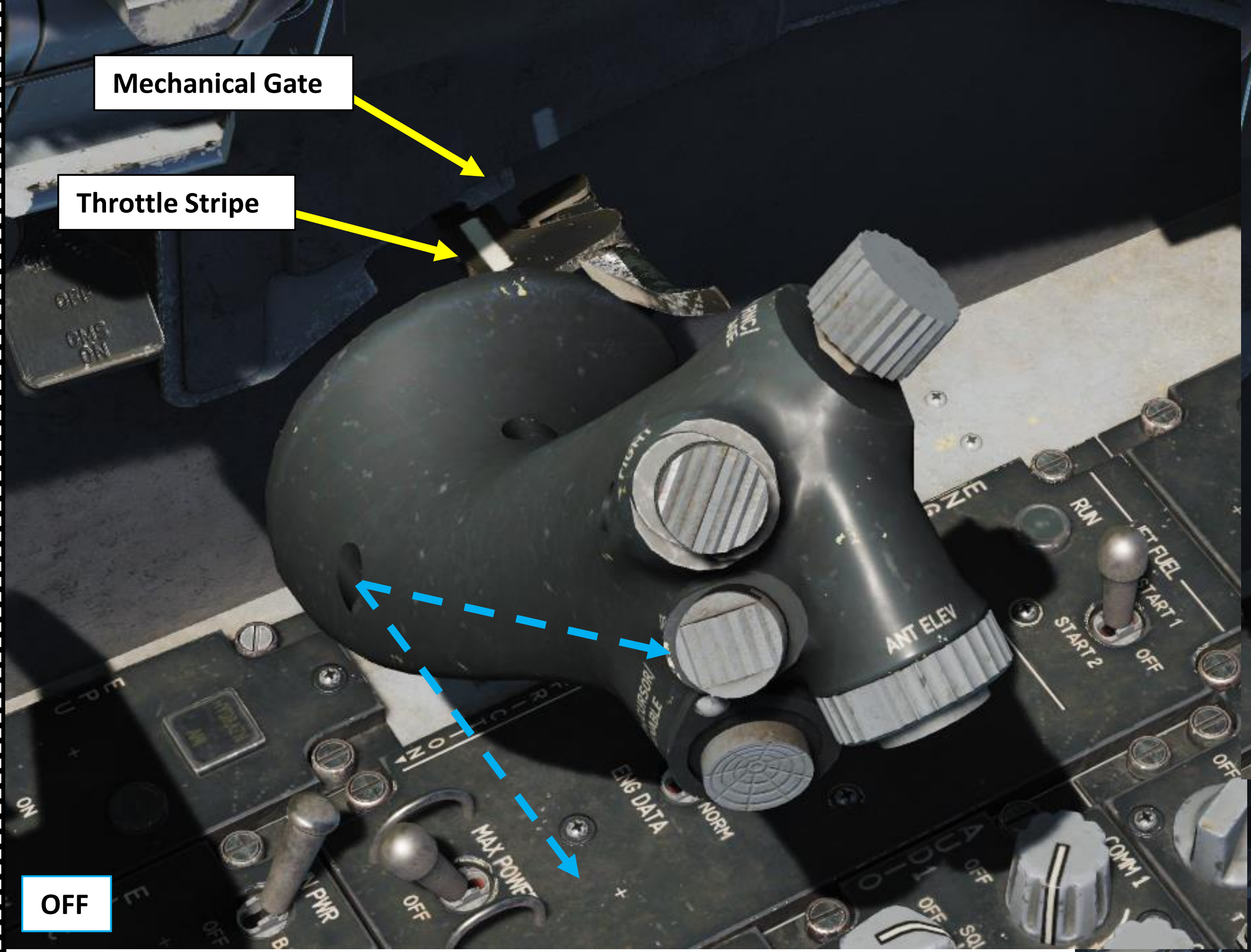
When illuminated, EPU has been commanded ON but the EPU is unable to provide power to the FLCS branches (normally through the EPU Permanent Magnet Generator).

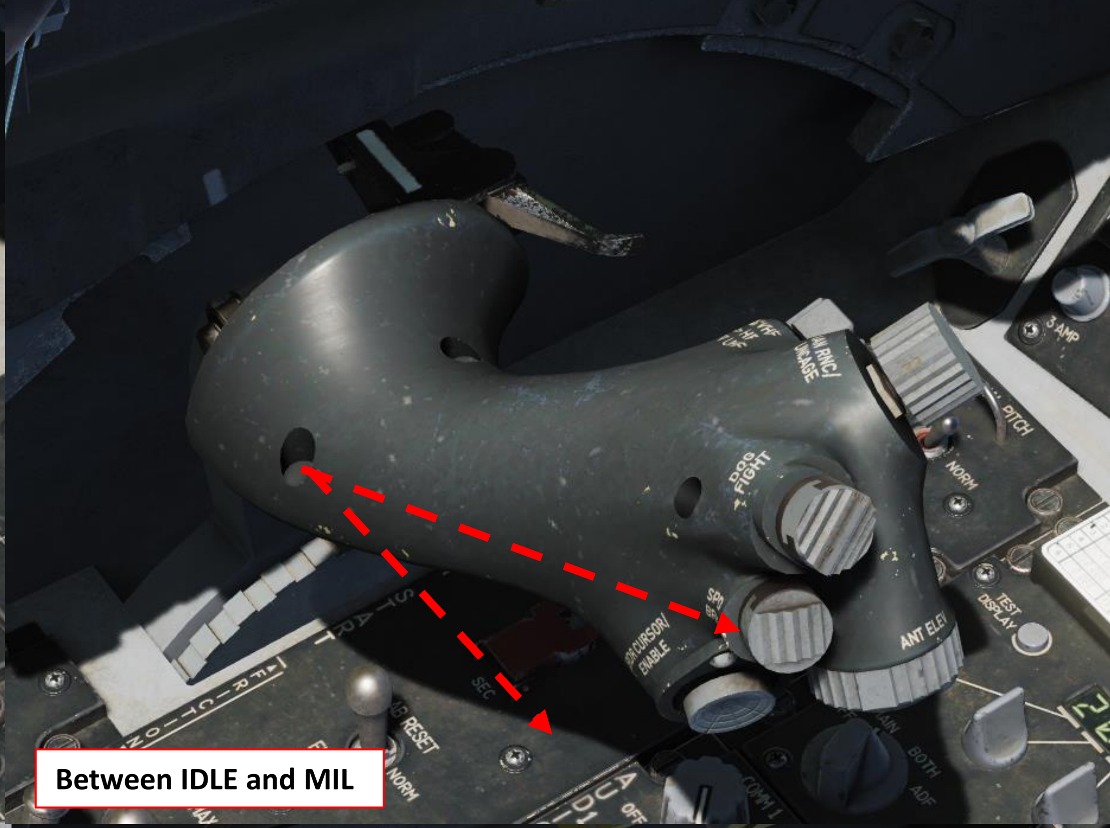

ECM Panel Dim Button
ECM (Electronic Countermeasures) Jammer Switch
OPR: Operate
STBY: Standby
OFF
ECM XMIT (Transmit) Switch
Seat Harness Lock Lever
FWD: Locked
ECM Reset Button
ECM Control Buttons
AVTR (Airborne Video Tape Recorder) Video Selector Switch
• HUD (Heads-Up Display): Records HUD and MFDs (Multifunction Display)
• HMD (Helmet-Mounted Display): Records HMD and MFDs (Multifunction Display)
Emergency Oxygen Bottle Handle
Video Recorder Switch
Event Marker / Record / Unthread (OFF)
ECM BIT (Built-In Test) Button


Throttle Cutoff Release
Pressed by using "RSHIFT+HOME" (throttle goes to IDLE) or "RSHIFT+END" (throttle goes to OFF)
Communications UHF/VHF Transmit Switch (4-Way)
MAN RNG/UNCAGE Knob/Switch
Can be rotated or depressed
Dogfight Switch
3-Position switch, Slide
Radar Antenna Elevation Knob
Rotates, Center Detent
Throttle
Radar Cursor/Enable Switch
Depress, Multidirectional
Speed Brake Switch
3-Position, Aft Momentary

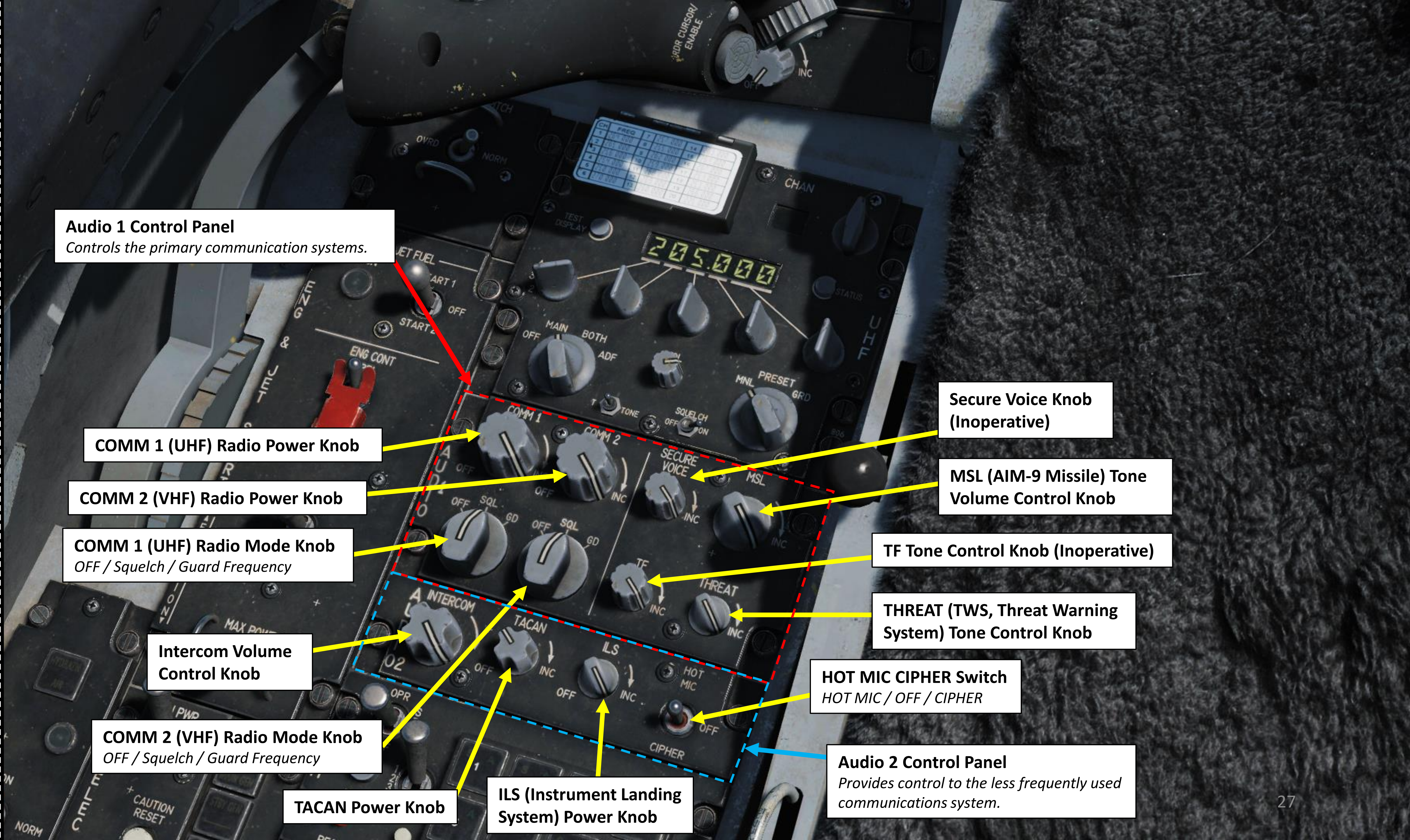

Throttle Stripe
Indicates Throttle Position on Quadrant


MAX AB (Afterburner) Detent
OFF Detent
IDLE Detent
MIL (Military) Power Detent
BUC IDLE Detent (only functional on the F-16A)
The backup control (BUC) for the DEEC (Digital Electronic Engine Control) system was a simple hydromechanical system provided in the event a major malfunction occurs in the DEEC.
AB (Afterburner) Detent



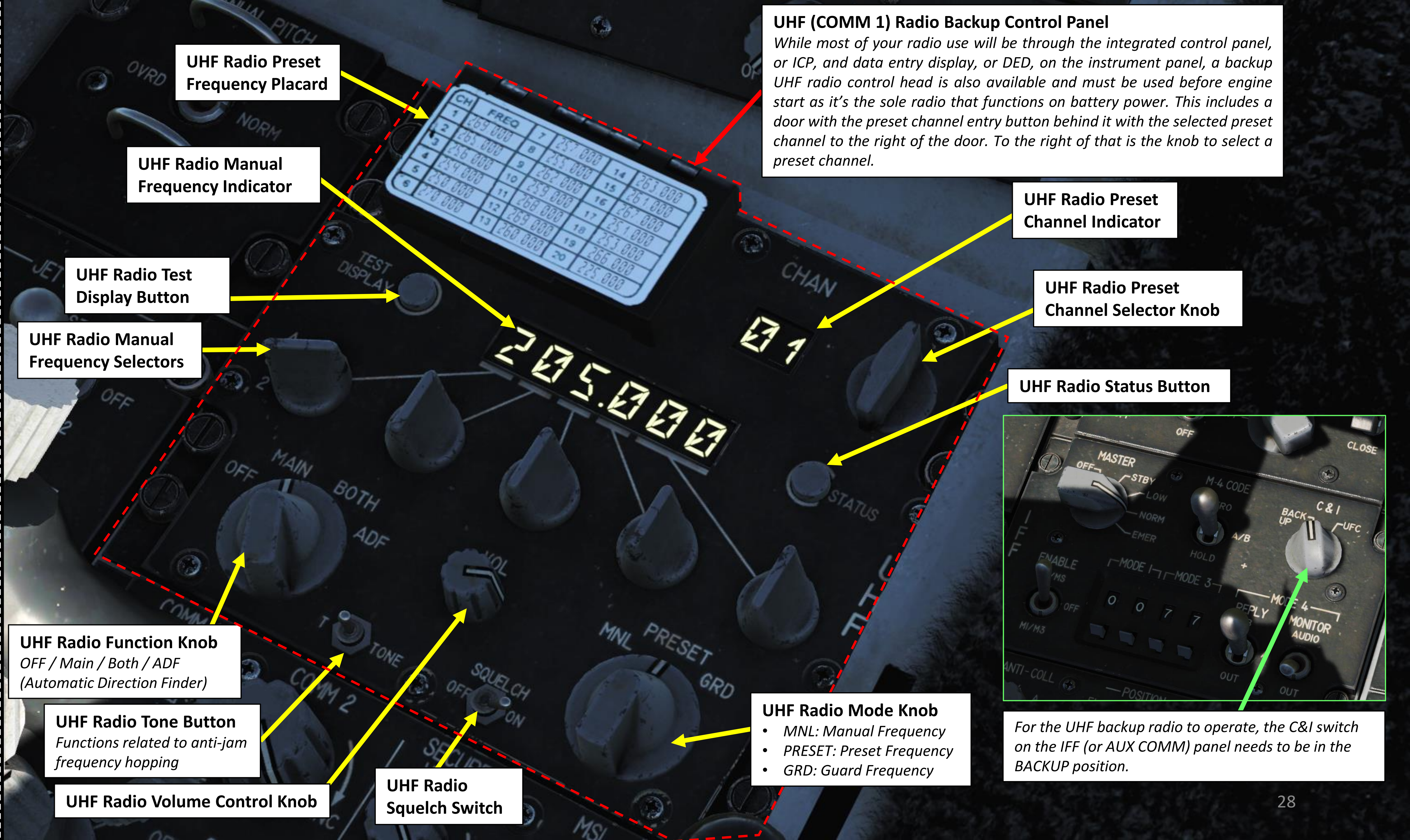


The geometry of the throttle quadrant means that depending on the position on the throttle on the quadrant, the orientation of the throttle must be varied to access certain power detents. As an example, the throttle must be angled up to go from the OFF to the IDLE detent due to the mechanical gate. The throttle must also be angled to go in the AB detent range.

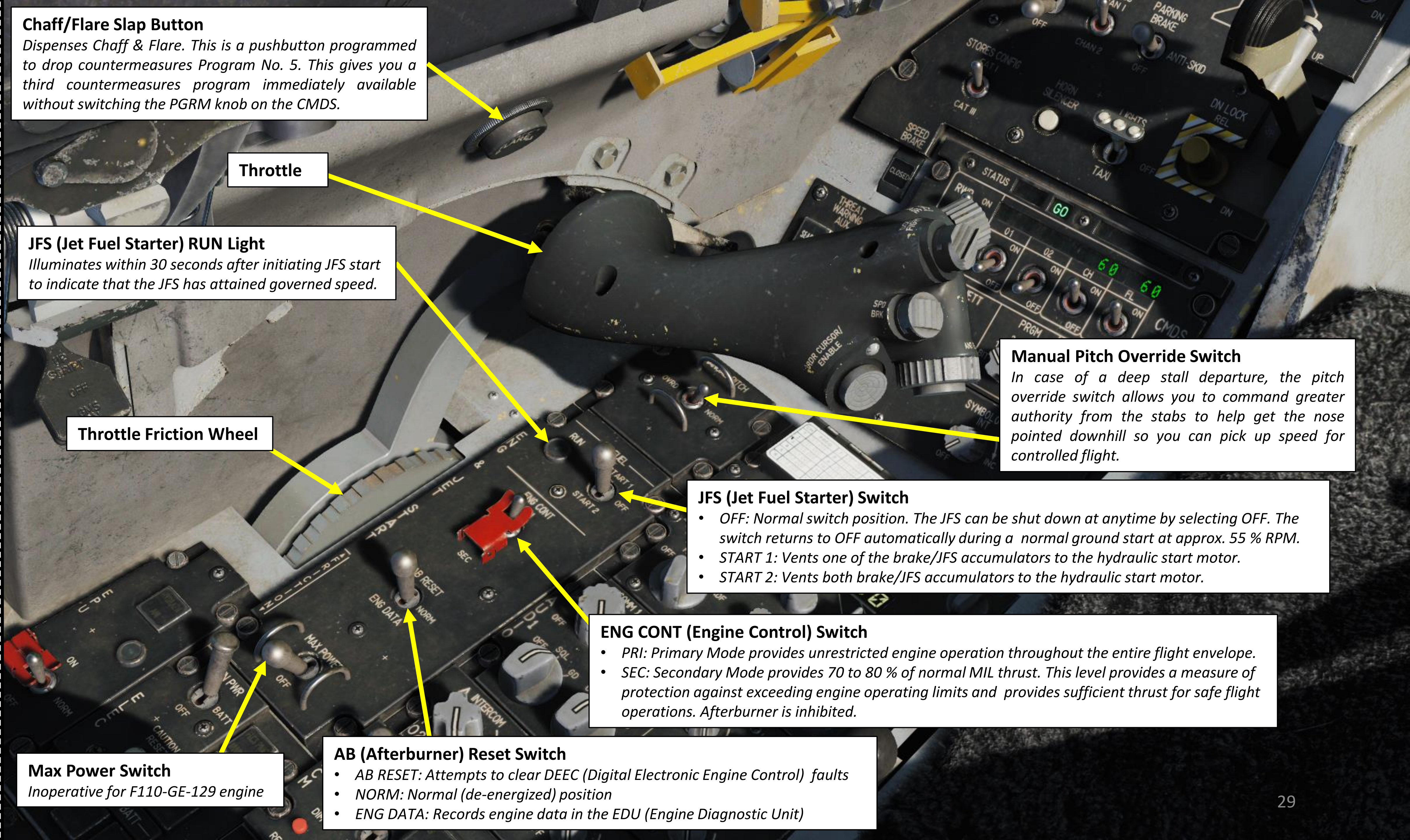

Audio 1 Control Panel
Controls the primary communication systems.
COMM 1 (UHF) Radio Power Knob
COMM 2 (VHF) Radio Power Knob
COMM 1 (UHF) Radio Mode Knob
OFF / Squelch / Guard Frequency
Intercom Volume Control Knob
COMM 2 (VHF) Radio Mode Knob
OFF / Squelch / Guard Frequency
TACAN Power Knob
ILS (Instrument Landing System) Power Knob
Secure Voice Knob (Inoperative)
MSL (AIM-9 Missile) Tone Volume Control Knob
TF Tone Control Knob (Inoperative)
THREAT (TWS, Threat Warning System) Tone Control Knob
HOT MIC CIPHER Switch
HOT MIC / OFF / CIPHER
Audio 2 Control Panel
Provides control to the less frequently used communications system.

UHF (COMM 1) Radio Backup Control Panel

While most of your radio use will be through the integrated control panel, or ICP, and data entry display, or DED, on the instrument panel, a backup UHF radio control head is also available and must be used before engine start as it's the sole radio that functions on battery power. This includes a door with the preset channel entry button behind it with the selected preset channel to the right of the door. To the right of that is the knob to select a preset channel.



For the UHF backup radio to operate, the C&I switch on the IFF (or AUX COMM) panel needs to be in the BACKUP position.



Chaff/Flare Slap Button
Dispenses Chaff & Flare. This is a pushbutton programmed to drop countermeasures Program No. 5. This gives you a third countermeasures program immediately available without switching the PGRM knob on the CMDS.

Throttle

JFS (Jet Fuel Starter) RUN Light
Illuminates within 30 seconds after initiating JFS start to indicate that the JFS has attained governed speed.

Throttle Friction Wheel

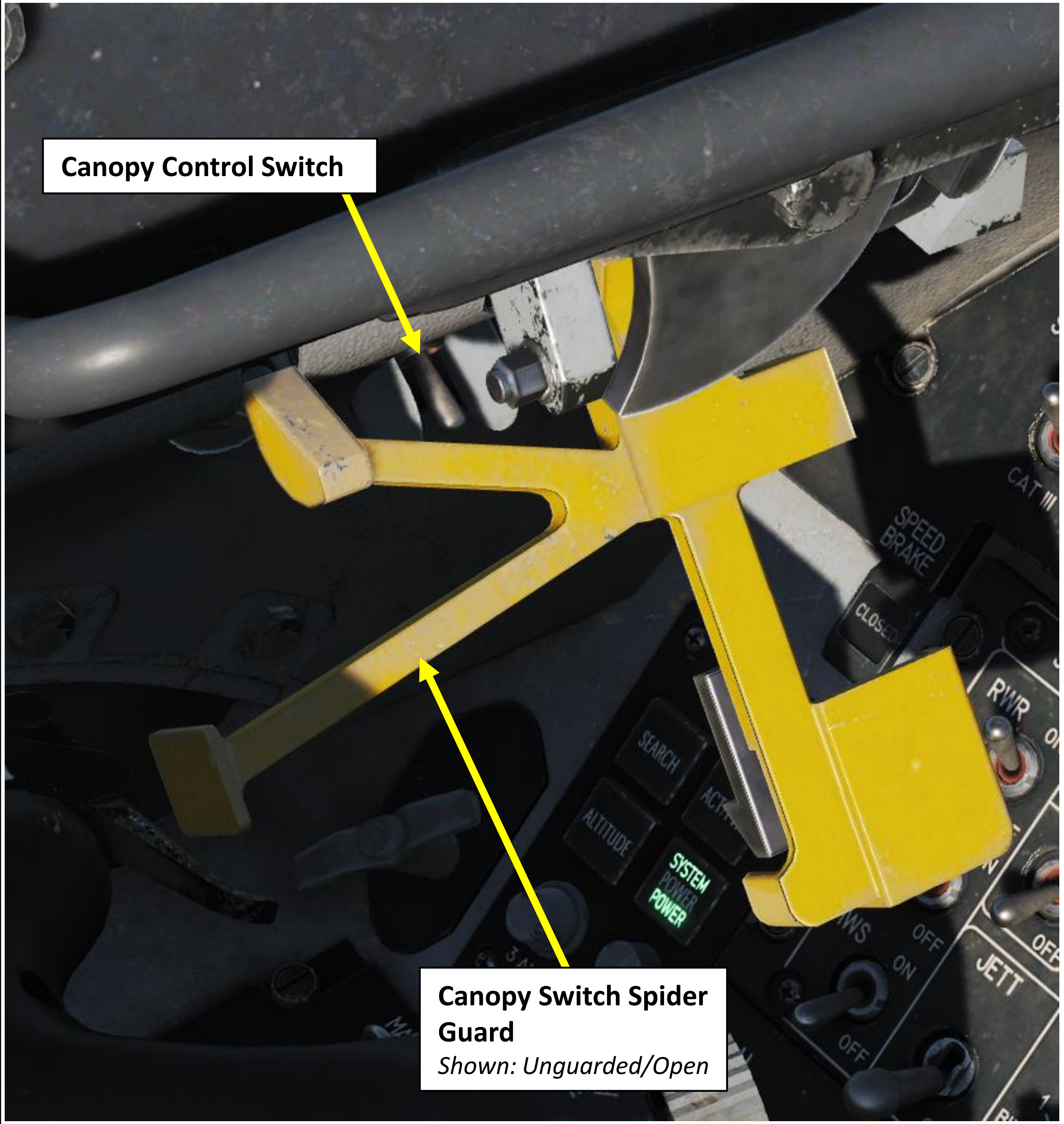
Manual Pitch Override Switch
In case of a deep stall departure, the pitch override switch allows you to command greater authority from the stabs to help get the nose pointed downhill so you can pick up speed for controlled flight.

JFS (Jet Fuel Starter) Switch
- *OFF: Normal switch position. The JFS can be shut down at anytime by selecting OFF. The switch returns to OFF automatically during a normal ground start at approx. 55 % RPM.*
- *START 1: Vents one of the brake/JFS accumulators to the hydraulic start motor.*
- *START 2: Vents both brake/JFS accumulators to the hydraulic start motor.*

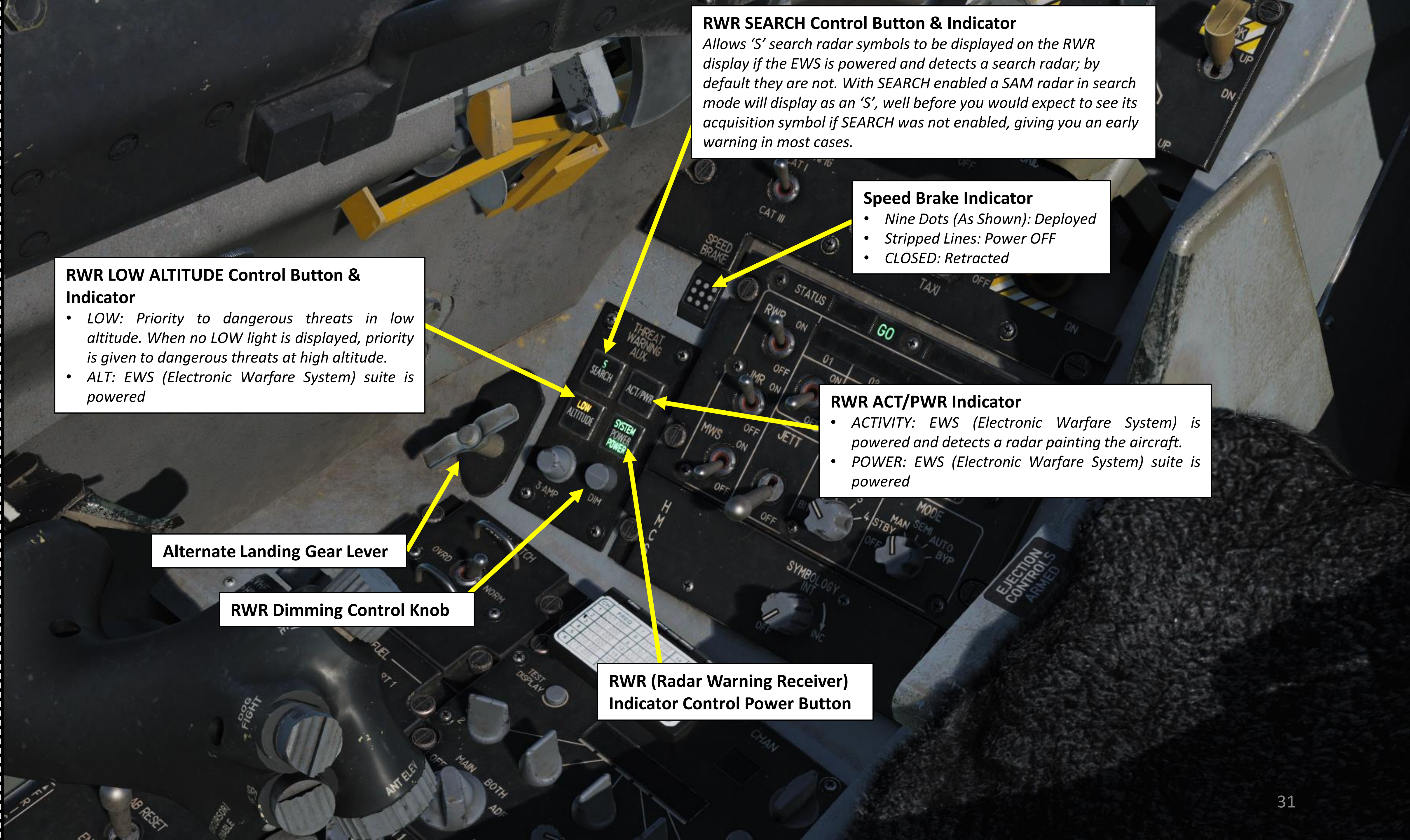
ENG CONT (Engine Control) Switch
- *PRI: Primary Mode provides unrestricted engine operation throughout the entire flight envelope.*
- *SEC: Secondary Mode provides 70 to 80 % of normal MIL thrust. This level provides a measure of protection against exceeding engine operating limits and provides sufficient thrust for safe flight operations. Afterburner is inhibited.*

Max Power Switch
Inoperative for F110-GE-129 engine

AB (Afterburner) Reset Switch
- *AB RESET: Attempts to clear DEEC (Digital Electronic Engine Control) faults*
- *NORM: Normal (de-energized) position*
- *ENG DATA: Records engine data in the EDU (Engine Diagnostic Unit)*


Canopy Control Switch
Canopy Switch Spider Guard
Shown: Unguarded/Open


Canopy Switch Spider Guard
Shown: Guarded/Closed



RWR SEARCH Control Button & Indicator

Allows 'S' search radar symbols to be displayed on the RWR display if the EWS is powered and detects a search radar; by default they are not. With SEARCH enabled a SAM radar in search mode will display as an 'S', well before you would expect to see its acquisition symbol if SEARCH was not enabled, giving you an early warning in most cases.

Speed Brake Indicator

- *Nine Dots (As Shown): Deployed*
- *Stripped Lines: Power OFF*
- *CLOSED: Retracted*

RWR LOW ALTITUDE Control Button & Indicator

- *LOW: Priority to dangerous threats in low altitude. When no LOW light is displayed, priority is given to dangerous threats at high altitude.*
- *ALT: EWS (Electronic Warfare System) suite is powered*

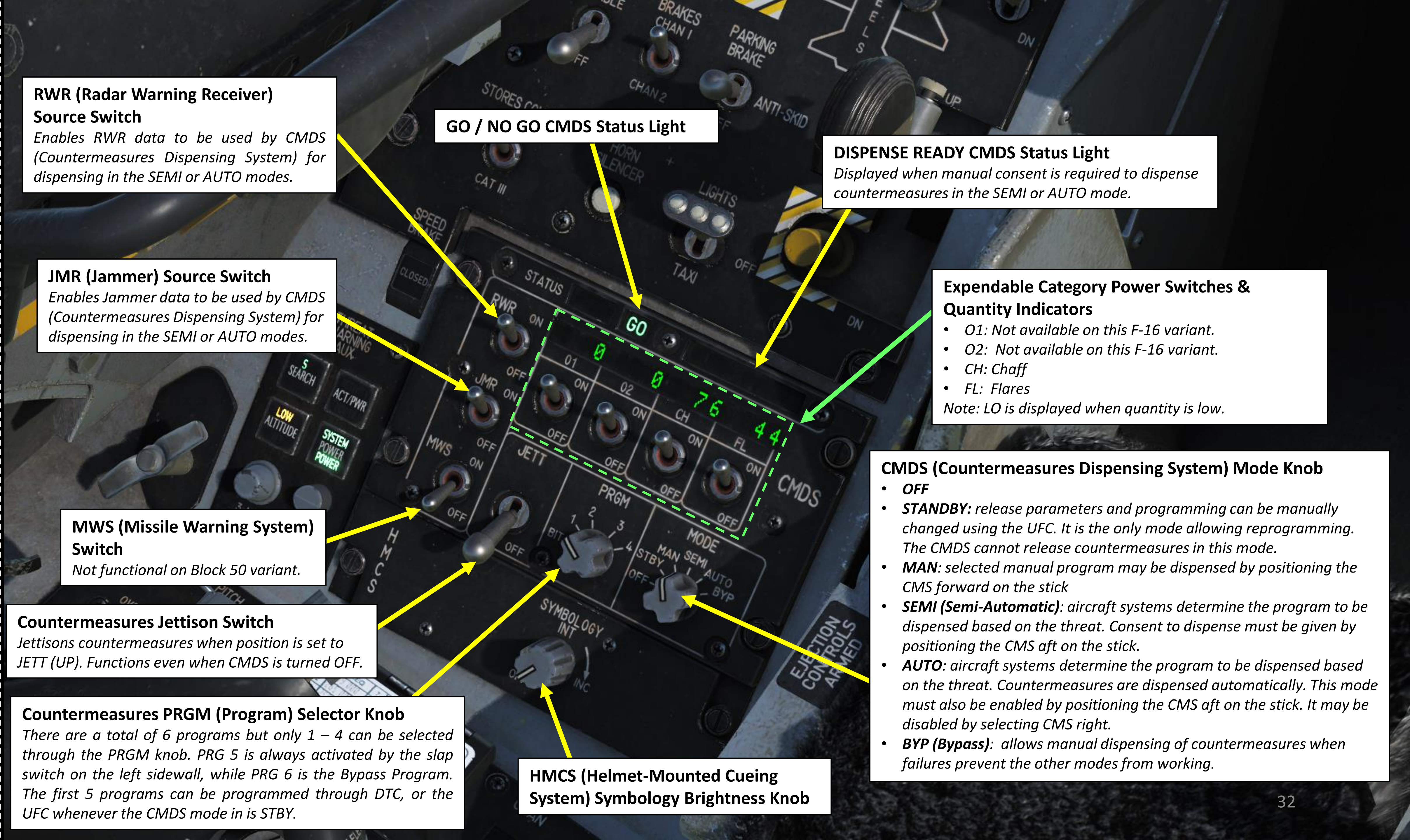
RWR ACT/PWR Indicator

- *ACTIVITY: EWS (Electronic Warfare System) is powered and detects a radar painting the aircraft.*
- *POWER: EWS (Electronic Warfare System) suite is powered*

Alternate Landing Gear Lever

RWR Dimming Control Knob

RWR (Radar Warning Receiver) Indicator Control Power Button



RWR (Radar Warning Receiver) Source Switch
Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

GO / NO GO CMDS Status Light

DISPENSE READY CMDS Status Light
Displayed when manual consent is required to dispense countermeasures in the SEMI or AUTO mode.

JMR (Jammer) Source Switch
Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

Expendable Category Power Switches & Quantity Indicators
- *O1: Not available on this F-16 variant.*
- *O2: Not available on this F-16 variant.*
- *CH: Chaff*
- *FL: Flares*

Note: LO is displayed when quantity is low.

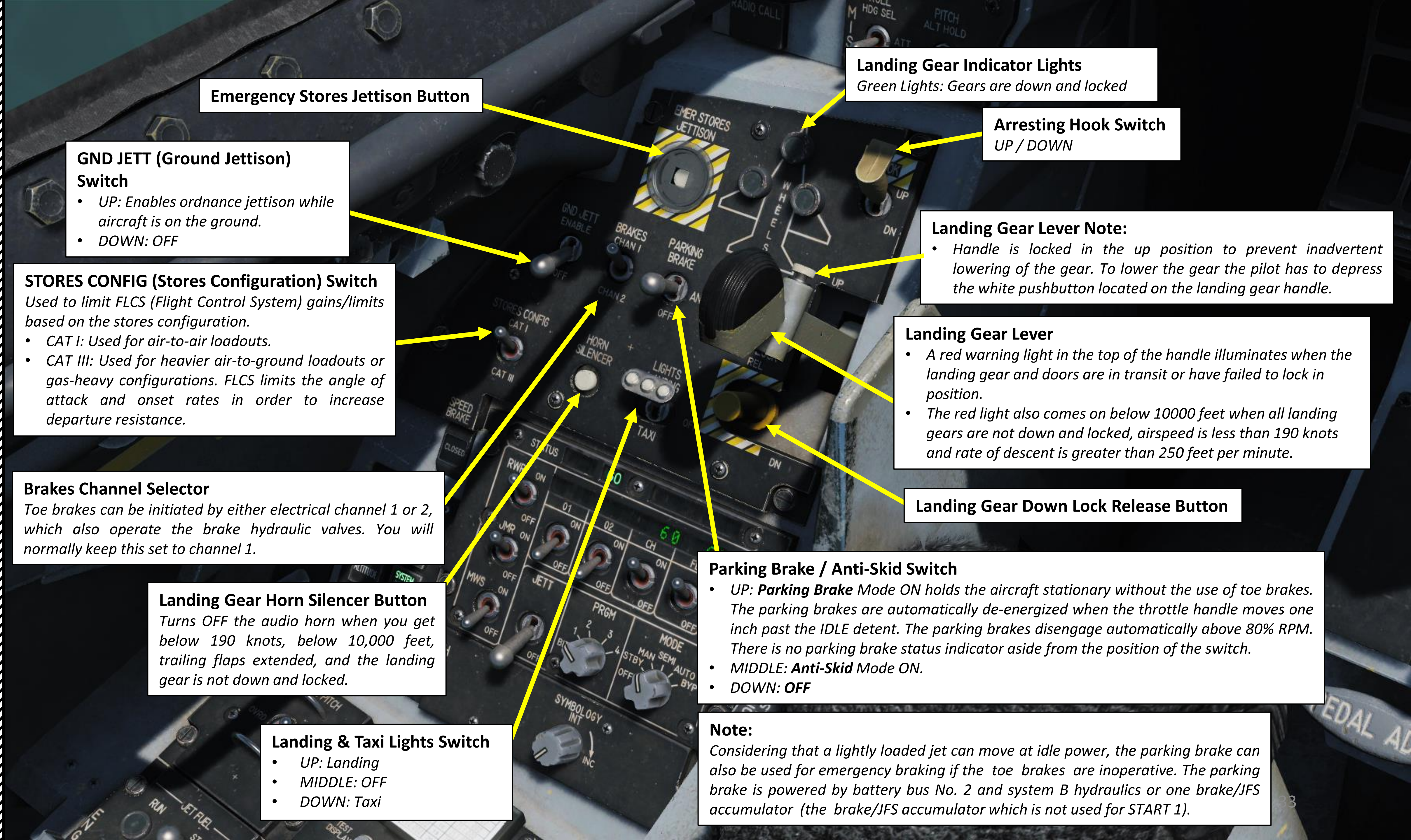
CMDS (Countermeasures Dispensing System) Mode Knob
- ***OFF***
- ***STANDBY:** release parameters and programming can be manually changed using the UFC. It is the only mode allowing reprogramming. The CMDS cannot release countermeasures in this mode.*
- ***MAN**: selected manual program may be dispensed by positioning the CMS forward on the stick*
- ***SEMI (Semi-Automatic)**: aircraft systems determine the program to be dispensed based on the threat. Consent to dispense must be given by positioning the CMS aft on the stick.*
- ***AUTO**: aircraft systems determine the program to be dispensed based on the threat. Countermeasures are dispensed automatically. This mode must also be enabled by positioning the CMS aft on the stick. It may be disabled by selecting CMS right.*
- ***BYP (Bypass)**: allows manual dispensing of countermeasures when failures prevent the other modes from working.*

MWS (Missile Warning System) Switch
Not functional on Block 50 variant.

Countermeasures Jettison Switch
Jettisons countermeasures when position is set to JETT (UP). Functions even when CMDS is turned OFF.

Countermeasures PRGM (Program) Selector Knob
There are a total of 6 programs but only 1 – 4 can be selected through the PRGM knob. PRG 5 is always activated by the slap switch on the left sidewall, while PRG 6 is the Bypass Program. The first 5 programs can be programmed through DTC, or the UFC whenever the CMDS mode in is STBY.

HMCS (Helmet-Mounted Cueing System) Symbology Brightness Knob



Emergency Stores Jettison Button

GND JETT (Ground Jettison) Switch
- *UP: Enables ordnance jettison while aircraft is on the ground.*
- *DOWN: OFF*

STORES CONFIG (Stores Configuration) Switch
Used to limit FLCS (Flight Control System) gains/limits based on the stores configuration.
- *CAT I: Used for air-to-air loadouts.*
- *CAT III: Used for heavier air-to-ground loadouts or gas-heavy configurations. FLCS limits the angle of attack and onset rates in order to increase departure resistance.*

Brakes Channel Selector
Toe brakes can be initiated by either electrical channel 1 or 2, which also operate the brake hydraulic valves. You will normally keep this set to channel 1.

Landing Gear Horn Silencer Button
Turns OFF the audio horn when you get below 190 knots, below 10,000 feet, trailing flaps extended, and the landing gear is not down and locked.

Landing & Taxi Lights Switch
- *UP: Landing*
- *MIDDLE: OFF*
- *DOWN: Taxi*

Landing Gear Indicator Lights
Green Lights: Gears are down and locked

Arresting Hook Switch
UP / DOWN

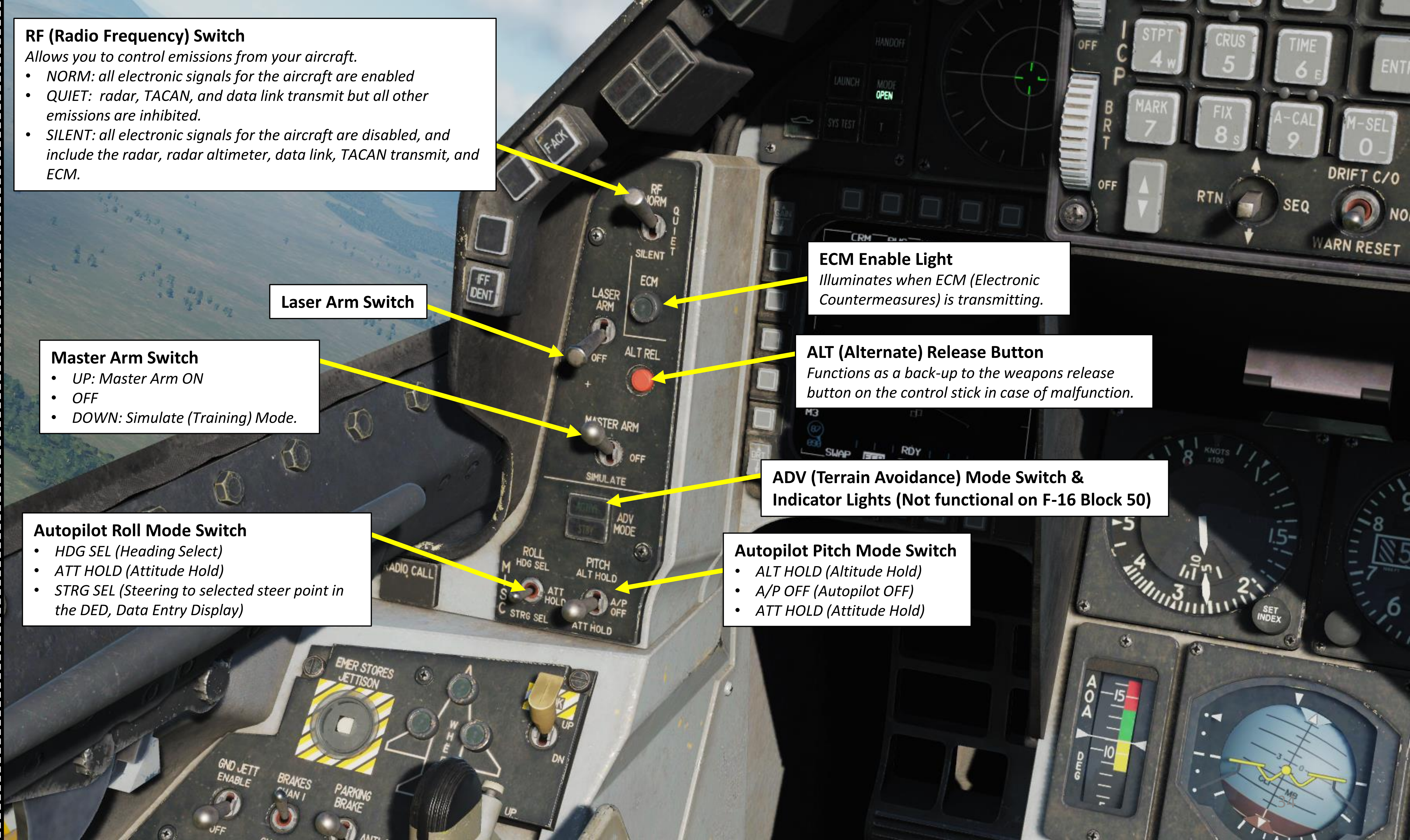
Landing Gear Lever Note:
- *Handle is locked in the up position to prevent inadvertent lowering of the gear. To lower the gear the pilot has to depress the white pushbutton located on the landing gear handle.*

Landing Gear Lever
- *A red warning light in the top of the handle illuminates when the landing gear and doors are in transit or have failed to lock in position.*
- *The red light also comes on below 10000 feet when all landing gears are not down and locked, airspeed is less than 190 knots and rate of descent is greater than 250 feet per minute.*

Landing Gear Down Lock Release Button

Parking Brake / Anti-Skid Switch
- *UP: **Parking Brake** Mode ON holds the aircraft stationary without the use of toe brakes. The parking brakes are automatically de-energized when the throttle handle moves one inch past the IDLE detent. The parking brakes disengage automatically above 80% RPM. There is no parking brake status indicator aside from the position of the switch.*
- *MIDDLE: **Anti-Skid** Mode ON.*
- *DOWN: **OFF***

Note:
Considering that a lightly loaded jet can move at idle power, the parking brake can also be used for emergency braking if the toe brakes are inoperative. The parking brake is powered by battery bus No. 2 and system B hydraulics or one brake/JFS accumulator (the brake/JFS accumulator which is not used for START 1).



RF (Radio Frequency) Switch

Allows you to control emissions from your aircraft.

- *NORM: all electronic signals for the aircraft are enabled*
- *QUIET: radar, TACAN, and data link transmit but all other emissions are inhibited.*
- *SILENT: all electronic signals for the aircraft are disabled, and include the radar, radar altimeter, data link, TACAN transmit, and ECM.*

Laser Arm Switch

Master Arm Switch

- *UP: Master Arm ON*
- *OFF*
- *DOWN: Simulate (Training) Mode.*

Autopilot Roll Mode Switch

- *HDG SEL (Heading Select)*
- *ATT HOLD (Attitude Hold)*
- *STRG SEL (Steering to selected steer point in the DED, Data Entry Display)*

ECM Enable Light

Illuminates when ECM (Electronic Countermeasures) is transmitting.

ALT (Alternate) Release Button

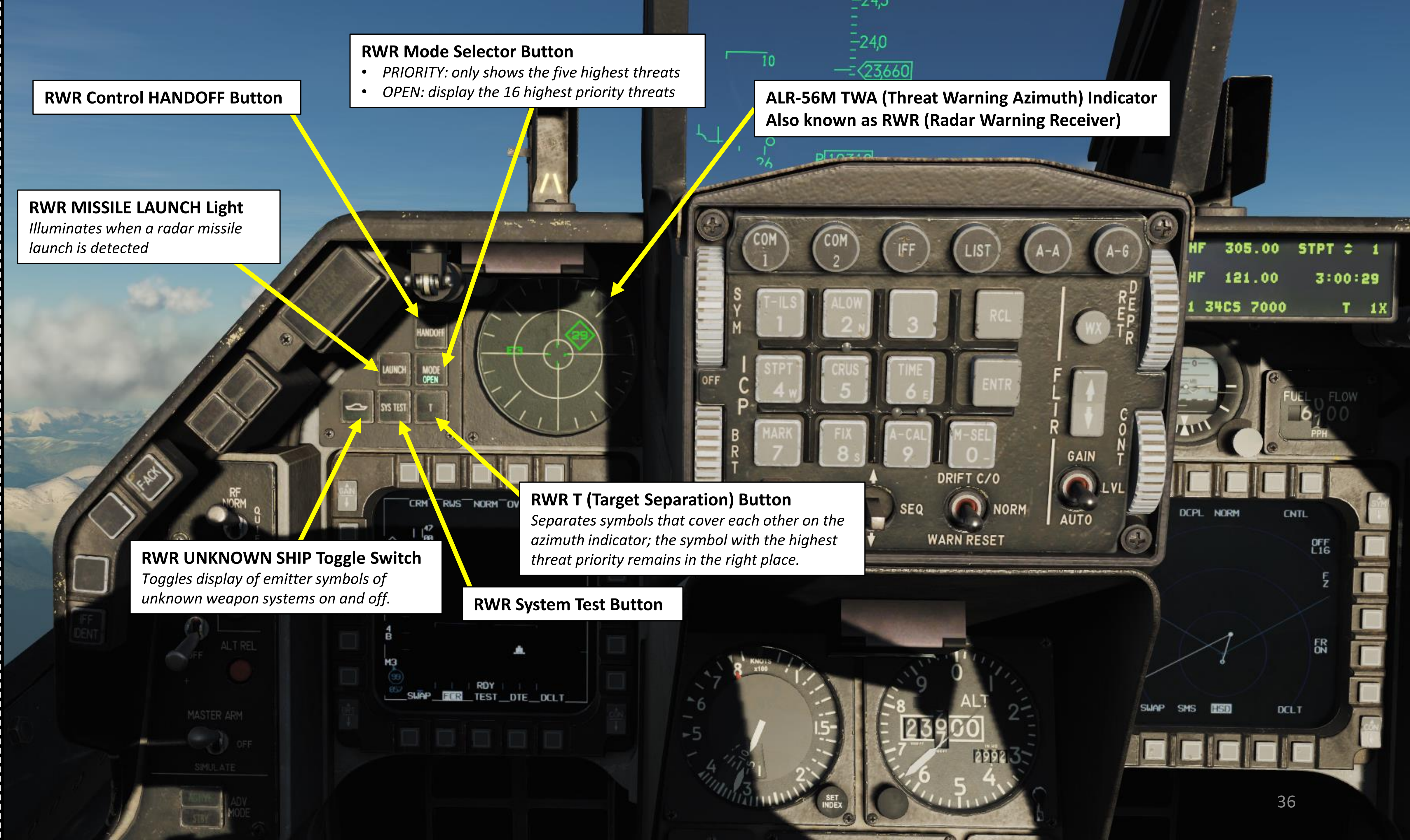
Functions as a back-up to the weapons release button on the control stick in case of malfunction.

ADV (Terrain Avoidance) Mode Switch & Indicator Lights (Not functional on F-16 Block 50)

Autopilot Pitch Mode Switch

- *ALT HOLD (Altitude Hold)*
- *A/P OFF (Autopilot OFF)*
- *ATT HOLD (Attitude Hold)*


AOA (Angle of Attack) Indexer
- *Top (Red) light: AOA is above 14° (on speed AOA too slow).*
- *Center (Green doughnut) light: AOA is between 11 and 14° (13° = on speed AOA for landing).*
- *Bottom (Yellow) light: AOA is below 11° (on speed AOA too fast for approach).*
AOA (Angle of Attack) Indexer Brightness Control Lever
Master Caution Light (Push to Reset)
Eyebrow Lights
TF FAIL Light
Indicates Terrain Following Radar Failure.
F-ACK (Fault Acknowledge) Light
When a fault appears on the Pilot Fault List Display, or PFLD, the fault acknowledge button is pressed to clear the fault.
IFF IDENT (Identify-Friend-or-Foe Identification) Light
Pressing the IFF identification button initiates an IFF response to an interrogation or request from air traffic control.



RWR Control HANDOFF Button

RWR Mode Selector Button

- *PRIORITY: only shows the five highest threats*
- *OPEN: display the 16 highest priority threats*

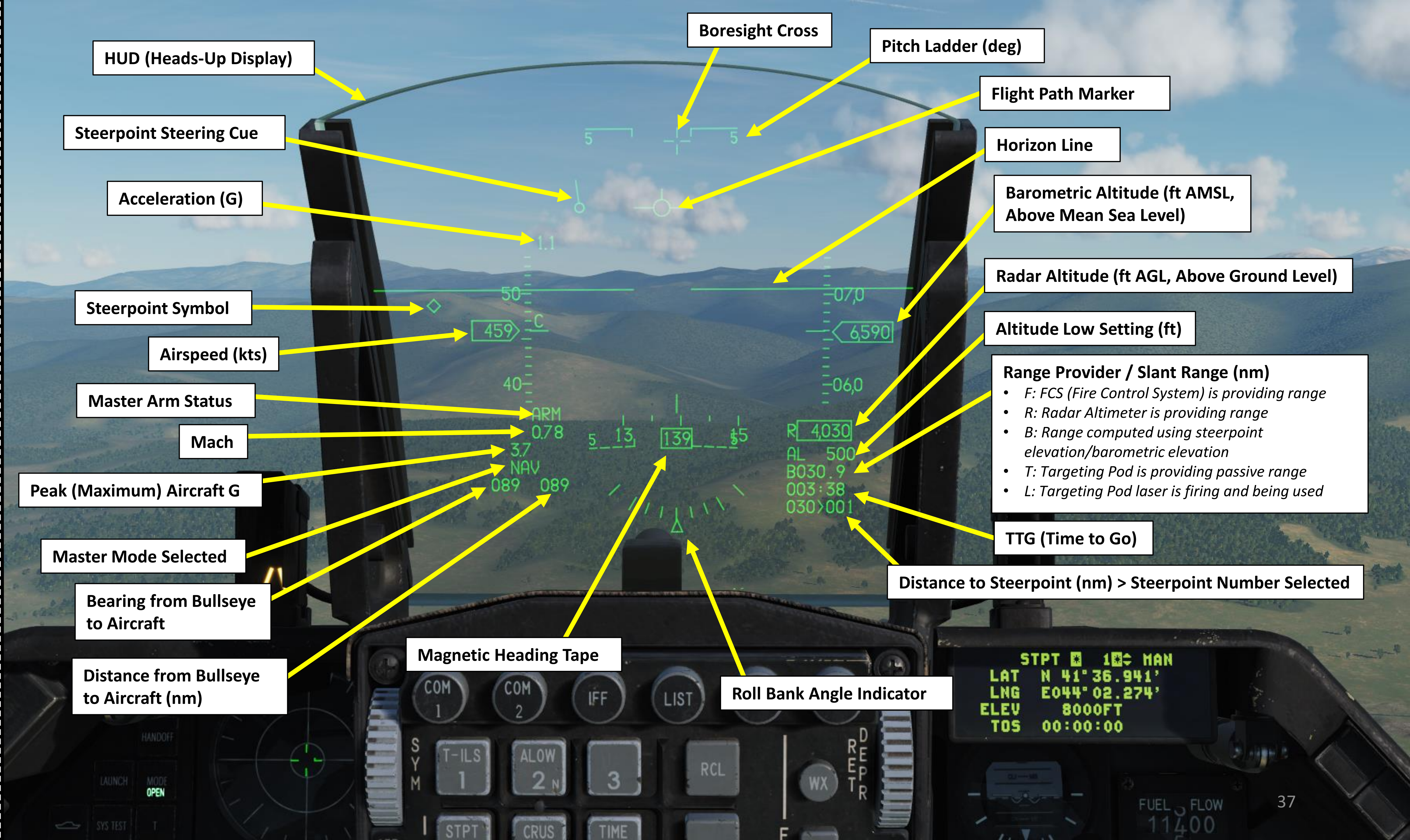
ALR-56M TWA (Threat Warning Azimuth) Indicator
Also known as RWR (Radar Warning Receiver)

RWR MISSILE LAUNCH Light
Illuminates when a radar missile launch is detected

RWR T (Target Separation) Button
Separates symbols that cover each other on the azimuth indicator; the symbol with the highest threat priority remains in the right place.

RWR UNKNOWN SHIP Toggle Switch
Toggles display of emitter symbols of unknown weapon systems on and off.

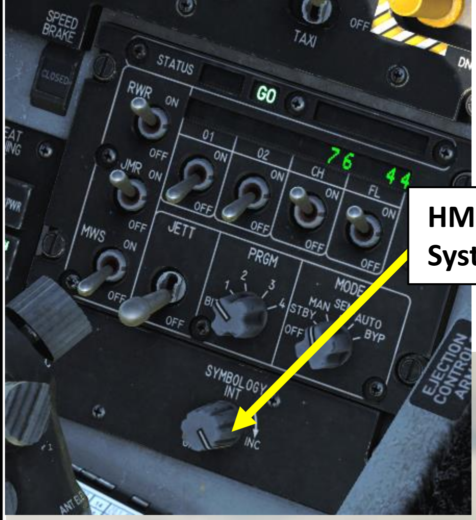
RWR System Test Button

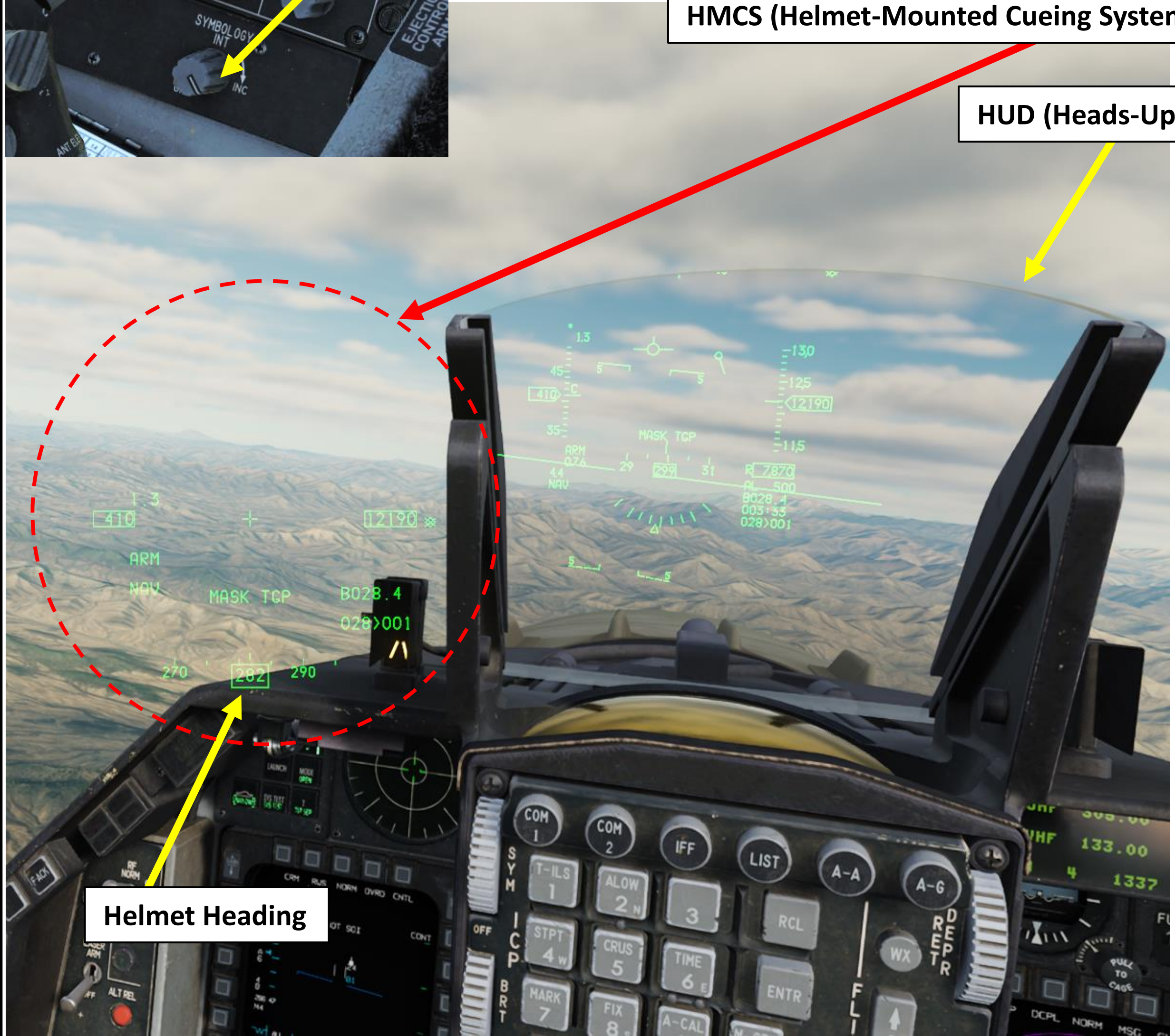

HUD (Heads-Up Display)
Boresight Cross
Pitch Ladder (deg)
Flight Path Marker
Steerpoint Steering Cue
Horizon Line
Acceleration (G)
Barometric Altitude (ft AMSL, Above Mean Sea Level)
Radar Altitude (ft AGL, Above Ground Level)
Steerpoint Symbol
Altitude Low Setting (ft)
Airspeed (kts)
Range Provider / Slant Range (nm)
• F: FCS (Fire Control System) is providing range
• R: Radar Altimeter is providing range
• B: Range computed using steerpoint elevation/barometric elevation
• T: Targeting Pod is providing passive range
• L: Targeting Pod laser is firing and being used
Master Arm Status
Mach
Peak (Maximum) Aircraft G
TTG (Time to Go)
Master Mode Selected
Distance to Steerpoint (nm) > Steerpoint Number Selected
Bearing from Bullseye to Aircraft
Magnetic Heading Tape
Roll Bank Angle Indicator
Distance from Bullseye to Aircraft (nm)

AVTR (Airborne Video Tape Recorder) Camera

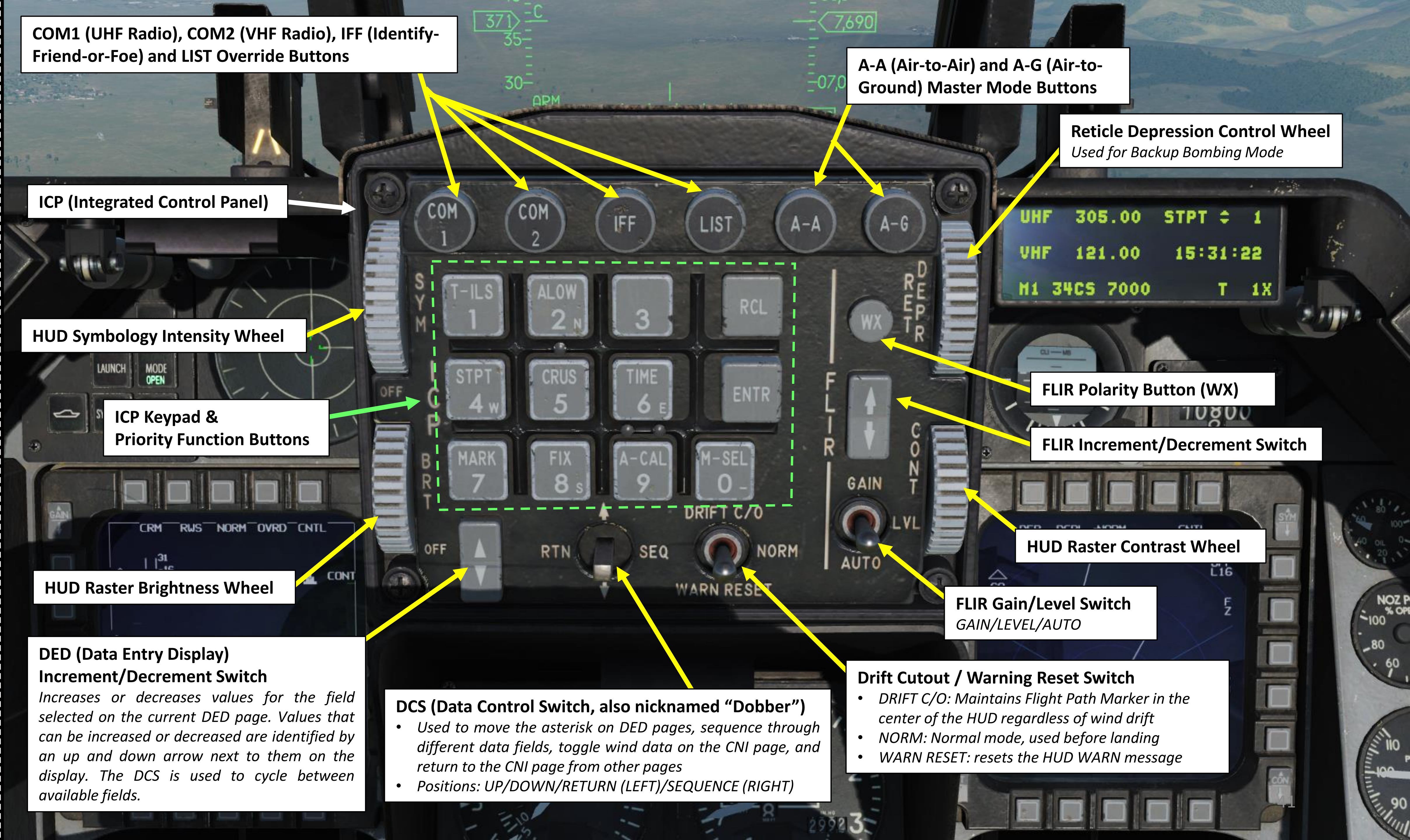
Records HUD (Heads-Up Display). Used for mission debrief.

Note:
Night Vision Goggles and HMCS are mutually exclusive helmet-mounted devices; you can only equip one or the other. You can select what to equip via Ground Crew request.






ICP (Integrated Control Panel)
Also referred as ***UFC (Upfront Control)***
DED (Data Entry Display)
MFD (Multifunction Display)
MFD (Multifunction Display)
UHF 305.00 STPT ⇕ 1
VHF 121.00 15:31:22
M1 34CS 7000 T 1X


COM1 (UHF Radio), COM2 (VHF Radio), IFF (Identify-Friend-or-Foe) and LIST Override Buttons
A-A (Air-to-Air) and A-G (Air-to-Ground) Master Mode Buttons
Reticle Depression Control Wheel
Used for Backup Bombing Mode
ICP (Integrated Control Panel)
HUD Symbology Intensity Wheel
ICP Keypad & Priority Function Buttons
FLIR Polarity Button (WX)
FLIR Increment/Decrement Switch
HUD Raster Contrast Wheel
HUD Raster Brightness Wheel
FLIR Gain/Level Switch
GAIN/LEVEL/AUTO
DED (Data Entry Display) Increment/Decrement Switch
Increases or decreases values for the field selected on the current DED page. Values that can be increased or decreased are identified by an up and down arrow next to them on the display. The DCS is used to cycle between available fields.
DCS (Data Control Switch, also nicknamed "Dobber")
• *Used to move the asterisk on DED pages, sequence through different data fields, toggle wind data on the CNI page, and return to the CNI page from other pages*
• *Positions: UP/DOWN/RETURN (LEFT)/SEQUENCE (RIGHT)*
Drift Cutout / Warning Reset Switch
• *DRIFT C/O: Maintains Flight Path Marker in the center of the HUD regardless of wind drift*
• *NORM: Normal mode, used before landing*
• *WARN RESET: resets the HUD WARN message*
COM 1
COM 2
IFF
LIST
A-A
A-G
T-ILS 1
ALOW 2 N
3
RCL
STPT 4 W
CRUS 5
TIME 6 E
ENTR
MARK 7
FIX 8 S
A-CAL 9
M-SEL 0
WX
SYM
ICP
BRT
OFF
FLIR
RET DEPR
CONT
GAIN
LVL
AUTO
RTN
SEQ
DRIFT C/O
NORM
WARN RESET
UHF 305.00 STPT 1
VHF 121.00 15:31:22
M1 34CS 7000 T 1X

Priority Function Pages

***T-ILS**: TACAN and ILS (Instrument Landing System) Settings*

***ALOW**: Altitude Low Page, settings for altitude advisory system*

***STPT**: Navigation Steerpoint information.*

***CRUS**: Cruise page provides 4 sub-modes: TOS (Time Over Steerpoint), RNG (Range), HOME and EDR (Endurance). Page gives information for navigation, time and fuel while cruising.*

***TIME**: allows the pilot to set a HACK timer and a DELTA TOS for ROLEX calls.*

***MARK**: creates markpoints*

***FIX**: Navigation Fix page.*

***ACAL**: Altitude Calibration page.*

Override Button Pages

***CNI** (Communication, Navigation & Identification)*

***COM1** – UHF Radio 1*

***COM2** – VHF Radio 2*

***IFF** – Identify-Friend-or-Foe*

***LIST**: Access to additional sub-pages*

LIST Sub-Pages

DEST (Destination): Allows changing coordinates of Steerpoints

BNGO (BINGO): input for Joker/Bingo fuel.

VIP: Visual Initial Point page

INTG: Interrogator Settings Page

NAV: Accuracy of navigation system (drift)

MAN: Adjusts gun EEGS (Enhanced Envelope Gun Sight) funnel width manual setting for cannon firing.

INS: Inertial Navigation System page

DLNK: Datalink page

CMDS: Countermeasures Dispenser System page

MODE: Allows an alternate way of changing Master Mode without using the ICP A-A or A-G buttons.

VRP: Visual Reference Point page

MISC (Miscellaneous): Access to additional sub-pages

MISC Sub-Pages

CORR: Correction page

MAGV: Magnetic Variation at this aircraft location.

OFP: Operational Flight Program page

INSM: Inertial Navigation System Memory page

LASR: Laser System page (used to set Targeting Pod and Laser Spot Tracker laser codes and modes)

GPS: Displays information on the Global Positioning System

DRNG: Not Simulated

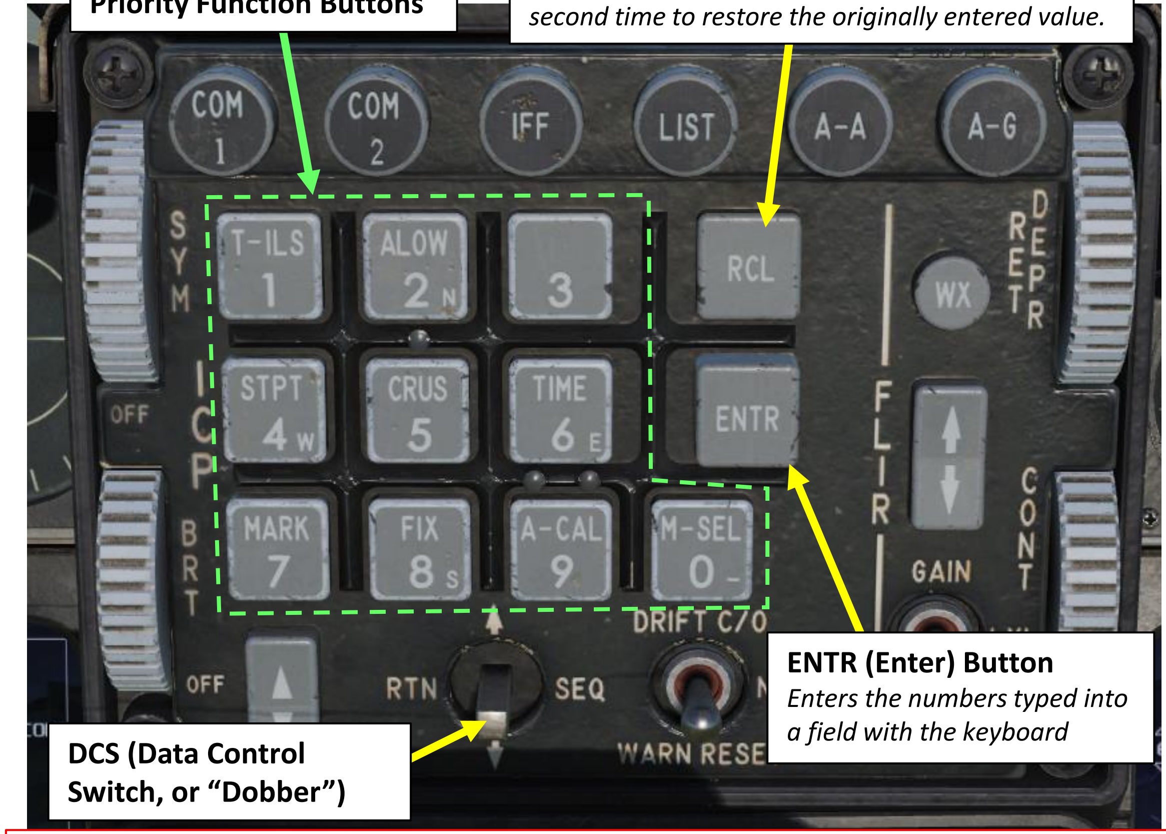
BULL: Bullseye reference point information.

HMCS: Helmet-Mounted Cueing System (HMCS) settings

HTS: AGM-88 (HARM) High-Speed Anti-Radiation Missile Targeting System (HTS) settings. Only visible if HTS pod is equipped.

HARM: AGM-88 (HARM) High-Speed Anti-Radiation Missile settings. Only visible if A-G (Air-to-Ground) Master Mode is selected.

DED Pages – Priority Functions



ICP Keypad & Priority Function Buttons

RCL (Recall) Button
Depress this button once to erase the last digit that was entered, i.e. backspace key. Depress it a second time to restore the originally entered value.

ENTR (Enter) Button
Enters the numbers typed into a field with the keyboard

DCS (Data Control Switch, or "Dobber")

Note 1:
Priority functions are accessed by pressing the ICP Keypad Priority Function Buttons. As an example, button "1" is for the T-ILS page, button "2" is for the ALOW page, etc.

Use the DCS (Data Control Switch, or "Dobber") LEFT to return (RTN) to the main CNI (Communications, Navigation & Identification) DED page.

Note 2 (very important):
To set the Dobber switch in a certain direction, left click on either the arrows above and below the switch, or on the "RTN" and "SEQ" text to the left and right of the switch.

T-ILS (TACAN-ILS) DED page

ALOW (Altitude Low) DED page

STPT (Steerpoint) DED page

CRUS (Cruise) DED page

TIME DED page

MARK (Markpoint) DED page

FIX (Navigation Fix) DED page

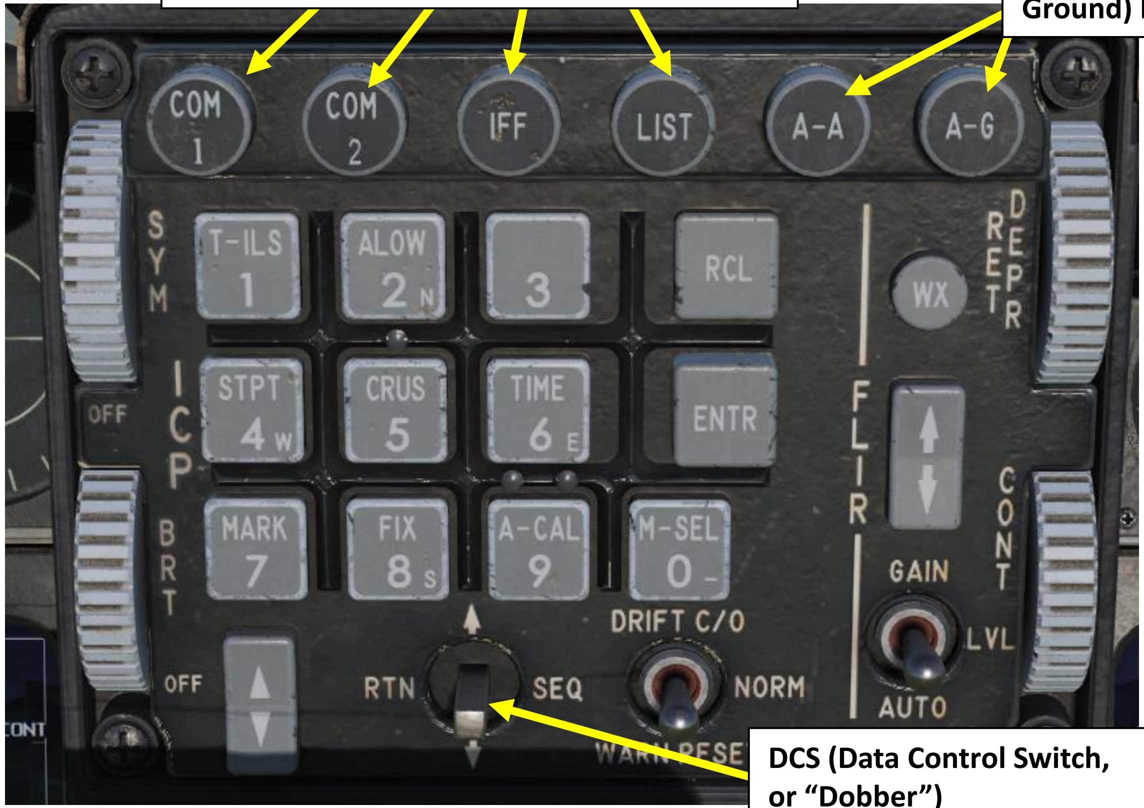
ACAL (Altitude Calibration) DED page

DED Pages – OVERRIDE Buttons

Note:
OVERRIDE pages are accessed by pressing the COM1, COM2, IFF or LIST Override Buttons on the ICP.

COM1, COM2, IFF and LIST Override Buttons

A-A (Air-to-Air) & A-G (Air-to-Ground) Master Mode Buttons



DCS (Data Control Switch, or "Dobber")

DCS RTN

CNI (Communications, Navigation & Identification) DED page
Accessed by toggling DCS (Data Control Switch) to RTN (Return)

COM1

COM1 (UHF Radio) DED page

COM2

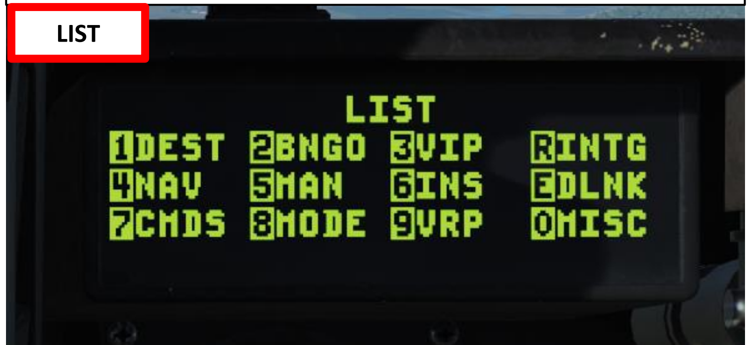
COM2 (VHF Radio) DED page

IFF

IFF (Identify-Friend-or-Foe) DED page

LIST DED page
Allows access to multiple sub-menus (see next page)

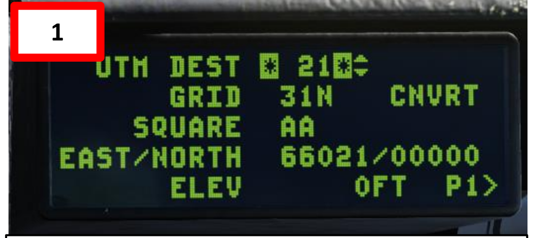
LIST



DED Pages – LIST Sub-Pages

LIST DED page

Allows access to multiple sub-menus. Press the LIST override button, then select desired LIST sub-page with the buttons on the ICP (Integrated Control Panel) keypad.



DEST (Destination) Sub-Page

BINGO Sub-Page

VIP (Visual Initial Point) Sub-Page

SCAN INTG (Interrogator) Sub-Page

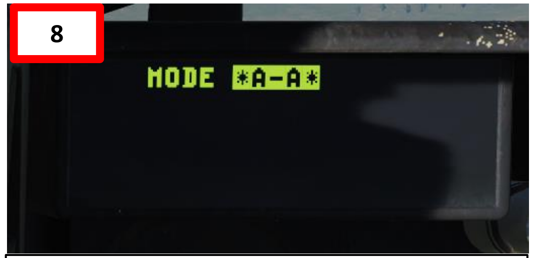
NAV (Navigation) Sub-Page

MAN (Manual Setting) Sub-Page

INS (Inertial Navigation System) Sub-Page

DLNK (Datalink) Sub-Page

CMDS (Countermeasures) Sub-Page



MODE Sub-Page

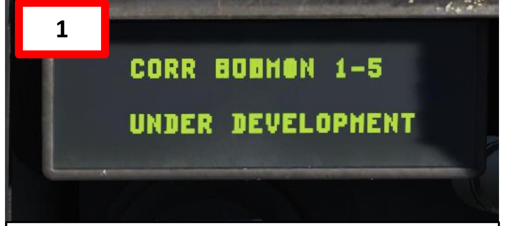
VRP (Visual Reference Point) Sub-Page

MISC (Miscellaneous) Sub-Page

DED Pages – LIST Sub-Pages MISC Pages

MISC DED page (LIST Sub-page)

Allows access to multiple sub-menus. Press the LIST override button, then select MISC LIST sub-page with "0 M-SEL" button on the ICP (Integrated Control Panel) keypad. From there, you can select the desired MISC sub-menu with the ICP keypad.



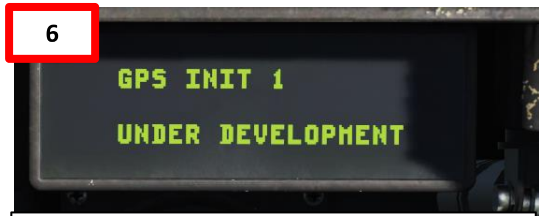
CORR (Correction) Sub-Page

MAGV (Magnetic Variation) Sub-Page

OFP (Operational Flight Program) Sub-Page

INSM (Inertial Navigation System Memory) Sub-Page

LASR (Laser System) Sub-Page



GPS Sub-Page

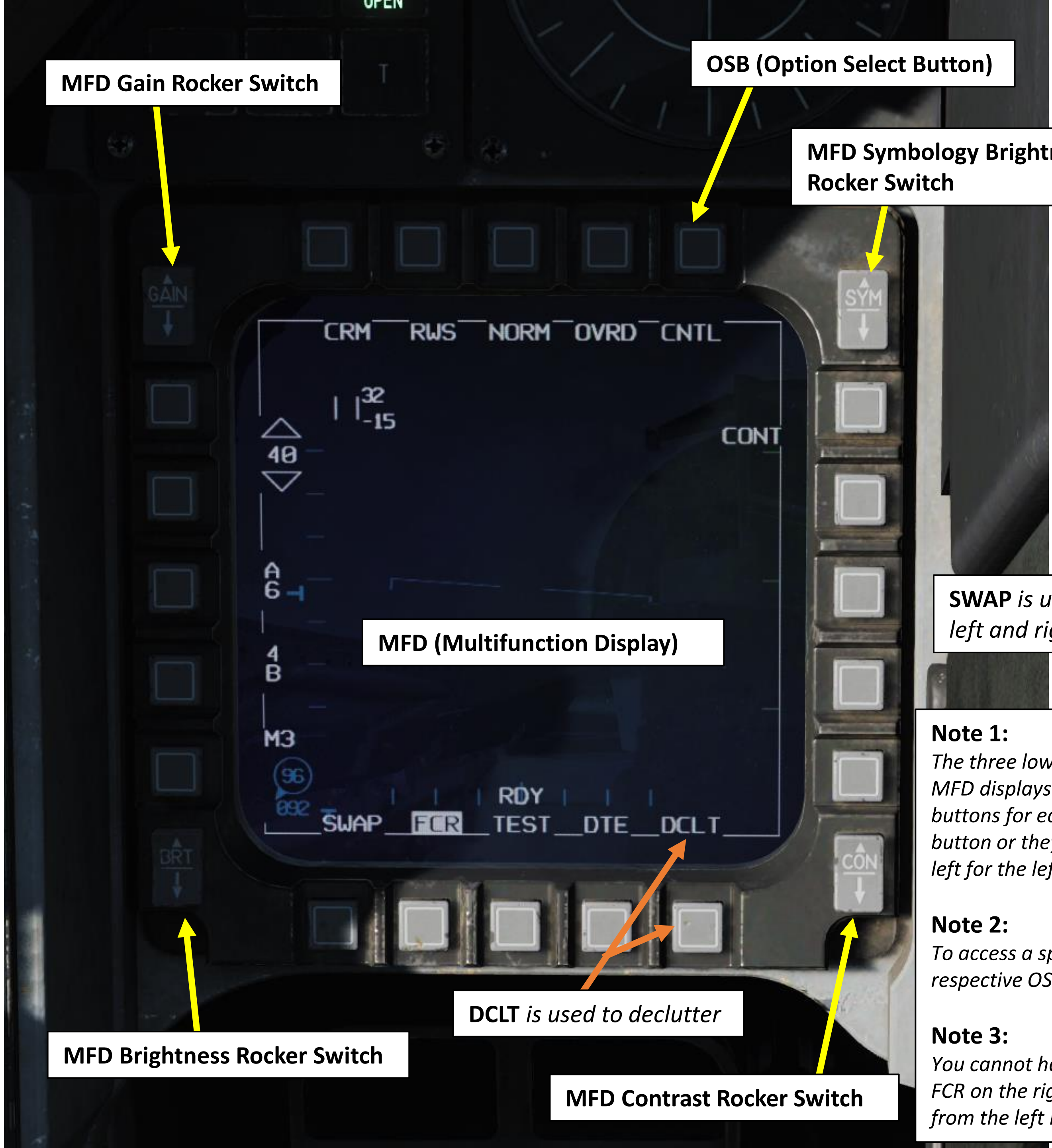
DRNG Sub-Page

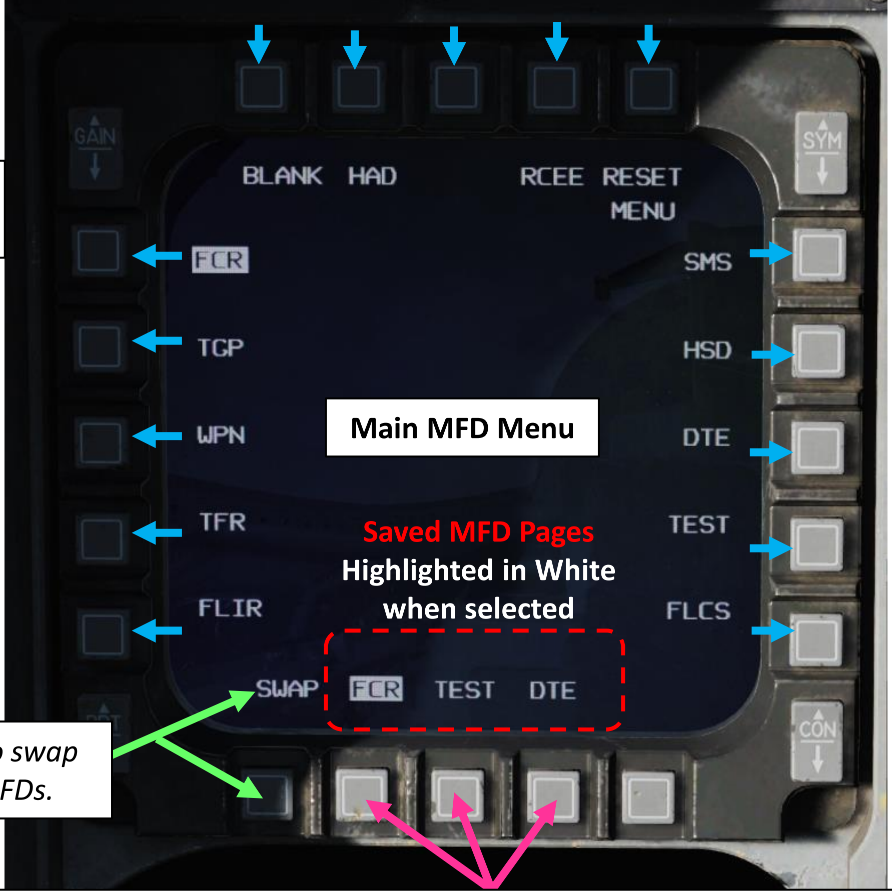
BULL (Bullseye) Sub-Page

HMCS (Helmet-Mounted Cueing System) settings

HTS (HARM Targeting System) settings Sub-Page

HARM (High-Speed Anti-Radiation Missile) settings Sub-Page





Note 1:

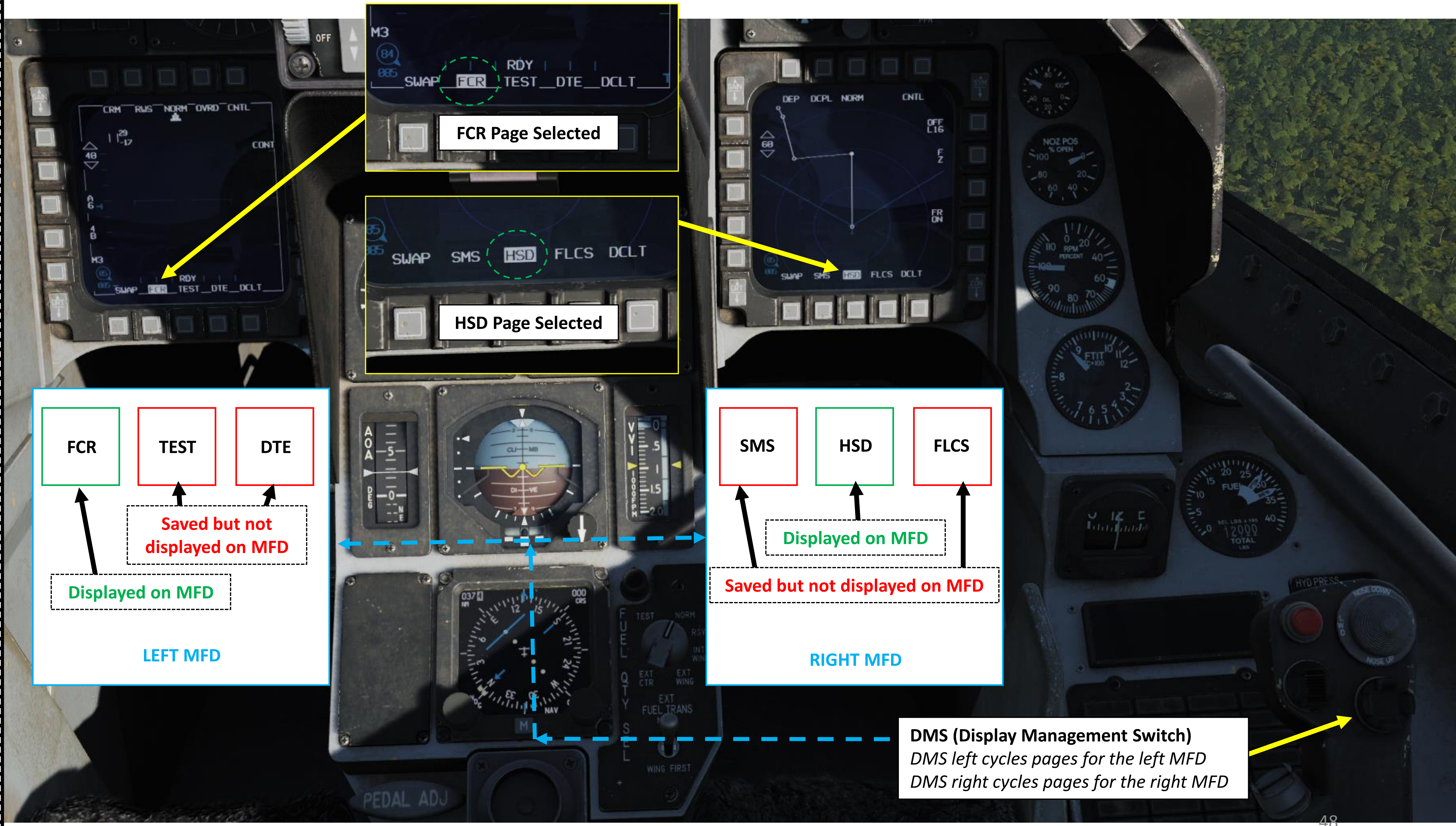
The three lower OSBs are Direct Access (DA) buttons (in pink) and provide direct access to the saved MFD displays according to master mode. Up to three pages for each MFD may be assigned to the DA buttons for each master mode. These pages are toggled by pressing the corresponding direct access OSB button or they can be cycled even faster with the HOTAS buttons: DMS right for the right MFD and DMS left for the left MFD.

Note 2:

To access a specific MFD page, press on one of these three OSBs once, then select desired page with its respective OSB (shown in blue) from the Main Menu page.

Note 3:

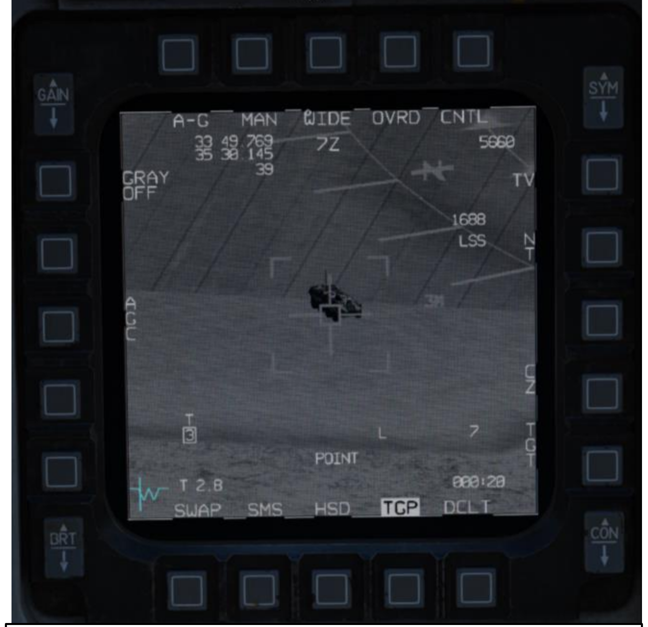
You cannot have the same page displayed on both MFDs at the same time, so if you try to display the FCR on the right MFD while it is already being displayed on the left MFD the FCR will simply be taken from the left MFD leaving an empty DA slot where it was originally assigned.


SWAP FCR RDY TEST DTE DCLT
FCR Page Selected
SWAP SMS HSD FLCS DCLT
HSD Page Selected
FCR
TEST
DTE
Saved but not displayed on MFD
Displayed on MFD
LEFT MFD
SMS
HSD
FLCS
Displayed on MFD
Saved but not displayed on MFD
RIGHT MFD
DMS (Display Management Switch)
DMS left cycles pages for the left MFD
DMS right cycles pages for the right MFD
PEDAL ADJ

MFD (Multifunction Display) Pages

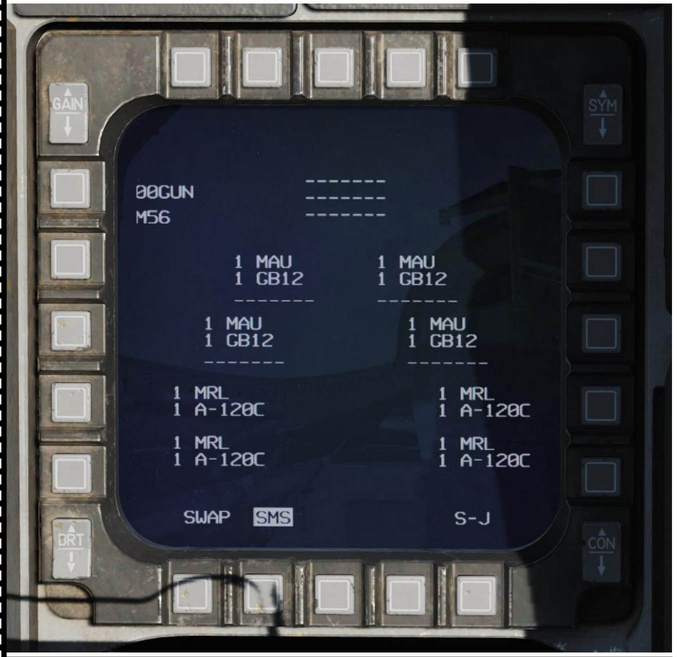
FCR: The Fire Control Radar is basically the radar display.	**SMS**: The Stores Management System page will be different depending on the Master Mode you are in when it is selected (NAV, A-A, A-G or S-J).
TGP: Targeting Pod page.	**HSD**: Horizontal Situation Display page is used for navigation.
WPN: Weapon Sensor page, used for AGM-65 Maverick and AGM-88 HARM sensor feed.	**DTE**: Data Transfer Equipment page is used to load the Data Cartridge prepared during mission planning in into the aircraft computer. Loading is done (usually at ramp start right after or just before switching the CNI to UFC) by depressing OSB (Option Select Button) next to LOAD.
TFR: Terrain Following Radar page. TFR is only available on F-16s carrying an AN/AAQ-13 LANTIRN navigation pod (on the left chin station). The TFR is a short range (36000 ft) forward and down radar that allows you to follow the terrain at very low altitude with automatic fly up protection.	**TEST**: Test page shows multiple BITs (Built-In Tests)
FLIR: The FLIR (Forward-Looking Infrared) page is only available on F-16s carrying an AN/AAQ-13 LANTIRN navigation pod (on the left chin station). The FLIR is a forward looking infrared camera used for low level night navigation. The FLIR is housed in the navigation pod of the LANTIRN system mounted alongside the TFR system.	**FLCS**: Flight Control System page.
BLANK: Turns off the MFD. Can be helpful when you need only one MFD page active from the Direct Access row for a specific Master Mode.	**RCCE**: Reconnaissance page that interfaces with Reconnaissance pods.
HAD: HARM Attack Display page is used for operating the AGM-88 HARM (High-Speed Anti-Radiation Missile) missile.	**RESET**: Not simulated.

FCR (Fire Control Radar) Page



TGP (Targeting Pod) Page

WPN (Weapon) Page



SMS (Stores Management Set) Page

HSD (Horizontal Situation Display) Page

DTE (Data Transfer Equipment) Page

TEST Page

FLCS (Flight Control System) Page

BLANK Page

TFR
PLACEHOLDER
(only available on F-16s carrying an AN/AAQ-13 LANTIRN navigation pod)

TFR (Terrain Following Radar) Page

FLIR
PLACEHOLDER
(only available on F-16s carrying an AN/AAQ-13 LANTIRN navigation pod)

FLIR (Forward-Looking Infrared) Page

HAD (HARM Attack Display) Page

RCCE
PLACEHOLDER

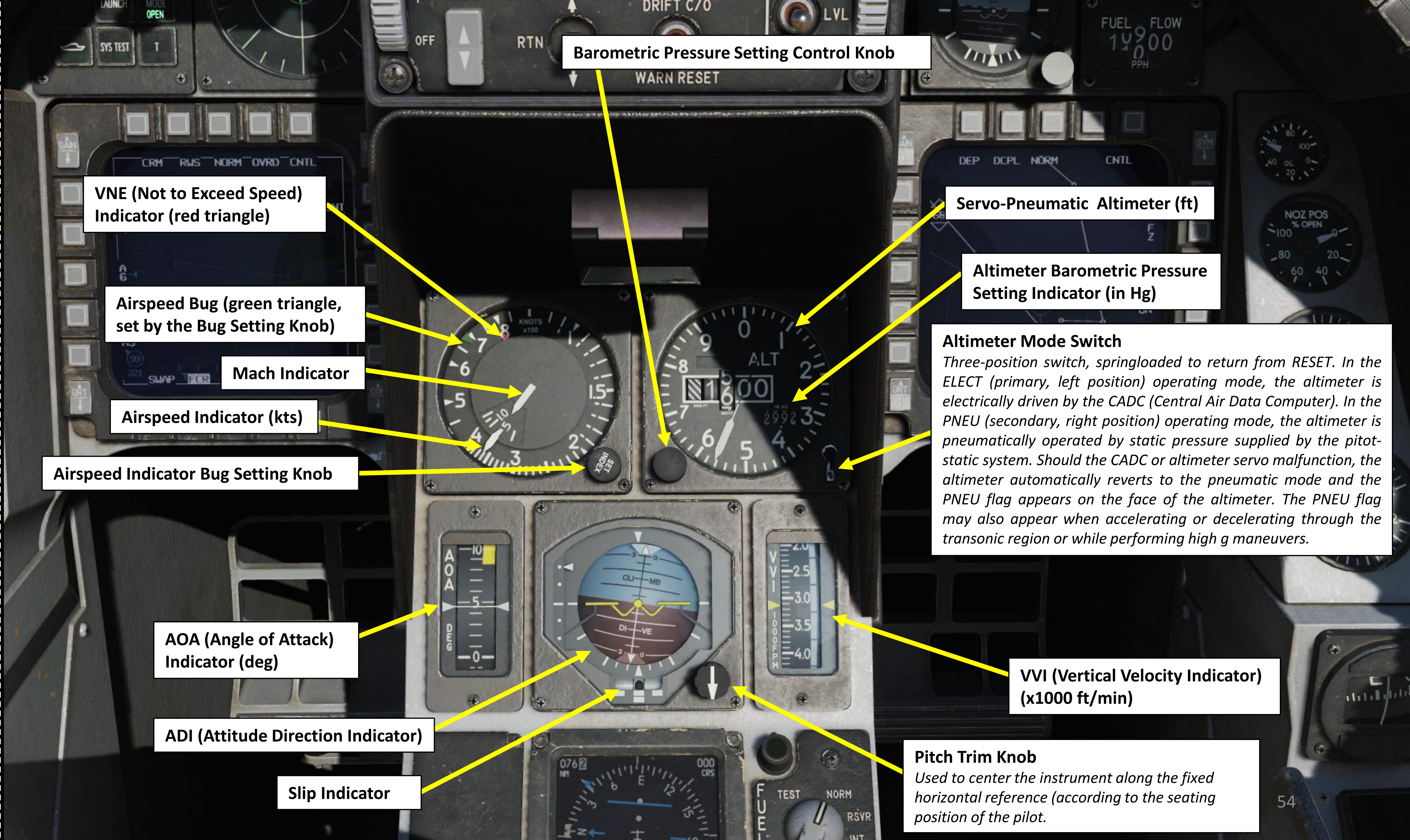
RCCE (Reconnaissance) Page

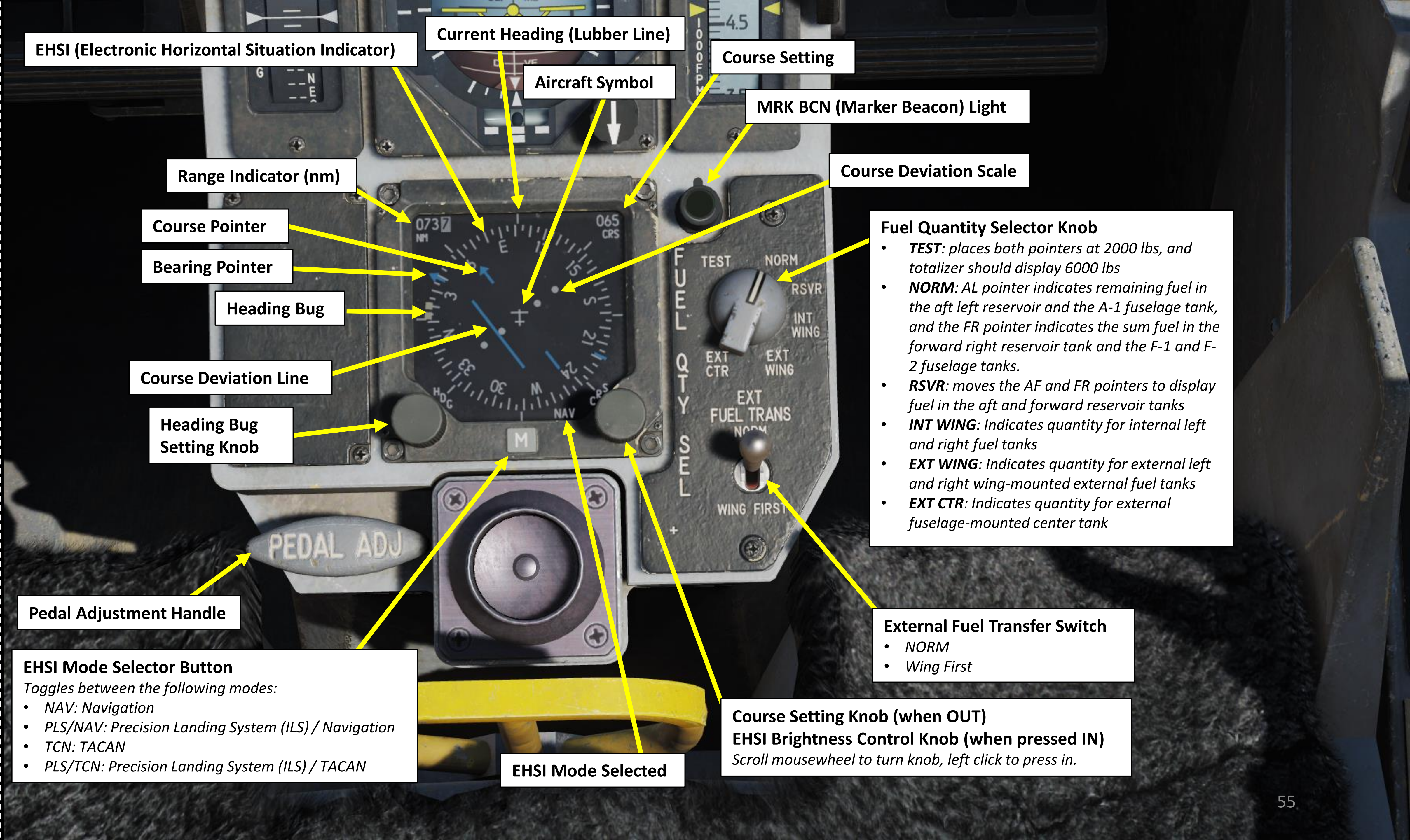
RESET
PLACEHOLDER

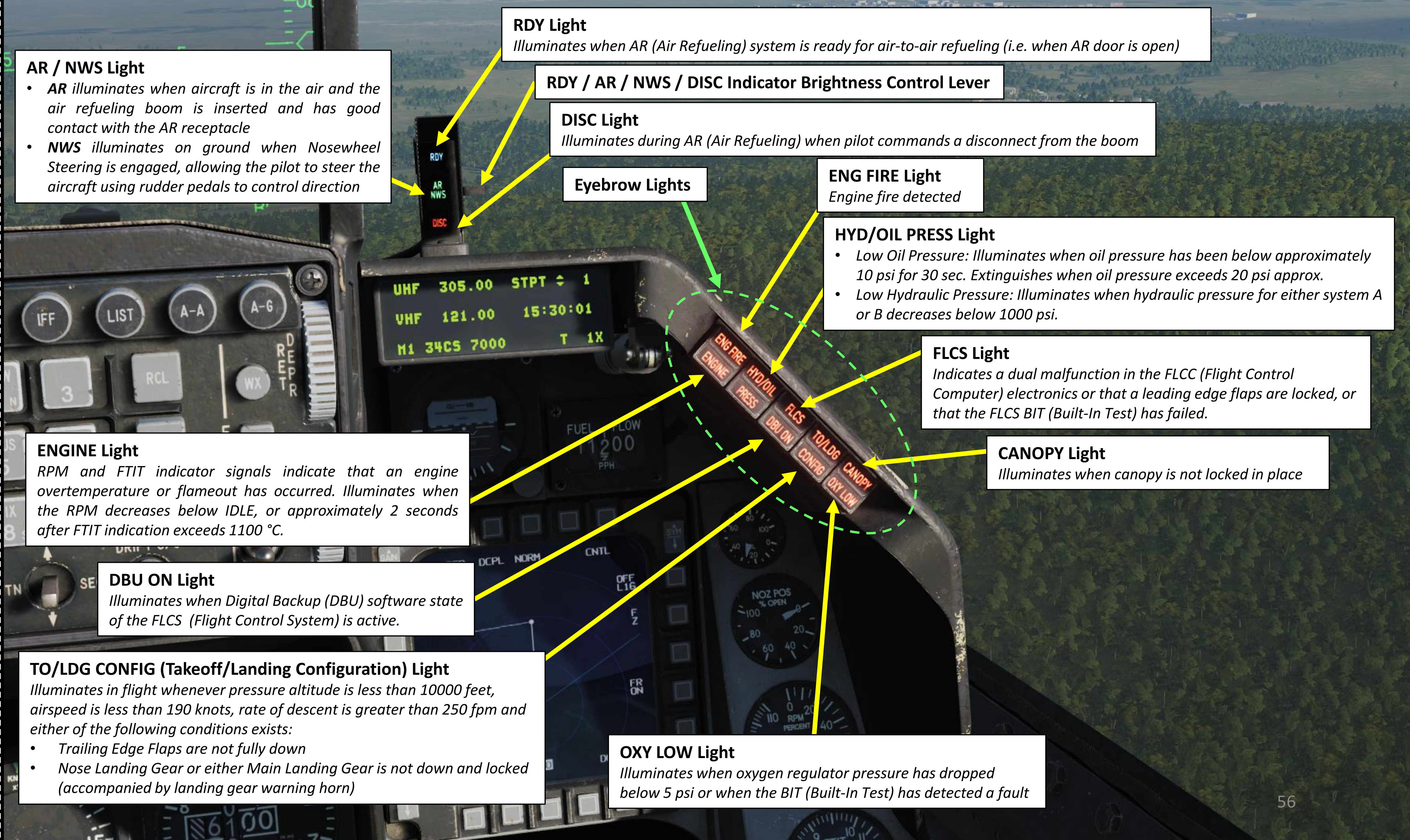
RESET Page

Primary vs Standby Indications

The HUD in all C-model Vipers is certified as a primary flight reference. However, it is not allowed to be used to recover from unusual attitudes while flying at night or in IMC (Instrument Meteorological Conditions). Most indications on the central console can be used as primary indications as well.


Barometric Pressure Setting Control Knob
VNE (Not to Exceed Speed) Indicator (red triangle)
Servo-Pneumatic Altimeter (ft)
Altimeter Barometric Pressure Setting Indicator (in Hg)
Airspeed Bug (green triangle, set by the Bug Setting Knob)
Altimeter Mode Switch
Three-position switch, springloaded to return from RESET. In the ELECT (primary, left position) operating mode, the altimeter is electrically driven by the CADC (Central Air Data Computer). In the PNEU (secondary, right position) operating mode, the altimeter is pneumatically operated by static pressure supplied by the pitot-static system. Should the CADC or altimeter servo malfunction, the altimeter automatically reverts to the pneumatic mode and the PNEU flag appears on the face of the altimeter. The PNEU flag may also appear when accelerating or decelerating through the transonic region or while performing high g maneuvers.
Mach Indicator
Airspeed Indicator (kts)
Airspeed Indicator Bug Setting Knob
AOA (Angle of Attack) Indicator (deg)
VVI (Vertical Velocity Indicator) (x1000 ft/min)
ADI (Attitude Direction Indicator)
Pitch Trim Knob
Used to center the instrument along the fixed horizontal reference (according to the seating position of the pilot.
Slip Indicator


EHSI (Electronic Horizontal Situation Indicator)
Current Heading (Lubber Line)
Aircraft Symbol
Course Setting
MRK BCN (Marker Beacon) Light
Course Deviation Scale
Range Indicator (nm)
Course Pointer
Bearing Pointer
Heading Bug
Course Deviation Line
Heading Bug Setting Knob
Pedal Adjustment Handle
PEDAL ADJ
FUEL QTY SEL
TEST
NORM
RSVR
INT WING
EXT WING
EXT CTR
EXT FUEL TRANS
WING FIRST
Fuel Quantity Selector Knob
- ***TEST**: places both pointers at 2000 lbs, and totalizer should display 6000 lbs*
- ***NORM**: AL pointer indicates remaining fuel in the aft left reservoir and the A-1 fuselage tank, and the FR pointer indicates the sum fuel in the forward right reservoir tank and the F-1 and F-2 fuselage tanks.*
- ***RSVR**: moves the AF and FR pointers to display fuel in the aft and forward reservoir tanks*
- ***INT WING**: Indicates quantity for internal left and right fuel tanks*
- ***EXT WING**: Indicates quantity for external left and right wing-mounted external fuel tanks*
- ***EXT CTR**: Indicates quantity for external fuselage-mounted center tank*
External Fuel Transfer Switch
- *NORM*
- *Wing First*
EHSI Mode Selector Button
Toggles between the following modes:
- *NAV: Navigation*
- *PLS/NAV: Precision Landing System (ILS) / Navigation*
- *TCN: TACAN*
- *PLS/TCN: Precision Landing System (ILS) / TACAN*
EHSI Mode Selected
Course Setting Knob (when OUT)
EHSI Brightness Control Knob (when pressed IN)
Scroll mousewheel to turn knob, left click to press in.



AR / NWS Light

- ***AR*** *illuminates when aircraft is in the air and the air refueling boom is inserted and has good contact with the AR receptacle*
- ***NWS*** *illuminates on ground when Nosewheel Steering is engaged, allowing the pilot to steer the aircraft using rudder pedals to control direction*

RDY Light

Illuminates when AR (Air Refueling) system is ready for air-to-air refueling (i.e. when AR door is open)

RDY / AR / NWS / DISC Indicator Brightness Control Lever

DISC Light

Illuminates during AR (Air Refueling) when pilot commands a disconnect from the boom

Eyebrow Lights

ENG FIRE Light

Engine fire detected

HYD/OIL PRESS Light

- *Low Oil Pressure: Illuminates when oil pressure has been below approximately 10 psi for 30 sec. Extinguishes when oil pressure exceeds 20 psi approx.*
- *Low Hydraulic Pressure: Illuminates when hydraulic pressure for either system A or B decreases below 1000 psi.*

FLCS Light

Indicates a dual malfunction in the FLCC (Flight Control Computer) electronics or that a leading edge flaps are locked, or that the FLCS BIT (Built-In Test) has failed.

CANOPY Light

Illuminates when canopy is not locked in place

ENGINE Light

RPM and FTIT indicator signals indicate that an engine overtemperature or flameout has occurred. Illuminates when the RPM decreases below IDLE, or approximately 2 seconds after FTIT indication exceeds 1100 °C.

DBU ON Light

Illuminates when Digital Backup (DBU) software state of the FLCS (Flight Control System) is active.

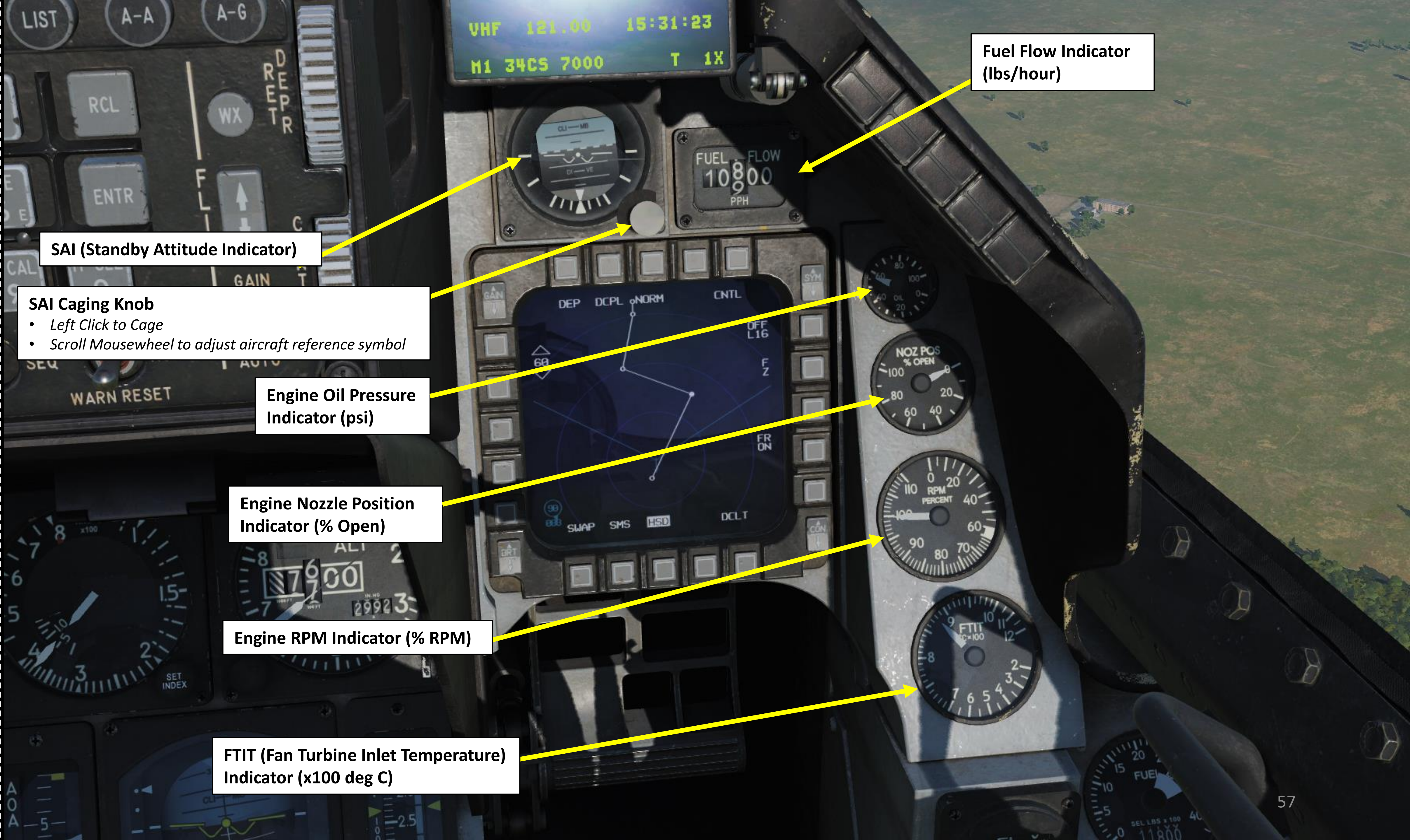
TO/LDG CONFIG (Takeoff/Landing Configuration) Light

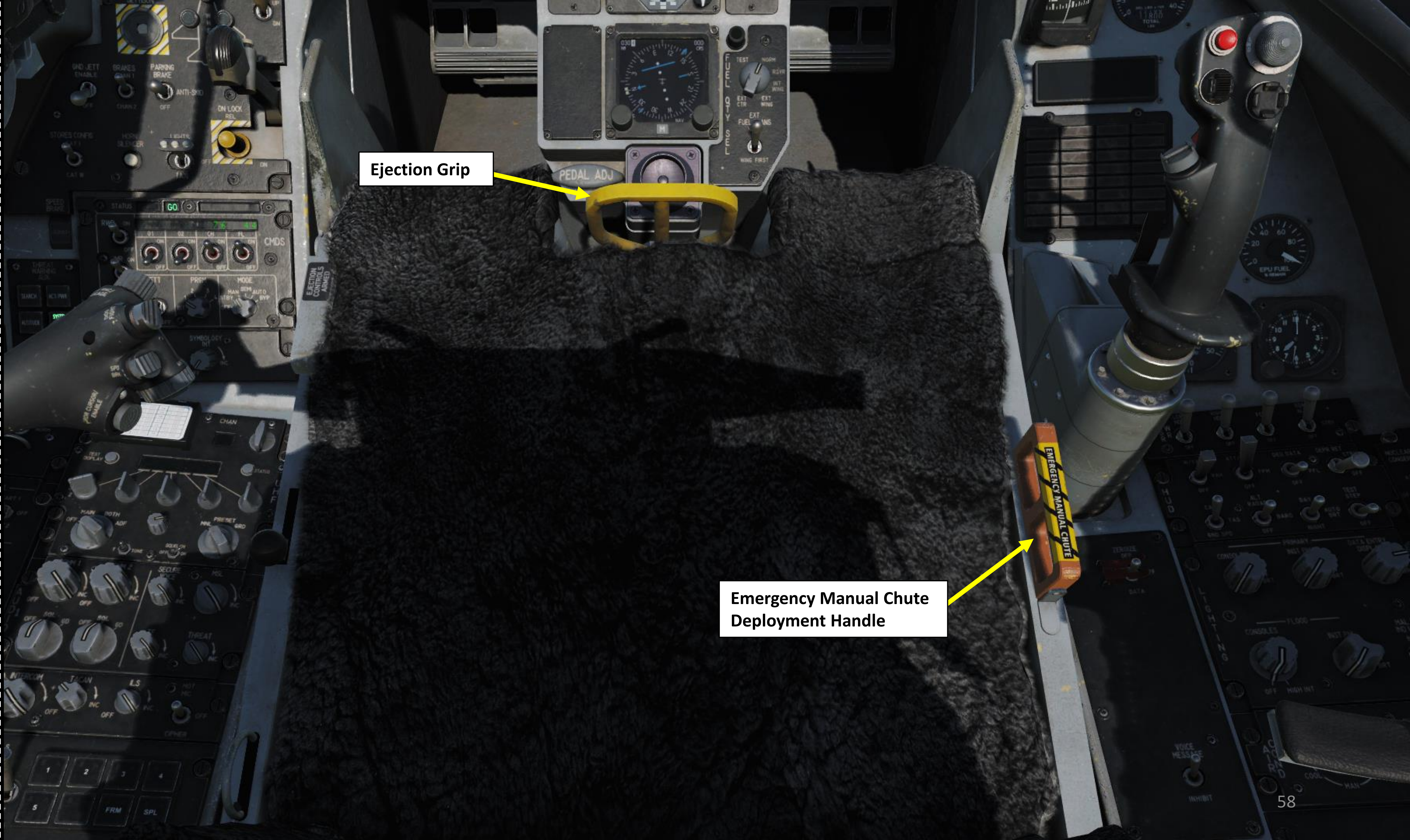
Illuminates in flight whenever pressure altitude is less than 10000 feet, airspeed is less than 190 knots, rate of descent is greater than 250 fpm and either of the following conditions exists:

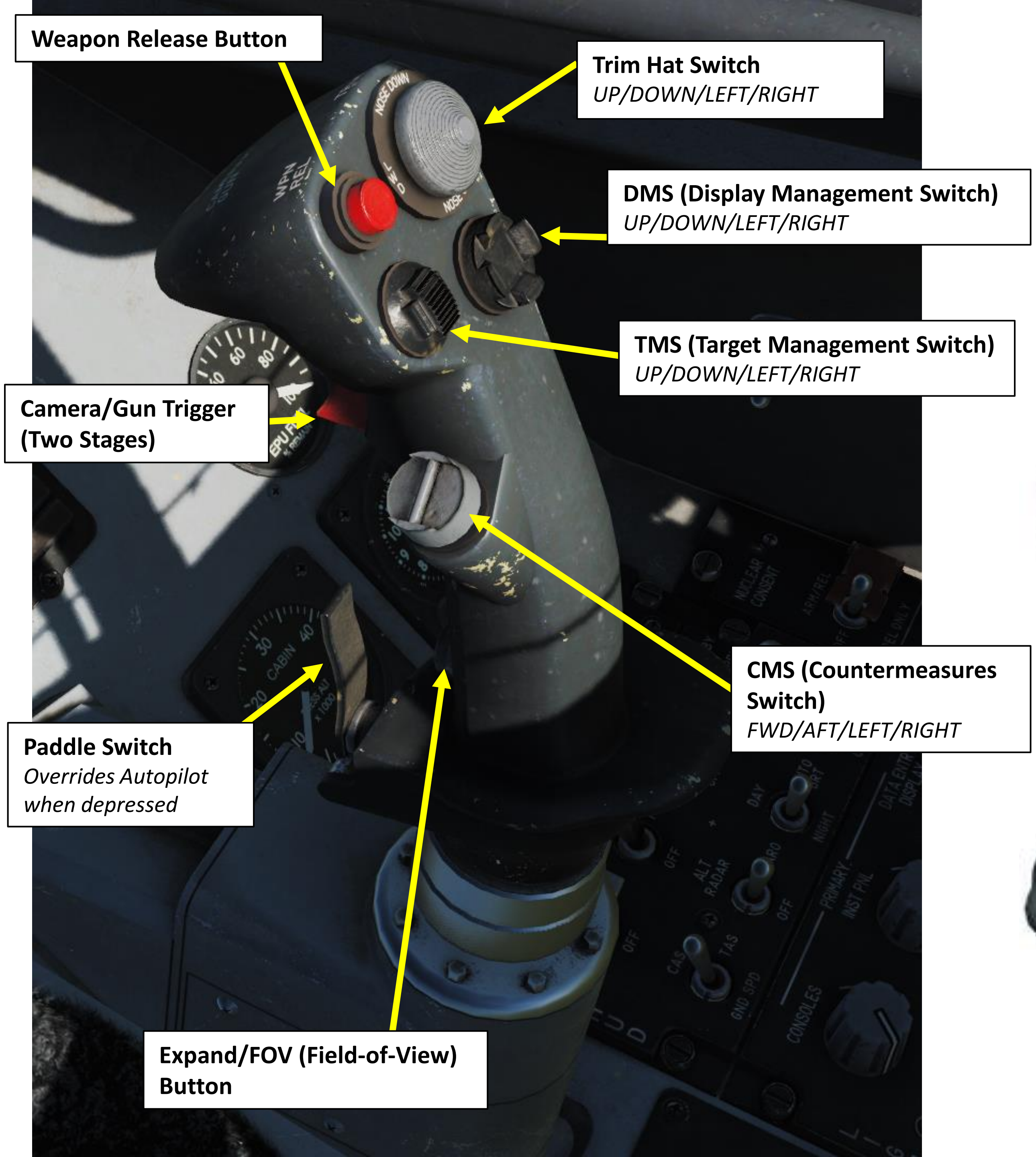
- *Trailing Edge Flaps are not fully down*
- *Nose Landing Gear or either Main Landing Gear is not down and locked (accompanied by landing gear warning horn)*

OXY LOW Light

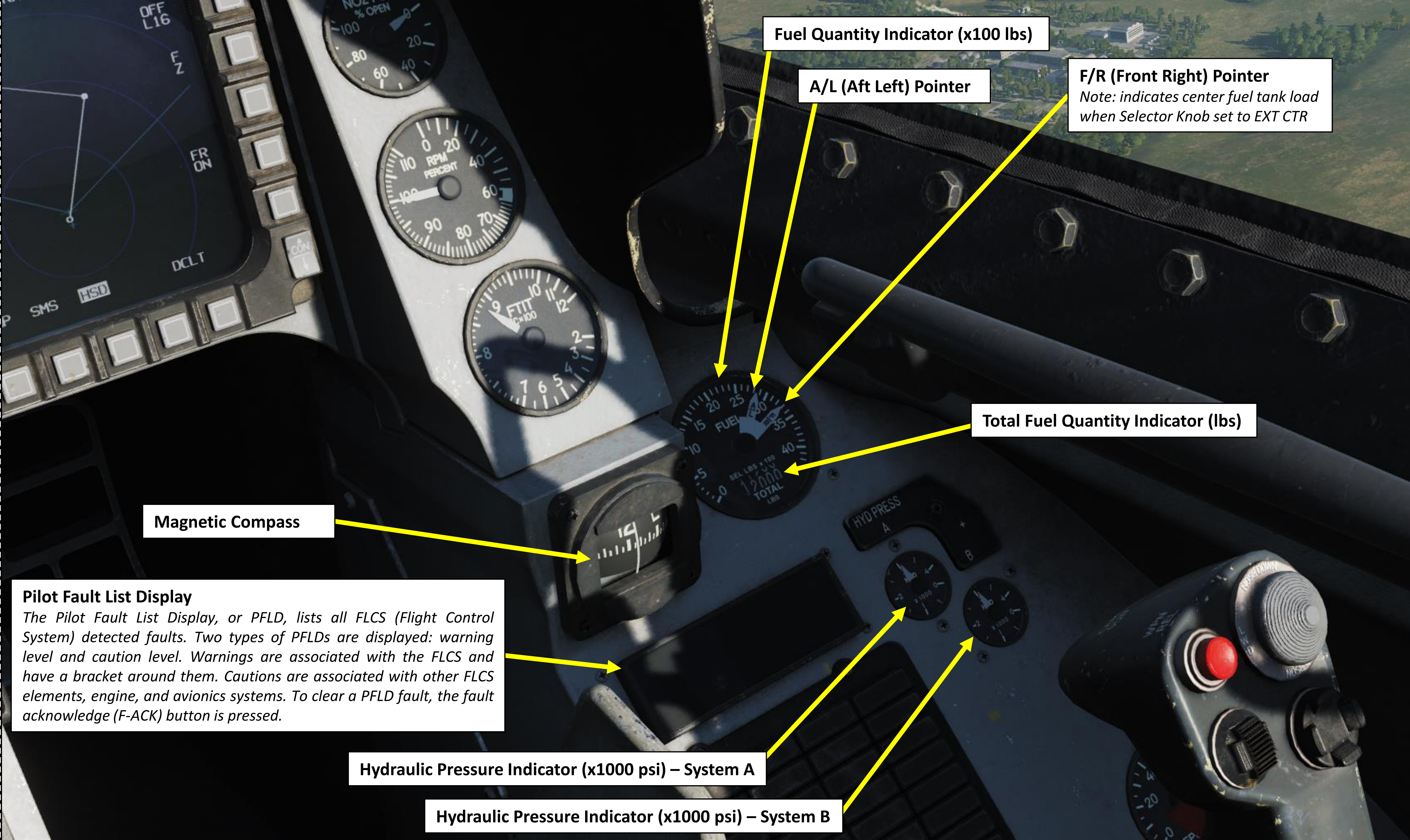
Illuminates when oxygen regulator pressure has dropped below 5 psi or when the BIT (Built-In Test) has detected a fault


Fuel Flow Indicator (lbs/hour)
SAI (Standby Attitude Indicator)
SAI Caging Knob
• *Left Click to Cage*
• *Scroll Mousewheel to adjust aircraft reference symbol*
Engine Oil Pressure Indicator (psi)
Engine Nozzle Position Indicator (% Open)
Engine RPM Indicator (% RPM)
FTIT (Fan Turbine Inlet Temperature) Indicator (x100 deg C)


Ejection Grip
Emergency Manual Chute Deployment Handle

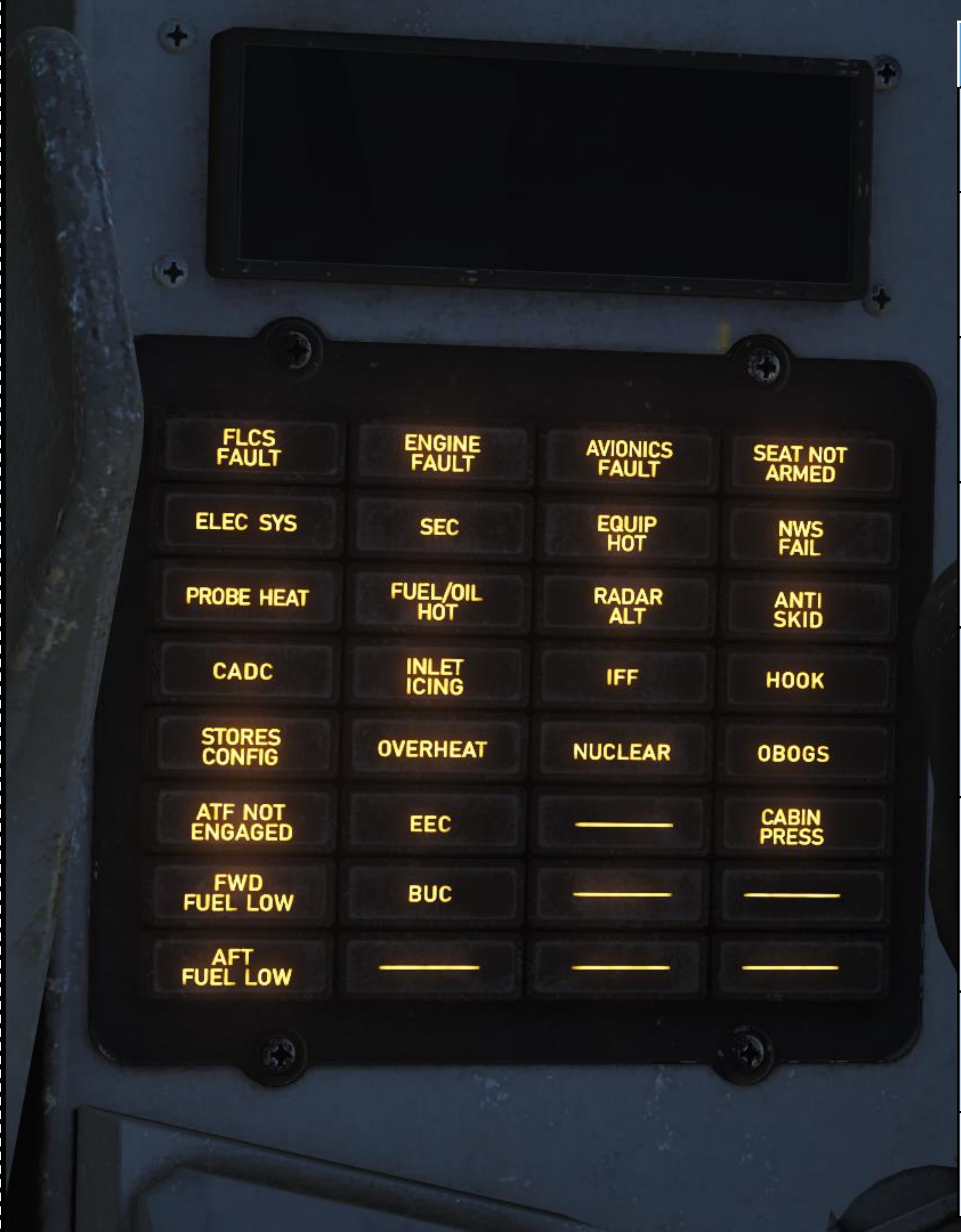

Weapon Release Button
Trim Hat Switch
UP/DOWN/LEFT/RIGHT
DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT
Camera/Gun Trigger
(Two Stages)
CMS (Countermeasures Switch)
FWD/AFT/LEFT/RIGHT
Paddle Switch
Overrides Autopilot
when depressed
Expand/FOV (Field-of-View) Button


NWS A/R DISC & MSL STEP Button
• NWS: Nosewheel Steering Activation
• A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching
• MSL (MISSILE) STEP: When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS.



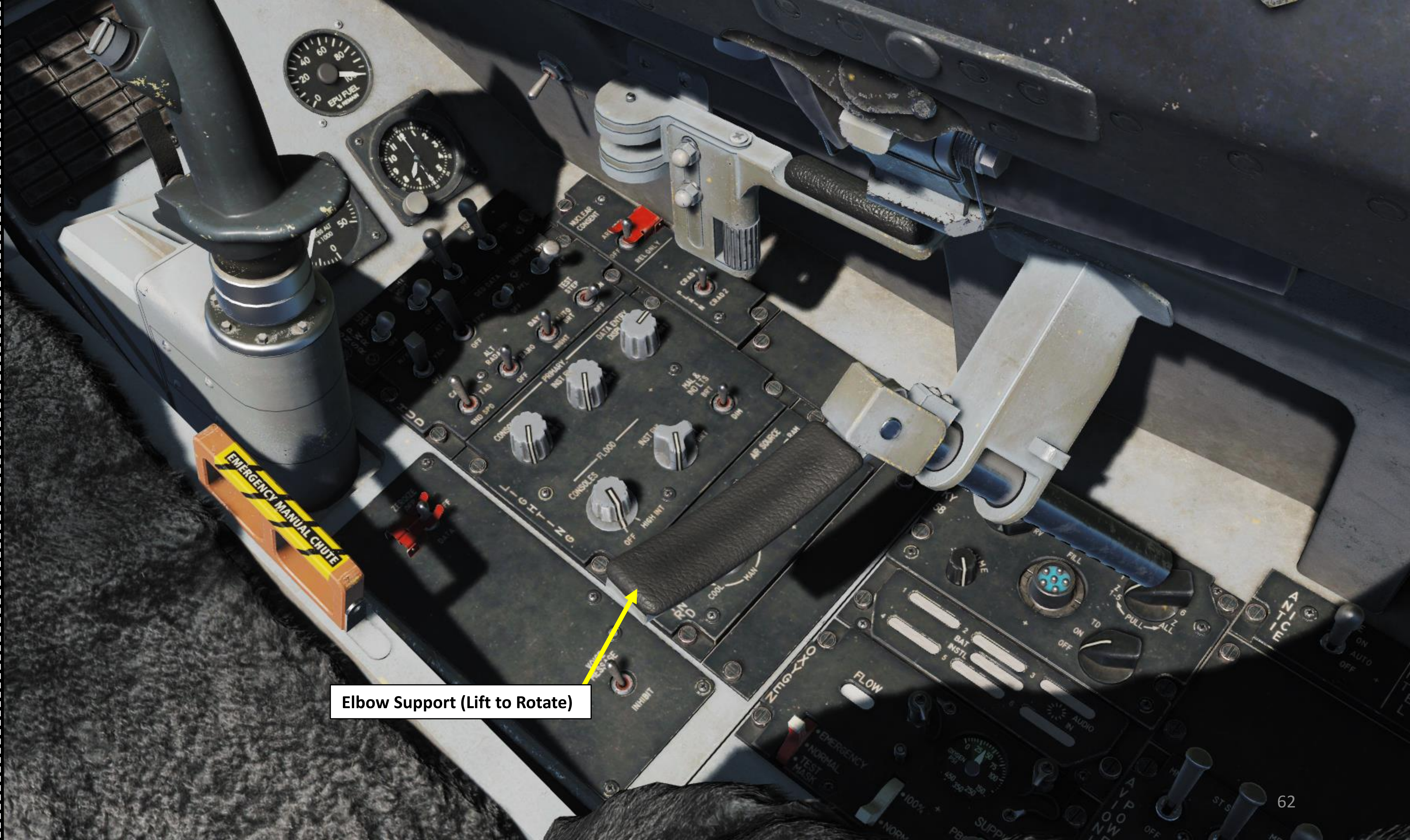
Pilot Fault List Display

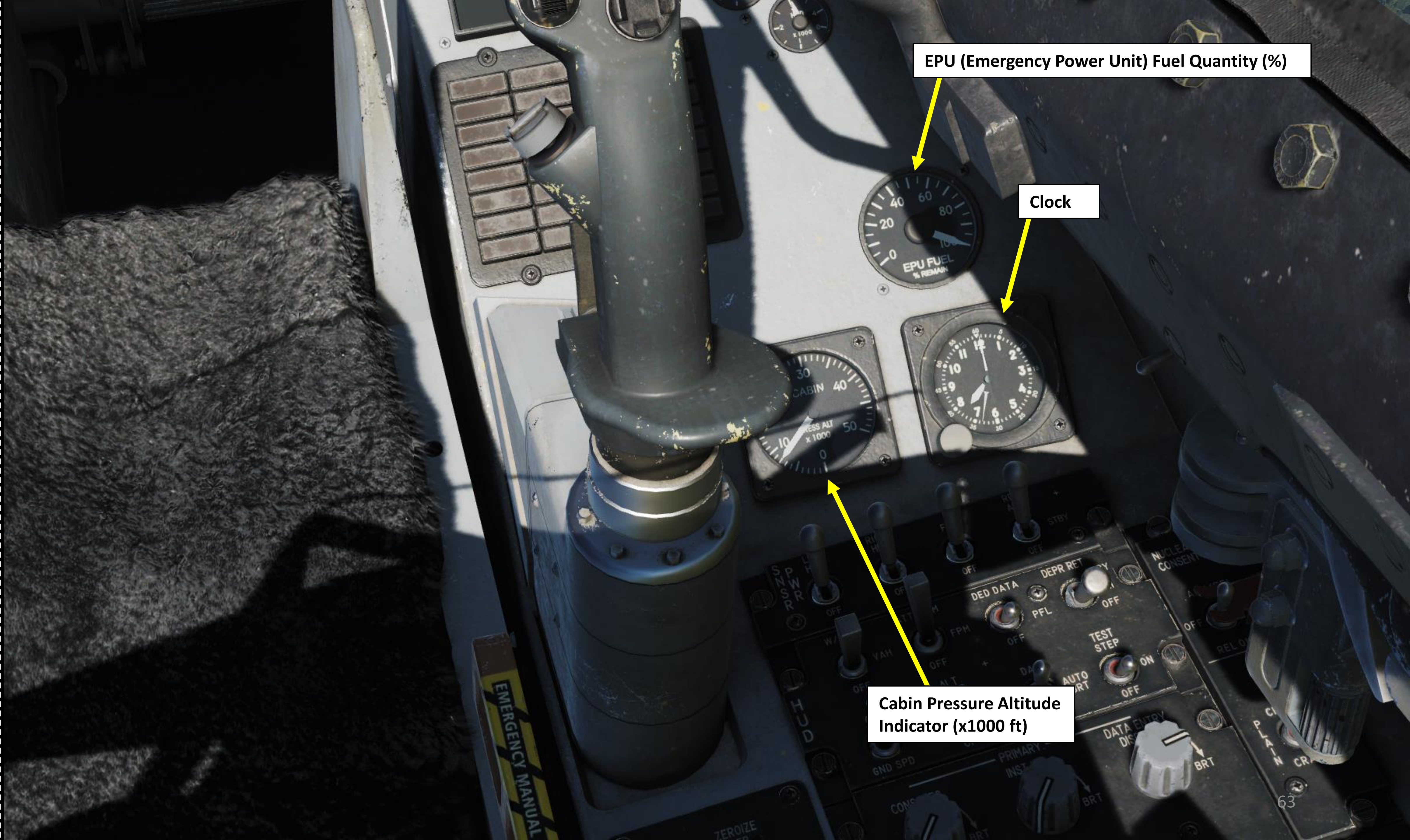
The Pilot Fault List Display, or PFLD, lists all FLCS (Flight Control System) detected faults. Two types of PFLDs are displayed: warning level and caution level. Warnings are associated with the FLCS and have a bracket around them. Cautions are associated with other FLCS elements, engine, and avionics systems. To clear a PFLD fault, the fault acknowledge (F-ACK) button is pressed.

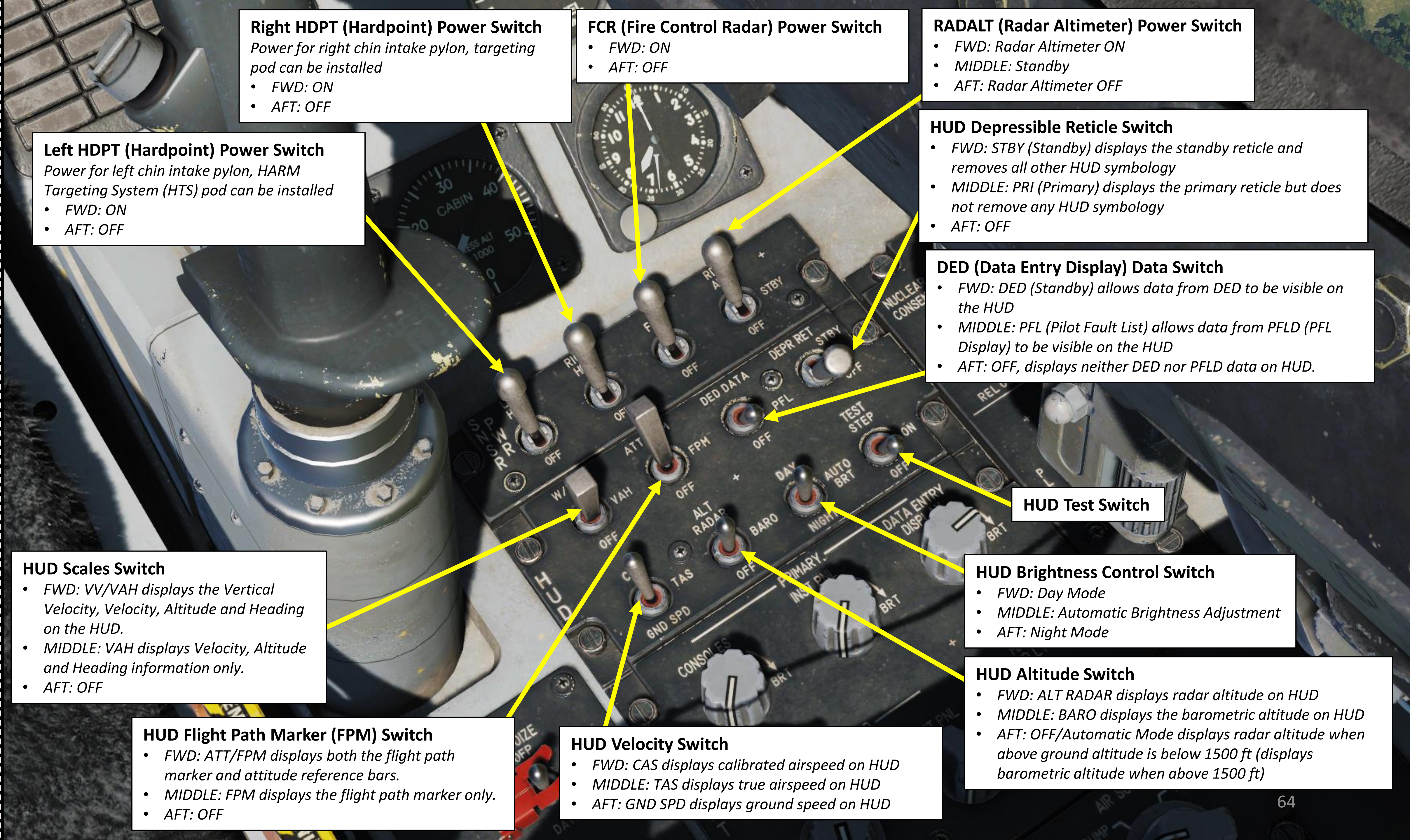


Caution Advisory Lights

FLCS FAULT Flight Control System Fault detected	**ENGINE FAULT** Engine fault detected	**AVIONICS FAULT** Fault detected in avionics systems.	**SEAT NOT ARMED** Ejection seat lever is UP (not armed).
ELEC SYS Electrical system failure. Check ELEC panel.	**SEC** Engine is operating in secondary mode (see if ENG CONT switch is set to SEC)	**EQUIP HOT** Avionics equipment cooling is insufficient: check AIR SOURCE knob position is set to NORM.	**NWS FAIL** Nosewheel Steering System has failed and steering with the nose gear is not possible.
PROBE HEAT Probe heater failure or monitoring system failure.	**FUEL/OIL HOT** Temperature of fuel going to the engine or engine oil is excessive.	**RADAR ALT** Malfunction of the radar altimeter.	**ANTI SKID** A failure affecting anti-skid braking performance is detected while the aircraft is moving above 5 kts ground speed.
CADC Central Air Data Computer failure.	**INLET ICING** Engine Inlet Icing detected	**IFF** There is a condition that prevents IFF (Identify Friend or Foe) Mode 4 operation.	**HOOK** Arresting hook is not up and locked.
STORES CONFIG STORES CONFIG switch on the gear panel is not in the correct position for the current loadout.	**OVERHEAT** Overheat condition detected in the engine compartment, main landing gear wheel wells, ECS bay or EPU bay.	**NUCLEAR** Malfunction in the NUCLEAR control circuitry.	**OBOGS** On-Board Oxygen Generating System caution indicates ECS (Environmental Control System) air supply has dropped below 10 psi.
ATF NOT ENGAGED Automatic Terrain Following system failure.	**EEC** Electronic Engine Controller caution, not applicable in F-16C Block 50.	----------	**CABIN PRESS** Cockpit pressurization is above 27000 ft. Check AIR SOURCE knob for NORM position. If caution light remains illuminated, descend below 25000 ft and reduce speed to 500 kts max.
FWD FUEL LOW Forward reservoir contains less than 400 lbs of fuel.	**BUC** Backup Control caution, not applicable in F-16C Block 50	----------	----------
AFT FUEL LOW Aft reservoir contains less than 400 lbs of fuel.	----------	----------	----------


Elbow Support (Lift to Rotate)
EMERGENCY MANUAL CHUTE
EPU FUEL


EPU (Emergency Power Unit) Fuel Quantity (%)
Clock
Cabin Pressure Altitude Indicator (x1000 ft)



Right HDPT (Hardpoint) Power Switch
Power for right chin intake pylon, targeting pod can be installed
- *FWD: ON*
- *AFT: OFF*

FCR (Fire Control Radar) Power Switch
- *FWD: ON*
- *AFT: OFF*

RADALT (Radar Altimeter) Power Switch
- *FWD: Radar Altimeter ON*
- *MIDDLE: Standby*
- *AFT: Radar Altimeter OFF*

Left HDPT (Hardpoint) Power Switch
Power for left chin intake pylon, HARM Targeting System (HTS) pod can be installed
- *FWD: ON*
- *AFT: OFF*

HUD Depressible Reticle Switch
- *FWD: STBY (Standby) displays the standby reticle and removes all other HUD symbology*
- *MIDDLE: PRI (Primary) displays the primary reticle but does not remove any HUD symbology*
- *AFT: OFF*

DED (Data Entry Display) Data Switch
- *FWD: DED (Standby) allows data from DED to be visible on the HUD*
- *MIDDLE: PFL (Pilot Fault List) allows data from PFLD (PFL Display) to be visible on the HUD*
- *AFT: OFF, displays neither DED nor PFLD data on HUD.*

HUD Test Switch

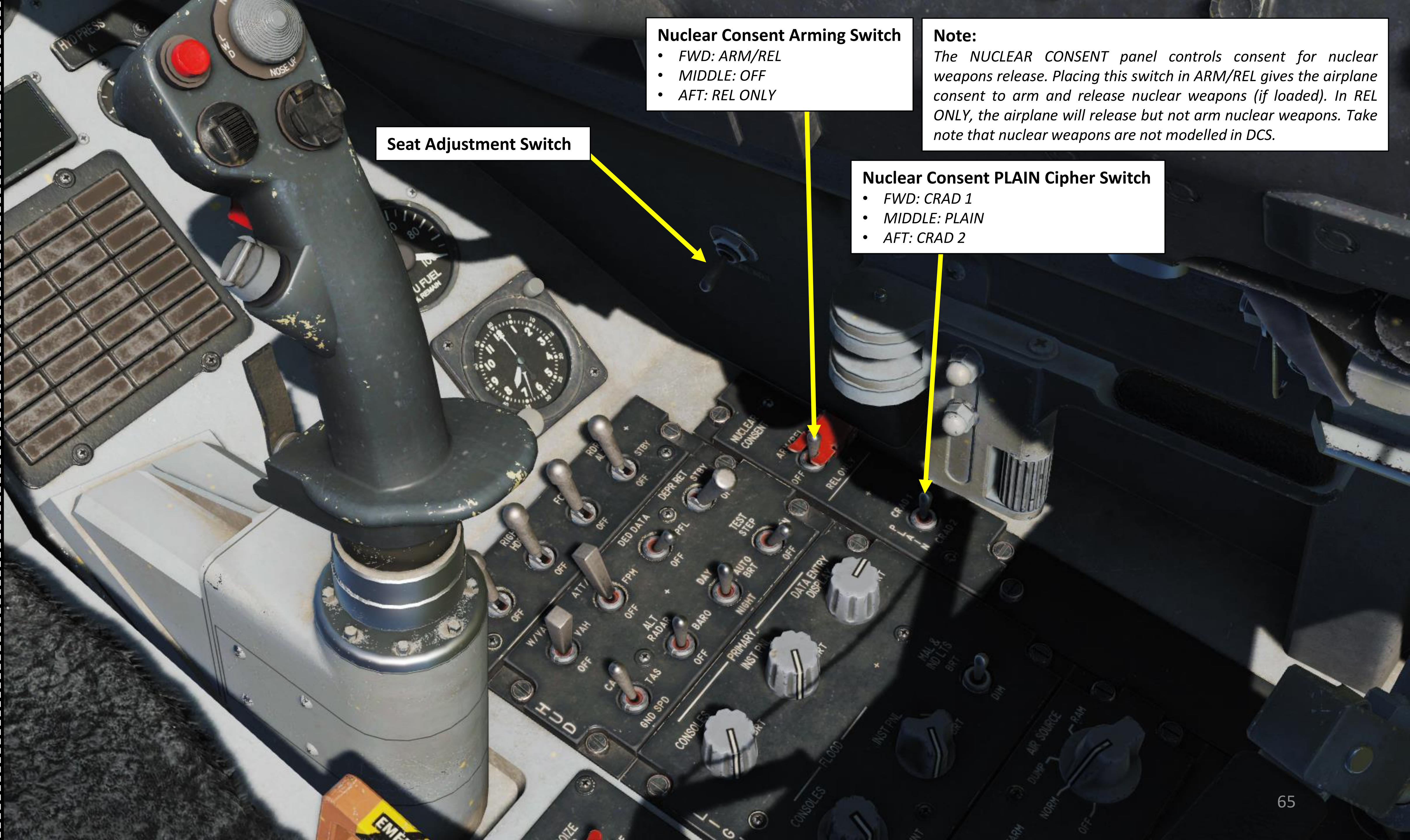
HUD Scales Switch
- *FWD: VV/VAH displays the Vertical Velocity, Velocity, Altitude and Heading on the HUD.*
- *MIDDLE: VAH displays Velocity, Altitude and Heading information only.*
- *AFT: OFF*

HUD Brightness Control Switch
- *FWD: Day Mode*
- *MIDDLE: Automatic Brightness Adjustment*
- *AFT: Night Mode*

HUD Altitude Switch
- *FWD: ALT RADAR displays radar altitude on HUD*
- *MIDDLE: BARO displays the barometric altitude on HUD*
- *AFT: OFF/Automatic Mode displays radar altitude when above ground altitude is below 1500 ft (displays barometric altitude when above 1500 ft)*

HUD Flight Path Marker (FPM) Switch
- *FWD: ATT/FPM displays both the flight path marker and attitude reference bars.*
- *MIDDLE: FPM displays the flight path marker only.*
- *AFT: OFF*

HUD Velocity Switch
- *FWD: CAS displays calibrated airspeed on HUD*
- *MIDDLE: TAS displays true airspeed on HUD*
- *AFT: GND SPD displays ground speed on HUD*

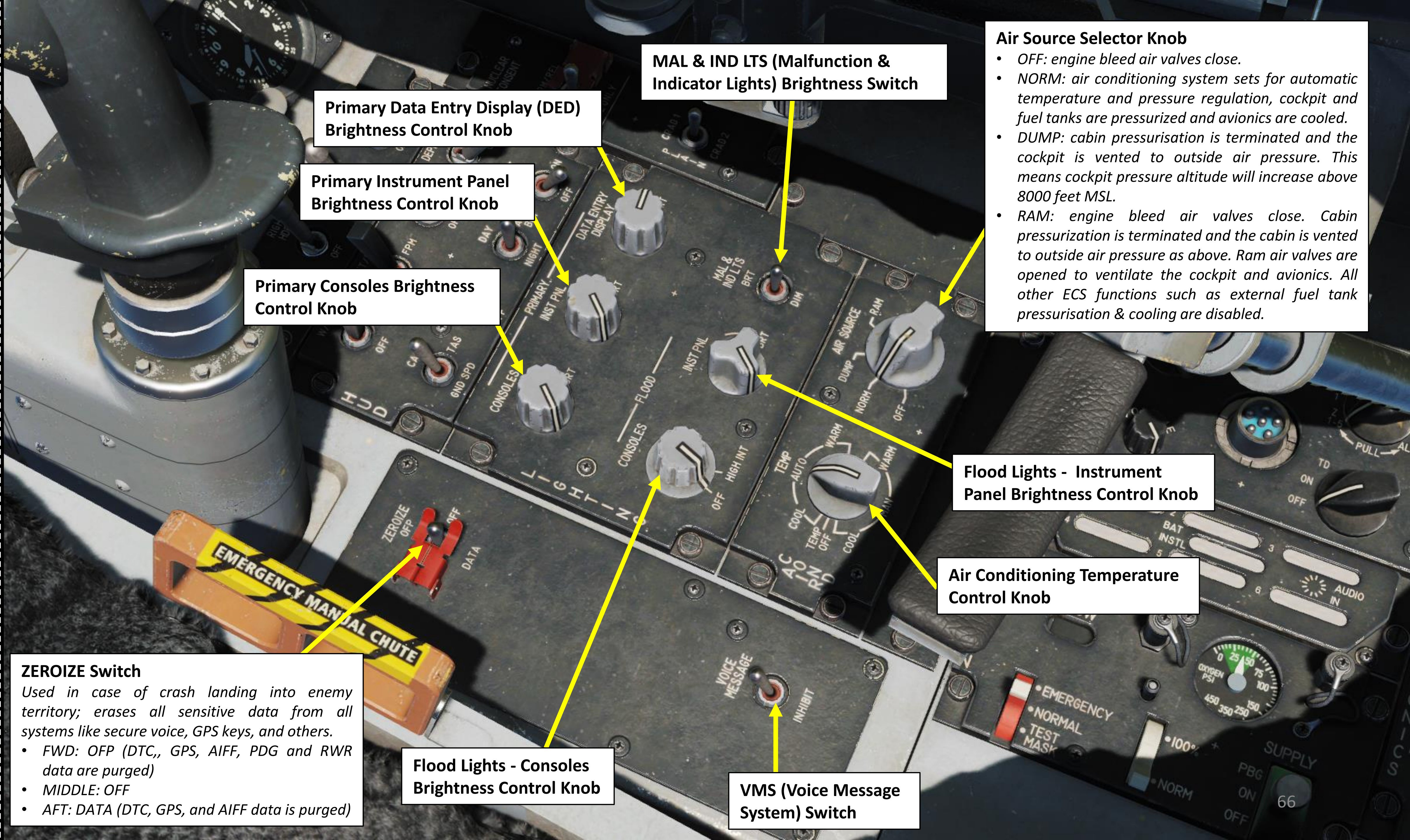


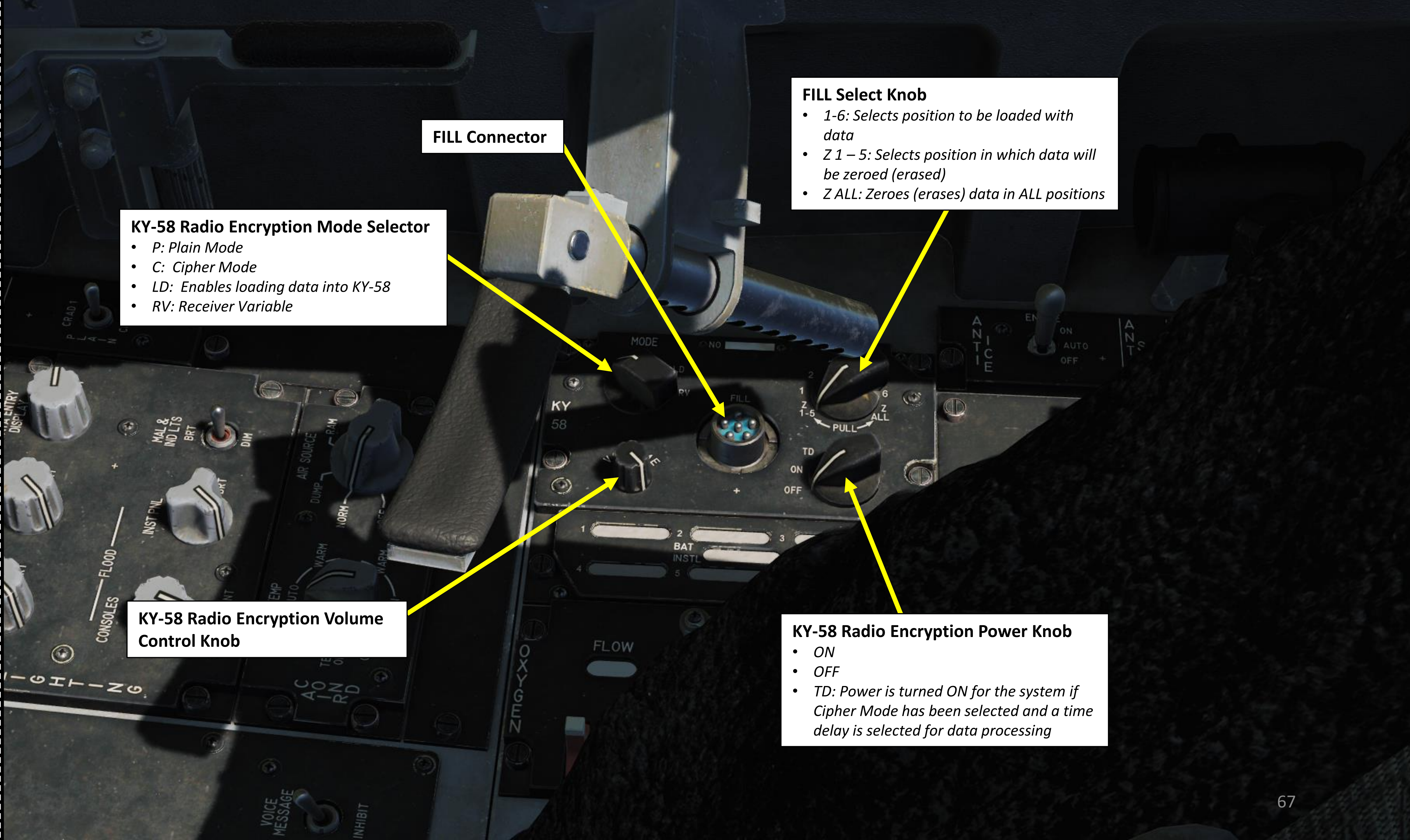
Nuclear Consent Arming Switch
- *FWD: ARM/REL*
- *MIDDLE: OFF*
- *AFT: REL ONLY*

Note:
The NUCLEAR CONSENT panel controls consent for nuclear weapons release. Placing this switch in ARM/REL gives the airplane consent to arm and release nuclear weapons (if loaded). In REL ONLY, the airplane will release but not arm nuclear weapons. Take note that nuclear weapons are not modelled in DCS.

Seat Adjustment Switch

Nuclear Consent PLAIN Cipher Switch
- *FWD: CRAD 1*
- *MIDDLE: PLAIN*
- *AFT: CRAD 2*


Primary Data Entry Display (DED) Brightness Control Knob
Primary Instrument Panel Brightness Control Knob
Primary Consoles Brightness Control Knob
MAL & IND LTS (Malfunction & Indicator Lights) Brightness Switch
Air Source Selector Knob
• OFF: engine bleed air valves close.
• NORM: air conditioning system sets for automatic temperature and pressure regulation, cockpit and fuel tanks are pressurized and avionics are cooled.
• DUMP: cabin pressurisation is terminated and the cockpit is vented to outside air pressure. This means cockpit pressure altitude will increase above 8000 feet MSL.
• RAM: engine bleed air valves close. Cabin pressurization is terminated and the cabin is vented to outside air pressure as above. Ram air valves are opened to ventilate the cockpit and avionics. All other ECS functions such as external fuel tank pressurisation & cooling are disabled.
Flood Lights - Instrument Panel Brightness Control Knob
Air Conditioning Temperature Control Knob
ZEROIZE Switch
Used in case of crash landing into enemy territory; erases all sensitive data from all systems like secure voice, GPS keys, and others.
• FWD: OFP (DTC,, GPS, AIFF, PDG and RWR data are purged)
• MIDDLE: OFF
• AFT: DATA (DTC, GPS, and AIFF data is purged)
Flood Lights - Consoles Brightness Control Knob
VMS (Voice Message System) Switch



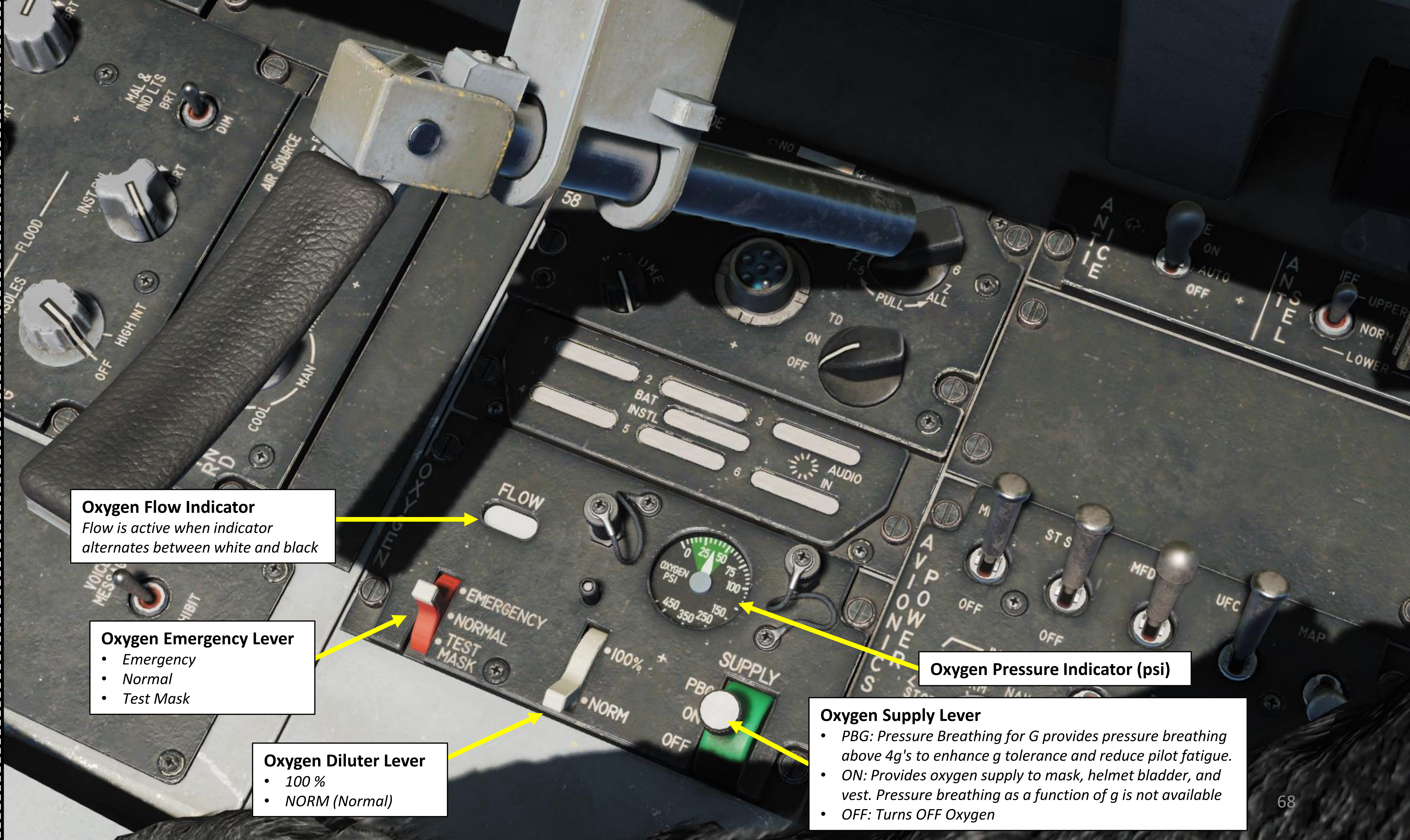
FILL Connector

KY-58 Radio Encryption Mode Selector
- *P: Plain Mode*
- *C: Cipher Mode*
- *LD: Enables loading data into KY-58*
- *RV: Receiver Variable*

FILL Select Knob
- *1-6: Selects position to be loaded with data*
- *Z 1 – 5: Selects position in which data will be zeroed (erased)*
- *Z ALL: Zeroes (erases) data in ALL positions*

KY-58 Radio Encryption Volume Control Knob

KY-58 Radio Encryption Power Knob
- *ON*
- *OFF*
- *TD: Power is turned ON for the system if Cipher Mode has been selected and a time delay is selected for data processing*



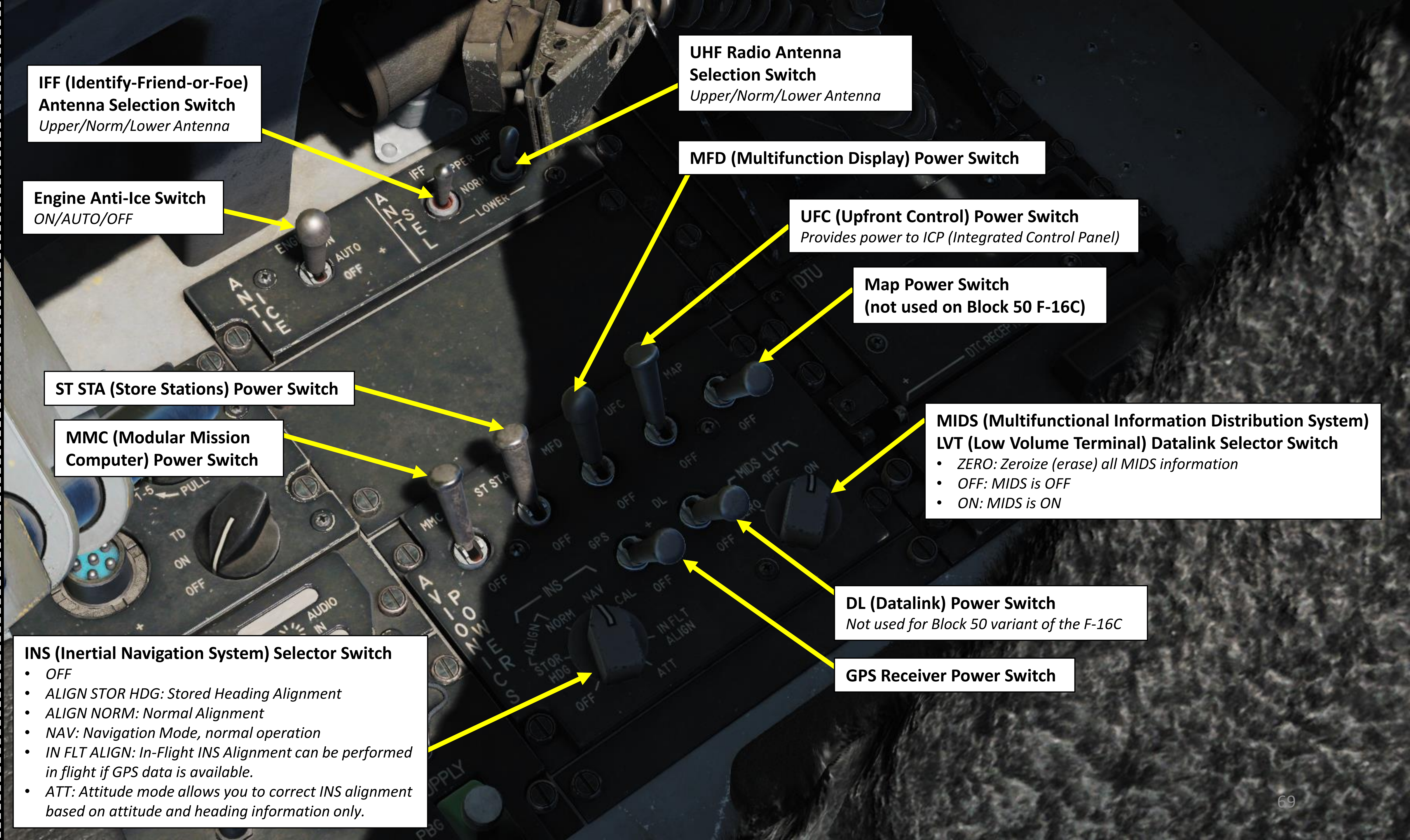
Oxygen Flow Indicator
Flow is active when indicator alternates between white and black

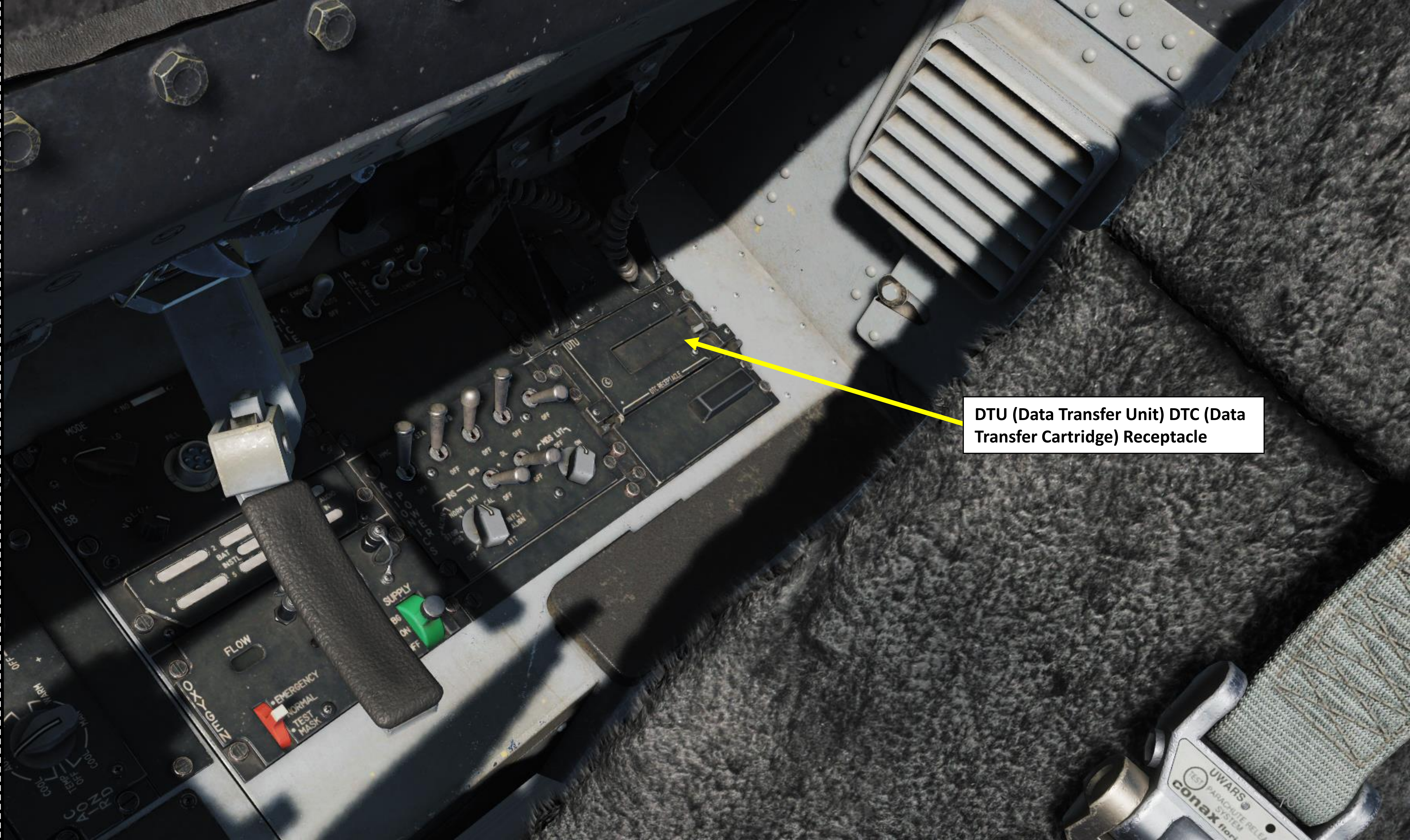
Oxygen Emergency Lever
- *Emergency*
- *Normal*
- *Test Mask*

Oxygen Diluter Lever
- *100 %*
- *NORM (Normal)*

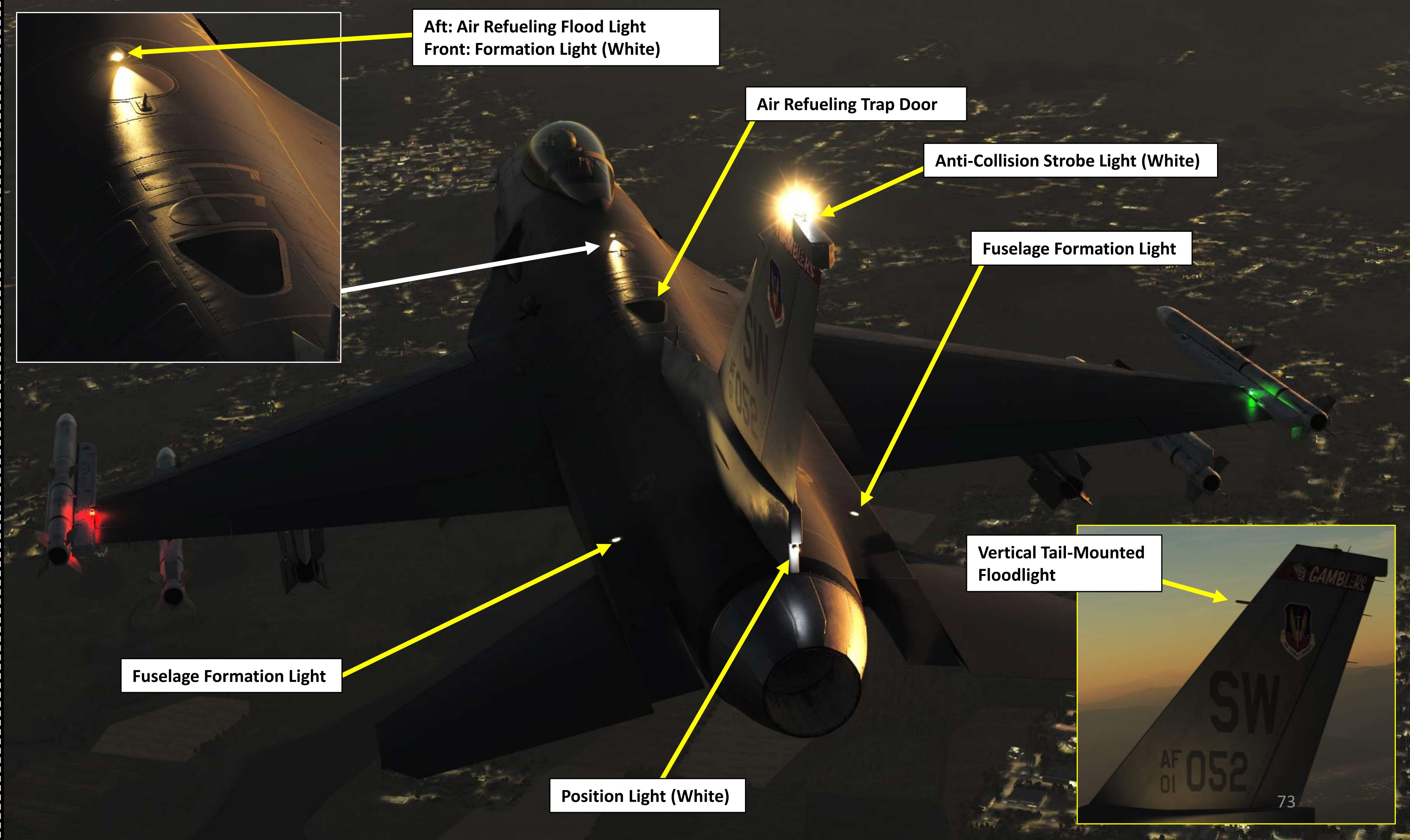
Oxygen Pressure Indicator (psi)

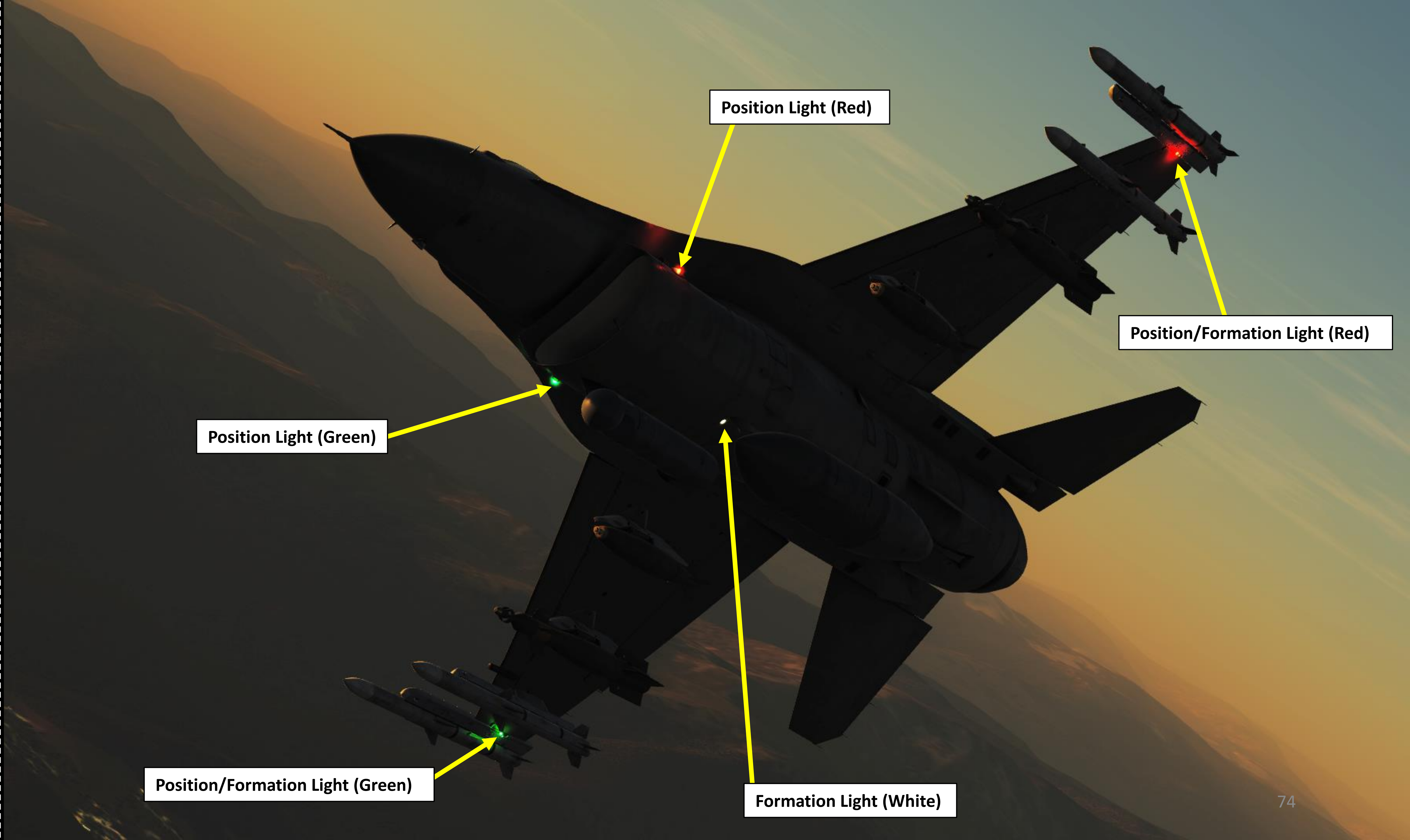
Oxygen Supply Lever
- *PBG: Pressure Breathing for G provides pressure breathing above 4g's to enhance g tolerance and reduce pilot fatigue.*
- *ON: Provides oxygen supply to mask, helmet bladder, and vest. Pressure breathing as a function of g is not available*
- *OFF: Turns OFF Oxygen*


IFF (Identify-Friend-or-Foe) Antenna Selection Switch
Upper/Norm/Lower Antenna
UHF Radio Antenna Selection Switch
Upper/Norm/Lower Antenna
Engine Anti-Ice Switch
ON/AUTO/OFF
MFD (Multifunction Display) Power Switch
UFC (Upfront Control) Power Switch
Provides power to ICP (Integrated Control Panel)
Map Power Switch
(not used on Block 50 F-16C)
ST STA (Store Stations) Power Switch
MMC (Modular Mission Computer) Power Switch
MIDS (Multifunctional Information Distribution System) LVT (Low Volume Terminal) Datalink Selector Switch
• ZERO: Zeroize (erase) all MIDS information
• OFF: MIDS is OFF
• ON: MIDS is ON
DL (Datalink) Power Switch
Not used for Block 50 variant of the F-16C
GPS Receiver Power Switch
INS (Inertial Navigation System) Selector Switch
• OFF
• ALIGN STOR HDG: Stored Heading Alignment
• ALIGN NORM: Normal Alignment
• NAV: Navigation Mode, normal operation
• IN FLT ALIGN: In-Flight INS Alignment can be performed in flight if GPS data is available.
• ATT: Attitude mode allows you to correct INS alignment based on attitude and heading information only.


DTU (Data Transfer Unit) DTC (Data Transfer Cartridge) Receptacle
DTU
FLOW
OXYGEN
SUPPLY
EMERGENCY
NORMAL
TEST MASK


Position/Formation Light (Green)
Position/Formation Light (Red)

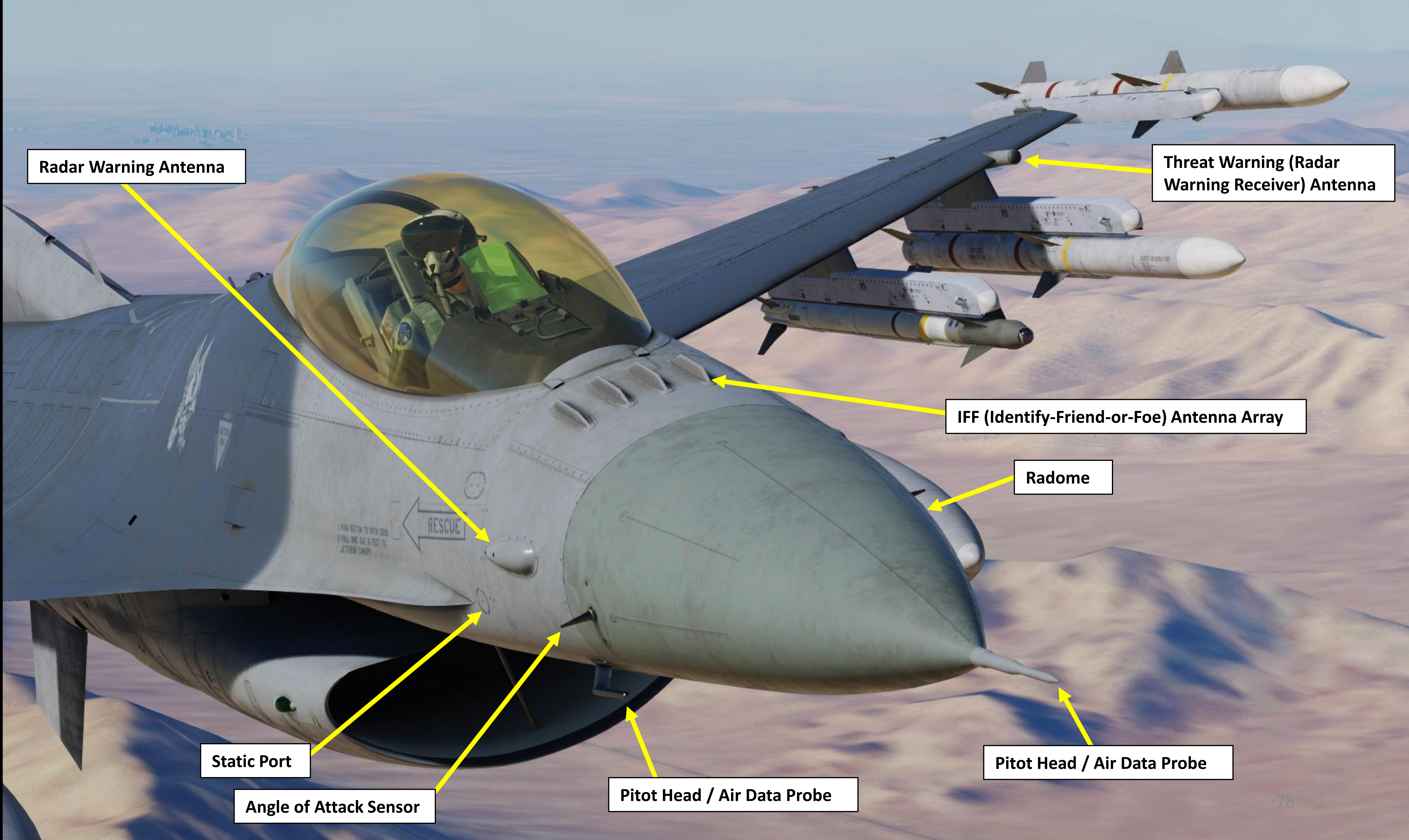

Aft: Air Refueling Flood Light
Front: Formation Light (White)
Air Refueling Trap Door
Anti-Collision Strobe Light (White)
Fuselage Formation Light
Vertical Tail-Mounted Floodlight
Fuselage Formation Light
Position Light (White)

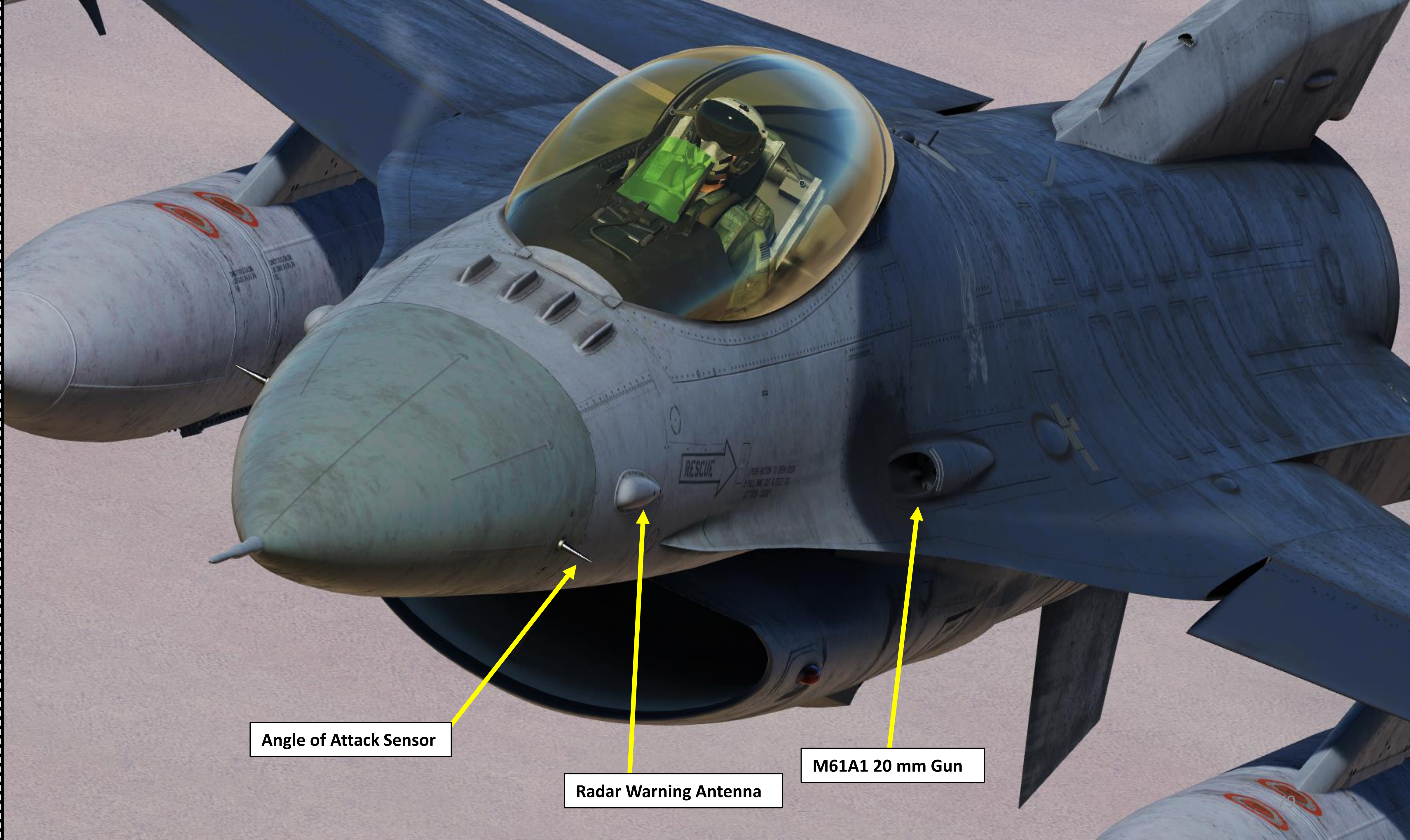

Position Light (Red)
Position/Formation Light (Red)
Position Light (Green)
Formation Light (White)
Position/Formation Light (Green)

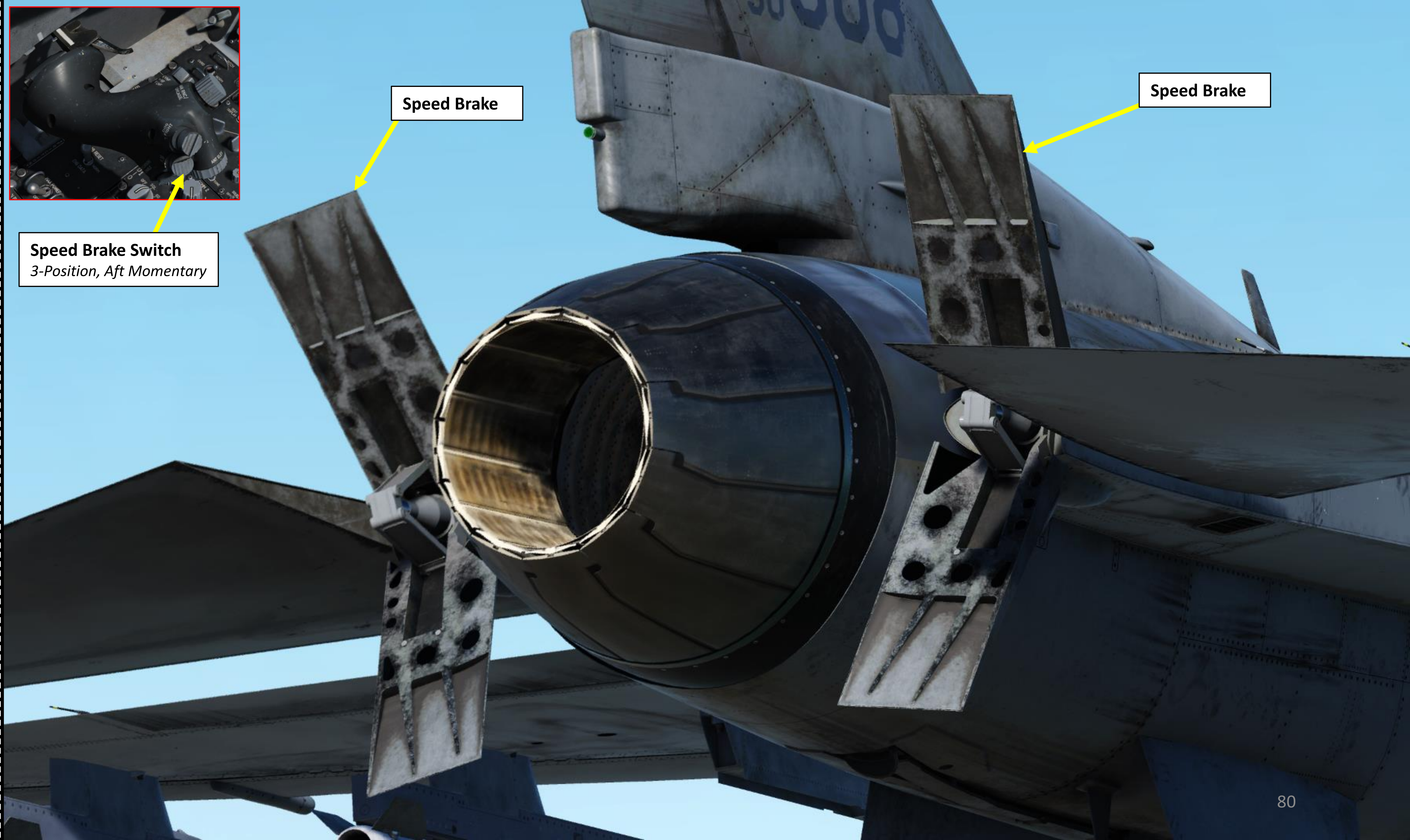

Landing Light


Taxi Light

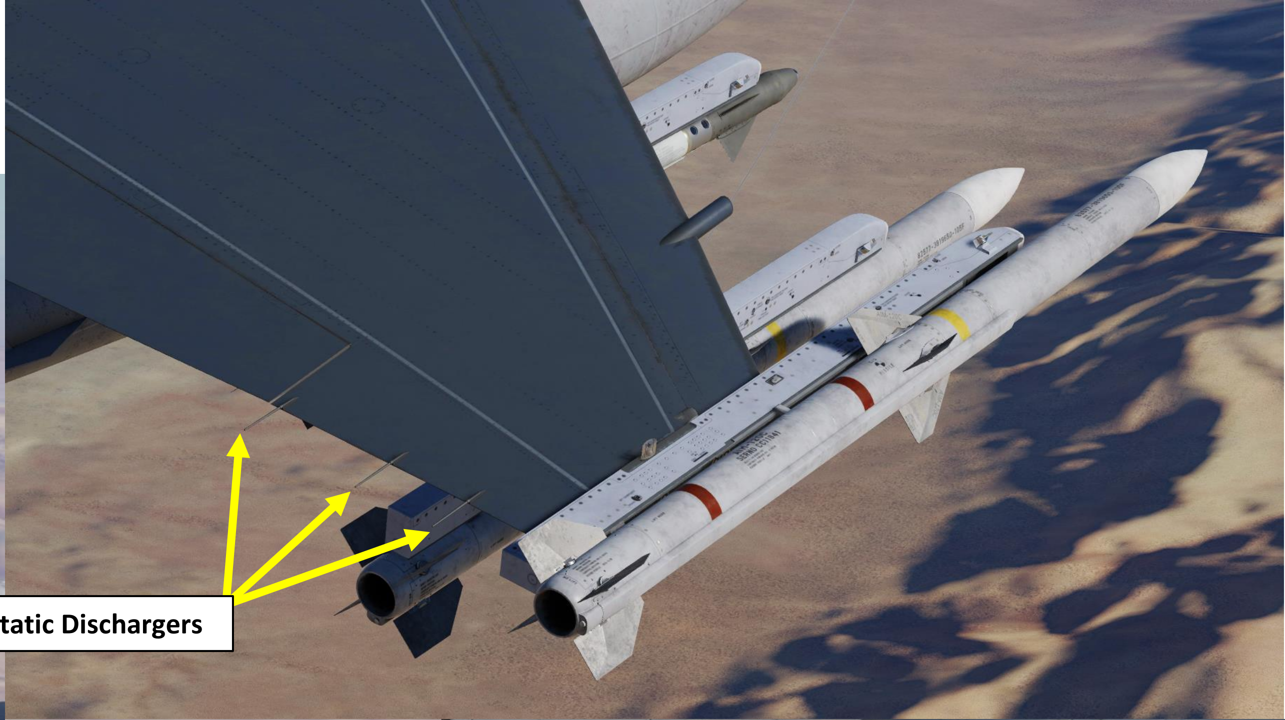

Engine Intake Splitter Plate
Controls airflow into the engine by diverting the boundary layer away from the engine intake
Structural Strut


Radar Warning Antenna
Threat Warning (Radar Warning Receiver) Antenna
IFF (Identify-Friend-or-Foe) Antenna Array
Radome
Static Port
Angle of Attack Sensor
Pitot Head / Air Data Probe
Pitot Head / Air Data Probe
RESCUE


Angle of Attack Sensor
Radar Warning Antenna
M61A1 20 mm Gun


Speed Brake
Speed Brake
Speed Brake Switch
3-Position, Aft Momentary


Static Dischargers


Static Dischargers


Static Dischargers

Note:
Night Vision Goggles and HMCS are mutually exclusive helmet-mounted devices; you can only equip one or the other. You can select what to equip via Ground Crew request.

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*


HUD
VAH
OFF
ATT
FPM
OFF
DED DATA
PFL
OFF
DEPR RET
PRI
OFF
TAS
GND SPD
ALT
RAD
BARO
AUTO
DAY
AUTO BRT
NIGHT
TEST STEP
ON
OFF
LIGHTING
PRIMARY
BRT
BRT
DATA ENTRY
BRT
FLOOD
CONSOLES
OFF
HIGH INT
BRT
MAL & IND LTS
BRT
DIM
TEMP

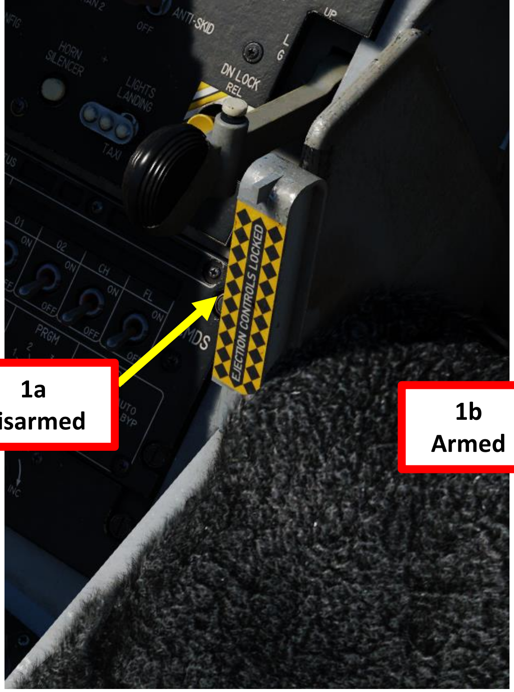

COM 1
COM 2
IFF
LIST
A-A
A-G
T-ILS 1
ALOW 2
3
RCL
STPT 4
CRUS 5
TIME 6
ENTR
MARK 7
FIX 8
A-CAL 9
M-SEL 0
WX
RTN
SEQ
NORM
GAIN
AUTO
FTIT

AIRCRAFT START-UP SUMMARY

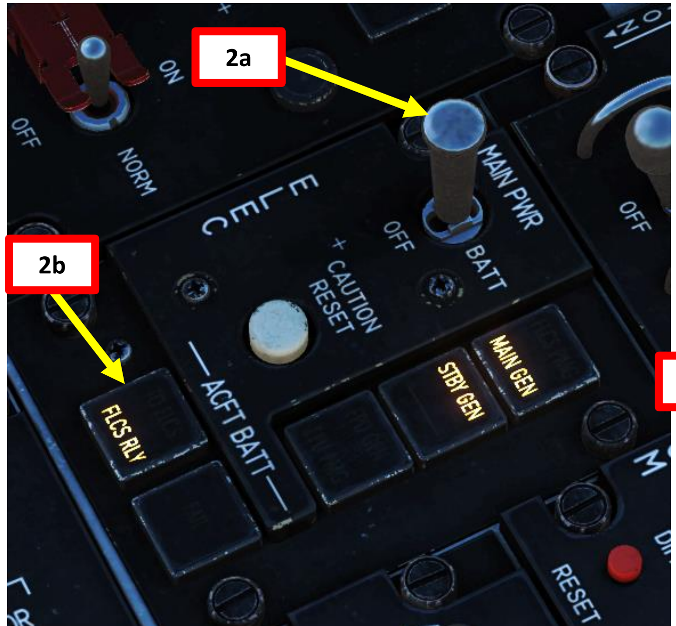
A. Provide Aircraft Power
B. Perform Aircraft Pre-Start Setup
C. Engine Start
D. Set Up Avionics
E. Perform INS (Inertial Navigation System) Alignment
F. Set Up Datalink
G. Set Up IFF
H. Complete Aircraft Setup
I. (Optional) Perform Aircraft Post-Start Checks

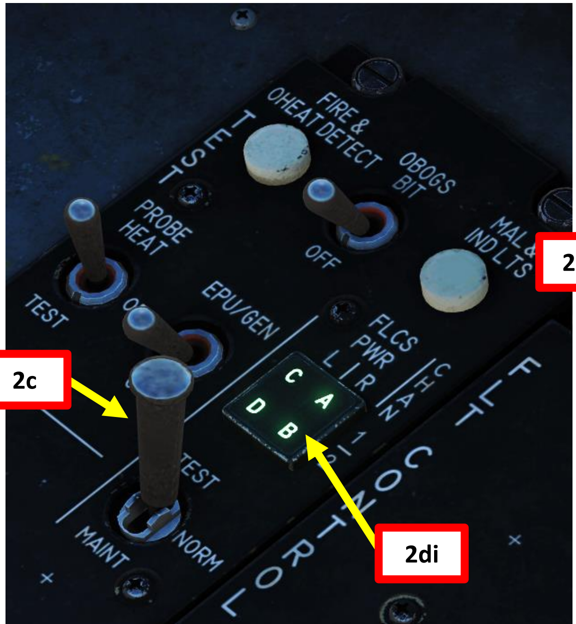
A – PROVIDE AIRCRAFT POWER

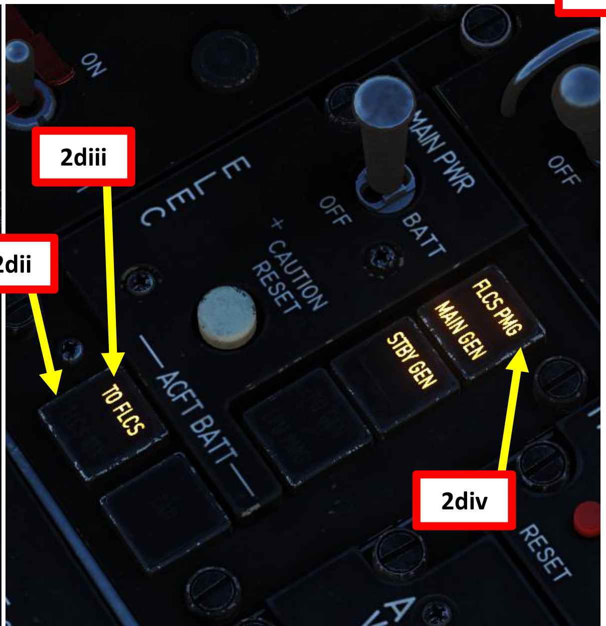
1. Set Ejection Seat Lever – DOWN & ARMED *(Note: this step is typically done just before takeoff)*
2. Test that the FLCS (Flight Control System) functions properly on battery power only
   a) (Mandatory) MAIN PWR Switch – BATT/MIDDLE (Right Click)
   Note: This will connect the aircraft's battery to essential systems and provide power to engine igniters.
   b) (Mandatory) Verify that the FLCS RLY (Flight Control System Relay) light is illuminated. This confirms that the FLCS's fault monitoring system operates properly.
   c) (Optional) Set and hold FLCS PWR TEST switch to TEST position (Right Click and hold).
   d) (Optional) While FLCS PWR TEST switch is set to TEST, confirm that:
      i. The four FLCS PWR (Power) lights illuminate
      ii. The FLCS RLY (Relay) light extinguishes
      iii. The TO FLCS light illuminates *(battery power is powering FLCS)*
      iv. The FLCS PMG (Permanent Magnet Generator) light illuminates
   e) (Optional) Release FLCS PWR TEST switch to NORM position (release Right Click).
3. Set MAIN PWR Switch – MAIN PWR/FWD (Right Click)
   Note: This will connect the aircraft's battery to essential systems and provide power to engine igniters.



Note: *The amount of power available from the battery is limited; do not leave the MAIN PWR switch in BATT or MAIN PWR for more than 5 minutes. Start the engine or apply external power if more time is needed.*



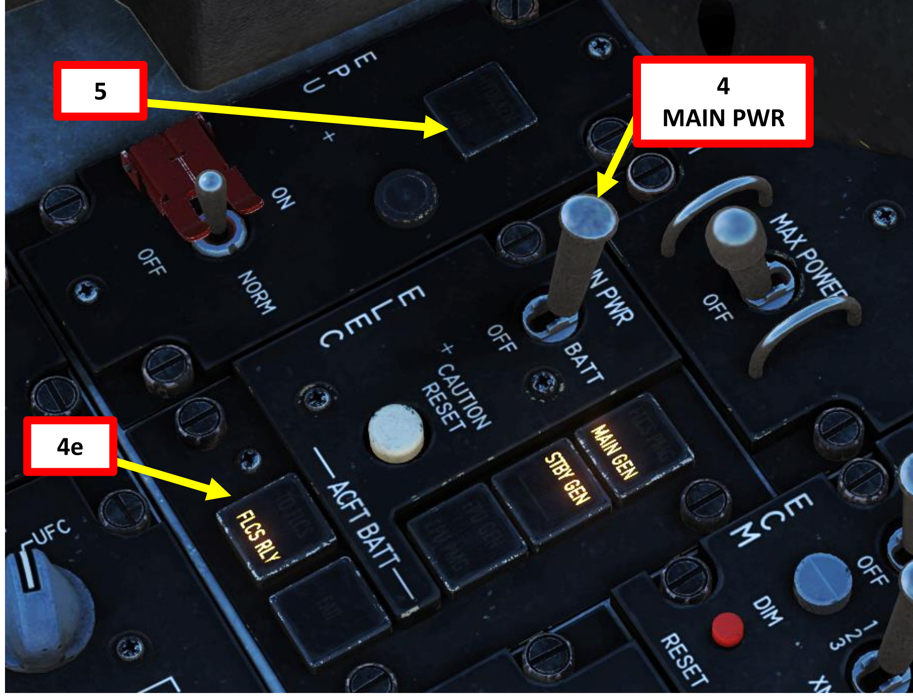


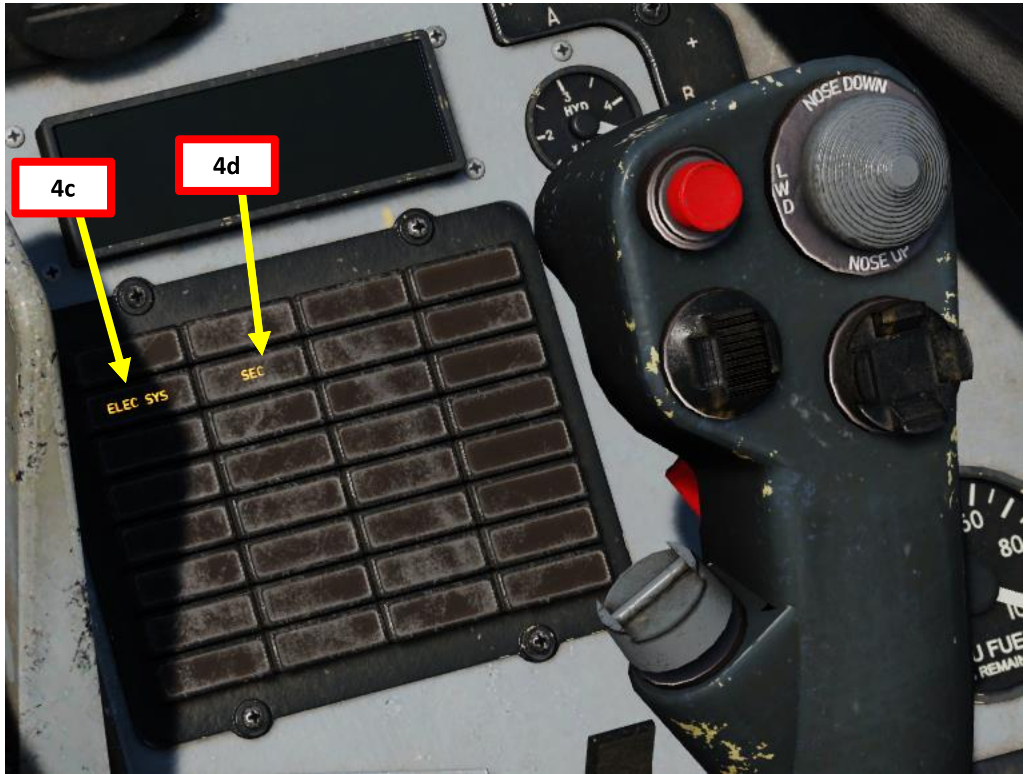


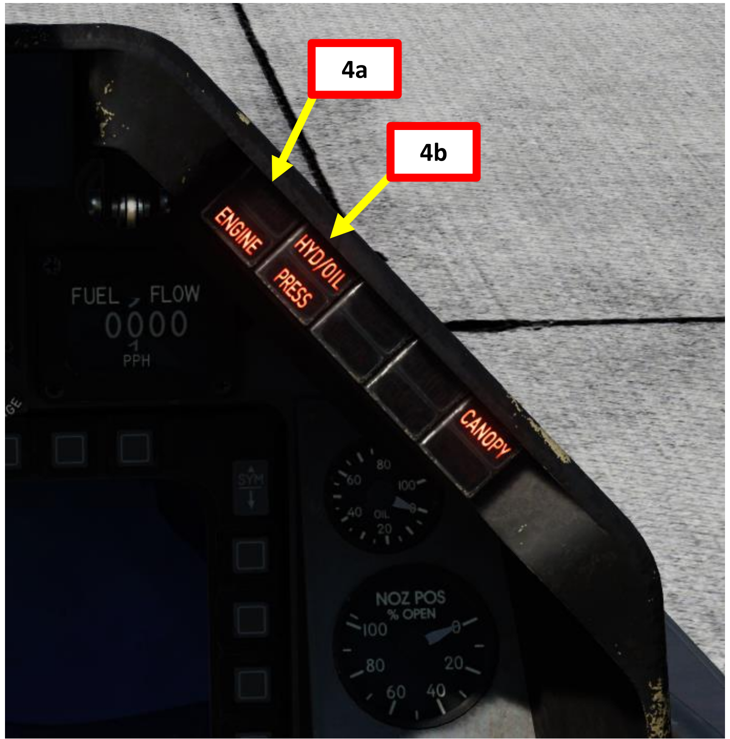
A – PROVIDE AIRCRAFT POWER

4. MAIN PWR prepares the aircraft to run off the engine-mounted generator, but electrical power is not available until the engine is running (IDLE RPM). For that reason the following warning lights should be illuminated:
   a) ENGINE warning Light
   b) HYD/OIL PRESS warning light
   c) ELEC SYS caution light
   d) SEC caution light
   e) FLCS RLY light
5. On EPU (Emergency Power Unit) Panel, verify that EPU GEN (Generator) and EPU PMG (Permanent Magnet Generator) lights are OFF.

   Note: Illumination of either light indicates criteria for EPU activation are met, which means that the EPU could activate and create a hazardous condition if the EPU safety pin is removed by the ground crew.

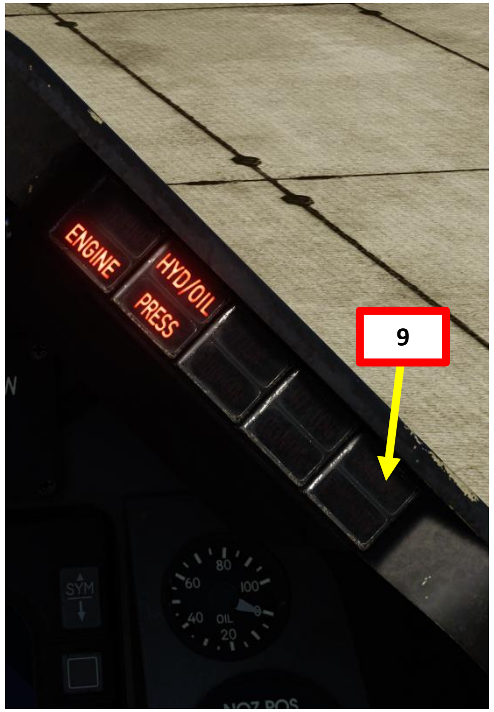


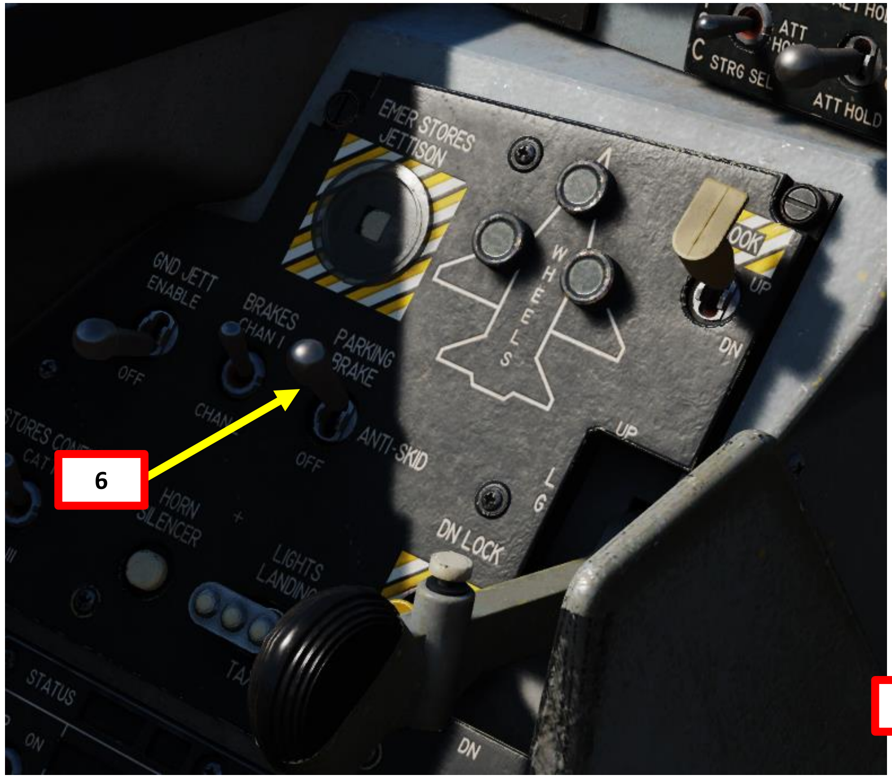


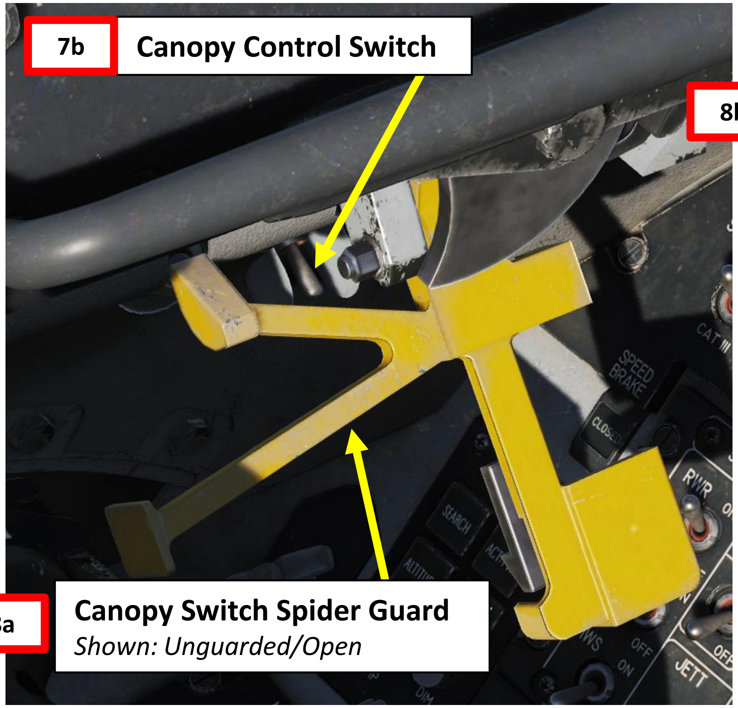


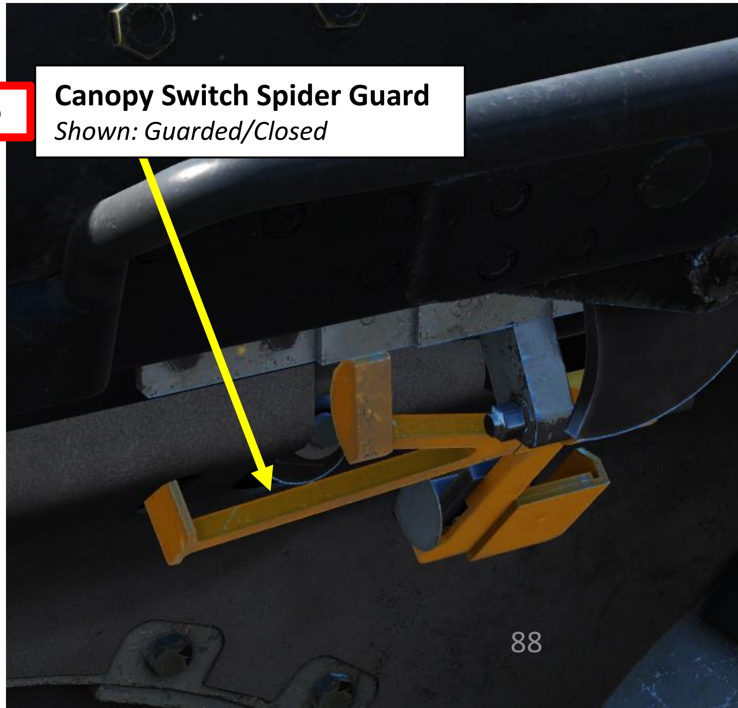
B – PERFORM AIRCRAFT PRE-START SETUP

6. Set Parking Brake / Anti-Skid Switch – PARKING BRAKE (UP)
   Note: the parking brake holds the aircraft stationary without the use of toe brakes. It can also be used for emergency braking if the toe brakes are inoperative. The parking brake is powered by battery bus No. 2 and system B hydraulics or one brake/JFS accumulator (the brake/Jet Fuel Starter accumulator which is not used for START 1).
7. Hold the Canopy Control Switch DOWN to close the Canopy (LCTRL+C).
8. Close the Canopy Switch Spider Guard (Left Click)
9. Confirm canopy is closed and locked with the CANOPY light being extinguished.





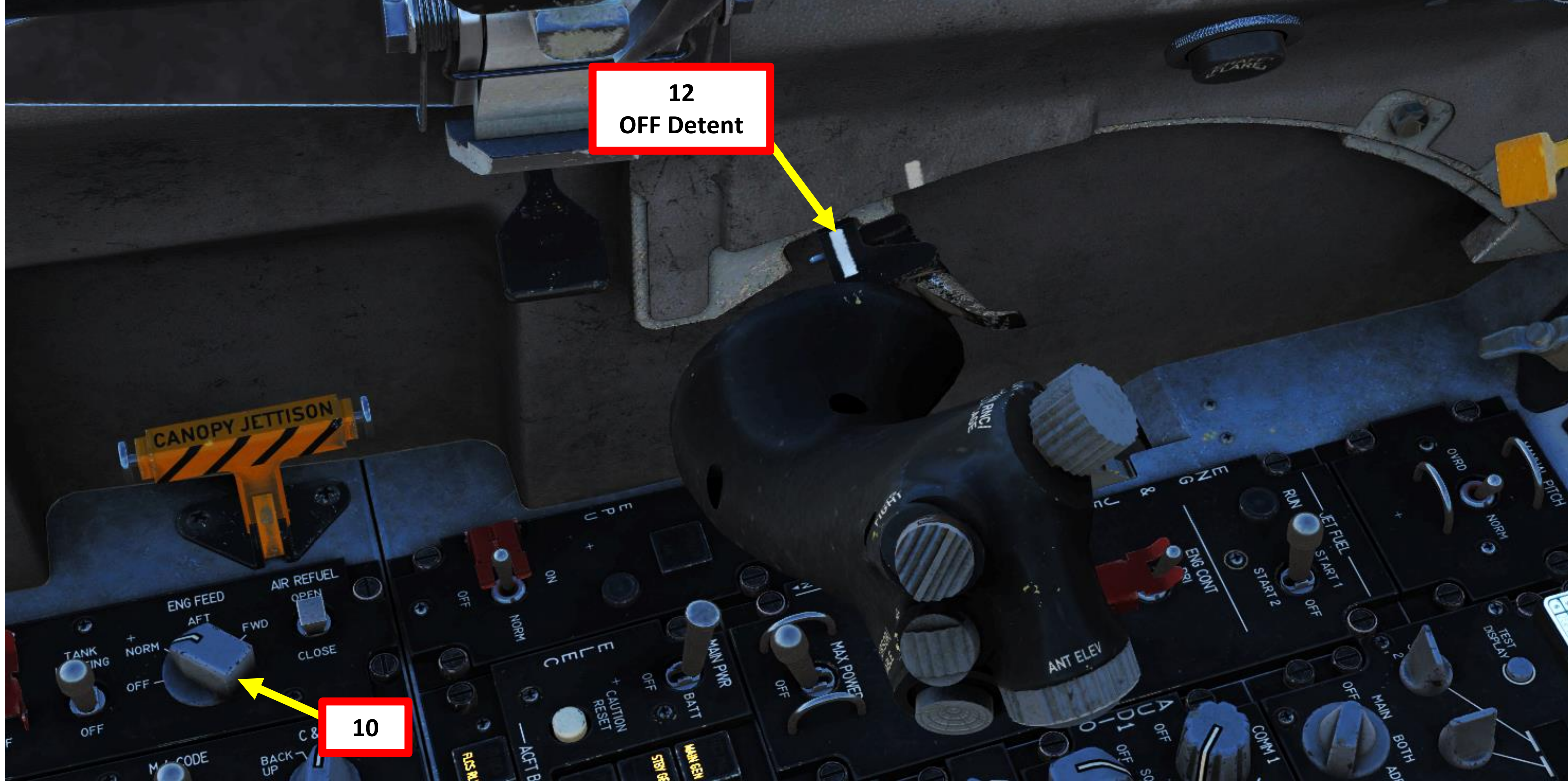


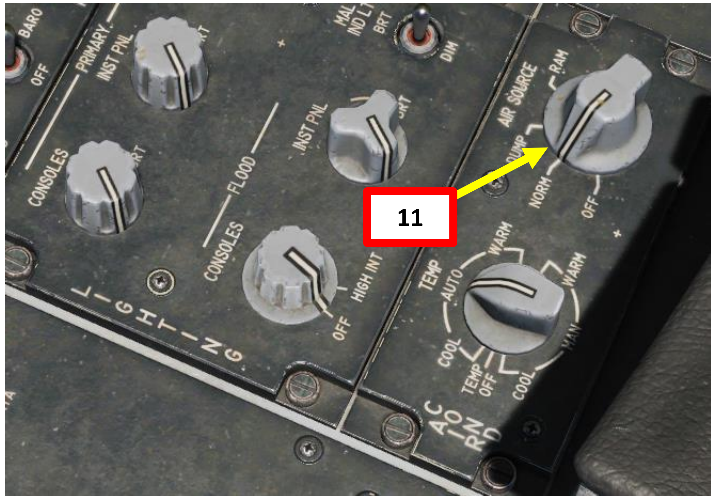


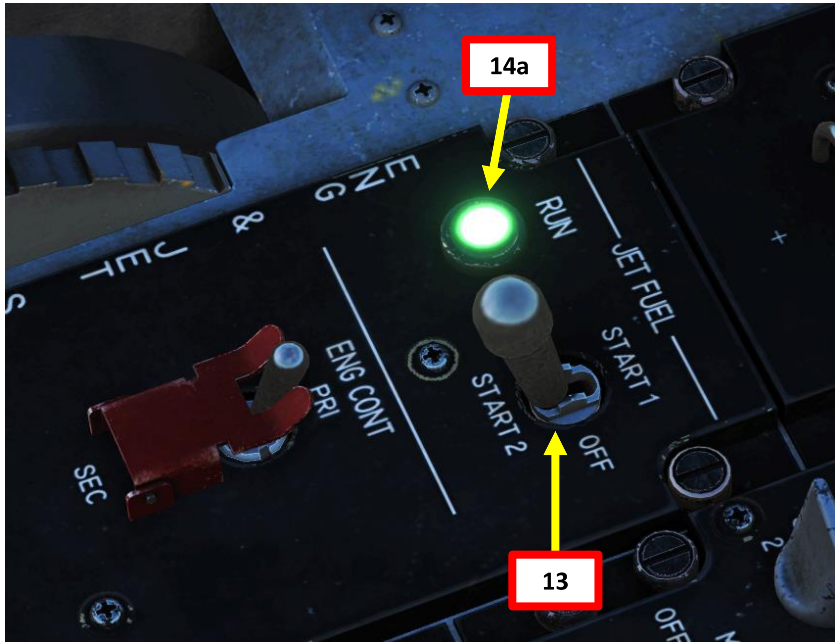
B – PERFORM AIRCRAFT PRE-START SETUP

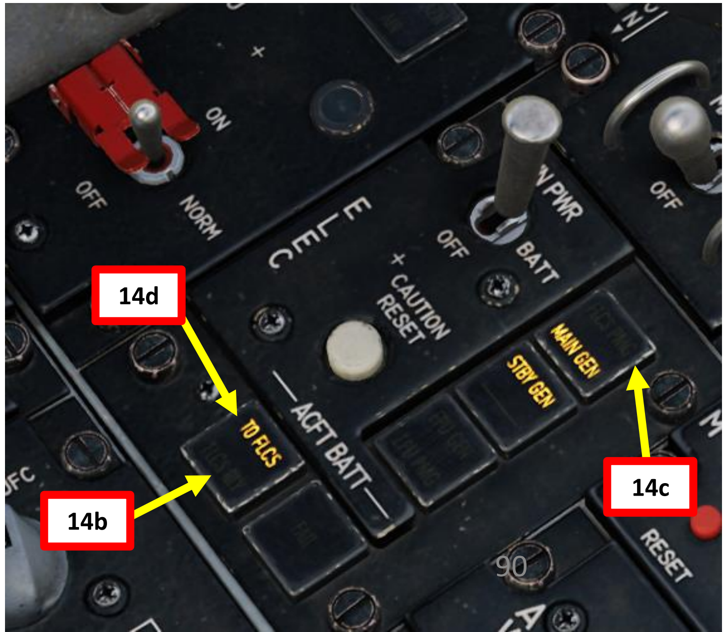
C – ENGINE START

10. Set ENGINE FEED Selector – NORM
    This will turn on all fuel pumps, which will also automatically control the aircraft CG (Centre of Gravity).
11. Set AIR SOURCE Selector Knob – NORM
    This will open the engine bleed air valves when engine is spooled up, which sets automatic air temperature control, cockpit pressure regulation, and <u>avionic systems cooling</u>.
12. Verify that throttle is at the OFF detent
    Note: you can use RSHIFT+END to set throttle to OFF.
13. Set JFS (Jet Fuel Starter) switch AFT to START2 (Left Click).
    Note: START1 and START2 refer to the number of compressed air bottles used to start the JFS. Normally, one should be sufficient in cold conditions. However, you may need to use two bottles on hot days or high altitudes to generate enough air pressure to spool up the JFS.
14. When the Jet Fuel Starter reaches IDLE RPM (within 30 seconds):
    a) The JFS RUN green light should illuminate
    b) FLCS RLY (Flight Control System Relay) light should extinguish
    c) FLCS PMG (Permanent Magnet Generator) light should be extinguished
    d) TO FLCS light should illuminate



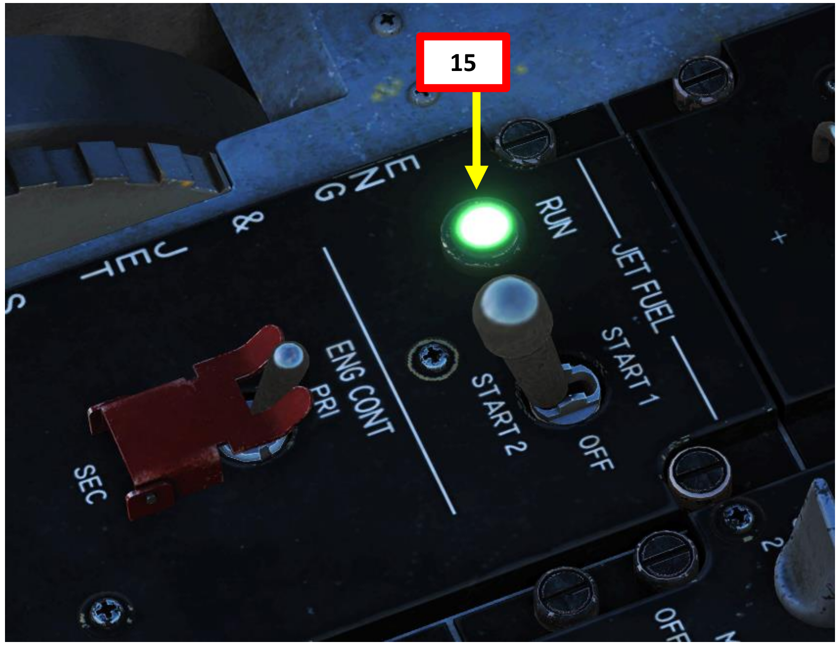


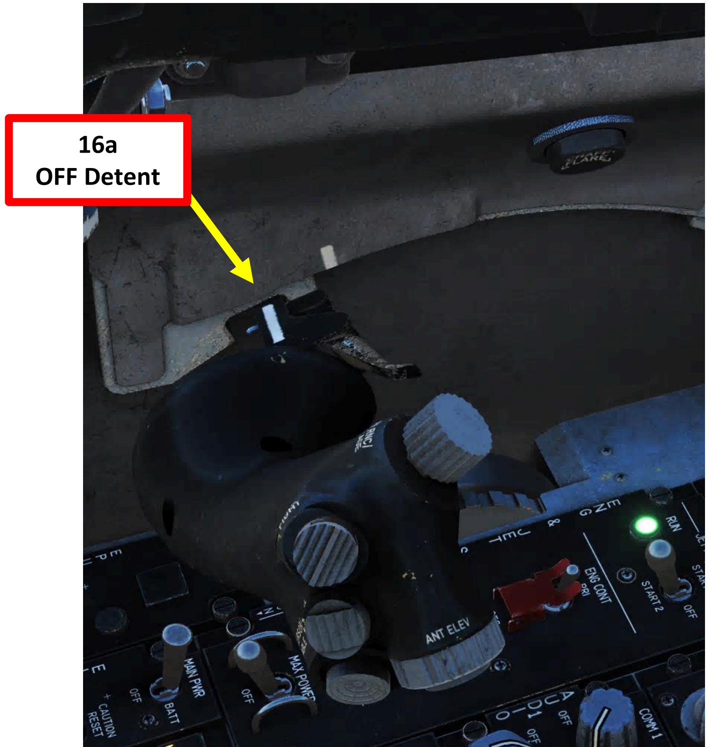


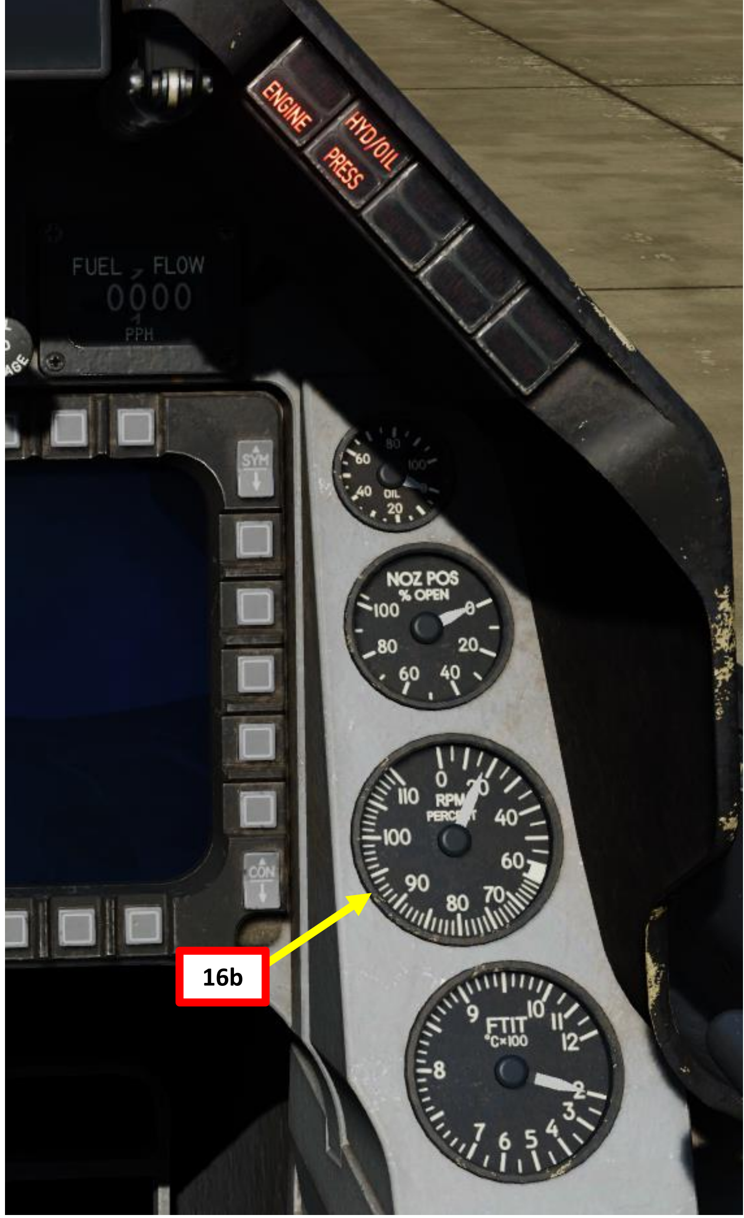


C – ENGINE START

15. When JFS (Jet Fuel Starter) is operational, a clutch inside the Accessory Drive Gearbox (ADG) will engage, driving the General Electric F-110 engine through the accessory drive gearbox and PTO (Power Takeoff) shaft. Engine RPM will increase, gradually spooling up to 20-25% RPM.
16. When engine RPM reaches between 20% and 25 %, move throttle from OFF position to IDLE position (RSHIFT+HOME). Moving throttle too early may result in an engine hot start or a hung start (introducing fuel too early causing RPM to stagnate below IDLE RPM).
17. The engine should light-off within 10 seconds. Engine RPM and FTIT (Fan Turbine Inlet Temperature) should increase. Only the RPM and FTIT indicators will function until the standby generator comes online.

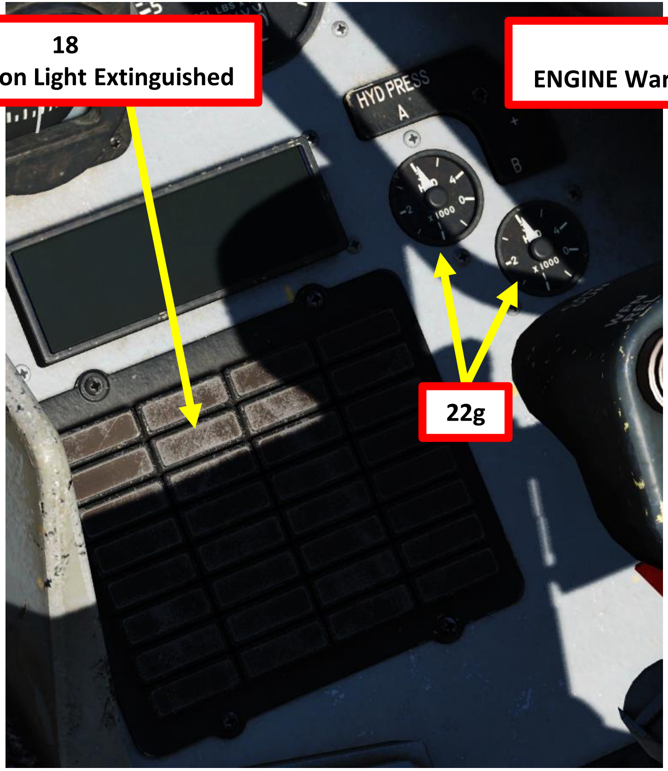


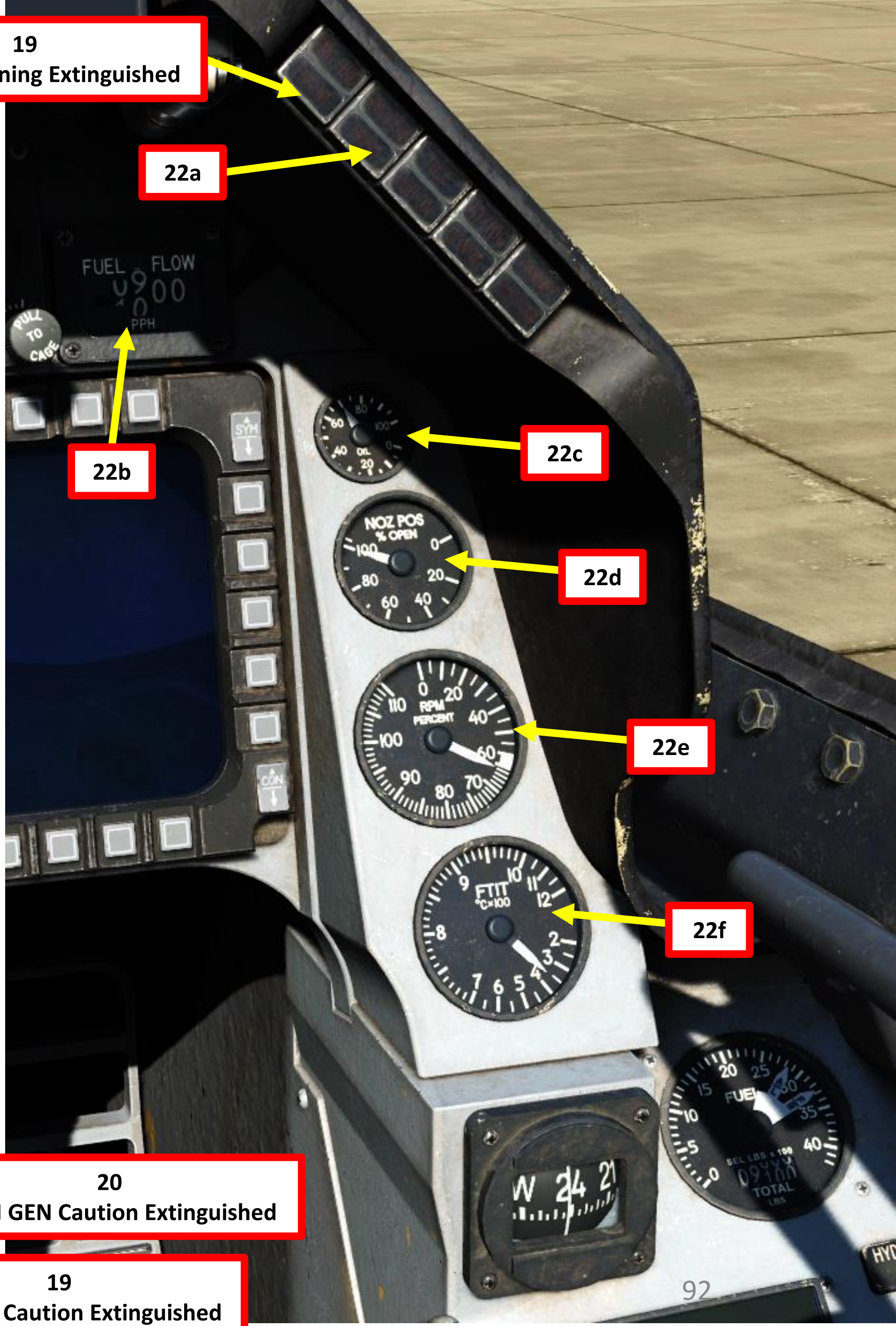


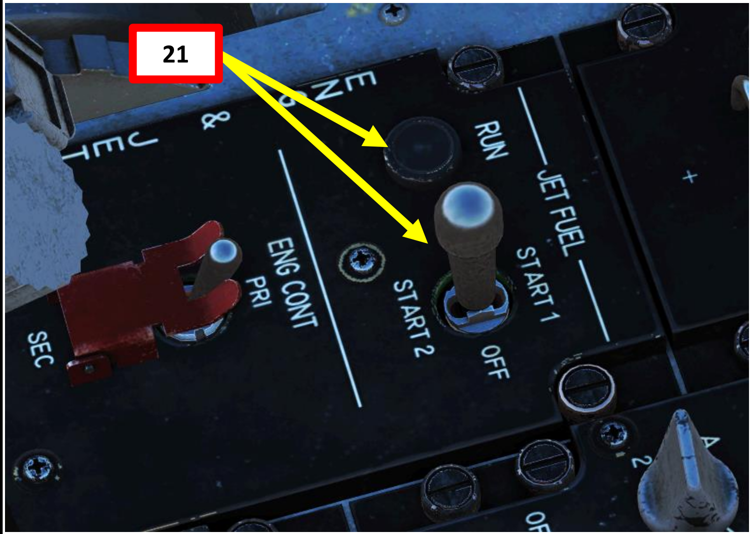


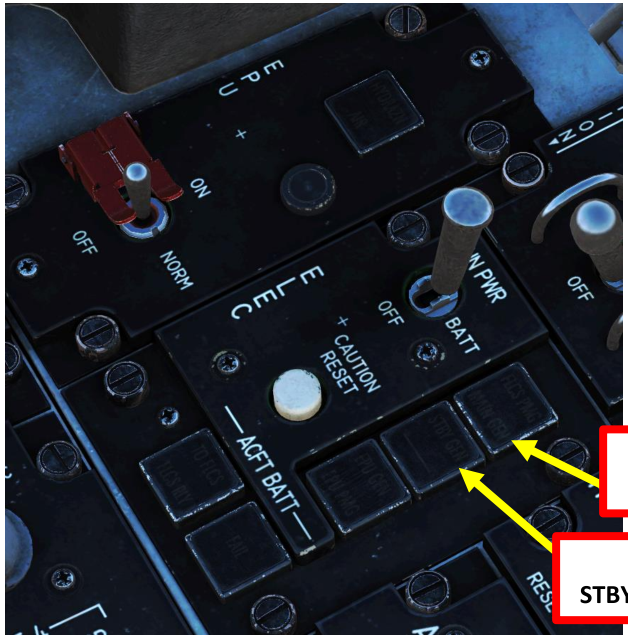
C – ENGINE START

18. The SEC caution light goes off at 20 % Engine RPM
19. The standby generator becomes operational at approximately 60% RPM. This should extinguish the ENGINE warning light and the STBY GEN light.
20. Five to ten seconds after the standby generator comes online, the main generator comes online (MAIN GEN light extinguishes) and the standby generator goes offline.
21. The JFS should have automatically shut down at approximately 55% RPM. Turn the JFS off if that did not occur.
22. Verify engine parameters stabilize as follows:
    a) HYD/OIL PRESS warning light – Off
    b) Fuel Flow– 700-1700 pph
    c) Oil pressure – 15 psi (minimum)
    d) Nozzle Position – Greater than 94 %
    e) Engine RPM – 62-80 %
    f) FTIT (Fan Turbine Inlet Temperature) – 650 deg C or less
    g) Hydraulic Pressure (Systems A & B) – 2850-3250 psi





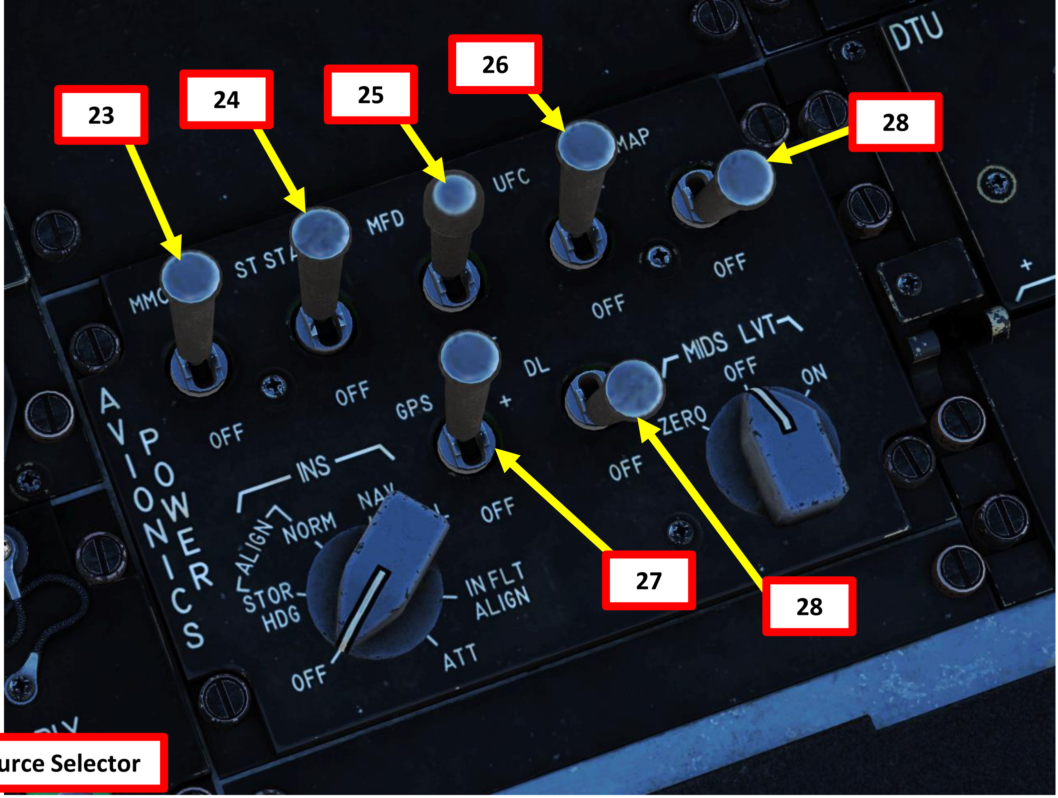




D – SET UP AVIONICS

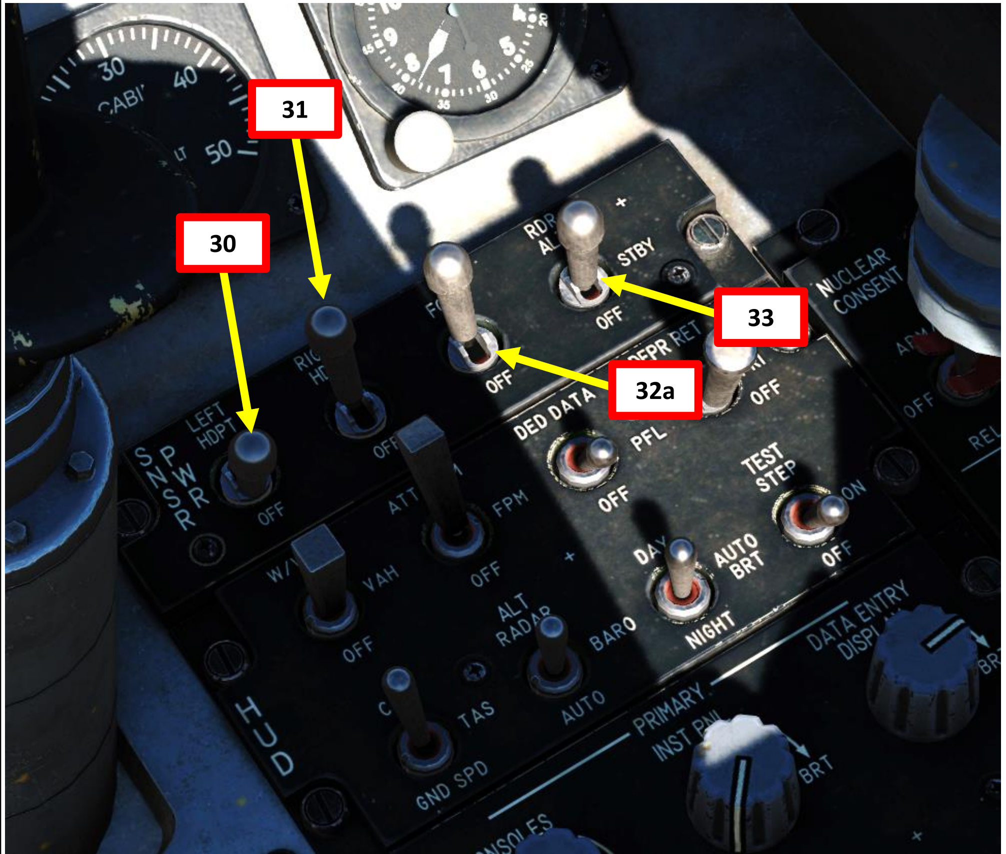
Very important Note: Verify that engine is running and **Air Source Selector** Knob is set to **NORM** since engine bleed air cooling is required before turning on avionic systems.

23. Set MMC (Modular Mission Computer) Power Switch – ON
24. Set ST STA (Store Stations) Power Switch – ON
25. Set MFD (Multifunction Display) Power Switch – ON
26. Set UFC (Upfront Control) Power Switch – ON
27. Set GPS (Global Positioning System) Receiver Power Switch – ON
28. DL (Datalink) Receiver and MAP switches can be left to OFF since they have no function on the F-16C Block 50.
29. A series of BITs (Built-In Tests) will be performed as avionic systems are powered.



D – SET UP AVIONICS

30. Set LEFT HDPT (Left Hardpoint) Power Switch – ON (FWD) if a HTS pod (HARM (High-Speed Anti-Radiation Missile) Targeting System) is equipped on the left chin hardpoint. However, in this mission we don't have a HTS pod equipped, so the switch should be left to OFF.
31. Set RIGHT HDPT (Right Hardpoint) Power Switch – ON (FWD) if a targeting pod is equipped on the right chin hardpoint.
32. Set FCR (Fire Control Radar) Power Switch – FCR/ON (FWD). The Fire Control Radar system will then enter a Built-In Test (BIT) that should take a few minutes to complete.
    Note: While on the ground, radar operation is inhibited.
33. Set RDR ALT (Radar Altimeter) Power Switch – STBY (MIDDLE).
    Note: While on the ground, Radar Altimeter functionality is inhibited.



D – SET UP AVIONICS

34. Set COMM1 UHF and COMM2 VHF Radio Power/Volume knobs – ON (Volume as required)
35. Set COMM1 UHF and COMM2 VHF Radio Mode Switches – SQL (Squelch)
36. Set UHF Backup Radio Function Knob – BOTH (or MAIN, as desired)
37. Scroll HUD (Heads-Up Display) Symbology Intensity Wheel (SYM) to turn on the HUD.
38. Set C&I (Communication and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.

E – PERFORM INS (INERTIAL NAVIGATION SYSTEM) ALIGNMENT

- ***Note:*** *You can either use a* ***Normal alignment*** *(takes roughly 8 minutes) or a* ***Stored Heading alignment*** *(takes roughly 90 seconds), which is quicker but accumulates drift error more rapidly and can only be used if the aircraft has been set up specifically for this alignment beforehand.*
- ***NORMAL alignment*** *is done with the INS Selector set to ALIGN NORM. Aircraft coordinates need to be confirmed. Alignment is done when INS Alignment Status reaches "10".*
- ***STORED HEADING*** *alignment is done with the INS Selector set to ALIGN STOR HDG. Aircraft coordinates do not need to be confirmed since they are already entered in the system. Alignment is done when INS Alignment Status reaches "10".*

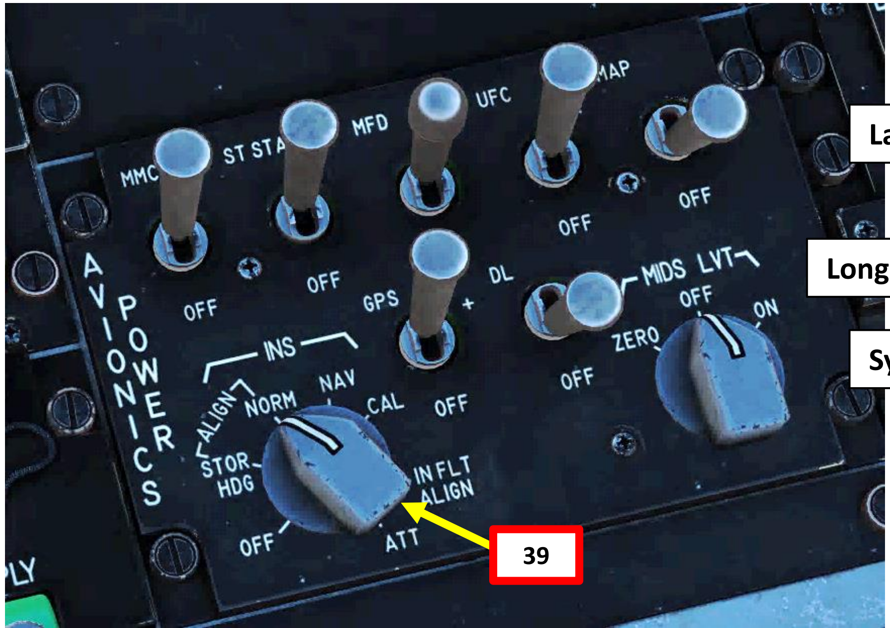
39. Set Inertial Navigation System Selector Switch to **ALIGN NORM** for **Normal Alignment** or **STOR HDG** for **Stored Heading Alignment**. This will perform the Inertial Navigation System Alignment.
    - A normal alignment will take approximately 8 minutes for a full alignment, while a stored heading alignment will take approximately 90 seconds.
40. The INS (Inertial Navigation System) Alignment Status is available on the DED (Data Entry Display) INS page, which is selected automatically when INS alignment is in progress.

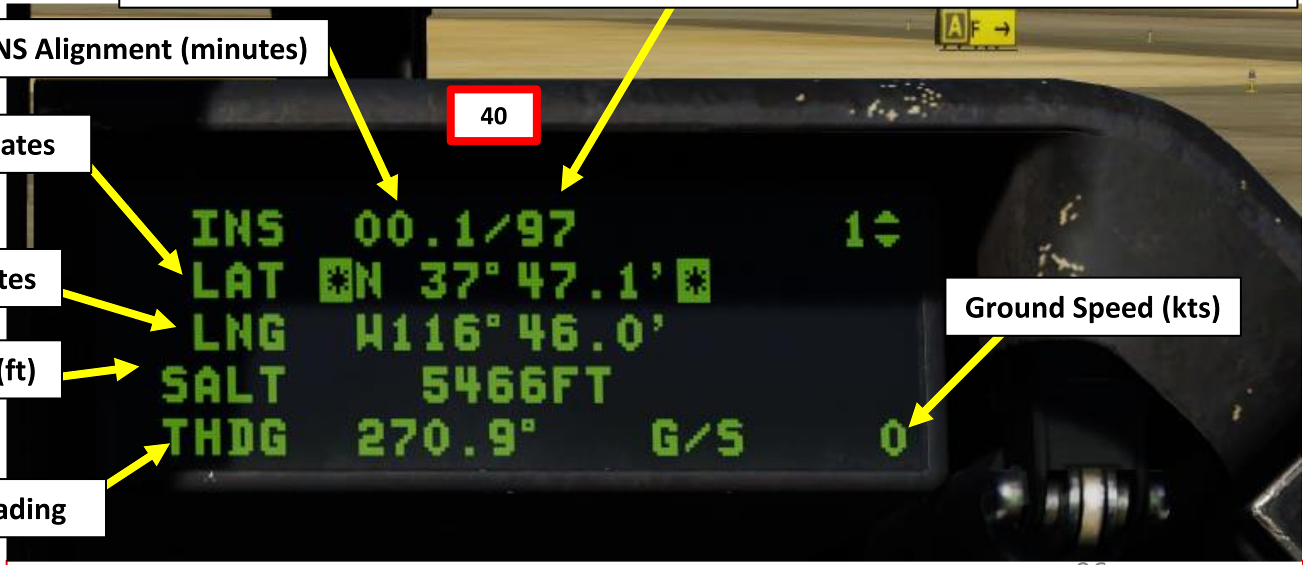
Note about GPS Era (1994 until present day) vs Pre-GPS Era (Before 1994)

- When flying at a time when GPS is available, the INS performs position corrections with GPS signal to remove accumulated INS drift.
- When flying a mission dated prior to 1994, position corrections need to be performed once airborne since GPS is not available. You will want to conduct alignment navigation fix procedures using Overfly, targeting pod, HUD, or FCR to remove accumulated INS drift.

INS (Inertial Navigation System) Alignment Status

- **99**: Initialization
- **90**: Valid Altitude data, coarse alignment begins
- **79**: Valid heading data
- **70**: Degraded navigation state, steady RDY displayed on DED, steady ALIGN displayed on HUD (Heads-Up Display)
- **60-20**: Estimated position error compared to fully aligned state
    - 60 = 6.0 times normal CEP (Circular error probability)
    - 20 = 2.0 times normal CEP (Circular error probability)
- **10**: INS fully aligned, RDY flashes on DED, ALIGN flashes on HUD
- **6**: INS fully aligned and enhanced to 0.6 times normal precision with GPS data or other techniques



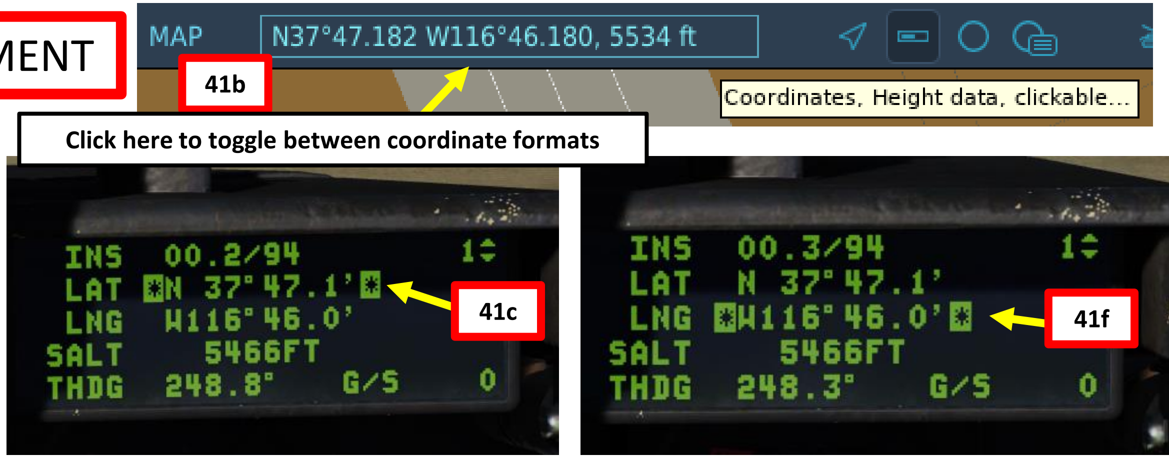


INS (Inertial Navigation System) DED (Data Entry Display) page

E – PERFORM INS (INERTIAL NAVIGATION SYSTEM) ALIGNMENT

*Note: This step is **Mandatory for NORMAL alignment**, but **not required for STORED HEADING alignment**.*

41. Enter and confirm aircraft coordinates used for INS alignment.
    a) **IMPORTANT: You must either enter or confirm the latitude and longitude coordinates of your aircraft on the INS DED page within two minutes after starting an alignment. Failing to do that within 2 minutes will result in a degraded INS alignment.**
    b) Check the aircraft coordinates via the F10 map.
       - *Note: Coordinate format should be in Degrees, Minute, Decimal-Minutes. F10 map coordinates format can be toggled by clicking on the MAP COORDINATES data field on the upper left corner of the F10 map.*
    c) The "*" symbols next to LAT indicate that the LATITUDE field is selected. Confirm that coordinates entered there match the aircraft coordinates. Normally, these coordinates should match and should not need to be corrected.
    d) Press "ENTR" button on the ICP (Integrated Control Panel) to enter/confirm LATITUDE coordinates.
    e) Press the DCS (Data Control Switch, also called "Dobber") DOWN to select the LNG (LONGITUDE) field.
    f) The "*" symbols next to LNG indicate that the LONGITUDE field is selected. Confirm that coordinates entered there match the aircraft coordinates. Normally, these coordinates should match and should not need to be corrected.
    g) Press "ENTR" button on the ICP (Integrated Control Panel) to enter/confirm LONGITUDE coordinates.

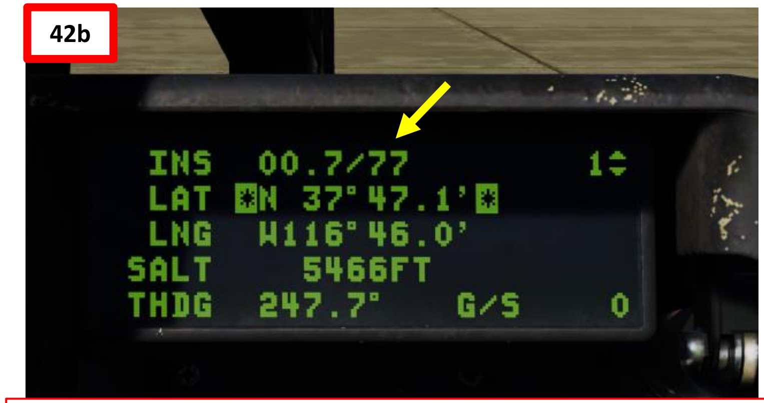


E – PERFORM INS (INERTIAL NAVIGATION SYSTEM) ALIGNMENT

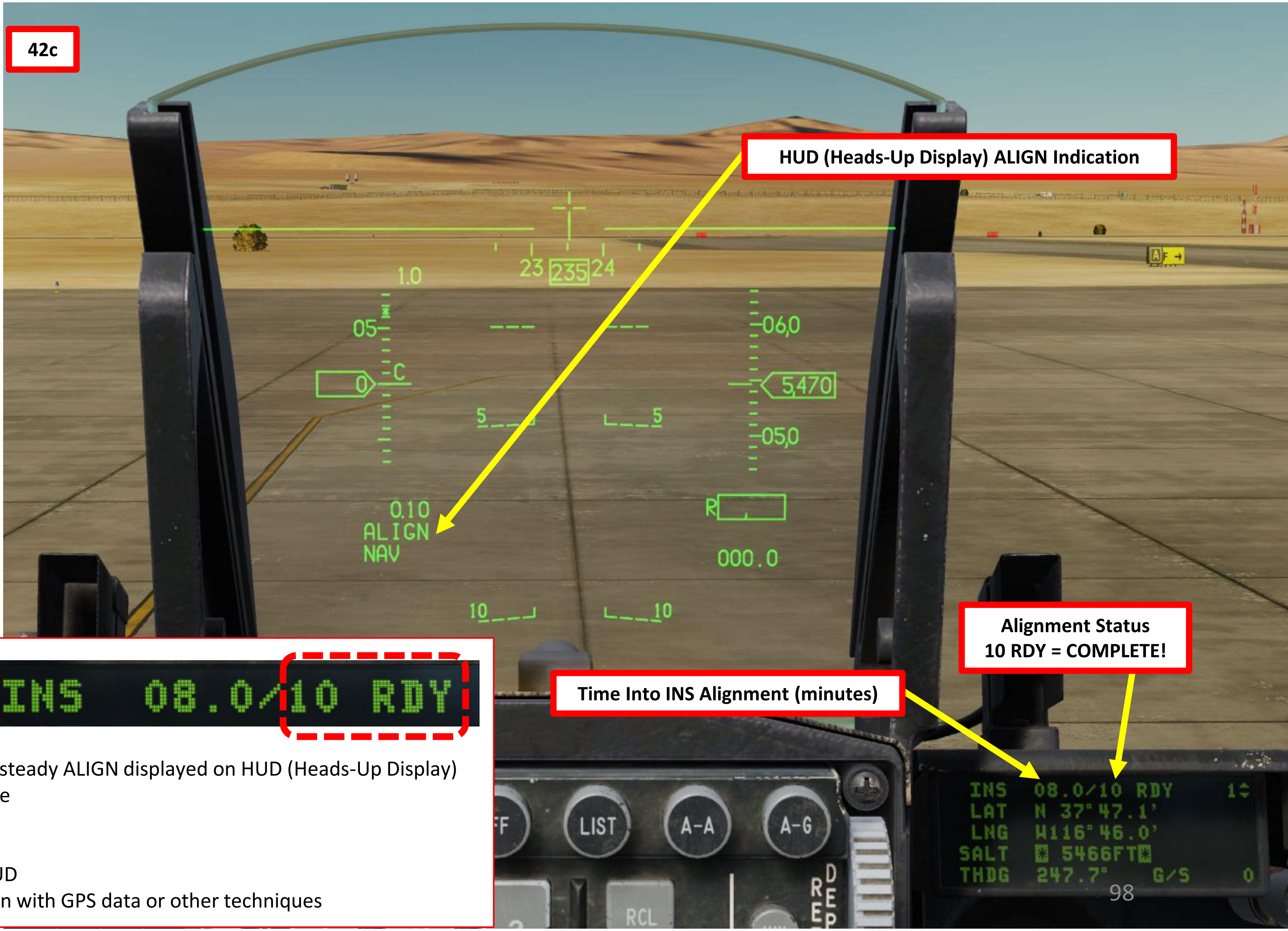
42. FOR BOTH NORMAL AND STORED HEADING ALIGNMENT: When Alignment Status indication reaches “10 RDY”, INS alignment is complete.

42a

42b



42c

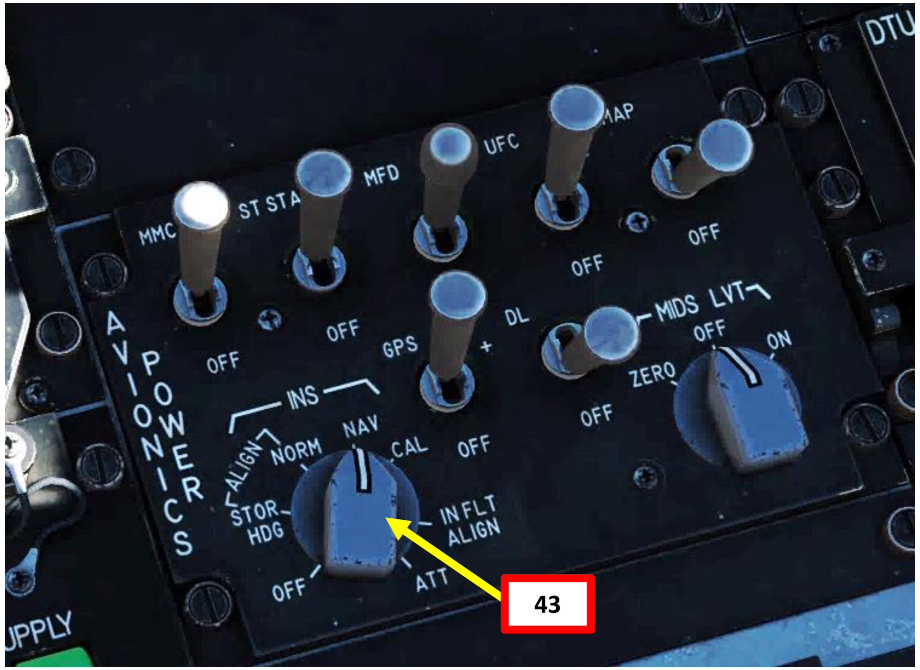


INS (Inertial Navigation System) Alignment Status

- **99**: Initialization
- **90**: Valid Altitude data, coarse alignment begins
- **79**: Valid heading data
- **70**: Degraded navigation state, steady RDY displayed on DED, steady ALIGN displayed on HUD (Heads-Up Display)
- **60-20**: Estimated position error compared to fully aligned state
  - 60 = 6.0 times normal CEP (Circular error probability)
  - 20 = 2.0 times normal CEP (Circular error probability)
- **10**: INS fully aligned, RDY flashes on DED, ALIGN flashes on HUD
- **6**: INS fully aligned and enhanced to 0.6 times normal precision with GPS data or other techniques

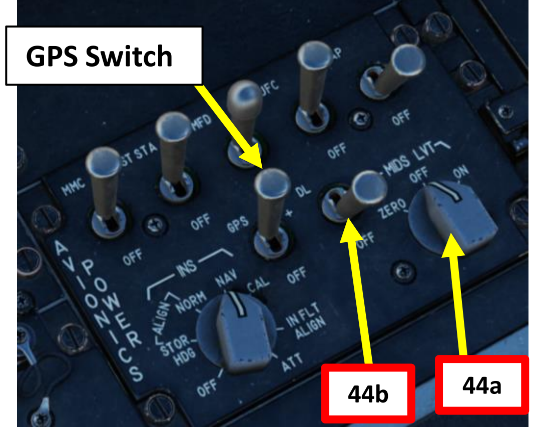
E – PERFORM INS (INERTIAL NAVIGATION SYSTEM) ALIGNMENT

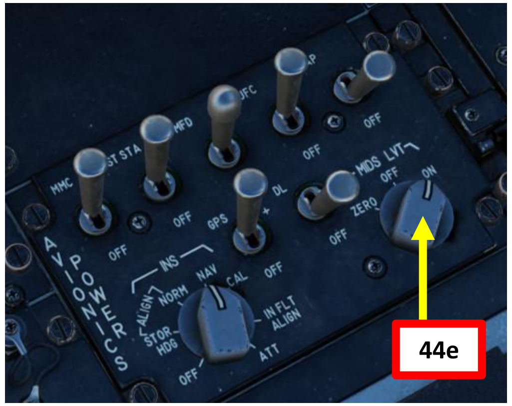
43. When INS (Inertial Navigation System) alignment is complete, set INS Selector Switch to NAV (Navigation).

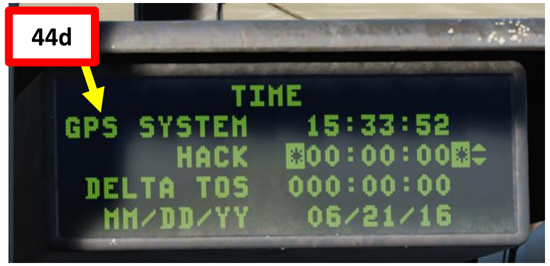


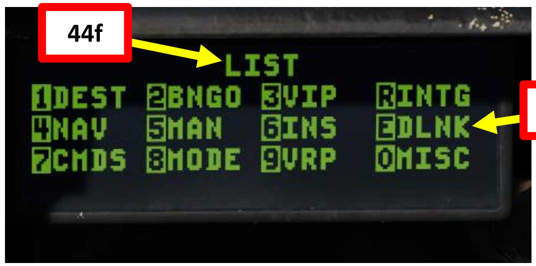
F – SET UP DATALINK

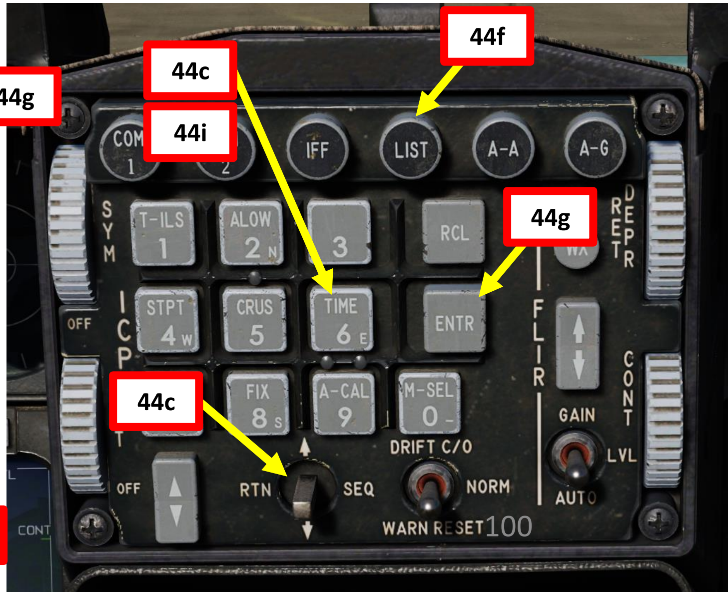
44. Set up Datalink **only once INS (Inertial Navigation System) alignment is complete**.
    a) MIDS LVT (Multifunctional Information Distribution System Low Volume Terminal) switch should be set to OFF by default.
    b) You can leave the DL (Datalink) Switch to OFF since it is not used on the Block 50 variant of the F-16.
    c) Press the DCS (Data Control Switch, also called "Dobber") LEFT (RETURN), then select TIME DED page by pressing TIME (6) button.
    d) Verify that "GPS SYSTEM" indication is visible on the TIME DED page; this should happen 60 seconds after setting the GPS Switch to ON (see previous steps).
    e) Power up Datalink by setting MIDS LVT (Multifunctional Information Distribution System Low Volume Terminal) switch to ON
    f) Press the LIST button on the ICP (Integrated Control Panel)
    g) Select Datalink (DLNK) page by pressing the ENTR (E) button.
    h) On the DED (Data Entry Display) Datalink page 1 (P1), consult **Datalink Network Status** and time references. You should see "GPS TIME: OFF".
    i) Press any number on the ICP (as an example: "6") to set GPS TIME: ON.
    j) Confirm that synchronization switches from SYNC COARSE to SYNC FINE.
    k) On HSD (Horizontal Situation Display) page, select Datalink Transmission Option (XMT) to TNDL (formerly referred as "L16" in earlier DCS versions) by toggling the OSB (Option Select Button) next to XMT.

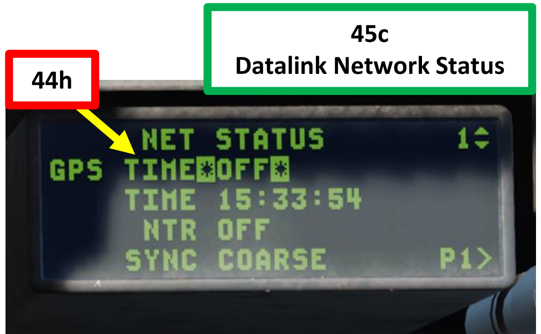


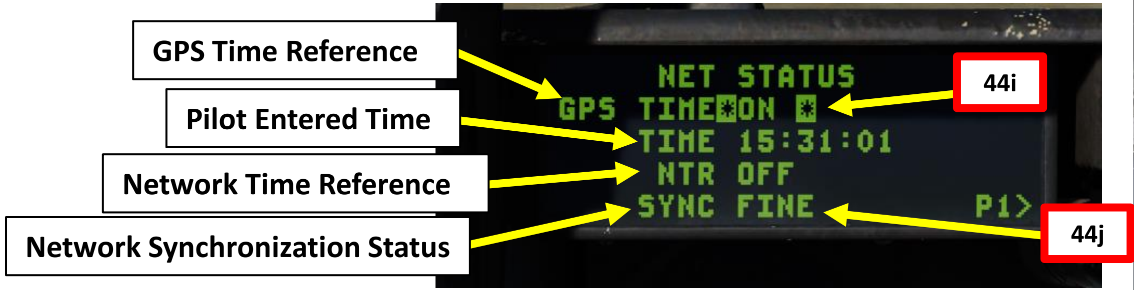






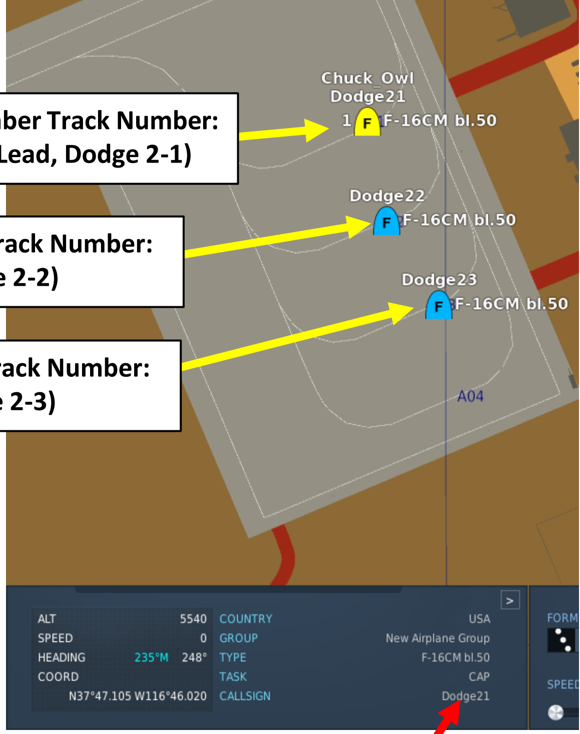






F – SET UP DATALINK

45. (Optional) If desired, consult Datalink page to customize settings
    a) On the DED (Data Entry Display) Datalink page 1 (P1), you can consult **Datalink Network Status** and time references.
        - Note: You can access page by pressing the LIST button on the ICP (Integrated Control Panel), then pressing the ENTR (E) button.
    b) Press the DCS (Data Control Switch, also called "Dobber") RIGHT (SEQ) select the DED Datalink page 2 (P2).
    c) On the DED Datalink page 2, you can consult **Datalink MIDS Radio Options**. Most MIDS settings can be left as is.
    d) Press the DCS (Data Control Switch, "Dobber") RIGHT (SEQ) select the DED Datalink page 3 (P3).
    e) On the DED Datalink page 3, you can consult **Datalink Flight Management** data .



YOU - Flight Member Track Number: 00201 (#1, Flight Lead, Dodge 2-1)

Flight Member Track Number: 00202 (#2, Dodge 2-2)

Flight Member Track Number: 00203 (#3, Dodge 2-3)

45a
Datalink Network Status

45b

45d

45c
MIDS Radio Options

Callsign (DE 21 = Dodge 2-1)

Flight Lead (FL) Identifier

Transmission Power (XMT)

Fighter Channel (FC) Selection

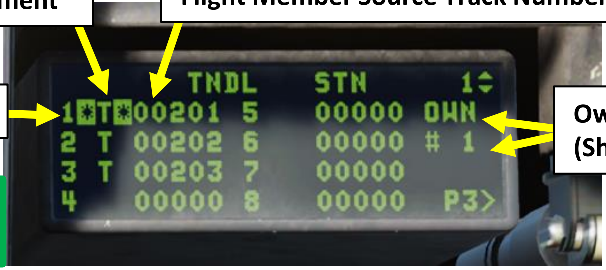
Mission Channel (MC) Selection

Surveillance Channel (SC) Selection

T: TDOA (Time Difference On Arrival) Assignment

Flight Member Source Track Numbers (STN)

Flight Member Number

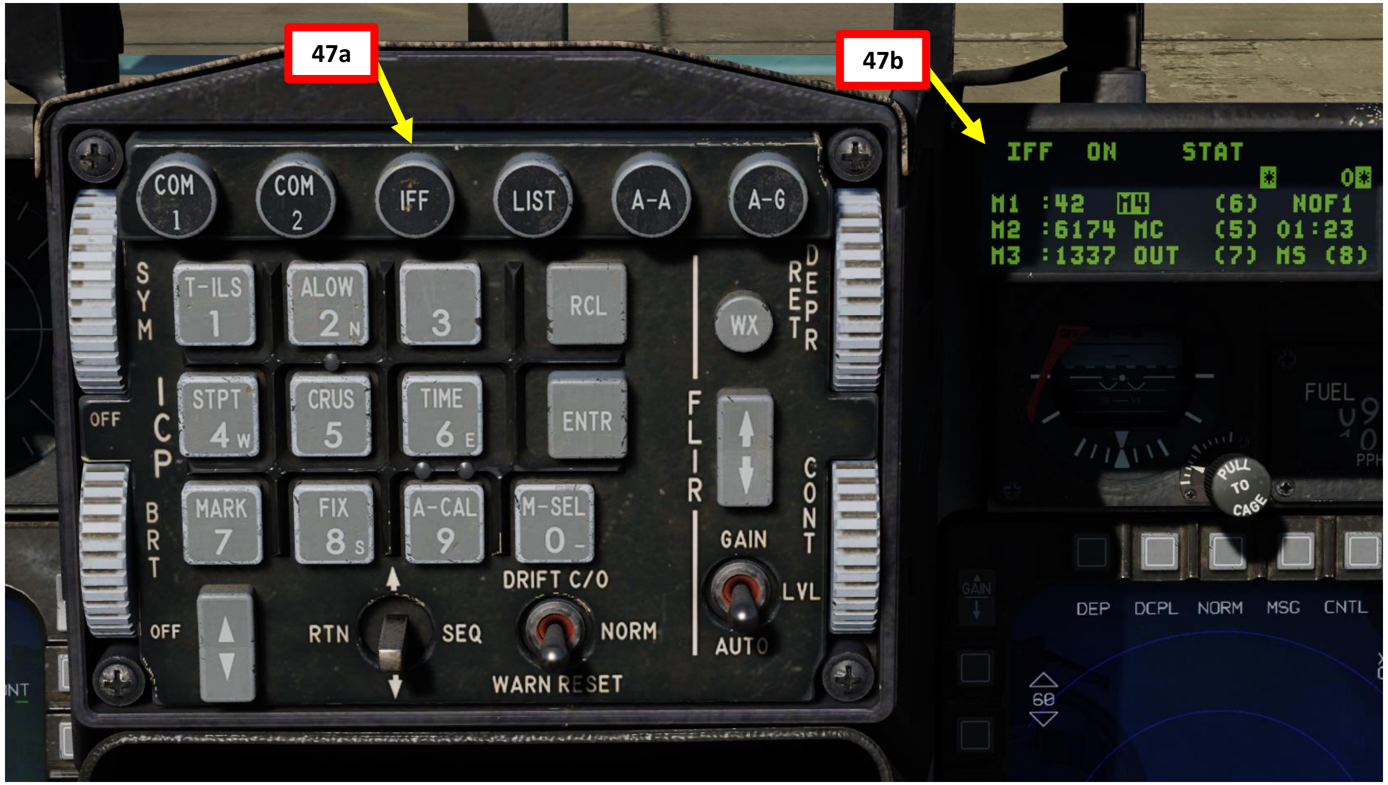


Own Flight Position (Shown: 1)

45e
Flight Management

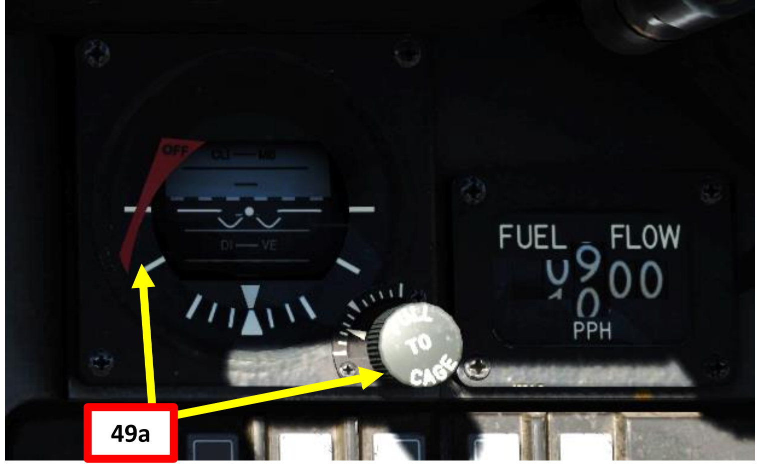
G – SET UP IFF (IDENTIFY-FRIEND-OR-FOE)

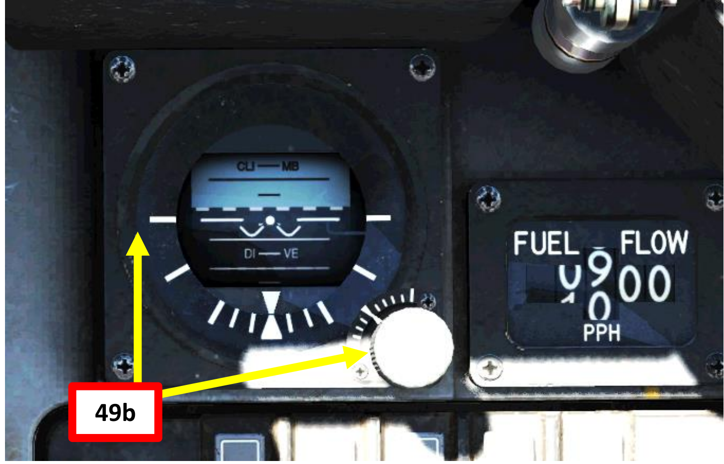
46. To turn on the IFF (Identify-Friend-or-Foe) system, set IFF Master Switch to NORM.
47. To consult your IFF Mode codes, press "IFF" button on the ICP (Integrated Control Panel). This will display the IFF DED (Data Entry Display) page.
48. By default, all IFF transponder/interrogator codes should already be set and do not need to be updated. In the case that IFF codes differ from your default values, as could be listed in a mission briefing, consult the "DATALINK & IFF" section.

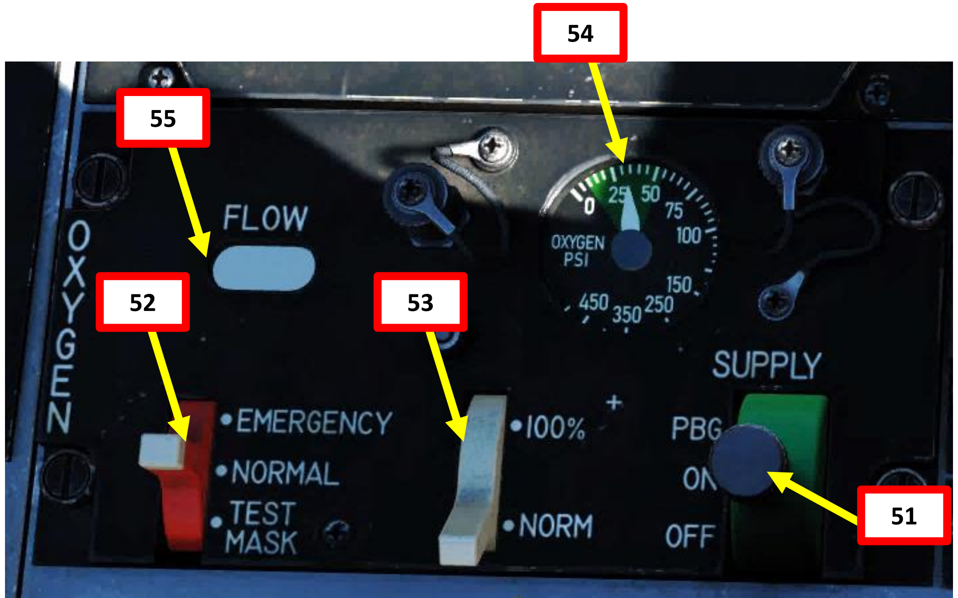


H – COMPLETE AIRCRAFT SETUP

49. Uncage SAI (Standby Attitude Director Indicator) by turning the caging knob to the MIDDLE position. Red “OFF” flag should disappear when SAI is uncaged.
50. Set appropriate Fly-By-Wire control mode by setting STORES CONFIG switch as per ordnance loadout:
    - CAT I: Air-to-Air loadouts without external wing tanks
    - CAT III: Air-to-Ground loadouts, or any loadout with external wing tanks
51. Set Oxygen Supply Lever – ON
52. Set Oxygen Emergency Lever – NORMAL
53. Set Oxygen Diluter Lever – NORMAL
54. Confirm that Oxygen Pressure Indicator is in the green range
55. Confirm that Oxygen Flow Indicator blinks, which confirms that oxygen supply to mask is adequate
56. In real life, you would need to request the ground crew to remove the EPU (Emergency Power Unit) Safety Pin, however this is not simulated.

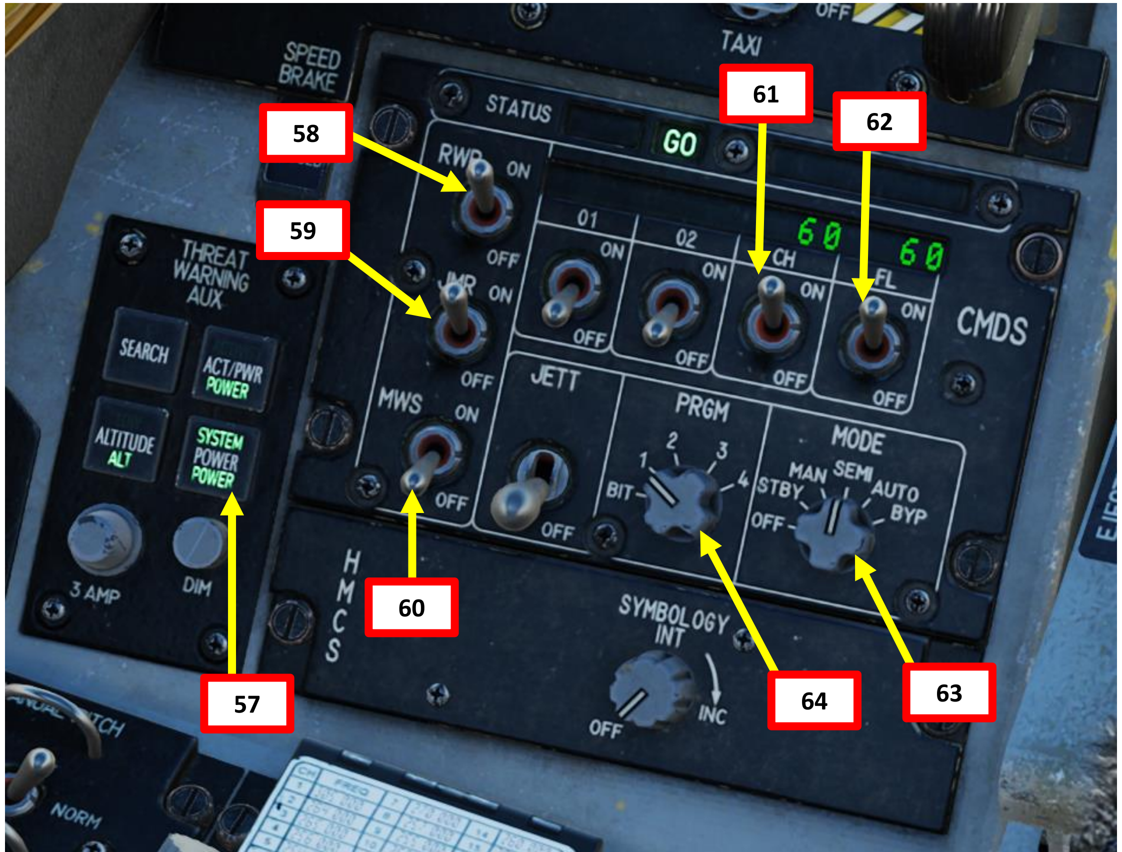






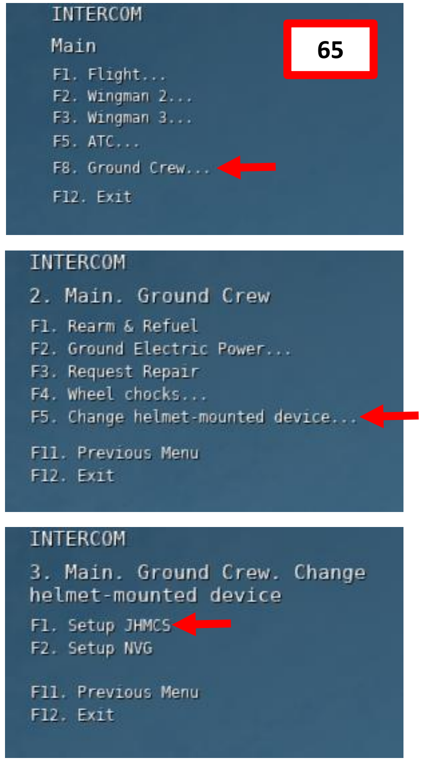
H – COMPLETE AIRCRAFT SETUP

57. Press the Threat Warning Azimuth / Radar Warning Receiver (TWA/RWR) Power Button. The RWR will enter a Built-In Test sequence.
58. Set CMDS RWR (Countermeasure Dispensing System Radar Warning Receiver) Switch – ON (UP)
59. Set CMDS JMR (Countermeasure Dispensing System Jammer) Switch – ON (UP)
60. Note: MWS (Missile Warning System) Switch can be left to OFF (switch is not applicable on Block 50 variant of the F-16)
61. Set CMDS (Countermeasure Dispenser System) CH (Chaff) Switch – ON (UP)
62. Set CMDS (Countermeasure Dispenser System) FL (Flares) Switch – ON (UP)
63. Set Countermeasure Mode Selector to desired release mode. In that case, we will choose SEMI-AUTOMATIC mode. However, MANUAL or AUTOMATIC could also be selected if desired.
64. Set Countermeasure PRGM (Program) Selector to desired Program (i.e. Program 1)



H – COMPLETE AIRCRAFT SETUP

65. Equip either HMCS (Helmet-Mounted Cueing System) helmet or NVGs (Night Vision Goggles) as required.
    a) Press “****” (communication menu binding) to contact ground crew
    b) Press “**F8**” to select “**Ground Crew”**
    c) Press “**F5**” to “**Change helmet-mounted device**”.
    d) Press either “F1” for HMCS or “F2” for NVGs.
    e) If you want to use the HMCS (Helmet-Mounted Cueing System), set the HMCS SYMBOLOGY INTENSITY knob to INC.



H – COMPLETE AIRCRAFT SETUP

66. Access the HMCS Alignment DED Page
    a) Press the LIST button
    b) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to select MISC (Miscellaneous) DED Page.
    c) Press "RCL" on the ICP (Integrated Control Panel) to select HMCS (Helmet-Mounted Cueing System) DED Page.
    d) Press the DCS (Data Control Switch, also called "Dobber") RIGHT (SEQ) to select the HMCS ALIGN DED page.

66a

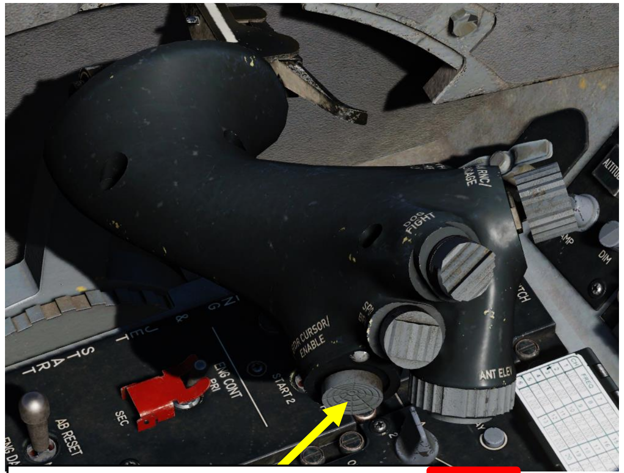
66b

66c

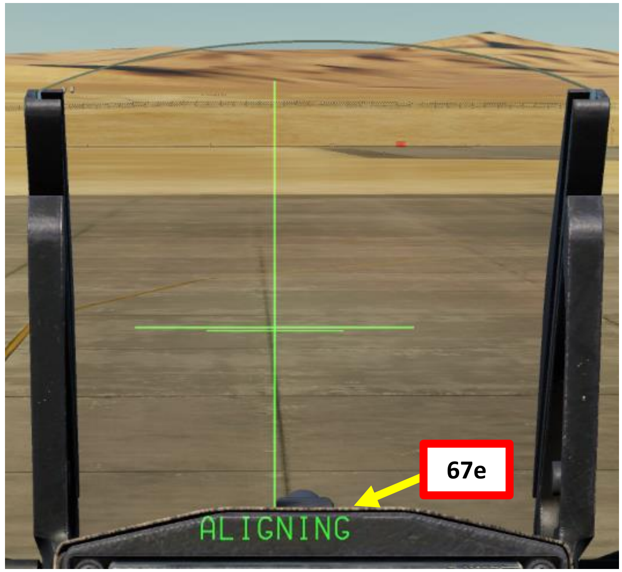
66d

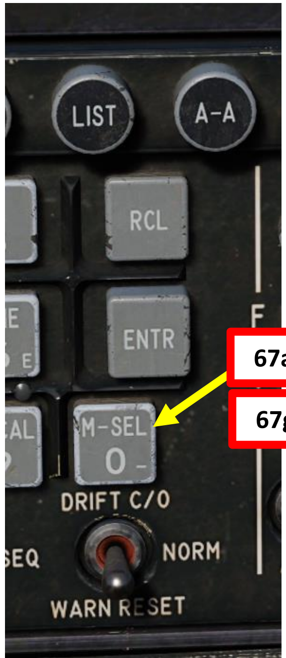
H – COMPLETE AIRCRAFT SETUP

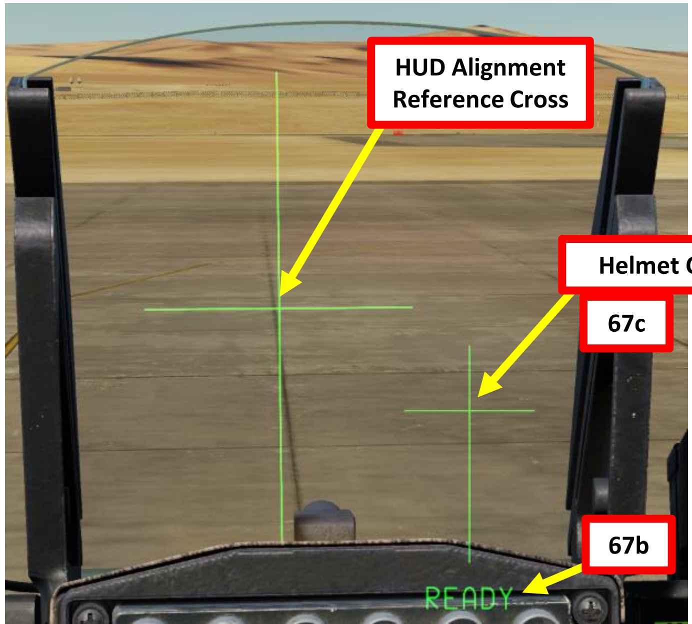
67. Perform HMCS Coarse Helmet Display Alignment
    a) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to begin COARSE HMCS alignment process.
    b) READY" indication will then appear on your helmet cross.
    c) Move helmet cross on the alignment reference cross of the Heads-Up Display (HUD).
    d) When helmet cross and HUD cross are roughly aligned, depress the Radar Cursor/Enable Switch. The default binding is "Enter".
    e) While the alignment process is taking place, the "ALIGNING" indication is visible.
    f) The "ALIGN OK" indication appears when the alignment is complete.
    g) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to save the HMCS coarse alignment.
    h) Once Coarse Alignment is saved, the HMCS ALIGN DED page will automatically switch to the AZ/EL (Azimuth/Elevation) fine alignment phase.

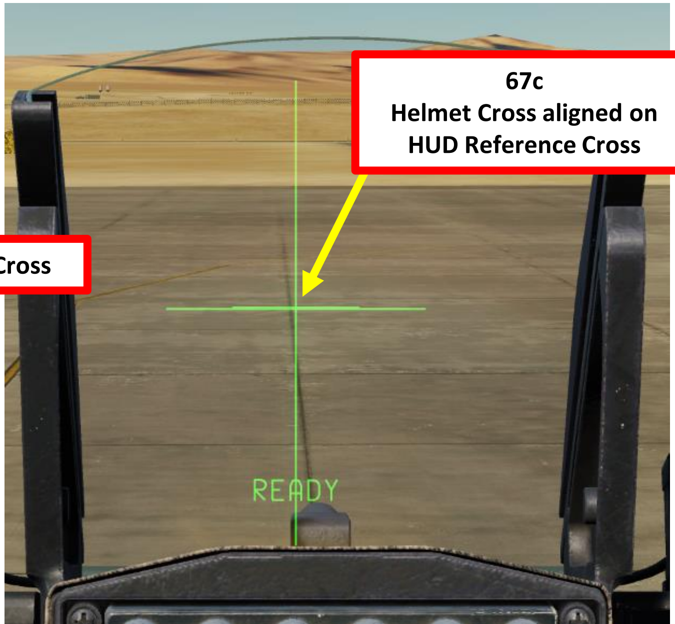


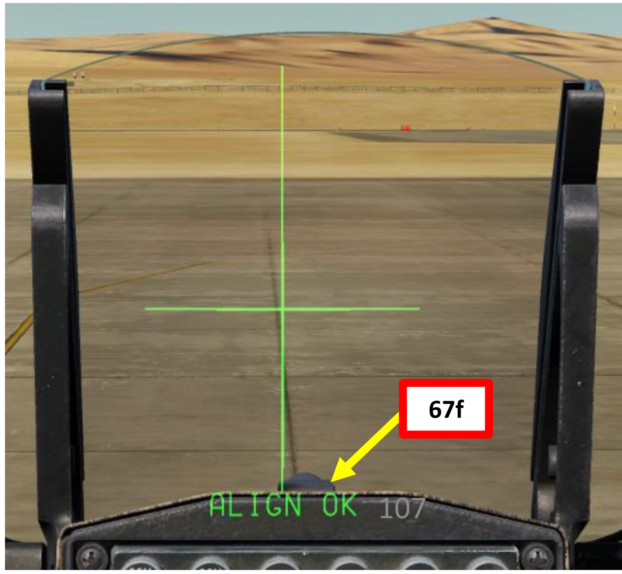
Radar Cursor/Enable Switch 67d





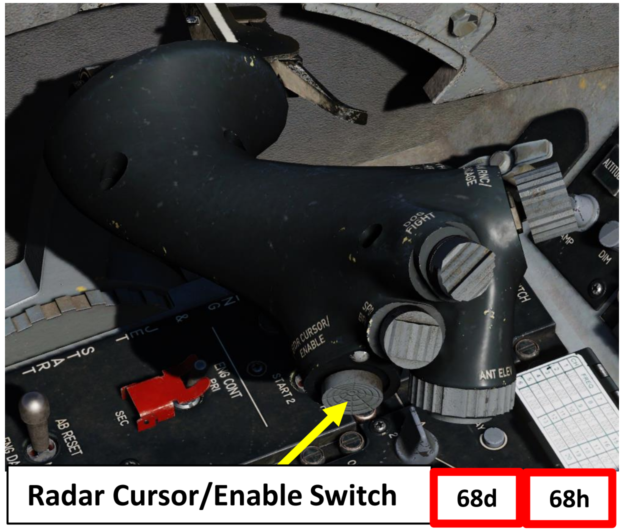


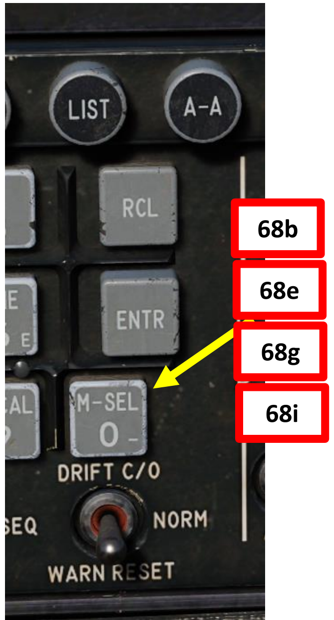


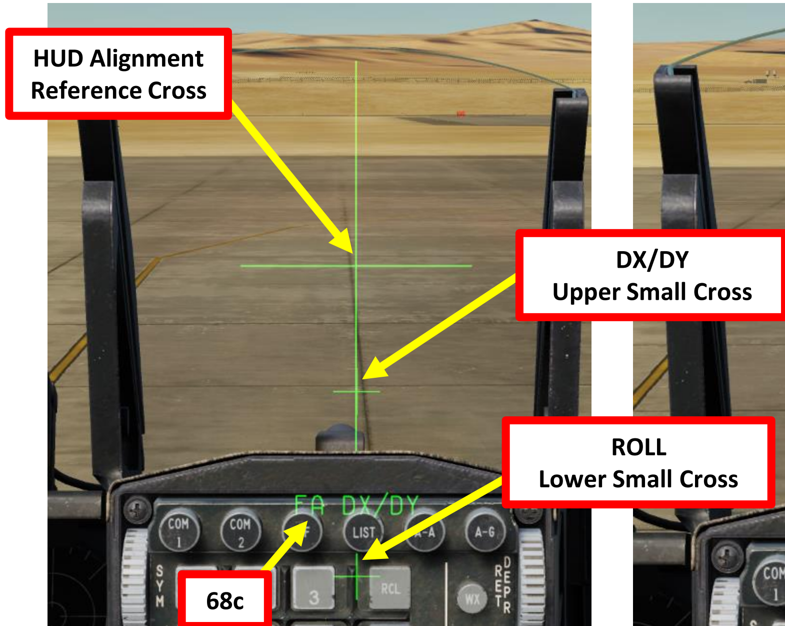


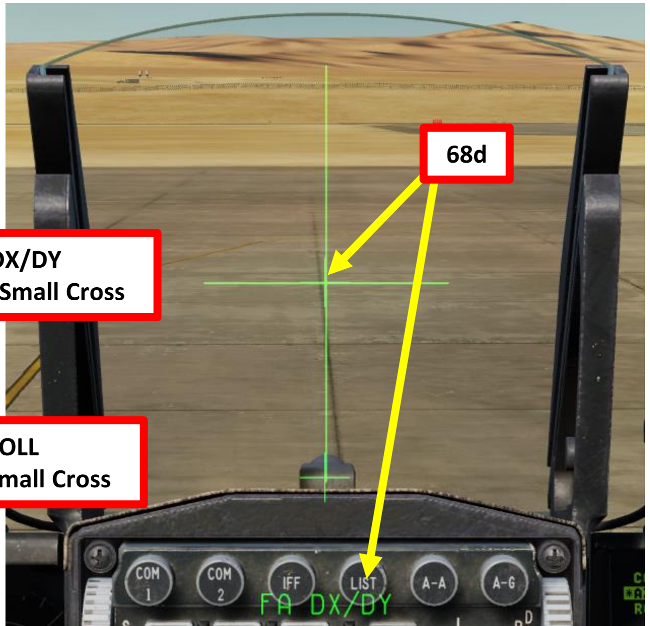
H – COMPLETE AIRCRAFT SETUP

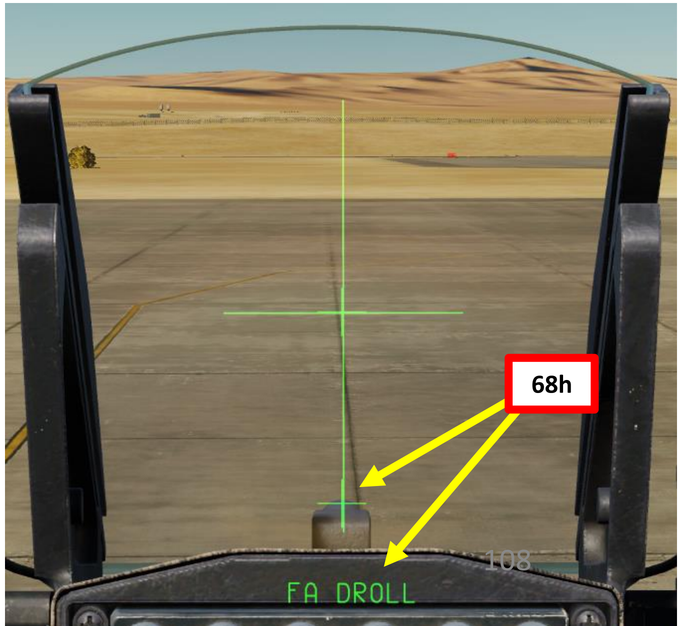
68. Perform HMCS Fine Helmet Display Alignment
    a) The coarse alignment may not be perfect and may require a fine adjustment (FA).
    b) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to begin FA DX/DY HMCS alignment process.
    c) The "FA DX/DY" indication means that an adjustment is needed for the horizontal and vertical axis.
    d) Use Radar Cursor/Enable Switch AFT/FWD/LEFT/RIGHT controls to align the upper small cross with the HUD reference cross.
    e) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to save the HMCS FA DX/DY (fine horizontal/vertical alignment).
    f) Once FA DX/DY Alignment is saved, the HMCS ALIGN DED page will automatically switch to the ROLL fine alignment phase.
    g) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to begin FA DROLL HMCS alignment process.
    h) Use Radar Cursor/Enable Switch AFT/FWD/LEFT/RIGHT controls to align the lower small cross with the vertical line of the HUD reference cross.
    i) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to save the HMCS FA DROLL (fine roll alignment).
    j) The HMCS alignment is now completed.







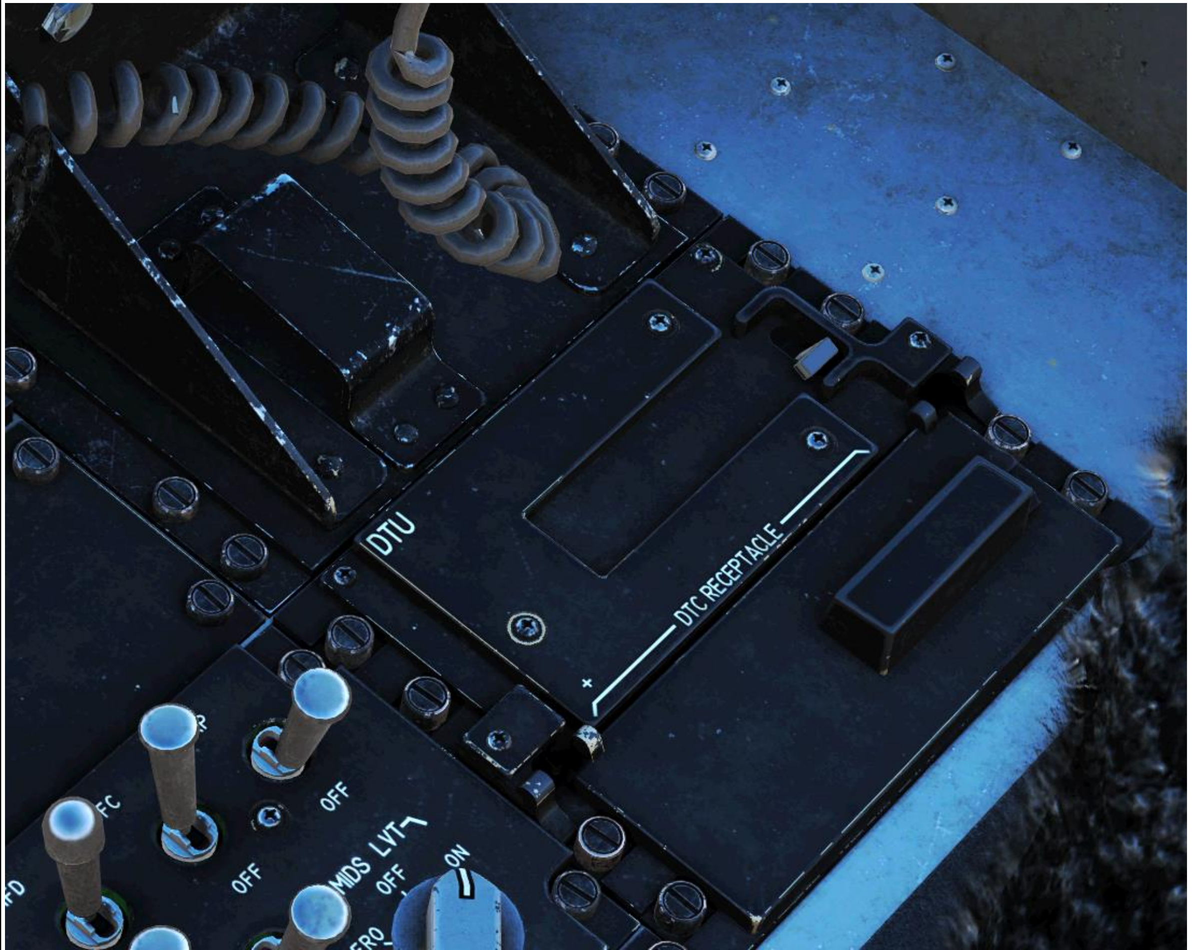




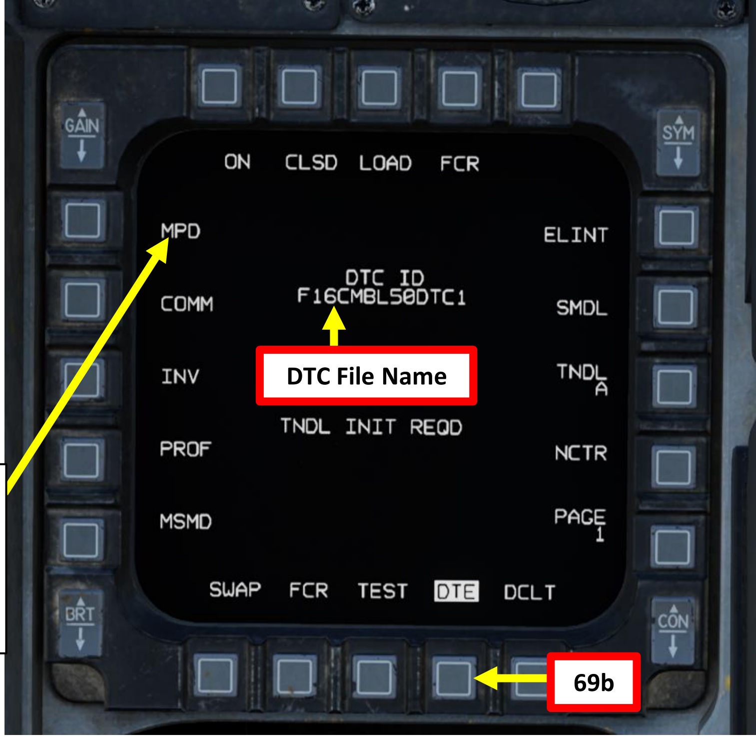
H – COMPLETE AIRCRAFT SETUP

69. Load the Data Transfer Cartridge (DTC) data via the DTE (Data Transfer Equipment) page. The DTC contains data for countermeasure programs, communication channels, navigation waypoints, targets, threats, datalink settings, route points, weapon settings, and more.
    a) Verify that DTC is set up and inserted.
    b) Press OSB (Option Select Button) next to "DTE" to select the DTE (Data Transfer Equipment) page
    c) Press OSB next to "LOAD" to load data saved in the DTC. This will load all DTC partitions.
        - Note: It is also possible to select manually individual data types by pressing on the OSB next to them.
    d) DTC items will become highlighted in white as their respective data type is being loaded.

- **Note: A custom DTC creation section will be available later when the tool is completed by Eagle Dynamics.**

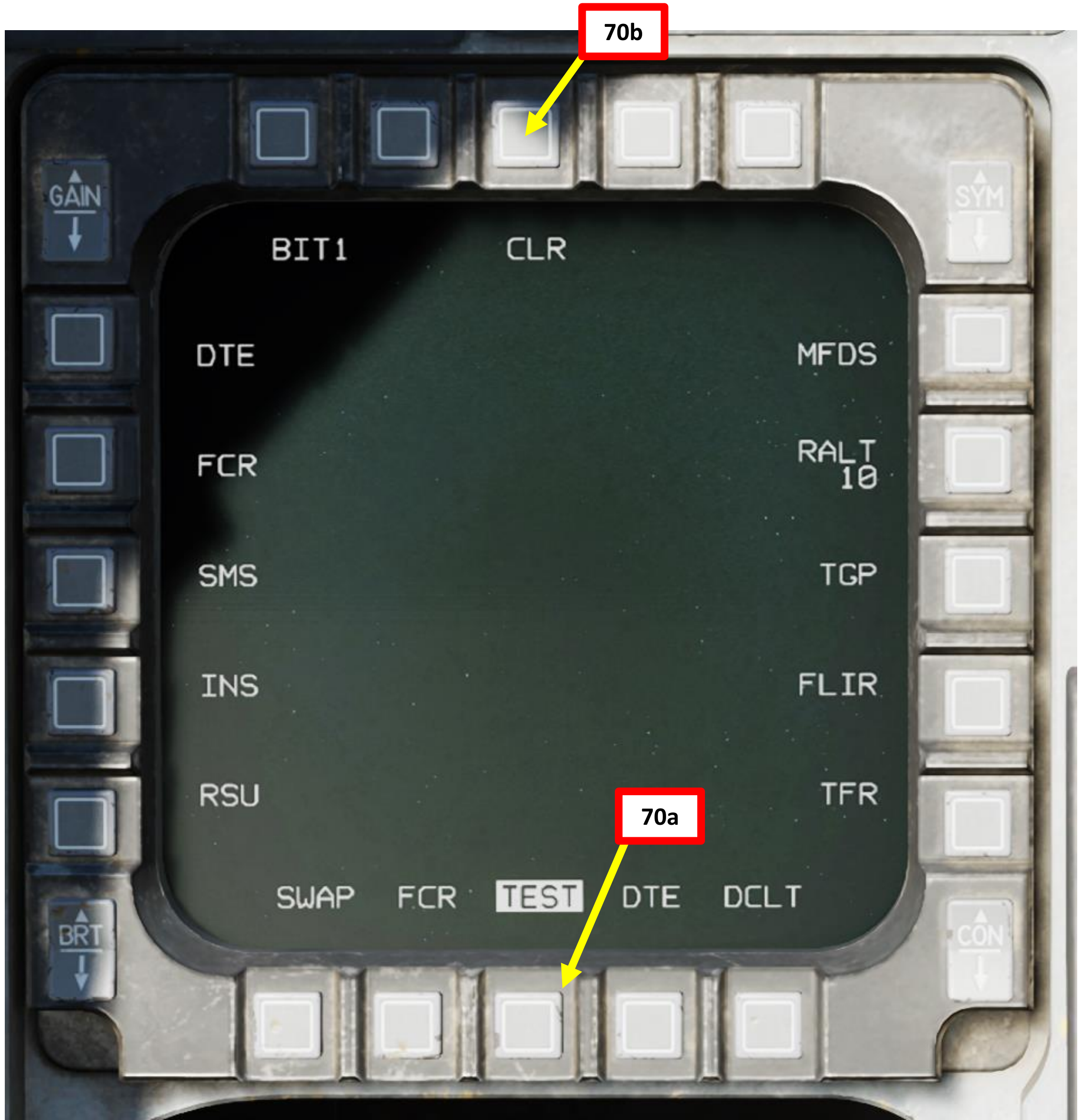


DTC Data Types
- *MPD: Mission Plan Data*
- *COMM: Communications*
- *INV: Inventory*
- *Etc…*



H – COMPLETE AIRCRAFT SETUP

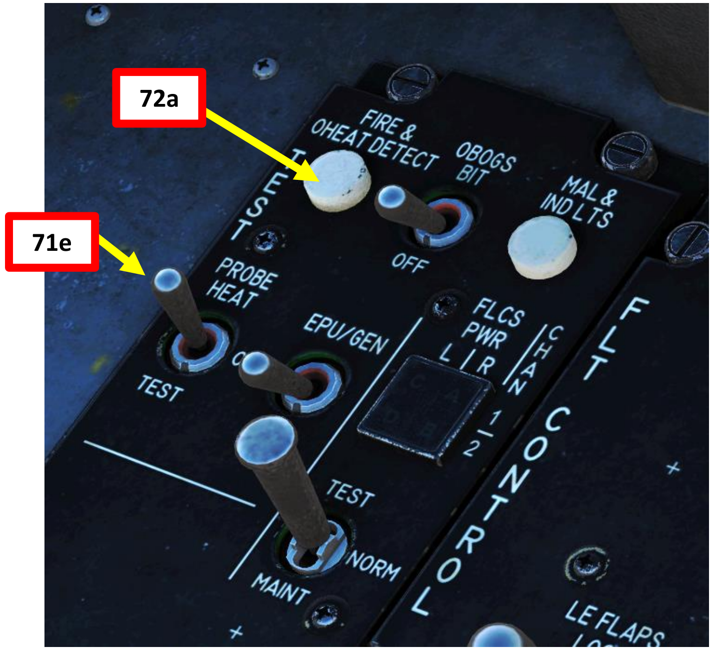
70. Clear avionic faults on the TEST page.
    a) (Not Simulated Yet) Press OSB (Option Select Button) next to “TEST” to select the Test page
    b) (Not Simulated Yet) Press OSB next to “CLR” to clear any faults listed in the MFL (Malfunction Fault List)

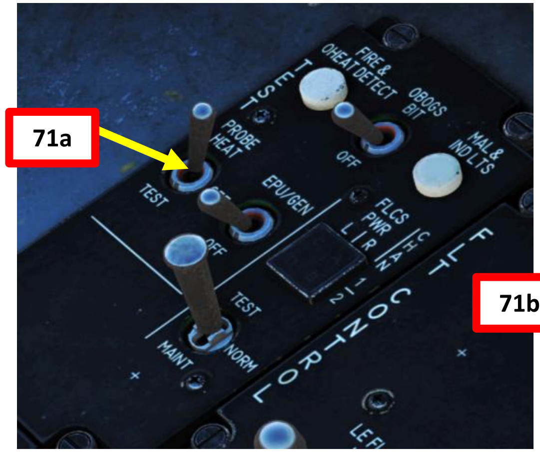


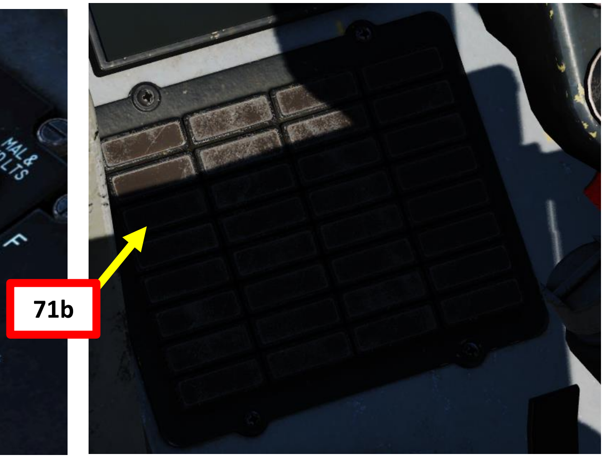
I – PERFORM AIRCRAFT POST-START CHECKS

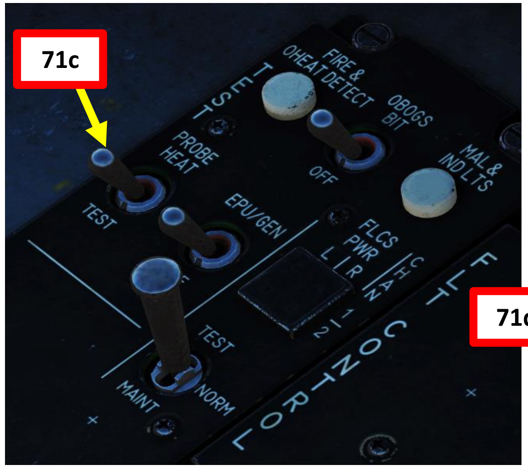
Note: The entirety of the post-start checks are optional and can be skipped. Normally, these checks are performed after the engine start, but for simplicity we will leave the post-start checks at the end of the Start-Up Procedure section.

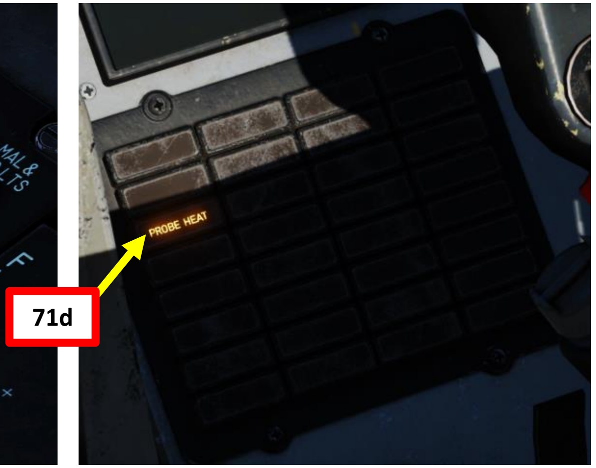
71. (Optional) Verify Pitot Probe Heater system operation
    a) Set PROBE HEAT switch to PROBE HEAT position.
    b) Verify PROBE HEAT caution light is OFF. Illumination means one or more probe heaters are inoperative.
    c) Set PROBE HEAT switch to TEST position.
    d) Verify PROBE HEAT caution flashes 3 to 5 times per second.
    e) Return PROBE HEAT switch to OFF position. Leaving it to ON while on the ground could risk overheating the probe; we will set it on 2 minutes prior to takeoff.
72. (Optional) Verify Fire & Overheat Detection system operation
    a) Press and hold the FIRE & OHEAT DETECT button
    b) While button is pressed, verify that the ENG FIRE warning light and the OVERHEAT caution light are illuminated
    c) Release the FIRE & OHEAT DETECT button

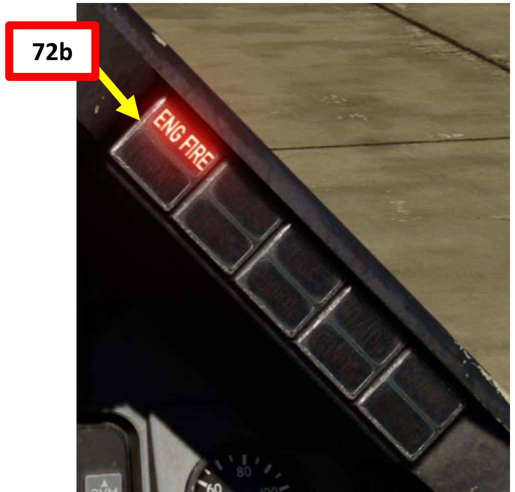


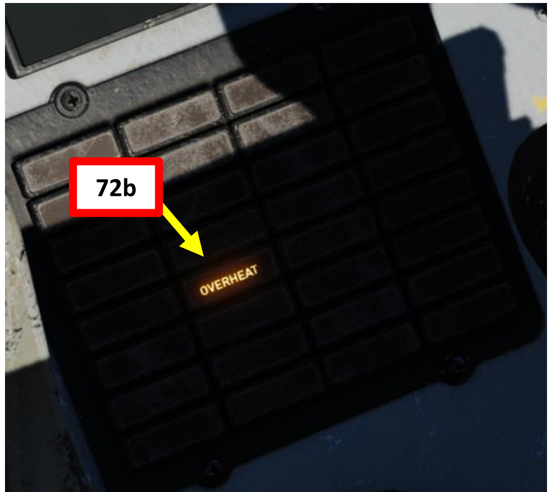






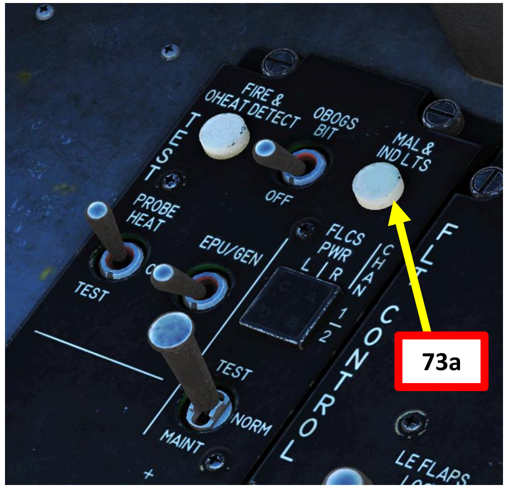






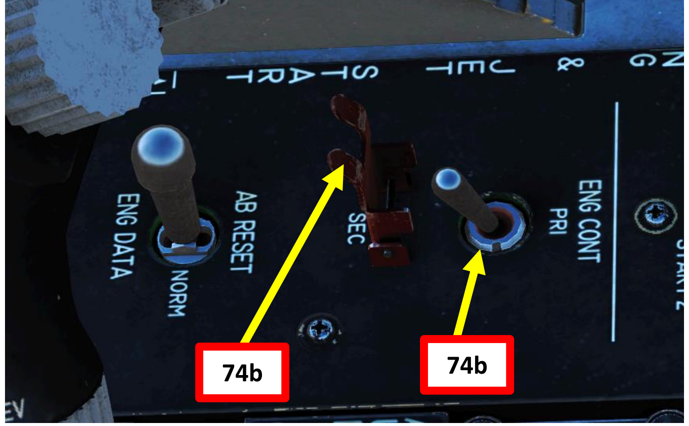
I – PERFORM AIRCRAFT POST-START CHECKS

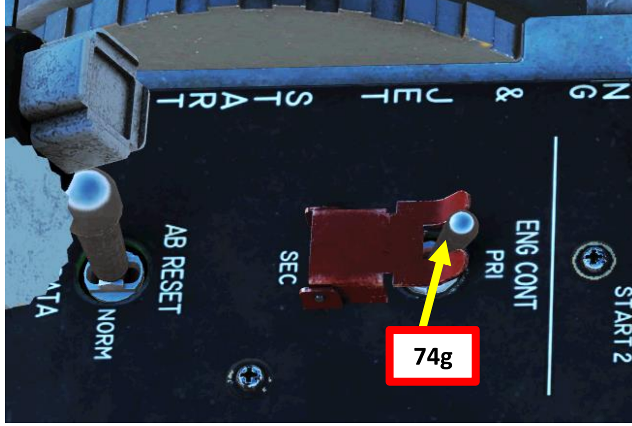
73. (Optional) Verify Malfunction & Indicator Lights system operation
    a) Press and hold the MAL & IND LTS button
    b) Verify all cockpit warning, caution & indicator lights illuminate when button is pressed
    c) Confirm VMS (Voice Message System) audio alerts are audible (“PULLUP”, “ALTITUDE”, “WARNING”, “JAMMER”, “COUNTER”, “CHAFF FLARE”, “LOW”, “ALT”, “LOCK”, “CAUTION”, “BINGO”, “DATA”, “IFF”.). A brief Landing Gear warning horn should be heard prior to the “WARNING” and “CAUTION” words.
    d) Release the MAL & IND LTS button

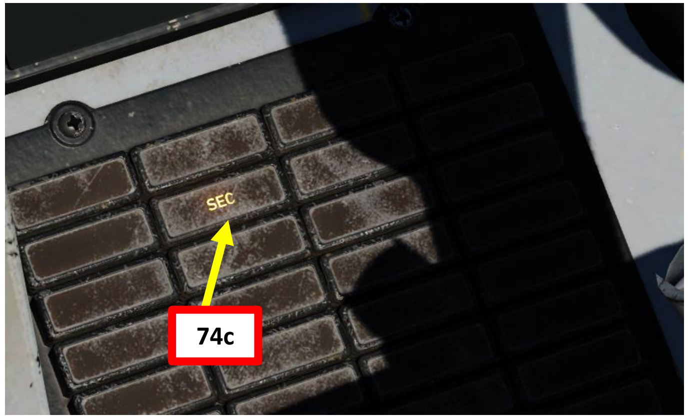


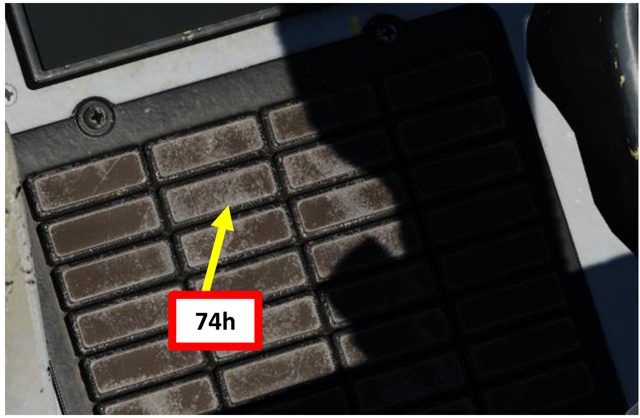
I – PERFORM AIRCRAFT POST-START CHECKS

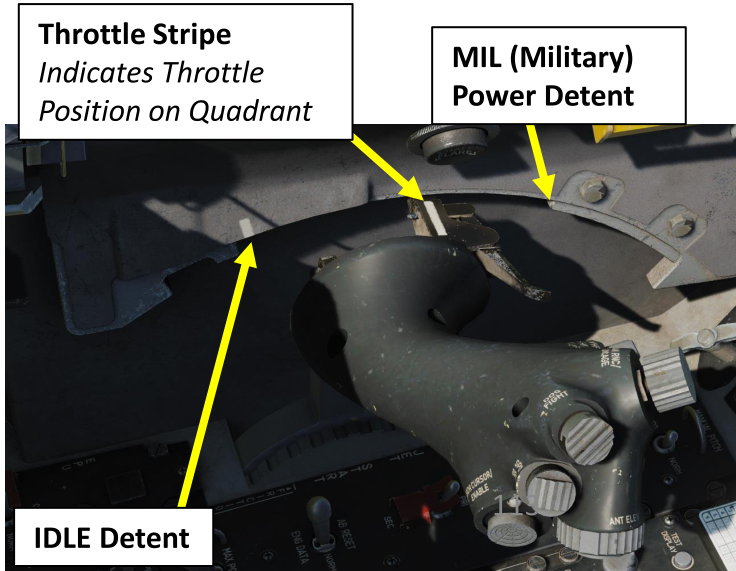
74. (Optional) Verify SEC (Secondary Engine Control) system operation. This mode is selected in the case of failure of the engine-mounted digital computer that controls fuel flow scheduling.
    a) Take note of the initial engine RPM and Nozzle position in PRI (Primary) engine control mode
    b) Raise ENG CONT (Engine Control) switch Guard, then set switch to SEC (Secondary)
    c) Verify the SEC caution light illuminates and engine RPM is stabilized. RPM may drop up to 10 % from PRI (Primary engine operation) value before stabilizing. Stabilized SEC IDLE RPM may be up to 5 % lower than in PRI (Primary) IDLE.
    d) Hold wheel brake pedals. The parking brake switch automatically disengages if engine RPM is greater than 85 %.
    e) Slowly advance throttle towards MIL (Military) Power detent and wait for engine RPM to increase to 85 %.
    f) When at 85 % RPM, snap throttle back to IDLE and check for normal indications and smooth operation. Nozzle should be 5 % or less within 30 seconds after selecting SEC.
    g) Set ENG CONT (Engine Control) switch back to PRI (Primary) and lower switch guard.
    h) Check that the SEC caution light extinguishes and nozzle position returns to greater than 94 %.





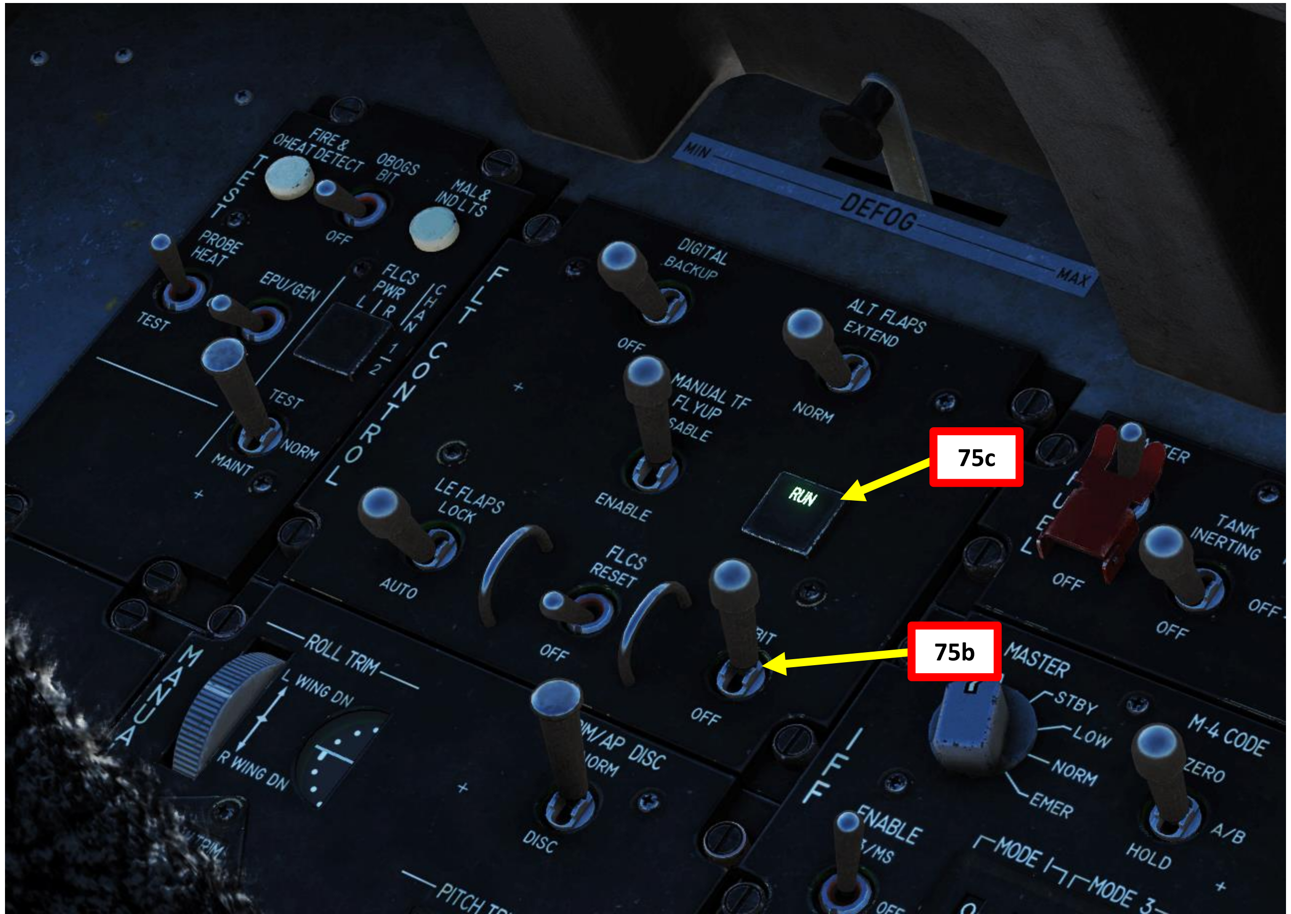


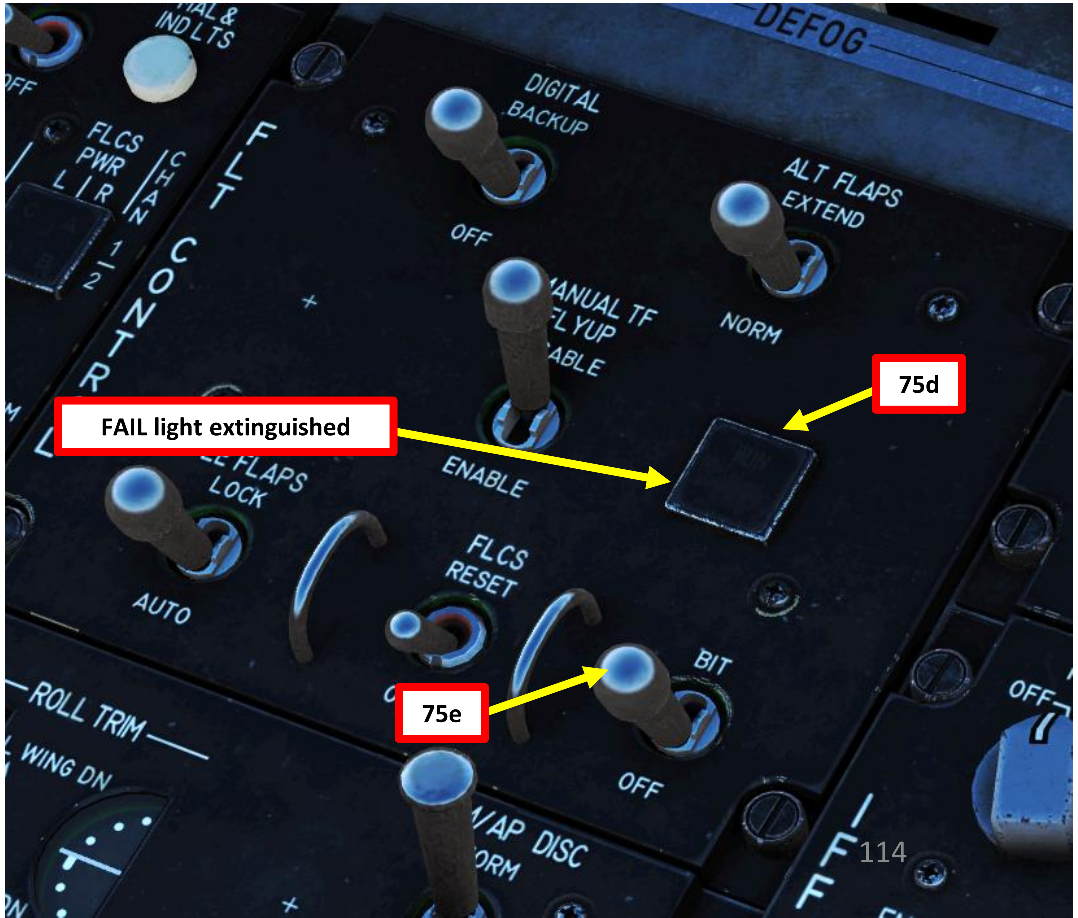




I – PERFORM AIRCRAFT POST-START CHECKS

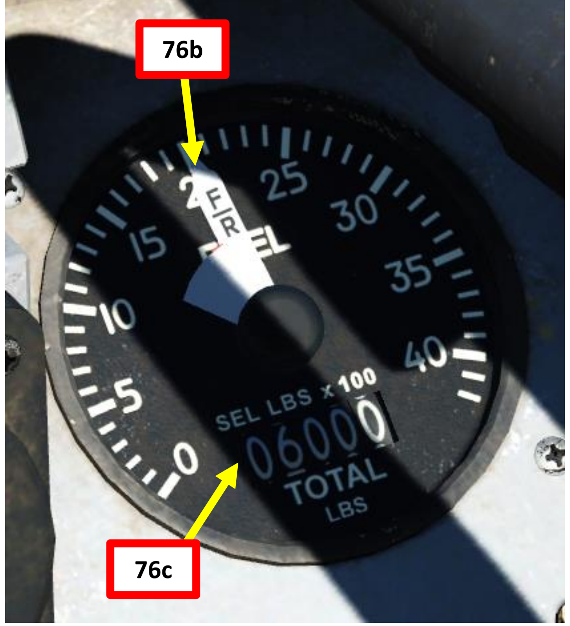
75. (Optional) Verify FLCS (Flight Control System) operation
    a) Cycle all your flight controls with the stick and rudder pedal input. Maximum stick inputs warm hydraulic fluid and removes air bubbles, making a test failure less likely.
    b) Set FLCS BIT (Flight Control System Built-In Test) Switch – BIT
    c) RUN light on the Flight Control Panel illuminates for the duration of the test.
    d) Approximately 45 seconds later, the RUN light extinguishes if the completion of the FLCS BIT is successful.
    e) The FLCS BIT switch will automatically spring back to OFF. The FAIL light and FLCS warning light should remain off.

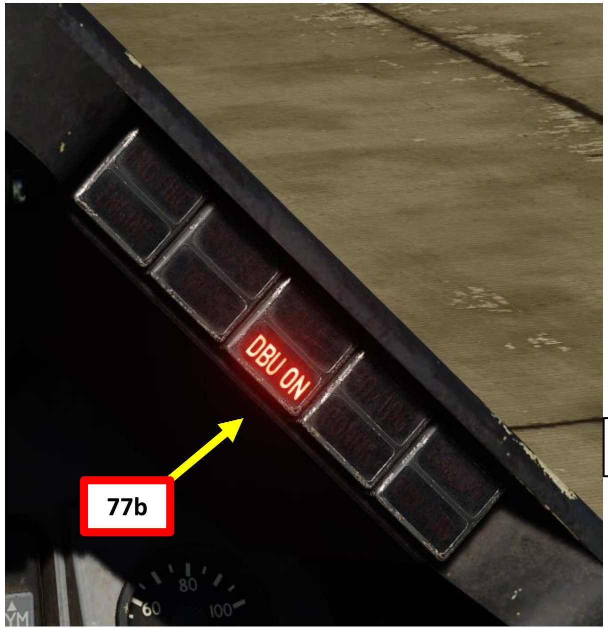


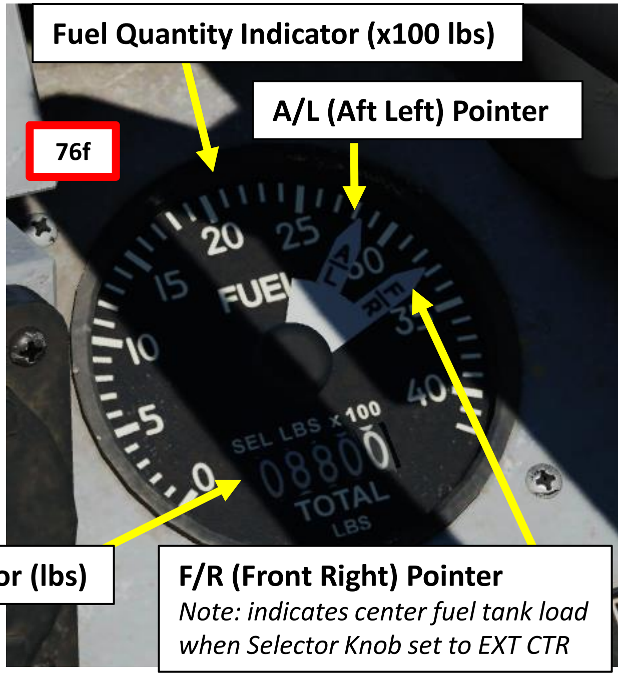


I – PERFORM AIRCRAFT POST-START CHECKS

76. (Optional) Verify Fuel Quantity Indicating system operation
    a) Set FUEL QUANTITY knob to TEST
    b) On fuel quantity indicator, verify that FR and AL pointers indicate 2000 (+/- 100) lbs.
    c) On fuel quantity indicator, verify that Fuel Totalizer indicates 6000 (+/- 100) lbs.
    d) Verify that FWD FUEL LOW and AFT FUEL LOW caution lights illuminate.
    e) Cycle FUEL QUANTITY knob to other positions and verify that quantity readouts in all other positions match the aircraft's actual fuel load.
    f) Set FUEL QUANTITY knob to NORM.
77. (Optional) Verify DBU (Digital Backup Software) system operation. The DBU is used if problems arise with the primary Flight Control System (FLCS) software.
    a) Set DIGITAL BACKUP switch to BACKUP
    b) Verify that DBU ON warning light illuminates.
    c) Operate flight controls with the stick and rudder and confirm that all control surfaces respond normally.
    d) Set DIGITAL BACKUP switch to OFF.
    e) Verify that DBU ON warning light extinguishes.

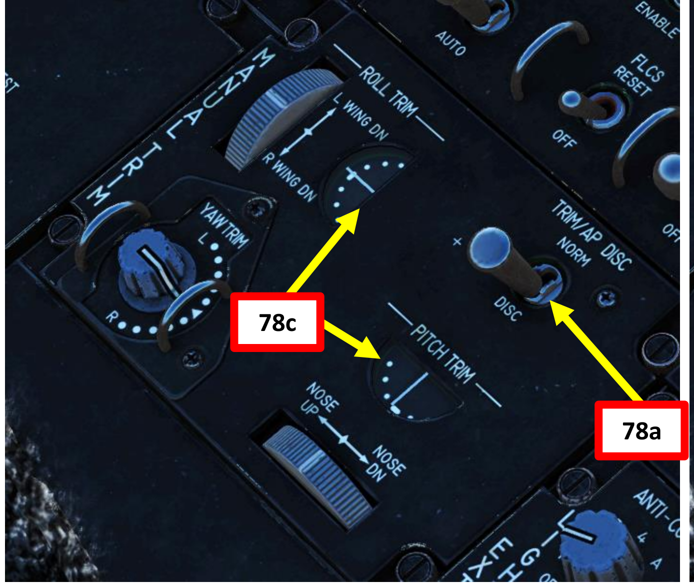


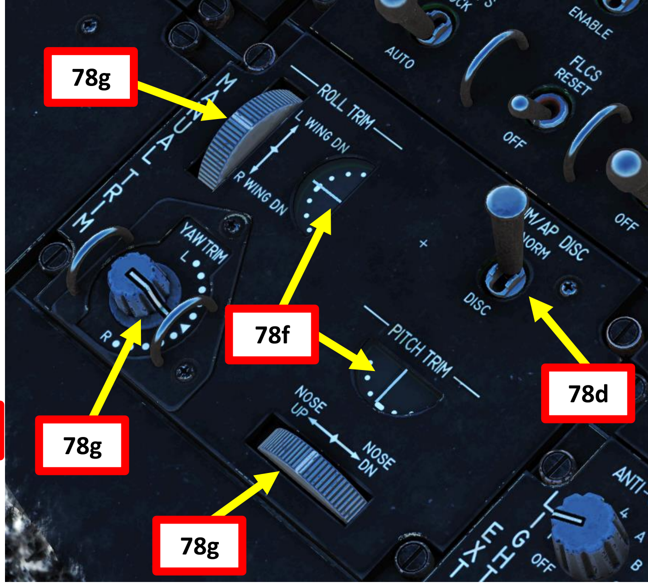


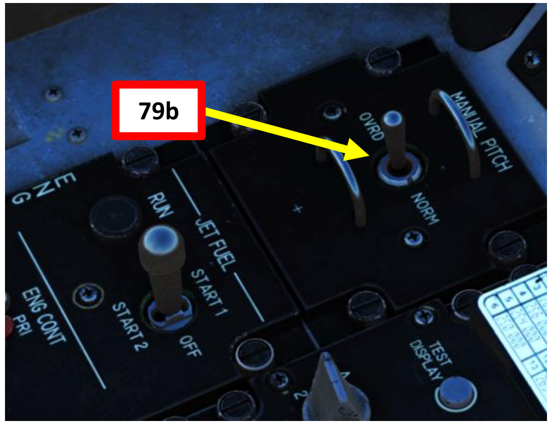


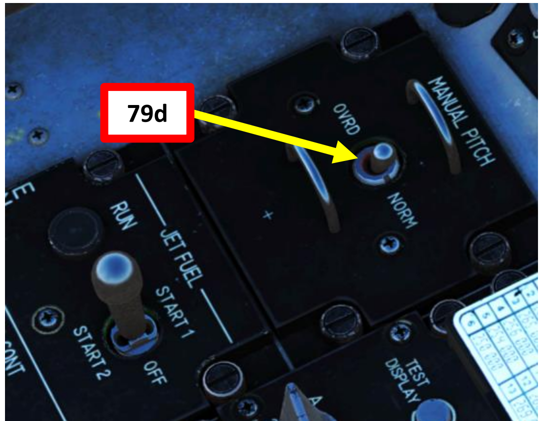
I – PERFORM AIRCRAFT POST-START CHECKS

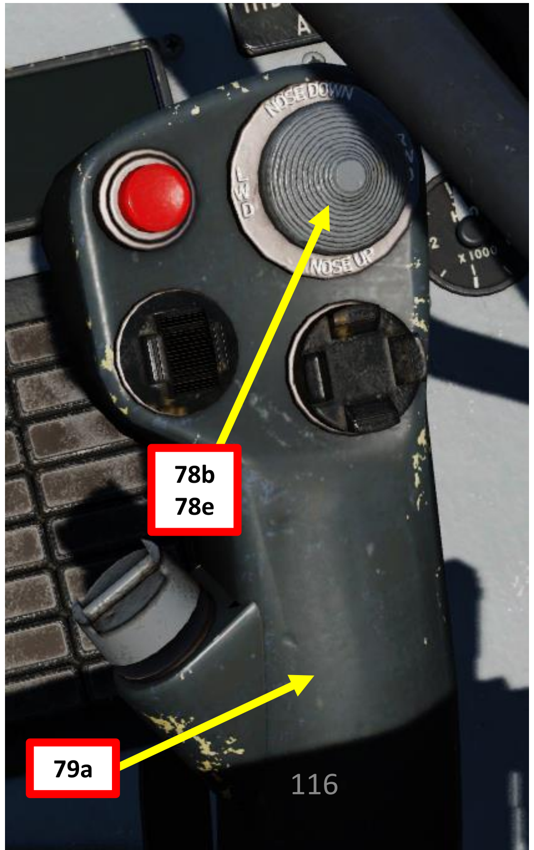
78. (Optional) Verify Trim system operation
    a) Set TRIM/AP DISC (Trim/Autopilot Disconnect) switch to DISC
    b) Use your trim hat on the stick to trim in both pitch and roll axis.
    c) Verify that there is no control surface motion and no movement on the TRIM wheel or indicators.
    d) Set TRIM/AP DISC (Trim/Autopilot Disconnect) switch to NORM
    e) Use your trim hat on the stick to trim in both pitch and roll axis.
    f) Verify that there is control surface motion and movement on the TRIM wheel or indicators.
    g) Center trim for pitch and roll, then use YAW TRIM knob to check and center trim for yaw.
79. (Optional) Verify MPO (Manual Pitch Override) system operation
    a) Push the stick full forward and hold it in that position. Horizontal tail should deflect down.
    b) Set and hold MPO (Manual Pitch Override) switch to OVRD position.
    c) Verify that horizontal tail trailing edges move farther down.
    d) Release stick and MPO switch (it will spring back to NORM).
    e) Confirm that horizontal tail returns to its original position.





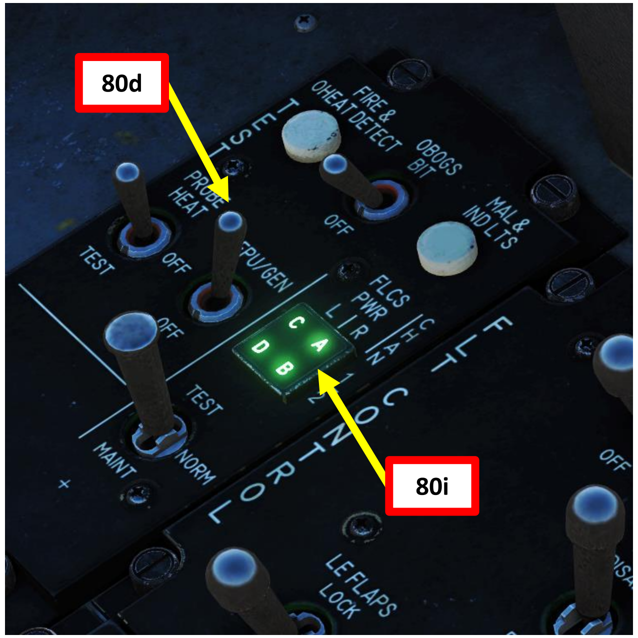


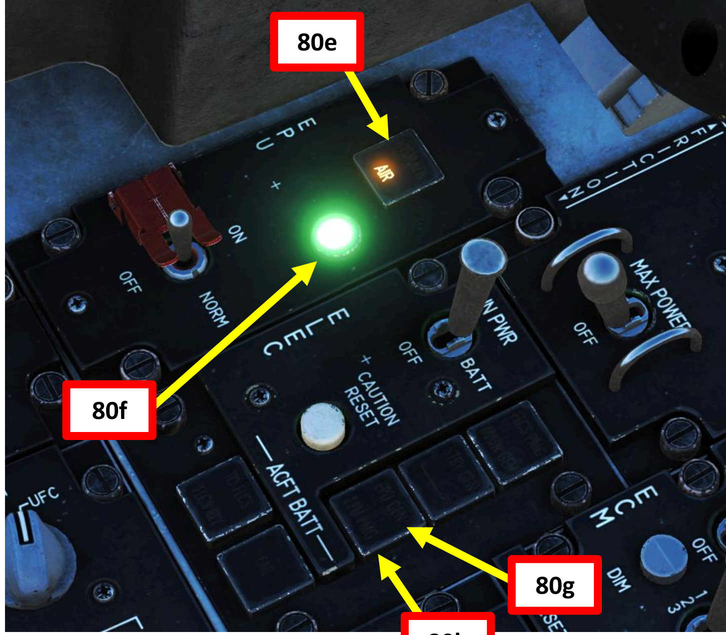


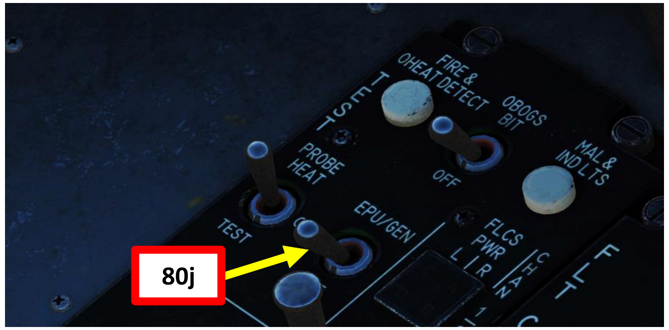


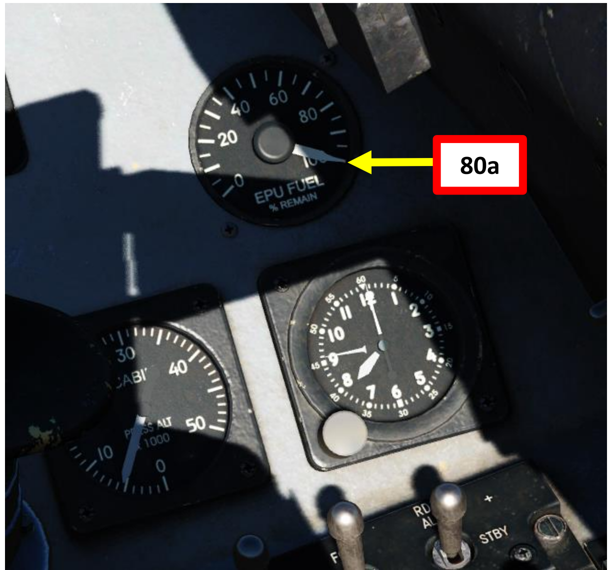
I – PERFORM AIRCRAFT POST-START CHECKS

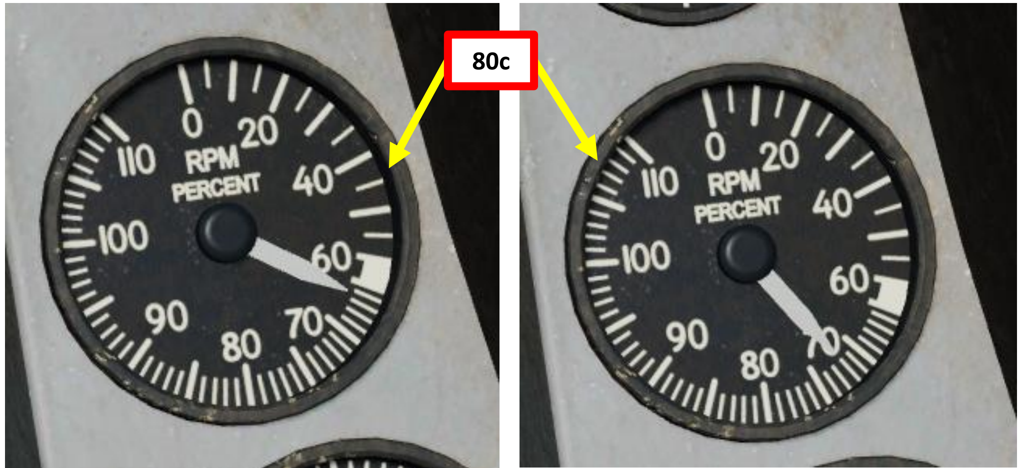
80. (Optional) Verify EPU (Emergency Power Unit) system operation. This test will verify that the EPU can provide electrical power in case of an engine failure, and it also tests the EPU generator and EPU PMG (Permanent Magnet Generator) output to FLCS on the ground without using hydrazine.
    a) Check EPU Fuel (Hydrazine) Quantity reads between 95 and 102 %
    b) Set OXYGEN switch to 100 %
    c) Hold down wheel brakes and increase engine RPM 10 % above normal IDLE power
    d) Set EPU/GEN TEST (Emergency Power Unit/Generator) switch to EPU/GEN and hold it in position.
    e) Verify that EPU AIR light illuminates
    f) Verify EPU RUN light illuminates for a minimum of 5 seconds
    g) Verify EPU GEN (Generator) light remains extinguished (may come on momentarily at the start of the test)
    h) Verify EPU PMG (Permanent Magnet Generator) light remains extinguished (may come on momentarily at the start of the test)
    i) Verify FLCS PWR (Flight Control System Power) lights illuminate
    j) Release EPU/GEN TEST switch – OFF
    k) Return throttle to IDLE
    l) Set OXYGEN back to NORMAL









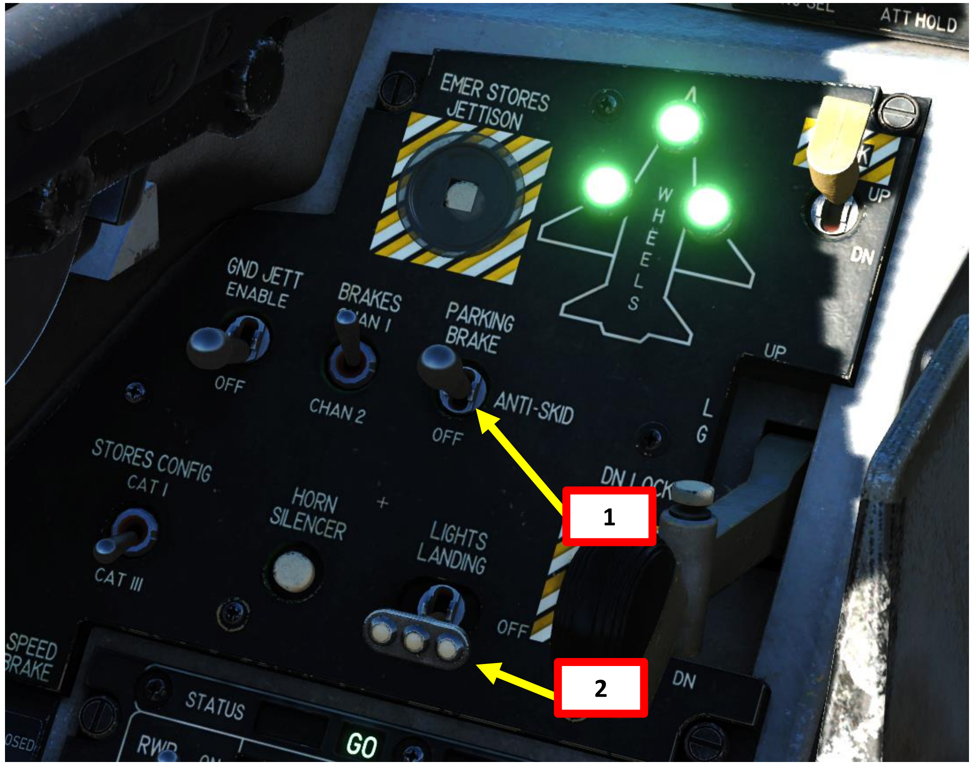


I – PERFORM AIRCRAFT POST-START CHECKS

81. Provision for additional steps.

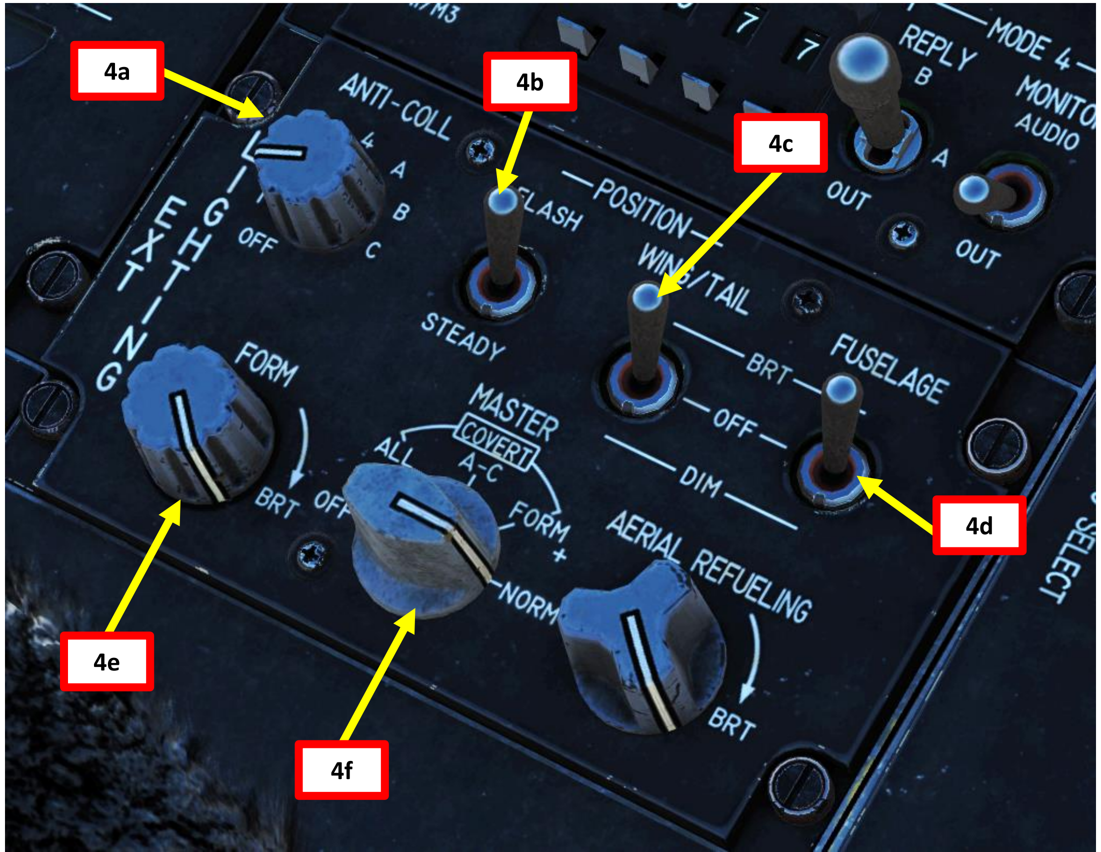
TAXI

1. Verify that Parking Brake / Anti-Skid Switch is DISENGAGED (ANTI-SKID).
   Note: The parking brake automatically disengages if engine RPM is greater than 85 % (which you reached when performing the engine run-up checks) or if the switch is manually set to the ANTI-SKID (Middle) position.
2. Turn on Taxi Light (DOWN)
3. Press the NWS A/R DISC & MSL STEP Button (Nosewheel Steering, Air Refueling Disconnect & Missile Step) on the stick to engage nosewheel steering for taxiing; this will allow you to turn using rudder pedals. The “NWS” Status light indicates nosewheel steering is active.



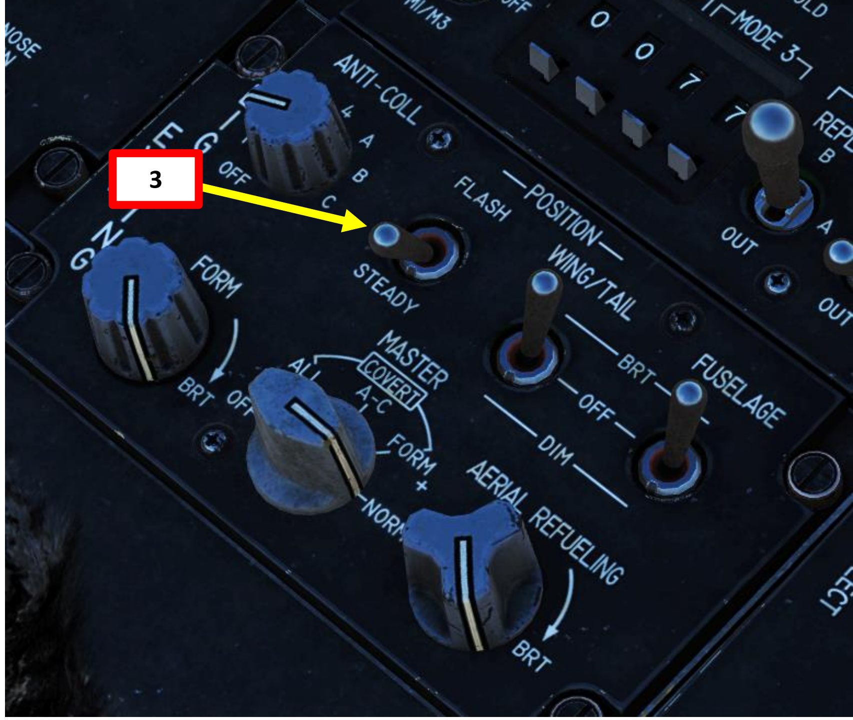
TAXI

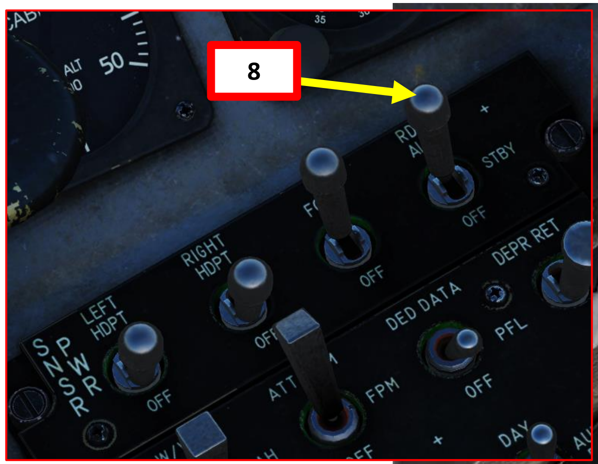
4. Set Formation, Anti-Collision & Position Lights – As Required.
    a) Set Anti-Collision Switch – 1 (or any other flash pattern setting)
    b) Set Position Lights Switch – FLASH (when parked or during taxi)
    c) Set Wing/Tail Position Lights Switch – BRT (Bright)
    d) Set Fuselage Position Lights Switch – BRT (Bright)
    e) Set Formation Lights Brightness Control Knob – BRT (Bright)
    f) Set Master Lights Switch – NORM (sets pattern with visible strobes) for day operations
5. Throttle up slightly above IDLE to start taxiing.
6. Perform taxi turns at 10 kts or less.
7. Taxi speed is generally kept below 25 kts.

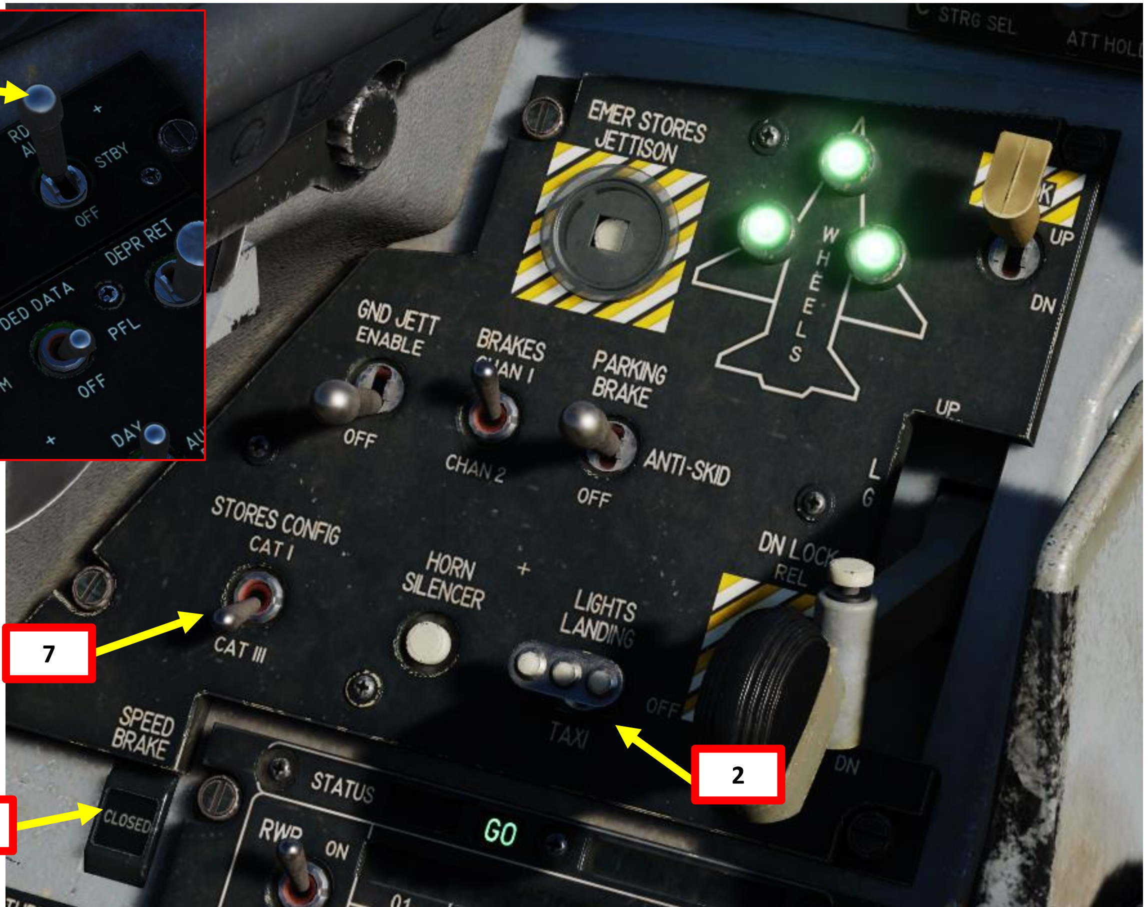


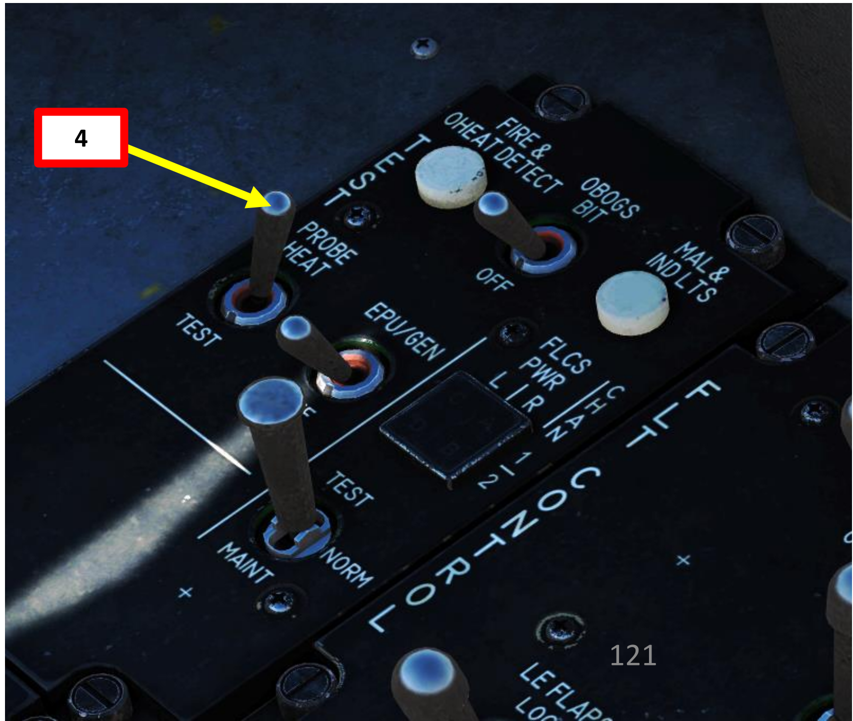
TAKEOFF

1. Line up on the runway
2. Turn OFF taxi light (MIDDLE).
3. Set Position Lights Switch - STEADY
4. Set Probe Heat switch – PROBE HEAT
5. Verify Nosewheel Steering is engaged
6. Check that Speed Brakes are CLOSED (Retracted)
7. Check the Status panel and confirm that correct Flight Control System mode is selected
    - CAT I for air-to-air loadouts
    - CAT III for air-to-ground/heavy loadouts
8. Set RADAR ALTIMETER switch to ON (FWD)



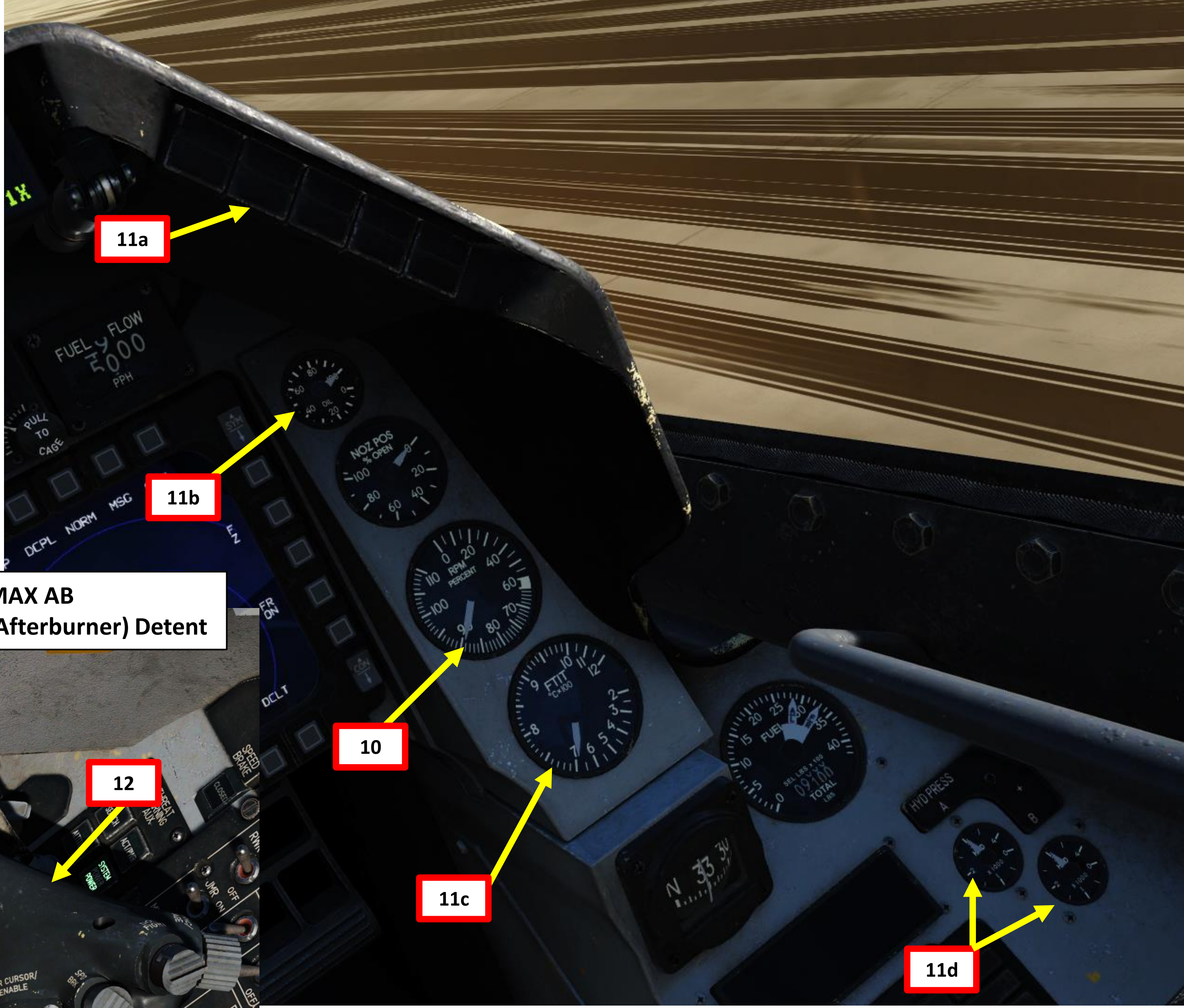


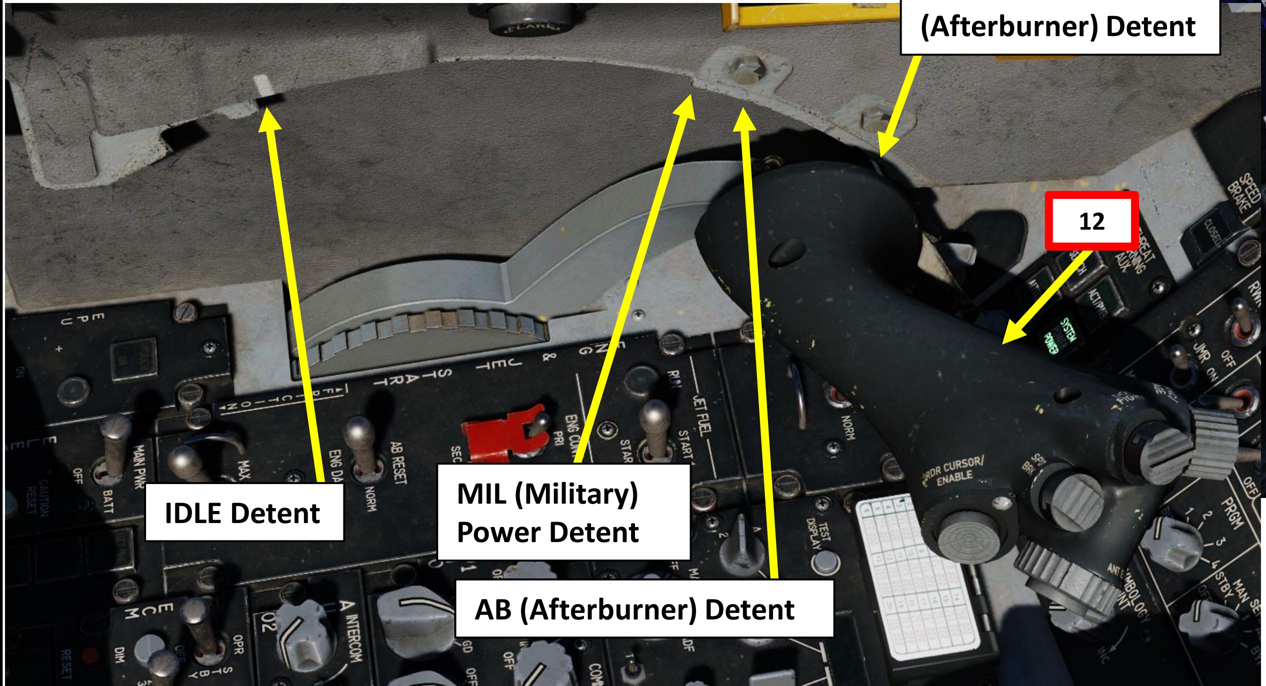




TAKEOFF

9. Hold wheel brakes
10. Throttle up to 90 % RPM
11. Confirm that engine spools up correctly
    a) HYD/OIL PRESS warning light is OFF
    b) Oil pressure is between 25 and 65 psi
    c) FTIT (Fan Turbine Inlet Temperature) is 935 deg C or less
    d) Hydraulic Pressure for systems A & B is between 2850 and 3250 psi
12. Throttle up to either MIL (Military) Power if using a light load or Full Afterburner if using heavy loads or using a short runway.
13. Release wheel brakes



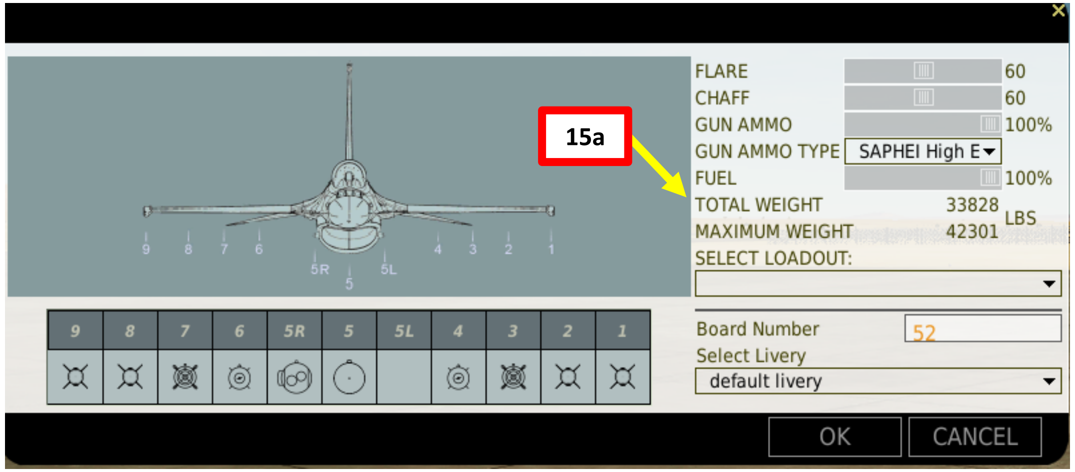


TAKEOFF

14. When reaching 70 kts, press the NWS A/R DISC & MSL STEP Button on the stick to disengage nosewheel steering. Confirm that NWS indication extinguishes
15. Your takeoff speed is a function of your aircraft weight, which can be obtained from the ground crew when choosing your loadout.
    - In our case, we have a takeoff weight of approx. 34,000 lbs
    - Using the Takeoff Speed table, we can determine that our takeoff speed for 34,000 lbs is approx. 173 kts
16. Gently pull back on the stick and establish a takeoff attitude (8-12 degrees of pitch).
    - When using MIL power, pull back on the stick at approx. 10 kts below the takeoff speed (163 kts in our case)
    - When using afterburner, pull back on the stick at approx. 15 kts below the takeoff speed (158 kts)

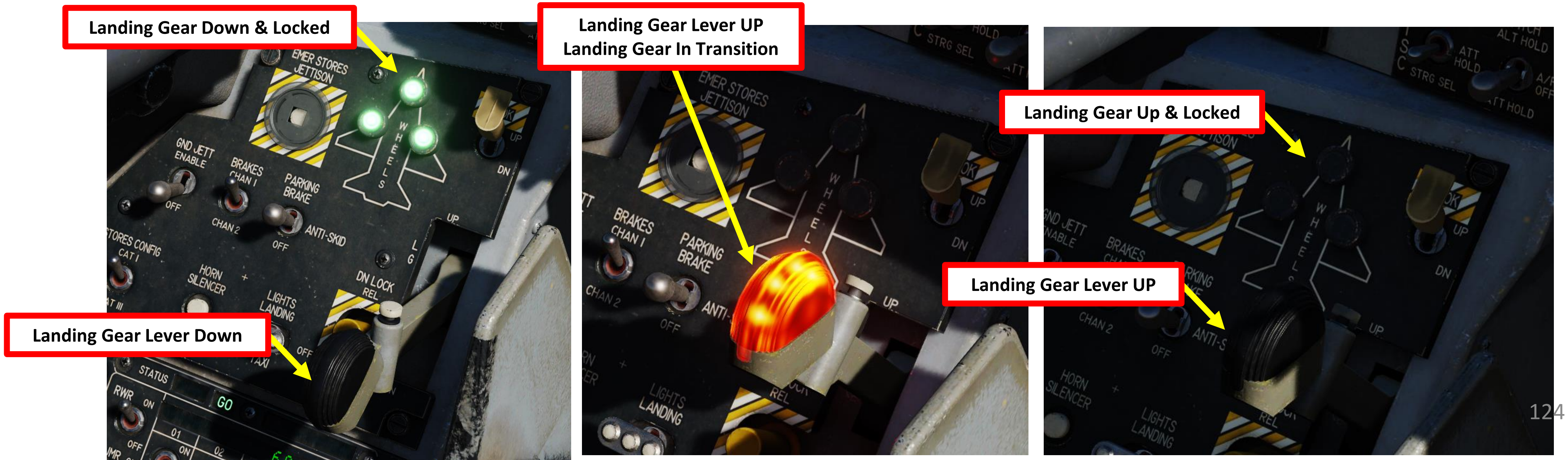
15b

Takeoff Speed Table							
Aircraft Weight (lbs)	20000	24000	28000	32000	36000	40000	44000
Takeoff Speed (kias)	128	142	156	168	178	188	198



TAKEOFF

17. Ensure a positive rate of climb, and then raise the landing gear.
    - Trailing edge flaps retract at the same time as the landing gear and may cause the aircraft to settle and scrape the runway when lift is lost.
    - Make sure the landing gear is retracted before reaching 300 kts, since higher airspeeds may cause structural damage to the landing gear doors.

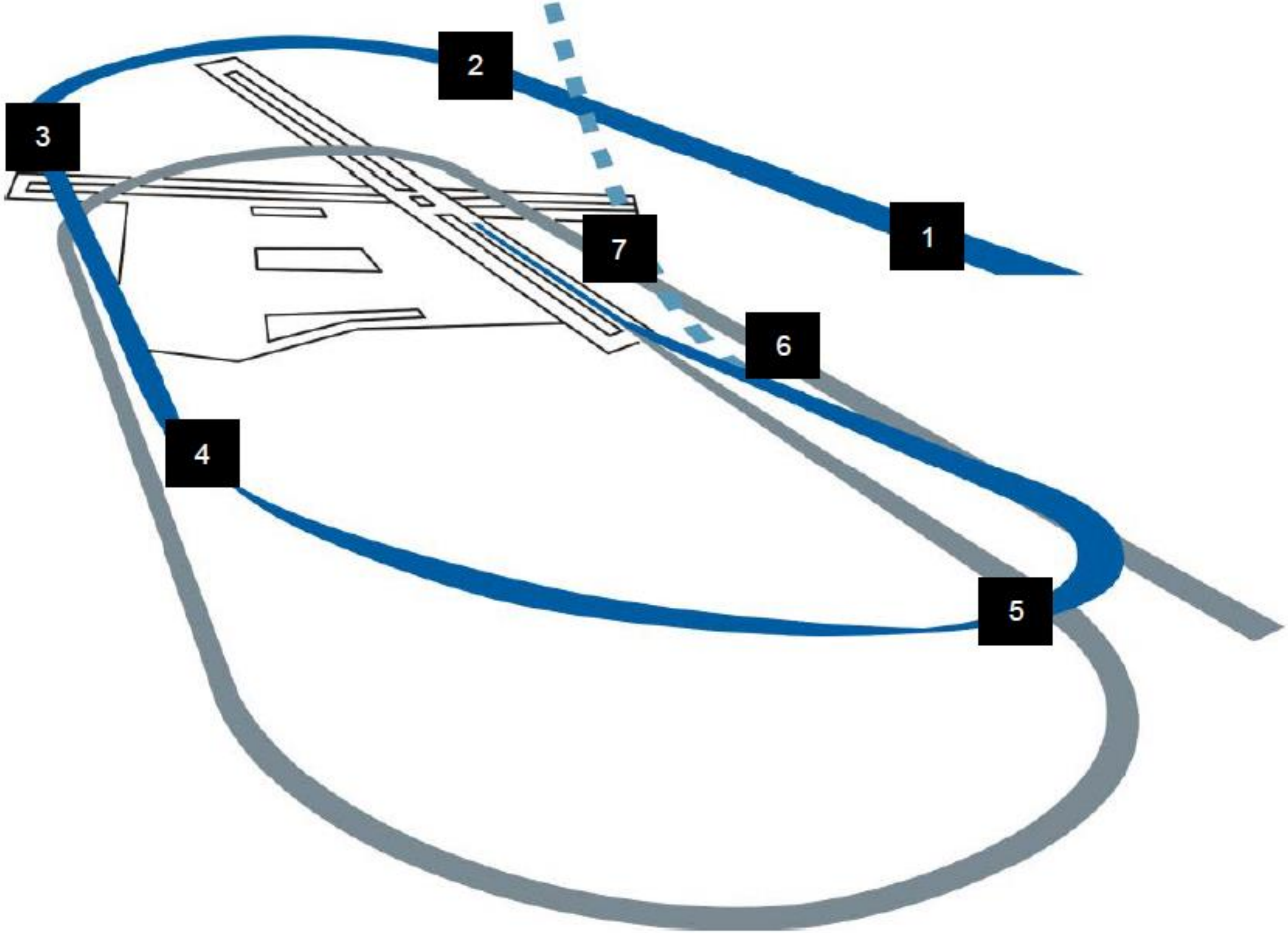


TAKEOFF


GAMBLERS
SW
052

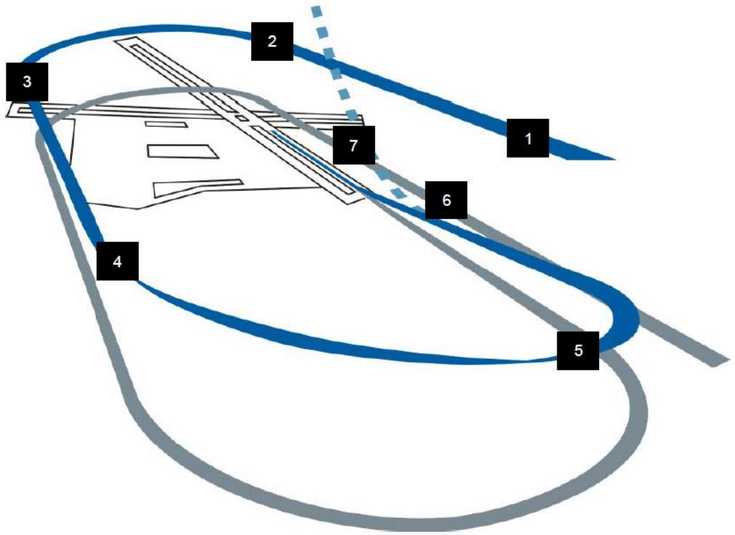
LANDING PATTERN

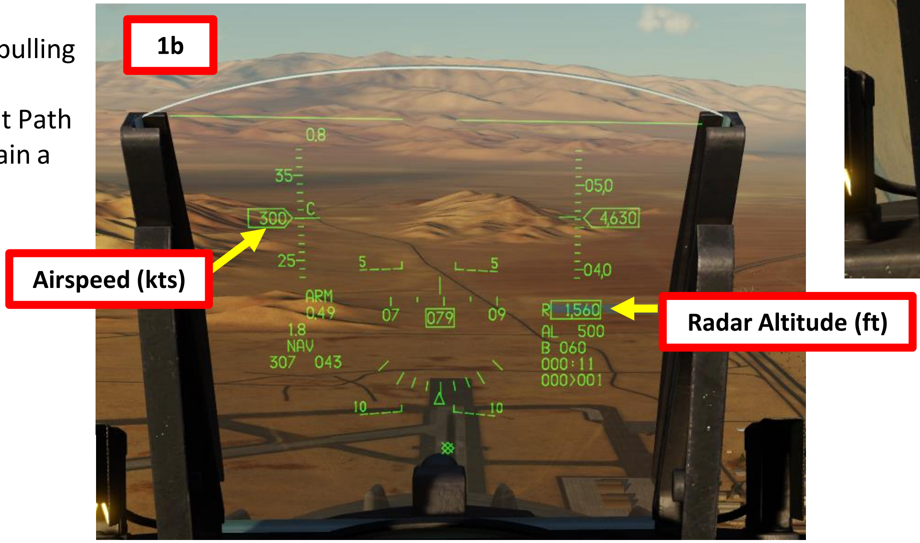
1. Initial Approach
2. Overhead Break
3. Downwind Leg
4. Base Turn
5. Final Turn
6. Short Final
7. Roll-Out

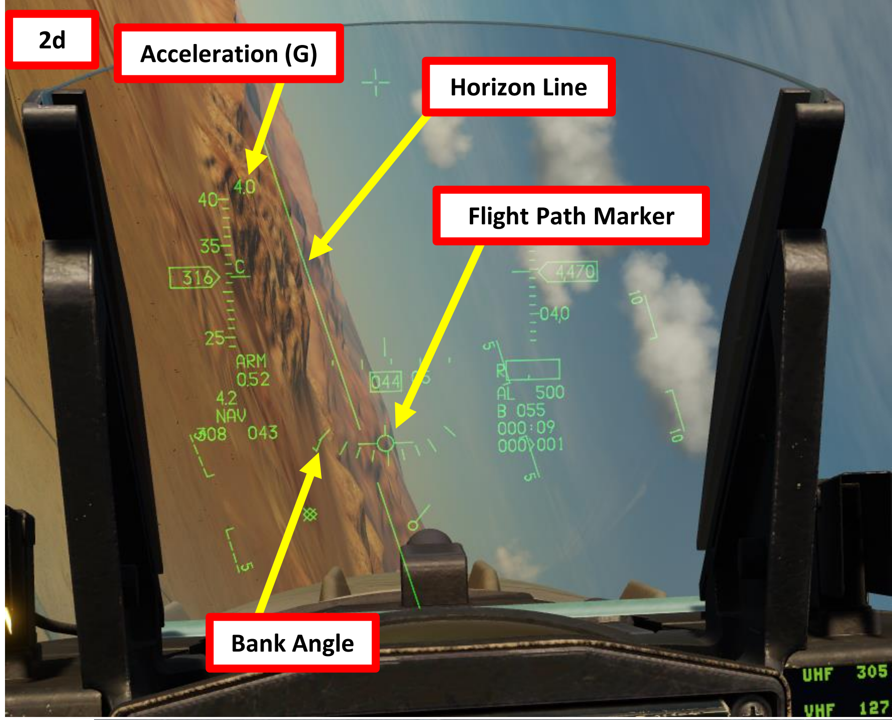


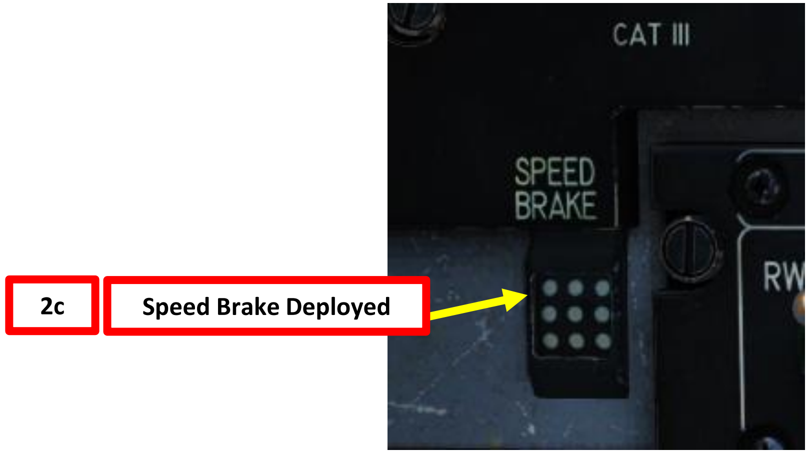
LANDING

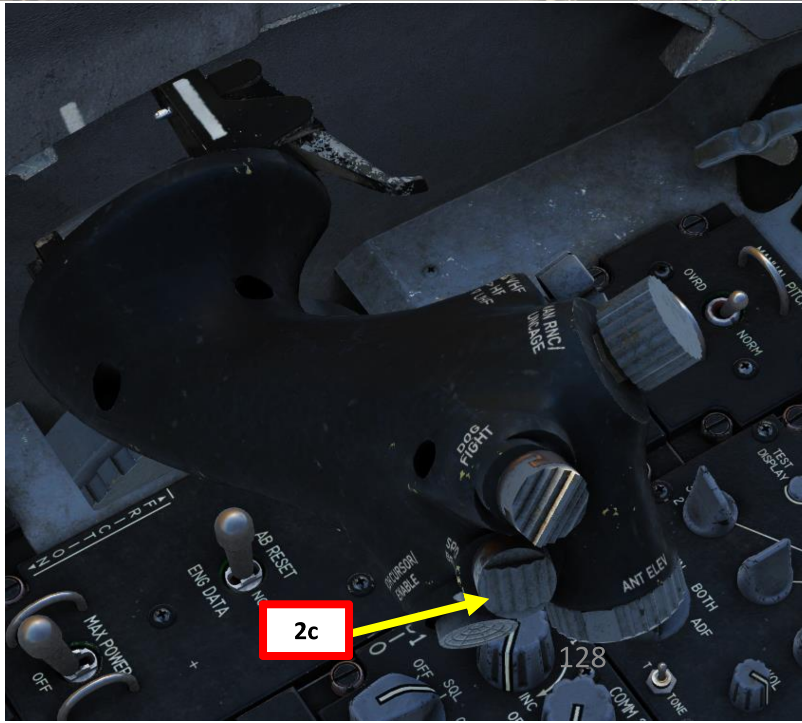
1. **Initial Approach**
    a) Set RADAR ALTIMETER switch to ON (FWD)
    b) Align your aircraft with the landing runway at 1500 ft above ground level and maintain 300 kts
2. **Overhead Break**
    a) Break left or right over the desired touchdown point
    b) Set throttle to 80 % RPM
    c) Deploy Speedbrakes
    d) Fly the break at about 70 deg of bank, pulling approx. 3 to 4 Gs.
    e) Align the HUD (Heads-Up Display) Flight Path Marker with the Horizon Line to maintain a level turn





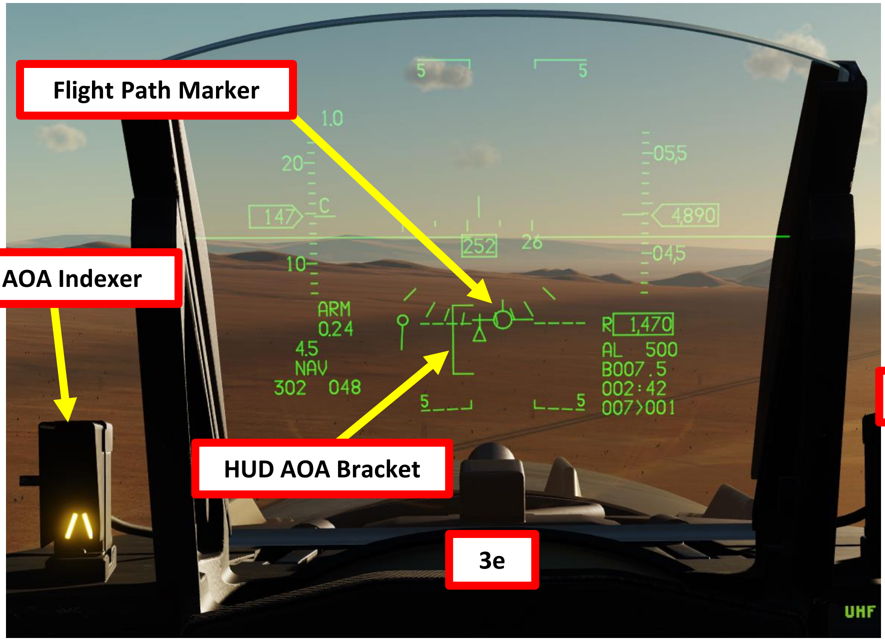


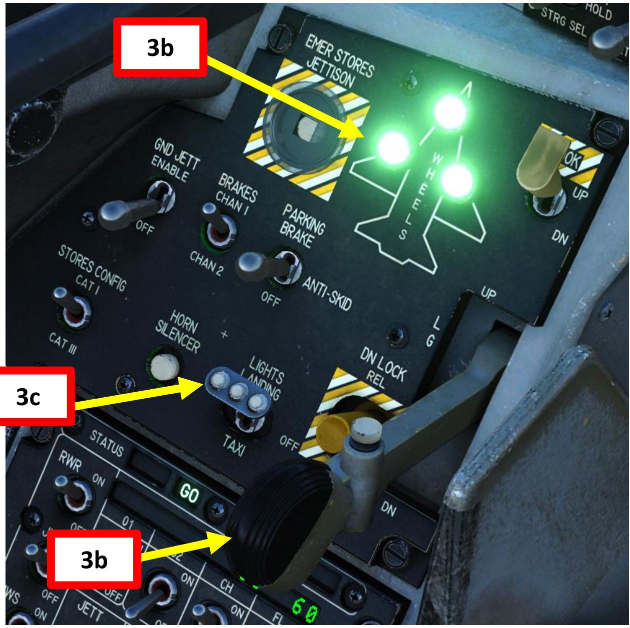


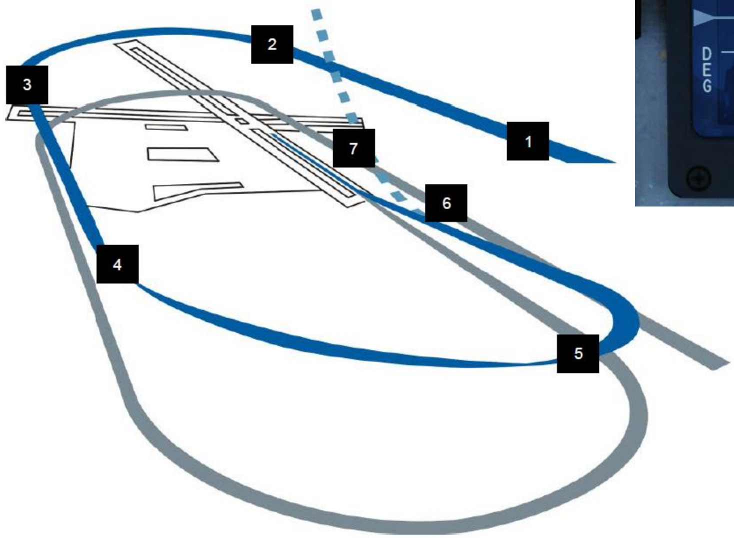


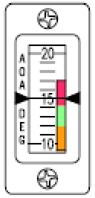
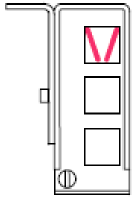
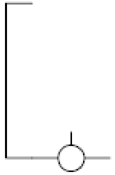
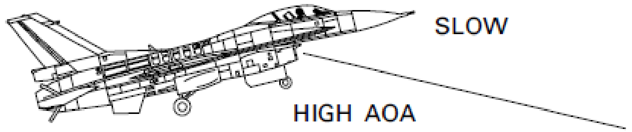
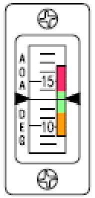
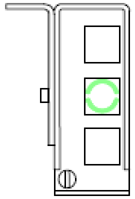
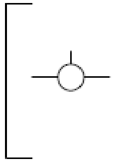
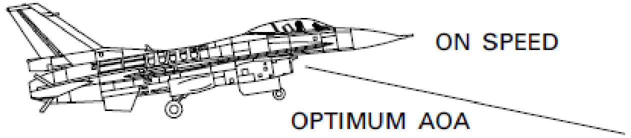
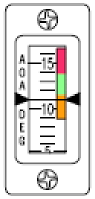
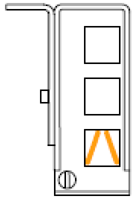
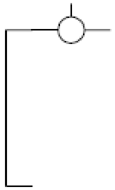
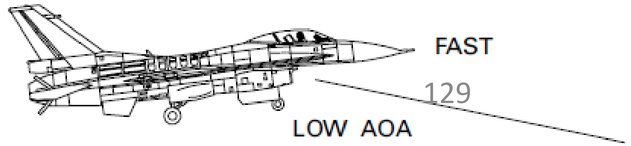
LANDING

3. **Downwind Leg**
   a) Roll out on the downwind leg opposite the landing heading at about 200-220 kts and 1500 ft AGL
   b) Extend landing gear
   c) Turn on LANDING light (UP).
   d) Reduce speed as required to prevent excessive airspeed buildup in the base turn
   e) Do not use Pitch Trim to control the angle of attack; use throttle instead and the fly-by-wire system will adjust the aircraft AoA by itself. Adjust throttle to set an angle of attack (AOA) of 11 deg. Angle of Attack can be monitored with the three following indications:
      - The AOA Indicator
      - The AOA Indexer
      - The HUD (Heads-Up Display) AOA Bracket (with Flight Path Marker)



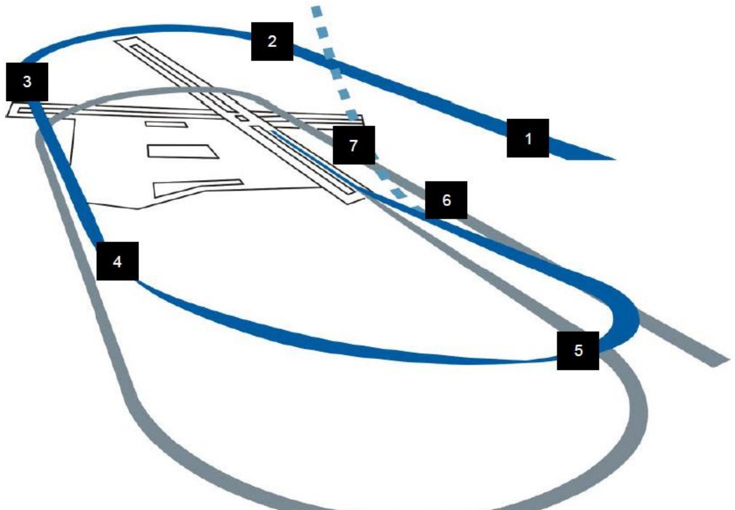


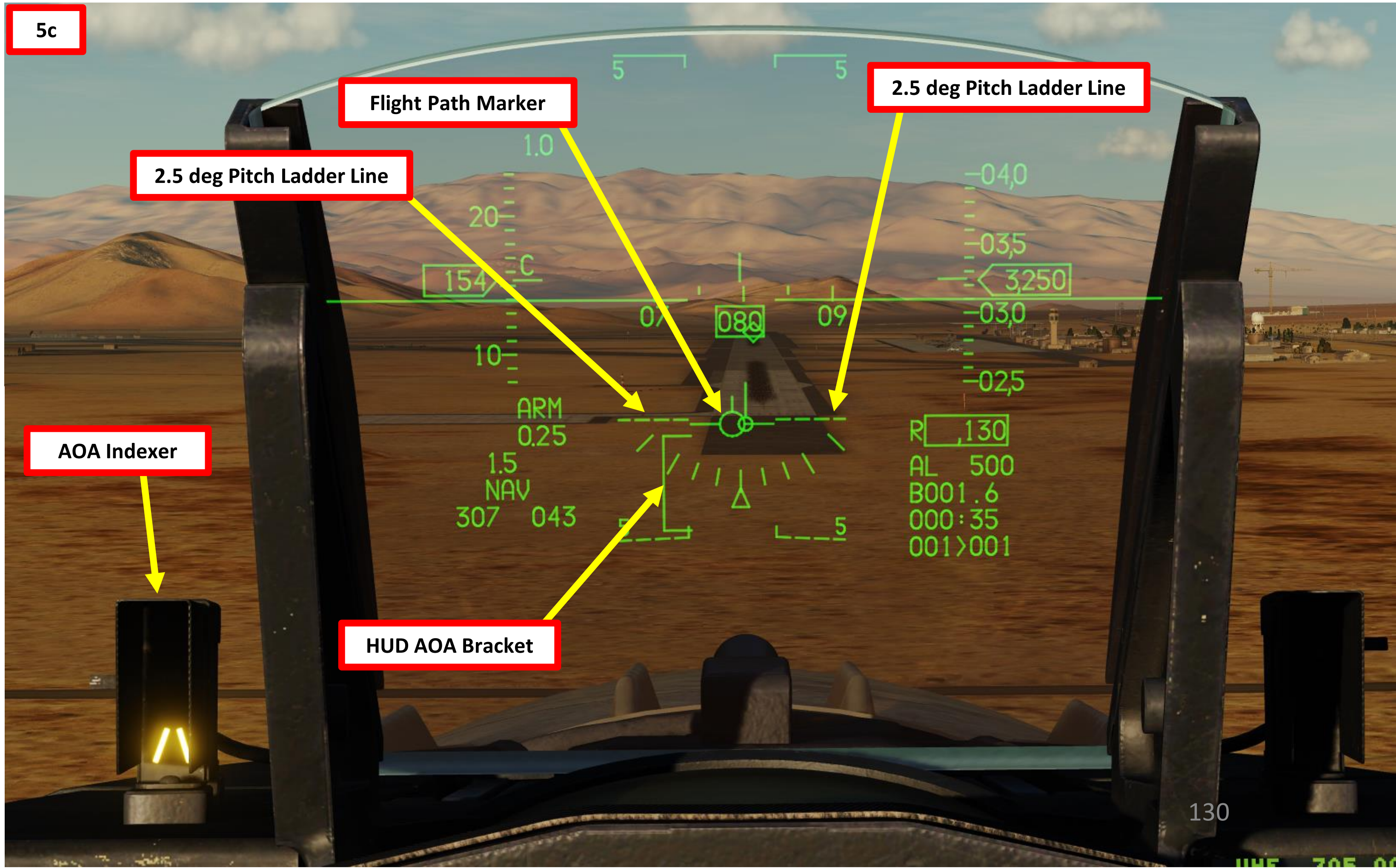


INDICATOR	INDEXER	HUD DISPLAY	ATTITUDE
 15			 SLOW HIGH AOA
 13			 ON SPEED OPTIMUM AOA
 11			 FAST LOW AOA

LANDING

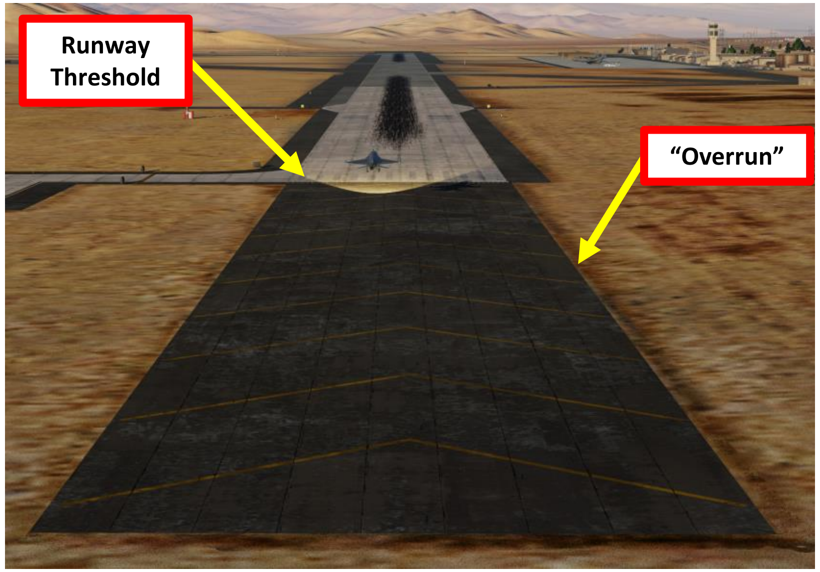
4. **Base Turn**
   a) Initiate base turn when abeam the rollout point. You may estimate this position by starting the turn when your wingtip is at the end of the runway.
   b) Lower the nose to 8-10 deg of pitch and fly the turn at 11 deg AOA
5. **Final Turn**
   a) Use throttle to control airspeed while using the stick to maintain a pitch of 8-10 deg nose low and 11 deg AOA through the turn
   b) Roll out on final and raise the nose to maintain proper glide path (300 ft AGL, 1 nm from the touchdown point)
   c) Align the HUD Flight Path Marker and the 2.5 deg pitch ladder lines with the runway threshold to ensure proper glidepath while maintaining 11 deg AOA

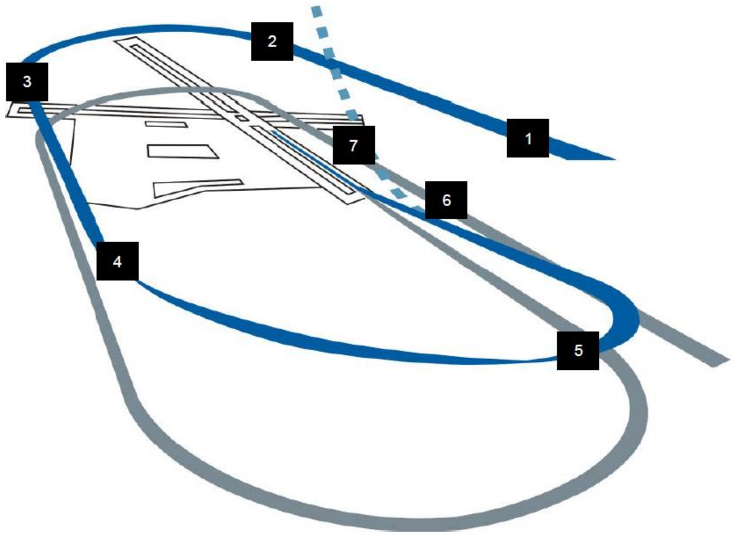




LANDING

6. **Short Final**
   a) When flying over the “overrun” (portion of the runway before the primary surface starts), shift the Flight Path Marker forward to a point 300-500 ft down the runway.
   b) Gently pull back on the stick to flare and reduce the descent rate. DO NOT level off!
   c) Pull the throttle back to IDLE and touchdown with a maximum AOA of 13 deg (green circle). More than 15 deg AOA during the landing roll-out may cause the speedbrakes or engine nozzle to smash the runway.





LANDING

7. **Roll-Out**
   a) Maintain 13 deg nose-up attitude for a two-point aerodynamic braking until your airspeed has reduced to approx. 100 kts. This step is **very important** since the F-16's brakes are not very effective.
   b) Reduce back stick pressure and lower the nosewheel to the runway.
   c) Open speedbrakes fully and maintain full aft stick for maximum braking effectiveness.
   d) Apply moderate to heavy braking to slow the aircraft.
   e) Engage nosewheel steering when below 30 kts and taxi off the runway.

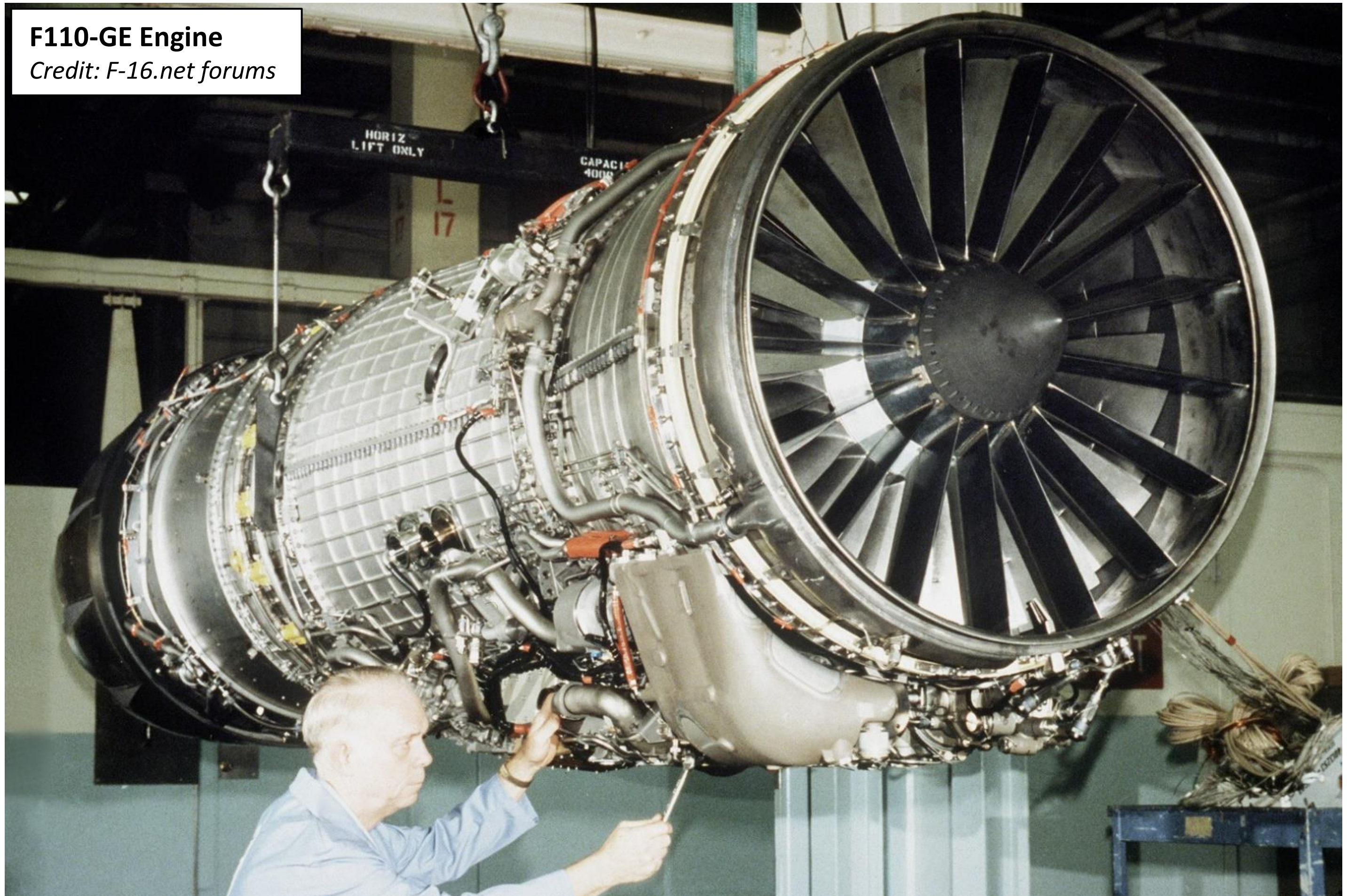
LANDING

GENERAL ELECTRIC F110-GE-129 ENGINE

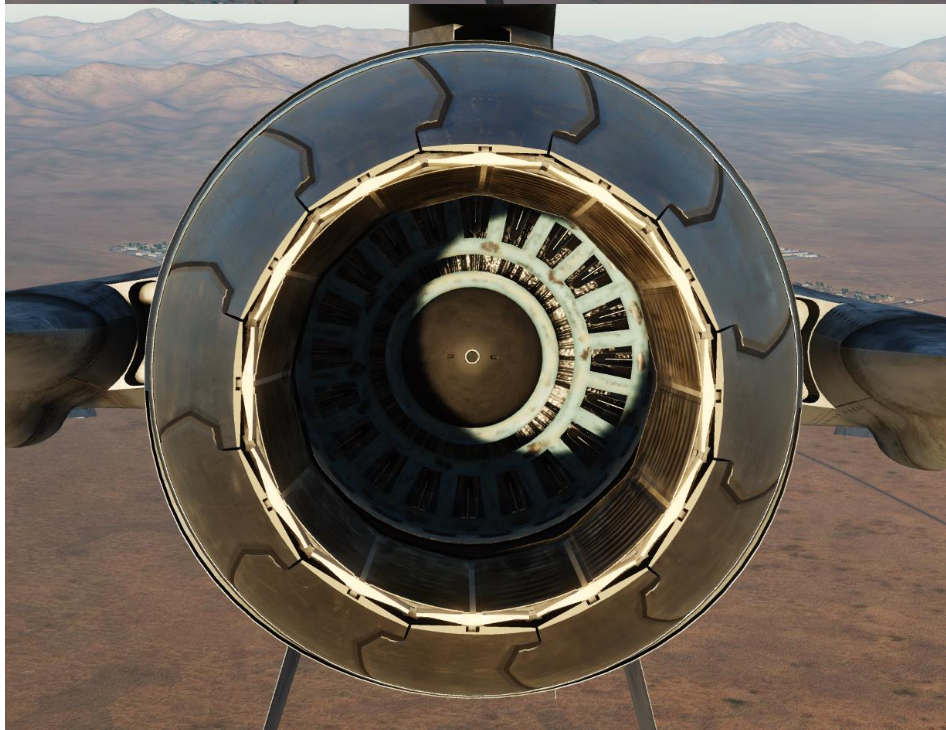
The F-16C modelled in DCS is powered by the General Electric F110-GE-129 afterburning turbofan engine. The F110 powers more than 70% of today's most advanced USAF F-16C/D aircraft. Derivatives of the F110 also powered the F-14B and the South Korean F-15K.

Initially, the F-16 entered service powered by the Pratt & Whitney F100. Seeking a way to drive unit costs down, the USAF implemented the Alternative Fighter Engine (AFE) program in 1984, under which the engine contract would be awarded through competition.

Initial orders were for the F110-GE-100 rated at 28,000 lbf (125 kN). Later versions of the F110 include the F110-GE-129 delivering 29,000 lbf (129 kN) thrust.



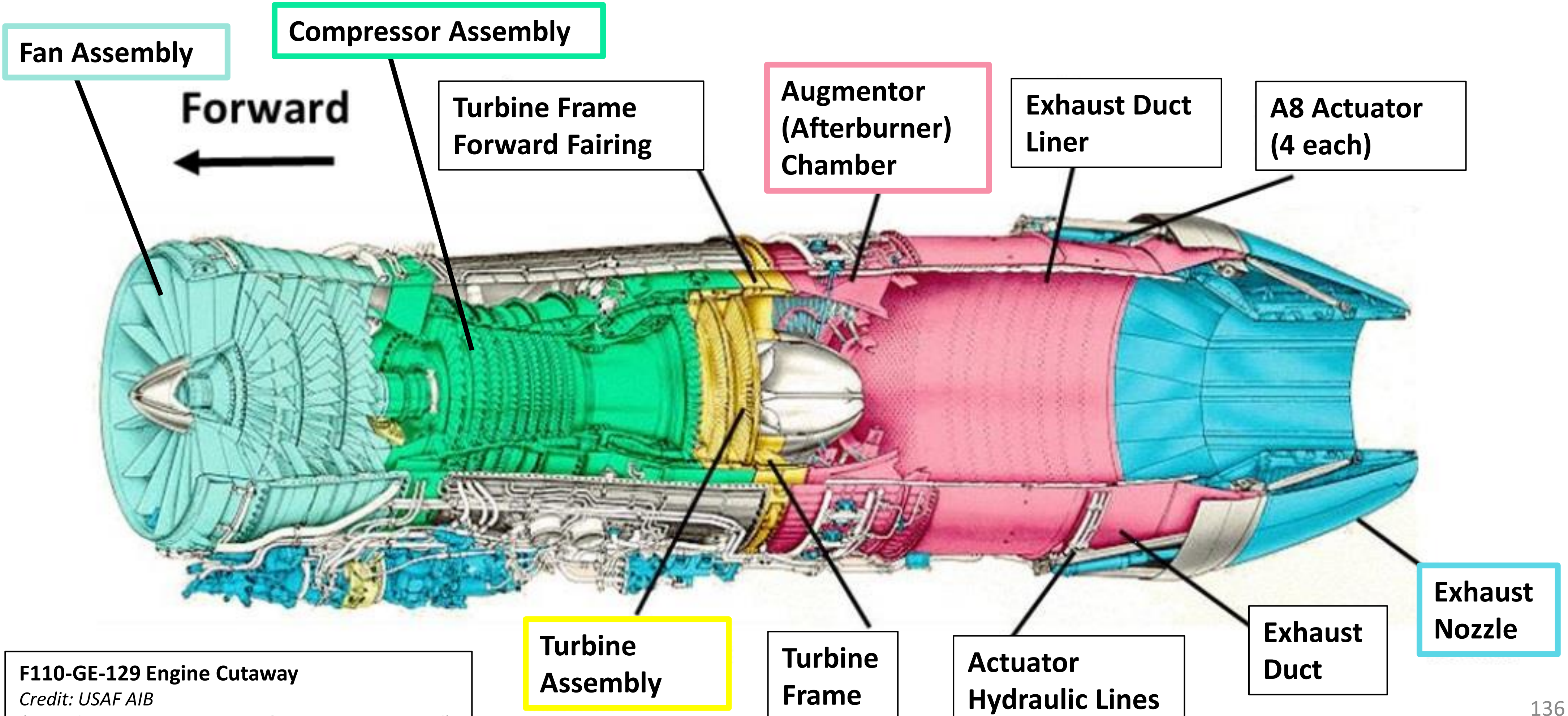
F110-GE Engine
Credit: F-16.net forums



GENERAL ELECTRIC F110-GE-129 ENGINE

The twin-spool F110 turbofan assembly has a 3-stage fan, 9 high-pressure compressor stages, a single high-pressure turbine stage and 2 low-pressure turbine stages. The engine is equipped with an annular combustion chamber and an augmentor (afterburner). The pressure ratio at maximum power is 30.7, while the Thrust-to-Weight Radio is 7.29.

Take note that the F-16 is not equipped with any auto-throttle system.



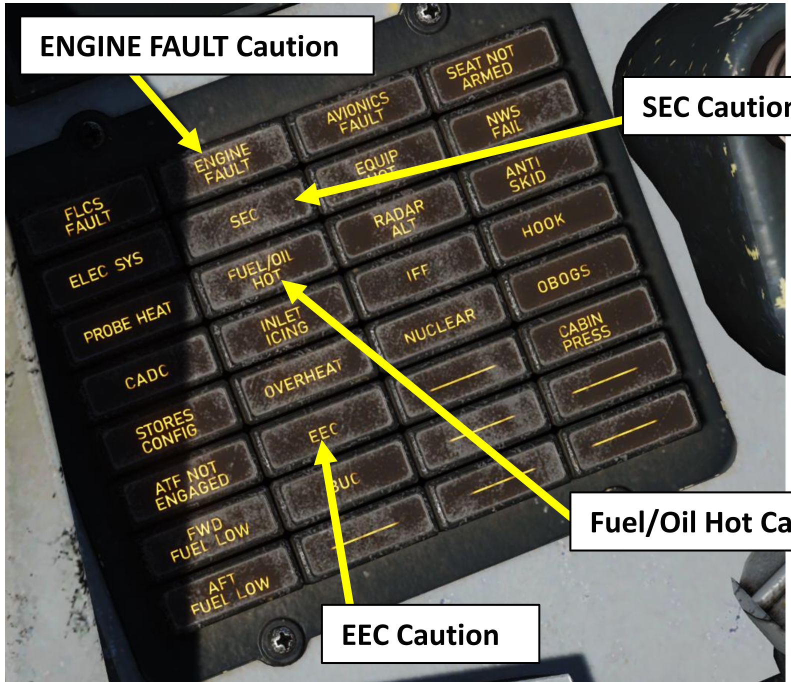
F110-GE-129 Engine Cutaway
Credit: USAF AIB
(United States Air Force Aircraft Investigation Board)

ENGINE INSTRUMENTS & PARAMETERS

ENG FIRE Light
Engine fire detected

HYD/OIL PRESS Light
- *Low Oil Pressure: Illuminates when oil pressure has been below approximately 10 psi for 30 sec. Extinguishes when oil pressure exceeds 20 psi approx.*
- *Low Hydraulic Pressure: Illuminates when hydraulic pressure for either system A or B decreases below 1000 psi.*

ENGINE Light
RPM and FTIT indicator signals indicate that an engine overtemperature or flameout has occurred. Illuminates when the RPM decreases below IDLE, or approximately 2 seconds after FTIT indication exceeds 1100 °C.

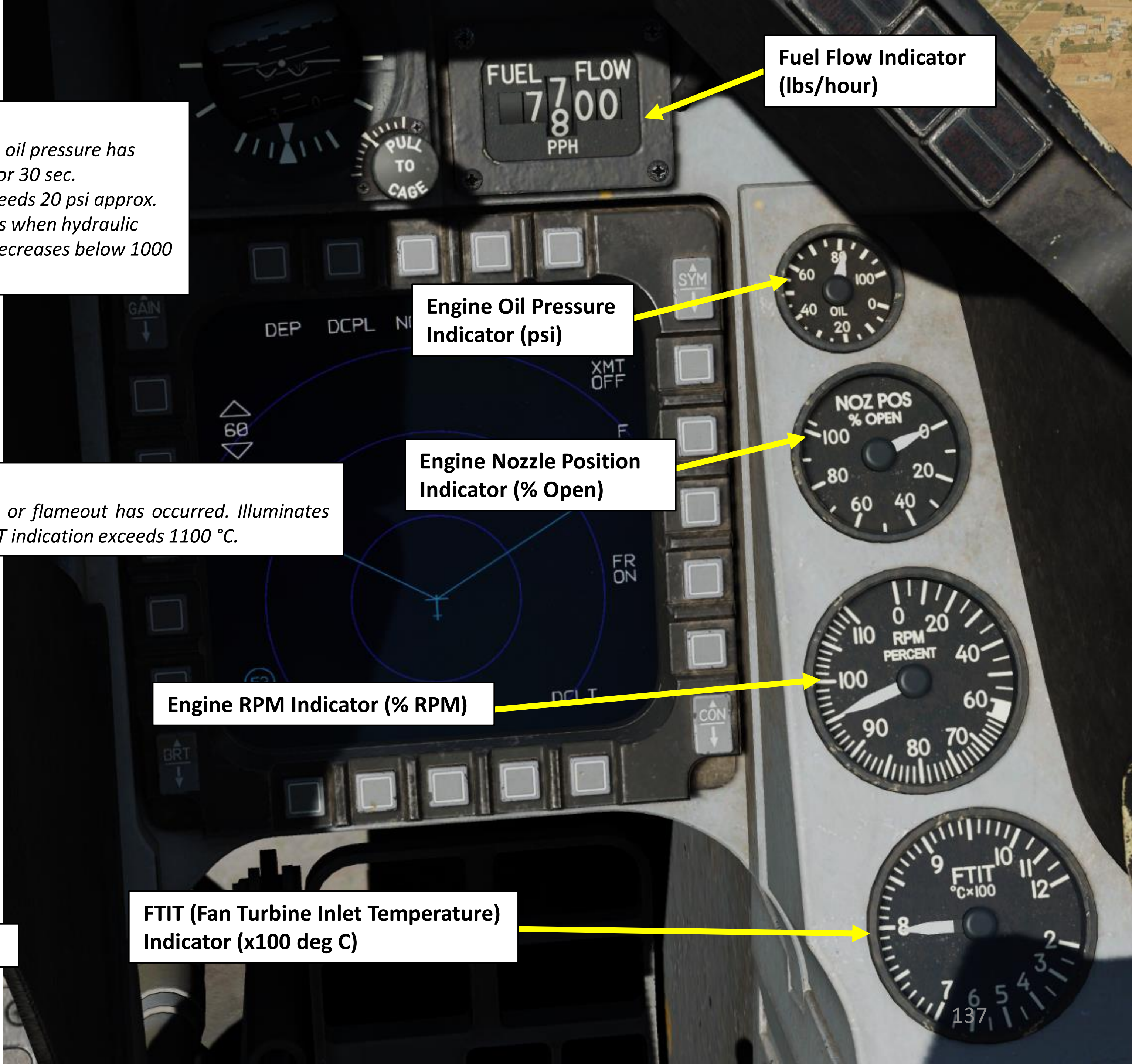


ENGINE FAULT Caution

SEC Caution

Fuel/Oil Hot Caution

EEC Caution



Fuel Flow Indicator (lbs/hour)

Engine Oil Pressure Indicator (psi)

Engine Nozzle Position Indicator (% Open)

Engine RPM Indicator (% RPM)

FTIT (Fan Turbine Inlet Temperature) Indicator (x100 deg C)

ENGINE LIMITS

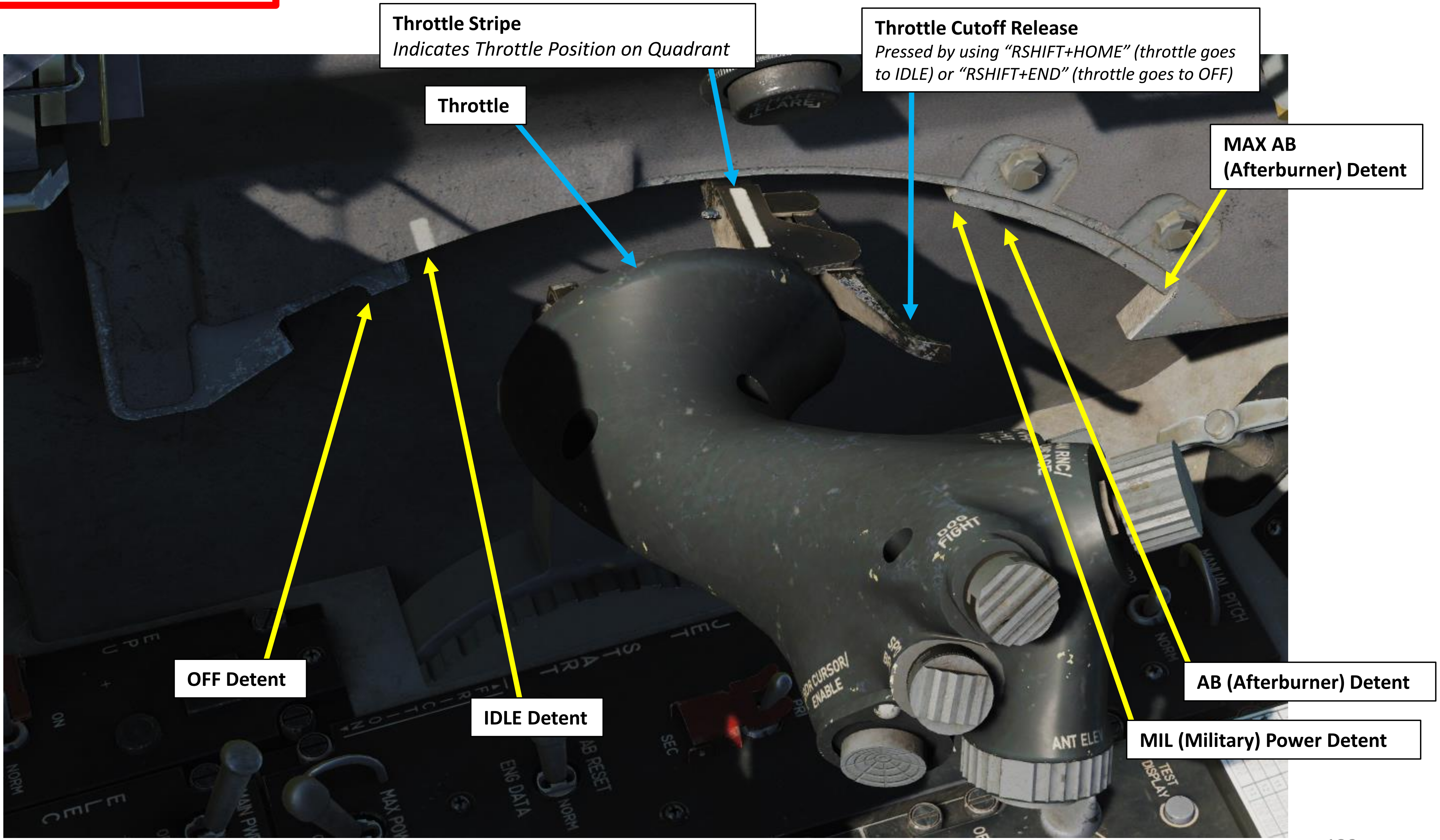
ENGINE LIMITS (ON GROUND)

CONDITION	FTIT (Fan Turbine Inlet Temperature) (deg C)	RPM (%)	Oil Pressure (psi)	Remarks
Engine Start	935	-	-	During cold start, oil pressure may be 100 psi for up to 2 minutes
Idle	650	-	15 (minimum)	-
MIL/AB (Military/Afterburner)	980	108	25-65	At MIL power and above, oil pressure must increase 10 PSI minimum above IDLE oil pressure
Transient	980	109	25-65	-
Fluctuation	+/- 10	+/- 1	+/- 5	Must remain within steady-state limits. Nozzle fluctuations limited to +/- 2 %

ENGINE LIMITS (IN FLIGHT)

CONDITION	FTIT (Fan Turbine Inlet Temperature) (deg C)	RPM (%)	Oil Pressure (psi)	Remarks
Engine Start	935	-	-	-
Idle	-	-	15 (minimum)	-
MIL/AB (Military/Afterburner)	980	108	25-65	Oil pressure must increase as RPM increases
Transient	980	109	25-65	-
Fluctuation	+/- 10	+/- 1	+/- 5	Must remain within steady-state limits. Zero oil pressure is allowable for periods up to 1 minute during flight at less than +1 G.

THROTTLE QUADRANT



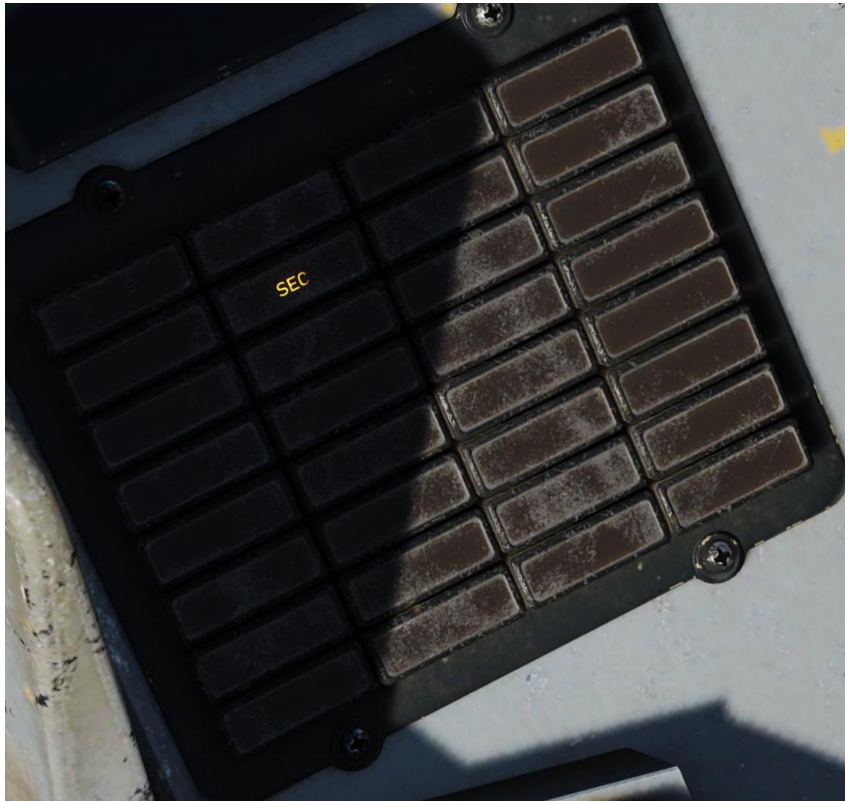
ENGINE CONTROL MODES

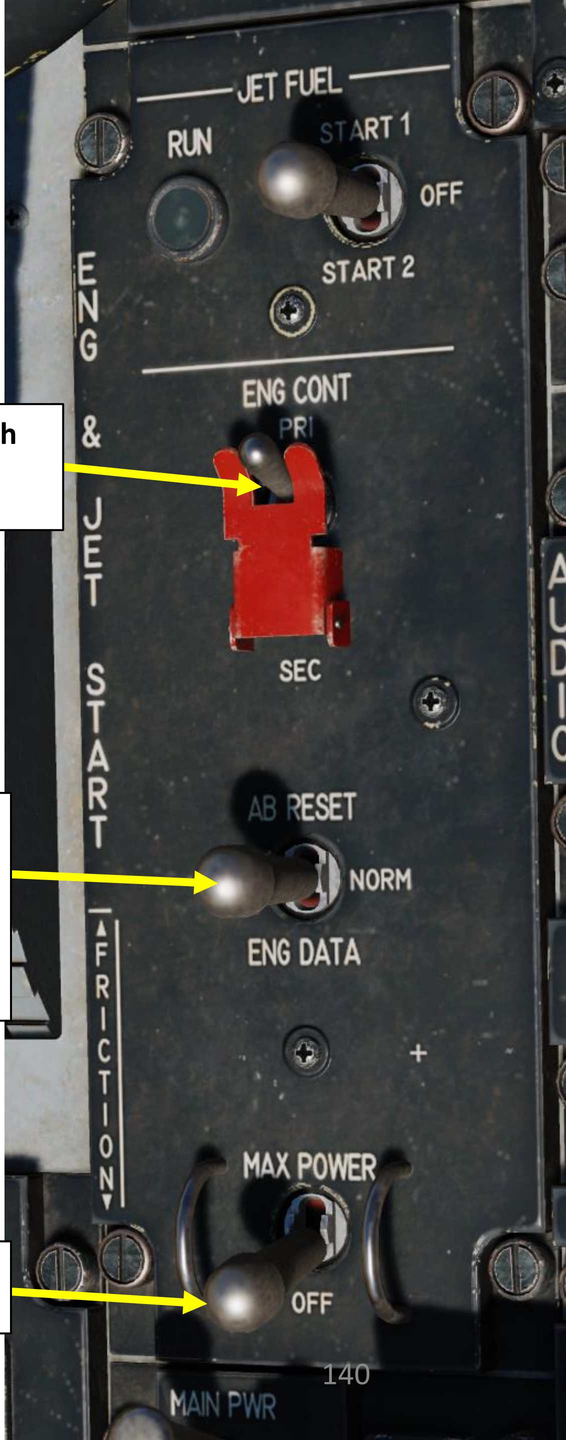
There are two main engine modes, which are controlled by the Engine Control (ENG CONT) switch:

- **PRI (Primary):** Primary Mode provides unrestricted engine operation throughout the entire flight envelope.

- **SEC (Secondary Engine Control):** Secondary Mode provides 70 to 80 % of normal MIL thrust. This mode may be set manually with the ENG CONT switch or automatically in case of certain failures being detected by the DEEC (Digital Electronic Engine Control). This level provides a measure of protection against exceeding engine operating limits and provides sufficient thrust for safe flight operations. This mode also closes exhaust nozzle and inhibits afterburner operation.

Note: the MAX POWER Switch (also known as "V_{Max} Switch") is not functional on the F110-GE-129 engine installed on our airplane. In certain Pratt & Whitney engines, this function is available and was mainly used as a "Hail Mary switch" to get away as fast as possible. This mode could destroy the engine in a matter of minutes, which is why it was mainly safetied off or completely disconnected/inhibited from the engine altogether.





ENG CONT (Engine Control) Switch
- *PRI: Primary Mode*
- *SEC: Secondary Mode*

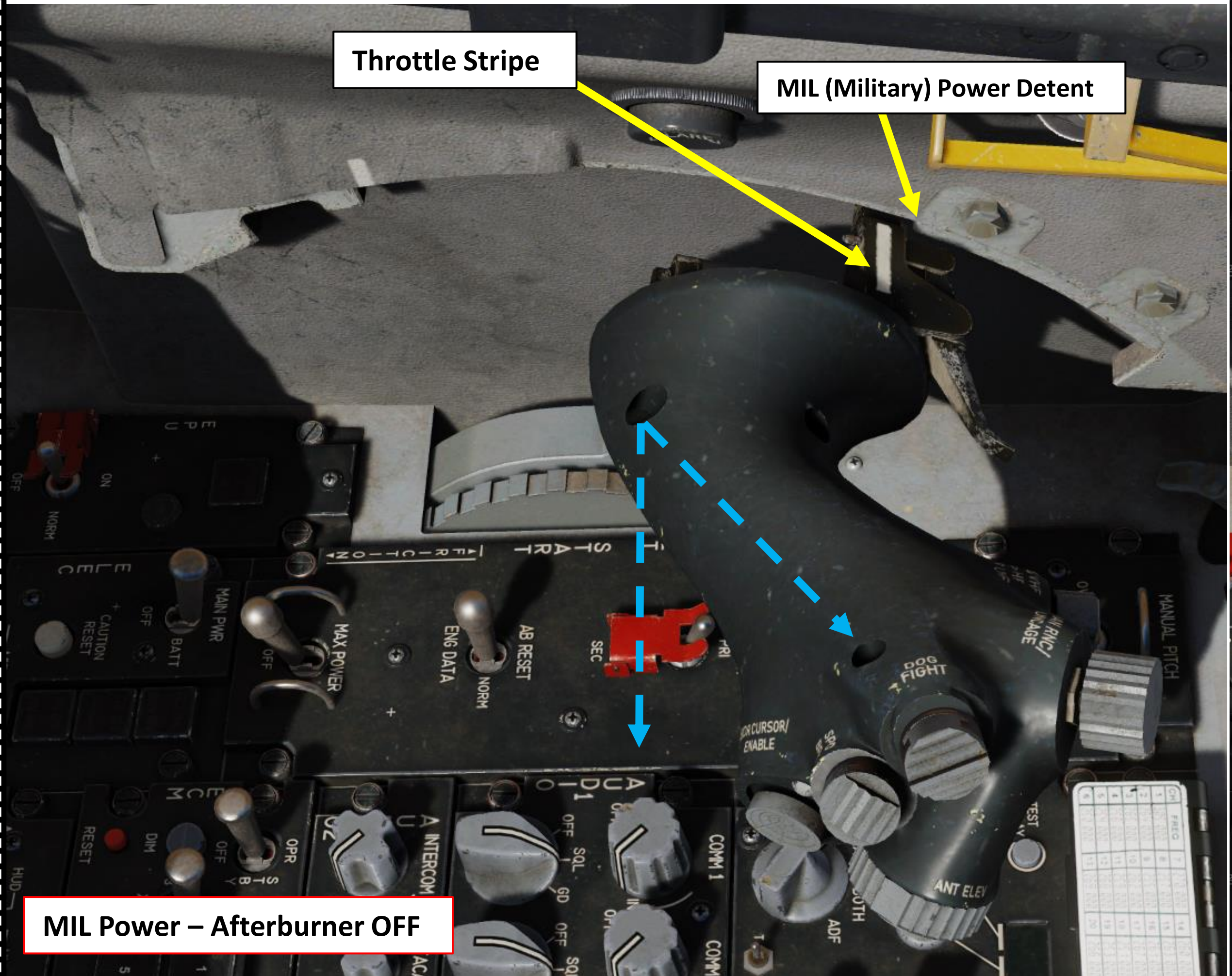
AB (Afterburner) Reset Switch
- *AB RESET: Attempts to clear DEEC (Digital Electronic Engine Control) faults*
- *NORM: Normal (de-energized) position*
- *ENG DATA: Records engine data in the EDU (Engine Diagnostic Unit)*

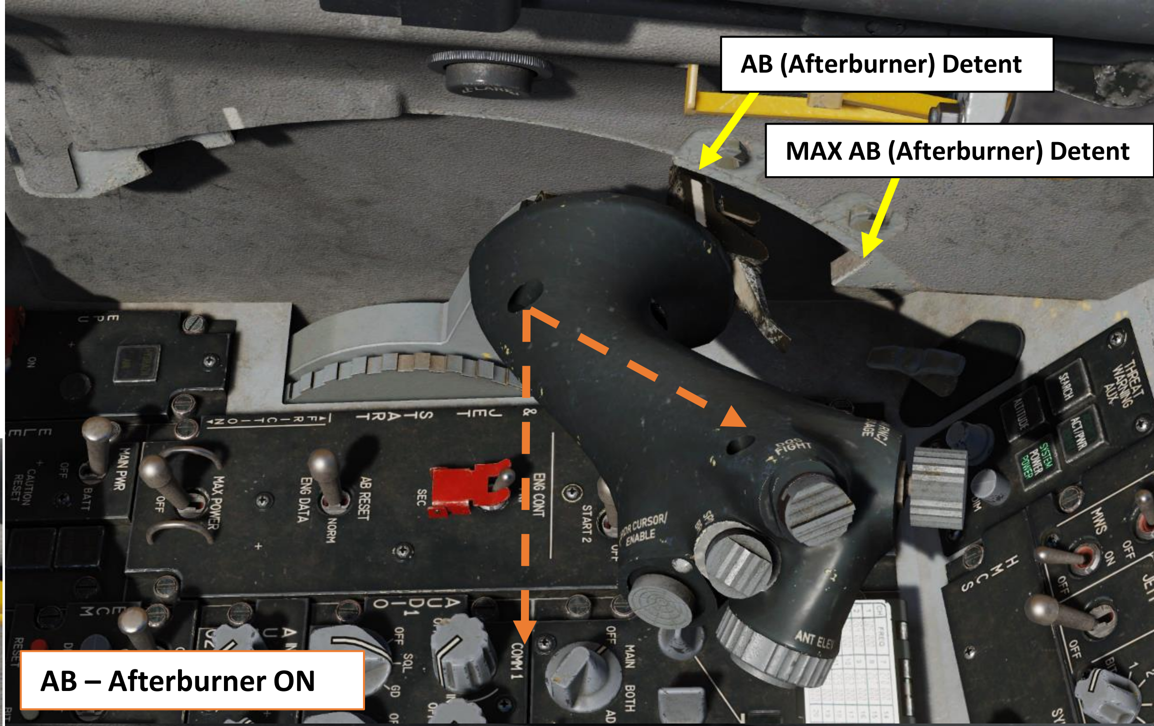
Max Power Switch
Inoperative for F110-GE-129 engine

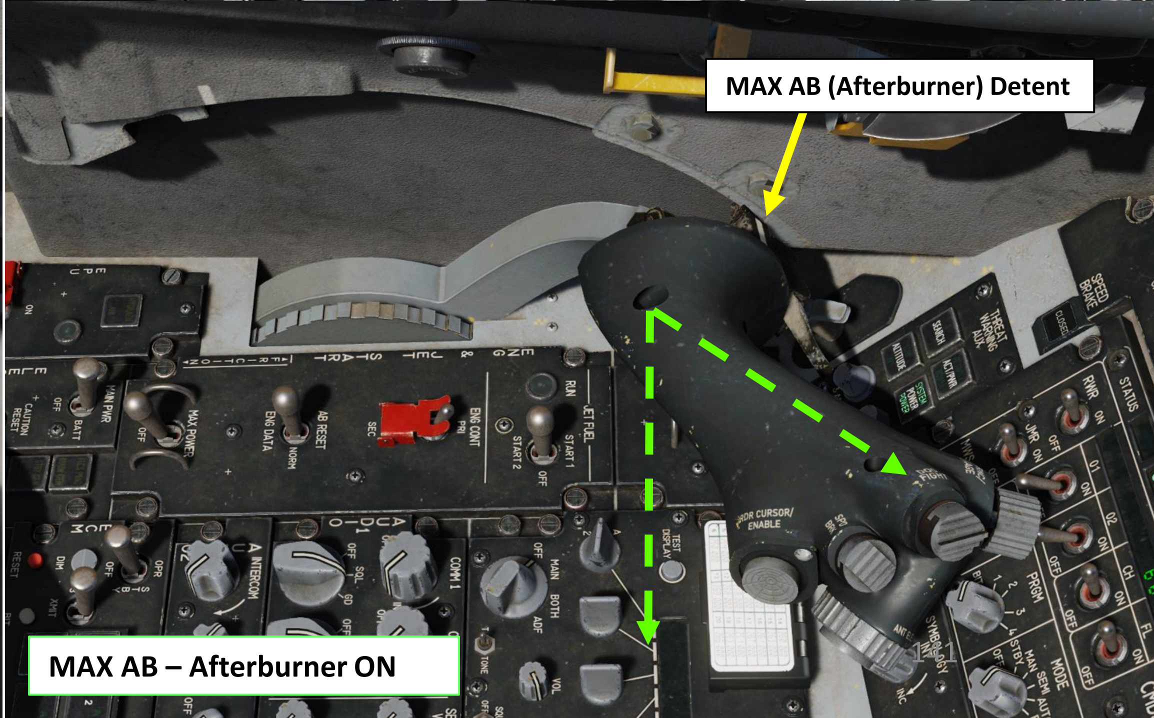
AFTERBURNER / AUGMENTOR

The **afterburner** is engaged by throttling past the MIL (Military) Power gate on the throttle quadrant.

The geometry of the throttle quadrant means that depending on the position on the throttle on the quadrant, the orientation/angle of the throttle must be varied to access certain power detents. To push the throttle past the MIL Power Detent, the throttle needs to be angled to allow the throttle stripe past the detent. Within DCS, this is done automatically for you as you throttle up.

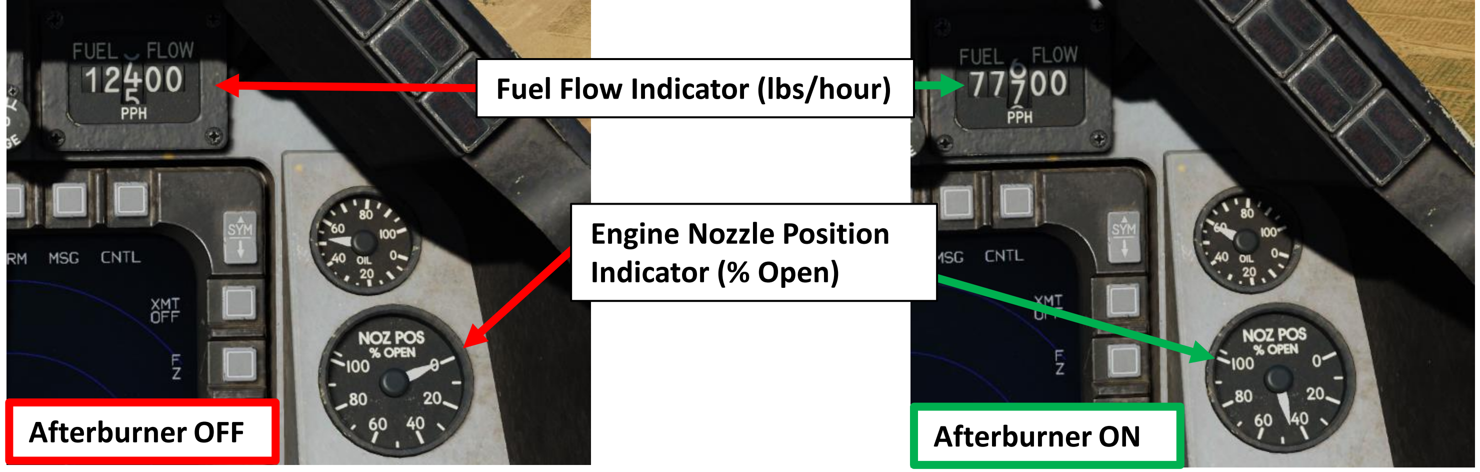






AFTERBURNER / AUGMENTOR

There is no “afterburner” indication in the cockpit, but you can monitor the fuel flow indication and the Nozzle Position indications. Keep in mind that the fuel flow consumption will increase dramatically; keep an eye on that fuel gauge!



EPU (EMERGENCY POWER UNIT)

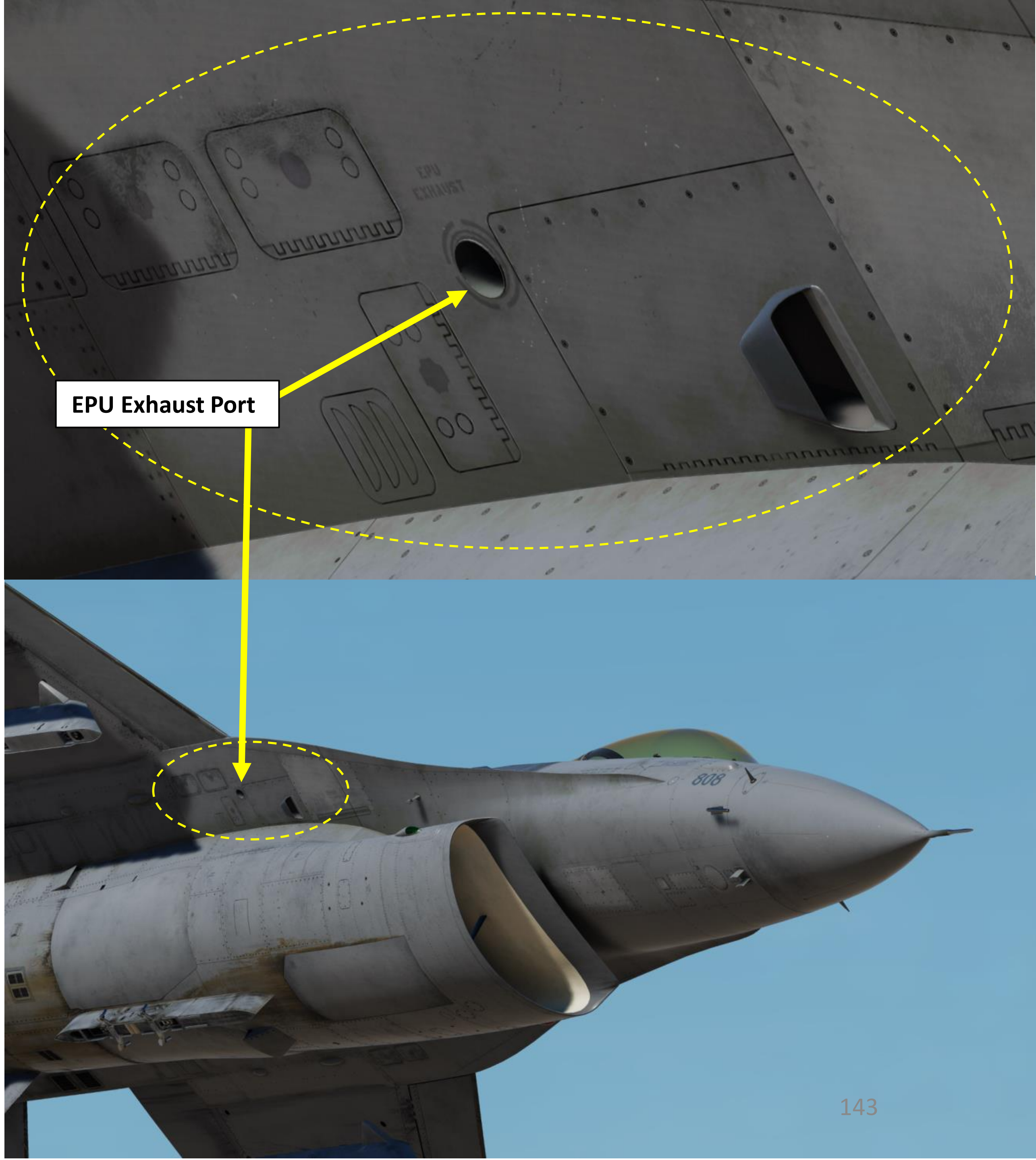
The EPU is a hydrazine-powered, self-contained unit that can **provide emergency hydraulic and electrical power for flight control systems**, when bleed air alone is not enough. The EPU has enough fuel to **run for about 10 to 15 minutes**.

You would most often use this if you lose your engine, and the EPU would provide power to the hydraulic and electrical systems, allowing you to keep flying the aircraft since the flight control systems are not mechanically linked to the stick.

The main requirements for the EPU are that it should be simple, maintenance free, supply power immediately and consistently for the required time. Use of Hydrazine assures this while requiring careful handling, but it is very toxic and inflammable.

Important note: the EPU has a safety pin set on the ground, which needs to be removed by the ground crew prior to the flight. This safety pin is not modelled yet in DCS.

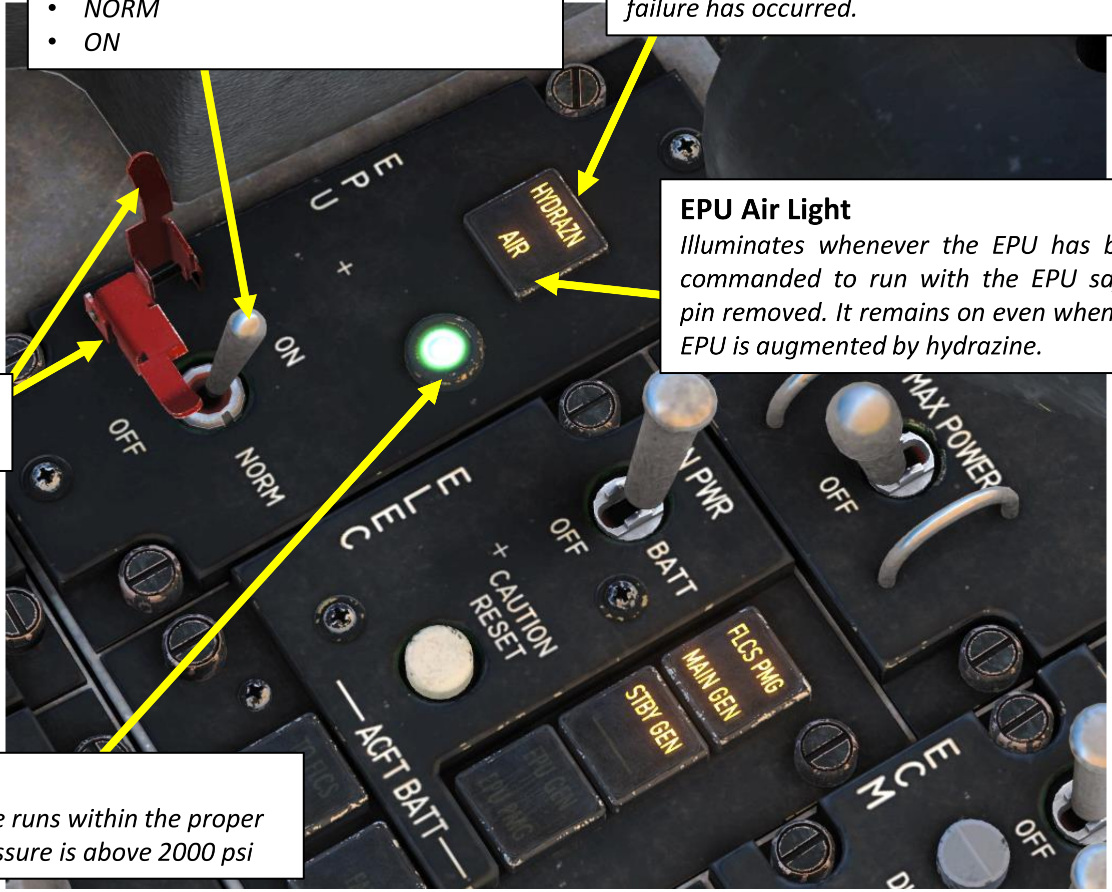
Here is an interesting video on the EPU: https://youtu.be/o8SdArJGWt8



EPU (EMERGENCY POWER UNIT)

There are three main operating modes for the EPU, which are controlled by the EPU Switch. During normal operation, you should leave the EPU switch to NORM.

- NORM:
  - When in NORM mode, EPU system is armed for automatic operation (except during engine shutdown on the ground).
  - If an engine flameout is detected, the EPU will automatically run.
  - With the Weight-On-Wheels and throttle in OFF, the EPU will not activate when the main and standby generators go offline.
- ON:
  - When ON, the EPU is commanded to run regardless of failure conditions.
- OFF:
  - When on ground, prevents or terminates EPU operation
  - When in flight and switch has remained OFF since takeoff, EPU operation is terminated or inhibited (except when main and standby generator failure is detected).
  - OFF will not prevent or terminate EPU operation in flight for main and standby generator failures if switch was cycled or placed to NORM any time since takeoff



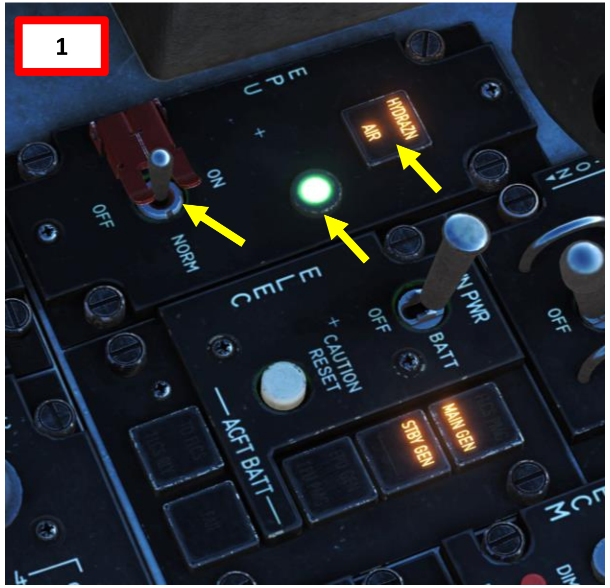
ENGINE RELIGHT PROCEDURE

A windmilling start is used when enough altitude and airspeed is available. Otherwise, a JFS (Jet Fuel Starter)-assisted start is required.

WINDMILLING RELIGHT

1. When engine flameout occurs, the EPU (Emergency Power Unit) will automatically activate (provided the EPU switch is set to NORM) to provide you electrical and hydraulic power for the flight control system. The EPU will be running until it runs out of fuel/hydrazine (about 10 minutes).
2. Verify ENGINE FEED Selector is set to NORM
3. Throttle back to IDLE, then set throttle to CUTOFF (RSHIFT+END).
4. Immediately nose down to gain enough airspeed for the engine's compressor blades to generate enough RPM due to windmilling (air flow drives compressor blades). Ensure you have enough airspeed to maintain a windmilling engine RPM above 20-25 %.
5. When engine RPM is windmilling above 20-25 %, move throttle from OFF position to IDLE position (RSHIFT+HOME).
6. Confirm engine RPM and FTIT increase
7. When engine RPM increases above 60 %, throttle up and resume normal operation.

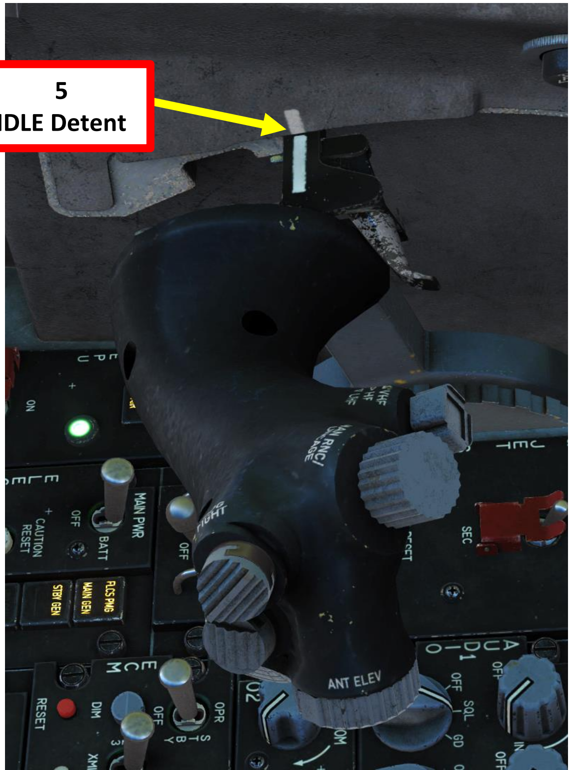
1

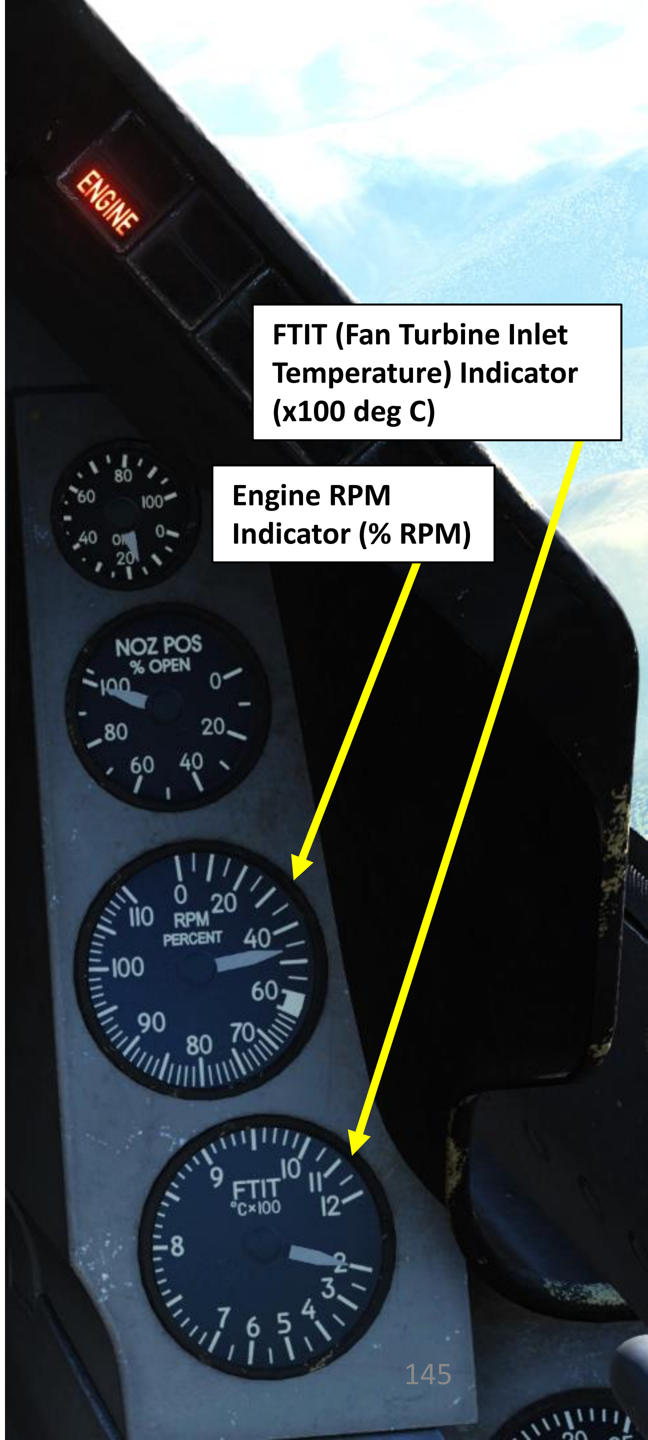


2

3
OFF Detent

5
IDLE Detent





FTIT (Fan Turbine Inlet Temperature) Indicator (x100 deg C)

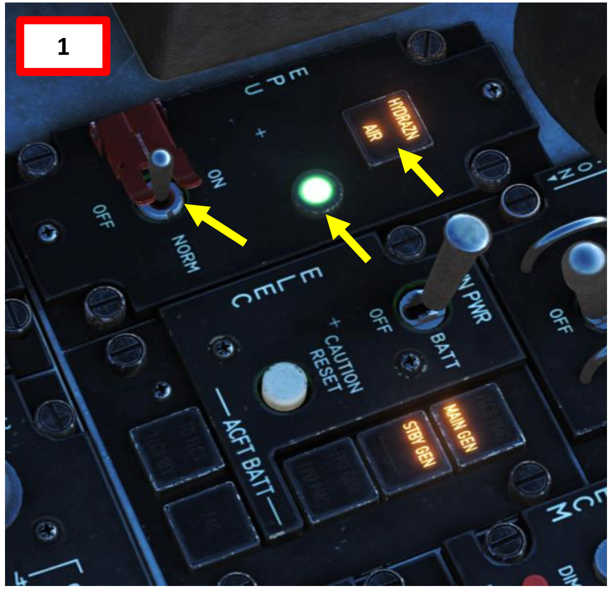
Engine RPM Indicator (% RPM)

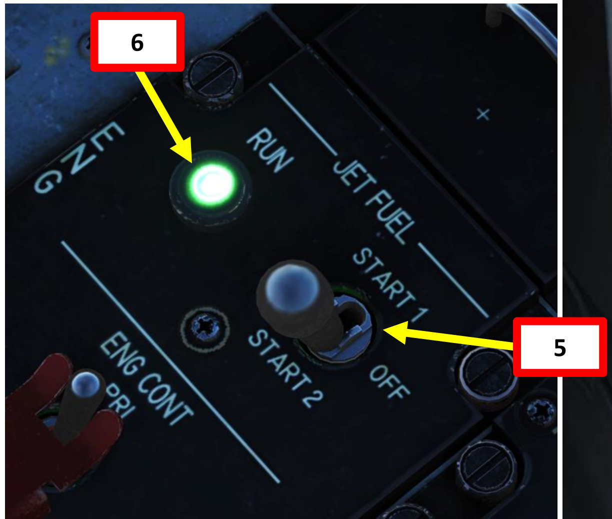
ENGINE RELIGHT PROCEDURE

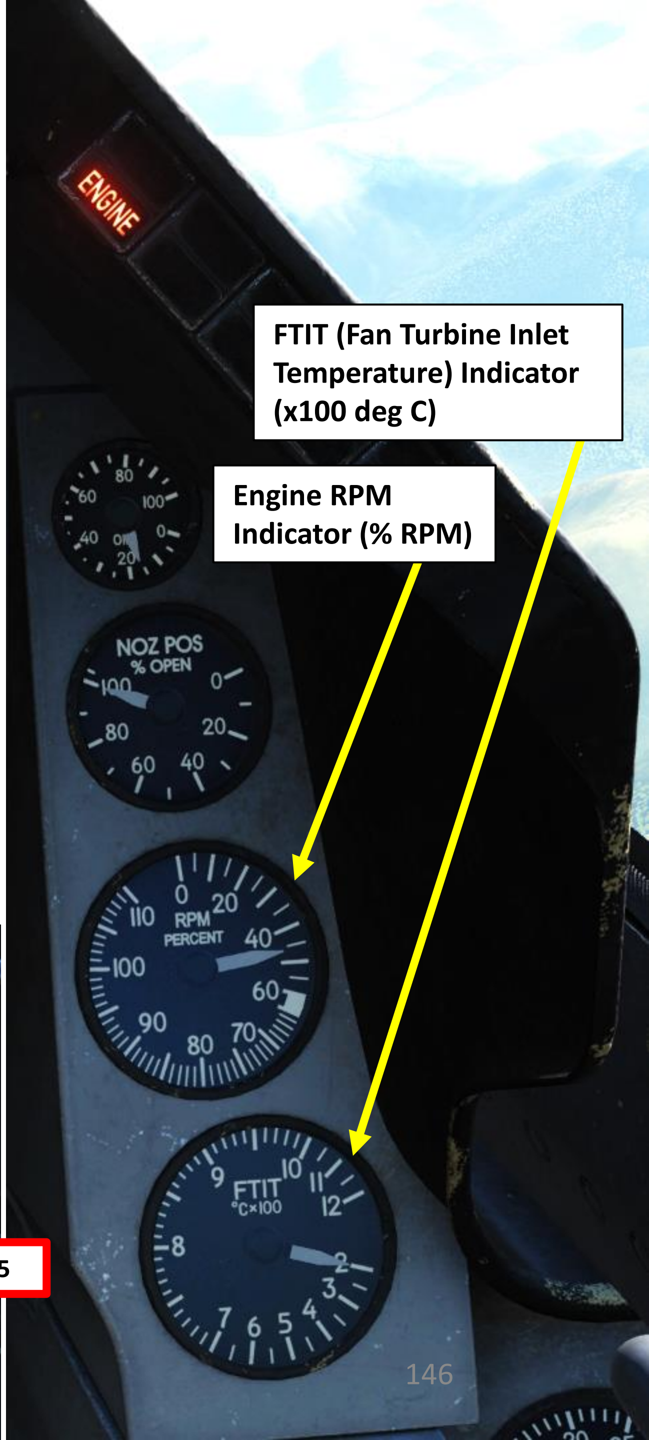
A windmilling start is used when enough altitude and airspeed is available. Otherwise, a JFS (Jet Fuel Starter)-assisted start is required.

JFS-ASSISTED RELIGHT

1. When engine flameout occurs, the EPU (Emergency Power Unit) will automatically activate (provided the EPU switch is set to NORM) to provide you electrical and hydraulic power for the flight control system. The EPU will be running until it runs out of fuel/hydrazine (about 10 minutes).
2. Verify ENGINE FEED Selector is set to NORM
3. Throttle back to IDLE, then set throttle to CUTOFF (RSHIFT+END).
4. Set aircraft flight parameters within JFS (Jet Fuel Starter) operation envelope:
    - Altitude should be below 20000 ft, airspeed should be below 400 kts
5. Set JFS (Jet Fuel Starter) switch AFT to START2 (Left Click).
6. When the Jet Fuel Starter reaches IDLE RPM (within 30 seconds), the JFS RUN green light should illuminate.
7. When JFS is operational, the Jet Fuel Starter accumulators will drive the hydraulic starter motor to start the engine. Engine RPM will increase.
8. When engine RPM reaches 20 %, move throttle from OFF position to IDLE position (RSHIFT+HOME).
9. The engine should light-off within 10 seconds. Engine RPM and FTIT (Fan Turbine Inlet Temperature) should increase.
10. When engine RPM increases above 60 %, throttle up and resume normal operation.



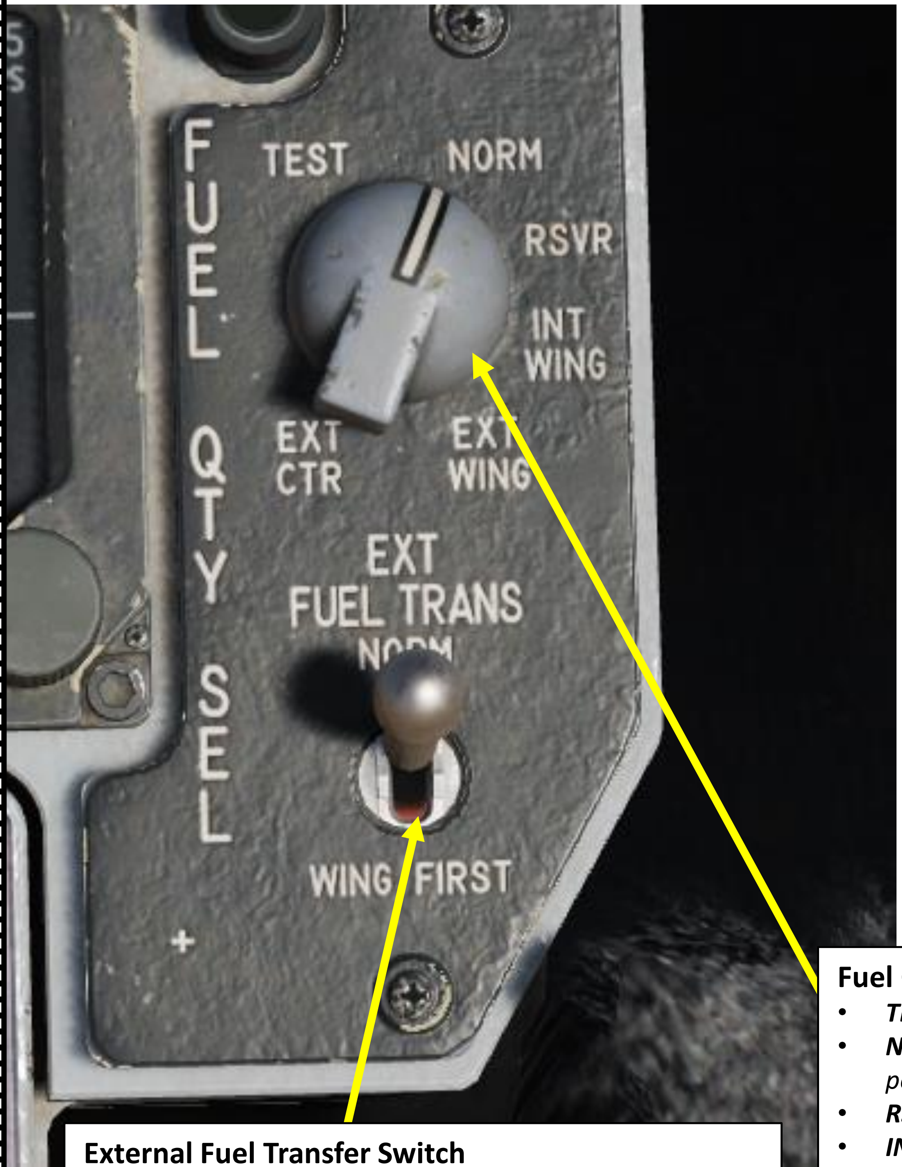


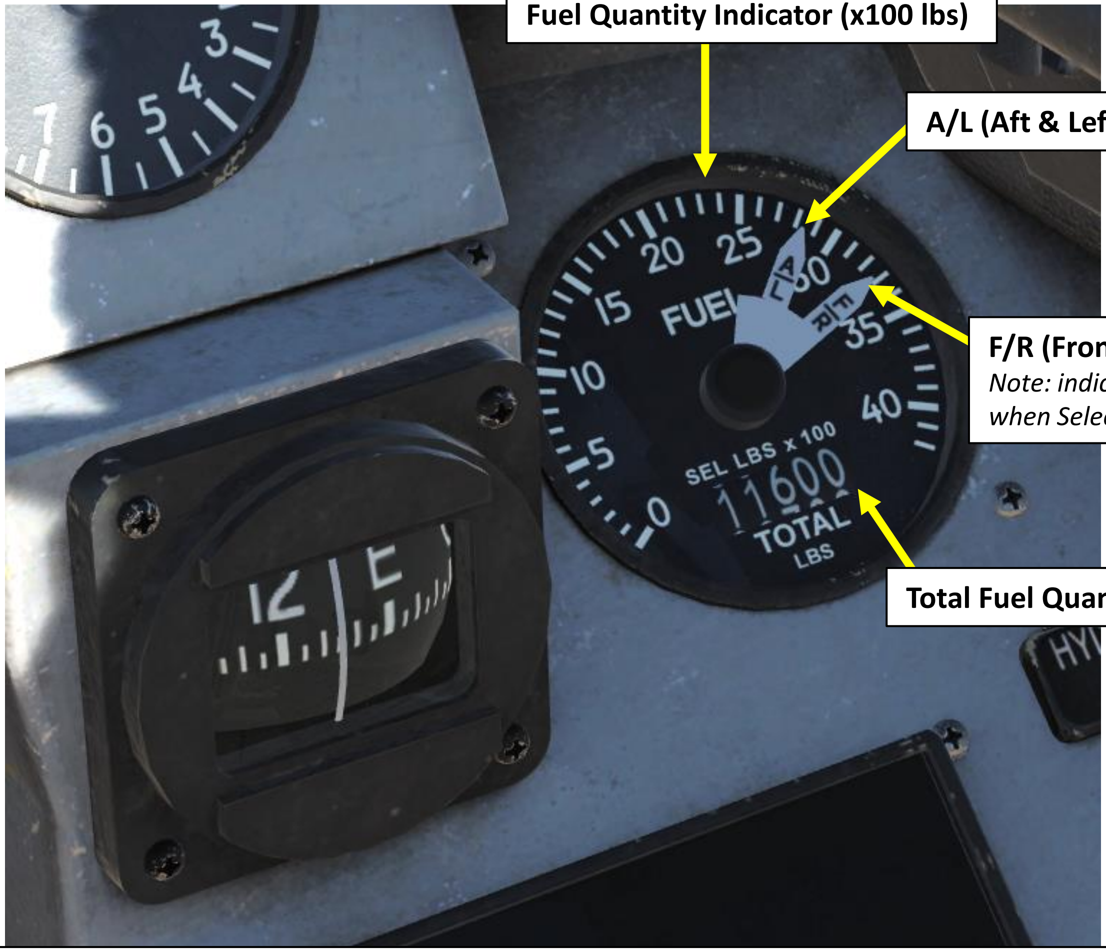


FUEL SYSTEM

The F-16 is equipped with 6 internal tanks (left wing, right wing, aft fuselage, aft fuselage reservoir, forward fuselage, forward fuselage reservoir). External fuel tanks can be equipped under the fuselage (300 Gal) and under the wings (370 Gal). Total fuel quantity is displayed on the fuel indicator. The Fuel Quantity Selector knob is used to choose what fuel quantity you wish you display.

FUEL SYSTEM





Fuel Quantity Indicator (x100 lbs)

A/L (Aft & Left) Pointer

F/R (Front & Right) Pointer
Note: indicates center fuel tank load when Selector Knob set to EXT CTR

Total Fuel Quantity Indicator (lbs)

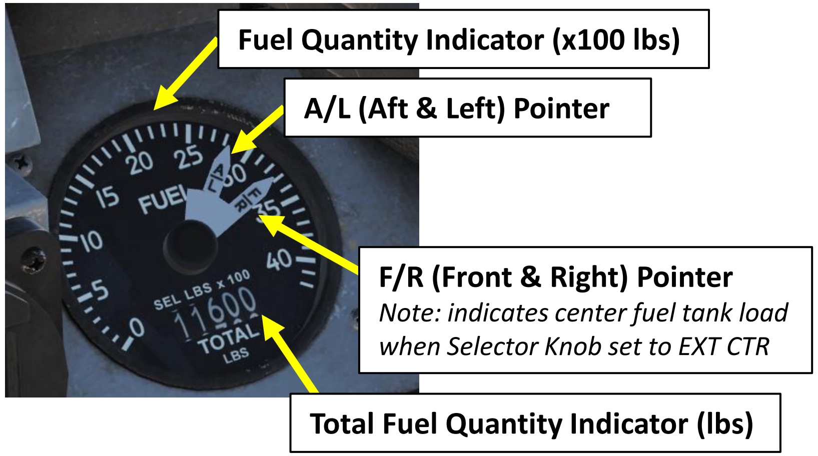
External Fuel Transfer Switch

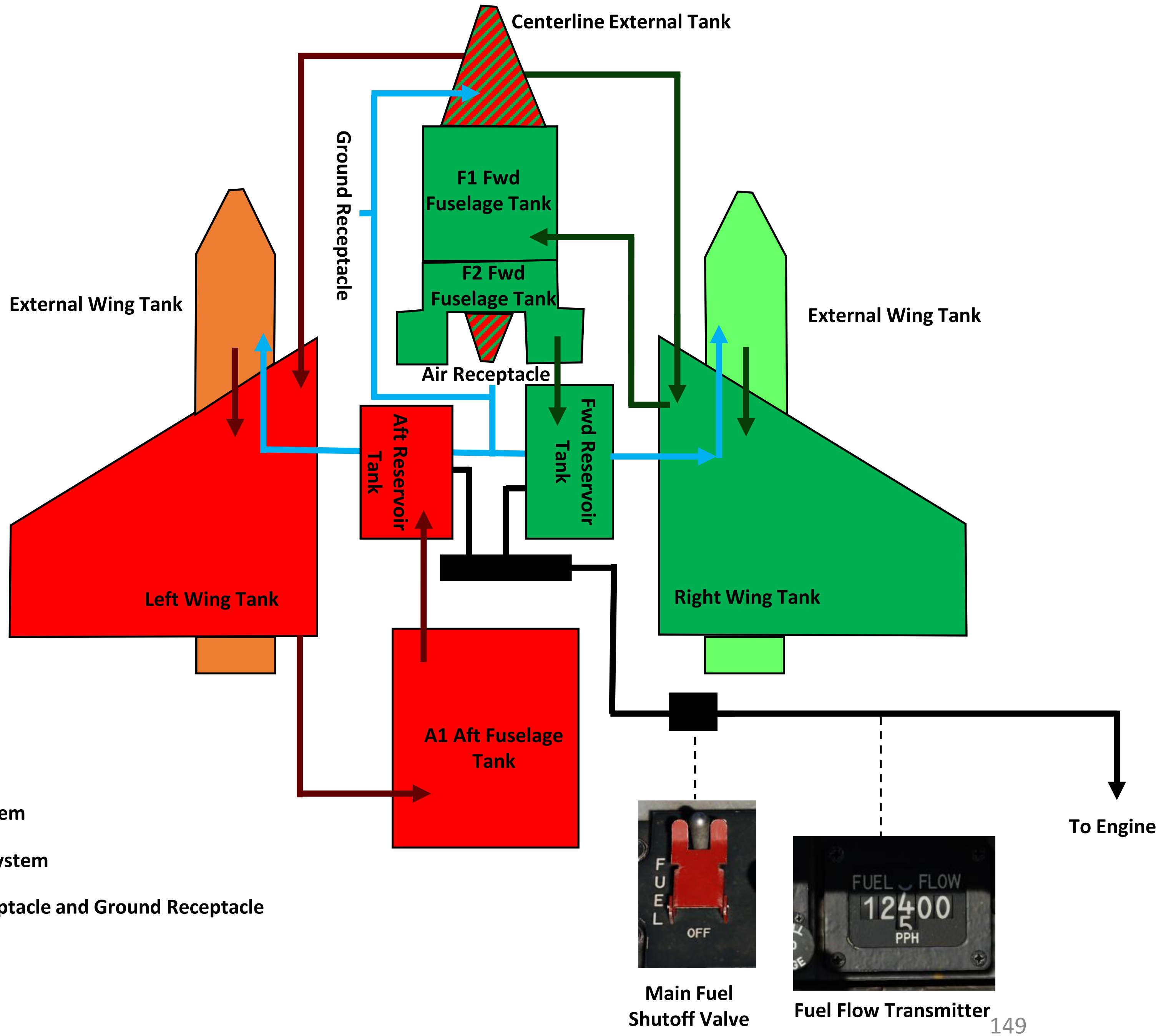
- *NORM: allows external centerline tank to empty first*
- *Wing First: allows the external wing tanks to empty first.*

Fuel Quantity Selector Knob

- ***TEST**: places both pointers at 2000 lbs, and totalizer should display 6000 lbs*
- ***NORM**: AL pointer indicates remaining fuel in the aft left reservoir and the A-1 fuselage tank, and the FR pointer indicates the sum fuel in the forward right reservoir tank and the F-1 and F-2 fuselage tanks.*
- ***RSVR**: moves the AF and FR pointers to display fuel in the aft and forward reservoir tanks*
- ***INT WING**: Indicates quantity for internal left and right fuel tanks*
- ***EXT WING**: Indicates quantity for external left and right wing-mounted external fuel tanks*
- ***EXT CTR**: Indicates quantity for external fuselage-mounted center tank*

FUEL SYSTEM





Forward & Right Fuel System

Aft & Left Fuel System

Fuel Transfer on Aft & Left system

Fuel Transfer on Fwd & Right system

Inbound transfer from Air Receptacle and Ground Receptacle

To Engine

FUEL SYSTEM

Fuel Master Switch
Guarded in MASTER position. When placed in OFF the fuel shutoff valve is closed, preventing fuel from reaching the engine.

Tank Inerting Switch
Reduces internal tank pressurisation when ON. This will pump non-volatile Halon 1301 gas into the fuel tanks to reduce internal pressure and reduce risk for fire during an emergency… like battle damage.

Air Refueling Door Control Switch
Open / Close
Also sets flight control gains to takeoff & landing mode

Engine Feed Selector Switch
Controls the way the fuel is pumped to the engine. Note that the fuel goes to the engine by gravity feed, so the engine will not starve when the fuel pumps are OFF. Use of the pumps prevents fuel starvation during negative G maneuvers and allows manual fuel balance whenever necessary.

- *OFF: all fuel pumps are off.*
- *NORM: all pumps are on, the CG (Centre of Gravity) is maintained automatically.*
- *AFT: aft pumps are on. Fuel is transferred from the AFT tank to the engine. The CG moves forward.*
- *FWD: forward pumps are on. Fuel is transferred from the FWD tank to the engine. CG moves back.*

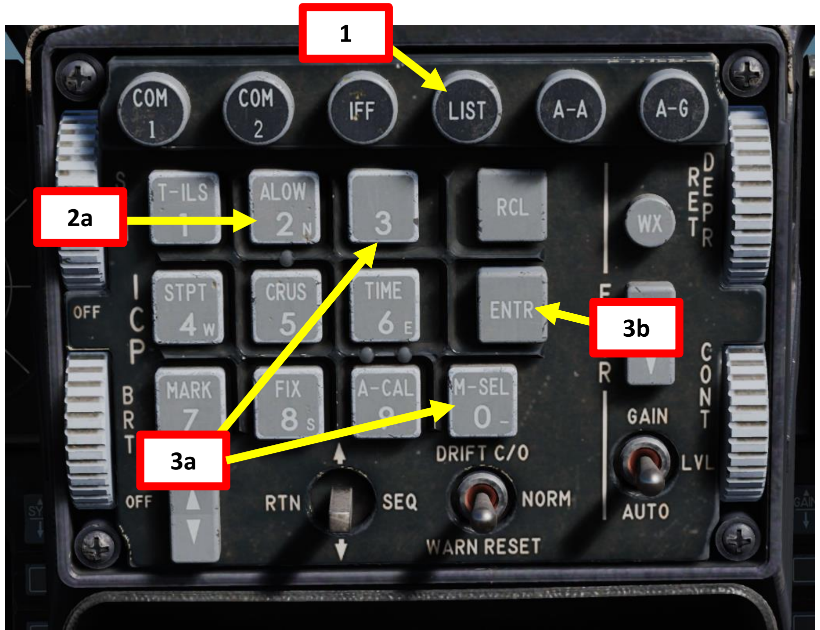
BINGO FUEL

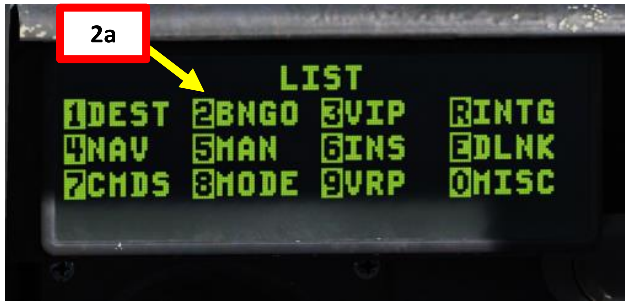
BINGO fuel is the amount of fuel that once reached triggers an immediate return to home plate (home base). It takes into account the fuel needed to fly the return leg of the flight, the fuel required to fly the briefed approach, the fuel to go to the alternate (if necessary) and the emergency fuel which is not supposed to be used except in an emergency.

JOKER fuel is usually set above BINGO as a warning that the bingo is approaching. We usually set it 1000 lbs above Bingo to allow 1 minute of combat time in afterburner.

Your "BINGO FUEL" can be set by:

1. Pressing the LIST button
2. Pressing "2" on the ICP (Integrated Control Panel) to select BNGO (Bingo Fuel) DED Page.
3. Entering the desired BINGO FUEL value via the ICP keypad, then pressing ENTR.
4. Setting the FUEL QTY SEL knob to NORM to ensure BINGO fuel warning computation is based on fuselage fuel.
5. When fuel state falls below BINGO fuel limit, a FUEL caution will appear in the HUD and the VMS (Voice Message System) will give a "BINGO, BINGO" aural cue.





FLIGHT PLAN BINGO FUEL CALCULATION

	FLIGHTPLAN BINGO FUEL CALCULATION				**EXAMPLE**
		lbs			lbs
1.	**FUEL FOR LANDING**	1200			1200
2.	**FUEL FOR GO-AROUND**	+			+
	Conditions at Homeplate:				
	A. VFR (Good Weather)	400			
	B. IFR (Bad Weather)	800		IFR Conditions	800
3.	**FUEL FOR GO-TO ALTERNATE**	+			+
	Distance from Homeplate to Alternate				40 nm to Alternate
		(Distance in nm) x 10			40 nm x 10 = 400
4.	**FUEL FOR EGRESS**	+			+
	Route from Target to Homeplate				140 nm for Egress Route
	A. Medium Altitude (x15)	(Distance in nm) x 15			(140 nm) x 15 = 2100
	B. Low Altitude (x20)	(Distance in nm) x 20			
	BINGO =	.... lbs		**BINGO =**	**4500** lbs
5.	**FUEL BUFFER**	1000 +			1000 +
	JOKER =	.... lbs			**5500** lbs

PART 8 – FLIGHT & AERODYNAMICS

AERODYNAMICS & AIRCRAFT LIMITS

AIRSPEED LIMITS

- Maximum Airspeed (V_{NE}): 800 kts at sea level or Mach 2.05 above 30000 ft
- Canopy Open or in Transit: 70 kts (includes ground wind velocity)
- Landing Gear Extended or In Transit: 300 kts / Mach 0.65 (whichever is less)
- Air Refueling Door Opening/Closing: 400 kts / Mach 0.85 (whichever is less)
- Air Refueling Door Open: 400 kts / Mach 0.95 (whichever is less)
- Flight in Severe Turbulence (+3 G): 500 kts
- Crosswind limit: 25 kts

G LIMITS

- Structural Limits for the aircraft are +9 G / - 3 G.
- Takeoff & Landing:
  - +4 G / 0 G for symmetric loadout
  - +2.0 G / 0 G for asymmetric loadout
- Landing Gear Retraction & Extension:
  - +4 G / 0 G for symmetric loadout
  - +2.0 G / 0 G for asymmetric loadout
  - If landing gear handle is raised near 2 Gs approaching 300 kts, actuator power may be insufficient to completely retract the landing gear until G load factor is reduced
- Negative G limits (with both reservoir tanks full)
  - Afterburner thrust: 10 seconds
  - MIL (Military) Power thrust or below: 30 seconds

- There can be an engine flameout if the afterburner is engaged for over 5 seconds during a negative G condition (or for over 12 seconds in zero G condition).

WEIGHT LIMITS

Maximum Takeoff Weight: 44,000 lbs

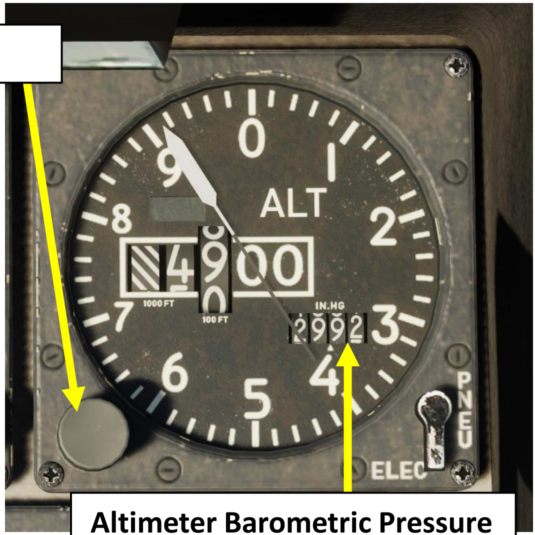
FLIGHT ENVELOPE

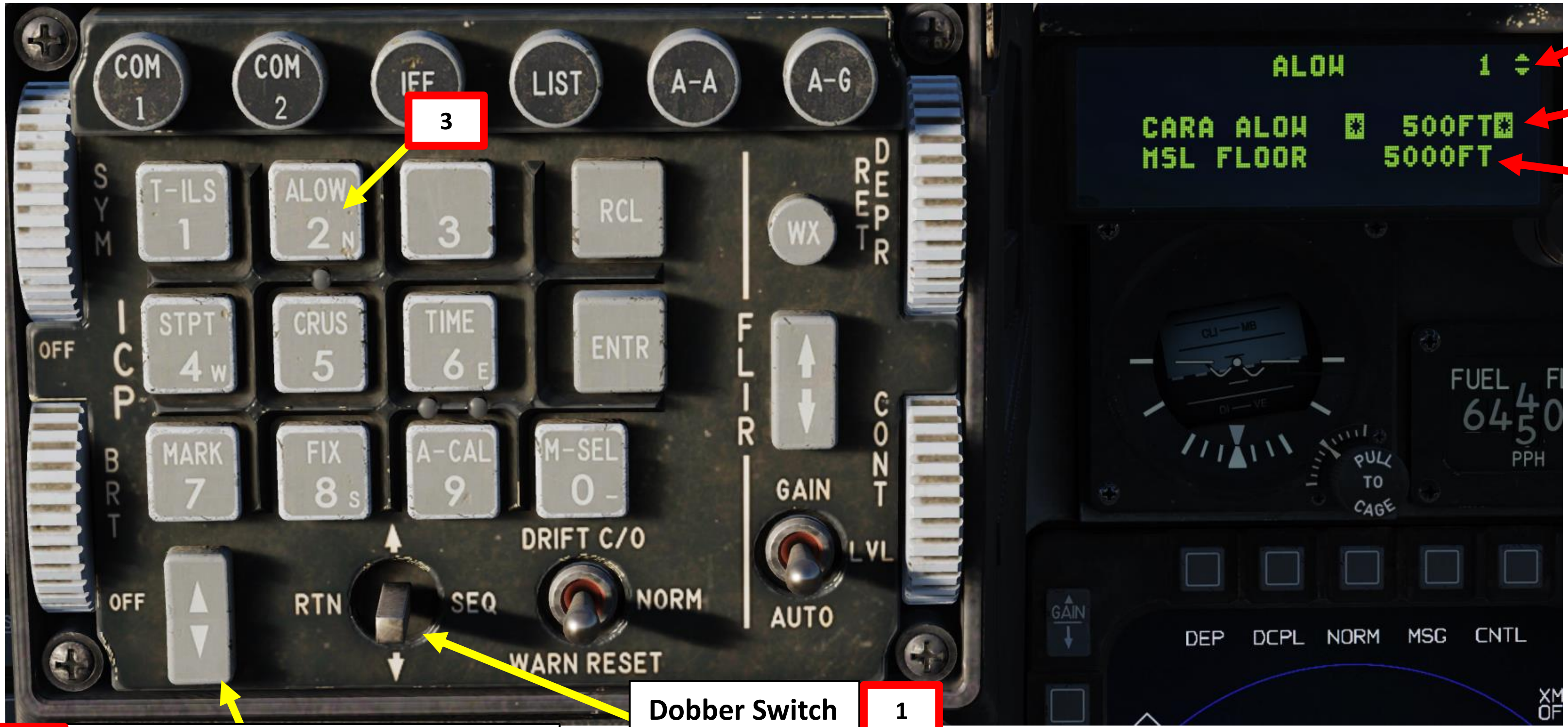
Service Ceiling: 59000+ ft

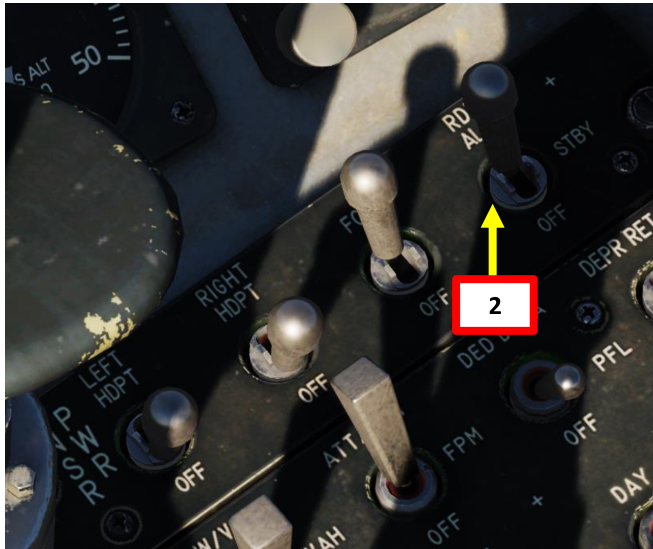
ALOW (ALTITUDE-LOW) ADVISORY SYSTEM

The Altitude-LOW (ALOW) page allows you (no pun intended) to set low altitude advisory settings. Here is a quick summary of how the system works.

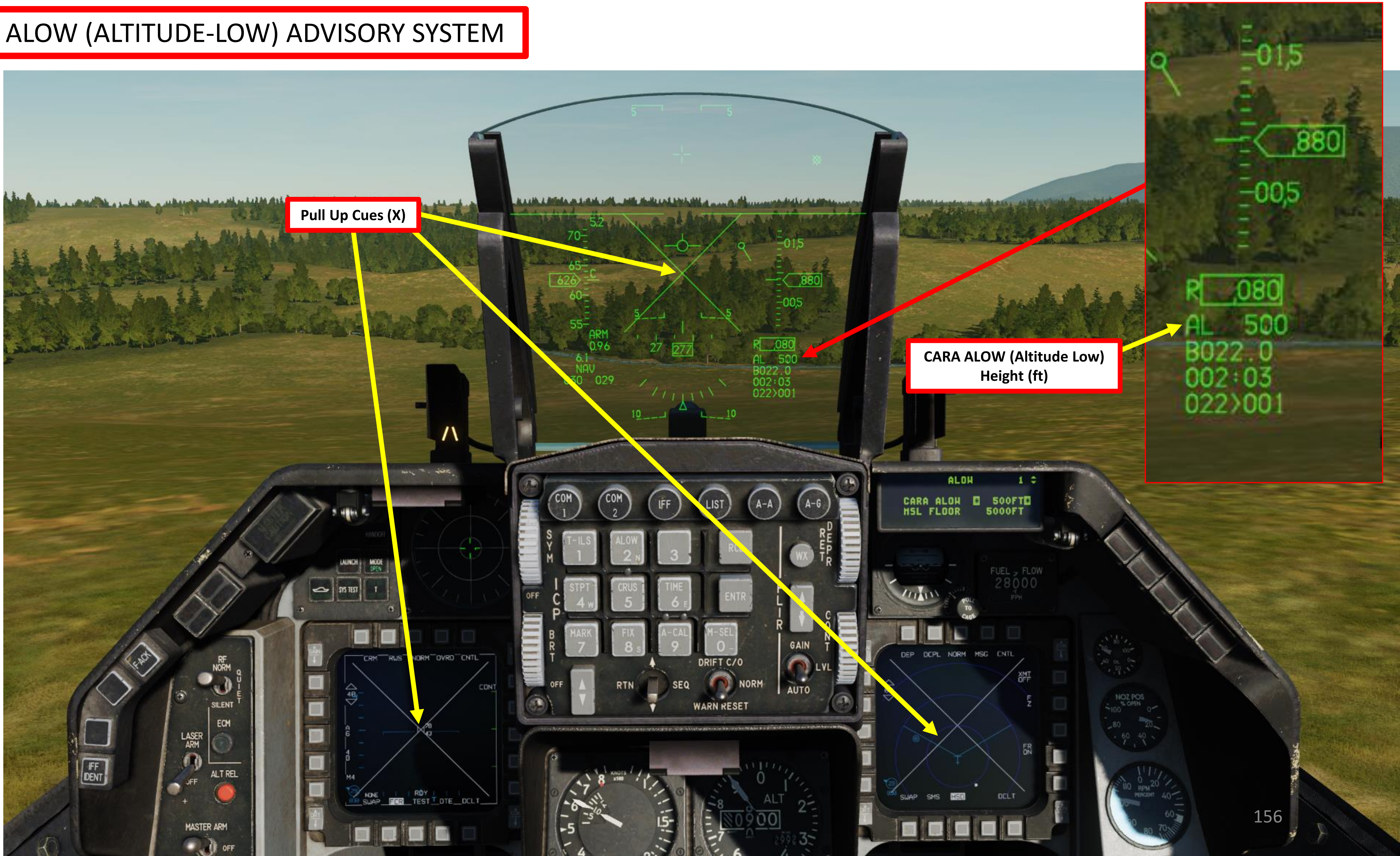
1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. RDR ALT (Radar Altimeter) switch should be set to ON (FWD) for the ALOW system to be active.
3. Select ALOW page by pressing ALOW (2) button on the ICP (Integrated Control Panel)
4. Altitude restrictions can be on the steerpoint of your choice, which can be selected with the DED Increment/Decrement Switch.
5. CARA ALOW (Combined Altitude Radar Altimeter – Altitude Low) is used as a warning setting for low altitude flying. When below this altitude setting, the "AL" notation flashes and VMS (Voice Message System) gives an aural "ALTITUDE" call.
6. MSL FLOOR is your Minimum Safe Level Floor, and is used as a warning setting for approaches. A MSL FLOOR of 18,000 ft is generally used as a reminder when flying below Transition Altitude, which is the altitude below which the pilot needs the switch to local barometric pressure setting (QNH) for the altimeter calibration setup. The MSL FLOOR can be set at any altitude of your choice, and descending below this altitude will trigger a VMS (Voice Message System) aural "ALTITUDE" call.
7. CARA ALOW or MSL FLOOR settings can be modified by selecting their data field with the Dobber Switch UP/DOWN (asterisks indicate which field is selected), then entering the desired value on the ICP keypad, then pressing ENTR button.







ALOW (ALTITUDE-LOW) ADVISORY SYSTEM



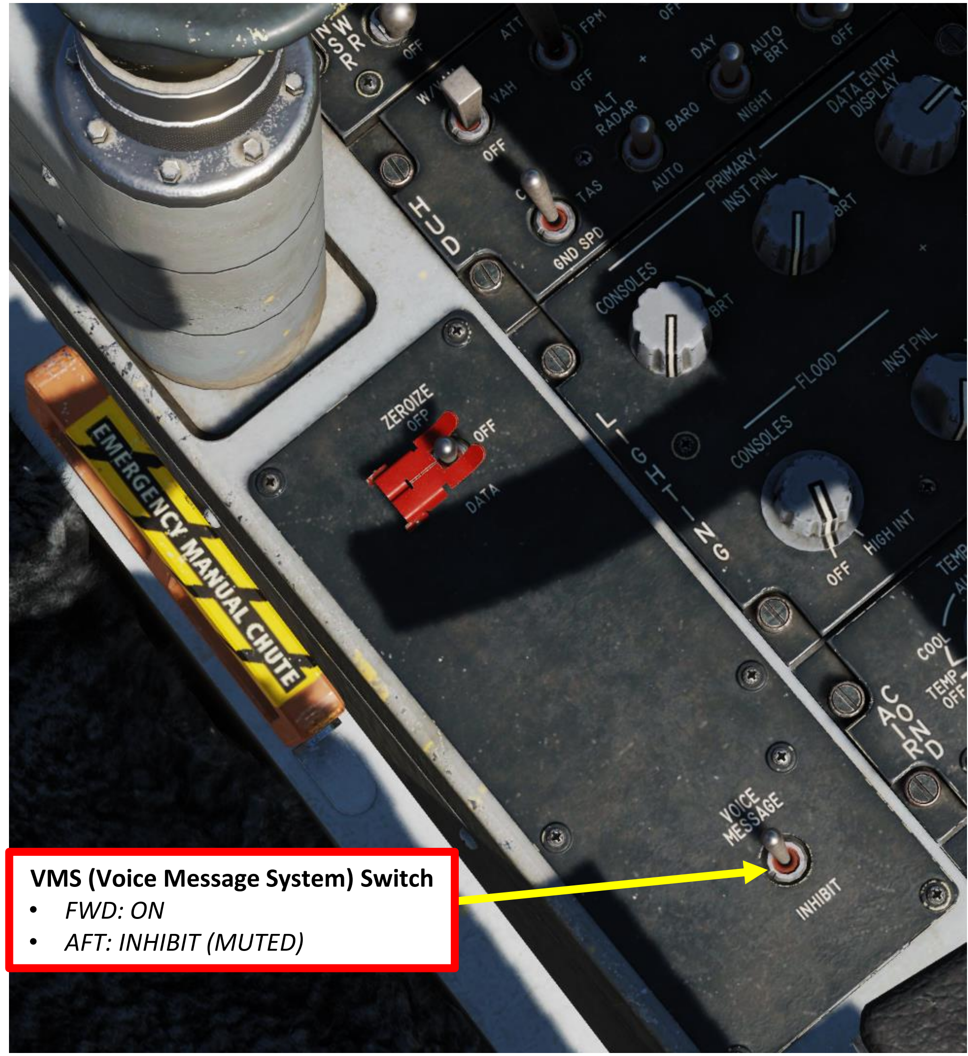
VMS (VOICE MESSAGE SYSTEM)

The VMS (Voice Message System), also nicknamed “Bitching Betty”, provides aural warning messages. The system is controlled with the VOICE MESSAGE switch.

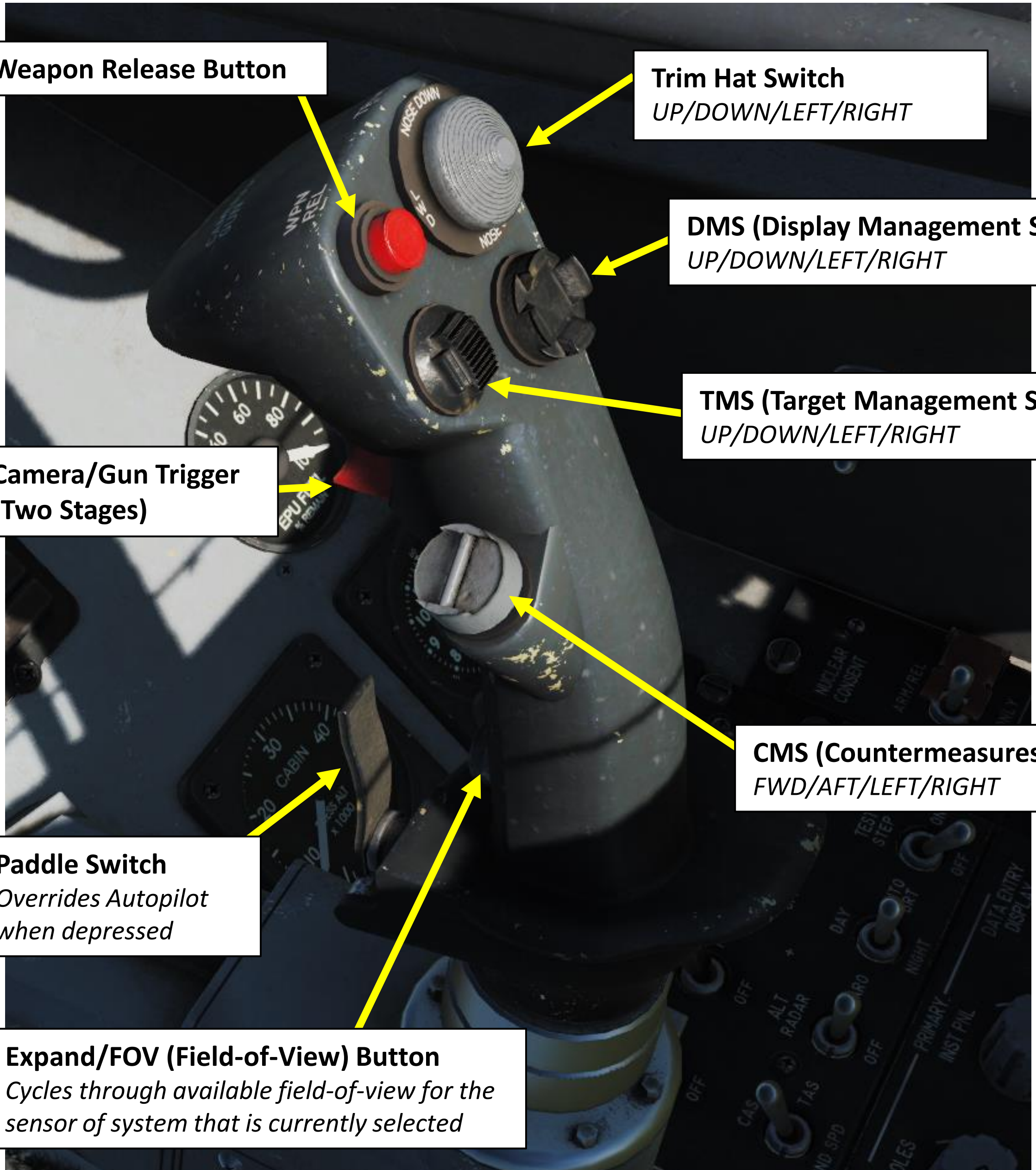
Note: Setting the VOICE MESSAGE switch to INHIBIT (AFT) will mute all voice messages.

Voice Message System (VMS) Warnings

WARNING MESSAGE	PRIORITY SEQUENCE	DESCRIPTION
PULLUP	1	Ground proximity warning is activated.
ALTITUDE	2	Descent is occuring after takeoff, or radar altitude is below entered radar ALOW value, or Barometric altitude is below the entered MSL ALOW value.
WARNING	3	Any glareshield-mounted warning light is illuminated
JAMMER	4	Advises that a threat should be jammed and pilot consent is required.
COUNTER	5	Advises that a dispense command should be initiated (CMDS semi-automatic mode only).
CHAFF-FLARE	6	CMDS has initiated a dispense program.
LOW	7	Advises that expendable (countermeasure) low quantity exists.
OUT	8	Advises that expendable (countermeasure) type is completely spent.
LOCK	9	Radar has locked on to target.
CAUTION	10	Any light on the caution light panel is illuminated (except IFF caution light).
BINGO	11	Bingo fuel warning has been activated
DATA	12	Datalink markpoint is received.
IFF	13	Identify-Friend-or-Foe system is not operable in flight (message heard during ground test)



HOTAS
SSC (SIDE STICK CONTROLLER) CONTROLS



Weapon Release Button

Trim Hat Switch
UP/DOWN/LEFT/RIGHT

DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

Camera/Gun Trigger (Two Stages)

CMS (Countermeasures Switch)
FWD/AFT/LEFT/RIGHT

Paddle Switch
Overrides Autopilot when depressed

Expand/FOV (Field-of-View) Button
Cycles through available field-of-view for the sensor of system that is currently selected

NWS A/R DISC & MSL STEP Button

- *NWS: Nosewheel Steering Activation*
- *A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching*
- *MSL (MISSILE) STEP: When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS.*

HOTAS
SSC (SIDE STICK CONTROLLER) CONTROLS

Display Management Switch (DMS). The DMS is used to control Sensor of Interest (SOI) selection.

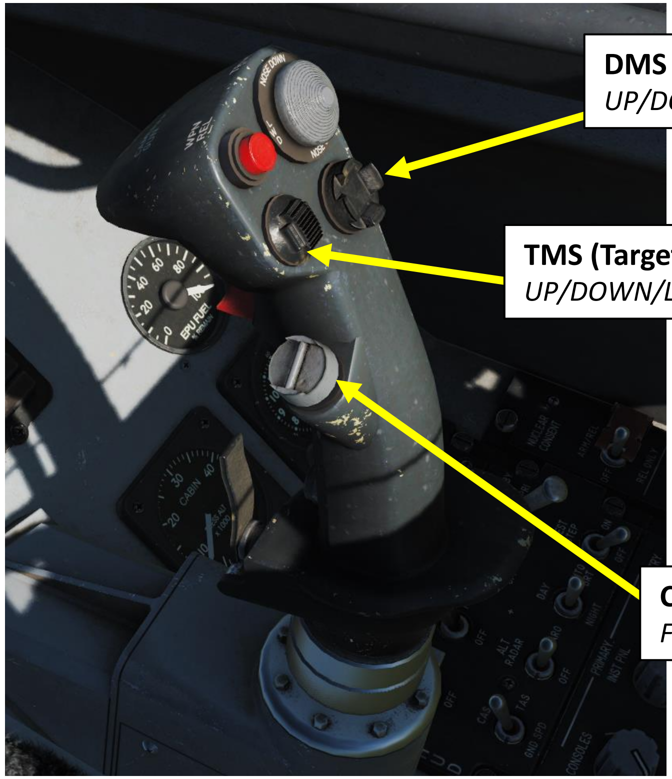
Direction	Duration	HUD	FCR	TGP	WPN
Fwd	Short		SOI to HUD	SOI to HUD	SOI to HUD
	Long				
Aft	Short	SOI to MFD	SOI MFD Swap	SOI MFD Swap	SOI MFD Swap
	Long				
Left	Short		Next LFT MFD Format	Next LFT MFD Format	Next LFT MFD Format
	Long				
Right	Short		Next RT MFD Format	Next RT MFD Format	Next RT MFD Format
	Long				

Target Management Switch (TMS). The TMS controls target designation and data management for the radar, AGM-65 Maverick missile, and the targeting pod.

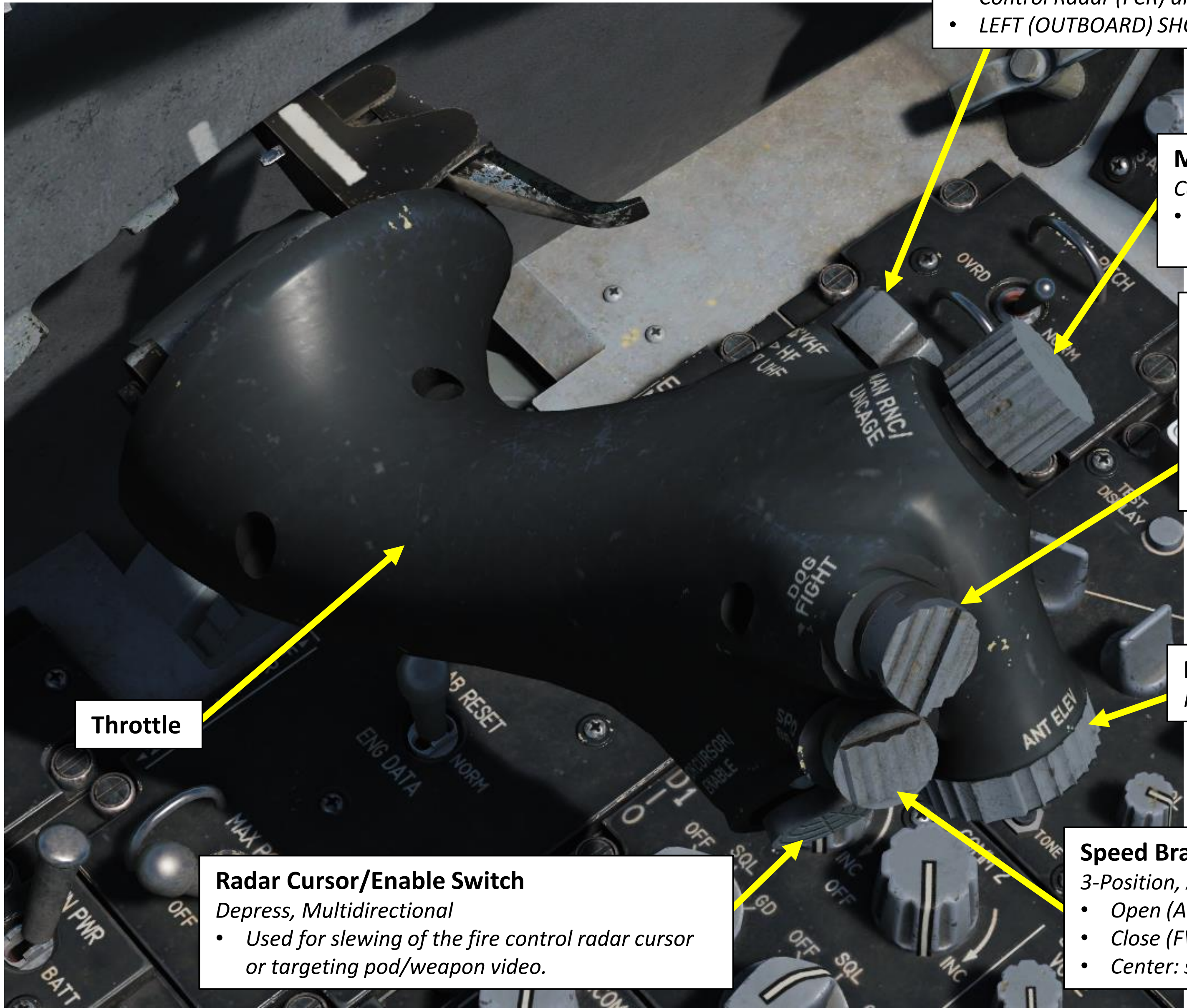
Direction	Duration	HUD	FCR	TGP	WPN	HSD
Fwd	Short	DTOS/EO-Vis Designate	RWS Spotlight / ACM BORE	Point Track	Track	Designate
	Long					
Aft	Short	Target Reject	Target Reject		Target Reject	Drop
	Long					
Left	Short		Interrogate All	Polarity Swap	Polarity Swap	
	Long		Interrogate Tgt			
Right	Short		TWS bug step / ACM rotary	Area Track		
	Long		TWS/RWS Swap			

Countermeasures Management Switch (CMS). The CMS controls deployment of countermeasures and operation of the ECM pod if installed.

ACTION		COUNTERMEASURE FUNCTION
FWD	ALL	Dispense 1x Manual Program 1-4 (as selected by CMDS PRGM knob)
LEFT	ALL	Dispense 1x Manual Program 6
RIGHT	MAN	Deactivate ECM Emissions
	SEMI	Disable ECM Emissions
	AUTO	Disable Dispensing of Auto Program / Interrupt Dispensing of current Program
AFT	MAN	Activate ECM Emissions if set to Mode 3
	SEMI	Dispense 1x Auto Program / Enables ECM Emissions if set to Mode 1 or 2
	AUTO	Enable Continuous Dispensing of Auto Program



HOTAS
TQS (THROTTLE QUADRANT SYSTEM) CONTROLS



Communications UHF/VHF Transmit Switch (4-Way)
- *AFT: transmits on UHF radio*
- *FWD: transmits on VHF radio*
- *RIGHT (INBOARD) SHORT: Filters datalink information on Fire Control Radar (FCR) display*
- *LEFT (OUTBOARD) SHORT: Toggles datalink tracks on and off*

MAN RNG/UNCAGE Knob/Switch
Can be rotated or depressed
- *Functions depend on the master mode and selected system*

Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*

Throttle

Radar Antenna Elevation Knob
Rotates, Center Detent

Radar Cursor/Enable Switch
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

Speed Brake Switch
3-Position, Aft Momentary
- *Open (AFT): speed brakes open/deployed*
- *Close (FWD): speed brakes close/retract*
- *Center: speed brakes remain in current position*

PART 10 – RADAR & SENSORS

SECTION STRUCTURE

1.1 – INTRODUCTION TO SENSORS

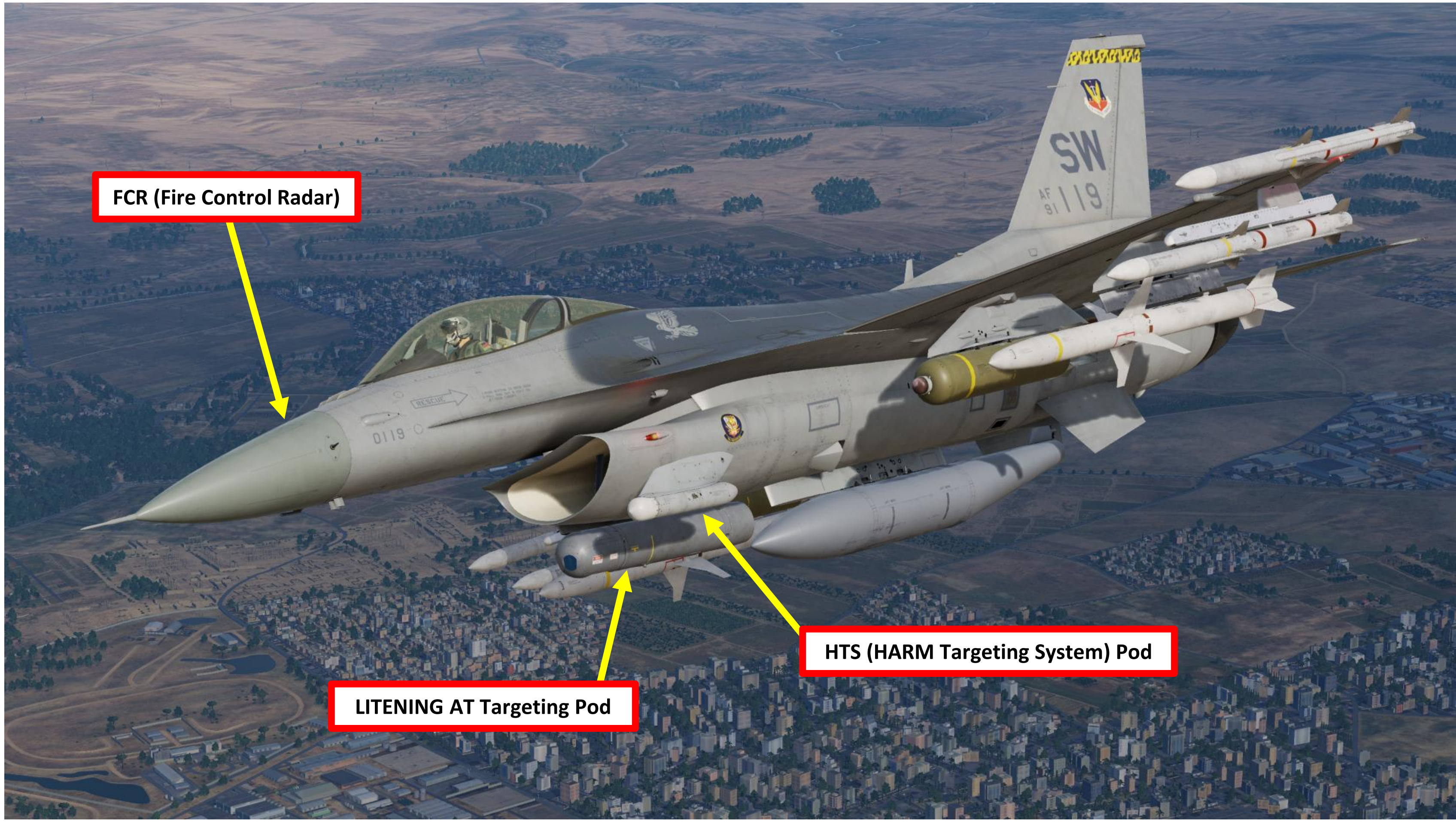
The F-16 is by definition one of the most versatile aircraft when it comes to armament and sensors. Here is an overview of how the Viper can "see" the outside world.

- **AN/APG-68 FCR (Fire Control Radar)**: pulse-Doppler, look-down/shoot-down radar with both BVR (Beyond Visual Range) and close in ACM (Air Combat Maneuvering) modes of operation for air-to-air combat. Air-to-Ground and Air-to-Sea modes are also implemented, which makes it a very powerful tool at your disposal.
    - Air-to-Air Modes currently implemented are RWS (Range While Search), TWS (Track While Scan), SAM (Situational Awareness Mode), STT (Single Target Track), DTT (Dual Target Track) and ACM (Air Combat Maneuvering).

- **AN/AAQ-28 LITENING AT Targeting Pod**: Targeting system developed to provide precision strike capability. Target designation is achieved by using a laser designator/range finder or an infrared laser marker, which can be created by the pod itself. It is also capable of displaying a FLIR (Forward-Looking Infrared) thermal imagery.

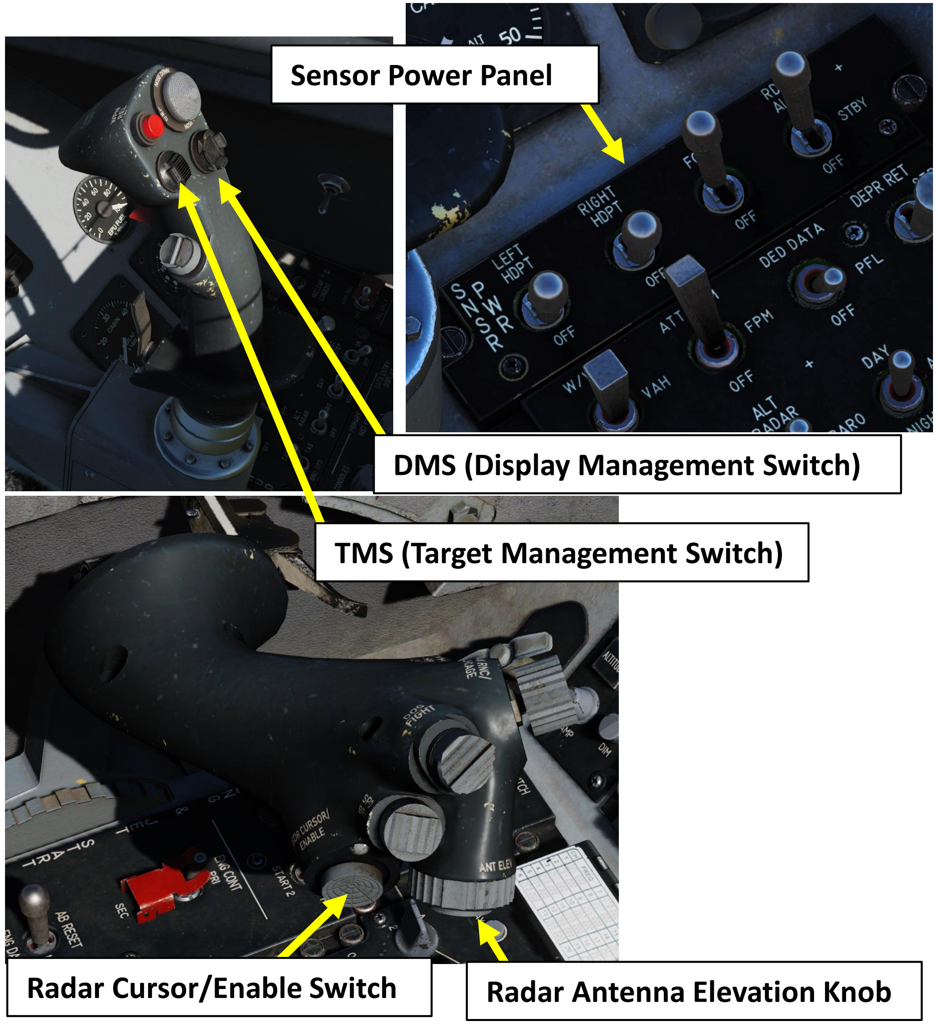
- **AGM-65 Maverick** Seeker Head feed: Maverick air-to-ground missiles have seeker heads that have video capability and that can be used as supplemental sensors.

- **AN/ASQ-213 HTS (HARM Targeting System) Pod**: This pod is used by High-Speed Anti-Radiation Missiles (HARM) to home on radar emitters for SEAD (Suppression of Enemy Air Defenses) operations.

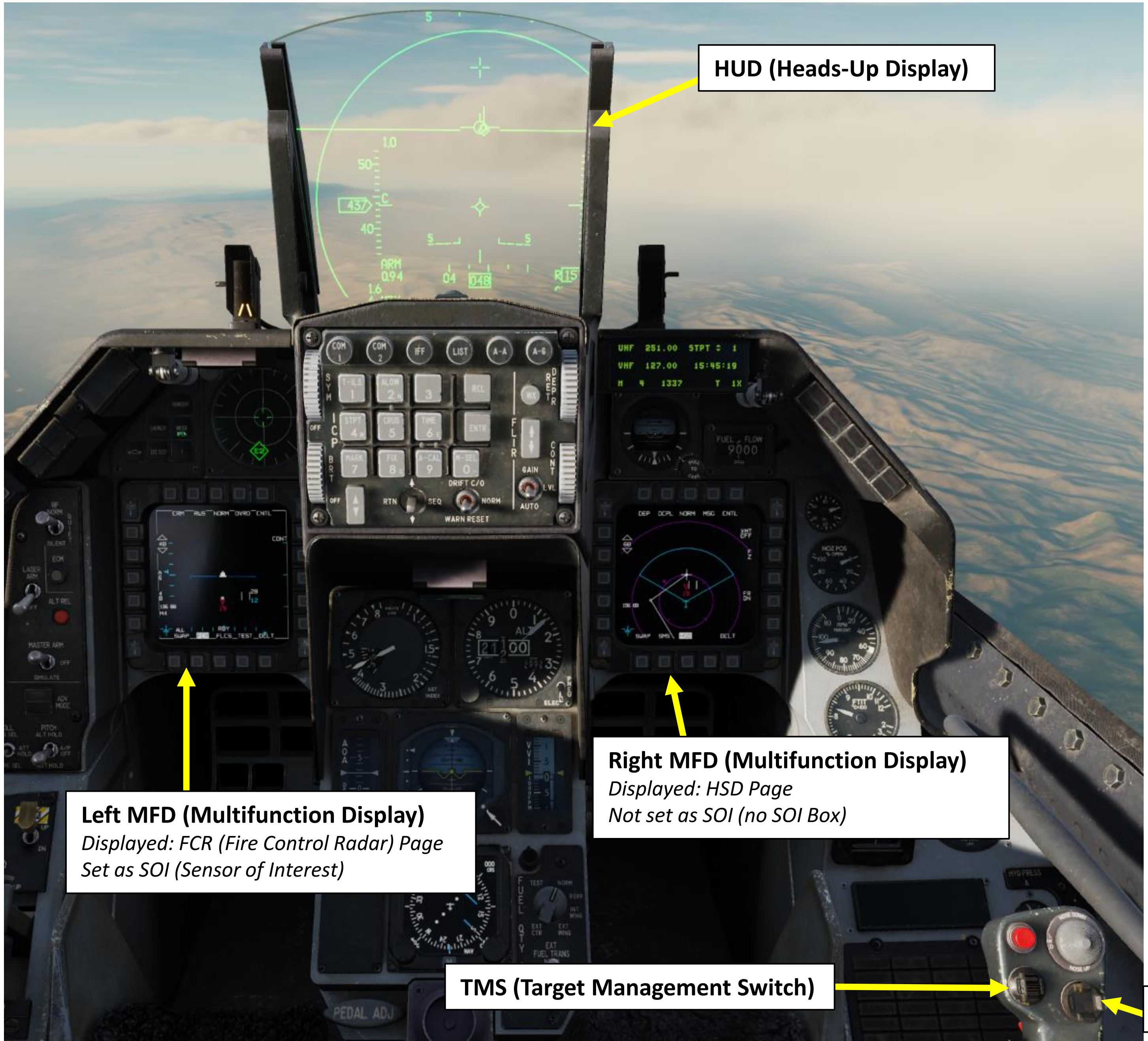


1.1 – INTRODUCTION TO SENSORS

This section will introduce you to various sensors. You will get the « what », but the « how » will be demonstrated later in the Weapons section since the use and application of sensors will make more sense to you once you start using them for a specific purpose. Just keep in mind that your sensors can be monitored from the HUD (Heads-Up Display) and various displays, while they can be operated from the HOTAS stick and throttle.



1.1 – INTRODUCTION TO SENSORS

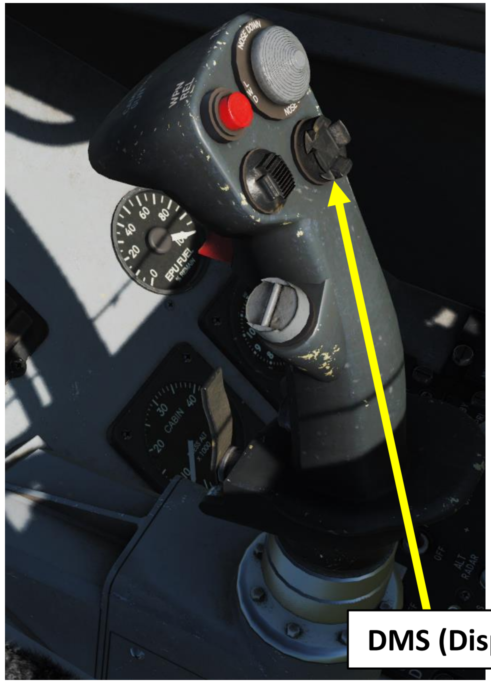


1.2 – SENSORS DISPLAY SELECTION

The SOI (Sensor of Interest) is the sensor or display for which the hands-on controls are currently active. Similar functions are activated by the same switches, whenever possible, to provide consistent operation regardless of the SOI or mode selected. The current SOI can be identified by the SOI Box around the MFD (Multifunction Display) screen or the asterisk in the top left of the HUD.

The SOI is changed from display to display with the Display Management Switch (DMS). Basic functionality as it applies to SOI is:

- **DMS UP**: SOI transitions to the HUD if in A-G Master Mode (asterisk will be visible on HUD when SOI)
- **DMS DOWN**: SOI transitions from the HUD to the highest priority MFD. DMS DOWN again swaps SOI to the other MFD. A white "SOI" box will be visible on the display when MFD is SOI.



DMS (Display Management Switch)

MFD SOI (Sensor of Interest) Box

HUD SOI (Sensor of Interest) HUD Asterisk

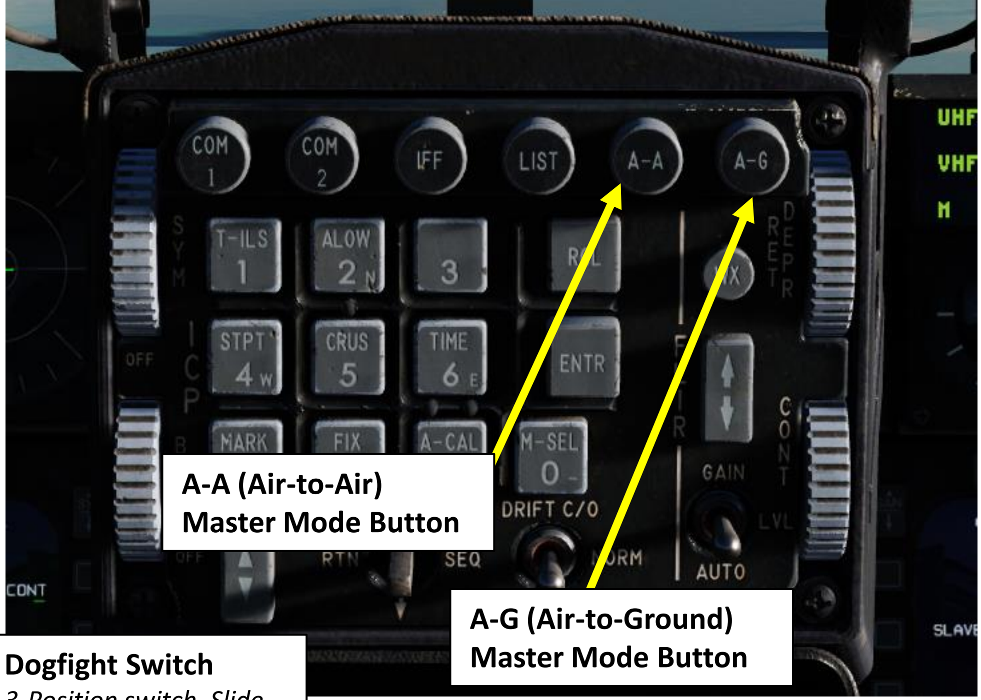
A-A (Air-to-Air) Master Mode Button

A-G (Air-to-Ground) Master Mode Button

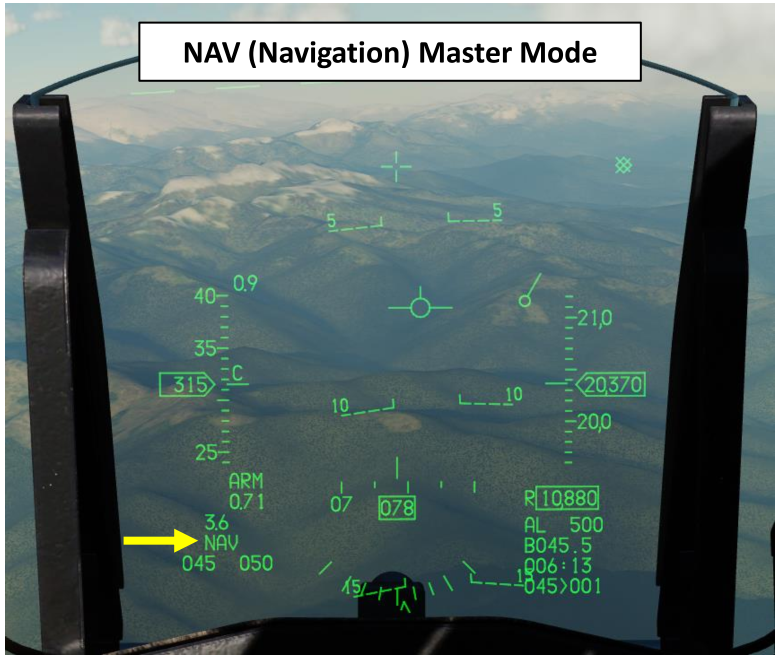
1.2 – SENSORS DISPLAY SELECTION

1.3 – SENSOR MASTER MODES

There are three Master Modes in the F-16:
- **A-A (Air-to-Air) Mode**, which is used for air-to-air missile and radar employment.
- **A-G (Air-to-Ground) Mode**, which is used for air-to-ground weapons. Upon selection of the A-G master mode, the SMS (Stores Management Set) Air-to-Ground (SMS A-G) page is displayed on the right MFD.
- **NAV (Navigation) Mode**, which is used for navigation (shocking, I know!).



<u>*Notes*</u>
- *Depressing the A-A button selects the Air-to-Air Master Mode, and the A-G button selects the Air-to-Ground Master Mode. This configures the aircraft systems and displays for the selected attack mode in one easy step.*
- *Depressing the same button a second time returns to the NAV (Navigation) Master Mode.*
- *When Dogfight or missile override mode is selected with the DOGFIGHT Switch, request for master mode changes via the Integrated Control Panel (ICP) buttons will be ignored.*



1.3 – SENSOR MASTER MODES

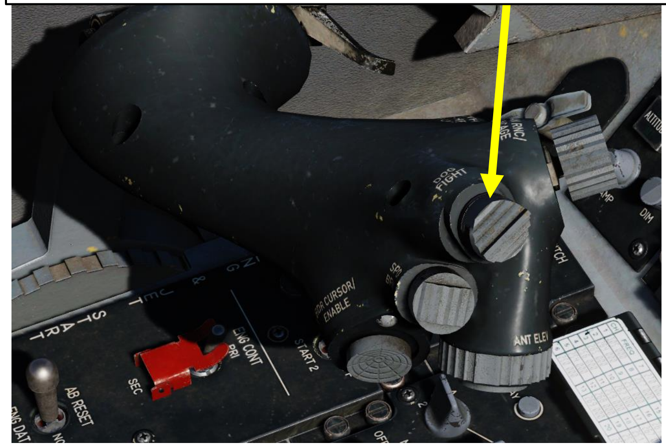
There are two Override Modes: **DGFT (Dogfight)** and **MSL OVRD (Missile Override)**. Both can be selected with the Dogfight Switch.

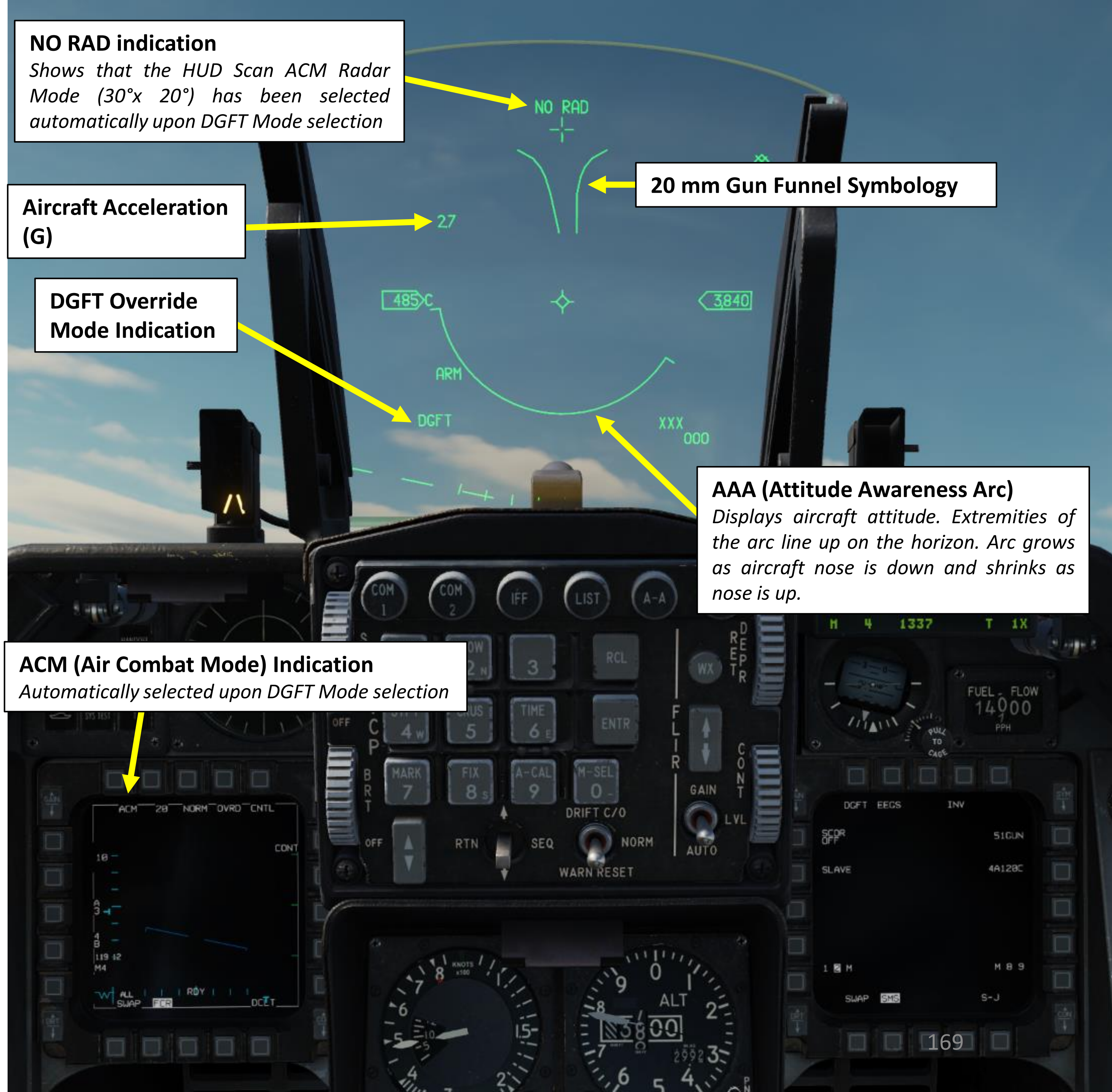
- **DGFT (Dogfight)** Override Mode is selected by pressing the Dogfight switch Outboard to the DOGFIGHT position. Upon DGFT mode selection:
    - A-A, A-G and NAV Master Modes are overridden
    - ACM (Air Combat Mode) Radar mode is automatically selected
    - Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
- **MSL OVRD (Missile Override)** Override Mode is selected by pressing the Dogfight switch Inboard to the MSL OVRD position. Upon mode selection:
    - A-A, A-G and NAV Master Modes are overridden
    - Symbology on the HUD is provided for air-to-air missile

Dogfight Switch

3-Position switch, Slide

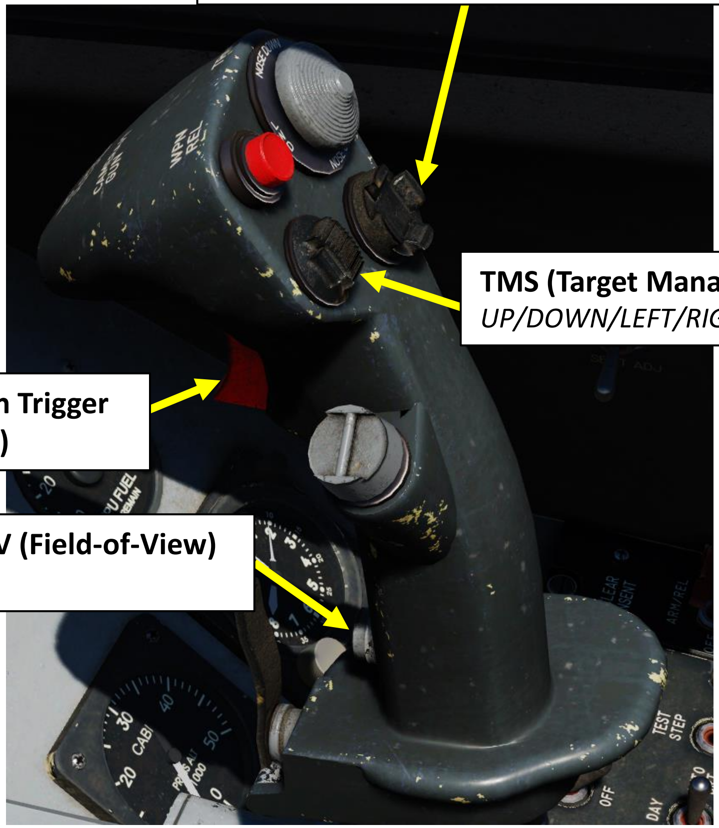
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*





1.4 – MY SENSORS CONTROL SETUP

Real Aircraft Controls

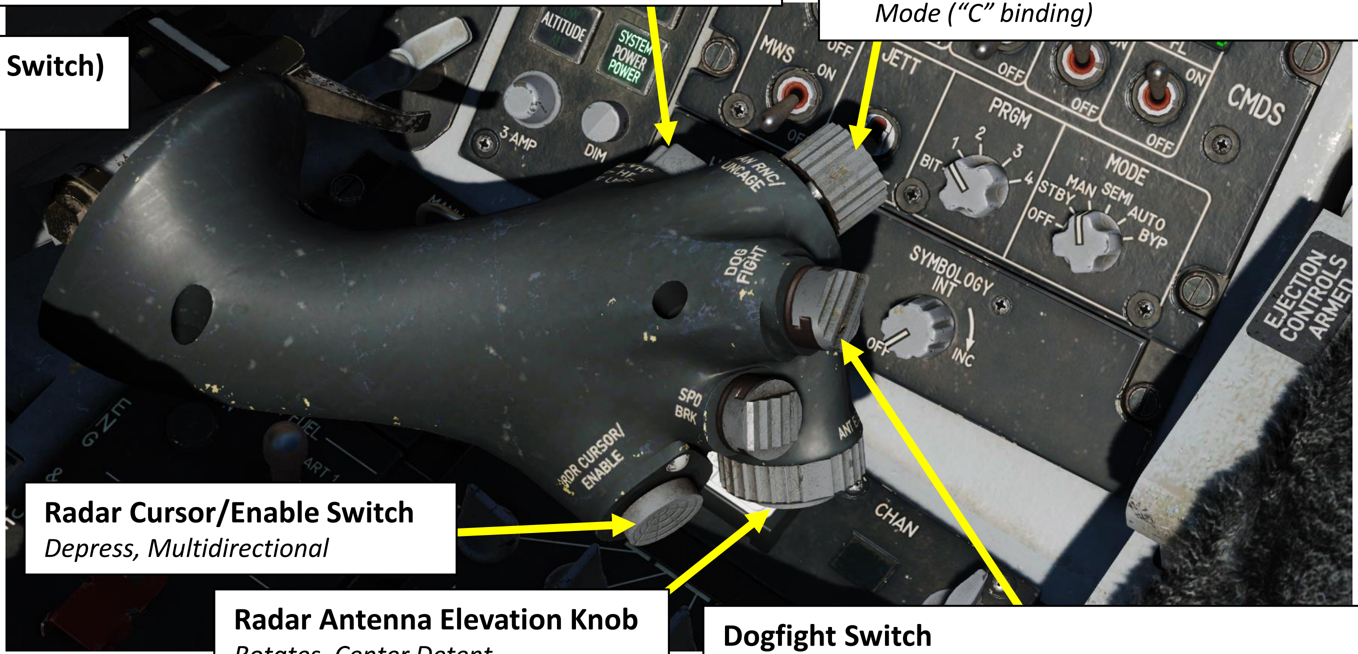


DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

Camera/Gun Trigger (Two Stages)

Expand/FOV (Field-of-View) Button



Communications UHF/VHF Transmit Switch (4-Way)
- *Transmit Switch – IFF IN (INBOARD): Cycles filter options*
- *Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks*

MAN RNG/UNCAGE Knob/Switch
- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)*

Radar Cursor/Enable Switch
Depress, Multidirectional

Radar Antenna Elevation Knob
Rotates, Center Detent

Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*

1.4 – MY SENSORS CONTROL SETUP

My Controls

WPN REL Button

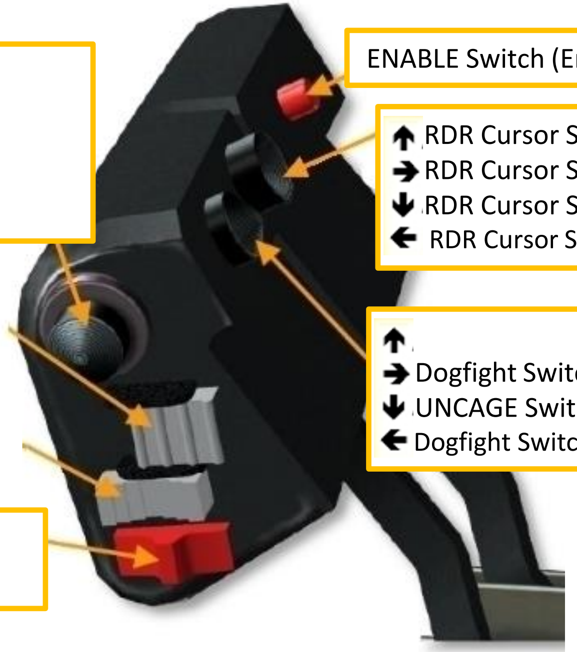
Camera/Gun Trigger (Two Detents)

Expand/FOV Button

- ↑ DMS UP
- → DMS RIGHT
- ↓ DMS DOWN
- ← DMS LEFT

- ↑ TMS UP
- → TMS RIGHT
- ↓ TMS DOWN
- ← TMS LEFT

ANT ELEV Knob (Radar Antenna Elevation)



- ↑
- → Transmit Switch – IFF IN
- ↓
- ← Transmit Switch – IFF OUT
- P

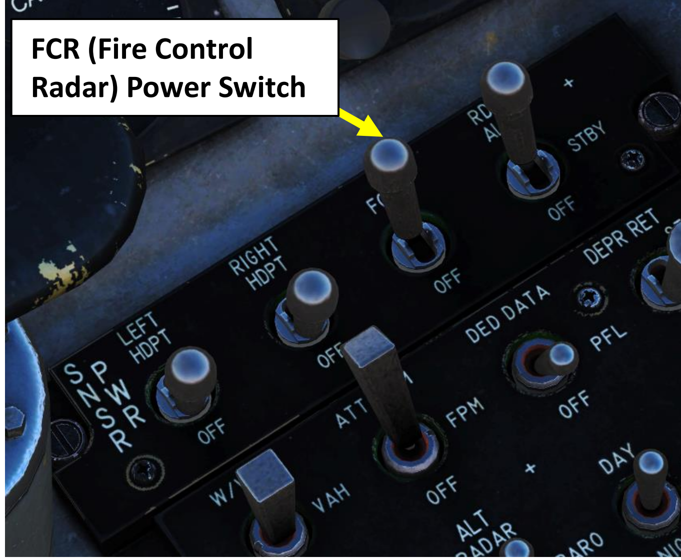
ENABLE Switch (Enter)

- ↑ RDR Cursor Switch – Y Axis
- → RDR Cursor Switch – X Axis
- ↓ RDR Cursor Switch – Y Axis
- ← RDR Cursor Switch – X Axis

- ↑
- → Dogfight Switch – MISSILE OVERRIDE/CENTER
- ↓ UNCAGE Switch
- ← Dogfight Switch – DOGFIGHT/CENTER

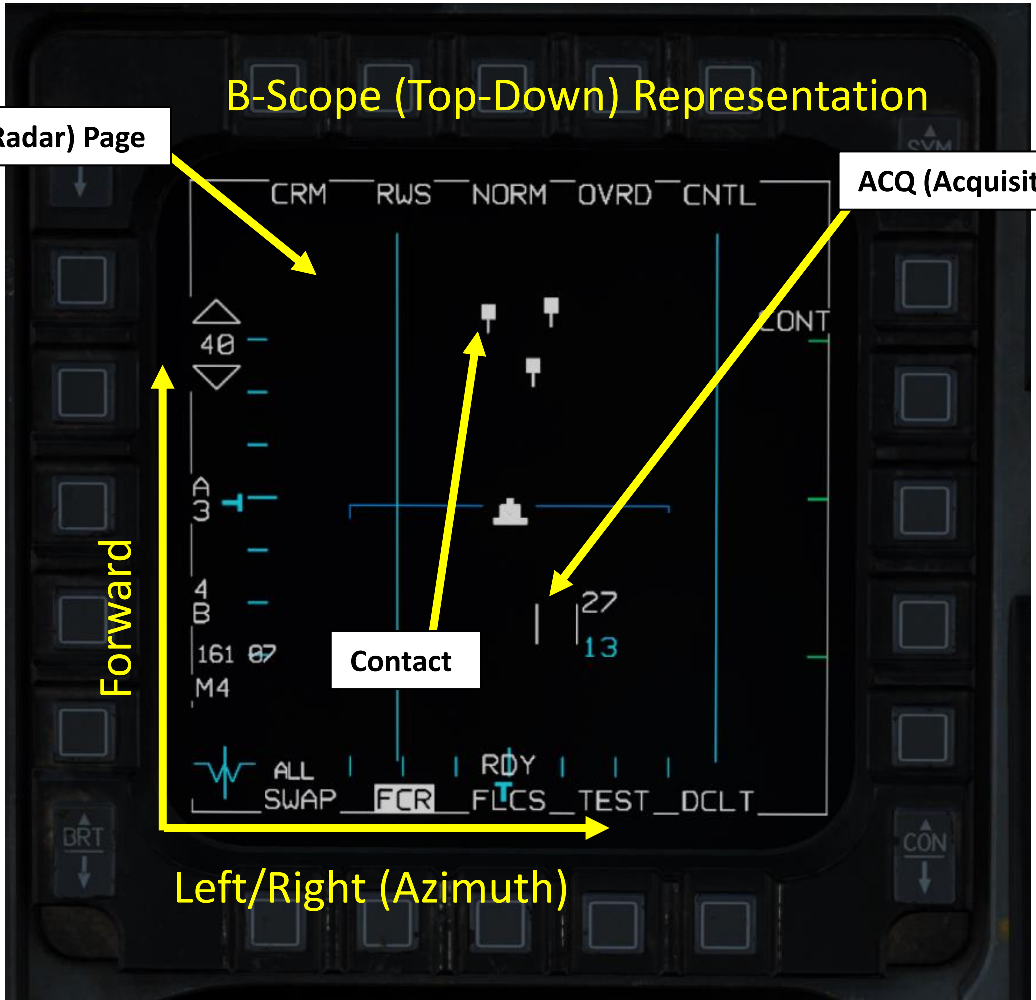
- ← MAN RNG Knob – CCW (Zoom Out)
- → MAN RNG Knob – CW (Zoom In)

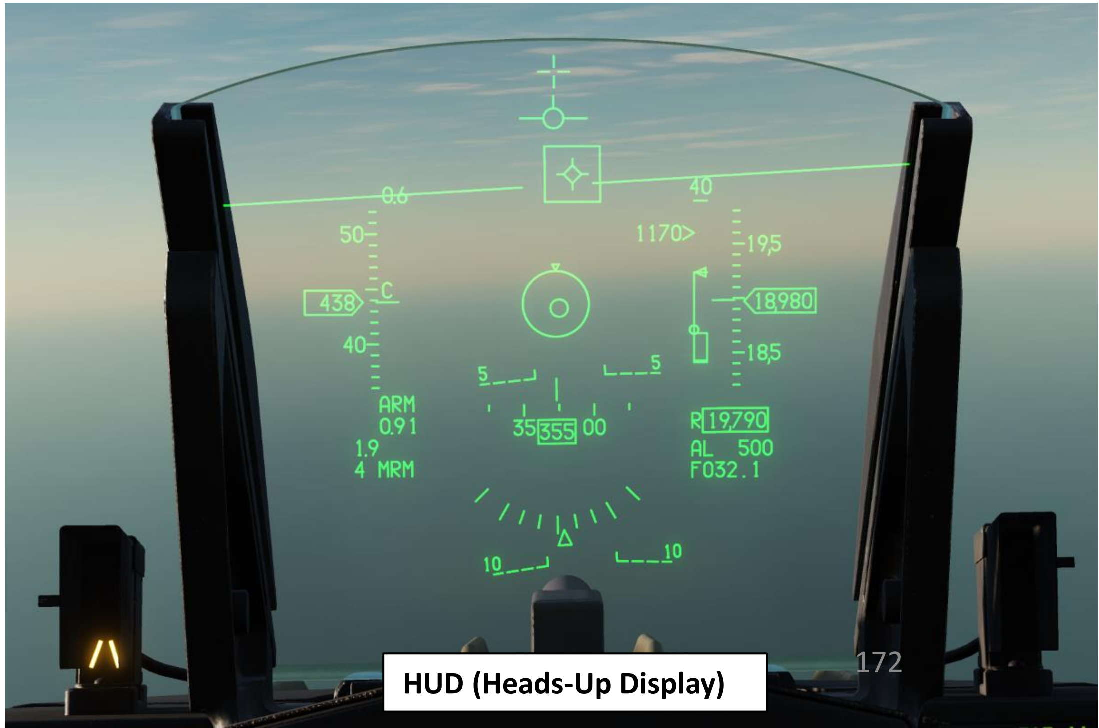
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance



The air-to-air radar uses a B-Scope representation, which is a top-down view of what's in front of you.

- Radar Data can be shown on the **FCR (Fire Control Radar) page** and on the HUD (Heads-Up Display).
- The **FCR Power Switch** must be set FWD and the Master Mode needs to be set to **A-A** (Air-to-Air) for the radar to be functional. Take note that FCR is inhibited while aircraft is on the ground.

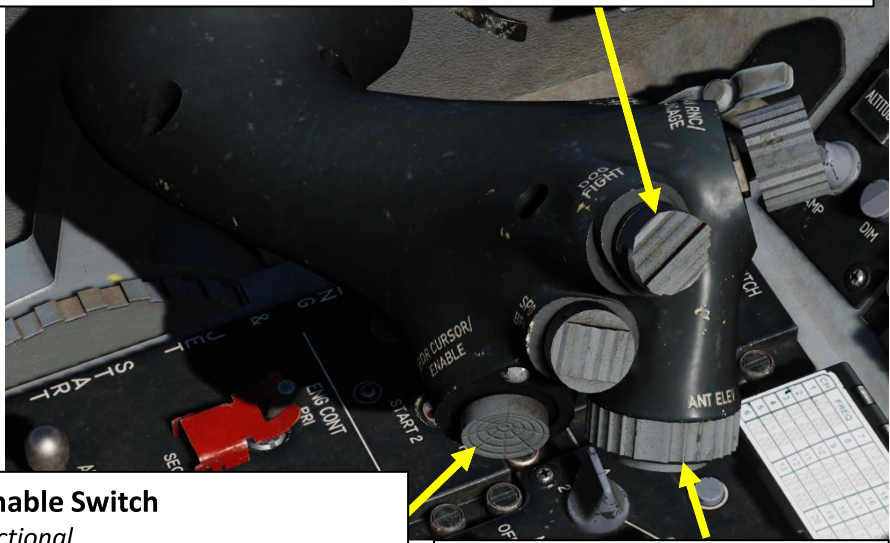




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

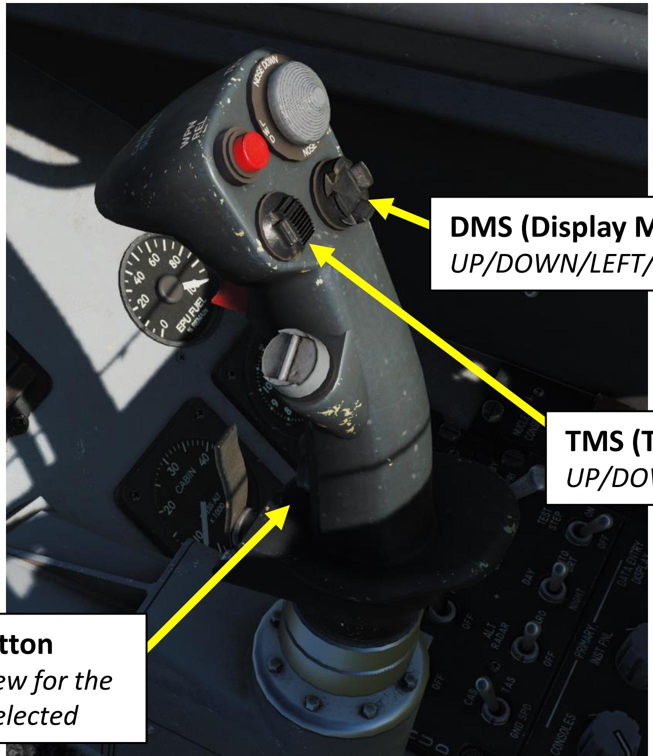
- You can slew your radar using the **Radar Cursor/Enable** Switch. This will move the ACQ (Acquisition) cursor on the FCR page.
- The **Radar Antenna Elevation Knob** on the throttle is used to control where your radar is scanning vertically.
- The **DMS (Display Management Switch)** is used to select which display (Multifunction Display or Heads-Up Display) is the current Sensor of Interest (SOI).
- The **TMS (Target Management Switch)** is used for RWS (Range While Search) spotlight, Target Rejection, Target Interrogation, TWS (Track While Scan) Bug Step and RWS/TWS swap functionalities.
    - **TMS UP** is used to radar lock a target
    - **TMS DOWN** is used to unlock a locked target
- The **Expand/FOV Button** is used to “expand” (zoom in) on a specific section of your radar screen.
- The **DOGFIGHT** Switch is used to select HUD Symbology for either DOGFIGHT mode (used for gun & air-to-air missile delivery) or MISSILE OVERRIDE mode (use for air-to-air missile delivery only).

Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*



Radar Cursor/Enable Switch
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

Radar Antenna Elevation Knob
Rotates, Center Detent

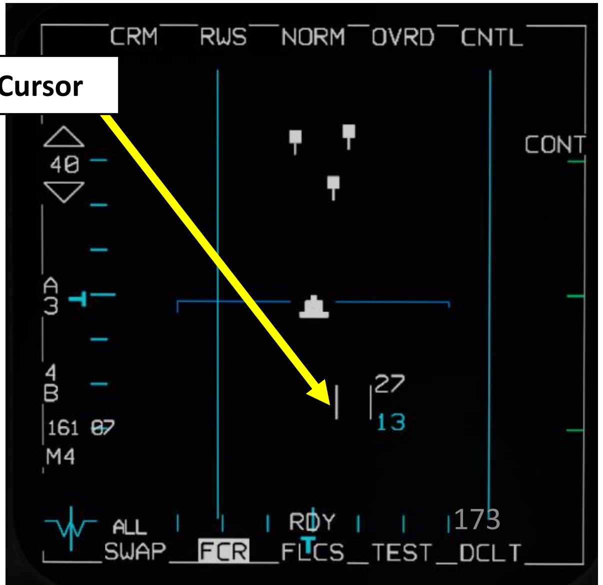


DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

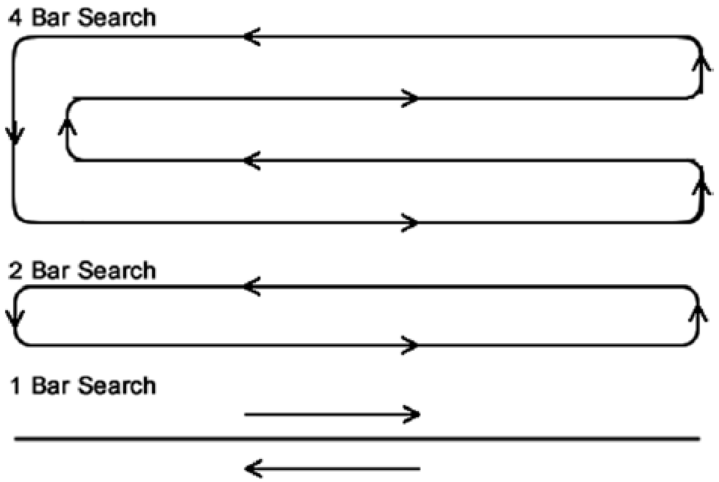
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

Expand/FOV (Field-of-View) Button
Cycles through available field-of-view for the sensor of system that is currently selected

ACQ (Acquisition) Cursor



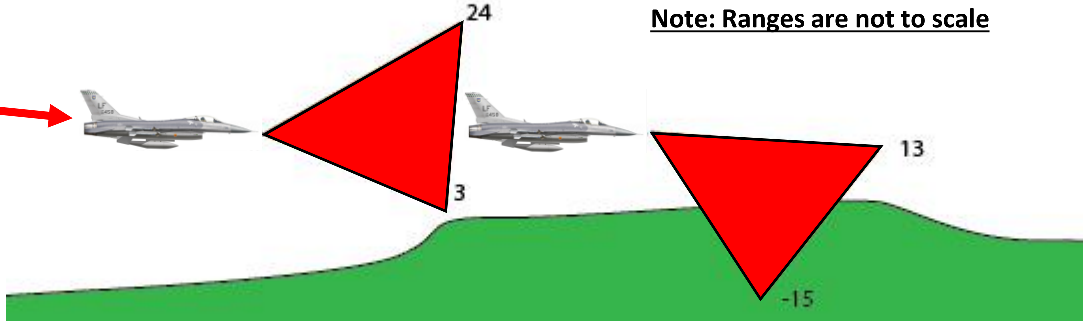
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

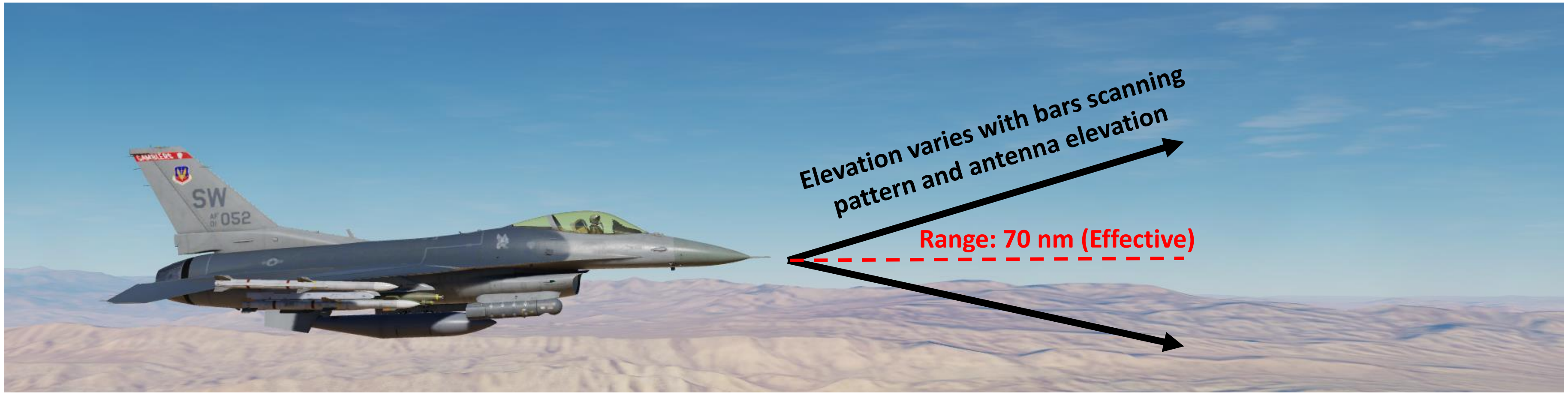


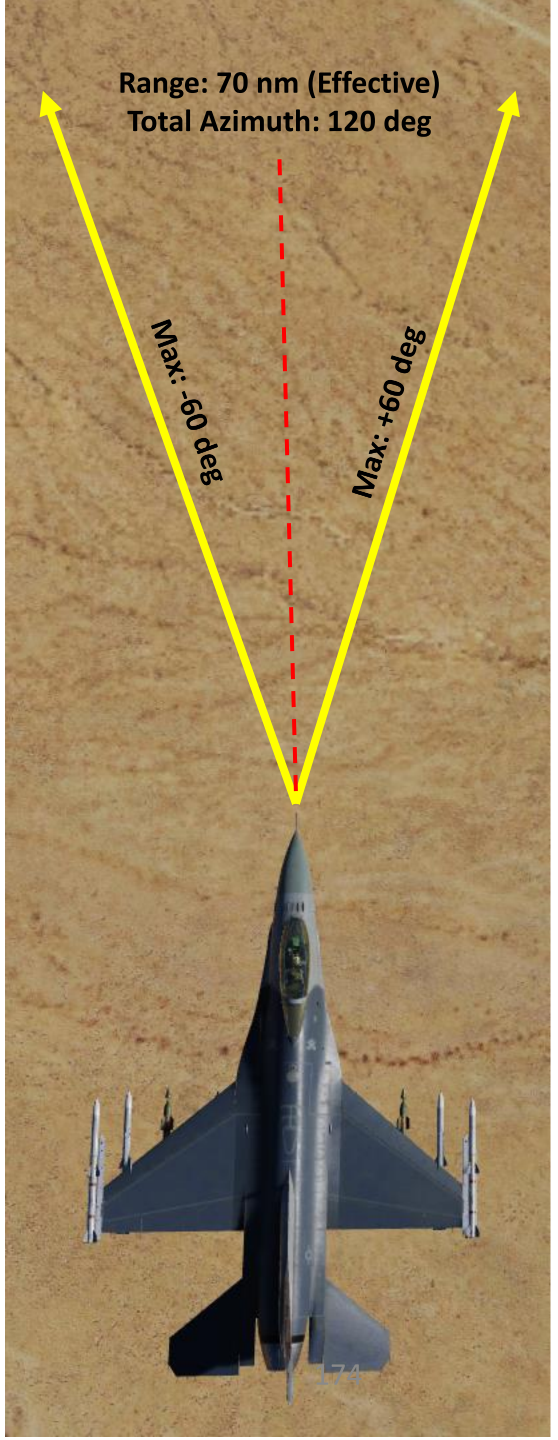
The F-16's radar has an effective range of approximately 70 nautical miles (with a maximum display range of 160 nm on the FCR page), a horizontal arc of 120 degrees and a variable vertical arc that is customizable. You can control the radar scan pattern (bars), which will give you a narrower or wider scanning area.

The numbers next to the Acquisition Cursor (ACQ) correspond to the altitudes (in thousands of feet) of the top and bottom of the radar beam at the distance of the target designator. As you move the cursor closer and further you will see the numbers change. The practical application is that the radar will not detect targets above or below these altitudes which is why you need to slew the radar antenna up and down to do a complete search.

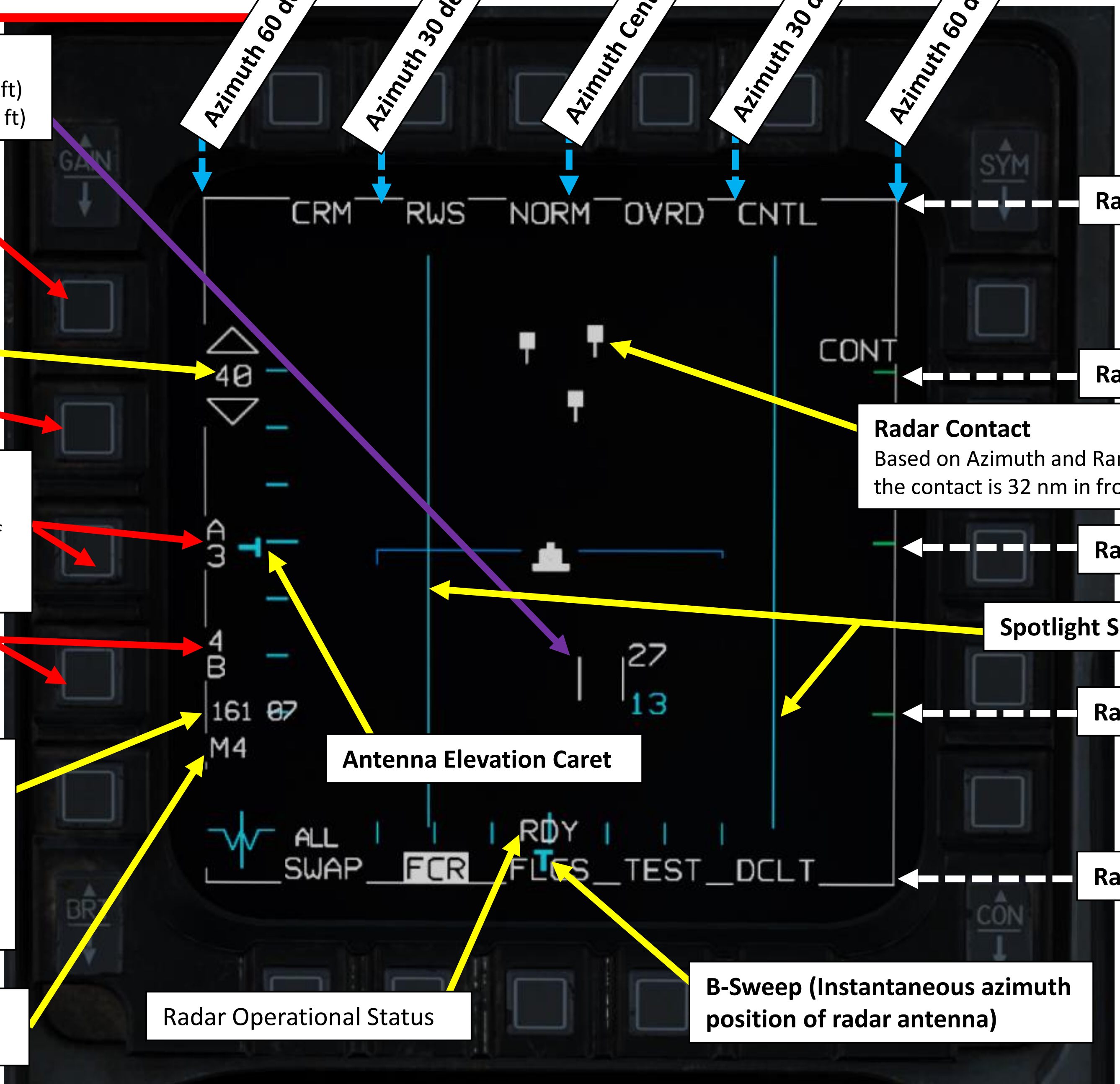
Acquisition (ACQ) Cursor
Upper number: Upper altitude covered by radar (21000 ft)
Lower number: Lower altitude covered by radar (-11000 ft)







2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance



Azimuth 60 deg Left

Azimuth 30 deg Left

Azimuth Center Line

Azimuth 30 deg Right

Azimuth 60 deg Right

Acquisition (ACQ) Cursor
Upper number: Upper altitude covered by radar (27000 ft)
Lower number: Lower altitude covered by radar (13000 ft)

Increase Range Scale

Range Scale Reference: 40 nm
(can be set to 5/10/20/40/80/160 nm)

Decrease Range Scale

Radar Azimuth (Scan Width)
(can be set to A10/30/60 deg)
- "A6" means the radar is scanning 60° to either side of boresight, which is the maximum scan azimuth. Options are A6, A3, and A1.

Elevation Bar Scan
Cycles between 1, 2, 3 and 4 bars of faster scanning
4B stands for "4 bars".

If Bullseye active:
- **Bearing and Distance (nm) from Bullseye to Acquisition (ACQ) Cursor**

If Bullseye is not active:
- **Bearing and Distance (nm) from Active Steerpoint to Acquisition (ACQ) Cursor**

IFF Interrogation Mode Selected
M4: Mode 4

Radar Operational Status

Antenna Elevation Caret

Range: Full Scale (40 nm)

Range: 3/4 Scale (30 nm)

Radar Contact
Based on Azimuth and Range Scale, we can deduce that the contact is 32 nm in front of us, 5 degrees to our right

Range: 1/2 Scale (20 nm)

Spotlight Scan Lines

Range: 1/4 Scale (10 nm)

Range: 0 nm

B-Sweep (Instantaneous azimuth position of radar antenna)

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

Radar Sub-Mode Selector
- RWS: Range While Search
- TWS: Track While Scan

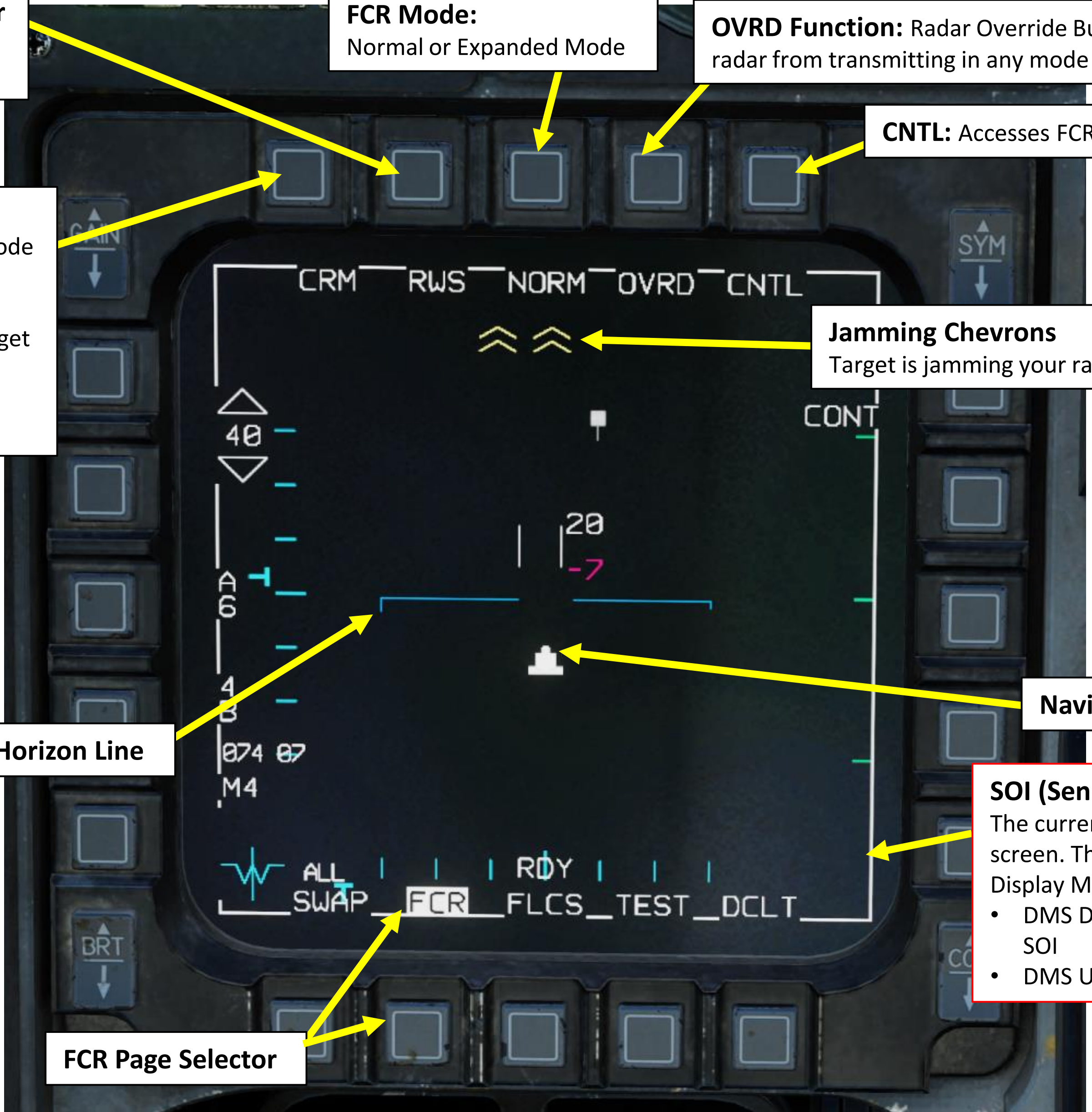
FCR Mode: Normal or Expanded Mode

OVRD Function: Radar Override Button prevent the radar from transmitting in any mode

CNTL: Accesses FCR Control Menu

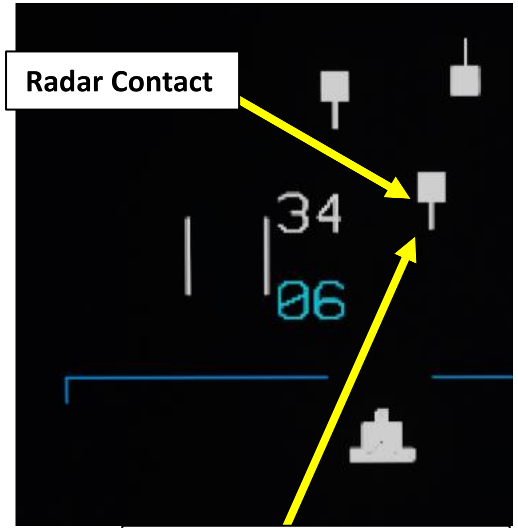
Radar Mode Selected
- CRM: Combined Radar Mode
- ACM: Air Combat Mode
- GM: Ground Mapping
- GMT: Ground Moving Target
- SEA: Sea Mode
- BCN: Beacon Mode
- STBY: Standby Mode

Jamming Chevrons
Target is jamming your radar



DMS (Display Management Switch)

Radar Contact



Radar Contact Vector Line (Direction of Target)

Horizon Line

Navigation Steerpoint

FCR Page Selector

SOI (Sensor of Interest) Control Indication Box
The current SOI can be identified by the box around the MFD screen. The SOI is changed from display to display with the Display Management Switch (DMS).
- DMS DOWN swaps Multifunction Displays (MFDs) as the SOI
- DMS UP sets the Heads-Up Display (HUD) as the SOI

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

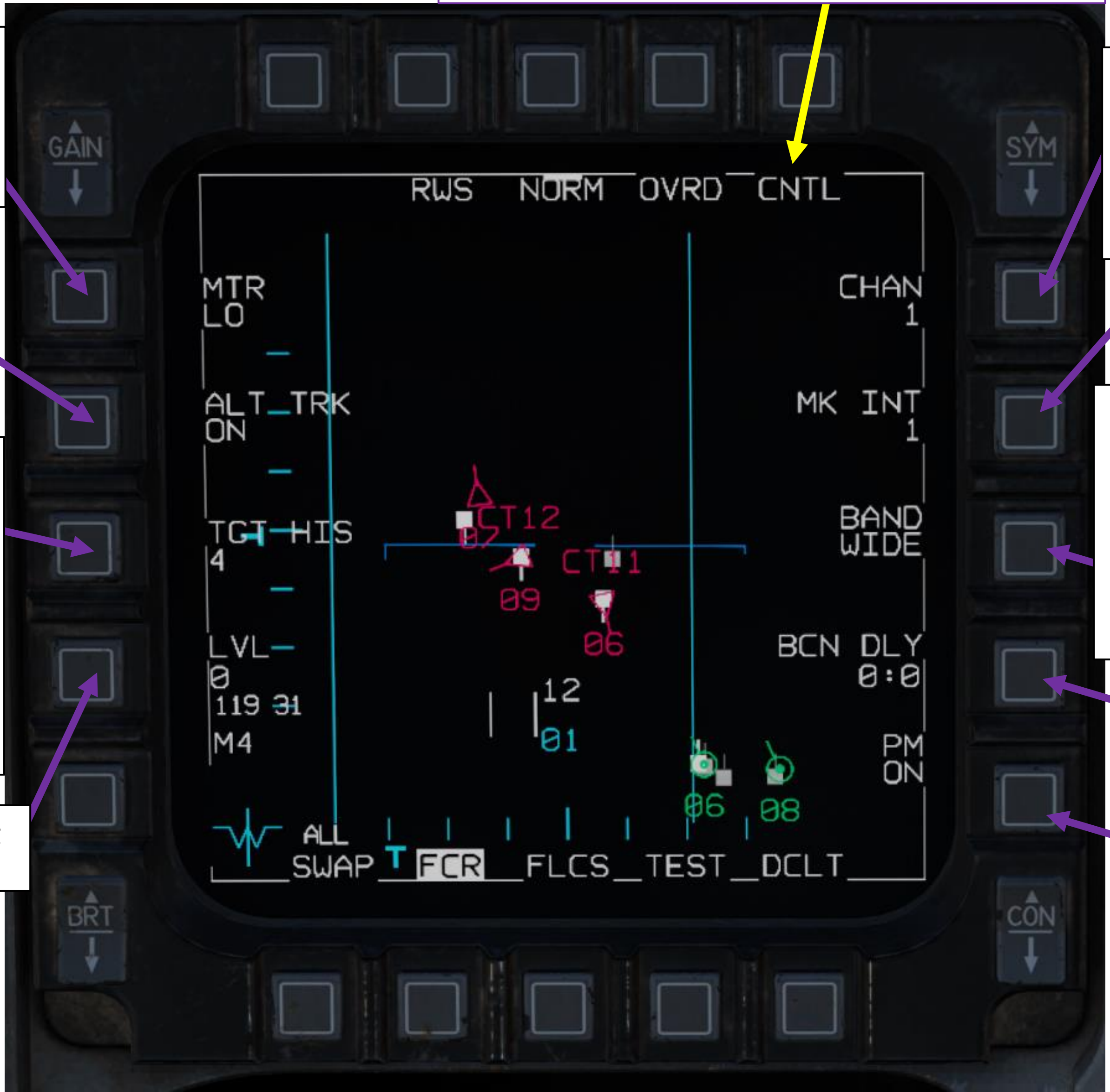
FCR CNTL (Control) Sub-Page Selected

Moving Target Rejection
- Sets the minimum relative velocity that a detected aircraft must have before it is displayed (Doppler gate). Settings are LO (Low Speed) and HI (High Speed).

Altitude Tracker Option
- Toggles on and off the altitude line tracker/blanker. When on, blanks all targets which are detected at the range of the altitude line.

Target History Setting
- Sets the number of frames that a radar return lives. When set to 1, a radar return is only displayed during the frame that it is detected. When set to 2, 3, or 4, the radar return is displayed for additional scan frames, becoming dimmer with each new frame. By setting the target history, you can get a broad idea of target relative bearing, since the frames will appear to form a line.

Radar Level Setting
- Not Simulated.



Channel
- Selects the frequency channel the radar uses, 1 through 4. Different aircraft within a flight should use different channels to avoid radar interference with each other. Not Simulated.

Mark Intensity Setting
- Not Simulated.

Radar Frequency Agility Band Setting
- Toggles between wide (WIDE) and narrow (NARO) frequency agility bandwidth (not implemented). Frequency agility refers to the radar's technique of randomly hopping between different frequencies within the agility band, to increase the difficulty of being jammed.

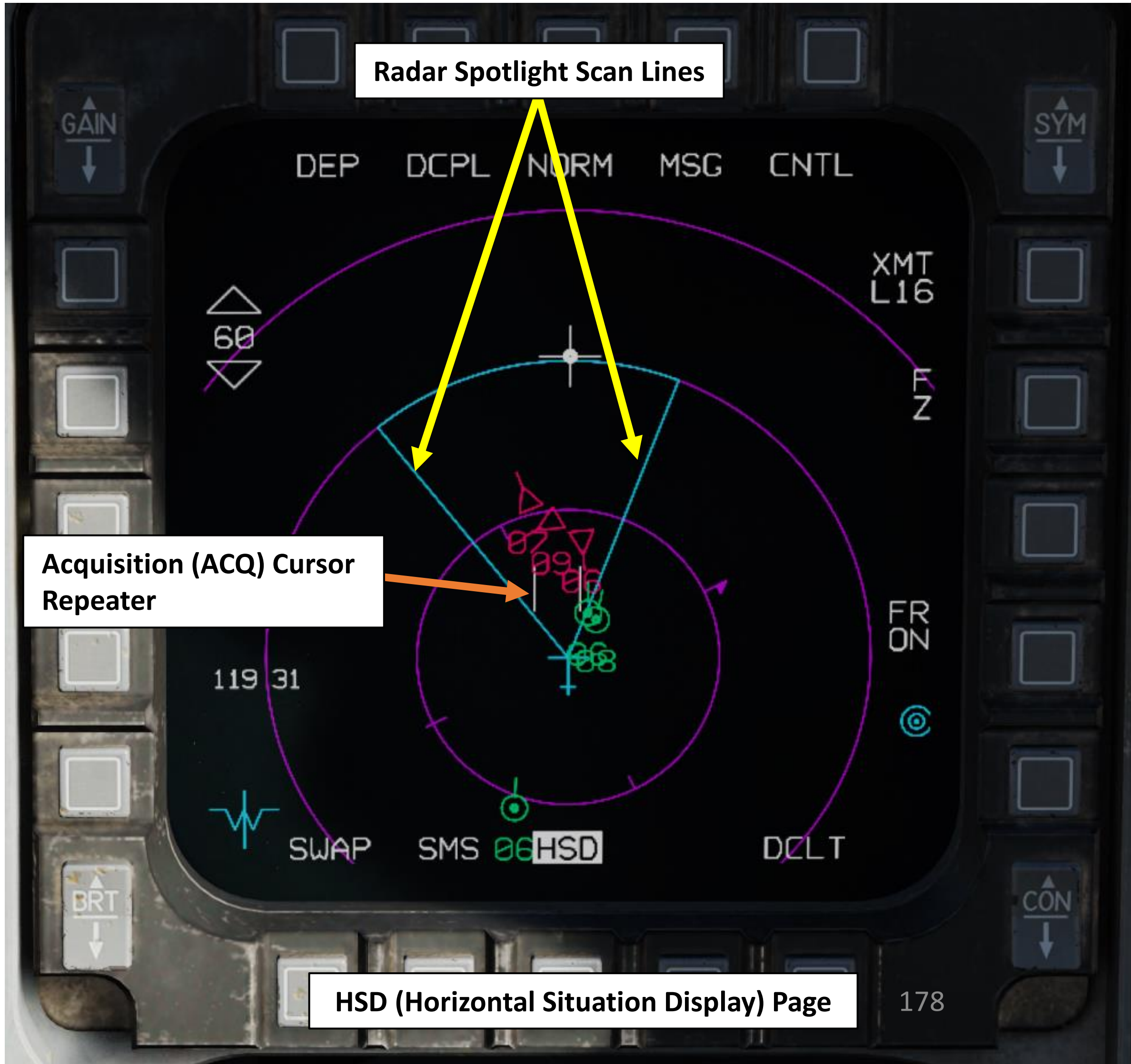
Beacon Mode Delay Setting
- Offset time delay for radar beacon reception. Not Simulated.

Power Management Setting
- Not Simulated.

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

The F-16 Spotlight Scan lines can be visible on both the FCR page and on the HSD (Horizontal Situation Display) page as well.

FCR (Fire Control Radar) Page



HSD (Horizontal Situation Display) Page

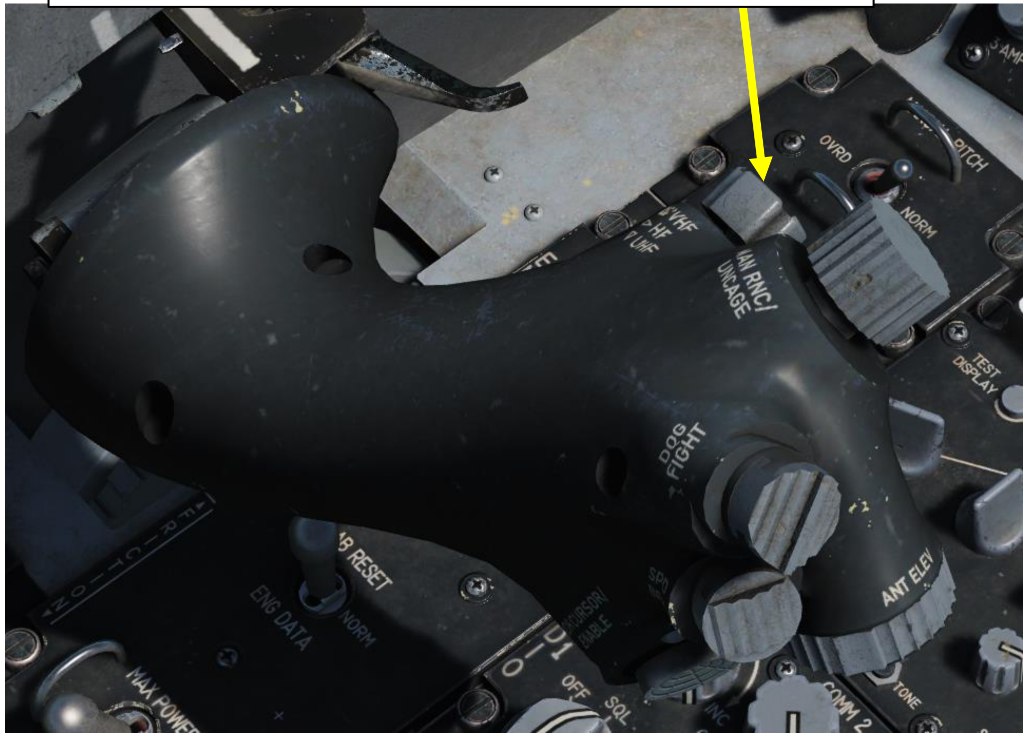
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.1 – Air-to-Air Radar Display & Performance

Track symbols displayed on the FCR page may be filtered using the UHF/VHF Transmit switch. This affects tracks displayed on the radar display only and does not affect those displayed on the HSD.

Positioning the **Transmit switch inboard short** (less than 0.5 sec) rotates between three filter options.

Positioning the **Transmit Switch outboard short** (less than 0.5 sec) selects **NONE** and removes all datalink tracks. Selecting **outboard short** again returns to the previously selected filter option.

Communications UHF/VHF Transmit Switch (4-Way)
- *Transmit Switch – IFF IN (INBOARD): Cycles filter options*
- *Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks*



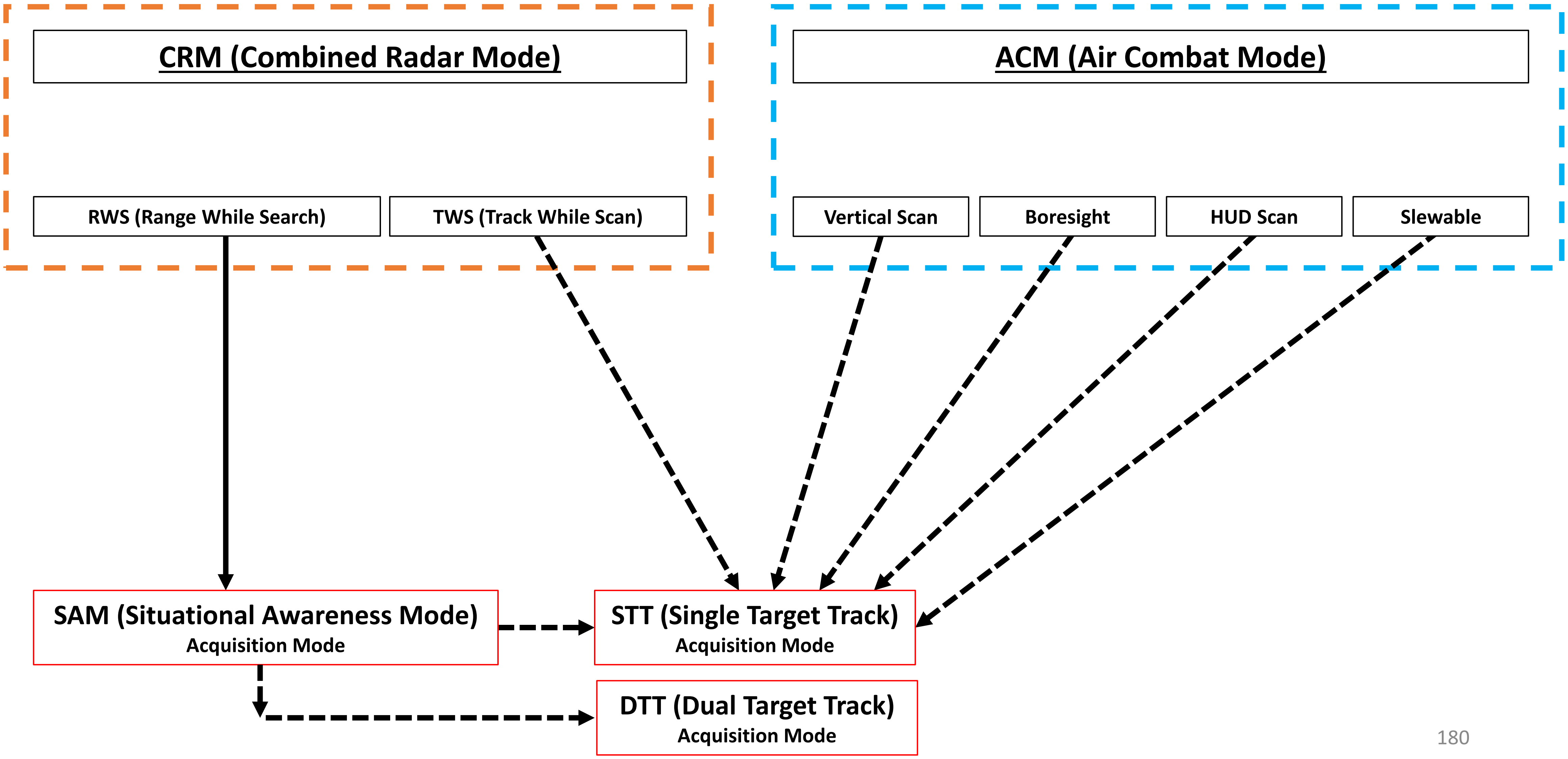
Filter Options
- **ALL:** All Datalink symbols are displayed
- **FTR+:** Datalink Surveillance tracks are removed
- **TGTS:** Datalink Surveillance and PPLI tracks are removed
- **NONE:** No Datalink symbols are displayed

Datalink Tracks

FCR (Fire Control Radar) Page

Datalink Contacts filtered out

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.2 – Air-to-Air Main Modes Overview



2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.2 – Air-to-Air Main Modes Overview

The radar has the following main modes: **BVR** (Beyond Visual Range, used for long-distance engagements), and **ACM** (Air Combat Maneuvering, used for close air engagements), and STT (Single Target Track).

BVR Search sub-modes include:

- **CRM** (Combined Radar Mode): CRM mode is selected by default at power-up. It is designed to reduce pilot workload by combining air-to-air submodes used for search under one interface. CRM sub-modes include RWS (Range While Search) and TWS (Track While Scan). These may also be cycled using the HOTAS by holding TMS (Target Management Switch) right for more than one second.

- **RWS** (Range While Search): RWS radar mode allows for detection of contacts in a large volume. It is the default search mode for air-to-air or when an air-to-air missile is placed in priority. RWS mode provides all-aspect (nose-on, tail-on) and all altitude (look-up, look-down) target detection. The display shows range as the vertical axis and azimuth angle on the horizontal.

- **TWS** (Track While Scan): TWS maintains an actual track on several aircraft while still searching for others. While in TWS mode, the radar can maintain up to 10 trackfiles (targets). The radar allocates part of its power to tracking the target or targets while part of its power is allocated to scanning, unlike the straight tracking mode, when the radar directs all its power to tracking the acquired targets. In the TWS mode the radar has a possibility to acquire additional targets as well as providing an overall view of the airspace and helping maintain better situational awareness. Since the radar is sharing its computing time between targets, the accuracy is less precise than for a single target track (STT) mode of operation. TWS mode allows for trackfiles to be kept at a high update rate. To accomplish this, TWS artificially limits the scan volume (bars/azimuth) and provides for automatic scan centering. It is also optimal for providing post-launch datalink for the AIM-120 AMRAAM missile while remaining in search.

- **SAM** (Situational Awareness Mode): SAM mode is a hybrid mode between RWS and STT. When locking a target in RWS mode, the radar enters SAM mode. In SAM mode, radar will periodically scan the locked target while scanning the whole area, and the controls are basically the same as RWS. In other words, target acquisition and lock is initiated by placing the acquisition cursor over a target, positioning the TMS on the stick forward once, then releasing the TMS. This starts the Situational Awareness Mode (SAM) acquisition sequence. During acquisition, the antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.

- **Radar Spotlight** Mode: When either in Range While Search or Track While Scan radar modes, a Spotlight Scan can be required to designate the target at longer ranges. To do so, place the radar cursor over the desired target on the FCR and press and hold the Target Management Switch UP for greater than one second. This will place the radar into 10-degree azimuth and elevation scan of a small volume to rapidly build track history. For best results, lead the target a tiny bit and let the radar build three to four target histories before releasing the Target Management Switch and commanding the radar track the target.

---

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.2 – Air-to-Air Main Modes Overview

STT

STT (Single Target Track): STT mode is a traditional radar "lock" where the radar continuously scans a single target, resulting in a very high update rate; this makes it the primary method of providing guidance to air-to-air weapons. STT maintains a trackfile for its target and automatically designates it. The radar is slaved to this trackfile; as such, manual antenna elevation control is inhibited and the B-sweep follows the trackfile. Only the trackfile that is placed in STT is visible and all onboard trackfiles are dropped. In STT, the FCR page format is presented in azimuth along the horizontal axis and range along the vertical axis.

Single Target Track is obtained by:
- Placing the acquisition cursor over a target (with the Radar Cursor switch), positioning the TMS (Target Management Switch) on the stick FWD twice in quick succession, then releasing the TMS.
- using an Air Combat Maneuvering mode

STT is exited by pressing the TMS (Target Management Switch) on the stick AFT.
- TMS DOWN once returns to SAM mode with the target bugged.
- TMS DOWN twice returns to RWS mode.
- The radar is returned to the last-entered search mode.

DTT

DTT (Dual Target Track): Dual Target Track mode is entered from SAM by bugging a second target. In DTT mode, the radar will dwell on two targets while continuing a scan pattern centered around the secondary target. If the primary target closes within 10 nm of the aircraft, the scan pattern is inhibited, and the radar will “ping-pong” between the two bugged targets. In DTT, pressing TMS right will swap the primary and secondary targets. The radar will shift its scan pattern to be centered around the new secondary target. AIM-120 launches in DTT will track the primary target.

EXP

EXP (Expanded) Feature: The radar provides the ability to enter an expanded field of view display that allows sorting and resolution of closely grouped contacts. This can be thought of as a zoom feature that provides a 4:1 scale view centered around the radar cursor. This feature is available in all radar modes.

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.2 – Air-to-Air Main Modes Overview

ACM sub-modes include:

- **Vertical Scan**: Radar will scan in a 10°× 60° vertical area. The scan center is 23° above the HUD's gun cross. This mode is indicated by a vertical line extending from the gun cross to the bottom of the HUD. The lock range is 10 nautical miles. The radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode.

- **BORE** (Boresight): BORE scan pattern searches a small one-beamwidth area located 3° below the HUD's gun cross. An additional Boresight Cross is displayed on the HUD at the center of the radar scan zone to aid in positioning the target in the radar beam. BORE is useful for quickly locking a target within visual range (WVR) and allows a degree fine control as to the target being locked. The first target detected within 20 nautical miles is locked and automatically tracked in STT mode.

- **HUD** (Heads-Up Display Area Scan): Radar will scan the HUD area (30°× 20°). The lock range is 10 nautical miles. The radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode. There is no special HUD symbology for this submode. This submode is less precise than the BORE submode and may take longer to achieve a lock because of the larger target area for the radar scan to cover.

- **Slewable**: The scan pattern is approximately 20° high x 60° wide. When selected, the scan is centered directly in front of the aircraft on the horizon. The scan is slewable via the CURSOR/ENABLE control on the throttle until a target is acquired. The amount of slew is limited by the radar gimbal limits. As with the other submodes, the radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode. This mode is useful when you have a direction to look, for example 'bandits 2 o'clock high', but have not picked them up visually yet.

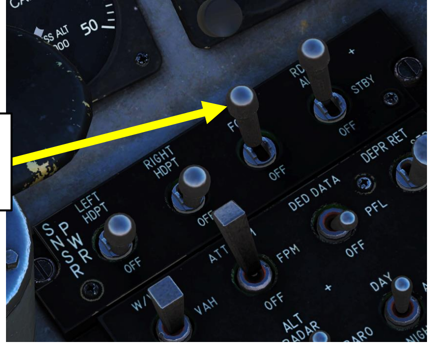
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3 – Air-to-Air CRM (Combined Radar Mode)

The Combined Radar Mode (CRM) is selected by default at power-up. It is designed to reduce pilot workload by combining air-to-air submodes used for search under one interface.

If you are using another radar mode, CRM Mode can be selected by:

1. Verifying that the FCR Power Switch is ON (FWD)
2. Selecting FCR page
3. Pressing OSB (Option Select Button) next to Radar Mode Selector Field
4. Pressing OSB next to CRM
5. CRM Sub-Modes can be toggled using the OSB next to the Radar Sub-Mode Selector Field.

1 FCR (Fire Control Radar) Power Switch



Radar Mode Selected
- CRM: Combined Radar Mode
- ACM: Air Combat Mode
- GM: Ground Mapping
- GMT: Ground Moving Target
- SEA: Sea Mode
- BCN: Beacon Mode
- STBY: Standby Mode

5

Radar Sub-Mode Selector
RWS: Range While Search
TWS: Track While Scan
VSR: Velocity Search with Ranging

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3 – Air-to-Air CRM (Combined Radar Mode)

CRM Sub-modes are:
- **RWS (Range While Search)**
- **TWS (Track While Scan)**
- **VSR (Velocity Search with Ranging)**

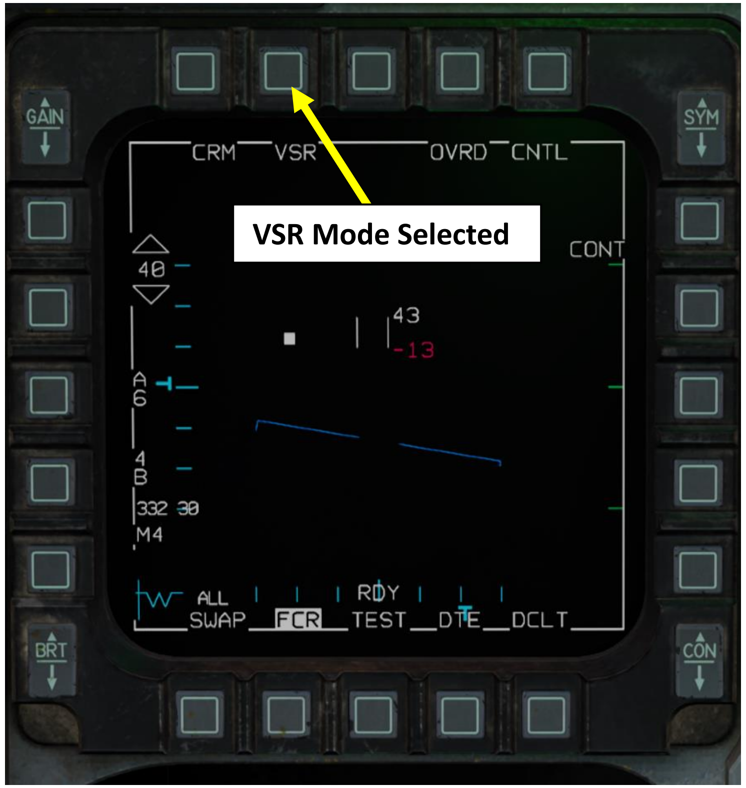
- **DMS DOWN**: sets the FCR page as the Sensor of Interest (SOI)
- **TMS RIGHT LONG**: Cycles between RWS and TWS sub-modes.

Note: Cycling between RWS and TWS sub-modes can also be done by pressing the OSB (Option Select Button) next to RWS/TWS.

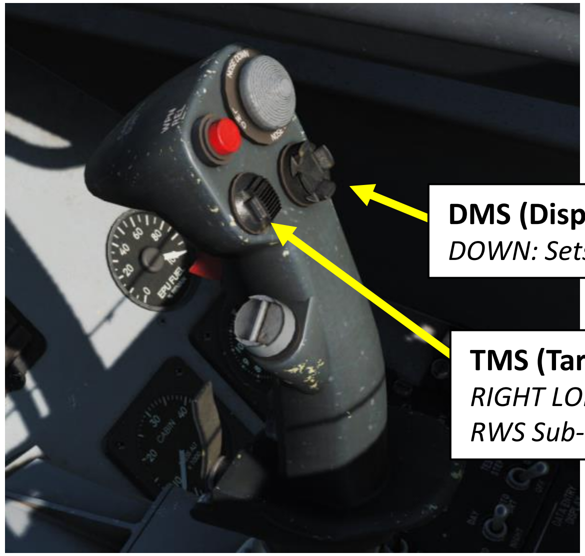
VSR (Velocity Search with Ranging) Mode can only be selected with the Radar Sub-Mode Selector Button on the FCR page.
- VSR mode allows additional detection range of nose-on aspect targets.
- It interleaves High Pulse Repetition Frequency (HPRF) with Medium Pulse Repetition Frequency (MPRF), but it does not support Situation Awareness Mode (SAM). The HPRF acts as an alert scan in which the target is detected along with its angle and velocity. The following MPRF scan determines range information.
- VSR will only be effective when the nose of the target is in high aspect to you.
- Once a target is detected in VSR, it can be designated and tracked as a Single Target Track (STT). This can be a useful mode to detect and lock onto high aspect targets at greater ranges than possible in Range While Search and Track While Scan CRM modes.

Radar Mode Selected
- CRM: Combined Radar Mode
- ACM: Air Combat Mode
- GM: Ground Mapping
- GMT: Ground Moving Target
- SEA: Sea Mode
- BCN: Beacon Mode
- STBY: Standby Mode

Radar Sub-Mode Selector
RWS: Range While Search
TWS: Track While Scan
VSR: Velocity Search with Ranging



VSR Mode Selected



DMS (Display Management Switch)
DOWN: Sets FCR page as SOI

TMS (Target Management Switch)
RIGHT LONG: Cycles between TWS and RWS Sub-Modes

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.1 – Air-to-Air RWS (Range While Search) Mode

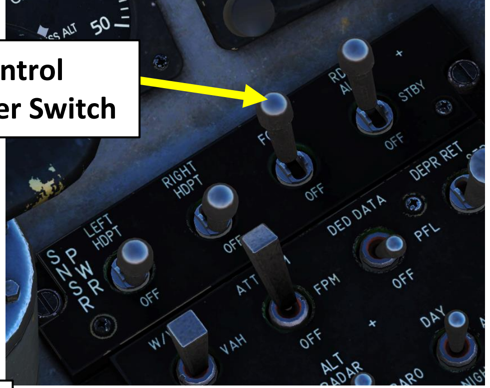
The Range While Search (RWS) submode is used for long-range acquisition and engagement. The pilot can set the acquisition range (10, 20, 40, 80, or 160 nautical miles) and change the azimuth width and elevation. You can then select a specific track and lock it into STT mode.

<u>**RWS is selected in the following manner:**</u>

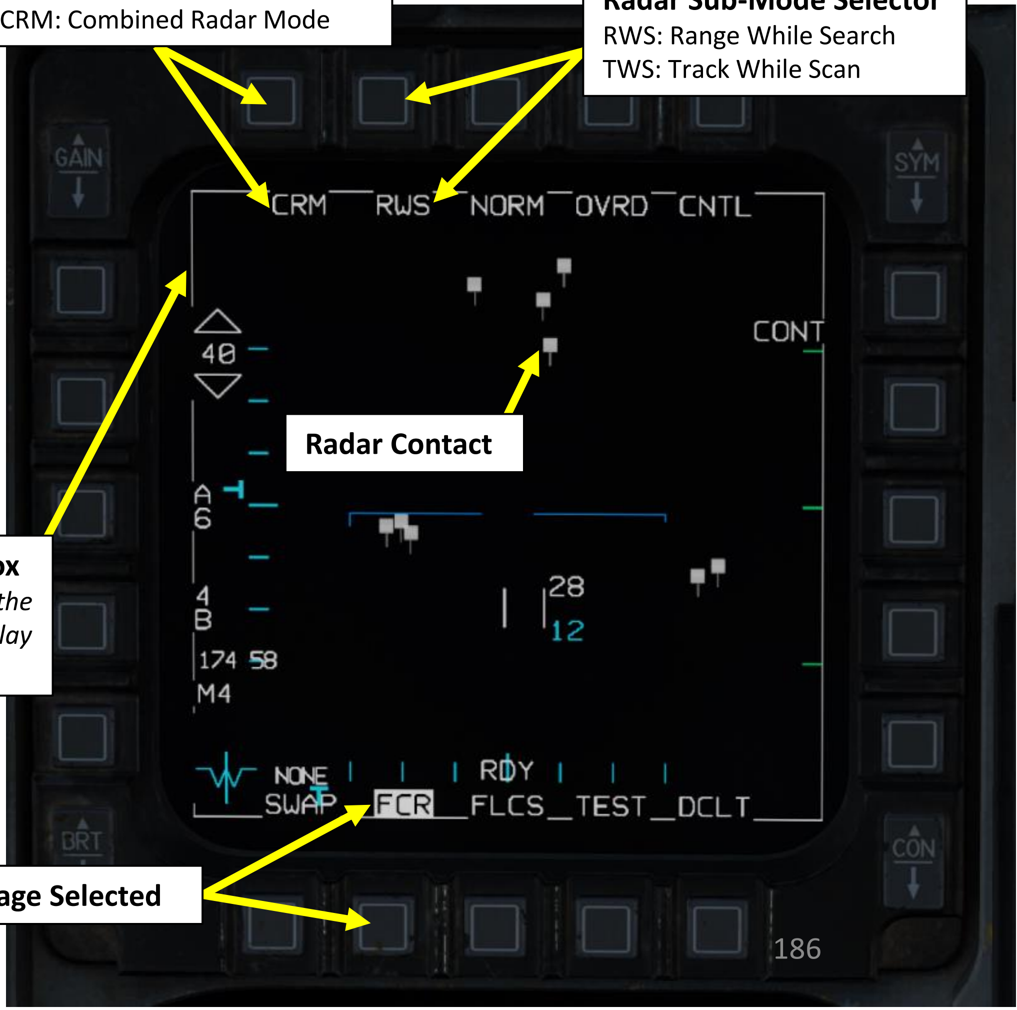
1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. Select RWS mode by either:
    a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
    b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.

Note 1*: from RWS Mode, you can either transition to SAM (Situational Awareness Mode) Mode or lock a target using STT (Single Target Track) Mode. Consult relevant SAM and STT sections to know how to transition to these modes.*

Note 2*: When in Range While Search radar mode, a* ***Spotlight Scan*** *can be required to designate the target at longer ranges. To do so, place the radar cursor over the desired target on the FCR and press and hold the Target Management Switch UP for greater than one second. This will place the radar into 10-degree azimuth and elevation scan of a small volume to rapidly build track history. For best results, lead the target a tiny bit and let the radar build three to four target histories before releasing the Target Management Switch and commanding the radar track the target.*



FCR (Fire Control Radar) Power Switch



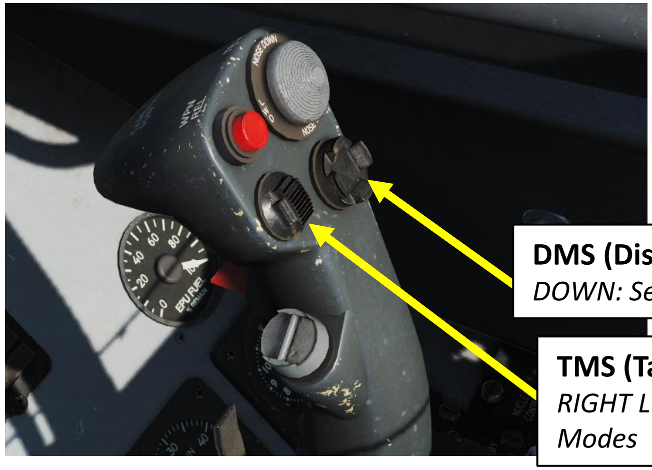
Radar Mode Selected
CRM: Combined Radar Mode

Radar Sub-Mode Selector
RWS: Range While Search
TWS: Track While Scan

Radar Contact

SOI (Sensor of Interest) Control Indication Box
The current SOI can be identified by the box around the MFD screen. The SOI is changed from display to display with the Display Management Switch (DMS).

FCR Page Selected



DMS (Display Management Switch)
DOWN: Sets FCR page as SOI

TMS (Target Management Switch)
RIGHT LONG: Cycles between TWS and RWS Sub-Modes

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

INTRODUCTION

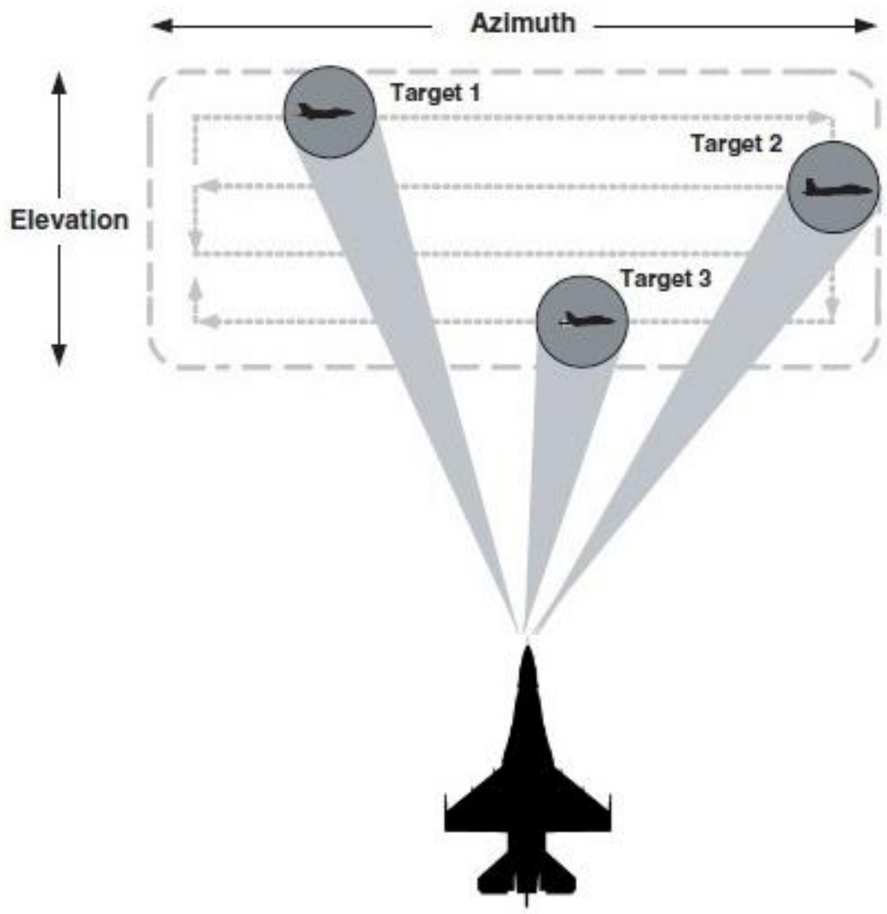
TWS (Track While Scan) mode combines the information unique to RWS and STT (Single Target Track) modes. Generally, the TWS display is very similar to the RWS display. TWS mode allows for trackfiles to be kept at a high update rate. To accomplish this, TWS artificially limits the scan volume (bars/azimuth) and provides for automatic scan centering. It is also optimal for providing post-launch datalink for the AIM-120 AMRAAM missile while remaining in search.

When combined with the AIM-120, TWS provides a powerful ability to engage multiple targets quickly. Nevertheless, the target tracking reliability is less than STT. Unlike STT though, a TWS launch with an AMRAAM will not provide the enemy aircraft with a radar lock and launch indication. As such, the first warning the enemy pilot will likely get is when the active radar seeker of the AIM-120 missile goes active near the target.

TWS has several restrictions. The radar will attempt to build track files for each contact, but given a large scan volume, there will be a sizable refresh time between scans. During each scan the radar will try to predict the position of the contact for the next scan. If, however the target takes evasive, high-G maneuvers and quickly changing its trajectory and speed, the radar can lose the track by making an incorrect track file prediction. Using such a defensive tactic, the hunter can quickly become the hunted.

Since TWS mode is one of the more complex (yet powerful!) radar modes, this section will be divided in the following sub-sections:

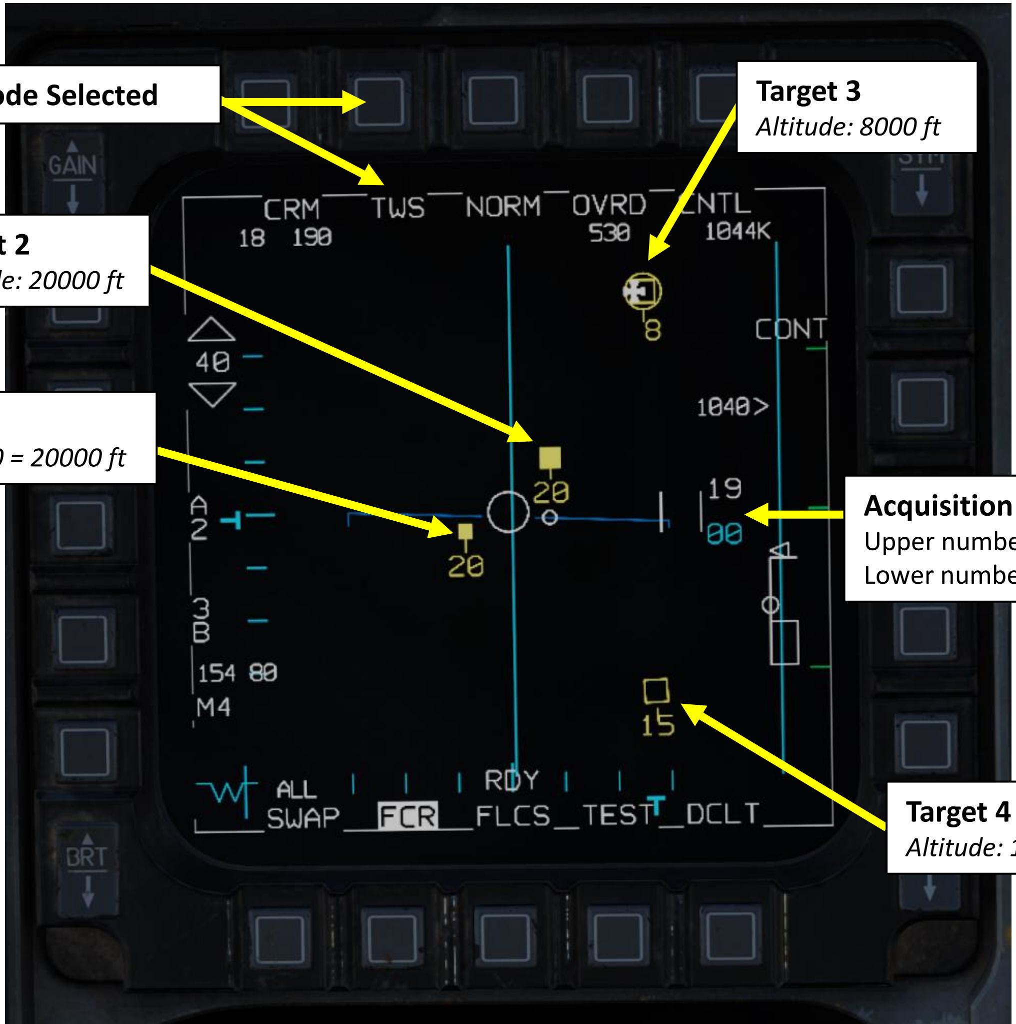
- **A: Information Display**
- **B: Symbology & Target Types**
- **C: TWS Scanning**
- **D: TWS Designation**

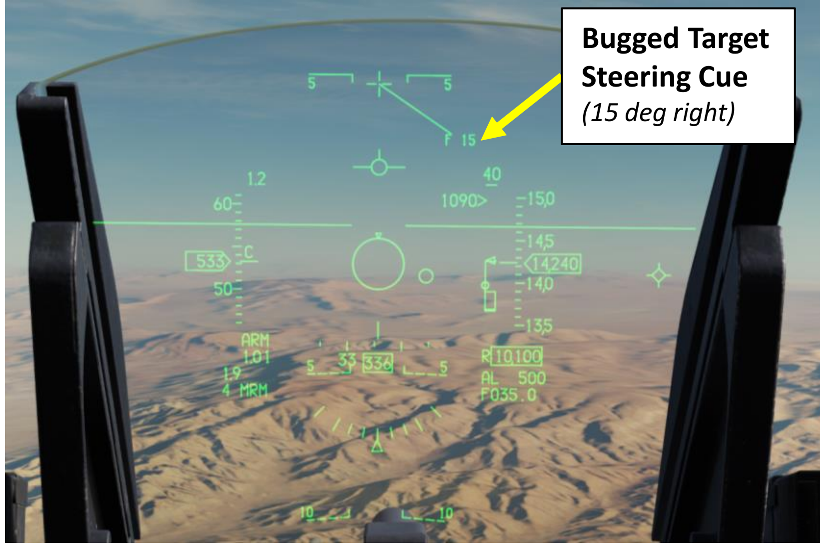


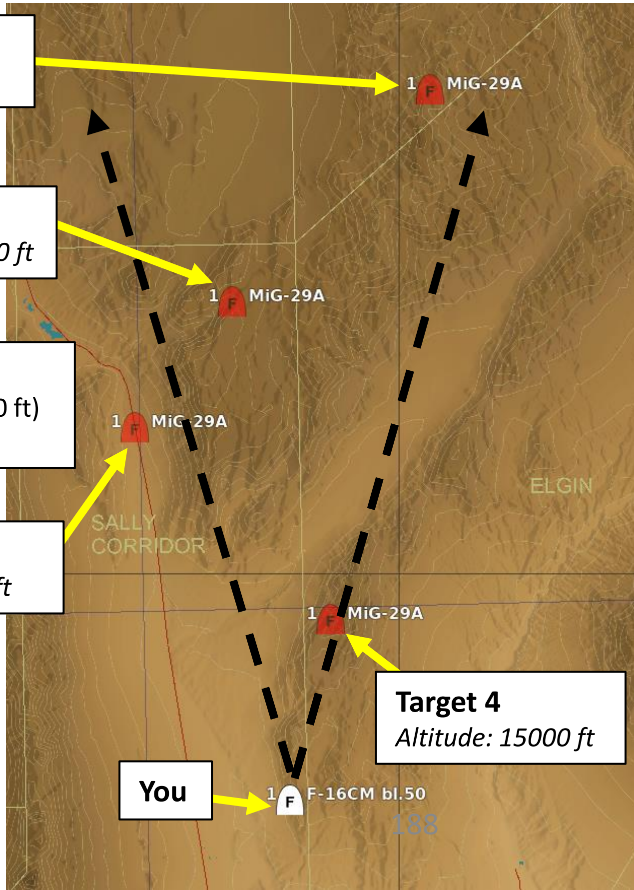
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

A – INFORMATION DISPLAY

TWS (Track While Scan) “Track Files” (fancy term for radar contacts) are established on up to 10 targets based on information received on each radar sweep. The radar scan volume options are identical to those used for RWS but are **reduced to 3-bar, ±25 degrees when a target is designated**.







2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

B – SYMBOLOGY & TARGET TYPES

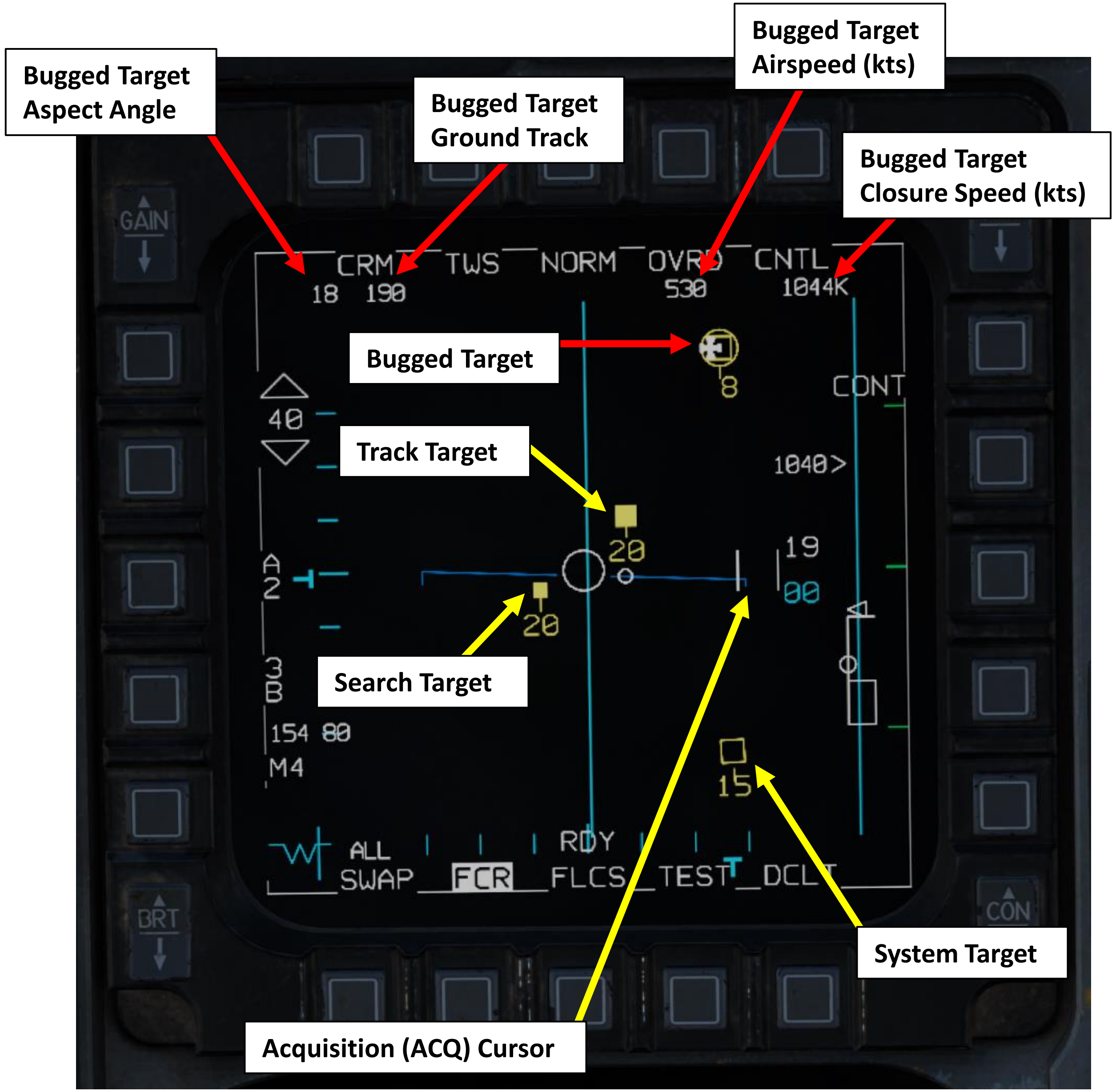
Four types of target symbols are available to help sort contacts in order of priority: **Search Target, Track Target, System Target** and **Bugged Target**.

- **Search Target:** These are radar contacts that have not been resolved well enough to build a track. These are displayed as a small box in much the same way as in RWS. These targets disappear after a few sweeps if a track cannot be obtained. If a valid track is obtained, usually after being detected on two consecutive sweeps, the contact becomes a Track Target.

- **Track Target:** These targets are displayed as large filled boxes with a velocity vector line showing their direction of travel. Their altitude is displayed just below each contact. Up to 10 of these tracks may be present at one time. Track targets can be considered the baseline contact type. Other options become available after a contact has reached this stage. Contacts that are determined to be friendly through IFF interrogation or other means may be left as a Track Target. Contacts that require closer attention can be transitioned to System Targets.

- **System Target:** The purpose of system targets is to ease designation and tracking of the contacts considered most important. These are displayed as empty boxes and include the velocity vector line and altitude.

- **Bugged Target:** This is the highest priority of all the tracked targets and the target an AIM-120 missile fired at that moment will engage. It is displayed as a contact with a circle around it.



2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

B – SYMBOLOGY & TARGET TYPES

Now that we know what different target types there are, how do we transition from one to the other?

Search Target

Track Target

System Target

Bugged Target

Acquisition (ACQ) Cursor

Search Target → **Track Target** → **System Target** → **Bugged Target** → **Radar STT Lock**

If a valid track is obtained from a **Search Target**, usually after being detected on two consecutive antenna sweeps, the contact becomes a Track Target automatically.

Track targets can be transitioned to system targets in two ways:

- Place the **Acquisition Cursor** over a track target with the **Radar Cursor Switch** and select **TMS UP** on the stick to transition only that target

Or…

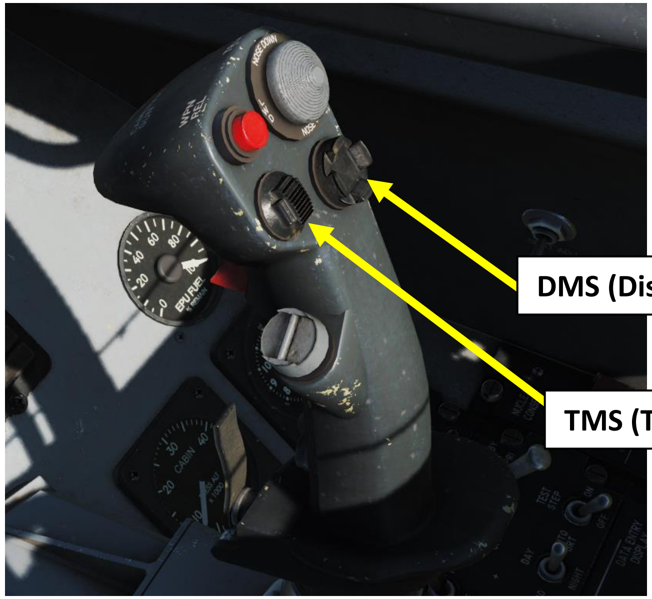
- **TMS RIGHT** on the stick to transition all track targets to system targets if no other system targets are displayed.

System Targets can be designated as the bugged target by placing the **Acquisition Cursor** over it with the **Radar Cursor Switch** and **TMS UP** on the stick. This transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track.

- **TMS RIGHT** will also select the closest system target as the bugged target.
- **Subsequent presses of TMS RIGHT** will cycle through all displayed system targets, making each the bugged target in turn.

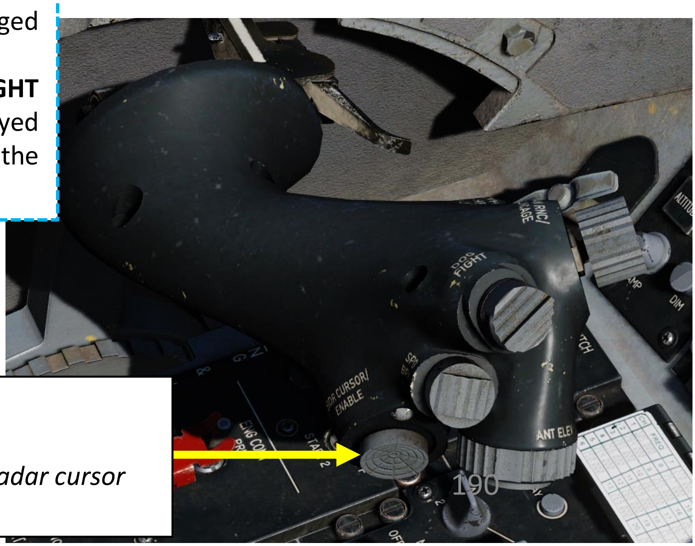
A Bugged Target may be transitioned to an STT (Single Target Track Radar Lock) track by selecting **TMS UP** with the **Acquisition Cursor** over the bugged target.

- Selecting **TMS DOWN** from STT returns to the TWS mode. Each subsequent TMS DOWN downgrades the status of the track files.



DMS (Display Management Switch)

TMS (Target Management Switch)



Radar Cursor/Enable Switch

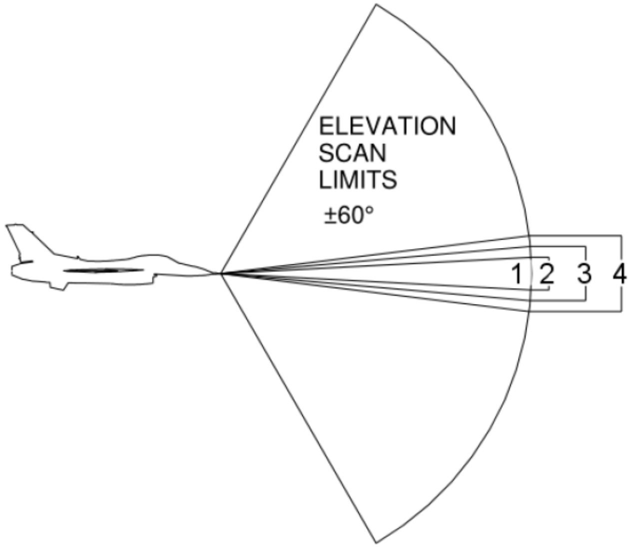
Depress, Multidirectional

- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

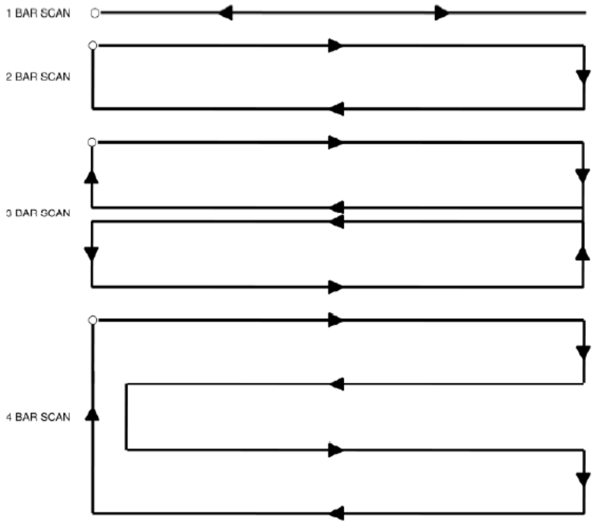
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

C – TWS SCANNING

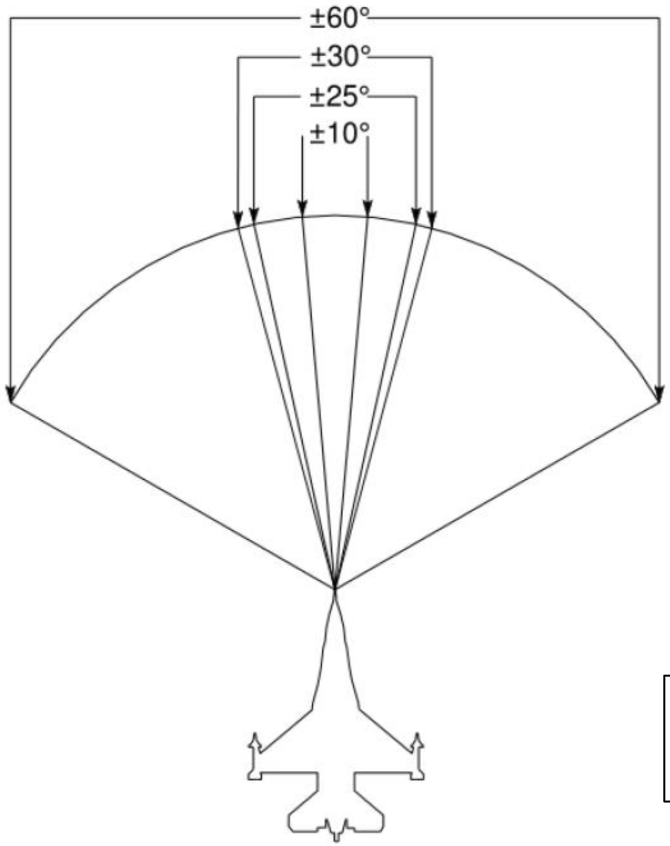
- The azimuth scans, depending on the mode, can be ±60° (the whole width of the radar scope) centred about the nose, or ±30°, ±25°, or ±10° centered about the acquisition (ACQ) cursor anywhere within the ±60° gimbal limits.
- **The ±25° azimuth (3 bar) scan is exclusive to Track-While-Scan (TWS) mode, which is only available when a bugged target is designated.**

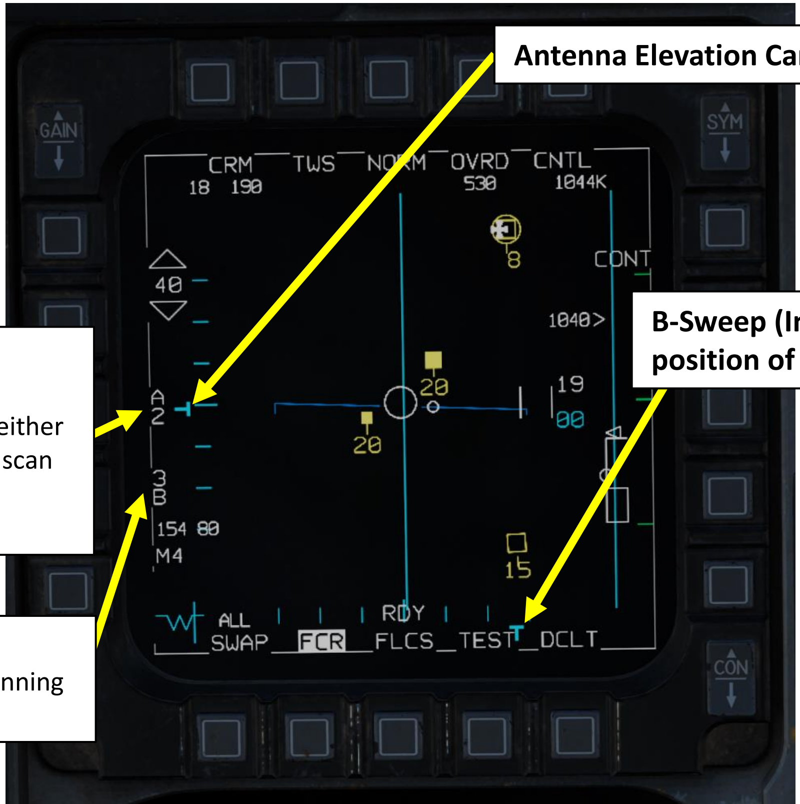


Radar Elevation Scan Limits



Radar Azimuth Limits





Antenna Elevation Caret

B-Sweep (Instantaneous azimuth position of radar antenna)

Radar Azimuth (Scan Width)
(can be set to +/-A10/30/60 deg)
- "A6" means the radar is scanning 60° to either side of boresight, which is the maximum scan azimuth. Options are A6, A3, A2 and A1.
- A2 stands for +/-25°

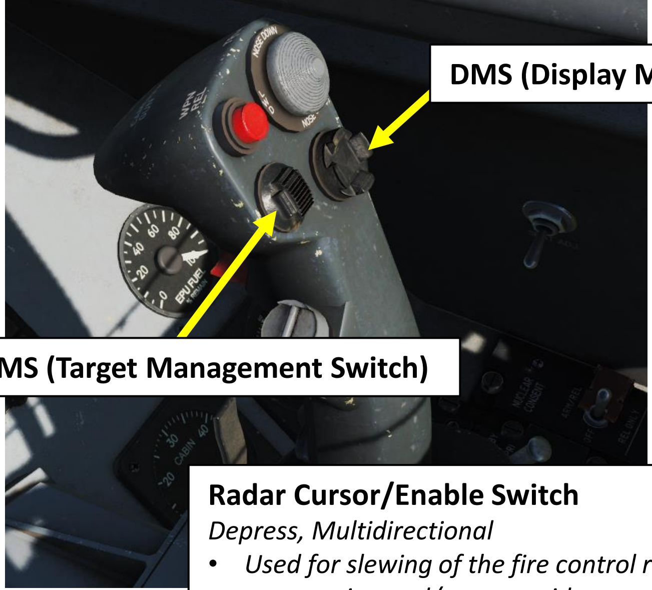
Elevation Bar Scan
Cycles between 1, 2, 3 and 4 bars of faster scanning
3B stands for "3 bars".

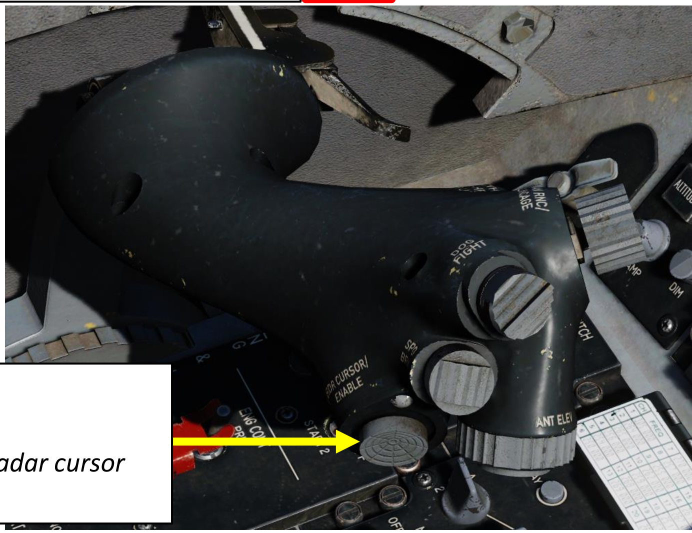
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

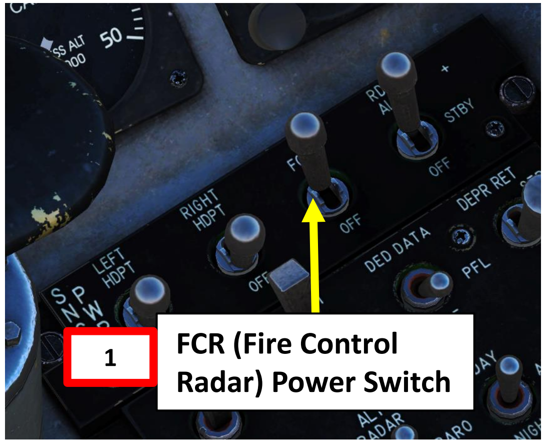
D – TWS DESIGNATION

1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. Select TWS mode by either:
    a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
    b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
4. Adjust radar range, azimuth and bar setting as desired.
5. Search targets will first appear when valid tracks (radar contacts) are obtained.
6. After being detected on two consecutive antenna sweeps, Search Targets become Track Targets automatically.

SOI (Sensor of Interest) Control Indication Box
The current SOI can be identified by the box around the MFD screen. The SOI is changed from display to display with the Display Management Switch (DMS).



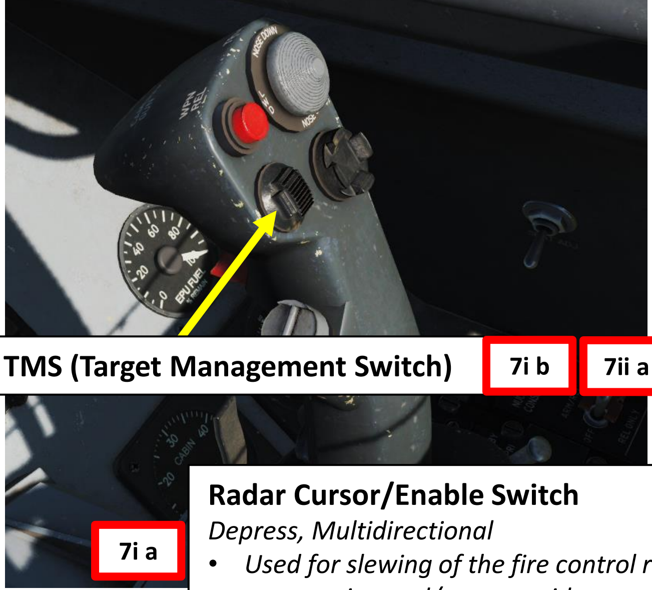


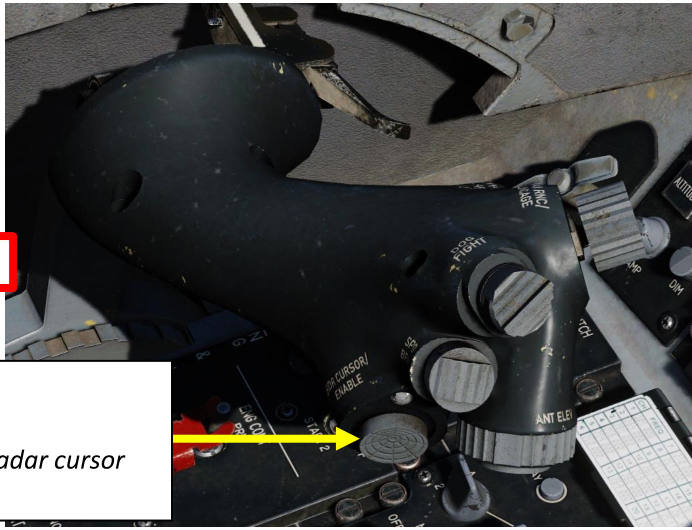


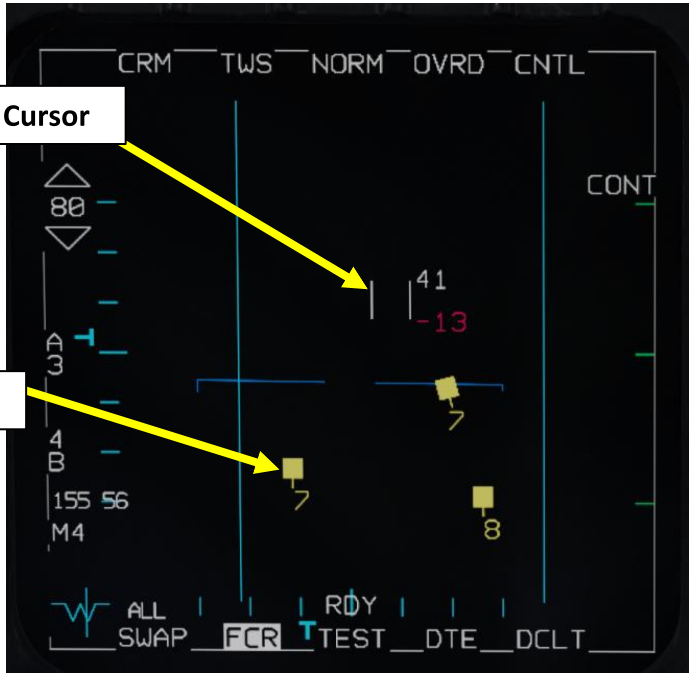
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

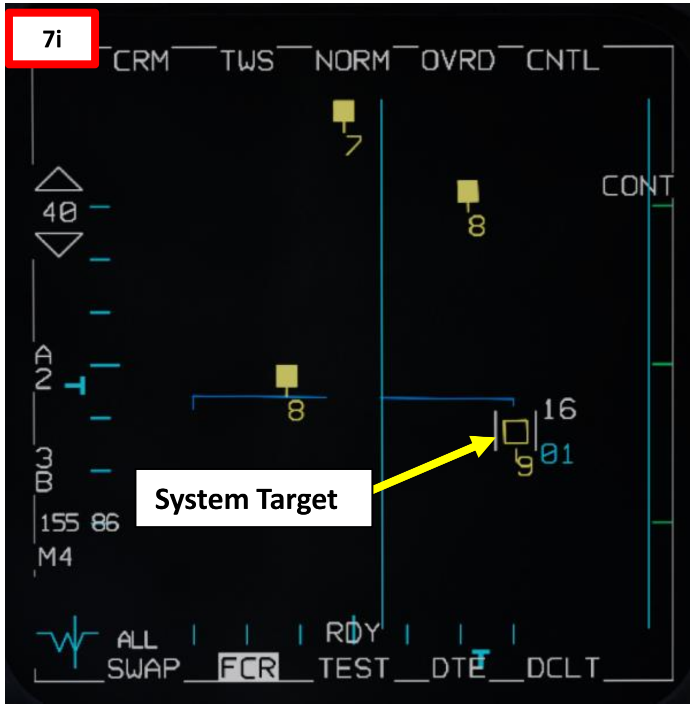
D – TWS DESIGNATION

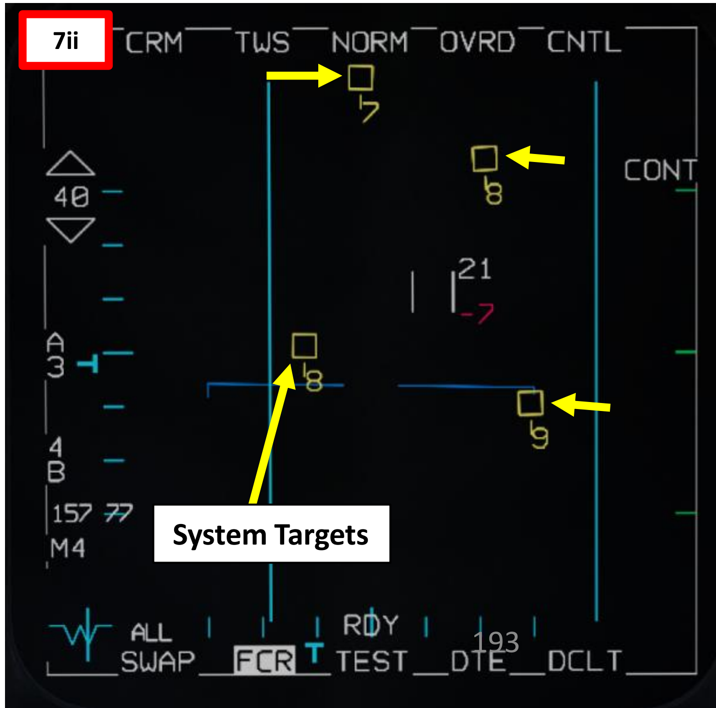
7. Transition Track Targets into System Targets, which can then be "bugged" subsequently. You can use two different procedures to do this:
   - i. **<u>PROCEDURE I: Establish a Cursor Target on the desired Track Target(s)</u>**
     - a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Track Target.
     - b) Press TMS (Target Management Switch) UP to set selected Track Target into a System Target.
     - c) Previous steps can be repeated to set other existing Track Targets into System Targets.
   - ii. **<u>PROCEDURE II: Transition all Track Targets into System Targets using TMS RIGHT SHORT</u>**
     - a) Press TMS (Target Management Switch) RIGHT SHORT
     - b) All existing Track Targets will transition into System Targets





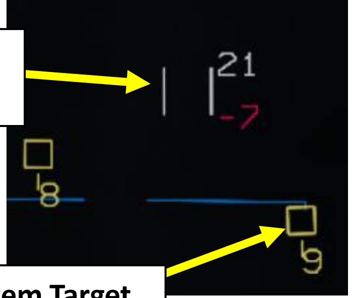


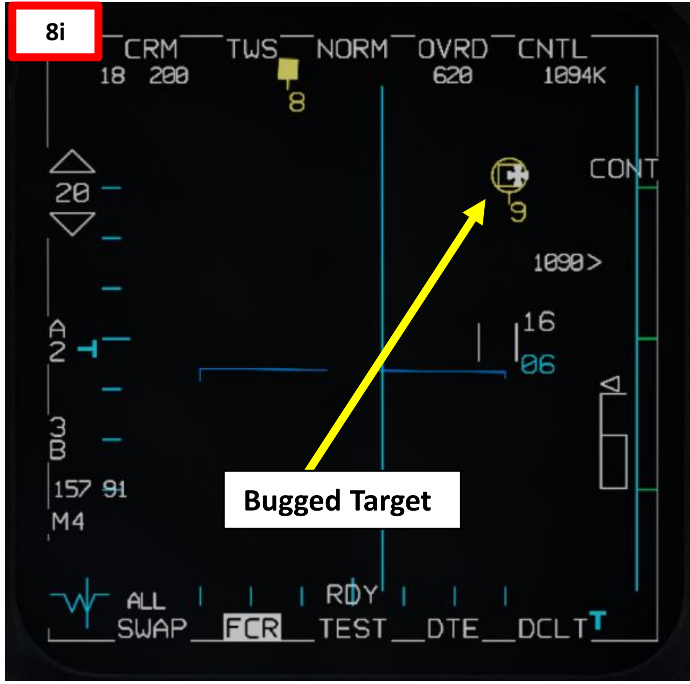




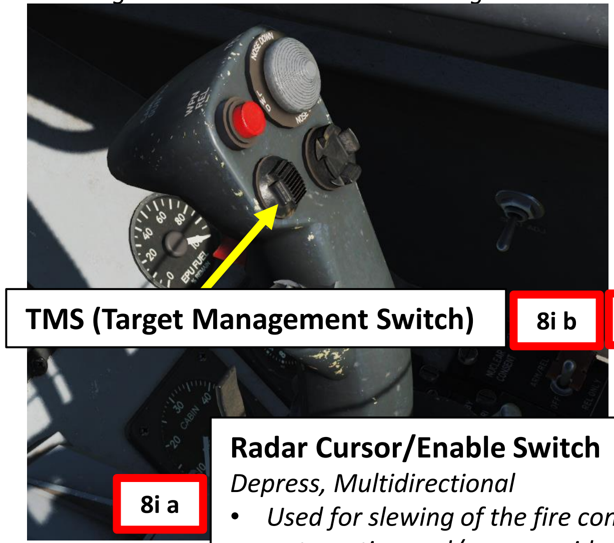
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

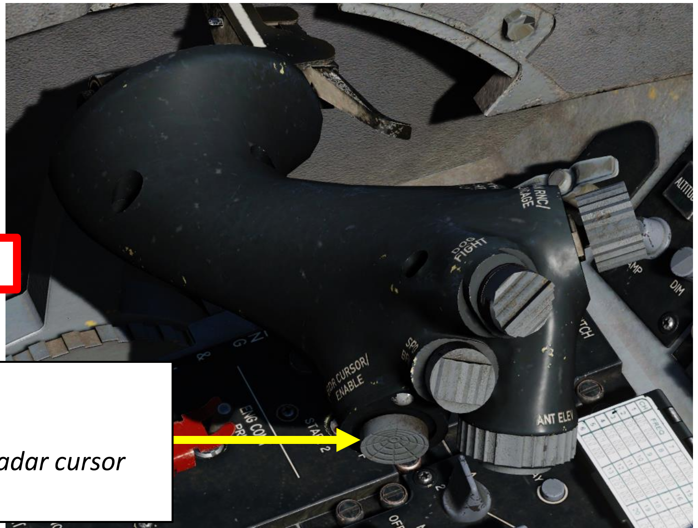
D – TWS DESIGNATION

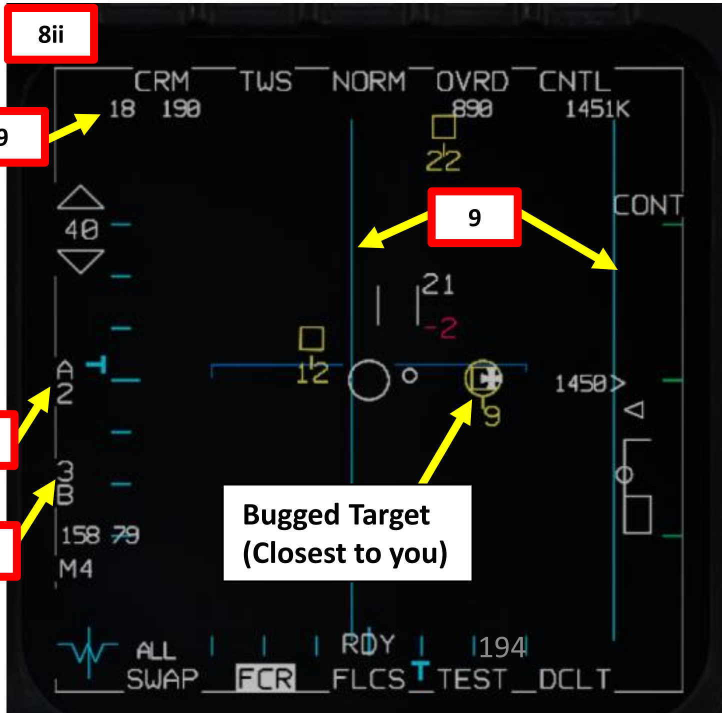




8. Designate the desired System Target as a “Bugged Target”. You can perform this in two ways:
   i. **PROCEDURE I: Bug System Target with Acquisition Cursor**
      a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired System Target.
      b) Press TMS (Target Management Switch) UP to set selected System Target into a Bugged Target.
   ii. **PROCEDURE II: Bug the closest System Target to you using TMS RIGHT SHORT**
      a) Press TMS (Target Management Switch) RIGHT SHORT
      b) System Target closest to you will automatically be selected as the Bugged Target.
      c) Subsequent presses of TMS RIGHT SHORT will cycle through all displayed System Targets, making each the Bugged Target in turn.
9. When a “Bugged Target” is designated, the radar automatically transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.
   - ***Note**: When in Track While Scan radar mode, a Spotlight Scan can be required to designate the target at longer ranges. To do so, place the radar cursor over the desired target on the FCR and press and hold the Target Management Switch UP for greater than one second. This will place the radar into 10-degree azimuth and elevation scan of a small volume to rapidly build track history. For best results, lead the target a tiny bit and let the radar build three to four target histories before releasing the Target Management Switch and commanding the radar track the target.*



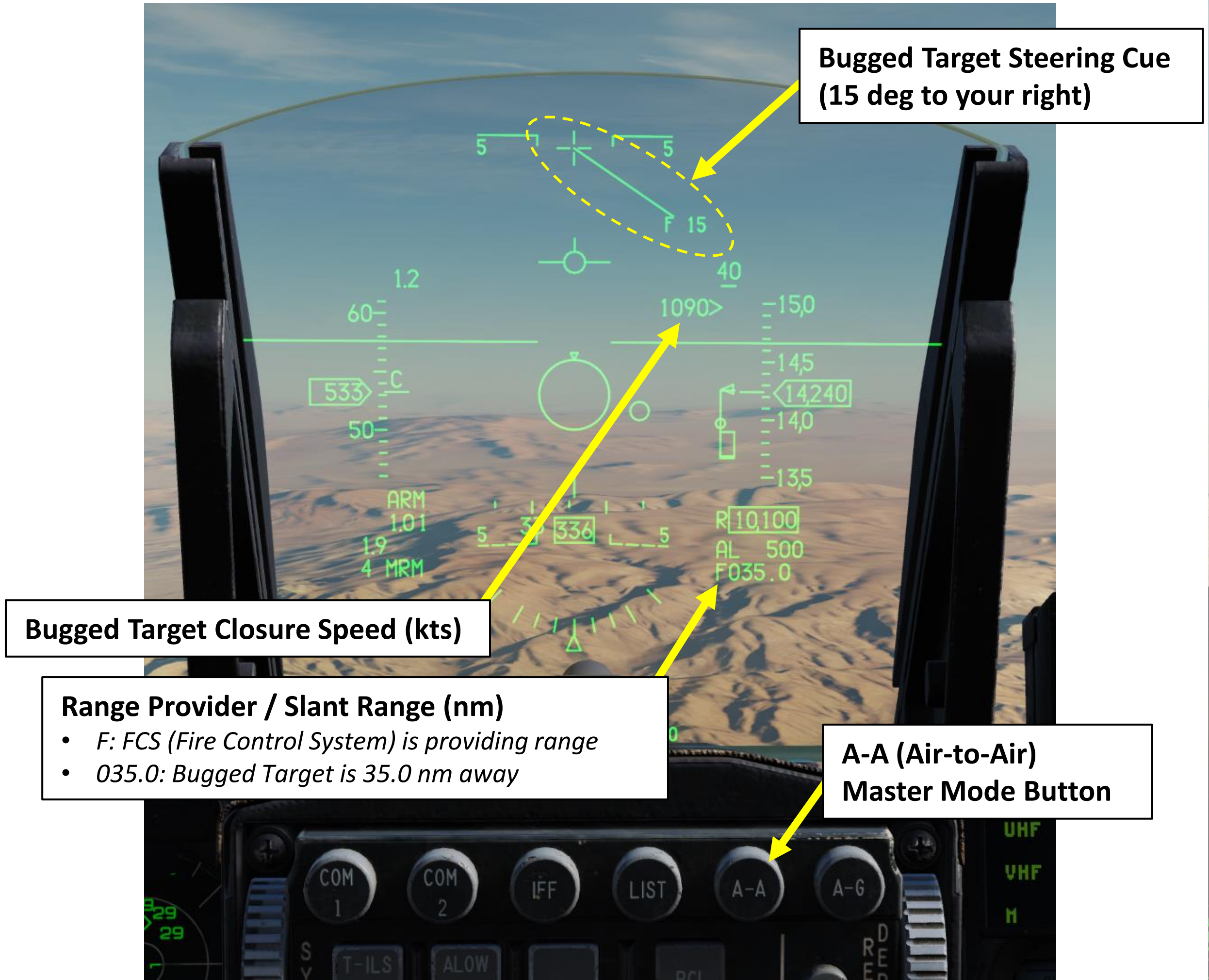




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

D – TWS DESIGNATION

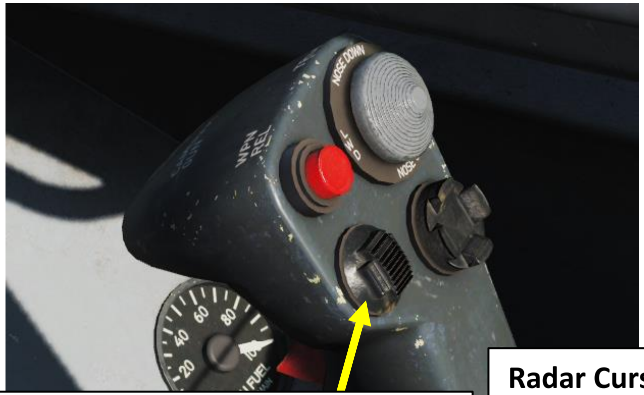
10. Depending on the direction of the target, either a Steering Cue (Tadpole) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.
    - *Note: The use of the A-A (Air-to-Air) Master Mode is not mandatory but strongly recommended if you want to use air-to-air missile symbology.*

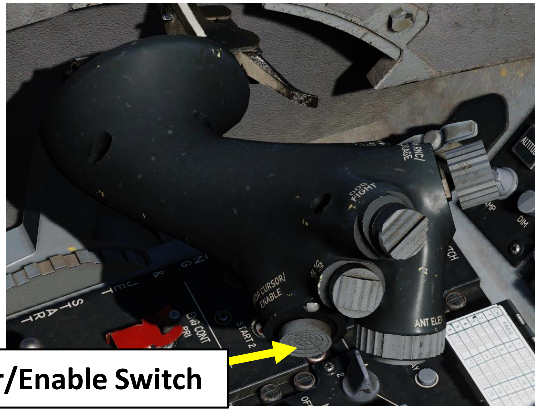


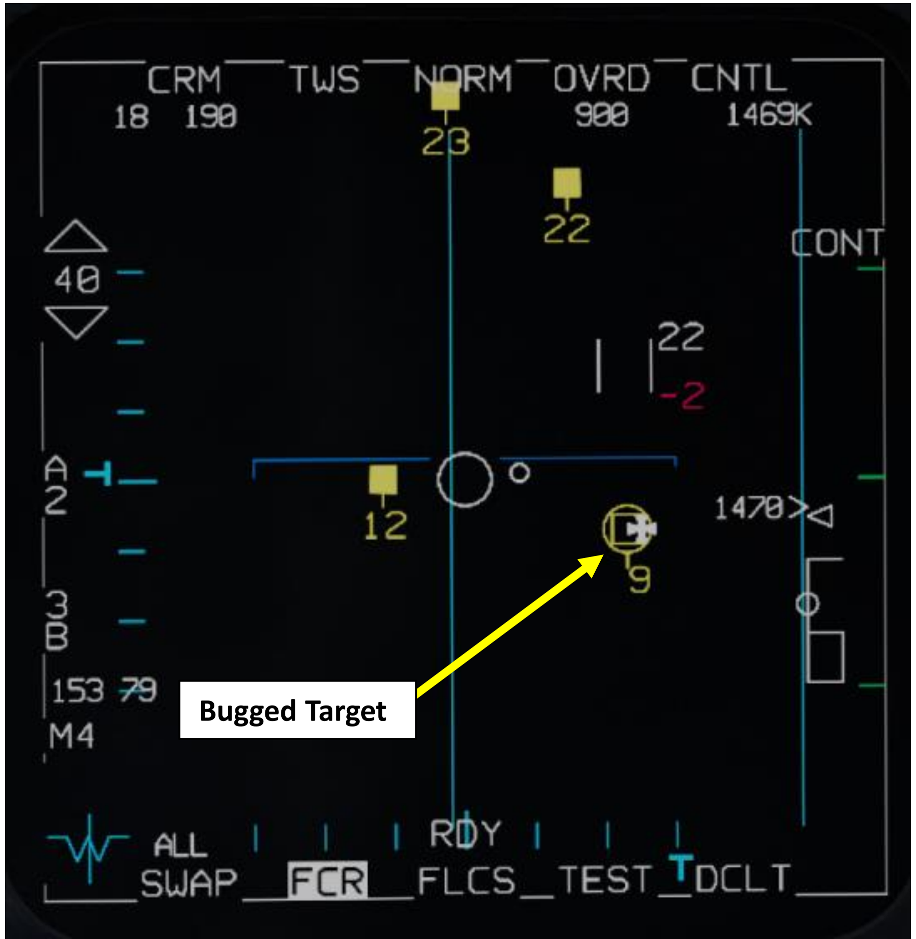
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.3.2 – Air-to-Air TWS (Track While Scan) Mode

D – TWS DESIGNATION

11. A Bugged Target may be transitioned to an STT (Single Target Track Radar Lock) Track by setting the Acquisition Cursor over the Bugged Target with the Radar Cursor Switch, then pressing TMS UP.
12. Selecting TMS DOWN from STT returns to the Track While Scan mode. Each subsequent TMS DOWN downgrades the status of the track files.







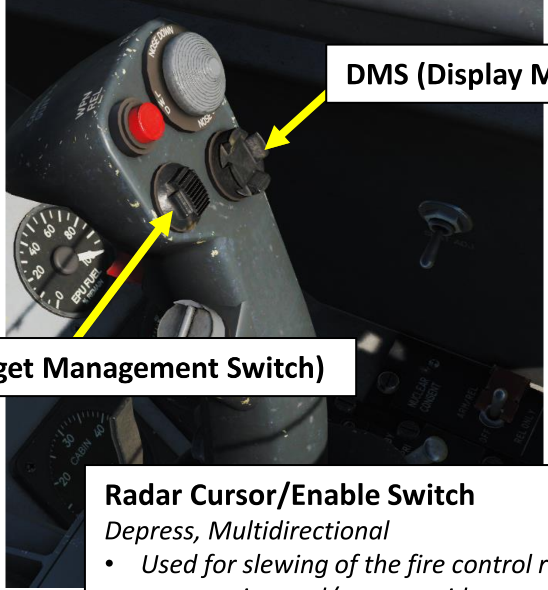
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

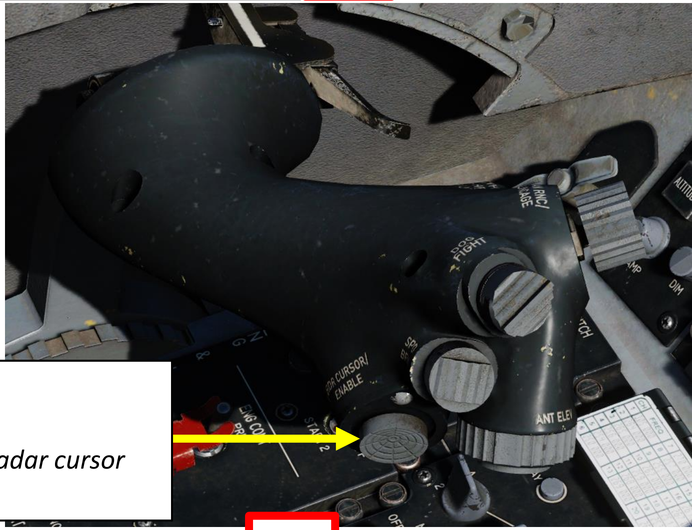
SAM (Situational Awareness Mode) is an “acquisition mode” (some sort of hybrid mode between RWS (Range While Search) and STT (Single Target Track/Radar Lock)). When locking a target in RWS mode, the radar enters SAM mode.

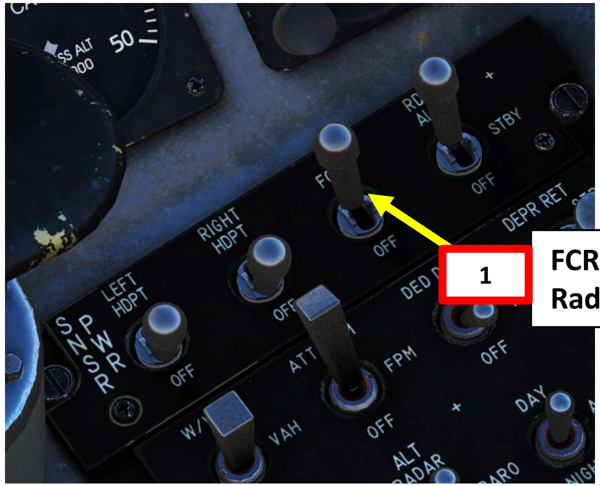
In SAM mode:

- Radar will periodically scan the locked target while scanning the whole area.
- The controls are basically same as RWS.
- During acquisition, the antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.

1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. Select RWS mode by either:
    a) Using the Radar Mode and Radar Sub-Mode OSBs (Option Select Button), or;
    b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
4. Adjust radar range, azimuth and bar setting as desired.
5. Search targets will first appear when valid tracks (radar contacts) are obtained.

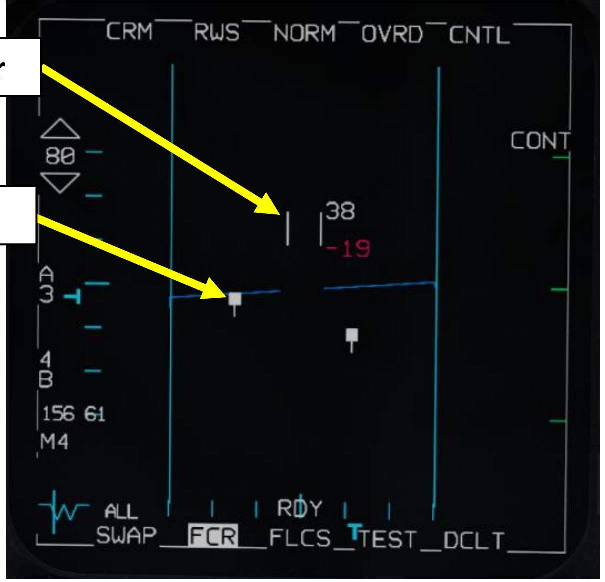


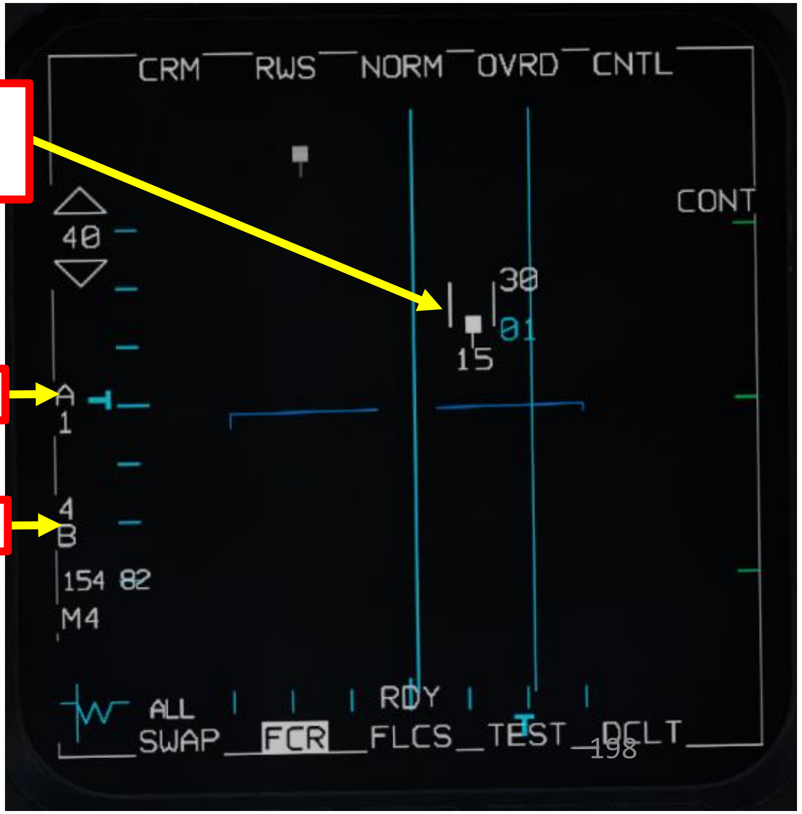


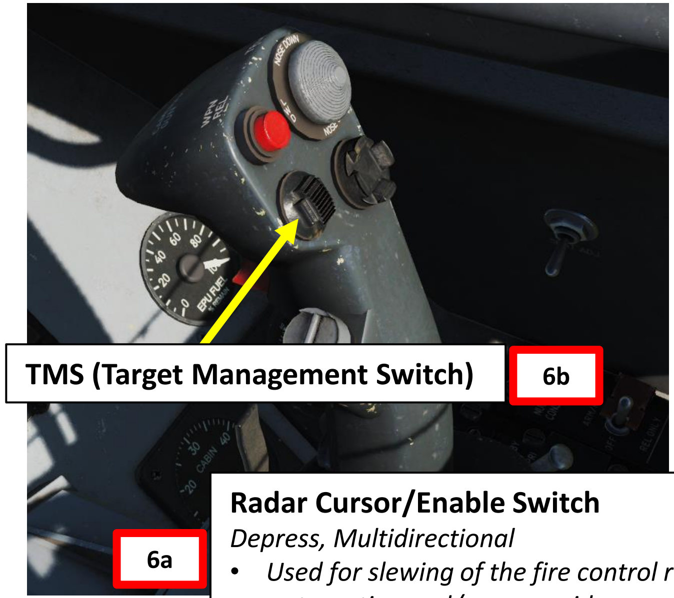
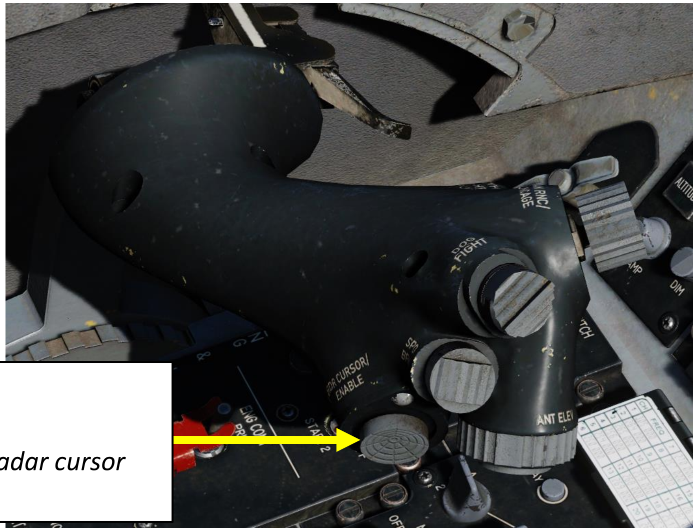


2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

6. Command SAM Mode
   a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Search Target.
   b) Press and hold TMS (Target Management Switch) UP to command SAM Mode.
7. Once Situational Awareness Mode (SAM) acquisition sequence is initiated, the radar antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed. Spotlight search will remain commanded as long as TMS UP is held.

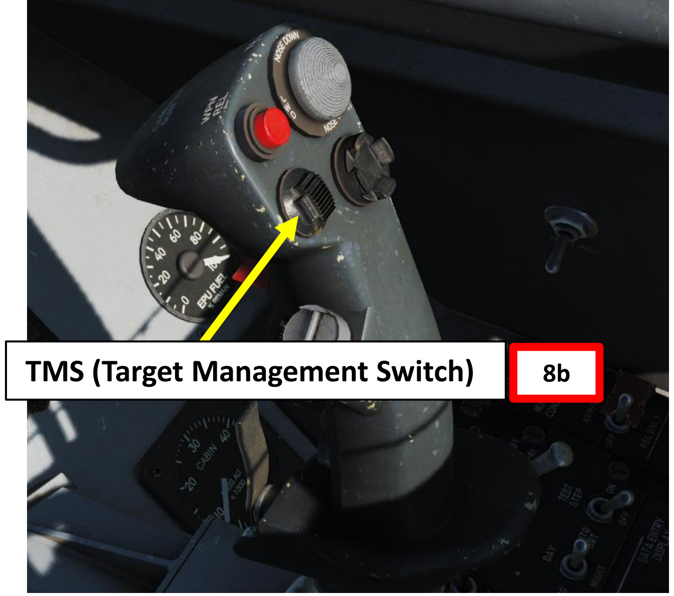


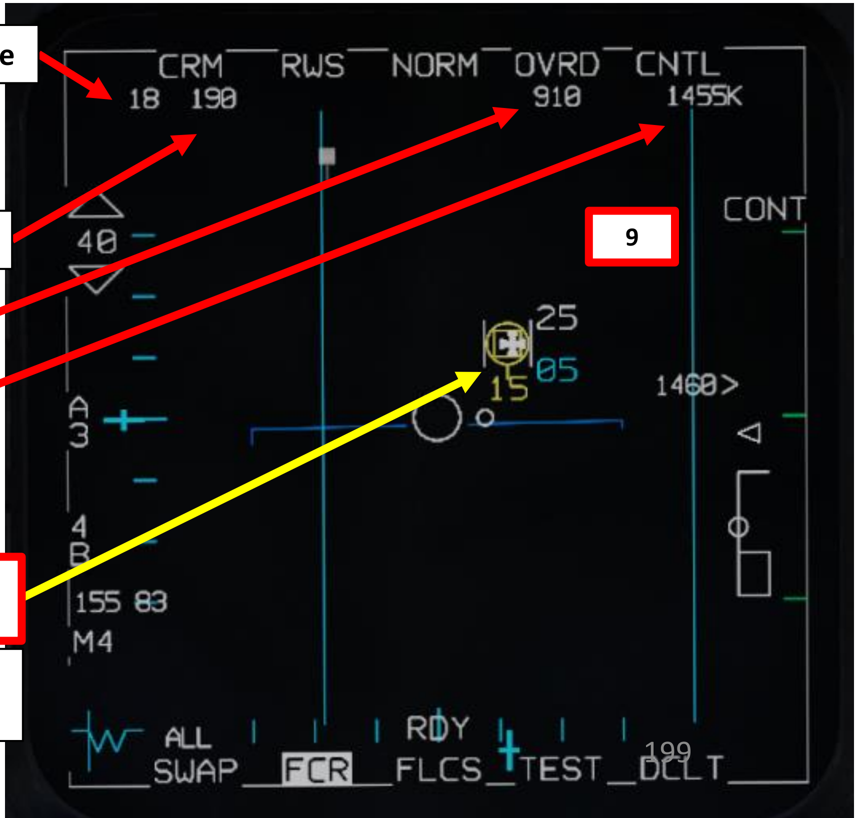


2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

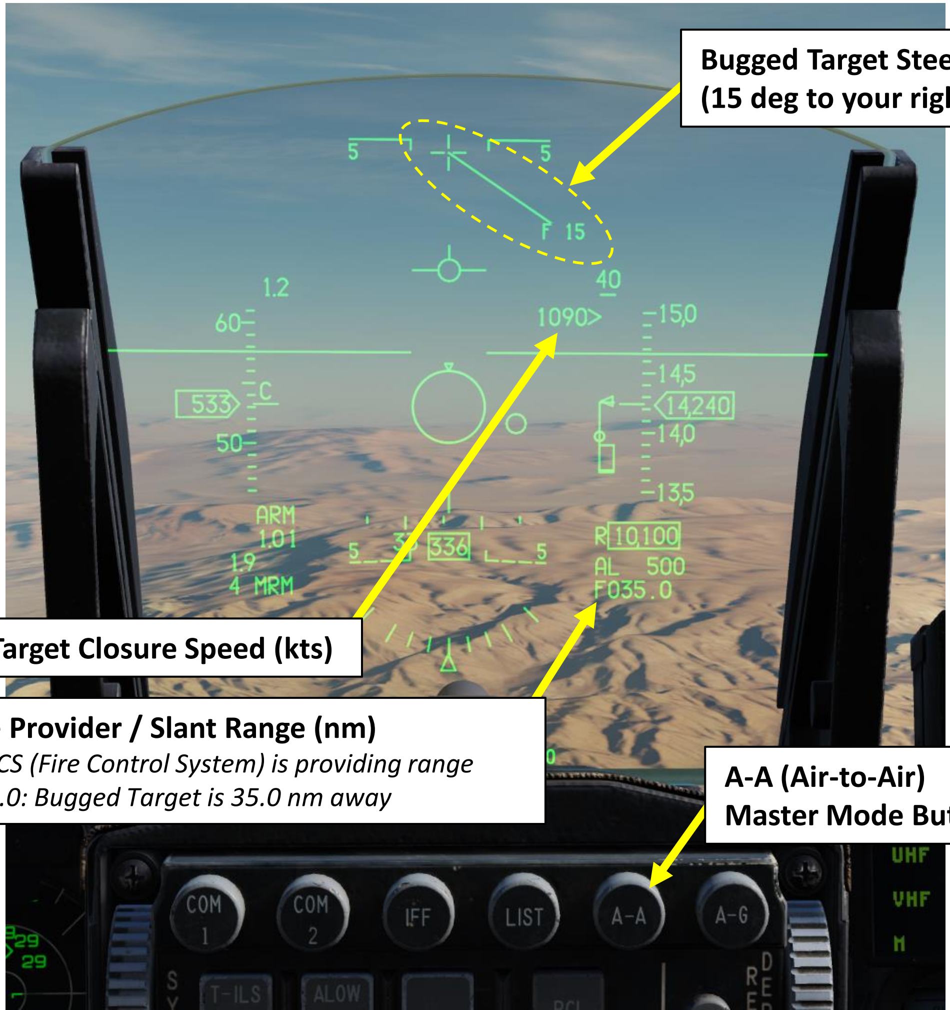
8. Release TMS UP to designate the target and make it the "bugged" target. If a target is not under the acquisition cursor when TMS forward is released or no target is detected, the scan coverage reverts to the previous scan pattern. The SAM acquisition sequence will only commence if a target was under the TDC when TMS forward was pressed.
9. After a successful acquisition, the radar enters SAM mode, with the target bugged. The radar will continue a scan pattern, pausing to dwell on the bugged target periodically. An AIM-120 AMRAAM will guide on the bugged target even without an STT lock.
10. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.





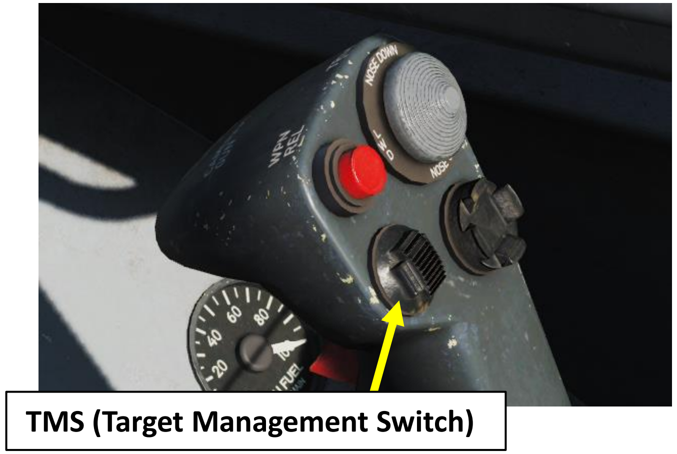
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

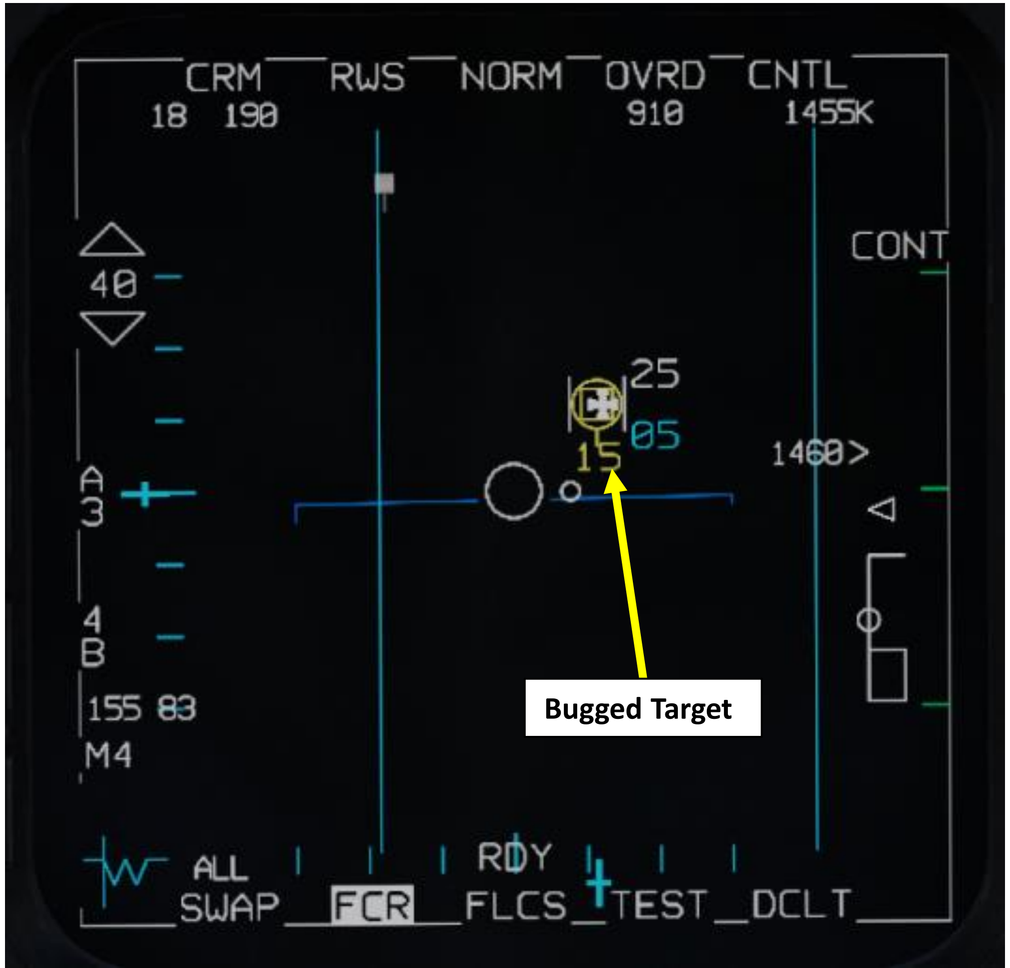
11. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.
    - *Note: The use of the A-A (Air-to-Air) Master Mode is not mandatory but strongly recommended if you want to use air-to-air missile symbology.*

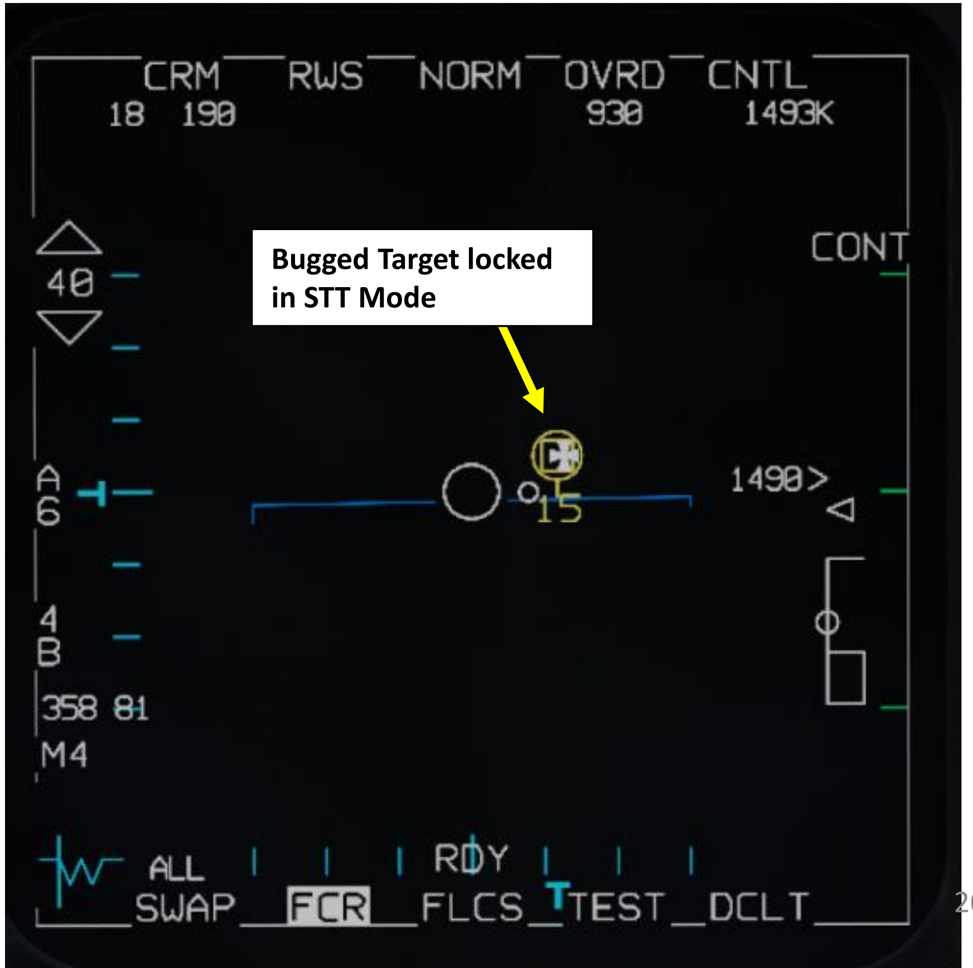


2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.4 – Air-to-Air SAM (Situational Awareness Mode)

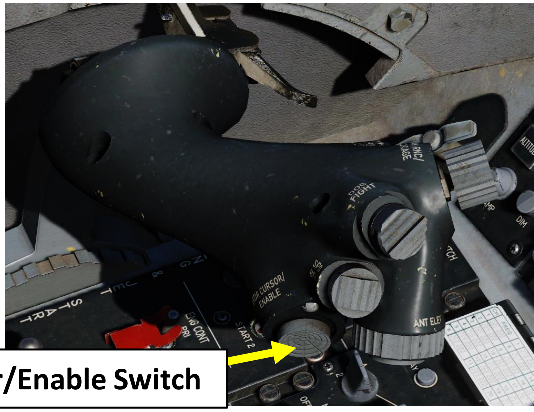
12. A Bugged Target may be transitioned to a STT (Single Target Track Radar Lock) Track by pressing TMS UP a second time.
13. Selecting TMS DOWN from STT returns to the Range While Search mode.







2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.5 – Air-to-Air STT (Single Target Track) & DTT (Dual Target Track) Radar Lock

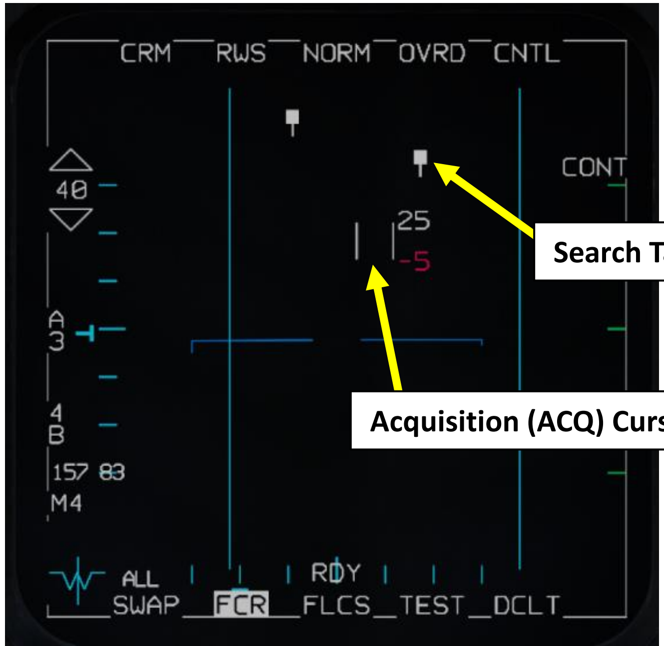


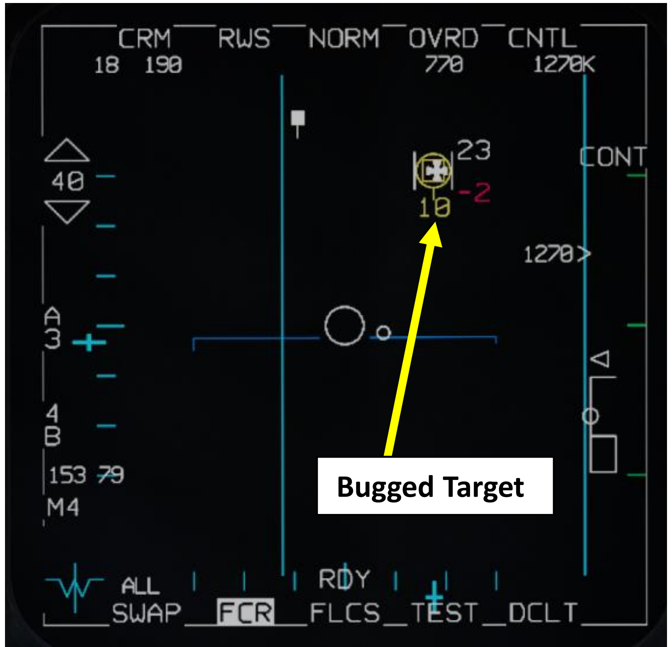
STT (Single Target Track)

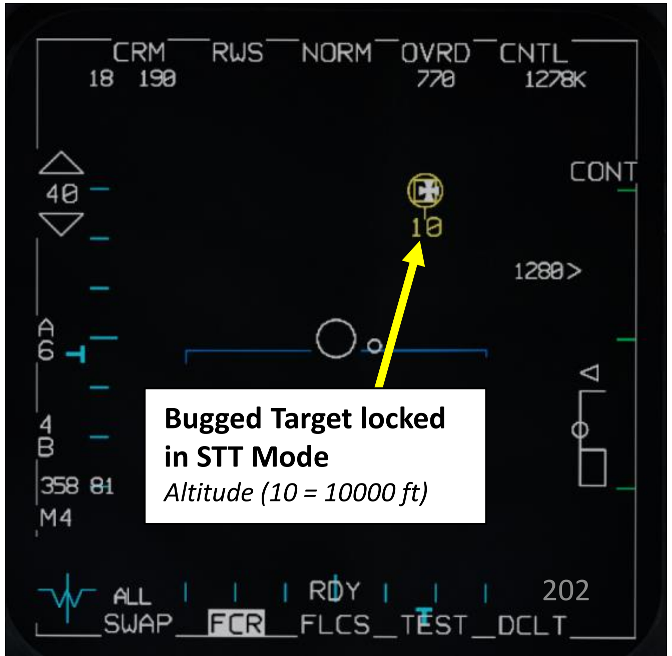
Single Target Track mode is a traditional radar "lock" where the radar continuously scans a single target, resulting in a very high update rate; this makes it the primary method of providing guidance to air-to-air weapons. STT maintains a trackfile for its target and automatically designates it. The radar is slaved to this trackfile; as such, manual antenna elevation control is inhibited and the B-sweep follows the trackfile. Only the trackfile that is placed in STT is visible and all onboard trackfiles are dropped. In STT, the FCR page format is presented in azimuth along the horizontal axis and range along the vertical axis.

Single Target Track is obtained by:
- Placing the acquisition cursor over a target (with the Radar Cursor switch), positioning the TMS (Target Management Switch) on the stick FWD twice in quick succession, then releasing the TMS.
- using an Air Combat Maneuvering mode

Single Target Track is exited by pressing the TMS (Target Management Switch) on the stick AFT.
- TMS DOWN once returns to SAM mode with the target bugged.
- TMS DOWN twice returns to RWS mode.
- The radar is returned to the last-entered search mode.



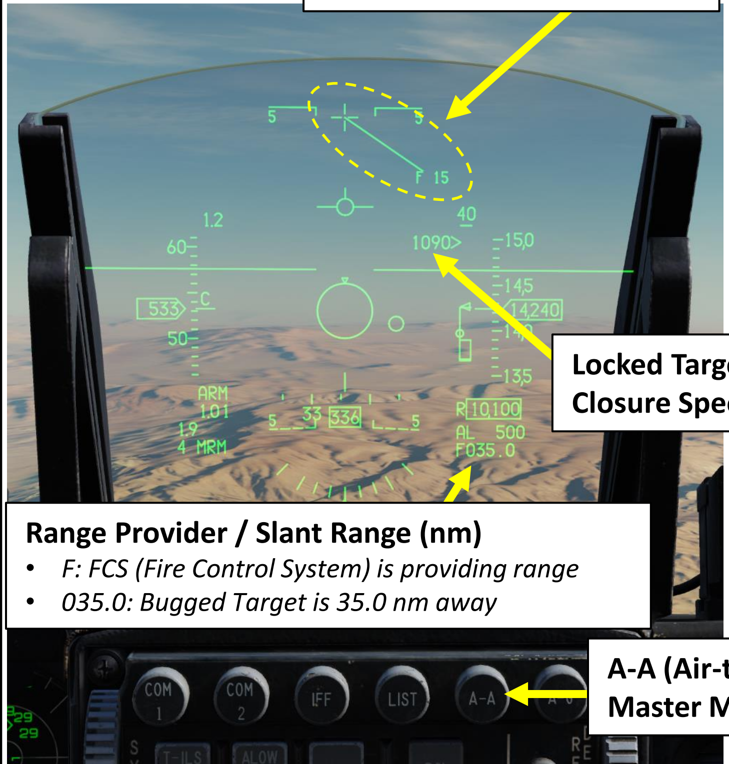




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.5 – Air-to-Air STT (Single Target Track) & DTT (Dual Target Track) Radar Lock

STT (Single Target Track)

When the locked target is outside the HUD field on view as shown below, a Target Locator Line (TLL) extends from the Gun Cross and points directly at the target. The Relative Angle is displayed next to the Gun Cross showing the number of degrees in tens between the cross and the target.



Locked Target Steering Cue (15 deg to your right)

Locked Target Closure Speed (kts)

Range Provider / Slant Range (nm)

- *F: FCS (Fire Control System) is providing range*
- *035.0: Bugged Target is 35.0 nm away*

Locked Target Target Designator (TD) Box

A-A (Air-to-Air) Master Mode Button

Locked Target Magnetic Heading

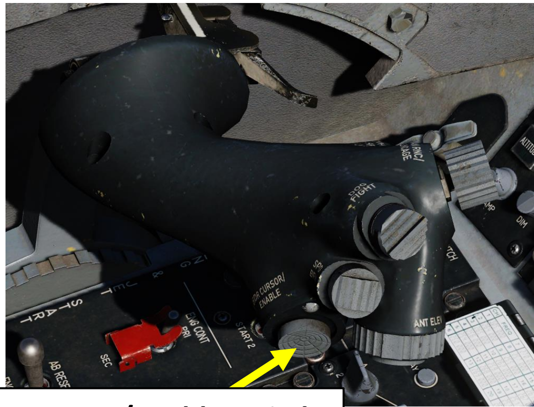
Locked Target Aspect Angle

Locked Target Closure Speed (kts)

Locked Target Airspeed (kts)

Bugged Target locked in STT Mode
Altitude (10 = 10000 ft)

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.5 – Air-to-Air STT (Single Target Track) & DTT (Dual Target Track) Radar Lock



DTT (Dual Target Track)

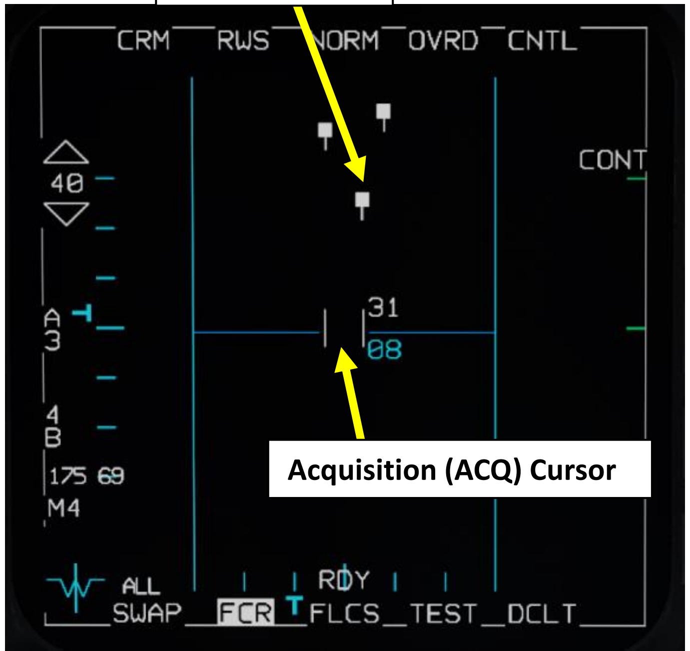
Dual Target Track mode is entered from SAM by bugging a second target. In DTT mode, the radar will dwell on two targets while continuing a scan pattern centered around the secondary target. If the primary target closes within 10 nm of the aircraft, the scan pattern is inhibited, and the radar will "ping-pong" between the two bugged targets. In DTT, pressing TMS right will swap the primary and secondary targets. The radar will shift its scan pattern to be centered around the new secondary target. AIM-120 launches in DTT will track the primary target.

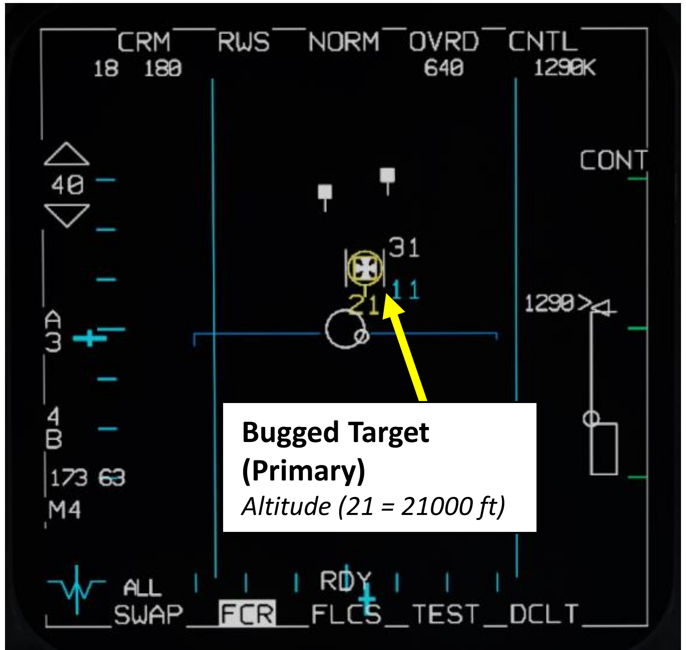
Dual Target Track is obtained by:

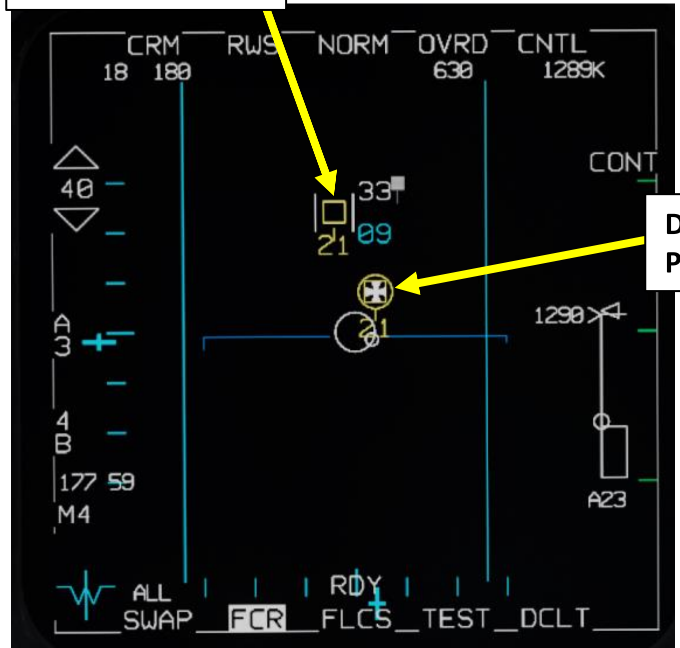
- Placing the acquisition cursor over a target (with the Radar Cursor switch), pressing the TMS (Target Management Switch) on the stick FWD to enter SAM mode, then placing the acquisition cursor over another target and bugging it as well with TMS FWD.

Dual Target Track is exited by pressing the TMS (Target Management Switch) on the stick AFT.

- TMS DOWN returns to RWS mode.
- The radar is returned to the last-entered search mode.



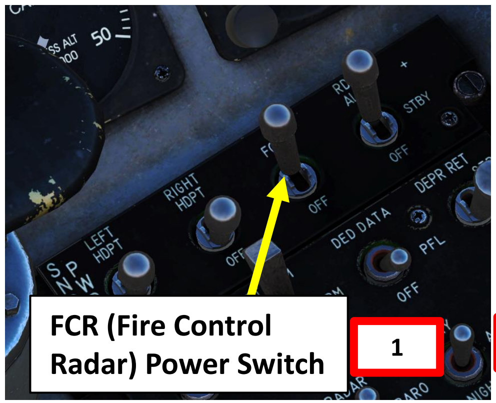




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.1 – Mode Selection

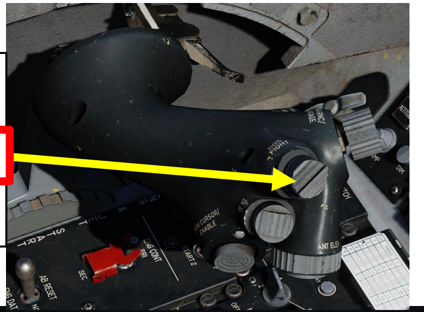
There are four main ACM (Air Combat Mode) Modes, which are used for close range air-to-air engagements. FCR Power Switch needs to be set to ON (FWD). **Selection of ACM Sub-modes can be done as follows:**

1. FCR Power Switch must be set to ON (FWD)
2. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
3. ACM Mode can be selected in two ways:
   i. Using the Main Radar Mode selector OSB (Option Select Button) on the FCR page, or;
   ii. Pressing the Dogfight Switch Outboard (DGFT)



FCR (Fire Control Radar) Power Switch — 1

2b — **DMS (Display Management Switch)**

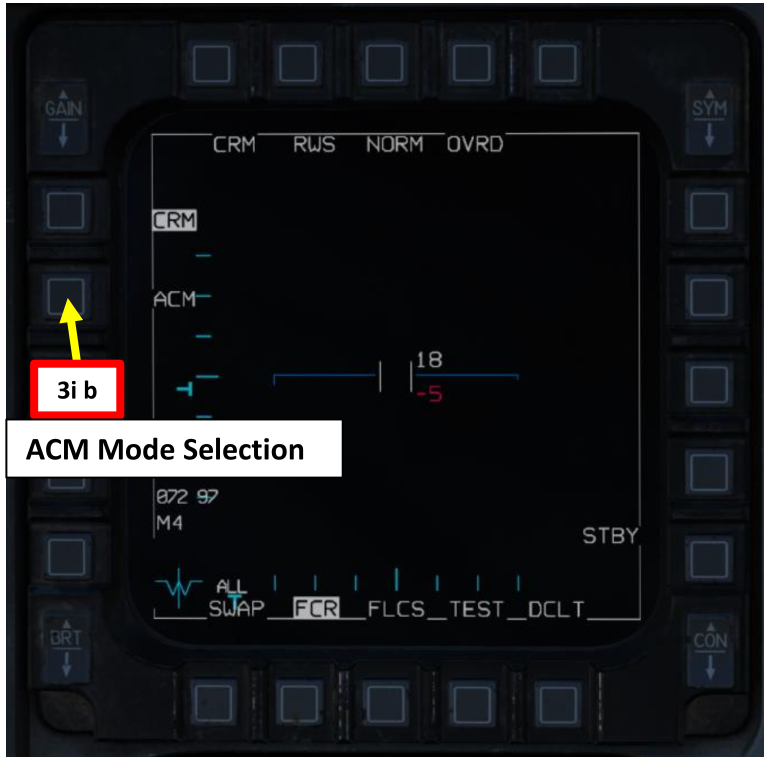


Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard)*
- *Missile Override (Inboard)*
- *Center: Returns to last selected Master Mode*

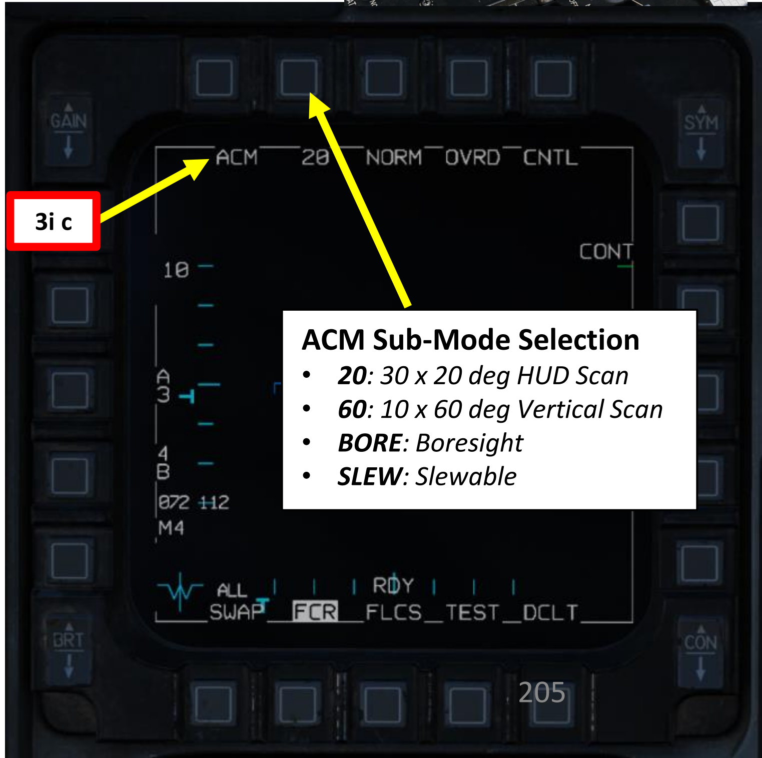
3ii

3i a — **Main Radar Mode Selection**

2b
2a



3i b — **ACM Mode Selection**



3i c

ACM Sub-Mode Selection
- ***20***: *30 x 20 deg HUD Scan*
- ***60***: *10 x 60 deg Vertical Scan*
- ***BORE***: *Boresight*
- ***SLEW***: *Slewable*

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.1 – Mode Selection

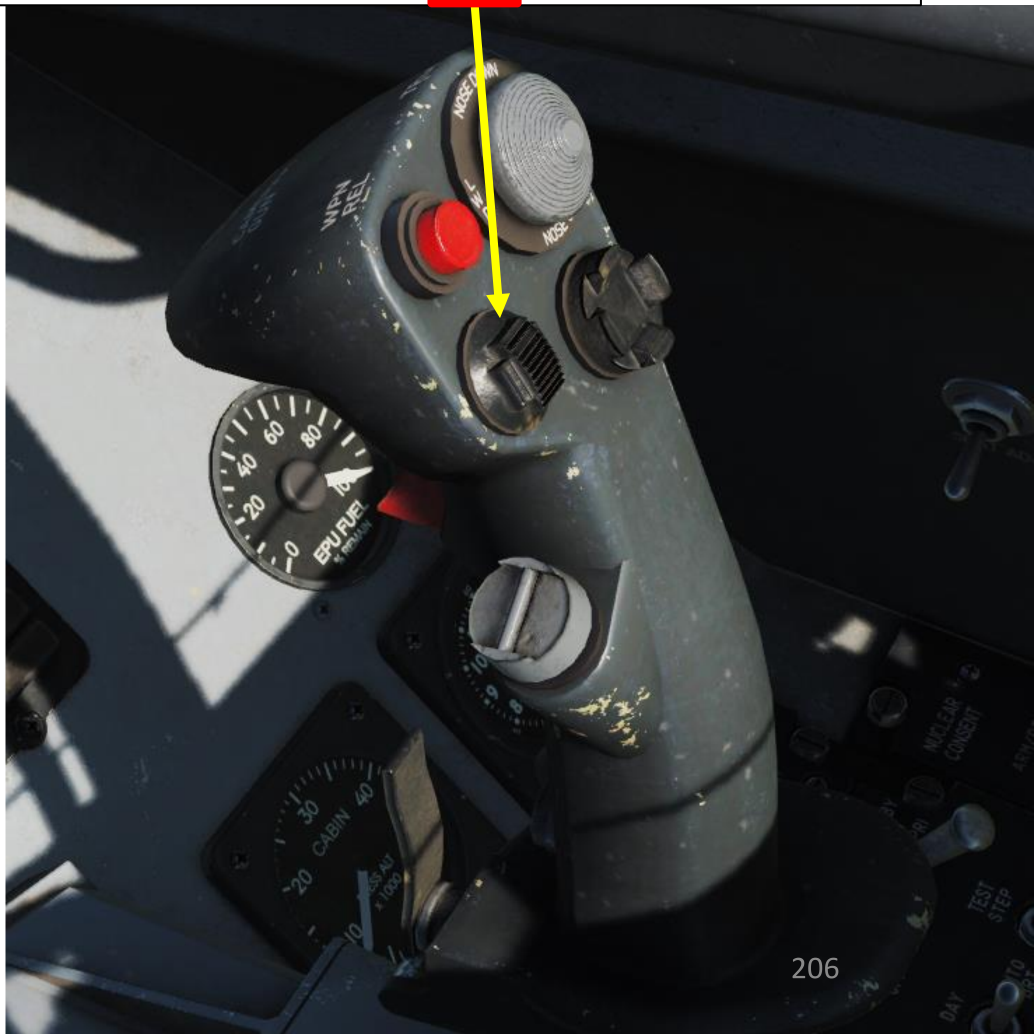
4. ACM Sub-Mode can be selected in two ways:
   a) Using the TMS (Target Management Switch), or;
   b) Using the ACM Sub-Mode Selection OSB

4b

ACM Sub-Mode Selection
- ***20***: *30 x 20 deg HUD Scan*
- ***60***: *10 x 60 deg Vertical Scan*
- ***BORE***: *Boresight*
- ***SLEW***: *Slewable*

TMS (Target Management Switch)
- UP: **Boresight (BORE)** Sub-mode
- DOWN:
  - Without target lock: **Vertical Scan** Sub-mode
  - With target lock: Target Reject and **HUD Scan NO RAD** Sub-mode.
- RIGHT: **HUD Scan** Sub-Mode
- LEFT: No Function

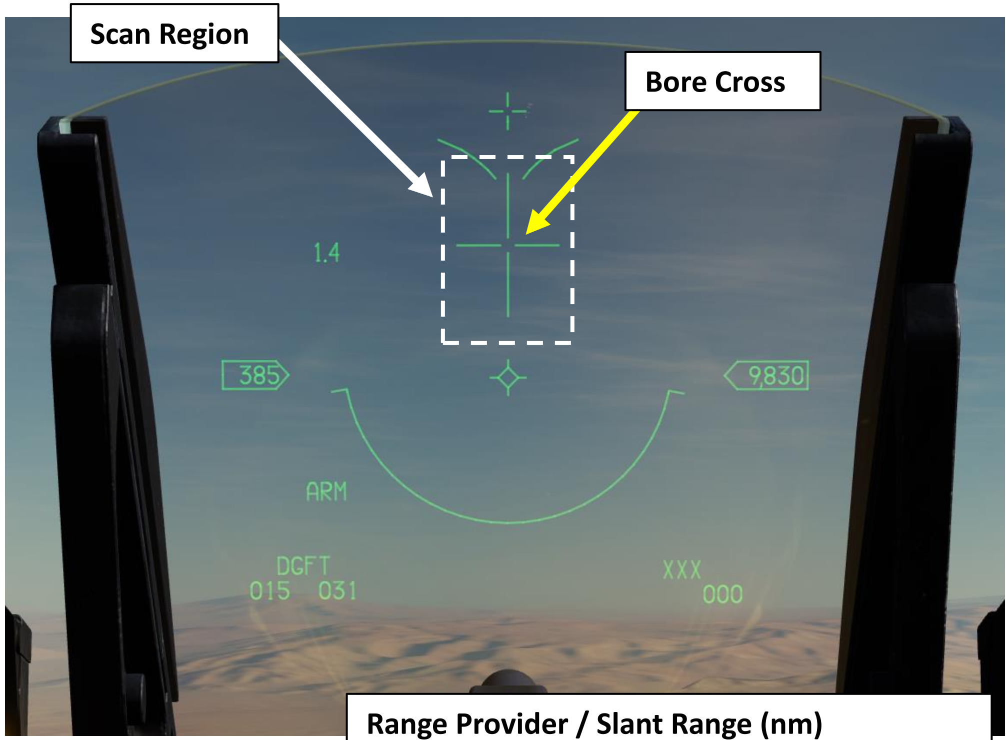
4a

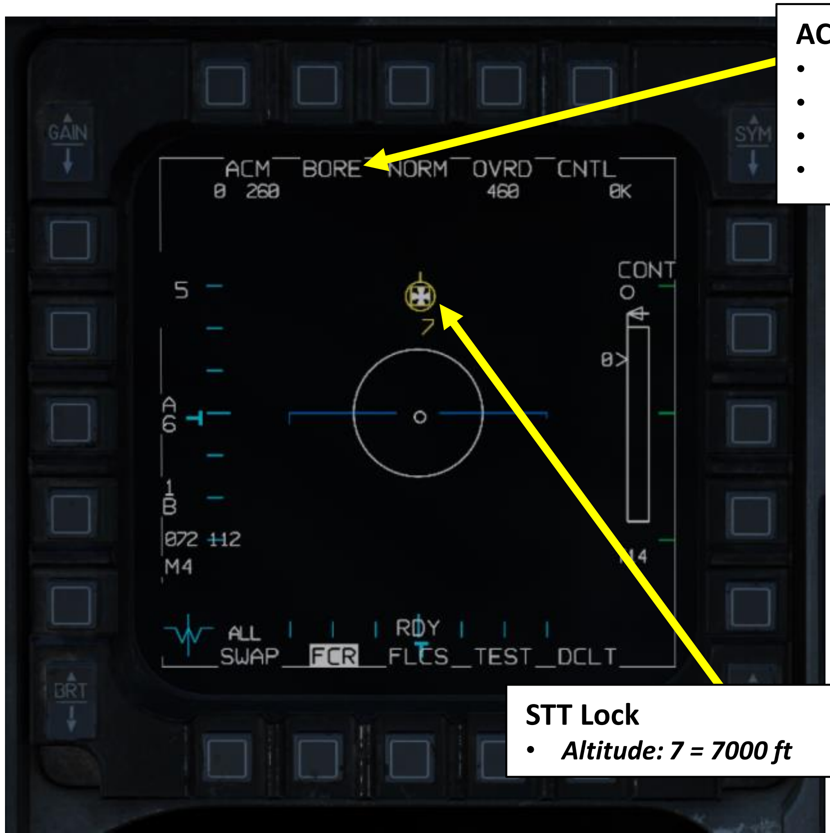


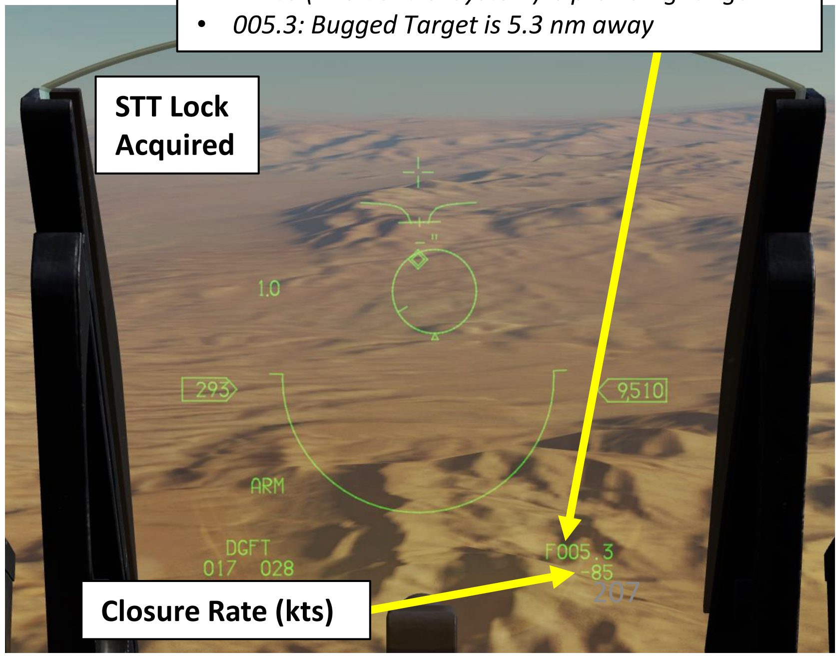
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.2 – Boresight (BORE) Sub-Mode

BORE scan pattern searches a small one-beamwidth area located 3° below the HUD's gun cross. An additional Boresight Cross is displayed on the HUD at the center of the radar scan zone to aid in positioning the target in the radar beam. BORE is useful for quickly locking a target within visual range (WVR) and allows a degree fine control as to the target being locked.

- BORE can be selected in two ways:
    - From FCR Page – ACM Sub-Mode OSB, or;
    - TMS (Target Management Switch) UP
- The first target detected within 20 nautical miles is locked and automatically tracked in STT mode.
- If STT lock is acquired, TMS DOWN can reject the target lock (unlock)



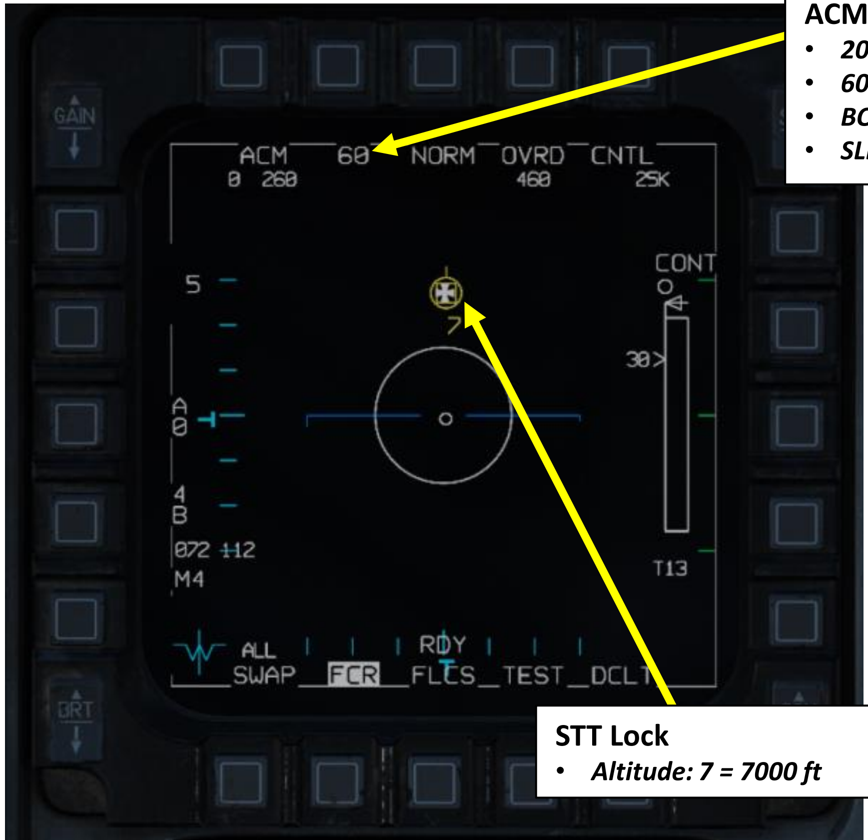


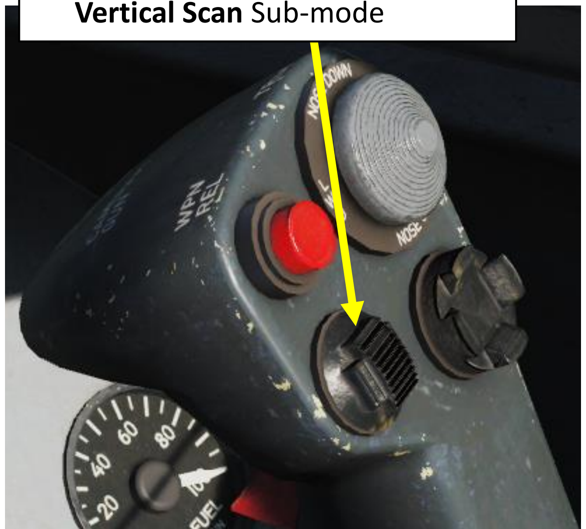


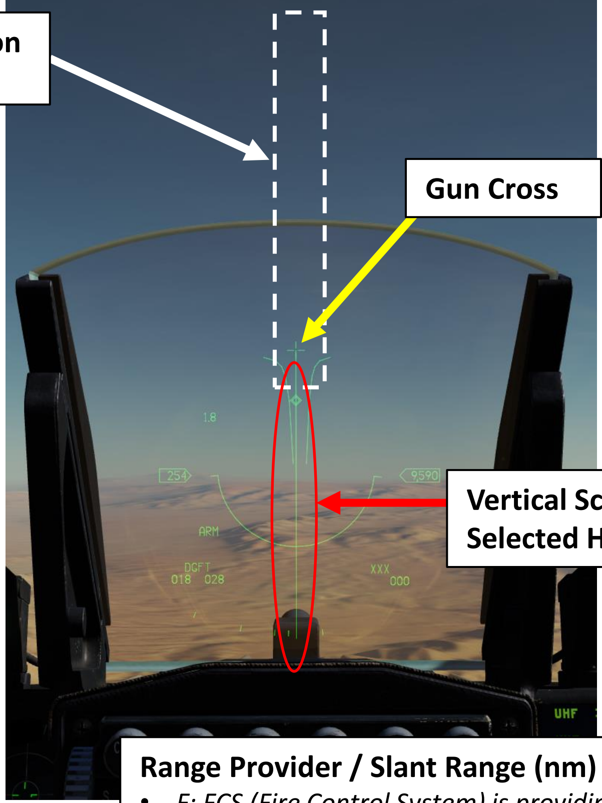
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.3 – Vertical Scan Sub-Mode

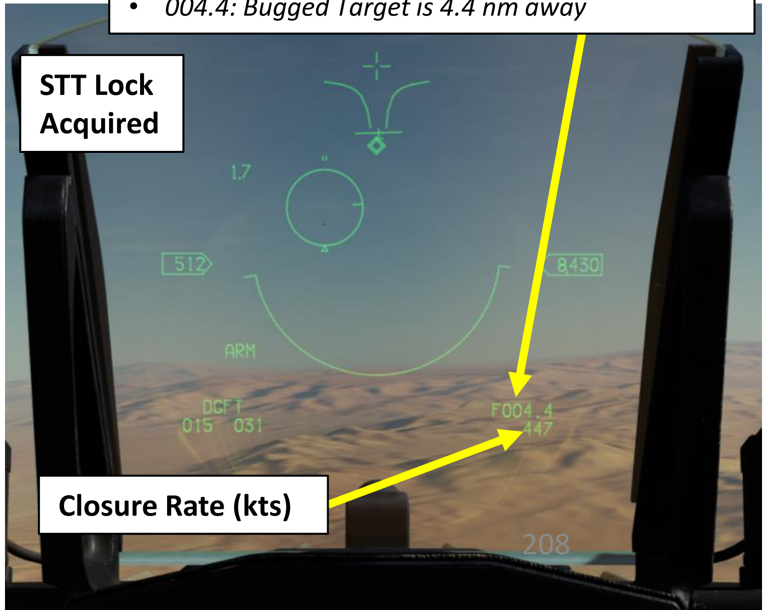
Vertical Scan Radar mode will scan in a 10°× 60° vertical area. The scan center is 23° above the HUD's gun cross. This mode is indicated by a vertical line extending from the gun cross to the bottom of the HUD. When locked, the target is automatically tracked in STT mode.

- Vertical Scan can be selected in two ways:
    - From FCR Page – ACM Sub-Mode OSB, or;
    - Without STT radar lock being active, set TMS (Target Management Switch) DOWN
- The first target detected within 10 nautical miles is locked and automatically tracked in STT mode.
- If STT lock is acquired, TMS DOWN can reject the target lock (unlock)





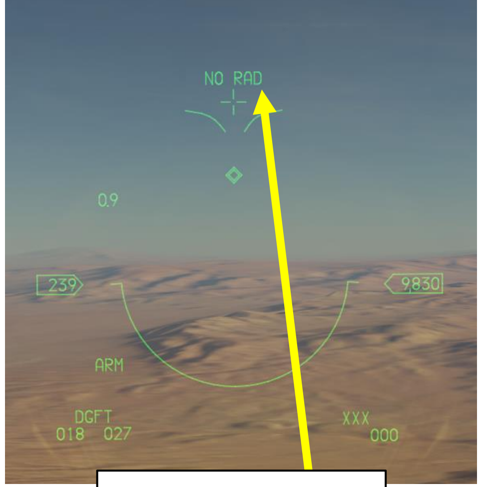




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.4 – HUD Scan Sub-Mode

The HUD (Heads-Up Display Area Scan) mode will scan the HUD area (30°× 20°). This ACM submode is the default selection commanded upon entry into ACM from any other mode. There is no special HUD symbology for this submode. This submode is less precise than the BORE submode and may take longer to achieve a lock because of the larger target area for the radar scan to cover.

- The HUD Scan submode is entered in a non-radiating (NO RAD) state by default when ACM mode is selected. Radiating mode can be selected in two ways:
  - From FCR Page – ACM Sub-Mode OSB, or;
  - Set TMS (Target Management Switch) RIGHT
- The first target detected within 10 nautical miles is locked and automatically tracked in STT mode.
- If a target is locked in STT mode, TMS DOWN can reject the target lock (unlock). However, it will also revert the ACM mode to the HUD Scan non-radiating NO RAD sub-mode.



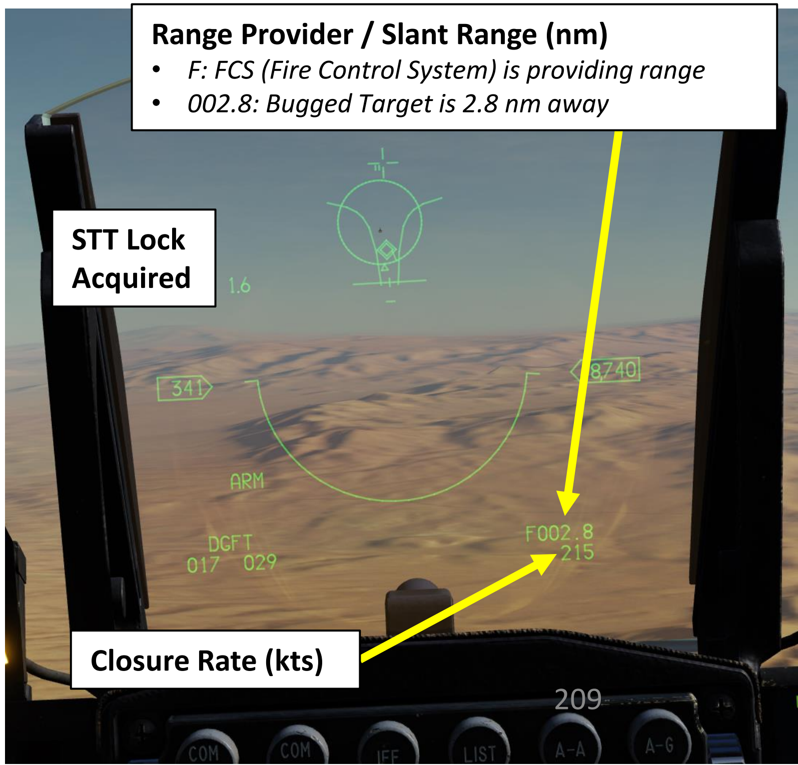
HUD Scan NO RAD

Scan Region
30 x 20 deg

ACM Sub-Mode Selection
- ***20****: 30 x 20 deg HUD Scan*
- ***60****: 10 x 60 deg Vertical Scan*
- ***BORE****: Boresight*
- ***SLEW****: Slewable*

STT Lock
- ***Altitude: 7 = 7000 ft***

TMS (Target Management Switch)
- DOWN (with target lock): Target Reject and **HUD Scan NO RAD** Sub-mode
- RIGHT: **HUD Scan Sub-Mode**



Range Provider / Slant Range (nm)
- *F: FCS (Fire Control System) is providing range*
- *002.8: Bugged Target is 2.8 nm away*

STT Lock Acquired

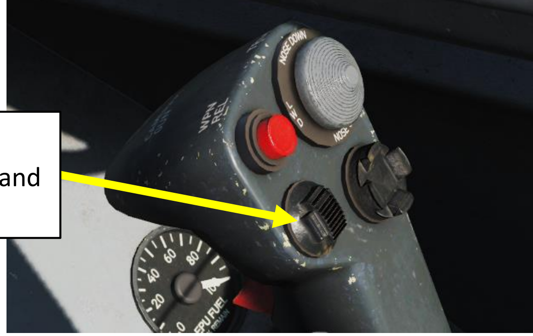
Closure Rate (kts)

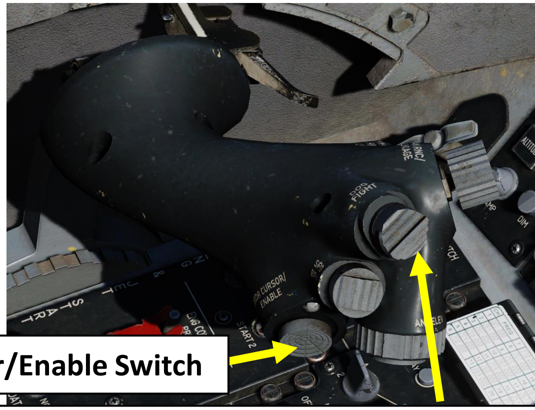
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.6 – Air-to-Air ACM (Air Combat Mode) Modes
2.1.6.5 – Slewable Sub-Mode

The scan pattern is approximately 20° high x 60° wide. When selected, the scan is centered directly in front of the aircraft on the horizon. The scan is slewable via the CURSOR/ENABLE control on the throttle until a target is acquired. The amount of slew is limited by the radar gimbal limits. As with the other submodes, the radar automatically locks on to the first target in this zone. When locked, the target is automatically tracked in STT mode. This mode is useful when you have a direction to look, for example 'bandits 2 o'clock high', but have not picked them up visually yet.

- The Slewable submode can be selected in two ways:
    - From FCR Page – ACM Sub-Mode OSB, or;
    - Entering Dogfight Mode with the Dogfight Switch OUTBOARD, then using the Radar Cursor/Enable switch to slew the slewable cross.
- The first target detected within 10 nautical miles is locked and automatically tracked in STT mode.
- If a target is locked in STT mode, TMS DOWN can reject the target lock (unlock). However, it will also revert the ACM mode to the HUD Scan non-radiating NO RAD sub-mode.

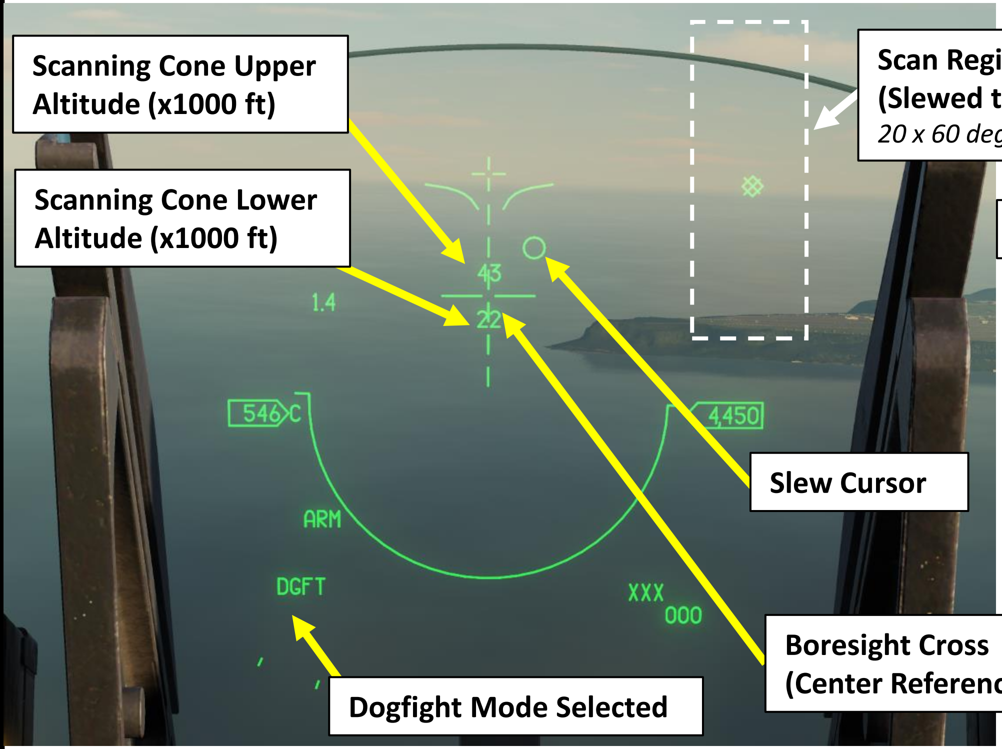
TMS (Target Management Switch)
- DOWN (with target lock): Target Reject and **HUD Scan NO RAD** Sub-mode





Radar Cursor/Enable Switch

Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard)*
- *Missile Override (Inboard)*
- *Center: Returns to last selected Master Mode*



Scanning Cone Upper Altitude (x1000 ft)

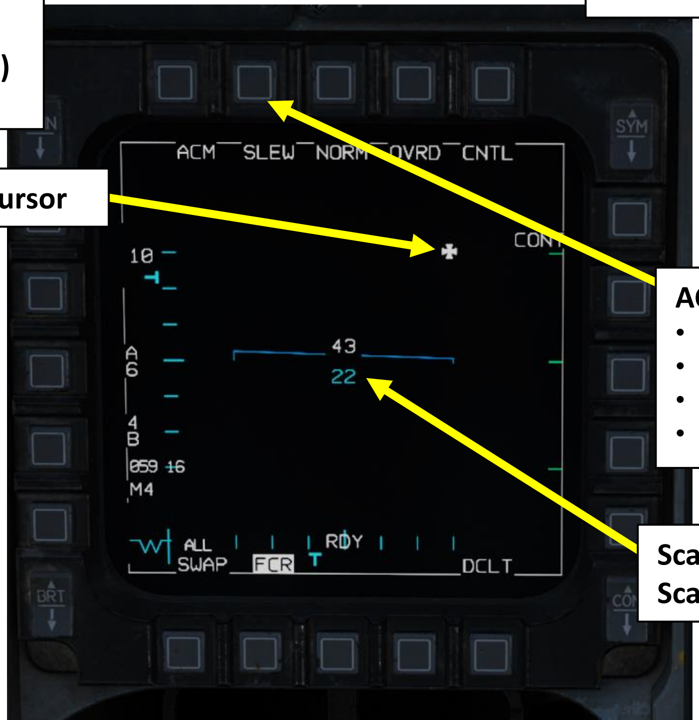
Scanning Cone Lower Altitude (x1000 ft)

Scan Region (Slewed top right)
20 x 60 deg

Slew Cursor

Boresight Cross (Center Reference)

Dogfight Mode Selected



Slew Cursor

ACM Sub-Mode Selection
- ***20***: *30 x 20 deg HUD Scan*
- ***60***: *10 x 60 deg Vertical Scan*
- ***BORE***: *Boresight*
- ***SLEW***: *Slewable*

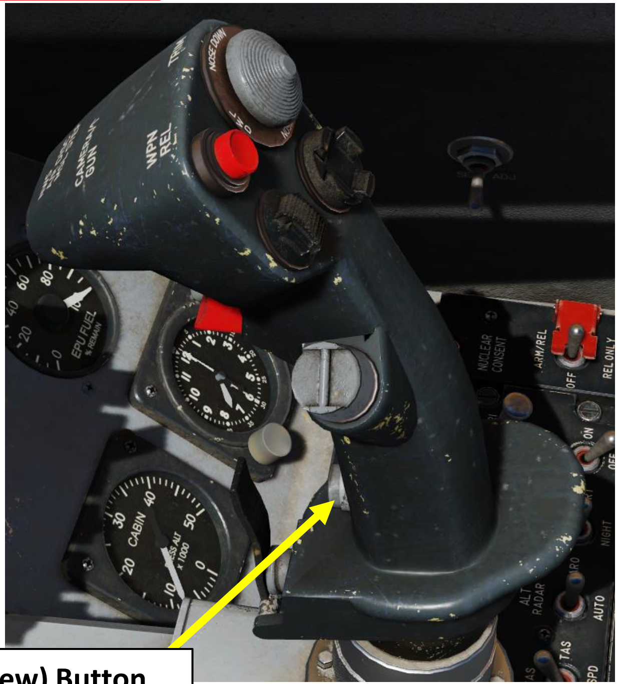
Scanning Cone Upper Altitude (x1000 ft)
Scanning Cone Lower Altitude (x1000 ft)

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.7 – Air-to-Air EXP (Expand) Feature

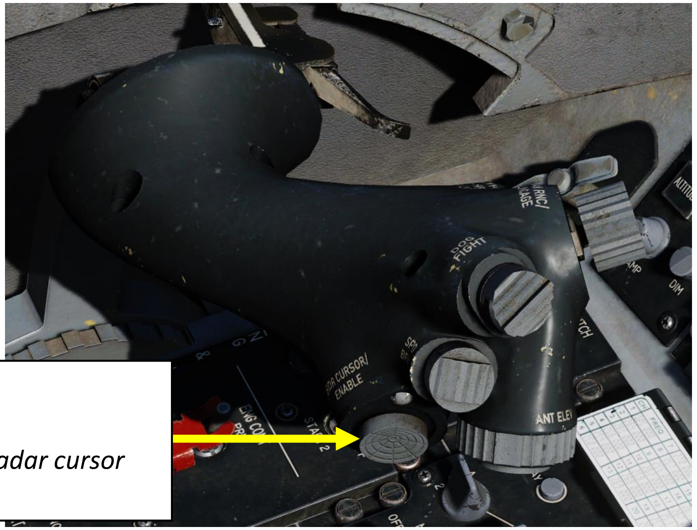
The radar provides the ability to enter an expanded field of view display that allows sorting and resolution of closely grouped contacts. This can be thought of as a zoom feature that provides a 4:1 scale view centered around the radar cursor. This feature is available in all radar modes.

The expanded display may be toggled on or off by selecting the **OSB (Option Select Button) next to NORM/EXP** or by depressing the **Expand/FOV Button (pinky switch)** on the stick while the FCR is sensor of interest.

The expanded display features a 2 nm x 2 nm reference box centered on the **Acquisition Cursor**, which is controlled by the **Radar Cursor Switch**. Basic functions and symbology are unchanged from the normal display.



Expand/FOV (Field-of-View) Button

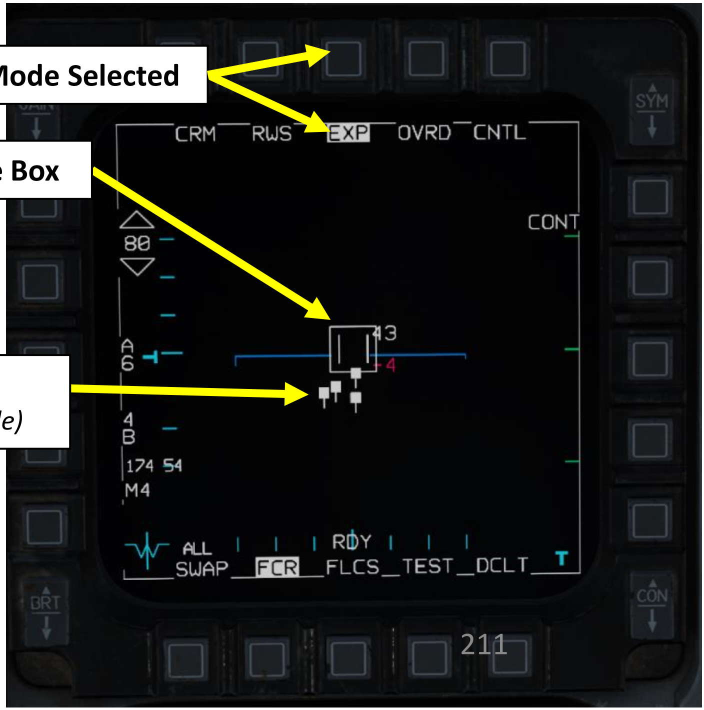


Radar Cursor/Enable Switch
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

Normal Mode Selected

Group of contacts *(closely grouped)*

Acquisition (ACQ) Cursor



Expanded Mode Selected

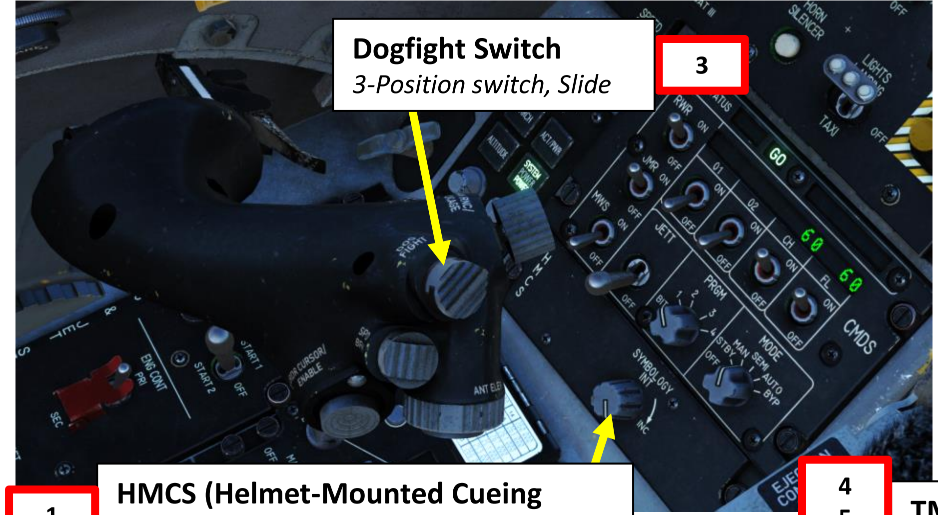
2 nm x 2 nm Reference Box

Group of contacts *(zoomed in with Expanded Mode)*

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.1.8 – Air-to-Air HMCS Radar Lock

To perform a **radar lock with the HMCS**:

1. The system Helmet-Mounted Cueing System (HMCS) is powered with the HMCS Symbology Brightness Knob.
2. Make sure the FCR (Fire Control Radar) switch is ON (FWD)
3. Select DGFT Mode with the Dogfight Switch (Outboard)
4. Select BORE (Boresight) ACM (Air Combat Mode) Search Sub-Mode by pressing the TMS (Target Management Switch) UP SHORT (less than 0.5 sec).
5. Press the TMS (Target Management Switch) UP LONG (more than 0.5 sec) to slave the boresight radar to the helmet line-of-sight. The HMCS Bore Ellipse will appear.
6. Move your helmet to put the HMCS Ellipse on the target. The radar will attempt to STT (Single Target Track) lock the nearest target within the HMCS Ellipse zone within locking range (10 nm).
7. A Target Designation Box will appear on the locked target.
8. You can unlock the target and exit BORE Search mode by pressing TMS (Target Management Switch) DOWN.



Dogfight Switch
3-Position switch, Slide
3

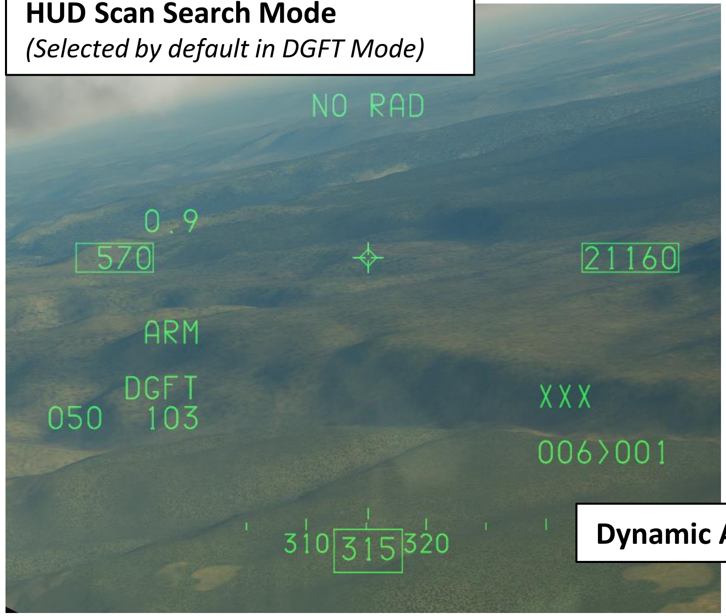
1
HMCS (Helmet-Mounted Cueing System) Symbology Brightness Knob

4
5
8
TMS (Target Management Switch)

2

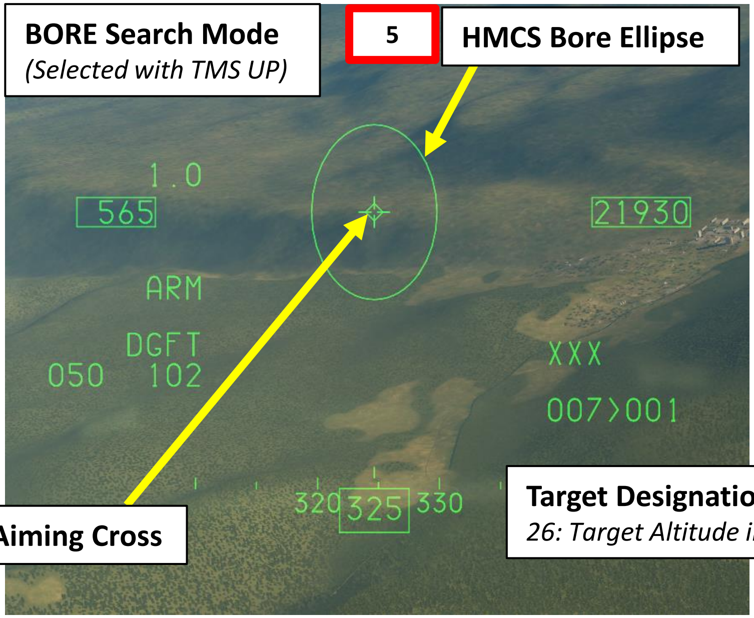
Range Provider / Slant Range (nm)
- *F: FCS (Fire Control System) is providing range*
- *R: Radar Altimeter is providing range*
- *B: Range computed using steerpoint elevation/barometric elevation*
- *T: Targeting Pod is providing passive range*
- *L: Targeting Pod laser is firing and being used*

HUD Scan Search Mode
(Selected by default in DGFT Mode)



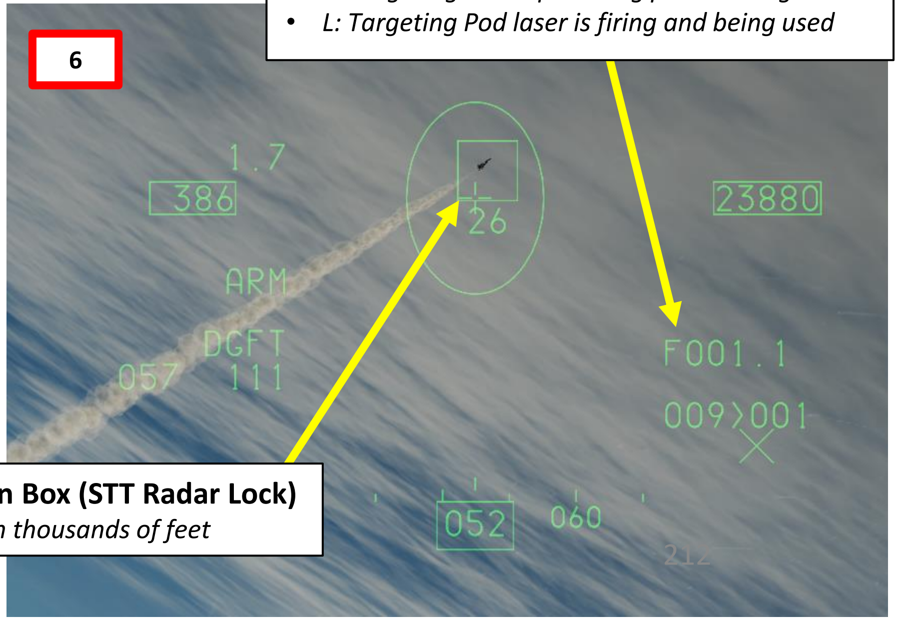
BORE Search Mode
(Selected with TMS UP)

5
HMCS Bore Ellipse



Dynamic Aiming Cross

6



Target Designation Box (STT Radar Lock)
26: Target Altitude in thousands of feet

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.1 – Air-to-Ground Operating Modes

The Air-to-Ground Radar features several operating modes, each designed for specific tasks ranging from target detection and tracking to navigation and ranging. These modes will never be as precise as a targeting pod, but it has a much longer range and can see through cloud layers obscuring the view. Using these functionalities will be entirely up to you and the type of mission you're flying… and the type of ordnance you have available (like JDAMs or JSOWs).

Here is an overview of the different modes available:

- **Ground Mapping (Normal GM)**
    - **Expanded Mapping Sub-Modes**
        - **EXP (Expanded Map)**
        - **DBS1 (Doppler-Beam-Sharpened Level 1)**
        - **DBS2 (Doppler-Beam-Sharpened Level 2)**
- **Ground Moving Target (GMT)**
- **Sea Search (SEA) Mode**

FCR (FIRE CONTROL RADAR) PAGE
A/G MASTER MODE SELECTED
GM (GROUND MAPPING) MODE

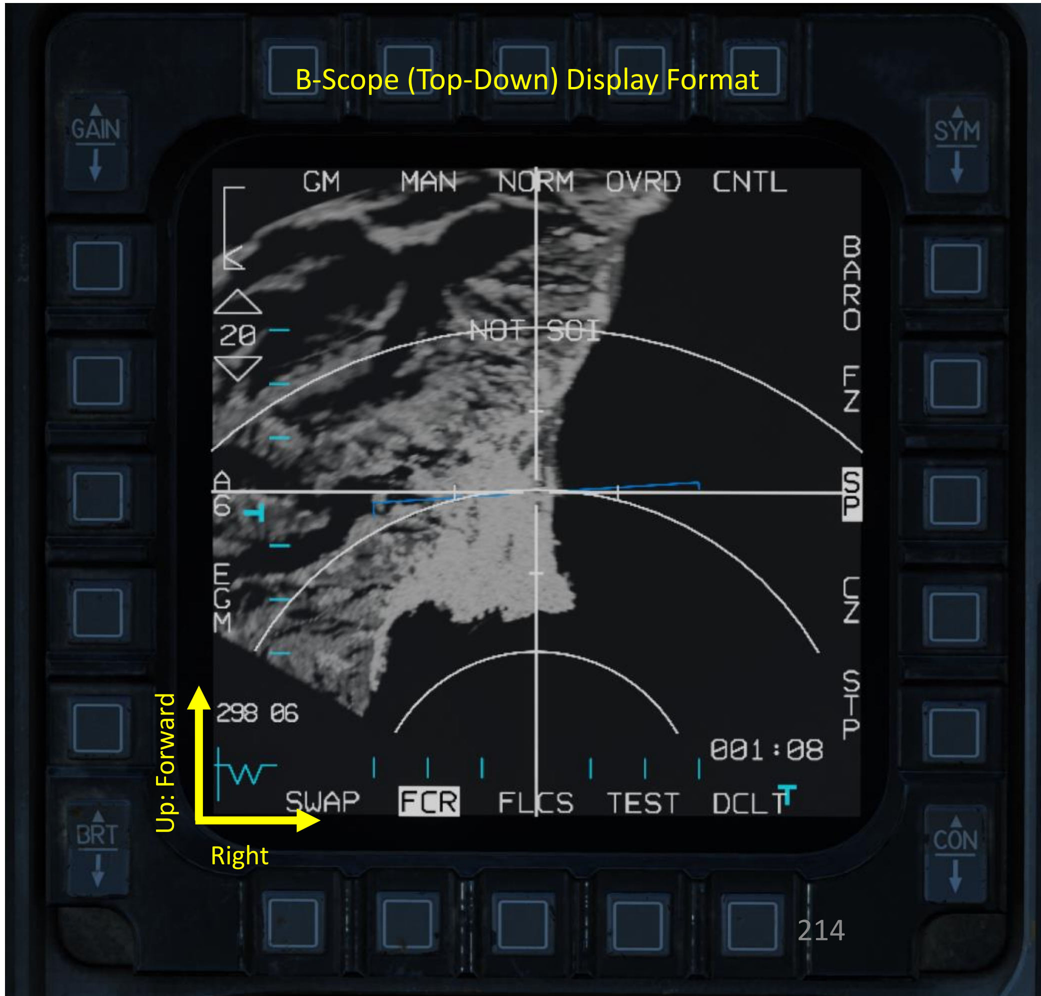
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

Display

The Ground Mapping mode is a B-scope raster scan of terrain ahead of the aircraft. Image intensity is a function of the strength of a radar return. Certain ground features will have higher intensity (e.g., buildings or vehicles) and others will have lower intensity (e.g., water). Terrain or tall structures will impede the radar beam from traveling further, creating distinctive shadows, giving the resulting image the appearance of an elevation relief map.

Keep in mind that in order to display the ground mapping overlay on the FCR (Fire Control Radar) page, the A/G Master Mode should be selected and the "GM" Mode should be selected from the FCR page.

A-G (Air-to-Ground) Master Mode Button

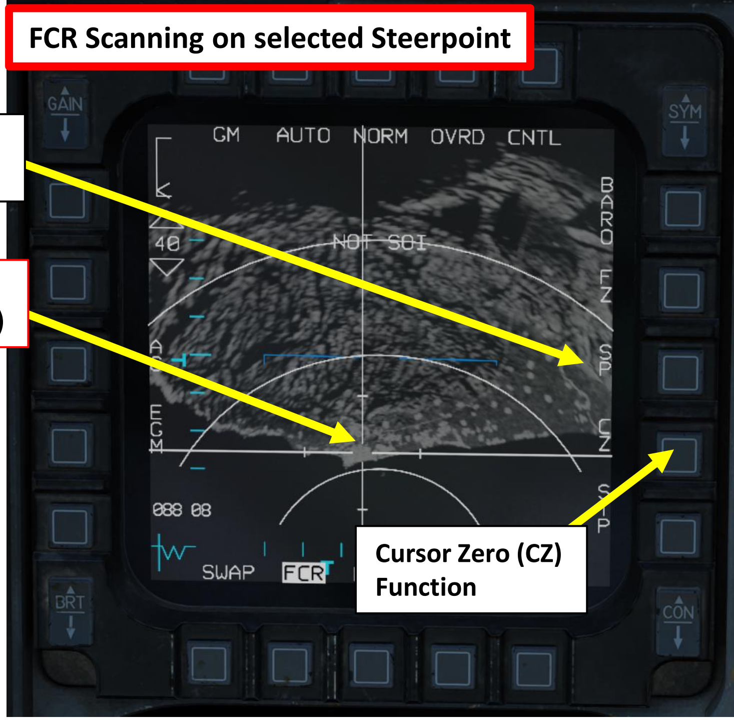


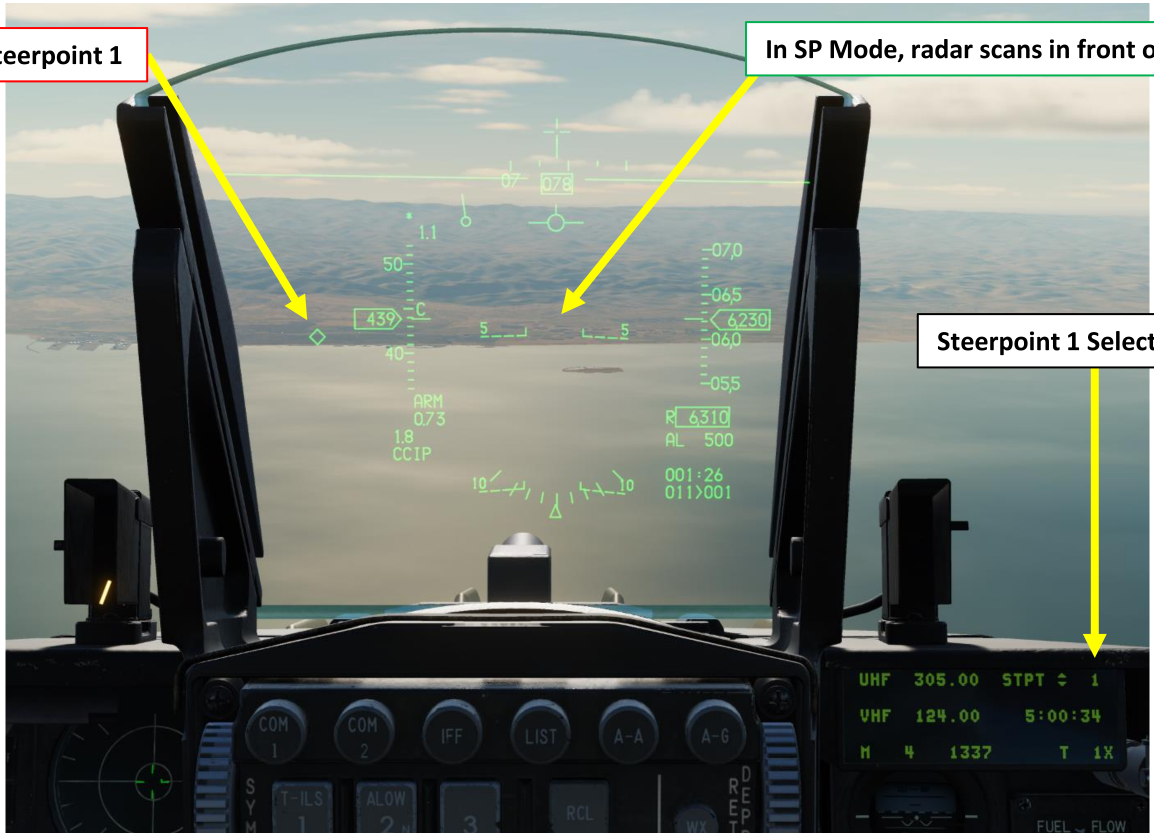
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

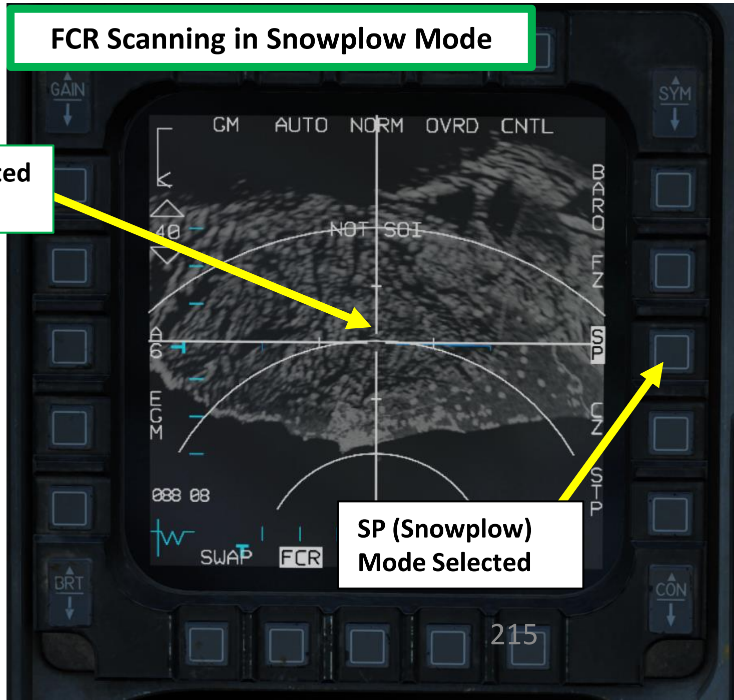
Display

Normally, the radar only **scans the area around the SPI** (Sensor Point of Interest, like a selected Steerpoint or a targeting pod area/point track), regardless of aircraft location or heading. If the SPI moves outside the radar field of view, the radar antenna is boresighted. The **CZ (Cursor Zero)** function allows you to reset the cursor to a steerpoint, which is useful when you want to use a specific location as a reference.

To scan directly ahead of the aircraft instead, use **Snowplow (SP) Mode**. This mode has the lowest resolution since it has the largest coverage.





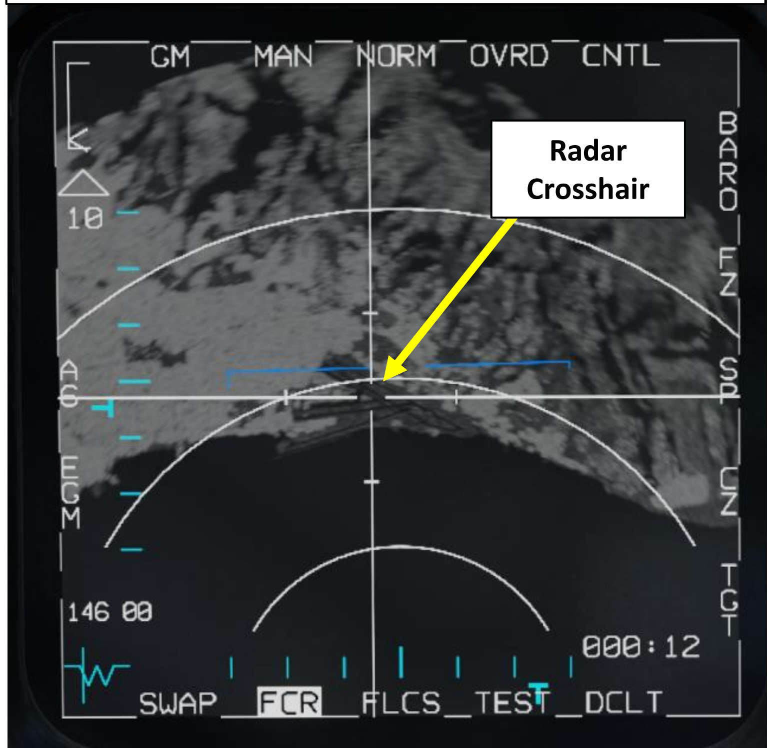


2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

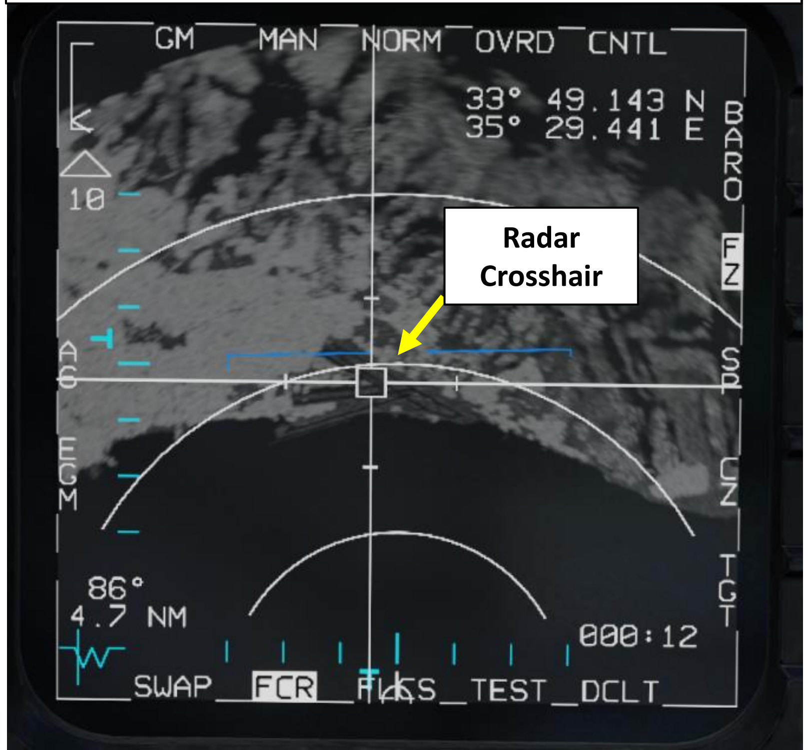
Display

The Radar Crosshair symbology indicates whether a Sensor Point of Interest (SPI) is designated from the FCR page.

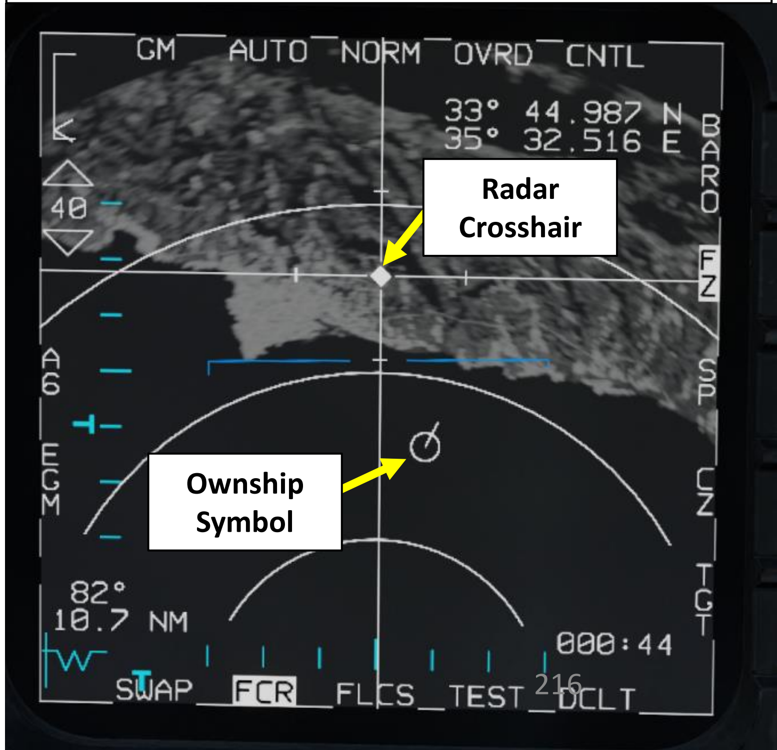
No Target Designated



Steerpoint Designated as SPI



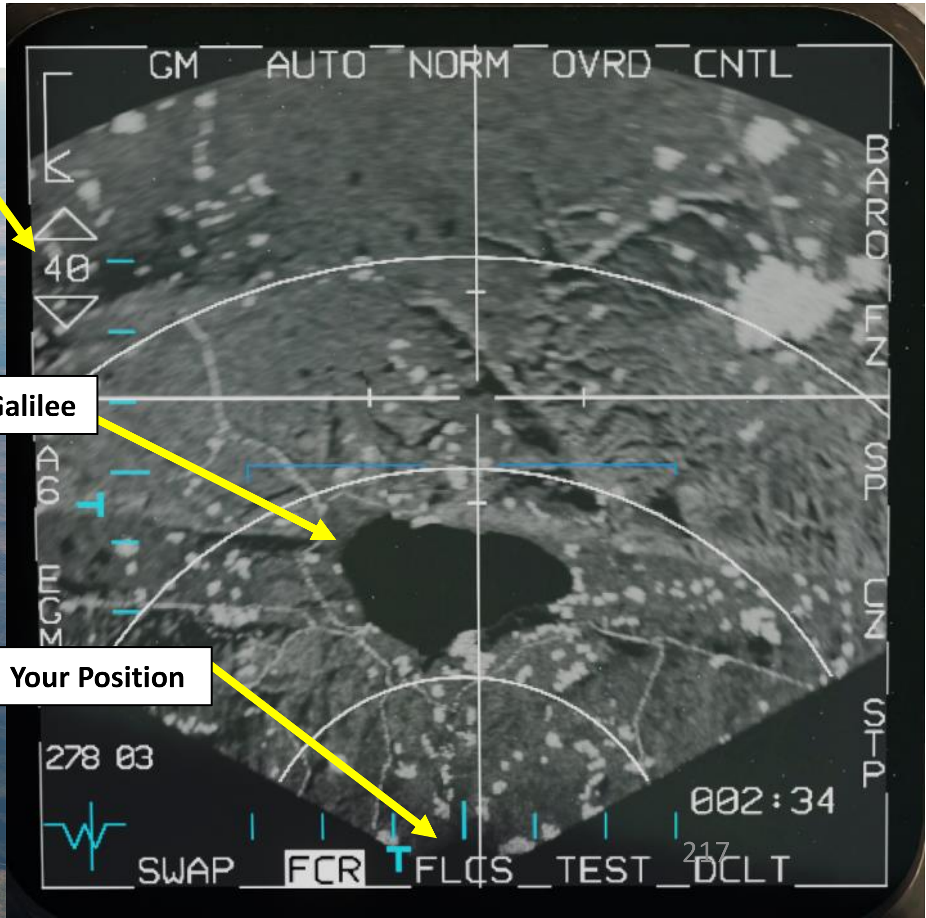
Target Designated as SPI via FCR Page



2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

Display

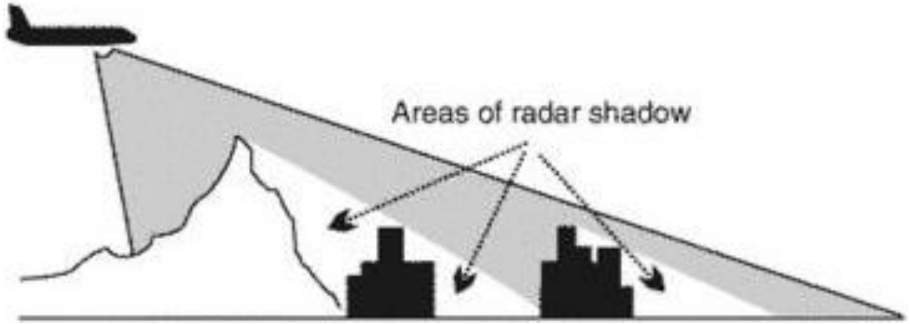
Regions that do not provide radar returns are black (such as water). The bright/white regions are generally man-made structures (buildings, power lines, roads, etc.) or mountains.

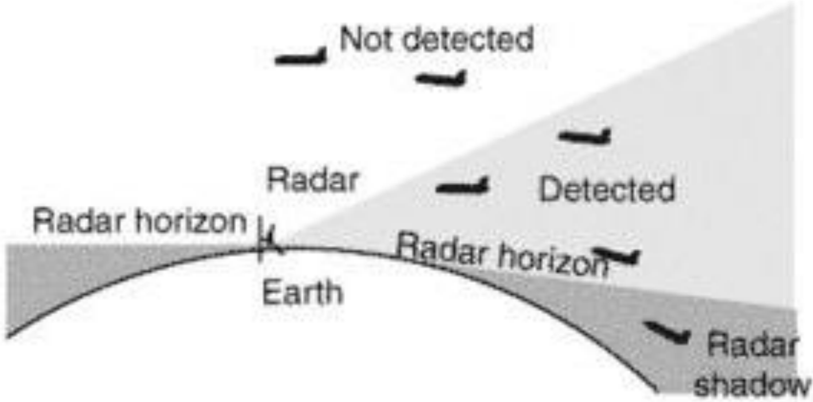


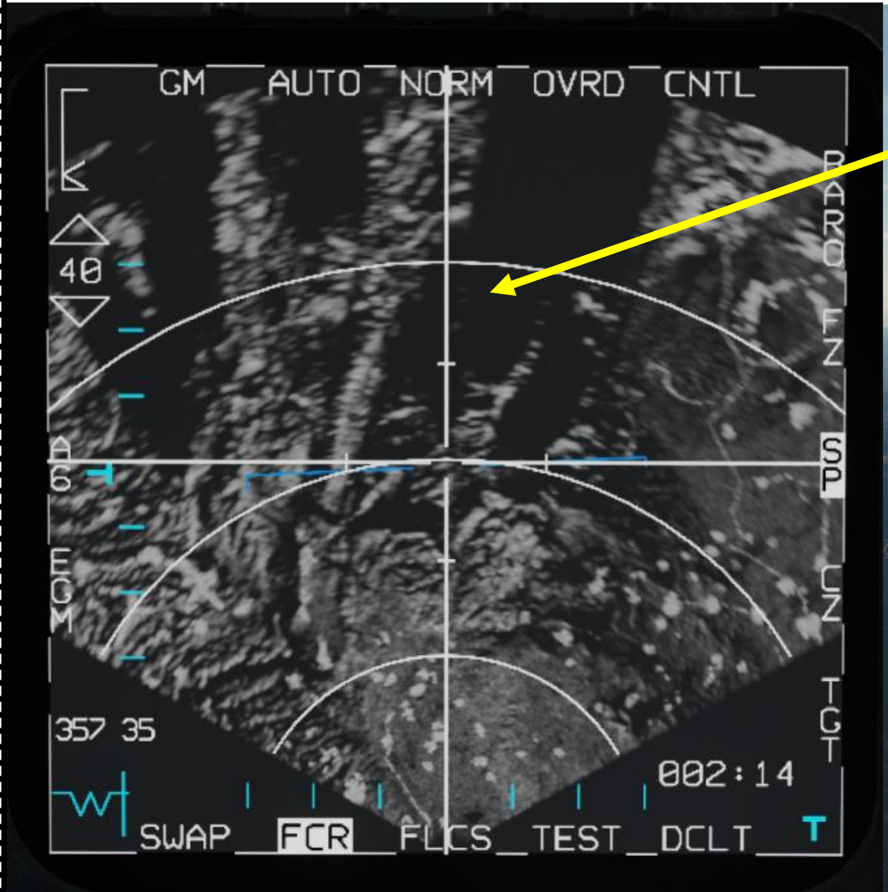
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

Display

Some of the black areas on the MAP display are part of the radar shadow, which are regions behind hills or mountains that the radar cannot see behind.





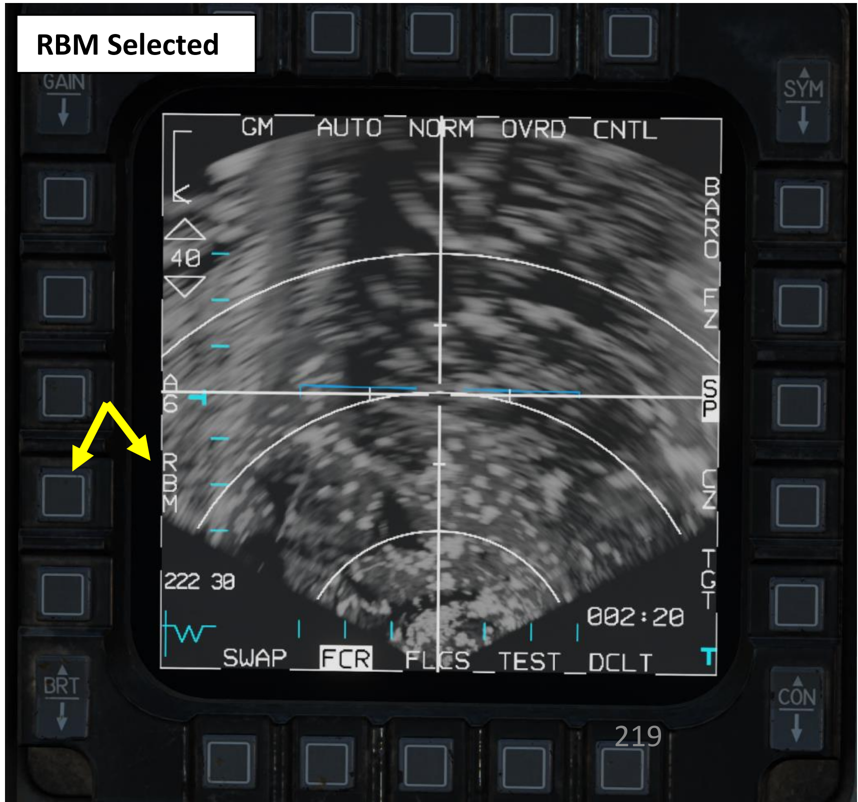


2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

EGM (Enhanced Ground Mode) vs RBM (Real Beam Mode) Image Processing

The EGM/RBM OSB (Option Select Button) on the GM FCR page allows you to select between Real Beam Mode (RBM) and Enhanced Ground Map (EGM) image processing.

- **RBM:** uses raw radar data to quickly produce an image. The resolution is lesser than EGM, but you get a faster image generation.
- **EGM:** uses post-processing to improve the image resolution but takes longer to render an image. This is generally the recommended setting since the increase in image clarity can be quite beneficial to recognize landmarks or terrain features. When EGM is on, only the center portion of the radar image is post-processed. Take note that EGM is not available at large bank angles.



2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

Controls (GM Page)

Here is an overview of the controls available from the FCR GM Page.

Automatic/Manual Range Selector
- Pressing this OSB toggles between AUTO and MAN (manual) range control. When in AUTO mode, moving the crosshairs to the top or bottom of the display increases or decreases the range. The label displays the mode that will be set if the OSB is pressed: AUTO is displayed when manual mode is active, and MAN is displayed when automatic mode is active.

Display Symbology Brightness Control

Radar Gain Control

Radar Gain Indicator
- The caret indicates the current radar gain. Radar gain is adjusted with the GAIN rocker to the left. Higher gain values will produce a brighter image but may wash out details.

Radar Range Controls & Indicator (nm)
- OSBs only work if Manual Ranging is selected or Radar Crosshair is moved to the top or the bottom of the display.
- Toggles between 80, 40, 20 and 10 nm settings.

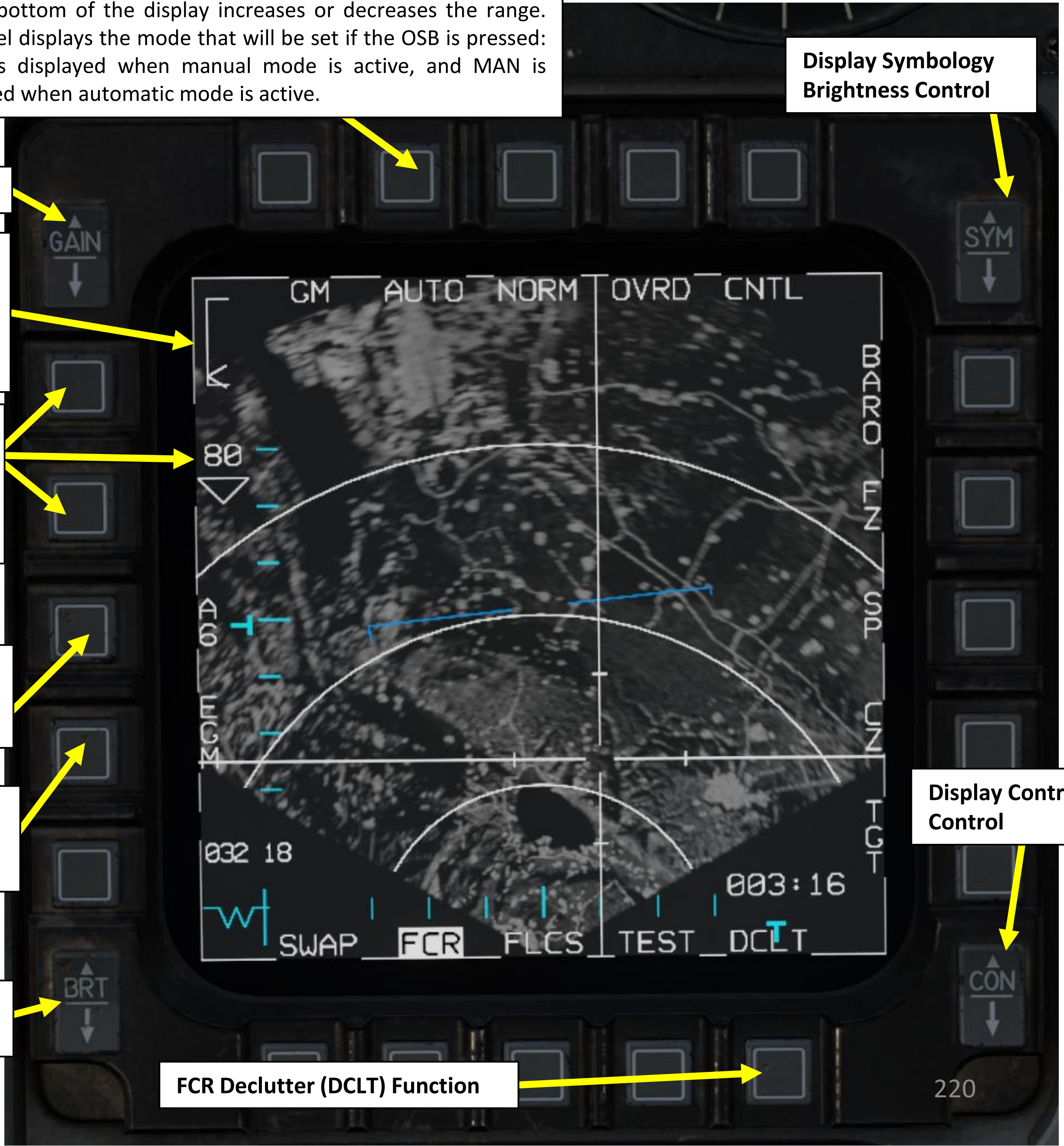
Radar Scanning Azimuth Width Control
- Toggles between A6 (60 deg each side), A2 (20 deg each side) and A1 (10 deg each side) settings

EGM/RBM Image Processing Option
- EGM: Enhanced Ground Mode (Recommended)
- RBM: Real Beam Mode

Display Contrast Control

Display Brightness Control

FCR Declutter (DCLT) Function



2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

Controls (GM Page)

Radar Sub-Mode Selector
- NORM
- EXP
- DBS1
- DBS2

Radar Override (OVRD) Function
- When highlighted, places the radar in standby mode and suppresses radar transmission.

Radar Control (CNTL) Page Selector
- Not Simulated for GM Page.

Radar Mode Selector
- GM (Ground Mapping)
- GMT (Ground Moving Target)
- SEA (Sea Search)
- BCN (Beacon)
- STBY (Standby)

Freeze (FZ) Function
- Pressing this OSB puts the radar in standby mode and freezes the current radar image on the display.

Snowplow (SP) Function
- Pressing this OSB moves the crosshairs to the center of the display and causes the radar to scan in front of the aircraft, regardless of its location relative to the SPI.

Cursor Zero (CZ) Function
- Pressing this OSB resets all cursor slew.

Radar Crosshair
- The crosshairs indicate the current sensor point of interest (SPI). When not in snowplow mode, the Radar Cursor/Enable control on the throttle can be used to move the crosshairs and change the SPI.

Sighting Option Selector
The selected sighting option determines the relationship between the current steerpoint and the SPI (Sensor Point of Interest).
- STP: SPI is the current steerpoint. Default in NAV master mode.
- TGT: SPI is the designated target (or the current steerpoint if no target is designated). Default in A-G master mode.
- OA1: SPI is Offset Aimpoint 1 for the current steerpoint.
- OA2: SPI is Offset Aimpoint 2 for the current steerpoint.
- RP: SPI is the Visual Reference Point for the current steerpoint (see Using Visual Reference Points).
- IP: SPI is the Visual Initial Point for the current steerpoint (related to using VIPs, or Visual Initial Points).
- SP (sensor point): Displayed when TMS Forward is pressed. SPI is the location designated on the FCR format.

Bearing & Range (nm) to SPI (Sensor Point of Interest)
- In that case, the SPI is on the Radar Crosshair.

SOI (Sensor of Interest) Box
- Indicates the radar FCR page is the sensor of interest.

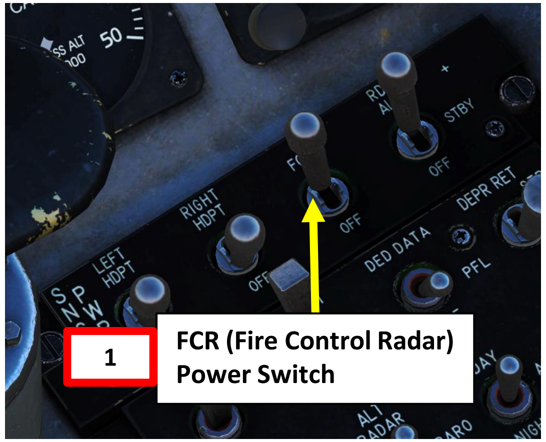
Time-To-Go
- Displays time until reaching the SPI (Sensor Point of Interest)

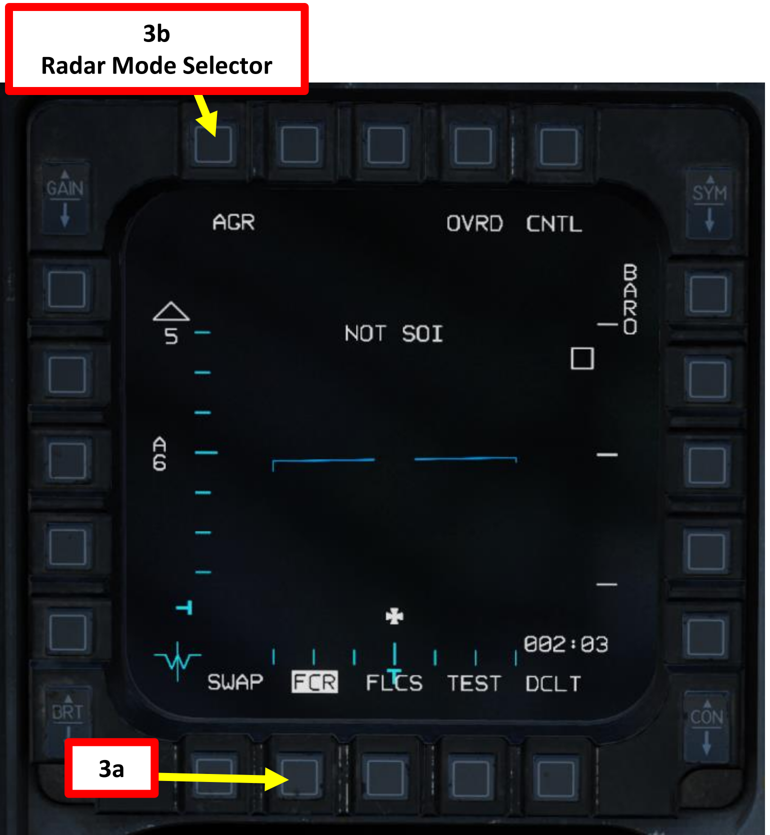
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.2 – GM (Ground Mapping) Mode

How to Select A/G Ground Mapping Mode

To display the ground mapping overlay on the FCR (Fire Control Radar) page:

1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. From the FCR page, select "GM" Mode using OSBs
4. Adjust Gain and Contrast as required.





2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – Expanded Modes

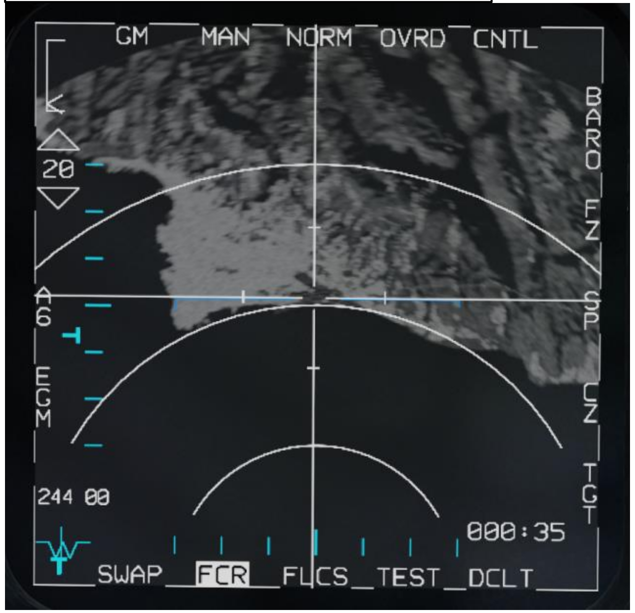
Introduction to EXP Modes

When ground mapping (GM) mode is selected, you can select « expanded » sub-modes, which can be seen as a « zoom » feature that can be used to designate target points for weapons delivery. These modes are called « Doppler-Beam-Sharpened » (DBS) modes since they are high resolution mapping modes used to identify and target detail down to individual structures or vehicles.

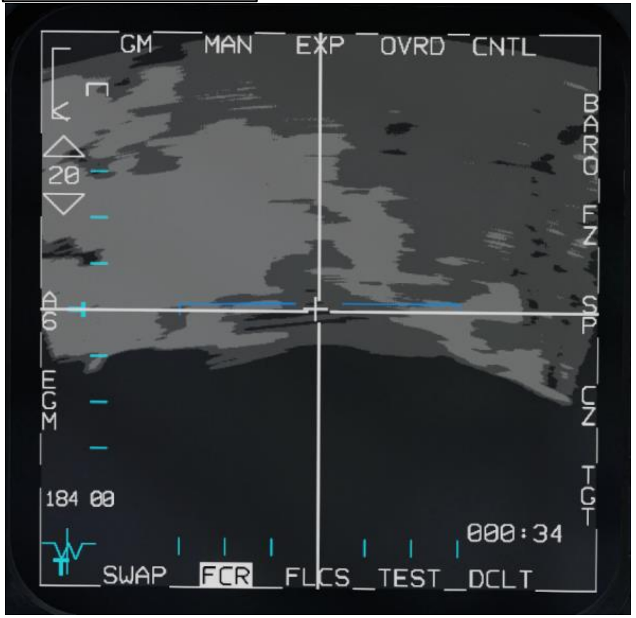
From the FCR GM page or any expanded mode currently selected, you can access any of the three expanded sub-modes:

- **EXP Map**
  - EXP is the lowest resolution expanded mode, with a 4:1 expansion of the NORM scan area. The EXP format contains most of the same options and symbology described for the MAP mode.
- **DBS1 Map**
  - DBS1 (Doppler Beam Sharpening mode level 1) is the next higher resolution mode up from EXP. The DBS mode can create a higher-resolution image than the enhanced ground mapping mode, though it takes longer to render the image. DBS level 1 produces a 24:1 sharpening. The rendered area is the same size as EXP mode.
- **DBS2 Map**
  - DBS2 (Doppler Beam Sharpening mode level 2) is the highest resolution expanded mode available. Level 2 creates an even sharper image, at 64:1, but raster takes three times longer than DBS1. The rendered area depends on range to target, with a minimum of 8 nm square.

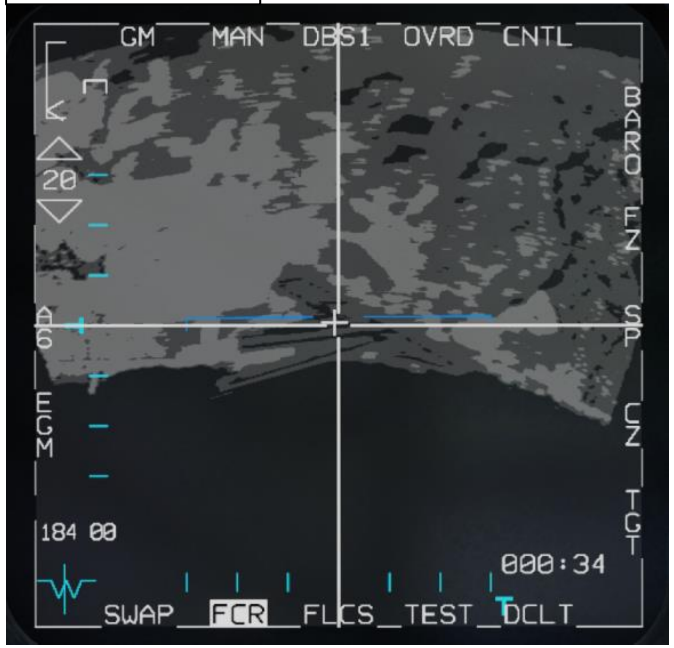
Ground Map Mode, Normal Scan



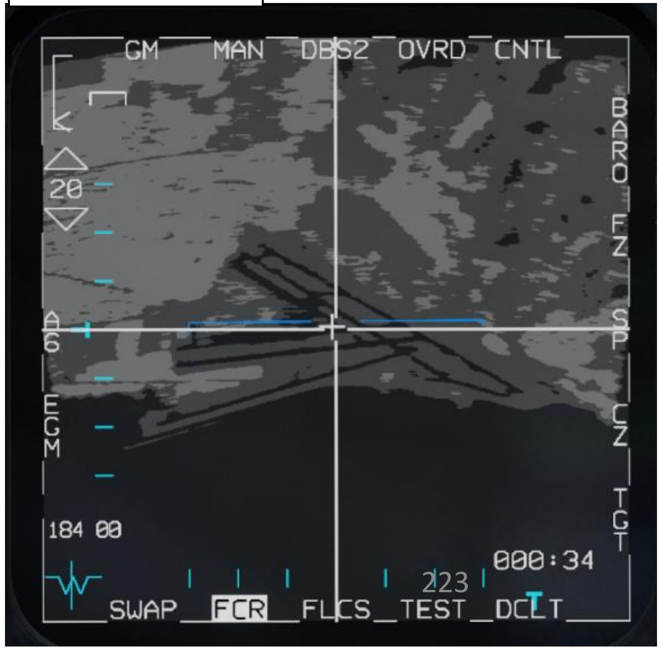
EXP Sub-Mode



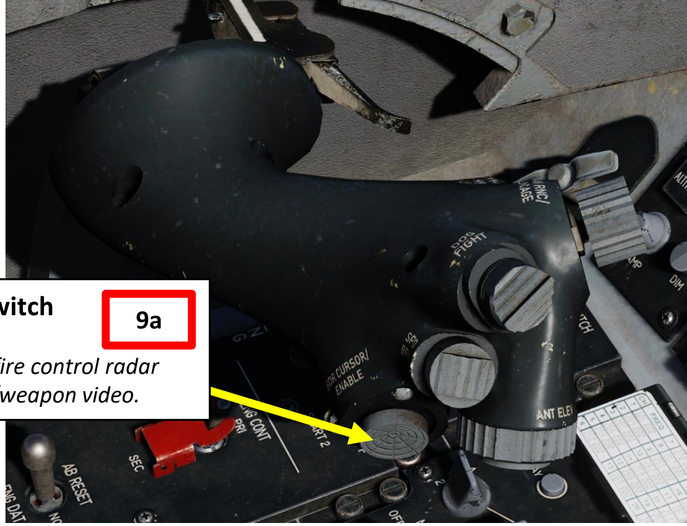
DBS1 Sub-Mode



DBS2 Sub-Mode

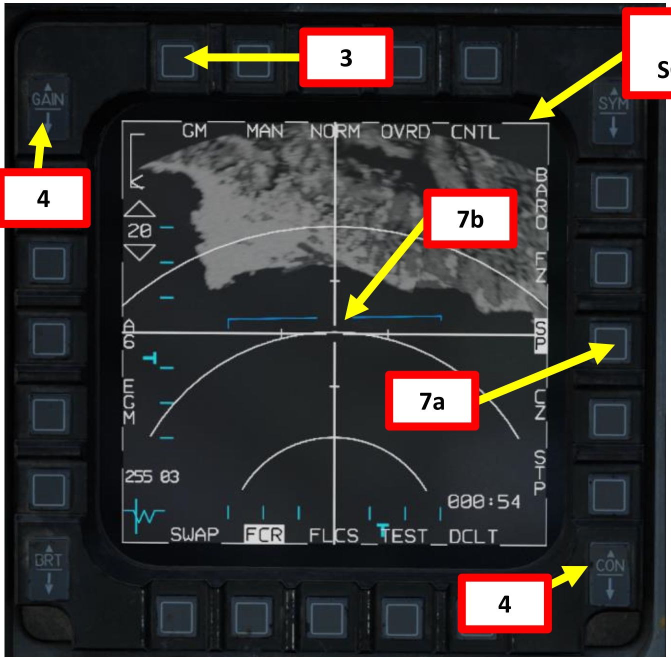


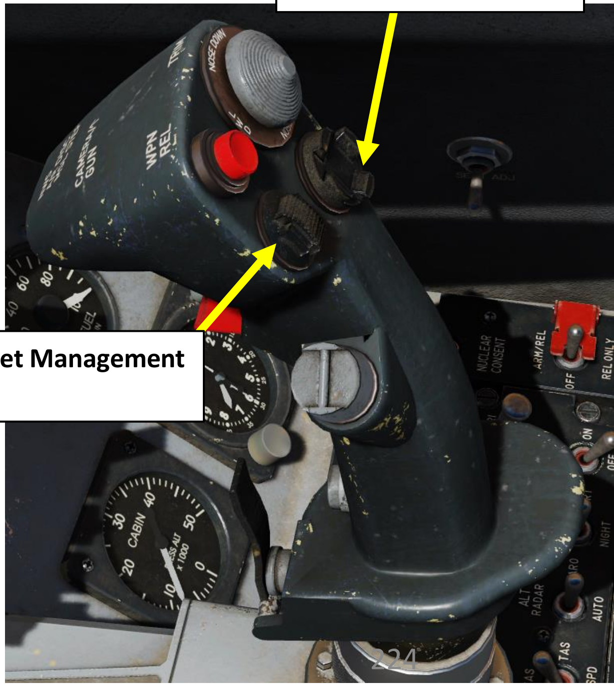
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – Expanded Modes
2.2.3.1 – EXP Sub-Mode



How to Select EXP Sub-Mode

1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. Select FCR page, then select "GM" Mode using OSBs
4. Adjust Gain and Contrast as desired.
5. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
6. The Radar Crosshair/Cursor should be set to the SPI (Sensor Point of Interest) location. In this example, it is set to a selected Steerpoint.
7. **If desired**, press OSB next to "SP" to select Snowplow Mode. The radar will scan directly ahead of the aircraft, independent of the SPI location, and the radar cursor will be fixed at the center of the display. Not using Snowplow means the Radar Crosshair will be set on the current SPI location (like a Steerpoint).
8. **If using Snowplow Mode**, press TMS (Target Management Switch) FWD to ground-stabilize the Radar Crosshair and exit Snowplow mode. This will allow you to move the Radar Crosshair. If not using Snowplow Mode, disregard this step.
9. Use the Radar Cursor/Enable switch to move the Radar Crosshair over the desired region.



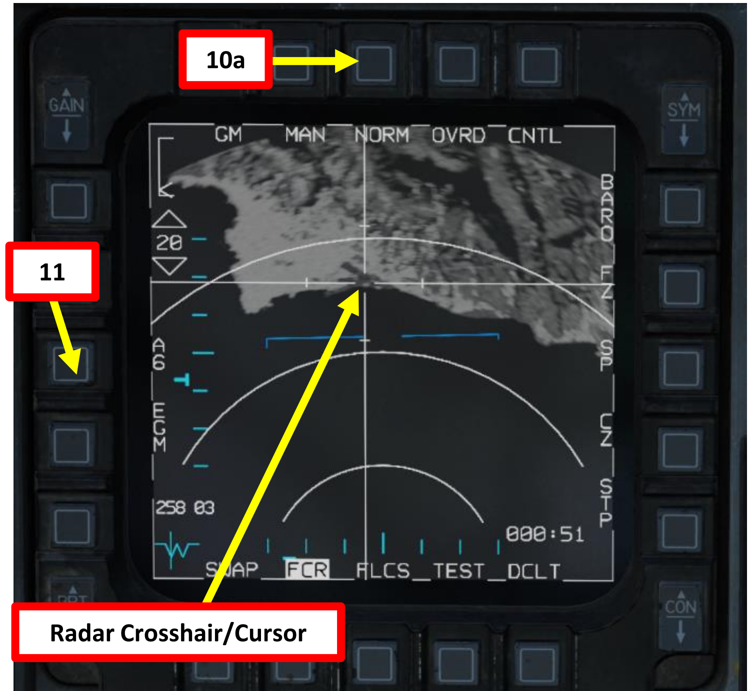


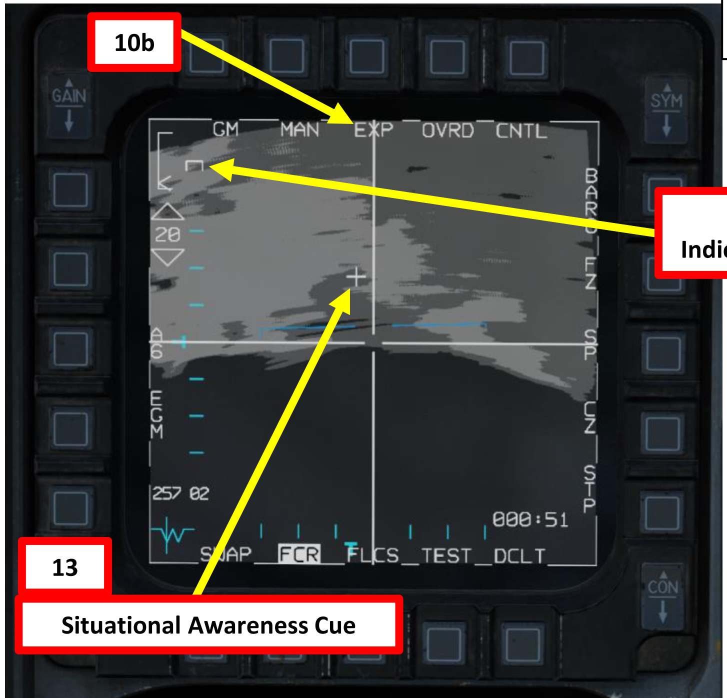
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – Expanded Modes
2.2.3.1 – EXP Sub-Mode

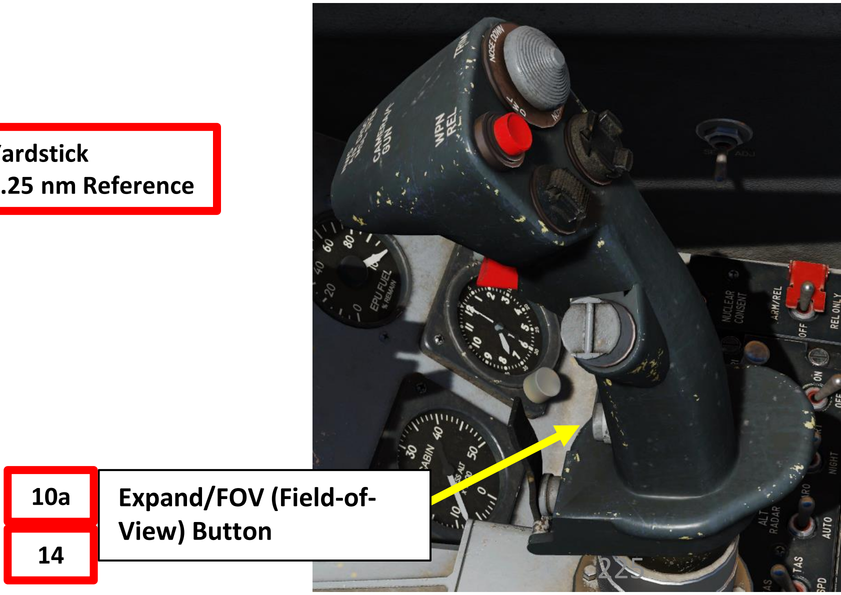
How to Select EXP Sub-Mode

10. Once Radar Crosshair is over the region you want to expand, either press the Expand/FOV Button or use the OSB next to the Radar Sub-Mode Selector to switch to EXP Sub-Mode.
11. Adjust Radar Scan Azimuth – As desired. Smaller azimuth means a faster update.
12. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded.
13. Once region is expanded with a 4:1 expansion of the NORM scan area, a Situational Awareness Cue (thin cross) appears on the display to show where the Radar Crosshair/Cursor would be upon return to the non-expanded NORM display. This is useful to determine range to the selected sighting point.
14. If you want to return to NORM (Non-Expanded), you can toggle between other Expanded Modes using the Expand/FOV Button.

When in an expanded sub-mode, the Radar Crosshair is fixed at the center of the screen, and using the Radar Cursor/Enable switch control slews the image, not the crosshairs. Take note that using the FZ (Freeze) function is helpful to keep the radar image frozen while slewing.







2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – Expanded Modes
2.2.3.2 – DBS1 Sub-Mode

How to Select DBS1 Sub-Mode

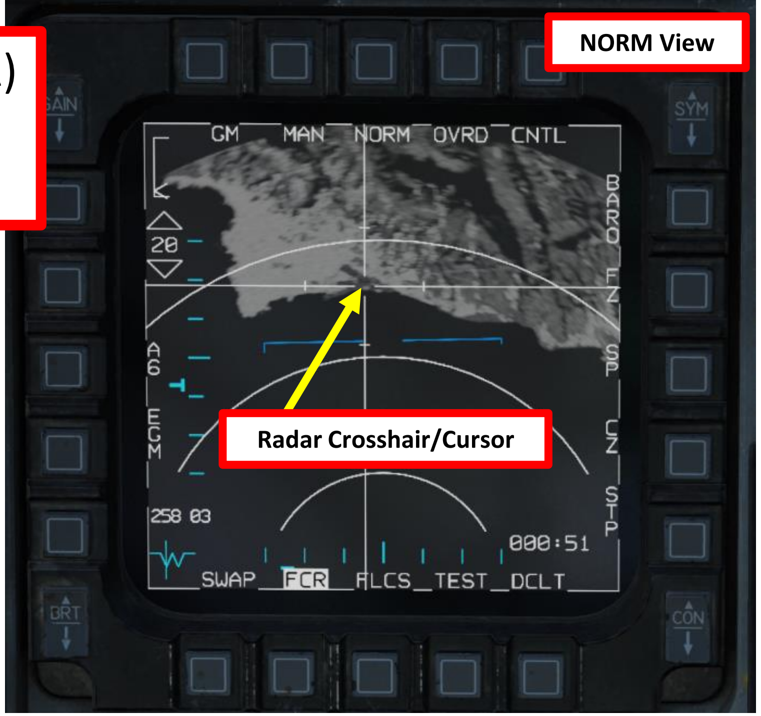
DBS1 (Doppler Beam Sharpening mode level 1) is the next higher resolution mode up from EXP. The DBS mode can create a higher-resolution image than the enhanced ground mapping mode, though it takes longer to render the image. DBS level 1 produces a 24:1 sharpening. The rendered area is the same size as EXP mode.

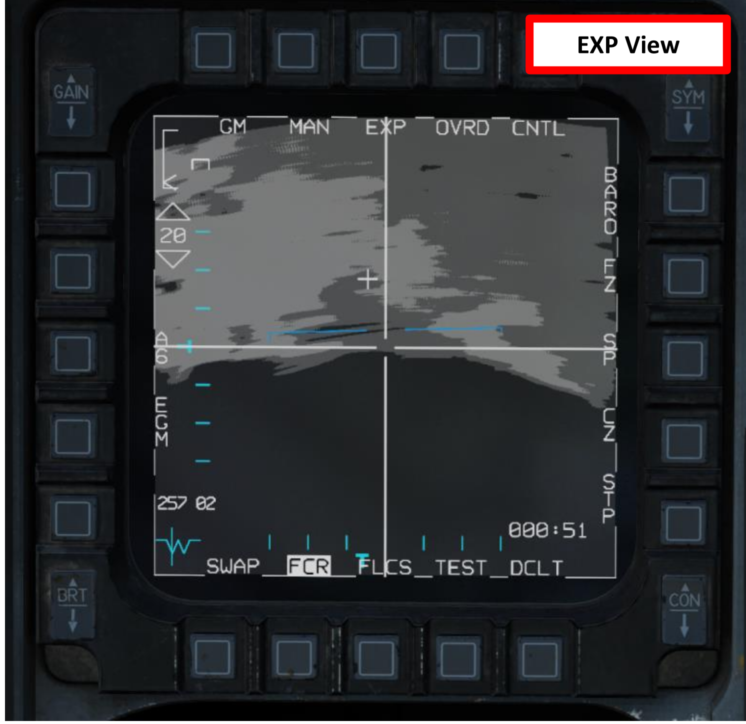
DBS1 Sub-Mode can be selected with the Expand/FOV Button or the OSB next to the Radar Sub-Mode Selector once you have already expanded a region with EXP Sub-Mode.

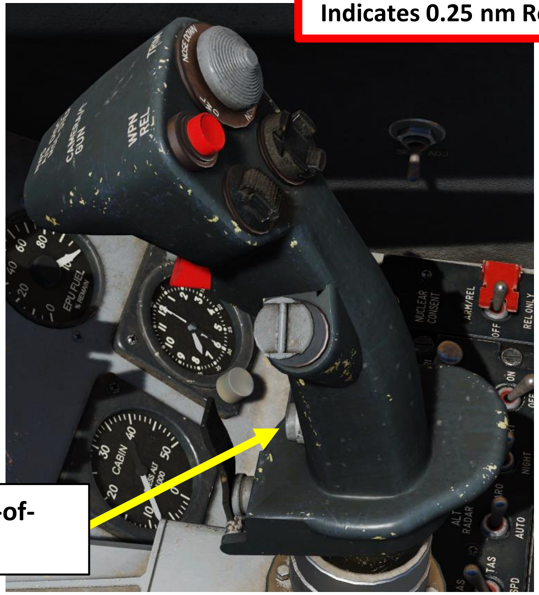
When in an expanded sub-mode, the Radar Crosshair is fixed at the center of the screen, and using the Radar Cursor/Enable switch control slews the image, not the crosshairs. Take note that using the FZ (Freeze) function is helpful to keep the radar image frozen while slewing.

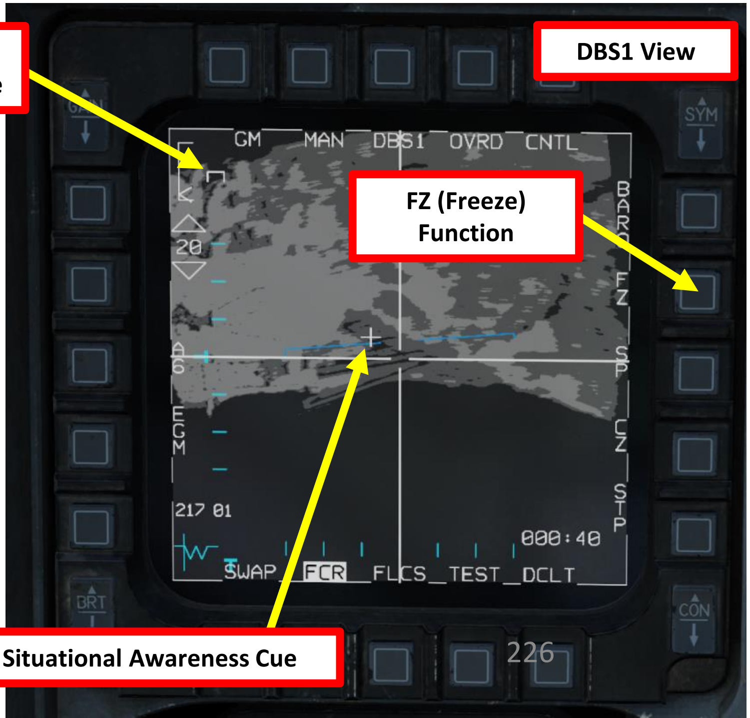
The Situational Awareness Cue (thin cross) appears on the display to show where the Radar Crosshair/Cursor would be upon return to the non-expanded NORM display. This is useful to determine range to the selected sighting point.

If you want to return to NORM (Non-Expanded), you can toggle between other Expanded Modes using the Expand/FOV Button.









2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – Expanded Modes
2.2.3.3 – DBS2 Sub-Mode

How to Select DBS2 Sub-Mode

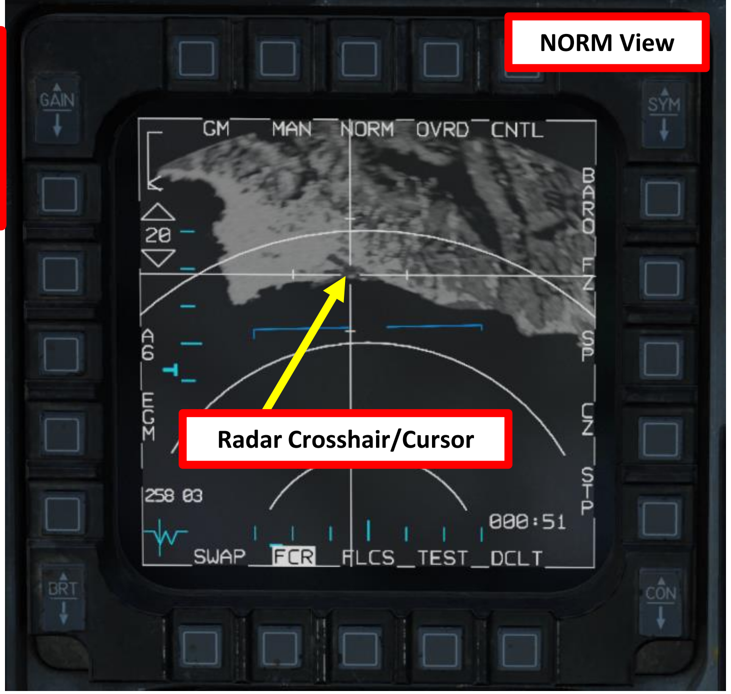
DBS2 (Doppler Beam Sharpening mode level 2) is the highest resolution expanded mode available. Level 2 creates an even sharper image, at 64:1, but raster takes three times longer than DBS1. The rendered area depends on range to target, with a minimum of 8 nm square.

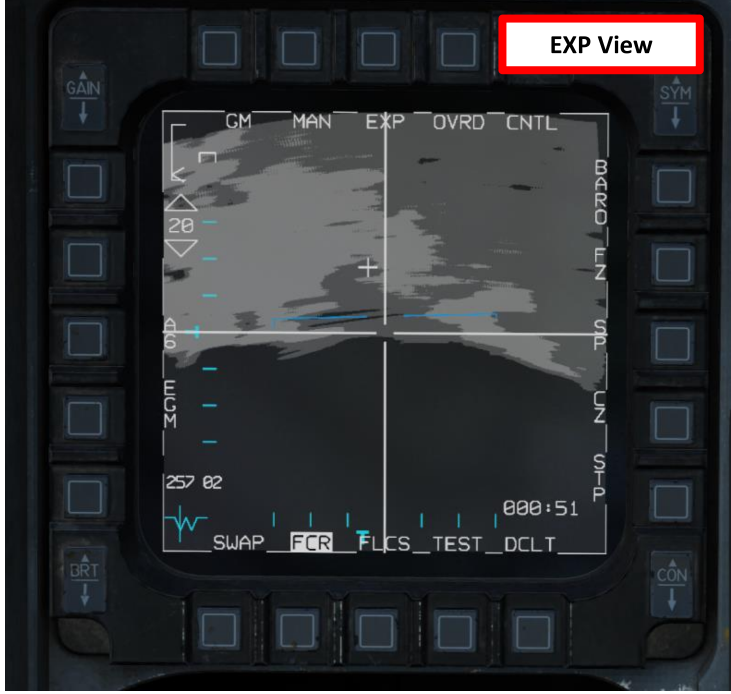
DBS2 Sub-Mode can be selected with the Expand/FOV Button or the OSB next to the Radar Sub-Mode Selector once you have already expanded a region with EXP Sub-Mode, then expanded it again with DBS1 Sub-Mode.

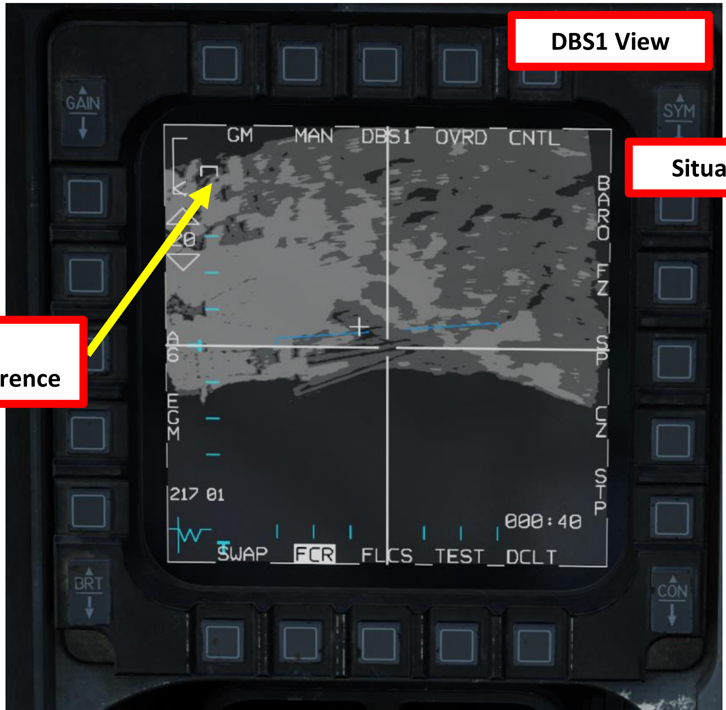
When in an expanded sub-mode, the Radar Crosshair is fixed at the center of the screen, and using the Radar Cursor/Enable switch control slews the image, not the crosshairs. Take note that using the FZ (Freeze) function is helpful to keep the radar image frozen while slewing.

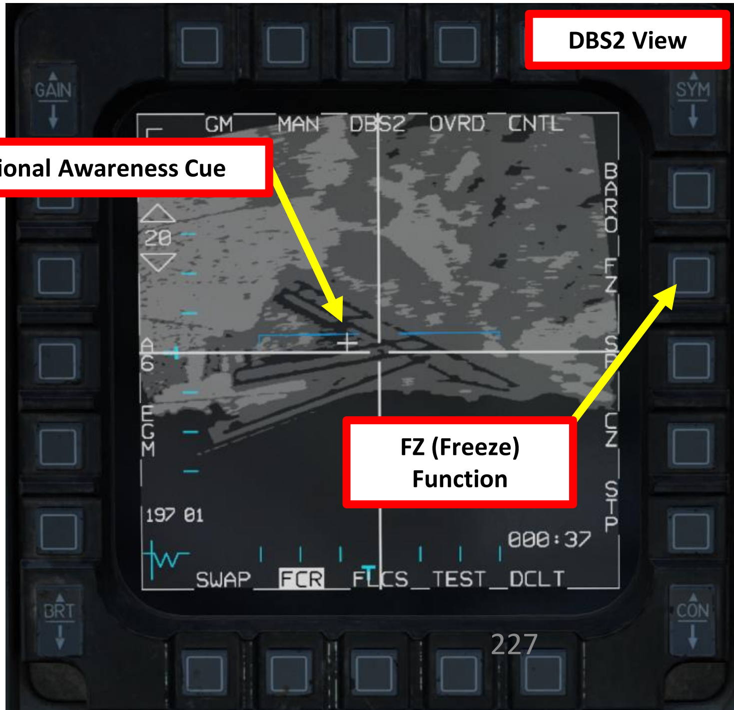
The Situational Awareness Cue (thin cross) appears on the display to show where the Radar Crosshair/Cursor would be upon return to the non-expanded NORM display. This is useful to determine range to the selected sighting point.

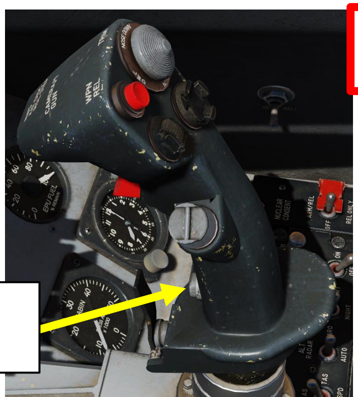
If you want to return to NORM (Non-Expanded), you can toggle between other Expanded Modes using the Expand/FOV Button.







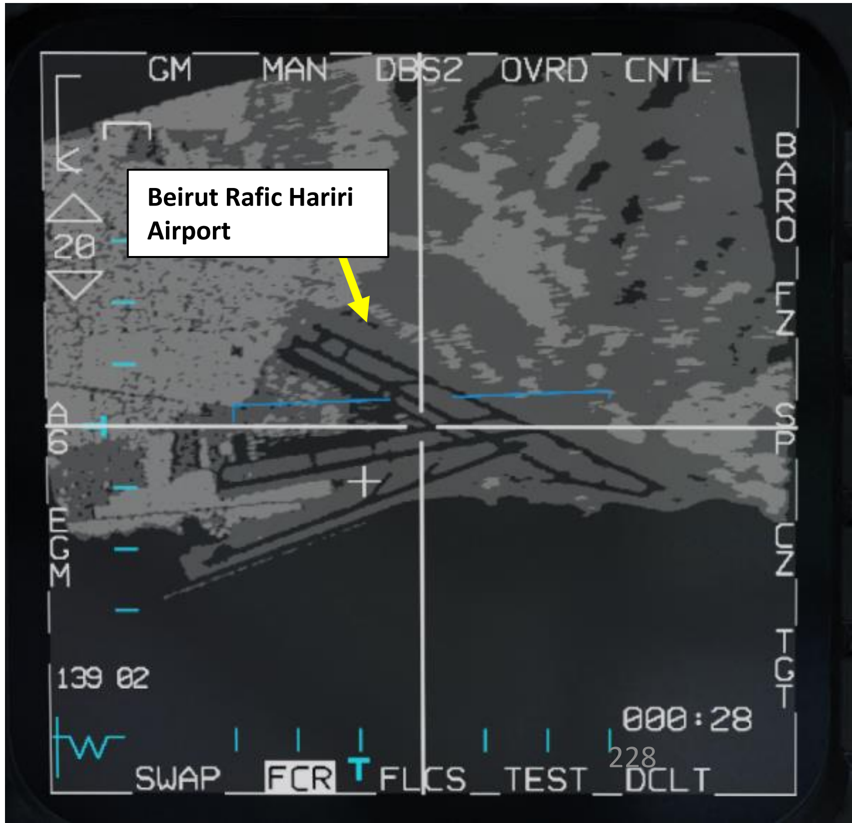




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.3 – Expanded Modes
2.2.3.3 – DBS2 Sub-Mode

How to Select DBS2 Sub-Mode

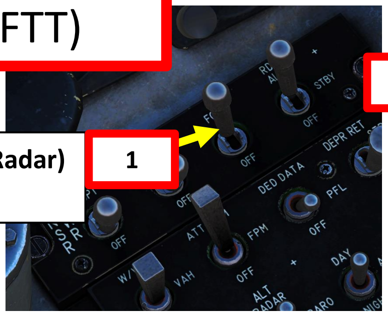
As you can see, even with the best Expanded Mode setting, the resolution isn't amazing. Some terrain features are recognizable, but you will definitely need to use other sensors like the targeting pod to have a good visual of a target before dropping ordnance on it.

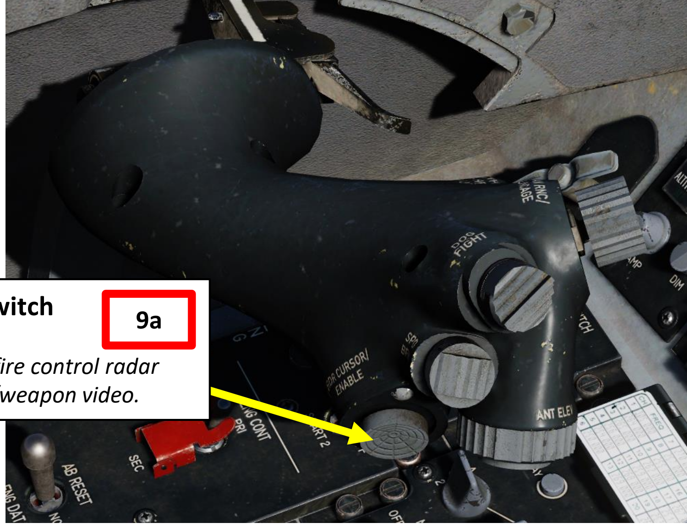


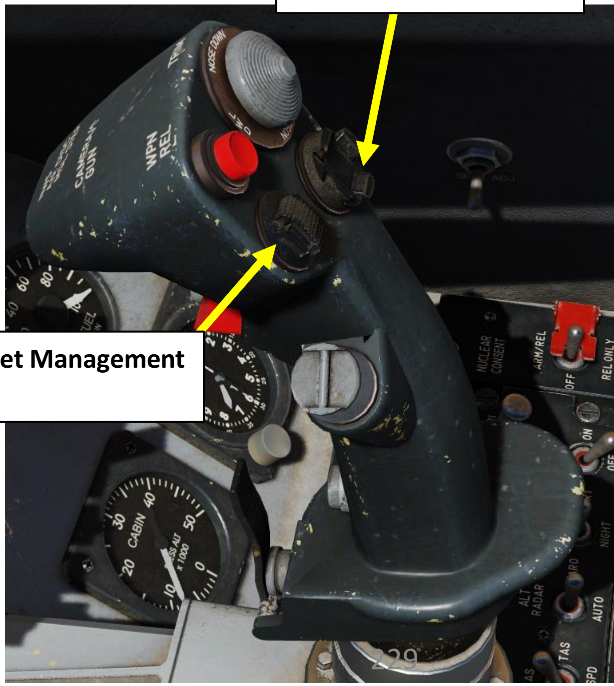
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.4 – Target Designation: Fixed Target Track (FTT)

How to Designate/Undesignate a Target

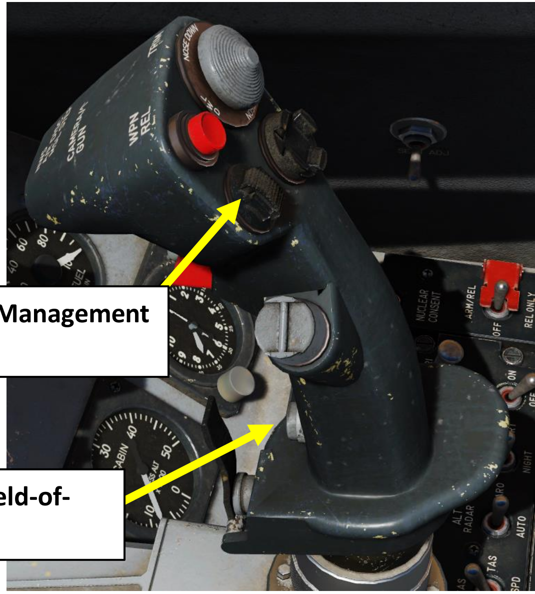
1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. Select FCR page, then select “GM” Mode using OSBs
4. Adjust Gain and Contrast as desired.
5. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
6. The Radar Crosshair/Cursor should be set to the SPI (Sensor Point of Interest) location. In this example, it is set to a selected Steerpoint.
7. **If desired**, press OSB next to “SP” to select Snowplow Mode. The radar will scan directly ahead of the aircraft, independent of the SPI location, and the radar cursor will be fixed at the center of the display. Not using Snowplow means the Radar Crosshair will be set on the current SPI location (like a Steerpoint).
8. **If using Snowplow Mode**, press TMS (Target Management Switch) FWD to ground-stabilize the Radar Crosshair and exit Snowplow mode. This will allow you to move the Radar Crosshair. If not using Snowplow Mode, disregard this step.
9. Use the Radar Cursor/Enable switch to move the Radar Crosshair over the desired region.





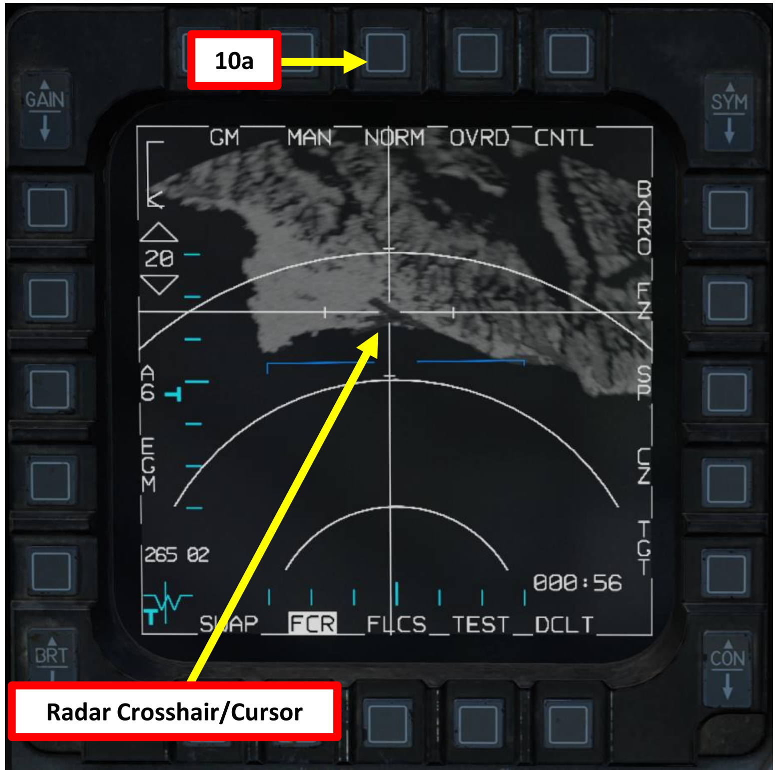


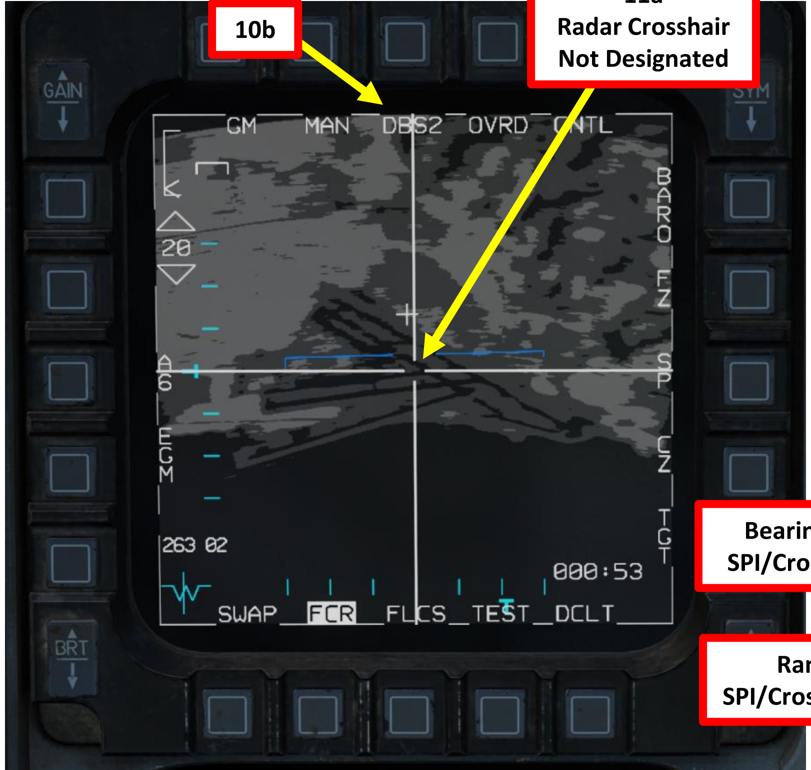
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.4 – Target Designation: Fixed Target Track (FTT)

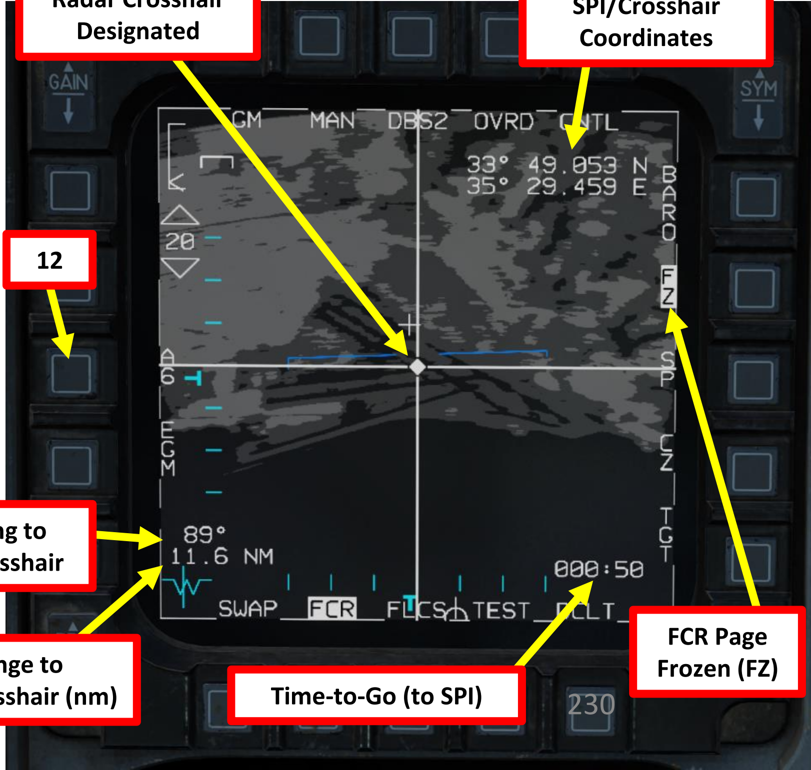


How to Designate/Undesignate a Target

10. Target Designation via the ground Fire Control Radar, also called Fixed Target Track (FTT), can be performed from any air-to-ground radar Ground Mapping mode (NORM, EXP, DBS1, DBS2). If you want to use Expanded sub-modes, either press the Expand/FOV Button or use the OSB next to the Radar Sub-Mode Selector to switch to desired Sub-Mode. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded. If you want to return to NORM (Non-Expanded), you can toggle between other Expanded Modes using the Expand/FOV Button.
11. To designate target on Radar Crosshair position, press TMS (Target Management Switch) UP. This will perform a ground-stabilized Fixed Target Track (FTT) and freeze (FZ) the FCR image.
12. Adjust Radar Scan Azimuth – As desired. Smaller azimuth means a faster update.
13. To un-designate target and exit FTT, press TMS (Target Management Switch) DOWN.







2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.4 – Target Designation: Fixed Target Track (FTT)

How to Designate/Undesignate a Target

14. When in FTT, the designated location becomes the SPI. The radar will continue to track the target location while line-of-sight (LOS) is maintained. If LOS is lost, the radar will coast for 10 seconds before the radar returns to GM or SEA mode. If the designated location moves outside the radar field of view, the radar will slew to boresight until the target returns into the radar FOV, at which point the radar will reacquire the target. If the target remains outside the radar FOV for 60 seconds, the radar will return to GM or SEA.
15. If you want to slave other sensors like the Targeting Pod to the SPI (Sensor Point of Interest) designated via the radar, first make sure a valid air-to-ground weapon is selected on the SMS (Stores Management Set) page and a valid release mode is selected (CCRP or PRE).
16. Pressing on the Sighting Option Selector (TGT in our case) OSB will slave the Targeting Pod to the FTT (Fixed Target Track).

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.5 – GMT (Ground Moving Target) Mode

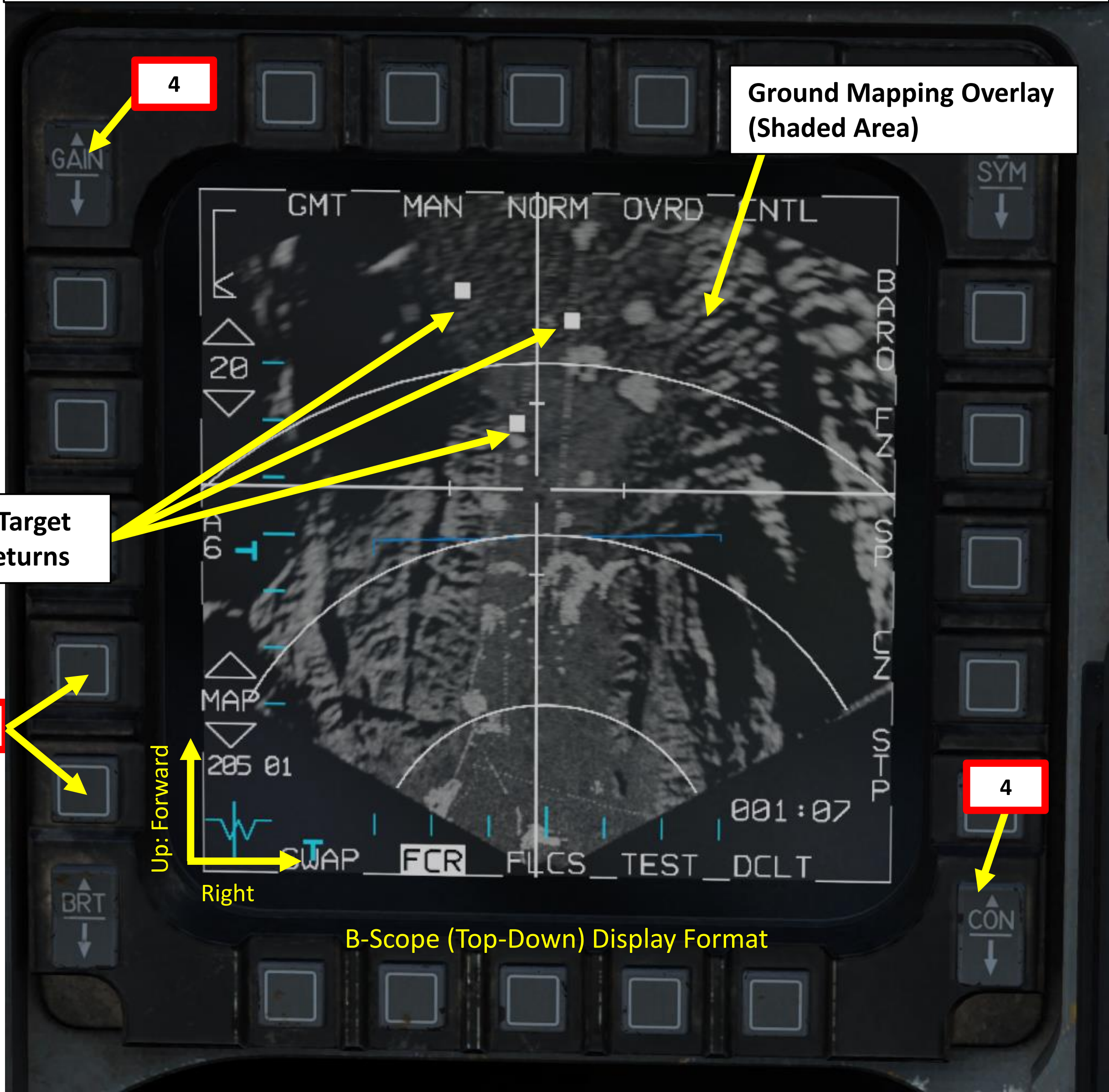
Display

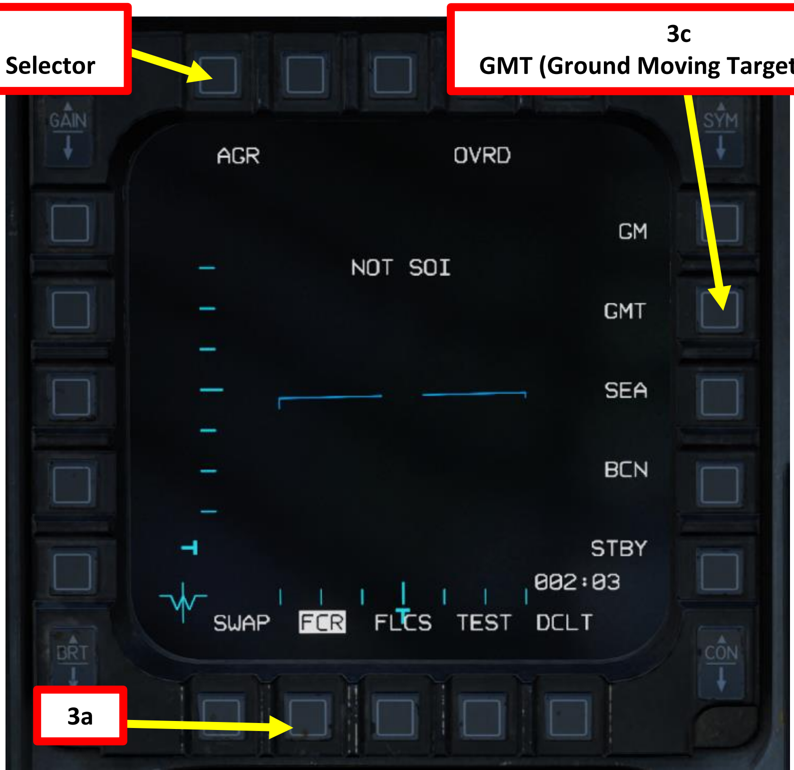
The Ground Moving Target (GMT) radar mode scans for and highlights moving targets, detected by their Doppler shift. Detected targets are displayed as white squares. The shaded area of the display shows antenna azimuth coverage and the ground mapping (GM) overlay.

Keep in mind that in order to display the GMT data on the FCR (Fire Control Radar) page:

1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. From the FCR page, select "GMT" Mode using OSBs
4. Adjust Contrast as required.
5. Adjust Ground Map Overlay Gain by using the OSBs next to "MAP".

GMT (Ground Moving Target) Radar Mode Selected





2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.5 – GMT (Ground Moving Target) Mode

Controls (GMT Page)

Controls for the GMT page are almost **identical to the controls of the GM (Ground Mapping) page**. Display range and azimuth settings are modified in the same manner. However, there are some differences with GM:

- In GMT, the field-of-view sub-modes can only be NORM or EXP. DBS sub-mode are not available in GMT.
- The ground map overlay gain is controlled by the Option Select Buttons (OSBs) next to "MAP".

Radar Mode Selector
- GM (Ground Mapping)
- GMT (Ground Moving Target)
- SEA (Sea Search)
- BCN (Beacon)
- STBY (Standby)

Radar Sub-Mode Selector
- NORM
- EXP

Radar Control (CNTL) Page Selector

Radar Gain Indicator
- The caret indicates the current radar gain. Radar gain is adjusted with the Ground Map Overlay Gain Control OSBs. Higher gain values will produce a brighter image but may wash out details.

Ground Map Overlay Gain Controls

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.5 – GMT (Ground Moving Target) Mode

Controls (GMT CNTL Page)

Moving Target Rejection

- Sets the minimum relative velocity that a detected aircraft must have before it is displayed (Doppler gate). Settings are LO (Low Speed) and HI (High Speed).
  - LO: Only displays targets from 8 kts to 55 kts
  - HI: Only displays targets from 60 kts to 75 kts

Altitude Tracker Option

- Toggles on and off the altitude line tracker/blanker. When on, blanks all targets which are detected at the range of the altitude line.

Target History Setting

- Sets the number of frames that a radar return lives. When set to 1, a radar return is only displayed during the frame that it is detected. When set to 2, 3, or 4, the radar return is displayed for additional scan frames, becoming dimmer with each new frame. By setting the target history, you can get a broad idea of target relative bearing, since the frames will appear to form a line.

Radar Level Setting

- Not Simulated.

FCR CNTL (Control) Sub-Page Selected

Channel

- Selects the frequency channel the radar uses, 1 through 4. Different aircraft within a flight should use different channels to avoid radar interference with each other. Not Simulated.

Mark Intensity Setting

- Not Simulated.

Radar Frequency Agility Band Setting

- Toggles between wide (WIDE) and narrow (NARO) frequency agility bandwidth (not implemented). Frequency agility refers to the radar's technique of randomly hopping between different frequencies within the agility band, to increase the difficulty of being jammed.

Beacon Mode Delay Setting

- Offset time delay for radar beacon reception. Not Simulated.

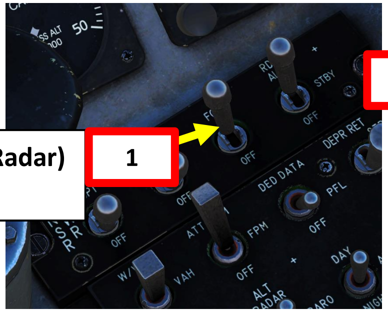
Power Management Setting

- Not Simulated.

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.5 – GMT (Ground Moving Target) Mode

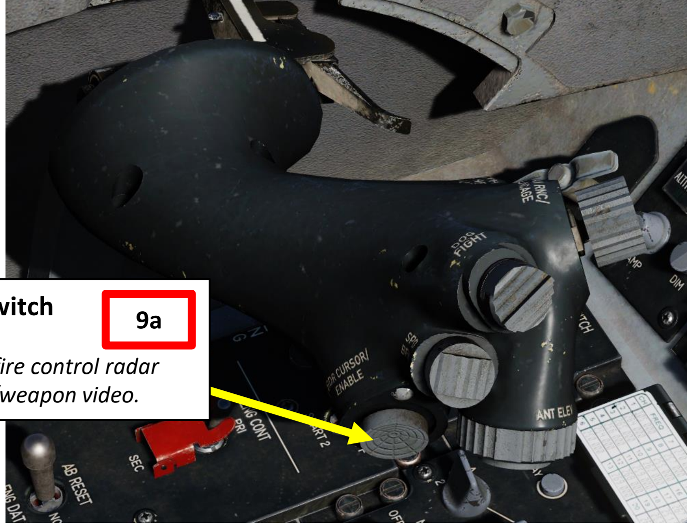
How to Track a Moving Target (GMTT)

1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. Select FCR page, then select “GMT” Mode using OSBs
4. Adjust Ground Map Overlay gain and contrast as desired.
5. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
6. The Radar Crosshair/Cursor should be set to the SPI (Sensor Point of Interest) location. In this example, it is set to a selected Steerpoint.
7. **If desired**, press OSB next to “SP” to select Snowplow Mode. The radar will scan directly ahead of the aircraft, independent of the SPI location, and the radar cursor will be fixed at the center of the display. Not using Snowplow means the Radar Crosshair will be set on the current SPI location (like a Steerpoint).
8. **If using Snowplow Mode**, press TMS (Target Management Switch) FWD to ground-stabilize the Radar Crosshair and exit Snowplow mode. This will allow you to move the Radar Crosshair. If not using Snowplow Mode, disregard this step.
9. Use the Radar Cursor/Enable switch to move the Radar Crosshair over the desired moving target (white square).



FCR (Fire Control Radar) Power Switch — 1

2 — A-G (Air-to-Ground) Master Mode Button



Radar Cursor/Enable Switch — 9a
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

3

5b SOI Box

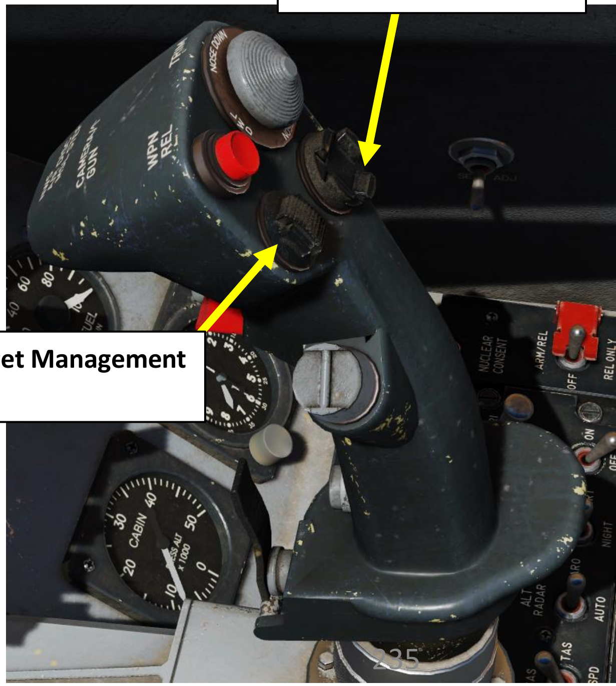
7b

7a

4 Gain

4 Contrast

9b Radar Crosshair Slewed on Moving Contact



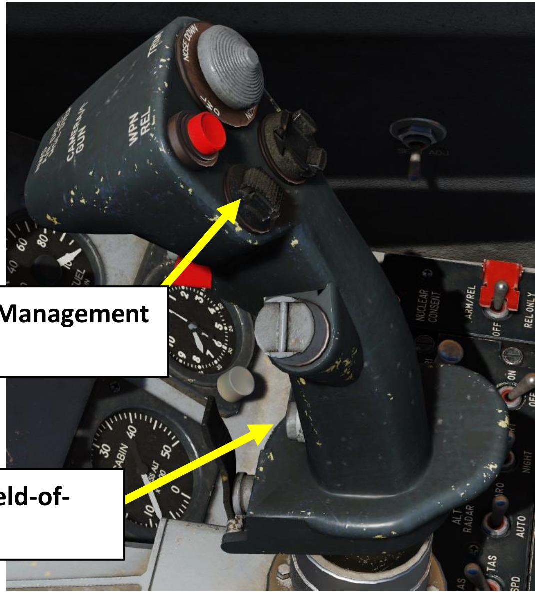
5a — DMS (Display Management Switch)

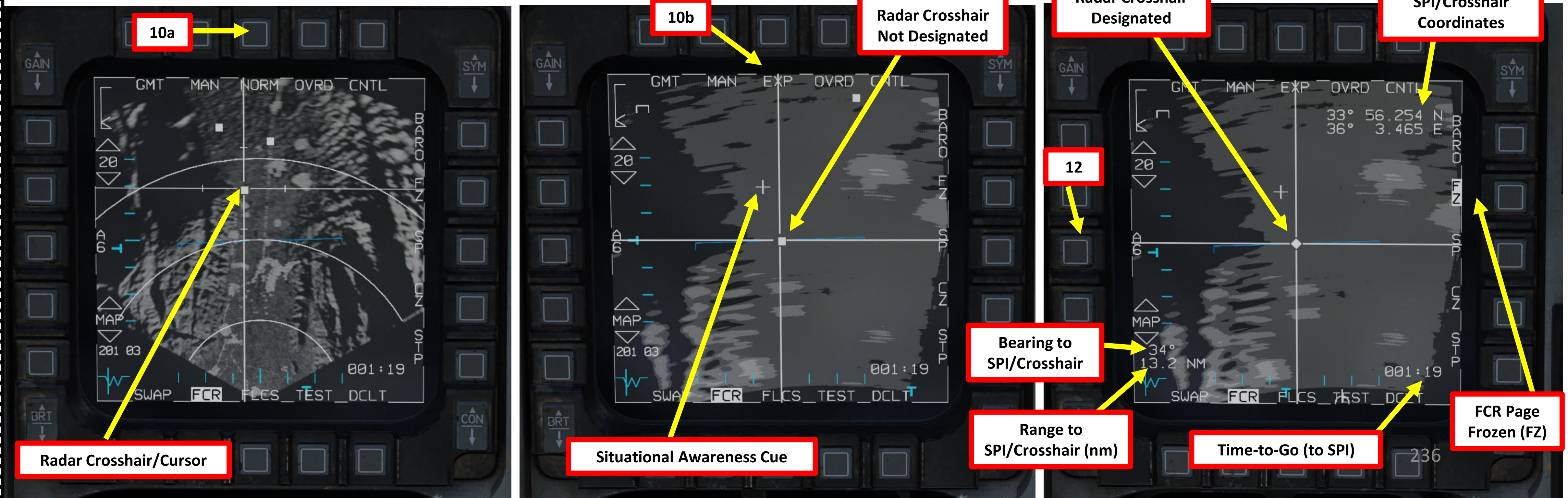
8 — TMS (Target Management Switch)

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.5 – GMT (Ground Moving Target) Mode

How to Track a Moving Target (GMTT)

10. A Moving Target Designation via the ground Fire Control Radar, also called Ground Moving Target Track (GMTT), can be performed from any air-to-ground radar Ground Moving Target mode (NORM or EXP). If you want to use EXP sub-mode, either press the Expand/FOV Button or use the OSB next to the Radar Sub-Mode Selector to switch to desired Sub-Mode. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded. If you want to return to NORM (Non-Expanded), you can use the Expand/FOV Button.
11. To designate target on Radar Crosshair position, press TMS (Target Management Switch) UP. This will perform a ground-stabilized Ground Moving Target Track (GMTT) and freeze (FZ) the FCR image.
12. Adjust Radar Scan Azimuth – As desired. Smaller azimuth means a faster update.
13. To un-designate target and exit GMTT, press TMS (Target Management Switch) DOWN.





2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.5 – GMT (Ground Moving Target) Mode

How to Track a Moving Target (GMTT)

14. When in GMTT, the designated location becomes the SPI. The radar will continue to track the target location while line-of-sight (LOS) is maintained. If LOS is lost, the radar will coast for 10 seconds before the radar returns to GM or SEA mode. If the designated location moves outside the radar field of view, the radar will slew to boresight until the target returns into the radar FOV, at which point the radar will reacquire the target. If the target remains outside the radar FOV for 60 seconds, the radar will return to GM or SEA.
15. If you want to slave other sensors like the Targeting Pod to the SPI (Sensor Point of Interest) designated via the radar, first make sure a valid air-to-ground weapon is selected on the SMS (Stores Management Set) page and a valid release mode is selected (CCRP or PRE).
16. Pressing on the Sighting Option Selector (TGT in our case) OSB will slave the Targeting Pod to the GMTT (Ground Moving Target Track).

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.2.6 – BCN (Beacon) Mode

Not yet implemented.

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.3.1 – SEA Mode

A-G (Air-to-Ground) Master Mode Button

2

Display

The Sea Search (SEA) mode works identically to GM mode. SEA mode is appropriate for tracking slow-moving or stationary objects on the water's surface.

Detected targets are displayed as grey/white bricks. The shaded area of the display shows antenna azimuth coverage and the ground mapping (GM) overlay. Keep in mind that in order to display the SEA data on the FCR (Fire Control Radar) page:

1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. From the FCR page, select "SEA" Mode using OSBs
4. Adjust Gain and Contrast as required.

SEA (Sea Search) Radar Mode Selected

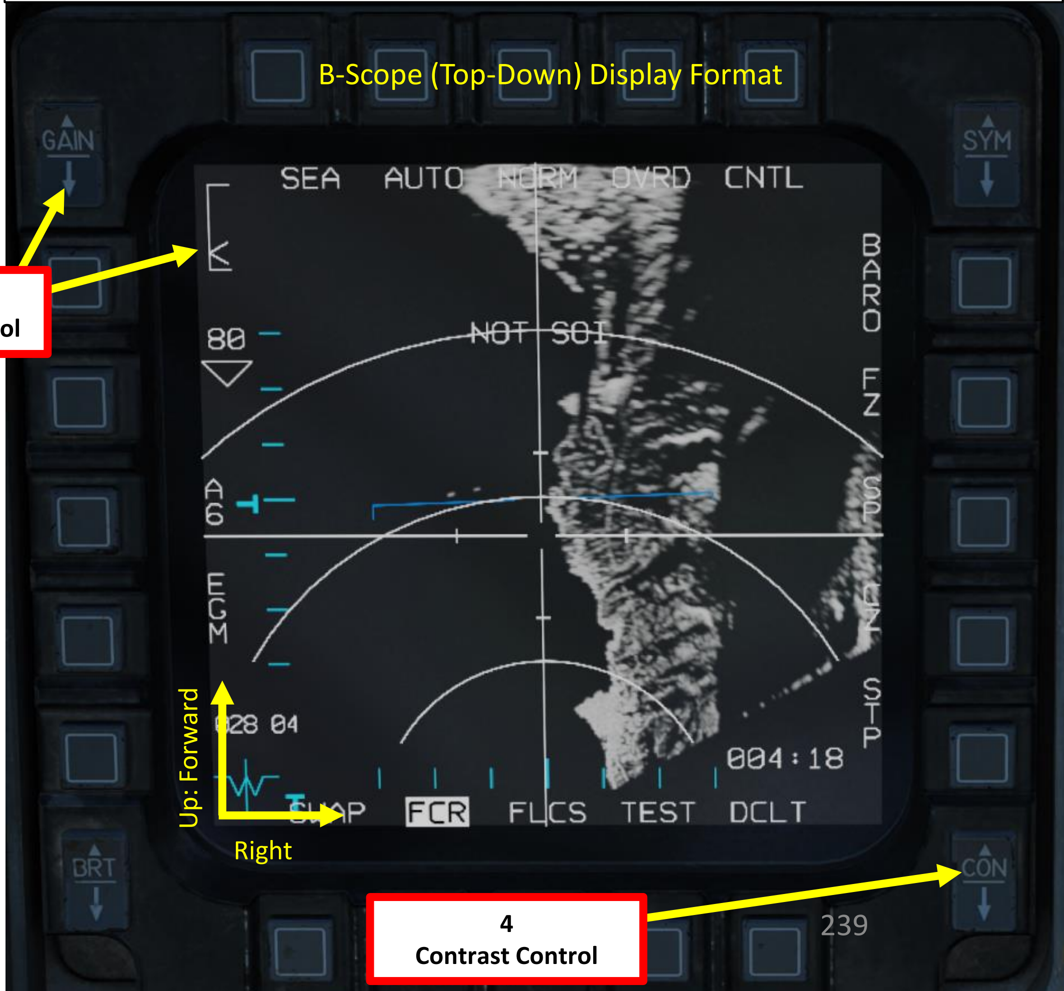
3b
Radar Mode Selector

3c
SEA (Sea Search) Mode

3a

1

4
Gain Control



4
Contrast Control

2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.3.1 – SEA Mode

Controls (SEA Page)

Here is an overview of the controls available from the FCR SEA Page. Controls for the SEA page are almost identical to the controls of the GM (Ground Mapping) page. Display range and azimuth settings are modified in the same manner. However, there is a small difference with GM:

- In SEA, the field-of-view sub-modes can only be NORM or EXP. DBS sub-mode are not available in SEA.

Automatic/Manual Range Selector
- Pressing this OSB toggles between AUTO and MAN (manual) range control. When in AUTO mode, moving the crosshairs to the top or bottom of the display increases or decreases the range. The label displays the mode that will be set if the OSB is pressed: AUTO is displayed when manual mode is active, and MAN is displayed when automatic mode is active.

Display Symbology Brightness Control

Radar Gain Control

Radar Gain Indicator
- The caret indicates the current radar gain. Radar gain is adjusted with the GAIN rocker to the left. Higher gain values will produce a brighter image but may wash out details.

Radar Range Controls & Indicator (nm)
- OSBs only work if Manual Ranging is selected or Radar Crosshair is moved to the top or the bottom of the display.
- Toggles between 80, 40, 20 and 10 nm settings.

Radar Scanning Azimuth Width Control
- Toggles between A6 (60 deg each side), A2 (20 deg each side) and A1 (10 deg each side) settings

EGM/RBM Image Processing Option
- EGM: Enhanced Ground Mode (Recommended)
- RBM: Real Beam Mode

Display Contrast Control

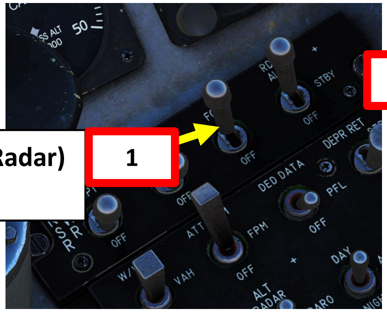
Display Brightness Control

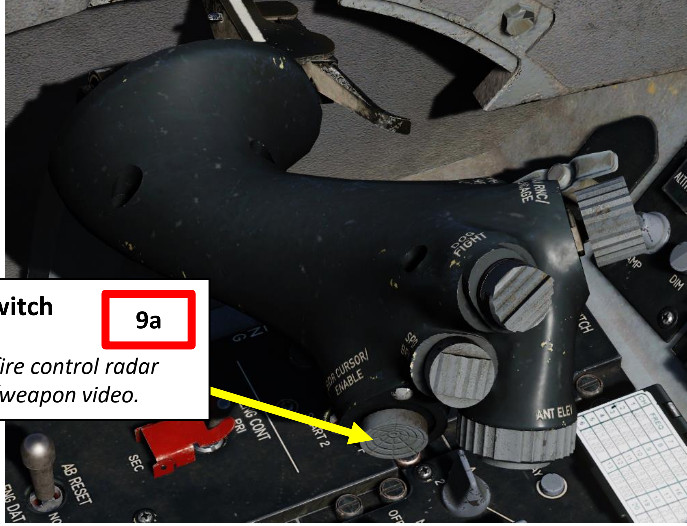
FCR Declutter (DCLT) Function

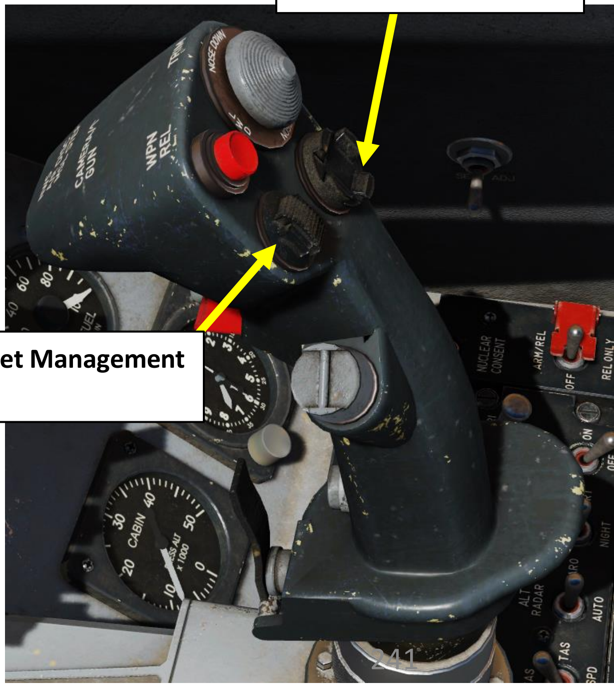
2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.3.1 – SEA Mode

How to Track a Naval Moving Target

1. FCR Power Switch must be set to ON (FWD)
2. Select A/G Master Mode
3. Select FCR page, then select "SEA" Mode using OSBs
4. Adjust Ground Map Overlay gain and contrast as desired.
5. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
6. The Radar Crosshair/Cursor should be set to the SPI (Sensor Point of Interest) location. In this example, it is set to a selected Steerpoint.
7. **<u>If desired</u>**, press OSB next to "SP" to select Snowplow Mode. The radar will scan directly ahead of the aircraft, independent of the SPI location, and the radar cursor will be fixed at the center of the display. Not using Snowplow means the Radar Crosshair will be set on the current SPI location (like a Steerpoint).
8. **<u>If using Snowplow Mode</u>**, press TMS (Target Management Switch) FWD to ground-stabilize the Radar Crosshair and exit Snowplow mode. This will allow you to move the Radar Crosshair. If not using Snowplow Mode, disregard this step.
9. Use the Radar Cursor/Enable switch to move the Radar Crosshair over the desired moving target (white brick).



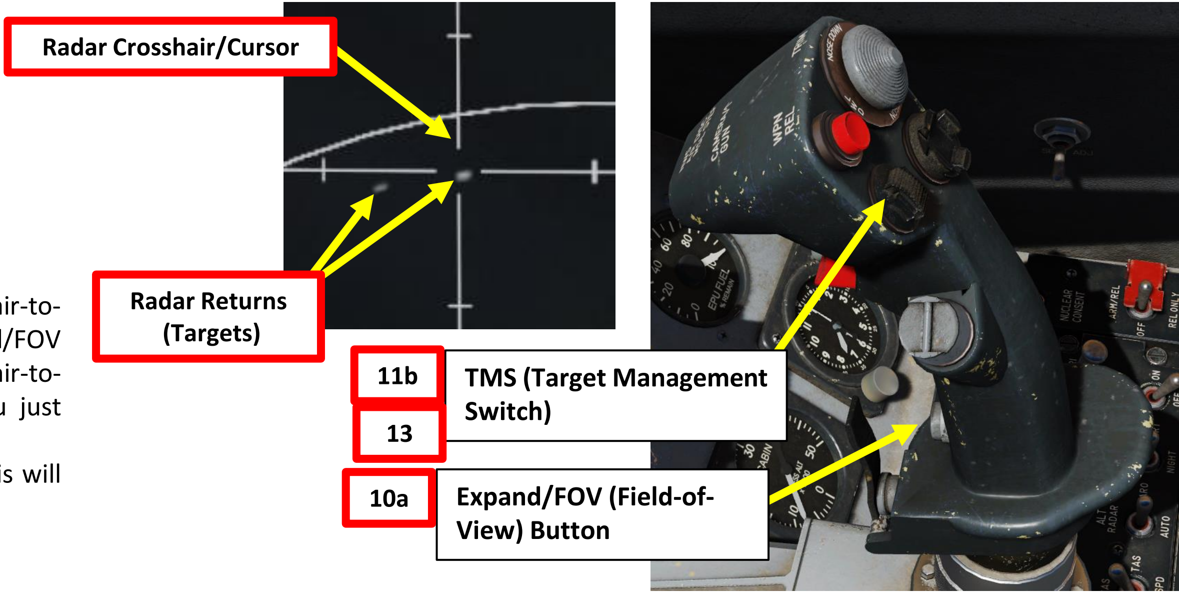


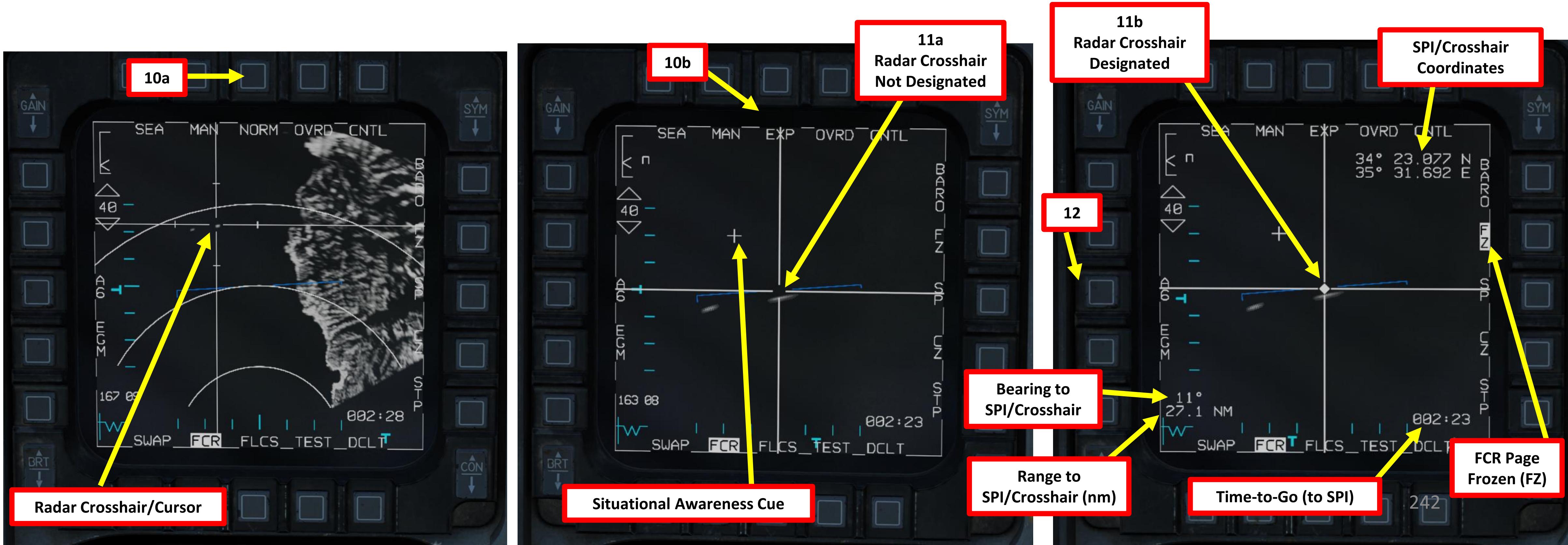


2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.3.1 – SEA Mode

How to Track a Naval Moving Target

10. A Moving Target Designation via the ground Fire Control Radar can be performed from any air-to-ground radar Sea mode (NORM or EXP). If you want to use EXP sub-mode, either press the Expand/FOV Button or use the OSB next to the Radar Sub-Mode Selector to switch to desired Sub-Mode. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded. If you want to return to NORM (Non-Expanded), you can use the Expand/FOV Button.
11. To designate target on Radar Crosshair position, press TMS (Target Management Switch) UP. This will perform a ground-stabilized tracking and freeze (FZ) the FCR image.
12. Adjust Radar Scan Azimuth – As desired. Smaller azimuth means a faster update.
13. To un-designate target and exit tracking, press TMS (Target Management Switch) DOWN.

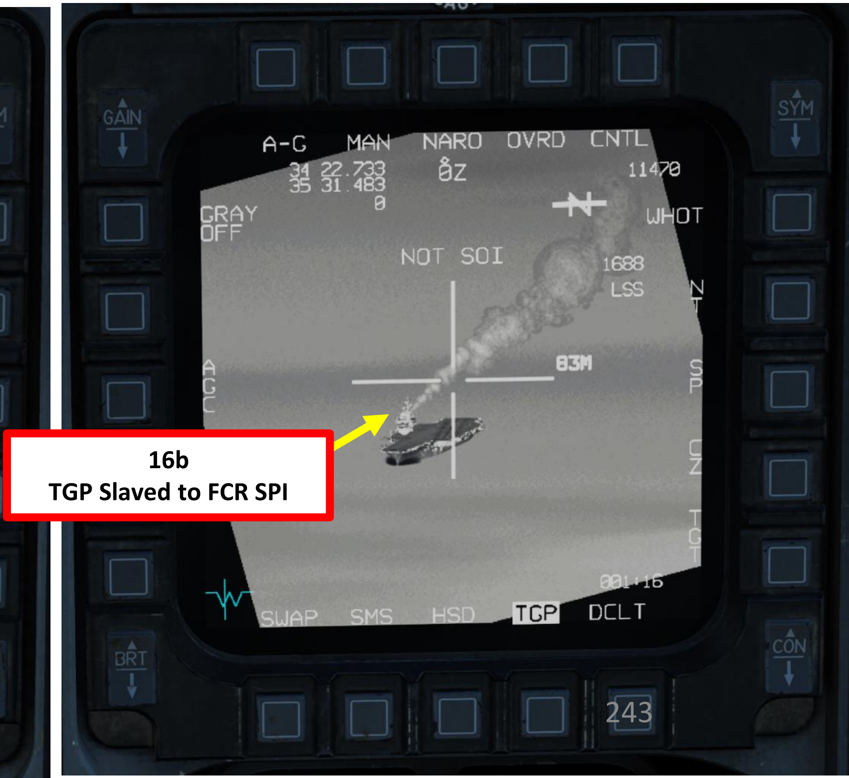




2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.3.1 – SEA Mode

How to Track a Naval Moving Target

14. When tracking the target, the designated location becomes the SPI. The radar will continue to track the target location while line-of-sight (LOS) is maintained. If LOS is lost, the radar will coast for 10 seconds before the radar returns to SEA mode. If the designated location moves outside the radar field of view, the radar will slew to boresight until the target returns into the radar FOV, at which point the radar will reacquire the target. If the target remains outside the radar FOV for 60 seconds, the radar will return to SEA.
15. If you want to slave other sensors like the Targeting Pod to the SPI (Sensor Point of Interest) designated via the radar, first make sure a valid air-to-ground weapon is selected on the SMS (Stores Management Set) page and a valid release mode is selected (CCRP or PRE).
16. Pressing on the Sighting Option Selector (TGT in our case) OSB will slave the Targeting Pod to the tracked naval target.



2 - AN/APG-68 FIRE CONTROL RADAR (FCR)
2.4 – Air-to-Air Radar Lingo & Terminology

- BANDIT: Identified Enemy Aircraft
- BOGEY: Unidentified Aircraft
- SPIKE: Air-to-Air radar is locked on you
- BUDDY SPIKE: Friendly radar is locked on you
- NAILS: RWR contact, which emits radar waves but does not have a radar lock on you
- FOX 1: semi-active radar missile (27R/ER + AIM-7)
- FOX 2: heat-seeking infrared missile (27T/ET + AIM-9 + R-73/60)
- FOX 3: active radar missile, meaning the missile tracks to an aircraft's radar up to a certain distance, then its internal radar activates (pitbull) (AIM-120/R-77)
- RIFLE: AGM-65 Air-to-Ground missile
- RAYGUN: When locking a target with your radar, it is good practice to say "RAYGUN" so your teammates are aware that you are locking someone. It is often used to identify a contact as friend or foe. If a person yells "BUDDY SPIKE!", it's very likely that you are locking a friendly contact.
- IFF: meaning "Is he friendly or bandit (enemy)?"
- PITBULL: Any FOX 3 (active radar) missile that starts using its onboard radar for tracking

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.1 – Introduction

The AN/AAQ-28 LITENING AT targeting pod system is a self-contained, multi-sensor targeting and surveillance system. The LITENING enables aircrews to detect, acquire, auto-track and identify targets at long ranges for weapon delivery or non-traditional intelligence, surveillance and reconnaissance missions. LITENING's FLIR, charged-coupled device (CCD), laser imaging sensors, advanced image processing and digital video output provide useful imagery of targets on the ground, allowing aircrews to identify and engage targets under a wide range of battlefield conditions.

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

Targeting Pod Mode Selected
- A-G: Air-to-Ground
- A-A: Air-to-Air
- STBY: Standby

Field-of-View Setting
Narrow/Wide

Override (OVRD) Select
- Overrides any current mode and returns to STBY.
- The last selected mode is returned to when OVRD is selected a second time.

Targeting Pod Control (CNTL) Page Selector
Used to set targeting pod settings

MFD Symbology Brightness Rocker Switch

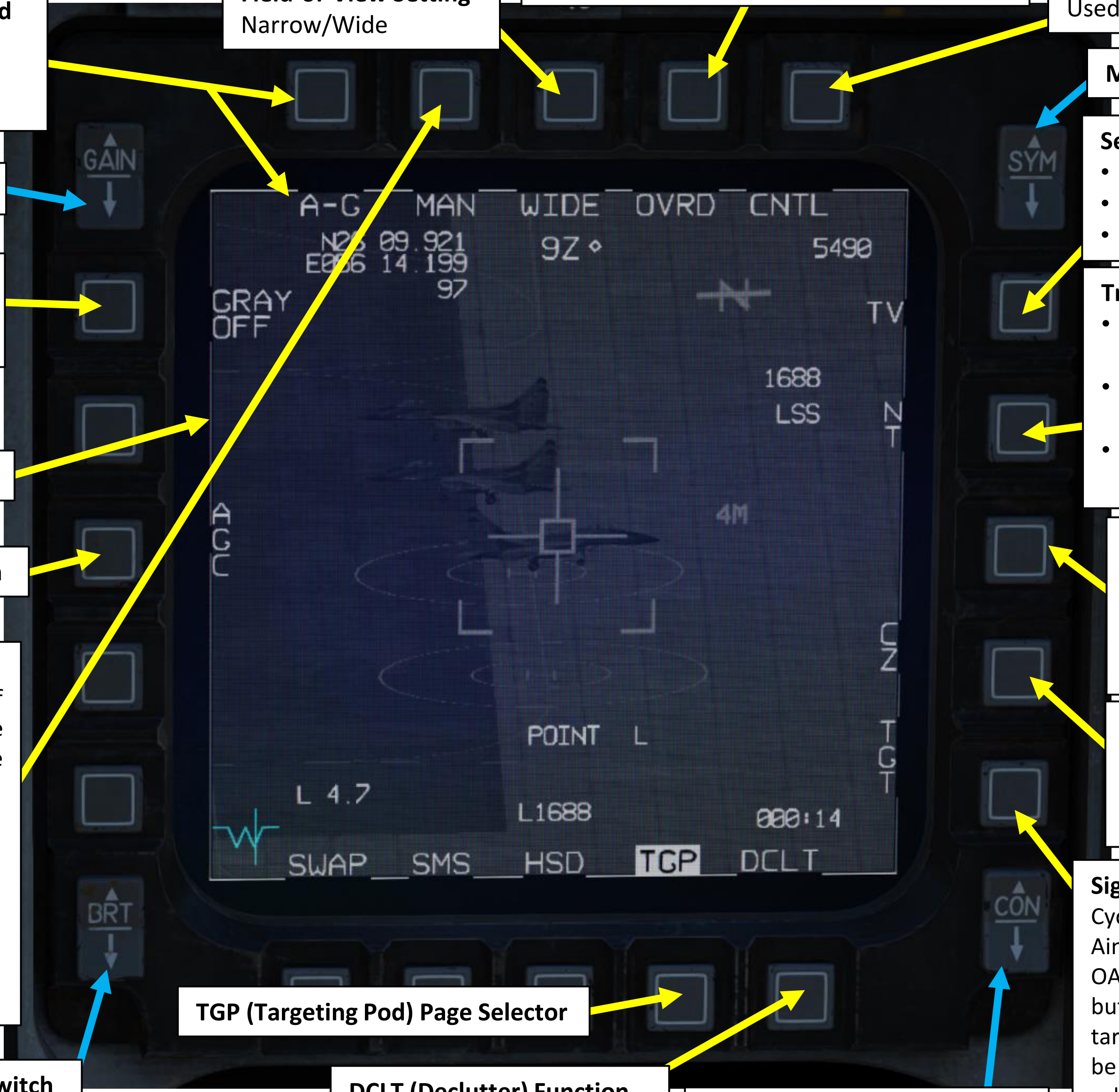
MFD Gain Rocker Switch

Grayscale Option
Displays a grayscale color strip for calibrating the level and gain.

SOI (Sensor of Interest) Box

AGC (Automatic Gain Control) Option

AGM-65 (Maverick Missile) Handoff Submode
- MAN: The AGM-65 will be slaved to the Line of Sight of the TGP but will not automatically be handed off the lock. Pilot must manually change SOI to AGM-65 and command lock manually.
- AUTO: TMS UP creates a point track, which automatically triggers an automatic hand off attempt.
  Alternatively: TMS RIGHT, with TGP SOI, will repeat hand off the lock to the AGM-65 if the target contrast and size meet criteria of missile lock.



Sensor Type
- TV / CCD (Charge Coupled Device)
- WHOT: White Hot FLIR (Forward-Looking Infrared)
- BHOT: Black Hot FLIR (Forward-Looking Infrared)

Track Polarity
- NT (Neutral Track) allows both white and black targets to be point tracked. Default A-G mode.
- WT (White Track) only allows white point targets to be tracked. Default A-A mode
- BT (Black Track) allows black point targets to be tracked.

SP (Snowplow) Mode
Snowplow mode is stabilized on the horizon, following our aircraft heading. It is a basic "look and designate" mode that is done through the targeting pod feed.

CZ (Cursor Zero) Function
Pressing CZ erases the cursor slew and returns the SPI (Sensor Point of Interest) to the currently selected steerpoint.

Sighting Option
Cycles between TGT-OAP1-OAP2 where OAP is the Offset Aim-Point, which can be added to each steer point. An OAP can be useful if the target is obscured by weather, but the OAP is in the clear. By selecting OAP1 or 2, the targeting pod slaves to the clear OAP and the aiming can be confirmed, although the steering and weapon delivery calculations will be to the target.

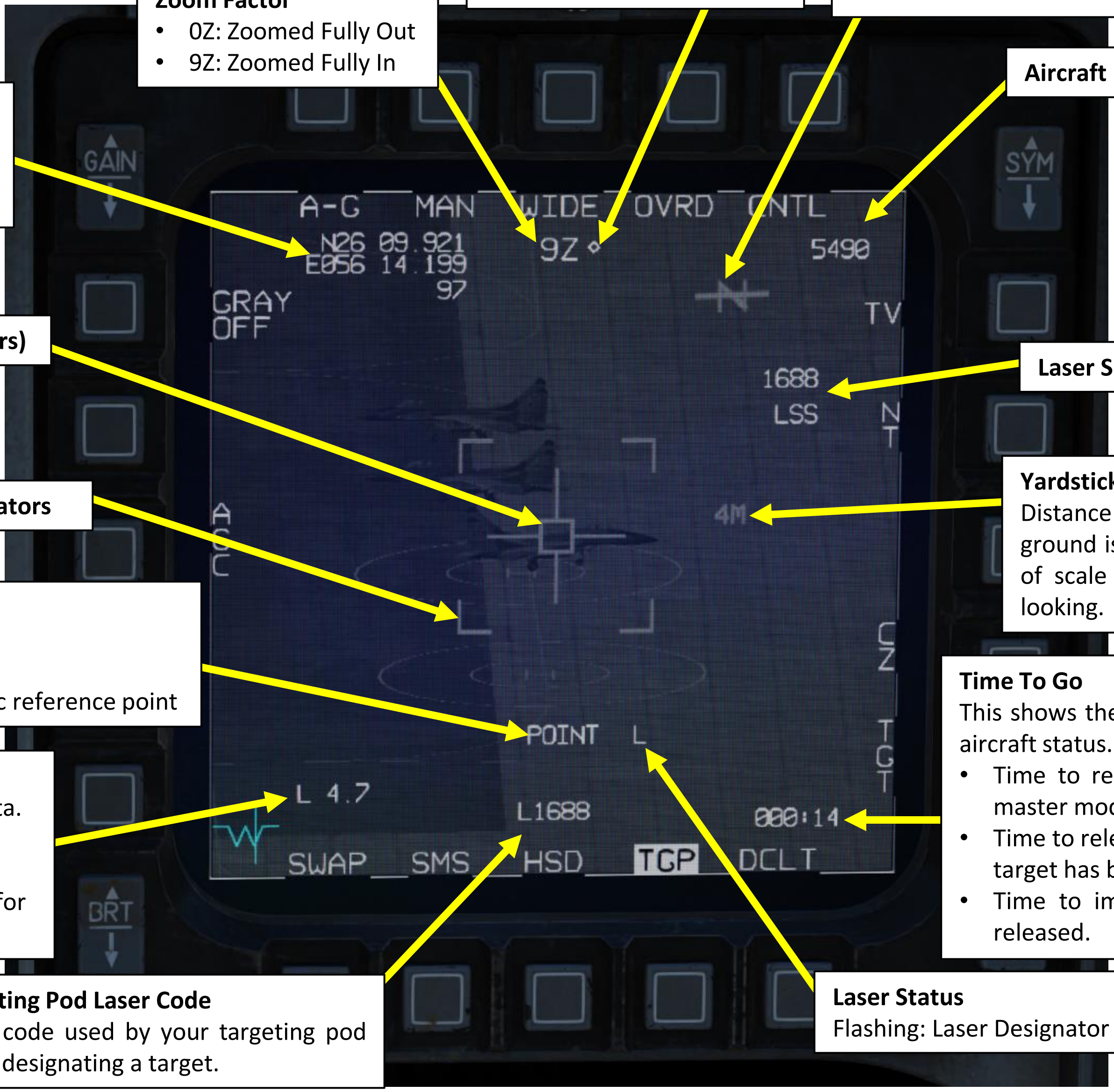
MFD Brightness Rocker Switch

TGP (Targeting Pod) Page Selector

DCLT (Declutter) Function

MFD Contrast Rocker Switch

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays



North Arrow / Ground Plane
- Regular line indicates ground plane relative to the FLIR orientation.
- Arrow points to the north and increases in length as a function of how far the FLIR is below (or above) the horizon.

Situational Awareness Cue

Zoom Factor
- 0Z: Zoomed Fully Out
- 9Z: Zoomed Fully In

Aircraft Radar Altitude (ft)

SPI (Sensor Point of Interest) Data
- Coordinates (North/South)
- Coordinates (East/West)
- Mean Sea Level Altitude (ft)

Targeting Pod Reticle (Crosshairs)

Laser Spot Search (LSS) Code

Field-of-View Indicators

Yardstick (Meterstick) Indication (meters)
Distance of one of the reticle lines relative to the ground is provided in meters. This provides a sense of scale for where the targeting pod is currently looking.

Track Mode
- POINT: Point Track
- AREA: Area Track
- INR: Inertial Rate, TGP will remain fixed on a geographic reference point

Time To Go
This shows the time to the next event depending on the aircraft status.
- Time to reach the steerpoint is displayed if in NAV master mode.
- Time to release weapon is displayed if in A-G mode if a target has been designated in an auto-delivery mode.
- Time to impact is displayed if a weapon has been released.

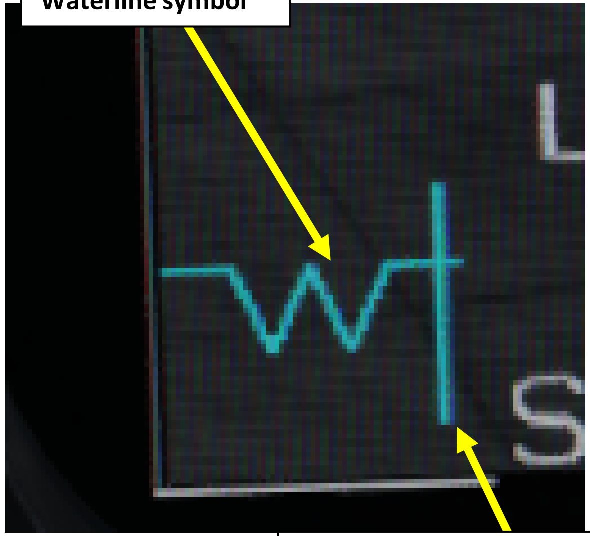
Slant Range to SPI (Sensor Point of Interest) (nm)
The preceding letter indicates the source of the range data.
- L: Laser (priority over all other sources)
- T: Targeting Pod passive ranging
- (blank): Sensor that is not the TGP is providing range (for example, FCR A-G ranging)

Targeting Pod Laser Code
Laser code used by your targeting pod when designating a target.

Laser Status
Flashing: Laser Designator is firing

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

Waterline symbol



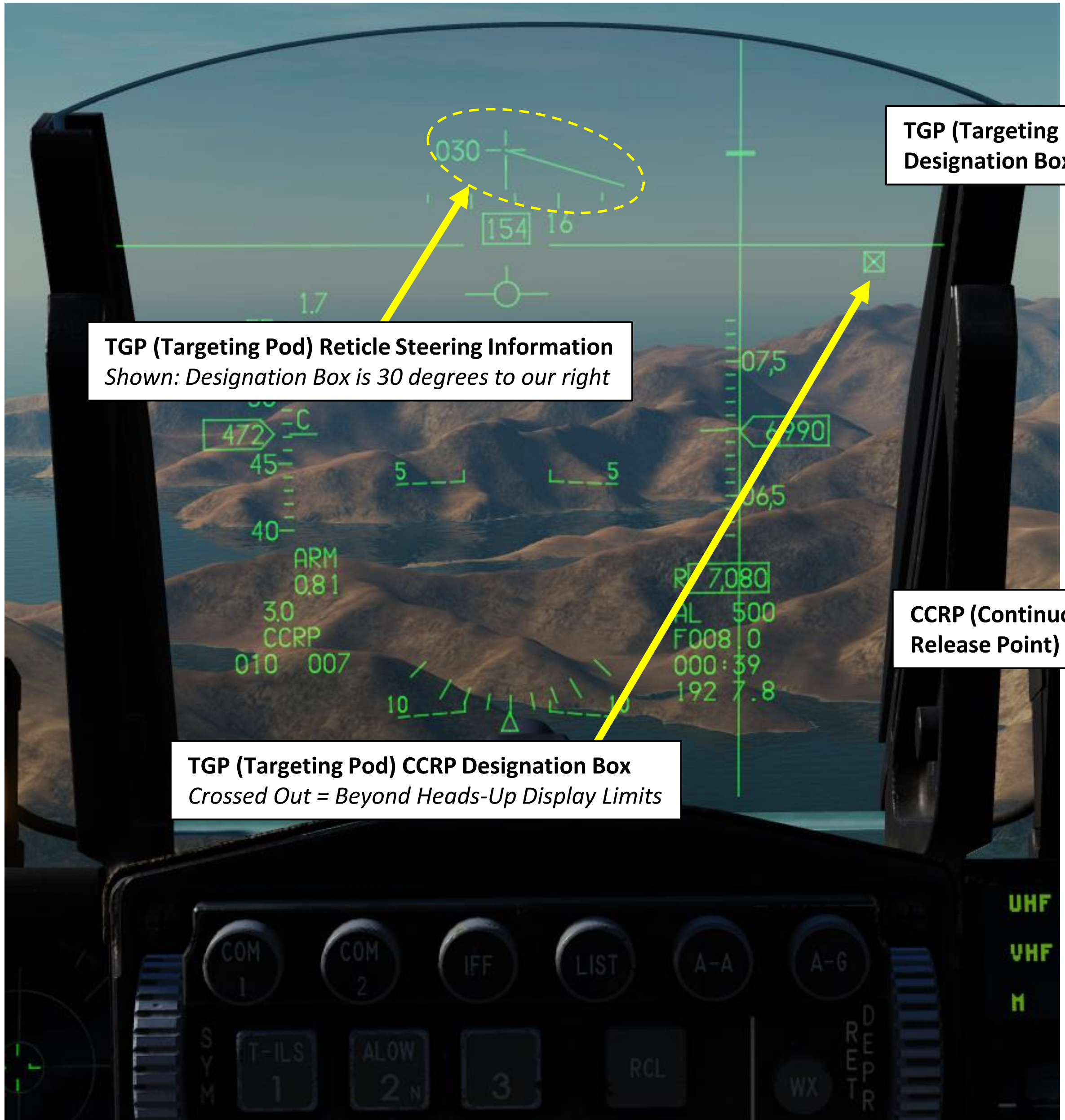
Steering Cue
This line must be centered with the Waterline symbol in order to fly the aircraft towards the SPI (Sensor Point of Interest). In this example, the steering line tells you to steer right to line up the target.

Situational Awareness Cue
This is where the targeting pod is looking in relationship to your aircraft

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

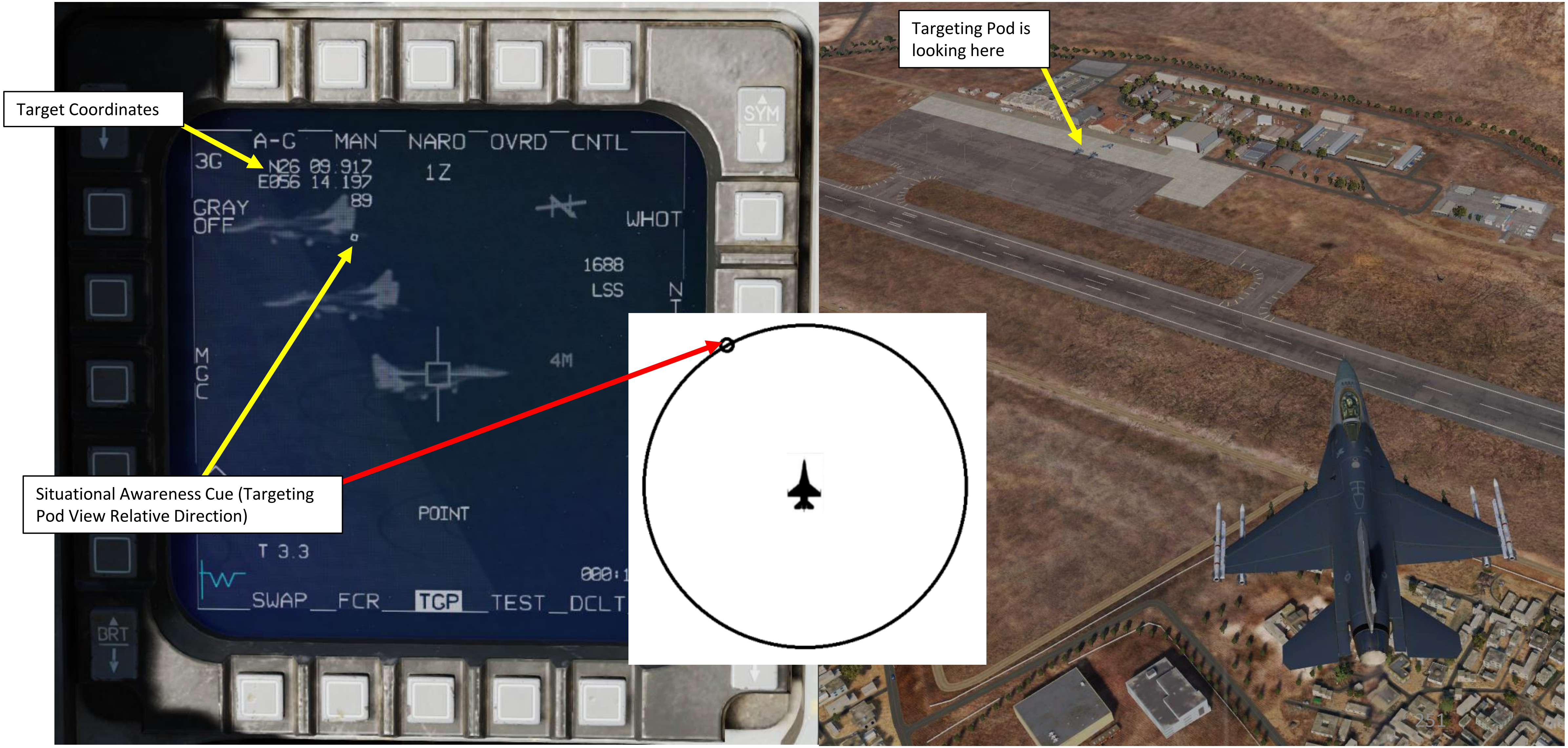
Targeting Pod A-G Control (CNTL) Page

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays



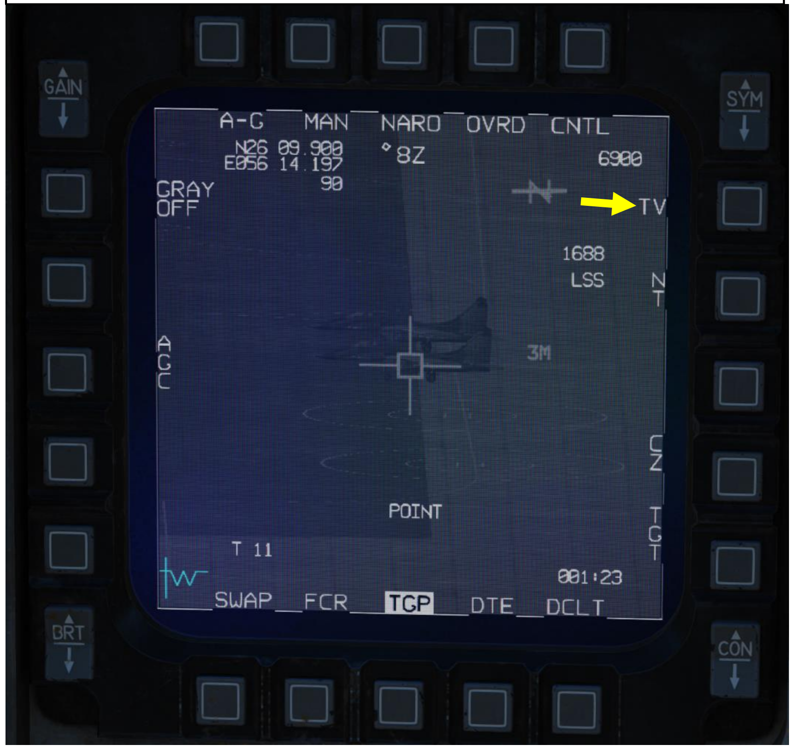
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

The Targeting Pod View Relative Direction symbol on the TGP display can give you a good idea of where the pod is pointing in relationship to your aircraft. This view direction is represented in a top-down view.



3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

TV / CCD Mode



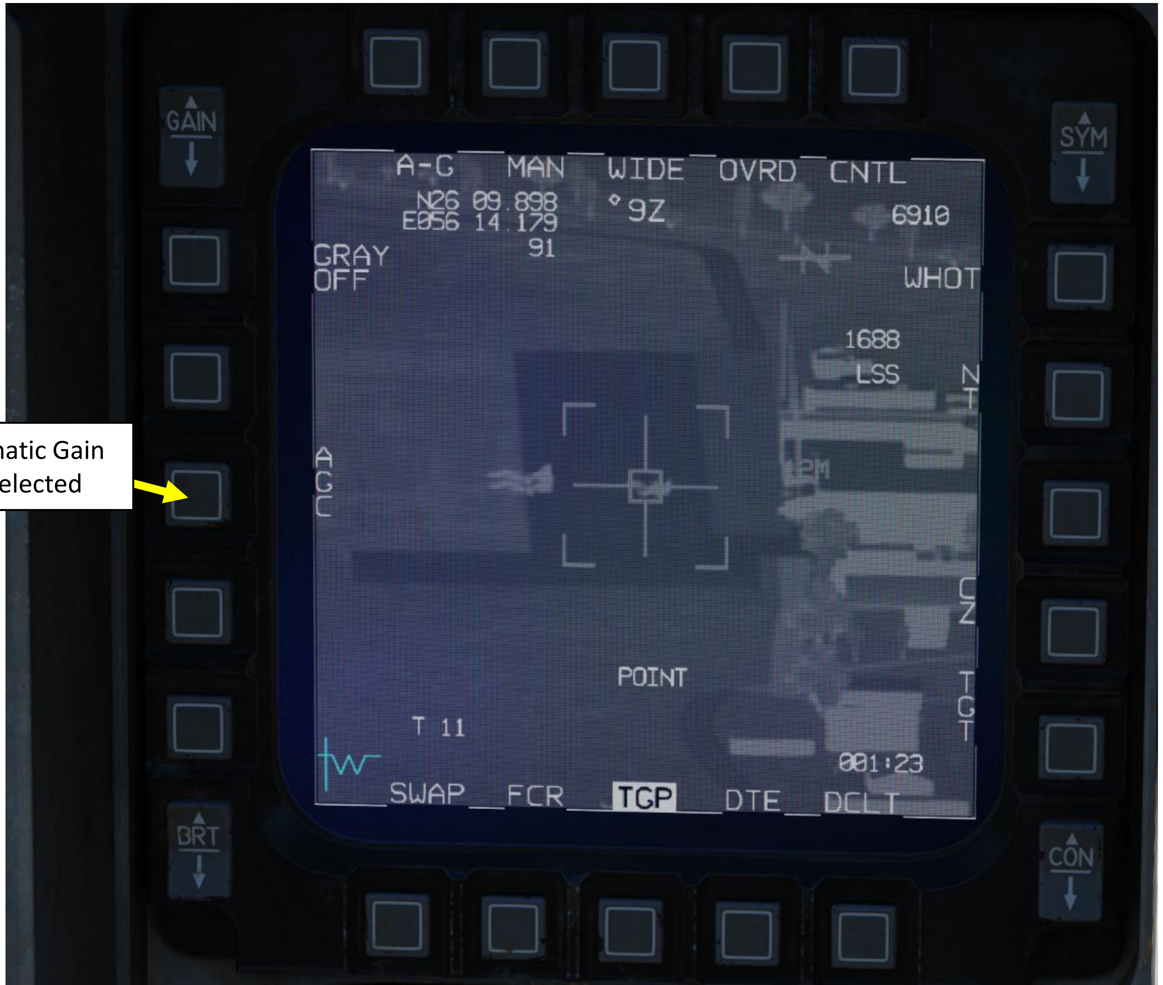
WHOT (White Hot) FLIR Mode

BHOT (Black Hot) FLIR Mode

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.2 – Displays

When using the FLIR in either BHOT (Black Hot) or WHOT (White Hot) modes, you can either use the AGC (Automatic Gain Control) or control the gain manually with MGC (Manual Gain Control) by pressing the OSB (Option Select Button) next to it, then using either the Gain Control Button on the top left of the display or the OSBs next to the Gain Level indicator.

AGC (Automatic Gain Control) Selected



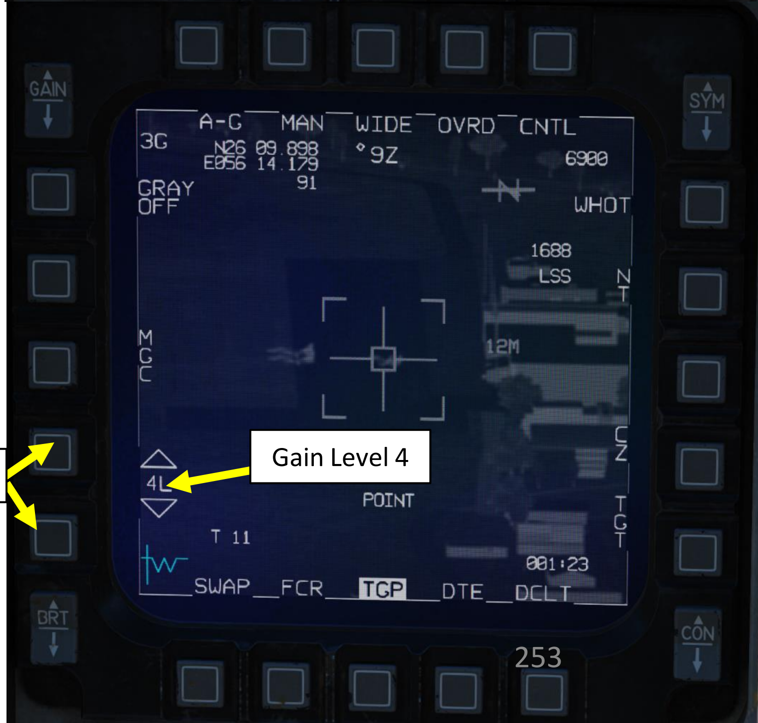
Gain Control Button

MCG (Manual Gain Control) Selected

Gain Level 7

Gain Control OSBs

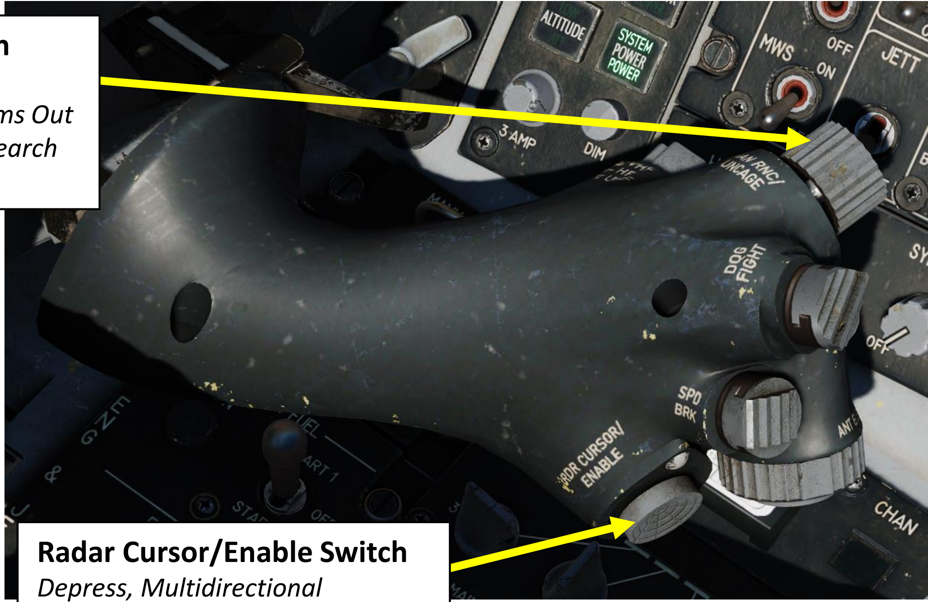
Gain Level 4

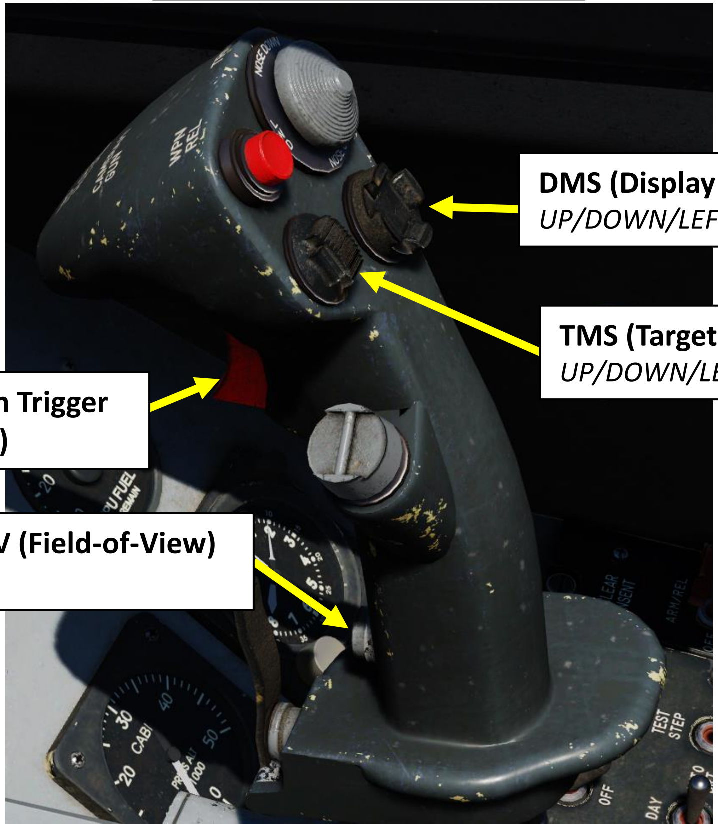


3 - AN/AAQ-28 LITENING AT TARGETING POD
3.3 – Controls

Some useful HOTAS functionalities when using the targeting pod:

- **DMS (Display Management Switch)**:
  - DOWN: Swaps SOI (Sensor of Interest) to the left or right display.
- **TMS (Target Management Switch)**:
  - UP: Selects Point Track (POINT, tracks an object like a high-contrast vehicle).
  - LEFT: Toggles TV camera and infrared polarity (TV/Charged-Coupled Device, WHOT/White Hot, BHOT/Black Hot)
  - RIGHT: Selects Area Track (AREA)
  - DOWN: Target Reject
- **MAN RNG (Manual Range) Knob:**
  - CCW (Counter-Clockwise): Zooms OUT
  - CW (Clockwise): Zooms IN
- **Expand/FOV Button**: Toggles between narrow and wide field-of-view
- **Camera/Gun Trigger First Detent**: Fires Laser
- **Radar Cursor Switch**: Slews targeting pod reticle
- **Uncage Switch (Depressed)**: Laser Spot Search Mode



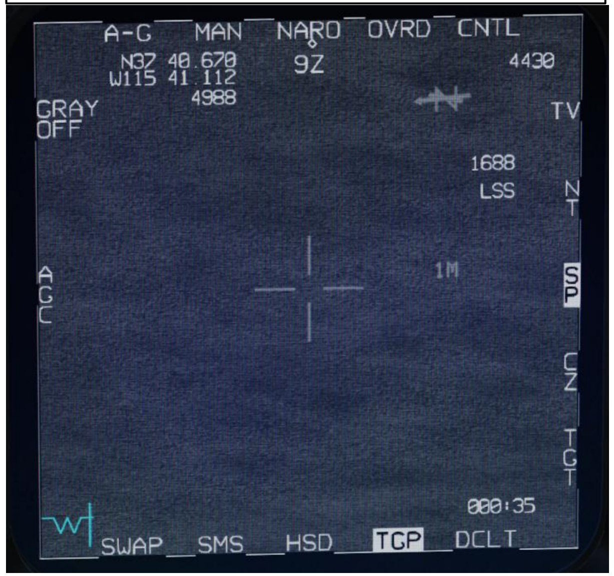


3 - AN/AAQ-28 LITENING AT TARGETING POD
3.4 – Target Designation Clarifications

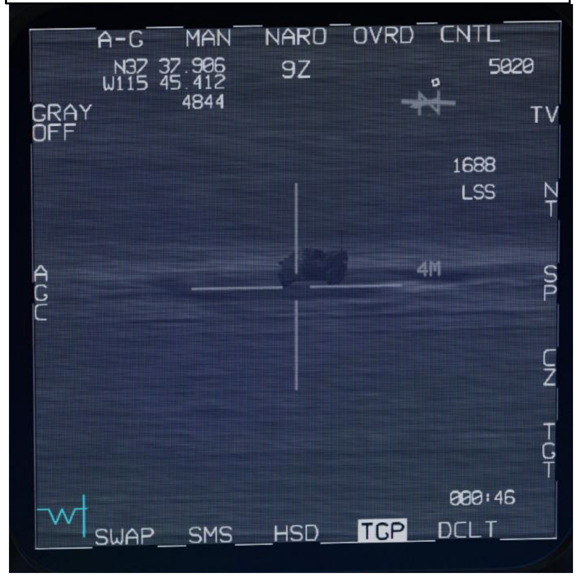
There are a few methods to point a target with the targeting pod.

- **Snowplow** mode is the default mode when no Target designation exists in NAV and A-G Master Modes. Slewing is disabled; however, it is possible to ground-stabilize by pressing TMS (Target Management Switch) UP. This will exit SP mode and enter a normal AREA track.
- **Waypoint Slaving** (TGP snaps to a selected navigation waypoint) is available using the Horizontal Situation Indicator page (see relevant section).
- **Area Track** is used to keep track of a specific area. This is best used for buildings of fixed targets. Area Track can be set from any other pointing method. Use TMS RIGHT.
- **Point Track** is used to keep track of a specific moving point. This is best used for moving targets. Point Track can be set from any other pointing method. Use TMS UP.

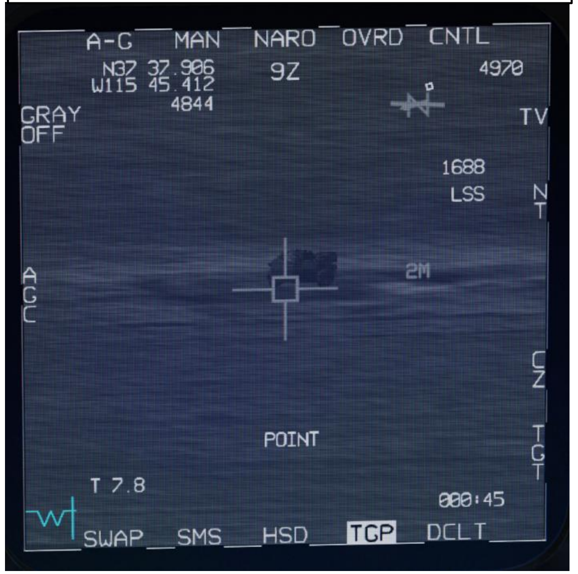
Targeting Pod Reticle
Snowplow



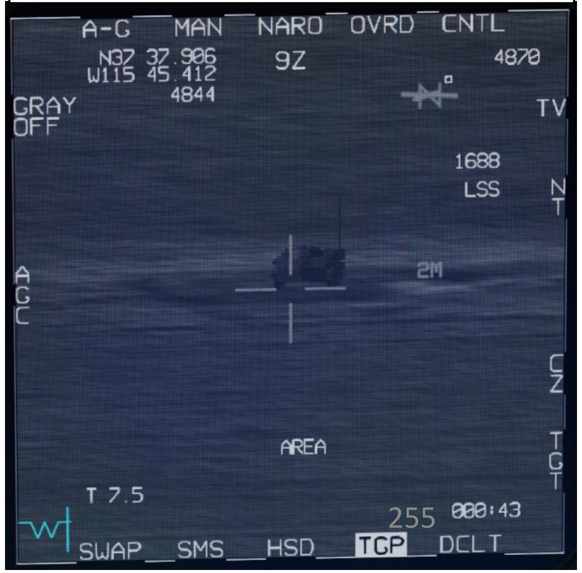
Targeting Pod Reticle
Waypoint Slaved



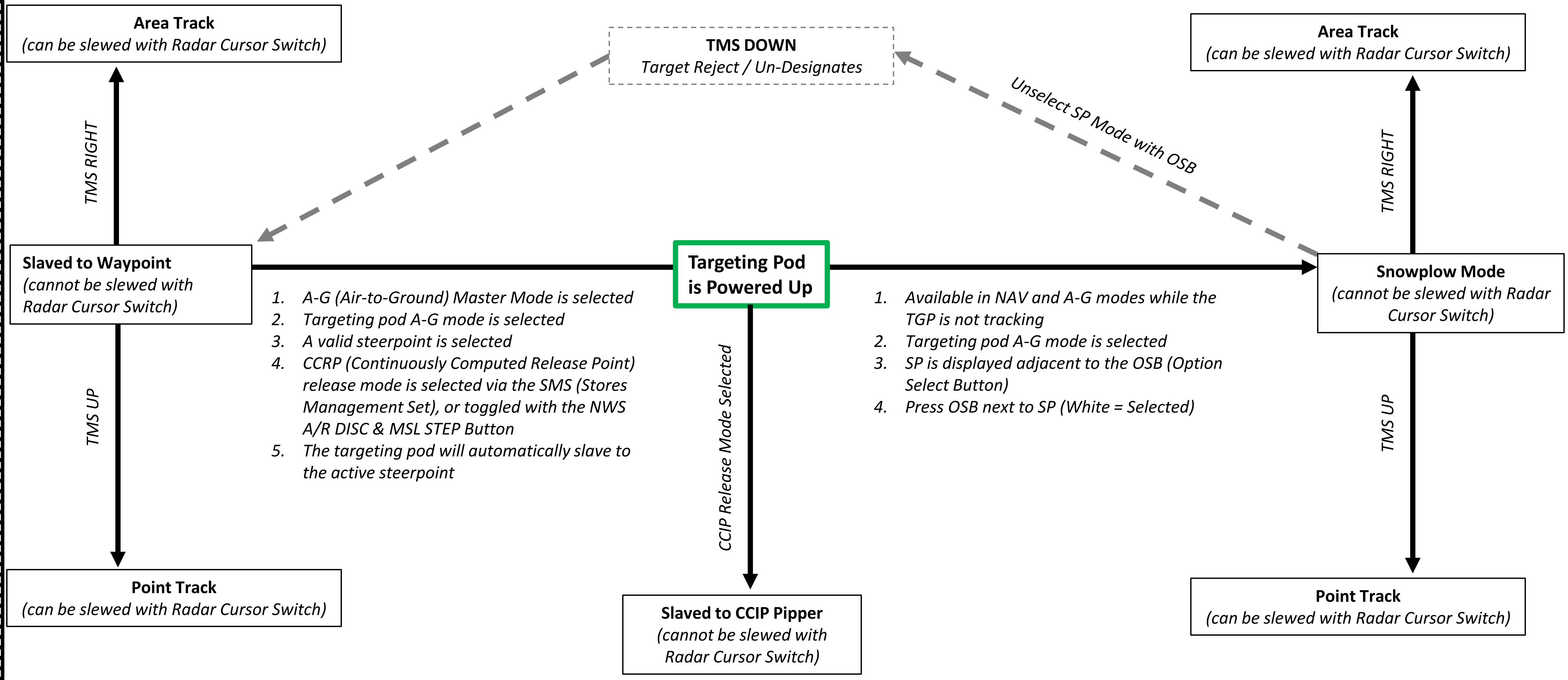
Targeting Pod Reticle
Point Track



Targeting Pod Reticle
Area Track



3 - AN/AAQ-28 LITENING AT TARGETING POD
3.4 – Target Designation Clarifications



3 - AN/AAQ-28 LITENING AT TARGETING POD
3.4 – Target Designation Clarifications

In the current Early Access implementation of the Targeting Pod, there are different ways to visualize and/or designate a ground target. Here are a few things to keep in mind.

a) The targeting pod functions available depend on what Master Mode is selected (A-A, A-G, or NAV).

b) The targeting pod works differently based on your weapon release mode like CCIP (Continuously Computed Impact Point) or CCRP (Continuously Computed Release Point), which can be set in the SMS (Stores Management Set) page. A valid weapon (bombs, for instance) needs to be equipped for these release modes to be available.

c) The use of the targeting pod in the F-16 relies heavily on waypoints/steerpoints of your flight plan. Generally, you will want to have a steerpoint already set near to a target, slave the targeting pod to this waypoint, then find the target and designate it.

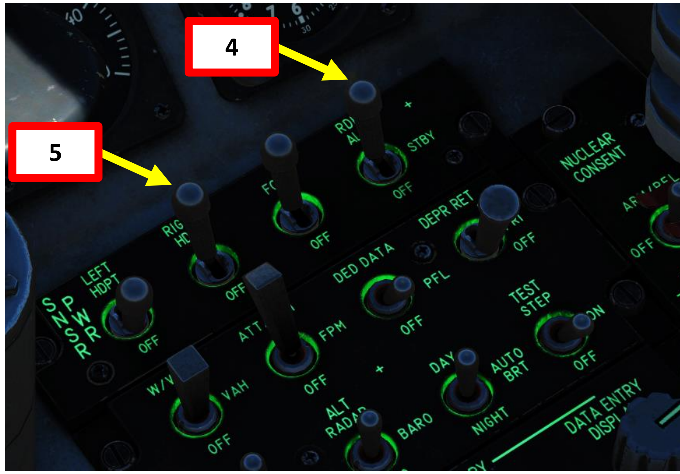
d) To slave the targeting pod to a waypoint, the following conditions must be met:
- A-G (Air-to-Ground) Master Mode must be selected
- Targeting pod A-G mode must be selected
- A valid steerpoint must be selected
- CCRP (Continuously Computed Release Point) release mode must be selected via the SMS (Stores Management Set), or toggled with the NWS A/R DISC & MSL STEP Button
- The targeting pod will automatically slave to the active steerpoint

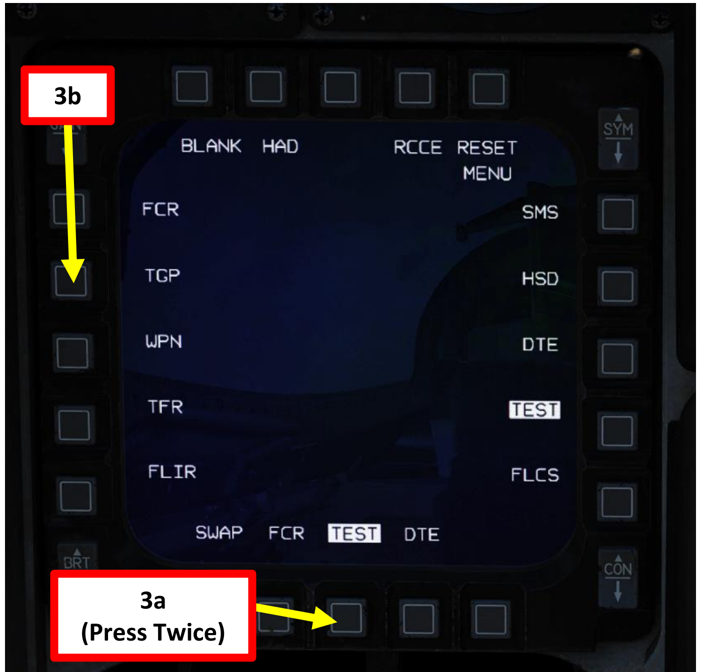
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.4 – Target Designation Clarifications

e) When CCIP (Continuously Computed Impact Point) release mode is selected, the **targeting pod's line of sight is slaved to the CCIP pipper location**. The targeting pod cannot designate anything in this mode, but it can be used to have a good visual cue of the target your are diving on.

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

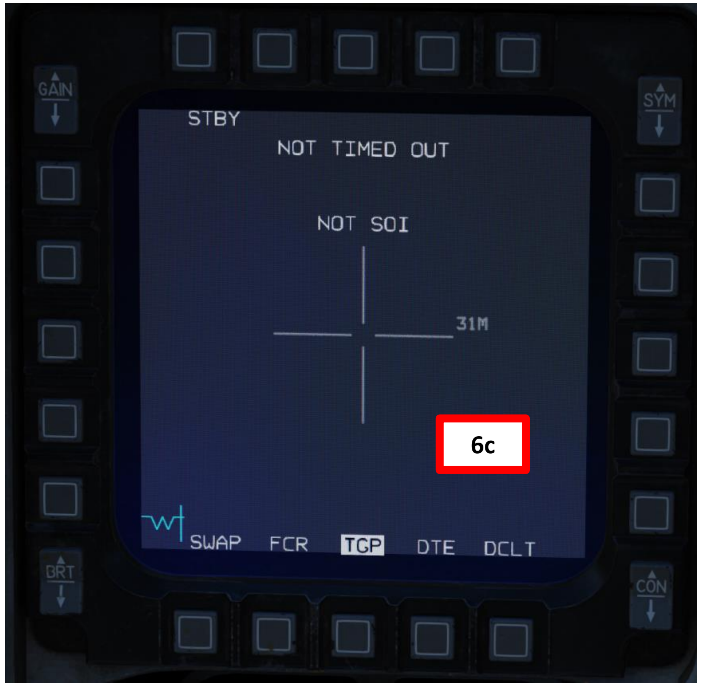
1. For the targeting pod features to be available, the following avionics systems must be powered ON
   - MMC (Modular Mission Computer) Switch – ON
   - ST STA (Store Station) switch – ON
   - MFD (Multifunction Display) switch – ON
   - UFC (Up Front Controller) switch – ON
   - EGI/INS switch - NAV
2. Select A-G (Air-to-Ground) Master Mode. The SMS (Stores Management Set) page will be set on the right MFD and the FCR (Fire Control Radar) will be set on the left MFD.
3. Set desired MFD to the TGP (Targeting Pod) page. We will set the left MFD as the TGP page.
4. Set Radar Altimeter Power Switch – ON (FWD)
5. Since the TGP is always installed on the right cheek of the fuselage, set RIGHT HDPT (Right Hardpoint) ON (FWD) to power up the pod.

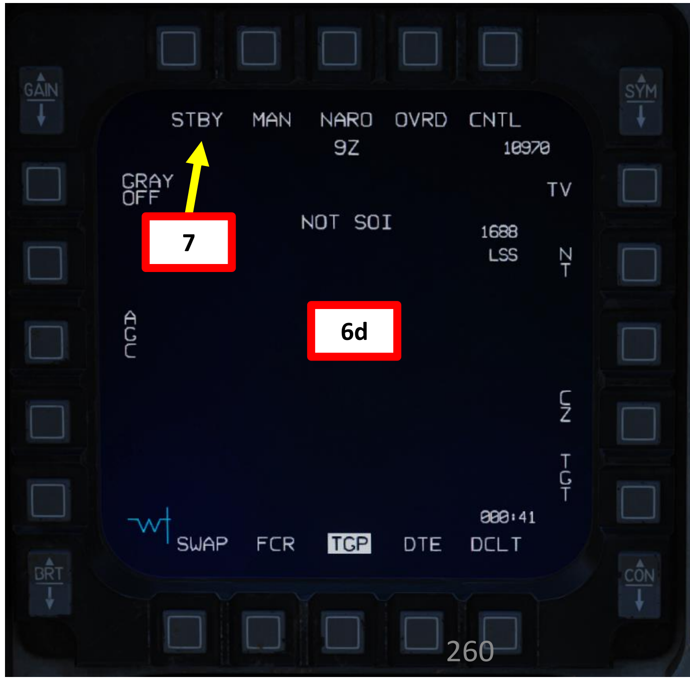




3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

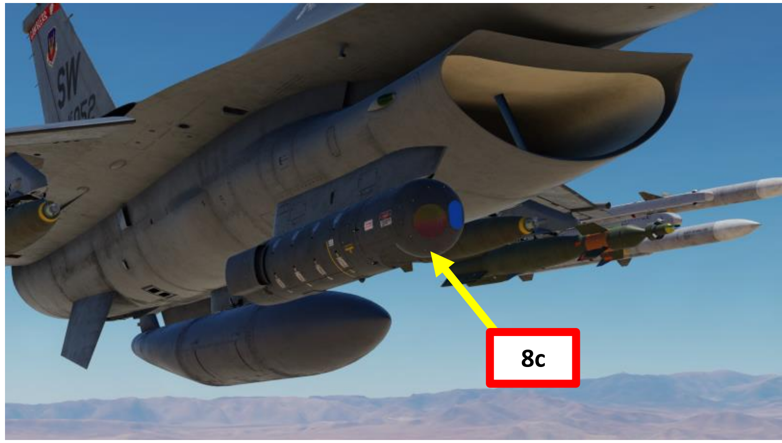
6. A series of power-up self tests and FLIR sensor cooldown will be initiated once the pod is powered.
    - When the TGP is initially activated, the Standby page will be displayed with a “NOT TIMED OUT” message displayed in the upper center portion. Time is needed to run automatic power-up self tests and for the FLIR sensor to cool down.
    - ***(Not simulated yet)*** A “FLIR HOT” message is displayed in white text on a black background with half the text height as the “NOT TIMED OUT” message. After about three minutes, the message will be removed, video will appear, and the Standby mode page will be selected.
7. After about three minutes, video will appear, and the Standby mode page will be selected.

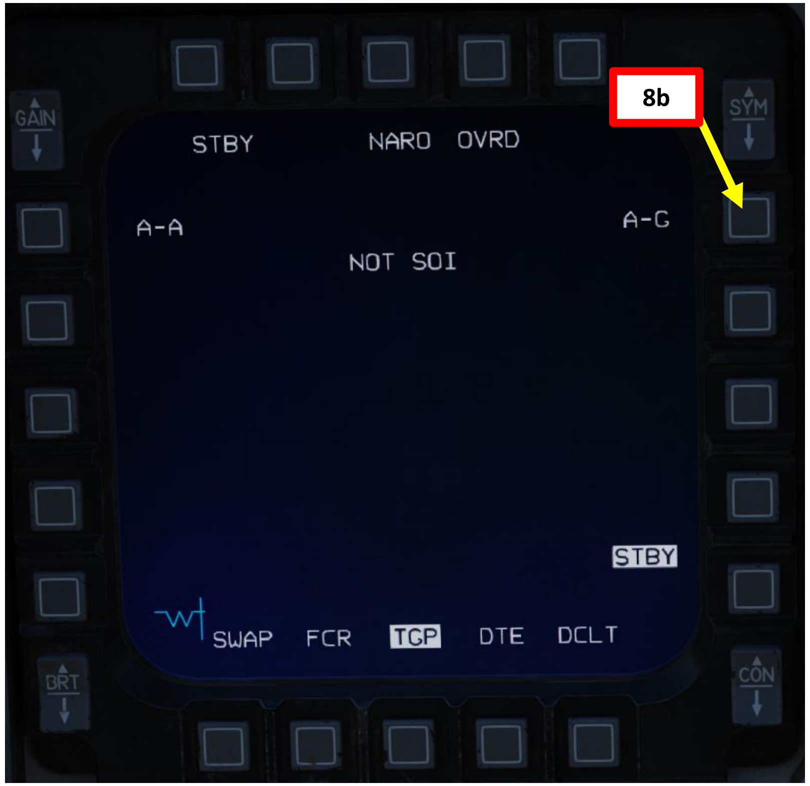




3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

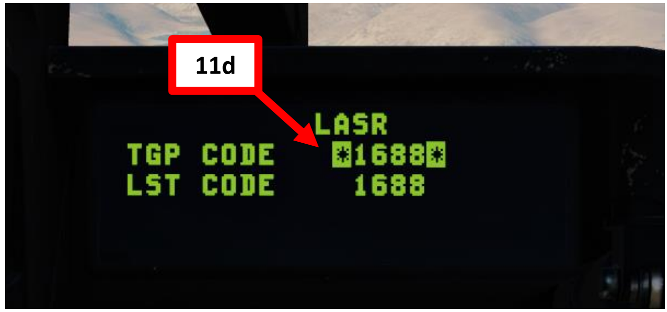
8. Set targeting pod mode from STBY (Standby) to A-G (Air-to-Ground). This will un-stow the camera.

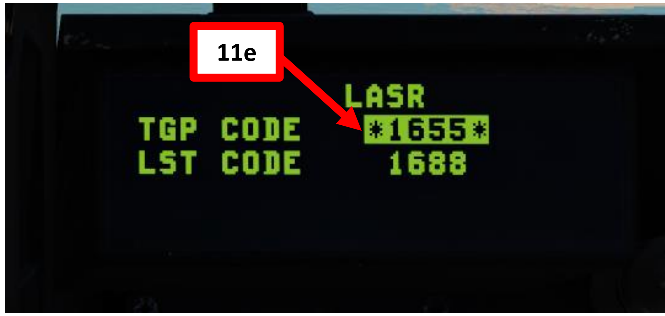


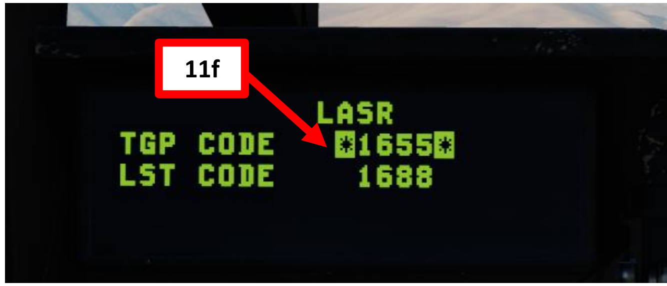


3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

9. Set Master Arm Switch – ON (UP)
10. Set Laser Switch – ARMED (UP)
11. Set the Targeting Pod's Laser Code as desired. The default laser code is 1688, but in this case we will choose 1655.
    a) Press the LIST button
    b) The LIST sub-menus will appear on the DED (Data Entry Display). Press the "0" button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
    c) Press the "5" button on the ICP to select the LASR (Laser) sub-menu.
    d) The TGP code is selected by default (asterisks indicate field is selected).
    e) To change laser code to "1655", type "1655" on the ICP keypad
    f) Press "ENTR" button (Enter) to update laser code.







3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

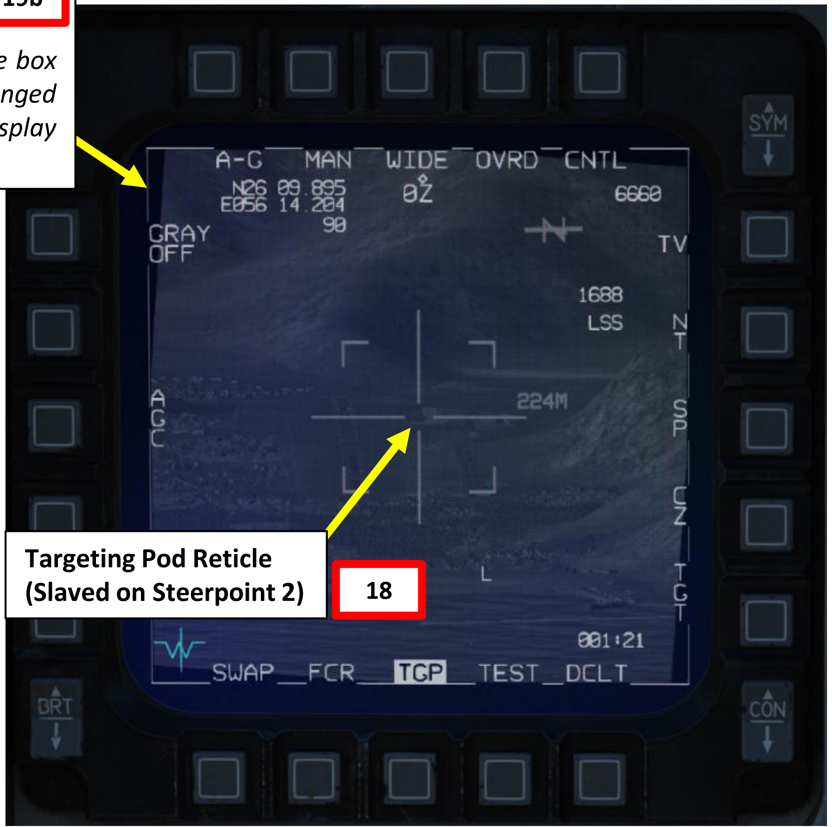
12. Make sure a steerpoint is set in the vicinity of the target (see Navigation section on how to create steerpoints).
13. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
14. Select desired steerpoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
15. On the SMS (Stores Management Set) page, select desired weapon (a valid weapon must be selected, like the GBU-12 laser-guided bomb).
16. On the SMS page, CCIP (Continuously Computed Impact Point) mode is selected by default. TGP is currently slaved to the CCIP pipper.

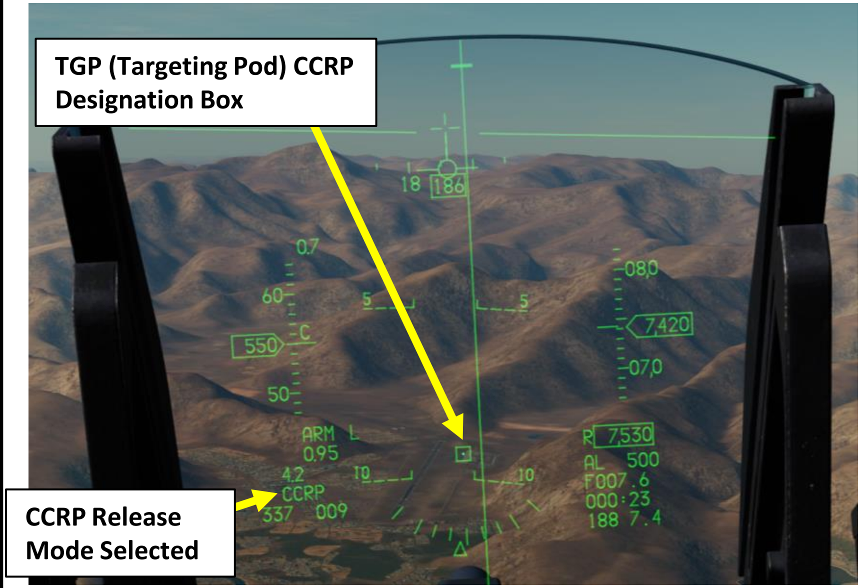
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

17. On SMS page, select CCRP (Continuously Computed Release Point) weapon release mode. You can do this through the SMS page or toggle release modes with the NWS A/R DISC & MSL STEP button on your stick.
18. Pod will automatically be slaved to the selected steerpoint.
19. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest)

SOI (Sensor of Interest) Control Indication Box 19b

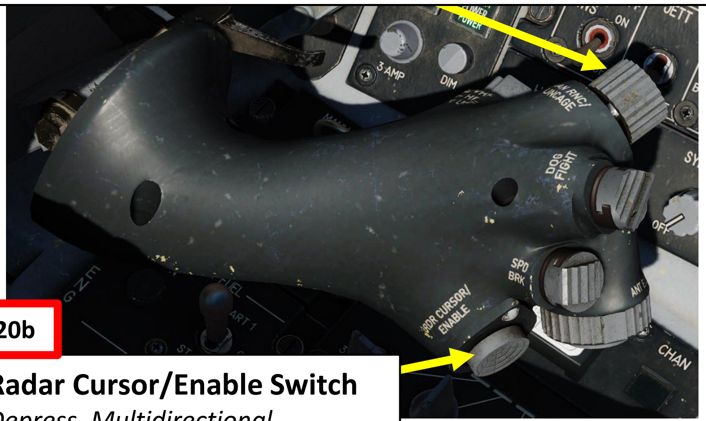
The current SOI can be identified by the box around the MFD screen. The SOI is changed from display to display with the Display Management Switch (DMS).

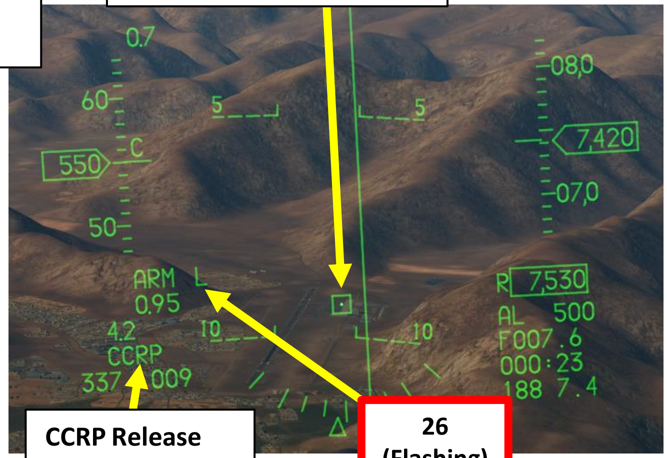


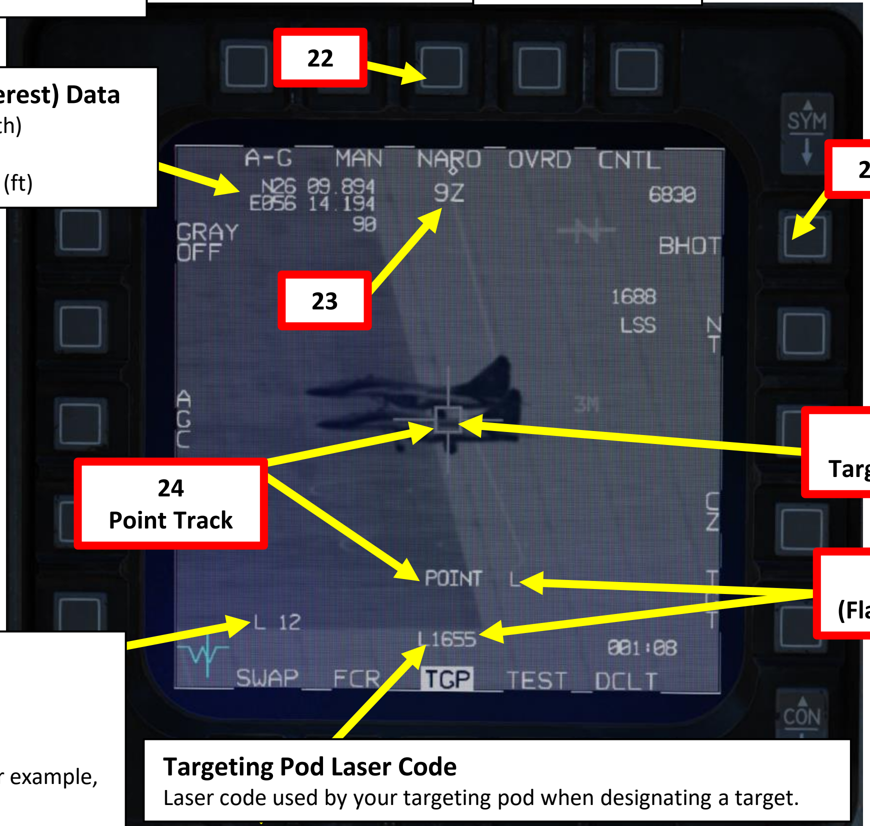


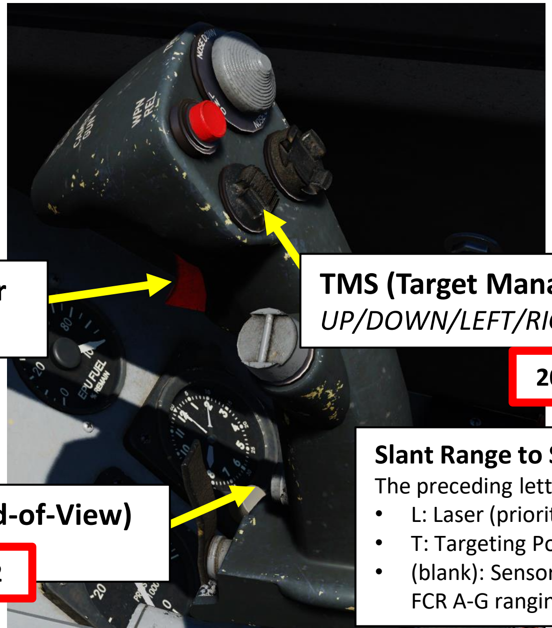
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.5 – Start-Up & Lasing Procedure

20. Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the steerpoint location. Then, slew the targeting pod using the Radar Cursor switch
21. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
22. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
23. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
    - CCW (Counter-Clockwise): Zooms OUT
    - CW (Clockwise): Zooms IN
24. Select Tracking Mode using the TMS (Target Management Switch): TMS UP for Point Track (POINT, tracks moving objects) or TMS RIGHT for Area Track (AREA, tracks static objects).
25. Fire Laser by pressing and holding the Camera/Gun First Stage Trigger.
26. A flashing "L" indicates laser is being fired. You may now launch laser-guided weapons as per their release procedure.
27. Release trigger to stop firing laser.



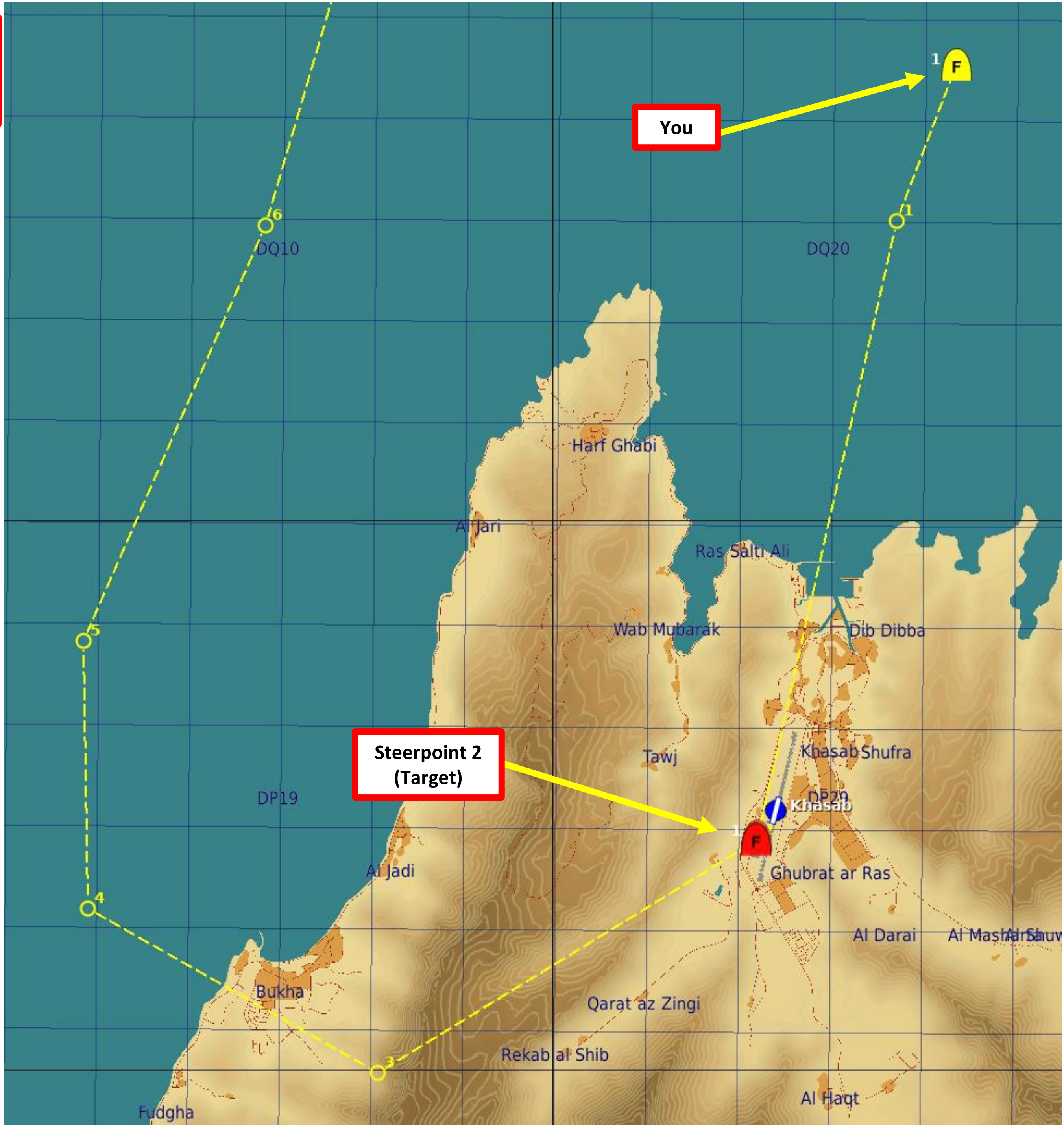






3 - AN/AAQ-28 LITENING AT TARGETING POD
3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)

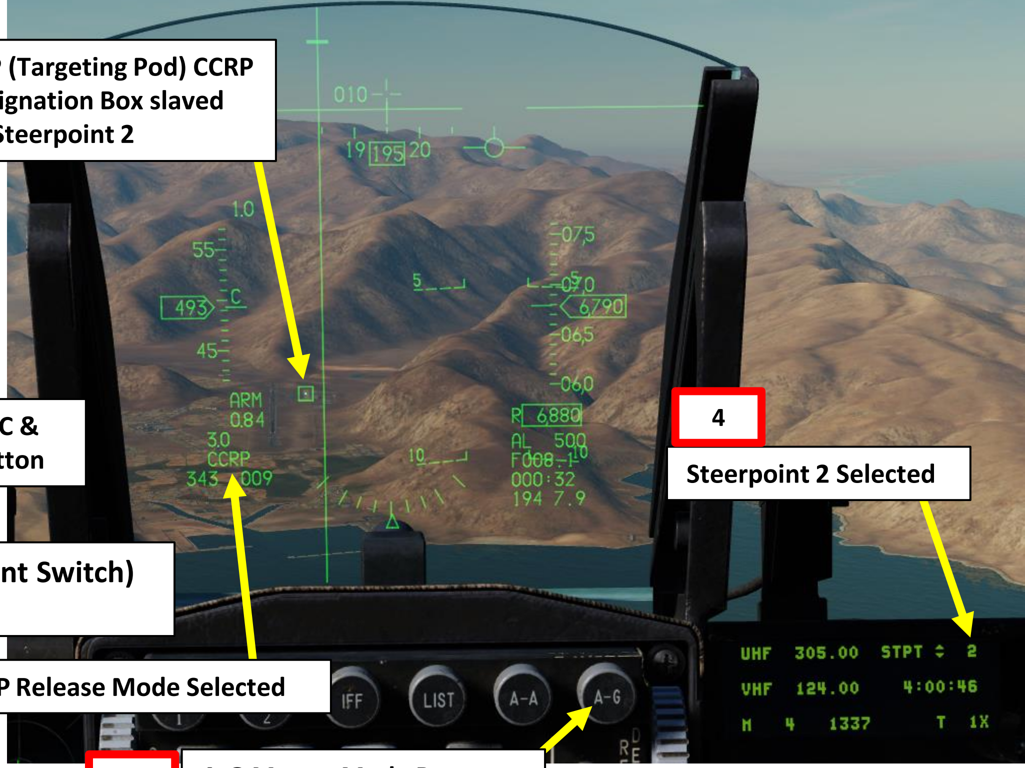
The F-16's targeting pod is used primarily by slaving the pod on waypoints/steerpoints of your flight plan. I highly recommend that you have a steerpoint already set near a target. Then, you can slave the targeting pod to this waypoint and find the target by slewing the pod reticle.

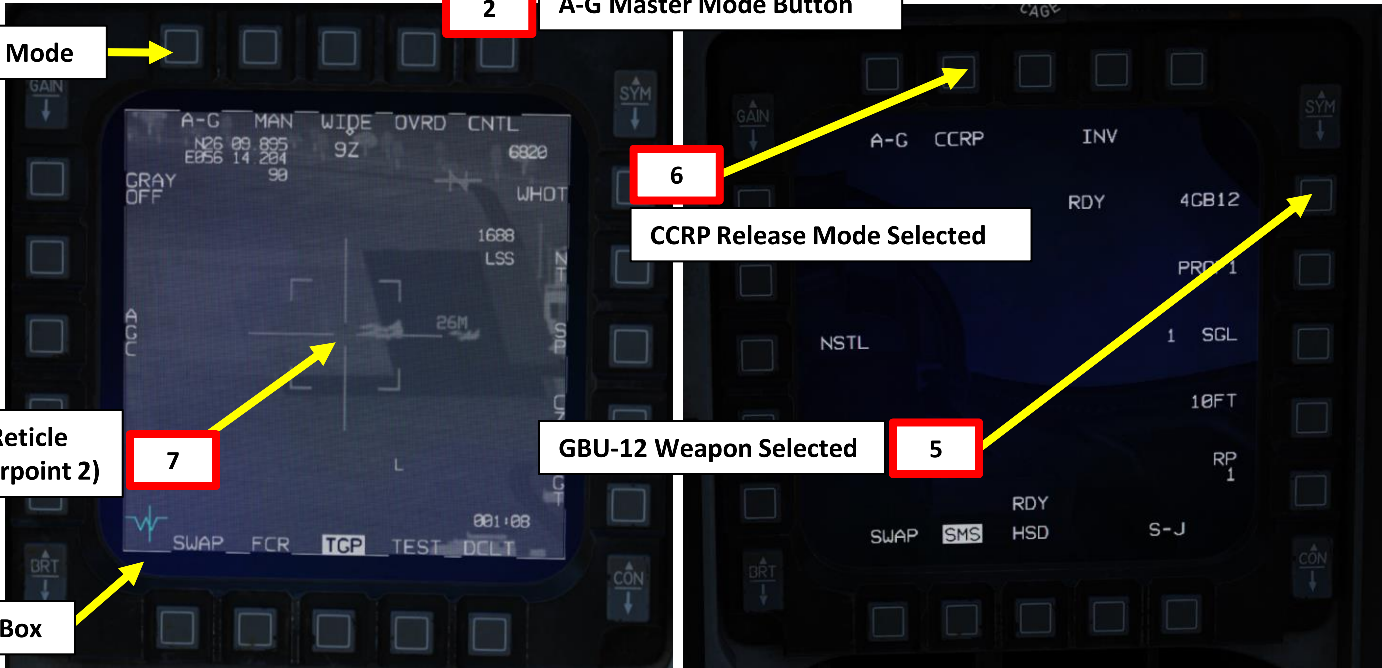


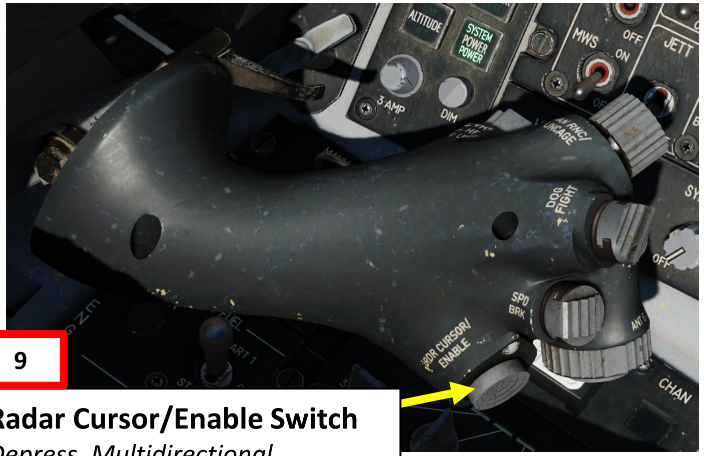
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)

To slave the targeting pod to a waypoint, the in-depth procedure is explained in the Lasing Procedure section. Here is a quick summary:

1. Targeting pod and radar altimeter must be powered on
2. A-G (Air-to-Ground) Master Mode must be selected
3. Targeting pod A-G mode must be selected
4. A valid steerpoint must be selected
5. A valid weapon must be selected
6. CCRP (Continuously Computed Release Point) release mode must be selected via the SMS (Stores Management Set), or toggled with the NWS A/R DISC & MSL STEP Button
7. The targeting pod will automatically slave to the active steerpoint
8. Set the TGP as the SOI using the DMS (Display Management Switch) DOWN.
9. Press TMS RIGHT to set an Area Track on the steerpoint location. Then, you can slew the targeting pod as desired using the Radar Cursor switch. Other TGP controls are as per the Lasing Procedure section.







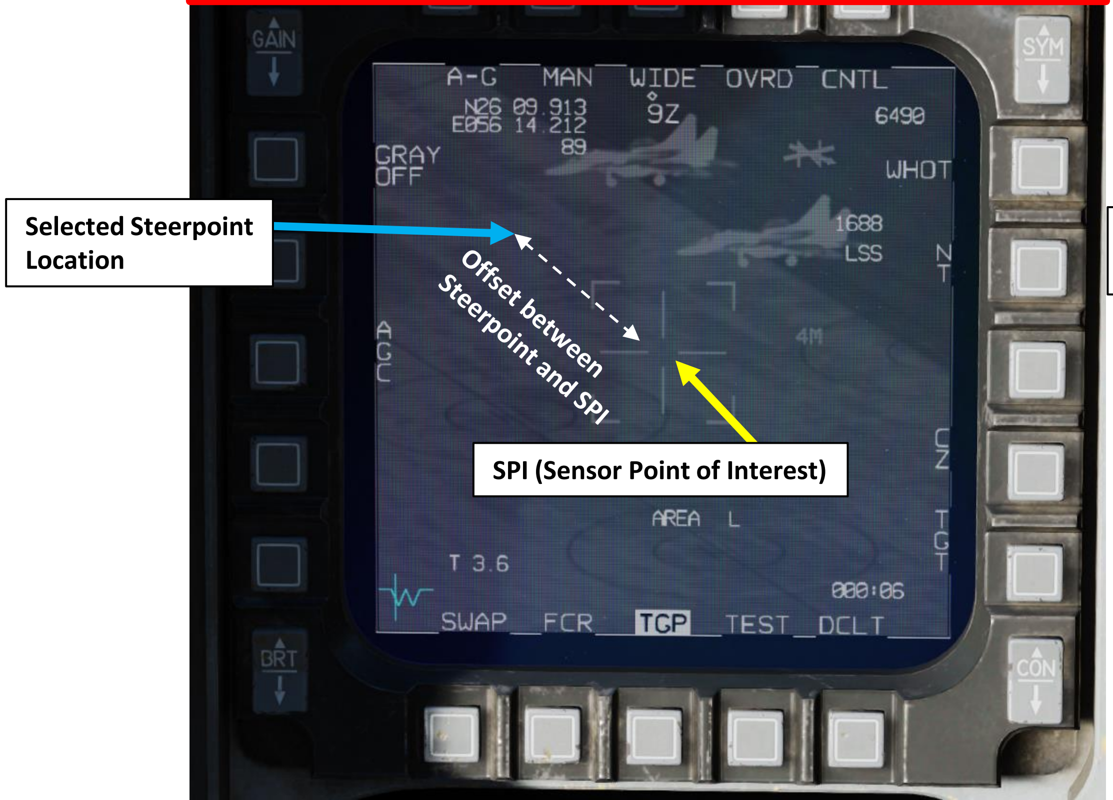
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.6 – Steerpoint Slaving Mode & Cursor Zero (CZ)

When the targeting pod is slaved to a steerpoint, the targeting pod's reticle will create a SPI (Sensor Point of Interest). Slewing the reticle of the pod will move the position of the SPI, which will dynamically create steerpoint offsets, also referred as "deltas".

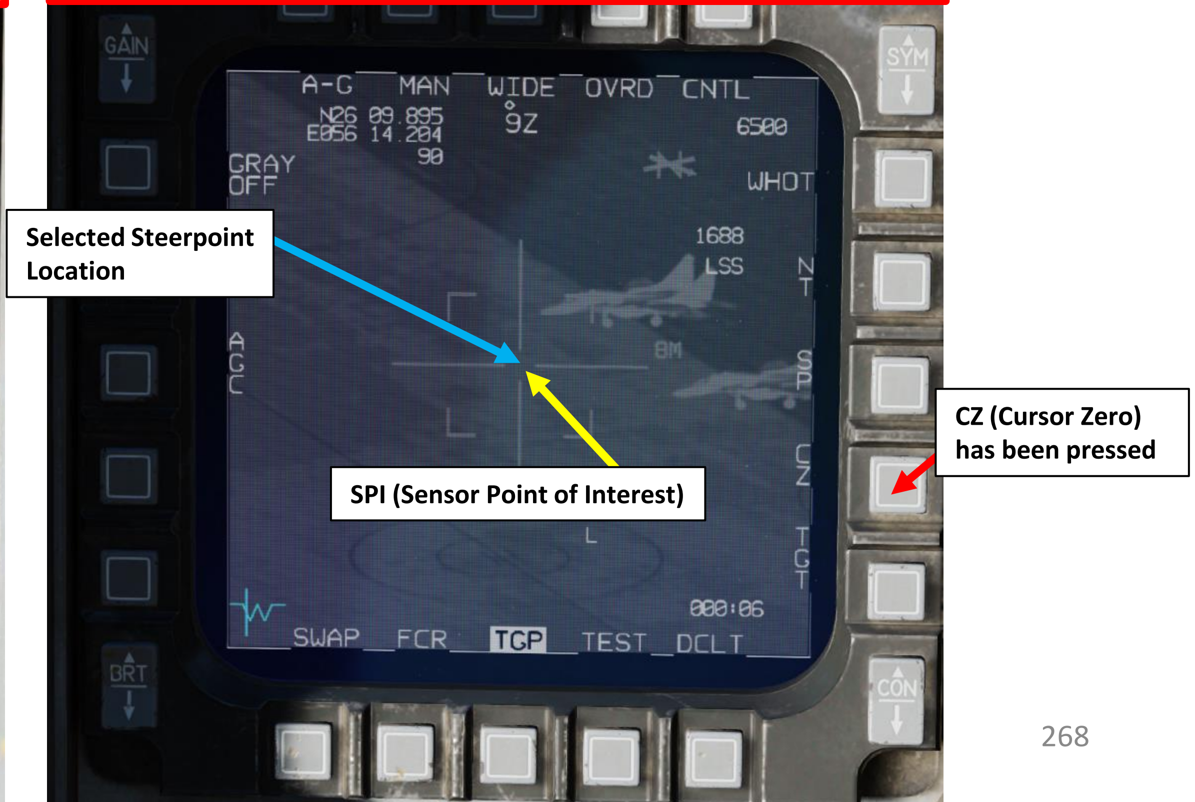
System deltas are longitude and latitude offset values which reflect the horizontal difference between the SPI position and the currently selected steerpoint's original position. The SPI position is initially locked on the steerpoint position. Once SPI is moved (by slewing the TGP) system delta values change. These delta values are applied to all steerpoints, even though the original steerpoint positions (including Bullseye) will still be displayed on the FCR (Fire Control Radar) and HSD (Horizontal Situation Display) pages.

The Cursor Zero function (which is available on the TGP page) allows you to erase any previously created system delta. All steerpoint offsets will return to their original position, and will return the SPI position to the current steerpoint position.

CZ has not been performed
TGP Reticle has been slewed away from steerpoint, creating an offset (delta)



CZ has been performed
TGP Reticle is slewed back directly on the steerpoint. No offset (delta) exists.



3 - AN/AAQ-28 LITENING AT TARGETING POD
3.7 – Snowplow Mode

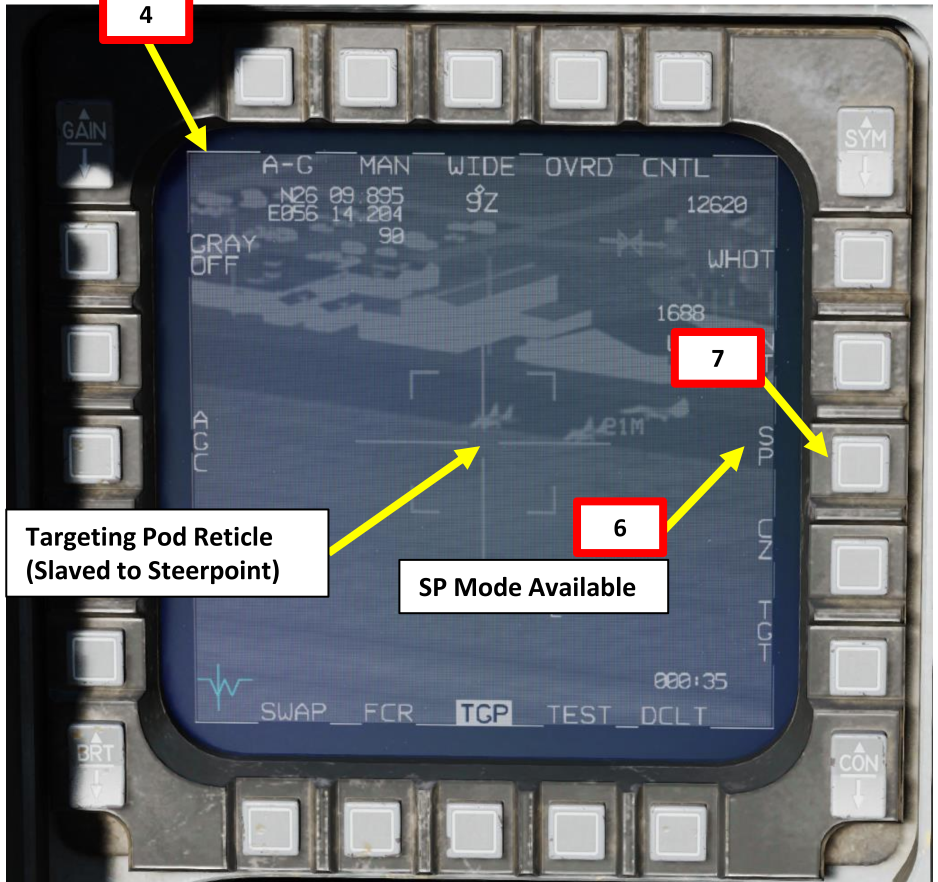
The “snowplow” (SP) mode is a basic “look and designate” mode that is done through the targeting pod feed. This is more or less the secondary employment mode of the targeting pod.

- This mode is available in NAV and A-G modes while the TGP is not tracking. This mode is available when SP is displayed adjacent to the OSB (not shown). When SP is pressed, both the FCR and TGP are commanded to snowplow mode.
- In snowplow mode, the TGP line-of-sight is commanded straight ahead and angled downwards to point to the ground ahead at half of the currently selected FCR (Fire Control Radar) scale (for example, if selected FCR scale is 40 nm, the TGP will look at the point on the ground 20 nm ahead). Because the location determined by the reticle is snowplowing, the SPI (Sensor Point of Interest) itself will also snowplow.
- In snowplow mode, slewing is disabled; however, it is possible to ground-stabilize by pressing TMS (Target Management Switch) UP to exit SP mode and enter a normal POINT track (or TMS RIGHT for AREA track).

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.7 – Snowplow Mode

In the eventuality that you have no waypoints to slave the Targeting pod to, you can:

1. Select A-G Master Mode
2. On the SMS page, select desired weapon (a valid weapon must be selected).
3. On the SMS page, select CCRP Mode
4. Set the TGP page as the SOI (Sensor of Interest) by using DMS (Display Management Switch) DOWN
5. By default, the TGP should be slaved to the selected steerpoint. Reject the target by using TMS (Target Management Switch) DOWN
6. SP function should be available on the TGP page.
7. **Press OSB (Option Select Button) next to SP to activate Snowplow mode.**



Targeting Pod Reticle (Slaved to Steerpoint)

SP Mode Available

4 **DMS (Display Management Switch)**
UP/DOWN/LEFT/RIGHT

5 **TMS (Target Management Switch)**
UP/DOWN/LEFT/RIGHT

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.7 – Snowplow Mode

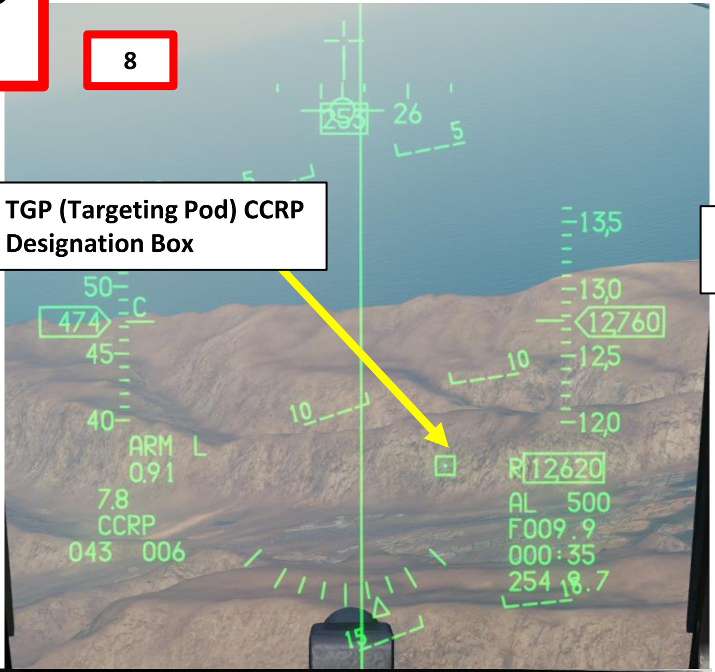
8. The targeting pod’s line-of-sight is commanded straight ahead and angled downwards to point to the ground ahead
9. Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the location of the TGP reticle. This will exit SP Mode and make the SPI slewable.
10. Slew the targeting pod as desired using the Radar Cursor switch. Other TGP controls are as per the Lasing Procedure section.
11. Rejecting the target by using TMS (Target Management Switch) DOWN will slave the targeting pod back to the selected steerpoint.

10

Radar Cursor/Enable Switch
Depress, Multidirectional

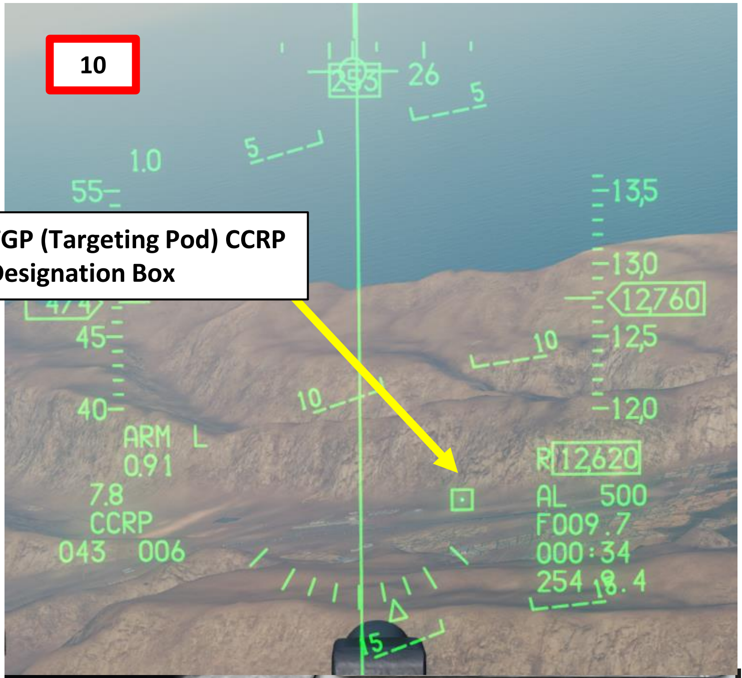
9

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT



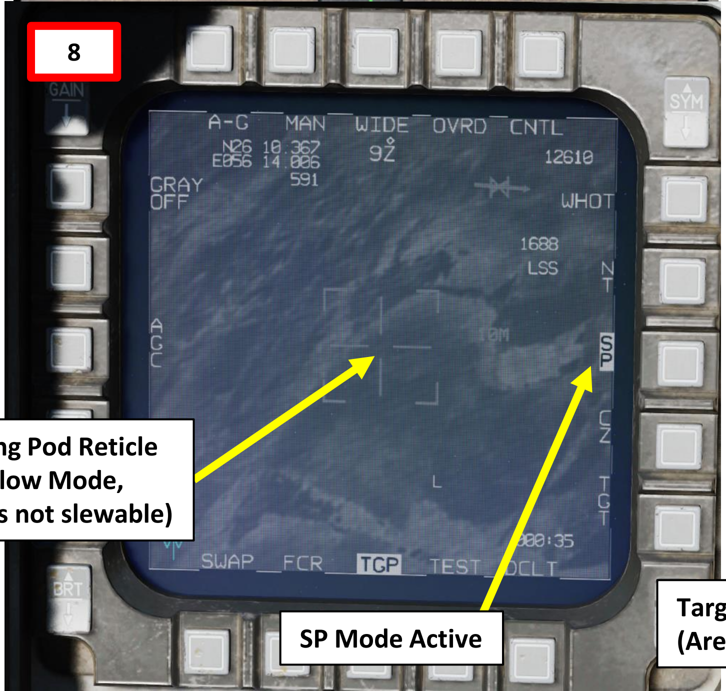
8

TGP (Targeting Pod) CCRP Designation Box



10

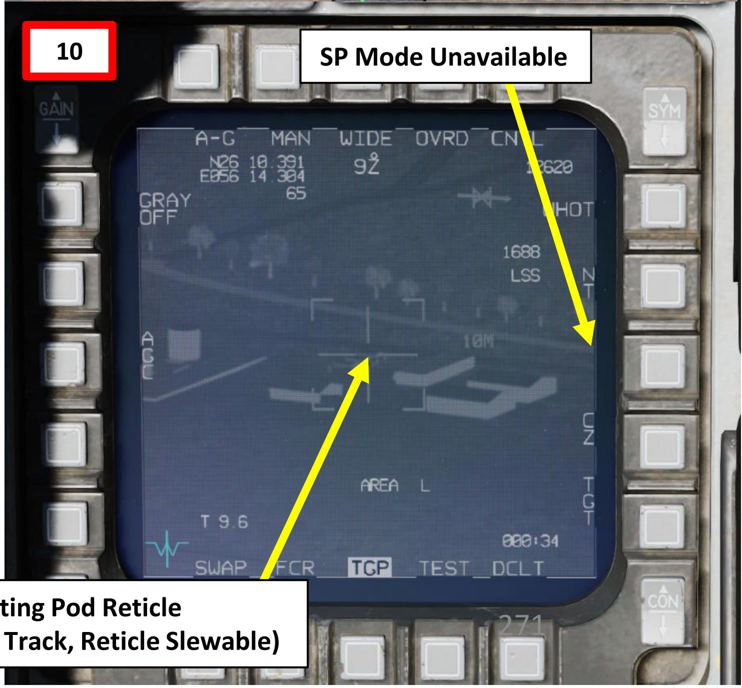
TGP (Targeting Pod) CCRP Designation Box



8

Targeting Pod Reticle (Snowplow Mode, reticle is not slewable)

SP Mode Active



10

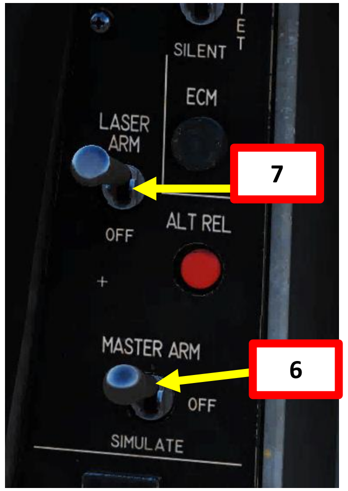
SP Mode Unavailable

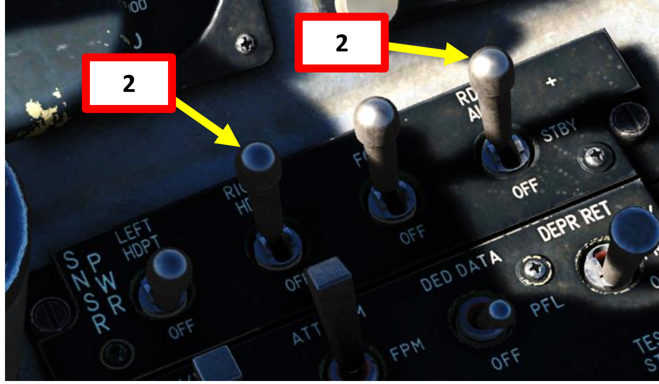
Targeting Pod Reticle (Area Track, Reticle Slewable)

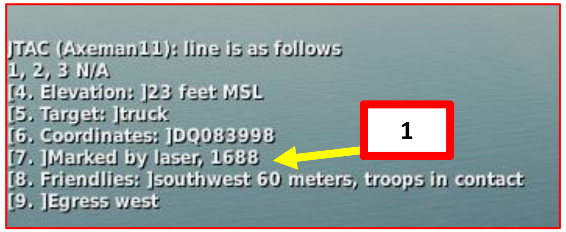
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.8 – Laser Spot Search (LSS) Mode

The targeting pod can also spot and track a laser from someone else (a friendly Hornet lasing his own target, or a JTAC, Joint Tactical Air Controller, calling an air strike). To track another laser:

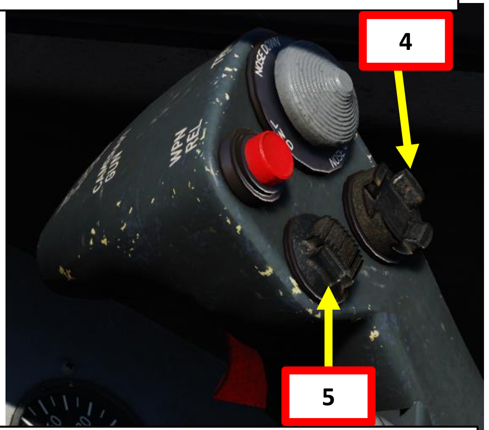
1. Find out what the laser code used by the friendly is (in our case, the friendly JTAC uses code 1688). Make sure the friendly asset is lasing the target before attempting to track it.
2. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
3. Select a valid air-to-ground weapon and CCRP release mode
4. Set the TGP page as the SOI (Sensor of Interest) by using DMS (Display Management Switch) DOWN
5. Uncage the targeting pod in boresight mode using TMS (Target Management Switch) DOWN
6. Set Master Arm Switch – ON (UP)
7. Set Laser Switch – ARMED (UP)






JTAC (Axeman11): line is as follows
1, 2, 3 N/A
[4. Elevation:]23 feet MSL
[5. Target:]truck
[6. Coordinates:]DQ083998
[7.]Marked by laser, 1688
[8. Friendlies:]southwest 60 meters, troops in contact
[9.]Egress west

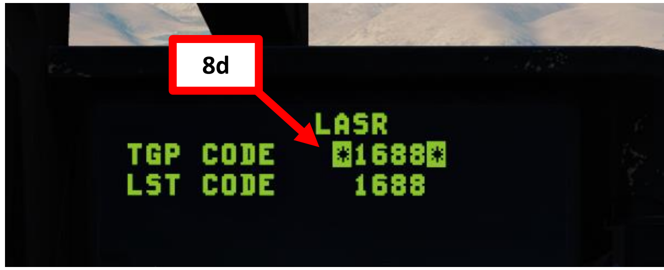
DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

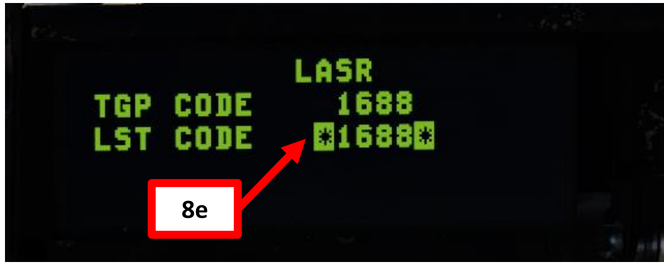


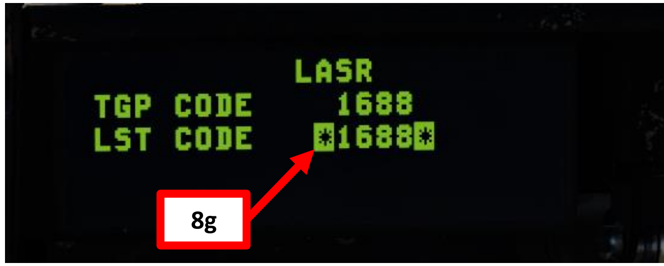
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.8 – Laser Spot Search (LSS) Mode

8. Set the Targeting Pod's LSS (Laser Spot Search) Code used by the JTAC. The default laser code is 1688.
    a) Press the LIST button
    b) The LIST sub-menus will appear on the DED (Data Entry Display). Press the "0" button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
    c) Press the "5" button on the ICP to select the LASR (Laser) sub-menu.
    d) The TGP code is selected by default (asterisks indicate field is selected).
    e) Press the DCS/Dobber (Data Control Switch) DOWN to select the LST (Laser Spot Track) Code.
    f) The default code of "1688" is already entered, but if we were to change the laser LST code to something else, we would need to type the code ("1688") on the ICP keypad,
    g) Press "ENTR" button (Enter) to update LST code if required.





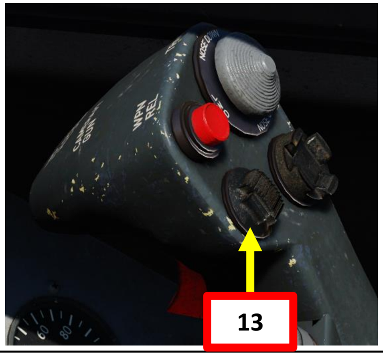


3 - AN/AAQ-28 LITENING AT TARGETING POD
3.8 – Laser Spot Search (LSS) Mode

9. Fly in the vicinity of the JTAC or laser designator. If a steerpoint is available next to the JTAC, it is good practice to slave your TGP to this steerpoint to narrow the laser search region and facilitate laser spotting.
10. Press the Uncage Switch (Depressed) on the MAN RNG/UNCAGE Knob to activate Laser Spot Search Mode.
11. Once selected, the LSS (Laser Spot Search) indication will be boxed.
12. When targeting pod has found a friendly laser, targeting pod mode will switch from LSS (Laser Spot Search) to LST (Laser Spot Track). It will actively track the JTAC laser.
13. Select Tracking Mode using the TMS (Target Management Switch) UP to toggle between Point Track (POINT, tracks moving objects) or Area Track (AREA, tracks static objects). This will allow you to designate this target.
14. You may now launch laser-guided weapons as per their release procedure.
15. When desired, press the Uncage Switch (Depressed) on the MAN RNG/UNCAGE Knob to stop tracking the laser.

MAN RNG/UNCAGE Knob/Switch
- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)*

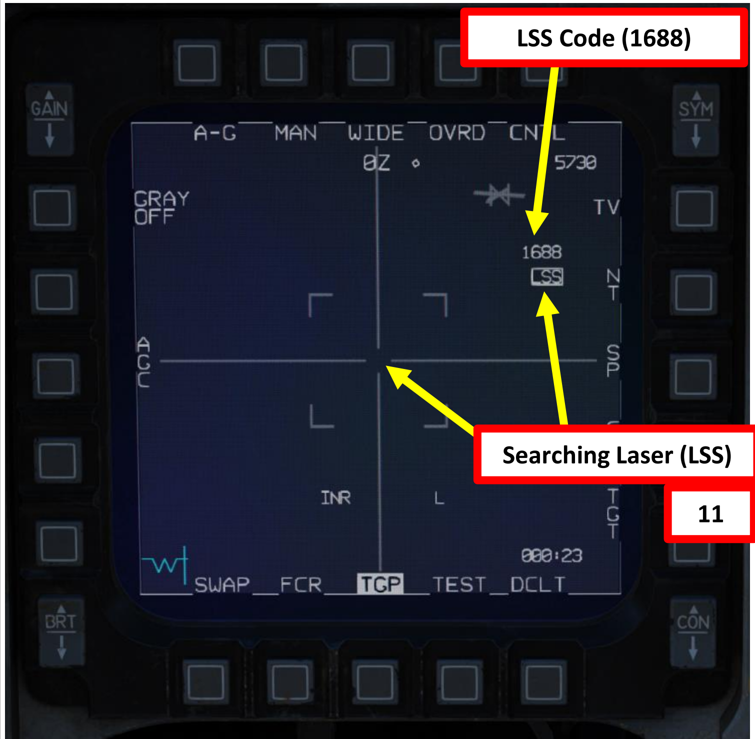
10



13

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

LSS Code (1688)



Searching Laser (LSS)

11

12

Tracking Laser (LST)

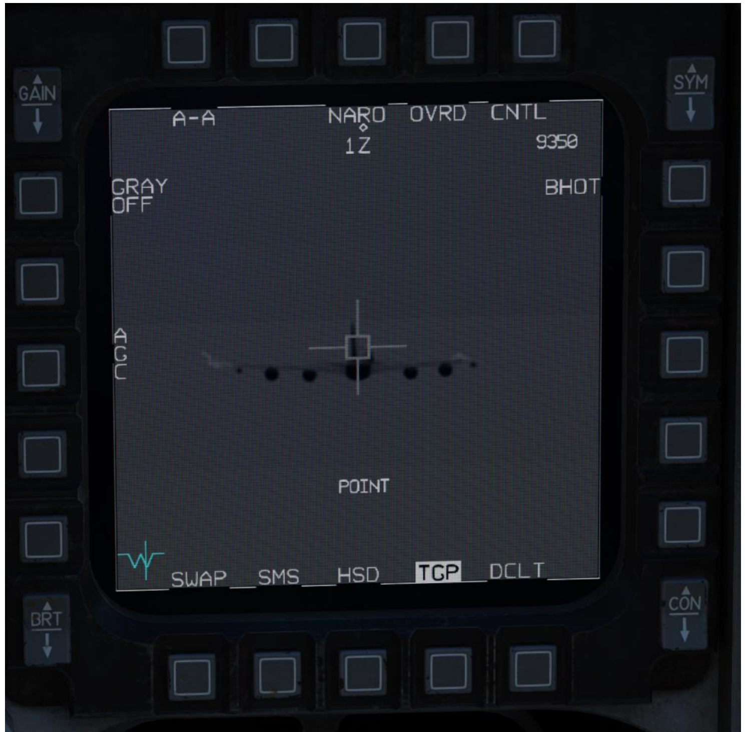
12

TGP (Targeting Pod) Designation Box Laser Spotted!

3 - AN/AAQ-28 LITENING AT TARGETING POD
3.9 – Air-to-Air Operation
3.9.1 - Operation Modes

The targeting pod can also be used in air-to-air modes in conjunction with the radar. This is quite useful to perform visual identifications of air targets. To use Air-to-Air mode, the LITENING TGP (Targeting Pod) requires the A-A Master Mode to be active. The TGP is automatically commanded to the radar line-of-sight when A-A master mode is selected, and the radar is tracking a target. If the radar is not tracking an aerial target, the pod directs its line-of-sight straight ahead at minus-3 degrees elevation. Here are the main A-A operation modes of the pod:

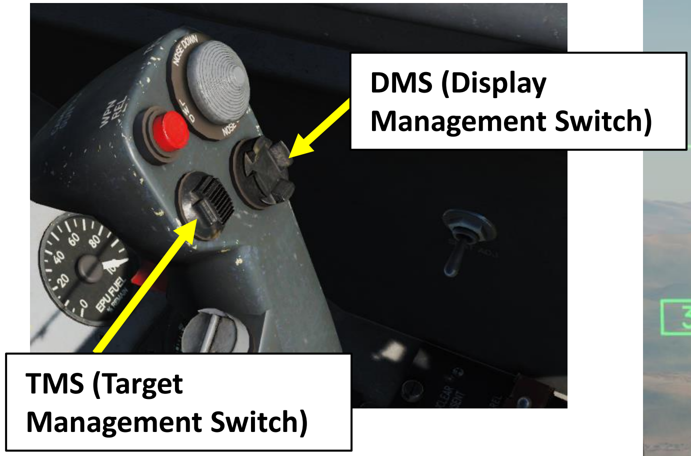
- **Radar Slaved (Body):** The TGP is slaved to radar's locked target.
- **Point Track (POINT):** The TGP itself is tracking a target. Point Track is accessed by "bumping" the TMS UP (Target Management Switch) while the TGP page is the SOI (Sensor of Interest), and will attempt to acquire a recognized target within the reticle.
- **Rate Track (RATES):** This tracking mode is automatically selected whenever the targeting pod loses a track.

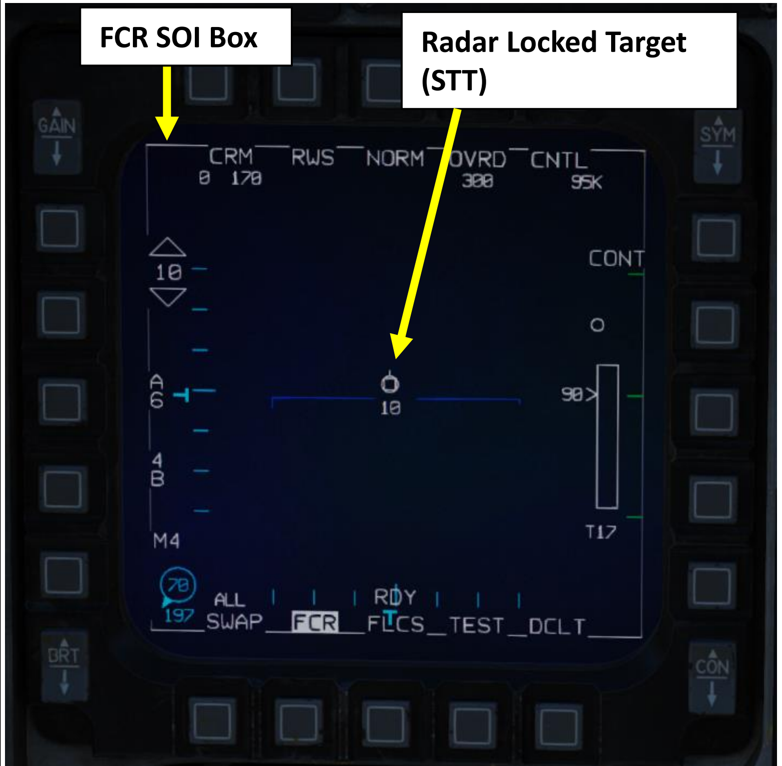


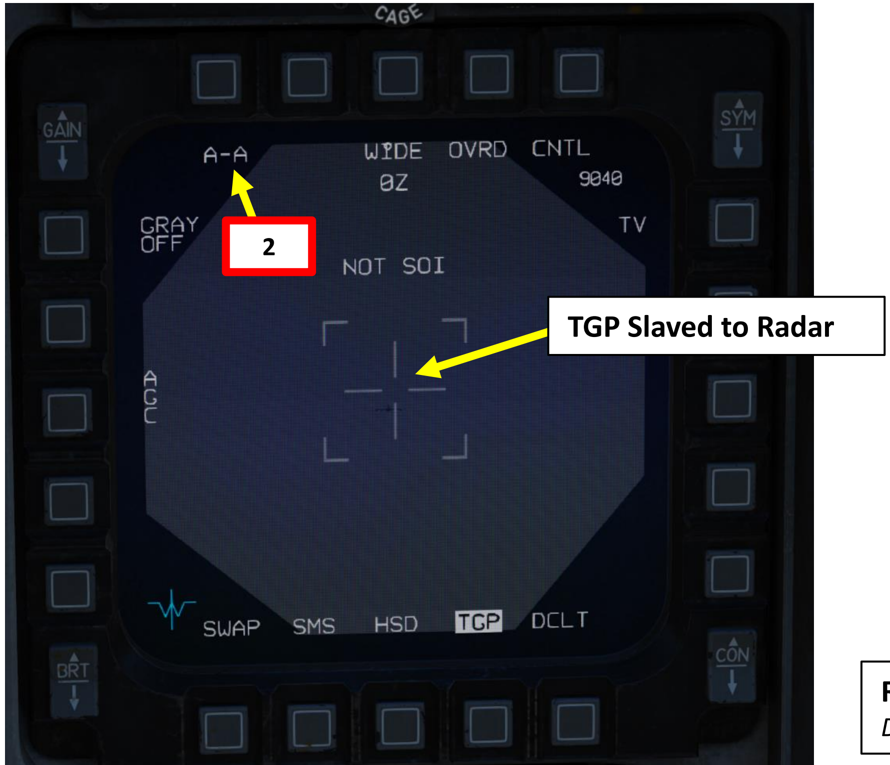
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.9 – Air-to-Air Operation
3.9.2 – Point Track (Slaved from Radar)

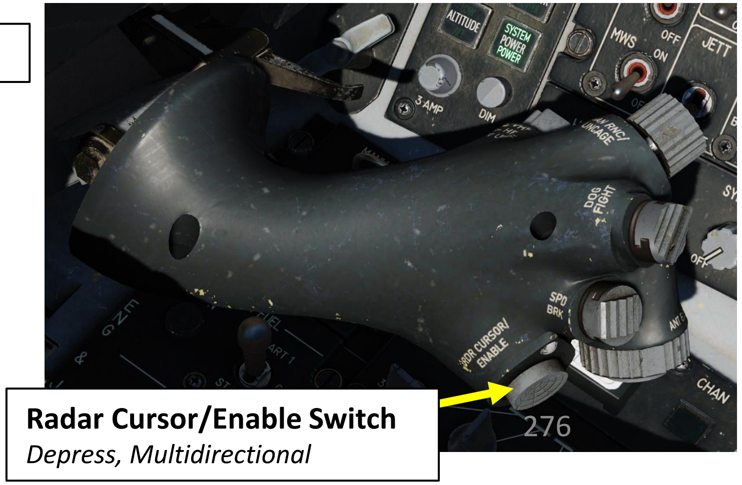
In order to **track a target with the targeting pod**:

1. Make sure the FCR (Fire Control Radar) and targeting pod are powered
2. Press the A-A Master Mode button. The Targeting Pod should automatically switch to A-A (Air-to-Air) mode.
3. Select FCR (Fire Control Radar) and TGP (Targeting Pod) pages.
4. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
5. Acquire STT (Single Target Track) radar lock using the Radar Cursor switch and TMS (Target Management Switch) UP twice in quick succession.
6. The targeting pod will automatically slew its reticle on the radar locked target. However, Point Track is not yet active.



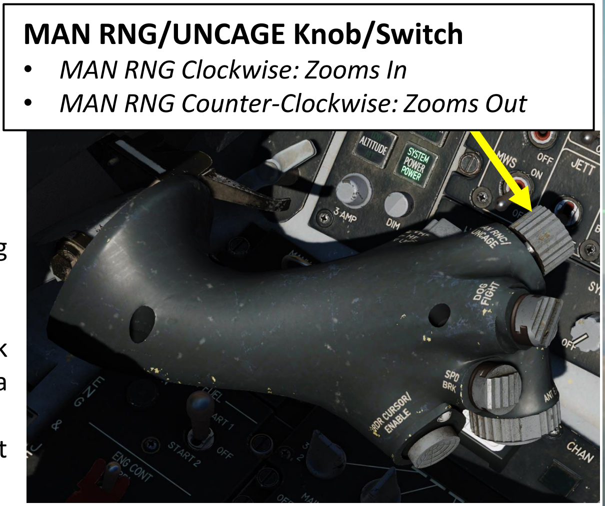


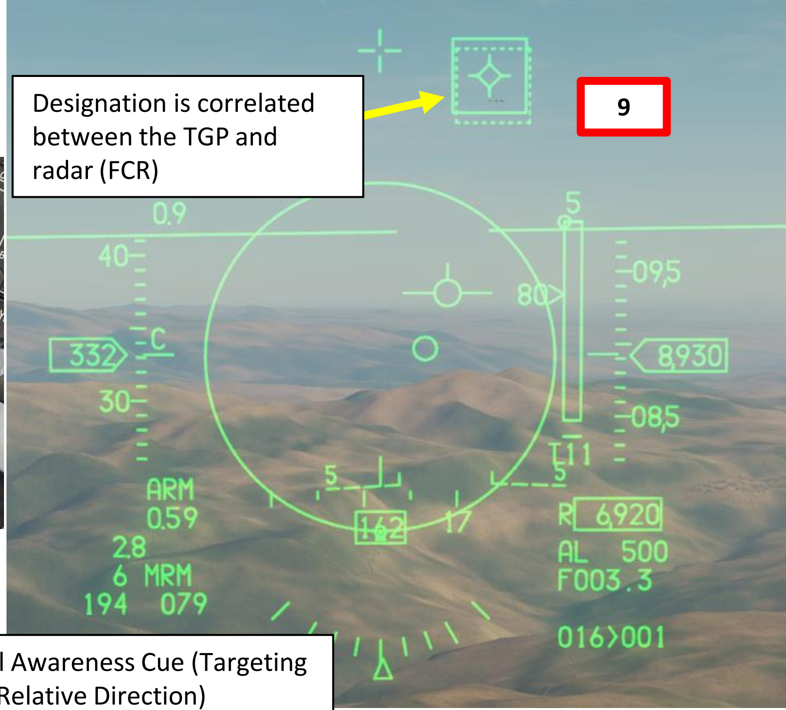


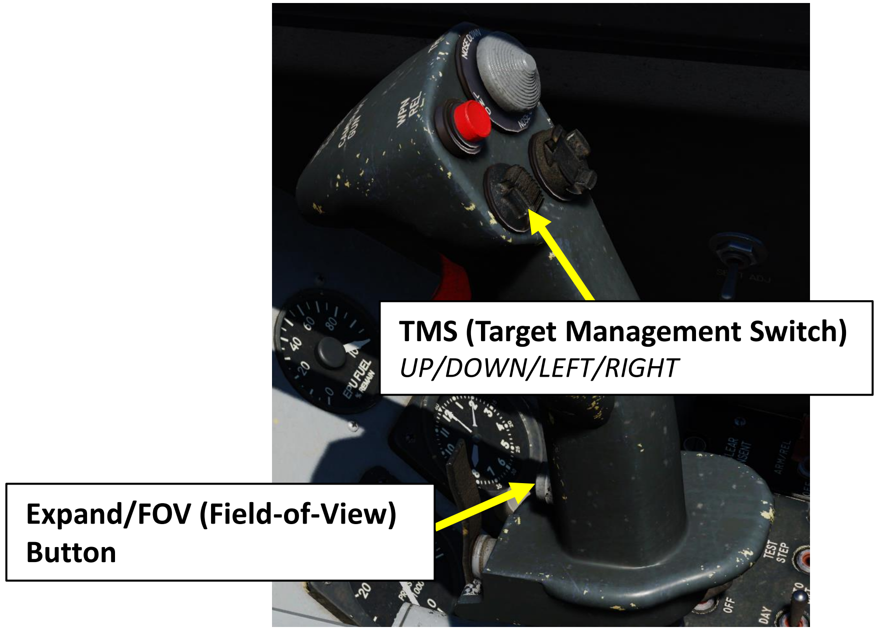


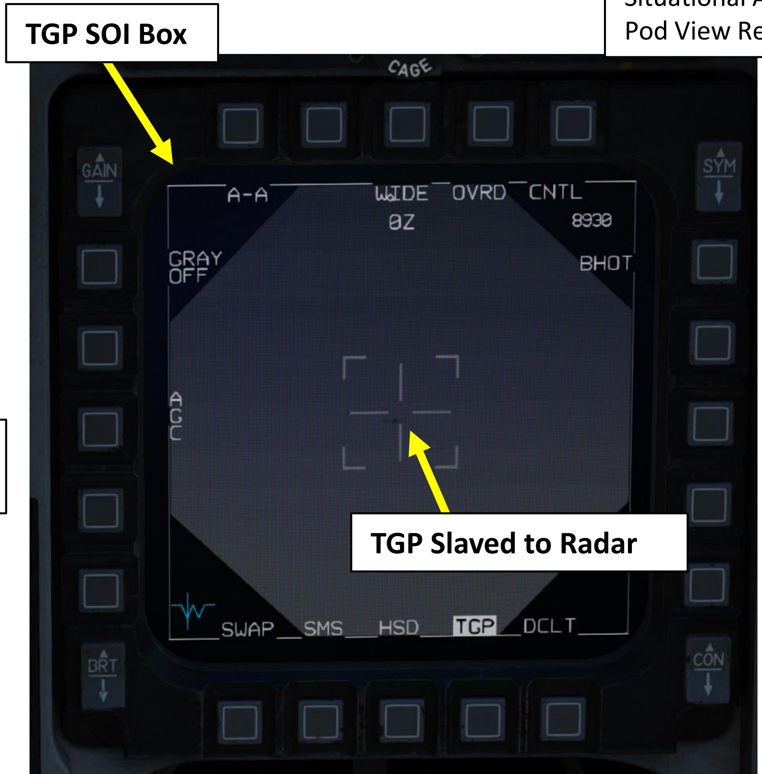
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.9 – Air-to-Air Operation
3.9.2 – Point Track (Slaved from Radar)

7. Press the DMS (Display Management Switch) DOWN to set the TGP (Targeting Pod) page as the SOI (Sensor of Interest).
8. Press TMS (Target Management Switch) UP to attempt a Point Track.
9. Once the target is both locked by the FCR and tracked by the TGP in Point Track mode, the target is "correlated" between sensors. On the Heads-Up Display, a "broken" (dashed) box and a solid box will both overlay the target.
10. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
11. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
12. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
    - CCW (Counter-Clockwise): Zooms OUT
    - CW (Clockwise): Zooms IN





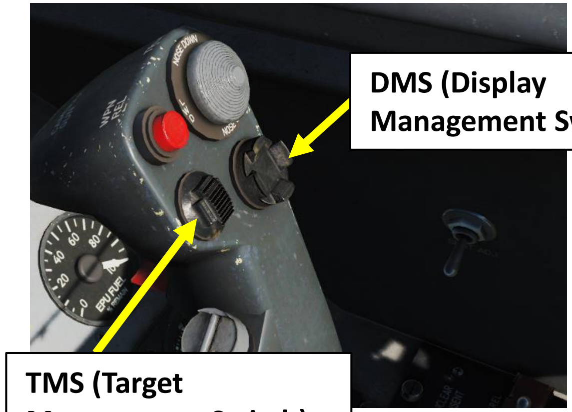


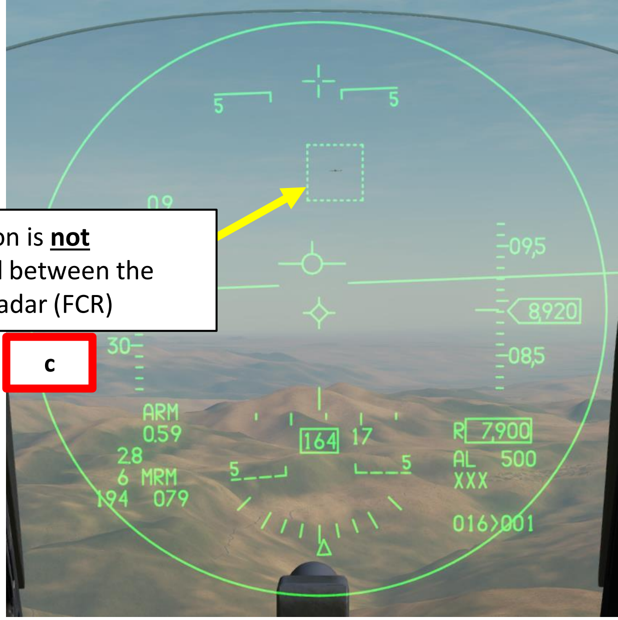


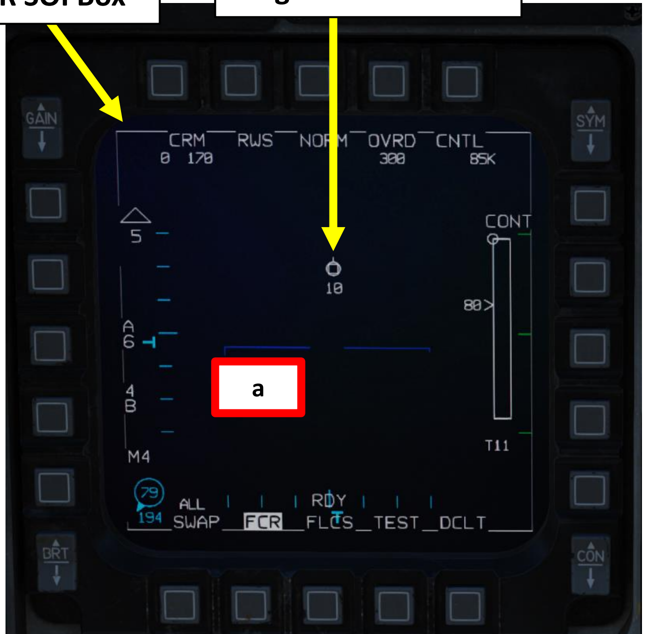
3 - AN/AAQ-28 LITENING AT TARGETING POD
3.9 – Air-to-Air Operation
3.9.3 – Target Correlation & Other Tips

- **Note 1:** If you want to "dump" (undesignate) the target from the targeting pod, press TMS (Target Management Switch) DOWN while the TGP is the Sensor of Interest (SOI). Tracking mode will revert to RATES.

- **Note 2:** If you want to exit radar STT (Single Target Track) lock and designate the target with the targeting pod only:
    a) Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
    b) Press the TMS (Target Management Switch) on the stick DOWN twice to exit STT and return to RWS (Range While Search) FCR mode
    c) On the Heads-Up Display, the solid box will disappear and only a "broken" (dashed) box will remain over the target. This means that the target is no longer correlated between the targeting pod and the radar.



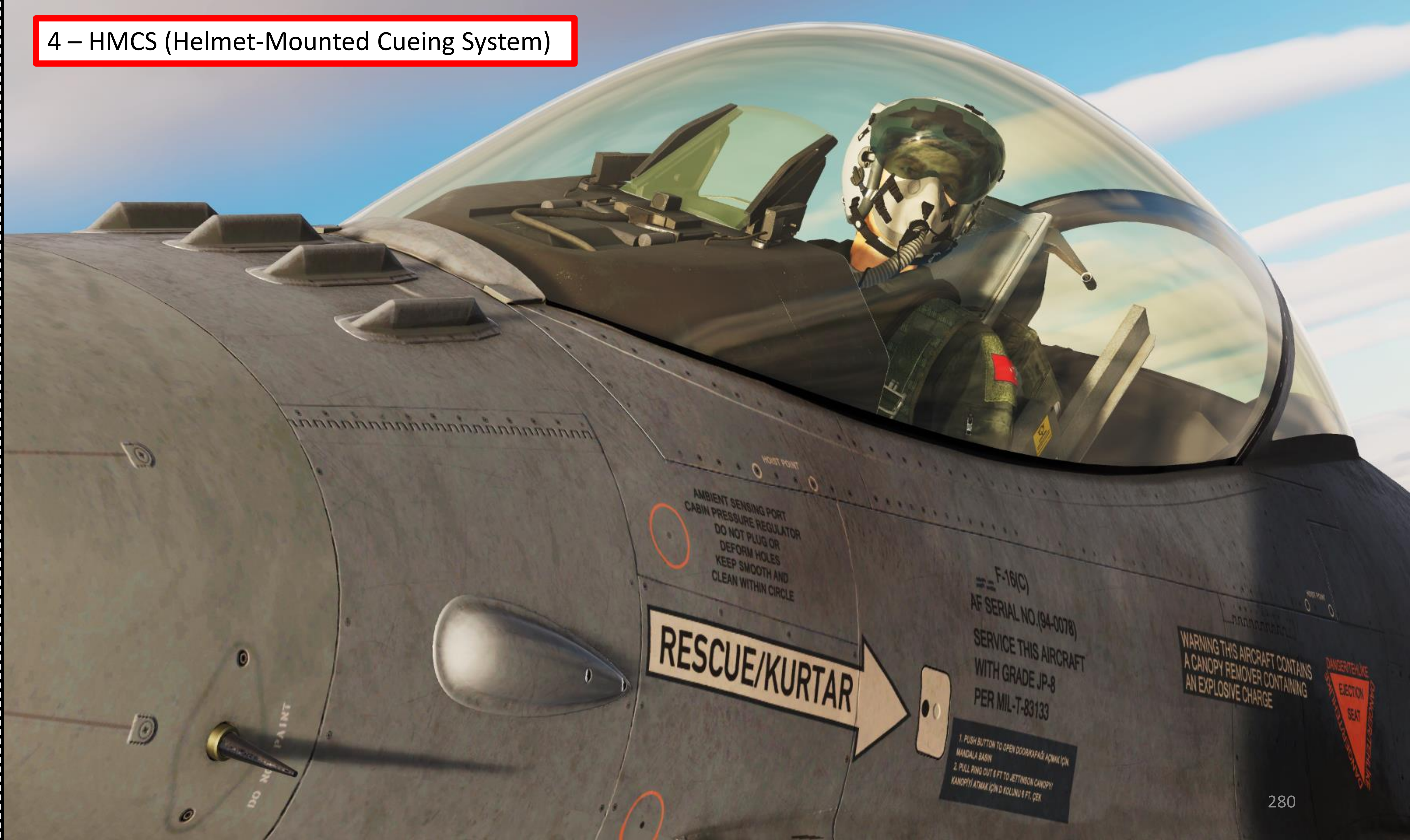




3 - AN/AAQ-28 LITENING AT TARGETING POD
3.9 – Air-to-Air Operation
3.9.3 – Target Correlation & Other Tips

- **Note 3:** If your target pod ever loses track of the target, the TGP will revert to RATES. In that case, set the FCR as the SOI (Sensor of Interest) with DMS DOWN, exit STT radar lock, perform a STT radar lock again, then the TGP will be slaved back to the target.

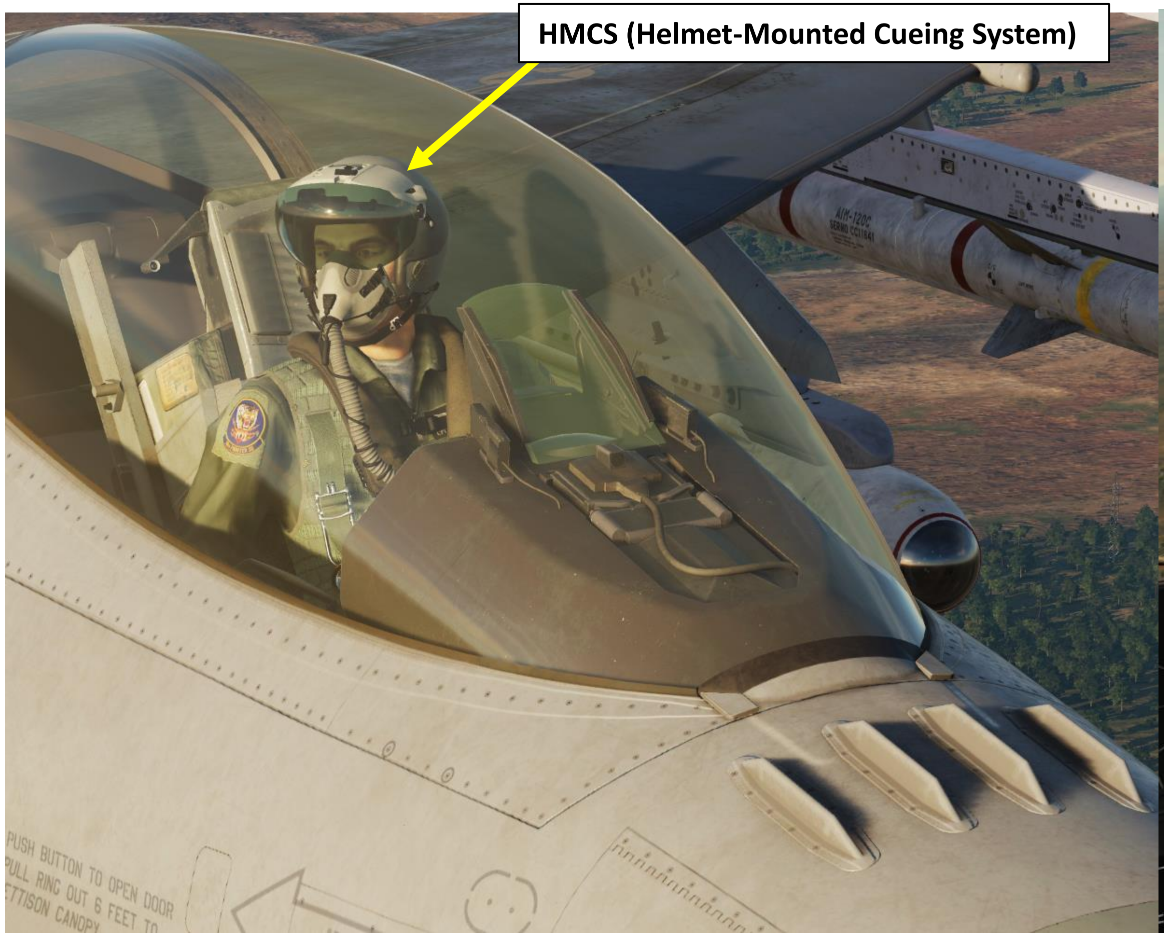
4 – HMCS (Helmet-Mounted Cueing System)



4 – HMCS (Helmet-Mounted Cueing System)
4.1 – Introduction

> **Note:**
> *Night Vision Goggles and HMCS are mutually exclusive helmet-mounted devices; you can only equip one or the other. You can select what to equip via Ground Crew request.*

The HMCS (Helmet-Mounted Cueing System) allows the pilot to command a sensor to the user line of sight and provides situational awareness via a Helmet Mounted Display (HMD). The HMCS allows the pilot to project the Heads-Up Display and datalink symbology in his field of vision at all times. It also allows the slaving of sensors and weapons to the helmet's line of sight.

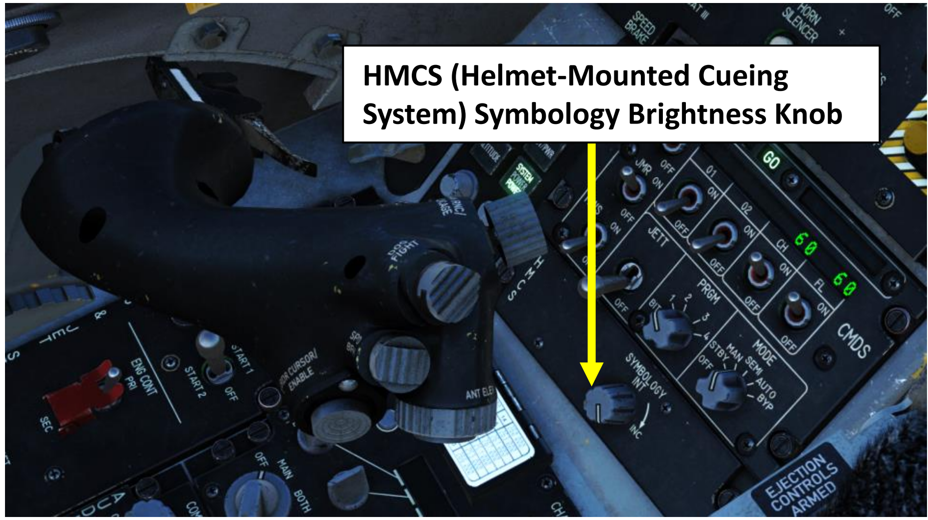


4 – HMCS (Helmet-Mounted Cueing System)
4.1 – Introduction

In the F-16, the HMCS is very useful for using missiles like the AIM-9X, an upgraded version of the AIM-9 with TVC (Thrust Vectoring Control) allowing 80 deg off-boresight shots.

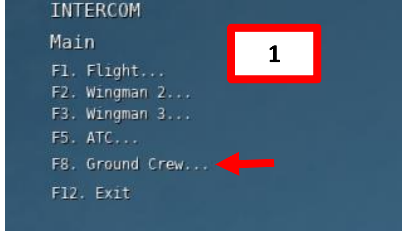
The HMD (Helmet-Mounted Display) can be used by turning the HMCS Symbology Brightness Control Knob to INC.

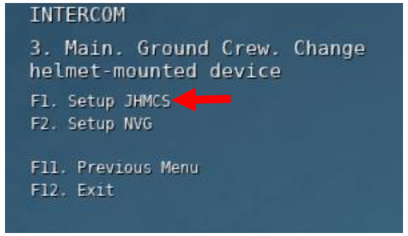
The HMCS projection can be **toggled on and off** pressing the **DMS (Display Management Switch) DOWN LONG** (for more than 0.5 sec).



4 – HMCS (Helmet-Mounted Cueing System)
4.2 – HMCS Power-Up & Alignment

1. To equip the HMCS (Helmet-Mounted Cueing System) helmet, you have to contact the ground crew.
    a) Press "\" (communication menu binding) to contact ground crew
    b) Press "**F8**" to select "**Ground Crew**"
    c) Press "**F8**" to "**Change helmet-mounted device**".
    d) Press either "F1" for HMCS.
2. Set the HMCS SYMBOLOGY INTENSITY knob to INC.
3. Access the HMCS Alignment DED Page
    a) Press the LIST button
    b) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to select MISC (Miscellaneous) DED Page.
    c) Press "RCL" on the ICP (Integrated Control Panel) to select HMCS (Helmet-Mounted Cueing System) DED Page.
    d) Press the DCS (Data Control Switch, also called "Dobber") RIGHT (SEQ) to select the HMCS ALIGN DED page.



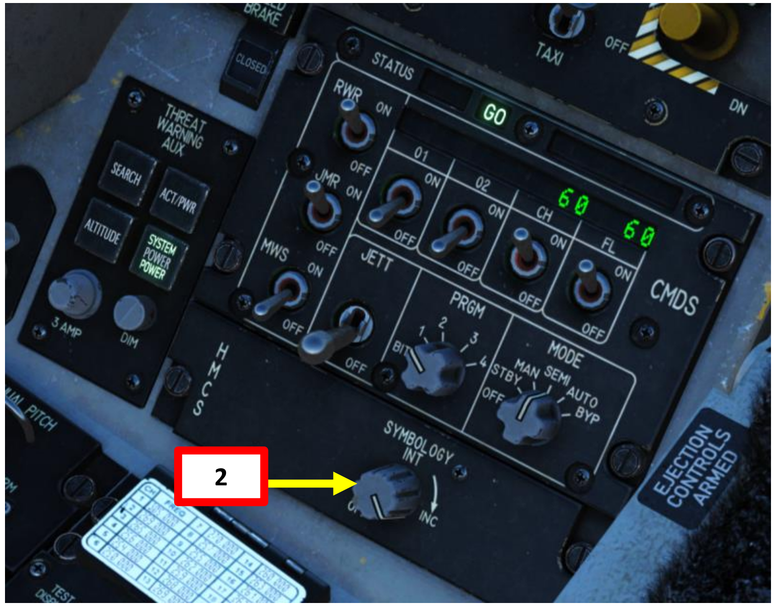


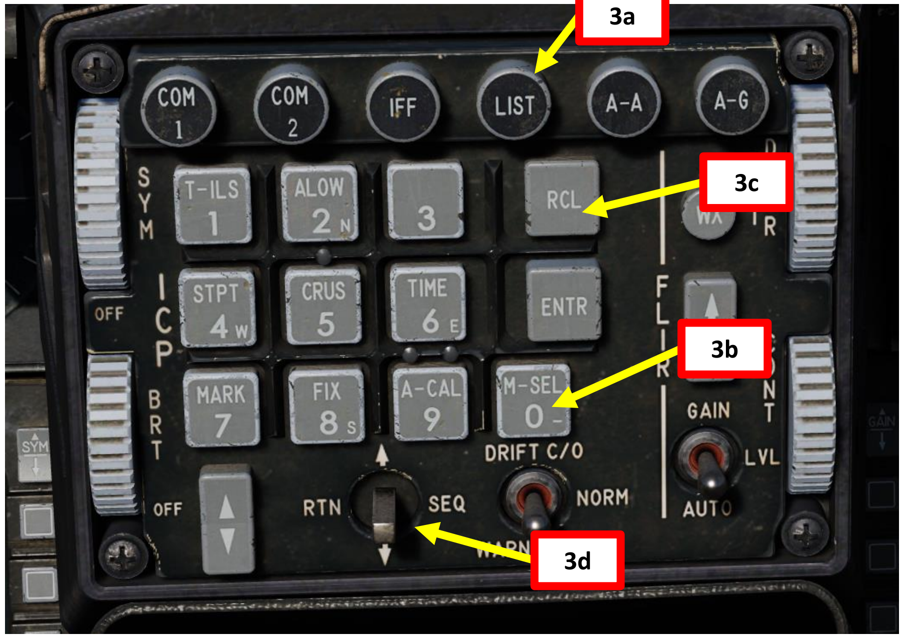
3a


3b


3c

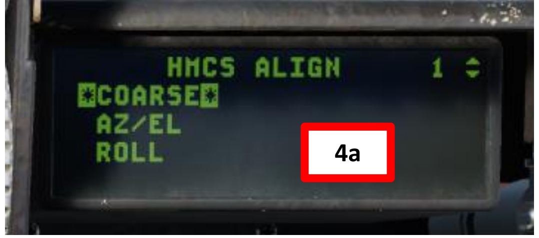

3d

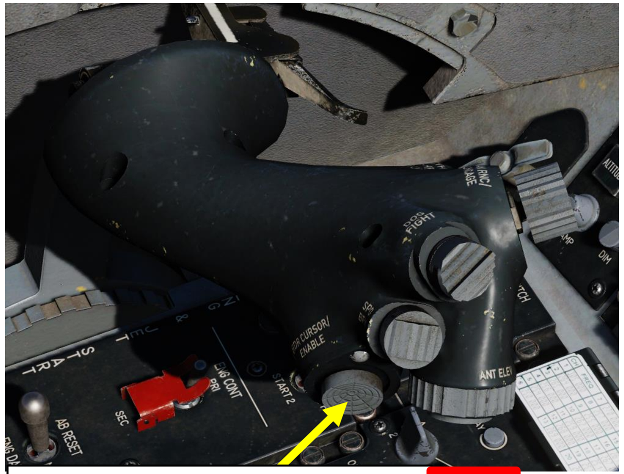





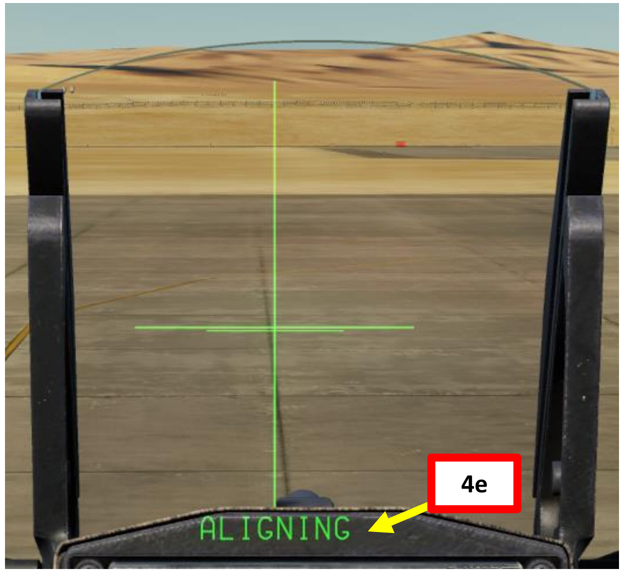
4 – HMCS (Helmet-Mounted Cueing System)
4.2 – HMCS Power-Up & Alignment

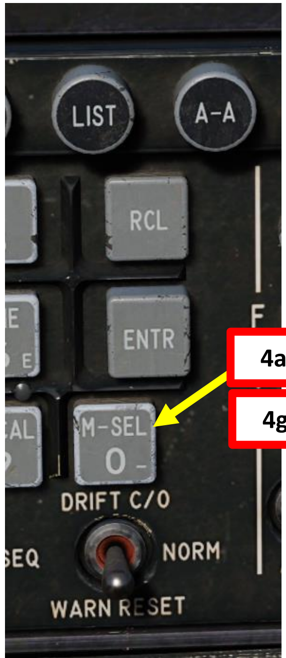
4. Perform HMCS Coarse Helmet Display Alignment
   a) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to begin COARSE HMCS alignment process.
   b) READY" indication will then appear on your helmet cross.
   c) Move helmet cross on the alignment reference cross of the Heads-Up Display (HUD).
   d) When helmet cross and HUD cross are roughly aligned, depress the Radar Cursor/Enable Switch. The default binding is "Enter".
   e) While the alignment process is taking place, the "ALIGNING" indication is visible.
   f) The "ALIGN OK" indication appears when the alignment is complete.
   g) Press "0 / M-SEL" on the ICP (Integrated Control Panel) to save the HMCS coarse alignment.
   h) Once Coarse Alignment is saved, the HMCS ALIGN DED page will automatically switch to the AZ/EL (Azimuth/Elevation) fine alignment phase.

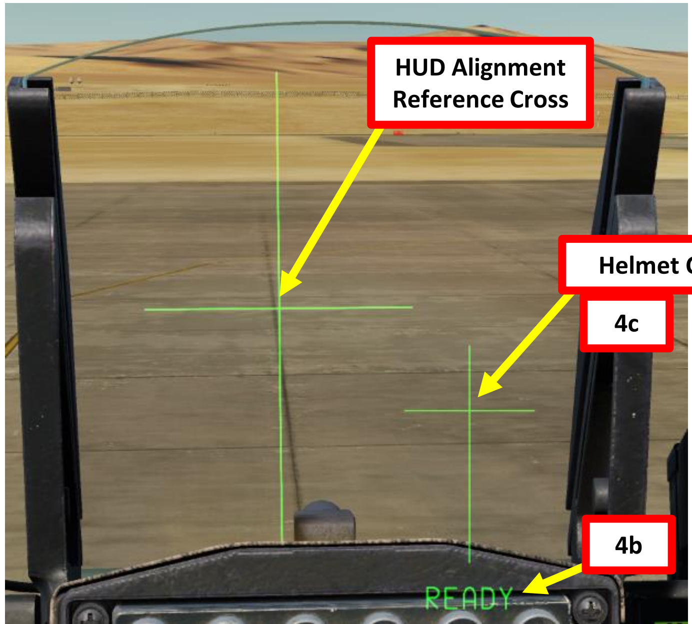


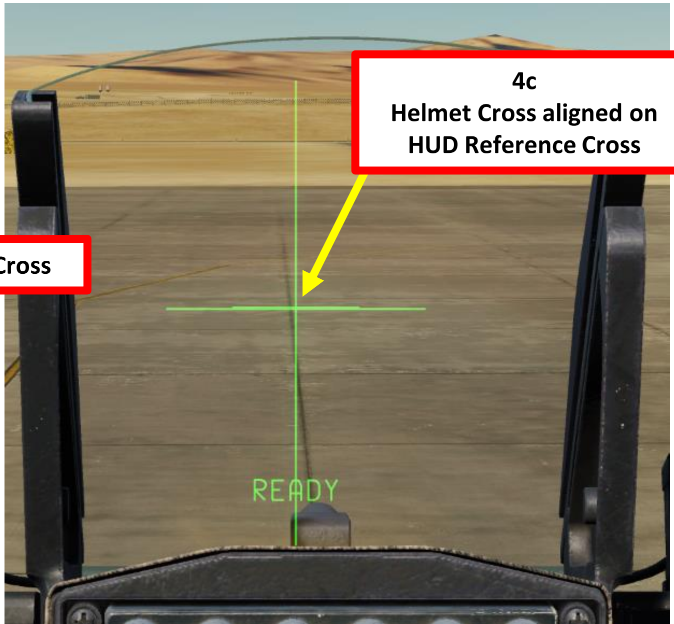


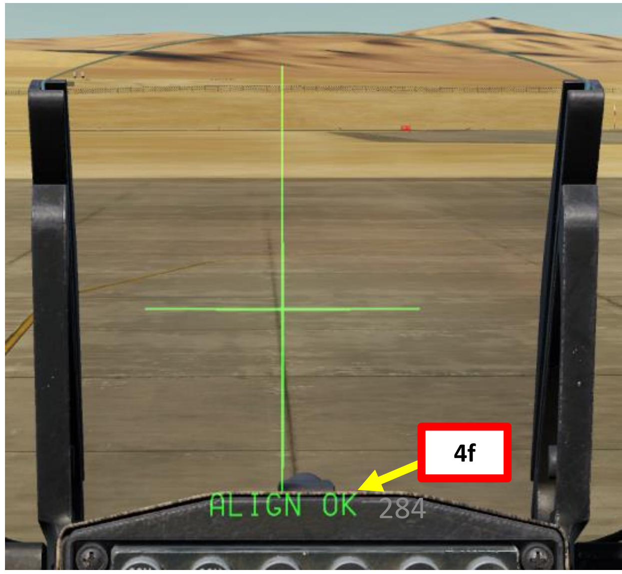
Radar Cursor/Enable Switch 4d



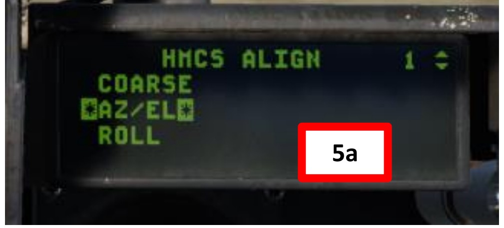




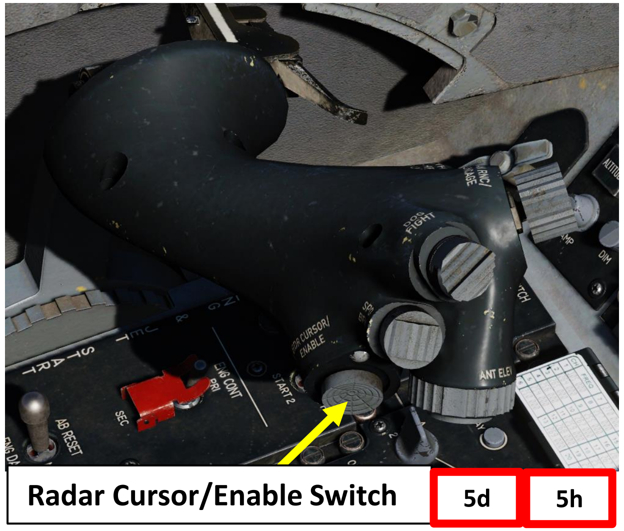


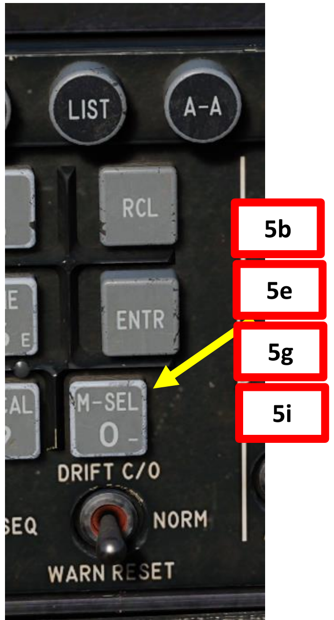


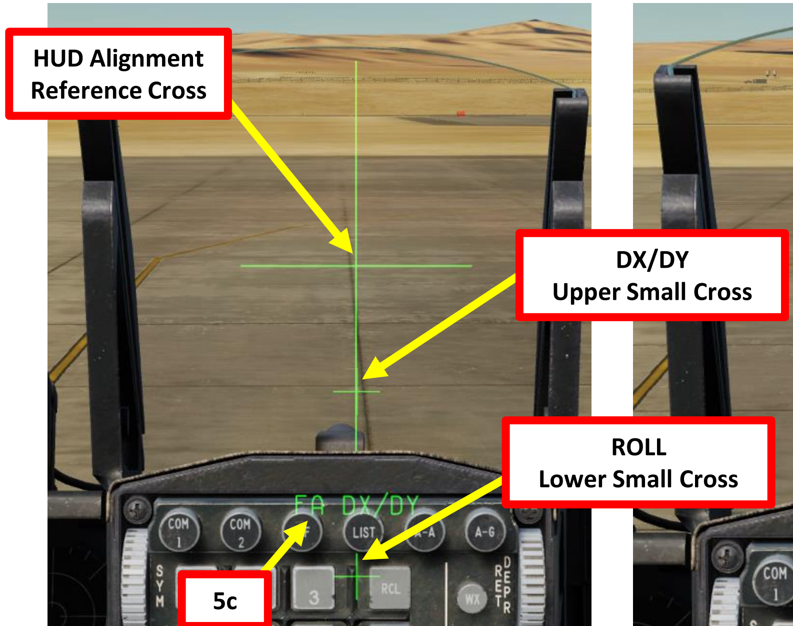
4 – HMCS (Helmet-Mounted Cueing System)
4.2 – HMCS Power-Up & Alignment

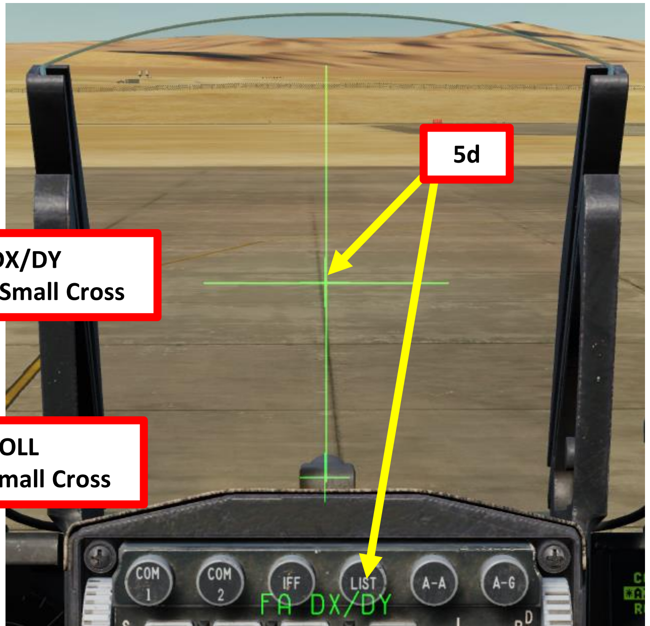


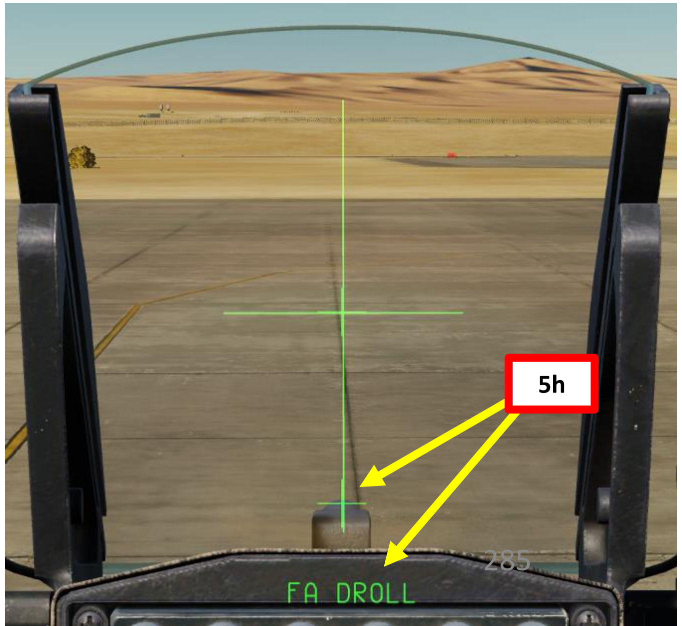
5. Perform HMCS Fine Helmet Display Alignment
   a) The coarse alignment may not be perfect and may require a fine adjustment (FA).
   b) Press “0 / M-SEL” on the ICP (Integrated Control Panel) to begin FA DX/DY HMCS alignment process.
   c) The “FA DX/DY” indication means that an adjustment is needed for the horizontal and vertical axis.
   d) Use Radar Cursor/Enable Switch AFT/FWD/LEFT/RIGHT controls to align the upper small cross with the HUD reference cross.
   e) Press “0 / M-SEL” on the ICP (Integrated Control Panel) to save the HMCS FA DX/DY (fine horizontal/vertical alignment).
   f) Once FA DX/DY Alignment is saved, the HMCS ALIGN DED page will automatically switch to the ROLL fine alignment phase.
   g) Press “0 / M-SEL” on the ICP (Integrated Control Panel) to begin FA DROLL HMCS alignment process.
   h) Use Radar Cursor/Enable Switch AFT/FWD/LEFT/RIGHT controls to align the lower small cross with the vertical line of the HUD reference cross.
   i) Press “0 / M-SEL” on the ICP (Integrated Control Panel) to save the HMCS FA DROLL (fine roll alignment).
   j) The HMCS alignment is now completed.





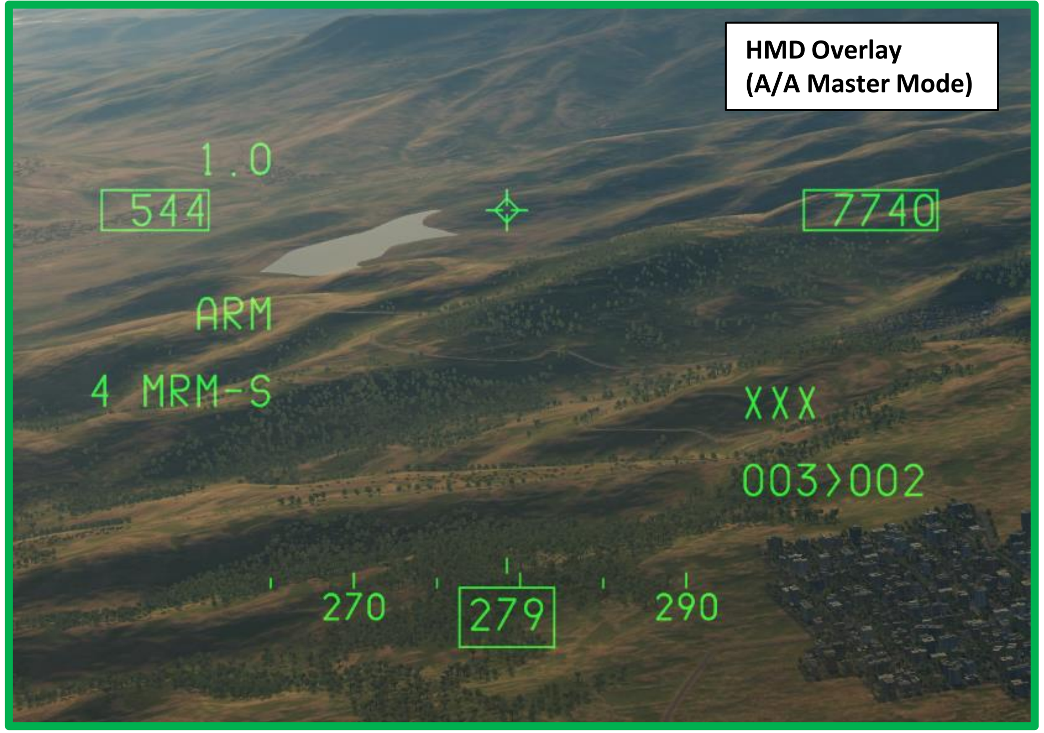


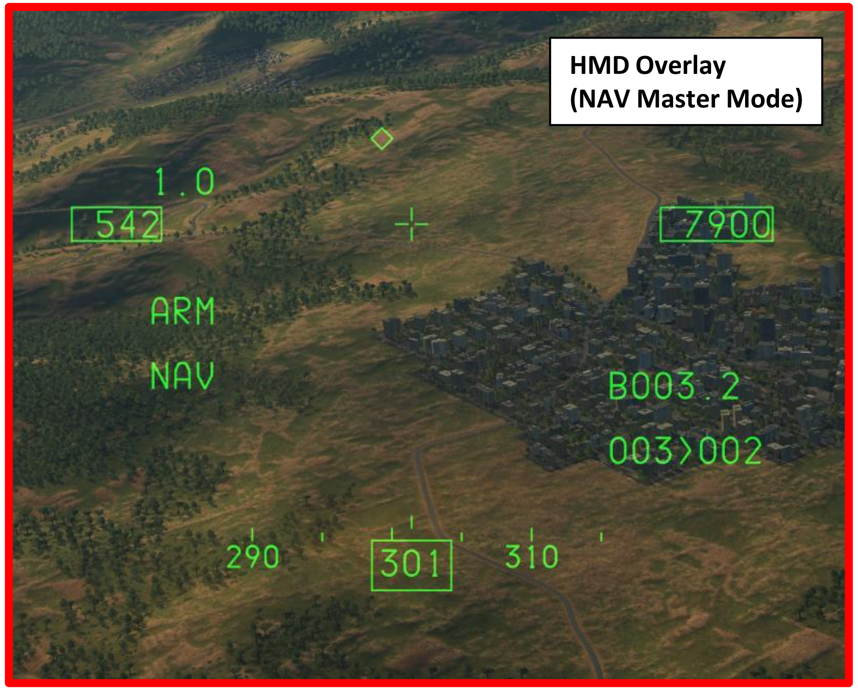


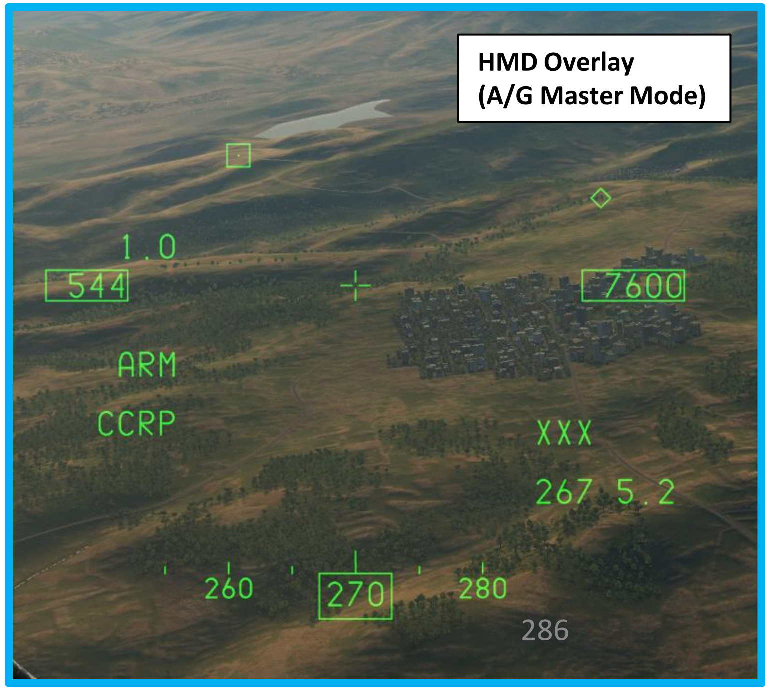


4 – HMCS (Helmet-Mounted Cueing System)
4.2 – HMCS Power-Up & Alignment

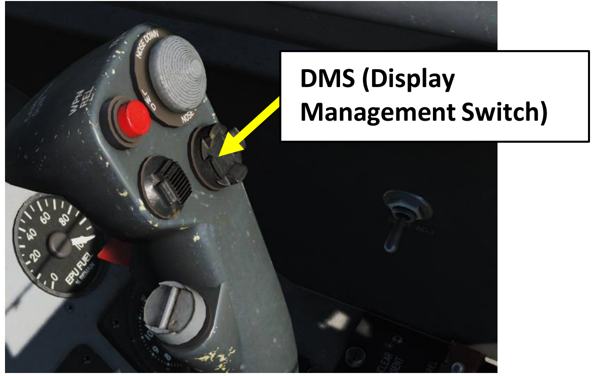
6. The default setting for the HMCS is that the HMD overlay will only be visible when looking away from the Heads-Up Display.
7. Select either A/A Master Mode for using the HMCS with air-to-air missiles or A/G Master Mode to designate ground targets with the helmet. When neither the A/A or the A/G modes are selected, the default mode is NAV.
8. The HMCS projection can be toggled on and off pressing the DMS (Display Management Switch) DOWN LONG (for more than 0.5 sec).







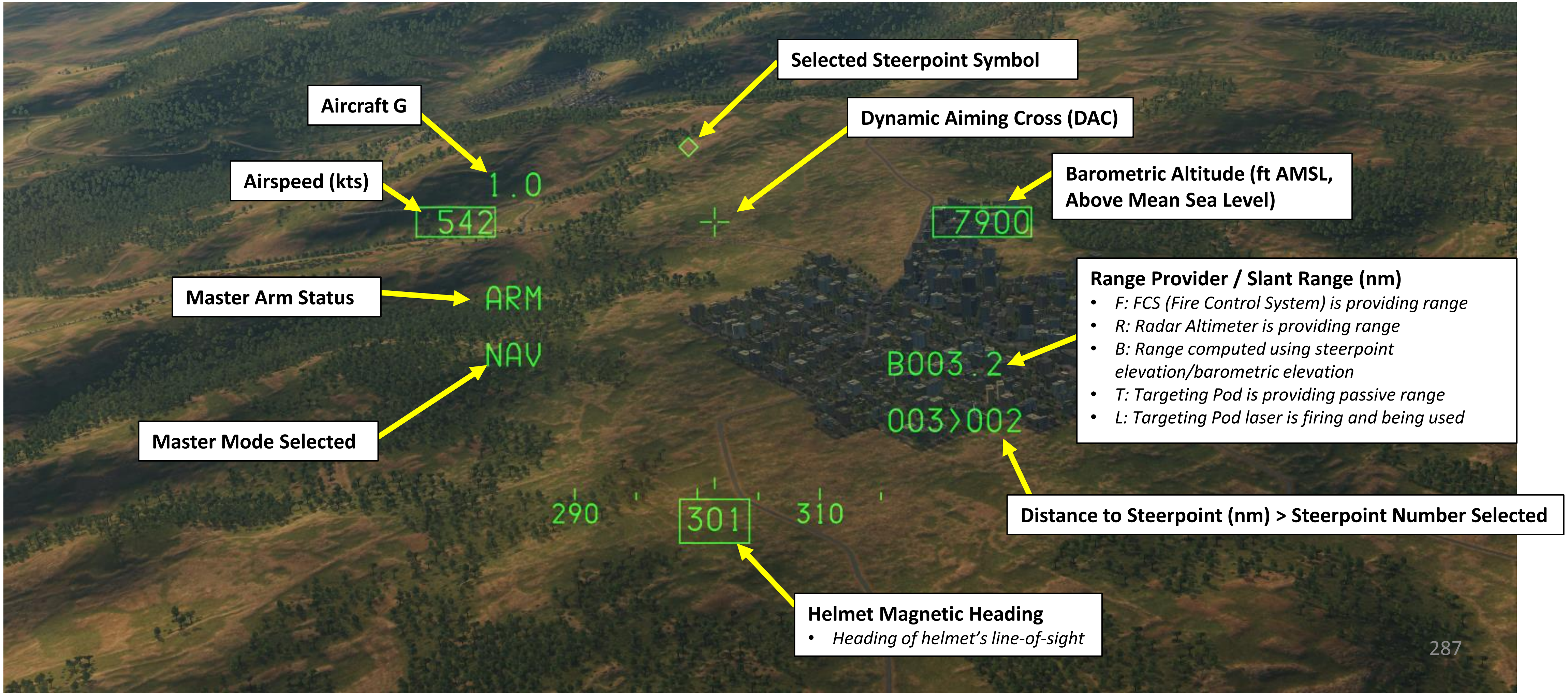
4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.1 – HMD Symbology



A – Basic Symbology

The Basic symbology refers mainly to aircraft flight parameters. This symbology Is similar to a Heads-Up Display repeater overlayed on your helmet.

- Note: The HMCS projection can be toggled on and off pressing the DMS (Display Management Switch) DOWN LONG (for more than 0.5 sec).



4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.1 – HMD Symbology

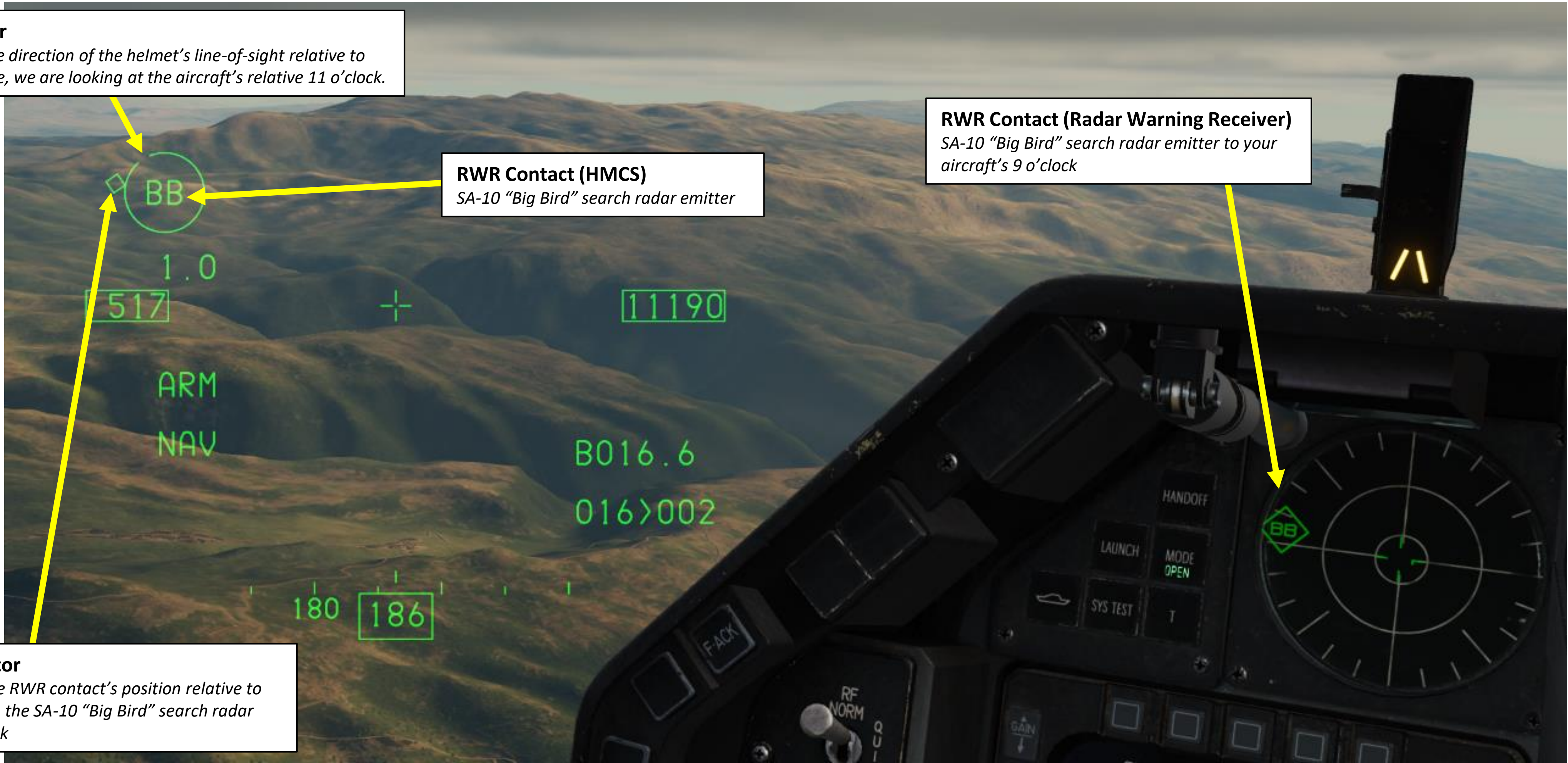
B – Radar Warning Receiver (RWR) Symbology

The HMD (Helmet-Mounted Display) displays radar emitters detected by the RWR (Radar Warning Receiver), but only the priority emitters.

HMCS Line-of-Sight Indicator
Circle discontinuity/gap shows the direction of the helmet's line-of-sight relative to the aircraft's nose. In this example, we are looking at the aircraft's relative 11 o'clock.

RWR Contact (HMCS)
SA-10 "Big Bird" search radar emitter

RWR Contact (Radar Warning Receiver)
SA-10 "Big Bird" search radar emitter to your aircraft's 9 o'clock



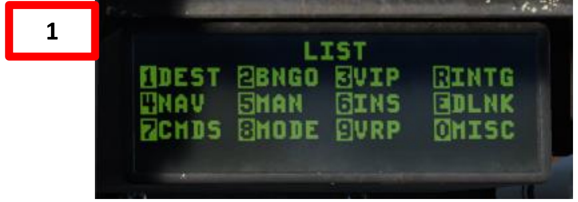
RWR Contact Position Indicator
Diamond shows the direction of the RWR contact's position relative to the aircraft's nose. In this example, the SA-10 "Big Bird" search radar emitter is to your aircraft's 9 o'clock

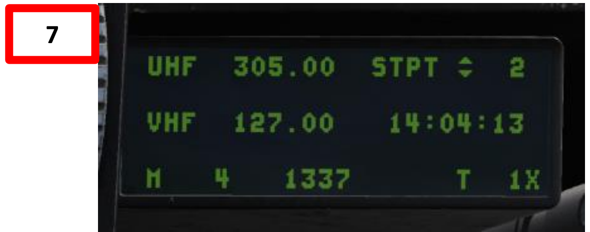
4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.1 – HMD Symbology

B – Radar Warning Receiver (RWR) Symbology

In order to display RWR contacts on the HMCS, you have to enable the option via the HMCS DED page.

1. Press the LIST button
2. Press "0 / M-SEL" on the ICP (Integrated Control Panel) to select MISC (Miscellaneous) DED Page.
3. Press "RCL" on the ICP (Integrated Control Panel) to select HMCS (Helmet-Mounted Cueing System) DED Page.
4. By default, the HMCS DISPLAY DED page should be visible. If you are at the HMCS ALIGN page instead, press the DCS (Data Control Switch, also called "Dobber") RIGHT (SEQ) to go from the HMCS ALIGN DED page to the HMCS DISPLAY DED page.
5. Press the DCS ("Dobber") DOWN until the "RWR DSPLY" (Radar Warning Receiver Display) field is selected. Selection of the field is indicated by asterisks.
6. If the RWR DSPLY is set to "OFF", press the "0 / M-SEL" on the ICP (Integrated Control Panel) to toggle the option from OFF to ON.
7. Return to CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN





C – Datalink Symbology – Part 1

No datalink symbology is available for the HMCS yet.

C – Datalink Symbology – Part 2

No datalink symbology is available for the HMCS yet.

4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.1 – HMD Symbology

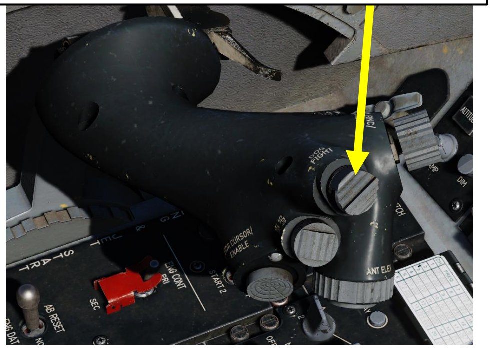
D – Air-to-Air Symbology

When using the radar in air-to-air mode (A/A Master Mode button pressed) and the Dogfight Switch is set to DGFT, the following symbology is visible.

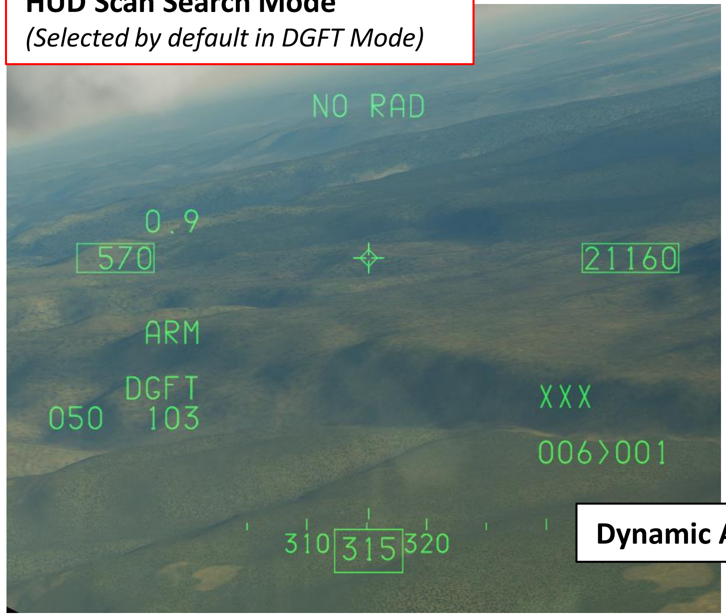
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

A-A (Air-to-Air) Master Mode Button

Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*



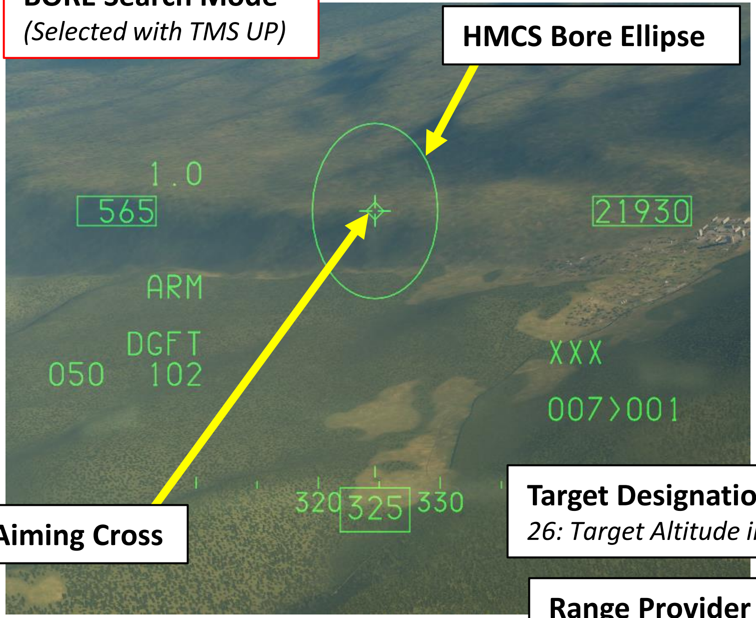
HUD Scan Search Mode
(Selected by default in DGFT Mode)



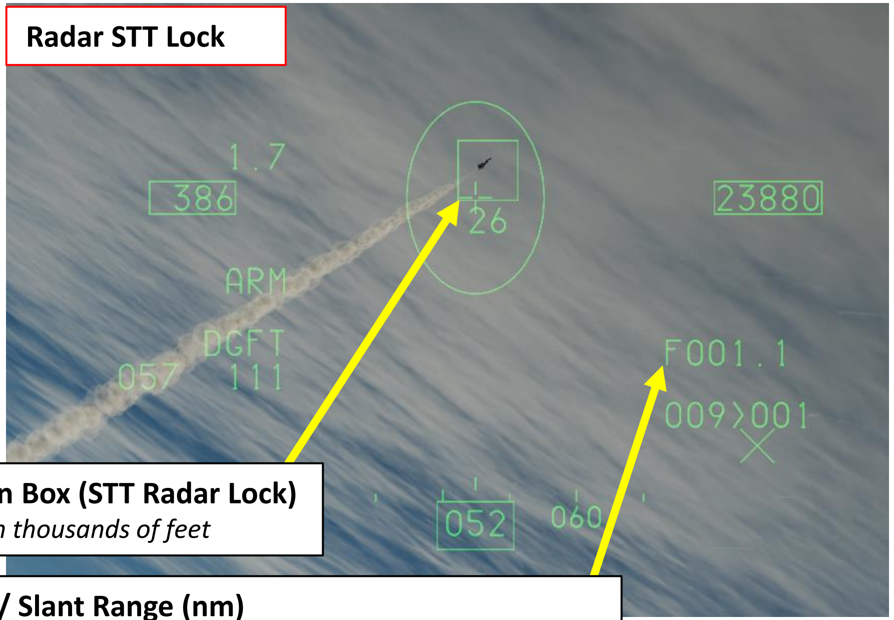
BORE Search Mode
(Selected with TMS UP)

HMCS Bore Ellipse

Dynamic Aiming Cross



Radar STT Lock



Target Designation Box (STT Radar Lock)
26: Target Altitude in thousands of feet

Range Provider / Slant Range (nm)
- *F: FCS (Fire Control System) is providing range*
- *R: Radar Altimeter is providing range*
- *B: Range computed using steerpoint elevation/barometric elevation*
- *T: Targeting Pod is providing passive range*
- *L: Targeting Pod laser is firing and being used*

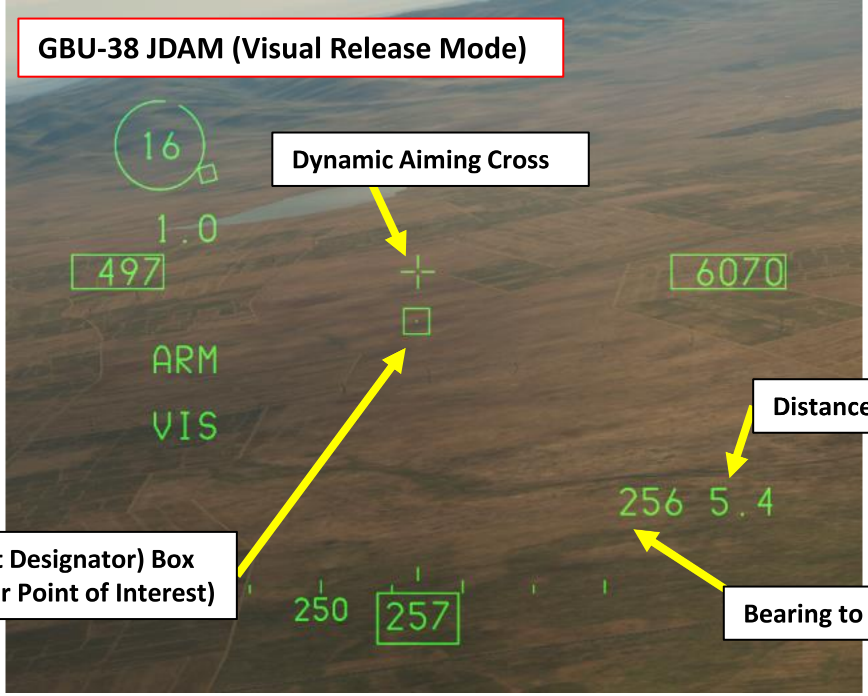
4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.1 – HMD Symbology

E – Air-to-Ground Symbology

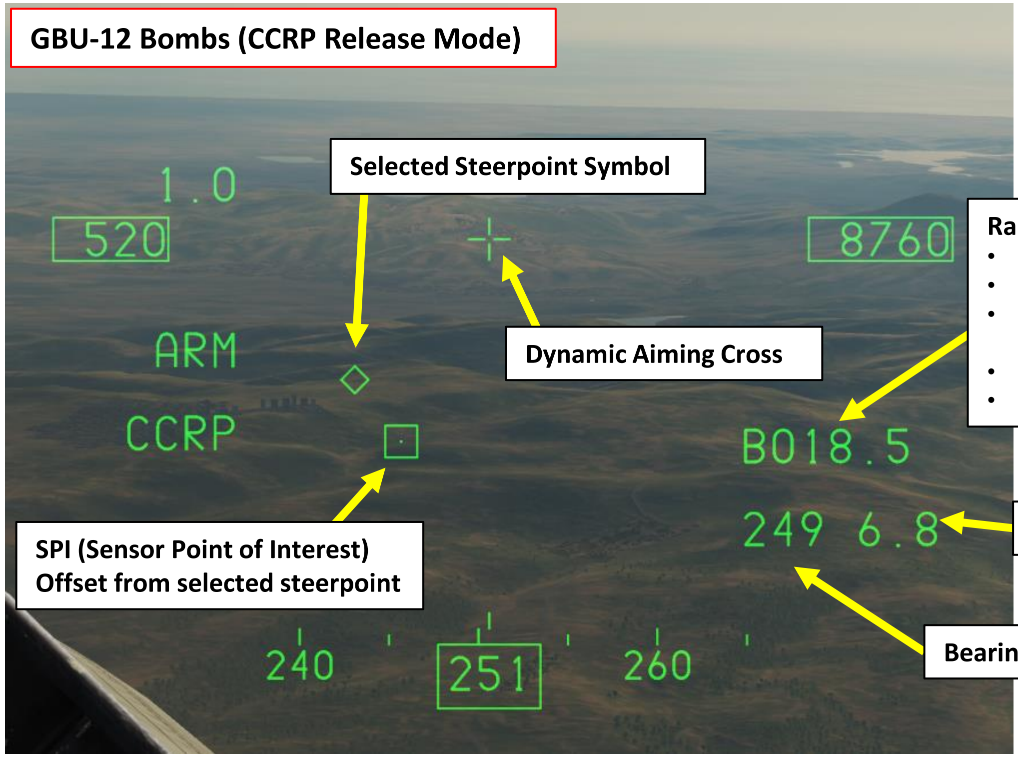
When using the air-to-ground Master mode (A/G Master Mode button pressed), the following symbology is visible. Keep in mind that the symbology and functionality changes based on what weapon and release mode is selected.

Designation can be performed as per sub-section 4.5.1 – Ground Target Designation).

GBU-38 JDAM (Visual Release Mode)



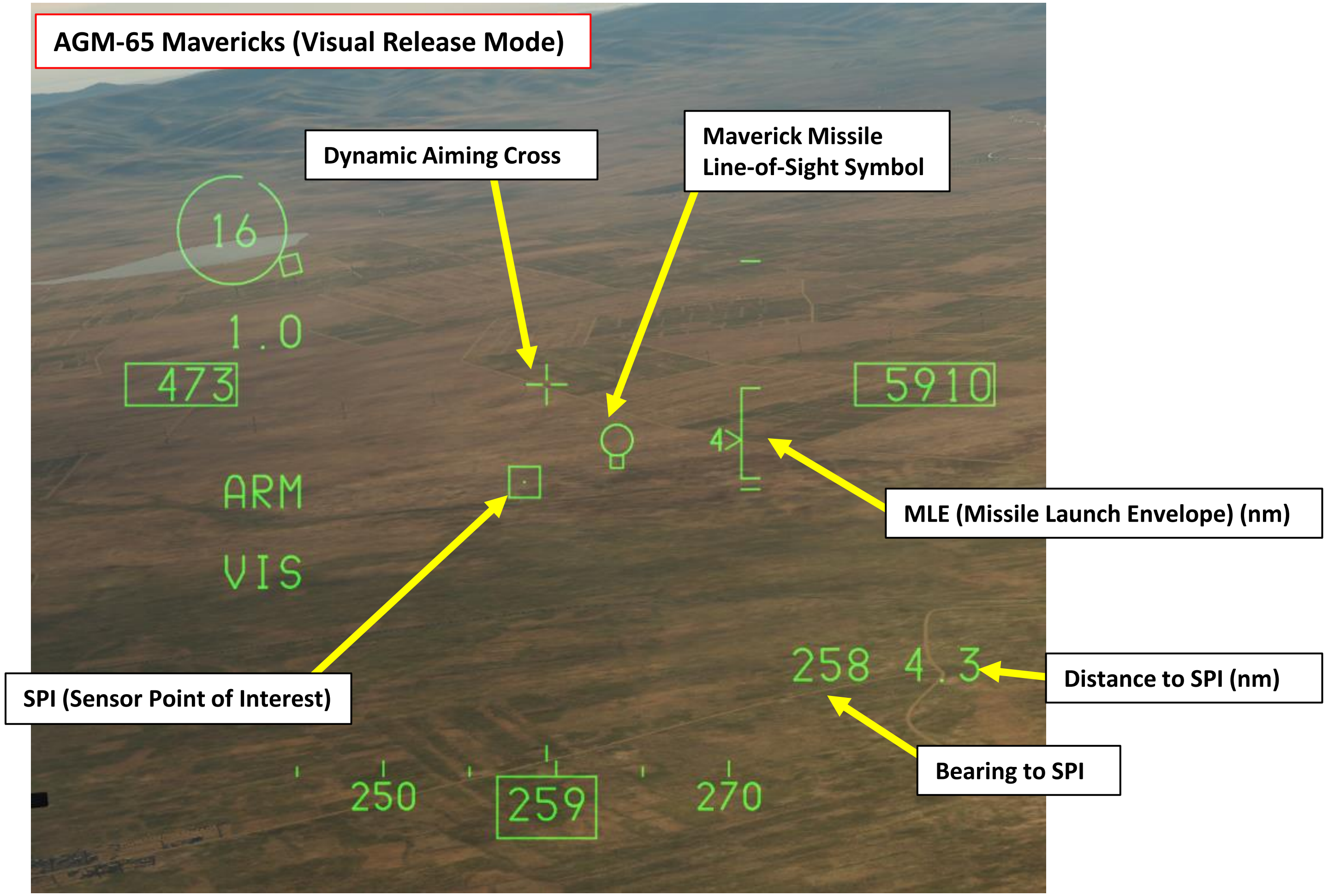
GBU-12 Bombs (CCRP Release Mode)



Range Provider / Slant Range (nm)
- *F: FCS (Fire Control System) is providing range*
- *R: Radar Altimeter is providing range*
- *B: Range computed using steerpoint elevation/barometric elevation*
- *T: Targeting Pod is providing passive range*
- *L: Targeting Pod laser is firing and being used*

4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.1 – HMD Symbology

E – Air-to-Ground Symbology



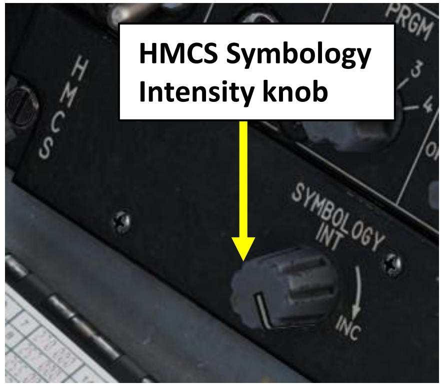
4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.2 – HMD Setup

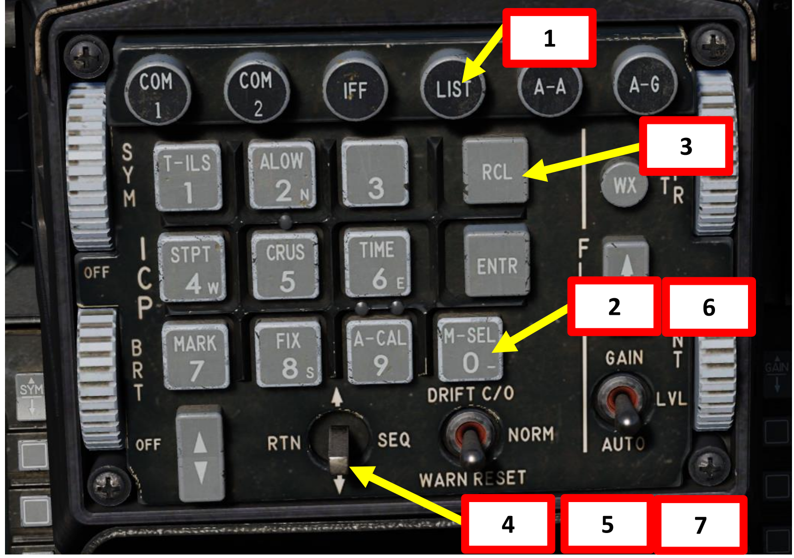
A – HMCS DED Page

When the HMCS is powered on (HMCS Symbology Intensity knob set to INC), you can access the HMCS DED page. This allows you to set up Helmet-Mounted Display options as desired.

In order to display HMCS options and modify them, you have to access the HMCS DED (Data Entry Display) menu:

1. Press the LIST button
2. Press "0 / M-SEL" on the ICP (Integrated Control Panel) to select MISC (Miscellaneous) DED Page.
3. Press "RCL" on the ICP (Integrated Control Panel) to select HMCS (Helmet-Mounted Cueing System) DED Page.
4. By default, the HMCS DISPLAY DED page should be visible. If you are at the HMCS ALIGN page instead, press the DCS (Data Control Switch, also called "Dobber") RIGHT (SEQ) to go from the HMCS ALIGN DED page to the HMCS DISPLAY DED page.
5. Press the DCS ("Dobber") DOWN until the desired field is selected. Selection of the field is indicated by asterisks.
6. To toggle the option of the selected field, press the "0 / M-SEL" on the ICP (Integrated Control Panel) to toggle the option ON/OFF.
7. Return to CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN

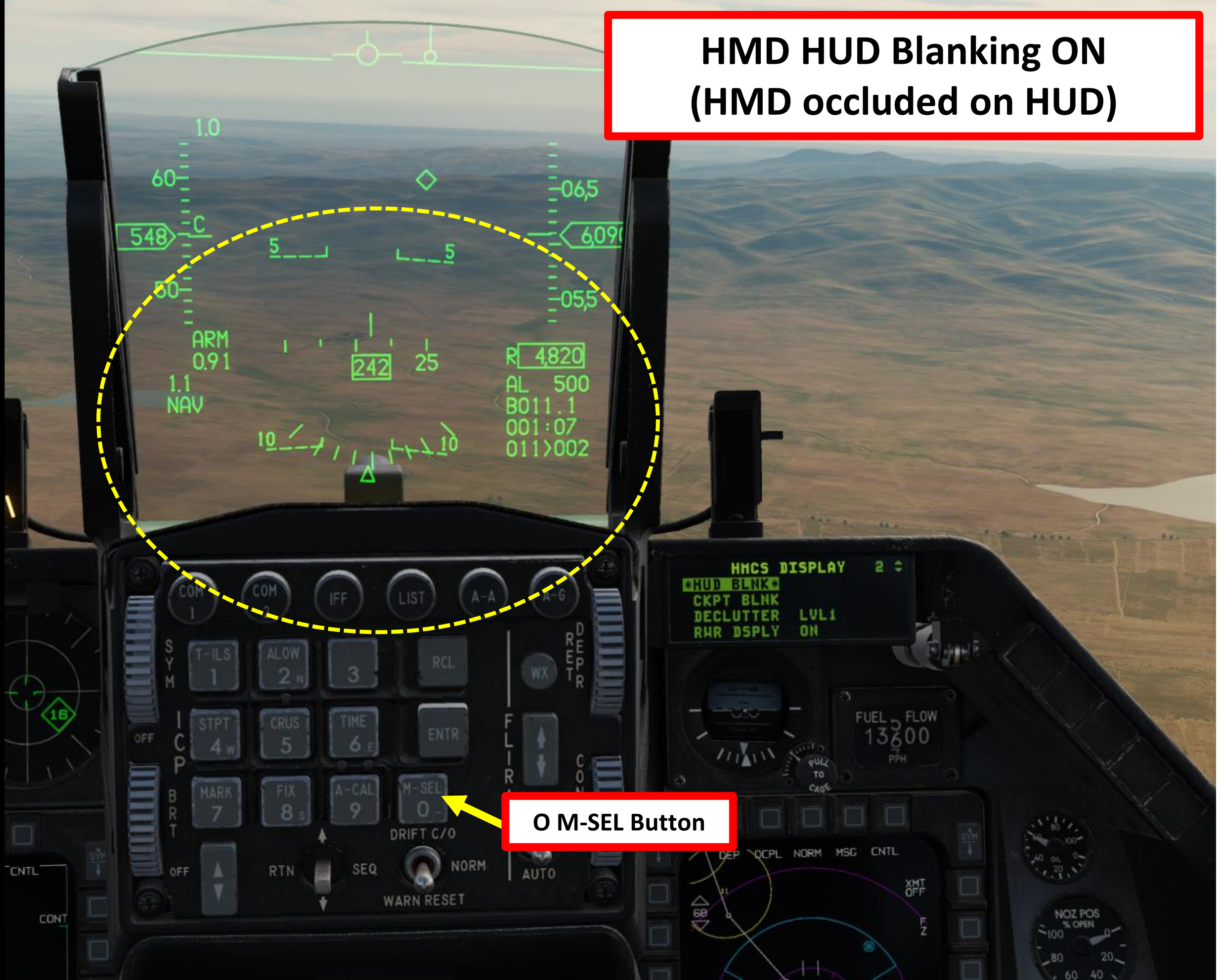




4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.2 – HMD Setup

B – HMD HUD Blanking

The HUD BLNK option toggles on or off HMCS blanking when looking at the Heads-Up Display. If this setting is on, HMCS symbology will disappear when looking at the HUD. To change, ensure the cursor is over the HUD BLNK field, then press (0) M-SEL button on the ICP to cycle between ON and OFF.



4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.2 – HMD Setup

C – HMD Cockpit Blanking

The CKPT BLNK option toggles on or off HMCS blanking when looking down in the cockpit. If this setting is on, HMCS symbology will disappear when looking inside the cockpit. To change, ensure the cursor is over the CKPT BLNK field, then press (0) M-SEL button on the ICP to cycle between ON and OFF.

4 – HMCS (Helmet-Mounted Cueing System)
4.3 – HMD (Helmet-Mounted Display) Symbology
4.3.2 – HMD Setup

D – HMD Declutter Levels

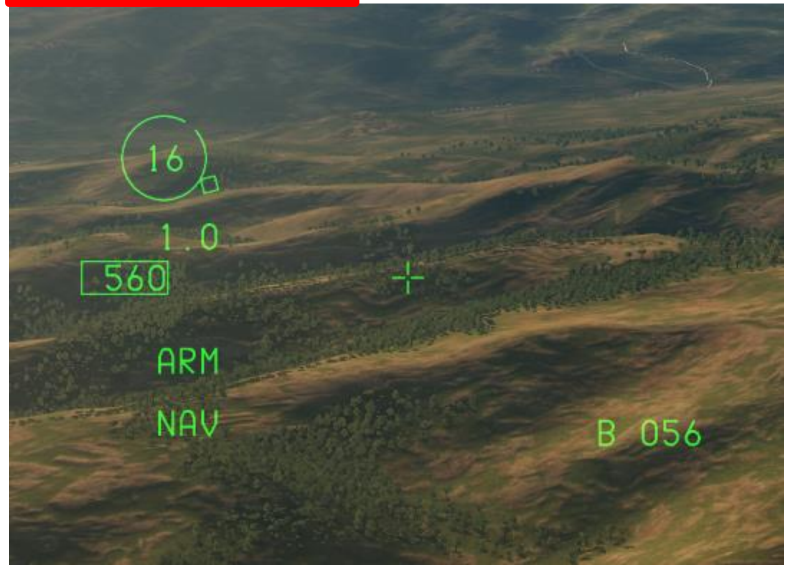
The DECLUTTER option defines what symbology is displayed on the HMD. Positioning the cursor over the DECLUTTER field and pressing M-SEL (0) button on the ICP cycles through three declutter levels:

- DECLUTTER LEVEL 1: All symbology is displayed.
- DECLUTTER LEVEL 2: Heading tape, altimeter and waypoint information is removed.
- DECLUTTER LEVEL 3: G-meter, airspeed tape, and master arm mode are removed.

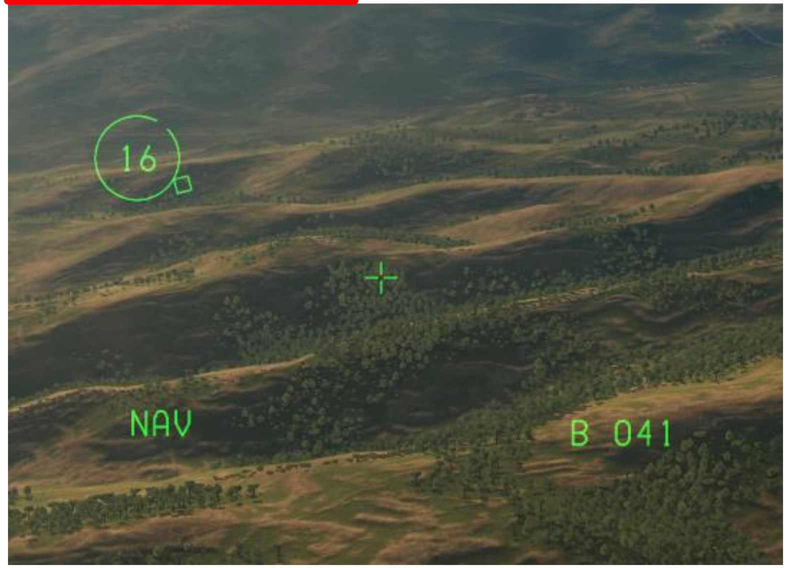
HMCS Declutter Level

Declutter Level 1

Declutter Level 2

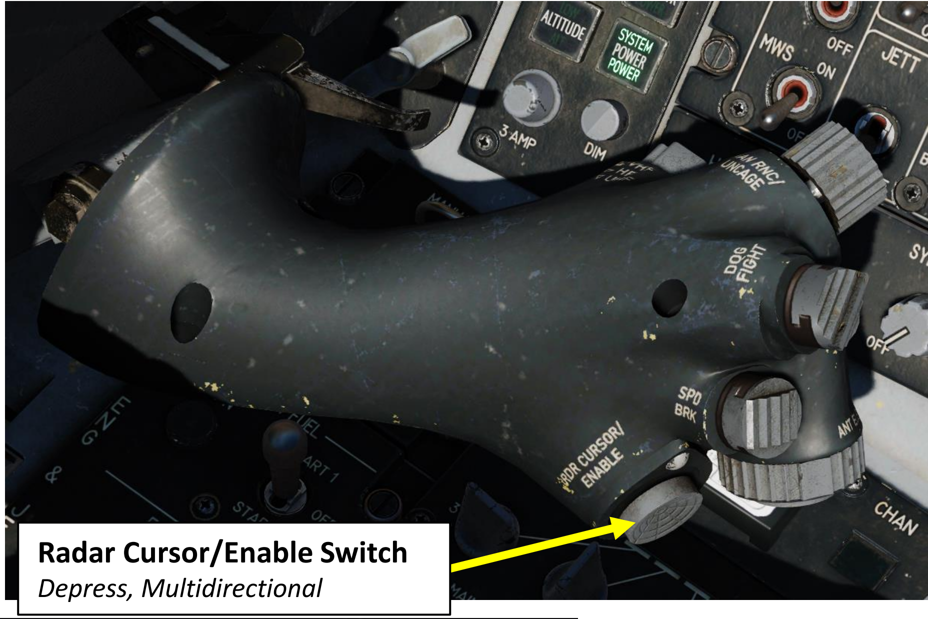


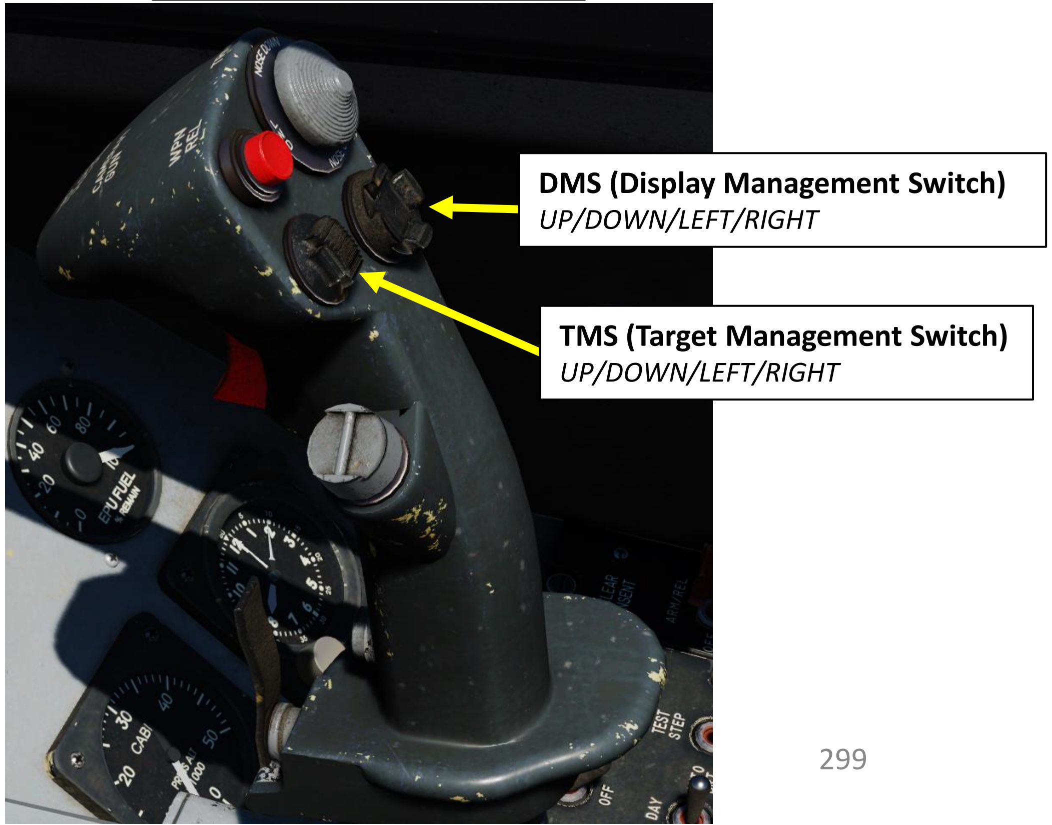
Declutter Level 3



4 – HMCS (Helmet-Mounted Cueing System)
4.4 – HMCS Controls

- **HMCS Symbology Intensity Knob**: When set to INC, powers on the HMCS system.
- **A/A & A/G Master Mode Buttons**: Controls symbology and functionality of the HMCS based on whether you are in air-to-air or air-to-ground master mode.
- **DMS (Display Management Switch)**:
  - UP: Sets SOI (Sensor of Interest) to the Heads-Up Display (HUD) and HMCS if applicable.
  - DOWN SHORT (less than 0.5 sec): Swaps SOI (Sensor of Interest) to the left or right display.
  - DOWN LONG (more than 0.5 sec): toggles on and off Helmet-Mounted Display (HMD) overlay
- **TMS (Target Management Switch)**:
  - UP: Used to designate a target. Function changes based on the duration of the switch press, what master mode is used, what weapon is employed, and what release mode is selected.
  - DOWN: Target Reject, used to un-designate a target.
- **Radar Cursor Switch**: Slews target designation box.



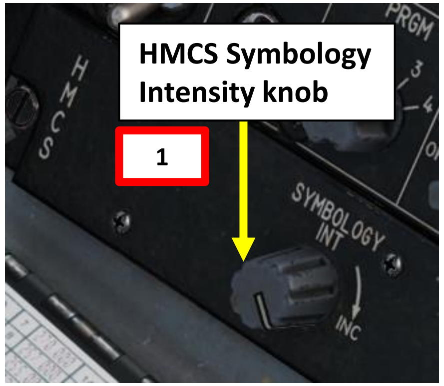


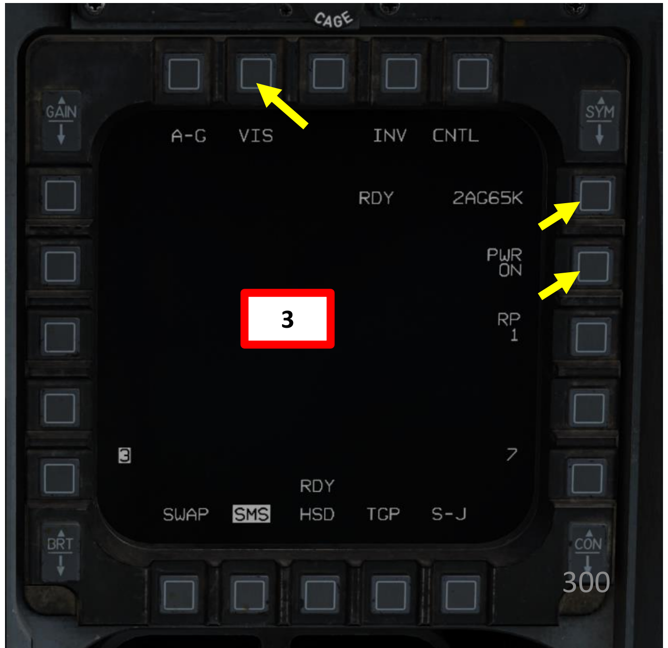
4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

A - With Maverick Missiles (VIS Mode)

The HMCS can be used to designate a target when the Maverick VIS (Visual) Mode is selected.

1. Make sure the HMCS Symbology Intensity knob is turned to INC
2. Select A-G (Air-to-Ground) Master Mode
3. Make sure Mavericks (AG65) are selected in VIS (Visual) mode via the SMS (Stores Management Set) page.
4. Press DMS (Display Management Switch) UP to set HUD (Heads-Up Display) as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.

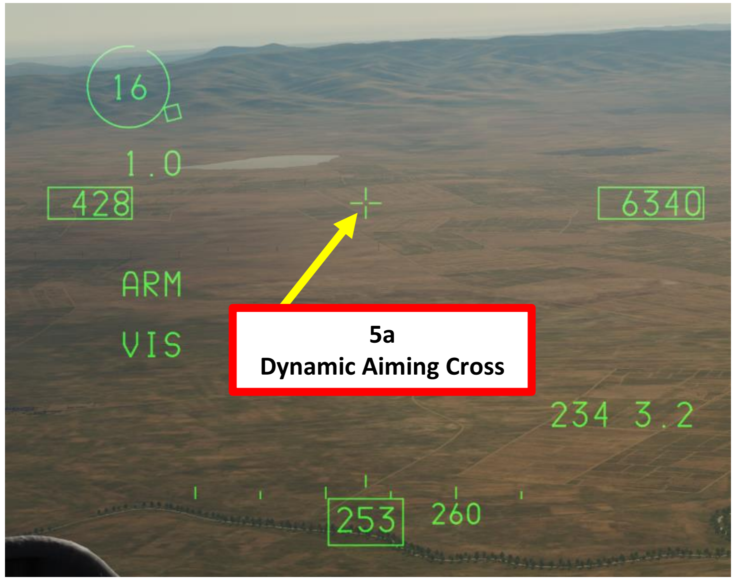


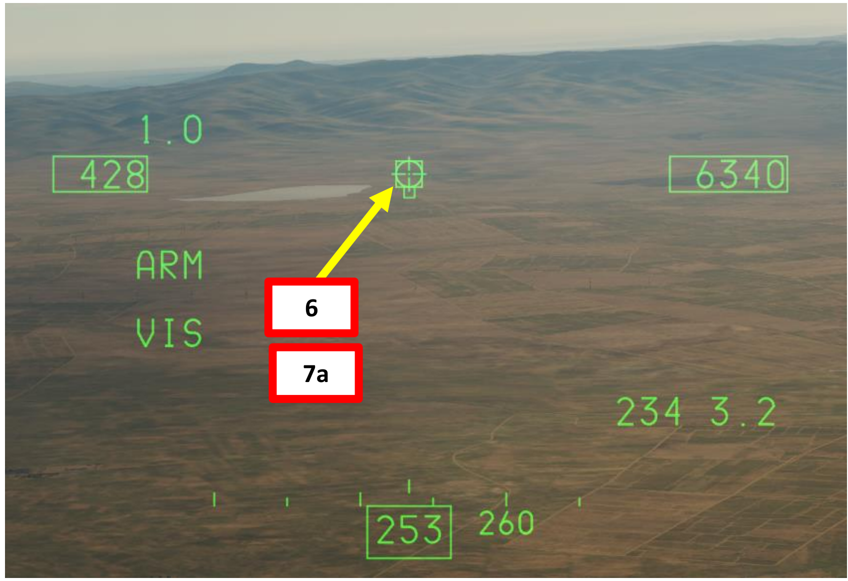


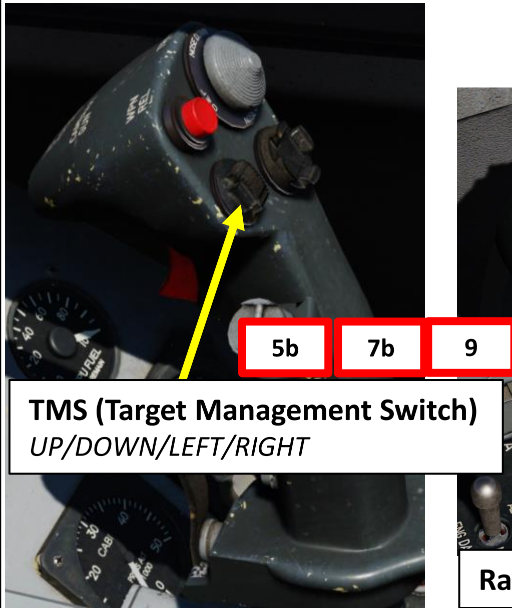
4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

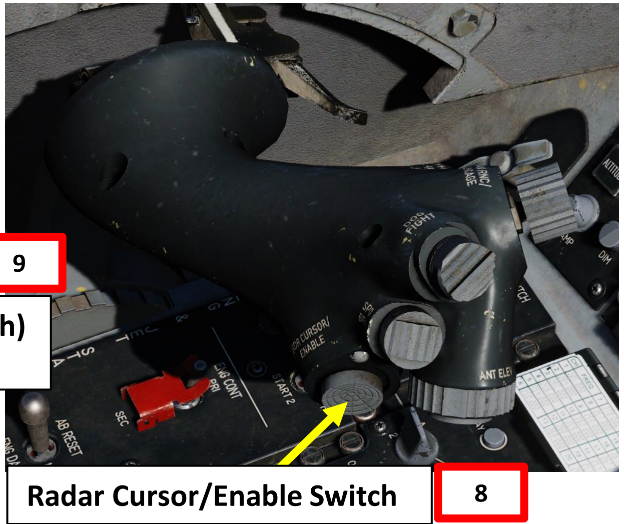
A - With Maverick Missiles (VIS Mode)

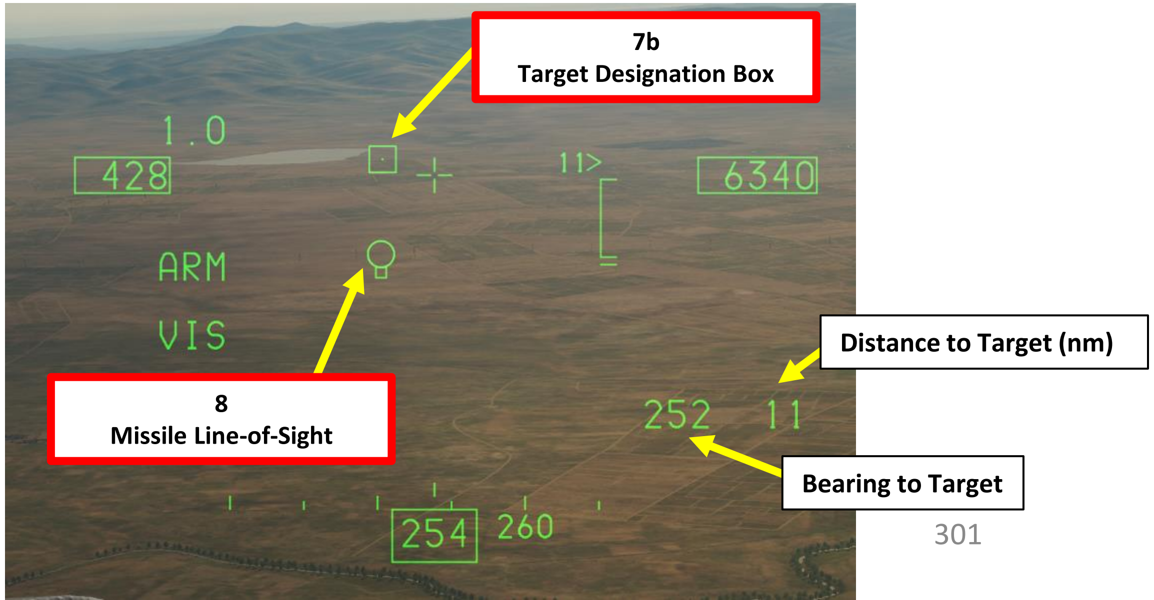
5. By default, only the Dynamic Aiming Cross (DAC) is visible. Press and hold the TMS (Target Management Switch) UP for more than 0.5 sec.
6. A TD (Target Designation) box will appear on the Dynamic Aiming Cross (DAC) of the helmet. A circle will also be visible, representing the Maverick's line-of-sight.
7. Move the helmet's aiming cross on the desired area, then press TMS (Target Management Switch) UP to designate target. The TD box will be slaved to this designated point.
8. Slew the Maverick line-of-sight circle with the Radar Cursor/Enable Switch controls as desired to aim the missile.
9. To un-designate the target, press TMS (Target Management Switch) DOWN.









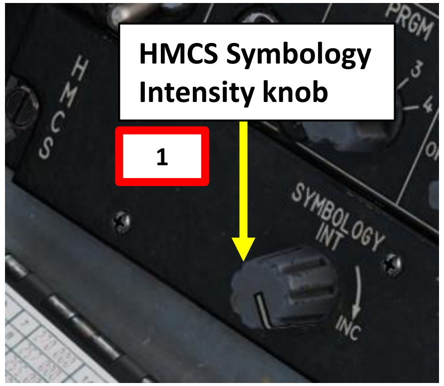


4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

B - With JDAM/JSOW (VIS Mode)

The HMCS can be used to designate a target when the JDAM or JSOW VIS (Visual) Mode is selected.

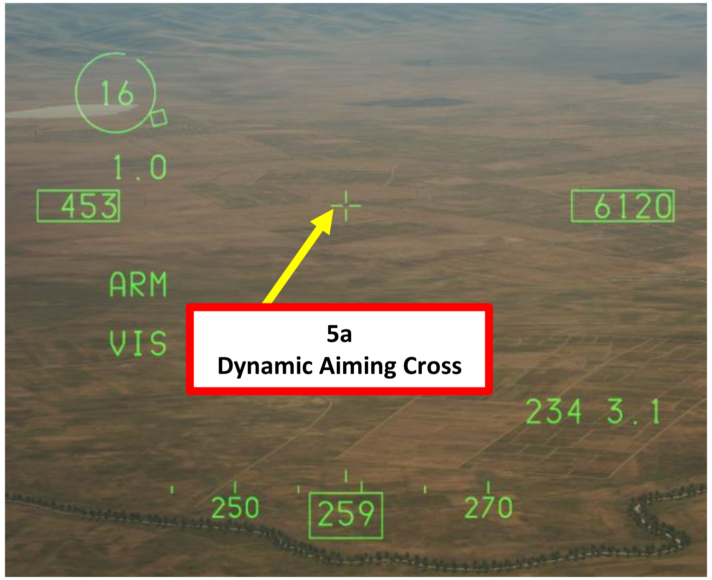
1. Make sure the HMCS Symbology Intensity knob is turned to INC
2. Select A-G (Air-to-Ground) Master Mode
3. Make sure JDAMs (GB38) are selected in VIS (Visual) mode via the SMS (Stores Management Set) page.
4. Press DMS (Display Management Switch) UP to set HUD (Heads-Up Display) as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.

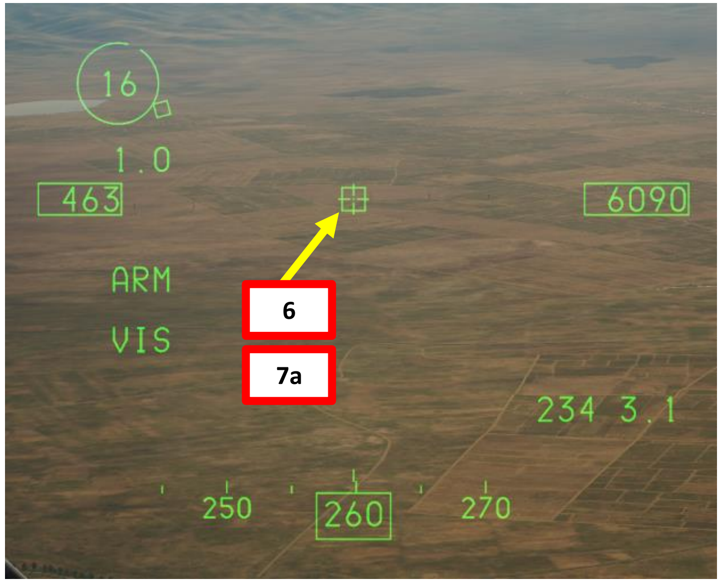


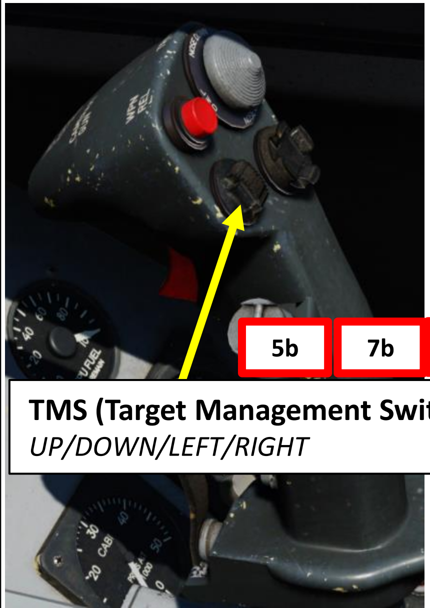
4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

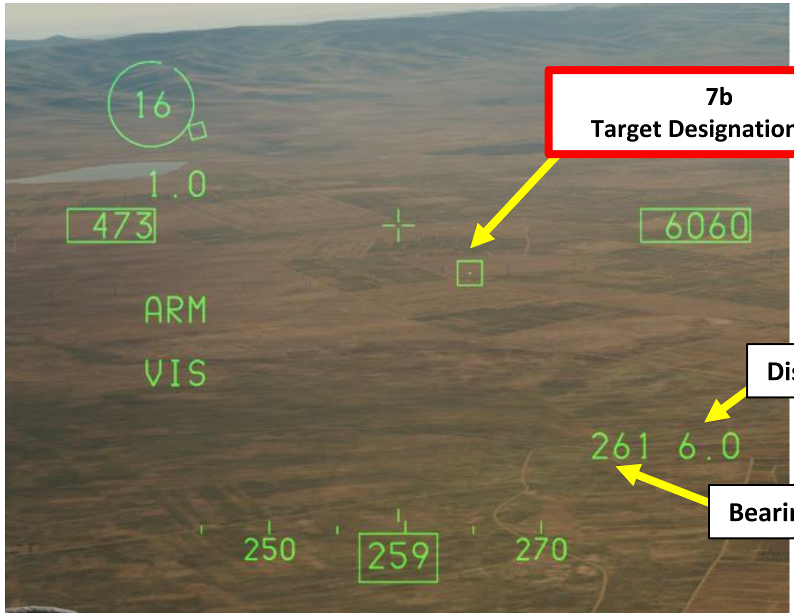
B - With JDAM/JSOW (VIS Mode)

5. By default, only the Dynamic Aiming Cross (DAC) is visible. Press and hold the TMS (Target Management Switch) UP for more than 0.5 sec.
6. A TD (Target Designation) box will appear on the Dynamic Aiming Cross (DAC) of the helmet.
7. Move the helmet's aiming cross on the desired area, then press TMS (Target Management Switch) UP to designate target. The TD box will be slaved to this designated point.
8. Slew the TD box with the Radar Cursor/Enable Switch controls as desired.
9. To un-designate the target, press TMS (Target Management Switch) DOWN.



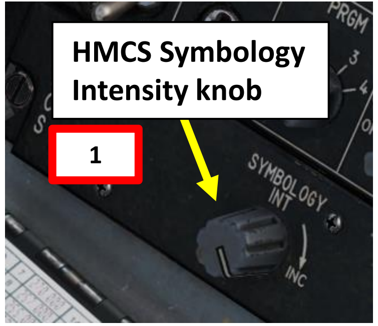






4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

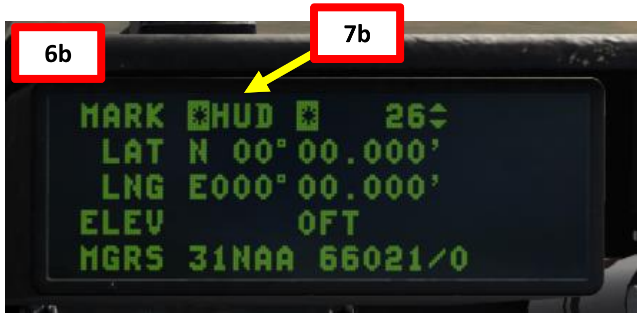
Click to navigate to Markpoint Navigation/Designation Section

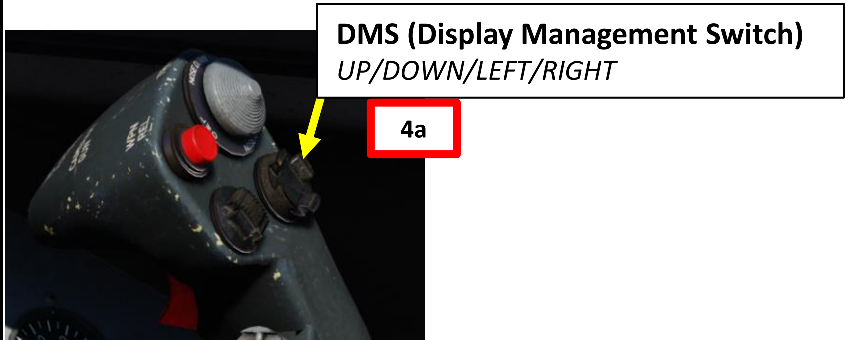


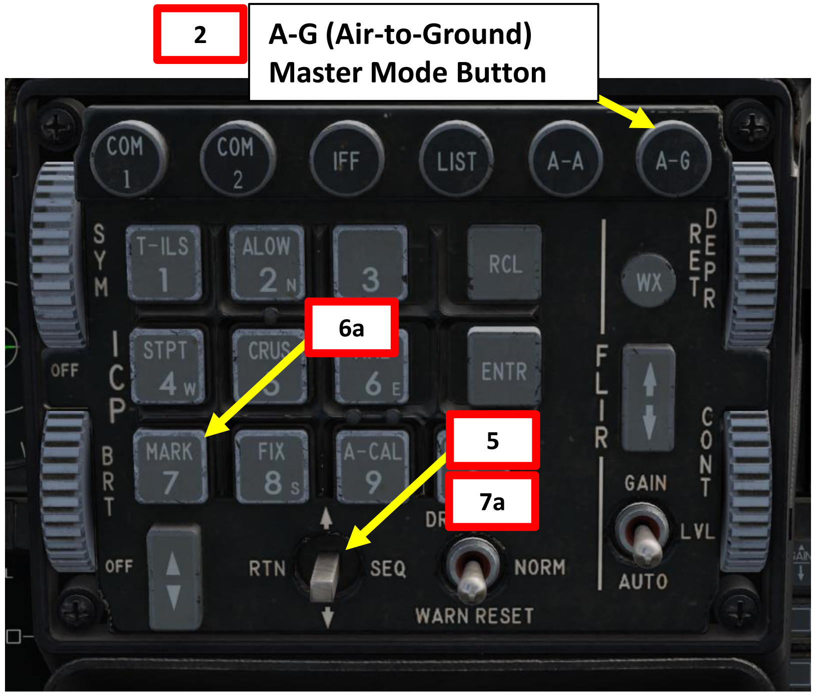
C - With Markpoints (Bombs in CCIP Mode)

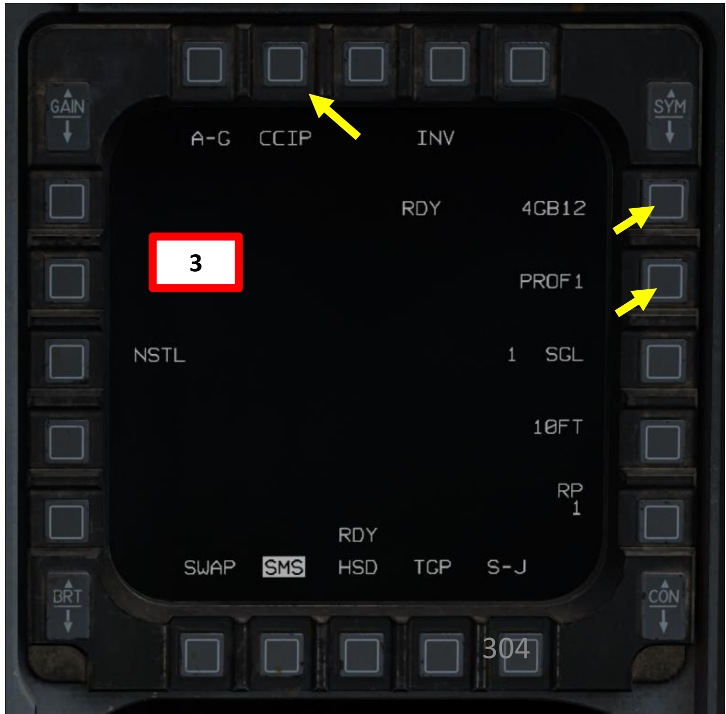
The HMCS can be used to designate a markpoint when a bomb in CCIP Mode is selected. The markpoint can then be set as the Sensor Point of Interest (SPI).

1. Make sure the HMCS Symbology Intensity knob is turned to INC
2. Select A-G (Air-to-Ground) Master Mode
3. Make sure bombs (GB12) are selected in CCIP mode via the SMS (Stores Management Set) page.
4. Press DMS (Display Management Switch) UP to set HUD (Heads-Up Display) as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.
5. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
6. Press MARK (7) button on the ICP (Integrated Control Panel) to select Markpoint DED page.
7. Toggle the Dobber Switch RIGHT (SEQ) to cycle through Markpoint Designation modes until HUD (Heads-Up Display) is selected.





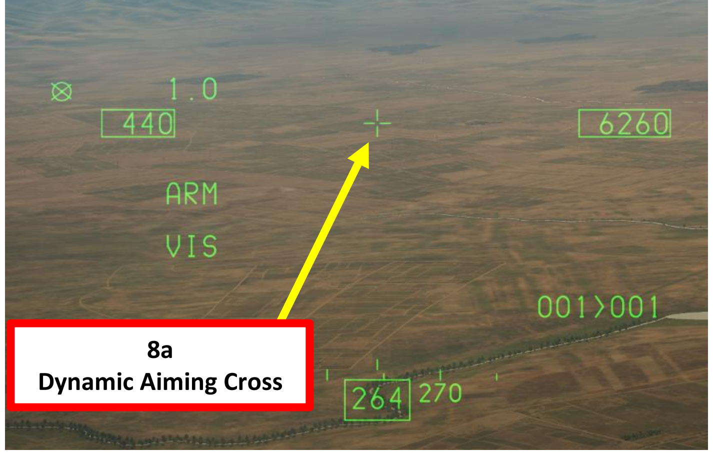


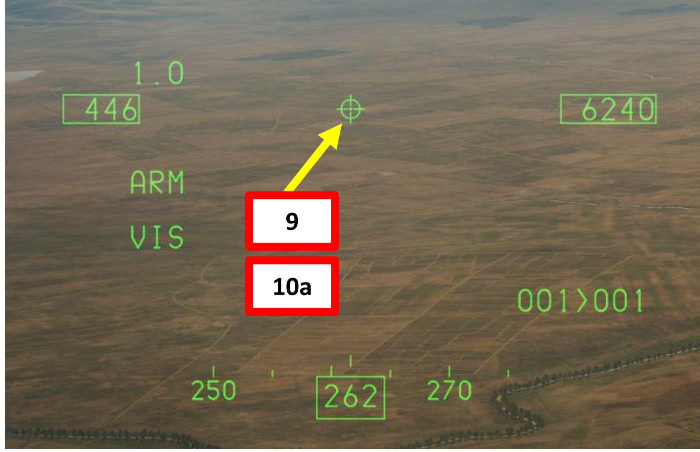


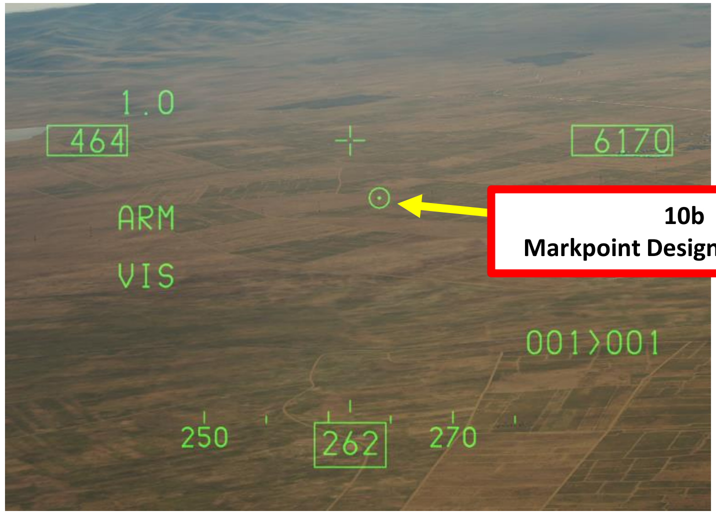
4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

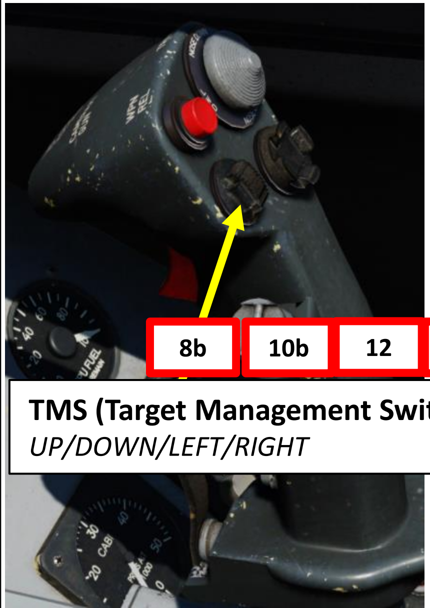
C - With Markpoints (Bombs in CCIP Mode)

8. By default, only the Dynamic Aiming Cross (DAC) is visible. Press and hold the TMS (Target Management Switch) UP for more than 0.5 sec.
9. A markpoint designation circle will appear on the Dynamic Aiming Cross (DAC) of the helmet.
10. Move the helmet's aiming cross on the desired area, then press TMS (Target Management Switch) UP to slave the designation circle to this location.
11. Slew the designation circle with the Radar Cursor/Enable Switch controls as desired.
12. Once designation circle is at the desired location, press TMS (Target Management Switch) UP to designate target. Coordinates will be saved for the selected markpoint (steerpoint No. 26 in this example).
13. To un-designate the target, press TMS (Target Management Switch) DOWN.





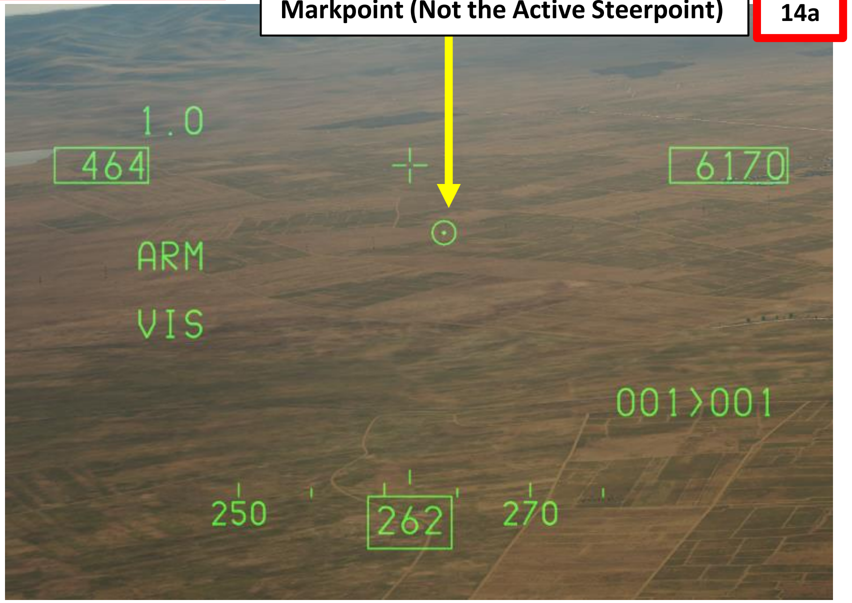


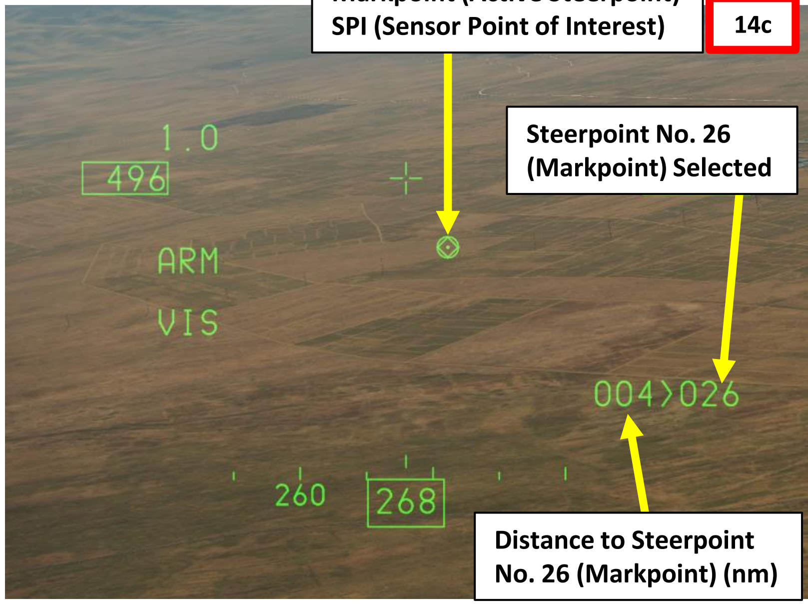


4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

C - With Markpoints (Bombs in CCIP Mode)

14. To make the markpoint the active steerpoint and become in the process the Sensor Point of Interest (SPI), press M-SEL (0) button on the ICP (Integrated Control Panel).
15. When the markpoint becomes the active steerpoint (or sensor point of interest), a diamond will appear over the markpoint designation circle. You will then be able to use this markpoint for weapon release in almost any mode.





4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

D - With Bombs (DTOS Mode)

The HMCS can be used to designate a target when a bomb in DTOS (Dive Toss) Mode is selected.

1. Make sure the HMCS Symbology Intensity knob is turned to INC
2. Select A-G (Air-to-Ground) Master Mode
3. Make sure bombs (M82) are selected in DTOS mode via the SMS (Stores Management Set) page. You can toggle bomb Release Mode by pressing the OSB next to the Release Mode option and select OSB next to "DTOS", or by pressing the NWS A/R DISC & MSL STEP button on the stick.
4. Press DMS (Display Management Switch) UP to set HUD (Heads-Up Display) as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.

HUD SOI Asterisk

4b

DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

4a

3

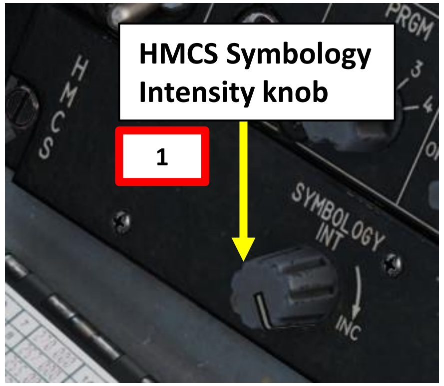
NWS A/R DISC & MSL STEP Button

2

A-G (Air-to-Ground) Master Mode Button

HMCS Symbology Intensity knob

1

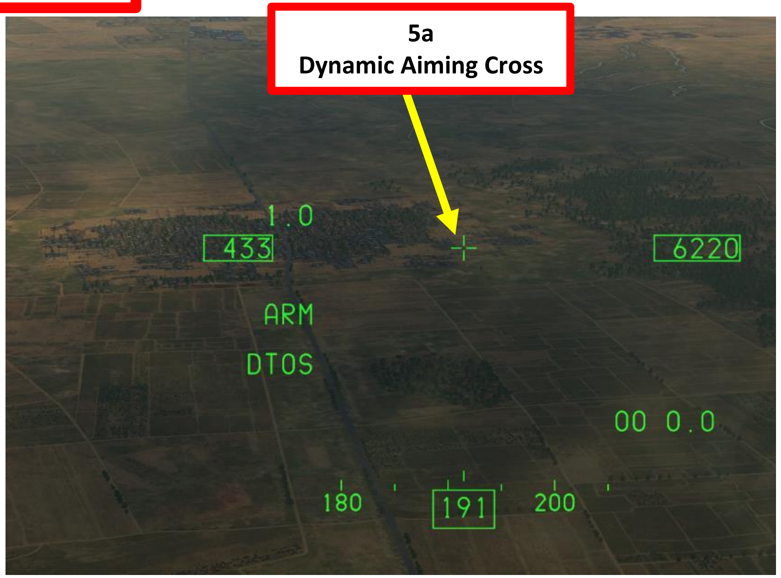


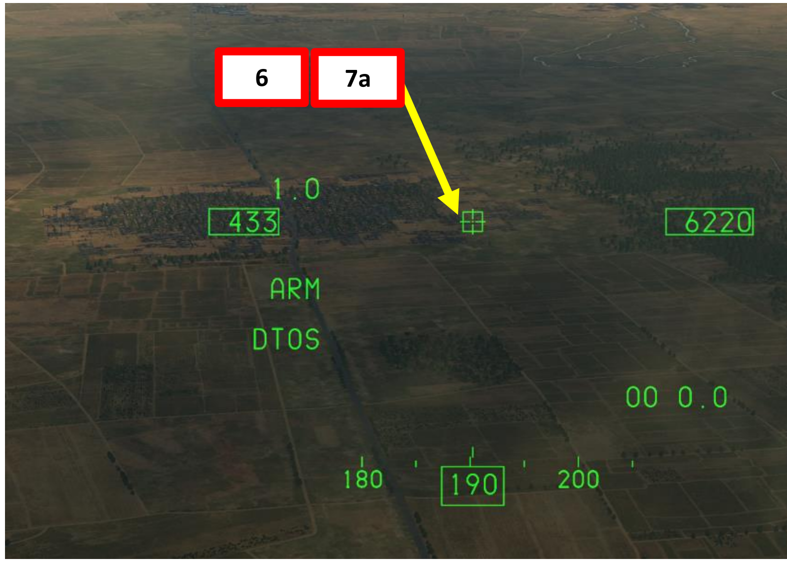
3

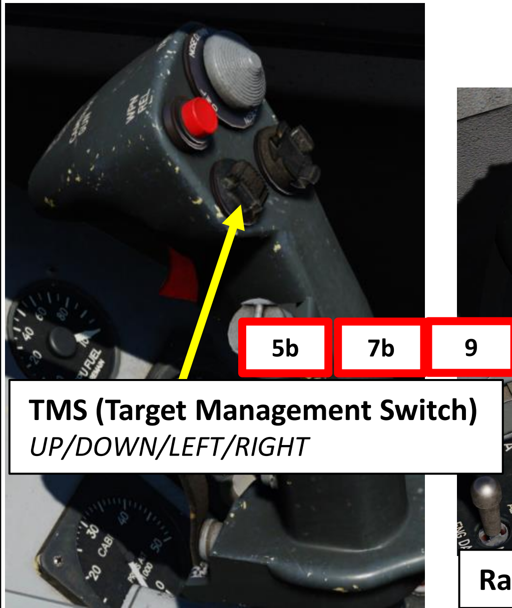
4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.1 – Ground Target Designation

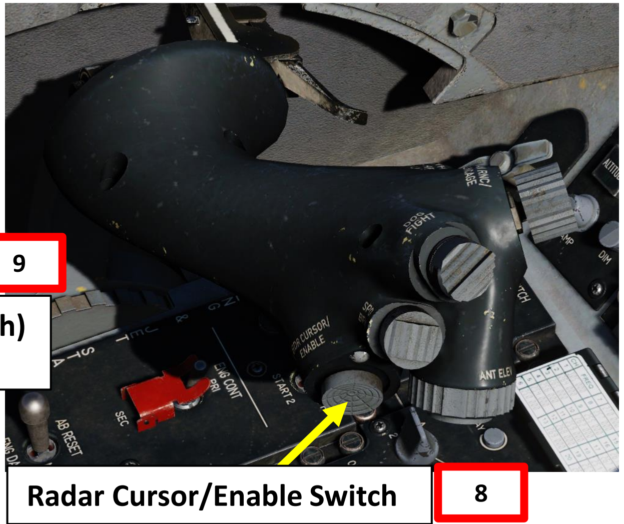
D - With Bombs (DTOS Mode)

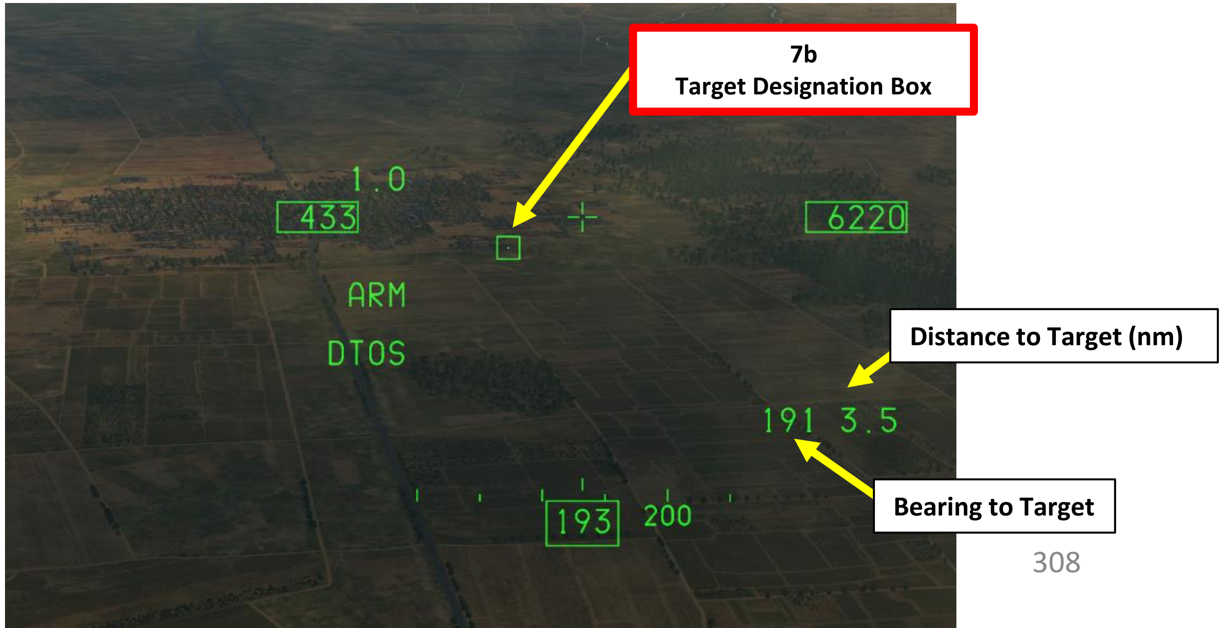
5. By default, only the Dynamic Aiming Cross (DAC) is visible. Press and hold the TMS (Target Management Switch) UP for more than 0.5 sec.
6. A TD (Target Designation) box will appear on the Dynamic Aiming Cross (DAC) of the helmet.
7. Move the helmet's aiming cross on the desired area, then press TMS (Target Management Switch) UP to designate target. The TD box will be slaved to this designated point.
8. Slew the TD box with the Radar Cursor/Enable Switch controls as desired.
9. To un-designate the target, press TMS (Target Management Switch) DOWN.











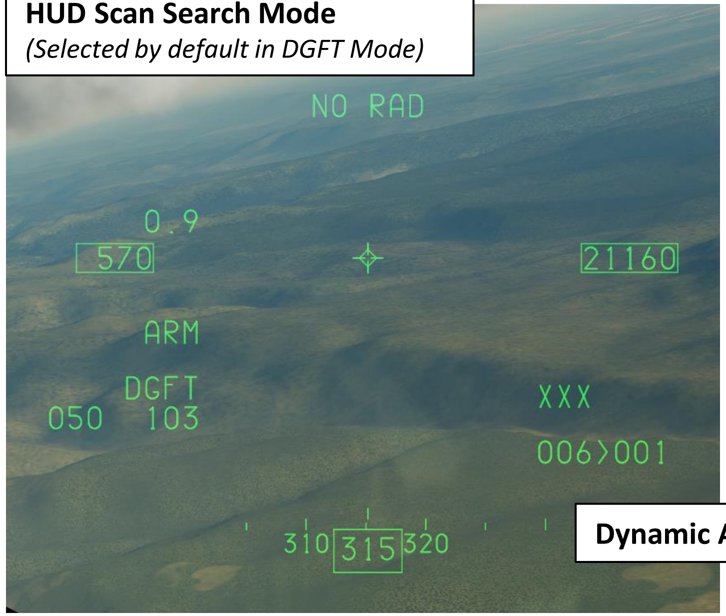
4 – HMCS (Helmet-Mounted Cueing System)
4.5 – HMCS Functions
4.5.2 – Air Target Radar Lock

While you can use the HMCS to radar lock a target (see tutorial PART 10 section 2.1.8 – HMCS Lock), you can also use the helmet to launch AIM-9X Sidewinder with HOBS (High Off-Boresight) missile shots (see tutorial PART 11 section 3.3 – AIM-9X Sidewinder (HMCS)).

Consult relevant tutorial sections as required.

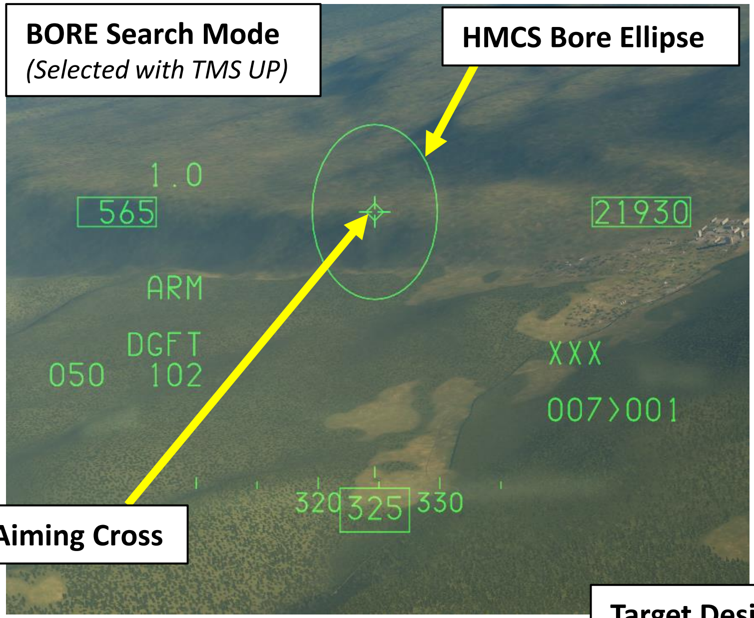
Range Provider / Slant Range (nm)
- *F: FCS (Fire Control System) is providing range*
- *R: Radar Altimeter is providing range*
- *B: Range computed using steerpoint elevation/barometric elevation*
- *T: Targeting Pod is providing passive range*
- *L: Targeting Pod laser is firing and being used*

HUD Scan Search Mode
(Selected by default in DGFT Mode)

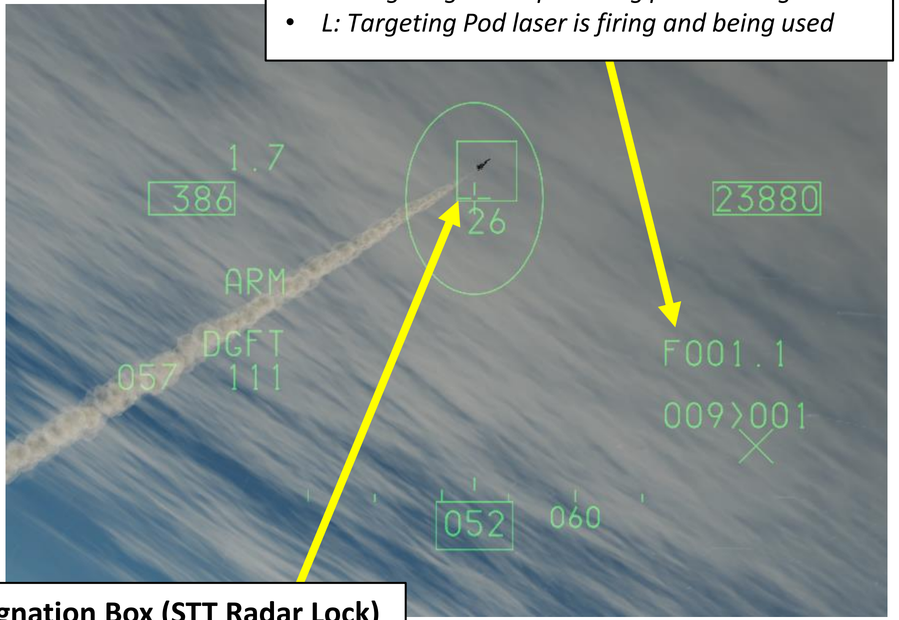


BORE Search Mode
(Selected with TMS UP)

HMCS Bore Ellipse



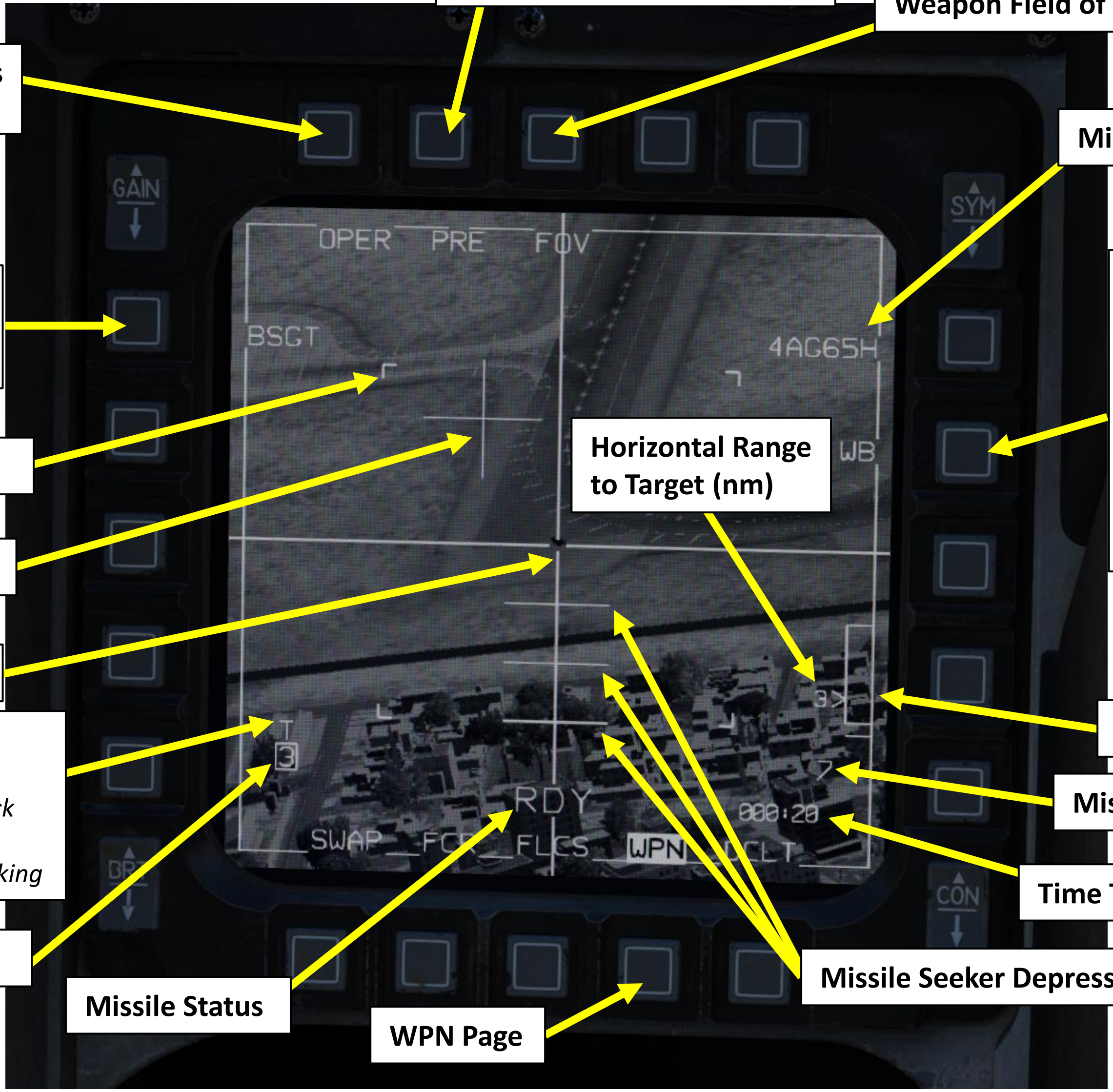
Dynamic Aiming Cross



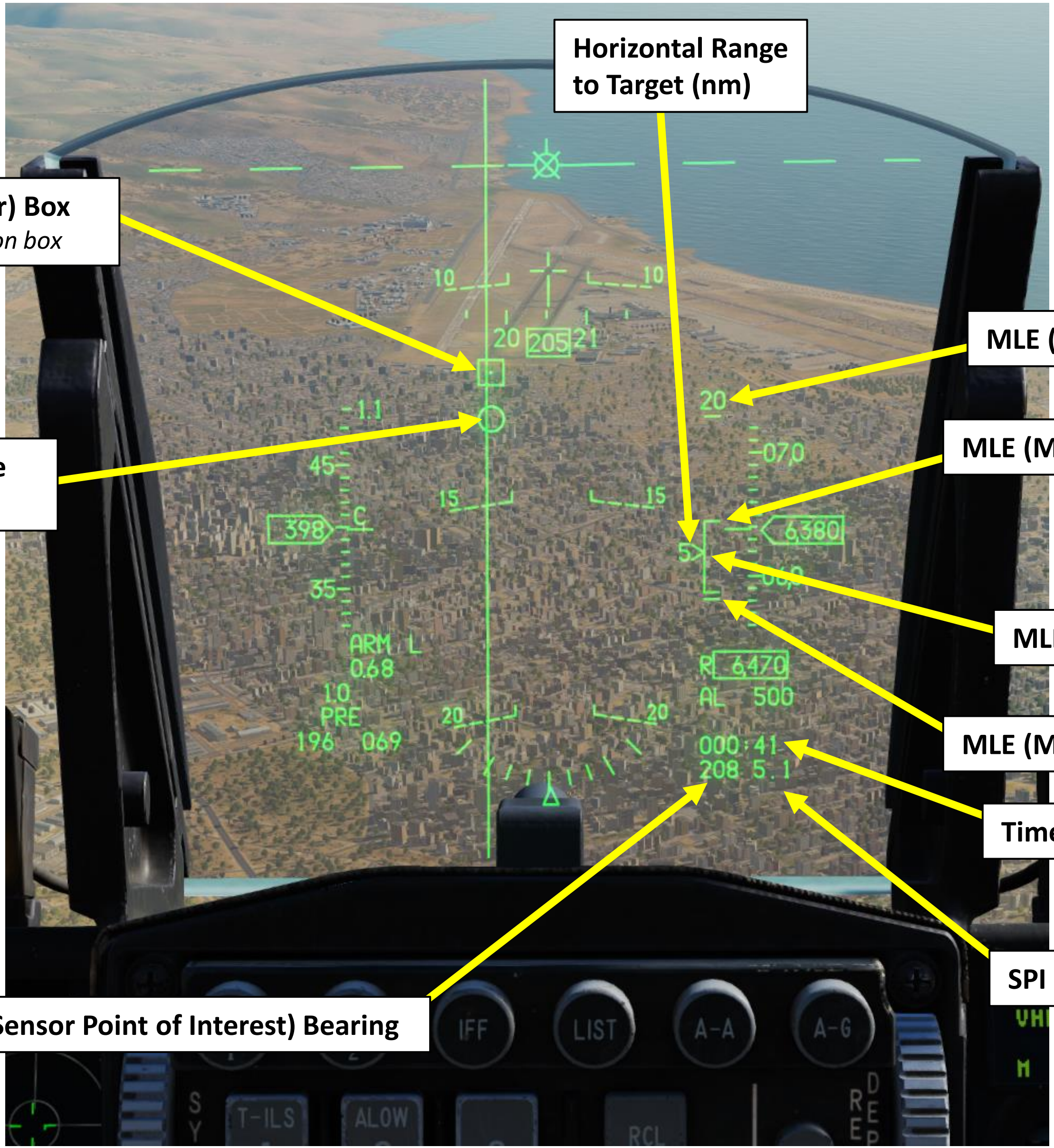
Target Designation Box (STT Radar Lock)
26: Target Altitude in thousands of feet

5 – AGM-65 MAVERICK AIR-TO-GROUND MISSILE
5.1 – Displays

The AGM-65 feed is displayed through the WPN (Weapon) page.



5 – AGM-65 MAVERICK AIR-TO-GROUND MISSILE
5.1 – Displays



5 – AGM-65 MAVERICK AIR-TO-GROUND MISSILE
5.2 – Controls

- **DMS (Display Management Switch)**:
  - UP: Swaps SOI (Sensor of Interest) to the HUD (Heads-Up Display)
  - DOWN: Swaps SOI (Sensor of Interest) to the left or right display.

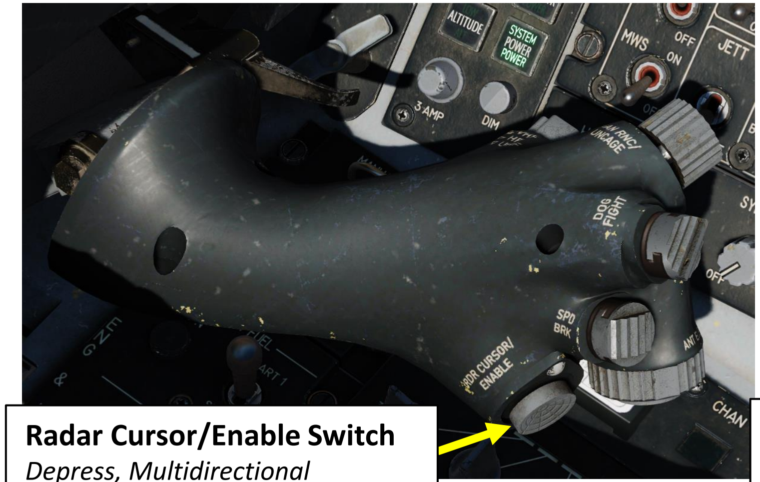
- **TMS (Target Management Switch) with WPN page SOI (Sensor of Interest)**:
  - UP: Selects Point Track (POINT, tracks an object like a high-contrast vehicle).
    - If AUTO Handoff is selected with an AGM-65D/G and point track is acquired, automatic handoff is performed.
  - LEFT: Toggles Polarity
    - WB/BW for AGM-65H/K
    - HOC/COH for AGM-65D/G
    - AREA for AGM-65G/K
  - RIGHT: With TGP SOI, will hand off the lock to the AGM-65 if the target contrast and size meet criteria of missile lock.
  - DOWN: Target Reject

- **Expand/FOV Button with WPN page SOI**: Toggles between narrow and wide field-of-view

- **Radar Cursor Switch**: Slews maverick reticle in VIS or BORE mode.

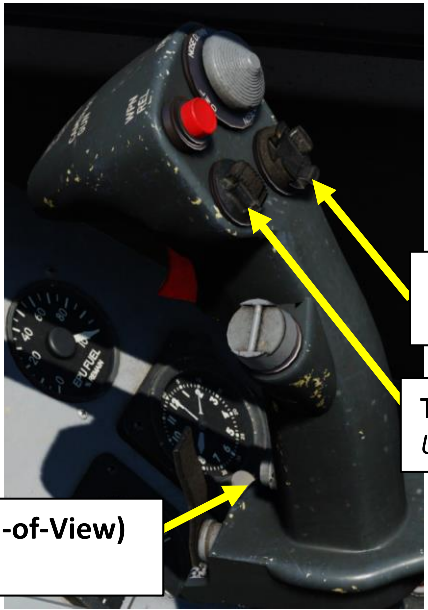
AGM-65 (Maverick Missile) Handoff Submode
- MAN: The AGM-65 will be slaved to the Line of Sight of the TGP but will not automatically be handed off the lock. Pilot must manually change SOI to AGM-65 and command lock manually.
- AUTO: TMS UP creates a point track, which automatically triggers an automatic hand off attempt. Alternatively: TMS RIGHT, with TGP SOI, will repeat hand off the lock to the AGM-65 if the target contrast and size meet criteria of missile lock.

TGP (Targeting Pod Page)



Radar Cursor/Enable Switch
Depress, Multidirectional

Expand/FOV (Field-of-View) Button



DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT


SW

SECTION STRUCTURE

SECTION STRUCTURE

1.1 – INTRODUCTION TO WEAPONS

The F-16 carries a good variety of weapons. The strength of the Viper lies in its array of sensors: the FCR (Fire Control Radar) and Targeting Pod provide you a lot of information in order to use both guided and unguided weapons with great precision. The Viper is a multirole aircraft by design, therefore the types of missions you can perform is quite extensive. Most of the weapon functions are directly accessible from HOTAS (Hands On Throttle And Stick) controls. The workload should be relatively light while allowing you as many options to use your weapons as the mission requires.

1.2 – ARMAMENT OVERVIEW

BOMBS

WEAPON	TYPE	WEAPON	TYPE
MK-82	500 lbs low-drag unguided bomb ***Fuze Setting:*** • ***Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.***	CBU-87	Combined Effects Munitions (CEM) weighs 950 lbs and is an all-purpose cluster bomb. ***Fuze Setting:*** • ***NSTL (Nose & Tail): Bomblets dispense using settings displayed on SMS page*** • ***NOSE: Bomblets dispense immediately after release*** • ***TAIL: Dud (Disarmed)***
MK-82SE (Snake Eye)	500 lbs unguided low-drag retarded bomb ***Fuze Setting:*** • ***NSTL (Nose & Tail): High Drag*** • ***NOSE: Low Drag*** • ***TAIL: High Drag***	CBU-97	1,000-pound class weapon containing sensor-fused sub-munitions for specifically attacking armor. ***Fuze Setting:*** • ***NSTL (Nose & Tail): Bomblets dispense using settings displayed on SMS page*** • ***NOSE: Bomblets dispense immediately after release*** • ***TAIL: Dud (Disarmed)***
MK-82AIR	500 lbs high-drag unguided bomb ***Fuze Setting:*** • ***NSTL (Nose & Tail): High Drag*** • ***NOSE: Low Drag*** • ***TAIL: High Drag***	CBU-105	Wind Corrected Munitions Dispenser (WCMD, or "Wick Mid") tail kit version of the CBU-97. Using Inertial Navigation System (INS) guidance, the CBU-105 can be dropped at much higher altitudes than the CBU-97 and guide to the targeted location (SPI). The CBU-105 contains sensor-fused sub-munitions for specifically attacking armor.
MK-84	2000 lbs low-drag unguided bomb ***Fuze Setting:*** • ***Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.***	BDU-33	25 lbs unguided training bomb ***Fuze Setting:*** • ***Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.***
GBU-10/12/16 PAVEWAY II	2000/500/1000 lbs laser-guided bomb ***Fuze Setting:*** • ***Either Nose, Tail, or NSTL (Nose/Tail) for redundancy.***	AGM-154A JSOW	Global Positioning System (GPS)-guided Joint Standoff Weapon (JSOW) glide bombs
		GBU-38 JDAM	Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs

1.2 – ARMAMENT OVERVIEW

GUN

WEAPON	TYPE
M61A1 Vulcan	Six-barrel 20 mm Gatling-type rotary cannon (512 rounds)

AIR-TO-AIR MISSILES

WEAPON	TYPE
AIM-9L/M Sidewinder	Infrared guided air-to-air missile. Referred as “**SRM**” (Short Range Missile) on the HUD.
AIM-9X Sidewinder	Infrared guided air-to-air missile with thrust vectoring. Referred as “**HOB**” (High Off-Boresight Missile) on the HUD.
AIM-120 AMRAAM	Advanced Medium Range Air-to-Air Missile (AMRAAM), active radar homing air-to-air missile. Referred as “**MRM**” (Medium Range Missile) on the HUD.

ROCKETS

WEAPON	TYPE
2.75 in	2.75 inches rocket, used for general purpose

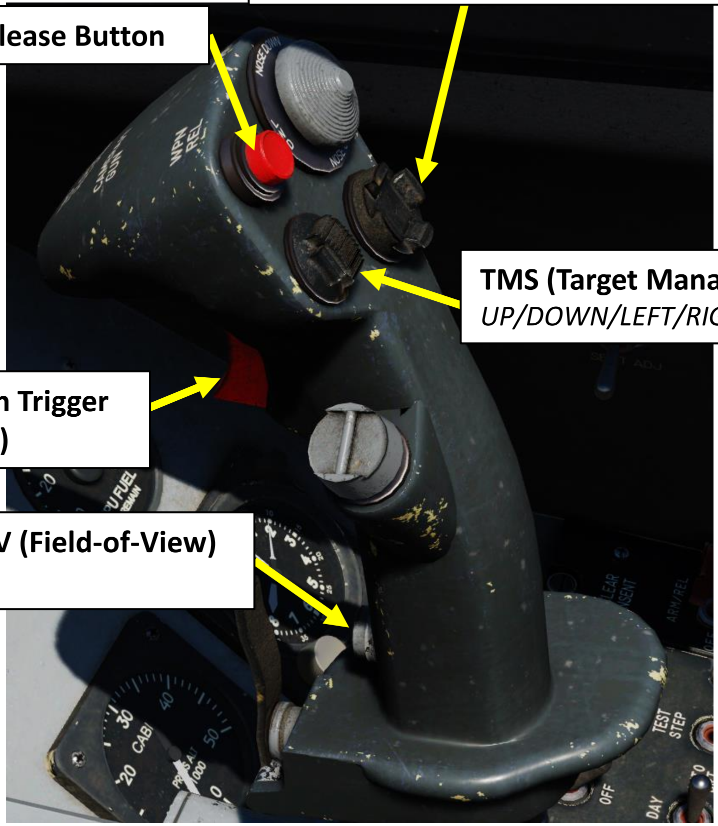
1.2 – ARMAMENT OVERVIEW

AIR-TO-GROUND MISSILES

WEAPON	TYPE
AGM-65D Maverick – IR Seeker	Air-to-Ground missile (126 lbs warhead) guided by imaging infrared system and used at night and during bad weather. Better suited against light and armored vehicles. Allows automatic target handoff from targeting pod.
AGM-65G Maverick – IR Seeker	Air-to-Ground missile (300 lbs warhead) guided by imaging infrared system and used at night and during bad weather. Better suited against ships, bunkers and larger structures. Allows automatic target handoff from targeting pod.
AGM-65H Maverick – EO Seeker	Air-to-Ground missile (126 lbs warhead) guided by electro-optical system. Better suited against light and armored vehicles.
AGM-65K Maverick – EO Seeker	Air-to-Ground missile (300 lbs warhead) guided by electro-optical system. Better suited against ships, bunkers and larger structures.
AGM-88C HARM	Air-to-Surface High-Speed Anti-Radiation Missile (HARM) missile. Anti-radiation guidance homes in on radiowave emissions from a radar, allowing it to attack surface-to-air missile (SAM) sites. Uses the HTS (HARM Targeting System) pod

1.3 – MY WEAPONS CONTROLS SETUP

Real Aircraft Controls



DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

Weapon Release Button

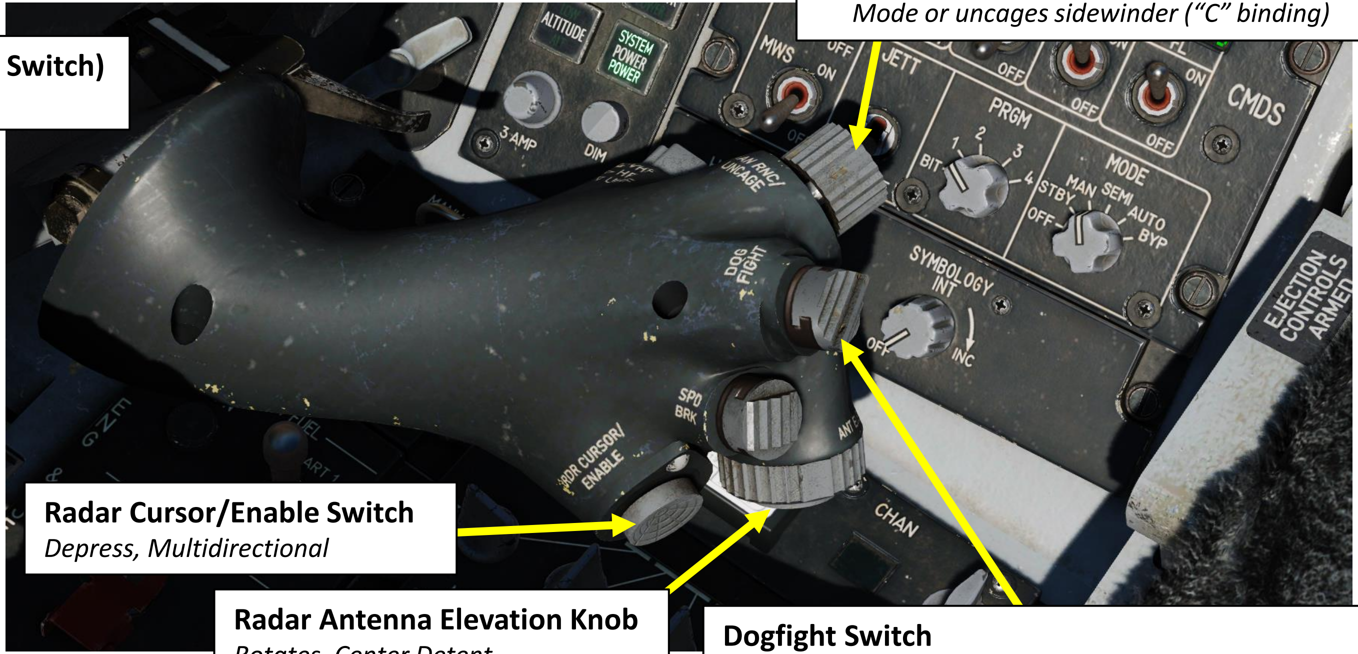
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

Camera/Gun Trigger (Two Stages)

Expand/FOV (Field-of-View) Button

NWS A/R DISC & MSL STEP Button

- *NWS: Nosewheel Steering Activation*
- *A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching*
- *MSL (MISSILE) STEP: When in flight, depressing the button in EO or A-A mode selects the next weapon station. Depressing the button in A-G Mode cycles between CCRP, CCIP and DTOS.*



MAN RNG/UNCAGE Knob/Switch

- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Laser Spot Search Mode or uncages sidewinder ("C" binding)*

Radar Cursor/Enable Switch
Depress, Multidirectional

Radar Antenna Elevation Knob
Rotates, Center Detent

Dogfight Switch
3-Position switch, Slide

- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*

1.3 – MY WEAPONS CONTROLS SETUP

My Controls

NWS A/R DISC MSL STEP Button (hidden grey button on right hand side)

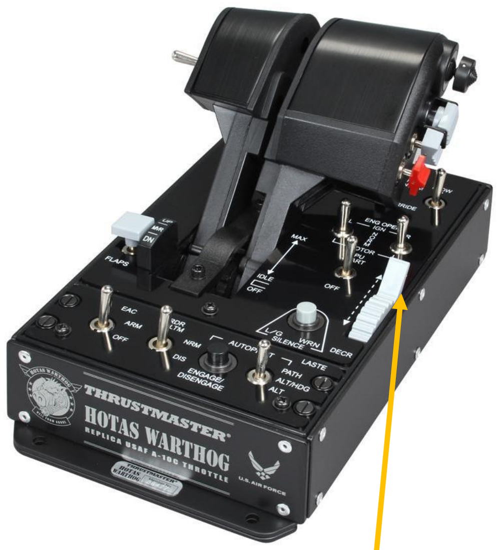
WPN REL Button

Camera/Gun Trigger (Two Detents)

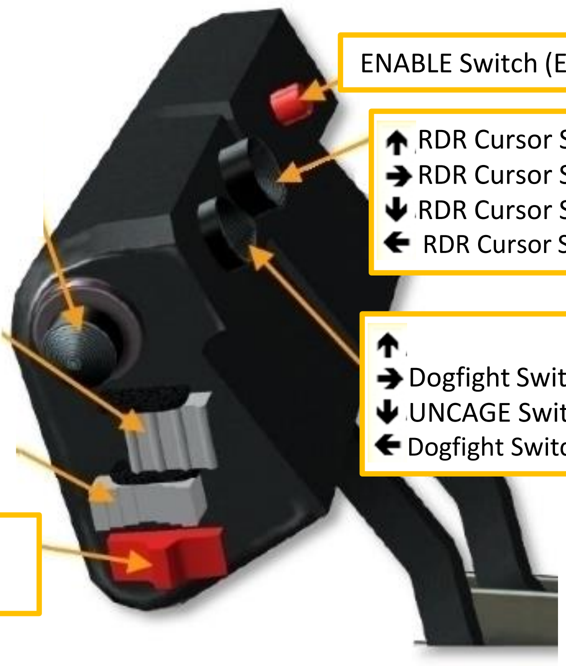
Expand/FOV Button

↑ DMS UP
→ DMS RIGHT
↓ DMS DOWN
← DMS LEFT

↑ TMS UP
→ TMS RIGHT
↓ TMS DOWN
← TMS LEFT



ANT ELEV Knob (Radar Antenna Elevation)



ENABLE Switch (Enter)

↑ RDR Cursor Switch – Y Axis
→ RDR Cursor Switch – X Axis
↓ RDR Cursor Switch – Y Axis
← RDR Cursor Switch – X Axis

↑
→ Dogfight Switch – MISSILE OVERRIDE/CENTER
↓ UNCAGE Switch
← Dogfight Switch – DOGFIGHT/CENTER

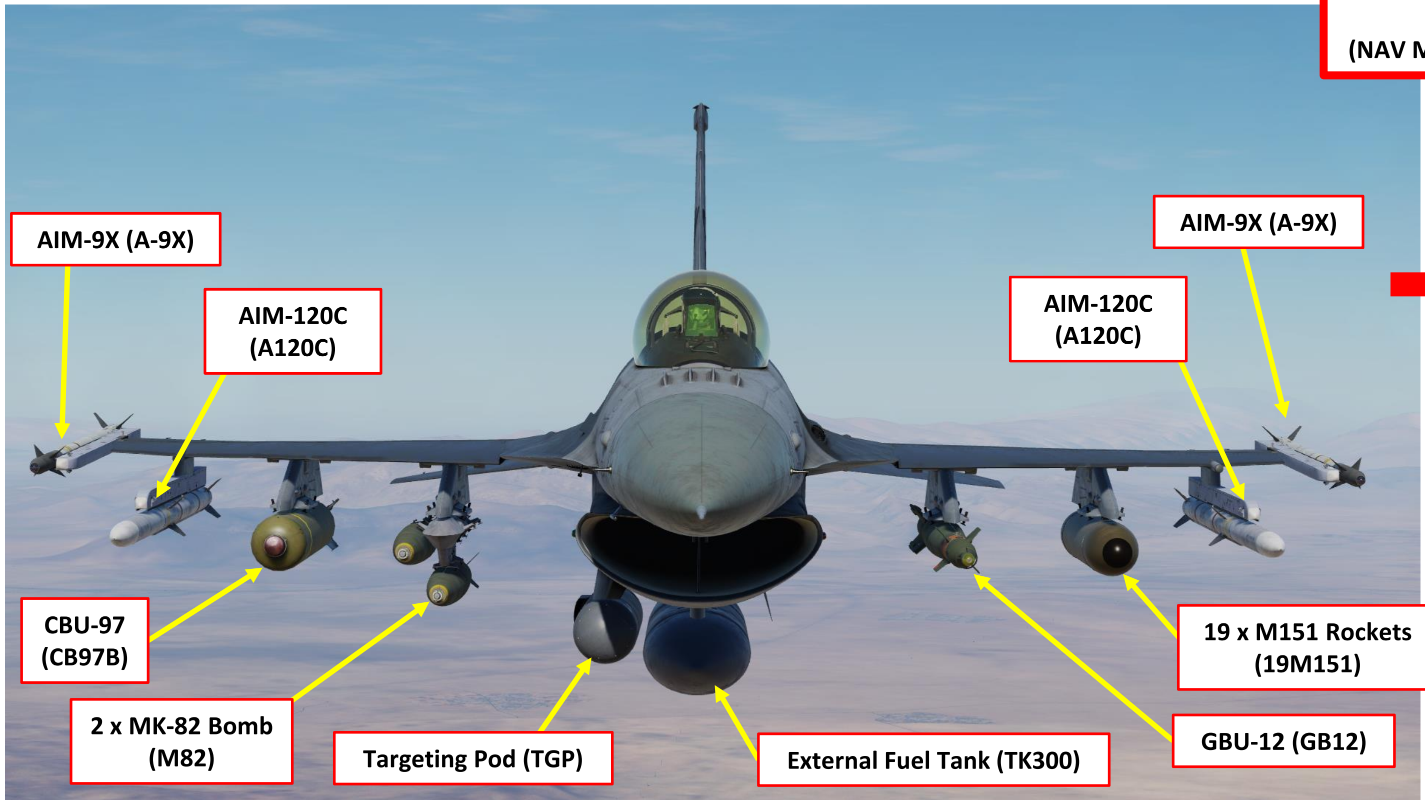
← MAN RNG Knob – CCW (Zoom Out)
→ MAN RNG Knob – CW (Zoom In)

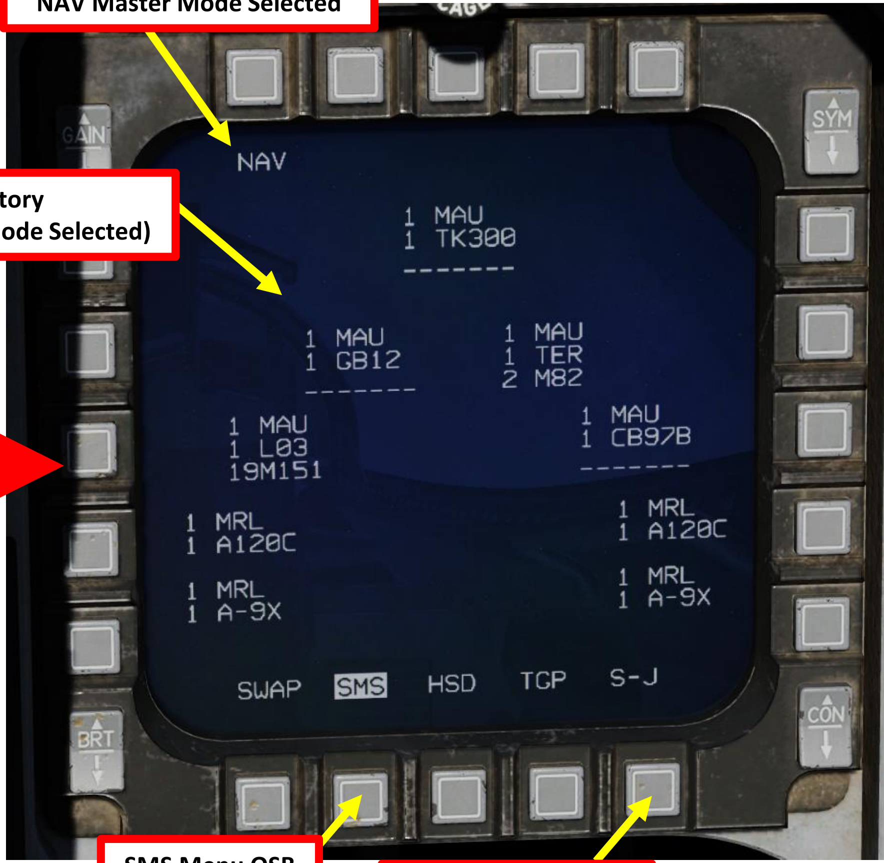
1.4 – SMS PAGE (STORES MANAGEMENT SET)

Note:
- *MAU* stands for "MAU-12 Bomb Ejector Rack".
- *TER* stands for "Triple Ejector Rack".
- *L03* stands for "LAU-3 Rocket Pod".
- *MRL* stands for "Missile Rail Launcher"

The SMS (Stores Management Set) page can be accessed by clicking on the SMS OSB (Option Select Button). This page allows for viewing, configuration and status monitoring of loaded stores. This page acts like the A-10C's DSMS (Digital Stores Management Systems) page and allows you to select your armament and program useful options like bomb delivery mode or advanced air-to-air missile modes.

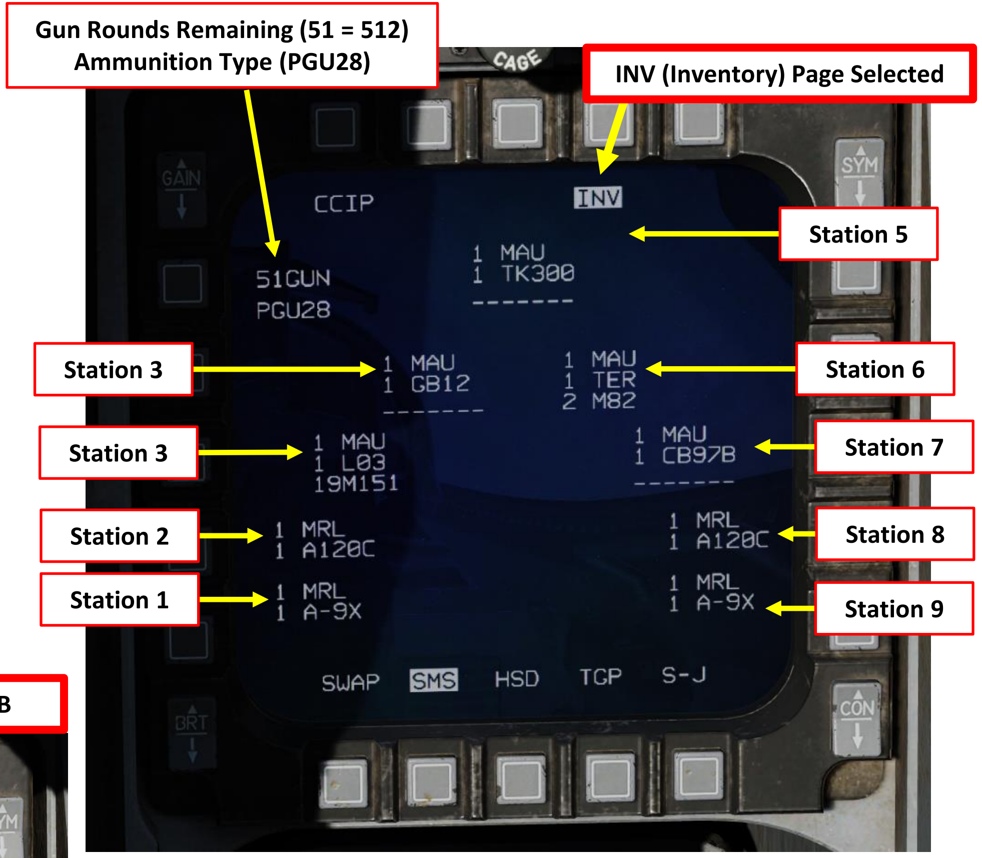
The display provides the number, type, and status of all stores loaded on the aircraft's weapon stations.
- Different options are available **depending on the type of weapons that are selected**
- If the **NAV Master Mode is selected** (neither A-A or A-G are selected), the **Inventory Page is selected by default**.
- A Selective Jettison page (S-J) is also available that allows selected stores to be jettisoned in an unarmed state.

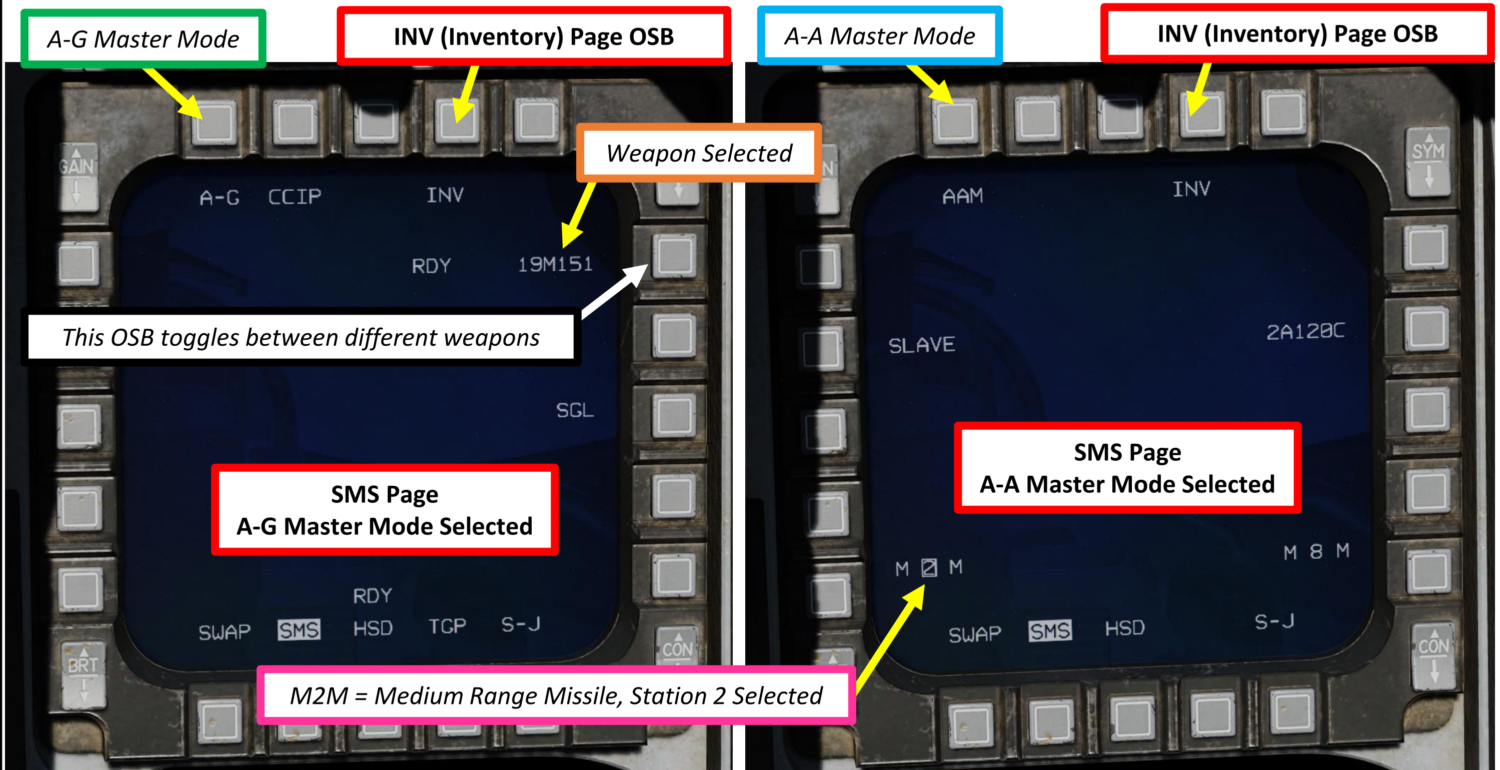


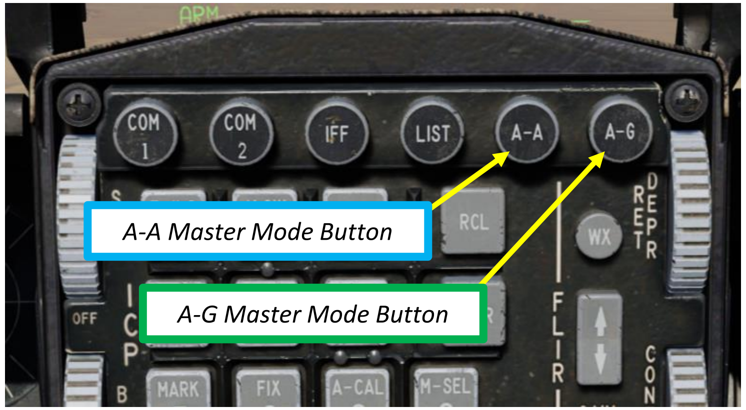


1.4 – SMS PAGE (STORES MANAGEMENT SET)

- If the **NAV Master Mode is selected** (neither A-A or A-G are selected), the **Inventory Page is selected by default**.
- If **either A-A (Air-to-Air) or A-G (Air-to-Ground) Master Mode is selected**, you can **access the Inventory page** by selecting the **INV OSB**.
- When SMS is selected and the Master Mode is A-G the SMS page displays only information relevant to A-G weapons.
- When SMS is selected and the Master Mode is A-A the SMS page displays only information relevant to AAM (Air-to-Air Missile) weapons.







1.5 – BOMB DELIVERY MODES CCIP & CCRP

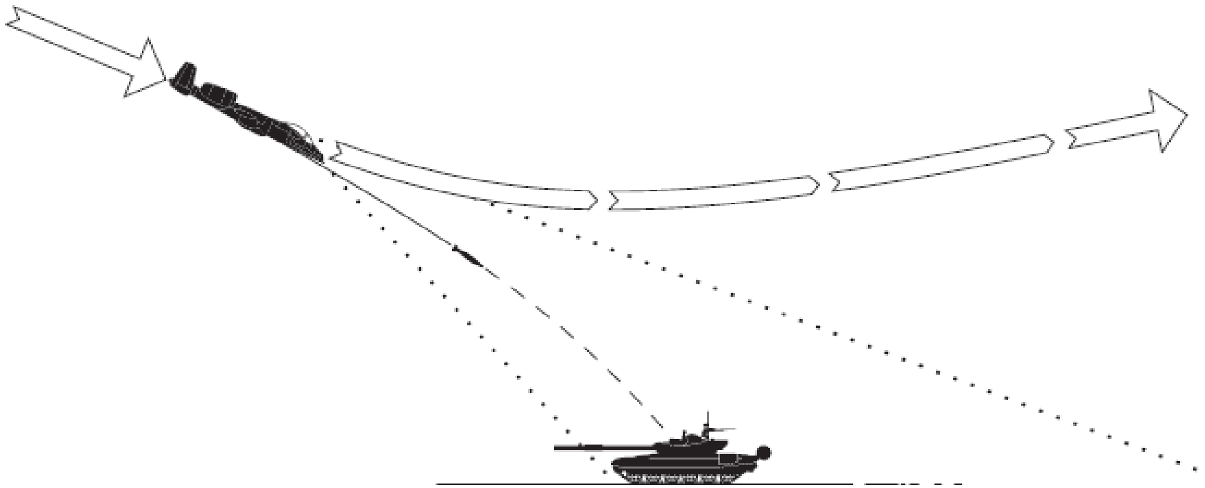
There are 5 main methods to deliver a bomb:

- CCIP (Continuously Computed Impact Point)
- CCRP (Continuously Computed Release Point)
- DTOS (Dive Toss)
- LADD (Low Altitude Drogue Delivery) – Not Simulated Yet
- MAN (Manual) – Not Simulated Yet

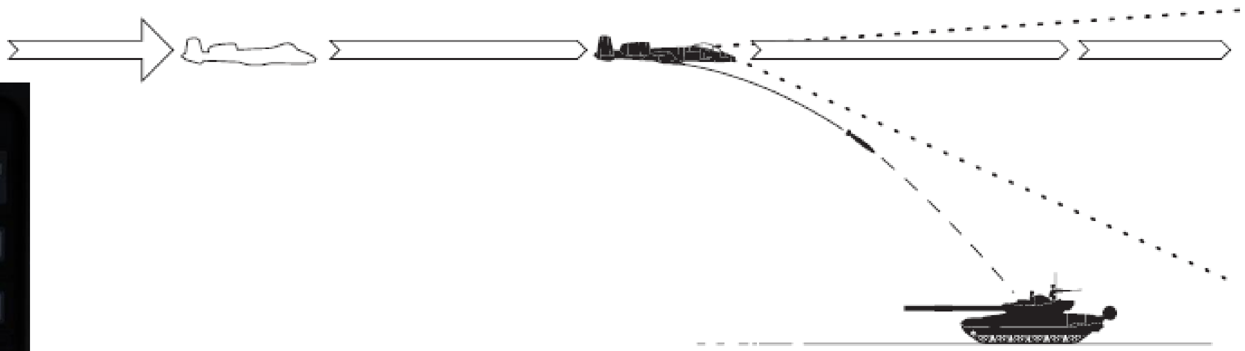
CCIP mode is the traditional dive bombing approach: you dive on target and the reticle will tell you where the bomb will impact.

However, dive bombing is a risky business, especially if anti-air defences are surrounding your target. The lower you go, the more vulnerable you are. This is why CCRP release mode was invented.

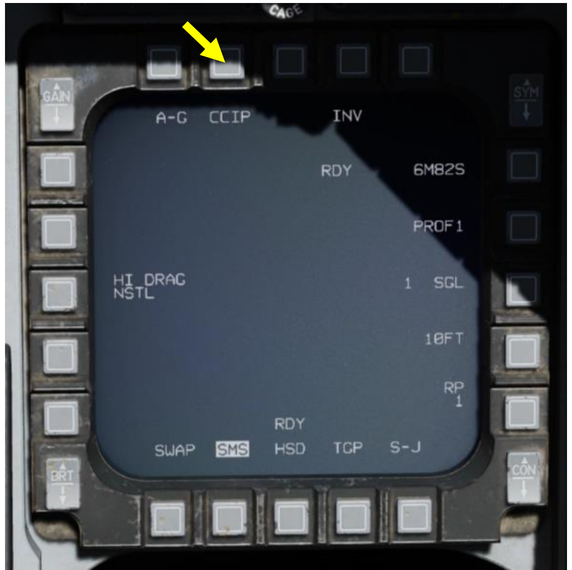
CCRP mode allows you to fly straight and level without having to dive down. The HUD will tell you when to release your bomb for the target you have designated with your radar. It is a much safer way to release a bomb, but as you may have guessed already, it is less precise.



CCIP: Continuously Computed Impact Point

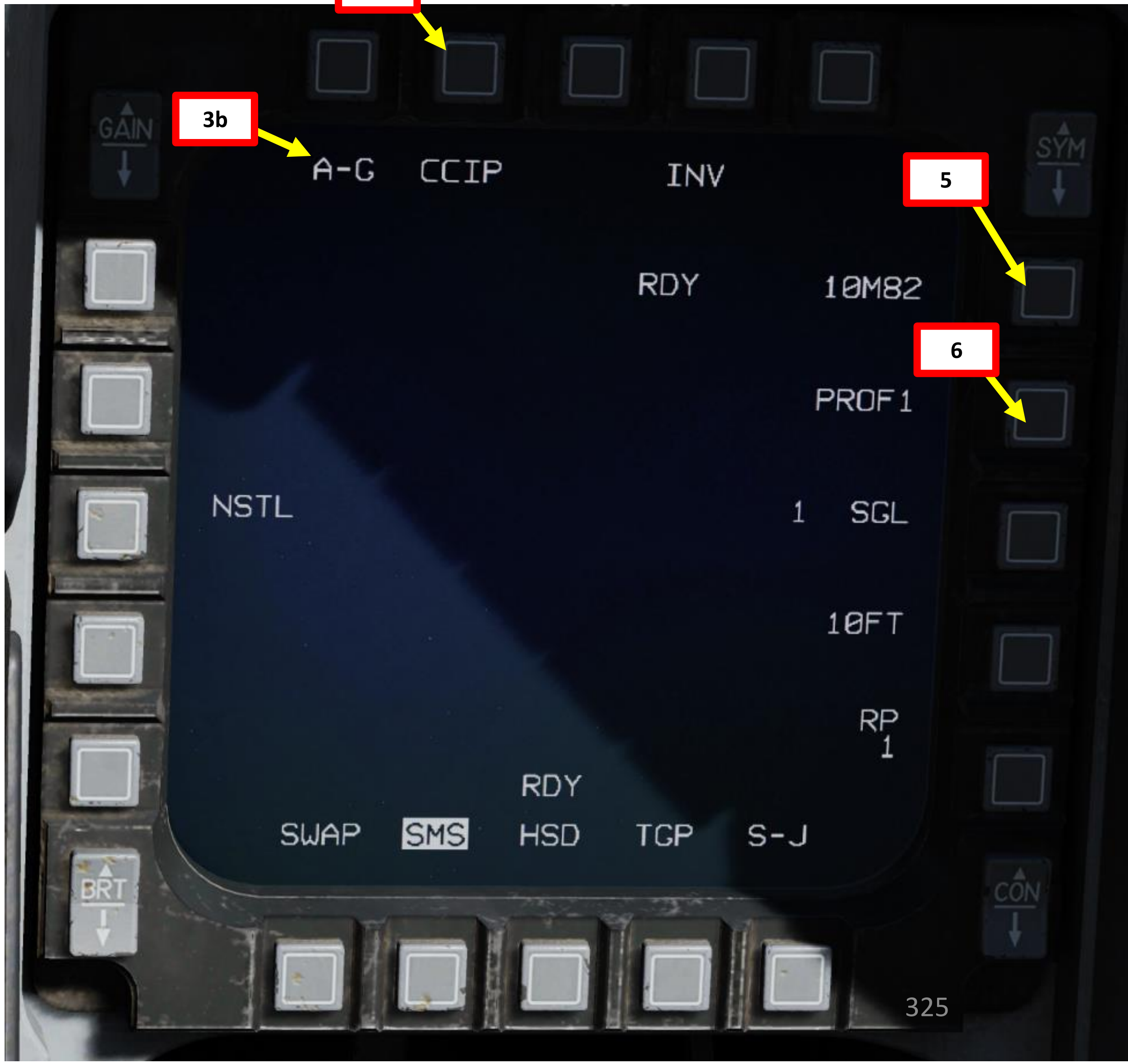


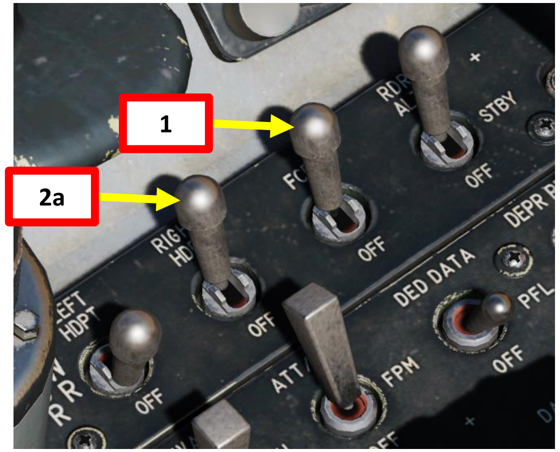
CCRP: Continuously Computed Release Point



2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

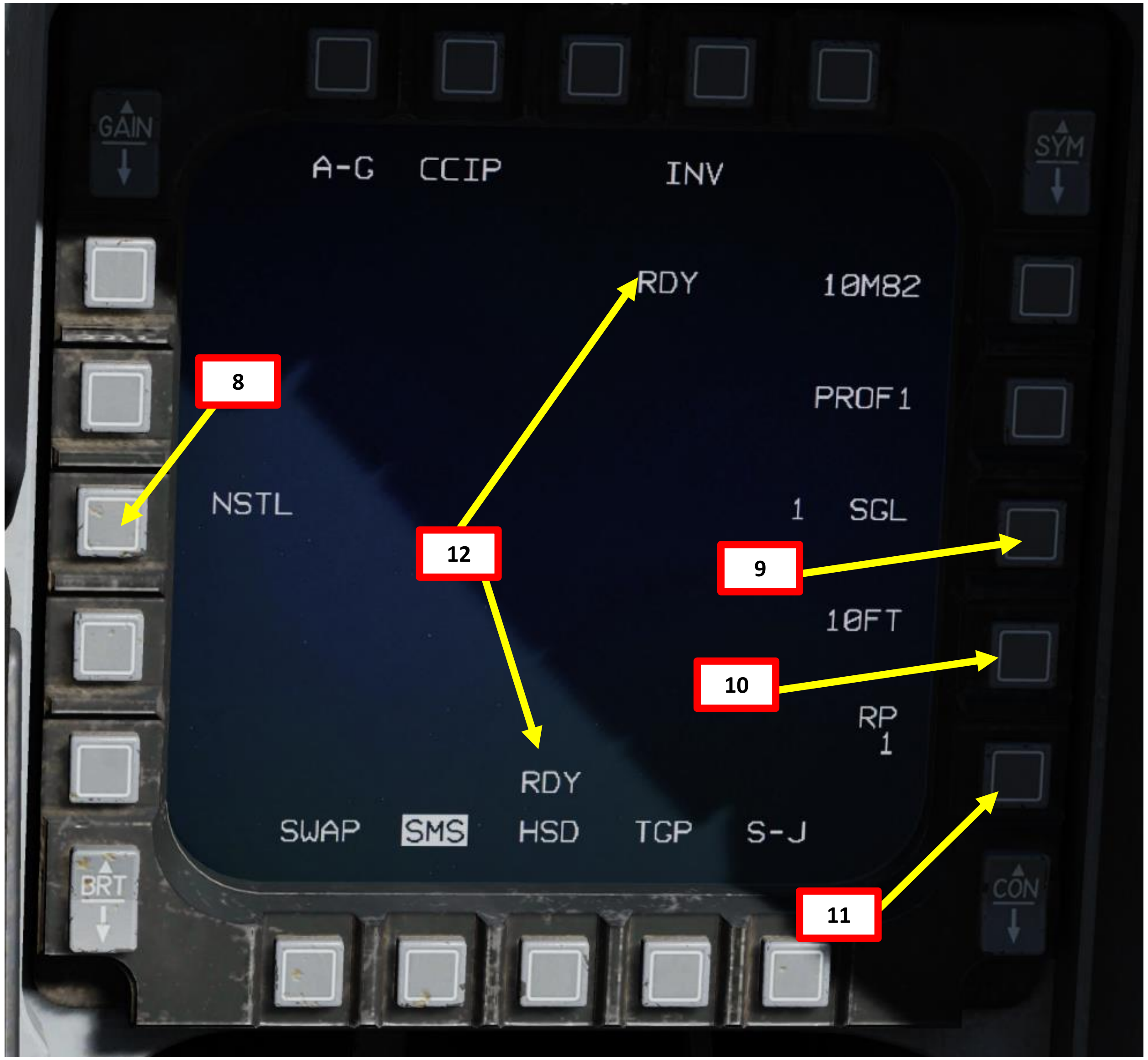
1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. (Optional) If you wish to use the targeting pod laser to range the target:
    a) Set the RIGHT HDPT switch to ON (FWD).
    b) Set Laser Switch – ARMED (UP)
3. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, select MK-82 bombs (M82) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
6. On the SMS page, select desired weapon profile. Let's take PROF1 since it is CCIP-compliant by default.
7. On the SMS page, verify that CCIP (Continuously Computed Impact Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to "CCIP". Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.





2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

8. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   - NOSE: Nose Fuze only
   - TAIL: Tail Fuze only
   - NSTL: Nose & Tail, typically used for redundancy.
9. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
   - SGL: Single Launcher
   - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
10. If more than one bomb is to be released, set desired Release Interval option. In our case, this setting is not relevant.
    - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
11. If more than one bomb is to be released, set the number of release pulses. We will leave it at 1.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
12. Verify that System Status displays RDY (Ready) on the SMS page.

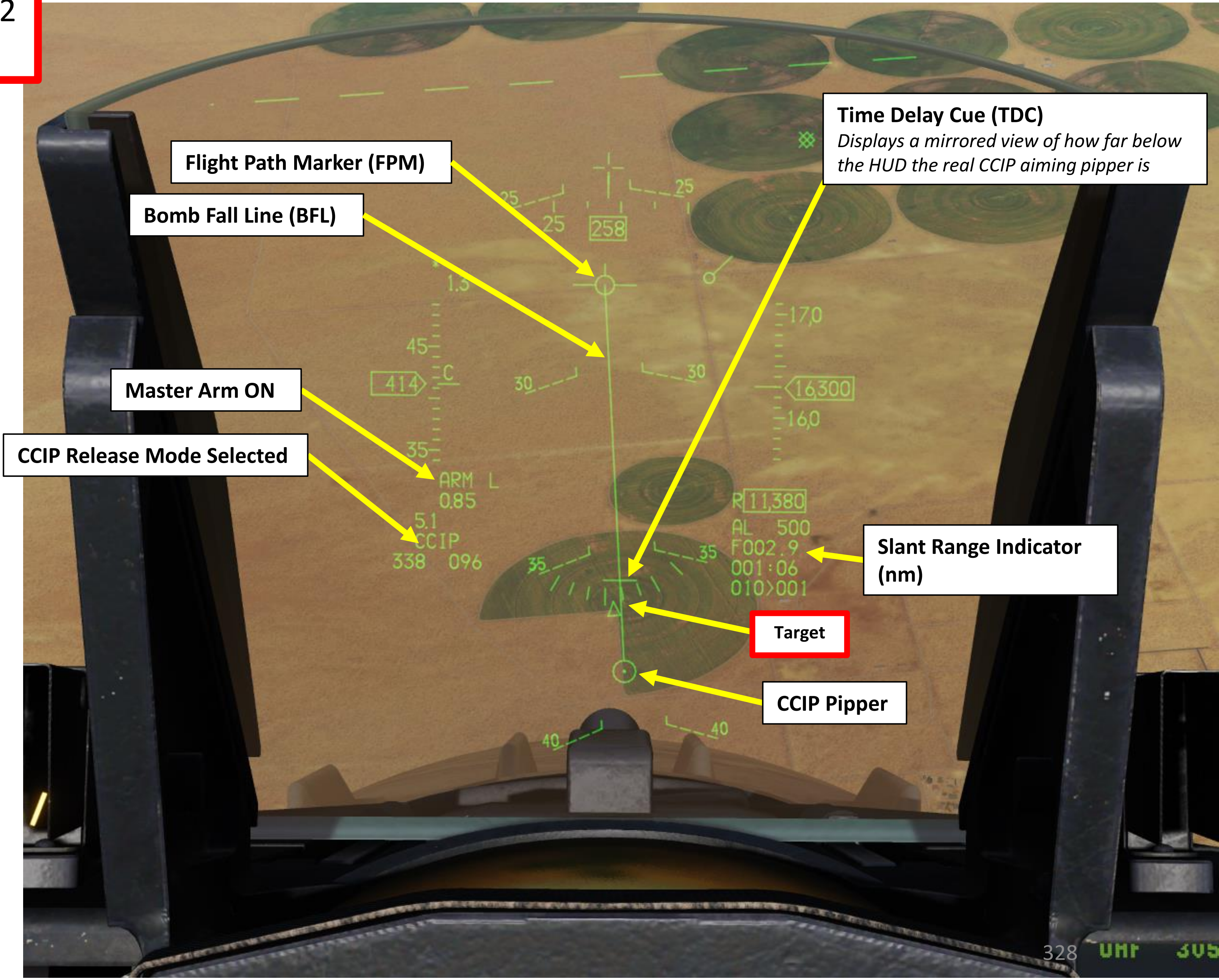


2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

13. Place the target 30 degrees off your nose, left or right.
    - For a 45-degree dive, place the target just below the canopy rail.
    - For a 30-degree dive, place the target one fist length above the canopy rail
    - For a 20-degree dive, place the target a fist with thumbs up above the canopy rail.
    - For a 10-degree dive, place the target the length of a hang-ten hand signal above the canopy rail (pinky tip to top of thumb).
14. Once you have the correct sight picture, roll in on the target. In our case, we will perform a 30-deg dive.

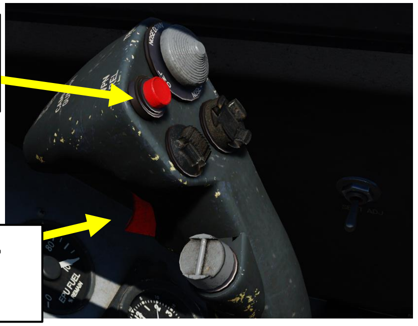
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

15. When performing your dive, place your FPM (Flight Path Marker) to an Aim Off Distance Point of your choosing (typically 2000 ft further than the target).
16. Align the BFL (Bomb Fall Line) with the target.
17. The CCIP pipper tracks up the bomb fall line towards the target.. Don't fly the pipper to the target or hold it on the target using forward stick (you risk colliding with your own bomb on release). Wait for the pipper to intersect the target naturally.
18. If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizonal line on the Bomb Fall Line.



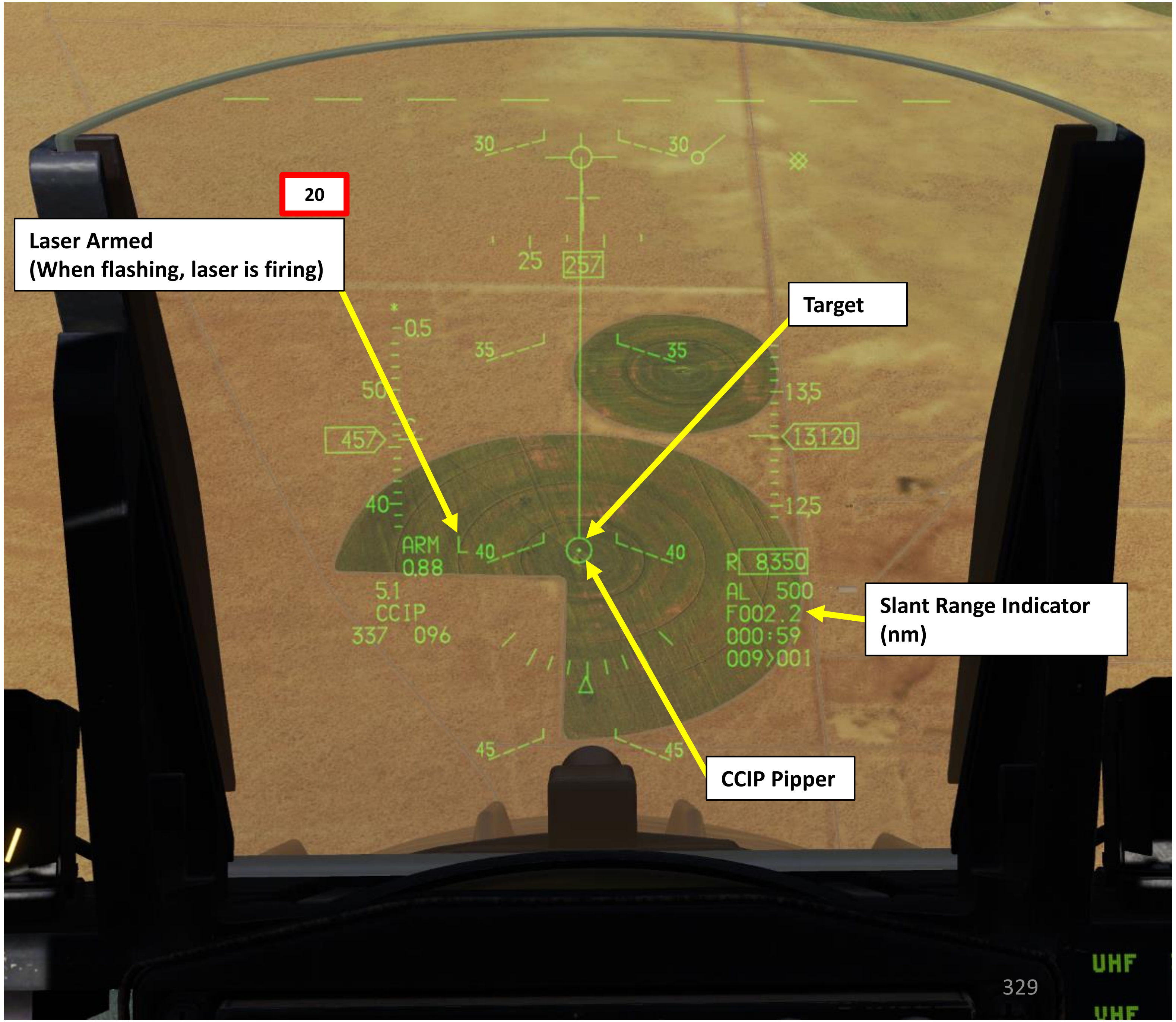
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

19. When the TDC is no longer displayed on the Bomb Fall Line, the pipper is in the HUD field of view. That will be the impact point if the bombs are released immediately.
20. (Optional) If the targeting pod is equipped, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the "L" symbol on the HUD will flash. Releasing the trigger stops lasing.
    - When "laser ranging", the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
    - If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.
21. Monitor the Pull-Up Anticipation Cue (PUAC) to ensure it does not go above the Flight Path Marker (see note on PUAC at the end of this tutorial).
22. When CCIP pipper intersects the target, depress the Weapon Release (RALT+SPACE) button to release the bomb.



22 Weapon Release Button

20 Camera/Gun Trigger (Two Stages)



2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

23. After release, fly a safe escape maneuver to avoid the bomb fragmentation.
    A 5G pull-up to a 30-deg climb is recommended.

2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

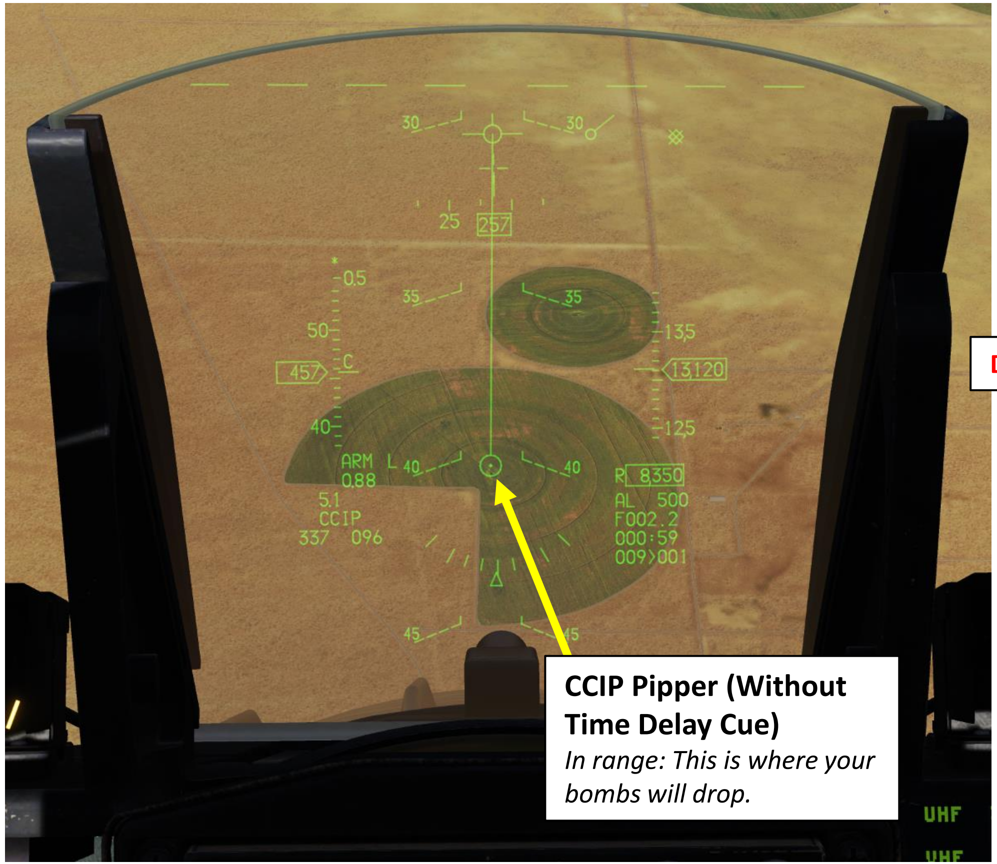
2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

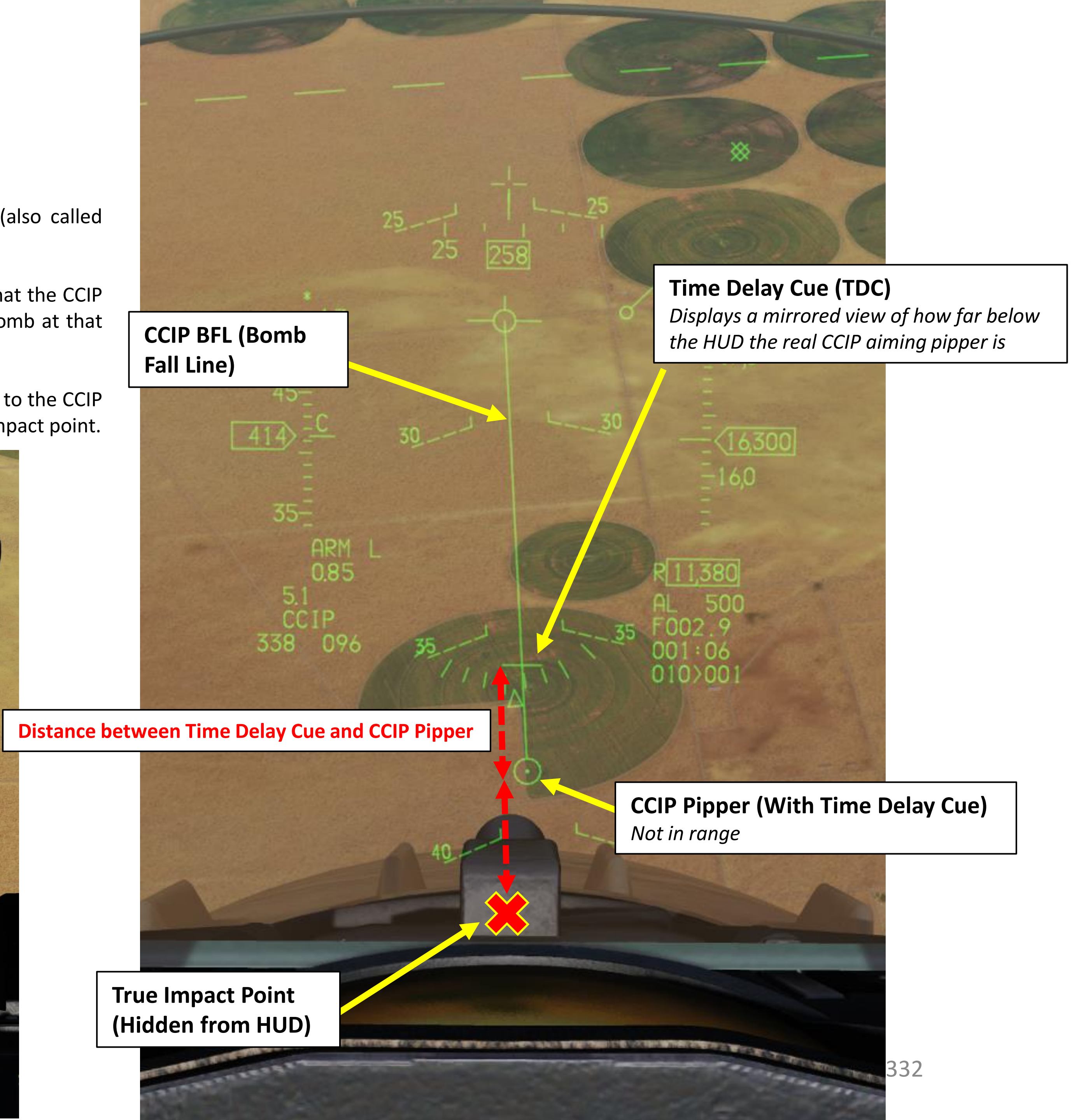
Note on Time Delay Cue (TDC):

Between the CCIP pipper and the velocity vector marker is the Time Delay Cue (also called Reflected Cue).

When the **Time Delay Cue (TDC)** is visible on the BFL (Bomb Fall Line), it indicates that the CCIP pipper on the HUD is not showing the true impact point if you were to drop the bomb at that moment.

Instead, the true impact location is a mirror of the distance from the Time Delay Cue to the CCIP pipper. When Reflected Cue disappears, the CCIP pipper will then indicate the true impact point.





2.1.1 – UNGUIDED BOMB – MK-82 (CCIP)

Note on the PUAC (Pull-Up Anticipation Cue):

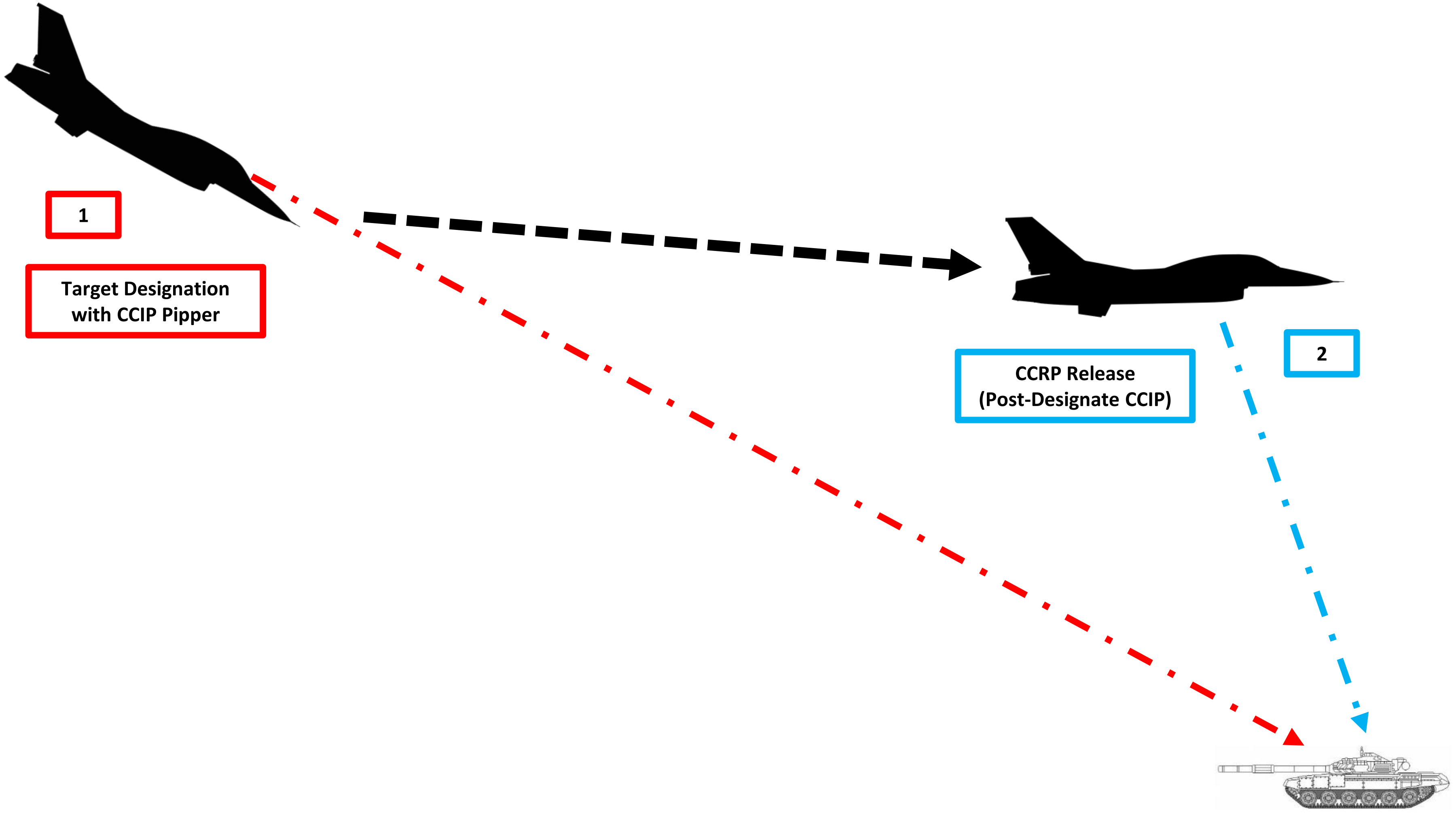
Monitor the Pull-Up Anticipation Cue to ensure it does not go above the Flight Path Marker.

The Pull-Up Anticipation Cue (PUAC) provides a visual representation of the altitude required for the bomb fuze to arm or altitude to initiate a pull-up to avoid impacting the ground, whichever is more immediate. It moves up toward the Flight Path Marker (FPM) as the aircraft loses altitude. Releasing a bomb with the FPM below the PUAC will not give the bomb time to arm and result in a dud.

Pull-Up Anticipation Cue (PUAC)

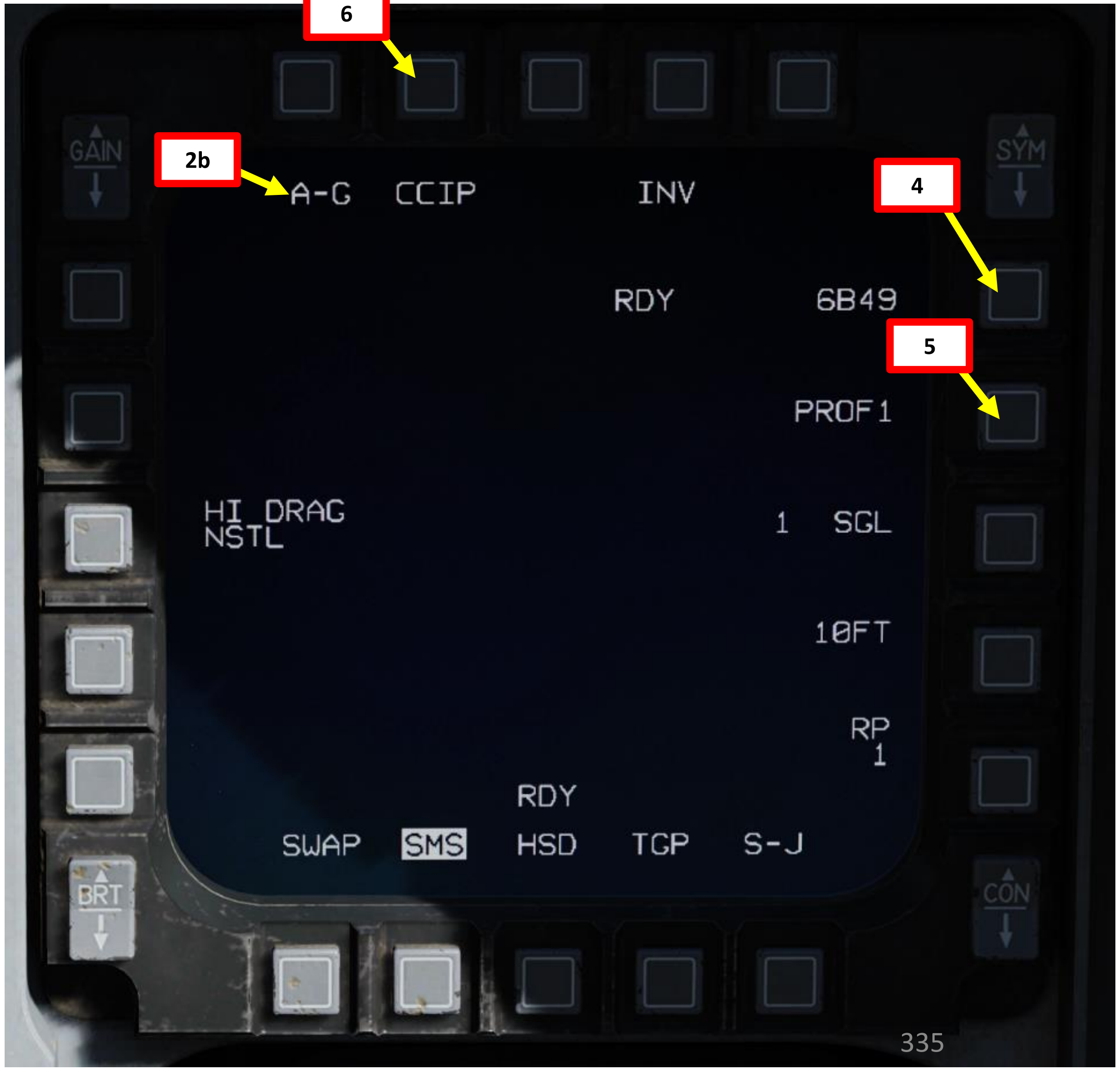
2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

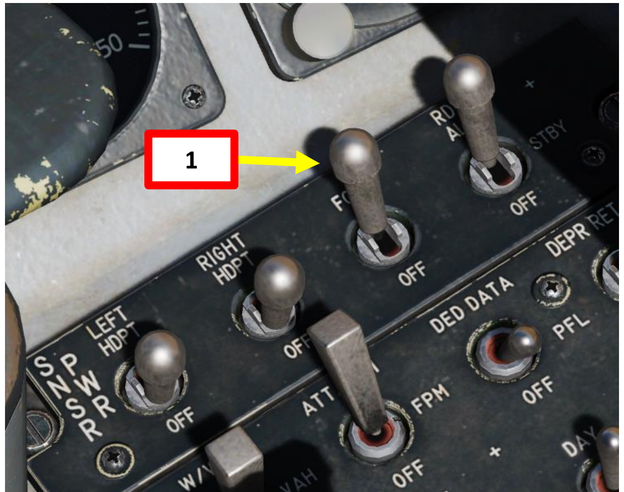
An option for CCIP bombs delivery is available for situations where the target cannot be within the HUD field of view at release. This can sometimes happen on attacks from a shallow dive angle or high altitude. The steps to enter CCIP mode are the same as described in the CCIP section. The difference is in when you depress and hold the Weapons Release button.



2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

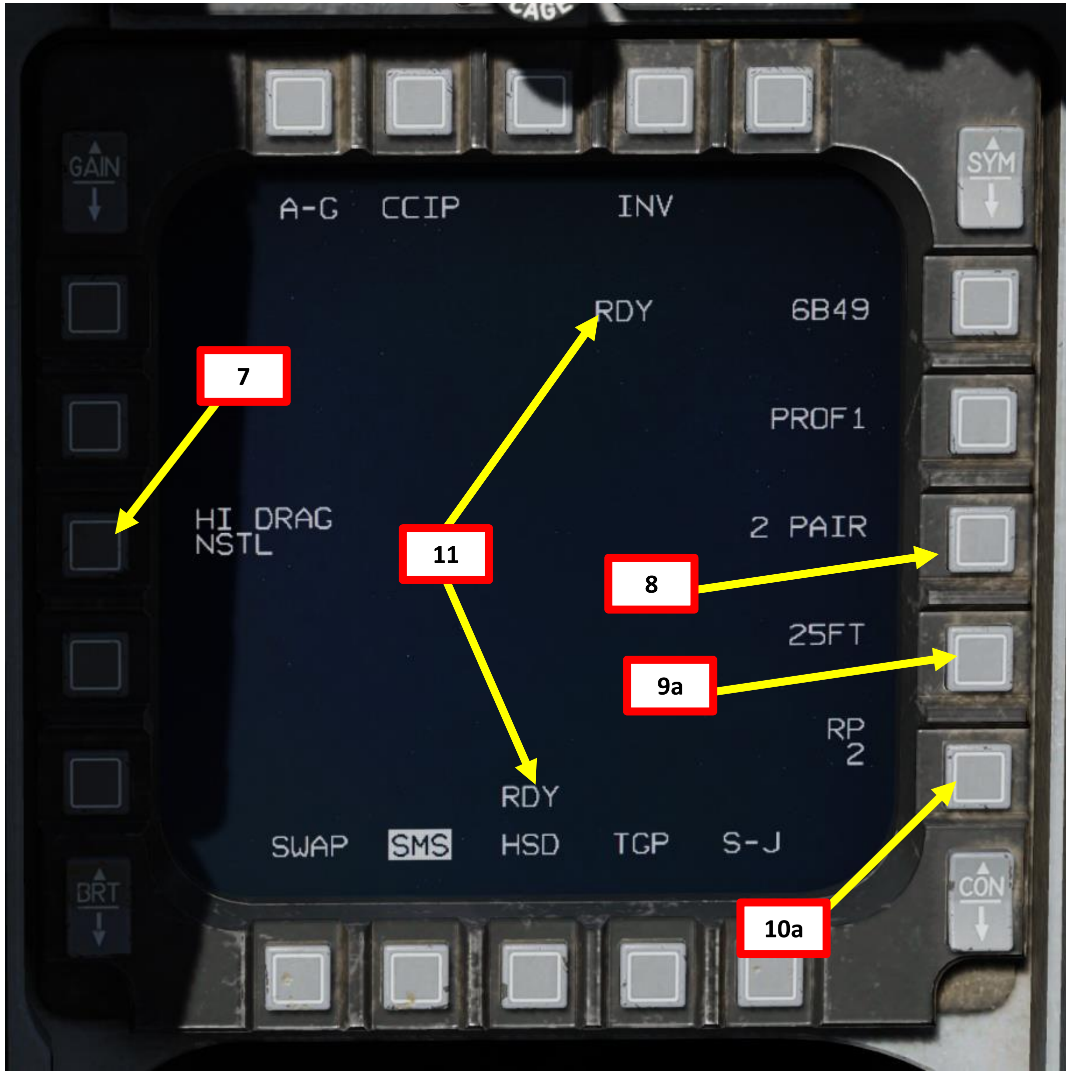
1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar and displays for air-to-ground attacks.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, select MK-82AIR bombs (**B49**, standing for the "BSU-49/B high drag tail assembly", also called a "ballute") by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
5. On the SMS page, select desired weapon profile. Let's take PROF1 since it is CCIP-compliant by default.
6. On the SMS page, verify that CCIP (Continuously Computed Impact Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to "CCIP". Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.

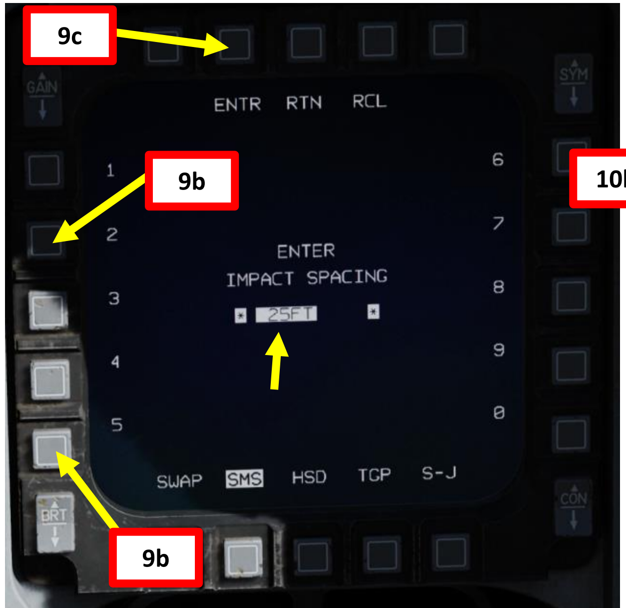




2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

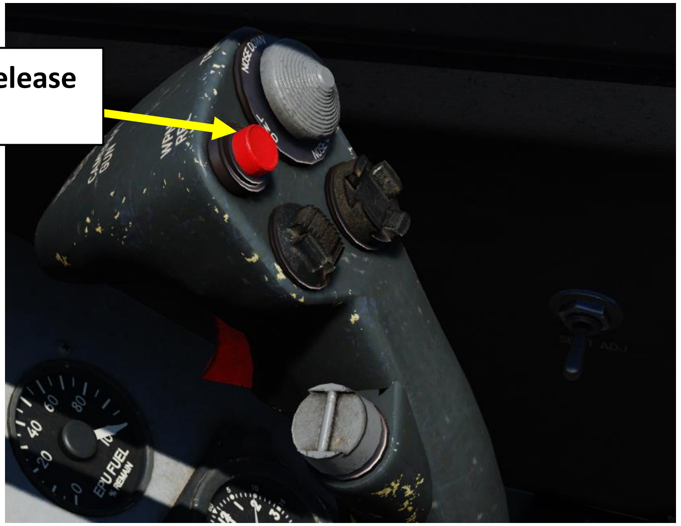
7. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
   - NSTL (Nose & Tail): High Drag
   - NOSE: Low Drag
   - TAIL: High Drag
8. Set desired Single/Pair option (press OSB to toggle setting). We will select PAIR.
   - SGL: Single Launcher
   - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
9. If more than one bomb is to be released, set desired Release Interval option. We will set it to 25 ft.
   - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
   - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
10. If more than one bomb is to be released, set the number of release pulses. We will set it to 2.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
11. Verify that System Status displays RDY (Ready) on the SMS page.

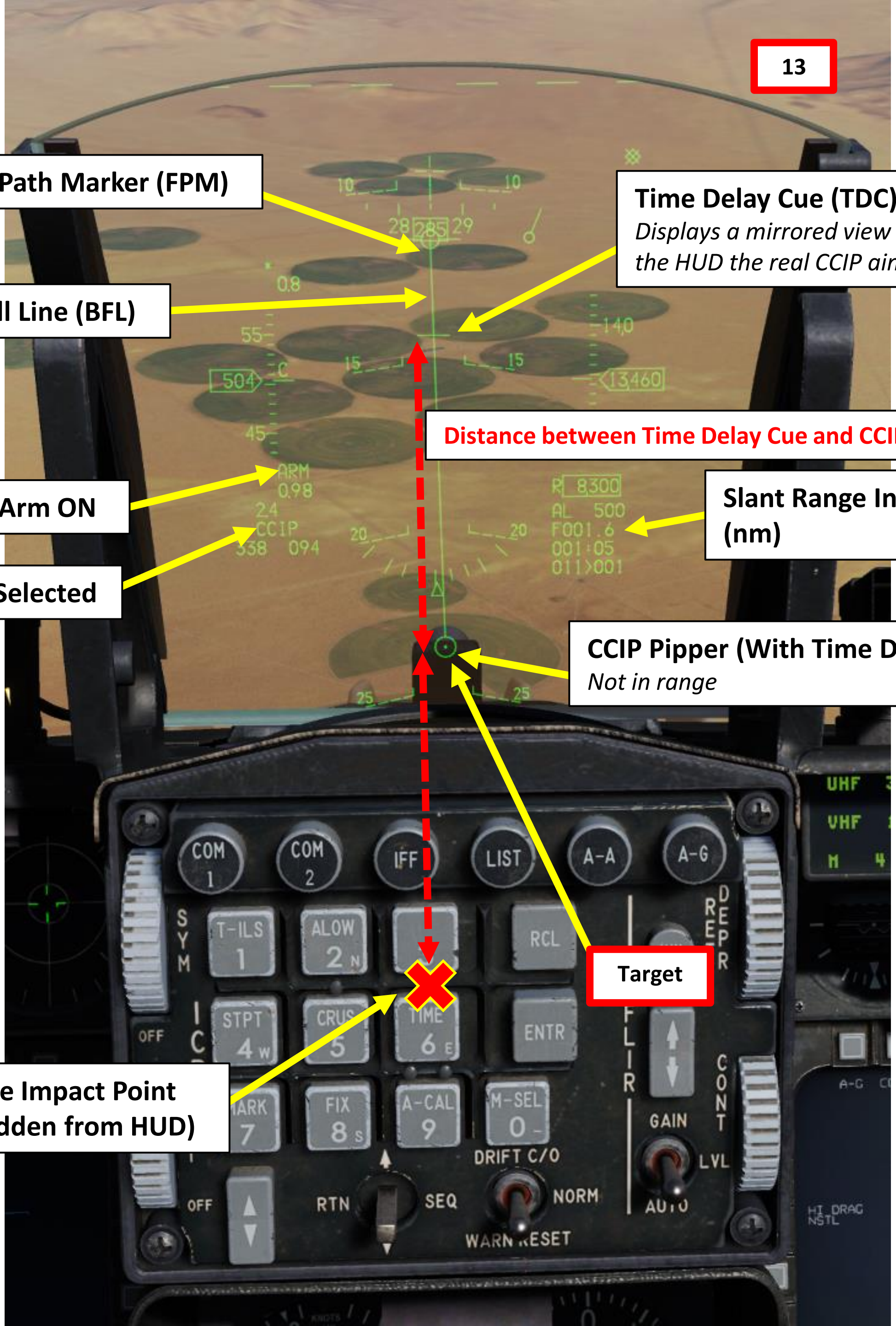




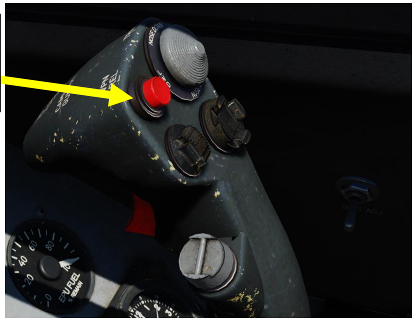
2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

12. Once you have the correct sight picture, roll in on the target. In our case, we will perform a shallow dive (between 10 and 15 deg).
13. If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizonal line on the Bomb Fall Line.
14. Manoeuver your aircraft to position the CCIP Pipper on target and align the BFL (Bomb Fall Line) with the target.
15. Designate the CCIP pipper's location as the target by depressing and holding the Weapons Release button (RALT+SPACE).

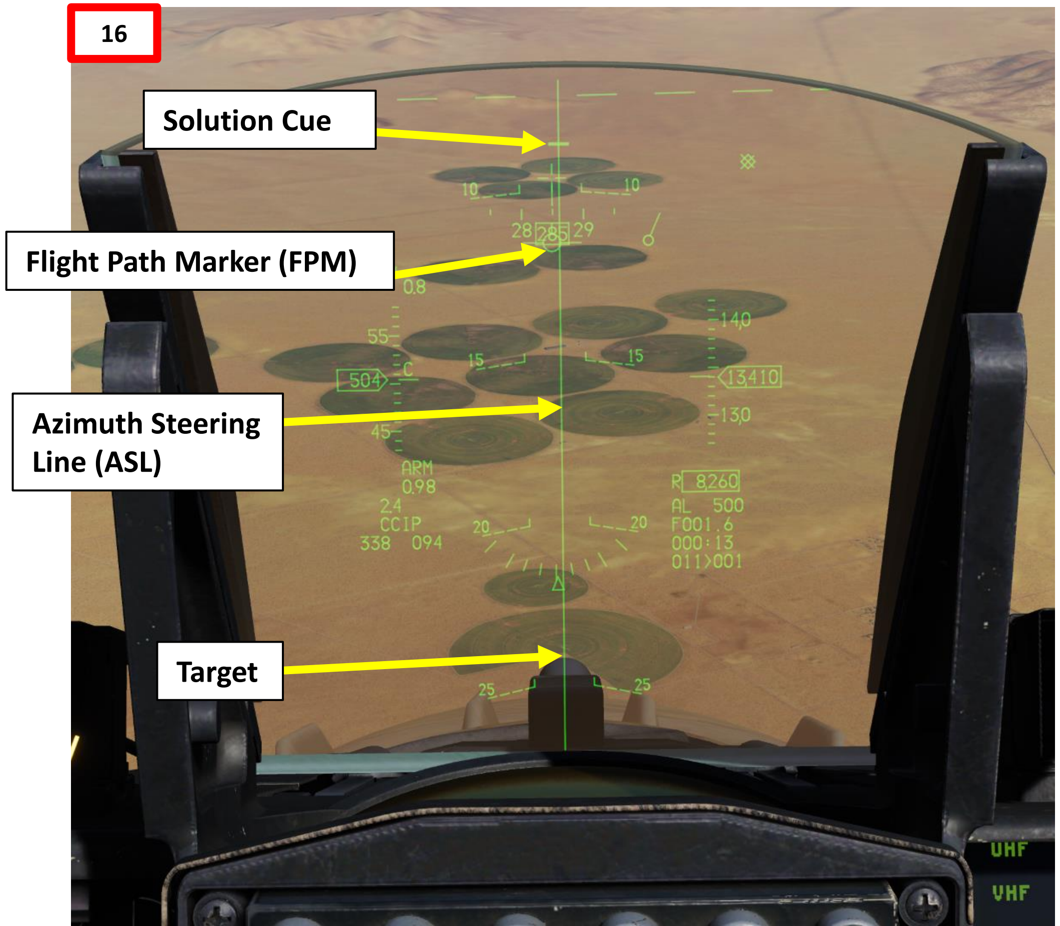


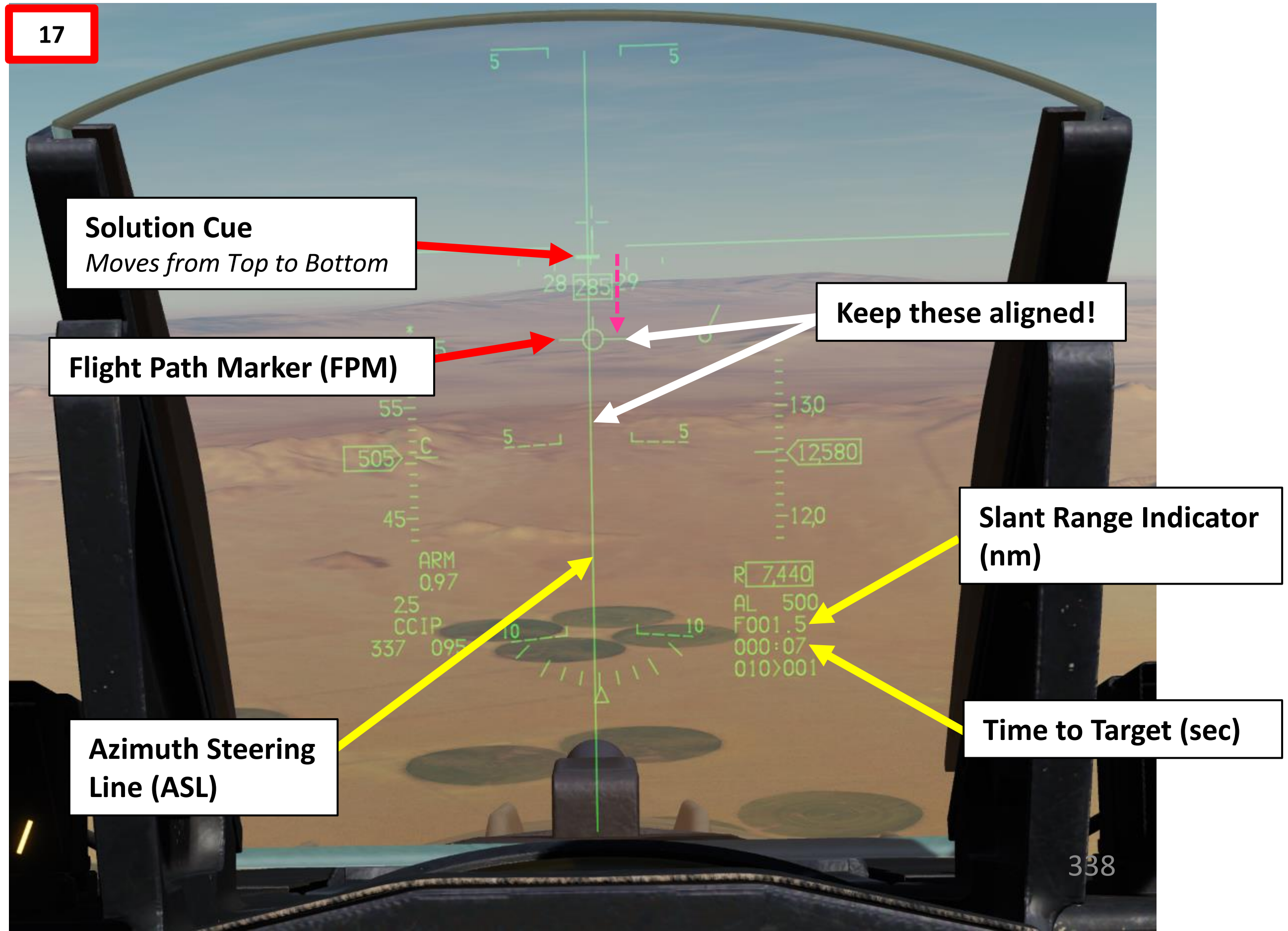


2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)



16. As you hold the Weapon Release button, the HUD symbology displayed will change to a symbology identical to that used for a CCRP delivery.
17. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target even though the target will be out of sight.
18. A Solution Cue is displayed at the top of the Steering Line. The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
19. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
20. The bombs are released when the Solution Cue passes the Flight Path Marker.

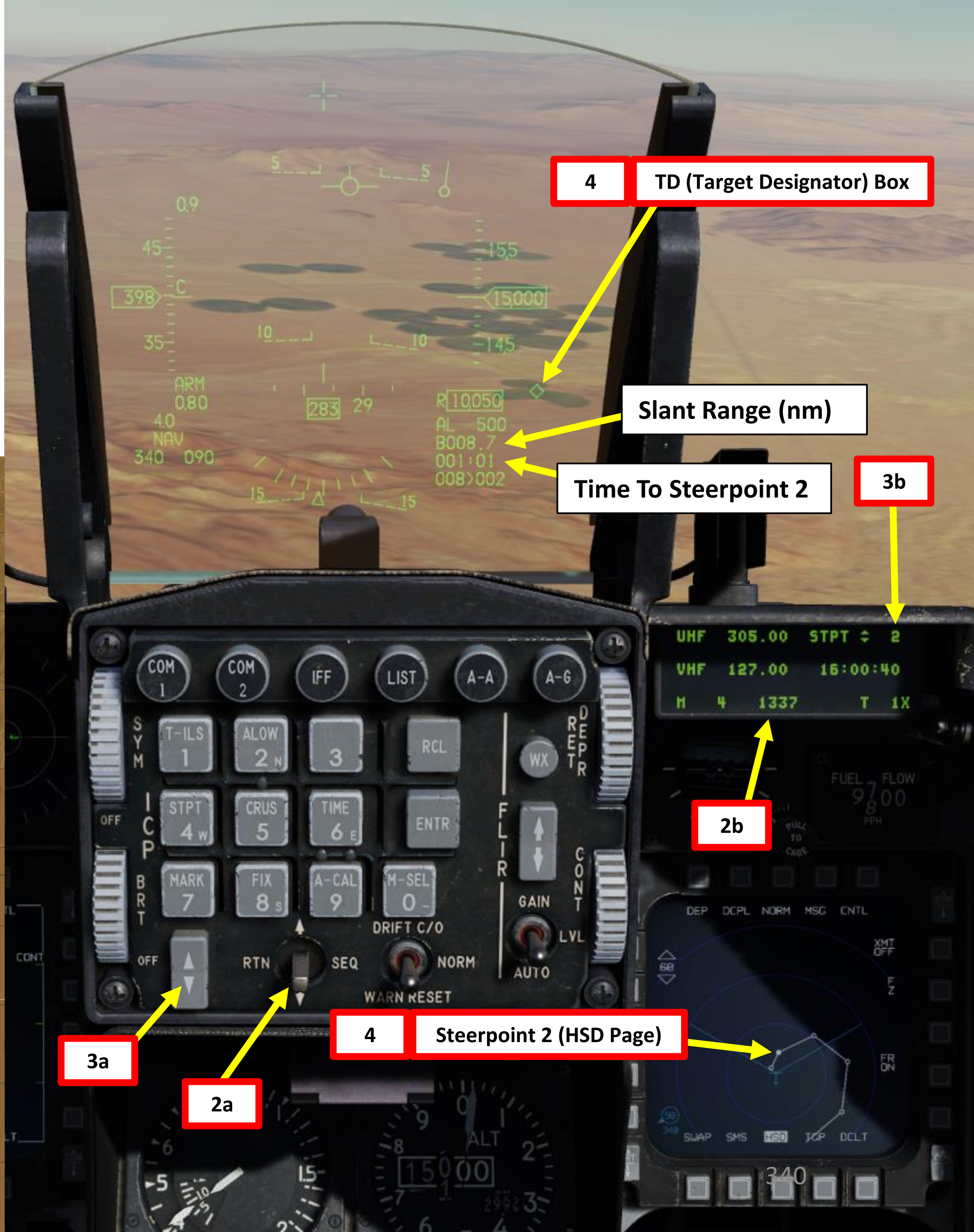




2.1.2 – UNGUIDED BOMB – MK-82AIR HIGH DRAG (Post-Designate CCIP)

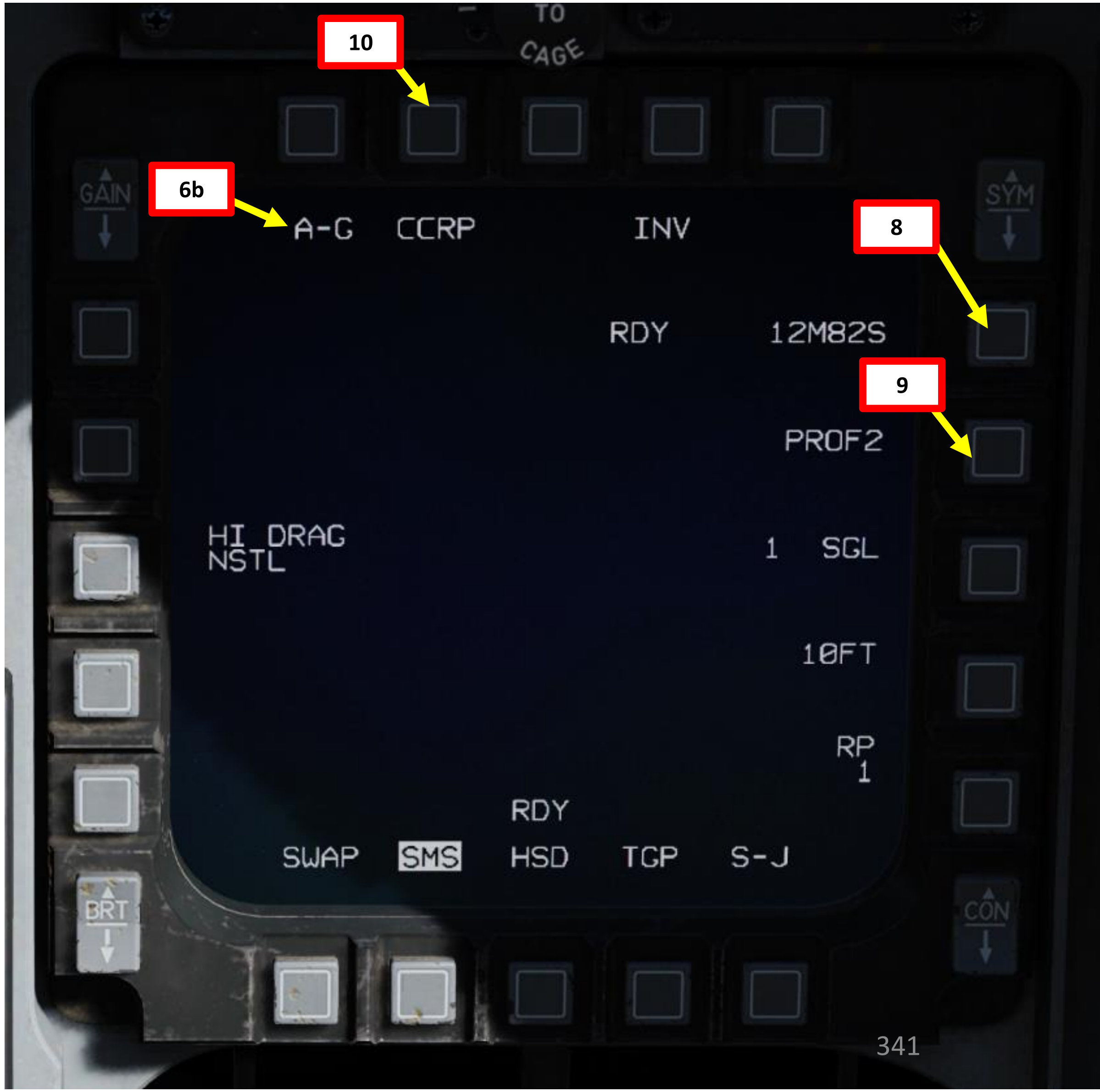
2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

1. We will be bombing a target that is directly on a steerpoint that is already in our flight plan (i.e. Steerpoint No. 2). To enter Steerpoint coordinates manually, see the Navigation section.
2. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
3. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
4. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.

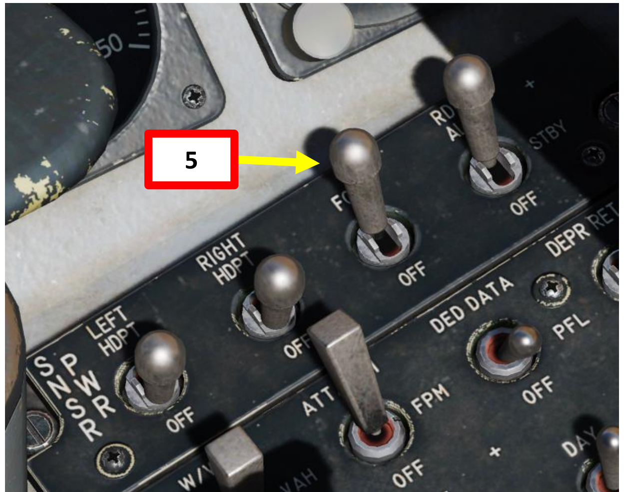


2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

5. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
6. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar and displays for air-to-ground attacks.
7. Set Master Arm switch – ARM (UP)
8. On the SMS (Stores Management Set) page, select MK-82 Snake Eye bombs (M82S) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
9. On the SMS page, select desired weapon profile. Let's take PROF2 since it is CCRP-compliant by default.
10. On the SMS page, verify that CCRP (Continuously Computed Release Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to "CCRP". Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.

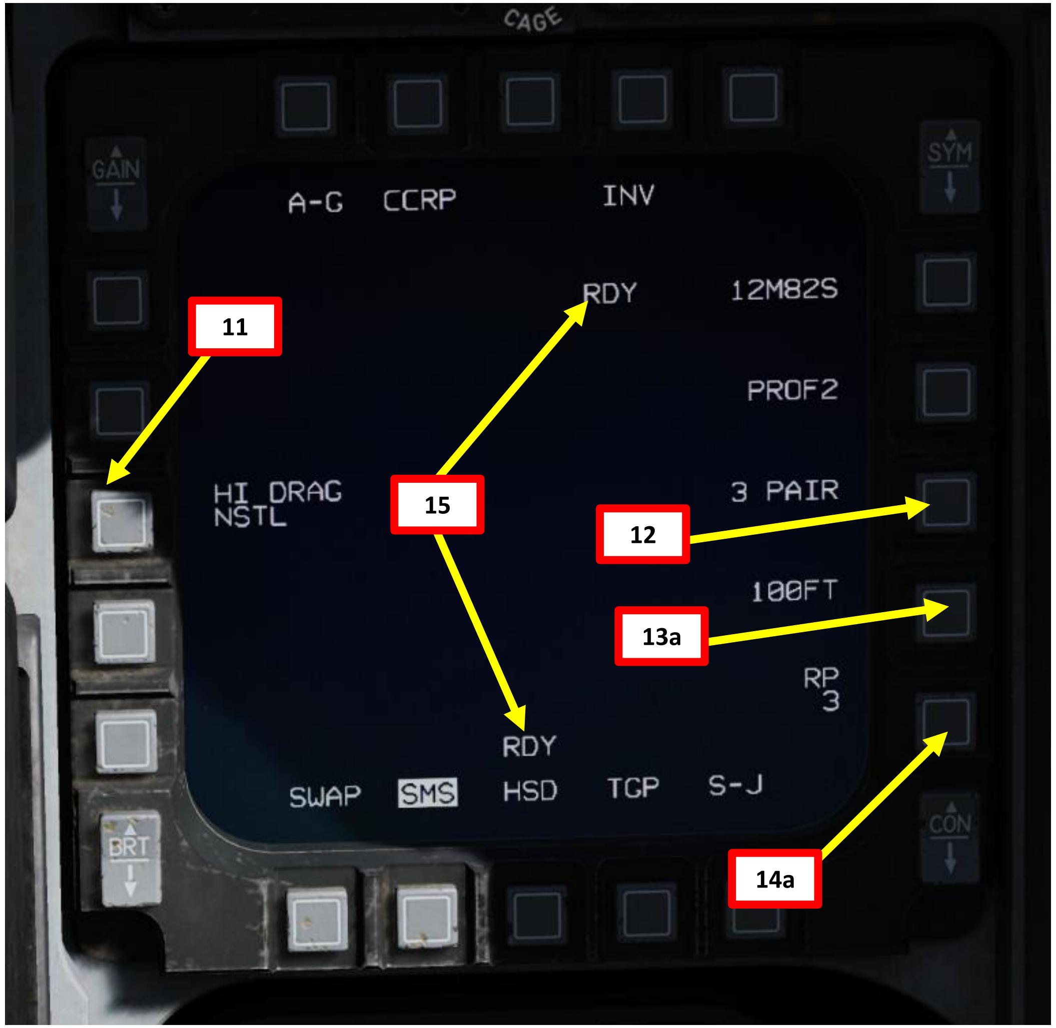


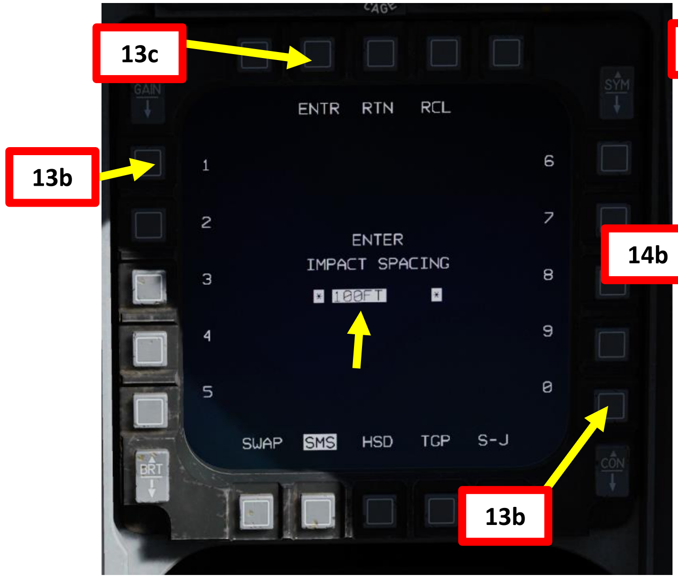
NWS A/R DISC & MSL STEP Button

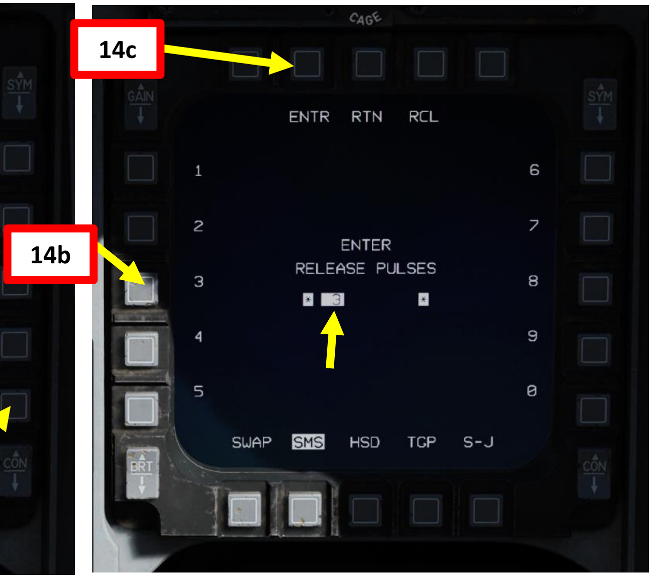


2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

11. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
    - NSTL (Nose & Tail): High Drag
    - NOSE: Low Drag
    - TAIL: High Drag
12. Set desired Single/Pair option (press OSB to toggle setting). We will select PAIR.
    - SGL: Single Launcher
    - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
13. If more than one bomb is to be released, set desired Release Interval option. We will set it to 100 ft.
    - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
14. If more than one bomb is to be released, set the number of release pulses. We will set it to 3.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
15. Verify that System Status displays RDY (Ready) on the SMS page.

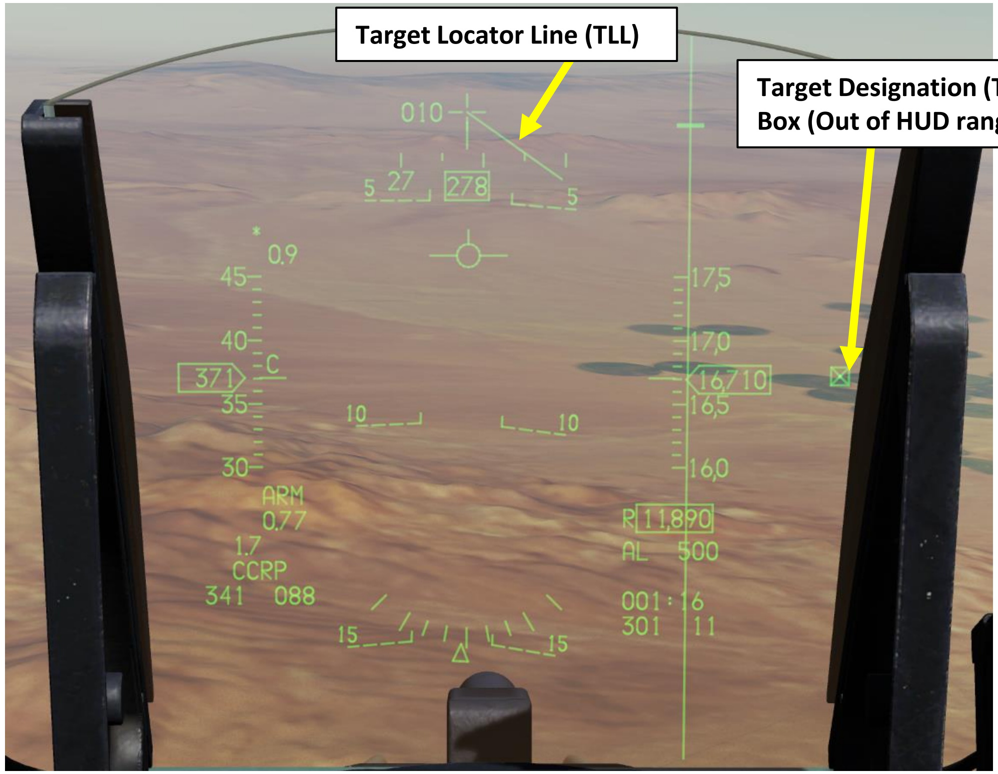


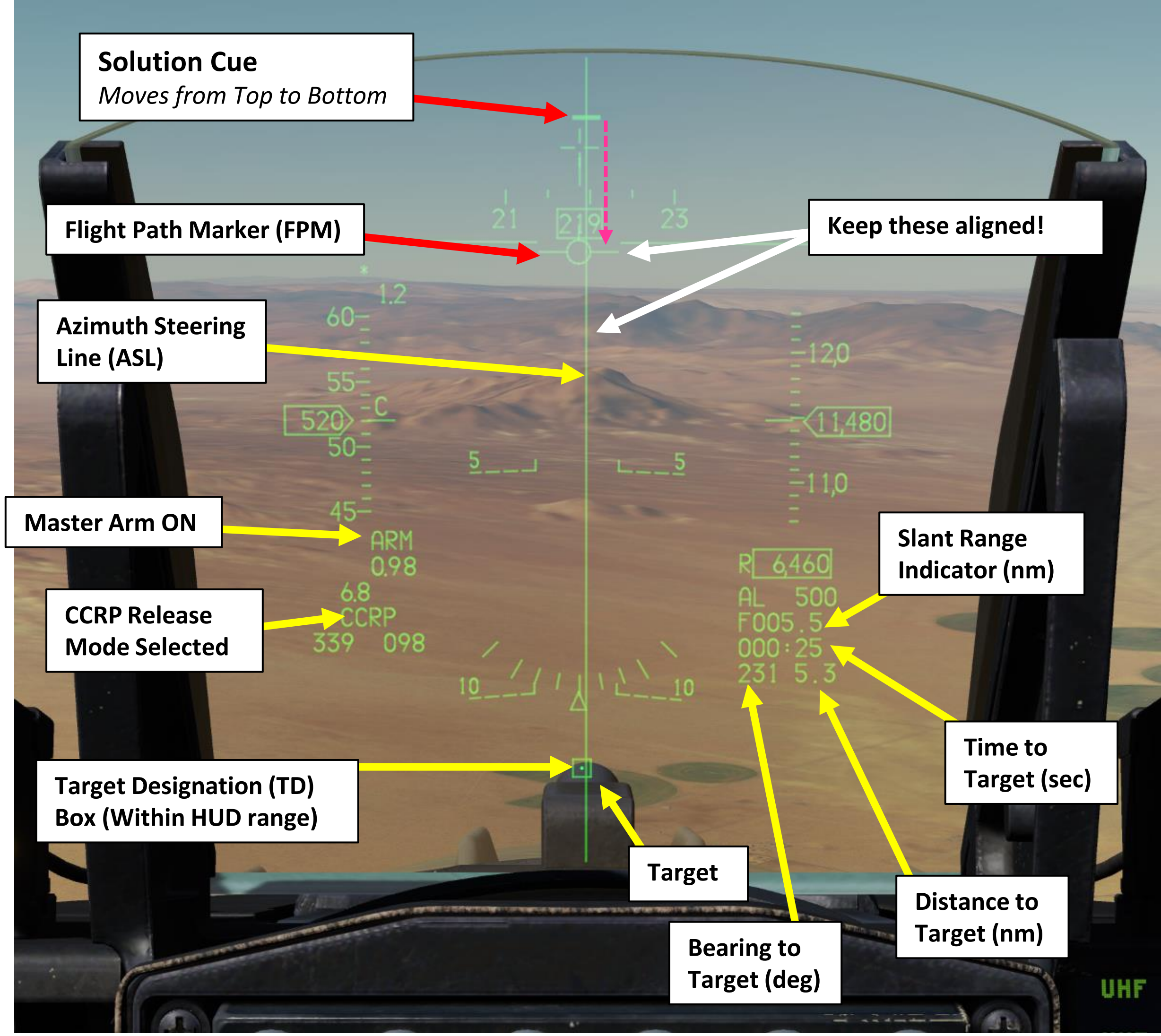


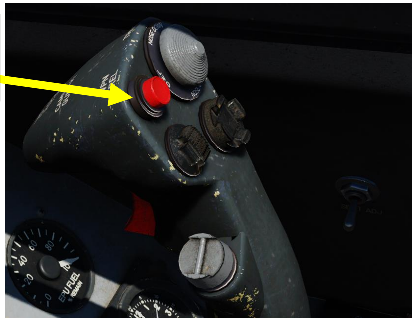


2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

16. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Steerpoint/Target is displayed on the Heads-Up Display.
17. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
18. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
19. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).
20. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
21. The bombs are released when the Solution Cue passes the Flight Path Marker.





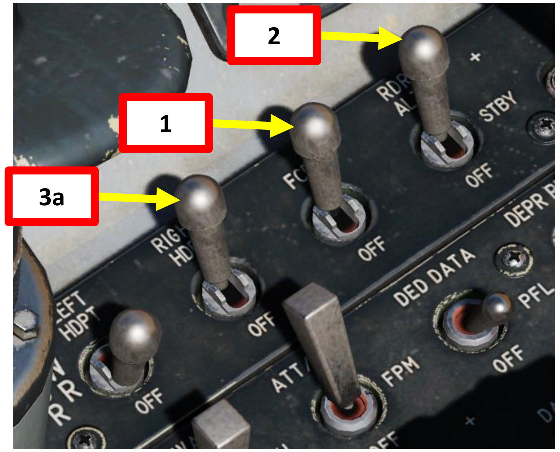


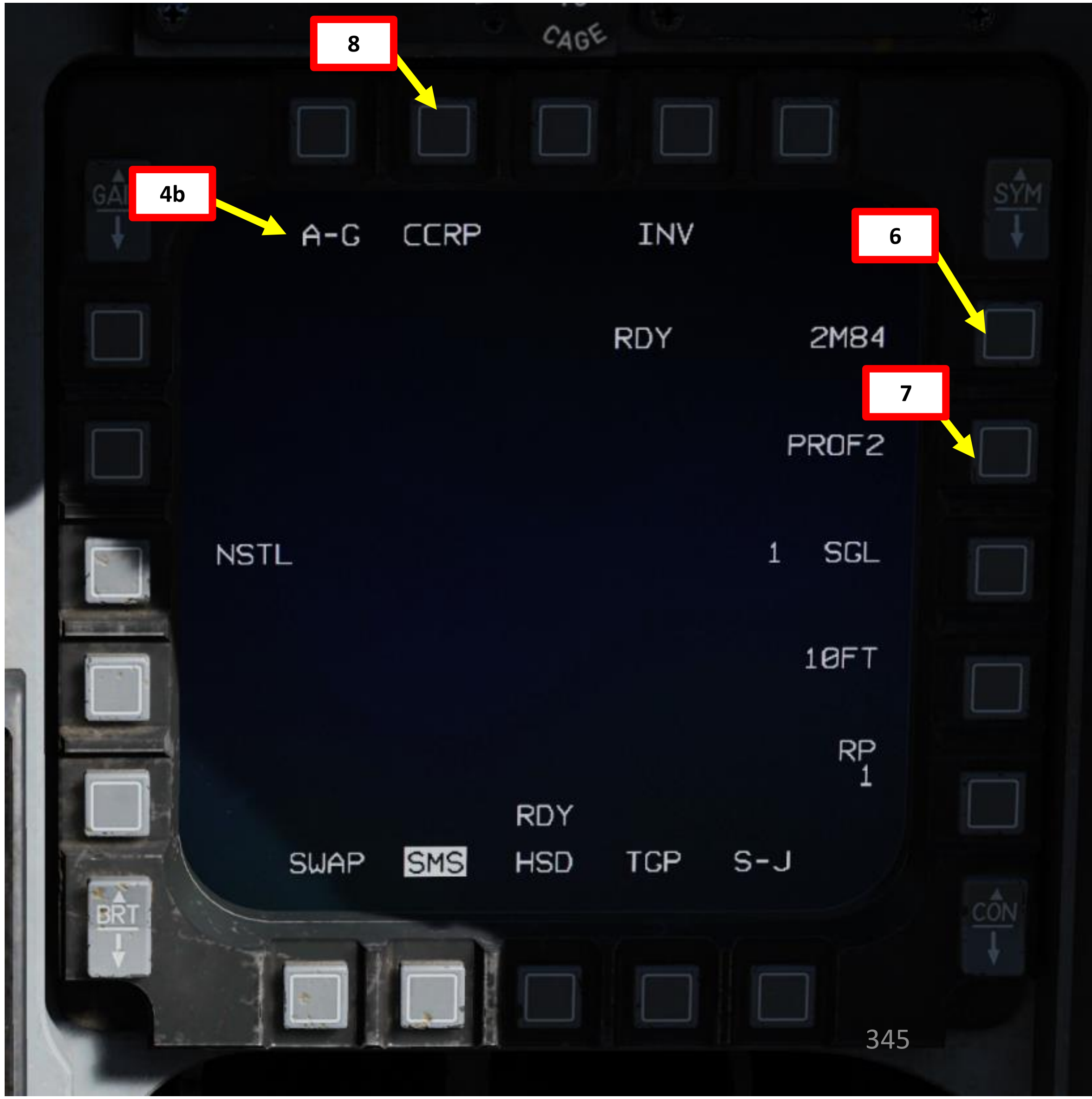
2.1.3 – UNGUIDED BOMB – MK-82SE (SNAKE EYES) (CCRP with Steerpoint)

2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Verify that Radar Altimeter (RDR ALT) switch is ON (FWD)
3. To use the targeting pod laser to range the target:
    a) Set the RIGHT HDPT switch to ON (FWD).
    b) Set Laser Switch – ARMED (UP)
4. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
5. Set Master Arm switch – ARM (UP)
6. On the SMS (Stores Management Set) page, select MK-84 bombs (M84) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
7. On the SMS page, select desired weapon profile. Let's take PROF2 since it is CCRP-compliant by default.
8. On the SMS page, verify that CCRP (Continuously Computed Release Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to "CCRP". Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.

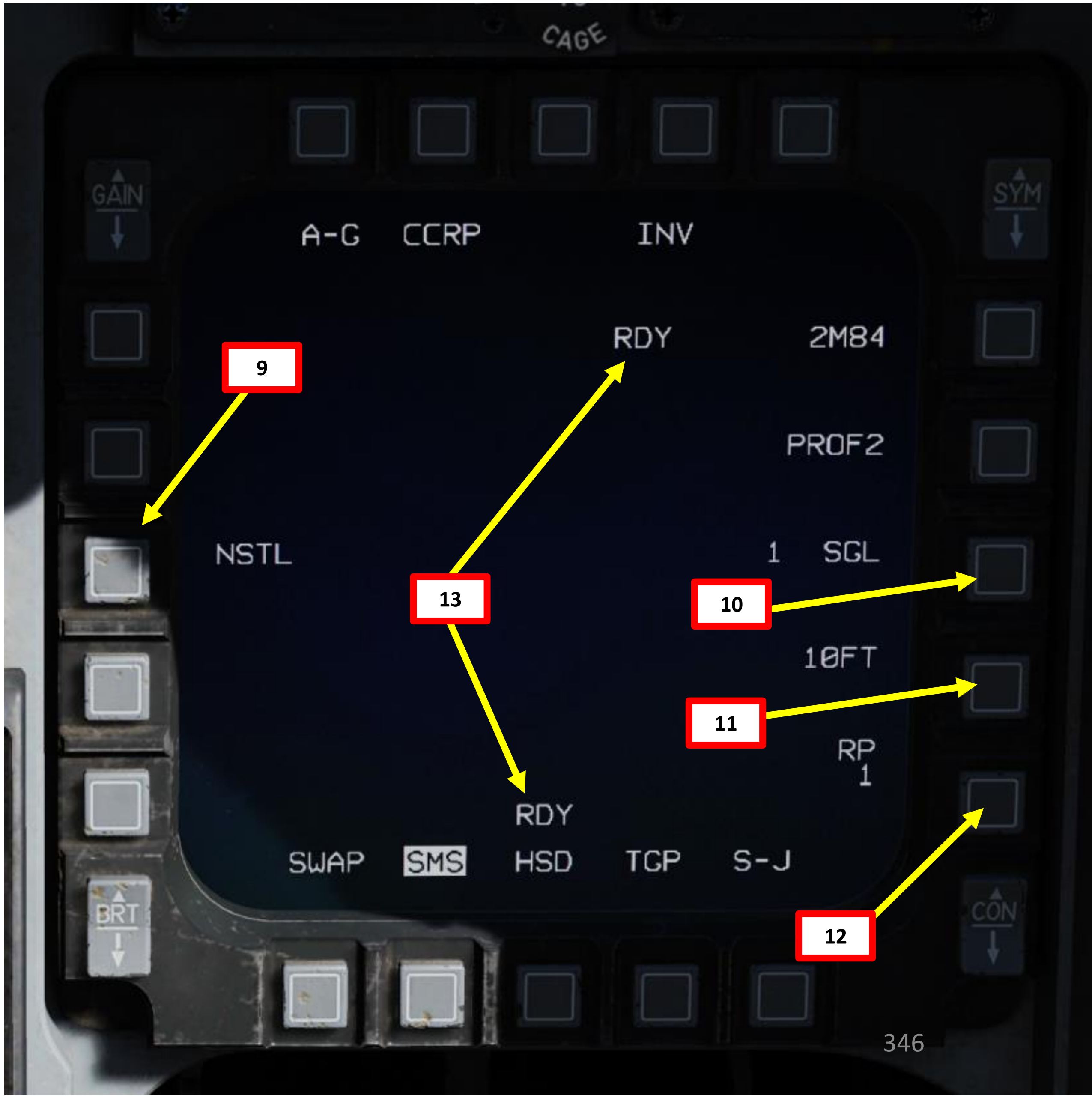
NWS A/R DISC & MSL STEP Button





2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

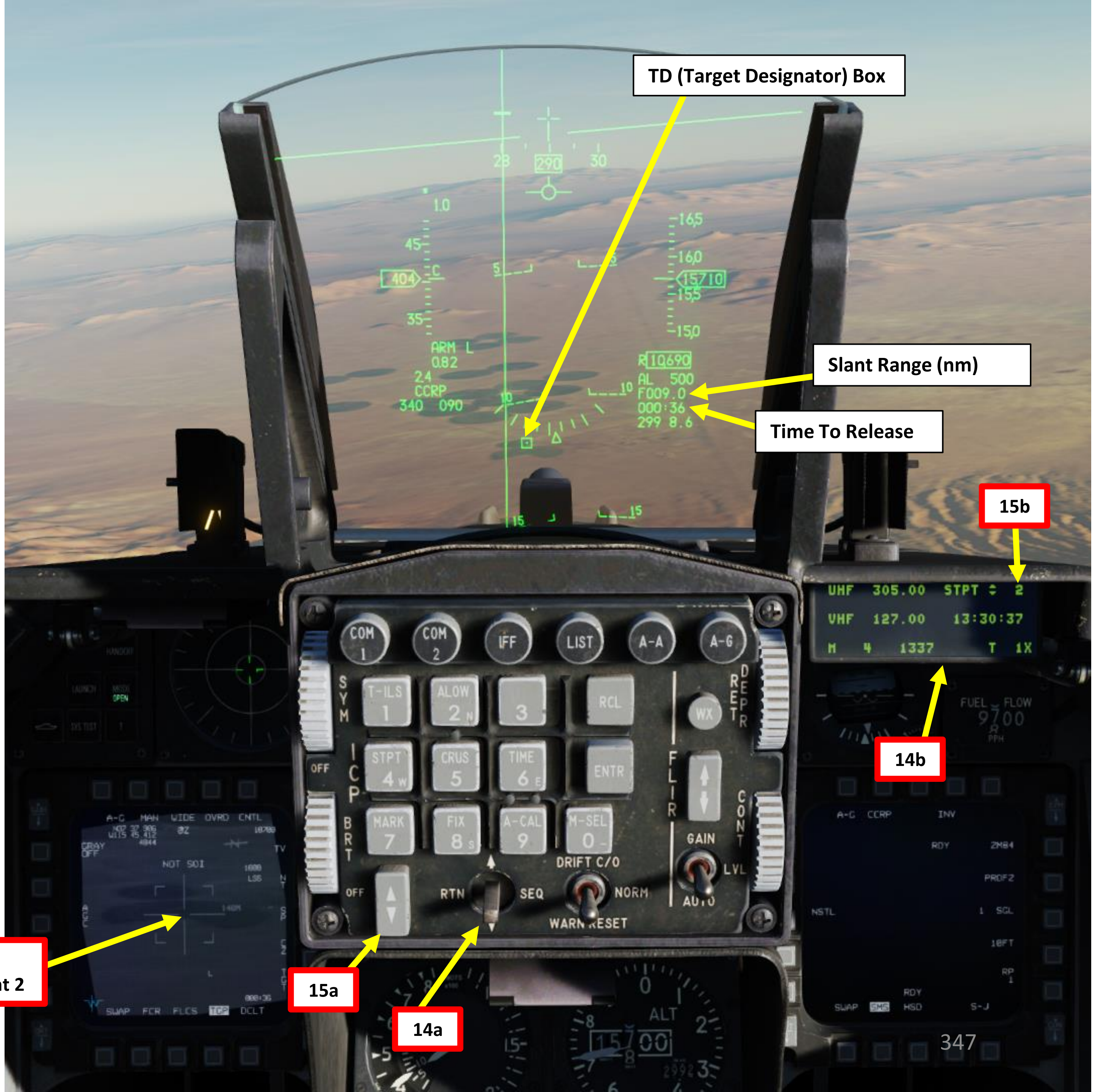
9. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
    - NOSE: Nose Fuze only
    - TAIL: Tail Fuze only
    - NSTL: Nose & Tail, typically used for redundancy.
10. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
    - SGL: Single Launcher
    - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
11. If more than one bomb is to be released, set desired Release Interval option. In our case, this setting is not relevant.
    - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
12. If more than one bomb is to be released, set the number of release pulses. We will leave it at 1.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
13. Verify that System Status displays RDY (Ready) on the SMS page.



2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

- Typically, a Steerpoint should be programmed in your flight plan near the target. In this case, we will assume Steerpoint 2 is set near the target.

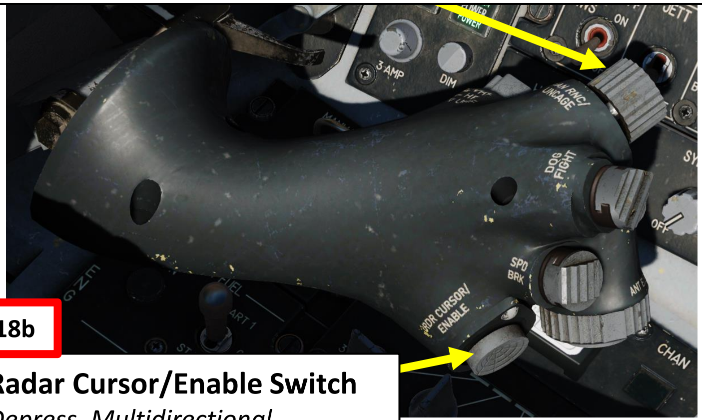
14. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
15. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
16. When CCRP release mode is selected, the Targeting Pod will automatically be slaved to the selected steerpoint (Steerpoint 2 in our case).



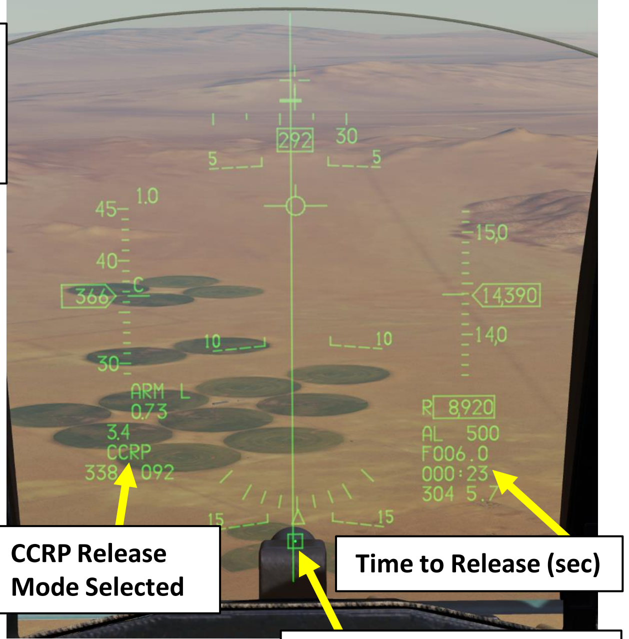
2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

17. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.
18. Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the steerpoint location. Then, slew the targeting pod using the Radar Cursor switch
19. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
20. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
21. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
    - CCW (Counter-Clockwise): Zooms OUT
    - CW (Clockwise): Zooms IN
22. Select Tracking Mode using the TMS (Target Management Switch): TMS UP for Point Track (POINT, tracks moving objects) or TMS RIGHT for Area Track (AREA, tracks static objects).

MAN RNG/UNCAGE Knob/Switch **21**
- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)*



18b
Radar Cursor/Enable Switch
Depress, Multidirectional



CCRP Release Mode Selected

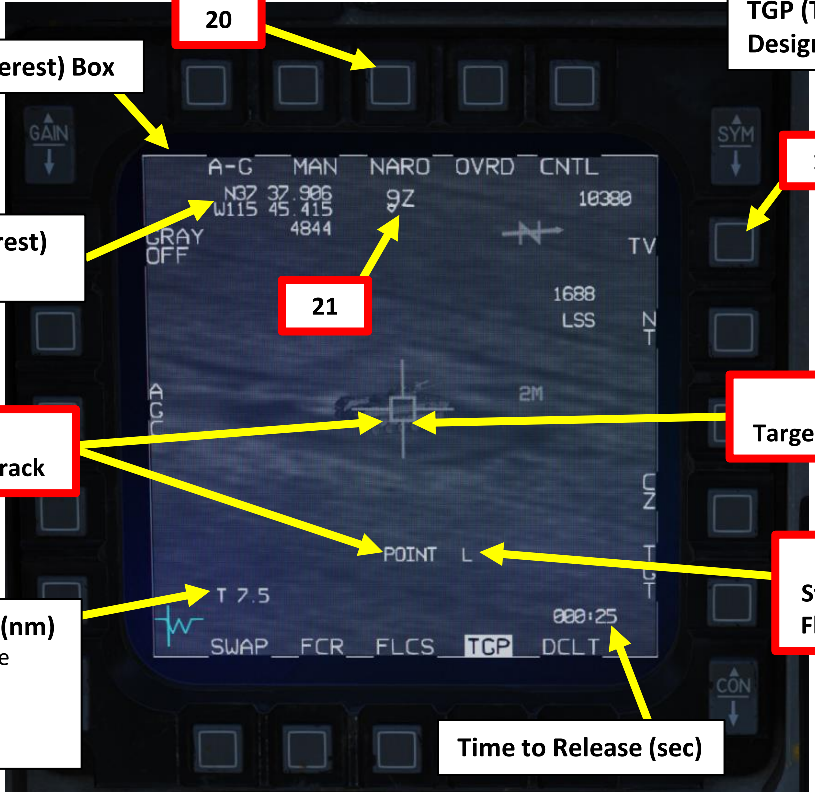
Time to Release (sec)

TGP (Targeting Pod) CCRP Designation Box

DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT **17a**

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT
18a **19** **22**

Expand/FOV (Field-of-View) Button **20**



20

17b **SOI (Sensor of Interest) Box**

SPI (Sensor Point of Interest) Coordinates & Elevation

21

19

18b
Targeting Pod Cursor

22
Point Track

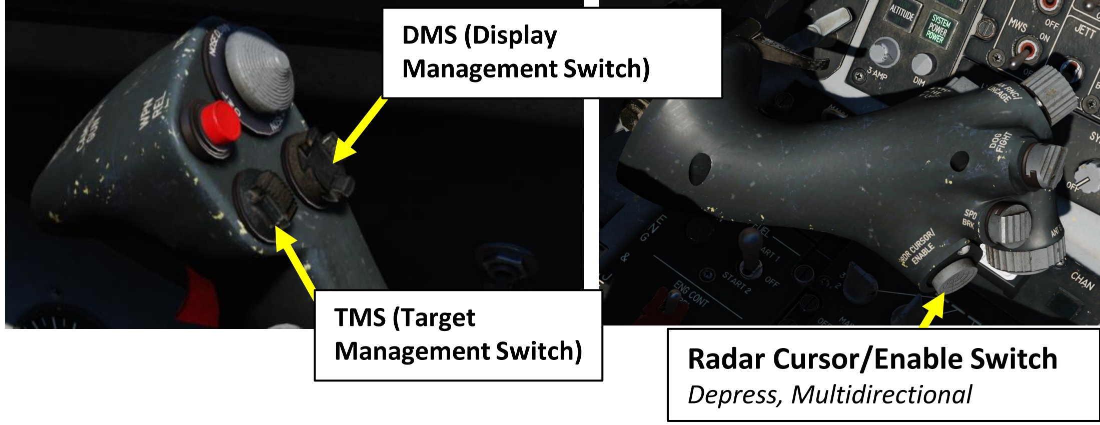
Laser Status
Steady L: Laser Armed
Flashing L: Laser Firing

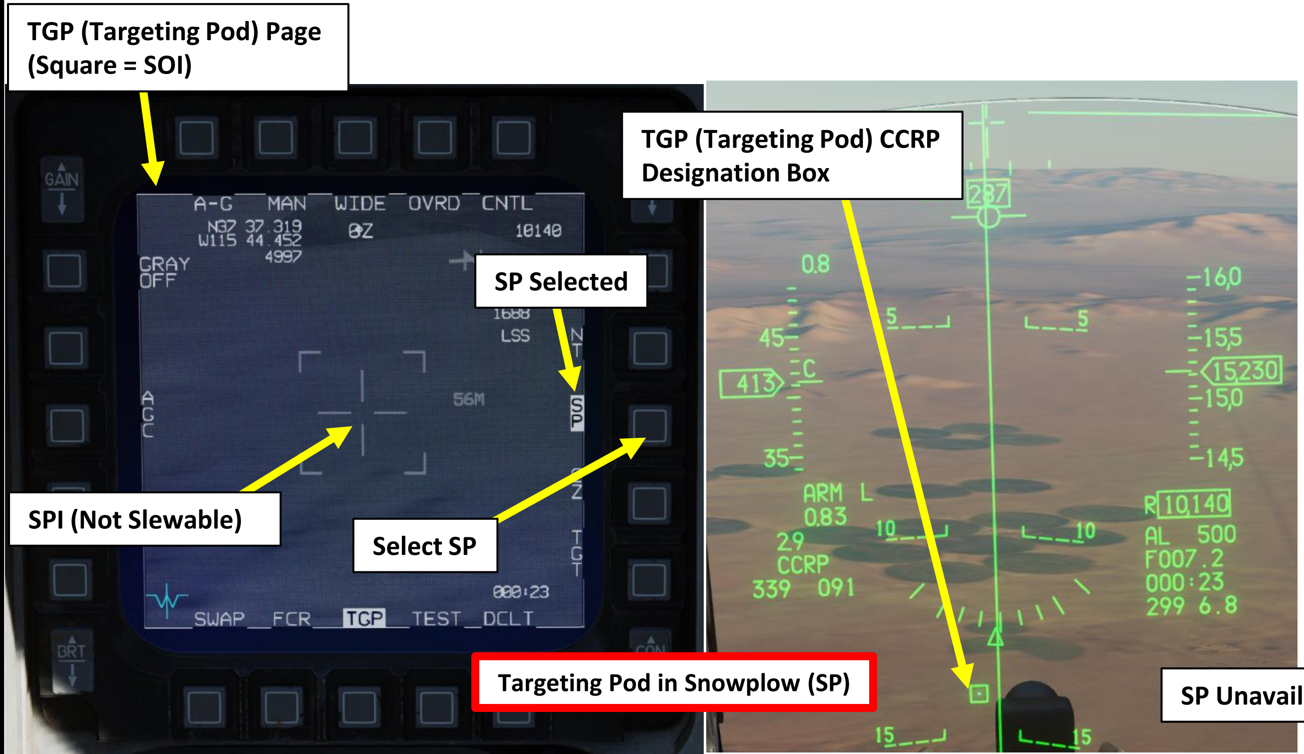
Slant Range to SPI (Sensor Point of Interest) (nm)
The preceding letter indicates the source of the range data.
- L: Laser (priority over all other sources)
- T: Targeting Pod passive ranging

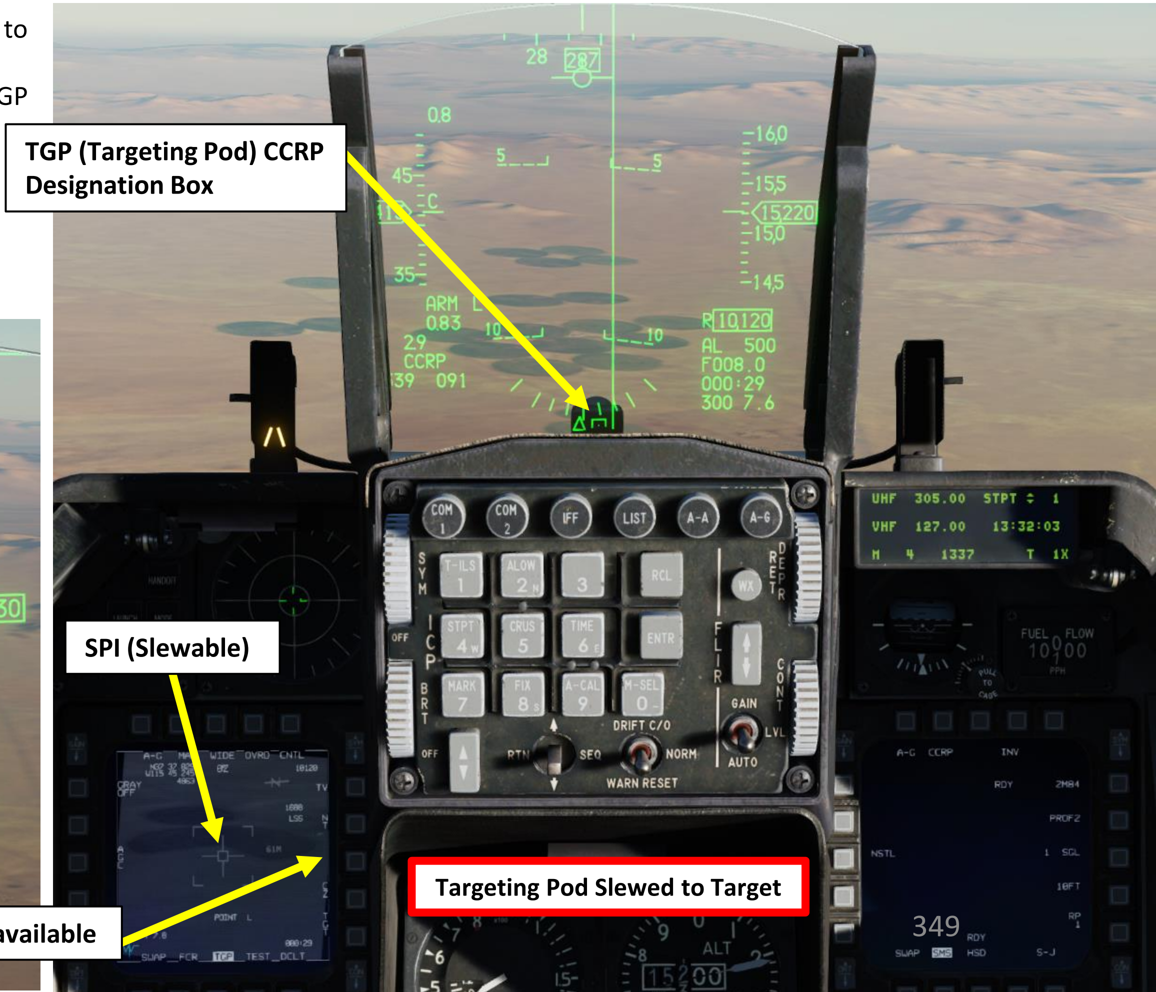
Time to Release (sec)

2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

- Important Note: In the case where a Steerpoint is not available near the target, you can use snowplow mode. To do so:
  a) Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest)
  b) By default, the TGP should be slaved to the selected steerpoint. Reject the target by using TMS (Target Management Switch) DOWN
  c) SP function should be available on the TGP page.
  d) Press OSB (Option Select Button) next to SP to activate Snowplow mode.
  e) The targeting pod's line-of-sight is commanded straight ahead and angled downwards to point to the ground ahead
  f) Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the location of the TGP reticle. This will exit SP Mode and make the SPI slewable.
  g) Slew the targeting pod as desired using the Radar Cursor switch.

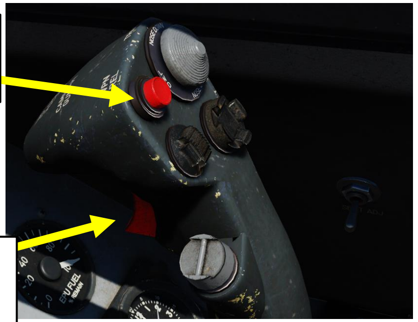


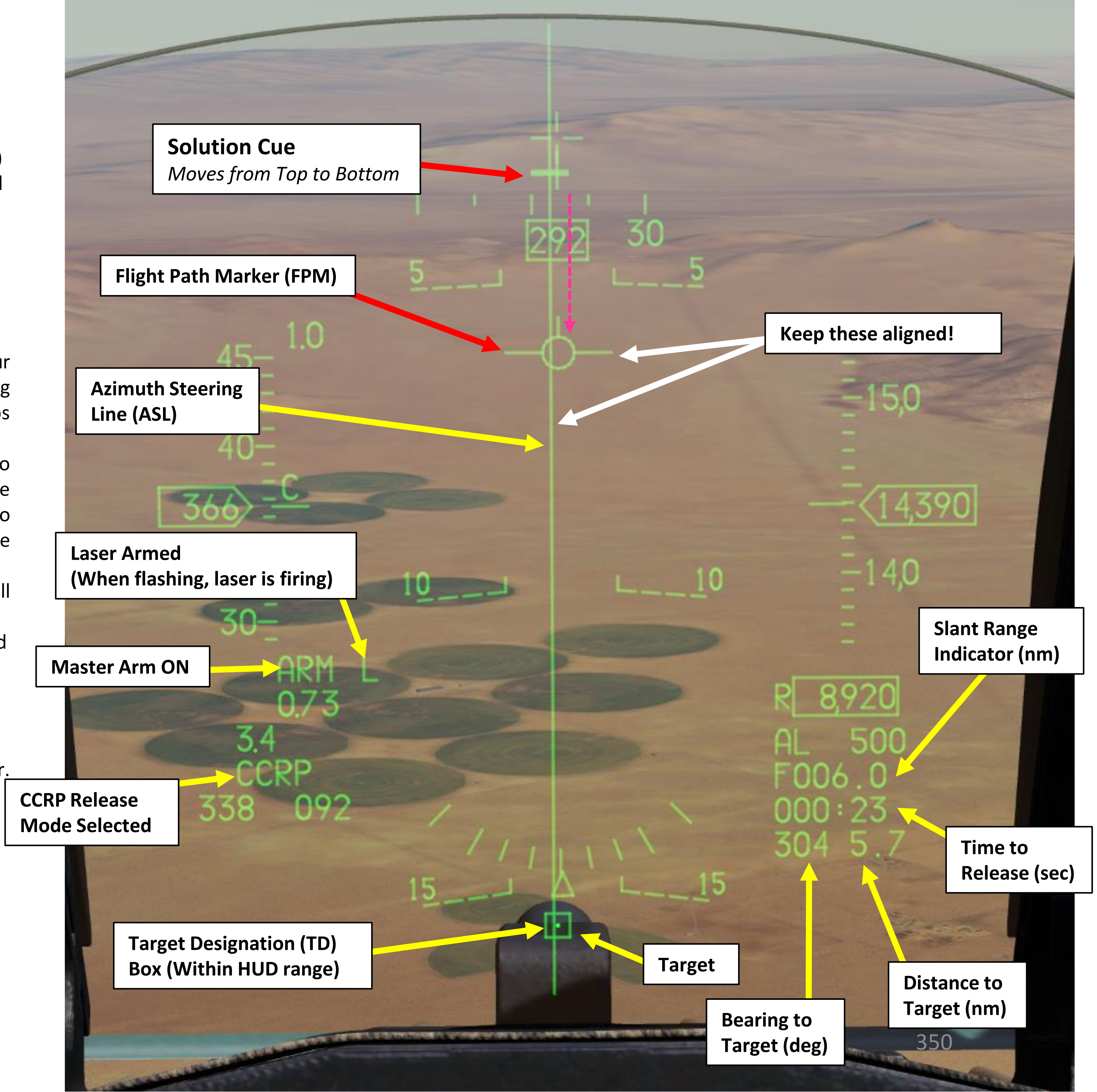




2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

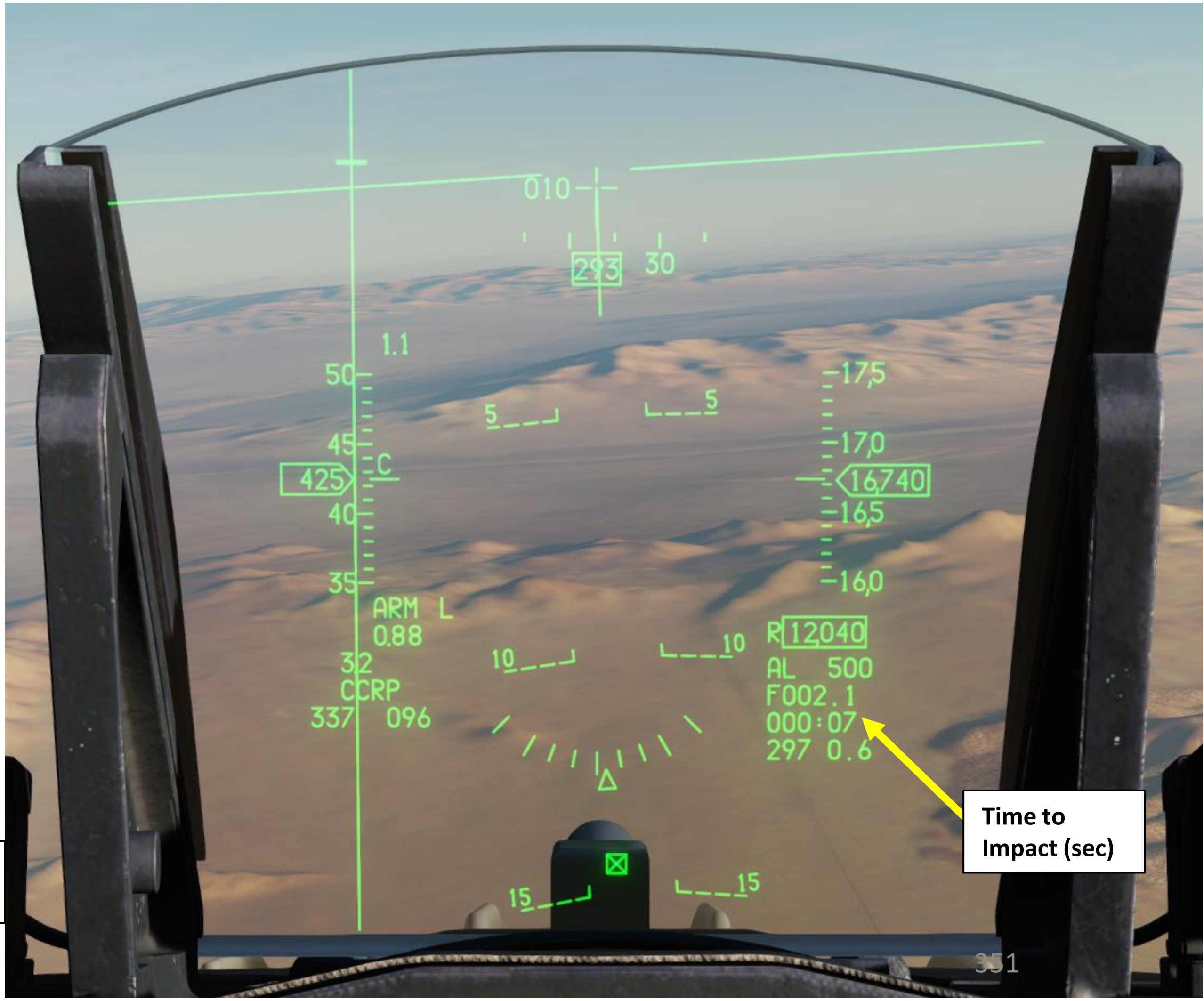
16. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Steerpoint/Target is displayed on the Heads-Up Display.
17. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
18. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
19. (Optional) If desired, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the "L" symbol on the HUD will flash. Releasing the trigger stops lasing.
    - When "laser ranging", the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
    - If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.
20. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).
21. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
22. The bomb is released when the Solution Cue passes the Flight Path Marker.





2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

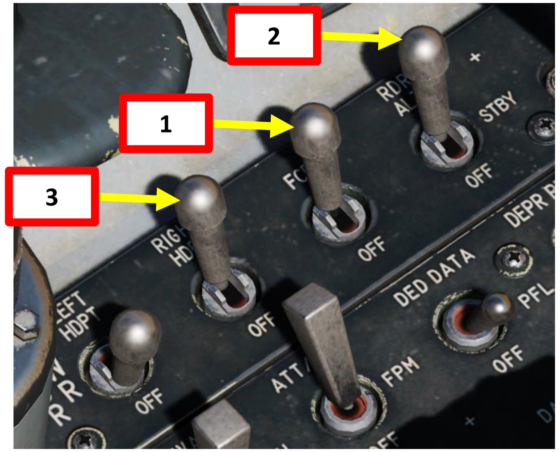
23. Once bomb is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the Targeting Pod and HUD.



2.1.4 – UNGUIDED BOMB – MK-84 (CCRP with Targeting Pod)

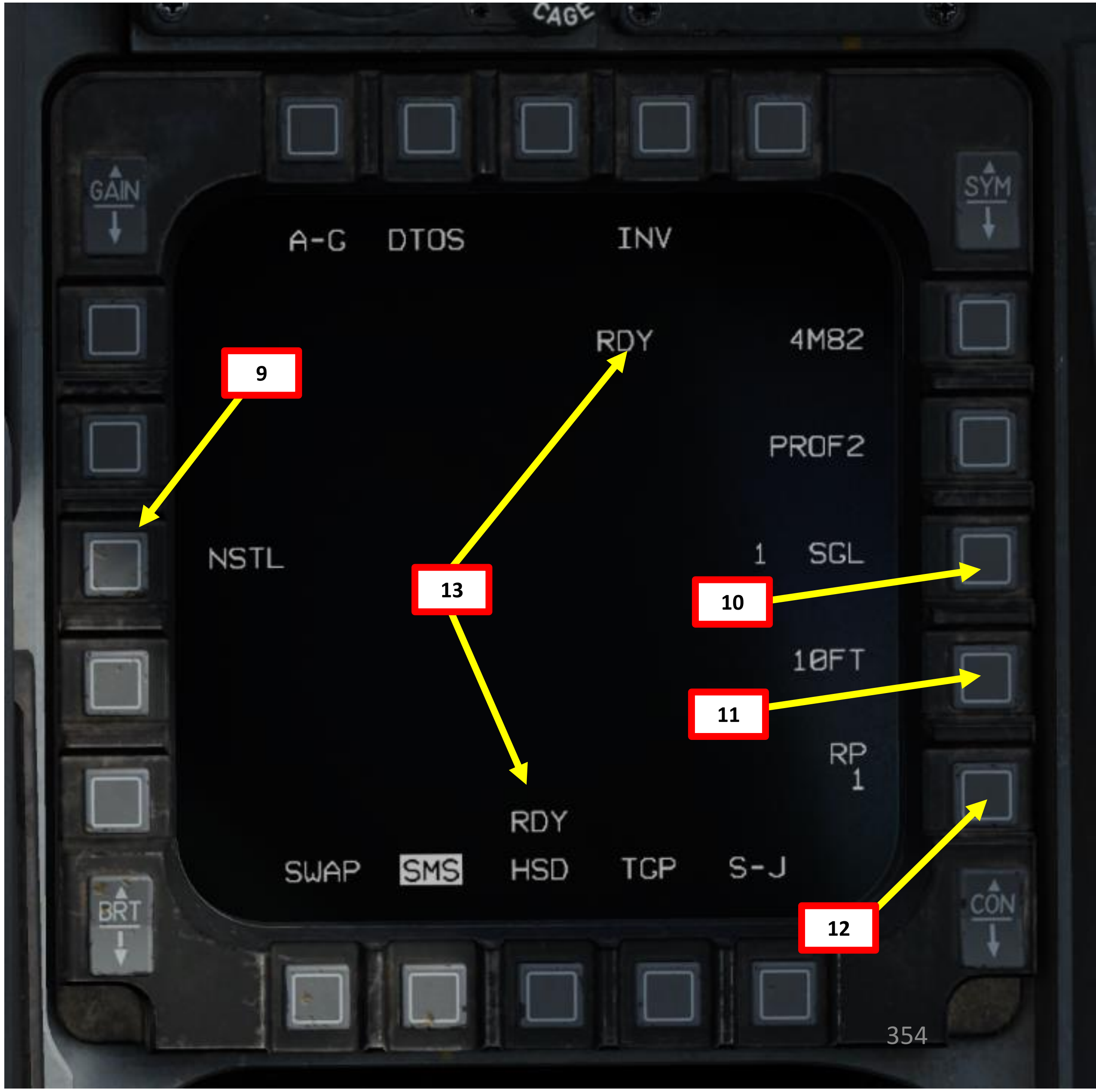
2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR can be used for target ranging if you switch between designation methods.
2. Verify that Radar Altimeter (RDR ALT) switch is ON (FWD)
3. Power up the targeting pod; set the RIGHT HDPT switch to ON (FWD).
4. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
5. Set Master Arm switch – ARM (UP)
6. On the SMS (Stores Management Set) page, select MK-82 bombs (M82) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
7. On the SMS page, select desired weapon profile.
8. On the SMS page, select DTOS (Dive Toss) release mode by pressing the OSB next to the Release Mode option and select OSB next to "DTOS". Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.



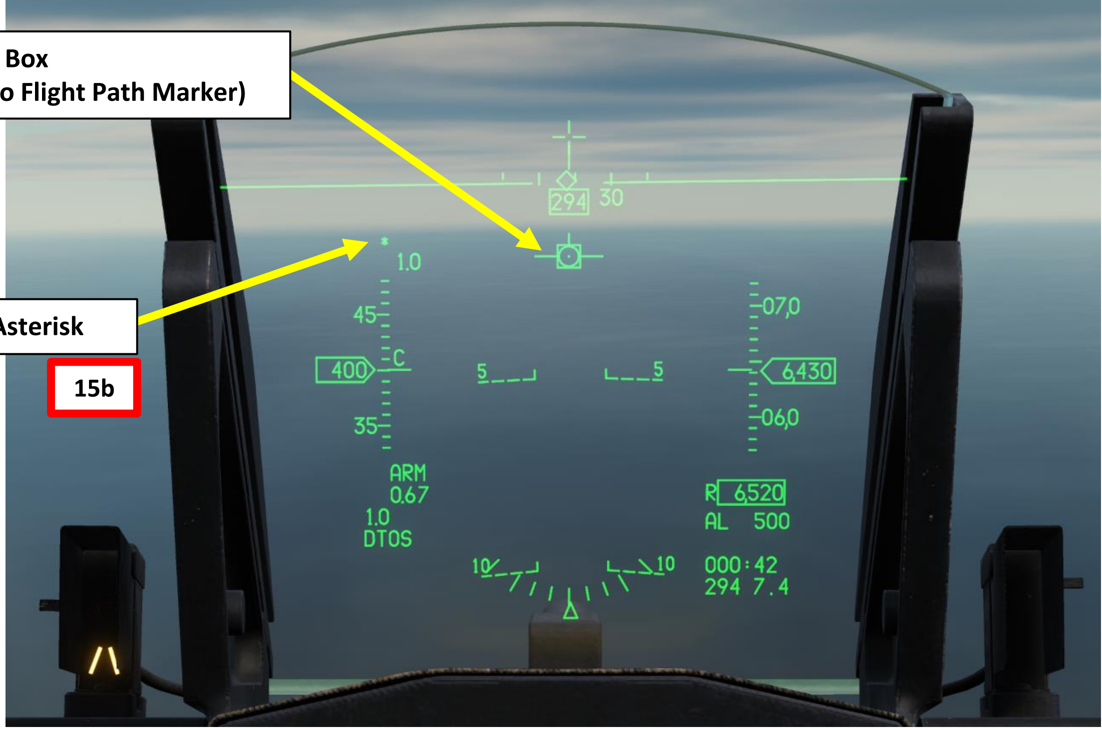
2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

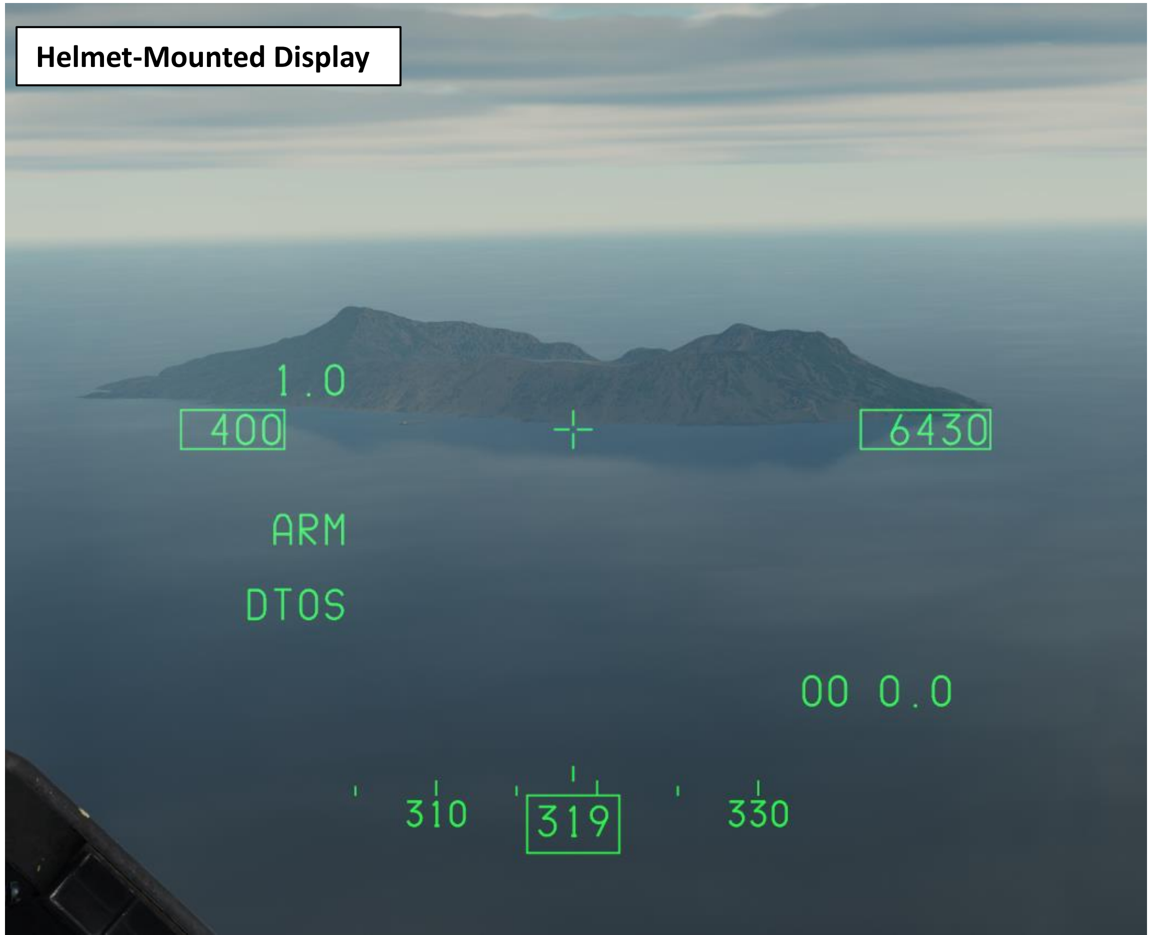
9. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
    - NOSE: Nose Fuze only
    - TAIL: Tail Fuze only
    - NSTL: Nose & Tail, typically used for redundancy.
10. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
    - SGL: Single Launcher
    - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
11. If more than one bomb is to be released, set desired Release Interval option. In our case, this setting is not relevant.
    - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
12. If more than one bomb is to be released, set the number of release pulses. We will leave it at 1.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
13. Verify that System Status displays RDY (Ready) on the SMS page.

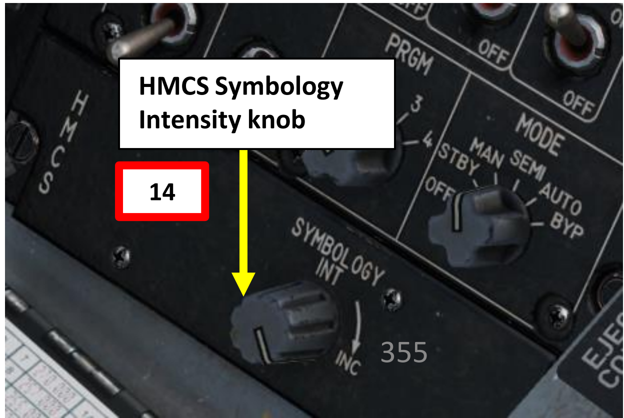


2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

14. Turn HMCS Symbology Intensity knob to INC.
15. Press DMS (Display Management Switch) UP to set HUD (Heads-Up Display) as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls. In DTOS (Dive Toss) mode, the HUD TD Box is initially caged to the Flight Path Marker (FPM).
    - While the HUD is set as the SOI, the HMD (Helmet-Mounted Display) will also be useable to designate the target.

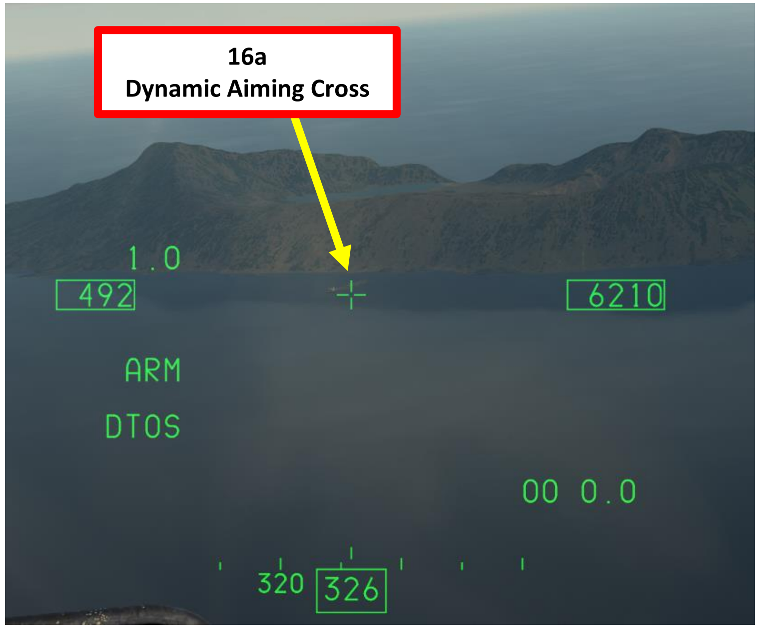


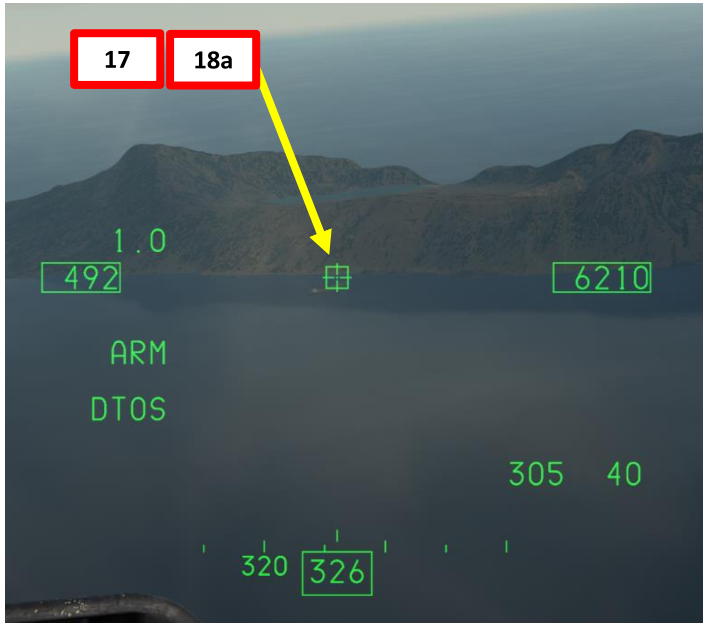


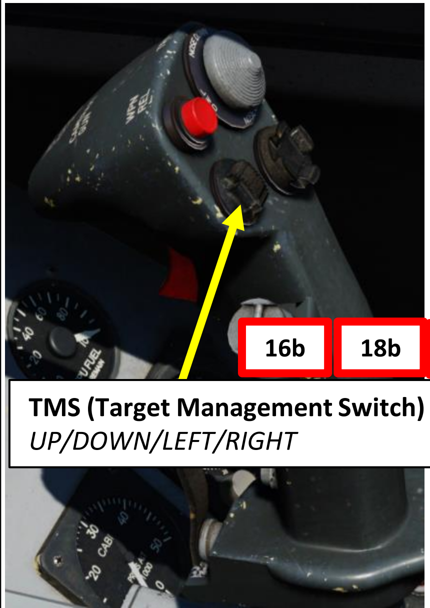


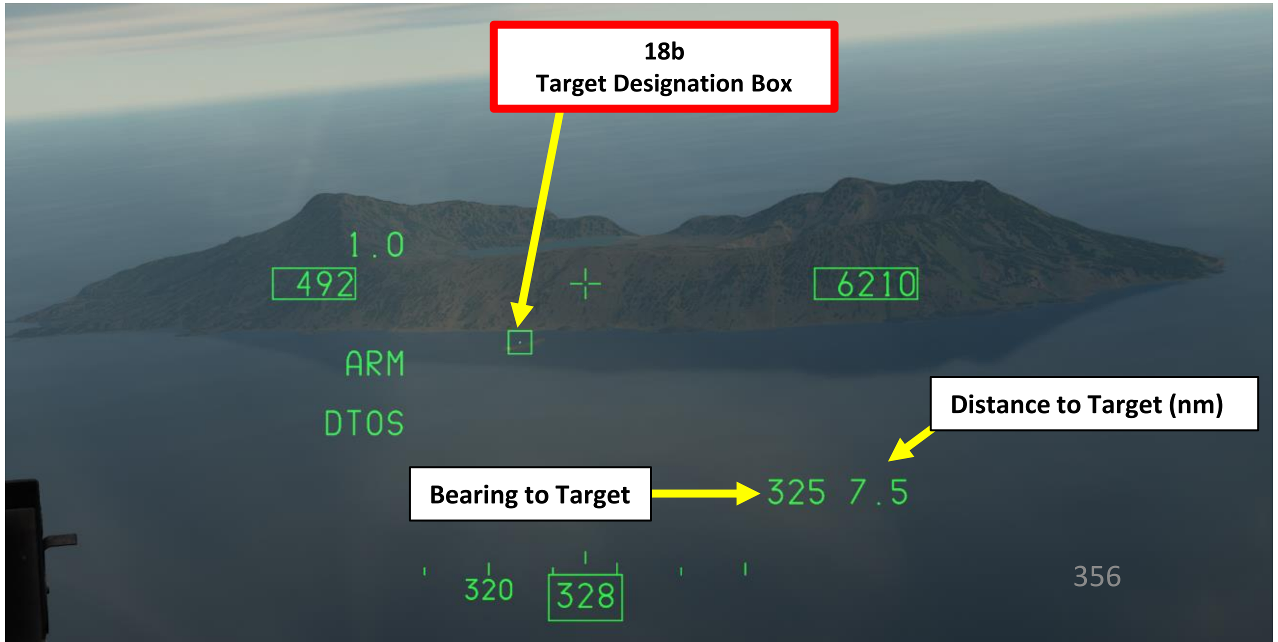
2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

16. By default, only the Dynamic Aiming Cross (DAC) is visible on the HMD (Helmet-Mounted Display). Press and hold the TMS (Target Management Switch) UP for more than 0.5 sec.
17. A TD (Target Designation) box will appear on the Dynamic Aiming Cross (DAC) of the helmet.
18. Move the helmet's aiming cross on the desired area, then press TMS (Target Management Switch) UP to designate target. The TD box will be slaved to this designated point and become the SPI (Sensor Point of Interest).
19. Slew the TD box with the Radar Cursor/Enable Switch controls as desired.
20. If you want to un-designate the target in order to re-designate, press TMS (Target Management Switch) DOWN.



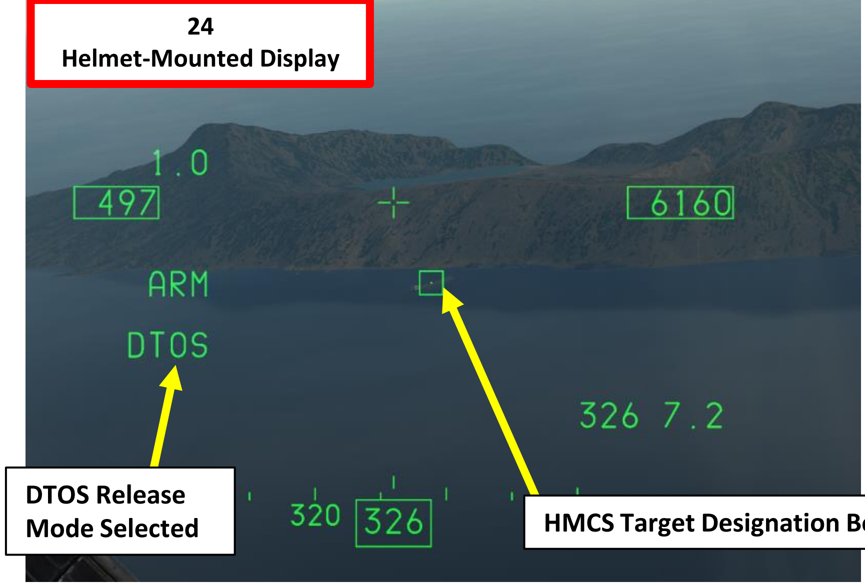


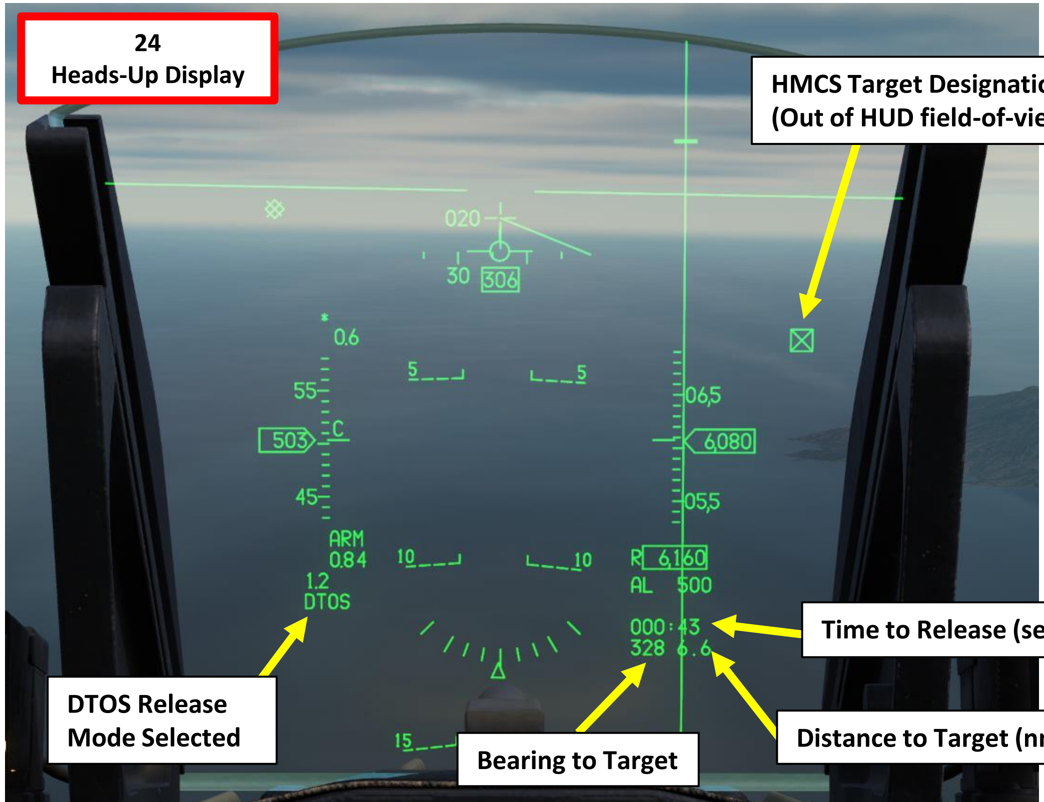




2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

21. Select TGP (Targeting Pod) page. Since the SPI (Sensor Point of Interest) was designated from the HMCS (Helmet-Mounted Cueing System), the targeting pod is automatically slaved to this designated target.
22. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button).
23. Set Field of View as desired using the NARO/WIDE.
24. Slew the HMCS TD (Target Designation) box using the Radar Cursor switch. Since the HUD/HMCS is the sensor of interest, the targeting pod will automatically track the HMCS TD box, allowing you to perform smaller adjustments while using the targeting pod feed as a sort of magnifying glass to use as visual feedback.



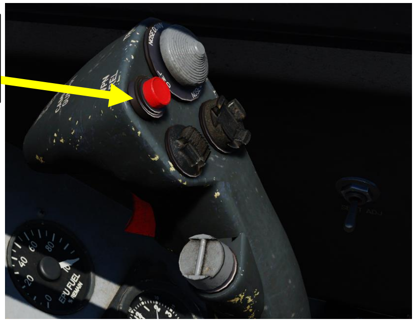


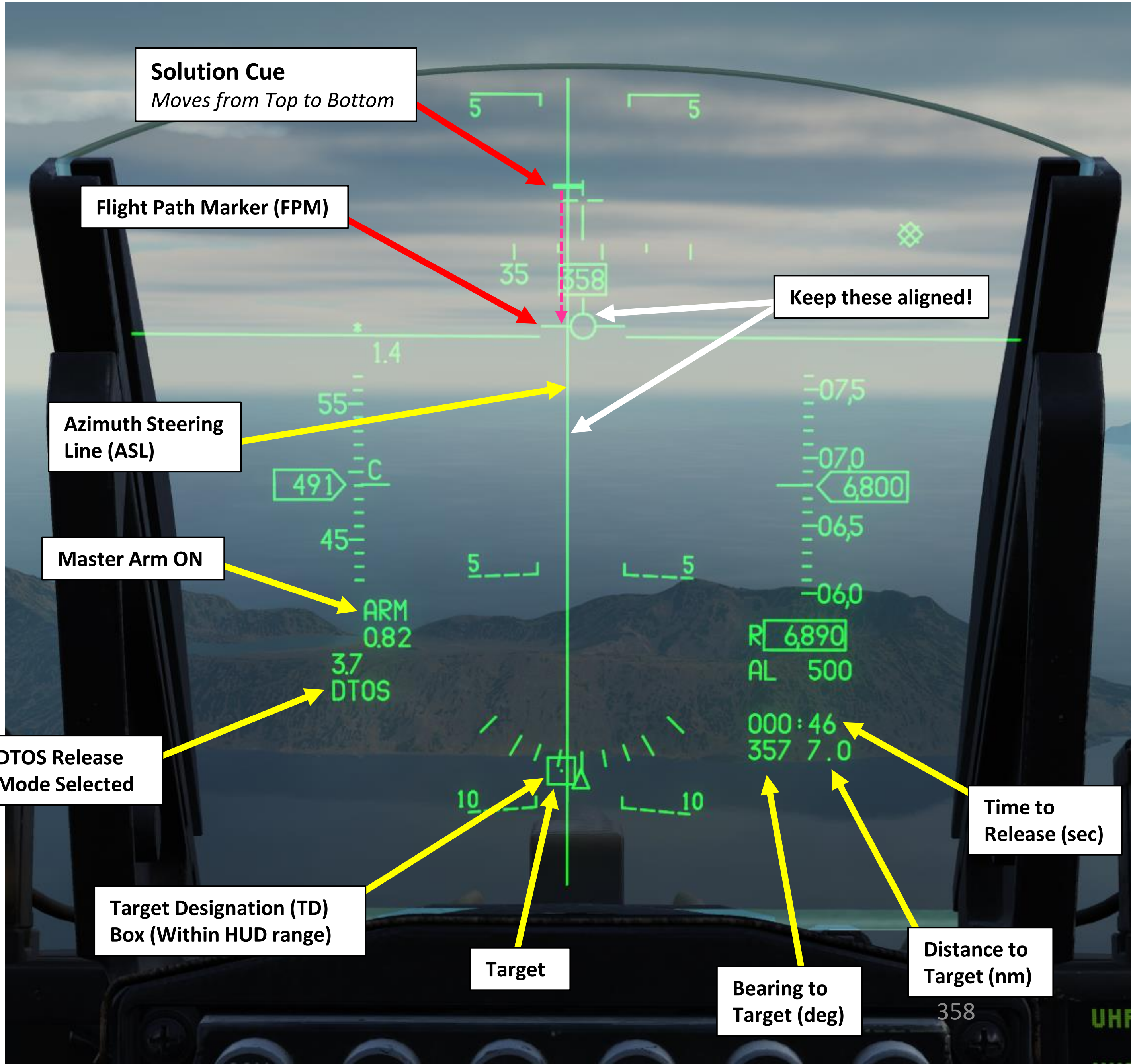
2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

25. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Target is displayed on the Heads-Up Display.
26. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
27. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
28. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).
29. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
30. The bomb is released when the Solution Cue passes the Flight Path Marker.

28

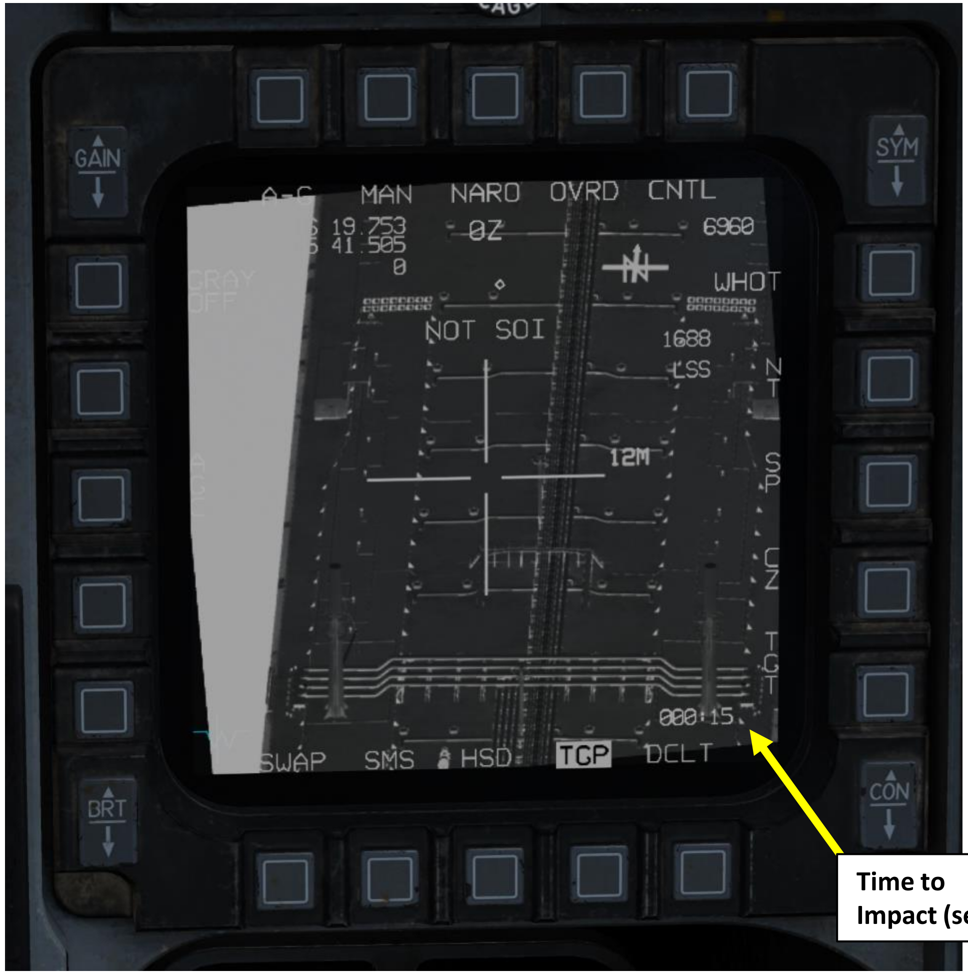
Weapon Release Button

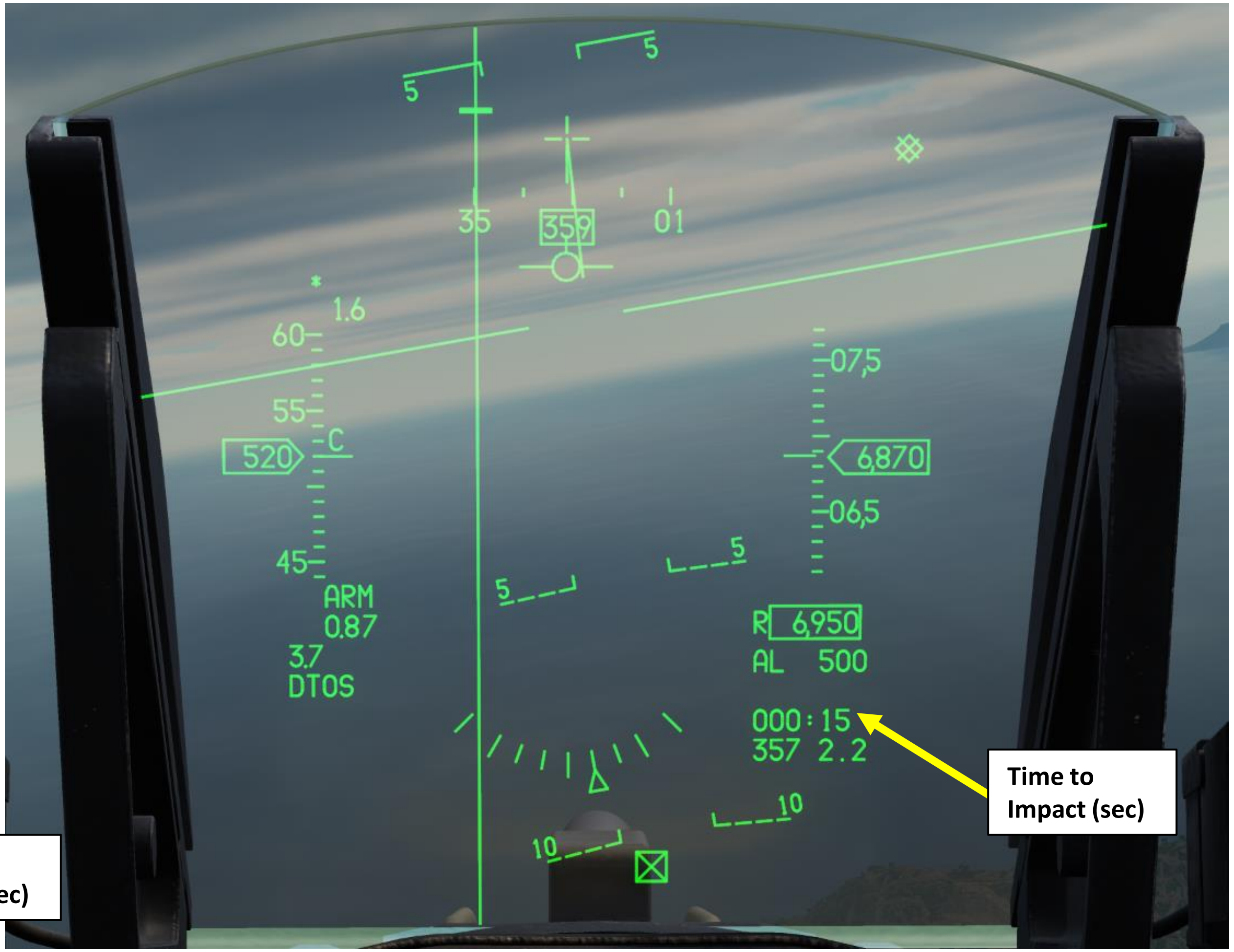




2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

31. Once bomb is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the Targeting Pod and HUD.





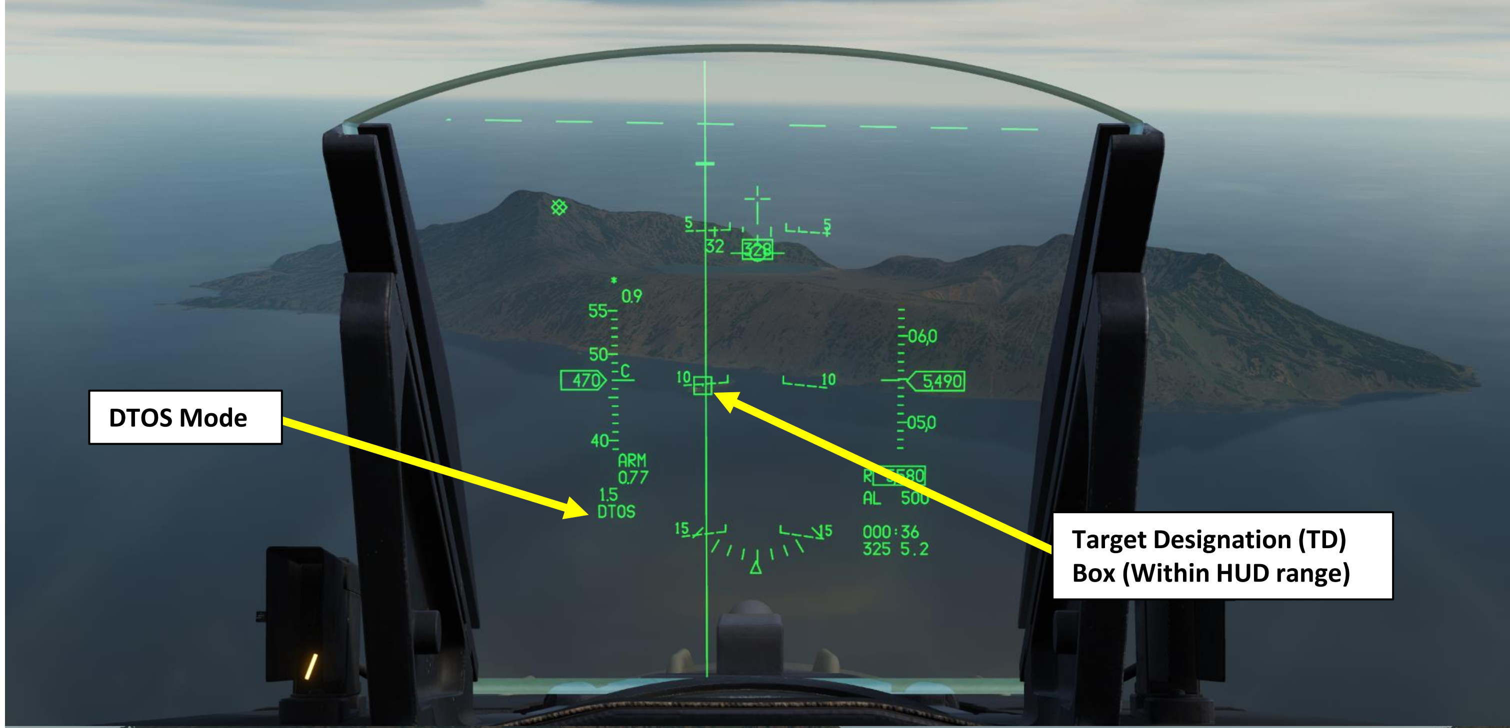
2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

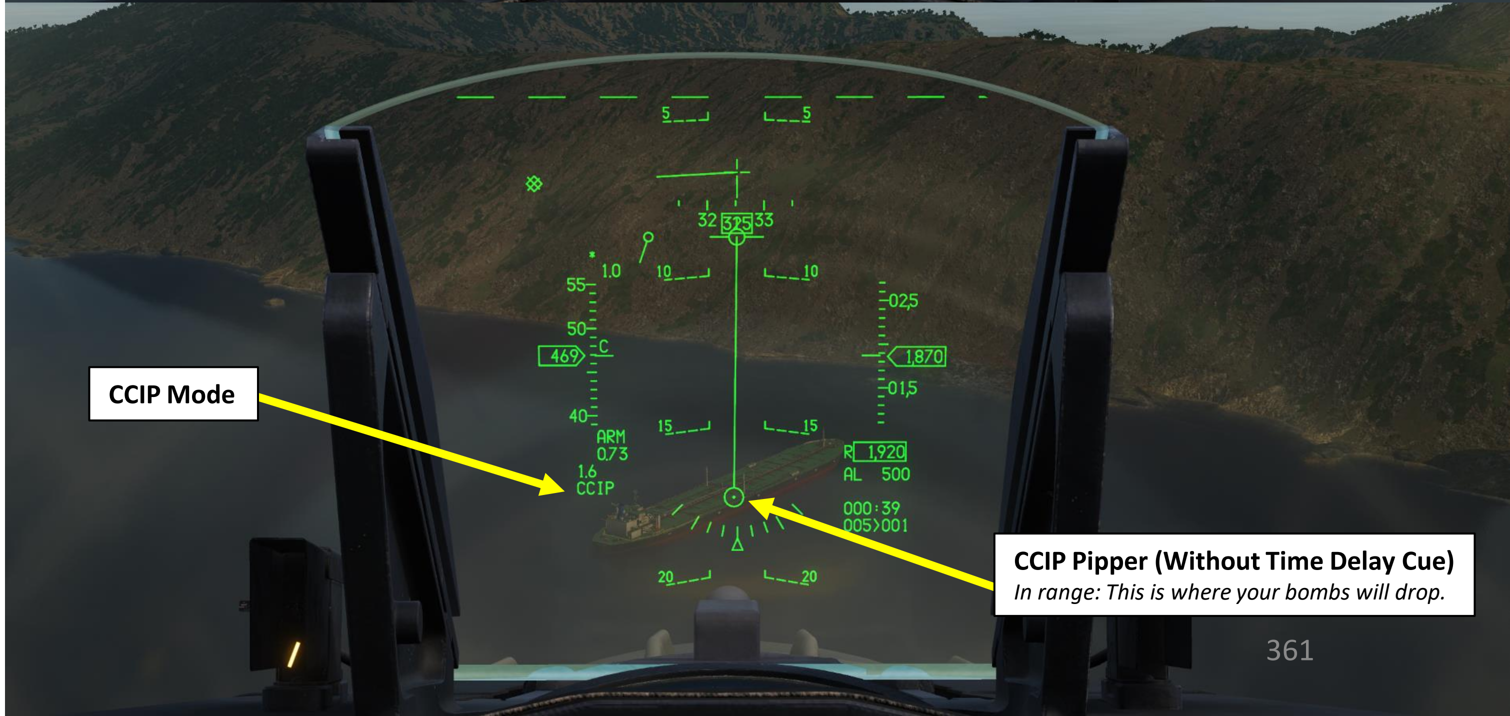
2.1.5 – UNGUIDED BOMB – MK-82 (DTOS with HMCS & Targeting Pod)

Note:

There are other techniques that can be use with DTOS mode, such as using the NWS A/R DISC & MSL STEP button on the stick to toggle release modes.

As an example you can first designate a target using DTOS (Dive Toss) mode, then dive on the target and use the NWS A/R DISC & MSL STEP button to switch to CCIP (Continuously Computed Impact Point) mode, which allows you to drop bombs more precisely.





2.2 – CLUSTER MUNITIONS

CBUs (Cluster Bomb Units) are generally used against “soft” targets. Some of them like the CBU-103 and CBU-105 use Wind Corrected Munition Dispenser kits to correct the effect of the wind on their trajectory.
Keep in mind that there are two parameters that affect the effectiveness of CBUs.

- **Height of Function (HoF),** which determines at which height the bomblets will release. It impacts area spread and accuracy.
- **RPM**, which is the area spread of the bomblets that affects the concentration of fire available on the target. This parameter is applicable to the CBU-87 and CBU-103 only.

Take note that the general bomblet footprint coverage is 200 by 400 meters.

CBU (Cluster Bomb Unit) Types

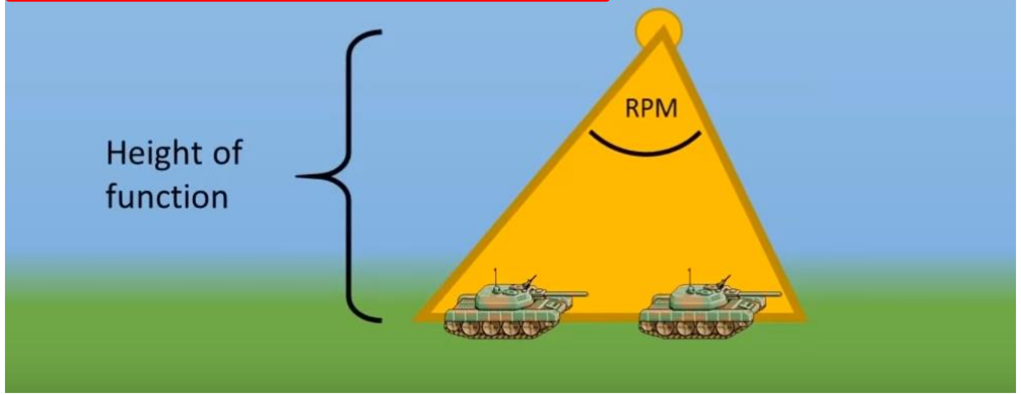
CBU-87 (CB87B): This Combined Effects Munitions (CEM) weighs 950 lbs and is an all-purpose cluster bomb. The SW-65 Tactical Munitions Dispenser contains 202 BLU-97/B Combined Effects Bomblets (CEB) and they are effective against armored and unarmored targets.
*Preset HoF parameter: 1500 ft / **(RPM parameter is fixed and cannot be changed)***

CBU-103 (CB103): Standard CBU-87 cluster bomb fitted with an INS guidance kit to form a Wind Corrected Munition Dispenser (WCMD, or “Wick Mid”). Unlike the GBU-31 and GBU-38, a WCMD does not use GPS guidance. Rather, the WCMD system uses the aircraft’s inertial navigation system to “know” its current location and the location of the target, and then use the tail kit to steer the bomb to the target location.
Recommended HoF/RPM parameters: 2000 ft/500

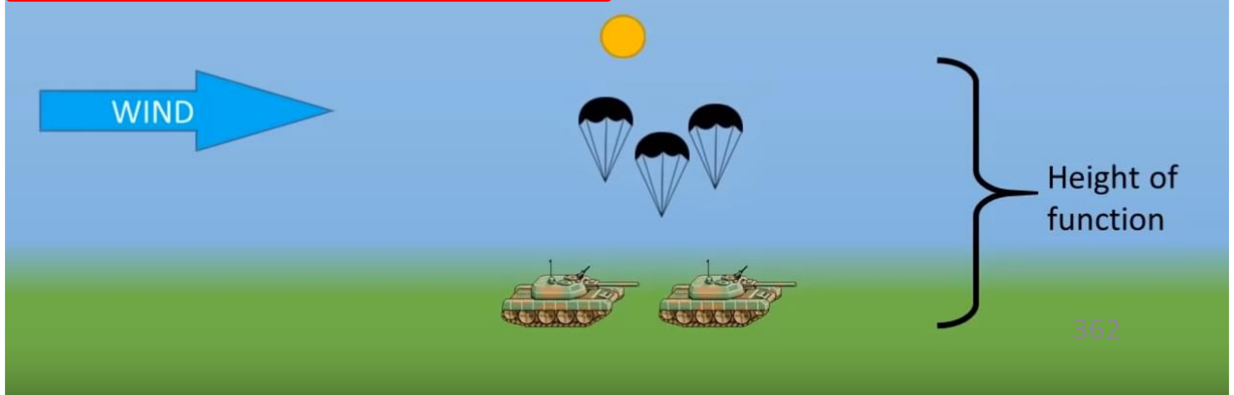
CBU-97 (CB97B): 1,000-pound class weapon containing sensor-fused sub-munitions for specifically attacking armor.
*Preset HoF parameter: 1500 ft / **(RPM parameter is fixed and cannot be changed)***

CBU-105 (CB105): Wind Corrected Munitions Dispenser (WCMD, or “Wick Mid”) tail kit version of the CBU-97. Using Inertial Navigation System (INS) guidance, the CBU-105 can be dropped at much higher altitudes than the CBU-97 and guide to the targeted location (SPI).
Recommended HoF parameter: 2000 ft

Parameters (Applicable for CBU-87 and CBU-103)

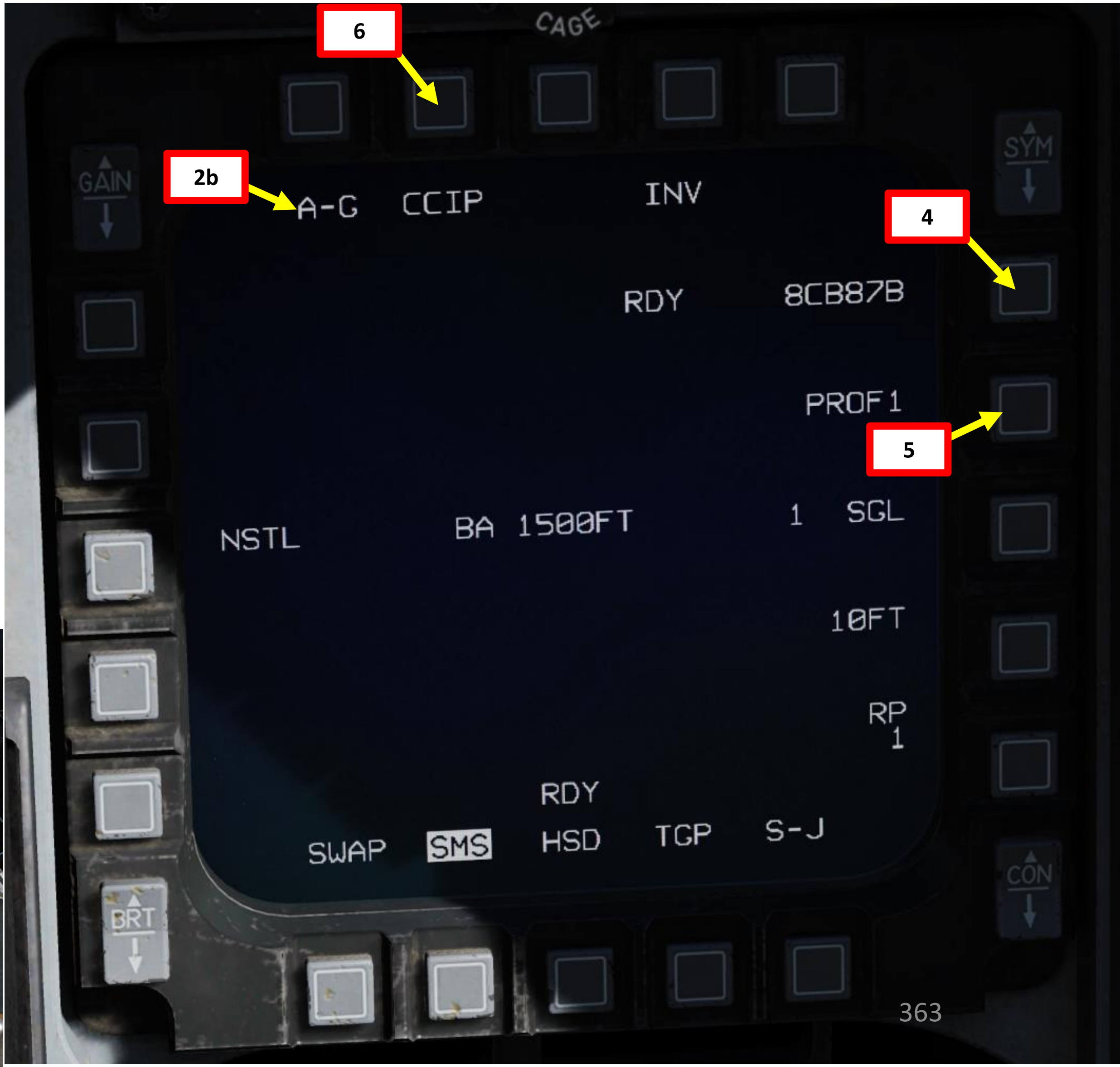


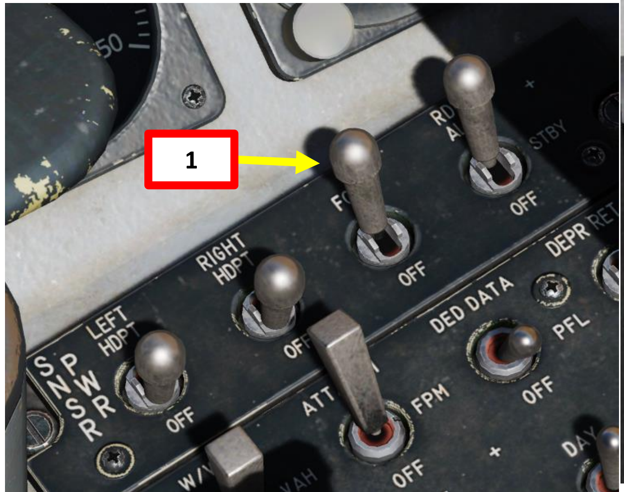
Parameters (Applicable for CBU-97 and CBU-105)



2.2.1 – CBU-87 CLUSTER BOMB (CCIP)

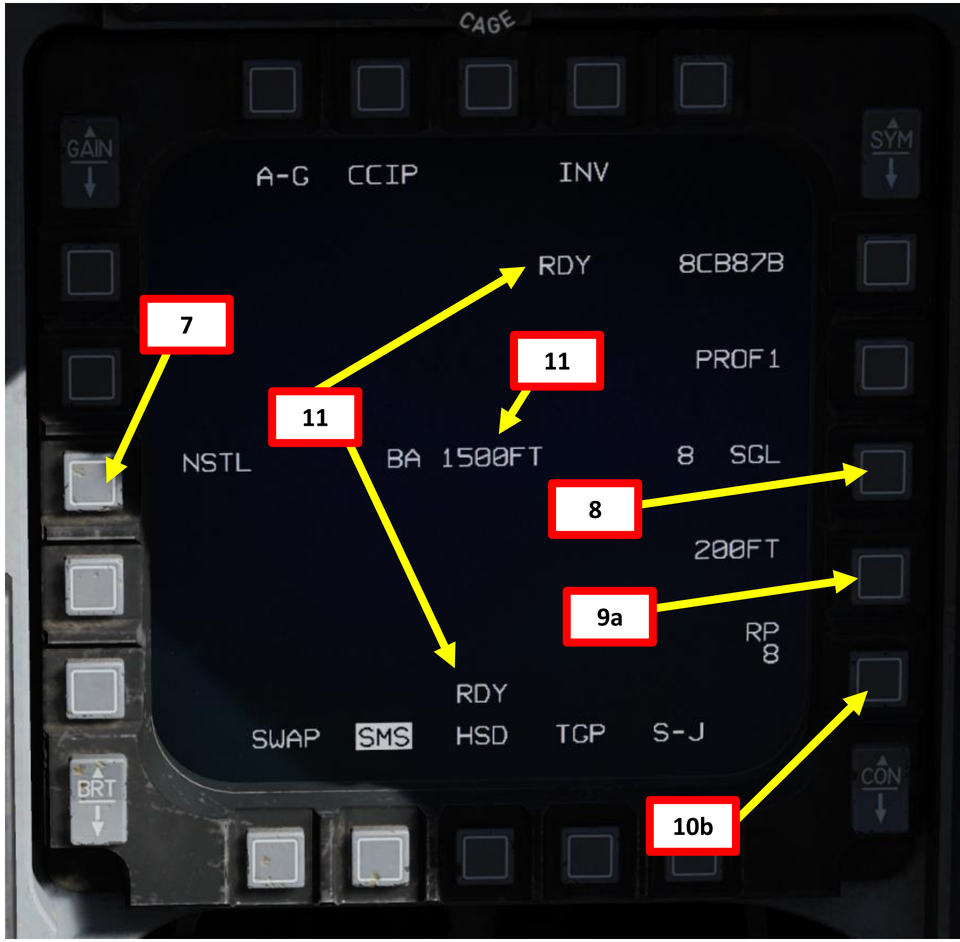
1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, select CBU-87 bombs (CB87B) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
5. On the SMS page, select desired weapon profile. Let's take PROF1 since it is CCIP-compliant by default.
6. On the SMS page, verify that CCIP (Continuously Computed Impact Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to "CCIP". Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.

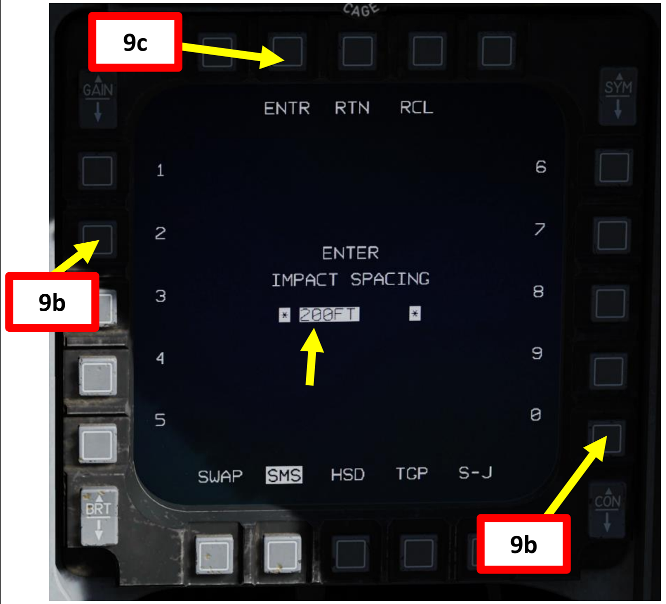


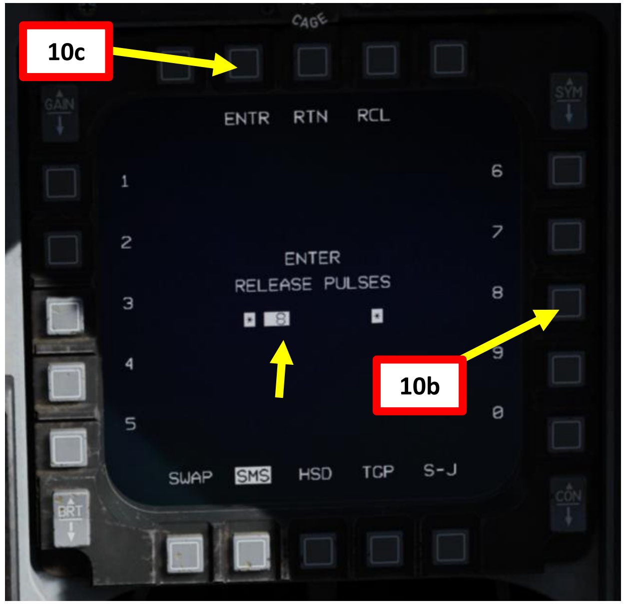


2.2.1 – CBU-87 CLUSTER BOMB (CCIP)

7. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
    - NSTL (Nose & Tail): Bomblets dispense using settings displayed on SMS page
    - NOSE: Bomblets dispense immediately after release
    - TAIL: Dud (Disarmed)
8. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
    - SGL: Single Launcher
    - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
9. If more than one bomb is to be released, set desired Release Interval option. In our case, we will set 200 ft.
    - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
10. If more than one bomb is to be released, set the number of release pulses. We will set it to 8.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
11. The Height of Function (BA stands for Burst Altitude) setting should be set to 1500 ft (cannot be modified yet).
12. Verify that System Status displays RDY (Ready) on the SMS page.

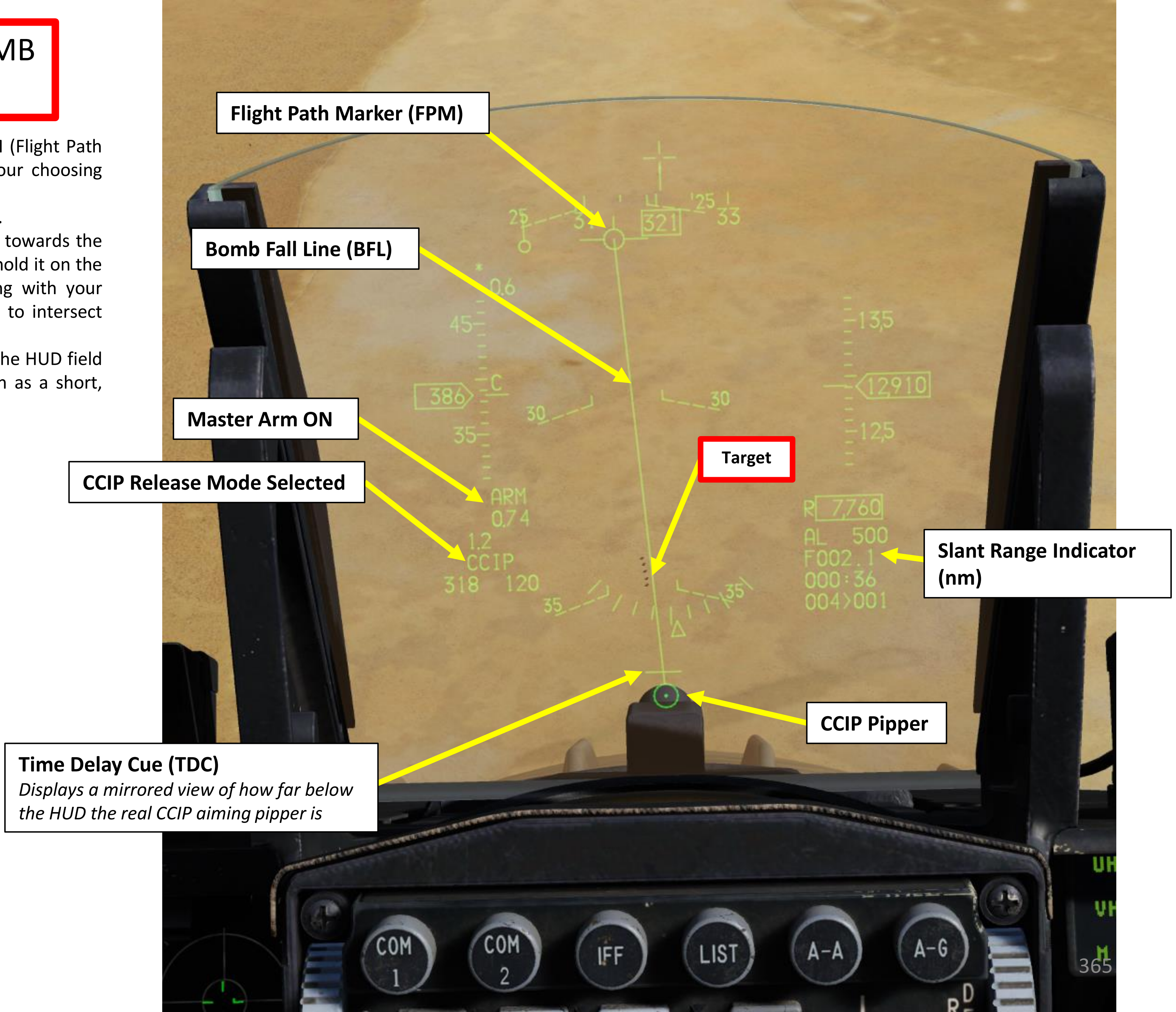






2.2.1 – CBU-87 CLUSTER BOMB (CCIP)

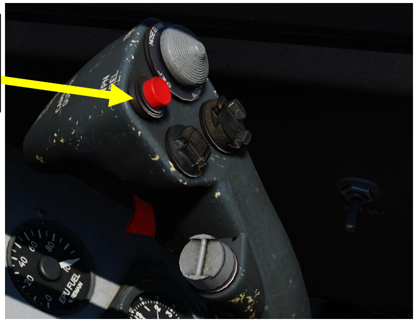
13. When performing your dive, place your FPM (Flight Path Marker) to an Aim Off Distance Point of your choosing (typically 2000 ft further than the target).
14. Align the BFL (Bomb Fall Line) with the target.
15. The CCIP pipper tracks up the bomb fall line towards the target.. Don't fly the pipper to the target or hold it on the target using forward stick (you risk colliding with your own bomb on release). Wait for the pipper to intersect the target naturally.
16. If the CCIP impact point does not lay within the HUD field of view, the Time Delay Cue (TDC) is shown as a short, horizonal line on the Bomb Fall Line.

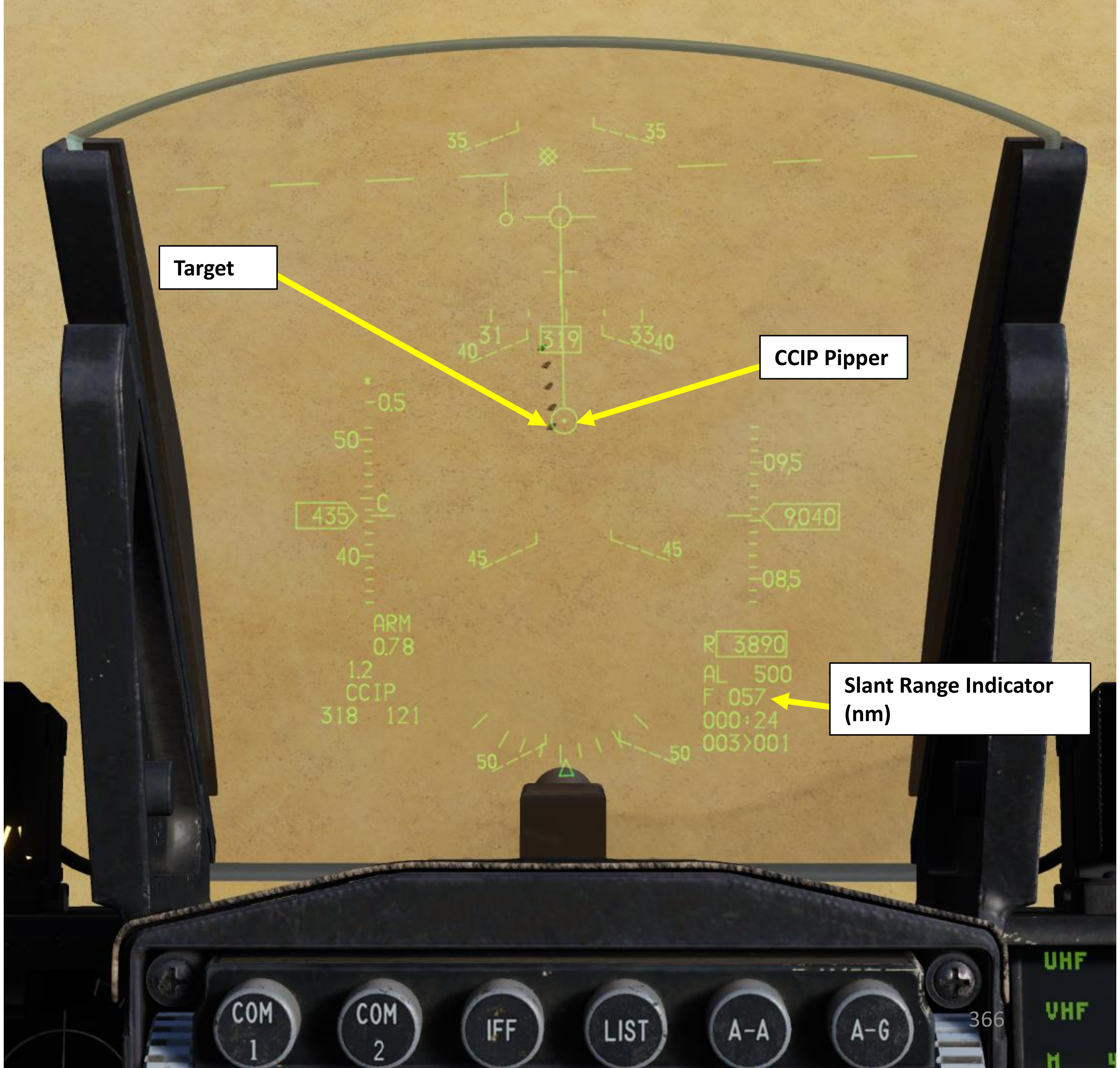


2.2.1 – CBU-87 CLUSTER BOMB (CCIP)

17. When the TDC is no longer displayed on the Bomb Fall Line, the pipper is in the HUD field of view. That will be the impact point if the bombs are released immediately.
18. Monitor the Pull-Up Anticipation Cue (PUAC) to ensure it does not go above the Flight Path Marker.
19. When CCIP pipper intersects the target, depress the Weapon Release (RALT+SPACE) button to release the bomb.

19 Weapon Release Button





2.2.1 – CBU-87 CLUSTER BOMB (CCIP)

20. After release, fly a safe escape maneuver to avoid the bomb fragmentation.
A 5G pull-up to a 30-deg climb is recommended.

2.2.1 – CBU-87 CLUSTER BOMB (CCIP)

2.2.2 – CBU-105 WCMD INTRODUCTION

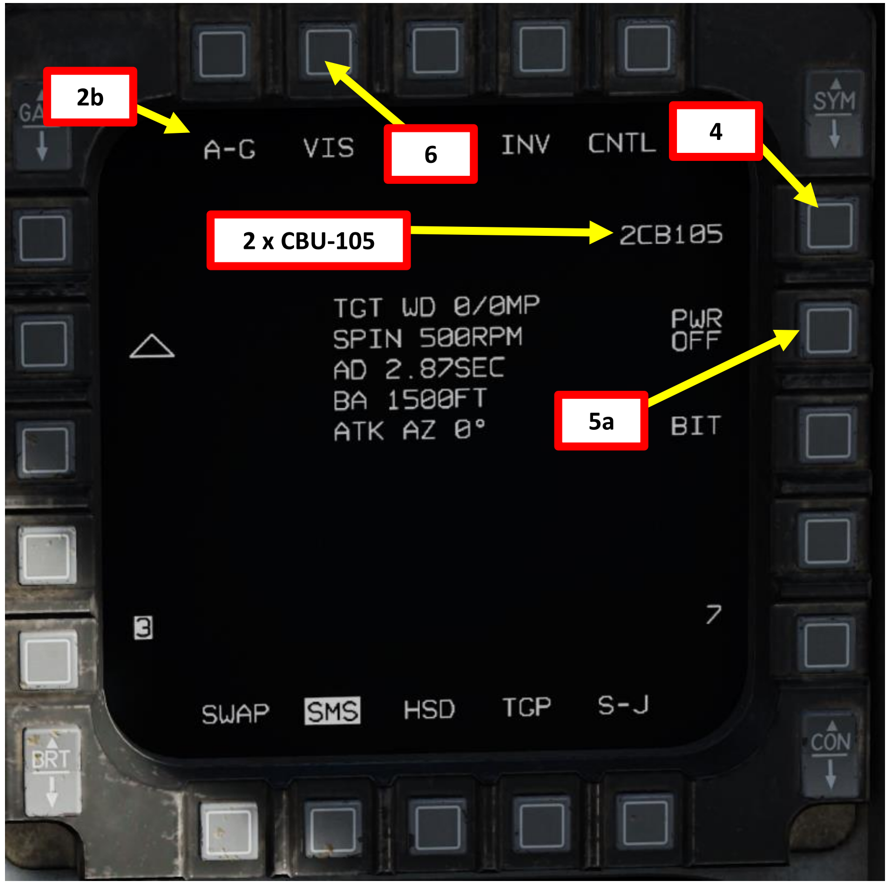
The WCMD can be released in either VIS (Visual) Mode or in PRE (Pre-Planned) Mode. VIS Mode is better used when a target is visible directly on the Heads-Up Display; you can designate the target from it by slewing the TDC (Target Designator Cursor) while using the Radar Cursor/Enable Switch. PRE Mode is better used when designating a target from the targeting pod or when using a preset steerpoint on the target.

PRE (Pre-Planned) Delivery

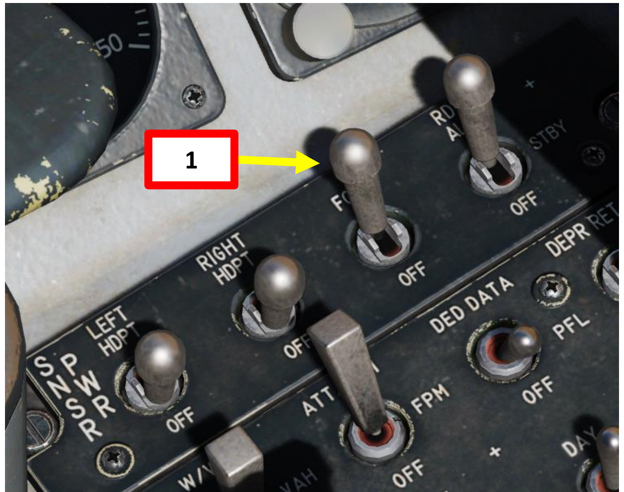
VIS (Visual) Delivery

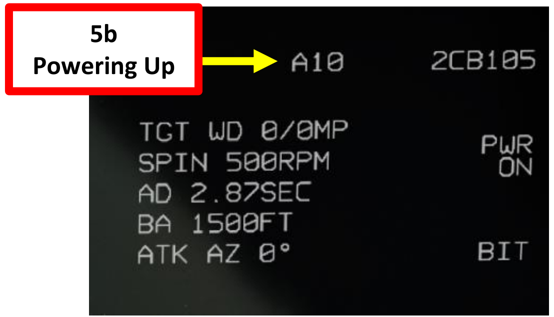
2.2.2 – CBU-105 WCMD (CCRP VIS MODE)

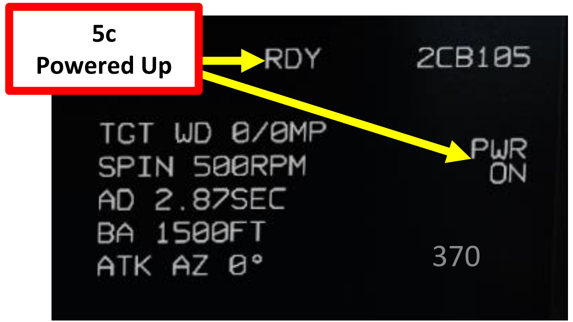
1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, select CBU-105 bombs (CB105) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
5. Power on CBU-105s by pressing OSB next to PWR. When countdown starting from "A10" disappears and "PWR ON" and "RDY" indications are visible, power-up sequence is complete.
6. On the SMS page, verify that VIS (Visual) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to "PRE" (Pre-Planned), which is the default CCRP release mode. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.



NWS A/R DISC & MSL STEP Button

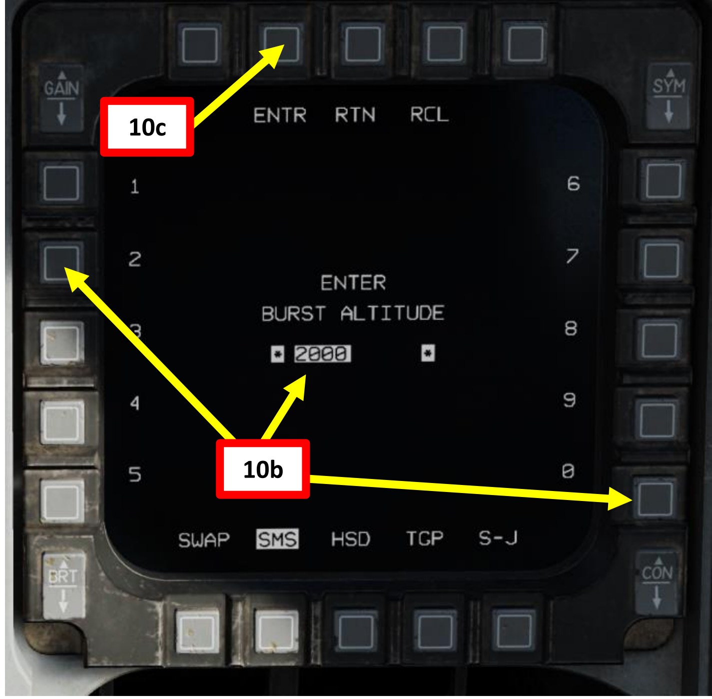


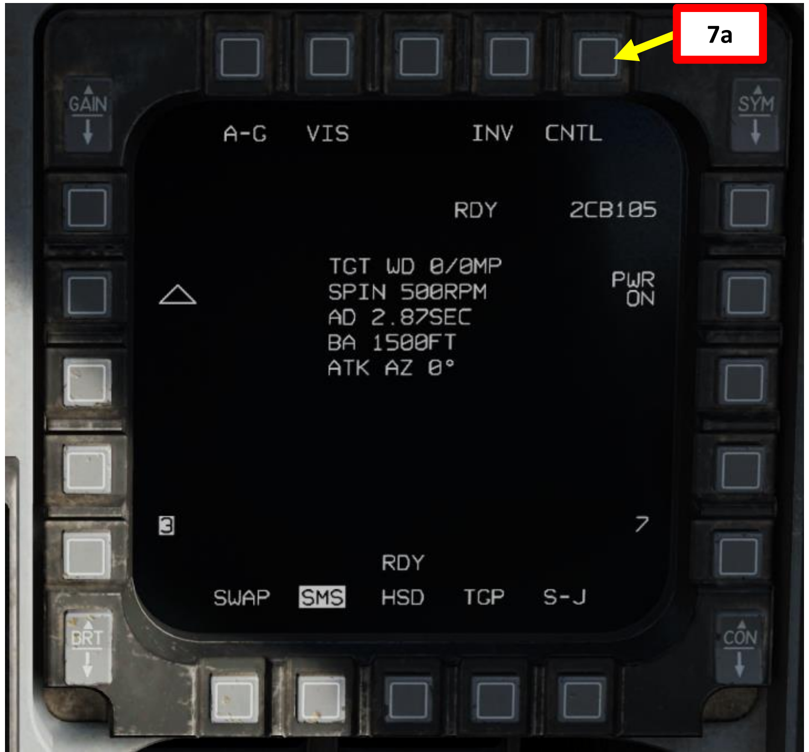


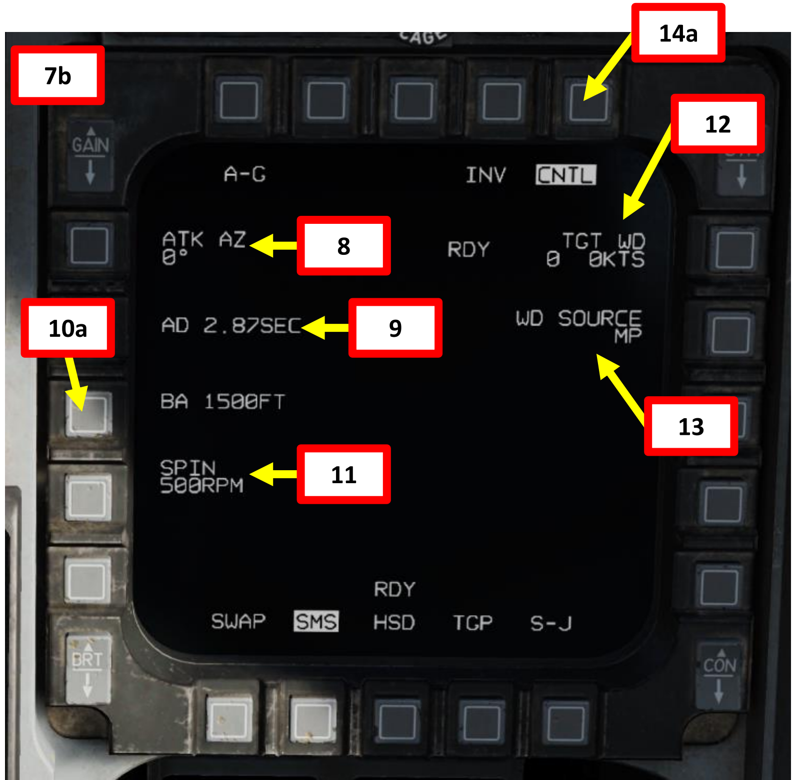


2.2.2 – CBU-105 WCMD (CCRP VIS MODE)

7. From the SMS page, press OSB next to CNTL to select the Control Page.
8. ATK AZ (Attack Azimuth) is not simulated yet.
9. AD (Arming Delay) is not simulated yet.
10. BA (Burst Altitude) sets the Height of Function (HoF) parameter. To set a HoF parameter of 2000 ft (which I recommend):
    a) Press OSB next to BA
    b) Use OSBs to type in the burst altitude (2000)
    c) Press OSB next to ENTR to confirm burst altitude selection.
11. Spin Rate (area spread of bomblets) is currently preset to 500.
12. TGT WD (Target manual winds aloft) entry is not simulated yet.
13. WD SOURCE (Wind Source) is not simulated yet. This parameter toggles wind data from mission planning (MP), pilot-entered (PI), and avionics system (SY). Currently, only MP is available.
14. Press OSB next to CNTL to return to the SMS page.







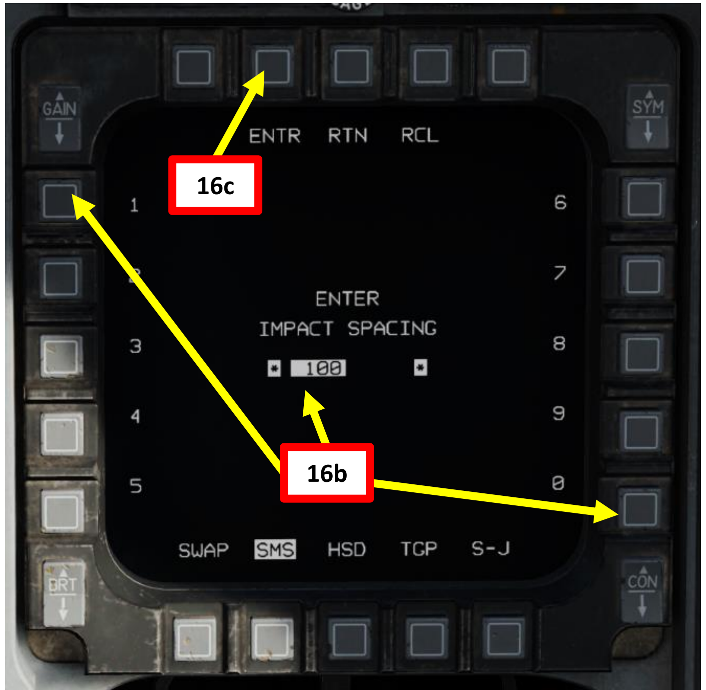
2.2.2 – CBU-105 WCMD (CCRP VIS MODE)

15. Press on OSB next to Ripple Setting (triangle) to toggle between Single Release (single triangle), Pairs Release with Longitudinal Separation (two triangles lined up vertically) or Pairs Release with Lateral Separation (two triangles lined up horizontally). In this example, we will select Longitudinal Separation.
16. Enter impact spacing (in feet) if a longitudinal or a lateral separation ripple setting is selected.
    a) Press OSB next to the Ripple Spacing Parameter
    b) Use OSBs to type in the spacing (100 ft)
    c) Press OSB next to ENTR to confirm spacing selection.

Single Release Setting

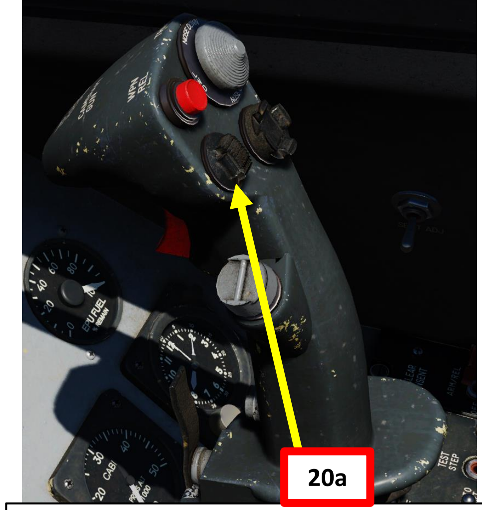
Pairs Release Setting With Longitudinal Separation

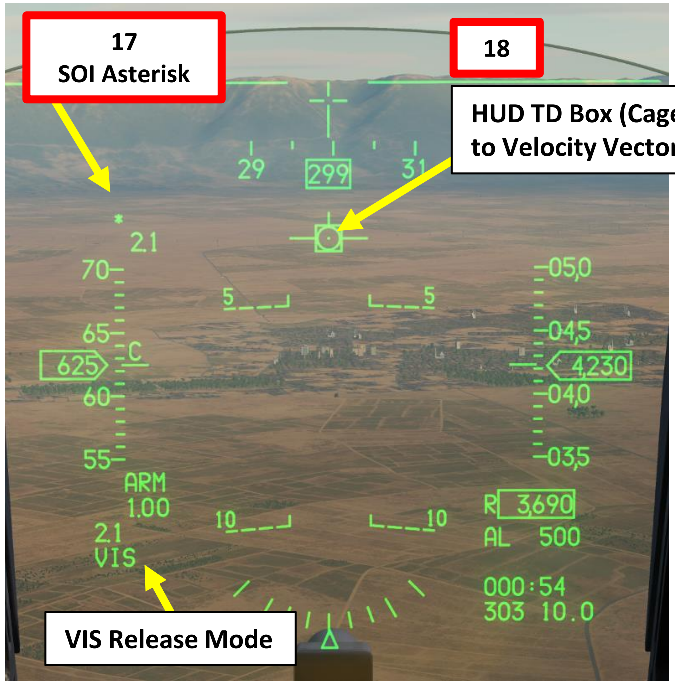
Pairs Release Setting With Lateral Separation

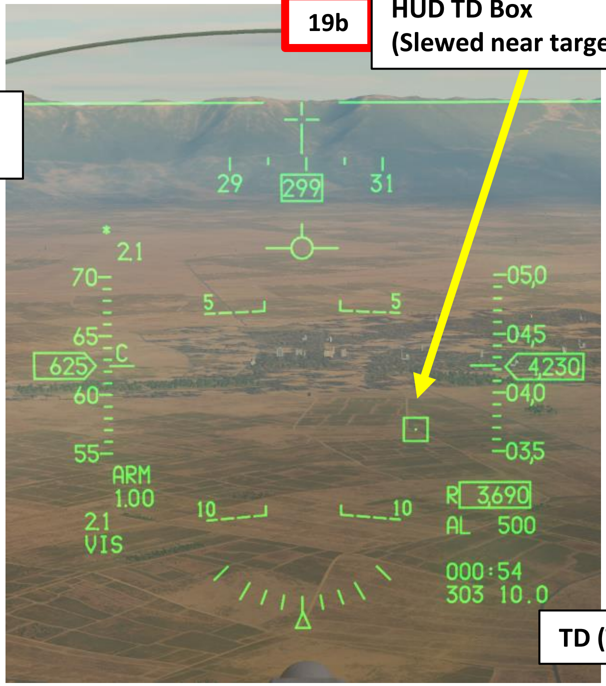


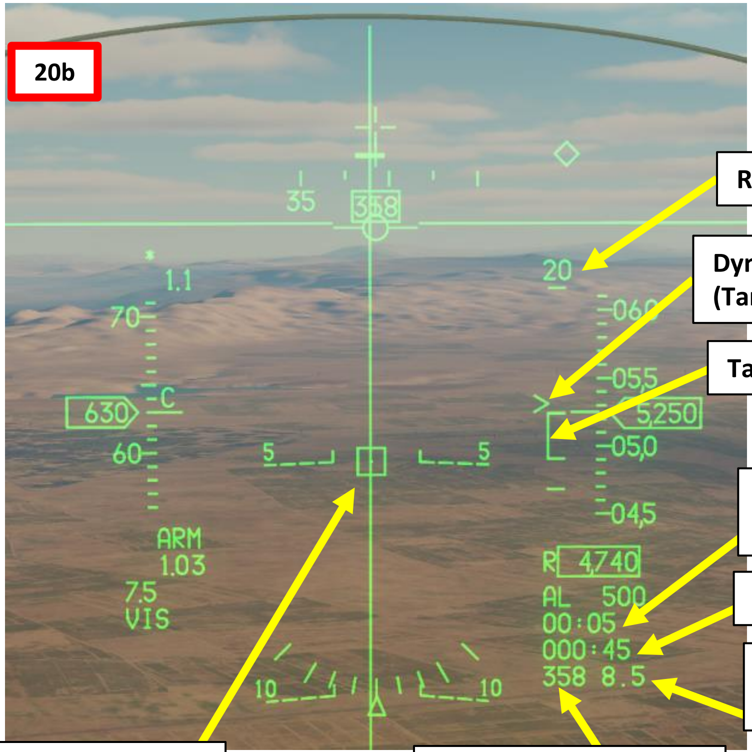
2.2.2 – CBU-105 WCMD (CCRP VIS MODE)

17. When VIS mode is selected, the HUD (Heads-Up Display) is automatically set as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.
18. By default, the Target Designation Box on the HUD will be caged to the velocity vector.
19. Spot the target visually, then slew the HUD TD (Target Designation) Box on the HUD within the vicinity of the target using the Radar Cursor switch. This method is useful if you have no targeting pod equipped.
    - The HUD TD Box is ground stabilized
    - If you want to cage the HUD TD Box on the velocity vector, press TMS DOWN.
19. Press TMS (Target Management Switch) UP to designate the target on the HUD TD Box location.
20. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Target is displayed on the Heads-Up Display with an Azimuth Steering Line (ASL) and a DLZ (Dynamic Launch Zone) indication.



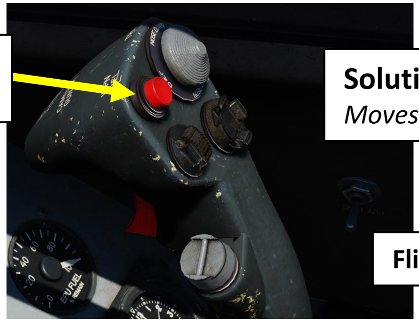


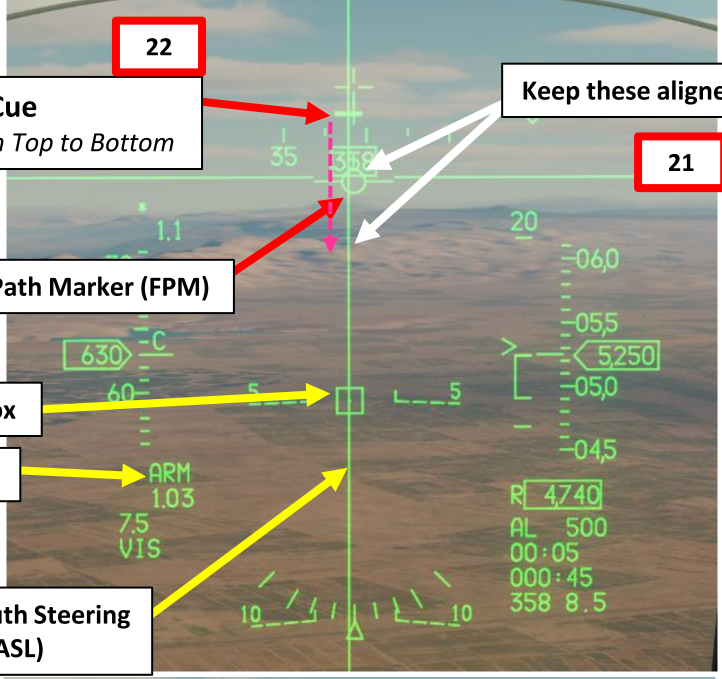


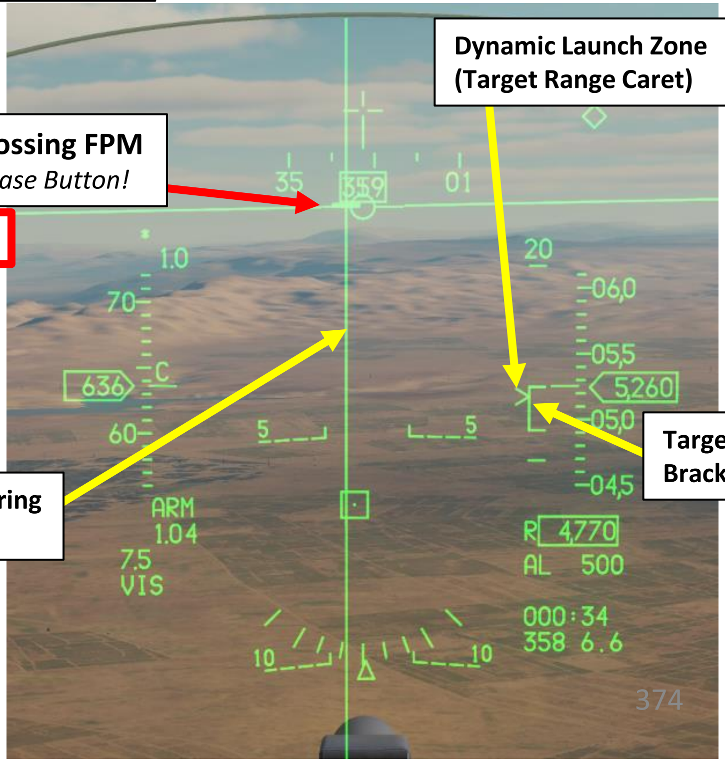


2.2.2 – CBU-105 WCMD (CCRP VIS MODE)

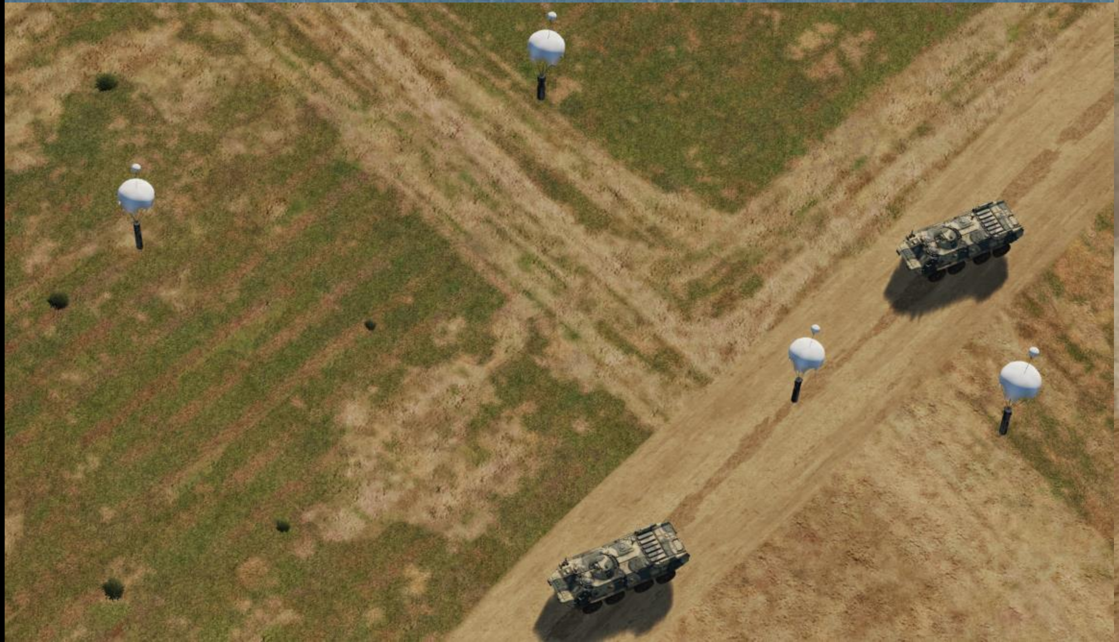
21. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
22. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released. The DLZ (Dynamic Launch Zone) provides ranging information.
23. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).
24. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
    - During this process, target coordinates and profile data is downloaded to the WCMD. If this process is interrupted by releasing the Weapons Release button before the download finishes, the weapon will become a hung store and will be unusable.
25. The bombs are released when the Solution Cue passes the Flight Path Marker.





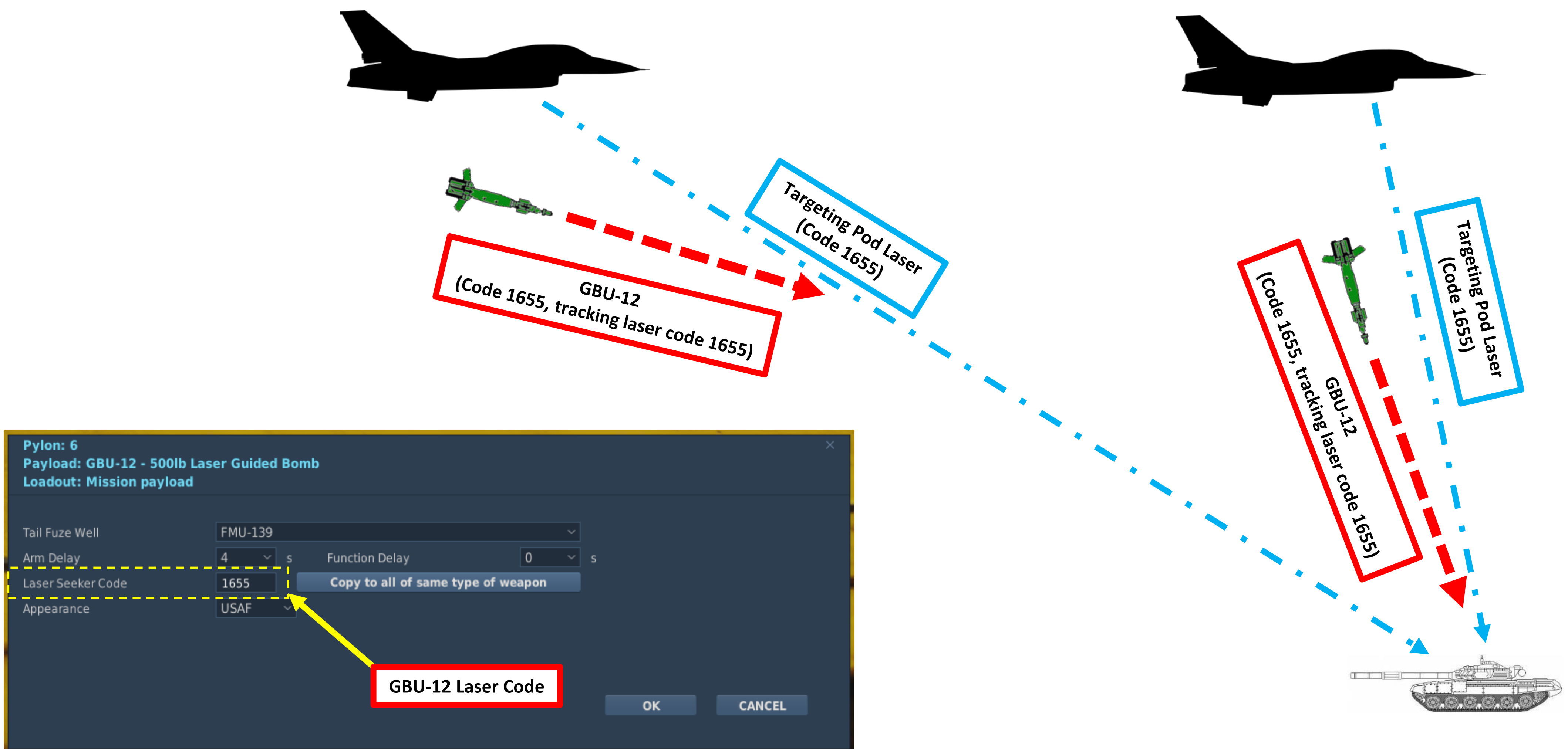


2.2.2 – CBU-105 WCMD (CCRP VIS MODE)

2.3 – GBU-12 PAVEWAY II (Laser-Guided)

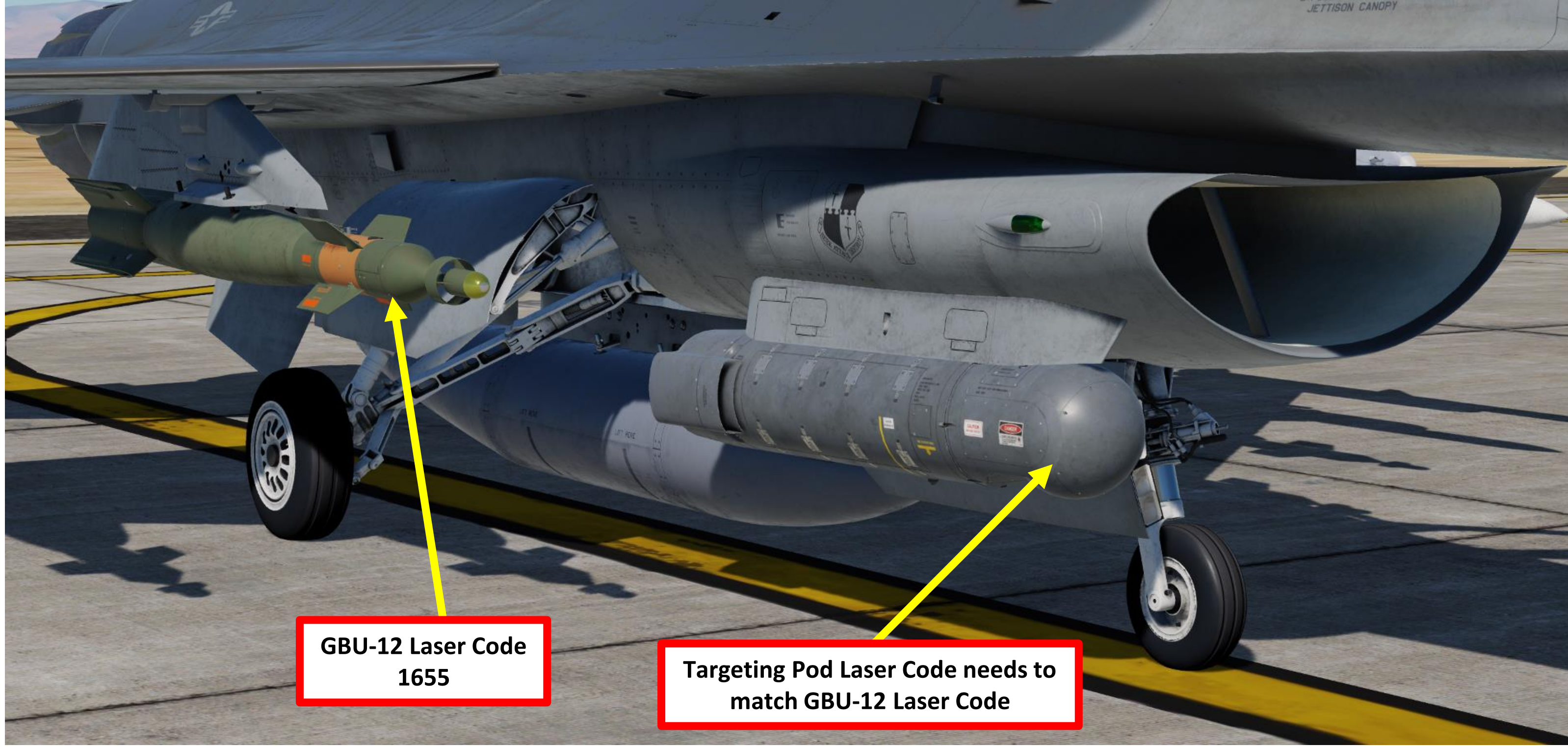
The GBU-12 Paveway II is the laser-guided version of the Mk-82 unguided, general purpose bomb. The GBU-12 guides using the same principles as the GBU-10, the only difference being the bomb the LGB is based on. The seeker head on each laser guided bomb is set to track only a specific laser pulse rate frequency (PRF) code. These are manually set by the weapons load crew during ground operations (via Mission Editor) and may not be set from the cockpit during flight.



2.3 – GBU-12 PAVEWAY II (Laser-Guided)

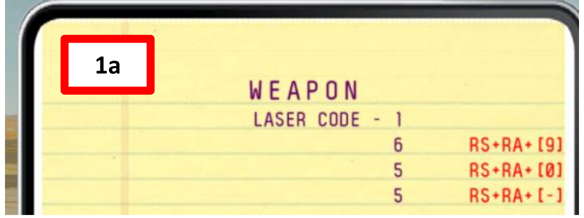
The GBU-12 laser code can currently be set from the Ground Crew menu. Laser code is changed by clicking on the yellow triangle on the GBU-12 station. If you are flying in multiplayer and do not know your GBU-12 code, you can assume it is "1688" by default.

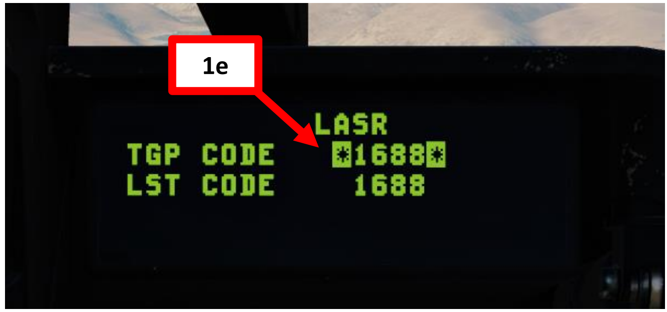
Take note that setting the bomb laser code should be done when the engine is shut down.

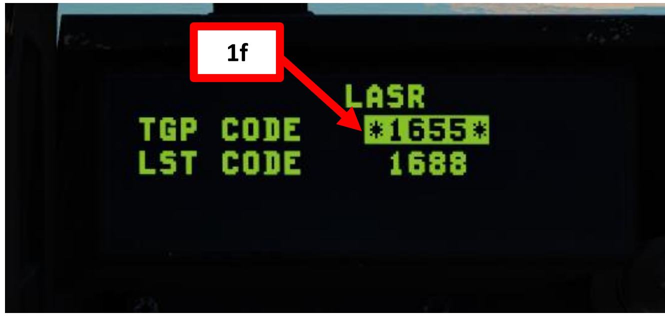


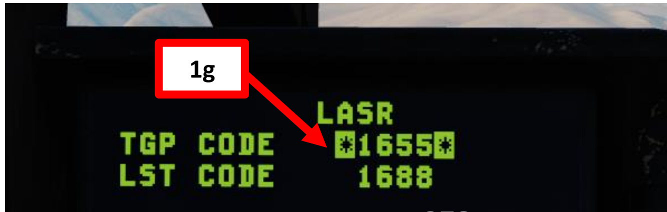
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

1. Set the Targeting Pod's Laser Code as per the GBU-12 code programmed on the guided bomb, which is set via the mission editor. The default laser code is 1688, but in this case we will pick a bomb with a laser code of 1655.
    a) "RSHIFT+K" displays the WEAPON Kneeboard page and your GBU-12 laser code (1655).
    b) Press the LIST button
    c) The LIST sub-menus will appear on the DED (Data Entry Display). Press the "0" button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
    d) Press the "5" button on the ICP to select the LASR (Laser) sub-menu.
    e) The TGP code is selected by default (asterisks indicate field is selected).
    f) To change laser code to "1655", type "1655" on the ICP keypad
    g) Press "ENTR" button (Enter) to update laser code.



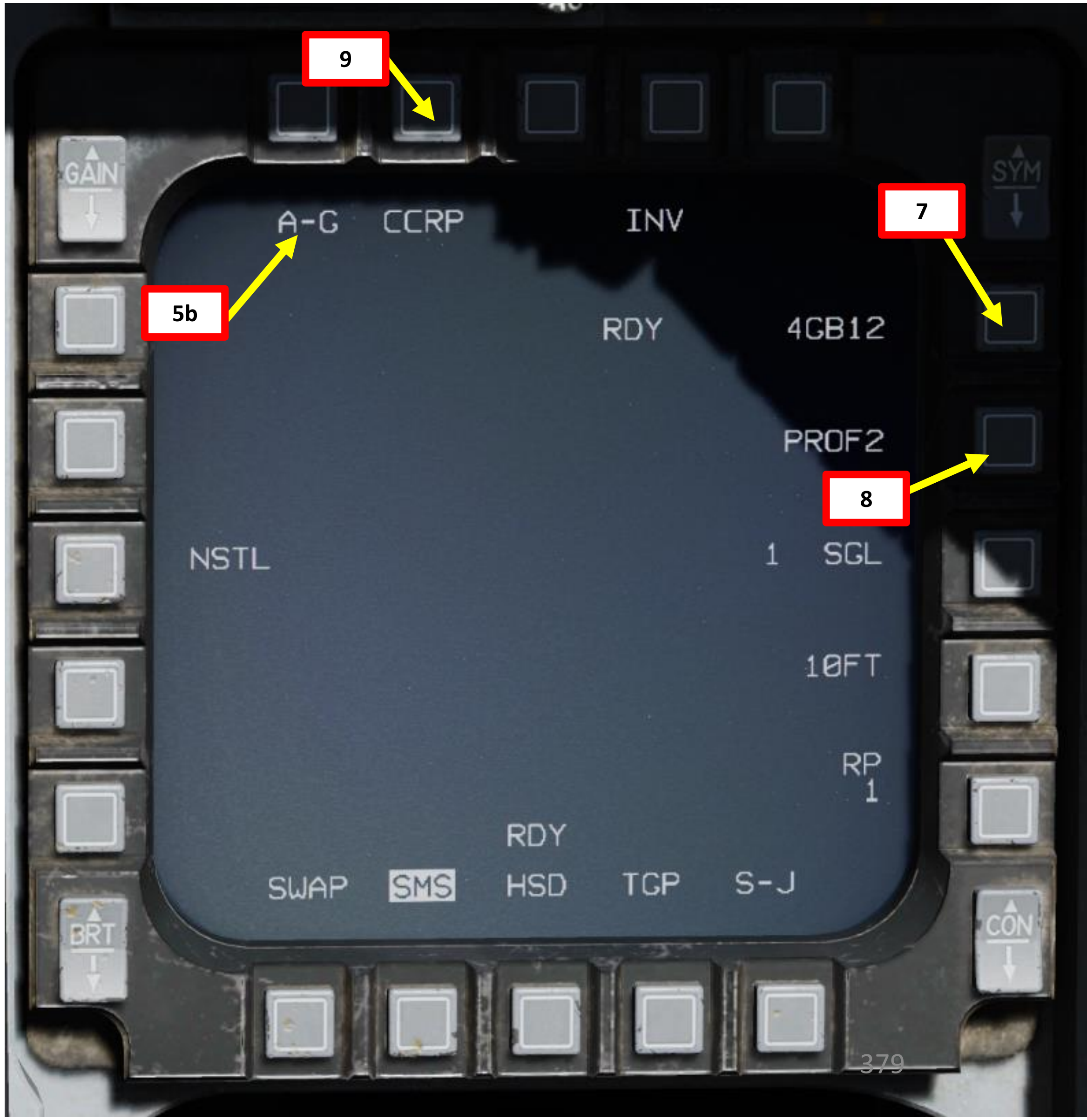


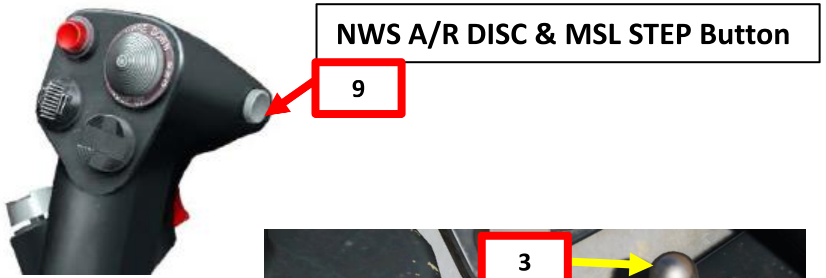


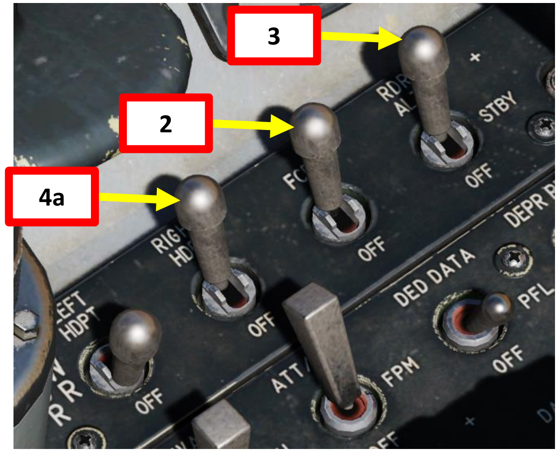


2.3 – GBU-12 PAVEWAY II (Laser-Guided)

2. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
3. Verify that Radar Altimeter (RDR ALT) switch is ON (FWD)
4. To use the targeting pod laser to range the target:
    a) Set the RIGHT HDPT switch to ON (FWD).
    b) Set Laser Switch – ARMED (UP)
5. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
6. Set Master Arm switch – ARM (UP)
7. On the SMS (Stores Management Set) page, select GBU-12 laser-guided bombs (GB12) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
8. On the SMS page, select desired weapon profile. Let’s take PROF2 since it is CCRP-compliant by default.
9. On the SMS page, verify that CCRP (Continuously Computed Release Point) release mode is selected. If it is not, press the OSB next to the Release Mode option and select OSB next to “CCRP”. Alternatively, you can toggle Release Mode with the NWS A/R DISC & MSL STEP button on the stick.

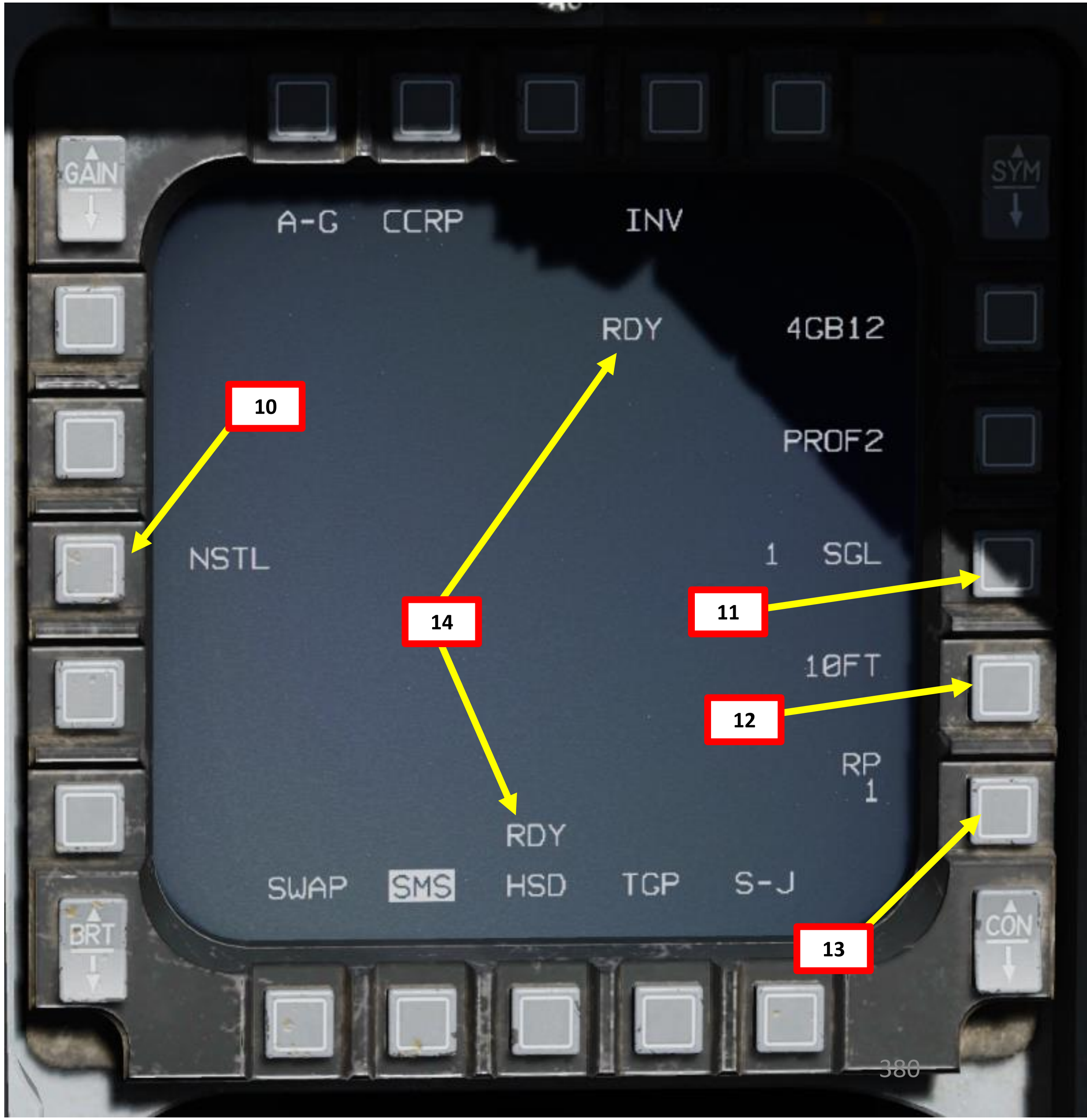






2.3 – GBU-12 PAVEWAY II (Laser-Guided)

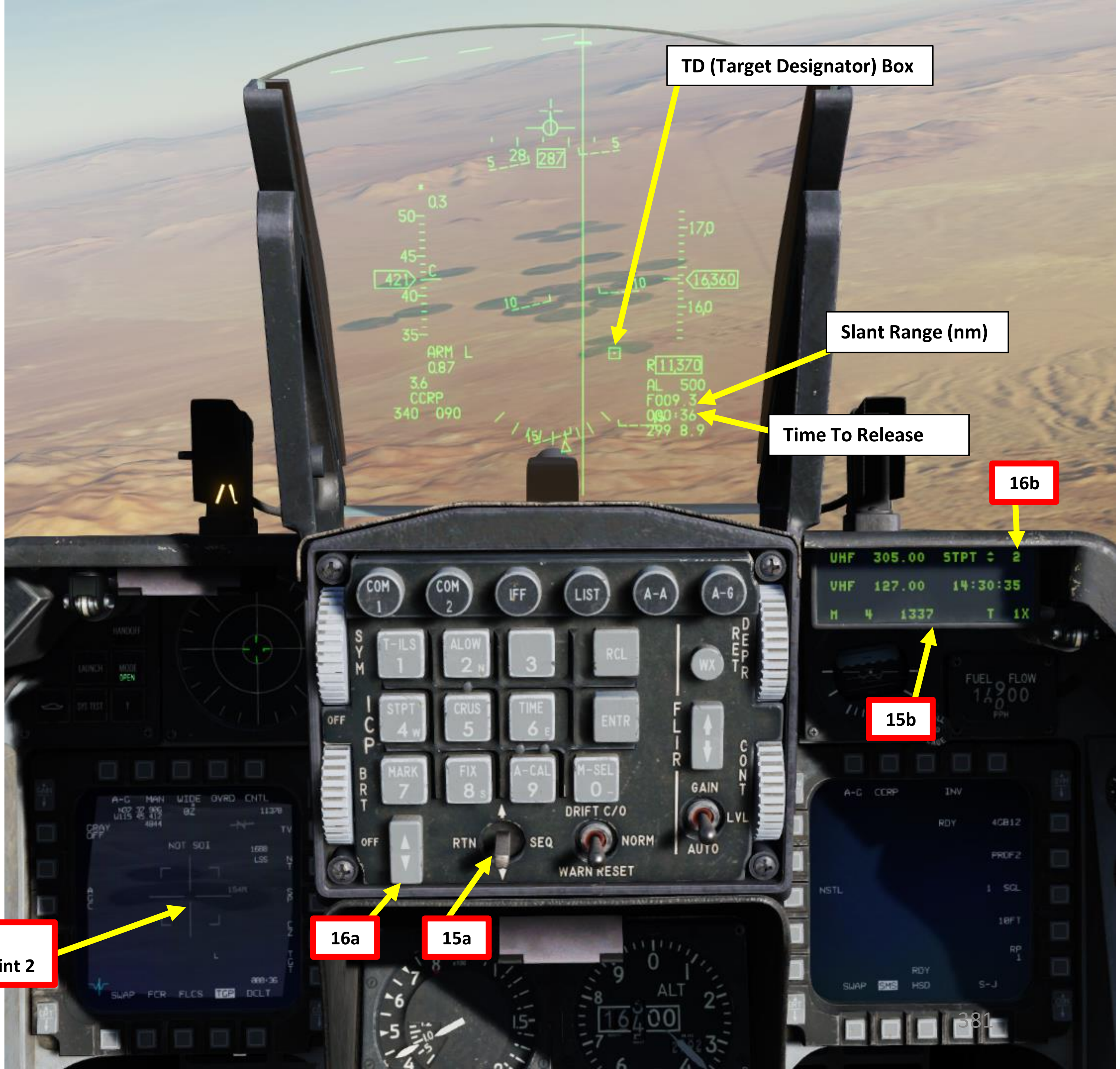
10. Set desired fuzing option (press OSB to toggle setting). We will set NSTL.
    - NOSE: Nose Fuze only
    - TAIL: Tail Fuze only
    - NSTL: Nose & Tail, typically used for redundancy.
11. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
    - SGL: Single Launcher
    - PAIR: With PAIR selected, bombs will be released from both opposite stations, assuming identical bombs are loaded on stations 4 and 6 or 3 and 7.
12. If more than one bomb is to be released, set desired Release Interval option. In our case, this setting is not relevant.
    - Type in the new impact spacing distance using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
13. If more than one bomb is to be released, set the number of release pulses. We will leave it at 1.
    - Type in the desired number of release pulses using the OSBs on the left and right of the display and select ENTR.
    - You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
14. Verify that System Status displays RDY (Ready) on the SMS page.



2.3 – GBU-12 PAVEWAY II (Laser-Guided)

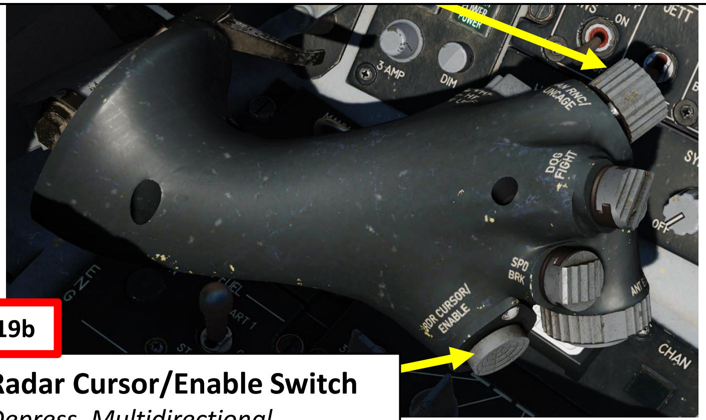
- Typically, a Steerpoint should be programmed in your flight plan near the target. In this case, we will assume Steerpoint 2 is set near the target.

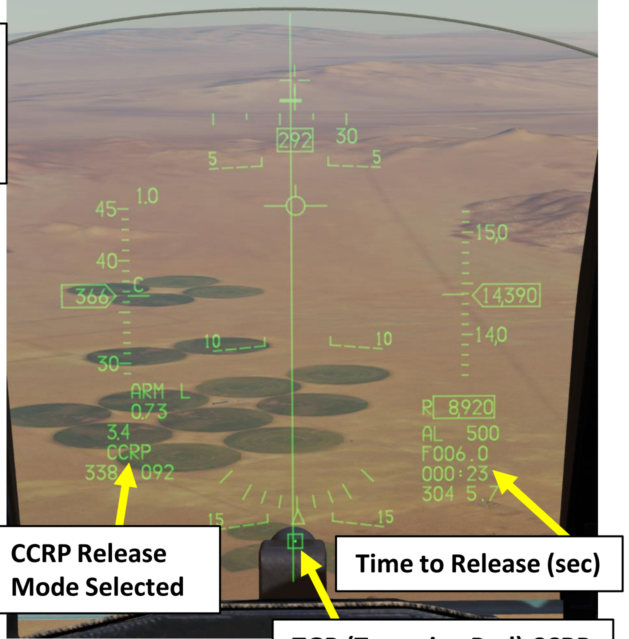
15. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
16. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
17. When CCRP release mode is selected, the Targeting Pod will automatically be slaved to the selected steerpoint (Steerpoint 2 in our case).

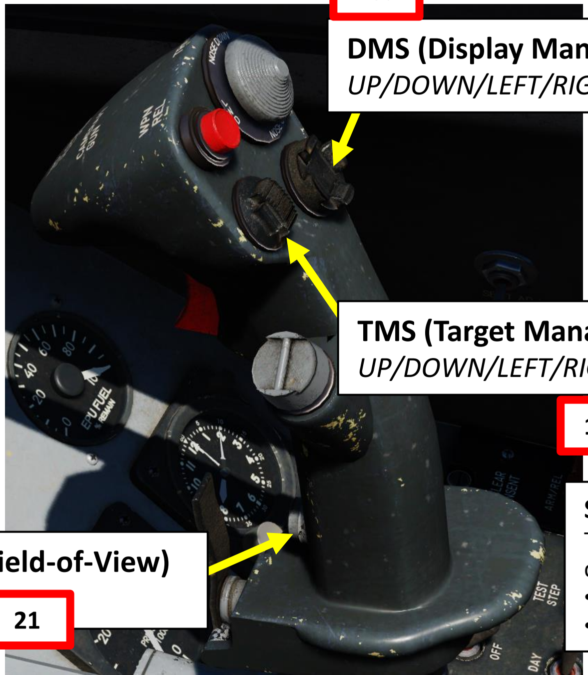


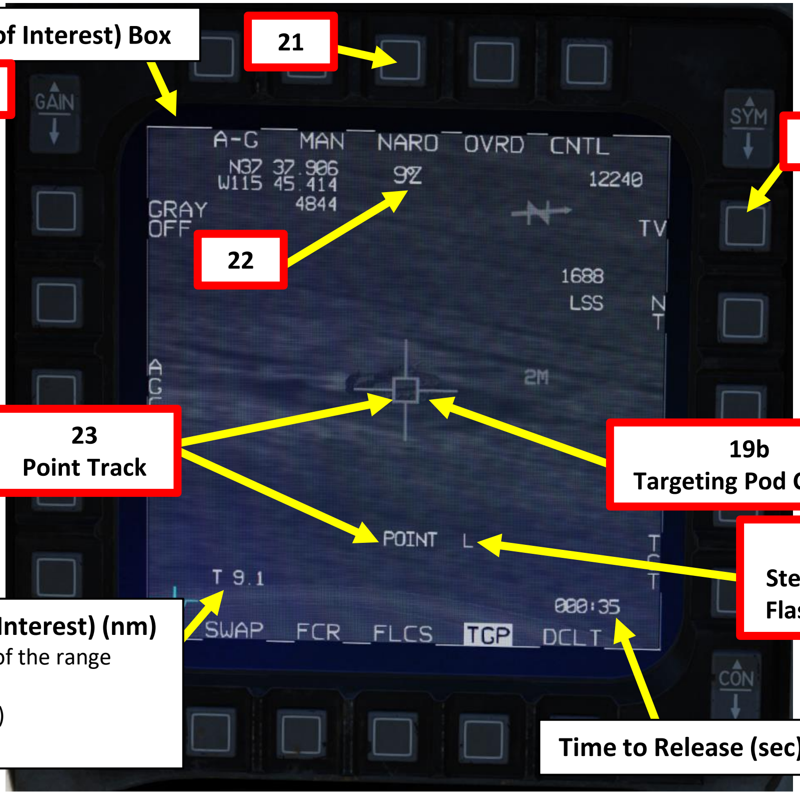
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

18. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.
19. Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the steerpoint location. Then, slew the targeting pod using the Radar Cursor switch
20. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
21. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
22. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
    - CCW (Counter-Clockwise): Zooms OUT
    - CW (Clockwise): Zooms IN
23. Select Tracking Mode using the TMS (Target Management Switch): TMS UP for Point Track (POINT, tracks moving objects) or TMS RIGHT for Area Track (AREA, tracks static objects).



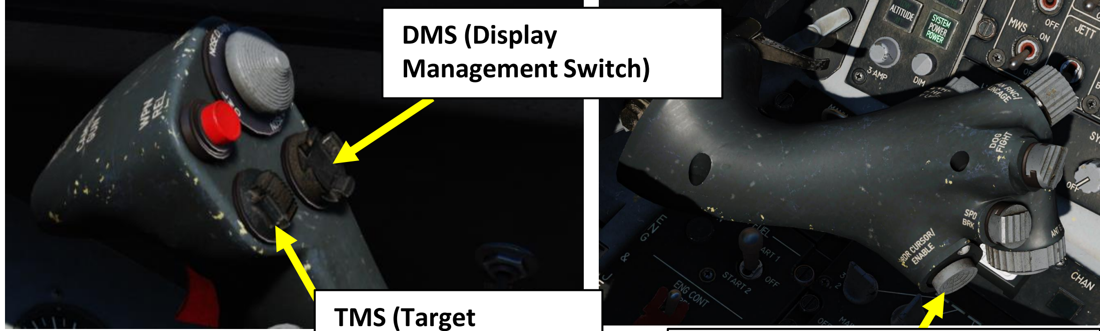


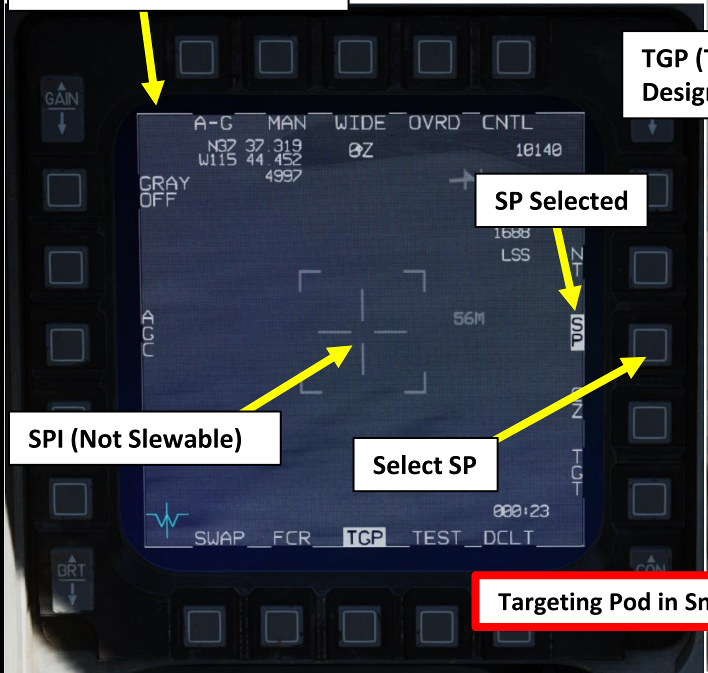


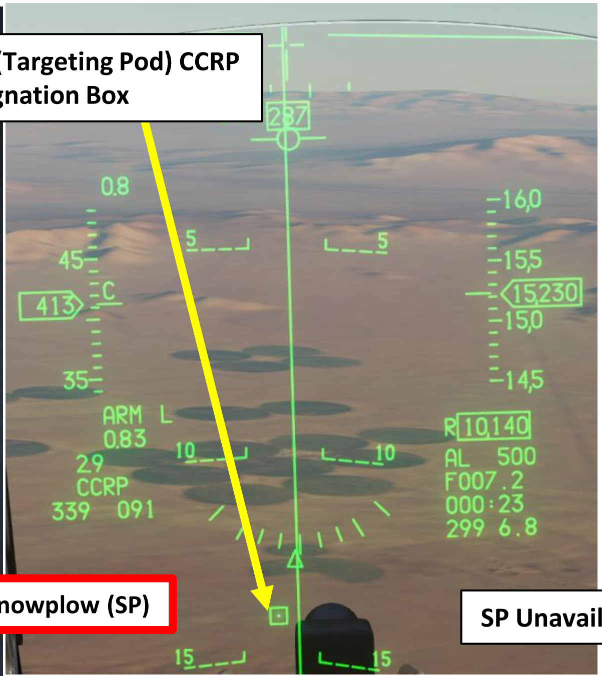


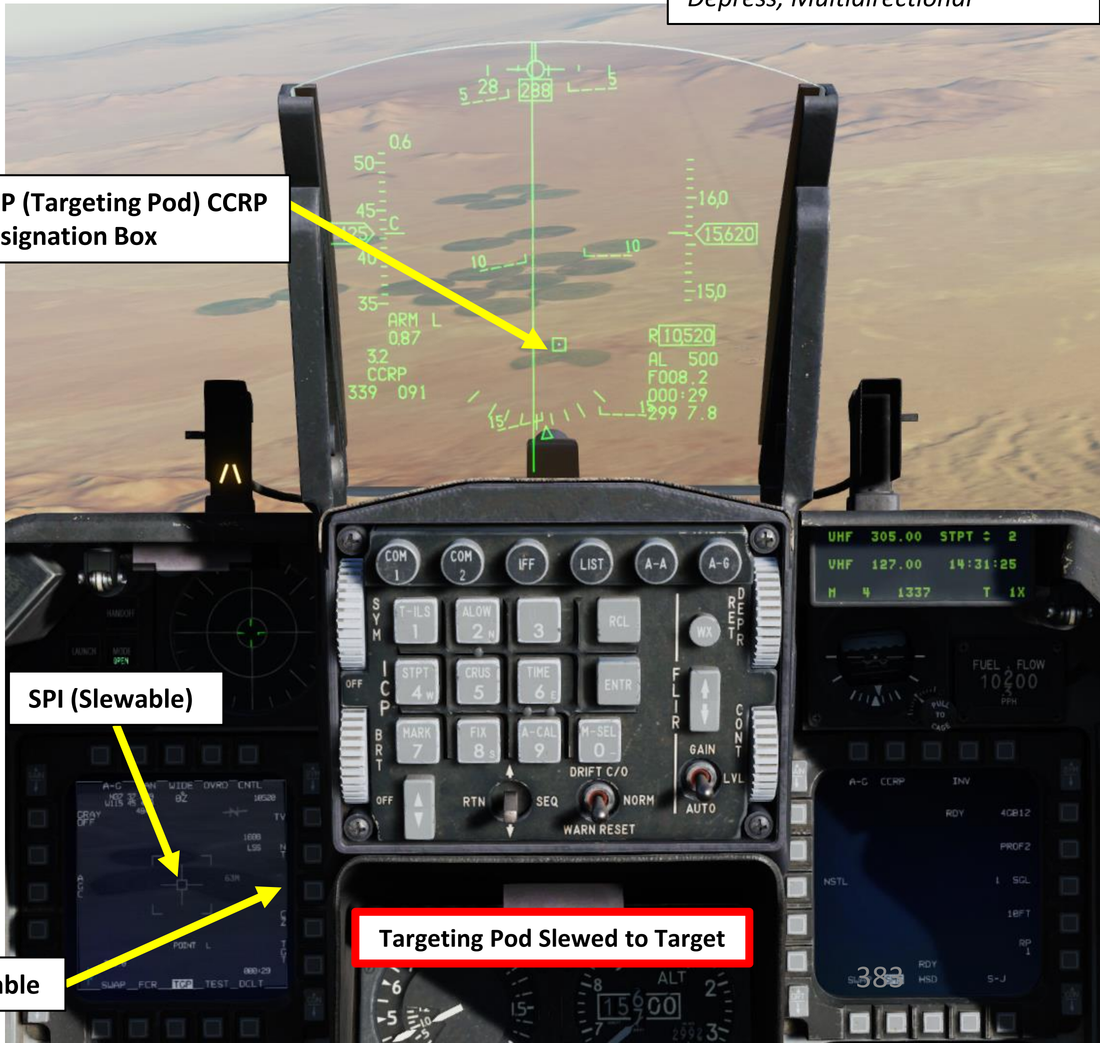
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

- Important Note: In the case where a Steerpoint is not available near the target, you can use snowplow mode. To do so:
    a) Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest)
    b) By default, the TGP should be slaved to the selected steerpoint. Reject the target by using TMS (Target Management Switch) DOWN
    c) SP function should be available on the TGP page.
    d) Press OSB (Option Select Button) next to SP to activate Snowplow mode.
    e) The targeting pod's line-of-sight is commanded straight ahead and angled downwards to point to the ground ahead
    f) Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the location of the TGP reticle. This will exit SP Mode and make the SPI slewable.
    g) Slew the targeting pod as desired using the Radar Cursor switch.



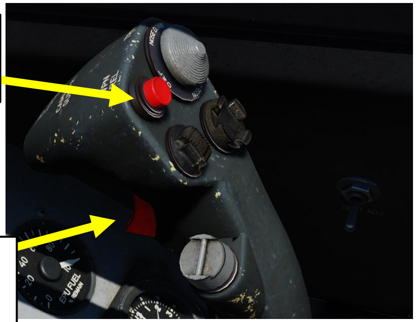


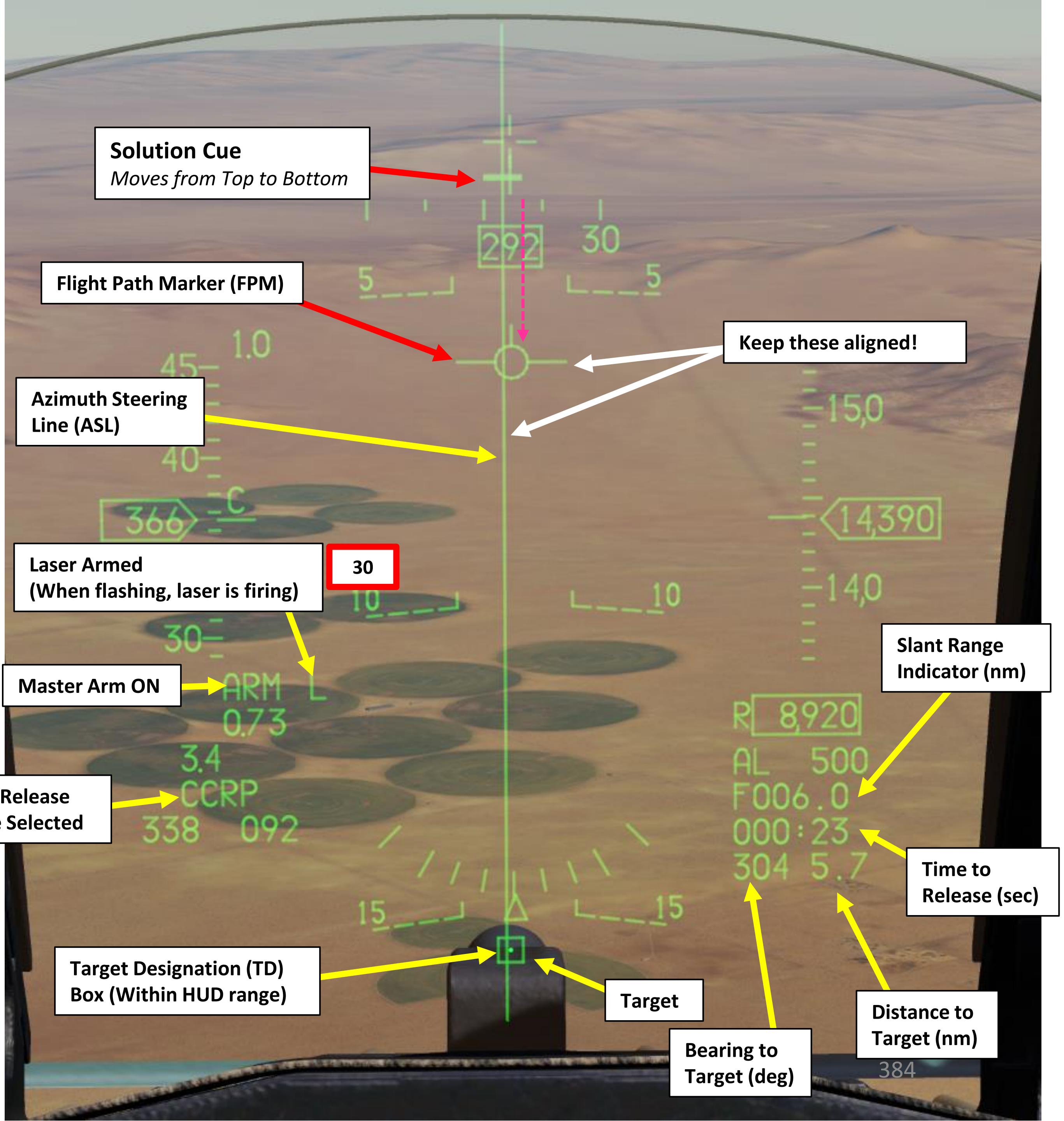




2.3 – GBU-12 PAVEWAY II (Laser-Guided)

24. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Steerpoint/Target is displayed on the Heads-Up Display.
25. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
26. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
27. When Solution Cue falls down towards the Flight Path Marker, depress and hold the Weapons Release button (RALT+SPACE).
28. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line as the Solution Cue continues to track downward.
29. The bomb is released when the Solution Cue passes the Flight Path Marker.
30. Once bomb is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the Targeting Pod and HUD.
31. Press and hold the first stage of the gun trigger to fire your targeting pod's laser. When laser is being fired, the "L" symbol on the HUD will flash. Releasing the trigger stops lasing.
    - Note: Lasing the target should be done no later than 8-12 seconds prior to impact.
31. The bomb will track the laser for as long as it is fired until it reaches the target.





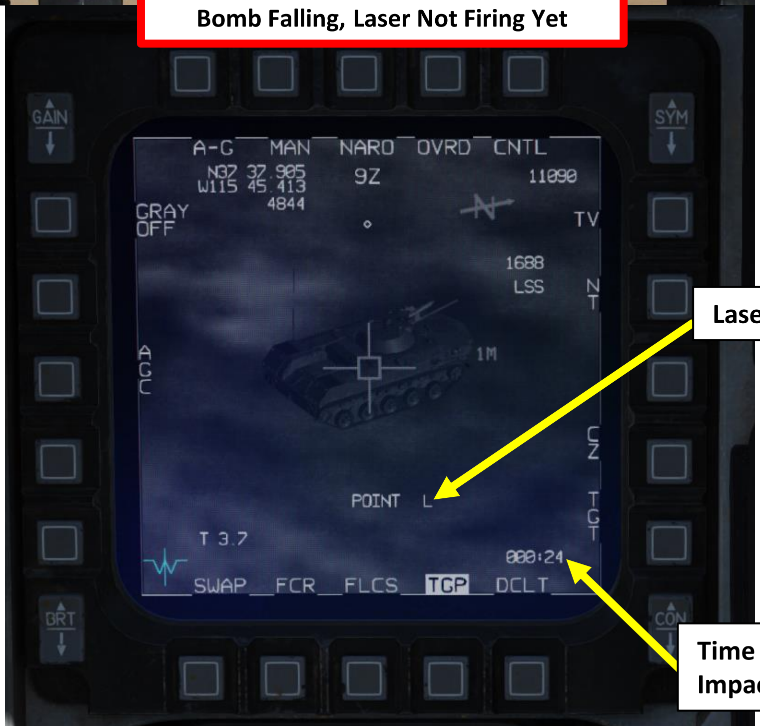
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

Laser Armed (Not Flashing)

Time to Impact (sec)

Camera/Gun Trigger (Two Stages)
Use to fire laser

Bomb Falling, Laser Not Firing Yet



Laser Armed (Not Flashing)

Time to Impact (sec)

Bomb Falling and Laser is Firing

Slant Range to SPI (Sensor Point of Interest) (nm)
The preceding letter indicates the source of the range data.

- L: Laser (priority over all other sources)
- T: Targeting Pod passive ranging

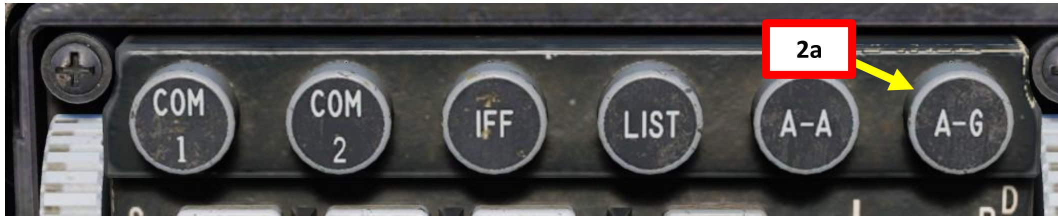
Targeting Pod Laser Code
Laser code used by your targeting pod when designating a target.

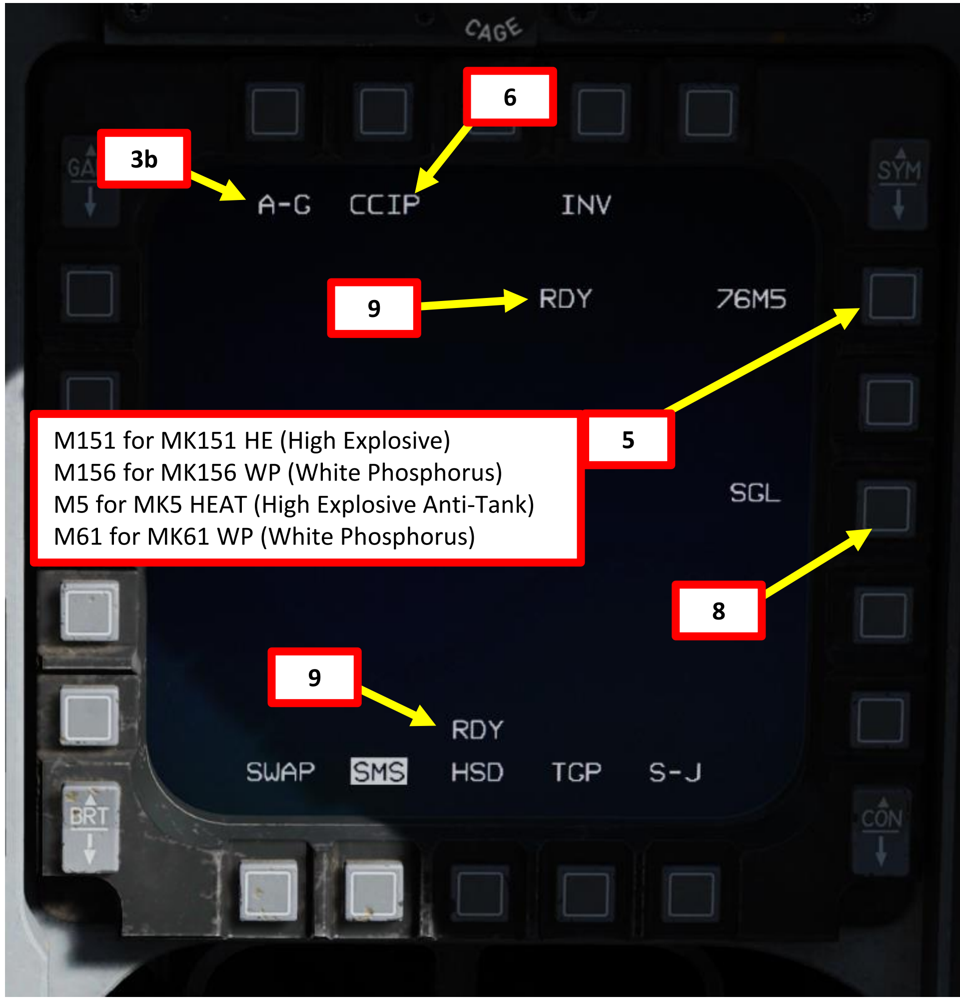
Laser Firing (Flashing)

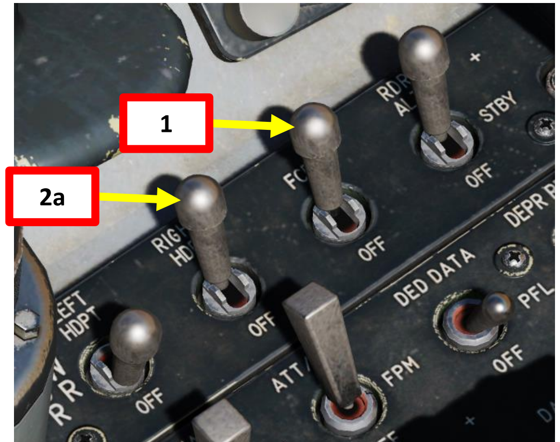
2.3 – GBU-12 PAVEWAY II (Laser-Guided)

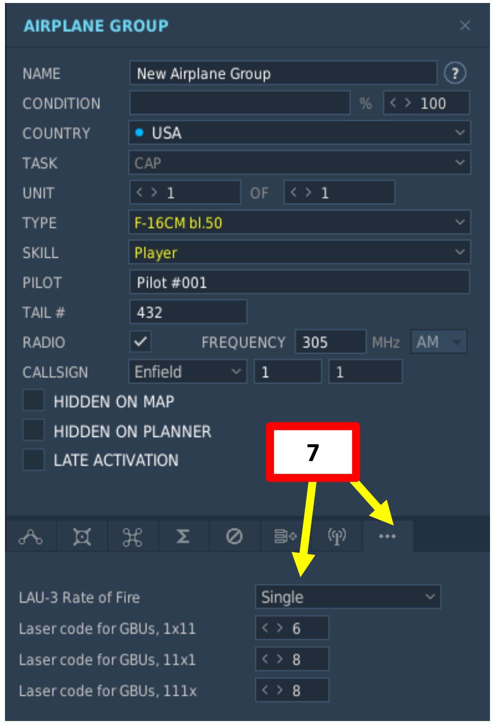
2.4 – ROCKETS

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. (Optional) If you wish to use the targeting pod laser to range the target:
    a) Set the RIGHT HDPT switch to ON (FWD).
    b) Set Laser Switch – ARMED (UP)
3. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, select Rockets by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
6. On the SMS page, CCIP (Continuously Computed Impact Point) release mode should be automatically selected.
7. The Rocket Rate of Fire (Single/Ripple) is set via the Mission Editor.
8. Set desired Single/Pair option (press OSB to toggle setting). We will select SINGLE.
    - SGL: Single Launcher
    - PAIR: With PAIR selected, rockets will be fired from each rocket launcher, assuming launchers are loaded on station 3 and 7.
9. Verify that System Status displays RDY (Ready) on the SMS page.



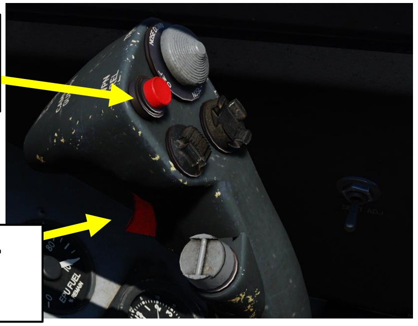


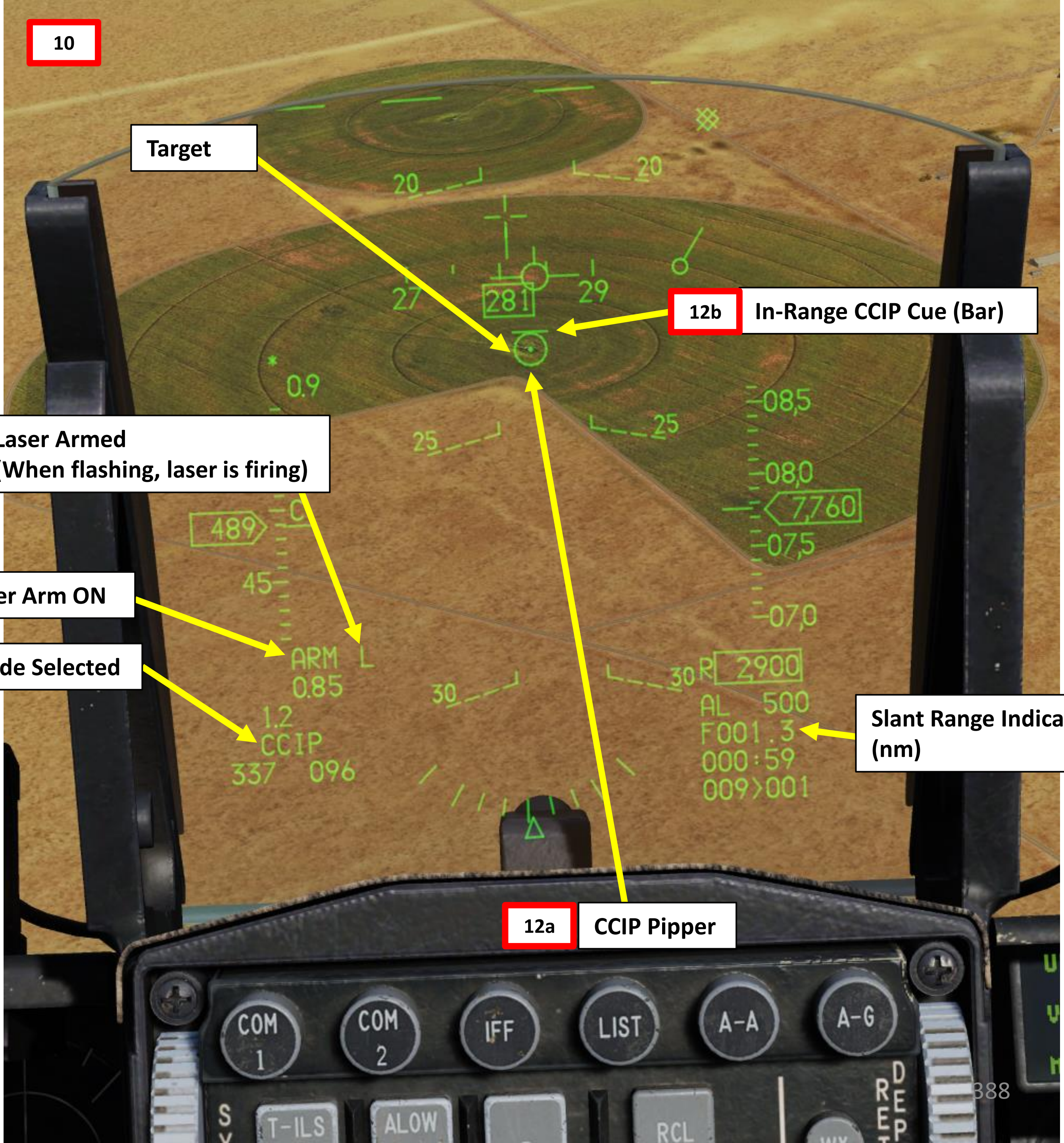




2.4 – ROCKETS

10. Perform a 20-30 deg dive on the target and place the CCIP Pipper on the target.
11. (Optional) If the targeting pod is equipped, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the "L" symbol on the HUD will flash. Releasing the trigger stops lasing.
    - When "laser ranging", the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
    - If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.
12. An In-Range Cue will be displayed over the CCIP pipper when slant range is less than 8,000 feet and rockets are most effective.
13. When CCIP In-Range Cue is visible, depress the Weapon Release (RALT+SPACE) button to fire rockets.

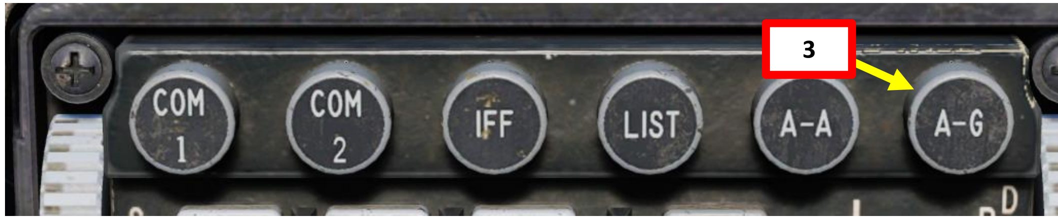


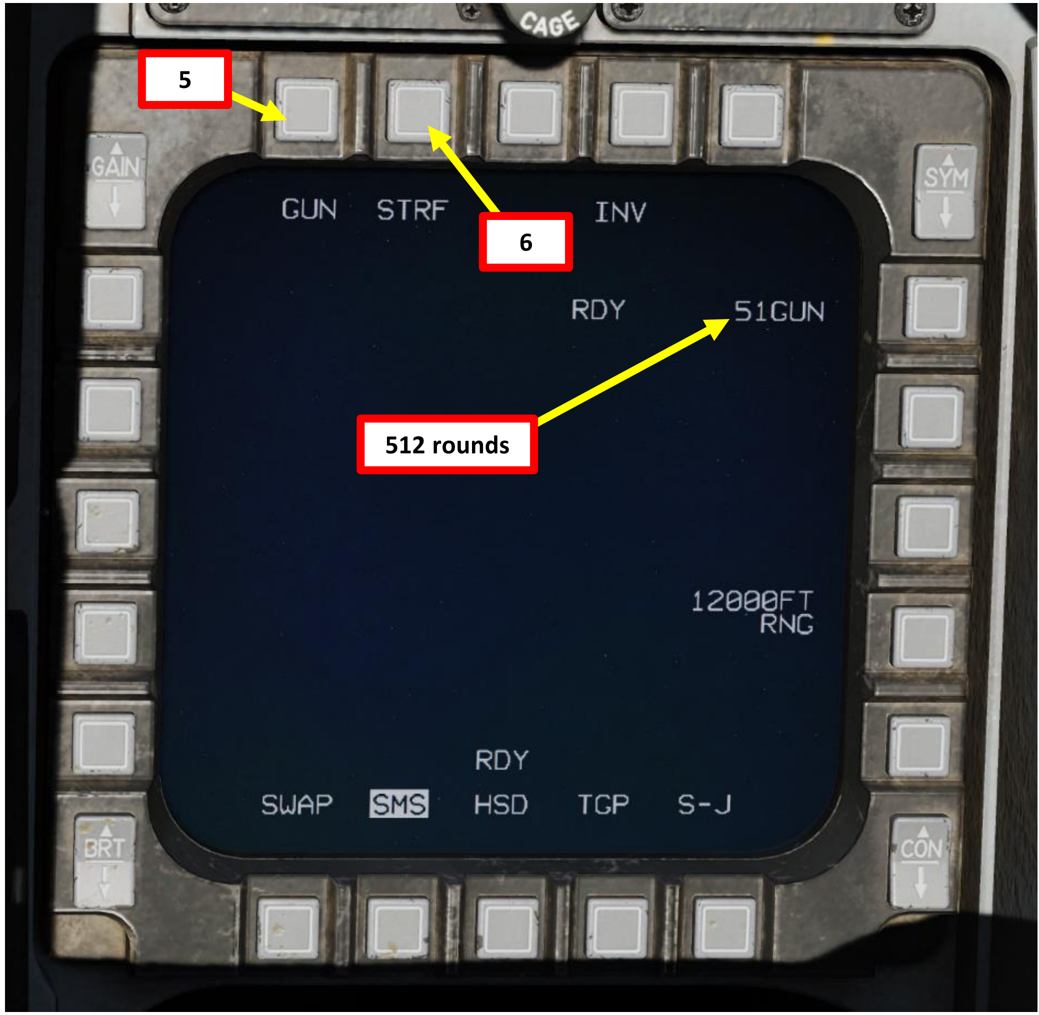


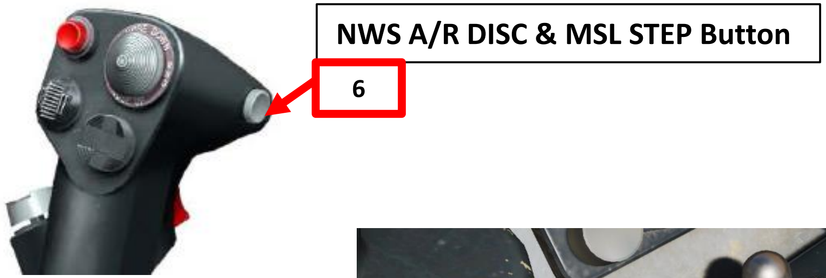
2.4 – ROCKETS

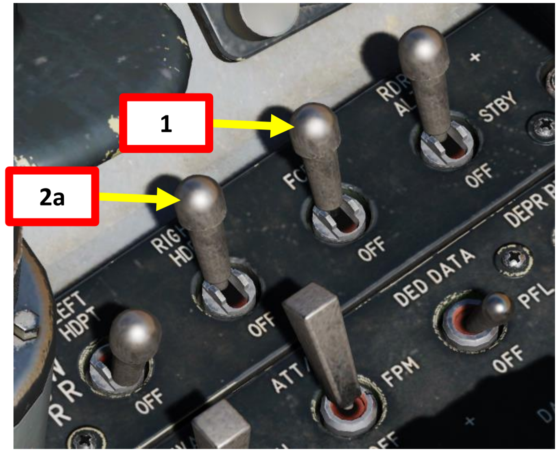
2.5 – M61A1 GUN (Air-to-Ground)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. (Optional) If you wish to use the targeting pod laser to range the target:
    a) Set the RIGHT HDPT switch to ON (FWD).
    b) Set Laser Switch – ARMED (UP)
3. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, select GUN by toggling Operating Mode with the OSB (Option Select Button) adjacent to the Operating Mode option.
6. On the SMS page, verify that STRF (Strafe) gun sub-mode is selected. If it is not, press the OSB next to the gun sub-mode option or toggle it with the NWS A/R DISC & MSL STEP button on the stick.



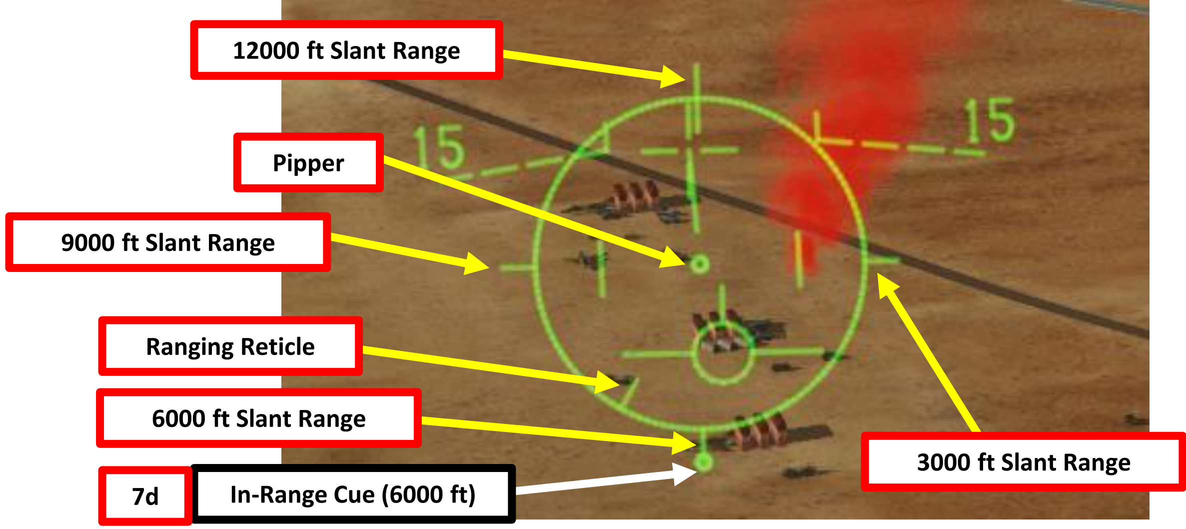


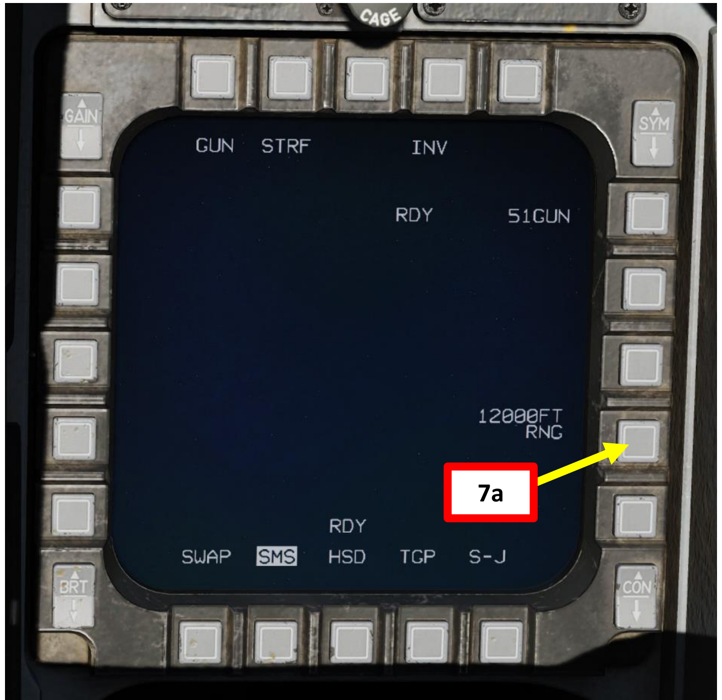


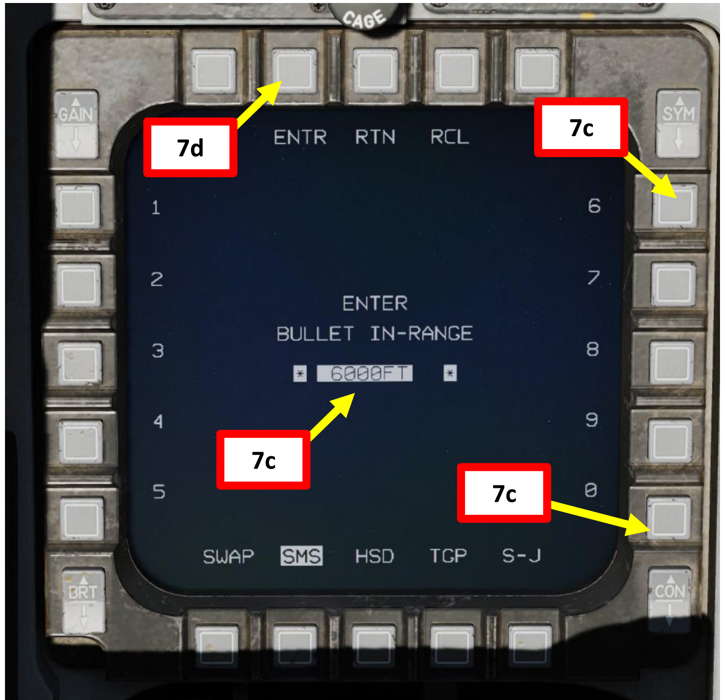


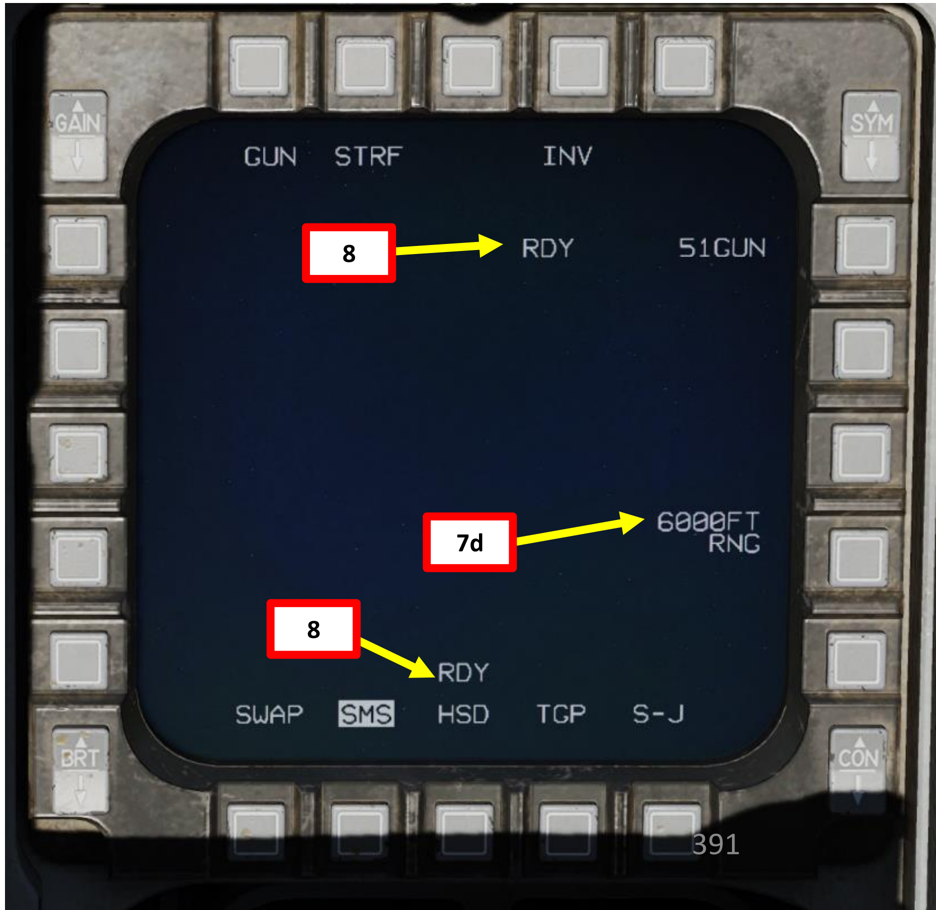
2.5 – M61A1 GUN (Air-to-Ground)

7. Set Gun's In-Range Cue Distance option as desired
   a) Select the OSB (Option Select Button) next to the In-Range Cue distance on the SMS page.
   b) Effective engagement range is generally from 2,500 to 7,000 feet. For armored vehicles, closer is better, and you should attack from behind the target where its armor is weakest.
   c) Type in the new in-range cue distance using the OSBs on the left and right of the display. We will take 6,000 ft.
   d) Select ENTR
   e) You may correct numbers entered in error by selecting RCL or return to the SMS page without making changes by selecting RTN.
8. Verify that System Status displays RDY (Ready) on the SMS page.



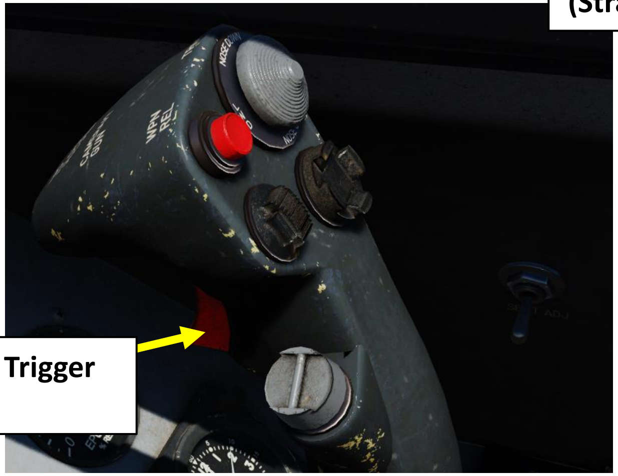


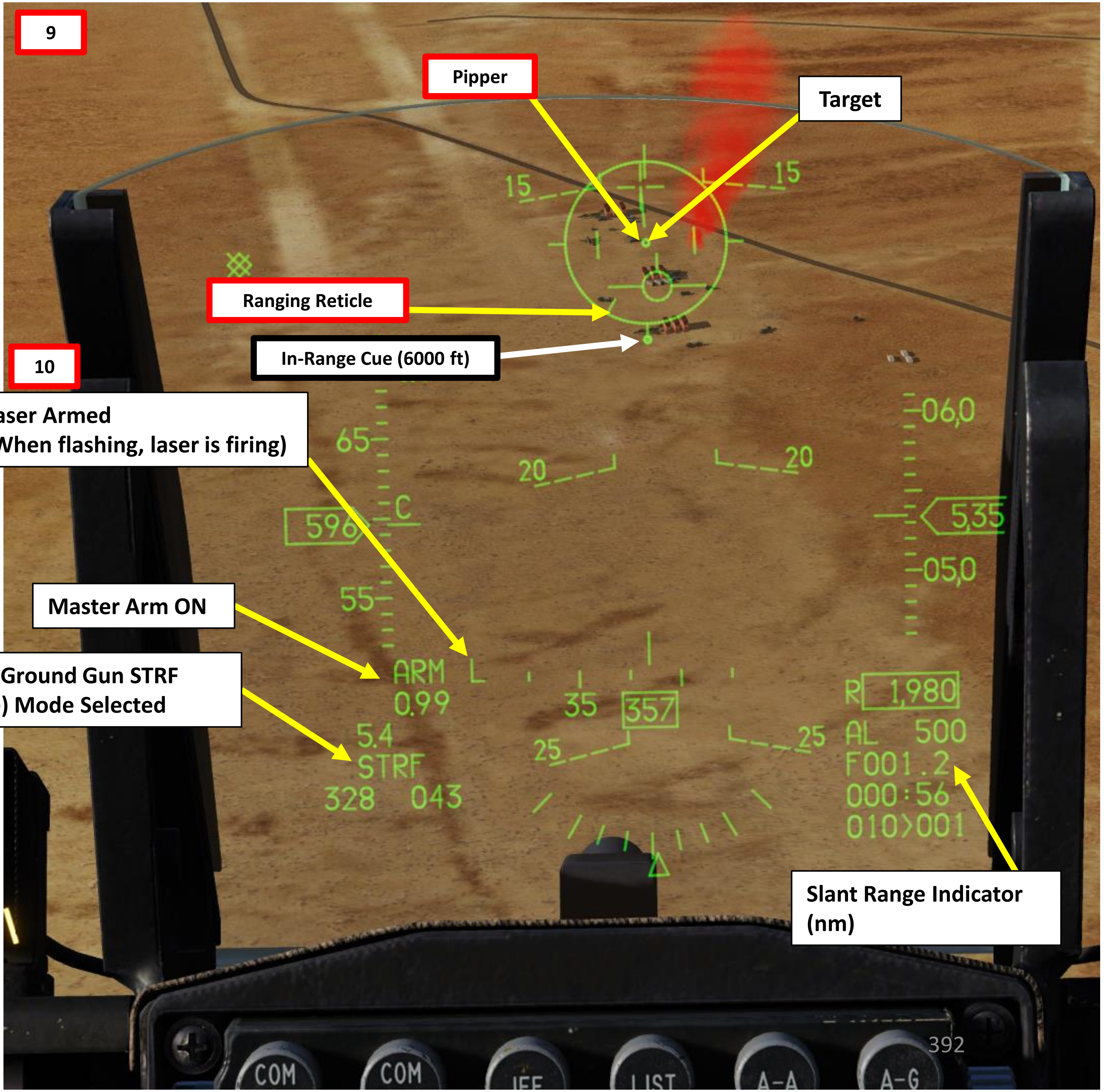




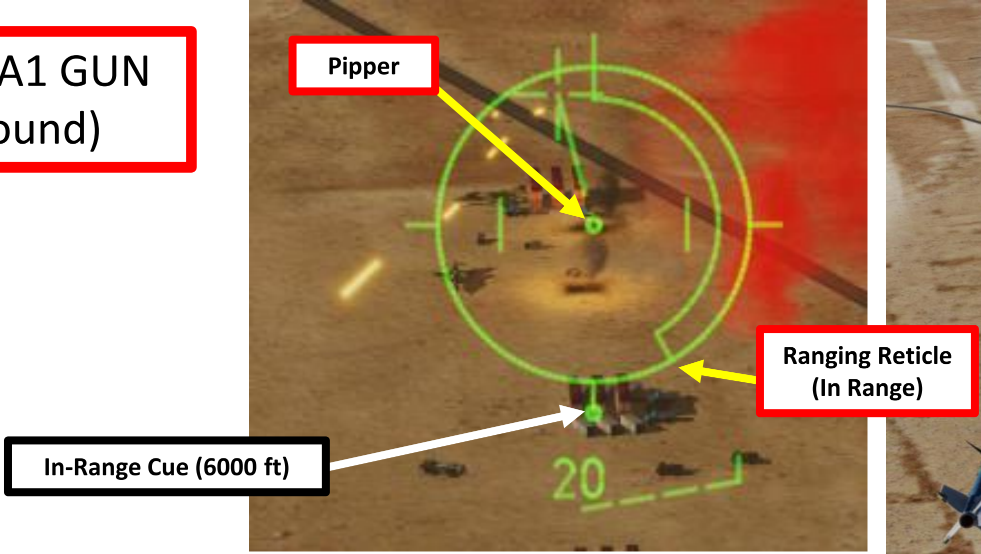
2.5 – M61A1 GUN (Air-to-Ground)

9. Dive on the target and place the Gun Pipper on the target.
10. (Optional) If the targeting pod is equipped, press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the "L" symbol on the HUD will flash. Releasing the trigger stops lasing.
    - When "laser ranging", the laser is fired and the time it takes to receive the reflected laser energy is measured, providing a precise range. This information is then fed to the Fire Control Computer to update the stored target elevation and greatly improve the accuracy of the computed firing solution.
    - If Laser Ranging is not used, the Fire Control Computer will still display a range, but not as precise.
11. Wait for the gun's Ranging Reticle to unwind until the In-Range Cue (previously set to 6000 ft) is reached. When In-Range Cue is reached, you are within effective gun range and may fire when ready.
12. Squeeze the trigger all the way to the second detent to fire the gun (SPACE).





2.5 – M61A1 GUN (Air-to-Ground)



2.6 – AGM-65 MAVERICK

2.6 – AGM-65 MAVERICK
2.6.1 – Introduction

The AGM-65 Maverick is an air-to-ground missile. The F-16 simulated in DCS has four versions available. The missile's standoff range is between 6 and 8 nm, and it is best used against short-range air defense systems and armored targets (i.e. tanks).

- **AGM-65D:** IR (infrared) imaging seeker, 126-lbs warhead, better suited against light and armored vehicles, allows automatic target handoff from targeting pod. Automatic handoff slaves the Maverick missile's seeker to where the targeting pod is looking and will automatically lock the missile on a pod-designated target if the missile is within effective range. Automatic handoff is useful since it doesn't require you to go to the Maverick WPN page, set it as the sensor of interest, manually lock the missile's seeker head to the target… which is what Manual handoff requires you to do before firing the missile (correlating both the missile's and the targeting pod's line of sight in the process).

- **AGM-65G:** IR (infrared) imaging seeker, 300-lbs warhead, better suited against ships, bunkers and larger structure, allows automatic target handoff from targeting pod.

- **AGM-65H:** Electro-optically guided seeker, 126-lbs warhead, better suited against light and armored vehicles.

- **AGM-65K:** Electro-optically guided seeker, 300-lbs warhead, better suited against ships, bunkers and larger structure.

AGM-65 missile launch restrictions:
- Max launch speed: Mach 1.2
- Max dive angle: 60°
- Max bank angle: 30°
- Max roll rate: 30°/s
- Min/Max load factor: +0.5 g/+3.0 g

2.6 – AGM-65 MAVERICK
2.6.1 – Introduction

The Maverick has three main operating modes:

Pre-Planned (PRE) Mode:

- The PRE delivery mode is used against pre-planned targets **using the targeting pod**'s line of sight. This approach is best used against targets that have a location known prior to takeoff (i.e. next to an existing steerpoint, on which you can slave the targeting pod and find the target). In PRE mode, the **Maverick D and G variants** can use either a **MANUAL or an AUTOMATIC handoff** methods.

Visual (VIS) Mode:

- VIS delivery mode is designed for Maverick attacks using dive toss (DTOS) type sighting. In VIS submode, the HUD is initialized as the sensor of interest (SOI) and the weapon seeker head is slaved to the HUD (Heads-Up Display) Target Designation (TD) box, which **is ground-stabilized**. Prior to designating a target, the TD box is caged about the Flight Path Marker (FPM). This mode is best used against targets that you can acquire visually (i.e. near smoke signals or known landmarks) or in situations where you do not have a targeting pod equipped.

Boresight (BORE) Mode:

- BORE delivery mode displays are similar to the PRE displays except that the AGM-65 seeker head is pointed to the nominal boresight (aligned with the Maverick reticle/cross on the HUD). This allows for firing on targets of opportunity without disturbing the targeting pod's track position. The Maverick reticle/cross can be slewed (and the Maverick's seeker head line of sight with it), but it **is NOT ground-stabilized** and will move with the aircraft. This is useful to scan large areas of land rapidly if you do not have a targeting pod equipped.

2.6 – AGM-65 MAVERICK
2.6.1 – Introduction

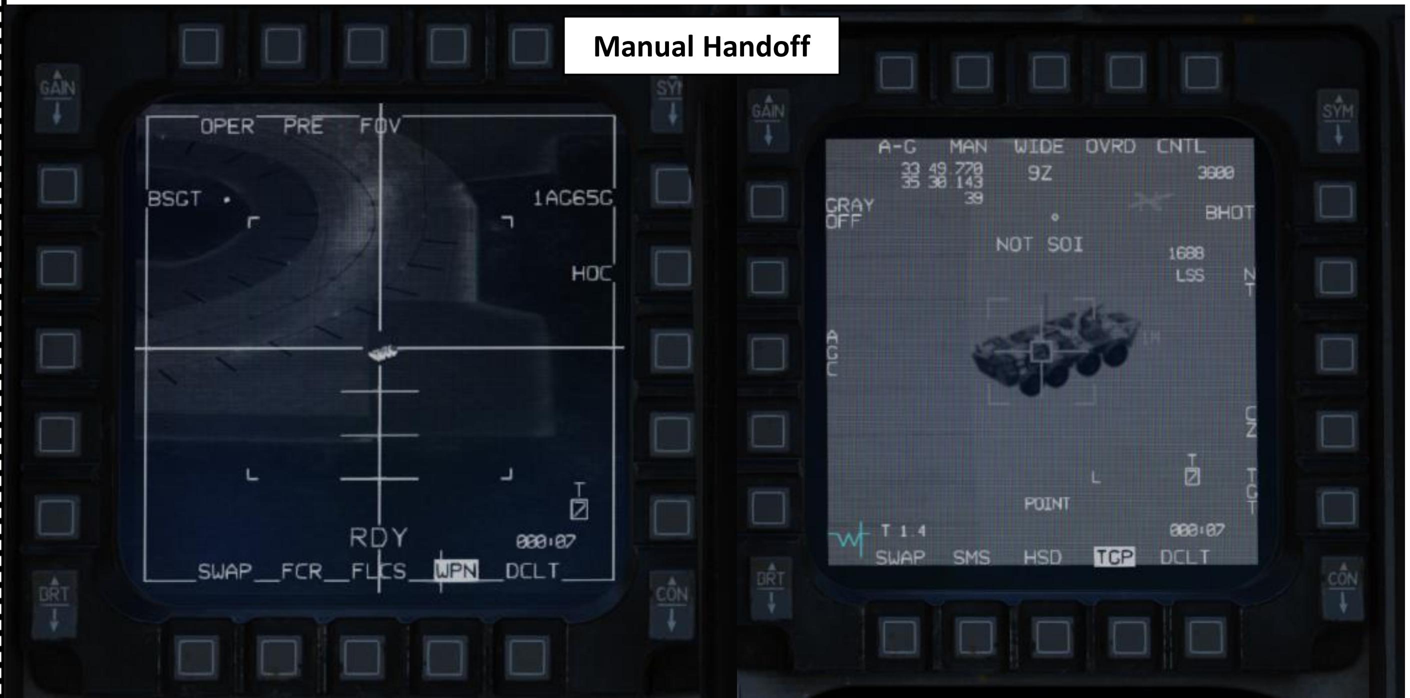
In PRE mode, the **Maverick D and G variants** can use either a MANUAL or an AUTOMATIC handoff. What does this mean?

MANUAL HANDOFF:

- The AGM-65 will be slaved to the Line of Sight of the TGP but will not automatically be handed off the lock. Pilot must manually change SOI (Sensor of Interest) to the AGM-65 (WPN page) with DMS DOWN, and then command lock manually with TMS UP.

AUTOMATIC HANDOFF (Applicable to AGM-65D/G only):

- The Targeting Pod is used to detect and track targets for semi-automated AGM-65D/G delivery. The missile boresight correlator (MBC) takes control, selects, configures, and controls missile slew and lock-on of the AGM-65D/G to achieve a tracking missile. This automated mechanization reduces workload by **deleting the requirement of using the WPN page**. When in A-G mode with an AGM-65D/G selected and the SOI is the TGP, the MBC is active.
- TMS UP creates a point track, which automatically triggers an automatic hand off attempt.
- **(Not yet simulated)** TMS RIGHT, with TGP SOI, will repeat hand off the lock to the AGM-65 if the target contrast and size meet criteria of missile lock.



Manual Handoff

Automatic Handoff

2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting

When it comes to the F-16, one of the most important aspects of the Maverick missile is the need to "boresight" it. What does this mean?

In short: there is an **alignment error between aircraft on-board sensors and the Maverick missile seeker head**. You need to correct this error by lining up manually the targeting pod's line-of-sight and the Maverick's line-of-sight, then press the "BSGT" button on the WPN page to confirm that the targeting pod (TGP) and Maverick seeker head are pointing at the same target.

In other words, while the targeting pod is looking at something, the Maverick missile might look at another target if both sensors are not boresighted properly. Instead of sending a missile on a tank, the Maverick could track the nearby ground, preventing a direct handoff for Maverick lock. The seeker could even be tracking another target entirely. The targeting pod's range and resolution being much higher than the Maverick's seeker's, it is a necessity to **make sure that both TGP and MAV are looking at the same thing.**

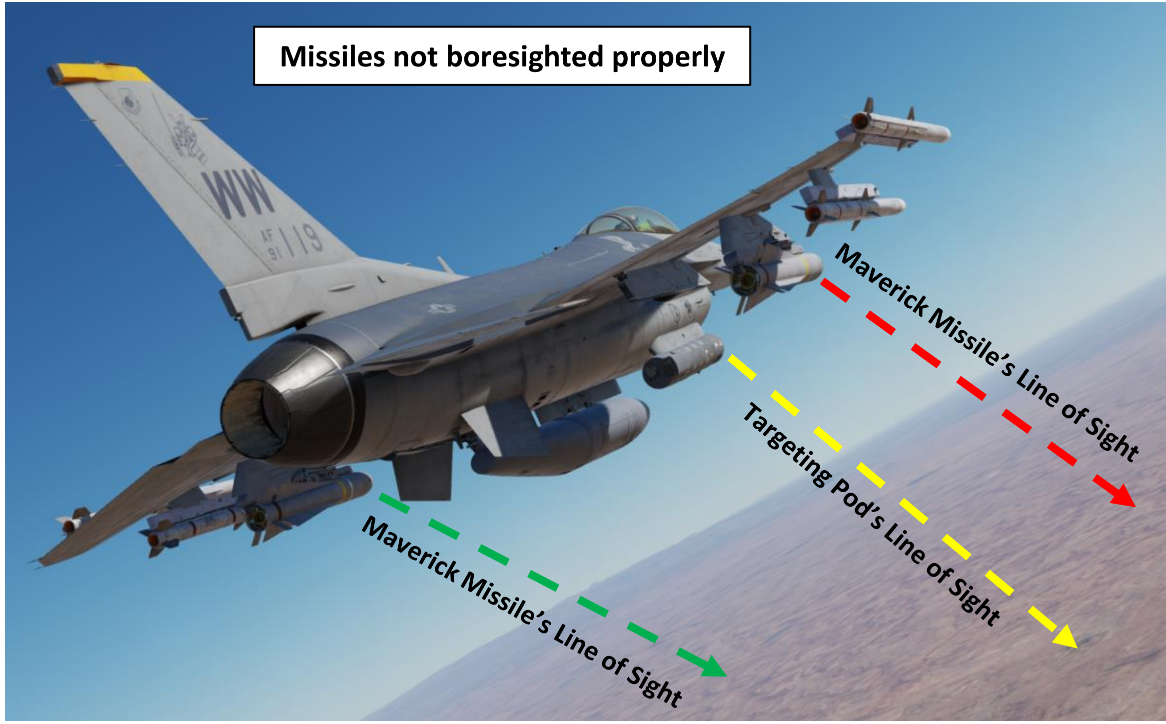
Boresighting isn't mandatory since you can always slew the Maverick tracking gate manually, but I would strongly advise doing it anyway since you really don't want to needlessly double your workload while in the area of operations.

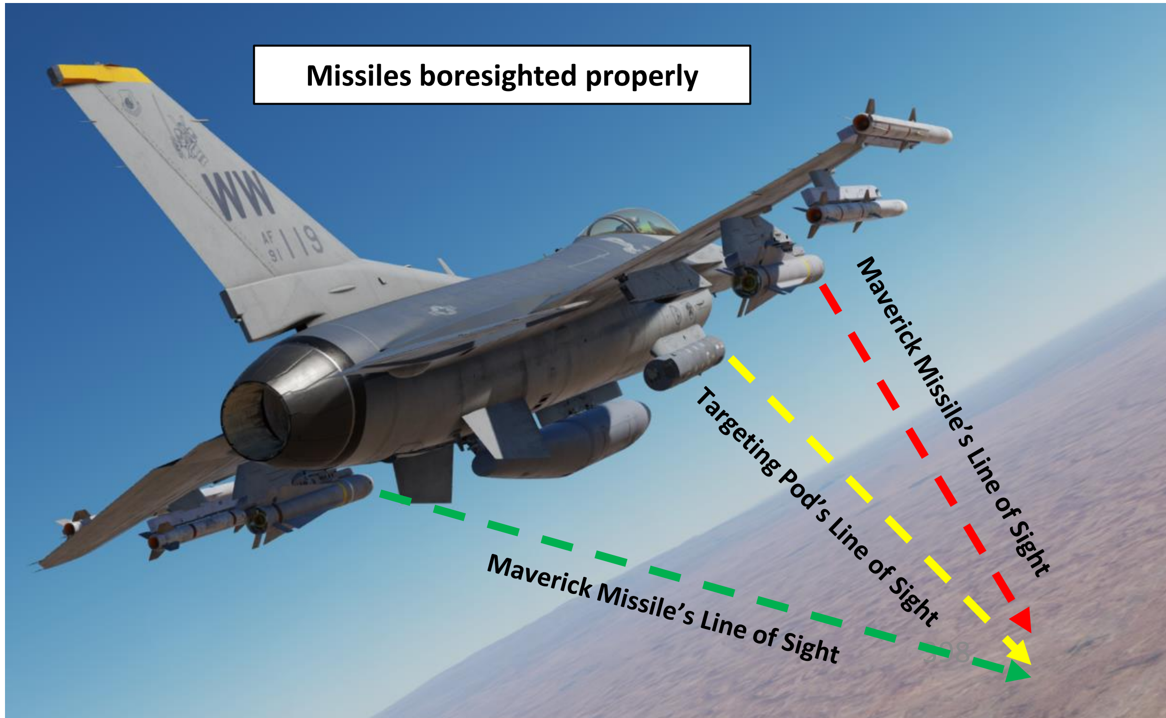
In practice, the boresighting procedure is performed before attacking your actual target, either in flight or on the ground. You "simply" find a friendly target/vehicle (or any recognizable object the Maverick can lock on), slew the targeting pod reticle over it, then you slew the Maverick seeker over the same target, then confirm that both the missile and the targeting pod are lined up ("boresighted"). This process needs to be repeated for every missile station, which can be a bit of a pain in the ***.

However, the advantage of doing this early on is that once you attack vehicles, you can easily use the targeting pod to spot individual targets, then perform either an automatic or a manual handoff from the TGP to the Maverick, increasing your precision and ease of use.

Click to navigate back to PRE Tutorial.

Click to navigate back to VIS Tutorial.



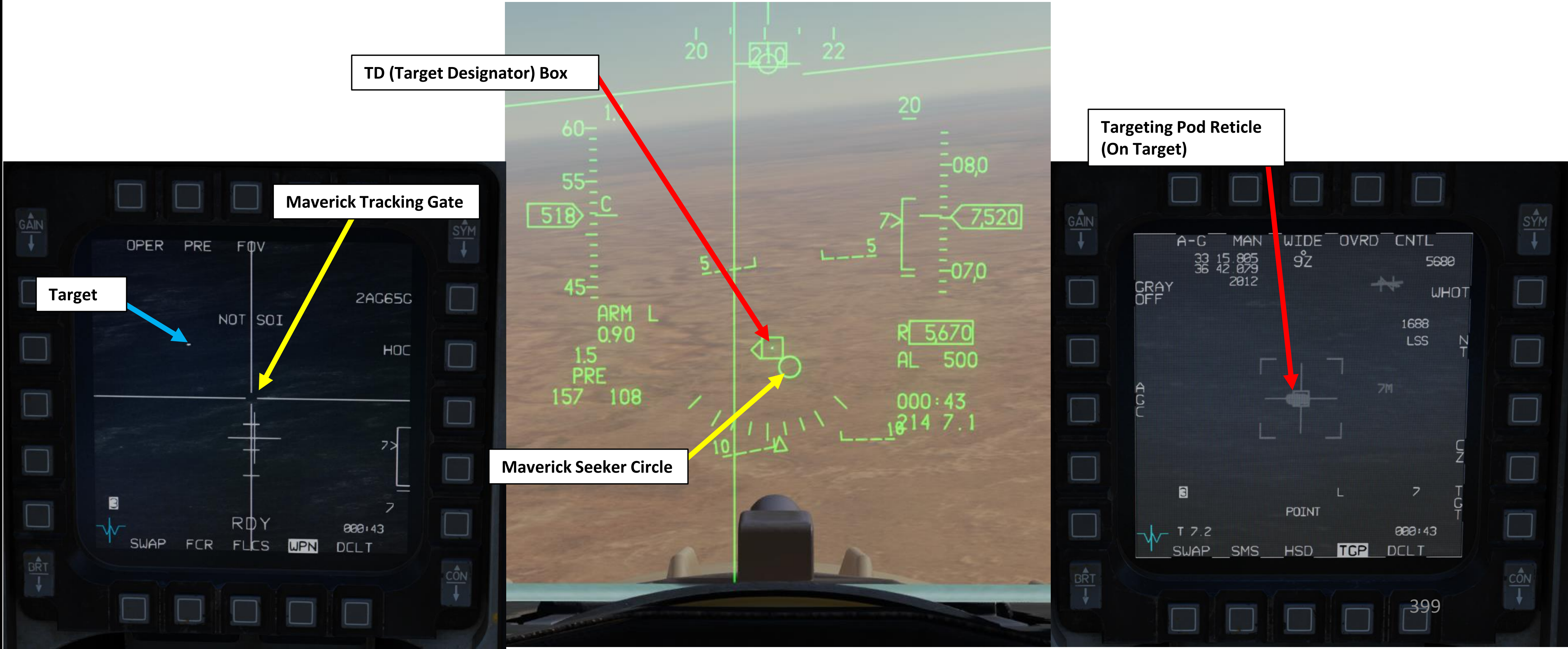


2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting

Here is an example of a misalignment between the Maverick seeker and the targeting pod's reticle. In this case, the TGP is right on the target, while the Maverick is completely off. This is how you recognize a situation where boresighting is necessary. The Heads-Up Display shows that the TD (Target Designator) Box of the Targeting Pod is not lined up with the Maverick Seeker Circle.

Summary

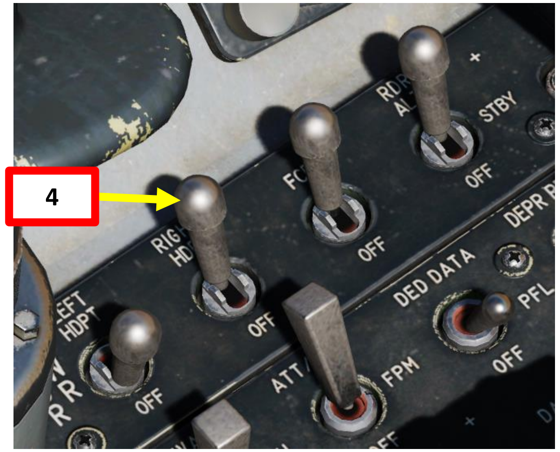
1. Power on the Mavericks and TGP.
2. Set GND JETT ENABLE ON, MASTER ARM SIM, A-G master mode, and A/G TGP mode.
3. On the SMS format, select AG65 and set E/O sub-mode to PRE or VIS.
4. On the TGP format, slew the seeker head to the boresight target.
5. On the WPN format, slew the seeker head to the same target and designate.
6. Press the BSGT button (OSB20).
7. Repeat steps 4–6 for for each station.
8. Power off the Mavericks and reset all switches.

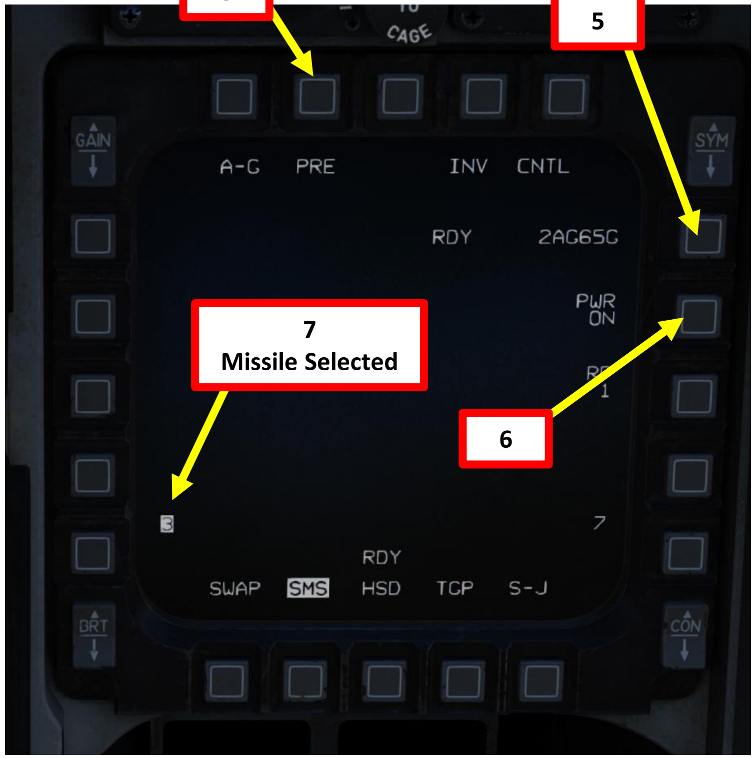


2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting


Here is an example of a Boresighting Procedure using the targeting pod.

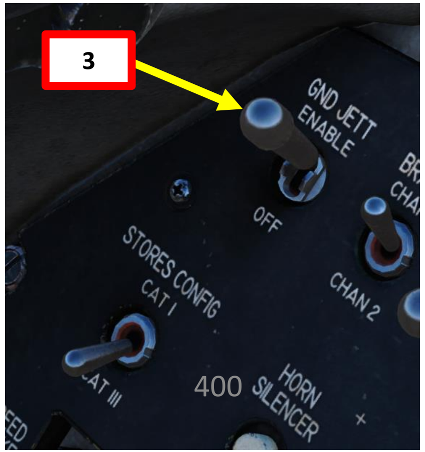
1. Press the A-G Master Mode Button
2. Set Master Arm switch – SIMULATE (DOWN). This is to ensure we don't fire any missile by mistake on a friendly target.
3. If you are on the ground, set GND JETT ENABLE switch – ENABLE (UP). If you are in the air, leave switch to OFF.
4. Power up the targeting pod: Set the RIGHT HDPT switch to ON (FWD).
5. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG65 (AGM-65 Maverick) missile. The number preceding AG65 is the number of missiles of this type equipped, and the letter following AG65 is the missile variant (D, G, H, or K).
6. Power on Maverick by pressing OSB next to PWR.
7. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
8. Toggle OSB next to Maverick Mode to select PRE (Pre-Planned) mode
9. Select desired waypoint near the target we will use for boresighting, using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 1.





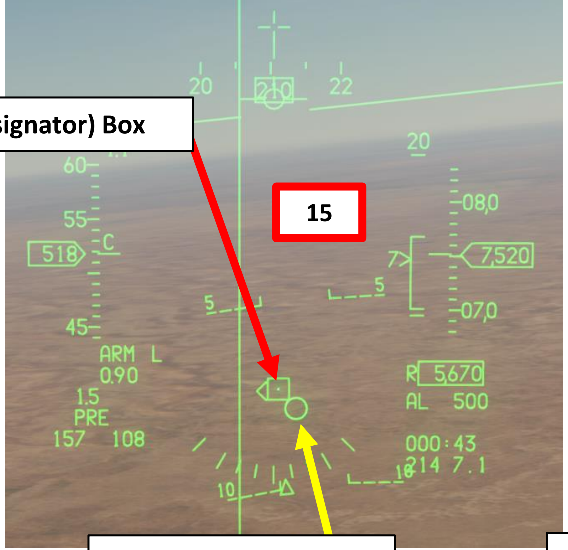
NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

7



2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting

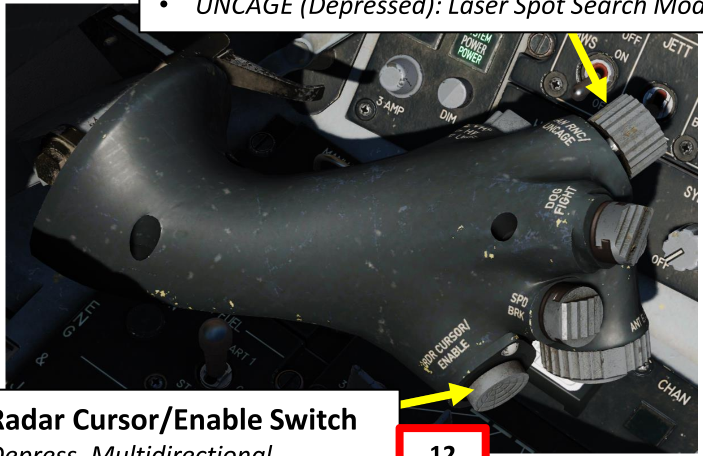
10. Set the TGP page and the WPN page to the left and right displays.
11. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.
12. Press TMS RIGHT to set an Area Track on the steerpoint location. Then, slew the targeting pod using the Radar Cursor switch
13. On the TGP page, select MAN Handoff Mode by toggling the OSB next to MAN/AUTO.
14. While TGP is the Sensor of Interest (SOI) and MAN handoff is selected, use TMS (Target Management Switch) UP to engage Point Track (POINT, tracks moving objects) while the radar cursor is on the desired target
15. We can already see the misalignment on the HUD between the TD Box and the Maverick Seeker.



TD (Target Designator) Box

15

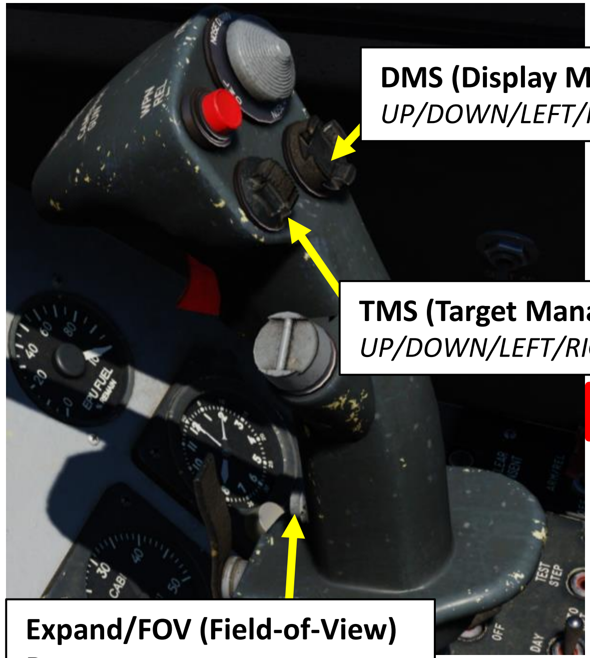
Maverick Seeker Circle



MAN RNG/UNCAGE Knob/Switch
- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)*

Radar Cursor/Enable Switch
Depress, Multidirectional

12



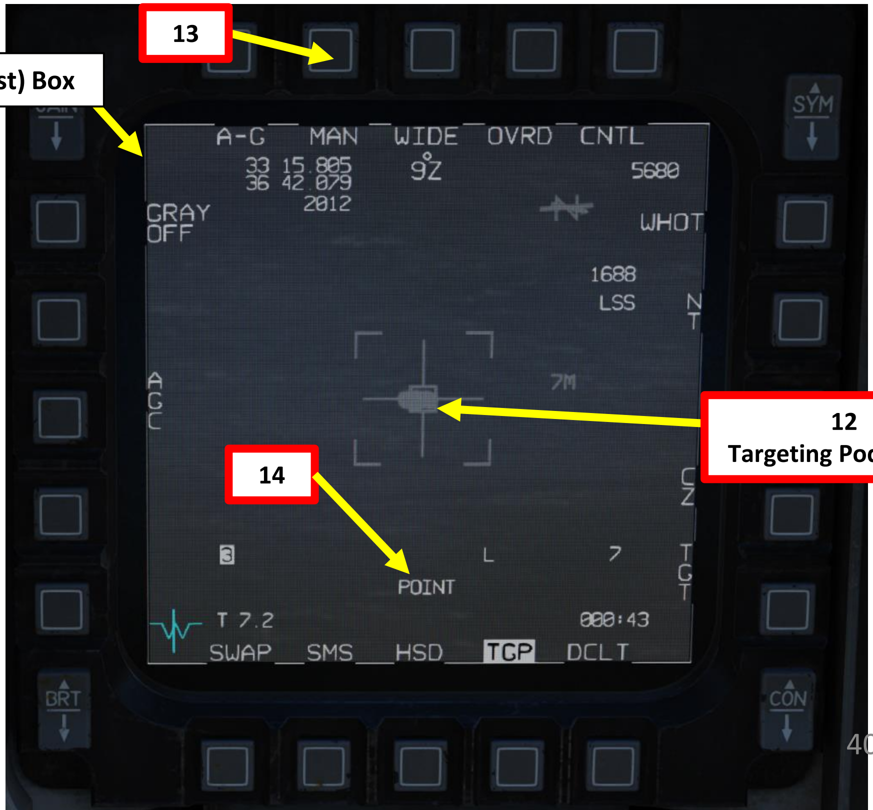
DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

11

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

12 **14**

Expand/FOV (Field-of-View) Button



13

11 **SOI (Sensor of Interest) Box**

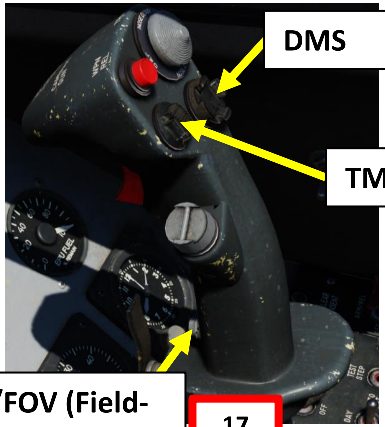
12
Targeting Pod Cursor

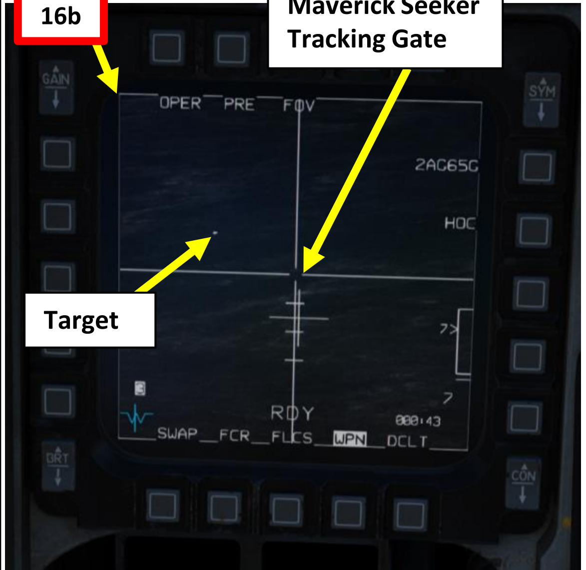
14

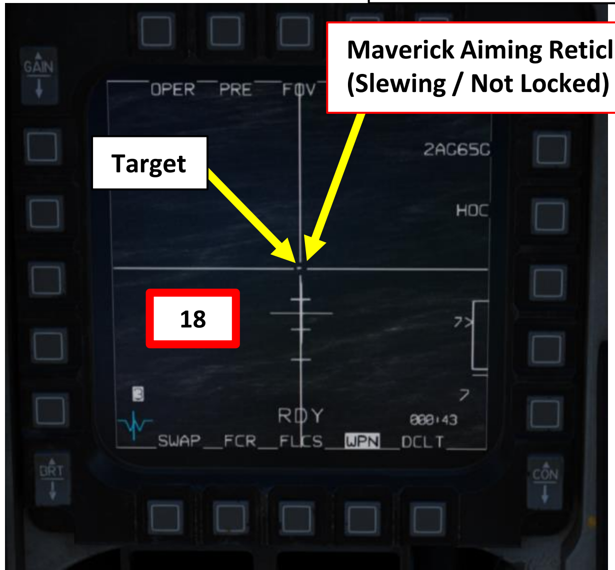
2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting

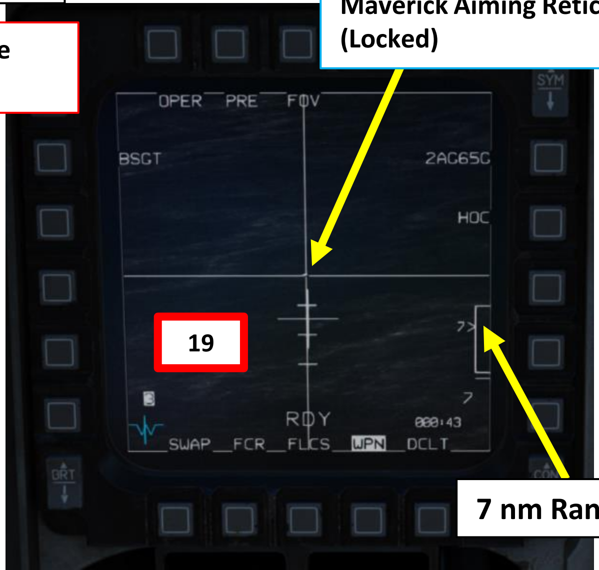
16. Press DMS (Display Management Switch) DOWN to set WPN page as the SOI (Sensor of Interest). The SOI Box around the WPN page will indicate when the Maverick seeker can be controlled with HOTAS controls.
17. Set Field of View as desired using the FOV OSB or using the Expand/FOV button.
18. Slew the Maverick WPN Tracking Gate / HUD Seeker Circle on the target using the Radar Cursor switch. A good method is to use the Maverick Seeker Circle on the HUD first and set it in the vicinity of the target (in our case the Target Designation Box of the TGP), and then use the WPN page Maverick feed to find the target.
19. When you are within effective Maverick range, press TMS (Target Management Switch) UP to attempt a Maverick lock on the target designated by the targeting pod. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.
20. Once the Maverick is locked on the target, we now know that both the targeting pod and the Maverick and aligned. Confirm on HUD that TGP TD (Target Designation) Box and Maverick Seeker Circle overlap. BSGT option appears.
21. On the WPN page, press BSGT (Boresight) OSB (Option Select Button) to boresight the missile. **<u>This will confirm that the targeting pod and Maverick seeker head are pointing at the same target, performing the "boresight" process</u>**.

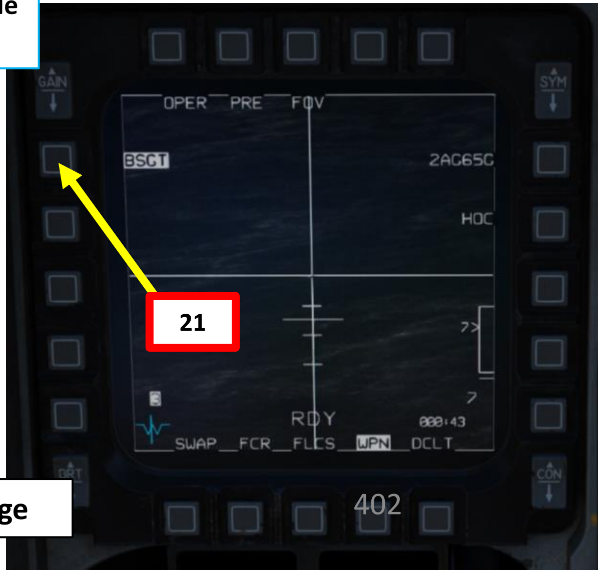
- Note: all missiles on the same station will be boresighted.











2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting

22. Press TMS (Target Management Switch) DOWN to unlock target.
23. Now, the previous steps need to be repeated for the other Maverick station. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
24. When you are done with all stations, power off missiles and reset all switches, including the Master Mode button.

NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

23

24

22

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

Station 3 Selected

22

Maverick Aiming Reticle (Unlocked)

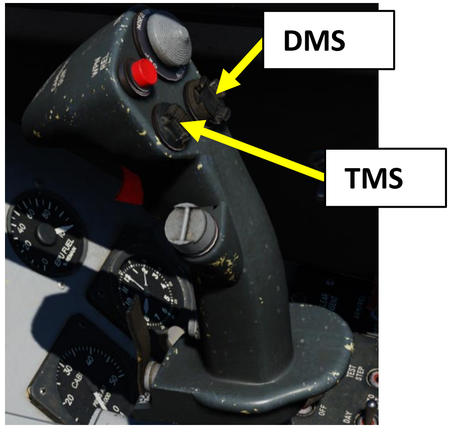
Station 7 Selected

23

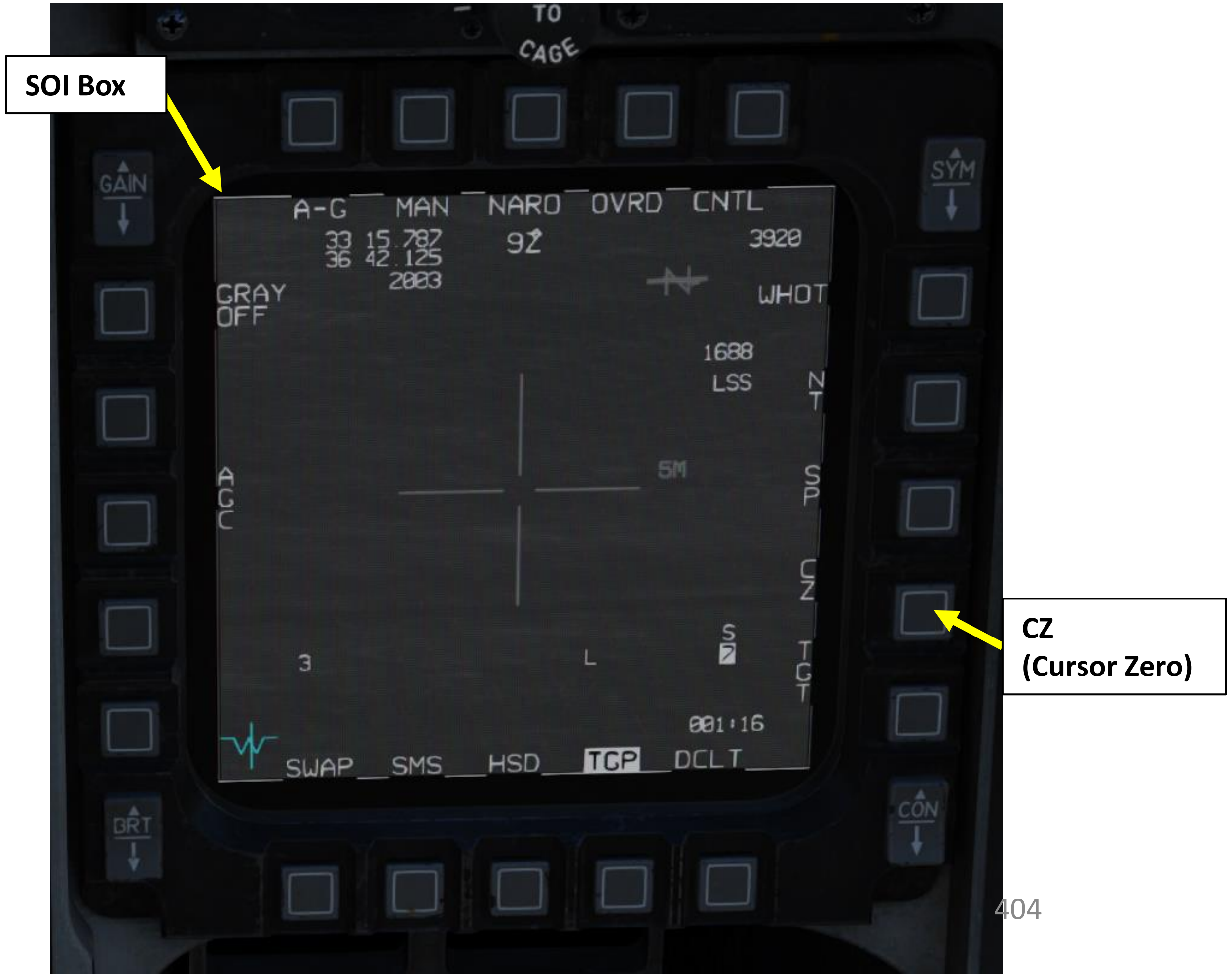
24

24

2.6 – AGM-65 MAVERICK
2.6.2 – Missile Boresighting

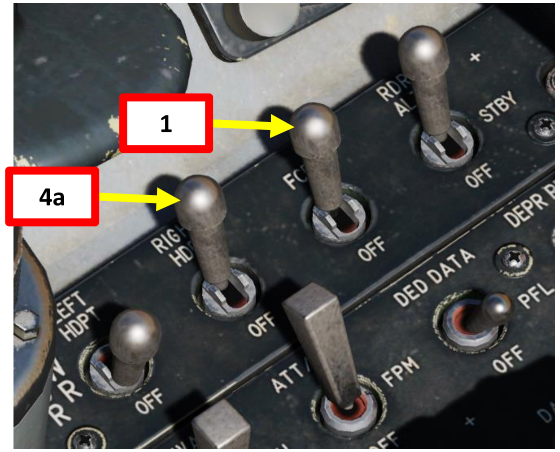


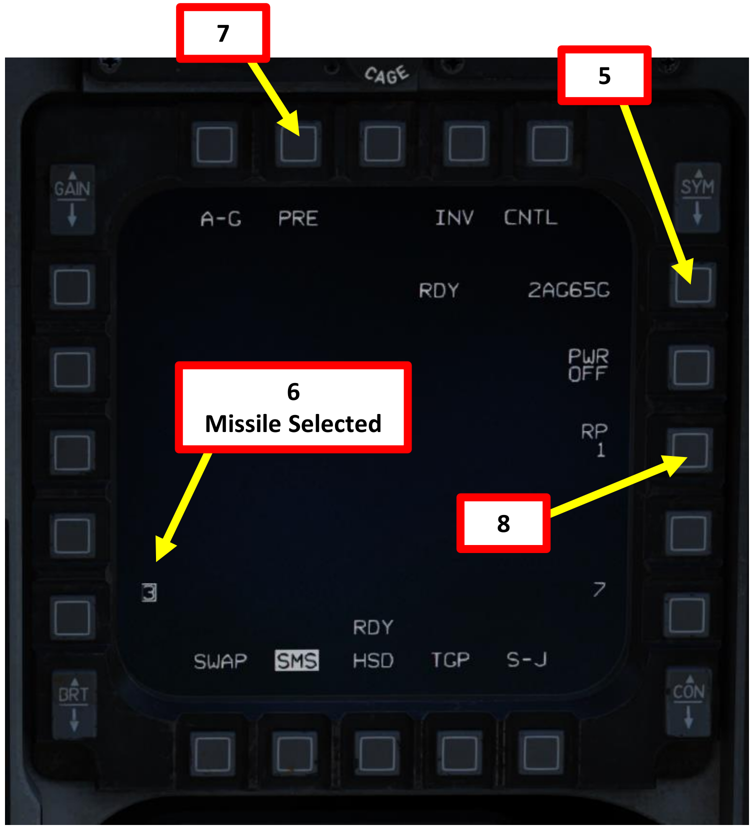
25. As a good practice… go on the TGP page, then:
    a) Set TGP as the Sensor of Interest (SOI) with DMS (Display Management Switch) DOWN
    b) Press TMS (Target Management Switch) DOWN to lose the TGP lock
    c) Press the "CZ" (Cursor Zero) OSB (Option Selector Button) on the TGP page to reset the SPI (Sensor Point of Interest) to the selected steerpoint.

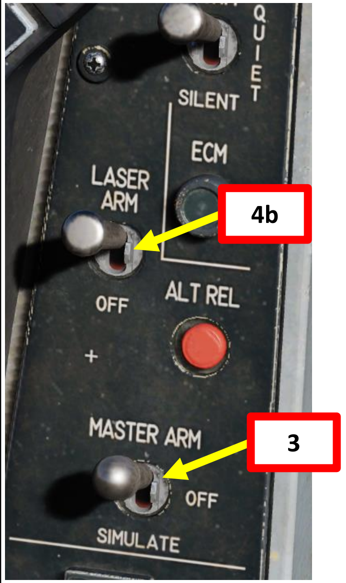


2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Press the A-G Master Mode Button
3. Set Master Arm switch – ARM (UP)
4. To use the targeting pod laser to range the target:
   a) Set the RIGHT HDPT switch to ON (FWD).
   b) Set Laser Switch – ARMED (UP)
5. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG65 (AGM-65 Maverick) missile. The number preceding AG65 is the number of missiles of this type equipped, and the letter following AG65 is the missile variant (D, G, H, or K).
6. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
7. Toggle OSB next to Maverick Mode to select PRE (Pre-Planned) mode.
   - Alternatively, you can also toggle Maverick modes with the Radar/Cursor Enable switch DEPRESSED control (ENTER by default).
8. If using LAU-88 missile racks, select desired Ripple Quantity using the OSB next to RP. We will leave it to 1.





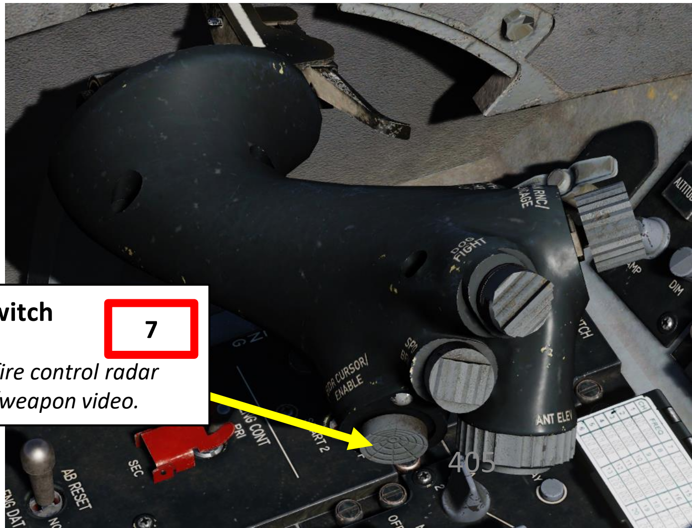


NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

6

Radar Cursor/Enable Switch
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

7



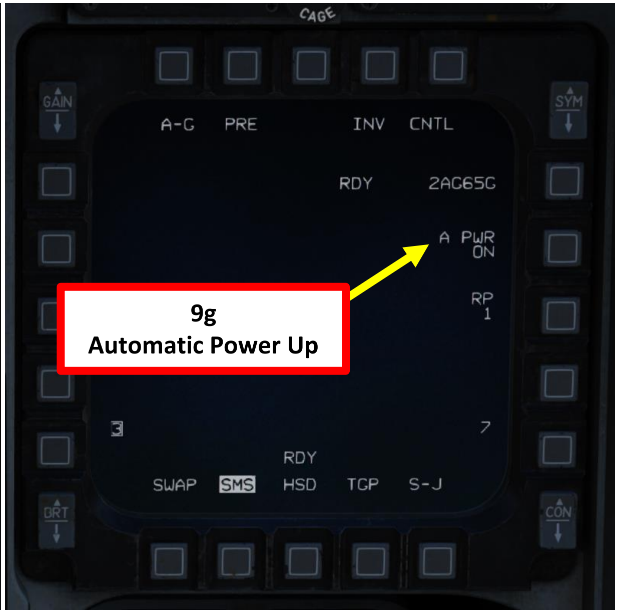
2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

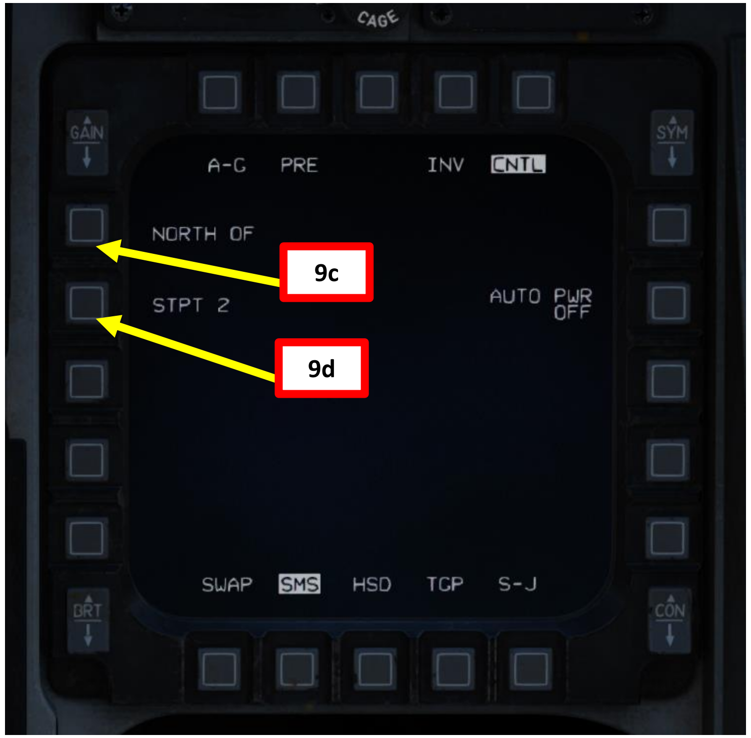
The AGM-65 requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled, which takes about 3 minutes.
Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.

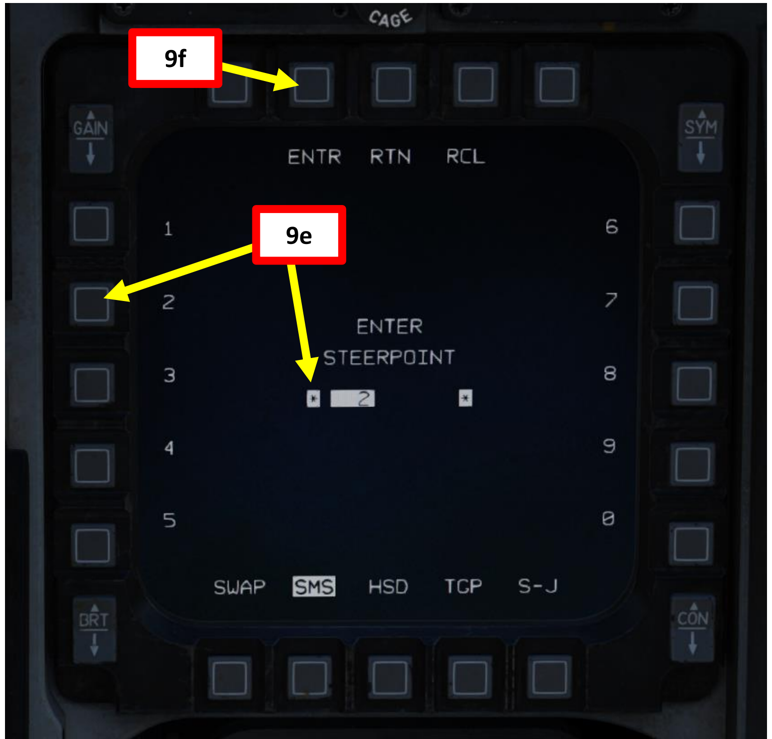
9. Power up Maverick and start seeker cooldown (**MANUAL cooldown method**)
   a) From the SMS page, press the OSB next to PWR OFF to start the power-up process of the Maverick.
   b) Once PWR ON is set, cooldown will take about 3 minutes.

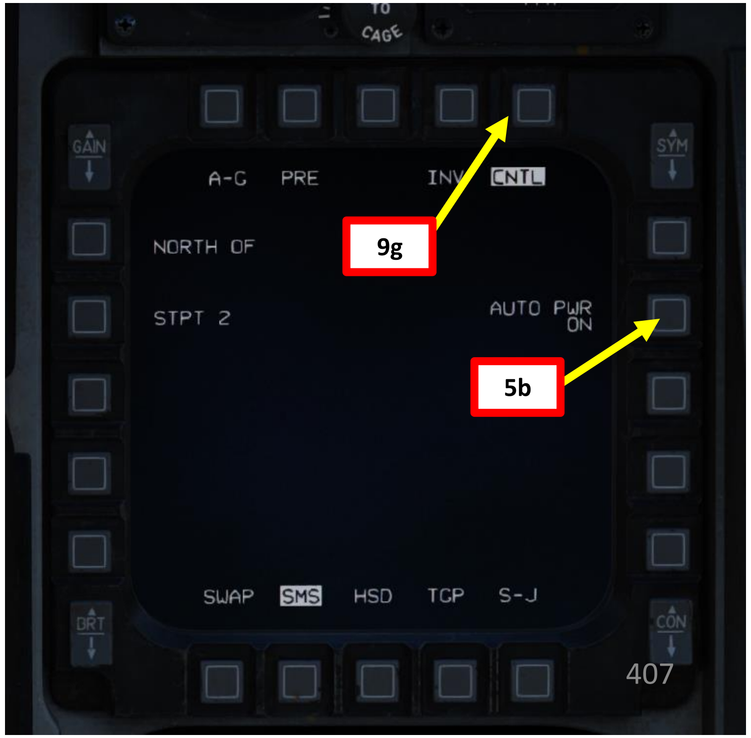
2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

9. Power up Maverick and start seeker cooldown (**AUTO cooldown method**)
    a) From the SMS page, press OSB next to CNTL to select the Control Page.
    b) We want the missile the automatically start its cooldown once we are North of Steerpoint #2.
    c) Toggle OSB next to NORTH/SOUTH/EAST/WEST OF to select where the Missile automatic cooldown will start in relationship to the selected steerpoint.
    d) Press OSB next to STPT (Steerpoint)
    e) Select desired Steerpoint you want to use as a reference using the OSBs of the STPT menu.
    f) Press OSB next to ENTR to confirm steerpoint selection.
    g) Press OSB next to CNTL to return to the SMS page.



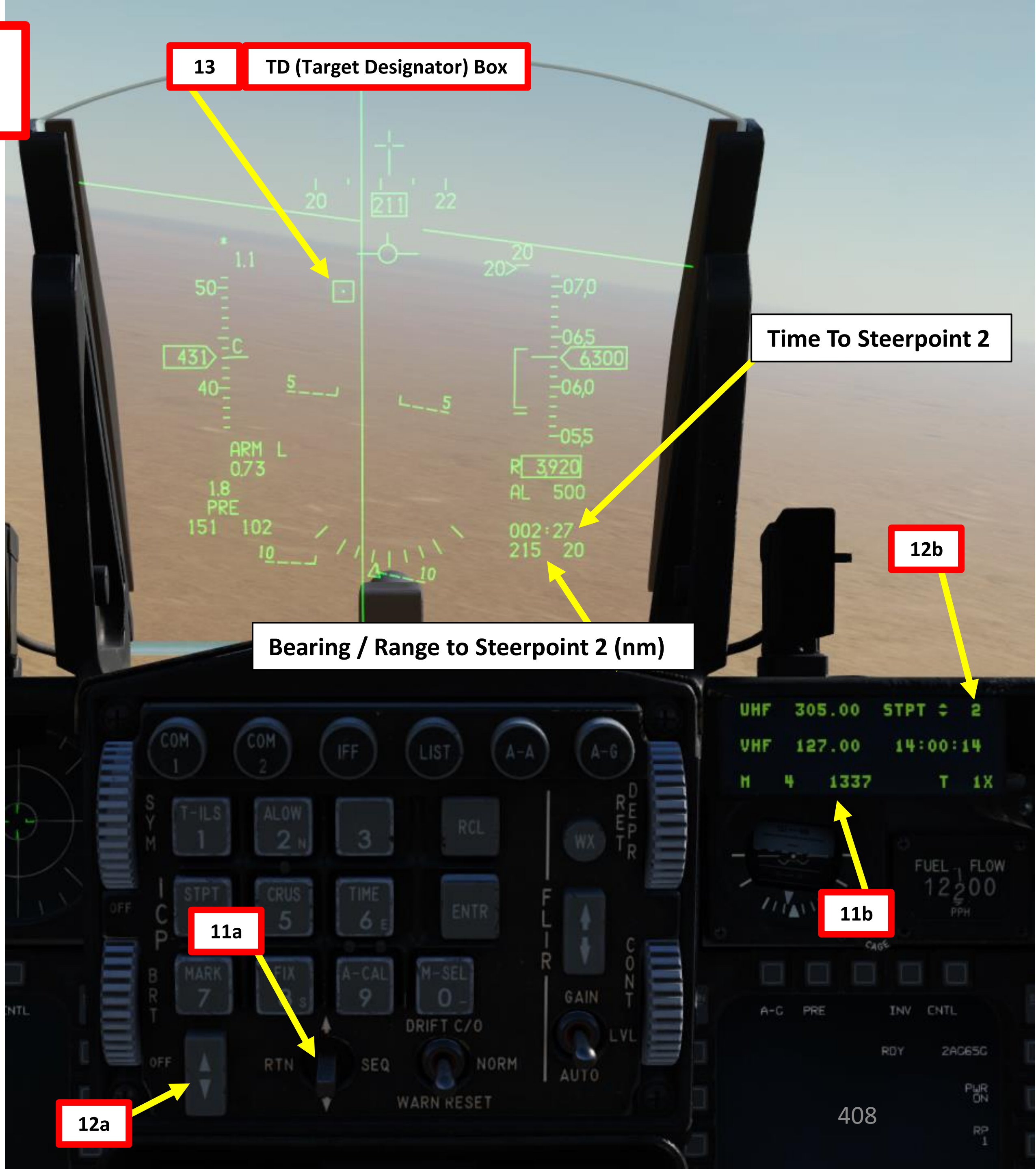






2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

10. We will be attacking a target that is next to a steerpoint that is already in our flight plan (i.e. Steerpoint No. 2). To enter Steerpoint coordinates manually, see the Navigation section.
11. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
12. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
13. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.

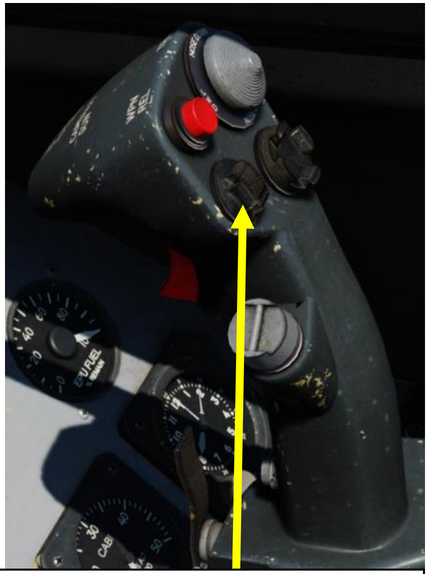


2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

14. Select the WPN (Weapon) page
15. During Maverick cooldown, the NOT TIMED OUT indication will be visible on the WPN page. Maverick feed will become visible once cooldown sequence is complete.
16. The WPN page should display PRE (Pre-Planned) Mode. If it isn't selected, toggle the OSB (Option Select Button) next to the Maverick Mode until PRE is selected.
17. Select Track Polarity as required using the OSB next to Track Polarity or using TMS LEFT
    <u>For AGM65H/K:</u>
    - *WB: White-On-Black (centroid track based on contrast)*
    - *BW: Black-On-White (centroid track based on contrast)*

    <u>For AGM-65D/G:</u>
    - *HOC: Hot-On-Cold Polarity Contrast (centroid track based on contrast)*
    - *COH: Cold-On-Hot Polarity Contrast (centroid track based on contrast)*

    <u>For AGM-65G/K:</u>
    - *AREA: Force Correlate Option (based on area scene like tall buildings)*
18. On the other display, select TGP (Targeting Pod) Page. TGP will already be slaved to selected steerpoint.

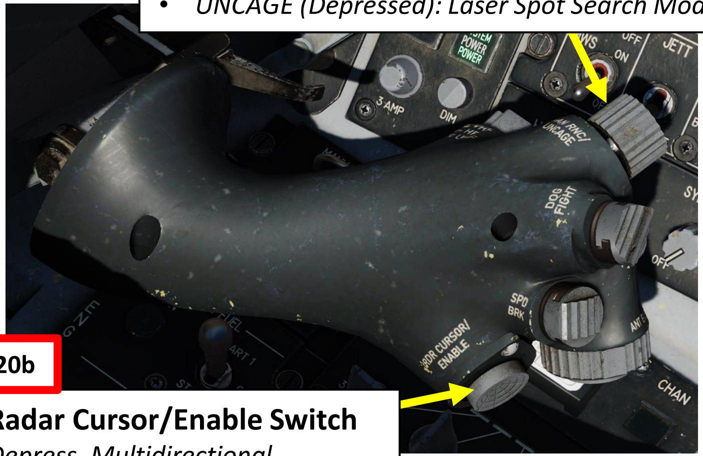


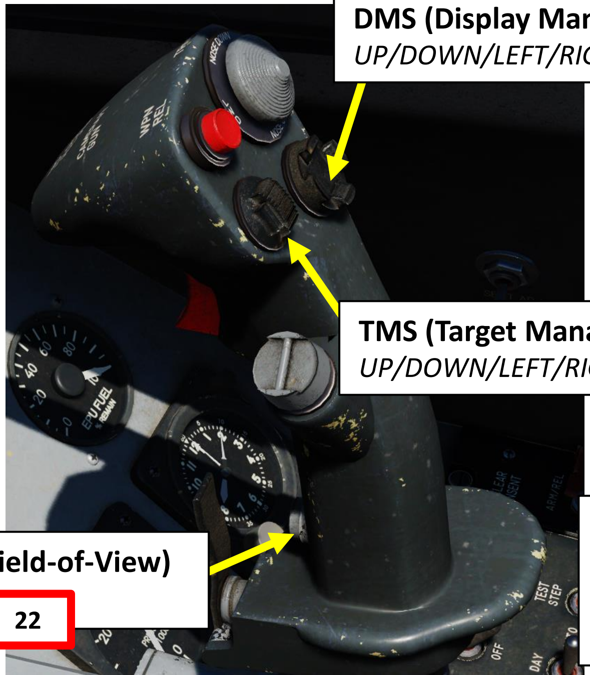
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

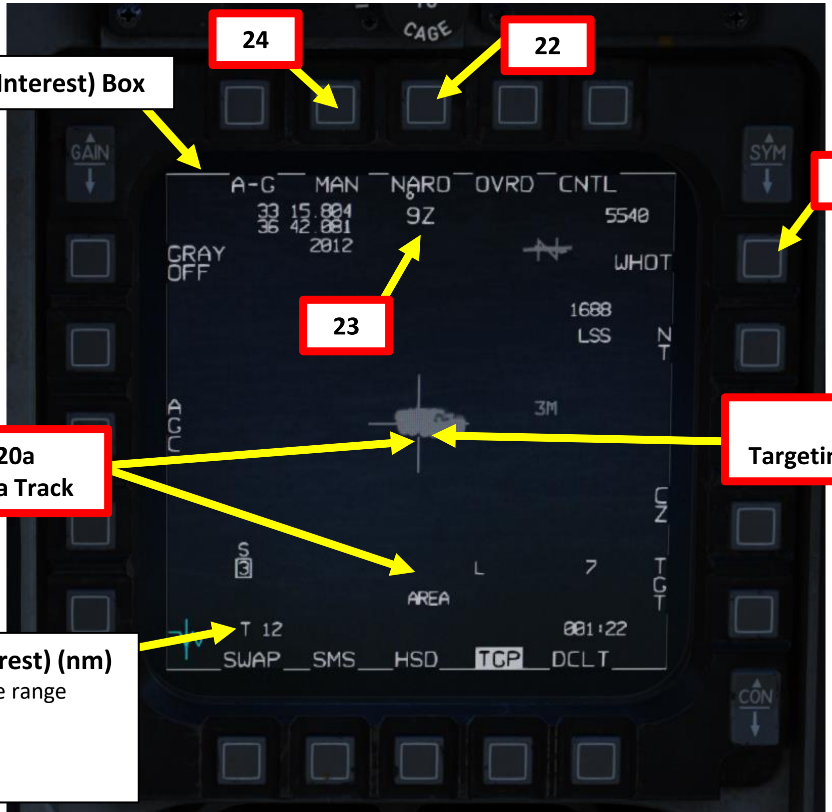
2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

19. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.
20. Press TMS RIGHT to set an Area Track on the steerpoint location. Then, slew the targeting pod using the Radar Cursor switch
21. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
22. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
23. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
    - CCW (Counter-Clockwise): Zooms OUT
    - CW (Clockwise): Zooms IN
24. On the TGP page, select desired Handoff Mode by toggling the OSB next to MAN/AUTO.

Make sure the missile is properly boresighted before performing a handoff.
See Boresighting Example.



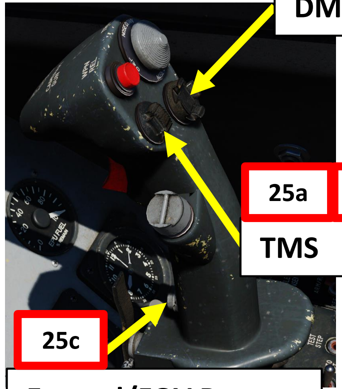


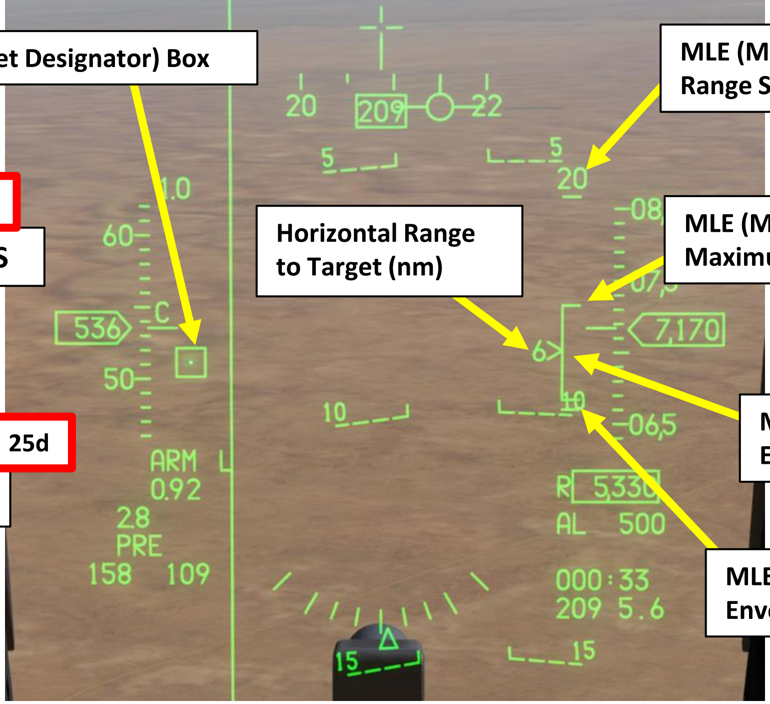


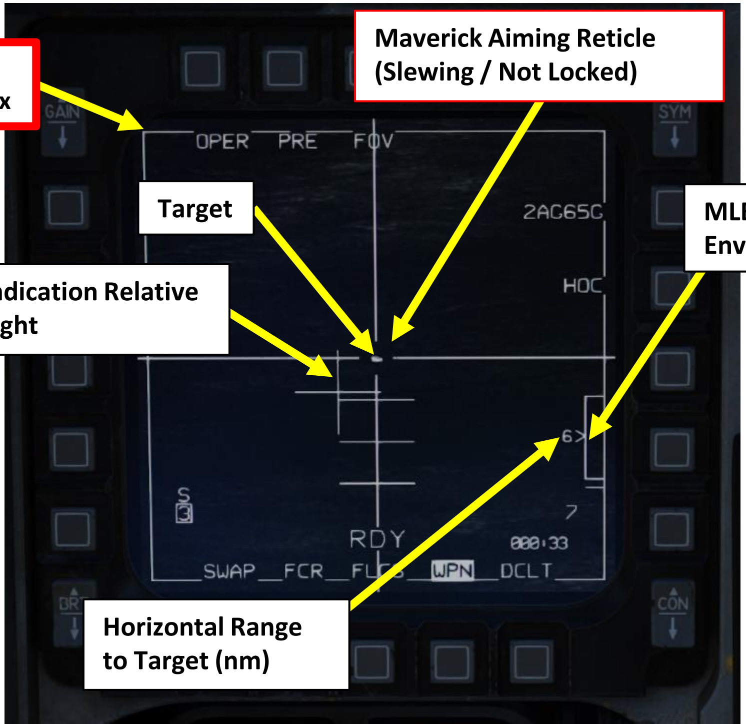
2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

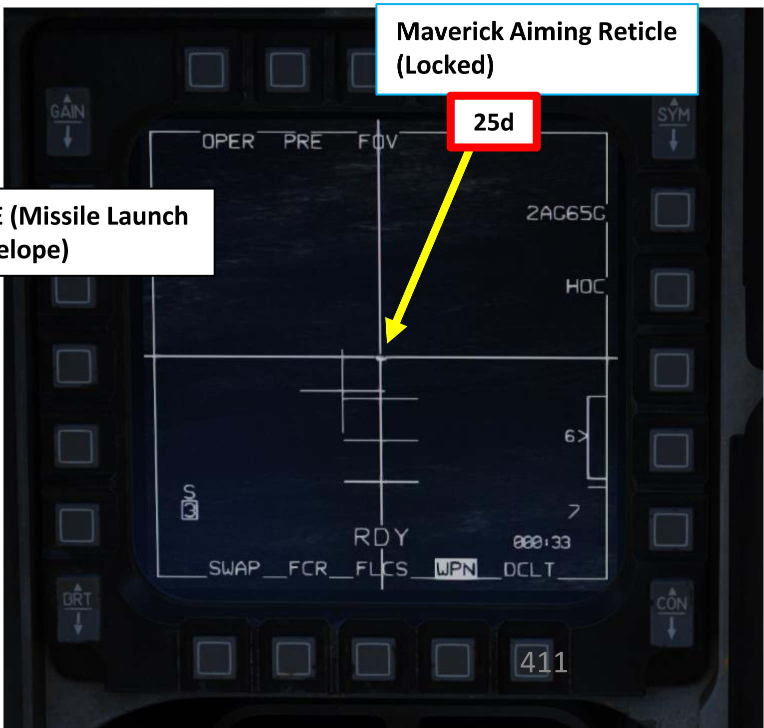
MANUAL HANDOFF METHOD (AGM-65D/G/H/K)

25. Perform Maverick Handoff
    a) While TGP is the Sensor of Interest (SOI) and MAN handoff is selected, use TMS (Target Management Switch) UP to engage Point Track (POINT, tracks moving objects) while the radar cursor is on the desired target
    b) Press DMS (Display Management Switch) DOWN to set WPN page as the SOI (Sensor of Interest). The SOI Box around the WPN page will indicate when the Maverick seeker can be controlled with HOTAS controls.
    c) Set Field of View as desired using the FOV OSB or using the Expand/FOV button.
    d) When you are within effective Maverick range, press TMS (Target Management Switch) UP to attempt a Maverick lock on the target designated by the targeting pod. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.





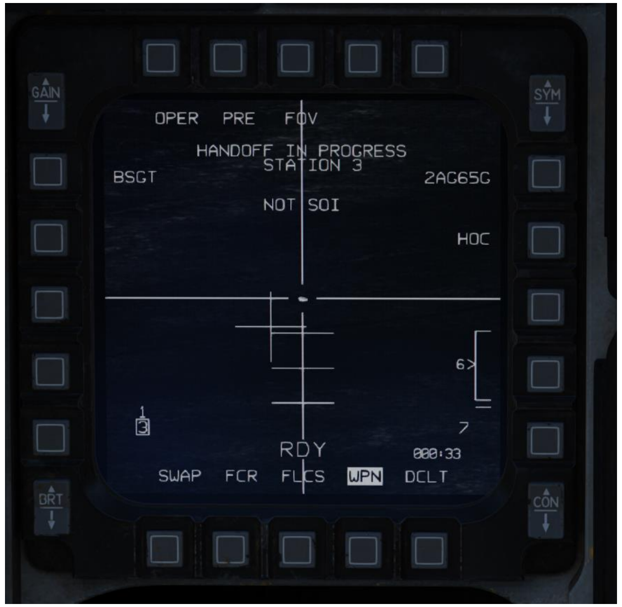


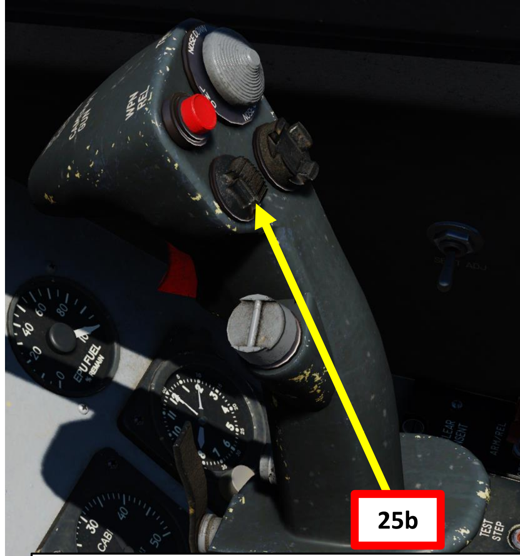


2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

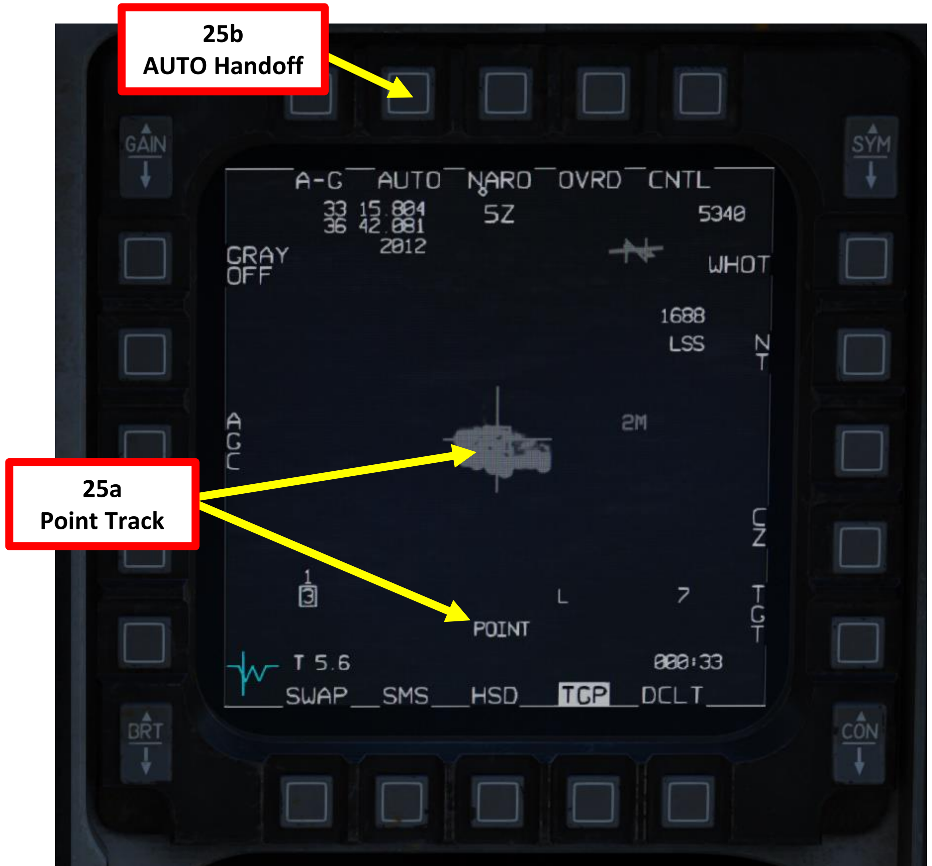
AUTOMATIC HANDOFF METHOD (AGM-65D/G)

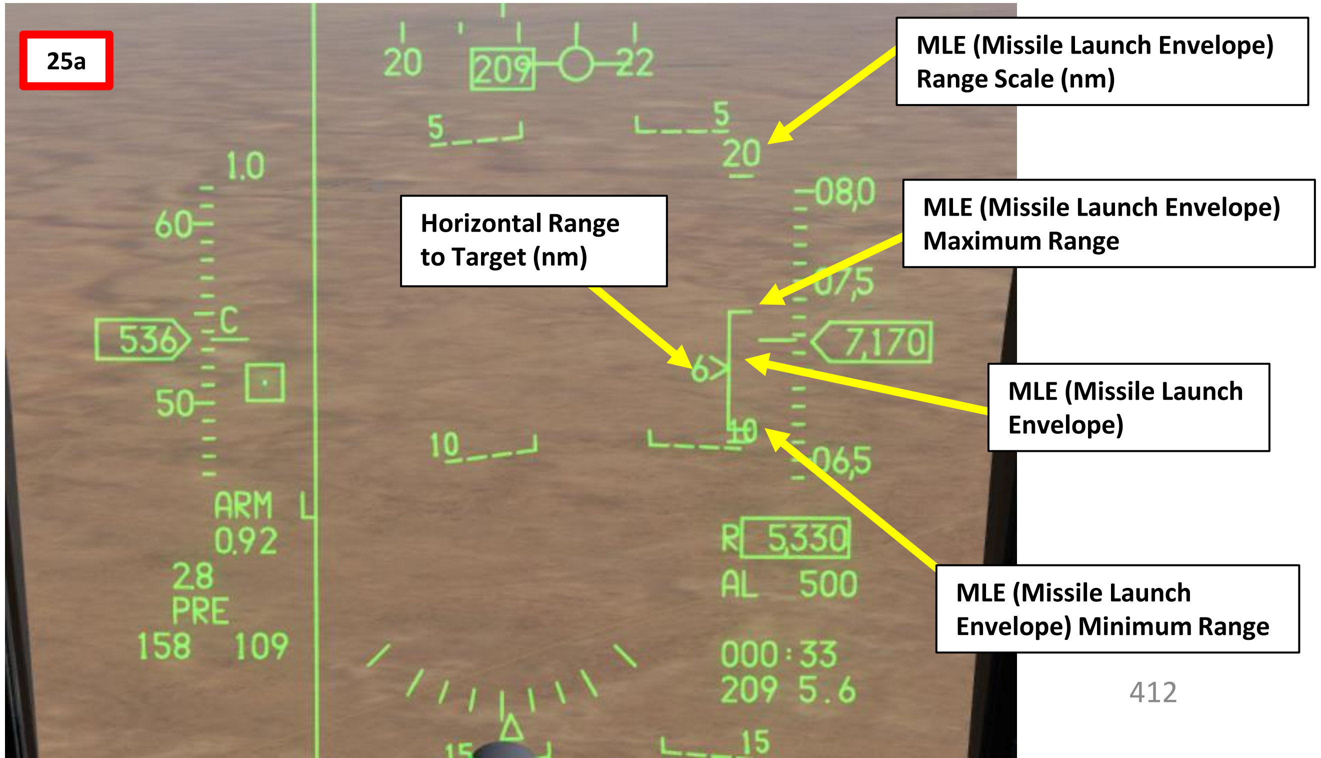
25. Perform Maverick Handoff
    a) Make sure you are within effective Maverick range. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.
    b) While TGP is the Sensor of Interest (SOI) and AUTO handoff is selected, use TMS (Target Management Switch) UP to engage Point Track (POINT, tracks moving objects) while the radar cursor is on the desired target
    c) Point Track automatically triggers an automatic hand off attempt (the Maverick seeker will attempt to lock a valid target where the targeting pod is looking).





TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT





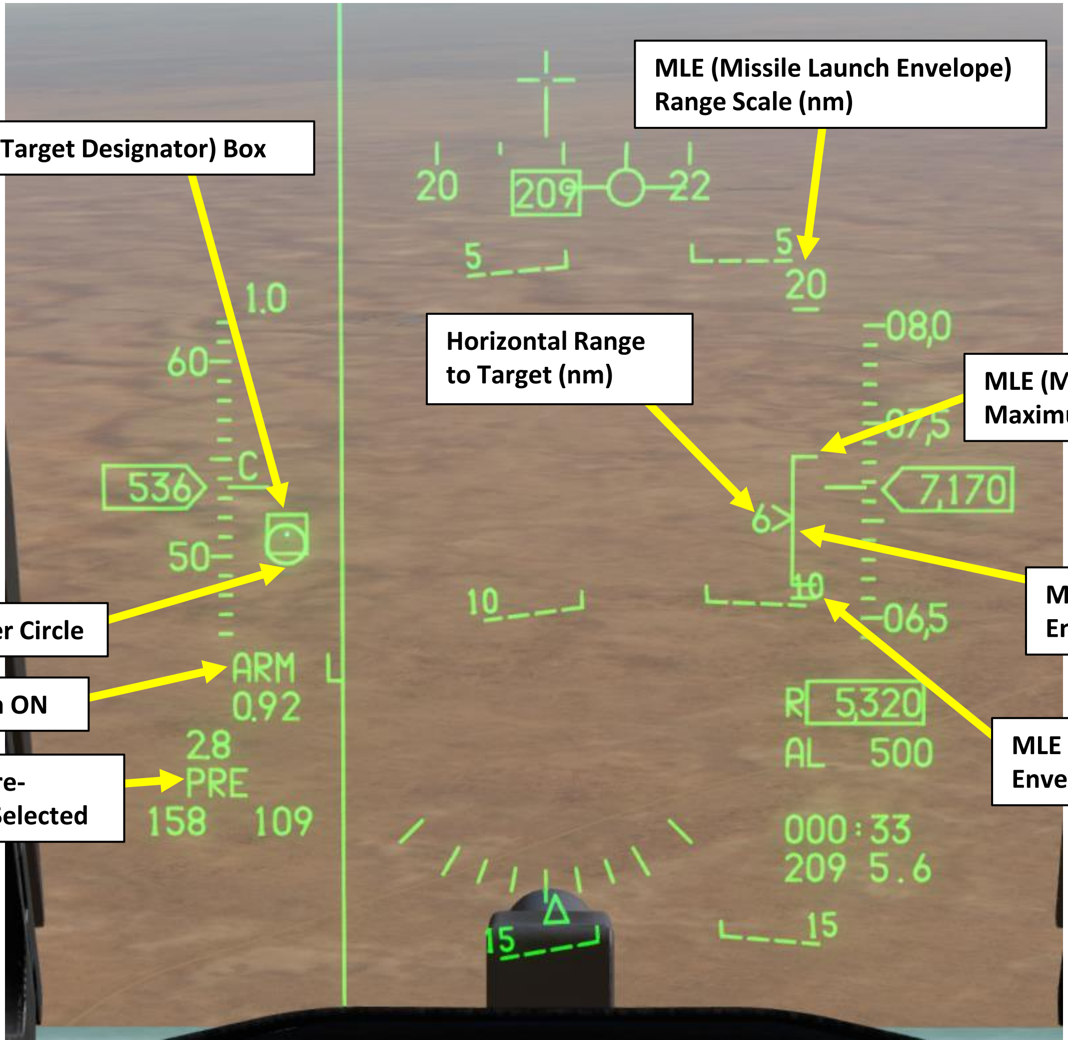
2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

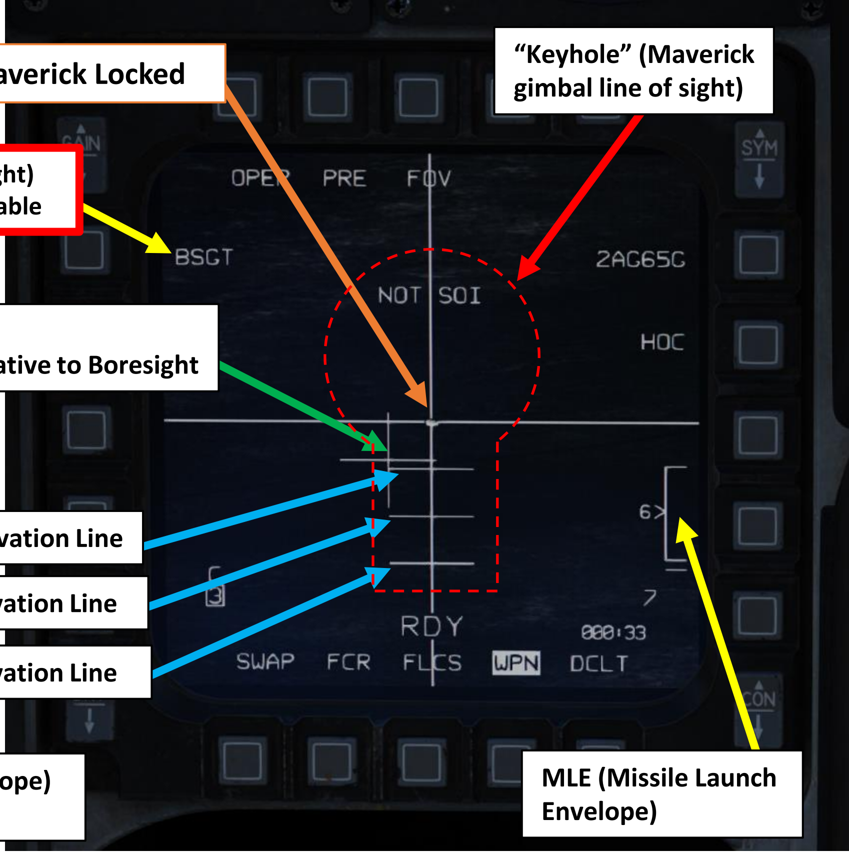
AUTOMATIC HANDOFF METHOD (AGM-65D/G)

25. Perform Maverick Handoff
    - d) WPN page will display HANDOFF IN PROGRESS until the missile has successfully performed a lock.
    - e) On both the TGP and WPN pages, the handoff process will have the symbol above the selected missile station change as follows:
        - **S**: Maverick seeker is slaved to the targeting pod
        - **1**: Correlating Maverick seeker to Point Track from Targeting Pod
        - **T**: Targeting pod is giving maverick the lock command on the designated target
        - **C**: Handoff is complete, Maverick and TGP locks are both correlated
    - f) When handoff is successful, the "C" indication will be visible on the TGP page, while the Maverick cross will be full on the WPN page.
        - **Note 1**: When using AUTO HANDOFF, you do not necessarily have to look at the WPN page, but it is a good indication to see if the lock after the automatic handoff process is successful.
        - **Note 2**: If the automatic handoff has failed to lock, you might have been too far from the target. Press TMS DOWN, then TMS UP to re-attempt automatic handoff.

2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

26. Confirm valid missile lock using the TGP page, WPN page and HUD (Heads-Up Display).
    - Maverick gimbals are 10 deg in azimuth and 15 deg in elevation.
    - To ensure valid missile before launch, the seeker cross must be within the "imaginary" line of sight keyhole centered on the WPN page crosshairs.
27. Verify that you are within effective Maverick range.





2.6 – AGM-65 MAVERICK
2.6.3 – AGM-65G (Pre-Planned Mode + Targeting Pod)

28. Depress the Weapon Release (RALT+SPACE) button to fire the missile.

- *Note: If you locked the wrong target and want to cancel the Maverick lock, use TMS DOWN.*

AGM-65 missile launch restrictions:
- Max launch speed: Mach 1.2
- Max dive angle: 60°
- Max bank angle: 30°
- Max roll rate: 30°/s
- Min/Max load factor: +0.5 g/+3.0 g

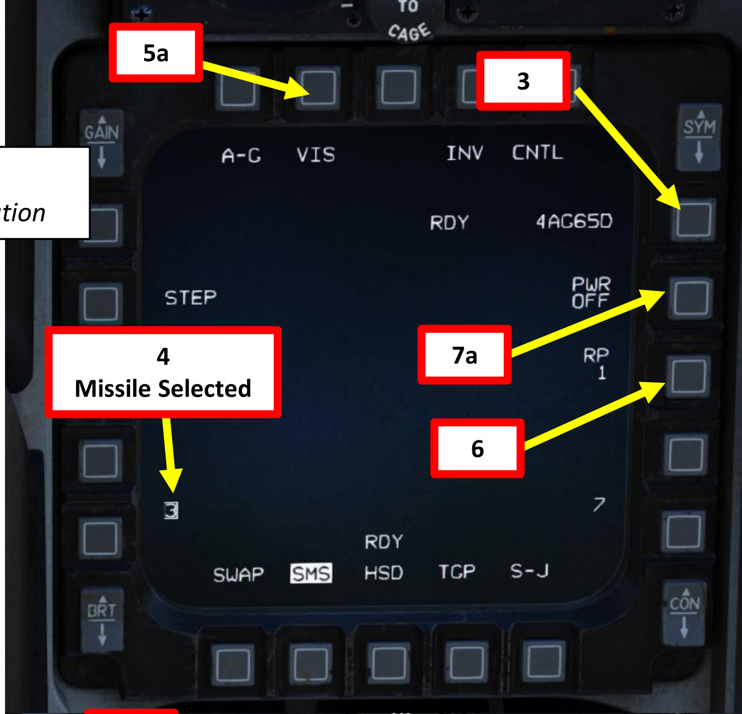
2.6 – AGM-65 MAVERICK
2.6.4 – AGM-65D (Boresight Mode)

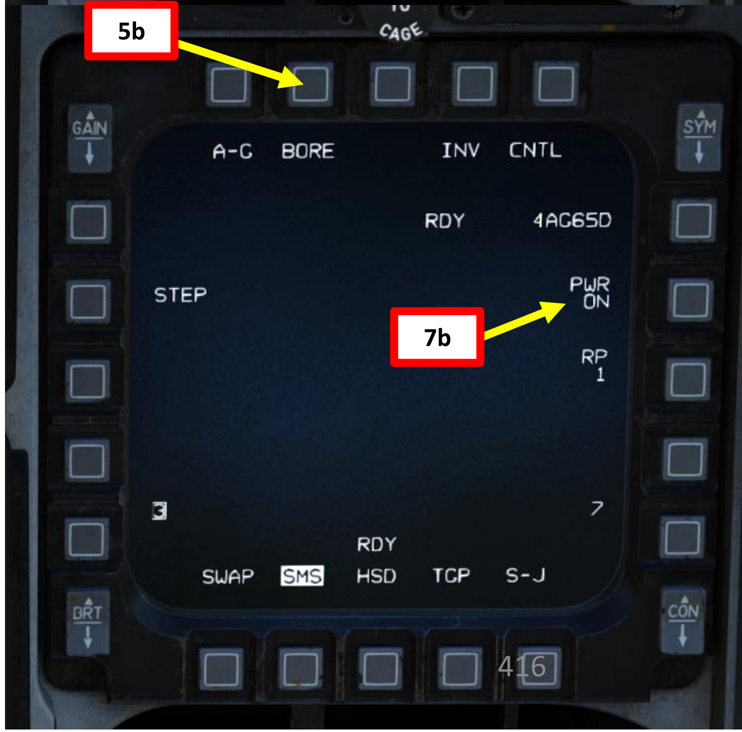
4

NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

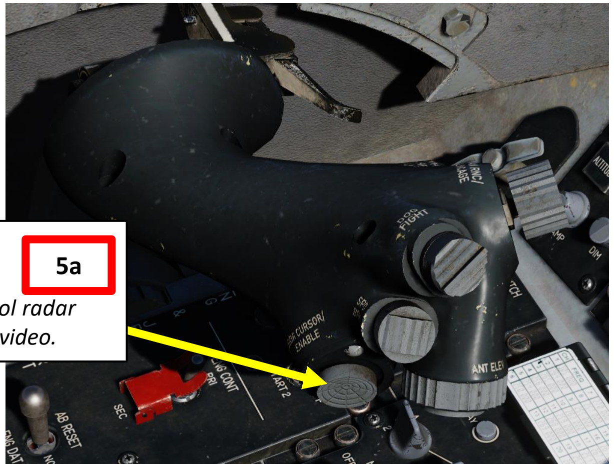
1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG65 (AGM-65 Maverick) missile. The number preceding AG65 is the number of missiles of this type equipped, and the letter following AG65 is the missile variant (D, G, H, or K).
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Toggle OSB next to Maverick Mode to select BORE (Boresight) mode
   - Alternatively, you can also toggle Maverick modes with the Radar/Cursor Enable switch DEPRESSED control (ENTER by default).
6. If using LAU-88 missile racks, select desired Ripple Quantity using the OSB next to RP. We will leave it to 1.
7. Power up Maverick and start seeker cooldown (**MANUAL cooldown method**)
   a) From the SMS page, press the OSB next to PWR OFF to start the power-up process of the Maverick.
   b) Once PWR ON is set, cooldown will take about 3 minutes.

The AGM-65 requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled, which takes about 3 minutes. **Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.**





Radar Cursor/Enable Switch 5a
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*



2.6 – AGM-65 MAVERICK
2.6.4 – AGM-65D (Boresight Mode)

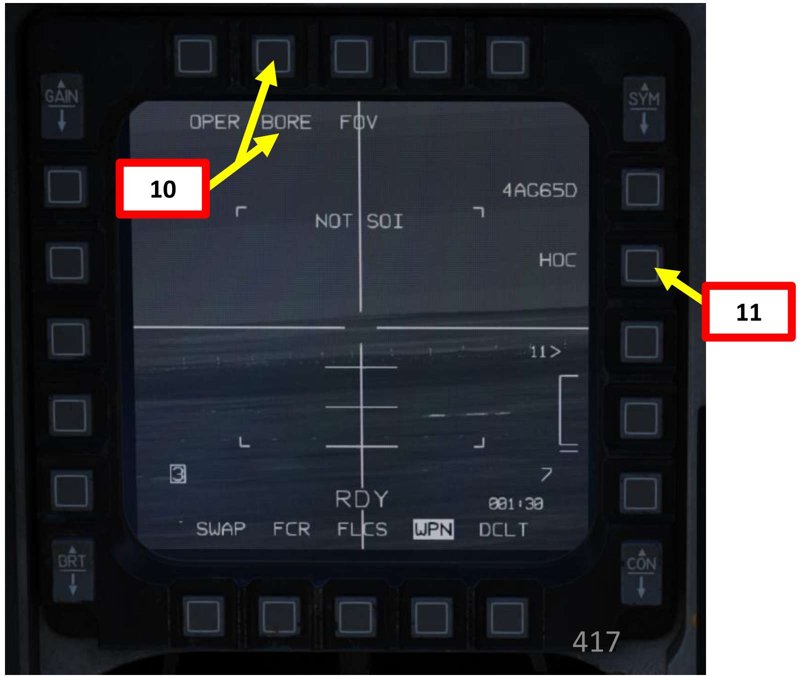
8. Select the WPN (Weapon) page
9. During Maverick cooldown, the NOT TIMED OUT indication will be visible on the WPN page. Maverick feed will become visible once cooldown sequence is complete.
10. The WPN page should display BORE (Boresight) Mode. If it isn't selected, toggle the OSB (Option Select Button) next to the Maverick Mode until BORE is selected.
11. Select Track Polarity as required using the OSB next to Track Polarity or using TMS LEFT

    For AGM65H/K:
    - *WB: White-On-Black (centroid track based on contrast)*
    - *BW: Black-On-White (centroid track based on contrast)*

    For AGM-65D/G:
    - *HOC: Hot-On-Cold Polarity Contrast (centroid track based on contrast)*
    - *COH: Cold-On-Hot Polarity Contrast (centroid track based on contrast)*

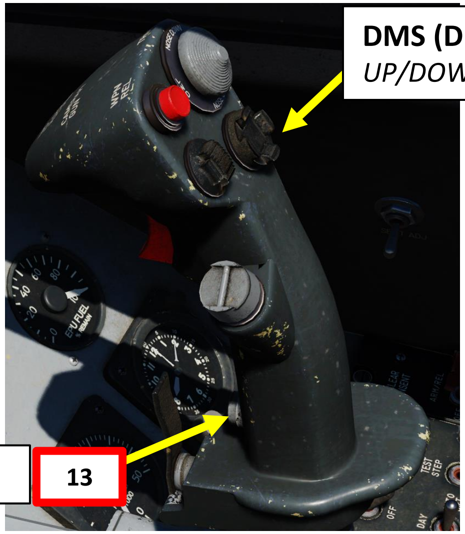
    For AGM-65G/K:
    - *AREA: Force Correlate Option (based on area scene like tall buildings)*

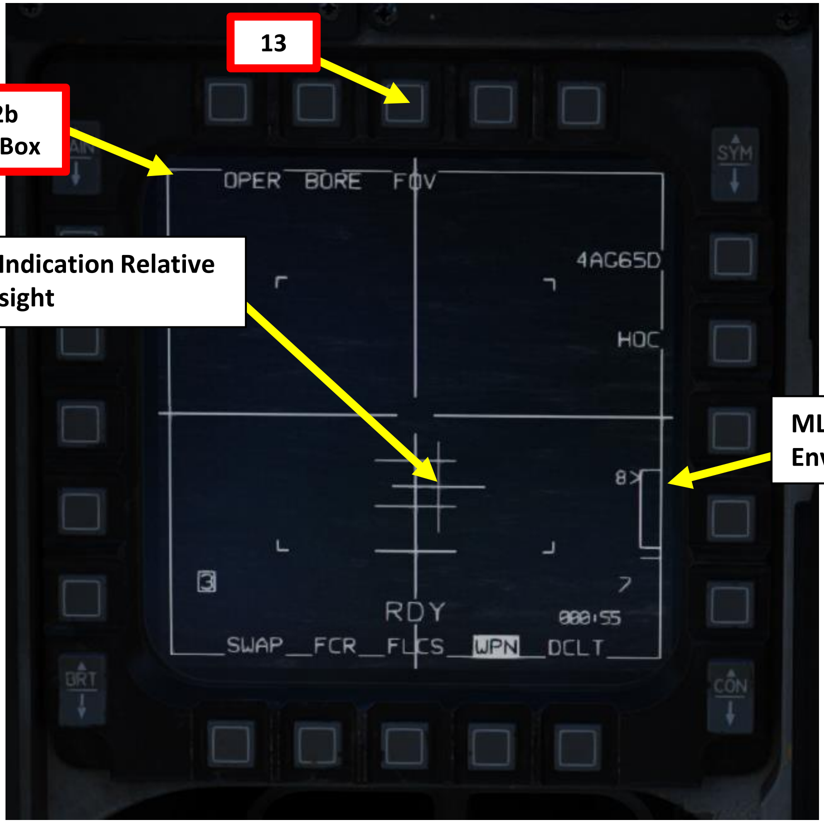
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

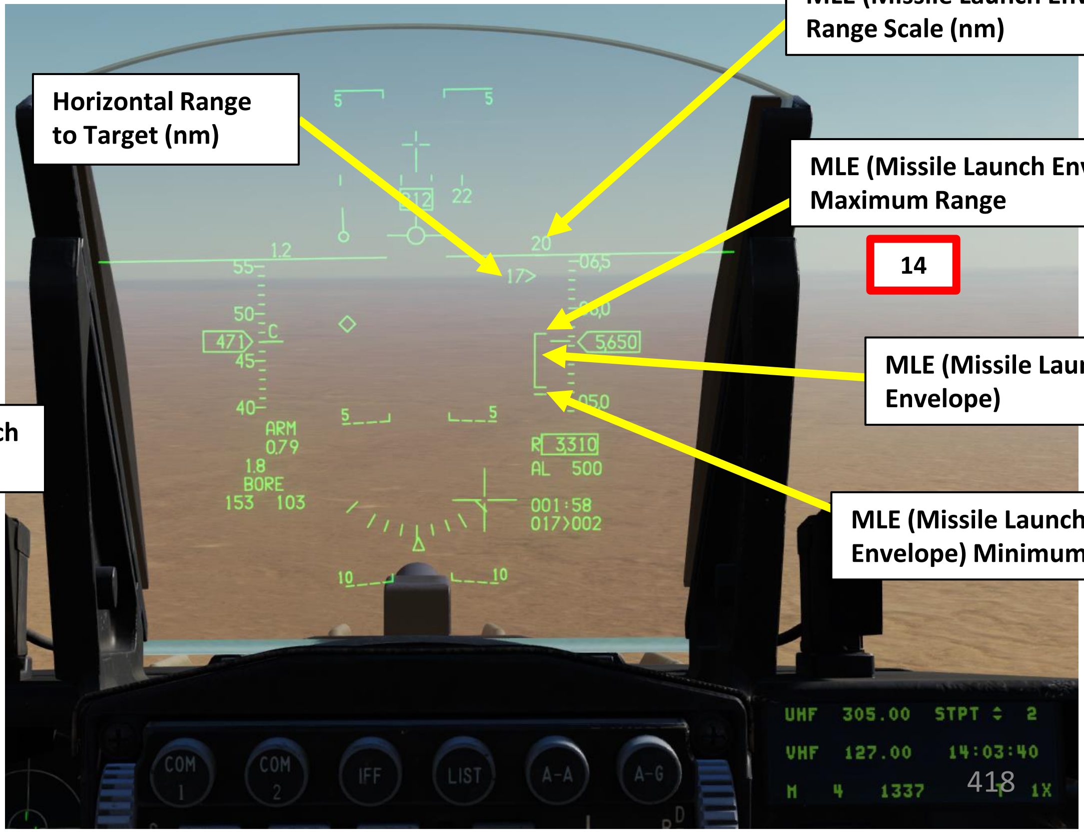


2.6 – AGM-65 MAVERICK
2.6.4 – AGM-65D (Boresight Mode)

12. Press DMS (Display Management Switch) DOWN to set WPN page as the SOI (Sensor of Interest). The SOI Box around the WPN page will indicate when the Maverick seeker can be controlled with HOTAS controls.
13. Set Field of View as desired using the FOV OSB or using the Expand/FOV button.
14. The MLE (Missile Launch Envelope) range will be available in relationship to the targeting pod designation point or the selected steerpoint (STPT)… NOT where the Maverick missile is looking.



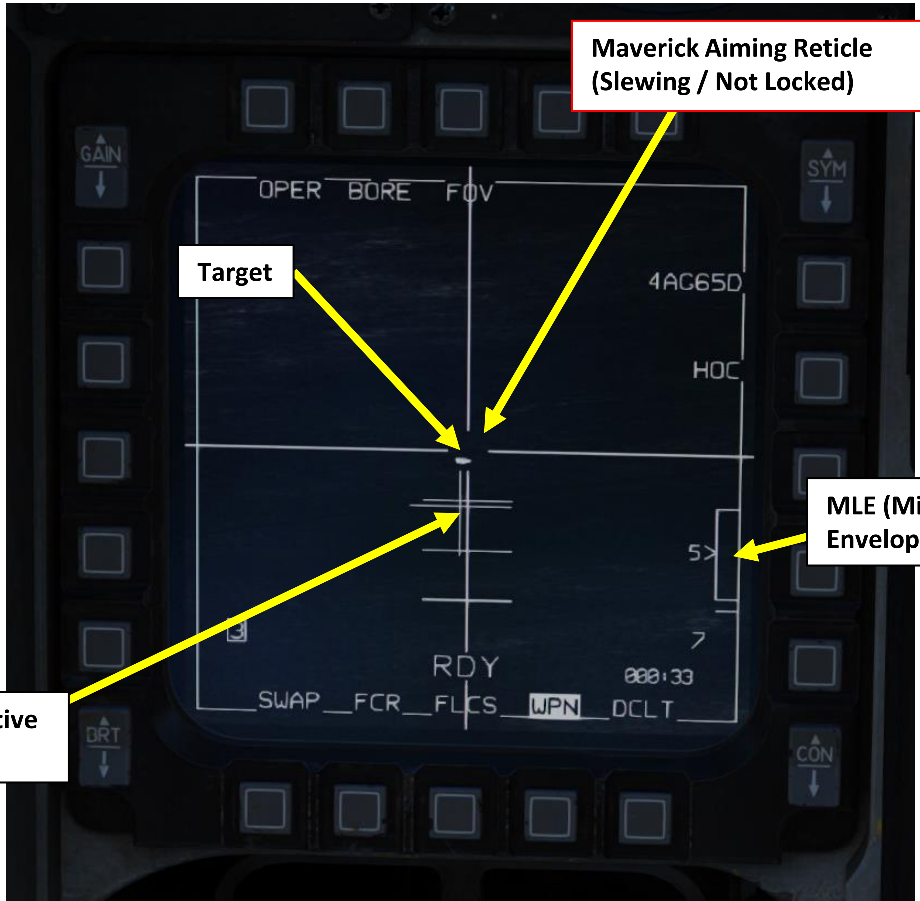


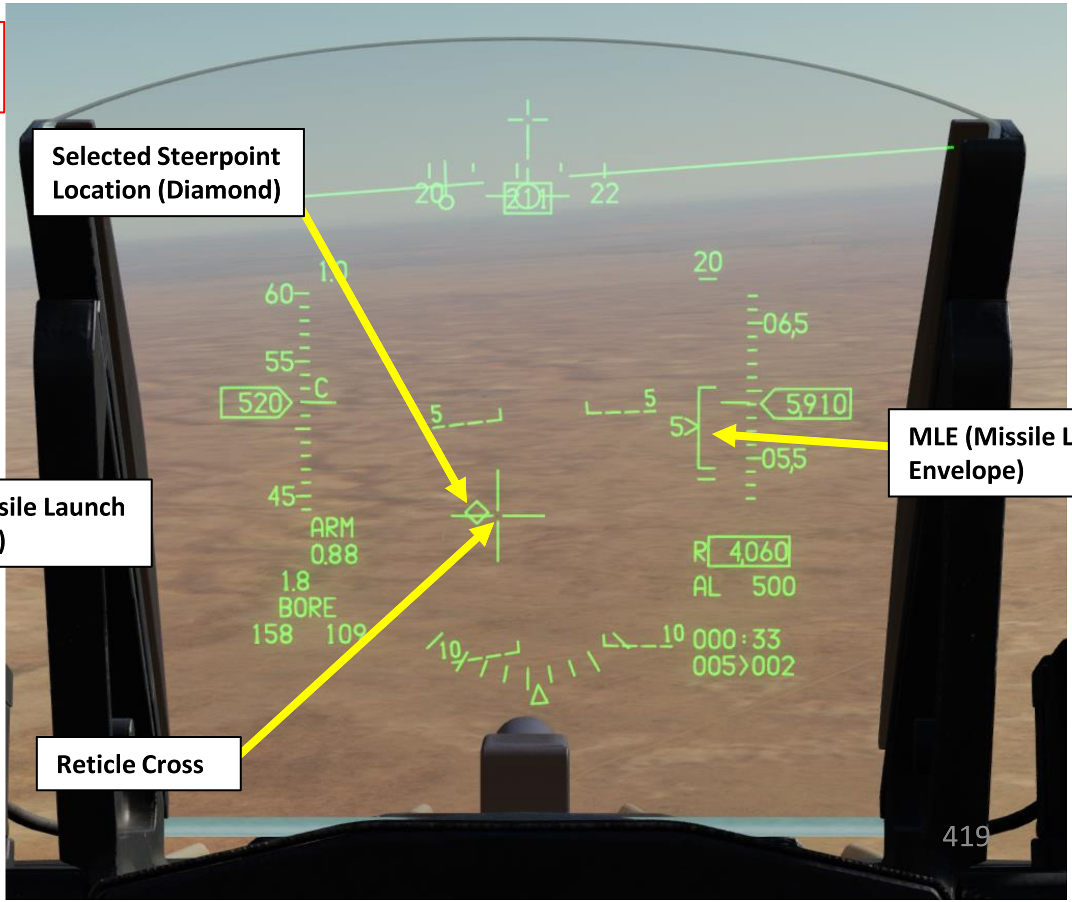


2.6 – AGM-65 MAVERICK
2.6.4 – AGM-65D (Boresight Mode)

15. Slew the Maverick Reticle Cross / Aiming Reticle on the target using the Radar Cursor switch. A good method is to use the Reticle cross on the HUD first and set it in the vicinity of the target (a steerpoint location, for instance, indicated by a diamond), and then use the WPN page Maverick feed to find the target.

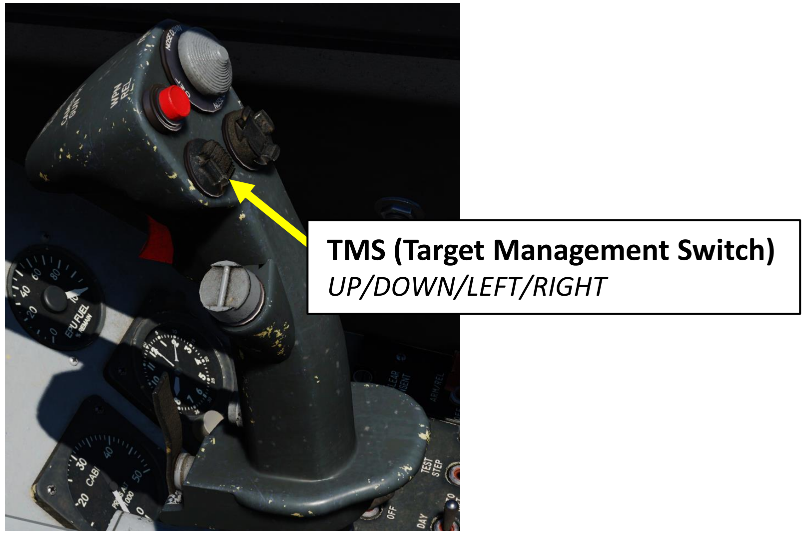
- Keep in mind that the reticle is NOT ground stabilized and will keep moving with the aircraft.

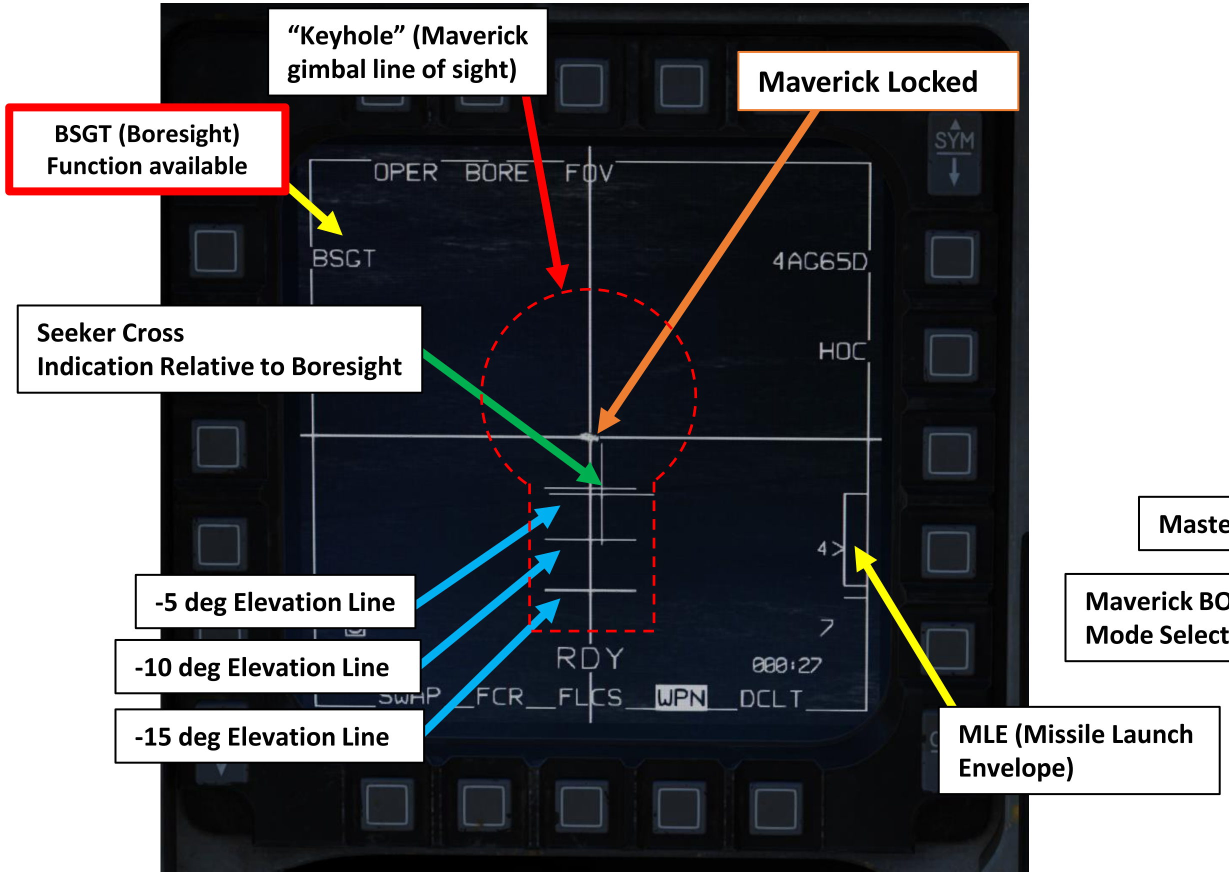


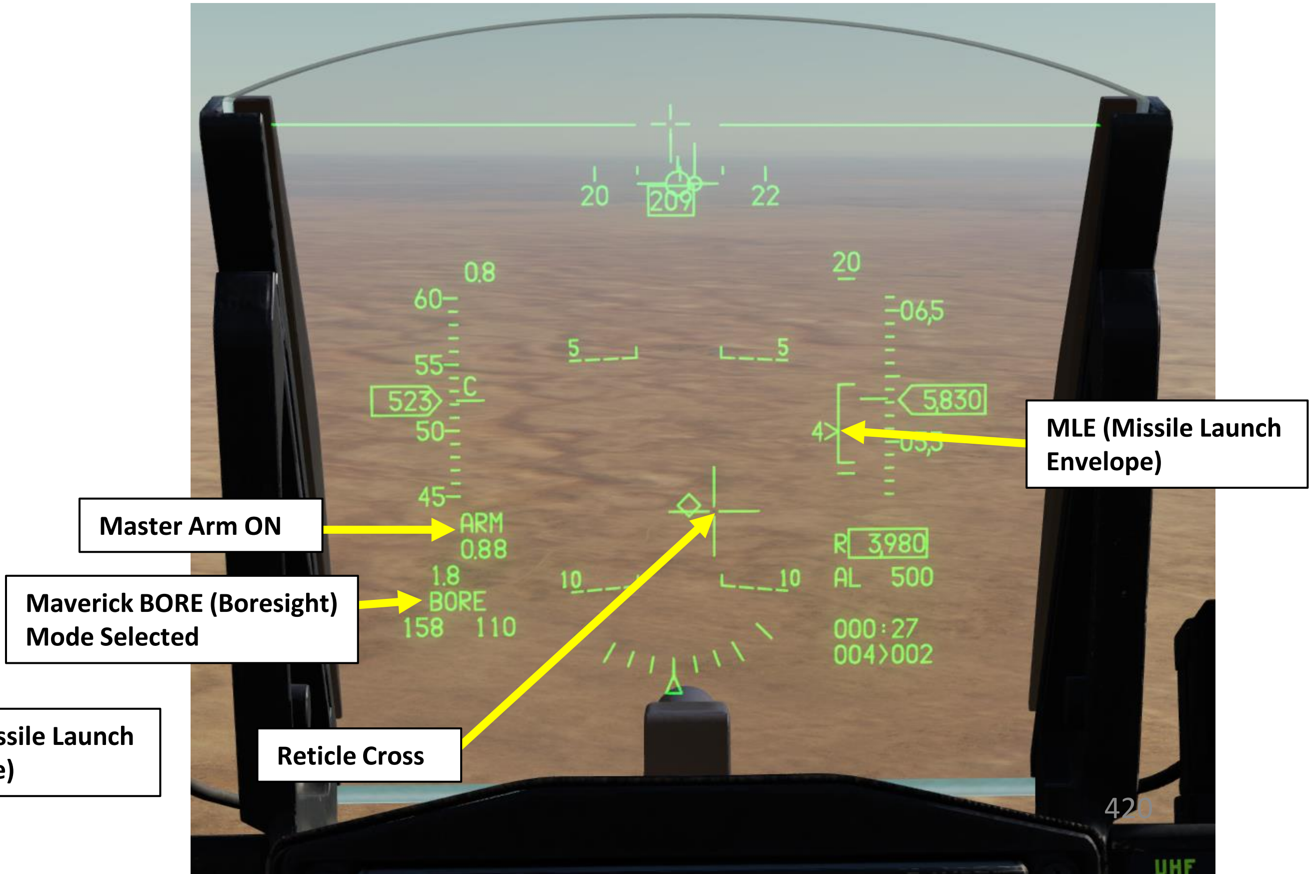


2.6 – AGM-65 MAVERICK
2.6.4 – AGM-65D (Boresight Mode)

16. When you are within effective Maverick range, press TMS (Target Management Switch) UP to attempt a Maverick lock on the target. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.
    - The MLE (Missile Launch Envelope) can be used to help you evaluate the range, but keep in mind that this is only an approximation since it refers to the location of the selected steerpoint (or targeting pod designation point).
17. Confirm a valid missile lock using the WPN page and HUD (Heads-Up Display).
    - Maverick gimbals are 10 deg in azimuth and 15 deg in elevation.
    - To ensure a valid missile track before launch, the seeker cross must be within the "imaginary" line of sight keyhole centered on the WPN page crosshairs.







2.6 – AGM-65 MAVERICK
2.6.4 – AGM-65D (Boresight Mode)

AGM-65 missile launch restrictions:
- Max launch speed: Mach 1.2
- Max dive angle: 60°
- Max bank angle: 30°
- Max roll rate: 30°/s
- Min/Max load factor: +0.5 g/+3.0 g

18. Depress the Weapon Release (RALT+SPACE) button to fire the missile.

- *Note: If you locked the wrong target and want to cancel the Maverick lock, or you want to cage back the Maverick, use TMS DOWN.*

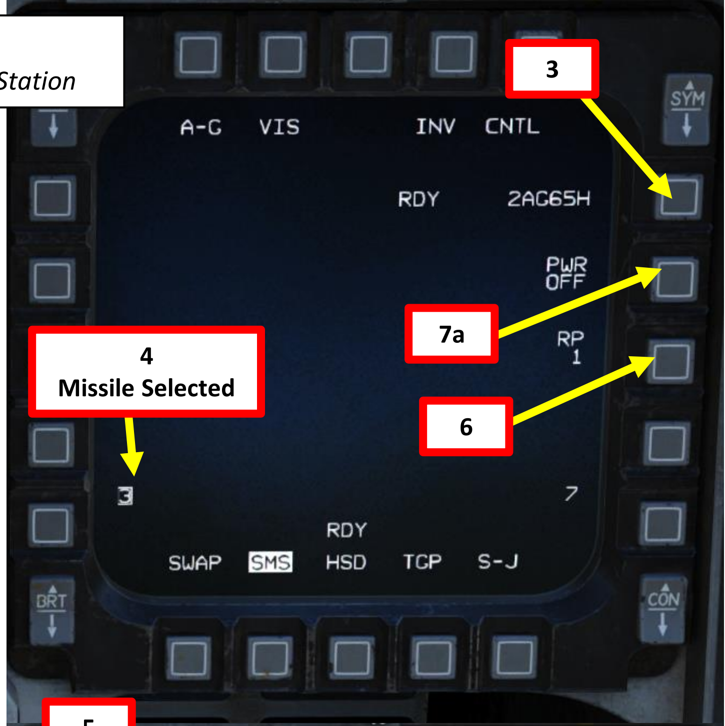
2.6 – AGM-65 MAVERICK
2.6.5 – AGM-65H (Visual Mode)

NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

4

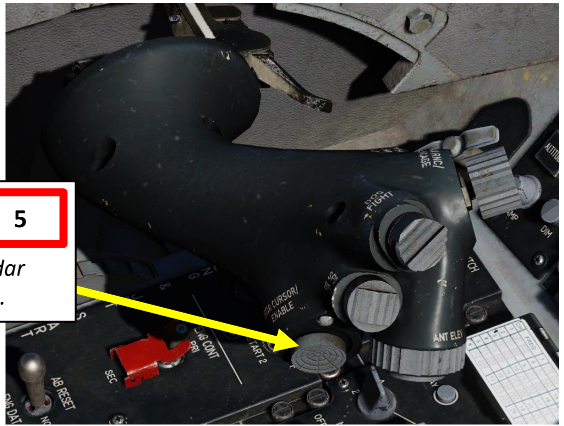
1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG65 (AGM-65 Maverick) missile. The number preceding AG65 is the number of missiles of this type equipped, and the letter following AG65 is the missile variant (D, G, H, or K).
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Toggle OSB next to Maverick Mode to select VIS (Visual) mode.
   - Alternatively, you can also toggle Maverick modes with the Radar/Cursor Enable switch DEPRESSED control (ENTER by default).
6. If using LAU-88 missile racks, select desired Ripple Quantity using the OSB next to RP. We will leave it to 1.
7. Power up Maverick and start seeker cooldown (MANUAL cooldown method)
   a) From the SMS page, press the OSB next to PWR OFF to start the power-up process of the Maverick.
   b) Once PWR ON is set, cooldown will take about 3 minutes.

The AGM-65 requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled, which takes about 3 minutes. **Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.**



Radar Cursor/Enable Switch
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

5



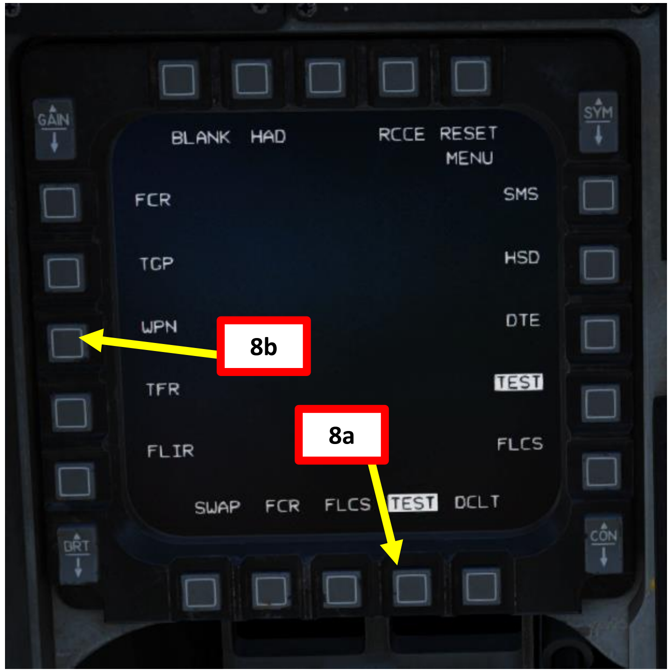
2.6 – AGM-65 MAVERICK
2.6.5 – AGM-65H (Visual Mode)

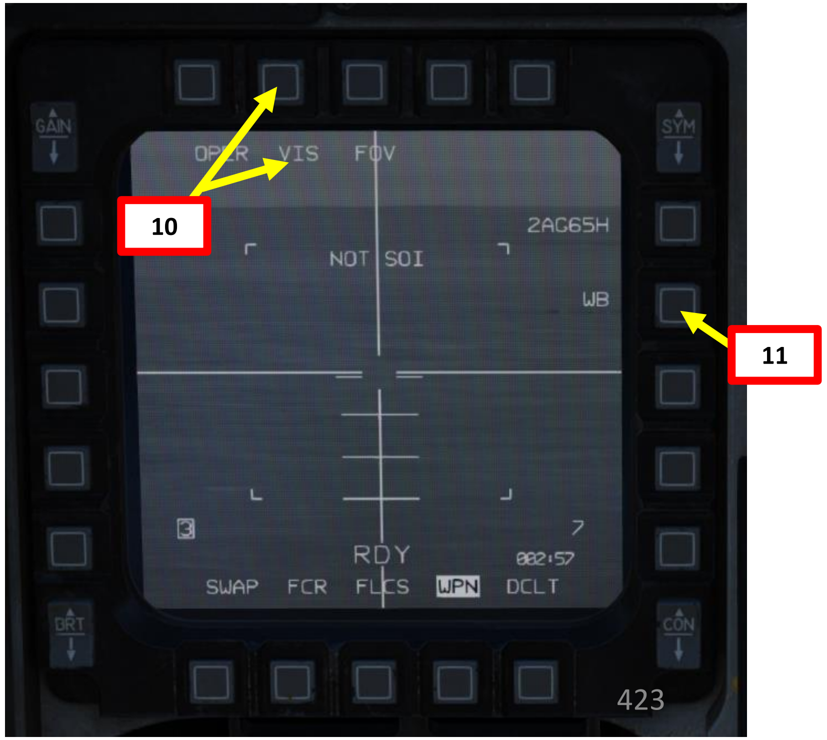
8. Select the WPN (Weapon) page
9. During Maverick cooldown, the NOT TIMED OUT indication will be visible on the WPN page. Maverick feed will become visible once cooldown sequence is complete.
10. The WPN page should display VIS (Visual) Mode. If it isn't selected, toggle the OSB (Option Select Button) next to the Maverick Mode until VIS is selected.
11. Select Track Polarity as required using the OSB next to Track Polarity or using TMS LEFT
    <u>For AGM65H/K:</u>
    - *WB: White-On-Black (centroid track based on contrast)*
    - *BW: Black-On-White (centroid track based on contrast)*

    <u>For AGM-65D/G:</u>
    - *HOC: Hot-On-Cold Polarity Contrast (centroid track based on contrast)*
    - *COH: Cold-On-Hot Polarity Contrast (centroid track based on contrast)*

    <u>For AGM-65G/K:</u>
    - *AREA: Force Correlate Option (based on area scene like tall buildings)*

TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

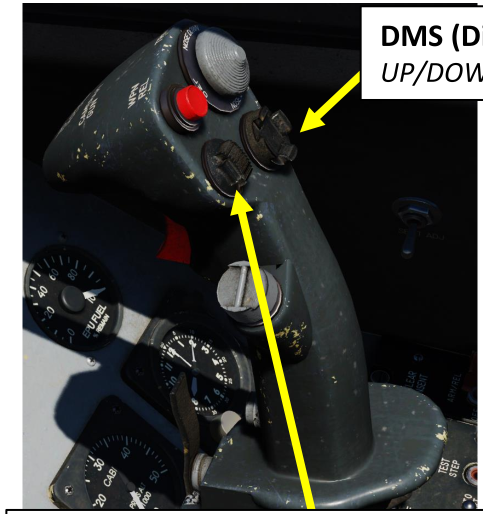


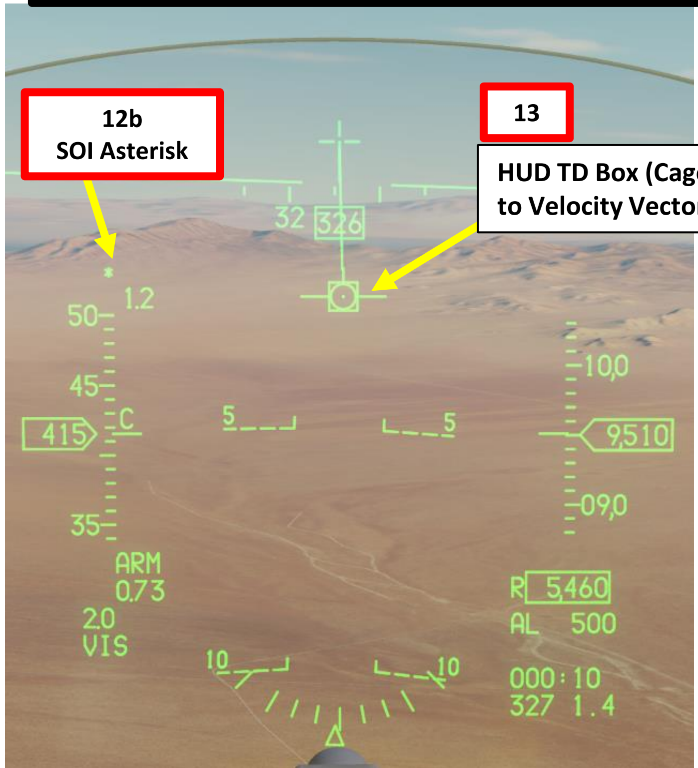


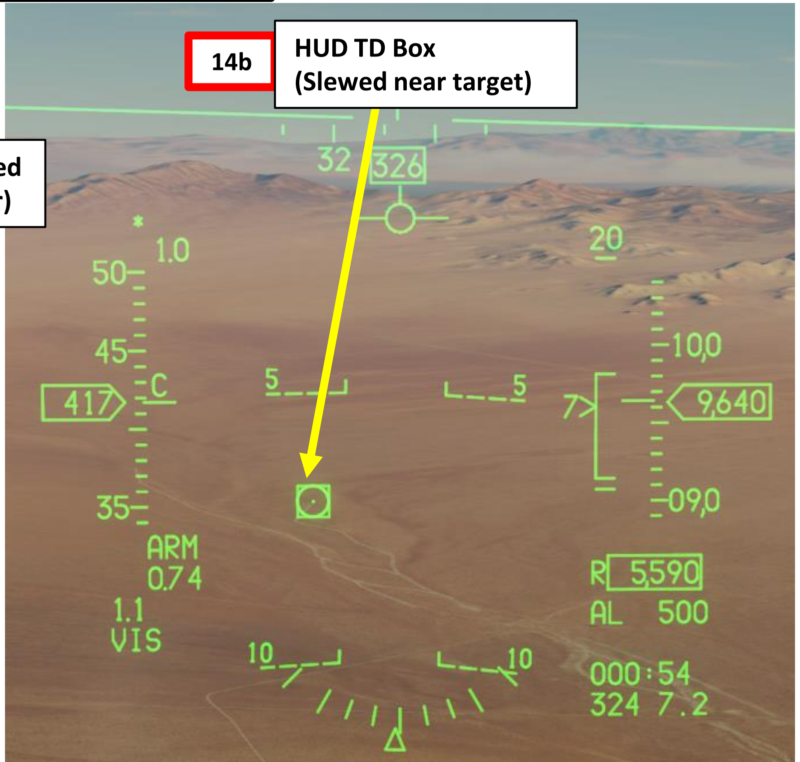
2.6 – AGM-65 MAVERICK
2.6.5 – AGM-65H (Visual Mode)

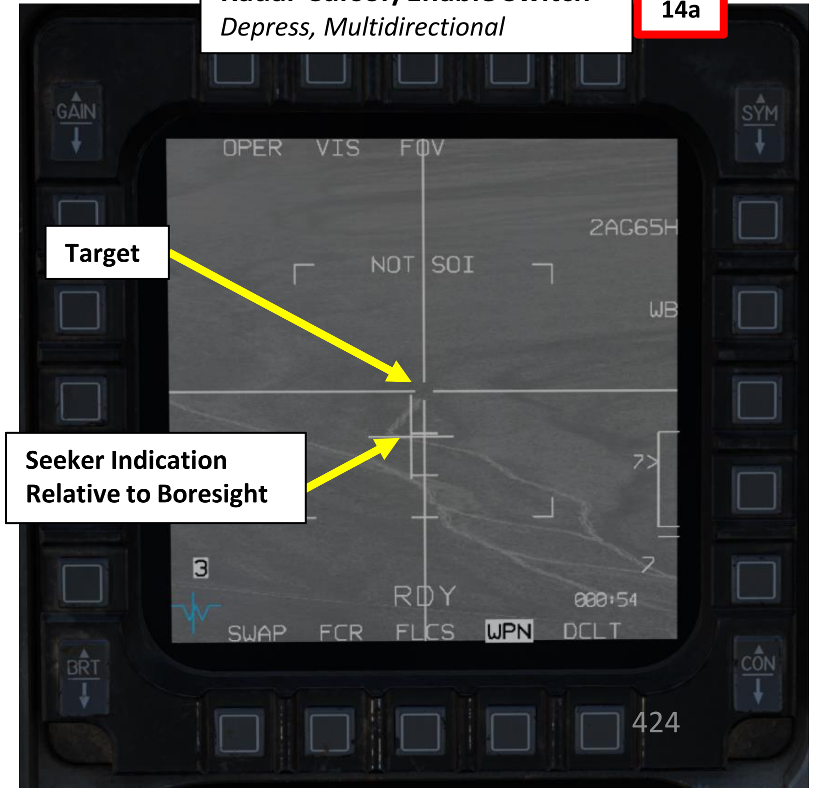
12. Press DMS (Display Management Switch) UP to set HUD (Heads-Up Display) as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.
13. By default, the Maverick Designation Box on the HUD will be caged to the velocity vector.
14. Spot the target visually, then slew the HUD TD (Target Designation) Box on the HUD within the vicinity of the target using the Radar Cursor switch. When TD box is over the desired location, press TMS (Target Management Switch) UP to designate this location. Remember: the missile has not acquired a lock yet. This method is useful if you do not have a targeting pod equipped.
    - The HUD TD Box is ground stabilized and will remain fixed where the Maverick seeker is looking at.
    - If you want to cage the HUD TD Box on the velocity vector, press TMS DOWN.

Make sure the missile is properly boresighted before slewing the HUD TD Box.
See Boresighting Example.





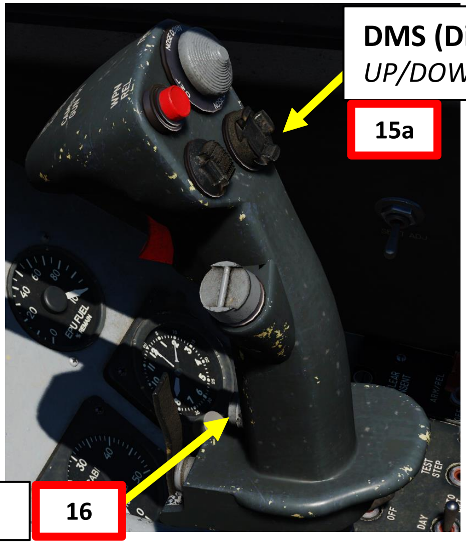


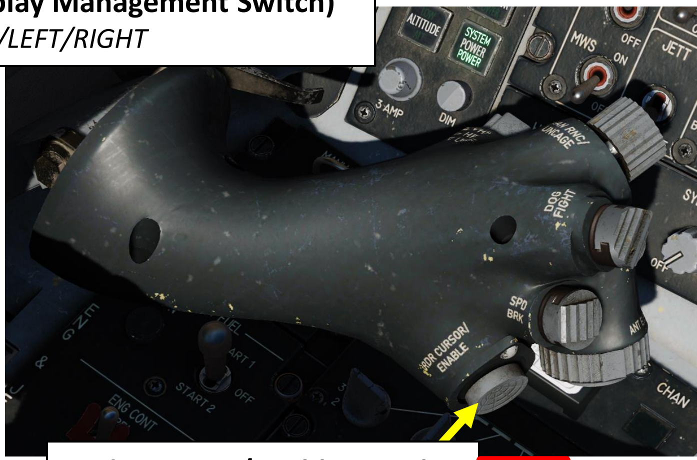


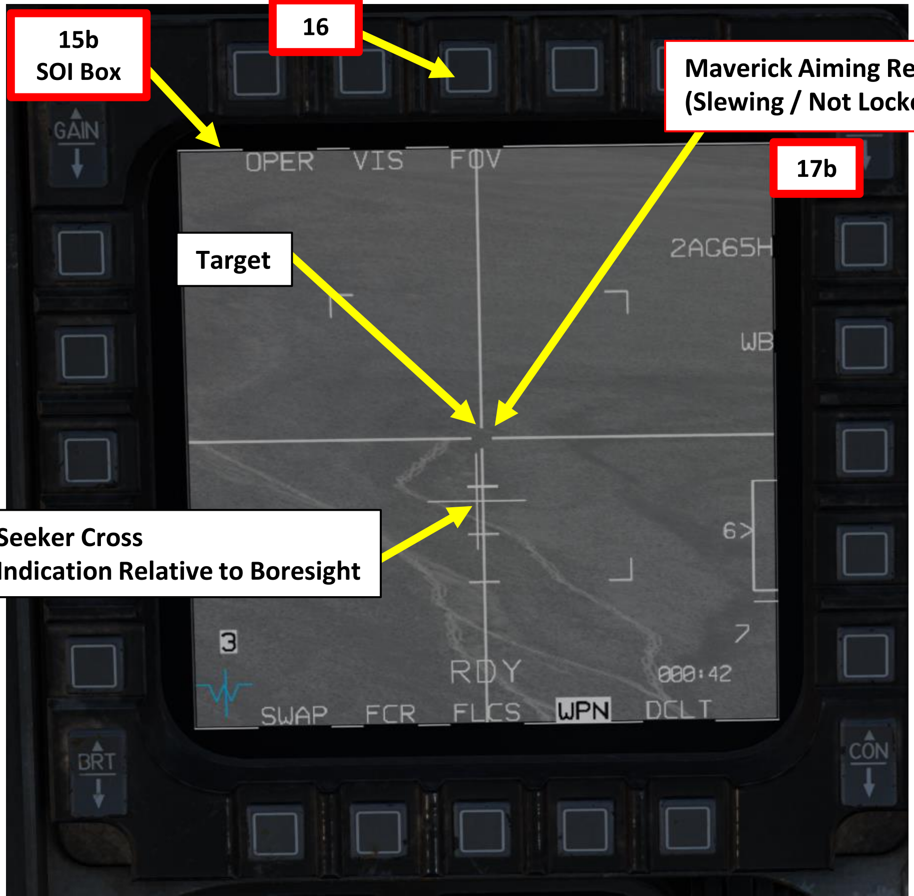
2.6 – AGM-65 MAVERICK
2.6.5 – AGM-65H (Visual Mode)

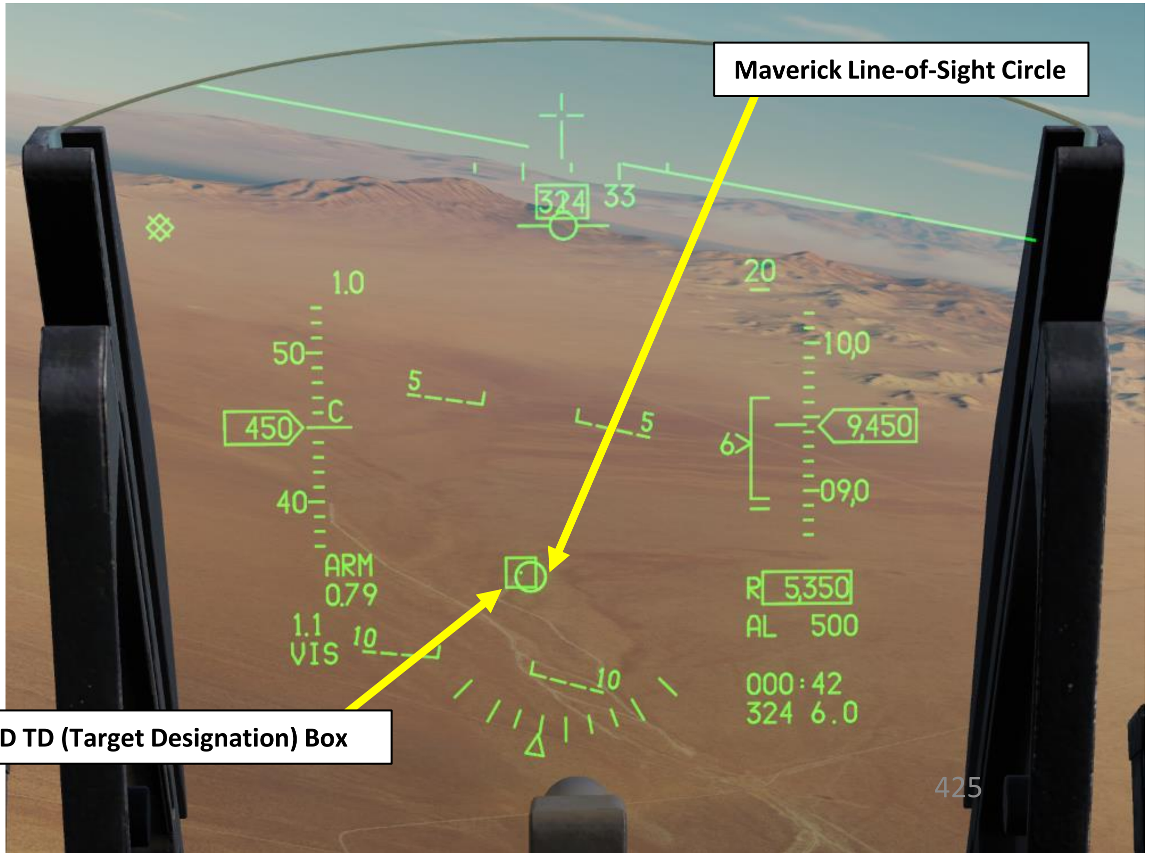
15. Press DMS (Display Management Switch) DOWN to set WPN page as the SOI (Sensor of Interest). The SOI Box around the WPN page will indicate when the Maverick seeker can be controlled with HOTAS controls.
16. Set Field of View as desired using the FOV OSB or using the Expand/FOV button.
17. Using the WPN page Maverick feed to find the target, slew the Maverick Aiming Reticle on the target using the Radar Cursor switch.

- Keep in mind that in VIS mode, the Maverick reticle is ground stabilized and its aiming cross will remain fixed (similarly to a targeting pod).



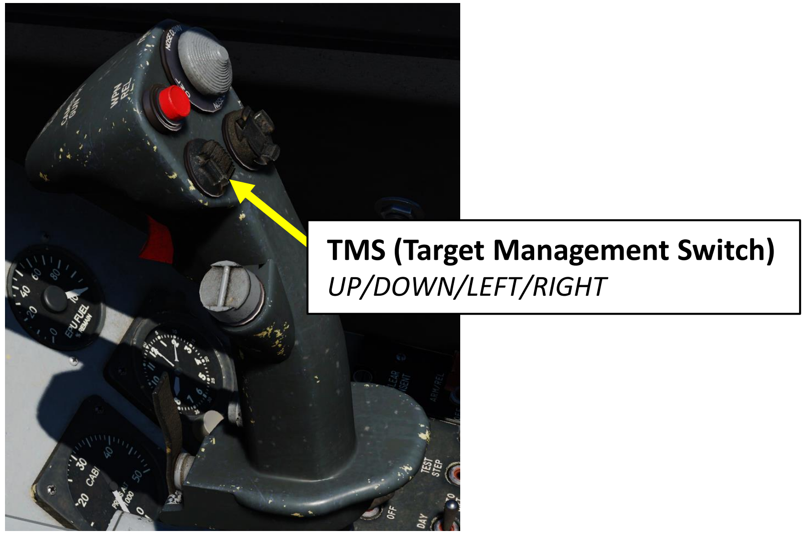


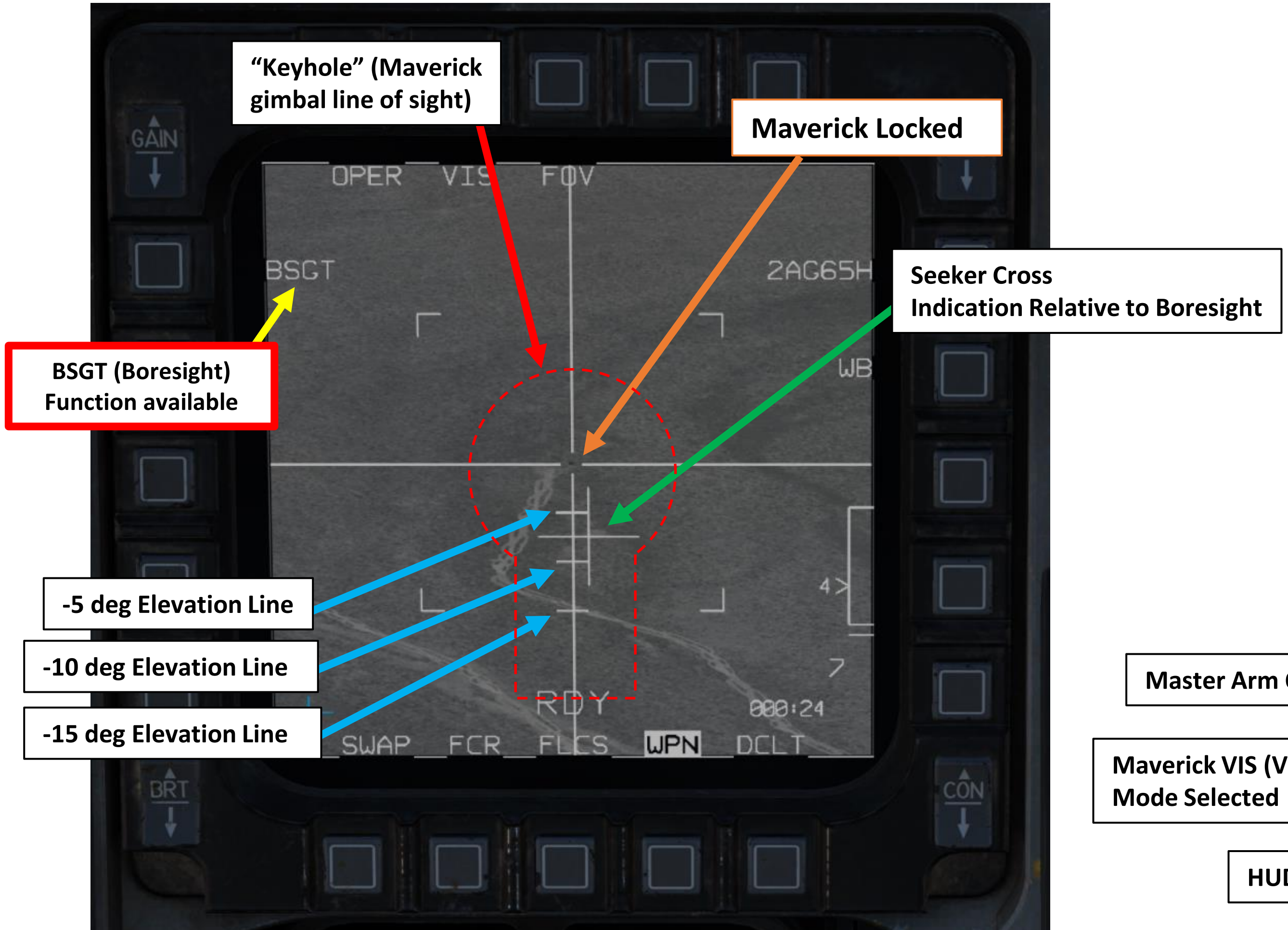


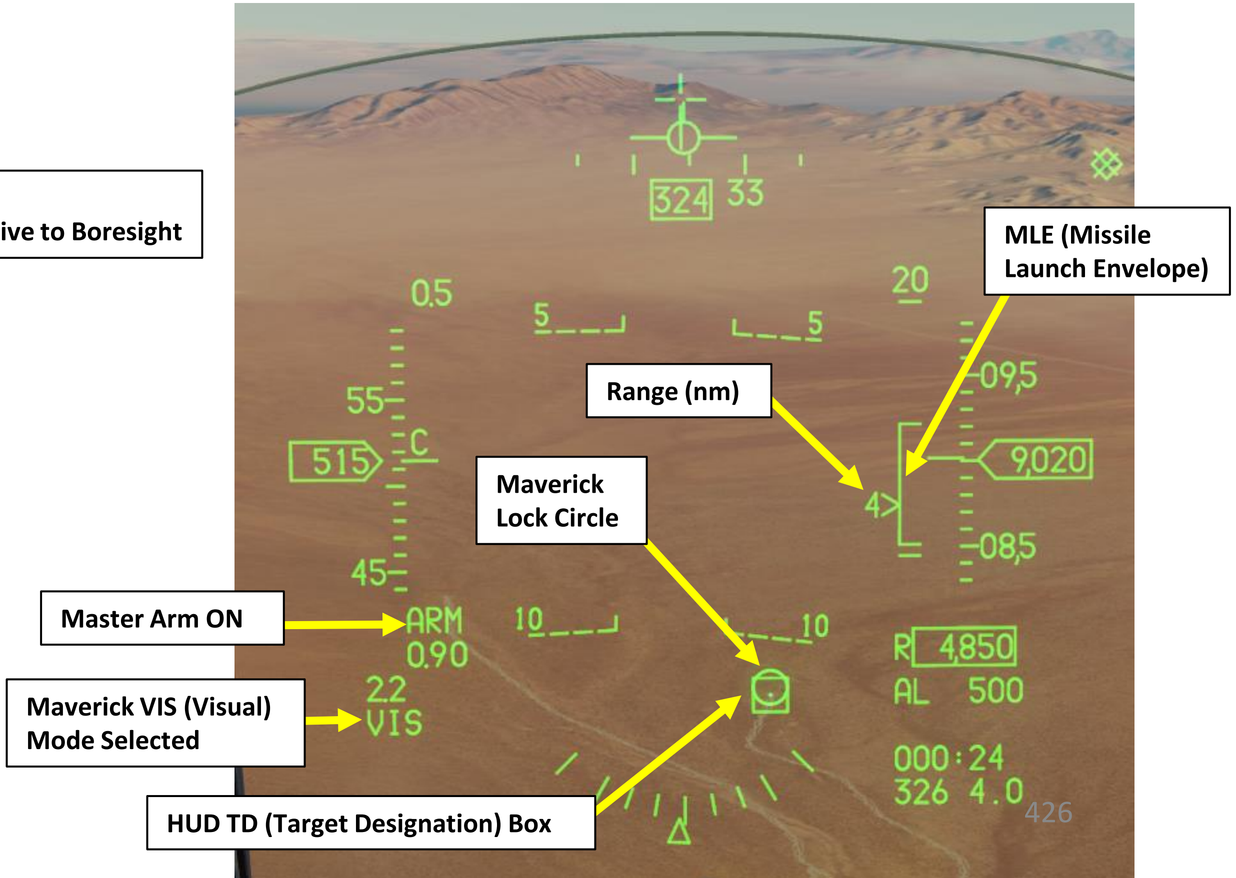


2.6 – AGM-65 MAVERICK
2.6.5 – AGM-65H (Visual Mode)

18. Press TMS (Target Management Switch) UP to attempt a Maverick lock. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.
19. Confirm a valid missile lock using the WPN page and HUD (Heads-Up Display).
    - When locking a target, a lock circle will appear on the HUD
    - Maverick gimbals are 10 deg in azimuth and 15 deg in elevation.
    - To ensure a valid missile track before launch, the seeker cross must be within the “imaginary” line of sight keyhole centered on the WPN page crosshairs.







2.6 – AGM-65 MAVERICK
2.6.5 – AGM-65H (Visual Mode)

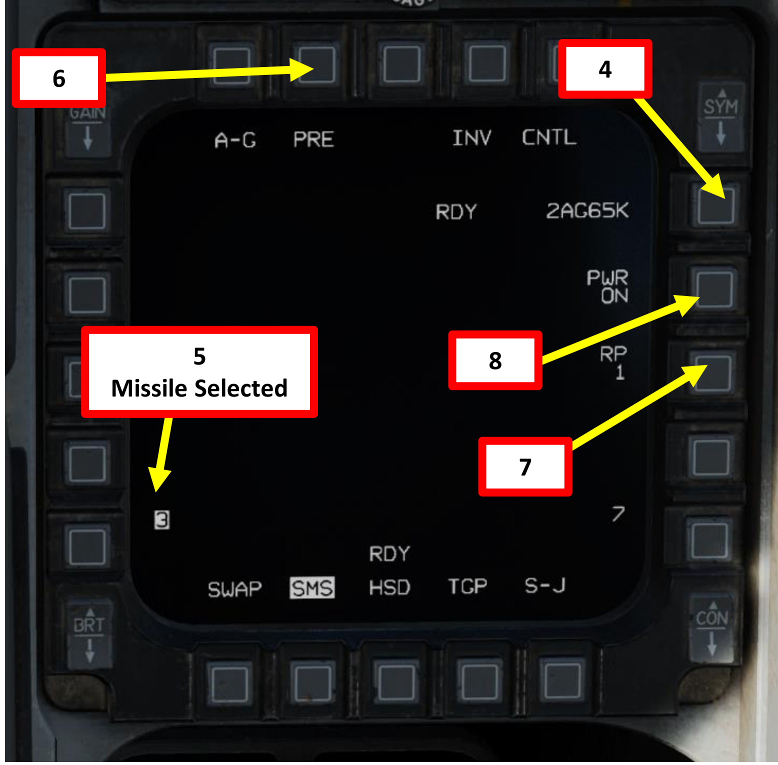
AGM-65 missile launch restrictions:
- Max launch speed: Mach 1.2
- Max dive angle: 60°
- Max bank angle: 30°
- Max roll rate: 30°/s
- Min/Max load factor: +0.5 g/+3.0 g

20. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
- *Note 1: If you locked the wrong target and want to cancel the Maverick lock, or you want to cage back the Maverick to the velocity vector, use TMS DOWN.*
- *Note 2: You can use the HMCS (Helmet-Mounted Cueing System) with the Maverick in VIS mode to designate the target. See Part 10 – HMCS section.*

2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

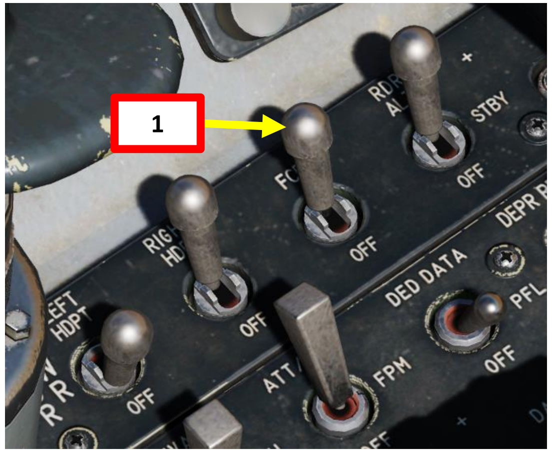
1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. Press the A-G Master Mode Button
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG65 (AGM-65 Maverick) missile. The number preceding AG65 is the number of missiles of this type equipped, and the letter following AG65 is the missile variant (D, G, H, or K).
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Toggle OSB next to Maverick Mode to select PRE (Pre-Planned) mode
   - Alternatively, you can also toggle Maverick modes with the Radar/Cursor Enable switch DEPRESSED control (ENTER by default).
7. If using LAU-88 missile racks, select desired Ripple Quantity using the OSB next to RP. We will leave it to 1.
8. Power up Maverick and start seeker cooldown (**MANUAL cooldown method**)
   a) From the SMS page, press the OSB next to PWR OFF to start the power-up process of the Maverick.
   b) Once PWR ON is set, cooldown will take about 3 minutes.

The AGM-65 requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled, which takes about 3 minutes. **Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.**



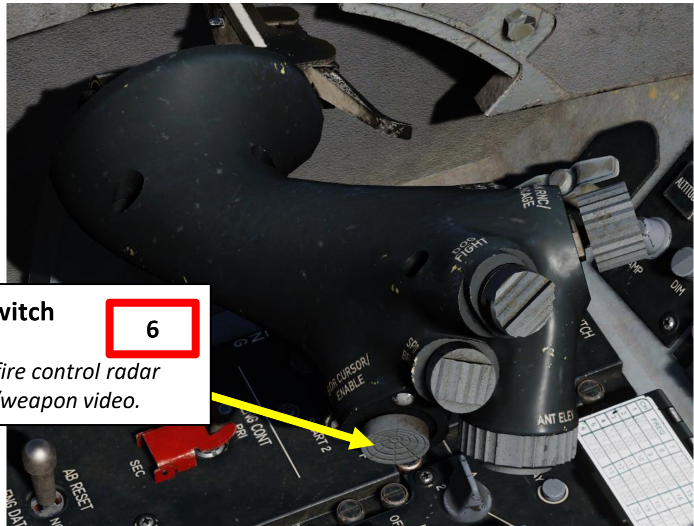
NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

5



Radar Cursor/Enable Switch
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

6



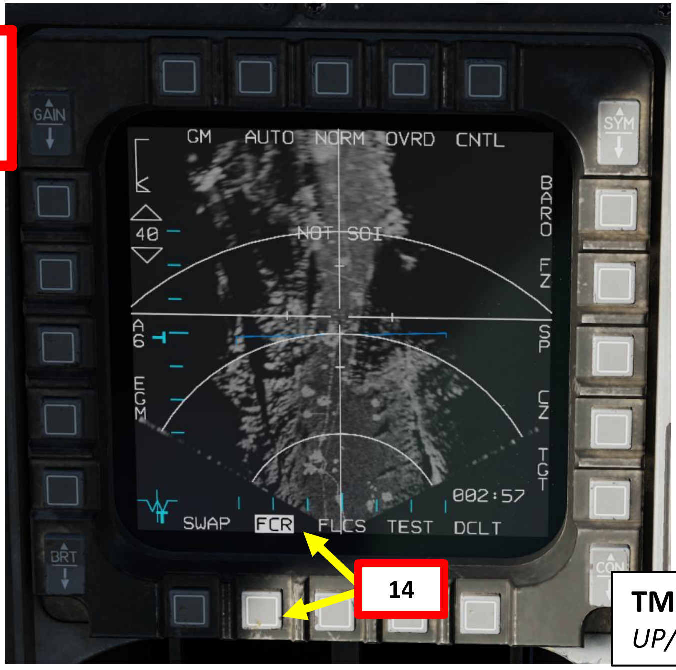
2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

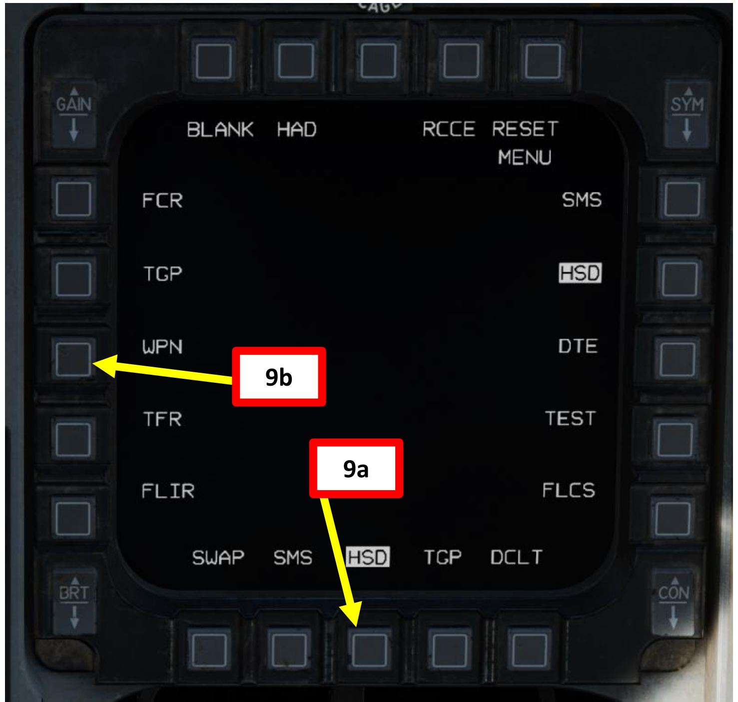
9. Select the WPN (Weapon) page on the right display
10. During Maverick cooldown, the NOT TIMED OUT indication will be visible on the WPN page. Maverick feed will become visible once cooldown sequence is complete.
11. The WPN page should display PRE (Pre-Planned) Mode. If it isn't selected, toggle the OSB (Option Select Button) next to the Maverick Mode until PRE is selected.
12. Select Track Polarity as required using the OSB next to Track Polarity or using TMS LEFT

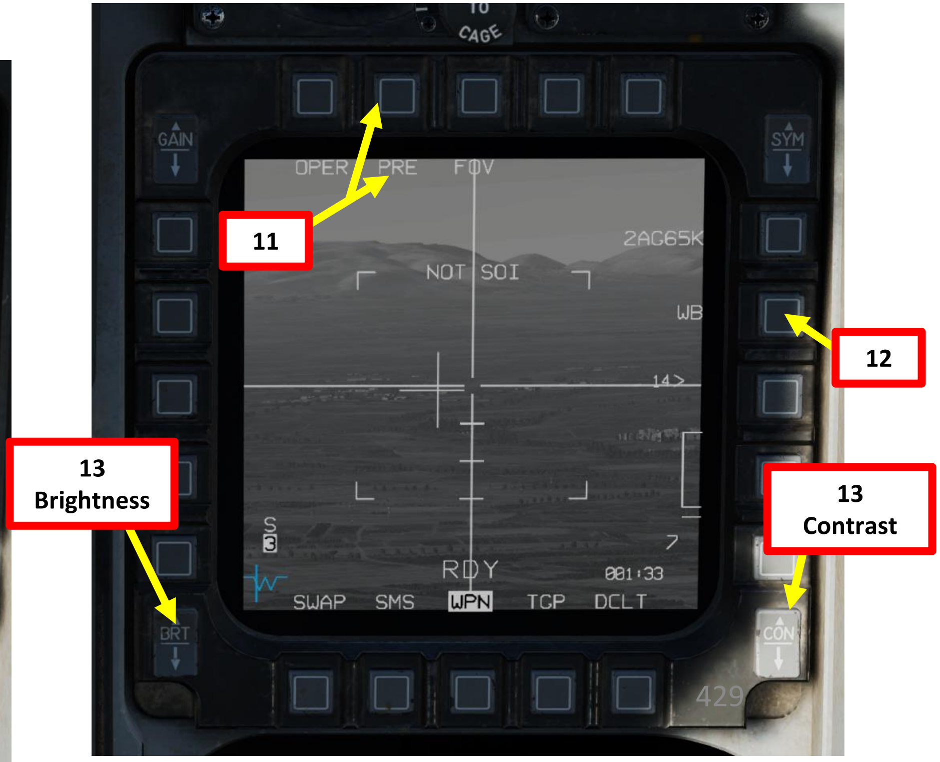
    For AGM65H/K:
    - *WB: White-On-Black (centroid track based on contrast)*
    - *BW: Black-On-White (centroid track based on contrast)*

    For AGM-65D/G:
    - *HOC: Hot-On-Cold Polarity Contrast (centroid track based on contrast)*
    - *COH: Cold-On-Hot Polarity Contrast (centroid track based on contrast)*

    For AGM-65G/K:
    - *AREA: Force Correlate Option (based on area scene like tall buildings)*
13. Adjust display brightness and contrast on the WPN display to allow good readability of symbology.
14. On the other display, select FCR (Fire Control Radar) Page.



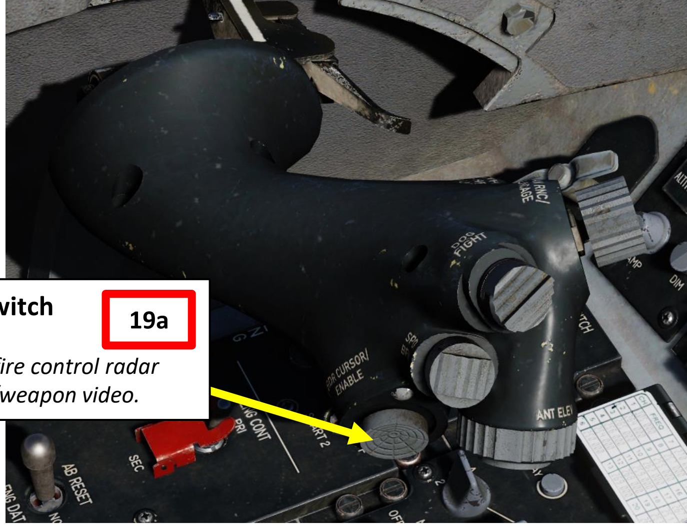




2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

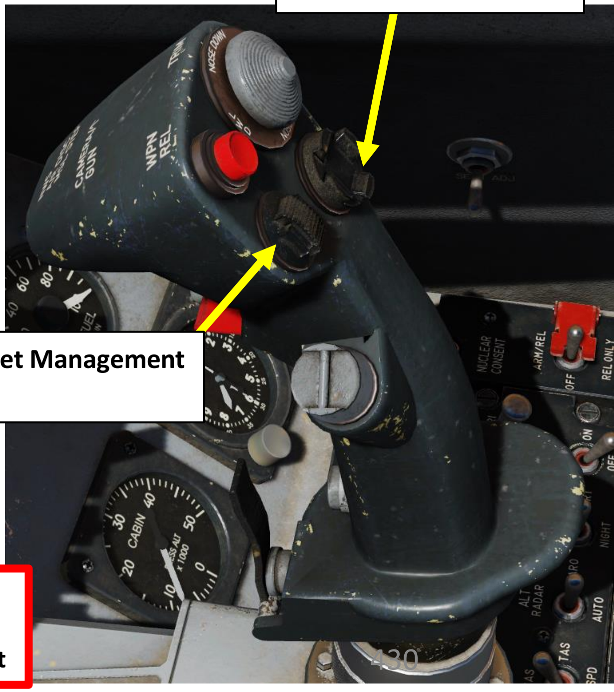
15. In this example, we will be attacking a column of moving armored targets. We will use the radar's GMT (Ground Moving Target) mode to detect these moving vehicles.
16. From the FCR page, then select "GMT" Mode using OSBs
17. Adjust Ground Map Overlay gain and contrast as desired.
18. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
19. The Radar Crosshair/Cursor should be set to the SPI (Sensor Point of Interest) location. In this example, it is set to a selected Steerpoint.
20. **<u>If desired</u>**, press OSB next to "SP" to select Snowplow Mode. The radar will scan directly ahead of the aircraft, independent of the SPI location, and the radar cursor will be fixed at the center of the display. Not using Snowplow means the Radar Crosshair will be set on the current SPI location (like a Steerpoint).
21. **<u>If using Snowplow Mode</u>**, press TMS (Target Management Switch) FWD to ground-stabilize the Radar Crosshair and exit Snowplow mode. This will allow you to move the Radar Crosshair. If not using Snowplow Mode, disregard this step.
22. Use the Radar Cursor/Enable switch to move the Radar Crosshair over the desired moving target (white square).

Radar Cursor/Enable Switch **19a**
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*



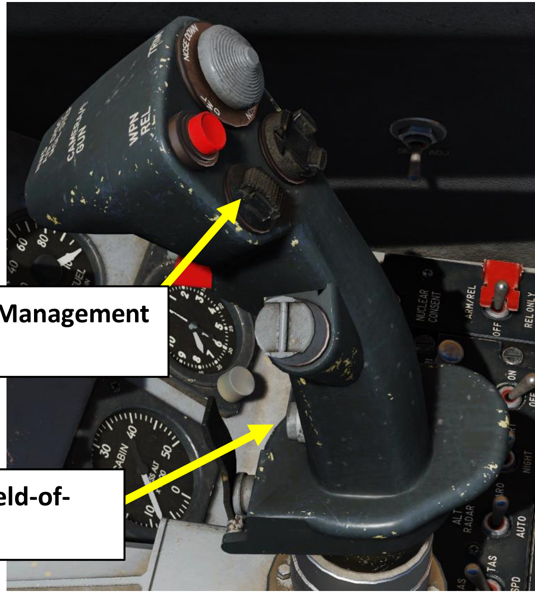
18a **DMS (Display Management Switch)**

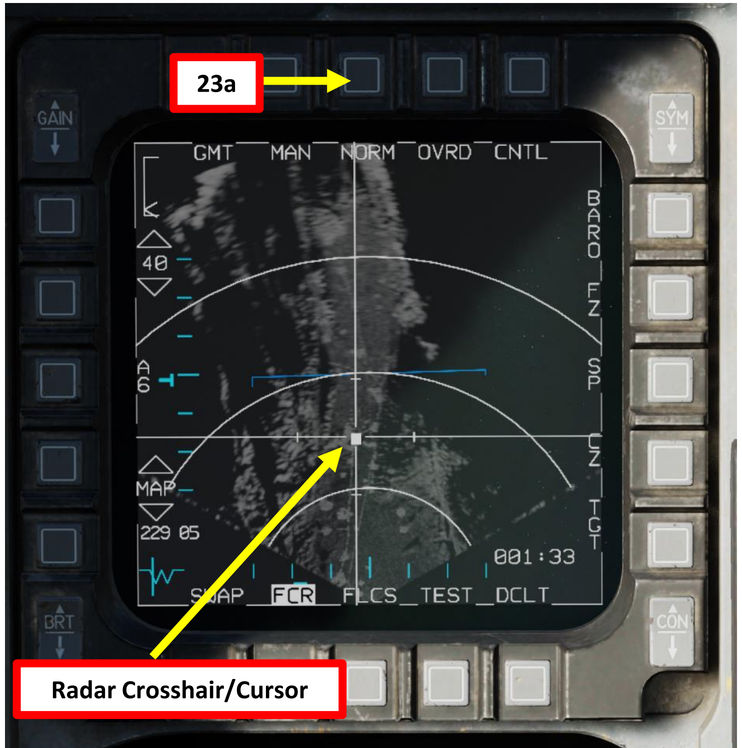
21 **TMS (Target Management Switch)**

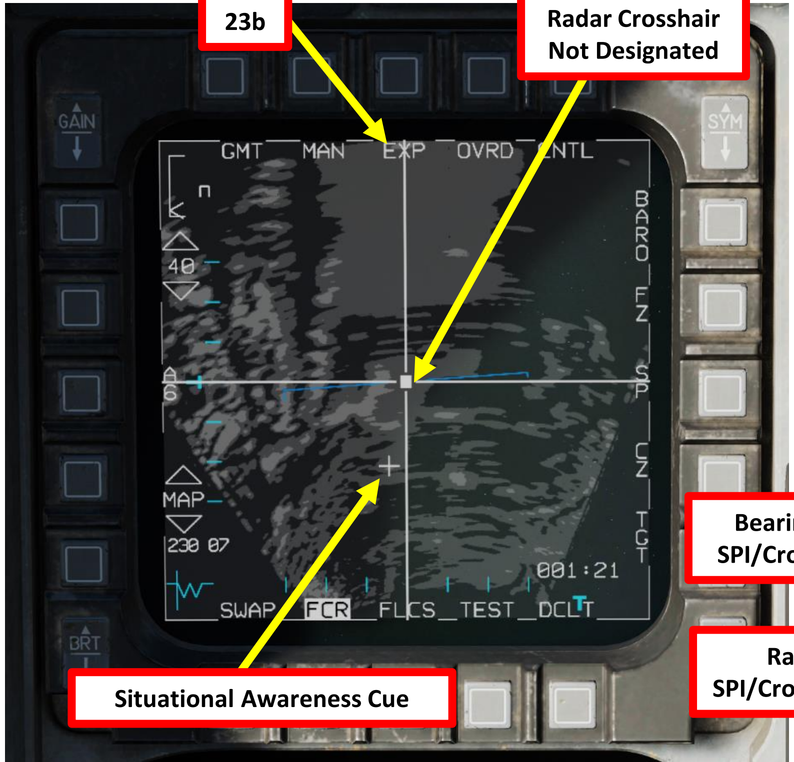


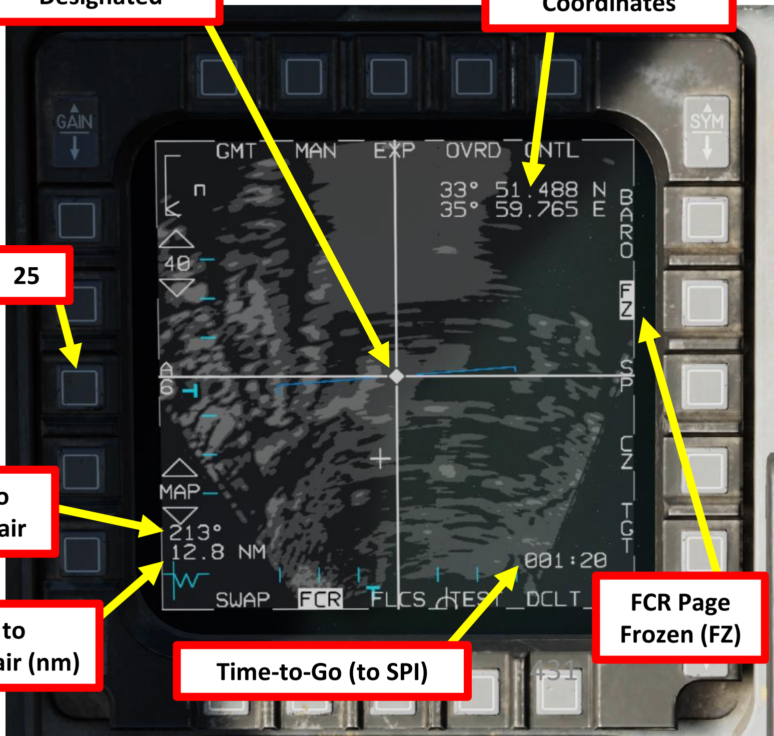
2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

23. A Moving Target Designation via the ground Fire Control Radar, also called Ground Moving Target Track (GMTT), can be performed from any air-to-ground radar Ground Moving Target mode (NORM or EXP). If you want to use EXP sub-mode, either press the Expand/FOV Button or use the OSB next to the Radar Sub-Mode Selector to switch to desired Sub-Mode. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded. If you want to return to NORM (Non-Expanded), you can use the Expand/FOV Button.
24. To designate target on Radar Crosshair position, press TMS (Target Management Switch) UP. This will perform a ground-stabilized Ground Moving Target Track (GMTT) and freeze (FZ) the FCR image.
25. Adjust Radar Scan Azimuth – As desired. Smaller azimuth means a faster update.
26. To un-designate target and exit GMTT, press TMS (Target Management Switch) DOWN.







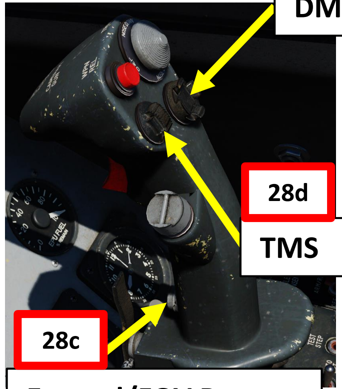


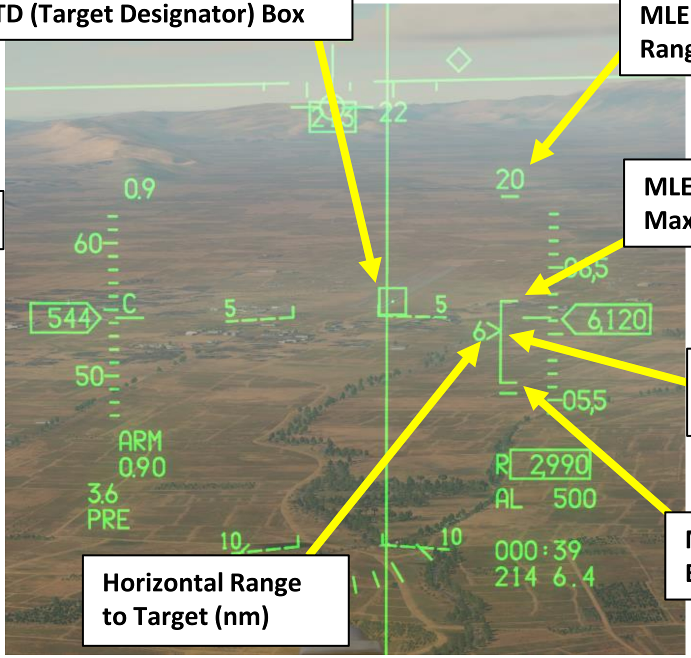
2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

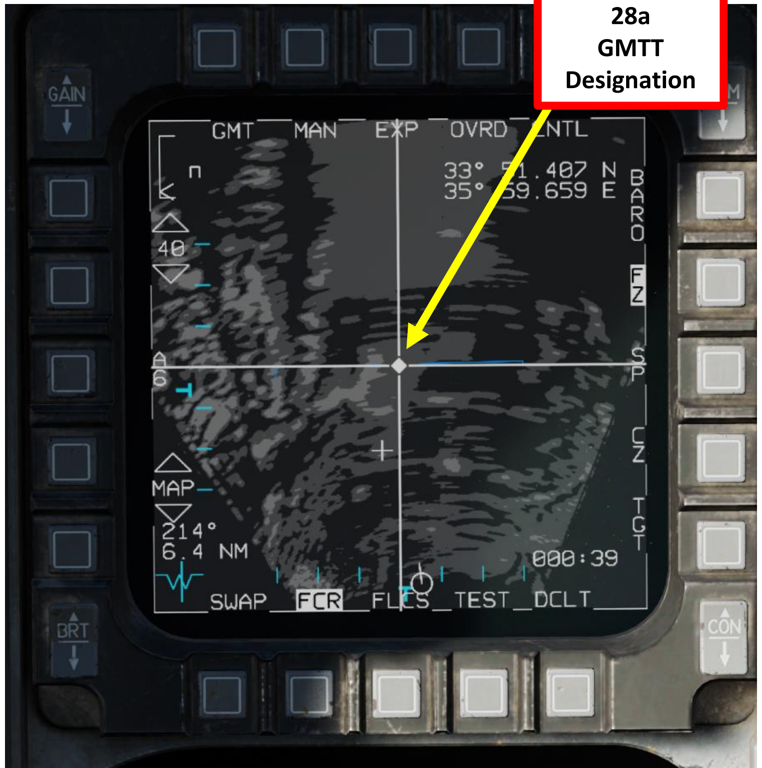
27. When in GMTT, the designated location becomes the SPI. The radar will continue to track the target location while line-of-sight (LOS) is maintained. If LOS is lost, the radar will coast for 10 seconds before the radar returns to GM or SEA mode. If the designated location moves outside the radar field of view, the radar will slew to boresight until the target returns into the radar FOV, at which point the radar will reacquire the target. If the target remains outside the radar FOV for 60 seconds, the radar will return to GM or SEA.

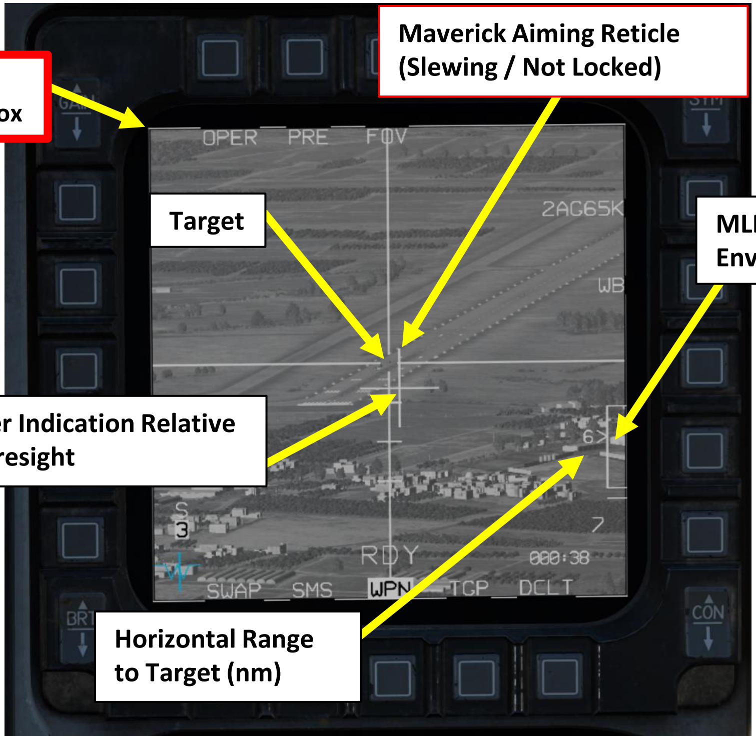
2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

28. Perform Maverick Lock
    a) While FCR is the Sensor of Interest (SOI), make sure a valid GMTT (Ground Moving Target Track) designation has been performed.
    b) Press DMS (Display Management Switch) DOWN to set WPN page as the SOI (Sensor of Interest). The SOI Box around the WPN page will indicate when the Maverick seeker can be controlled with HOTAS controls.
    c) Set Field of View as desired using the FOV OSB or using the Expand/FOV button.
    d) When you are within effective Maverick range, press TMS (Target Management Switch) UP to attempt a Maverick lock on the target designated by the radar. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.



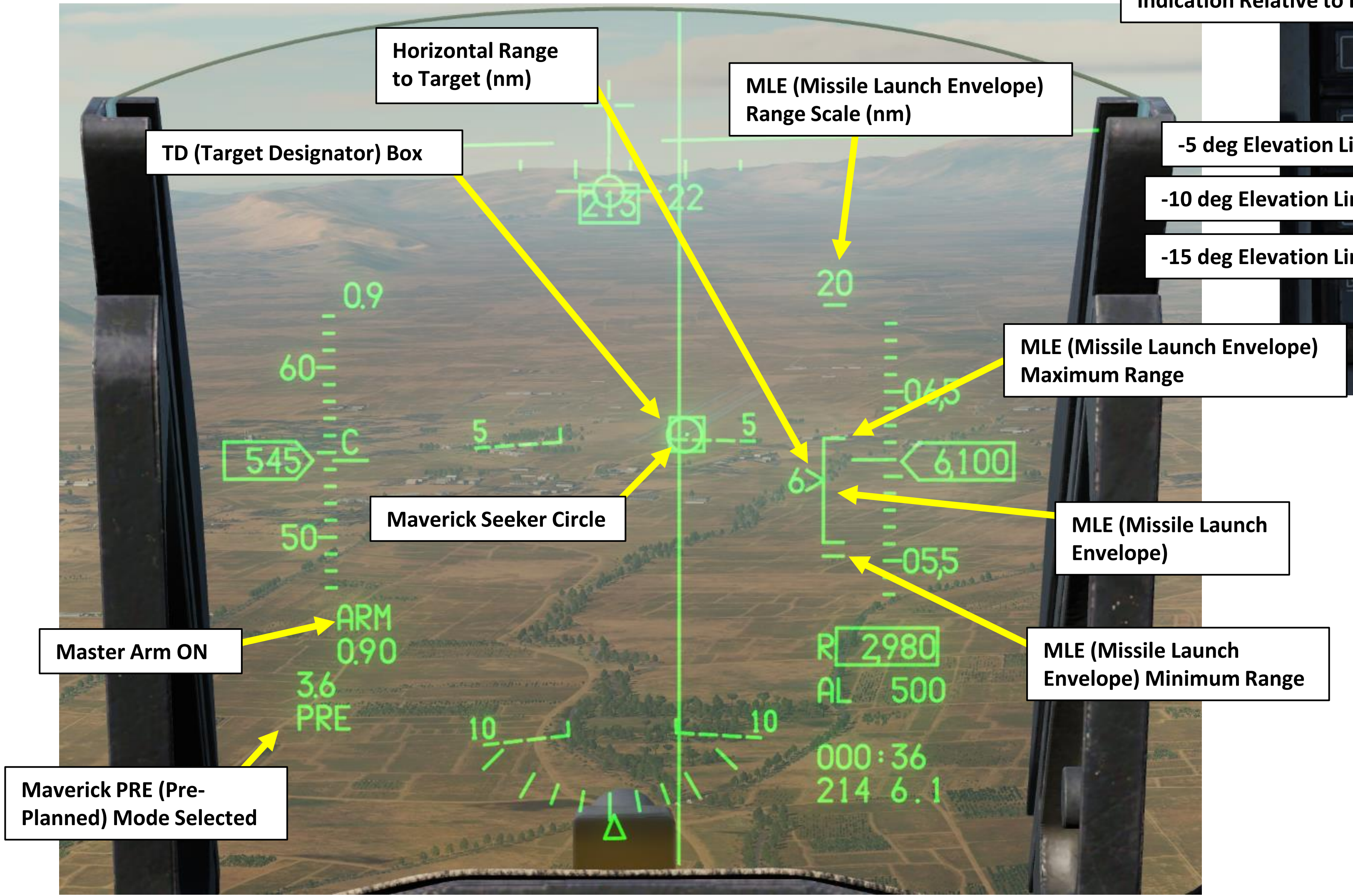


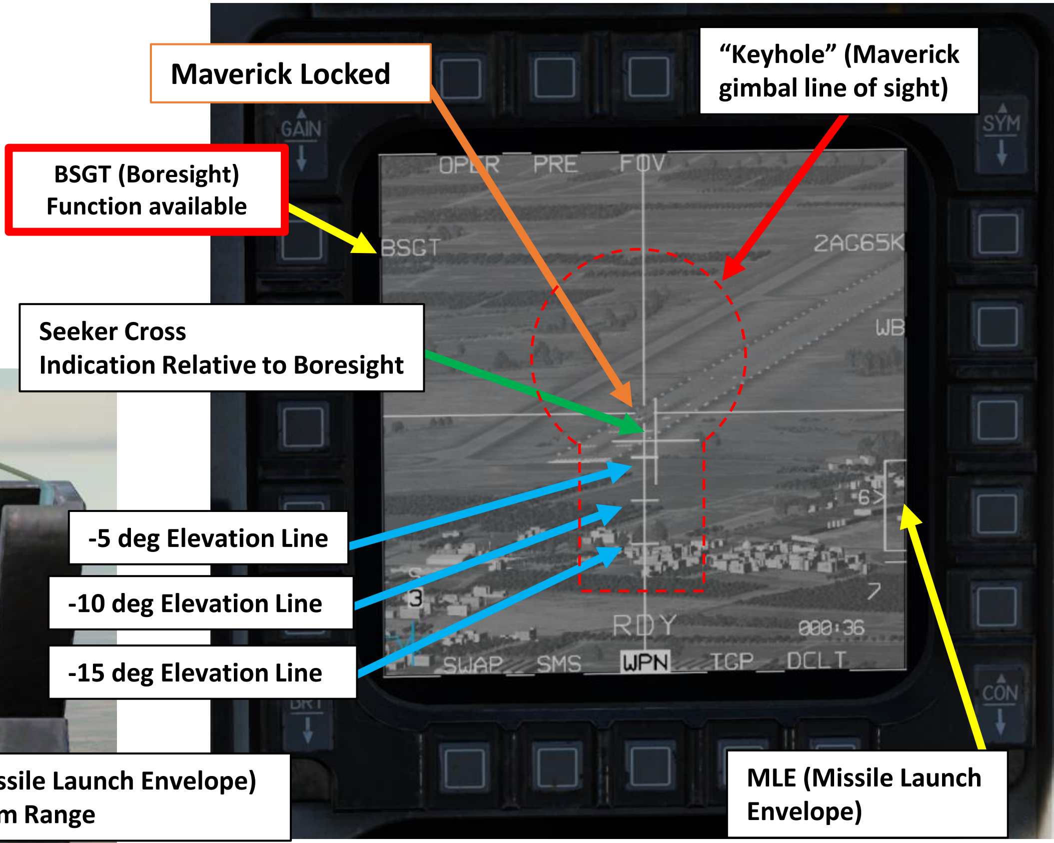




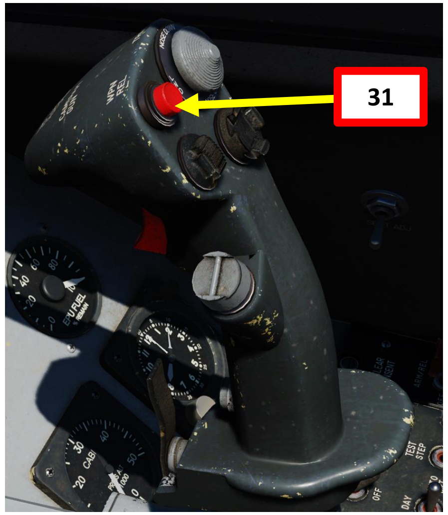
2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)

29. Confirm valid missile lock using the WPN page and HUD (Heads-Up Display).
    - Maverick gimbals are 10 deg in azimuth and 15 deg in elevation.
    - To ensure valid missile before launch, the seeker cross must be within the “imaginary” line of sight keyhole centered on the WPN page crosshairs.
30. Verify that you are within effective Maverick range.





2.6 – AGM-65 MAVERICK
2.6.6 – AGM-65K (Pre-Planned Mode + Air-to-Ground Radar)



31. Depress the Weapon Release (RALT+SPACE) button to fire the missile.

- *Note: If you locked the wrong target and want to cancel the Maverick lock, use TMS DOWN.*

<u>AGM-65 missile launch restrictions:</u>

- Max launch speed: Mach 1.2
- Max dive angle: 60°
- Max bank angle: 30°
- Max roll rate: 30°/s
- Min/Max load factor: +0.5 g/+3.0 g

2.7 – AGM-88C HARM

2.7 – AGM-88C HARM
2.7.1 – Introduction

Suppression of Enemy Air Defenses (SEAD, also known in the United States as "Wild Weasel" and (initially) "Iron Hand" operations) are military actions to suppress enemy surface-based air defenses, including not only surface-to-air missiles (SAMs) and anti-aircraft artillery (AAA) but also interrelated systems such as early-warning radar and command, control and communication (C3) functions, while also marking other targets to be destroyed by an air strike. Suppression can be accomplished both by physically destroying the systems or by disrupting and deceiving them through electronic warfare.

The **AGM-88 HARM** (High-speed Anti-radiation Missile) is a tactical, air-to-surface anti-radiation missile designed to home in on electronic transmissions coming from surface-to-air radar systems. The AGM-88 can detect, attack and destroy a radar antenna or transmitter with minimal aircrew input. The proportional guidance system that homes in on enemy radar emissions has a fixed antenna and seeker head in the missile's nose.

TLDR version? The HARM mainly homes on radar emitters. The best way to use the HARMs is to use the HAS (HARM As Sensor) page, and the RWR (Radar Warning Receiver) together to detect which radar emitters are actively tracking, which ones are locking you, what level of threat each emitter poses, and which one to target.

Here is an interesting DCS-centric SEAD Reference Guide by the 16th AGR Flight Training School:
https://drive.google.com/file/d/1jUbi9-2YJiKO3E2ZuHijFf231_cnslw8/view

HAS (HARM As Sensor) WPN Page

ALR-56M TWA (Threat Warning Azimuth) Indicator
Also known as RWR (Radar Warning Receiver)

2.7 – AGM-88C HARM
2.7.1 – Introduction

The HARM Missile has the following operating modes:

HAS (HARM As Sensor) Mode

- HAS Mode uses the sensor in the nose of the missile to detect and track detected radars that are in one of the three threat tables (see section 2.7.2). Once the threat is handed off to the ALIC (Aircraft Launcher Interface Computer) and the missile is launched, it will fly a directly to the target with no range data. As such, it has more limited range than other modes.

POS (Position) Mode

- POS mode requires the missile to be fired at a known position/steerpoint. This kind of attack is generally performed against pre-planned threats. Once launched, the missile will fly to the steerpoint area, activate its seeker and look for the handed off threat (single radar emitter). If a SAM radar comes online, the missile will target it. If not, the missile will likely miss unless the radar site is at the precise location of the targeted steerpoint.
    - **PB (Pre-Briefed)** POS Sub-Mode: used for long range delivery with a target location that is pretty much known with a high degree of confidence (i.e. known range). The seeker head will activate 15 nm from the steerpoint with a wide field of view of 120°.
    - **RUK (Range Unknown)** POS Sub-Mode: similar to a degraded EOM mode with high uncertainty about threat range. The seeker head is activated roughly 20 nm from the steerpoint with a wide 120° field of view.
    - **EOM (Equation of Motion)** POS Sub-Mode: most accurate of the three POS sub-modes. The seeker is activated with a narrow 40° field of view, 5 nm from the known SAM threat position. This mode should only be used when the location of the emitter is well known… as in the steerpoint used is in close vicinity of the radar emitter.

HAD (HARM Attack Display) and HTS (HARM Targeting System) Pod Integration

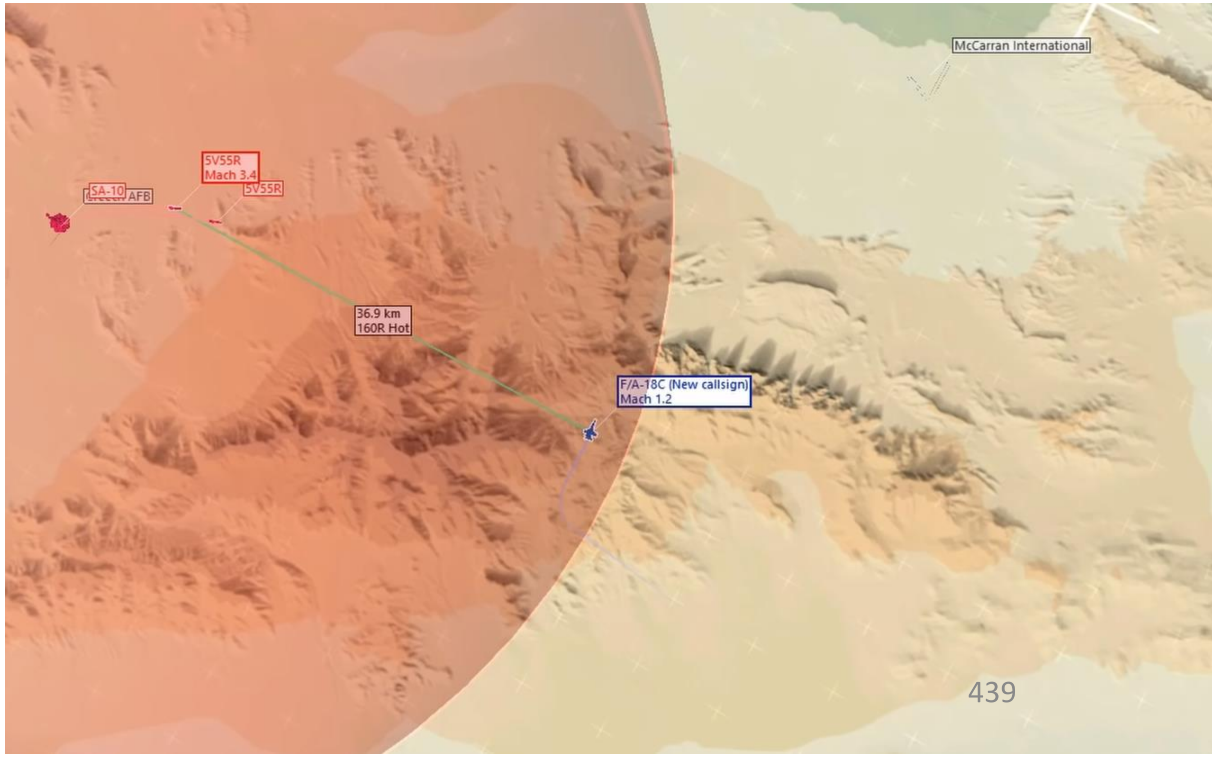
- The AN/ASQ-213 HARM Targeting System (HTS) pod can be installed on the left cheek station and gives you the capability to employ the HARM missile in its most effective mode (which means it can be used with Position modes such as PB, EOM and RUK). It can autonomously detect, identify and locate radar guided threats at long ranges and displays the target location for HARM designation and firing. The MFD display for using HTS is called the HARM Attack Display (HAD).

2.7 – AGM-88C HARM
2.7.1 – Introduction

Flying at high altitudes greatly enhances the HARM's range. However, the higher you are, the easier you are to find by enemy radars. Keep in mind that doing SEAD operations means that you will be locked by multiple radar stations and SAM sites can fire missiles on you or on your own HARM missiles. This means that your countermeasures programs must be ready at all times and you must often break away from the target once you have fired your weapon. A great way to do SEAD is to use terrain to mask your approach and fire your weapons at the last second before breaking off back your egress route.

Keep in mind that SAM sites do not necessarily emit continuously. The radar emitters can remain off until you are right on top of them, which makes their detection impossible by either the RWR or HARM sensor. This is why you should not perform a SEAD mission alone and not fly directly over the expected SAM site location at high altitude.

HARM Range Table (Ref: RedKite Tutorial) Direct Flight Profile		
Range (nm)	Altitude (ft)	Airspeed (kts IAS)
40	40000	380
35	30000	400
25	20000	400
20	10000	400
15	1000	550



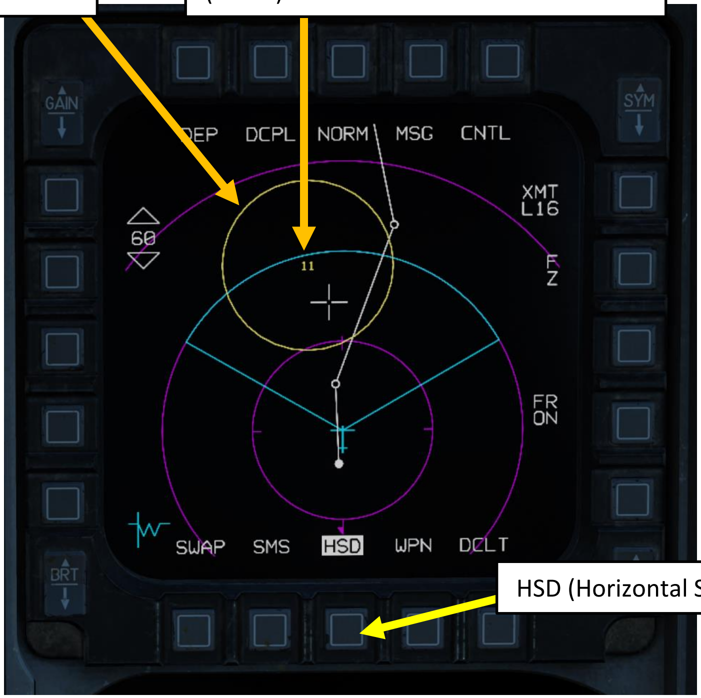
2.7 – AGM-88C HARM
2.7.1 – Introduction

There are multiple tools at your disposal to detect a radar emitter.

- The Radar Warning Receiver (RWR) is a good indication of radar azimuth, but it doesn't indicate range.
- The HAS (HARM As Sensor) WPN page displays what the HARM missile seeker itself detects, but no range is visible either.
- The HSD (Horizontal Situation Display) page has Threat Rings and SAM Site symbols, but these are not necessarily representative if the site has been destroyed.

SAM (Surface-to-Air Missile) Site Threat Ring
- This ring is set by the DTC (Data Transfer Cartridge) via the Mission Editor. This is an indicator of the SAM radar range and this region should be avoided if possible.
- If SAM site is destroyed, the Threat Ring will remain displayed. It does not update dynamically with the SAM site itself, it is merely a visual marker set prior to the mission according to currently available intelligence on deployment of enemy forces.

SAM (Surface-to-Air Missile) Site Symbol (SA-11)



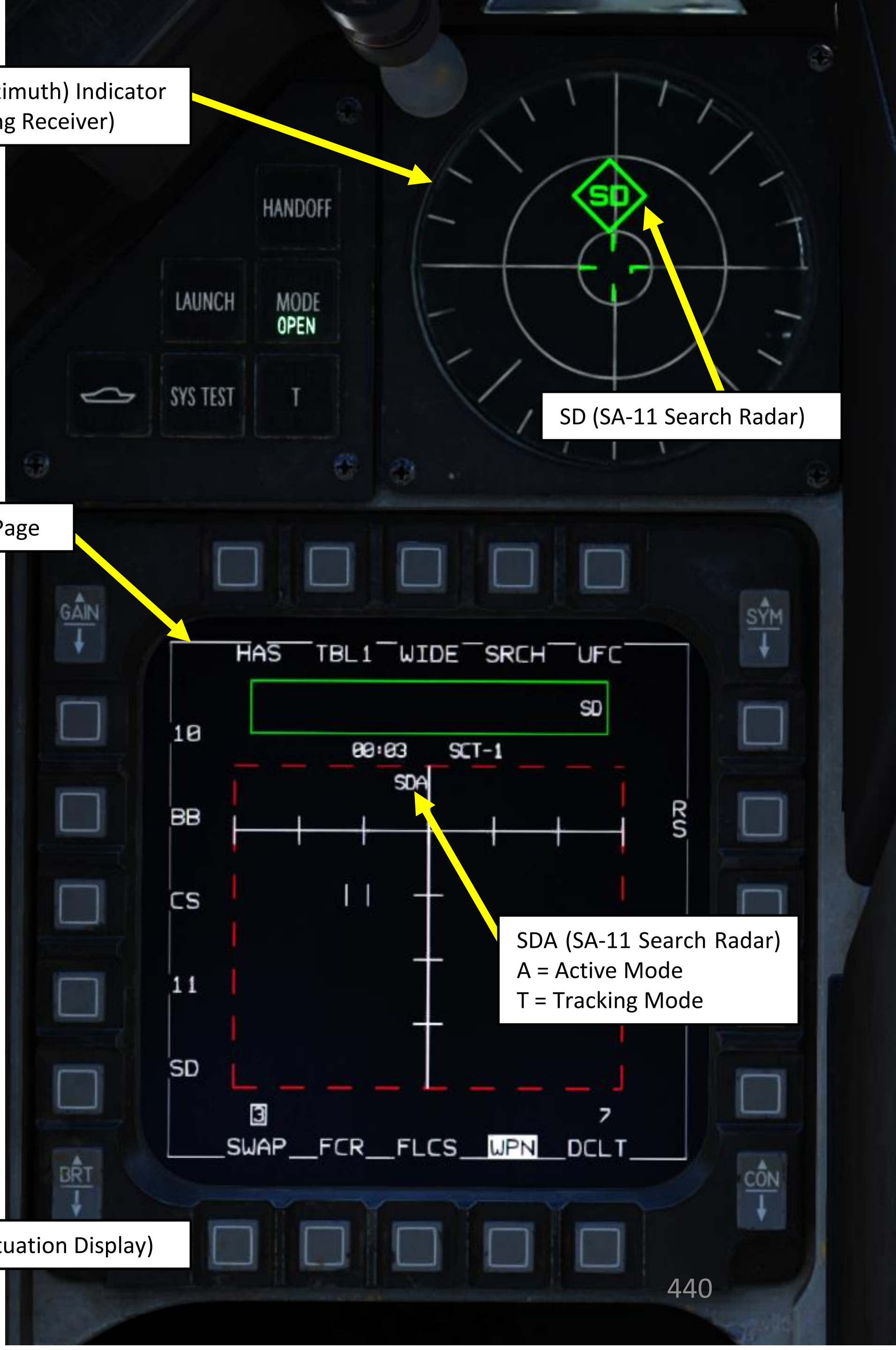
HSD (Horizontal Situation Display)

ALR-56M TWA (Threat Warning Azimuth) Indicator
Also known as RWR (Radar Warning Receiver)

SD (SA-11 Search Radar)

HAS (HARM As Sensor) WPN Page

SDA (SA-11 Search Radar)
A = Active Mode
T = Tracking Mode



2.7 – AGM-88C HARM
2.7.1 – Introduction

There are also devices that supplement HARM sensors.

- The HAD (HARM Attack Display) page displays what the HTS (HARM Targeting System) pod detects with ranging information as well.

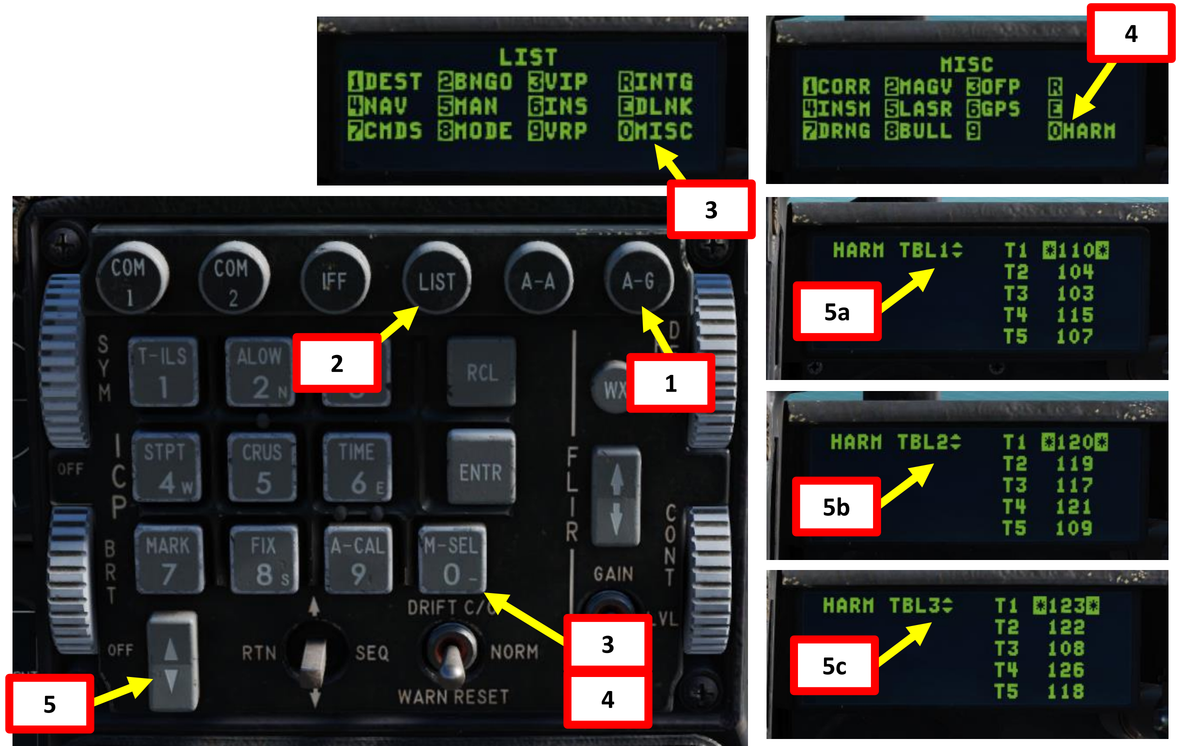
HAD (HARM Attack Display) Page

AN/ASQ-213 HARM Targeting System (HTS) pod

2.7 – AGM-88C HARM
2.7.2 – ALIC (Aircraft Launcher Interface Computer) Tables

The HARM sensor cannot search every radar wave frequency all at once; in HAS mode, the sensor can only search for five different radar emitter frequencies at the same time, which are contained in an ALIC (Aircraft Launcher Interface Computer) table. Three independent sets of these radar threat tables are available. However, you can edit any table to contain any radar emitter type of your choice.

TO EDIT A TABLE:
1. Press the A-G Master Mode Button
2. Press the LIST button
3. The LIST sub-menus will appear on the DED (Data Entry Display). Press the "0" button on the ICP (Integrated Control Panel) to select the MISC (Miscellaneous) sub-menu.
4. Press the "0" button on the ICP to select the HARM sub-menu.
5. Select desired table (TBL1, 2 or 3) using the DED (Data Entry Display) Increment/Decrement Switch



ALIC (Aircraft Launcher Interface Computer) Table 1

ID Number / RWR Symbol		Designation (Russia)	Designation (NATO)
110	10	S300PS TR 30N6	SA-10 Track Radar
104	BB	S300PS SR 64H6E	SA-10 Search Radar
103	CS	S300PS SR 5N66M	SA-10 Search Radar
115	11	Buk LN 9A310M1	SA-11 Track Radar
107	SD	Buk SR 9S18M1	SA-11 Snow Drift Search Radar

ALIC (Aircraft Launcher Interface Computer) Table 2

ID Number / RWR Symbol		Designation (Russia)	Designation (NATO)
120	19	Tunguska 2S6	SA-19
119	15	Tor 9A331	SA-15
117	8	Osa 9A33	SA-8
121	A	ZSU-23-4 Shilka	ZSU-23-4
109	DE	Dog Ear	SA-9 Dog Ear Search Radar

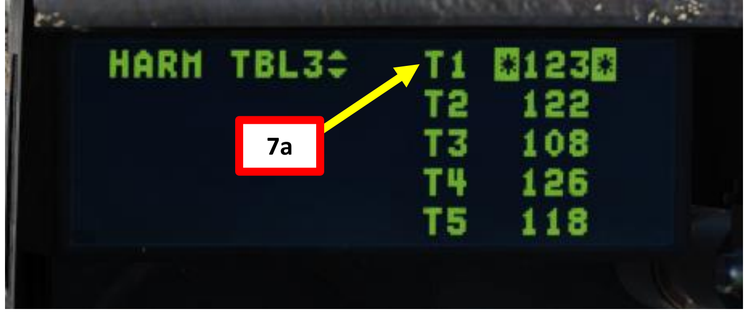
ALIC (Aircraft Launcher Interface Computer) Table 3

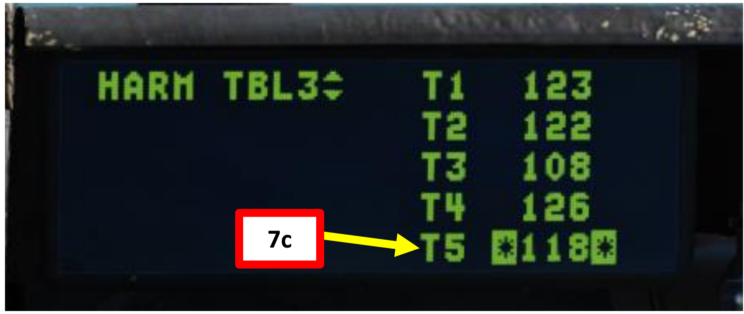
ID Number / RWR Symbol		Designation (Russia)	Designation (NATO)
123	3	S125 TR SNR	SA-3 Low Blow Track Radar
122	S	S125 SR-P-19	SA-3 Flat Face Search Radar
108	6	Kub STR 9S91	SA-6
126	2	SNR-75V	SA-2 Fan Song Track Radar
118	13	Strela 9A35M3	SA-13

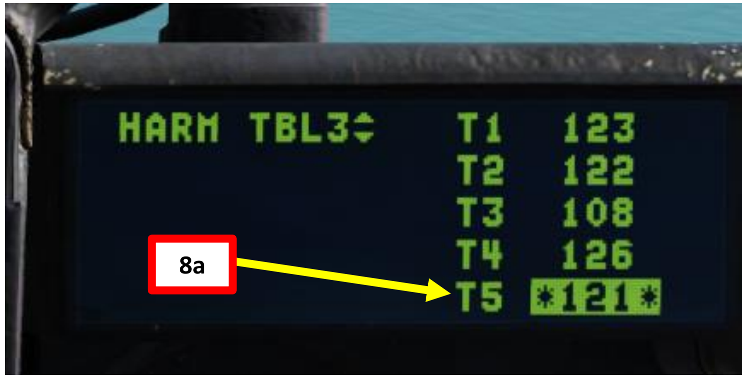
2.7 – AGM-88C HARM
2.7.2 – ALIC (Aircraft Launcher Interface Computer) Tables

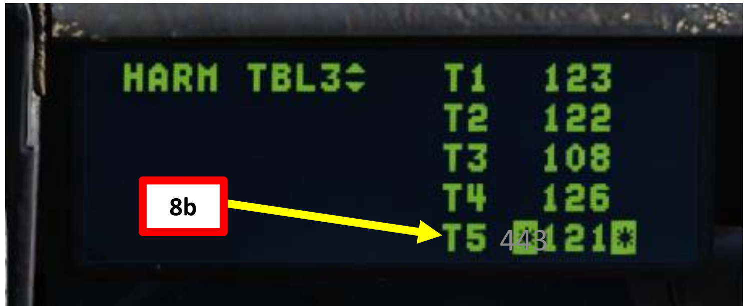
TO EDIT A TABLE:

6. In our case, we want to switch field T5 from a SA-13 Strela 9A35M3 (ID Number 118) to a ZSU-23-4 (ID Number 121).
7. Select desired Threat field (T1 to T5) by pressing the DCS/Dobber (Data Control Switch) DOWN (asterisks indicate field is selected).
8. Type the ID number ("121") on the ICP keypad of the threat type you want to change T5 to, then press ENTR button.
9. You can repeat the previous steps to customize your own threat table as per the needs of your mission. The advantage of having three tables is that you can easily switch between three different mission profiles on the fly.









2.7 – AGM-88C HARM
2.7.2 – ALIC (Aircraft Launcher Interface Computer) Tables

AGM-88C HARM ALIC Tables by AstonMartinDBS

DCS: F-16C Viper

v3.0.0

Table				
HAS	HAD	ID	RWR	Name
1	1	103	CS	SAM SA-10 S-300PS SR 5N66M
1	1	104	BB	SAM SA-10 S-300PS SR 64H6E
1	1	107	SD	SAM SA-11 Buk SR 9S18M1
1	1	110	10	SAM SA-10 S-300PS TR 30N6
1	1	115	11	SAM SA-11 Buk LN 9A310M1
2	1	119	15	SAM SA-15 Tor 9A331
2	2	117	8	SAM SA-8 Osa 9A33
2	3	109	DE	CP 9S80M1 Sborka
2	3	120	19	SAM SA-19 Tunguska 2S6
2	3	121	A	AAA ZSU-23-4 Shilka
3	2	108	6	SAM SA-6 Kub STR 1S91
3	2	118	13	SAM SA-13 Strela-10M3 9A35M3
3	2	122	S	SAM SR P-19
3	2	123	3	SAM SA-3 S-125 TR SNR
3	2	126	2	SAM SA-2 TR SNR-75 Fan Song
	1	127	7	HQ7 Self-Propelled LN
	1	128	HQ	HQ7 Self-Propelled STR
	1	130	TS	SAM SA-5 SR "Tin Shield"
	2	129	5	SAM SA-5 SR "Gammon"
	4	101	S	EWR 1L13
	4	102	S	EWR 55G6
	5	301	SW	CV 1143.5 Admiral Kuznetsov
	5	303	T2	CG 1164 Moskva
	5	306	HP	FFL 1124.4 Grisha
	5	309	TP	FF 1135M Rezky
	5	312	PS	FSG 1241.1MP Molniya
	5	313	HN	CGN 1144.2 Piotr Velikiy
	5	319	TP	FFG 11540 Neustrashimy
	5	320	SW	CV 1143.5 Admiral Kuznetsov(2017)
	5	408	PS	Type 071 Amphibious Transport Dock
	5	409	MR	Type 052B Destroyer
	5	410	HN	Type 052C Destroyer
	5	411	MR	Type 054A Frigate

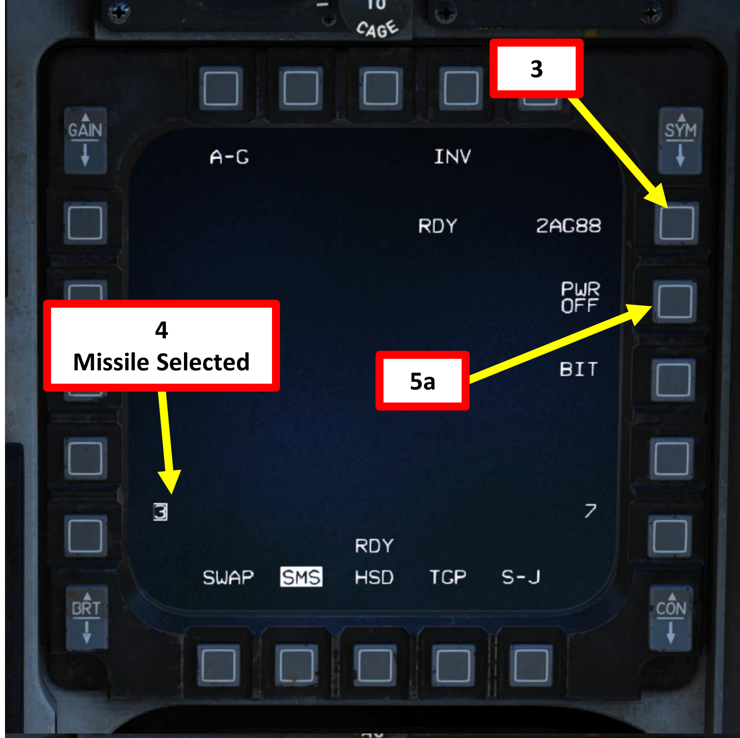
Table				
HAS	HAD	ID	RWR	Name
	6	202	P	SAM Patriot STR AN/MPQ-53
	6	209	NS	SAM NASAMS SR MPQ64F1
	7	124	RP	Rapier FSA Blindfire Tracker
	7	125	RT	Rapier FSA Launcher
	7	201	RO	SAM Roland ADS
	7	203	HK	SAM Hawk SR AN/MPQ-50
	7	204	HK	SAM Hawk TR AN/MPQ-46
	7	205	RO	SAM Roland SR
	7	206	HK	SAM Hawk CWAR AN/MPQ-55
	8	207	A	AAA Gepard
	8	208	A	AAA Vulcan M163
	10	315	AE	Ticonderoga class
	10	401	49	Oliver Hazzard Perry class
	10	402	SS	CVN-70 Carl Vinson
	10	403	SS	CVN-71 Theodore Roosevelt
	10	404	SS	CVN-72 Abraham Lincoln
	10	405	SS	CVN-73 George Washington
	10	406	SS	CVN-74 John C. Stennis
	10	407	40	LHA-1 Tarawa
	10	412	AE	DDG Arleigh Burke IIa
	10	413	SS	CVN-75 Harry S. Truman

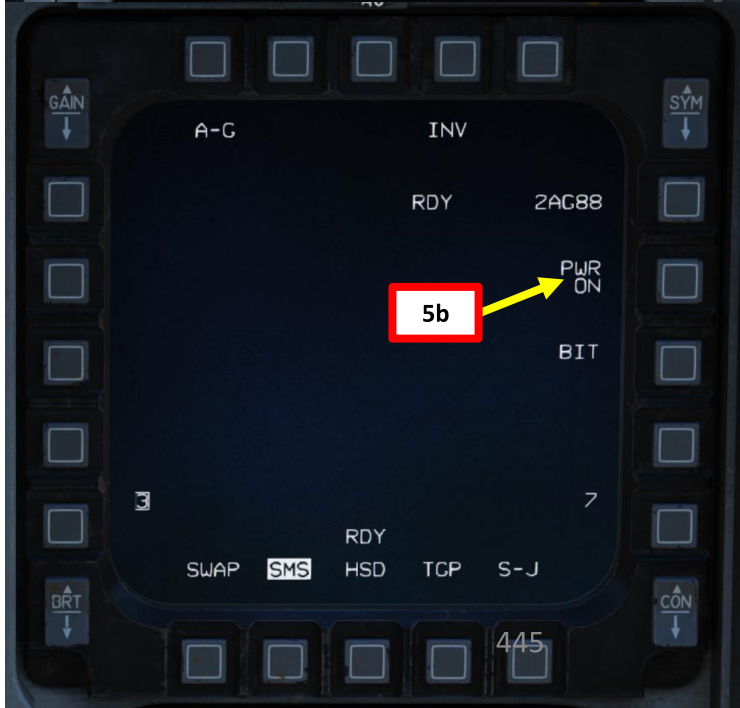
2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG88 (AGM-88C HARM) missile. The number preceding AG88 is the number of missiles of this type equipped.
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Press the OSB next to PWR OFF to start the power-up process of the HARM. A BIT (Built-In Test) will be initiated.

NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

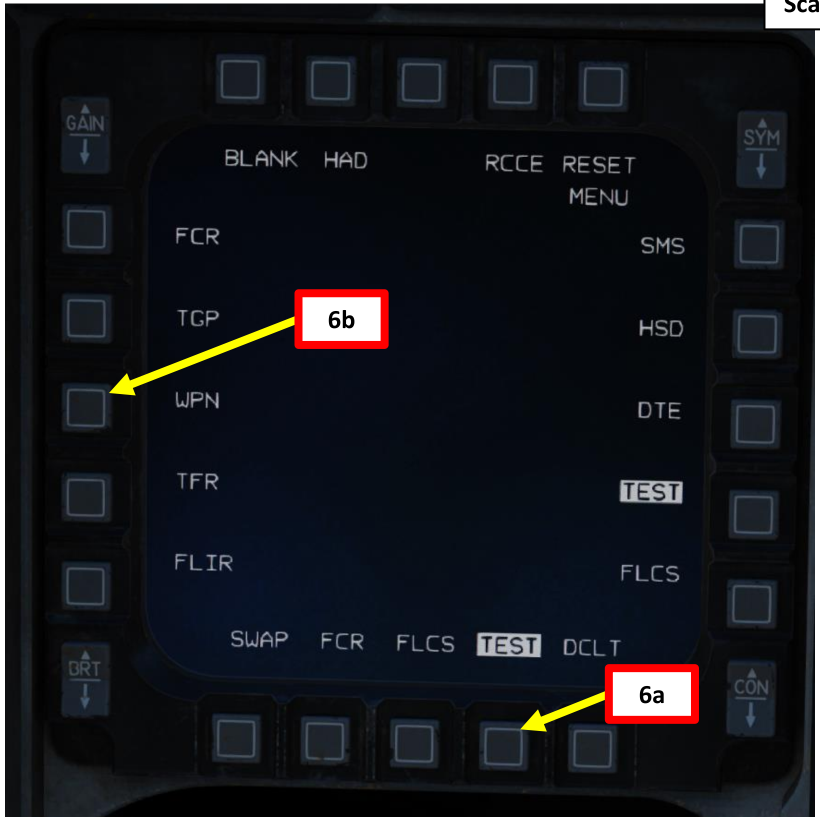
4

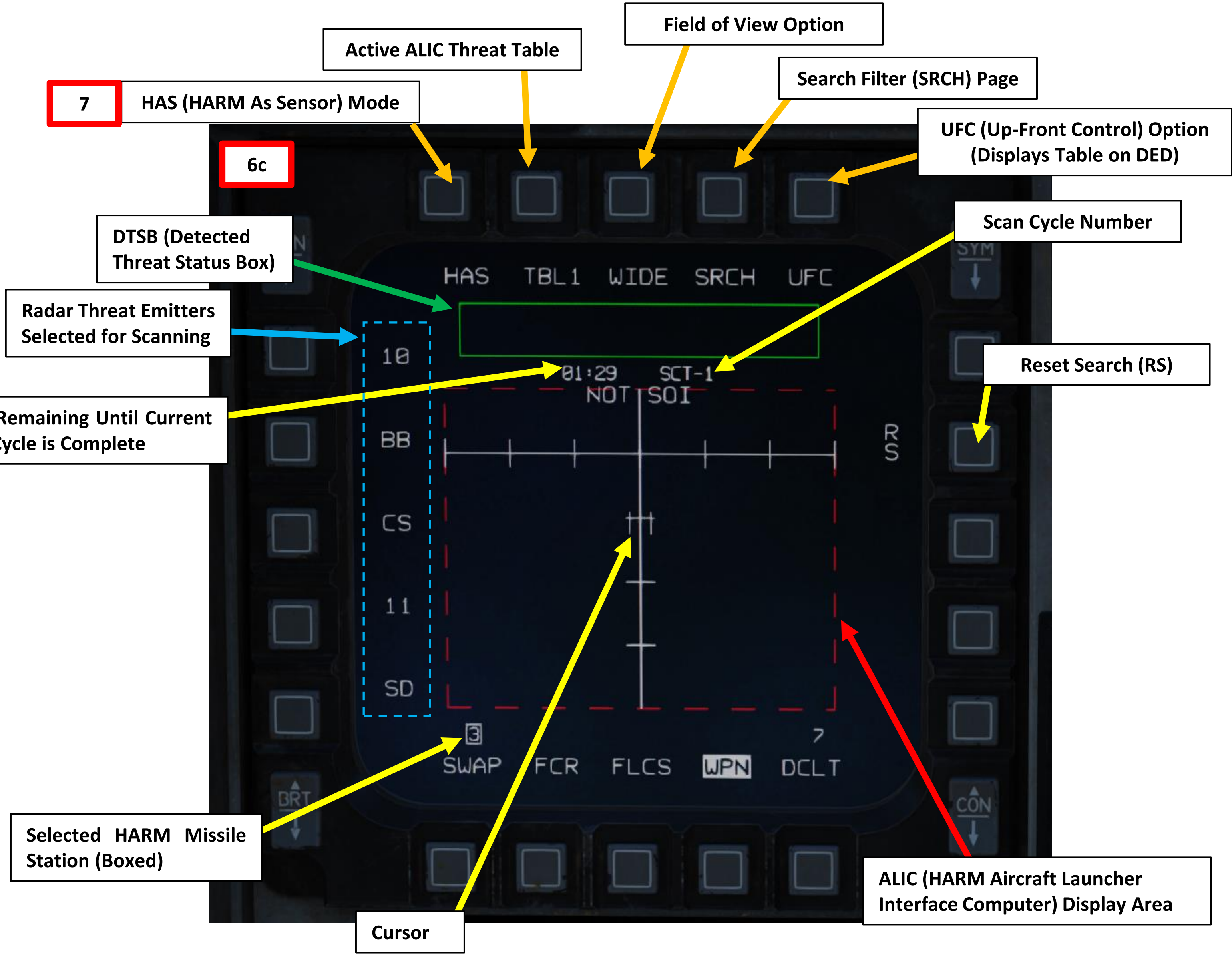




2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

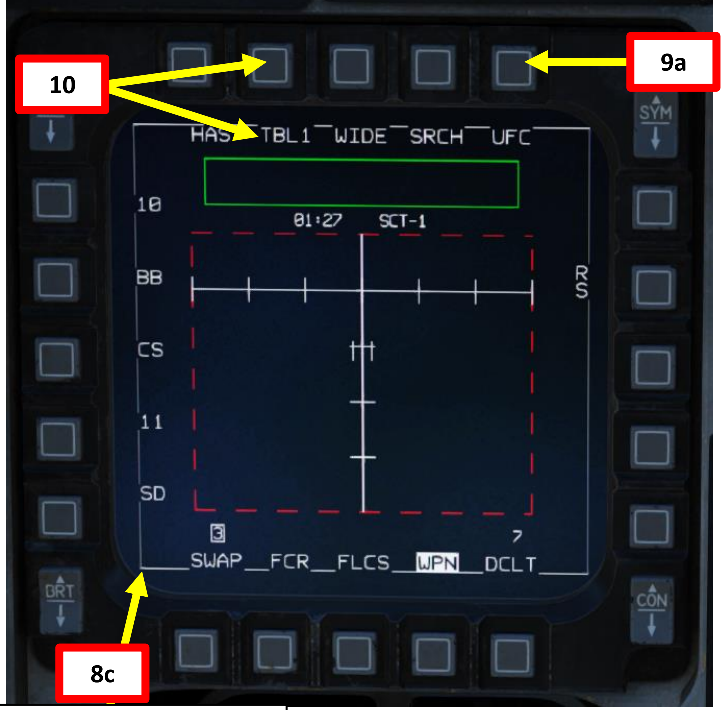
6. Select the WPN (Weapon) page
7. The WPN page should display HAS Mode by default. If it isn't selected, toggle the OSB (Option Select Button) next to the HARM Mode until HAS is selected. The HAS Mode page will display up to 10 radar emitters at once. However, only 2 radar emitters of the same type can be displayed at the same time.





2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

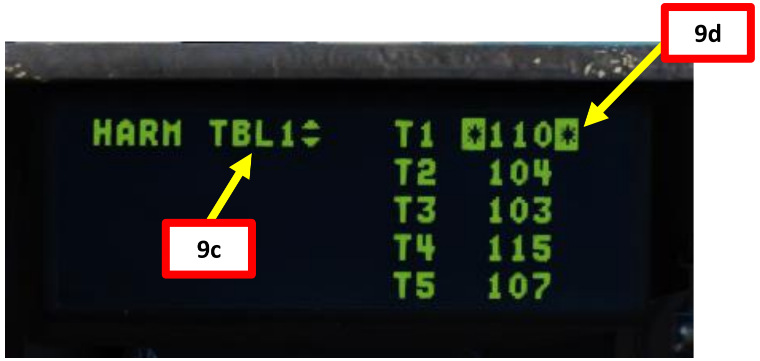
8. Press the DMS (Display Management Switch) DOWN to set the WPN (Weapon) page as the SOI (Sensor of Interest), indicated by a white SOI box.
9. (Optional) If you wish to edit the HARM threat tables to set your own threats, you can select the HARM sub-menu on the DED (Data Entry Display) by pressing the OSB (Option Select Button) next to UFC (Up-Front Control). Then, select desired table (TBL1, 2 or 3) using the DED (Data Entry Display) Increment/Decrement Switch and edit the desired field as shown in section 2.7.2.
10. Select the desired ALIC table by either toggling the OSB next to TBL#, or by pressing TMS (Target Management Switch) LEFT SHORT while the WPN page is the SOI (Sensor of Interest). In our case, we want to hunt a SA-11, so we will pick Table #1.



MFD SOI (Sensor of Interest) Box

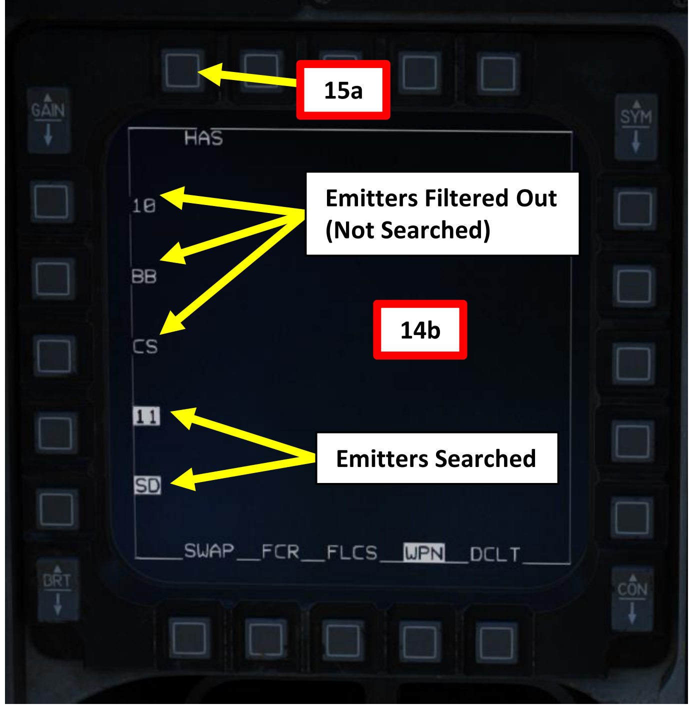
8b
DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT

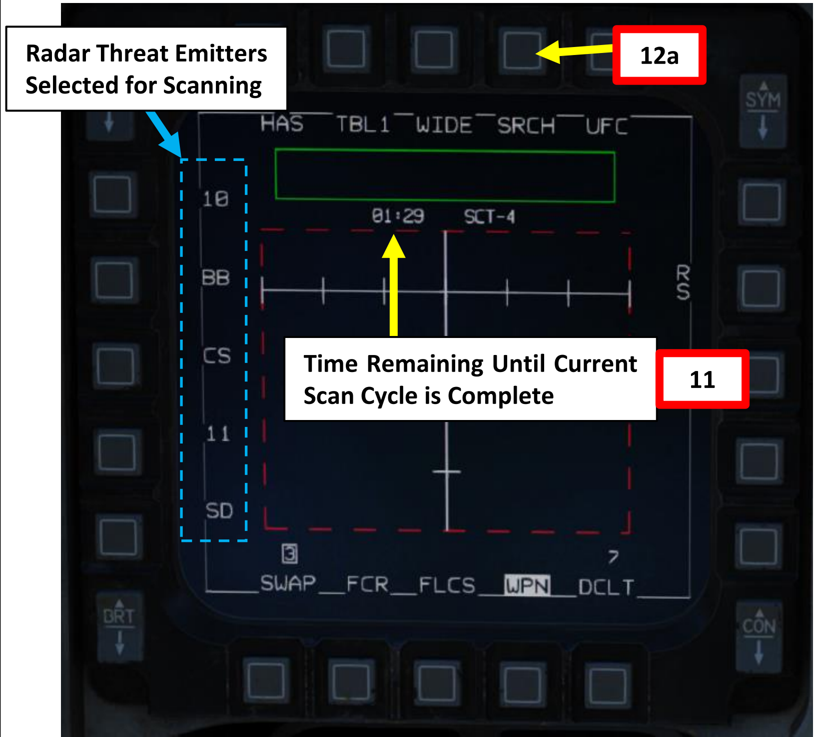
TMS (Target Management Switch)
UP/DOWN/LEFT/RIGHT

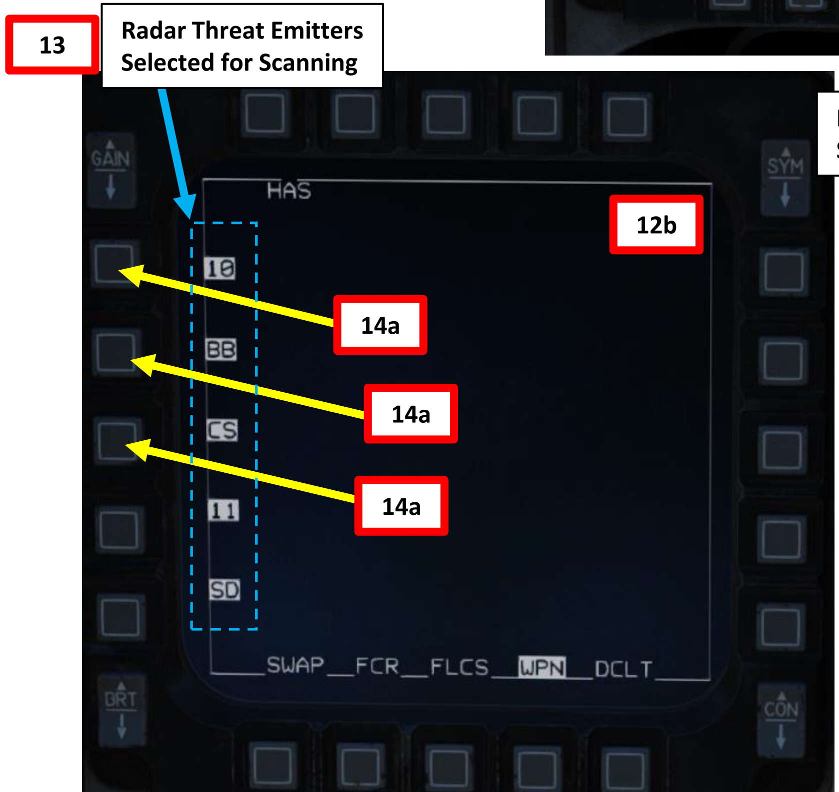


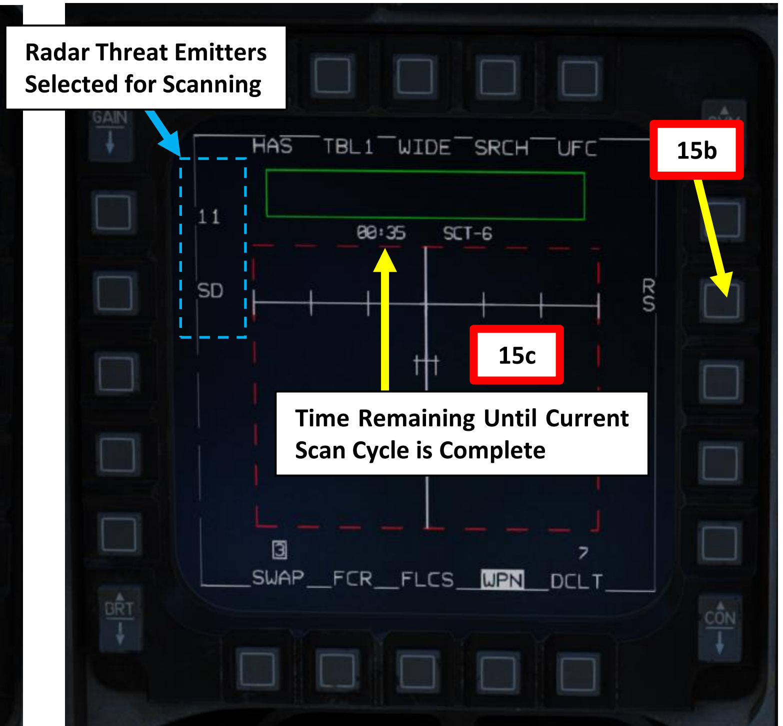
2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

11. If the HARM sensor scans all threat types listed in Table 1, a single scanning cycle can last about 1:30. We can choose to discard certain threat types to reduce scanning time.
12. Press OSB next to SRCH (Search Filter)
13. Currently searched threat types are highlighted in white.
14. Press on the OSBs next to the threat types you want to filter out. In our case, we will leave out 10 (SA-10 Track Radar), BB (SA-10 Search Radar) and CS (SA-10 Search Radar).
15. Click on the OSB next to HAS to return to the HAS Mode page, then press OSB next to RS (Reset Search). As we can see, the scanning cycle time is reduced from 1:30 to 0:35. Not bad!







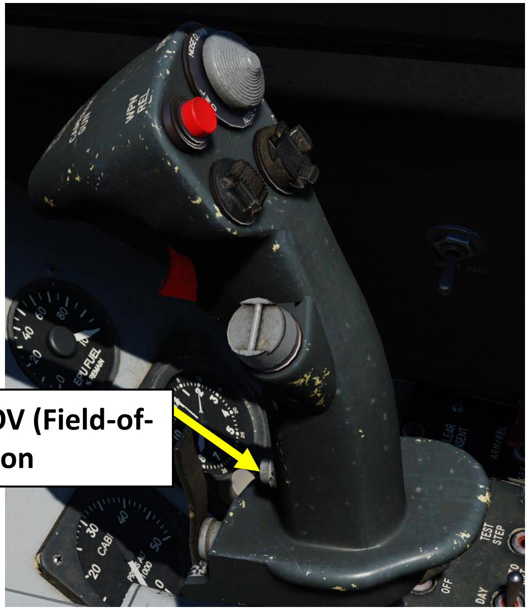


2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

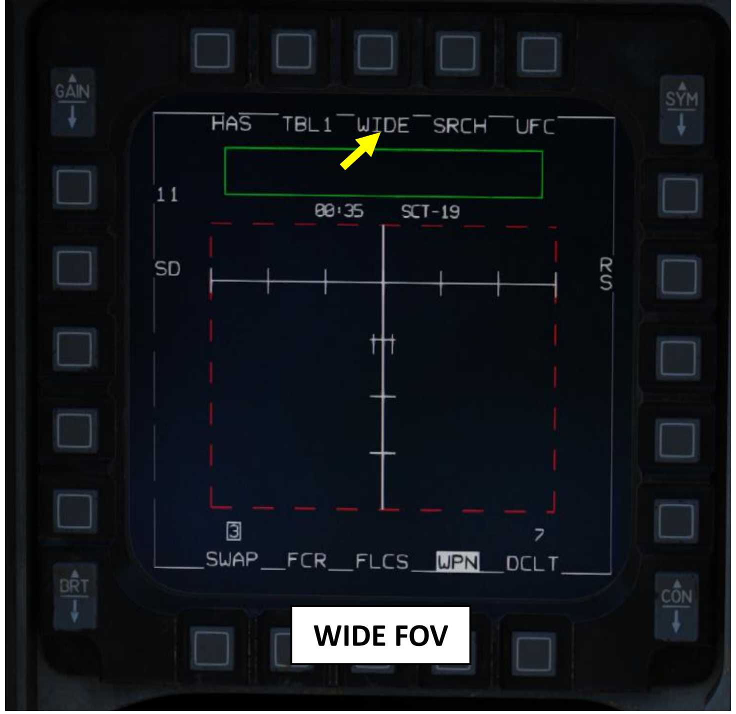
16. To find an appropriate area to scan for radar emitters, consult your RWR (Radar Warning Receiver) and HSD (Horizontal Situation Display). Keep in mind that the RWR is used to give you rough approximation of the direction of the emitter, while the HSD threat ring information can be used as a very basic way to estimate the range to the emitter (these rings are not dynamic; they are set by the mission editor in the mission data cartridge). The HAS mode itself has no proper way to have an accurate estimate of the range of the emitter.

2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

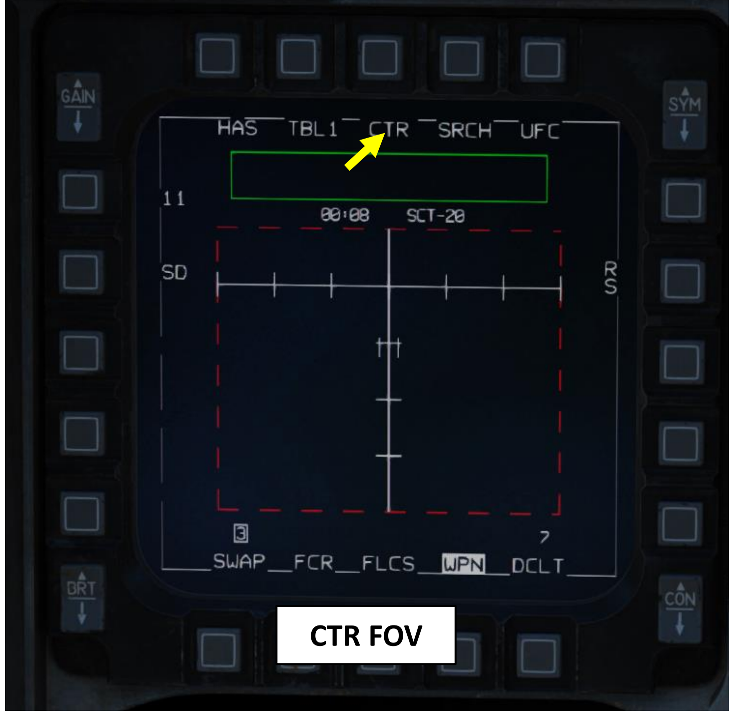
17. You can toggle between FOV (Field-of-View) options as desired using either the Expand/FOV Button on the stick or the OSB next to the FOV Option. Scanning times will vary depending on the FOV option selected:
    - WIDE: Scans in all directions, long range (altitude dependent)
    - CTR (Center): Scans front only with half the WIDE range. Useful in situations where you already know where the emitter is since scanning cycle time is much shorter in CTR.
    - LT: Scans left only
    - RT: Scans right only
18. Each time the FOV is changed, the HAS page resets and threats disappear until detected again.



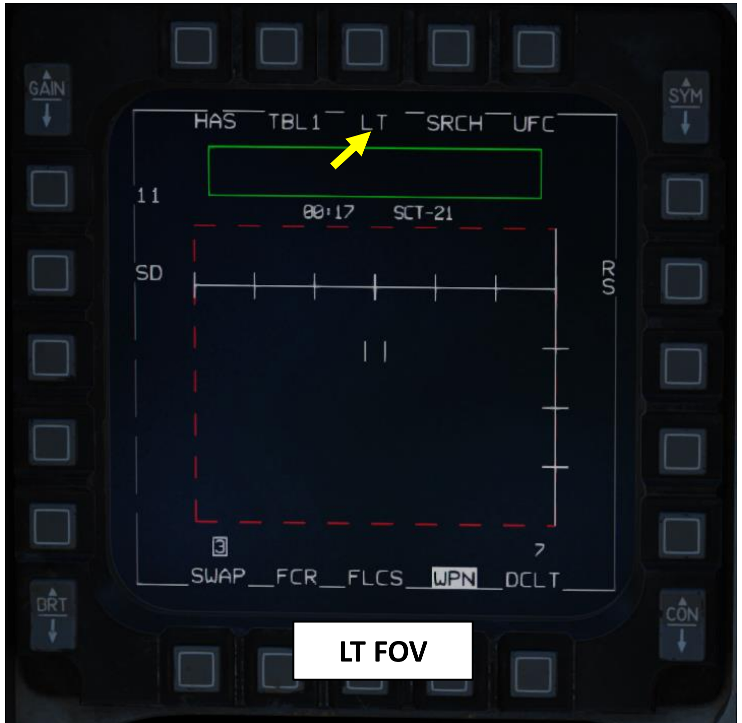
Expand/FOV (Field-of-View) Button



WIDE FOV



CTR FOV

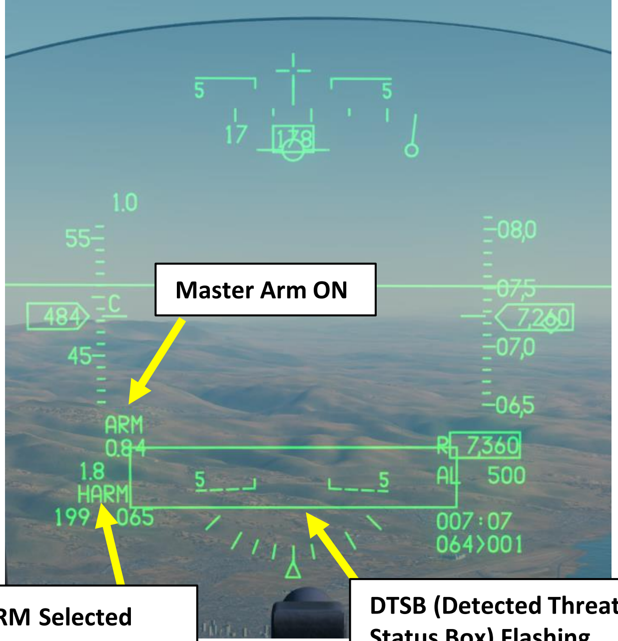


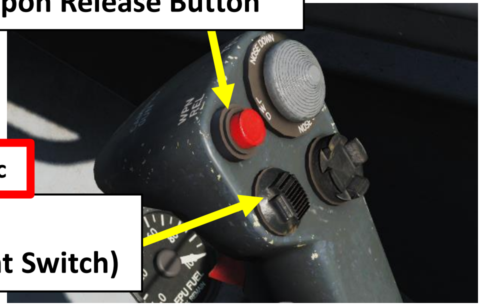
LT FOV

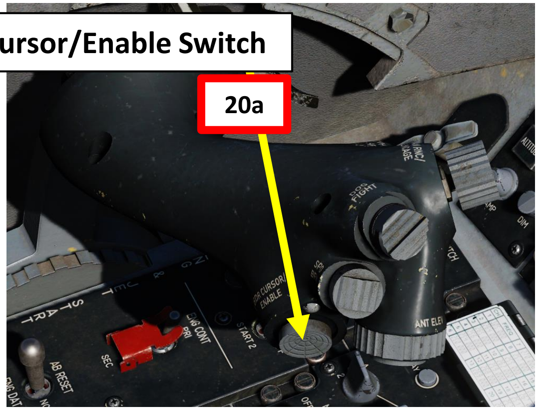
RT FOV

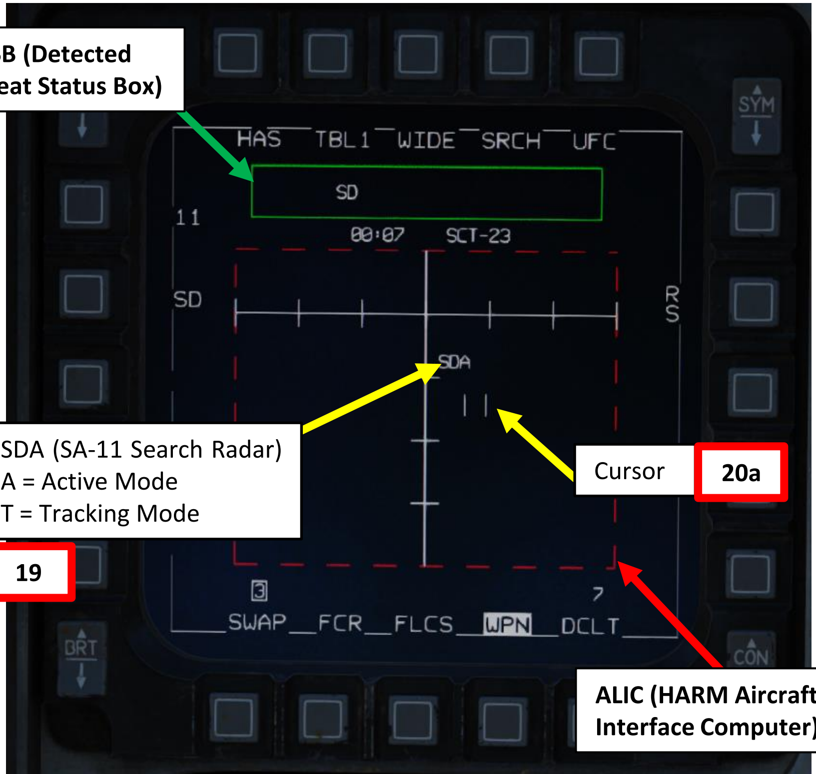
2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

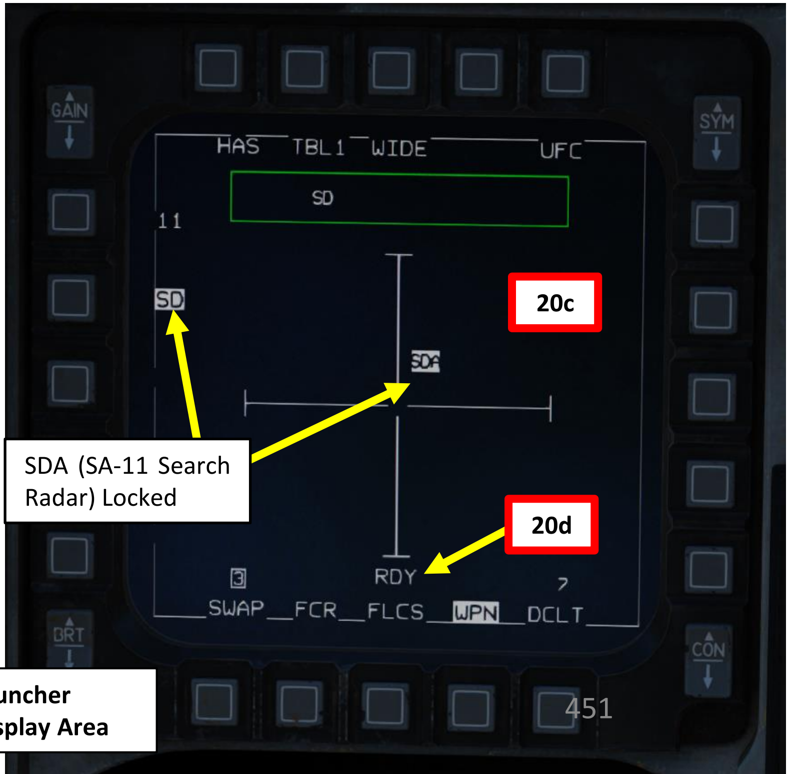
19. Once radar emitters are detected, symbols appear on the ALIC Display and the DTSB (Detected Threat Status Box). The location of a symbol in relationship to the HAS page centerline indicates the position of the emitter in relationship to the HARM missile sensor boresight.
20. Acquire radar emitter detected by the HARM sensor and lock it
    a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Radar Emitter on the HAS page.
    b) In our case, we will lock the "SDA" symbol: "SD" stands for SA 11 "Snow Drift" Search Radar, and "A" stands for Active Mode (a "T" would stand for Tracking Mode, when a missile is likely heading your way).
    c) Press TMS (Target Management Switch) UP, then release it to lock up the radar emitter and handoff the target to the missile.
    d) When handoff process is complete (process takes about 5 seconds or less), the RDY indication appears on the HAS WPN page and the HARM DTSB (Detected Threat Status Box) on the HUD flashes.
    - Note: to unlock an emitter, press TMS AFT.
21. Depress the Weapon Release (RALT+SPACE) button to fire the missile.











2.7 – AGM-88C HARM
2.7.3 – HAS (HARM As Sensor) Mode

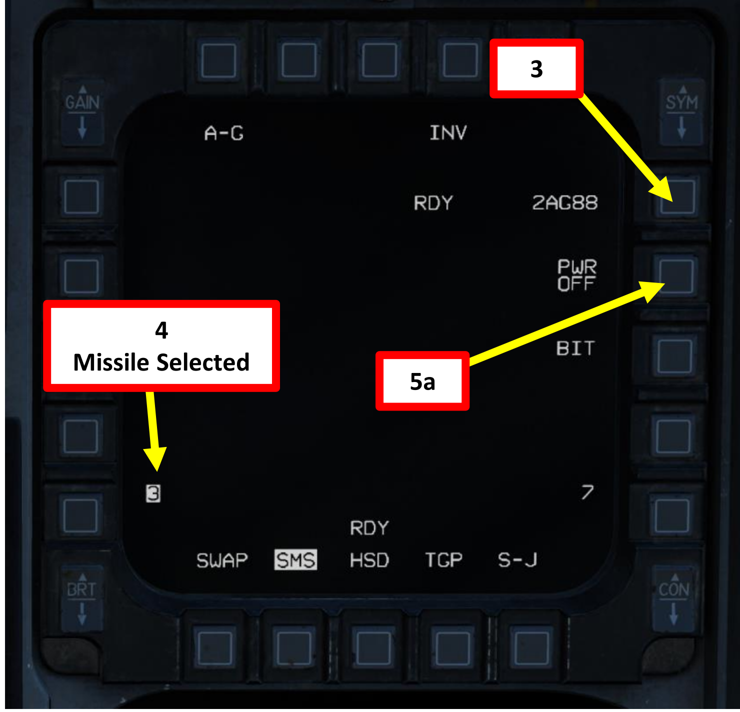
22. The missile will home on the locked radar emitter. When an anti-radiation missile is launched, the brevity call is “Magnum”.

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

Position Known (POS) mode is a pre-planned employment mode that relies on a steerpoint being placed ***<u>at or near the target radar emitter</u>****. The radar type will be downloaded to the ALIC, and the HARM will fly towards the target steerpoint until the radar is detected, at which point it will home on the radar signal.*

Pre-Briefed (PB) sub-mode is the most effective profile at longer ranges but requires an on-bearing attack. By default, PB uses an existing steerpoint as a target reference. To launch with PB selected, the pilot must first turn the aircraft to point at the target, then fly to the AMZ (Aircraft Manoeuver Zone), then loft and launch once within the MMZ (Missile Manoeuver Zone). PB is most effective at longer ranges but requires the aircraft to fly directly at the target.

1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG88 (AGM-88C HARM) missile. The number preceding AG88 is the number of missiles of this type equipped.
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Press the OSB next to PWR OFF to start the power-up process of the HARM. A BIT (Built-In Test) will be initiated.

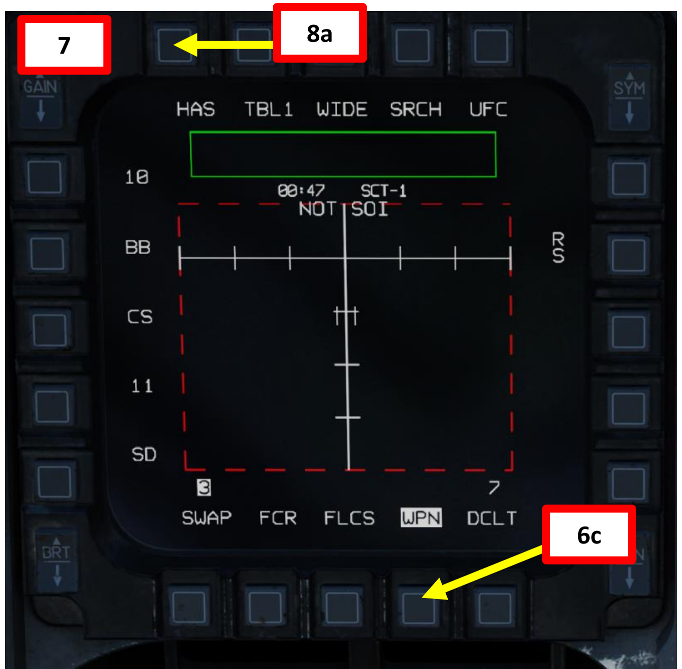


NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

4

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

6. Select the WPN (Weapon) page
7. The WPN page should display HAS Mode by default.
8. Toggle the OSB (Option Select Button) next to the HARM Mode until POS (Position) Mode is selected.
9. Toggle the OSB next to HARM POS Sub-Mode until PB (Pre-Briefed) is selected.

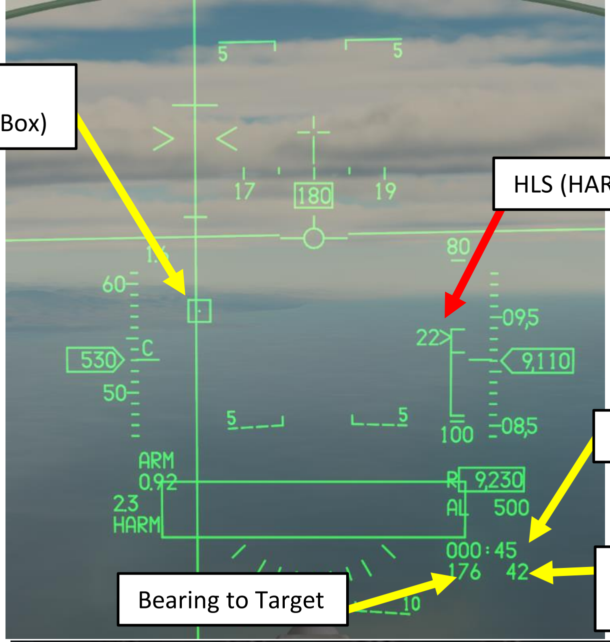


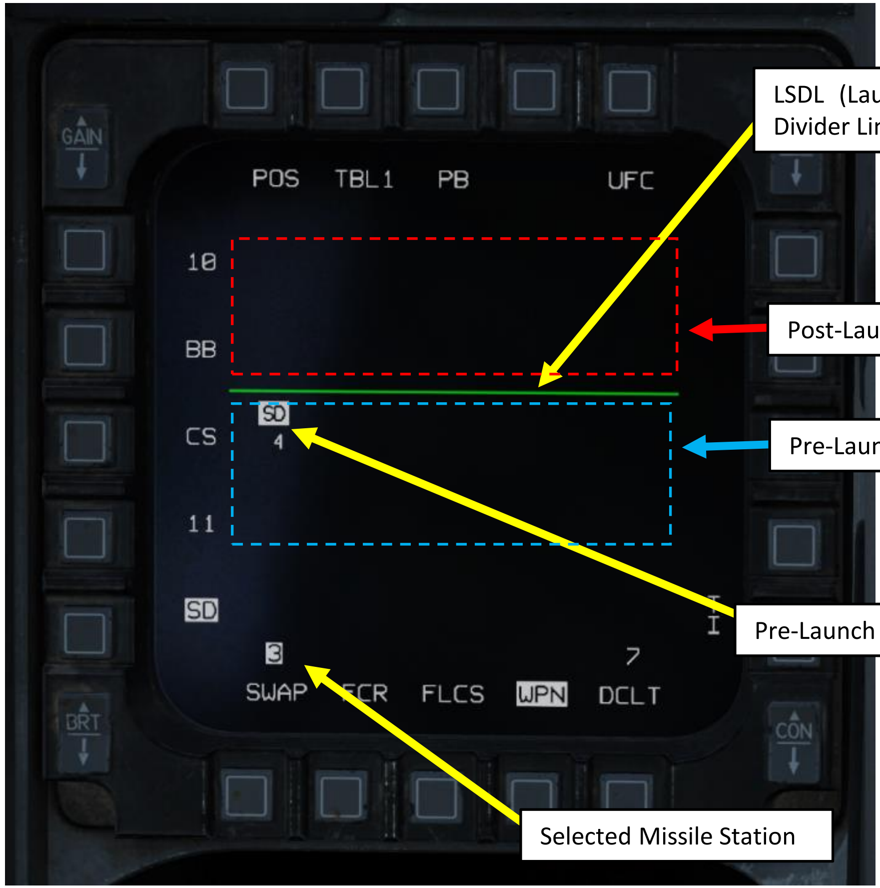
2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

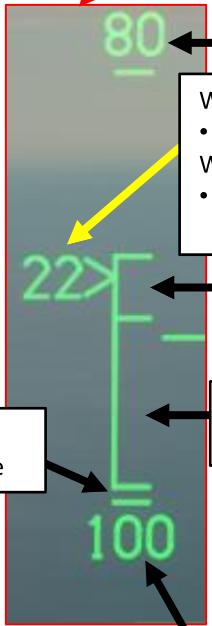
10. Toggle the OSB next to Table Selector until desired ALIC (Aircraft Launcher Interface Computer) table is selected with the appropriate radar emitter type available. We will select Table 1 (TBL1).
11. Select the expected radar emitter type. In our case, we will select “SD” for a for SA-11 “Snow Drift” Search Radar. See section 2.7.2 for reference.
12. We will be attacking a target that is directly on a steerpoint that is already in our flight plan (i.e. Steerpoint No. 4). To enter Steerpoint coordinates manually, see the Navigation section. Another option would be to designate a markpoint (data stored in steerpoints No. 26 through No. 30) and use it as a reference.
13. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
14. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 4.
15. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

16. When in Pre-Briefed mode, you must be within 10 deg of bearing to the target. Once your aircraft is pointed towards the target (you can use the HSD and the HUD Target Designation Box as a reference), keep flying towards the steerpoint/target until you are within AMZ (Aircraft Manoeuver Zone), which is indicated on the HLS (HARM Launch Scale). The HLS indicates the range potential of the missile to reach the current target. The target is assumed to be at the current steerpoint.
    - AMZ (Aircraft Manoeuver Zone): range/zone where the missile can reach the target if the launching aircraft lofts or turns towards the target first.
    - MMZ (Missile Manoeuver Zone): range/zone where the missile can reach the target by doing entirely its own maneuvering.

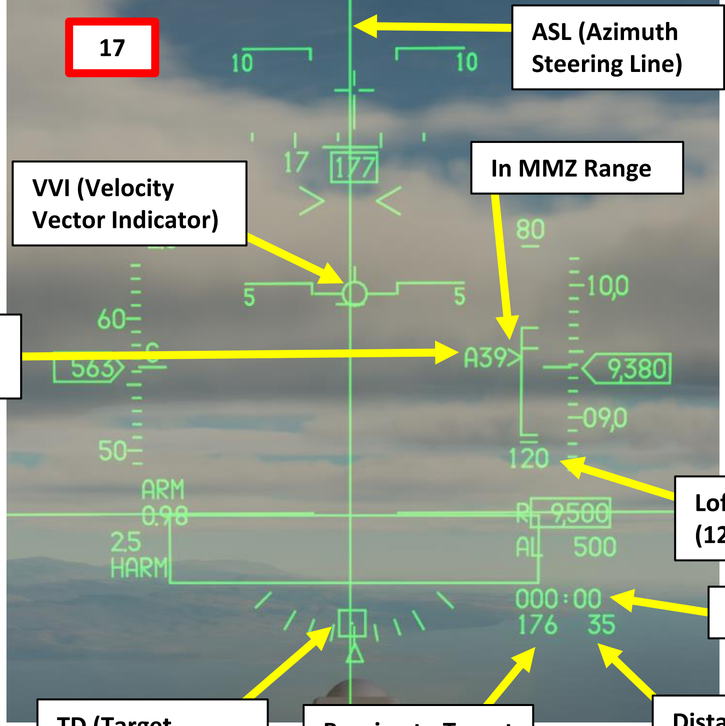


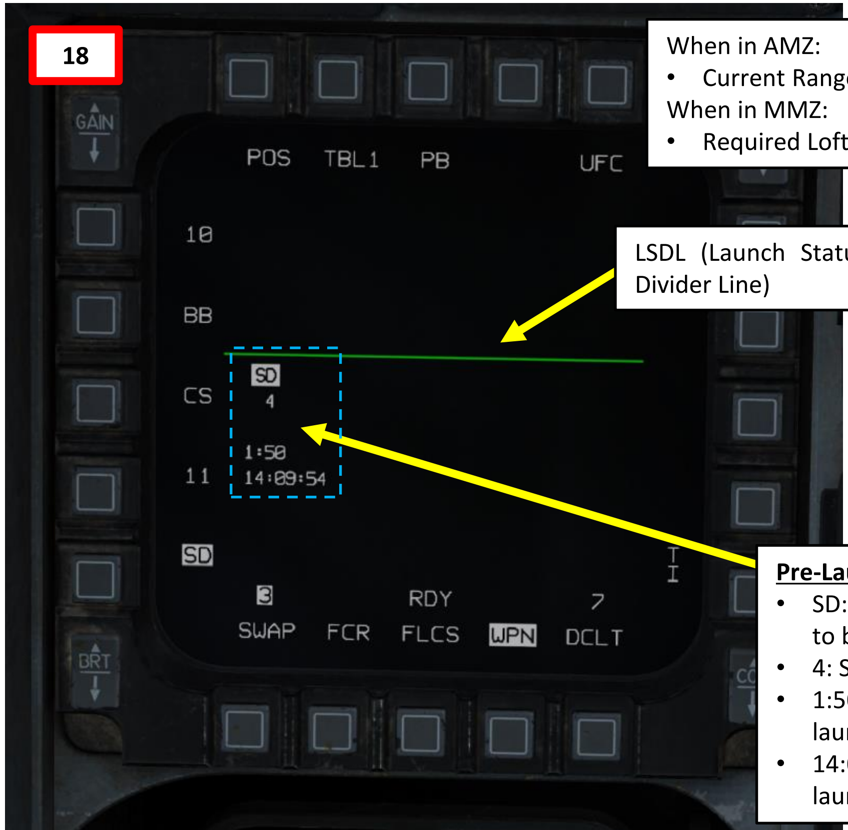


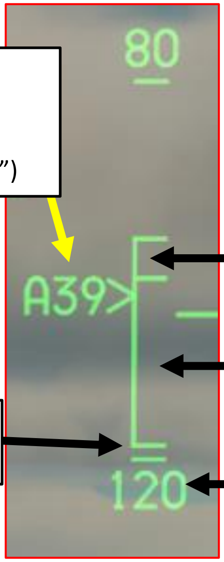


2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

17. Steer the aircraft to line up the Velocity Vector Indicator (VVI) on the ASL (Azimuth Steering Line). You should be within 10 deg of bearing to the target.
18. Once aircraft enters the MMZ (Missile Manoeuver Zone) range on the HLS (HARM Launch Scale), predicted time-to-impact and impact time are computed on the WPN page.
19. Check on the Radar Warning Receiver to see if the radar emitter is locking you up. Without the radar emitting, the HARM missile may have trouble homing on the radar emitter.

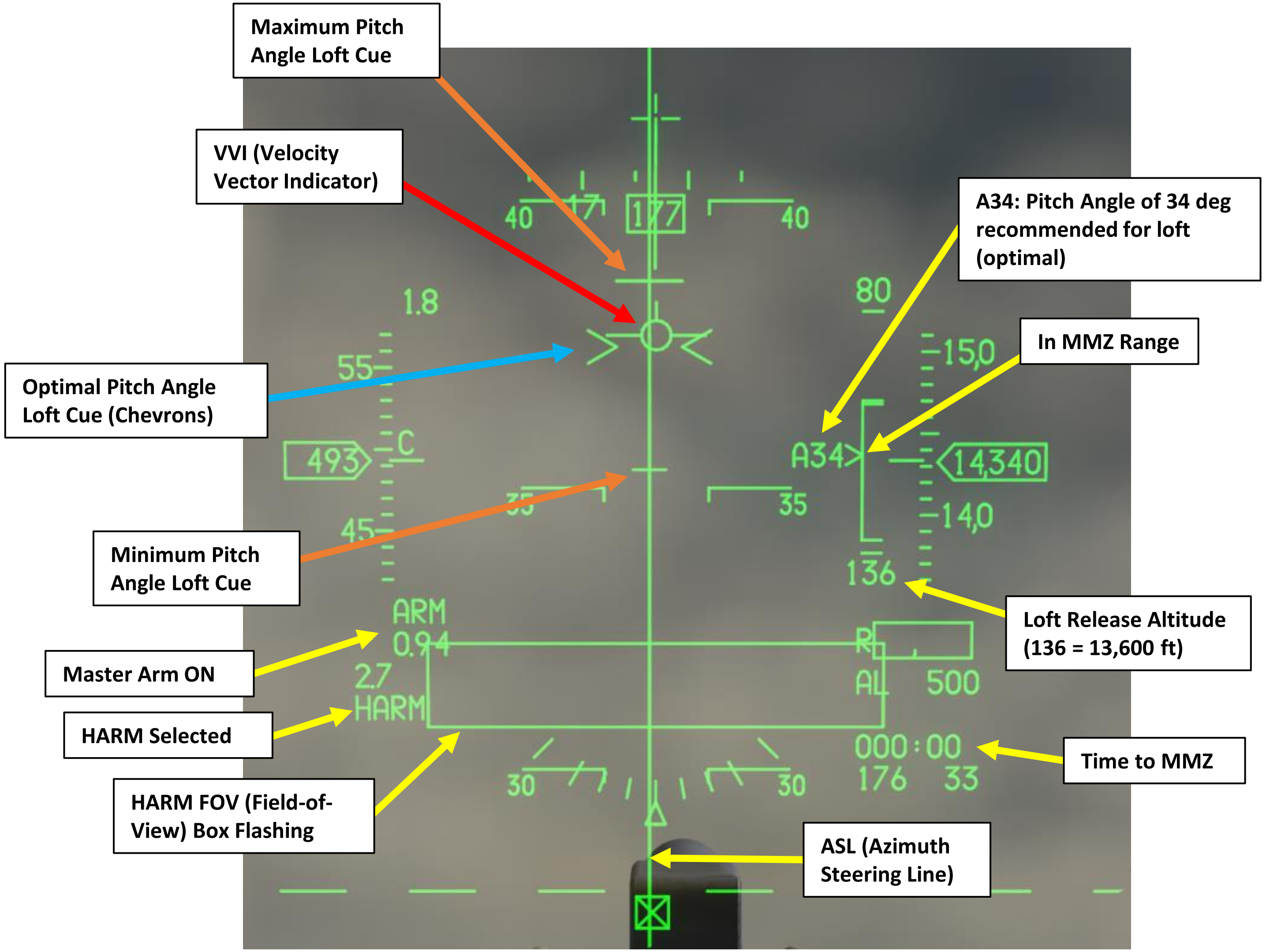






2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

20. You will see the minimum, optimal, and maximum loft cues on the ASL. Throttle up and pitch the aircraft up to place the VVI (Velocity Vector Indicator) between the minimum and maximum loft cues.
    - Maximum loft is the larger tick and represents the loft angle that will give the missile maximum range.
    - Minimum loft is the smaller tick and represents the range where the missile would have to do a max-g pulldown to reach the target.
21. You may launch HARM missile when the following conditions are met:
    - HARM FOV (Field-of-View) box is flashing, indicating when the aircraft is within the missile maneuver zone, target handoff is completed, and the missile is ready to be fired. The FOV box represents the end-game field-of-view of the HARM.
    - VVI is lined up with the ASL
    - VVI is between the minimum and maximum loft cues
    - You are within MMZ (Missile Manoeuvering Zone) range

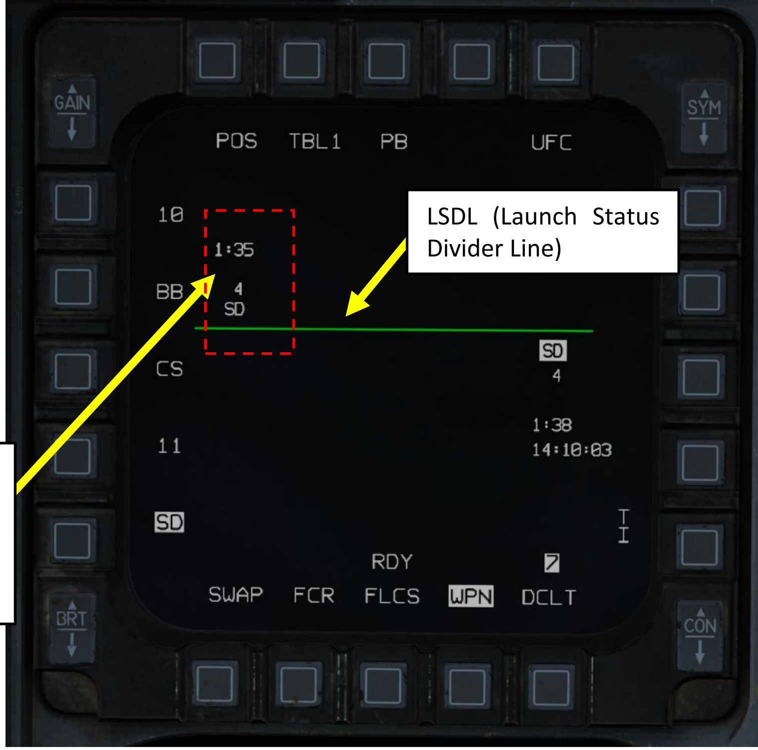


2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.1 – PB (Pre-Briefed) Sub-Mode

22. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
23. The HARM missile will loft above you and fly towards the selected steerpoint until the radar is detected, at which point it will home on the radar signal. In PB mode, the missile seeker head is activated roughly 15 nm from the steerpoint. When an anti-radiation missile is launched, the brevity call is "Magnum".
24. On the WPN page, post-launch information is displayed above the LSDL (Launch Status Divider Line).

Weapon Release Button

22



LSDL (Launch Status Divider Line)

Post-Launch Data Block
- 1:35: missile time-of-flight until impact
- 4: Steerpoint #4 handed off to the missile
- SD: SA-11 "Snow Drift" Search Radar threat type handed off to the missile

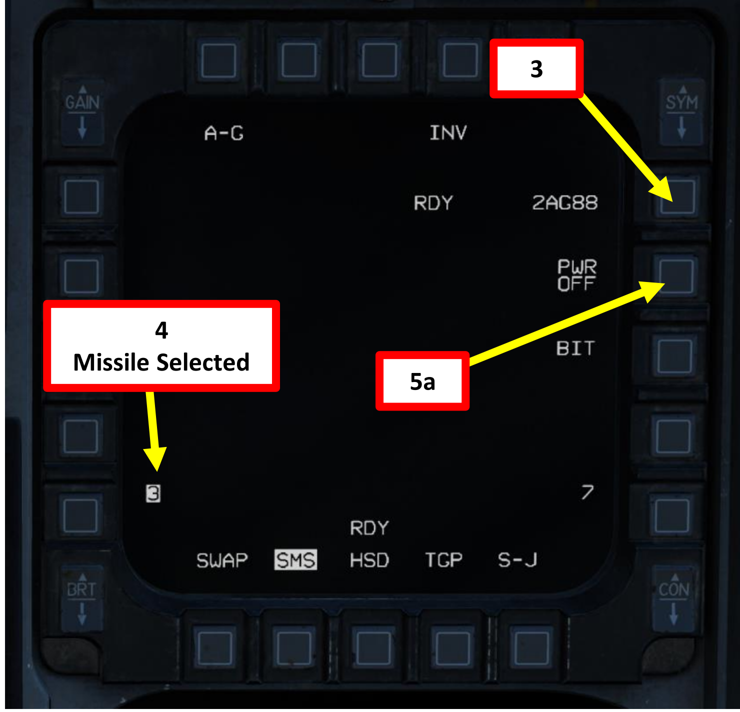
Steerpoint No. 4

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.2 – RUK (Range Unknown) Sub-Mode

*Position Known (POS) mode is a pre-planned employment mode that relies on a steerpoint being placed **at or near the target radar emitter**. The radar type will be downloaded to the ALIC, and the HARM will fly towards the target steerpoint until the radar is detected, at which point it will home on the radar signal.*

Range Unknown (RUK) sub-mode is the most versatile profile when working with degraded target data, mainly in situations where you have a general idea of where the target is but with a significant uncertainty about its location. The HARM in RUK mode can look for targets within 20 nm of the selected steerpoint used for reference. To launch with RUK selected, the pilot must fly the aircraft into the MMZ (Missile Manoeuvering Zone), where the missile can make all required maneuvering to reach the target. RUK is much more tolerant of inaccurate target steerpoints, or when fighting threats where only bearing information is available.

1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG88 (AGM-88C HARM) missile. The number preceding AG88 is the number of missiles of this type equipped.
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Press the OSB next to PWR OFF to start the power-up process of the HARM. A BIT (Built-In Test) will be initiated.

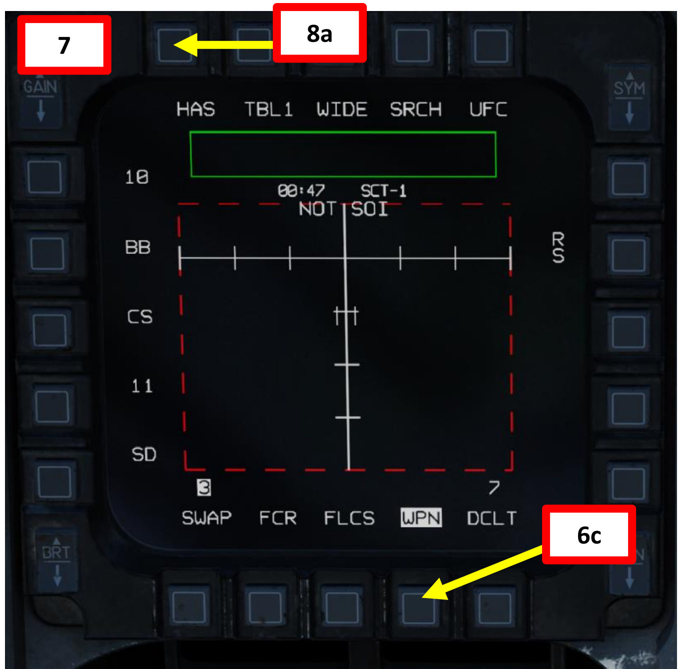


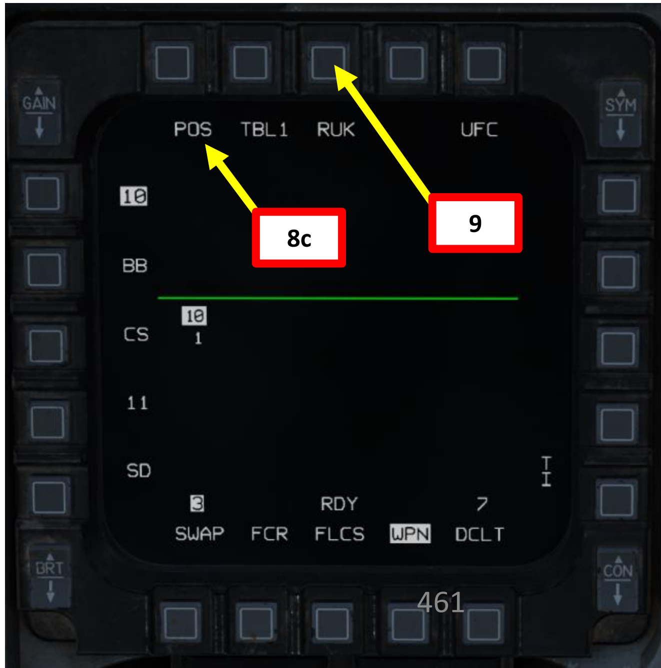
NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

4

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.2 – RUK (Range Unknown) Sub-Mode

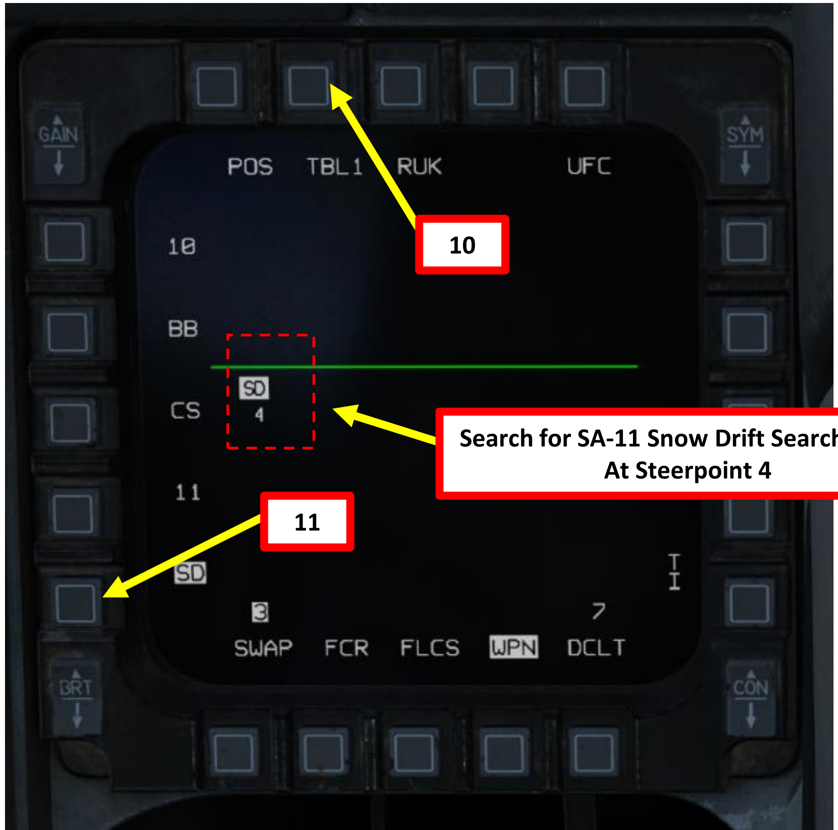
6. Select the WPN (Weapon) page
7. The WPN page should display HAS Mode by default.
8. Toggle the OSB (Option Select Button) next to the HARM Mode until POS (Position) Mode is selected.
9. Toggle the OSB next to HARM POS Sub-Mode until RUK (Range Unknown) is selected.





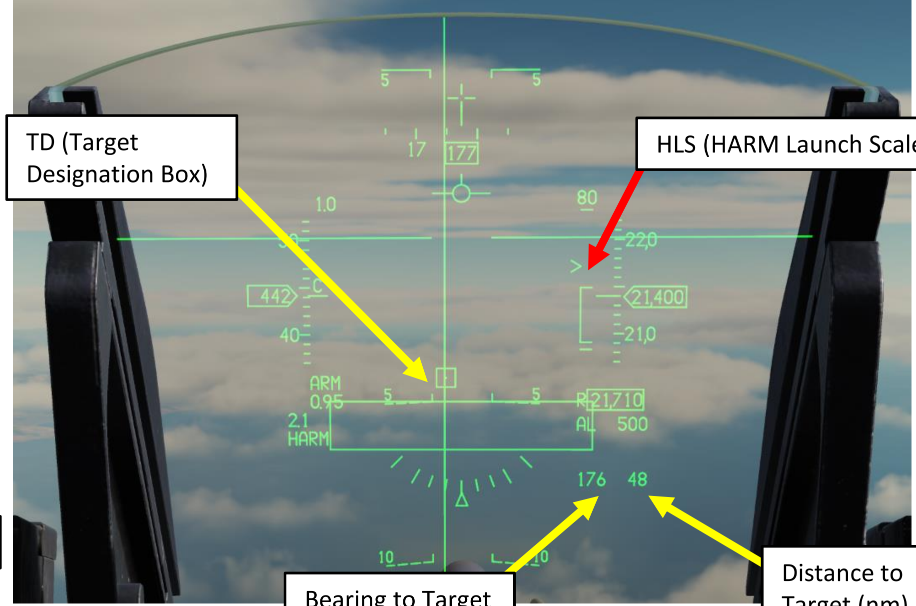
2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.2 – RUK (Range Unknown) Sub-Mode

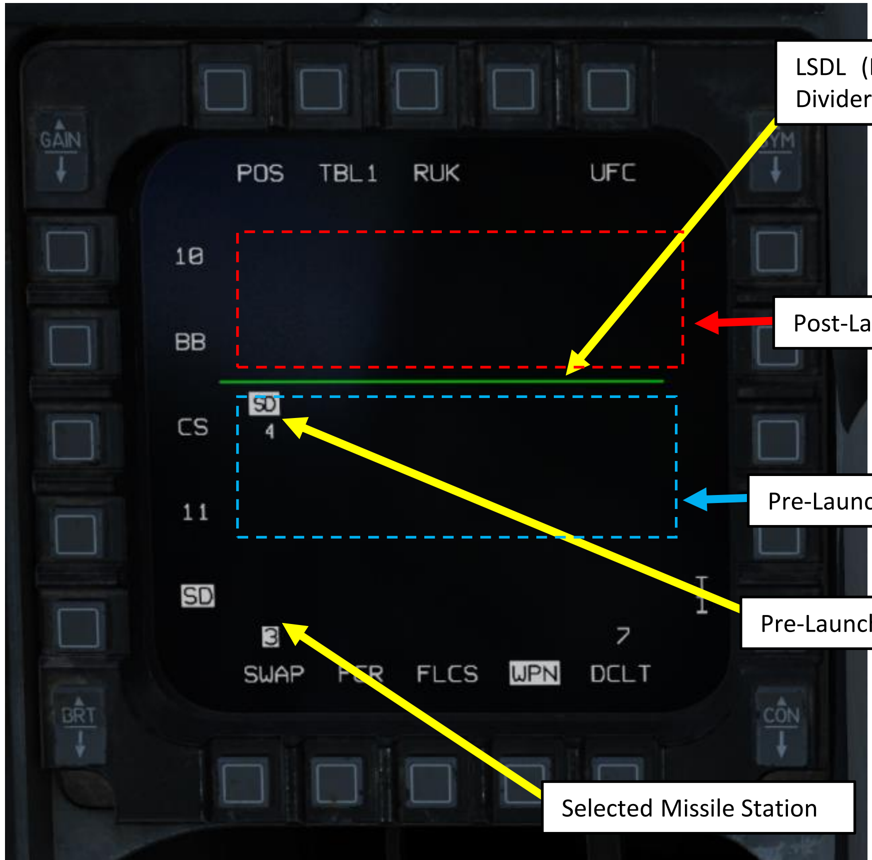
10. Toggle the OSB next to Table Selector until desired ALIC (Aircraft Launcher Interface Computer) table is selected with the appropriate radar emitter type available. We will select Table 1 (TBL1).
11. Select the expected radar emitter type. In our case, we will select “SD” for a for SA-11 “Snow Drift” Search Radar. See section 2.7.2 for reference.
12. We will be attacking a target that is directly on a steerpoint that is already in our flight plan (i.e. Steerpoint No. 4). To enter Steerpoint coordinates manually, see the Navigation section. Another option would be to designate a markpoint (data stored in steerpoints No. 26 through No. 30) and use it as a reference.
13. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
14. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 4.
15. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.

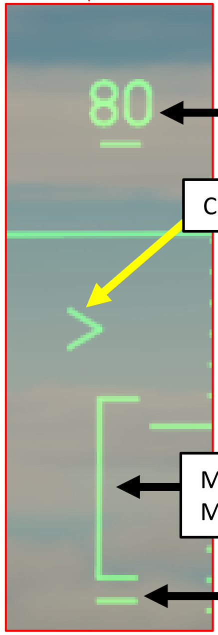


2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.2 – RUK (Range Unknown) Sub-Mode

16. When in RUK mode, you must be within 120 deg of bearing to the target. Once your aircraft is pointed towards the target (you can use the HSD and the HUD Target Designation Box as a reference), keep flying towards the steerpoint/target until you are within MMZ (Missile Manoeuver Zone), which is indicated on the HLS (HARM Launch Scale). The HLS indicates the range potential of the missile to reach the current target. The target is assumed to be at the current steerpoint.
    - MMZ (Missile Manoeuver Zone): range/zone where the missile can reach the target by doing entirely its own maneuvering.

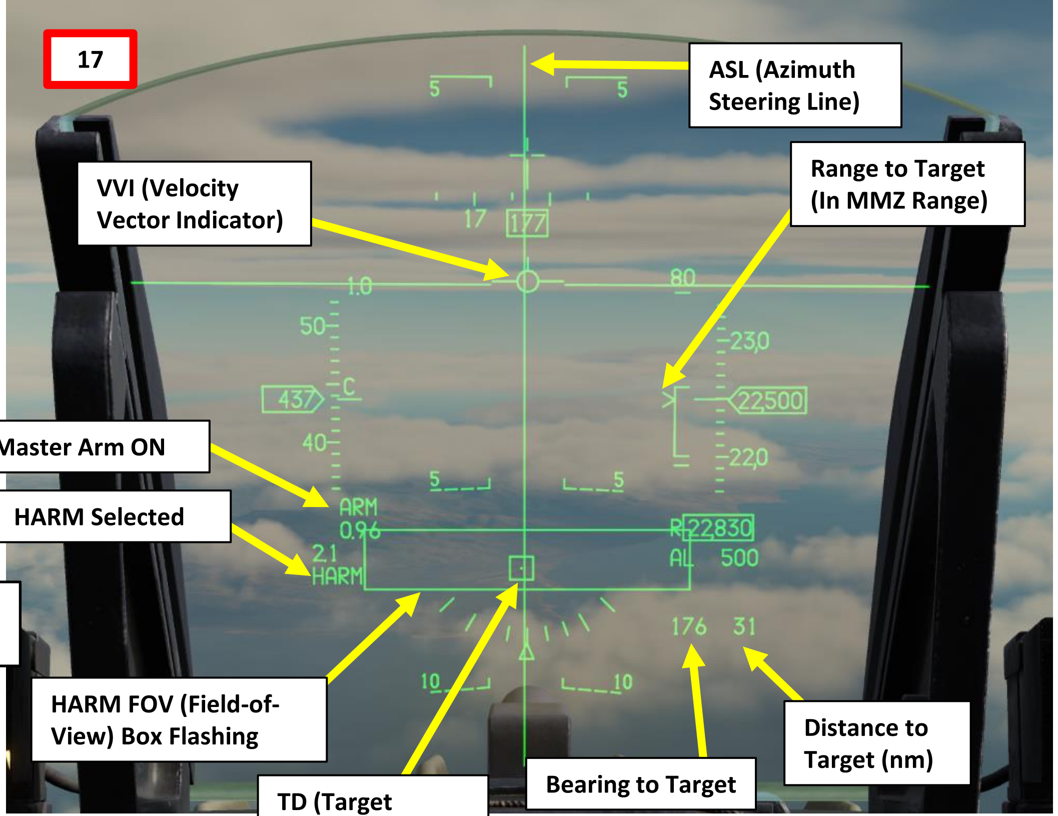


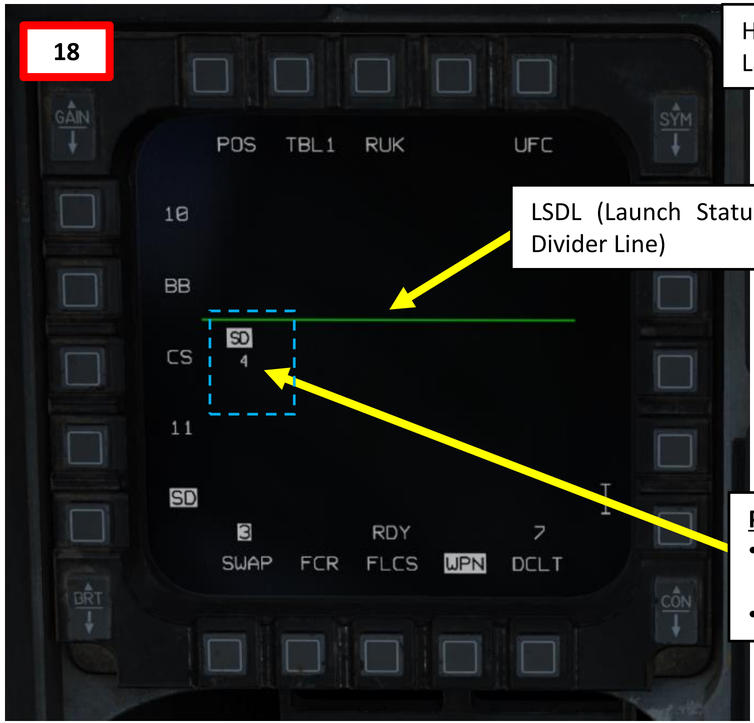




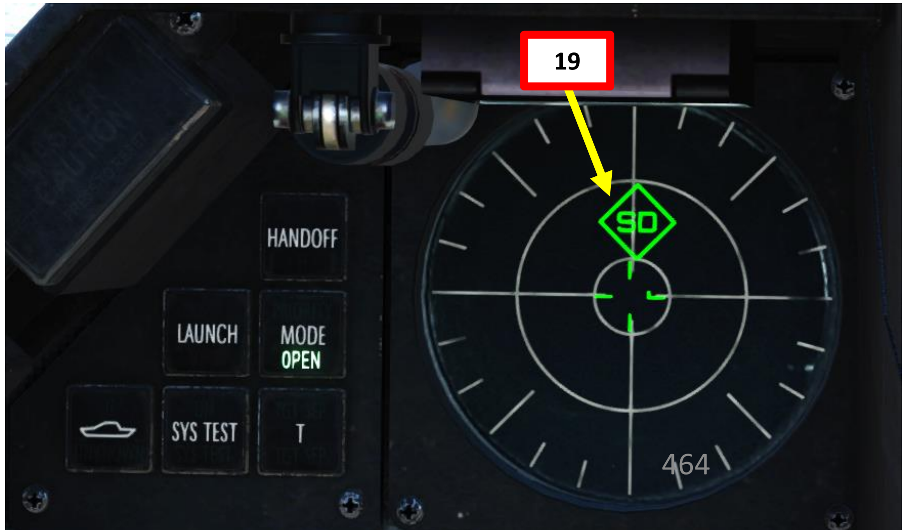
2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.2 – RUK (Range Unknown) Sub-Mode

17. Steer the aircraft to line up the Velocity Vector Indicator (VVI) on the ASL (Azimuth Steering Line). You should be within 120 deg of bearing to the target.
18. Take note that once aircraft enters the MMZ (Missile Manoeuver Zone) range on the HLS (HARM Launch Scale), **no predicted time-to-impact nor impact time are computed on the WPN page**.
19. Check on the Radar Warning Receiver to see if the radar emitter is locking you up. Without the radar emitting, the HARM missile may have trouble homing on the radar emitter.
20. You may launch HARM missile when the following conditions are met:
    - HARM FOV (Field-of-View) box is flashing, indicating when the aircraft is within the missile maneuver zone, target handoff is completed, and the missile is ready to be fired. The FOV box represents the end-game field-of-view of the HARM.
    - VVI is lined up with the ASL
    - You are within MMZ (Missile Manoeuvering Zone) range





Pre-Launch Data Block
- SD: SA-11 "Snow Drift" Search Radar threat type to be handed off to the missile
- 4: Steerpoint #4 to be handed off to the missile



2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.2 – RUK (Range Unknown) Sub-Mode

21. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
22. The HARM missile will fly towards the selected steerpoint until the radar is detected, at which point it will home on the radar signal. In RUK mode, the missile seeker head is activated roughly 20 nm from the steerpoint. When an anti-radiation missile is launched, the brevity call is “Magnum”.
23. On the WPN page, post-launch information is displayed above the LSDL (Launch Status Divider Line).

Weapon Release Button

21

LSDL (Launch Status Divider Line)

Post-Launch Data Block
- 4: Steerpoint #4 handed off to the missile
- SD: SA-11 “Snow Drift” Search Radar threat type handed off to the missile

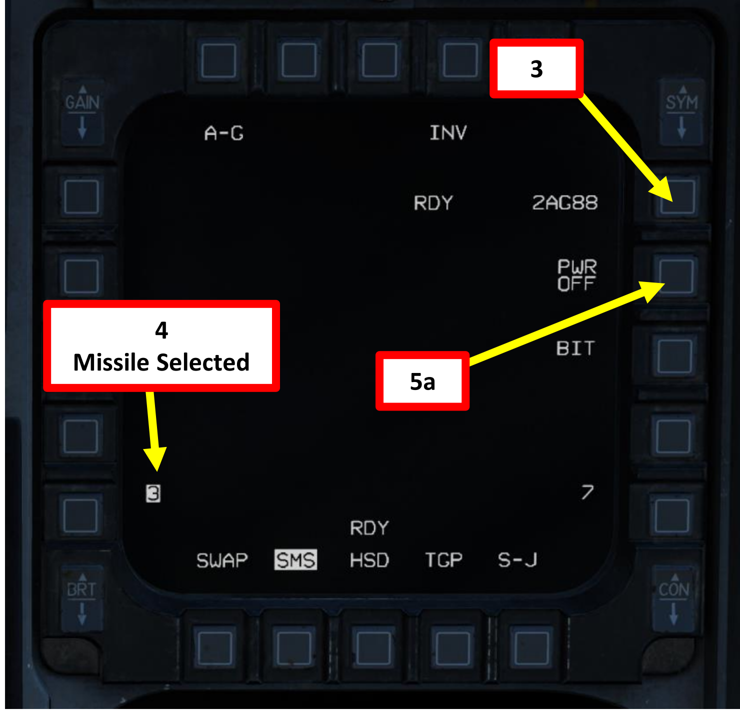
Steerpoint No. 4

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

Position Known (POS) mode is a pre-planned employment mode that relies on a steerpoint being placed ***<u>at or near the target radar emitter</u>****. The radar type will be downloaded to the ALIC, and the HARM will fly towards the target steerpoint until the radar is detected, at which point it will home on the radar signal.*

In Equation-of-Motion (EOM) sub-mode, you can launch from any relative bearing (even targets that are behind you!), as long as you follow the cues to the MMZ (Missile Manoeuver Zone). First fly towards the target until the HLS (HARM Launch Scale) range caret indicates that you are within the AMZ (Aircraft Manoeuver Zone). If a required turn is indicated on the datablock below the HLS, turn as indicated until it reads "00". You do not necessarily need to be facing the target, as long as there is no required turn. Then, pull up until the VVI (Velocity Vector Indicator) is between the minimum and maximum loft cues on the ASL (Azimuth Steering Line). When the FOV box is flashing, you can launch. This mode should only be used when the location of the emitter is well known (i.e. near a known steerpoint).

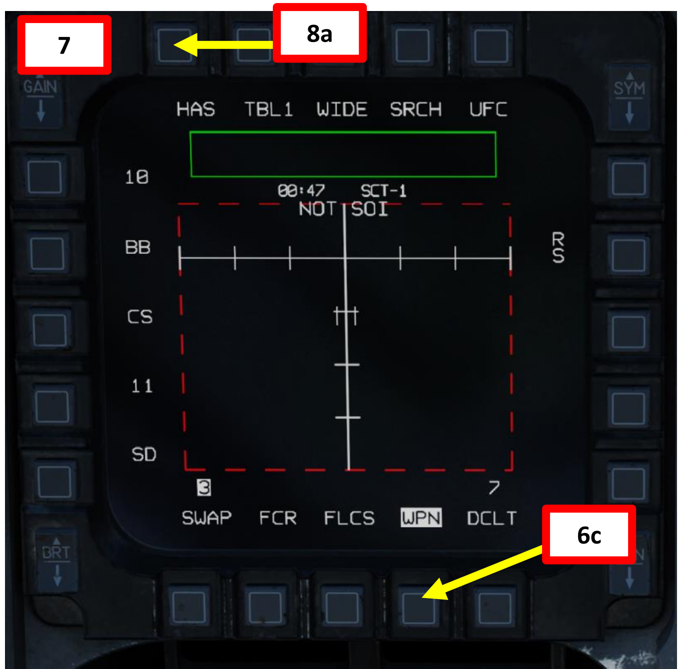
1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG88 (AGM-88C HARM) missile. The number preceding AG88 is the number of missiles of this type equipped.
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Press the OSB next to PWR OFF to start the power-up process of the HARM. A BIT (Built-In Test) will be initiated.

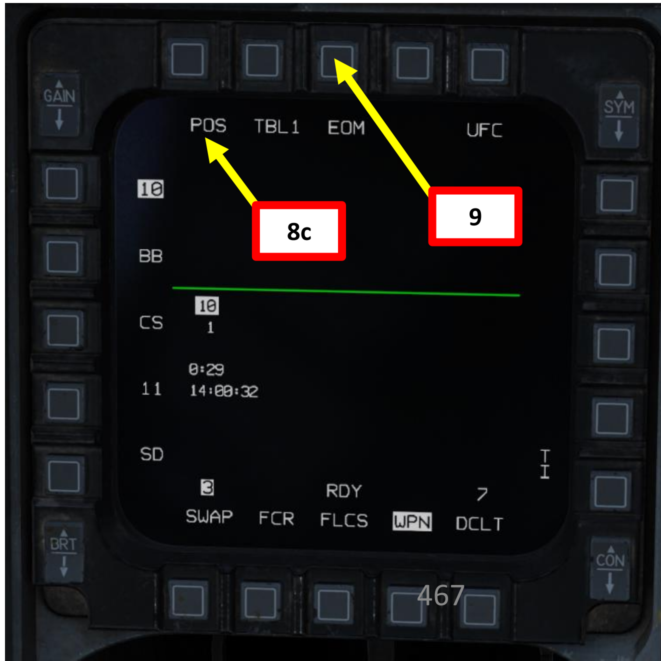


NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

6. Select the WPN (Weapon) page
7. The WPN page should display HAS Mode by default.
8. Toggle the OSB (Option Select Button) next to the HARM Mode until POS (Position) Mode is selected.
9. Toggle the OSB next to HARM POS Sub-Mode until EOM (Equation-of-Motion) is selected.



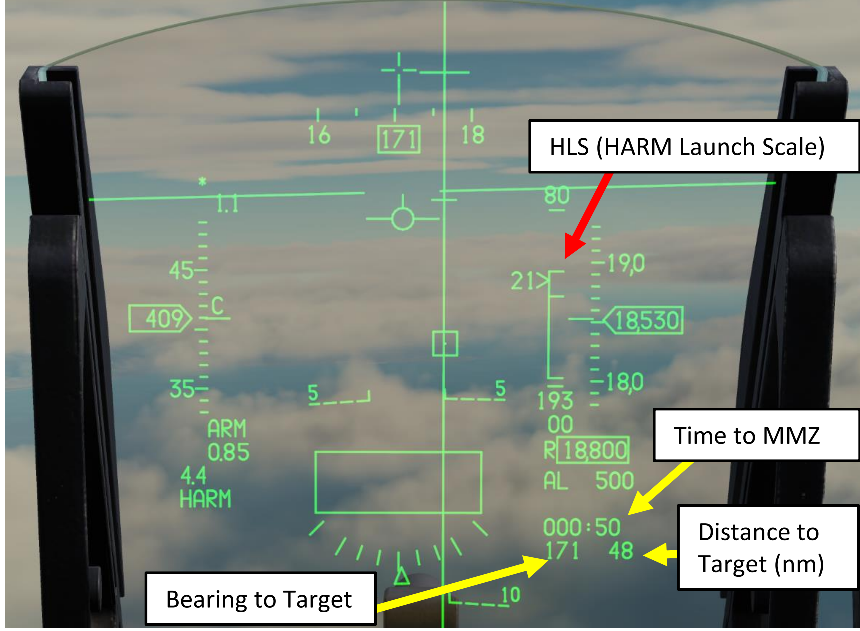


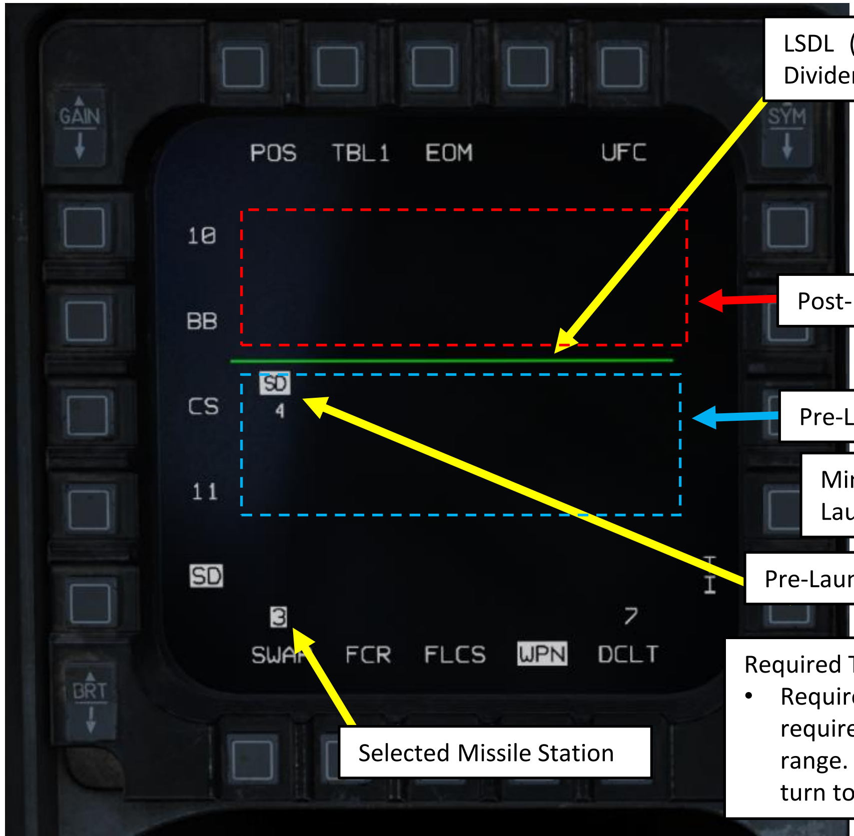
2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

10. Toggle the OSB next to Table Selector until desired ALIC (Aircraft Launcher Interface Computer) table is selected with the appropriate radar emitter type available. We will select Table 1 (TBL1).
11. Select the expected radar emitter type. In our case, we will select “SD” for a for SA-11 “Snow Drift” Search Radar. See section 2.7.2 for reference.
12. We will be attacking a target that is directly on a steerpoint that is already in our flight plan (i.e. Steerpoint No. 4). To enter Steerpoint coordinates manually, see the Navigation section. Another option would be to designate a markpoint (data stored in steerpoints No. 26 through No. 30) and use it as a reference.
13. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
14. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 4.
15. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.

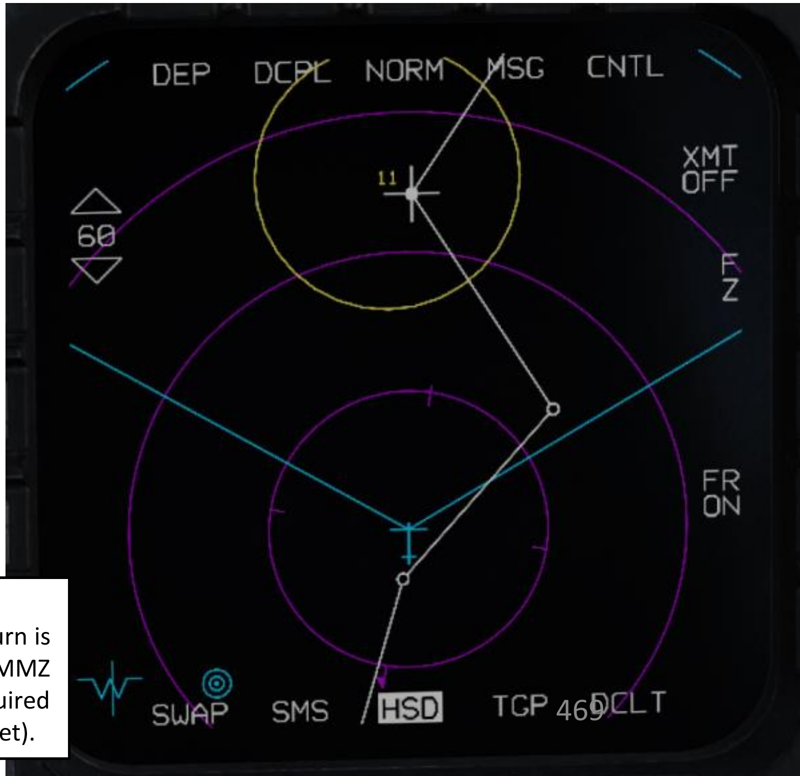
2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

16. When in EOM mode, you have no bearing requirement towards the target; high off-boresight shots will expend/waste more missile energy than needed, therefore you should still try to aim for the selected steerpoint to minimize energy loss if possible. Once your aircraft is pointed towards the target (you can use the HSD and the HUD Target Designation Box as a reference), keep flying towards the steerpoint/target until you are within AMZ (Aircraft Manoeuver Zone), which is indicated on the HLS (HARM Launch Scale). The HLS indicates the range potential of the missile to reach the current target. The target is assumed to be at the current steerpoint.
    - AMZ (Aircraft Manoeuver Zone): range/zone where the missile can reach the target if the launching aircraft lofts or turns towards the target first.
    - MMZ (Missile Manoeuver Zone): range/zone where the missile can reach the target by doing entirely its own maneuvering.



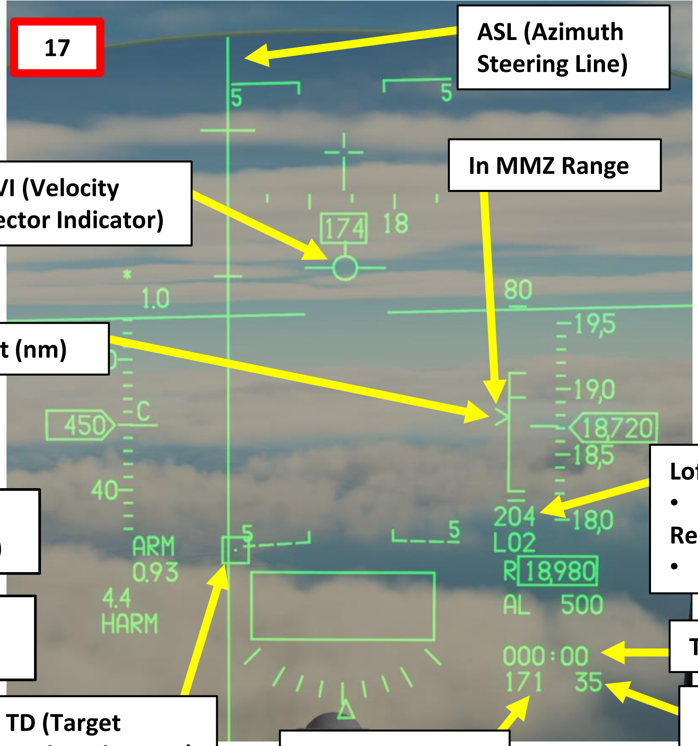


Required Turn Indicator
- Required turn to place the aircraft within the MMZ (e.g., "L03" if a 3° left turn is required). Shows "00" if the aircraft is on-bearing but not yet within the MMZ range. Once the aircraft is within the MMZ, this field shows the aircraft required turn to face the target (e.g., "L90" if the aircraft nose is 90° right of the target).

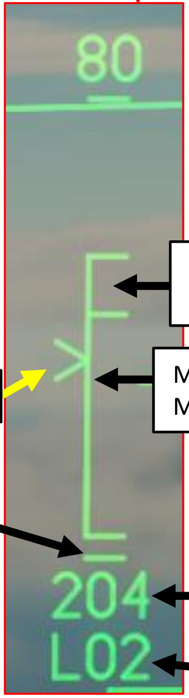


2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

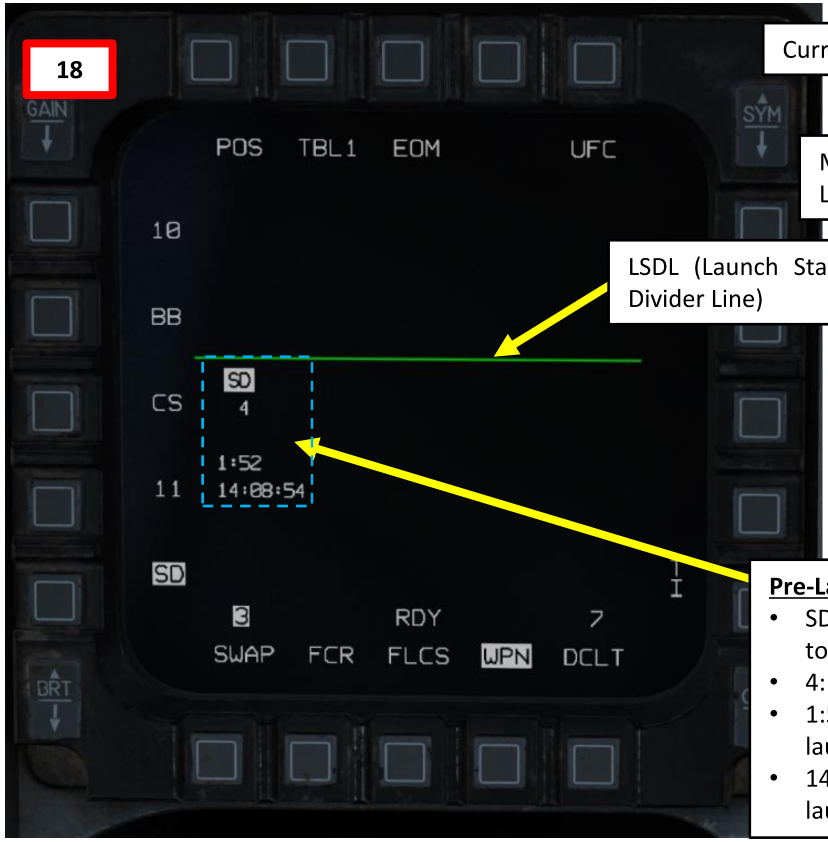
17. If practical, try to steer the aircraft to line up the Velocity Vector Indicator (VVI) on the ASL (Azimuth Steering Line) to minimize missile angle off boresight (energy loss). However, keep in mind that this isn't mandatory since the missile can manoeuver quite well.
18. Once aircraft enters the MMZ (Missile Manoeuver Zone) range on the HLS (HARM Launch Scale), predicted time-to-impact and impact time are computed on the WPN page.
19. Check on the Radar Warning Receiver to see if the radar emitter is locking you up. Without the radar emitting, the HARM missile may have trouble homing on the radar emitter.



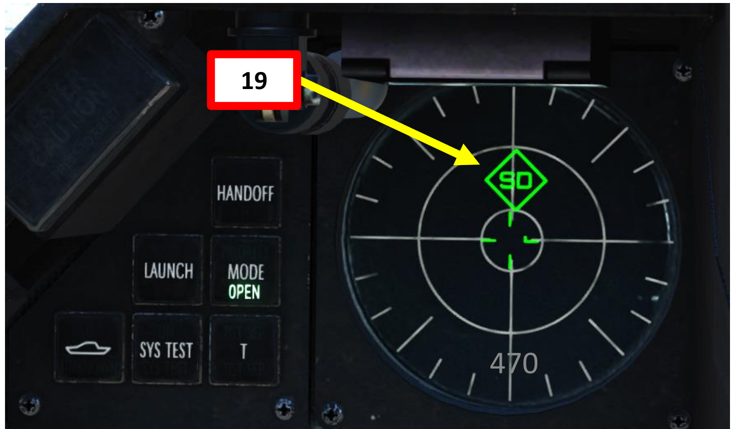
HLS (HARM Launch Scale)



Required Turn Indicator
- Required turn to place the aircraft within the MMZ (e.g., "L03" if a 3° left turn is required). Shows "00" if the aircraft is on-bearing but not yet within the MMZ range. Once the aircraft is within the MMZ, this field shows the aircraft required turn to face the target (e.g., "L90" if the aircraft nose is 90° right of the target).

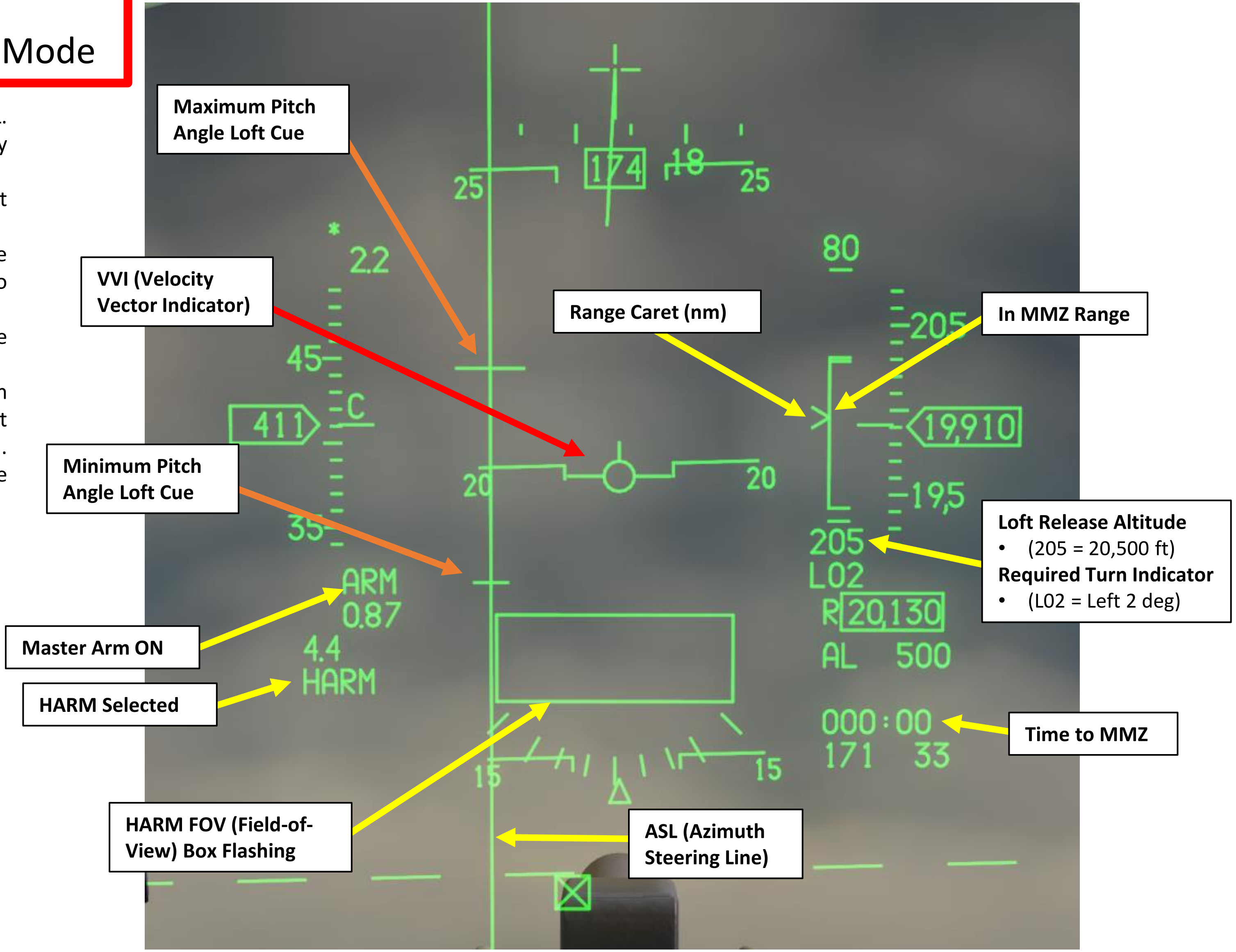


Pre-Launch Data Block
- SD: SA-11 "Snow Drift" Search Radar threat type to be handed off to the missile
- 4: Steerpoint #4 to be handed off to the missile
- 1:52: predicted time until impact if missile is launched now
- 14:08:54: predicted impact time if missile is launched now



2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

20. You will see the minimum, and maximum loft cues on the ASL. Throttle up and pitch the aircraft up to place the VVI (Velocity Vector Indicator) between the minimum and maximum loft cues.
    - Maximum loft is the larger tick and represents the loft angle that will give the missile maximum range.
    - Minimum loft is the smaller tick and represents the range where the missile would have to do a max-g pulldown to reach the target.
21. You may launch HARM missile when the following conditions are met:
    - HARM FOV (Field-of-View) box is flashing, indicating when the aircraft is within the missile maneuver zone, target handoff is completed, and the missile is ready to be fired. The FOV box represents the end-game field-of-view of the HARM.
    - VVI is between the minimum and maximum loft cues
    - You are within MMZ (Missile Manoeuvering Zone) range



2.7 – AGM-88C HARM
2.7.4 – POS (Position) Mode
2.7.4.3 – EOM (Equation of Motion) Sub-Mode

22. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
23. The HARM missile will fly towards the selected steerpoint until the radar is detected, at which point it will home on the radar signal. In EOM mode, the missile seeker head is activated with a narrow 40° field-of-view, 5 nm from the known threat position (steerpoint) selected.
24. . When an anti-radiation missile is launched, the brevity call is “Magnum”.
25. On the WPN page, post-launch information is displayed above the LSDL (Launch Status Divider Line).

Weapon Release Button

22

LSDL (Launch Status Divider Line)

Post-Launch Data Block
- 1:39: missile time-of-flight until impact
- 4: Steerpoint #4 handed off to the missile
- SD: SA-11 “Snow Drift” Search Radar threat type handed off to the missile

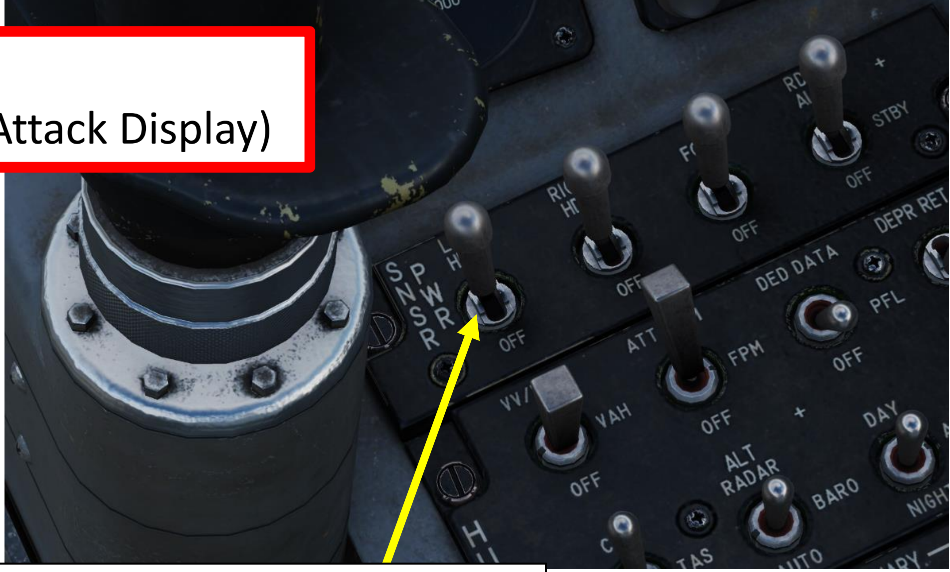
Steerpoint No. 4

2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

Using the HARM with HAS (HARM As Sensor) Mode provides no ranging information, while using POS (Position Known) modes limits you to pre-planned steerpoints. What about situations where you don't really know where SAM sites are? The AN/ASQ-213 HARM Targeting System (HTS) pod is a solution to both these problems. The HTS pod can be installed on the left cheek station and gives you the capability to employ the HARM missile in its most effective mode (which means it can be used with Position modes such as PB, EOM and RUK). It can autonomously detect, identify and locate radar guided threats at long ranges and displays the target location for HARM designation and firing. This way, you can slave the HARMs to a SPI (Sensor Point of Interest) generated on the HAD (HARM Attack Display) based on radar emitter triangulation computed by the HTS pod; the HAD is the MFD display interface to use the HTS with.

- To **power up the HTS pod**, set the Left HDPT (Hardpoint) Power Switch ON (FWD).

Note: the AN/ASQ-213 HARM Targeting System (HTS) implementation in DCS is an artistic interpretation from the developers (Eagle Dynamics) and is not an exact representation of the real-life system. This section is based on the current behavior as simulated in DCS only, not the real thing.



Left HDPT (Hardpoint) Power Switch
Power for left chin intake pylon, HARM Targeting System (HTS) pod can be installed
- *FWD: ON*
- *AFT: OFF*

HAD (HARM Attack Display) Page

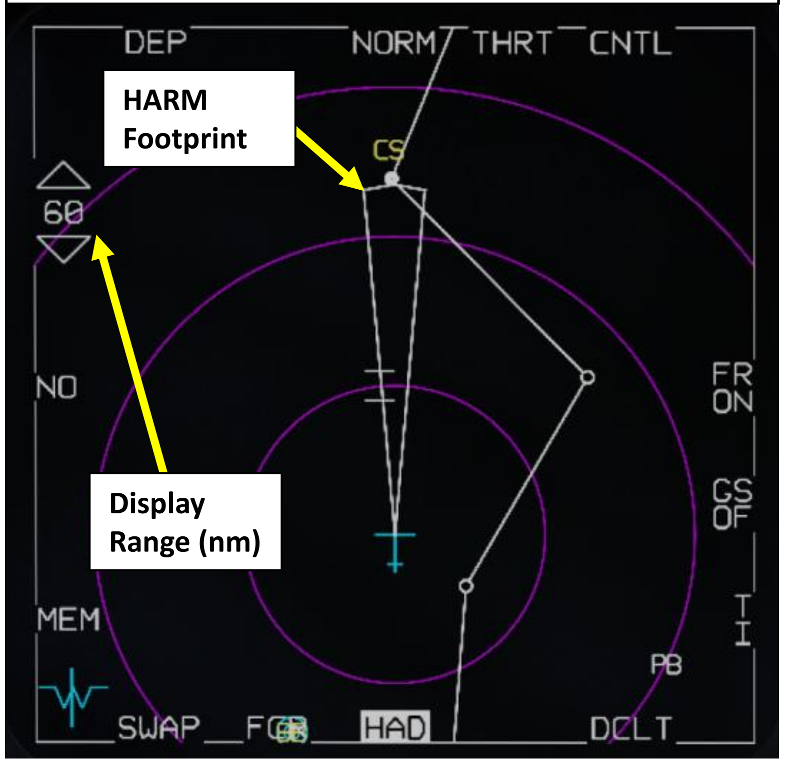
AN/ASQ-213 HARM Targeting System (HTS) pod

2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

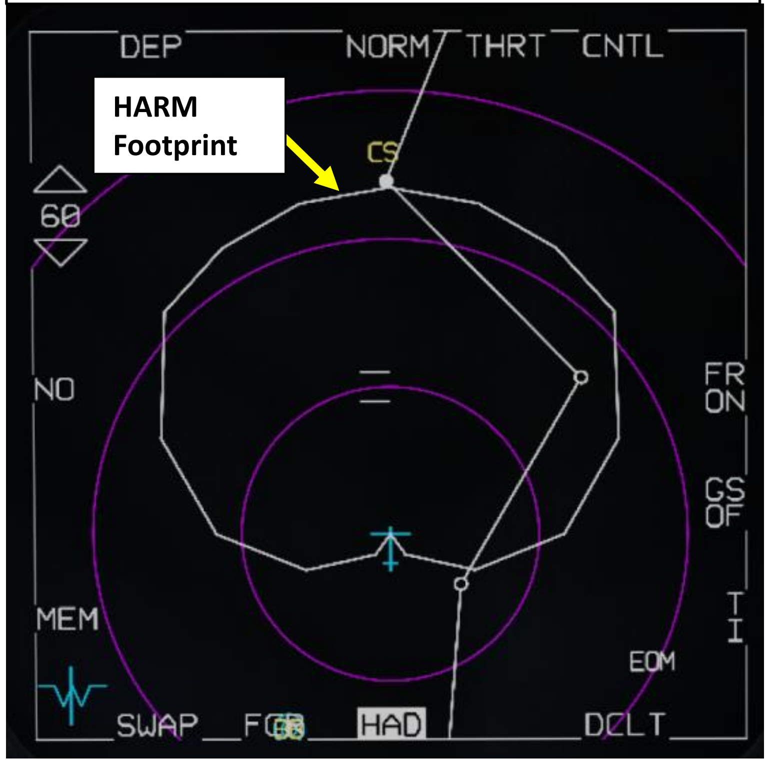
The HARM's footprint, also known as the WEZ (Weapon Engagement Zone), is a top-down representation of the maximum range (R_{Max}) of the AGM-88C HARM missile. The footprint lines are dashed when the HARM WEZ is greater than the selected display range. The shape of the WEZ changes based on what HARM mode is selected and with the aircraft speed and altitude.

POS Sub-Mode can be toggled via the WPN page once HARMs are powered on and selected.

HAD Page: Pre-Briefed POS Mode



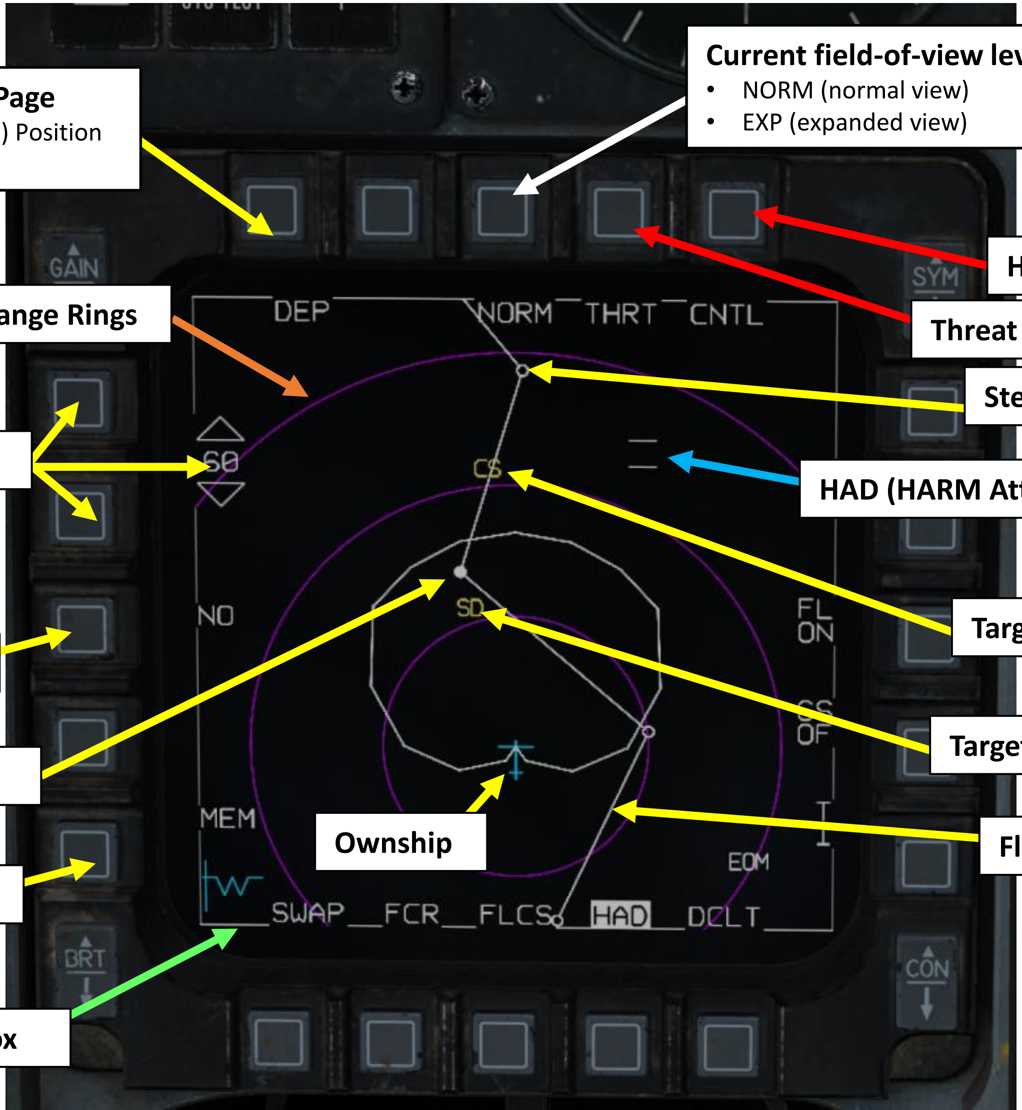
HAD Page: EOM (Equation-of-Motion) POS Mode

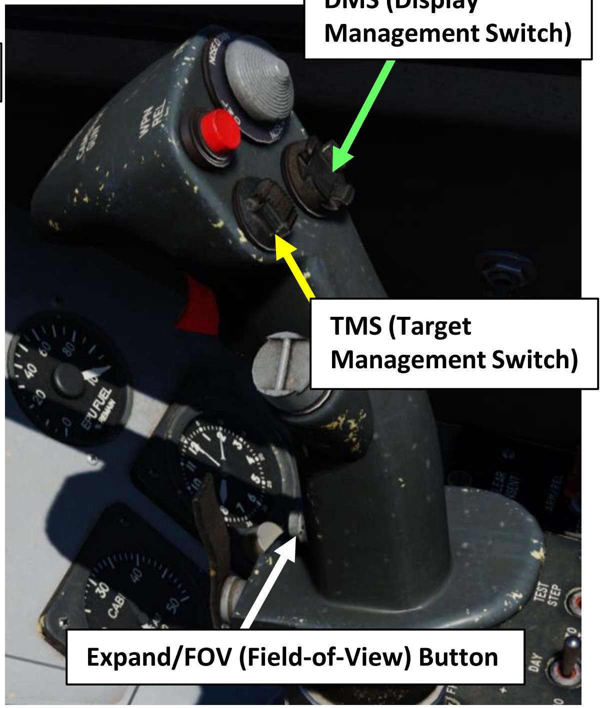


HAD Page: RUK (Range Unknown) POS Mode

2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

On the HAD (HARM Attack Display) page, which is very similar to the HSD (Horizontal Situation Display), the flight plan is displayed. Once the HAD page is the Sensor of Interest (SOI, performed with DMS DOWN), the Cursor/Enable Switch control can move the HAD Cursors over target symbols, then hand-off the target to the missile using TMS UP. The HAD page can be expanded at the HAD Cursor Location twice (EXP1 and EXP2 field-of-views) by either pressing the OSB next to NORM (Current Field-of-View Level) or pressing the Expand/FOV Button on the HOTAS stick.





2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

Detected radar emitters are represented with symbols on the display. Their location is continuously being computed by the HTS (HARM Targeting System) pod based on triangulation from the radar signals received by the pod. The color code is as follows:

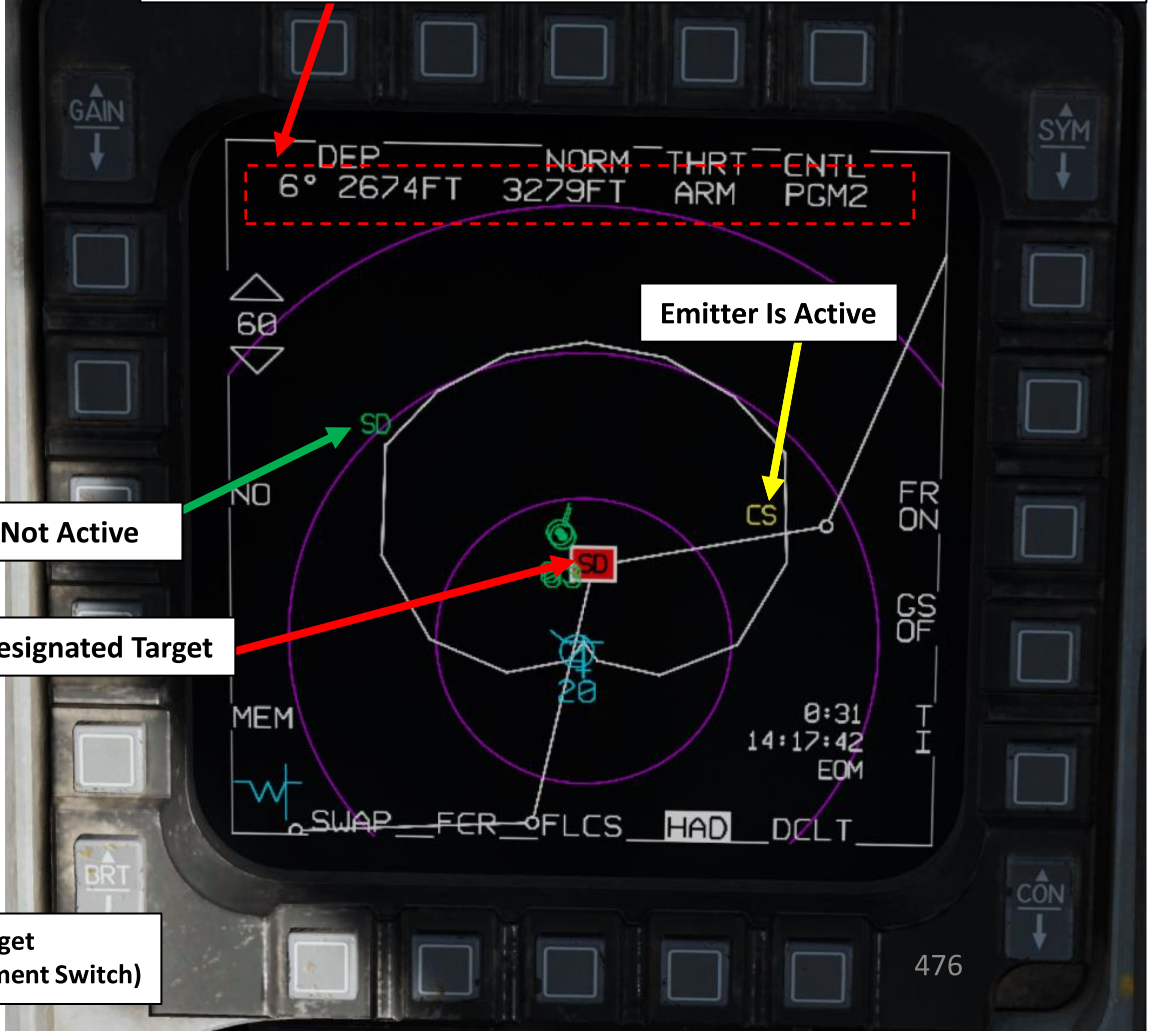
- Green: Emitter is not active (radar has been turned off)
- Yellow: Emitter is active (radar in search & acquisition mode)
- Red: Emitter is tracking (radar lock on you)
- Flashing Red: Emitter is launching a missile
- Red Box: Emitter is designated and handed off to the HARM missile

Once a target is handed off to the missile (performed by slewing the HAD Cursor with the Cursor/Enable Switch control, then pressing TMS UP), a red box surrounds the symbol with designation information. When target is designated:

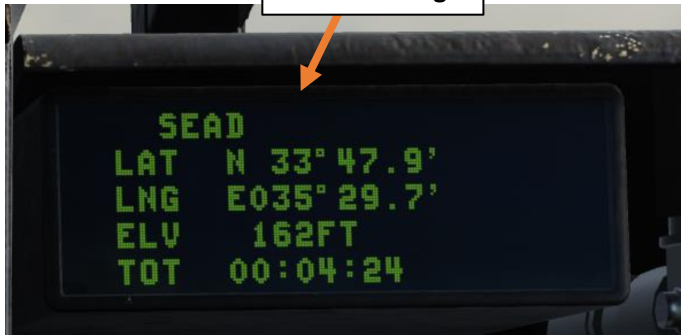
- Pressing **TMS LEFT** will **display the SEAD (Suppression of Enemy Air Defenses) DED (Data Entry Display) page**. The data displayed is the emitter's latitude (LAT), longitude (LNG), elevation (ELV, in ft) and time-on-target.
- Pressing **TMS RIGHT** will **cycle designation between different emitters** displayed on the HAD.
- Pressing **TMS AFT** will **return DED page to CNI (Communication, Navigation & Information) page**.

Designated Target Information (based on HTS pod triangulation)

- *6 deg: Bearing to designated target*
- *2674 ft: Major Axis Length*
- *3279 ft: Minor Axis Length*
- *ARM: Arming Status*
- *PGM2: Target Position Quality, from PGM5 (worst quality) to PGM1 (best quality)*



SEAD DED Page

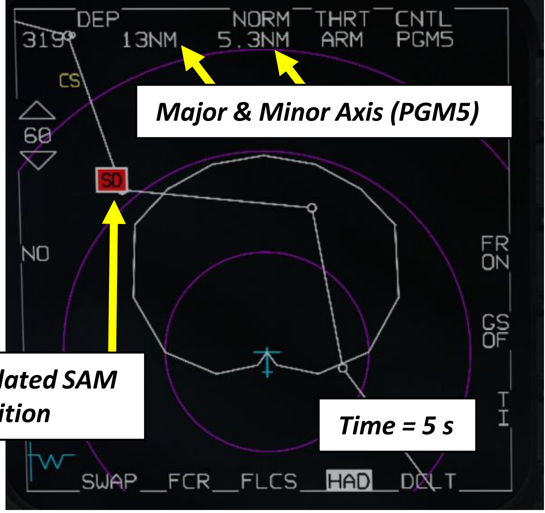


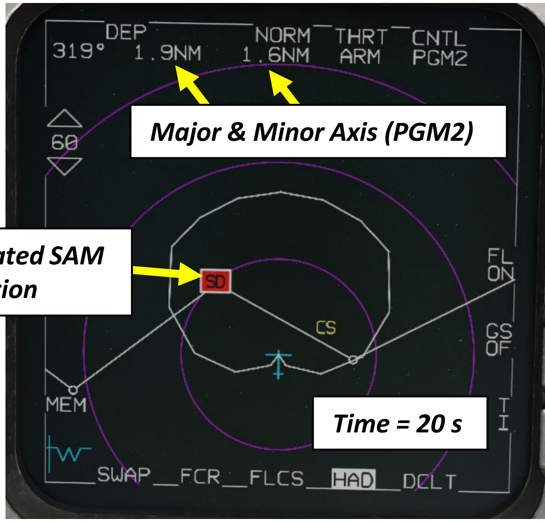
2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

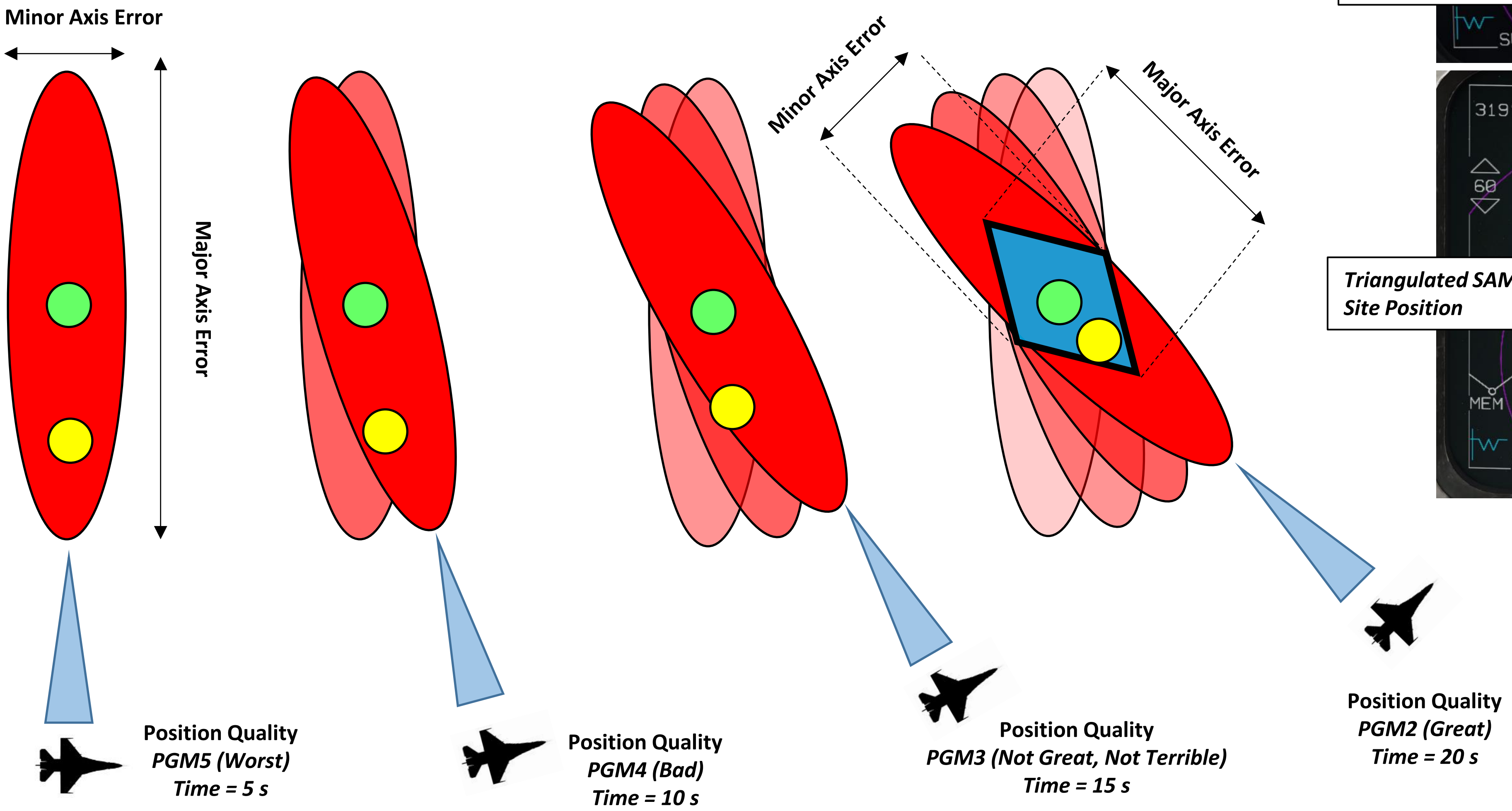
In order to determine the location of a radar emitter, make sure you do not fly directly towards it; try to fly perpendicularly instead. Each time the radar scans you, the HTS pod can better determine (triangulate) the source of the radar wave emission. The Major and Minor Axis indications represent the position error of an ellipse placed on the SAM site, and the error diminishes as the Target Position Quality goes from PGM5 (worst quality) to PGM1 (best quality).

Real SAM Site Position

Triangulated SAM Site Position







Note: the timings indicated in this example are arbitrary and purely for illustrative purposes.

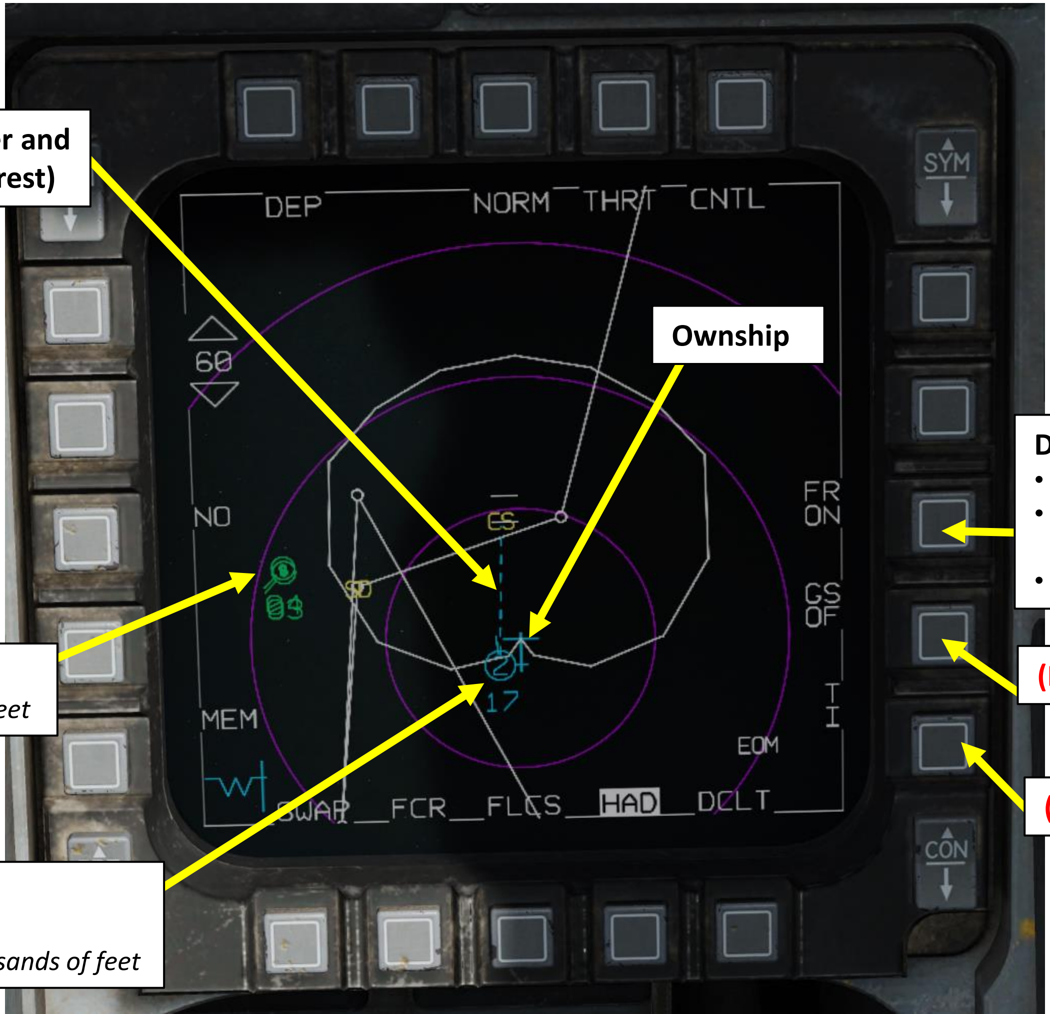
The drawings are also not to scale. Deal with it.

2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

The HAD page can display datalink contacts such as friendly flights (green) and members of your own flight (blue).
These contacts can be filtered out using the Datalink Symbology Option OSB (Option Select Button).

Line between Flight Member and his SPI (Sensor Point of Interest)

Ownship



Datalink Symbology Option
- *FR ON: Friendly Flights & Own Flight are displayed*
- *FL ON: Own Flight is displayed, but Friendly Flights are not displayed.*
- *FR OFF: Friendly Flights and Own Flight are not displayed (OFF).*

(Not Simulated)

(Not Simulated)

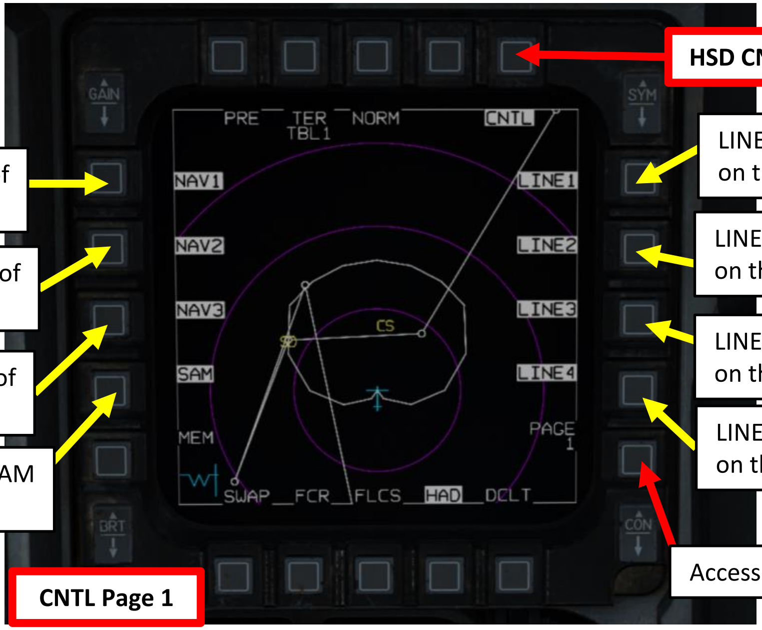
Friendly Flight (Green)
- *09 = Altitude in thousands of feet*

Own Flight (Blue)
- *2 (Top Number) = Wingman Number*
- *17 (Bottom Number) = Altitude in thousands of feet*

2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

The HAD CNTL (control) menu allows you to filter out symbology, similarly to the HSD (Horizontal Situation Display) page.

Options on CNTL Page 2 are not simulated yet.



HSD CNTL (Control) Sub-Page

NAV1: Toggles the display of your navigational route 1.

NAV2: Toggles the display of your navigational route 2.

NAV3: Toggles the display of your navigational route 3.

SAM: Toggles the display of SAM sites around your aircraft.

LINE1: Toggles the display of map information line 1 on the HSD (i.e. Forward Line of Troops).

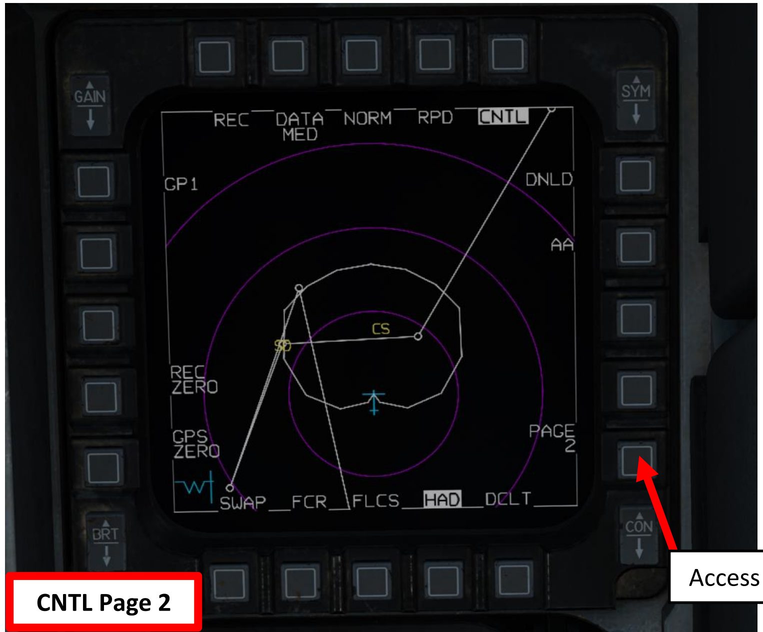
LINE2: Toggles the display of map information line 2 on the HSD.

LINE3: Toggles the display of map information line 3 on the HSD.

LINE4: Toggles the display of map information line 4 on the HSD.

Access to CNTL Page 2

CNTL Page 1



Access to CNTL Page 1

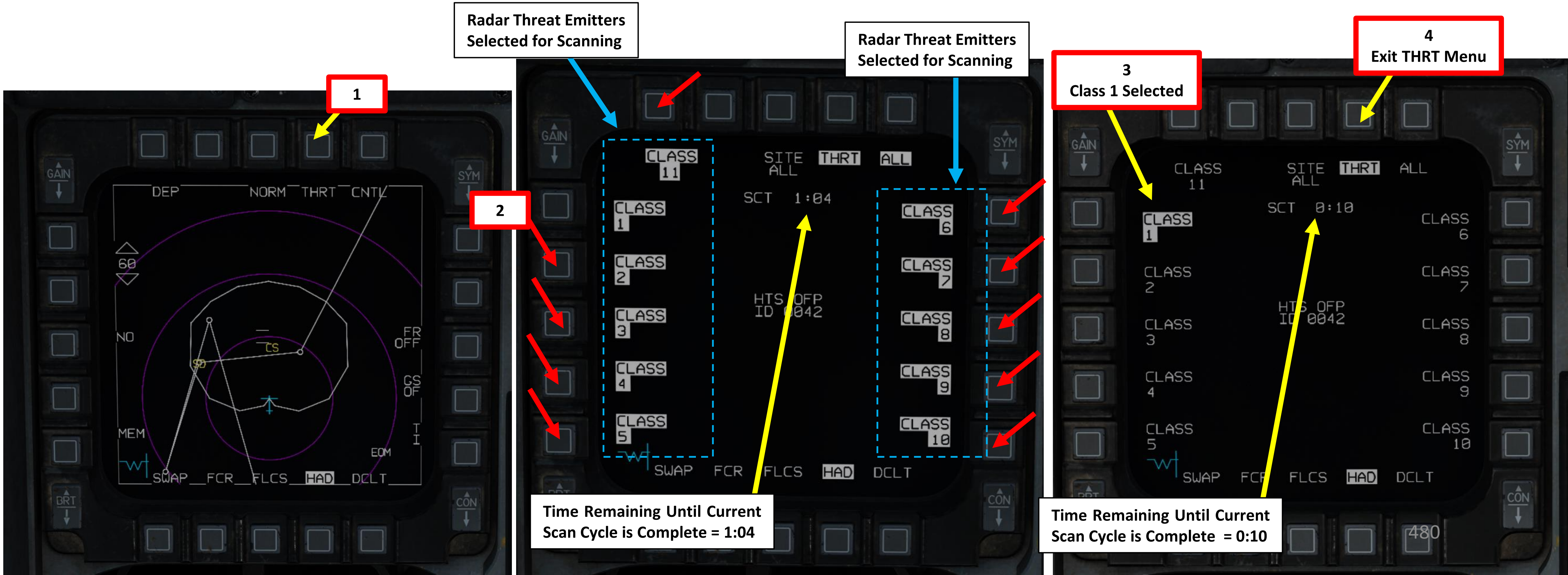
CNTL Page 2

2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

The THRT (Threat) menu allows you to select what classes/types of radar emitters the HTS (HARM Targeting System) pod scans. By pressing the OSB (Option Select Button) next to THRT, you can see what emitter types are being searched and how much time remains until current scan cycle is complete.

In this example, we see that having all classes/types selected takes a long time. A good practice is to only select the radar emitter classes that you want to search for, which will significantly reduce the scanning time and triangulation process to determine the position of radar emitters. You can select (highlighted in white) or un-select (not highlighted) classes by pressing the OSB next to the CLASS numbers. Each class contains a number of radar emitter types, which are listed in the next page.

To exit THRT menu and return to the HAD main page, press on the OSB next to THRT a second time.



2.7 – AGM-88C HARM
2.7.5 – AN/ASQ-213 HTS (HARM Targeting System) Pod & HAD (HARM Attack Display)

Here is a table by AstonMartinDBS that shows what radar threat emitter is associated to which class for the HAD (HARM Attack Display). This table is useful if you want to filter out unnecessary threat classes from the scanning process, which will accelerate the HTS pod scan. See the "HAD" column.

HAD THRT Menu (Class 1 Selected Only)

AGM-88C HARM ALIC Tables by AstonMartinDBS

DCS: F-16C Viper

v3.0.0

Table HAS	Table HAD	ID	RWR	Name
1	1	103	CS	SAM SA-10 S-300PS SR 5N66M
1	1	104	BB	SAM SA-10 S-300PS SR 64H6E
1	1	107	SD	SAM SA-11 Buk SR 9S18M1
1	1	110	10	SAM SA-10 S-300PS TR 30N6
1	1	115	11	SAM SA-11 Buk LN 9A310M1
2	1	119	15	SAM SA-15 Tor 9A331
2	2	117	8	SAM SA-8 Osa 9A33
2	3	109	DE	CP 9S80M1 Sborka
2	3	120	19	SAM SA-19 Tunguska 2S6
2	3	121	A	AAA ZSU-23-4 Shilka
3	2	108	6	SAM SA-6 Kub STR 1S91
3	2	118	13	SAM SA-13 Strela-10M3 9A35M3
3	2	122	S	SAM SR P-19
3	2	123	3	SAM SA-3 S-125 TR SNR
3	2	126	2	SAM SA-2 TR SNR-75 Fan Song
	1	127	7	HQ7 Self-Propelled LN
	1	128	HQ	HQ7 Self-Propelled STR
	1	130	TS	SAM SA-5 SR "Tin Shield"
	2	129	5	SAM SA-5 SR "Gammon"
	4	101	S	EWR 1L13
	4	102	S	EWR 55G6
	5	301	SW	CV 1143.5 Admiral Kuznetsov
	5	303	T2	CG 1164 Moskva
	5	306	HP	FFL 1124.4 Grisha
	5	309	TP	FF 1135M Rezky
	5	312	PS	FSG 1241.1MP Molniya
	5	313	HN	CGN 1144.2 Piotr Velikiy
	5	319	TP	FFG 11540 Neustrashimy
	5	320	SW	CV 1143.5 Admiral Kuznetsov(2017)
	5	408	PS	Type 071 Amphibious Transport Dock
	5	409	MR	Type 052B Destroyer
	5	410	HN	Type 052C Destroyer
	5	411	MR	Type 054A Frigate

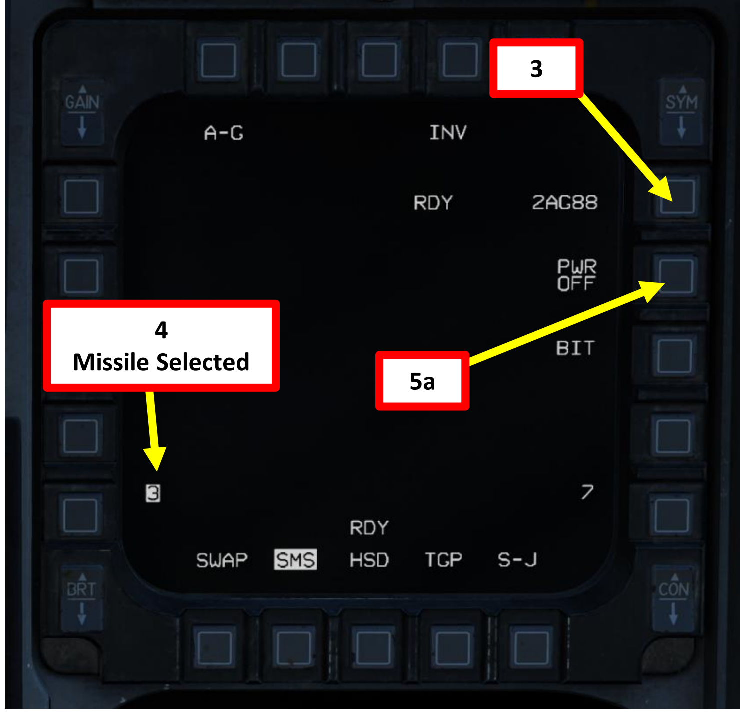
Table HAS	Table HAD	ID	RWR	Name
	6	202	P	SAM Patriot STR AN/MPQ-53
	6	209	NS	SAM NASAMS SR MPQ64F1
	7	124	RP	Rapier FSA Blindfire Tracker
	7	125	RT	Rapier FSA Launcher
	7	201	RO	SAM Roland ADS
	7	203	HK	SAM Hawk SR AN/MPQ-50
	7	204	HK	SAM Hawk TR AN/MPQ-46
	7	205	RO	SAM Roland SR
	7	206	HK	SAM Hawk CWAR AN/MPQ-55
	8	207	A	AAA Gepard
	8	208	A	AAA Vulcan M163
	10	315	AE	Ticonderoga class
	10	401	49	Oliver Hazzard Perry class
	10	402	SS	CVN-70 Carl Vinson
	10	403	SS	CVN-71 Theodore Roosevelt
	10	404	SS	CVN-72 Abraham Lincoln
	10	405	SS	CVN-73 George Washington
	10	406	SS	CVN-74 John C. Stennis
	10	407	40	LHA-1 Tarawa
	10	412	AE	DDG Arleigh Burke IIa
	10	413	SS	CVN-75 Harry S. Truman

2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

In this example, we will use the HTS (HARM Targeting System) pod while using the HARM missile in POS (Position) EOM (Equation-of-Motion) mode. The HTS pod will look for radar emitters and passively gather data to triangulate emitter location. With the HAD (HARM Attack Display), we will be able to select these emitters and make them our SPI (Sensor Point of Interest), which can be used by the HARM missile as position reference in POS EOM mode. Instead of having a steerpoint, we can then fire HARMs on any target of opportunity the HTS pod finds.

1. Press the A-G Master Mode Button
2. Set Master Arm switch – ARM (UP)
3. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the AG88 (AGM-88C HARM) missile. The number preceding AG88 is the number of missiles of this type equipped.
4. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
5. Press the OSB next to PWR OFF to start the power-up process of the HARM. A BIT (Built-In Test) will be initiated.

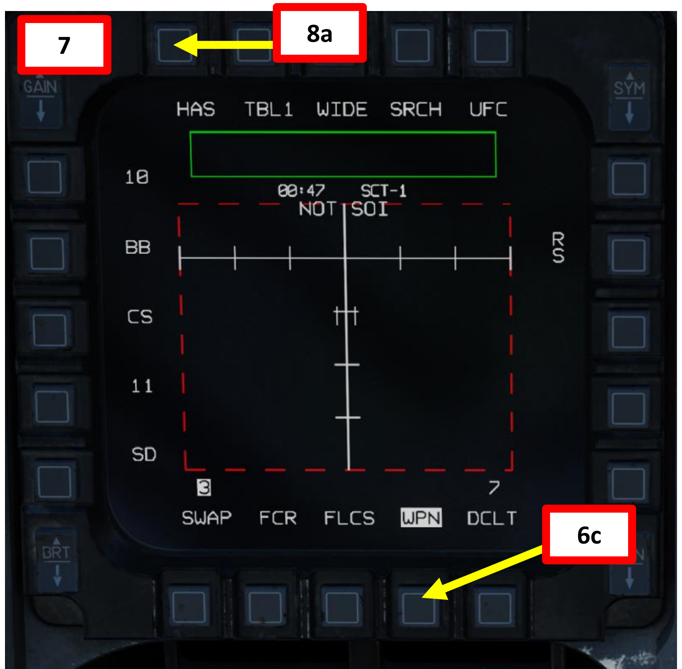


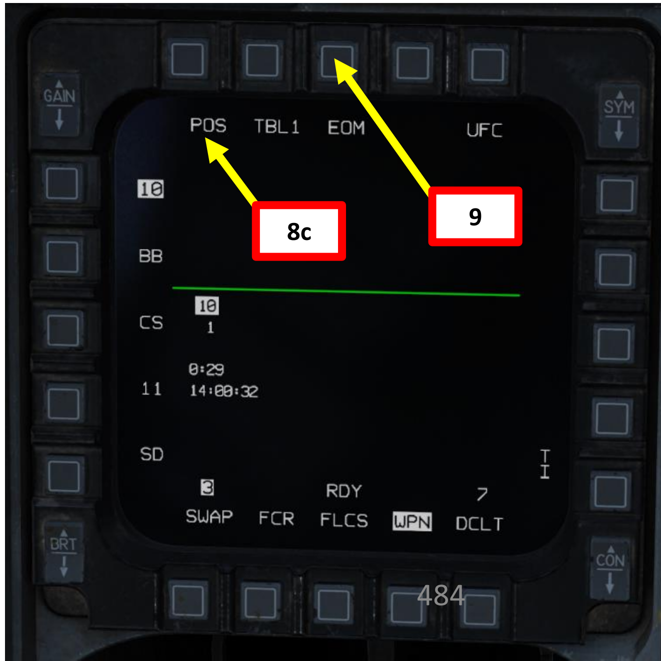
NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*

4

2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

6. Select the WPN (Weapon) page
7. The WPN page should display HAS Mode by default.
8. Toggle the OSB (Option Select Button) next to the HARM Mode until POS (Position) Mode is selected.
9. Toggle the OSB next to HARM POS Sub-Mode until EOM (Equation-of-Motion) is selected.
    - *The HTS pod can use any HARM position mode (PB, RUK or EOM).*



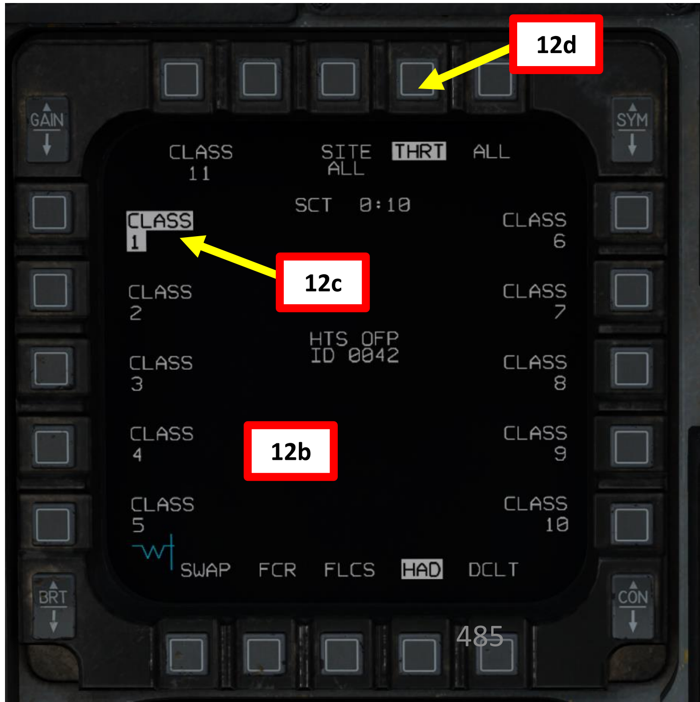


2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

10. Power up the HTS pod by setting the Left HDPT (Hardpoint) Power Switch ON (FWD).
11. Select the HAD (HARM Attack Display) page.
12. (Optional) If desired, filter out unnecessary radar emitter classes from the THRT (Threat) sub-menu and selecting/un-selecting classes with the OSBs (Option Select Button) next to them. . In our case, we want to search for a "SD" (SA-11 "Snow Drift" Search Radar), which is in Class 1. To return to HAD page, press on OSB next to THRT a second time.

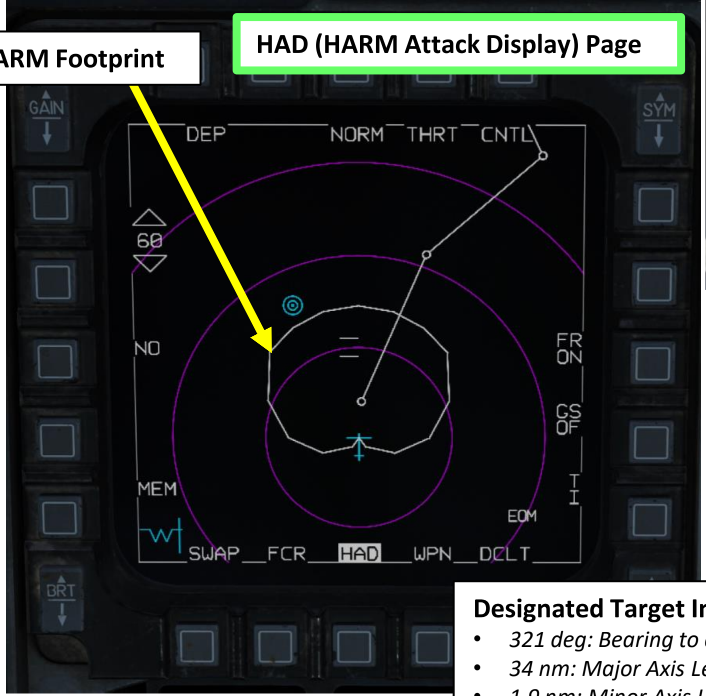
Left HDPT (Hardpoint) Power Switch
Power for left chin intake pylon, HARM Targeting System (HTS) pod can be installed
- *FWD: ON*
- *AFT: OFF*

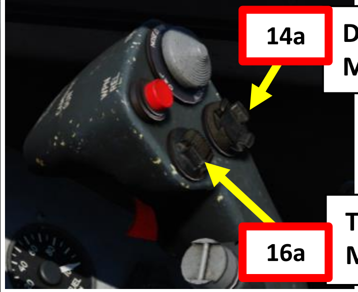
10



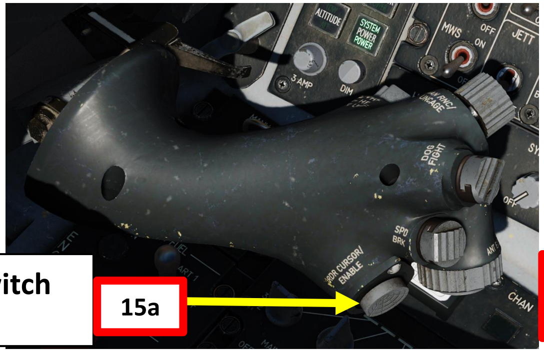
2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

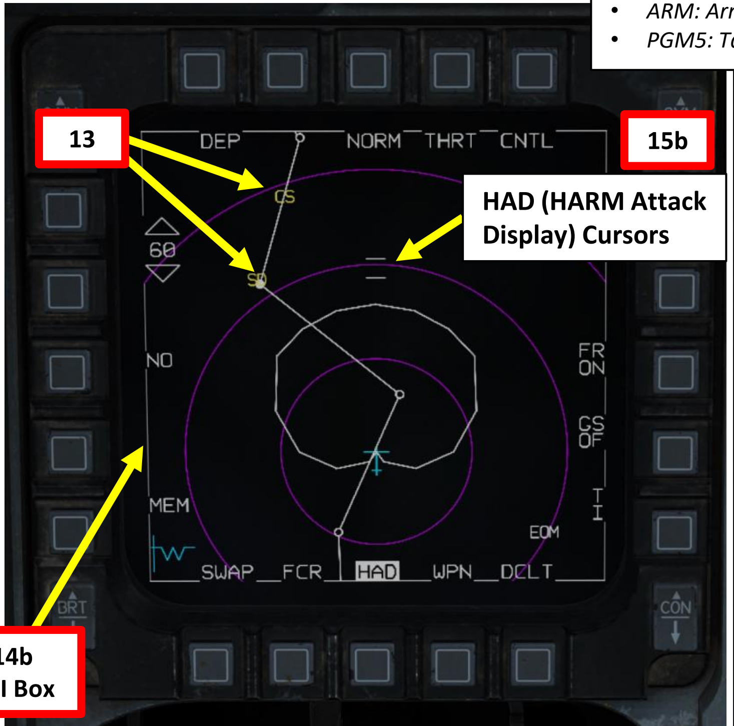
13. As you approach near the SAM sites, the HTS pod will gradually start displaying radar emitter symbols near the triangulated positions.
    - Green: Emitter is not active (radar has been turned off)
    - Yellow: Emitter is active (radar in search & acquisition mode)
    - Red: Emitter is tracking (radar lock on you)
    - Flashing Red: Emitter is launching a missile
14. Press DMS (Display Management Switch) DOWN to make the HAD page the SOI (Sensor of Interest), indicated by a white box.
15. Slew the HAD Cursors over the desired emitter symbol with the Cursor/Enable Switch control.
    - Note: If desired, you can press the Expand/FOV HOTAS Button or use the OSB next to NORM to expand the HAD page view.
16. When HAD cursor is over desired symbol, press TMS (Target Management Switch) UP to designate the target as the SPI (Sensor Point of Interest). A red box will surround the symbol with designation information. When target is designated:
    - Pressing TMS LEFT will display the SEAD (Suppression of Enemy Air Defenses) DED (Data Entry Display) page. The data displayed is the emitter's latitude (LAT), longitude (LNG), elevation (ELV, in ft) and time-on-target.
    - Pressing TMS RIGHT will cycle designation between different emitters displayed on the HAD.
    - Pressing TMS AFT will return DED page to CNI (Communication, Navigation & Information) page.
17. In this example, we locked a "SD", or a SA-11 "Snow Drift" Search Radar.





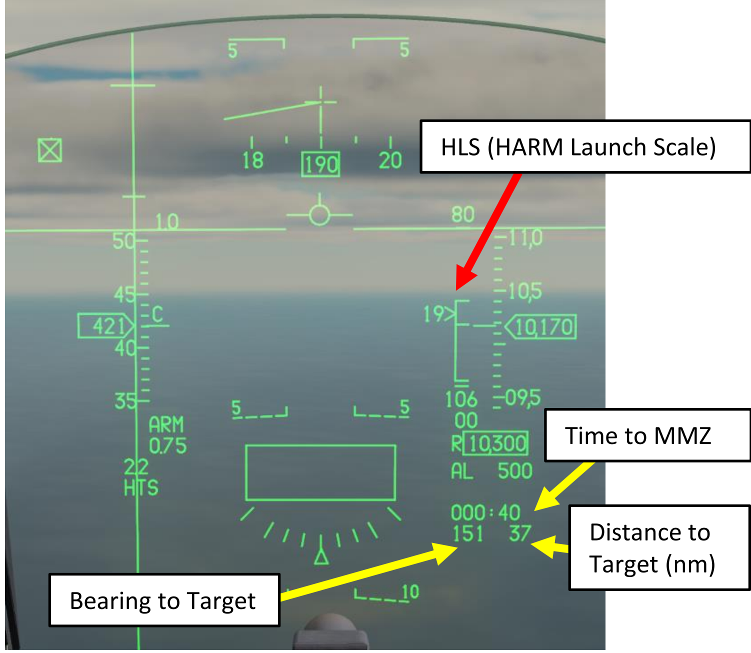
Designated Target Information (based on HTS pod triangulation)
- *321 deg: Bearing to designated target*
- *34 nm: Major Axis Length*
- *1.9 nm: Minor Axis Length*
- *ARM: Arming Status*
- *PGM5: Target Position Quality, from PGM5 (worst quality) to PGM1 (best quality)*

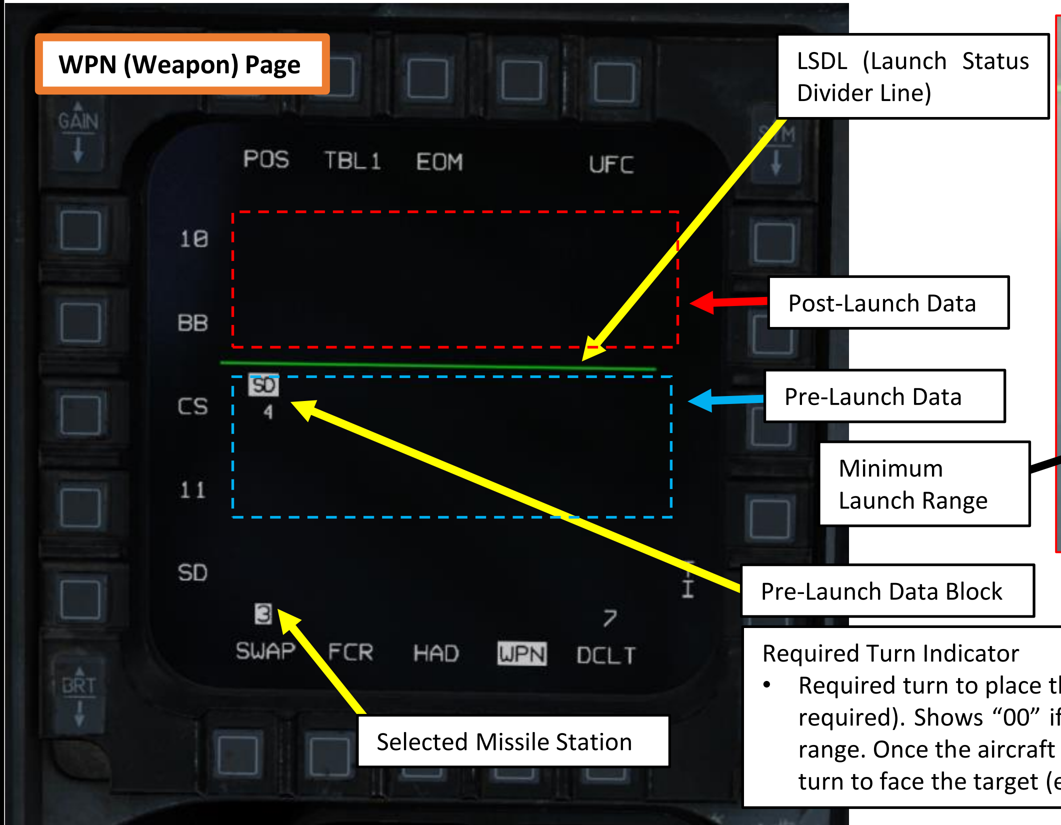


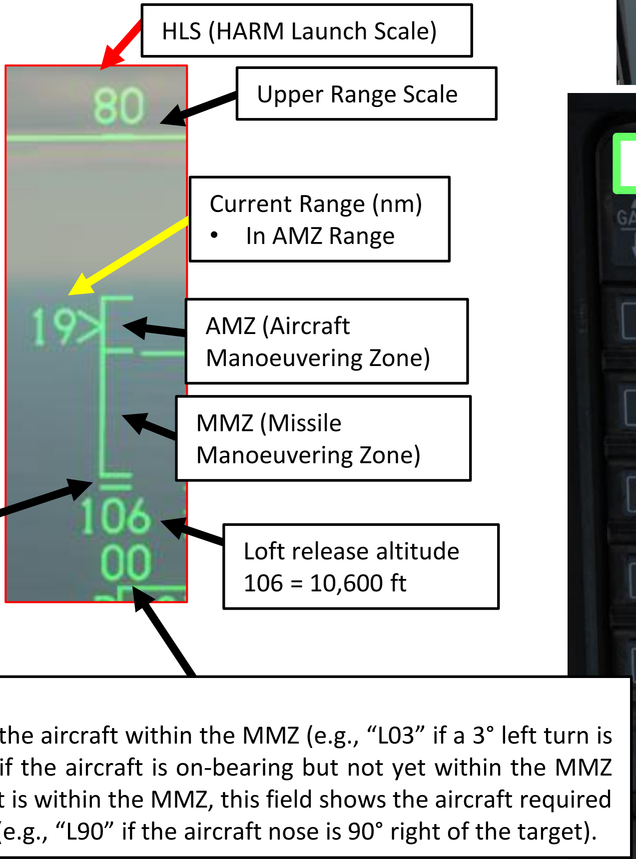


2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

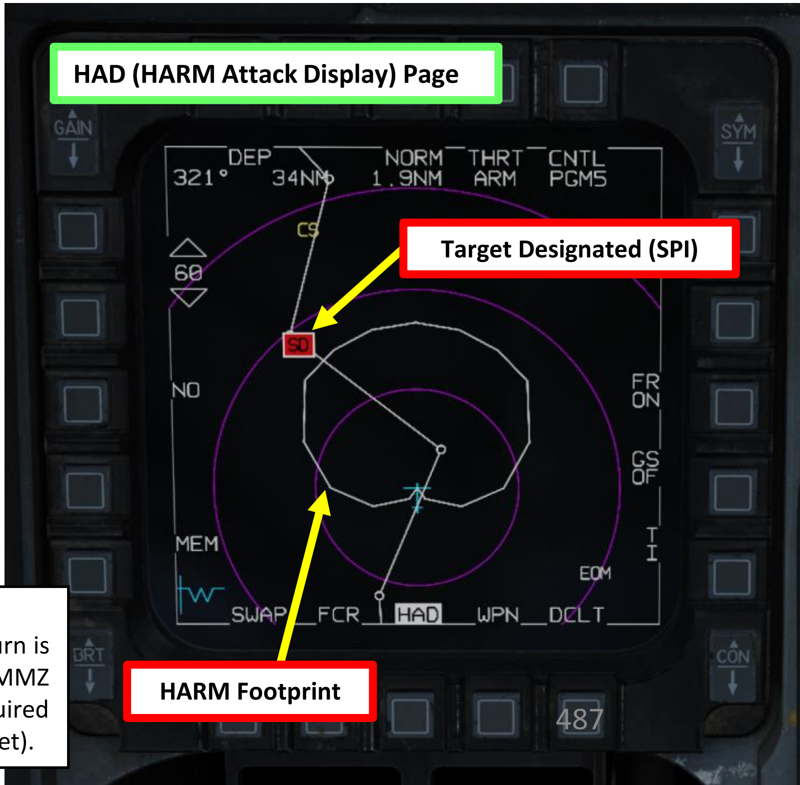
18. When in EOM mode, you have no bearing requirement towards the target; high off-boresight shots will expend/waste more missile energy than needed, therefore you should still try to aim for the selected SPI (Sensor Point of Interest) designated from the HAD (HARM Attack Display) to minimize energy loss if possible. Once your aircraft is pointed towards the target (you can use the HSD and the HUD Target Designation Box as a reference), keep flying until you are within AMZ (Aircraft Manoeuver Zone), which is indicated on the HLS (HARM Launch Scale). The HLS indicates the range potential of the missile to reach the current target. The target is assumed to be at the current SPI (Sensor Point of Interest) triangulated by the HARM Targeting System (HTS) pod.
    - AMZ (Aircraft Manoeuver Zone): range/zone where the missile can reach the target if the launching aircraft lofts or turns towards the target first.
    - MMZ (Missile Manoeuver Zone): range/zone where the missile can reach the target by doing entirely its own maneuvering.







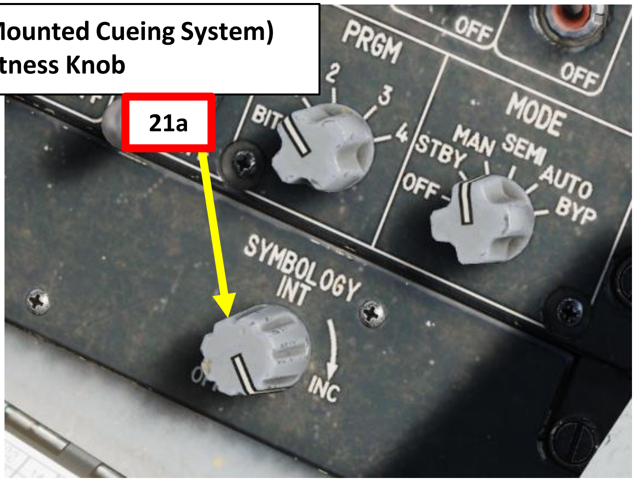
Required Turn Indicator
- Required turn to place the aircraft within the MMZ (e.g., "L03" if a 3° left turn is required). Shows "00" if the aircraft is on-bearing but not yet within the MMZ range. Once the aircraft is within the MMZ, this field shows the aircraft required turn to face the target (e.g., "L90" if the aircraft nose is 90° right of the target).

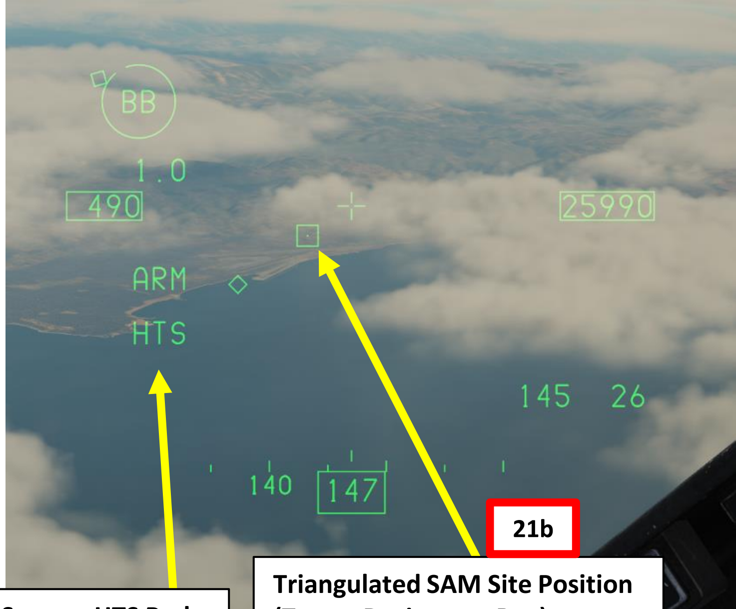


2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

19. In order to determine the location of a radar emitter, make sure you do not fly directly towards it; try to fly around it instead. Each time the radar scans you, the HTS pod can better determine (triangulate) the source of the radar wave emission. See section 2.7.5 for more information.
20. Check the PGM (Position Quality) indication to see how accurate the triangulation of the emitter is. A position quality accurate enough for a good shot should be either PGM2 (great) or PGM1 (best). As the HTS pod gathers data, the position quality increases gradually. Once a good PGM is obtained, you can start thinking about performing the missile attack.
21. (Optional) If desired, you can turn on the HMCS (Helmet-Mounted Cueing System) and see on the helmet overlay the position of the designated target. This will greatly help your situational awareness.

HMCS (Helmet-Mounted Cueing System) Symbology Brightness Knob





SPI Source: HTS Pod

Triangulated SAM Site Position (Target Designator Box)

HAD (HARM Attack Display) Page

Position Quality PGM3 (Not Great, Not Terrible)

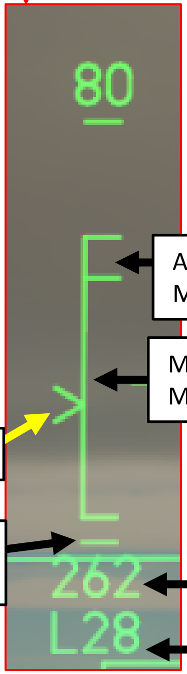
Triangulated SAM Site Position

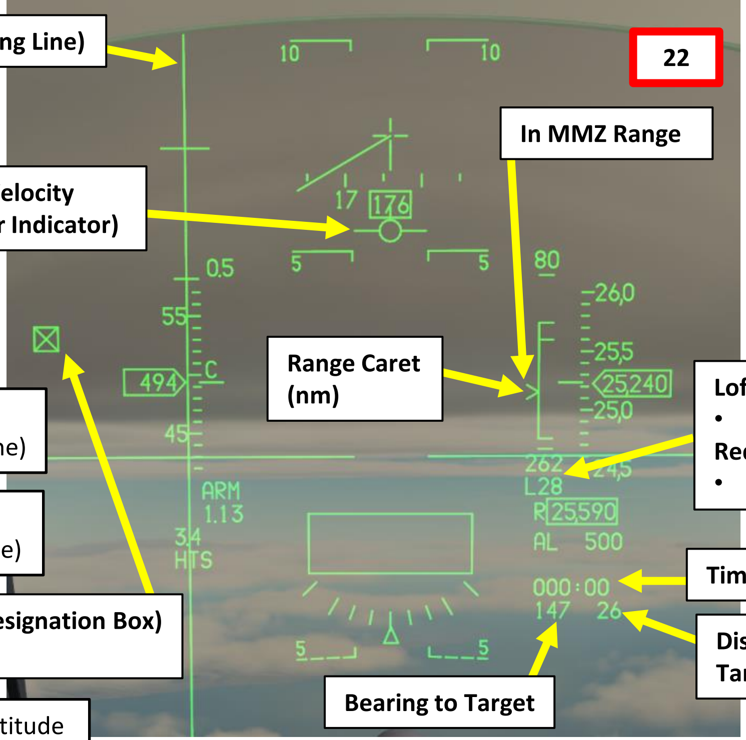
Position Quality PGM2 (Great)

Triangulated SAM Site Position

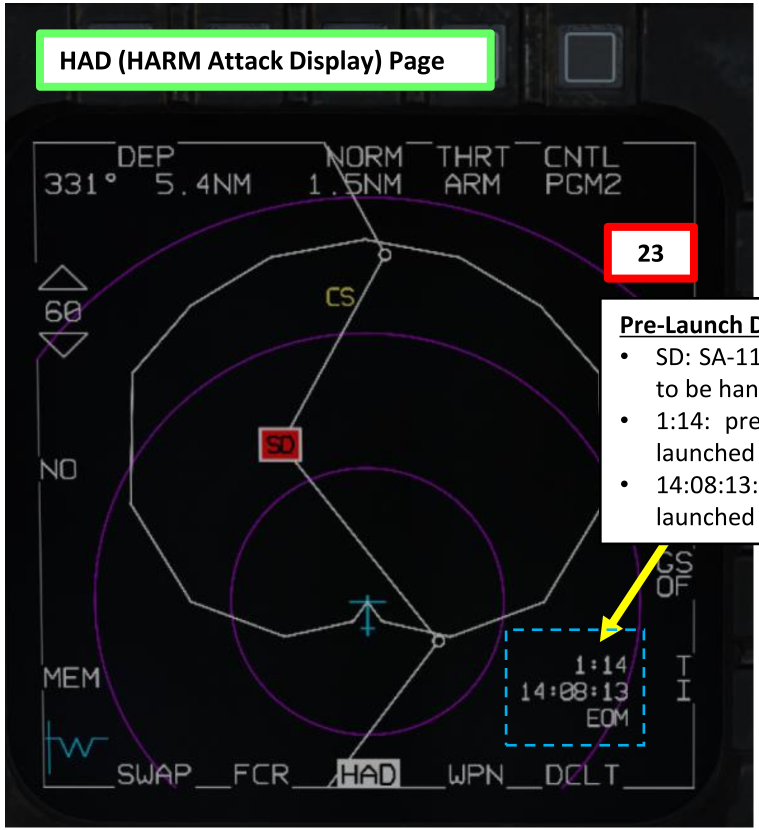
2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

22. If practical, try to steer the aircraft to line up the Velocity Vector Indicator (VVI) on the ASL (Azimuth Steering Line) to minimize missile angle off boresight (energy loss). However, keep in mind that this isn't mandatory since the missile can manoeuver quite well.
23. Once aircraft enters the MMZ (Missile Manoeuver Zone) range on the HLS (HARM Launch Scale), predicted time-to-impact and impact time are computed on the HAD and WPN pages.
24. Check on the Radar Warning Receiver to see if the radar emitter is locking you up. Without the radar emitting, the HARM missile may have trouble homing on the radar emitter.

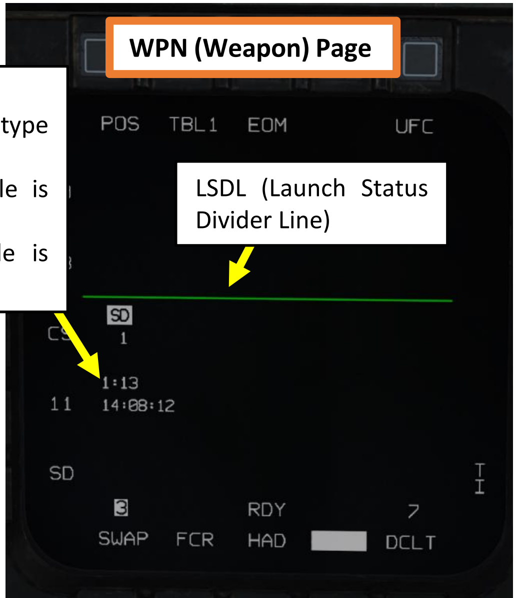




Required Turn Indicator
- Required turn to place the aircraft within the MMZ (e.g., "L03" if a 3° left turn is required). Shows "00" if the aircraft is on-bearing but not yet within the MMZ range. Once the aircraft is within the MMZ, this field shows the aircraft required turn to face the target (e.g., "L90" if the aircraft nose is 90° right of the target).

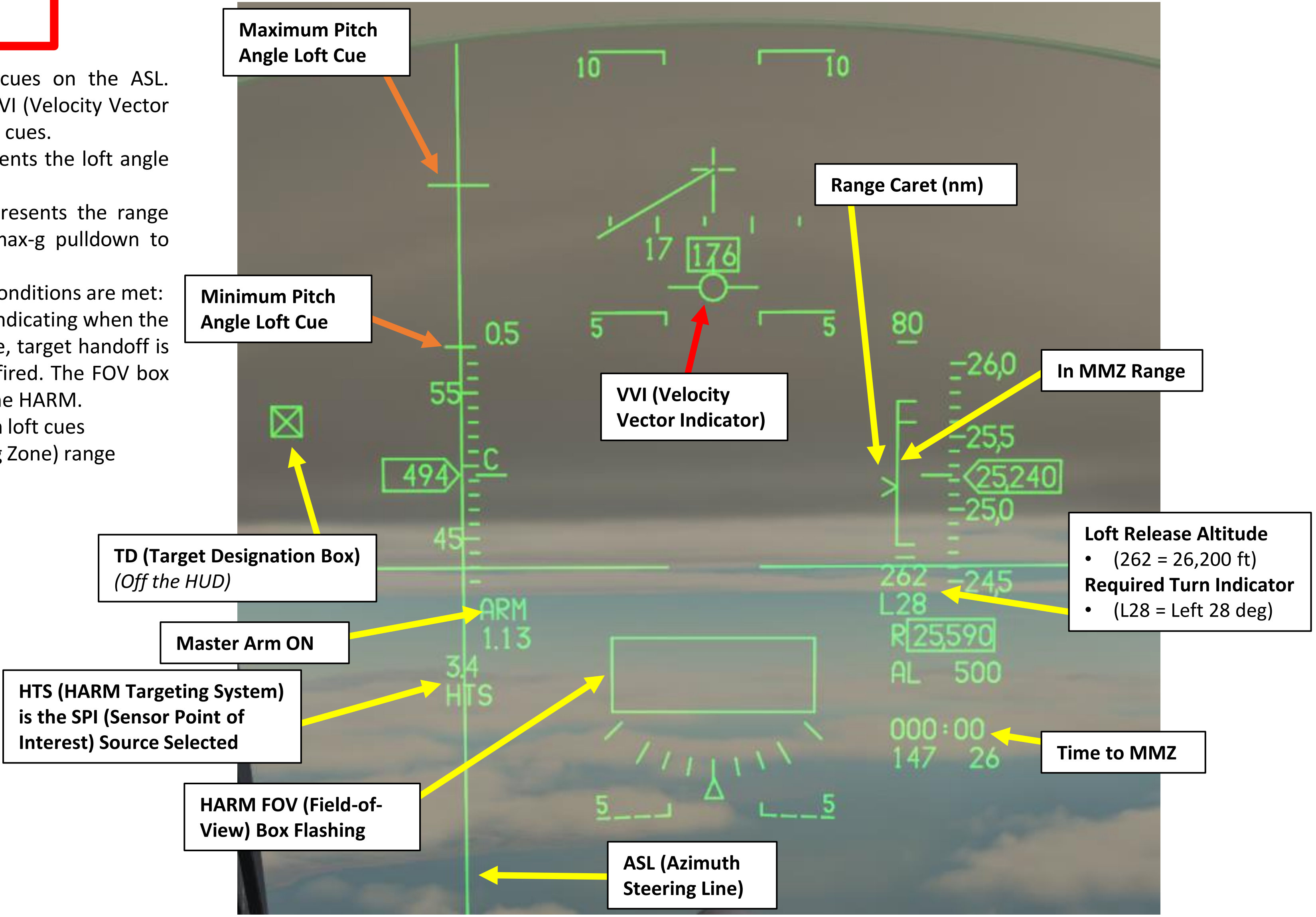


Pre-Launch Data Block
- SD: SA-11 "Snow Drift" Search Radar threat type to be handed off to the missile
- 1:14: predicted time until impact if missile is launched now
- 14:08:13: predicted impact time if missile is launched now



2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

25. You will see the minimum, and maximum loft cues on the ASL. Throttle up and pitch the aircraft up to place the VVI (Velocity Vector Indicator) between the minimum and maximum loft cues.
    - Maximum loft is the larger tick and represents the loft angle that will give the missile maximum range.
    - Minimum loft is the smaller tick and represents the range where the missile would have to do a max-g pulldown to reach the target.
26. You may launch HARM missile when the following conditions are met:
    - HARM FOV (Field-of-View) box is flashing, indicating when the aircraft is within the missile maneuver zone, target handoff is completed, and the missile is ready to be fired. The FOV box represents the end-game field-of-view of the HARM.
    - VVI is between the minimum and maximum loft cues
    - You are within MMZ (Missile Manoeuvering Zone) range



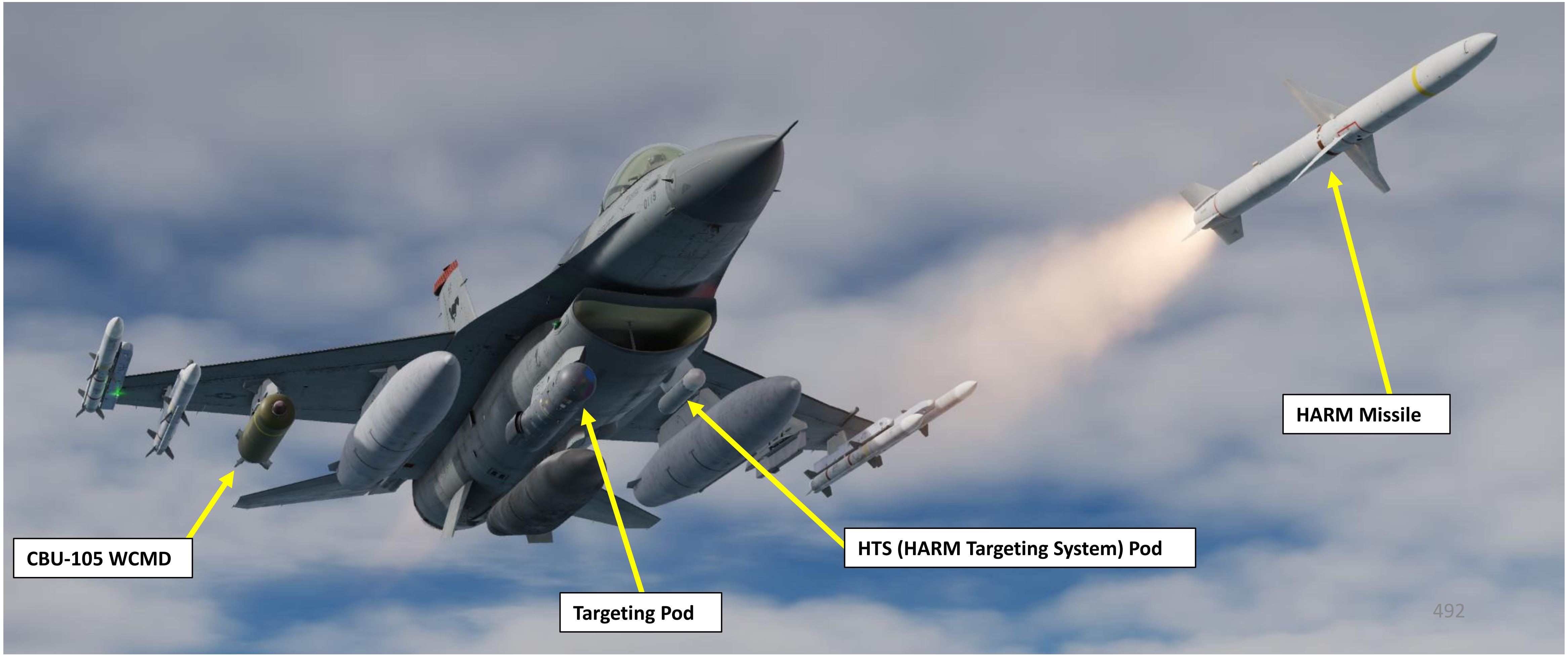
2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

27. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
28. The HARM missile will fly towards the selected SPI (Sensor Point of Interest) designated from the HAD (HARM Attack Display) until the radar is detected, at which point it will home on the radar signal. In EOM mode, the missile seeker head is activated with a narrow 40° field-of-view, 5 nm from the known threat position selected (triangulated by the HTS pod).
29. When an anti-radiation missile is launched, the brevity call is “Magnum”.
30. On the WPN page, post-launch information is displayed above the LSDL (Launch Status Divider Line).

2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

BONUS TIPS

There is a subtlety between SEAD (Suppression of Enemy Air Defences) and DEAD (Destruction of Enemy Air Defences). In the grand scheme of things, the primary intent when launching a HARM is to force radar emitters to turn off their radar in order to not get detected, then destroyed by the missile. This is what suppression of air defences (SEAD) missions are supposed to do. However, there are weapons better suited to destroy SAM sites such as cluster munitions, which are great for DEAD missions. One useful aspect of the HTS (HARM Targeting System) pod is that not only does it allow the triangulation of the radar emitter positions, but it also allows the pilot to slave other sensors to these triangulated positions. As an example, if you fired a HARM missile at an enemy SAM site, you can select other weapons, re-designate the target on the HAD (HARM Attack Display), then use the targeting pod to observe the target and perform BDA (Bomb Damage Assessment).



2.7 – AGM-88C HARM
2.7.6 – Employment with HTS Pod (POS/EOM Sub-Mode)

BONUS TIPS

In this situation, we have just fired a HARM missile to the target, and we want to finish it off with CBU-105 cluster munitions.

- First select the CBU-105s via the SMS page in PRE (Pre-Planned) mode.
- Target designation on the HAD page is performed the same way as before; DMS DOWN to make the HAD page SOI (Sensor of Interest), slew the cursor over the radar emitter symbol, press TMS UP to designate the SPI (Sensor Point of Interest).
- All sensors will be slaved to the triangulated position of the radar emitter.
- Selecting the TGP (Targeting Pod) page will allow you to see the SPI designation point. If desired, you may use the DMS switch to make the TGP SOI, and use it to find the real position of the SAM site, re-designate with the targeting pod, then perform the attack on this suppressed target.

2.8 – GPS-GUIDED ORDNANCE

2.8.1 – GBU-38 JDAM
2.8.1.1 – Introduction

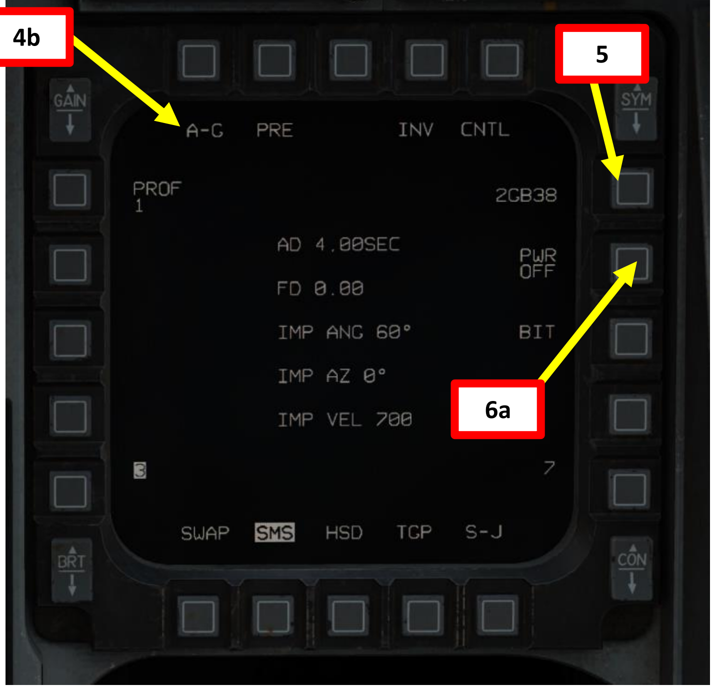
The F-16C is able to employ the Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs and the Joint Standoff Weapon (JSOW) glide bombs. JDAMs are modified general purpose bombs, equipped with a GPS and inertial navigation system (INS) for guidance as well as flight controls. The JSOW has the same guidance and is a bomb with wings to provide lift and maneuvering flight controls. As such, it has a significantly longer range than JDAMs. The JDAMs/JSOWs have (at optimal INS alignment) a margin of error of approximately 16 ft (5 m).

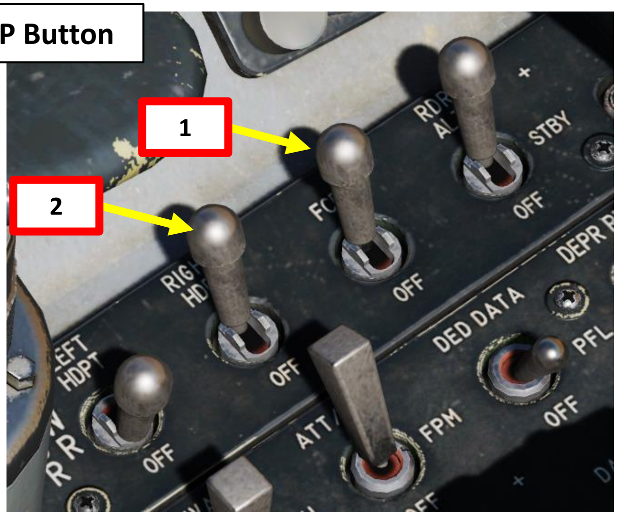
Basically, the way to employ JDAMs is to perform a target designation either in Pre-Planned or Visual Mode. Pre-Planned Mode requires a target designation from any valid sensor (targeting pod, an existing steerpoint or markpoint, or even the Fire Control Radar). Visual Mode requires a target designation from the Heads-Up Display (HUD), which implies that you are close enough to spot a target visually. While Visual Mode is much quicker, it is good practice to verify the target designation with appropriate sensors to make sure that you don't drop your ordnance at the wrong place. JSOW operation is almost identical to the JDAM's since they both share Pre-Planned and Visual employment modes.

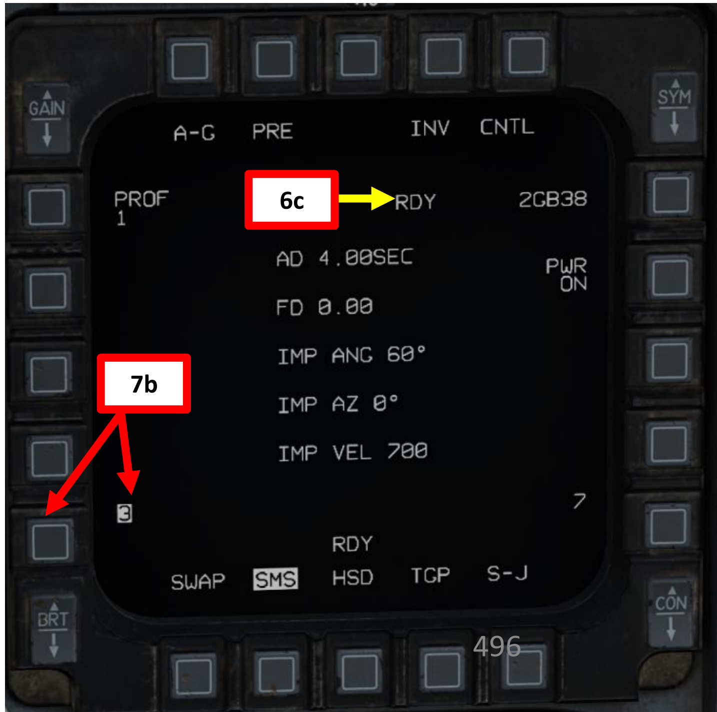
The DCS F-16 has three JDAM types available:
- GBU-38: Mk82 500-pound bomb with JDAM guidance kit.
- GBU-31(V)1/B: Mk84 2,000-pound bomb with JDAM guidance kit.
- GBU-31(V)3/B: BLU-109 2,000-pound hardened penetration bomb with JDAM guidance kit.

2.8.1 – GBU-38 JDAM
2.8.1.2 – Weapon Preparation

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. If using a targeting pod laser to range the target, set the RIGHT HDPT switch to ON (FWD).
3. Set Master Arm switch – ARM (UP)
4. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
5. On the SMS (Stores Management Set) page, select GBU-38 JDAMS (GB38) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
6. Power on GBU-38s by pressing OSB next to PWR. When countdown starting from “A10” disappears and “PWR ON” and “RDY” indications are visible, power-up sequence is complete.
7. Select desired JDAM station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).

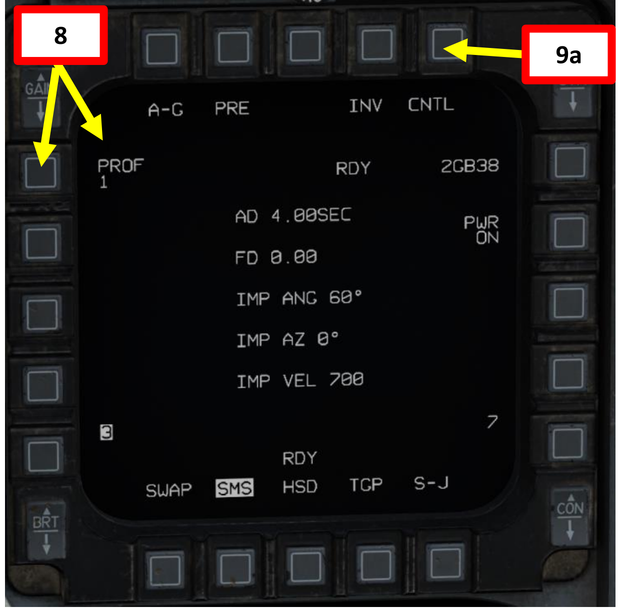


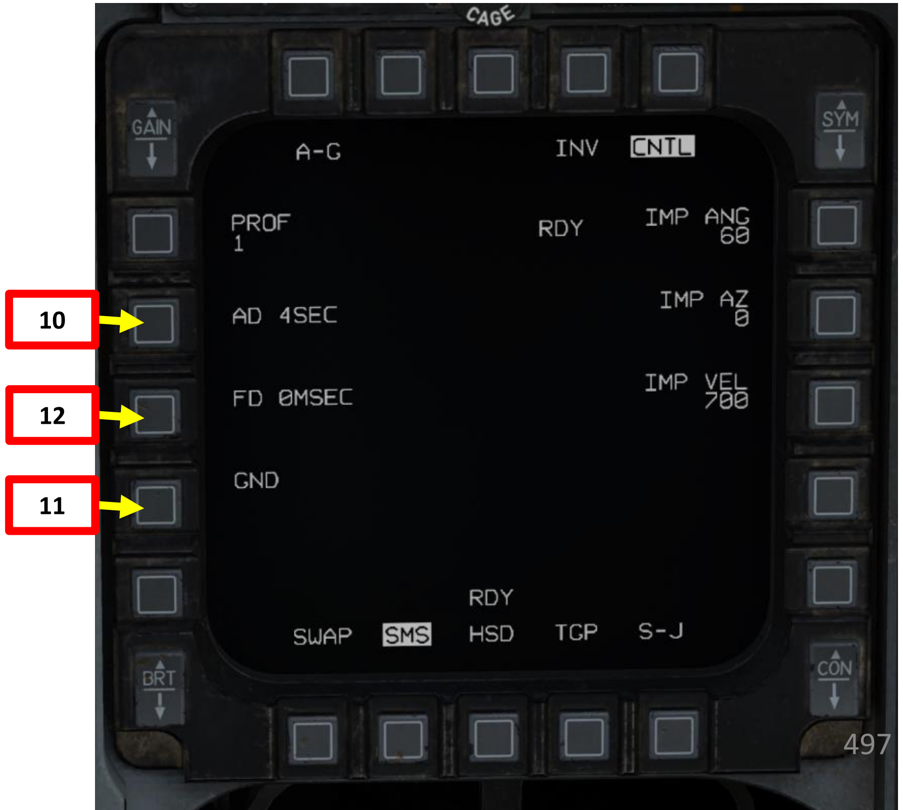




2.8.1 – GBU-38 JDAM
2.8.1.2 – Weapon Preparation

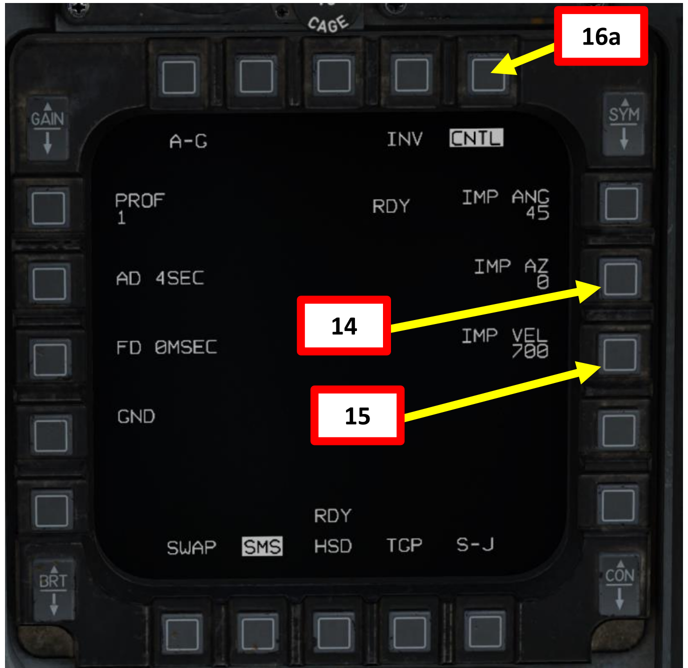
8. Select desired weapon profile by pressing OSB next to PROF. We will select Profile 1, then modify the profile manually.
9. From the SMS page, press OSB next to CNTL to select the Control Page.
10. Press OSB next to “AD” to toggle between arming delay settings; this option is the time between weapon release and JDAM fuze arming. Options are 4, 4.5, 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 14, 21, and 25 seconds.
11. Press OSB next to “AIR” (or “GND” or “GND DLY” if these options are selected) to toggle between fuzing options. We will select GND.
    - AIR: Weapon will air-burst above the target. This reduces the penetrative effect of the bomb but improves its area effect.
    - GND: Weapon will explode on impact. Selecting GND will reveal an additional option labeled FD (fuzing delay). Selectable fuzing delays are 0 (instant), 5, 15, 25, 45, 60, 90, 180, and 240 milliseconds. Adding a fuzing delay allows the weapon to penetrate the target prior to exploding.
    - GND DLY: Weapon will impact target inert, and then explode after an extended period. Selecting GND DLY will reveal an additional option labeled FD (fuzing delay).
12. If GND DLY fuzing option is selected, press OSB next to “FD” (Fuzing Delay) to toggle between fuzing delay options. Since we have selected GND, we will leave FD parameter to “0” hour.
    - Selectable fuzing delays are 0.25, 0.5, 0.75, 1, 4, 8, 12, 16, 20, and 24 hours after impact.





2.8.1 – GBU-38 JDAM
2.8.1.2 – Weapon Preparation

13. Enter impact angle (in degrees). A higher impact angle should be used if tall structures surround the target. In this example, I suggest using "45 deg".
    a) Press OSB next to the IMP ANG (Impact Angle) parameter.
    b) Use OSBs to type in the desired impact angle (45).
    c) Press OSB next to ENTR to confirm impact angle selection.
14. Enter impact azimuth (in degrees). This sets the heading that the bomb will attempt to fly to the target during the terminal phase. A value of "0" means no specific heading; use a value of "360" if you want the bomb to impact the target from the south flying north. In this case, we will use "0 deg".
    a) Press OSB next to the IMP AZ (Impact Azimuth) parameter.
    b) Use OSBs to type in the desired impact azimuth (0).
    c) Press OSB next to ENTR to confirm impact azimuth selection.
15. Enter impact vertical velocity (in ft/sec). This sets the vertical velocity the bomb will attempt to achieve when impacting the target in feet per second. A higher vertical velocity creates more effective penetration. In this case, we will use "700 ft/sec".
    a) Press OSB next to the IMP VEL (Impact Velocity) parameter.
    b) Use OSBs to type in the desired impact velocity (700).
    c) Press OSB next to ENTR to confirm impact azimuth selection.
16. When all parameters are entered correctly for our weapon profile, press OSB next to CNTL to return to the SMS page.

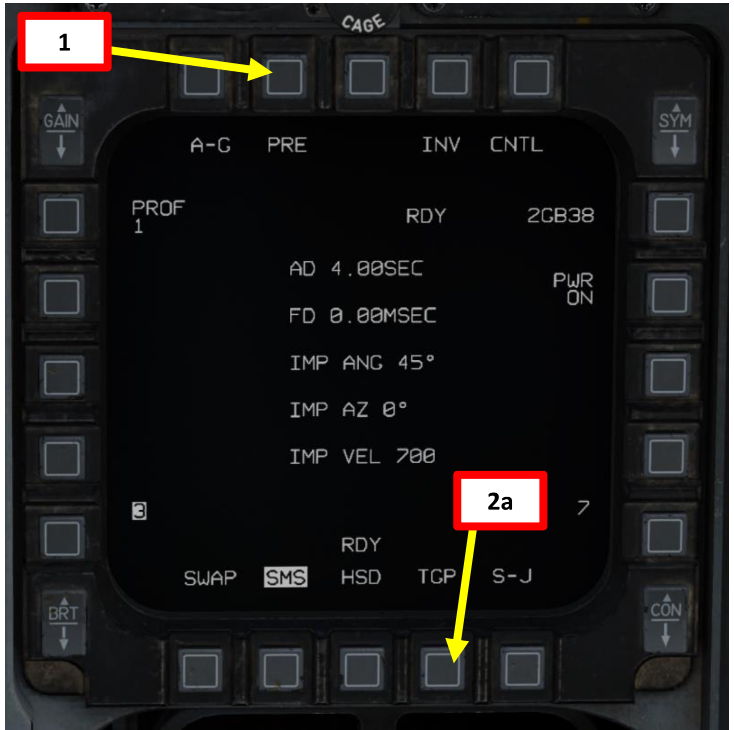


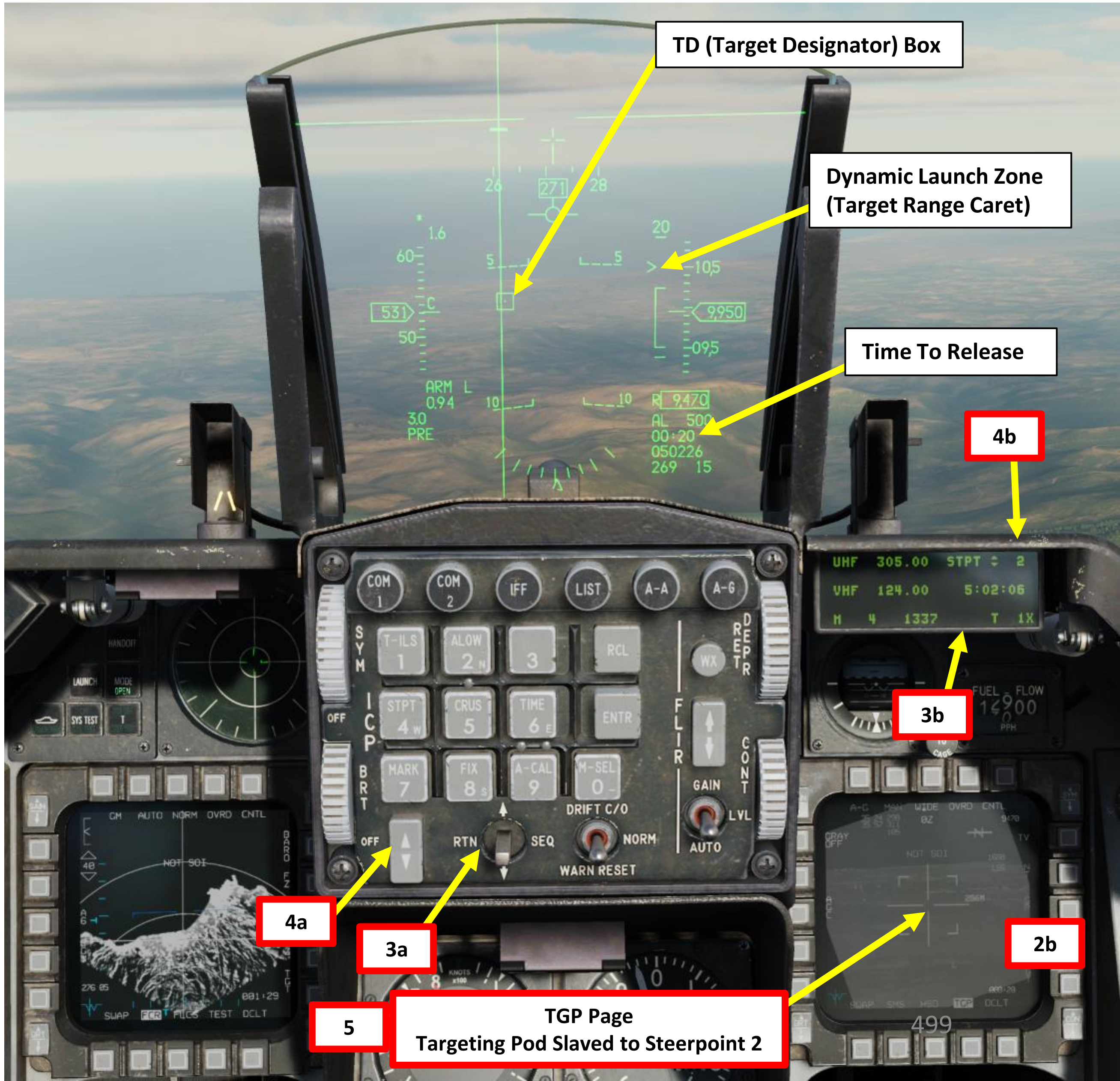
2.8.1 – GBU-38 JDAM
2.8.1.3 – Delivery: Pre-Planned Mode + Targeting Pod

1. From the SMS page, toggle OSB next to Weapon Delivery Mode to select PRE (Pre-Planned) mode.
2. On the SMS page, press OSB next to TGP to select Targeting Pod feed page.

- *Note: Typically, a Steerpoint should be programmed in your flight plan near the target. This isn't absolutely necessary since you can use Snowplow Mode to scan the area, but In this case, we will assume Steerpoint 2 is set near the target In order to facilitate target acquisition.*

3. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
4. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
5. When Pre-Planned release mode is selected, the Targeting Pod will automatically be slaved to the selected steerpoint (Steerpoint 2 in our case).

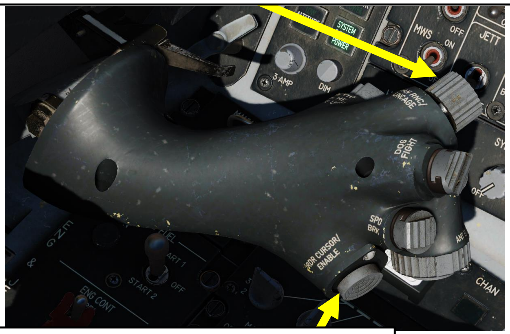




2.8.1 – GBU-38 JDAM
2.8.1.3 – Delivery: Pre-Planned Mode + Targeting Pod

6. Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest). The SOI Box around the TGP page will indicate when the targeting pod can be controlled with HOTAS controls.
7. Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the steerpoint location. Then, slew the targeting pod using the Radar Cursor switch.
8. Select desired Sensor Mode using the TV/BHOT/WHOT OSB (Option Select Button) or using the TMS (Target Management Switch) LEFT.
9. Set Field of View as desired using the NARO/WIDE OSB or using the Expand/FOV button.
10. Use the MAN RNG (Manual Range) Knob controls to set zoom level.
    - CCW (Counter-Clockwise): Zooms OUT
    - CW (Clockwise): Zooms IN
11. Select Tracking Mode using the TMS (Target Management Switch): TMS UP for Point Track (POINT, tracks moving objects) or TMS RIGHT for Area Track (AREA, tracks static objects).

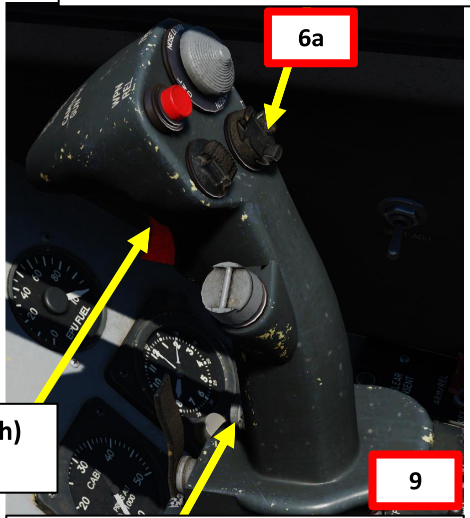
MAN RNG/UNCAGE Knob/Switch **10**
- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Laser Spot Search Mode ("C" binding)*



Radar Cursor/Enable Switch **7b**
Depress, Multidirectional

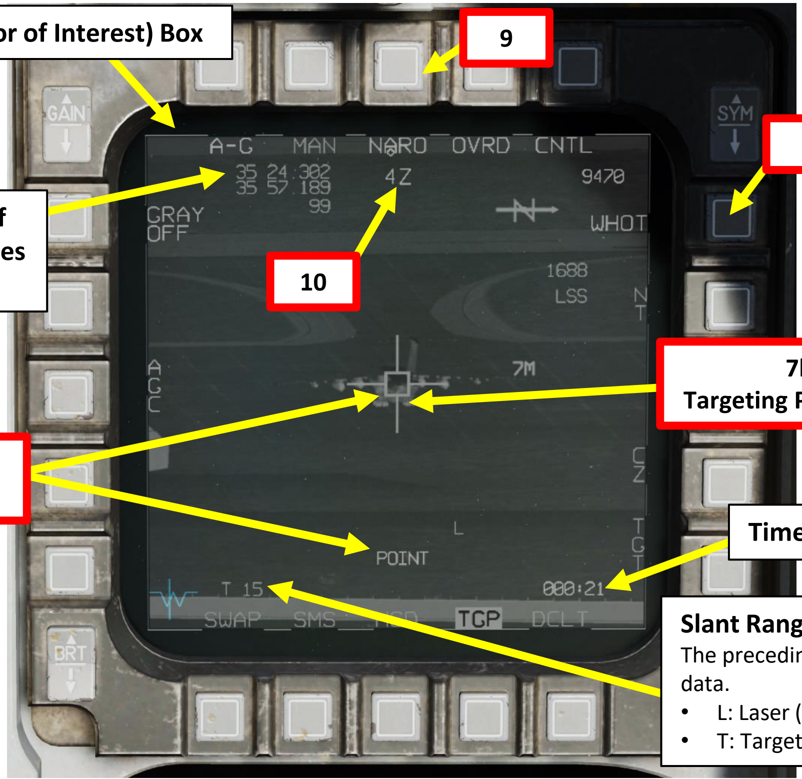
7a **8** **11** **TMS (Target Management Switch)**
UP/DOWN/LEFT/RIGHT

DMS (Display Management Switch)
UP/DOWN/LEFT/RIGHT
6a



9 **Expand/FOV (Field-of-View) Button**

6b **SOI (Sensor of Interest) Box**



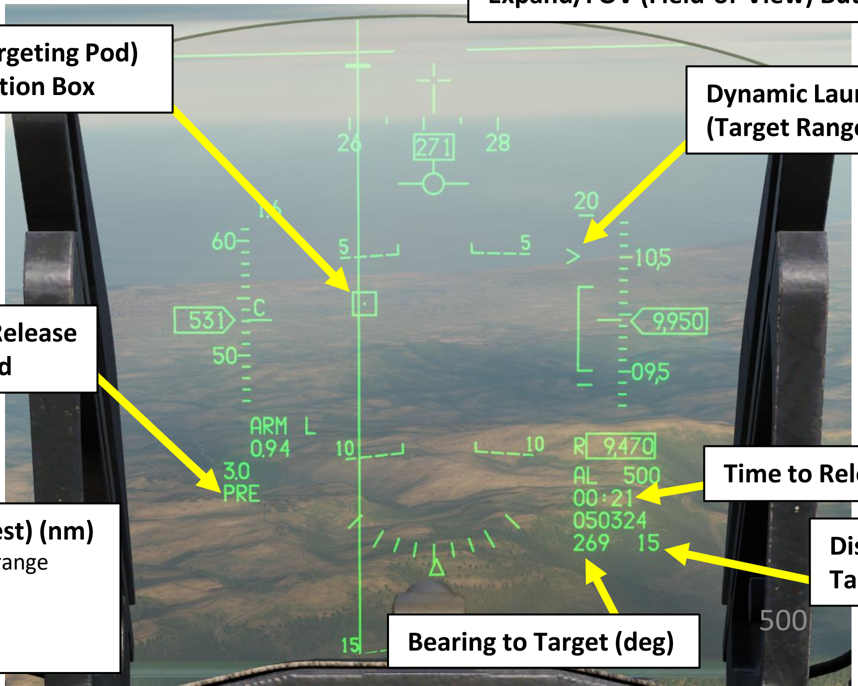
9
8
SPI (Sensor Point of Interest) Coordinates & Elevation (ft)
10
7b Targeting Pod Cursor
11 Point Track
Time to Release (sec)

Slant Range to SPI (Sensor Point of Interest) (nm)
The preceding letter indicates the source of the range data.
- L: Laser (priority over all other sources)
- T: Targeting Pod passive ranging

TGP (Targeting Pod) Designation Box

Dynamic Launch Zone (Target Range Caret)

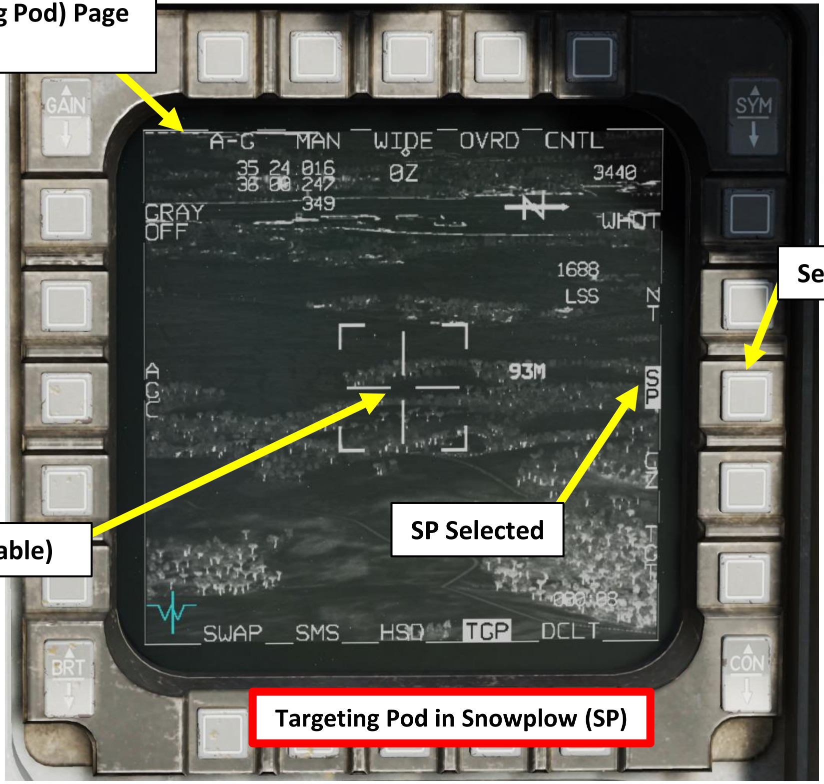
Pre-Planned Release Mode Selected

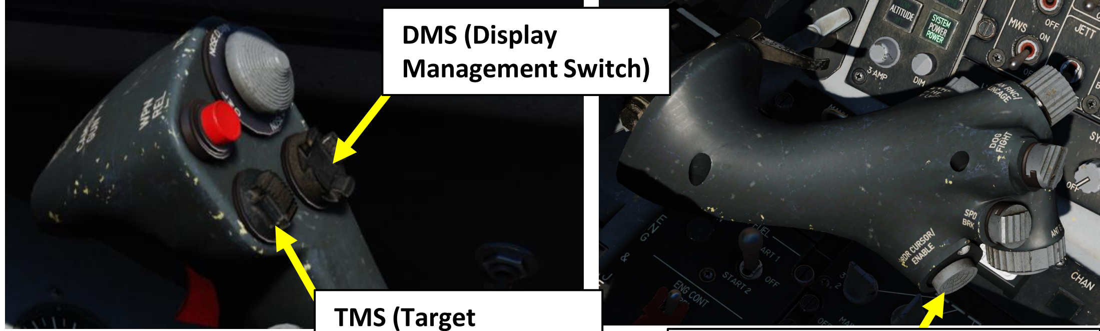


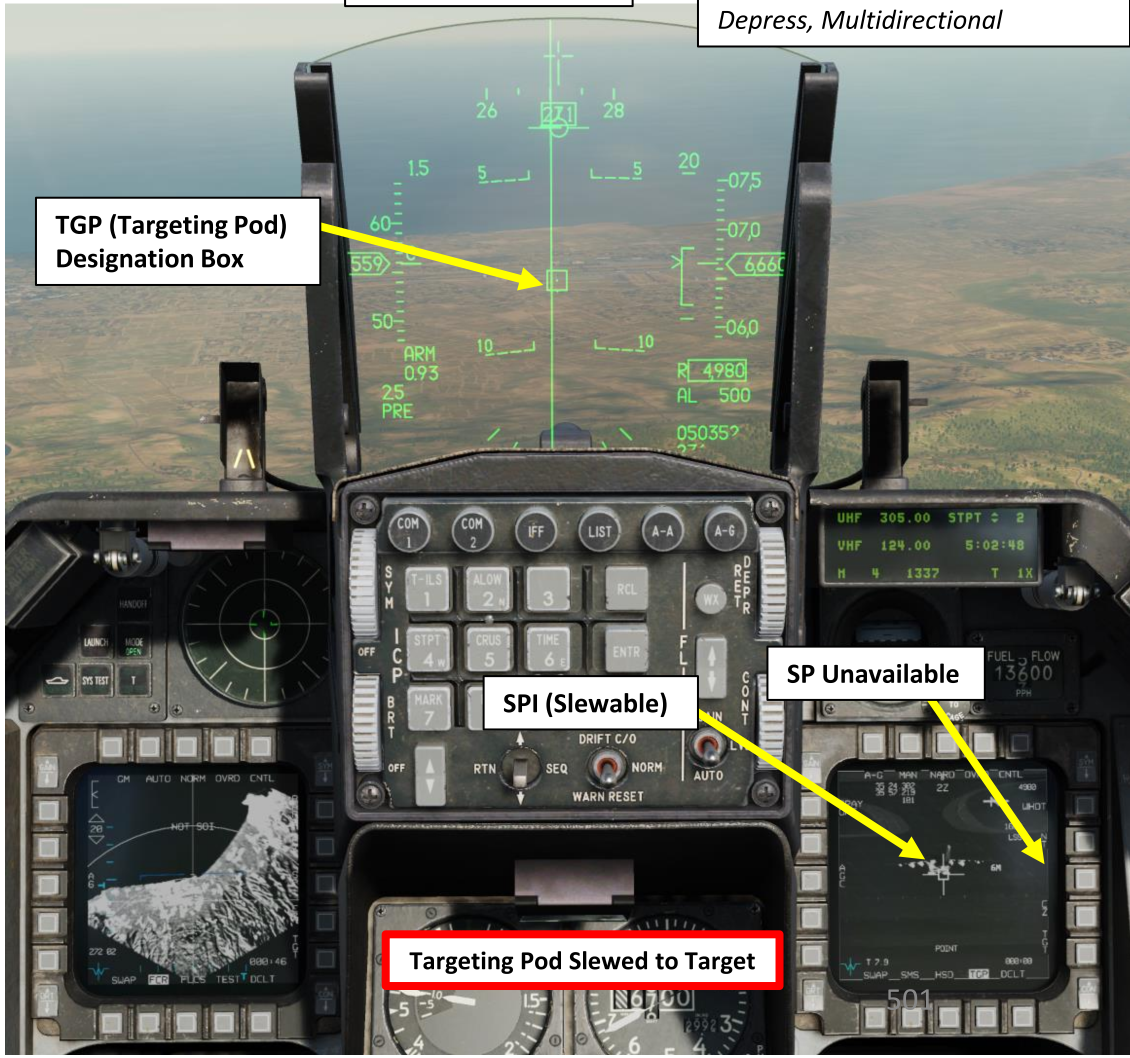
Time to Release (sec)
Distance to Target (nm)
Bearing to Target (deg)

2.8.1 – GBU-38 JDAM
2.8.1.3 – Delivery: Pre-Planned Mode + Targeting Pod

- **Important Note**: In the case where a Steerpoint is not available near the target, you can use Snowplow (SP) mode. To do so:
  a) Press DMS (Display Management Switch) DOWN to set TGP page as the SOI (Sensor of Interest)
  b) By default, the TGP should be slaved to the selected steerpoint. Reject the target by using TMS (Target Management Switch) DOWN
  c) SP function should be available on the TGP page.
  d) Press OSB (Option Select Button) next to SP to activate Snowplow mode.
  e) The targeting pod's line-of-sight is commanded straight ahead and angled downwards to point to the ground ahead
  f) Press TMS RIGHT to set an Area Track (or TMS UP for a Point Track) on the location of the TGP reticle. This will exit SP Mode and make the SPI slewable.
  g) Slew the targeting pod as desired using the Radar Cursor switch.

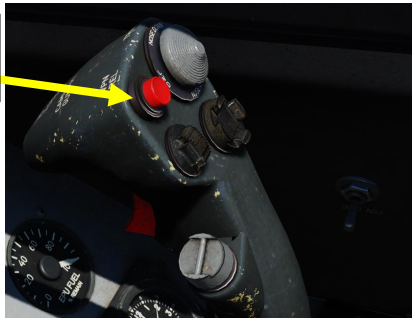


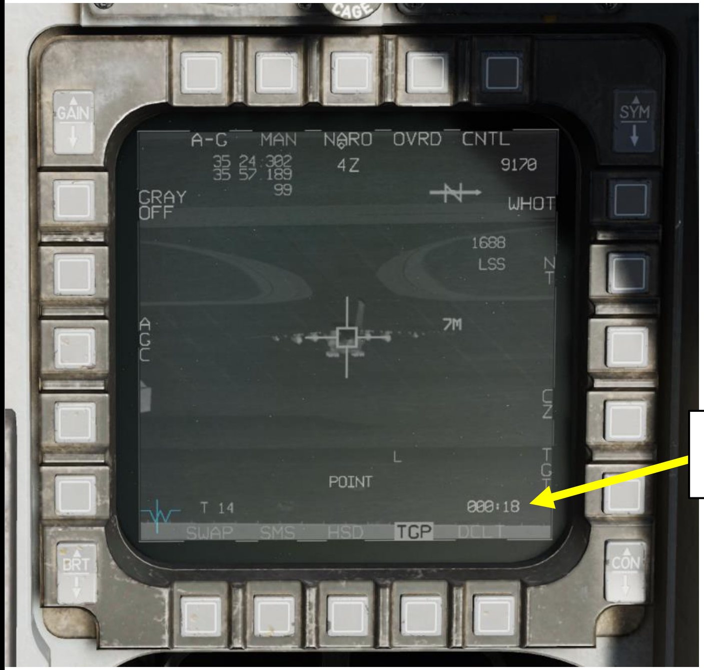


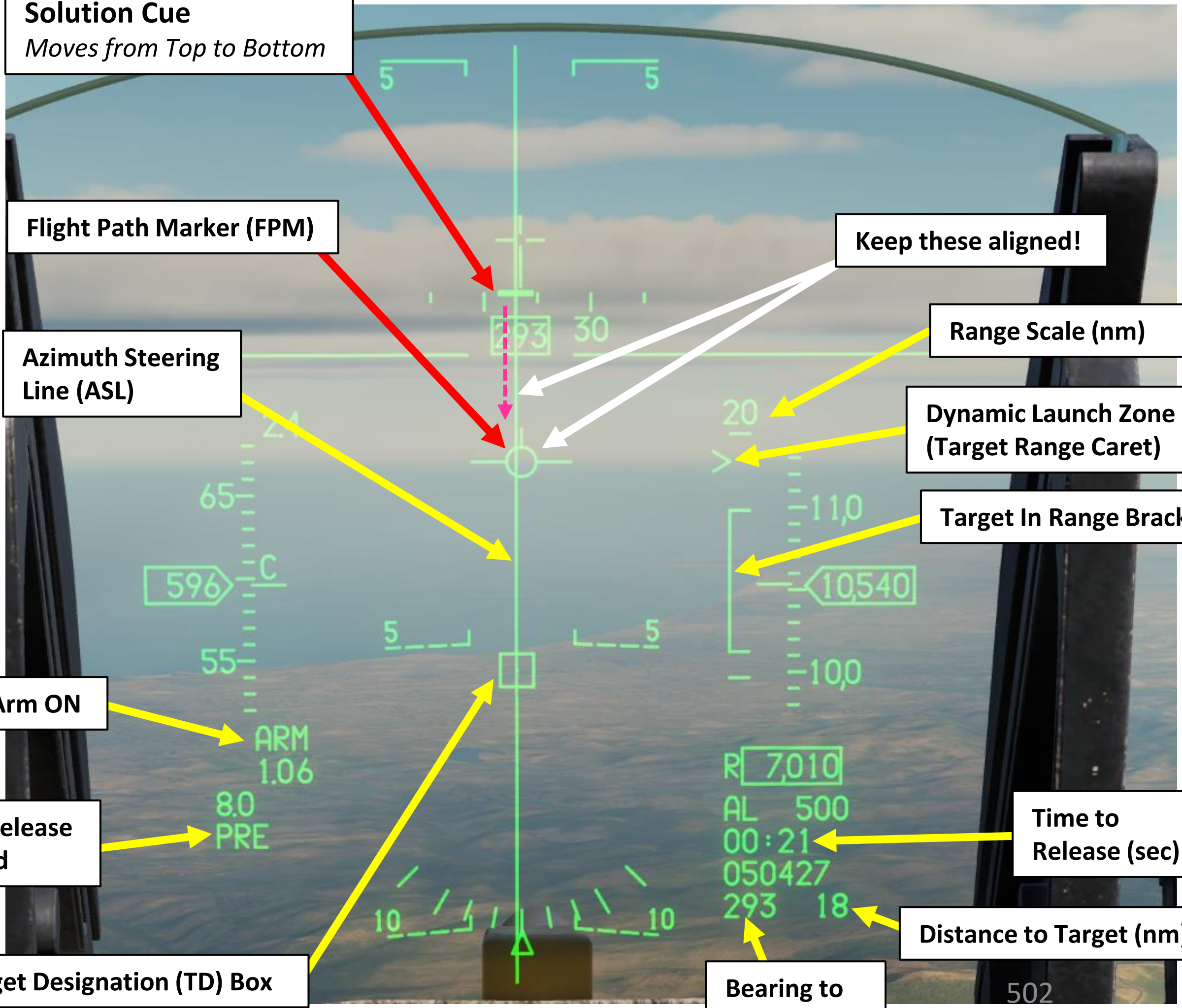


2.8.1 – GBU-38 JDAM
2.8.1.3 – Delivery: Pre-Planned Mode + Targeting Pod

12. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Target is displayed on the Heads-Up Display.
13. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
14. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
15. When Solution Cue falls down towards the Flight Path Marker (FPM) and crosses the FPM, you have entered the maximum range release zone. Once in range, depress and hold the Weapons Release button (RALT+SPACE).
16. During the process of keeping the Weapon Release Button pressed continuously until weapon release, target coordinates and profile data is downloaded to the JDAM kit. If this process is interrupted by releasing the Weapons Release button before the download finishes, the weapon will become a hung store and will be unusable.
17. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line.
18. The JDAM is only released after the Solution Cue has passed the Flight Path Marker.



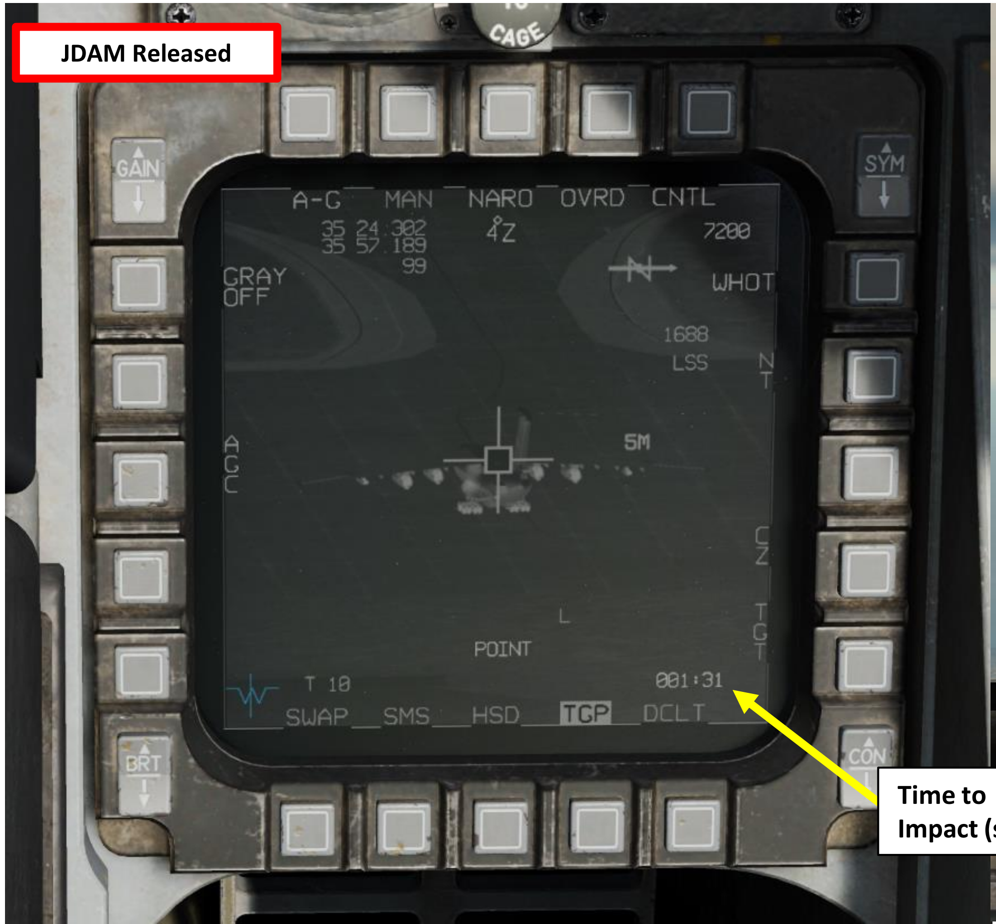


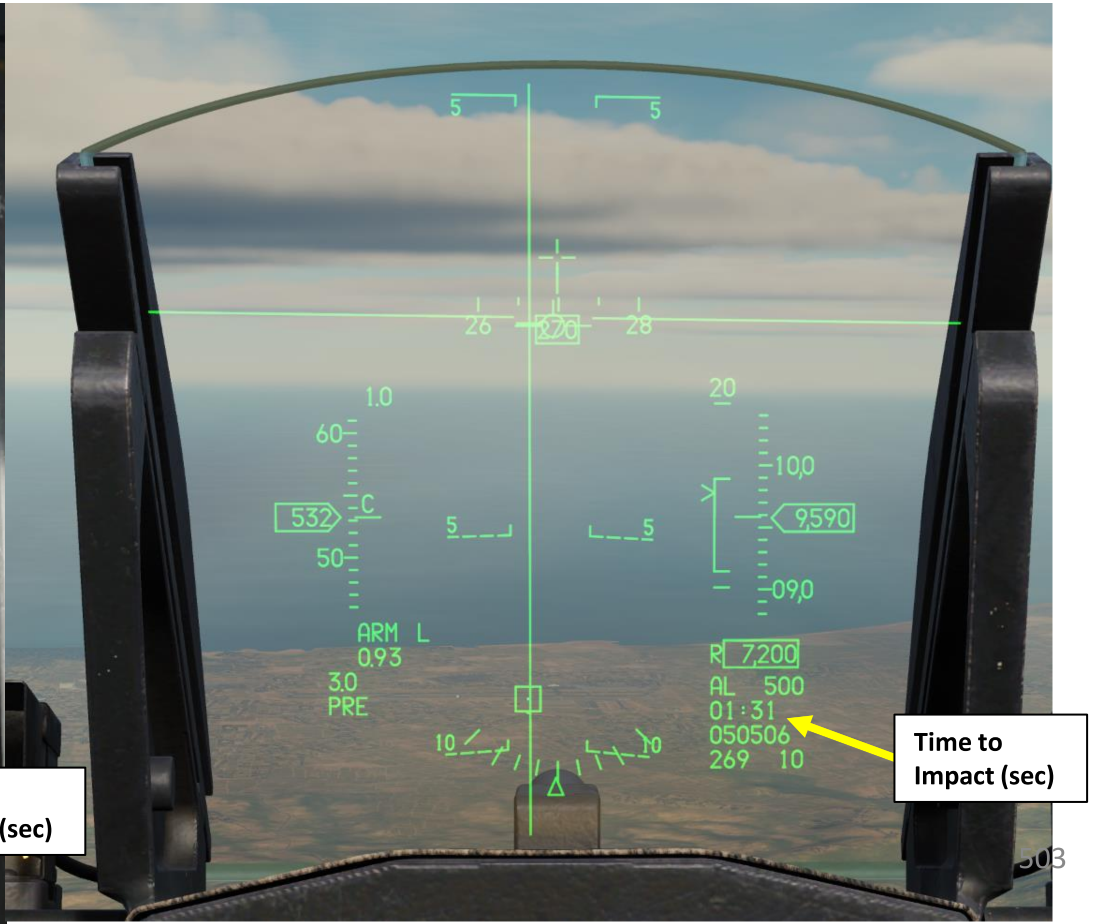


2.8.1 – GBU-38 JDAM
2.8.1.3 – Delivery: Pre-Planned Mode + Targeting Pod

19. Once JDAM is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the Targeting Pod and HUD. The JDAM will then guide itself towards the coordinates designated previously until impact.

- Note: The weapon is completely fire-and-forget but cannot be steered or re-targeted post-launch.

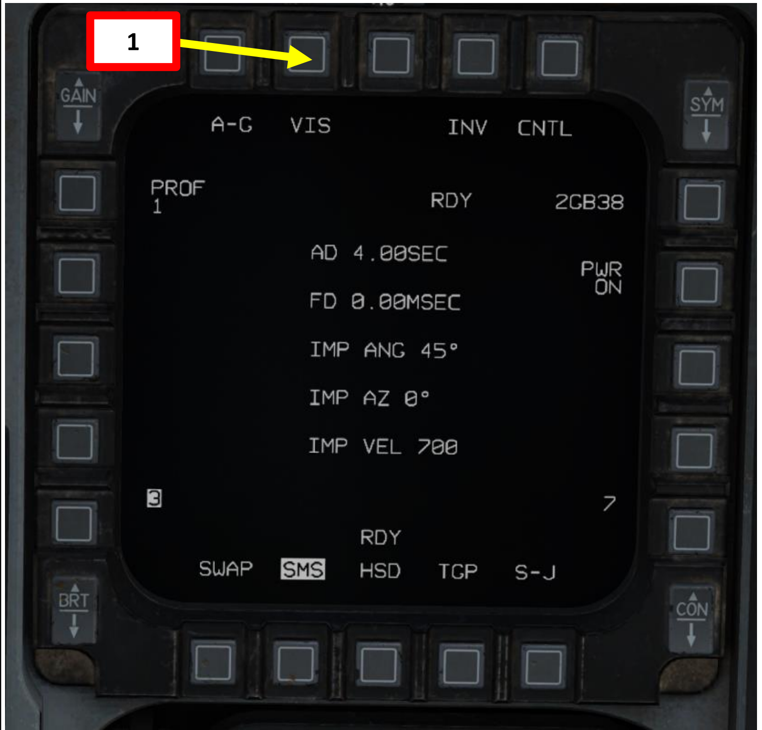


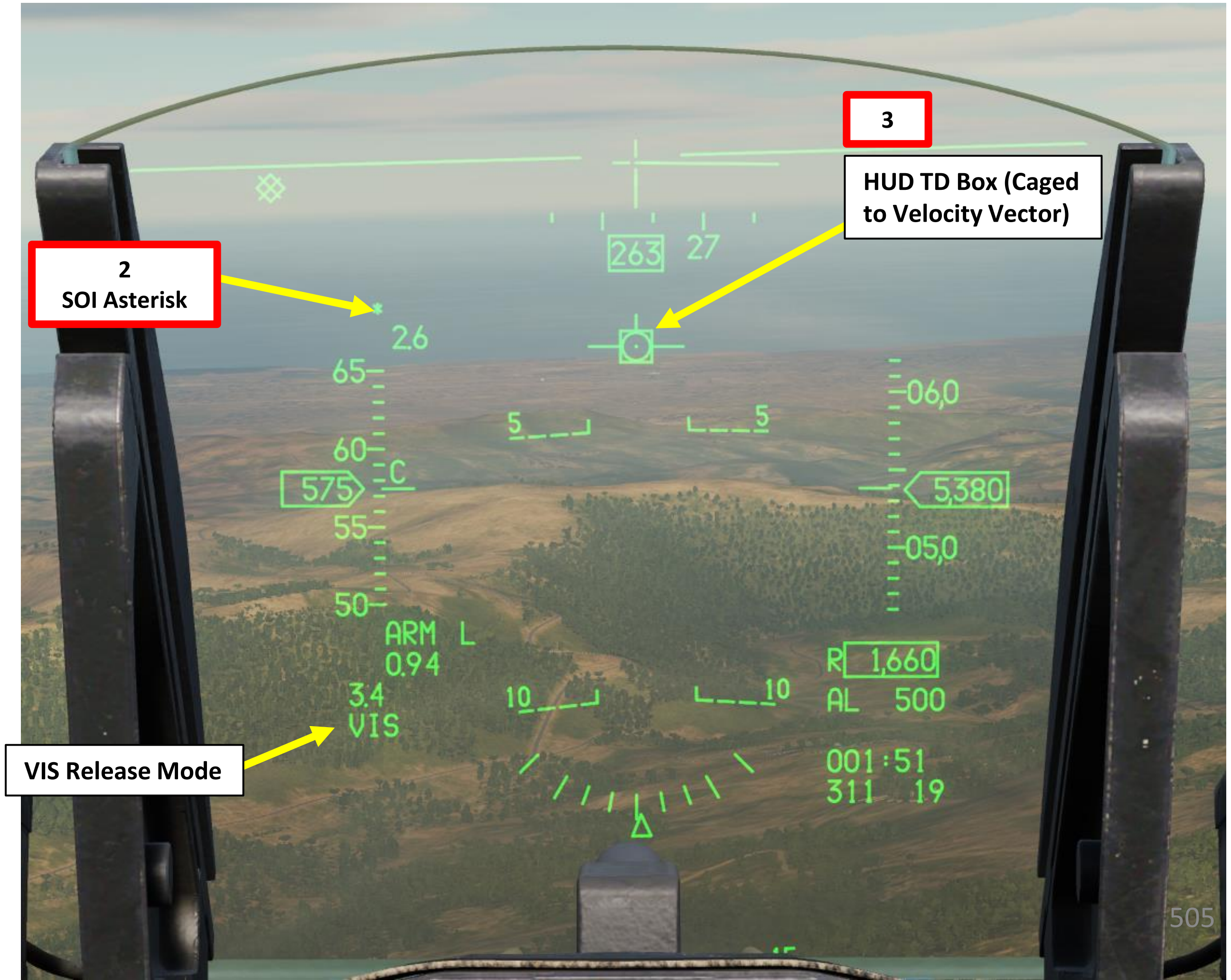


2.8.1 – GBU-38 JDAM
2.8.1.3 – Delivery: Pre-Planned Mode + Targeting Pod

2.8.1 – GBU-38 JDAM
2.8.1.4 – Delivery: Visual Mode

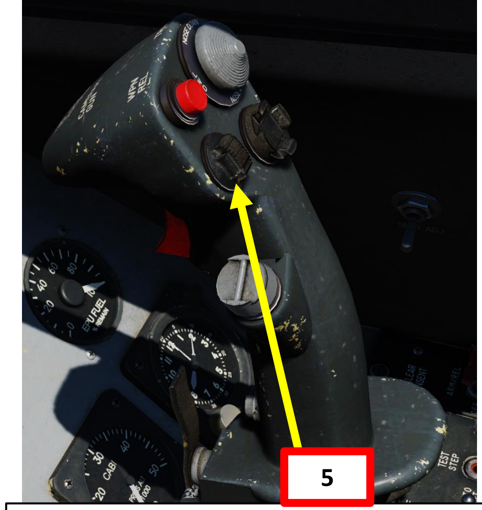
1. From the SMS page, toggle OSB next to Weapon Delivery Mode to select VIS (Visual) mode.
2. When VIS mode is selected, the HUD (Heads-Up Display) is automatically set as the SOI (Sensor of Interest). The SOI Asterisk will indicate when the HUD TD (Target Designation) Box on the HUD can be controlled with HOTAS controls.
3. By default, the Target Designation Box on the HUD will be caged to the velocity vector.

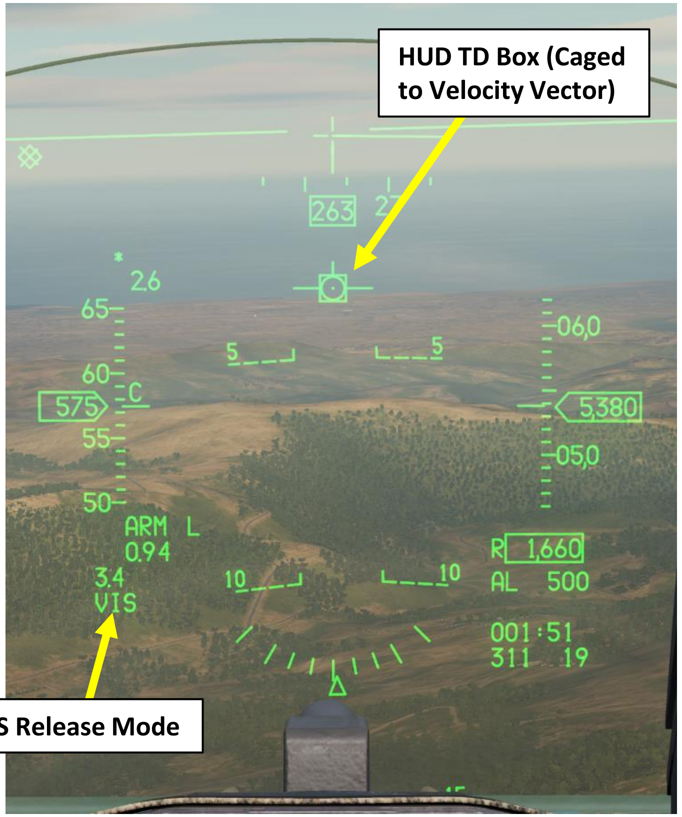


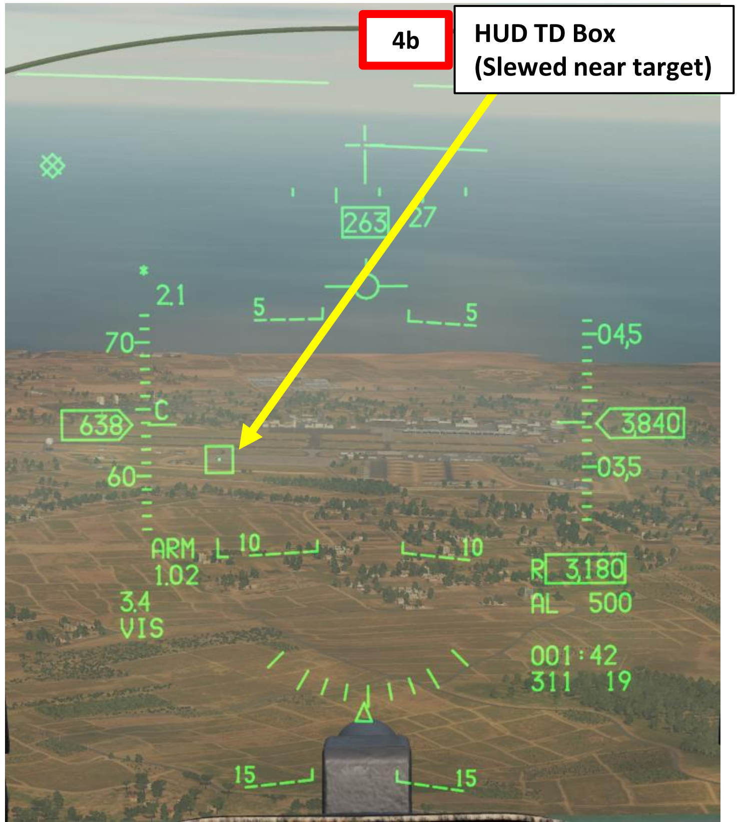


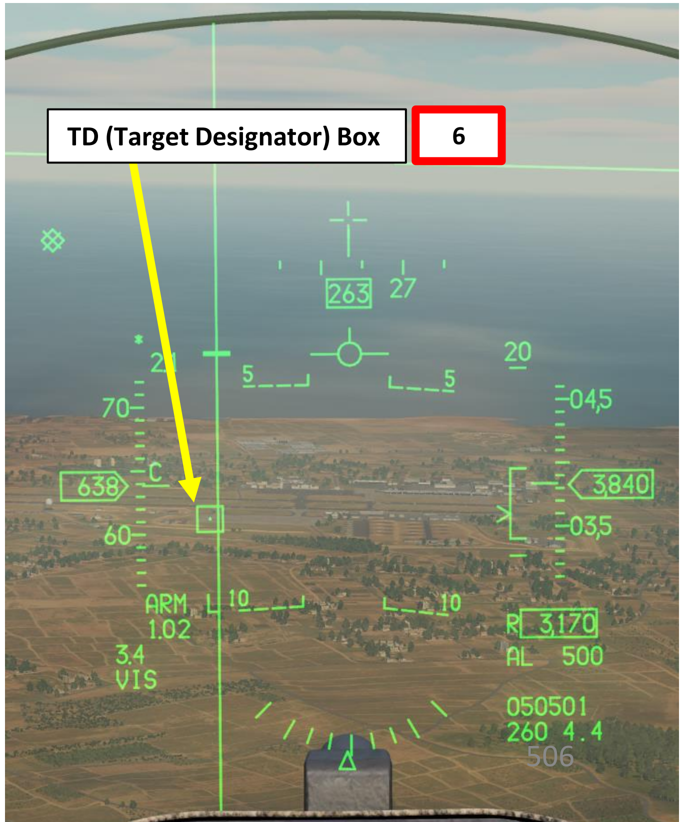
2.8.1 – GBU-38 JDAM
2.8.1.4 – Delivery: Visual Mode

4. Spot the target visually, then slew the HUD TD (Target Designation) Box on the HUD within the vicinity of the target using the Radar Cursor switch. This method is useful if you have no targeting pod equipped.
    - The HUD TD Box is ground stabilized
    - If you want to cage the HUD TD Box on the velocity vector, press TMS DOWN.
5. Press TMS (Target Management Switch) UP to designate the target on the HUD TD Box location.
6. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Target is displayed on the Heads-Up Display with an Azimuth Steering Line (ASL) and a DLZ (Dynamic Launch Zone) indication.



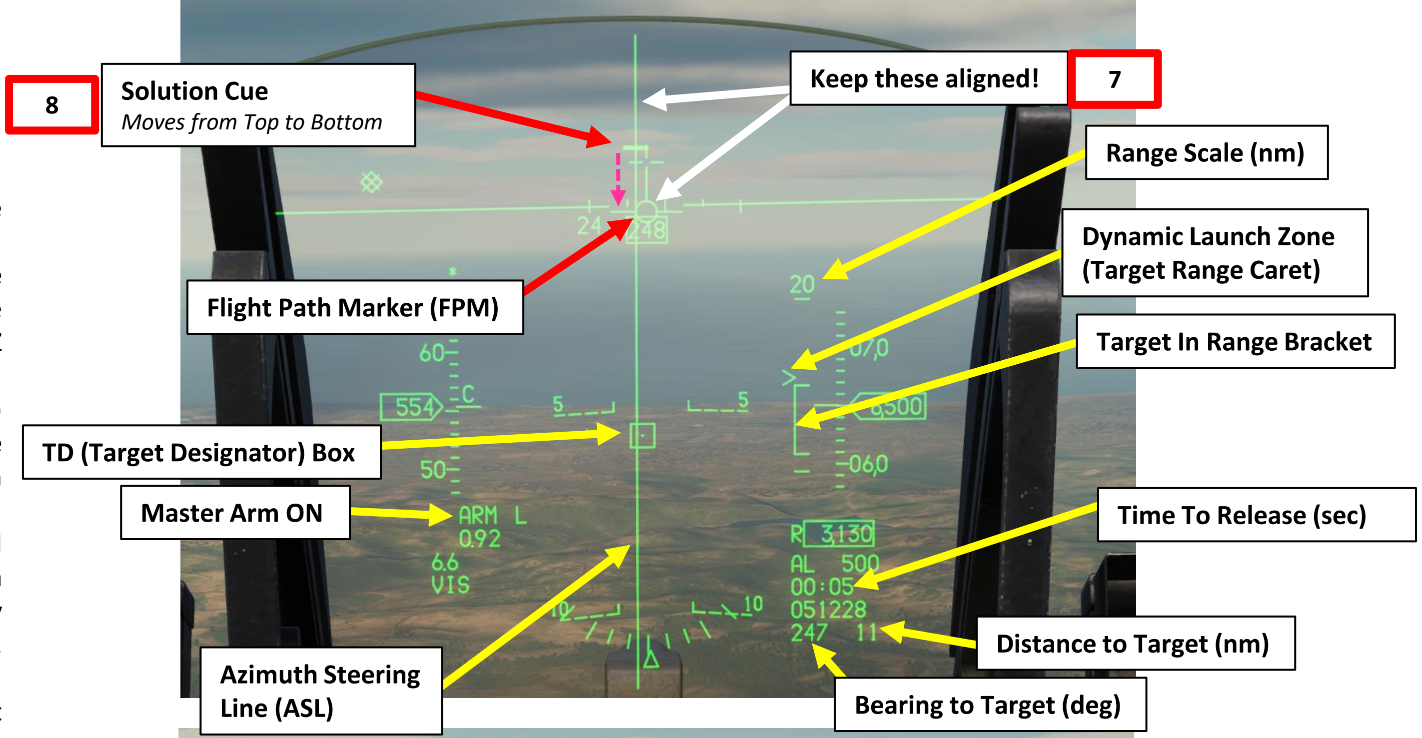


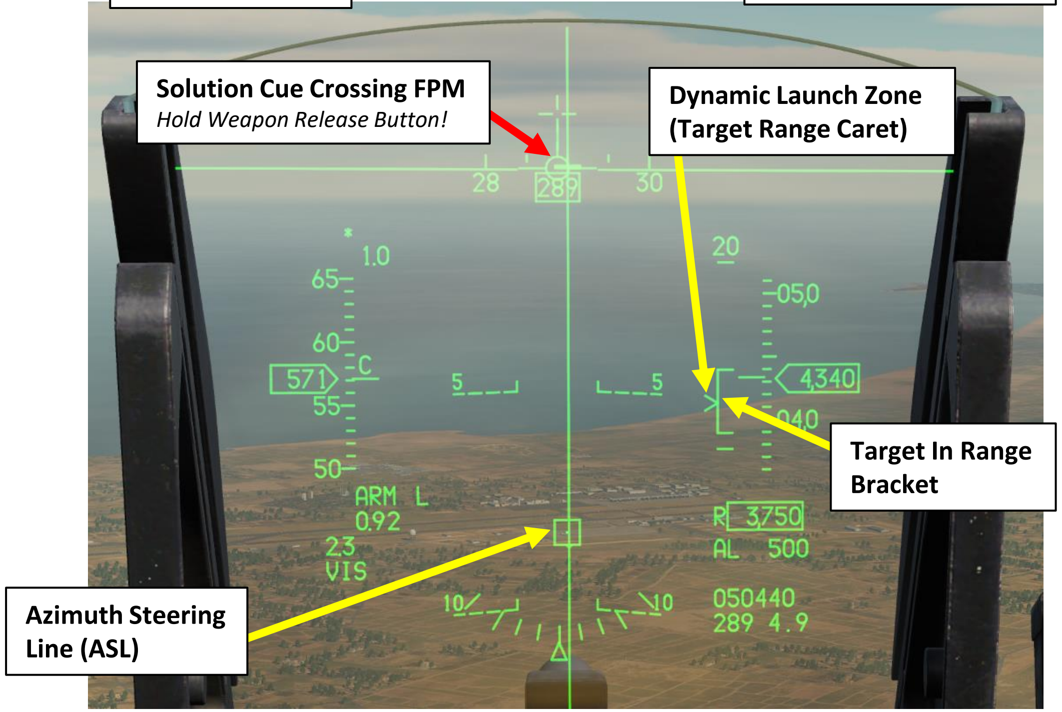


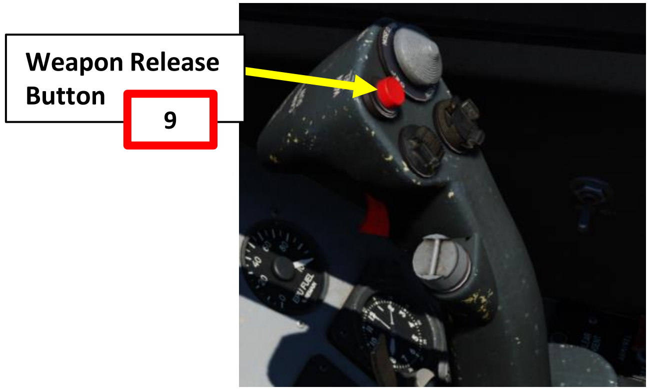


2.8.1 – GBU-38 JDAM
2.8.1.4 – Delivery: Visual Mode

7. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
8. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released. The DLZ (Dynamic Launch Zone) provides ranging information.
9. When Solution Cue falls down towards the Flight Path Marker (FPM) and crosses the FPM, you have entered the maximum range release zone. Once in range, depress and hold the Weapons Release button (RALT+SPACE).
10. During the process of keeping the Weapon Release Button pressed continuously until weapon release, target coordinates and profile data is downloaded to the JDAM kit. If this process is interrupted by releasing the Weapons Release button before the download finishes, the weapon will become a hung store and will be unusable.
11. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line.
12. The JDAM is only released after the Solution Cue has passed the Flight Path Marker.



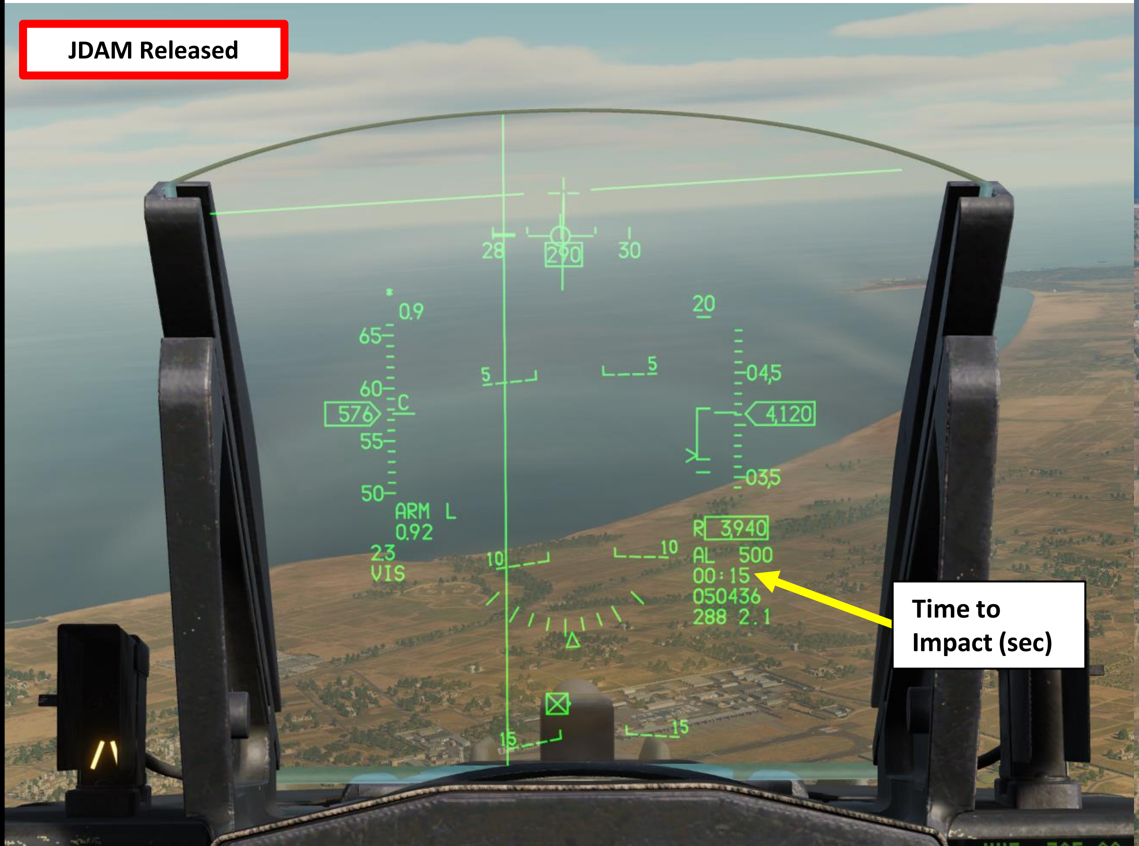




2.8.1 – GBU-38 JDAM
2.8.1.4 – Delivery: Visual Mode

14. Once JDAM is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the Targeting Pod and HUD. The JDAM will then guide itself towards the coordinates designated previously until impact.

- *Note 1: The weapon is completely fire-and-forget but cannot be steered or re-targeted post-launch.*
- *Note 2: You can use the HMCS (Helmet-Mounted Cueing System) with the JDAM or JSOW in VIS mode to designate the target. See Part 10 – HMCS section.*



2.8.2 – AGM-154A JSOW
2.8.2.1 – Introduction

The F-16C is able to employ the Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs and the Joint Standoff Weapon (JSOW) glide bombs. JDAMs are modified general purpose bombs, equipped with a GPS and inertial navigation system (INS) for guidance as well as flight controls. The JSOW has the same guidance and is a bomb with wings to provide lift and maneuvering flight controls. As such, it has a significantly longer range than JDAMs. The JDAMs/JSOWs have (at optimal INS alignment) a margin of error of approximately 16 ft (5 m). JSOWs have a strike capability of almost 70 nautical miles based on release speed and altitude.

Basically, the way to employ JSOWs is to perform a target designation either in Pre-Planned or Visual Mode. Pre-Planned Mode requires a target designation from any valid sensor (targeting pod, an existing steerpoint or markpoint, or even the Fire Control Radar). Visual Mode requires a target designation from the Heads-Up Display (HUD), which implies that you are close enough to spot a target visually. While Visual Mode is much quicker, it is good practice to verify the target designation with appropriate sensors to make sure that you don't drop your ordnance at the wrong place. JDAM operation is almost identical to the JSOW's since they both share Pre-Planned and Visual employment modes.

The warhead of the **AGM-154A** consists of 145 BLU-97/B Combined Effects Bomb (CEB) submunitions. These bomblets have a shaped charge for armor defeating capability, a fragmenting case for material destruction, and a zirconium ring for incendiary effects.

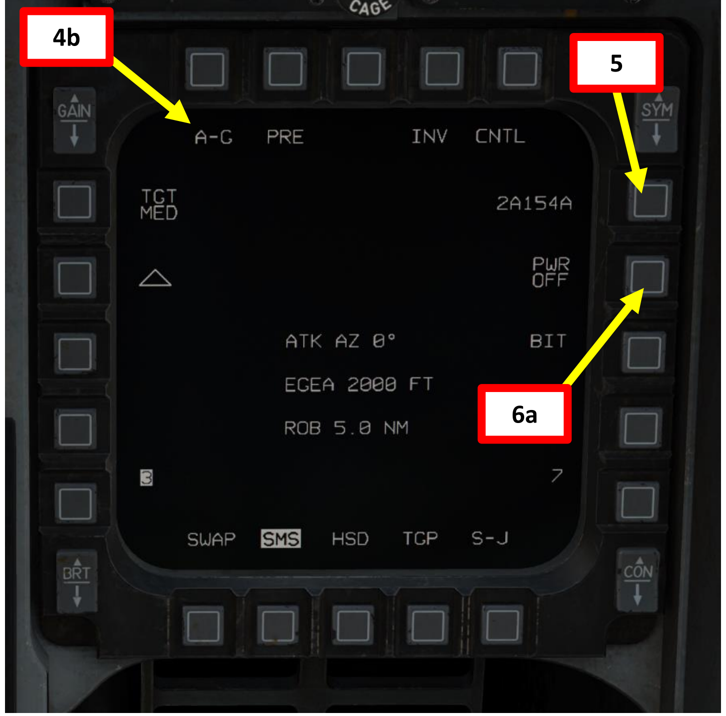
JSOW A-1 with the BLU-111 warhead

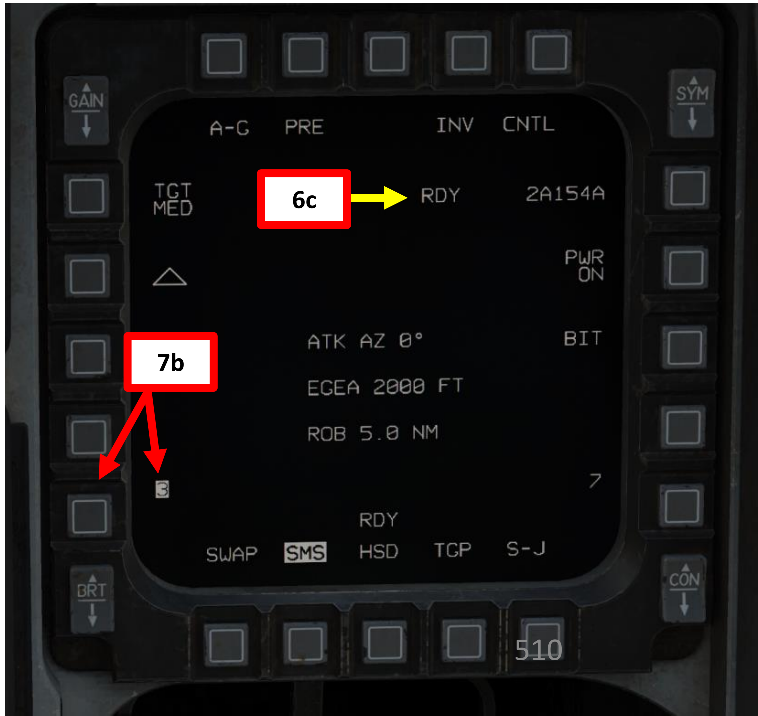
JSOW C with the BROACH warhead

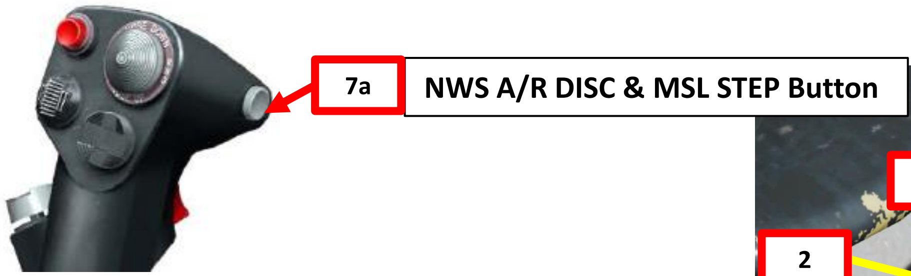
JSOW C-1 with the BROACH warhead and data link

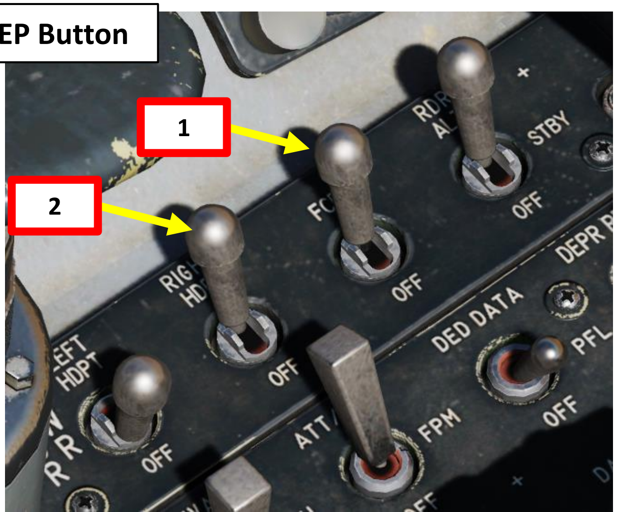
2.8.2 – AGM-154A JSOW
2.8.2.2 – Weapon Preparation

1. Verify that FCR (Fire Control Radar) switch is ON (FWD); the FCR is used for target ranging.
2. If using a targeting pod laser to range the target, set the RIGHT HDPT switch to ON (FWD).
3. Set Master Arm switch – ARM (UP)
4. Select Air-to-Ground Master Mode by pressing the A-G Button on the ICP (Integrated Control Panel). This will configure the Fire Control Radar, Targeting Pod and displays for air-to-ground attacks.
5. On the SMS (Stores Management Set) page, select AGM-154 JSOWs (A154A) by toggling weapons with the OSB (Option Select Button) adjacent to the Selected Weapon option.
6. Power on AGM-154s by pressing OSB next to PWR. When countdown starting from “A10” disappears and “PWR ON” and “RDY” indications are visible, power-up sequence is complete.
7. Select desired JSOW station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).





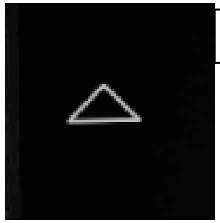




2.8.2 – AGM-154A JSOW
2.8.2.2 – Weapon Preparation

8. Target Size (TGT) is currently preset to MED (Medium). We can leave it as is.
9. Press on OSB next to Ripple Setting (triangle) to toggle between Single Release (single triangle), Pairs Release with Longitudinal Separation (two triangles lined up vertically) or Pairs Release with Lateral Separation (two triangles lined up horizontally). In this example, we will select Longitudinal Separation.
10. Enter impact spacing (in feet) if a longitudinal or a lateral separation ripple setting is selected.
    a) Press OSB next to the Ripple Spacing Parameter
    b) Use OSBs to type in the spacing (200 ft)
    c) Press OSB next to ENTR to confirm spacing selection.

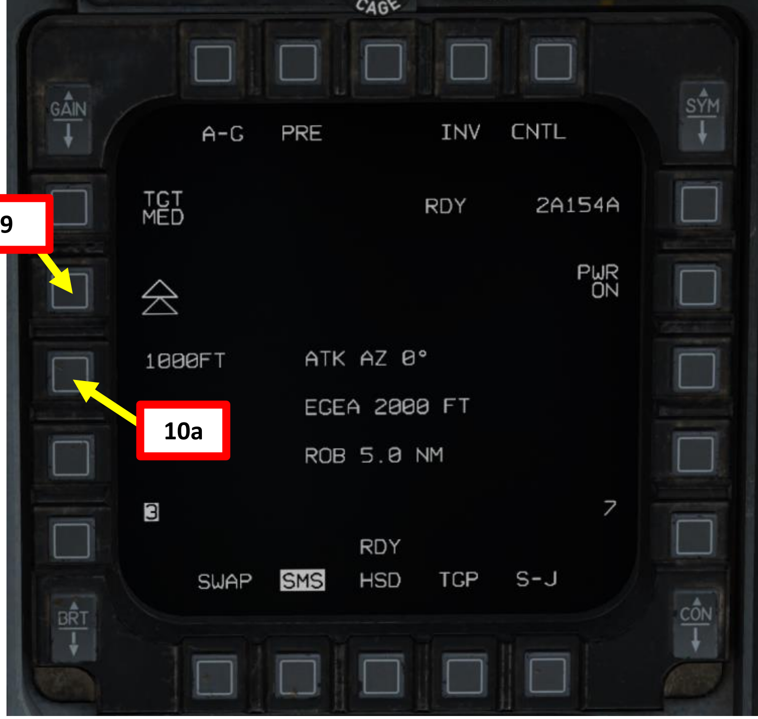
9

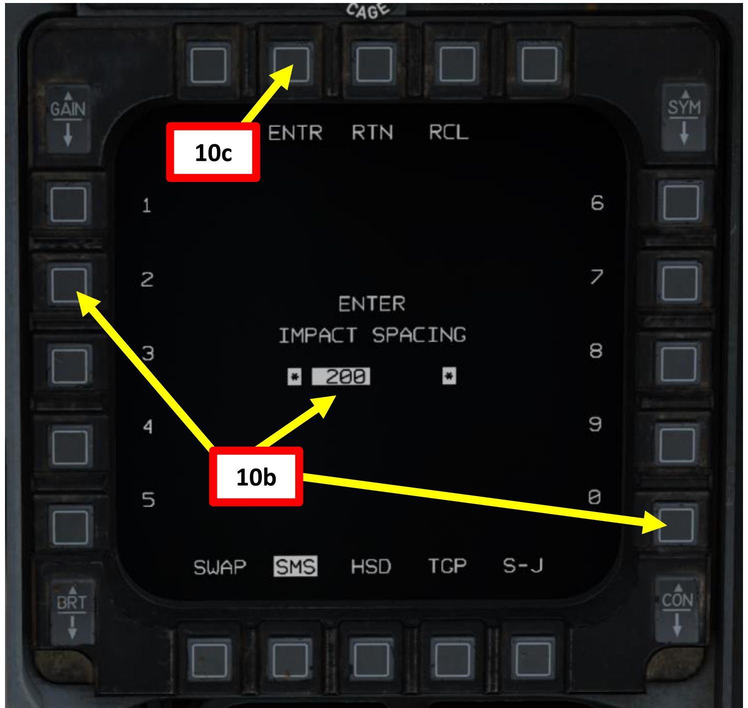


Single Release Setting

Pairs Release Setting
With Longitudinal Separation

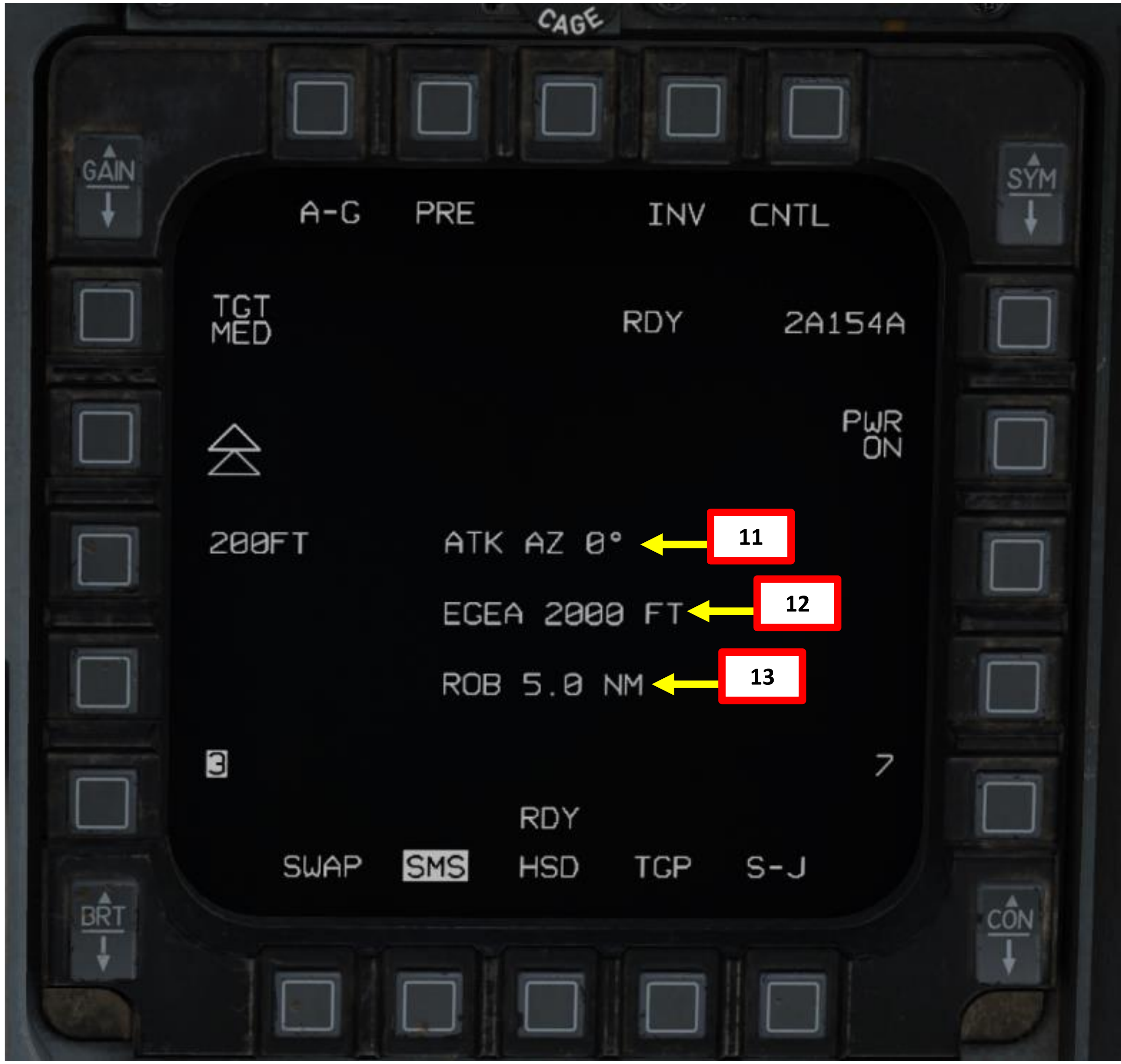
Pairs Release Setting
With Lateral Separation





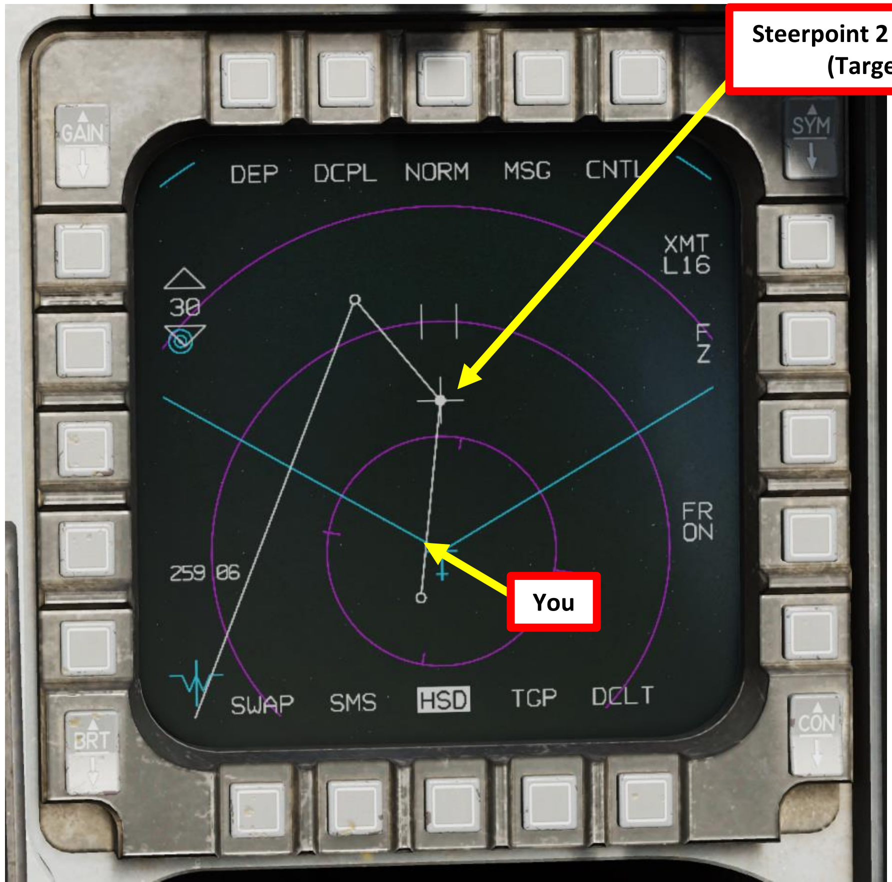
2.8.2 – AGM-154A JSOW
2.8.2.2 – Weapon Preparation

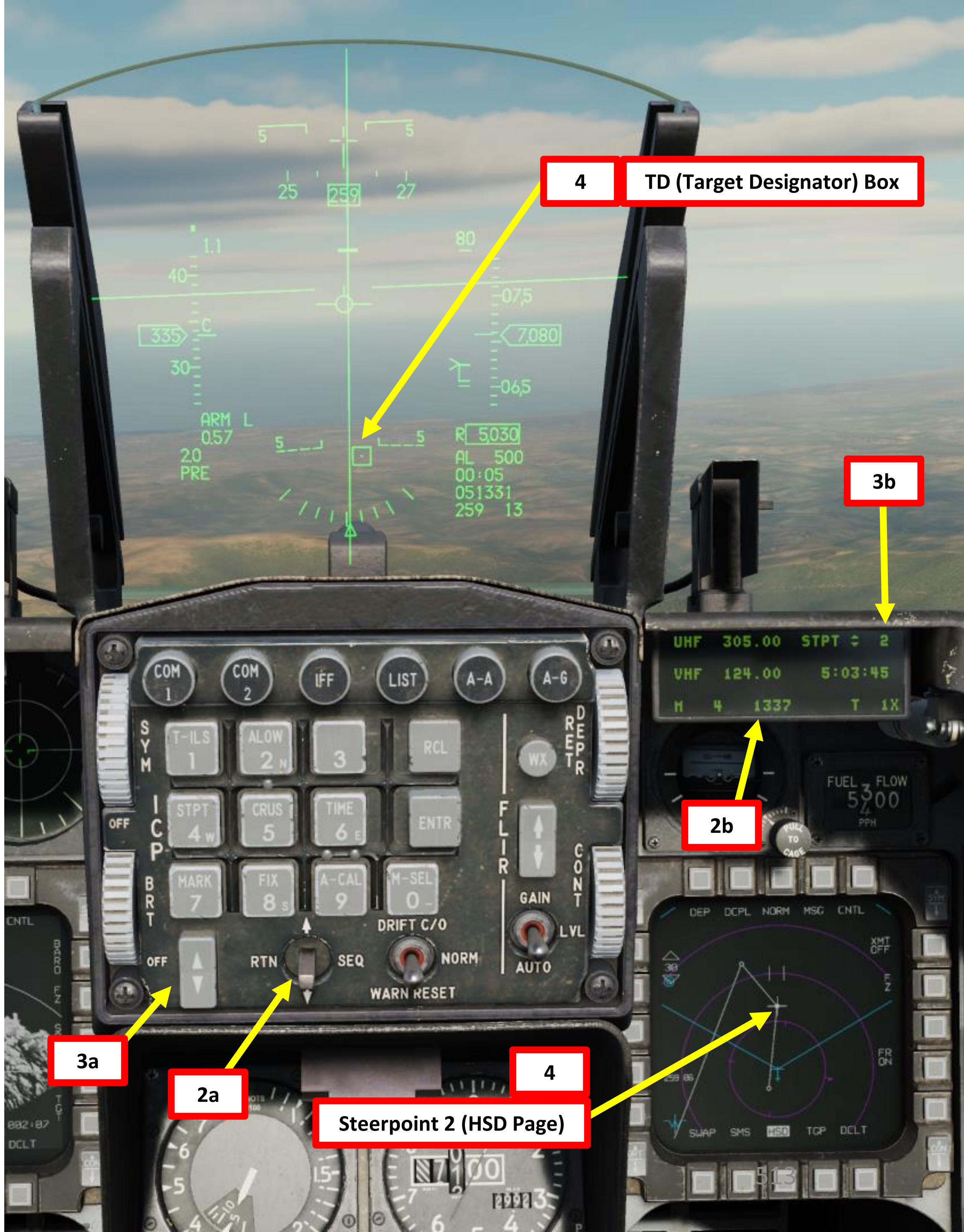
11. ATK AZ (Attack Azimuth) Setting is currently not simulated (shown set to 0 deg).
12. EGEA (End Game Entry Altitude) Setting is currently not simulated (shown set to 2000 ft).
13. ROB (Range On Bearing) Setting is currently not simulated (shown set to 5.0 nm).



2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

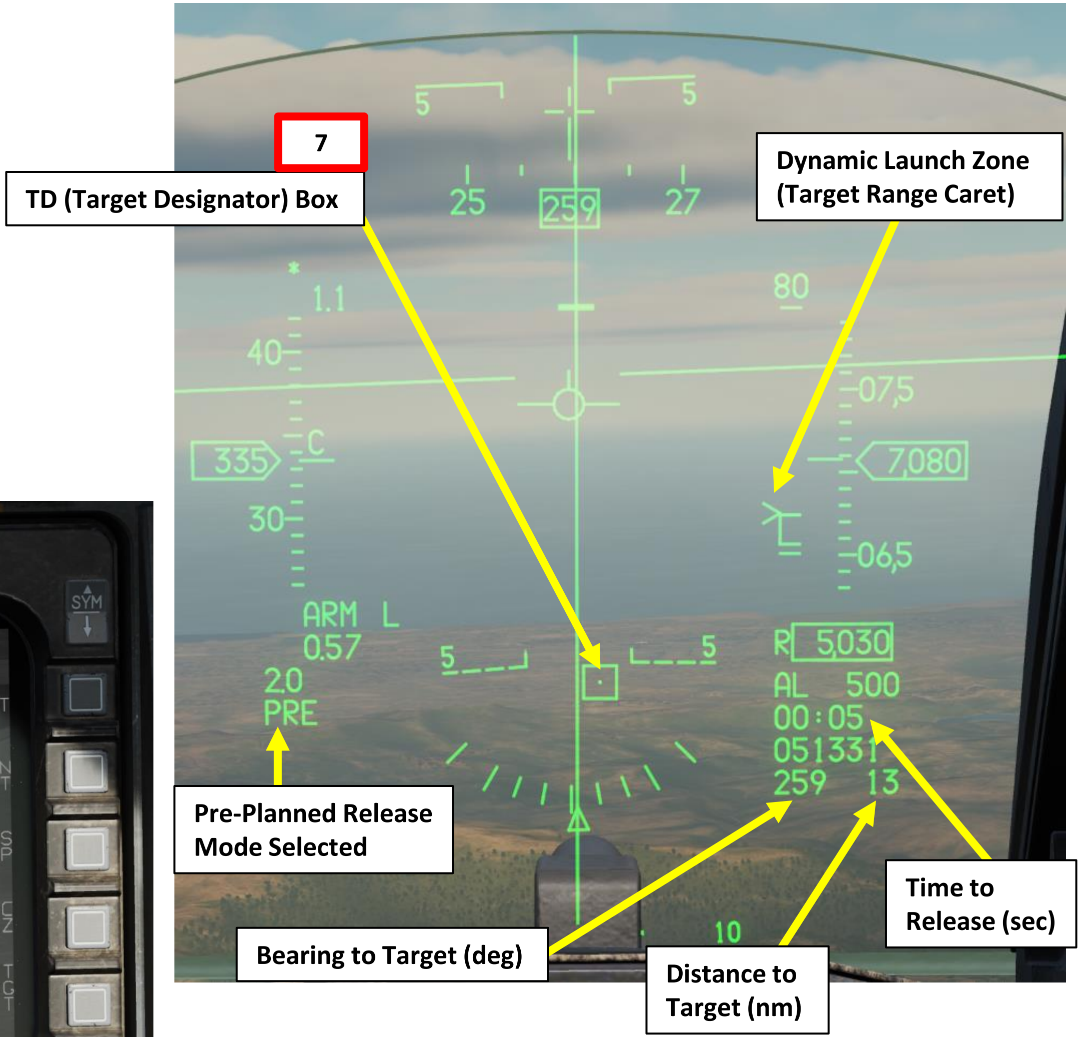
1. We will be attacking a target that is directly on a steerpoint that is already in our flight plan (i.e. Steerpoint No. 2). To enter Steerpoint coordinates manually, see the Navigation section. Another option would be to designate a markpoint (data stored in steerpoints No. 26 through No. 30) and use it as a reference.
2. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
3. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 2.
4. Steer towards selected Steerpoint using cues on the HUD and HSD (Horizontal Situation Display) page.





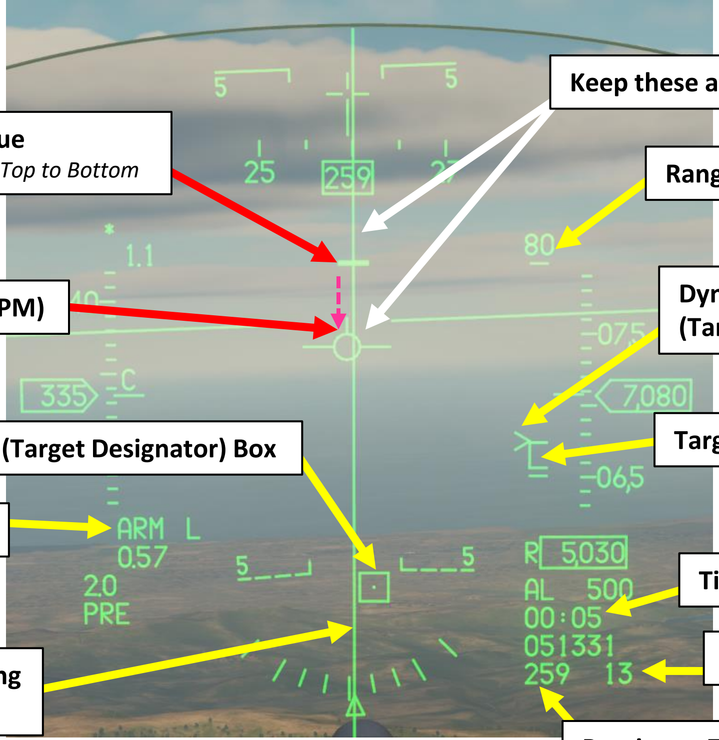
2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

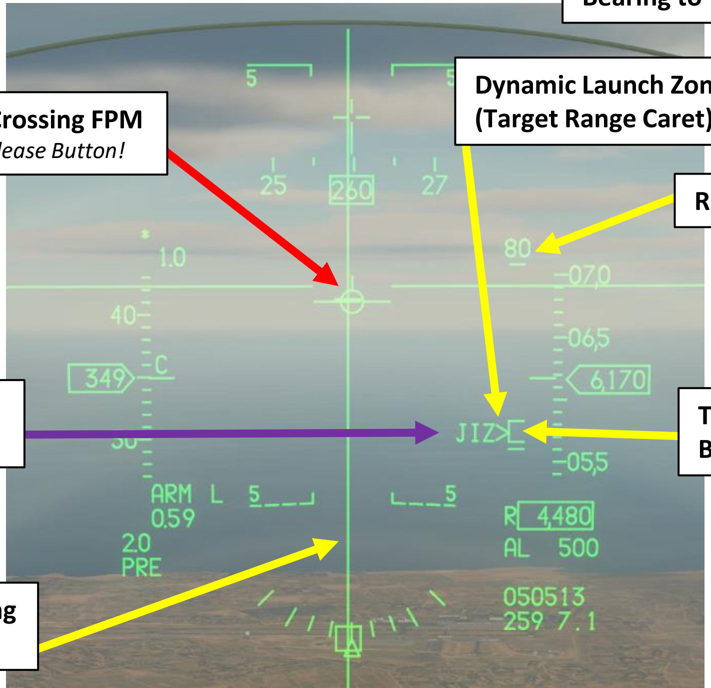
5. From the SMS page, toggle OSB next to Weapon Delivery Mode to select PRE (Pre-Planned) mode.
6. If desired, press OSB next to TGP to select Targeting Pod feed page. This will allow you to have a better view of the steerpoint from the targeting pod, which is slaved to the steerpoint. In this case, we have a clear visual on a tank column.
7. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Target is displayed on the Heads-Up Display.



2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

8. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
9. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
10. When Solution Cue falls down towards the Flight Path Marker and the "JIZ" indication (JSOW In Zone) is visible, you have entered the maximum range release zone. Once in range, depress and hold the Weapons Release button (RALT+SPACE).
11. During the process of keeping the Weapon Release Button pressed continuously until weapon release, target coordinates and profile data is downloaded to the JSOW kit. If this process is interrupted by releasing the Weapons Release button before the download finishes, the weapon will become a hung store and will be unusable.
12. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line.
13. The JSOW is only released after the Solution Cue has passed the Flight Path Marker.





2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

14. Once JSOW is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the Targeting Pod and HUD. The JSOW will then guide itself towards the coordinates designated previously until impact.

- Note: The weapon is completely fire-and-forget but cannot be steered or re-targeted post-launch.

2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

JDAM/JSOW RIPPLE

Note: If you want to launch multiple JSOWs (or JDAMs) in quick succession, a good technique is to create markpoints beforehand. See [Part 16 – Navigation Section for markpoint creation tutorials](). Once target coordinates are stored, it is quick and easy to switch between markpoints/steerpoints and launch your GPS-guided ordnance.

Chazflyz has a good tutorial on how to create markpoints and ripple launch.
See video tutorial here: https://youtu.be/I95AQP9P9zU

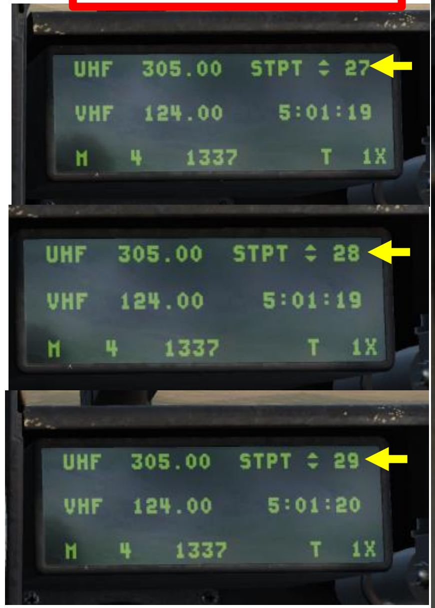
The following pages will show you the general concepts behind this technique.

2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

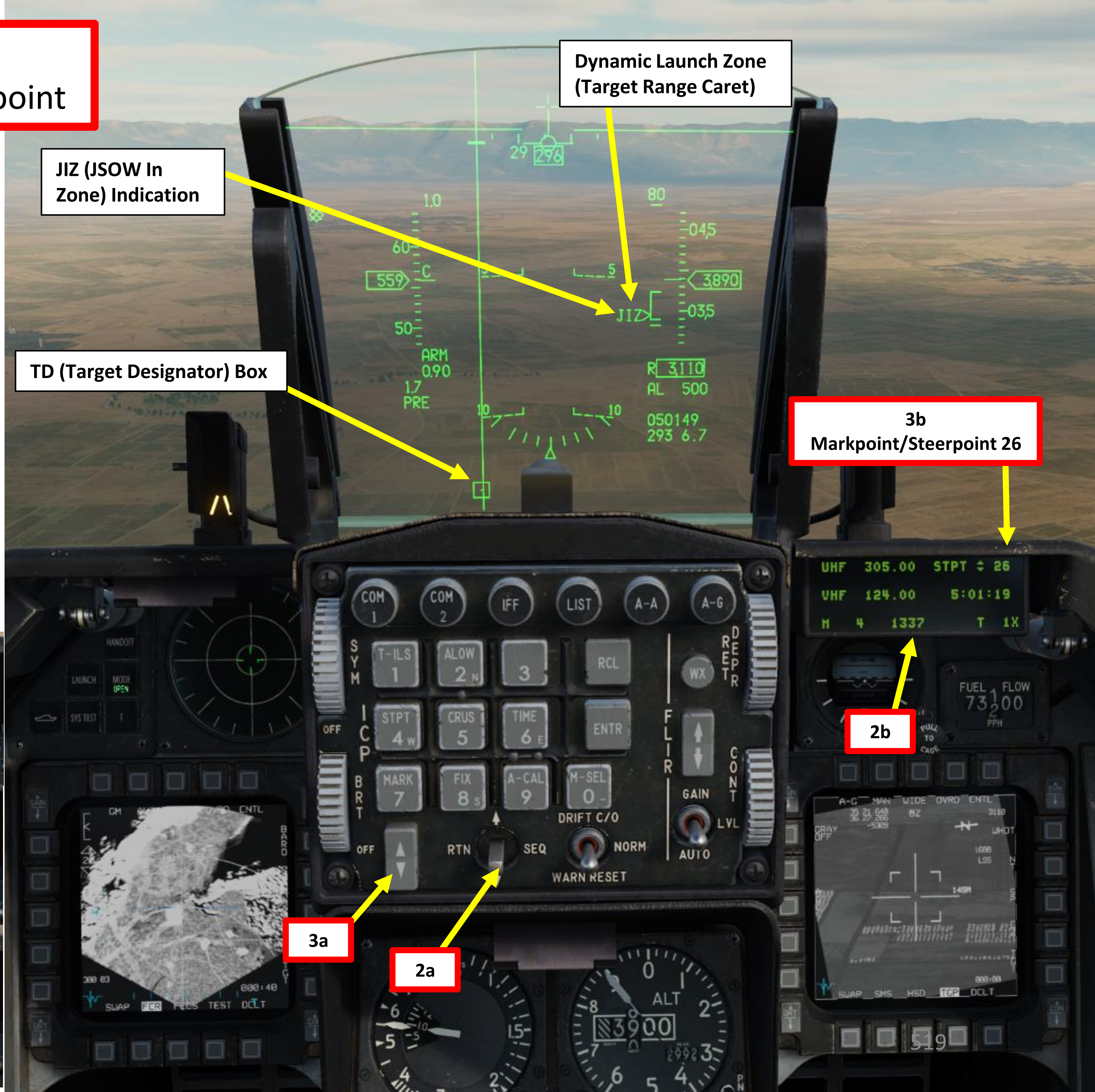
JDAM/JSOW RIPPLE

1. Let's assume we have designated four markpoints and that their coordinates are stored in steerpoints No. 26, 27, 28 and 29. Up to five markpoints can be designated and stored into steerpoints 26 through 30. JSOWs should be set to PRE (Pre-Planned) Mode.
2. Select CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN
3. Select desired waypoint using the DED (Data Entry Display) Increment/Decrement Switch. We will select Steerpoint 26.
4. When Solution Cue falls down towards the Flight Path Marker and the "JIZ" indication (JSOW In Zone) is visible, depress and hold the Weapons Release button (RALT+SPACE). This will drop the first JSOW.
5. Select steerpoint 27 using the DED (Data Entry Display) Increment/Decrement Switch, then repeat step 4 to release second JSOW.
6. Repeat step 5) for steerpoints 28 and 29.

Markpoints/Steerpoints 27, 28 and 29



Weapon Release Button
4



2.8.2 – AGM-154A JSOW
2.8.2.3 – Delivery: Pre-Planned Mode + Steerpoint

JDAM/JSOW RIPPLE

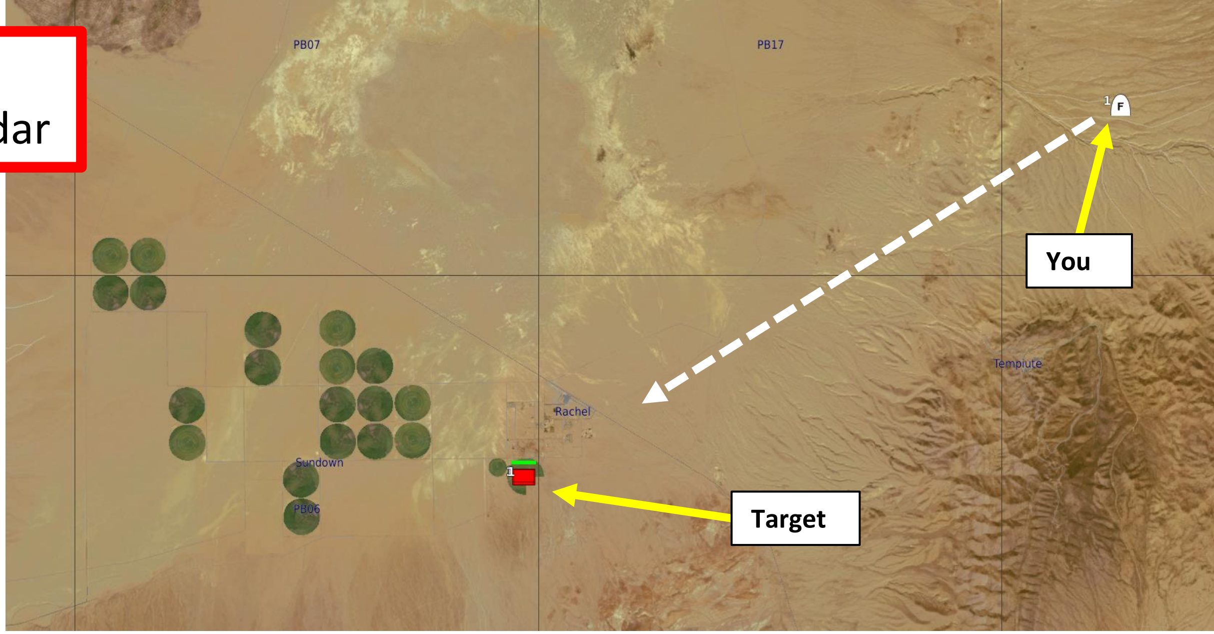
And there you go! You can now launch multiple JSOWs or JDAMs in a single pass.

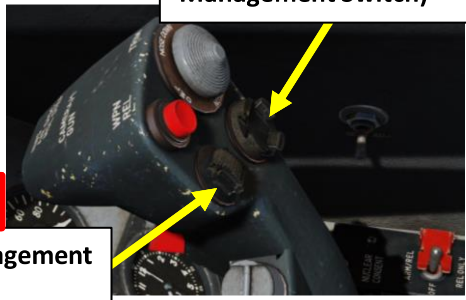
2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

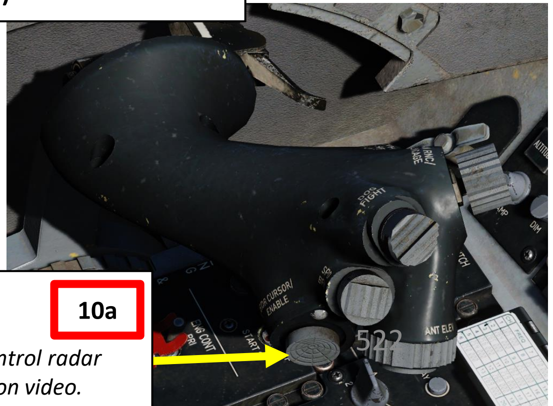
1. We will be attacking a target that is using the air-to-ground radar on a pre-determined target area. Verify that radar is powered on and that A-G Master Mode is selected.
2. From the SMS page, toggle OSB next to Weapon Delivery Mode to select PRE (Pre-Planned) mode.

2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

3. Verify that radar is powered on and that A-G Master Mode is selected.
4. Select FCR page, then select "GM" (Ground Mapping) Mode using OSBs
5. Adjust Gain and Contrast as desired.
6. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
7. The Radar Crosshair/Cursor should be set to the SPI (Sensor Point of Interest) location. In this example, it is set to a selected Steerpoint.
8. **<u>If desired</u>**, press OSB next to "SP" to select Snowplow Mode. The radar will scan directly ahead of the aircraft, independent of the SPI location, and the radar cursor will be fixed at the center of the display. Not using Snowplow means the Radar Crosshair will be set on the current SPI location (like a Steerpoint).
9. **<u>If using Snowplow Mode</u>**, press TMS (Target Management Switch) FWD to ground-stabilize the Radar Crosshair and exit Snowplow mode. This will allow you to move the Radar Crosshair. If not using Snowplow Mode, disregard this step.
10. Use the Radar Cursor/Enable switch to move the Radar Crosshair over the desired region.

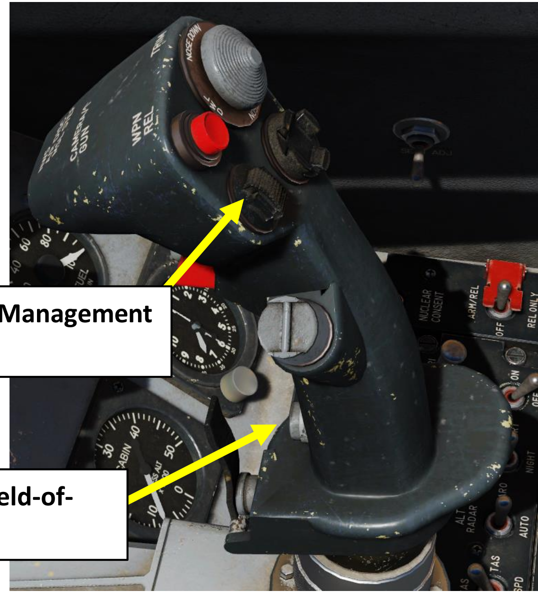


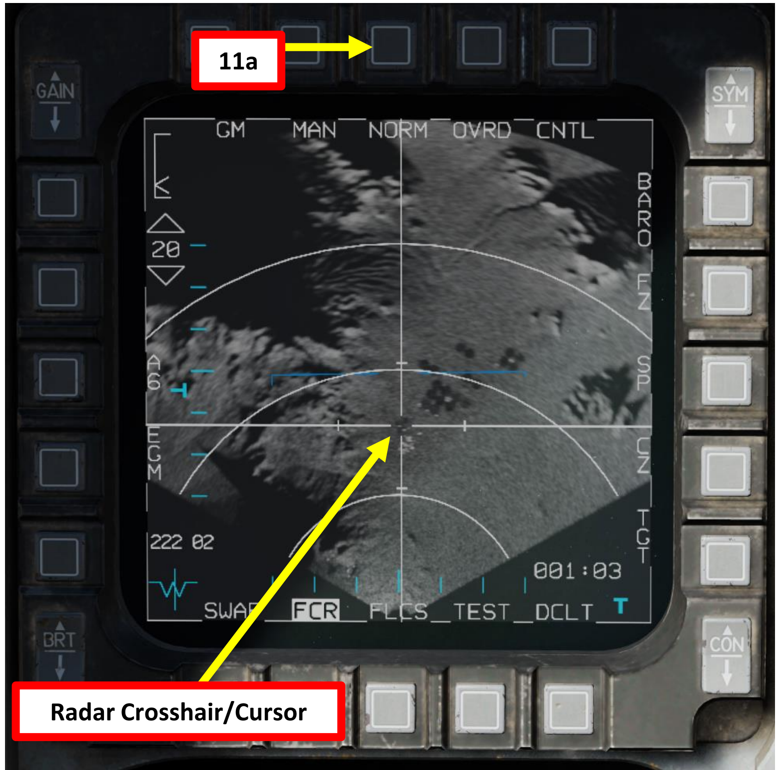


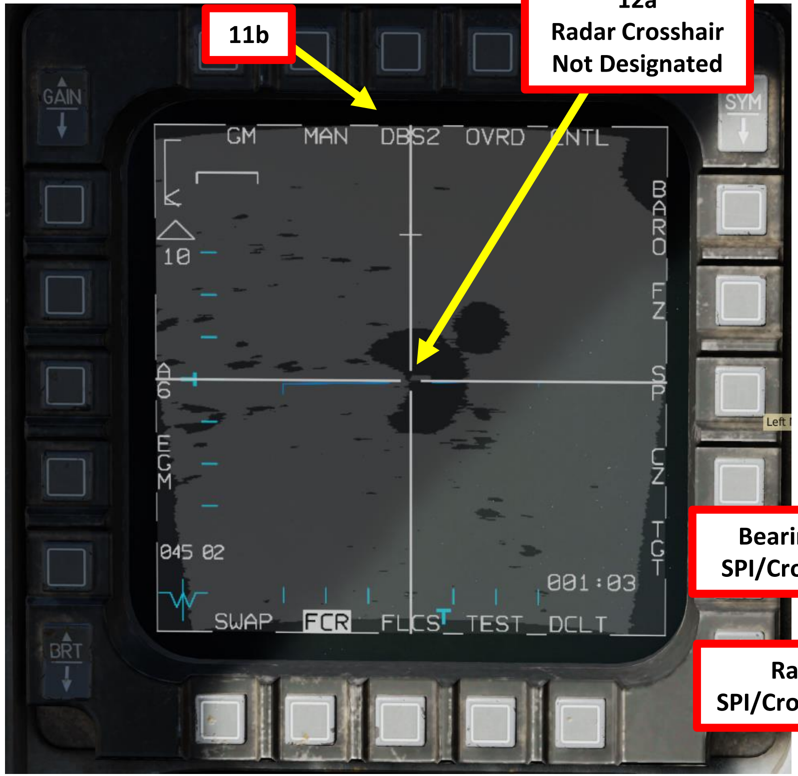


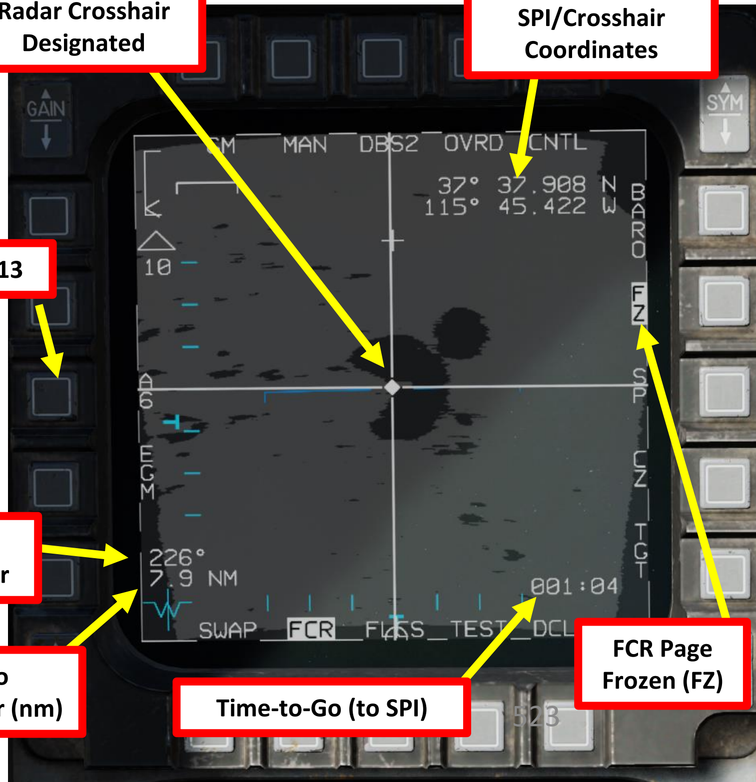
2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

11. Target Designation via the ground Fire Control Radar, also called Fixed Target Track (FTT), can be performed from any air-to-ground radar Ground Mapping mode (NORM, EXP, DBS1, DBS2). If you want to use Expanded sub-modes, either press the Expand/FOV Button or use the OSB next to the Radar Sub-Mode Selector to switch to desired Sub-Mode. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded. If you want to return to NORM (Non-Expanded), you can toggle between other Expanded Modes using the Expand/FOV Button.
12. To designate target on Radar Crosshair position, press TMS (Target Management Switch) UP. This will perform a ground-stabilized Fixed Target Track (FTT) and freeze (FZ) the FCR image.
13. Adjust Radar Scan Azimuth – As desired. Smaller azimuth means a faster update.







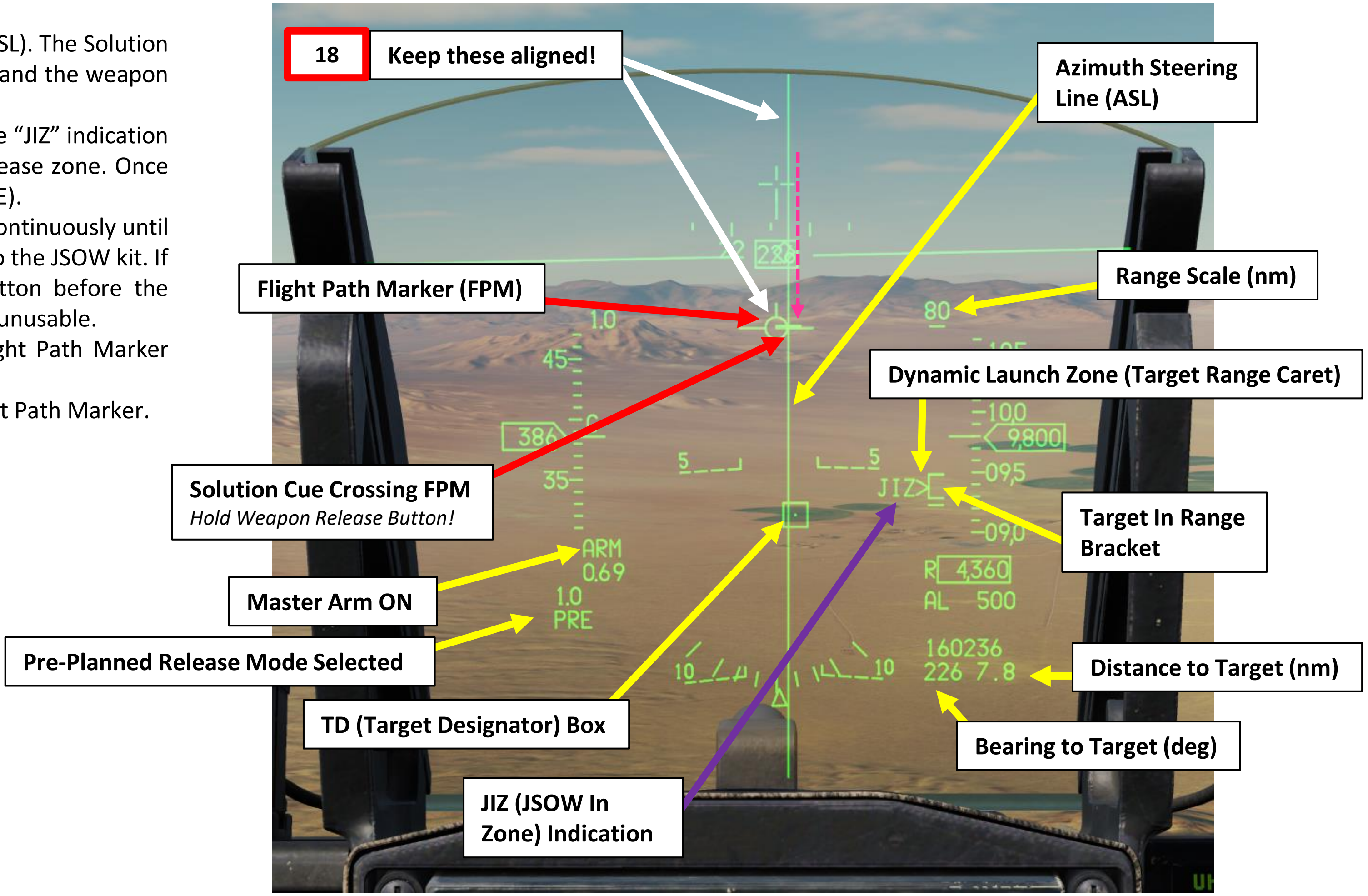


2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

14. When in FTT, the designated location becomes the SPI. The radar will continue to track the target location while line-of-sight (LOS) is maintained. If LOS is lost, the radar will coast for 10 seconds before the radar returns to GM or SEA mode. If the designated location moves outside the radar field of view, the radar will slew to boresight until the target returns into the radar FOV, at which point the radar will reacquire the target. If the target remains outside the radar FOV for 60 seconds, the radar will return to GM or SEA.
15. If you want to slave other sensors like the Targeting Pod to the SPI (Sensor Point of Interest) designated via the radar, first make sure a valid air-to-ground weapon is selected on the SMS (Stores Management Set) page and a valid release mode is selected (CCRP or PRE).
16. Pressing on the Sighting Option Selector (TGT in our case) OSB will slave the Targeting Pod to the FTT (Fixed Target Track). If adjustments are needed, make the TGP SOI (Sensor of Interest) by using the DMS (Display Management Switch) DOWN and designate the target with the TGP. In this example, we will assume the FTT designation with the air-to-ground radar is precise enough and no TGP designation fine tuning is required.

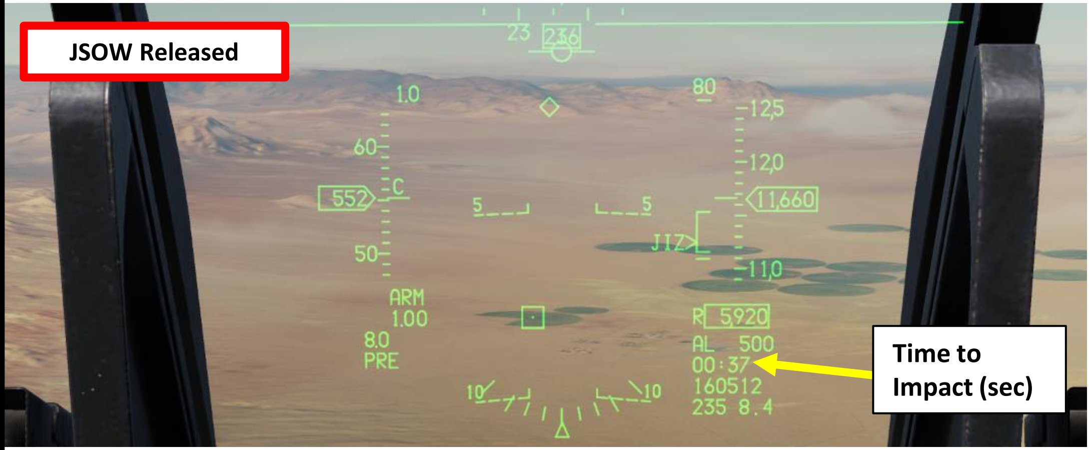
2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

17. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Target is displayed on the Heads-Up Display.
18. Level off the aircraft and keep the Flight Path Marker aligned with the Azimuth Steering Line (ASL). This will align your aircraft with the target.
19. A Solution Cue is displayed at the top of the Azimuth Steering Line (ASL). The Solution Cue will fall down the Azimuth Steering Line as the range decreases and the weapon is about to be released.
20. When Solution Cue falls down towards the Flight Path Marker and the “JIZ” indication (JSOW In Zone) is visible, you have entered the maximum range release zone. Once in range, depress and hold the Weapons Release button (RALT+SPACE).
21. During the process of keeping the Weapon Release Button pressed continuously until weapon release, target coordinates and profile data is downloaded to the JSOW kit. If this process is interrupted by releasing the Weapons Release button before the download finishes, the weapon will become a hung store and will be unusable.
22. As you keep the Weapon Release button held, keep flying the Flight Path Marker over the Azimuth Steering Line.
23. The JSOW is only released after the Solution Cue has passed the Flight Path Marker.



2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

24. Once JSOW is released, the Time-to-Release indication will become a Time-to-Impact indication (in seconds) on the HUD. The JSOW will then guide itself towards the coordinates designated previously until impact.
    - Note: The weapon is completely fire-and-forget but cannot be steered or re-targeted post-launch.

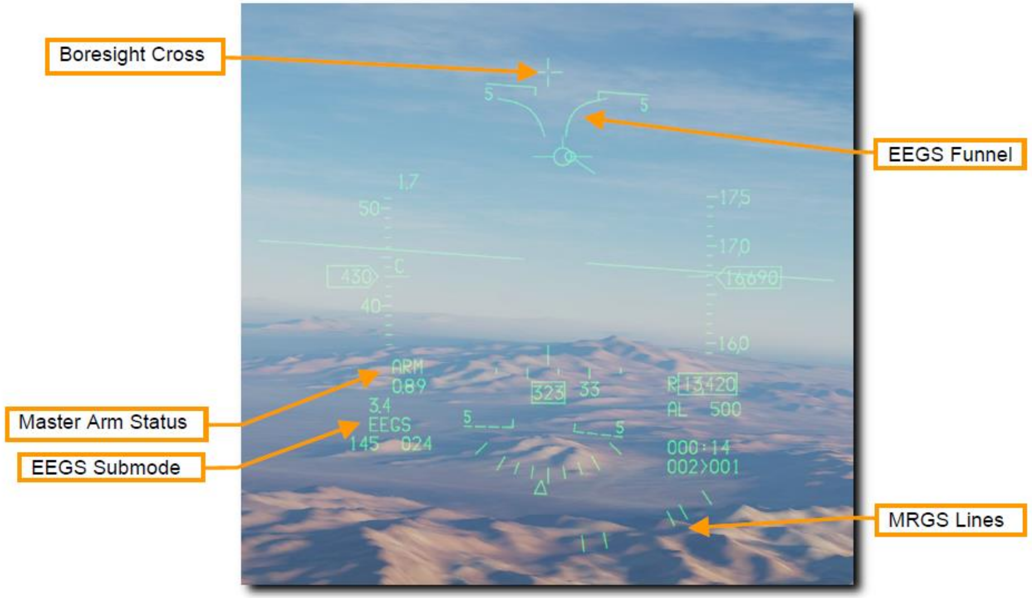


2.8.2 – AGM-154A JSOW
2.8.2.4 – Delivery: Pre-Planned Mode + Air-to-Ground Radar

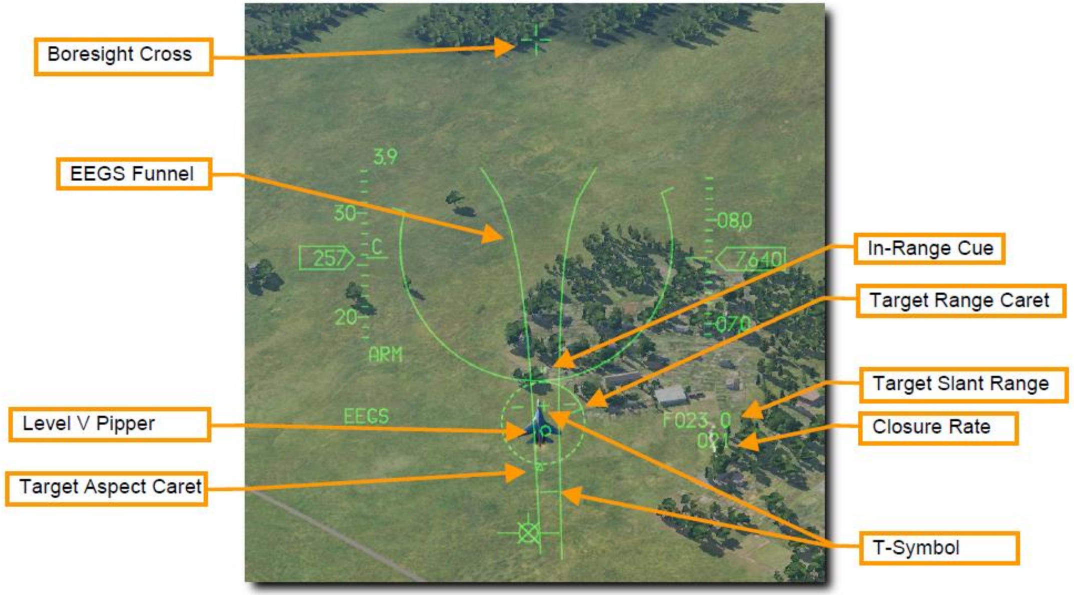
3.1 – M61A1 GUN
3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction

The F-16 is equipped with a 20 mm Gatling-type rotary cannon. The Enhanced Envelope Gun Sight (EEGS) provides the capability to accurately employ the gun at all aspects, with or without a radar lock. The EEGS consists of five levels of displays, each providing an increasing level of capability. Take note that only Levels II and V are relevant to DCS.

- **LEVEL I:** failure mode that only displays the Boresight Cross in the event of a Rate Sensor Unit (RSU) and INS failure. It should almost never be encountered.
- **LEVEL II:** provides a prediction of the bullet path when there is **no radar lock**. The Boresight Cross, EEGS Funnel and Multiple Reference Gunsight (MRGS) Lines are provided.
- **LEVEL III:** intermediate level that leads to the Level V display.
- **LEVEL IV:** intermediate level that leads to the Level V display
- **LEVEL V:** displayed **after radar lock-on** and a firing solution has been computed using that data. Additional references in the HUD include the Target Designator, T-Symbol, Slant Range, Closure Rate and Level V Pipper.



Level II Symbology (no radar lock)



Level V Symbology (with radar lock)

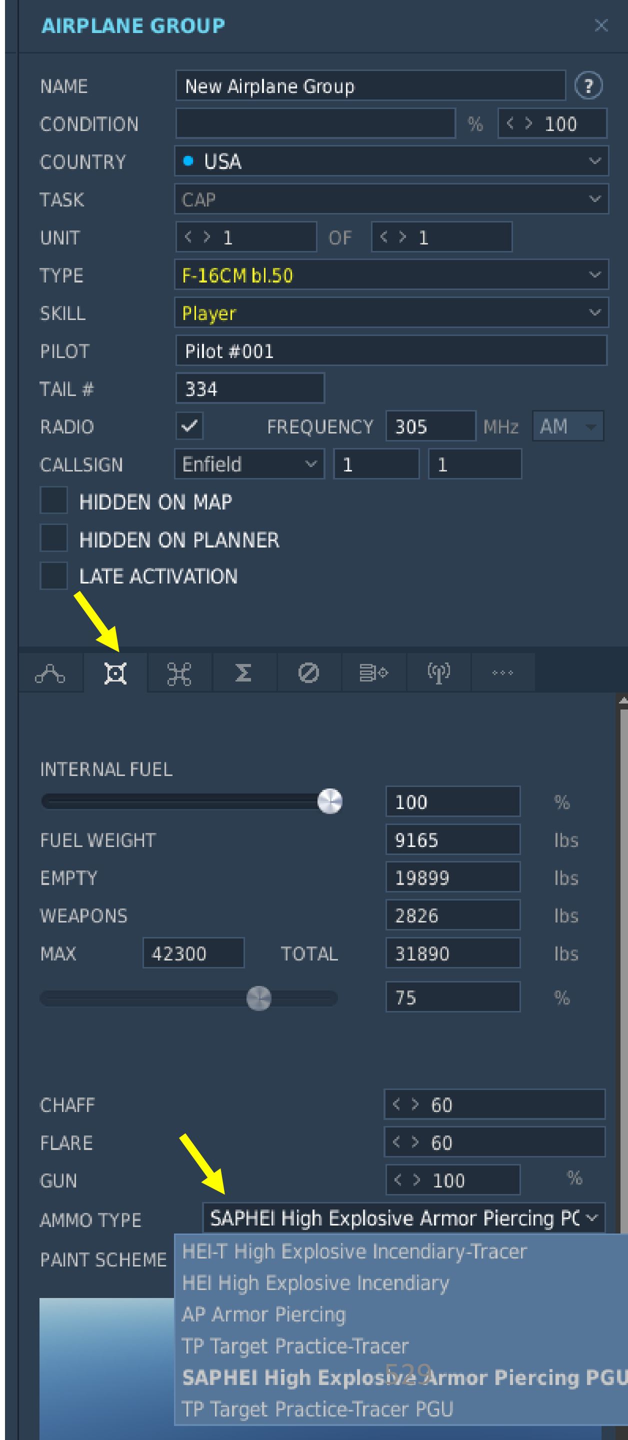
3.1 – M61A1 GUN
3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction

Ammunition types for the gun can only be set through the mission editor. Here are the available ammo types:

- HEI-T: High-Explosive Incendiary-Tracer
- HEI: High-Explosive Incendiary
- AP: Armor Piercing
- TP: Target Practice Tracer
- SAPHEI PGU: High Explosive Armor Piercing PGU
- TP PGU: Target Practice Tracer PGU

SAPHEI PGU Rounds

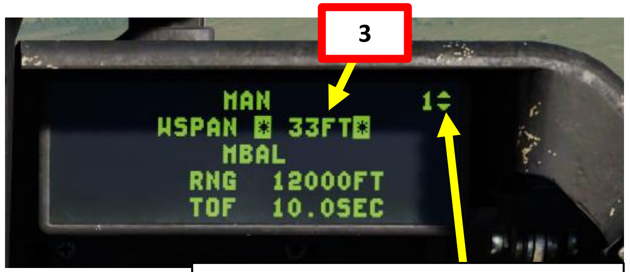
HEI-T Rounds



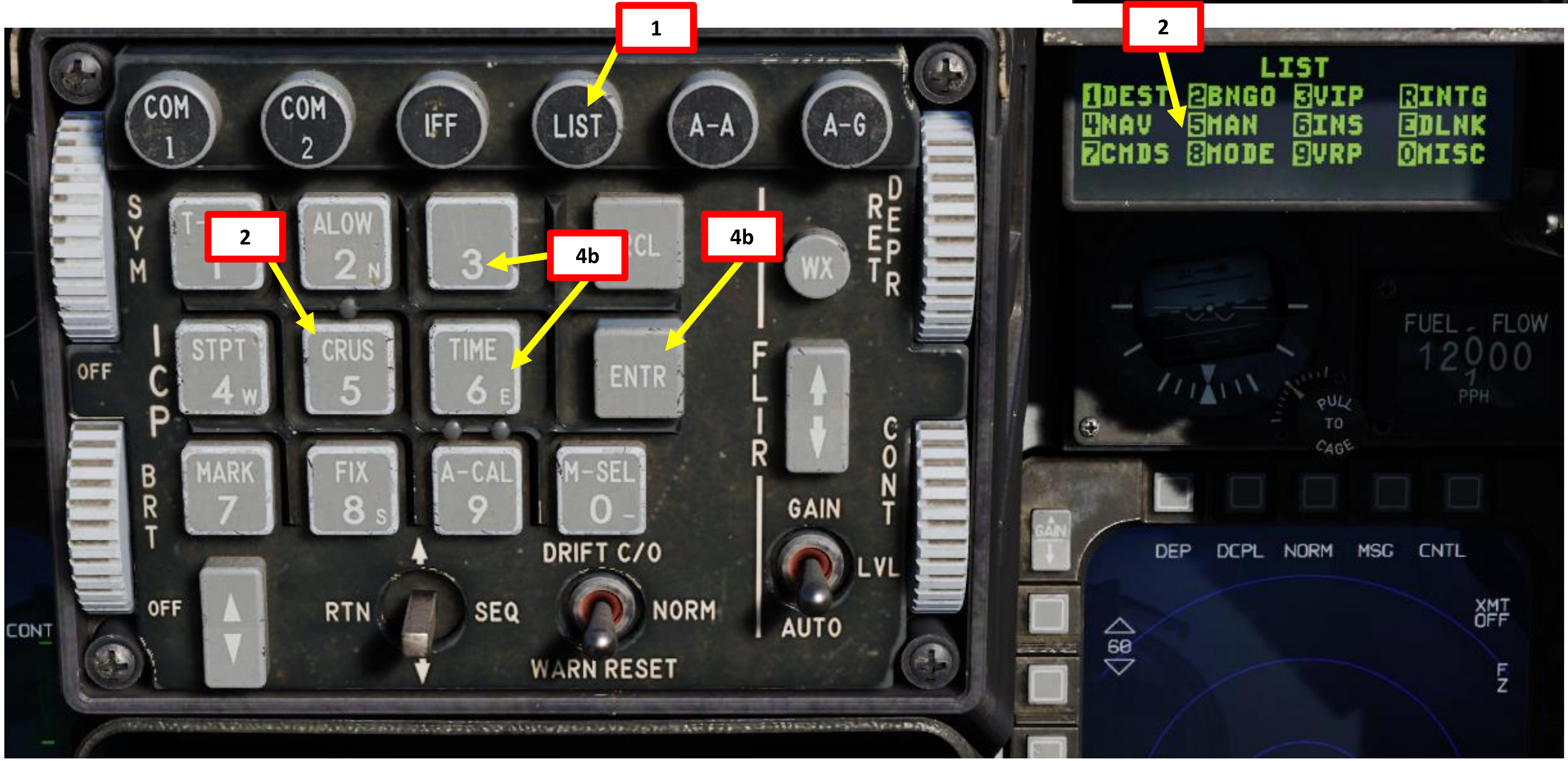
3.1 – M61A1 GUN
3.1.1 – EEGS (Enhanced Envelope Gun Sight) Introduction

If you already know the type of aircraft you are engaging and its wingspan, you can set the EEGS Gun Funnel properties to match the wingspan (ft). As an example, we will set the wingspan property to a MiG-29's, which is 36 ft (11 m).

1) Press the LIST button on the ICP (Integrated Control Panel)
2) Press "5" button to select the MAN (Manual Setting) sub-menu.
3) On the DED (Data Entry Display), the WSPAN data field is set to 33 ft by default.
4) Press "36" on the ICP, then press "ENTR" to set the wingspan to 36 ft.



MAN Setting Profile 1 Selected

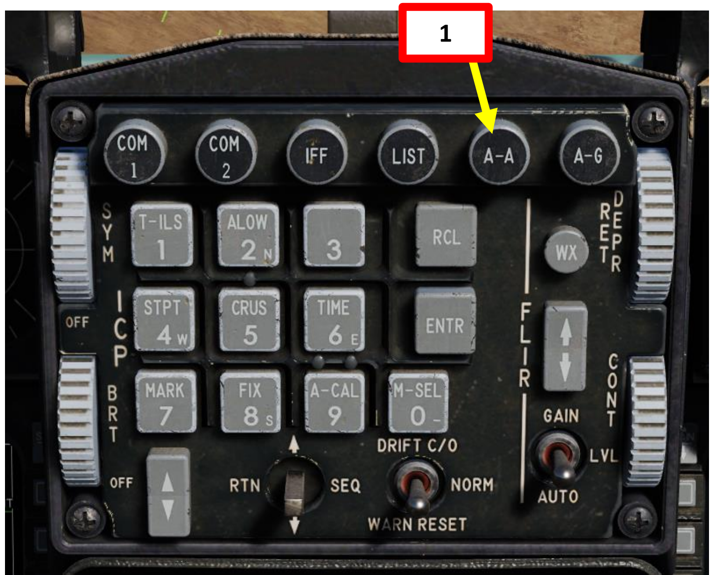


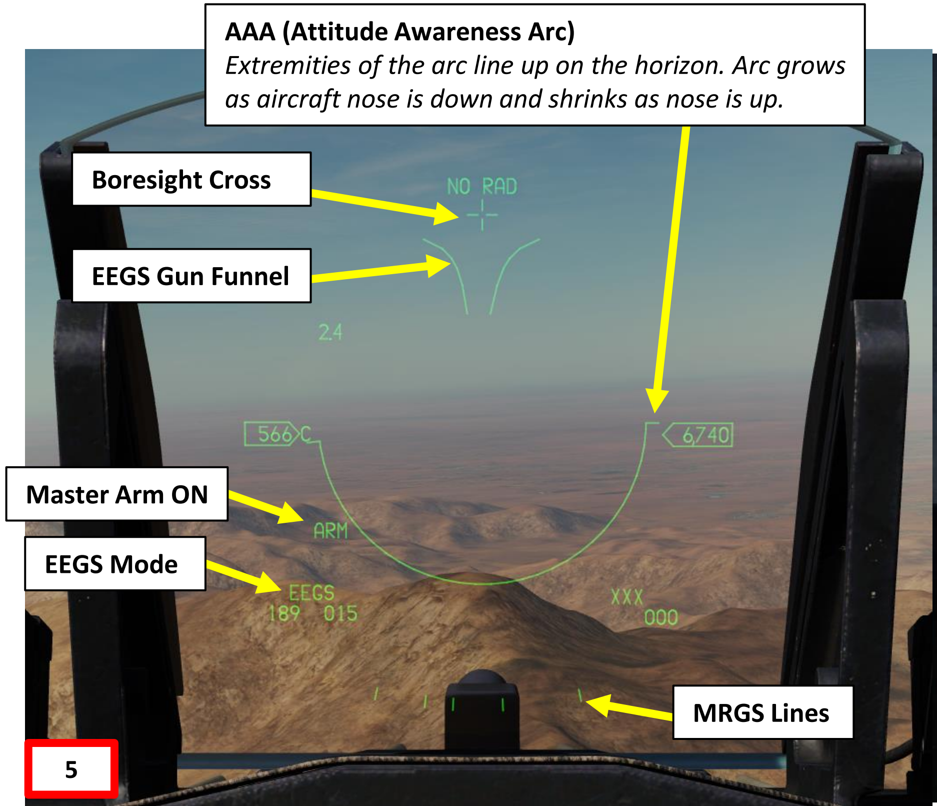
Aircraft	Wingspan (ft)
A-10	58
F-111	48
F-14	51
F-15	43
F-16	31
F/A-18	38
F-4	39
F-5	27
MiG-21	24
MiG-23	37
MiG-25	46
MiG-29	36
MiG-31	46
Su-24	44
Su-25	51
Su-27	42

3.1 – M61A1 GUN
3.1.2 – EEGS LEVEL II (No Radar)

Note: The gun can be selected either through the AAM (Air-to-Air Missile Mode) or DGFT (Dogfight Override Mode). In this case, we will use AAM Mode.

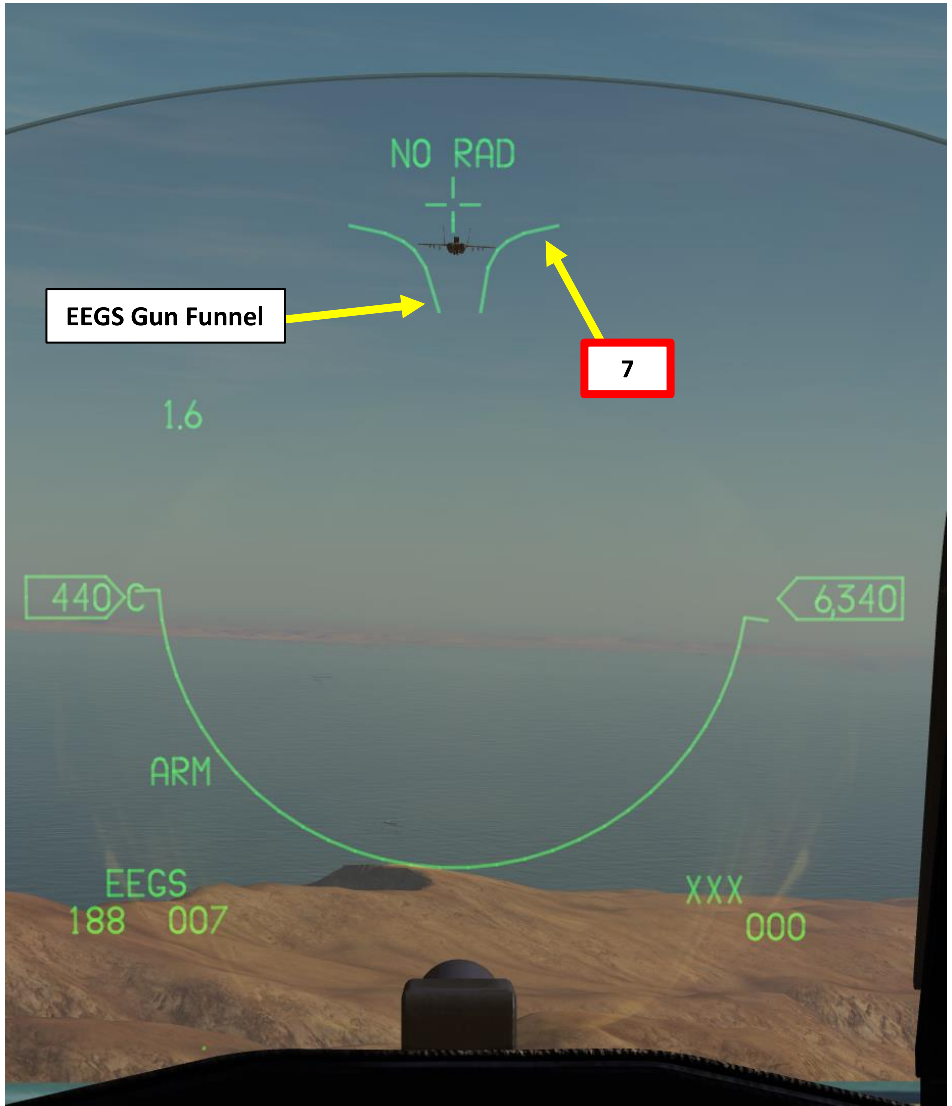
1. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
2. Set Master Arm switch – ARM (UP)
3. In the case where you do NOT want to use the FCR (Fire Control Radar) to lock the target, set the RF (Radio Frequency) Switch to SILENT (DOWN).
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to AAM to select the Air-to-Air EEGS Gun Mode.
5. The EEGS (Enhanced Envelope Gun Sight) Level II symbology will appear on the Heads-Up Display. The Boresight Cross, EEGS Funnel and Multiple Reference Gunsight (MRGS) Lines are provided.

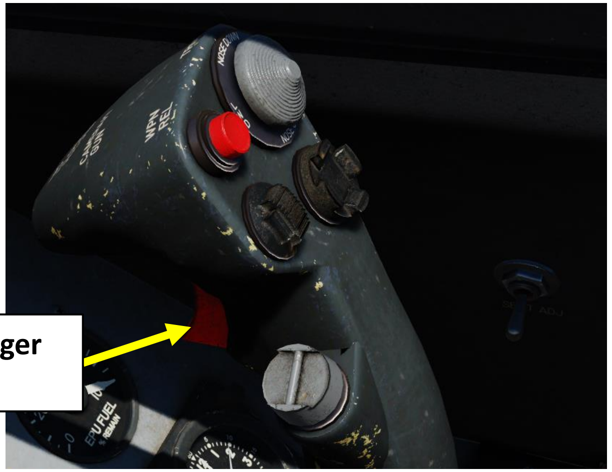




3.1 – M61A1 GUN
3.1.2 – EEGS LEVEL II (No Radar)

6. Maneuver your aircraft to frame the target aircraft within the EEGS funnel. The top of the funnel is 600 ft range, and the bottom is between 2500 ft and 3000 ft depending upon altitude.
7. When the target's wing tips are on the EEGS funnel lines, you can fire your gun.
8. Squeeze the trigger all the way to the second detent to fire the gun (SPACE).





3.1 – M61A1 GUN
3.1.2 – EEGS LEVEL II (No Radar)

Note:

While during normal chase you should always use the gun funnel, there are instances where the target could require you to pull a substantial amount of lead for high aspect shots. For high aspect chases, you can use the MRGS (Multiple Reference Gunsight) Lines.

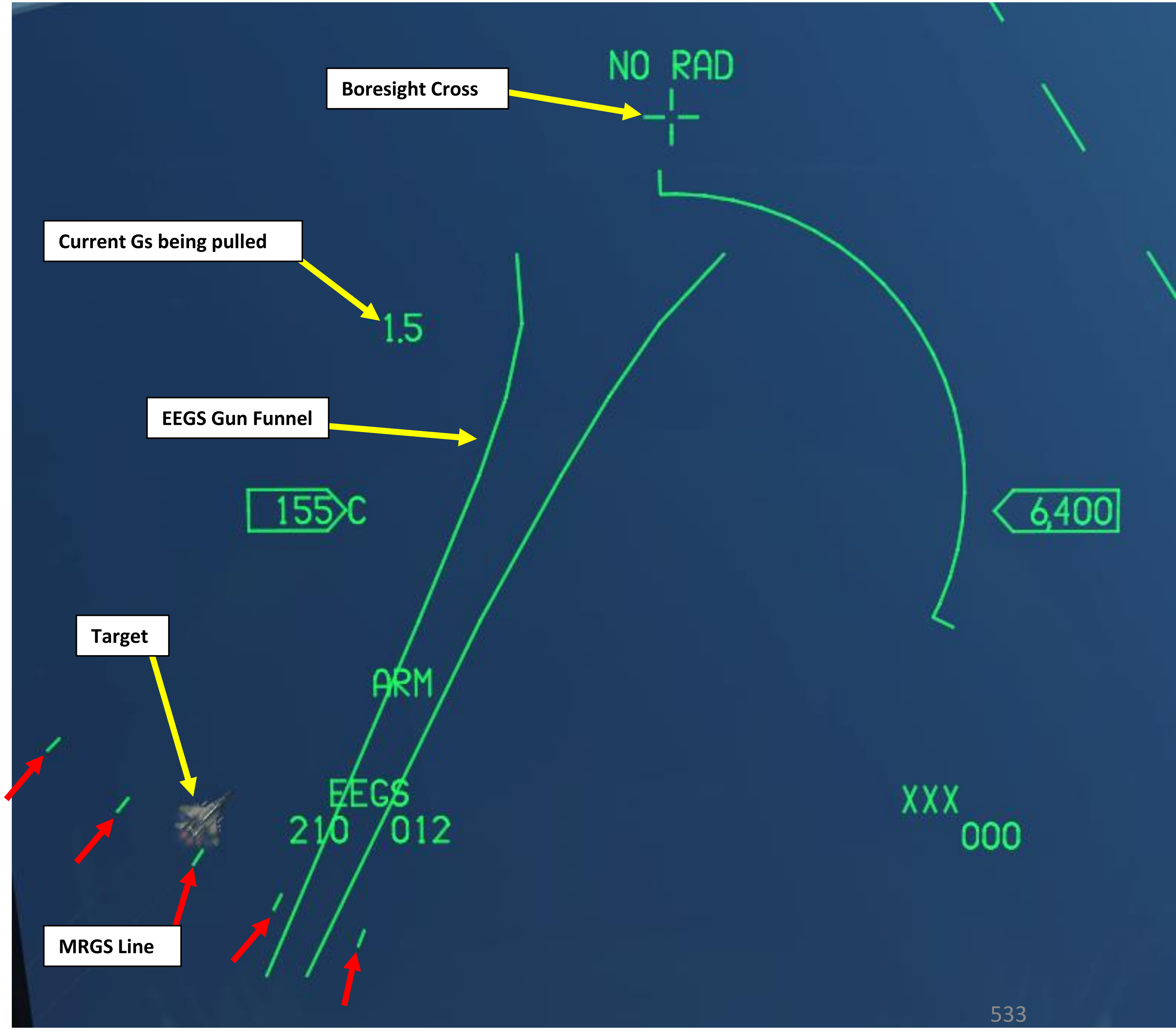
The MRGS sight is composed of a series of five line segments pointing toward the Gun Bore Line, and spaced in an arc near the bottom of the HUD. They aid in lining up long range, high aspect shots by providing the correct lateral aiming solution so the target flies up the funnel.

The length of the lines correspond to the approximate length of the fuselage of an aircraft at that position with the proper amount of lead.

To use, pull lead until the aircraft is over one of the lines.

- If the **aircraft is smaller than the line**, you are pulling too little lead and **need to be closer or add back pressure**.
- If the **aircraft is larger than the line**, you are pulling too much lead and **need to get further or relax the g**.

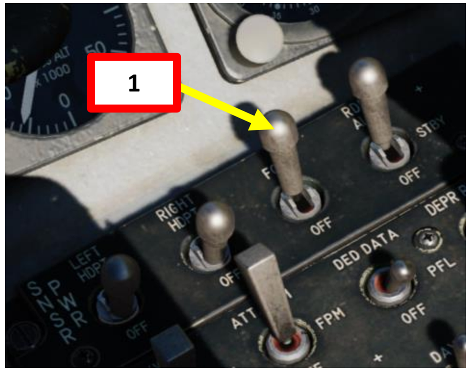
In the example to the right, the aircraft is larger than the MGRS line… therefore we need to either slow down and let the target gain some distance… or pull less Gs.

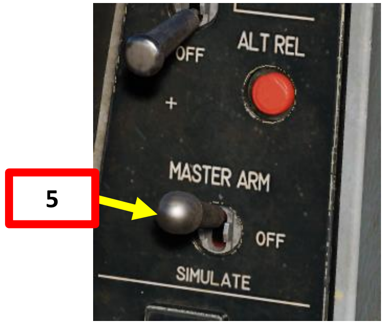


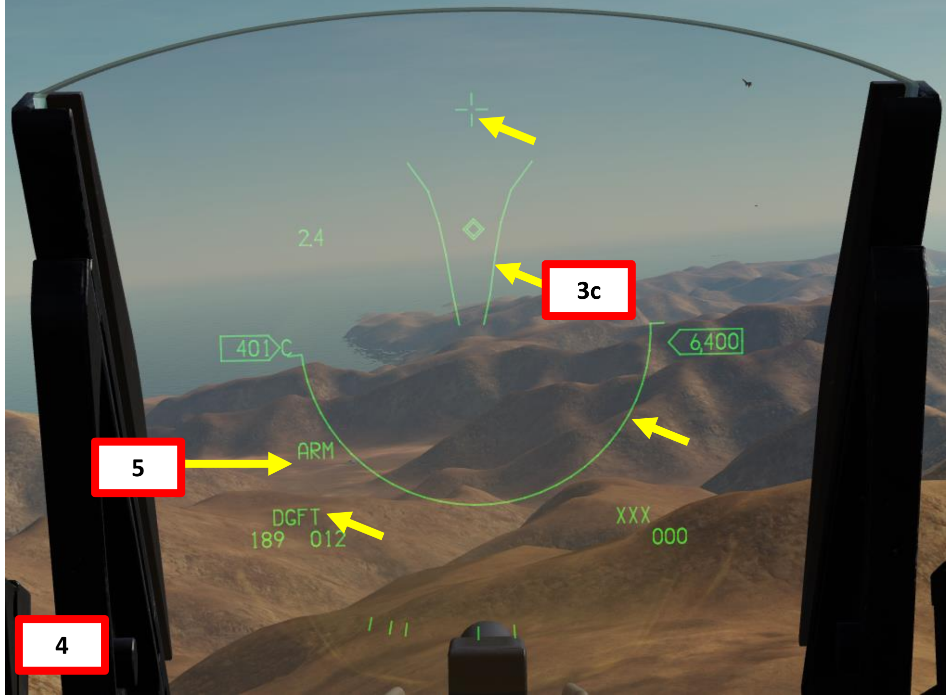
3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)

Note: The gun can be selected either through the AAM (Air-to-Air Missile Mode) or DGFT (Dogfight Override Mode). In this case, we will use DGFT Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select DGFT (Dogfight) Override Mode by pressing the Dogfight switch Outboard to the DOGFIGHT position.
3. With DGFT Override selected:
   a) The Gun is automatically selected with Air-to-Air EEGS Gun Mode
   b) ACM (Air Combat Mode) Radar mode is automatically selected with HUD Scan ACM Radar Sub-Mode (30°x 20°).
   c) Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
4. The EEGS (Enhanced Envelope Gun Sight) Level II symbology will appear on the Heads-Up Display. The Boresight Cross, EEGS Funnel and Multiple Reference Gunsight (MRGS) Lines are provided.
5. Set Master Arm switch – ARM (UP)



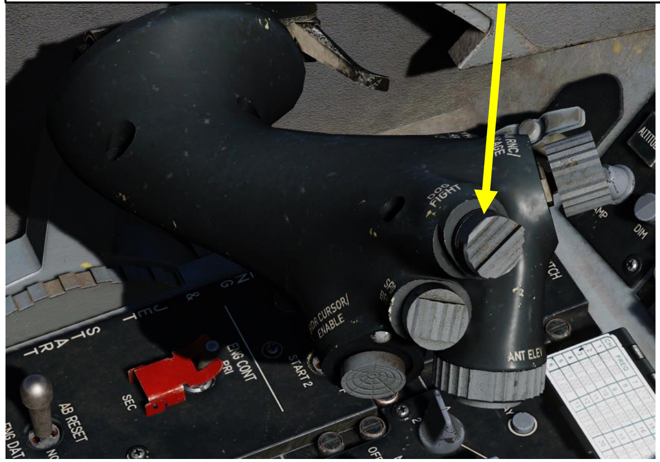




Dogfight Switch 2

3-Position switch, Slide

- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Center: Returns to last selected Master Mode*

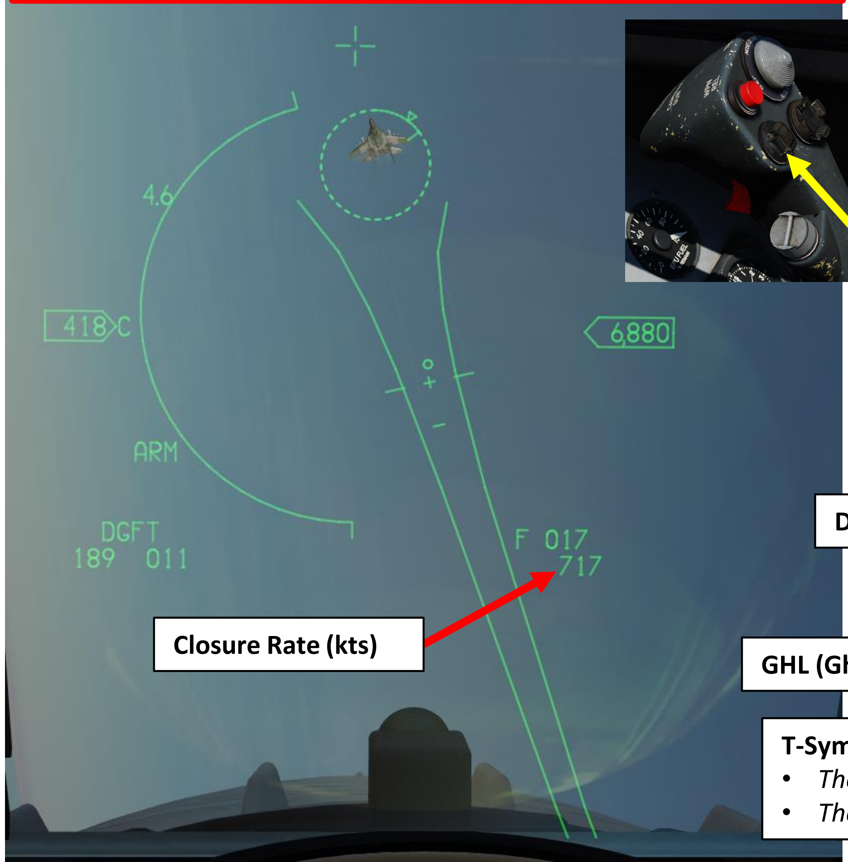


3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)

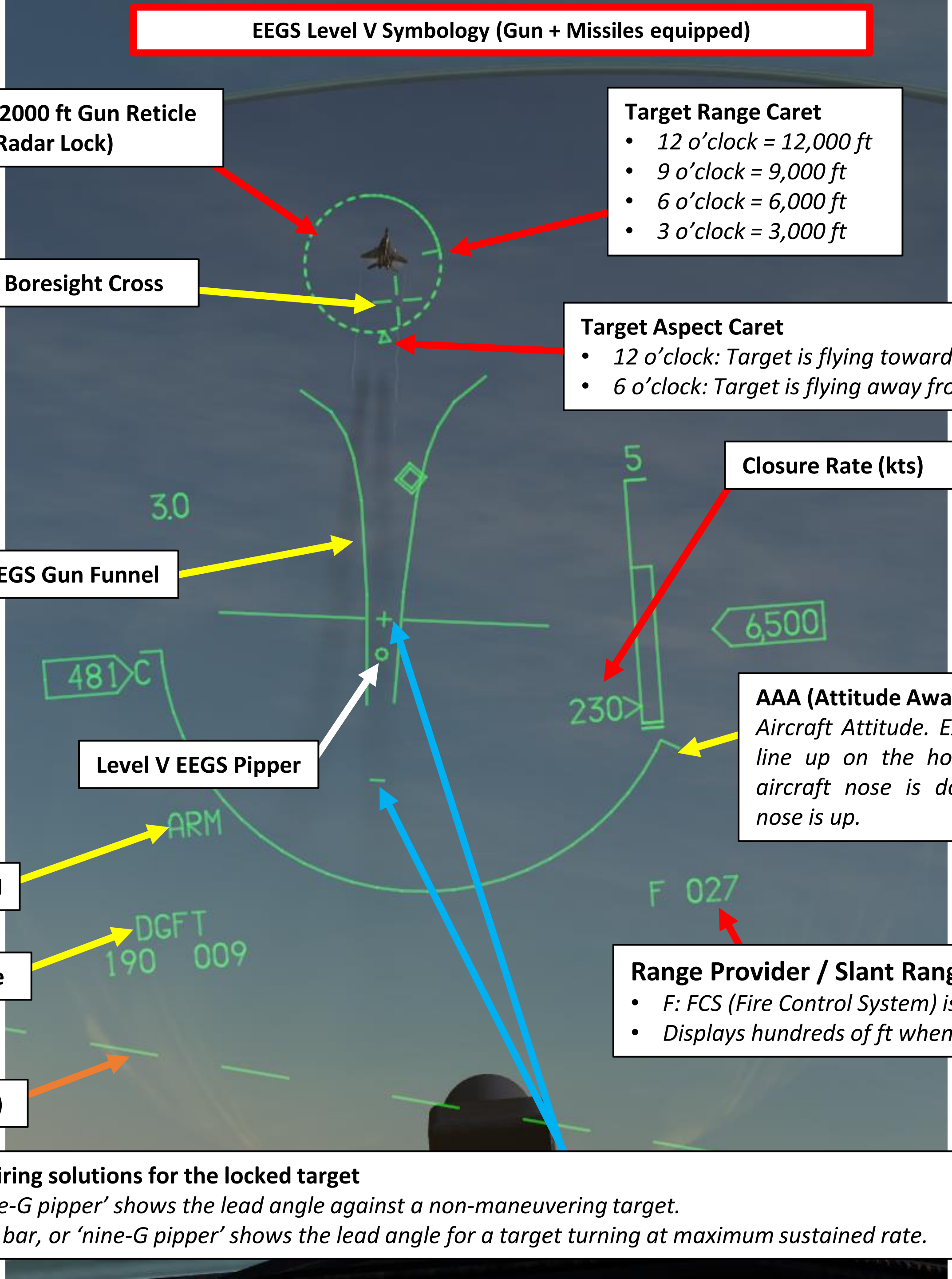
6. In ACM Radar Mode, target lock will be automatically performed. Press TMS (Target Management Switch) UP to enter ACM Boresight Mode.
7. When radar STT (Single Target Track) lock is acquired, EEGS (Enhanced Envelope Gun Sight) Level V symbology will appear on the Heads-Up Display.

Note: When using DGFT mode, symbology for both missiles and gun is displayed. The Closure Rate indication will be displayed differently depending on whether you have air-to-air missiles equipped or not. Since you are most likely not going on a mission with "just" a single gun to defend yourself, I decided to show both types of symbology.

EEGS Level V Symbology (Gun only, no missiles equipped)

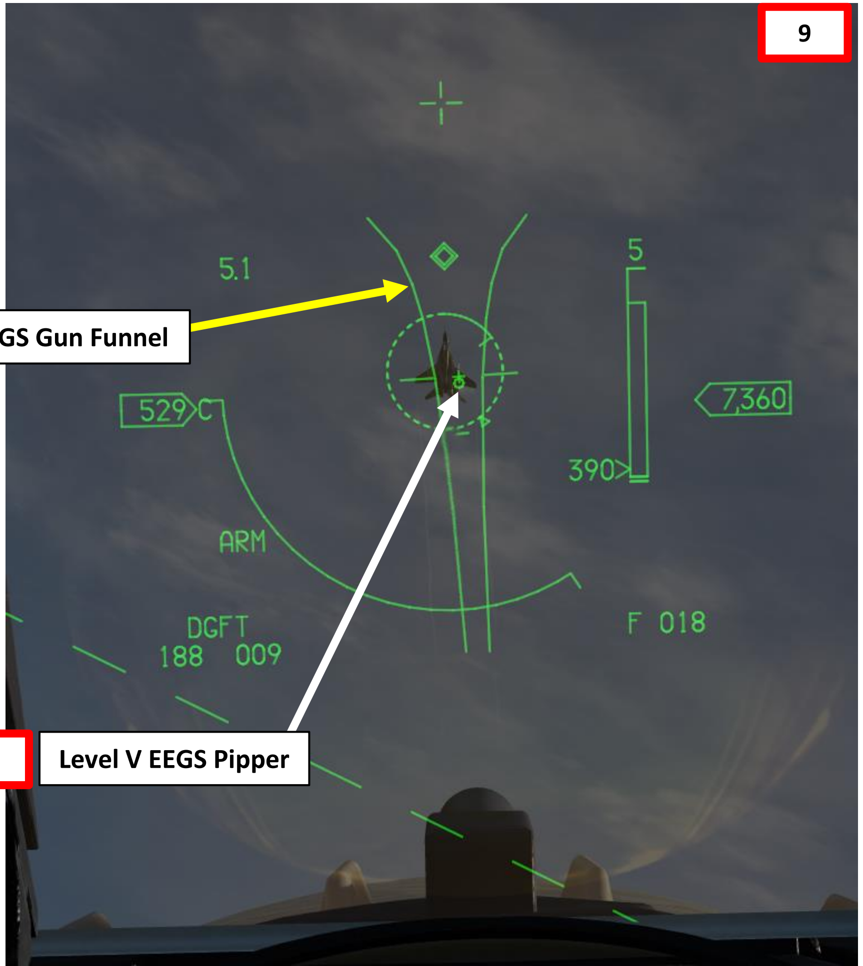


EEGS Level V Symbology (Gun + Missiles equipped)



3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)

8. Maneuver your aircraft to frame the target aircraft within the EEGS funnel and stabilize the Level V EEGS Pipper on the target.
9. When the Level V EEGS Pipper is on the target, you can fire the gun.
10. Squeeze the trigger all the way to the second detent to fire the gun (SPACE).
11. The Bullets at Target Range (BATR) Symbol is displayed after rounds are fired. The BATR is displayed as the first real or simulated round passes the target range and is removed after the last round has passed.



EEGS Gun Funnel

8 Level V EEGS Pipper

10 Camera/Gun Trigger (Two Stages)

BATR (Bullets At Target Range) Symbol

3.1 – M61A1 GUN
3.1.3 – EEGS LEVEL V (With Radar)

3.2 – AIM-9M SIDEWINDER
3.2.1 – Sidewinder Introduction

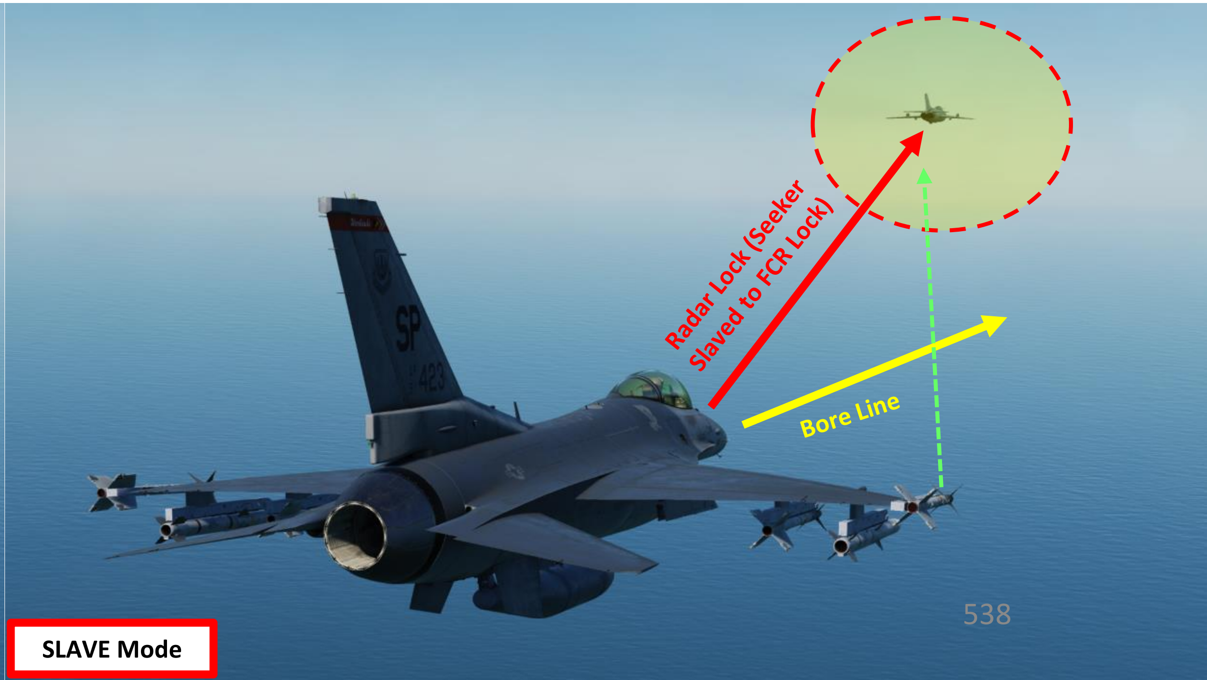
The AIM-9 Sidewinder missile has two main operating modes: BORE and SLAVE.

Boresight (BORE) mode:
- When HMCS (Helmet-Mounted Cueing System) is not powered, the missile seeker “looks” ahead on the aircraft bore line.
- When HMCS is powered, the seeker is boresighted to the Helmet Mounted Display’s reticle. This is useful when using the AIM-9X for a HOBS (High Off Boresight) shot.

Slaved (SLAVE) mode:
- When a radar lock is acquired, the missile seeker is slaved to the FCR (Fire Control Radar)
- When no radar lock is acquired, the seeker is slaved to the aircraft bore line

BORE Mode (HMCS ON)

BORE Mode (HMCS OFF)



SLAVE Mode

3.2 – AIM-9M SIDEWINDER
3.2.1 – Sidewinder Introduction

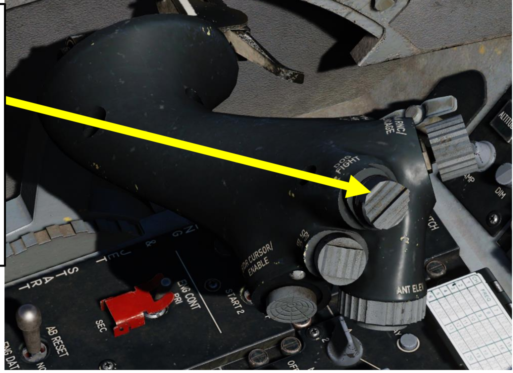
There are three main methods of selecting an AIM-9 missile:

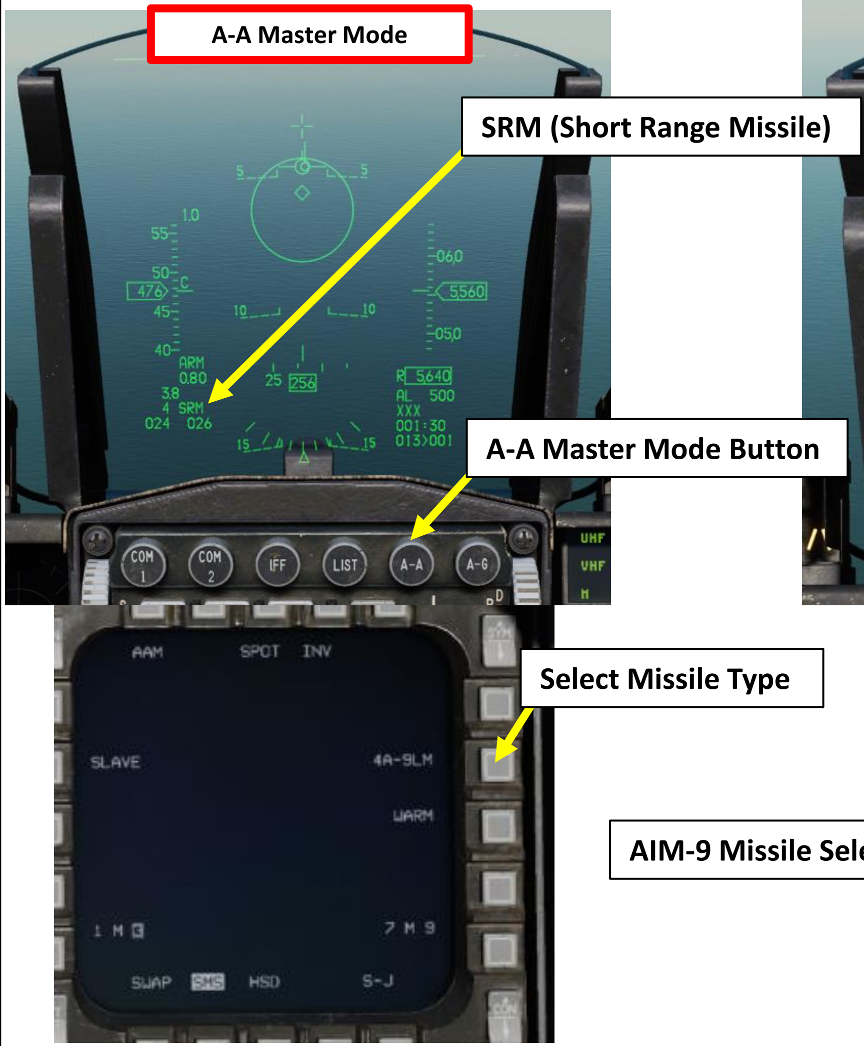
- Press **Dogfight Switch OUTBOARD (DGFT)**. AIM-9 missiles will be automatically selected.
- Press **Dogfight Switch INBOARD (MSL OVRD/Missile Override)**. Then, from the SMS page, select the desired missile.
- Select **Air-to-Air Master Mode** by pressing the A-A Button. Then, from the SMS page, select the desired missile.

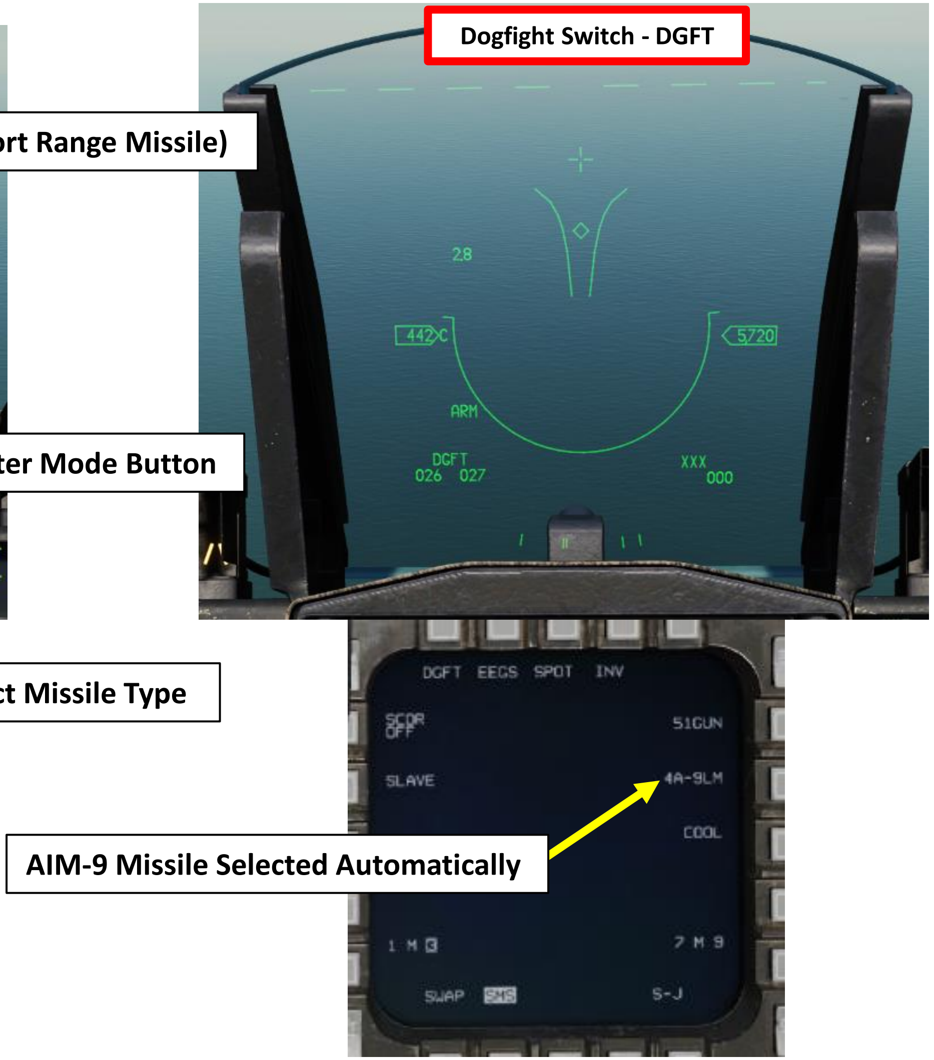
Dogfight Switch

3-Position switch, Slide

- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*







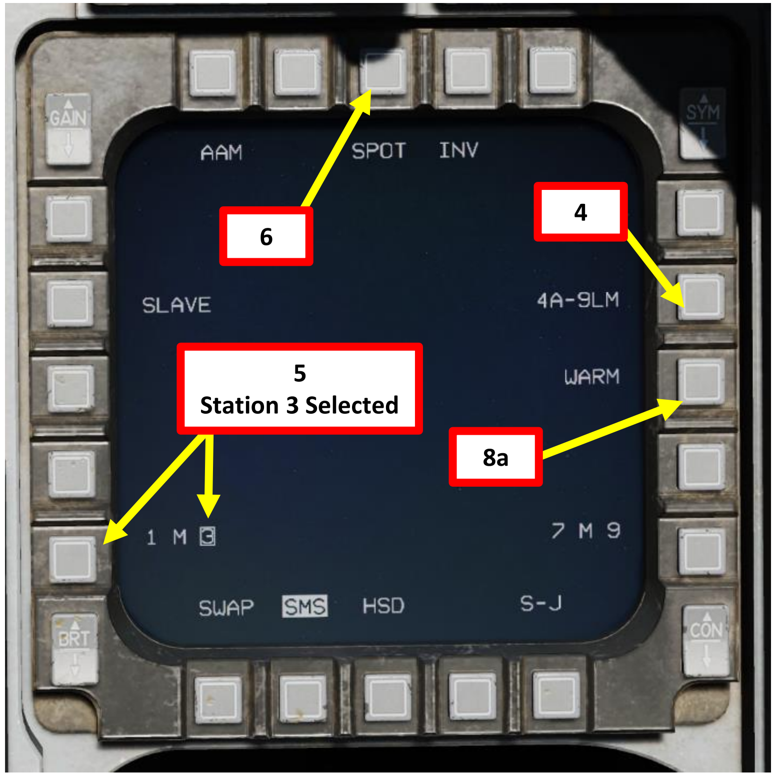
3.2 – AIM-9M SIDEWINDER
3.2.2 – No Radar

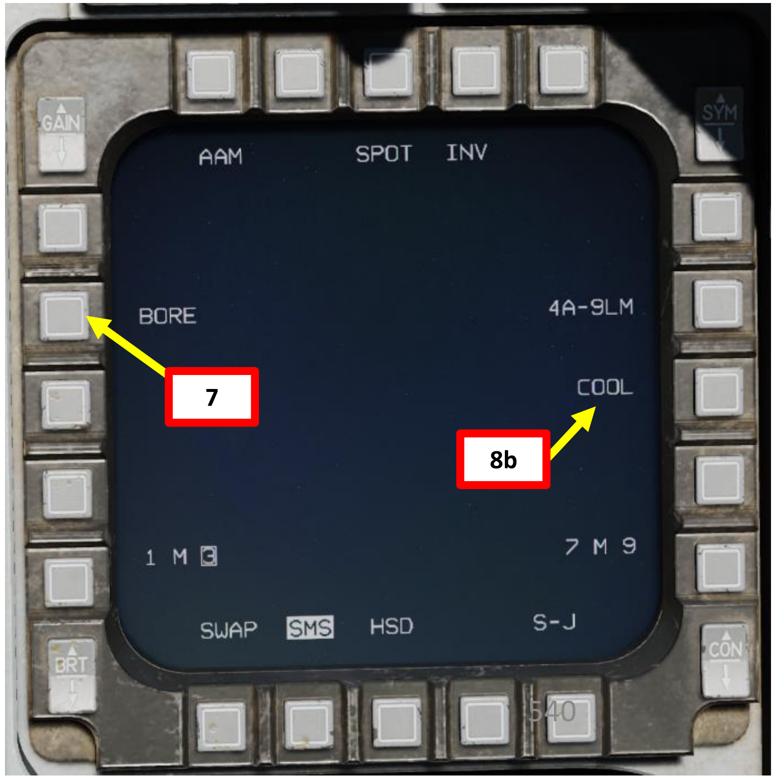
Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use AAM Mode.

1. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
2. Set Master Arm switch – ARM (UP)
3. In the case where you do NOT want to use the FCR (Fire Control Radar) to lock the target, set the RF (Radio Frequency) Switch to SILENT (DOWN).
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the 9LM (AIM-9M) missile. *Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.*
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Select desired missile field-of-view by pressing the OSB next to SPOT/SCAN
   - SPOT: Narrow field-of-view, detection range is increased
   - SCAN: Wide field-of-view, detection range is decreased
7. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose BORE.
   - BORE: Missile follows aircraft boresight line
   - SLAVE: Missile follows radar line-of-sight
8. Activate missile seeker head argon cooling by setting the cooling status to COOL (press OSB next to WARM/COOL). It will increase missile detection sensitivity.
   - *Note: COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.*

NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*
- *MSL (MISSILE) STEP LONG: Toggles Missile Type*

4 5





3.2 – AIM-9M SIDEWINDER
3.2.2 – No Radar

9. Maneuver until target is within the missile launch zone
10. Fly the missile reticle in the HUD over a target. If the missile detects enough infrared energy from the target, target detection is indicated by an audio missile detection tone (growling sound).
11. When the AIM-9 seeker detects a target, uncage it by pressing the Cage/Uncage button on the throttle. This will allow the seeker to lock on and follow the target within the confines of the missile seeker's field of view.
12. When the missile is tracking a heat signature, the Missile Diamond latches to the target and the missile growl sound will become high pitched.
13. Depress the Weapon Release (RALT+SPACE) button to fire the missile.

13 **Weapon Release Button**

11 **MAN RNG/UNCAGE Knob/Switch**
- *MAN RNG Clockwise: Zooms In*
- *MAN RNG Counter-Clockwise: Zooms Out*
- *UNCAGE (Depressed): Uncages Sidewinder ("C" binding)*

10

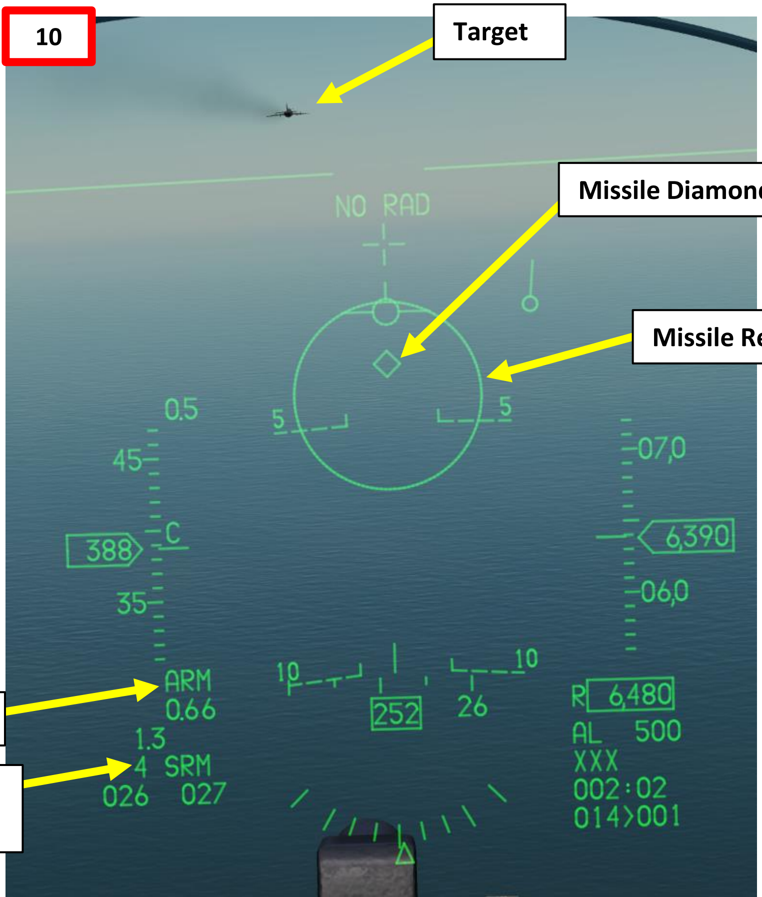
Target

Missile Diamond

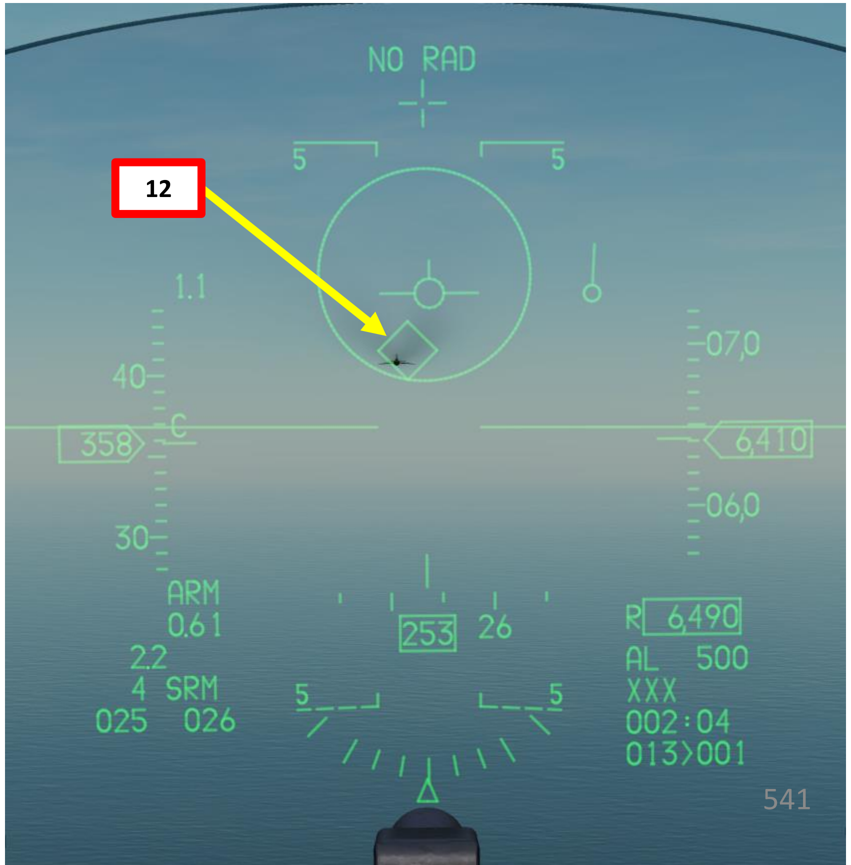
Missile Reticle

Master Arm is ON

4 SRM (Short Range Missiles) Available



12

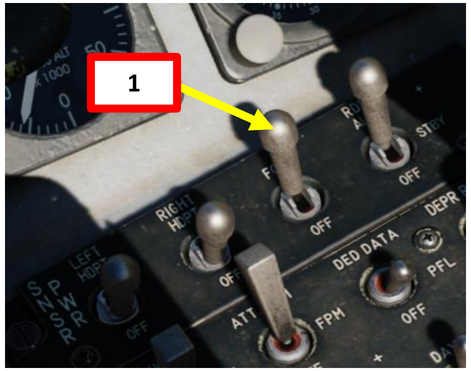


3.2 – AIM-9M SIDEWINDER
3.2.2 – No Radar

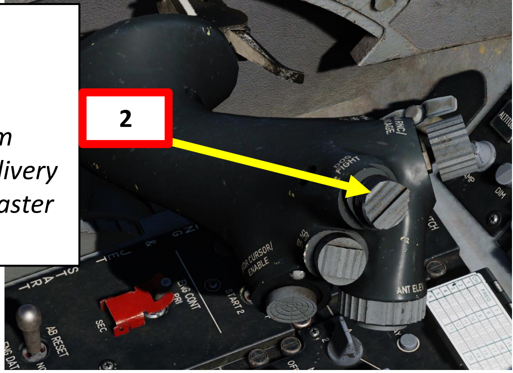
3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar

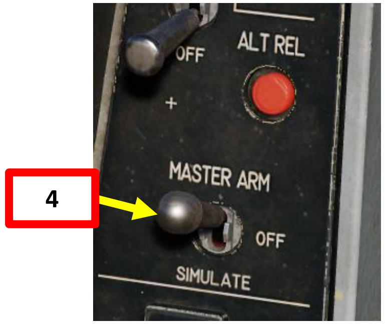
Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use DGFT Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select DGFT (Dogfight) Override Mode by pressing the Dogfight switch Outboard to the DOGFIGHT position.
3. With DGFT Override selected:
   a) The Gun is automatically selected with Air-to-Air EEGS Gun Mode
   b) ACM (Air Combat Mode) Radar mode is automatically selected with HUD Scan ACM Radar Sub-Mode (30°x 20°).
   c) Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the 9LM (AIM-9M) missile. *Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.*
6. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
7. Select desired missile field-of-view by pressing the OSB next to SPOT/SCAN
   - SPOT: Narrow field-of-view, detection range is increased
   - SCAN: Wide field-of-view, detection range is decreased
8. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose SLAVE.
   - BORE: Missile follows aircraft boresight line
   - SLAVE: Missile follows radar line-of-sight
9. Activate missile seeker head argon cooling by setting the cooling status to COOL (press OSB next to WARM/COOL). It will increase missile detection sensitivity.
   - *Note: COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.*



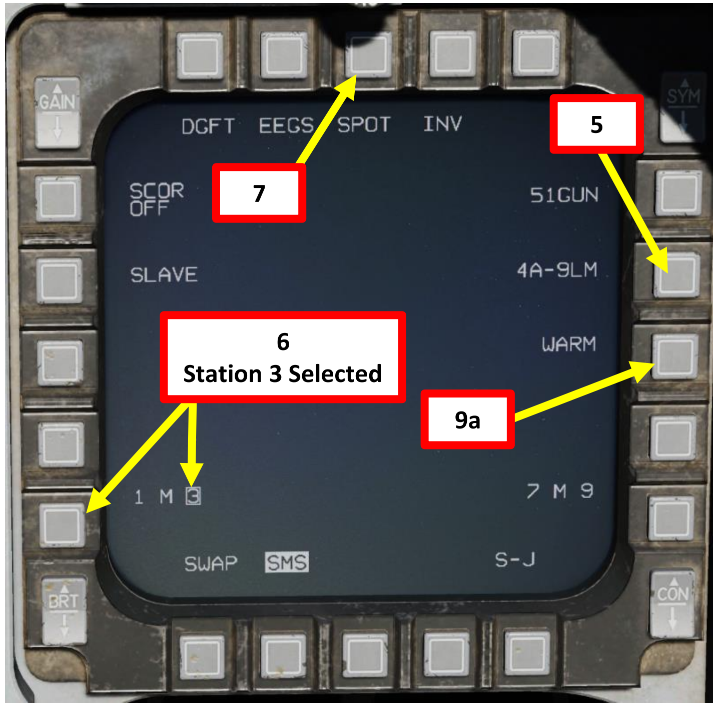
Dogfight Switch
3-Position switch, Slide
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Center: Returns to last selected Master Mode*

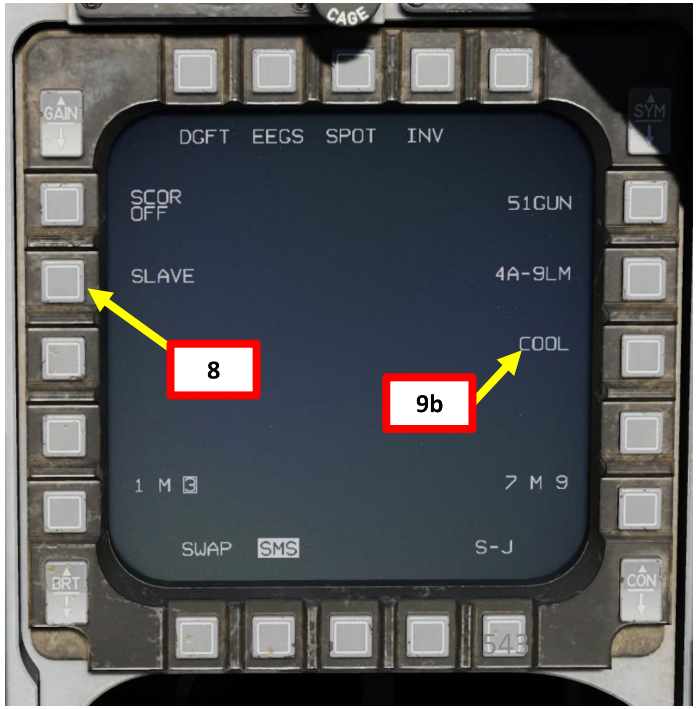




NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*
- *MSL (MISSILE) STEP LONG: Toggles Missile Type*

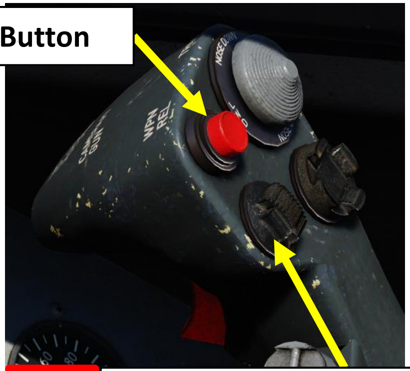
5 6

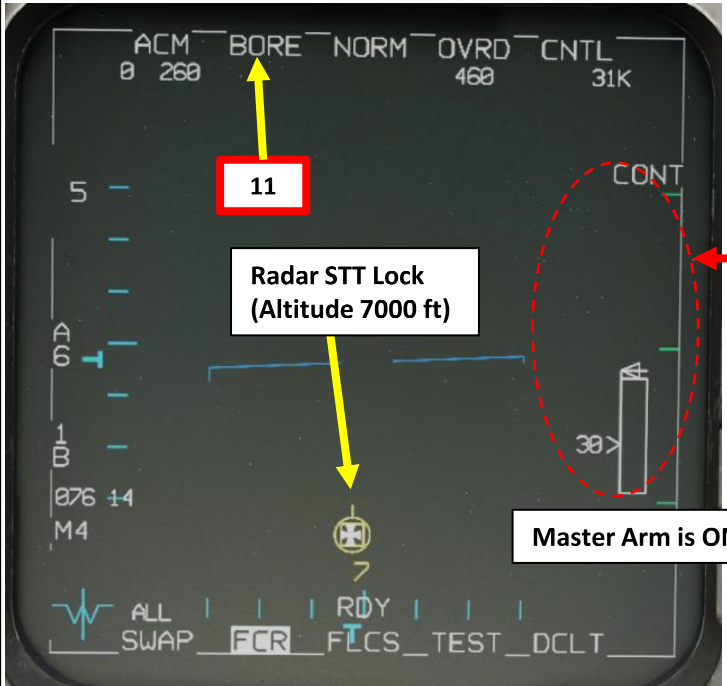


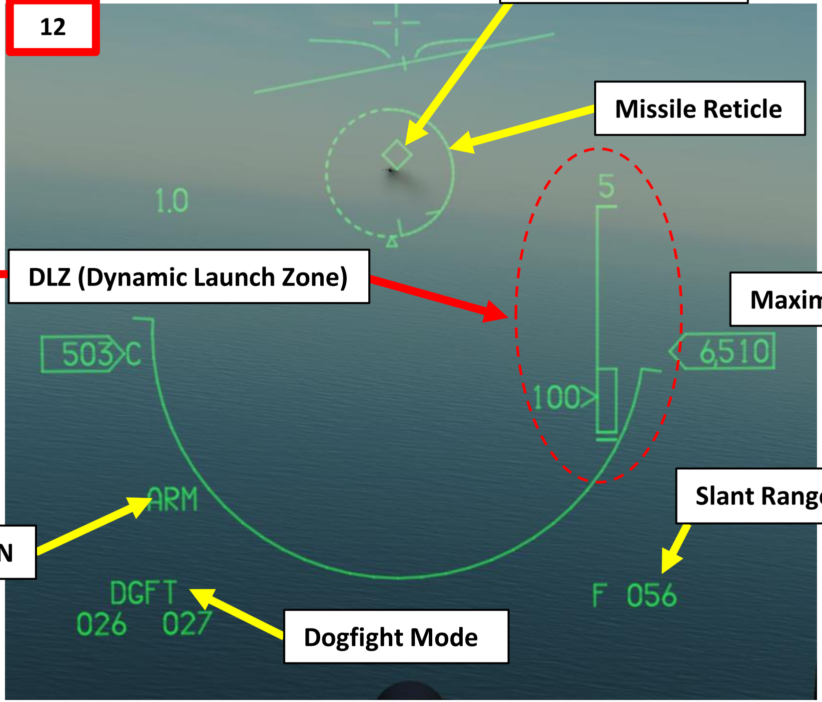


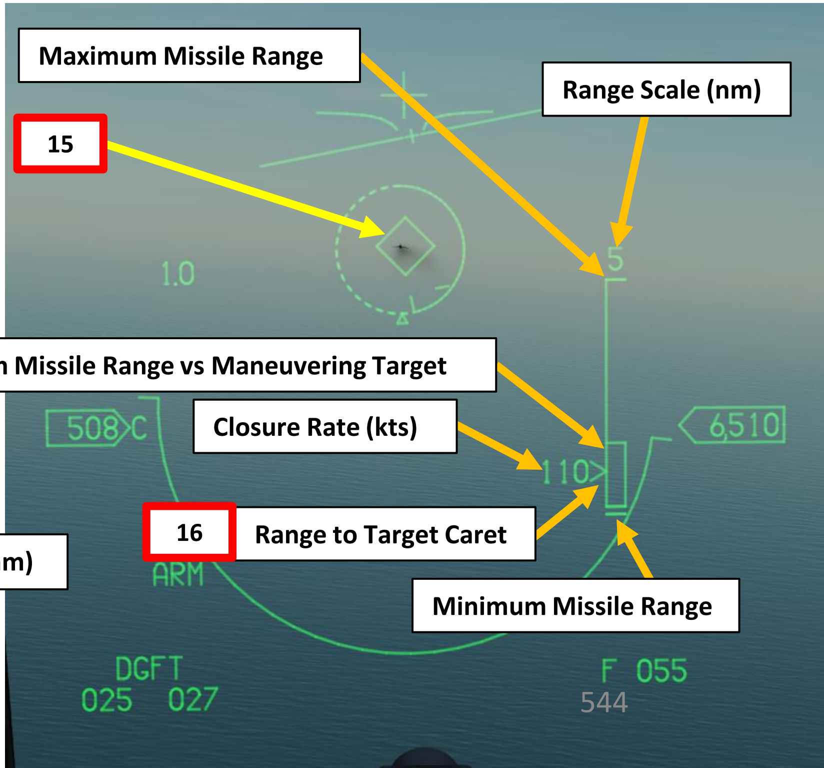
3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar

10. Maneuver until target is within the missile launch zone
11. Press TMS (Target Management Switch) UP to enter ACM Boresight Mode. In ACM Radar Mode, target lock will be automatically performed.
12. When radar STT (Single Target Track) lock is acquired, missile symbology should appear on your HUD (DLZ and Slant Range).
13. Fly the missile reticle in the HUD over the target. If the missile detects enough infrared energy from the target, target detection is indicated by an audio missile detection tone (growling sound).
14. When the AIM-9 seeker detects a target, uncage it by pressing the Cage/Uncage button on the throttle. This will allow the seeker to lock on and follow the target within the confines of the missile seeker's field of view.
15. When the missile is tracking a heat signature, the Missile Diamond latches to the target and the missile growl sound will become high pitched.
16. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.
17. Depress the Weapon Release (RALT+SPACE) button to fire the missile.





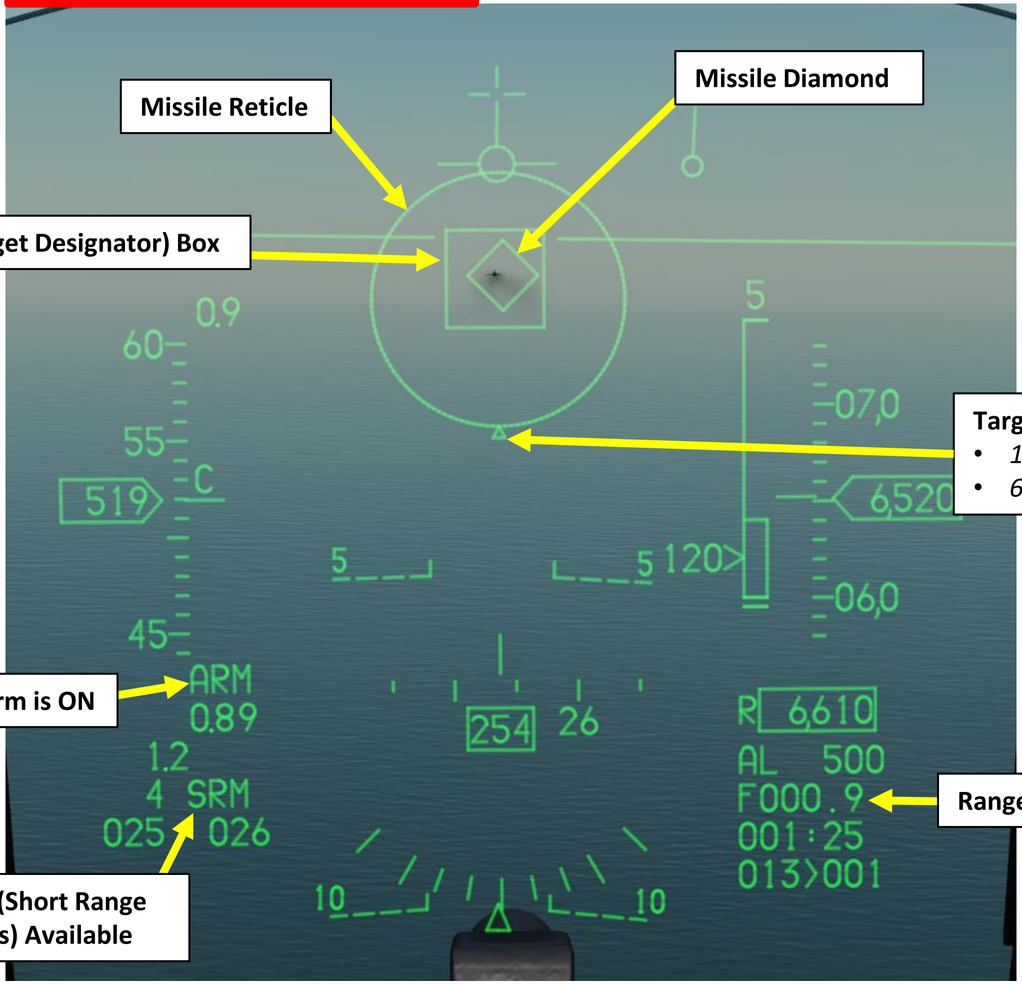




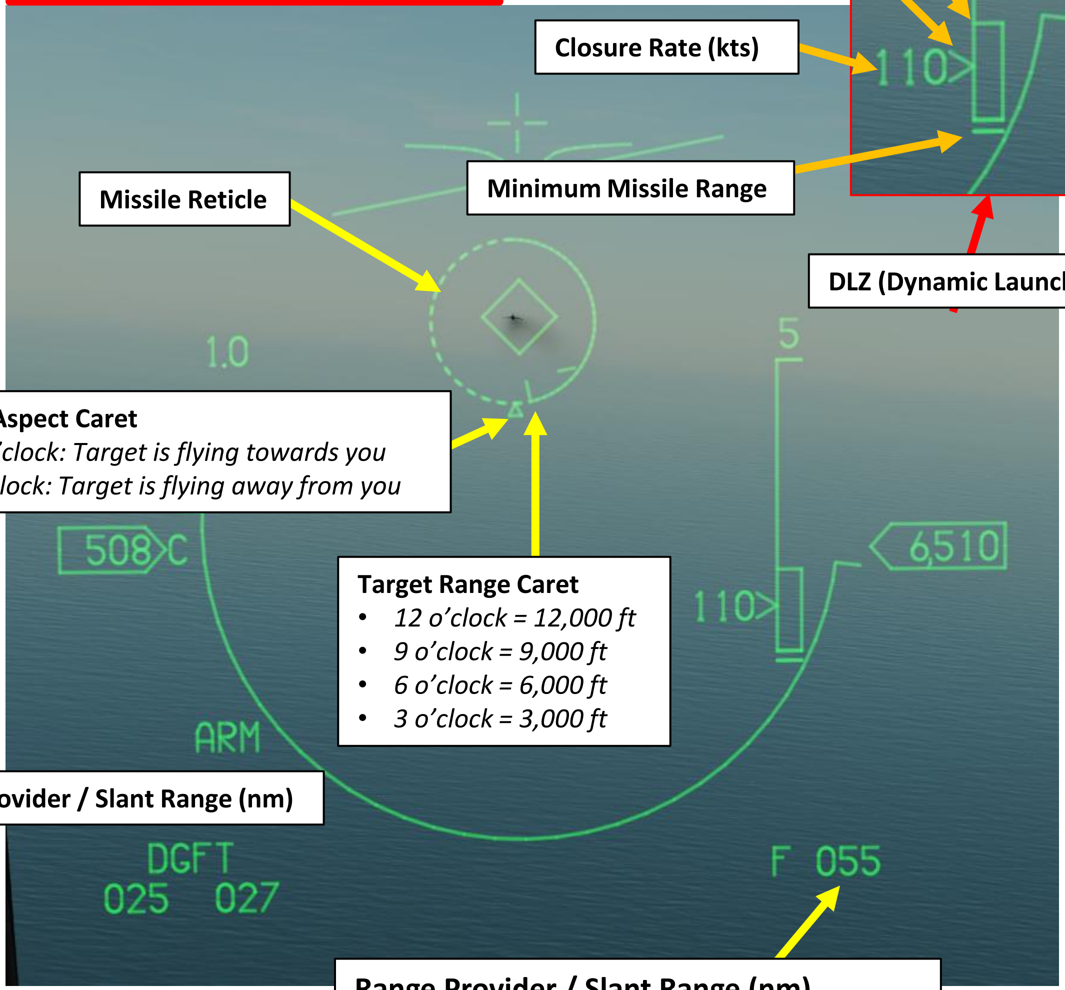
3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar

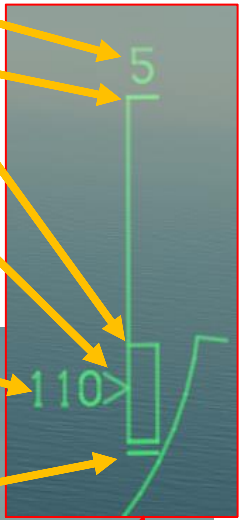
Take note that HUD symbology will be slightly different if you use DGFT mode or A-A Mode to acquire a radar lock. For instance, A-A mode will display a TD (Target Designator) Box over the locked contact.

HUD Radar Symbology with A-A Mode



HUD Radar Symbology with DGFT Mode

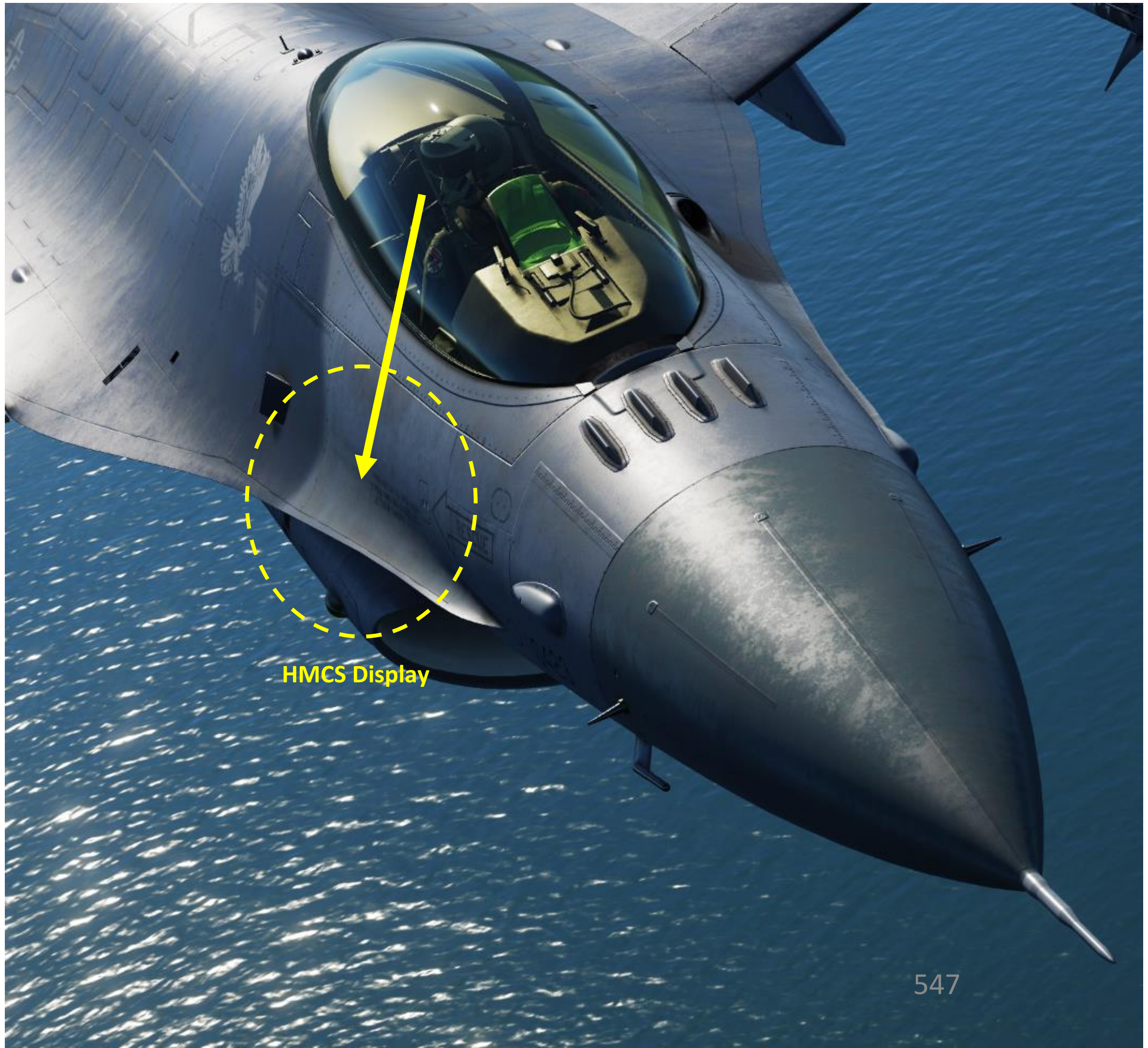




3.2 – AIM-9M SIDEWINDER
3.2.3 – With Radar

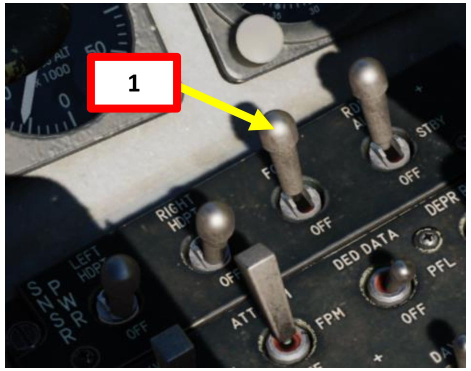
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

The HMD (Helmet-Mounted Display) and HMCS (Helmet-Mounted Cueing System) allow the pilot to project the Heads-Up Display in his field of vision at all times. It also allows the slaving of sensors and weapons to the helmet's line of sight. In the F-16, the HMCS is very useful for using missiles like the AIM-9X, an upgraded version of the AIM-9 with TVC (Thrust Vectoring Control) allowing 80 deg off-boresight shots.



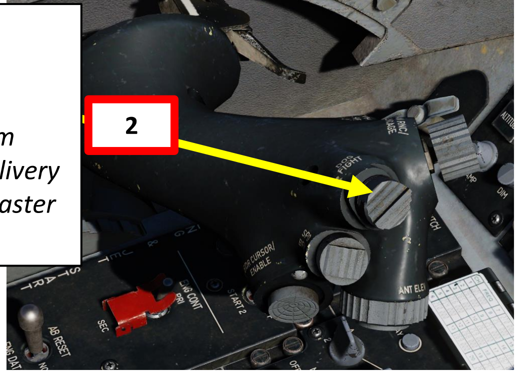
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select DGFT (Dogfight) Override Mode by pressing the Dogfight switch Outboard to the DOGFIGHT position.
3. With DGFT Override selected:
   a) The Gun is automatically selected with Air-to-Air EEGS Gun Mode
   b) ACM (Air Combat Mode) Radar mode is automatically selected with HUD Scan ACM Radar Sub-Mode (30°x 20°).
   c) Symbology on the HUD is provided for both 20 mm gun firing and air-to-air missile
4. Set Master Arm switch – ARM (UP)
5. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the 9X (AIM-9X) missile. *Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.*
6. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
7. Select desired missile field-of-view by pressing the OSB next to SPOT/SCAN
   - SPOT: Narrow field-of-view, detection range is increased
   - SCAN: Wide field-of-view, detection range is decreased
8. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose BORE.
   - BORE: Missile follows HMCS boresight line
   - SLAVE: Missile follows radar line-of-sight
9. Activate missile seeker head argon cooling by setting the cooling status to COOL (press OSB next to WARM/COOL). It will increase missile detection sensitivity.
   - *Note: COOL is selected automatically when entering DGFT or MSL Override mode. Argon supply duration varies depending on outside air temperature, pressure and bottle charge level at installation, but the average duration is 90 minutes.*



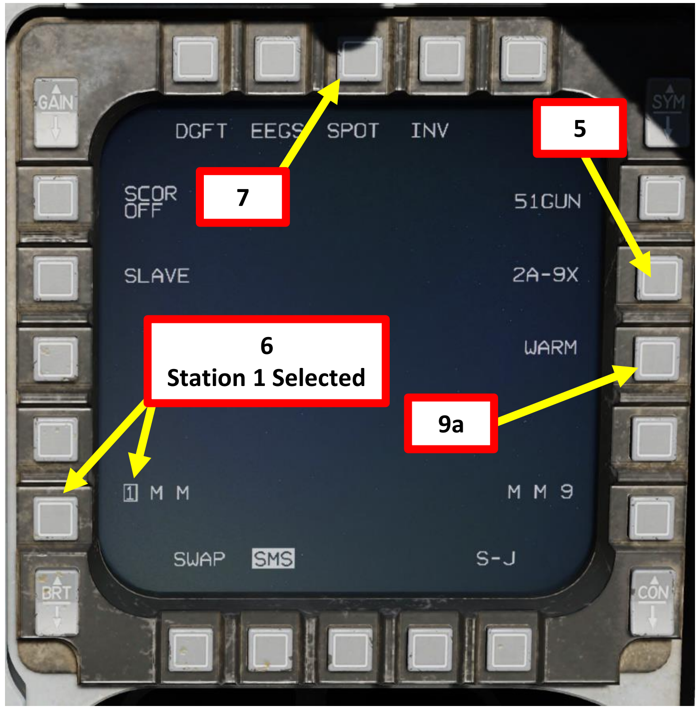
Dogfight Switch

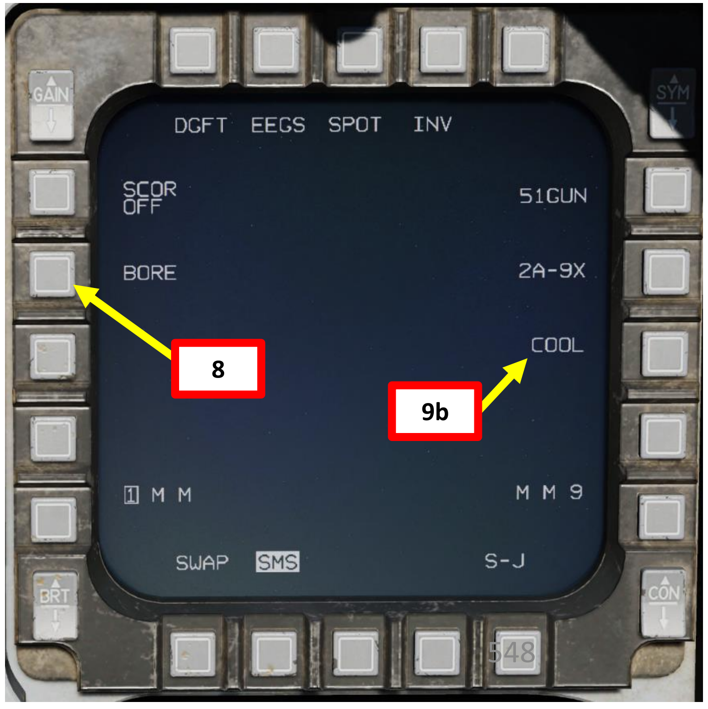
3-Position switch, Slide
- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Center: Returns to last selected Master Mode*



NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*
- *MSL (MISSILE) STEP LONG: Toggles Missile Type*

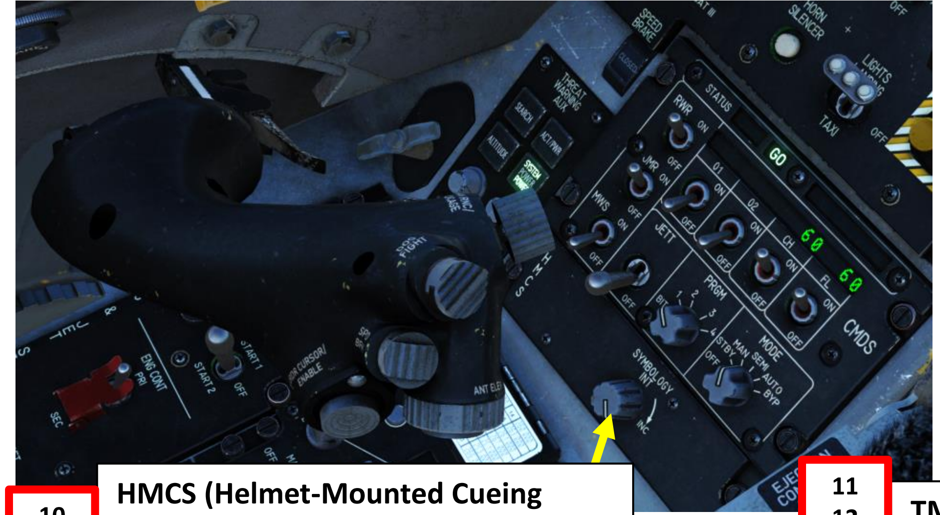
5 6

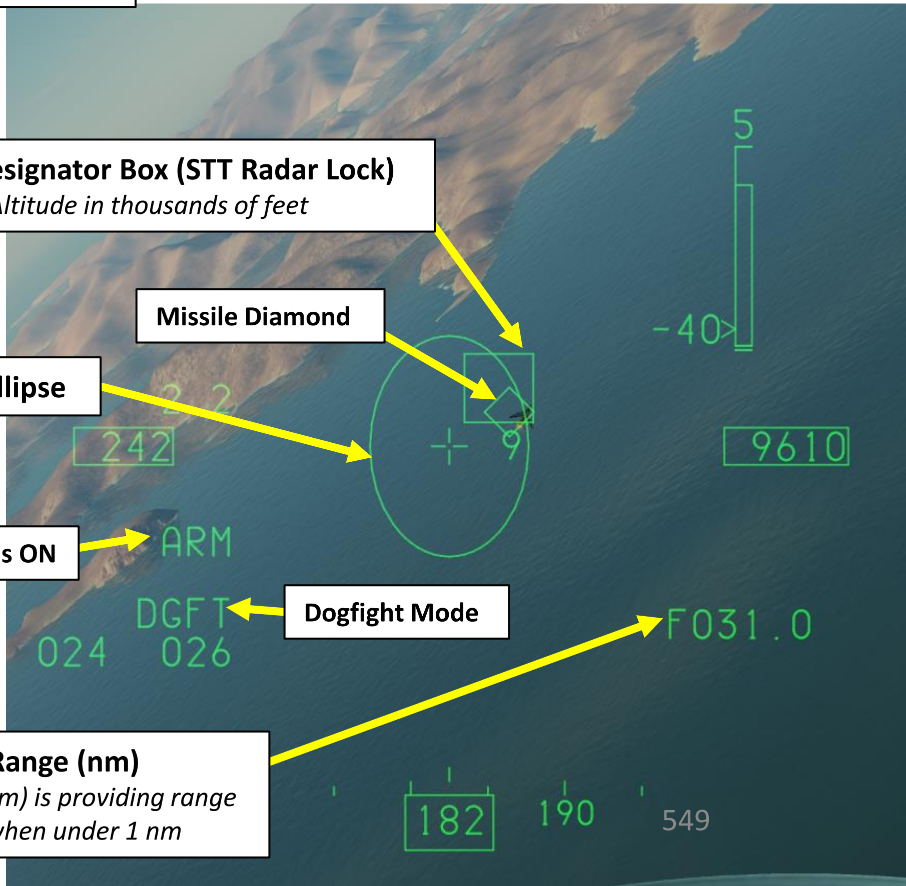




3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

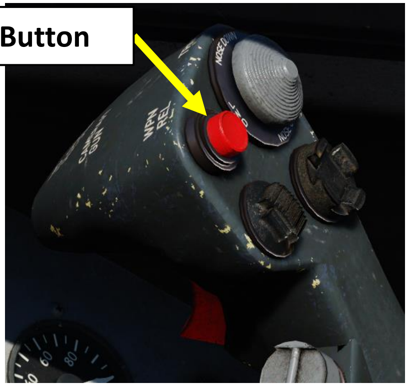
10. Power up the Helmet-Mounted Cueing System (HMCS) by turning HMCS Symbology Brightness Knob RIGHT (Clockwise).
11. Select BORE (Boresight) ACM (Air Combat Mode) Search Sub-Mode by pressing the TMS (Target Management Switch) UP SHORT (less than 0.5 sec).
12. Press the TMS (Target Management Switch) UP LONG (more than 0.5 sec) to slave the boresight radar to the helmet line-of-sight. The HMCS Bore Ellipse will appear.
13. Move your helmet to put the HMCS Ellipse on the target. The radar will attempt to STT (Single Target Track) lock the nearest target within the HMCS Ellipse zone within locking range (10 nm).
14. A Target Designator Box will appear on the locked target.

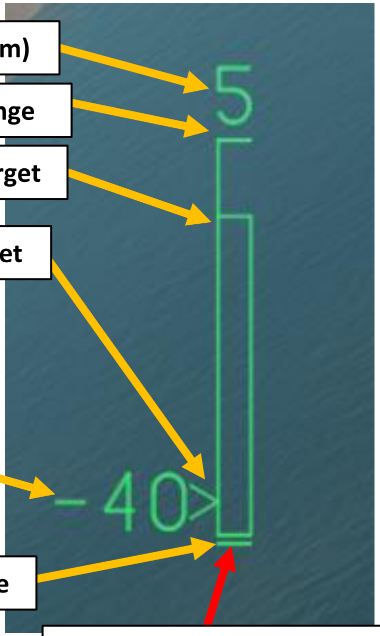


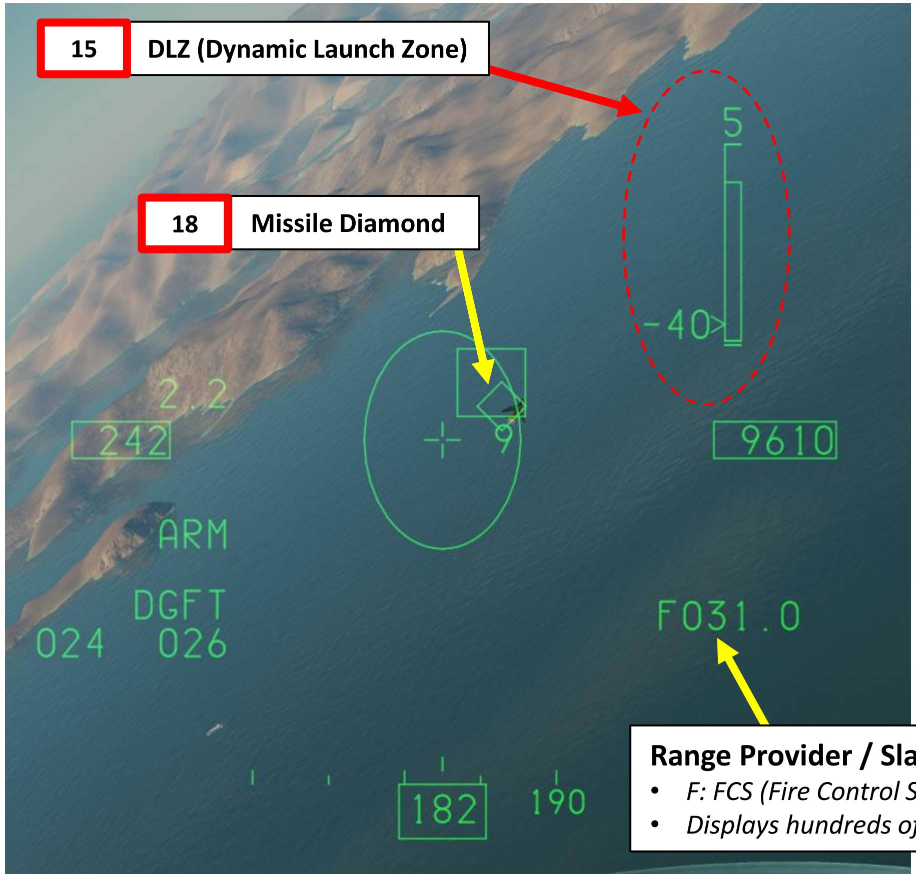


3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

15. When radar STT (Single Target Track) lock is acquired, missile symbology should appear on your HUD (DLZ and Slant Range).
16. If the missile detects enough infrared energy from the target, target detection is indicated by an audio missile detection tone (growling sound).
17. When the AIM-9 seeker detects a target, uncage it by pressing the Cage/Uncage button on the throttle. This will allow the seeker to lock on and follow the target within the confines of the missile seeker's field of view.
18. When the missile is tracking a heat signature, the Missile Diamond latches to the target and the missile growl sound will become high pitched.
19. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.
20. Depress the Weapon Release (RALT+SPACE) button to fire the missile.







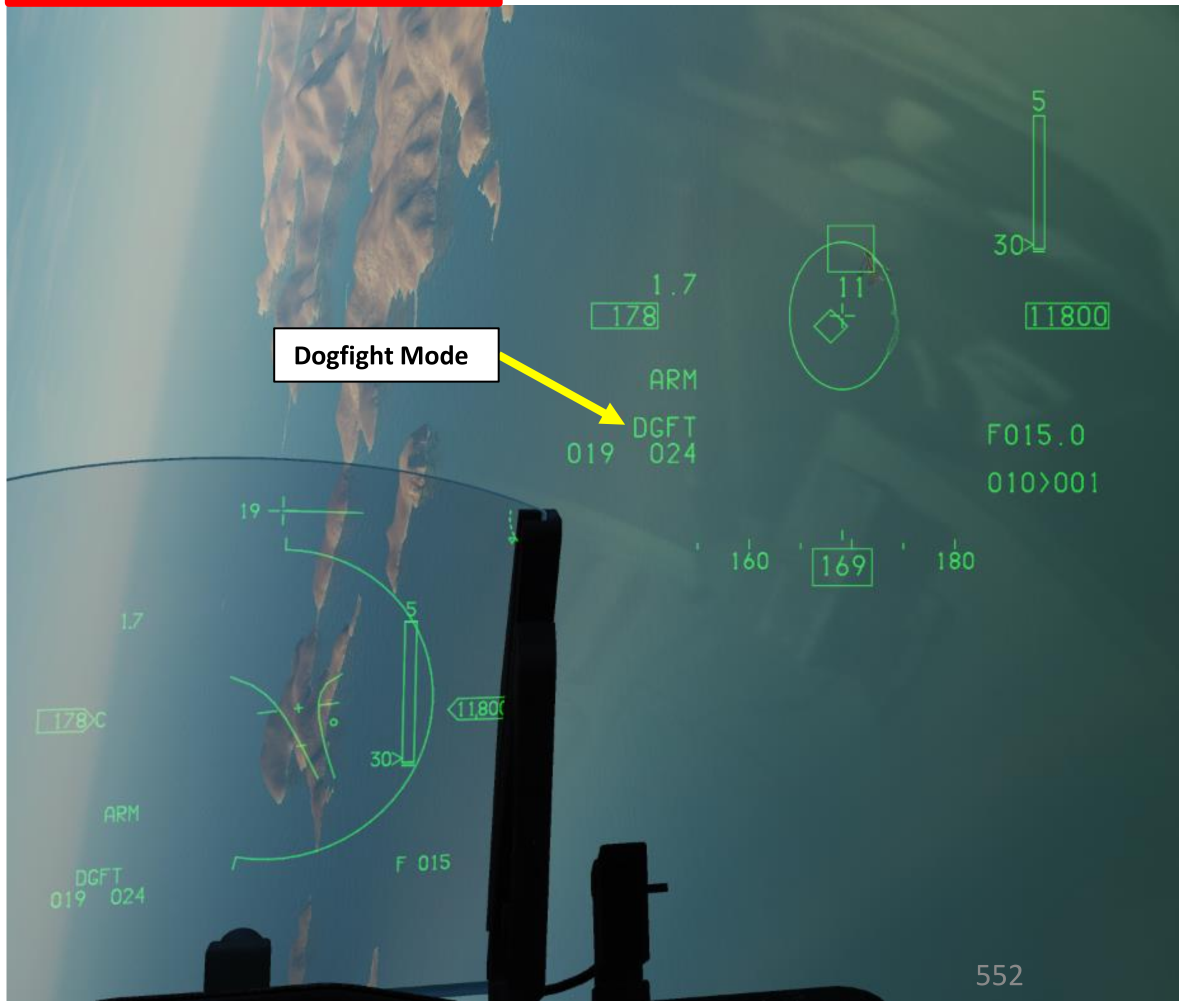
3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

3.3 – AIM-9X HOBS SIDEWINDER (HMCS)

Take note that HUD symbology will be slightly different if you use DGFT mode or A-A Mode to acquire a radar lock.

HUD Radar Symbology with A-A Mode

HUD Radar Symbology with DGFT Mode



3.4 – AIM-120C AMRAAM
3.4.1 – AMRAAM Introduction

The AIM-120 AMRAAM (Advanced Medium-Range Air-to-Air Missile) has two main operating modes: BORE and SLAVE. BORE mode is rarely use since in practice, you will always need to identify your target before firing.

Boresight (BORE) mode:

- **When HMCS (Helmet-Mounted Cueing System) is not powered**, the missile seeker “looks” ahead on the aircraft bore line. This is called a "mad dog" shot since the missile flies ballistically out to a point without guidance, then turns on its onboard radar and locks up and flies to the first radar contact it finds. It has no IFF (Identify-Friend-or-Foe) system, so it doesn't distinguish between a friendly or a hostile.
- **When HMCS is powered**, the seeker is boresighted to the Helmet Mounted Display’s reticle. However, the missile is confined to the restrictions of the FCR’s field of view.

Slaved (SLAVE) mode:

- When a radar lock is acquired, the missile seeker is slaved to the FCR (Fire Control Radar). This is the standard mode of operation you should be using.
- When no radar lock is acquired, the seeker is slaved to the aircraft bore line.

BORE Mode (HMCS OFF)

BORE Mode (HMCS ON)

SLAVE Mode


3.4 – AIM-120C AMRAAM
3.4.1 – AMRAAM Introduction

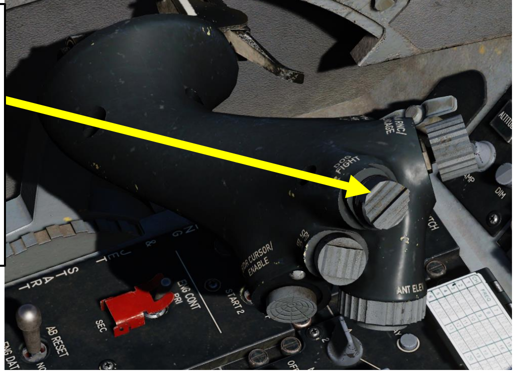
There are three main methods of selecting an AMRAAM missile:

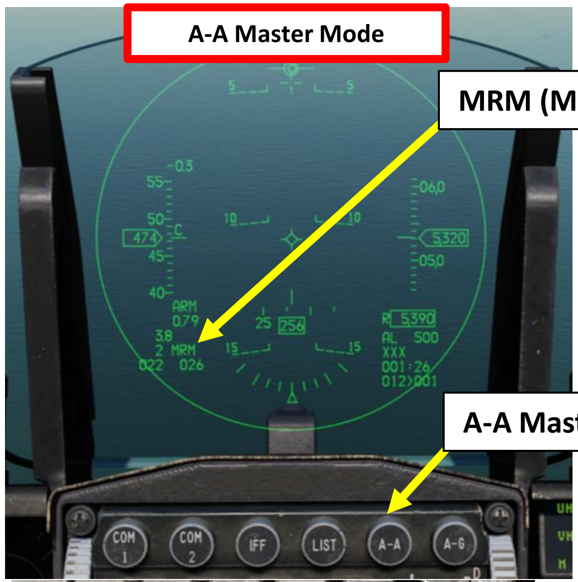
- Press **Dogfight Switch OUTBOARD (DGFT)**. AIM-9 missiles will be automatically selected. Then, from the SMS page, select the AIM-120 missile.
- Press **Dogfight Switch INBOARD (MSL OVRD/Missile Override)**. Then, from the SMS page, select the desired missile.
- Select **Air-to-Air Master Mode** by pressing the A-A Button. Then, from the SMS page, select the desired missile.

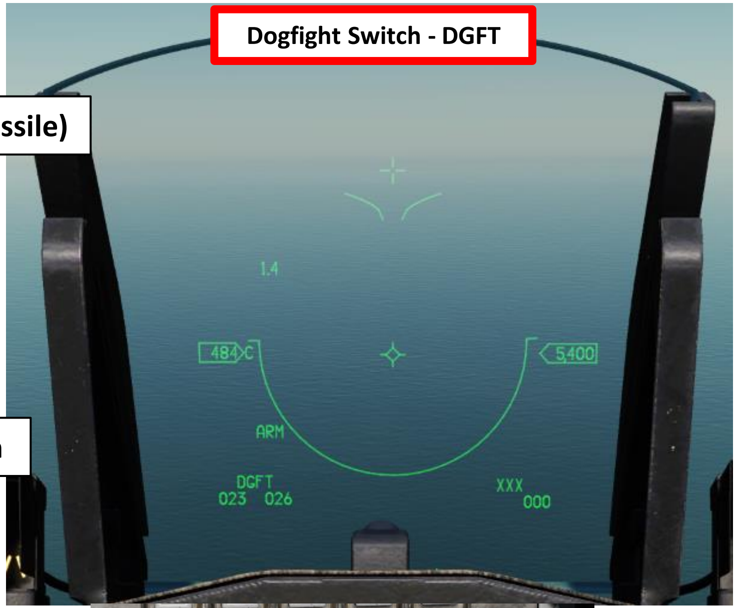
Dogfight Switch

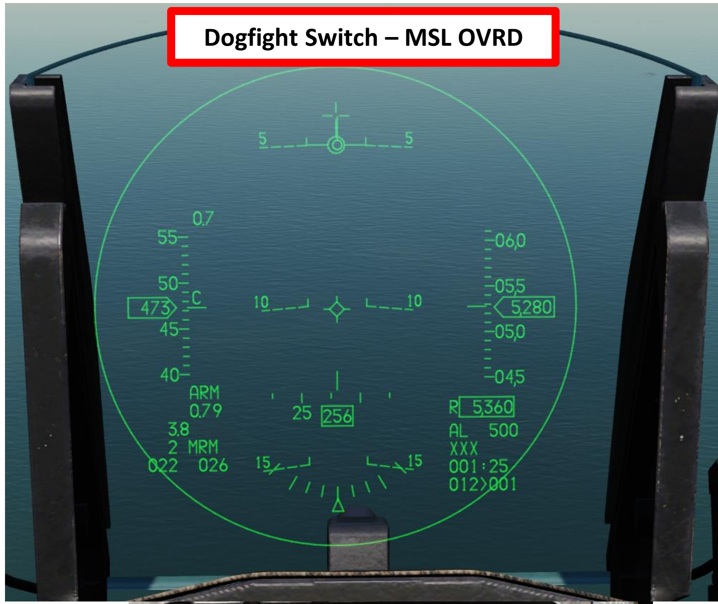
3-Position switch, Slide

- *DOGFIGHT (Outboard): provides symbology on HUD for both 20 mm gun firing and air-to-air missile delivery*
- *Missile Override (Inboard): provides symbology on HUD for air-to-air missile firing only*
- *Center: Returns to last selected Master Mode*









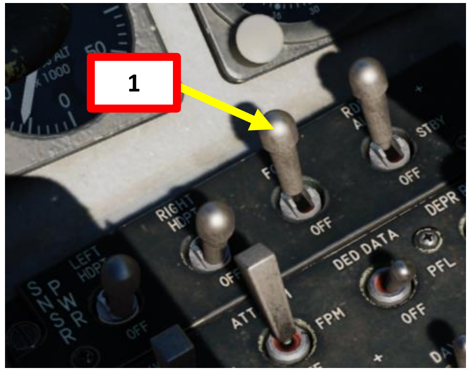
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use Air-to-Air Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the A120C (AIM-120C) missile. *Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.*
    - *Note: As the AIM-120 missile is selected, symbology for the ASEC (Allowable Steering Error Circle) and the Missile Diamond will appear.*
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose SLAVE.
    - BORE: Missile follows aircraft boresight line
    - SLAVE: Missile follows radar line-of-sight

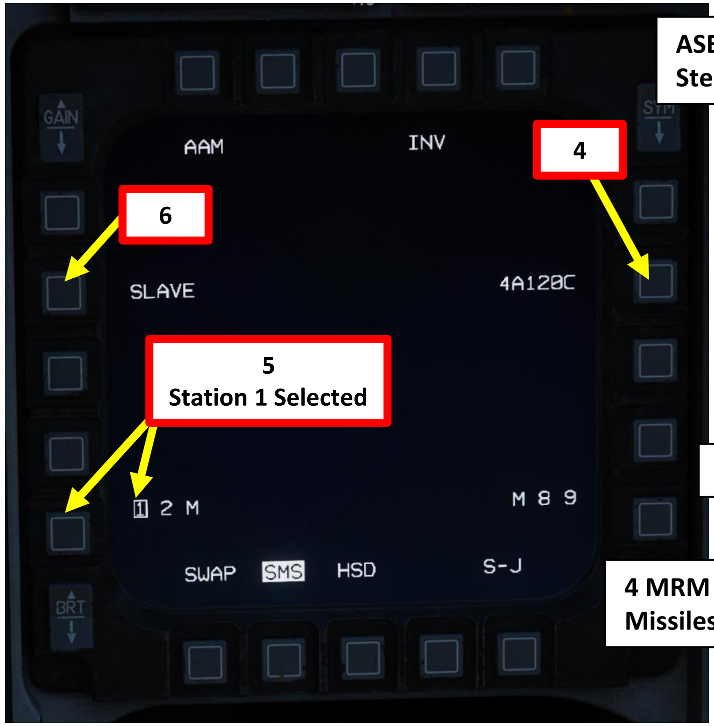
The Allowable Steering Error Circle (ASEC) shows the zone in which the **Attack Steering Cue (ASC)** should be located prior to launch to hit the target with a given probability of kill. The ASC is displayed after radar lock.

The ASEC shows the maximum, angular steering error probability. In other words, the circle increases in size when the distance to the target intercept point decreases, which means that as the distance decreases, the missile can be launched with greater steering error.



NWS A/R DISC & MSL STEP Button
- *MSL (MISSILE) STEP SHORT: Toggles Missile Station*
- *MSL (MISSILE) STEP LONG: Toggles Missile Type*

4 5



ASEC (Allowable Steering Error Circle)

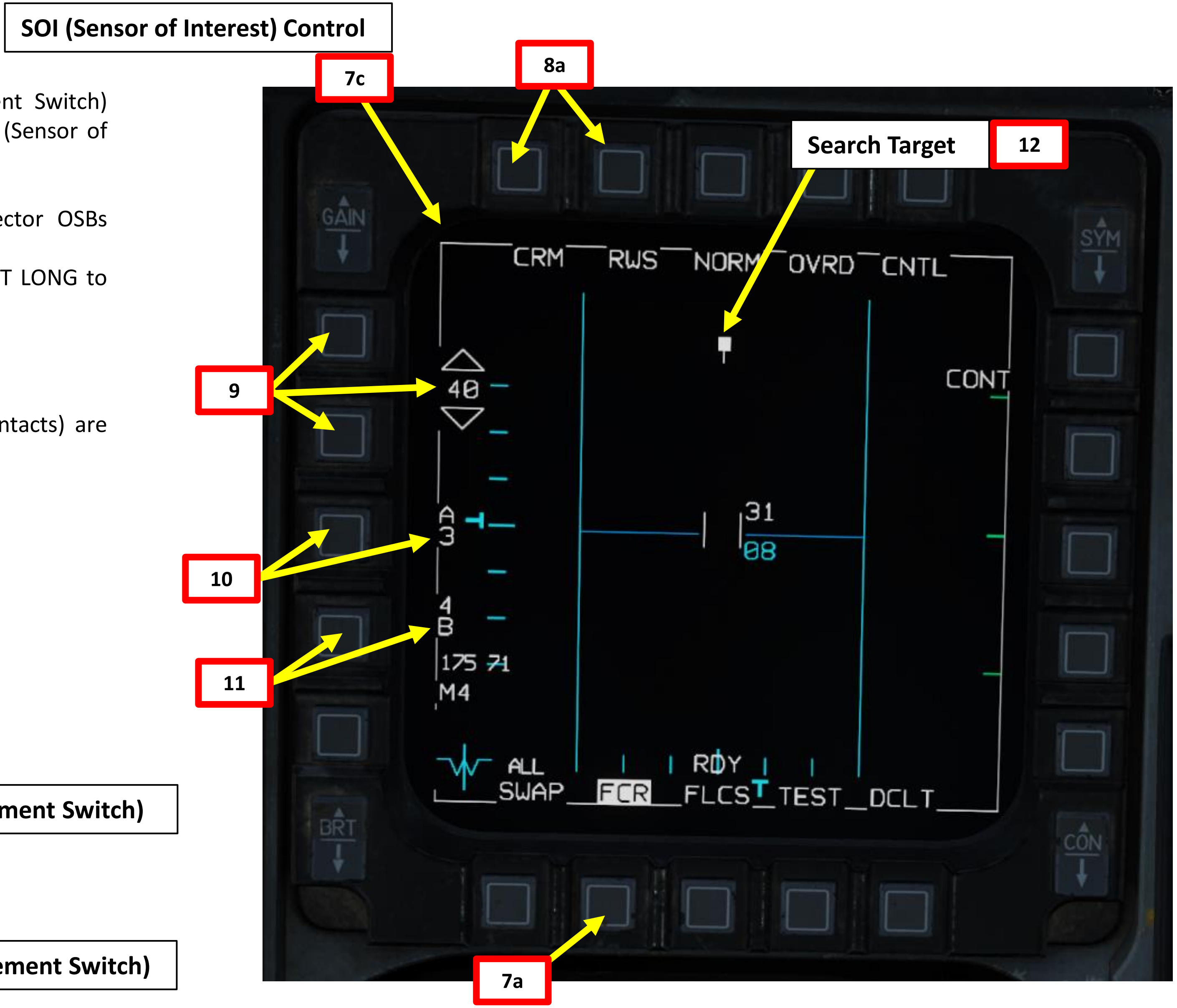
Missile Diamond

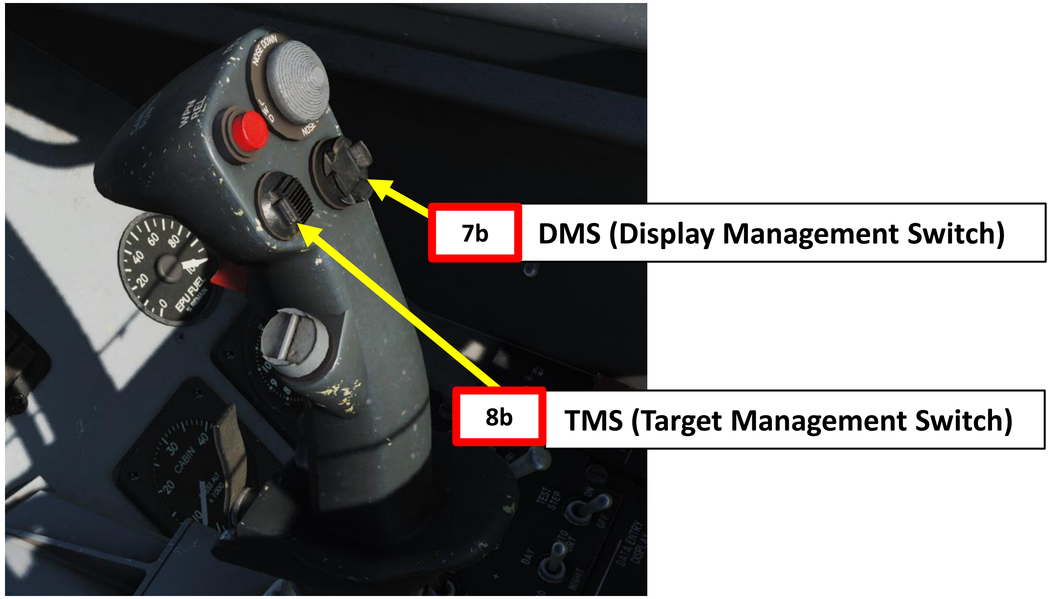
Master Arm is ON

4 MRM (Medium Range Missiles) Available

3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

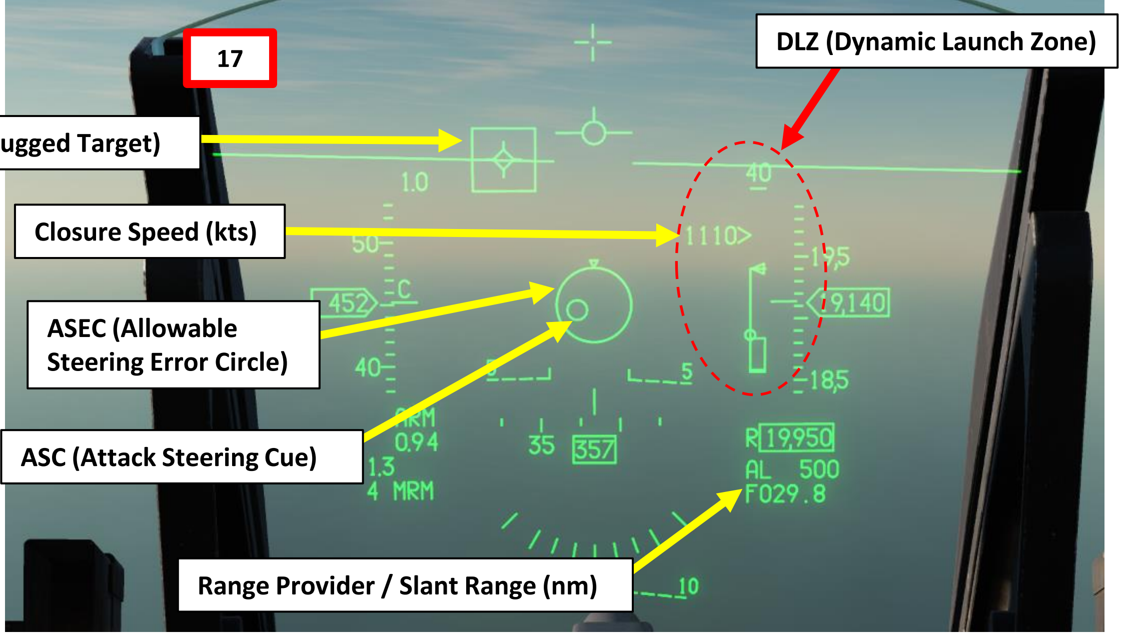
7. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
8. Select RWS mode by either:
   a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
   b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
9. Set desired radar range scale (40 nm in our case)
10. Set desired radar azimuth range (+/- 30 deg in our case)
11. Set desired radar bar mode (4 or 2 bars are generally used)
12. Search targets will first appear when valid tracks (radar contacts) are obtained.

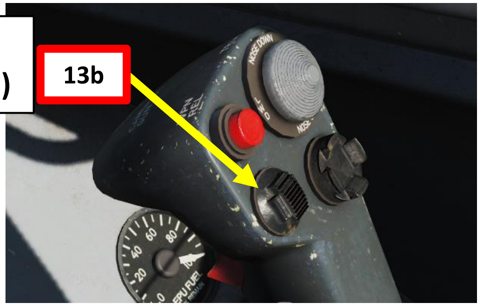


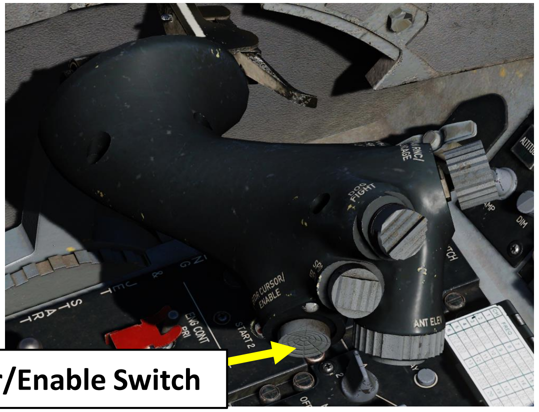


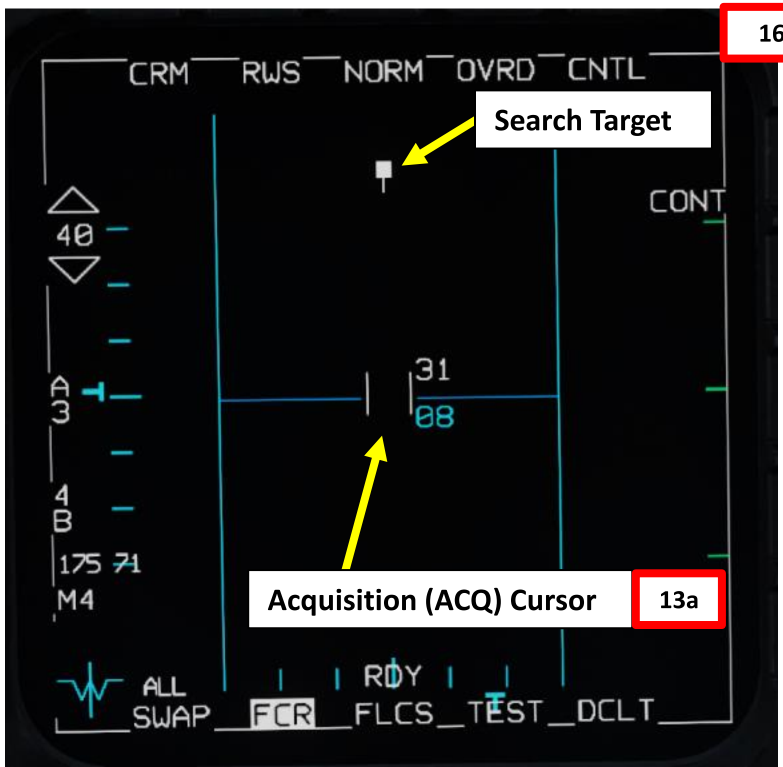
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

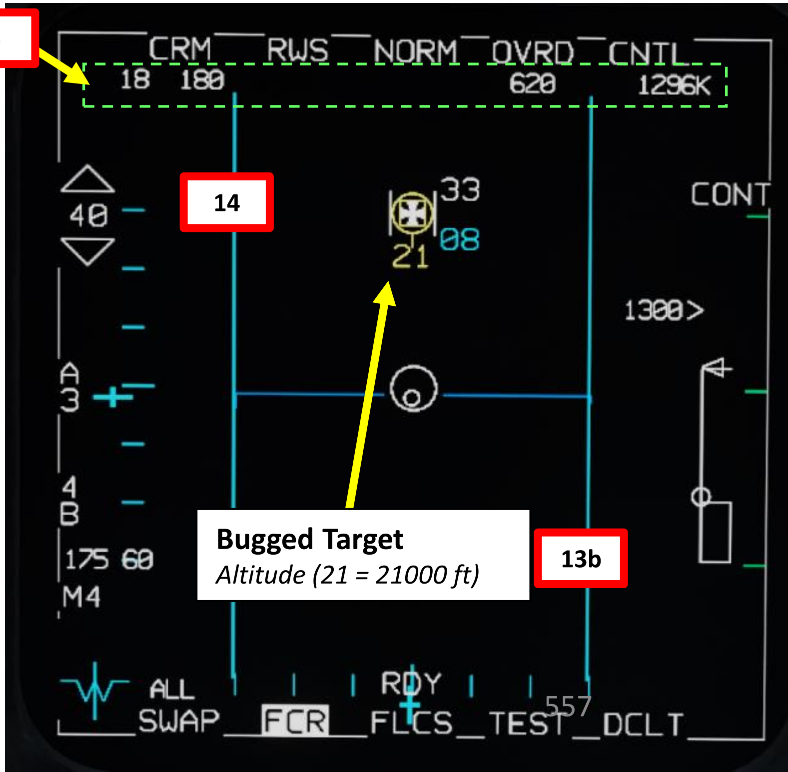
13. Acquire target and designate it as a "Bugged Target"
    a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired Search Target.
    b) Press TMS (Target Management Switch) UP, then release it to set selected Search Target into a Bugged Target.
14. Once target is designated as a "Bugged Target", the Situational Awareness Mode (SAM) acquisition sequence is initiated.
15. During acquisition, the radar antenna is directed to the last known target position, and a 4-bar, ±10-degree Spotlight search is performed.
16. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.
17. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.





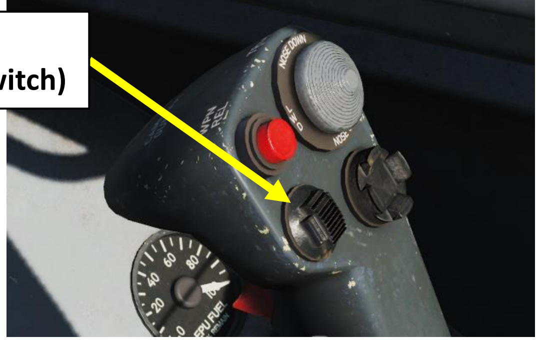


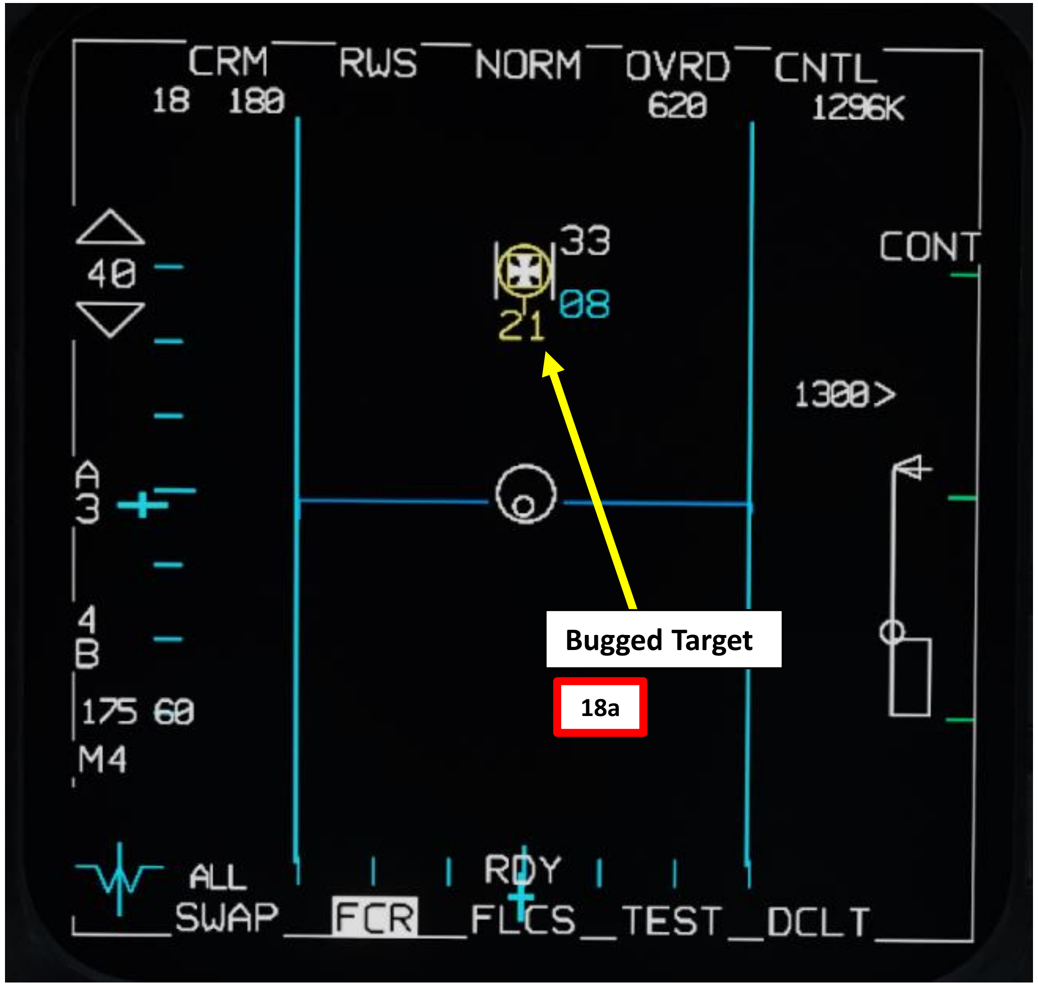




3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

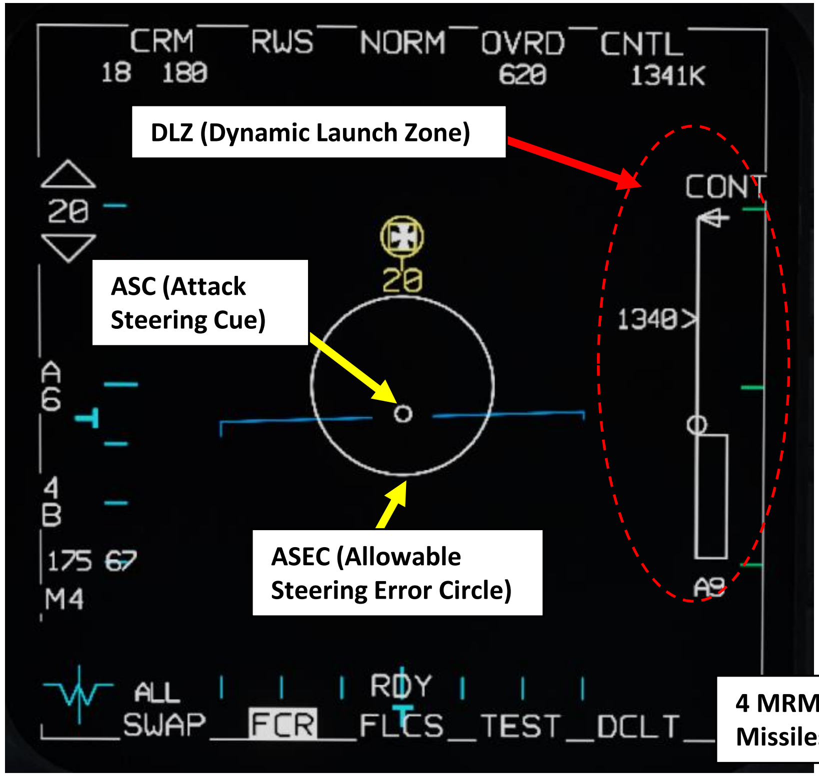
18. Transition Bugged Target to a STT (Single Target Track Radar Lock) Track by pressing TMS UP a second time.

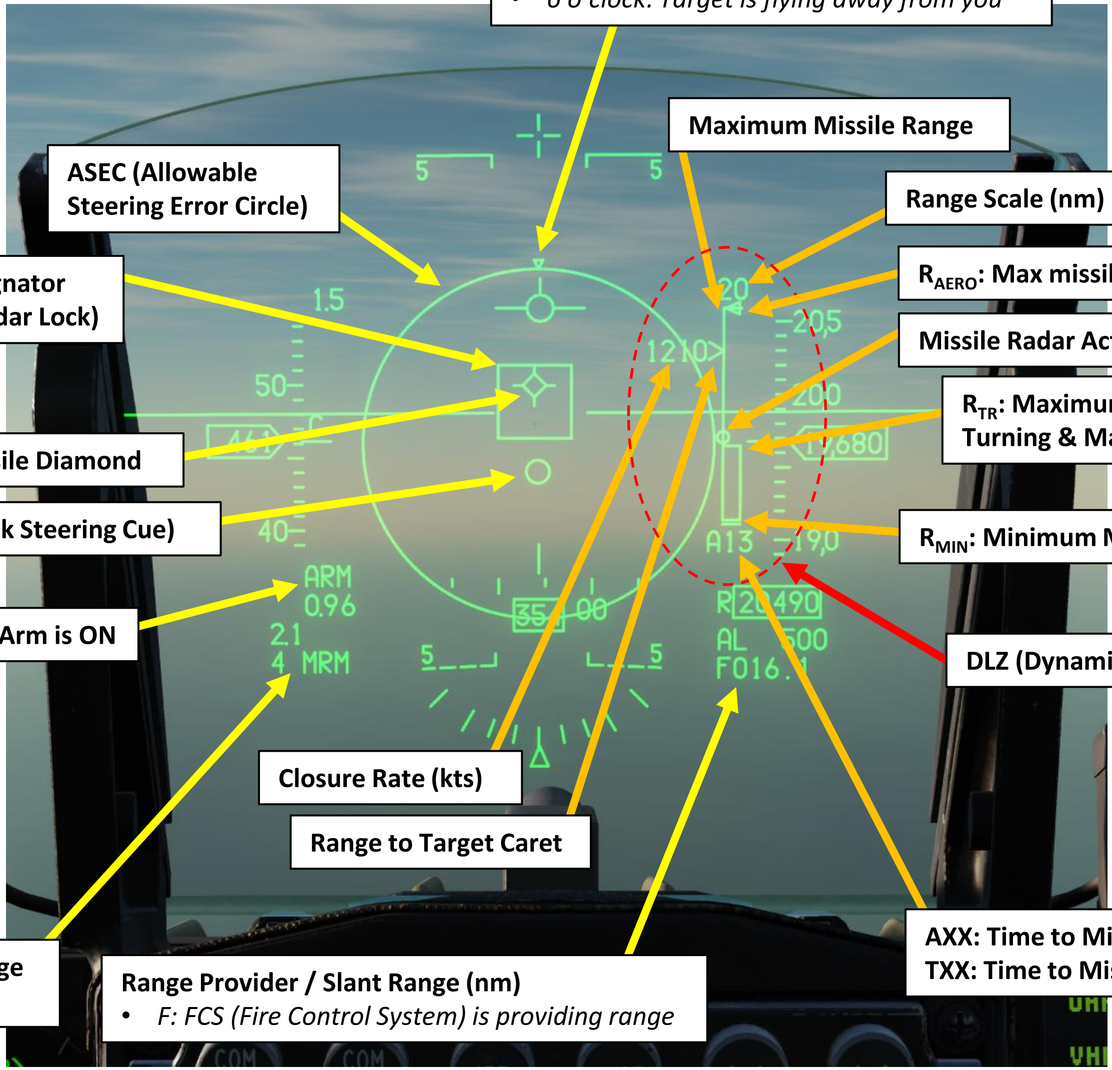




3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

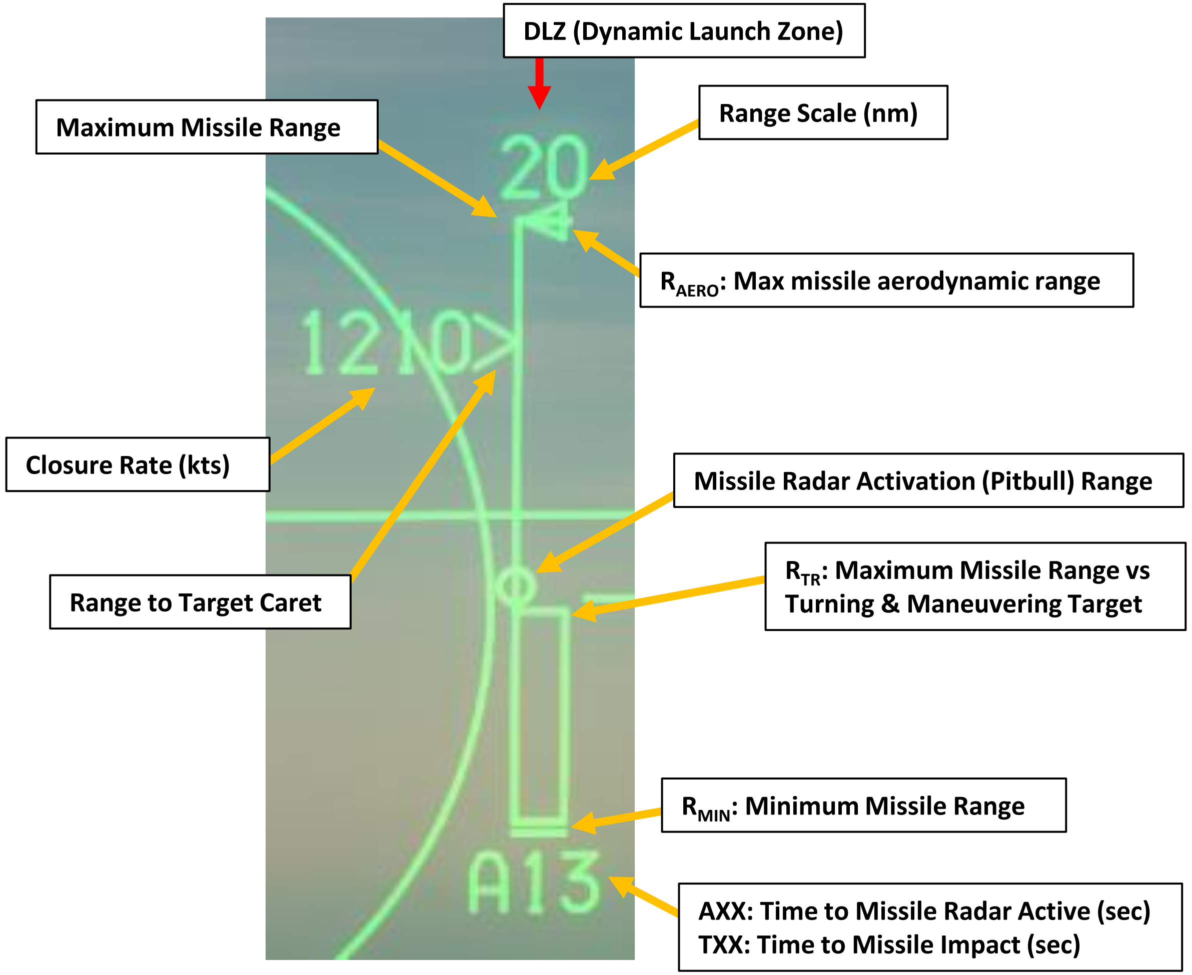
19. When the target enters the HUD, the Target Designator Box will be displayed over the target and the Missile Diamond will track that location.
20. Maneuver until Attack Steering Cue (ASC) is inside the Allowable Steering Error Circle (ASEC)
21. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.
22. Depress the Weapon Release (RALT+SPACE) button to fire the missile.

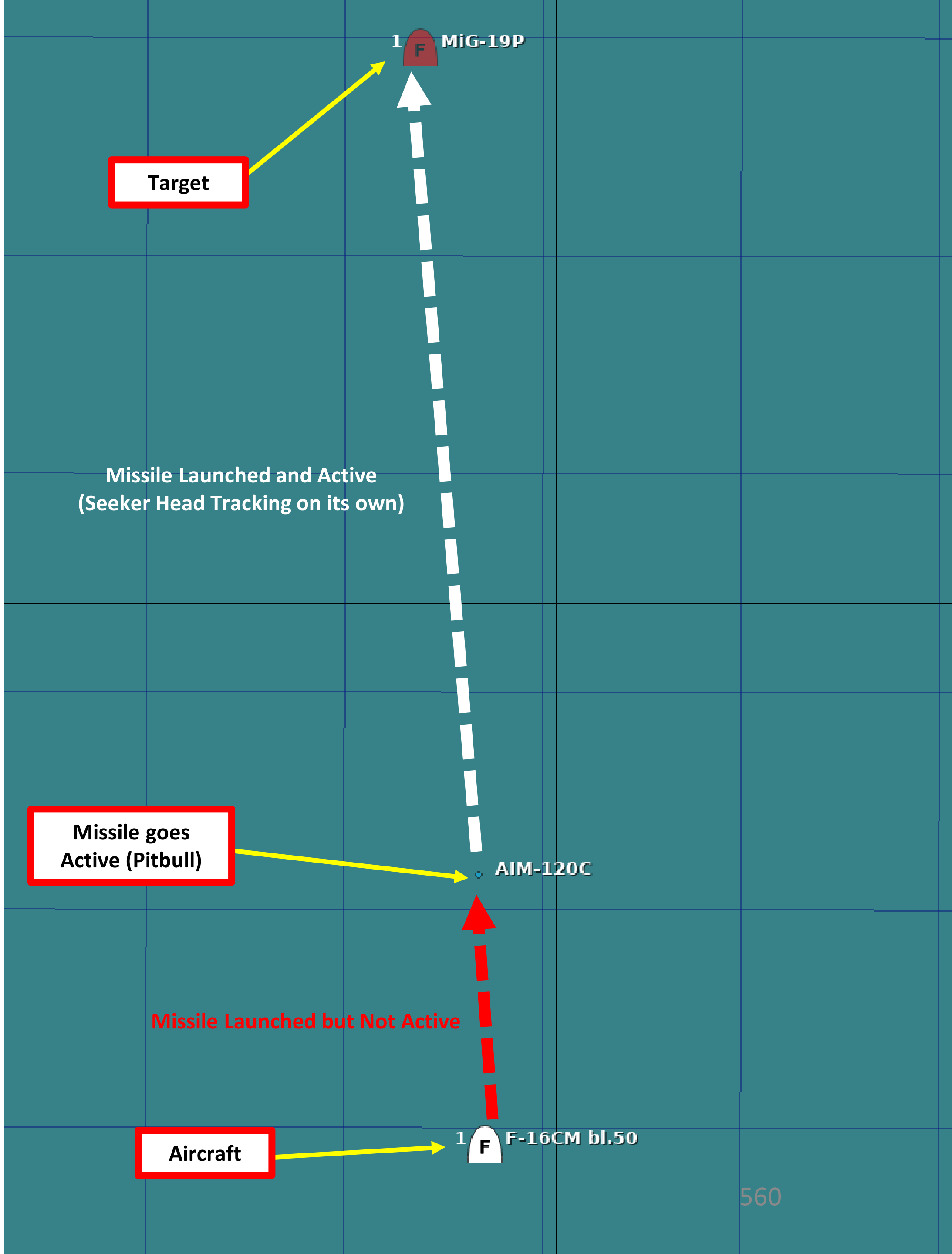




3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

Note: When you first fire an AMRAAM missile, the missile is initially guided by your own radar. However, an « active radar homing missile » also has its own radar inside the seeker head. The moment the missile goes « active » (meaning it will start self-homing/tracking targets on his own instead of using your aircraft's radar) is called « Pitbull ». When the missile goes « Pitbull », the missile truly becomes fire-and-forget. NATO brevity word "Pitbull" would be called out on the radio to inform other pilots, just as "Fox Three" would be called out upon launch.





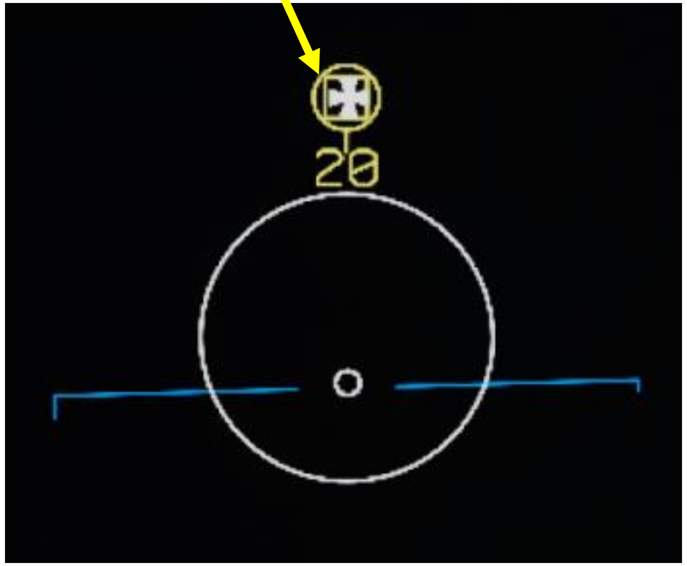
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

T1: Time to Missile Impact (1 sec)

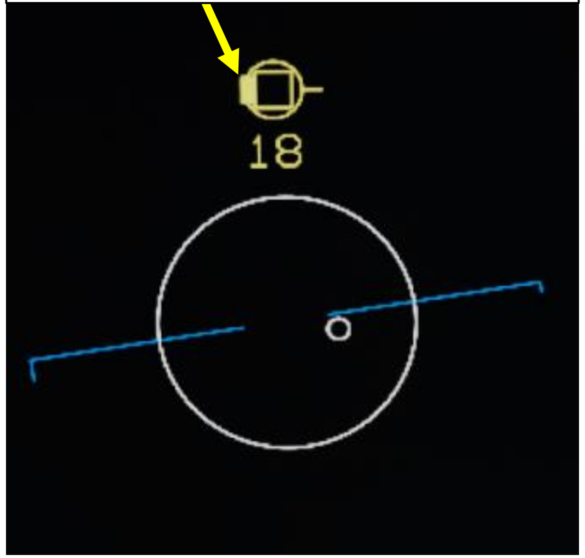
3.4 – AIM-120C AMRAAM
3.4.2 – Radar (Single Target)

Here is an overview of the post-launch symbology on the FCR page.

Bugged Target locked in STT Mode
Missile not fired yet
Altitude (20 = 20000 ft)



Bugged Target locked in STT Mode
- *Solid tail indicates missile has been fired on the bugged target. The tail represents the opposite of its trend vector.*
- *Flashing tail indicates missile has been fired on bugged target and seeker head has gone active.*



Bugged Target locked in STT Mode
Flashing "X" indicates at least one AMRAAM has reached predicted time of impact

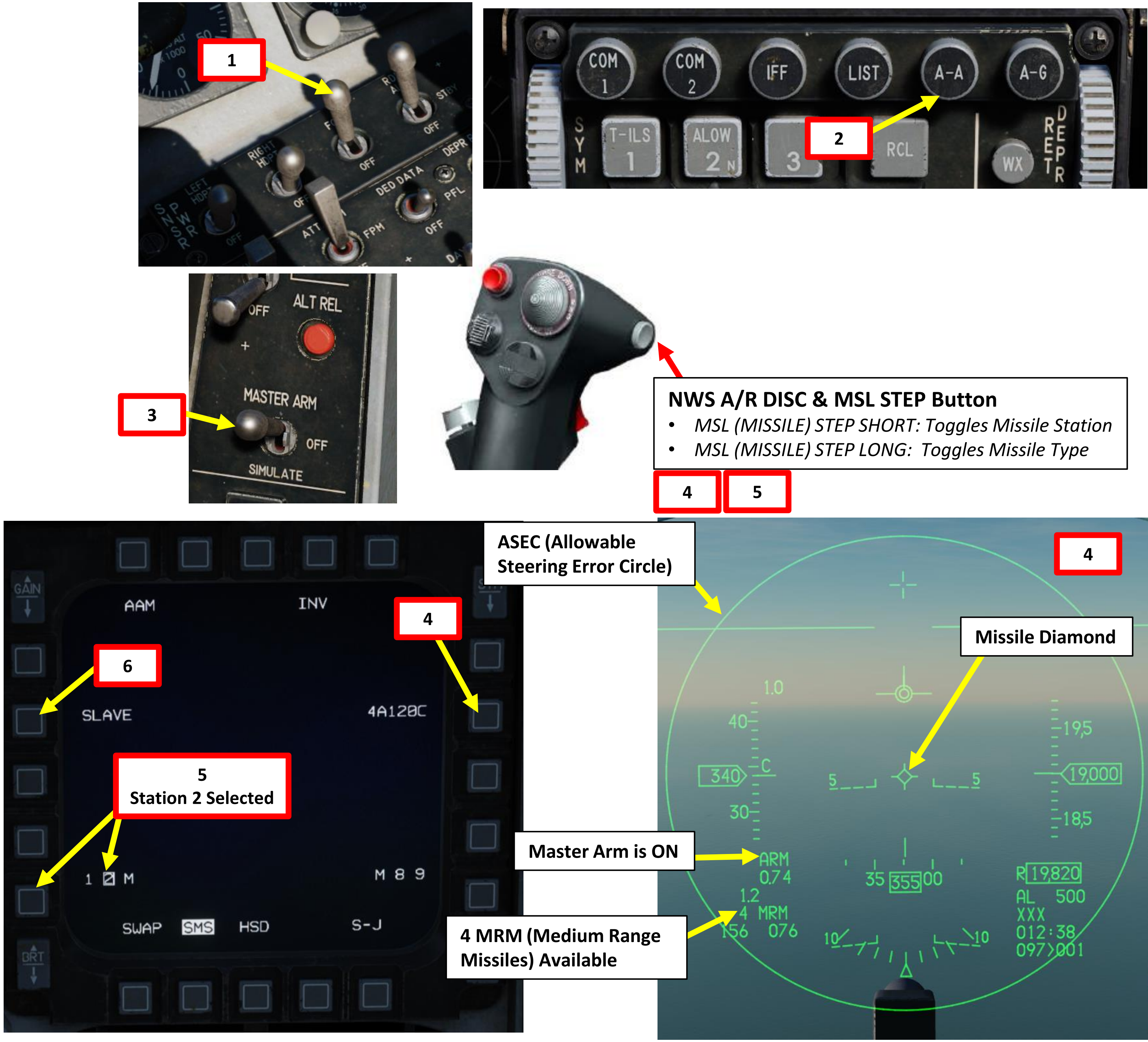
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

Note: The missile can be selected either through the AAM (Air-to-Air Missile Mode), DGFT (Dogfight Override Mode) or MSL OVRD (Missile Override Mode). In this case, we will use Air-to-Air Mode.

1. Verify that FCR (Fire Control Radar) Switch is ON (FWD)
2. Select AAM (Air-to-Air Missile Mode) by pressing the A-A (Air-to-Air) Master Mode button.
3. Set Master Arm switch – ARM (UP)
4. On the SMS (Stores Management Set) page, press on the OSB (Option Select Button) next to the current Missile Type to toggle to the A120C (AIM-120C) missile. *Alternatively, you can press the NWS / MSL STEP button on the stick for more than 0.5 sec (LONG) to toggle the missile type.*
   - *Note: As the AIM-120 missile is selected, symbology for the ASEC (Allowable Steering Error Circle) and the Missile Diamond will appear.*
5. Select desired missile station by pressing the NWS / MSL STEP button on the stick for less than 0.5 sec (SHORT).
6. Select desired missile line-of-sight parameters by pressing the OSB next to SLAVE/BORE. In this case, choose SLAVE.
   - BORE: Missile follows aircraft boresight line
   - SLAVE: Missile follows radar line-of-sight

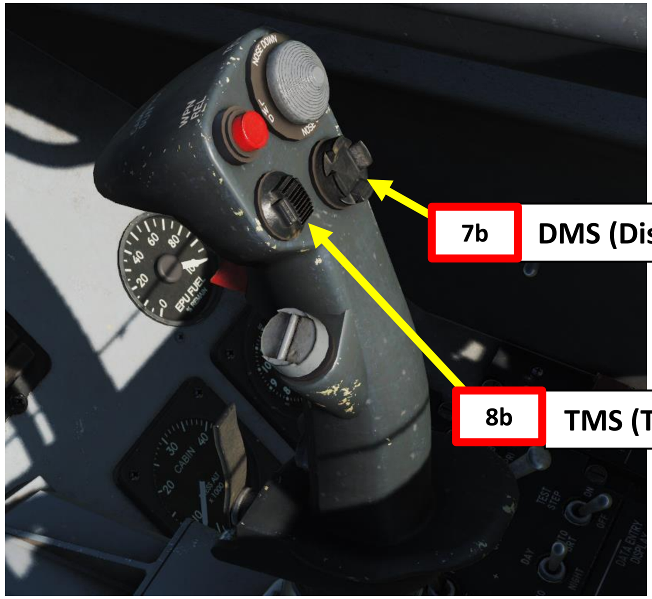
The Allowable Steering Error Circle (ASEC) shows the zone in which the **Attack Steering Cue (ASC)** should be located prior to launch to hit the target with a given probability of kill. The ASC is displayed after radar lock.

The ASEC shows the maximum, angular steering error probability. In other words, the circle increases in size when the distance to the target intercept point decreases, which means that as the distance decreases, the missile can be launched with greater steering error.



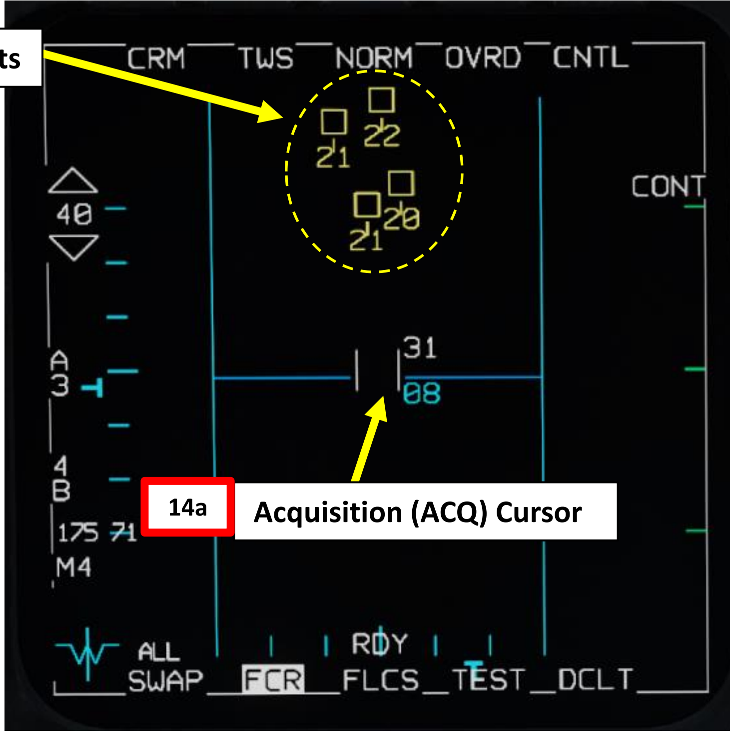
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

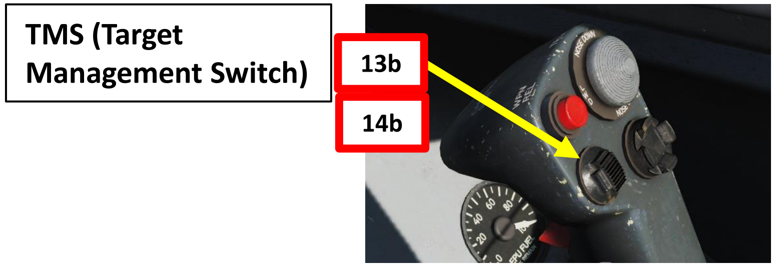
7. Select FCR page, then press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
8. Select TWS mode by either:
    a) Using the Radar Mode and Radar Sub-Mode selector OSBs (Option Select Button), or;
    b) Pressing the TMS (Target Management Switch) RIGHT LONG to cycle between RWS and TWS mode.
9. Set desired radar range scale (40 nm in our case)
10. Set desired radar azimuth range (+/- 30 deg in our case)
11. Set desired radar bar mode (4 or 2 bars are generally used)
12. After being detected on two consecutive antenna sweeps, Search Targets become Track Targets automatically.

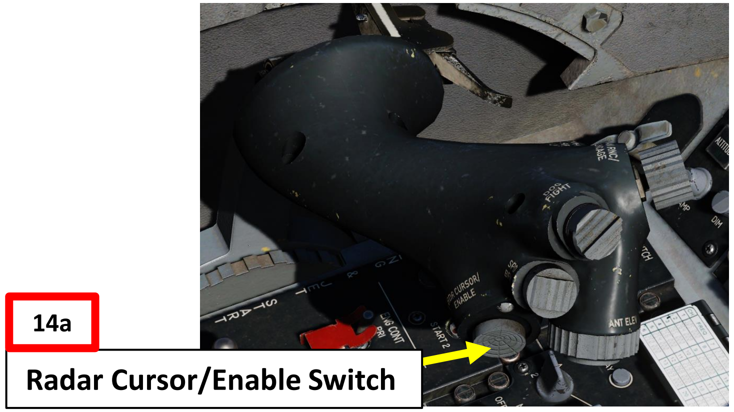


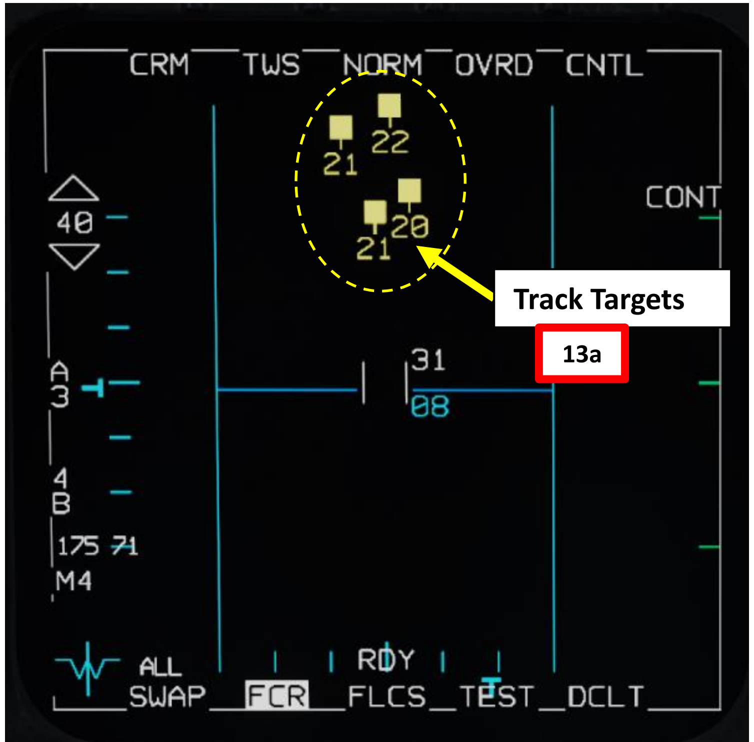
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

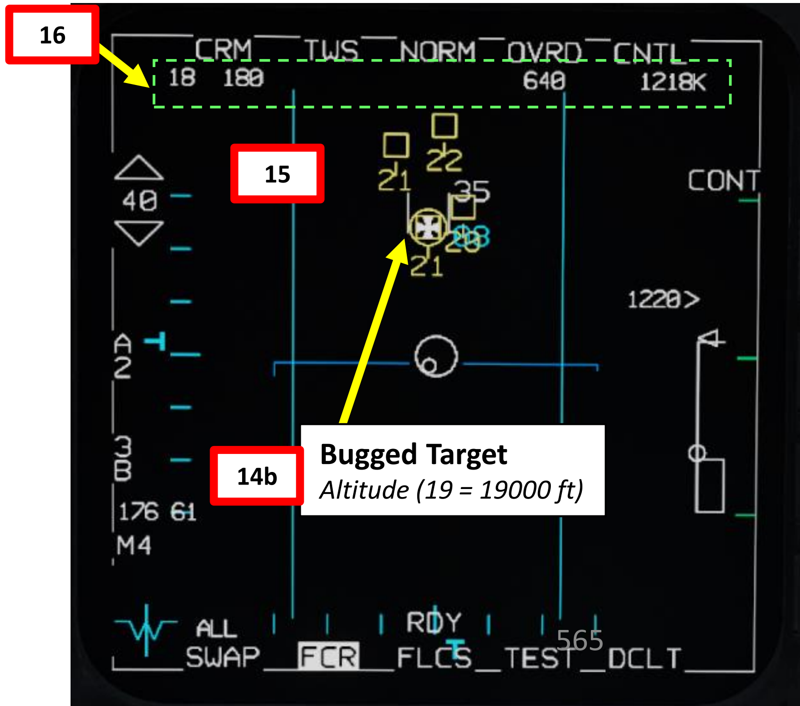
13. Transition Track Targets into System Targets, which can then be "bugged" subsequently. **Transition all Track Targets into System Targets using TMS RIGHT SHORT**
    a) Track targets are visible as filled squares
    b) Press TMS (Target Management Switch) RIGHT SHORT
    c) All existing Track Targets will transition into System Targets
14. Designate the desired System Target as a "Bugged Target". **Bug System Target with the Acquisition Cursor**
    a) Use the Radar Cursor/Enable switch to move the Acquisition Cursor over the desired System Target.
    b) Press TMS (Target Management Switch) UP to set selected System Target into a Bugged Target.
15. When a "Bugged Target" is designated, the radar automatically transitions the scan to 3-bar, ±25 degrees centered on the bugged target to provide faster updates and reduce the chance of losing the track.
16. Bugged Target information (Aspect Angle, Ground Track, Airspeed (kts), Closure Speed (kts)) will be displayed on the upper region of the FCR page.





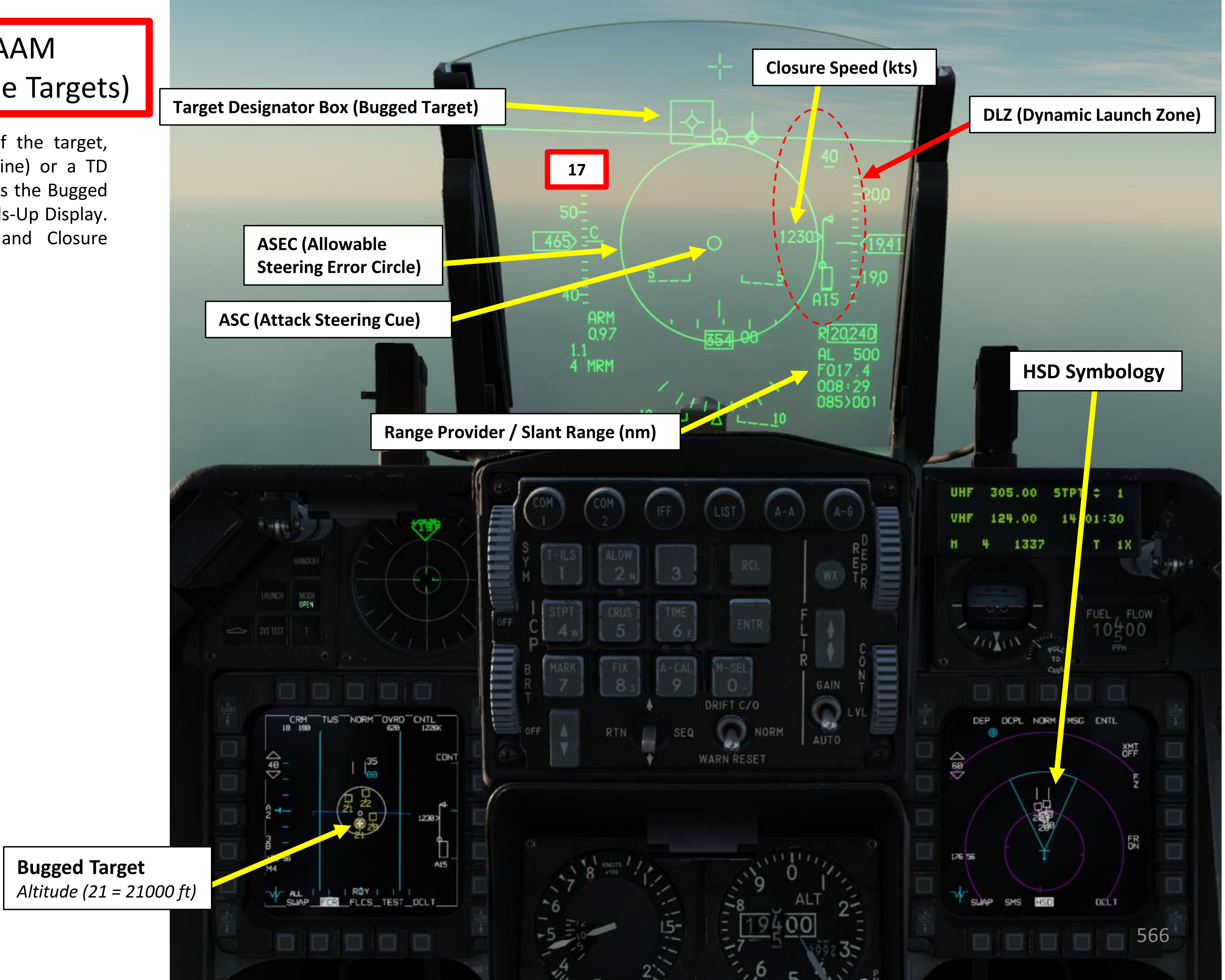






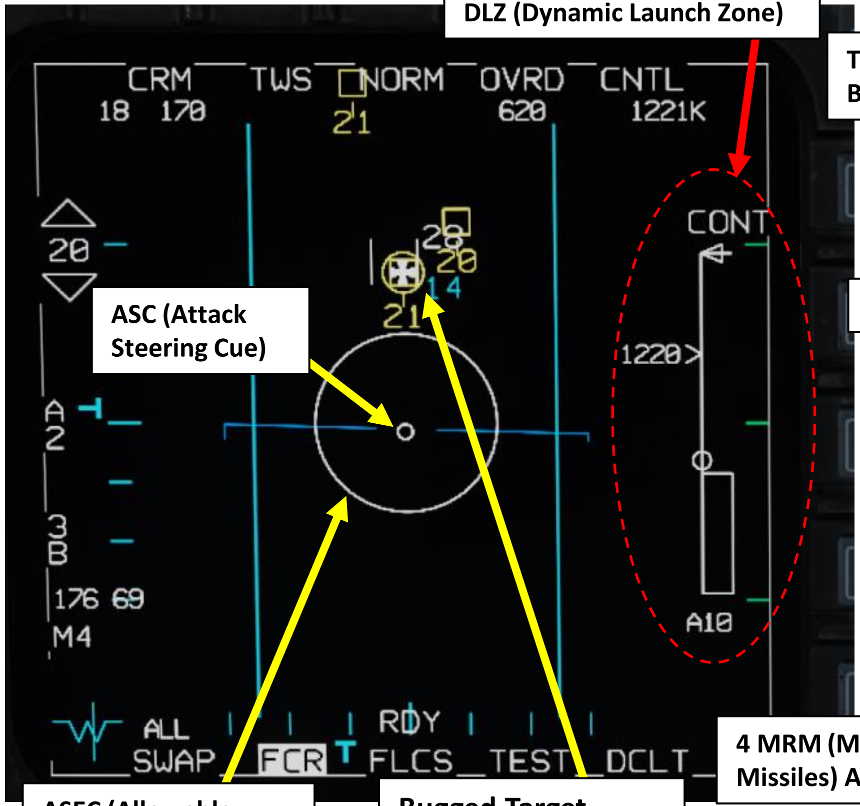
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

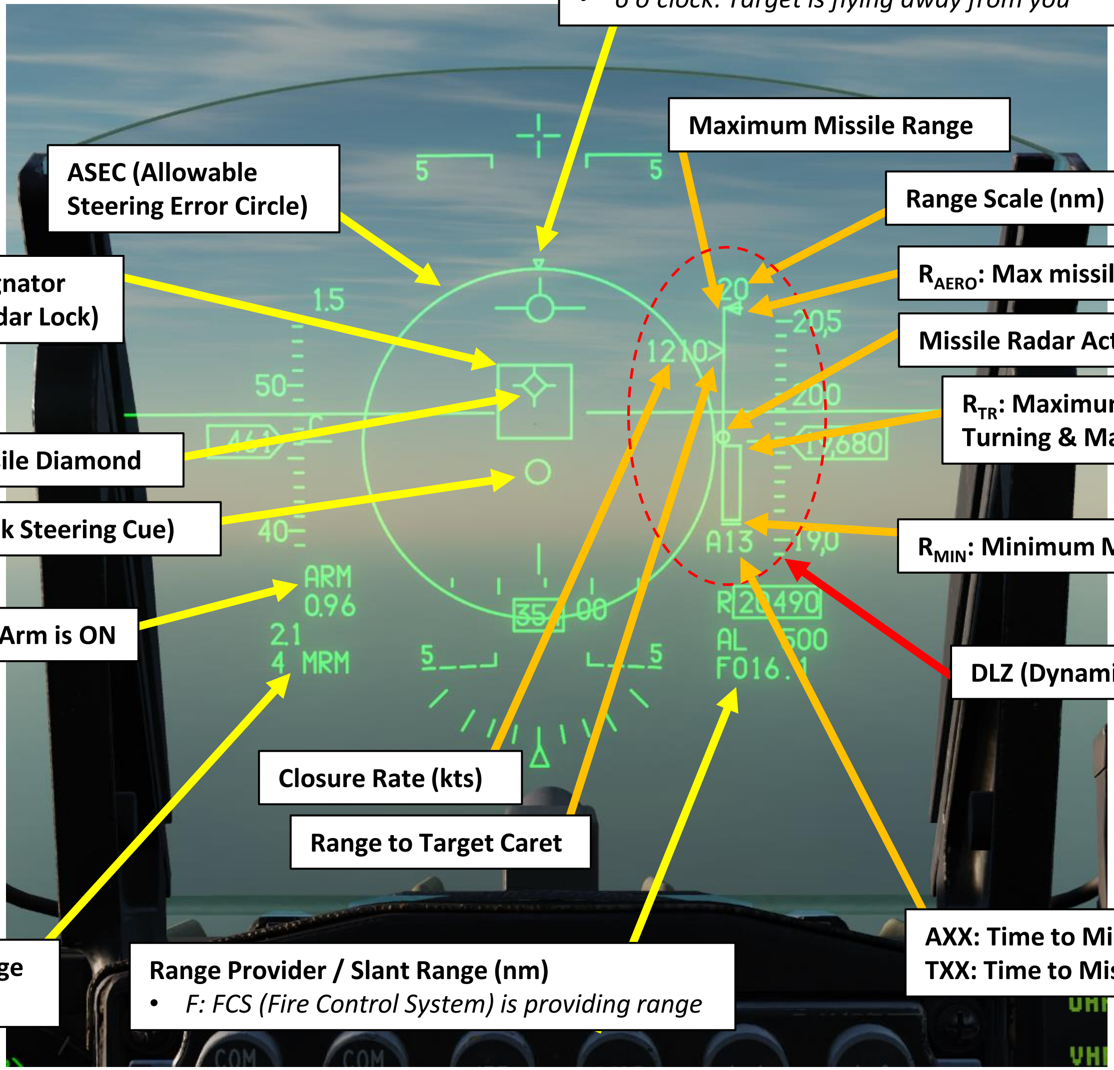
17. Depending on the direction of the target, either a TLL (Target Locator Line) or a TD (Target Designator) Box towards the Bugged Target is displayed on the Heads-Up Display. Bugged Target Range (nm) and Closure Speed (kts) are also displayed.



3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

18. When the target enters the HUD, the Target Designator Box will be displayed over the target and the Missile Diamond will track that location.
19. Maneuver until Attack Steering Cue (ASC) is inside the Allowable Steering Error Circle (ASEC)
20. Consult DLZ (Dynamic Launch Zone) indicator and make sure the range to target is between the Minimum Range and the Max Missile Range vs Maneuvering Target.
21. Depress the Weapon Release (RALT+SPACE) button to fire the missile.



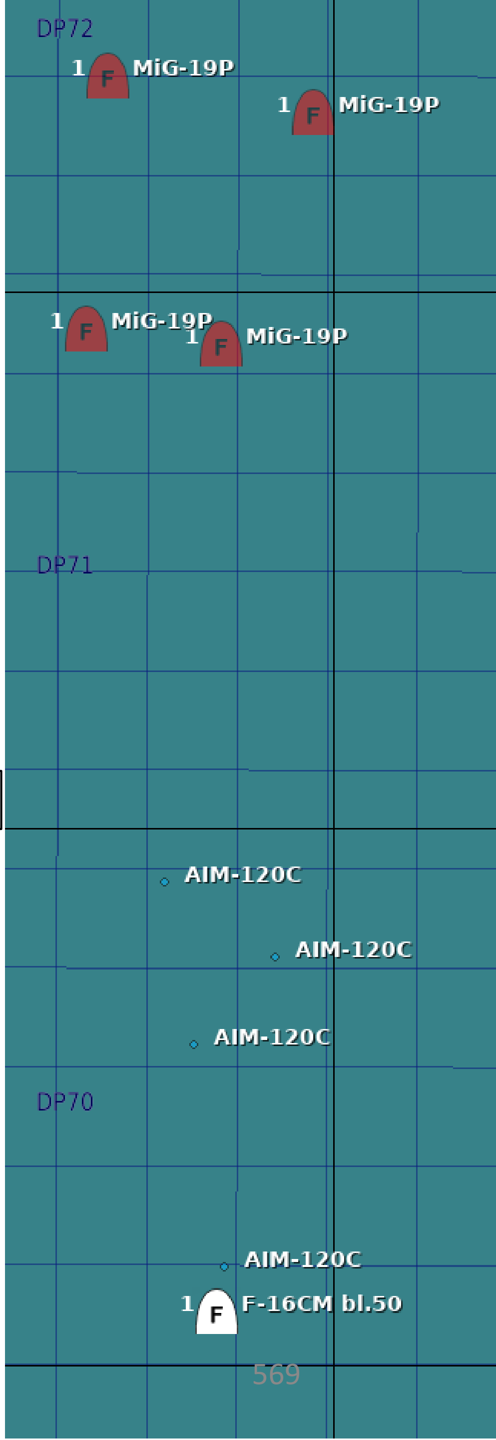


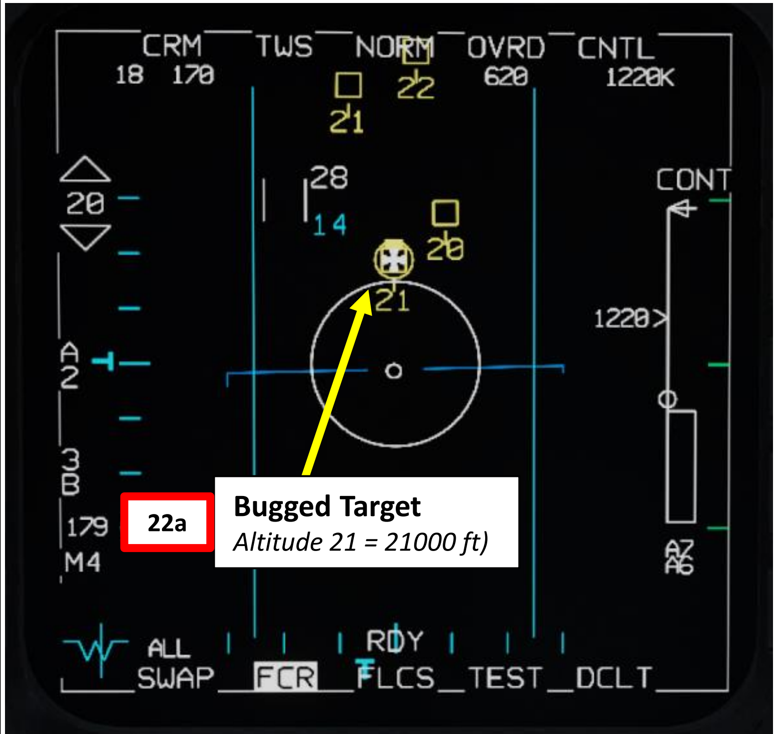
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

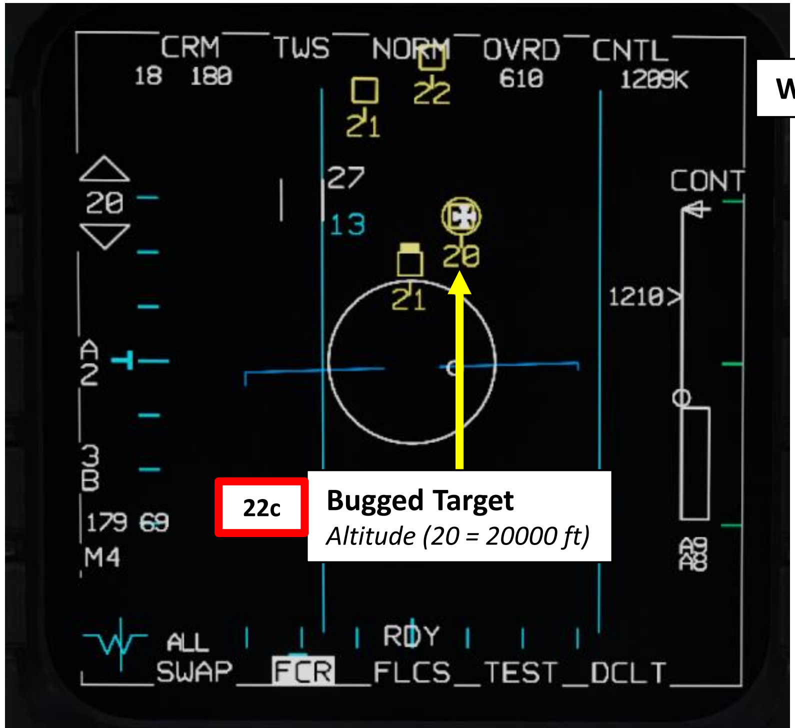
T1: Time to Missile Impact (1 sec)

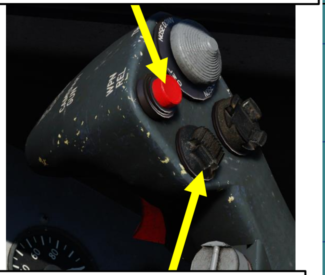
3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

22. To engage other targets, press TMS (Target Management Switch) RIGHT SHORT to cycle to next displayed system target.
23. Depress the Weapon Release (RALT+SPACE) button to fire the missile.
24. Repeat steps 22 and 23 to engage further targets.





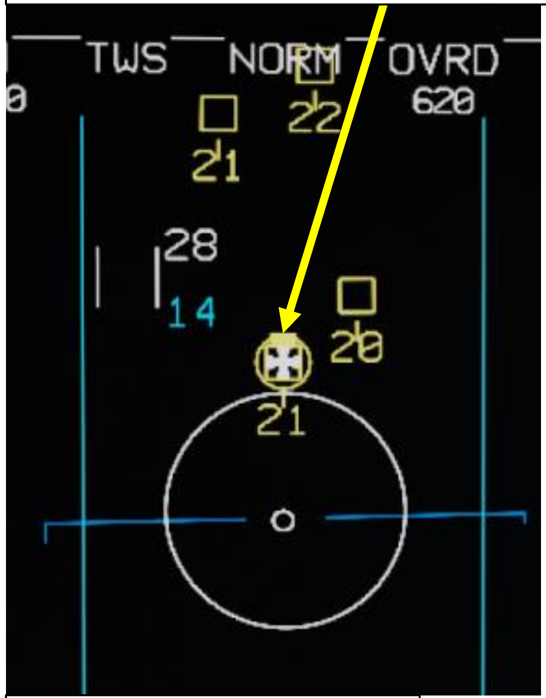




3.4 – AIM-120C AMRAAM
3.4.3 – Radar (Multiple Targets)

Here is an overview of the post-launch symbology on the FCR page.

Bugged Target
- *Solid tail indicates missile has been fired on the bugged target. The tail represents the opposite of its trend vector.*
- *Flashing tail indicates missile has been fired on bugged target and seeker head has gone active.*



First target bugged
Missile fired on first target

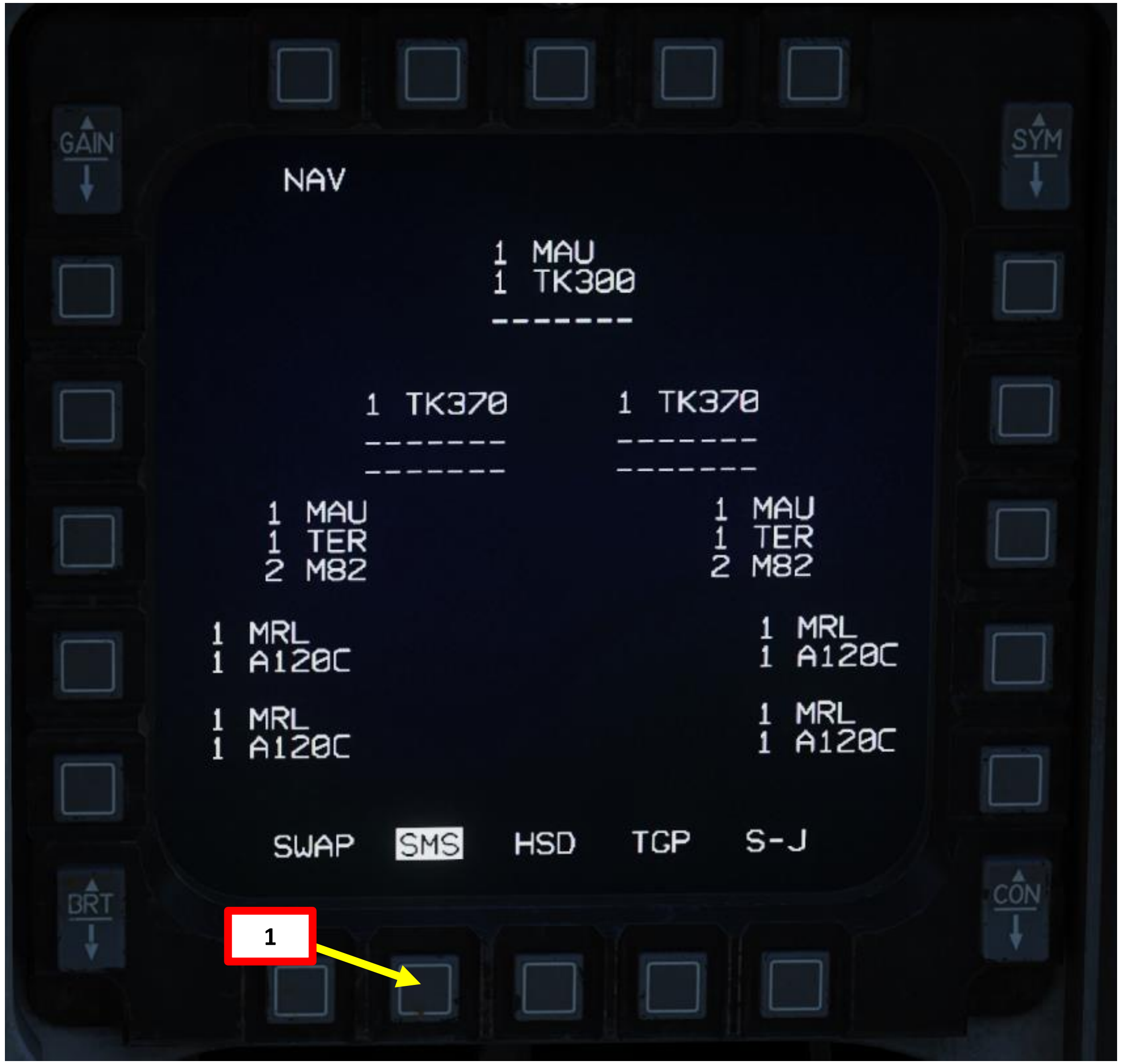
Second target bugged
Missile fired on first and second target

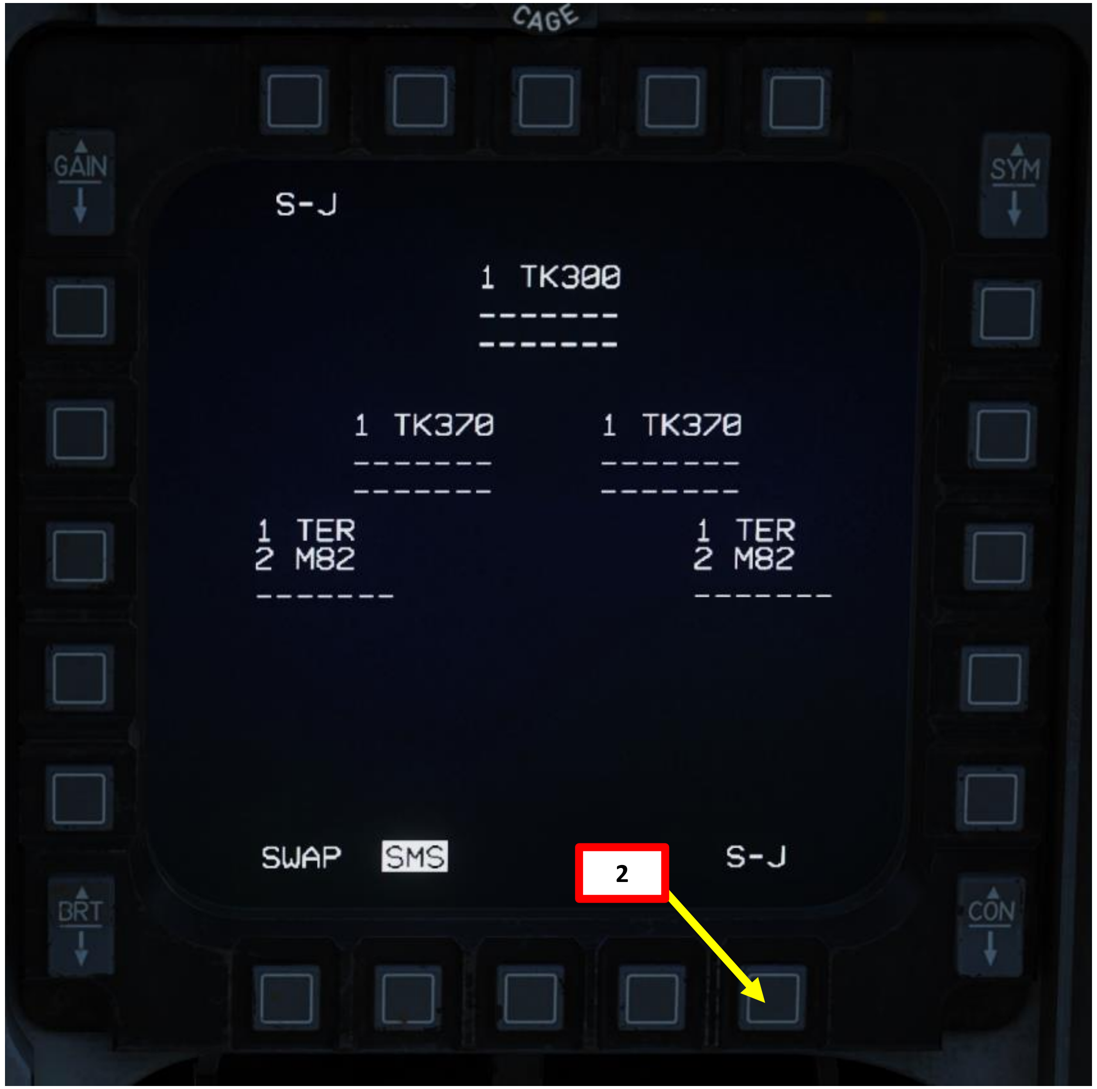
Third target bugged
Missile fired on first, second and third target

Fourth target bugged
Missile fired on first, second, third and fourth target

4 – ORDNANCE JETTISON
4.1 – Selective Ordnance Jettison

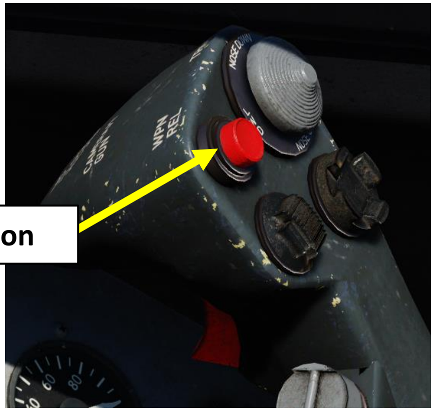
1. Select SMS (Stores Management Set) page by pressing the OSB (Option Select Button) next to SMS
2. Select Selective Jettison menu by pressing the OSB next to S-J

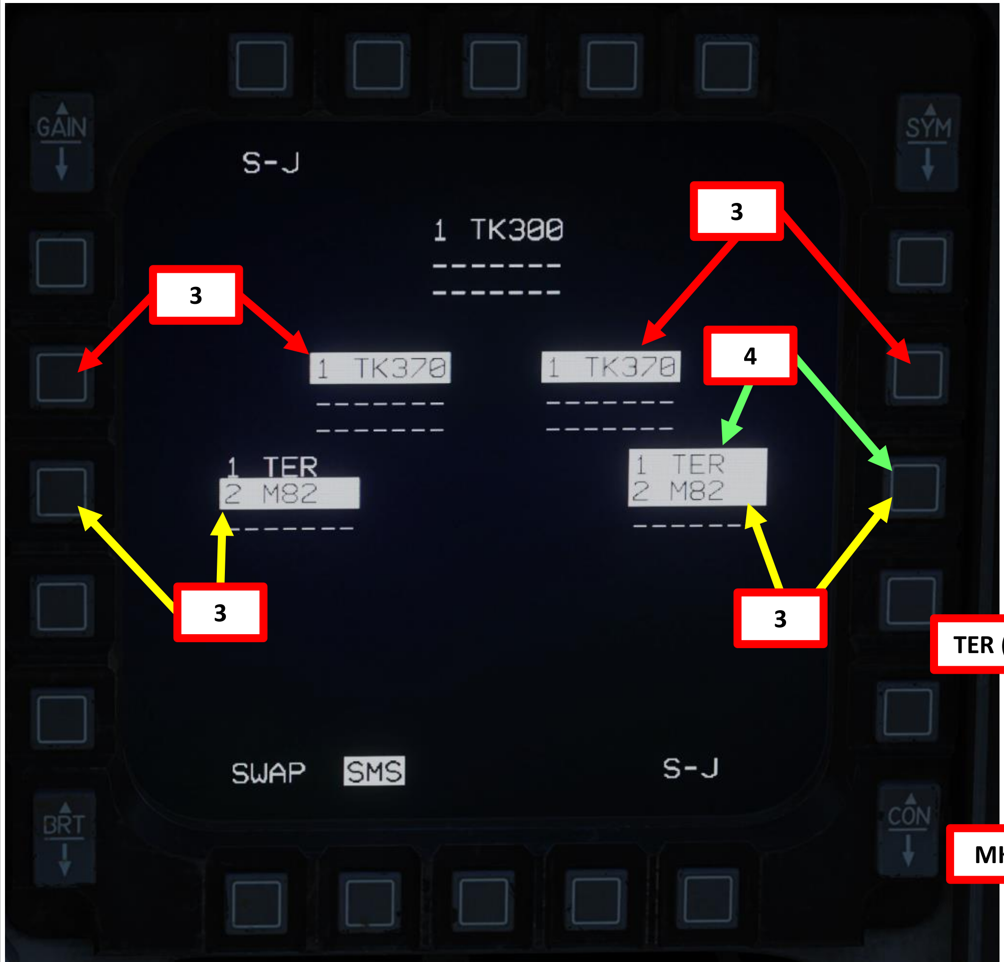




4 – ORDNANCE JETTISON
4.1 – Selective Ordnance Jettison

3. Depress the OSB next to the store to highlight it for jettison.
4. If more than one jettisonable store is loaded on a station, for example stores on a TER-9 (Triple Ejector Rack), one depression of the OSB highlights the store and another depression highlights both the store and the rack.
5. Depress the Weapon Release (RALT+SPACE) button to jettison highlighted (selected) stations





4 – ORDNANCE JETTISON
4.2 – Emergency Stores Jettison

The emergency jettison button will jettison all fuel tanks, carted suspension racks, and free fall ordnance.

Emergency Stores Jettison Button

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.

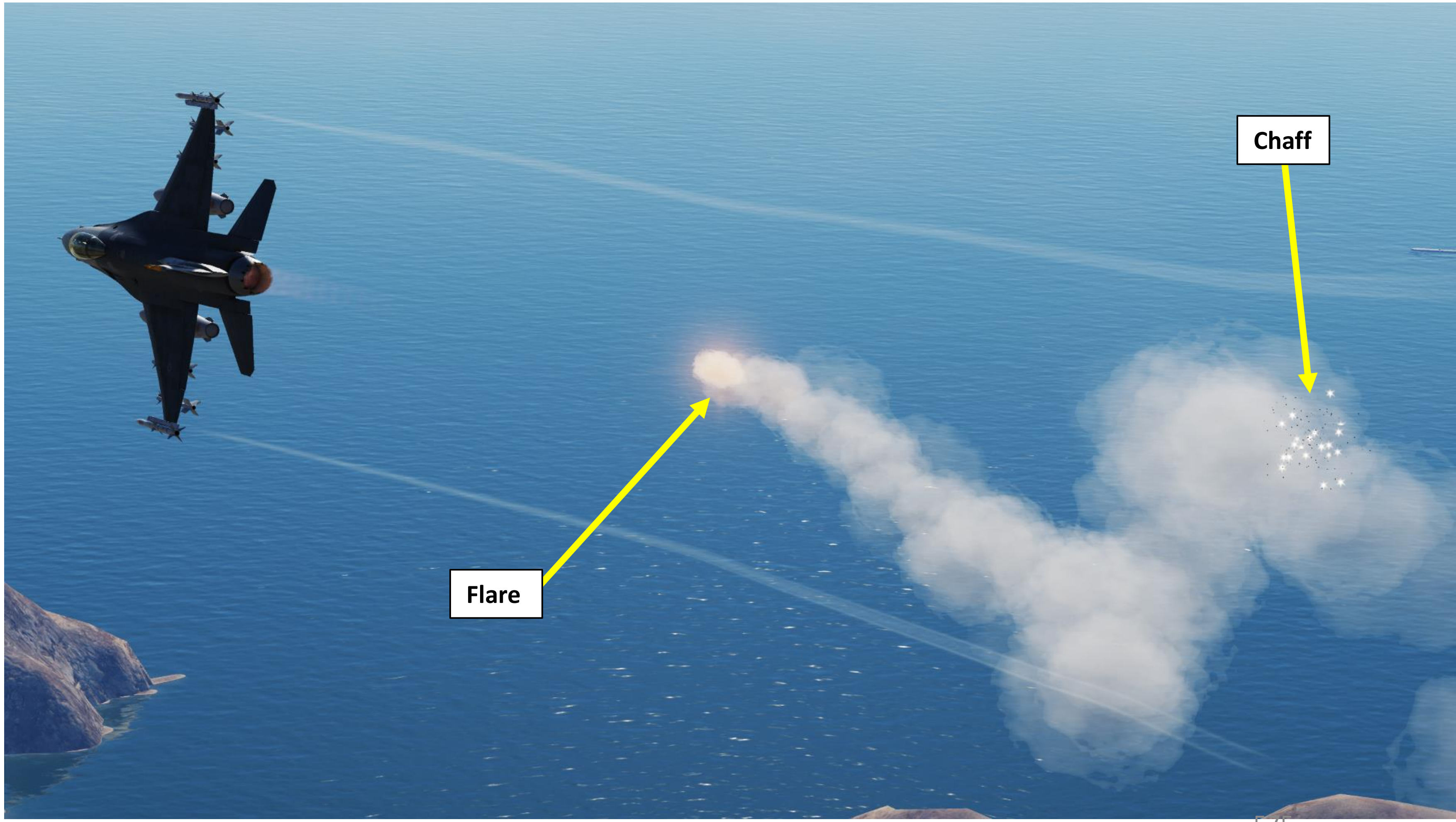
Missiles can generally track you using 2 things: radar signature (radar waves are sent at you and you reflect them, which is called a "radar signature") and heat signature (like the exhaust of your engines). Countermeasures will only be effective against the kind of weapon it was meant to counter; a 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 **RWR** (Radar Warning Receiver) is for: to help you know what is firing at you so you can take the adequate action to counter it.

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-184 ECM pod** is an Electronic Countermeasure/Jammer system. It 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.



AN/ALR-56M AZIMUTH INDICATOR/RWR RADAR WARNING RECEIVER

Detected radars are displayed on the Azimuth Indicator (aka Radar Warning Receiver). The Azimuth Indicator is a circular-shaped display on the left of the front dash that provides you a visual representation of radar emitters around your aircraft. The display is in plan view with your aircraft in the center. Take note that RWR symbols are also displayed on the **HMD (Helmet-Mounted Display)**.

As threats are displayed around the center of the display, the icons represent the azimuth direction to the threat. In addition to the icons, an audio system will alert you to the status of the radars detected (search, track, and launch).

The **locations of radar emitters on the display do not necessarily correlate to emitter range from your aircraft**. The distance of the threat icon from the center of the display **indicates radar signal strength**. The closer the icon is to the center of the display generally indicates the closer the radar is to you.

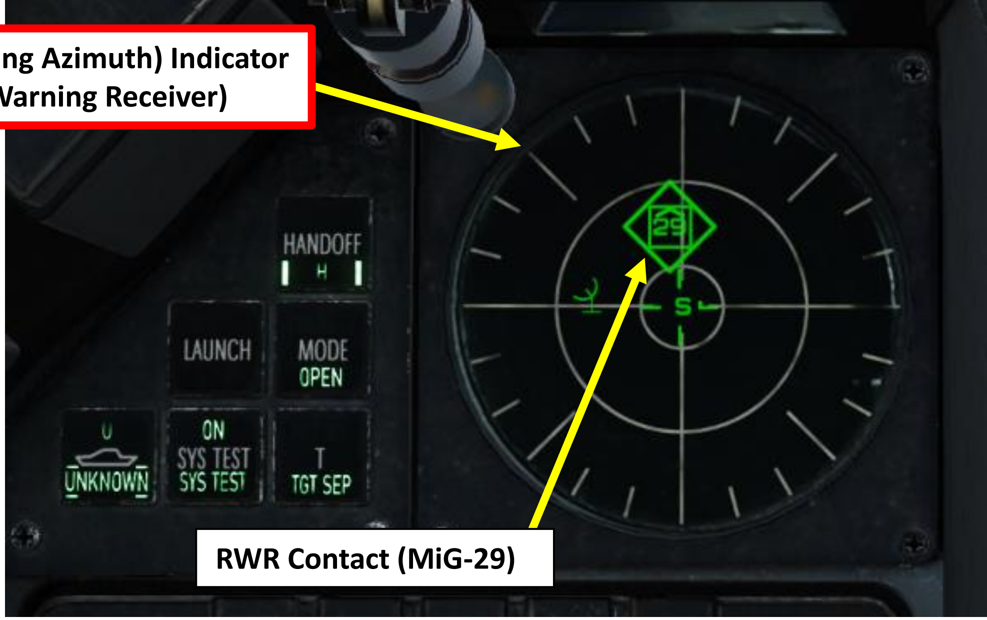
Any time a new emitter symbol is displayed on the azimuth indicator, a status change tone is generated by the system. Special tones are also generated for specific threats or critical threat modes of operation.

The TWA (Threat Warning Azimuth) / RWR (Radar Warning Receiver) is **powered by pressing the RWR POWER Button on the Threat Warning Auxiliary Panel.**

Threat Warning Auxiliary Panel

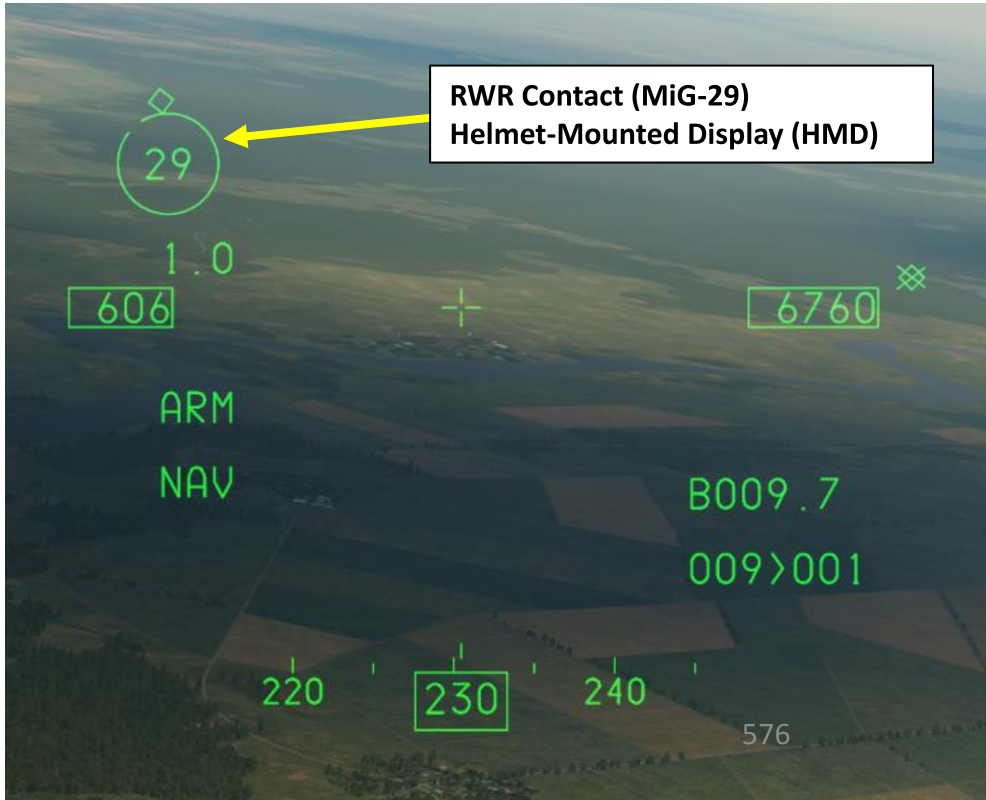
RWR (Radar Warning Receiver) Indicator Control Power Button

ALR-56M TWA (Threat Warning Azimuth) Indicator Also known as RWR (Radar Warning Receiver)



RWR Contact (MiG-29)

RWR Contact (MiG-29) Helmet-Mounted Display (HMD)



AN/ALR-56M AZIMUTH INDICATOR/RWR RADAR WARNING RECEIVER

AN/ALR-56M AZIMUTH INDICATOR/RWR RADAR WARNING RECEIVER

- A **diamond** indicates the highest threat level.
- If a symbol is displayed with **no circle around it**, it indicates that the **radar is in acquisition/search mode**. When a new emitter is detected, a new threat tone will be heard.
- If a symbol has a **square around it**, it indicates that the **radar is tracking/locked on to your aircraft**. When being tracked by an engagement radar, you will be provided a radar lock tone.
- If a symbol has a **flashing circle around it**, it indicates that the **radar is supporting a missile that has been launched at you**.

- When being launched on by a radar-guided missile, you will hear a missile launch tone and the LAUNCH light to the left will illuminate. The Missile Launch tone has a high-frequency launch alert tone of about seven beeps, and then it will go silent for 15 seconds. If after 15 seconds a missile is still being radar-guided on you, the tone will repeat but at a lower tone. This pattern will continue until the radar is no longer in missile guidance mode.

- Newly detected emitters will pulsate for a few seconds between half size and full size to grab your attention.

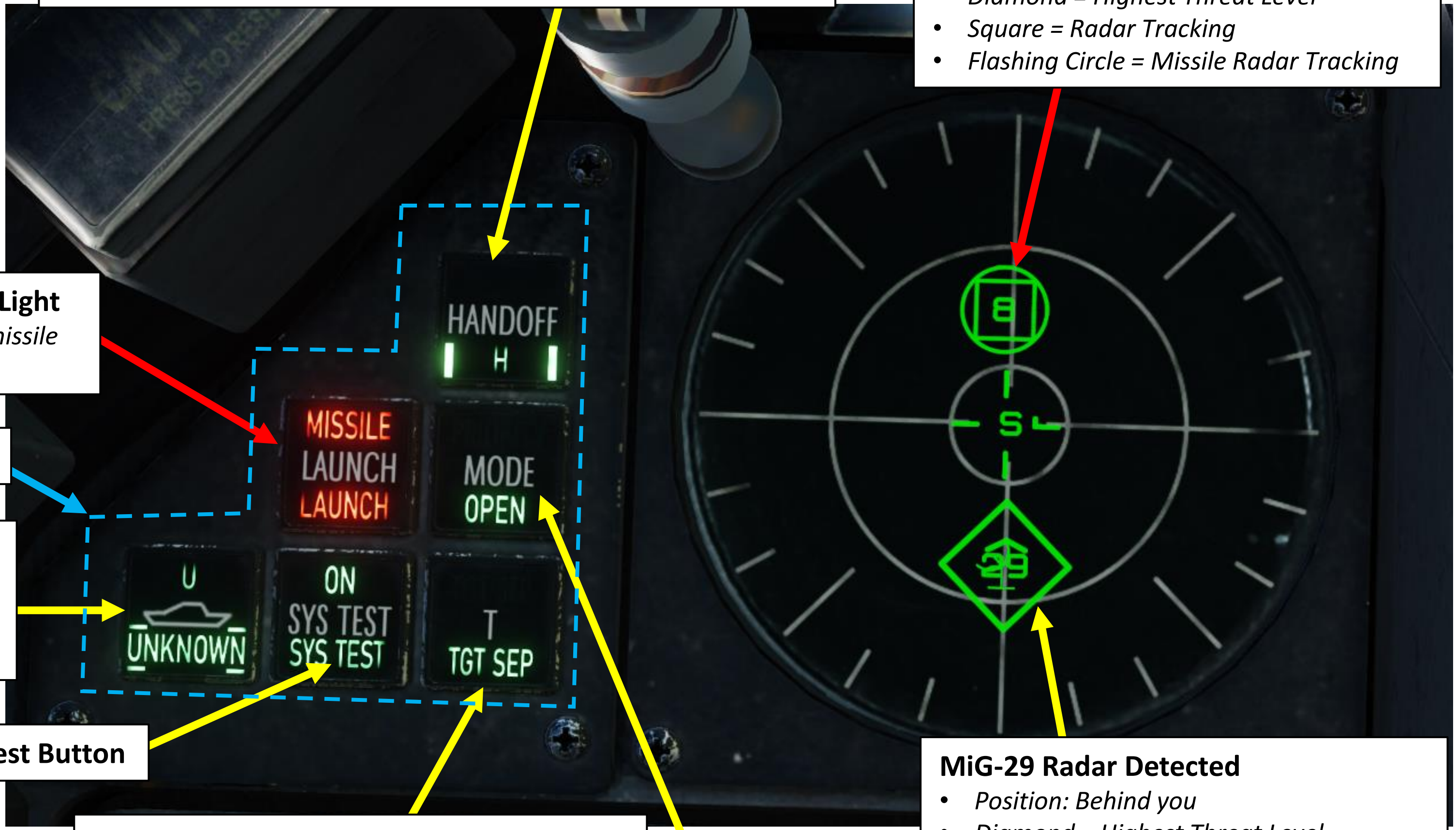
- When a new airborne emitter is detected, you will hear a high frequency alert tone and when a ground emitter is first detected you will hear a lower alert tone.

MiG-29 Radar Detected
- *Position: In front of you*
- *Diamond = Highest Threat Level*
- *Square = Radar Tracking*
- *Flashing Circle = Missile Radar Tracking*

AN/ALR-56M AZIMUTH INDICATOR/RWR THREAT WARNING PRIME (TWP) PANEL

The TWP (Threat Warning Prime) panel is used for primary RWR functions.

As soon as the EWS (Electronic Warfare System) detects a radar missile launched at you, the MISSILE LAUNCH light will illuminate and a warning tone is audible. Keep in mind that this function only detects radar-guided missiles. Infrared-guided missiles are not detected by this system.



RWR Control HANDOFF Button (Not Simulated Yet)
Used to set the mode of operation of the RWR. The four modes are:
- *Normal*
- *Diamond Float*
- *Transient*
- *Latch*

SA-8 SAM Detected
- *Position: In front of you*
- *Diamond = Highest Threat Level*
- *Square = Radar Tracking*
- *Flashing Circle = Missile Radar Tracking*

RWR MISSILE LAUNCH Light
Illuminates when a radar missile launch is detected

Threat Warning Prime (TWP) Panel

RWR UNKNOWN SHIP Toggle Switch (Not Simulated Yet)
Toggles display of emitter symbols of unknown weapon systems on and off.

RWR System Test Button

RWR T (Target Separation) Button
Separates symbols that cover each other on the azimuth indicator; the symbol with the highest threat priority remains in the right place.

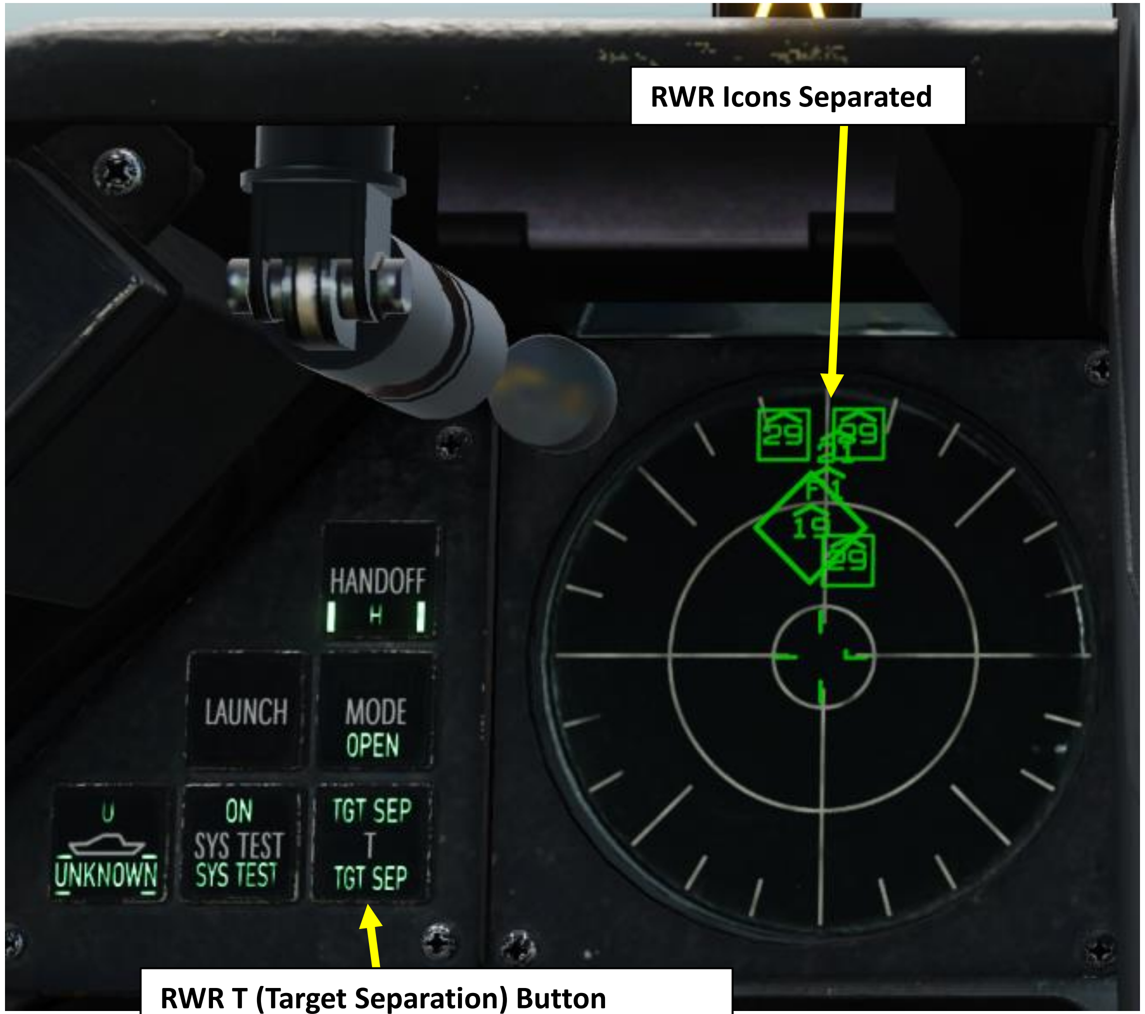
MiG-29 Radar Detected
- *Position: Behind you*
- *Diamond = Highest Threat Level*
- *Square = Radar Tracking*
- *Flashing Circle = Missile Radar Tracking*

RWR Mode Selector Button
- *PRIORITY: only shows the five highest threats*
- *OPEN: display the 16 highest priority threats*

THREAT (TWS, Threat Warning System) Tone Control Knob

AN/ALR-56M AZIMUTH INDICATOR/RWR TARGET SEPARATION

If too many contacts start overlapping each other, you can press the “TARGET SEPARATION” function (TGT SEP), which will separate enemy icons.



RWR T (Target Separation) Button
Separates symbols that cover each other on the azimuth indicator; the symbol with the highest threat priority remains in the right place.

AN/ALR-56M AZIMUTH INDICATOR/RWR THREAT WARNING AUXILIARY PANEL

The TWA (Threat Warning Auxiliary) panel is used to power up the EWS (Electronic Warfare System) Suite.

RWR (Radar Warning Receiver) Source Switch
Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

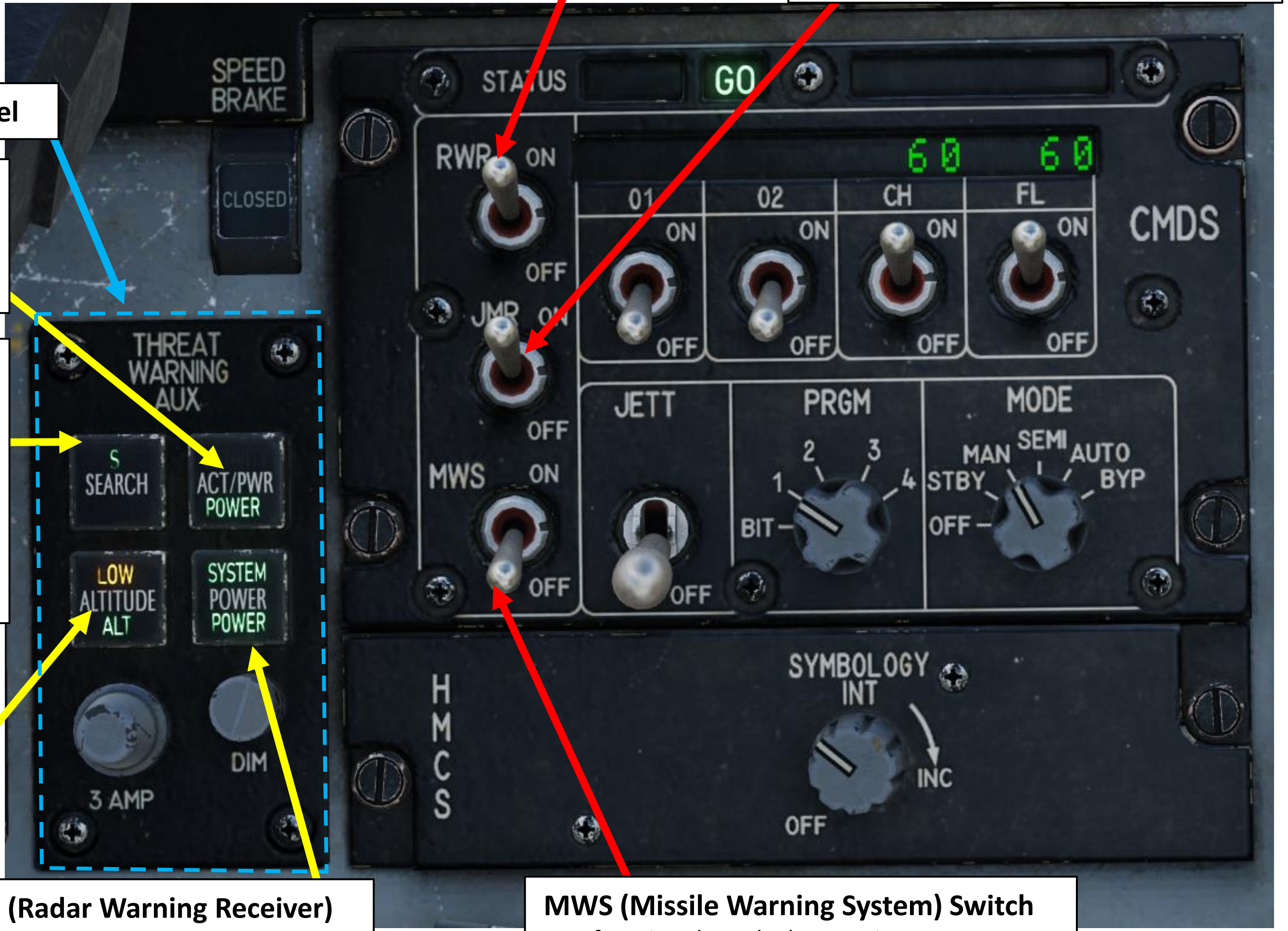
JMR (Jammer) Source Switch
Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

Threat Warning Auxiliary Panel

RWR ACT/PWR Indicator
- *ACTIVITY: EWS (Electronic Warfare System) is powered and detects a radar painting the aircraft.*
- *POWER: EWS (Electronic Warfare System) suite is powered*

RWR SEARCH Control Button & Indicator
- *Allows 'S' search radar symbols to be displayed on the RWR display if the EWS is powered and detects a search radar; by default they are not. With SEARCH enabled (pressed), a SAM radar in search mode will display as an 'S', well before you would expect to see its acquisition symbol if SEARCH was not enabled, giving you an early warning in most cases.*
- *Flashing S: Acquisition radars are filtered out (not displayed) on the RWR display*
- *Steady S: Acquisition radars are displayed on the RWR display*

RWR LOW ALTITUDE Control Button & Indicator
- *LOW: Dangerous threats in low altitude (ground-based radar emitters) are prioritized. When no LOW light is displayed, priority is given to dangerous airborne radar emitter threats at high altitude (like fighter jets).*
- *ALT: EWS (Electronic Warfare System) suite is powered*



RWR (Radar Warning Receiver) Indicator Control Power Button

MWS (Missile Warning System) Switch
Not functional on Block 50 variant.

AN/ALR-56M AZIMUTH INDICATOR/RWR EXAMPLE OF RWR MODES

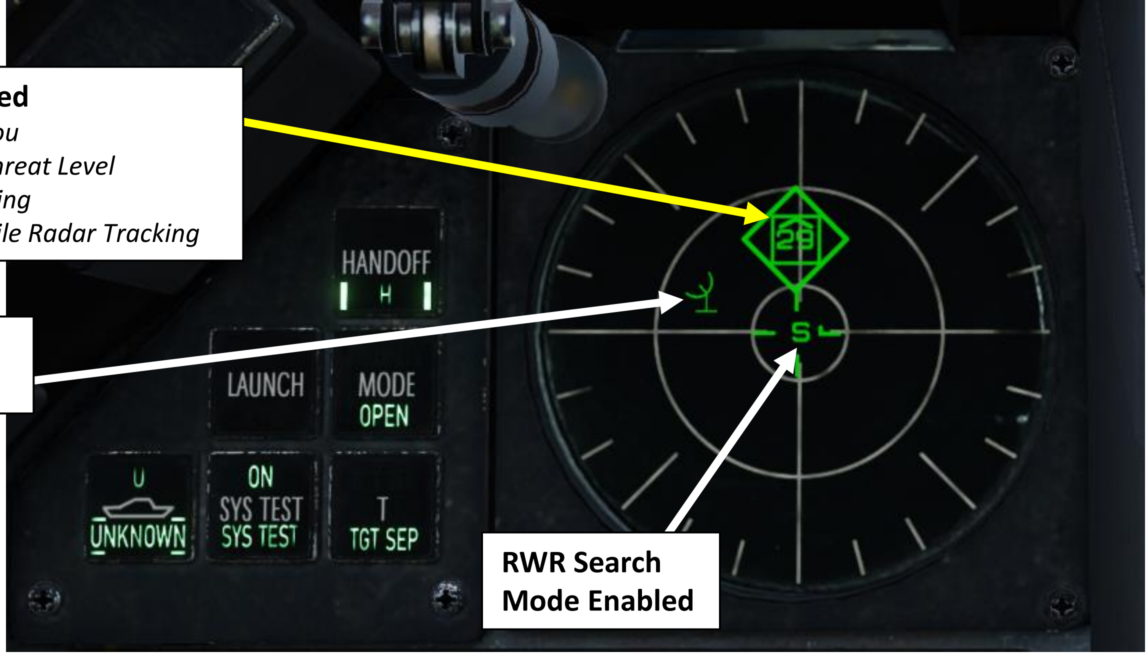
In this example, we have pressed the RWR SEARCH Control Button, which means Search Mode is enabled. Acquisition radars are displayed on the RWR display, as shown by the Early Warning Radar Symbol. A MiG-29 is also locking us up.

The RWR LOW ALTITUDE Mode is not enabled, which means that ground-based radar emitters are not prioritized.

MiG-29 Radar Detected
- *Position: In front of you*
- *Diamond = Highest Threat Level*
- *Square = Radar Tracking*
- *Flashing Circle = Missile Radar Tracking*

Early Warning Radar Detected

RWR Search Mode Enabled



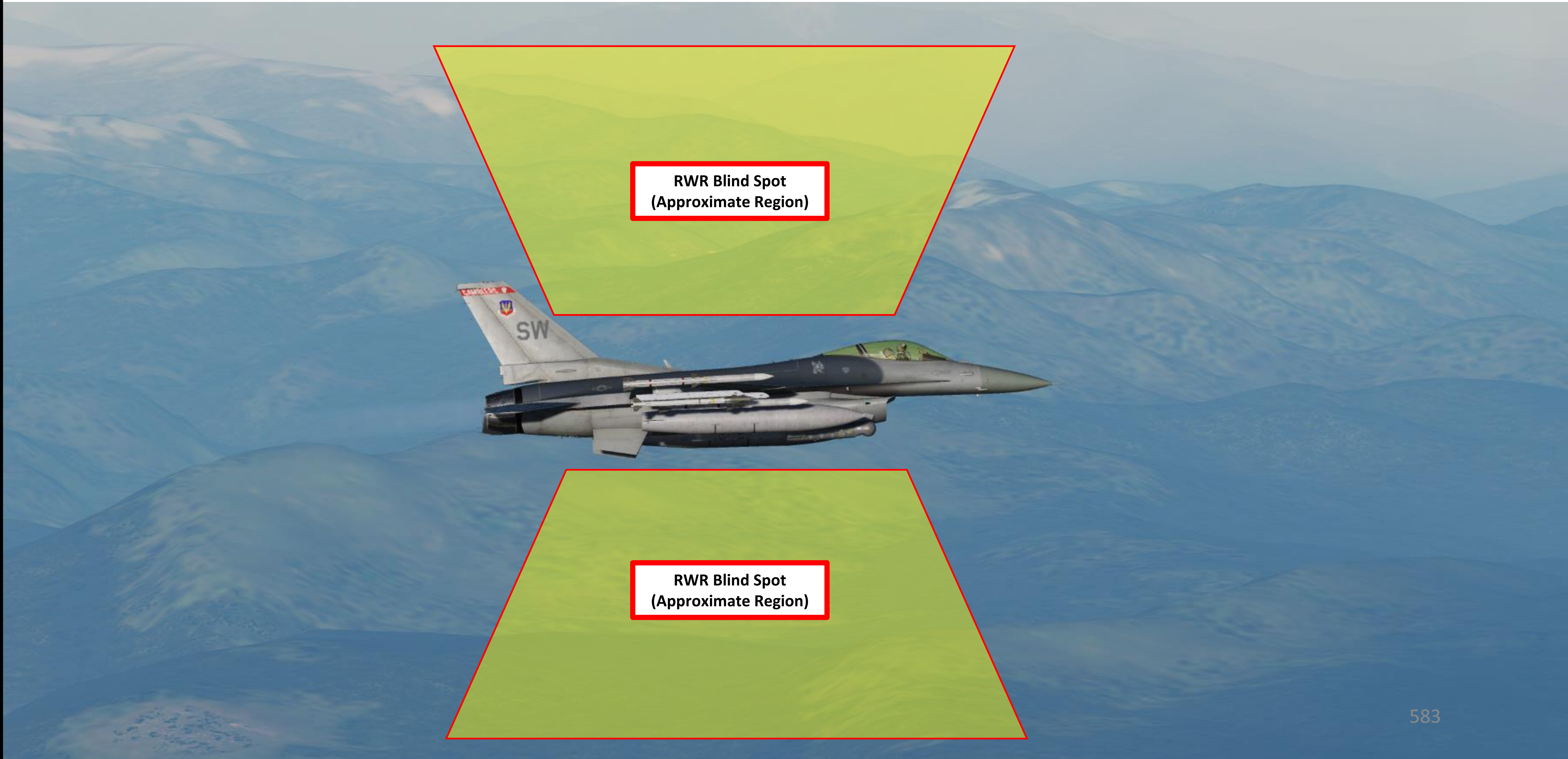
RWR ACT/PWR Indicator (ACTIVITY: EWS (Electronic Warfare System) is powered and detects a radar painting the aircraft)

RWR SEARCH Control Button & Indicator (Steady S)

RWR LOW ALTITUDE Control Button & Indicator (LOW extinguished)

AN/ALR-56M AZIMUTH INDICATOR/RWR RADAR WARNING RECEIVER LIMITATIONS

Keep in mind that there are two blind spots on the RWR. Therefore, you cannot rely completely on the RWR to detect radar locks.

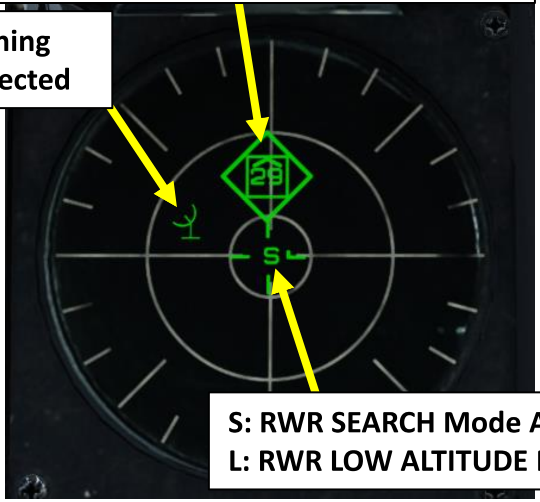


AN/ALR-56M AZIMUTH INDICATOR/RWR SYMBOLOGY

Note: “U” or “UKN” symbol stands for “Unknown”, which is sometimes attributed to ships.

MiG-29 Radar Detected
- *Position: In front of you*
- *Diamond = Highest Threat Level*
- *Square = Radar Tracking*
- *Flashing Circle = Missile Radar Tracking*

Early Warning Radar Detected



S: RWR SEARCH Mode Active
L: RWR LOW ALTITUDE Mode Active

Ship Threats

SW – Admiral Kuznetsov Carrier	48 – Carl Vinson Nimitz Supercarrier
HN – Pyotr Velikiy Kirov Battlecruiser	49 – Oliver Hazard Perry Frigate
T2 – Moskva Cruiser	U – John C Stennis Nimitz Supercarrier
TP – Neustrashimyy Frigate	U – Tarawa Essex-Class Carrier
TP – Retsky Krivak Frigate	AE – Normandy Ticonderoga Cruiser
HP – Grisha Corvette	
PS – Molniya Tarantul Corvette	

Air Threats		Ground Threats	
19 – MiG-19P	AV – AV-8B	A – ZU 23 AA	A – Vulcan M163 – A
21 – MiG-21Bis	11 – F-111	A – ZSU 23 Shilka	A – Gepard
22 – Tu-22M3	13 – C-130	8 – SA-8	RO – Roland ADS
23 – MiG-23	14 – F-14	11 – SA-11	GR – Roland EWR
24 – Su-24	15 – F-15	13 – SA-13	RS – Rapier Blindfire Track Radar
25 – MiG-25	16 – F-16	15 – SA-15	RT – Rapier Launcher Radar
29 – J-11	17 – C-17	S6 – SA-19	HA – Hawk Search Radar
29 – MiG-29	18 – F/A-18C	FS – SA-2 Fan Song Track Radar	HK – Hawk Track Radar
29 – Su-27	37 – AJS-37 Viggen	FF – SA-3 Flat Face Search Radar	HK – Hawk Acquisition Radar
29 – Su-33	52 – B-52	LB – SA-3 Low Blow Track Radar	PT – Patriot Search/Track Radar
30 – Su-30	B1 – B-1	06 – SA-6	S – Search Radar
39 – Su-39	E2 – E-2D AWACS	DE – SA-9 Dog Ear Search Radar	
31 – MiG-31	E3 – E-3A AWACS	SD – SA-11 Snow Drift Search Radar	
34 – Su-34	E6 – EA-6B	CS – SA-11 Clam Shell Search Radar	
50 – KJ-2000 AWACS	F2 – F-2 / Tornado	10 – SA-10 Track Radar	
50 – A-50 AWACS	F4 – F-4E	BB – SA-10 Big Bird Search Radar	
76 – Il-76	F5 – F-5E3	EW – Box Spring Early Warning Radar	
78 – Il-78	KC – KC-130	EW – Tail Rack Early Warning Radar	
95 – Tu-95	KC – KC-135		
AN – AN-26	M2 – Mirage 2000C		
AN – AN-30	S3 – S-3B Tanker		
BJ – Tu-160	JF – JF-17 Thunder		
Tu – Tu-142			

AN/ALR-56M AZIMUTH INDICATOR/RWR HANDOFF FUNCTION

Not yet implemented.

COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

CMDS CONTROLS (REAL AIRCRAFT CONTROLS)

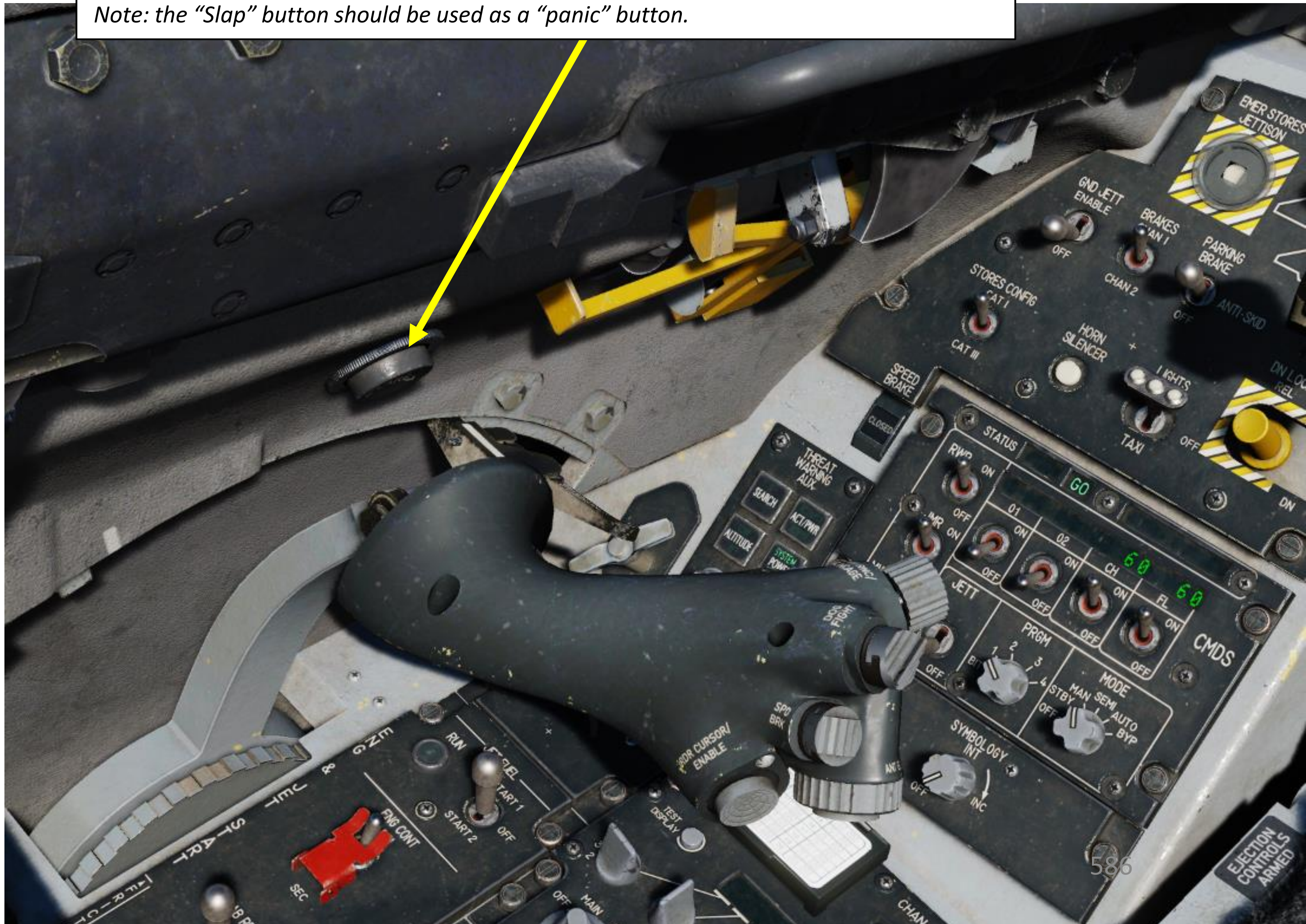
CMS (Countermeasures Switch)

- *FWD: Dispenses currently selected CMDS program*
- *AFT: Gives Consent to Semi-Automatic and Automatic CMDS programs to release their countermeasures automatically*
- *LEFT: Dispenses CMDS manual program 6.*
- *RIGHT: Disables Consent to Semi-Automatic and Automatic CMDS programs to release their countermeasures automatically*

Chaff/Flare Slap Button

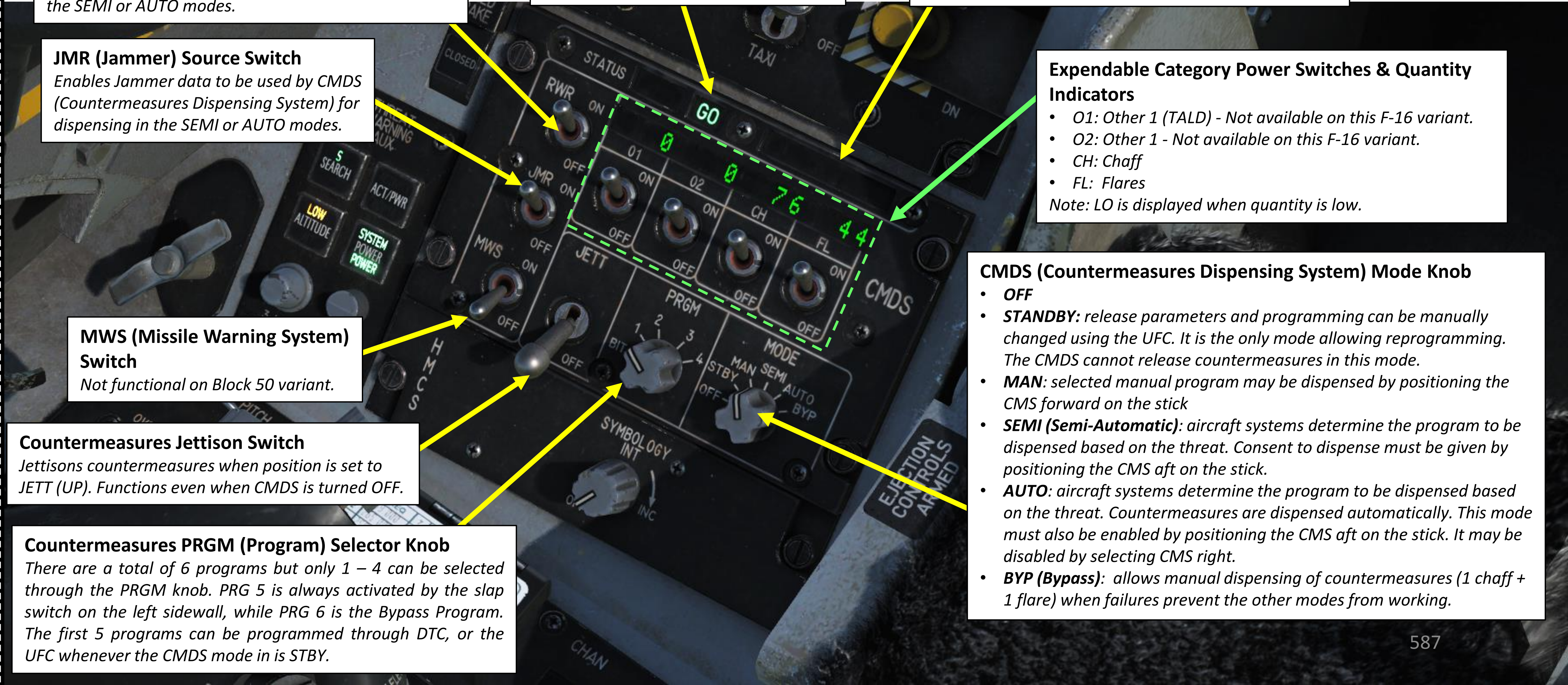
Dispenses Chaff & Flare. This is a pushbutton programmed to drop countermeasures Program No. 5. This gives you a third countermeasures program immediately available without switching the PGRM knob on the CMDS.

Note: the "Slap" button should be used as a "panic" button.



COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

CMDS CONTROLS (REAL AIRCRAFT CONTROLS)



RWR (Radar Warning Receiver) Source Switch
Enables RWR data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

GO / NO GO CMDS Status Light

DISPENSE READY CMDS Status Light
Displayed when manual consent is required to dispense countermeasures in the SEMI or AUTO mode.

JMR (Jammer) Source Switch
Enables Jammer data to be used by CMDS (Countermeasures Dispensing System) for dispensing in the SEMI or AUTO modes.

Expendable Category Power Switches & Quantity Indicators
- *O1: Other 1 (TALD) - Not available on this F-16 variant.*
- *O2: Other 1 - Not available on this F-16 variant.*
- *CH: Chaff*
- *FL: Flares*

Note: LO is displayed when quantity is low.

MWS (Missile Warning System) Switch
Not functional on Block 50 variant.

CMDS (Countermeasures Dispensing System) Mode Knob
- ***OFF***
- ***STANDBY:** release parameters and programming can be manually changed using the UFC. It is the only mode allowing reprogramming. The CMDS cannot release countermeasures in this mode.*
- ***MAN**: selected manual program may be dispensed by positioning the CMS forward on the stick*
- ***SEMI (Semi-Automatic)**: aircraft systems determine the program to be dispensed based on the threat. Consent to dispense must be given by positioning the CMS aft on the stick.*
- ***AUTO**: aircraft systems determine the program to be dispensed based on the threat. Countermeasures are dispensed automatically. This mode must also be enabled by positioning the CMS aft on the stick. It may be disabled by selecting CMS right.*
- ***BYP (Bypass)**: allows manual dispensing of countermeasures (1 chaff + 1 flare) when failures prevent the other modes from working.*

Countermeasures Jettison Switch
Jettisons countermeasures when position is set to JETT (UP). Functions even when CMDS is turned OFF.

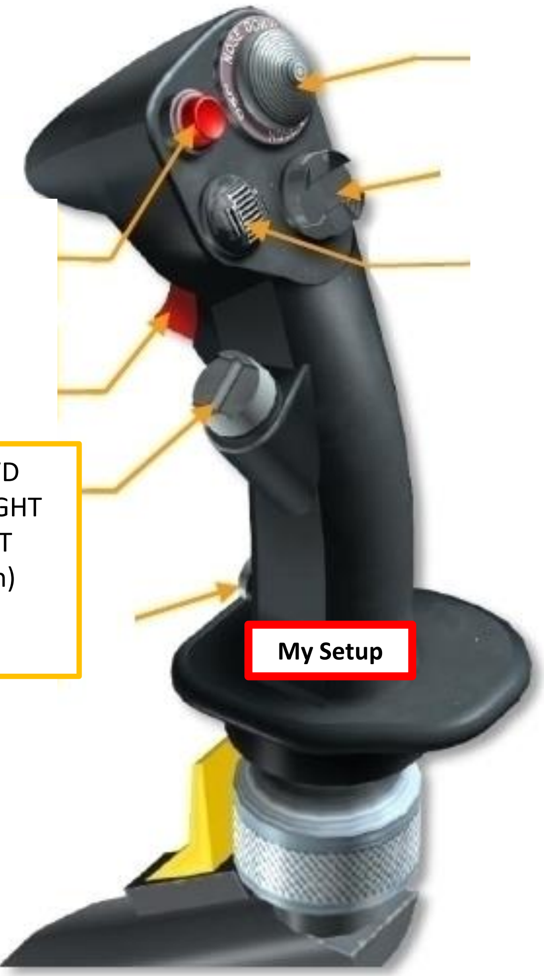
Countermeasures PRGM (Program) Selector Knob
There are a total of 6 programs but only 1 – 4 can be selected through the PRGM knob. PRG 5 is always activated by the slap switch on the left sidewall, while PRG 6 is the Bypass Program. The first 5 programs can be programmed through DTC, or the UFC whenever the CMDS mode in is STBY.

COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

CMDS CONTROLS (MY CONTROLS)

I usually go for a simpler control setup. However, nothing stops you from mapping other switches of the CMDS panel (like the CMDS Mode knob or the CMDS Program Selector knob) to other buttons if you want.

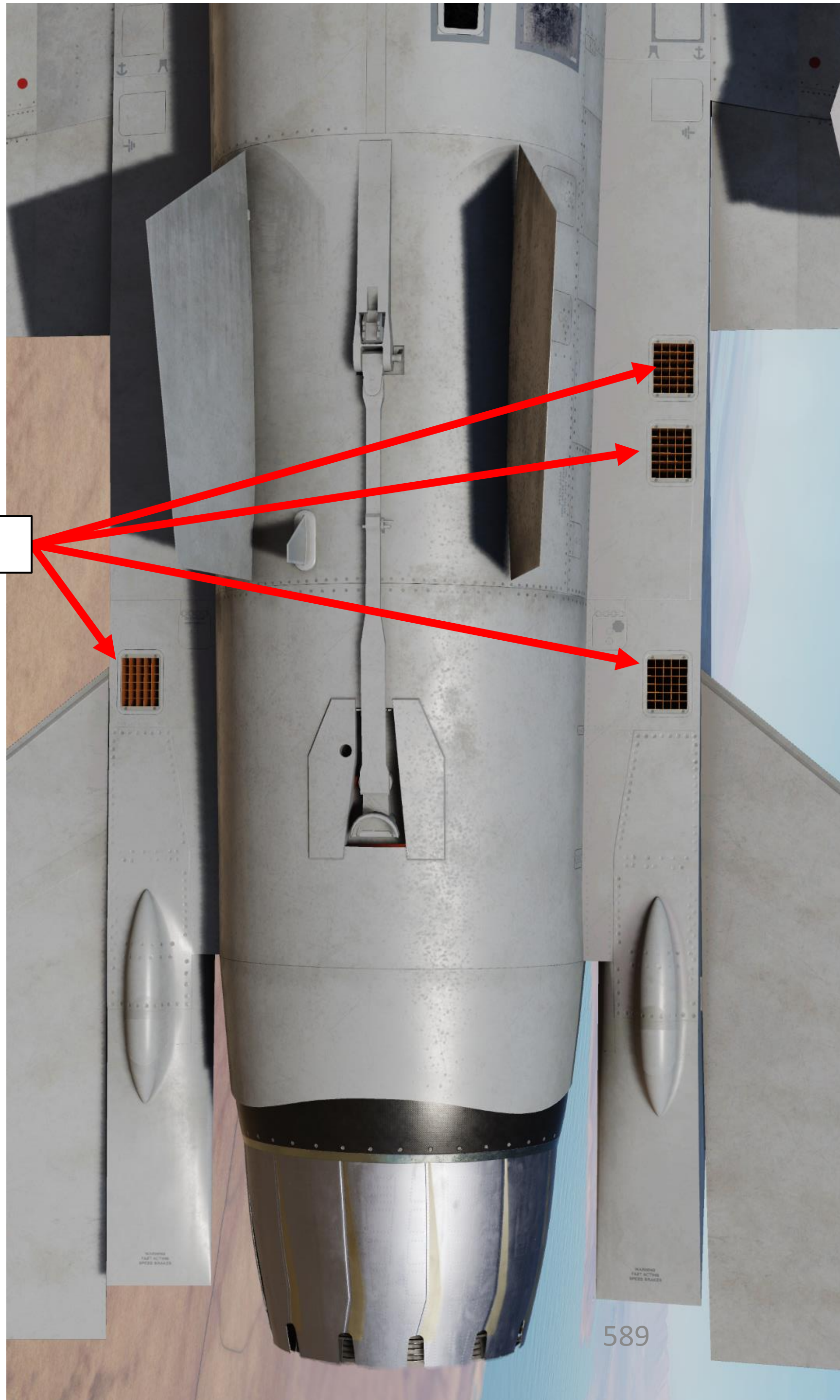
↑ Countermeasures Management Sw - FWD
→ Countermeasures Management Sw – RIGHT
↓ Countermeasures Management Sw – AFT
← Chaff/Flare Dispense Button (Slap Switch)
P



COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

FCD (FLARE/CHAFF DISPENSER)

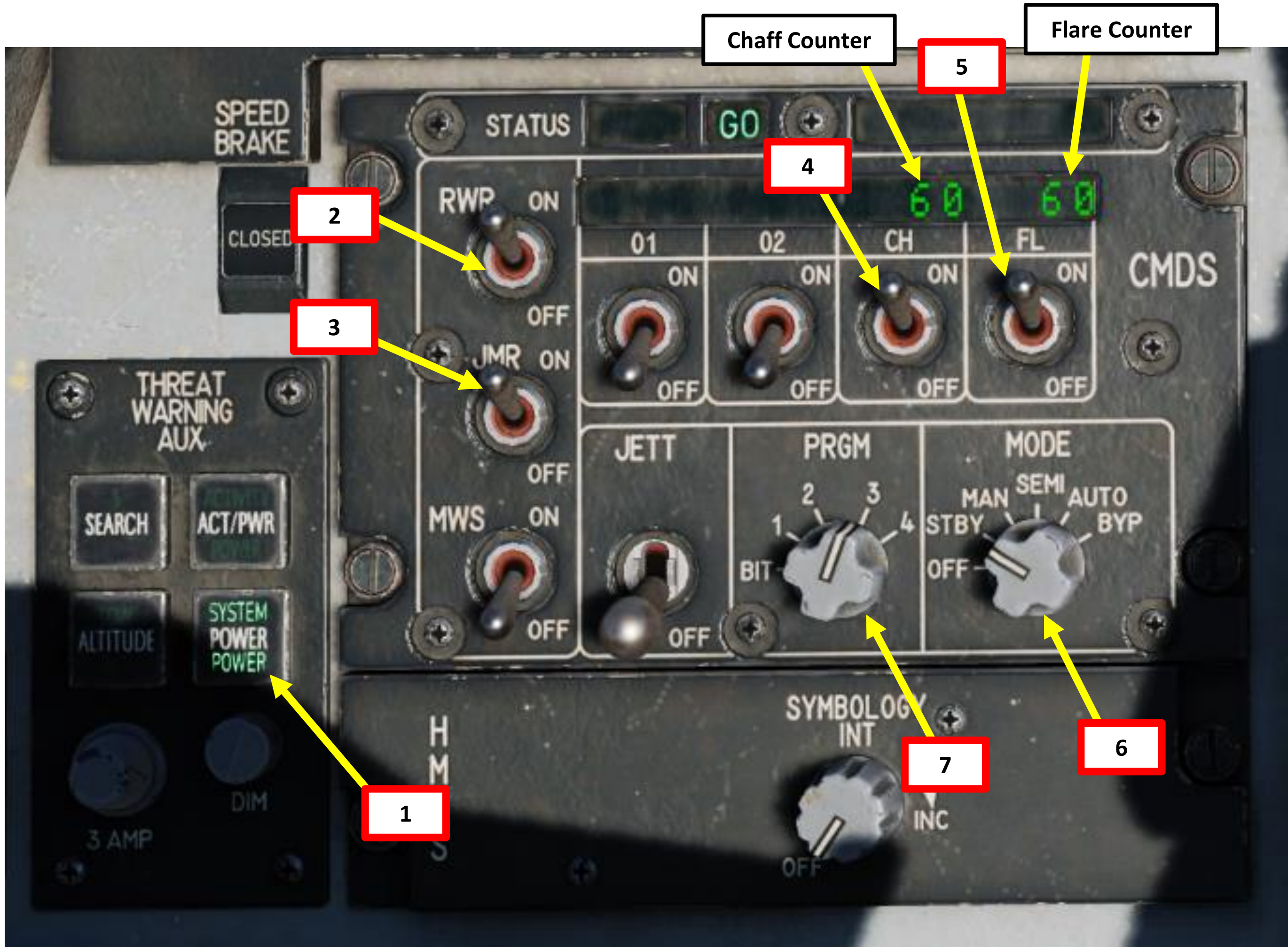
Flare and Chaff dispensers are located inside the body fairing. You can request the ground crew to set the number of chaff and flares as desired, for a maximum of 120 combined flares and chaff. A typical loadout is set to 60 chaff and 60 flares.



COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

1. Press the Threat Warning Azimuth / Radar Warning Receiver (TWA/RWR) Power Button. The RWR will enter a Built-In Test sequence. This step must be performed if you intend to use Semi-Automatic or Automatic Modes.
2. Set CMDS RWR (Countermeasure Dispensing System Radar Warning Receiver) Switch – ON (UP)
3. Set CMDS JMR (Countermeasure Dispensing System Jammer) Switch – ON (UP)
4. Set CMDS (Countermeasure Dispenser System) CH (Chaff) Switch – ON (UP)
5. Set CMDS (Countermeasure Dispenser System) FL (Flares) Switch – ON (UP)
6. Set Countermeasure Mode Selector to STBY (Standby).
7. Set Countermeasure PRGM (Program) Selector to desired Program (i.e. Program 3)



COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

8. Press the LIST button on the ICP (Integrated Control Panel)
9. Press “7” button to select the CMDS (Countermeasures Dispenser System) sub-menu.
10. On the DED (Data Entry Display), the CMDS BINGO page will be displayed.
11. Using the Dobber Switch UP/DOWN and the ICP keypad, you can select and modify any of the BINGO options as desired. ENTR button confirms changes.
12. Toggle the Dobber Switch RIGHT (SEQ) to display CMDS Countermeasure Page on the DED (Data Entry Display).

10

CMDS BINGO DED Page

Chaff Bingo Quantity
Threshold when you are low on countermeasures

Flare Bingo Quantity

Other Countermeasure (O1) Bingo Quantity

Other Countermeasure (O2) Bingo Quantity

FDBK: Feedback Message
Enables or disables the ‘Chaff Flare’ audio message that plays when a countermeasures program has been initiated.

REQCTR: Request Countermeasures Message
Enables or disables the ‘Counter’ audio message that plays when consent to release countermeasures is requested in the SEMI or AUTO mode

BINGO: Bingo Message
Enables or disables the ‘Low’ or ‘Out’ audio message that plays when the bingo quantity is reached, or all countermeasures have been expended

CMDS Countermeasure DED Page

12b

BQ: Burst Quantity
Number of countermeasures released per burst.

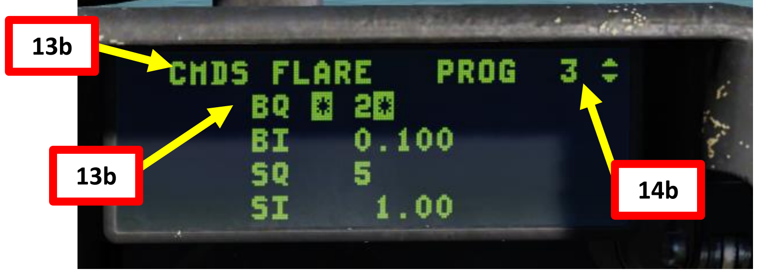
BI: Burst Interval (sec)
Interval in seconds between countermeasures per burst

SQ: Salvo Quantity
Number of bursts commanded when release consent is given

SI: Salvo Interval (sec)
Time in seconds between each burst

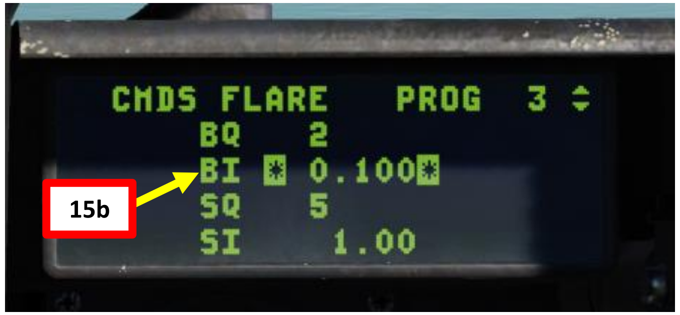
Selected Countermeasure Program
Selected program is toggled by using the DED Increment/Decrement Switch

COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)



COUNTERMEASURE PROGRAM & USAGE TUTORIAL

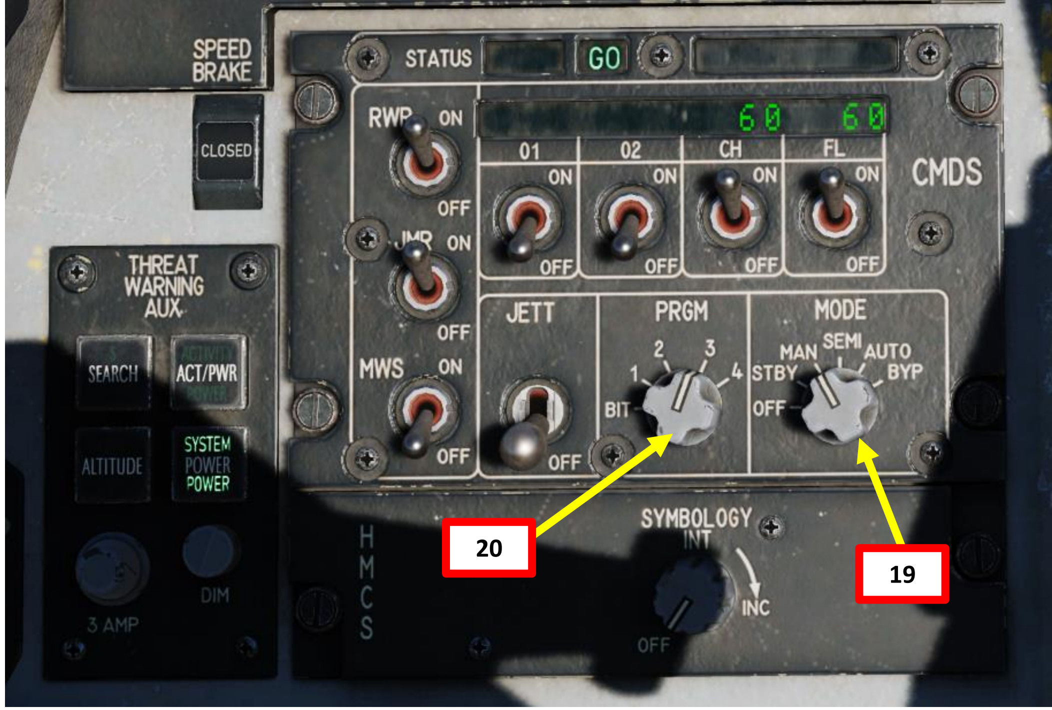
13. Toggle the Dobber Switch RIGHT (SEQ) to display the desired CMDS Countermeasure Page on the DED (Data Entry Display). We will pick the FLARE page. The CMDS pages are listed as follows:
    - BINGO
    - CHAFF
    - FLARE
    - OTHER 1
    - OTHER 2
14. Select the profile you want to edit using the DED Increment/Decrement Switch. We will edit Program 3.
15. Press Dobber Switch DOWN to highlight the desired field (* means "selected"). We will edit the BI (Burst Interval) field.
16. Use the ICP keypad to type in the new desired value (020 will set 0.020 seconds).
17. Press ENTR to accept the changes.
18. Repeat steps 13 to 17 if you want to change any other setting for the selected countermeasure program.

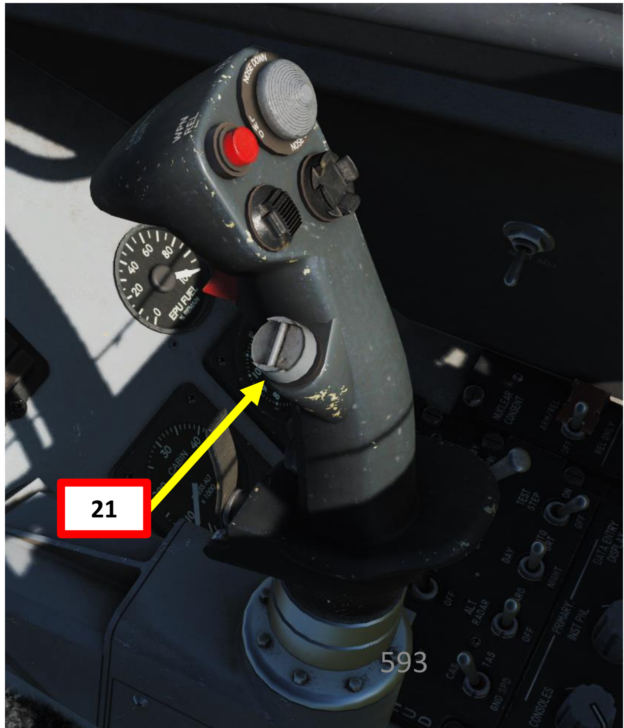


COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

19. Set Countermeasure Mode Selector to MAN (Manual).
20. Double-check to see if the Countermeasure PRGM (Program) Selector is set to the desired Program (Program 3).
21. Press the CMS (Countermeasure Switch) FWD to dispense countermeasures as per the selected program.





CMDS DEFAULT PROFILES

Program	Chaff	Flare	BQ Burst Quantity	BI Burst Interval (sec)	SQ Salvo Quantity	SI Salvo Interval (sec)
1	1	1	1	0.020	10	1.0
2	1	1	1	0.020	10	0.5
3	2	2	2	0.100	5	1.0
4	2	2	2	0.100	10	0.5
Panic (PRG 5) Slap Switch	2	2	2	0.050	20	0.75
Bypass (PRG 6)	1	1	1	0.020	1	0.5

COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 CMDS (COUNTERMEASURES DISPENSER SYSTEM)

CMDS PAGE STRUCTURE

LIST Button

DED (Data Entry Display) Increment/Decrement Switch

DCS (Data Control Switch, also nicknamed "Dobber")

LIST Button
Press "7" to select CMDS DED Page

CMDS BINGO Page

Dobber RIGHT (SEQ)

CMDS CHAFF Page Prog 1

Dobber RIGHT (SEQ)

CMDS FLARE Page Prog 1

Dobber RIGHT (SEQ)

CMDS FLARE Page Other 1

Dobber RIGHT (SEQ)

CMDS FLARE Page Other 2

DED Increment/Decrement Switch

CMDS CHAFF Page Prog 2

DED Increment/Decrement Switch

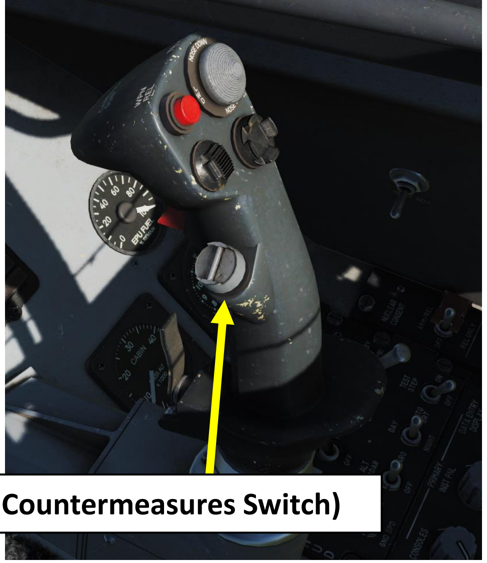
CMDS CHAFF Page Prog 3

AN/ALQ-184 SHORT ECM POD (ELECTRONIC COUNTERMEASURE JAMMER)

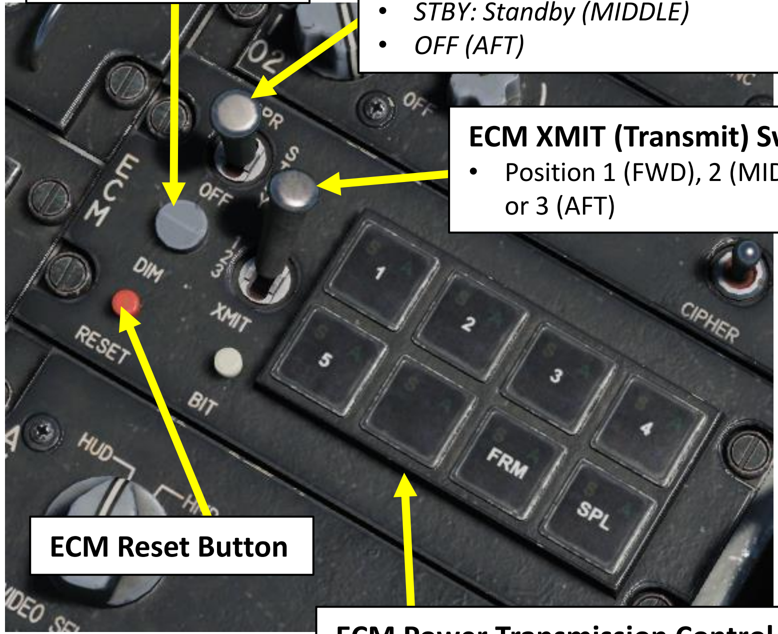
The AN/ALQ-184 Short ECM Pod is an electronic countermeasure jamming device. It is a form of “continuous” jamming, also called “active” or “transmitted” jamming. This device transmits its own synchronized radar waves back at your enemy’s radar receiver to simulate erroneous radar wave returns. Simply put, active jamming will try to drown a radar in white noise. ECM operations can be conducted in Self Protection Jammer (SPJ) mode (Position 1 and 2 on the Transmit switch) and Barrage Noise Jammer (Position 3 on the Transmit switch). CMS aft and right on the control stick are used to activate and deactivate ECM transmission. ECM is most effective against hostile radar acquisition greater than 25 nm. Under this range, ECM is less effective.

AN/ALQ-184 SHORT ECM POD (ELECTRONIC COUNTERMEASURE JAMMER)

Controls



CMS (Countermeasures Switch)



ECM Panel Dim Button

ECM (Electronic Countermeasures) Jammer Switch
- *OPR: Operate (FWD)*
- *STBY: Standby (MIDDLE)*
- *OFF (AFT)*

ECM XMIT (Transmit) Switch
- Position 1 (FWD), 2 (MIDDLE) or 3 (AFT)

ECM Reset Button

ECM Power Transmission Control Buttons
- S: Standby Mode
- A: Active Mode
- T: Transmit Mode
- F: Failure

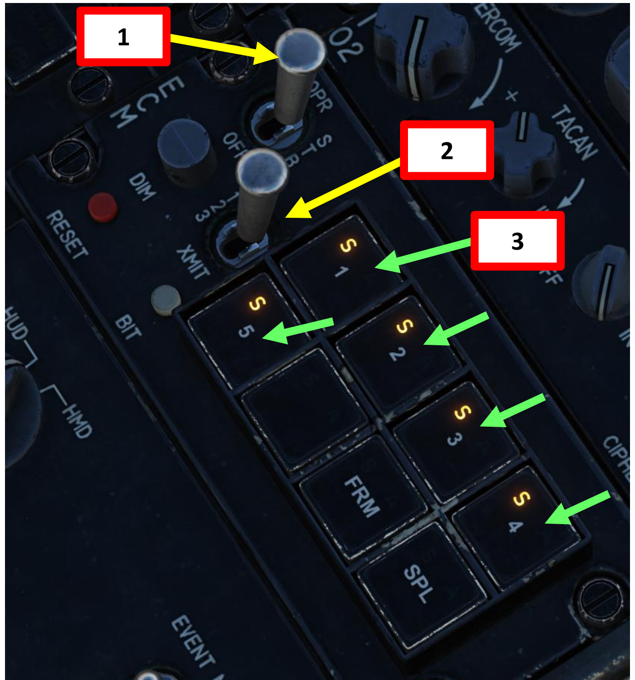
ECM Enable Light
Illuminates when ECM (Electronic Countermeasures) is transmitting.

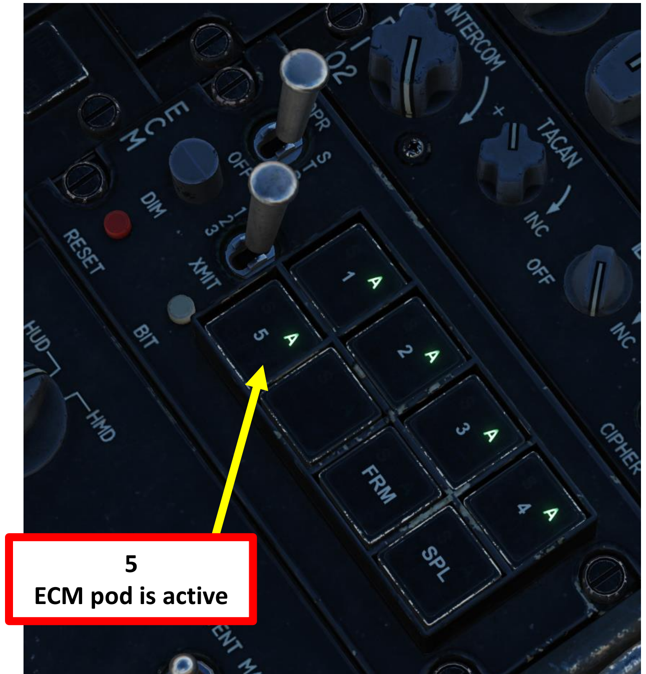
CMDS (Countermeasures Dispensing System) Mode Knob

AN/ALQ-184 SHORT ECM POD (ELECTRONIC COUNTERMEASURE JAMMER)

To use the ECM Pod in SPJ (Self-Protection Jammer) Mode:

1. Set ECM Jammer Switch – OPERATE (FWD)
2. Set ECM XMIT (Transmit) Switch – Position 1 (FWD) or 2 (MIDDLE)
3. Power on the desired ECM Power Transmission Control Buttons by pressing them. An amber "S" light indicates that these transmission modules are in "Standby" mode.
4. Set CMDS (Countermeasures Dispensing System) Mode Knob to SEMI-AUTOMATIC or AUTOMATIC.
5. Press the CMS (Countermeasure Switch) AFT to set to set the pod SPJ mode to active. The ECM pod will not transmit jamming signals until an external radar emitter is attempting a radar lock on your aircraft.
6. If an external radar emitter is attempting a radar lock, the ECM pod will automatically transmit jamming signals to attempt to break the radar lock. When ECM pod is transmitting jamming signals, blue "T" (Transmit) lights illuminate and a green ECM ENABLE light is visible.
7. Press the CMS (Countermeasure Switch) RIGHT to go back to Standby once radar lock is broken.

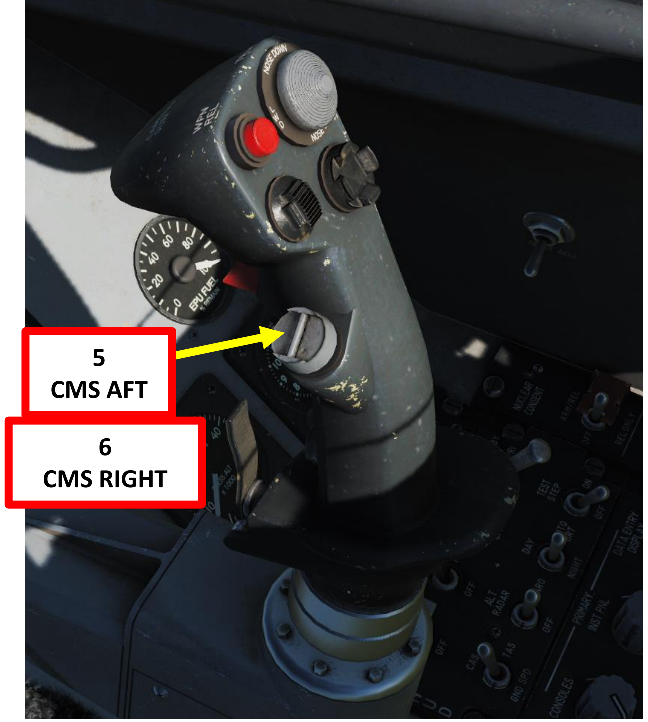


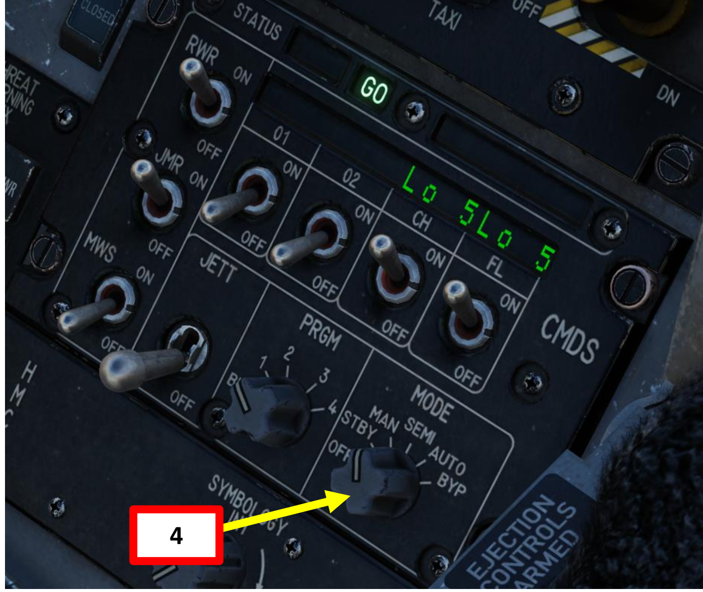


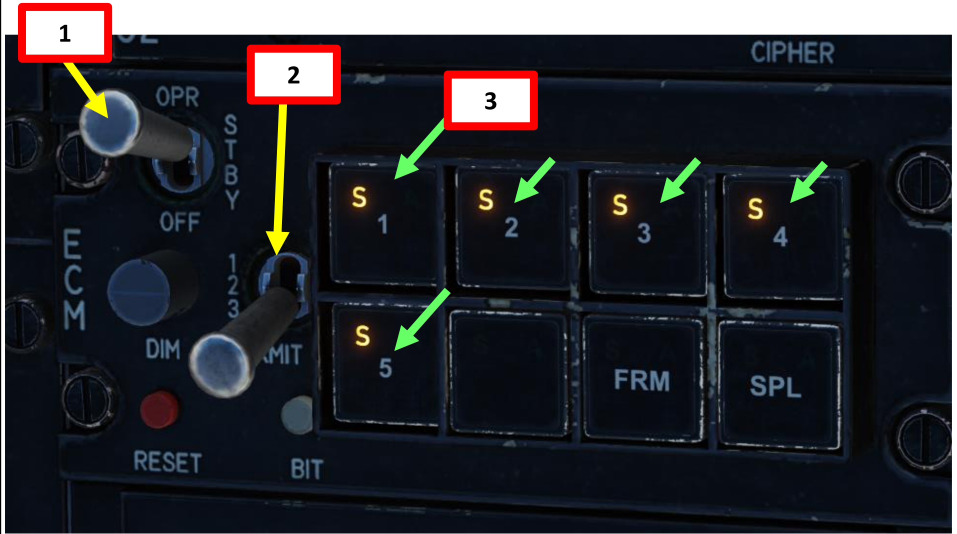
AN/ALQ-184 SHORT ECM POD (ELECTRONIC COUNTERMEASURE JAMMER)

To use the ECM Pod in Barrage Noise Mode:

1. Set ECM Jammer Switch – OPERATE (FWD)
2. Set ECM XMIT (Transmit) Switch – Position 3 (AFT)
3. Power on the desired ECM Power Transmission Control Buttons by pressing them. An amber “S” light indicates that these transmission modules are in “Standby” mode.
4. Set CMDS (Countermeasures Dispensing System) Mode Knob to MANUAL.
5. Press the CMS (Countermeasure Switch) AFT to set the ECM pod to Barrage Noise Mode; the ECM pod will start transmitting jamming signals to attempt to break any radar lock, even if no radar emitter is locking up your aircraft. While ECM pod is transmitting jamming signals, blue “T” (Transmit) lights illuminate and a green ECM ENABLE light is visible.
6. Press the CMS (Countermeasure Switch) RIGHT to go back to Standby to stop jamming signal transmission from the ECM pod.







F-16C VIPER

PART 13 – DATALINK & IFF

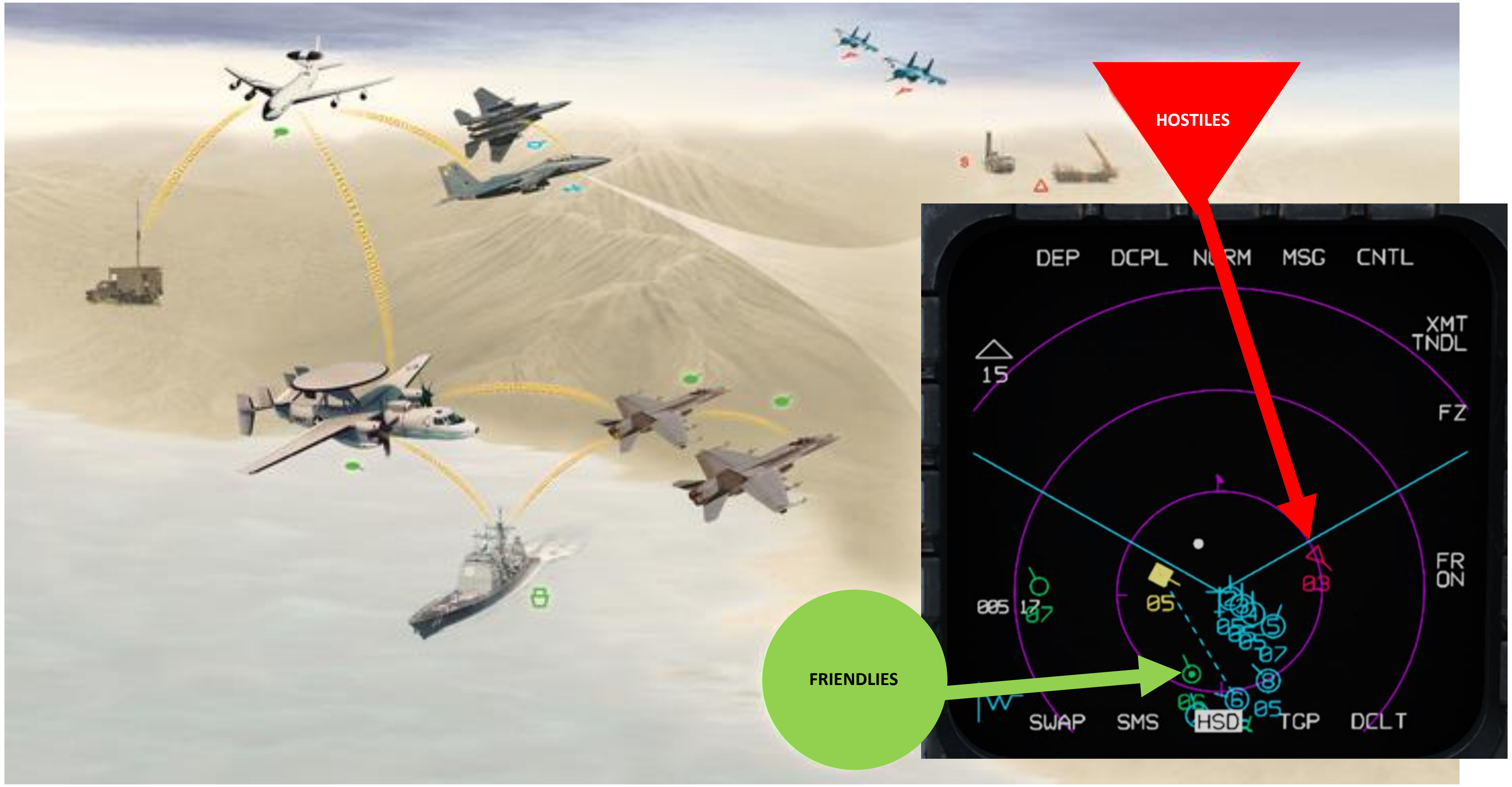
SECTION STRUCTURE

1 – DATALINK & IFF INTRODUCTION

One of the biggest challenges of integrated modern warfare is the identification of contacts. As various information donors like friendly fighters, ground radar stations, AWACS (Airborne Warning and Control System, like an E-3 Sentry or an E-2 Hawkeye), and ships interrogate unknown contacts with IFF (Identify-Friend-or-Foe) systems, this information needs to be relayed to everyone within a given Network. This is where Datalink comes in; with Link 16 Datalink, military aircraft as well as ships and ground forces may exchange their tactical picture in near-real time. Link 16 also supports the exchange of text messages, imagery data and provides two channels of digital voice (2.4 kbit/s and/or 16 kbit/s in any combination).

Multifunctional Information Distribution System (MIDS) is the NATO name for the communication component of Link-16. MIDS is an advanced command, control, communications, computing and intelligence (C4I) system incorporating high-capacity, jam-resistant, digital communication links for exchange of near real-time tactical information, including both data and voice, among air, ground, and sea elements. MIDS is intended to support key theater functions such as surveillance, identification, air control, weapons engagement coordination and direction for all Services.

The aircraft relies on the MIDS radios that allow the transmission and reception of data over the Link 16 Tactical Data Information Link (TADIL) network.

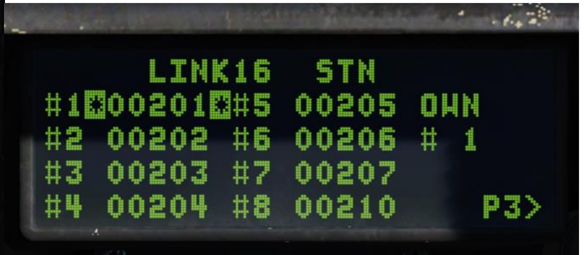


2 – DATALINK
2.1 – TNDL (TACTICAL NETWORK DATALINK) CONCEPT

The current implementation of the Datalink system for the DCS F-16 by Eagle Dynamics is known as the "Tactical Network Datalink" (TNDL). Formerly referred as "L16" in previous DCS builds, TNDL symbology has not really changed compared to its earlier version… but its capability and ability to customize the network has changed significantly. **<u>You may see references to "L16", "Link-16" or "TNDL" throughout the guide… just keep in mind… They are functionally the same within the scope of DCS World.</u>**

Within the DCS World environment, TNDL allows F-16s and F/A-18s to exchange data on the same network. What does that mean, though? In practical terms, you can have multiple flights on the same network finding radar contacts, which in turn send this information to other members on the net.

Old (Deprecated) Datalink Implementation

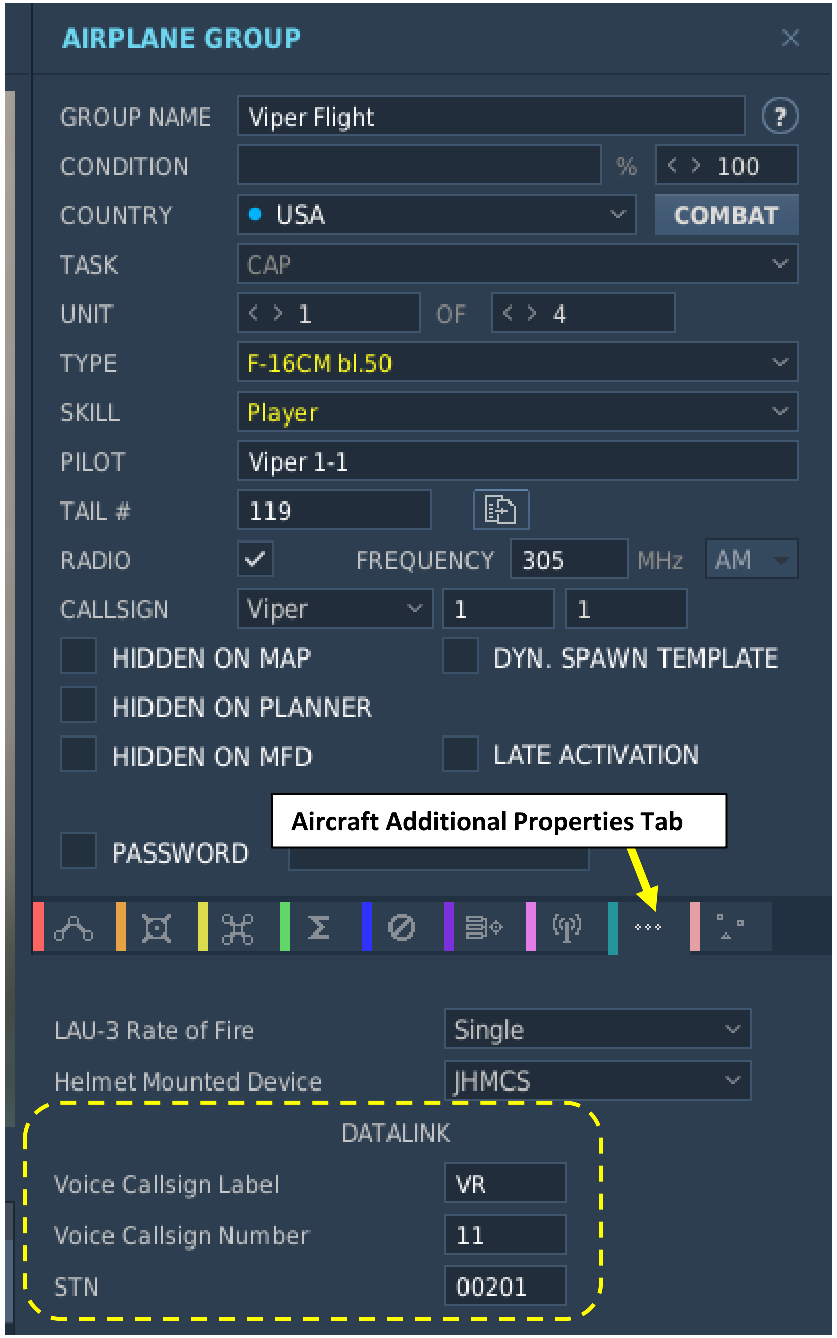


Current Datalink Implementation

2 – DATALINK
2.1 – TNDL (TACTICAL NETWORK DATALINK) CONCEPT

General Concepts: STN & Voice Callsigns

- A “flight” has up to four “members”. Each flight has a specific callsign, which is used for general communications.
- Each member on the datalink network’s Fighter Channel is identified with a unique **“Source Track Number” (STN).**
- The STN numbering convention must be an “octal” (only values of 0 to 7 are valid). As an example: “00201” is a valid STN number.
- The **Voice Callsign Label** is a two-letter label that refers to a flight’s callsign. As an example: “VR” for “Viper” or “ST” for “Sting”.
- The **Voice Callsign Number** refers to the flight number (first number) and the member’s position in the flight (second number). As an example: “14” is for “Flight No. 1 / Member No. 4”.
- In the **Mission Editor,** the **“Settings” tab** allows you to set the Voice Callsign Label, Voice Callsign Number and STN for each aircraft.



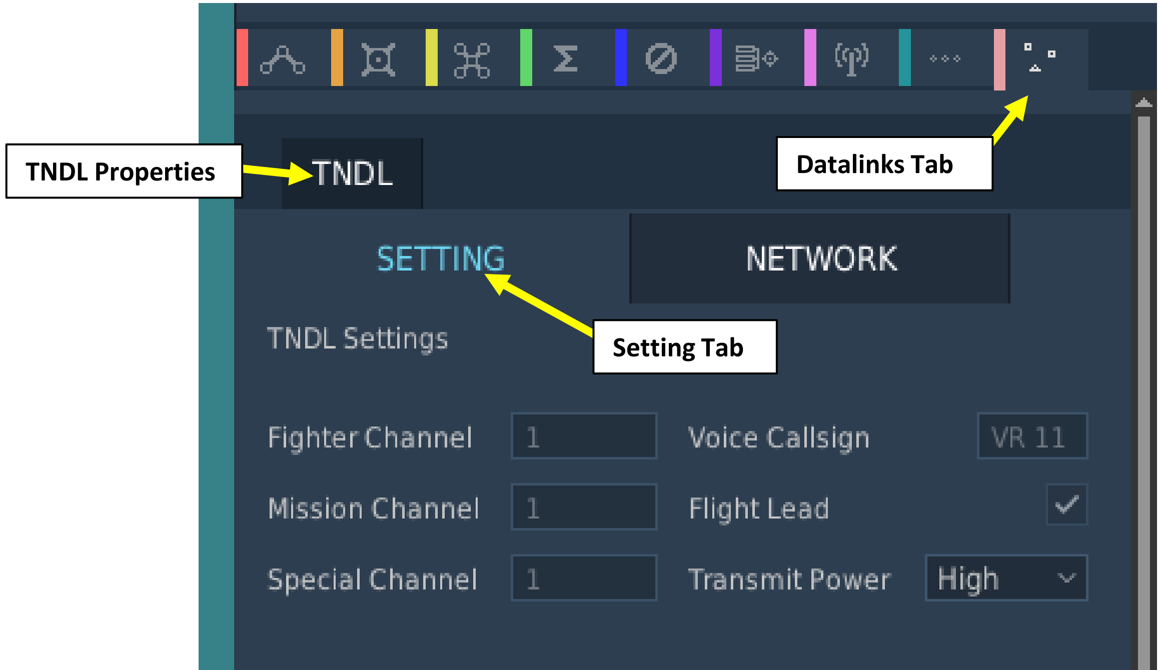
2 – DATALINK
2.1 – TNDL (TACTICAL NETWORK DATALINK) CONCEPT

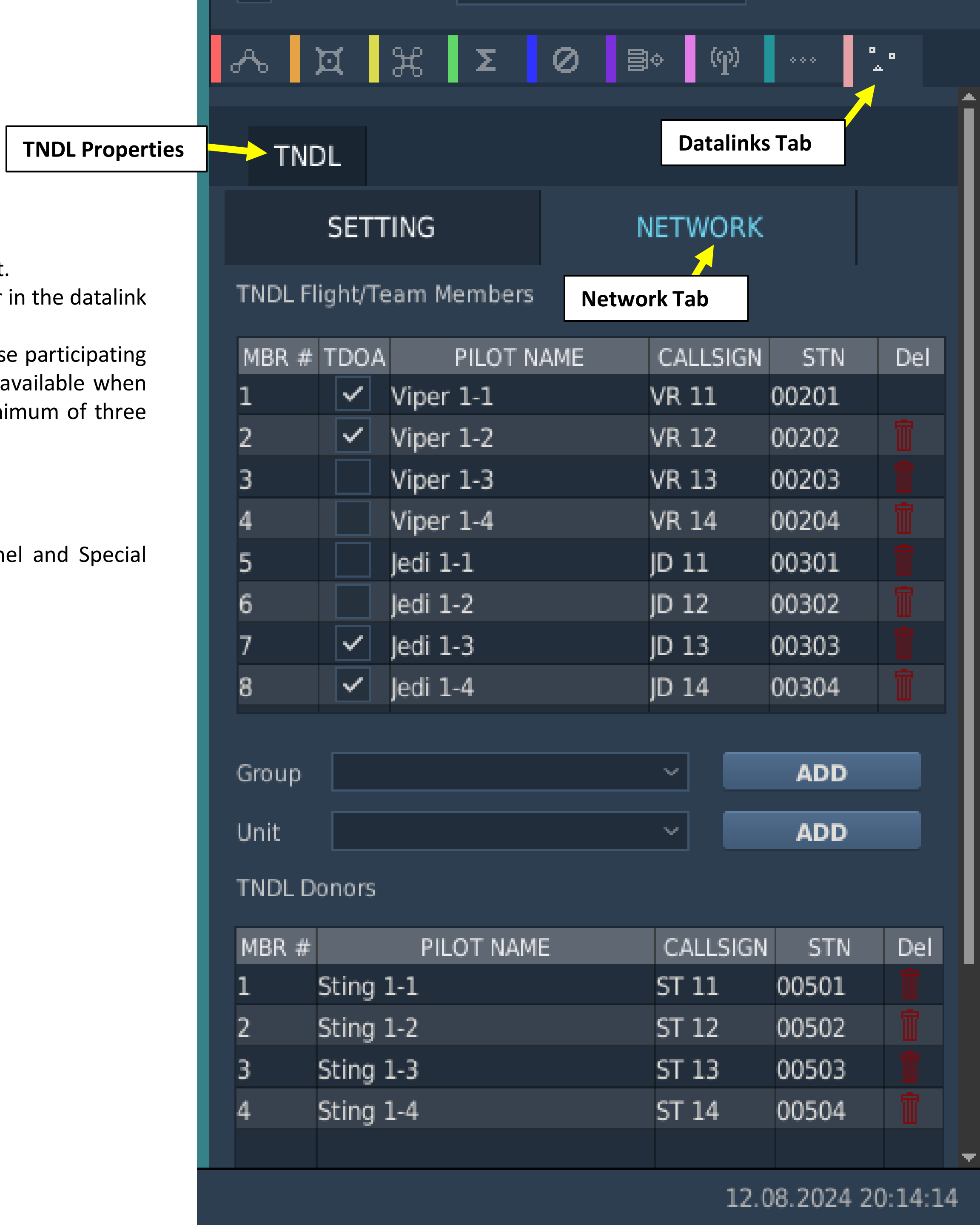
Mission Editor – Network Tab

- The Datalink Fighter Channel can have up to 8 members from different flights + 4 donors.
- Datalink members can be changed, but datalink donors cannot be viewed or edited once in the cockpit.
- Surveillance aircraft like E-3A AWACS does not need to be added in the TNDL Donors; they will appear in the datalink network regardless and feed your flight with information.
- The TDOA assignment setting stands for “Time Difference of Arrival”; it boils down to the ability to use participating datalinked team members to quickly pinpoint a threat radar emitter like a SAM site. TDOA is only available when each Team member is loaded with a HTS pods (HARM Targeting System). There must also be a minimum of three Team members in a TDOA team.

Mission Editor – Setting Tab

- The Setting Tab is mostly automatically filled. It contains datalink Fighter Channel, Mission Channel and Special Channel settings for each aircraft.
- If the aircraft is to be the Team leader, the Flight Lead property is enabled.
- The Transmit Power setting determines the datalink broadcast range.

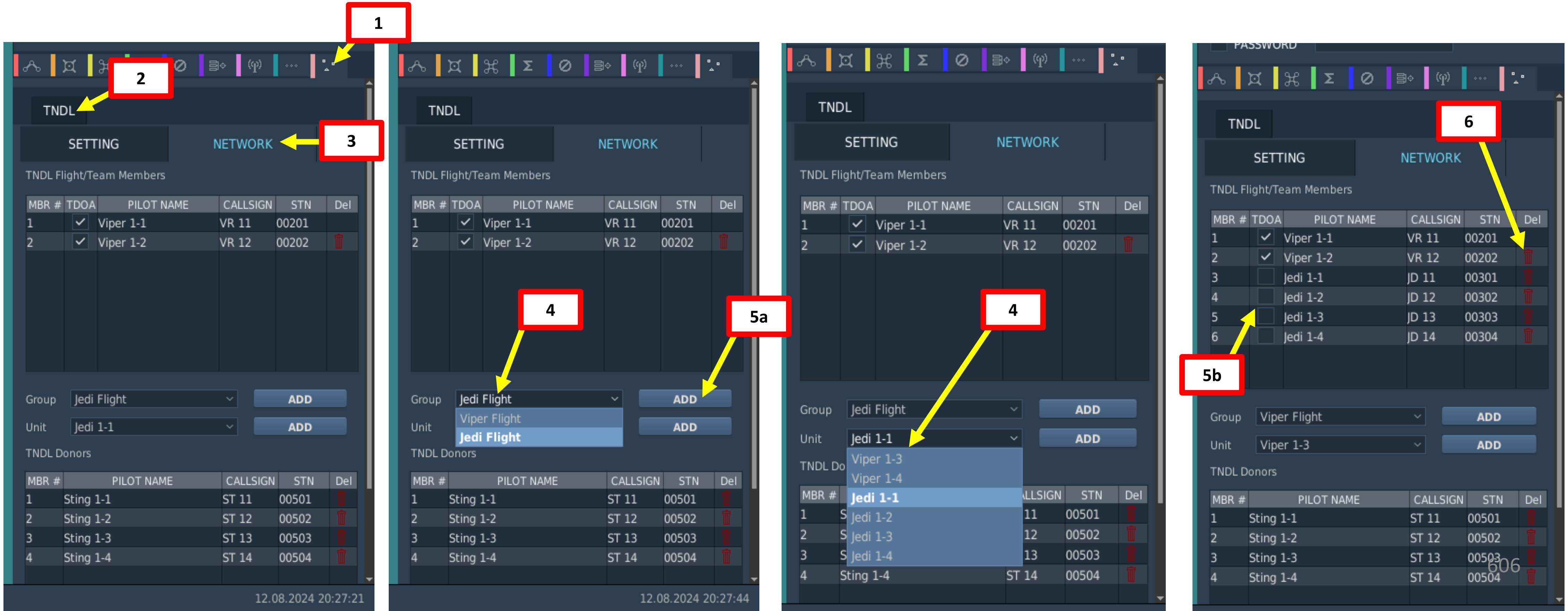




2 – DATALINK
2.1 – TNDL (TACTICAL NETWORK DATALINK) CONCEPT

Mission Editor – Adding a Member to the Network

1. Select Datalinks Tab
2. Select TNDL menu
3. Select Network Tab
4. You can select either a single unit or an entire group of units to add to the network
5. Select ADD on the desired unit/group you want to add.
6. Units can be removed using the DEL (Delete) button.



2 – DATALINK
2.1 – TNDL (TACTICAL NETWORK DATALINK) CONCEPT

Network Example

Viper Flight 1

Viper 1-1 (F-16)
Flight 1 / Member 1
STN: 00201
Voice Callsign Label: VR
Voice Callsign Number: 11

Viper 1-2 (F-16)
Flight 1 / Member 2
STN: 00202
Voice Callsign Label: VR
Voice Callsign Number: 12

Viper 1-3 (F-16)
Flight 1 / Member 3
STN: 00203
Voice Callsign Label: VR
Voice Callsign Number: 13

Viper 1-4 (F-16)
Flight 1 / Member 4
STN: 00204
Voice Callsign Label: VR
Voice Callsign Number: 14

Jedi Flight 1

Jedi 1-1 (F-16)
Flight 1 / Member 1
STN: 00301
Voice Callsign Label: JD
Voice Callsign Number: 11

Jedi 1-2 (F-16)
Flight 1 / Member 2
STN: 00302
Voice Callsign Label: JD
Voice Callsign Number: 12

Jedi 1-3 (F-16)
Flight 1 / Member 3
STN: 00303
Voice Callsign Label: JD
Voice Callsign Number: 13

Jedi 1-4 (F-16)
Flight 1 / Member 4
STN: 00304
Voice Callsign Label: JD
Voice Callsign Number: 14

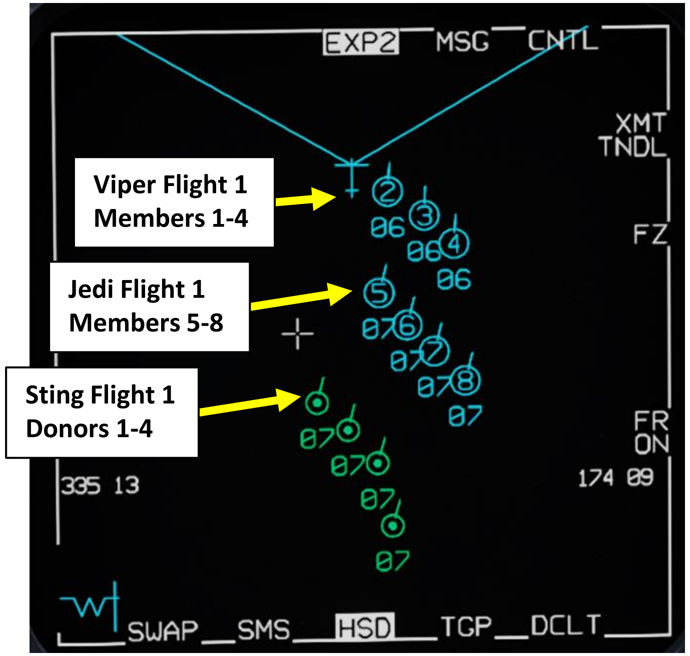
Sting Flight 1 (Donors)

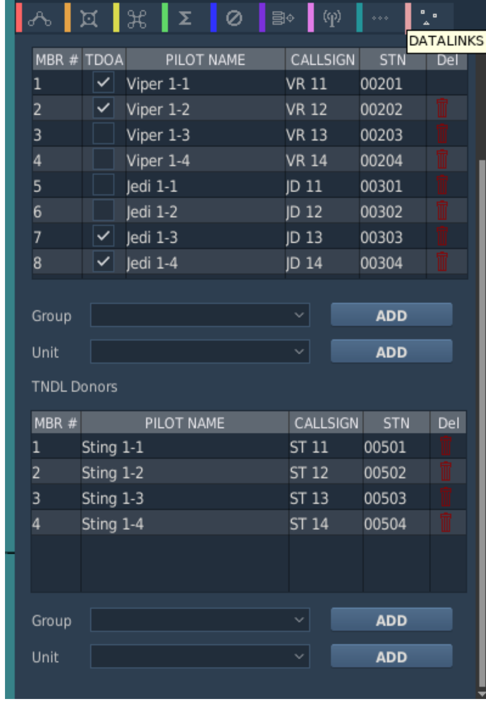
Sting 1-1 (F/A-18)
Flight 1 / Member 1
STN: 00501
Voice Callsign Label: ST
Voice Callsign Number: 11

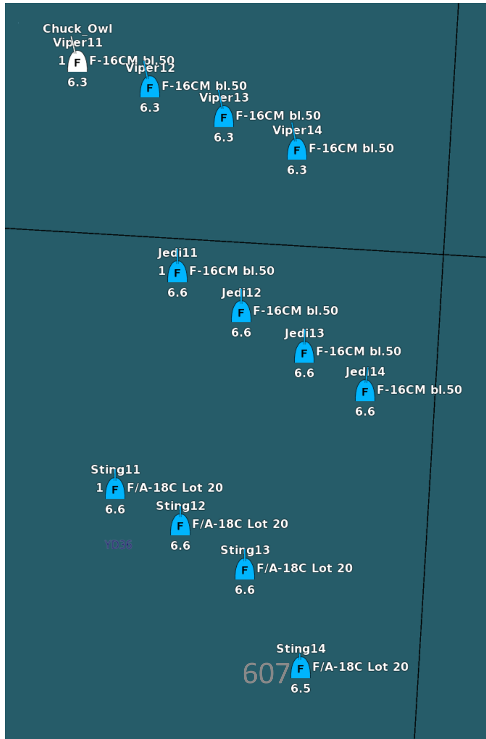
Sting 1-2 (F/A-18)
Flight 1 / Member 2
STN: 00502
Voice Callsign Label: ST
Voice Callsign Number: 12

Sting 1-3 (F/A-18)
Flight 1 / Member 3
STN: 00503
Voice Callsign Label: ST
Voice Callsign Number: 13

Sting 1-4 (F/A-18)
Flight 1 / Member 4
STN: 00504
Voice Callsign Label: ST
Voice Callsign Number: 14







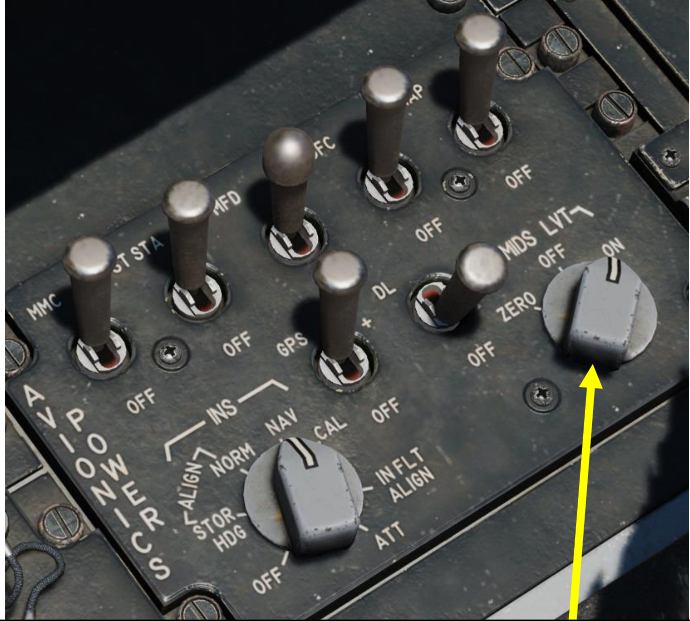
2 – DATALINK
2.2 – COMPONENTS BREAKDOWN

The Datalink system on the F-16 can be turned ON using the **MIDS (Multifunctional Information Distribution System) LVT (Low Volume Terminal) Datalink Selector Switch.**

Datalink parameters can be accessed from the DED (Data Entry Display) DLNK sub-menu and modified through the ICP (Integrated Control Panel).

Datalink data is visible on both the FCR (Fire Control Radar) page and on the HSD (Horizontal Situation Display) page.

ICP (Integrated Control Panel)



MIDS (Multifunctional Information Distribution System) LVT (Low Volume Terminal) Datalink Selector Switch

- *ZERO: Zeroize (erase) all MIDS information*
- *OFF: MIDS is OFF*
- *ON: MIDS is ON*

FCR (Fire Control Radar) Page

HSD (Horizontal Situation Display) Page

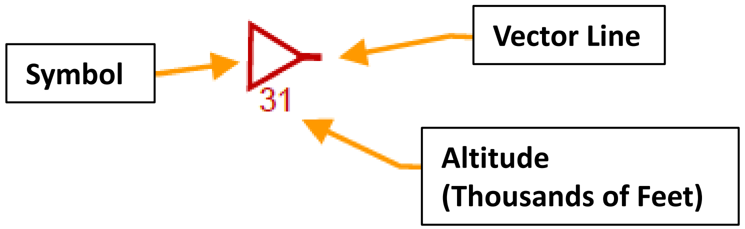
DED (Data Entry Display) LIST – DLNK Sub-Menu

2 – DATALINK
2.3 – DATALINK TRACK FILE TYPES

Datalink can receive and display three types of track files:

- **Surveillance Tracks**, provided by data sources like AWACS and radar ground stations.
- **Fighter Tracks**, provided by donor aircraft, other fighters providing track data, on the network. They are all correlated against each other to avoid duplicate trackfiles. These are visually identical to surveillance tracks.
- **PPLI (Precise Participant Location and Identification) Tracks**, show the location and status of members of the pilot's own flight and up to four additional donor aircraft.

*Take note that on the FCR (Fire Control Radar) page, the **RWS (Range While Search) contacts are uncorrelated** because they lack tracking precision, whereas **TWS (Track While Scan) contacts are correlated** because of much more precise tracking information.*



This information comes from a surveillance donor (like an AWACS or a ship) on the same datalink network. This is an **offboard trackfile**.

	Hostile	Unknown	Suspect	Friendly
Surveillance Tracks	31	25	21	29

This information comes from a friendly fighter donor (F/F: Fighter-to-Fighter) on the same datalink network, however you have not acquired this track yourself. This is an **offboard trackfile**.

	Hostile	Unknown	Suspect	Friendly
Fighter Tracks	31	25	21	29

The Precise Participant Location and Identification (PPLI) system broadcasts to other aircraft on datalink positional information about the PPLI donor itself. These symbols show the location and status of members of the pilot's own flight and up to four additional donor aircraft.

	Wingman	Other Donor		
PPLI Tracks	2 29	22		

You have acquired this track and another information donor has given you information (offboard trackfile) about it as well. This means this information is correlated/coherent between an onboard (you) and an offboard information source. This is termed Multi Source Integration (MSI).

	Hostile	Unknown	Suspect	Friendly
Tracks Correlated with Onboard Sensors	31	25	21	29

	Wingman	Other Donor		
PPLI Tracks Correlated with Onboard Sensors	2 29	22		

2 – DATALINK
2.4 – HSD (HORIZONTAL SITUATION DISPLAY) SYMBOLOGY

SAM (Surface-to-Air Missile) Site Symbol (SA-10)

Hostile Track, altitude 30000 ft

SAM (Surface-to-Air Missile) Site Threat Ring
- This ring is set by the DTC (Data Transfer Cartridge) via the Mission Editor. This is an indicator of the SAM radar range and this region should be avoided if possible.
- If SAM site is destroyed, the Threat Ring will remain displayed. It does not update dynamically with the SAM site itself, it is merely a visual marker set prior to the mission according to currently available intelligence on deployment of enemy forces.

Friendly Track, altitude 31000 ft.

HSD (Horizontal Situation Display) Page

2 – DATALINK
2.4 – HSD (HORIZONTAL SITUATION DISPLAY) SYMBOLOGY

View Coupled (CPL) or De-coupled (DCPL) from FCR (Fire Control Radar) Range

View Position of HSD
- DEP: Depressed (Default) Position
- CEN: Centered Position

Current zoom level on the HSD
- NORM (normal view)
- EXP1 (area around your aircraft is expanded
- EXP2 (area around your aircraft is expanded further)

Displays Datalink Message (MSG)

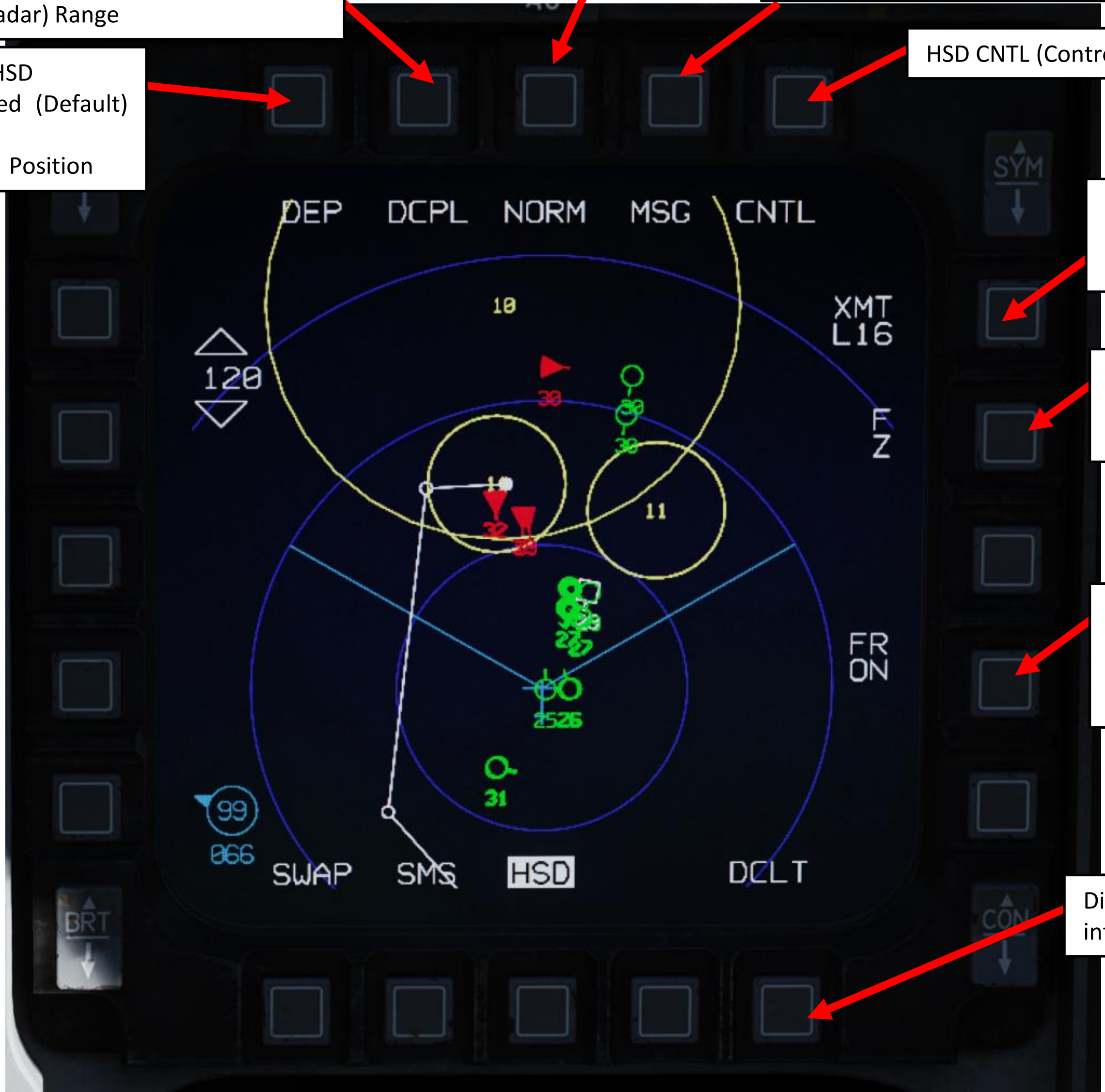
HSD CNTL (Control) Page

HSD Datalink XMT (Transmit) Option
- TNDL (Tactical Network Datalink, formerly referred as “L16” in earlier DCS versions)

HSD FZ (Freeze) Function. HSD will freeze in its current position, and will not turn with your aircraft or reposition itself to keep you centered.

HSD Datalink Contact Filter
- FR ON: All Friendly Contacts
- FL ON: Flight Leaders Only
- FR OFF: Friendly Contacts OFF

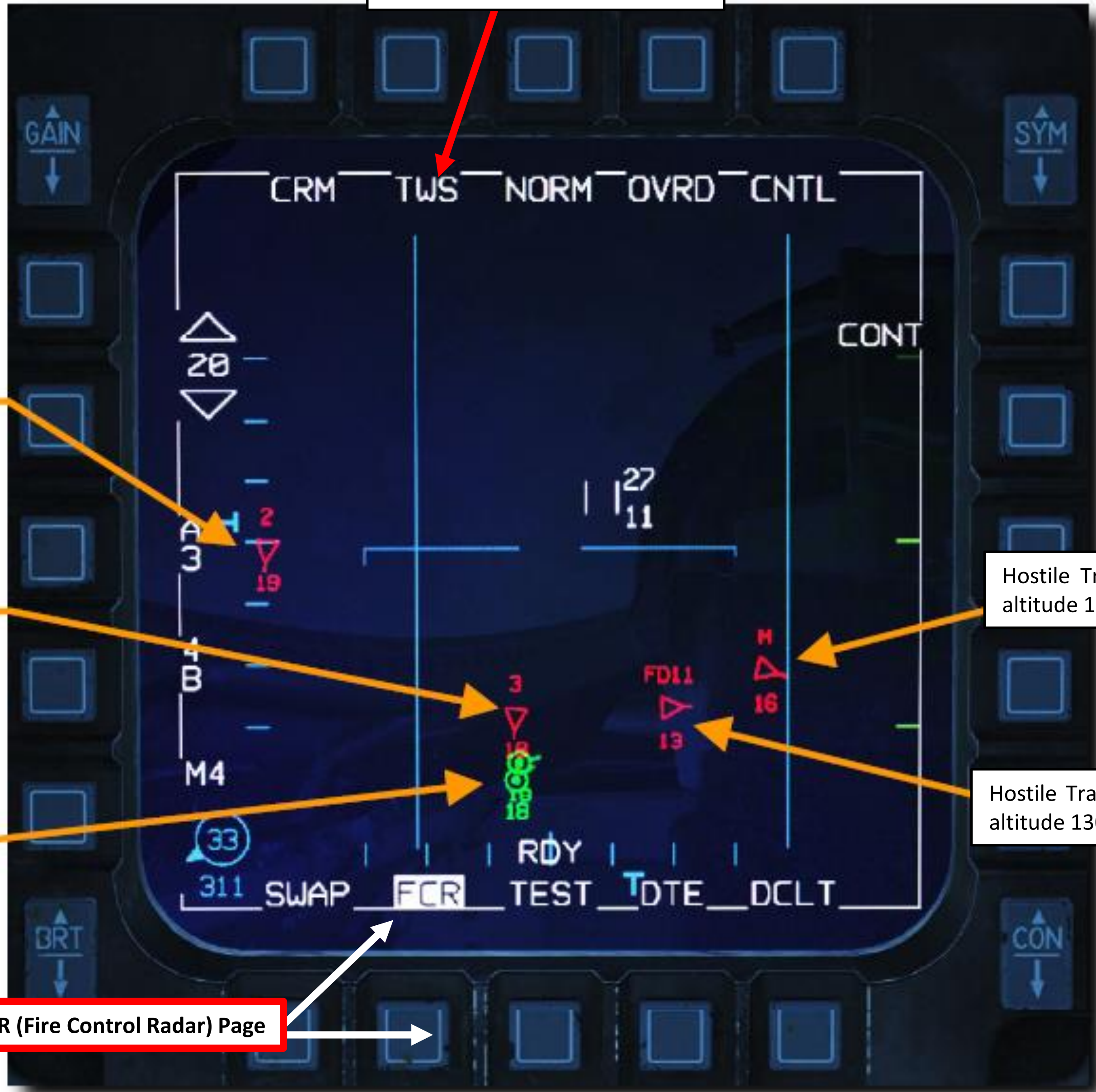
Display Declutter (DCLT) Function. Removes information from HSD to make it more readable.



2 – DATALINK
2.5 – FCR (FIRE CONTROL RADAR) SYMBOLOGY

RWS contacts are uncorrelated because they lack tracking precision.

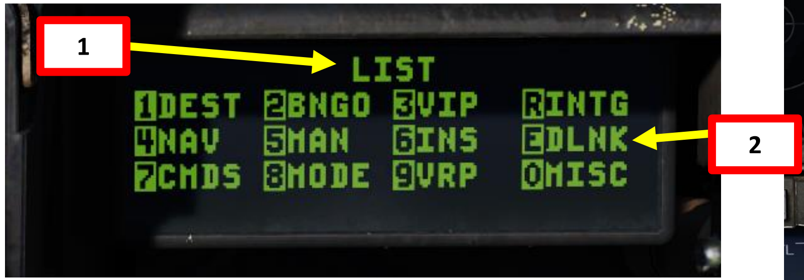
TWS contacts are correlated because TWS generates more precise tracking information.



2 – DATALINK
2.6 – DED (DATA ENTRY DISPLAY) DLNK PAGES

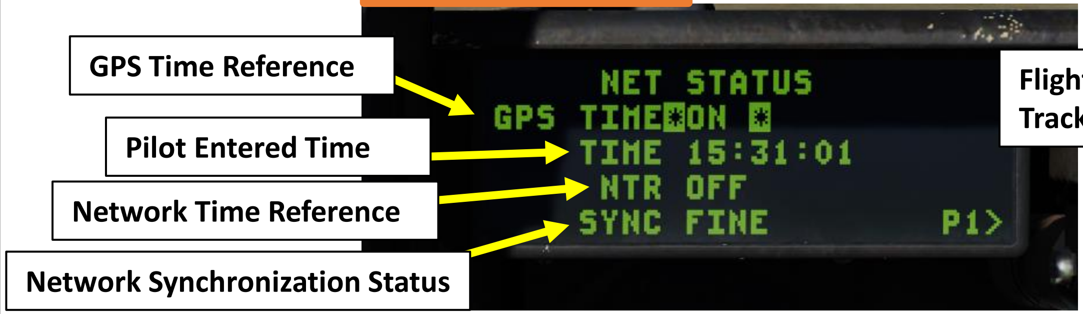
To consult the MIDS Network Data on the DLNK DED Pages:

1. Press the LIST button on the ICP (Integrated Control Panel)
2. Select Datalink (DLNK) page by pressing the ENTR (E) button.
3. On the DED (Data Entry Display) Datalink page 1 (P1), you can consult **Datalink Network Status** and time references.
4. Press the DCS (Data Control Switch, also called "Dobber") RIGHT (SEQ) select the DED Datalink page 2 (P2).
5. On the DED Datalink page 2, you can consult **Datalink MIDS Radio Options**. Most MIDS settings can be left as is.
6. If desired, you can modify your MIDS settings by selecting a field with the "Dobber" switch UP or DOWN. "*" symbols will indicate which data field is selected. Then, enter the field value on the ICP keypad, then press "ENTR" button on the ICP to modify the field.
7. Press the DCS (Data Control Switch, "Dobber") RIGHT (SEQ) select the DED Datalink page 3 (P3).
8. On the DED Datalink page 3, you can consult **Datalink Flight Management** data .

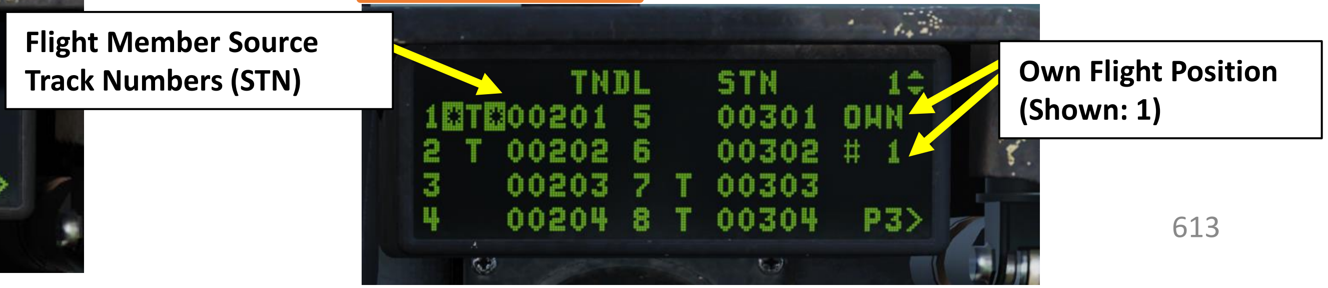


MIDS Radio Options

Datalink Network Status



Flight Management



2 – DATALINK
2.6 – DED (DATA ENTRY DISPLAY) DLNK PAGES

DLNK PAGE STRUCTURE

LIST Button

ENTR Button

DCS (Data Control Switch, also nicknamed "Dobber")

LIST Button
Press "ENTR" to select DLNK DED Page

LIST Menu

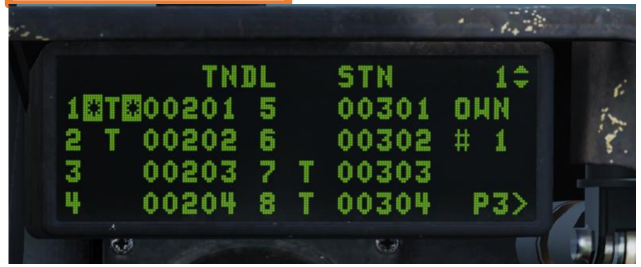
Datalink Network Status

Dobber RIGHT (SEQ)

MIDS Radio Options

Dobber RIGHT (SEQ)

Flight Management



2 – DATALINK
2.7.1 – MIDS NETWORK – OVERVIEW

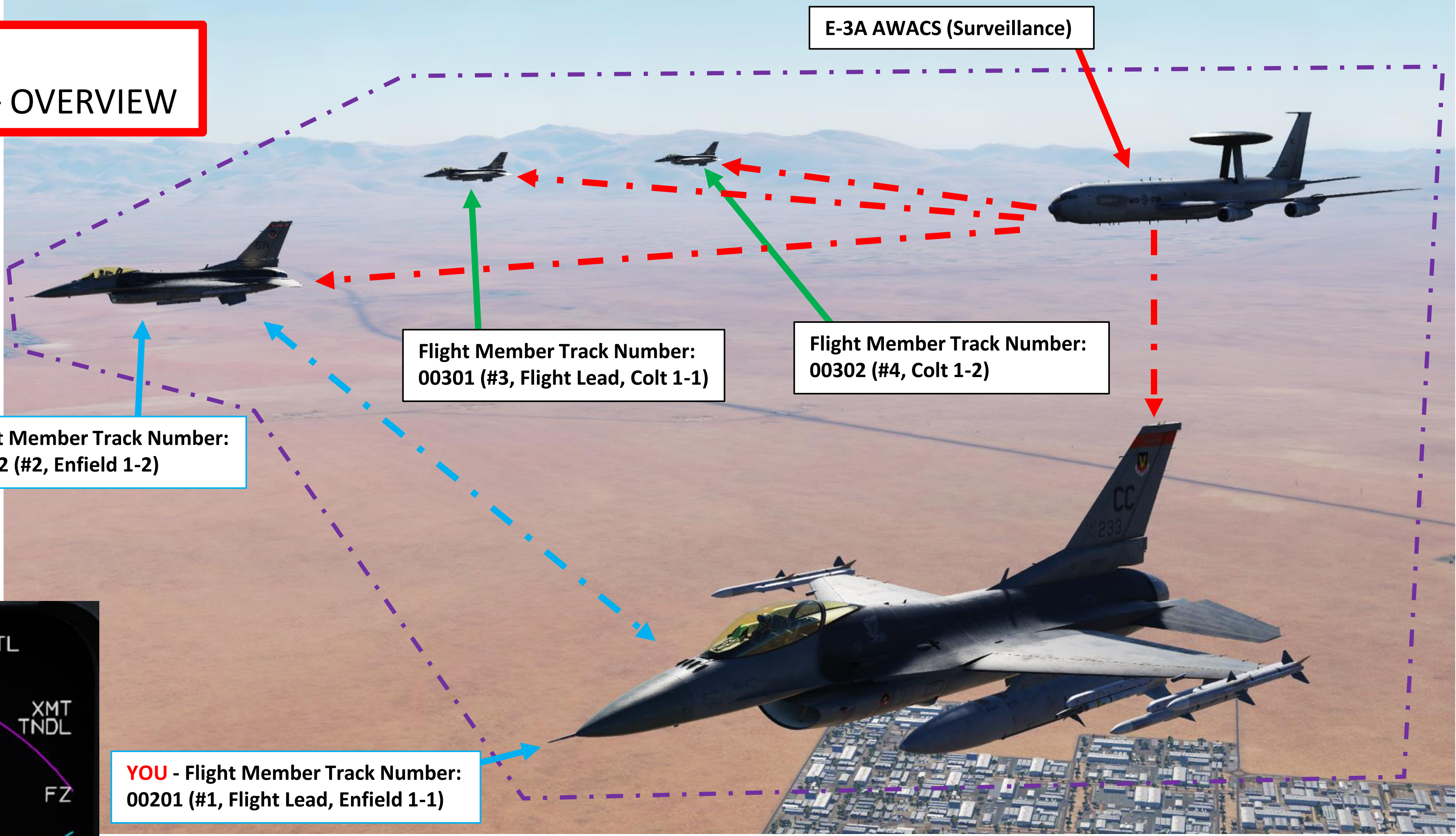
Here is an overview of the three different kinds of channels you can set.

- Fighter Channel (FC) is for members of your own flight
- Mission Channel (MC) is for members of other flights
- Surveillance Channel (SC) is for tactical datalink with information donors (i.e. AWACS)

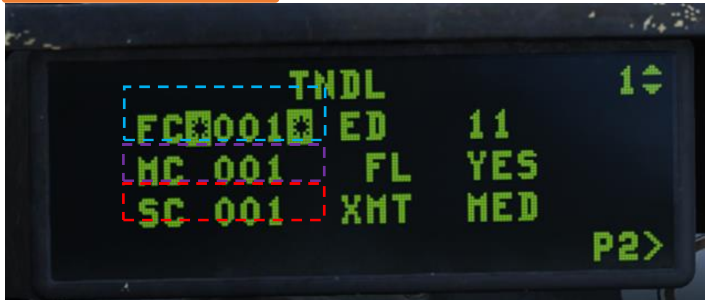
FC (Fighter Channel) 1 (Enfield)

MC (Mission Channel) 1

SC (Surveillance Channel) 1



MIDS Radio Options



Flight Management

T: TDOA (Time Difference On Arrival) Assignment

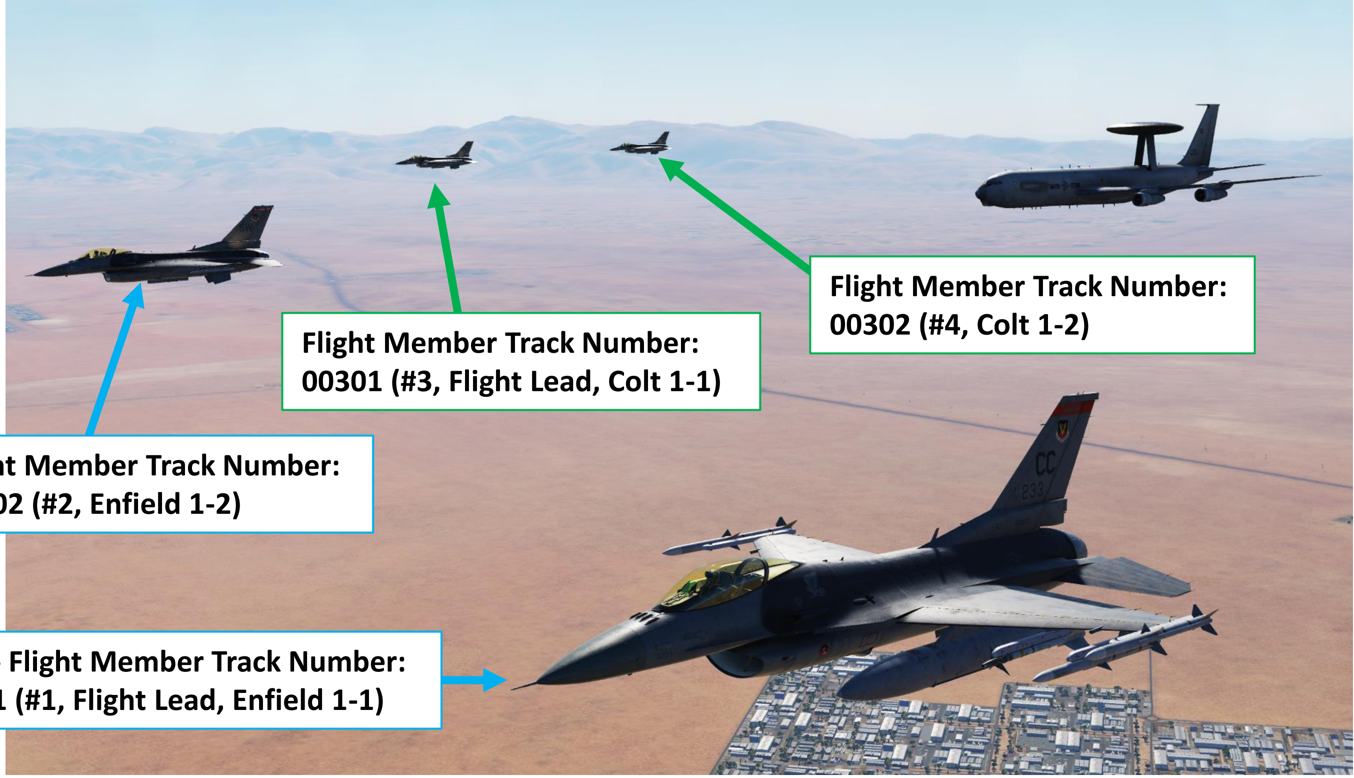
2 – DATALINK
2.7.1 – MIDS NETWORK – OVERVIEW

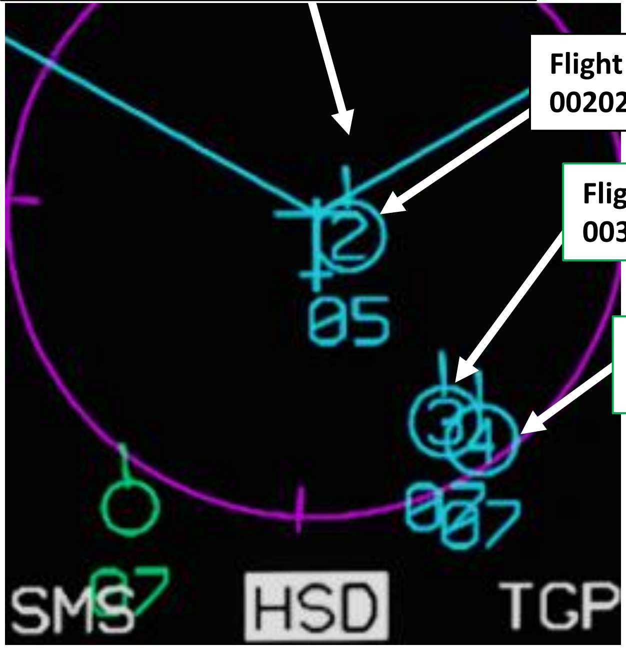
At the moment, you should assume that your STN (Source Track Number), Callsign and Flight Lead (FL) Identifiers are all set correctly since they are generated by the Mission Editor.

The Own Flight Position ID number indicates your position in your current flight (i.e. Enfield Flight in our case).

Blue Symbols indicate member of your current flight. Green symbols are friendly donors of your Datalink network, but from different flights.

The **number inside the circle symbol** is the Own Flight Position Number within your own flight. The **number below the circle symbol** is the altitude of the Datalink contact in thousands of feet (06 = 6000 ft).

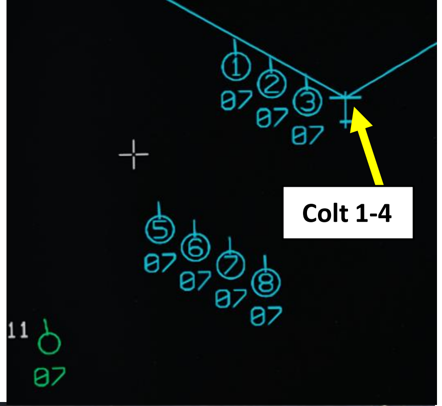


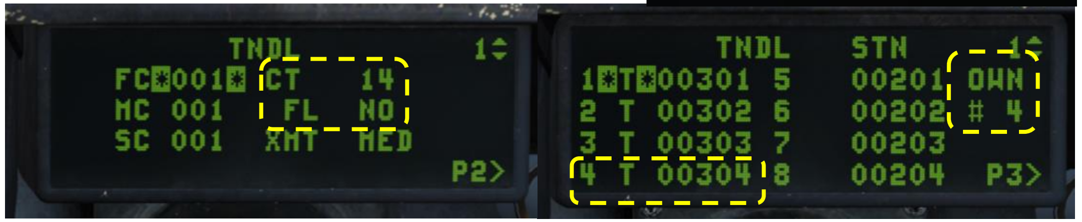


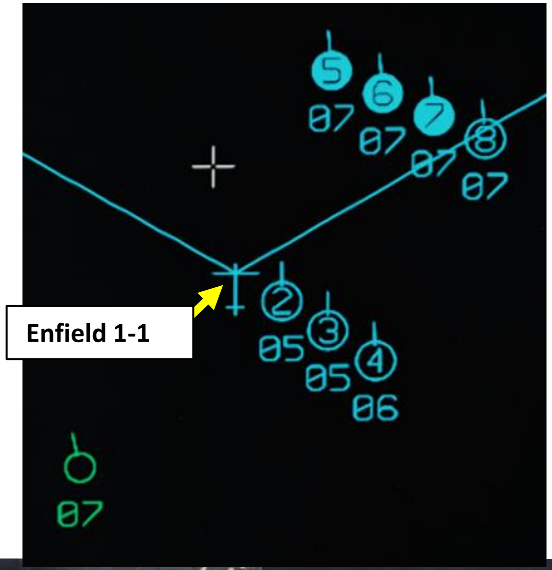
2 – DATALINK
2.7.1 – MIDS NETWORK – OVERVIEW

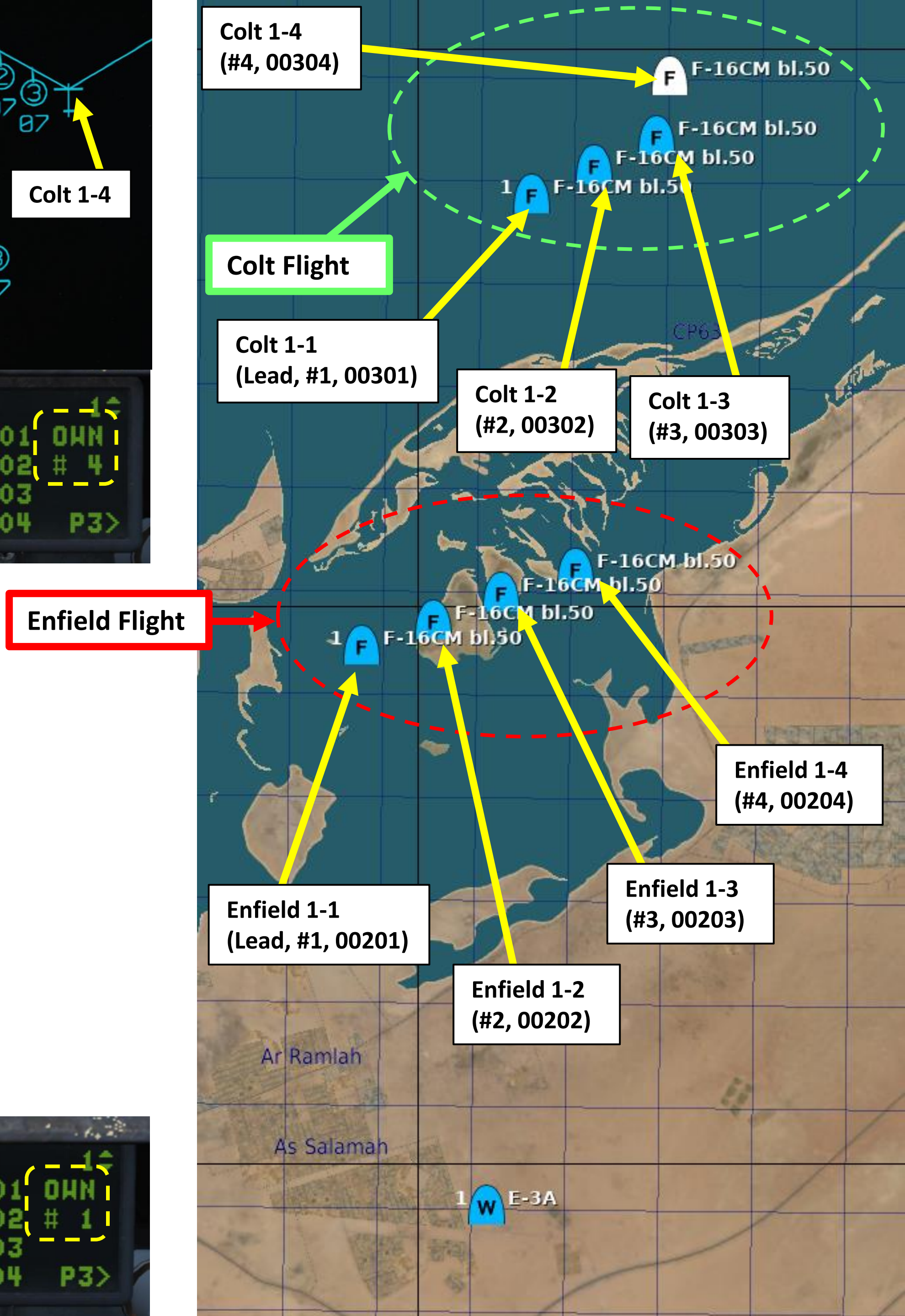
This is an example of how members of two different flights on a same Datalink network would see each other.

Enfield Flight	Colt Flight
# 1 – 00201 Enfield 1-1 (Flight Lead)	# 1 – 00301 Colt 1-1 (Flight Lead)
# 2 – 00202 Enfield 1-2	# 2 – 00302 Colt 1-2
# 3 – 00203 Enfield 1-3	# 3 – 00303 Colt 1-3
# 4 – 00204 Enfield 1-4	# 4 – 00304 Colt 1-4







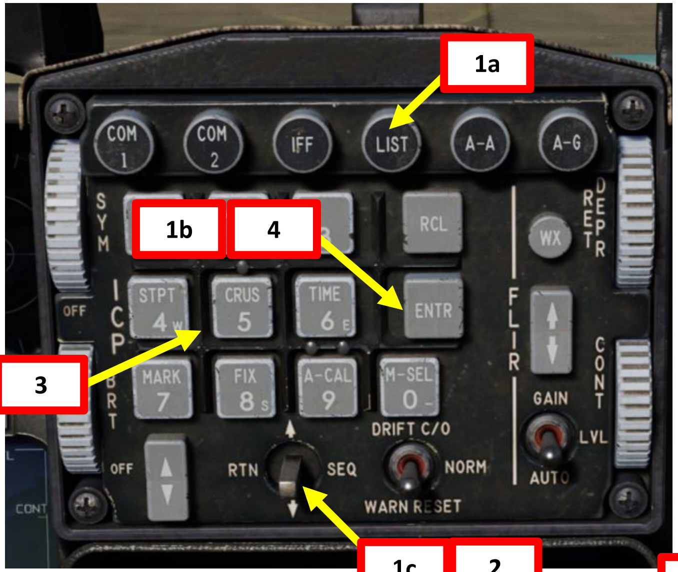


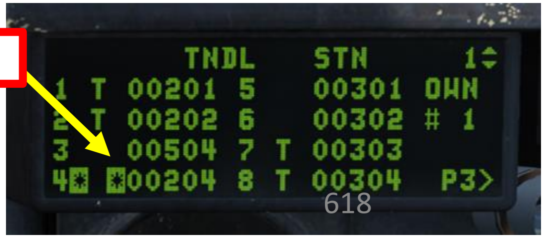
2 – DATALINK
2.7.2 – MIDS NETWORK – ADD/MODIFY MEMBERS

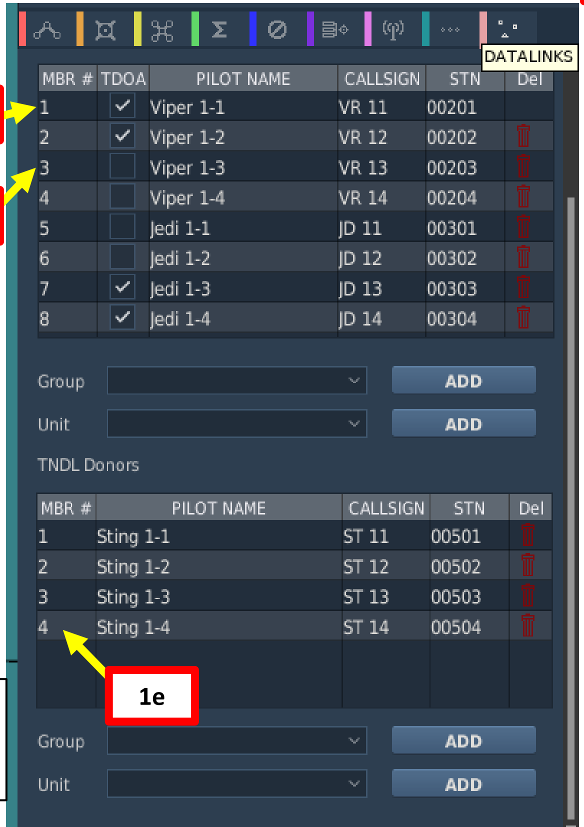
If desired, you can **add or modify team members** on your flight's Datalink Network. Team Member Numbers can be changed and assigned a unique **STN (Source Track Number)**, Remember: STNs themselves are associated to one aircraft only. STNs cannot be changed and are hard-coded in the Mission Editor.

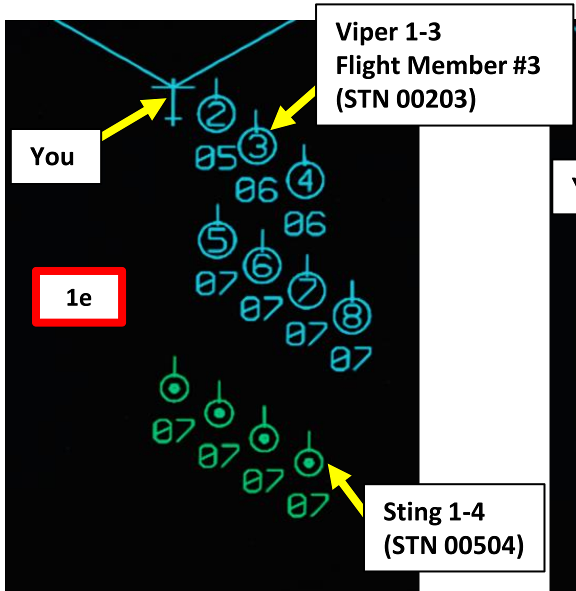
As an example, if you want to replace Team Member #3 with Sting 1-4 (STN 00504) :

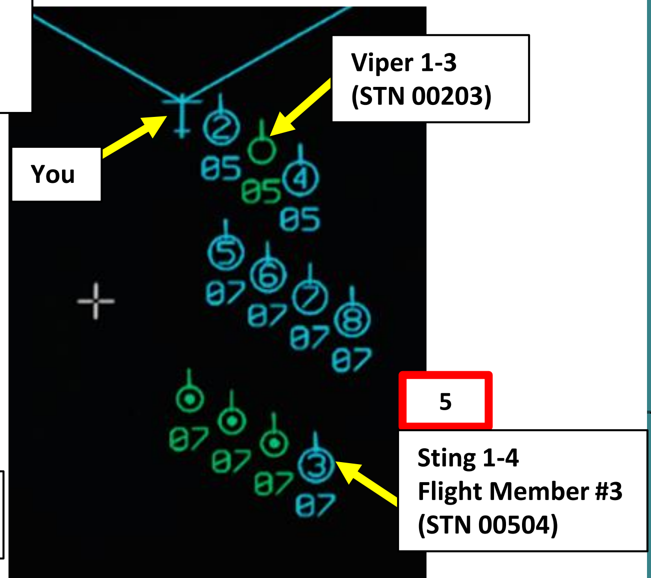
1. Select MIDS FLIGHT MANAGEMENT page
   a) Press LIST Button
   b) Press ENTR Button
   c) Select Dobber RIGHT (SEQ) twice
   d) Your Current Own Team Member Number within your flight can be seen as #1 (Your STN is 00201)
   e) The Current Team Member #3 slot is taken by Viper 1-3 (STN 00203). We want to replace #3 slot with Sting 1-4 (STN 00504).
2. Select the "STN" field for Team Member #3 with the "Dobber" switch UP or DOWN. "*" symbols will indicate which data field is selected.
3. Enter the STN value of Sting 1-4 on the ICP keypad (00504)
4. Press "ENTR" button on the ICP to modify the field.
5. Team Member #3 slot is now assigned to Sting 1-4 (STN 00504).







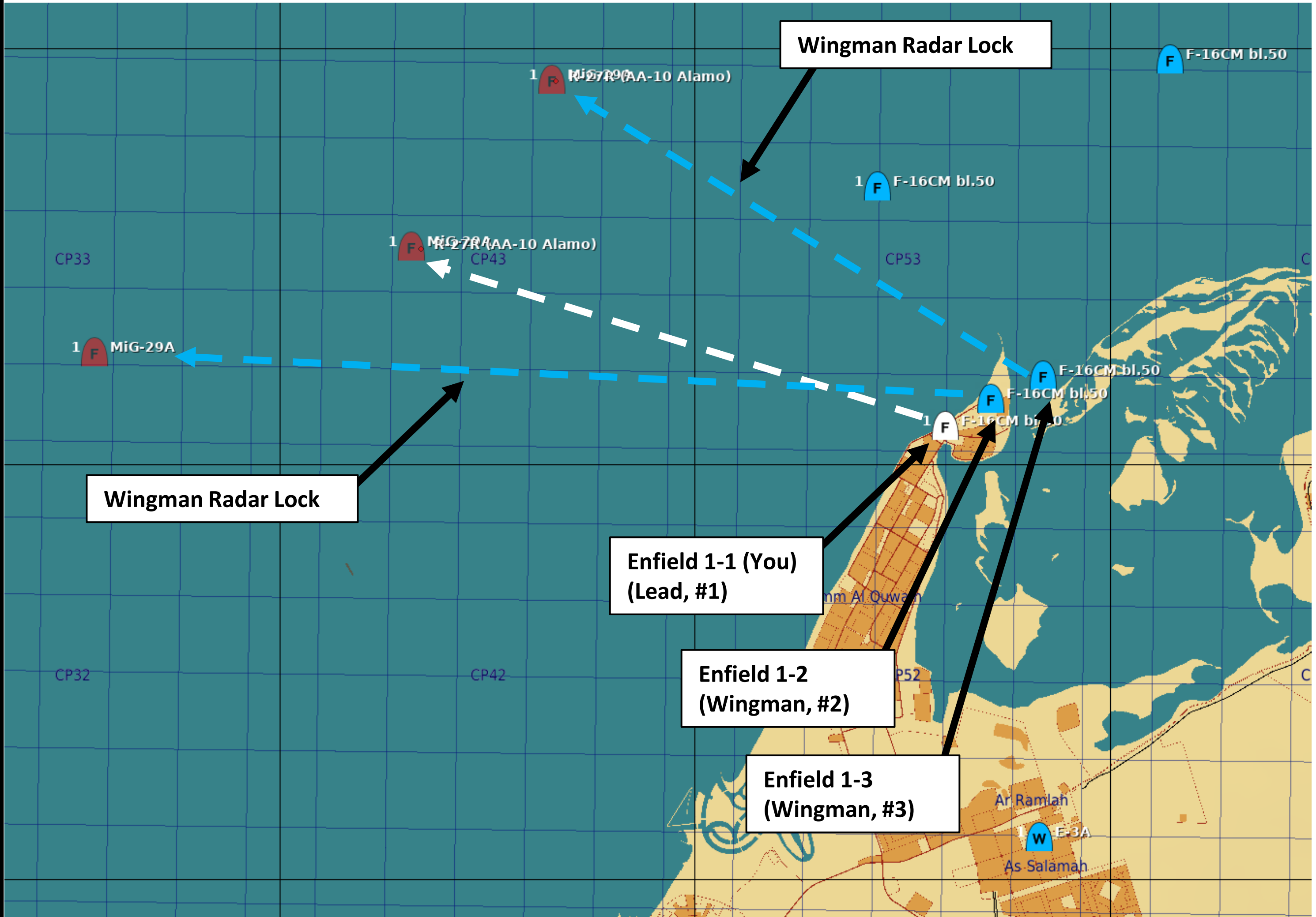


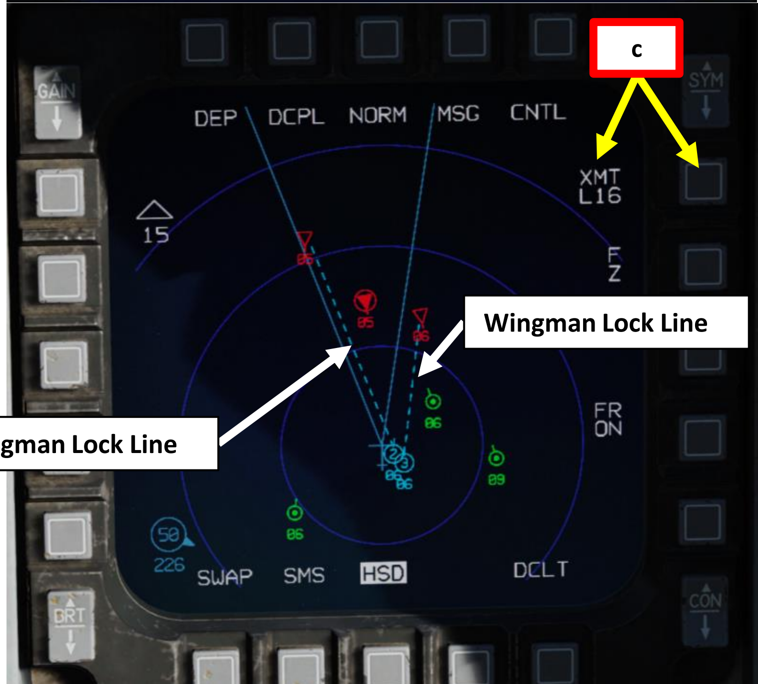


2 – DATALINK
2.8 – WINGMAN RADAR LOCK LINES

A dashed cyan wingman lock line is drawn from wingmen to their currently bugged (or radar locked) targets.

a. Wingman lock lines are **only displayed for flight members (blue)** and not for all donors on the network.
b. There is **no lock line visible for your own bugged targets** on your own HSD page
c. Your wingmen will see your lock line for your own bugged targets if the **XMT option is set to TNDL** (Tactical Network Datalink, formerly referred to as "L16" in earlier DCS versions) **on the HSD page**.





2 – DATALINK
2.9.1 – DATA FILTERS: FCR PAGE

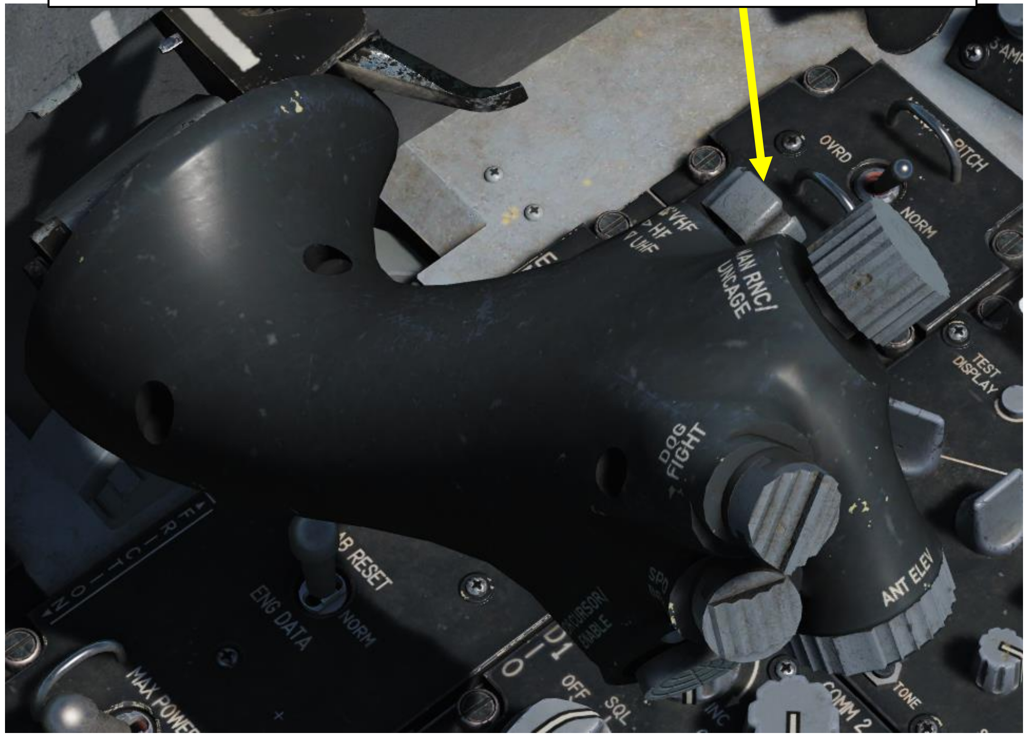
Track symbols displayed on the FCR page may be filtered using the UHF/VHF Transmit switch. This affects tracks displayed on the radar display only and does not affect those displayed on the HSD.

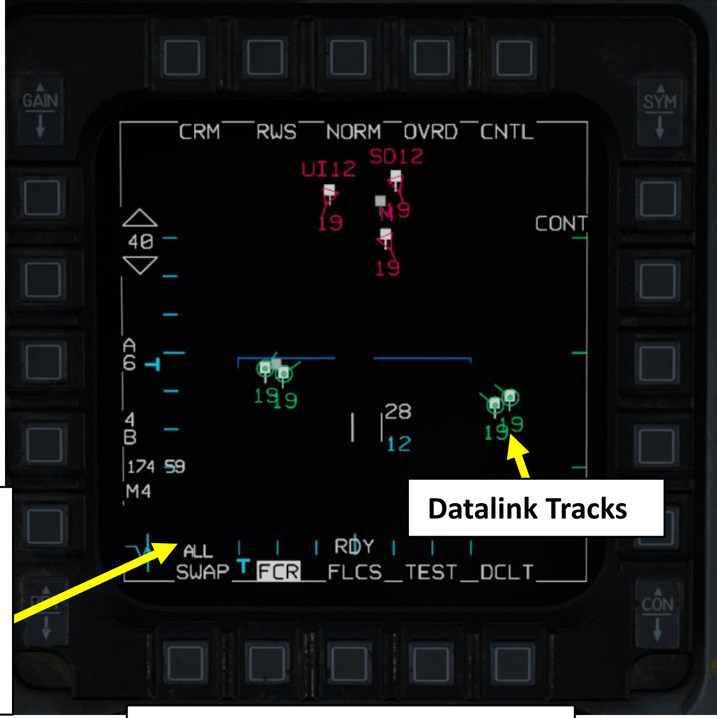
Positioning the **Transmit switch inboard short** (less than 0.5 sec) rotates between three filter options.

Positioning the **Transmit Switch outboard short** (less than 0.5 sec) selects **NONE** and removes all datalink tracks. Selecting **outboard short** again returns to the previously selected filter option.

Filter Options
- **ALL:** All Datalink symbols are displayed
- **FTR+:** Datalink Surveillance tracks are removed
- **TGTS:** Datalink Surveillance and PPLI tracks are removed
- **NONE:** No Datalink symbols are displayed

Communications UHF/VHF Transmit Switch (4-Way)
- *Transmit Switch – IFF IN (INBOARD): Cycles filter options*
- *Transmit Switch – IFF OUT (OUTBOARD): Removes datalink tracks*





FCR (Fire Control Radar) Page

2 – DATALINK
2.9.2 – DATA FILTERS: HSD CNTL PAGE

If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

AIFF: Toggles the display of Advanced IFF (Identify-Friend-or-Foe) responses from other aircraft.

PRE (Pre-Programmed): Toggles the display of enemy targets that were programmed into your aircraft's computer before takeoff

FCR: toggles display of the radar scan area and the "ghost" cursor showing the position of your FCR (Fire Control Radar) cursor

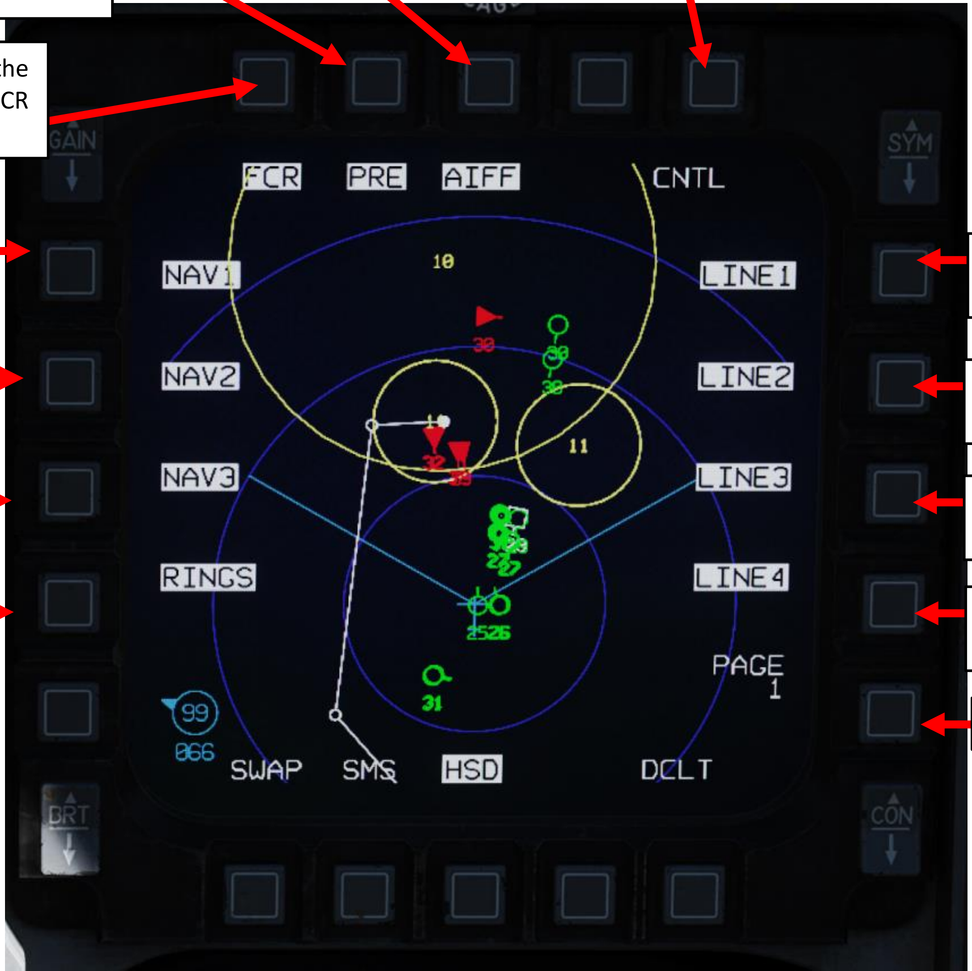
HSD CNTL (Control) Sub-Page

NAV1: Toggles the display of your navigational route 1.

NAV2: Toggles the display of your navigational route 2.

NAV3: Toggles the display of your navigational route 3.

RINGS: Toggles the display of range rings around your aircraft.



LINE1: Toggles the display of map information line 1 on the HSD (i.e. Forward Line of Troops).

LINE2: Toggles the display of map information line 2 on the HSD.

LINE3: Toggles the display of map information line 3 on the HSD.

LINE4: Toggles the display of map information line 4 on the HSD.

Access to CNTL Page 2

2 – DATALINK
2.9.2 – DATA FILTERS: HSD CNTL PAGE

If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

PDLT RNG (Primary Datalink Track Range): HSD range scale automatically increases to maintain the PDLT within the HSD Field of View

REF PT: Not Functional

TNDL (Previously L16) ENG: Not Functional

HSD CNTL (Control) Sub-Page

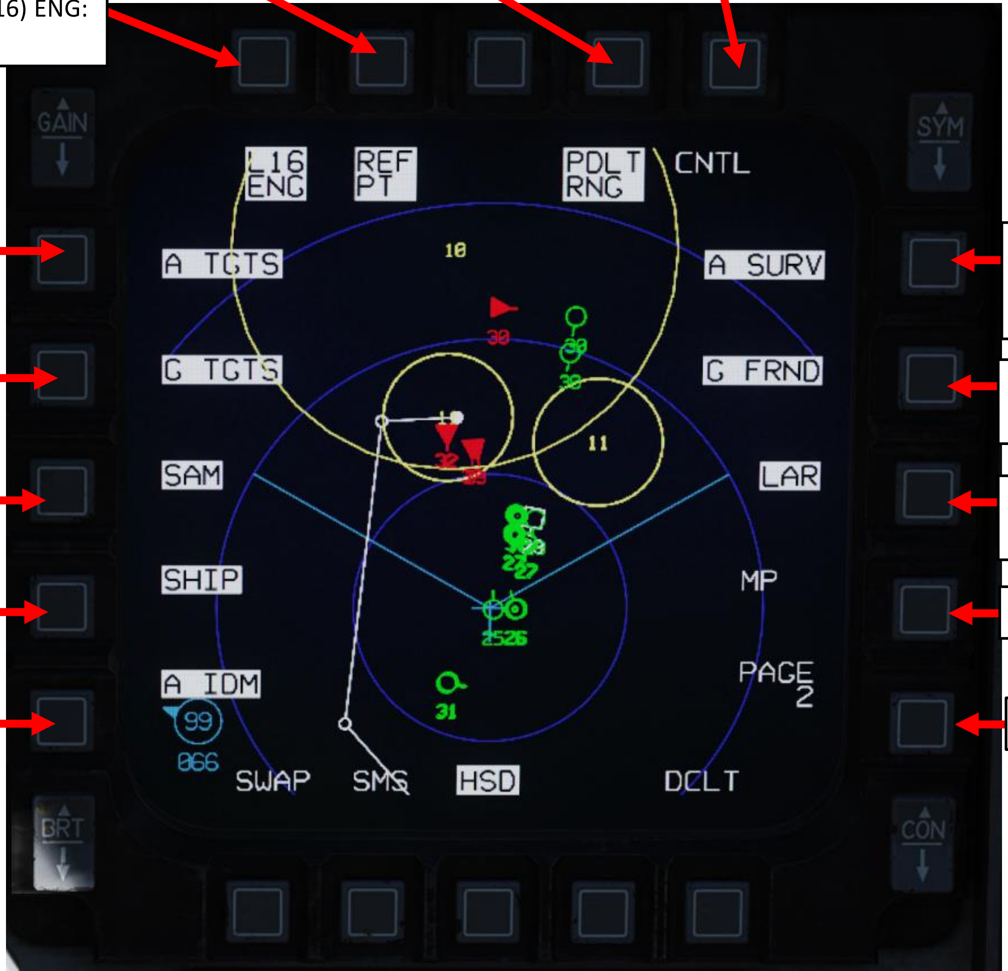
A TGTS: Toggles the display of air threats/targets uploaded to your computer from data link

G TGTS: Toggles the display of ground threats/targets uploaded to your computer from data link

SAM: Toggles the display of SAM (Surface-to-Air Missile) symbols and threat rings

SHIP: Toggles the display of Ship symbols uploaded to your computer from data link

A SMDL (Previously IDM) : Not Functional



A SURV: Toggles the display of surveillance air threats/targets uploaded to your computer from data link

G FRND: Toggles the display of friendly ground units uploaded to your computer from data link

LAR: Toggles Launch Acceptable Range (LAR) Symbology from HSD

MP: Not Functional

Access to CNTL Page 1

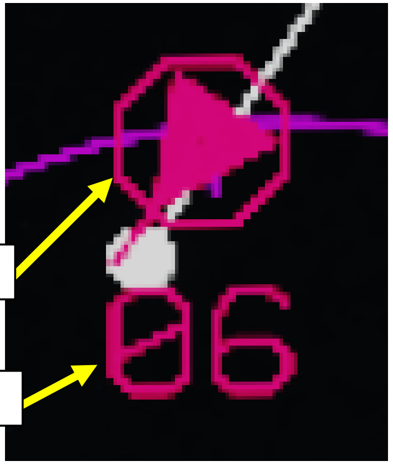
2 – DATALINK
2.10 – PRIMARY DATALINK TRACK (PDLT)

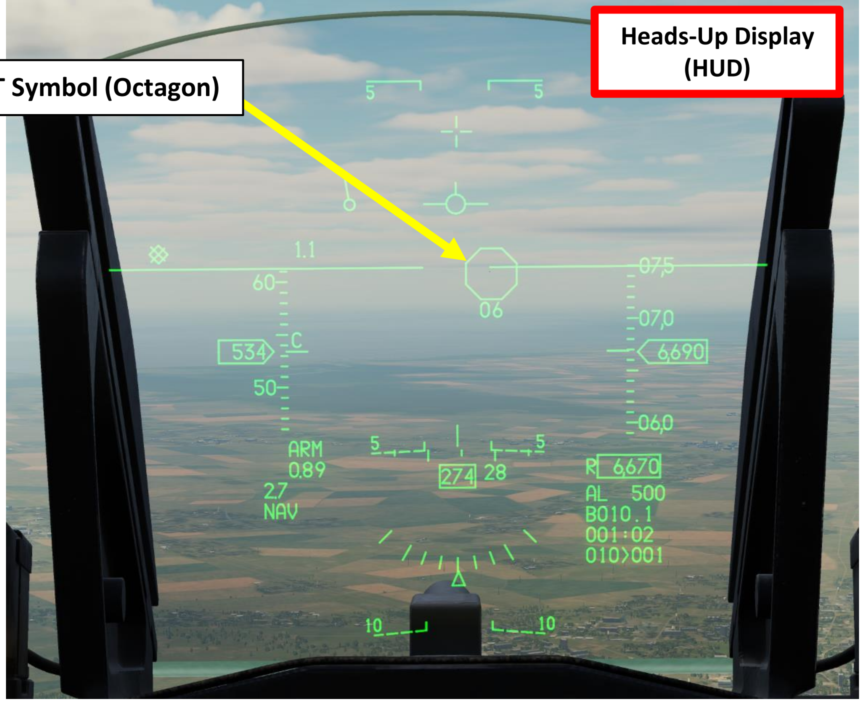
PDLT (Primary Datalink Track) allows you to designate a datalink-only or a correlated track on the HSD and have an octagon symbol around it on the HSD, FCR, HUD, and HMCS. This is a useful tool to maintain situational awareness on your wingman, element lead, or a target.

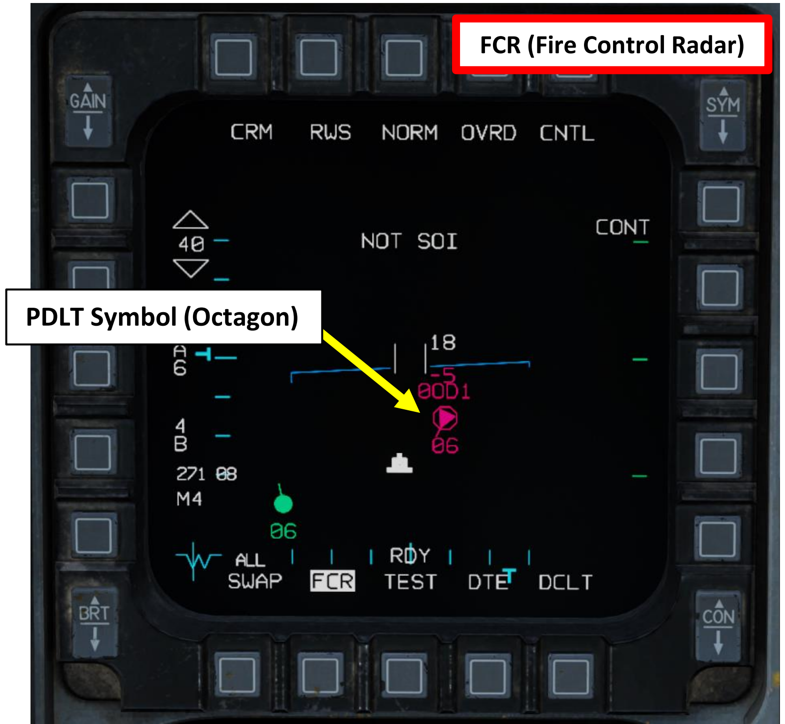
This means that you can assign a PDLT to a wingman or an unknown contact spotted by an AWACS.

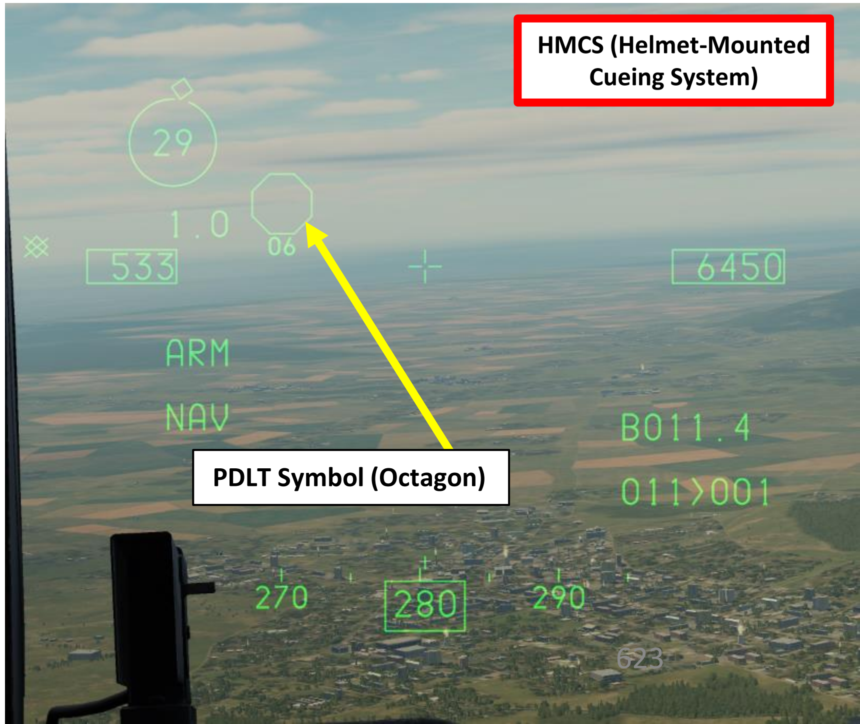
PDLT Symbol (Octagon)

Target Altitude (in thousands of feet)





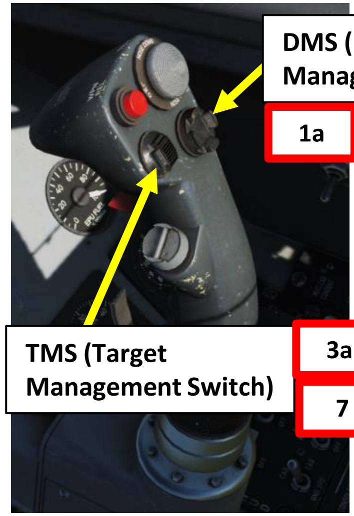




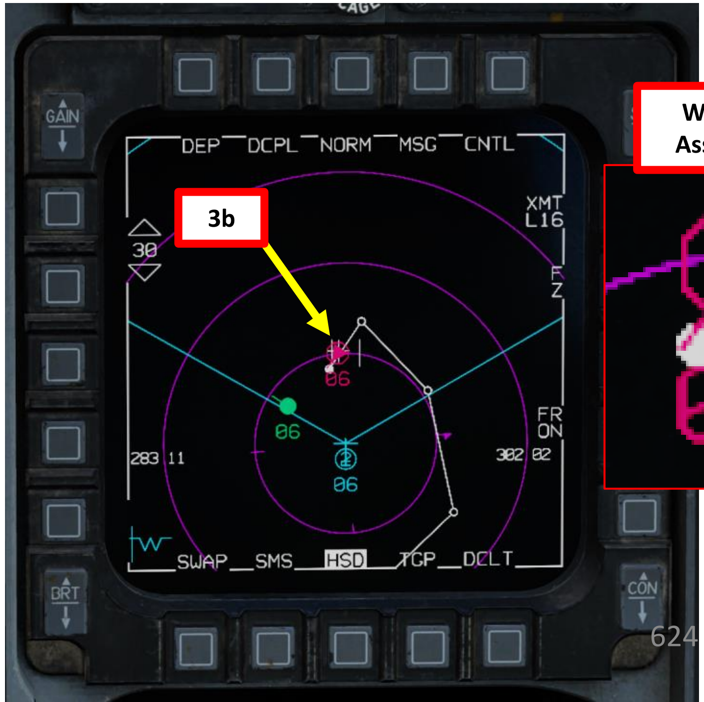
2 – DATALINK
2.10 – PRIMARY DATALINK TRACK (PDLT)

To assign the PDLT to a datalinked contact:

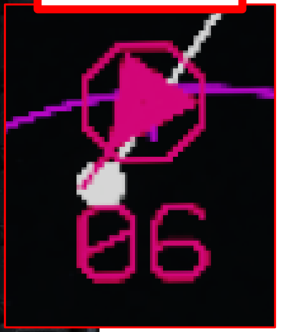
1. Make the HSD (Horizontal Situation Display) the SOI (Sensor of Interest) with the DMS (Display Management Switch) DOWN.
2. Slew the HSD Cursor over a datalink-only or a non-designated correlated contact using the Radar Cursor/Enable switch.
3. Press TMS (Target Management Switch) UP.
4. An already designated (bugged) contact cannot be assigned as the PDLT, assigning it would make it a designated contact.
5. If a PDLT contact becomes the designated contract, the PDLT octagon is removed.
6. If there is a PDLT assigned contact, and a different contact is assigned to be the PDLT, the PDLT assignment is moved to the newly assigned contact.
7. If there is an assigned PDLT contract, pressing TMS Right will cycle the PDLT through the undesignated datalink and correlated A-A (Air-to-Air) contacts. The step order is from the bottom of the HSD to the top. If of equal distance on the HSD, then left to right.



2b **Radar Cursor/Enable Switch**
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*



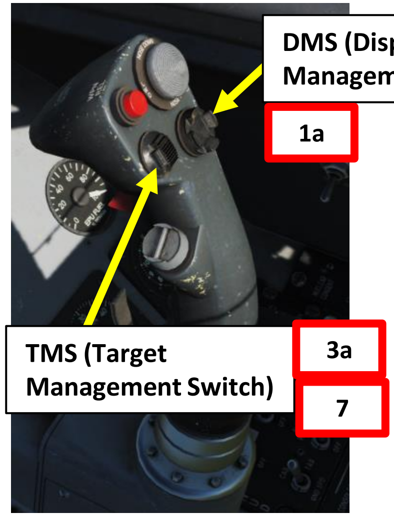
With PDLT Assignment

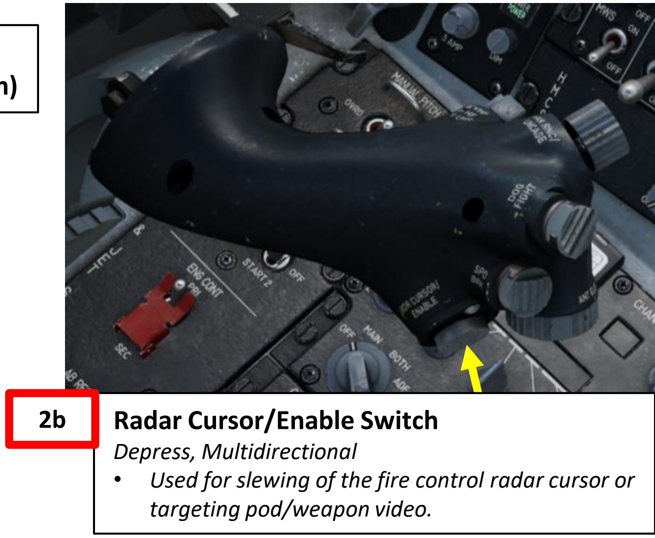


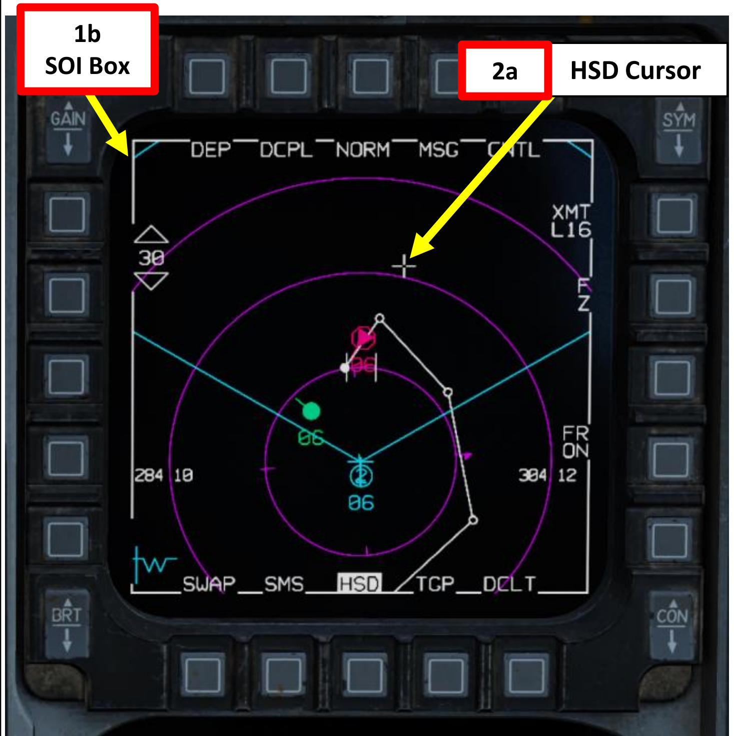
2 – DATALINK
2.10 – PRIMARY DATALINK TRACK (PDLT)

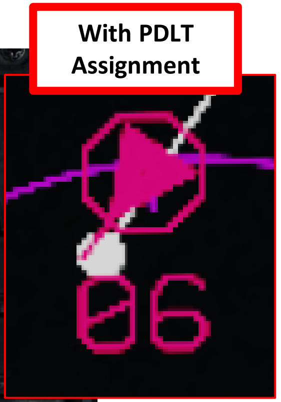
To remove a PDLT assignment:

1. Make the HSD (Horizontal Situation Display) the SOI (Sensor of Interest) with the DMS (Display Management Switch) DOWN.
2. Slew the HSD Cursor over the PDLT octagon using the Radar Cursor/Enable switch.
3. Press TMS (Target Management Switch) DOWN.
4. The PDLT assignment is now removed.
5. If the PDLT is also over a threat ring, the first TMS Aft removes the threat ring, and the second TMS Aft removes the PDLT assignment.
6. If the datalink track is lost on the PDLT contact assignment, the PDLT symbol is removed.









2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.1 – MARKPOINT/STEERPOINT SHARING

SENDING DATA

To transmit/broadcast a selected markpoint or steerpoint:

1. We have already created a Markpoint with the targeting pod (stored in Steerpoint 26).
2. On HSD (Horizontal Situation Display), press OSB next to HSD Datalink XMT (Transmit) Option to TNDL (Tactical Network Datalink, formerly referred as “L16” in earlier DCS versions)
3. Make the HSD (Horizontal Situation Display) the SOI (Sensor of Interest) with the DMS (Display Management Switch) DOWN.
4. Select the steerpoint or markpoint you want to transmit with the DED Increment/Decrement Switch.
   - Reminder: Steerpoints 26 to 30 are reserved for ownship markpoints.
5. Press the Communications UHF/VHF Transmit Switch INBOARD (IFF IN) for more than 0.5 sec. This will transmit the selected steerpoint/markpoint to your flight members in the same datalink network.

DED Increment/Decrement Switch

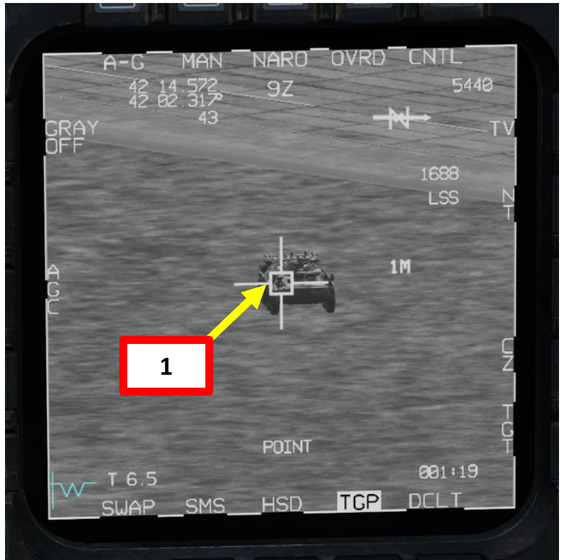
4

1

4

Communications UHF/VHF Transmit Switch (4-Way)
- *Transmit Switch – IFF IN (INBOARD)*
- *Transmit Switch – IFF OUT (OUTBOARD)*

5a



1

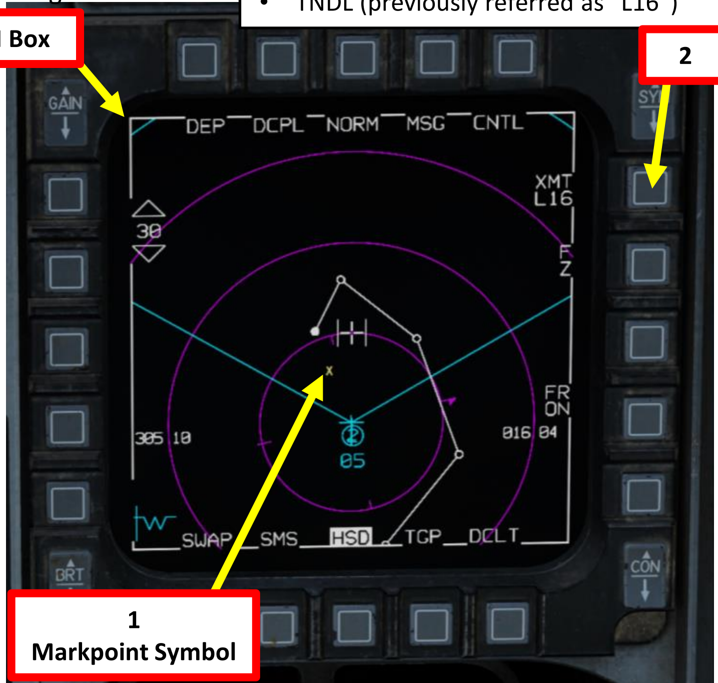
DMS (Display Management Switch)

3

HSD SOI Box

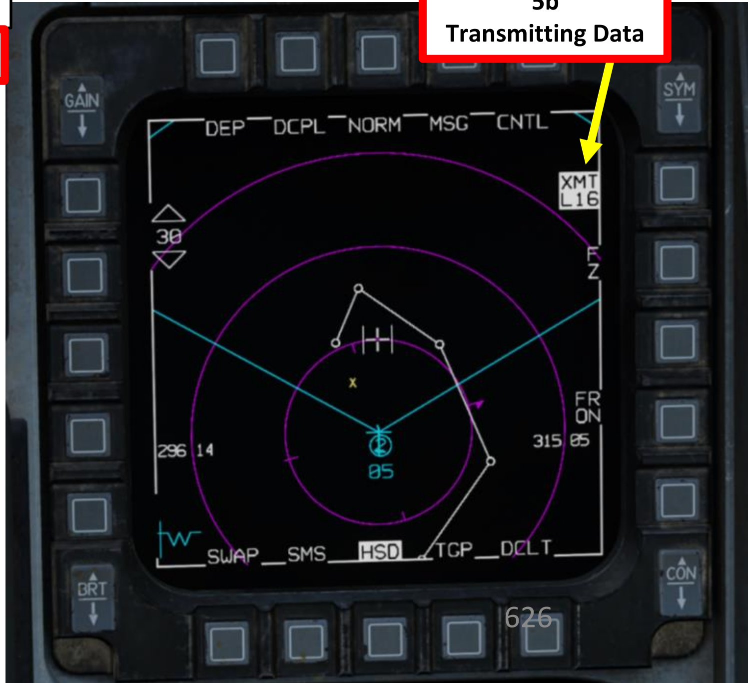
HSD Datalink XMT (Transmit) Option
- TNDL (previously referred as “L16”)

2



1
Markpoint Symbol

5b
Transmitting Data

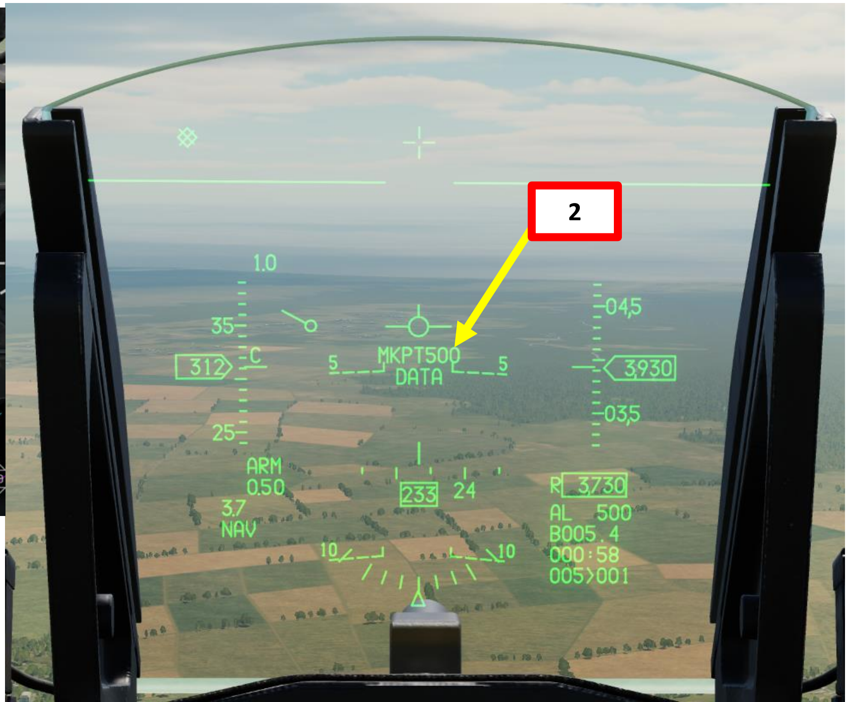


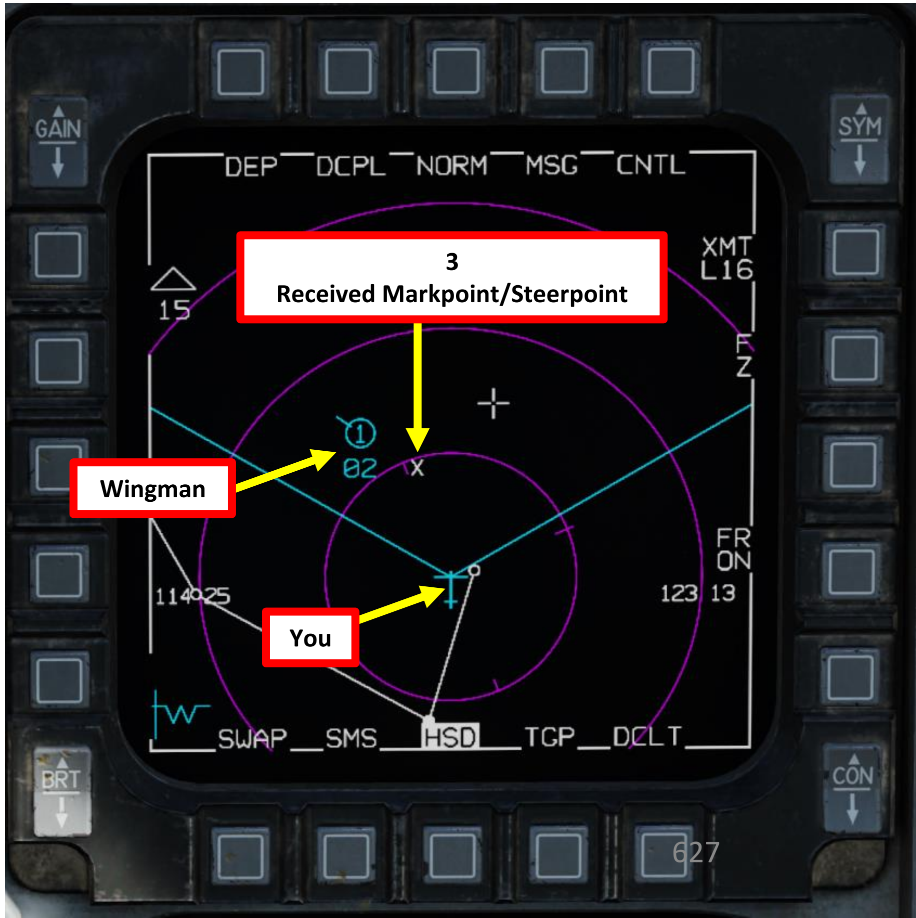
2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.1 – MARKPOINT/STEERPOINT SHARING

RECEIVING DATA

When your wingman receives a markpoint or steerpoint shared through the datalink system:

1. A “Data” audio cue is heard
2. On the HUD (Heads-Up Display), the MKPTXXXX DATA indication shows the reference number of the SPI sent to you, which is “500” in our case.
3. On HSD, a large white cross indicates the sent/transmitted markpoint or steerpoint.
4. If you want to see the markpoint/steerpoint coordinates, you can go in the STPT DED page and look at STPT No. 500 (reference number).
5. To remove the MKPTXXXX DATA indication on the HUD, press the Warning Reset Switch DOWN on the ICP.



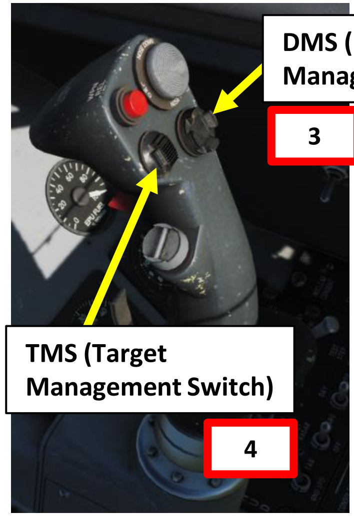


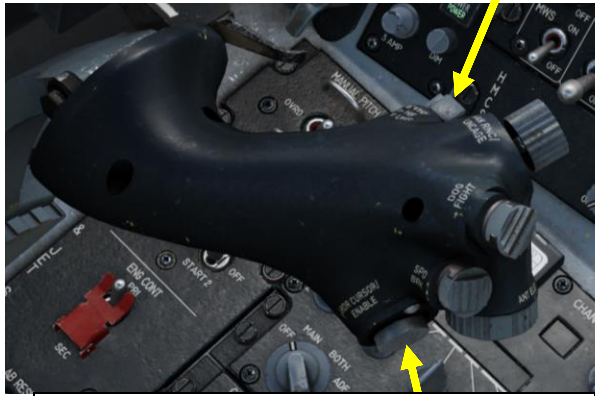
2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.2 – SPI (SENSOR POINT OF INTEREST) SHARING

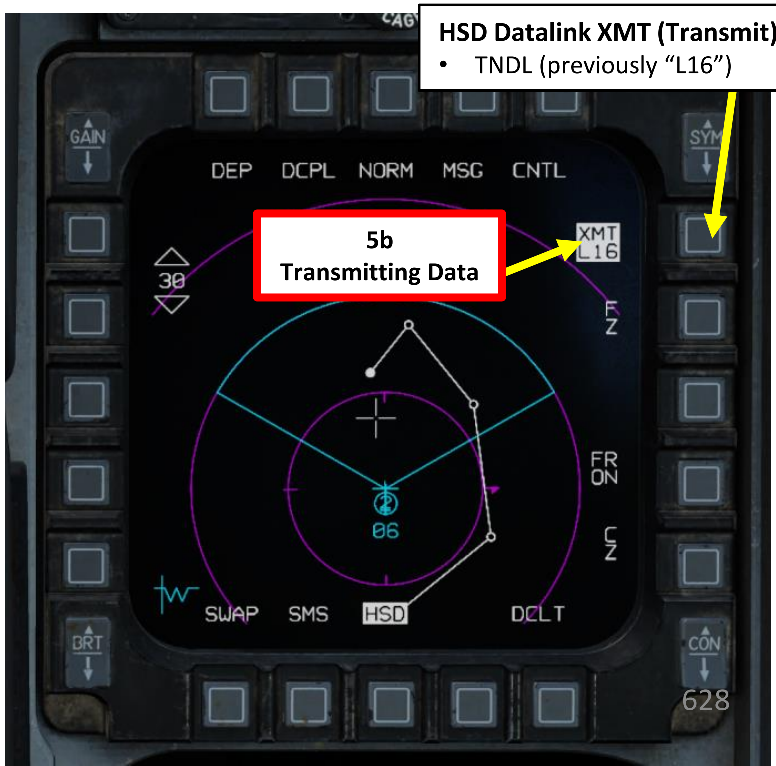
SENDING DATA

To transmit/broadcast a target designated as the SPI (Sensor Point of Interest):

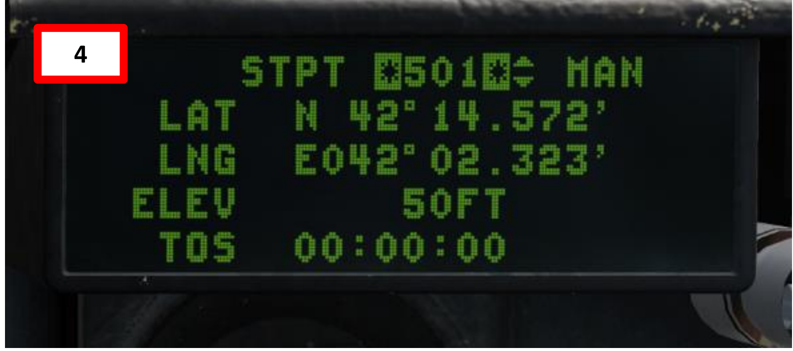
1. Press A-G (Air-to-Ground) Master Mode Button
2. On HSD (Horizontal Situation Display), press OSB next to HSD Datalink XMT (Transmit) Option to TNDL (Tactical Network Datalink, formerly referred as "L16" in earlier DCS versions).
3. Make the targeting pod (or a sensor of your choice) the SOI (Sensor of Interest) with the DMS (Display Management Switch) DOWN.
4. Designate target with the targeting pod (or another sensor of your choice) using a CCRP release mode, the Radar Cursor/Enable switch and TMS (Target Management Switch) UP.
5. Press the Communications UHF/VHF Transmit Switch INBOARD (IFF IN) for more than 0.5 sec. This will transmit the selected SPI to your flight members in the same Link-16 datalink network.







2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.2 – SPI (SENSOR POINT OF INTEREST) SHARING



RECEIVING DATA

When your wingman receives a SPI (Sensor Point of Interest) shared through the datalink system:

1. A “Data” audio cue is heard
2. On the HUD (Heads-Up Display), the MKPTXXXX DATA indication shows the reference number of the SPI sent to you, which is “501” in our case.
3. The data recipient will see the transmitted SPI as a line and the reference number of the flight member. You will also see a dashed, blue line between the transmitting flight member and the target.
4. If you want to see the SPI coordinates, you can go in the STPT DED page and look at STPT No. 501 (reference number).
5. To remove the MKPTXXXX DATA indication on the HUD, press the Warning Reset Switch DOWN on the ICP.

2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.3 – HTS (HARM TARGETING SYSTEM) POD RADAR EMITTER SHARING

TDOA (TIME DIFFERENCE OF ARRIVAL) ASSIGNMENT

The TDOA assignment setting stands for “Time Difference of Arrival”; it boils down to the ability to use participating datalinked team members to quickly pinpoint a threat radar emitter like a SAM site. This is very useful when performing SEAD (Suppression of Enemy Air Defences) missions and you want to triangulate the position of a radar emitter with multiple HTS (HARM Targeting System) pod operators.

TDOA REQUIREMENTS

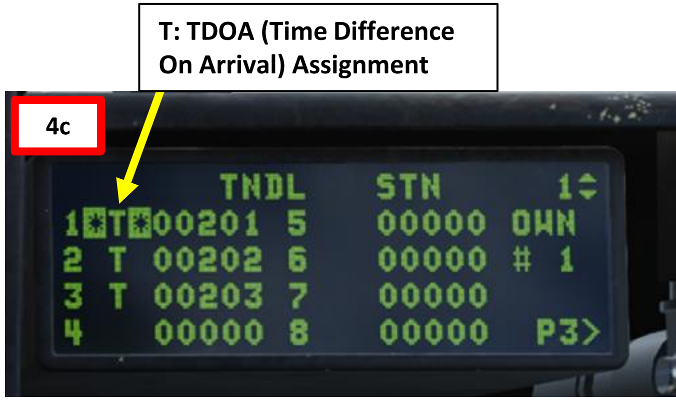
TDOA is only available when each Team member is loaded with a HTS pods (HARM Targeting System). There must also be a **minimum of three Team members in a TDOA team**.

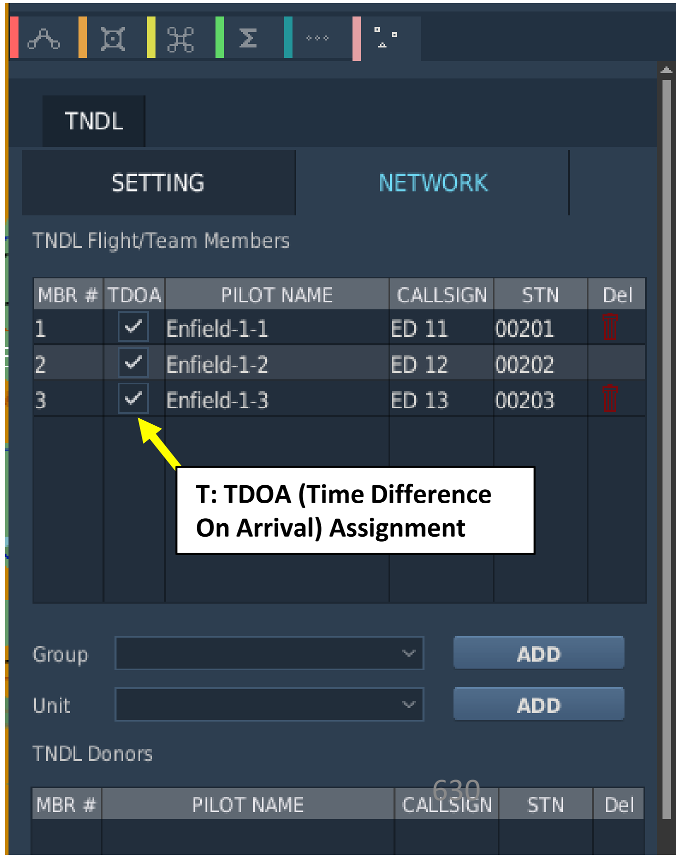
For a Team member to participate in the TDOA team, it must have the **“T” enabled next to it in the Datalink DED page**. This page is accessed by:

1. Selecting LIST from the ICP
2. Pressing Enter to select Data Link
3. Pressing Dobber RIGHT twice to display the data link assignments of Team members.
4. “T” assignments can be toggled by pressing Dobber UP and DOWN to select the Team member and then selecting any ICP keypad buttons 1 to 9 to toggle the TDOA selection

TDOA CONCEPT

In a TDOA team, there is one “TDOA Master” and the remaining members are referred as “TDOA Slaves”. The TDOA Master can command other TDOA participant members/slaves to designate the same target with their HTS pods and provide multiple triangulation angles for a same radar emitter.



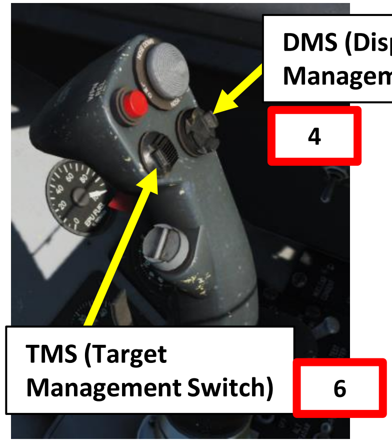


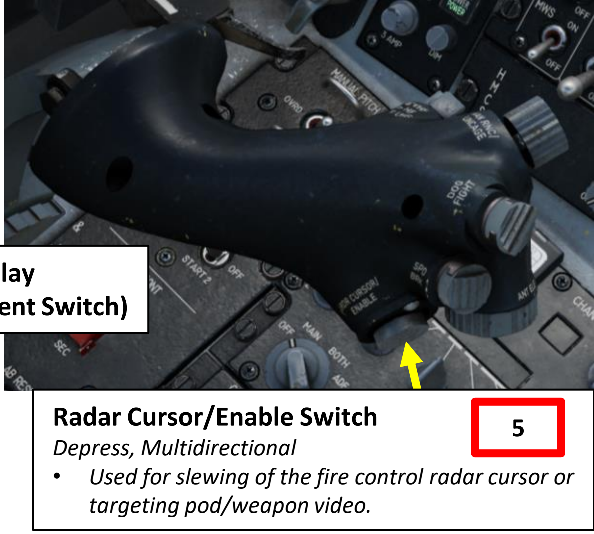
2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.3 – HTS (HARM TARGETING SYSTEM) POD RADAR EMITTER SHARING

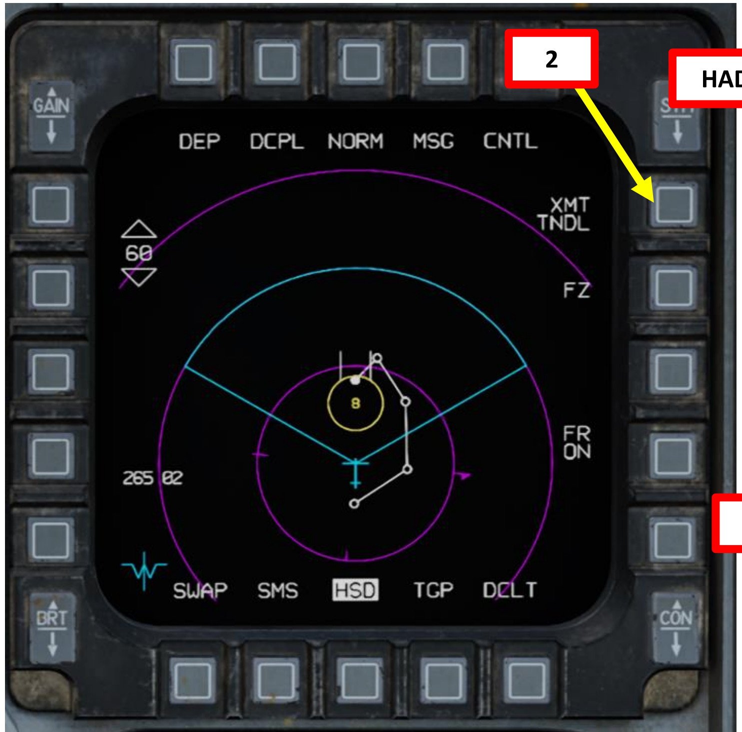
TDOA TRIANGULATION EXAMPLE

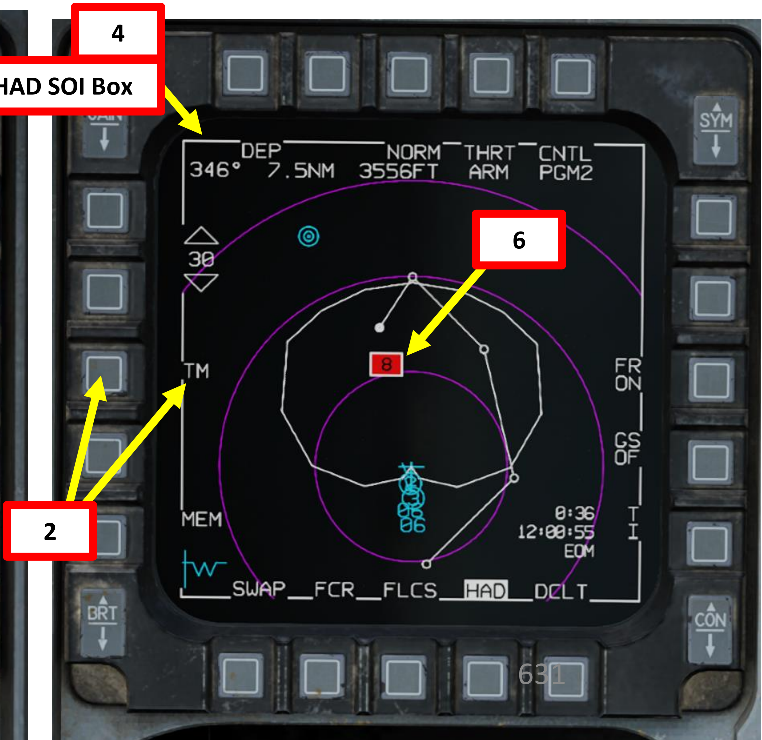
In this example, we will show how a TDOA team can triangulate the position of a radar emitter. We will assume all TDOA members are already in the same datalink network and that their respective TDOA assignment is enabled.

1. Press A-G (Air-to-Ground) Master Mode Button
2. On HSD (Horizontal Situation Display), press OSB next to HSD Datalink XMT (Transmit) Option to TNDL (Tactical Network Datalink, formerly referred as "L16" in earlier DCS versions).
3. Power-up the HTS (HARM Targeting System) Pod as shown in Part 11 in the HARM HTS Pod tutorial.
4. Make the HAD (HARM Attack Display) the SOI (Sensor of Interest) with the DMS (Display Management Switch) DOWN.
5. From the HAD page, select TM for Team members or AL for all to have all selected TDOA members to participate. If you wish to disable then, select NO.
6. On the HAD page, designate a radar emitter using the Radar Cursor/Enable switch and TMS (Target Management Switch) UP.





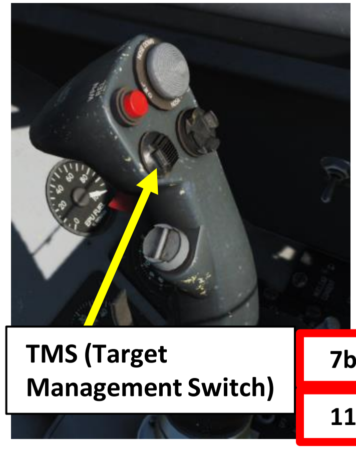


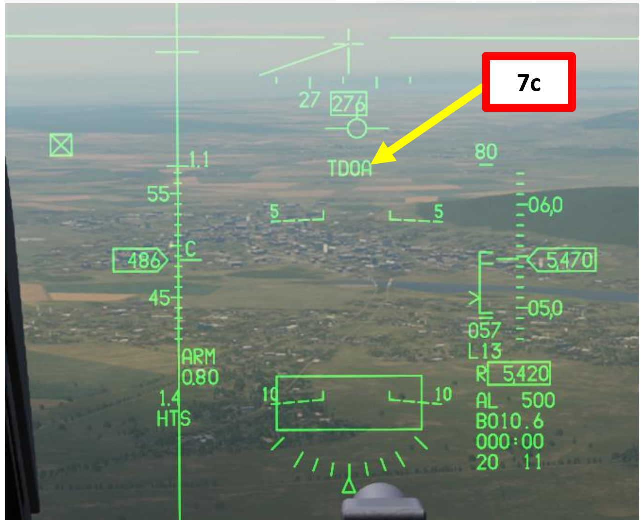


2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.3 – HTS (HARM TARGETING SYSTEM) POD RADAR EMITTER SHARING

TDOA TRIANGULATION EXAMPLE

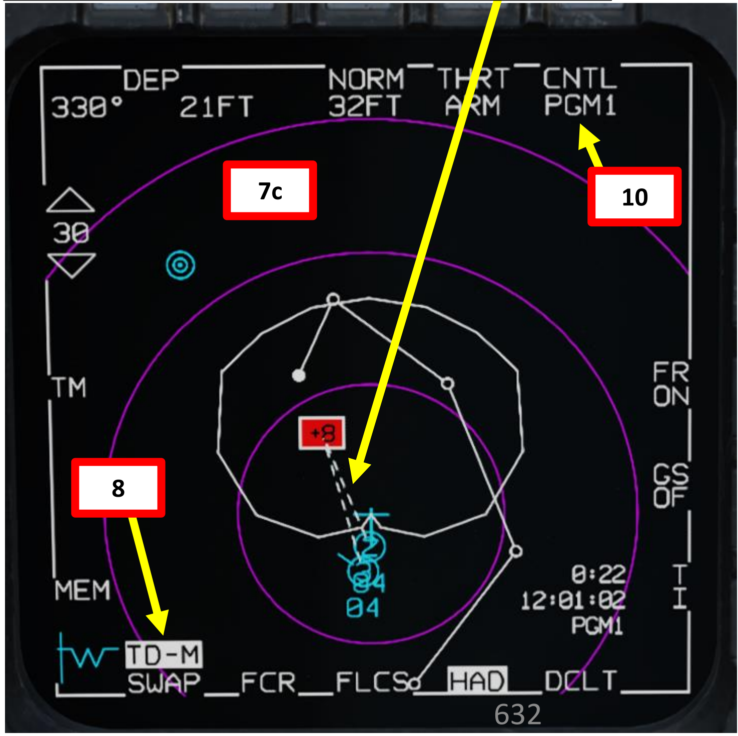
7. After designated an emitter while the cursor is over a target, press TMS (Target Management System) LEFT for greater than one second. This will to display "TDOA" on the HUD and command TDOA participant members to designate the same target with their HTS and provide multiple triangulation angles.
   - Note that the target will need to be within the Team member's HTS field of view.
8. When TDOA designated, TD-M indicates that the target has been designated and that you are the TDOA Master.
9. If you receive a designation as the TDOA Slave, you get a TDOA HUD message and DATA voice message, and once you designate, you'll see a TD-S on the HAD for Target Designated Slave.
10. When a TDOA Team member participant is also tracking the target and contributing, it will have a segmented, white line between it and the target. The Position Quality (PGM) value will attain a high precision value of "1" much faster.
11. To exit TDOA tracking, press TMS (Target Management Switch) DOWN.





White Lines: Other TDOA slaves are also triangulating target position and feeding this position data across the TDOA datalink network.

10

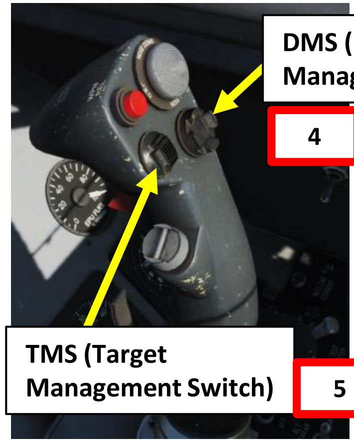


2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.3 – HTS (HARM TARGETING SYSTEM) POD RADAR EMITTER SHARING

SENDING DATA

To transmit/broadcast a radar emitter designated with the HTS Pod in the HAD page:

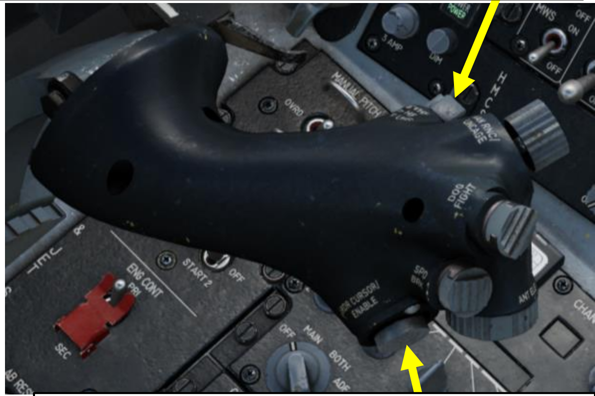
1. Press A-G (Air-to-Ground) Master Mode Button
2. On HSD (Horizontal Situation Display), press OSB next to HSD Datalink XMT (Transmit) Option to TNDL (Tactical Network Datalink, formerly referred as "L16" in earlier DCS versions).
3. Power-up the HTS (HARM Targeting System) Pod as shown in Part 11 in the HARM HTS Pod tutorial.
4. Make the HAD (HARM Attack Display) the SOI (Sensor of Interest) with the DMS (Display Management Switch) DOWN.
5. On the HAD page, designate a radar emitter using the Radar Cursor/Enable switch and TMS (Target Management Switch) UP.
6. Press the Communications UHF/VHF Transmit Switch INBOARD (IFF IN) for more than 0.5 sec. This will transmit the selected SPI to your flight members in the same datalink network.



DMS (Display Management Switch) 4

TMS (Target Management Switch) 5

Communications UHF/VHF Transmit Switch (4-Way) 6a
- *Transmit Switch – IFF IN (INBOARD)*
- *Transmit Switch – IFF OUT (OUTBOARD)*



Radar Cursor/Enable Switch 5
Depress, Multidirectional
- *Used for slewing of the fire control radar cursor or targeting pod/weapon video.*

1

HAD SOI Box

5

HSD Datalink XMT (Transmit) Option 2
- TNDL (previously "L16")

6b Transmitting Data

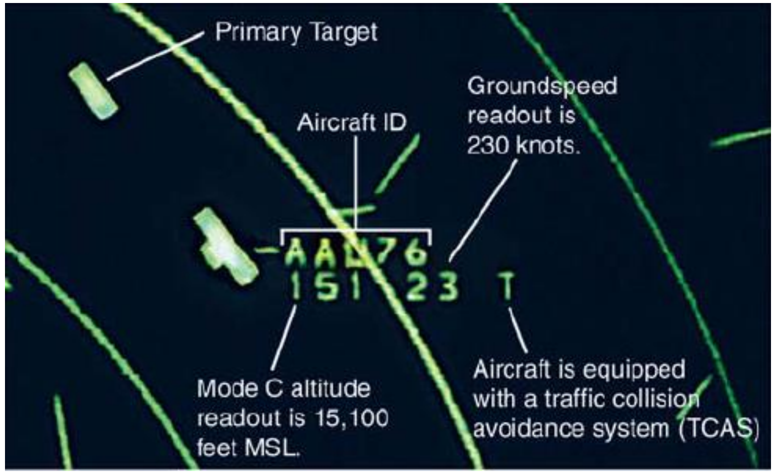
2 – DATALINK
2.11 – DATA SHARING VIA DATALINK
2.11.3 – HTS (HARM TARGETING SYSTEM) POD RADAR EMITTER SHARING

RECEIVING DATA

When your wingman receives a radar emitter designated with the HTS Pod in the HAD page shared through the datalink system:

1. A "Data" audio cue is heard
2. On the HUD (Heads-Up Display), the MKPTXXXX DATA indication shows the reference number of the radar emitter sent to you, which is "107" in our case.
3. The data recipient will see the transmitted radar emitter as yellow symbol with a strike through it and the reference number of the flight member. You will also see a dashed, blue line between the transmitting flight member and the target.
4. If you want to see the radar emitter's coordinates, you can go in the STPT DED page and look at STPT No. 107 (reference number).
5. To remove the MKPTXXXX DATA indication on the HUD, press the Warning Reset Switch DOWN on the ICP.

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.1 – IFF INTRODUCTION



Identifying what you may or may not shoot should be your primary concern at all times. This is where the IFF (Identify-Friend-or-Foe) system comes into play.

An IFF system 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 if you set an incorrect transponder code, friendly contacts may not be able to identify you as a friendly.

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.2 – IFF MODES & PRINCIPLES

In its simplest form, a "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.

Take note that only Mode 4 is simulated as of 2022/01/16.

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

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.2 – IFF MODES & PRINCIPLES

The “Interrogator” component of the IFF system is used to interrogate unknown contacts. The “Transponder” component of the IFF system is used to respond to interrogations from other aircraft.

Interrogation Code (Who are you?)	Transponder Code (Who am I?)
Mode 4	Mode 4
Key A	Key A

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.3 – IFF COMPONENTS & CONTROLS

The **primary components** you will use when performing target identification are the **TMS** (Target Management Switch), the **FCR** (Fire Control Radar) page and the **IFF Master Switch**, which powers the IFF system.

Take note that all switches in ***red*** *on the IFF panel are only* ***meant to be used as a backup only****. In order to use them, the C&I Switch must be set to BACKUP. Otherwise, all IFF codes are set via the UFC (Up-Front Control) on the ICP (Integrated Control Panel).*

TMS (Target Management Switch)
LEFT: Interrogates Contact

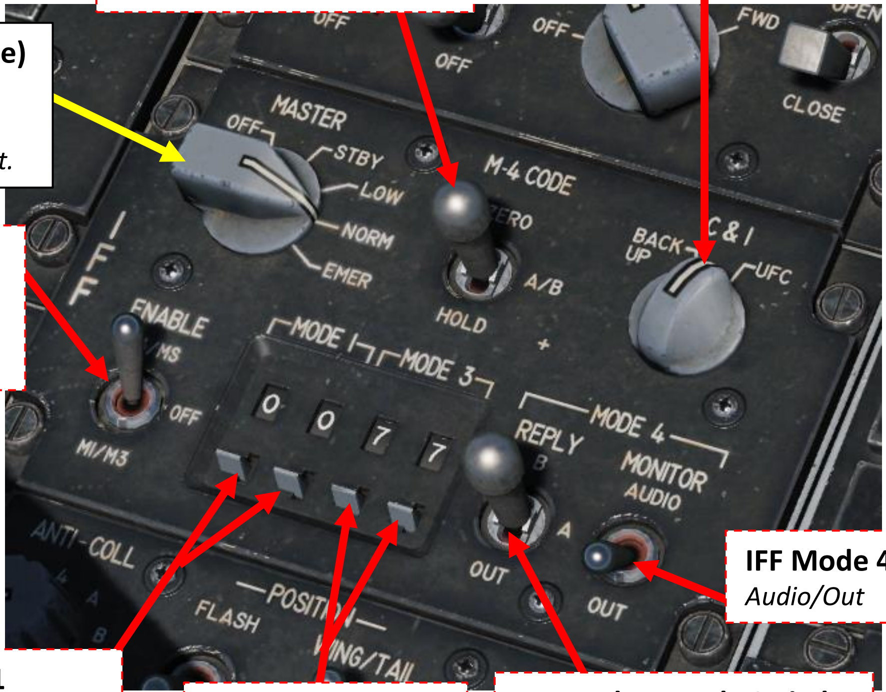
FCR (Fire Control Radar) Page

C&I (Communication and Identification) Switch
Allows the pilot to toggle between the BACKUP system and the UFC (Up Front Controller). BACKUP is only used if engine generator failure has occurred.

IFF Mode 4 Code Switch
Zero / A/B / Hold

IFF (Identify-Friend-or-Foe) Master Switch
Controls power to the IFF transponder/interrogator unit.

IFF Enable Switch
- *M3/MS*
- *OFF*
- *M1/M3*



IFF Mode 4 Monitor Switch
Audio/Out

IFF Mode 1 Selector Switches

IFF Mode 3 Selector Switches

IFF Mode 4 Reply Switch
B / A / Out

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.3 – IFF COMPONENTS & CONTROLS

The **CNI DED page** is used to monitor what IFF Transponder modes and codes are active.

The **IFF Menu DED page** is used to monitor and set Transponder codes, which are used to "respond" to IFF interrogations. Currently, only Mode 4 is available.

Take note that as of 2023/01/28, these codes are already set for you and cannot be modified yet.

IFF Menu Button

DCS (Data Control Switch, also nicknamed "Dobber")

ICP (Integrated Control Panel)

CNI (Communications, Navigation & Identification) DED page

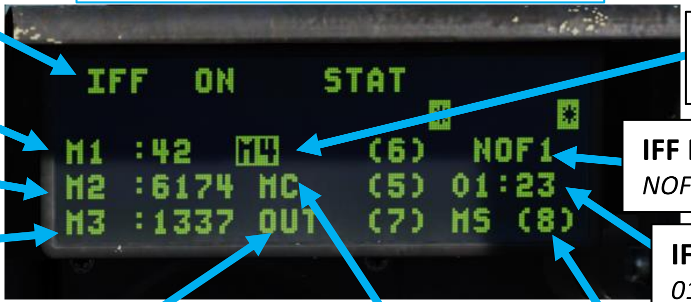
Selected by pressing the DCS/Dobber (Data Control Switch) left to RTN

Active IFF Transponder Modes
Only Mode 4 is active

IFF Mode 3 Transponder Code

DED (Data Entry Display) IFF Menu

Selected by pressing IFF Button on the ICP



IFF Master Mode Status
ON / STBY / OFF / EMER

IFF Mode 1 Transponder Code & Status
Code: 42, highlighted if active

IFF Mode 2 Transponder Code & Status
Code: 6174, highlighted if active

IFF Mode 3 Transponder Code & Status
Code: 1337, highlighted if active

IFF Visual/Audio feedback Setting
- *OUT: No feedback when interrogated by another aircraft with Mode 4*
- *LIT: Number 4 illuminates on CNI page when you are interrogated with Mode 4*
- *AUD: You receive an audio tone when you are interrogated with Mode 4*

IFF Mode 4 Transponder Key & Status
Highlighted if active, key not yet simulated

IFF POS (Position) Event Setting
NOF1: Selected Modes change when aircraft flies North of Steerpoint 1

IFF Time Event Setting
01:23 - Selected Modes change when at 01:23

IFF Mode C Transponder Key & Status

IFF Mode S Transponder Code & Status

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.3 – IFF COMPONENTS & CONTROLS

INTG DED Pages are used to monitor and set Interrogator codes, which are used to interrogate unknown contacts. **INTG LOS** (Line of Sight) and **INTG SCAN** are two different interrogation methods, which are divided in INTG sub-menus that can be toggled with the Dobber Switch set to RIGHT (SEQ).

Take note that as of 2023/01/28, these codes are already set for you and cannot be modified yet.

LIST Button

"RCL" Button

DCS (Data Control Switch, also nicknamed "Dobber")

ICP (Integrated Control Panel)

INTG (Interrogator Settings) DED Page – SCAN Sub-Menu

Selected by pressing LIST Button, then pressing "RCL" to select INTG SCAN Sub-Menu

Interrogator Mode 1 Code
Code: 72, highlighted if active

Interrogator Mode 2 Code
Code: 1234, highlighted if active

Interrogator Mode 3 Code
Code: 7000, highlighted if active

Mode 4 Key
Key: A, highlighted if active

IFF Jamming (Not Simulated)

IFF coupling options
- *DCPL (decoupled): interrogator is decoupled from the transponder*
- *ALL (all modes are coupled)*
- *SOME (some modes are coupled)*

Selected by pressing LIST Button, then pressing "RCL" to select INTG SCAN Sub-Menu, then pressing the DCS/Dobber (Data Control Switch) right to SEQ to select LOS Sub-Menu

INTG (Interrogator Settings) DED Page – LOS (Line of Sight) Sub-Menu

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.4 – SETTING IFF CODES

Take note that as of 2023/01/28, IFF codes are already set for you and cannot be modified yet.

IFF Menu – Transponder Codes

INTG SCAN Menu – Interrogator Codes

INTG LOS Menu – Interrogator Codes

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

There are two methods of interrogating a target:

- <u>SCAN</u> interrogates all contacts in the radar scan volume.
- <u>LOS (Line of Sight)</u> interrogates a locked target or immediate area around the radar cursor.

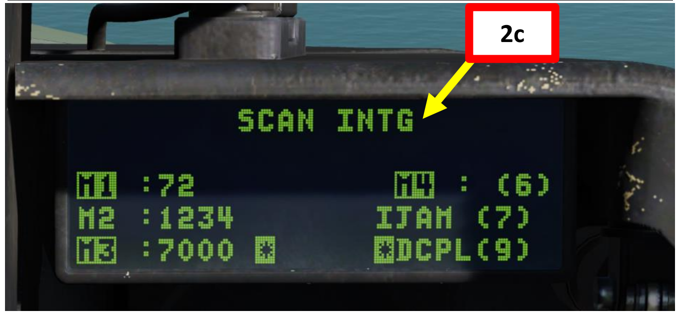
SCAN INTERROGATION METHOD

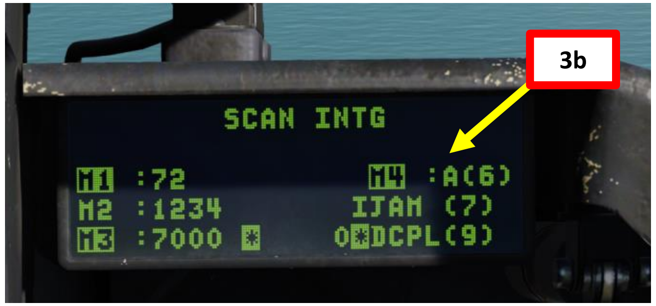
1. Set the IFF Master Switch to NORM to power up the IFF System.
2. Display SCAN Interrogation Codes by pressing LIST Button, then pressing “RCL” to select INTG SCAN Sub-Menu
3. (Not Simulated Yet) Set required key/code for Mode 4 IFF Interrogator by pressing “6” on the ICP (Integrated Control Panel), then pressing “ENTR”. This will set Mode 4 Interrogator key for SCAN mode to “A”.
4. (Not Simulated Yet) Display Transponder Codes by pressing IFF Menu Button, then set required key/code for Mode 4 IFF Transponder by pressing “6” on the ICP (Integrated Control Panel), then pressing “ENTR”. This will set Mode 4 Transponder key for mode 4 to “A”.

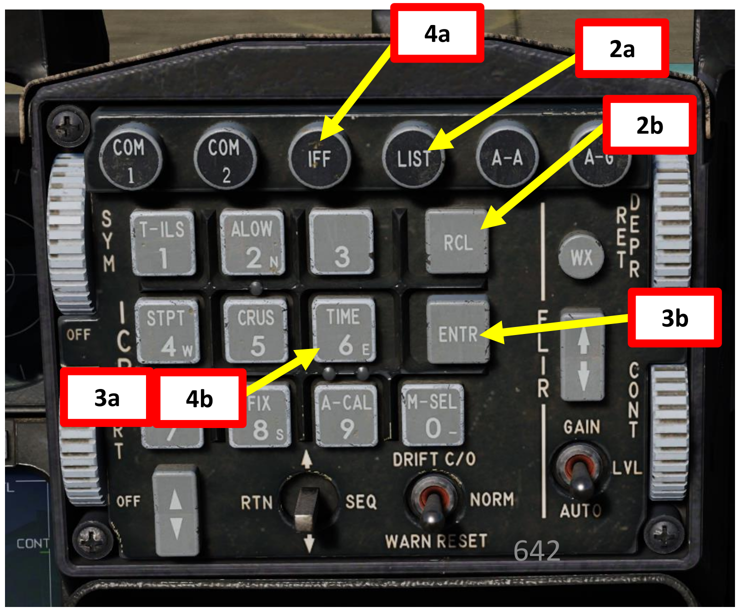
1

IFF (Identify-Friend-or-Foe) Master Switch
Controls power to the IFF transponder/interrogator unit.

Interrogation Code (Who are you?)	Transponder Code (Who am I?)
Mode 4	Mode 4
Key A	Key A



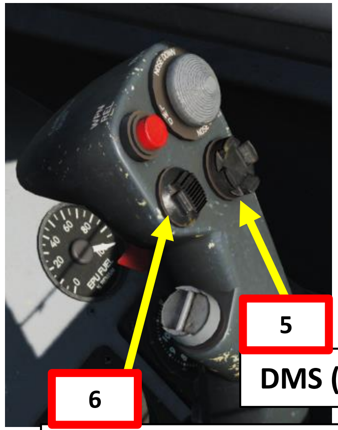


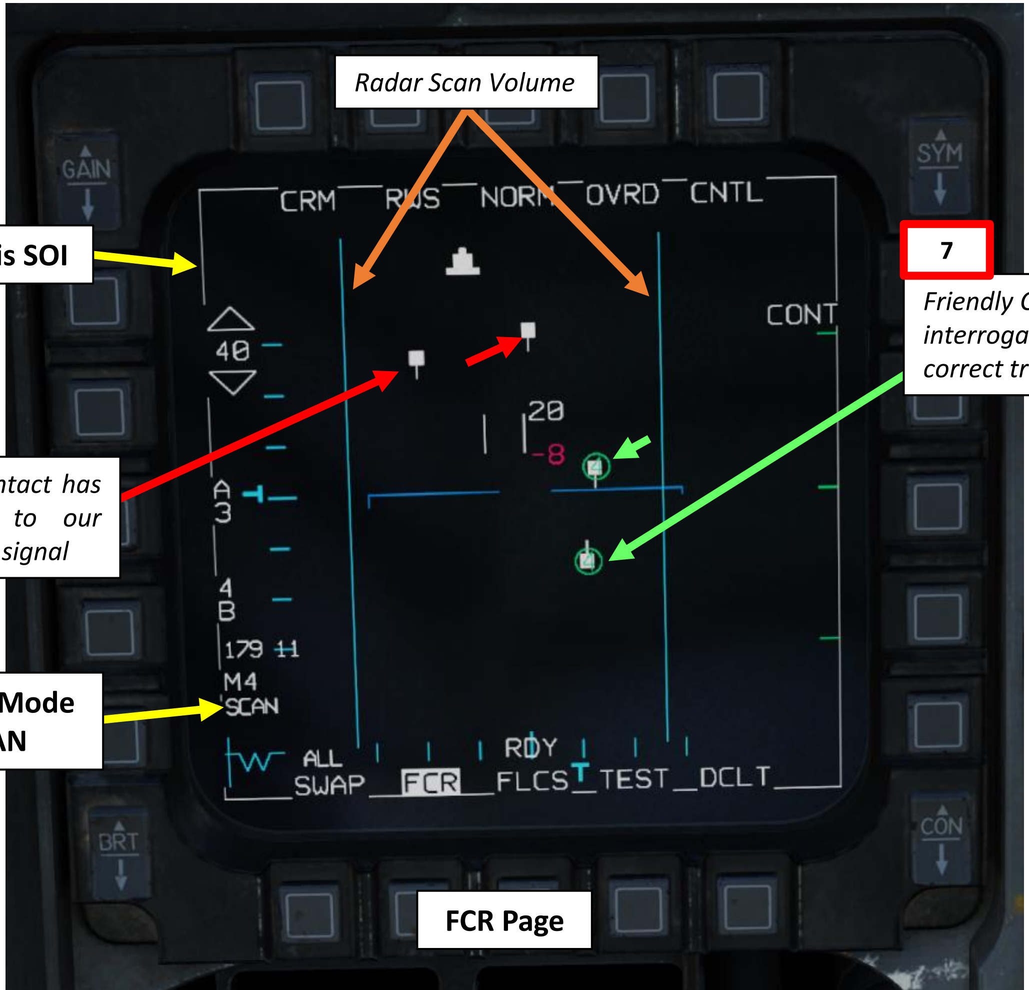


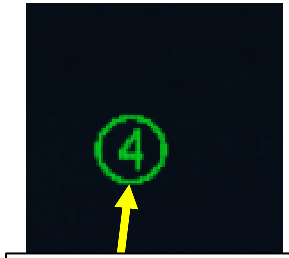
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

SCAN INTERROGATION METHOD

5. Set FCR (Fire Control Radar) page as the Sensor of Interest (SOI) by pressing DMS (Display Management Switch) DOWN.
6. Press **TMS (Target Management Switch) LEFT SHORT** (1 second or less) to interrogate all contacts in the radar scan volume.
7. If the contact is **friendly**, a green circle is drawn around the contact for three seconds.
8. If **no reply is received**, **no indication is displayed**, and the contact is classified as **unknown**. These contacts may be assumed to be hostile depending on the rules of engagement (ROE) in your current scenario.







3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

1 **IFF (Identify-Friend-or-Foe) Master Switch**
Controls power to the IFF transponder/interrogator unit.

There are two methods of interrogating a target:

- **SCAN** interrogates all contacts in the radar scan volume.
- **LOS (Line of Sight)** interrogates a locked target or immediate area around the radar cursor.

4c

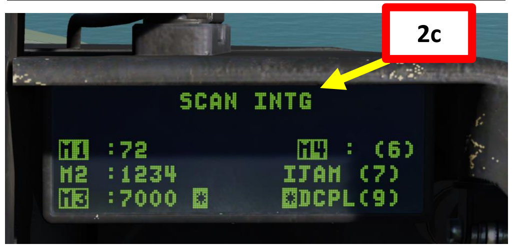
Interrogation Code (Who are you?)	Transponder Code (Who am I?)
Mode 4	Mode 4
Key A	Key A

LOS (LINE OF SIGHT) INTERROGATION METHOD

1. Set the IFF Master Switch to NORM to power up the IFF System.
2. Display LOS Interrogation by pressing LIST Button, then pressing "RCL" to select INTG SCAN Sub-Menu. Then, press Dobber switch right (SEQ) to select LOS Sub-Menu.
3. (Not Simulated Yet) Set required key/code for Mode 4 IFF by pressing "6" on the ICP (Integrated Control Panel), then pressing "ENTR". This will set Mode 4 Interrogator key for SCAN mode to "A".
4. (Not Simulated Yet) Display Transponder Codes by pressing IFF Menu Button, then set required key/code for Mode 4 IFF Transponder by pressing "6" on the ICP (Integrated Control Panel), then pressing "ENTR". This will set Mode 4 Transponder key for mode 4 to "A".

2b

2c

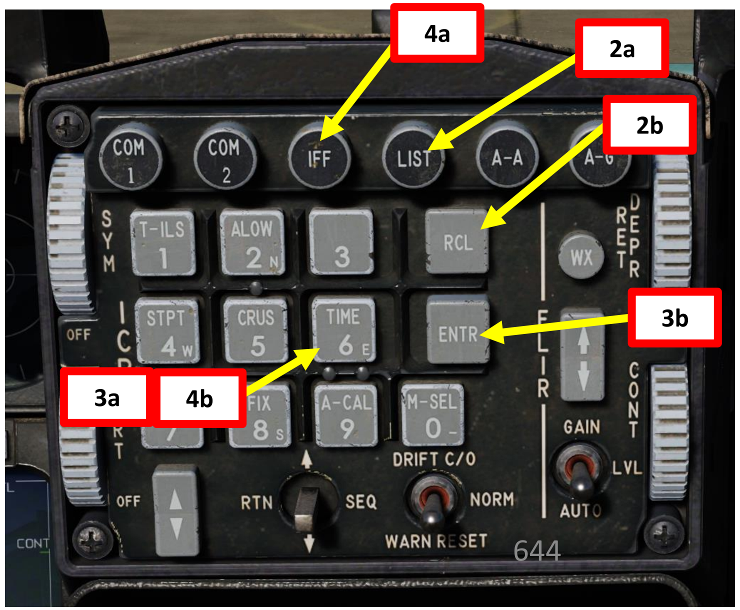


2d

3a

3b

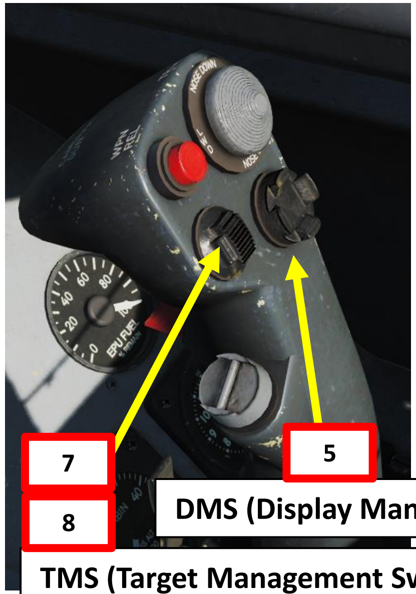
4a 2a 2b 3b 3a 4b

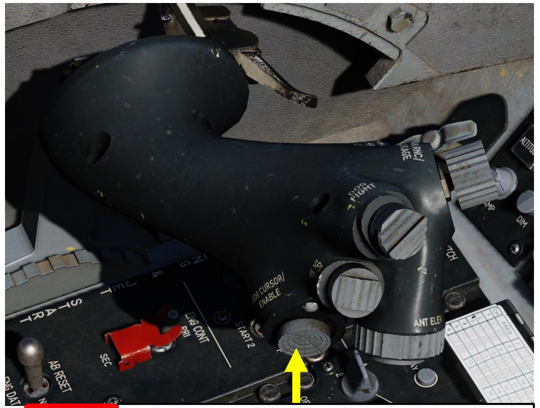


3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

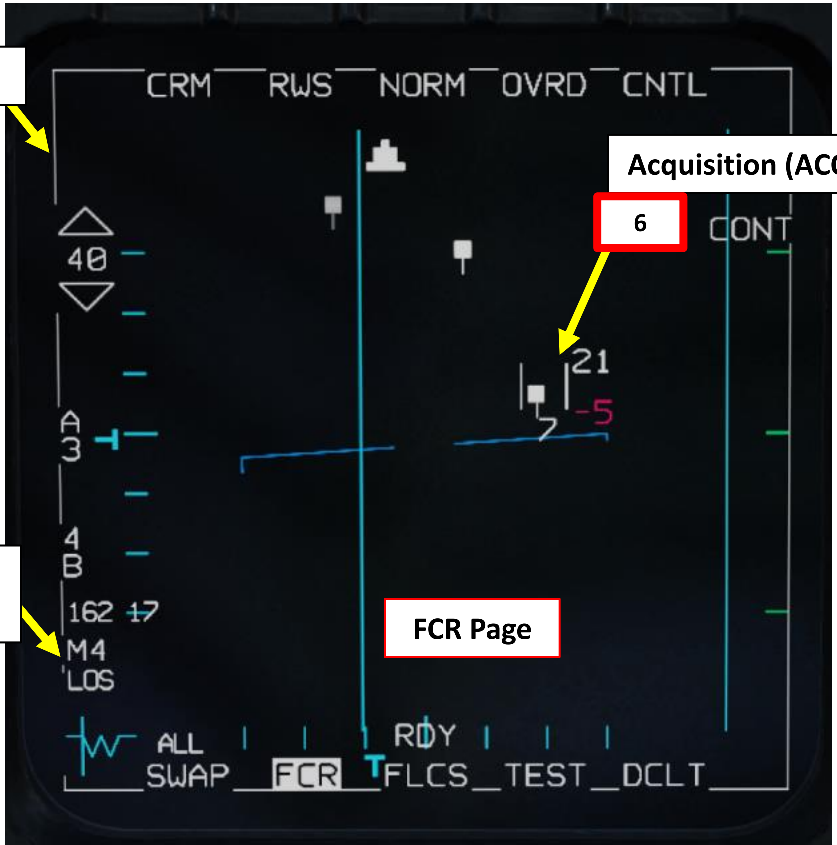
LOS (LINE OF SIGHT) INTERROGATION METHOD

5. Set FCR (Fire Control Radar) page as the Sensor of Interest (SOI) by pressing DMS (Display Management Switch) DOWN.
6. With Radar Cursor/Enable Switch, slew the Acquisition Cursor (ACQ) over the contact you want to interrogate.
7. If desired, you can bug the target by using TMS (Target Management Switch) UP, but this step is not necessary.
8. Press **TMS (Target Management Switch) LEFT LONG** (more than 1 second) to interrogate the locked target or immediate area around the radar cursor.
9. If the contact is **friendly**, a green circle is drawn around the contact for three seconds. Friendly contacts will be displayed on the HSD (Horizontal Situation Display) as well.





5 FCR Page is SOI

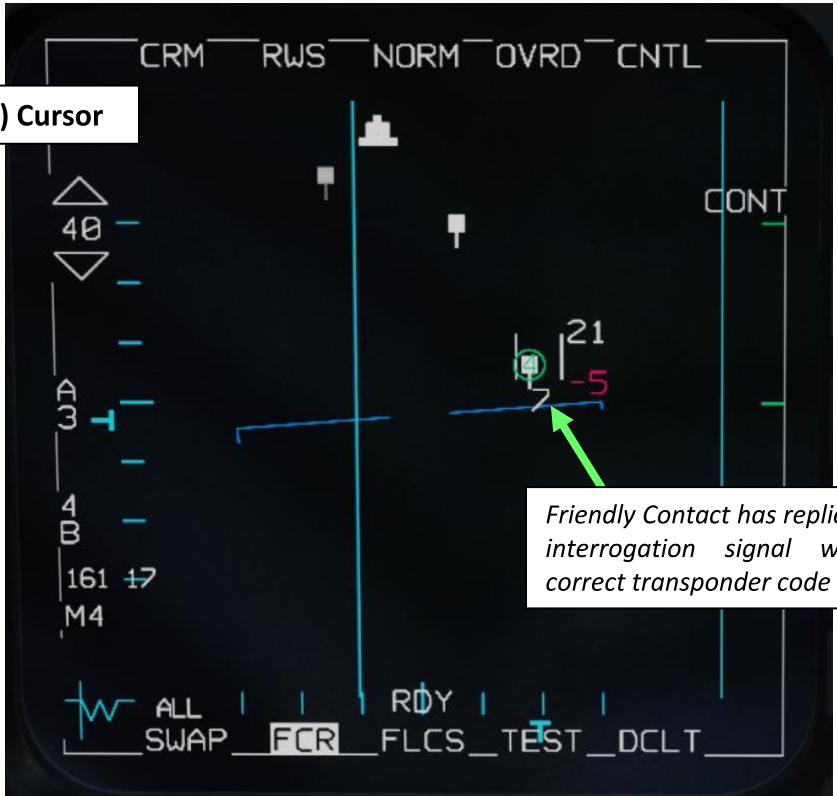


Acquisition (ACQ) Cursor

6

8 Interrogator Mode Mode 4 - LOS

FCR Page



"4" symbol inside a contact means that you have received a good response from your Mode 4 Interrogation.

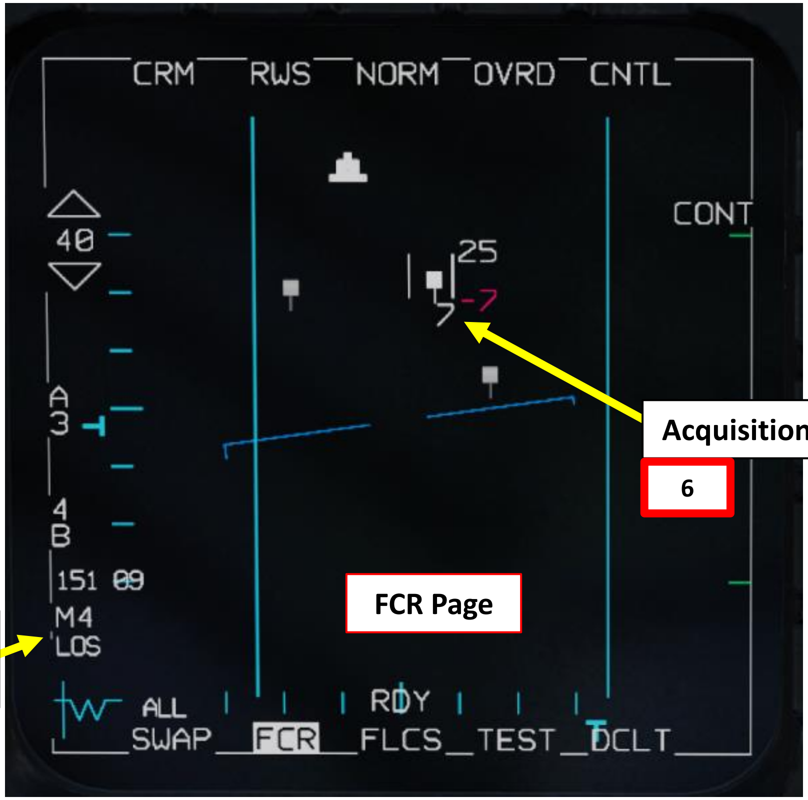
9

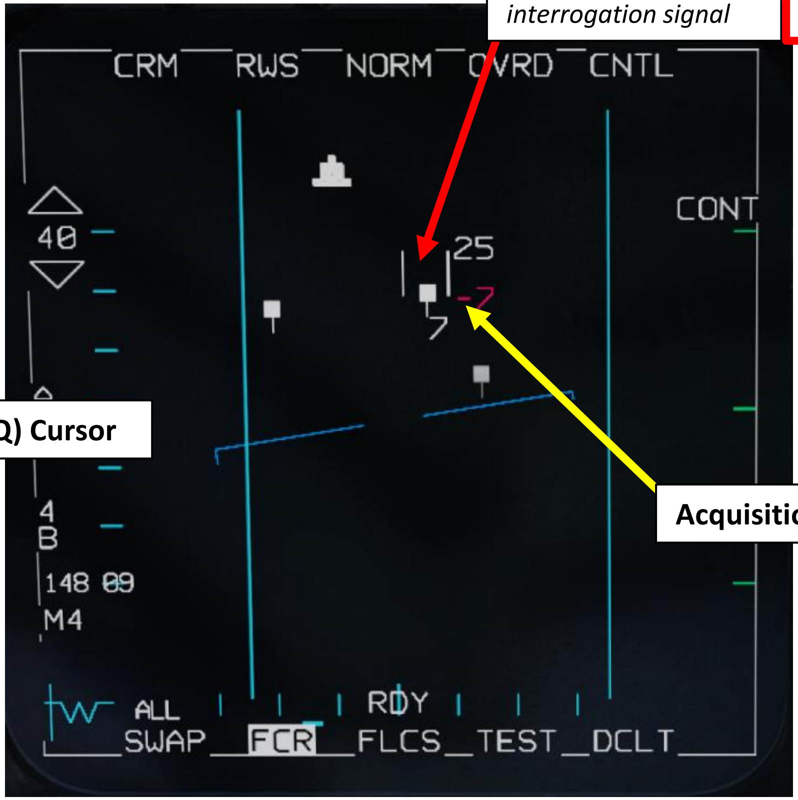
Friendly Contact has replied to our interrogation signal with the correct transponder code

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.5 – IFF TUTORIAL (MODE 4)

LOS (LINE OF SIGHT) INTERROGATION METHOD

10. If **no reply is received**, **no indication is displayed**, and the contact is classified as **unknown**. These contacts may be assumed to be hostile depending on the rules of engagement (ROE) in your current scenario.





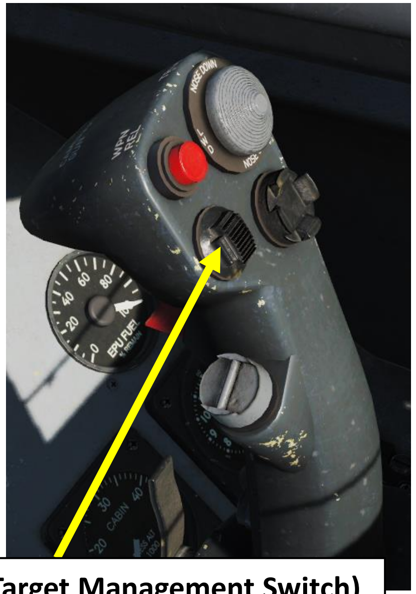
3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.6 – NCTR (NON-COOPERATIVE TARGET RECOGNITION)

Non-Cooperative Target Recognition (NCTR) can be used to identify the aircraft type. This system compares turbine blade signatures of different engines to a database of associated aircraft types. This can be a useful system to identify the aircraft at beyond visual range of up to around 25 nm. Because NCTR requires the radar to see the engine blades, there some important requirements to meet:

1. The target nose or tail must be within 30-degrees in azimuth and elevation of your nose.
2. The target must be within about 25 nm
3. You must be in Single Target Track (STT) radar mode.

To interrogate with IFF (Identify-Friend-or-Foe) and NCTR at the same time, **press and hold Target Management Switch Left for greater than one second**. It will both perform an NCTR print on the target and perform an Identify Friend or Foe interrogation along the line of sight of the STT target.

- Note 1: If the target is outside the range and angle constraints, an INVL, or Invalid, message will appear on the Fire Control Radar, FCR, page.
- Note 2: It's important to note that performing both an IFF interrogation and an NCTR print implies that you have two identification sources that allow the Rules of Engagement tree to identify the target as hostile, indicated as red. In plain terms, this means that you will be able to identify hostile targets with **your ownship systems only**.



INVL (Invalid)
Target is beyond 25 nm

Su-25 Target
Identified as Hostile

3 – IFF (IDENTIFY FRIEND-OR-FOE)
3.7 – IN CONCLUSION

One of the biggest challenges of IFF is **that a lack of IFF response does NOT guarantee that the contact you are interrogating is an enemy**.

A lack of response could be explained by:

- A friendly aircraft that is damaged and has a damaged transponder
- A friendly aircraft that has not set correct transponder (response) codes
- A friendly aircraft that forgot to turn on his IFF
- A friendly aircraft that is not equipped with an IFF system compatible with yours
- A hostile aircraft

This is why **Datalink and IFF are meant to be used together** in order to complement the information gathered by your radar, radar warning receiver and other datalink information donors. This minimizes the chances of friendly fire.

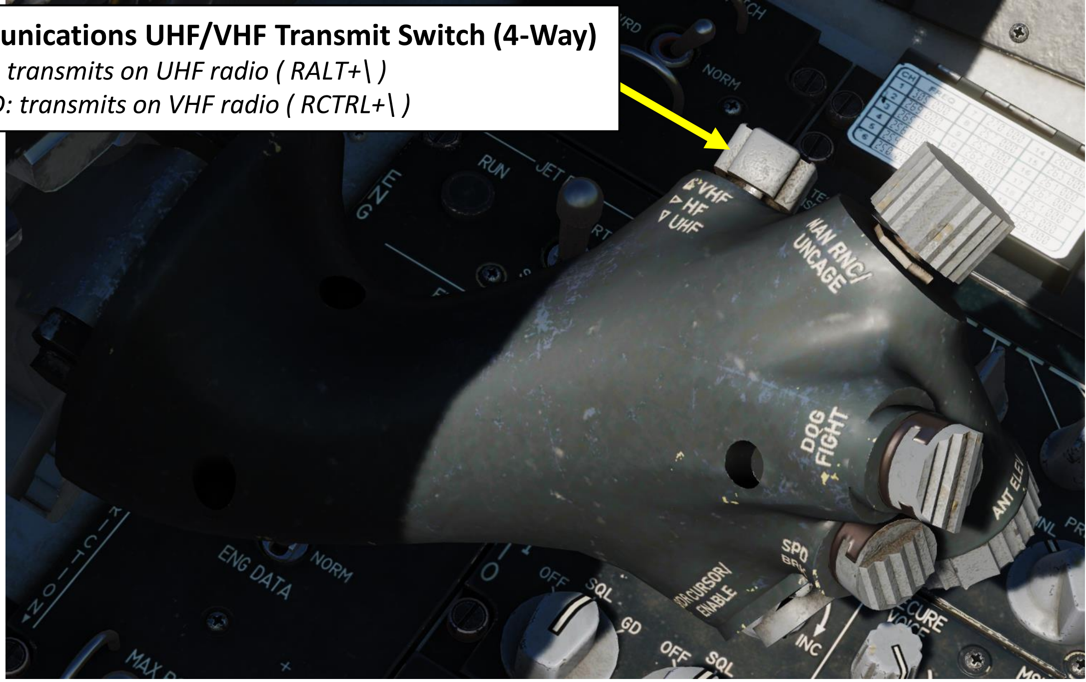
RADIO SYSTEM OVERVIEW

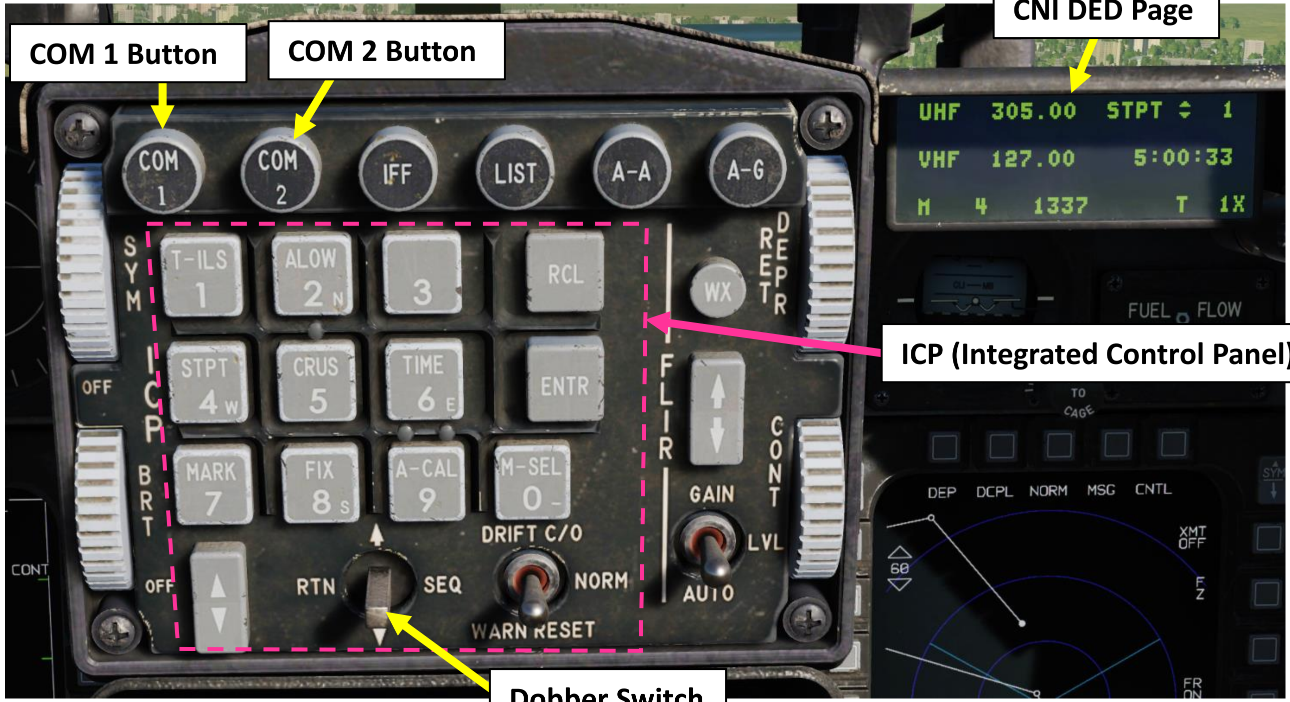
The F-16 uses two radio sets: one for UHF frequencies (AN/ARC-164, or COM1) and one for VHF frequencies (AN/ARC-222, or COM2).

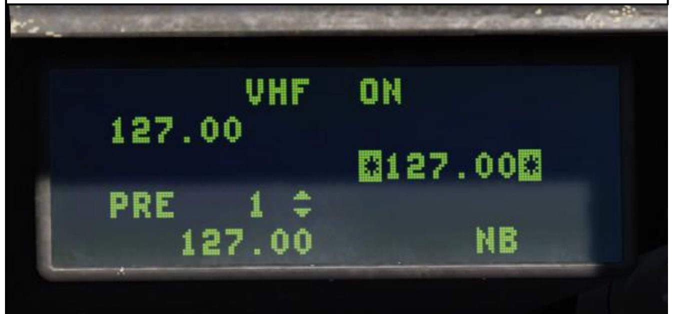
- **COM1 covers the UHF band (225.000 – 399.975 MHz)** and is used for primary voice communications.
- **COM2 covers the VHF band (108.000 – 151.975 MHz)** and is used as a backup for voice communications.
- Radio transmission is done with the **Communication Transmit switch** AFT (COM1 UHF, “RALT+\”) or FWD (COM2 VHF, “RCTRL+\”)

The **ICP (Integrated Control Panel)** is used to tune radios rapidly using preset or manual frequencies in either VHF or UHF frequency bands.

- The Main CNI (Communication, Navigation & Identification) DED (Data Entry Display) page appears when pressing the Dobber Switch LEFT (RTN). This is used as a summary of radio frequencies currently tuned.
- The UHF DED Page is accessed when pressing the COM1 button. Frequencies can be tuned with the ICP.
- The VHF DED Page is accessed when pressing the COM2 button. Frequencies can be tuned with the ICP.



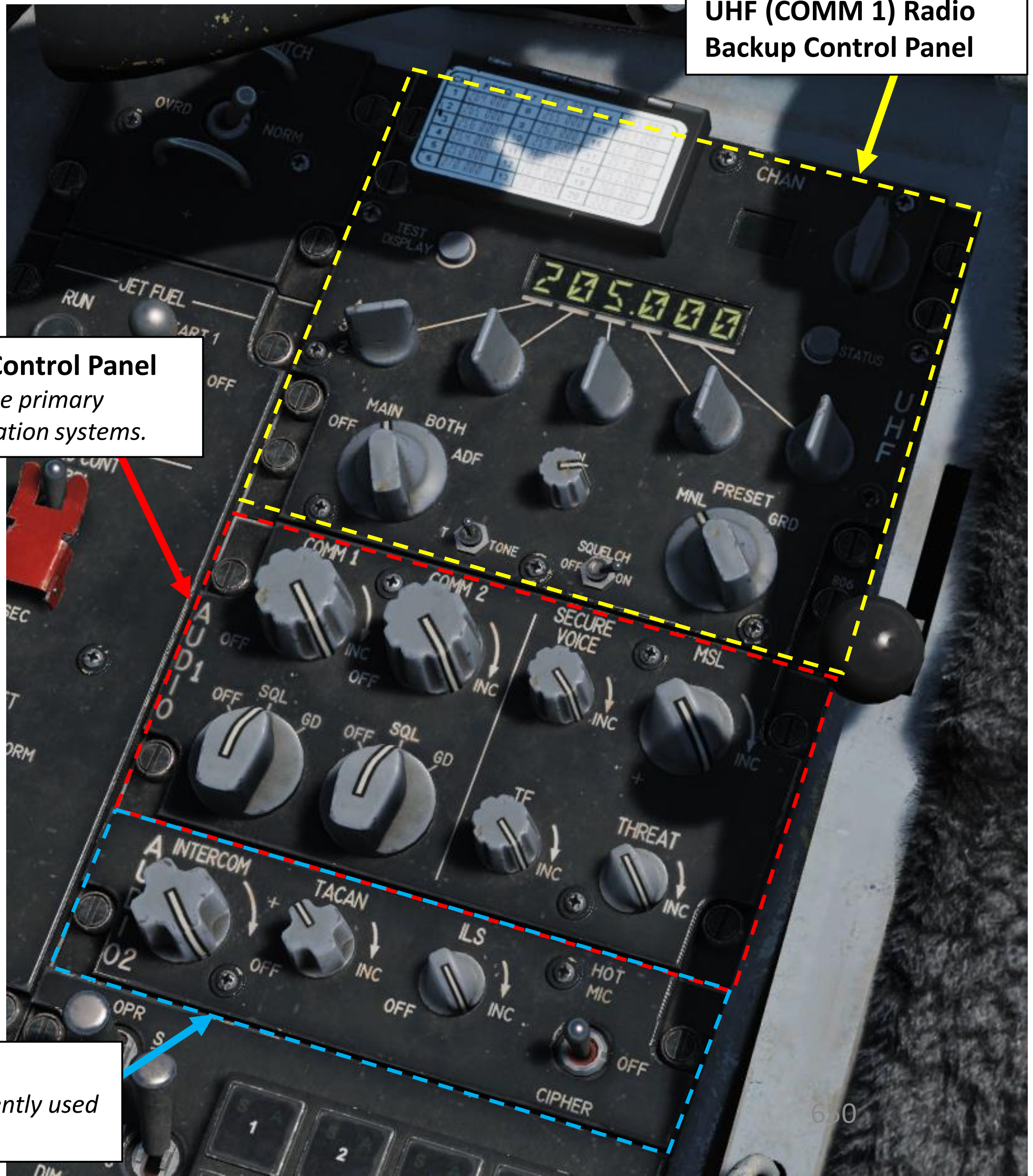




RADIO SYSTEM OVERVIEW

- The **Audio 1 Control Panel** is mainly used to tune UHF COM1 and VHF COM2 radio volume.
- The **Audio 2 Control Panel** is mainly used to tune volume for other auxiliary systems (Intercom, TACAN, ILS)
- The **Backup UHF Control Panel** is the only radio that can function with battery power alone. This means that this panel can be used before engine start or if an engine failure or generator failure has occurred.
  - If you have to use the UHF Radio Backup Control Panel, the C&I switch must be set to BACKUP.
  - During normal operation, you will want to use the regular UHF COM1 and VHF COM2 radios using the ICP (Integrated Control Panel) / UFC (Up-Front Control) panel. To do that, the C&I switch must be set to UFC.

C&I (Communication & Identification) switch
- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*



UHF (COMM 1) Radio Backup Control Panel

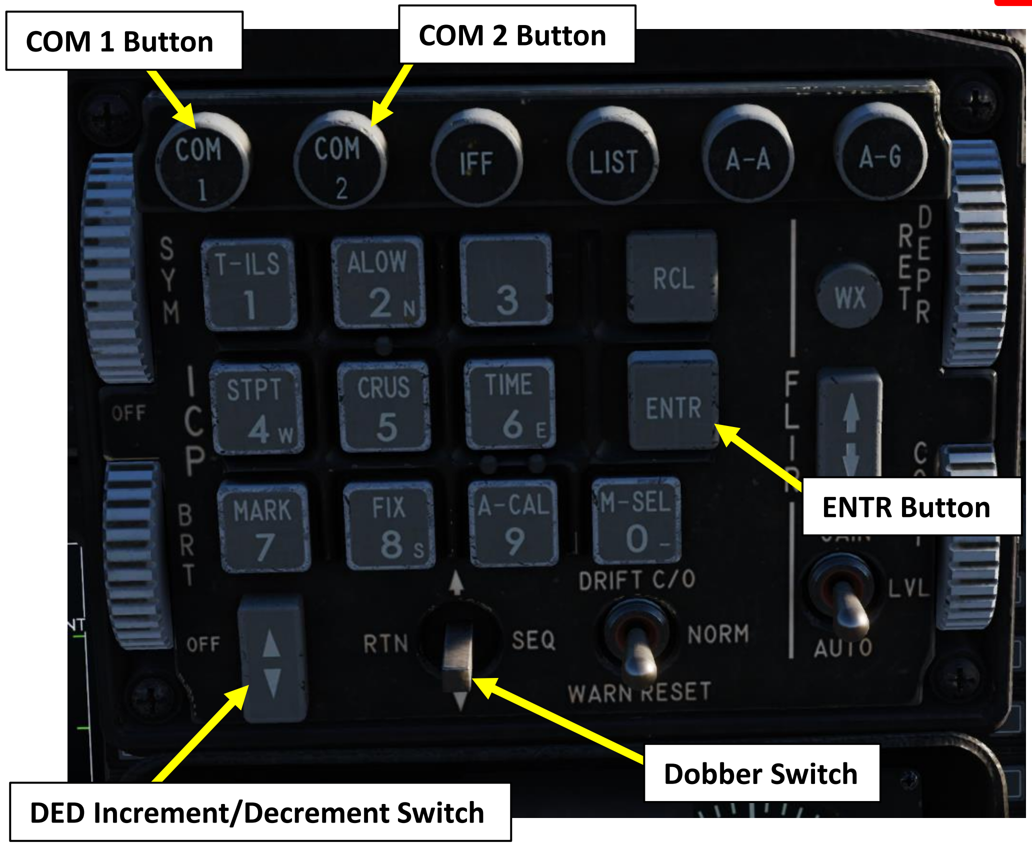
Audio 1 Control Panel
Controls the primary communication systems.

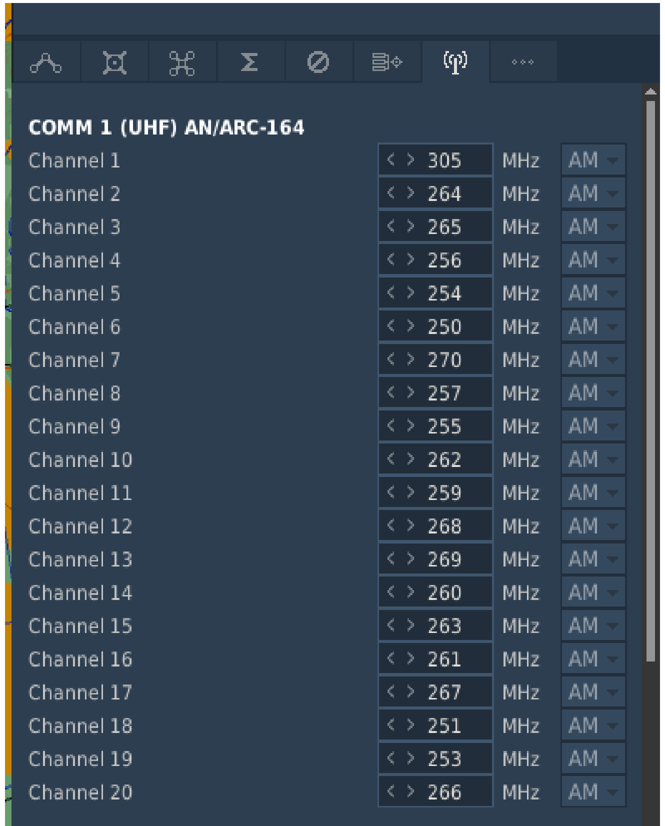
Audio 2 Control Panel
Provides control to the less frequently used communications system.

PRESET FREQUENCIES

Take note that the 20 preset frequencies are set in the Mission Editor. To modify a preset channel:

1. Select COM1 or COM2 button as required (depends on which radio you want to modify)
2. Press the DED Increment/Decrement Switch to select desired Preset Channel that you want to modify. We will select Preset Channel 3.
3. Press Dobber Switch DOWN three times to select the Preset Channel Frequency Data Field (asterisks indicate the field is selected).
4. On the ICP, type in the frequency you want to set the preset channel to (26600 for frequency 266.00 MHz).
5. Press ENTR button to save the frequency to the Preset Channel.



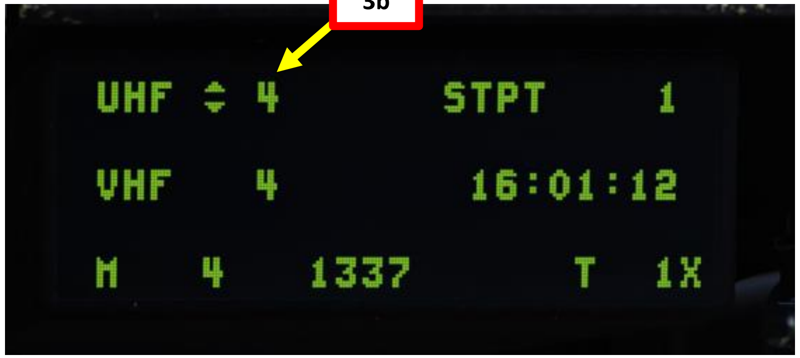


PRESET FREQUENCIES

Here's a cool trick if you intend to operate with preset frequencies and want to switch between preset radio channels rapidly.

1. Normally, you would be flying with your CNI (Communication, Navigation & Identification) page, which can be selected by pressing Dobber Switch LEFT (RTN).
2. If you press the Dobber Switch UP/DOWN, you can set the "DED Increment/Decrement arrows" next to the UHF or VHF data fields.
3. Pressing the DED Increment/Decrement Switch will then allow you to quickly change the Preset Channel selected.

Take note that this trick only works with Preset Channels. This will not work with manual frequencies.

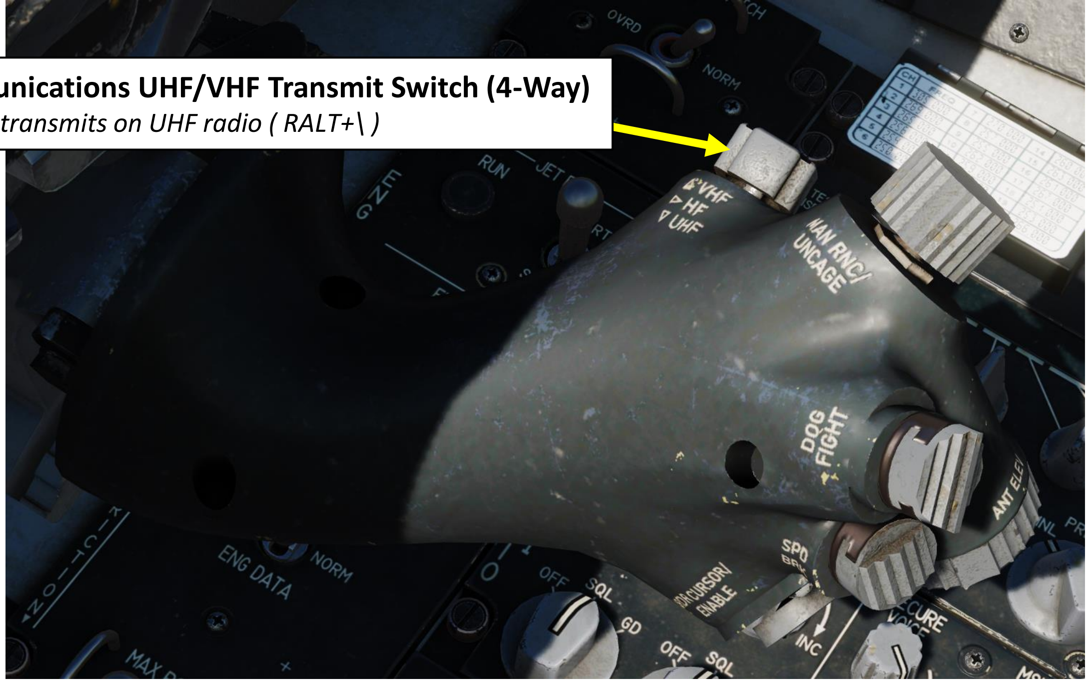


AN/ARC-164 UHF RADIO (COM1)

COMPONENTS

UHF Radio Antenna Selection Switch
Upper/Norm/Lower Antenna

Communications UHF/VHF Transmit Switch (4-Way)
- *AFT: transmits on UHF radio (RALT+\ )*

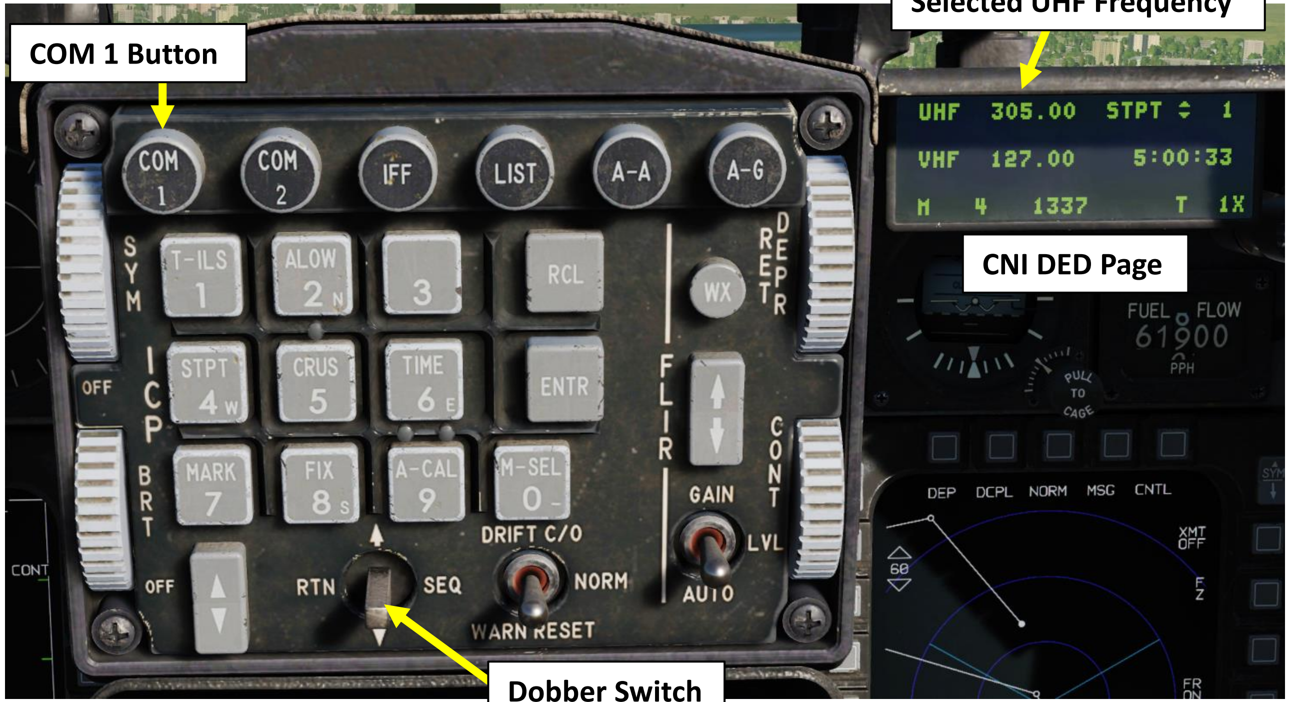


Selected UHF Frequency

COM 1 Button

CNI DED Page

Dobber Switch



COMM 1 (UHF) Radio Power Knob

COMM 1 (UHF) Radio Mode Knob
OFF / Squelch / Guard Frequency

UHF DED Page

Selected UHF Frequency

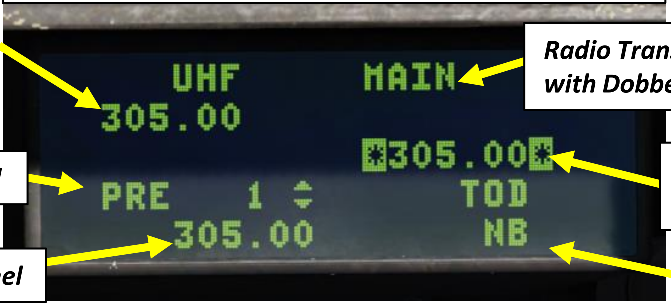
Radio Transmission Status (Toggled with Dobber Switch RIGHT (SEQ)

Preset Channel

Radio Frequency/Channel Input Data Field

Frequency of Preset Channel

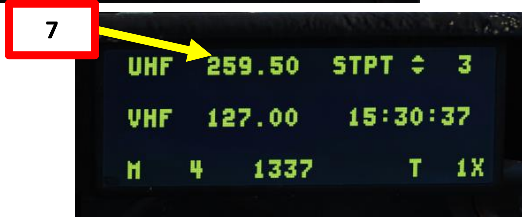
NB (Narrow Band) / WB (Wide Band) Selector

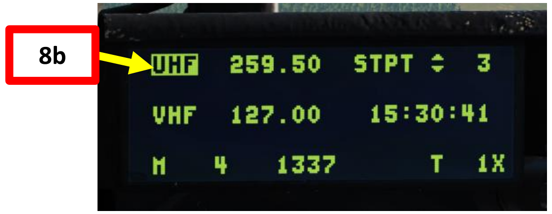


AN/ARC-164 UHF RADIO (COM1)

TUTORIAL (MANUAL FREQUENCY)

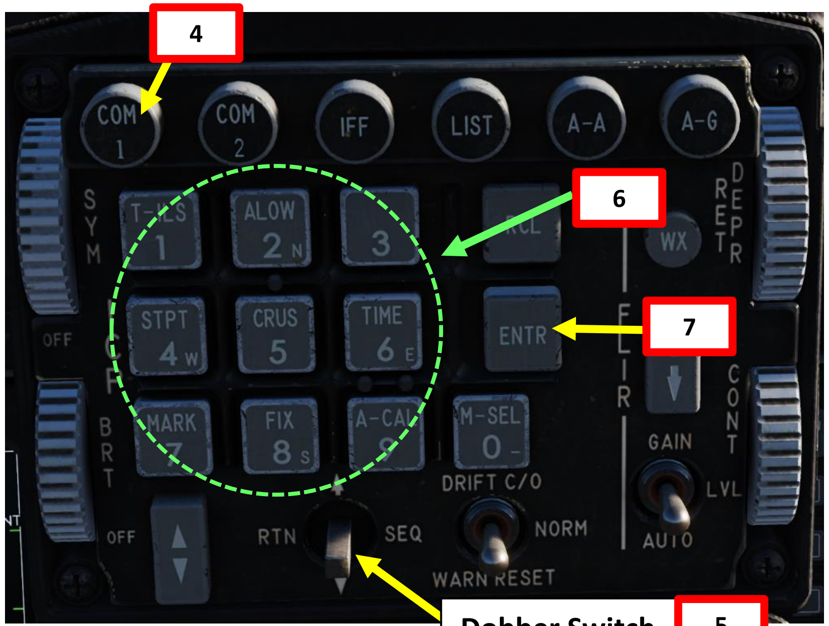
1. Set COMM1 UHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM1 Radio Mode Switch – SQL (Squelch)
3. Set C&I (Communication and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM1 button on the ICP (Integrated Control Panel)
5. Set UHF Radio Function as desired using the Dobber Switch Right (SEQ).
    - MAIN means transmissions are received only on the main UHF receiver.
    - BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
6. To set manual frequency, enter the frequency on the ICP keypad (25950 for 259.500 Mhz)
7. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
8. To transmit on UHF COM 1 radio, press the Communications Transmit Switch AFT (*RALT+*). UHF text will be highlighted when transmitting.





C&I (Communication & Identification) switch

- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*



Dobber Switch 5

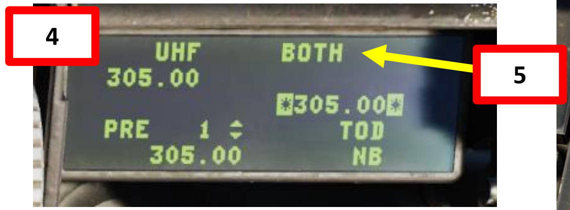
Communications UHF/VHF Transmit Switch (4-Way)

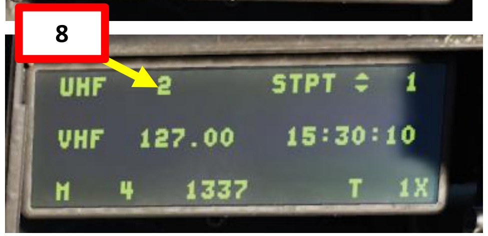
- *AFT: transmits on UHF radio (RALT+\ )*

AN/ARC-164 UHF RADIO (COM1)

TUTORIAL (PRESET FREQUENCY)

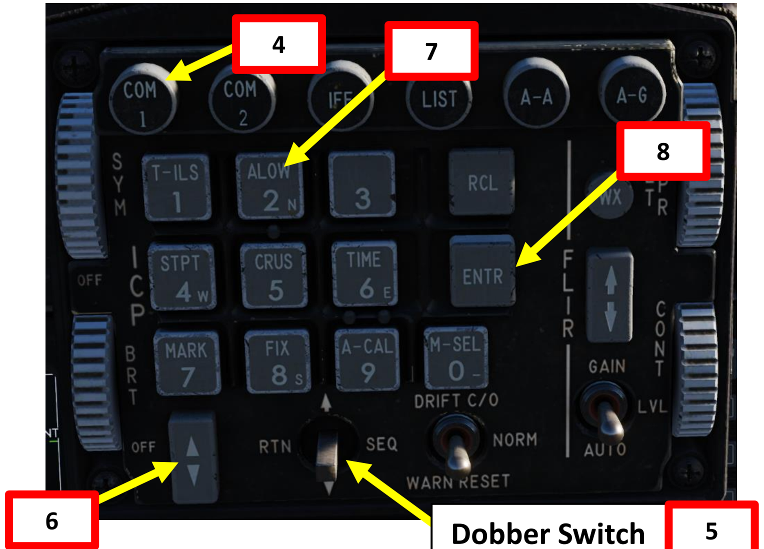
1. Set COMM1 UHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM1 Radio Mode Switch – SQL (Squelch)
3. Set C&I (Communication and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM1 button on the ICP (Integrated Control Panel)
5. Set UHF Radio Function as desired using the Dobber Switch Right (SEQ).
    - MAIN means transmissions are received only on the main UHF receiver.
    - BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
6. You can check the associated frequency to a preset channel by toggling the channel with the DED Increment/Decrement Switch. This will **NOT** tune the radio to this channel; this is merely used to see the channel's frequency (i.e. Preset Channel 2 is set to 269.00 MHz).
7. To select preset frequency, enter the frequency on the ICP keypad ("2" for Preset Frequency #2)
8. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
9. To transmit on UHF COM 1 radio, press the Communications Transmit Switch AFT (*RALT+*). UHF text will be highlighted when transmitting.





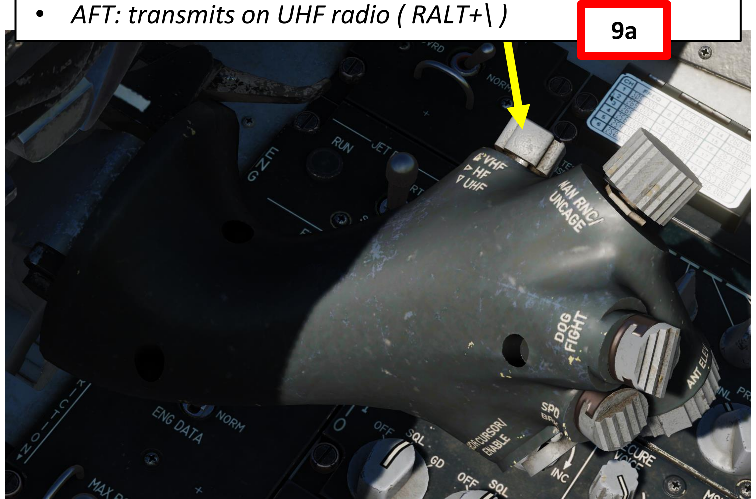
C&I (Communication & Identification) switch

- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*



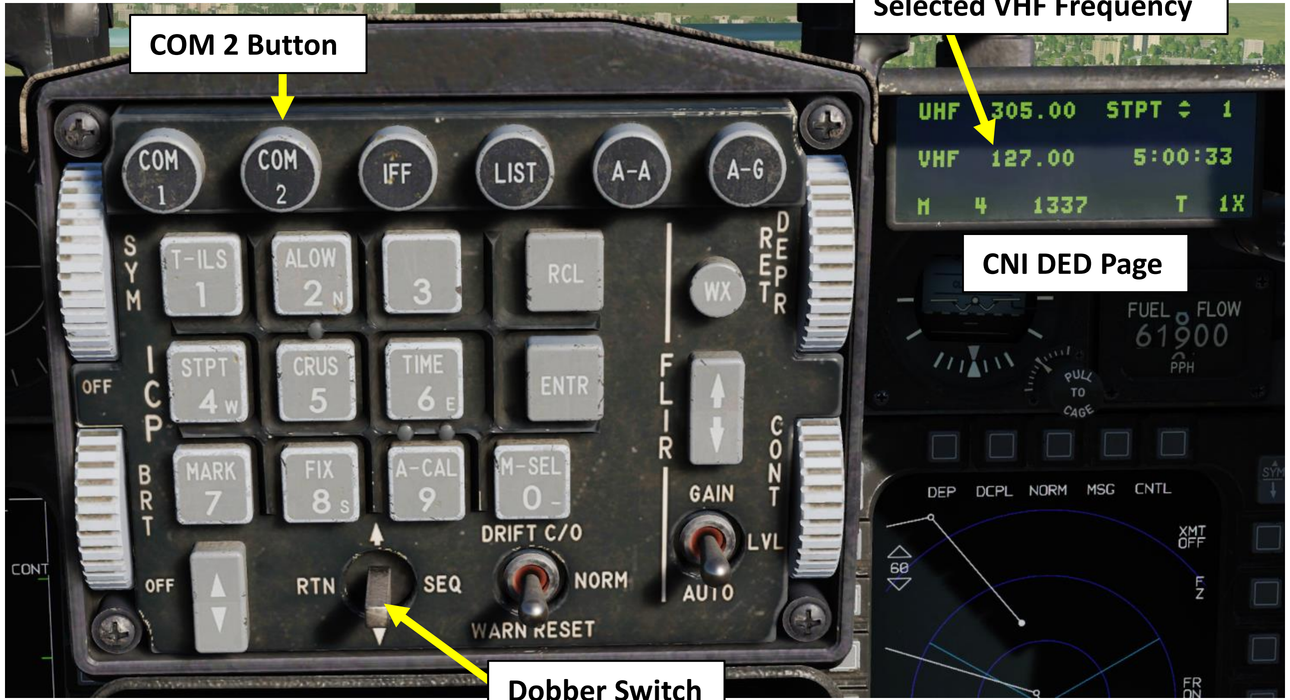
Communications UHF/VHF Transmit Switch (4-Way)

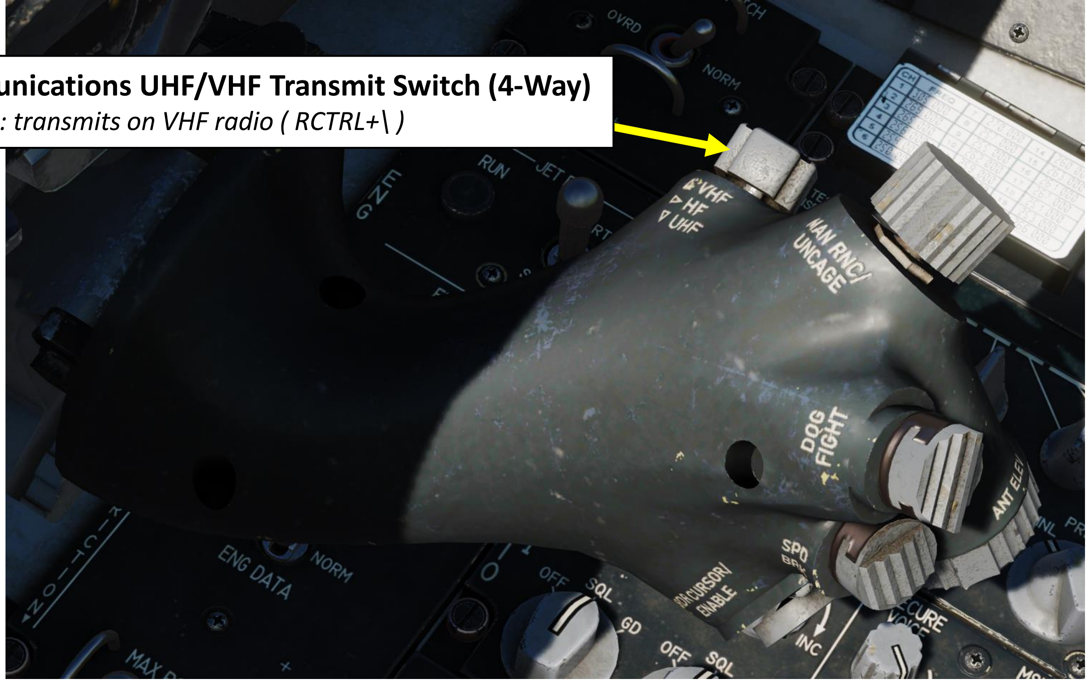
- *AFT: transmits on UHF radio (RALT+\ )*



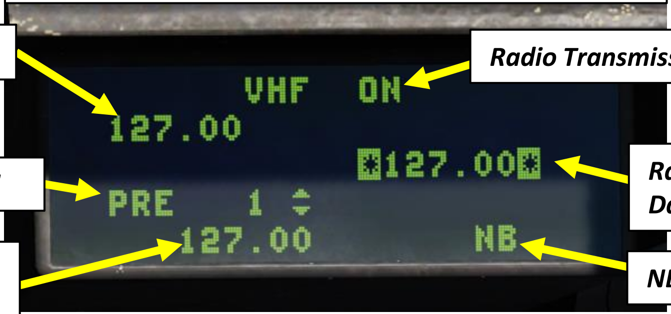
AN/ARC-222 VHF RADIO (COM2)

COMPONENTS





VHF DED Page



AN/ARC-222 VHF RADIO (COM2)

TUTORIAL (MANUAL FREQUENCY)

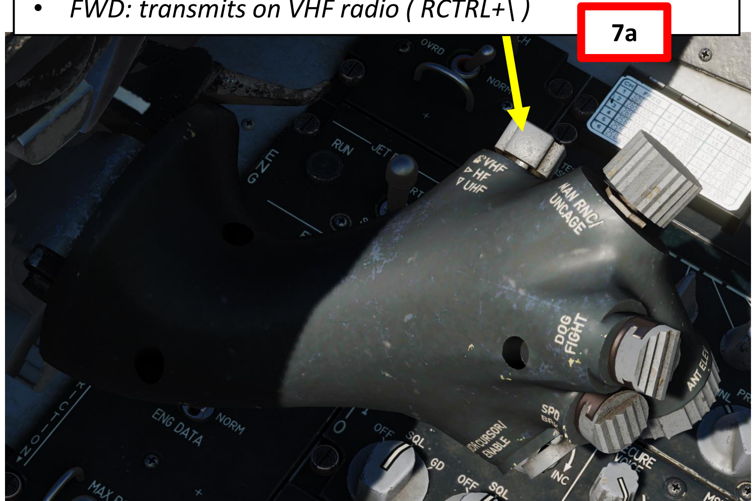
1. Set COMM2 VHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM2 Radio Mode Switch – SQL (Squelch)
3. Set C&I (Communication and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM2 button on the ICP (Integrated Control Panel)
5. To set manual frequency, enter the frequency on the ICP keypad (12950 for 129.500 Mhz)
6. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
7. To transmit on VHF COM 2 radio, press the Communications Transmit Switch AFT (*RCTRL+\ ). VHF* text will be highlighted when transmitting.

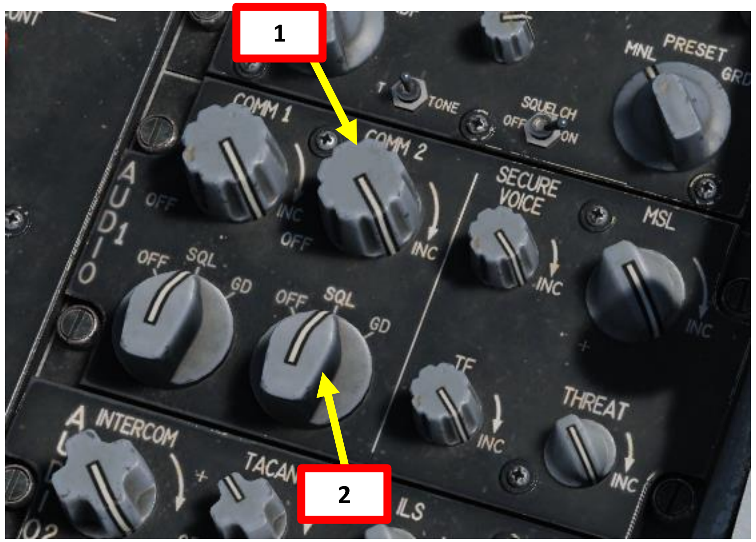
C&I (Communication & Identification) switch

- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*

Communications UHF/VHF Transmit Switch (4-Way)

- *FWD: transmits on VHF radio (RCTRL+\ )*





AN/ARC-222 VHF RADIO (COM2)

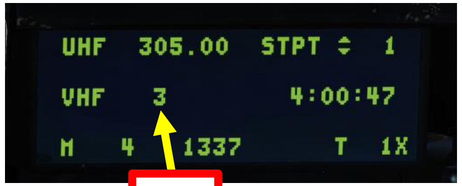
TUTORIAL (PRESET FREQUENCY)

1. Set COMM2 VHF Radio Power/Volume knob – ON (Volume as required)
2. Set COMM2 Radio Mode Switch – SQL (Squelch)
3. Set C&I (Communication and Identification) Switch to UFC (Upfront Control). This enables control of primary communications, navigation and identification functions from the upfront controls.
4. Press COM2 button on the ICP (Integrated Control Panel)
5. You can check the associated frequency to a preset channel by toggling the channel with the DED Increment/Decrement Switch. This will **NOT** tune the radio to this channel; this is merely used to see the channel's frequency (i.e. Preset Channel 3 is set to 136.00 MHz).
6. To select preset frequency, enter the frequency on the ICP keypad ("3" for Preset Frequency #3)
7. Press ENTR button to confirm. DED (Data Entry Display) page will automatically switch back to CNI (Communications, Navigation & Identification) DED page.
8. To transmit on VHF COM 2 radio, press the Communications Transmit Switch AFT (*RCTRL+*). VHF text will be highlighted when transmitting.

4

5

6



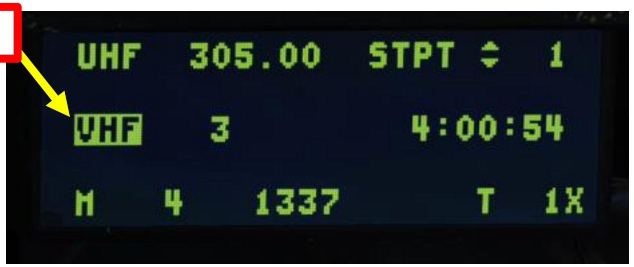
7

3

C&I (Communication & Identification) switch

- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*

8b



4

6

7

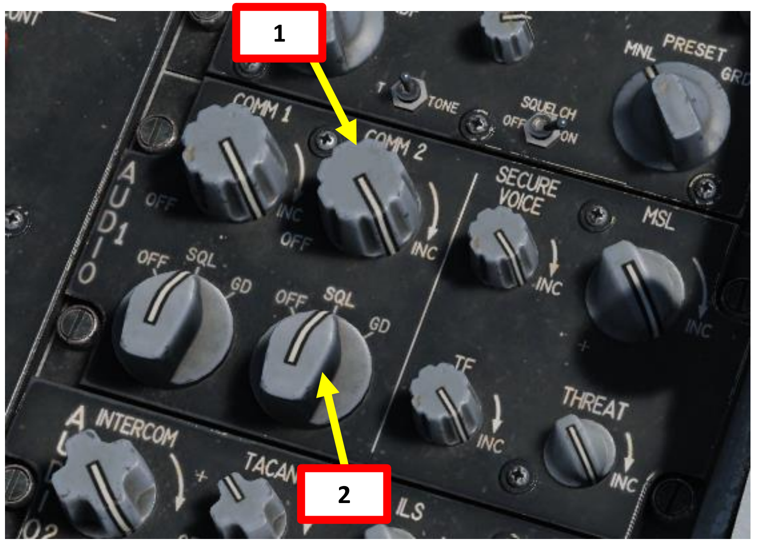
5

Communications UHF/VHF Transmit Switch (4-Way)

- *FWD: transmits on VHF radio (RCTRL+\ )*

8a

1

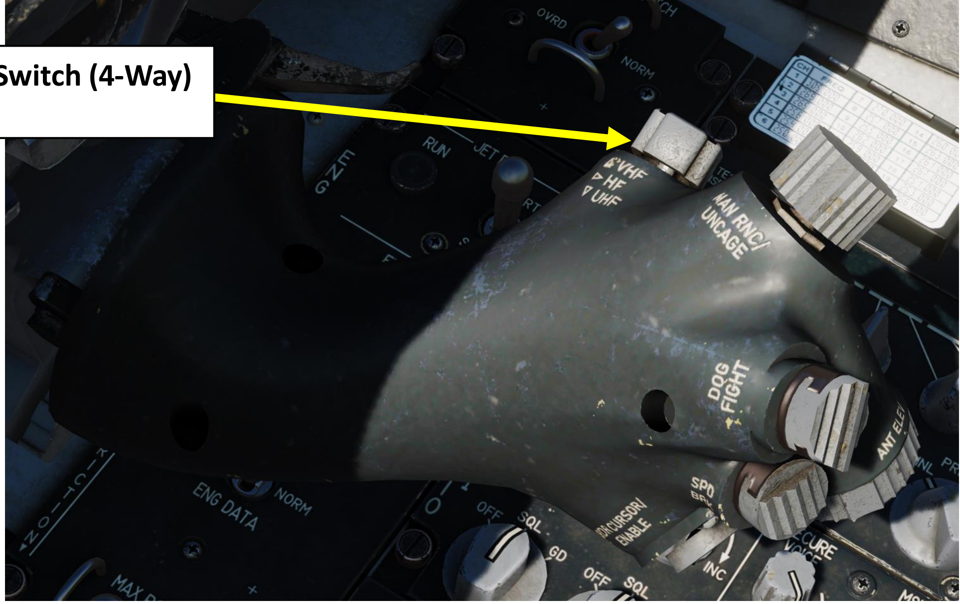


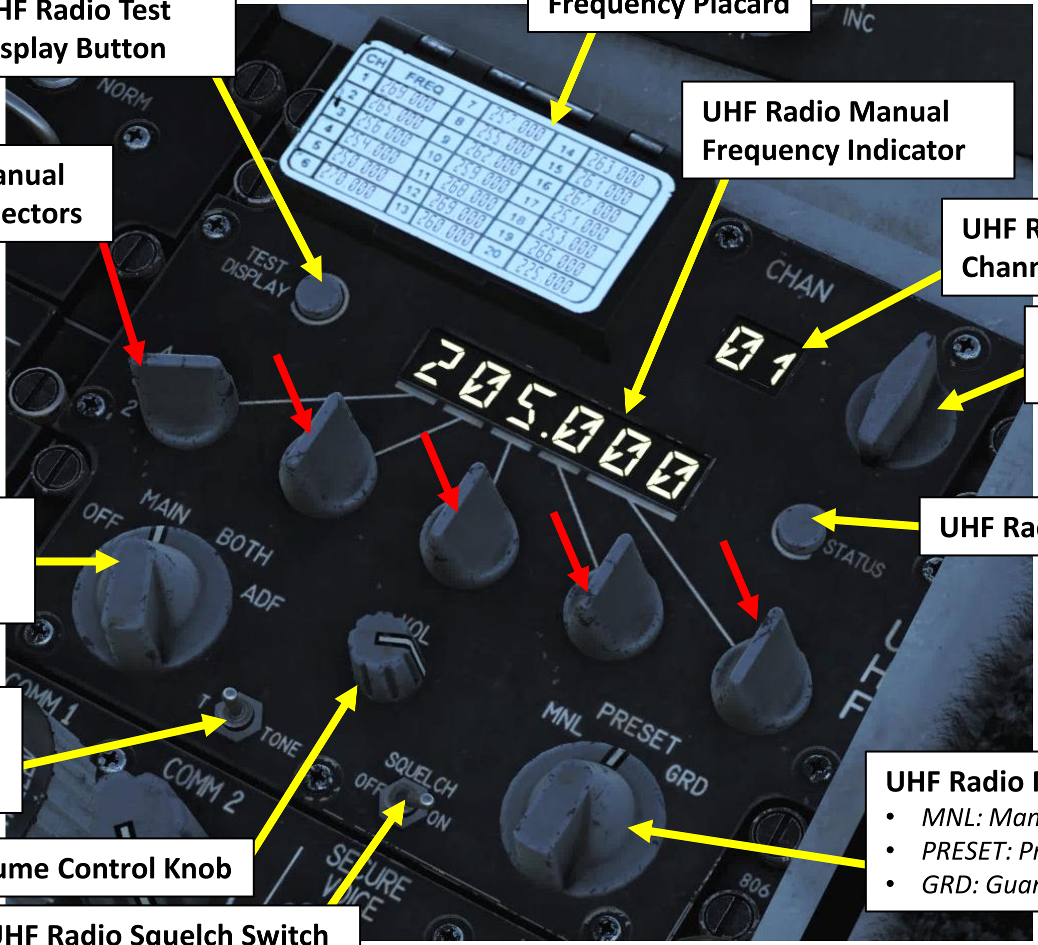
2

UHF RADIO BACKUP CONTROL

COMPONENTS

Communications UHF/VHF Transmit Switch (4-Way)
- *AFT: transmits on UHF radio (RALT+\ )*





UHF Radio Test Display Button

UHF Radio Preset Frequency Placard

UHF Radio Manual Frequency Selectors

UHF Radio Manual Frequency Indicator

UHF Radio Preset Channel Indicator

UHF Radio Preset Channel Selector Knob

UHF Radio Function Knob
OFF / Main / Both / ADF
(Automatic Direction Finder)

UHF Radio Status Button

UHF Radio Tone Button
Functions related to anti-jam frequency hopping

UHF Radio Volume Control Knob

UHF Radio Squelch Switch

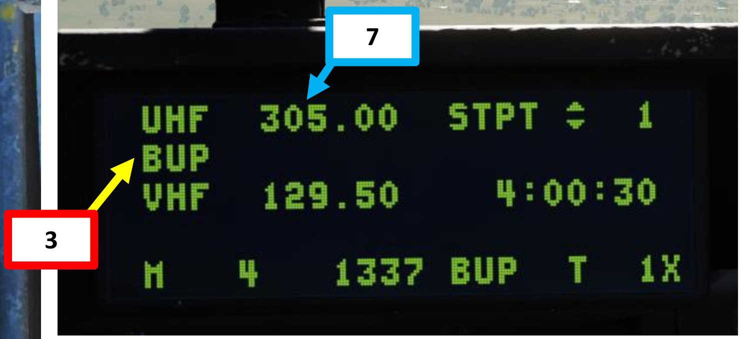
UHF Radio Mode Knob
- *MNL: Manual Frequency*
- *PRESET: Preset Frequency*
- *GRD: Guard Frequency*

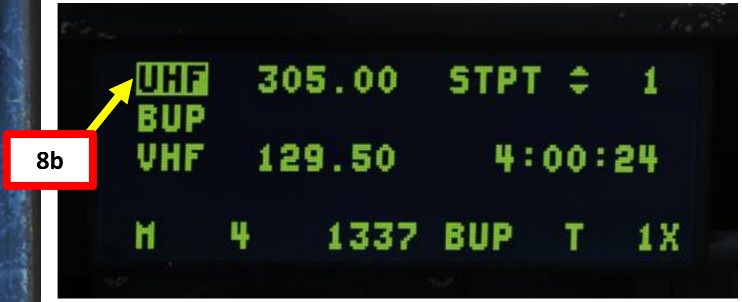
C&I (Communication & Identification) switch
- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*

UHF RADIO BACKUP CONTROL

TUTORIAL (MANUAL FREQUENCY)

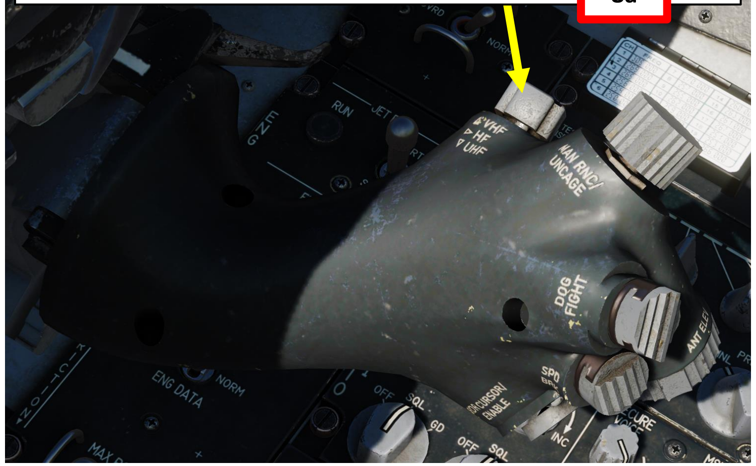
1. Set UHF Radio Backup Function knob – MAIN or BOTH
    - MAIN means transmissions are received only on the main UHF receiver.
    - BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
2. Set C&I (Communication and Identification) Switch to BACKUP.This allows you to use the UHF Backup Radio.
3. On CNI (Communication, Navigation & Identification) page, the “UHF BUP” text shows that the UHF Backup Radio is ON.
4. Set Volume knob as required
5. Set Squelch switch – ON
6. Set UHF Radio Mode Knob to MNL (Manual Frequency)
7. To tune manual frequency, use UHF Radio Manual Frequency Selectors
8. To transmit on UHF Backup radio, press the Communications Transmit Switch AFT (*RALT+*). UHF text will be highlighted when transmitting.

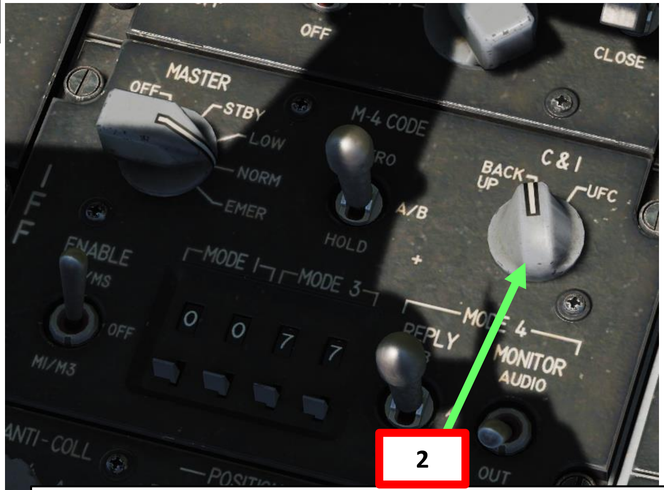




Communications UHF/VHF Transmit Switch (4-Way)
- *AFT: transmits on UHF radio (RALT+\ )*

8a



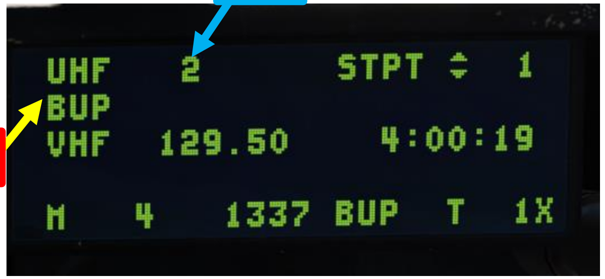


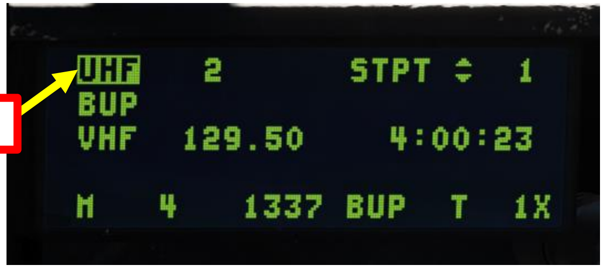
C&I (Communication & Identification) switch
- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*

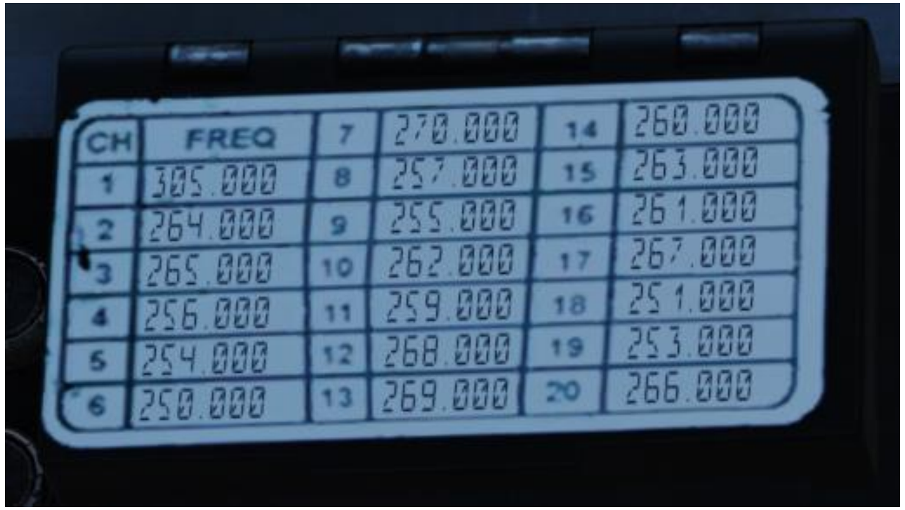
UHF RADIO BACKUP CONTROL

TUTORIAL (PRESET FREQUENCY)

1. Set UHF Radio Backup Function knob – MAIN or BOTH
   - MAIN means transmissions are received only on the main UHF receiver.
   - BOTH means transmissions are received on both the main and guard frequency (243.000) receivers.
2. Set C&I (Communication and Identification) Switch to BACKUP.This allows you to use the UHF Backup Radio.
3. On CNI (Communication, Navigation & Identification) page, the “UHF BUP” text shows that the UHF Backup Radio is ON.
4. Set Volume knob as required
5. Set Squelch switch – ON
6. Set UHF Radio Mode Knob to PRESET
7. To select preset frequency channel, use UHF Radio Preset Channel knob
8. To transmit on UHF Backup radio, press the Communications Transmit Switch AFT (*RALT+*). UHF text will be highlighted when transmitting.

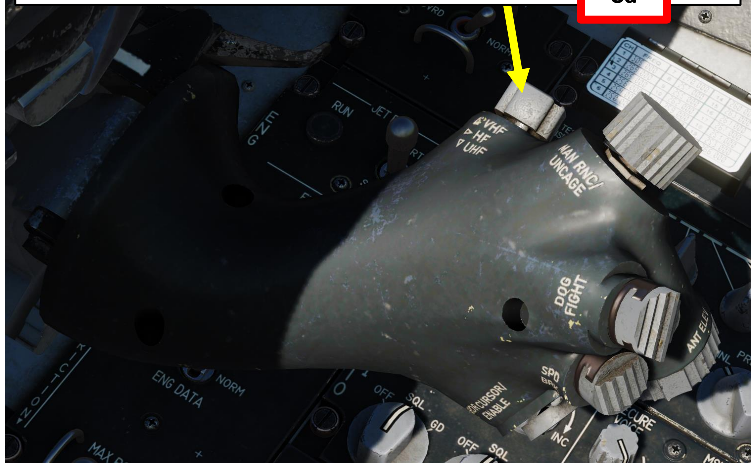


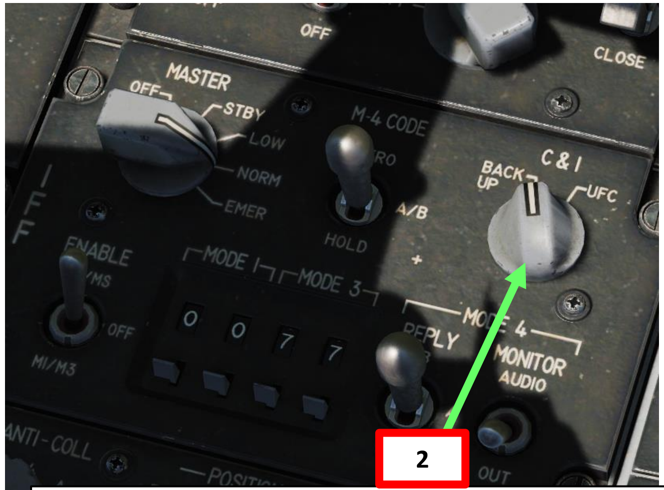




CH	FREQ				
1	305.000	7	270.000	14	260.000
2	264.000	8	257.000	15	263.000
3	265.000	9	255.000	16	261.000
4	256.000	10	262.000	17	267.000
5	254.000	11	259.000	18	251.000
6	250.000	12	268.000	19	253.000
		13	269.000	20	266.000

Communications UHF/VHF Transmit Switch (4-Way)
- *AFT: transmits on UHF radio (RALT+\ )*





C&I (Communication & Identification) switch
- *For normal UHF/VHF radio operation, set to UFC.*
- *For the UHF backup radio to operate, set to BACKUP.*

FLCS (FLIGHT CONTROL SYSTEM)

Like the F/A-18 and the Mirage 2000C, the F-16 is equipped with a fly-by-wire system. **Fly-by-wire** (FBW) is a system that replaces the conventional manual flight controls of an aircraft with an electronic interface. The movements of flight controls are converted to electronic signals transmitted by wires (hence the fly-by-wire term), and flight control computers determine how to move the actuators at each control surface to provide the ordered response. The fly-by-wire system also allows automatic signals sent by the aircraft's computers to perform functions without the pilot's input, as in systems that automatically help stabilize the aircraft, or prevent unsafe operation of the aircraft outside of its performance envelope.

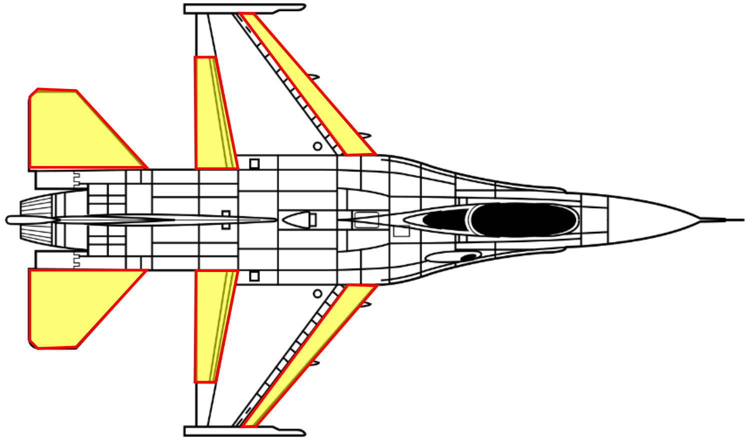
Flying the F-16 feels different from other fighter jets like the F-15. Control surfaces are controlled by a computer: you merely tell the aircraft what you want it to do.

I highly recommend this article about the F-16's fly-by-wire system. It is very instructive and quite interesting.
http://www.ausairpower.net/AADR-FBW-CCV.html

Pilot input on joystick

FLIGHT COMPUTER

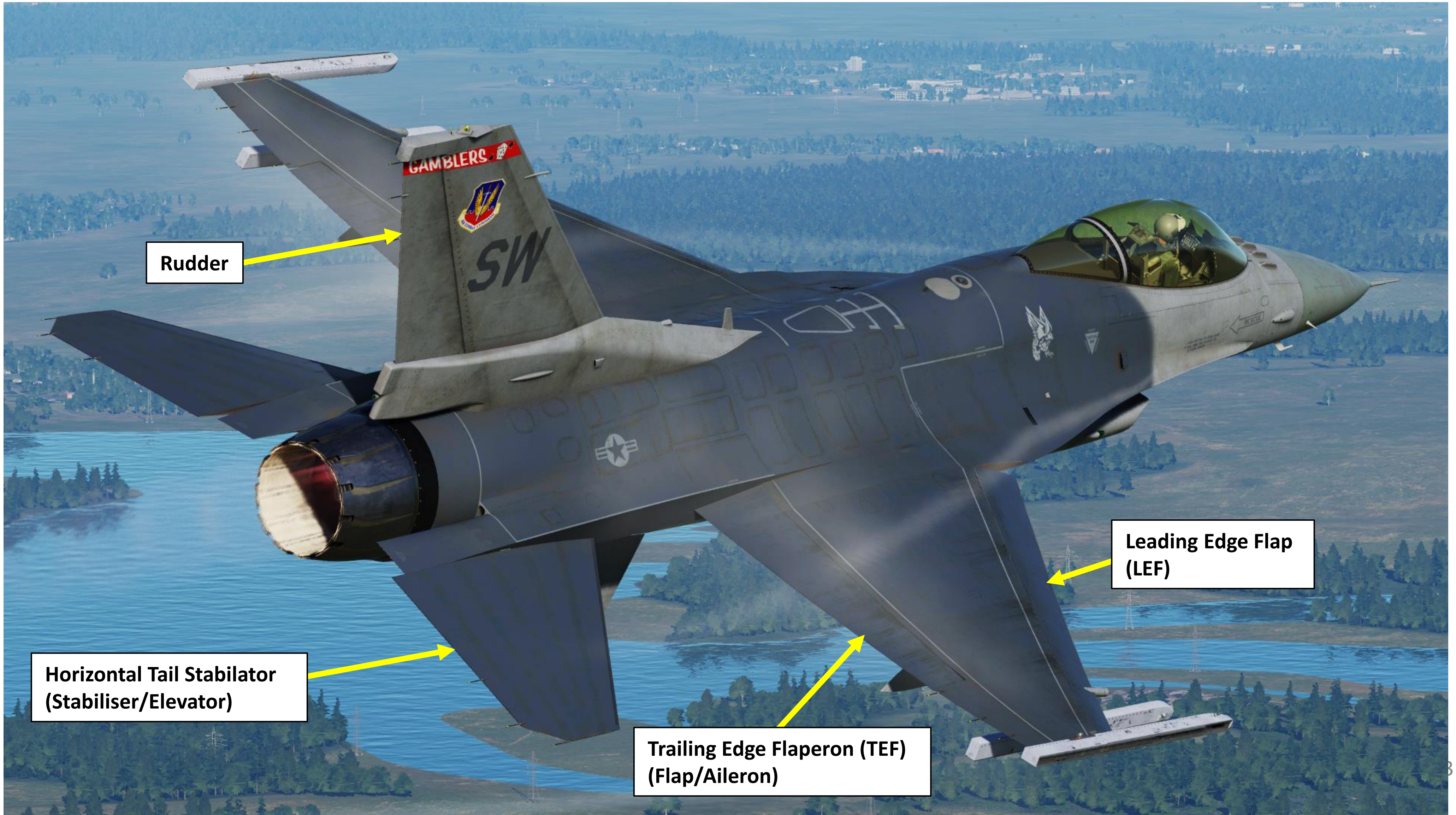
Control Laws will determine how control surfaces must be moved in order to reproduce the movement dictated by pilot input on joystick



Electrical signal sent to actuators of control surfaces

FLCS (FLIGHT CONTROL SYSTEM)

The FLCS (Flight Control System, also nicknamed “Flickiss”) is a digital four-channel system which hydraulically positions control surfaces. The FLCS has a certain level of control over pitch, roll and yaw control inputs. Pitch motion is controlled by symmetrical movement of the horizontal tails. Roll motion is controlled by differential movement of the flaperons and horizontal tails. Yaw motion is controlled by the rudder. Roll coordination is provided by an ARI (Aileron-Rudder Interconnection). The ARI function is not available whenever main landing gear wheel speed exceeds 60 knots or if the angle of attack exceeds 35 degrees.



FLCS (FLIGHT CONTROL SYSTEM)

FLCS OPERATIONAL MODES (GAINS)

The Flight Control System (FLCS) can use three main operation modes, also called "gains". These gains will modify how the fly-by-wire system will move the control surfaces.

- **Cruise Gains (Normal Operating Mode)**
  - Active during normal aircraft flight (landing gear up, no FLCS failure)
- **Takeoff & Landing Gains**
  - Active below 400 kts when landing gear is deployed, or when ALT FLAPS switch is set to EXTEND, or when the air refueling trap door is open
- **Standby Gains**
  - Active when flight control computer has detected a FLCS failure

****

GUN COMPENSATION

The FLCS automatically compensates for the off-center gun firing and the gun gas emissions during gun firing by moving the rudder and flaperons. Gun compensation is optimized for 0.7 – 0.9 Mach. Firing outside of those speeds may create adverse effects.

****

LEF (LEADING EDGE FLAPS) and TEF (TRAILING EDGE FLAPS)

Leading Edge Flaps are controlled by the FLCS as a function of Mach Number and Angle of Attack.

Trailing Edge Flaps are controlled by the FLCS as a function of the Landing Gear handle position, ALT FLAPS switch position and airspeed.

FLCS (FLIGHT CONTROL SYSTEM)

The Flight Control Computer takes a number of input parameters in order to calculate adequate movements for your flight control surfaces. FLCS controller gains are scheduled by air data inputs, and sideslip angle and rate is calculated based on the Inertial Navigation System (INS) inputs. Here is a simplified representation of the FLCC (Flight Control Computer).

PITCH INPUTS
- Pitch Trim —> Mechanical Limit
- Horizontal Tail Stick Force
- Angle of Attack
- Pitch Rate
- Normal Acceleration
- Impact Pressure

ROLL INPUTS
- Roll Trim —> Mechanical Limit
- Aileron Stick Force
- Roll Rate

YAW INPUTS
- Yaw Trim —> Mechanical Limit
- Rudder Pedal Force
- Yaw Rate
- Lateral Acceleration

GUN COMPENSATION INPUT
- Gun Fire

INERTIAL NAVIGATION SYSTEM INPUTS
- Angles and Velocities

FLIGHT CONTROL COMPUTER

LEFT & RIGHT HORIZONTAL TAIL/STABILATOR

LEFT & RIGHT FLAPERON

RUDDER

FLCS (FLIGHT CONTROL SYSTEM)

FLCS CONFIGURATION MODES & LIMITERS

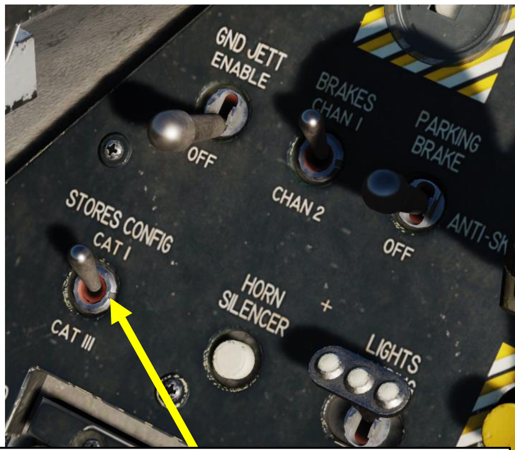
The Flight Control System (FLCS) can use two main configuration modes: CAT I and CAT III.

Depending on the weapon and external fuel tank loadout, the aircraft will automatically detect what CONFIG setting you should be in. The STORES CONFIG warning indicates that the FLCS Stores Configuration switch is not set properly.

- **CAT I**: Air-to-Air configuration, used when Air-to-Air weapons and centreline fuel tank is loaded.
  - FCS limits aircraft acceleration from -3 G to +9 G until 15 deg AoA (Angle of Attack) is reached.
  - Above 15 deg, max G is a function of AoA and airspeed (+7.3 G at 20 deg AoA, +1G at 25 deg AoA)
  - FCS limits max AoA to 25 deg
  - Max rudder deflection starts decreasing around 14 deg AoA, then cannot be deflected at 26 deg AoA

- **CAT III**: Air-to-Ground configuration, used when air-to-ground weapons are mounted and external wing fuel tanks are mounted.
  - FCS limits aircraft acceleration from -3 G to +9 G until 15 deg AoA (Angle of Attack) is reached.
  - FCS limits max AoA to 15.5 - 15.8 deg
  - Commanded roll rate is reduced by 40 % of max commanded roll rate in CAT I in order to reduce risks of roll-coupled departures from flight
  - Max rudder deflection starts decreasing at 3 deg AoA, then cannot be deflected at 15 deg AoA

Notes:
- Note 1: the CAT Config switch is not a “G limiter” selector switch per se. It limits Angle of Attack, which in turn limits maximum attainable G based on a function of AoA and airspeed.
- Note 2: When the landing gear is deployed (during takeoff/landing), the FLCS gains operate as a pitch rate command system until 10 deg AoA. Above 10 deg AoA, the FLCS operates as a pitch rate/AoA command system.
- Note 3: Above 35 deg AoA, yaw rate limiter provides roll and yaw axis anti-spin control inputs. It also cuts out stick roll commands.
- Note 4: Below -5 deg AoA and less than 170 kts, yaw rate limiter provides anti-spin rudder inputs.



STORES CONFIG (Stores Configuration) Switch

Used to limit FLCS (Flight Control System) gains/limits based on the stores configuration.
- *CAT I: Used for air-to-air loadouts.*
- *CAT III: Used for heavier air-to-ground loadouts or gas-heavy configurations. FLCS limits the angle of attack and onset rates in order to increase departure resistance.*

STORES CONFIG Caution

STORES CONFIG switch on the gear panel is not in the correct position for the current loadout.

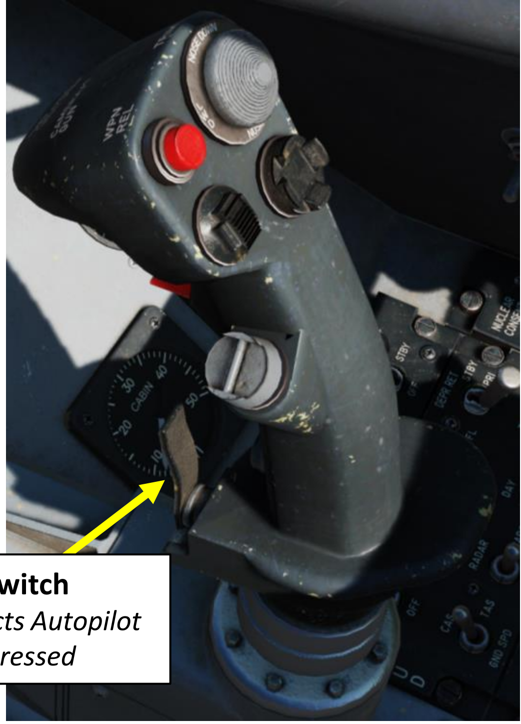
AUTOPILOT

The F-16 has a number of autopilot “relief modes” that assist the pilot in flying the aircraft.

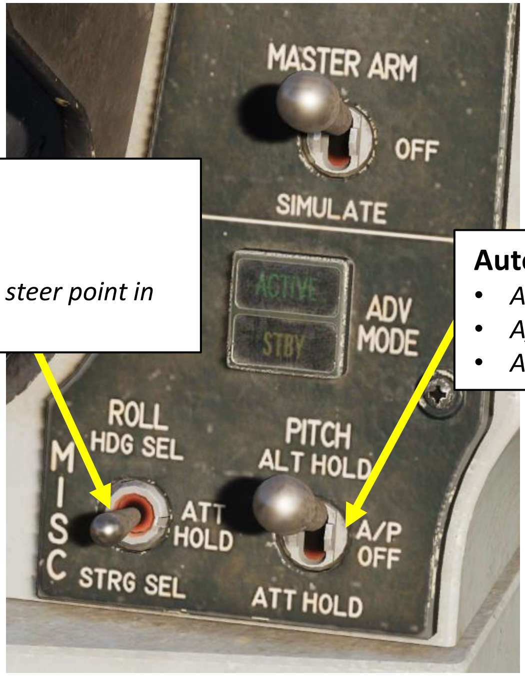
AUTOPILOT MODES

1. **PITCH ATT HOLD**: Attitude Hold in the pitch axis. Aircraft will maintain the existing pitch attitude, as long as the attitude is +/- 60 degrees in pitch.
2. **ROLL ATT HOLD**: Attitude Hold in the roll axis. Aircraft will maintain the existing roll attitude, as long as the attitude is +/- 60 degrees in roll.
3. **ALT HOLD**: Barometric Altitude Hold. When engaged, aircraft will maintain current barometric altitude
4. **HDG SEL**: Heading Select. Aircraft will turn to and fly the heading as set on the EHSI (Electronic Horizontal Situation Indicator).
5. **STRG SEL**: Steering Select. Aircraft will turn to and fly to the active steerpoint.

Take note that pitch and roll modes can be combined together. As an example, you could set STRG SEL and ALT HOLD simultaneously. The aircraft would then follow the active steerpoint while maintaining your current altitude.



Paddle Switch
Disconnects Autopilot when depressed



Autopilot Roll Mode Switch
- *HDG SEL (Heading Select)*
- *ATT HOLD (Attitude Hold)*
- *STRG SEL (Steering to selected steer point in the DED, Data Entry Display)*

Autopilot Pitch Mode Switch
- *ALT HOLD (Altitude Hold)*
- *A/P OFF (Autopilot OFF)*
- *ATT HOLD (Attitude Hold)*

HDG SEL (Heading Select) Bug

HDG SEL (Heading Select) Setting Knob

AUTOPILOT

AUTOPILOT LIMITS

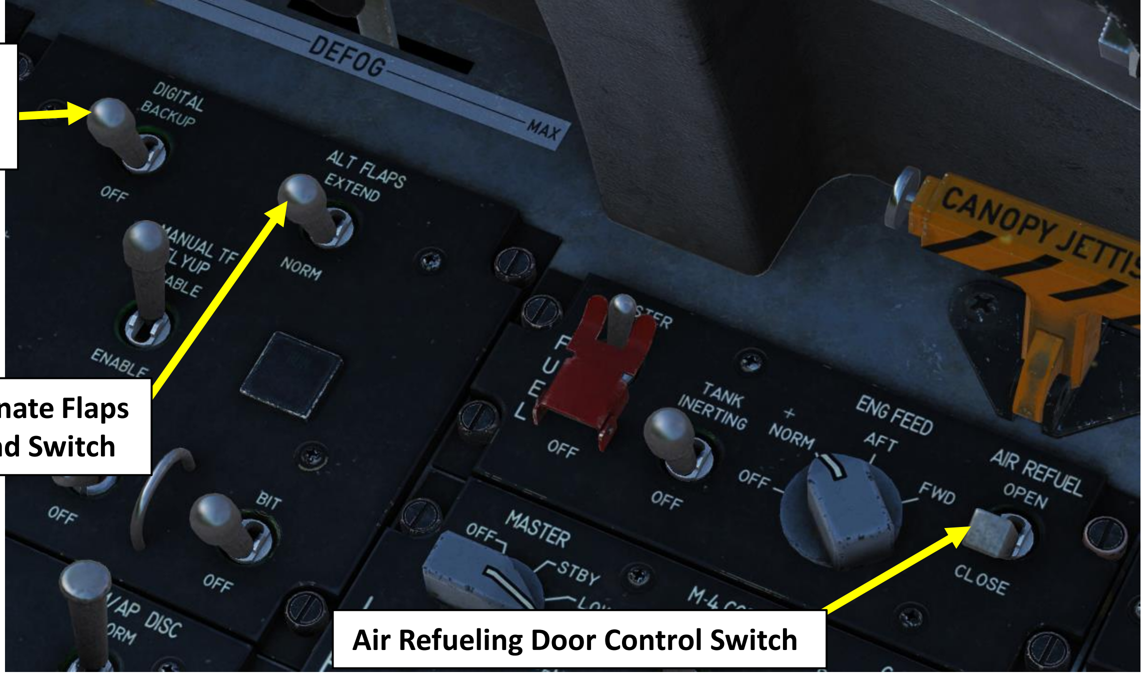
The autopilot will automatically disengage if one of the following conditions is met:

- Paddle Switch (on Stick) is pressed
- TRIM A/P Disc Switch is set to DISC
- Landing Gear is DOWN
- Air Refueling Trap Door is open
- ALT Flaps (Alternate Flaps) switch is set to EXTEND
- Angle of Attack is greater than 15 deg
- DBU (Digital Backup Flight Control Mode) is engaged
- MPO (Manual Pitch Override) switch is held in OVRD
- Autopilot failure or FLCS failure has occured
- Stall Horn is active

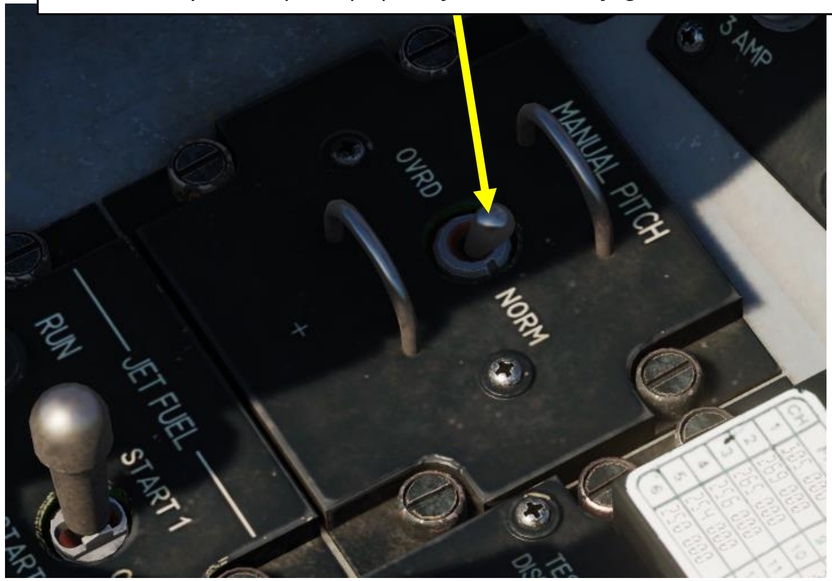
Digital Backup (DBU) Switch
Allowing the pilot to manually select a backup software state of the FLCS

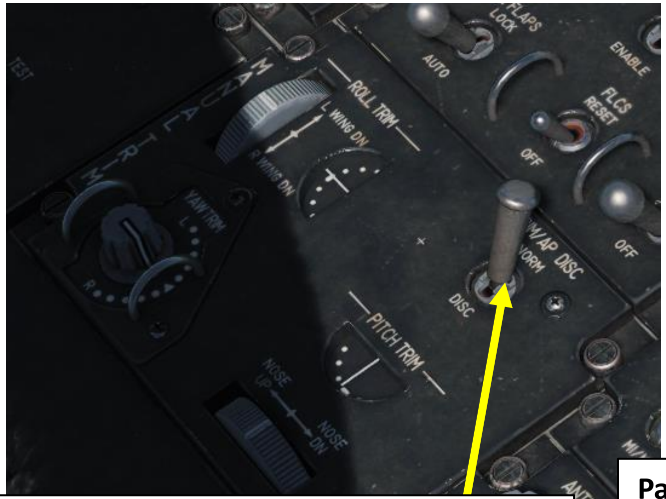
Alternate Flaps Extend Switch

Air Refueling Door Control Switch



Manual Pitch Override Switch
In case of a deep stall departure, the pitch override switch allows you to command greater authority from the stabs to help get the nose pointed downhill so you can pick up speed for controlled flight.





Trim/AP Disc Switch
- *NORM: Stick trims are energized and autopilot is possible*
- *DISC: Stick trims and autopilot are inhibited*

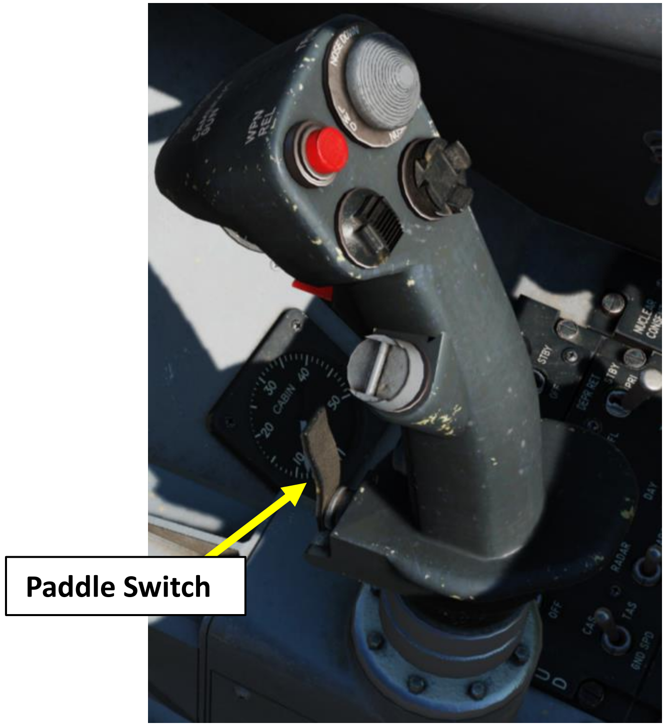
Paddle Switch
Overrides Autopilot when depressed

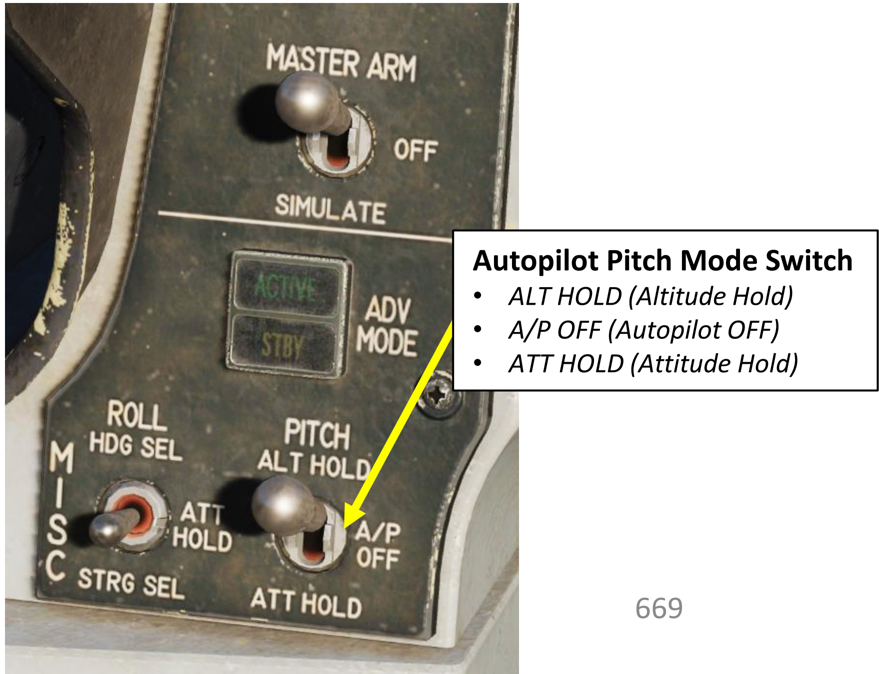
AUTOPILOT

AUTOPILOT ALT HOLD (ALTITUDE HOLD) MODE

1. Fly at the desired altitude you want to maintain
2. Set Autopilot Pitch Mode Switch to ALT HOLD. Your current altitude will become the « reference altitude ».
3. Autopilot will maintain altitude when autopilot was engaged +/- 100 ft.
    - Note: Vertical velocity above +2000 ft/min or below -2000 ft/min will prevent the autopilot from capturing the required altitude.
4. If you want to set a new reference altitude while autopilot is engaged (i.e. the autopilot is maintaining 10,000 ft and you want to fly to climb and level off at 15,000 ft):
    a) Press and hold the Autopilot Paddle switch, and move stick to make the aircraft climb to desired altitude
    b) Autopilot will be disengaged as long as the Paddle switch is held
    c) When new target altitude is reached, release the Autopilot Paddle switch.
    d) Upon release the Paddle switch, the autopilot will take the new actual altitude as the « reference altitude » and maintain this altitude.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF. Paddle Switch can be held to override autopilot.

NOTE: ALT HOLD can be combined with any Autopilot Roll Mode.





AUTOPILOT

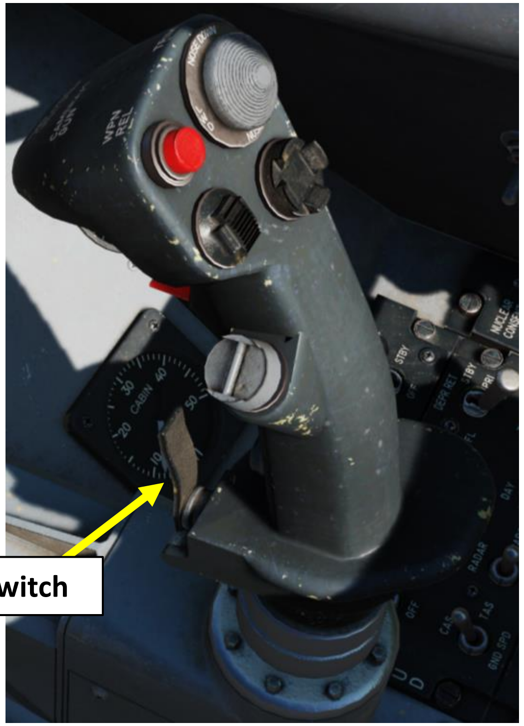
AUTOPILOT PITCH ATT HOLD (ATTITUDE HOLD) MODE

1. Set aircraft in desired pitch attitude
2. Set Autopilot Pitch Mode Switch to ATT HOLD.
3. Autopilot will maintain current pitch attitude. Angles above 60 deg in pitch will not be captured.
4. While autopilot is engaged, aircraft pitch can be changed with stick input. Any time the stick is moved, the attitude hold mode will capture this new attitude and maintain it.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF. Paddle Switch can be held to override autopilot.

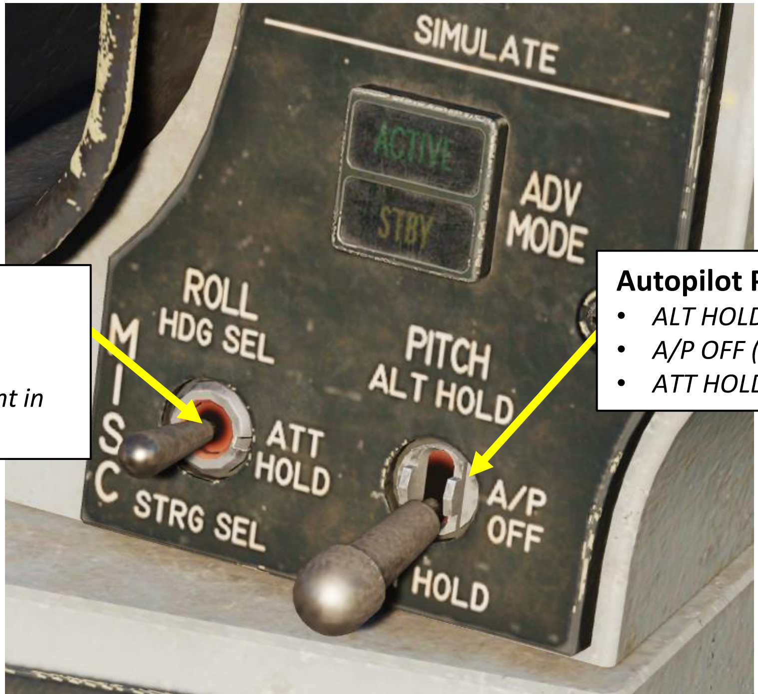
AUTOPILOT ROLL ATT HOLD (ATTITUDE HOLD) MODE

1. Set aircraft in desired roll attitude
2. Set Autopilot Roll Mode Switch to ATT HOLD.
3. Autopilot will maintain current roll attitude. Angles above 60 deg in roll will not be captured.
4. While autopilot is engaged, aircraft roll angle can be changed with stick input. Any time the stick is moved, the attitude hold mode will capture this new attitude and maintain it.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF. Paddle Switch can be held to override autopilot.

NOTE: PITCH ATT HOLD and ROLL ATT HOLD can be combined together or with other autopilot modes.



Paddle Switch



Autopilot Roll Mode Switch
- *HDG SEL (Heading Select)*
- *ATT HOLD (Attitude Hold)*
- *STRG SEL (Steering to selected steer point in the DED, Data Entry Display)*

Autopilot Pitch Mode Switch
- *ALT HOLD (Altitude Hold)*
- *A/P OFF (Autopilot OFF)*
- *ATT HOLD (Attitude Hold)*

AUTOPILOT

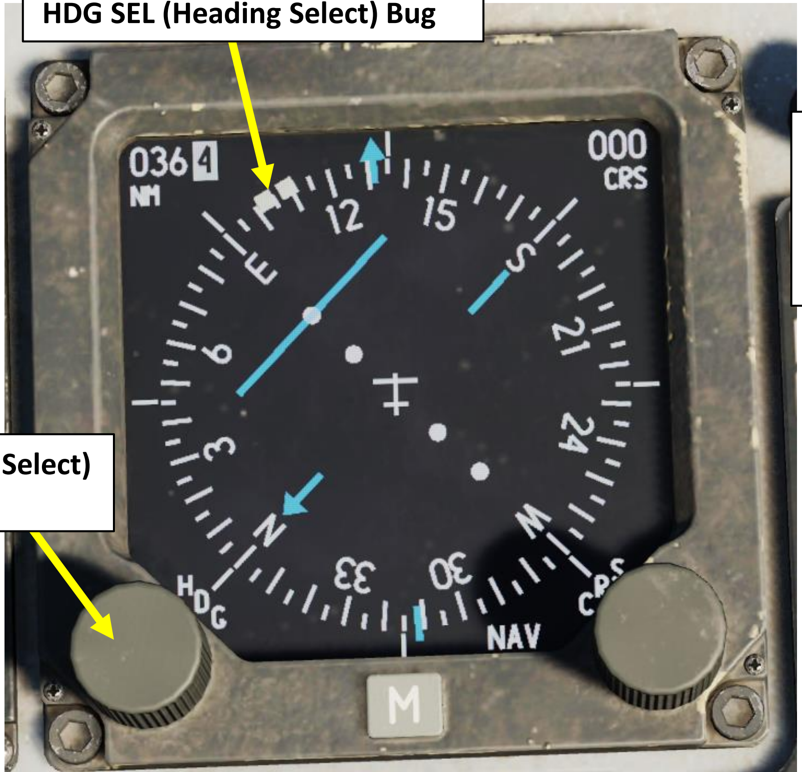
AUTOPILOT HDG SEL (HEADING SELECT) MODE

1. Turn the HDG knob on the EHSI (Electronic Horizontal Situation Indicator) and set the Heading Select Bug to the desired heading you want to capture.
2. Set Autopilot Pitch Mode Switch to either ATT HOLD (Attitude) or ALT HOLD (Altitude Hold), as desired. Without a Pitch mode active, the autopilot will not be able to engage any roll mode.
3. Set Autopilot Roll Mode Switch to HDG SEL to engage the Heading Select mode.
4. Autopilot will limit bank angle to 45 deg and steer towards the selected heading until it is captured.
5. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF.

Note: Paddle Switch will not disengage autopilot while in HDG SEL.

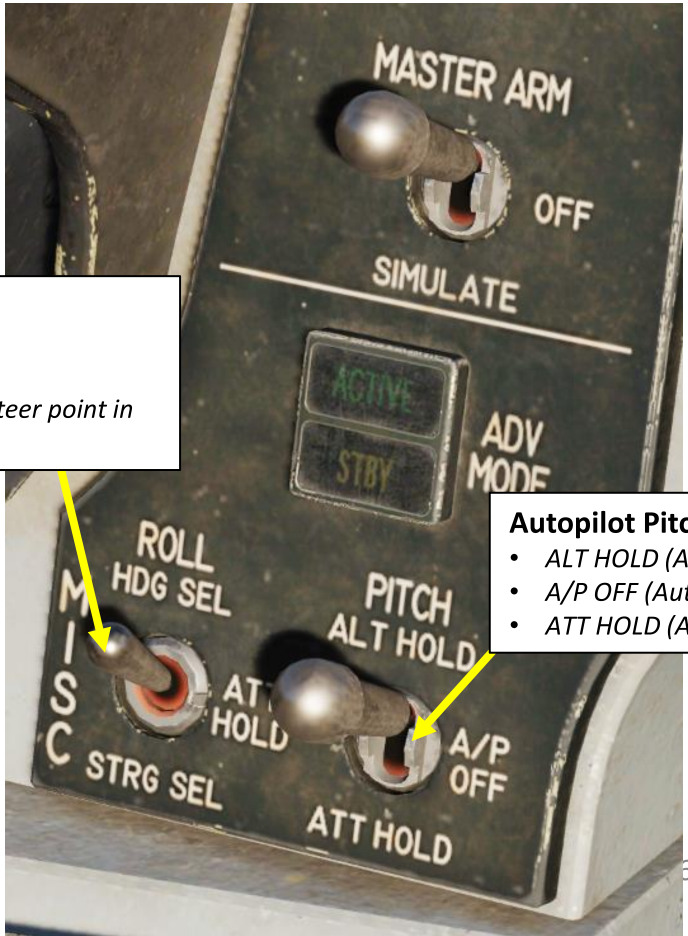
HDG SEL (Heading Select) Bug

HDG SEL (Heading Select) Setting Knob



Autopilot Roll Mode Switch
- *HDG SEL (Heading Select)*
- *ATT HOLD (Attitude Hold)*
- *STRG SEL (Steering to selected steer point in the DED, Data Entry Display)*

Autopilot Pitch Mode Switch
- *ALT HOLD (Altitude Hold)*
- *A/P OFF (Autopilot OFF)*
- *ATT HOLD (Attitude Hold)*

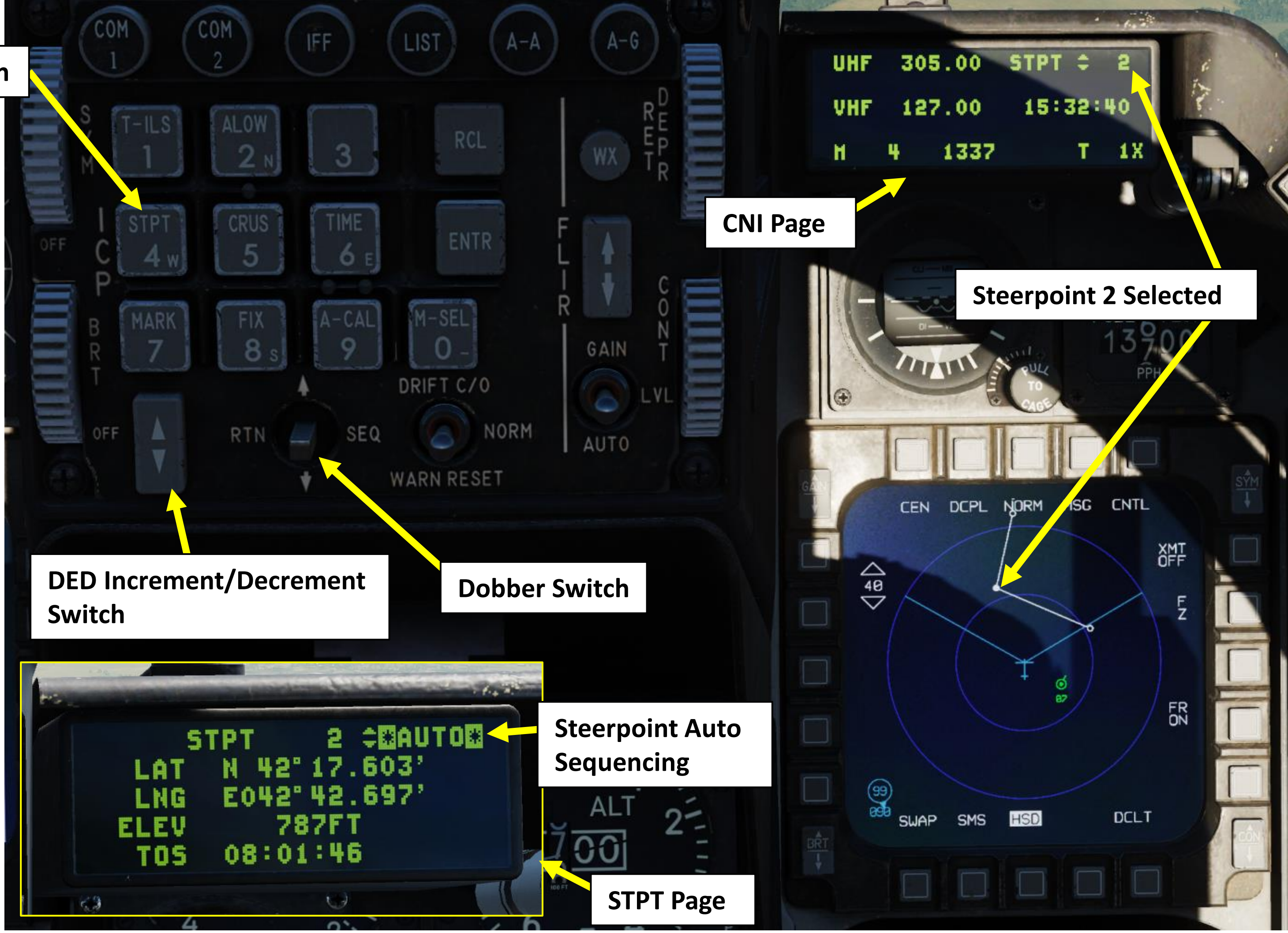


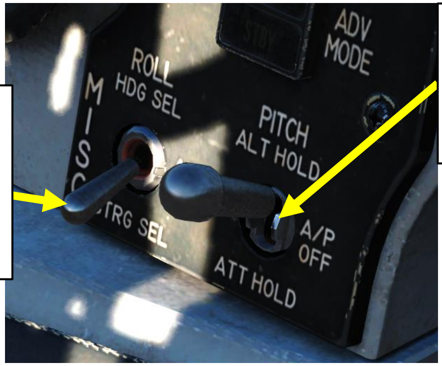
AUTOPILOT

AUTOPILOT STRG SEL (STEERING SELECT) MODE

1. Select steerpoint you want to navigate to.
    a) CNI (Communication, Navigation & Information) page must be selected beforehand (**Dobber switch pressed LEFT to RTN**)
    b) Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 2.
        - *Alternatively, you can also select a steerpoint by pressing "STPT (4)" button on the ICP, entering the Steerpoint Number (i.e. "2" button for Steerpoint 2), then pressing "ENTR" button.*
    c) Selected steerpoint will be visible on your HSD (Horizontal Situation Display) as a white circle
    d) Access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel).
2. Toggle between MANUAL and AUTOMATIC Steerpoint Sequencing mode as desired. This is done by pressing the Dobber Switch DOWN to select the MAN/AUTO data field, then pressing the M-SEL (0) button to toggle between MAN and AUTO Steerpoint Sequencing.
3. Set Autopilot Pitch Mode Switch to either ATT HOLD (Attitude) or ALT HOLD (Altitude Hold), as desired. Without a Pitch mode active, the autopilot will not be able to engage any roll mode.
4. Set Autopilot Roll Mode Switch to STRG SEL to engage the Steering Select mode.
5. Autopilot will limit bank angle to 45 deg and steer towards the selected steerpoint until it is captured.
    - AUTOMATIC sequencing means that when reaching the vicinity of the currently selected steerpoint, the autopilot STRG SEL mode will steer to the next steerpoint automatically.
    - MANUAL sequencing means that when reaching the vicinity of the currently selected steerpoint, the autopilot STRG SEL mode will circle the steerpoint at a 30 deg bank angle.
6. To disengage autopilot, set Autopilot Pitch Mode Switch to A/P OFF.

Note: Paddle Switch will not disengage autopilot while in STRG SEL.





Autopilot Roll Mode Switch
- *HDG SEL (Heading Select)*
- *ATT HOLD (Attitude Hold)*
- *STRG SEL (Steering to selected steer point in the DED, Data Entry Display)*

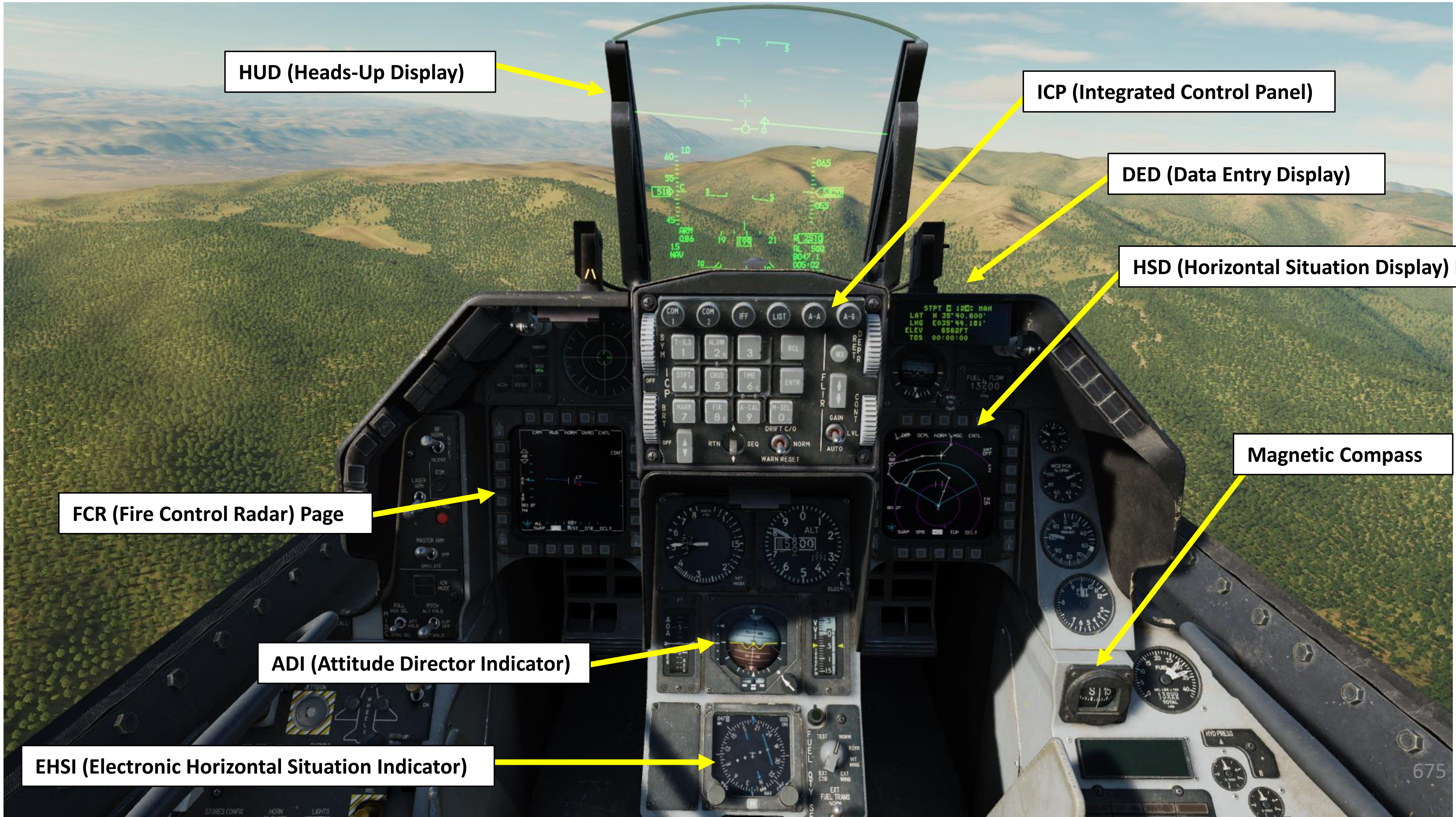
Autopilot Pitch Mode Switch
- *ALT HOLD (Altitude Hold)*
- *A/P OFF (Autopilot OFF)*
- *ATT HOLD (Attitude Hold)*


94-0432

NAVIGATION SECTION STRUCTURE

1 – NAVIGATION INTRODUCTION

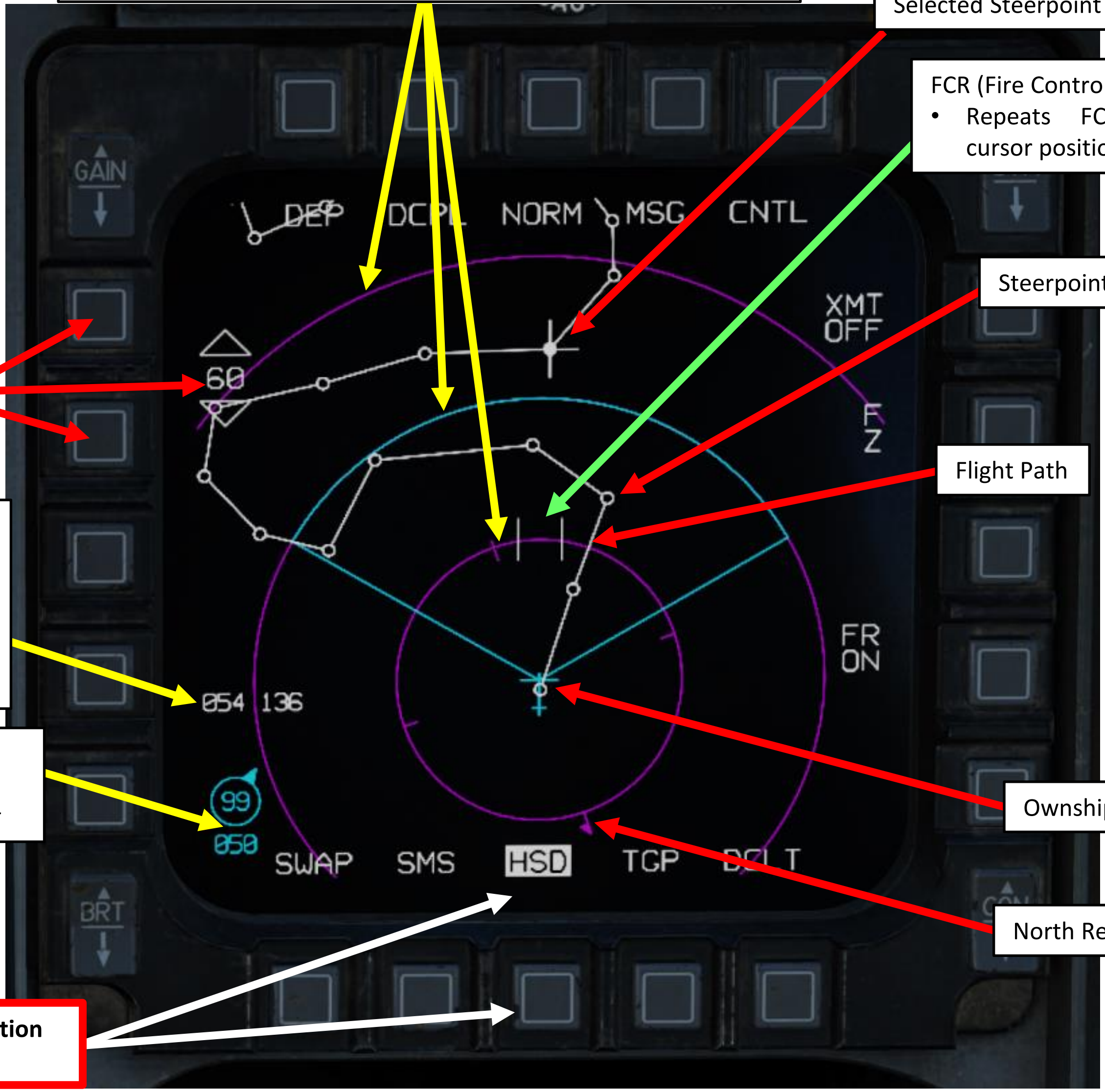
Navigation in the F-16C is mostly done through the HSD (Horizontal Situation Display), EHSI (Electronic Horizontal Situation Indicator), HUD (Heads-Up Display) and ADI (Attitude Director Indicator) localizer & glide slope reference bars. The Standby Magnetic Compass can also be used as a backup. The DED (Data Entry Display) and ICP (Integrated Control Panel) allow you to consult and edit navigation data. The FCR (Fire Control Radar) page also displays steerpoints. Take note that while TACAN and ILS beacons are supported in the F-16, NDB (Non-Directional Beacons) navigation with an ADF (Automatic Direction Finder) is **not** supported.



2 – HSD (HORIZONTAL SITUATION DISPLAY) HSD Main Page

The HSD (Horizontal Situation Display) is one of the most important tools at your disposal for navigation.

The HSD displays a plan-view of your current tactical situation with the symbols representing your aircraft position (Ownship), current steerpoint, active flight plan, and range rings.



Range Ring
- Outer Ring: HSD Display Range *(Shown: 60 nm)*
- Middle Ring: Two Thirds of HSD Display Range *(Shown: 40 nm)*
- Inner Ring: One Third of HSD Display Range *(Shown: 20 nm)*

Selected Steerpoint (White Dot)

FCR (Fire Control Radar) Ghost Cursor
- Repeats FCR Acquisition (ACQ) cursor position

Steerpoint (Black Dot)

Flight Path

Ownship Marker

North Reference Arrow

HSD Display Range (nm)
Shown: 60 nm

If Bullseye active:
- Bearing and Distance (nm) from Bullseye to Acquisition (ACQ) Cursor

If Bullseye is not active:
- Bearing and Distance (nm) from Active Steerpoint to Acquisition (ACQ) Cursor

Bullseye Information
- *Range from the Bullseye to your own aircraft*
- *Bearing from the Bullseye to your own aircraft*

HSD (Horizontal Situation Display) Page

2 – HSD (HORIZONTAL SITUATION DISPLAY)
HSD Main Page

With the HSD selected as the Sensor of Interest (SOI) with DMS (Display Management Switch) DOWN, HSD Cursor Bearing & Range information from currently selected steerpoint to the HSD cursor is available.

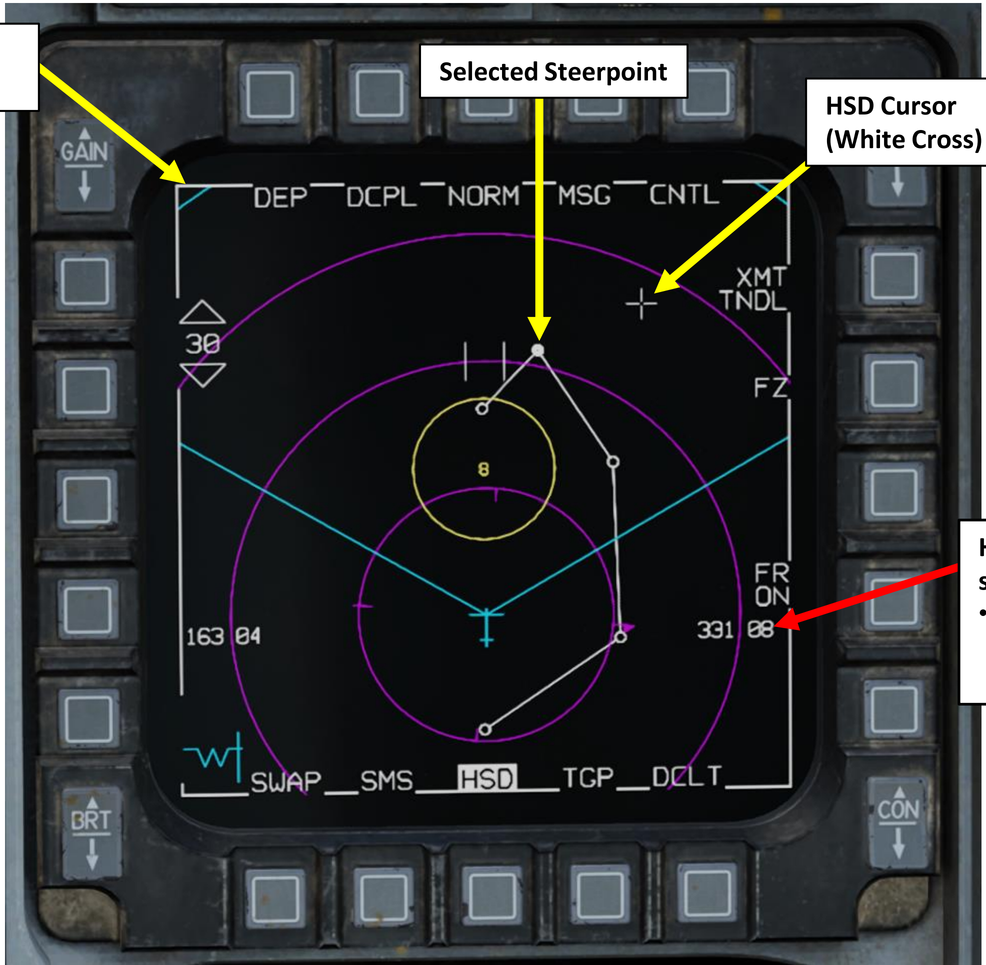
Selected Steerpoint

DMS (Display Management Switch)

Sensor of Interest (SOI) Box

Selected Steerpoint

HSD Cursor (White Cross)



HSD Cursor Bearing & Range (nm) from the currently selected steerpoint to the HSD cursor.

- Note: If Bullseye is enabled on the BULL DED page, this data field will display the bearing and range from the Bullseye point to the HSD cursor.

2 – HSD (HORIZONTAL SITUATION DISPLAY) HSD Main Page

Current zoom level on the HSD
- NORM (normal view)
- EXP1 (area around your aircraft is expanded
- EXP2 (area around your aircraft is expanded further)

View Coupled (CPL) or De-coupled (DCPL) from FCR (Fire Control Radar) Range

Displays Datalink Free Text Messages (MSG)

HSD CNTL (Control) Page

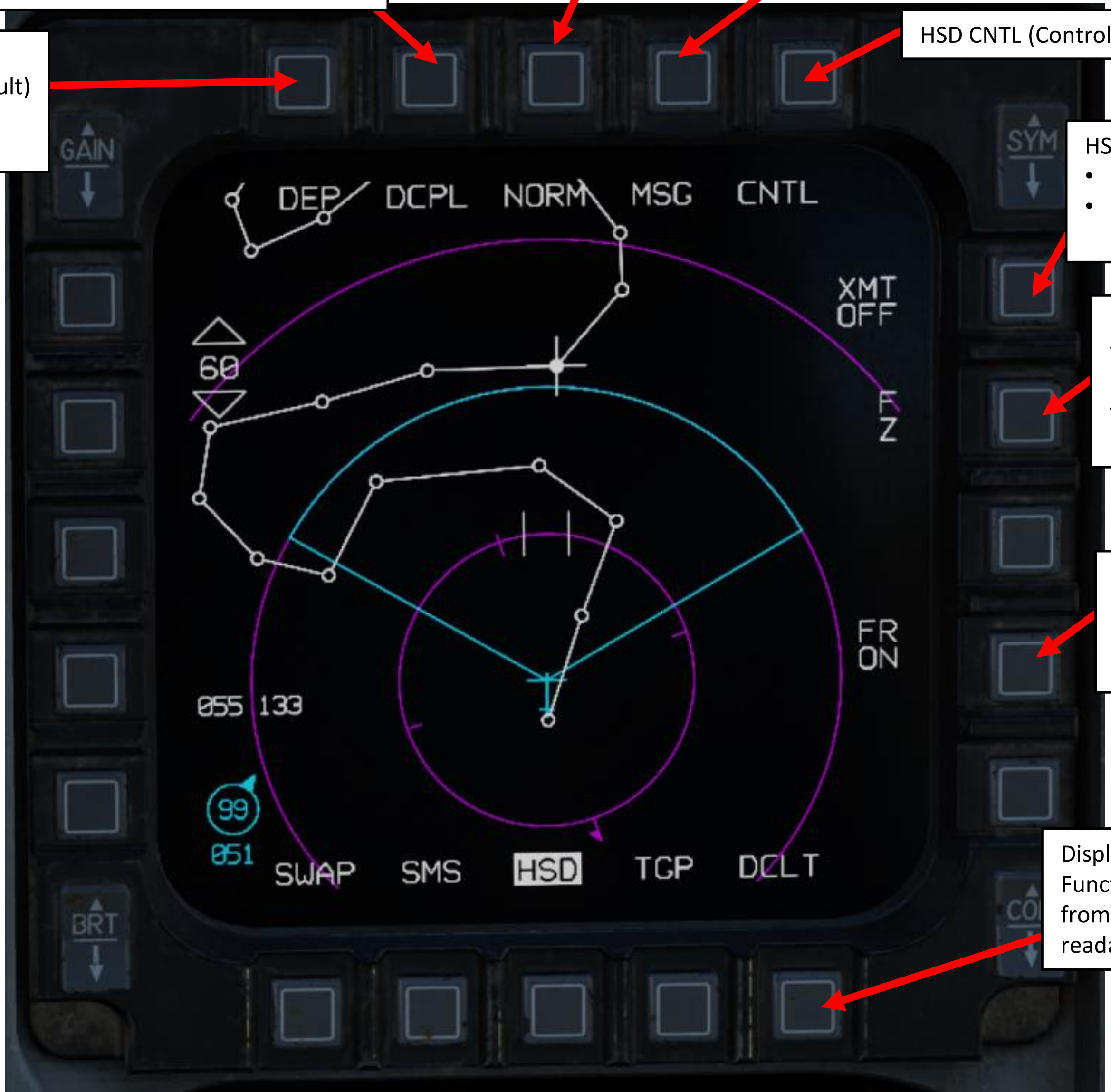
View Position of HSD
- DEP: Depressed (Default) Position
- CEN: Centered Position

HSD Datalink XMT (Transmit) Option
- OFF
- TNDL (Tactical Network Datalink, formerly referred as “L16” in earlier DCS versions)

HSD FZ (Freeze) Function. HSD will freeze in its current position, and will not turn with your aircraft or reposition itself to keep you centered.

HSD Datalink Contact Filter
- FR ON: All Friendly Contacts
- FL ON: Flight Leaders Only
- FR OFF: Friendly Contacts OFF

Display Declutter (DCLT) Function. Removes information from HSD to make it more readable.



2 – HSD (HORIZONTAL SITUATION DISPLAY) HSD CNTL (Control) Page 1

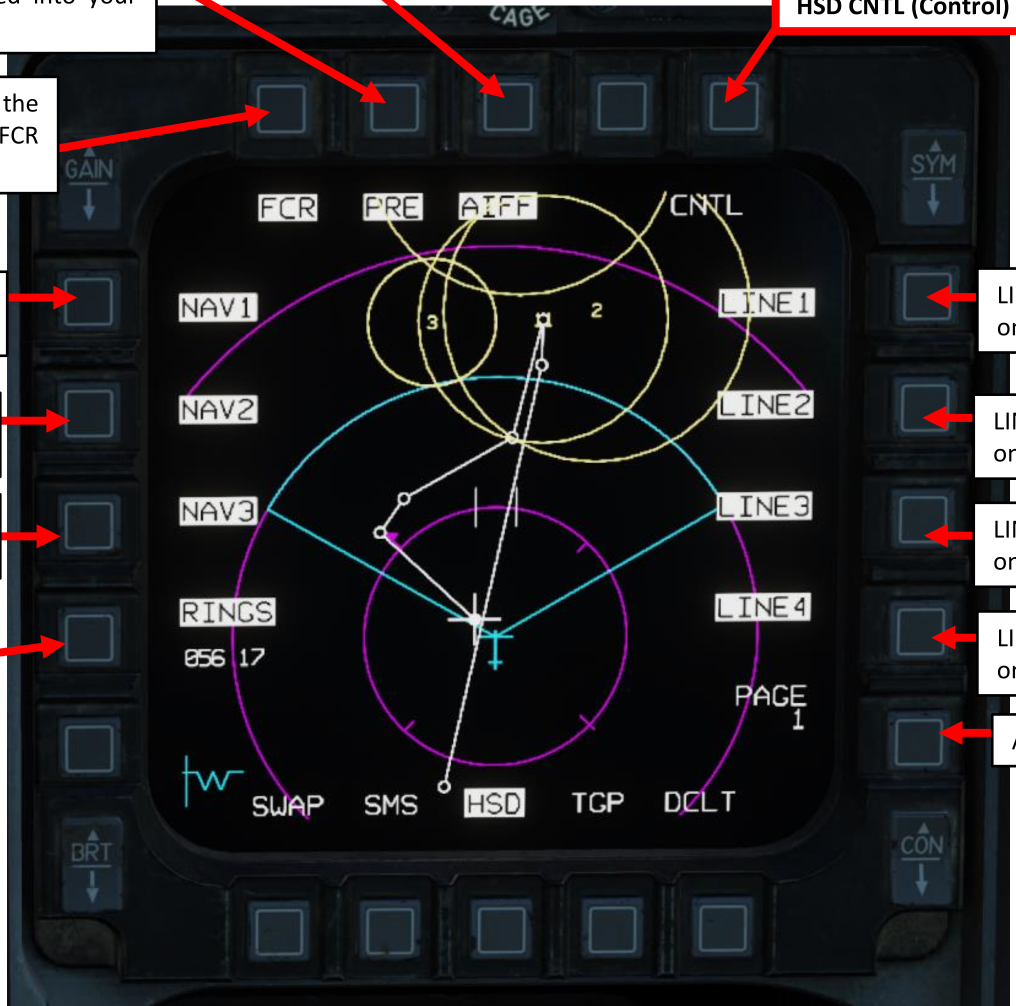
If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

AIFF: Toggles the display of Advanced IFF (Identify-Friend-or-Foe) responses from other aircraft.

PRE (Pre-Programmed): Toggles the display of enemy targets that were programmed into your aircraft's computer before takeoff

FCR: toggles display of the radar scan area and the "ghost" cursor showing the position of your FCR (Fire Control Radar) cursor

HSD CNTL (Control) Sub-Page



NAV1: Toggles the display of your navigational route 1.

NAV2: Toggles the display of your navigational route 2.

NAV3: Toggles the display of your navigational route 3.

RINGS: Toggles the display of range rings around your aircraft.

LINE1: Toggles the display of map information line 1 on the HSD (i.e. Forward Line of Troops).

LINE2: Toggles the display of map information line 2 on the HSD.

LINE3: Toggles the display of map information line 3 on the HSD.

LINE4: Toggles the display of map information line 4 on the HSD.

Access to CNTL Page 2

2 – HSD (HORIZONTAL SITUATION DISPLAY) HSD CNTL (Control) Page 2

If you press on the CNTL (Control) OSB (Option Select Button) of the HSD page, you can configure what kind of data is displayed.

PDLT RNG (Primary Datalink Track Range): HSD range scale automatically increases to maintain the PDLT within the HSD Field of View

REF PT: Not Functional

L16 ENG: Not Functional

HSD CNTL (Control) Sub-Page

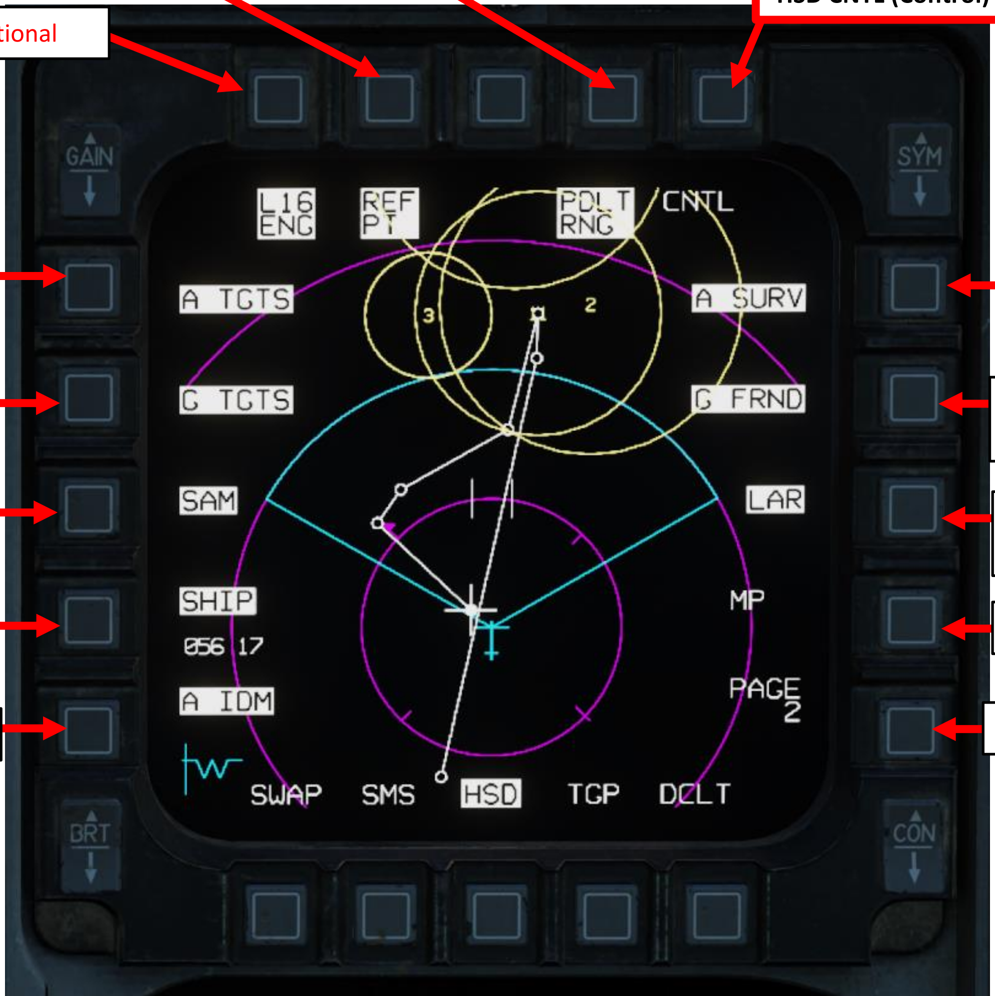
A TGTS: Toggles the display of air threats/targets uploaded to your computer from data link

G TGTS: Toggles the display of ground threats/targets uploaded to your computer from data link

SAM: Toggles the display of SAM (Surface-to-Air Missile) symbols and threat rings

SHIP: Toggles the display of Ship symbols uploaded to your computer from data link

A IDM: Not Functional



A SURV: Toggles the display of surveillance air threats/targets uploaded to your computer from data link

G FRND: Toggles the display of friendly ground units uploaded to your computer from data link

LAR: Toggles Launch Acceptable Range (LAR) Symbology from HSD

MP: Not Functional

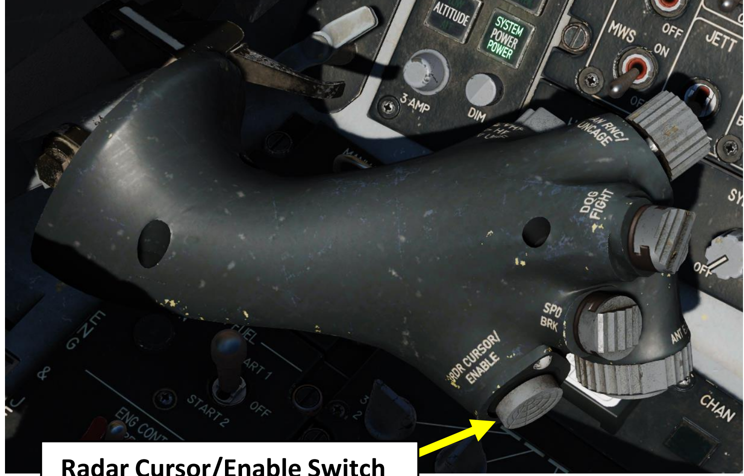
Access to CNTL Page 1

2 – HSD (HORIZONTAL SITUATION DISPLAY) HSD EXPAND FUNCTION

With the HSD selected as our Sensor of Interest (SOI) with DMS (Display Management Switch) DOWN, we can position the HSD Cursor with the Radar Cursor/Enable Switch where we wish to expand the HSD.

We can expand by **either pressing the OSB next to NORM (Current zoom level on the HSD), or pressing the Expand/FOV (Field-of-View) button on the control stick for less than half a second**.

- Expand defaults to the Normal level, with the first press selecting EXP1 for a 2:1 expansion and a second press selects EXP2 for a 4:1 expansion. A third press cycles back to normal with no expansion. The HSD EXP modes are very useful when you have several HSD symbols close together.

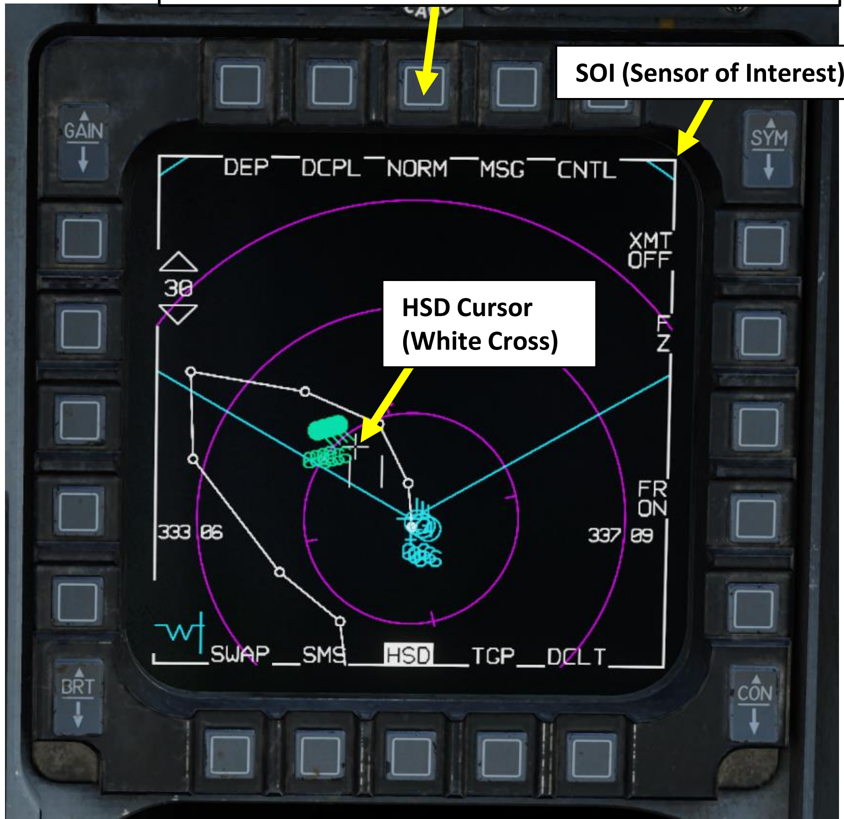


Radar Cursor/Enable Switch
Depress, Multidirectional

Current zoom level on the HSD
- NORM (normal view)
- EXP1 (area around your aircraft is expanded
- EXP2 (area around your aircraft is expanded further)

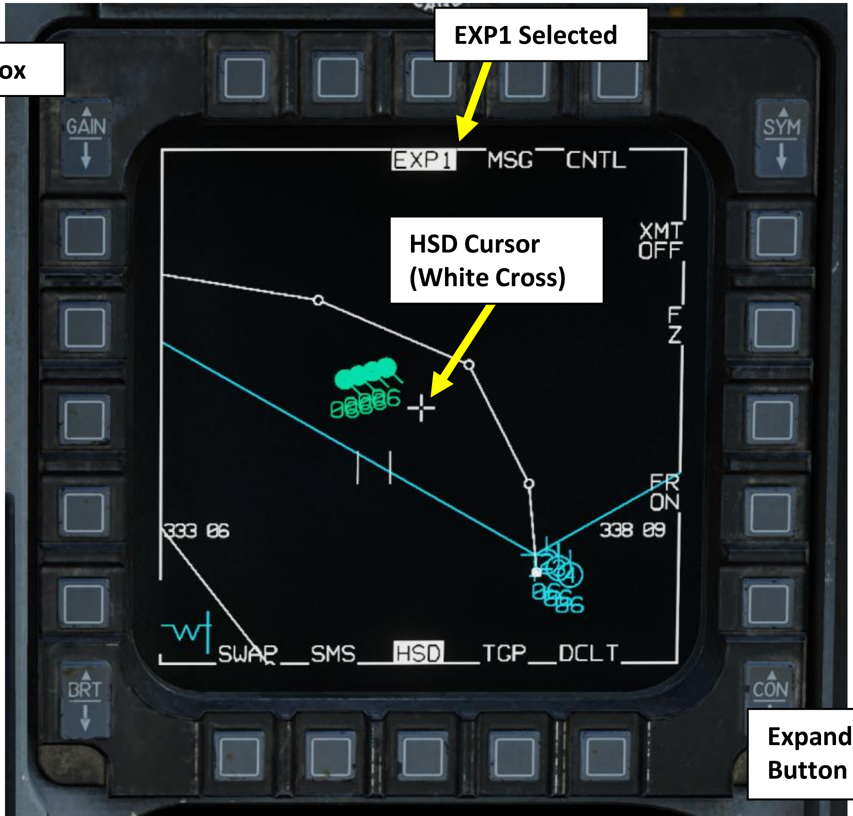
SOI (Sensor of Interest) Box

HSD Cursor (White Cross)



EXP1 Selected

HSD Cursor (White Cross)



DMS (Display Management Switch)

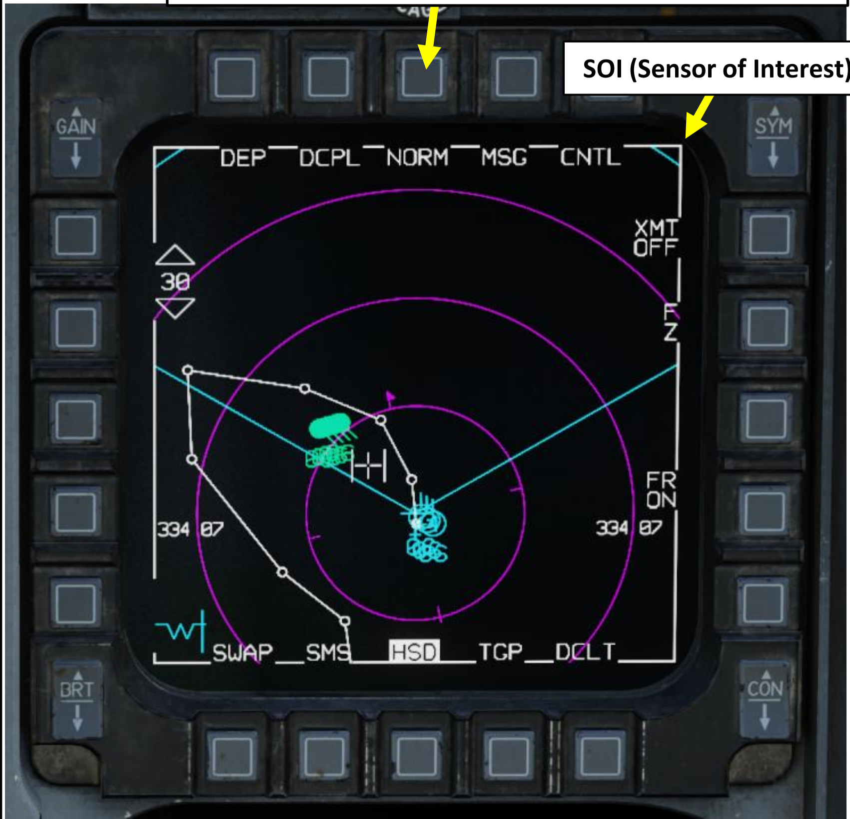
Expand/FOV (Field-of-View) Button

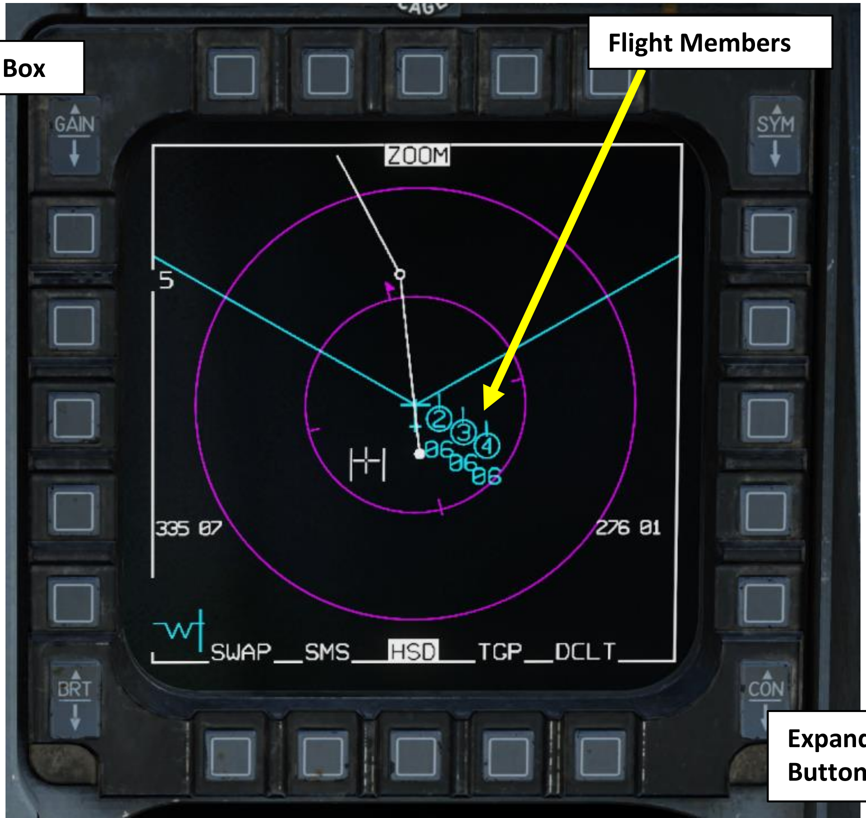
2 – HSD (HORIZONTAL SITUATION DISPLAY) HSD EXPAND FUNCTION

If you **press and hold the OSB next to NORM (Current zoom level on the HSD)** or the **Expand/FOV (Field-of-View) button** on the stick for **greater than half a second**, the HSD goes into **Zoom mode**, as indicated by the flashing Zoom label at the top of the HSD.

- If you have flight members that are part of your datalink network, the HSD will select the smallest range to display all flight members. This can be as low as a 5 nm range, and it is useful to quickly understand where all flight members are in relation to you. If there are no flight members, the HSD will be set to 5 nm around your aircraft.

Current zoom level on the HSD
- NORM (normal view)
- EXP1 (area around your aircraft is expanded
- EXP2 (area around your aircraft is expanded further)

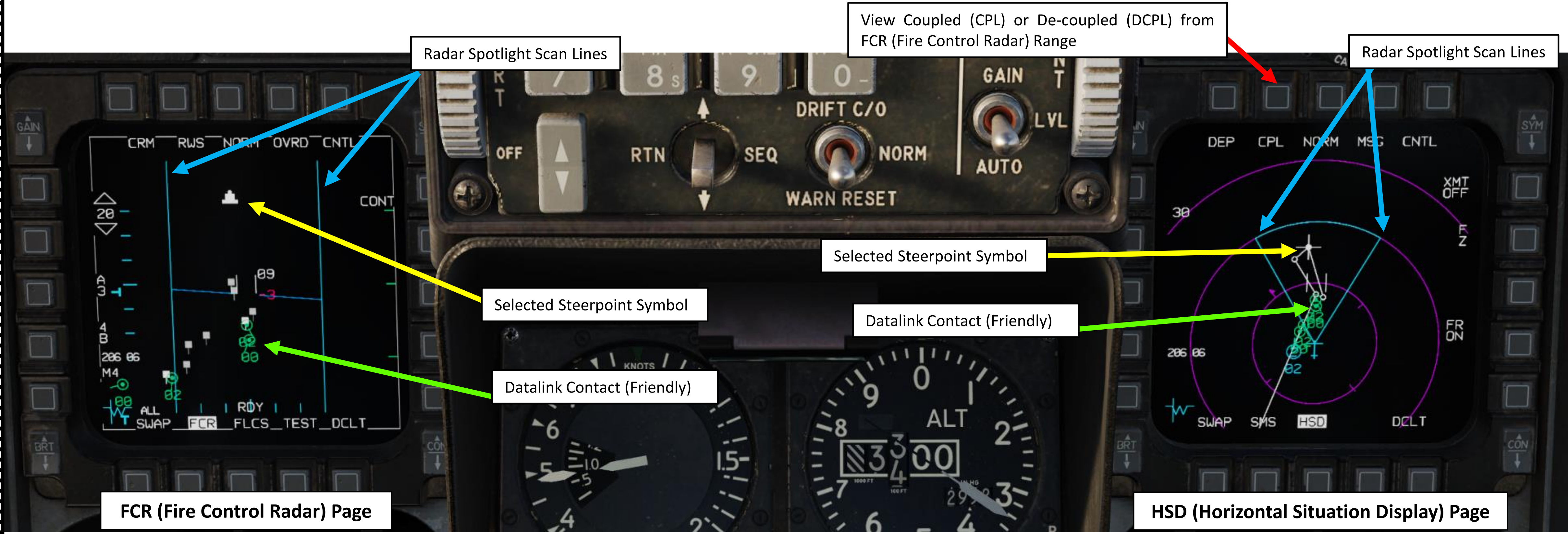




2 – HSD (HORIZONTAL SITUATION DISPLAY)
HSD & FCR (FIRE CONTROL RADAR) COUPLING

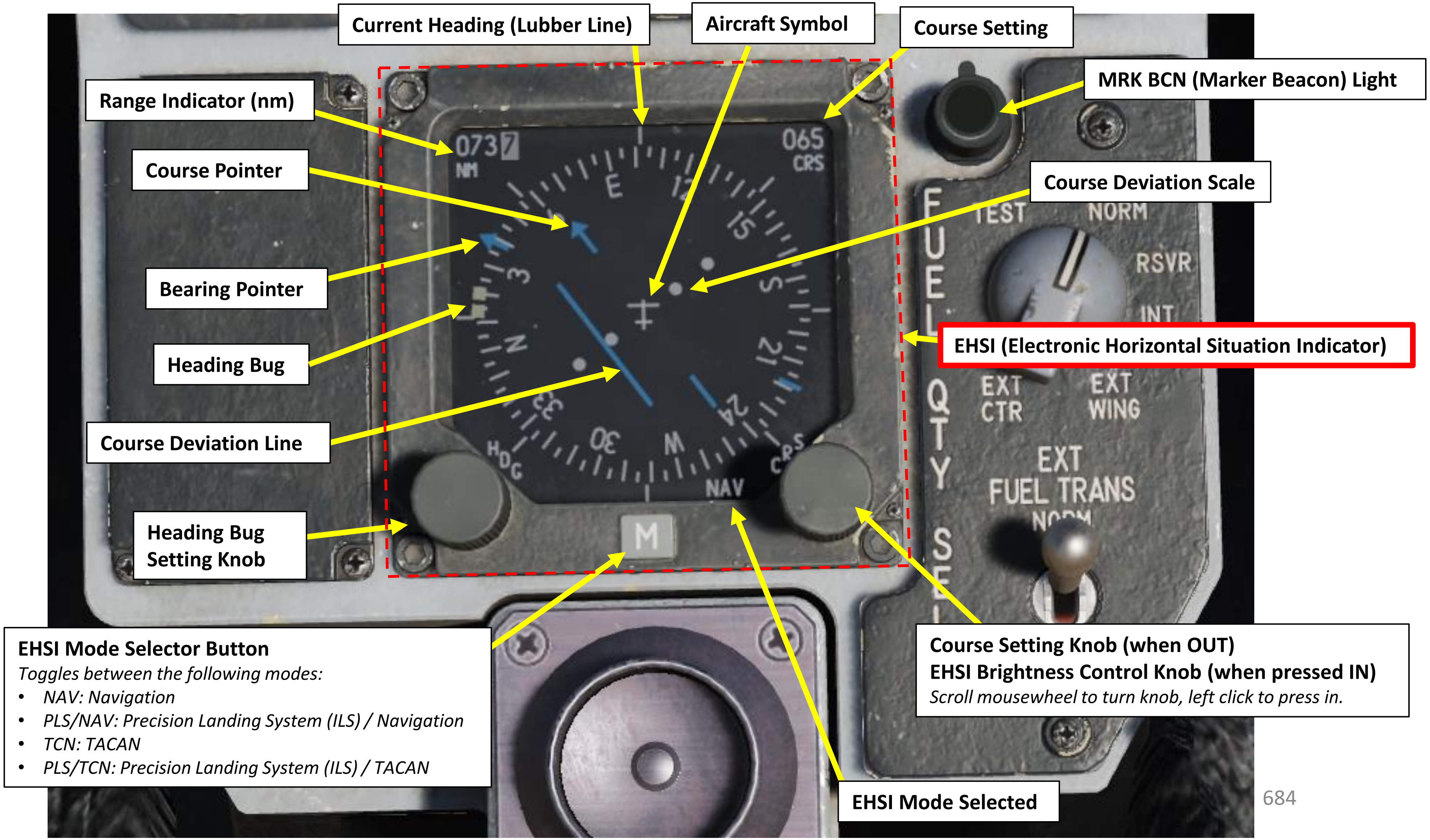
An interesting feature of the F-16 is how seamlessly integrated the Fire Control Radar page and the Horizontal Situation Display page are. For instance, Datalink symbology and selected steerpoint information is available on both pages. Also, radar spotlight scan lines are visible on both pages, but in a slightly different form.

You can couple (CPL) or de-couple (DCPL) HSD view from the Fire Control Radar as desired. To toggle the coupling mode, press the OSB (Option Select Button) next to CPL/DCPL. This coupling feature allows you to change the FCR range, and then automatically scale the HSD accordingly. This way, you do not need to change the scale on each display individually, which reduces your workload significantly in a target-rich environment.



3 – EHSI (ELECTRONIC HORIZONTAL SITUATION INDICATOR)

The EHSI is your primary gauge to assist in navigation to steerpoints and TACAN beacons. While you will likely be using HUD symbology for most of your navigation purposes, a firm understanding of the EHSI is necessary for access to additional navigation data that is not present on the HUD or DED displays, and in case of battle damage.

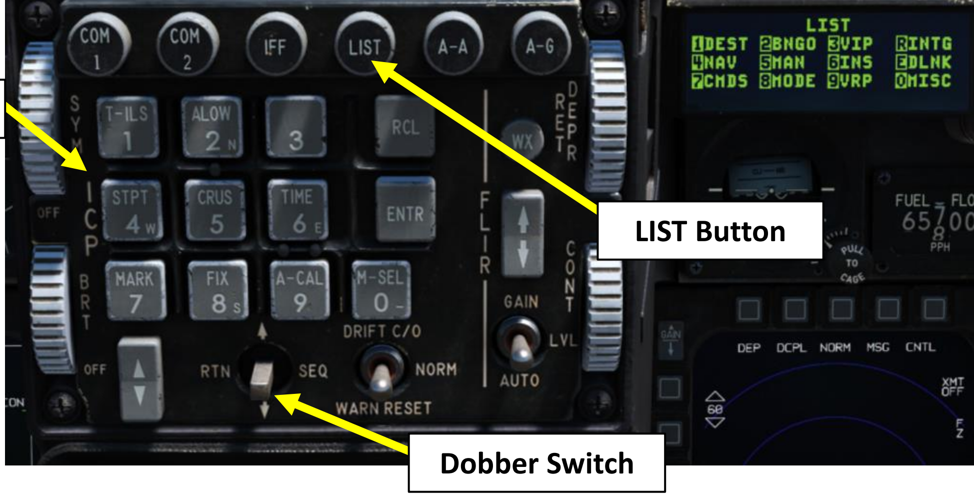


4 – NAVIGATION POINT TYPES

These are the available Navigation Point types used in the F-16:

- **Steerpoints**
    - Steerpoints (or Waypoints) are pre-planned navigational points of reference for you to follow on route to your area of operation. You can create new ones, edit their coordinates and create flight plans with them.
- **Markpoints**
    - Markpoints are used to "mark" a point of interest, whether flying over an interesting area or an enemy sighting.
- **Anchor Point / Bullseye**
    - Also referred to as a “Bullseye”, an anchor point serves as a common geographic reference for a mission amongst friendly forces.

5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.1 – Steerpoint Database



The F-16 can store up to 99 steerpoints. However, certain steerpoint numbers have a specific use (see Steerpoint Database table).

INS (Inertial Navigation System) related DED (Data Entry Display) pages include:

- The **STPT** (Steerpoint) page, which gives the pilot information about the INS steerpoint. It allows you to edit steerpoint coordinates.
  - Access this page by pressing STPT (4) button on the ICP (*CNI page must be selected beforehand with the Dobber switch pressed LEFT to RTN*).
- The **DEST** (Destination) page, which is similar to the STPT page. However, you can change any steerpoint coordinates without affecting the HSD.
  - Access DEST page by pressing LIST button, then “1” button on the ICP.
  - UTM page is selected first. Selecting Dobber switch RIGHT (SEQ) goes to DIR page. OA1/2 sub-page is used to create Offset Aimpoints and is accessed from DEST DIR page by selecting Dobber switch RIGHT (SEQ).
- The **BULLSEYE** page, which gives you information about the steerpoint selected for the Bullseye (Anchor Point).
  - Access this page by pressing LIST button, then “0” button on the ICP (MISC page), then “8” to select BULL menu.

STPT DED Page

STEERPOINT DATABASE

Steerpoint #	Function
1 to 24	Reserved for Navigation Route / general flight planning
25	Reserved for Bullseye (automatically assigned)
26 to 30	Reserved for Ownship Markpoints
31 to 54	Reserved for HSD lines (4 lines with up to 6 points in each line)
56 to 70	Reserved for Pre-planned threats
71 to 80	Reserved for Datalink Markpoints
81 to 89	Open (not used, but available to store coordinates as desired by the pilot)
90 to 99	Used for AGM-84 HARPOON Anti-Ship Missiles in certain F-16 Blocks, but in the Block 50 these steerpoints are open (not used, but available to store coordinates as desired by the pilot).

DEST UTM DED Page

Dobber RIGHT (SEQ)

DEST DIR DED Page

Dobber RIGHT (SEQ)

DEST OA1/2 DED Page

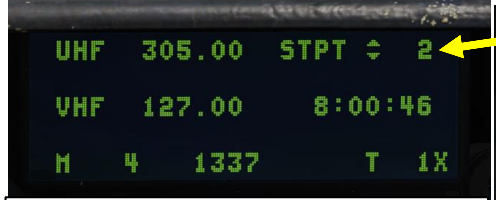
BULLSEYE DED Page

5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.2 – Manual vs Auto Sequencing

When following a flight plan and reaching the steerpoint you have currently selected, "sequencing" modes determine whether you need to manually select the next steerpoint with the DED Increment/Decrement Switch (MAN Sequencing) or if the navigation computer will automatically select the next steerpoint in your flight plan (AUTO Sequencing). Take note that **automatic sequencing is only available for steerpoints 1 to 20.**

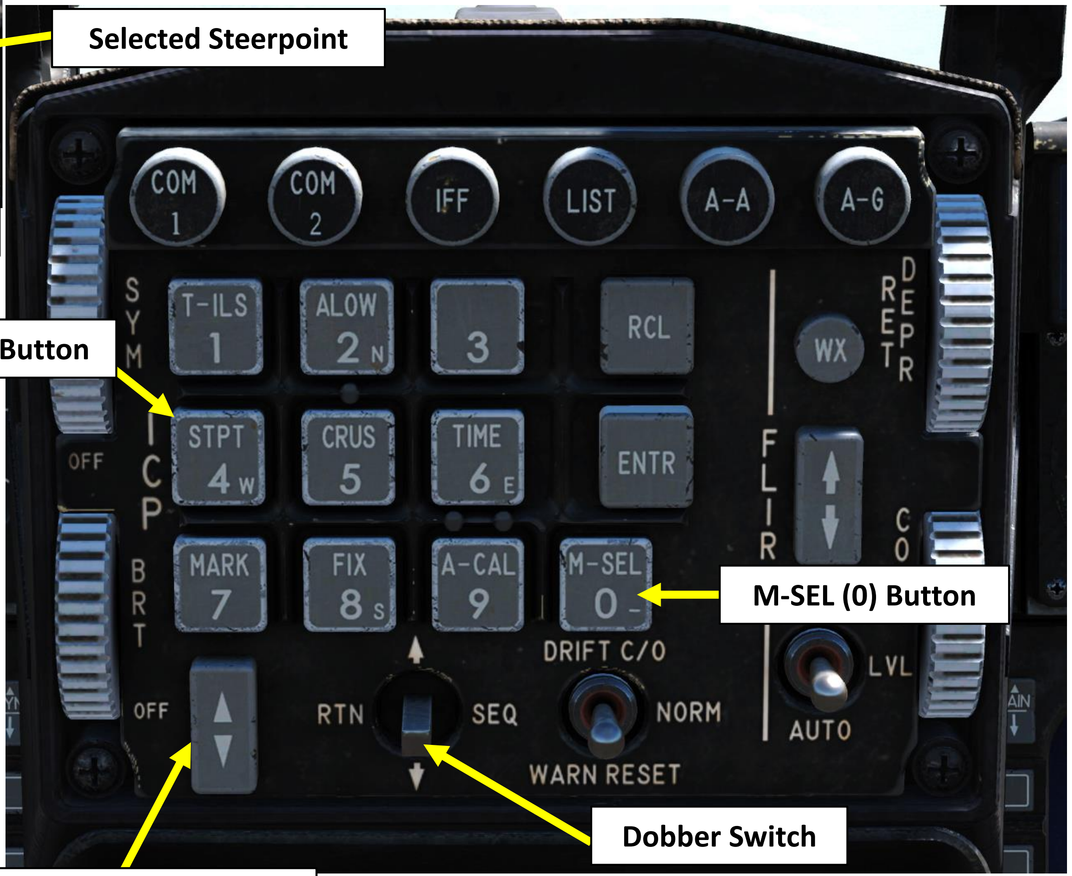
To select Automatic or Manual Steerpoint Sequencing:

1. CNI (Communication, Navigation & Information) page must be selected beforehand (**Dobber switch pressed LEFT to RTN**)
2. Access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel).
3. Press the **Dobber Switch DOWN to select the MAN/AUTO data field.**
4. Press the **M-SEL (0) button** to toggle between MANUAL and AUTOMATIC Steerpoint Sequencing modes.



CNI DED Page

Selected Steerpoint



STPT (4) Button

M-SEL (0) Button

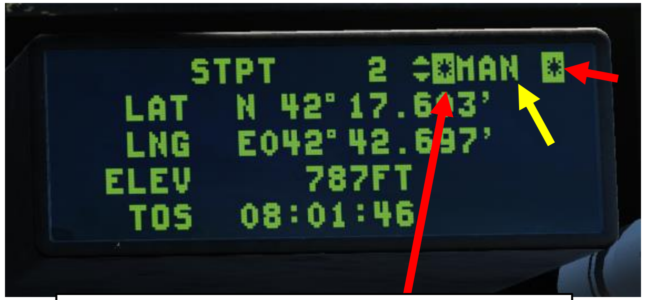
Dobber Switch

DED Increment/Decrement Switch

Selected Steerpoint

You

STPT DED Page
Manual Steerpoint Sequencing

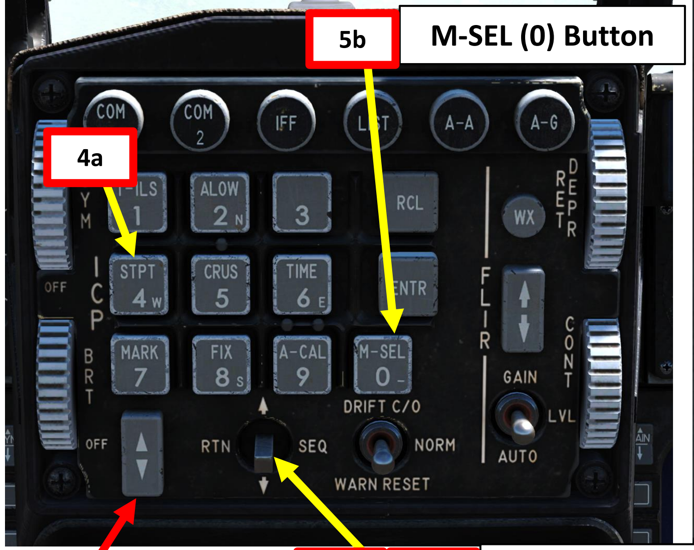


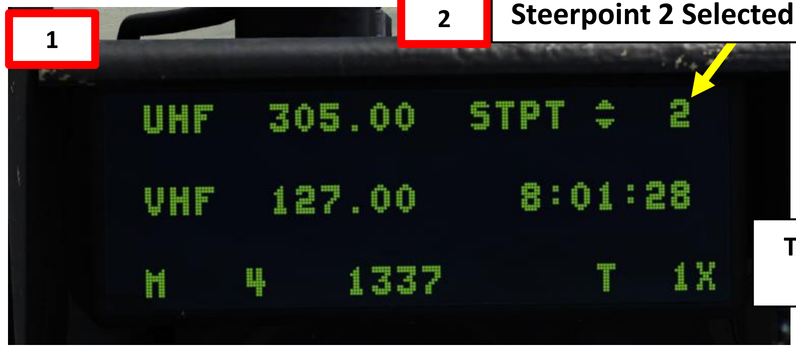
MAN/AUTO Data Field Selected

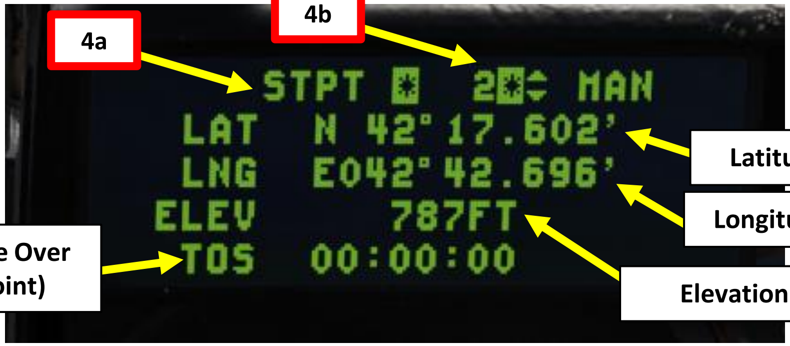
STPT DED Page
Automatic Steerpoint Sequencing

5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

1. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
2. Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 2.
    - *Alternatively, you can also select a steerpoint by pressing "STPT (4)" button on the ICP, entering the Steerpoint Number (i.e. "2" button for Steerpoint 2), then pressing "ENTR" button.*
3. Selected steerpoint will be visible on your HSD (Horizontal Situation Display) as a white circle
4. If you want to see steerpoint 2 coordinates, access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel). Then, use DED Increment/Decrement Switch to select steerpoint 2.
5. Select Manual or Automatic Sequencing as desired. This is done by pressing the **Dobber Switch DOWN to select the MAN/AUTO data field, then** pressing the **M-SEL (0) button** to toggle between MANUAL and AUTOMATIC Steerpoint Sequencing modes.

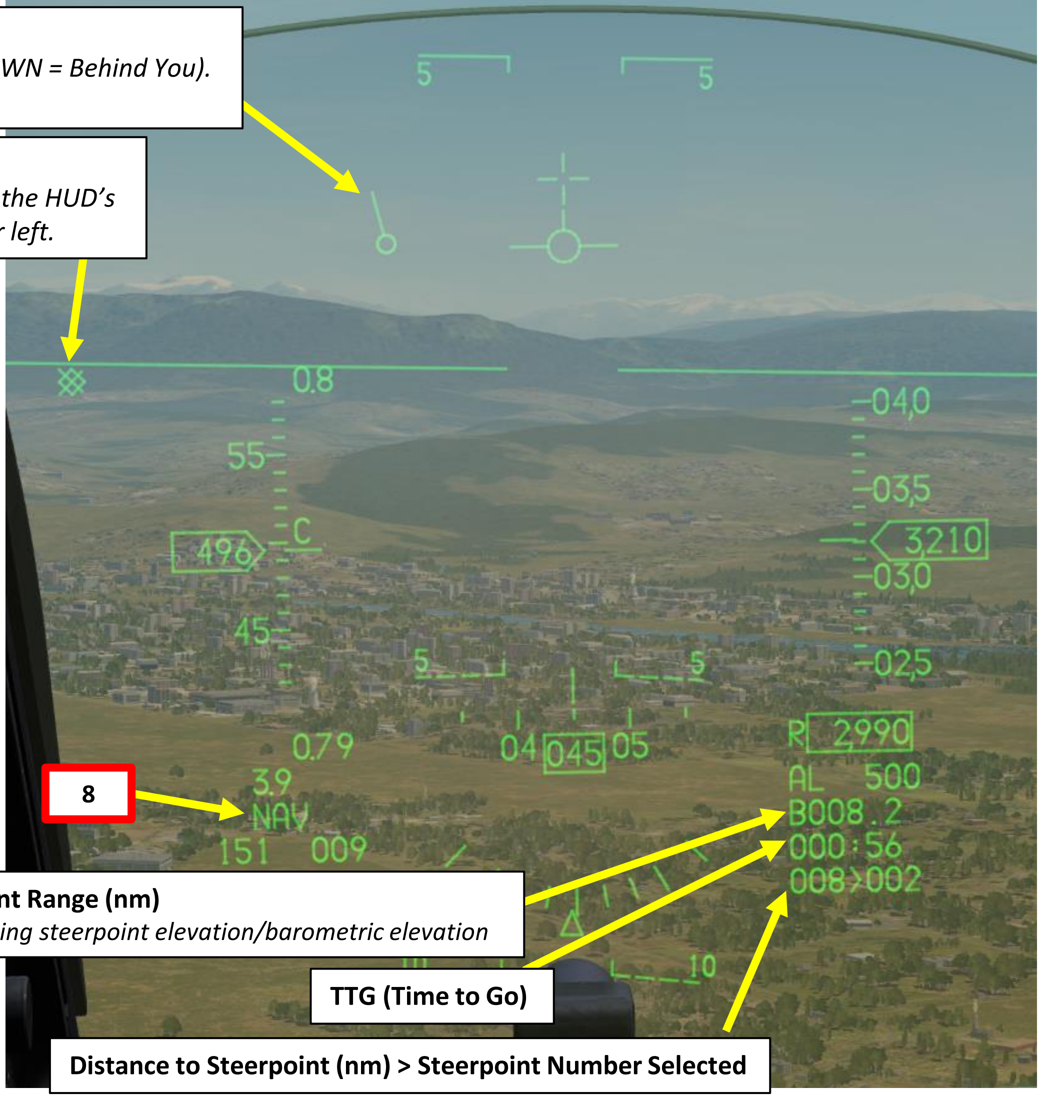






5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

6. Set EHSI (Electronic Horizontal Situation Indicator) Navigation Mode to NAV by pressing the "M" (EHSI Mode Selector) button to toggle between modes.
7. If you want to intercept the steerpoint from a specific direction, set desired course using the CRS knob. In our case, we will leave the intercept course to 000.
8. Verify that NAV Master Mode is selected on the Heads-Up Display (HUD). If either A-A or A-G mode is selected, pressing their respective ICP button will revert the master mode back to NAV.
9. Direction and range to the Steerpoint are indicated on the HUD. Consult Diamond and Tadpole symbols.
10. Direction and range to the Steerpoint are indicated on the EHSI as well.

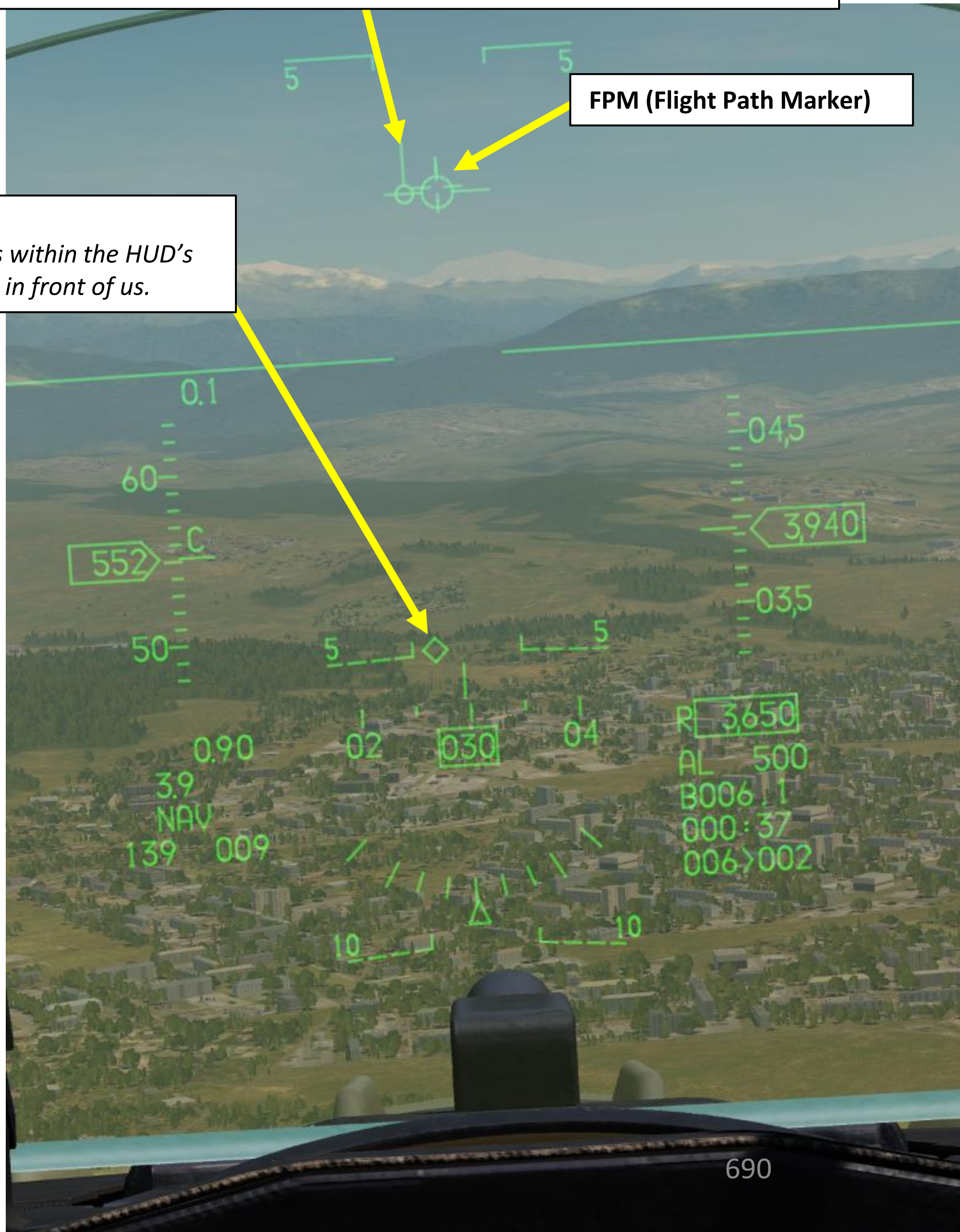


5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

11. Fly towards selected steerpoint by aligning the Steerpoint Tadpole with the FPM (Flight Path Marker). When flying towards the steerpoint, the tadpole should be pointing up and be centered.

Steerpoint Tadpole
Line points towards steerpoint (UP = In Front of You / DOWN = Behind You). Steerpoint is in front of us.

Steerpoint Diamond
Diamond indicates STPT is within the HUD's field of view. Steerpoint is in front of us.



Direction to Steerpoint

5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.3 – Navigation Tutorial

Steerpoint Tadpole Representation

Tadpole pointing to Steerpoint 1

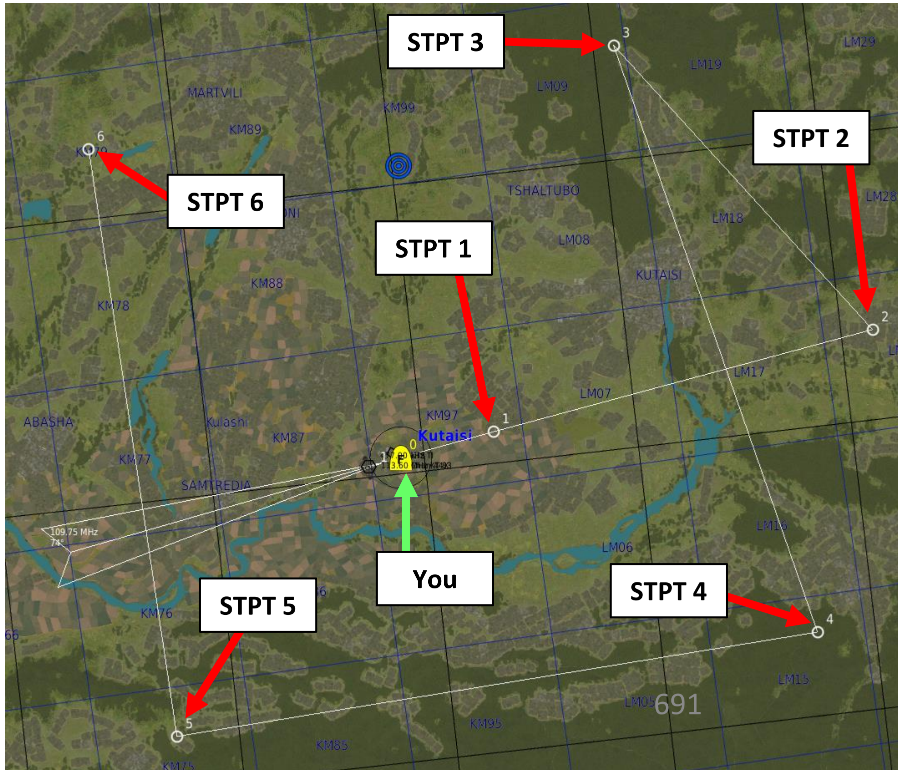
Tadpole pointing to Steerpoint 2

Tadpole pointing to Steerpoint 3

Tadpole pointing to Steerpoint 4

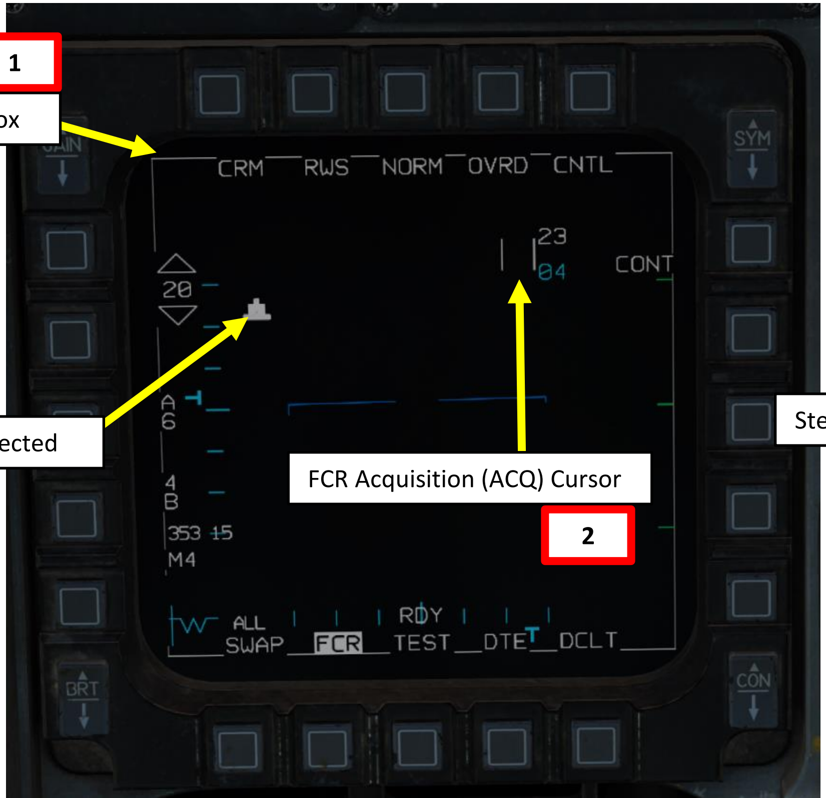
Tadpole pointing to Steerpoint 5

Tadpole pointing to Steerpoint 6



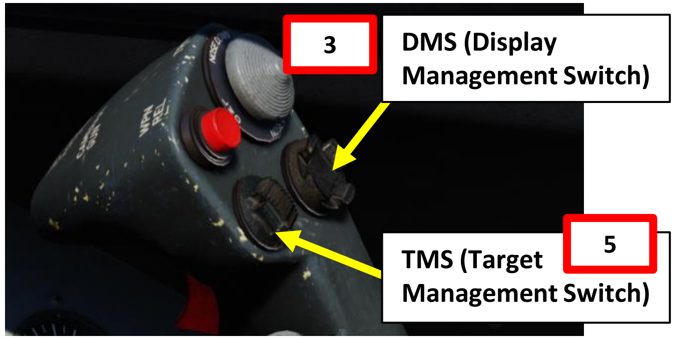
5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.4 – Steerpoint Selection via HSD

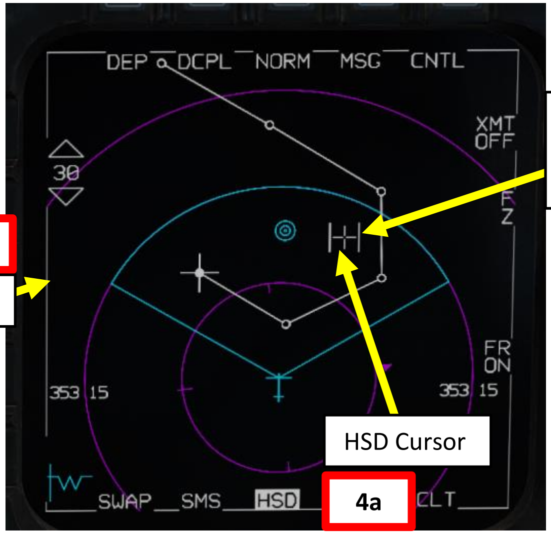
1. Press the DMS (Display Management Switch) DOWN to set the FCR (Fire Control Radar) page as the SOI (Sensor of Interest).
2. Use the Radar Cursor/Enable switch to move the Radar Crosshair, which will also move the FCR Ghost Cursor on the HSD. Place the FCR Ghost Cursor in the area near the steerpoint you want to select.



5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.4 – Steerpoint Selection via HSD

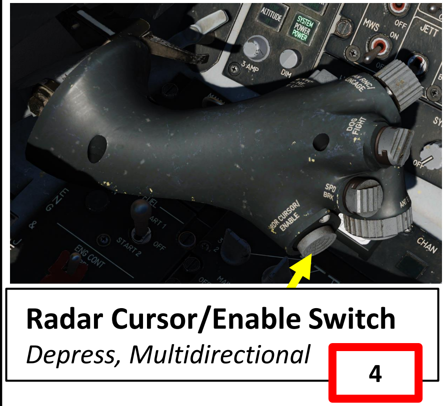
3. Press the DMS (Display Management Switch) DOWN to set the HSD (Horizontal Situation Display) page as the SOI (Sensor of Interest).
4. Use the Radar Cursor/Enable switch to move the HSD cursor (smaller cross within the FCR Ghost Cursor on the HSD) over the steerpoint symbol you want to select.
5. Press TMS (Target Management Switch) UP to select steerpoint.
6. Selected steerpoint will be visible on your HSD (Horizontal Situation Display) as a white circle.





3

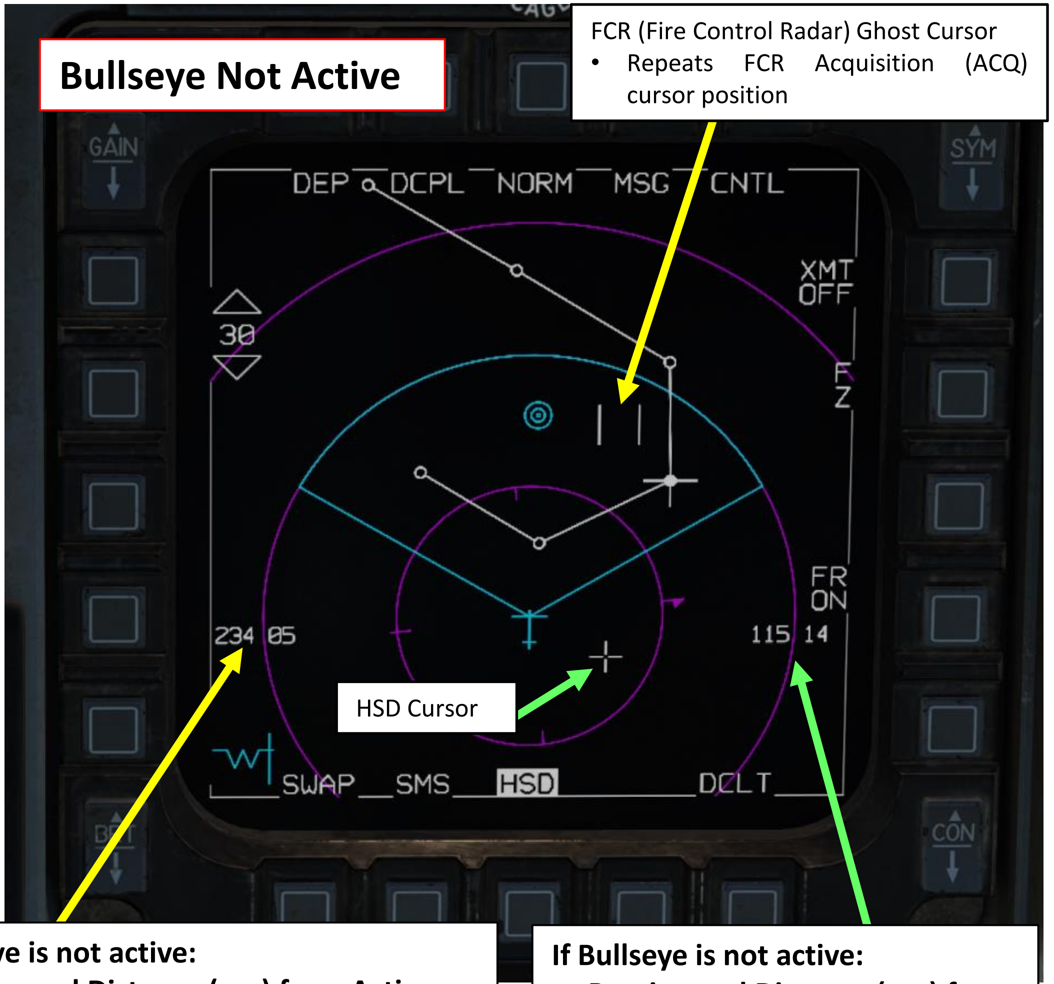
SOI (Sensor of Interest) Box



5 – STEERPOINTS
5.1 – Steerpoint Navigation
5.1.4 – Steerpoint Selection via HSD

Bullseye Not Active

FCR (Fire Control Radar) Ghost Cursor
- Repeats FCR Acquisition (ACQ) cursor position

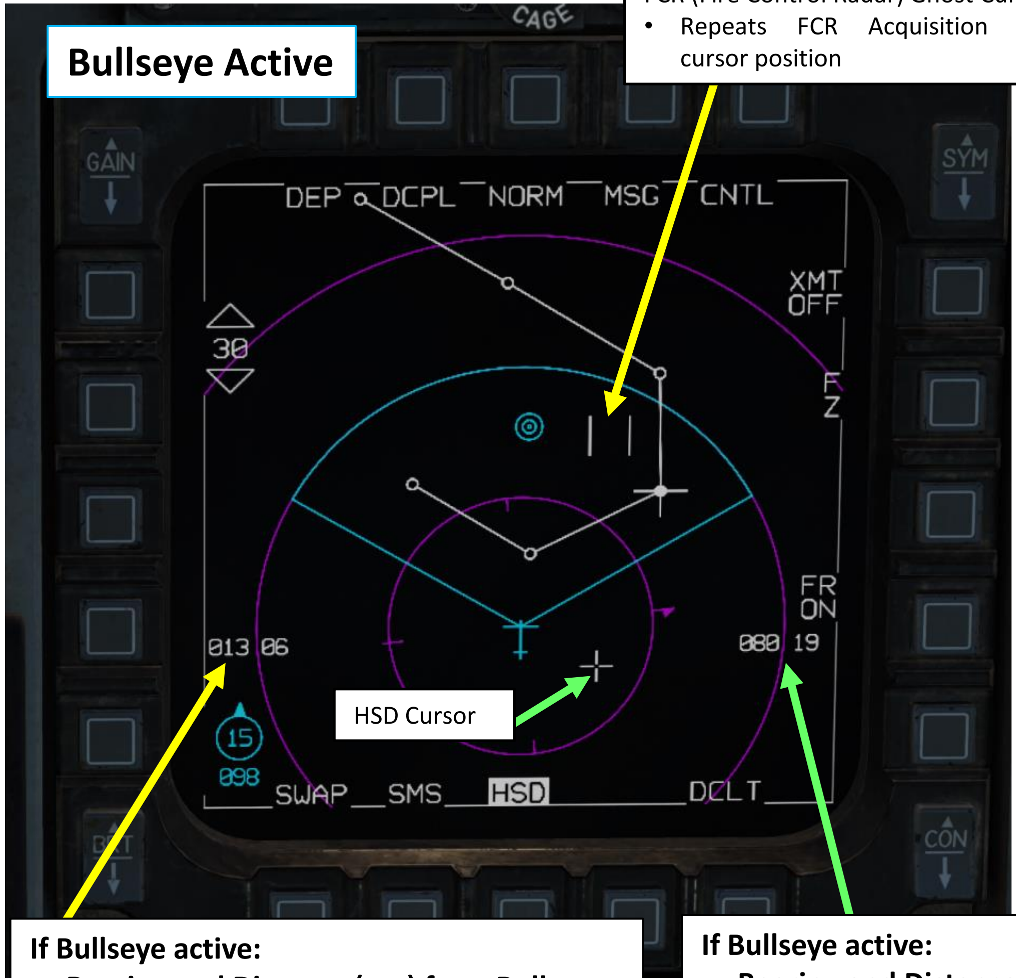


If Bullseye is not active:
- **Bearing and Distance (nm) from Active Steerpoint to Acquisition (ACQ) Cursor**

If Bullseye is not active:
- **Bearing and Distance (nm) from Active Steerpoint to HSD Cursor**

Bullseye Active

FCR (Fire Control Radar) Ghost Cursor
- Repeats FCR Acquisition (ACQ) cursor position



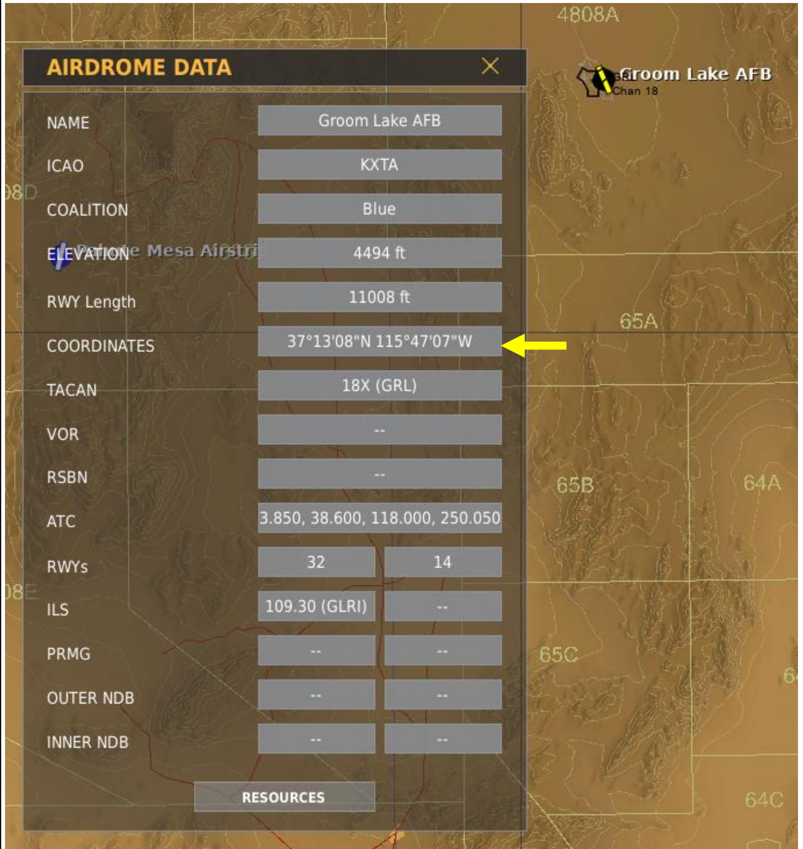
If Bullseye active:
- **Bearing and Distance (nm) from Bullseye to Acquisition (ACQ) Cursor**

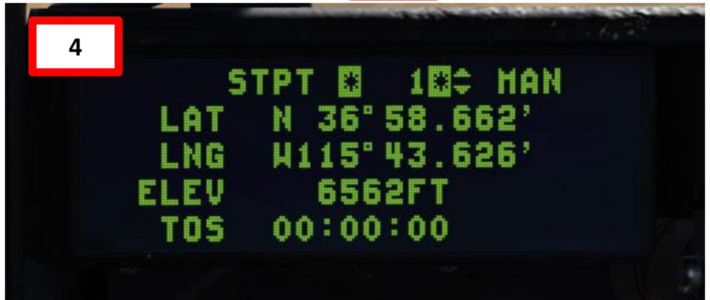
If Bullseye active:
- **Bearing and Distance (nm) from Bullseye to HSD Cursor**

5 – STEERPOINTS
5.2 – How To Add Steerpoints

Take note that the **F-16 takes coordinates in Degrees, minutes, decimal minutes**. By default, map coordinates are given in Degrees, minutes, seconds. To change coordinate format on the F10 map, use “LALT+Y”.

1. We will add the coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
    - **37°13’08’’ North 115°47’07’’ West (Deg, minutes, seconds)**
    - **37°13.133’ North 115°47.116’ West (Deg, minutes, decimal minutes)**
    - **Elevation 4494 ft**
2. Our current flight plan has four steerpoints. We will add a fifth one (STPT #5).
3. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
4. Access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel).





5 – STEERPOINTS
5.2 – How To Add Steerpoints

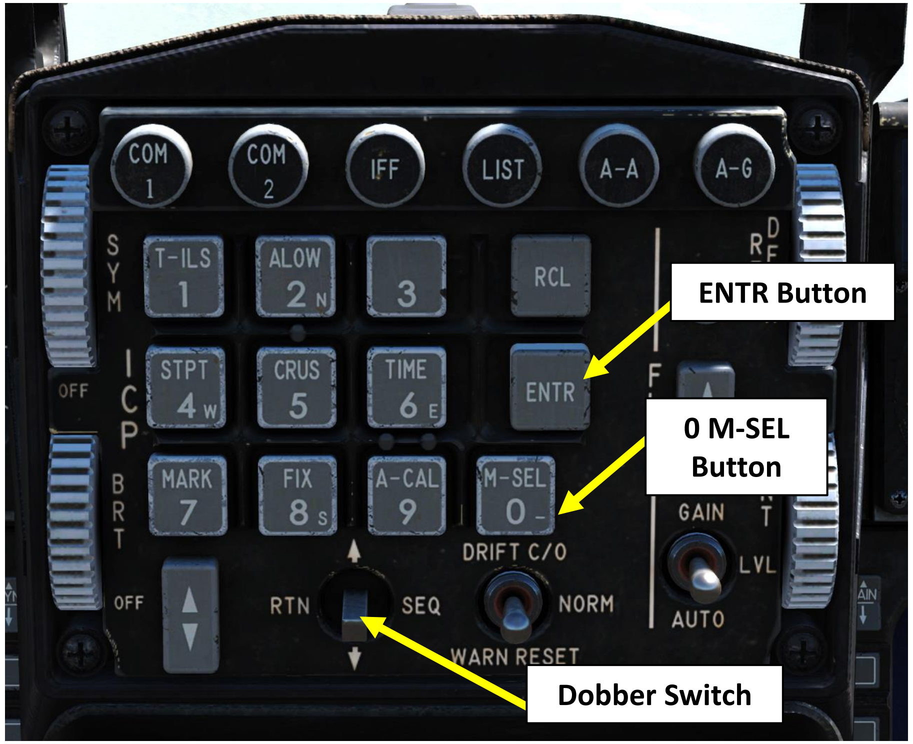
- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - **37°13'08'' North 115°47'07'' West (Deg, minutes, seconds)**
  - **37°13.133' North 115°47.116' West (Deg, minutes, decimal minutes)**
  - **Elevation 4494 ft**

5. Select Steerpoint by entering the Steerpoint Number (i.e. "5" button for Steerpoint 5), then pressing "ENTR" button. Alternatively, you can also use DED Increment/Decrement Switch to select steerpoint 5.
6. Press the Dobber Switch DOWN to select the LAT (LATITUDE) field. The "*" symbols next to LAT indicate that the LATITUDE field is selected.
7. If coordinate latitude is North, press ***"2" (N)*** on the ICP. If coordinate latitude is South, press "8" (S).
8. Enter the latitude of the new steerpoint using the ICP keypad (***3713133***).
9. Press "ENTR" button on the ICP (Integrated Control Panel) to enter/confirm LATITUDE coordinates.
10. Press the Dobber Switch DOWN to select the LNG (LONGITUDE) field. The "*" symbols next to LNG indicate that the LONGITUDE field is selected.
11. If coordinate longitude is West, press ***"4" (W)*** on the ICP. If coordinate longitude is East, press "6" (E).
12. Enter the longitude of the new steerpoint using the ICP keypad (***11547116***).
13. Press "ENTR" button on the ICP (Integrated Control Panel) to enter/confirm LONGITUDE coordinates.

5 – STEERPOINTS
5.2 – How To Add Steerpoints

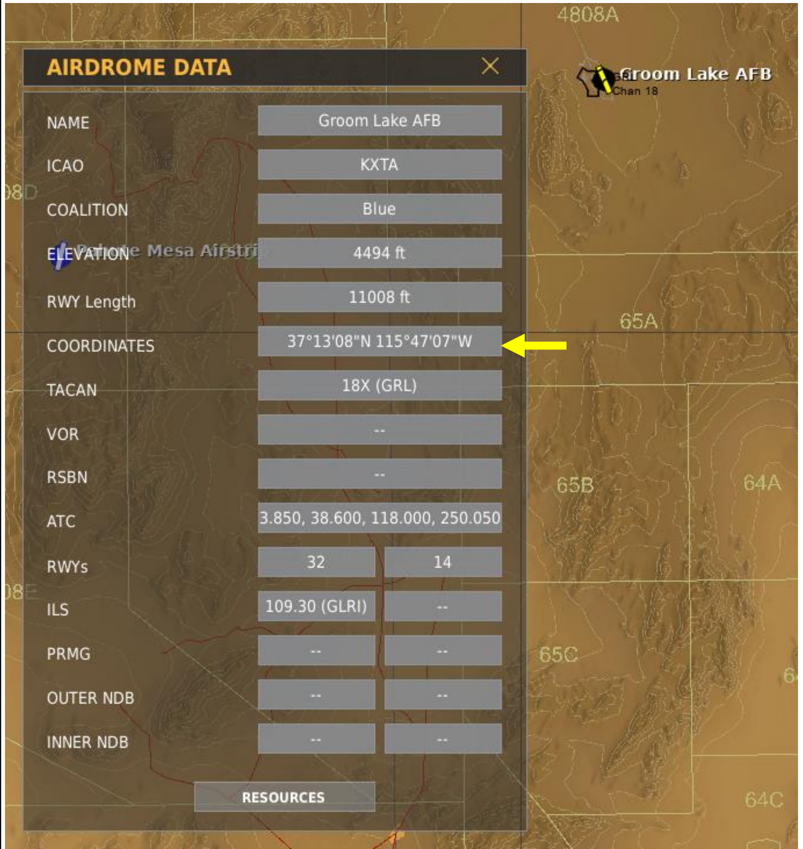
- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - **37°13’08’’ North 115°47’07’’ West (Deg, minutes, seconds)**
  - **37°13.133’ North 115°47.116’ West (Deg, minutes, decimal minutes)**
  - **Elevation 4494 ft**

14. Press the Dobber Switch DOWN to select the ELEV (Elevation) field. The “ * ” symbols next to ELEV indicate that the ELEVATION field is selected.
15. If steerpoint elevation is negative, press ***“0 M-SEL” (-)*** on the ICP. Otherwise, no action is required.
16. Enter the elevation of the new steerpoint using the ICP keypad (***4494***).
17. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm ELEVATION (in feet).
18. New steerpoint #5 should now be visible and selected on your HUD and HSD.



5 – STEERPOINTS
5.3 – How To Edit Steerpoints

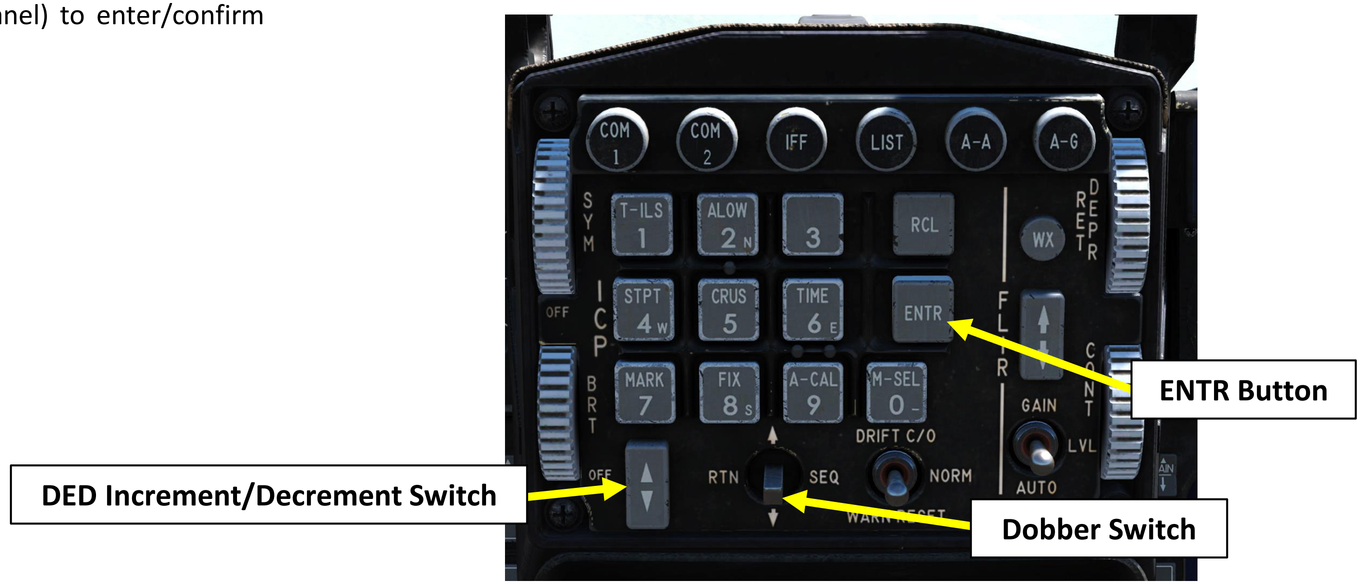
1. We will edit the coordinates of an existing Steerpoint 5 (Deg, minutes, decimal minutes) to the coordinates for Groom Lake AFB, which are:
    - **37°13’08’’ North 115°47’07’’ West (Deg, minutes, seconds)**
    - **37°13.133’ North 115°47.116’ West (Deg, minutes, decimal minutes)**
    - **Elevation 4494 ft**
2. Our current flight plan has five steerpoints. We will edit the fifth one (STPT #5).
3. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
4. Access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel).
5. Select Steerpoint 5 (the one that we want to edit) by entering the Steerpoint Number (i.e. “5” button for Steerpoint 5), then pressing “ENTR” button. Alternatively, you can also use DED Increment/Decrement Switch to select steerpoint 5.



5 – STEERPOINTS
5.3 – How To Edit Steerpoints

- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
    - **37°13’08’’ North 115°47’07’’ West (Deg, minutes, seconds)**
    - **37°13.133’ North 115°47.116’ West (Deg, minutes, decimal minutes)**
    - **Elevation 4494 ft**

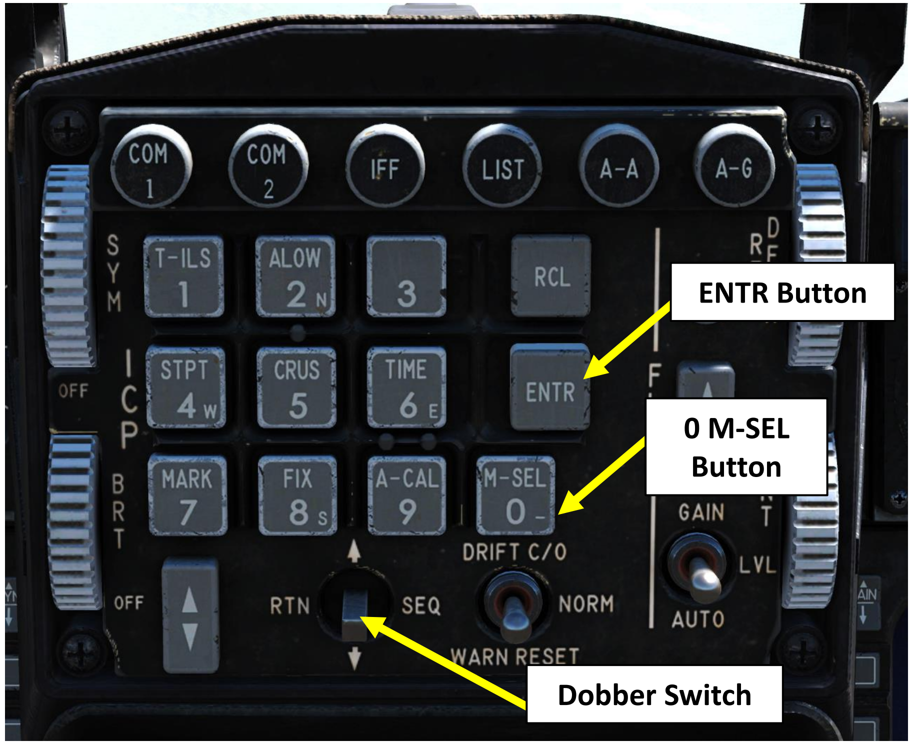
6. Press the Dobber Switch DOWN to select the LAT (LATITUDE) field. The “*” symbols next to LAT indicate that the LATITUDE field is selected.
7. If coordinate latitude is North, press *“2” (N)* on the ICP. If coordinate latitude is South, press “8” (S).
8. Enter the new latitude of the existing steerpoint using the ICP keypad (*3713133*).
9. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LATITUDE coordinates.
10. Press the Dobber Switch DOWN to select the LNG (LONGITUDE) field. The “*” symbols next to LNG indicate that the LONGITUDE field is selected.
11. If coordinate longitude is West, press *“4” (W)* on the ICP. If coordinate longitude is East, press “6” (E).
12. Enter the new longitude of the existing steerpoint using the ICP keypad (*11547116*).
13. Press “ENTR” button on the ICP (Integrated Control Panel) to enter/confirm LONGITUDE coordinates.



5 – STEERPOINTS
5.3 – How To Edit Steerpoints

- Coordinates (Deg, minutes, decimal minutes) for Groom Lake AFB:
  - **37°13'08'' North 115°47'07'' West (Deg, minutes, seconds)**
  - **37°13.133' North 115°47.116' West (Deg, minutes, decimal minutes)**
  - **Elevation 4494 ft**

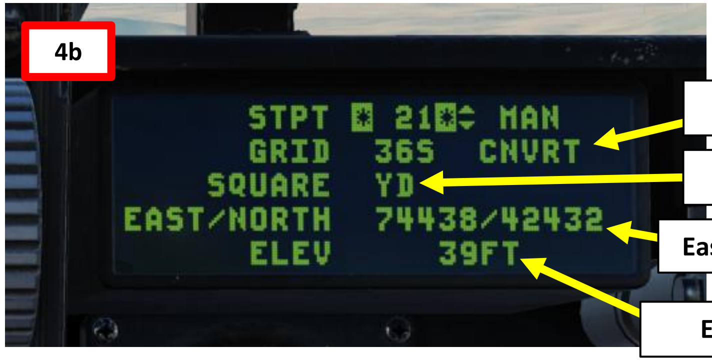
14. Press the Dobber Switch DOWN to select the ELEV (Elevation) field. The "*" symbols next to LAT indicate that the ELEVATION field is selected.
15. If steerpoint elevation is negative, press ***"0 M-SEL" (-)*** on the ICP. Otherwise, no action is required.
16. Enter the new elevation of the existing steerpoint using the ICP keypad (***4494***).
17. Press "ENTR" button on the ICP (Integrated Control Panel) to enter/confirm ELEVATION (in feet).
18. Steerpoint #5 should now have its coordinates updated and its new location will be reflected on your HUD and HSD.



5 – STEERPOINTS
5.4 – MGRS Coordinates Conversion

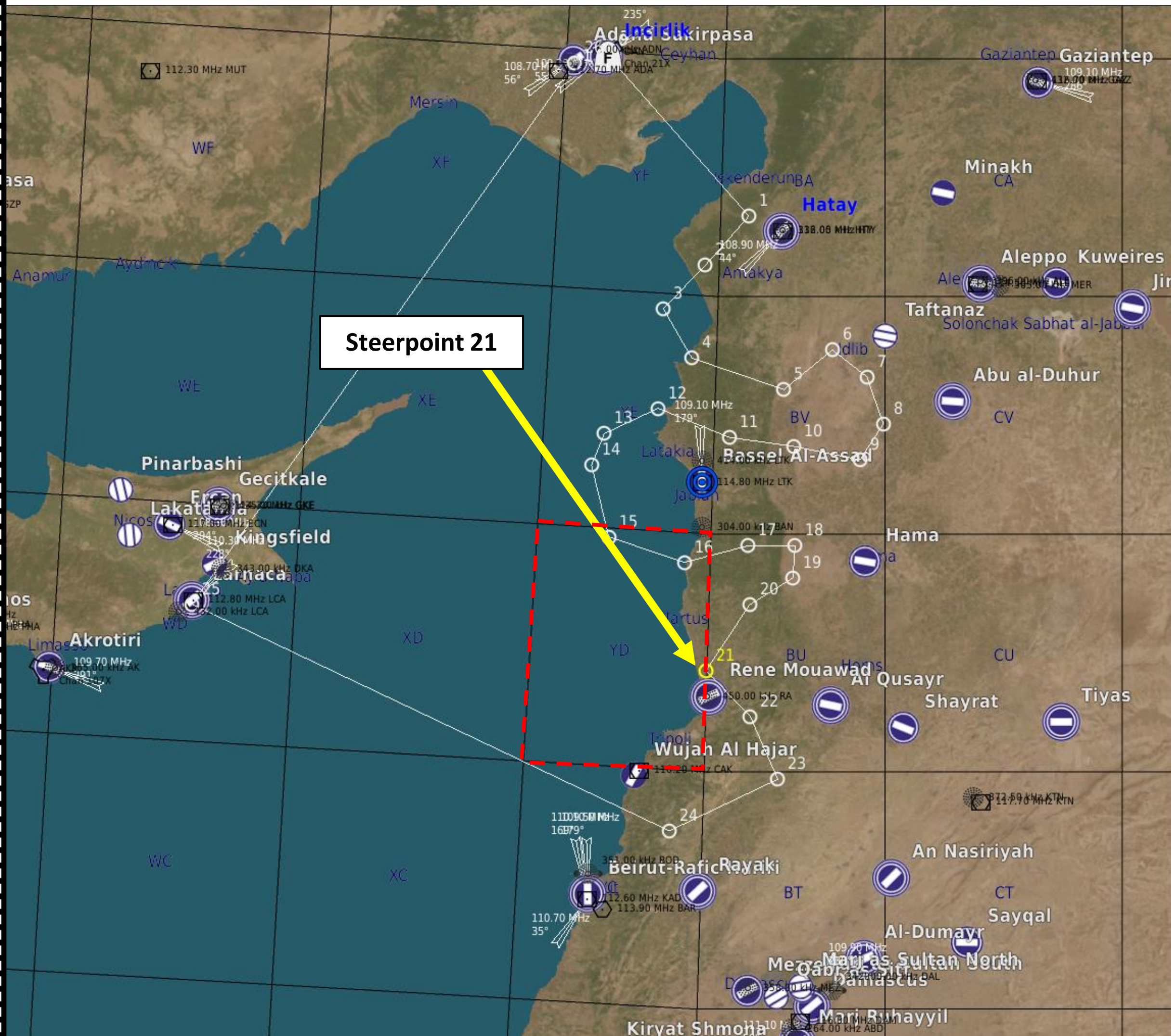
The DED (Data Entry Display) can display Military Grid Reference System (MGRS) coordinates, but only for steerpoints 21 to 25.

1. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN**)
2. Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 21.
    - *Alternatively, you can also select a steerpoint by pressing "STPT (4)" button on the ICP, entering the Steerpoint Number (i.e. "2" and 1" buttons for Steerpoint 21), then pressing "ENTR" button.*
3. If you want to see steerpoint 21 coordinates, access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel). Then, use DED Increment/Decrement Switch to select steerpoint 21.
4. To display coordinates to MGRS format, set **Dobber switch RIGHT (SEQ**). The DED STPT page will display MGRS 3 seconds later.
    - Take note that Latitude, Longitude and Elevation data fields are editable.
    - To revert back to LAT/LONG coordinates, set Dobber switch RIGHT (SEQ) again.



5 – STEERPOINTS
5.4 – MGRS Coordinates Conversion

Here is an overview of the MGRS grid system.

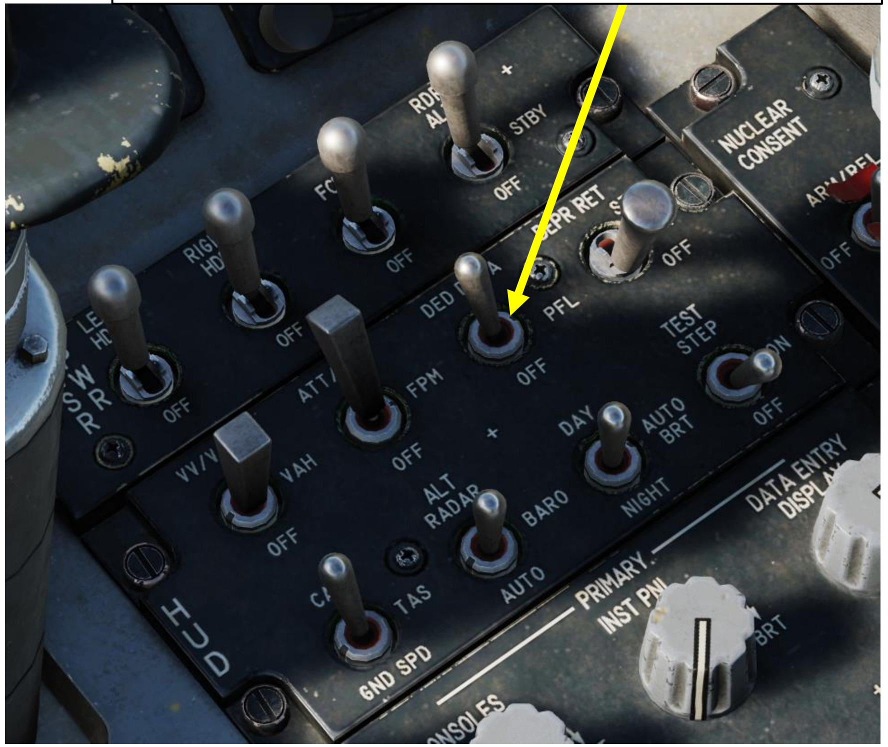


5 – STEERPOINTS
5.4 – MGRS Coordinates Conversion

If you want to display coordinates on the Heads-Up Display, you can set the DED (Data Entry Display) Data Switch FWD.

DED (Data Entry Display) Data Switch

- *FWD: DED (Standby) allows data from DED to be visible on the HUD*
- *MIDDLE: PFL (Pilot Fault List) allows data from PFLD (PFL Display) to be visible on the HUD*
- *AFT: OFF, displays neither DED nor PFLD data on HUD.*



MGRS Crid Coordinates (Repeated on HUD)

6 – MARKPOINTS
6.1 – Markpoint Navigation

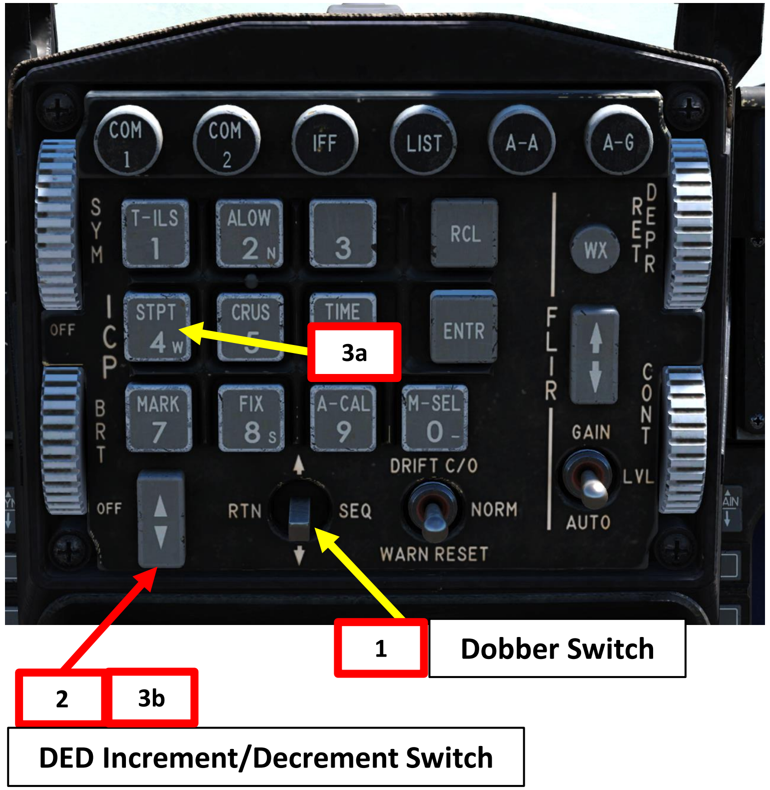
In order to navigate to a markpoint, the method is almost identical to navigating to a steerpoint. Why? Because markpoints are stored in Steerpoints 26 to 30, therefore you will have to access them the same way you would access any other steerpoint.

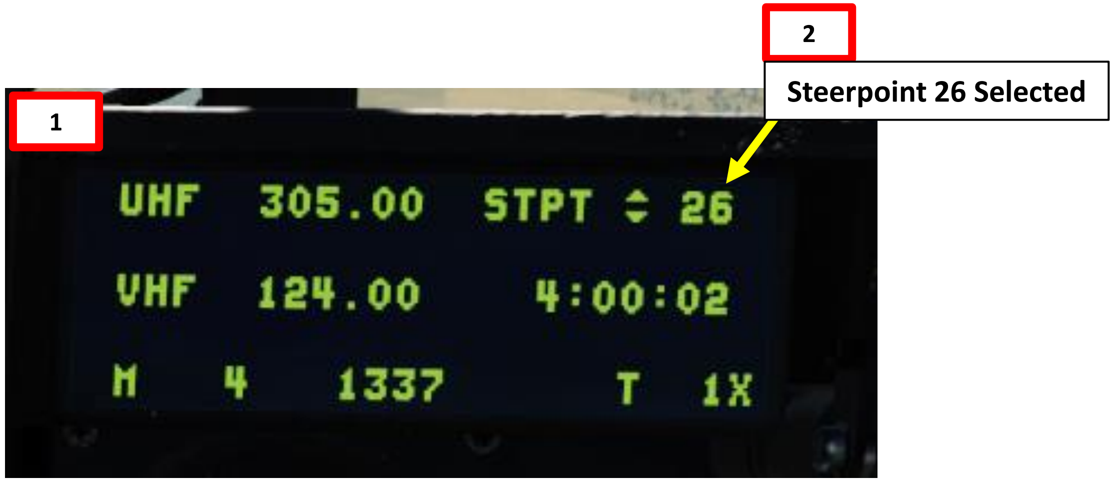
In this tutorial, we will assume a markpoint has already been created (Steerpoint #26).

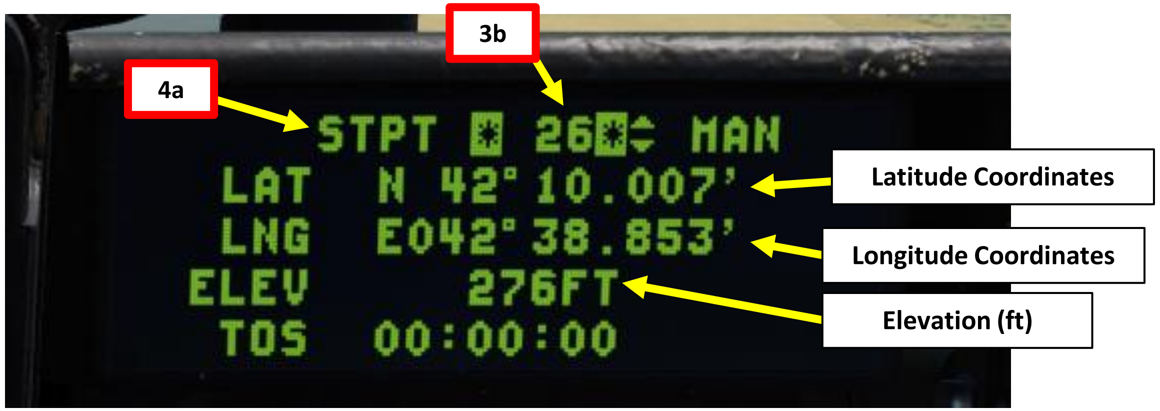
1. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
2. Use DED Increment/Decrement Switch to select desired steerpoint. We will select Steerpoint 26.
   - *Alternatively, you can also select a steerpoint by pressing "STPT (4)" button on the ICP, entering the Steerpoint Number (i.e. "2" and "6" buttons for Steerpoint 26), then pressing "ENTR" button.*
3. If you want to see steerpoint 26 coordinates, access STPT page by pressing **STPT (4)** button on the ICP (Integrated Control Panel). Then, use DED Increment/Decrement Switch to select steerpoint 26.

STEERPOINT DATABASE

Steerpoint #	Function
26 to 30	Reserved for Ownship Markpoints

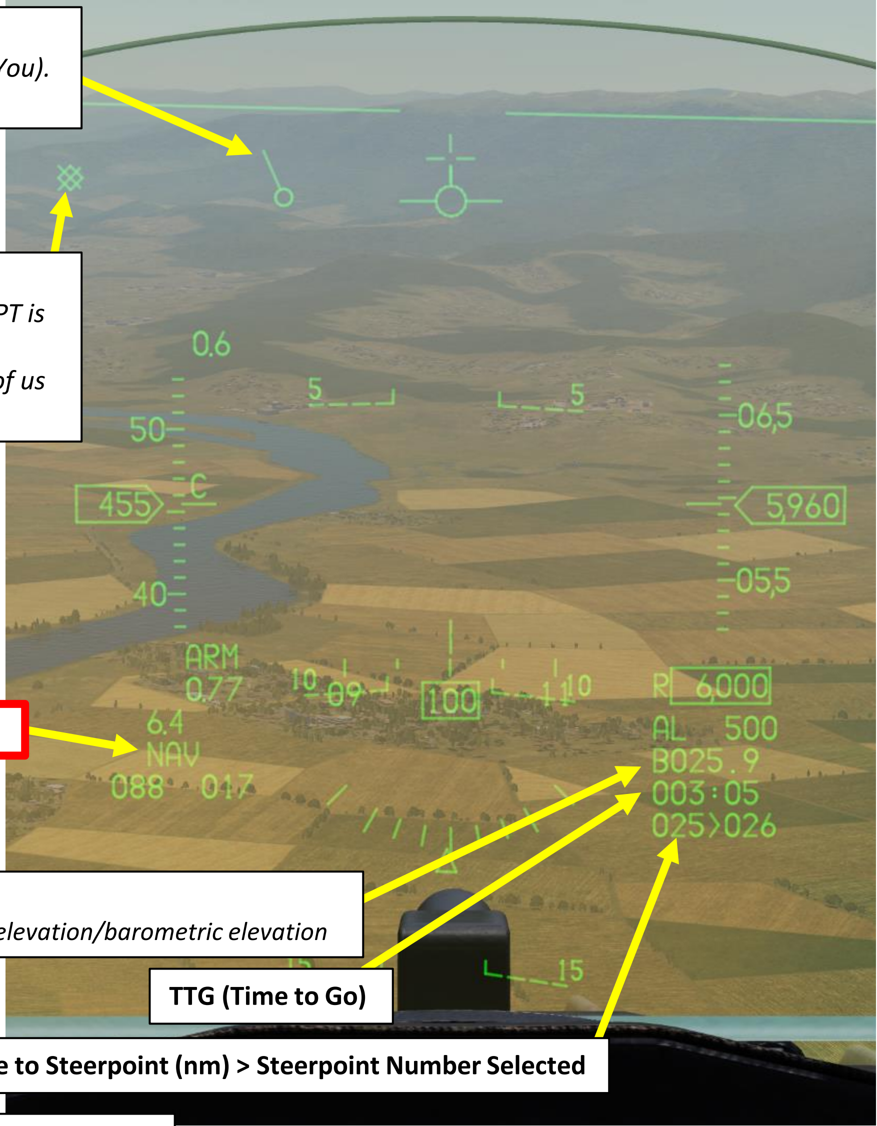






6 – MARKPOINTS
6.1 – Markpoint Navigation

4. Set EHSI (Electronic Horizontal Situation Indicator) Navigation Mode to NAV by pressing the "M" (EHSI Mode Selector) button to toggle between modes.
5. If you want to intercept the steerpoint from a specific direction, set desired course using the CRS knob. In our case, we will leave the intercept course to 000.
6. Verify that NAV Master Mode is selected on the Heads-Up Display (HUD). If either A-A or A-G mode is selected, pressing their respective ICP button will revert the master mode back to NAV.
7. Direction and range to the Steerpoint are indicated on the HUD. Consult Diamond and Tadpole symbols.
8. Direction and range to the Steerpoint are indicated on the EHSI as well.



6 – MARKPOINTS
6.1 – Markpoint Navigation

9. Fly towards selected steerpoint (markpoint) by aligning the Steerpoint Tadpole with the FPM (Flight Path Marker). When flying towards the steerpoint, the tadpole should be pointing up and be centered.

6 – MARKPOINTS
6.2 – How to Add Markpoints

You must access the MARK (Markpoint) DED (Data Entry Display) page to create a Markpoint:

a) Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
b) Press **MARK (7)** button on the ICP (Integrated Control Panel).
c) Toggle the Dobber Switch RIGHT (SEQ) to cycle through Markpoint Designation modes (FCR, TGP, HUD and OFLY)

There are four main methods to create markpoints:

FCR (Fire Control Radar) Designated Markpoint

- If Master Mode is either NAV or A-G, the **FCR page is SOI** (Sensor of Interest, performed with **DMS DOWN**), entering the MARK page will default to MARK FCR. The first markpoint will remain blank.
- Designate the target by slewing the FCR Reticle on the FCR page with the Radar Cursor/Enable Switch, then **create markpoint by pressing TMS UP**

TGP (Targeting Pod) Designated Markpoint

- If Master Mode is either NAV or A-G, the **TGP page is SOI** (Sensor of Interest, performed with **DMS DOWN**), entering the MARK page will default to MARK TGP. The first markpoint will remain blank.
- Designate the target by slewing the Targeting Pod Reticle on the TGP page with the Radar Cursor/Enable Switch, then **create markpoint by pressing TMS UP**

HUD (Heads-Up Display) Designated Markpoint

- If Master Mode is either NAV or A-G… and **neither the FCR page nor the TGP page is SOI** (Sensor of Interest, performed with **DMS UP**), entering the MARK page will default to MARK HUD. The first markpoint will remain blank.
- Designate the target by slewing the HMC (HUD Mark Cue circle) on the Heads-Up Display with the Radar Cursor/Enable Switch. After, press **TMS UP to ground stabilise the HMC**. Then, **create markpoint by pressing TMS UP.**
- Note: The HUD Markpoint mode can also be used with the HMCS (Helmet-Mounted Cueing System).

OFLY (Overfly) Designated Markpoint

- If Master mode is A-A, entering the MARK page will default to MARK OFLY. Press TMS UP to designate markpoint over current overflown position.

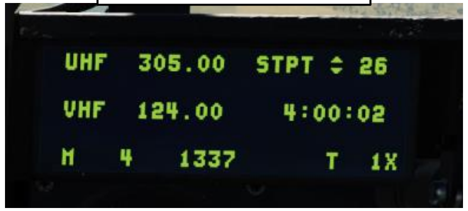
MARK Page – FCR Sub-Page

MARK Page – TGP Sub-Page

MARK Page – HUD Sub-Page

MARK Page – OFLY Sub-Page

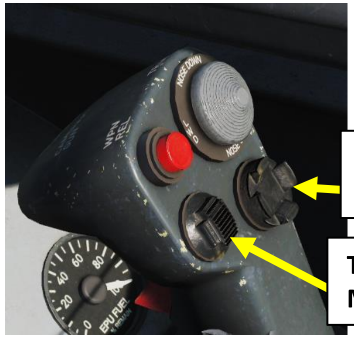
CNI DED Page



Master Mode Buttons

MARK (7) Button

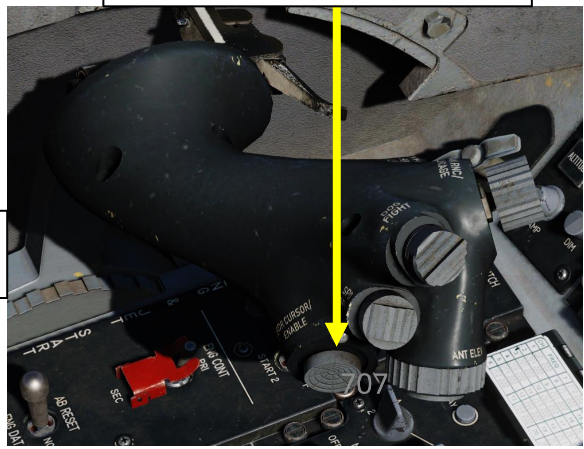
Dobber Switch



DMS (Display Management Switch)

TMS (Target Management Switch)

Radar Cursor/Enable Switch

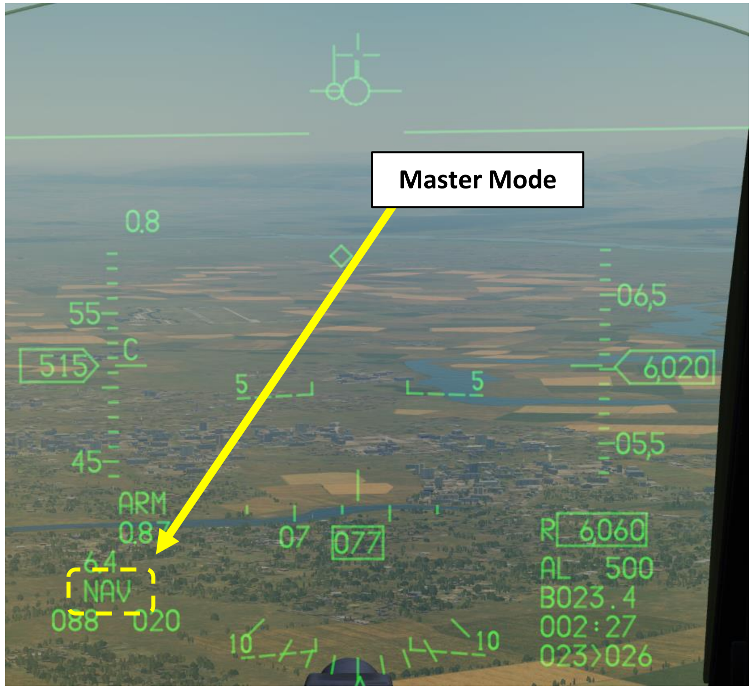


6 – MARKPOINTS
6.2 – How to Add Markpoints

Here is an overview of the Markpoint sub-mode logic.

A-G (Air-to-Ground) or NAV Master Mode Selected
- A-G FCR is SOI and FCR is designating → FCR MARKPOINT (Manual, TMS UP)
- TGP is SOI and TGP is ground stabilised → TGP MARKPOINT (Manual, TMS UP)
- All Other Cases → HUD MARKPOINT (Manual, TMS UP x 2)

A-A (Air-to-Air) Master Mode Selected
- → OFLY MARKPOINT (Manual, TMS UP)



MARK Page – FCR Sub-Page

MARK Page – TGP Sub-Page

MARK Page – HUD Sub-Page

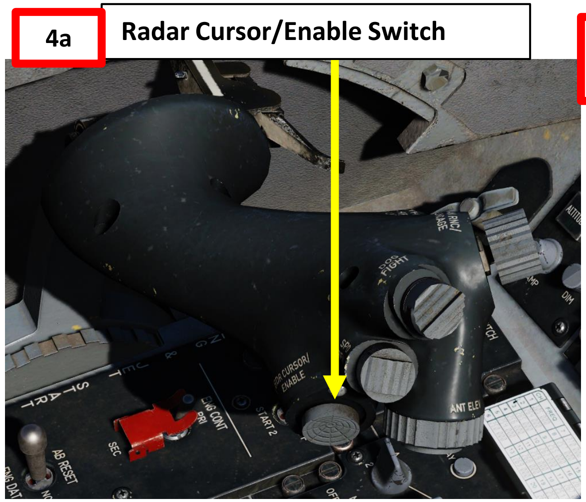
MARK Page – OFLY Sub-Page

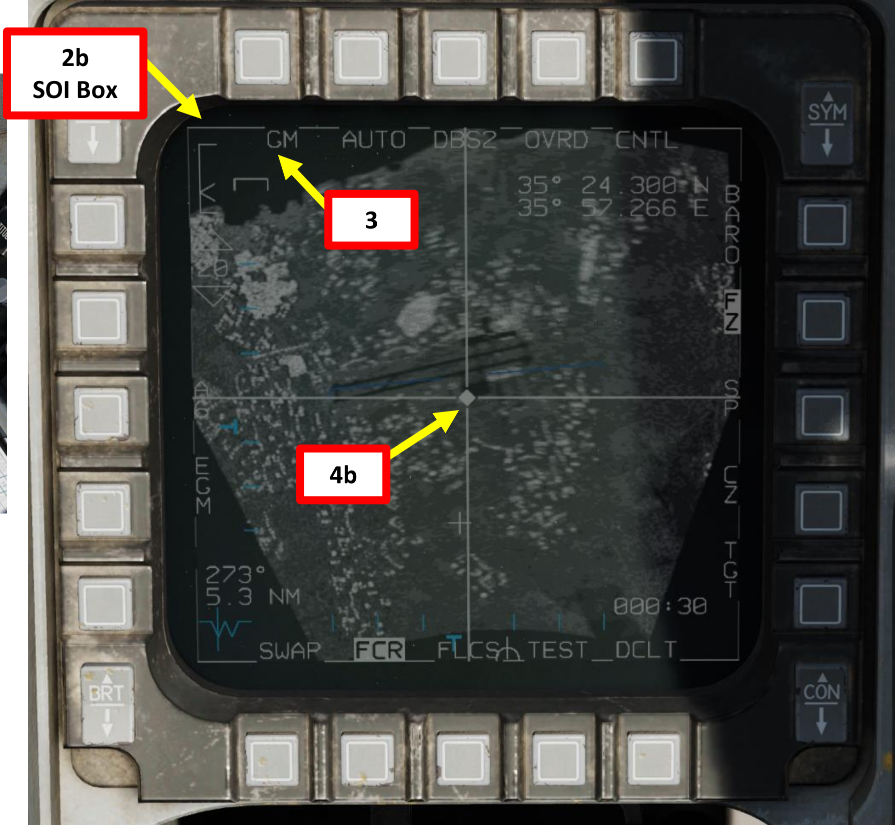
Notes:
- *If previous automatic markpoints were recorded, the markpoint rotary will increment and the next available steerpoint in the MARK bank will be selected.*
- *Ownship markpoints are stored in steerpoint 26 to 30. Once #30 is filled, the next markpoint will overwrite #26 and so on.*

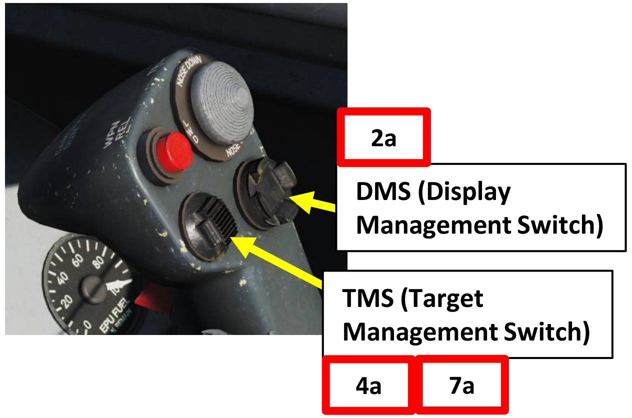
6 – MARKPOINTS
6.2 – How to Add Markpoints

FCR (Fire Control Radar) Designated Markpoint

1. Select A-G (Air-to-Ground) Master Mode
2. Set FCR (Fire Control Radar) page as the SOI (Sensor of Interest) using DMS (Display Management Switch) DOWN. The SOI Box around the FCR page will indicate when the FCR can be controlled with HOTAS controls.
3. Select desired radar mode (i.e. Ground Mapping or Ground Moving Target) via the FCR page.
4. Designate a target using the Radar Cursor Switch to slew the reticle and TMS UP to designate.
5. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
6. Press MARK (7) button on the ICP (Integrated Control Panel). Since the FCR is the sensor of interest, the "FCR" markpoint option is already selected.
7. Press TMS (Target Management Switch) UP to set the designated point by the fire control radar sensor as the markpoint.



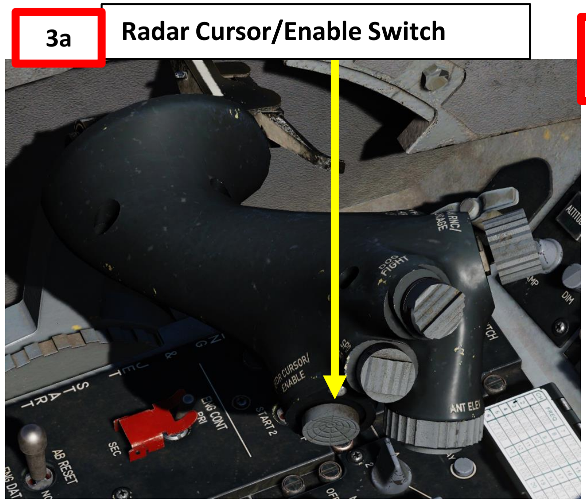


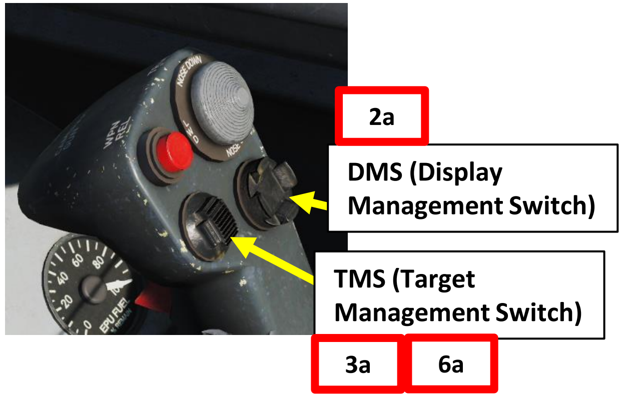


6 – MARKPOINTS
6.2 – How to Add Markpoints

TGP (Targeting Pod) Designated Markpoint

1. Select A-G (Air-to-Ground) Master Mode
2. Set TGP (Targeting Pod) page as the SOI (Sensor of Interest) using DMS (Display Management Switch) DOWN. The SOI Box around the TGP page will indicate when the TGP can be controlled with HOTAS controls.
3. Designate a target using the Radar Cursor Switch to slew the reticle and TMS UP (Point Track) or TMS RIGHT (Area Track) to designate.
4. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
5. Press MARK (7) button on the ICP (Integrated Control Panel). Since the TGP is the sensor of interest, the “TGP” markpoint option is already selected.
6. Press TMS (Target Management Switch) UP to set the designated point by the targeting pod sensor as the markpoint.

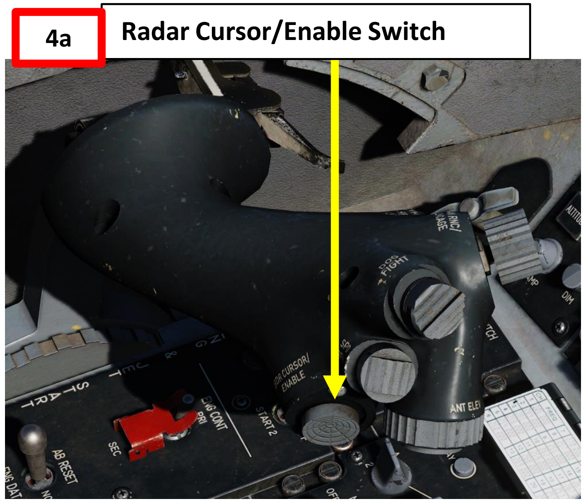


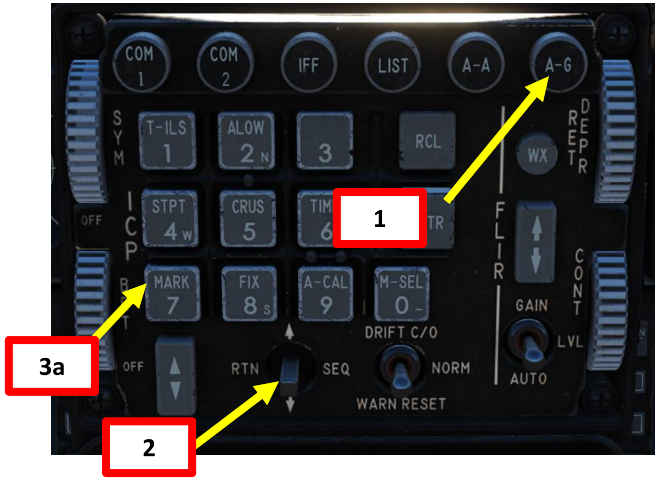


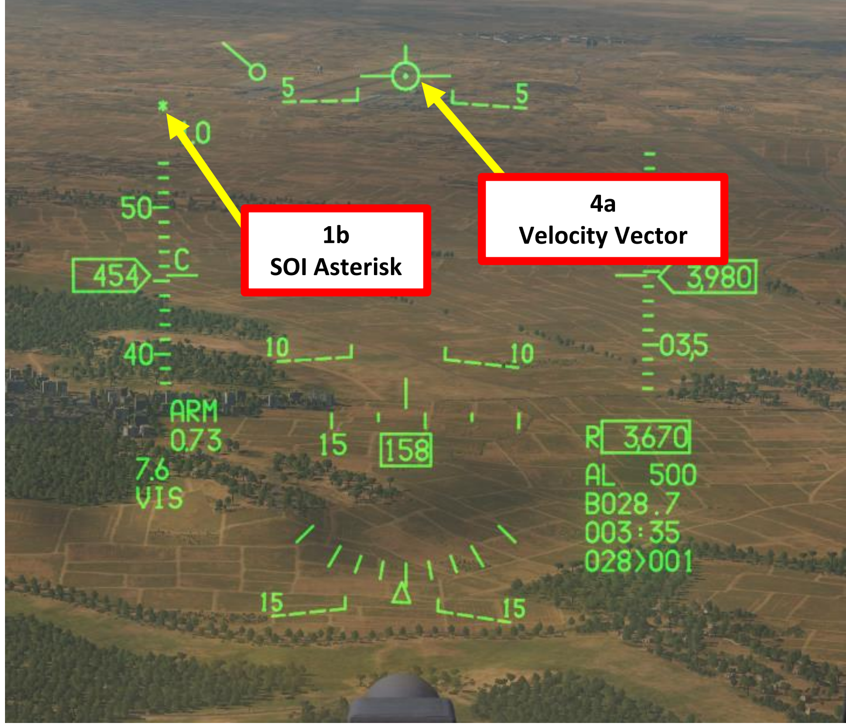
6 – MARKPOINTS
6.2 – How to Add Markpoints

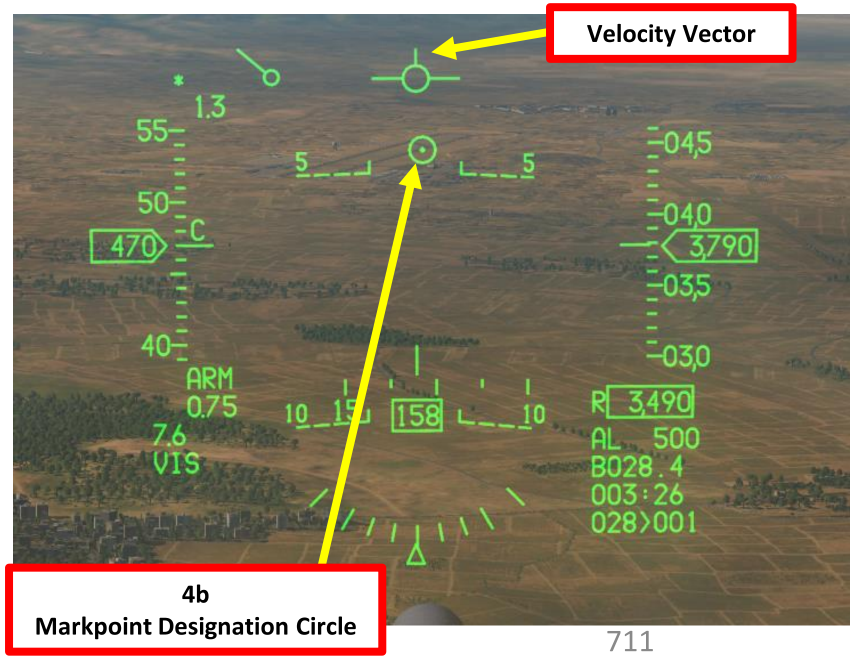
HUD (Heads-Up Display) Designated Markpoint

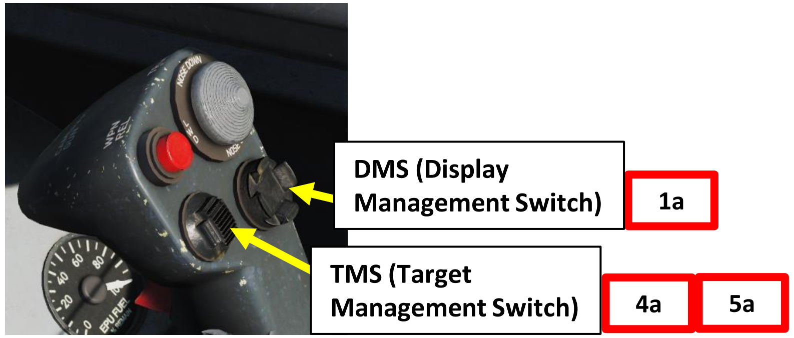
1. Set HUD (Heads-Up Display) as the SOI (Sensor of Interest) using DMS (Display Management Switch) UP. The SOI asterisk will indicate when the HUD interface can be controlled with HOTAS controls.
2. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
3. Press MARK (7) button on the ICP (Integrated Control Panel). Since the HUD is the sensor of interest, the "HUD" markpoint option is already selected.
4. Fly the aircraft to place the velocity vector near the target, then pressing TMS UP to space stabilize the designation circle. Use the Radar Cursor Switch to slew the designation circle on the target.
5. Press TMS (Target Management Switch) UP to set the designated point by the HUD designation circle as the markpoint.











6 – MARKPOINTS
6.2 – How to Add Markpoints

HUD (Heads-Up Display) Designated Markpoint - With Helmet-Mounted Cueing System (HMCS)

The Helmet-Mounted Cueing System can be used to designate markpoints; the designation method is similar to the HUD markpoint technique.

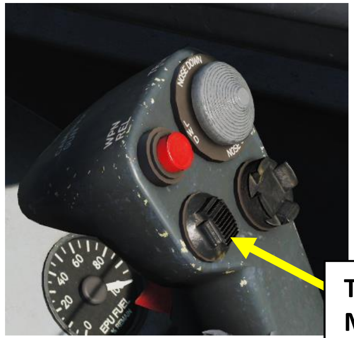
See Part 10, section 4.5.1.c for a demonstration.

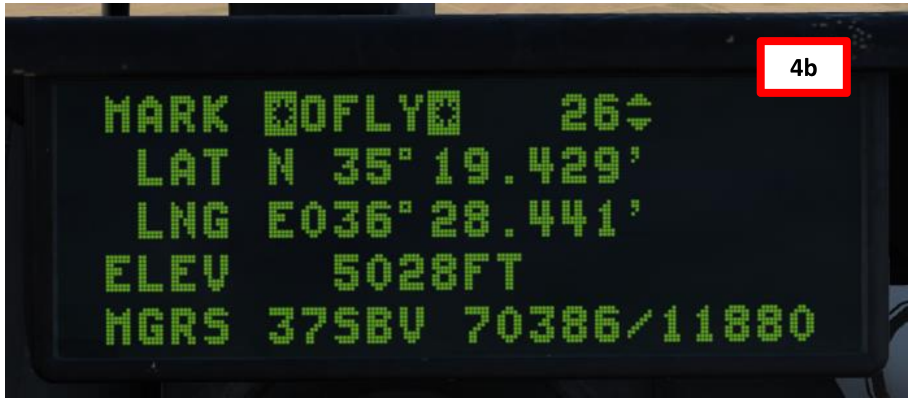
Click to navigate to HMCS Markpoint Designation Tutorial

6 – MARKPOINTS
6.2 – How to Add Markpoints

OFLY (Overfly) Designated Markpoint

1. Select A-A (Air-to-Air) Master Mode
2. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
3. Press MARK (7) button on the ICP (Integrated Control Panel).
4. Press TMS (Target Management Switch) UP to designate current overflown position as the markpoint.

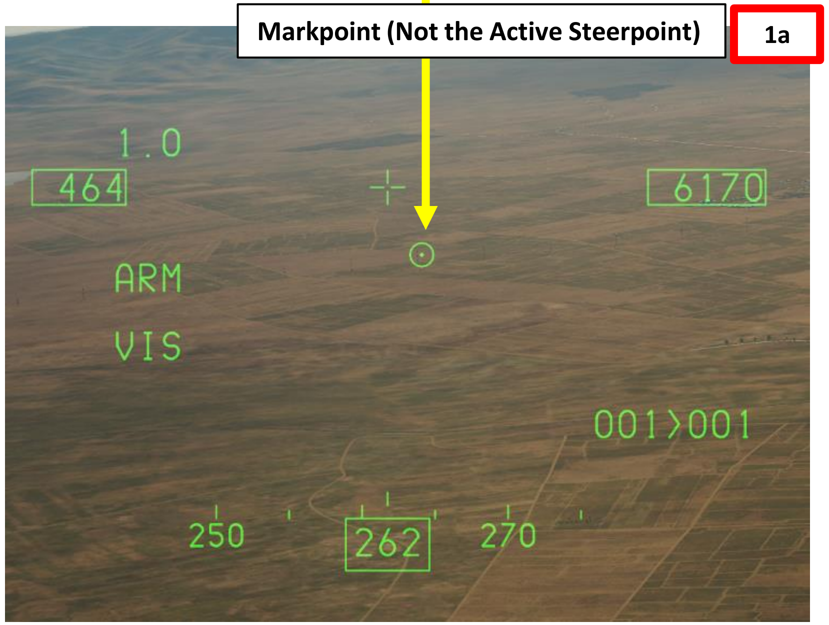


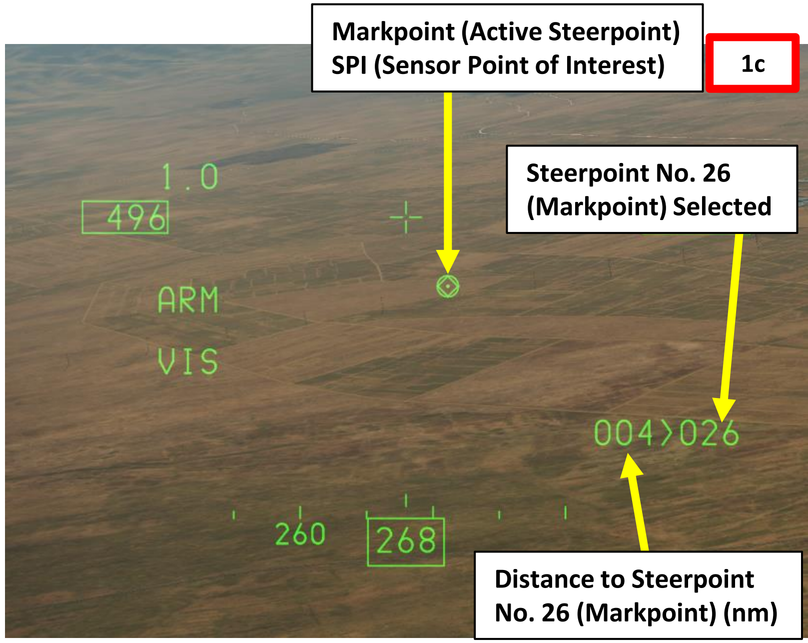


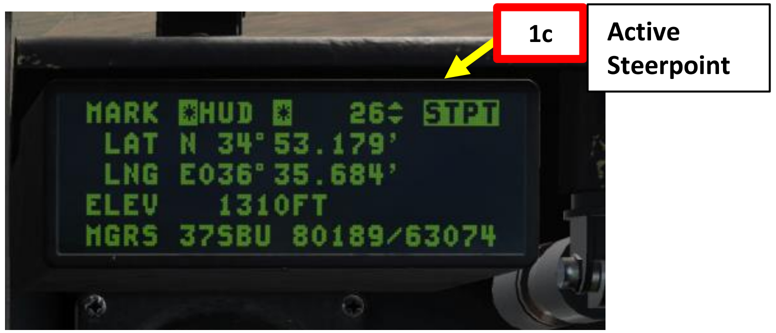
6 – MARKPOINTS
6.3 – Markpoint Tips

When you create a markpoint, it is important to remember that this **markpoint is not automatically set as your SPI (Sensor Point of Interest)**. The SPI is used to deliver weapons. The long procedure would be to select the steerpoint/markpoint as shown in section 6.1, but there is a useful shortcut to quickly make the markpoint you just designated the sensor point of interest (active steerpoint).

1. Once you have created a markpoint (this example shows a markpoint created with the HMCS), press M-SEL (0) button on the ICP (Integrated Control Panel). This will make the markpoint the active steerpoint and become in the process the Sensor Point of Interest (SPI).
2. When the markpoint becomes the active steerpoint (or sensor point of interest), a diamond will appear over the markpoint designation circle. You will then be able to use this markpoint for weapon release in almost any mode.







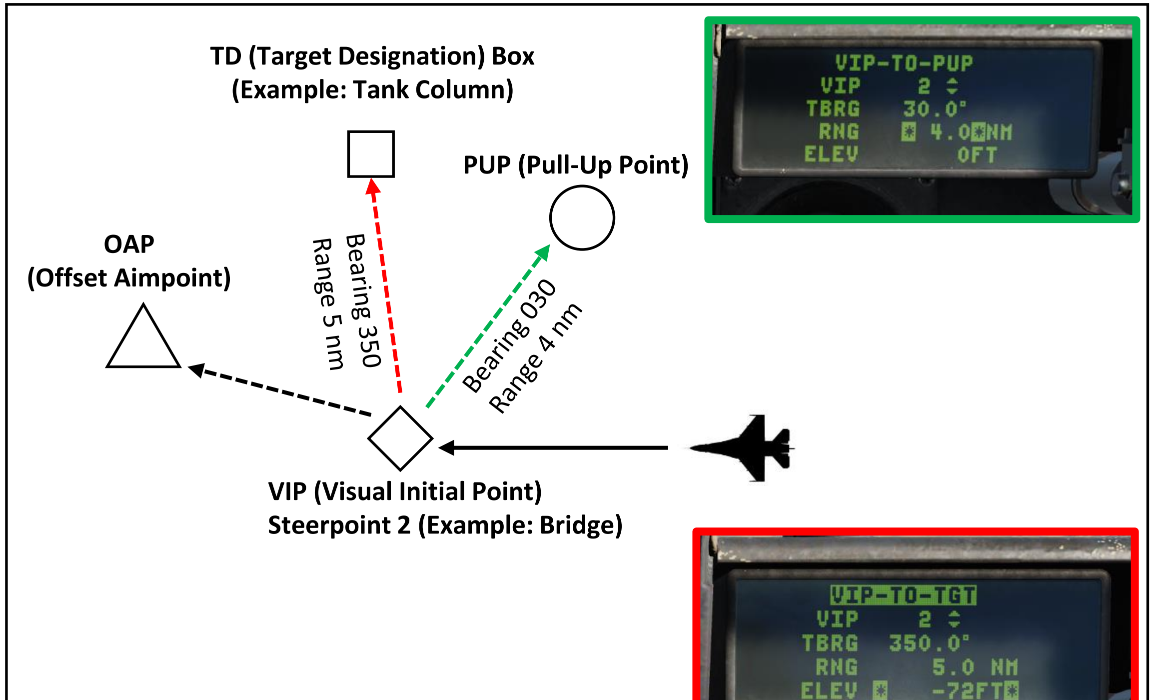
7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.1 – Introduction

The F-16 has the capability of displaying visual indicators to assist in making attacks from locations relative to the target. These indicators can assist the pilot in knowing where the target is relative to a prominent visual reference, where to commence the attack, and when to begin a pop-up attack. These visual indicators are programmed using the Data Entry Display (DED) and are displayed on the HUD in pre-planned air-to-ground sub-modes (e.g., CCRP). Here is a good video about the subject by the 476th vFG: https://youtu.be/Tbs62vWmSkM

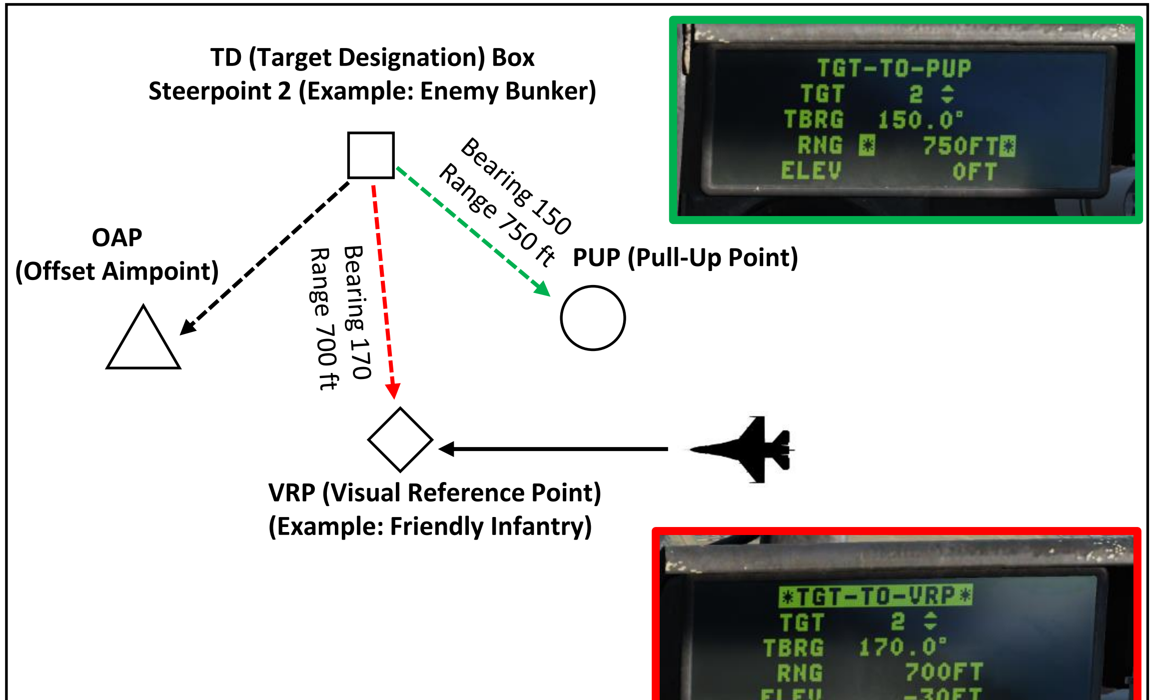
Here are a few different types of reference points:

- A **Visual Initial Point (VIP)** is used when the location of the target is not known precisely but is known relative to a visually prominent object. For example, the target may be known to be five miles northwest of an identifiable bridge.
- A **Visual Reference Point (VRP)** is used when the pilot desires a visual indication of a location to begin an attack (or otherwise reference relative to a known target position).
- A **Pull-up Point (PUP)** is a location where a pop-up attack commences.
- An **Offset Aimpoint (OAP)** is a steerpoint with an offset defined as a true bearing and range from the steerpoint and a separate elevation.

Note that a single steerpoint cannot have both a VIP and a VRP active.



VIP Sighting Concept



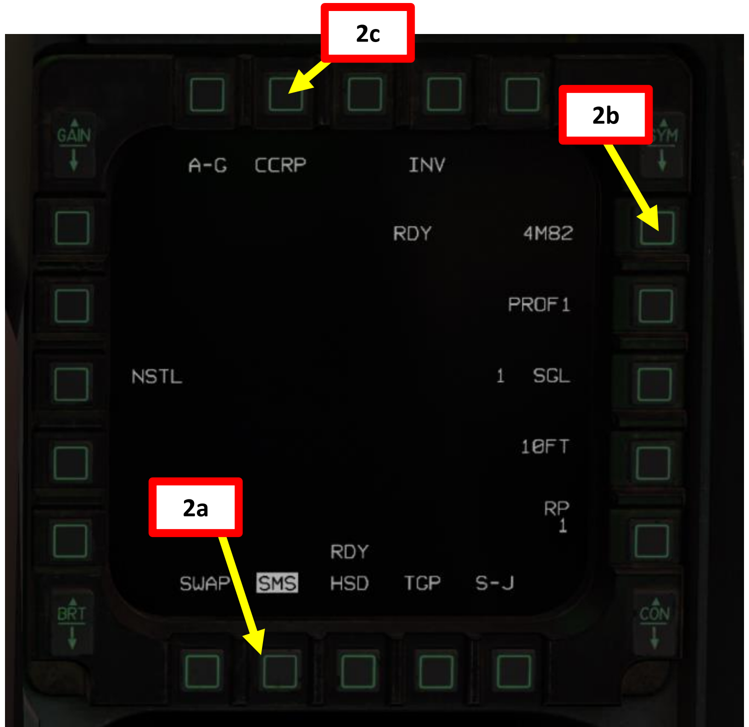
VRP Sighting Concept

7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.2 – VIP (Visual Initial Point)

In this example, we will set a VIP over a recognizable visual landmark (docks, located at steerpoint No. 1) in order to use it as our initial point for a bombing attack run on a pumping station located 1.3 nm from the VIP, 500 ft higher. The bearing from the VIP to the target is 346.

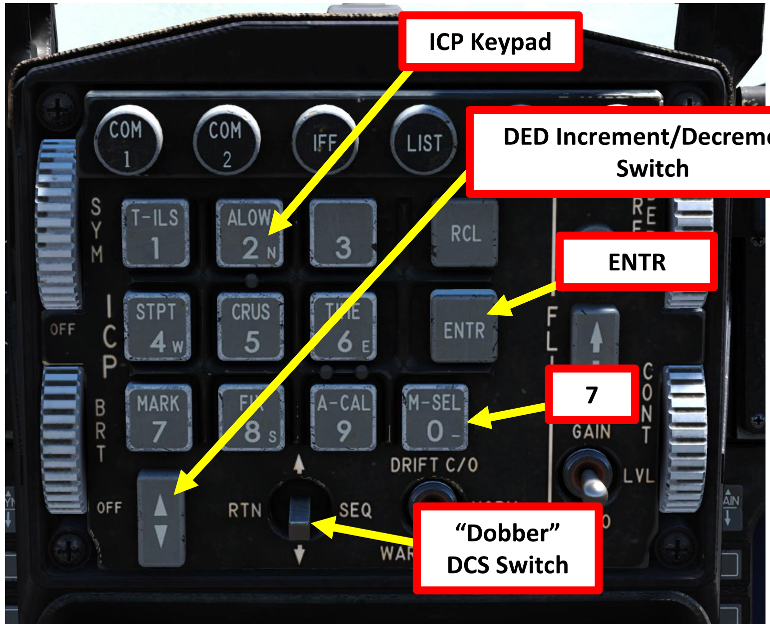
In this tutorial, we will assume the steerpoint coordinates have already been entered correctly.

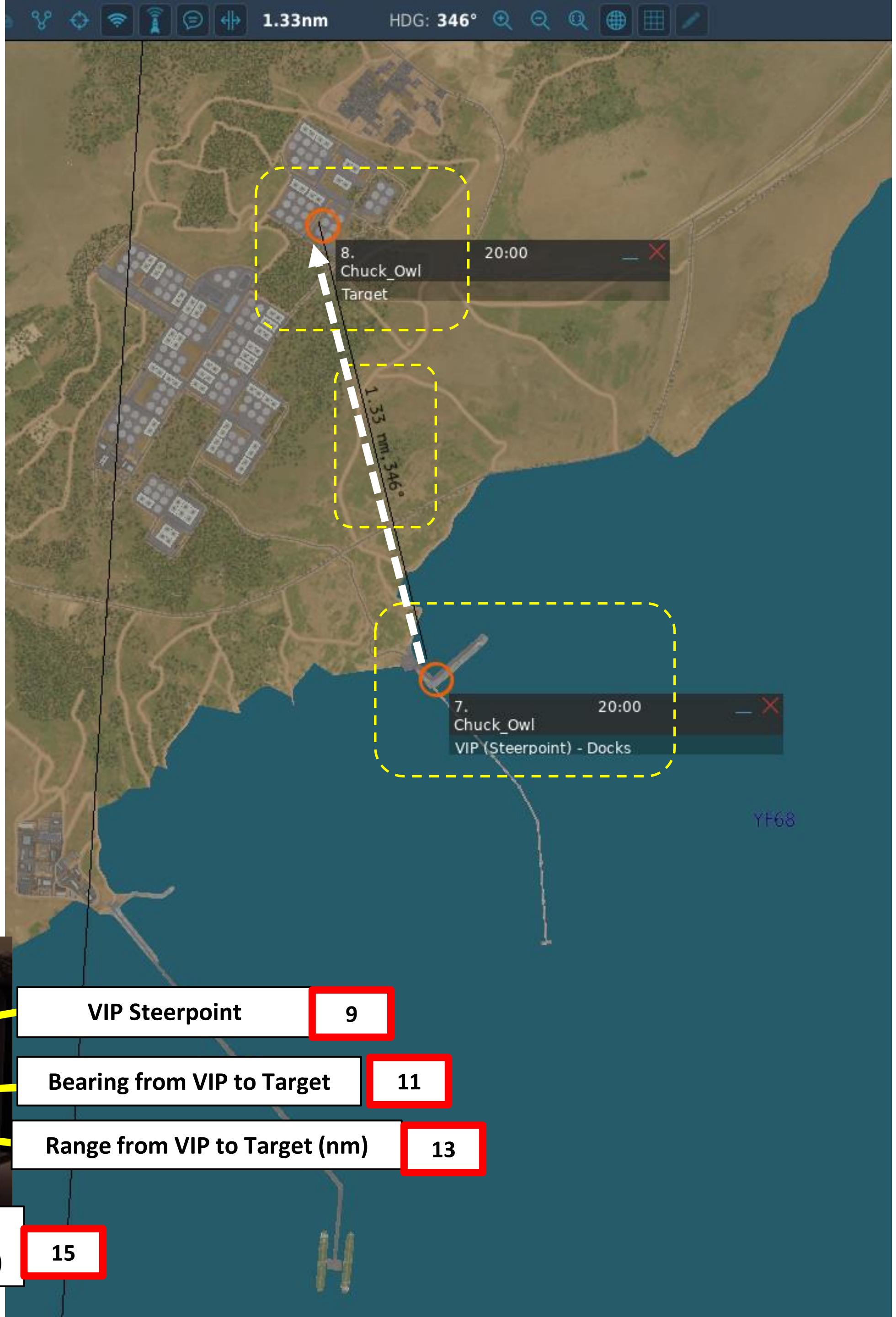
1. Select A-G (Air-to-Ground) Master Mode
2. Select ordnance (bombs) with a CCRP release mode from the SMS (Stores Management Set) page.
3. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
4. Use DED Increment/Decrement Switch to select desired steerpoint located on the VIP. We will select Steerpoint 1.
5. Press the LIST button
6. Press “3” on the ICP (Integrated Control Panel) to VIP (Visual Initial Point) DED Page.



7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.2 – VIP (Visual Initial Point)

7. By default, the VIP-TO-TGT function is not activated. Press “0 / M-SEL” on the ICP (Integrated Control Panel) to activate VIP-TO-TGT (highlighted when active).
8. Press the DCS (“Dobber”) DOWN to select the VIP field. Selection of the field is indicated by asterisks.
9. Use DED Increment/Decrement Switch to set the steerpoint you want to use as a VIP. We will select Steerpoint 1.
    - *Alternatively, you can also set steerpoint by entering the Steerpoint Number (i.e. “1” button for Steerpoint 1), then pressing “ENTR” button.*
10. Press the DCS (“Dobber”) DOWN to select the TBRG (True Bearing) field. Selection of the field is indicated by asterisks.
11. Enter true bearing from VIP to the target on the ICP (in our case, 346.0), then press “ENTR” button.
12. Press the DCS (“Dobber”) DOWN to select the RNG (Range) field. Selection of the field is indicated by asterisks.
13. Enter range from VIP to the target on the ICP (in our case, 1.3 nm), then press “ENTR” button.
14. Press the DCS (“Dobber”) DOWN to select the ELEV (Elevation differential) field. Selection of the field is indicated by asterisks.
15. Enter elevation difference from VIP to the target on the ICP (in our case, “500” since the target is 500 ft higher), To enter a negative number, first press “0” twice. Press “ENTR” button to enter value and complete the VIP data input process.





7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.2 – VIP (Visual Initial Point)

16. On the HUD, the VIP (steerpoint 1) is indicated by a diamond and the target computed from the VIP-TO-TGT function is indicated by a TD (Target Designation) Box.
17. To deactivate VIP-TO-TGT, press the DCS ("Dobber") UP to select the VIP-TO-TGT field, indicated by asterisks. Press "0 / M-SEL" on the ICP to de-activate. This function is useful since TGT-TO-VRP and TGT-TO-PUP functions are unavailable if VIP-TO-TGT is activated.

VIP-TO-TGT ON

VIP-TO-TGT OFF

TD (Target Designation Box)
Target Computed from VIP

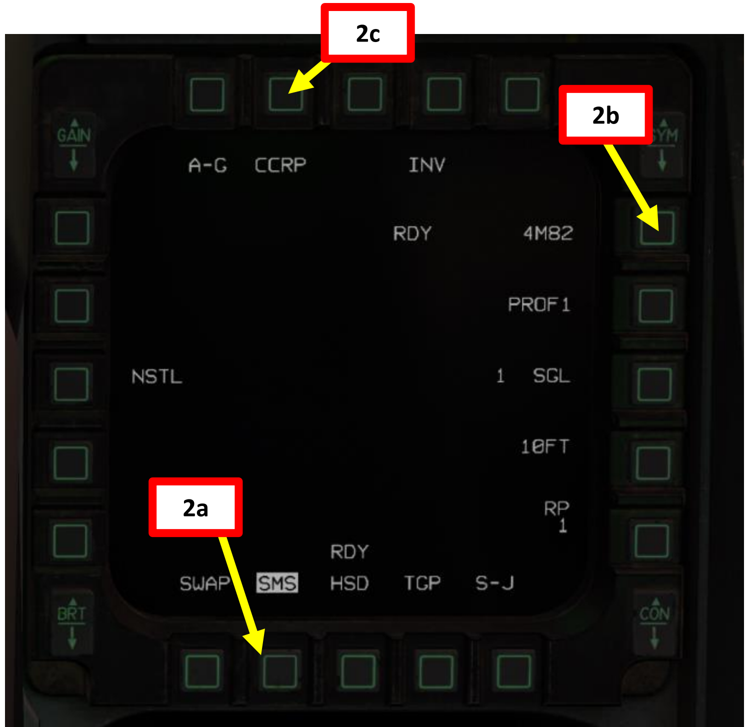
VIP (Visual Initial Point)
(Steerpoint 1)

7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.3 – VRP (Visual Reference Point)

In this example, we have a target (pumping station) located on steerpoint 1. A friendly unit of amphibious armored vehicles is close to the target, and we want to create a VRP over their location. The VRP is located 1.2 nm (7290 ft) from the pumping station, 500 ft lower. The bearing from the target to the VRP is 169.

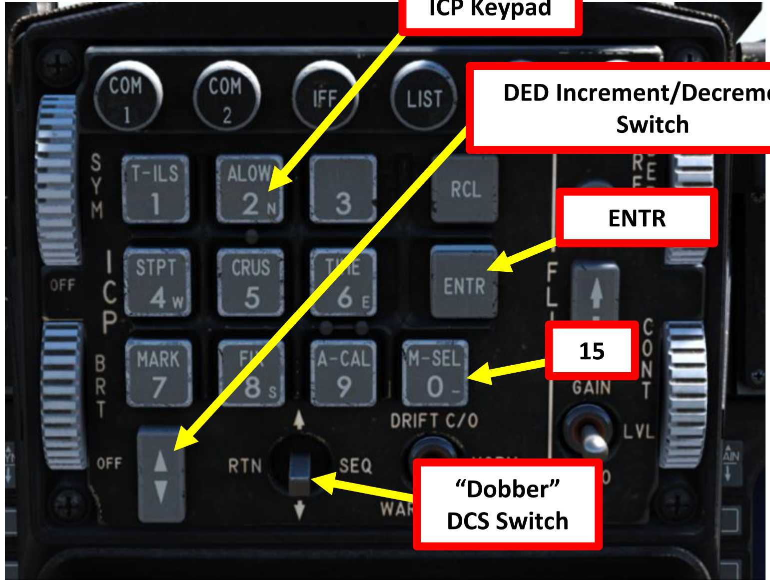
In this tutorial, we will assume the steerpoint coordinates have already been entered correctly.

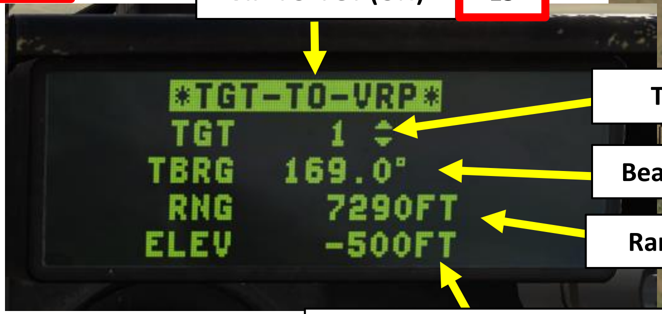
1. Select A-G (Air-to-Ground) Master Mode
2. Select ordnance (bombs) with a CCRP release mode from the SMS (Stores Management Set) page.
3. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
4. Use DED Increment/Decrement Switch to select desired steerpoint located on the target. We will select Steerpoint 1, which is located on the pumping station.
5. Press the LIST button
6. Press "9" on the ICP (Integrated Control Panel) to VRP (Visual Reference Point) DED Page.

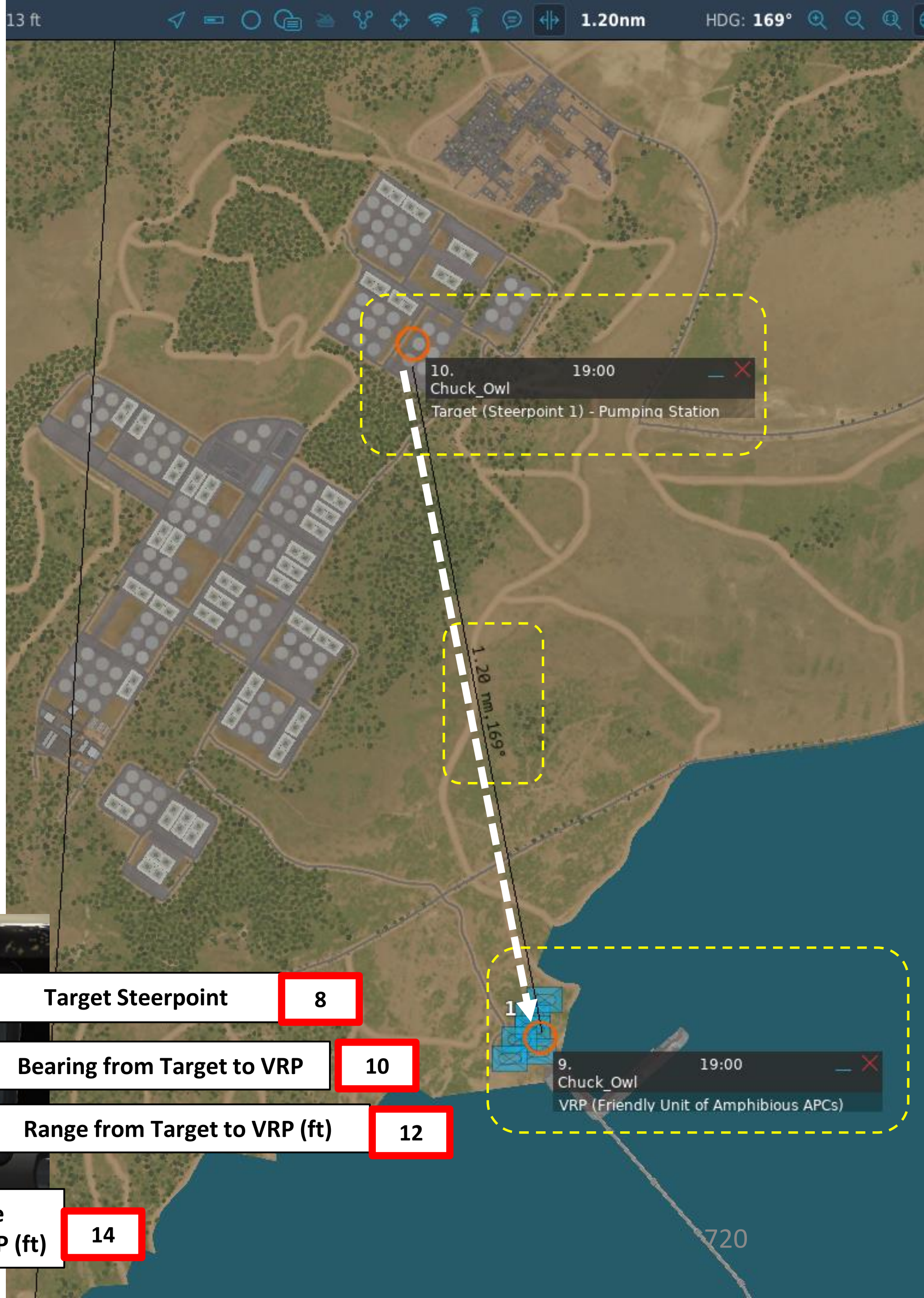


7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.3 – VRP (Visual Reference Point)

7. Press the DCS ("Dobber") DOWN to select the TGT field. Selection of the field is indicated by asterisks.
8. Use DED Increment/Decrement Switch to set the steerpoint you want to use as the target. We will select Steerpoint 1.
   - *Alternatively, you can also set steerpoint by entering the Steerpoint Number (i.e. "1" button for Steerpoint 1), then pressing "ENTR" button.*
9. Press the DCS ("Dobber") DOWN to select the TBRG (True Bearing) field. Selection of the field is indicated by asterisks.
10. Enter true bearing from the target to the VRP on the ICP (in our case, 169.0), then press "ENTR" button.
11. Press the DCS ("Dobber") DOWN to select the RNG (Range) field. Selection of the field is indicated by asterisks.
12. Enter range from target to the VRP on the ICP (in our case, 7290 ft), then press "ENTR" button.
13. Press the DCS ("Dobber") DOWN to select the ELEV (Elevation differential) field. Selection of the field is indicated by asterisks.
14. Enter elevation difference from target to the VRP on the ICP (in our case, "-500" since the VRP is 500 ft lower than the target), To enter a negative number, first press "0" twice. Press "ENTR" button to enter value and complete the VRP data input process.
15. By default, the TGT-TO-VRP function is not activated. press the DCS ("Dobber") UP to select the TGT-TO-VRP field, indicated by asterisks. Press "0 / M-SEL" on the ICP (Integrated Control Panel) to activate TGT-TO-VRP (highlighted when active).







7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.3 – VRP (Visual Reference Point)

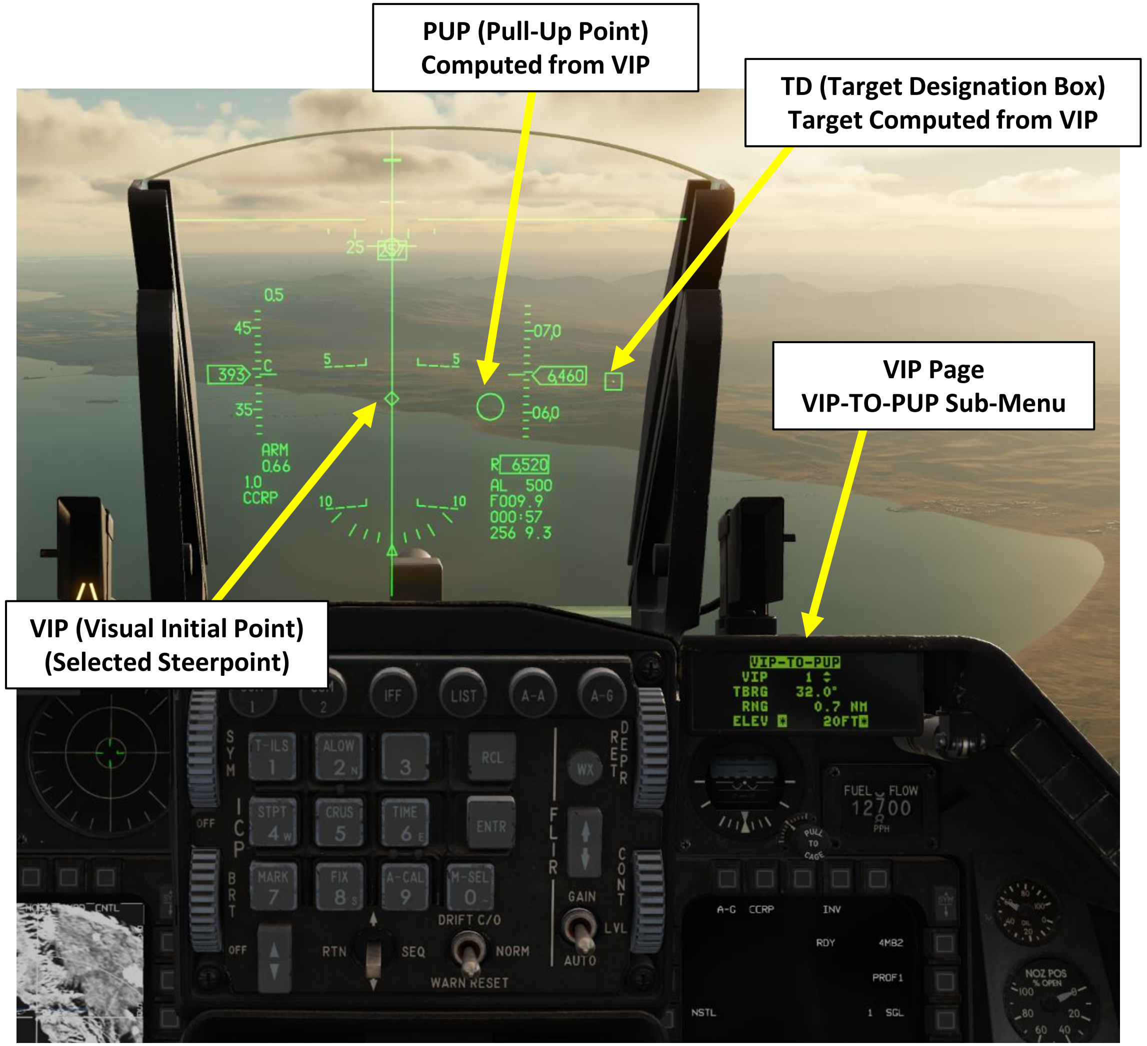
16. On the HUD, the VRP computed from the target TGT-TO-VRP function is indicated by a diamond and the target is indicated by a TD (Target Designation) Box.
17. To deactivate TGT-TO-VRP, press the DCS (“Dobber”) UP to select the TGT-TO-VRP field, indicated by asterisks. Press “0 / M-SEL” on the ICP to de-activate. This function is useful since VIP-TO-TGT, and VIP-TO-PUP functions are unavailable if TGT-TO-VRP is activated.

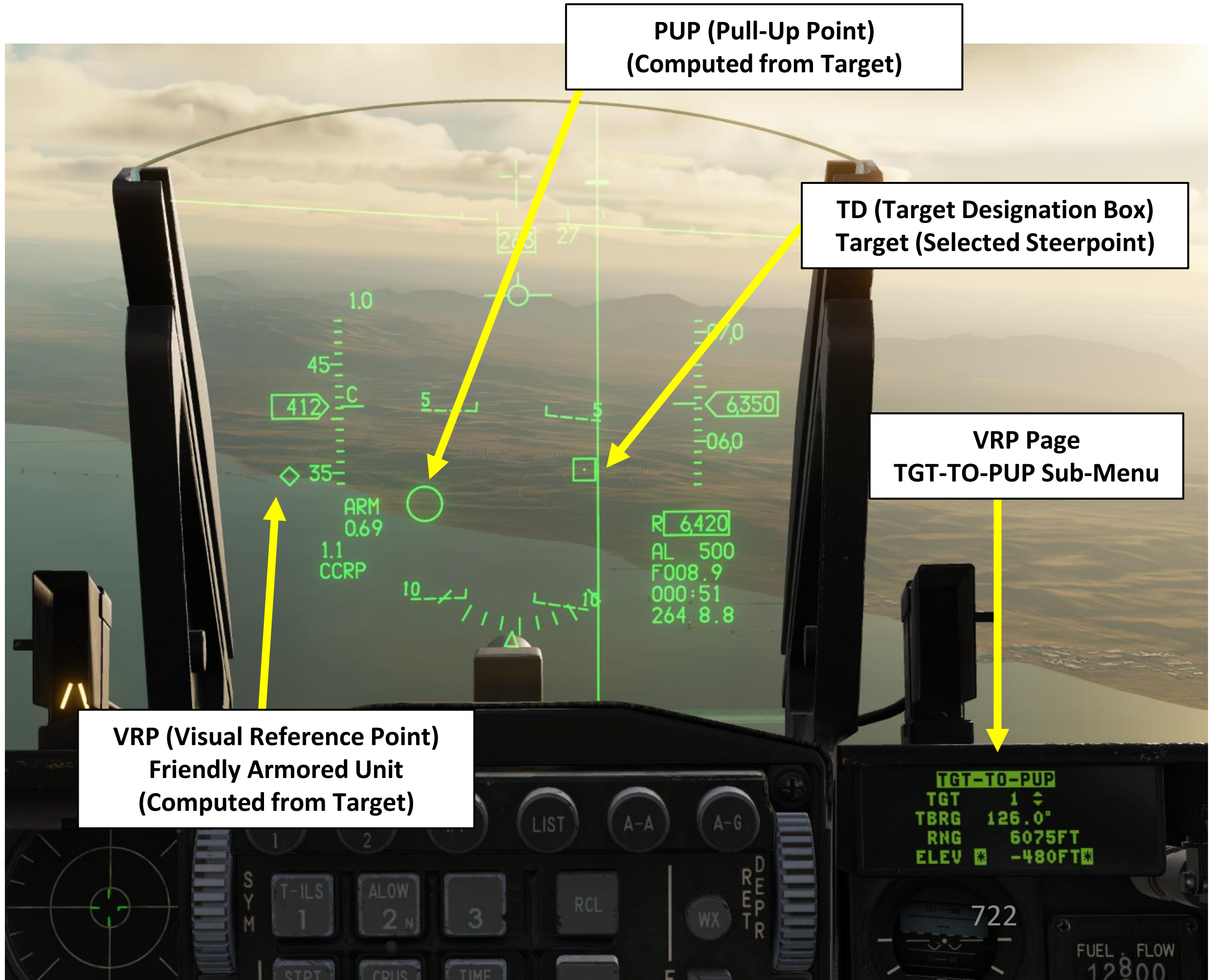
TGT-TO-VRP ON

TGT-TO-VRP OFF

7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.4 – PUP (Pull-Up Point)

A pull-up-point (PUP) is a location where a pop-up attack begins. Pull-up locations are typically precomputed to allow an aircraft to make a pre-planned pop-up attack with sufficient altitude and time to release weapons and perform a safe-escape maneuver prior to reaching minimum safe altitude. Once these calculations are completed, the pull-up point configured in the DED the aircraft and displayed on the HUD. A PUP can be combined with either a VRP or a VIP. The procedures are very similar.



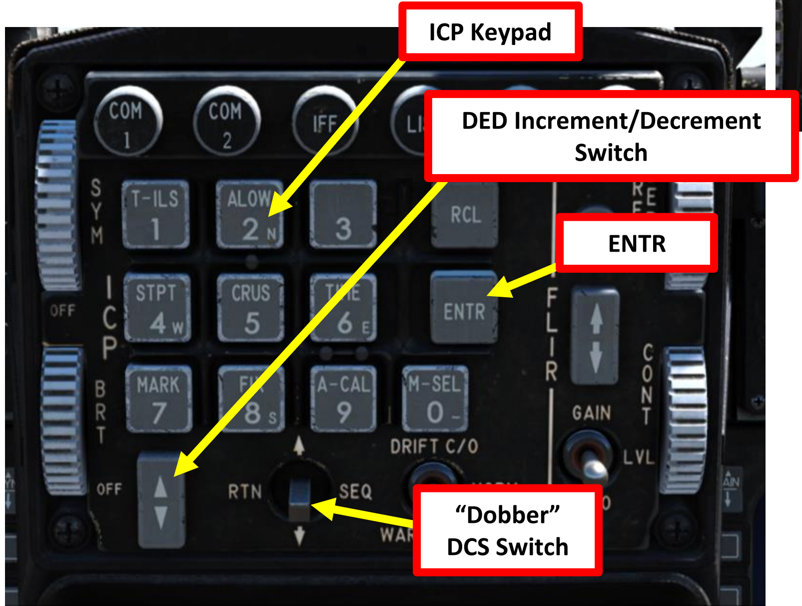


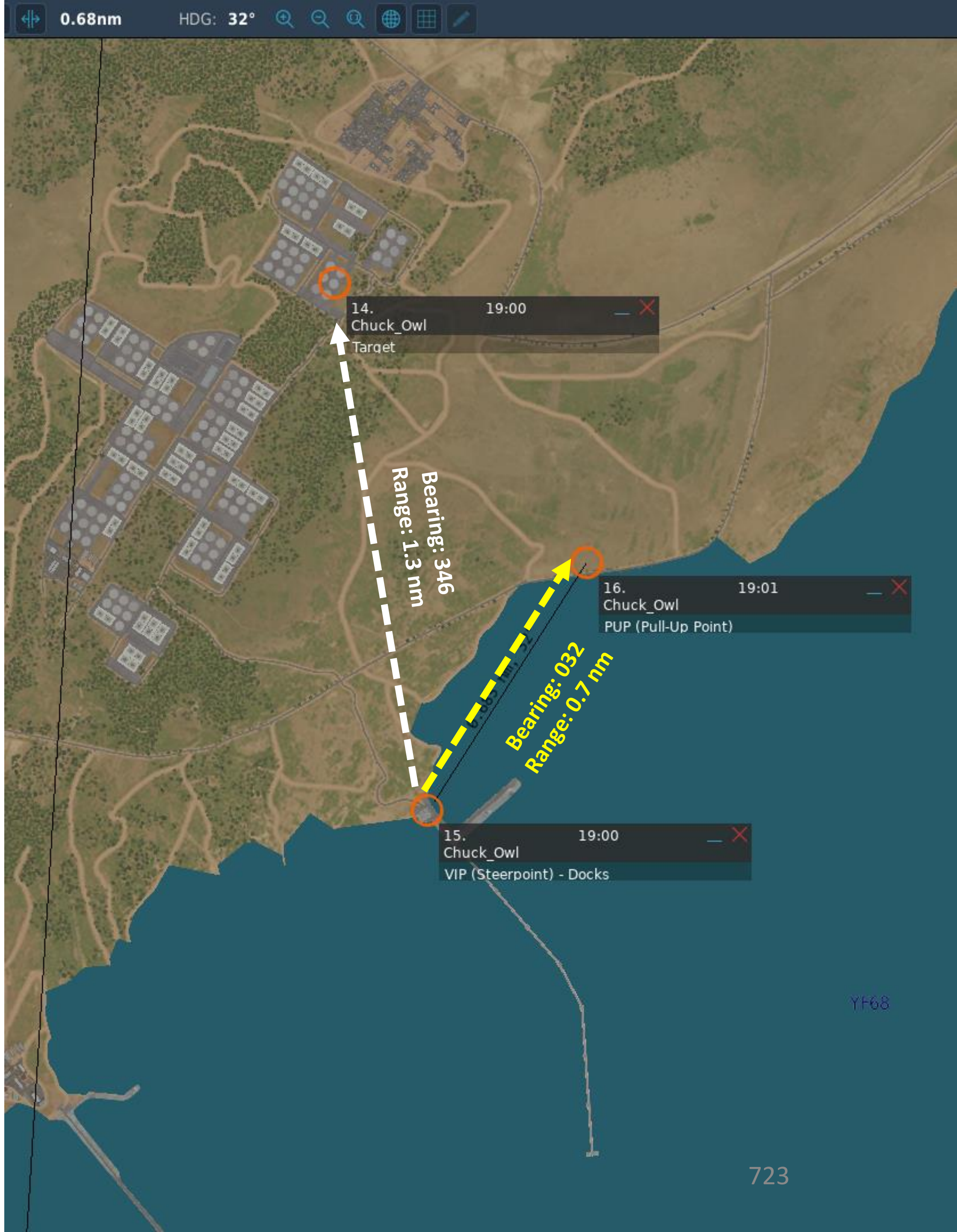
7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.4 – PUP (Pull-Up Point)

VIP-TO-PUP

If you are using VIP (Visual Initial Point) sighting for a target, you can define the pull-up point relative to the VIP rather than the target. The procedure is very similar to VIP-TO-TGT.

To do this, first ensure that you are in air-to-ground mode, then press LIST on the ICP, then “3”, to show the VIP page. The VIP-TO-TGT page is then shown. Press Dobber RIGHT (SEQ) to move to the VIP-TO-PUP page. Ensure the “VIP-TO-PUP” text is surrounded by the cursor, and press “0” (M-SEL) to activate VIP-TO-PUP. (It will be displayed in reverse video when active.) Dobber down to the VIP line and select the visual initial steerpoint. Dobber down to each successive line and enter the bearing from the VIP to the pull-up point, then the range from the VIP to the pull-up point, and finally the elevation difference from the VIP to the pull-up point. To enter a negative number, first press “0” twice.





7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.4 – PUP (Pull-Up Point)

VIP-TO-PUP

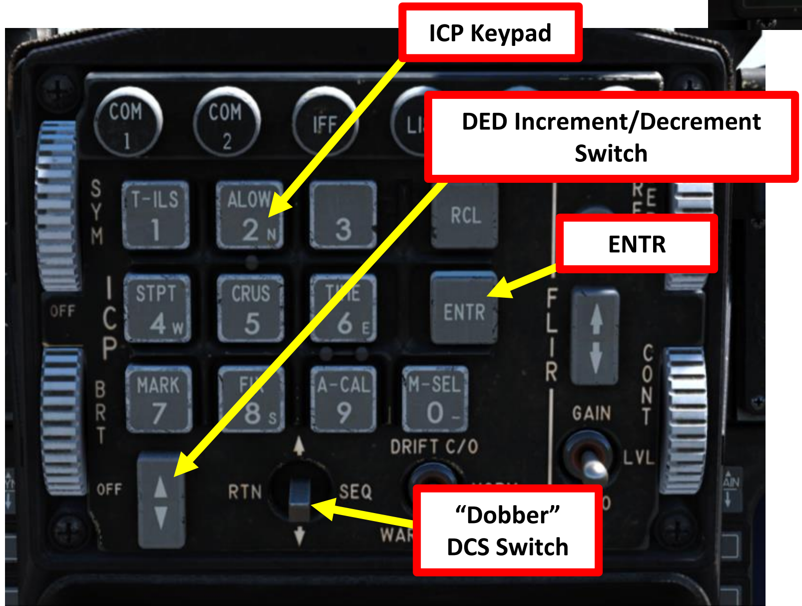
Here is an example where we combined a VIP-TO-TGT and a VIP-TO-PUP function.

7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.4 – PUP (Pull-Up Point)

PUP-TO-VRP

To define a pull-up point relative to the target steerpoint, the procedure is very similar to TGT-TO-VRP.

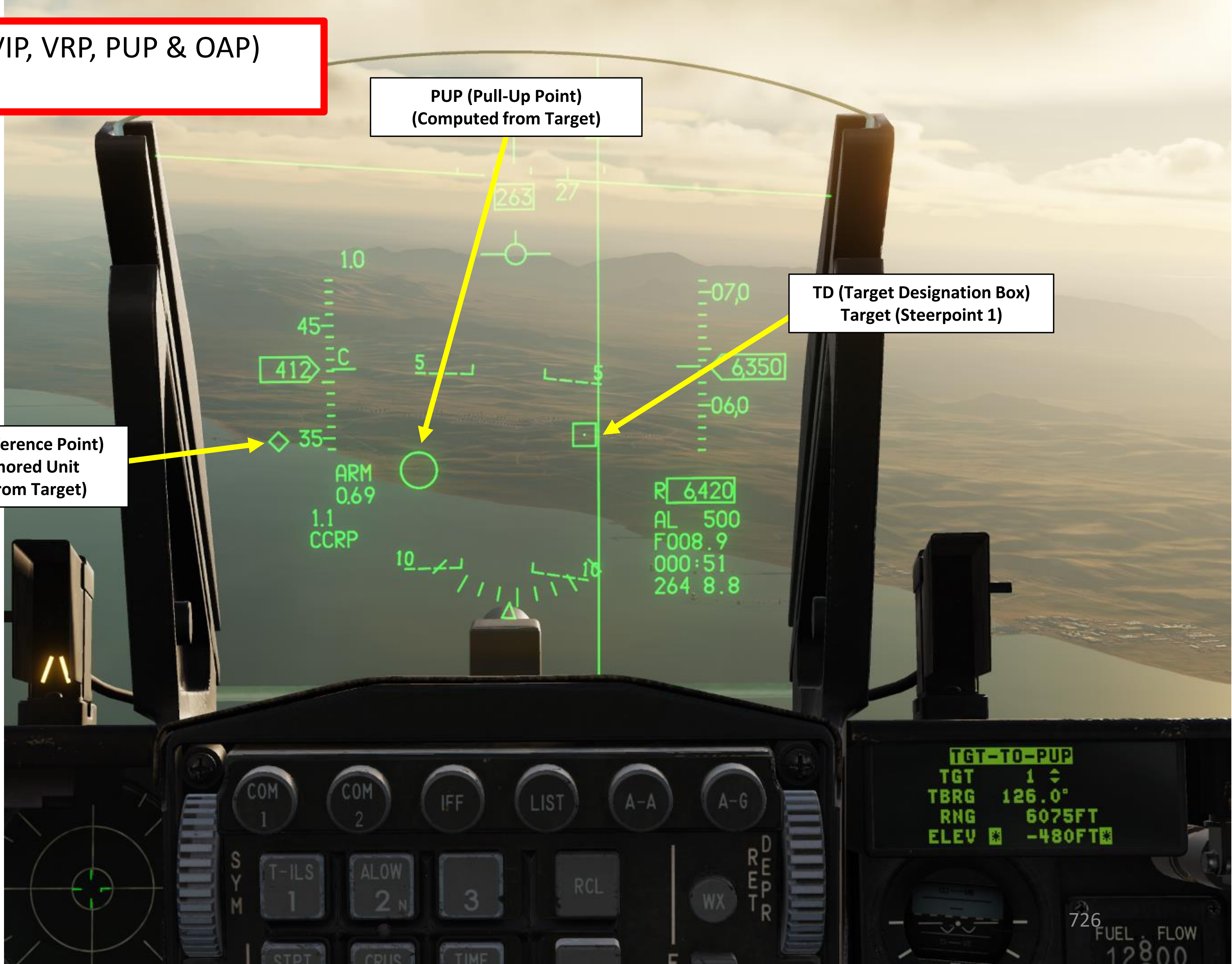
To do this, first ensure that you are in air-to-ground mode, then press LIST on the ICP, then "9", to show the VRP page. The TGT-TO-VRP page is then shown. Press Dobber RIGHT (SEQ) to move to the TGT-TO-PUP page. Ensure the "TGT-TO-PUP" text is surrounded by the cursor, and press "0" (M-SEL) to activate TGT-TO-PUP. (It will be displayed in reverse video when active.) Dobber down to the TGT line and select the target steerpoint. Dobber down to each successive line and enter the bearing from the target to the pull-up point, then the range from the target to the pull-up point, and finally the elevation difference from the target to the pull-up point. To enter a negative number, first press "0" twice.



7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.4 – PUP (Pull-Up Point)

PUP-TO-VRP

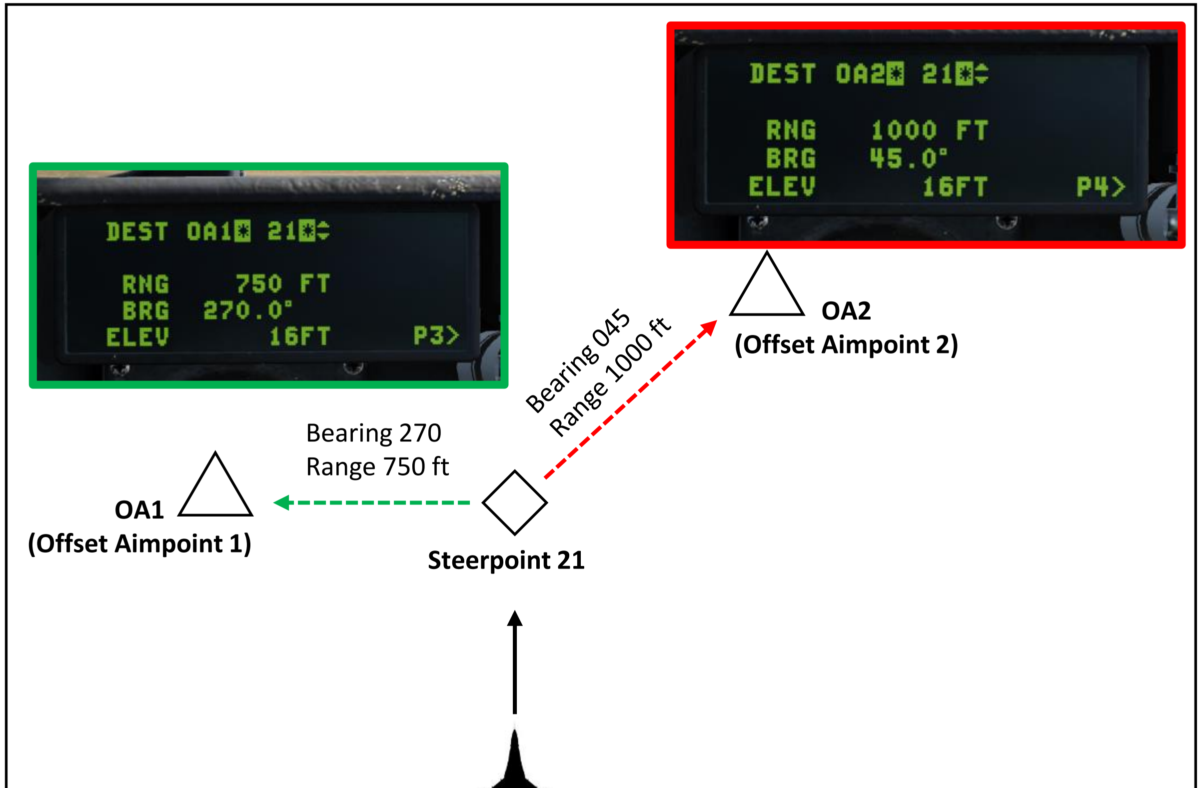
Here is an example where we combined a TGT-TO-VRP and a TGT-TO-PUP function.



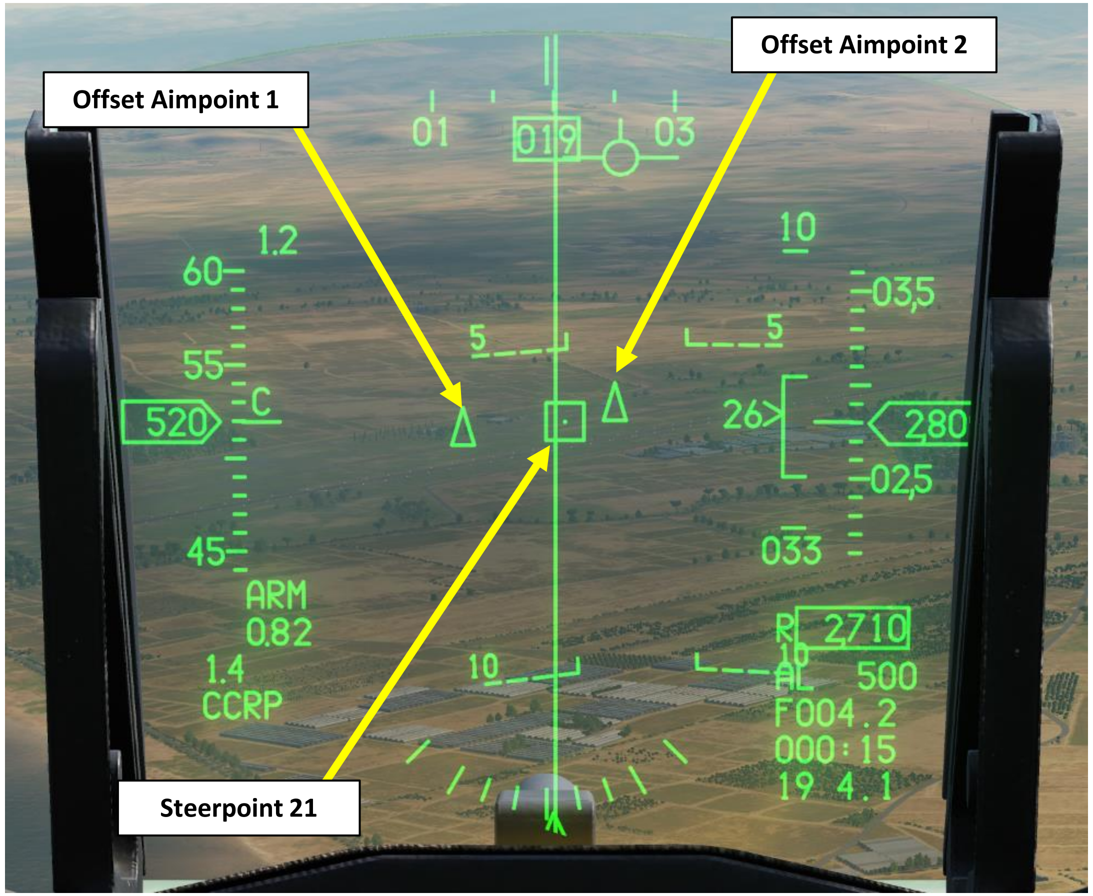
7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.5 – OAP (Offset Aimpoint)

An **Offset Aimpoint (OAP)** is a steerpoint with an offset defined as a true bearing and range (in feet) from the steerpoint and a separate elevation. Two different offset aimpoints (OA1 and OA2) can be associated to a single steerpoint.

The third and fourth DEST DED pages are the Destination Offset Aimpoint 1 **(DEST OA1)** and Offset Aimpoint 2 **(DEST OA2)** pages respectively, which display the relative distance, relative direction, and elevation of the destination steerpoint's offset aimpoints. . Each offset aimpoint and its respective values can be modified from these pages, but if the steerpoint itself is modified to a new position, the offset aimpoints will move with their associated steerpoint accordingly.



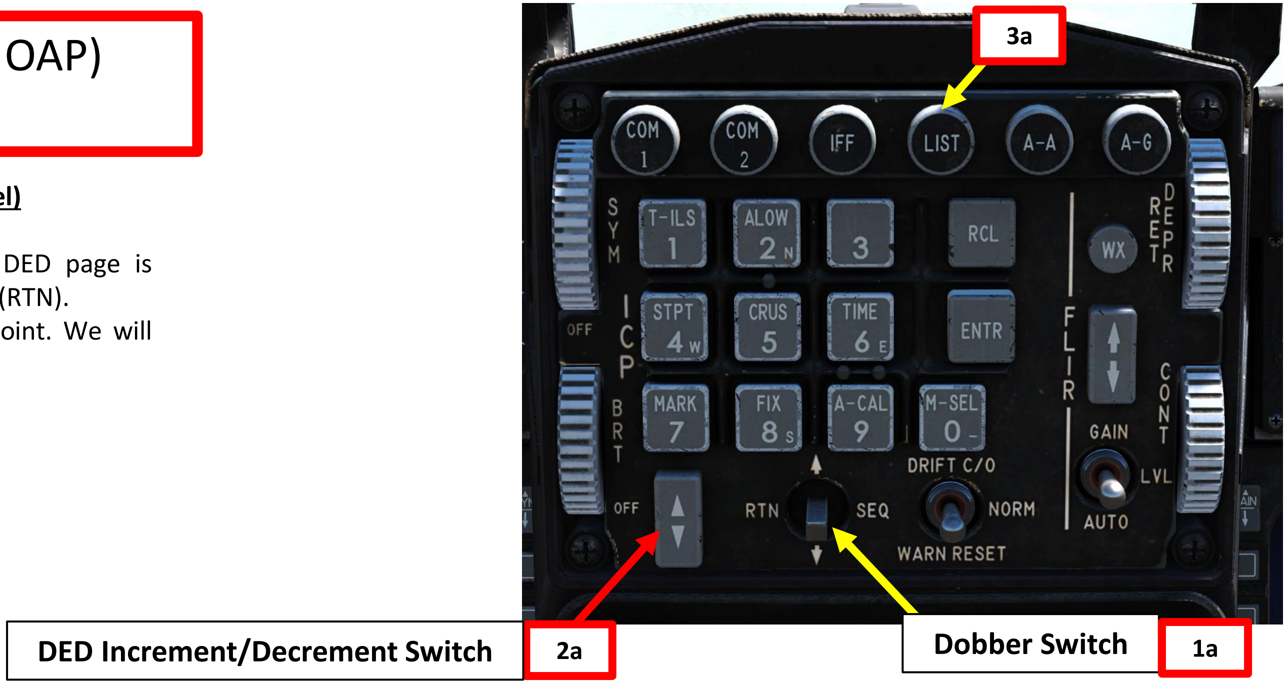
OAP Sighting Concept

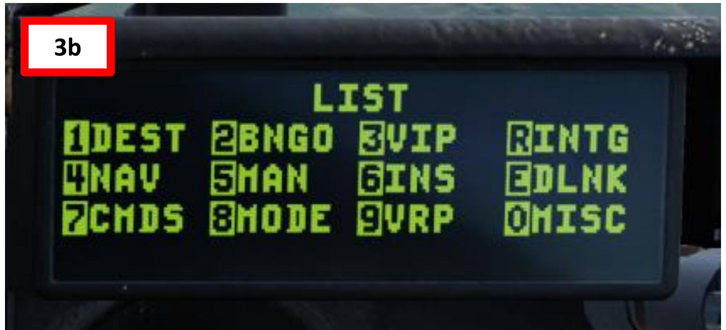


7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.5 – OAP (Offset Aimpoint)

Programming offset aimpoints from the ICP (Integrated Control Panel)

1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. Use DED Increment/Decrement Switch to select desired steerpoint. We will use Steerpoint 21.
3. Press the LIST button

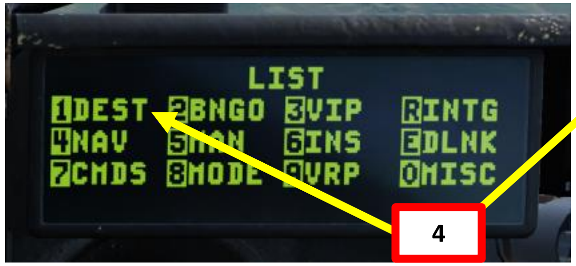




7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.5 – OAP (Offset Aimpoint)

Programming offset aimpoints from the ICP (Integrated Control Panel)

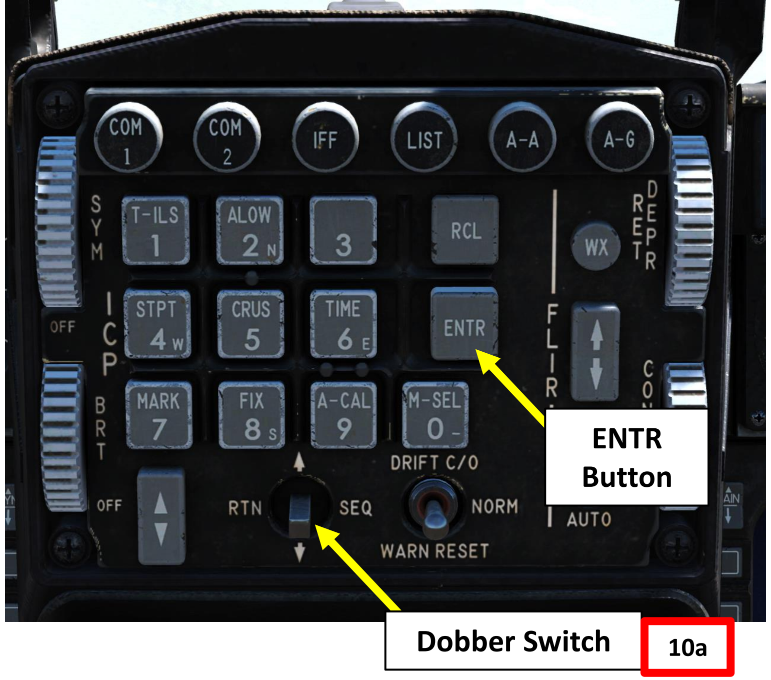
4. The LIST sub-menus will appear on the DED (Data Entry Display). Press the "1" button on the ICP (Integrated Control Panel) to select the DEST (Destination) sub-menu.
5. By default, the UTM DEST page is displayed.
6. Press Dobber Switch RIGHT to toggle DEST pages until DEST OA1 is selected.
7. Use DED Increment/Decrement Switch to select desired steerpoint. We will use Steerpoint 21. Current Range and Bearing values indicate that the OA1 is currently lined up with the active steerpoint.
8. Press Dobber Switch DOWN to select RNG (Range) field.
9. On ICP keypad, enter desired range of offset aimpoint from the steerpoint. We will enter 750 ft, then press ENTR button.



7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.5 – OAP (Offset Aimpoint)

Programming offset aimpoints from the ICP (Integrated Control Panel)

10. Press Dobber Switch DOWN to select BRG (Bearing) field.
11. On ICP keypad, enter desired bearing of offset aimpoint from the steerpoint. We will enter “2700” for a bearing of “270.0”, then press ENTR button.
12. Repeat the same process for elevation (in ft). In this example, we will leave it as is since the offset aimpoint has the same elevation as the steerpoint (16 ft).
13. If you want to add a second offset aimpoing, press Dobber Switch RIGHT to display DEST OA2 page, then repeat steps 7 through 12.



7 – REFERENCE POINTS (VIP, VRP, PUP & OAP)
7.5 – OAP (Offset Aimpoint)

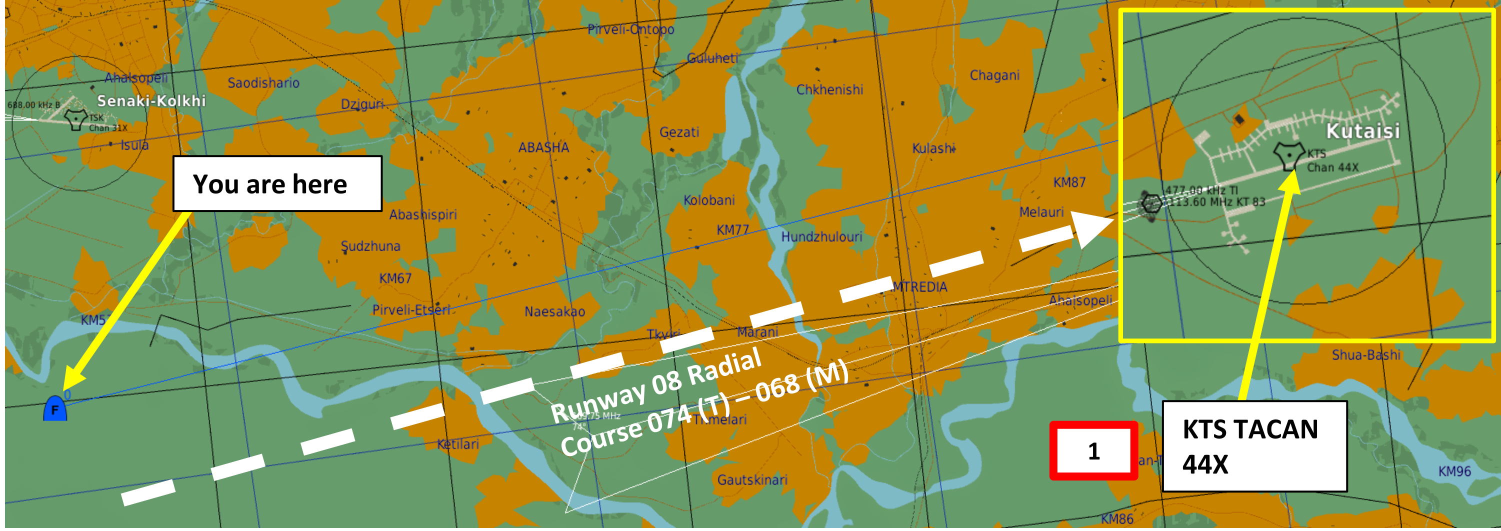
Programming offset aimpoints from the ICP (Integrated Control Panel)

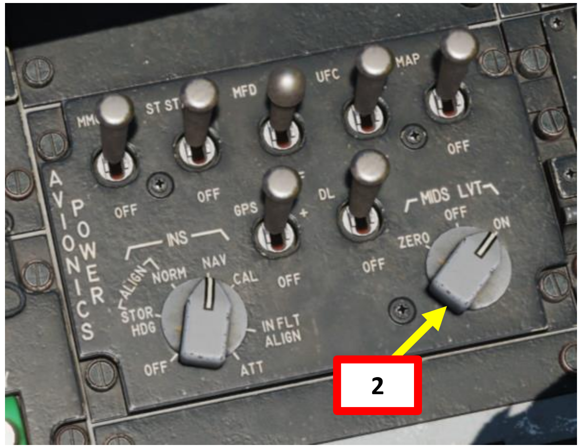
14. The offset aimpoint is displayed on your HUD (Heads-Up Display) as a triangle, provided that you are in A-G (Air-to-Ground) Master Mode, have steerpoint 21 selected, have a CCRP delivery programmed and have the sighting option selector set to OA1 on the TGP (Targeting Pod) page.

8 – TACAN NAVIGATION

TACAN (Tactical Air Navigation) stations are navigation aids typically used by the military and provide you directional and distance guidance. TACAN beacons can be installed on airdromes, air refueling tankers or even aircraft carriers. Many VOR stations are collocated with a TACAN. These stations broadcast both signals so they can be used by military and/or civilian aircraft. These stations are known as “VORTACS”.

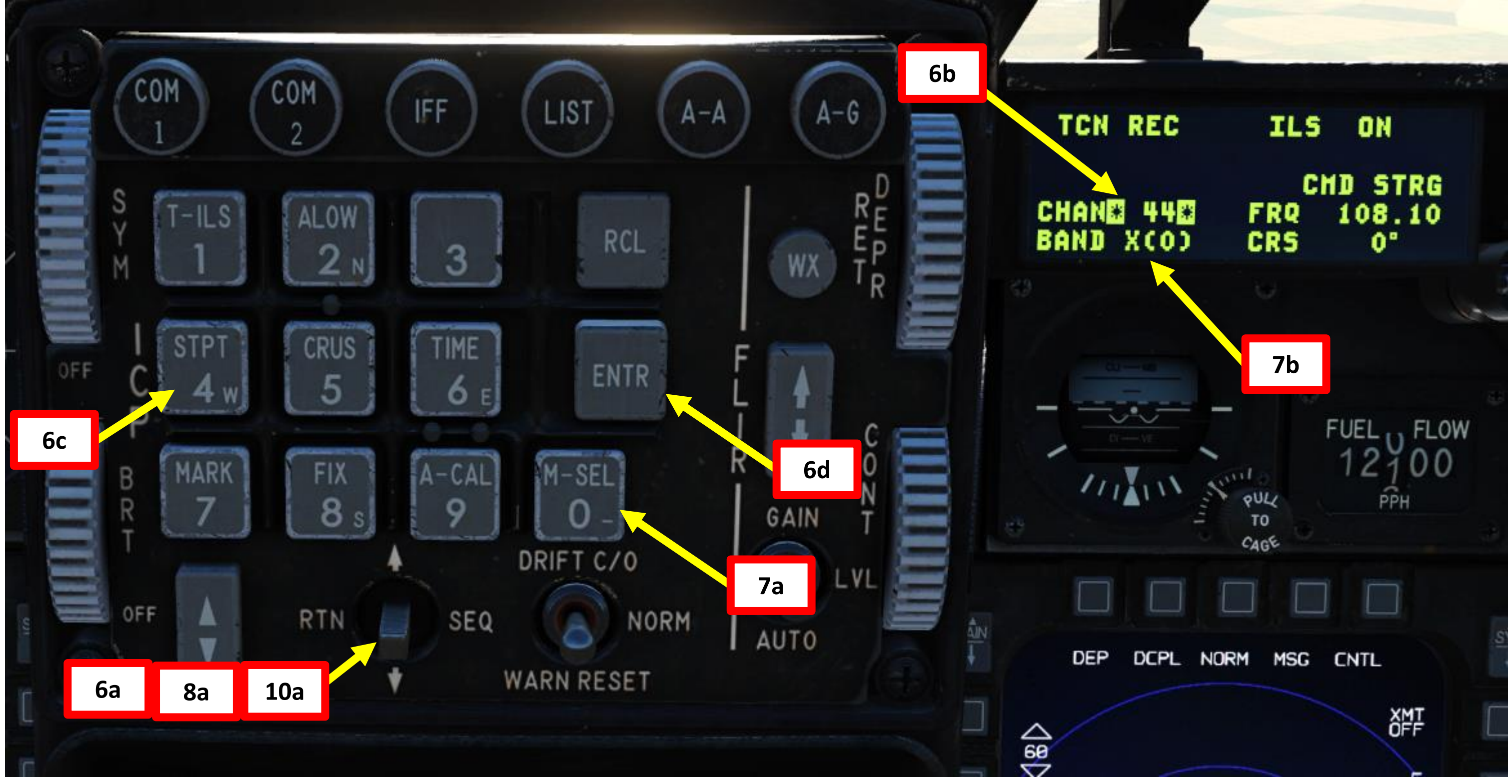
1. We will track Kutaisi’s TACAN 44X.
2. Set MIDS LVT (Multifunctional Information Distribution System) LVT (Low Volume Terminal) knob on the Avionics Power Panel to the ON position.
    - *Take note that the TACAN is part of the MIDS radio system*
3. Adjust TACAN audio tone volume as required.
4. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
5. Press T-ILS (1) Button on the ICP (Integrated Control Panel) to access TACAN-ILS DED (Data Entry Display) menu.





8 – TACAN NAVIGATION

6. Press Dobber Switch DOWN to highlight the CHAN field. Use the ICP keypad to type in the new channel (44). Press ENTR to accept the changes.
7. If required, you may change the band by selecting the M-SEL (0) button on the ICP, then pressing ENTR. This toggles the band between X and Y.
8. Toggle the Dobber Switch RIGHT (SEQ) to cycle through TACAN modes until TCN T/R (Transmit-Receive) is selected.
9. The navigation will identify TACAN beacon as beacon KTS, a TACAN station at Kutaisi.
10. Press Dobber Switch LEFT (RTN) to return to CNI (Communication, Navigation & Identification) DED menu. The selected TACAN station will be displayed on it.
11. On the EHSI (Electronic Horizontal Situation Indicator), press "M" (Mode Selector) button to select "TCN" mode. This will slave the EHSI to the TACAN beacon.
12. Set the desired course to the TACAN using the EHSI CRS Course Select knob (068)

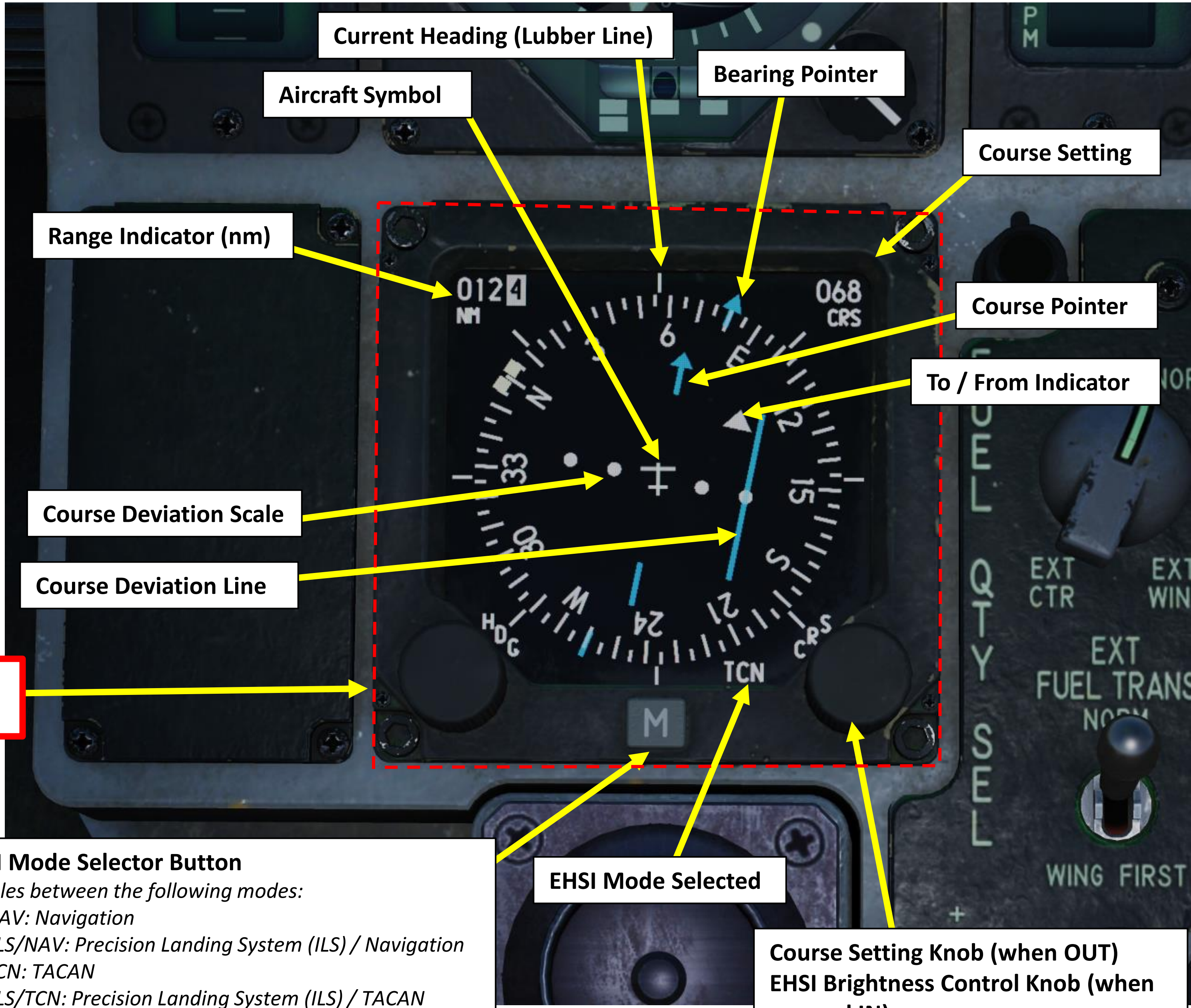


TACAN OPERATION MODES:

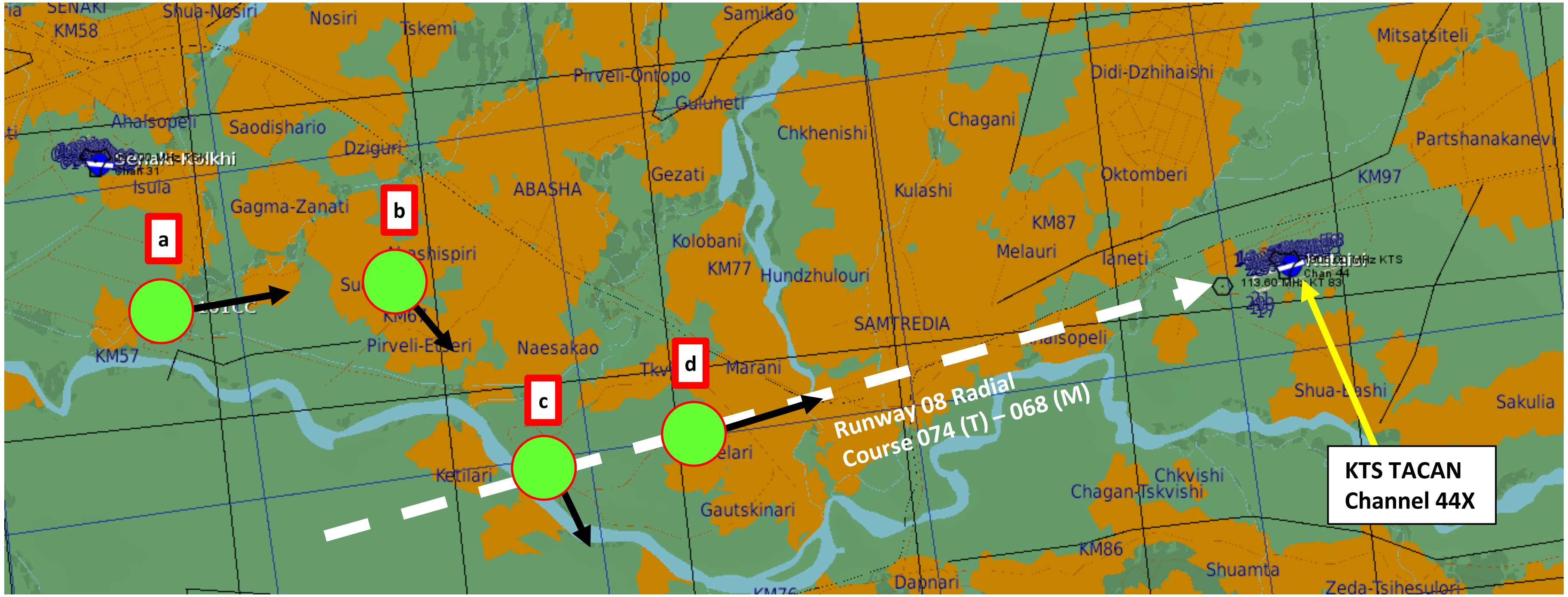
- **REC**: Your TACAN operates in receive mode only and provides bearing, course deviation, and station identification.
- **T/R**: The TACAN acts in a transceiver mode (send and receive) and provides bearing, range, deviation and station identification. This will be your most common selection.
- **A/A REC**: TACAN operates in Air-to-Air mode and can only receive bearing, course deviation and station identification for a TACAN-equipped aircraft.
- **A/A T/R**: TACAN operates in Air-to-Air transceiver mode and provides bearing, range, deviation, and station identification with a TACAN-equipped aircraft.

8 – TACAN NAVIGATION

13. After a few seconds, the EHSI will display DME (Distance Measuring Equipment) distance to the TACAN in nautical miles.
14. Steer the aircraft towards the TACAN CDI (Course Deviation Indicator) Reference Line. As you approach the radial, the line deviation with the centerline of the EHSI will gradually diminish.
15. The direction of the TACAN beacon will be displayed by the Bearing Pointer.
16. CDI (Course Deviation Indicator) will indicate how far off the TACAN radial course (068) you are.
17. The To / From Indicator (White Triangle) will indicate whether you are heading towards the radial or away from it.
18. When CDI Reference line is centered, this means you are on the 068 radial.
19. Then, turn towards the TACAN Bearing Pointer (or Course Pointer) to follow the radial to the runway.



8 – TACAN NAVIGATION

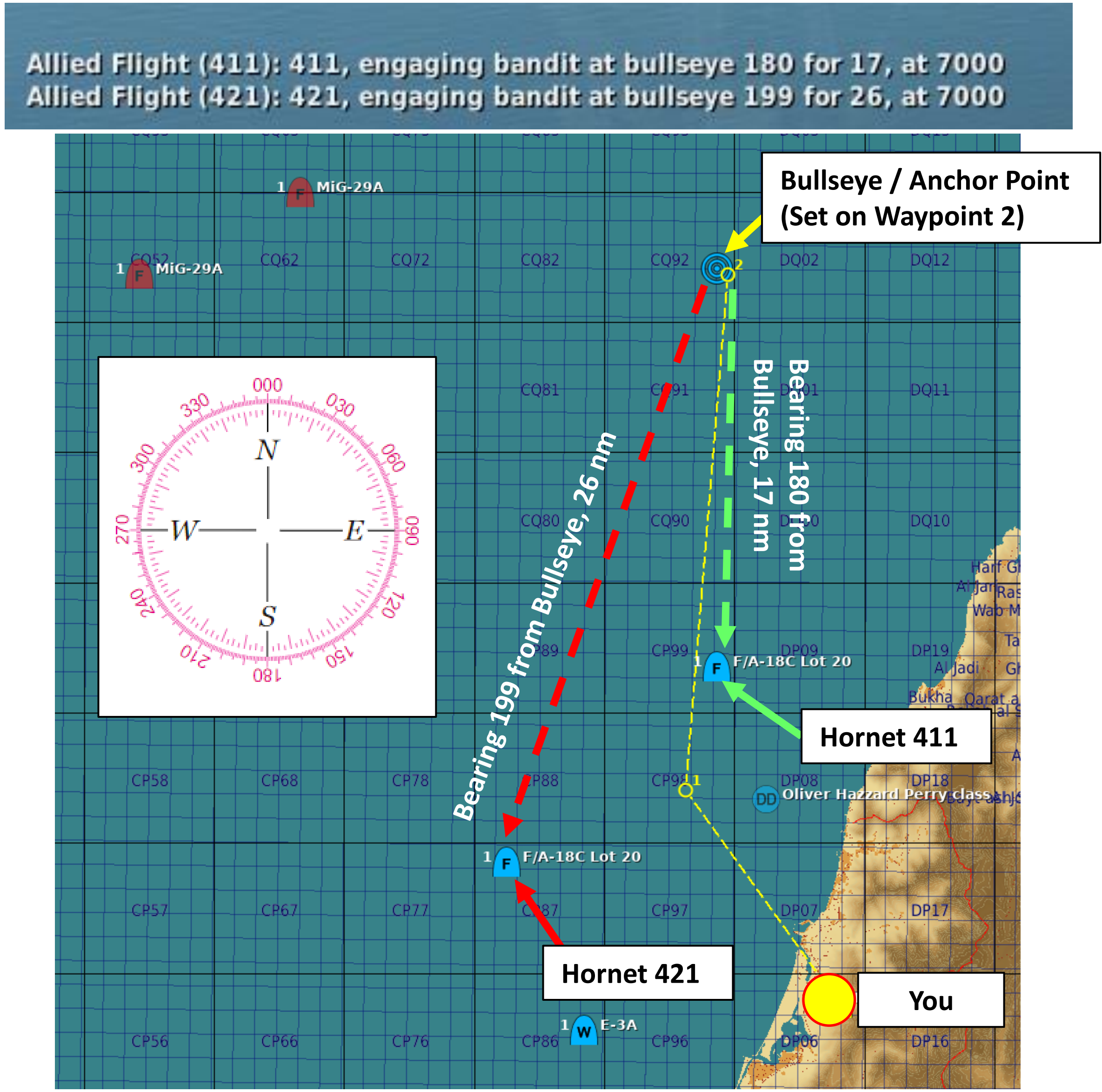


9 – BULLSEYE

A "Bullseye" or "Anchor Point" is a fictional point in space that serves as a common geographic reference for a mission amongst friendly forces. If you know where the bullseye is and the enemy doesn't, it gives you a way to communicate positions without the enemy knowing where to look from. Your wingmen and AWACS will often refer to "bulls" or "bullseye" on the radio. A bullseye call, used to communicate your position, is done in the following format:

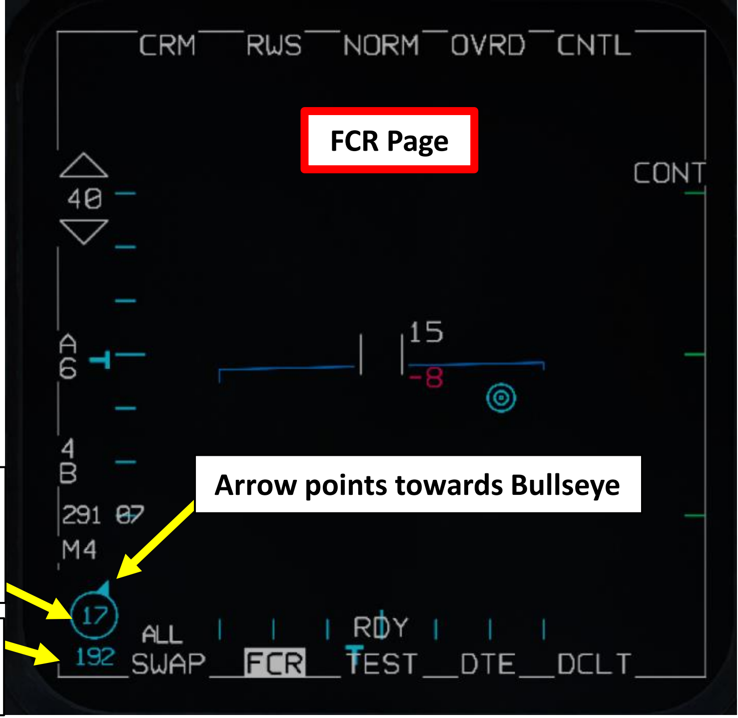
- Bearing from bullseye
- Range from bullseye
- Altitude

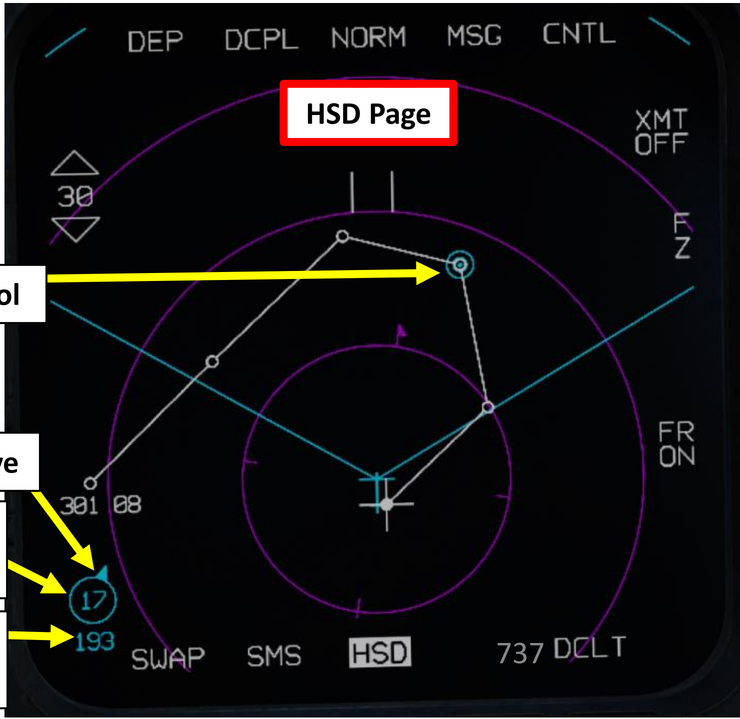
Bullseye Explanation by JediLinks: https://youtu.be/vgcXcfeGb2M



9 – BULLSEYE

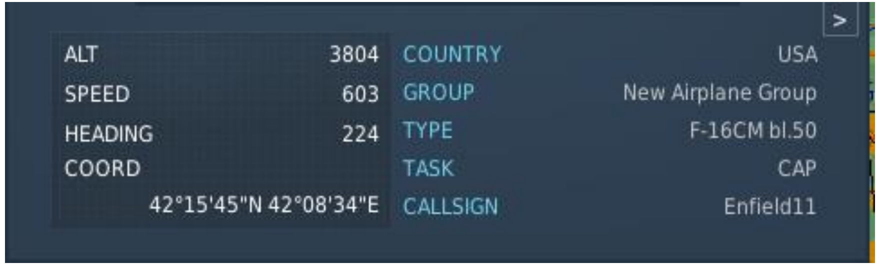
Bearing and range from the Bullseye to your aircraft is displayed in three places: the Heads-Up Display, the FCR (Fire Control Radar) page and the HSD (Horizontal Situation Display) page.

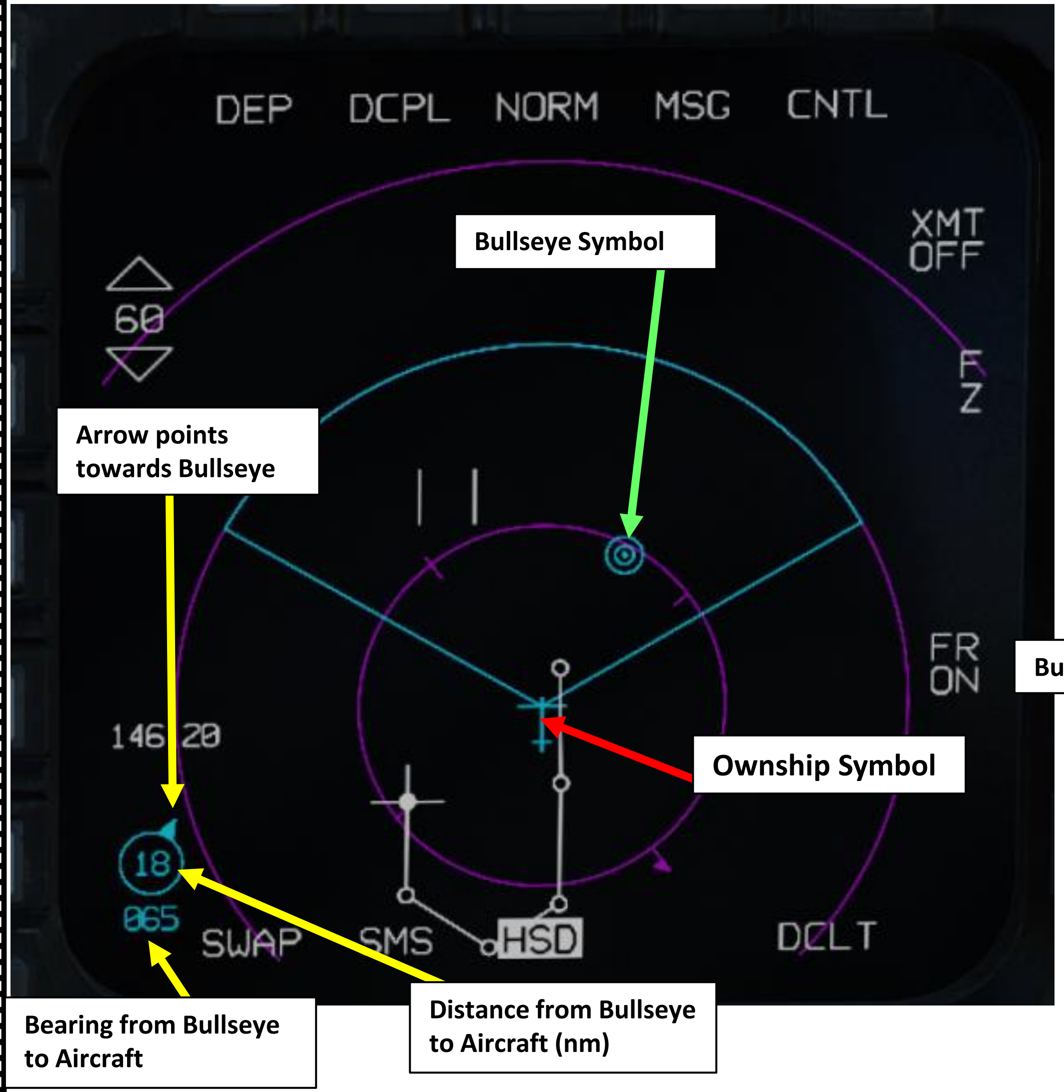


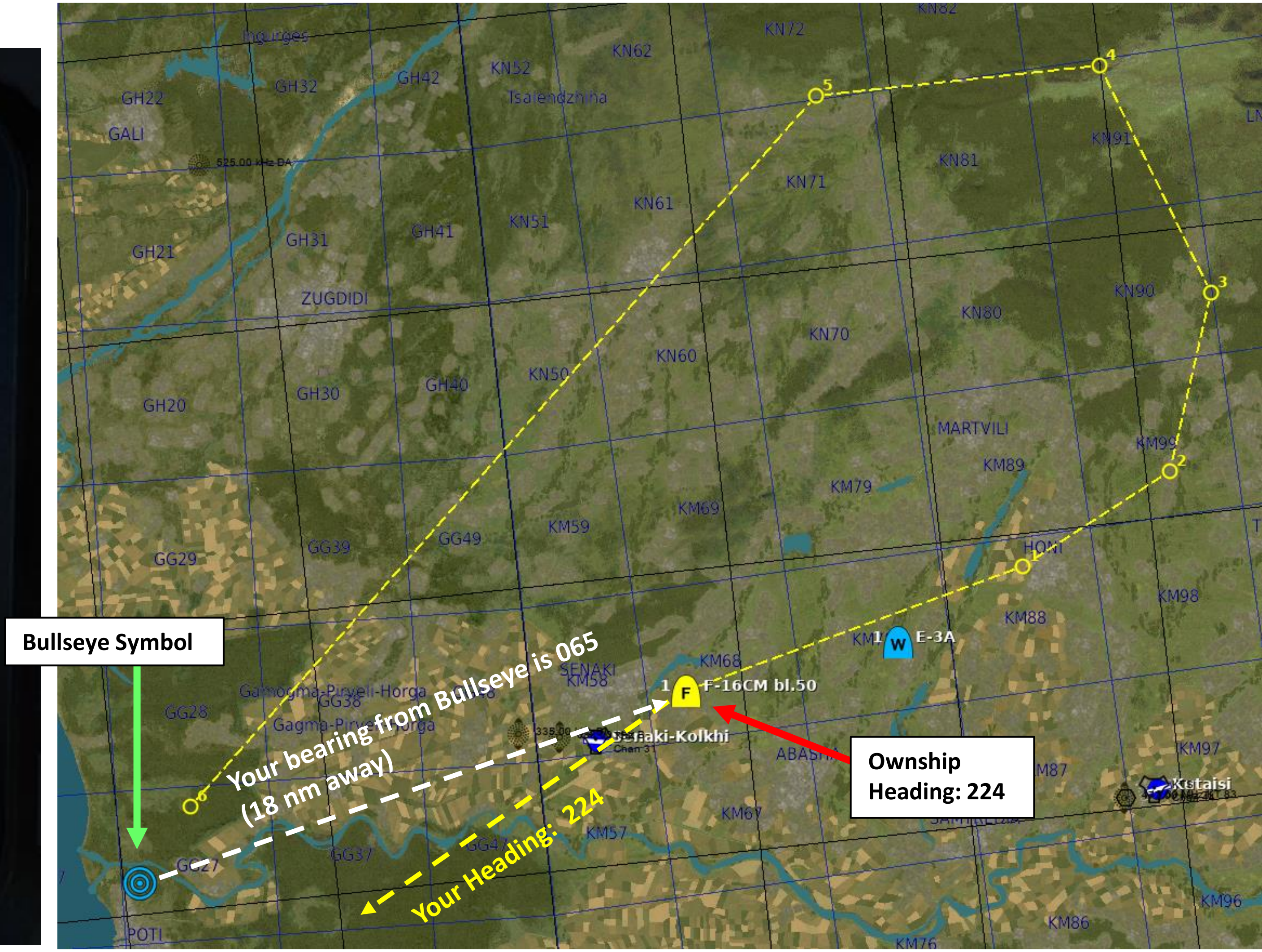


9 – BULLSEYE

In this example, we are at a bearing of 065 degrees from the bullseye: the reciprocal of that is 65 + 180 = 245 degrees. Since we are on a heading of 224 degrees, in the example we subtract 245 - 224 to get the 21 degrees we would have to turn in West to get to the bullseye.



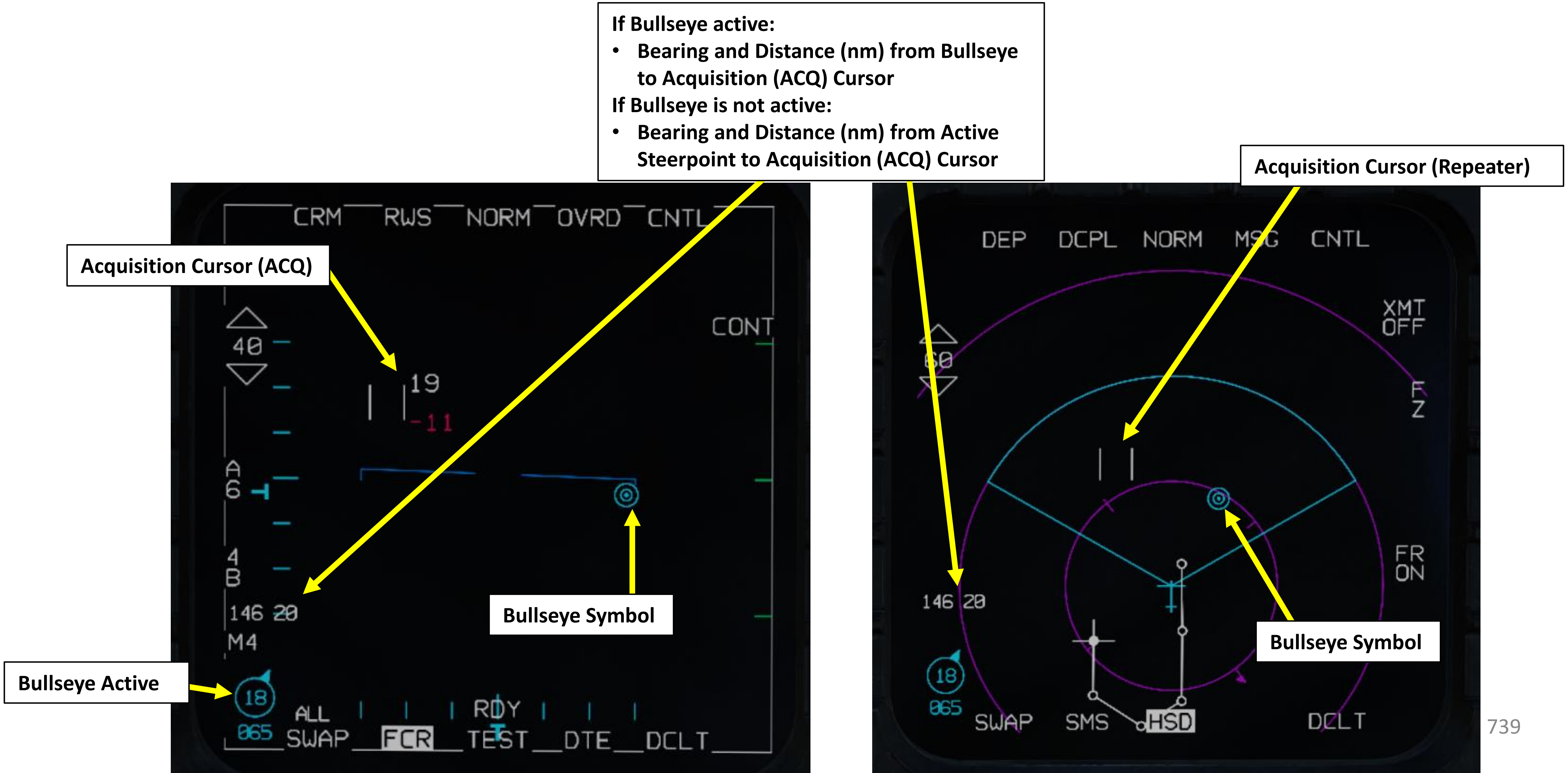




9 – BULLSEYE

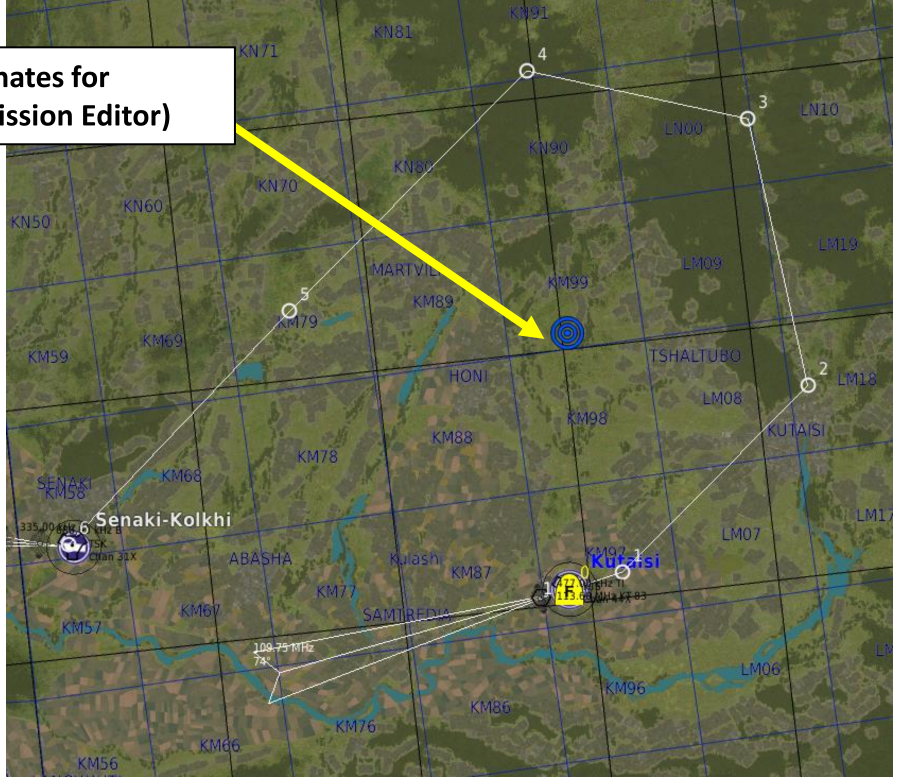
There is an information block on the FCR and HSD pages that shows FCR acquisition cursor information based on whether or not the bullseye function is active.

- If bullseye is inactive, the Bearing and Distance information displayed is from the active steerpoint to the acquisition cursor.
- If bullseye is active, the Bearing and Distance information displayed is from the bullseye to the acquisition cursor.



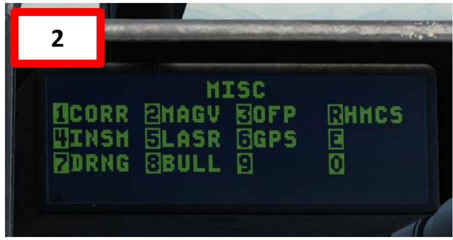
9 – BULLSEYE

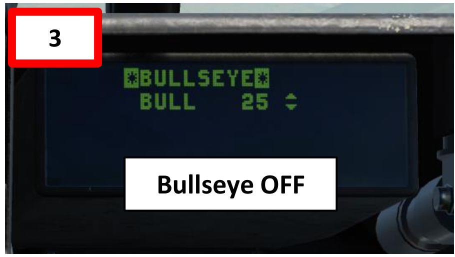
Bullseye, default coordinates for Steerpoint 25 (set via Mission Editor)



To activate bullseye (default: steerpoint 25):

1. Press the LIST button
2. Press "0 / M-SEL" on the ICP (Integrated Control Panel) to select MISC (Miscellaneous) DED Page.
3. Press "8" on the ICP (Integrated Control Panel) to select BULLS (Bullseye) DED Page.
4. By default, the bullseye function is not activated. Press "0 / M-SEL" on the ICP (Integrated Control Panel) to activate bullseye (highlighted when active).
5. By default, steerpoint 25 is selected as the Bullseye. If you have not entered manually coordinates for steerpoint 25, the coordinates by default are set to the Bullseye marker set via the Mission Editor.

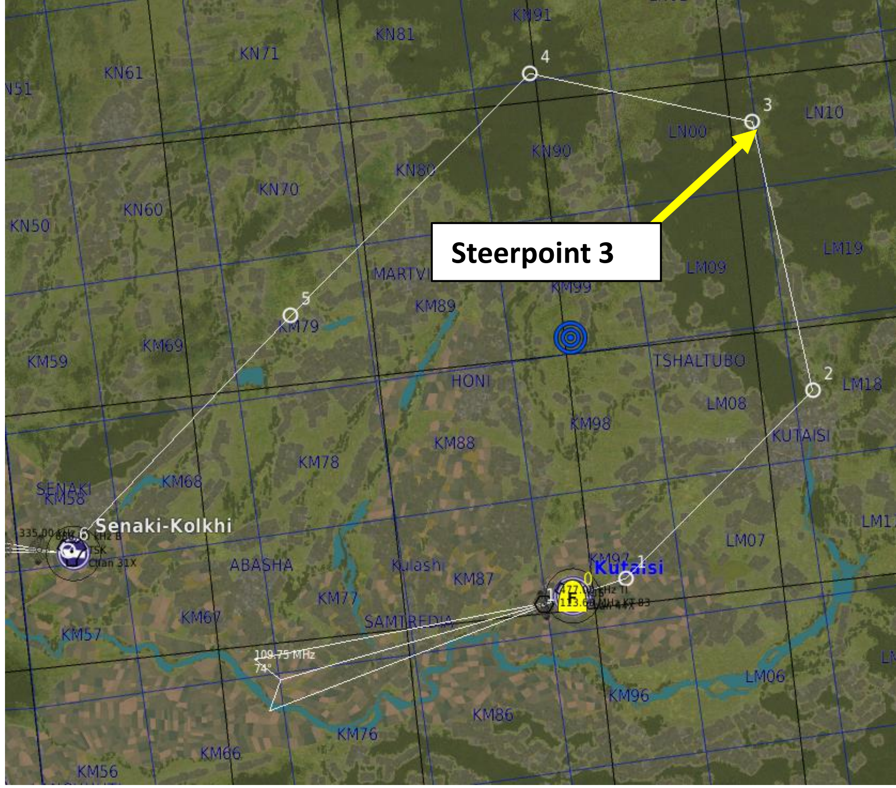


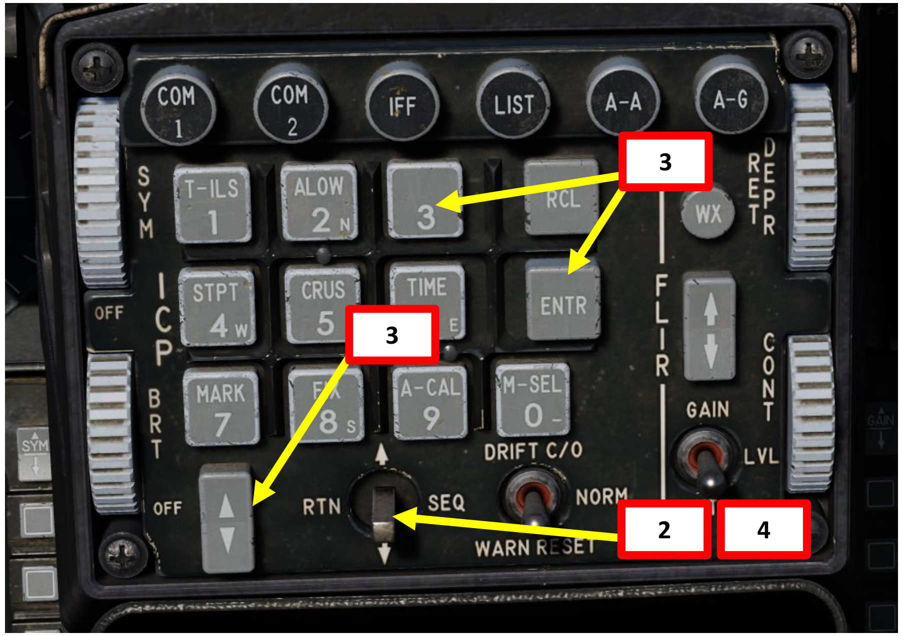


9 – BULLSEYE

To set bullseye to another steerpoint:

1. Go to the Bullseye DED page (see previous page).
2. Press the DCS ("Dobber") DOWN to select the BULL field. Selection of the field is indicated by asterisks.
3. Use DED Increment/Decrement Switch to set the steerpoint you want to use as a bullseye. We will select Steerpoint 3.
   - *Alternatively, you can also set steerpoint by entering the Steerpoint Number (i.e. "3" button for Steerpoint 3), then pressing "ENTR" button.*
4. Return to CNI (Communications, Navigation & Identification) DED page by pressing the DCS/Dobber (Data Control Switch) left to RTN





10 – CRUS (CRUISE) PAGE

The CRUS (Cruise) DED (Data Entry Display) page provides you valuable navigation information while cruising. This page is selected by:

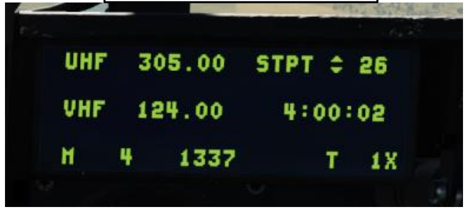
1. Selecting CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
2. Pressing CRUS (5) Button on the ICP (Integrated Control Panel) will select the TOS (Time Over Steerpoint) sub-page by default.

The CRUS page has four sub-modes, which can be toggled by using the Dobber Switch RIGHT (SEQ):

- **TOS (Time Over Steerpoint)**
- **RNG (Range)**
- **HOME**
- **EDR (Endurance)**

Note: When toggling from one submode to another, you must always use the M-SEL (0) Button, which will "mode select" the new CRUS mode. If you don't do so, the computed airspeed/altitude caret(s) may be computed from the previous CRUS submode.

CNI DED Page



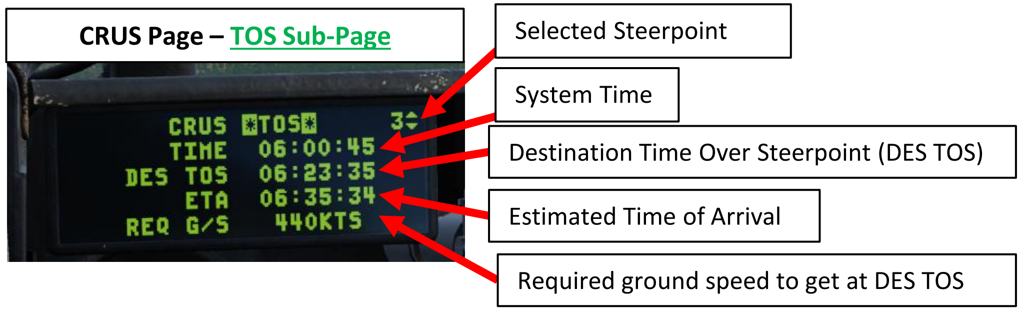
CRUS Page – TOS Sub-Page

CRUS Page – RNG Sub-Page

CRUS Page – HOME Sub-Page

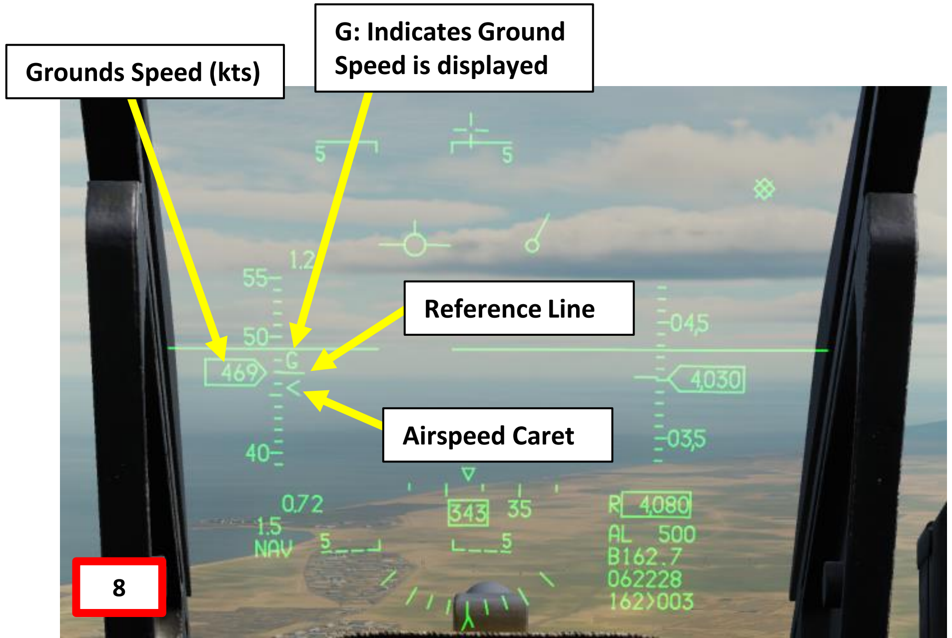
CRUS Page – EDR Sub-Page

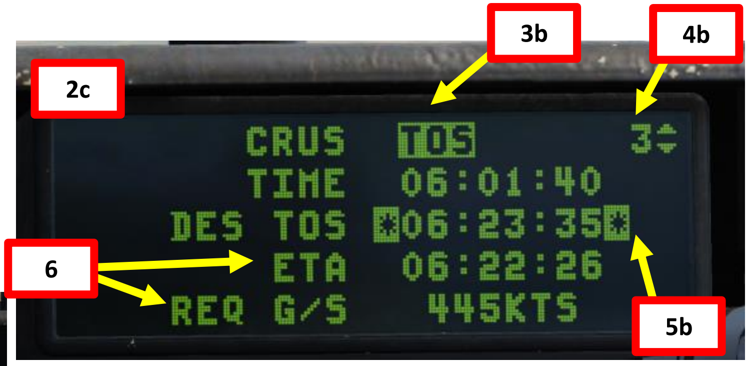
10 – CRUS (CRUISE) PAGE



TOS (Time Over Steerpoint): This will provide you airspeed information (**Airspeed Caret** on HUD speed tape) to ensure that you reach selected steerpoint at the required TOS (Time Over Steerpoint) set for the mission.

1. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
2. Press CRUS (5) Button on the ICP (Integrated Control Panel). This will select the TOS (Time Over Steerpoint) sub-page by default. If another sub-page is selected, press Dobber switch RIGHT (SEQ) until the TOS sub-page is displayed.
3. Press M-SEL (0) button to display TOS CRUS symbology on the HUD.
4. Select desired steerpoint using the DED Increment/Decrement Switch.
5. Press Dobber switch DOWN to select DES TOS (Desired Time Over Steerpoint), enter desired time on the ICP keypad, then press ENTR.
6. The ETA and REQ G/S fields will update accordingly.
7. Set HUD Velocity Switch to GNS SPD (Ground Speed).
8. The Airspeed Caret on the HUD helps you figure out the speed you should be flying at to fly over the selected steerpoint and arrive at the desired time.
    - When caret is below the reference line, you are going too fast.
    - When caret is above the reference line, you are going too slow.



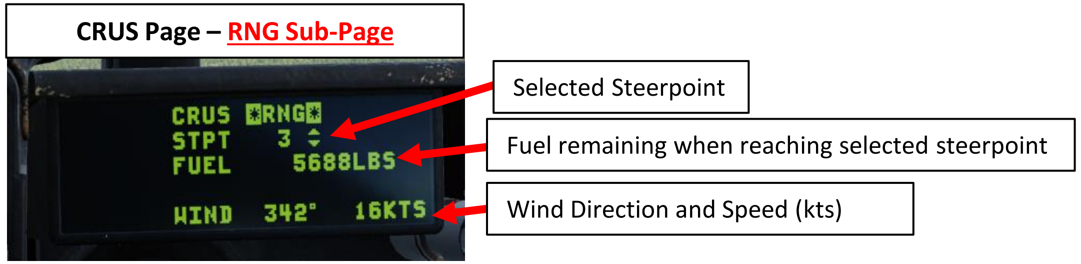


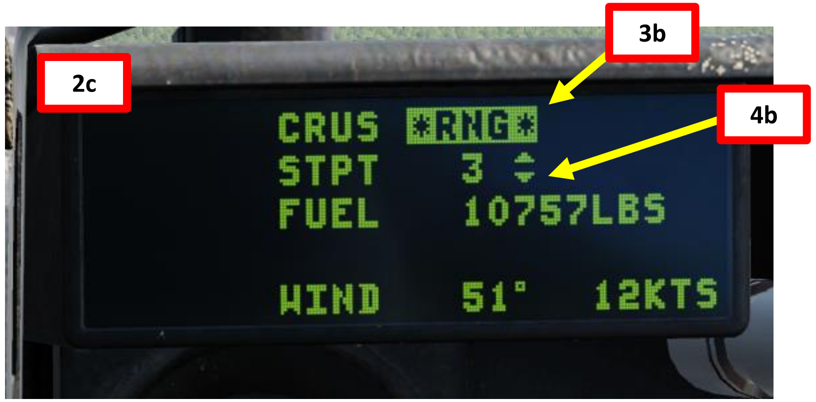
HUD Velocity Switch
- *FWD: CAS displays calibrated airspeed on HUD*
- *MIDDLE: TAS displays true airspeed on HUD*
- *AFT: GND SPD displays ground speed on HUD*

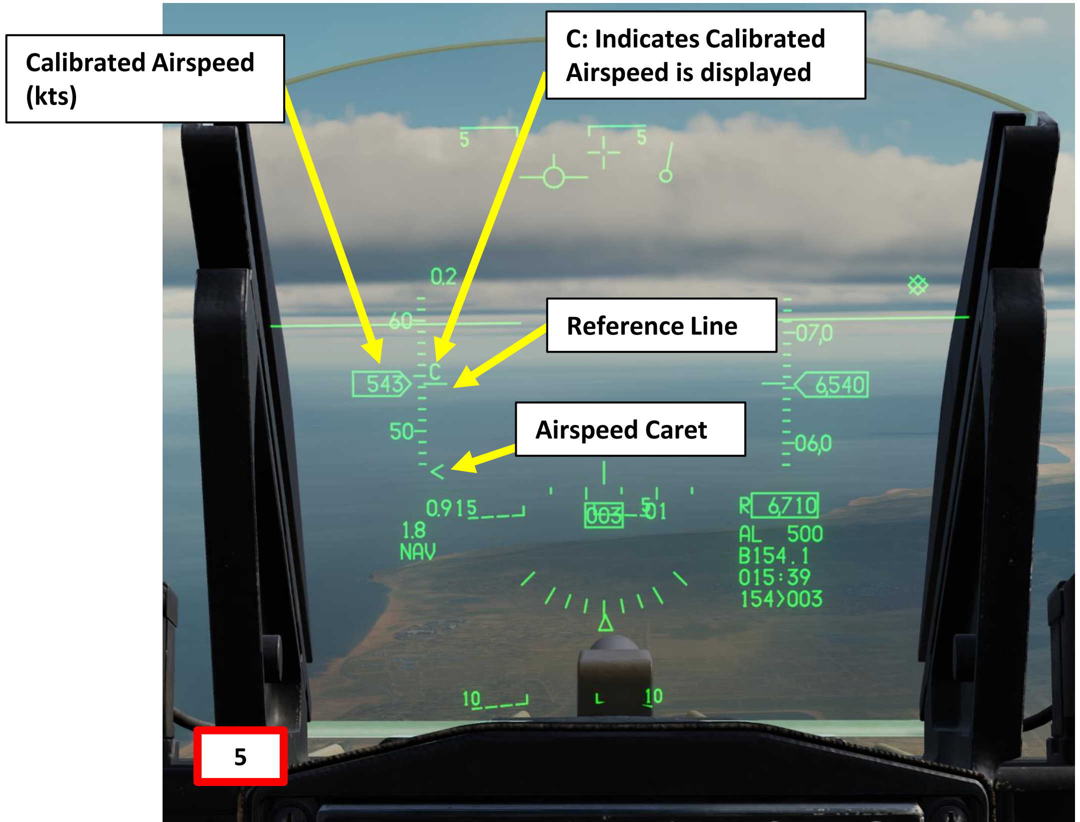
10 – CRUS (CRUISE) PAGE

RNG (Range): An **Airspeed caret** is displayed on the HUD speed tape to pinpoint the optimal speed to best conserve fuel at this altitude.

1. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
2. Press CRUS (5) Button on the ICP (Integrated Control Panel). This will select the TOS (Time Over Steerpoint) sub-page by default. Press Dobber switch RIGHT (SEQ) until the RNG sub-page is displayed.
3. Press M-SEL (0) button to display RNG CRUS symbology on the HUD.
4. Select desired steerpoint using the DED Increment/Decrement Switch.
5. The Airspeed Caret on the HUD helps you figure out the speed you should be flying at to best conserve fuel at this altitude.
    - When caret is below the reference line, you are going too fast.
    - When caret is above the reference line, you are going too slow.





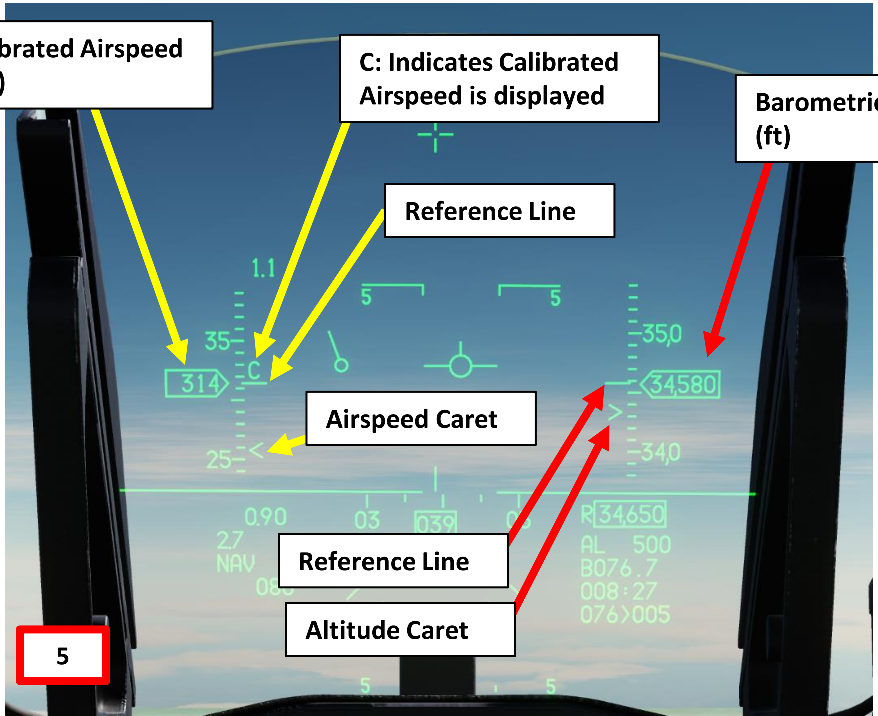


10 – CRUS (CRUISE) PAGE

HOME: Two carets are displayed in the HUD on the speed tape and on the altitude tape. Following the computed **Airspeed Caret** and **Altitude Caret** will establish the best profile to reach Home Plate (or any steerpoint designated as HMPT).

1. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
2. Press CRUS (5) Button on the ICP (Integrated Control Panel). This will select the TOS (Time Over Steerpoint) sub-page by default. Press Dobber switch RIGHT (SEQ) until the HOME sub-page is displayed.
3. Press M-SEL (0) button to display HOME CRUS symbology on the HUD.
4. Select desired steerpoint you want to use as a Home Plate for landing using the DED Increment/Decrement Switch.
5. The Airspeed and Altitude Carets on the HUD helps you figure out the speed and altitude you should be flying at to get to home plate as "fuel-efficiently" as possible.
   - When airspeed caret is below the reference line, you are going too fast.
   - When airspeed caret is above the reference line, you are going too slow.
   - When altitude caret is below the reference line, you are flying too high.
   - When altitude caret is above the reference line, you are flying too low.

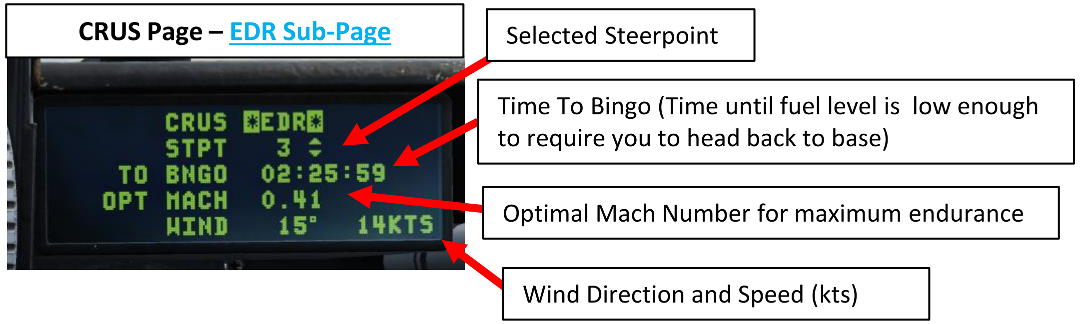
CRUS Page – HOME Sub-Page

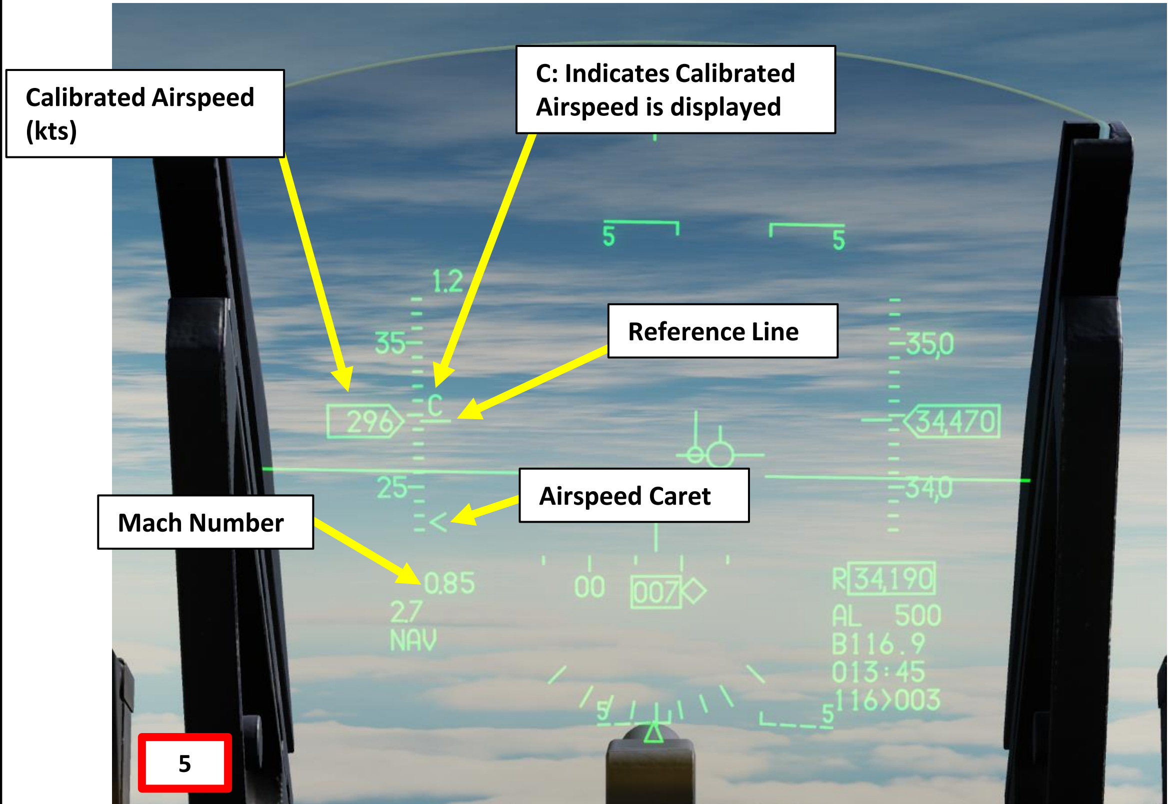


10 – CRUS (CRUISE) PAGE

EDR (Endurance): An **Airspeed caret** is displayed on the HUD speed tape to pinpoint the optimal speed for best endurance at this altitude. Endurance is the maximum length of time that an aircraft can spend in cruising flight.

1. Select CNI (Communication, Navigation & Information) page by setting Dobber switch LEFT (RTN)
2. Press CRUS (5) Button on the ICP (Integrated Control Panel). This will select the TOS (Time Over Steerpoint) sub-page by default. Press Dobber switch RIGHT (SEQ) until the EDR sub-page is displayed.
3. Press M-SEL (0) button to display EDR CRUS symbology on the HUD.
4. Select desired steerpoint using the DED Increment/Decrement Switch.
5. The Airspeed Caret on the HUD helps you figure out the speed you should be flying at to maximize aircraft endurance (time available to fly before having to go back to base to refuel).
    - When caret is below the reference line, you are going too fast.
    - When caret is above the reference line, you are going too slow.





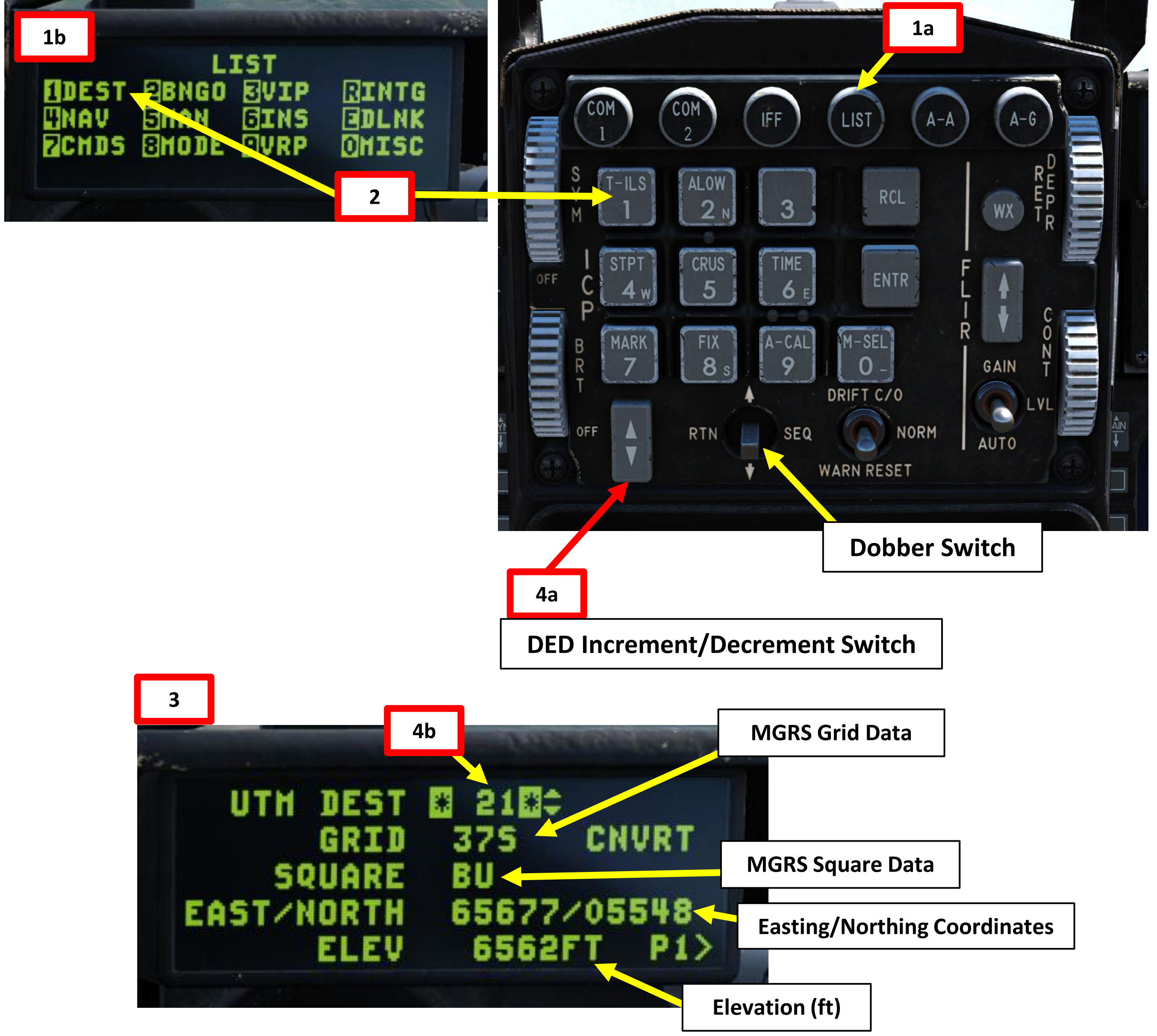
11 – DEST (Destination) Page

The DEST (Destination) page is similar to the STPT DED page, in that it displays the position, elevation, and TOS of steerpoints within the navigational database. However, unlike the STPT page, the DEST page permits review and modification of steerpoint data fields without selecting that steerpoint for navigation.

UTM Sub-Page

The first DEST DED page is the **UTM Destination page**, which may **display steerpoints 21-25 only** for the purposes of MGRS coordinate entry. MGRS (Military Grid Reference System) is a UTM-derived coordinate system used as an alternative to Latitude/Longitude and is the primary coordinate system used by many military ground forces. This functionality is very useful if a JTAC (Joint Tactical Air Controller) or a friendly asset provides you coordinates to a target in MGRS format.

1. Press the LIST button
2. The LIST sub-menus will appear on the DED (Data Entry Display). Press the "1" button on the ICP (Integrated Control Panel) to select the DEST (Destination) sub-menu.
3. By default, the UTM DEST page is displayed.
4. Use DED Increment/Decrement Switch to select desired steerpoint. We will use Steerpoint 21.

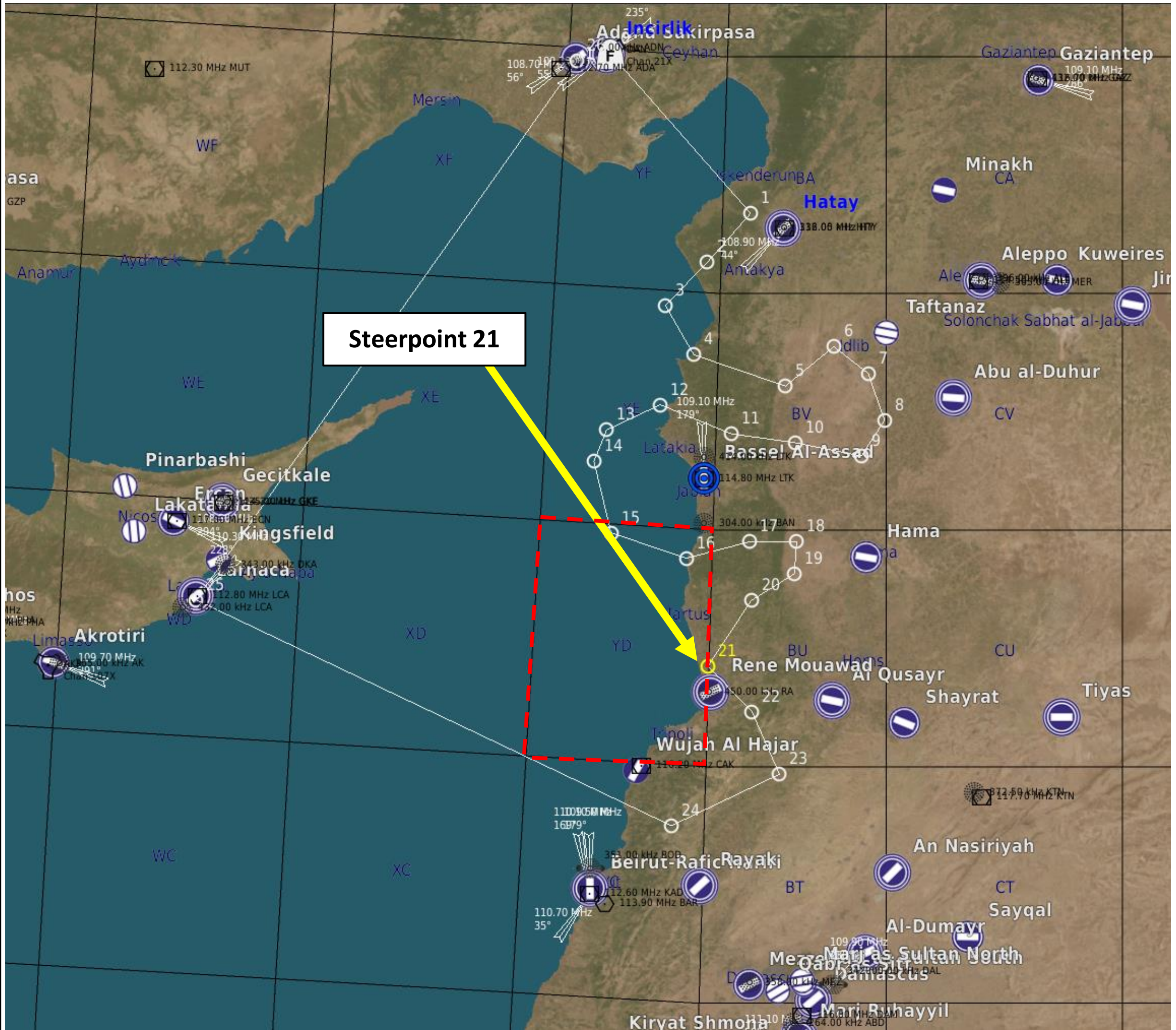


11 – DEST (Destination) Page

UTM Sub-Page

If a steerpoint is entered using MGRS, then a conversion must be manually commanded by selecting the CNVRT data field and pressing ENTR.

As an example, let's enter MGRS coordinates for Grid 36S, Square YD, and coordinates 74438 East / 42432 North, with an elevation of 39 ft.

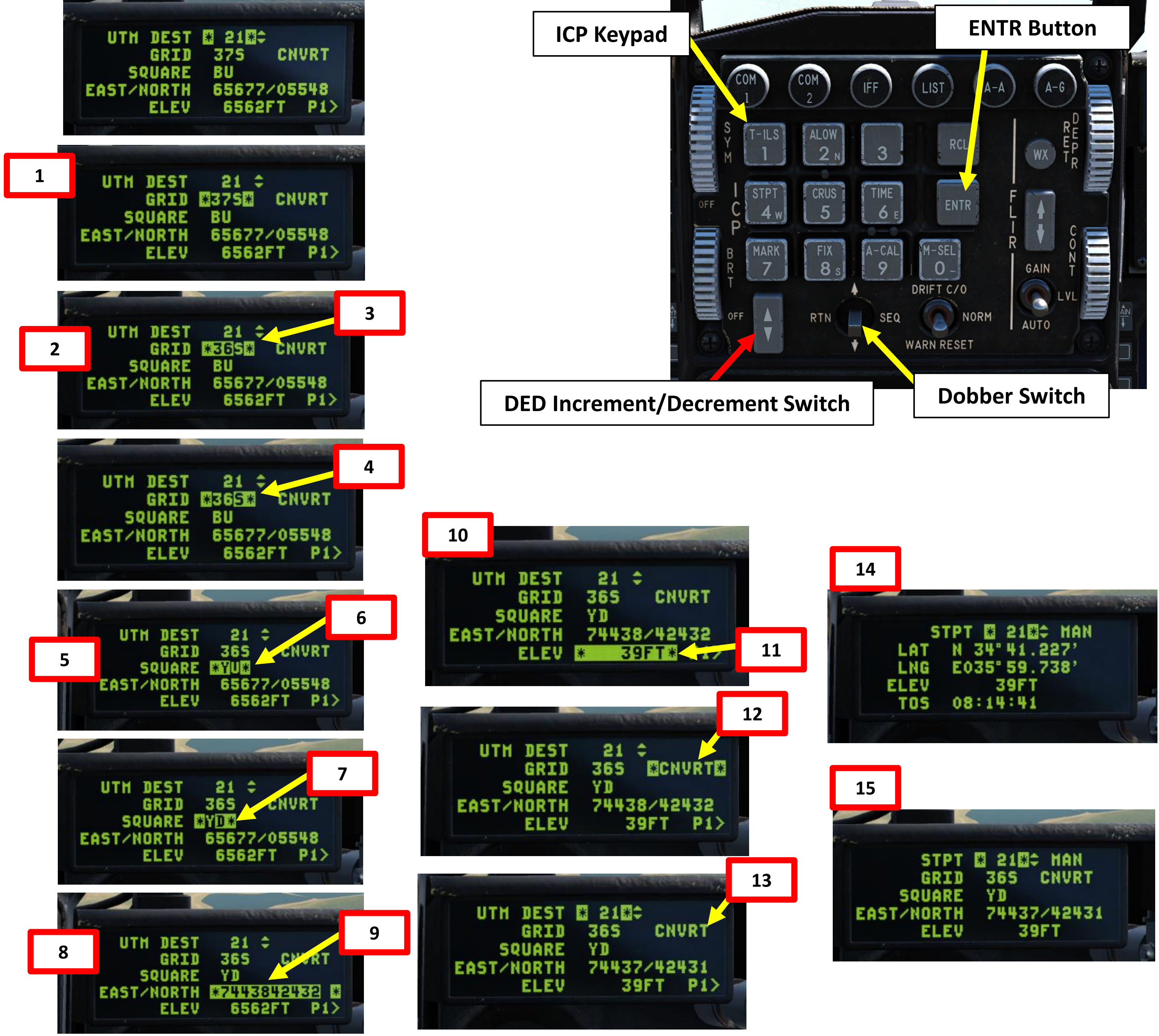


11 – DEST (Destination) Page

UTM Sub-Page

MGRS coordinates to enter: Grid 36S, Square YD, and coordinates 74438 East / 42432 North, with an elevation of 39 ft.

1. From the UTM DEST page, press Dobber Switch DOWN to select MGRS Grid Data field.
2. Press ENTR button to select GRID field.
3. Enter "36" on the ICP keypad, then press ENTR button.
4. Use the DED Increment/Decrement Switch to cycle between grid letters until "S" is selected, then press ENTR button.
5. Press ENTR button to select SQUARE field
6. Use the DED Increment/Decrement Switch to cycle between grid letters until "Y" is selected, then press ENTR button.
7. Use the DED Increment/Decrement Switch to cycle between grid letters until "D" is selected, then press ENTR button.
8. EAST/NORTH field is automatically selected.
9. Enter "7443842432" on the ICP (East/North MGRS coordinates), then press ENTR button.
10. Press Dobber Switch DOWN to select ELEV (Elevation) Data field.
11. Enter "39" on the ICP keypad (elevation in ft), then press ENTR button.
12. Press Dobber Switch DOWN to select CNVRT.
13. Press ENTR button to manually command the coordinate conversion.
14. To double-check if the coordinates have been converted correctly, you can select the STPT page and check Steerpoint 21. If you want to see steerpoint 21 coordinates, access STPT page by pressing STPT (4) button on the ICP (Integrated Control Panel). Then, use DED Increment/Decrement Switch to select steerpoint 21.
15. To display coordinates to MGRS format, set Dobber switch RIGHT (SEQ). The DED STPT page will display MGRS 3 seconds later.



11 – DEST (Destination) Page

DIR & OA1/OA2 Sub-Pages

The second DEST DED page is the **Destination Direct (DEST DIR)** page, which displays the position and elevation of the currently selected steerpoint, along with the desired Time-Over-Steerpoint (TOS), all of which can be modified from this page in the same manner as the STPT DED page. To modify a field, move the selection asterisks using Dobber Switch UP/DOWN, then type the new value on the ICP keypad, then press ENTR button.

The third and fourth DEST DED pages are the Destination Offset Aimpoint 1 **(DEST OA1)** and Offset Aimpoint 2 **(DEST OA2)** pages respectively, which display the relative distance, relative direction, and elevation of the destination steerpoint's offset aimpoints. Each offset aimpoint and its respective values can be modified from these pages, but if the steerpoint itself is modified to a new position, the offset aimpoints will move with their associated steerpoint accordingly.

Selected Destination Steerpoint

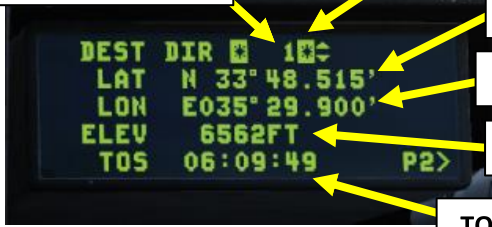
Selection Asterisks

Latitude Coordinates

Longitude Coordinates

Elevation (ft)

TOS (Time Over Steerpoint)



Selected Destination Steerpoint

Relative range/distance (in feet) of the offset aimpoint (OA) from the destination steerpoint. This field may be modified using the ICP keypad

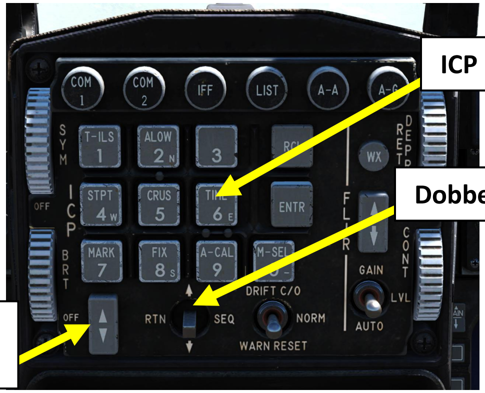
Relative bearing (in degrees, Magnetic) of the offset aimpoint (OA) from the destination steerpoint. This field may be modified using the ICP keypad.

Elevation of the offset aimpoint (OA) (ft)

ICP Keypad

Dobber Switch

DED Increment/Decrement Switch



DEST UTM DED Page

Dobber RIGHT (SEQ)

DEST DIR DED Page

Dobber RIGHT (SEQ)

DEST OA1 DED Page

Dobber RIGHT (SEQ)

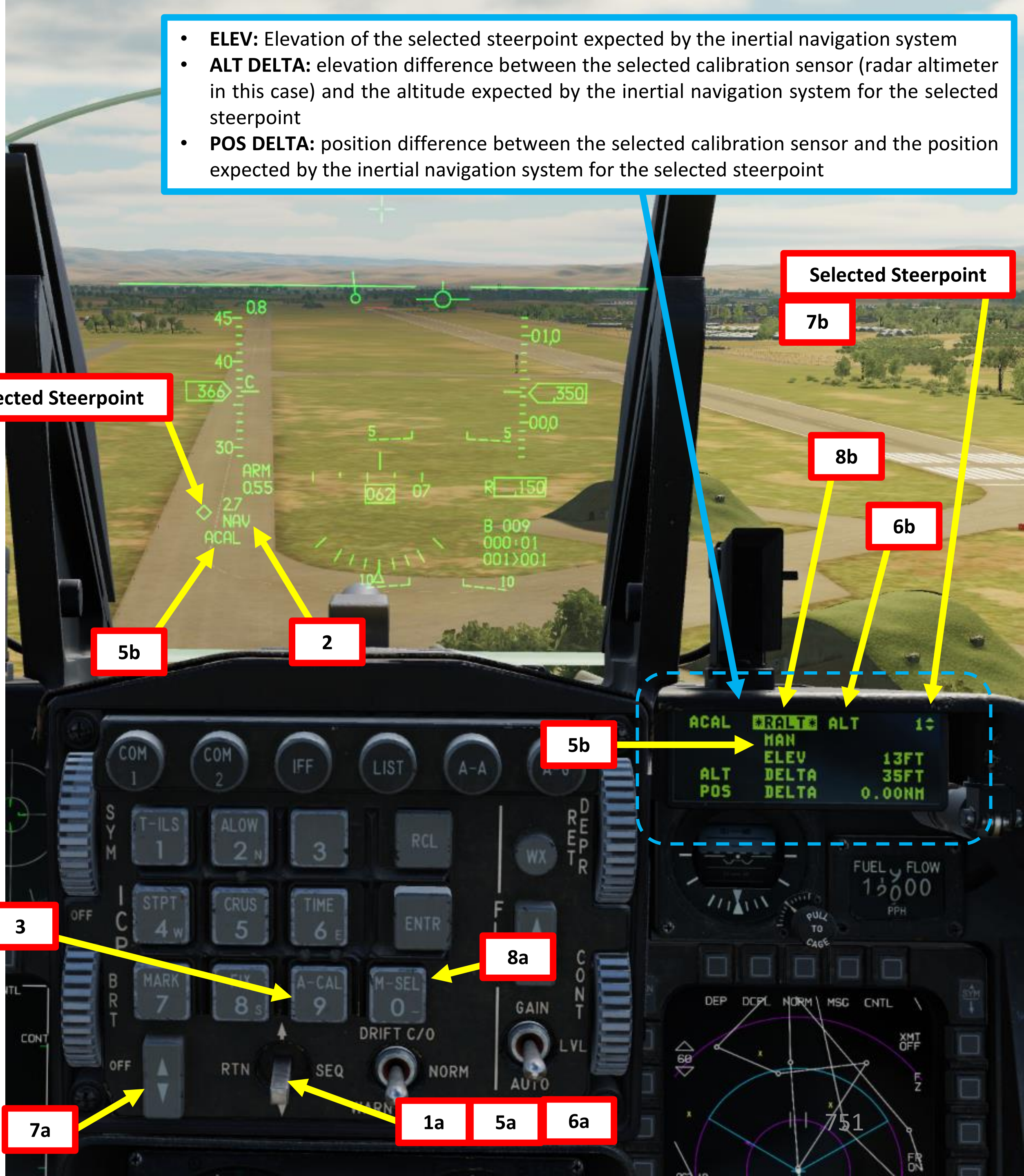
DEST OA2 DED Page

12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.1 – ACAL (Altitude Calibration) Page

While the onboard GPS can certainly assist with updating the INS (Inertial Navigation System), INS drift can still happen over time as the navigation system gradually accumulates position errors. This is not only true for a fix position as stored in the mission computer planning table, but also for altitudes. To calibrate the INS for altitude drift, we have the altitude calibration, or A-CAL, function from the ICP (Integrated Control Panel). We basically use an aircraft sensor (radar, targeting pod, etc.) to correct the drift error.

To enable Manual ACAL (Altitude Calibration):

1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
3. Select button 9 (ACAL) on the ICP (Integrated Control Panel). Upon doing so, the A-CAL DED page is displayed.
4. By default, the GPS automatic A-CAL options is enabled. This allows the onboard GPS to update elevations, or both.
5. To enable manual calibration, press the Dobber Switch RIGHT. Manual calibrations can be useful in case we lose GPS signal due to battle damage or if GPS is denied in some way.
6. You can cycle between ALT (Altitude Calibration), POS (Position Calibration) or BOTH (Altitude and Position Calibration) by pressing the Dobber Switch RIGHT. For the purposes of this tutorial, we will set calibration mode to ALT (Altitude Only).
7. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration.
8. Toggle between desired altitude calibration methods by pressing "0 / M-SEL" on the ICP (Integrated Control Panel).
   - **RALT** is used for altitude calibration with the Radar Altimeter
   - **FCR** is used for altitude calibration with the Fire Control Radar
   - **HUD** is used for altitude calibration with the Heads-Up Display
   - **TGP** is used for altitude calibration with the Targeting Pod



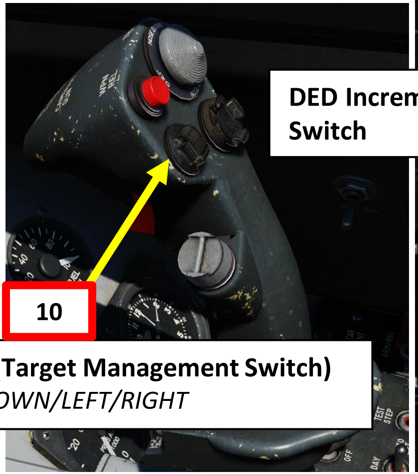
12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.1 – ACAL (Altitude Calibration) Page

To revert ACAL from MANUAL to GPS calibration:

1. Make sure the ACAL page is selected and MAN mode is selected (see previous tutorial).
2. Press the Dobber Switch DOWN to select the MAN data field.
3. Press "0 / M-SEL" on the ICP (Integrated Control Panel) to select GPS calibration.

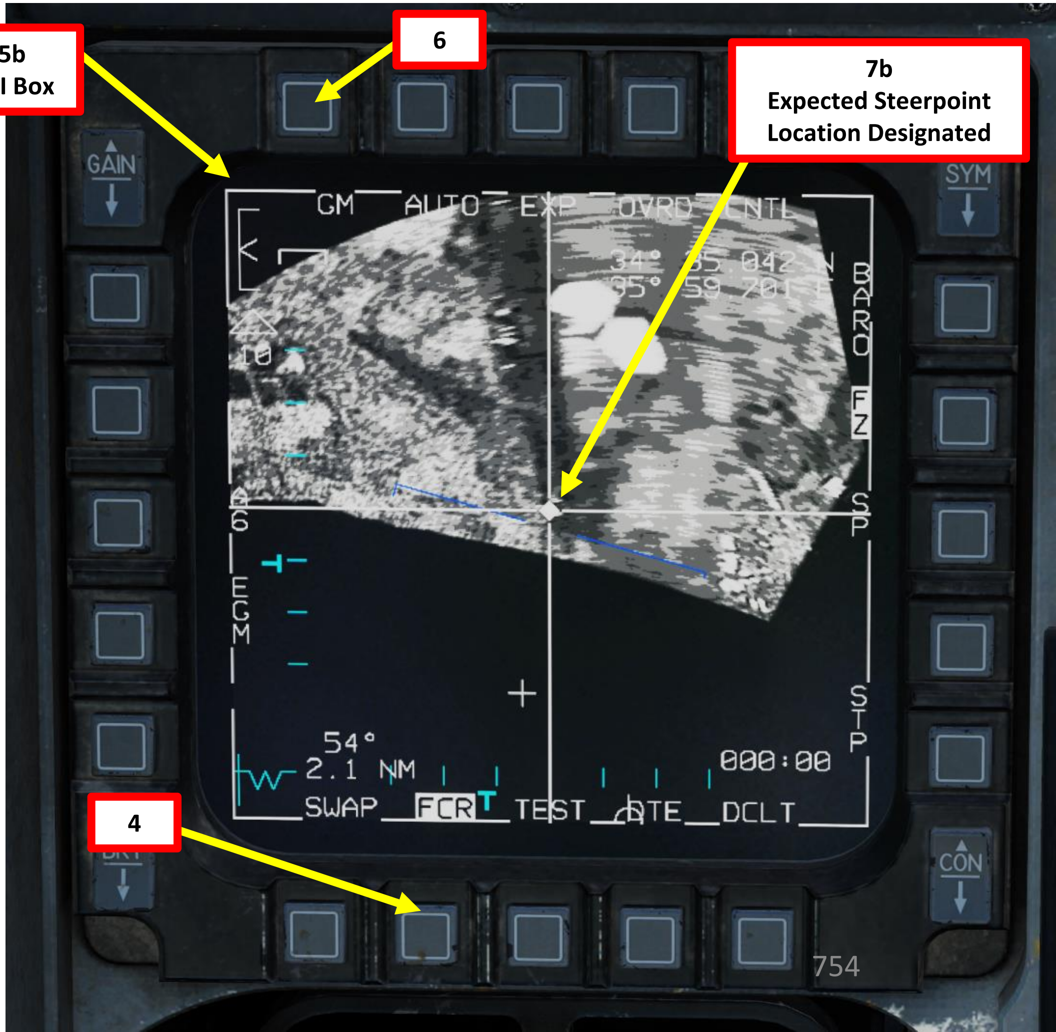
12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.2 – Radar Altimeter Calibration Method

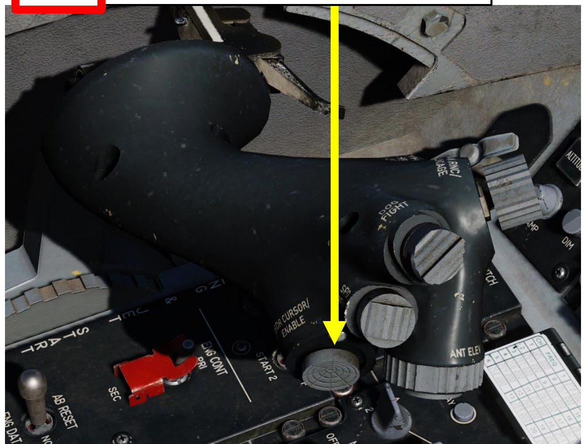
1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
3. Select button 9 (ACAL) on the ICP (integrated Control Panel). Upon doing so, the A-CAL DED page is displayed.
4. By default, the GPS automatic A-CAL options is enabled. This allows the onboard GPS to update elevations, or both.
5. To enable manual calibration, press the Dobber Switch RIGHT.
6. Select ALT (Altitude Calibration Only) by pressing the Dobber Switch RIGHT repeatedly until ALT is selected.
7. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration.
8. Toggle between desired altitude calibration methods by pressing “0 / M-SEL” on the ICP (Integrated Control Panel).
    - **RALT** is used for altitude calibration with the Radar Altimeter
9. The ACAL page’s ALT DELTA data field displays the elevation drift of the selected steerpoint’s elevation in the INS database.
10. When flying over the selected steerpoint, press TMS (Target Management Switch) UP to freeze the ALT DELTA field.
11. Press ENTR to perform altitude calibration. ACAL page automatically returns to CNI.
12. If you return to the ACAL page, you will notice that the ALT DELTA data field value is now close to 0 ft, which means the calibration is successful.



12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.3 – FCR (Fire Control Radar) Calibration Method

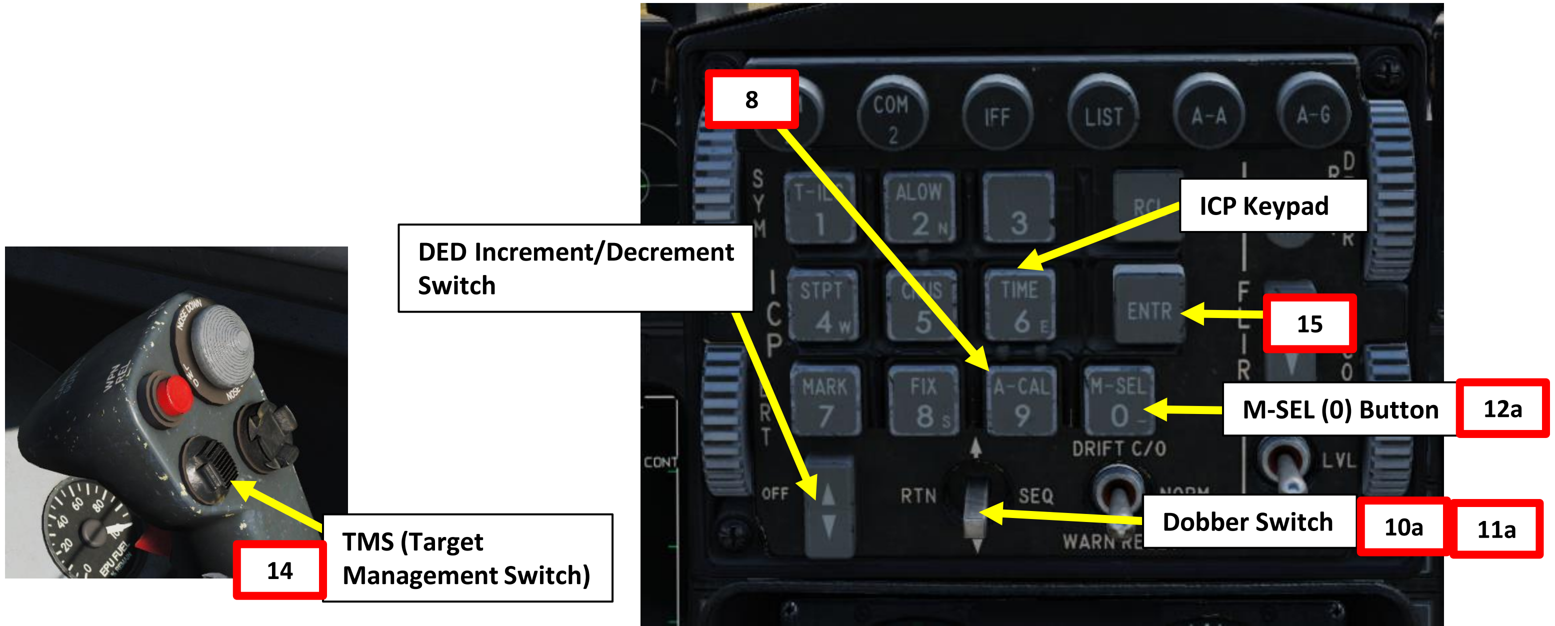
1. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
2. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
3. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration. We will select Steerpoint 1.
4. Select FCR (Fire Control Radar) page.
5. Set FCR (Fire Control Radar) page as the SOI (Sensor of Interest) using DMS (Display Management Switch) DOWN. The SOI Box around the FCR page will indicate when the FCR can be controlled with HOTAS controls.
6. Select ground mapping radar mode via the FCR page.
7. Designate the expected location of the steerpoint as accurately as possible using the Radar Cursor Switch to slew the reticle and TMS UP to designate.





12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.3 – FCR (Fire Control Radar) Calibration Method

8. Select button 9 (ACAL) on the ICP (integrated Control Panel). Upon doing so, the A-CAL DED page is displayed.
9. By default, the GPS automatic A-CAL options is enabled. This allows the onboard GPS to update elevations, or both.
10. To enable manual calibration, press the Dobber Switch RIGHT.
11. Select ALT (Altitude Calibration Only) by pressing the Dobber Switch RIGHT repeatedly until ALT is selected.
12. Toggle between desired altitude calibration methods by pressing “0 / M-SEL” on the ICP (Integrated Control Panel).
    - **FCR** is used for altitude calibration with the fire control radar
13. The ACAL page’s ALT DELTA data field displays the elevation drift of the selected steerpoint’s elevation in the INS database.
14. When you are within 10 nm or closer to the selected steerpoint, press TMS (Target Management Switch) UP to freeze the ALT DELTA field.
15. Press ENTR to perform altitude calibration. ACAL page automatically returns to CNI.
16. If you return to the ACAL page, you will notice that the ALT DELTA data field value is now close to 0 ft, which means the calibration is successful.



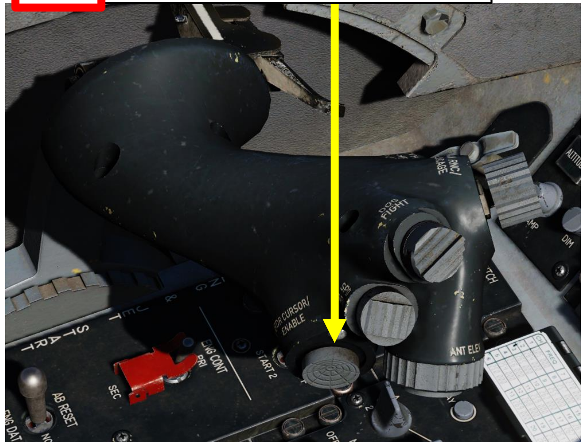
12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.4 – HUD (Heads-Up Display) Calibration Method

1. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
2. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
3. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration. We will select Steerpoint 1.
4. Select button 9 (ACAL) on the ICP (integrated Control Panel). Upon doing so, the A-CAL DED page is displayed.
5. By default, the GPS automatic A-CAL options is enabled. This allows the onboard GPS to update elevations, or both.
6. To enable manual calibration, press the Dobber Switch RIGHT.
7. Select ALT (Altitude Calibration Only) by pressing the Dobber Switch RIGHT repeatedly until ALT is selected.
8. Toggle between desired altitude calibration methods by pressing “0 / M-SEL” on the ICP (Integrated Control Panel).
    - **HUD** is used for altitude calibration with the Heads-Up Display
9. The ACAL page’s ALT DELTA data field displays the elevation drift of the selected steerpoint’s elevation in the INS database.

12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.4 – HUD (Heads-Up Display) Calibration Method

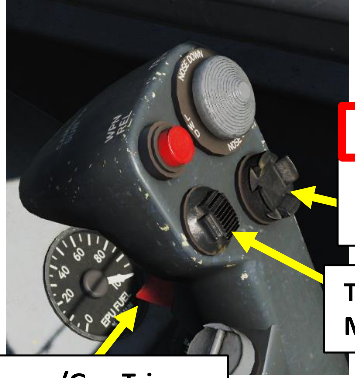
10. Set HUD (Heads-Up Display) as the SOI (Sensor of Interest) using DMS (Display Management Switch) UP. The SOI asterisk will indicate when the HUD interface can be controlled with HOTAS controls.
11. Use the Radar Cursor Switch to slew the steerpoint diamond on the expected location of the steerpoint.
12. Press TMS (Target Management Switch) UP to freeze the ALT DELTA field.
13. Press ENTR to perform altitude calibration. ACAL page automatically returns to CNI.
14. If you return to the ACAL page, you will notice that the ALT DELTA data field value is now close to 0 ft, which means the calibration is successful.

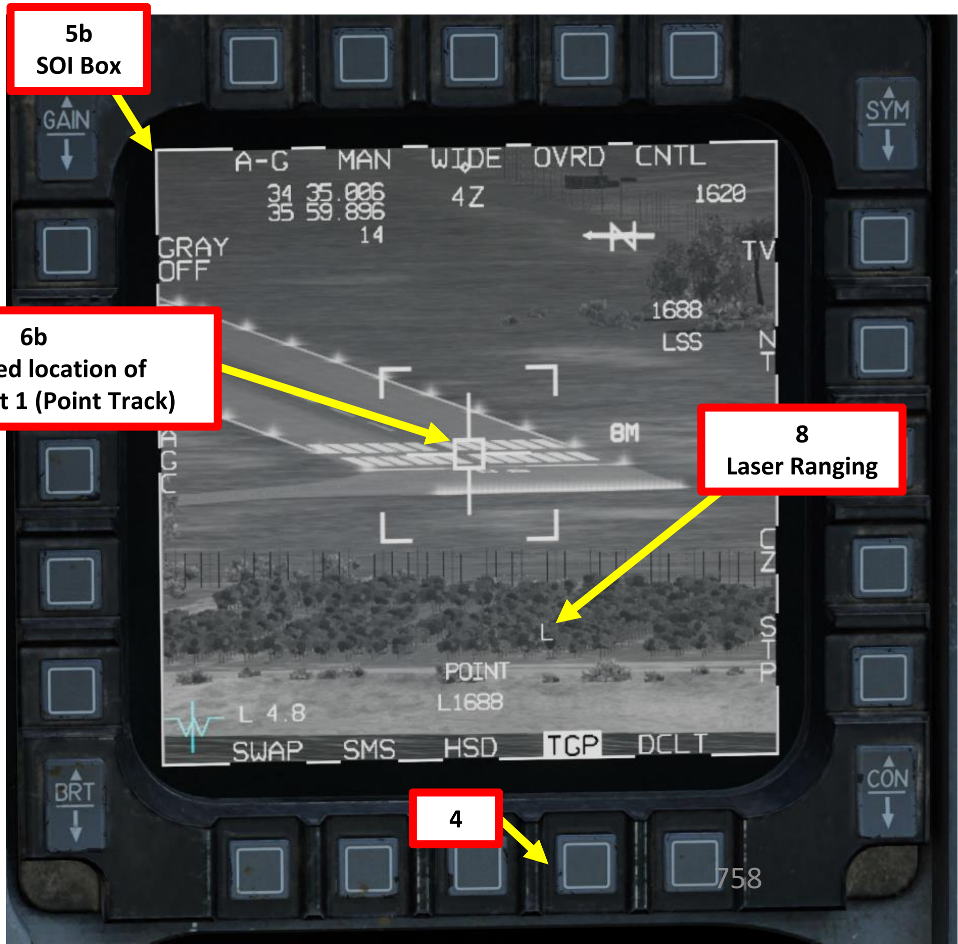
11a Radar Cursor/Enable Switch

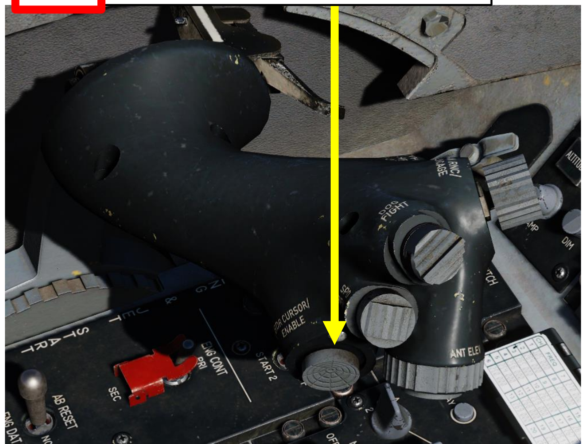


12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.5 – TGP (Targeting Pod) Calibration Method

1. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
2. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
3. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration. We will select Steerpoint 1.
4. Select TGP page.
5. Set TGP (Targeting Pod) page as the SOI (Sensor of Interest) using DMS (Display Management Switch) DOWN. The SOI Box around the TGP page will indicate when the TGP can be controlled with HOTAS controls.
6. Designate the expected location of the steerpoint as accurately as possible using the Radar Cursor Switch to slew the reticle and press TMS UP (Point Track) to set the designated point by the targeting pod sensor as the reference point for the altitude calibration.
    - Note: TMS DOWN can be use to quickly slave the targeting pod to the steerpoint.
7. Set Laser Arming Switch to ARM (UP).
8. Press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the "L" symbol on the HUD will flash. Releasing the trigger stops lasing.

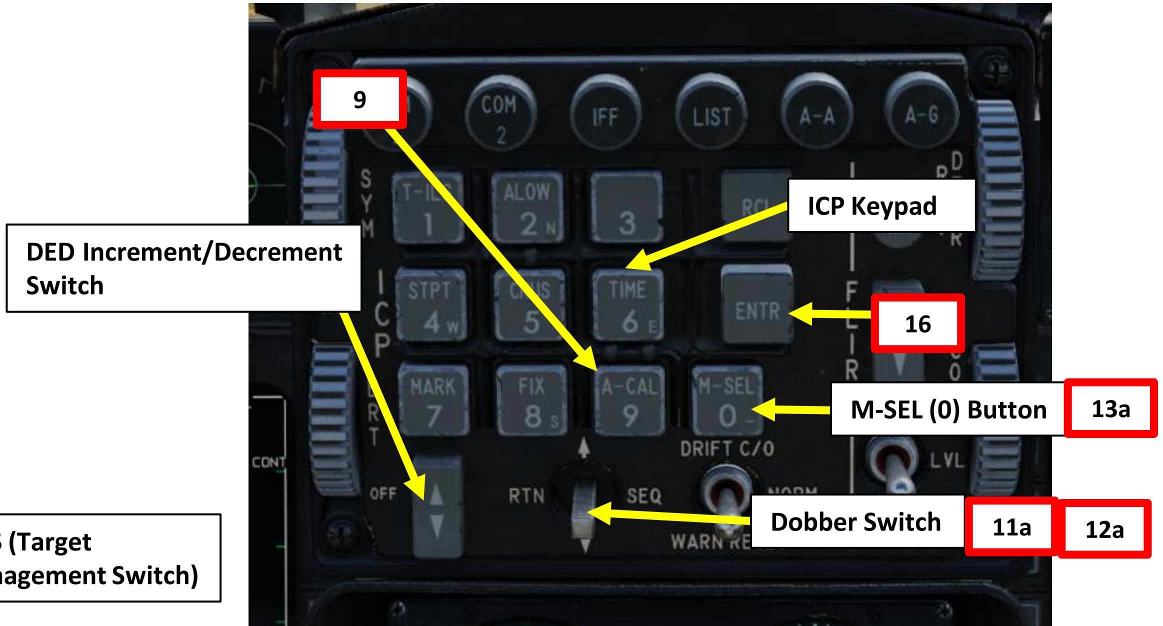


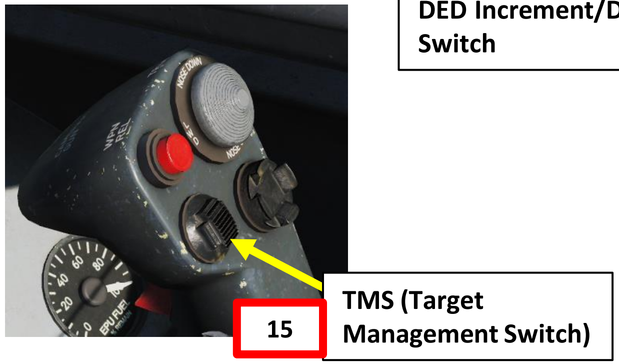




12 – INS (Inertial Navigation System) Drift
12.1 – Navigation Altitude Calibration
12.1.5 – TGP (Targeting Pod) Calibration Method

9. Select button 9 (ACAL) on the ICP (integrated Control Panel). Upon doing so, the A-CAL DED page is displayed.
10. By default, the GPS automatic A-CAL options is enabled. This allows the onboard GPS to update elevations, or both.
11. To enable manual calibration, press the Dobber Switch RIGHT.
12. Select ALT (Altitude Calibration Only) by pressing the Dobber Switch RIGHT repeatedly until ALT is selected.
13. Toggle between desired altitude calibration methods by pressing "0 / M-SEL" on the ICP (Integrated Control Panel).
    - **TGP** is used for altitude calibration with the targeting pod
14. The ACAL page's ALT DELTA data field displays the elevation drift of the selected steerpoint's elevation in the INS database.
15. When you are within 10 nm or closer to the selected steerpoint, press TMS (Target Management Switch) UP to freeze the ALT DELTA field.
16. Press ENTR to perform altitude calibration. ACAL page automatically returns to CNI.
17. If you return to the ACAL page, you will notice that the ALT DELTA data field value is now close to 0 ft, which means the calibration is successful.



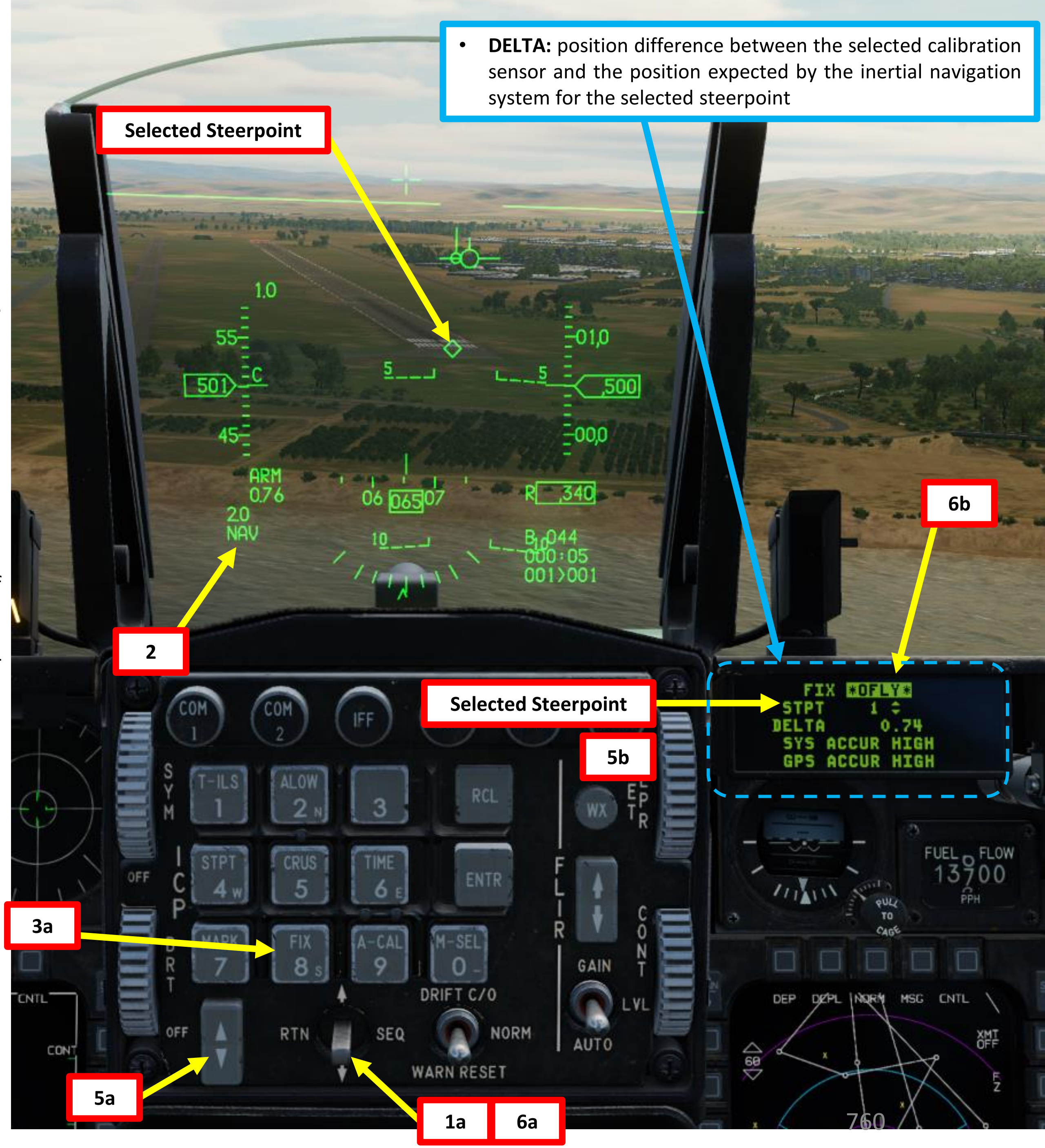


12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.1 – FIX Page

While the onboard GPS can certainly assist with updating the INS (Inertial Navigation System), INS drift can still happen over time as the navigation system gradually accumulates position errors. To calibrate the INS for position drift, we have a FIX function from the ICP (Integrated Control Panel). We basically use an aircraft sensor (radar, targeting pod, etc.) to correct the position drift error.

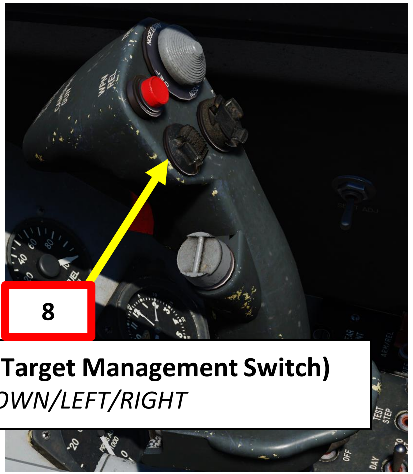
To enable Fix Taking:

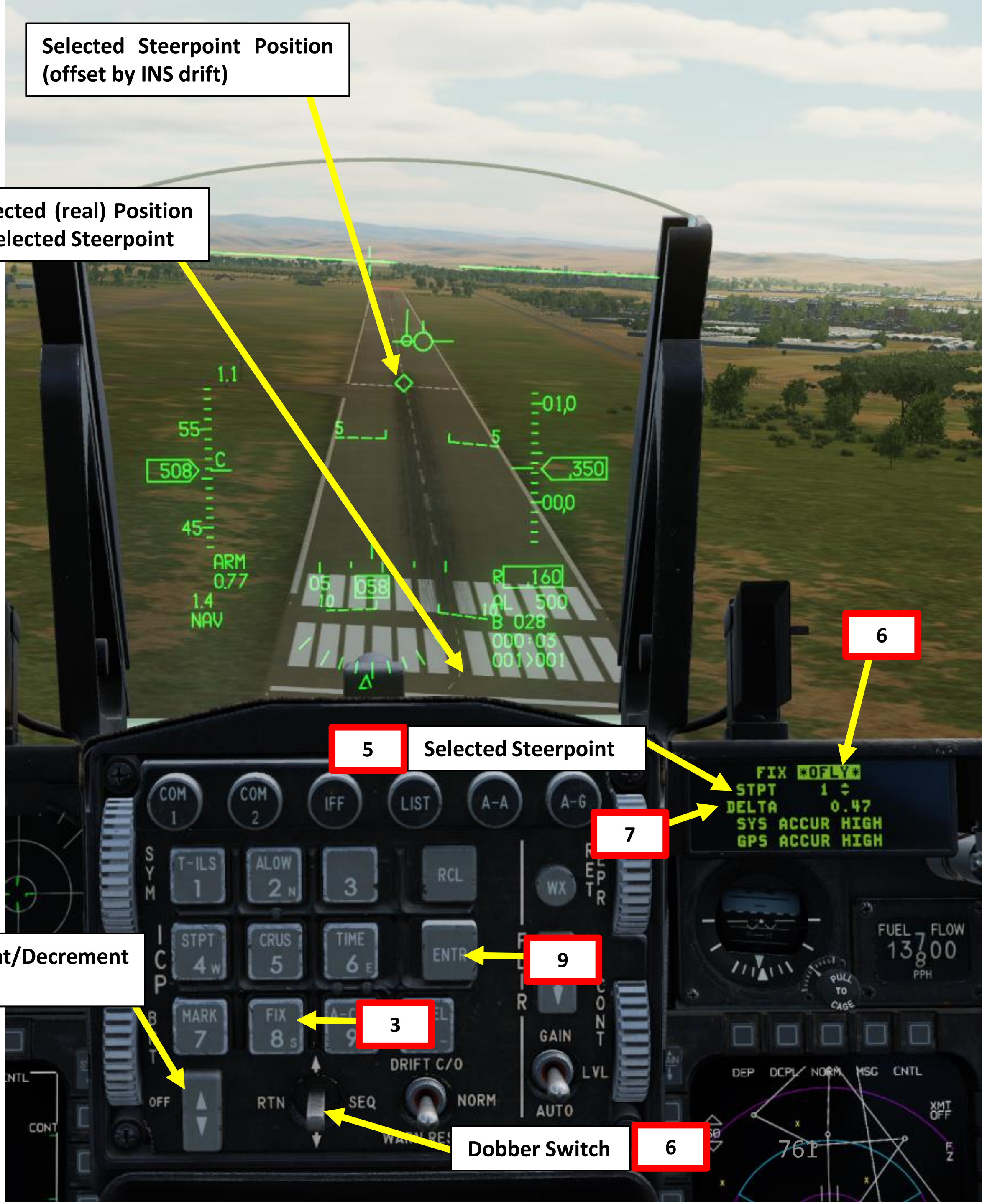
1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
3. Select button 8 (FIX) on the ICP (Integrated Control Panel). Upon doing so, the A-CAL DED page is displayed.
4. Navigation fix taking can be useful in case we lose GPS signal due to battle damage or if GPS is denied in some way.
5. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration.
6. Toggle between desired navigation fix taking methods by pressing Dobber Switch RIGHT (SEQ) on the ICP (Integrated Control Panel).
    - **OFLY** is used for a navigation fix when overflying the steerpoint
    - **FCR** is used for a navigation fix with the Fire Control Radar
    - **HUD** is used for a navigation fix with the Heads-Up Display
    - **TGP** is used for a navigation fix with the Targeting Pod



12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.2 – OFLY (Overfly) Fix Method

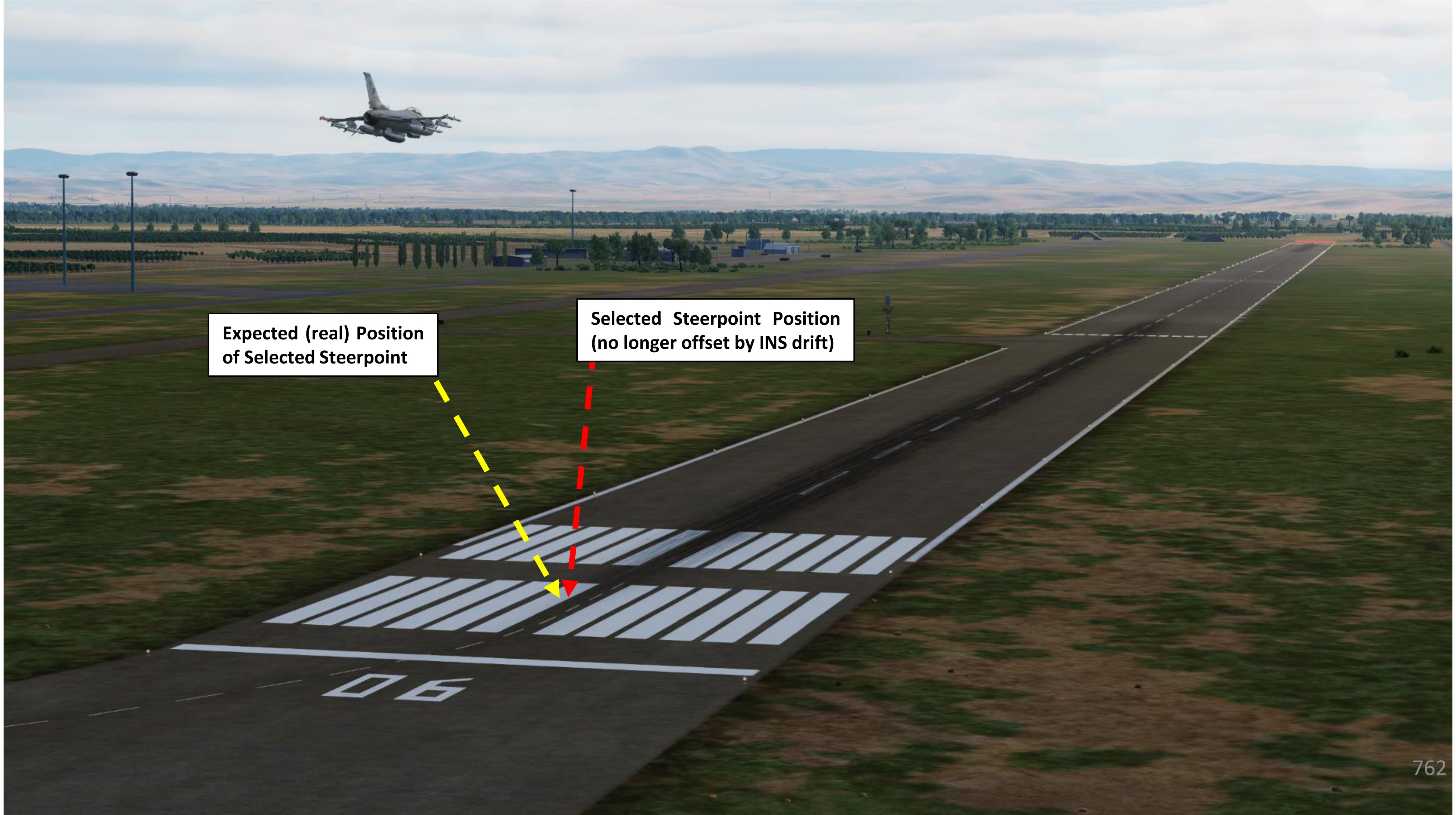
1. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
2. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
3. Select button 8 (FIX) on the ICP (Integrated Control Panel). Upon doing so, the FIX DED page is displayed.
4. Navigation fix taking can be useful in case we lose GPS signal due to battle damage or if GPS is denied in some way.
5. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration.
6. Toggle between desired navigation fix taking methods by pressing Dobber Switch RIGHT (SEQ) on the ICP (Integrated Control Panel).
   - **OFLY** is used for a navigation fix when overflying the steerpoint
7. The FIX page's DELTA data field displays the position drift of the selected steerpoint's coordinates in the INS database.
8. When flying over the expected (real) position of the selected steerpoint, press TMS (Target Management Switch) UP to freeze the DELTA field.
9. Press ENTR to perform position calibration (navigation fix). FIX page automatically returns to CNI.





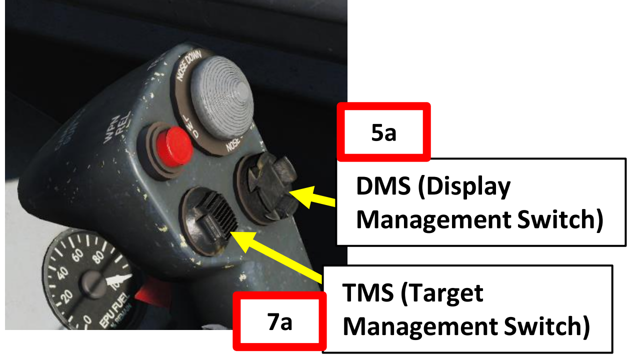
12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.2 – OFLY (Overfly) Fix Method

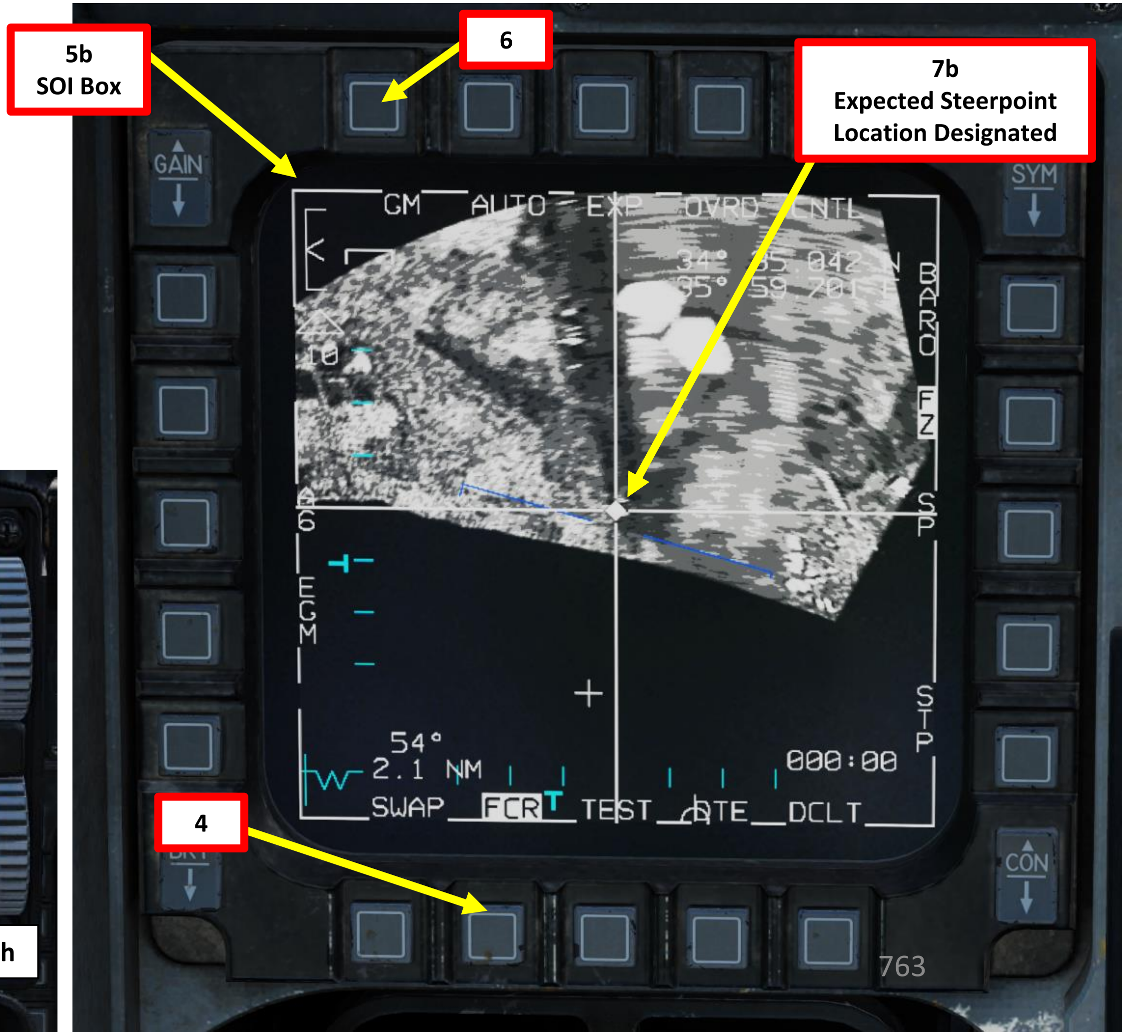
10. Your inertial navigation system should now be re-aligned.

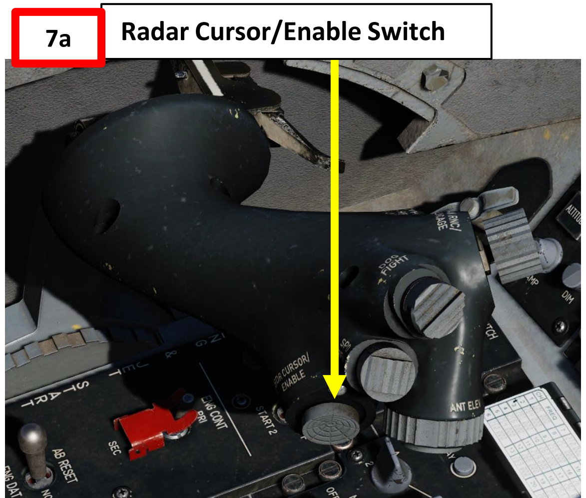


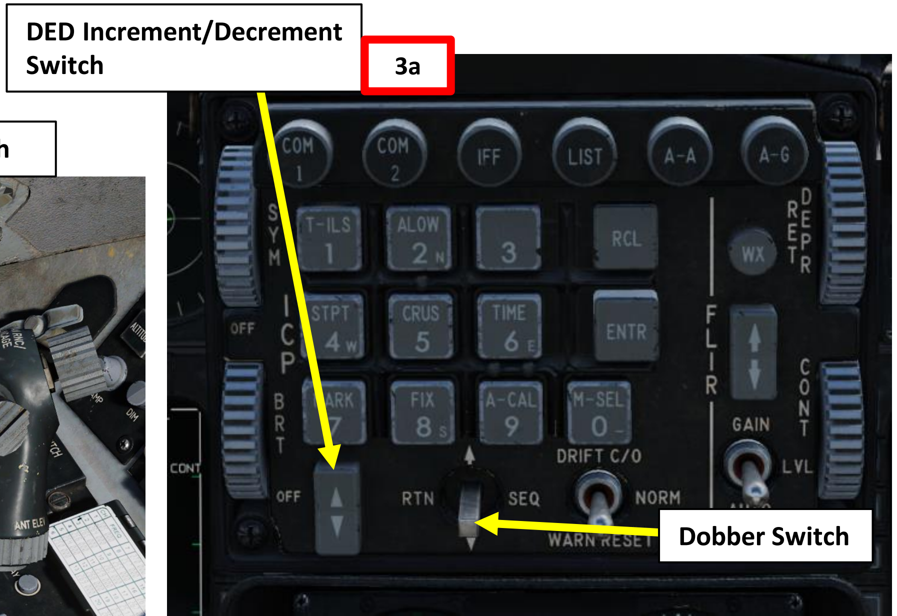
12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.3 – FCR (Fire Control Radar) Fix Method

1. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
2. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
3. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration. We will select Steerpoint 1.
4. Select FCR (Fire Control Radar) page.
5. Set FCR (Fire Control Radar) page as the SOI (Sensor of Interest) using DMS (Display Management Switch) DOWN. The SOI Box around the FCR page will indicate when the FCR can be controlled with HOTAS controls.
6. Select ground mapping radar mode via the FCR page.
7. Designate the expected location of the steerpoint as accurately as possible using the Radar Cursor Switch to slew the reticle and TMS UP to designate.



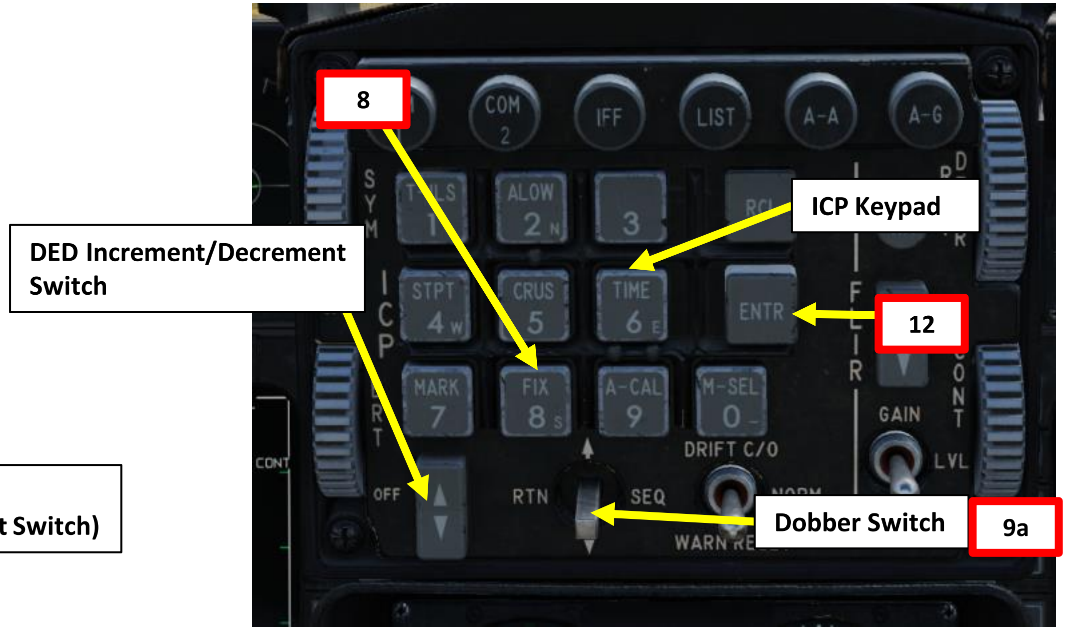


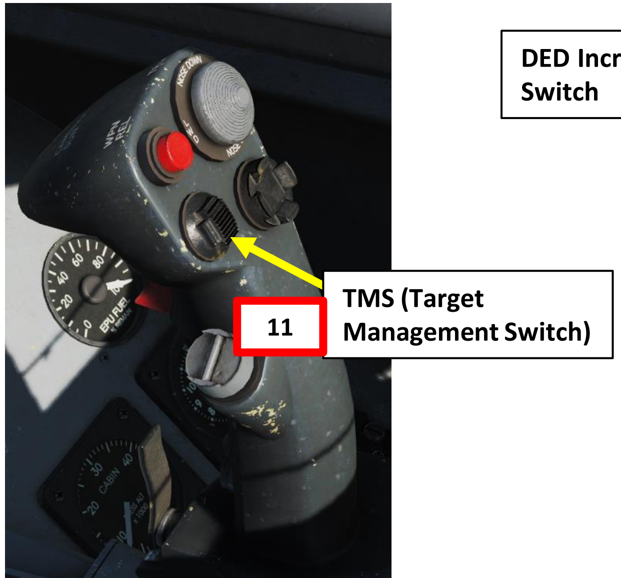




12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.3 – FCR (Fire Control Radar) Fix Method

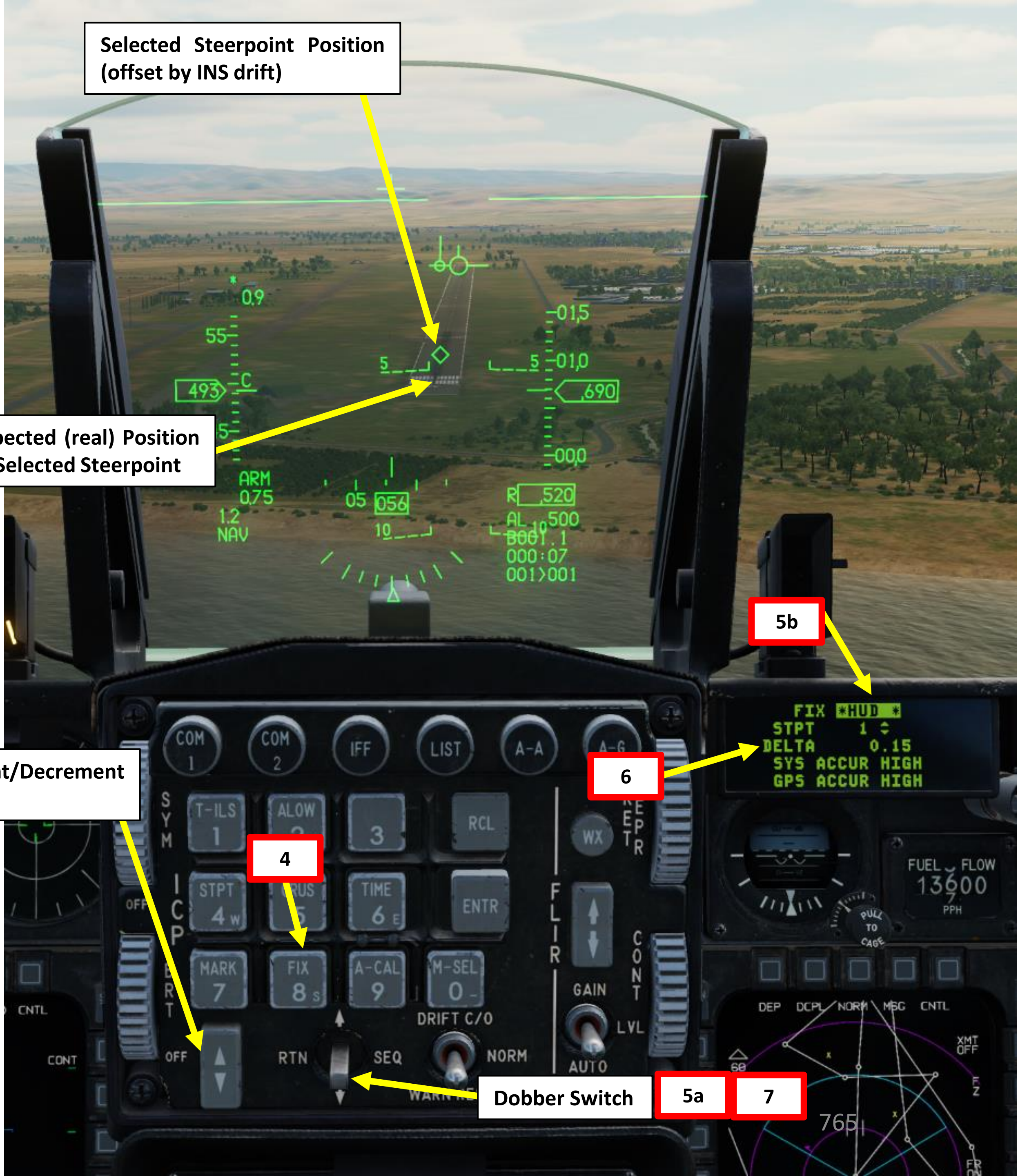
8. Select button 8 (FIX) on the ICP (Integrated Control Panel). Upon doing so, the FIX DED page is displayed.
9. Toggle between desired navigation fix taking methods by pressing Dobber Switch RIGHT (SEQ) on the ICP (Integrated Control Panel).
    - **FCR** is used for a navigation fix with the fire control radar
10. The FIX page's DELTA data field displays the position drift of the selected steerpoint's coordinates in the INS database.
11. When you are within 10 nm or closer to the selected steerpoint, press TMS (Target Management Switch) UP to freeze the DELTA field.
12. Press ENTR to perform position calibration (navigation fix). FIX page automatically returns to CNI.
13. Your inertial navigation system should now be re-aligned.





12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.4 – HUD (Heads-Up Display) Fix Method

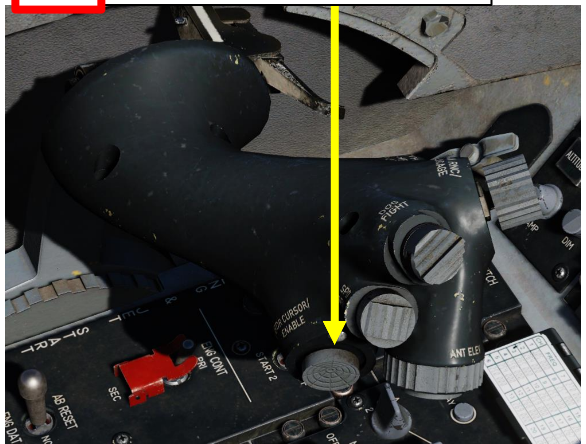
1. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
2. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
3. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration. We will select Steerpoint 1.
4. Select button 8 (FIX) on the ICP (integrated Control Panel). Upon doing so, the FIX DED page is displayed.
5. Toggle between desired navigation fix taking methods by pressing Dobber Switch RIGHT (SEQ) on the ICP (Integrated Control Panel).
    - **HUD** is used for a navigation fix with the heads-up display
6. The FIX page's DELTA data field displays the position drift of the selected steerpoint's coordinates in the INS database.

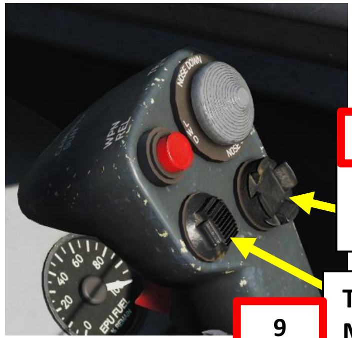


12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.4 – HUD (Heads-Up Display) Fix Method

7. Set HUD (Heads-Up Display) as the SOI (Sensor of Interest) using DMS (Display Management Switch) UP. The SOI asterisk will indicate when the HUD interface can be controlled with HOTAS controls.
8. Use the Radar Cursor Switch to slew the steerpoint diamond on the expected location of the steerpoint.
9. Press TMS (Target Management Switch) UP to freeze the ALT DELTA field.
10. Press ENTR to perform position calibration (navigation fix). FIX page automatically returns to CNI.
11. Your inertial navigation system should now be re-aligned.

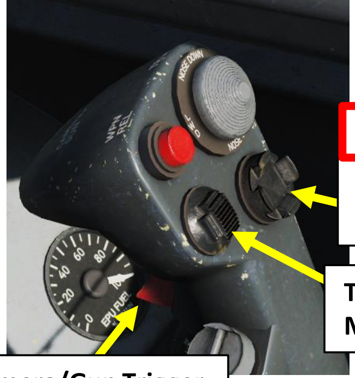
8a Radar Cursor/Enable Switch

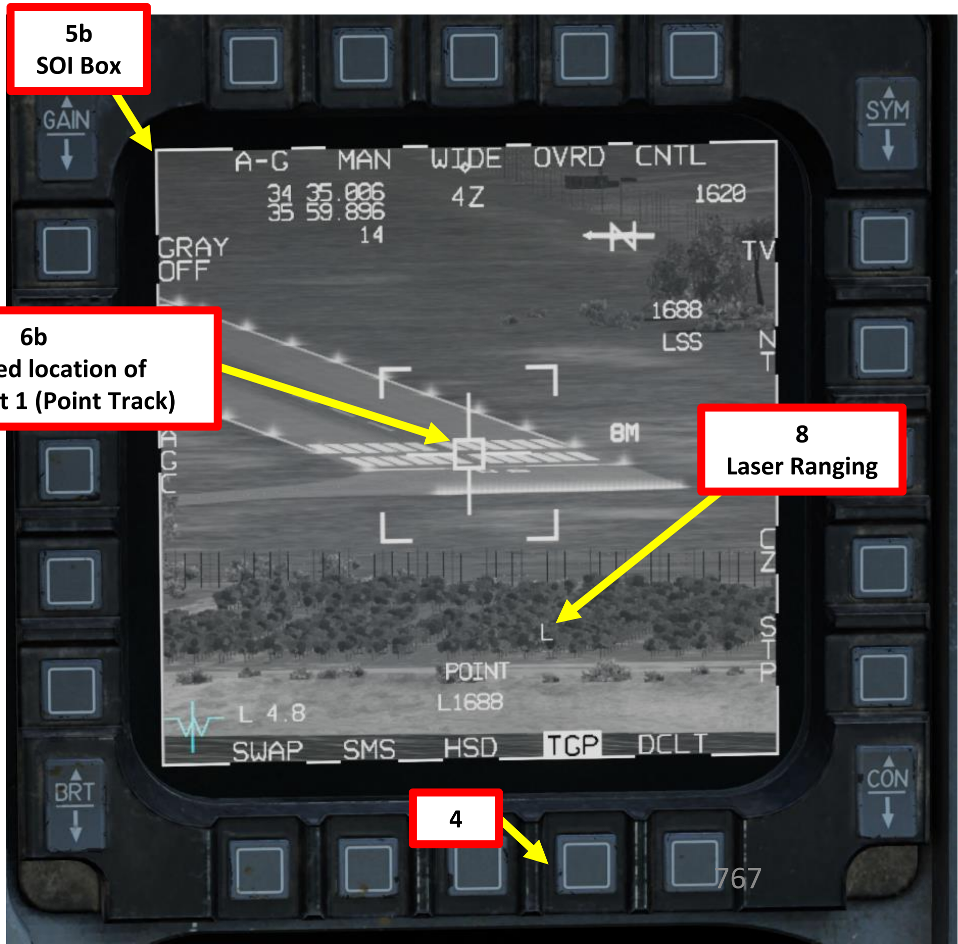


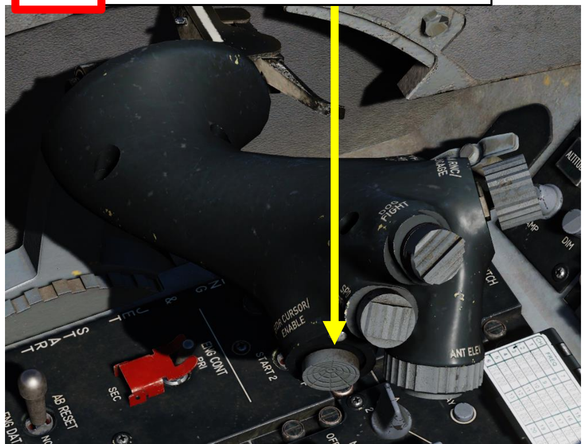


12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.5 – TGP (Targeting Pod) Fix Method

1. Make sure Master Mode is set to NAV (neither A-A nor A-G mode is selected).
2. Make sure CNI (Communication, Navigation & Identification) DED page is displayed, which can be selected by pressing Dobber Switch LEFT (RTN).
3. Use the DED Increment/Decrement Switch to select desired steerpoint for calibration. We will select Steerpoint 1.
4. Select TGP page.
5. Set TGP (Targeting Pod) page as the SOI (Sensor of Interest) using DMS (Display Management Switch) DOWN. The SOI Box around the TGP page will indicate when the TGP can be controlled with HOTAS controls.
6. Designate the expected location of the steerpoint as accurately as possible using the Radar Cursor Switch to slew the reticle and press TMS UP (Point Track) to set the designated point by the targeting pod sensor as the reference point for the navigation position fix.
    - Note: TMS DOWN can be use to quickly slave the targeting pod to the steerpoint.
7. Set Laser Arming Switch to ARM (UP).
8. Press the first stage of the gun trigger to fire your laser and acquire ranging information from the laser. When laser is being fired, the “L” symbol on the HUD will flash. Releasing the trigger stops lasing.

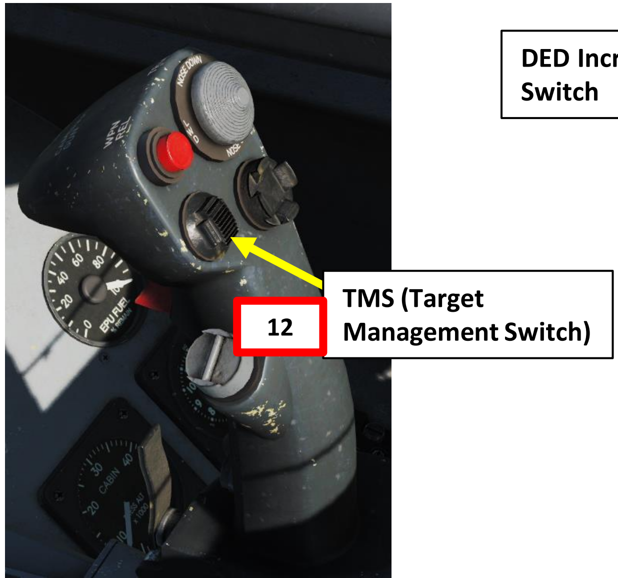


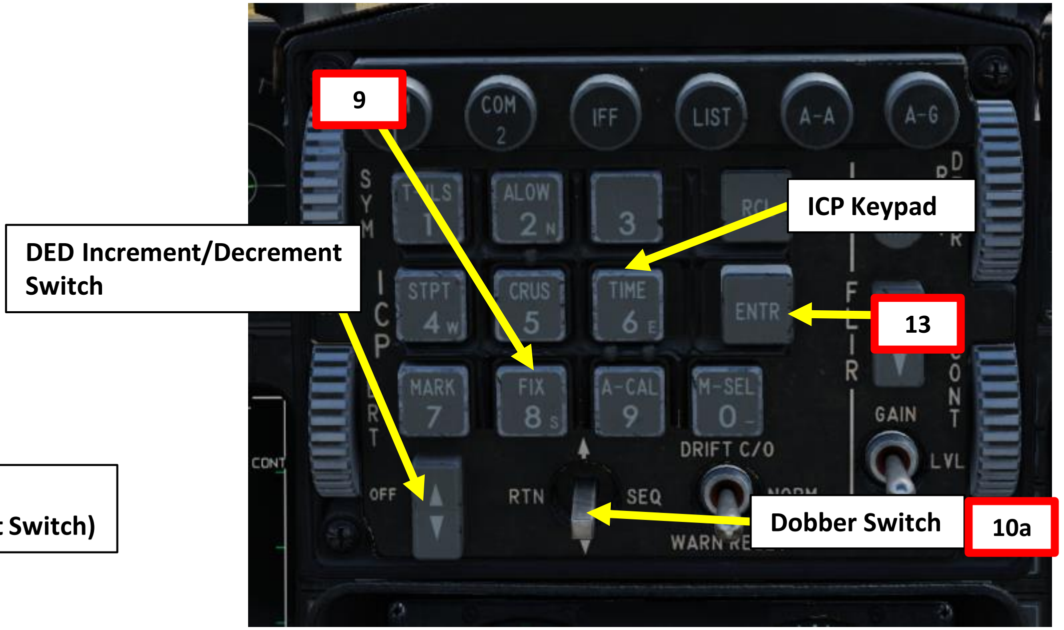




12 – INS (Inertial Navigation System) Drift
12.2 – Navigation Fix
12.2.5 – TGP (Targeting Pod) Fix Method

9. Select button 8 (FIX) on the ICP (Integrated Control Panel). Upon doing so, the FIX DED page is displayed.
10. Toggle between desired navigation fix taking methods by pressing Dobber Switch RIGHT (SEQ) on the ICP (Integrated Control Panel).
    - **TGP** is used for a navigation fix with the targeting pod
11. The FIX page's DELTA data field displays the position drift of the selected steerpoint's coordinates in the INS database.
12. When you are within 10 nm or closer to the selected steerpoint, press TMS (Target Management Switch) UP to freeze the DELTA field.
13. Press ENTR to perform position calibration (navigation fix). FIX page automatically returns to CNI.
14. Your inertial navigation system should now be re-aligned.

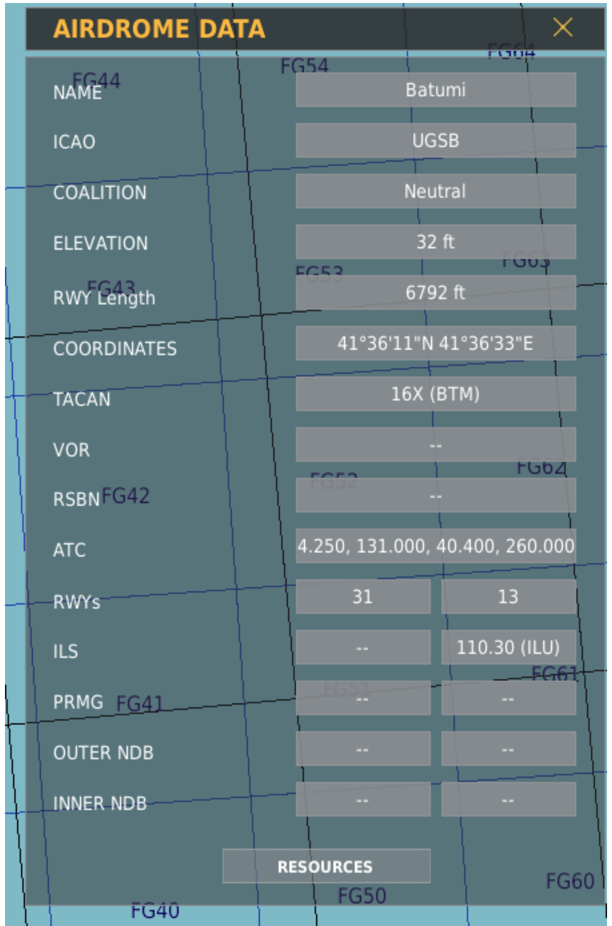




13 – ILS (INSTRUMENT LANDING SYSTEM) TUTORIAL

Our ILS (Instrument Landing System) approach will be done for Batumi airfield's runway 13.

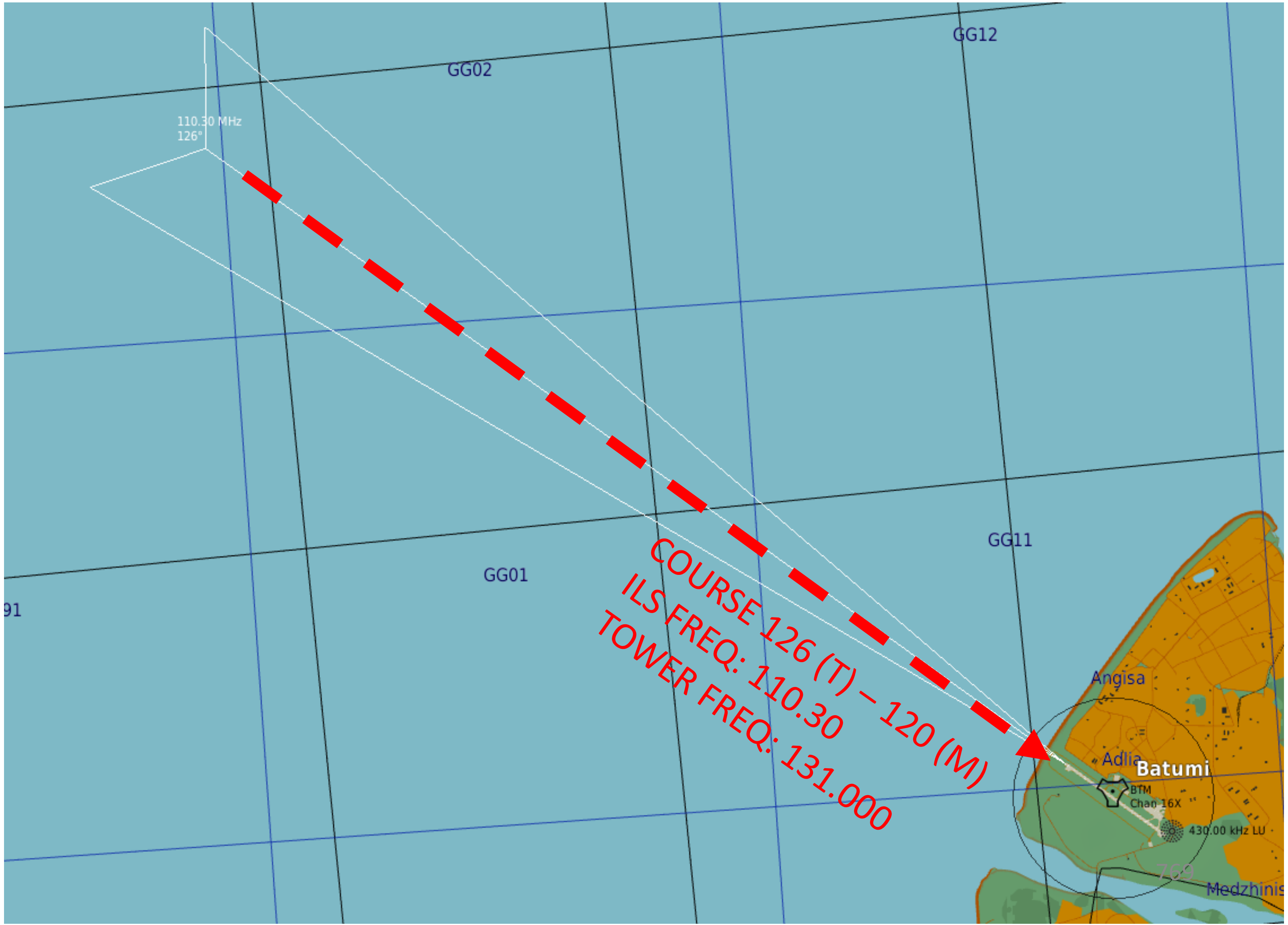
- ILS frequency: 110.30
- Runway heading: 120 Magnetic Heading / 126 True Heading
- Radio tower frequency: 131.000



AIRDROME DATA

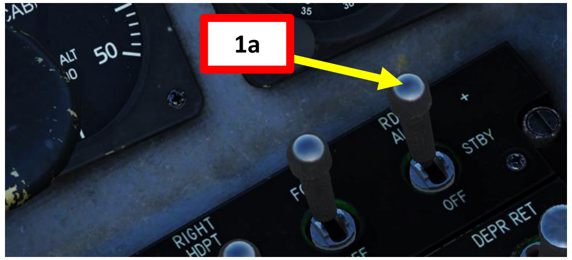
NAME	Batumi	
ICAO	UGSB	
COALITION	Neutral	
ELEVATION	32 ft	
RWY Length	6792 ft	
COORDINATES	41°36'11"N 41°36'33"E	
TACAN	16X (BTM)	
VOR	--	
RSBN	--	
ATC	4.250, 131.000, 40.400, 260.000	
RWYs	31	13
ILS	--	110.30 (ILU)
PRMG	--	--
OUTER NDB	--	--
INNER NDB	--	--

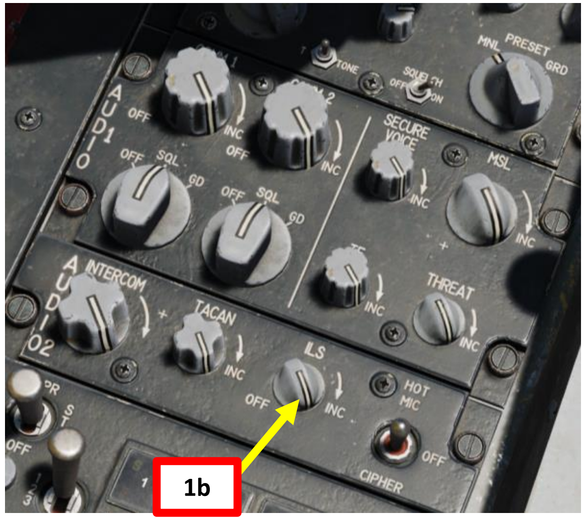
RESOURCES

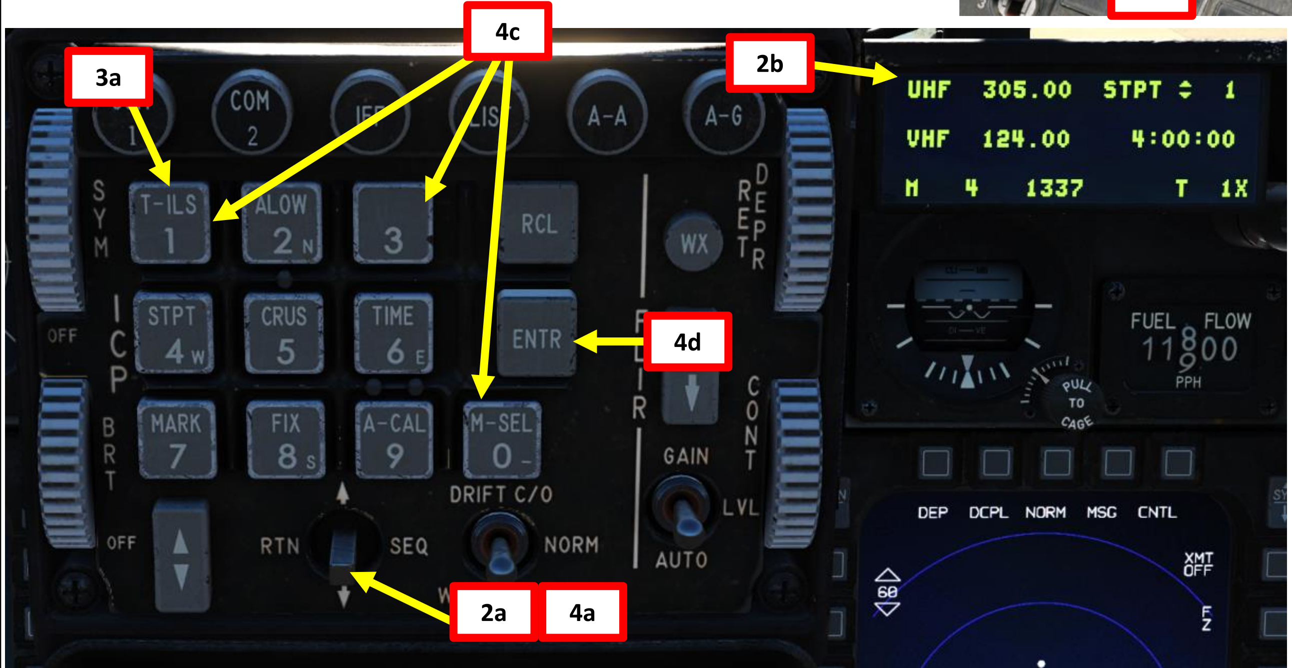


13 – ILS TUTORIAL

1. Set Radar Altimeter Switch ON (FWD) and adjust ILS audio tone volume as required.
2. Select CNI (Communication, Navigation & Information) page by setting **Dobber switch LEFT (RTN)**
3. Press T-ILS (1) Button on the ICP (Integrated Control Panel) to access TACAN-ILS DED (Data Entry Display) menu.
4. Press Dobber Switch DOWN until the ILS FRQ field is highlighted. Use the ICP keypad to type in the new channel ("11030" for 110.30). Press ENTR to accept the changes.
5. CMD STRG (Command Steering) is highlighted when the ILS signal is being received.
6. Once CMD STRG is highlighted, the CRS (Course) field will automatically be selected. Set the desired course to 120 (runway magnetic heading) by pressing "120" on the ICP, then press ENTR to accept the changes.

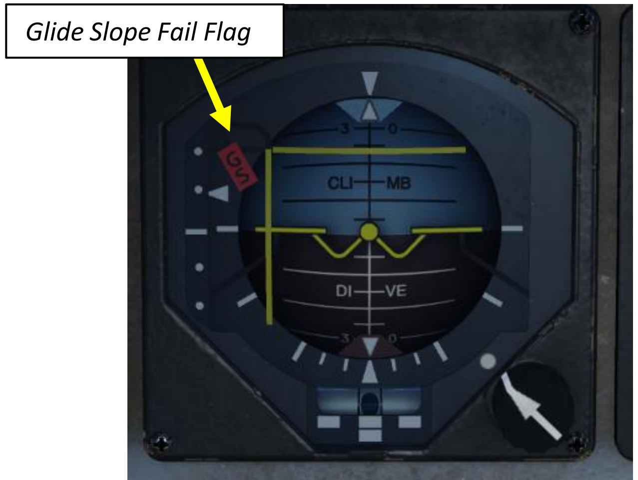


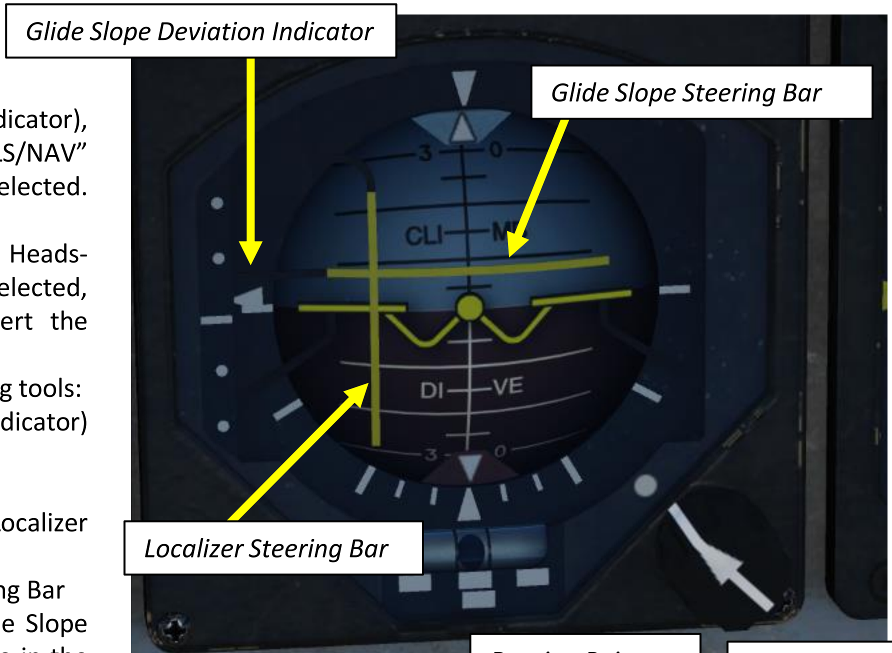


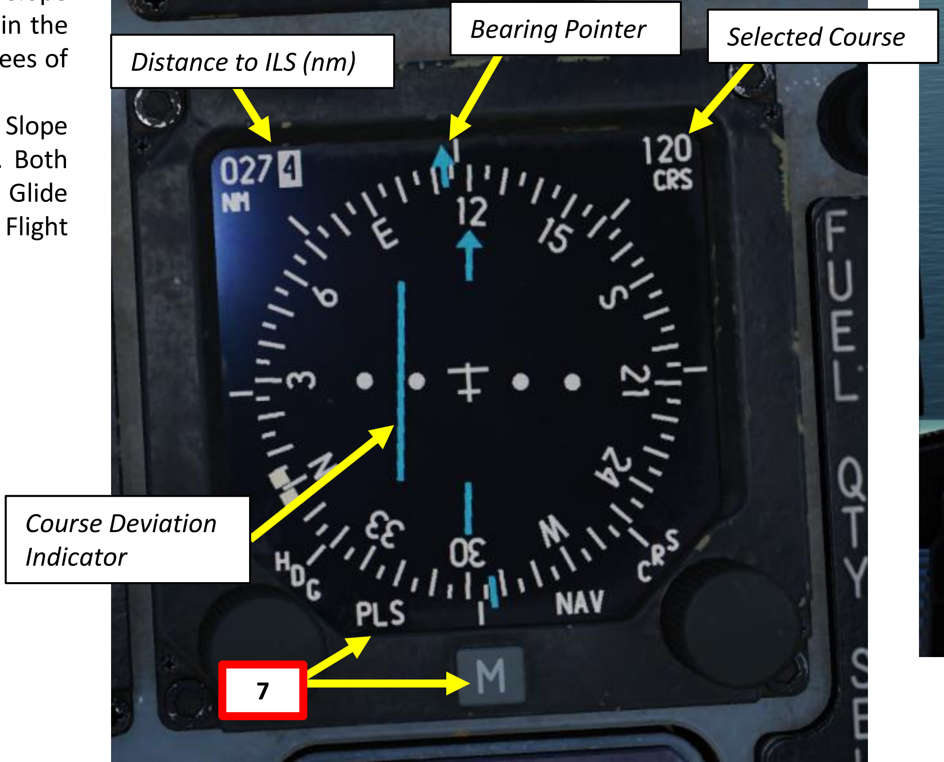


13 – ILS TUTORIAL

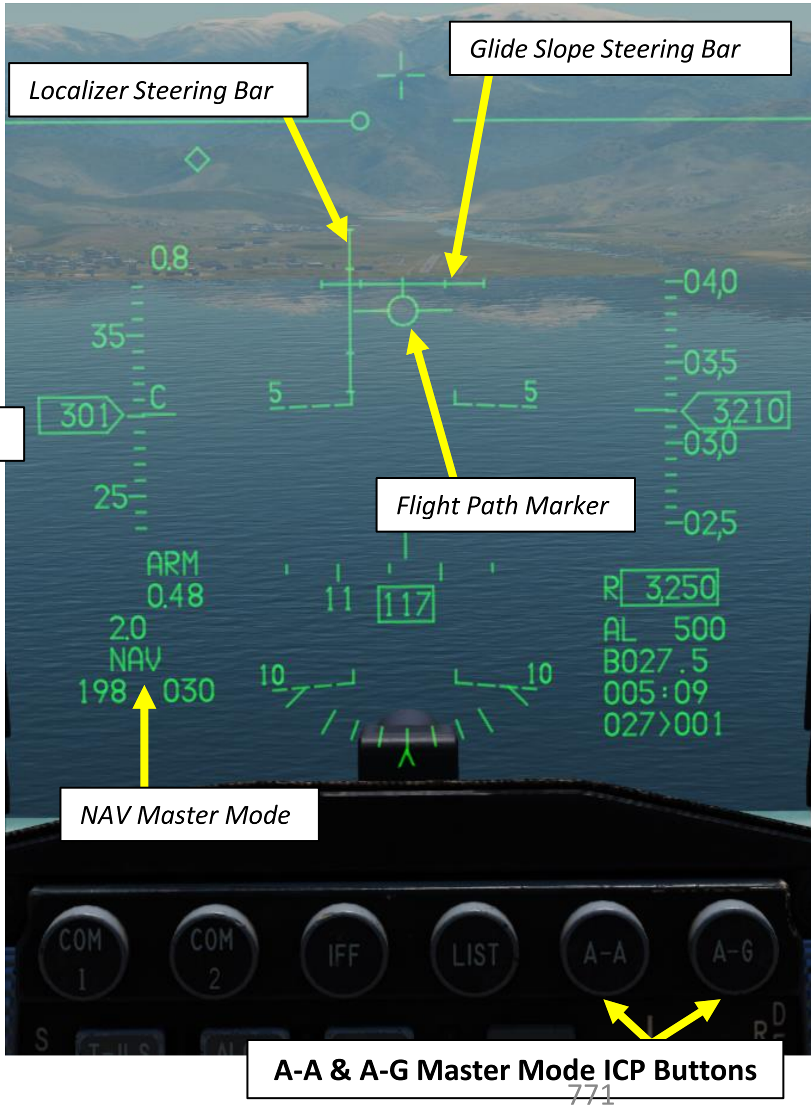
7. On the EHSI (Electronic Horizontal Situation Indicator), press "M" (Mode Selector) button until the "PLS/NAV" (Precision Landing System/Navigation) mode is selected. This will slave the EHSI to the ILS station signal.
8. Verify that NAV Master Mode is selected on the Heads-Up Display (HUD). If either A-A or A-G mode is selected, pressing their respective ICP button will revert the master mode back to NAV.
9. Align yourself with the runway using the following tools:
    a) EHSI (Electronic Horizontal Situation Indicator) Bearing Pointer
    b) CDI (Course Deviation Indicator)
    c) ADI (Attitude Director Indicator) Localizer Steering Bar
    d) HUD (Heads-Up Display) Localizer Steering Bar
10. Once you are close enough to the ILS, the Glide Slope Fail Flag will disappear and provide you guidance in the vertical plane to perform an approach with 3 degrees of glide slope.
11. Fly the aircraft to the glide slope by use the Glide Slope Steering bar and Glide Slope Deviation Indicator. Both should be centered. On the HUD, the localizer and Glide Slope bars should form a perfect cross with the Flight Path Marker in the center of this cross.





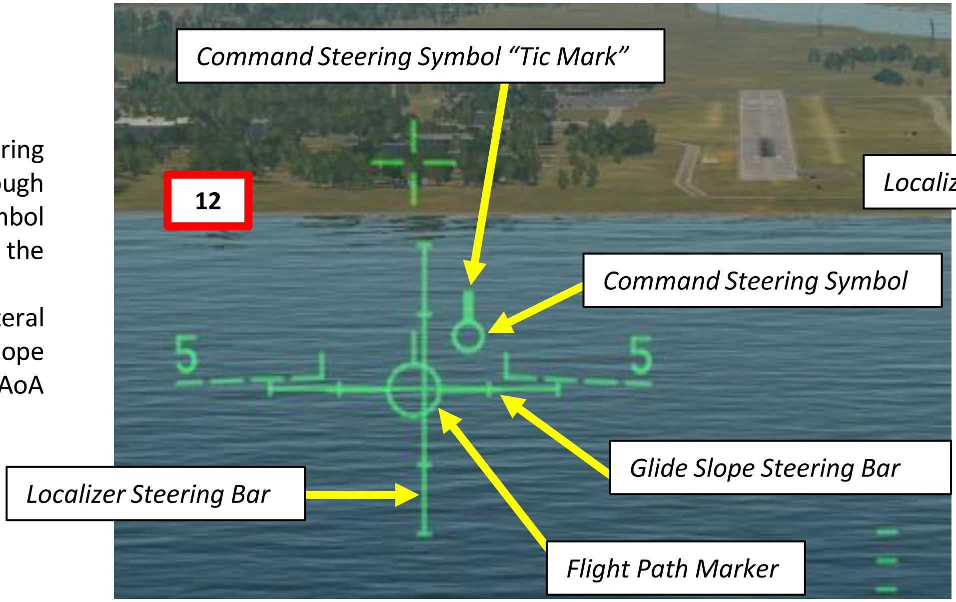


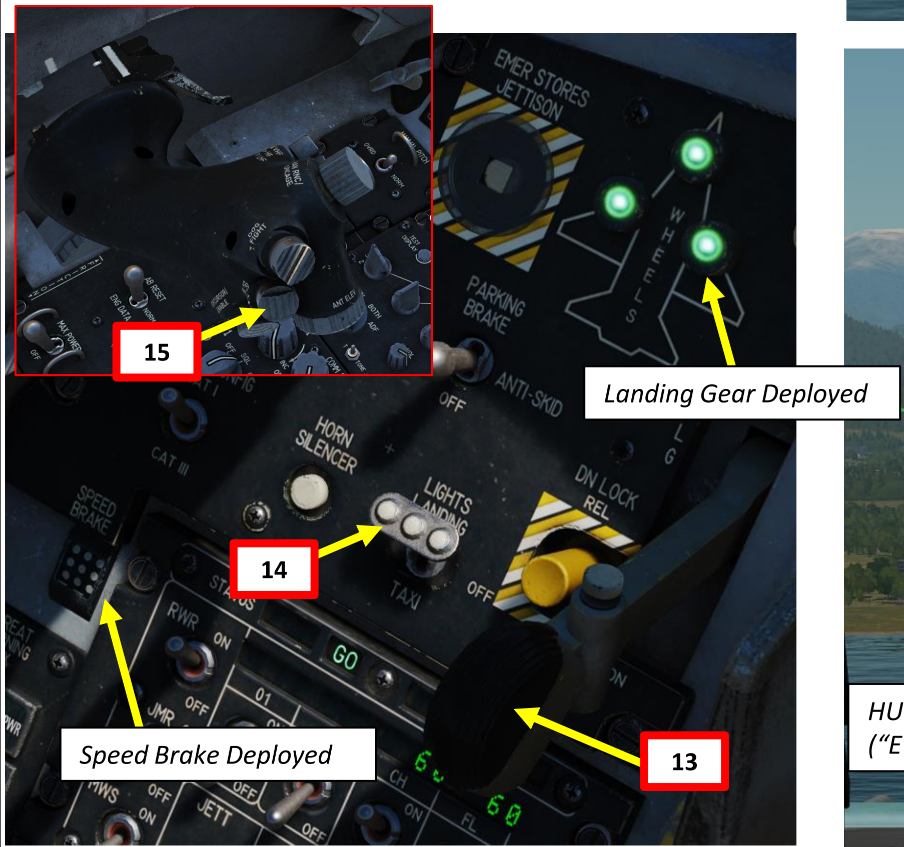
If the horizontal glide slope bar is above the center of the FPM (Flight Path Marker), it indicates that you are below glide slope and you need to increase altitude. The vertical localizer bar indicates if you are left or right of runway alignment. If the bar is right of FPM center, fly to the right to center it. For a proper glide slope approach, you want the two bars centered and forming a perfect cross on the FPM (aka "center the bars").

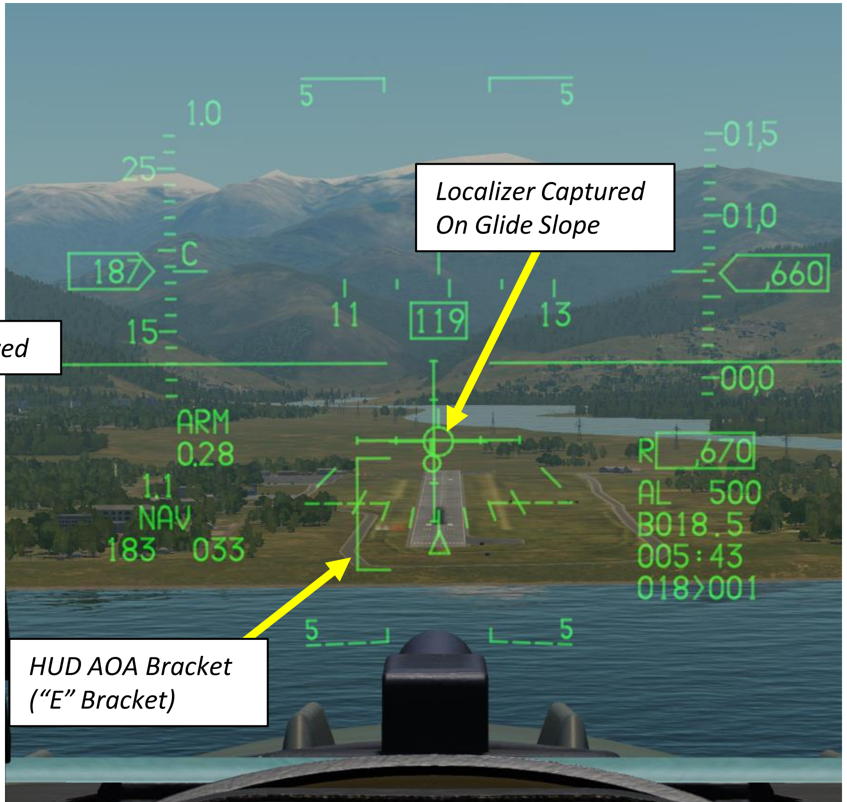


13 – ILS TUTORIAL

12. When valid localizer data is received, a Command Steering Symbol will be displayed on the HUD to guide you through the approach (circle). A tic mark appears on the symbol when nearing the center of the glideslope to indicate the pitch steering data is valid.
13. When you have captured the ILS localizer (no lateral deviation from runway axis) and captured the glide slope as well, deploy landing gear. The "E" bracket (HUD AoA Bracket) will appear upon landing gear deployment.
14. Turn on LANDING light (UP).
15. Deploy Speed Brake

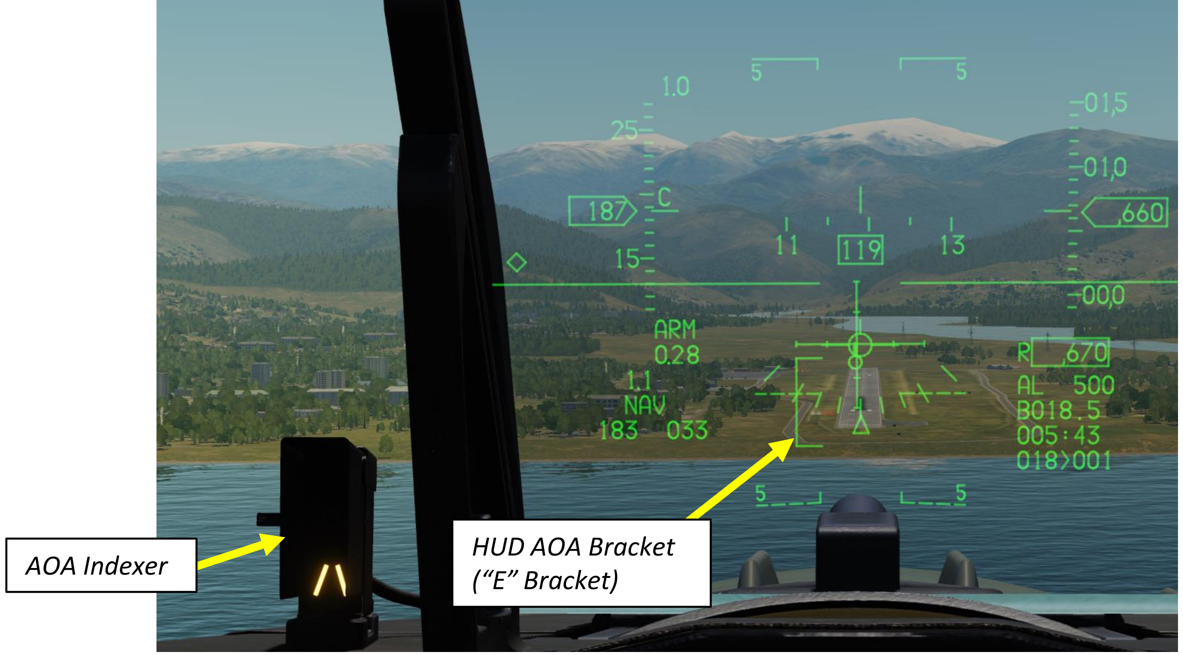


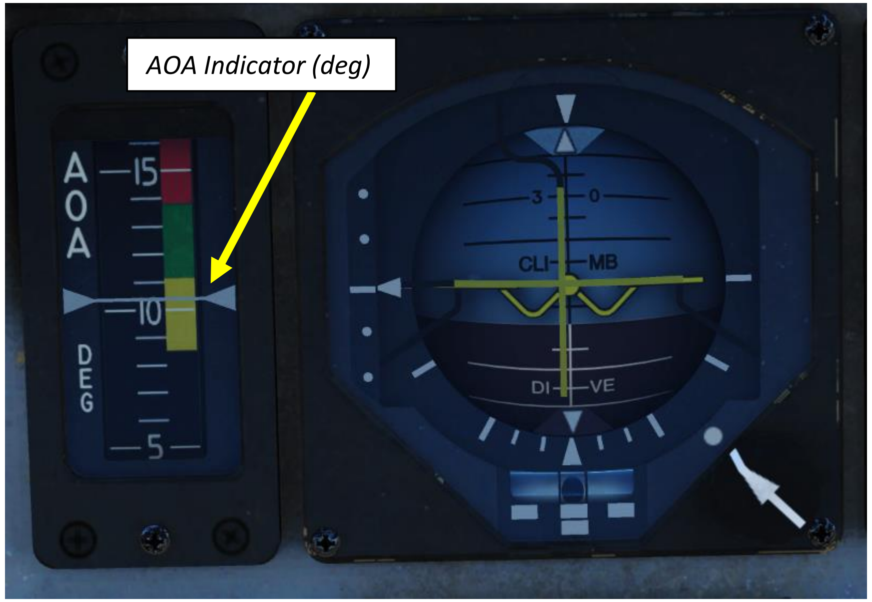


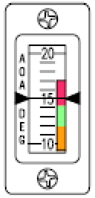
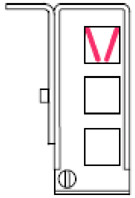
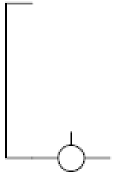
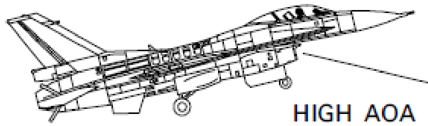
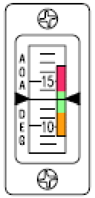
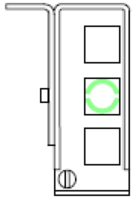
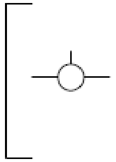
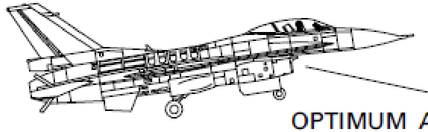
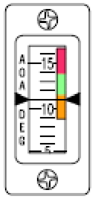
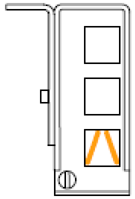
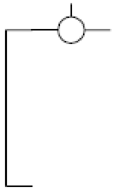
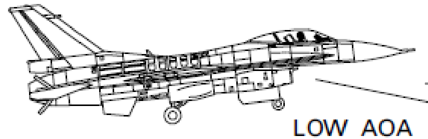


13 – ILS TUTORIAL

16. Do not use Pitch Trim to control the angle of attack; use throttle instead and the fly-by-wire system will adjust the aircraft AoA by itself. Adjust throttle to set an angle of attack (AOA) of 11 deg. Angle of Attack can be monitored with the three following indications:
    - The AOA Indicator
    - The AOA Indexer
    - The HUD (Heads-Up Display) AOA Bracket (with Flight Path Marker)





INDICATOR	INDEXER	HUD DISPLAY	ATTITUDE
 15			 SLOW HIGH AOA
 13			 ON SPEED OPTIMUM AOA
 11			 FAST LOW AOA

13 – ILS TUTORIAL

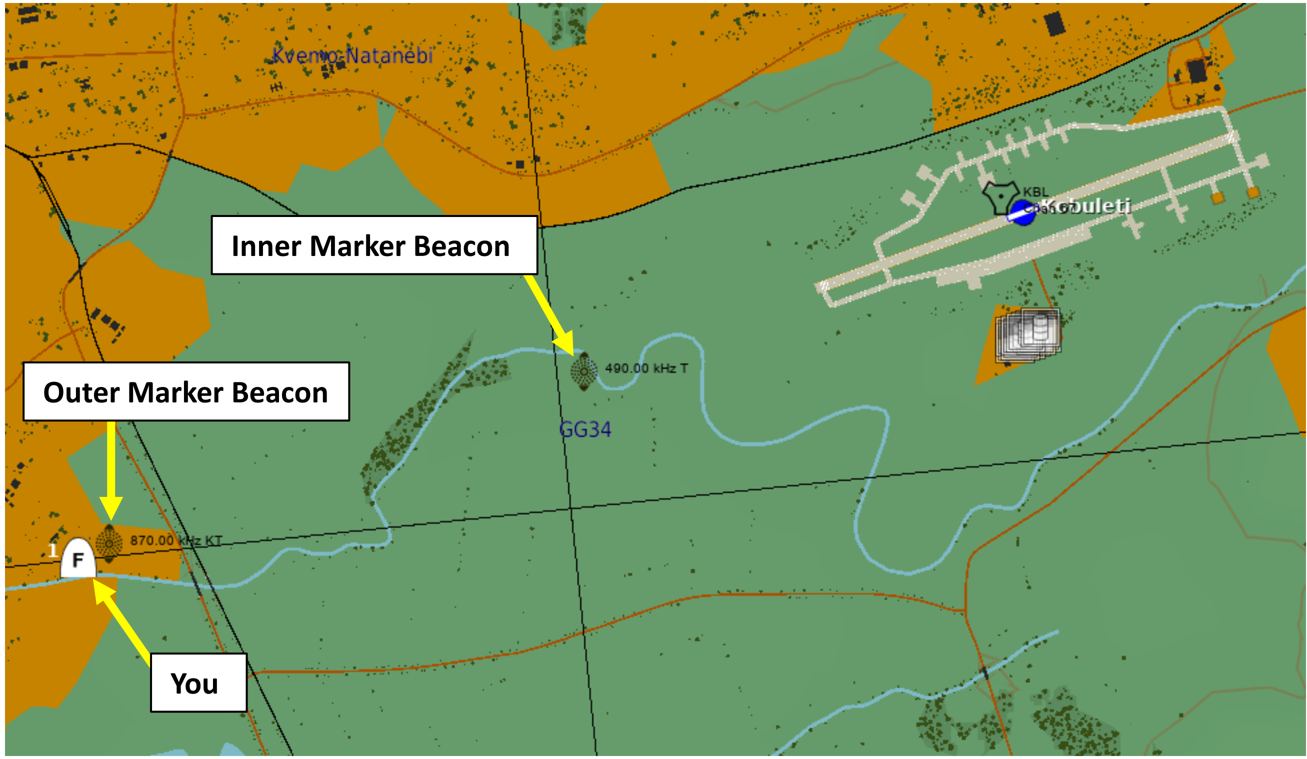
17. When flying over the “overrun” (portion of the runway before the primary surface starts), shift the Flight Path Marker forward to a point 300-500 ft down the runway.
18. Gently pull back on the stick to flare and reduce the descent rate. DO NOT level off!
19. Pull the throttle back to IDLE and touchdown with a maximum AOA of 13 deg (green circle). More than 15 deg AOA during the landing roll-out may cause the speedbrakes or engine nozzle to smash the runway.

13 – ILS TUTORIAL

20. Maintain 13 deg nose-up attitude for a two-point aerodynamic braking until your airspeed has reduced to approx. 100 kts. This step is **very important** since the F-16's brakes are not very effective.
21. Reduce back stick pressure and lower the nosewheel to the runway.
22. Open speedbrakes fully and maintain full aft stick for maximum braking effectiveness.
23. Apply moderate to heavy braking to slow the aircraft.
24. Engage nosewheel steering when below 30 kts and taxi off the runway.

13 – ILS TUTORIAL

Note: If flying over an Outer or Inner Marker beacon, the Marker Light will illuminate. Here is an example with Kobuleti's Outer Marker.



13 – ILS TUTORIAL

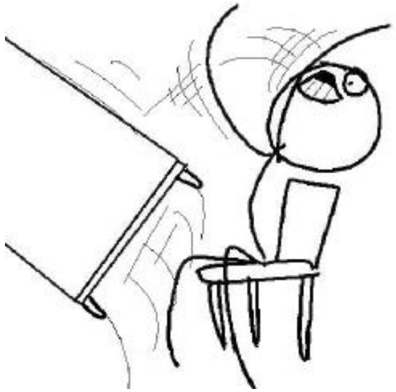
INTRODUCTION

AIR-TO-AIR REFUELING – WHY WE ALL HATE IT

Air-to-air refueling is one of the hardest, most hated, and most frustrating tasks in DCS. Ever. Of all time.

Why? Well, one of the main reasons for the difficulty behind refueling is the skill required to do formation flying. Flying in formation with another aircraft requires much more practice than you would initially think. Another reason is pure physics: there is this thing called “wake turbulence”. An aircraft flies through a fluid: air. Just like with any fluid, if you have something that displaces itself through it at a certain speed, the fluid will become disrupted (turbulence). Wingtip vortices and jetwash are both effects of this simple concept. Wake turbulence is the reason why airliners need to wait a minimum time between takeoffs: flying through disrupted air will destabilize the aircraft and it is unsafe, especially during critical phases of flight like takeoff and landing.

Unfortunately, wake turbulence is something a pilot **has** to deal with during air-to-air refueling. This is why the aircraft will fly just fine when approaching the tanker, but start wobbling around when flying in close proximity of the refueling basket/drogue and tanker engines.



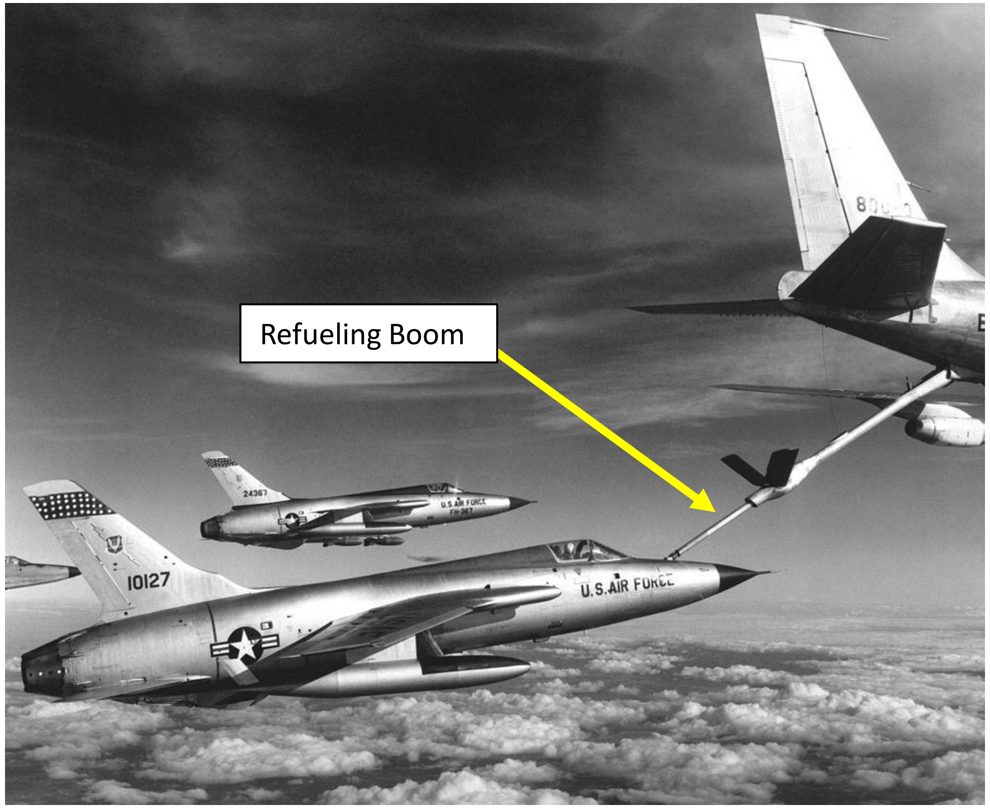
Feel free to consult Redkite’s F-16 Air-to-Air Refueling Tutorial
https://youtu.be/kCews8fZv_o

INTRODUCTION

TYPES OF AIR-TO-AIR REFUELING

There are four main air-to-air refueling techniques used in military aviation:

- Probe-and-drogue (refueling probe must be inserted in the tanker's drogue basket)
- Flying Refueling Boom (guided by boom operator aboard the tanker)
- Buddy Refueling (two fighters can refuel one another independently without a tanker)
- Nose-Probe refueling



F-105 Thunderchiefs being refueled by a Boom system during the Vietnam War

Tornado GR4 being refueling by a Probe-and-Drogue system

INTRODUCTION

TYPES OF AIR-TO-AIR REFUELING

The refueling aircraft available in DCS are:

- The Ilyushin Il-78M "Midas", a russian **probe-and-drogue** tanker, which was developed from the Il-76.
- The Boeing KC-135 "Stratotanker", a US Air Force **flying boom** tanker, which was developed from the Boeing 367-80.
- The KC-135 MPRS (Multi-point Refueling Systems), a US Air Force KC-135 tanker modified to add refueling pods to the KC-135's wings, making it useable as a **probe-and-drogue** tanker.
- The Lockheed S-3B "Viking", a US Navy **probe-and-drogue** tanker.
- The Lockheed KC-130 "Hercules", a USMC **probe-and-drogue** tanker, which was developed from the C-130.

The F-16C is equipped with a refueling door compatible with a tanker's flying boom system, so air-to-air refueling can only be performed from the KC-135 tanker in DCS.

KC-135 MPRS

KC-135 Stratotanker

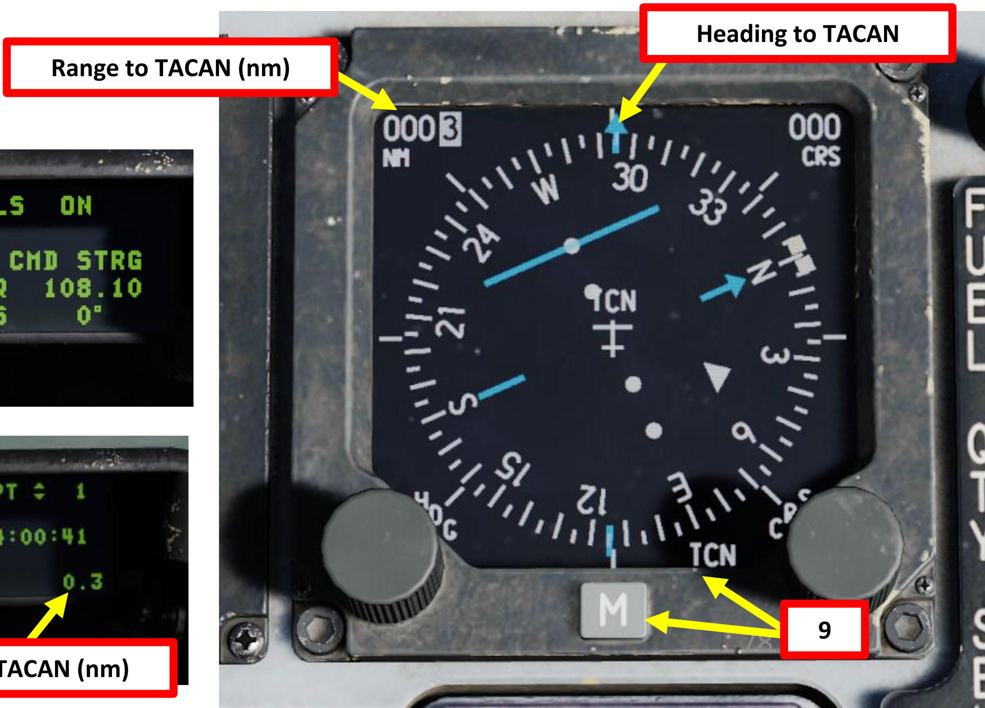
Il-78M

KC-130

S-3B Viking

AIR-TO-AIR REFUELING – HOW TO

1. Read your mission briefing to know the TACAN station channel of your KC-135 Tanker (14X) and the UHF AM channel frequency you can communicate with it (251.000).
2. Power up your TACAN by setting the MIDS LVT switch to ON
3. Adjust TACAN volume as desired
4. Press T-ILS Button on the ICP (Integrated Control Panel) to access TACAN-ILS DED (Data Entry Display) menu.
5. Press Dobber Switch DOWN to highlight the CHAN field. Use the ICP keypad to type in the new channel. Press ENTR to accept the changes.
6. If required, you may change the band by selecting the M-SEL (0) button on the ICP, then pressing ENTR. This toggles the band between X and Y.
7. Toggle the Dobber Switch RIGHT (SEQ) to cycle through TACAN modes until TCN A/A TR (Air-to-Air Transmit-Receive) is selected.
   - *Note: Current DCS implementation now requires TACAN mode to be set to T/R (Transmit-Receive) instead of A/A TR.*
8. Press Dobber Switch LEFT (RTN) to return to CNI (Communication, Navigation & Identification) DED menu. The range to TACAN (nm) will be displayed on the DED.
9. On the EHSI (Electronic Horizontal Situation Indicator), press "M" (Mode Selector) button to select "TCN" mode. This will slave the EHSI to the TACAN beacon.



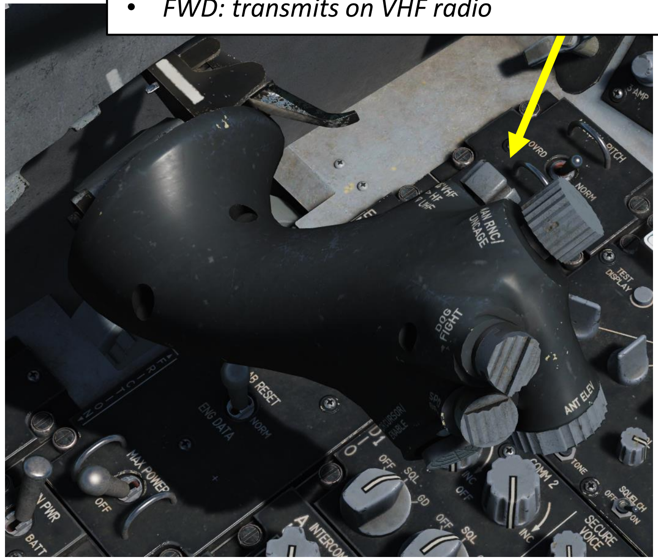
AIR-TO-AIR REFUELING – HOW TO

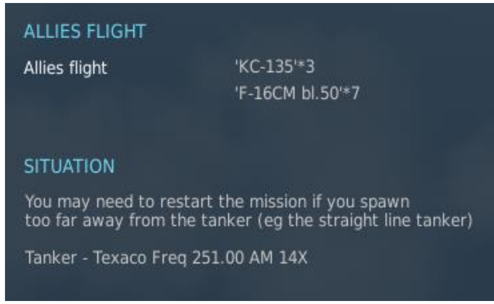
10. Verify that C&I Selector (Communication, Navigation aids, and Identification) is set to UFC (Up Front Control)
11. Press COM1 button on the ICP (Integrated Control Panel) to select UHF Radio
12. On the ICP, enter frequency the tanker's UHF frequency as "25100" (251.00 MHz), then press "ENTR" button.
13. Press Communications Transmit Switch AFT and contact tanker (F6).
14. Select "Intent to refuel" in the tanker menu. The tanker will give you an altitude (usually 20,000 ft or 10,000 ft) to rendezvous at and a speed to match (i.e. 300 kts).

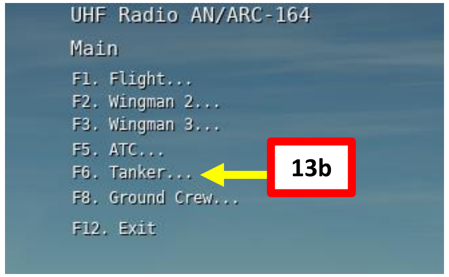
13a

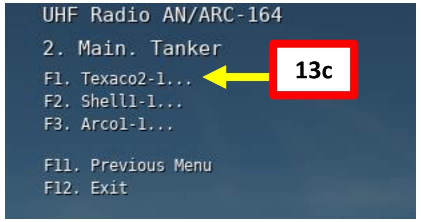
Communications UHF/VHF Transmit Switch (4-Way)

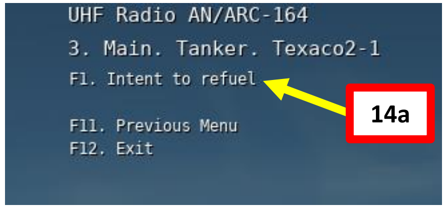
- *AFT: transmits on UHF radio*
- *FWD: transmits on VHF radio*



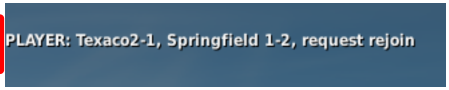


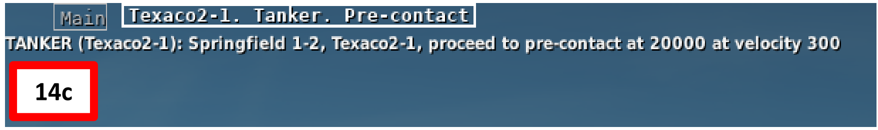






14b

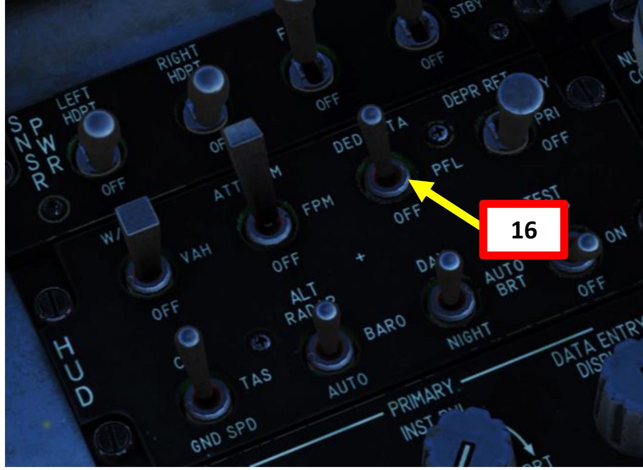




14c

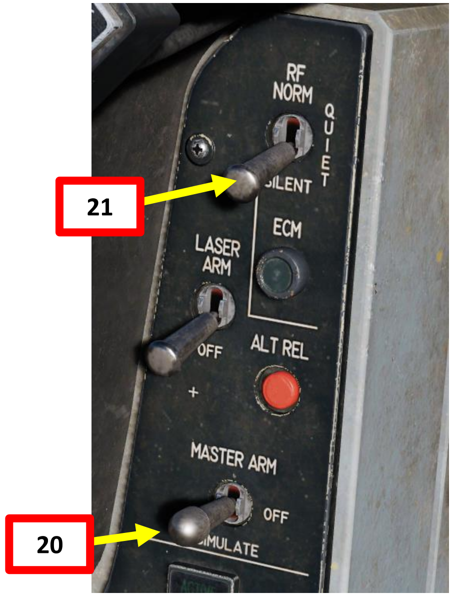
AIR-TO-AIR REFUELING – HOW TO

15. Before attempting a refueling, we need to reduce our workload as much as possible. One such measure is to display the BINGO FUEL DED page data on the Heads-Up Display, which means you don't need to glance at that awkwardly positioned Fuel Quantity Indicator.
16. Set DED (Data Entry Display) Data Switch FWD, which will allow data from the DED to be visible on the HUD.
17. Press the LIST button, then press "2" on the ICP (Integrated Control Panel) to select BNGO (Bingo Fuel) DED Page.



AIR-TO-AIR REFUELING – HOW TO

18. Open AIR REFUEL trap door.
    - *Note 1: If refueling with external tanks, this must be done 5 to 6 minutes prior to refueling to allow the external tanks to depressurize (required if you want to fill them up with fuel as well).*
    - *Note 2: When door is open, the Flight Control System (FLCS) will change its control gain to make precise movements easier.*
19. Confirm that RDY light illuminates, which indicates that door has opened properly.
20. Set Master Arm switch to OFF.
21. Set RF (Radio Frequency) Switch to SILENT. All electronic signals for the aircraft will be disabled, including the radar, radar altimeter, data link, TACAN transmit, and ECM (Electronic Countermeasures).

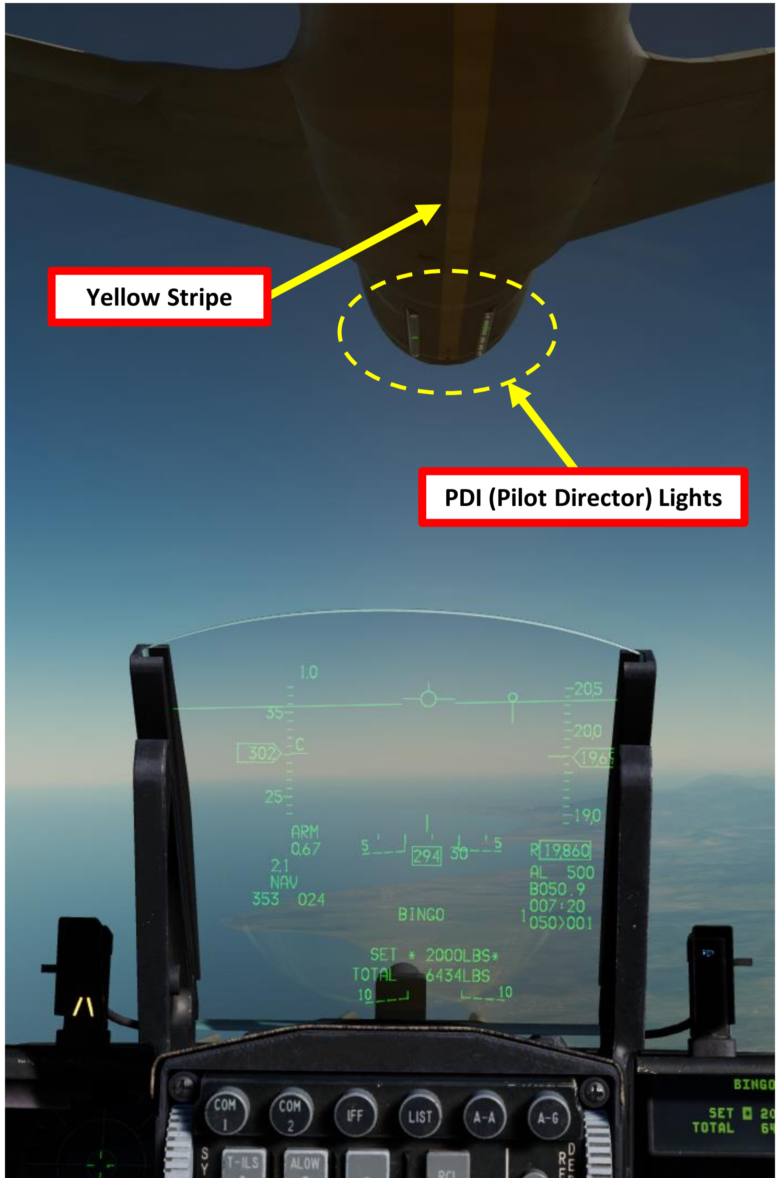


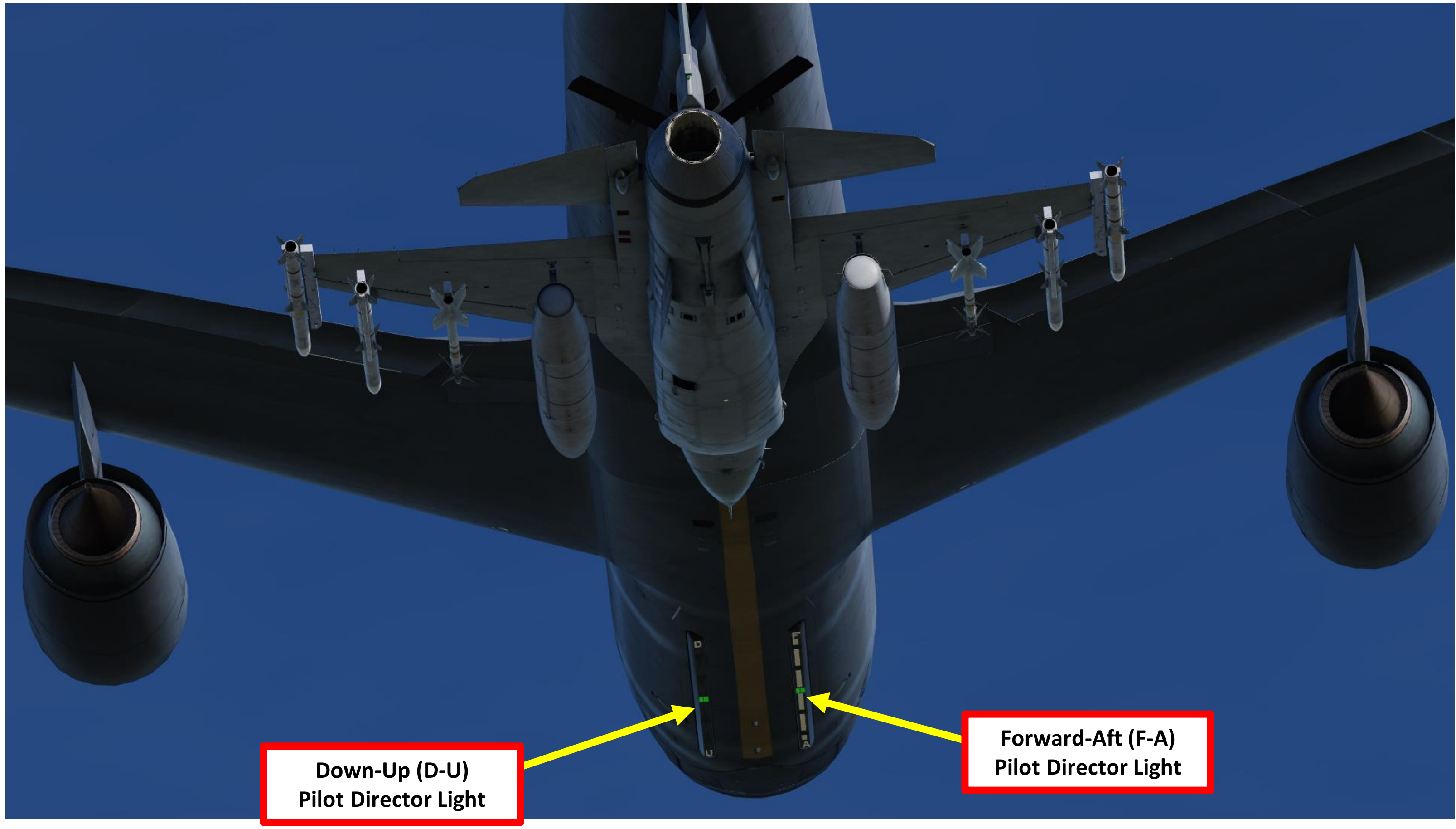
AIR-TO-AIR REFUELING – HOW TO

22. Once you are close enough, position yourself 20 ft below the refueling boom and call the tanker to begin pre-contact. If you are lined up properly, he will grant you permission to approach.
23. Make sure you are perfectly trimmed before beginning your approach.
24. Fly formation with the tanker, not the boom.
25. Perform gentle, small stick inputs to move towards the boom. Do not use rudder pedals. Use short bursts of throttle to advance towards the tanker.
26. Allow the boom to pass just left or right of your canopy, about 2-3 feet above your head. This serves as a good first check that you are at the proper height relative to the tanker.

AIR-TO-AIR REFUELING – HOW TO

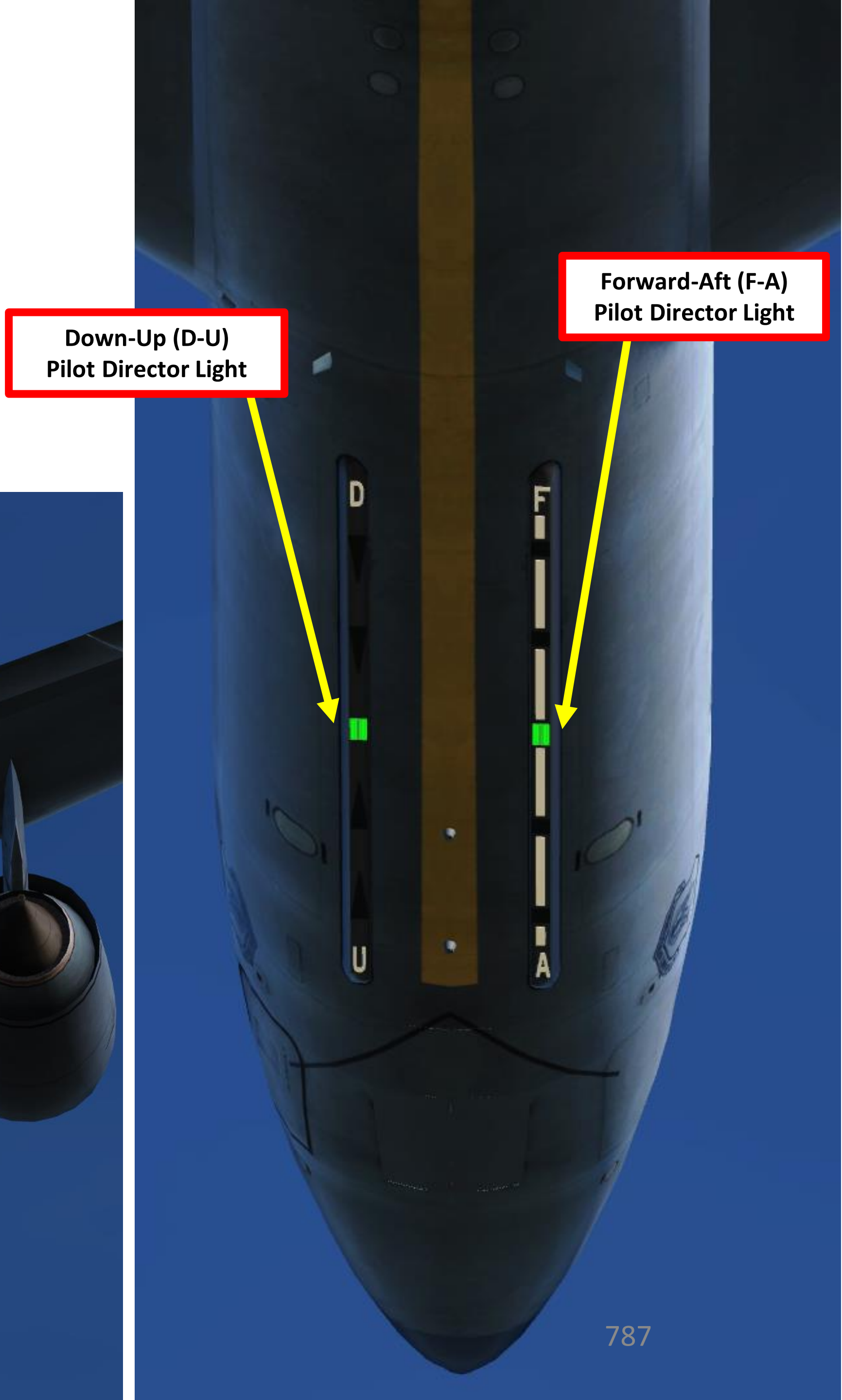
27. Continue to move slowly forward, maintaining alignment with the yellow stripe painted on the bottom of the tanker. Use the Pilot Director lights on the bottom of the tanker to maintain a position within the limits of the boom.





AIR-TO-AIR REFUELING – HOW TO

28. The PDI (Pilot Director) lights are directive, meaning they tell you the direction to travel and not your current position. In other words, preface the D, U, F and A with the word Go.
    - If the light moves toward the D, go down and if it moves toward the U, go up.
    - If the light moves toward the A, go aft and if it moves toward the F, go forward.
    - A steady light means a substantial correction is required
    - A flashing light means a small correction is required

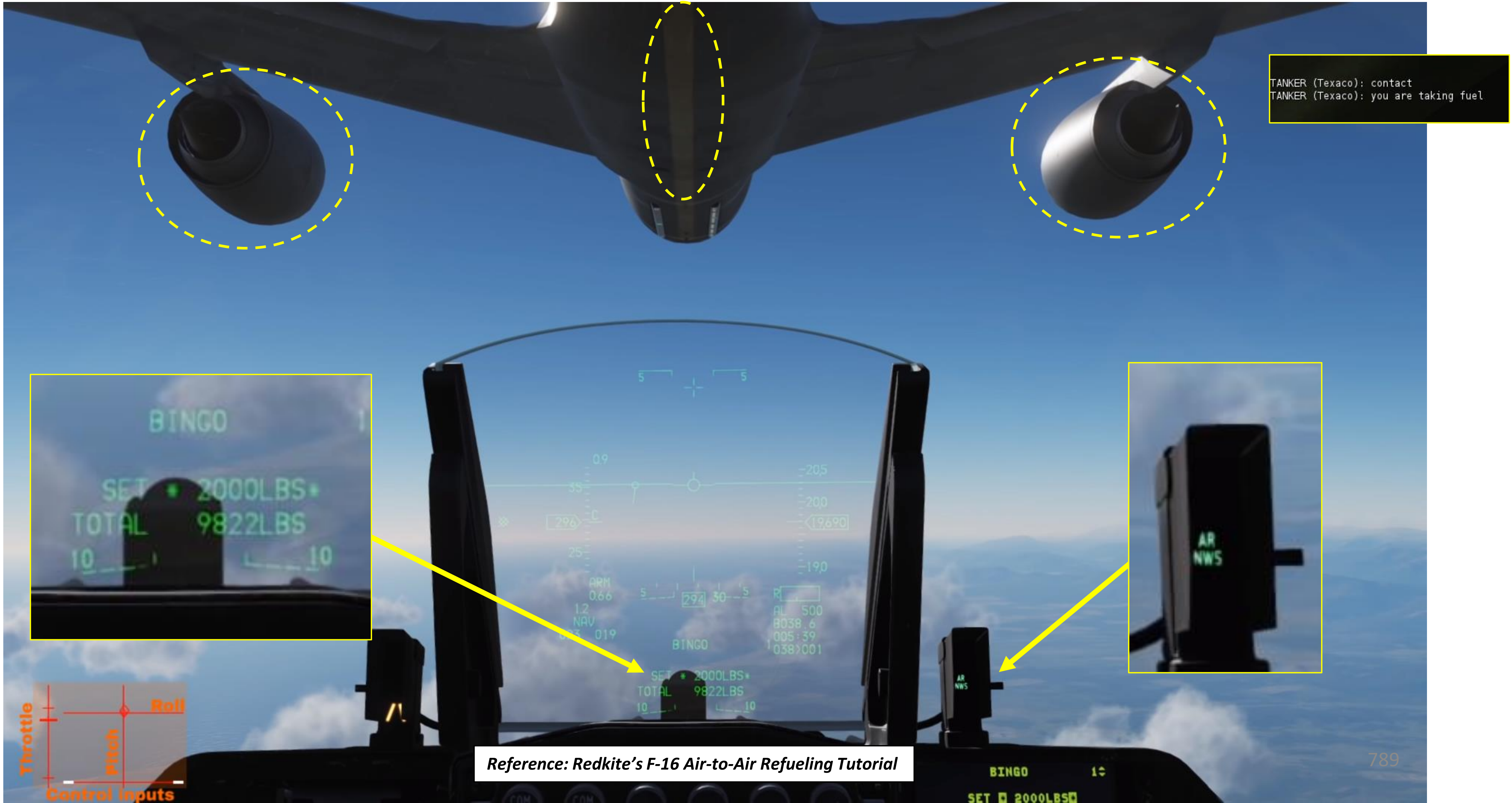


AIR-TO-AIR REFUELING – HOW TO

29. Fly formation on the tanker and allow the boom operator to direct the boom into the refueling receptacle behind the cockpit on your aircraft.

AIR-TO-AIR REFUELING – HOW TO

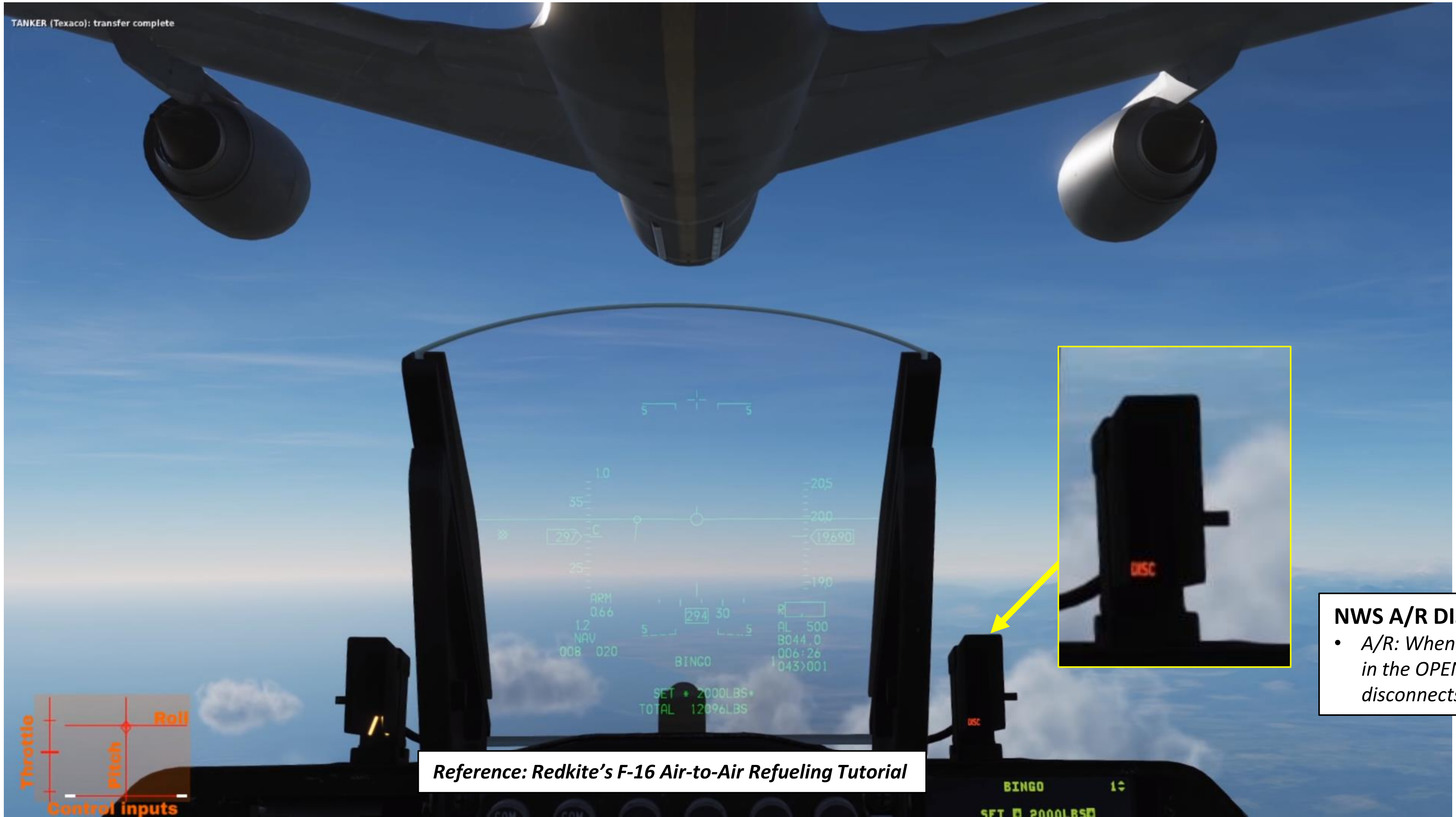
30. The boomer will announce “contact” and ”you are taking fuel” when the connection is established.
31. The AR/NWS light will illuminate. Monitor your fuel transfer on the HUD (Heads-Up Display) and BNGO DED (Data Entry Display) page.
32. Keep the aircraft aligned with the tanker using reference points such as its engines and its centerline. This will help you evaluate if your aircraft drifts or not. Correct one axis at a time only.



Reference: Redkite’s F-16 Air-to-Air Refueling Tutorial

AIR-TO-AIR REFUELING – HOW TO

33. Refueling procedure will be completed when the “DISC” (Disconnect) warning light illuminates.
34. If you wish to disconnect before that, press your “Nosewheel Steering A/R Disc” button on your HOTAS joystick (or “S” key binding) to unlatch the boom from your fuel trap door.
35. Close AIR REFUEL trap door and resume flight.
    - Note: failing to shut the trap door may result in your aircraft not being able to use fuel from your external tanks.



Reference: Redkite’s F-16 Air-to-Air Refueling Tutorial

NWS A/R DISC & MSL STEP Button
- *A/R: When in flight and the AIR REFUEL switch in the OPEN position, depressing the button disconnects boom latching*

PART 17 – AIR-TO-AIR REFUELING

USEFUL RESOURCES

Eagle Dynamics (Official Developer) Work-In-Progress Early Access Guide
https://www.digitalcombatsimulator.com/en/downloads/documentation/viper_early_access_guide_en/

TO-BMS1F-16CM-1
Falcon 4.0 BMS Flight Manual - F-16C/D BMS 4.34

TO-BMS1F-16CM-34-1-1
Falcon 4.0 BMS Avionics and Non-Nuclear Weapons Delivery Flight Manual - F-16C/D BMS 4.34

Matt Wagner (Eagle Dynamics Producer) DCS F-16C Viper Video Tutorials
https://www.youtube.com/watch?v=uJrMSNM7X08&list=PLer9oF4AanvFoD2t2Aq3aYRYkJs6v9wG8

Redkite's Youtube Tutorials
https://www.youtube.com/watch?v=kCews8fZv_o&list=PLml_c09ciucucGNhd843UNNJMeXwhS8t6

F-16.net Website
http://www.f-16.net/

Hoggit Wiki
https://wiki.hoggitworld.com/view/F-16C

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:

- David Titus
- Goodknight
- John Mouat
- ChazFlyz
- M. D.
- Brandon Glenn
- Patrick
- Teitur Samuelsen
- Jack Nieh
- Jeannette Benoit
- Tim Perry
- Athena International
- David Ogea
- James W.
- Kappa
- Hoggit
- Kilanov


DCS digital combat series
Chuck_Owl
DIGITAL COMBAT SIMULATOR
F-16C VIPER
INSTANT ACTION
CREATE FAST MISSION
MISSION
CAMPAIGN
MULTIPLAYER
LOGBOOK
ENCYCLOPEDIA
TRAINING
REPLAY
MISSION EDITOR
CAMPAIGN BUILDER
EXIT
F-14B EA
F-16C EA
F-5E
F-86F
F/A-18C EA
FC3
Fw 190 A-8 EA
Fw 190 D-9
I-16 beta
JF-17 EA
Ka-50
L-39
M-2000C
Mi-8MTV2
MiG-15bis
MiG-19P 2.5.5
MiG-21bis trunk
Disclaimer: The manufacturers and intellectual property right owners of the vehicles, weapons, sensors and other systems represented in DCS World in no way endorse, sponsor or are otherwise involved in the development of DCS World and its modules
Version: 2.5.6.47404