DCS GUIDE

Mirage F1

By Chuck

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

The Dassault Mirage is the very first aircraft I ever heard of. I discovered the Mirage III by reading one of my father's old "Tanguy et Laverdure" comic books by Joseph "Jijé" Gillain, Jean-Michel Charlier and Albert Uderzo. Believe it or not, these fictional French Mirage pilots are part of what sparked my interest in military aviation. The 1960's were the golden age for Franco-Belgian aviation comics like Buck Danny, Michel Tanguy, Ernest Laverdure and Dan Cooper. Artists painstakingly reproduced technical drawings by hand and drew airplane cutaway views to a level of detail that remains unparalleled even by today's standards. Some even went on airbases and talked to the pilots and ground crews directly in order to get as much information about their planes as possible. And who would blame them? After all, these were some of the most beautiful fighter jets ever built.

French military aviation history is an incredibly interesting subject. French engineers had to compete against Cold War superpowers like the United States and Russia to export their airframes to a world arming itself to the teeth. Various countries like Egypt, Greece, India, Taiwan and the United Arab Emirates became political hot spots and needed a multirole jet fighter that could reach speeds over Mach 2 while having a relatively low operation and maintenance cost.

The Mirage's bold design has a rich history that spans over decades. Many variants of the supersonic delta-winged Mirage were manufactured by Dassault Aviation such as the Mirage IV, Mirage 5, Mirage 50, Mirage F1 and Mirage 2000... but other countries developed their own version of the Mirage as well. For example, the Israeli Aircraft Industries *Kfir* and *Nesher* were modified versions of the Mirage 5. The israeli IAI *Nammer*, south african Atlas *Cheetah*, and the chilean ENAER *Pantera* are other designs strongly inspired by the French creation.

The **Dassault Mirage F1** is a French fighter and attack aircraft designed and manufactured by Dassault Aviation. The F1 was developed in the 1960’s as a successor to the popular Mirage III family.

The Mirage F1 emerged from a series of design studies conducted by Dassault. As a result, a larger swept wing derivative of the Mirage III became the Mirage F2. The F2 can best be described as a vertical take-off and landing (VTOL) propulsion testbed akin to the Dassault Mirage IIIV. However, engineers quickly recognized that the emerging design could also function as the basis for a competent fighter as well. Both the Mirage F2 and a smaller derivative referred to the Mirage F3 received substantial attention from both Dassault and the *Armée de l’Air* (French Air Force), the latter being interested in its adoption as a long-range fighter bomber as a stopgap measure prior to the adoption of the envisioned Anglo-French Variable Geometry (AFVG) strike aircraft.

Dassault studied a single-seat derivative of the F3 powered by the SNECMA Atar 9K-50 turbojet engine, which had been used on the larger Dassault Mirage IV. With the intention of producing a successor to its delta-winged Mirage III and Mirage 5 fighters, Dassault commenced design work on the smaller aircraft in 1964, subsequently designated as the Mirage F1. Unlike its predecessors, the F1 shared the layout of a swept wing mounted high on the fuselage and a conventional tail surface as used by the F2. Although it has a smaller wingspan than the Mirage III, the Mirage F1 nevertheless proved to be superior to its predecessor, carrying more fuel while possessing a shorter take-off run and superior maneuverability.

On 23 December 1966, the first prototype of the Mirage F1 conducted its maiden flight. The first flight had been delayed due to a funding shortage affecting the overall program. During its fourth flight, the prototype was recorded as having attained a top speed in excess of Mach 2. On 18 May 1967, the first prototype was lost in an accident at DGA (Direction Générale de l’Armament) Essais en Vol (Flight Tests) in Istres. The crash had resulted from a loss of control after encountering flutter, killing its pilot. Despite this misfortune, during late 1966, the Mirage F1 programme was officially adopted by the *Armée de l’Air*. Following a redesign period, on 20 March 1967, the second prototype performed its first flight. On 26 May 1967, an order for three Mirage F1 prototypes was placed, while the larger and more expensive Mirage F2 was formally abandoned. These three pre-service aircraft, along with a static structural test airframe, soon joined the test programme.

In order to comply with the French Air Force's requirement for an all-weather interceptor, the first production Mirage F1C was equipped with a Thomson-CSF Cyrano IV radar system. The later Cyrano IV-1 version added a limited look-down capability. However, Mirage F1 pilots reported that the radar was prone to overheating, which reduced its efficiency. During May 1973, the first deliveries to the French Air Force took place; the type entered squadron service with EC 2/30 Normandie-Niemen (EC: *Escadron de Chasse*, Fighter Squadron) in December of that year. By October 1971, the Mirage F1 was under production at both Dassault's Bordeaux facility and at SABCA's own plant in Belgium. Since then, more than 700 units of the Mirage F1 have been produced.

Mirage F1C of EC 2/30 Normandie-Niemen at the 1975 Paris Air Show
Photograph by RuthAS

Compared to the delta wing of the Mirage III, the Mirage F1's shoulder-mounted swept wings resulted in a reduction of more than 50% in required runway lengths. The increased internal fuel capacity of the F1 provided an increase of a 40% greater combat range. The approach speed prior to landing is 25% less when compared to its Mirage IIIE predecessor. According to Dassault, the negative performance impact associated with the increased thickness of the Mirage F1's wing over the Mirage III's counterpart had been offset by improvements made to the propulsion system.

The SNECMA Atar 9K-50 turbojet engine provided great power, especially with its afterburners. However, the pilot had to pay special care to avoid certain manoeuvers since the engine could suffer compressor stalls in certain conditions. The relatively slow engine response time had to be taken into account when moving the throttle. Keep in mind that back in those days, engine protection systems were still in their infancy, which means that failures due to pilot error were a distinct possibility.

The initial armament of the Mirage F1 was a pair of internal DEFA 30 mm cannons, and a single Matra R530 medium-range air-to-air missile, which was carried under the fuselage. After 1979, the medium-range R530 was replaced by the improved Matra Super 530F missile as the latter came into service in quantity with the *Armée de l'Air*. In 1977, the R550 Magic was released, which the Mirage F1 mounted on wingtip rails. Around the same time, the American AIM-9 Sidewinder was also introduced to the Mirage F1's armament; both the Spanish and Hellenic Air Forces had requested the integration of the Sidewinder upon their own Mirage F1CE and Mirage F1CG fighters.

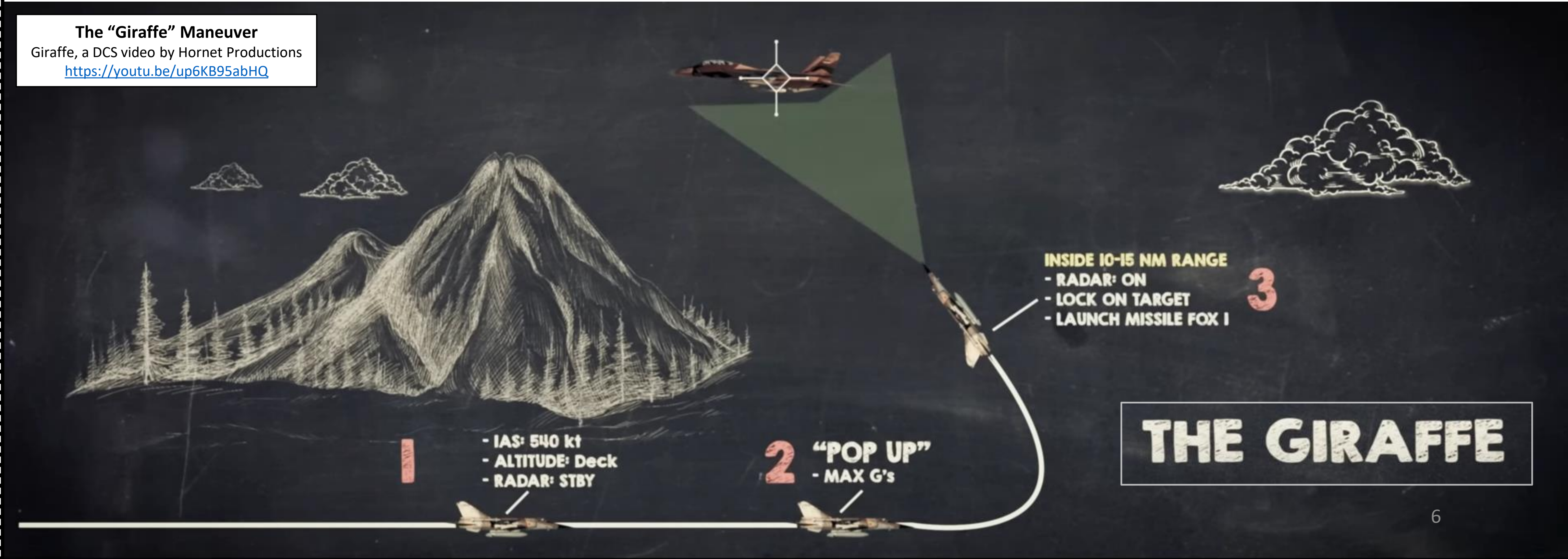
The variants flyable in DCS are all based on the Spanish Mirage F1CE, F1EE, F1BE and F1M variants.

During 1984, the first operational deployment to be performed by French Air Force Mirage F1s was conducted during Operation Manta, the French intervention in Chad to counteract the growing Libyan encroachment in the region. A force of four Mirage F1C-200s provided air cover for a further group of four Jaguar strike aircraft; they also participated in a number of skirmishes against pro-Libyan Transitional Government of National Unity (GUNT) rebels. In 1986, French Mirage F1s were redeployed to Chad as part of Operation Épervier. In response to the Iraqi invasion of Kuwait, France performed two deployments of Mirage F1s to the Persian Gulf. In October 1990, 12 Mirage F1Cs were dispatched to Doha, Qatar in order to boost air defences, while a further four Mirage F1CRs of ER 33 were deployed to Saudi Arabia as part of Operation Daguet in September 1990. To avoid the risk of being mistaken for hostile Iraqi Mirage F1s, all of the French F1CRs were grounded during the first few days of the Allied air attacks, flying their first combat mission on 26 January 1991; an additional reason for their initial grounding was the lack of compatible night vision equipment. They were used in the fighter bomber role, using their more capable navigation systems to lead formations of French Jaguar fighter bombers, as well as to fly reconnaissance missions; in this capacity, 114 sorties had been flown by the end of hostilities.

The Mirage F1 was widely exported and was considered a great platform for a variety of missions. Among its prominent operators were France, Ecuador, Greece, Iraq, Morocco, South Africa, Libya, and Spain. Interestingly, Draken International acquired 20 former Spanish Air Force Mirage F1Ms and 2 F1B aircraft for use in the Adversary Air role providing support to the United States Air Force.

As a side note, during the Iran–Iraq War, Iraq's Mirage F1EQs were used intensively for interception, ground attack and anti-shipping missions. In November 1981, an Iraqi Mirage F1 accounted for the first Iranian F-14 Tomcat to be shot down, followed by several more in the following months, giving the previously timid Iraqi Air Force new confidence in air-to-air combat engagements with the Iranians. In this instance, Iraqi pilots successfully used the “Giraffe” technique, which is an aggressive pop-up attack maneuver performed from very low level to avoid detection.

The “Giraffe” Maneuver
Giraffe, a DCS video by Hornet Productions
https://youtu.be/up6KB95abHQ



Overall, the Mirage F1 is a fantastic aircraft to fly in Cold War scenarios. Its cockpit is still chock full of Mirage III legacy systems and it showcases many of the limitations pilots had to deal with before the era of modern fighter jets bristling with high-tech sensors and smart weapons. The Mirage is a fighter aircraft that will keep you on your toes and provide a tremendous sense of satisfaction once you have performed a successful strike using old school attack profiles. You will feel an intoxicating sense of speed when flying at tree-top level, fully loaded with enough bombs to obliterate any target of your choosing. In many regards, it is a surprisingly accessible and simple aircraft to operate, but mastering it requires practice, consistency and a bit of planning if you want to survive high-threat environments. You will have to fly by the numbers, and experience will be your best teacher.

If you ever find yourself wondering if this aircraft is for you… just watch it in action. Seeing a pair of Mirages roar past you in full afterburner is a spectacular sight to behold. Whether you employ bombs, rockets, cannons or missiles… you have to put in the work if you want to hit anything at all. Once things start to "click", this is when the fun really begins. The Mirage may seem like an arcane, mysterious French aircraft at first, but there is a certain elegance and practicality to its design that makes it a great, flexible platform with just enough system automation to make your life easier by reducing your considerable workload.

In my humble opinion, Aerges Engineering successfully recreated quite an impressive simulation of one of the most iconic aircraft of its time. The aircraft feels rugged, responsive and powerful, while its radar feels antiquated and clunky compared to modern fighter jets. The available variants of the plane provide a unique insight into the aircraft's evolution across the years, and this incredible effort by the Aerges team is no small feat.

Strap in and let's get this beautiful french *fléchette* up in the air, shall we? Allez hop!

Mirage F1CE

The F1C version of the Mirage is the original all-weather interceptor production variant for the French ”*Armée de l’Air*”. The F1C was exported to several countries (F1CE for Spain, F1CG for Greece, F1CH for Morocco, F1CJ for Jordan, F1CK for Kuwait, F1CZ for South Africa, F1ED for Libya, etc.). Several of these aircraft were reconverted to the CT (close air support) specification for France. Despite its main role as an interceptor, the F1C has a secondary role as ground attacker and a wide selection of air-to-ground ordnance is also available for these models.

The F1CE version we have in DCS has no INS (Inertial Navigation System) and no air-to-air refueling capability.

Mirage F1EE

The F1E variant is an all-weather, multirole and ground-attack version of the Mirage F1C. It is equipped with a better navigation suite and air-to-air refueling capability. All of the E versions made were for export clients (F1EQ for Iraq, F1EE for Spain, F1EJ for Jordan, F1JA for Ecuador, F1EH for Morocco, F1EDA for Qatar, etc.). Of special note are the later Iraqi versions, which were equipped with a wide variety of guided air-to-ground weapons.

The F1EE version we have in DCS includes a more advanced AN/ALR-300 radar warning receiver (RWR) and an INS (Inertial Navigation System), which allows the pilot to navigate using waypoints. Some of the switches in the cockpit are at different places, but general aircraft handling and weapon employment is mostly the same as its older F1CE variant.

Mirage F1BE

The F1BE is a Spanish two-seat conversion trainer of the Mirage F1C. It is capable of carrying the same ordnance as the Mirage F1C, but the extra seat comes at the cost of less fuel, a slight increase in weight and the loss of the internal cannons. However, external cannon pods can be mounted instead.

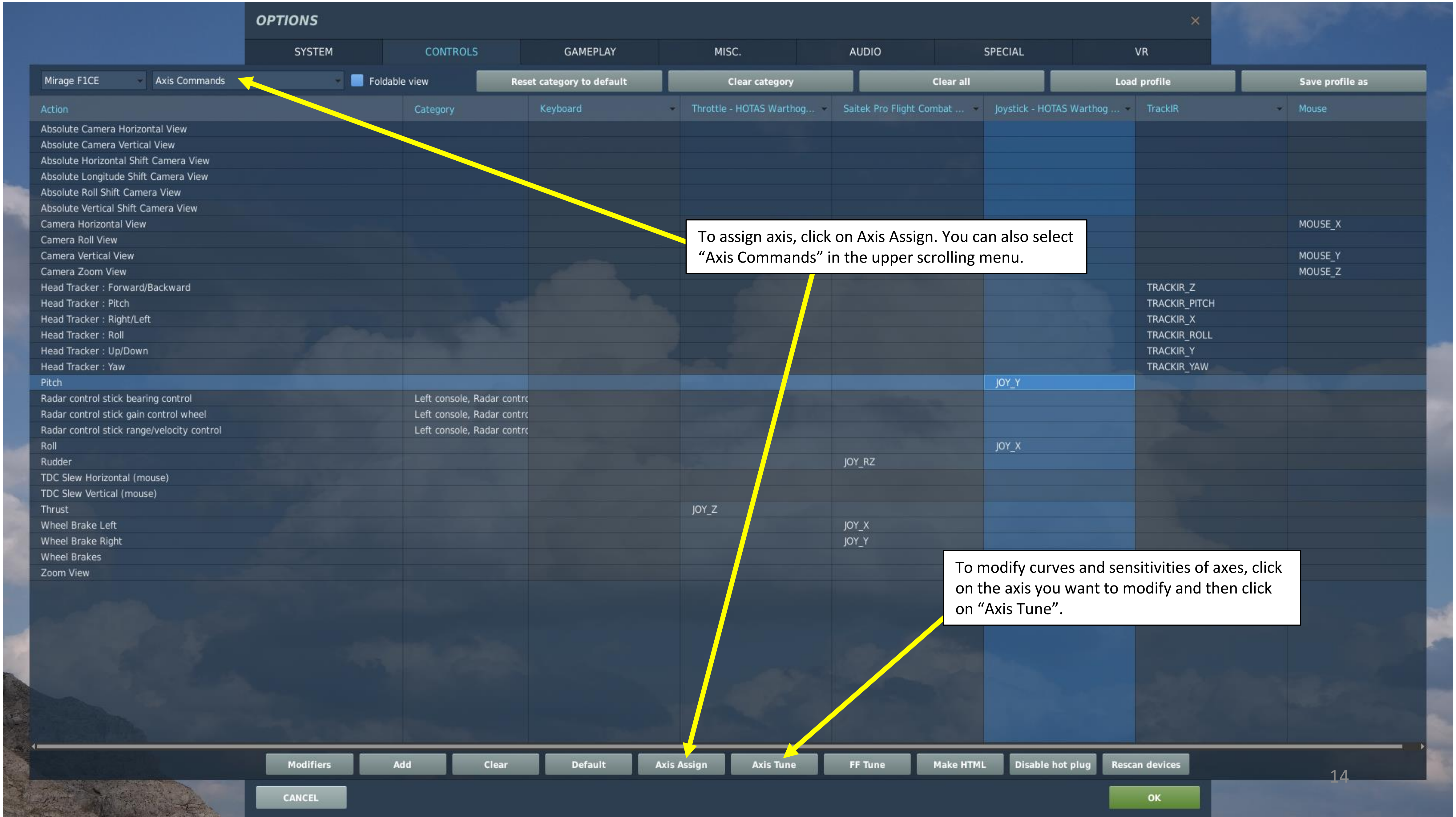
Mirage F1M

The F1M is a Spanish modernized version based on the Spanish C and E models carried out by Thomson-CSF. The modernization vastly improves air-to-ground capability, includes the new Cyrano IVM radar with sea search modes, as well as new navigation suites, a color LCD (Liquid Crystal Display) and new HUD (Heads-Up Display).

This aircraft variant is not available yet in DCS as of 2023/07/28.

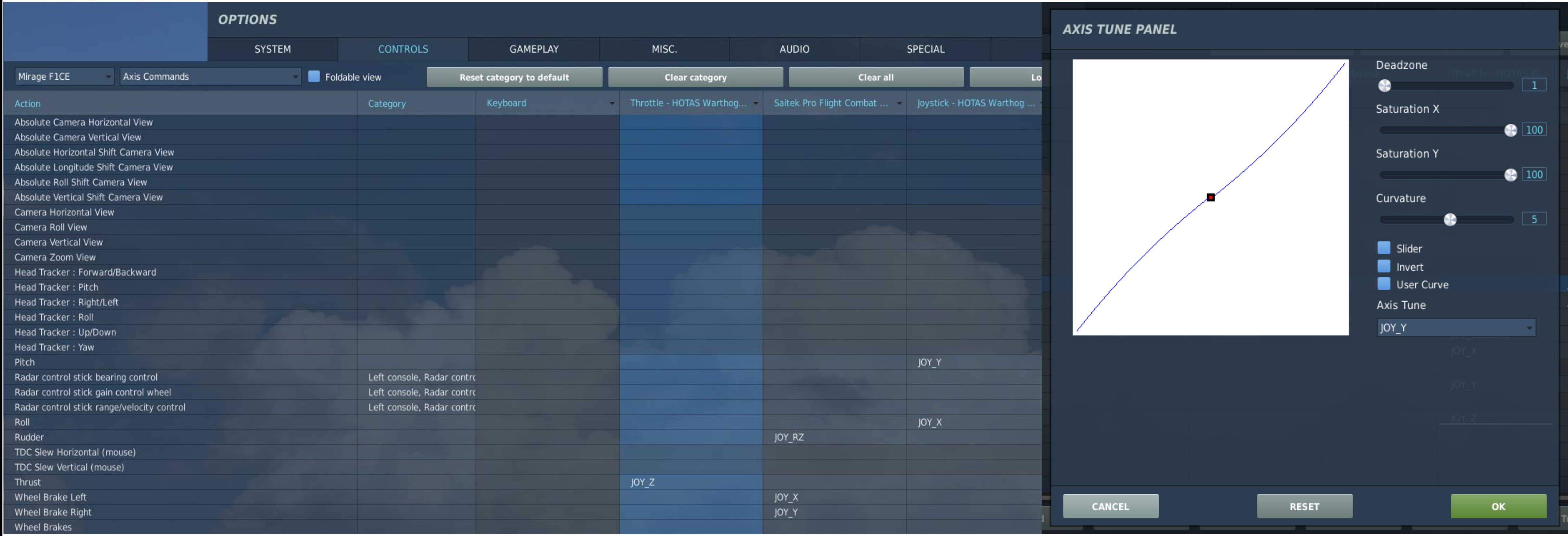
In the Special Options Tab of the Mirage F1, I recommend using the following settings:

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
- WHEEL BRAKE LEFT / RIGHT



WHAT YOU NEED MAPPED

Chaff/Flares Release Button (D)
(hidden grey button on right hand side)

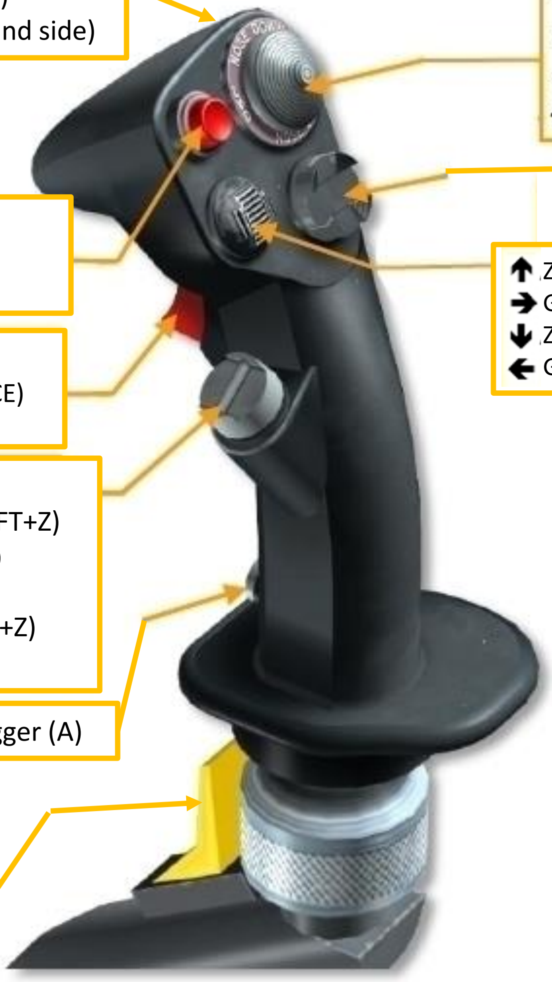
Bombs, Rockets Missiles & Sight Recorder Button (RALT+SPACE)

Gun Button (SPACE)

↑ (C+M or SW) “R” Button (LCTRL+R)
→ Telemeter/Zone Scanning Switch TEL – UP (LALT+LSHIFT+Z)
↓ (C+M or SW) “R” Deselection Switch (LCTRL+LWIN+W)
← Telemeter/Zone Scanning Switch BPZ – DOWN
P Telemeter/Zone Scanning Switch CENTER (LALT+LWIN+Z)

Autopilot Disconnect Trigger (A)

Autopilot Disengage Lever (P)



↑ Trim Hat – Nose DOWN
→ Trim Hat – Roll RIGHT
↓ Trim Hat – Nose UP
← Trim Hat – Roll LEFT

↑ Radar Control Stick APS/APC – Lock-On (APC/DOWN)
→ Radar Control Stick Unlocking Control
↓ Radar Control Stick APS/APC – TWS (APS/UP)
←

↑ Zoom In Slow
→ Gun Firing Trigger – UNFOLDED (RCTRL+SPACE)
↓ Zoom Out Slow
← Gun Firing Safety – OUT (LCTRL+LWIN+SPACE)

+ TOE BRAKES (MAPPED ON PEDALS)

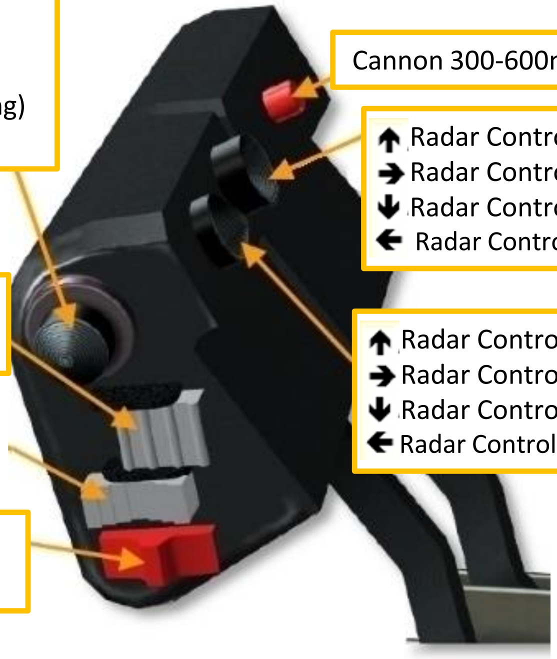
WHAT YOU NEED MAPPED

← Slat/Flap Lever – One Step DOWN (LSHIFT+F)
→ Slat/Flap Lever – One Step UP (LCTRL+F)

↑
→
↓
← PTT (Push-to-Talk) Button (“\” binding)
P

Cannon 300-600m & Missile Lock/Unlock Button (RCTRL+C)

↑ Radar Control Stick – Range/Velocity Control Axis (Y)
→ Radar Control Stick – Bearing Control Axis (X)
↓ Radar Control Stick – Range/Velocity Control Axis (Y)
← Radar Control Stick – Bearing Control Axis (X)



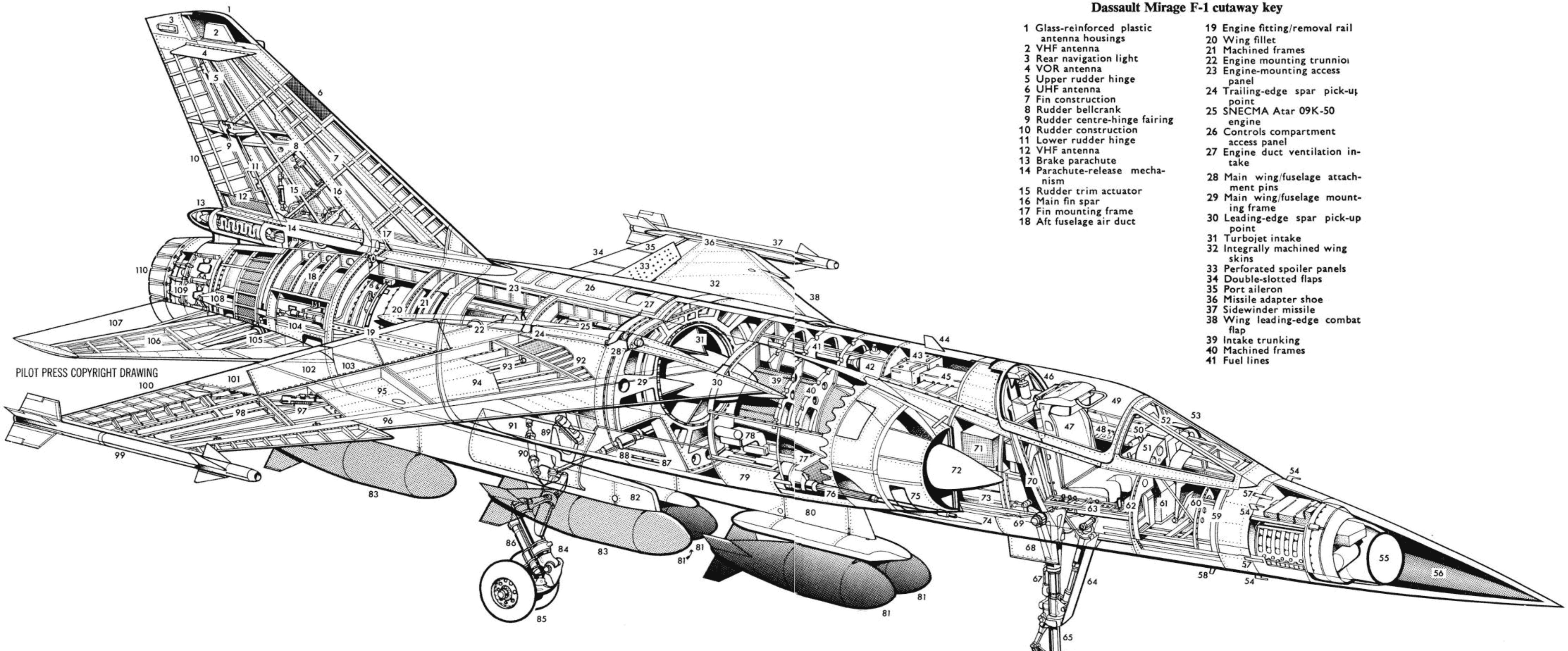
← Airbrake OFF (LCTRL+B)
→ Airbrake ON (LSHIFT+B)

↑ Radar Control Stick Elevation (Antenna) Increase
→ Radar Control Stick Gain Control Wheel Increase
↓ Radar Control Stick Elevation (Antenna) Decrease
← Radar Control Stick Gain Control Wheel Decrease

← Combat Flap Button (V)
→ Combat Flap Lever (LCTRL+V)

Landing Gear UP/DOWN (G)


CHAFF
FLARE
RETARD OVER.RUN
TEST
LIM
LARG. EXT.
DETRESSE
LARGAGE
TUYERE
OUVERTURE
VERROUILLAGE VERRIERE



Dassault Mirage F-1 cutaway key

1 Glass-reinforced plastic antenna housings
2 VHF antenna
3 Rear navigation light
4 VOR antenna
5 Upper rudder hinge
6 UHF antenna
7 Fin construction
8 Rudder bellcrank
9 Rudder centre-hinge fairing
10 Rudder construction
11 Lower rudder hinge
12 VHF antenna
13 Brake parachute
14 Parachute-release mechanism
15 Rudder trim actuator
16 Main fin spar
17 Fin mounting frame
18 Aft fuselage air duct
19 Engine fitting/removal rail
20 Wing fillet
21 Machined frames
22 Engine mounting trunnion
23 Engine-mounting access panel
24 Trailing-edge spar pick-up point
25 SNECMA Atar 09K-50 engine
26 Controls compartment access panel
27 Engine duct ventilation intake
28 Main wing/fuselage attachment pins
29 Main wing/fuselage mounting frame
30 Leading-edge spar pick-up point
31 Turbojet intake
32 Integrally machined wing skins
33 Perforated spoiler panels
34 Double-slotted flaps
35 Port aileron
36 Missile adapter shoe
37 Sidewinder missile
38 Wing leading-edge combat flap
39 Intake trunking
40 Machined frames
41 Fuel lines
42 Inverted-flight collector tank
43 UHF/VHF electronics compartment
44 IFF aerial
45 Amplifier
46 Canopy lift mechanism
47 Martin Baker Mk 4 ejection seat
48 Radar control console
49 Jettisonable canopy
50 Throttle
51 Instrument panel
52 Reflector sight and head-up display unit
53 Heated windscreen
54 Pitot heads
55 Cyrano IV fire-control radar
56 Glass-reinforced plastic radar nose-cone
57 Release catches
58 TACAN aerial
59 Forward pressure bulkhead
60 Rudder pedals
61 Radar console
62 Missile guidance joystick
63 Starboard control console
64 Nosewheel retraction jack and door
65 Shock absorber
66 Steerable nosewheel assembly
67 Nosewheel leg
68 Nosewheel door
69 Aileron spring rod
70 Aft pressure bulkhead
71 Air-data computer
72 Air intake centre-body half-cone
73 Batteries
74 Gun trough
75 Auxiliary intake
76 DEFA 553 30-mm cannon
77 Forward fuselage integral fuel tank
78 Cannon shell magazine
79 Starboard airbrake
80 Ventral stores pylon (Alkan)
81 Two pairs of 882 lb (400 kg) bombs (typical close support mission)
82 Starboard inner store pylon
83 Two 882 lb (400 kg) bombs in tandem (typical)
84 Messier main landing gear
85 Twin mainwheels
86 Mainwheel shock absorbers
87 Mainwheel well
88 Hydraulic down-lock strut
89 Undercarriage trunnion
90 Mainwheel retraction jack
91 Mainwheel leg door
92 Main wing attachment fitting
93 Control rod conduits
94 Wing integral fuel tanks
95 Wing skinning
96 Wing leading-edge structure
97 Aileron servo control unit
98 Wing outer construction
99 Sidewinder missile
100 Aileron construction
101 Double-slotted flaps
102 Spoilers
103 Aft fuselage integral fuel tank
104 Elevator servo control unit and linkage
105 Tailplane mounting trunnion
106 Tailplane machined ribs
107 Honeycomb construction trailing-edge
108 Jet pipe mounting link
109 Pneumatic nozzle actuators
110 Exhaust nozzle

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

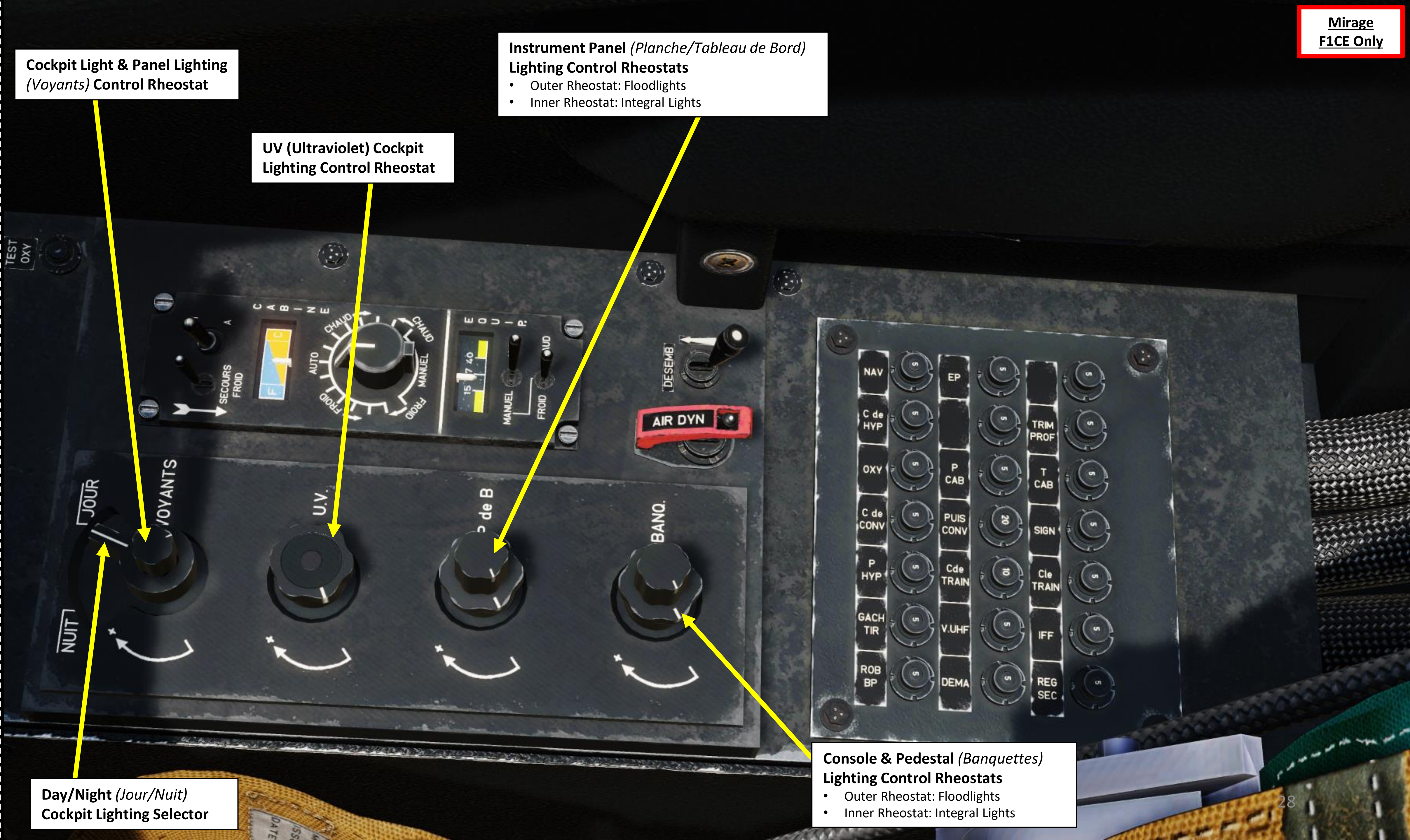
Mirage F1CE Only

Mirage F1CE Only

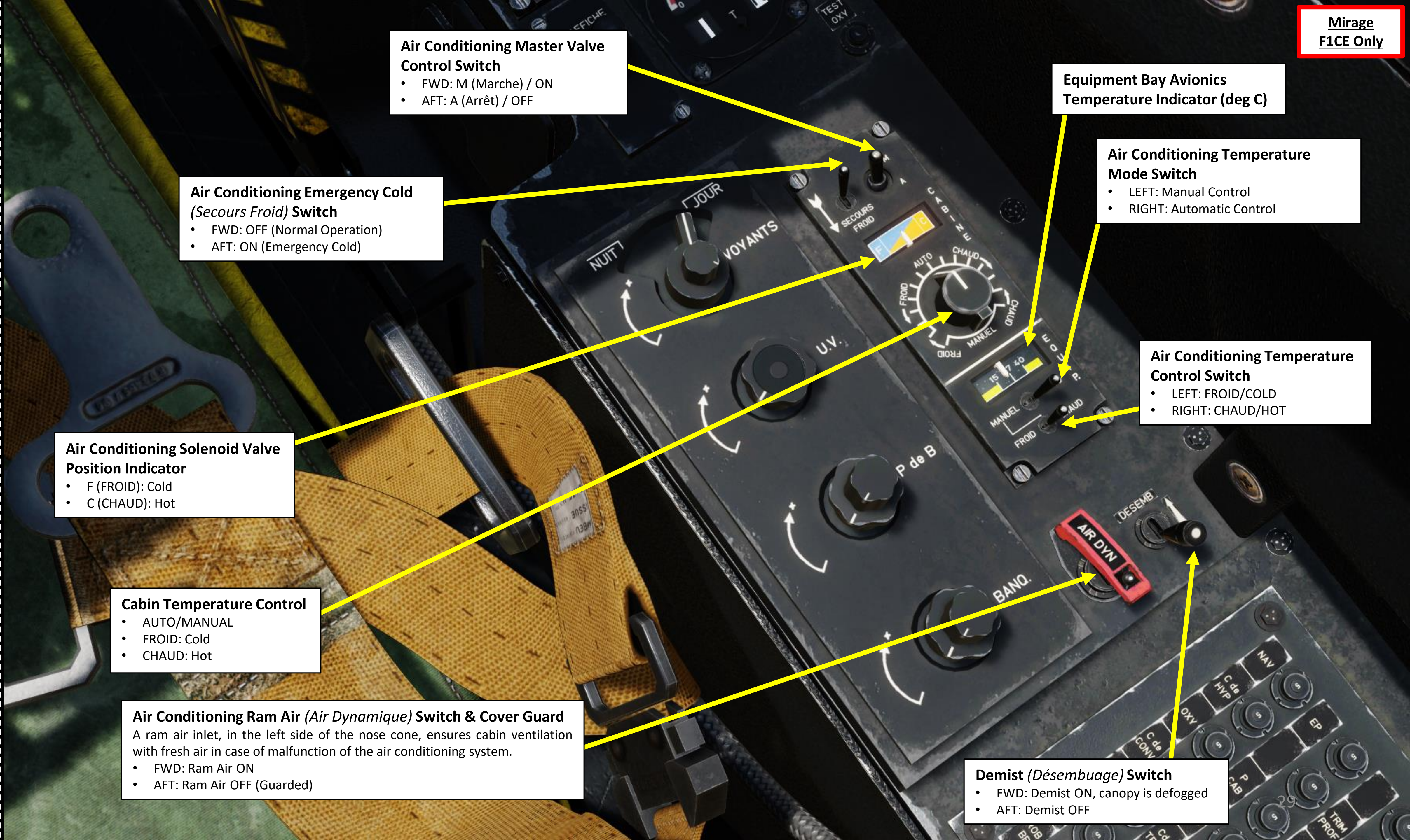
Circuit Breaker *(Disjoncteurs)* Panel

- **NAV: Gyro Control Unit Power Supply**
- **C de HYP** *(Commande des Volets Hypersustentateurs)*: **High-Lift Devices (wing slats/flaps, combat flaps) Servo Unit Power Supply**
- **OXY : Oxygen indicator and failure detector power supply**
- **C de CONV** *(Commande de Convertisseur)*: **Inverter Transfer Unit power supply and control**
- **P HYP** *(Pression hydraulique des Volets Hypersustentateurs)*: **Dual hydraulic pressure gauge power supply**
- **GACH TIR** *(Gachette de Tir)*: **Gun firing trigger power supply**
- **ROB BP** *(Robinet Basse Pression)*: **LP (Low-Pressure) fuel cock power supply**
- **EP** *(Électro-Pompe)*: **Backup Hydraulic Electro-Pump relay power supply**
- **REMP VOL** *(Remplissage/Ravitaillement en Vol)* **(Circuit breaker not labelled, Not Functional for Mirage F1CE): Flight refueling system power supply**
- **P CAB** *(Pressurisation de Cabine)*: **Cabin Pressurization system power supply**
- **PUIS CONV** *(Puissance Convertisseur)*: **Inverter 28 V power supply**
- **C de TRAIN** *(Commande de Train d'Atterrissage)*: **Landing Gear normal operation power supply**
- **V/UHF: V/UHF radio power supply**
- **DEMA** *(Démarrage)*: **Starter and sequencing system power supply**
- **Refueling Probe Control Power Supply (Circuit breaker not labelled, Not Functional for Mirage F1CE)**
- **TRIM PROF** *(Trim de Profondeur)*: **Manual trim control power supply**
- **T CAB** *(Température de Cabine)*: **Valve position repeater, control valve and ground mode power supply**
- **SIGN: Failure warning panel and master failure warning light power supply**
- **Cle TRAIN** *(Contrôle de Train d'Atterrissage)*: **Configuration indicator (landing gear section) and landing gear warning light power supply**
- **IFF: Identify-Friend-or-Foe System power supply**
- **REG SEC** *(Régulateur de Secours)*: **Emergency fuel regulation system and control lever power supply**

Mirage F1CE Only



Mirage F1CE Only



Air Conditioning Master Valve Control Switch
- FWD: M (Marche) / ON
- AFT: A (Arrêt) / OFF

Air Conditioning Emergency Cold *(Secours Froid)* Switch
- FWD: OFF (Normal Operation)
- AFT: ON (Emergency Cold)

Equipment Bay Avionics Temperature Indicator (deg C)

Air Conditioning Temperature Mode Switch
- LEFT: Manual Control
- RIGHT: Automatic Control

Air Conditioning Temperature Control Switch
- LEFT: FROID/COLD
- RIGHT: CHAUD/HOT

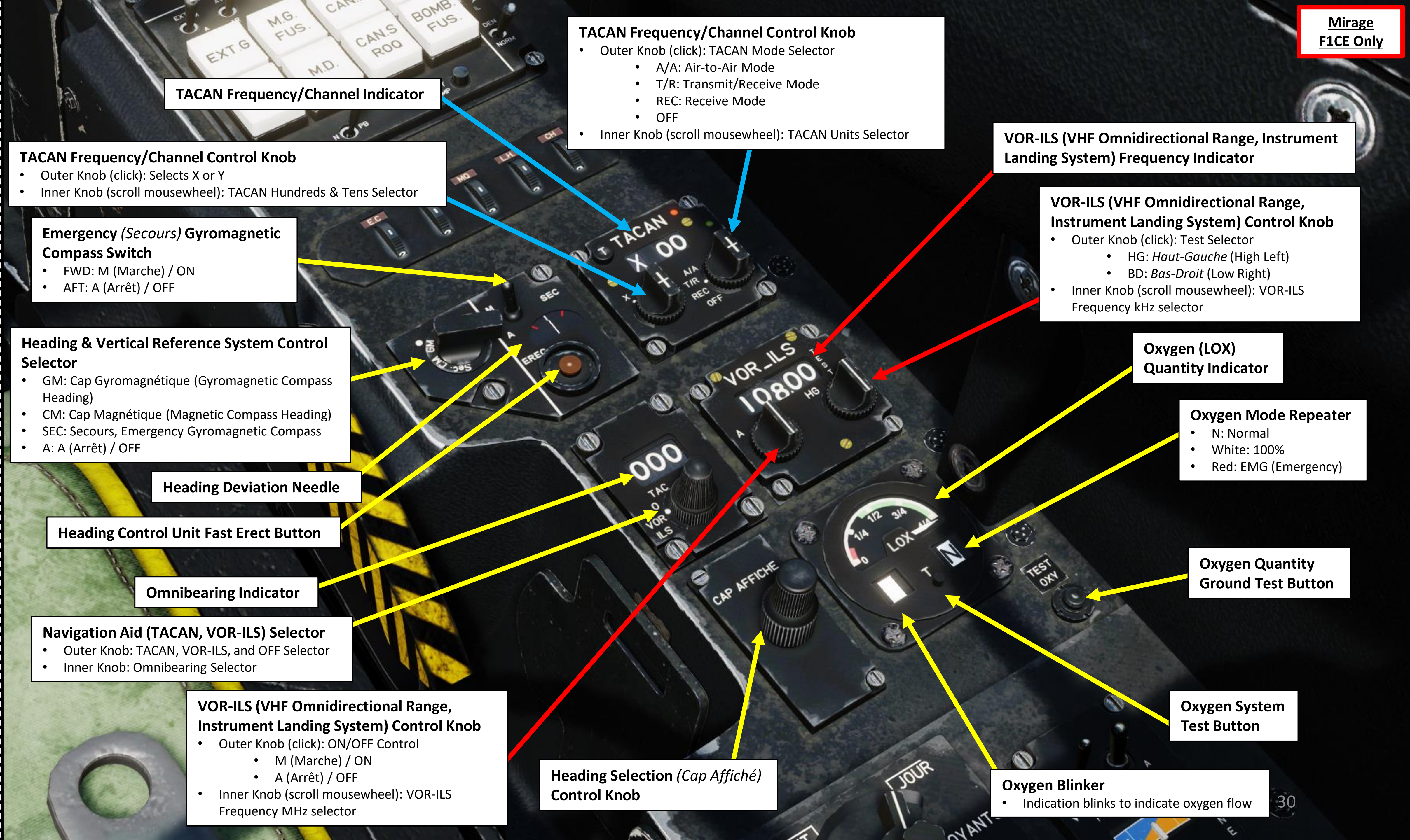
Air Conditioning Solenoid Valve Position Indicator
- F (FROID): Cold
- C (CHAUD): Hot

Cabin Temperature Control
- AUTO/MANUAL
- FROID: Cold
- CHAUD: Hot

Air Conditioning Ram Air *(Air Dynamique)* Switch & Cover Guard

A ram air inlet, in the left side of the nose cone, ensures cabin ventilation with fresh air in case of malfunction of the air conditioning system.
- FWD: Ram Air ON
- AFT: Ram Air OFF (Guarded)

Demist *(Désembuage)* Switch
- FWD: Demist ON, canopy is defogged
- AFT: Demist OFF


Mirage F1CE Only
TACAN Frequency/Channel Indicator
TACAN Frequency/Channel Control Knob
• Outer Knob (click): TACAN Mode Selector
• A/A: Air-to-Air Mode
• T/R: Transmit/Receive Mode
• REC: Receive Mode
• OFF
• Inner Knob (scroll mousewheel): TACAN Units Selector
TACAN Frequency/Channel Control Knob
• Outer Knob (click): Selects X or Y
• Inner Knob (scroll mousewheel): TACAN Hundreds & Tens Selector
Emergency *(Secours)* Gyromagnetic Compass Switch
• FWD: M (Marche) / ON
• AFT: A (Arrêt) / OFF
Heading & Vertical Reference System Control Selector
• GM: Cap Gyromagnétique (Gyromagnetic Compass Heading)
• CM: Cap Magnétique (Magnetic Compass Heading)
• SEC: Secours, Emergency Gyromagnetic Compass
• A: A (Arrêt) / OFF
Heading Deviation Needle
Heading Control Unit Fast Erect Button
Omnibearing Indicator
Navigation Aid (TACAN, VOR-ILS) Selector
• Outer Knob: TACAN, VOR-ILS, and OFF Selector
• Inner Knob: Omnibearing Selector
VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Control Knob
• Outer Knob (click): ON/OFF Control
• M (Marche) / ON
• A (Arrêt) / OFF
• Inner Knob (scroll mousewheel): VOR-ILS Frequency MHz selector
Heading Selection *(Cap Affiché)* Control Knob
VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Frequency Indicator
VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Control Knob
• Outer Knob (click): Test Selector
• HG: *Haut-Gauche* (High Left)
• BD: *Bas-Droit* (Low Right)
• Inner Knob (scroll mousewheel): VOR-ILS Frequency kHz selector
Oxygen (LOX) Quantity Indicator
Oxygen Mode Repeater
• N: Normal
• White: 100%
• Red: EMG (Emergency)
Oxygen Quantity Ground Test Button
Oxygen System Test Button
Oxygen Blinker
• Indication blinks to indicate oxygen flow

Mirage F1CE Only

Seat Adjustment Control Switch

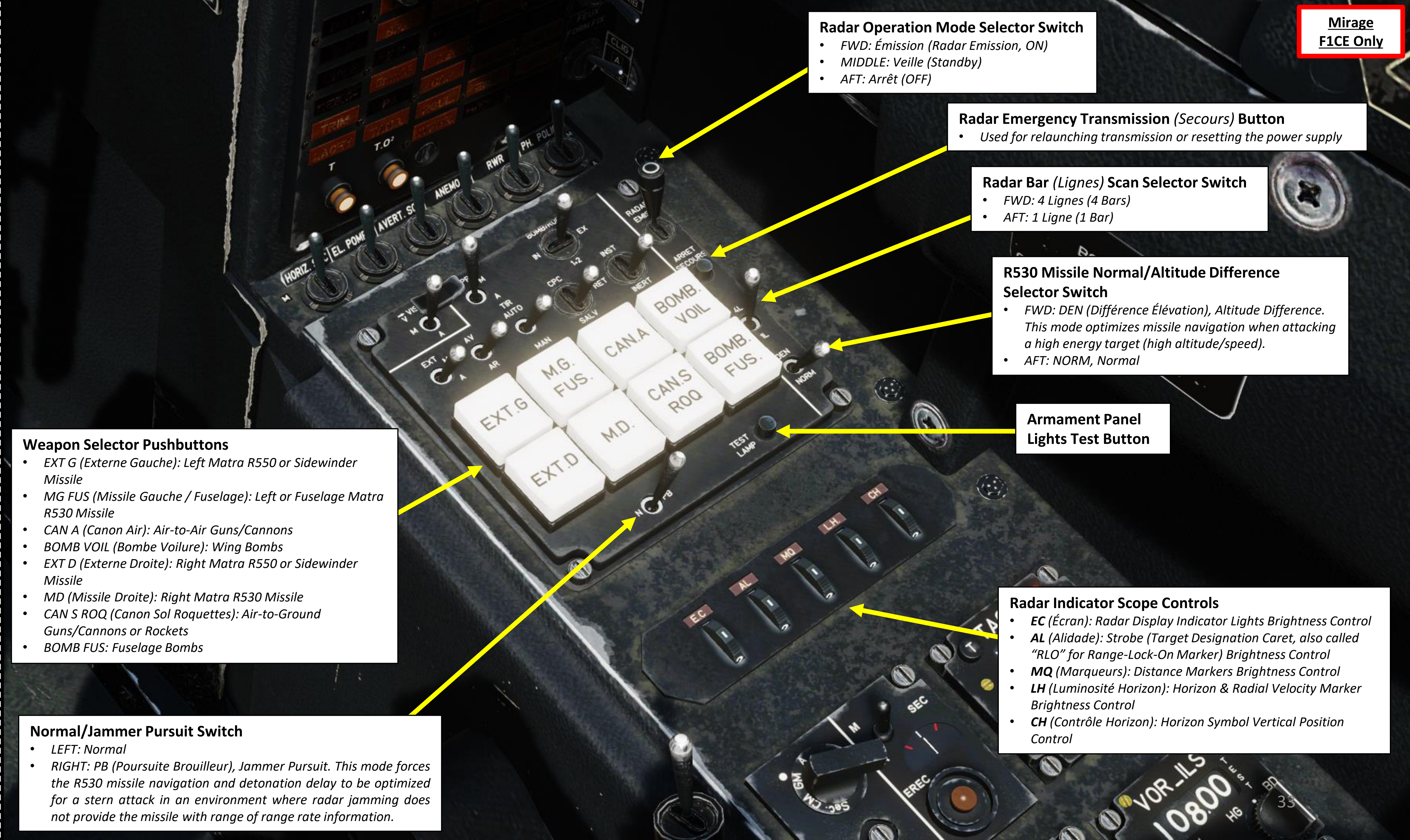
- *FWD: Seat DOWN*
- *AFT: Seat UP*

Mirage F1CE Only

Canopy Seal Valve ***(Commande Boudin)*** **Control Lever**

- *FWD: Inflated (Gonflage)*
- *AFT: Deflated (Dégonflage)*

Mirage F1CE Only



Radar Operation Mode Selector Switch
- *FWD: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *AFT: Arrêt (OFF)*

Radar Emergency Transmission *(Secours)* Button
- *Used for relaunching transmission or resetting the power supply*

Radar Bar *(Lignes)* Scan Selector Switch
- *FWD: 4 Lignes (4 Bars)*
- *AFT: 1 Ligne (1 Bar)*

R530 Missile Normal/Altitude Difference Selector Switch
- *FWD: DEN (Différence Élévation), Altitude Difference. This mode optimizes missile navigation when attacking a high energy target (high altitude/speed).*
- *AFT: NORM, Normal*

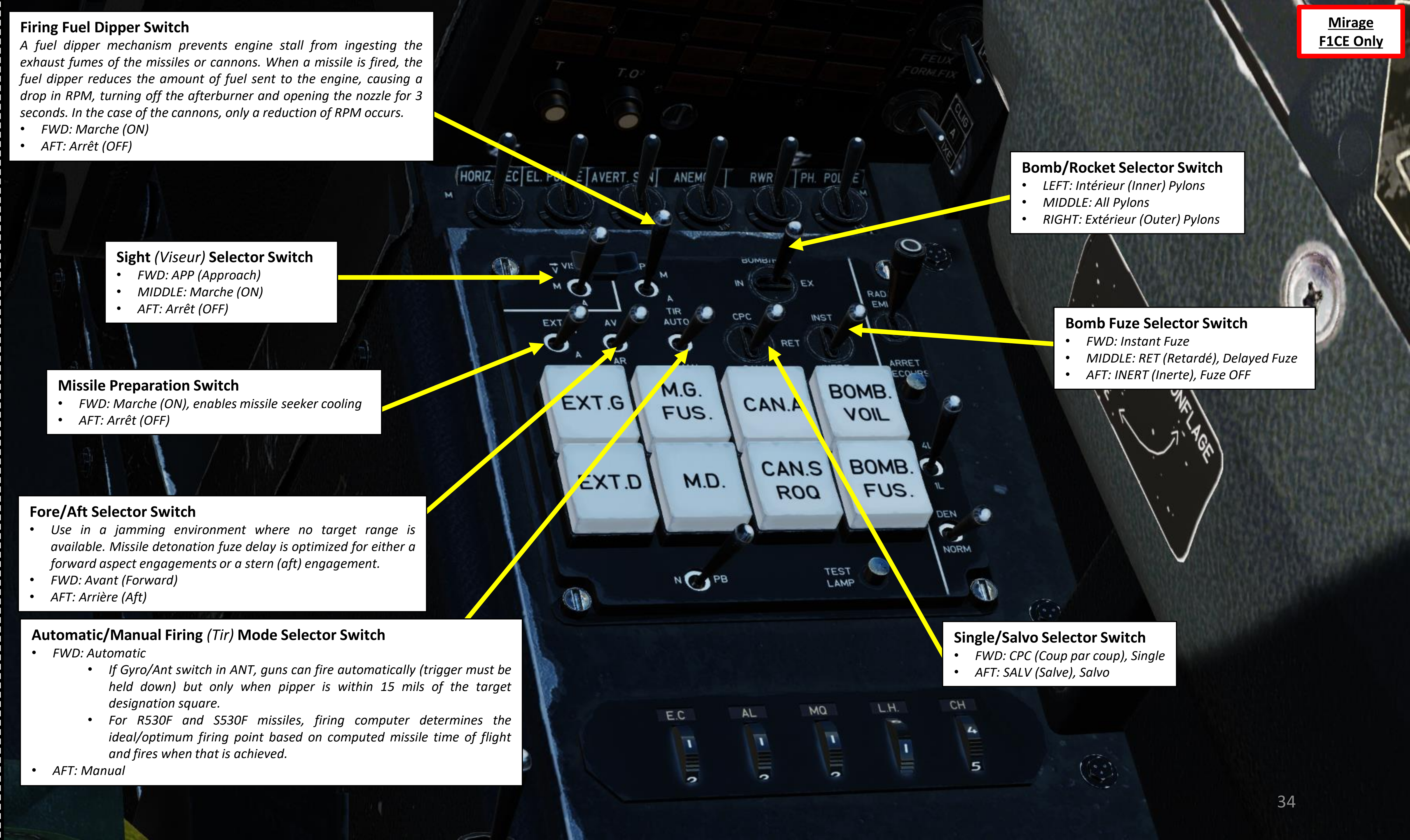
Armament Panel Lights Test Button

Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

Radar Indicator Scope Controls
- ***EC** (Écran): Radar Display Indicator Lights Brightness Control*
- ***AL** (Alidade): Strobe (Target Designation Caret, also called "RLO" for Range-Lock-On Marker) Brightness Control*
- ***MQ** (Marqueurs): Distance Markers Brightness Control*
- ***LH** (Luminosité Horizon): Horizon & Radial Velocity Marker Brightness Control*
- ***CH** (Contrôle Horizon): Horizon Symbol Vertical Position Control*

Normal/Jammer Pursuit Switch
- *LEFT: Normal*
- *RIGHT: PB (Poursuite Brouilleur), Jammer Pursuit. This mode forces the R530 missile navigation and detonation delay to be optimized for a stern attack in an environment where radar jamming does not provide the missile with range of range rate information.*

Mirage F1CE Only



Firing Fuel Dipper Switch

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.

- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Sight *(Viseur)* Selector Switch

- *FWD: APP (Approach)*
- *MIDDLE: Marche (ON)*
- *AFT: Arrêt (OFF)*

Missile Preparation Switch

- *FWD: Marche (ON), enables missile seeker cooling*
- *AFT: Arrêt (OFF)*

Fore/Aft Selector Switch

- *Use in a jamming environment where no target range is available. Missile detonation fuze delay is optimized for either a forward aspect engagements or a stern (aft) engagement.*
- *FWD: Avant (Forward)*
- *AFT: Arrière (Aft)*

Automatic/Manual Firing *(Tir)* Mode Selector Switch

- *FWD: Automatic*
  - *If Gyro/Ant switch in ANT, guns can fire automatically (trigger must be held down) but only when pipper is within 15 mils of the target designation square.*
  - *For R530F and S530F missiles, firing computer determines the ideal/optimum firing point based on computed missile time of flight and fires when that is achieved.*
- *AFT: Manual*

Bomb/Rocket Selector Switch

- *LEFT: Intérieur (Inner) Pylons*
- *MIDDLE: All Pylons*
- *RIGHT: Extérieur (Outer) Pylons*

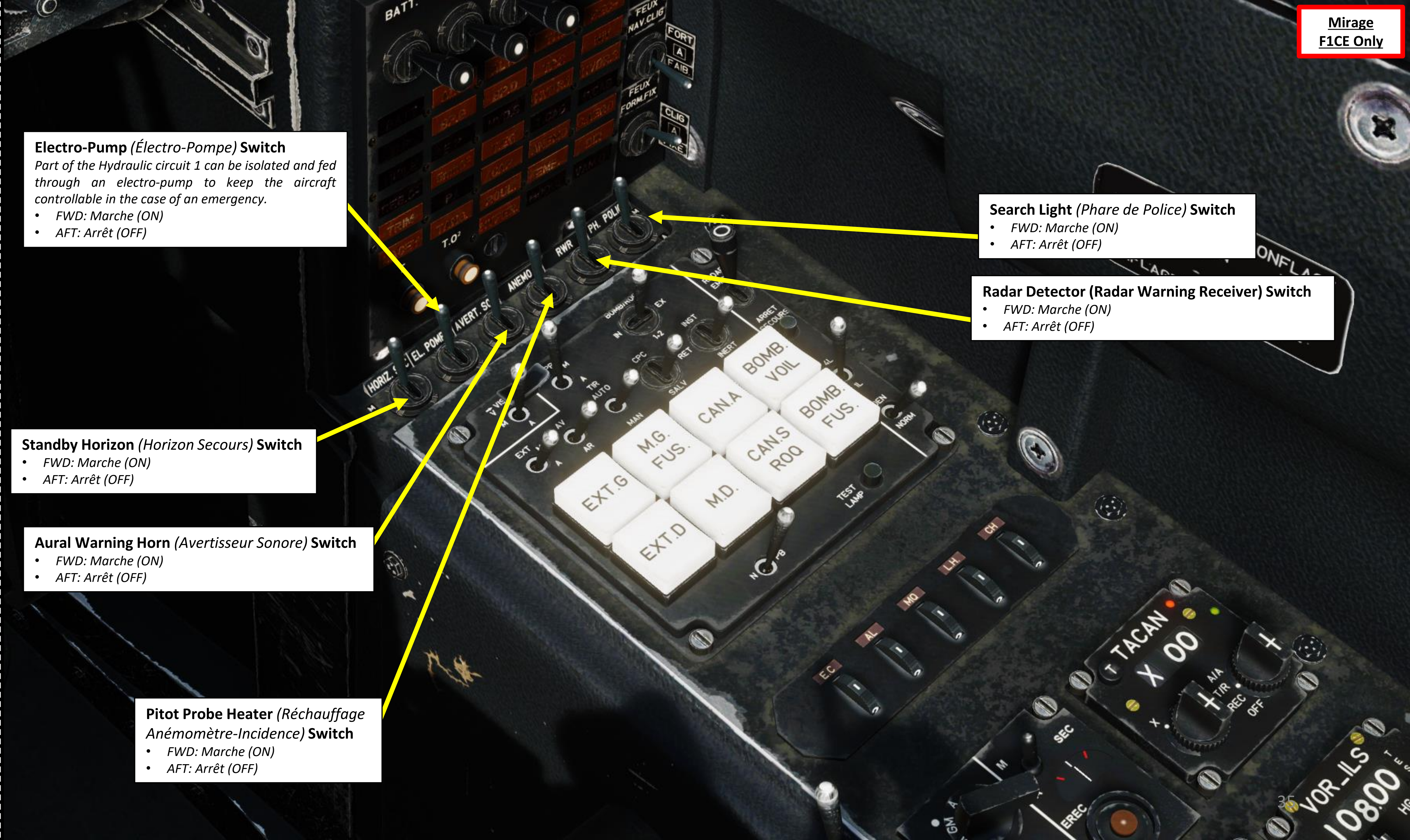
Bomb Fuze Selector Switch

- *FWD: Instant Fuze*
- *MIDDLE: RET (Retardé), Delayed Fuze*
- *AFT: INERT (Inerte), Fuze OFF*

Single/Salvo Selector Switch

- *FWD: CPC (Coup par coup), Single*
- *AFT: SALV (Salve), Salvo*

Mirage F1CE Only



Electro-Pump *(Électro-Pompe)* **Switch**
Part of the Hydraulic circuit 1 can be isolated and fed through an electro-pump to keep the aircraft controllable in the case of an emergency.
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Search Light *(Phare de Police)* **Switch**
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

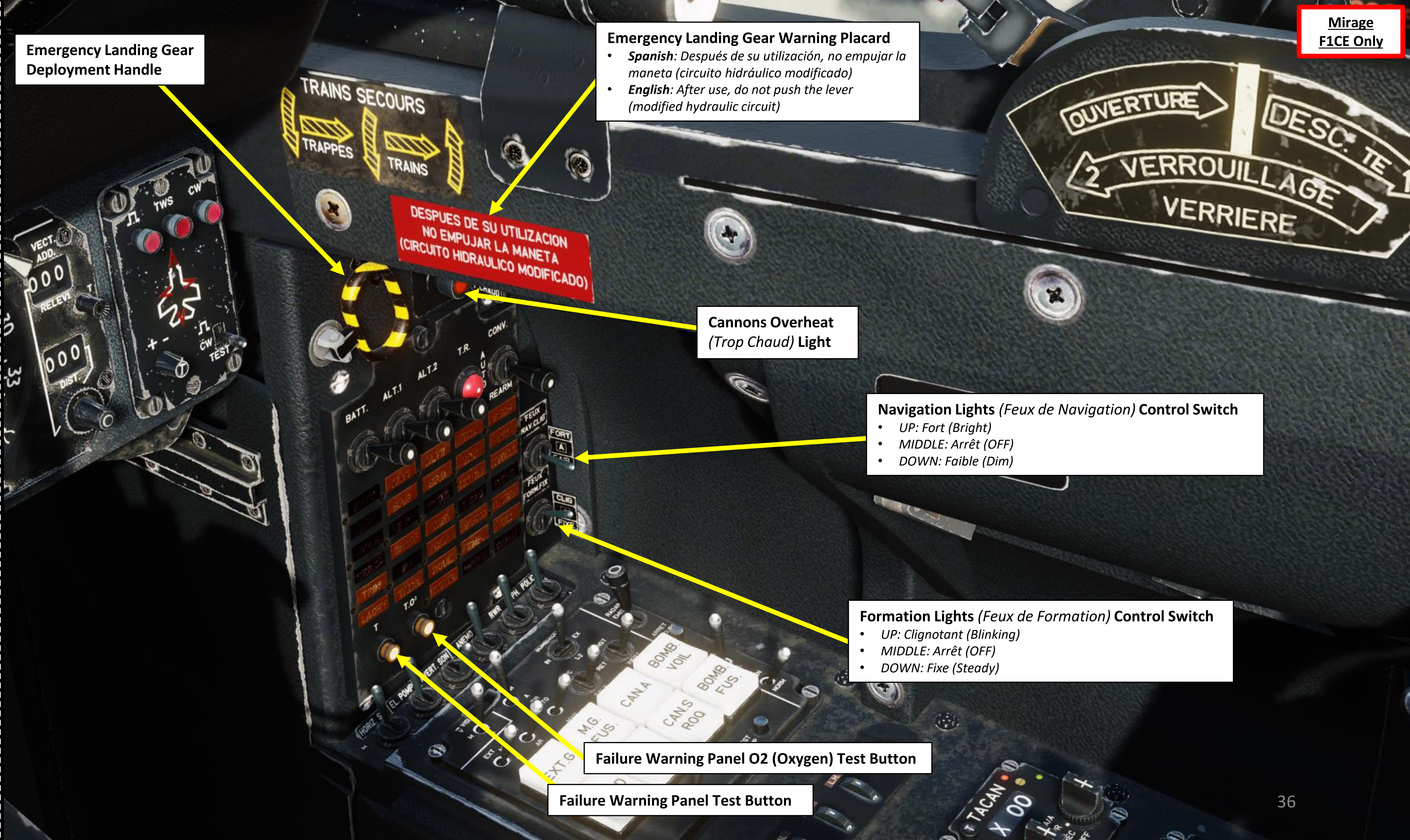
Radar Detector (Radar Warning Receiver) Switch
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Standby Horizon *(Horizon Secours)* **Switch**
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Aural Warning Horn *(Avertisseur Sonore)* **Switch**
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Pitot Probe Heater *(Réchauffage Anémomètre-Incidence)* **Switch**
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Mirage F1CE Only



Emergency Landing Gear Deployment Handle

Emergency Landing Gear Warning Placard
- ***Spanish***: *Después de su utilización, no empujar la maneta (circuito hidráulico modificado)*
- ***English***: *After use, do not push the lever (modified hydraulic circuit)*

Cannons Overheat *(Trop Chaud)* **Light**

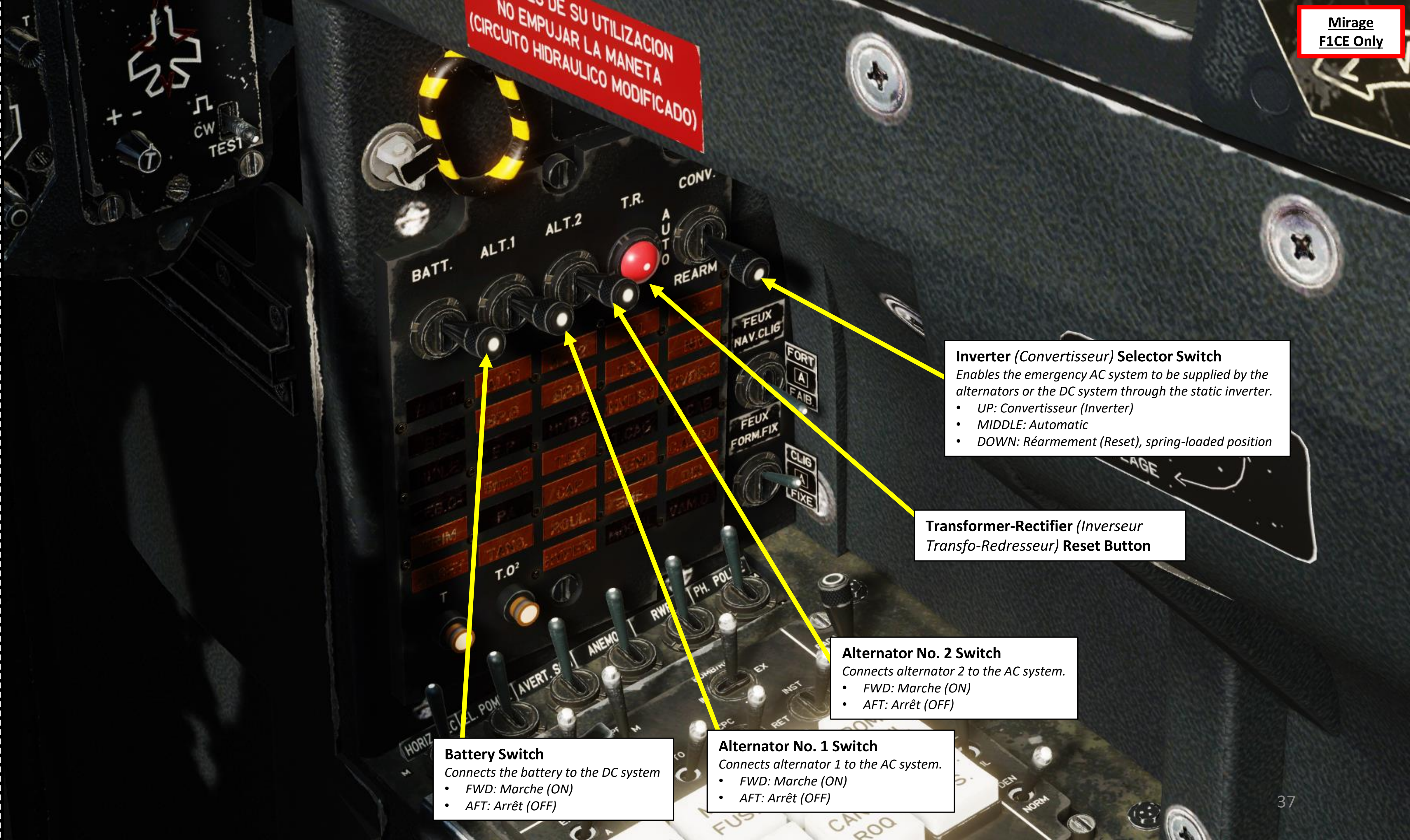
Navigation Lights *(Feux de Navigation)* **Control Switch**
- *UP: Fort (Bright)*
- *MIDDLE: Arrêt (OFF)*
- *DOWN: Faible (Dim)*

Formation Lights *(Feux de Formation)* **Control Switch**
- *UP: Clignotant (Blinking)*
- *MIDDLE: Arrêt (OFF)*
- *DOWN: Fixe (Steady)*

Failure Warning Panel O2 (Oxygen) Test Button

Failure Warning Panel Test Button

Mirage F1CE Only



Inverter *(Convertisseur)* **Selector Switch**

Enables the emergency AC system to be supplied by the alternators or the DC system through the static inverter.

- *UP: Convertisseur (Inverter)*
- *MIDDLE: Automatic*
- *DOWN: Réarmement (Reset), spring-loaded position*

Transformer-Rectifier *(Inverseur Transfo-Redresseur)* **Reset Button**

Alternator No. 2 Switch

Connects alternator 2 to the AC system.

- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Alternator No. 1 Switch

Connects alternator 1 to the AC system.

- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Battery Switch

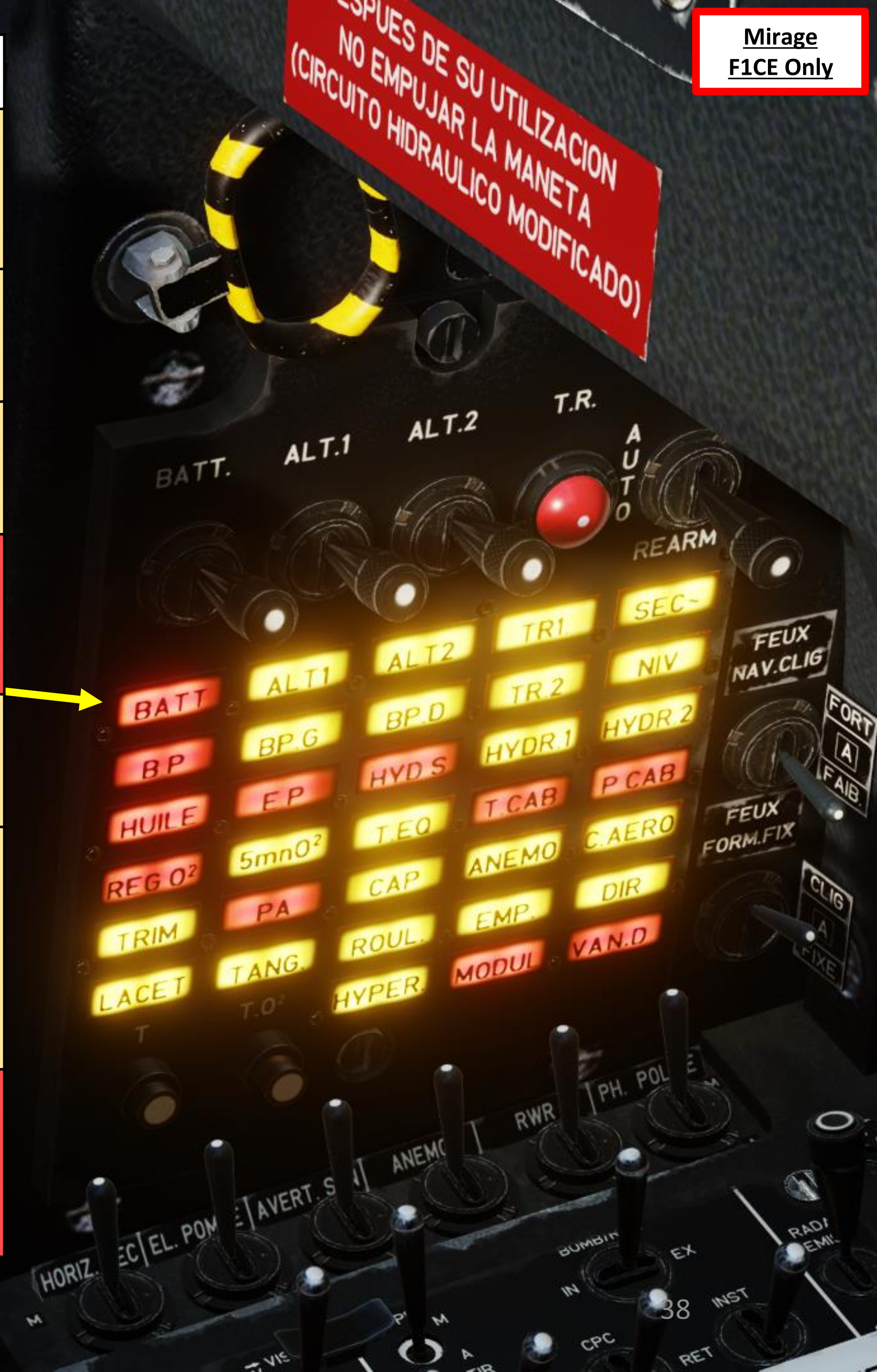
Connects the battery to the DC system

- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Failure Warning Panel

BATT Battery is isolated or failed	**ALT1** Alternator 1 is disconnected or failed	**ALT2** Alternator 2 is disconnected or failed	**TR1** Transformer-Rectifier 1 is not supplying DC system	**SEC~** Emergency *(Secours)* AC Busses are supplied by inverter instead of alternators
BP Engine Fuel Low Pressure *(Basse Pression)*	**BP G** Left (*Gauche*) Fuel Pump Low Pressure *(Basse Pression)*	**BP D** Right (*Droite*) Fuel Pump Low Pressure *(Basse Pression)*	**TR2** Transformer-Rectifier 2 is not supplying DC system	**NIV** Fuel level in feeder tanks is below 250 liters
HUILE Oil pressure pump low (below 0.75 bar or 11 psi)	**EP** Electric Hydraulic Pump (*Électro-Pompe*) operating for more than 8 sec	**HYD S** Emergency Hydraulic System pressure is below 115 bar (1668 psi)	**HYDR 1** Hydraulic System 1 Low Pressure	**HYDR 2** Hydraulic System 2 Low Pressure
REG O2 Oxygen regulator failure	**5mn O2** Emergency Oxygen cock not open, emergency system has 5 minutes remaining	**T EQ** Air temperature flowing into equipment bay is below 5 deg C or above 50 deg C	**T CAB** Duct sensor temperature is above 60°C and cabin air temperature is above 32°C	**P CAB** Cabin pressure altitude is above 30000 ft. Canopy control not in correct position.
TRIM Automatic pitch or roll trim failure. Autopilot or trim function not affected.	**PA** *Pilote Automatique* (Autopilot) disengaged or autopilot failure.	**CAP** Failure in the heading (*cap*) chain or in the magnetic surveillance box.	**ANEMO** Left/Right Pitot Probe or static pressure probe failure.	**C AERO** ADC (Air Data Computer) failure.
LACET Failure of both electrical rudder circuits (*lacet* = yaw). Yaw damper not operational.	**TANG** Failure of both electrical pitch circuits (*tangage* = pitch). Pitch damper not operational.	**ROUL** Failure of the roll (*roulis*) damper (Only used by the autopilot). Autopilot cannot be operated.	**EMP** First electrical pitch circuit failure for the empennage. Elevator pitch control operation in electrical mode on the second circuit.	**DIR** Failure of the first electrical rudder (*gouverne de direction*) circuit. Rudder control operation in electrical mode on the second circuit.
		HYPER Disagreement between High-Lift Devices (slats/flaps) positions or combat flaps commanded outside permitted speeds.	**MODUL** Excessive modulations of the vario-alternator driving torque.	**VAN.D** Electronics box signal and bleed discharge valves (*vannes de décharge*) position disagreement.

Mirage F1CE Only




Mirage F1CE Only
Canopy (*Verrière*) Locking Lever
Canopy Handle
→ *OUVERTURE* (OPEN) | *DESCENTE* (DOWN)
← *VERROUILLAGE VERRIÈRE* (LOCK CANOPY)

Mirage F1CE Only

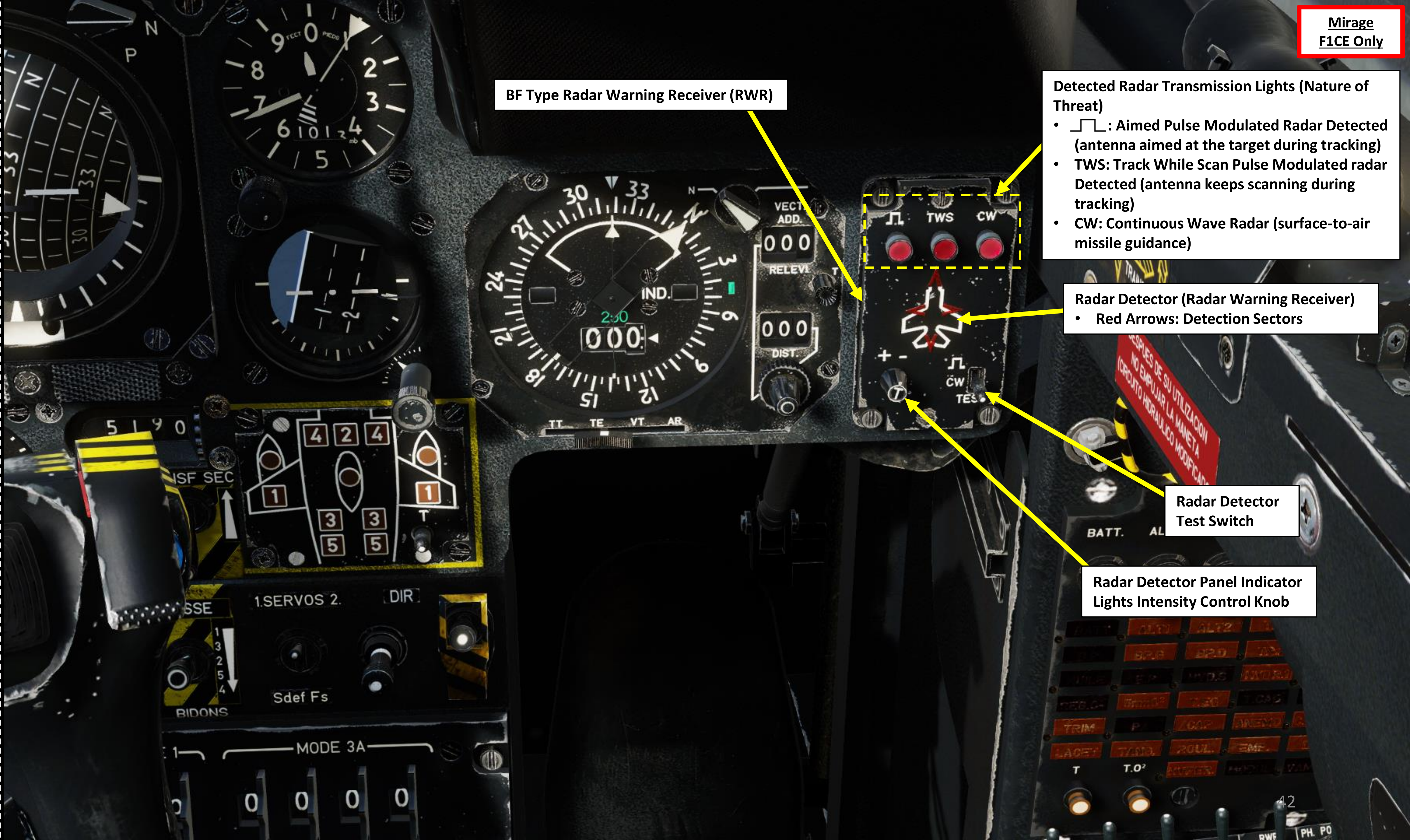
Dinghy Puncher *(Crève-Dinghy)*

- *Tool that allows the pilot to puncture the ejection seat's dinghy if it were to inflate in-flight.*

Mirage F1CE Only


Rudder Pedals & Toe Brakes

Mirage F1CE Only



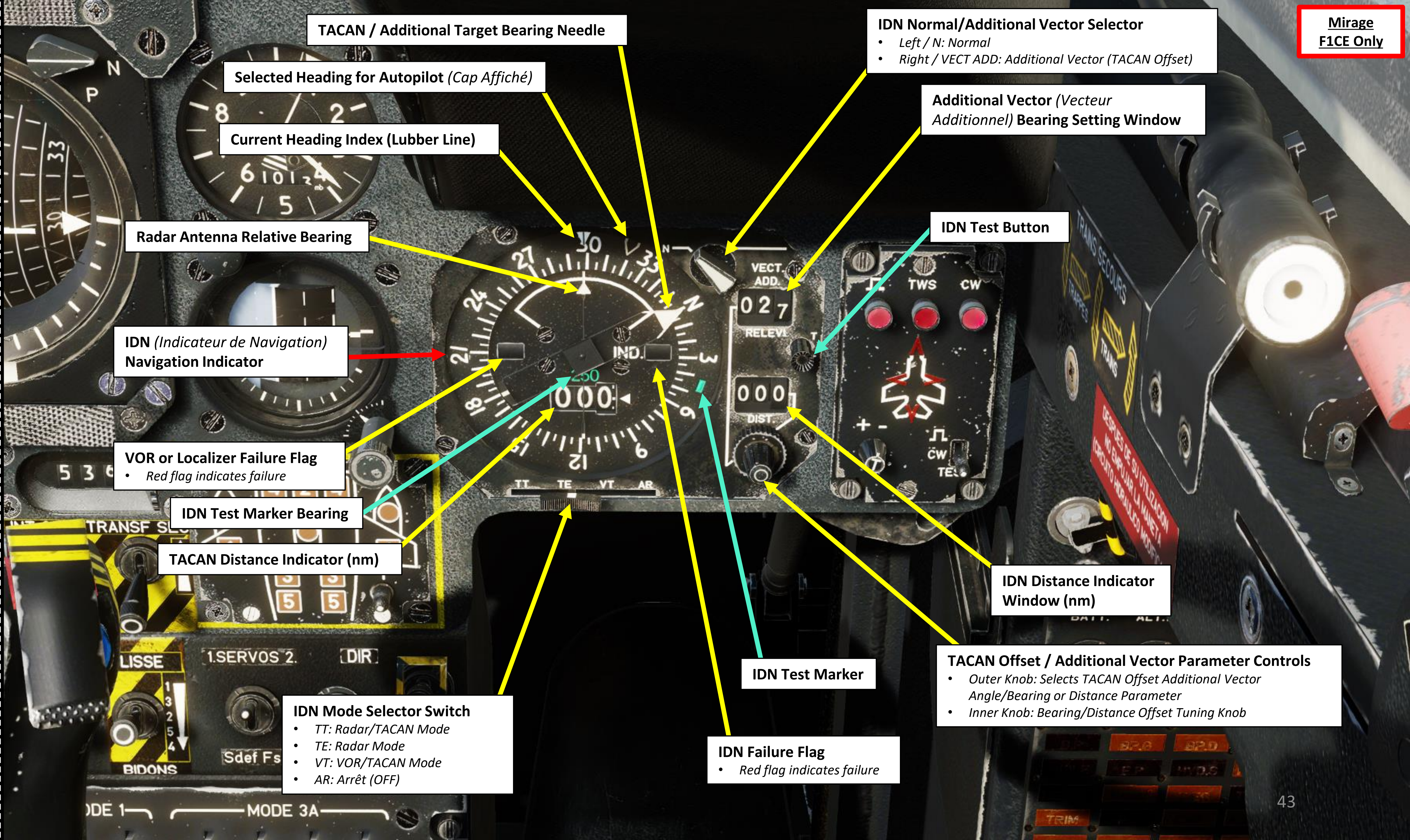
BF Type Radar Warning Receiver (RWR)

Detected Radar Transmission Lights (Nature of Threat)
- ⎍ : Aimed Pulse Modulated Radar Detected (antenna aimed at the target during tracking)
- TWS: Track While Scan Pulse Modulated radar Detected (antenna keeps scanning during tracking)
- CW: Continuous Wave Radar (surface-to-air missile guidance)

Radar Detector (Radar Warning Receiver)
- Red Arrows: Detection Sectors

Radar Detector Test Switch

Radar Detector Panel Indicator Lights Intensity Control Knob


Mirage F1CE Only
TACAN / Additional Target Bearing Needle
Selected Heading for Autopilot (Cap Affiché)
Current Heading Index (Lubber Line)
Radar Antenna Relative Bearing
IDN (Indicateur de Navigation) Navigation Indicator
VOR or Localizer Failure Flag
• Red flag indicates failure
IDN Test Marker Bearing
TACAN Distance Indicator (nm)
IDN Mode Selector Switch
• TT: Radar/TACAN Mode
• TE: Radar Mode
• VT: VOR/TACAN Mode
• AR: Arrêt (OFF)
IDN Normal/Additional Vector Selector
• Left / N: Normal
• Right / VECT ADD: Additional Vector (TACAN Offset)
Additional Vector (Vecteur Additionnel) Bearing Setting Window
IDN Test Button
IDN Distance Indicator Window (nm)
TACAN Offset / Additional Vector Parameter Controls
• Outer Knob: Selects TACAN Offset Additional Vector Angle/Bearing or Distance Parameter
• Inner Knob: Bearing/Distance Offset Tuning Knob
IDN Test Marker
IDN Failure Flag
• Red flag indicates failure

Mirage F1CE Only

Mirror

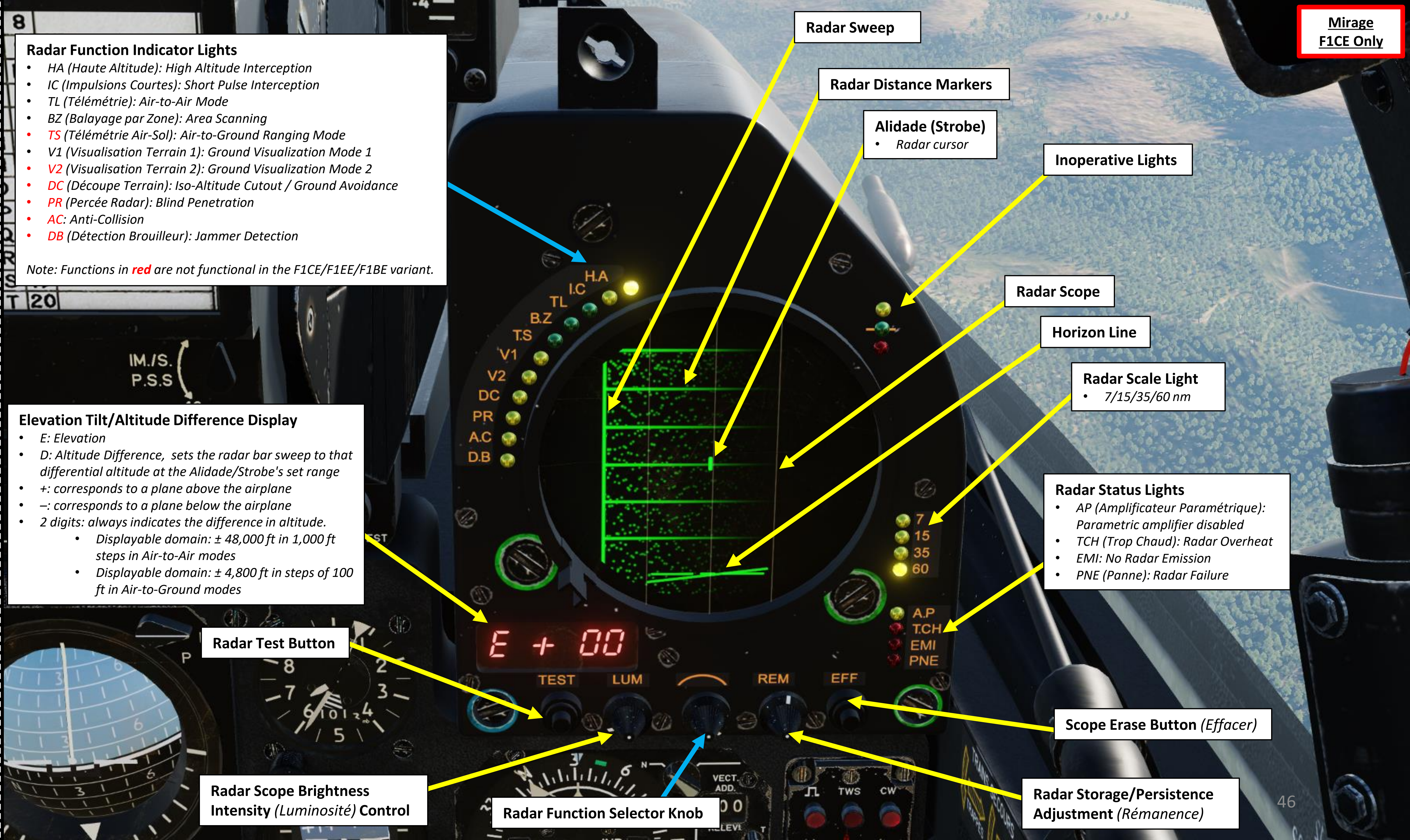
Radar Shroud Screw
- *Click on this screw to install or remove the radar shroud. The aircraft needs to be on the ground with the engine OFF.*
- *There is also a "Radar Cover Remove Toggle" binding that can be used for this function.*

Cyrano IV Radar Scope

Radar Shroud
- *Can be uninstalled via either the Mission Editor, the "Special Options" tab or by clicking on the Radar Shroud Screw.*
- *The shroud is used because the radar scope is a CRT (Cathode Ray Tube) unit, which becomes difficult to see when sun rays illuminate it at certain angles.*

Mirage F1CE Only

Mirage F1CE Only



Radar Function Indicator Lights

- *HA (Haute Altitude): High Altitude Interception*
- *IC (Impulsions Courtes): Short Pulse Interception*
- *TL (Télémétrie): Air-to-Air Mode*
- *BZ (Balayage par Zone): Area Scanning*
- *TS (Télémétrie Air-Sol): Air-to-Ground Ranging Mode*
- *V1 (Visualisation Terrain 1): Ground Visualization Mode 1*
- *V2 (Visualisation Terrain 2): Ground Visualization Mode 2*
- *DC (Découpe Terrain): Iso-Altitude Cutout / Ground Avoidance*
- *PR (Percée Radar): Blind Penetration*
- *AC: Anti-Collision*
- *DB (Détection Brouilleur): Jammer Detection*

*Note: Functions in **red** are not functional in the F1CE/F1EE/F1BE variant.*

Radar Sweep

Radar Distance Markers

Alidade (Strobe)

- *Radar cursor*

Inoperative Lights

Radar Scope

Horizon Line

Radar Scale Light

- *7/15/35/60 nm*

Radar Status Lights

- *AP (Amplificateur Paramétrique): Parametric amplifier disabled*
- *TCH (Trop Chaud): Radar Overheat*
- *EMI: No Radar Emission*
- *PNE (Panne): Radar Failure*

Elevation Tilt/Altitude Difference Display

- *E: Elevation*
- *D: Altitude Difference, sets the radar bar sweep to that differential altitude at the Alidade/Strobe's set range*
- *+: corresponds to a plane above the airplane*
- *–: corresponds to a plane below the airplane*
- *2 digits: always indicates the difference in altitude.*
  - *Displayable domain: ± 48,000 ft in 1,000 ft steps in Air-to-Air modes*
  - *Displayable domain: ± 4,800 ft in steps of 100 ft in Air-to-Ground modes*

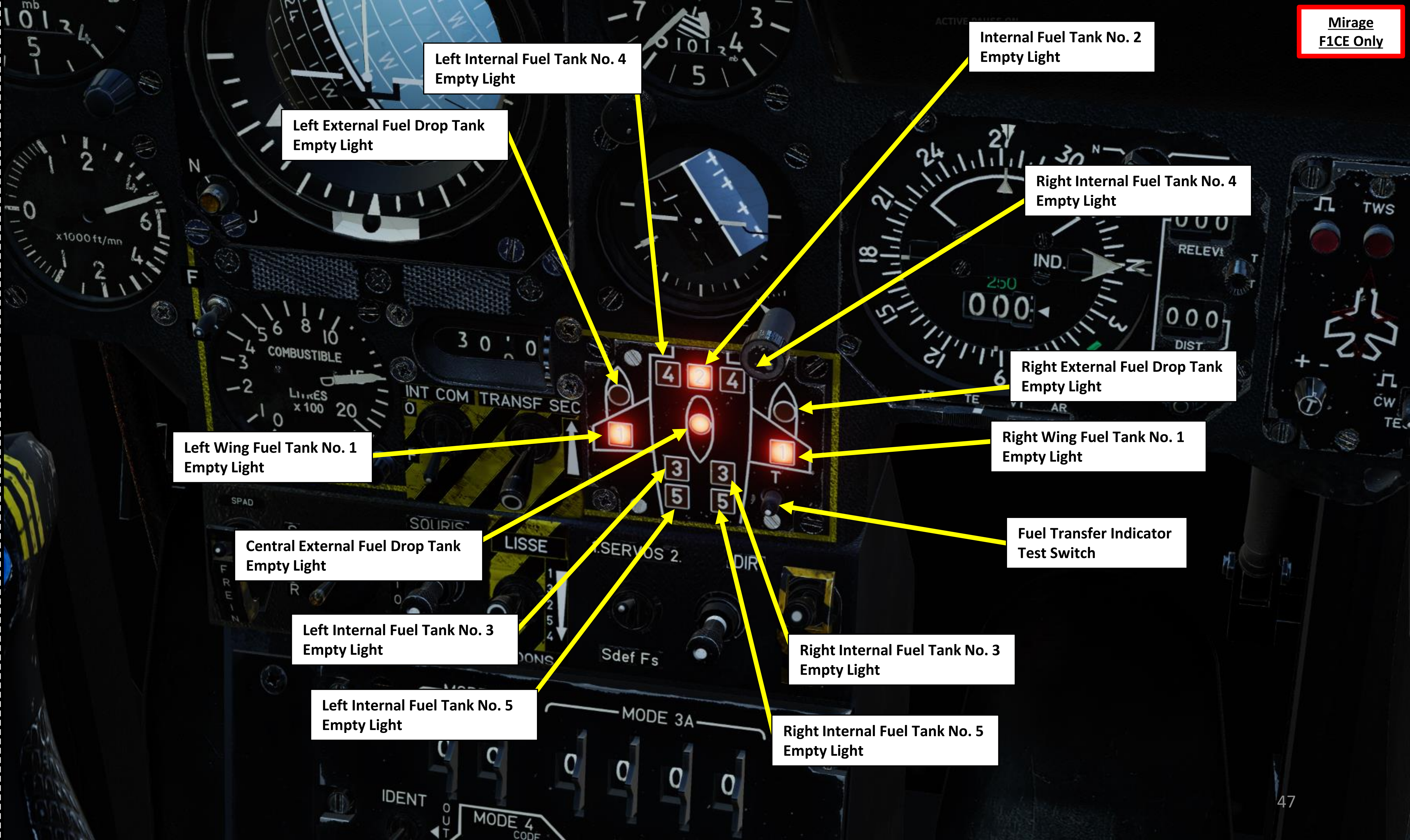
Radar Test Button

Radar Scope Brightness Intensity *(Luminosité)* **Control**

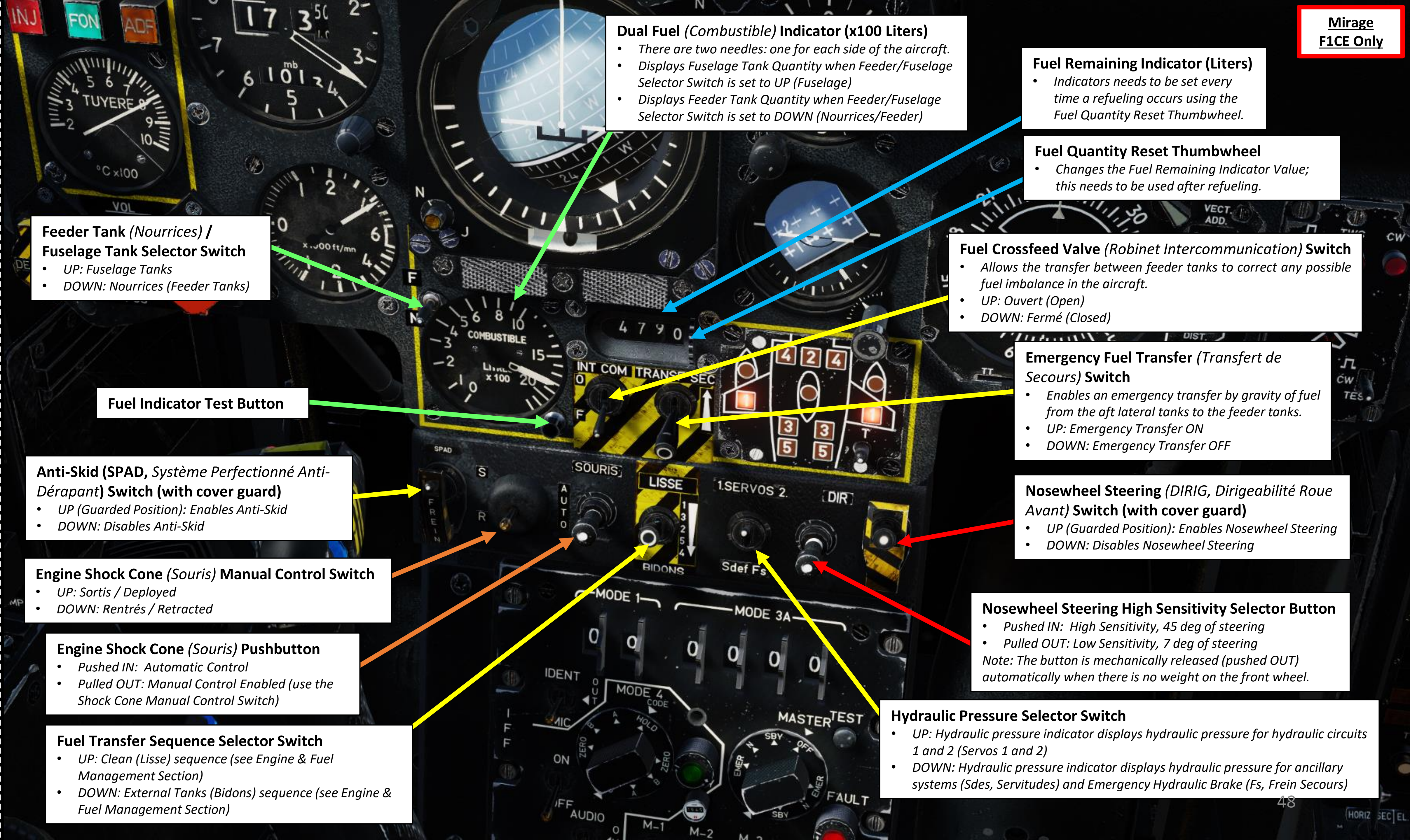
Radar Function Selector Knob

Scope Erase Button *(Effacer)*

Radar Storage/Persistence Adjustment *(Rémanence)*


Mirage F1CE Only
Internal Fuel Tank No. 2 Empty Light
Left Internal Fuel Tank No. 4 Empty Light
Left External Fuel Drop Tank Empty Light
Right Internal Fuel Tank No. 4 Empty Light
Right External Fuel Drop Tank Empty Light
Left Wing Fuel Tank No. 1 Empty Light
Right Wing Fuel Tank No. 1 Empty Light
Fuel Transfer Indicator Test Switch
Central External Fuel Drop Tank Empty Light
Left Internal Fuel Tank No. 3 Empty Light
Left Internal Fuel Tank No. 5 Empty Light
Right Internal Fuel Tank No. 3 Empty Light
Right Internal Fuel Tank No. 5 Empty Light

Mirage F1CE Only



Dual Fuel *(Combustible)* **Indicator (x100 Liters)**
- *There are two needles: one for each side of the aircraft.*
- *Displays Fuselage Tank Quantity when Feeder/Fuselage Selector Switch is set to UP (Fuselage)*
- *Displays Feeder Tank Quantity when Feeder/Fuselage Selector Switch is set to DOWN (Nourrices/Feeder)*

Fuel Remaining Indicator (Liters)
- *Indicators needs to be set every time a refueling occurs using the Fuel Quantity Reset Thumbwheel.*

Fuel Quantity Reset Thumbwheel
- *Changes the Fuel Remaining Indicator Value; this needs to be used after refueling.*

Feeder Tank *(Nourrices)* **/ Fuselage Tank Selector Switch**
- *UP: Fuselage Tanks*
- *DOWN: Nourrices (Feeder Tanks)*

Fuel Crossfeed Valve *(Robinet Intercommunication)* **Switch**
- *Allows the transfer between feeder tanks to correct any possible fuel imbalance in the aircraft.*
- *UP: Ouvert (Open)*
- *DOWN: Fermé (Closed)*

Fuel Indicator Test Button

Emergency Fuel Transfer *(Transfert de Secours)* **Switch**
- *Enables an emergency transfer by gravity of fuel from the aft lateral tanks to the feeder tanks.*
- *UP: Emergency Transfer ON*
- *DOWN: Emergency Transfer OFF*

Anti-Skid (SPAD, *Système Perfectionné Anti-Dérapant***) Switch (with cover guard)**
- *UP (Guarded Position): Enables Anti-Skid*
- *DOWN: Disables Anti-Skid*

Nosewheel Steering *(DIRIG, Dirigeabilité Roue Avant)* **Switch (with cover guard)**
- *UP (Guarded Position): Enables Nosewheel Steering*
- *DOWN: Disables Nosewheel Steering*

Engine Shock Cone *(Souris)* **Manual Control Switch**
- *UP: Sortis / Deployed*
- *DOWN: Rentrés / Retracted*

Nosewheel Steering High Sensitivity Selector Button
- *Pushed IN: High Sensitivity, 45 deg of steering*
- *Pulled OUT: Low Sensitivity, 7 deg of steering*

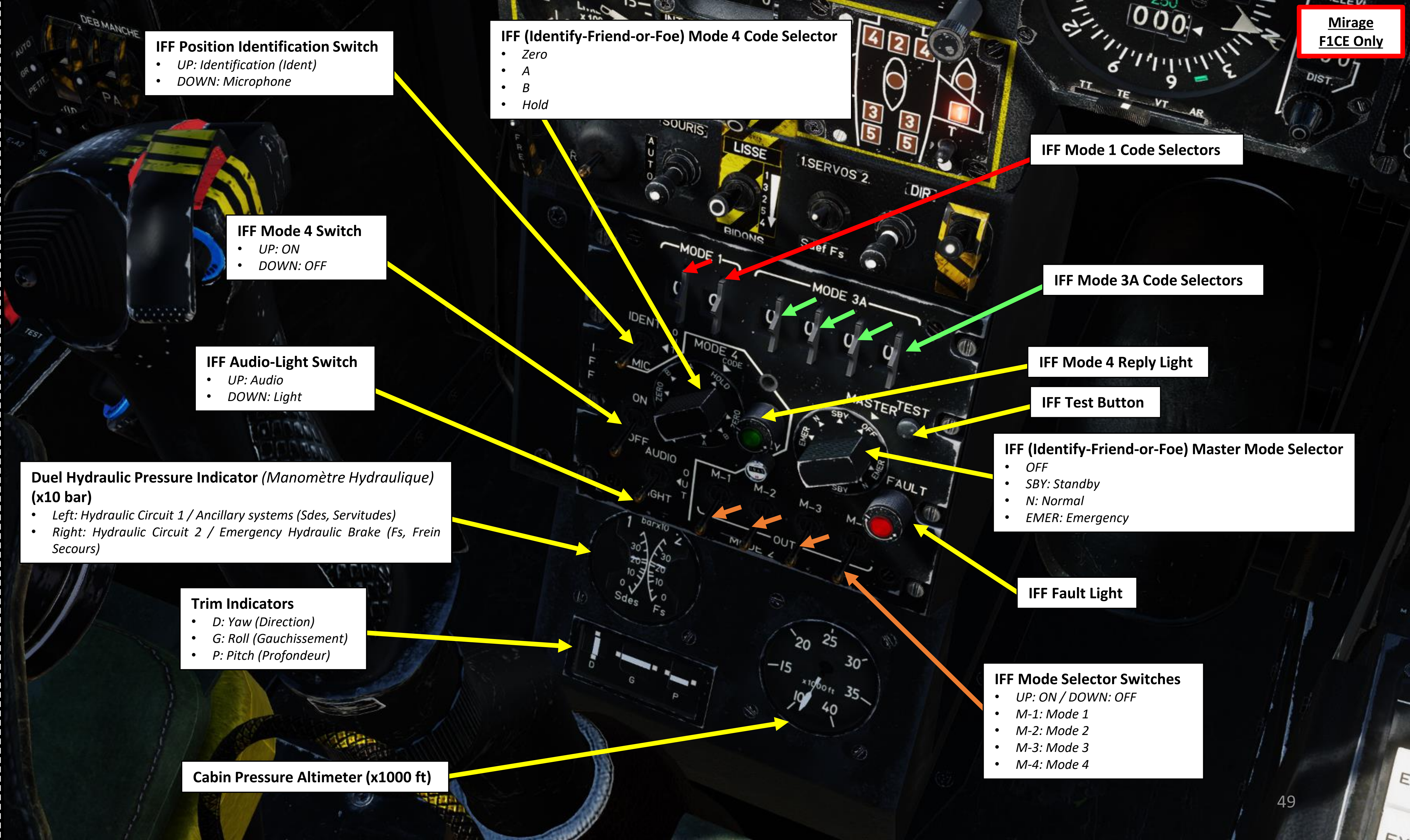
Note: The button is mechanically released (pushed OUT) automatically when there is no weight on the front wheel.

Engine Shock Cone *(Souris)* **Pushbutton**
- *Pushed IN: Automatic Control*
- *Pulled OUT: Manual Control Enabled (use the Shock Cone Manual Control Switch)*

Hydraulic Pressure Selector Switch
- *UP: Hydraulic pressure indicator displays hydraulic pressure for hydraulic circuits 1 and 2 (Servos 1 and 2)*
- *DOWN: Hydraulic pressure indicator displays hydraulic pressure for ancillary systems (Sdes, Servitudes) and Emergency Hydraulic Brake (Fs, Frein Secours)*

Fuel Transfer Sequence Selector Switch
- *UP: Clean (Lisse) sequence (see Engine & Fuel Management Section)*
- *DOWN: External Tanks (Bidons) sequence (see Engine & Fuel Management Section)*

Mirage F1CE Only



IFF Position Identification Switch
- *UP: Identification (Ident)*
- *DOWN: Microphone*

IFF (Identify-Friend-or-Foe) Mode 4 Code Selector
- *Zero*
- *A*
- *B*
- *Hold*

IFF Mode 1 Code Selectors

IFF Mode 4 Switch
- *UP: ON*
- *DOWN: OFF*

IFF Mode 3A Code Selectors

IFF Audio-Light Switch
- *UP: Audio*
- *DOWN: Light*

IFF Mode 4 Reply Light

IFF Test Button

IFF (Identify-Friend-or-Foe) Master Mode Selector
- *OFF*
- *SBY: Standby*
- *N: Normal*
- *EMER: Emergency*

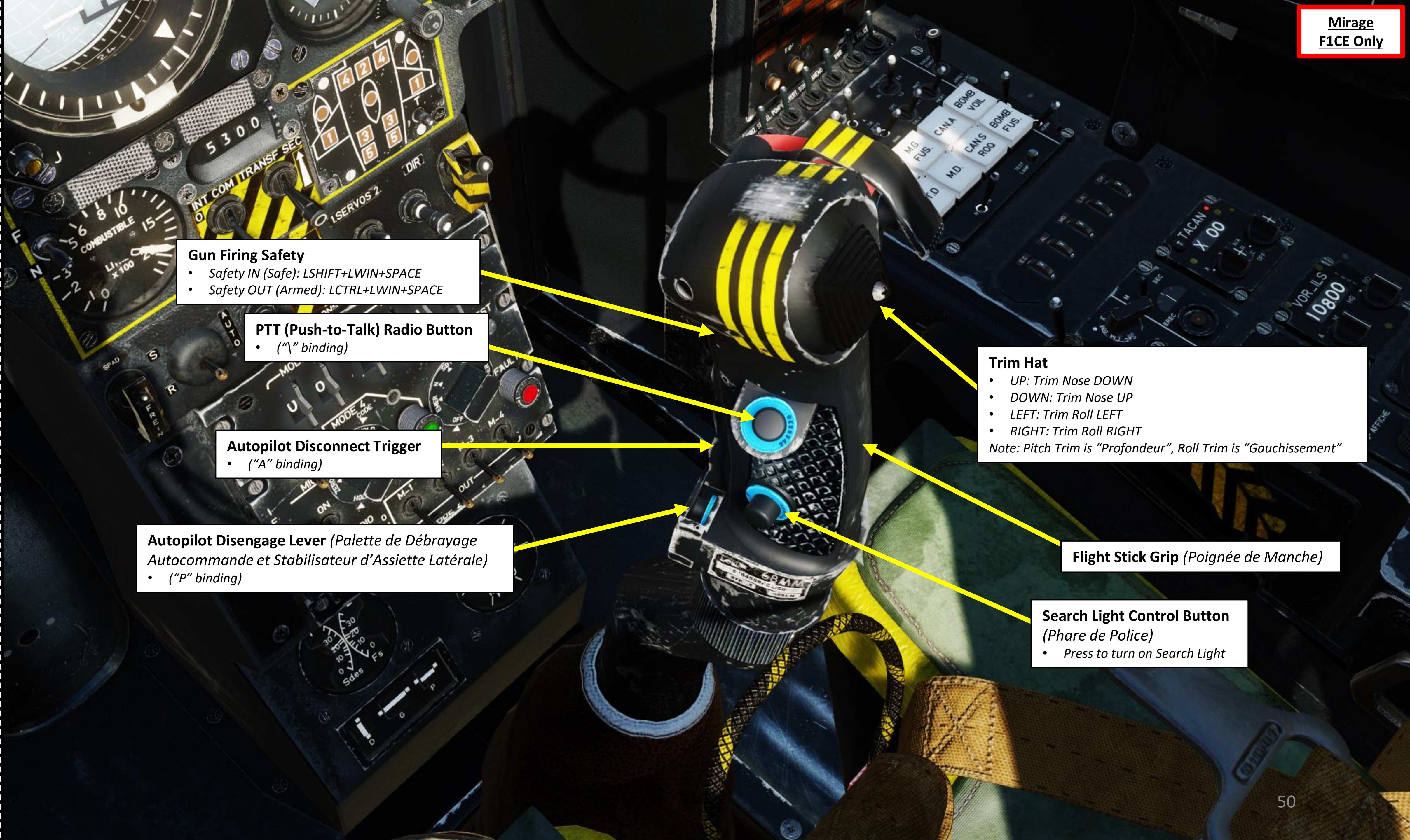
Duel Hydraulic Pressure Indicator *(Manomètre Hydraulique)* **(x10 bar)**
- *Left: Hydraulic Circuit 1 / Ancillary systems (Sdes, Servitudes)*
- *Right: Hydraulic Circuit 2 / Emergency Hydraulic Brake (Fs, Frein Secours)*

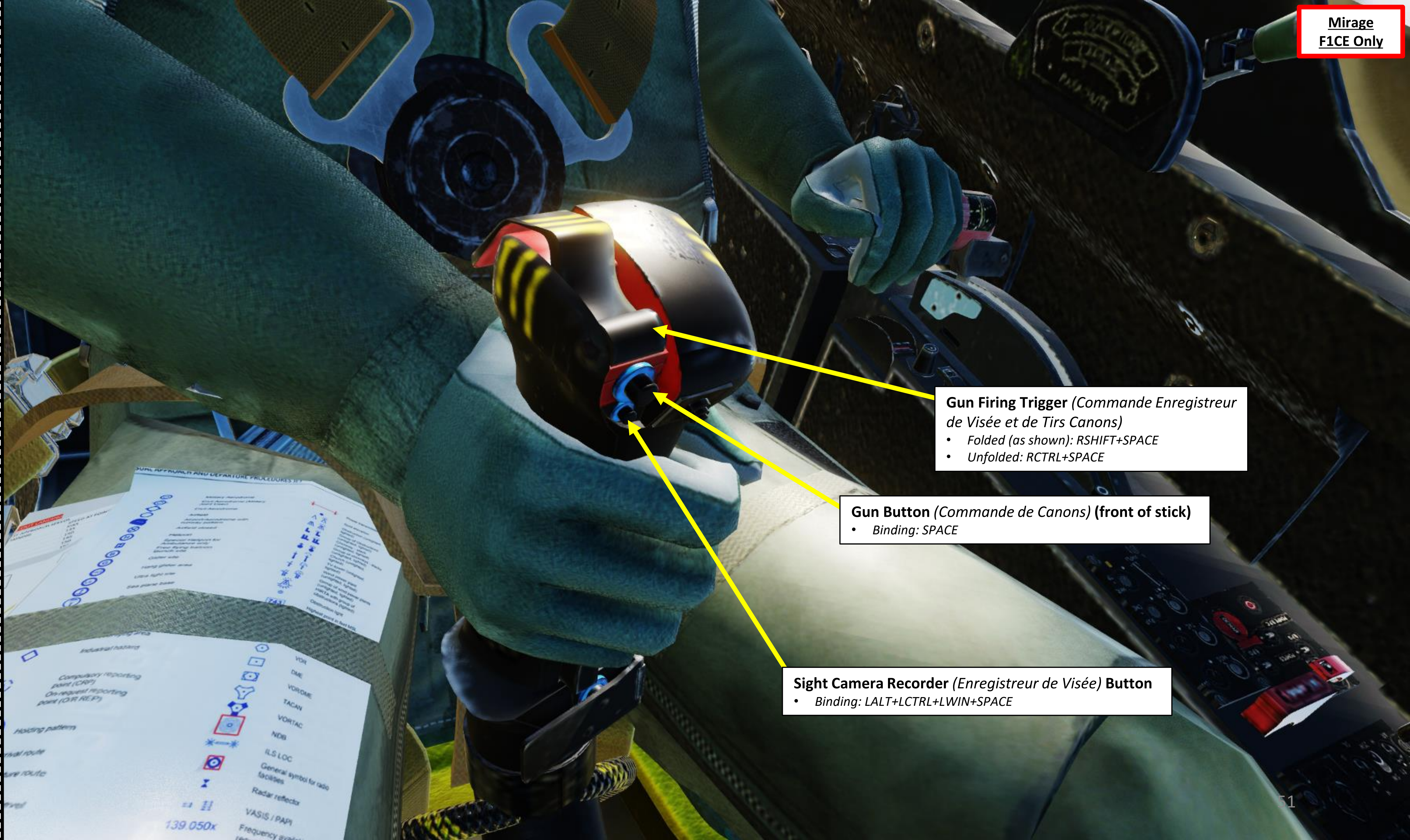
IFF Fault Light

Trim Indicators
- *D: Yaw (Direction)*
- *G: Roll (Gauchissement)*
- *P: Pitch (Profondeur)*

IFF Mode Selector Switches
- *UP: ON / DOWN: OFF*
- *M-1: Mode 1*
- *M-2: Mode 2*
- *M-3: Mode 3*
- *M-4: Mode 4*

Cabin Pressure Altimeter (x1000 ft)


Mirage F1CE Only
Gun Firing Safety
• Safety IN (Safe): LSHIFT+LWIN+SPACE
• Safety OUT (Armed): LCTRL+LWIN+SPACE
PTT (Push-to-Talk) Radio Button
• (“\” binding)
Autopilot Disconnect Trigger
• (“A” binding)
Autopilot Disengage Lever (Palette de Débrayage Autocommande et Stabilisateur d’Assiette Latérale)
• (“P” binding)
Trim Hat
• UP: Trim Nose DOWN
• DOWN: Trim Nose UP
• LEFT: Trim Roll LEFT
• RIGHT: Trim Roll RIGHT
Note: Pitch Trim is “Profondeur”, Roll Trim is “Gauchissement”
Flight Stick Grip (Poignée de Manche)
Search Light Control Button (Phare de Police)
• Press to turn on Search Light

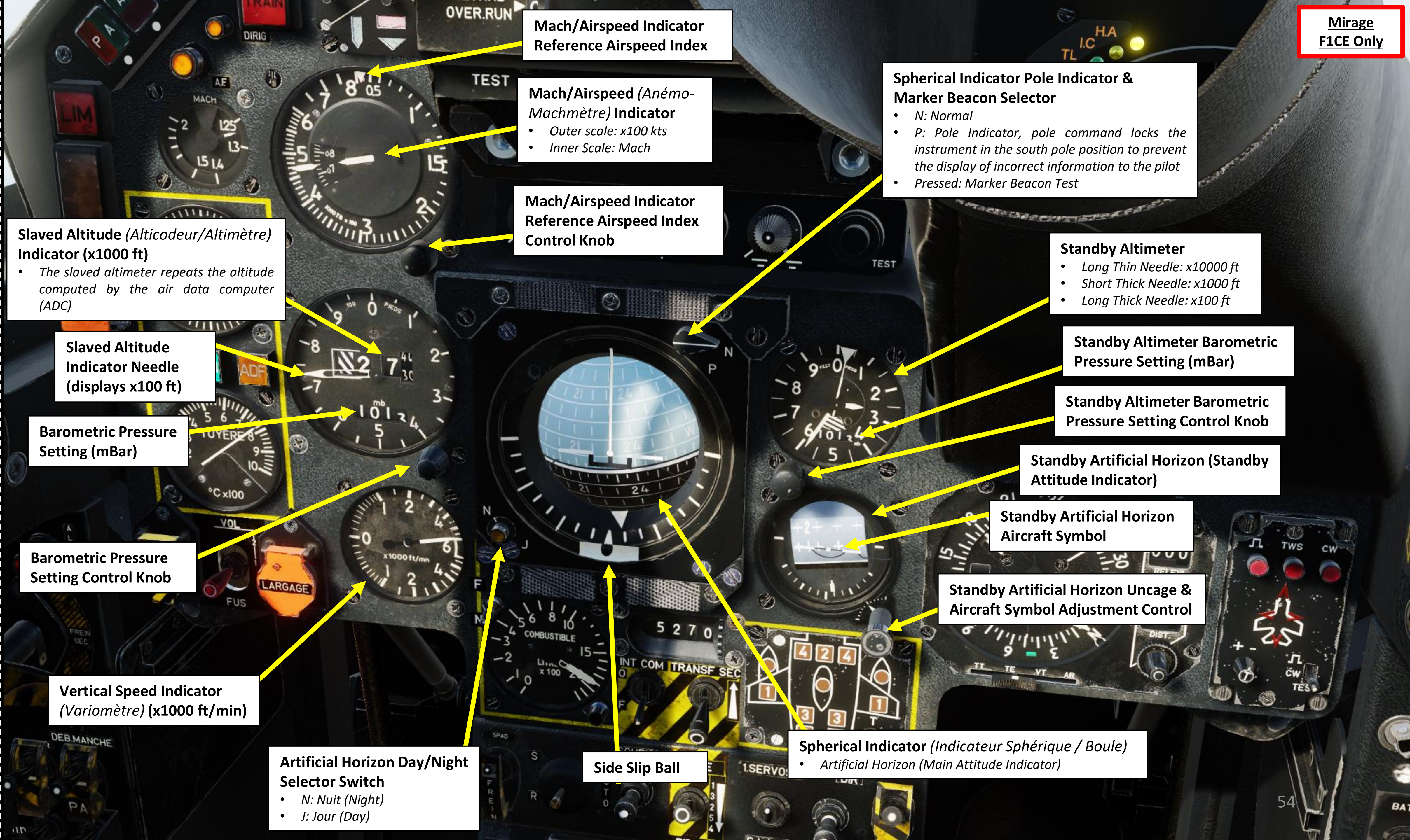

Mirage F1CE Only
Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded (as shown): RSHIFT+SPACE*
- *Unfolded: RCTRL+SPACE*
Gun Button *(Commande de Canons)* **(front of stick)**
- *Binding: SPACE*
Sight Camera Recorder *(Enregistreur de Visée)* **Button**
- *Binding: LALT+LCTRL+LWIN+SPACE*

Mirage F1CE Only

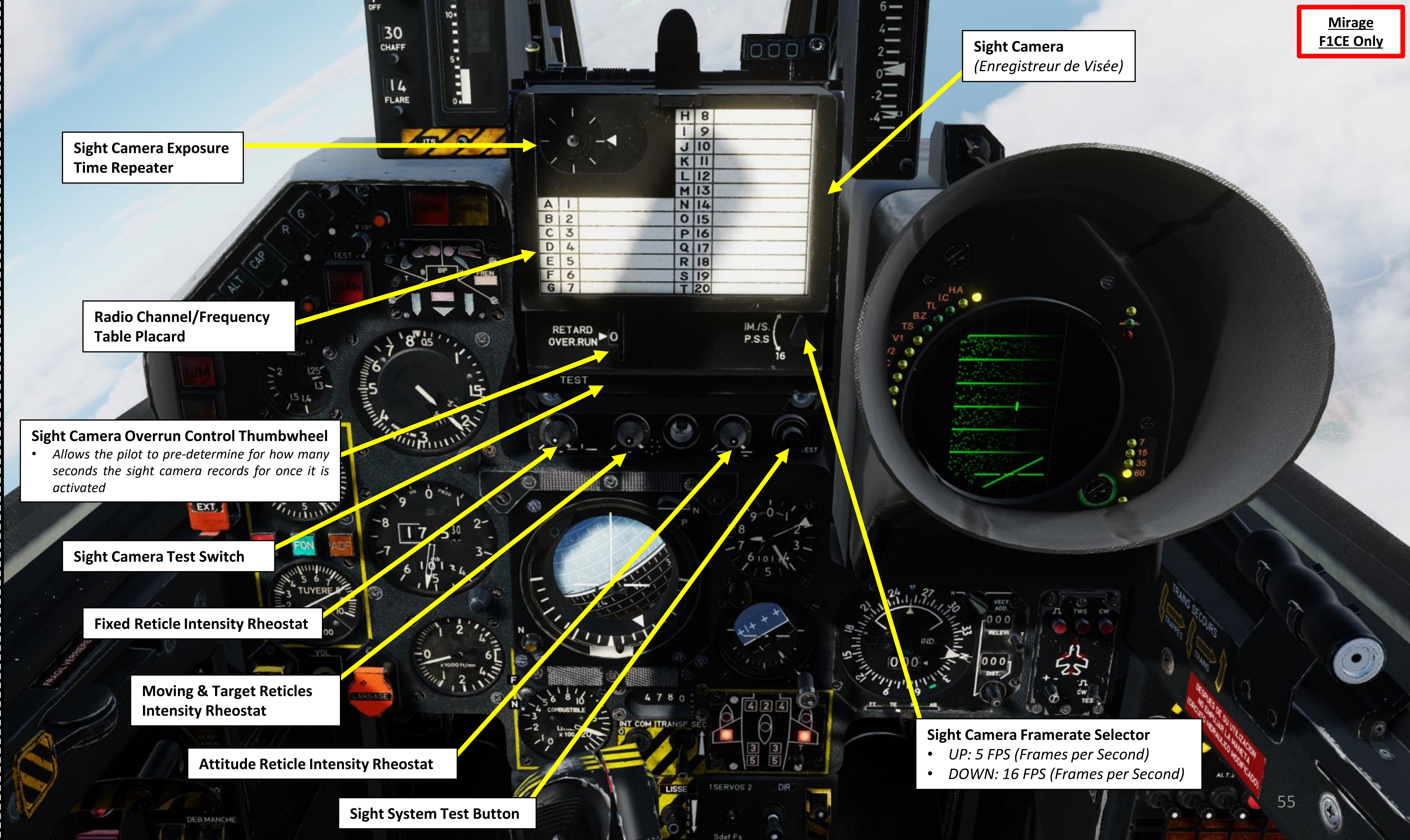
Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Bombs, Rockets, Missile & Sight Recorder Button
- *Binding: RALT+SPACE*

Mirage F1CE Only

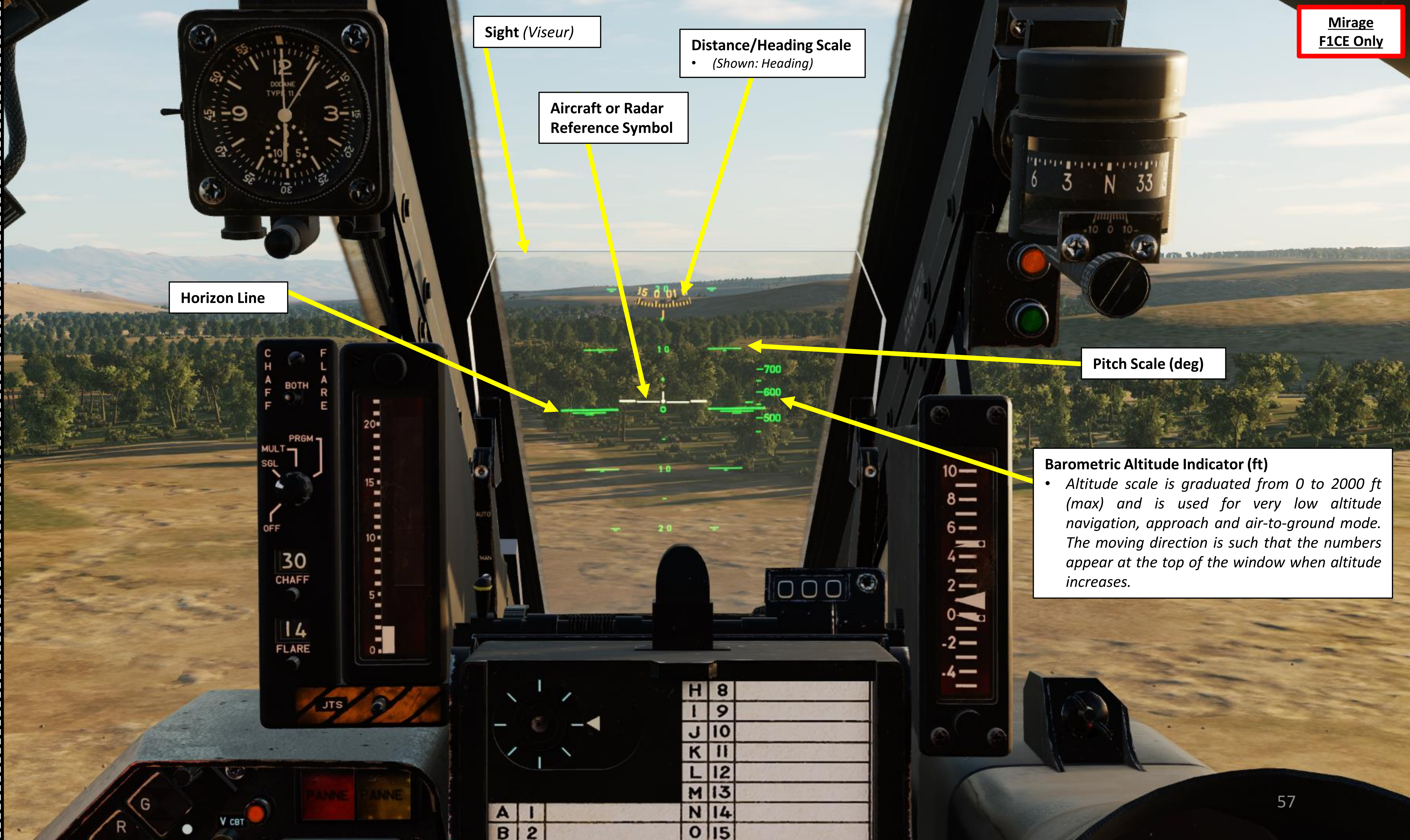

Mirage F1CE Only
Mach/Airspeed Indicator Reference Airspeed Index
Mach/Airspeed (Anémo-Machmètre) Indicator
• Outer scale: x100 kts
• Inner Scale: Mach
Mach/Airspeed Indicator Reference Airspeed Index Control Knob
Spherical Indicator Pole Indicator & Marker Beacon Selector
• N: Normal
• P: Pole Indicator, pole command locks the instrument in the south pole position to prevent the display of incorrect information to the pilot
• Pressed: Marker Beacon Test
Slaved Altitude (Alticodeur/Altimètre) Indicator (x1000 ft)
• The slaved altimeter repeats the altitude computed by the air data computer (ADC)
Slaved Altitude Indicator Needle (displays x100 ft)
Barometric Pressure Setting (mBar)
Barometric Pressure Setting Control Knob
Vertical Speed Indicator (Variomètre) (x1000 ft/min)
Artificial Horizon Day/Night Selector Switch
• N: Nuit (Night)
• J: Jour (Day)
Side Slip Ball
Spherical Indicator (Indicateur Sphérique / Boule)
• Artificial Horizon (Main Attitude Indicator)
Standby Altimeter
• Long Thin Needle: x10000 ft
• Short Thick Needle: x1000 ft
• Long Thick Needle: x100 ft
Standby Altimeter Barometric Pressure Setting (mBar)
Standby Altimeter Barometric Pressure Setting Control Knob
Standby Artificial Horizon (Standby Attitude Indicator)
Standby Artificial Horizon Aircraft Symbol
Standby Artificial Horizon Uncage & Aircraft Symbol Adjustment Control

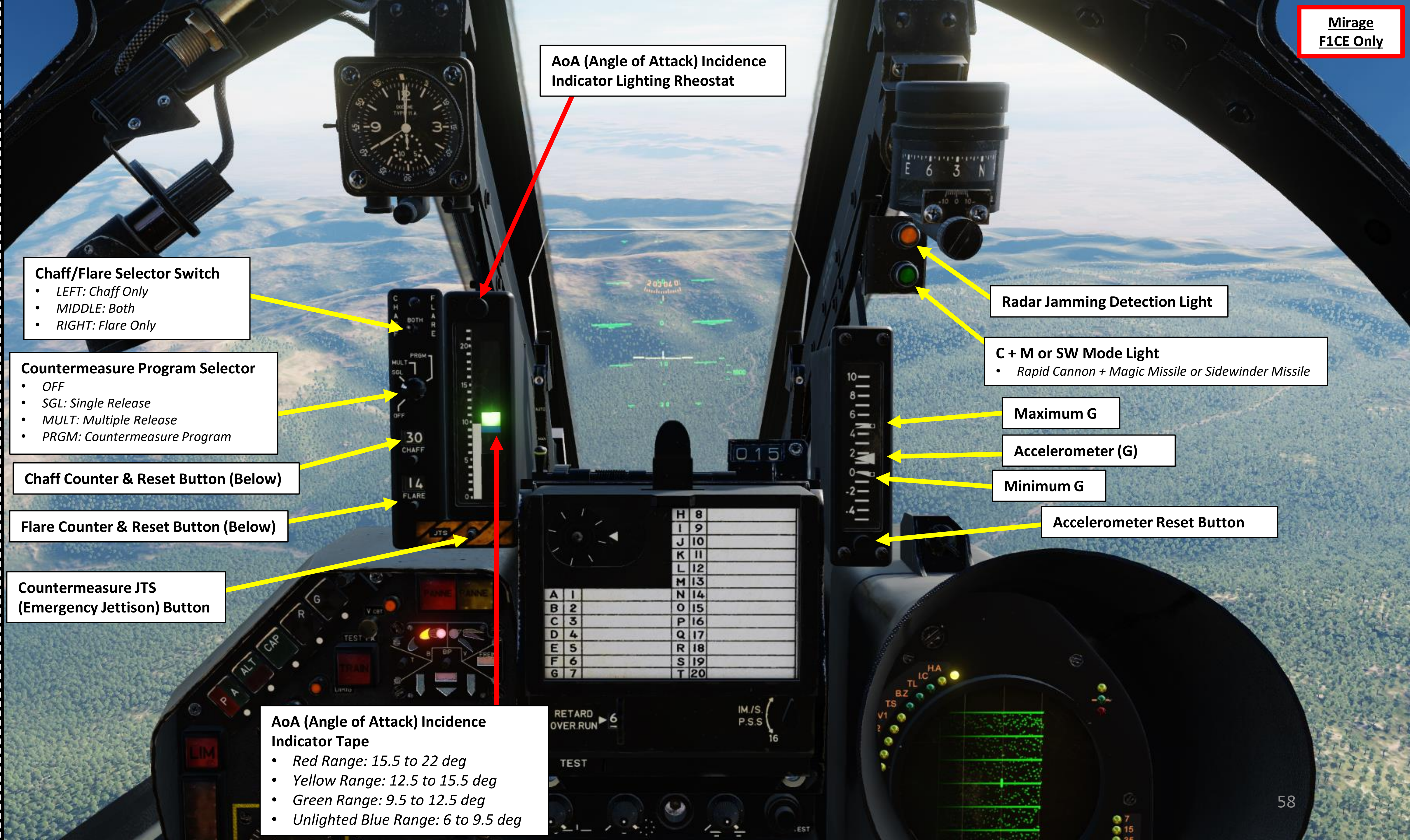
Mirage F1CE Only



Mirage F1CE Only

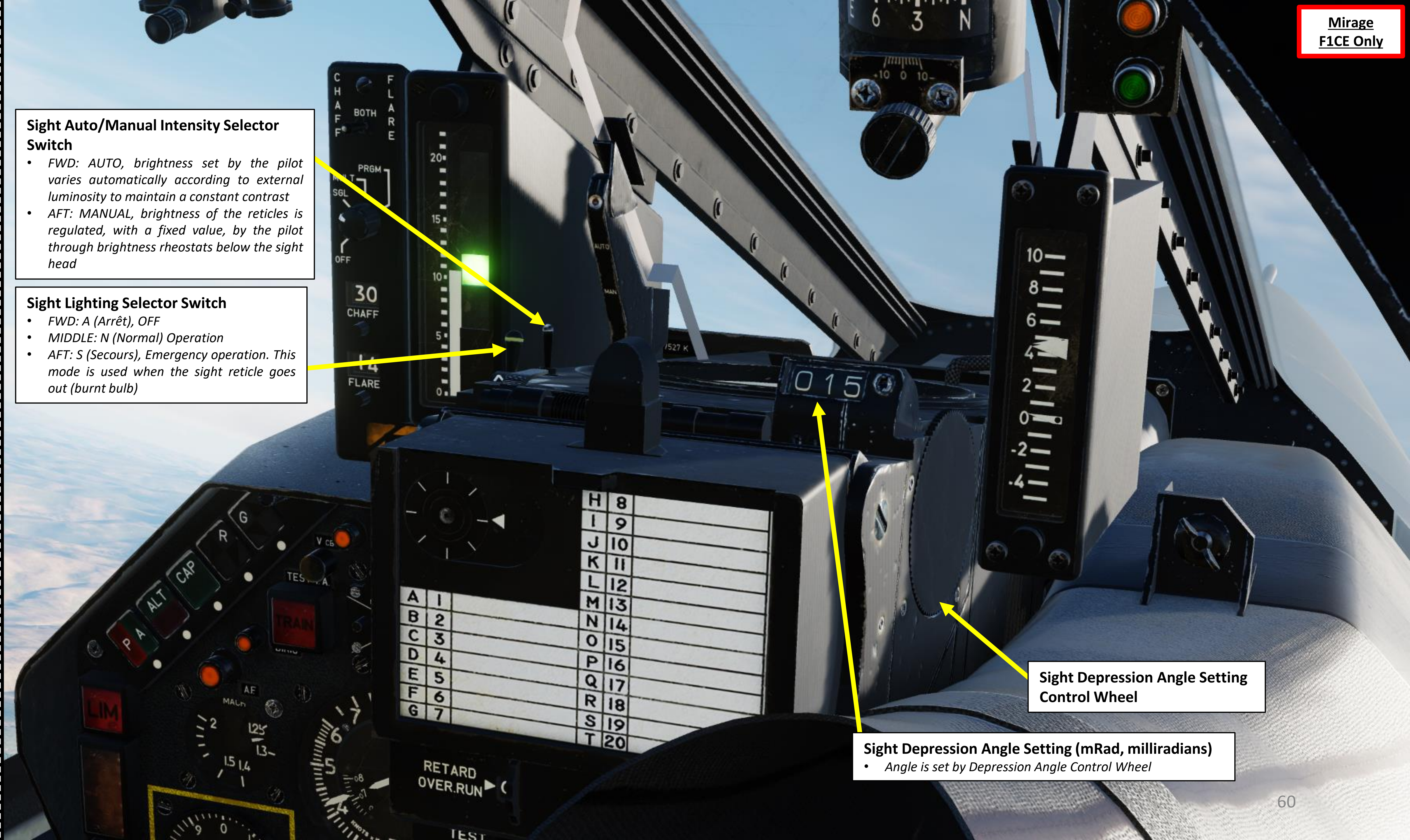
Mirage F1CE Only




Mirage F1CE Only
AoA (Angle of Attack) Incidence Indicator Lighting Rheostat
Chaff/Flare Selector Switch
- LEFT: Chaff Only
- MIDDLE: Both
- RIGHT: Flare Only
Countermeasure Program Selector
- OFF
- SGL: Single Release
- MULT: Multiple Release
- PRGM: Countermeasure Program
Chaff Counter & Reset Button (Below)
Flare Counter & Reset Button (Below)
Countermeasure JTS (Emergency Jettison) Button
AoA (Angle of Attack) Incidence Indicator Tape
- Red Range: 15.5 to 22 deg
- Yellow Range: 12.5 to 15.5 deg
- Green Range: 9.5 to 12.5 deg
- Unlighted Blue Range: 6 to 9.5 deg
Radar Jamming Detection Light
C + M or SW Mode Light
- Rapid Cannon + Magic Missile or Sidewinder Missile
Maximum G
Accelerometer (G)
Minimum G
Accelerometer Reset Button


Mirage F1CE Only
Clock *(Montre)*
Standby Magnetic Compass *(Compas de Secours)*
Miscellaneous Instruments Lighting Switch
• *Allows lighting standby compass, clock, accelerometer and AoA (Angle of Attack) indicator tape*
• *AFT: ON*
• *FWD: OFF*
Map Light Rheostat
Chronometer Starting Control and Clock Winding/Setting Knob
Clock Winding/Setting Lever
Miscellaneous Instruments Integral Lighting Rheostat
• *Allows control of lighting intensity of the standby compass, clock, accelerometer and AoA (Angle of Attack) indicator tape*
Standby Magnetic Compass Deviation Setting
Standby Magnetic Compass Deviation Control Knob

Mirage F1CE Only



Sight Auto/Manual Intensity Selector Switch

- *FWD: AUTO, brightness set by the pilot varies automatically according to external luminosity to maintain a constant contrast*
- *AFT: MANUAL, brightness of the reticles is regulated, with a fixed value, by the pilot through brightness rheostats below the sight head*

Sight Lighting Selector Switch

- *FWD: A (Arrêt), OFF*
- *MIDDLE: N (Normal) Operation*
- *AFT: S (Secours), Emergency operation. This mode is used when the sight reticle goes out (burnt bulb)*

Sight Depression Angle Setting Control Wheel

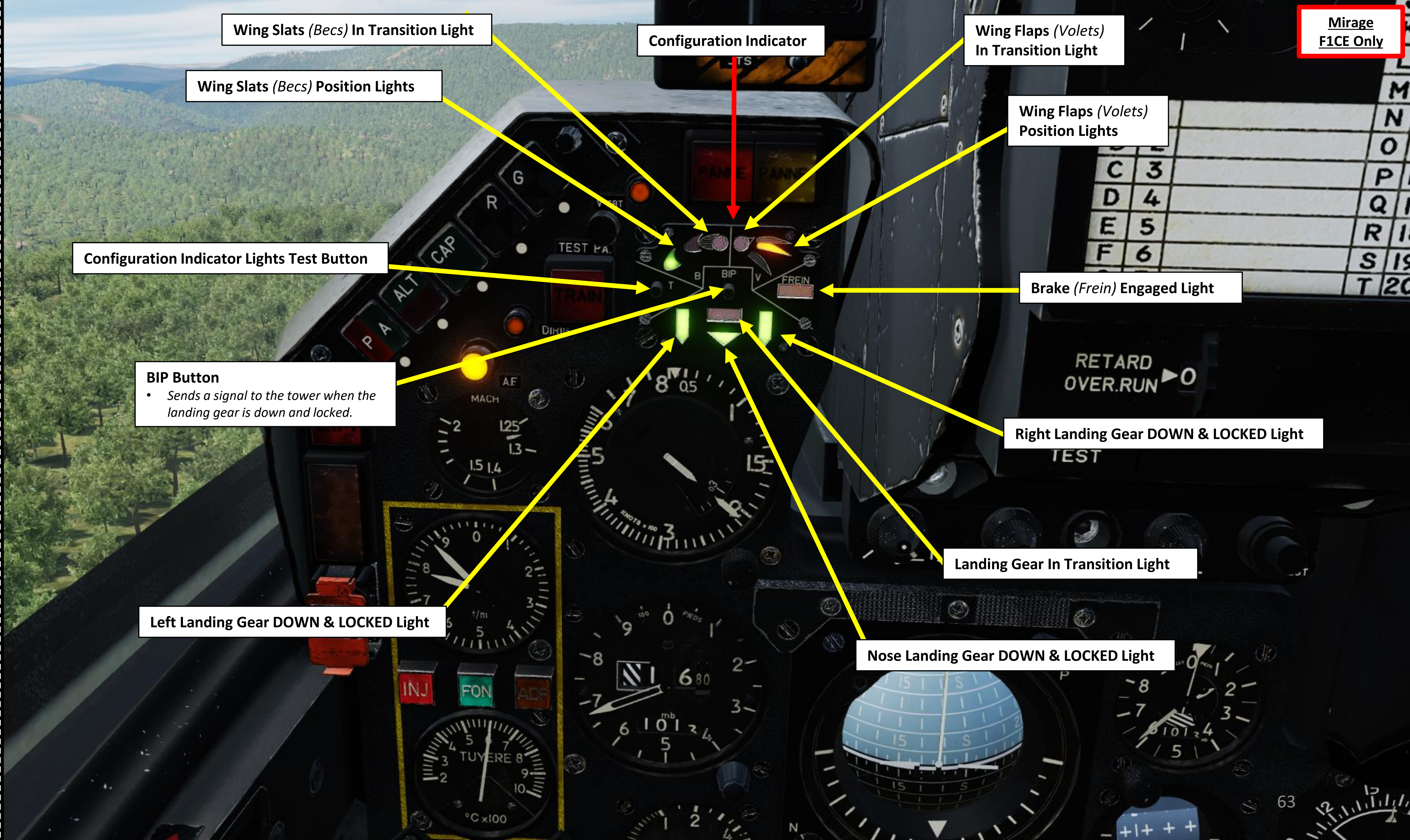
Sight Depression Angle Setting (mRad, milliradians)

- *Angle is set by Depression Angle Control Wheel*

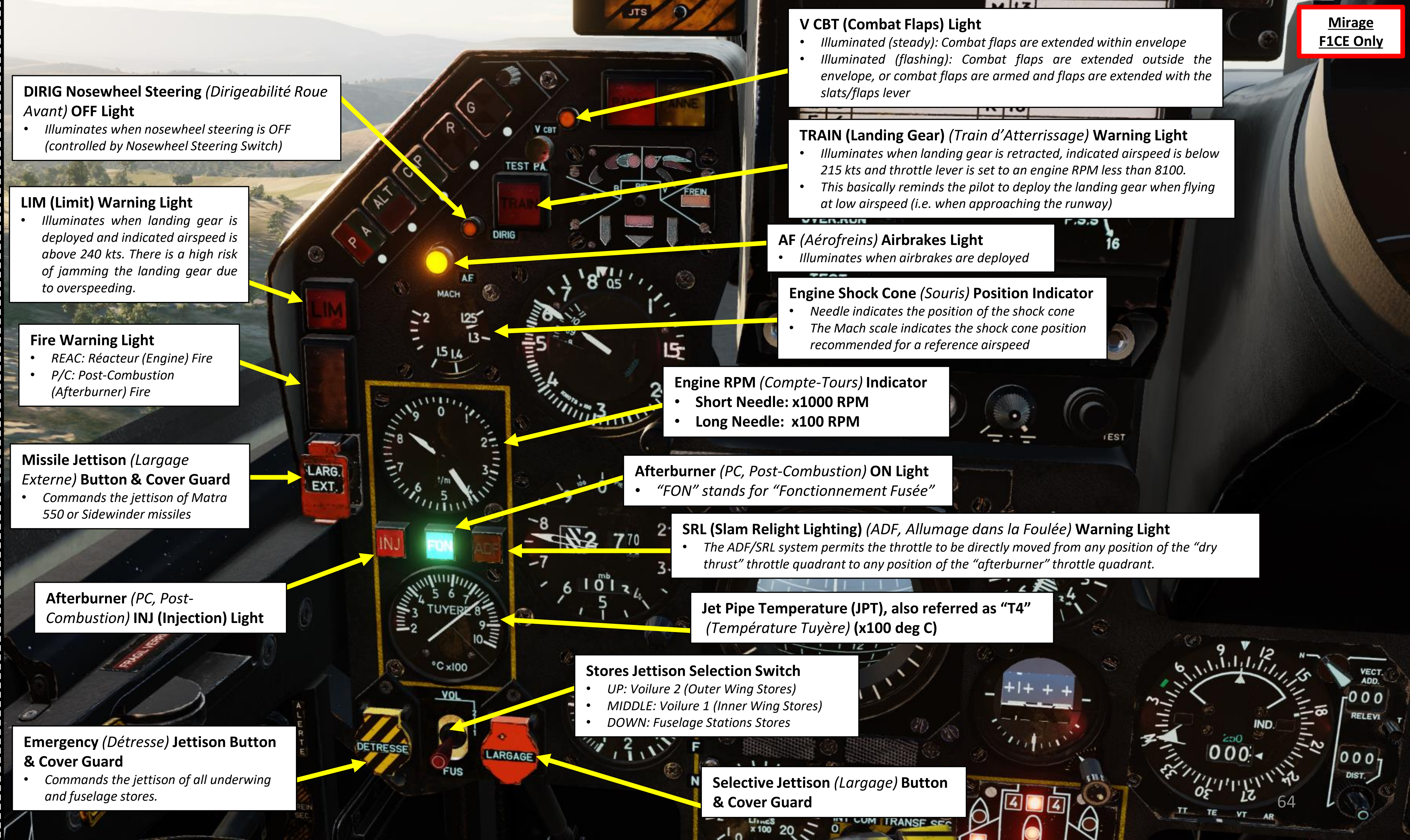

Mirage F1CE Only
Mirror
Mirror
Canopy Hinged Handle
• *Used to hold the canopy half-open during taxi*


Mirage F1CE Only
Master Failure (Panne) Warning Light
• Press to Reset
Autopilot Lights Intensity Control Knob
Autopilot Glide Slope (G) Mode Selector
Autopilot Localizer (R, Route) Mode Selector
Autopilot Heading (Cap) Mode Selector
Autopilot Altitude Hold Mode Selector
Autopilot (PA, Pilote Automatique) Master Control Button
• Green: Autopilot engaged
• Amber: Disconnected
Autopilot Test Button

Mirage F1CE Only



Mirage F1CE Only



V CBT (Combat Flaps) Light
- *Illuminated (steady): Combat flaps are extended within envelope*
- *Illuminated (flashing): Combat flaps are extended outside the envelope, or combat flaps are armed and flaps are extended with the slats/flaps lever*

DIRIG Nosewheel Steering *(Dirigeabilité Roue Avant)* **OFF Light**
- *Illuminates when nosewheel steering is OFF (controlled by Nosewheel Steering Switch)*

TRAIN (Landing Gear) *(Train d'Atterrissage)* **Warning Light**
- *Illuminates when landing gear is retracted, indicated airspeed is below 215 kts and throttle lever is set to an engine RPM less than 8100.*
- *This basically reminds the pilot to deploy the landing gear when flying at low airspeed (i.e. when approaching the runway)*

LIM (Limit) Warning Light
- *Illuminates when landing gear is deployed and indicated airspeed is above 240 kts. There is a high risk of jamming the landing gear due to overspeeding.*

AF *(Aérofreins)* **Airbrakes Light**
- *Illuminates when airbrakes are deployed*

Engine Shock Cone *(Souris)* **Position Indicator**
- *Needle indicates the position of the shock cone*
- *The Mach scale indicates the shock cone position recommended for a reference airspeed*

Fire Warning Light
- *REAC: Réacteur (Engine) Fire*
- *P/C: Post-Combustion (Afterburner) Fire*

Engine RPM *(Compte-Tours)* **Indicator**
- **Short Needle: x1000 RPM**
- **Long Needle: x100 RPM**

Missile Jettison *(Largage Externe)* **Button & Cover Guard**
- *Commands the jettison of Matra 550 or Sidewinder missiles*

Afterburner *(PC, Post-Combustion)* **ON Light**
- *"FON" stands for "Fonctionnement Fusée"*

SRL (Slam Relight Lighting) *(ADF, Allumage dans la Foulée)* **Warning Light**
- *The ADF/SRL system permits the throttle to be directly moved from any position of the "dry thrust" throttle quadrant to any position of the "afterburner" throttle quadrant.*

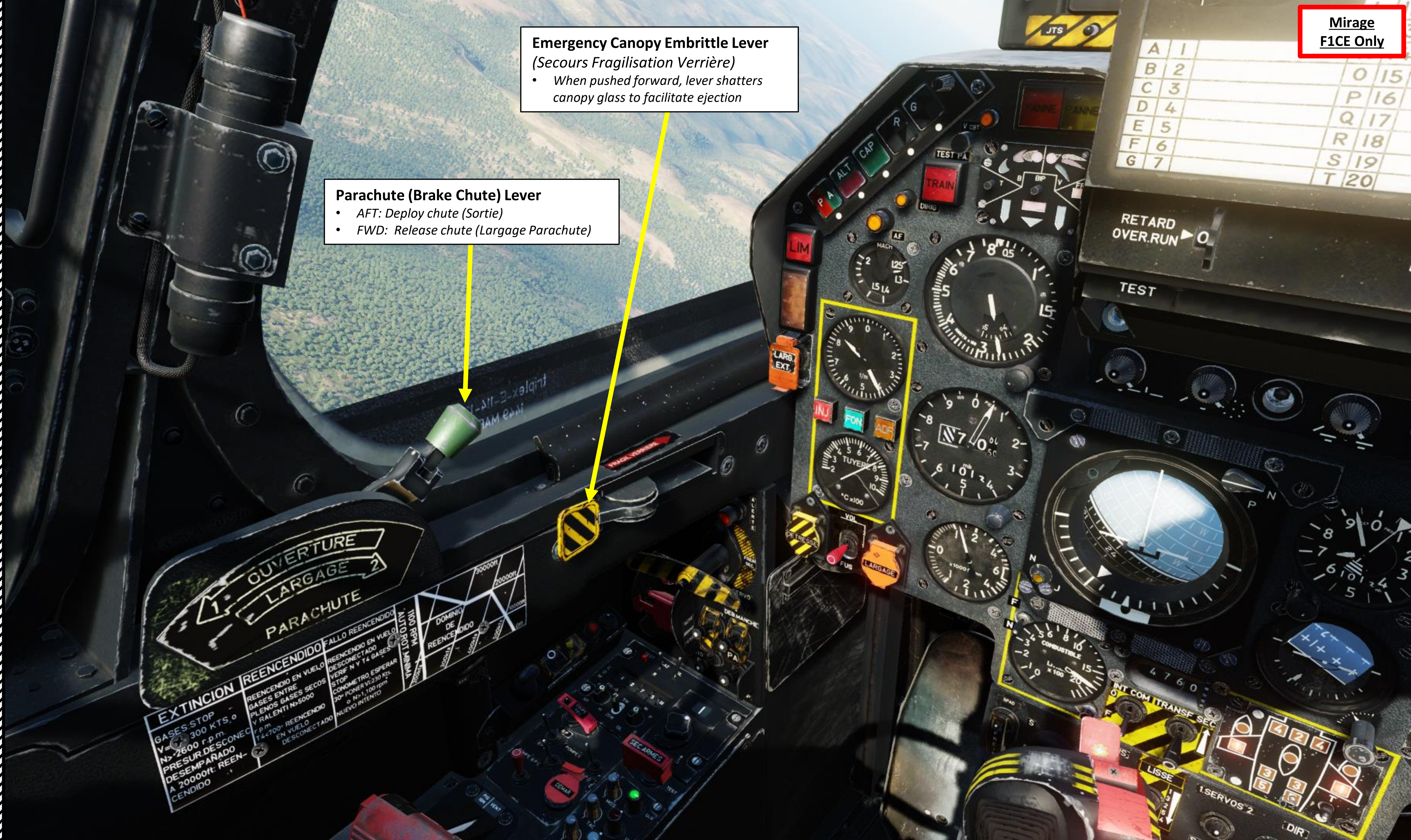
Afterburner *(PC, Post-Combustion)* **INJ (Injection) Light**

Jet Pipe Temperature (JPT), also referred as "T4" *(Température Tuyère)* **(x100 deg C)**

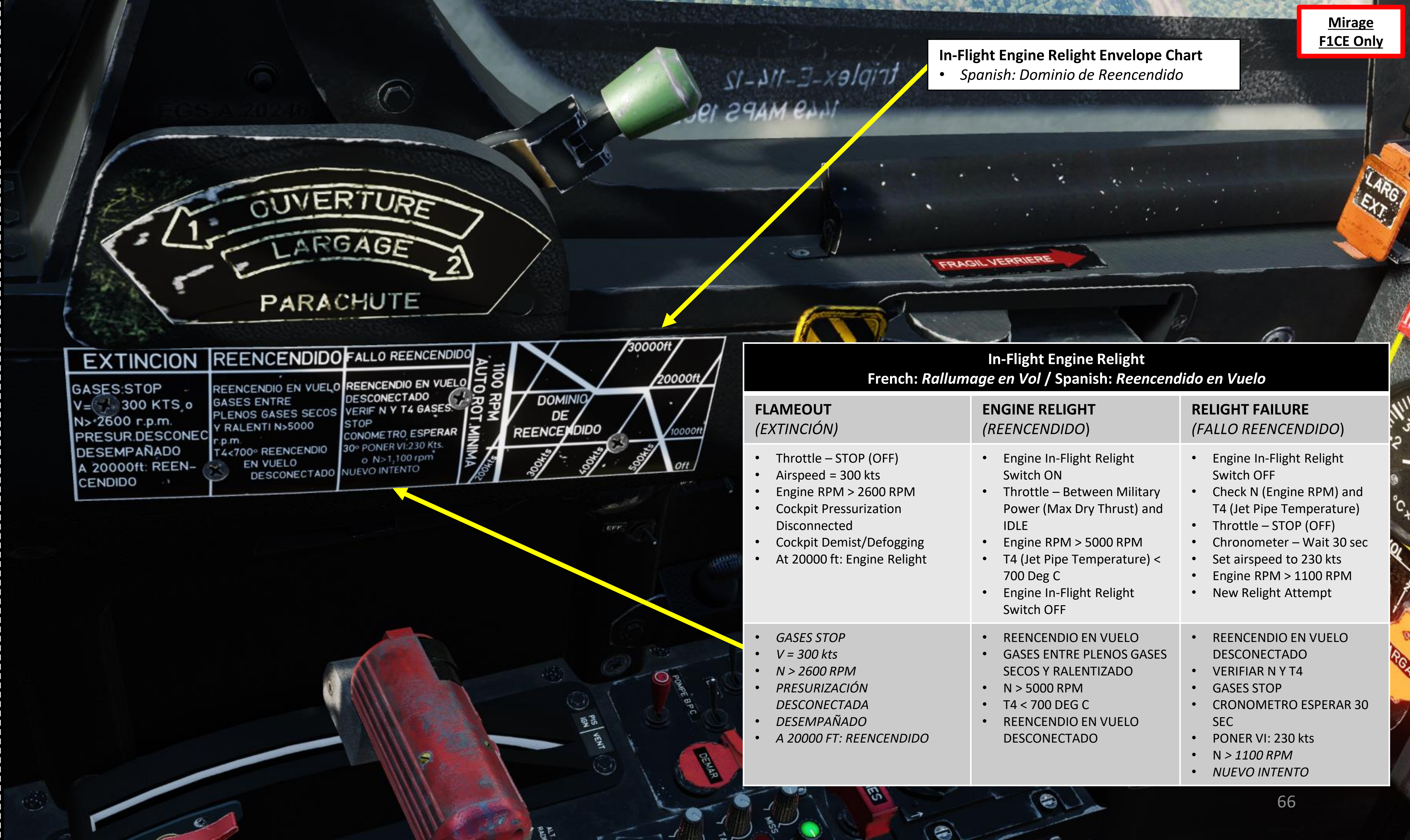
Stores Jettison Selection Switch
- *UP: Voilure 2 (Outer Wing Stores)*
- *MIDDLE: Voilure 1 (Inner Wing Stores)*
- *DOWN: Fuselage Stations Stores*

Emergency *(Détresse)* **Jettison Button & Cover Guard**
- *Commands the jettison of all underwing and fuselage stores.*

Selective Jettison *(Largage)* **Button & Cover Guard**


Mirage F1CE Only
Emergency Canopy Embrittle Lever
(Secours Fragilisation Verrière)
• *When pushed forward, lever shatters canopy glass to facilitate ejection*
Parachute (Brake Chute) Lever
• *AFT: Deploy chute (Sortie)*
• *FWD: Release chute (Largage Parachute)*

Mirage F1CE Only



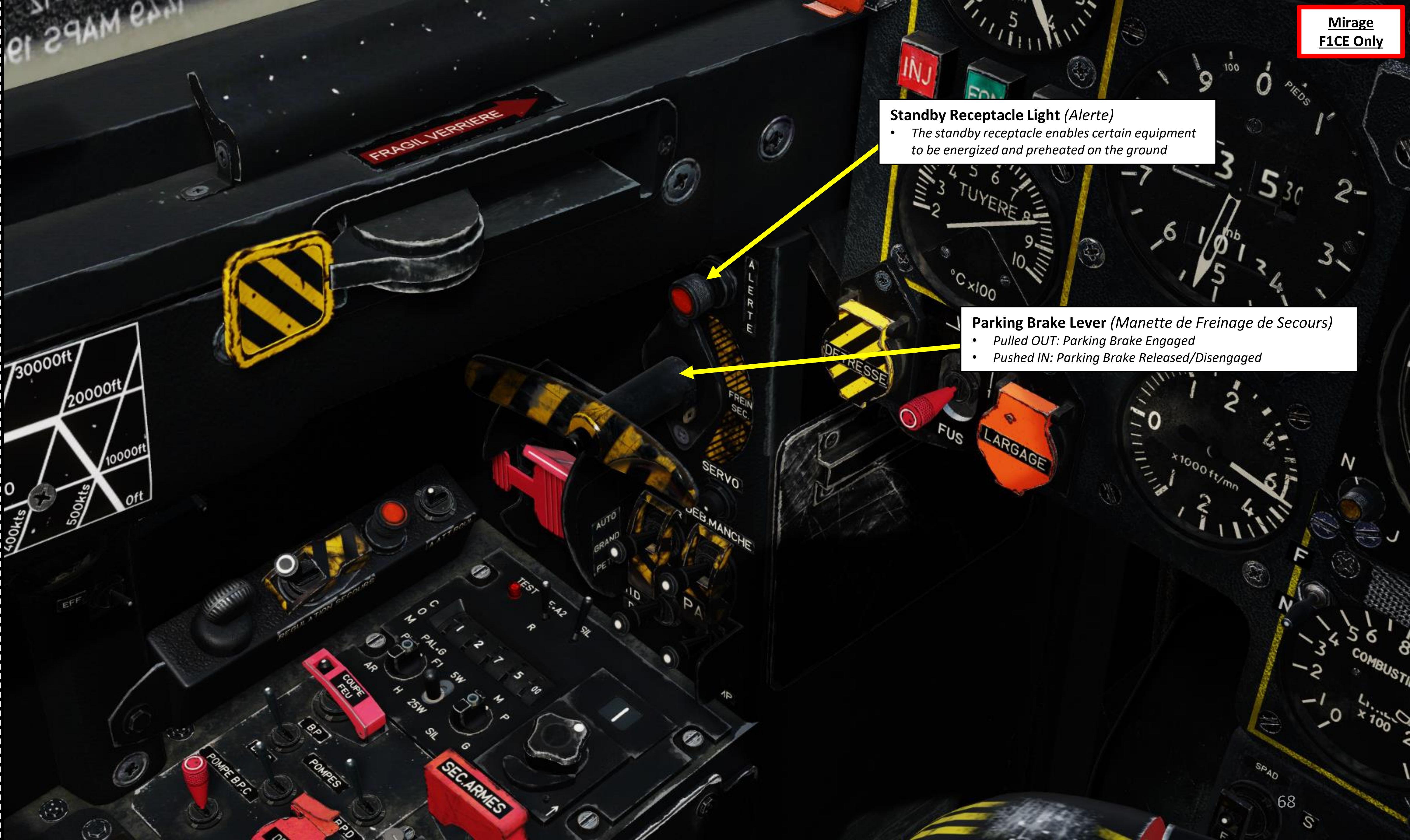
In-Flight Engine Relight Envelope Chart

- *Spanish: Dominio de Reencendido*

In-Flight Engine Relight French: *Rallumage en Vol* / Spanish: *Reencendido en Vuelo*		
FLAMEOUT *(EXTINCIÓN)*	**ENGINE RELIGHT** *(REENCENDIDO)*	**RELIGHT FAILURE** *(FALLO REENCENDIDO)*
• Throttle – STOP (OFF) • Airspeed = 300 kts • Engine RPM > 2600 RPM • Cockpit Pressurization Disconnected • Cockpit Demist/Defogging • At 20000 ft: Engine Relight	• Engine In-Flight Relight Switch ON • Throttle – Between Military Power (Max Dry Thrust) and IDLE • Engine RPM > 5000 RPM • T4 (Jet Pipe Temperature) < 700 Deg C • Engine In-Flight Relight Switch OFF	• Engine In-Flight Relight Switch OFF • Check N (Engine RPM) and T4 (Jet Pipe Temperature) • Throttle – STOP (OFF) • Chronometer – Wait 30 sec • Set airspeed to 230 kts • Engine RPM > 1100 RPM • New Relight Attempt
• *GASES STOP* • *V = 300 kts* • *N > 2600 RPM* • *PRESURIZACIÓN DESCONECTADA* • *DESEMPAÑADO* • *A 20000 FT: REENCENDIDO*	• REENCENDIO EN VUELO • GASES ENTRE PLENOS GASES SECOS Y RALENTIZADO • N > 5000 RPM • T4 < 700 DEG C • REENCENDIO EN VUELO DESCONECTADO	• REENCENDIO EN VUELO DESCONECTADO • VERIFIAR N Y T4 • GASES STOP • CRONOMETRO ESPERAR 30 SEC • PONER VI: 230 kts • N > *1100 RPM* • *NUEVO INTENTO*

Mirage F1CE Only

Mirage F1CE Only



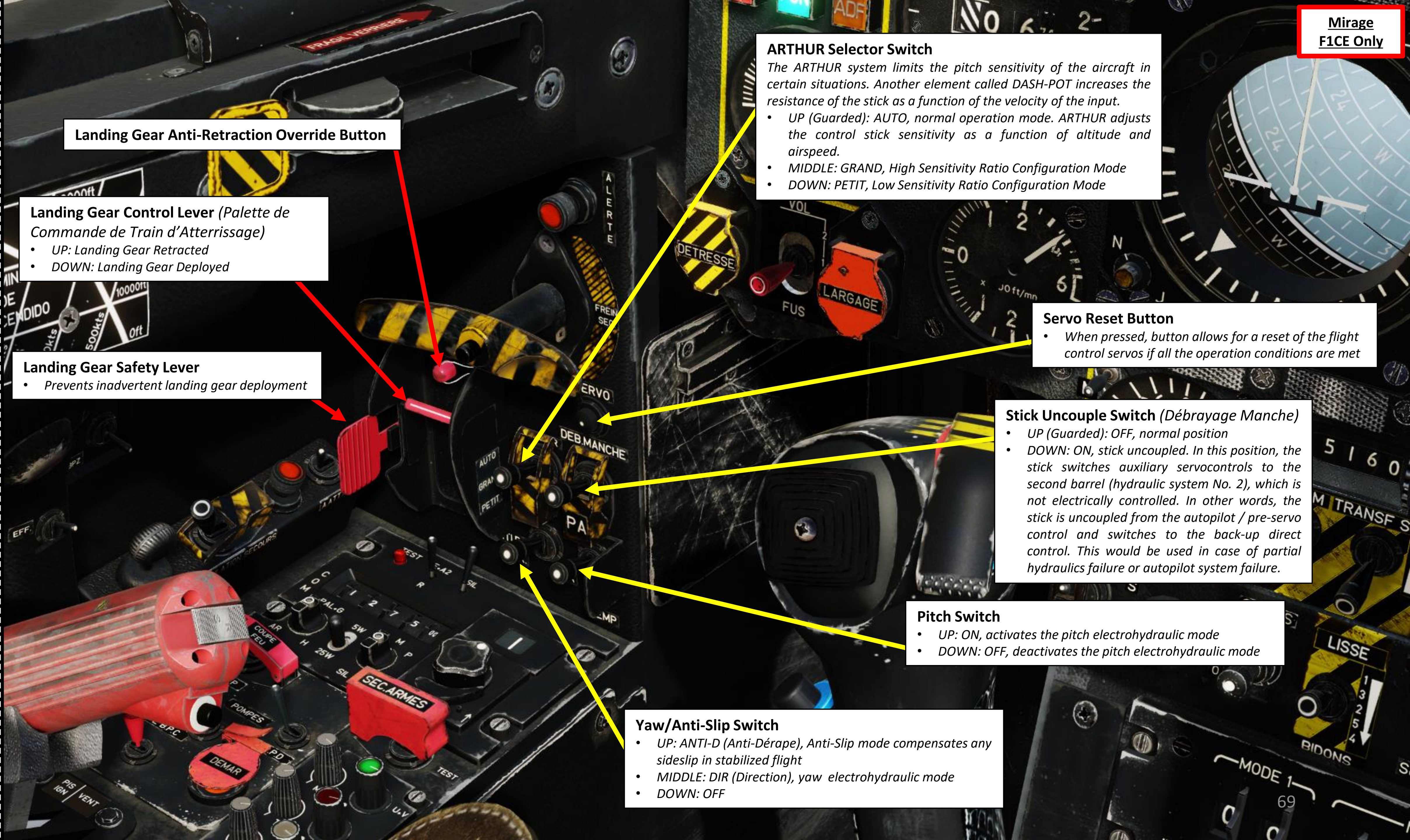
Standby Receptacle Light *(Alerte)*

- *The standby receptacle enables certain equipment to be energized and preheated on the ground*

Parking Brake Lever *(Manette de Freinage de Secours)*

- *Pulled OUT: Parking Brake Engaged*
- *Pushed IN: Parking Brake Released/Disengaged*

Mirage F1CE Only



Landing Gear Anti-Retraction Override Button

Landing Gear Control Lever *(Palette de Commande de Train d'Atterrissage)*
- *UP: Landing Gear Retracted*
- *DOWN: Landing Gear Deployed*

Landing Gear Safety Lever
- *Prevents inadvertent landing gear deployment*

ARTHUR Selector Switch
The ARTHUR system limits the pitch sensitivity of the aircraft in certain situations. Another element called DASH-POT increases the resistance of the stick as a function of the velocity of the input.
- *UP (Guarded): AUTO, normal operation mode. ARTHUR adjusts the control stick sensitivity as a function of altitude and airspeed.*
- *MIDDLE: GRAND, High Sensitivity Ratio Configuration Mode*
- *DOWN: PETIT, Low Sensitivity Ratio Configuration Mode*

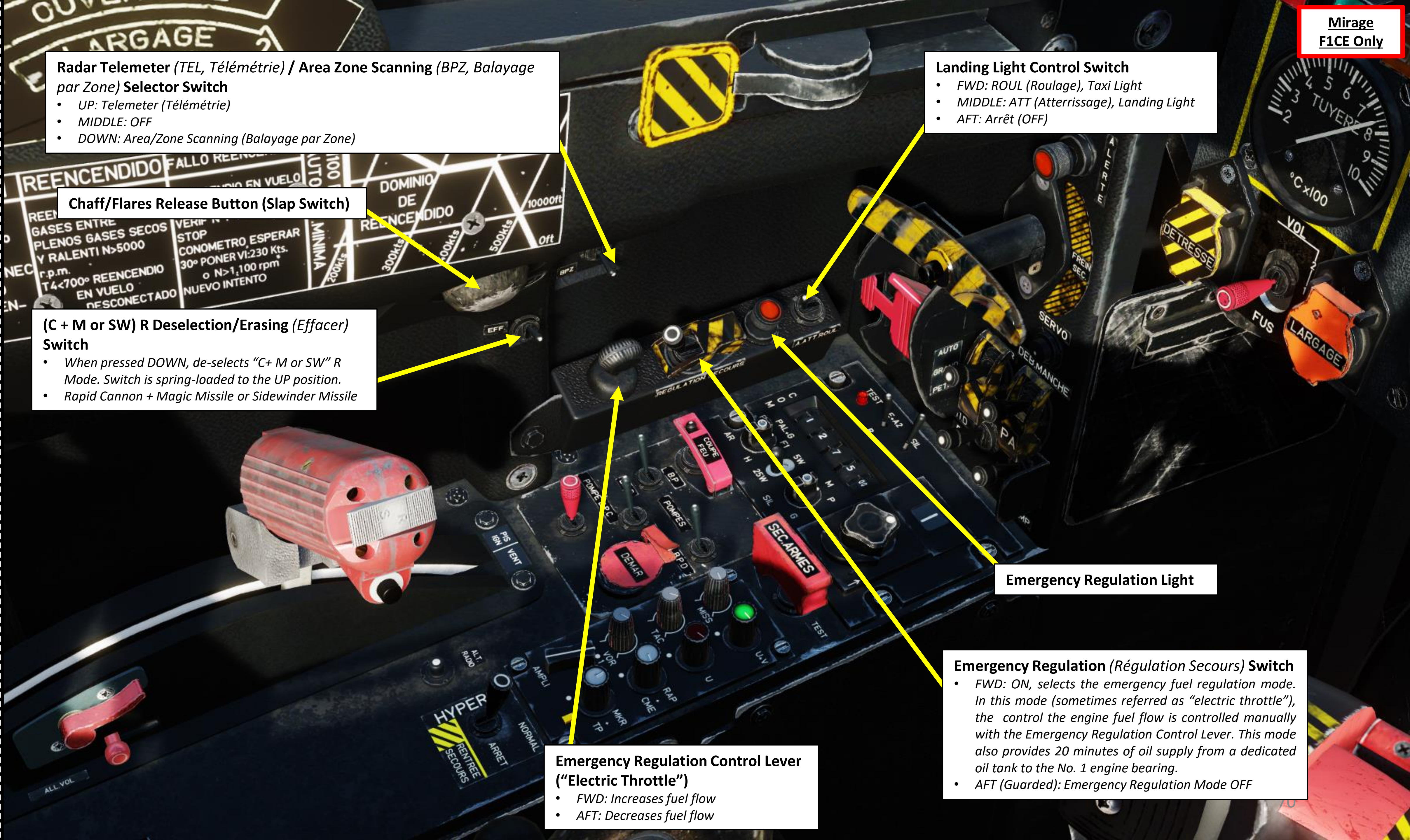
Servo Reset Button
- *When pressed, button allows for a reset of the flight control servos if all the operation conditions are met*

Stick Uncouple Switch *(Débrayage Manche)*
- *UP (Guarded): OFF, normal position*
- *DOWN: ON, stick uncoupled. In this position, the stick switches auxiliary servocontrols to the second barrel (hydraulic system No. 2), which is not electrically controlled. In other words, the stick is uncoupled from the autopilot / pre-servo control and switches to the back-up direct control. This would be used in case of partial hydraulics failure or autopilot system failure.*

Pitch Switch
- *UP: ON, activates the pitch electrohydraulic mode*
- *DOWN: OFF, deactivates the pitch electrohydraulic mode*

Yaw/Anti-Slip Switch
- *UP: ANTI-D (Anti-Dérape), Anti-Slip mode compensates any sideslip in stabilized flight*
- *MIDDLE: DIR (Direction), yaw electrohydraulic mode*
- *DOWN: OFF*

Mirage F1CE Only



Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

Chaff/Flares Release Button (Slap Switch)

(C + M or SW) R Deselection/Erasing *(Effacer)* **Switch**
- *When pressed DOWN, de-selects "C+ M or SW" R Mode. Switch is spring-loaded to the UP position.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

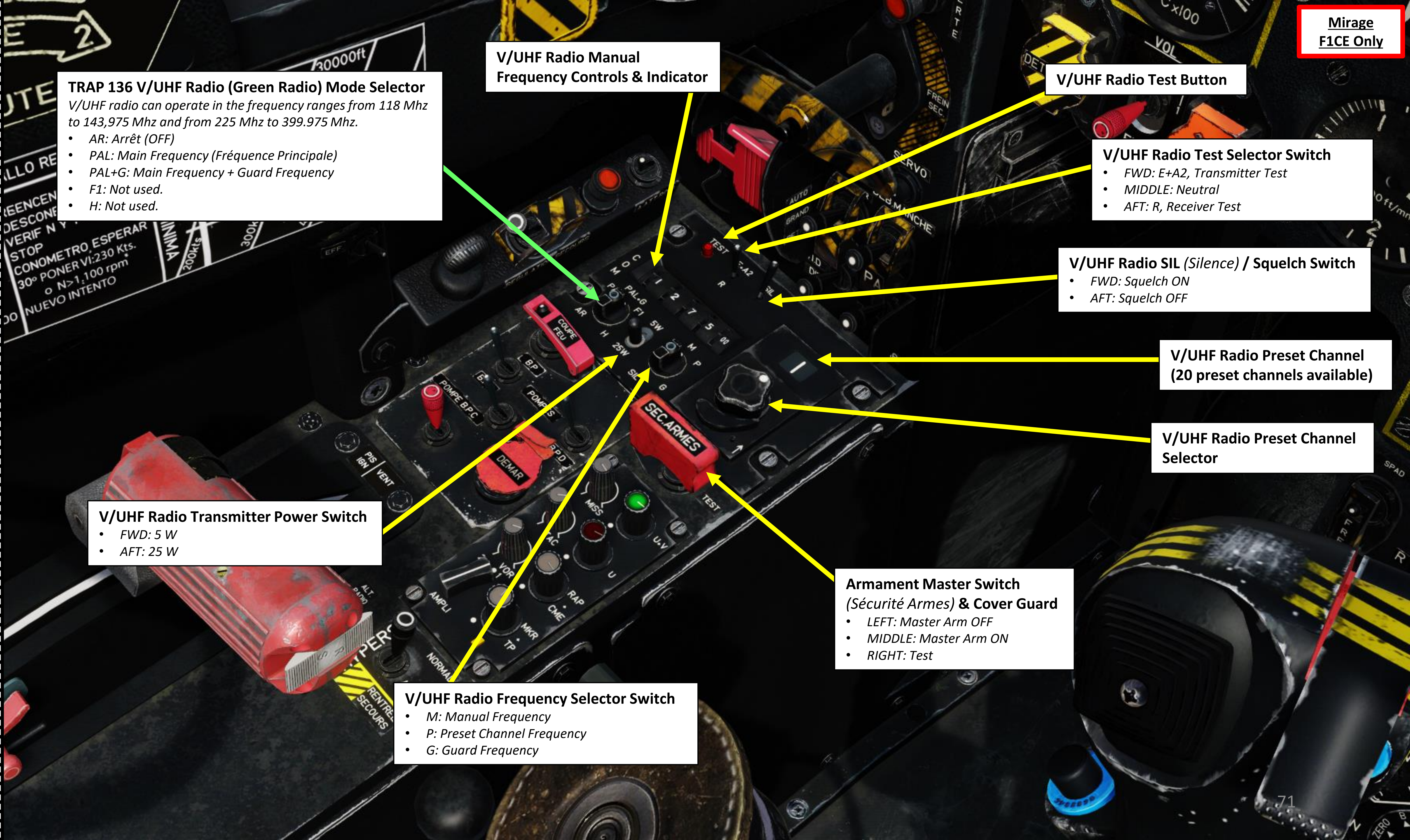
Landing Light Control Switch
- *FWD: ROUL (Roulage), Taxi Light*
- *MIDDLE: ATT (Atterrissage), Landing Light*
- *AFT: Arrêt (OFF)*

Emergency Regulation Light

Emergency Regulation Control Lever ("Electric Throttle")
- *FWD: Increases fuel flow*
- *AFT: Decreases fuel flow*

Emergency Regulation *(Régulation Secours)* **Switch**
- *FWD: ON, selects the emergency fuel regulation mode. In this mode (sometimes referred as "electric throttle"), the control the engine fuel flow is controlled manually with the Emergency Regulation Control Lever. This mode also provides 20 minutes of oil supply from a dedicated oil tank to the No. 1 engine bearing.*
- *AFT (Guarded): Emergency Regulation Mode OFF*

Mirage F1CE Only



TRAP 136 V/UHF Radio (Green Radio) Mode Selector
V/UHF radio can operate in the frequency ranges from 118 Mhz to 143,975 Mhz and from 225 Mhz to 399.975 Mhz.
- *AR: Arrêt (OFF)*
- *PAL: Main Frequency (Fréquence Principale)*
- *PAL+G: Main Frequency + Guard Frequency*
- *F1: Not used.*
- *H: Not used.*

V/UHF Radio Manual Frequency Controls & Indicator

V/UHF Radio Test Button

V/UHF Radio Test Selector Switch
- *FWD: E+A2, Transmitter Test*
- *MIDDLE: Neutral*
- *AFT: R, Receiver Test*

V/UHF Radio SIL ***(Silence)*** **/ Squelch Switch**
- *FWD: Squelch ON*
- *AFT: Squelch OFF*

V/UHF Radio Preset Channel (20 preset channels available)

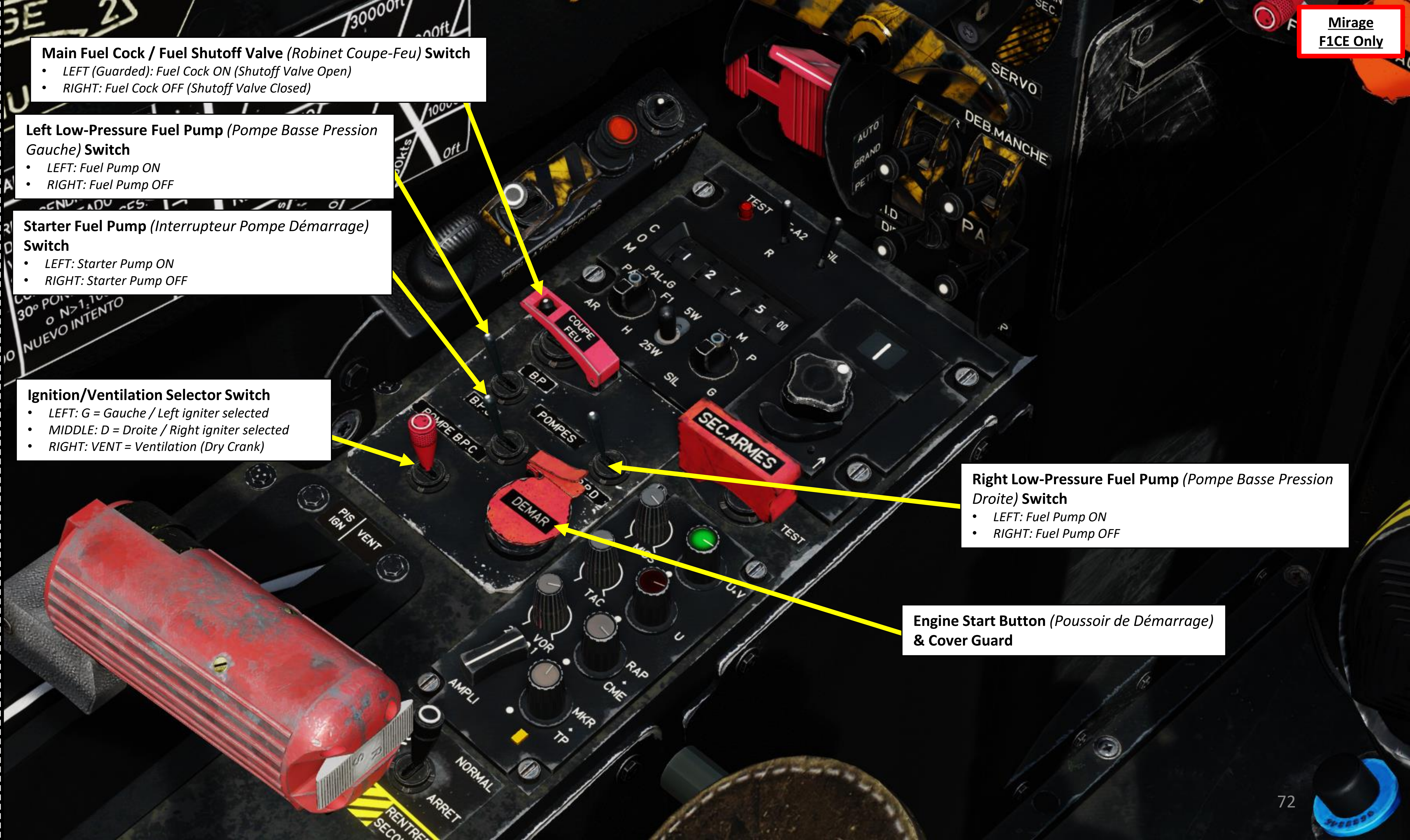
V/UHF Radio Preset Channel Selector

V/UHF Radio Transmitter Power Switch
- *FWD: 5 W*
- *AFT: 25 W*

Armament Master Switch ***(Sécurité Armes)*** **& Cover Guard**
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

V/UHF Radio Frequency Selector Switch
- *M: Manual Frequency*
- *P: Preset Channel Frequency*
- *G: Guard Frequency*

Mirage F1CE Only



Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*

Left Low-Pressure Fuel Pump *(Pompe Basse Pression Gauche)* **Switch**
- *LEFT: Fuel Pump ON*
- *RIGHT: Fuel Pump OFF*

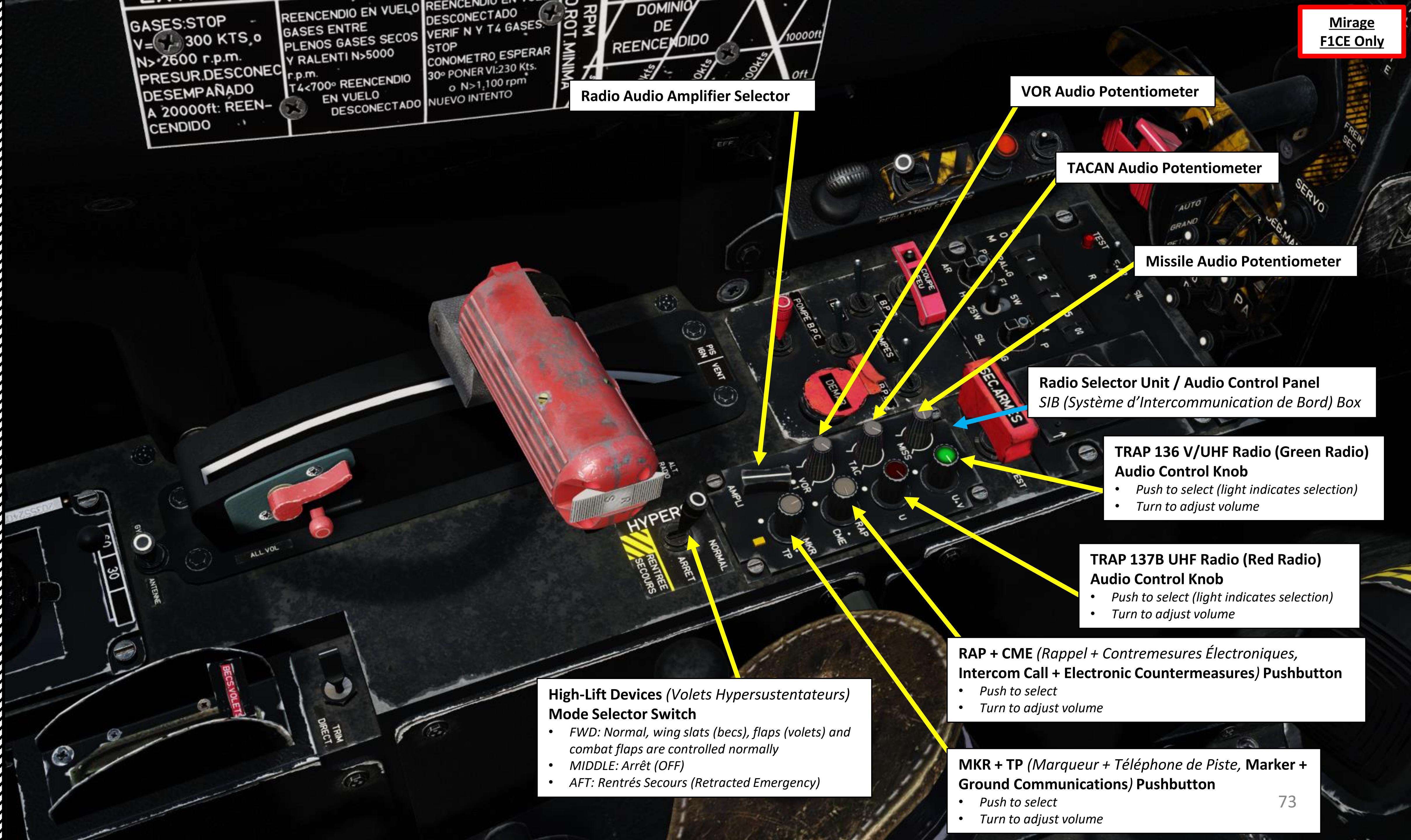
Starter Fuel Pump *(Interrupteur Pompe Démarrage)* **Switch**
- *LEFT: Starter Pump ON*
- *RIGHT: Starter Pump OFF*

Ignition/Ventilation Selector Switch
- *LEFT: G = Gauche / Left igniter selected*
- *MIDDLE: D = Droite / Right igniter selected*
- *RIGHT: VENT = Ventilation (Dry Crank)*

Right Low-Pressure Fuel Pump *(Pompe Basse Pression Droite)* **Switch**
- *LEFT: Fuel Pump ON*
- *RIGHT: Fuel Pump OFF*

Engine Start Button *(Poussoir de Démarrage)* **& Cover Guard**

Mirage F1CE Only



Radio Audio Amplifier Selector

VOR Audio Potentiometer

TACAN Audio Potentiometer

Missile Audio Potentiometer

Radio Selector Unit / Audio Control Panel
SIB (Système d'Intercommunication de Bord) Box

TRAP 136 V/UHF Radio (Green Radio) Audio Control Knob
- *Push to select (light indicates selection)*
- *Turn to adjust volume*

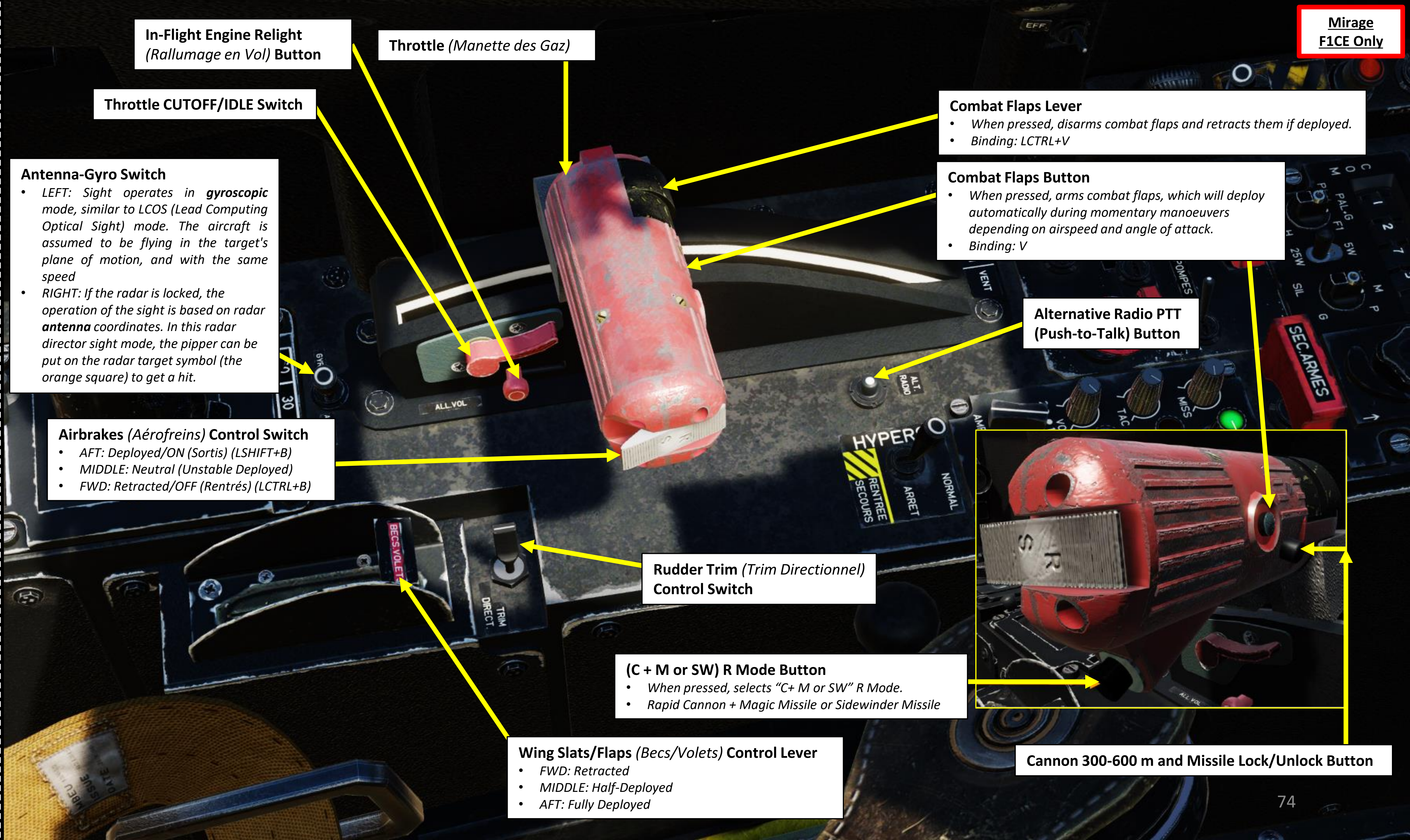
TRAP 137B UHF Radio (Red Radio) Audio Control Knob
- *Push to select (light indicates selection)*
- *Turn to adjust volume*

RAP + CME *(Rappel + Contremesures Électroniques,* **Intercom Call + Electronic Countermeasures***)* **Pushbutton**
- *Push to select*
- *Turn to adjust volume*

MKR + TP *(Marqueur + Téléphone de Piste,* **Marker + Ground Communications***)* **Pushbutton**
- *Push to select*
- *Turn to adjust volume*

High-Lift Devices *(Volets Hypersustentateurs)* **Mode Selector Switch**
- *FWD: Normal, wing slats (becs), flaps (volets) and combat flaps are controlled normally*
- *MIDDLE: Arrêt (OFF)*
- *AFT: Rentrés Secours (Retracted Emergency)*

Mirage F1CE Only



In-Flight Engine Relight *(Rallumage en Vol)* **Button**

Throttle *(Manette des Gaz)*

Throttle CUTOFF/IDLE Switch

Antenna-Gyro Switch
- *LEFT: Sight operates in* ***gyroscopic*** *mode, similar to LCOS (Lead Computing Optical Sight) mode. The aircraft is assumed to be flying in the target's plane of motion, and with the same speed*
- *RIGHT: If the radar is locked, the operation of the sight is based on radar* ***antenna*** *coordinates. In this radar director sight mode, the pipper can be put on the radar target symbol (the orange square) to get a hit.*

Airbrakes *(Aérofreins)* **Control Switch**
- *AFT: Deployed/ON (Sortis) (LSHIFT+B)*
- *MIDDLE: Neutral (Unstable Deployed)*
- *FWD: Retracted/OFF (Rentrés) (LCTRL+B)*

Combat Flaps Lever
- *When pressed, disarms combat flaps and retracts them if deployed.*
- *Binding: LCTRL+V*

Combat Flaps Button
- *When pressed, arms combat flaps, which will deploy automatically during momentary manoeuvers depending on airspeed and angle of attack.*
- *Binding: V*

Alternative Radio PTT (Push-to-Talk) Button

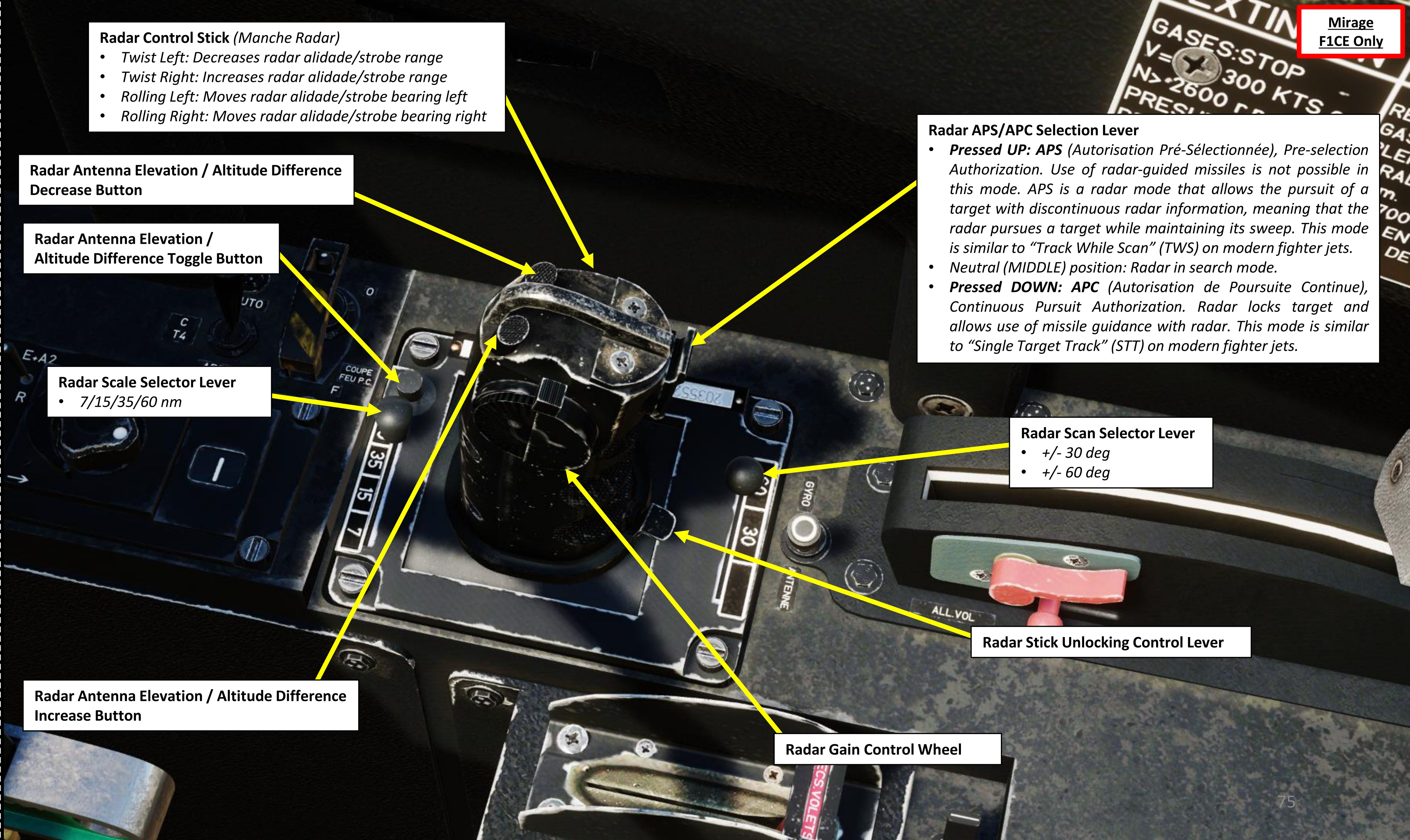
Rudder Trim *(Trim Directionnel)* **Control Switch**

(C + M or SW) R Mode Button
- *When pressed, selects "C+ M or SW" R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

Wing Slats/Flaps *(Becs/Volets)* **Control Lever**
- *FWD: Retracted*
- *MIDDLE: Half-Deployed*
- *AFT: Fully Deployed*

Cannon 300-600 m and Missile Lock/Unlock Button

Mirage F1CE Only



Radar Control Stick *(Manche Radar)*
- *Twist Left: Decreases radar alidade/strobe range*
- *Twist Right: Increases radar alidade/strobe range*
- *Rolling Left: Moves radar alidade/strobe bearing left*
- *Rolling Right: Moves radar alidade/strobe bearing right*

Radar Antenna Elevation / Altitude Difference Decrease Button

Radar Antenna Elevation / Altitude Difference Toggle Button

Radar Scale Selector Lever
- *7/15/35/60 nm*

Radar Antenna Elevation / Altitude Difference Increase Button

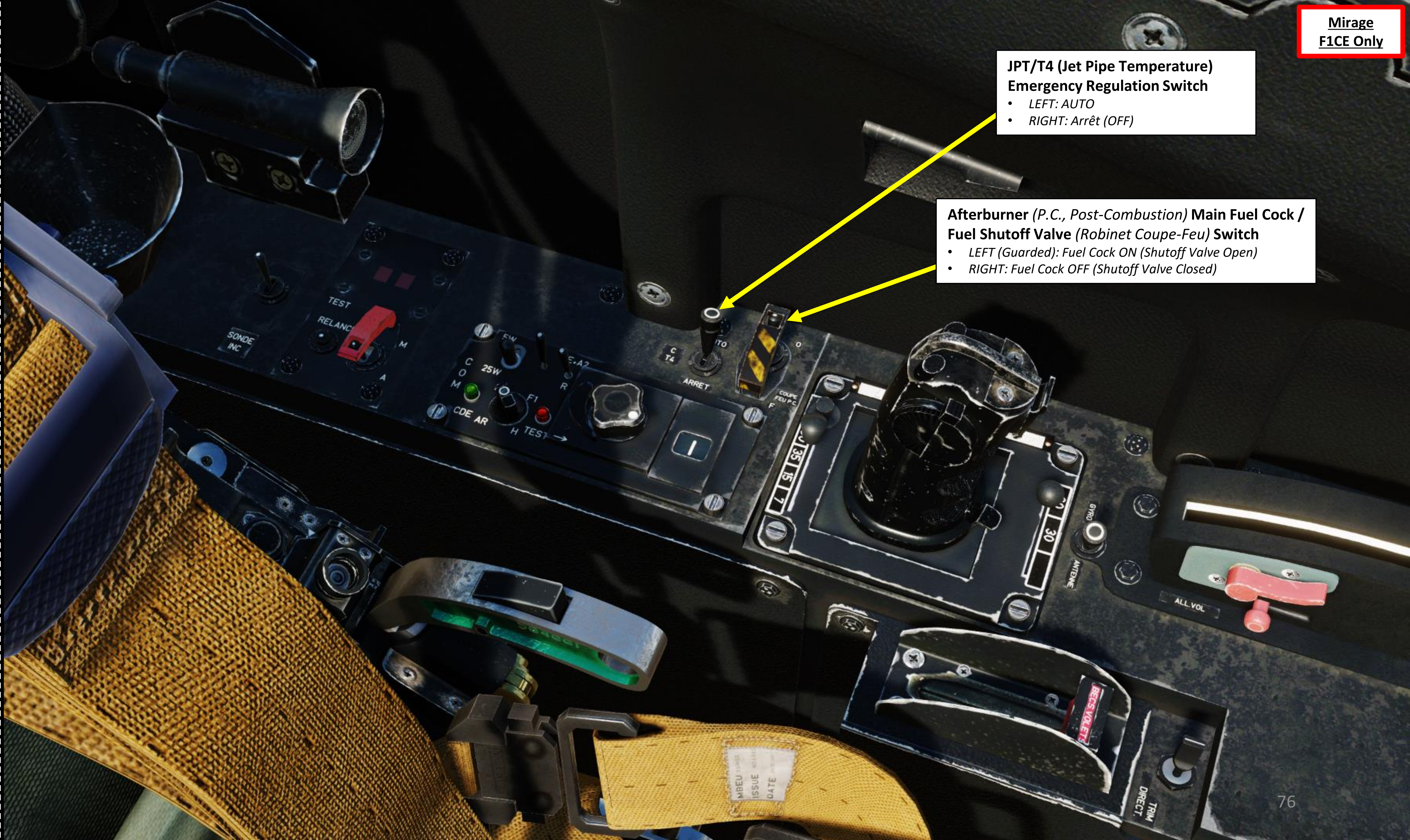
Radar APS/APC Selection Lever
- ***Pressed UP: APS*** *(Autorisation Pré-Sélectionnée), Pre-selection Authorization. Use of radar-guided missiles is not possible in this mode. APS is a radar mode that allows the pursuit of a target with discontinuous radar information, meaning that the radar pursues a target while maintaining its sweep. This mode is similar to "Track While Scan" (TWS) on modern fighter jets.*
- *Neutral (MIDDLE) position: Radar in search mode.*
- ***Pressed DOWN: APC*** *(Autorisation de Poursuite Continue), Continuous Pursuit Authorization. Radar locks target and allows use of missile guidance with radar. This mode is similar to "Single Target Track" (STT) on modern fighter jets.*

Radar Scan Selector Lever
- *+/- 30 deg*
- *+/- 60 deg*

Radar Stick Unlocking Control Lever

Radar Gain Control Wheel

Mirage F1CE Only



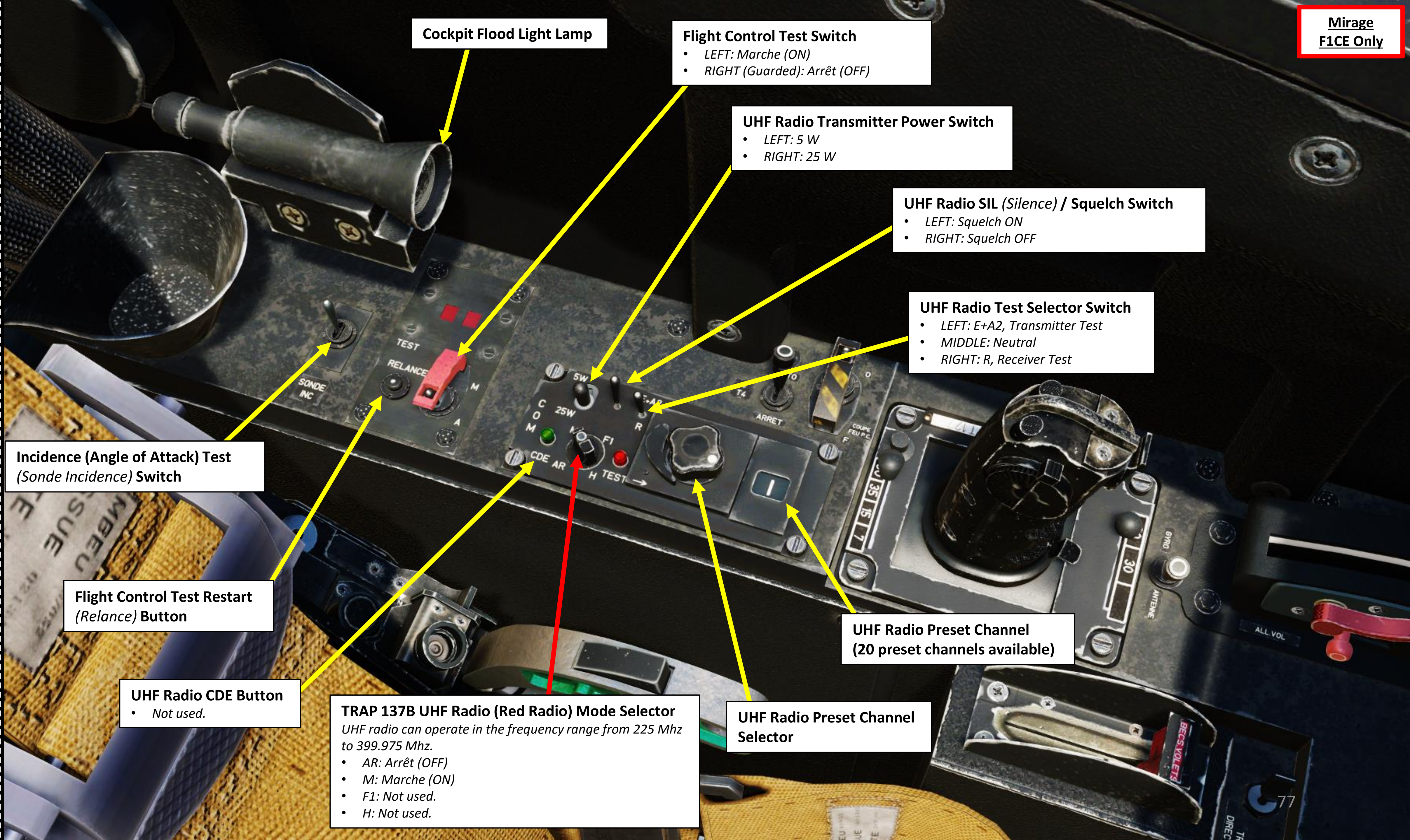
JPT/T4 (Jet Pipe Temperature) Emergency Regulation Switch

- *LEFT: AUTO*
- *RIGHT: Arrêt (OFF)*

Afterburner *(P.C., Post-Combustion)* **Main Fuel Cock / Fuel Shutoff Valve** *(Robinet Coupe-Feu)* **Switch**

- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*

Mirage F1CE Only



Cockpit Flood Light Lamp

Flight Control Test Switch
- *LEFT: Marche (ON)*
- *RIGHT (Guarded): Arrêt (OFF)*

UHF Radio Transmitter Power Switch
- *LEFT: 5 W*
- *RIGHT: 25 W*

UHF Radio SIL *(Silence)* **/ Squelch Switch**
- *LEFT: Squelch ON*
- *RIGHT: Squelch OFF*

UHF Radio Test Selector Switch
- *LEFT: E+A2, Transmitter Test*
- *MIDDLE: Neutral*
- *RIGHT: R, Receiver Test*

Incidence (Angle of Attack) Test *(Sonde Incidence)* **Switch**

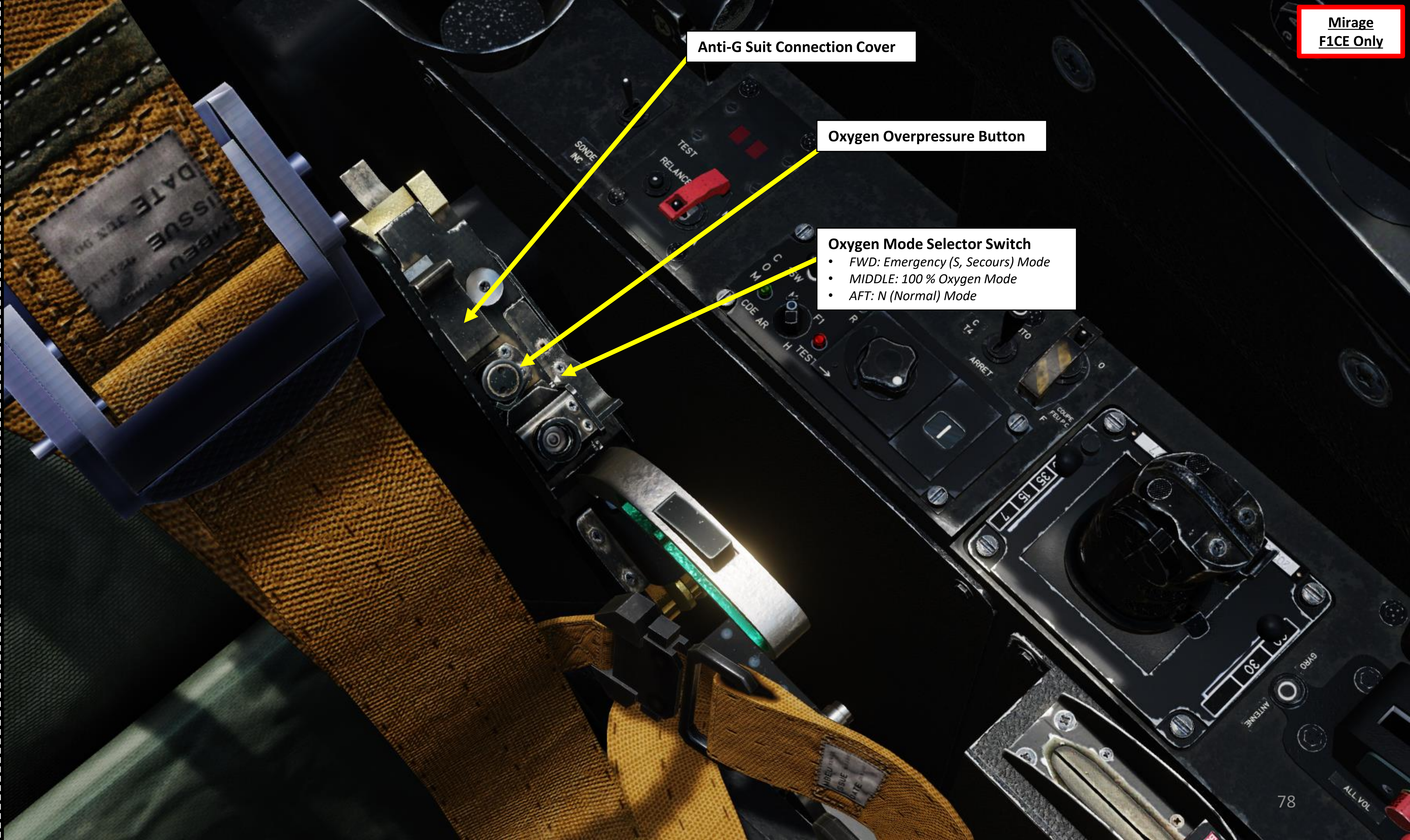
Flight Control Test Restart *(Relance)* **Button**

UHF Radio CDE Button
- *Not used.*

TRAP 137B UHF Radio (Red Radio) Mode Selector
UHF radio can operate in the frequency range from 225 Mhz to 399.975 Mhz.
- *AR: Arrêt (OFF)*
- *M: Marche (ON)*
- *F1: Not used.*
- *H: Not used.*

UHF Radio Preset Channel Selector

UHF Radio Preset Channel (20 preset channels available)


Mirage F1CE Only
Anti-G Suit Connection Cover
Oxygen Overpressure Button
Oxygen Mode Selector Switch
• FWD: Emergency (S, Secours) Mode
• MIDDLE: 100 % Oxygen Mode
• AFT: N (Normal) Mode
SONDE INC
TEST
RELANCE
COE AR
TEST
FI
R
ARRET
COUPE FEU P.C.
ANTENNE
GYRO
ALL VOL

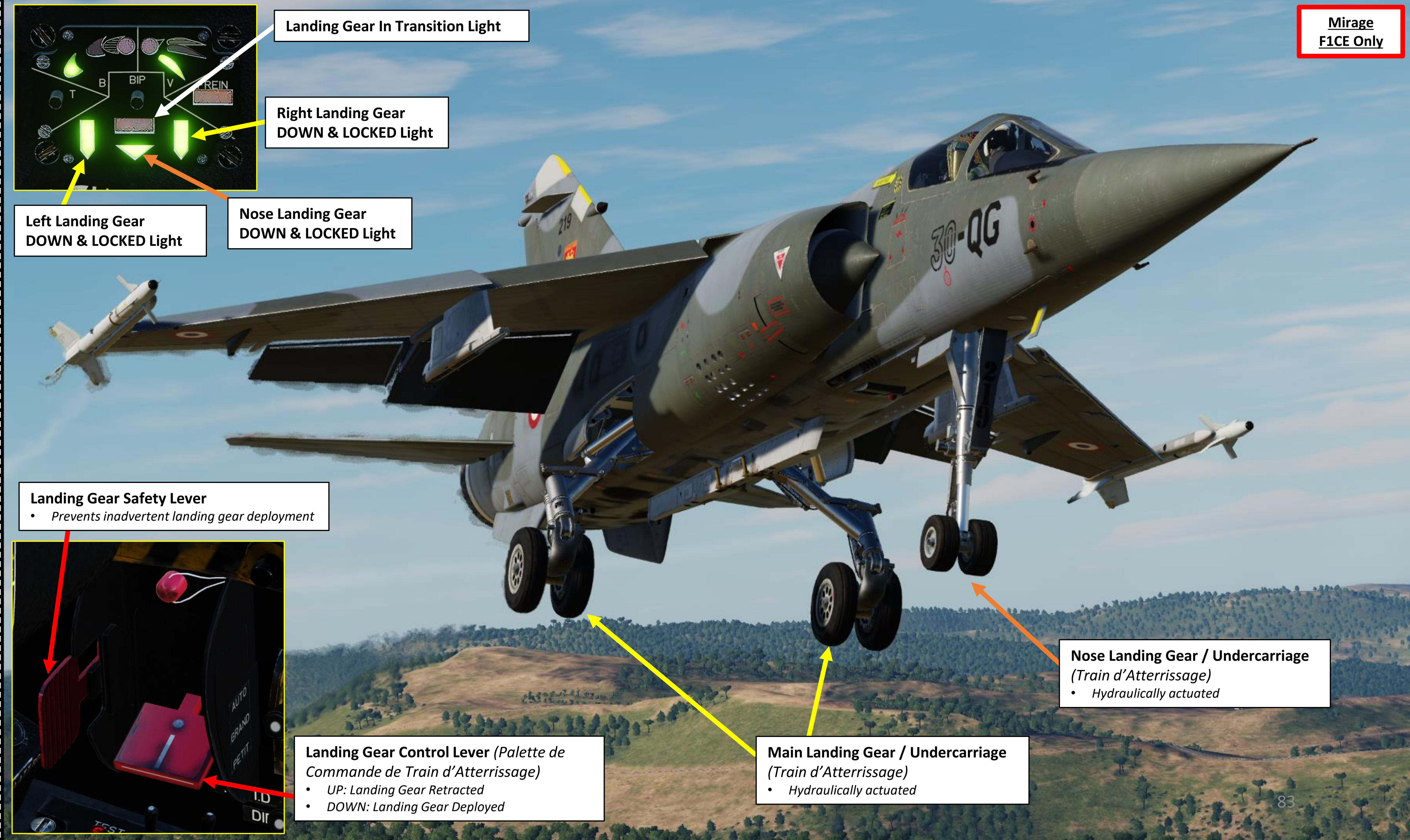
Mirage F1CE Only


Mirage F1CE Only
Canopy Breaker Knife
(Couteau Brise-Verrière)
- *Canopy breaker tool used to shatter the canopy glass*

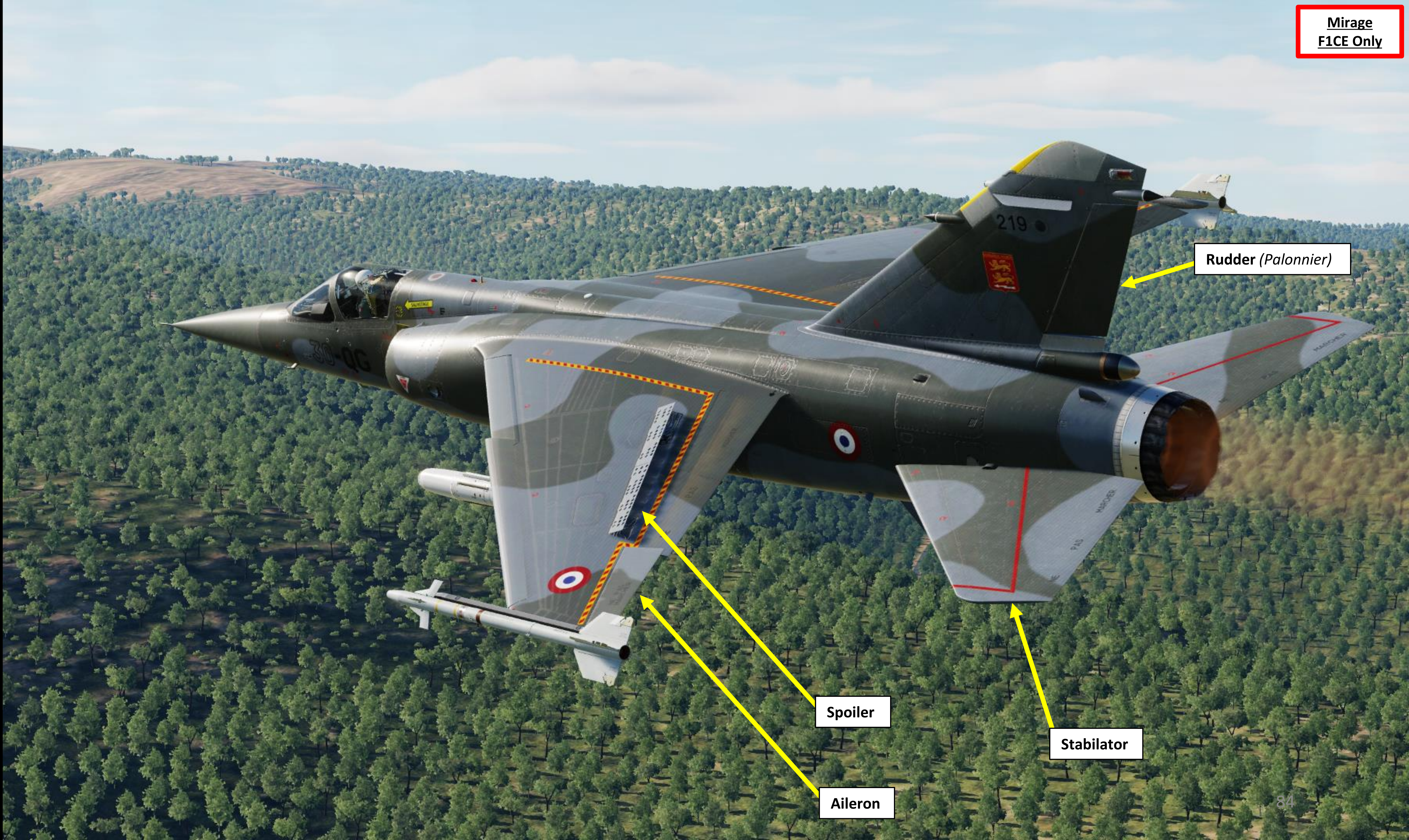
Mirage F1CE Only

Mirage F1CE Only

Flashlight
- ON/OFF: LALT+L


Mirage F1CE Only
Landing Gear In Transition Light
Right Landing Gear DOWN & LOCKED Light
Left Landing Gear DOWN & LOCKED Light
Nose Landing Gear DOWN & LOCKED Light
BIP
B
V
T
FREIN
Landing Gear Safety Lever
• Prevents inadvertent landing gear deployment
Landing Gear Control Lever (Palette de Commande de Train d’Atterrissage)
• UP: Landing Gear Retracted
• DOWN: Landing Gear Deployed
AUTO
GRAND
PETIT
DIR
Main Landing Gear / Undercarriage (Train d’Atterrissage)
• Hydraulically actuated
Nose Landing Gear / Undercarriage (Train d’Atterrissage)
• Hydraulically actuated
30-QG
219

Mirage F1CE Only



Mirage F1CE Only

Engine Shock Cone *(Souris)*

- Slows the flow of air from supersonic flight speed to a subsonic speed before it enters the engine to prevent ingestion of shock waves.

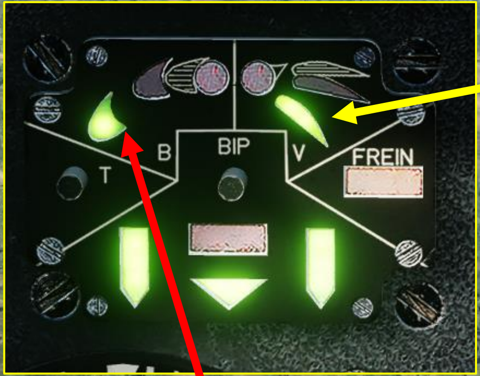
Mirage F1CE Only

AF ***(Aérofreins)*** **Airbrakes Light**
- *Illuminates when airbrakes are deployed*

Airbrakes ***(Aérofreins)*** **Control Switch**
- *AFT: Deployed/ON (Sortis) (LSHIFT+B)*
- *MIDDLE: Neutral (Unstable Deployed)*
- *FWD: Retracted/OFF (Rentrés) (LCTRL+B)*

Airbrakes ***(Aérofreins)***
- *Hydraulically actuated*

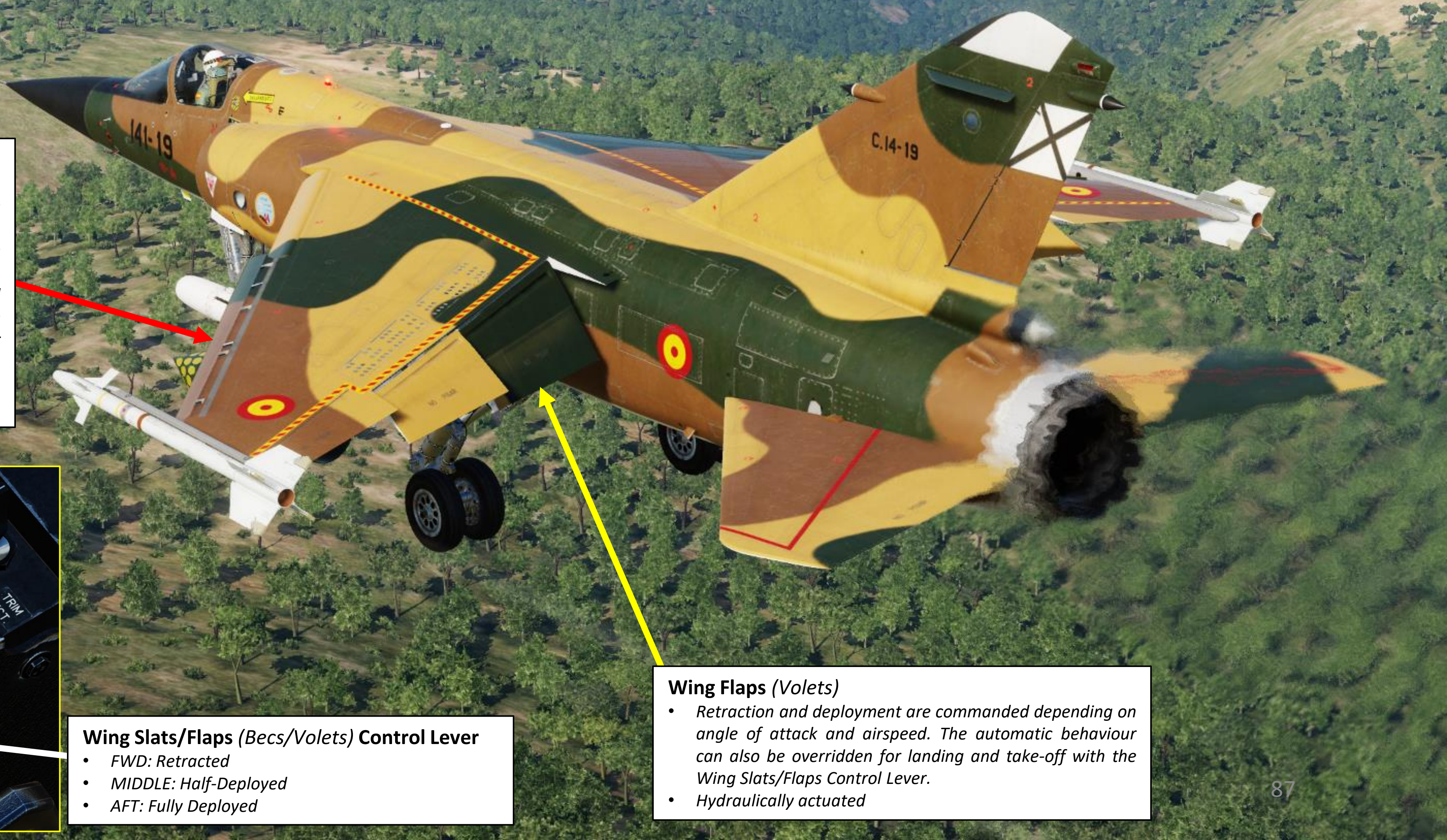
Mirage F1CE Only



Wing Flaps *(Volets)* **Position Lights**

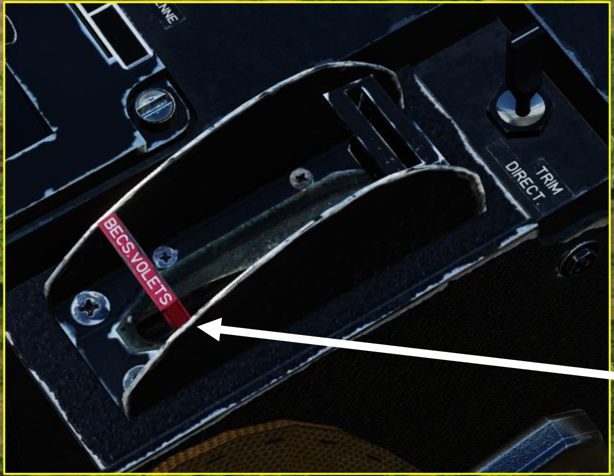
Wing Slats *(Becs)* **Position Lights**

Selected configuration		Slats		Flaps	
		Inner	Outer	Inner	Outer
Automatic / combat mode	Automatic slats (aoa > 8º, Vi < 440 kt and M < 0.98)	Full out	Half out	Retracted	Retracted
	Combat flaps/slats (Vi < 300 kt, M < 0.75)	Full out	Full out	Half out	Half out
Take-off/landing mode	Slats + medium flaps	Full out	Full out	Half out	Half out
	Slats + full flaps	Full out	Full out	Full out	Full out



Wing Slats *(Becs)*

- *Re-directs the airflow at the front of the wing, allowing it to flow more smoothly over the upper surface at a high angle of attack. This allows the wing to be operated effectively at the higher angles required to produce more lift.*
- *Retraction and deployment are commanded depending on angle of attack and airspeed. The automatic behaviour can also be overridden for landing and take-off with the Wing Slats/Flaps Control Lever.*
- *Hydraulically actuated*



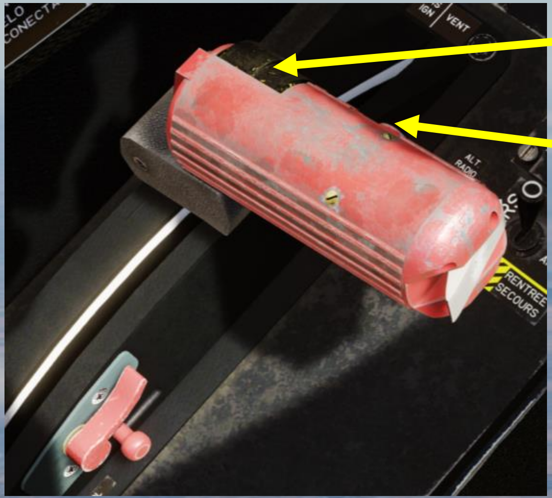
Wing Slats/Flaps *(Becs/Volets)* **Control Lever**

- *FWD: Retracted*
- *MIDDLE: Half-Deployed*
- *AFT: Fully Deployed*

Wing Flaps *(Volets)*

- *Retraction and deployment are commanded depending on angle of attack and airspeed. The automatic behaviour can also be overridden for landing and take-off with the Wing Slats/Flaps Control Lever.*
- *Hydraulically actuated*

Mirage F1CE Only

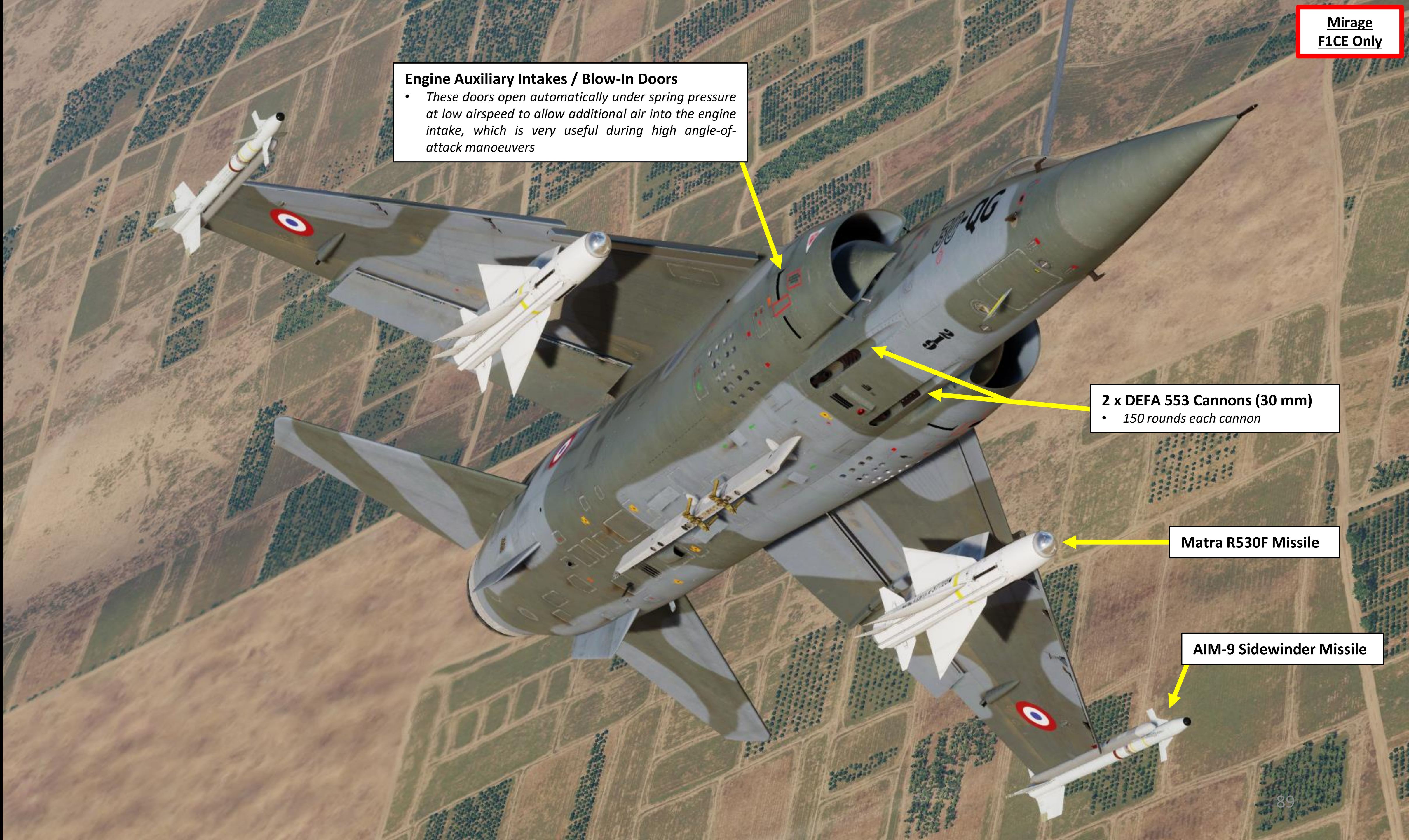


Combat Flaps Lever
- *When pressed, disarms combat flaps and retracts them if deployed.*
- *Binding: LCTRL+V*

Combat Flaps Button
- *When pressed, arms combat flaps, which will deploy automatically during momentary manoeuvers depending on airspeed and angle of attack.*
- *Binding: V*

V CBT (Combat Flaps) Light
- *Illuminated (steady): Combat flaps are extended within envelope*
- *Illuminated (flashing): Combat flaps are extended outside the envelope, or combat flaps are armed and flaps are extended with the slats/flaps lever*

Combat Flaps
- *Combat flaps operate at a higher speed than intermediate flaps and give better angle of attack control and energy management*
- *Combat flaps are armed using the Combat Flaps Button and automatically deploy depending on airspeed and angle of attack restrictions.*
- *Note: Moving the Slat/Flap handle to HALF (MIDDLE) or FULL (AFT) disables the High-Lift Devices function and combat flaps.*


Mirage F1CE Only
Engine Auxiliary Intakes / Blow-In Doors
• These doors open automatically under spring pressure at low airspeed to allow additional air into the engine intake, which is very useful during high angle-of-attack manoeuvers
2 x DEFA 553 Cannons (30 mm)
• 150 rounds each cannon
Matra R530F Missile
AIM-9 Sidewinder Missile

Mirage F1CE Only

Landing Light Control Switch
- *FWD: ROUL (Roulage), Taxi Light*
- *MIDDLE: ATT (Atterrissage), Landing Light*
- *AFT: Arrêt (OFF)*

<u>**Mirage F1CE Only**</u>

Navigation Light *(Feu de Navigation)*

Formation Light *(Feu de Formation)*

Navigation Light *(Feu de Navigation)*

Navigation Light *(Feu de Navigation)*

Navigation Light *(Feu de Navigation)*

Navigation Lights *(Feux de Navigation)* **Control Switch**
- *UP: Fort (Bright)*
- *MIDDLE: Arrêt (OFF)*
- *DOWN: Faible (Dim)*

Formation Lights *(Feux de Formation)* **Control Switch**
- *UP: Clignotant (Blinking)*
- *MIDDLE: Arrêt (OFF)*
- *DOWN: Fixe (Steady)*

Mirage F1CE Only

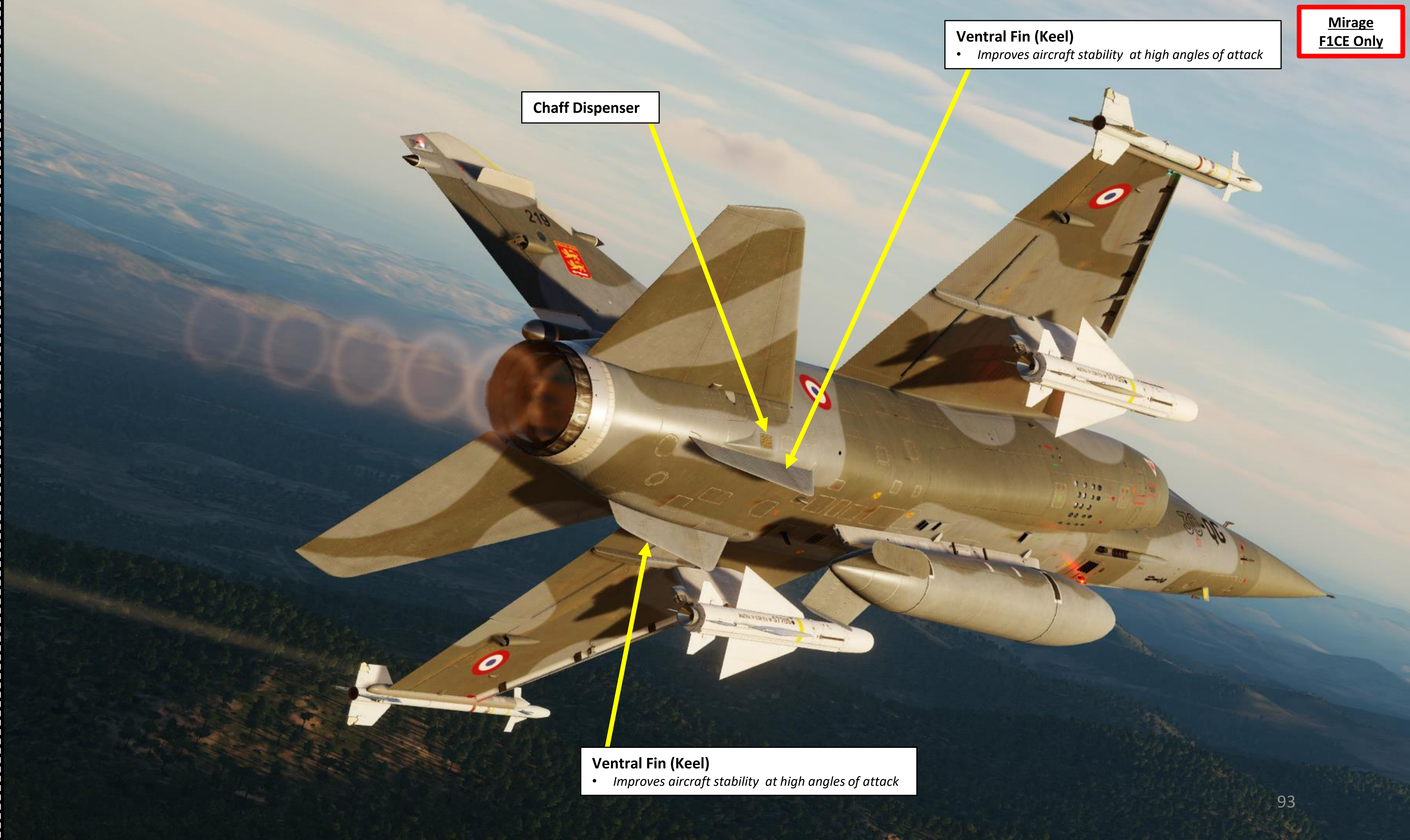
Search Light *(Phare de Police)*

Search Light Control Button *(Phare de Police)*

- *Press to turn on Search Light*

Search Light *(Phare de Police)* **Switch**

- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*


Mirage F1CE Only
Ventral Fin (Keel)
• Improves aircraft stability at high angles of attack
Chaff Dispenser
219
Ventral Fin (Keel)
• Improves aircraft stability at high angles of attack

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

Mirage F1CE Only

PART 4 – COCKPIT & EQUIPMENT

MIRAGE F1EE

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only

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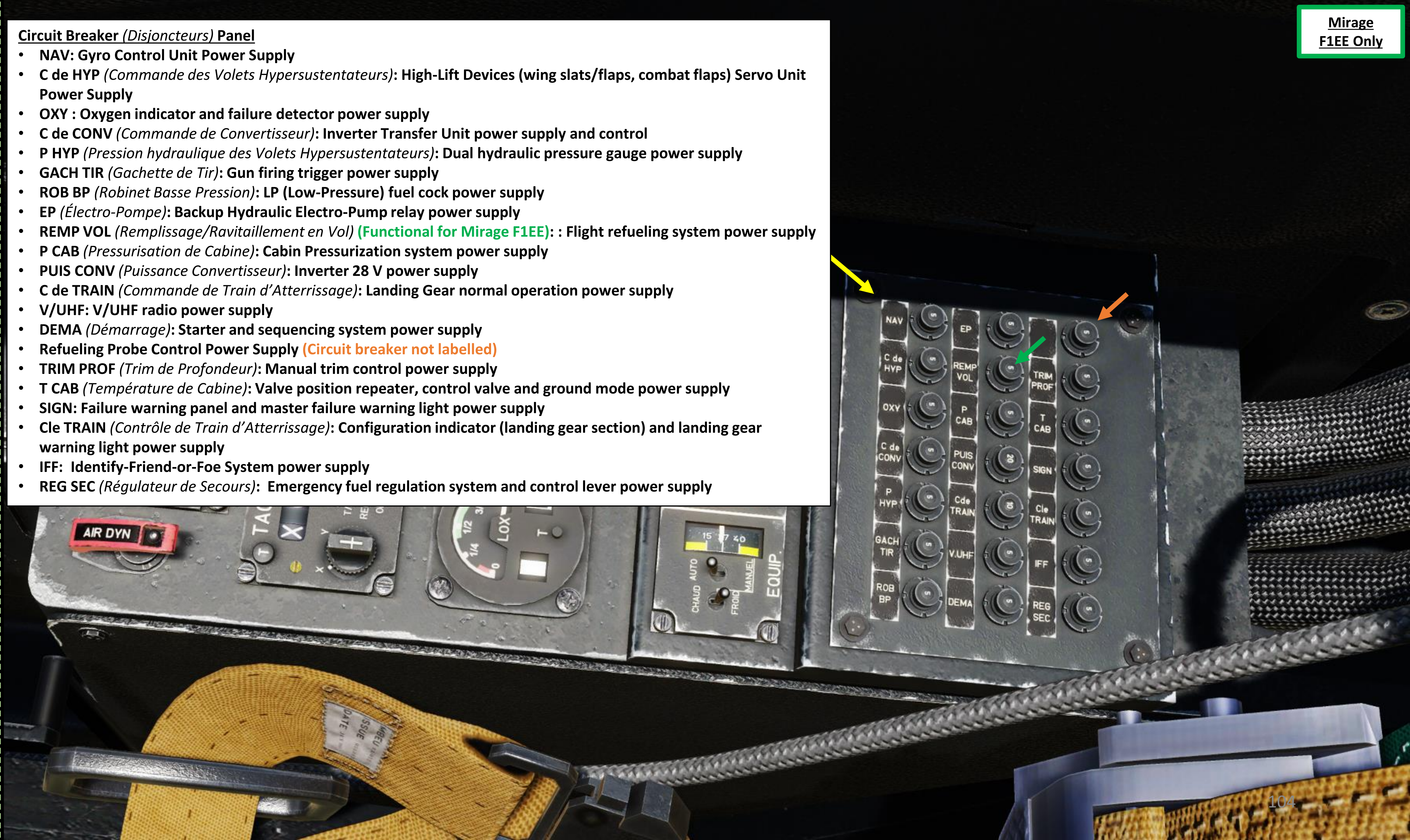
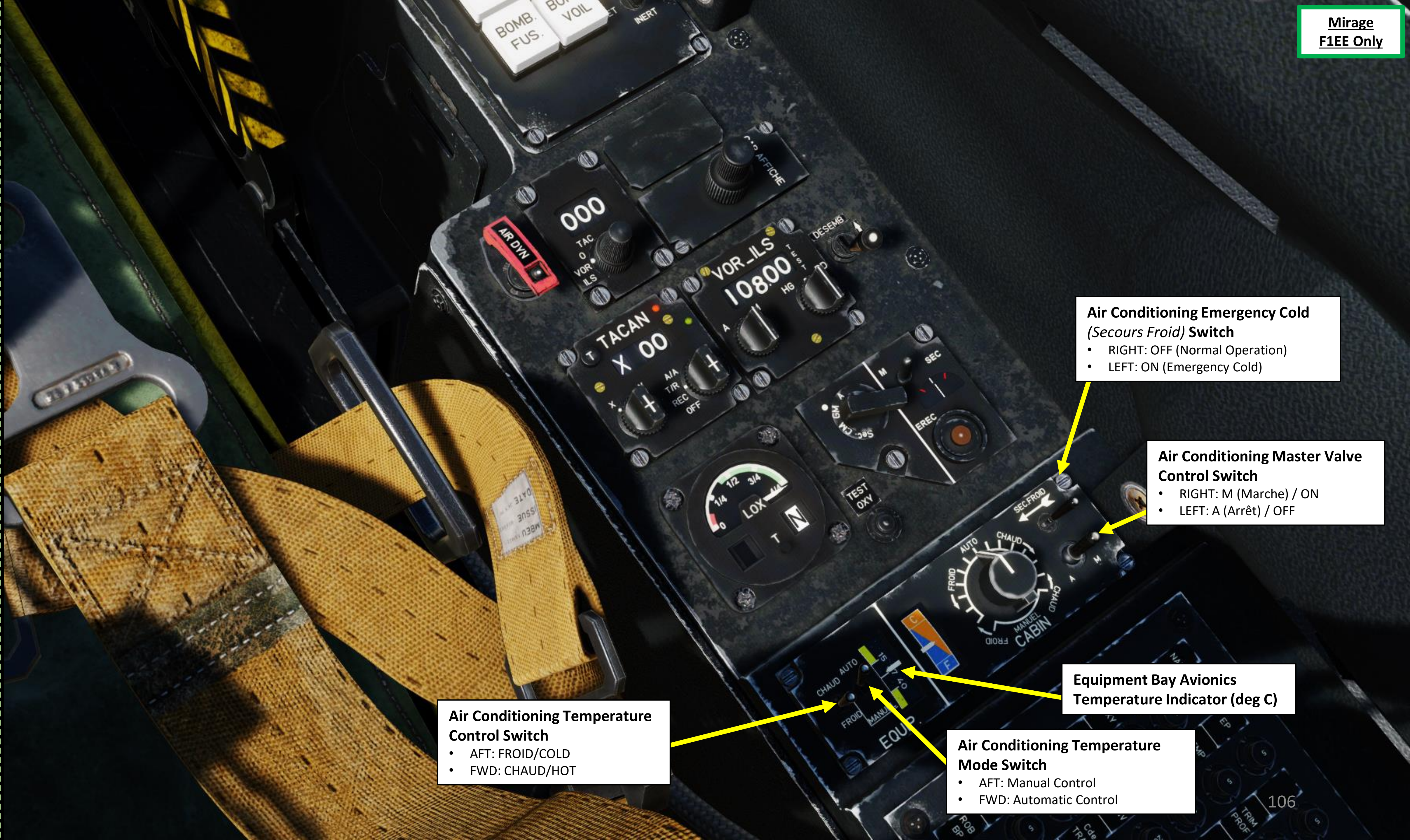


Circuit Breaker *(Disjoncteurs)* Panel

- **NAV: Gyro Control Unit Power Supply**
- **C de HYP** *(Commande des Volets Hypersustentateurs)*: **High-Lift Devices (wing slats/flaps, combat flaps) Servo Unit Power Supply**
- **OXY : Oxygen indicator and failure detector power supply**
- **C de CONV** *(Commande de Convertisseur)*: **Inverter Transfer Unit power supply and control**
- **P HYP** *(Pression hydraulique des Volets Hypersustentateurs)*: **Dual hydraulic pressure gauge power supply**
- **GACH TIR** *(Gachette de Tir)*: **Gun firing trigger power supply**
- **ROB BP** *(Robinet Basse Pression)*: **LP (Low-Pressure) fuel cock power supply**
- **EP** *(Électro-Pompe)*: **Backup Hydraulic Electro-Pump relay power supply**
- **REMP VOL** *(Remplissage/Ravitaillement en Vol)* **(Functional for Mirage F1EE): : Flight refueling system power supply**
- **P CAB** *(Pressurisation de Cabine)*: **Cabin Pressurization system power supply**
- **PUIS CONV** *(Puissance Convertisseur)*: **Inverter 28 V power supply**
- **C de TRAIN** *(Commande de Train d'Atterrissage)*: **Landing Gear normal operation power supply**
- **V/UHF: V/UHF radio power supply**
- **DEMA** *(Démarrage)*: **Starter and sequencing system power supply**
- **Refueling Probe Control Power Supply (Circuit breaker not labelled)**
- **TRIM PROF** *(Trim de Profondeur)*: **Manual trim control power supply**
- **T CAB** *(Température de Cabine)*: **Valve position repeater, control valve and ground mode power supply**
- **SIGN: Failure warning panel and master failure warning light power supply**
- **Cle TRAIN** *(Contrôle de Train d'Atterrissage)*: **Configuration indicator (landing gear section) and landing gear warning light power supply**
- **IFF: Identify-Friend-or-Foe System power supply**
- **REG SEC** *(Régulateur de Secours)*: **Emergency fuel regulation system and control lever power supply**

Mirage F1EE Only

Mirage F1EE Only



Air Conditioning Emergency Cold *(Secours Froid)* Switch
- RIGHT: OFF (Normal Operation)
- LEFT: ON (Emergency Cold)

Air Conditioning Master Valve Control Switch
- RIGHT: M (Marche) / ON
- LEFT: A (Arrêt) / OFF

Equipment Bay Avionics Temperature Indicator (deg C)

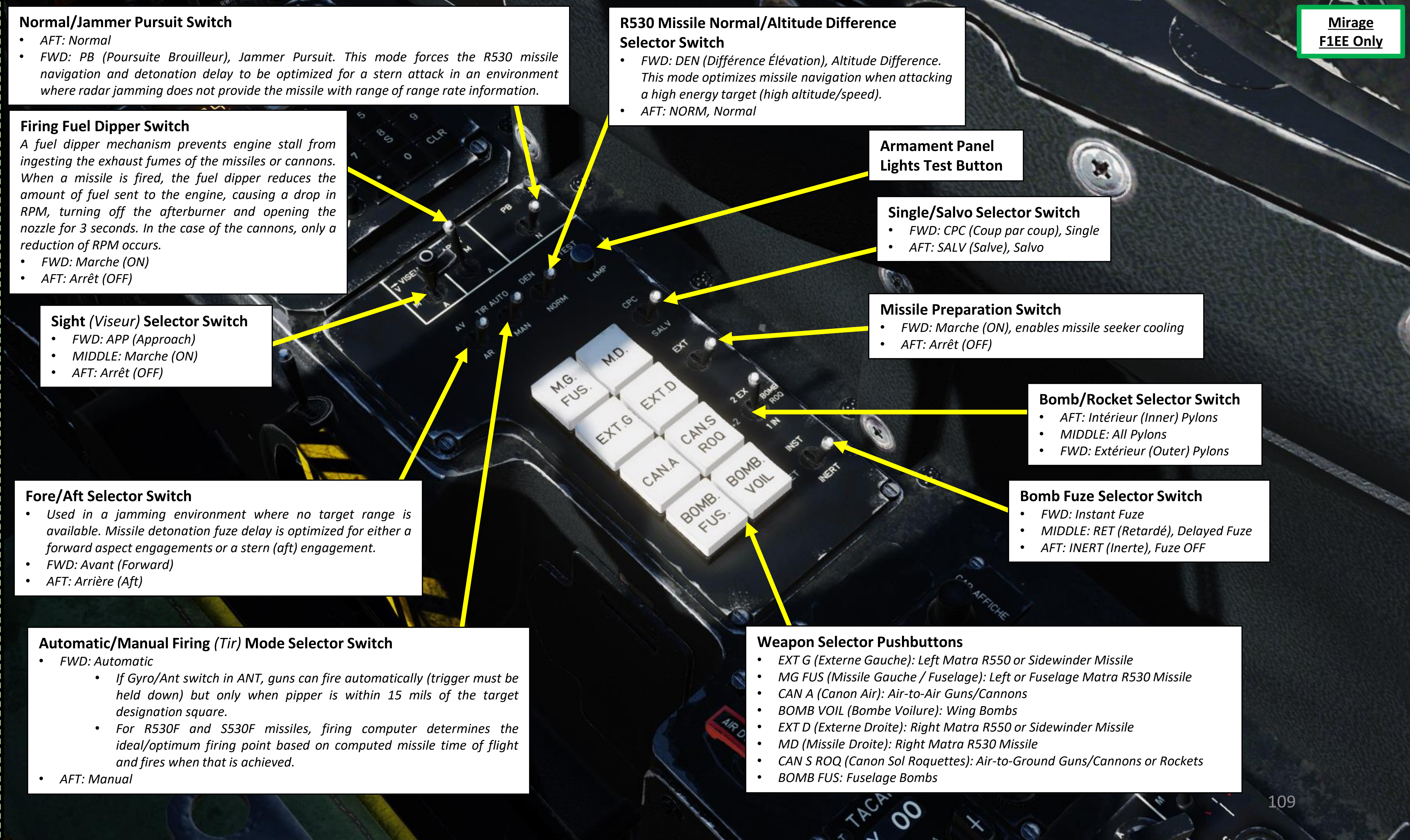
Air Conditioning Temperature Control Switch
- AFT: FROID/COLD
- FWD: CHAUD/HOT

Air Conditioning Temperature Mode Switch
- AFT: Manual Control
- FWD: Automatic Control

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only



Normal/Jammer Pursuit Switch
- *AFT: Normal*
- *FWD: PB (Poursuite Brouilleur), Jammer Pursuit. This mode forces the R530 missile navigation and detonation delay to be optimized for a stern attack in an environment where radar jamming does not provide the missile with range of range rate information.*

Firing Fuel Dipper Switch

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Sight *(Viseur)* Selector Switch
- *FWD: APP (Approach)*
- *MIDDLE: Marche (ON)*
- *AFT: Arrêt (OFF)*

Fore/Aft Selector Switch
- *Used in a jamming environment where no target range is available. Missile detonation fuze delay is optimized for either a forward aspect engagements or a stern (aft) engagement.*
- *FWD: Avant (Forward)*
- *AFT: Arrière (Aft)*

Automatic/Manual Firing *(Tir)* Mode Selector Switch
- *FWD: Automatic*
  - *If Gyro/Ant switch in ANT, guns can fire automatically (trigger must be held down) but only when pipper is within 15 mils of the target designation square.*
  - *For R530F and S530F missiles, firing computer determines the ideal/optimum firing point based on computed missile time of flight and fires when that is achieved.*
- *AFT: Manual*

R530 Missile Normal/Altitude Difference Selector Switch
- *FWD: DEN (Différence Élévation), Altitude Difference. This mode optimizes missile navigation when attacking a high energy target (high altitude/speed).*
- *AFT: NORM, Normal*

Armament Panel Lights Test Button

Single/Salvo Selector Switch
- *FWD: CPC (Coup par coup), Single*
- *AFT: SALV (Salve), Salvo*

Missile Preparation Switch
- *FWD: Marche (ON), enables missile seeker cooling*
- *AFT: Arrêt (OFF)*

Bomb/Rocket Selector Switch
- *AFT: Intérieur (Inner) Pylons*
- *MIDDLE: All Pylons*
- *FWD: Extérieur (Outer) Pylons*

Bomb Fuze Selector Switch
- *FWD: Instant Fuze*
- *MIDDLE: RET (Retardé), Delayed Fuze*
- *AFT: INERT (Inerte), Fuze OFF*

Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

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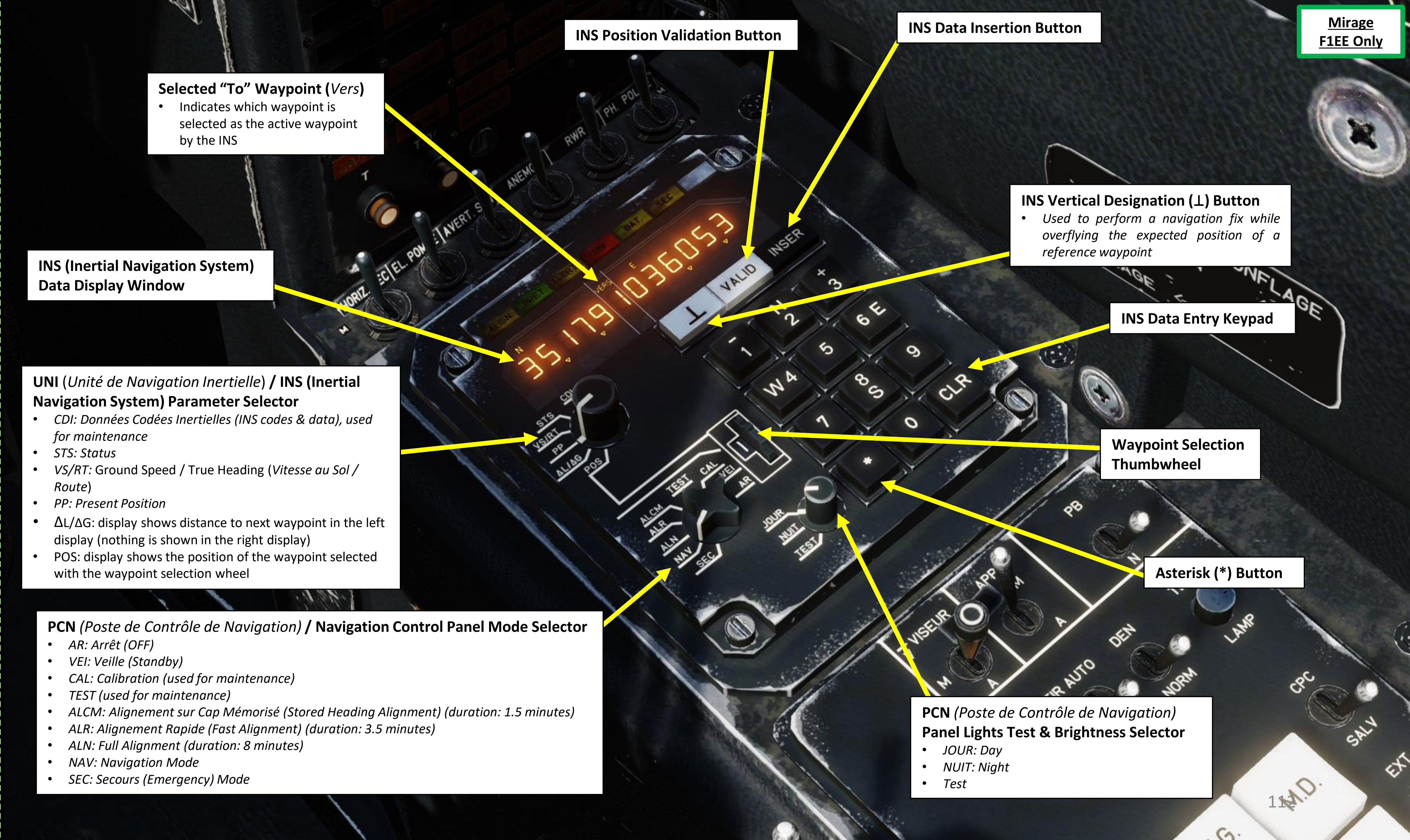

Selected “To” Waypoint (*Vers*)
- Indicates which waypoint is selected as the active waypoint by the INS

INS Position Validation Button

INS Data Insertion Button

INS (Inertial Navigation System) Data Display Window

INS Vertical Designation (⊥) Button
- *Used to perform a navigation fix while overflying the expected position of a reference waypoint*

INS Data Entry Keypad

UNI (*Unité de Navigation Inertielle*) **/ INS (Inertial Navigation System) Parameter Selector**
- *CDI: Données Codées Inertielles (INS codes & data), used for maintenance*
- *STS: Status*
- *VS/RT:* Ground Speed / True Heading (*Vitesse au Sol / Route*)
- *PP: Present Position*
- ΔL/ΔG: display shows distance to next waypoint in the left display (nothing is shown in the right display)
- POS: display shows the position of the waypoint selected with the waypoint selection wheel

Waypoint Selection Thumbwheel

Asterisk (*) Button

PCN (*Poste de Contrôle de Navigation*) **/ Navigation Control Panel Mode Selector**
- *AR: Arrêt (OFF)*
- *VEI: Veille (Standby)*
- *CAL: Calibration (used for maintenance)*
- *TEST (used for maintenance)*
- *ALCM: Alignement sur Cap Mémorisé (Stored Heading Alignment) (duration: 1.5 minutes)*
- *ALR: Alignement Rapide (Fast Alignment) (duration: 3.5 minutes)*
- *ALN: Full Alignment (duration: 8 minutes)*
- *NAV: Navigation Mode*
- *SEC: Secours (Emergency) Mode*

PCN (*Poste de Contrôle de Navigation*) **Panel Lights Test & Brightness Selector**
- *JOUR: Day*
- *NUIT: Night*
- *Test*

Mirage F1EE Only

INS (Inertial Navigation System) Status Lights

- *ALIGN (amber):*
  - *Blinking: in Standby (VEILLE) Mode or in the initial INS alignment phase*
  - *Steady: last phase of INS alignment (precision phase)*
  - *OFF: INS alignment complete*
- *PRÊT (green): INS alignment is complete and ready*
- *ALERTE (amber):*
  - *Blinking: in Standby (VEILLE) Mode, or on "ALN", "ALR" or "ALCM" as long as "*" has not been pressed, or at the end of the INU self-test ("TEST" position of the mode selector)*
  - *Steady: PCN failure or anomaly in information sharing*
- *UNI (red): INS Failure*
- *BAT (amber): Operation of the INU on the protected 28 V DC battery bus*
- *SEC (amber): Mode selector is set to Secours (Emergency) Mode*

Mirage F1EE Only

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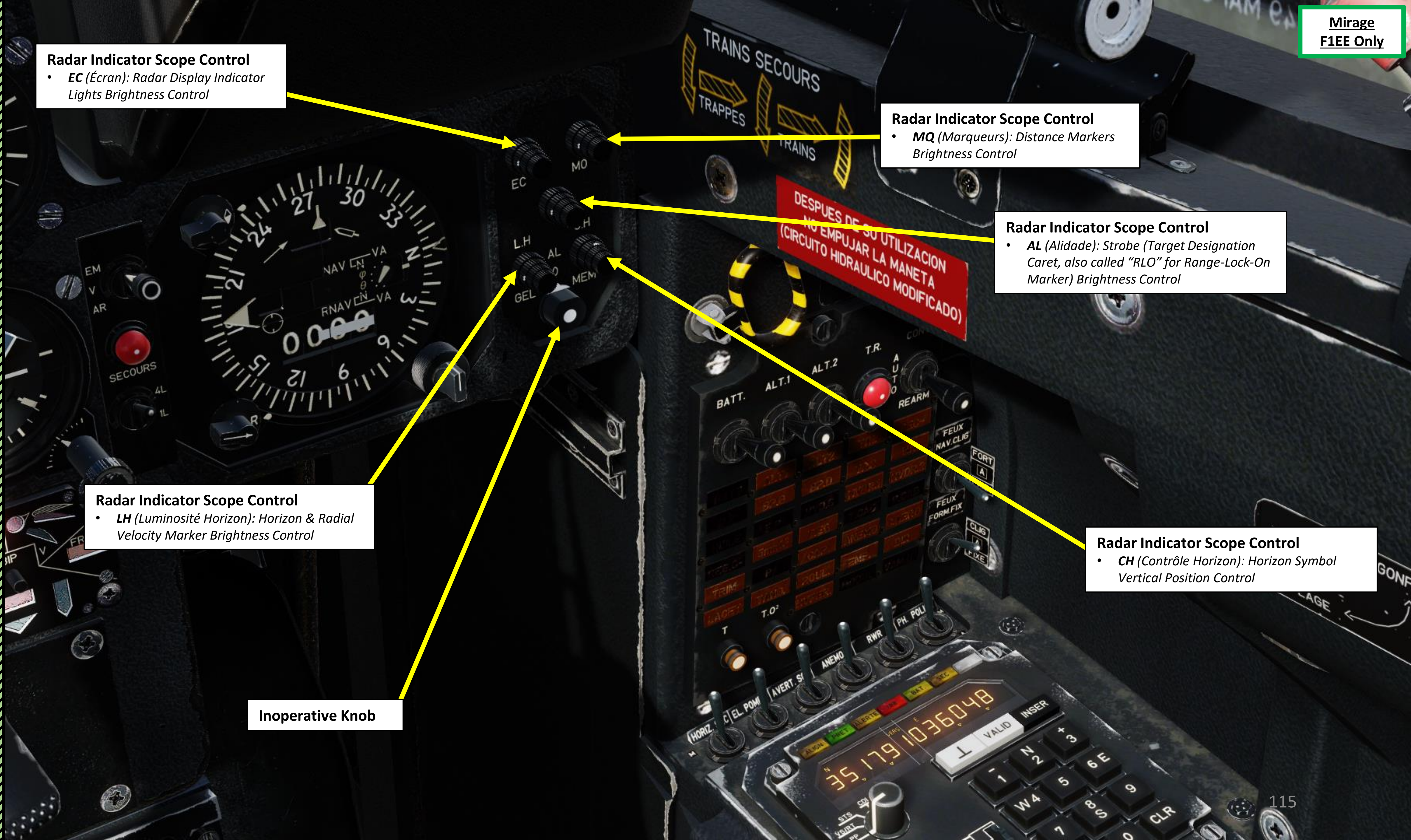


Radar Indicator Scope Control
- ***EC*** *(Écran): Radar Display Indicator Lights Brightness Control*

Radar Indicator Scope Control
- ***MQ*** *(Marqueurs): Distance Markers Brightness Control*

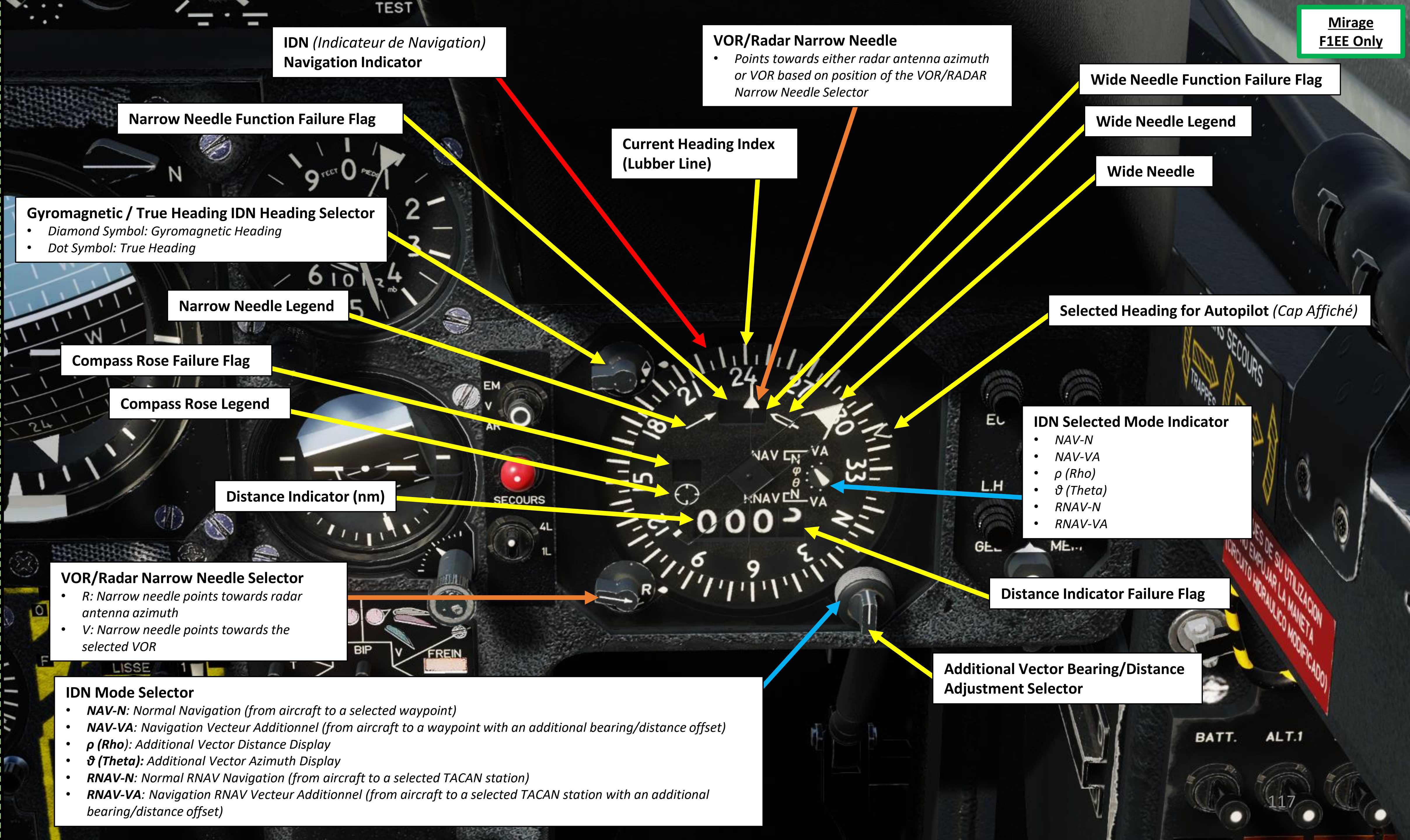
Radar Indicator Scope Control
- ***AL*** *(Alidade): Strobe (Target Designation Caret, also called "RLO" for Range-Lock-On Marker) Brightness Control*

Radar Indicator Scope Control
- ***LH*** *(Luminosité Horizon): Horizon & Radial Velocity Marker Brightness Control*

Radar Indicator Scope Control
- ***CH*** *(Contrôle Horizon): Horizon Symbol Vertical Position Control*

Inoperative Knob

Mirage F1EE Only


Mirage F1EE Only
IDN (Indicateur de Navigation) Navigation Indicator
VOR/Radar Narrow Needle
• Points towards either radar antenna azimuth or VOR based on position of the VOR/RADAR Narrow Needle Selector
Wide Needle Function Failure Flag
Wide Needle Legend
Wide Needle
Narrow Needle Function Failure Flag
Current Heading Index (Lubber Line)
Gyromagnetic / True Heading IDN Heading Selector
• Diamond Symbol: Gyromagnetic Heading
• Dot Symbol: True Heading
Narrow Needle Legend
Selected Heading for Autopilot (Cap Affiché)
Compass Rose Failure Flag
Compass Rose Legend
IDN Selected Mode Indicator
• NAV-N
• NAV-VA
• ρ (Rho)
• ϑ (Theta)
• RNAV-N
• RNAV-VA
Distance Indicator (nm)
VOR/Radar Narrow Needle Selector
• R: Narrow needle points towards radar antenna azimuth
• V: Narrow needle points towards the selected VOR
Distance Indicator Failure Flag
Additional Vector Bearing/Distance Adjustment Selector
IDN Mode Selector
• NAV-N: Normal Navigation (from aircraft to a selected waypoint)
• NAV-VA: Navigation Vecteur Additionnel (from aircraft to a waypoint with an additional bearing/distance offset)
• ρ (Rho): Additional Vector Distance Display
• ϑ (Theta): Additional Vector Azimuth Display
• RNAV-N: Normal RNAV Navigation (from aircraft to a selected TACAN station)
• RNAV-VA: Navigation RNAV Vecteur Additionnel (from aircraft to a selected TACAN station with an additional bearing/distance offset)
TEST
SECOURS
BATT.
ALT.1

Mirage F1EE Only

Radar Operation Mode Selector Switch
- *UP: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *DOWN: Arrêt (OFF)*

Radar Emergency Transmission *(Secours)* **Button**
- *Used for relaunching transmission or resetting the power supply*

Radar Bar *(Lignes)* **Scan Selector Switch**
- *UP: 4 Lignes (4 Bars)*
- *DOWN: 1 Ligne (1 Bar)*

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only


Mirage F1EE Only
Radar Jamming Detection / Feeder Tank Overflow Light
CHAFF
FLARE
BOTH
PRGM
MULT
SGL
OFF
30
CHAFF
14
FLARE
JTS

Mirage F1EE Only

AN/ALR-300 RWR (Radar Warning Receiver) Control Panel
UCC (*Unidad de Control de Cabina,* Cockpit Control Unit)

- ***CURS* (Cursor):** *Provides more accurate information on the status of the threat.*
- ***REG* (Recording):** *Allows the recording of the parameters of the threats on the screen.*
- ***AMEN ELIM* (Threat Removal):** *Leaves the five (5) threats considered most dangerous on the screen. If the criterion changes, the substitute appears and the warning AMENAZA (THREAT) is heard.*
- ***TONO ELIM* (Tone Removal):** *Removes the tones that come along with the appearance of threats.*
- ***EXPL ELIM* (Scan Removal):** *Deletes from the screen the radars classified as scanning*

AN/ALR-300 RWR (Radar Warning Receiver)
IA (*Indicador de Acimut*, Azimuth Indicator)

AN/ALR-300 RWR (Radar Warning Receiver) Test Button

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Mirage F1EE Only

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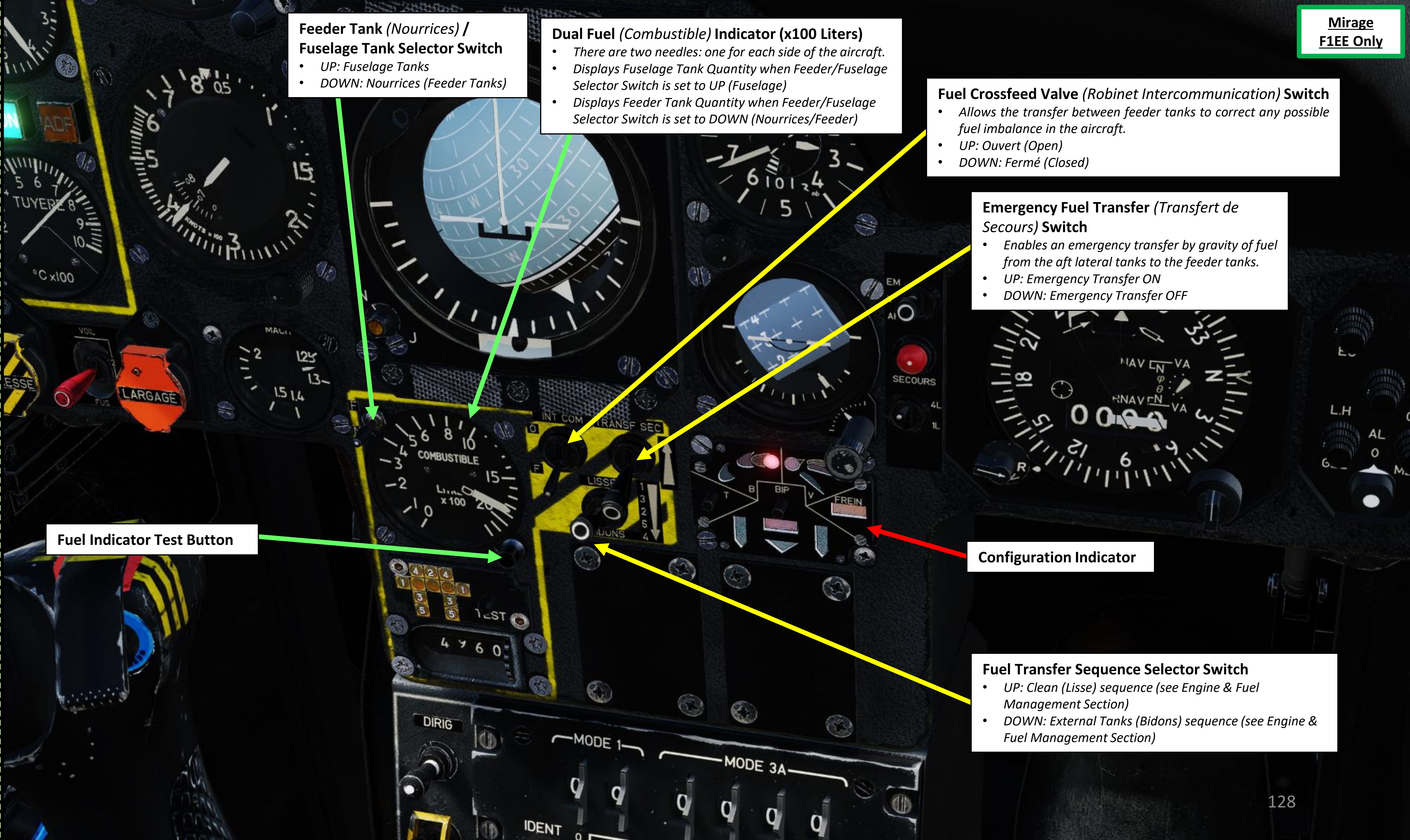


Feeder Tank *(Nourrices)* **/ Fuselage Tank Selector Switch**
- *UP: Fuselage Tanks*
- *DOWN: Nourrices (Feeder Tanks)*

Dual Fuel *(Combustible)* **Indicator (x100 Liters)**
- *There are two needles: one for each side of the aircraft.*
- *Displays Fuselage Tank Quantity when Feeder/Fuselage Selector Switch is set to UP (Fuselage)*
- *Displays Feeder Tank Quantity when Feeder/Fuselage Selector Switch is set to DOWN (Nourrices/Feeder)*

Fuel Crossfeed Valve *(Robinet Intercommunication)* **Switch**
- *Allows the transfer between feeder tanks to correct any possible fuel imbalance in the aircraft.*
- *UP: Ouvert (Open)*
- *DOWN: Fermé (Closed)*

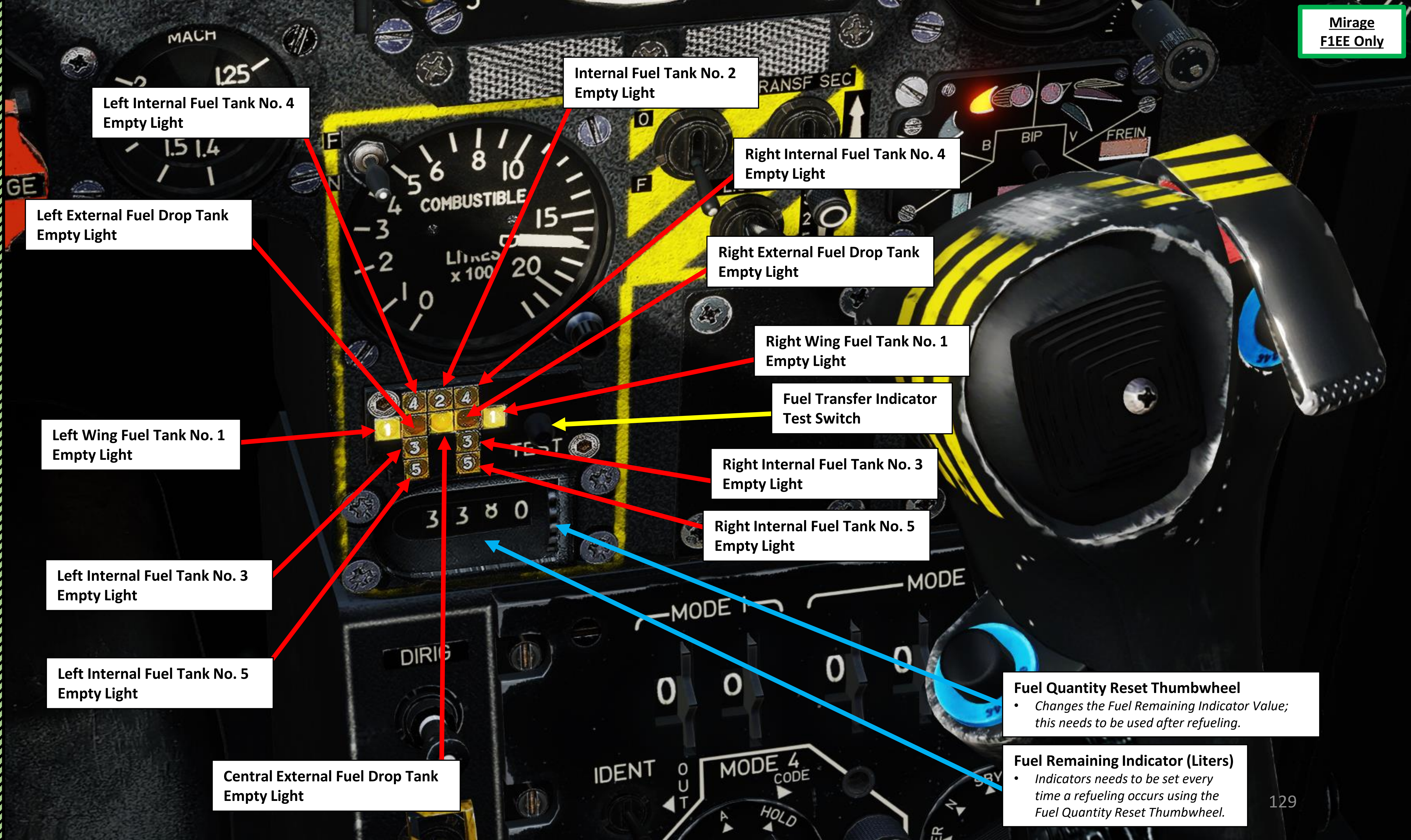
Emergency Fuel Transfer *(Transfert de Secours)* **Switch**
- *Enables an emergency transfer by gravity of fuel from the aft lateral tanks to the feeder tanks.*
- *UP: Emergency Transfer ON*
- *DOWN: Emergency Transfer OFF*

Fuel Indicator Test Button

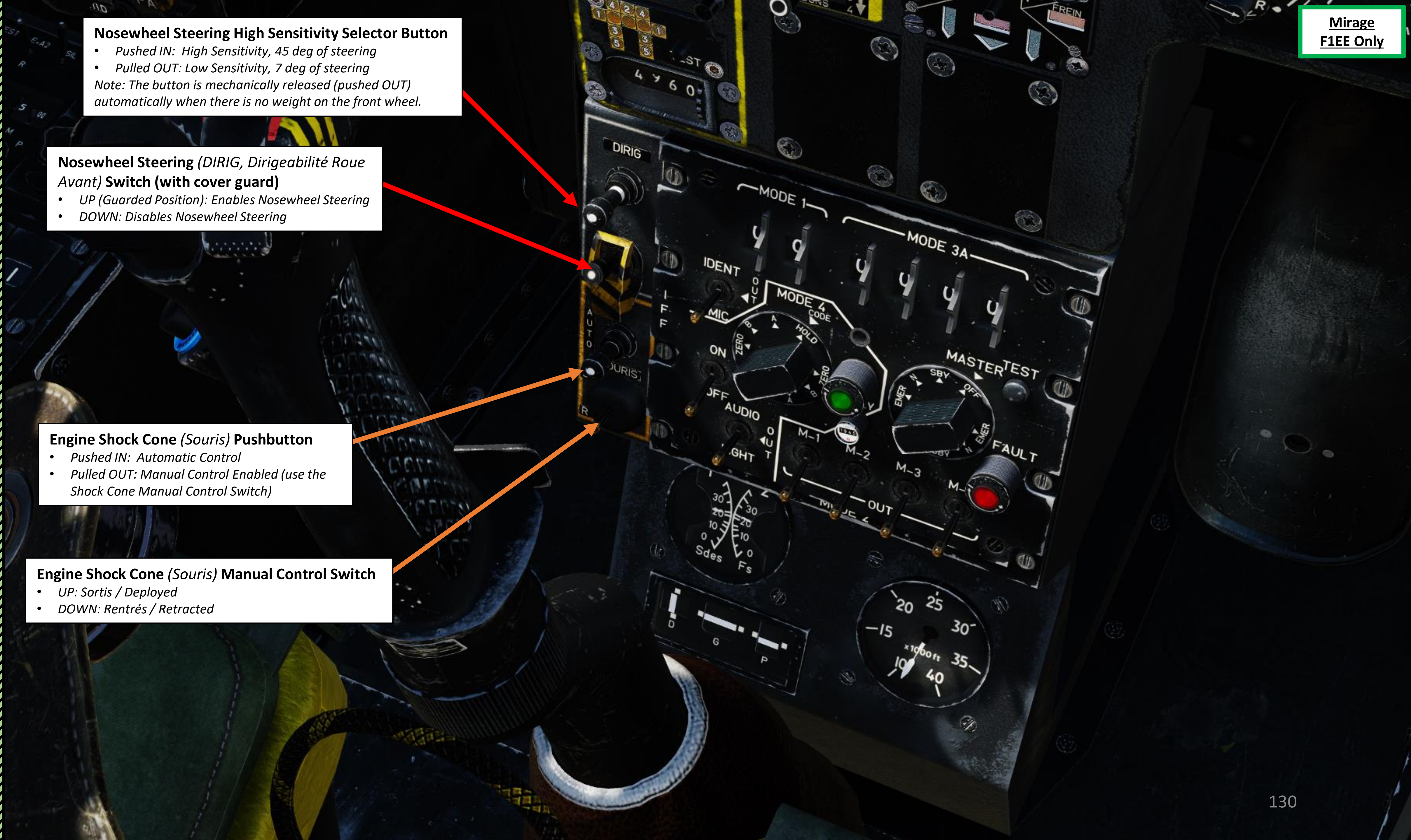
Configuration Indicator

Fuel Transfer Sequence Selector Switch
- *UP: Clean (Lisse) sequence (see Engine & Fuel Management Section)*
- *DOWN: External Tanks (Bidons) sequence (see Engine & Fuel Management Section)*

Mirage F1EE Only



Mirage F1EE Only



Nosewheel Steering High Sensitivity Selector Button
- *Pushed IN: High Sensitivity, 45 deg of steering*
- *Pulled OUT: Low Sensitivity, 7 deg of steering*

Note: The button is mechanically released (pushed OUT) automatically when there is no weight on the front wheel.

Nosewheel Steering *(DIRIG, Dirigeabilité Roue Avant)* **Switch (with cover guard)**
- *UP (Guarded Position): Enables Nosewheel Steering*
- *DOWN: Disables Nosewheel Steering*

Engine Shock Cone *(Souris)* **Pushbutton**
- *Pushed IN: Automatic Control*
- *Pulled OUT: Manual Control Enabled (use the Shock Cone Manual Control Switch)*

Engine Shock Cone *(Souris)* **Manual Control Switch**
- *UP: Sortis / Deployed*
- *DOWN: Rentrés / Retracted*

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only

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Hydraulic Pressure Selector Switch

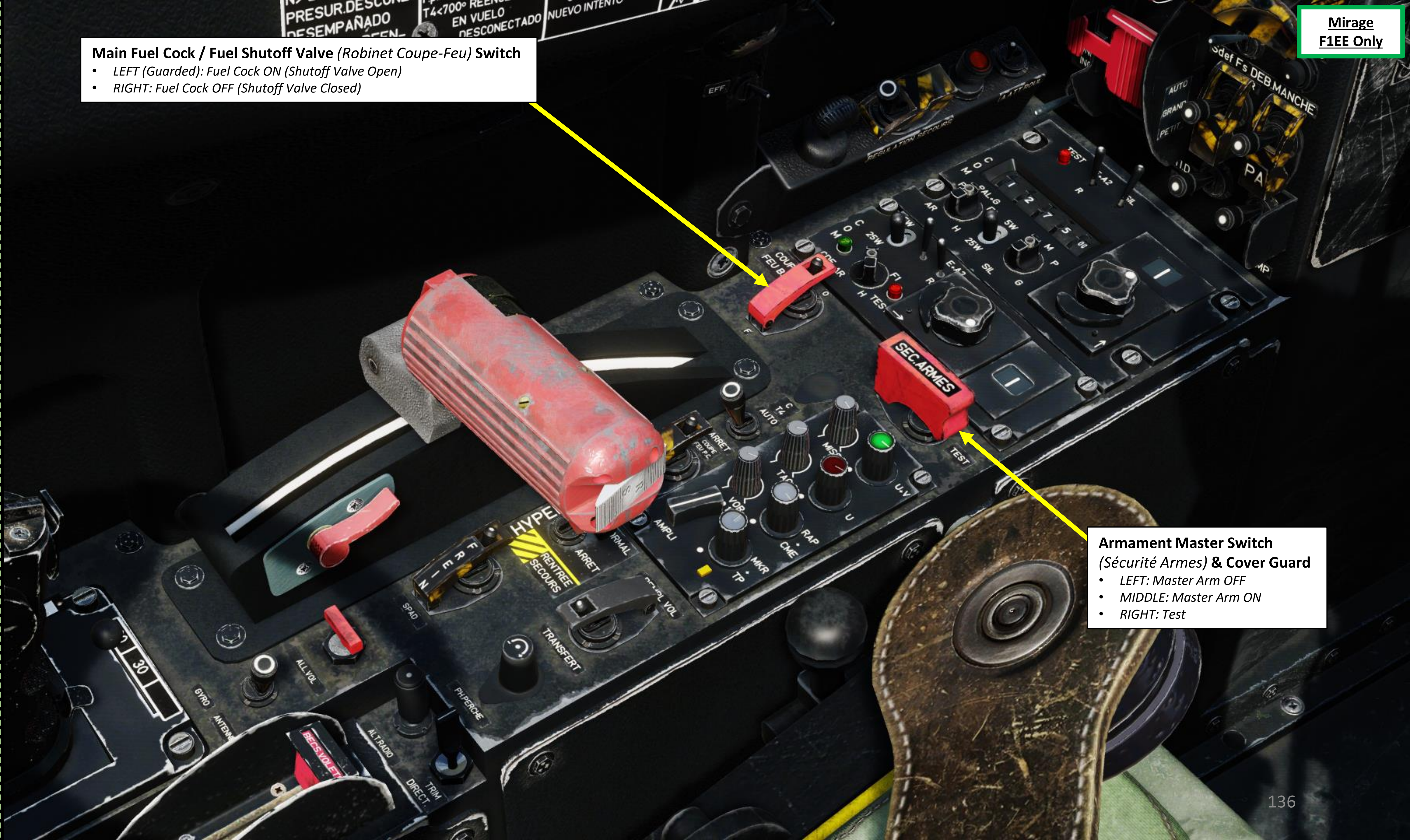
- *UP: Hydraulic pressure indicator displays hydraulic pressure for hydraulic circuits 1 and 2 (Servos 1 and 2)*
- *DOWN: Hydraulic pressure indicator displays hydraulic pressure for ancillary systems (Sdes, Servitudes) and Emergency Hydraulic Brake (Fs, Frein Secours)*

Mirage F1EE Only

Mirage F1EE Only

Main Fuel Cock / Fuel Shutoff Valve ***(Robinet Coupe-Feu)*** **Switch**

- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*

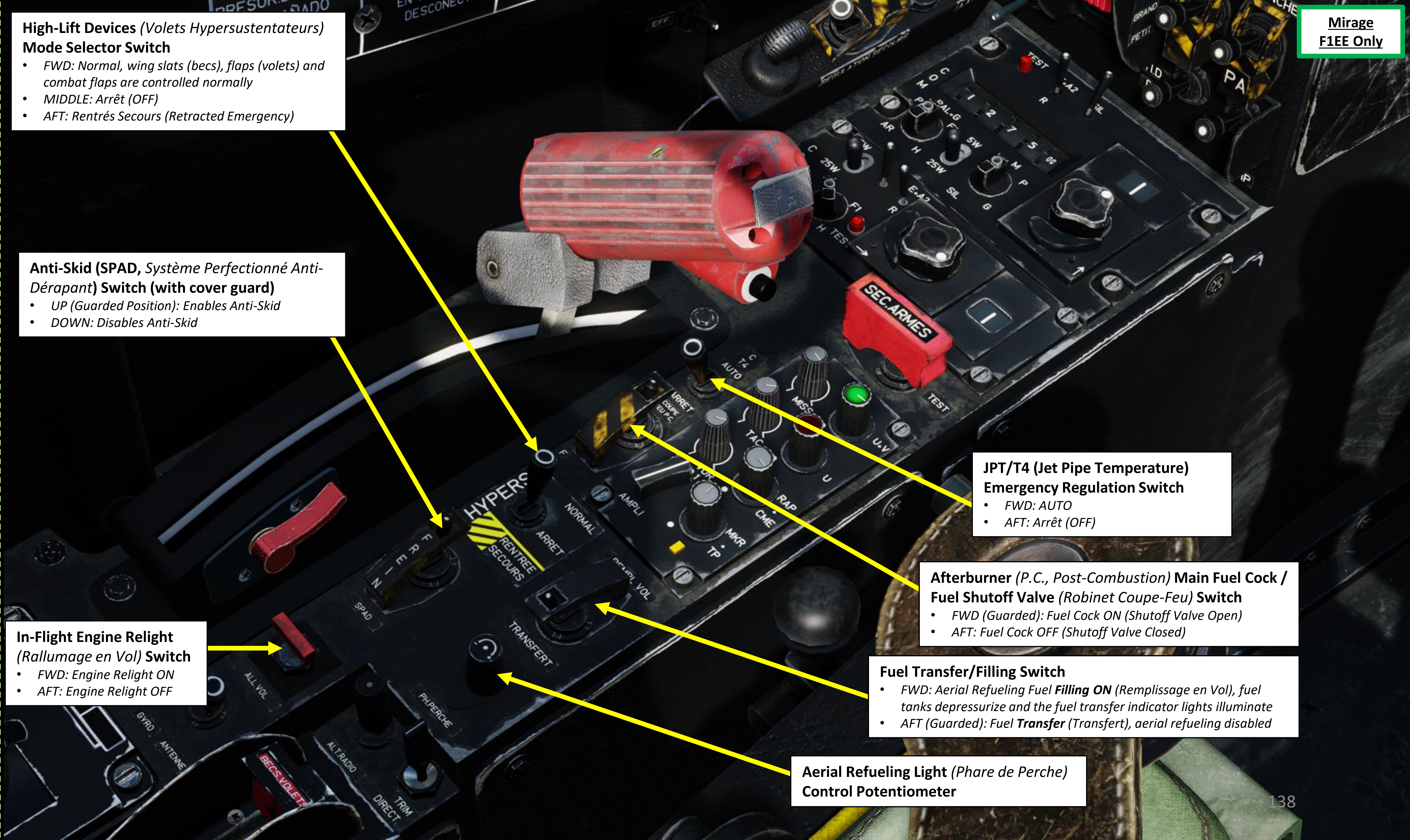


Armament Master Switch ***(Sécurité Armes)*** **& Cover Guard**

- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*


OUVERTURE
LARGAGE
PARACHUTE
1
2
EXTINCION
GASES:STOP
V= 300 KTS o
N>2600 r.p.m.
PRESUR.DESCONEC
DESEMPAÑADO
A 20000ft: REENCENDIDO
REENCENDIDO
REENCENDIO EN VUELO
GASES ENTRE PLENOS GASES SECOS Y RALENTI N>5000 r.p.m.
T4<700° REENCENDIO EN VUELO DESCONECTADO
FALLO REENCENDIDO
REENCENDIO EN VUELO DESCONECTADO
VERIF N Y T4 GASES STOP
CONOMETRO ESPERAR
30° PONER Vi:230 Kts. o N>1,100 rpm
NUEVO INTENTO
1100 RPM AUTOROT.MINIMA
DOMINIO DE REENCENDIDO
30000ft
20000ft
10000ft
0ft
300kts
400kts
500kts
FRAGIL VERRIERE
SEC.ARMES
TEST
HYPER
ARRET
NORMAL
TRANSFERT

Mirage F1EE Only



High-Lift Devices *(Volets Hypersustentateurs)* **Mode Selector Switch**

- *FWD: Normal, wing slats (becs), flaps (volets) and combat flaps are controlled normally*
- *MIDDLE: Arrêt (OFF)*
- *AFT: Rentrés Secours (Retracted Emergency)*

Anti-Skid (SPAD, *Système Perfectionné Anti-Dérapant***) Switch (with cover guard)**

- *UP (Guarded Position): Enables Anti-Skid*
- *DOWN: Disables Anti-Skid*

In-Flight Engine Relight *(Rallumage en Vol)* **Switch**

- *FWD: Engine Relight ON*
- *AFT: Engine Relight OFF*

JPT/T4 (Jet Pipe Temperature) Emergency Regulation Switch

- *FWD: AUTO*
- *AFT: Arrêt (OFF)*

Afterburner *(P.C., Post-Combustion)* **Main Fuel Cock / Fuel Shutoff Valve** *(Robinet Coupe-Feu)* **Switch**

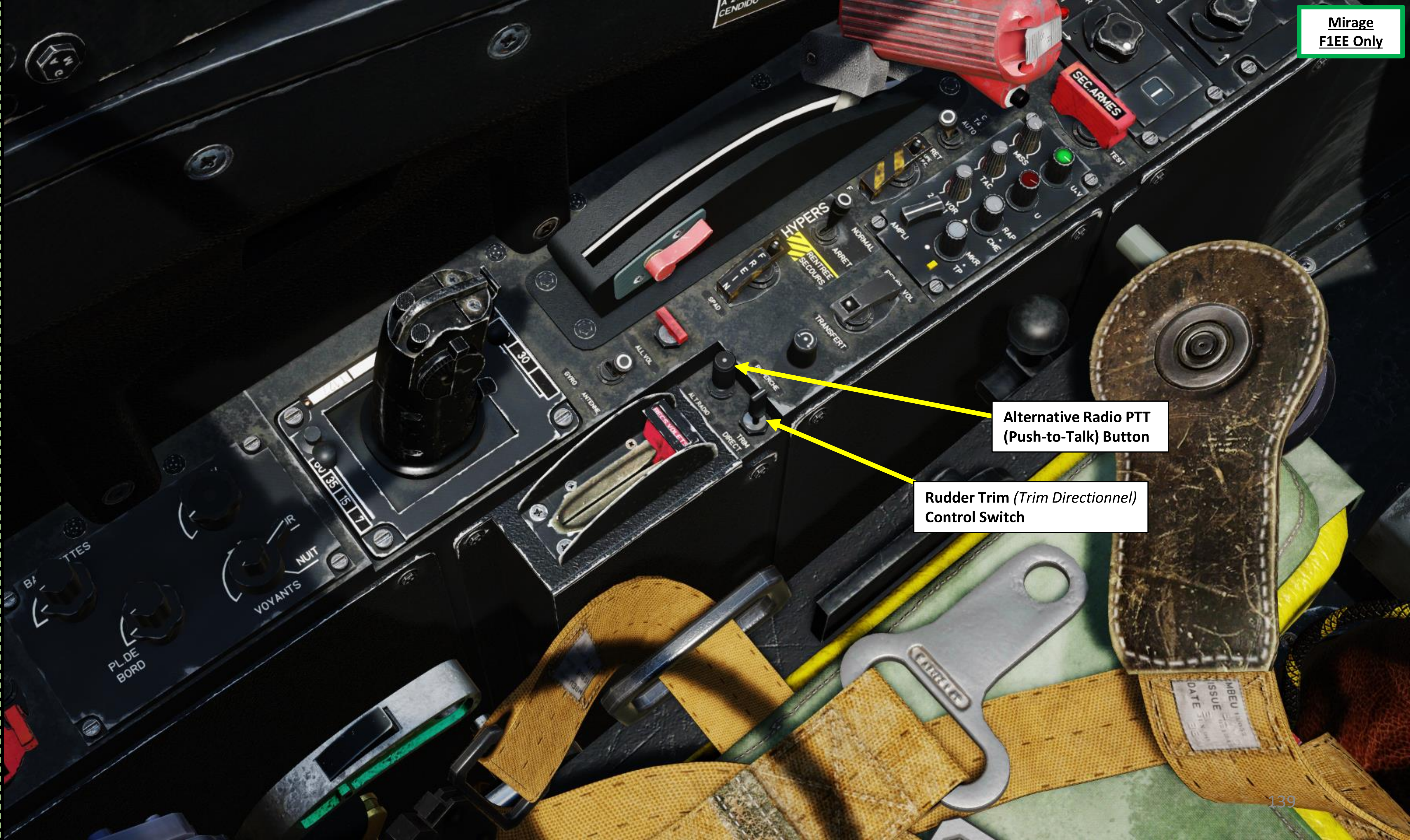
- *FWD (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *AFT: Fuel Cock OFF (Shutoff Valve Closed)*

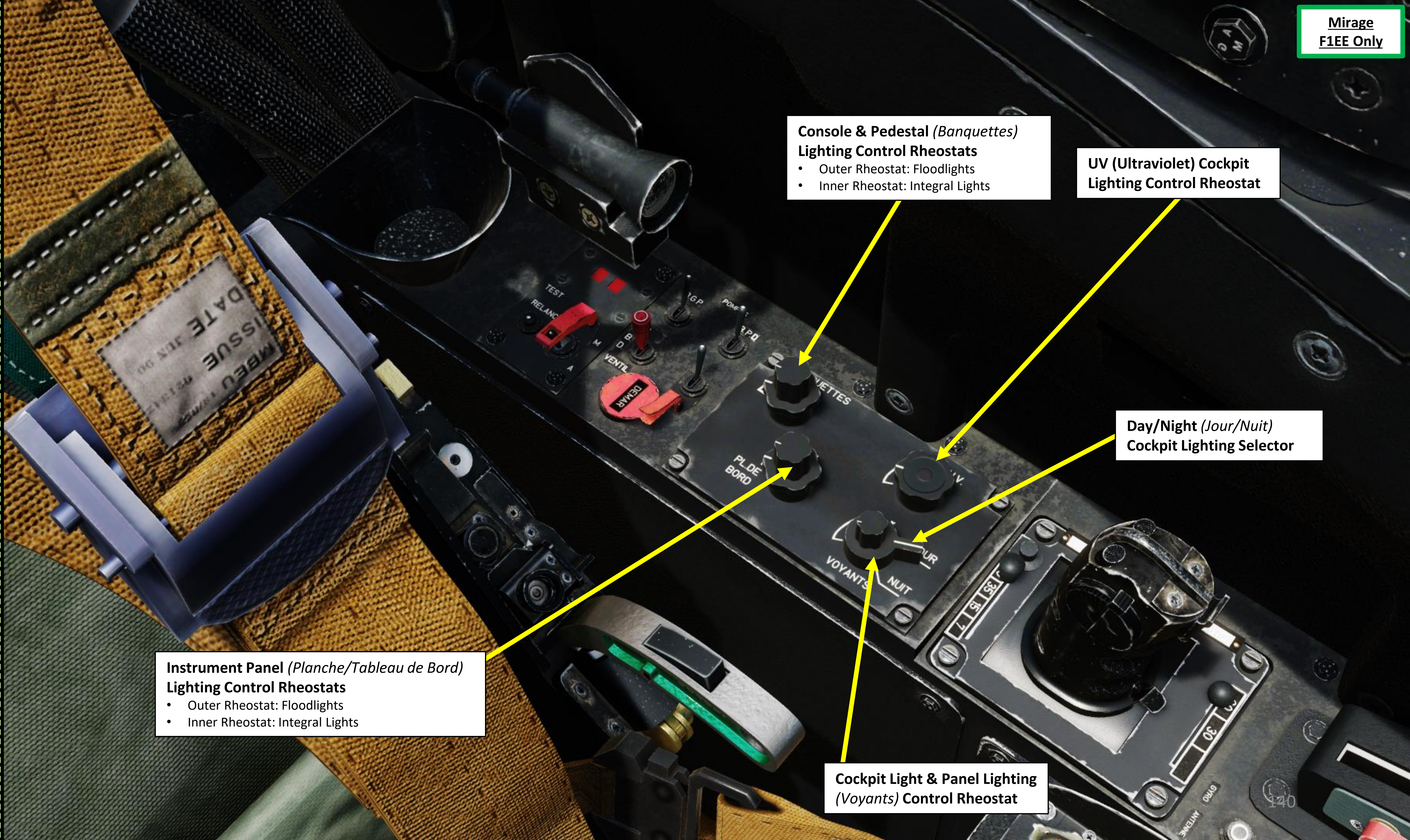
Fuel Transfer/Filling Switch

- *FWD: Aerial Refueling Fuel* ***Filling ON*** *(Remplissage en Vol), fuel tanks depressurize and the fuel transfer indicator lights illuminate*
- *AFT (Guarded): Fuel* ***Transfer*** *(Transfert), aerial refueling disabled*

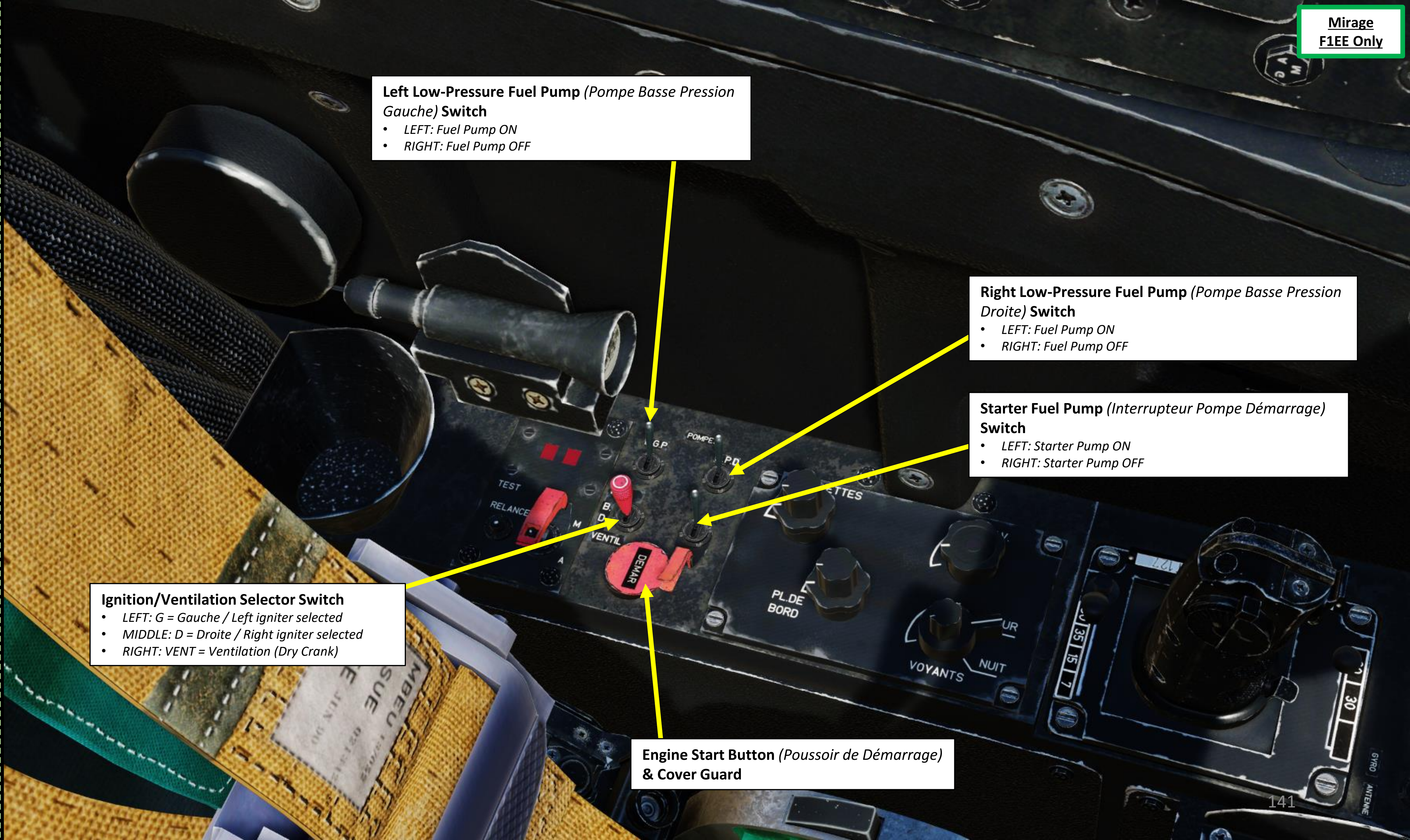
Aerial Refueling Light *(Phare de Perche)* **Control Potentiometer**

Mirage F1EE Only




Mirage F1EE Only
Console & Pedestal *(Banquettes)* **Lighting Control Rheostats**
• Outer Rheostat: Floodlights
• Inner Rheostat: Integral Lights
UV (Ultraviolet) Cockpit Lighting Control Rheostat
Day/Night *(Jour/Nuit)* **Cockpit Lighting Selector**
Instrument Panel *(Planche/Tableau de Bord)* **Lighting Control Rheostats**
• Outer Rheostat: Floodlights
• Inner Rheostat: Integral Lights
Cockpit Light & Panel Lighting *(Voyants)* **Control Rheostat**

Mirage F1EE Only



Left Low-Pressure Fuel Pump *(Pompe Basse Pression Gauche)* **Switch**
- *LEFT: Fuel Pump ON*
- *RIGHT: Fuel Pump OFF*

Right Low-Pressure Fuel Pump *(Pompe Basse Pression Droite)* **Switch**
- *LEFT: Fuel Pump ON*
- *RIGHT: Fuel Pump OFF*

Starter Fuel Pump *(Interrupteur Pompe Démarrage)* **Switch**
- *LEFT: Starter Pump ON*
- *RIGHT: Starter Pump OFF*

Ignition/Ventilation Selector Switch
- *LEFT: G = Gauche / Left igniter selected*
- *MIDDLE: D = Droite / Right igniter selected*
- *RIGHT: VENT = Ventilation (Dry Crank)*

Engine Start Button *(Poussoir de Démarrage)* **& Cover Guard**

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only

Mirage F1EE Only

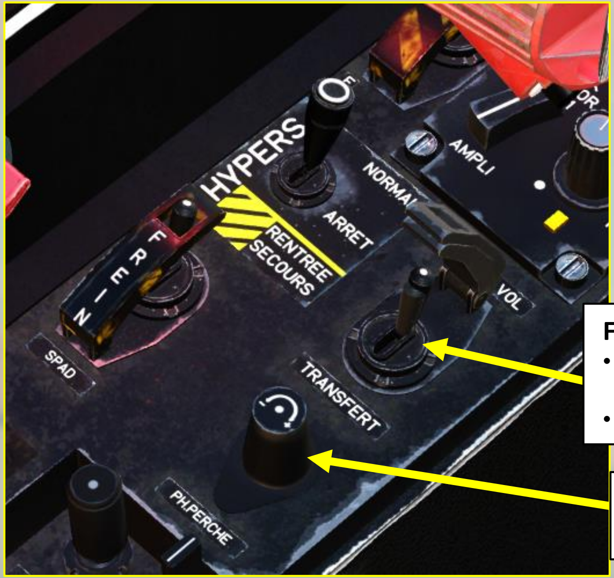
Refueling Probe *(Perche)*

- *Allows air-to-air refueling. Probe (male part) must be inserted into a drogue (female part) of a tanker.*

Mirage F1EE Only

Aerial Refueling Light *(Phare de Perche)*

- *The stowable aerial refueling light is unstowed when setting the Fuel Transfer/Filling Switch FWD (Filling ON).*
- *The light is turned on or off by using the Aerial Refueling Light Control Potentiometer.*
- *Note: Do not attempt to deploy/un-stow the light when flying above 375 kts; it may damage it or jam it in a stowed position.*



Fuel Transfer/Filling Switch

- *FWD: Aerial Refueling Fuel* ***Filling ON*** *(Remplissage en Vol), fuel tanks depressurize and the fuel transfer indicator lights illuminate*
- *AFT (Guarded): Fuel* ***Transfer*** *(Transfert), aerial refueling disabled*

Aerial Refueling Light *(Phare de Perche)*
Control Potentiometer

Mirage F1EE Only

Mirage F1CE Only

MIRAGE F1CE START-UP PROCEDURE OVERVIEW

A. *Before Start-Up*

B. *Engine Start*

C. *After Start-Up*

1. Radio Communications Setup
2. Flight Control Servos Setup
3. High-Lift Devices Setup
4. Gyroscopic Heading & Reference System Setup
5. Navigation Systems & Sensors Setup
6. Air Conditioning & Avionics Cooling Setup
7. Aircraft Controls Setup
8. Countermeasures Setup
9. Last Interior Checks

A – BEFORE START-UP

Mirage F1CE Only

1. Perform exterior checks and request ground crew to install required ordnance for the mission.

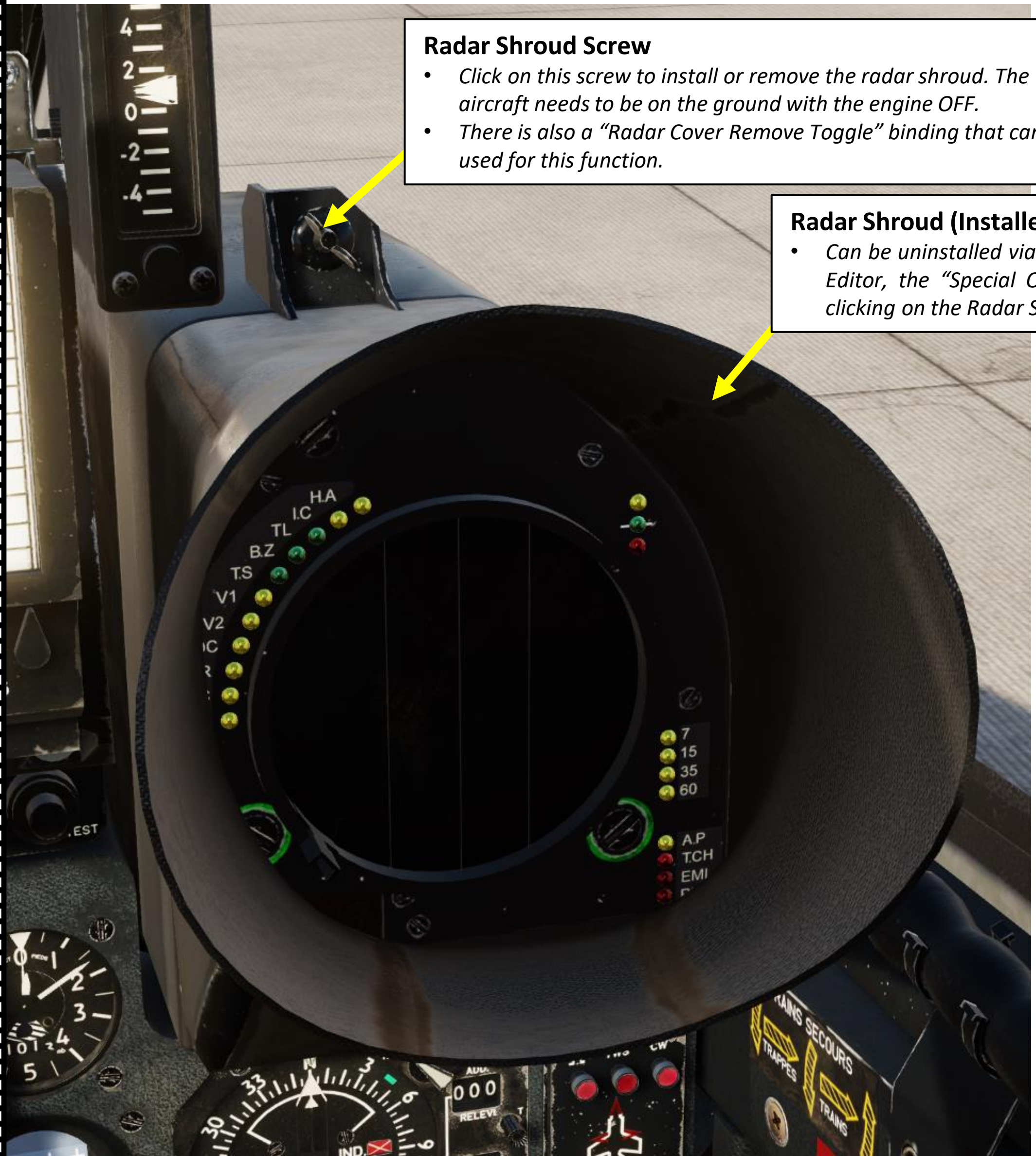
A – BEFORE START-UP

2. Engage Parking Brake – Pull Parking Brake Lever OUT.

Mirage F1CE Only

A – BEFORE START-UP

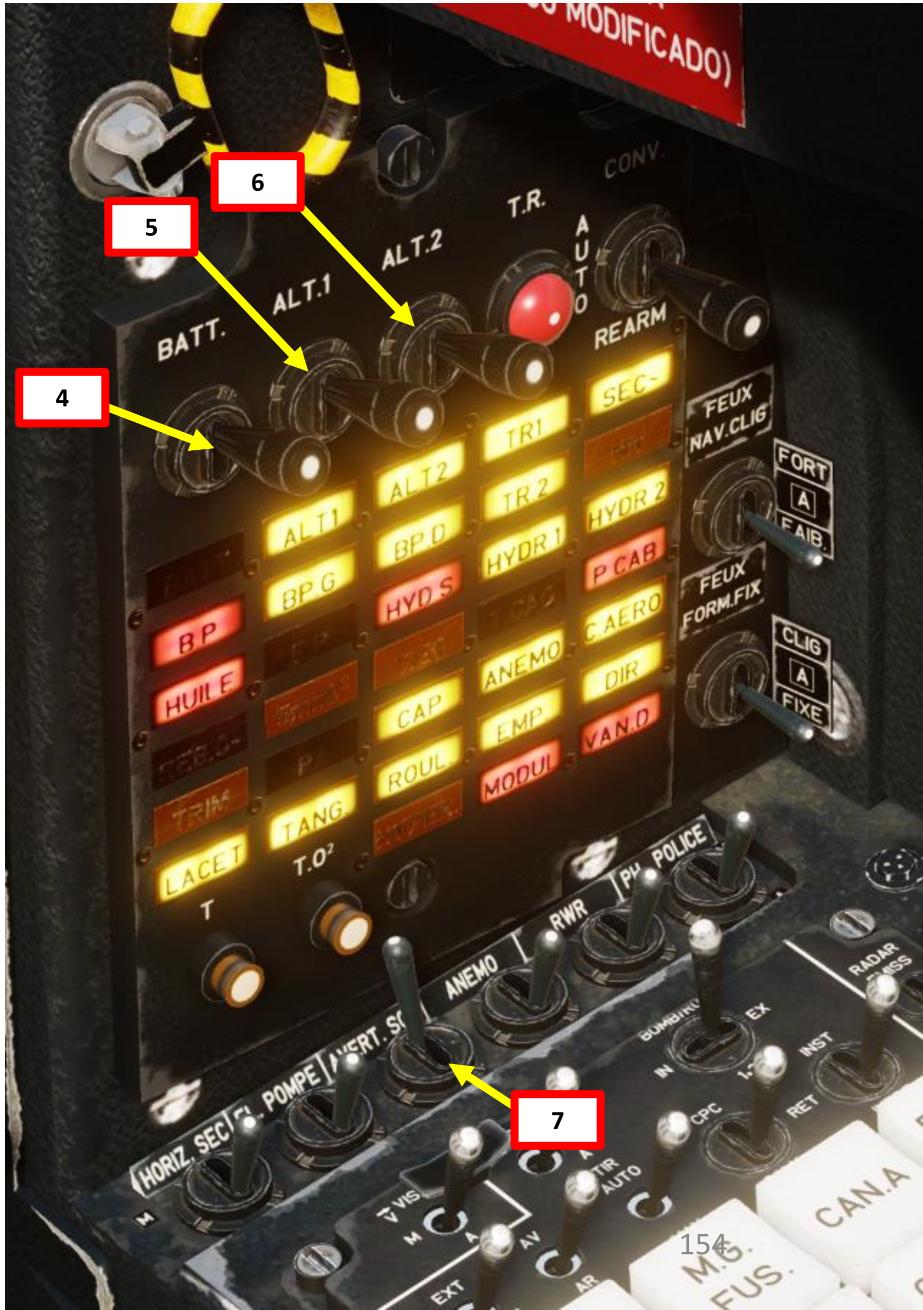
3. If desired, remove or install the radar shroud by clicking on the radar shroud screw. The shroud allows better visibility of the radar scope in sunlit conditions but restricts the pilot to a narrow field-of-view.



Mirage F1CE Only

A – BEFORE START-UP

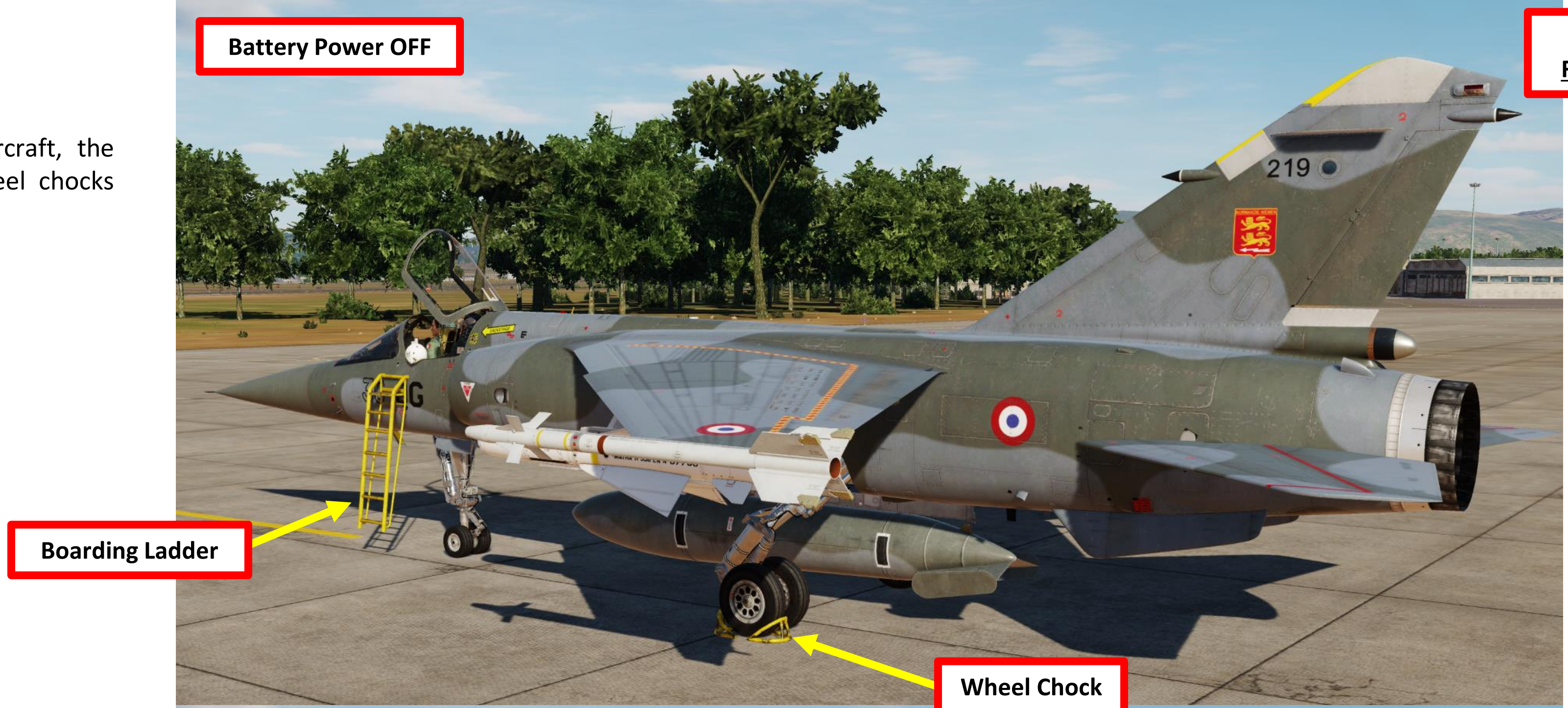
4. Set Battery Switch – MARCHE/ON (UP).
5. Set Alternator No. 1 Switch – MARCHE/ON (UP).
6. Set Alternator No. 2 Switch – MARCHE/ON (UP).
7. Set Aural Warning Horn *(Avertisseur Sonore)* Switch – MARCHE/ON (FWD).
8. Press the Master Failure Warning *(Panne)* Button to reset the aural warning.
9. Adjust Seat Height – As desired.



Mirage F1CE Only

A – BEFORE START-UP

10. Once battery power is provided to the aircraft, the ground crew will automatically remove wheel chocks and the boarding ladder.



A – BEFORE START-UP

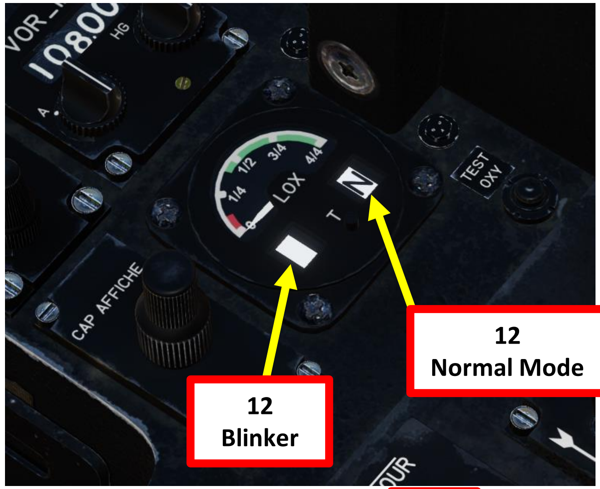
Mirage F1CE Only

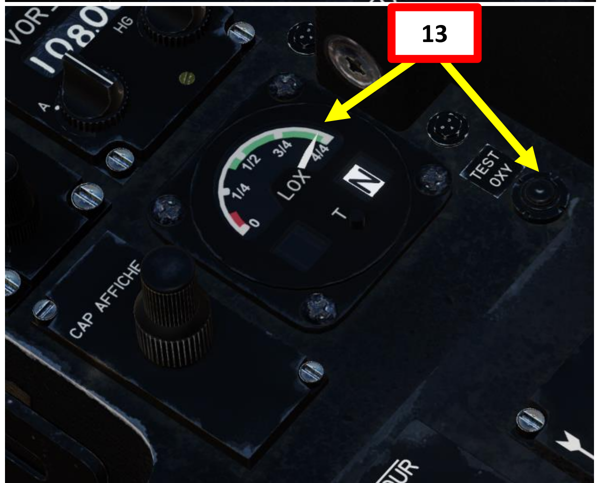
Note: the Mirage F1CE can be started on battery power alone. External ground power can still be provided from a GPU (Ground Power Unit), but it is not mandatory.

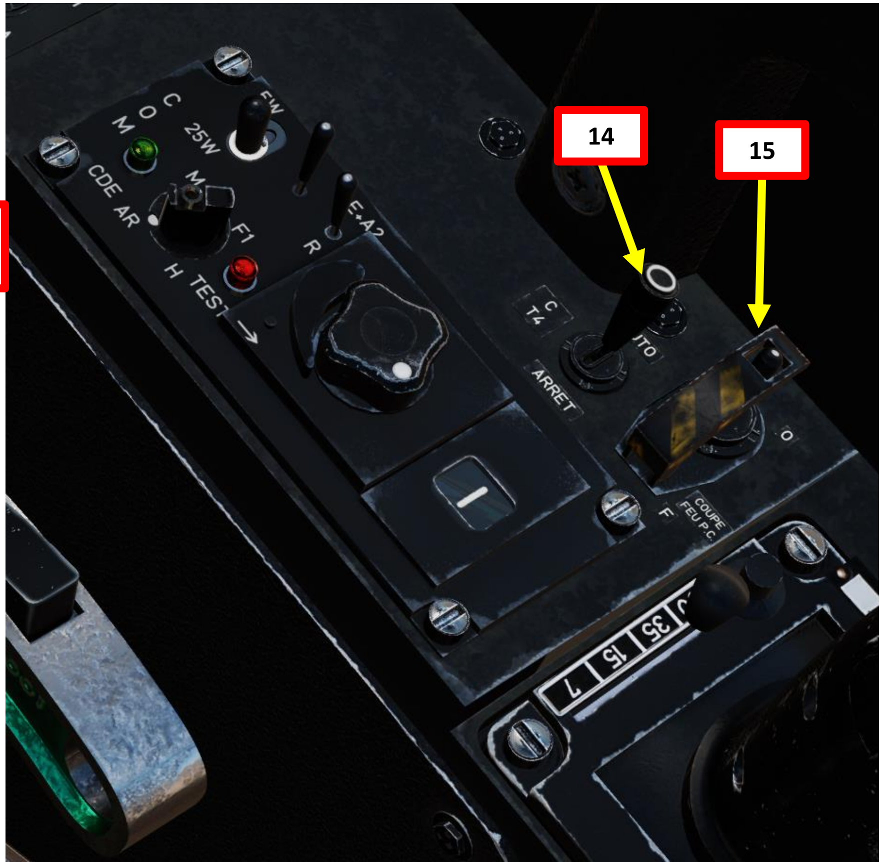
A – BEFORE START-UP

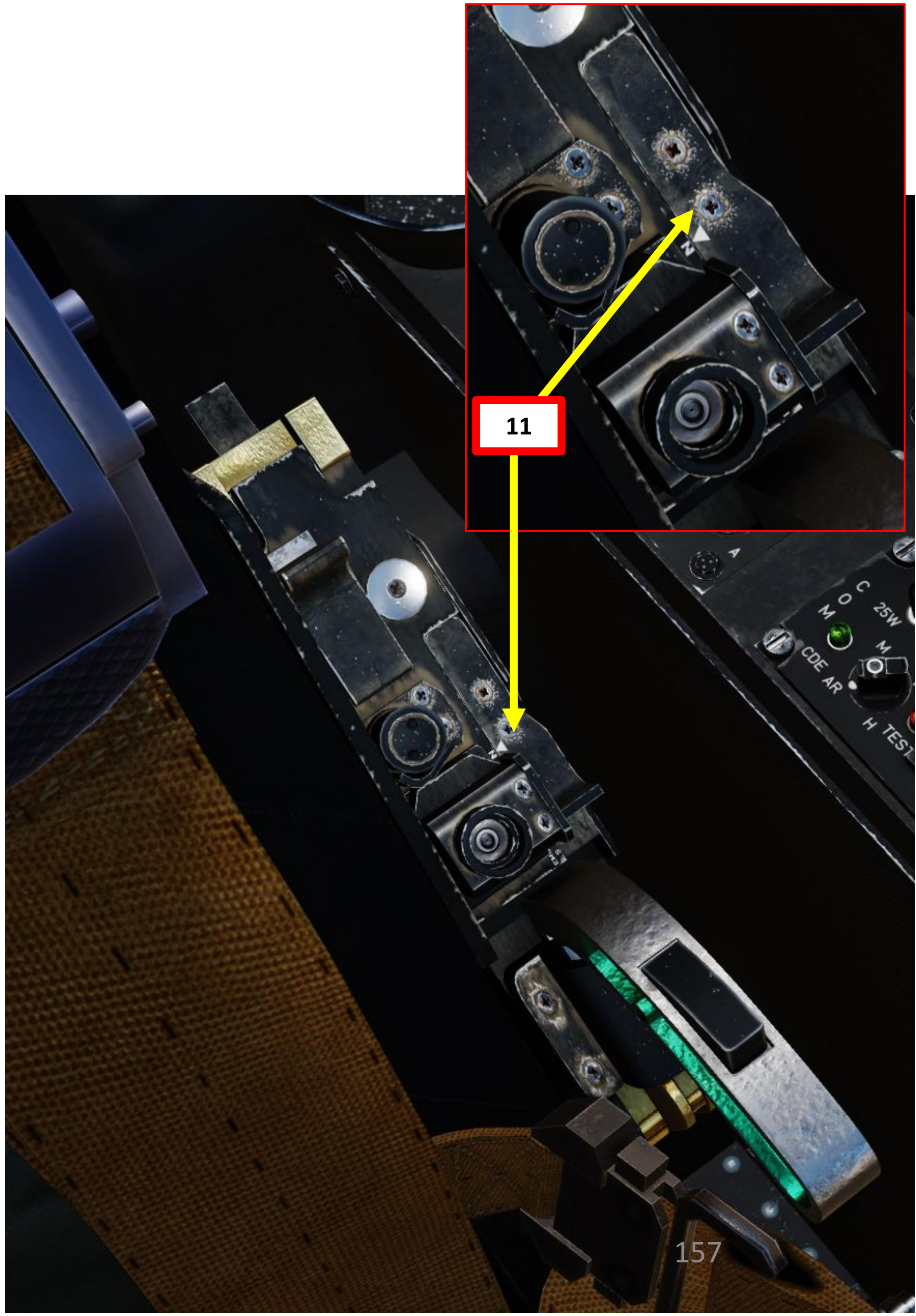
Mirage F1CE Only

11. Set Oxygen Mode Selector Switch – NORMAL (AFT)
12. Confirm "N" is visible on the Oxygen Mode Repeater and that the Oxygen Blinker is operating.
13. Depress the Oxygen Quantity Ground Test Button for a few seconds and ensure the Oxygen Quantity (LOX) Indicator goes into the green range for the duration of the test.
14. Set JPT/T4 (Jet Pipe Temperature) Emergency Regulation Switch – AUTO (LEFT).
15. Set Afterburner *(P.C., Post-Combustion)* Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* Switch – OPEN (LEFT).



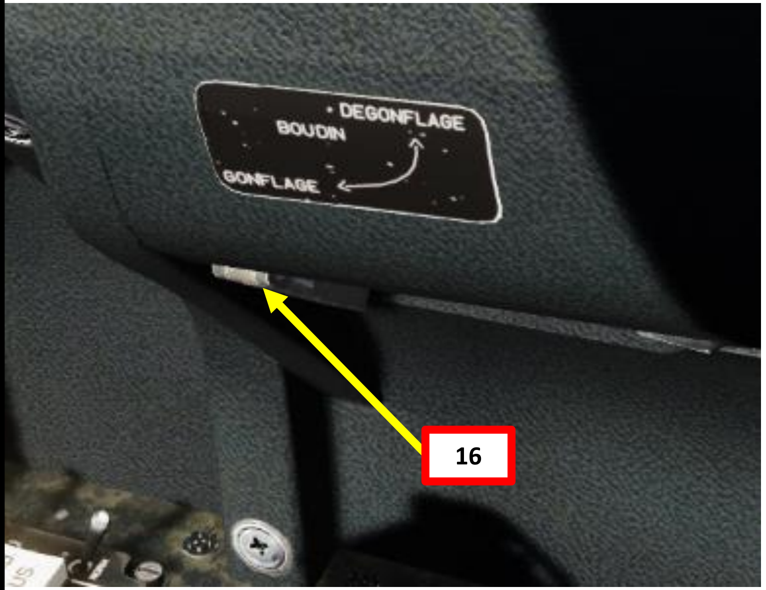


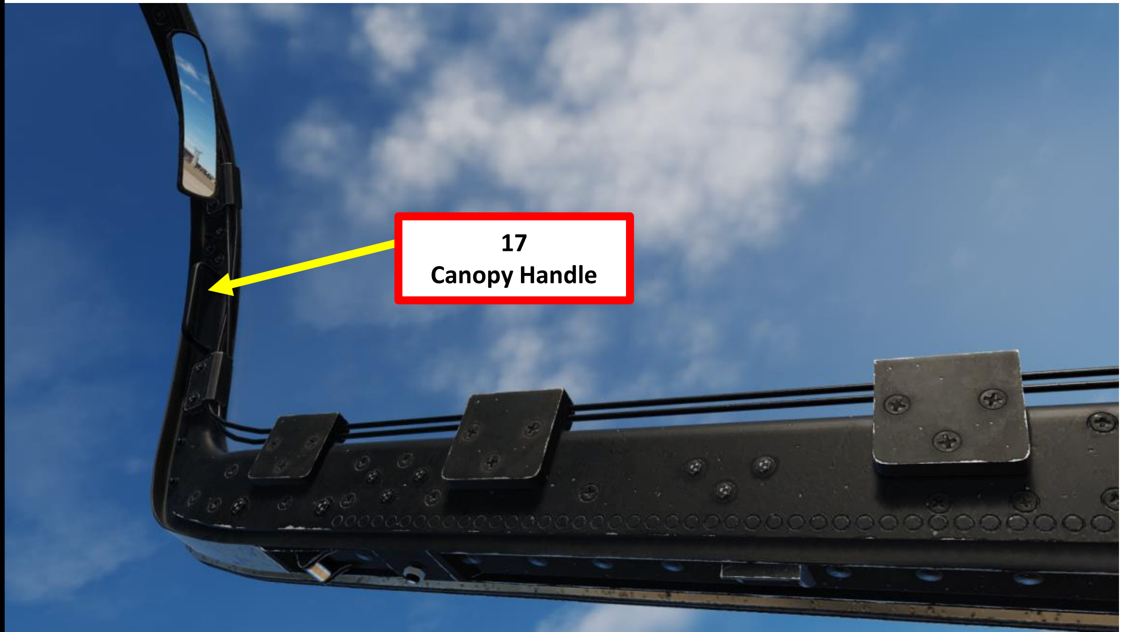




A – BEFORE START-UP

16. Set Canopy Seal Valve *(Boudin)* Control Lever – INFLATED/*GONFLAGE* (FWD).
17. Close canopy with the Canopy Handle or by pressing "LCTRL+C".





Mirage F1CE Only

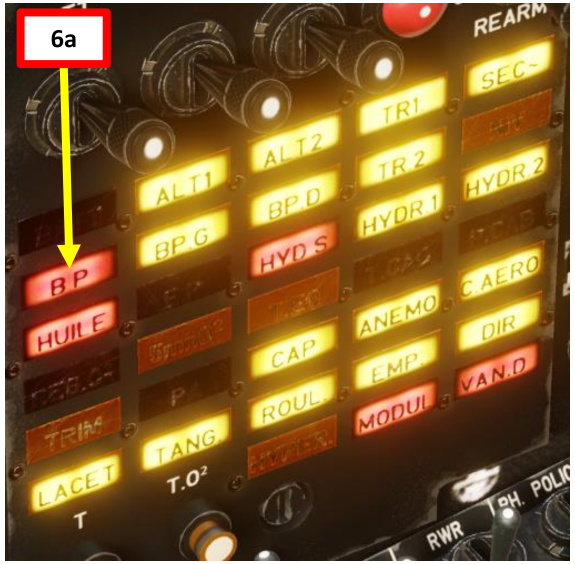
A – BEFORE START-UP

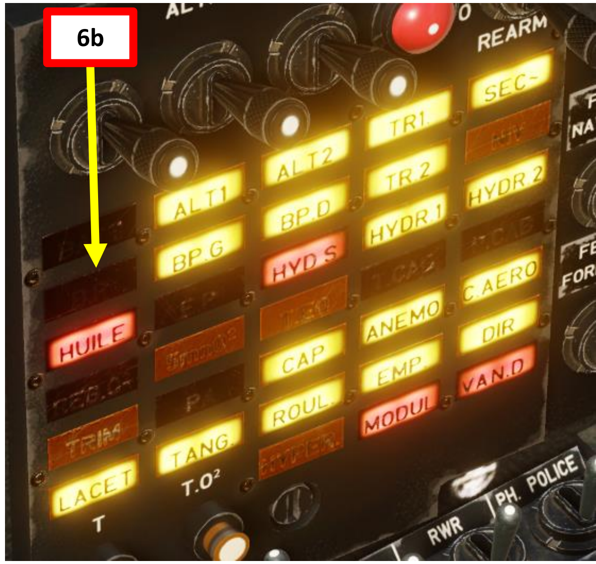
18. Once the canopy is lowered, push Canopy Lock lever FWD to lock and seal the cockpit.
    - Confirm P CAB (Cabin Pressurization) Warning Light is extinguished.
19. Verify that the Canopy Rest Stick is folded.

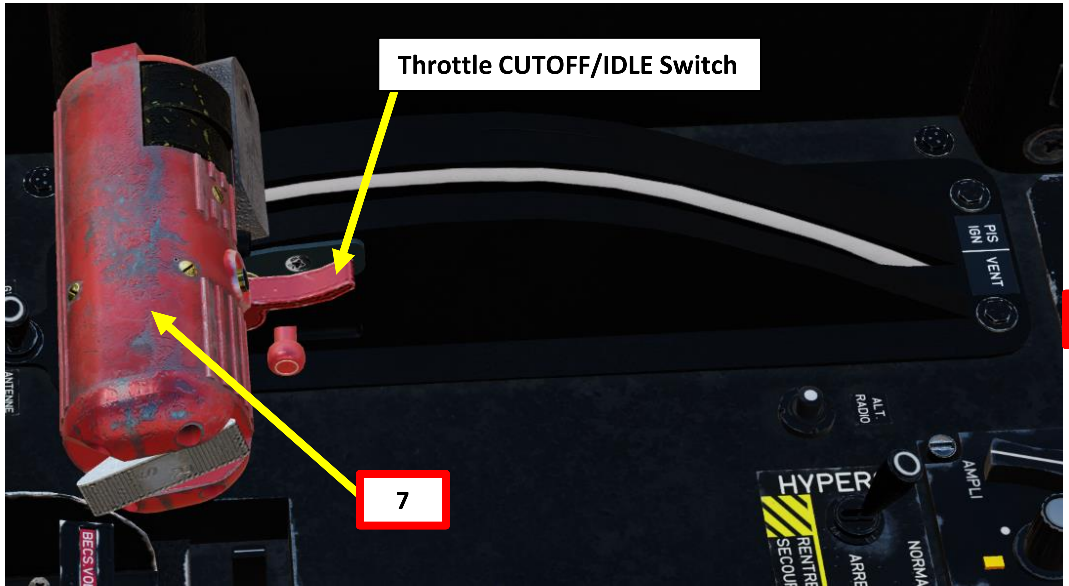
Mirage F1CE Only

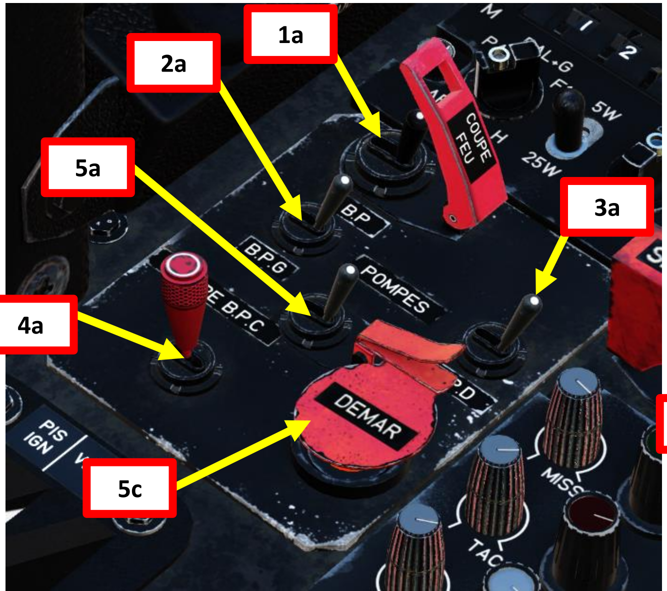
B – ENGINE START

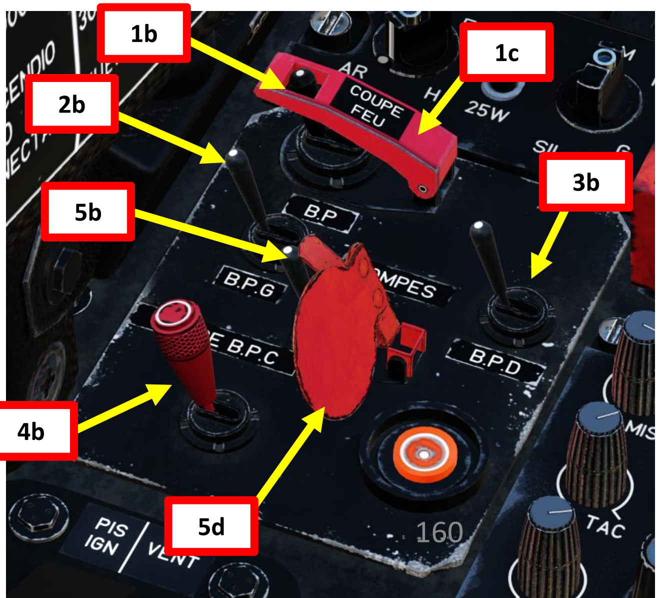
1. Set Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* Switch – OPEN (LEFT).
    - I recommend setting the cover guard over the switch once it is set to OPEN to prevent inadvertently setting the shutoff valve to CLOSED.
2. Set Left Low-Pressure Fuel Pump *(Pompe Basse Pression Gauche)* Switch – MARCHE/ON (LEFT).
3. Set Right Low-Pressure Fuel Pump *(Pompe Basse Pression Droite)* Switch – MARCHE/ON (LEFT).
4. Set Ignition/Ventilation Selector Switch – LEFT (Left Igniter) or MIDDLE (Right Igniter) position.
5. Set Starter Fuel Pump *(Interrupteur Pompe Démarrage)* Switch – ON (LEFT)
    - Lift the Engine Start Button Cover (*Poussoir de Démarrage*) to ensure starter fuel pump is ON.
6. Confirm that BP warning light extinguishes within 2 seconds after the starter pump has been turned ON.
7. Check that Throttle is at the OFF/CUTOFF detent (FULLY AFT).
    - If the throttle is not set to OFF/CUTOFF detent, throttle back to IDLE position and press the Throttle CUTOFF/IDLE Switch.





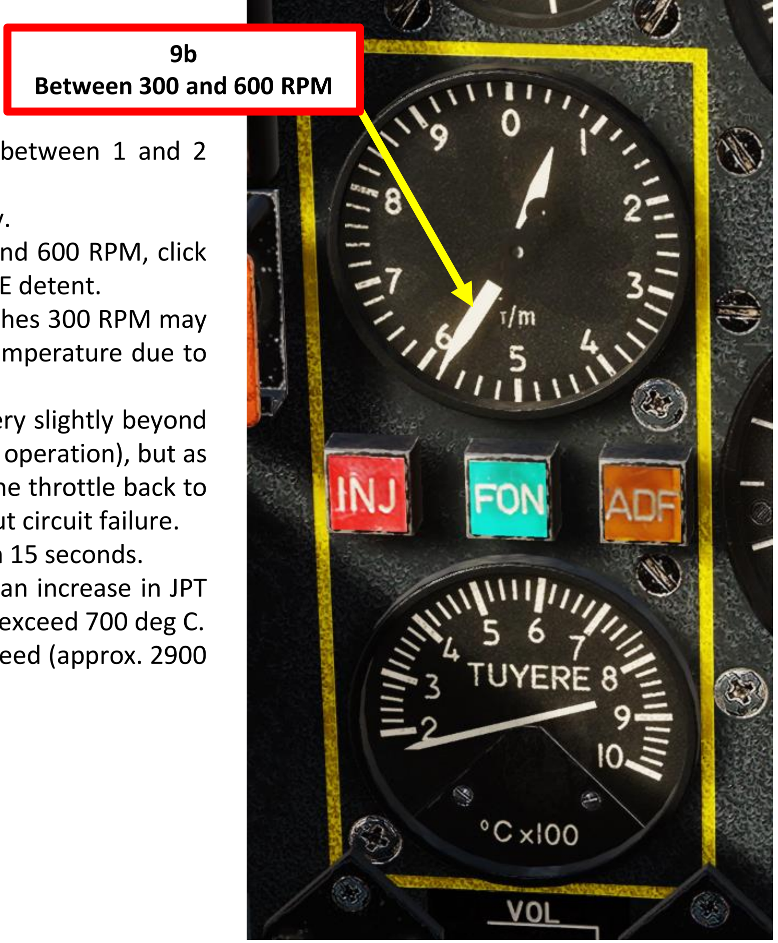




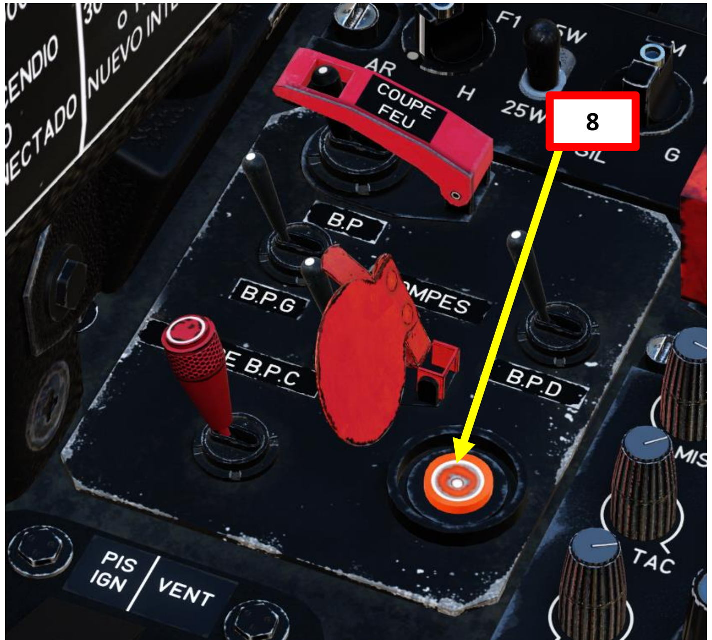


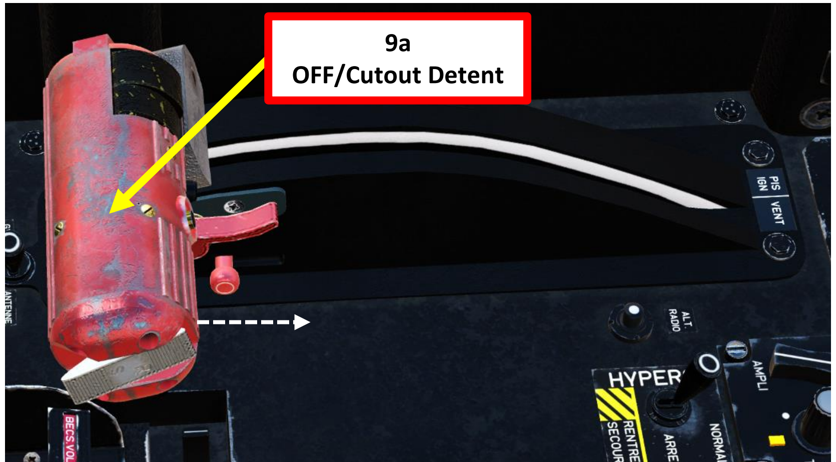
B – ENGINE START

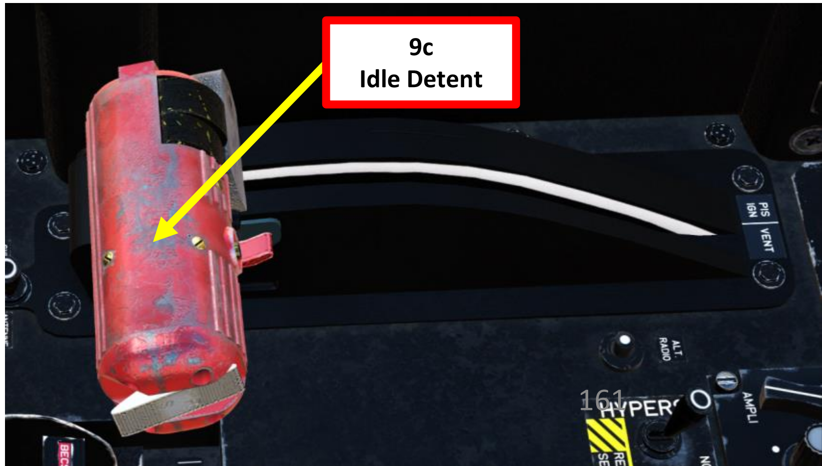
8. Press and hold the Engine Start Button (*Poussoir de Démarrage*) between 1 and 2 seconds.
   - The electrical turbo-starter is powered by the aircraft battery.
9. Monitor engine RPM carefully. When engine RPM is between 300 and 600 RPM, click on the throttle to advance it from the OFF/CUTOUT detent to the IDLE detent.
   - Note 1: Moving the throttle to IDLE **before** engine RPM reaches 300 RPM may lead to an engine fire or JPT (Jet Pipe Temperature) over-temperature due to an accumulation of fuel during the start-up sequence.
   - Note 2: With a cold engine, you can advance the throttle very slightly beyond IDLE to open the fuel metering valve a bit more (faster valve operation), but as soon as the engine starts accelerating at 2500 RPM, move the throttle back to IDLE to prevent starter turbine disintegration in case of cutout circuit failure.
10. Confirm that engine speed accelerates normally to 2000+ RPM within 15 seconds.
    a) Engine ignition occurs at about 1200 RPM, noticeable with an increase in JPT (Jet Pipe Temperature, *Température Tuyère*). JPT should not exceed 700 deg C.
    b) Fuel flow increases and the engine accelerates until idling speed (approx. 2900 RPM).



Mirage F1CE Only



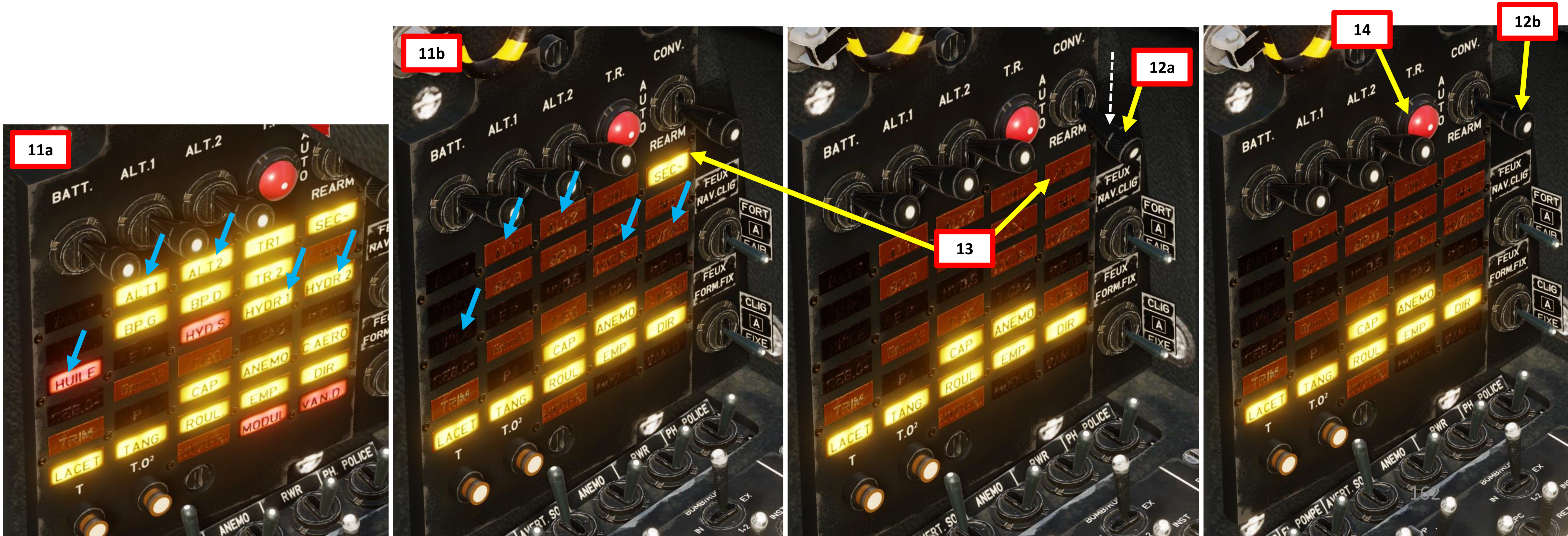




Mirage F1CE Only

B – ENGINE START

11. Once engine speed has stabilized around 2900 RPM, the alternators will kick in, hydraulic pressure will build up and oil pressure will increase. Confirm that the following warning lights are extinguished:
    - HYDR 1: Low Hydraulic Pressure (System 1)
    - HYDR 2: Low Hydraulic Pressure (System 2)
    - HUILE: Low Oil Pressure
    - ALT1: Alternator 1 disconnected or failed
    - ALT2: Alternator 2 disconnected or failed
12. Set the Inverter *(Convertisseur)* Selector Switch DOWN (RESET) momentarily, then release it. The switch will automatically be spring-loaded to the AUTO (MIDDLE) position.
13. Confirm that the SEC~ warning light is extinguished, which means that the emergency AC busses are now supplied by the alternators instead of the inverter.
14. If TR1 or TR2 Warning Lights remain illuminated, press the Transformer-Rectifier (*Inverseur Transfo-Redresseur*) Reset Button,

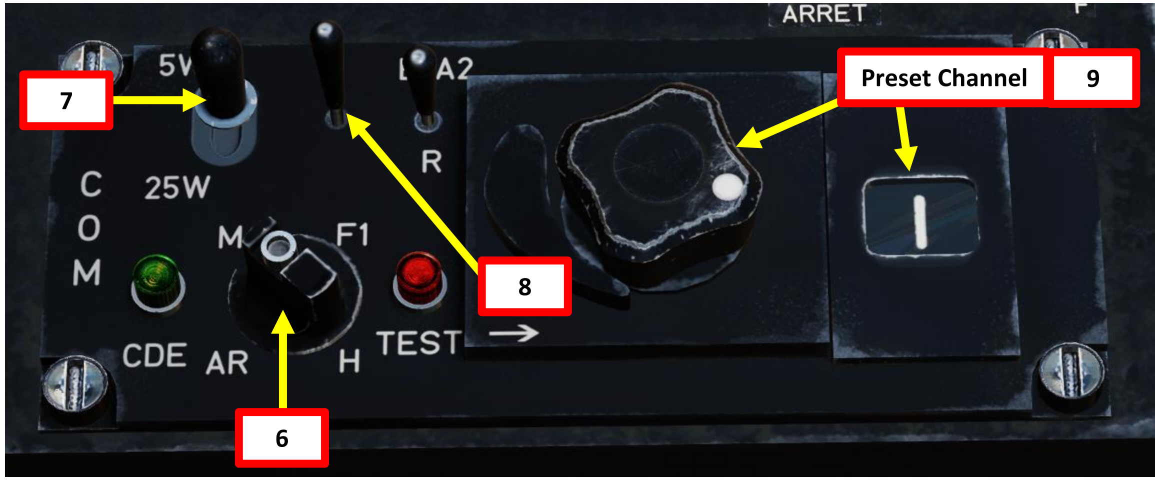


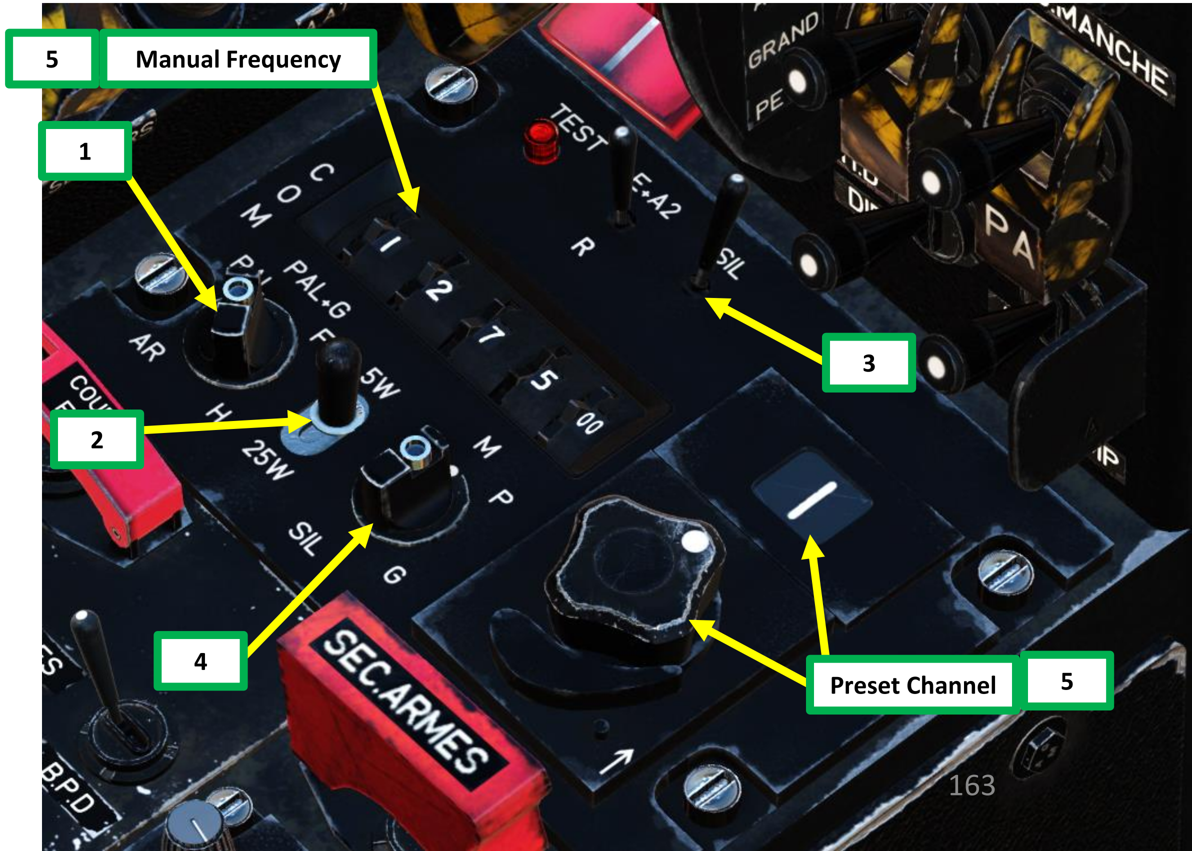
C – AFTER START-UP

Mirage F1CE Only

1 – Radio Communications Setup

1. Set TRAP 136 V/UHF Radio (Green Radio) Mode Selector – PAL (*Fréquence Principale*, Main Frequency).
2. Set V/UHF Radio Transmitter Power Switch – 5 W (FWD).
3. Set V/UHF Radio SIL *(Silence)* / Squelch Switch – ON (FWD).
4. Set V/UHF Radio Frequency Selector – As required (Manual Frequency or Preset Channel Frequency).
5. Set V/UHF Radio Manual Frequency or Preset Channel – As required.
6. Set TRAP 137B UHF Radio (Red Radio) Mode Selector – MARCHE/ON.
7. Set UHF Radio Transmitter Power Switch – 5 W (LEFT).
8. Set UHF Radio SIL *(Silence)* / Squelch Switch – ON (LEFT).
9. Set UHF Radio Preset Channel – As required.

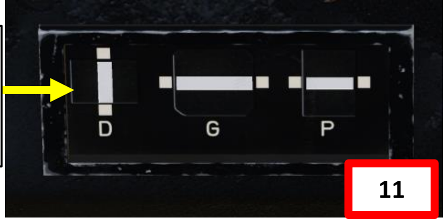




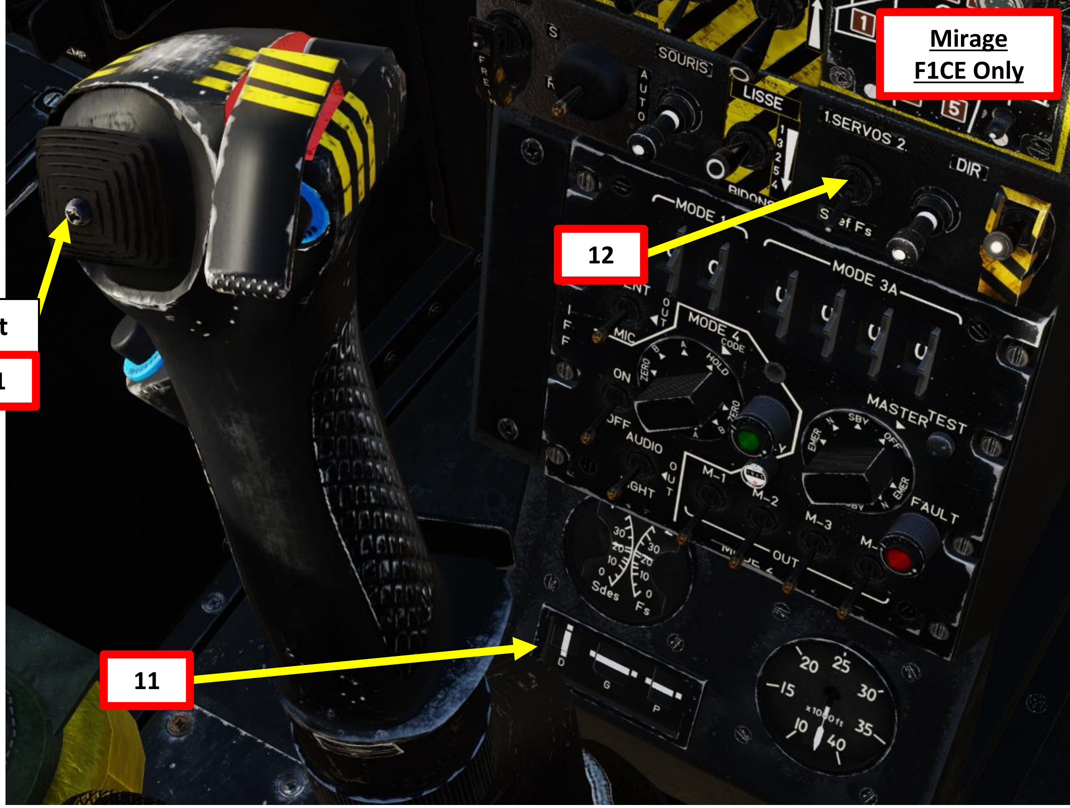
C – AFTER START-UP

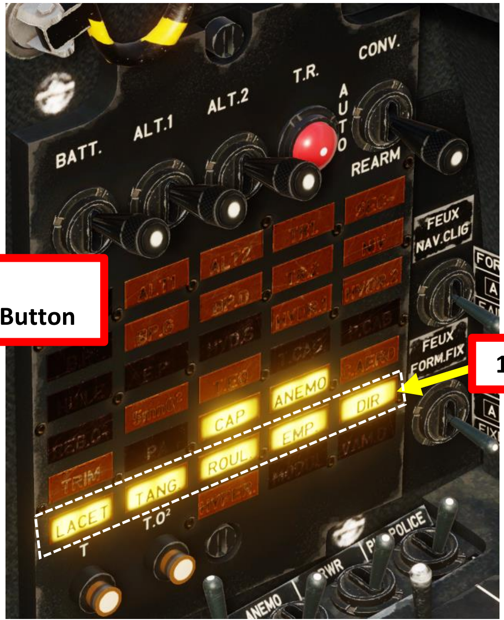
2 – Flight Control Servos Setup

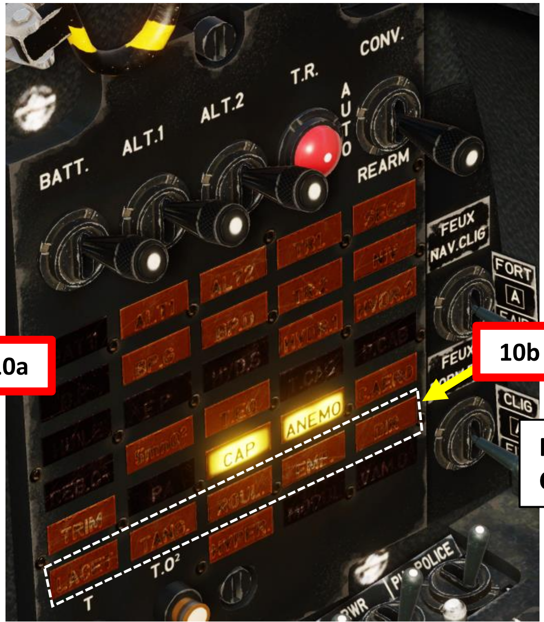
Trim Indicators
- *D: Yaw (Direction)*
- *G: Roll (Gauchissement)*
- *P: Pitch (Profondeur)*



10. Press the Servo Reset Button
    a) When pressed, the servo reset button allows for a reset of the flight control servos if all the operation conditions are met.
    b) Confirm that the following warning lights are extinguished:
        - LACET (Yaw)
        - TANG (*Tangage*, Pitch)
        - ROUL (*Roulis*, Roll)
        - EMP (Empennage)
        - DIR (*Gouverne de Direction*, Rudder)
11. Confirm Pitch, Roll and Yaw trim tabs are NEUTRAL.
    - If trim tabs are not set correctly, adjust accordingly using the Trim Hat switch on the stick and the Rudder Trim *(Trim Directionnel)* Control Switch.
12. Set Hydraulic Pressure Selector Switch – SDES (DOWN). This makes the Hydraulic Pressure Indicator displays hydraulic pressure for ancillary systems (*Sdes, Servitudes*) and Emergency Hydraulic Brake (*Fs, Frein Secours*).



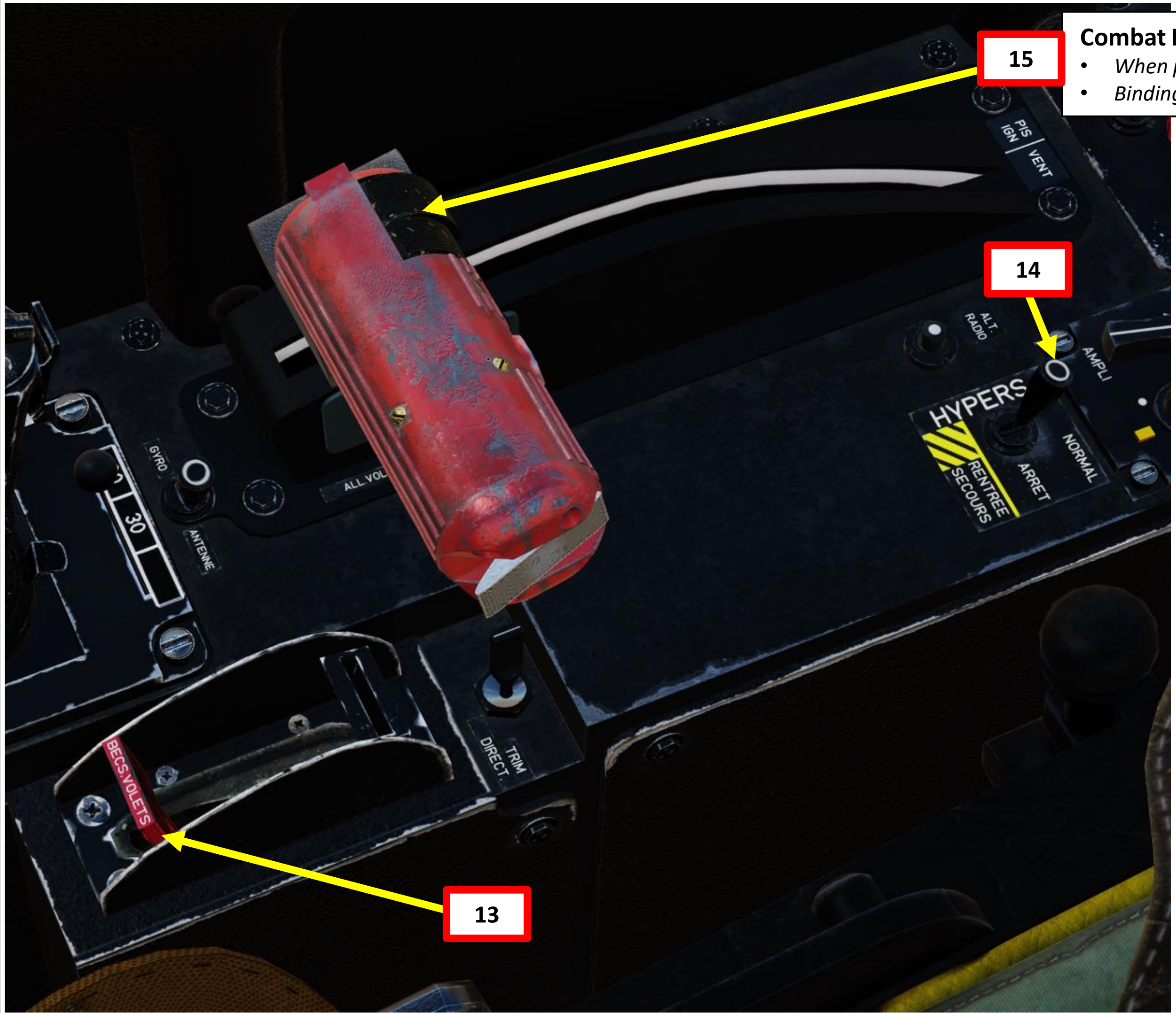




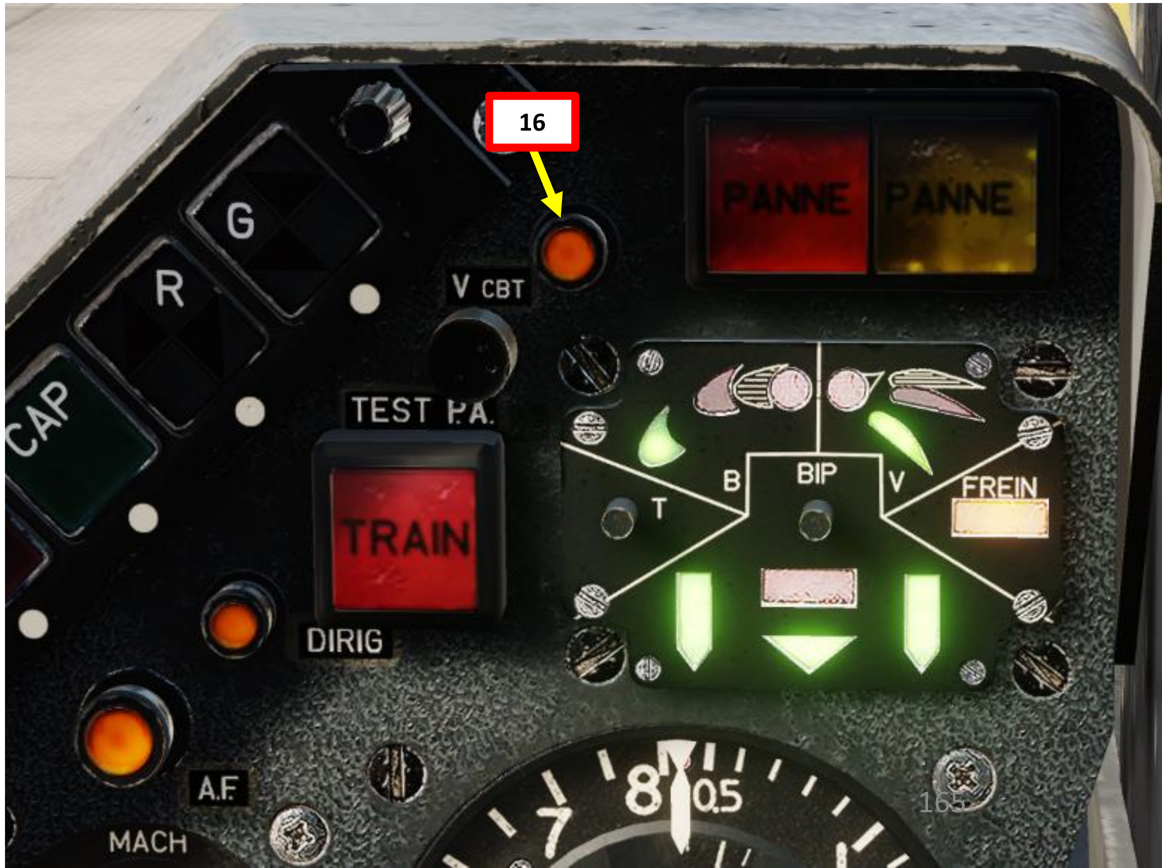
C – AFTER START-UP

3 – High-Lift Devices Setup

13. Set Wing Slats/Flaps *(Becs/Volets)* Control Lever – DEPLOYED (FULLY AFT)
14. Set High-Lift Devices *(Volets Hypersustentateurs)* Mode Selector Switch – NORMAL (FWD).
15. Press the Combat Flap Lever ("LCTRL+V" binding) to disarm combat flaps and retract them if deployed.
16. Confirm that V CBT (Combat Flaps) Light is extinguished.



Combat Flaps Lever
- *When pressed, disarms combat flaps and retracts them if deployed.*
- *Binding: LCTRL+V*

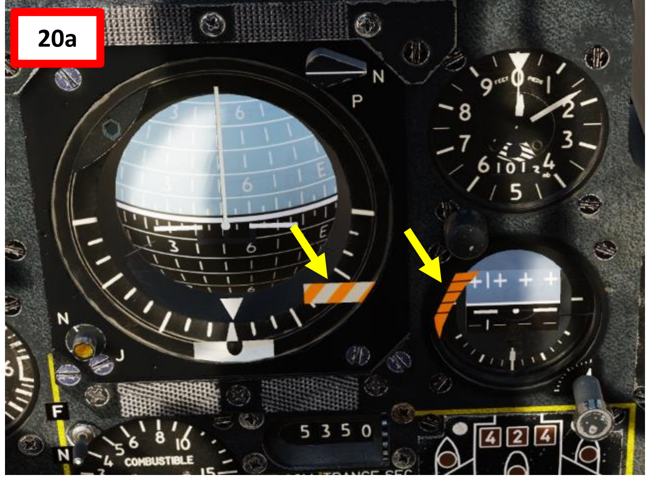


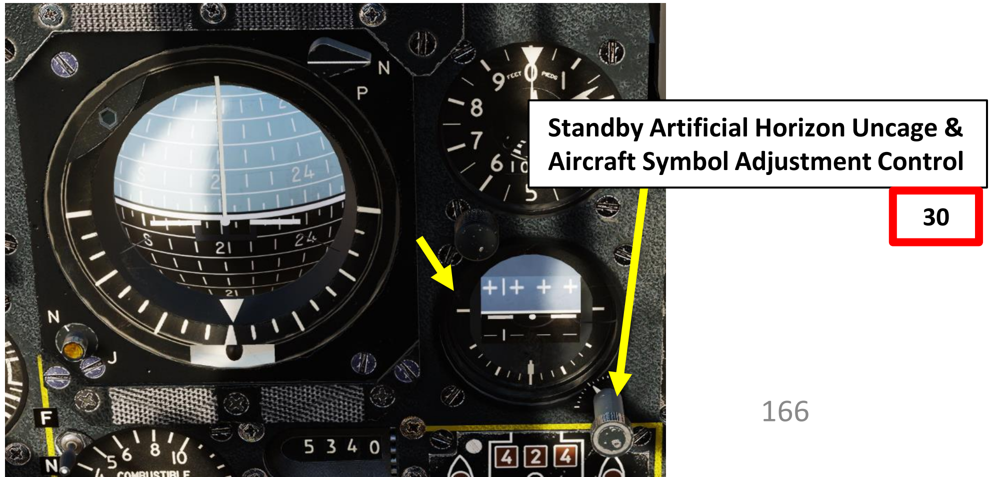
C – AFTER START-UP

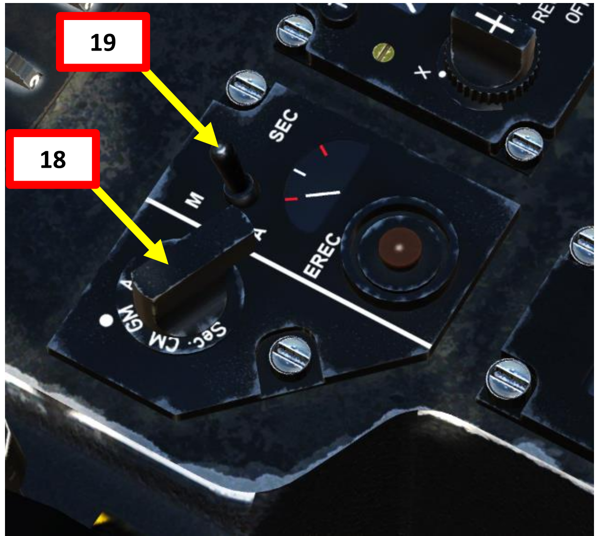
Mirage F1CE Only

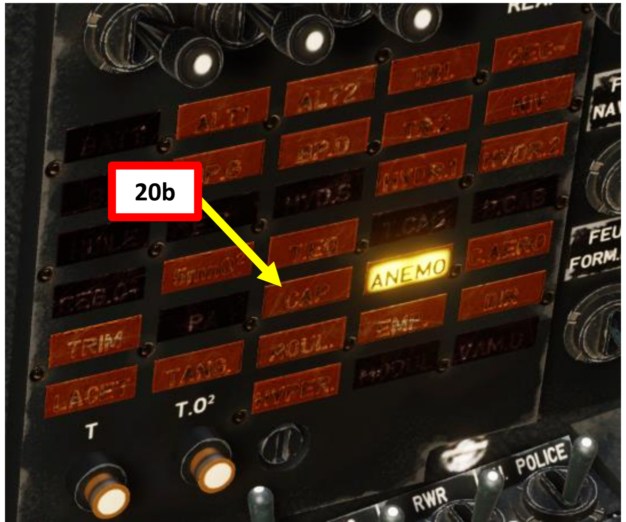
4 – Gyroscopic Heading & Reference System Setup

17. Set Standby Horizon *(Horizon Secours)* Switch – MARCHE/ON (FWD).
18. Set Gyroscopic Heading & Vertical Reference System Control Selector – GM (Gyromagnetic Compass Heading).
19. Set Emergency *(Secours)* Gyromagnetic Compass Switch – MARCHE/ON (FWD).
20. Full alignment of the Heading and Vertical Reference System takes approximately 1 to 2 minutes. Once gyro alignment is complete, the CAP warning light extinguishes and the failure flag disappears on the Spherical Indicator *(Indicateur Sphérique / Boule)*.
21. Uncage the Standby Artificial Horizon by scrolling mousewheel on the caging knob. Once uncaged, the failure flag will disappear on the Standby Artificial Horizon.





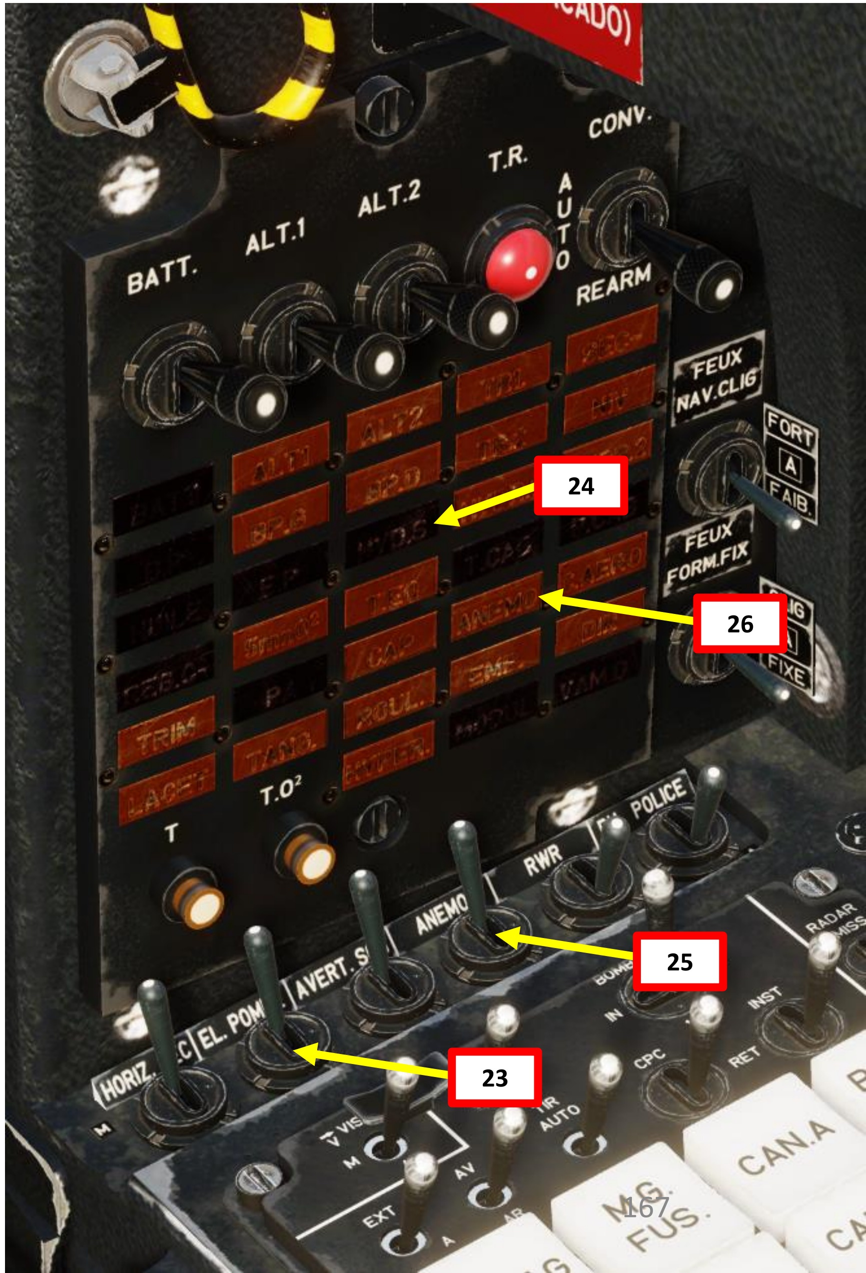




C – AFTER START-UP

5 – Navigation Systems & Sensors Setup

22. Set IDN (*Indicateur de Navigation*, Navigation Indicator) Mode Selector – As Required. We will select TE (Radar Mode).
23. Set Electro-Pump Switch – MARCHE/ON (FWD).
24. Confirm that HYD.S (Emergency Hydraulic System) Warning Light is extinguished.
25. Set Pitot Probe Heater *(Réchauffage Anémomètre-Incidence)* Switch – MARCHE/ON (FWD).
26. Confirm that ANEMO Warning Light is extinguished.

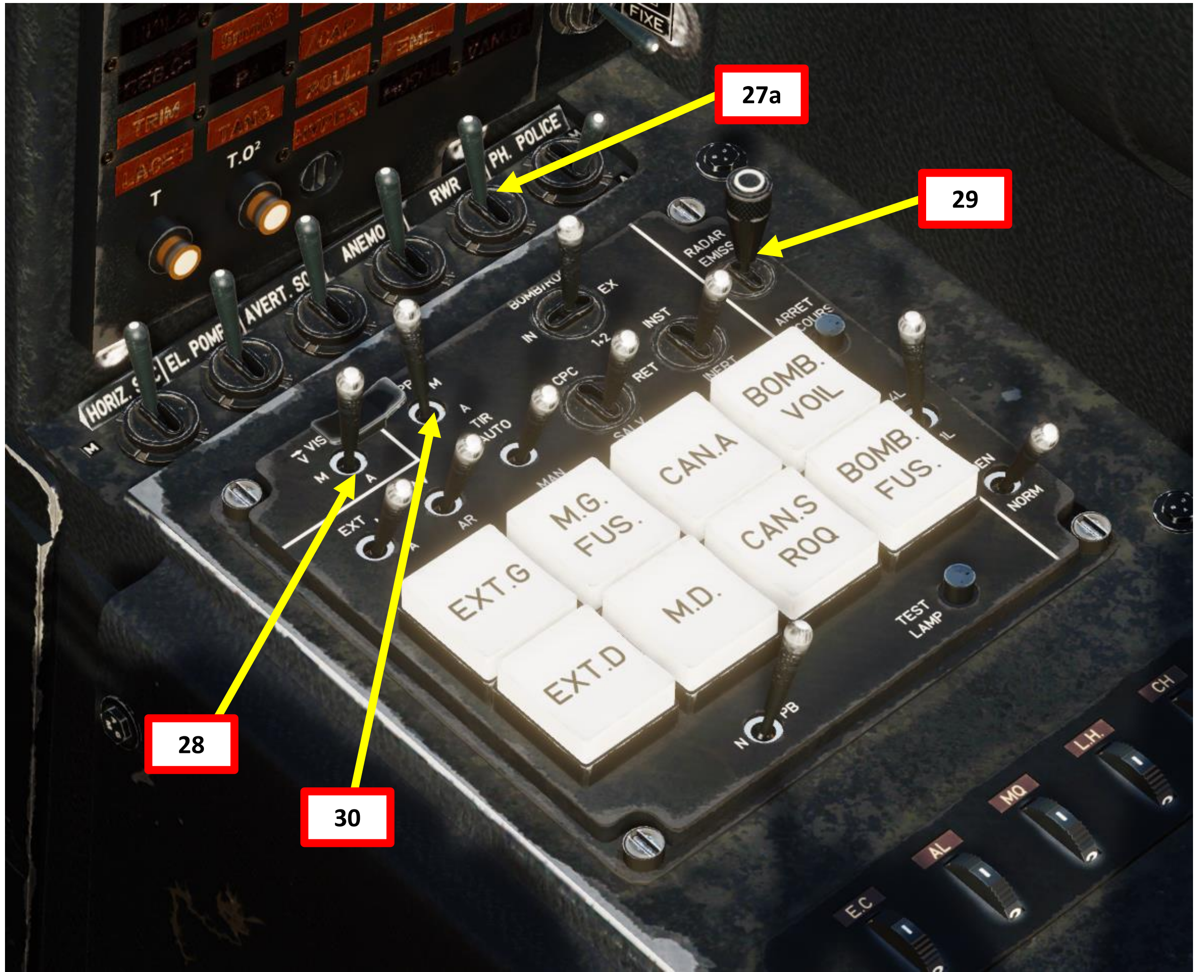


C – AFTER START-UP

Mirage F1CE Only

5 – Navigation Systems & Sensors Setup

27. Set Radar Detector (Radar Warning Receiver) Switch – MARCHE/ON (FWD).
    - Hold the Radar Detector Test Switch DOWN to the TEST position and check that RIGHT and FORWARD Detection Sector Indicators (red arrows) and CW light illuminate when the switch is held down. Release test switch once check is performed.
28. Set Sight *(Viseur)* Selector Switch – MARCHE/ON (MIDDLE position).
29. Set Radar Operation Mode Selector Switch – VEILLE/STANDBY (MIDDLE position).
30. Set Firing Fuel Dipper Switch - MARCHE/ON (FWD).

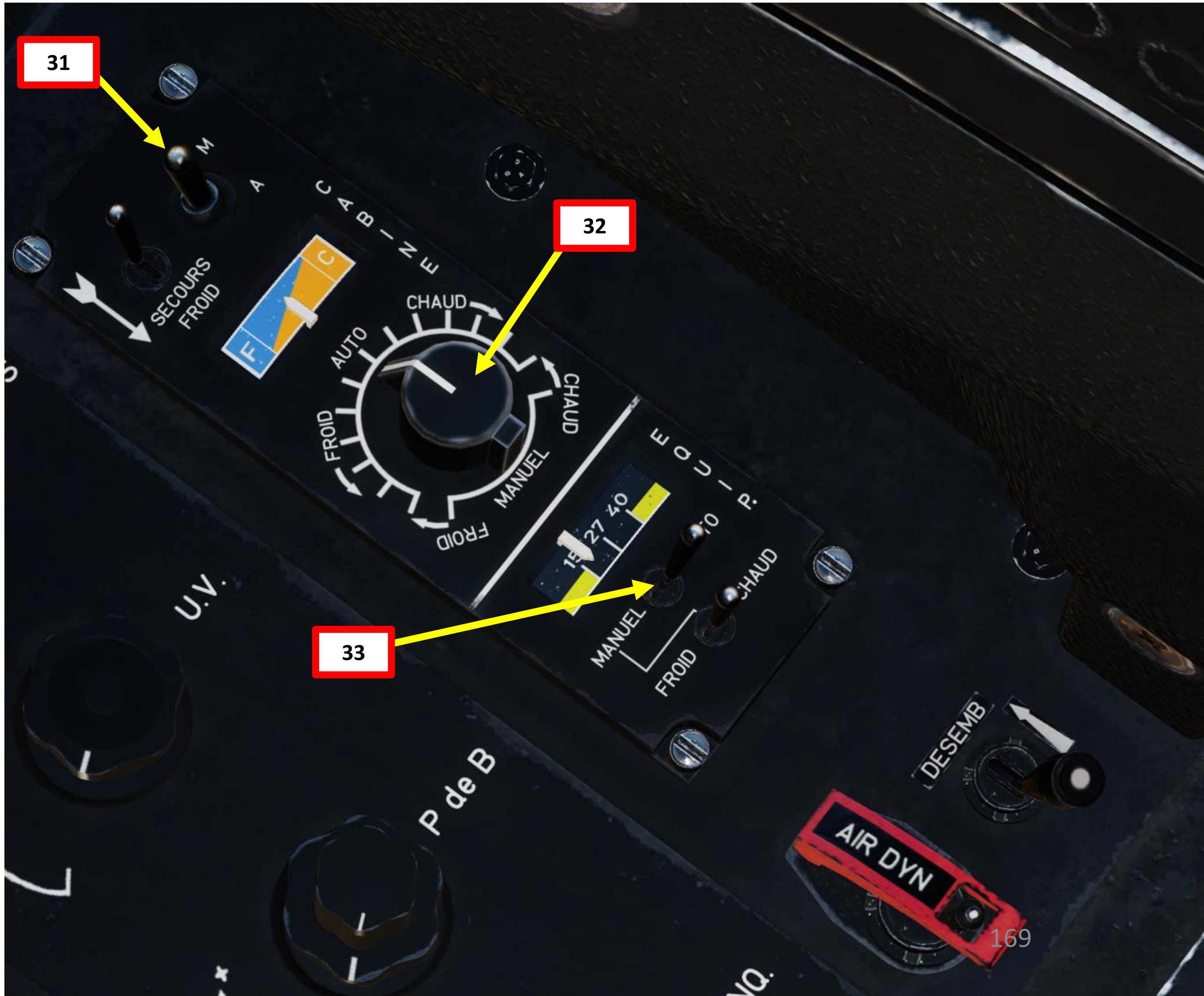


C – AFTER START-UP

Mirage F1CE Only

6 – Air Conditioning & Avionics Cooling Setup

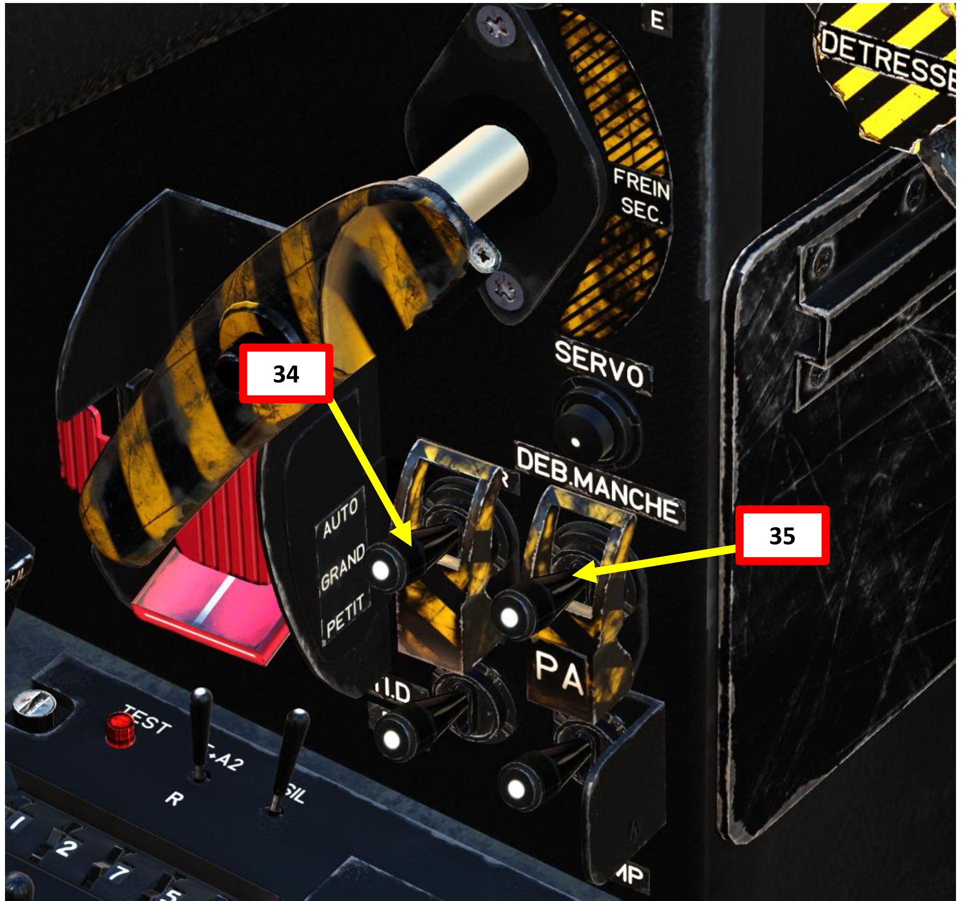
31. Set Air Conditioning Master Valve Control Switch – MARCHE/ON (FWD).
32. Set Cabin Temperature Control – AUTO.
33. Set Air Conditioning Temperature Mode Switch – AUTO (RIGHT)

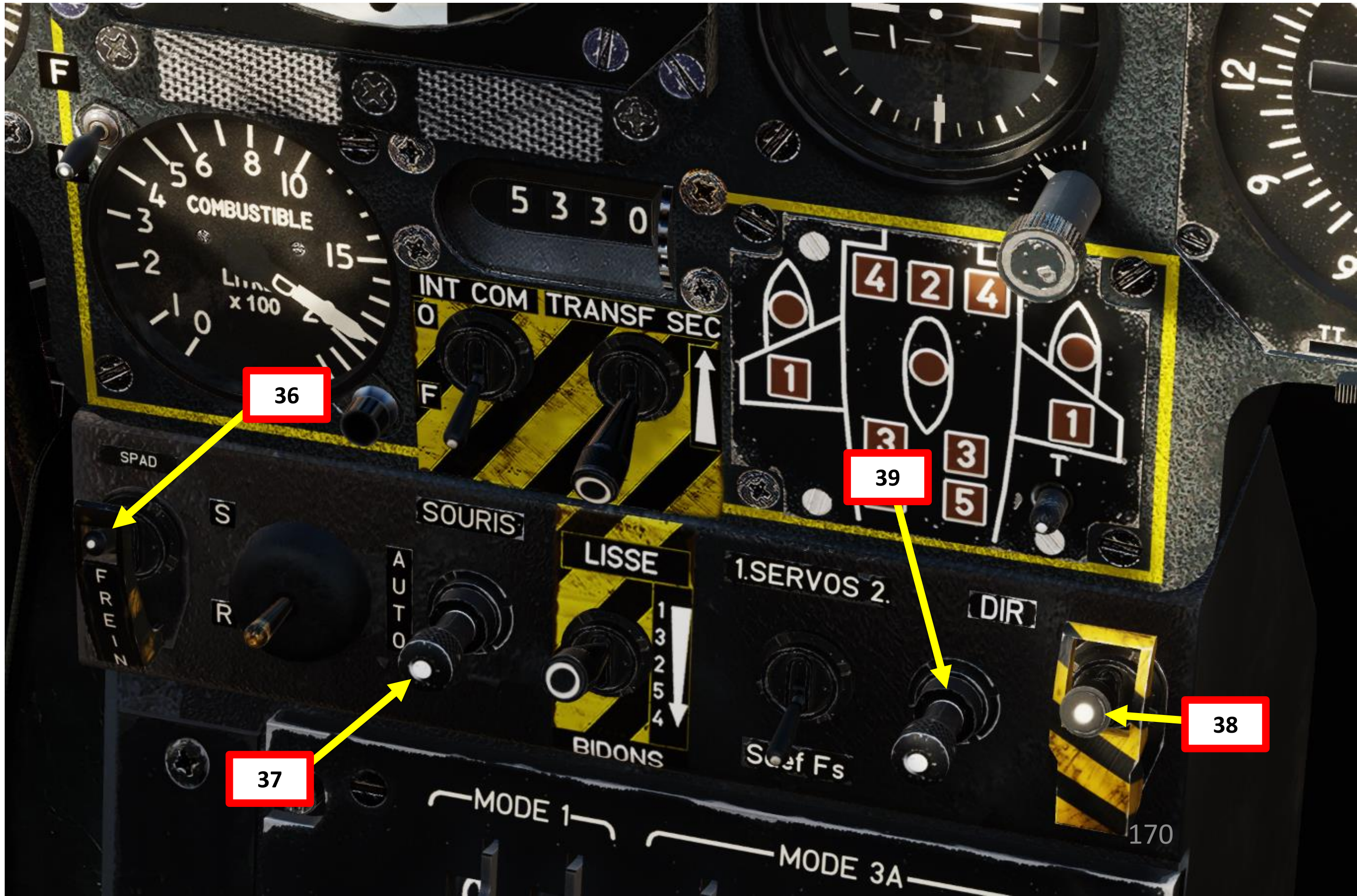


C – AFTER START-UP

7 – Aircraft Controls Setup

34. Verify ARTHUR Selector Switch is set to AUTO (UP).
    - The ARTHUR (variable sensitivity crank bell) system adjusts the control stick sensitivity as a function of altitude and airspeed.
35. Verify Stick Uncouple Switch *(Débrayage Manche)* is set to OFF (UP).
36. Set Anti-Skid (SPAD, *Système Perfectionné Anti-Dérapant*) Switch – ON (UP).
37. Set Engine Shock Cone *(Souris)* Pushbutton – ON/AUTOMATIC (PUSHED IN).
38. Set Nosewheel Steering *(DIRIG, Dirigeabilité Roue Avant)* Switch – ON (UP).
39. Set Nosewheel Steering High Sensitivity Selector Button – HIGH SENSITIVITY (PUSHED IN).



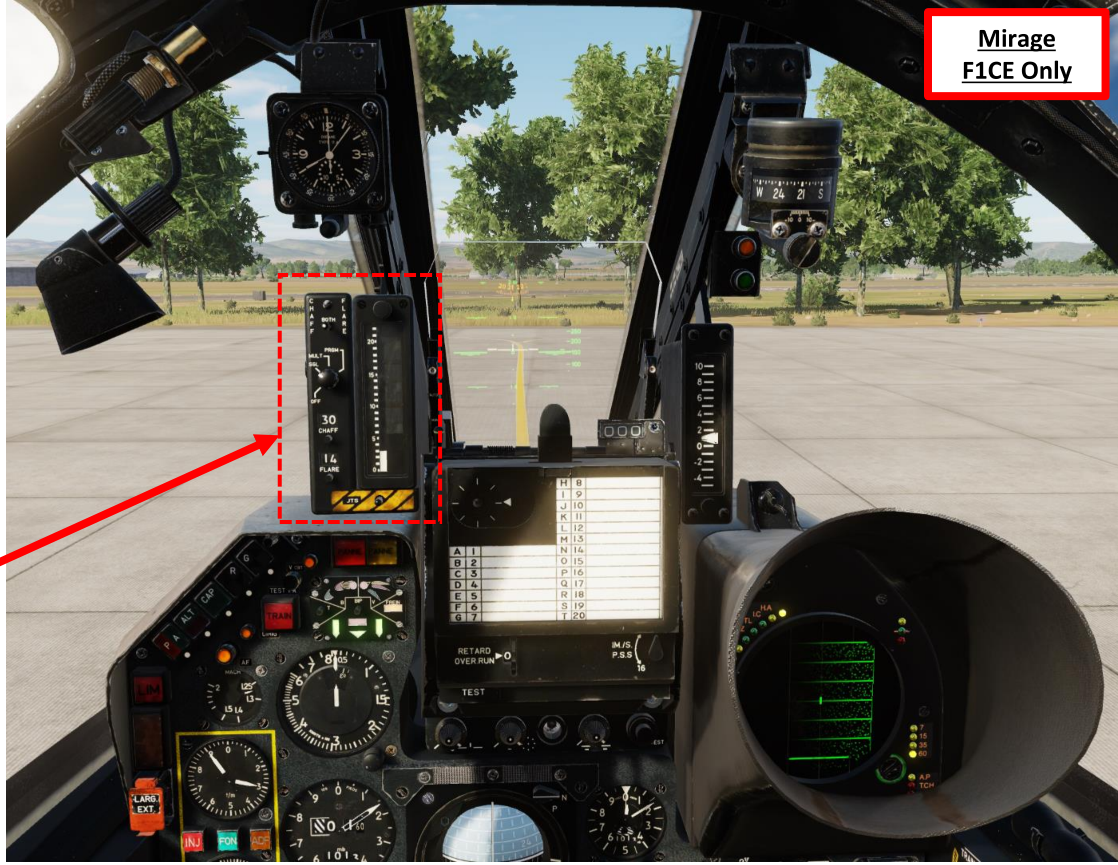


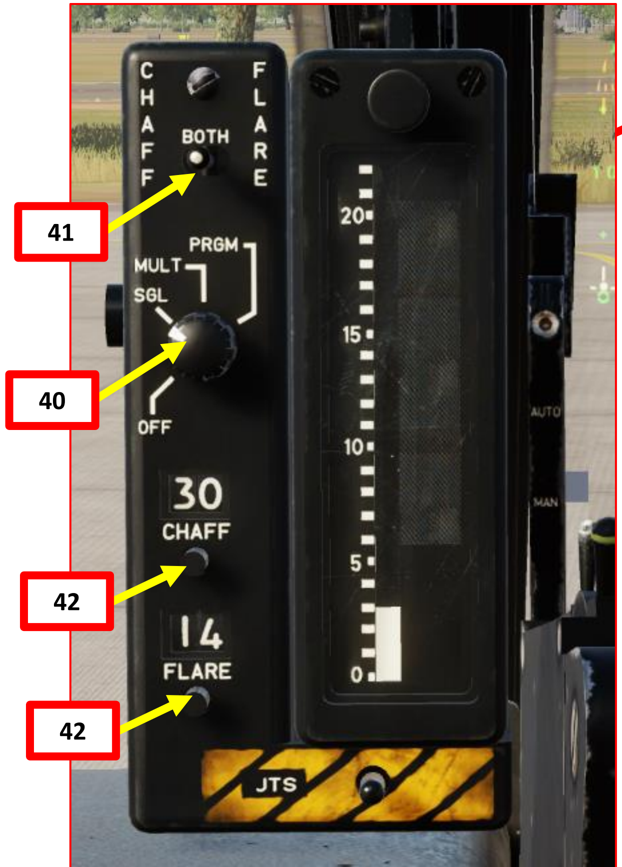
C – AFTER START-UP

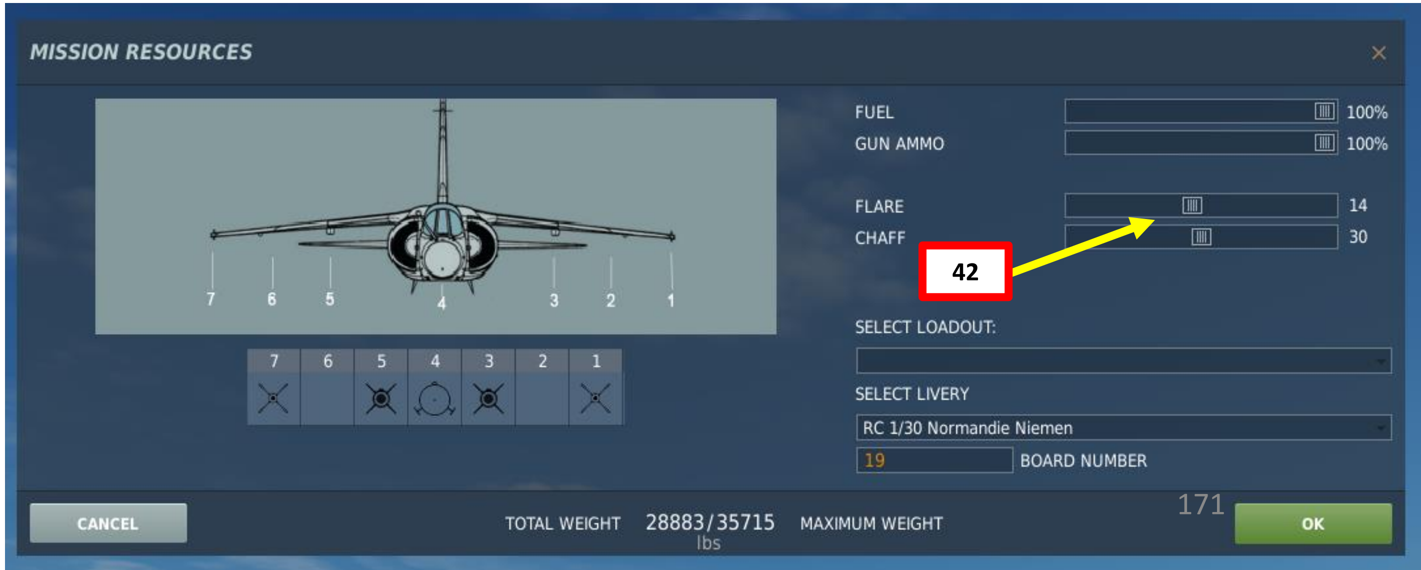
8 – Countermeasures Setup

40. Select Countermeasure Program Selector – As desired.
41. Select Chaff/Flare Selector Switch – As desired.
42. Based on your countermeasure loadout, press the Chaff Counter & Reset Button and the Flare Counter & Reset Button (Below) to obtain the correct chaff and flare counter values.

Mirage F1CE Only





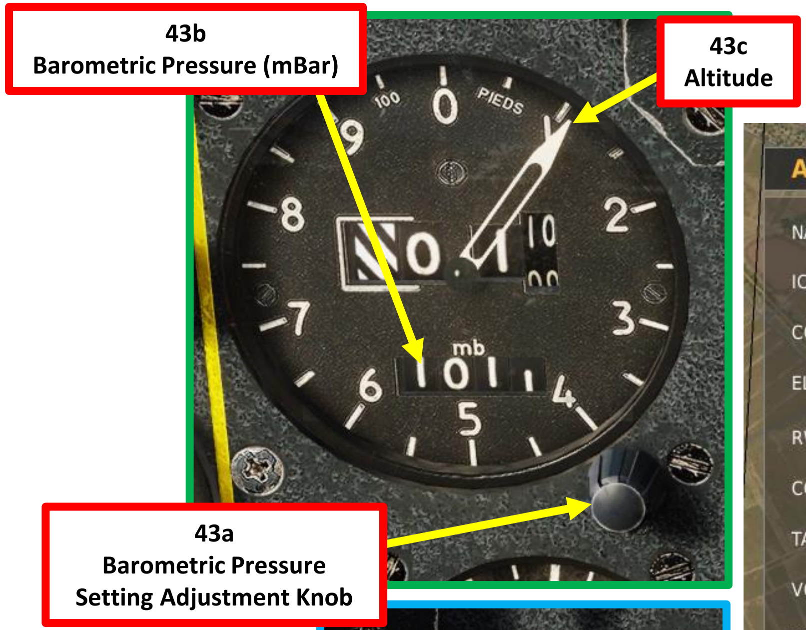


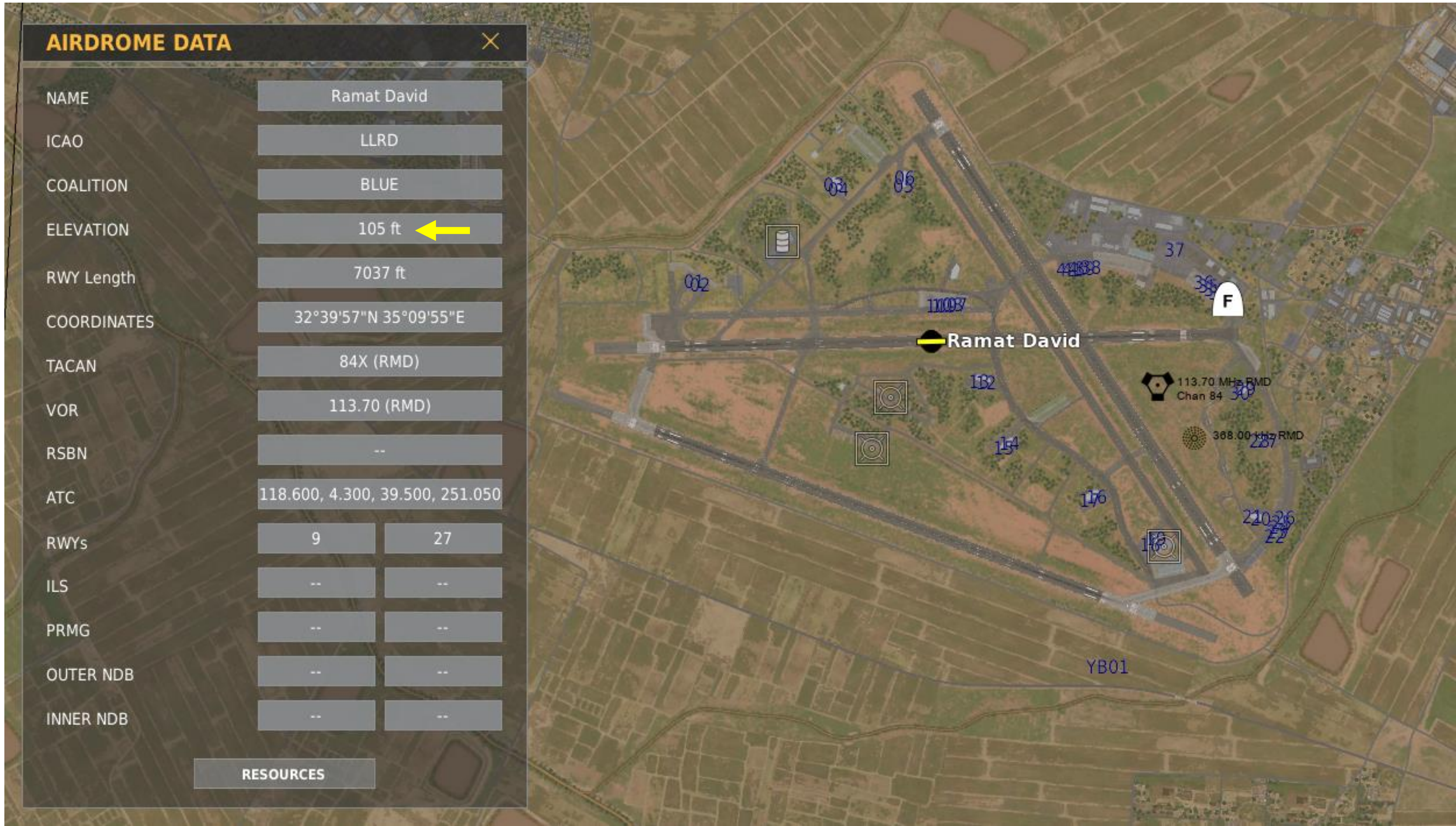
Mirage F1CE Only

C – AFTER START-UP

9 – Last Interior Checks

43. Set altimeter barometric pressure setting for both the **Slaved Altitude** *(Alticodeur/Altimètre)* Indicator and the **Standby Altimeter**.
    - If airfield elevation data is available, you can adjust the barometric pressure knobs to make the altimeter reading match the airfield elevation (which would be 105 ft in our case since we takeoff from Ramat David). However, you will have to keep in mind that your altitude reading will be AMSL (Above Mean Sea Level), not above ground level. This is important to remember when being directed by the ATC (Air Traffic Controller). For airfields with variable elevation, you might want to perform this step when lined up on the runway.
    - Alternatively, you can set the barometric pressure knob to make the altimeter reading match "0". In that case, the altitude reading will be AGL (Above Ground Level), not from sea level.

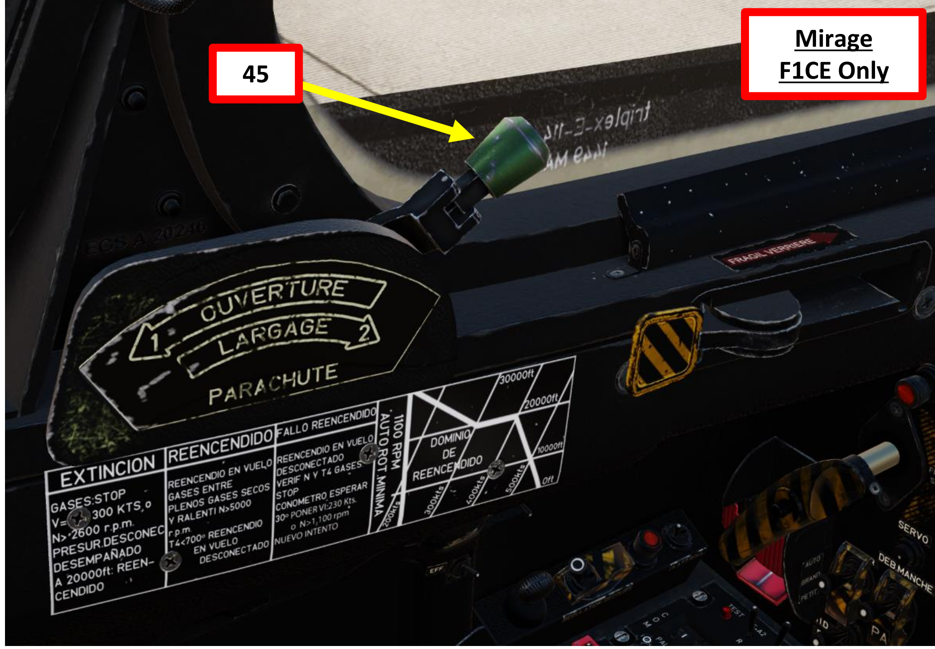


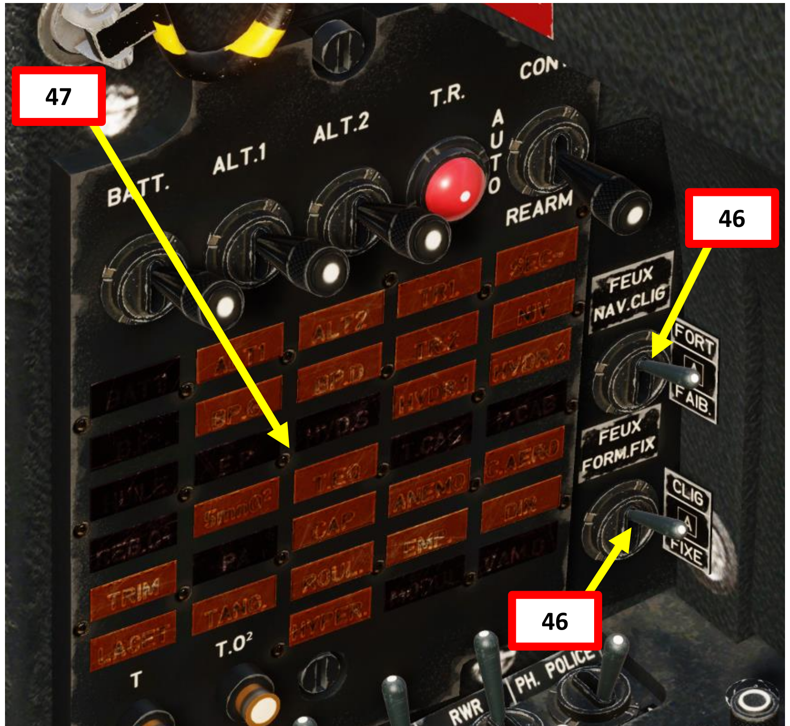


C – AFTER START-UP

9 – Last Interior Checks

44. Set IFF (Identify-Friend-or-Foe) Master Mode – SBY (Standby).
45. Verify Parachute (Brake Chute) Lever is set to LARGAGE/RELEASE position (FWD).
46. Set External Lights – As Required
    - Navigation Lights *(Feux de Navigation)* Control Switch - UP (Fort, Bright)
    - Formation Lights *(Feux de Formation)* Control Switch – UP (*Clignotant*/Blinking) or DOWN (*Fixe*/Steady)
    - Landing Light Control Switch – FWD (*ROUL (Roulage), Taxi Light*)
47. Verify that there are no more warning lights illuminated on the Warning Panel.

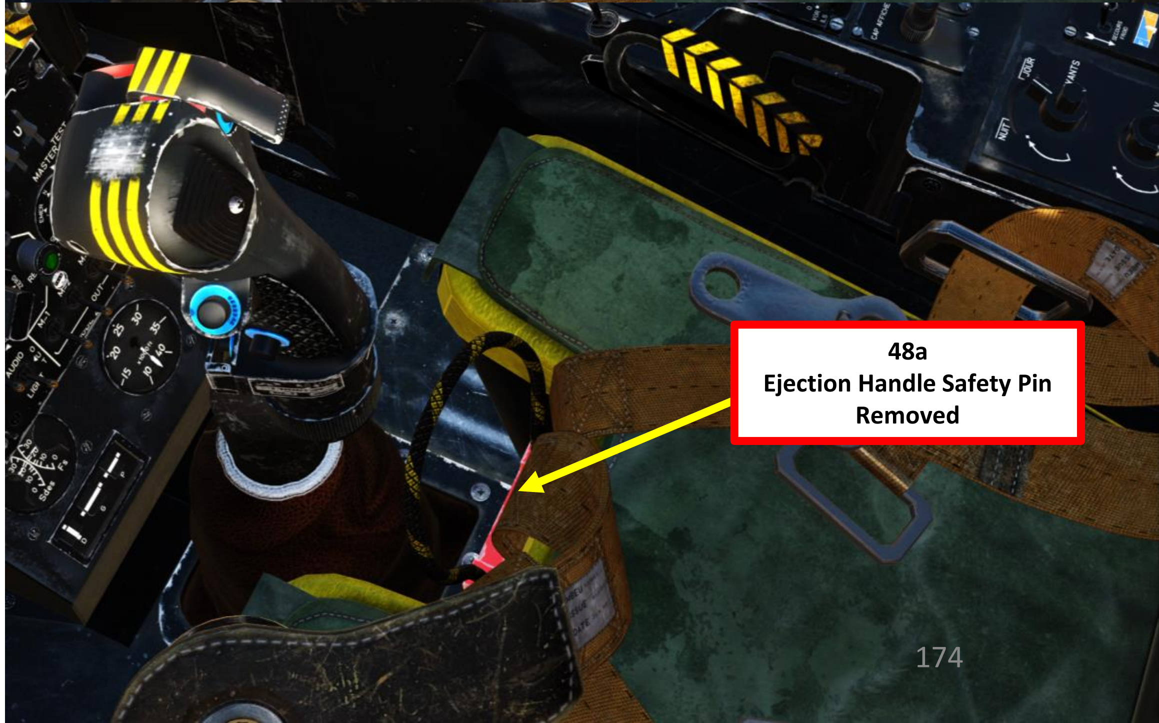




C – AFTER START-UP

9 – Last Interior Checks

48. Remove Ejection Handle Safety Pin (scroll mousewheel on ejection handle).
49. You are now ready to taxi.



Mirage F1CE Only

Mirage F1EE Only

MIRAGE F1EE START-UP PROCEDURE OVERVIEW

A. *Before Start-Up*

B. *Engine Start*

C. *After Start-Up*

1. Radio Communications Setup
2. Flight Control Servos Setup
3. High-Lift Devices Setup
4. Gyroscopic Heading & Reference System Setup
5. UNI/INS (*Unité de Navigation Inertielle* / Inertial Navigation System) Alignment
    - Option 1: Stored Heading (*ALCM, Alignement sur Cap Mémorisé*)
    - Option 2: Full Alignment
6. Navigation Systems & Sensors Setup
7. Air Conditioning & Avionics Cooling Setup
8. Aircraft Controls Setup
9. Countermeasures Setup
10. Last Interior Checks

A – BEFORE START-UP

Mirage F1EE Only

1. Perform exterior checks and request ground crew to install required ordnance for the mission.

Mirage F1EE Only

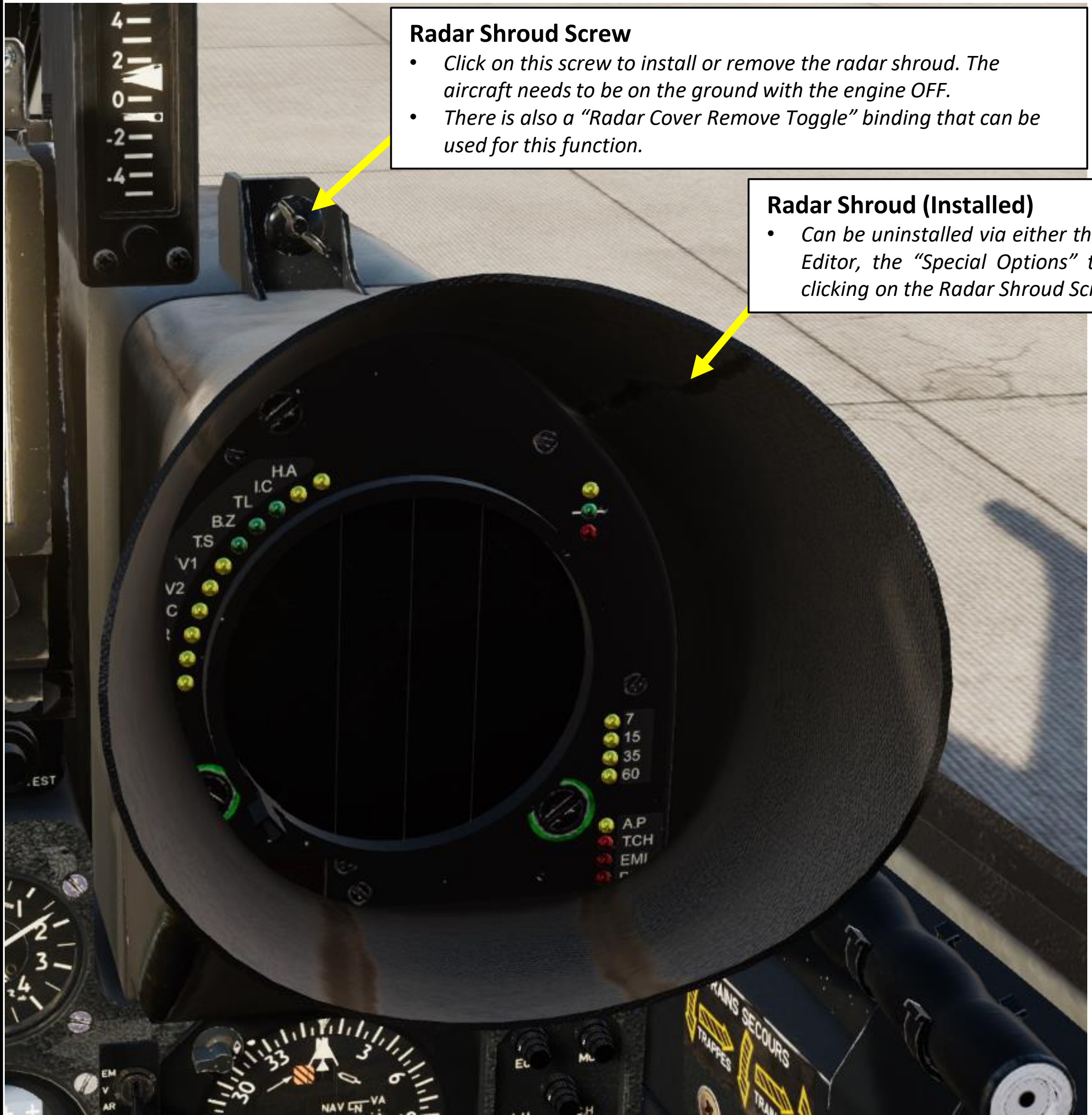
A – BEFORE START-UP

2. Engage Parking Brake – Pull Parking Brake Lever OUT.

A – BEFORE START-UP

Mirage F1EE Only

3. If desired, remove or install the radar shroud by clicking on the radar shroud screw. The shroud allows better visibility of the radar scope in sunlit conditions but restricts the pilot to a narrow field-of-view.

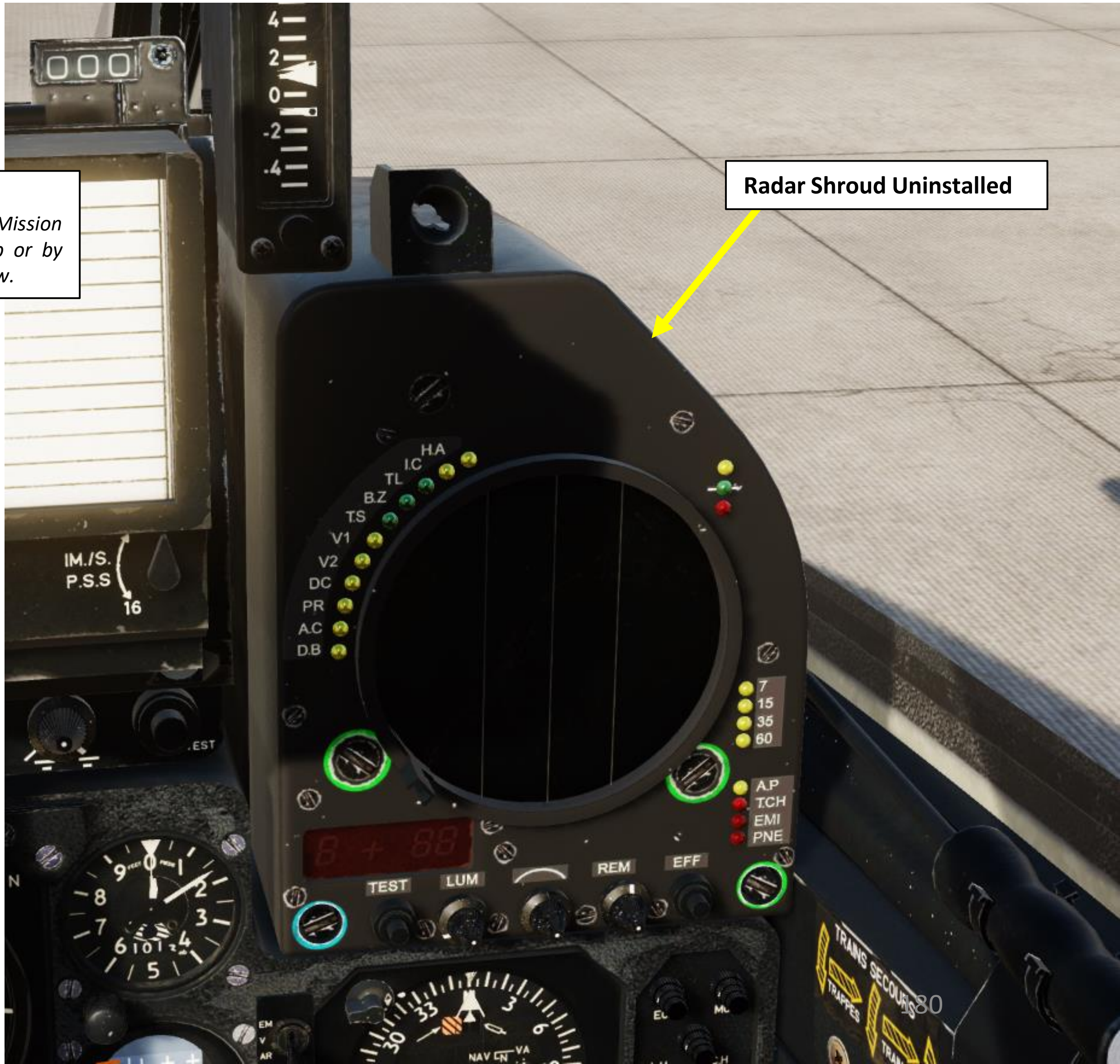


Radar Shroud Screw

- *Click on this screw to install or remove the radar shroud. The aircraft needs to be on the ground with the engine OFF.*
- *There is also a "Radar Cover Remove Toggle" binding that can be used for this function.*

Radar Shroud (Installed)

- *Can be uninstalled via either the Mission Editor, the "Special Options" tab or by clicking on the Radar Shroud Screw.*

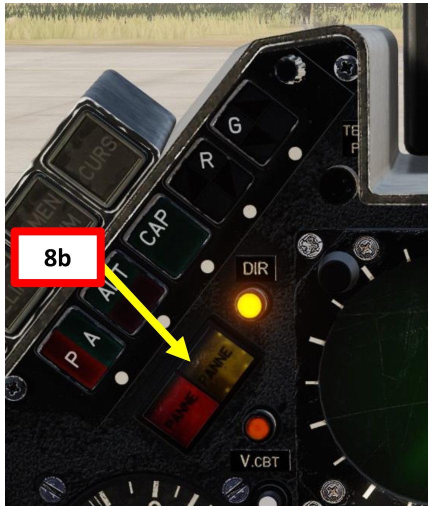


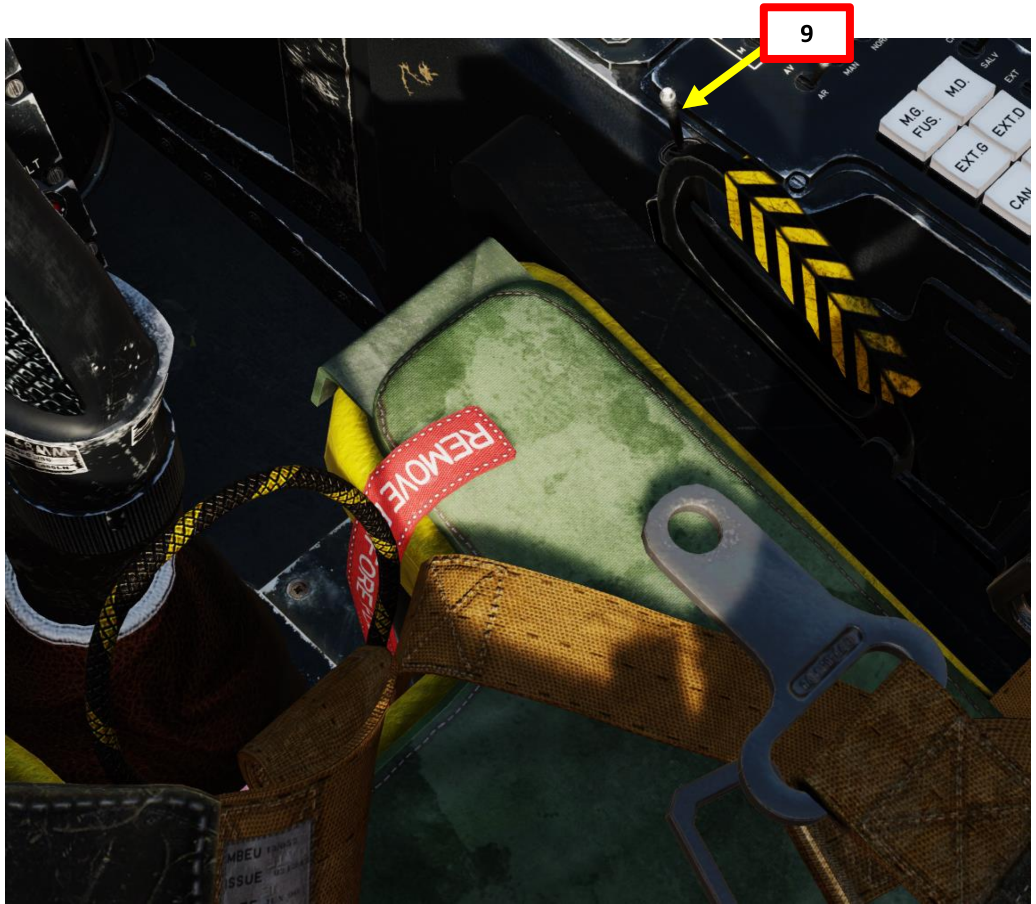
Radar Shroud Uninstalled

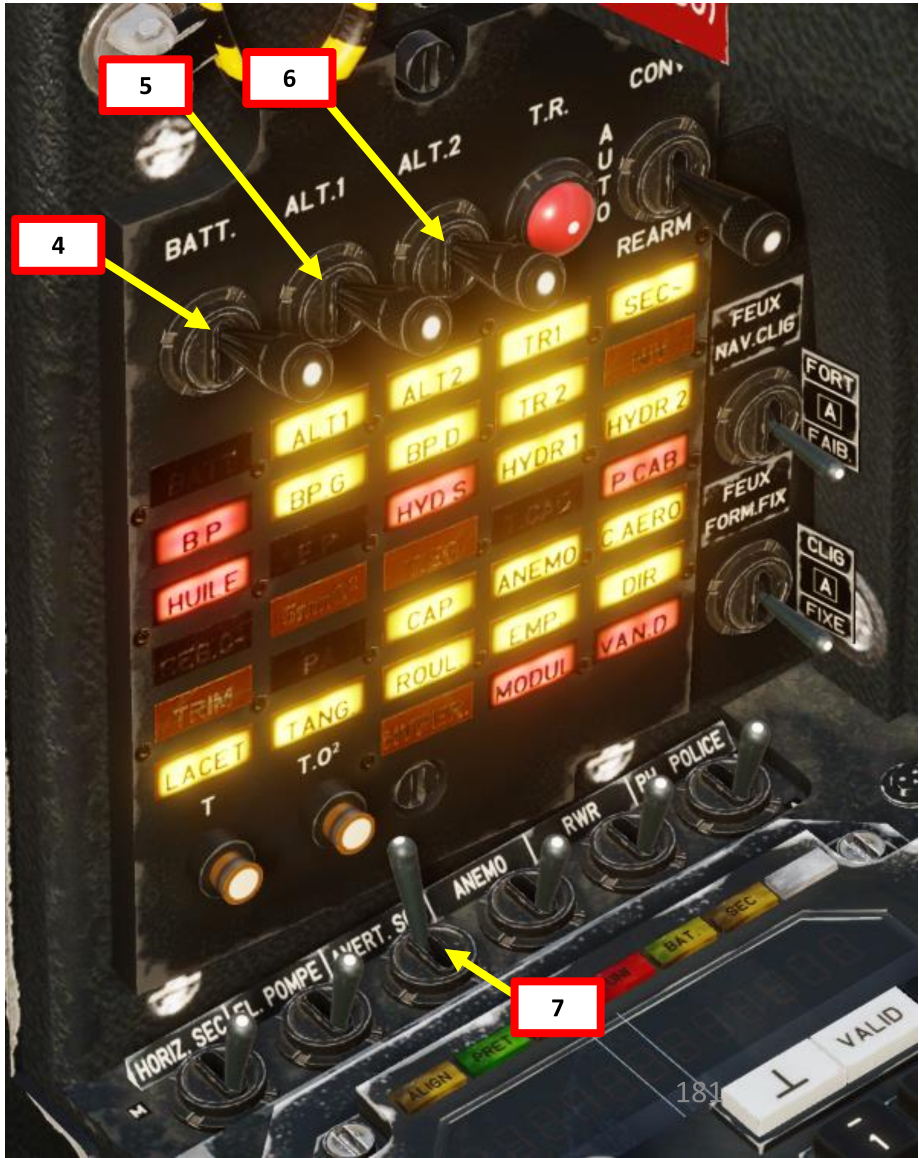
Mirage F1EE Only

A – BEFORE START-UP

4. Set Battery Switch – MARCHE/ON (UP).
5. Set Alternator No. 1 Switch – MARCHE/ON (UP).
6. Set Alternator No. 2 Switch – MARCHE/ON (UP).
7. Set Aural Warning Horn *(Avertisseur Sonore)* Switch – MARCHE/ON (FWD).
8. Press the Master Failure Warning *(Panne)* Button to reset the aural warning.
9. Adjust Seat Height – As desired.







A – BEFORE START-UP

Mirage F1EE Only

10. Once battery power is provided to the aircraft, the ground crew will automatically remove wheel chocks and the boarding ladder.

A – BEFORE START-UP

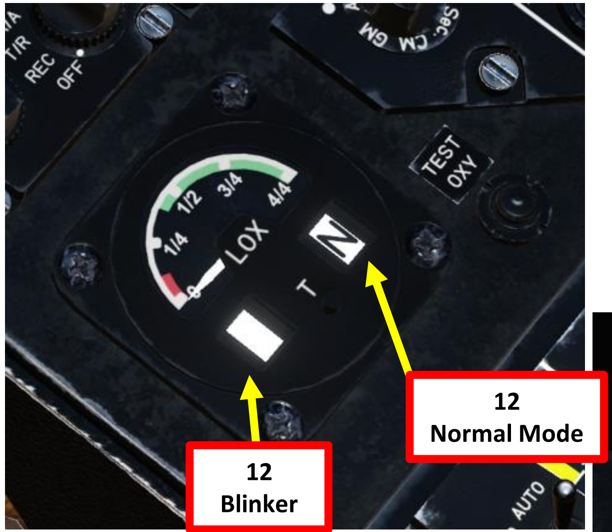
Mirage F1EE Only

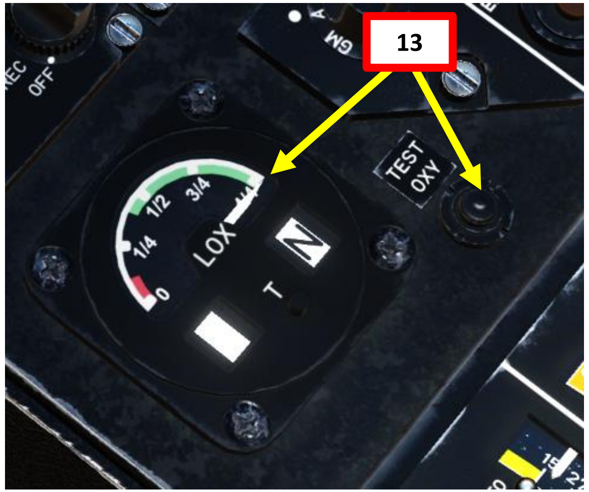
Note: the Mirage F1EE can be started on battery power alone. External ground power can still be provided from a GPU (Ground Power Unit), but it is not mandatory.

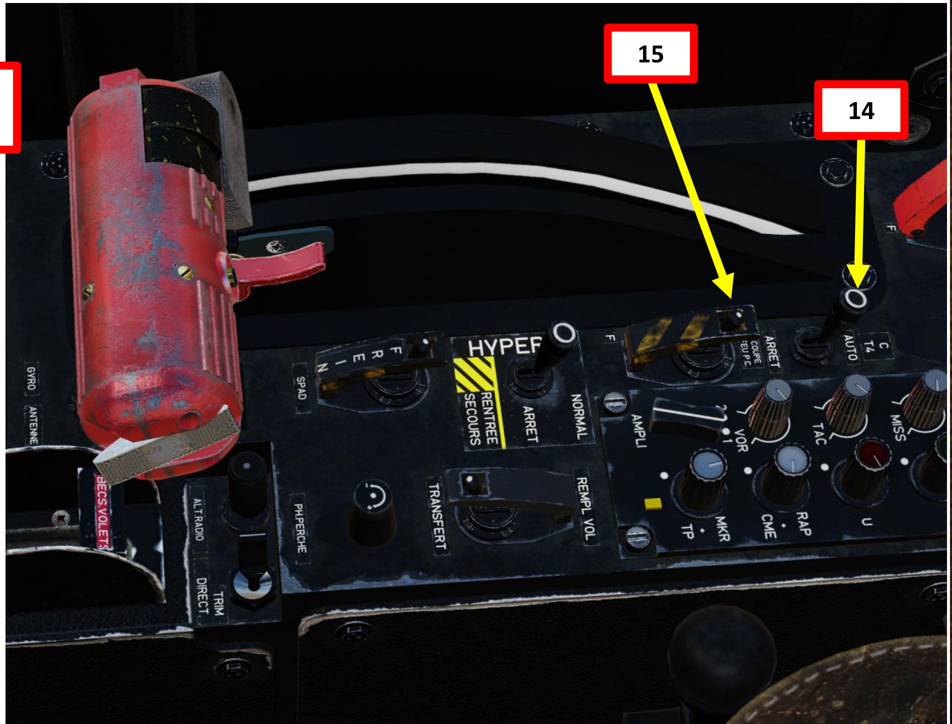
Mirage F1EE Only

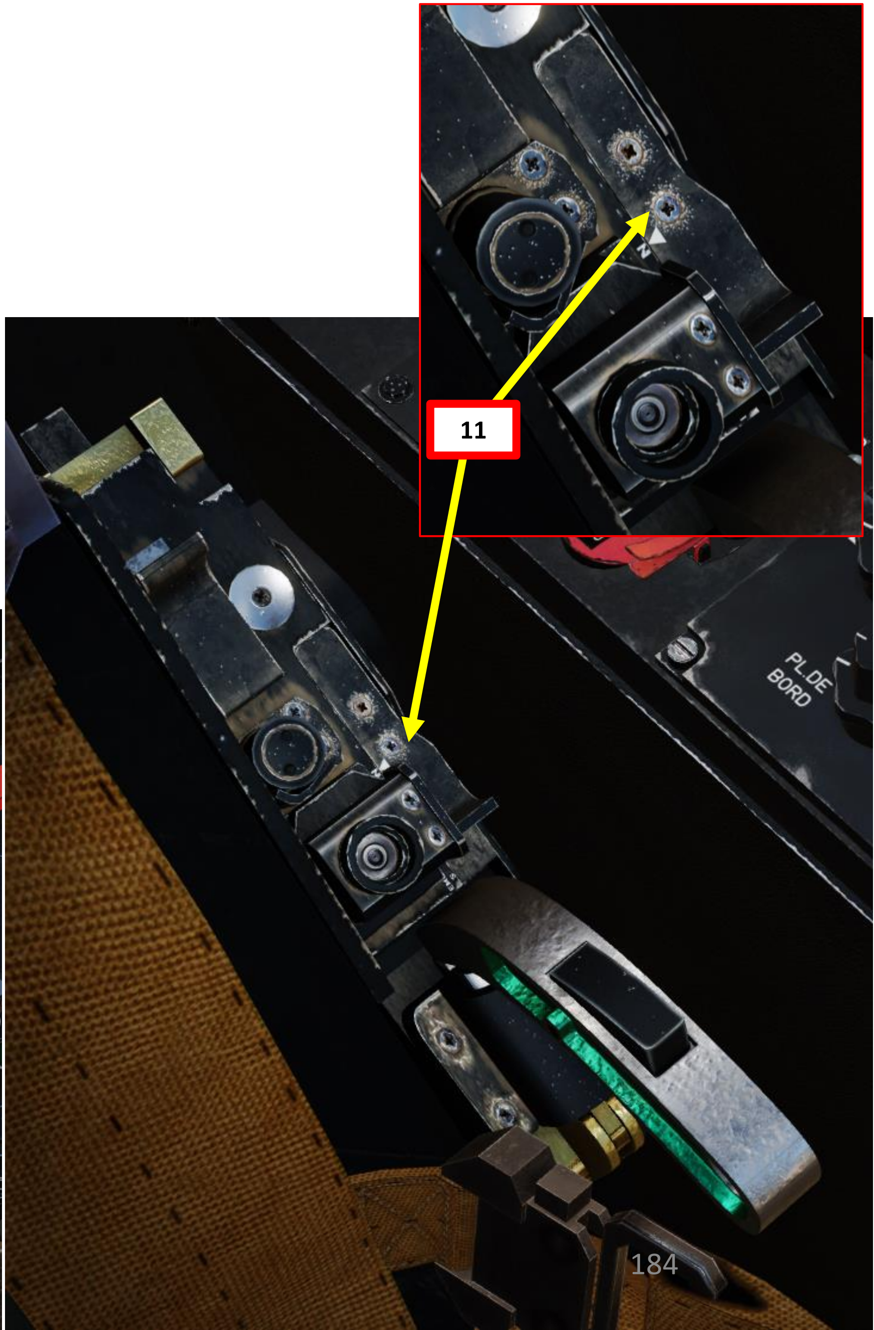
A – BEFORE START-UP

11. Set Oxygen Mode Selector Switch – NORMAL (AFT)
12. Confirm "N" is visible on the Oxygen Mode Repeater and that the Oxygen Blinker is operating.
13. Depress the Oxygen Quantity Ground Test Button for a few seconds and ensure the Oxygen Quantity (LOX) Indicator goes into the green range for the duration of the test.
14. Set JPT/T4 (Jet Pipe Temperature) Emergency Regulation Switch – AUTO (FWD).
15. Set Afterburner *(P.C., Post-Combustion)* Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* Switch – OPEN (FWD).



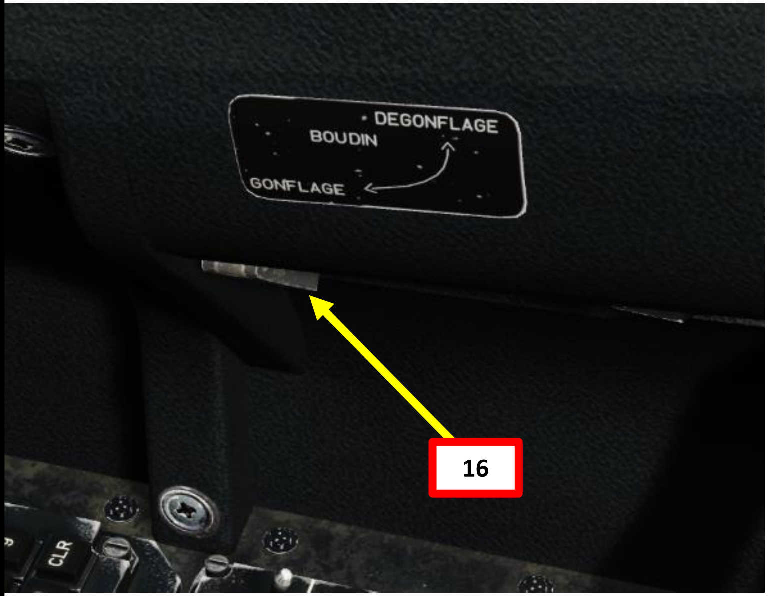


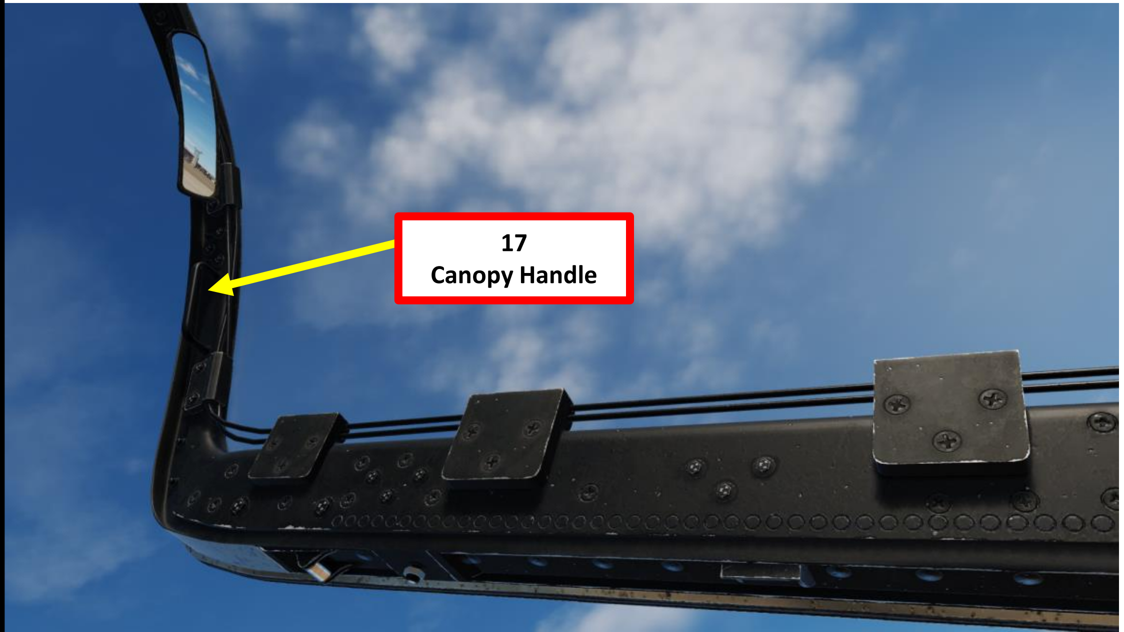




A – BEFORE START-UP

16. Set Canopy Seal Valve *(Boudin)* Control Lever – INFLATED/*GONFLAGE* (FWD).
17. Close canopy with the Canopy Handle or by pressing “LCTRL+C”.





Mirage F1EE Only

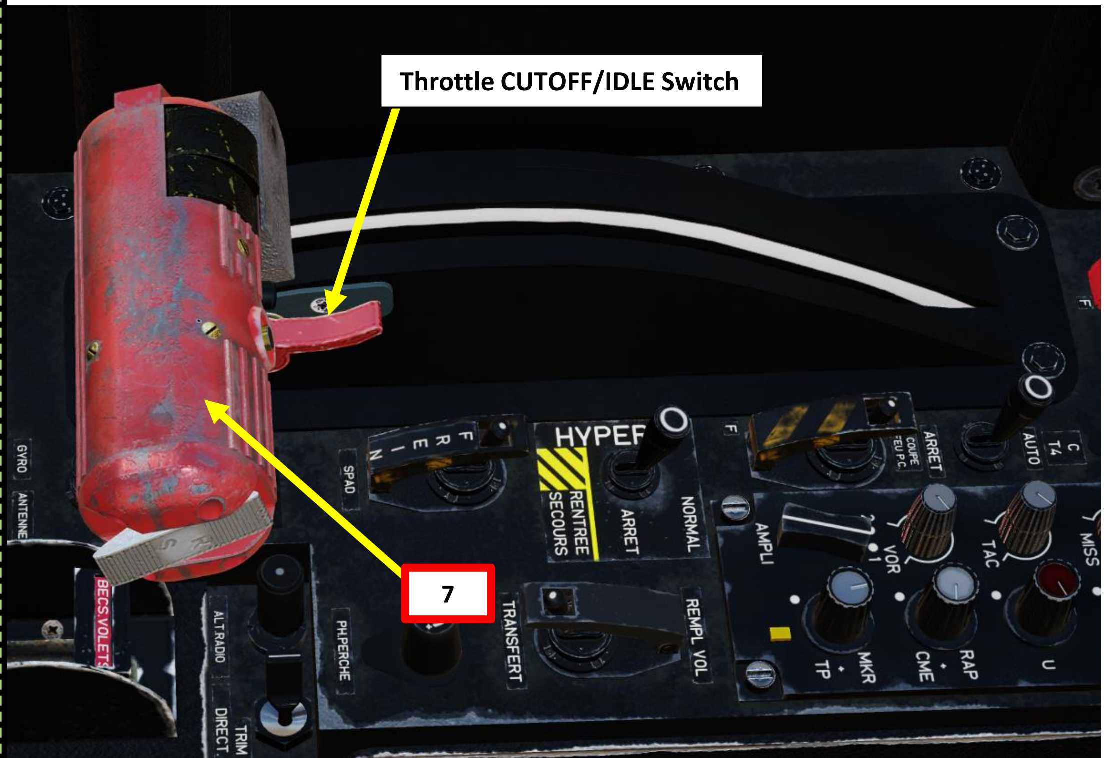
A – BEFORE START-UP

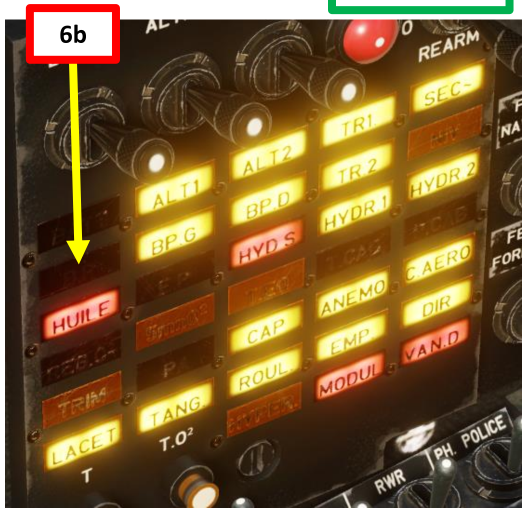
18. Once the canopy is lowered, push Canopy Lock lever FWD to lock and seal the cockpit.
    - Confirm P CAB (Cabin Pressurization) Warning Light is extinguished.
19. Verify that the Canopy Rest Stick is folded.

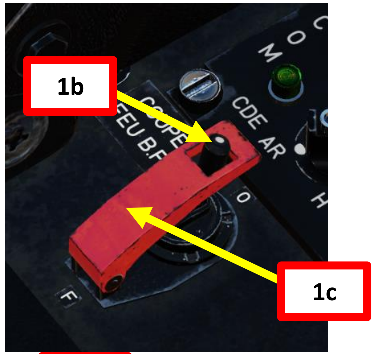
B – ENGINE START

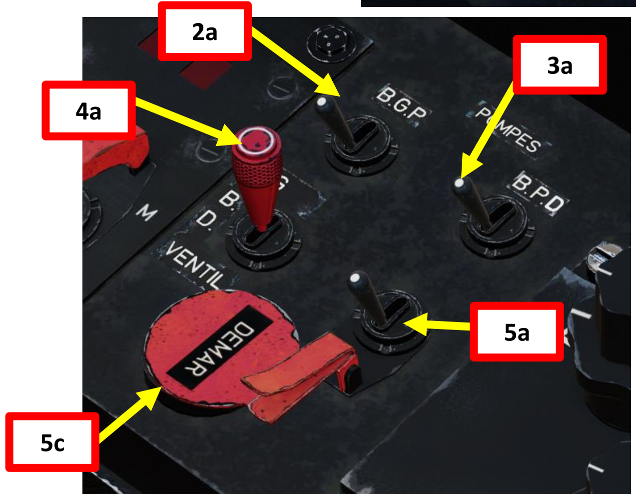
Mirage F1EE Only

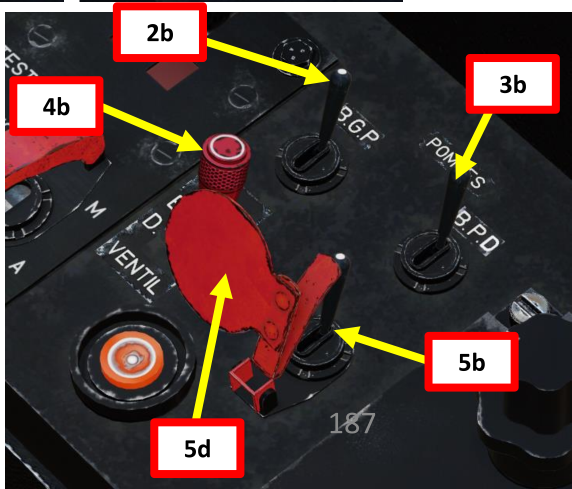
1. Set Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* Switch – OPEN (FWD).
   - I recommend setting the cover guard over the switch once it is set to OPEN to prevent inadvertently setting the shutoff valve to CLOSED.
2. Set Left Low-Pressure Fuel Pump *(Pompe Basse Pression Gauche)* Switch – MARCHE/ON (LEFT).
3. Set Right Low-Pressure Fuel Pump *(Pompe Basse Pression Droite)* Switch – MARCHE/ON (LEFT).
4. Set Ignition/Ventilation Selector Switch – LEFT (Left Igniter) or MIDDLE (Right Igniter) position.
5. Set Starter Fuel Pump *(Interrupteur Pompe Démarrage)* Switch – ON (LEFT)
   - Lift the Engine Start Button Cover (*Poussoir de Démarrage*) to ensure starter fuel pump is ON.
6. Confirm that BP warning light extinguishes within 2 seconds after the starter pump has been turned ON.
7. Check that Throttle is at the OFF/CUTOFF detent (FULLY AFT).
   - If the throttle is not set to OFF/CUTOFF detent, throttle back to IDLE position and press the Throttle CUTOFF/IDLE Switch.







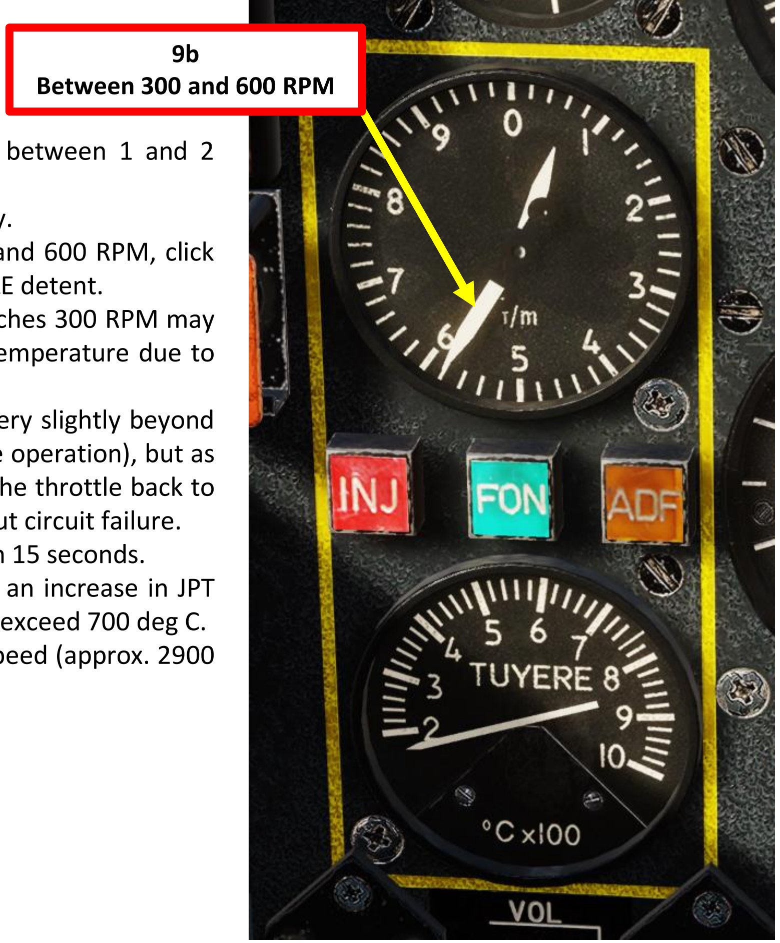


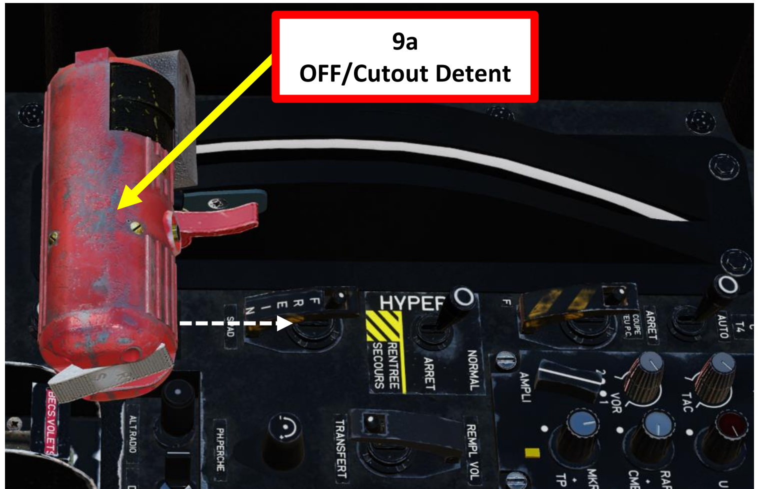


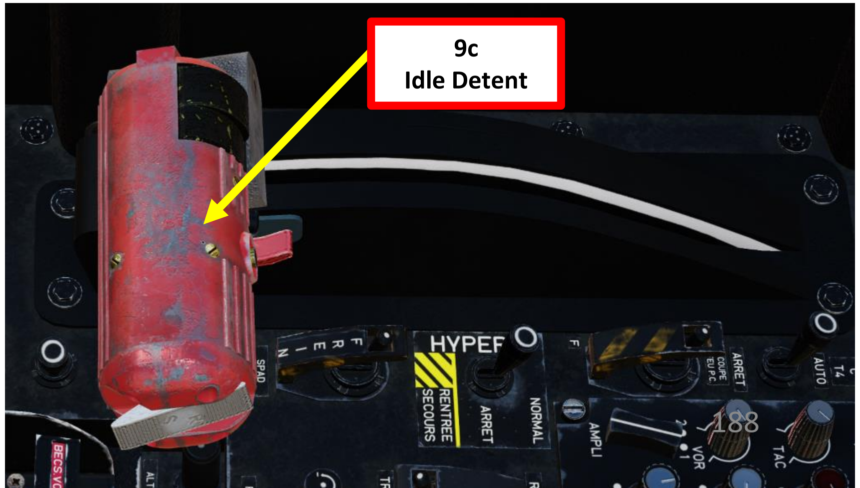
B – ENGINE START

Mirage F1EE Only

8. Press and hold the Engine Start Button (*Poussoir de Démarrage*) between 1 and 2 seconds.
    - The electrical turbo-starter is powered by the aircraft battery.
9. Monitor engine RPM carefully. When engine RPM is between 300 and 600 RPM, click on the throttle to advance it from the OFF/CUTOUT detent to the IDLE detent.
    - Note 1: Moving the throttle to IDLE **before** engine RPM reaches 300 RPM may lead to an engine fire or JPT (Jet Pipe Temperature) over-temperature due to an accumulation of fuel during the start-up sequence.
    - Note 2: With a cold engine, you can advance the throttle very slightly beyond IDLE to open the fuel metering valve a bit more (faster valve operation), but as soon as the engine starts accelerating at 2500 RPM, move the throttle back to IDLE to prevent starter turbine disintegration in case of cutout circuit failure.
10. Confirm that engine speed accelerates normally to 2000+ RPM within 15 seconds.
    a) Engine ignition occurs at about 1200 RPM, noticeable with an increase in JPT (Jet Pipe Temperature, *Température Tuyère*). JPT should not exceed 700 deg C.
    b) Fuel flow increases and the engine accelerates until idling speed (approx. 2900 RPM).

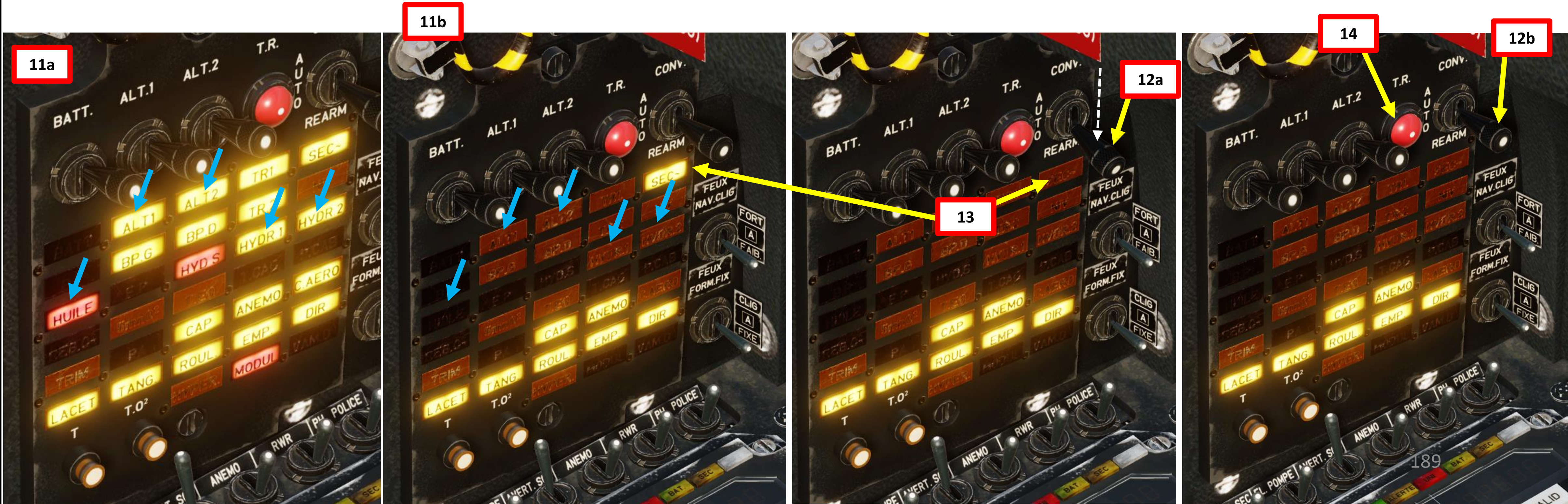






B – ENGINE START

11. Once engine speed has stabilized around 2900 RPM, the alternators will kick in, hydraulic pressure will build up and oil pressure will increase. Confirm that the following warning lights are extinguished:
    - HYDR 1: Low Hydraulic Pressure (System 1)
    - HYDR 2: Low Hydraulic Pressure (System 2)
    - HUILE: Low Oil Pressure
    - ALT1: Alternator 1 disconnected or failed
    - ALT2: Alternator 2 disconnected or failed
12. Set the Inverter *(Convertisseur)* Selector Switch DOWN (RESET) momentarily, then release it. The switch will automatically be spring-loaded to the AUTO (MIDDLE) position.
13. Confirm that the SEC~ warning light is extinguished, which means that the emergency AC busses are now supplied by the alternators instead of the inverter.
14. If TR1 or TR2 Warning Lights remain illuminated, press the Transformer-Rectifier (*Inverseur Transfo-Redresseur*) Reset Button,

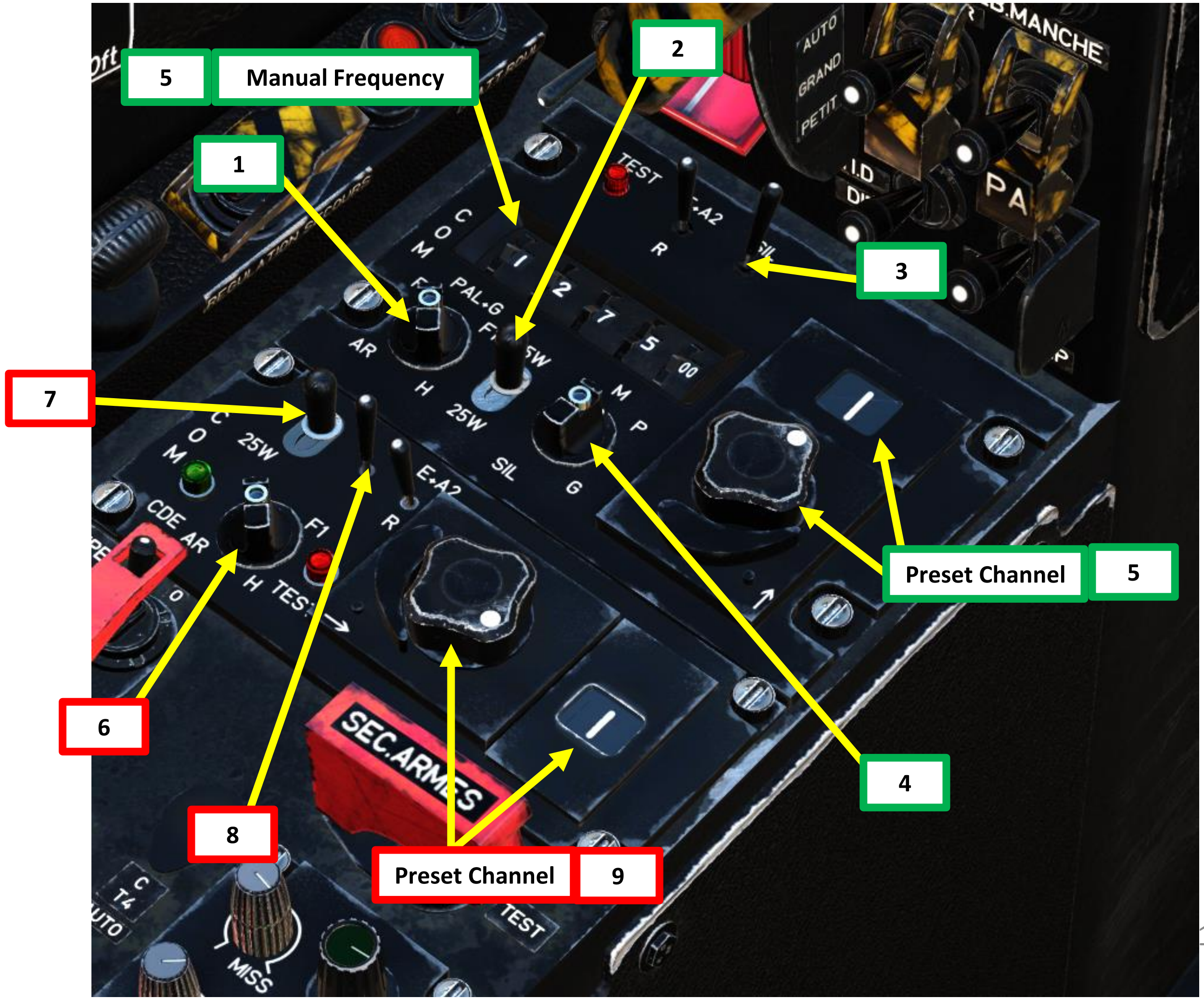


Mirage F1EE Only

C – AFTER START-UP

1 – Radio Communications Setup

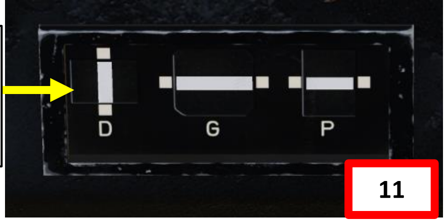
1. Set TRAP 136 V/UHF Radio (Green Radio) Mode Selector – PAL (*Fréquence Principale*, Main Frequency).
2. Set V/UHF Radio Transmitter Power Switch – 5 W (FWD).
3. Set V/UHF Radio SIL *(Silence)* / Squelch Switch – ON (FWD).
4. Set V/UHF Radio Frequency Selector – As required (Manual Frequency or Preset Channel Frequency).
5. Set V/UHF Radio Manual Frequency or Preset Channel – As required.
6. Set TRAP 137B UHF Radio (Red Radio) Mode Selector – MARCHE/ON.
7. Set UHF Radio Transmitter Power Switch – 5 W (LEFT).
8. Set UHF Radio SIL *(Silence)* / Squelch Switch – ON (LEFT).
9. Set UHF Radio Preset Channel – As required.



C – AFTER START-UP

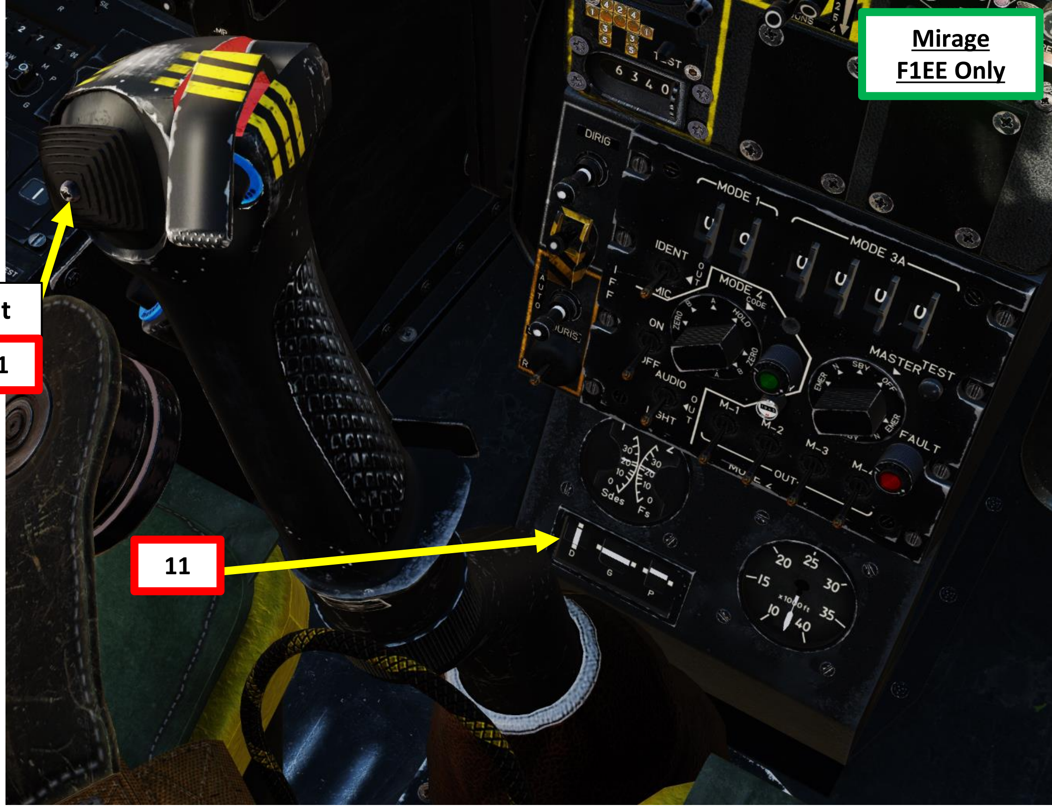
2 – Flight Control Servos Setup

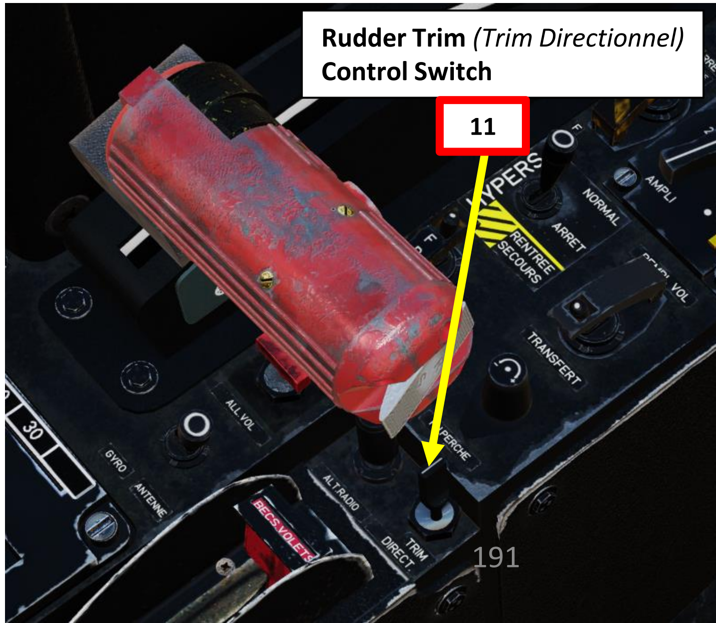
Trim Indicators
- *D: Yaw (Direction)*
- *G: Roll (Gauchissement)*
- *P: Pitch (Profondeur)*



10. Press the Servo Reset Button
    a) When pressed, the servo reset button allows for a reset of the flight control servos if all the operation conditions are met.
    b) Confirm that the following warning lights are extinguished:
        - LACET (Yaw)
        - TANG (*Tangage*, Pitch)
        - ROUL (*Roulis*, Roll)
        - EMP (Empennage)
        - DIR (*Gouverne de Direction*, Rudder)
11. Confirm Pitch, Roll and Yaw trim tabs are NEUTRAL.
    - If trim tabs are not set correctly, adjust accordingly using the Trim Hat switch on the stick and the Rudder Trim *(Trim Directionnel)* Control Switch.
12. Set Hydraulic Pressure Selector Switch – SDES (DOWN). This makes the Hydraulic Pressure Indicator displays hydraulic pressure for ancillary systems (*Sdes, Servitudes*) and Emergency Hydraulic Brake (*Fs, Frein Secours*).

Mirage F1EE Only



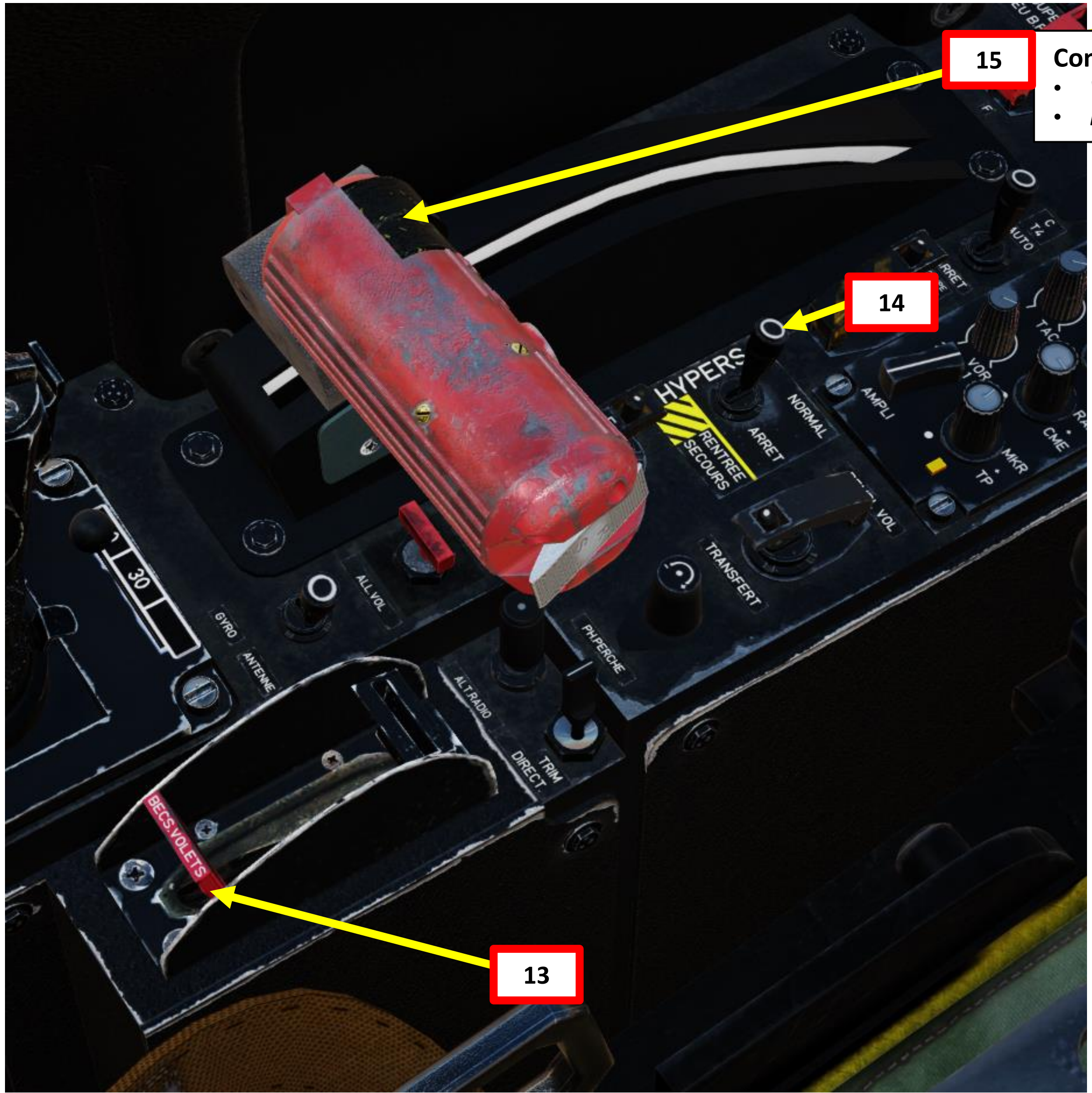


Mirage F1EE Only

C – AFTER START-UP

3 – High-Lift Devices Setup

13. Set Wing Slats/Flaps *(Becs/Volets)* Control Lever – DEPLOYED (FULLY AFT)
14. Set High-Lift Devices *(Volets Hypersustentateurs)* Mode Selector Switch – NORMAL (FWD).
15. Press the Combat Flap Lever ("LCTRL+V" binding) to disarm combat flaps and retract them if deployed.
16. Confirm that V CBT (Combat Flaps) Light is extinguished.

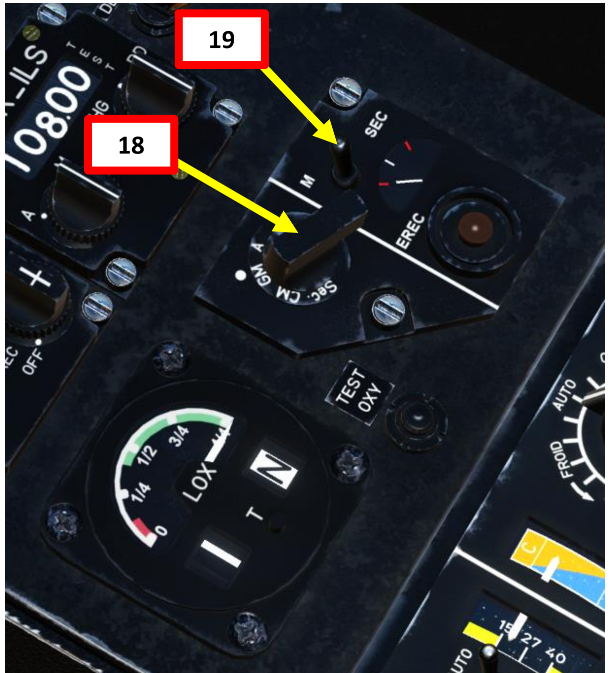


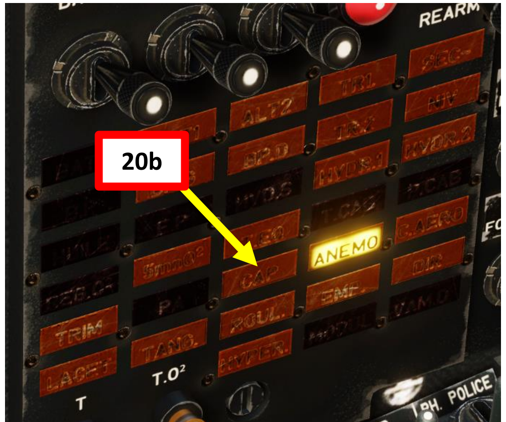
Combat Flaps Lever
- *When pressed, disarms combat flaps and retracts them if deployed.*
- *Binding: LCTRL+V*

C – AFTER START-UP

4 – Gyroscopic Heading & Reference System Setup

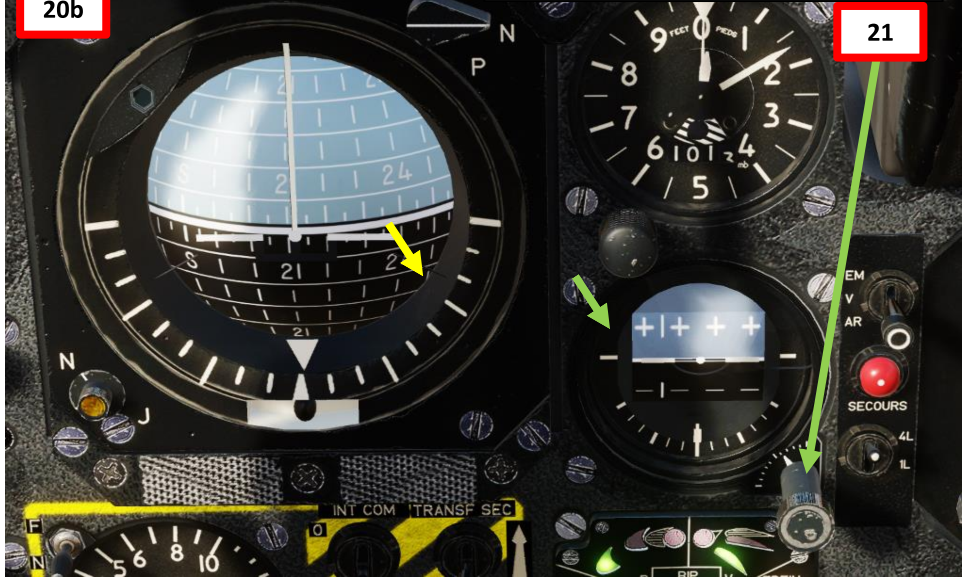
17. Set Standby Horizon *(Horizon Secours)* Switch – MARCHE/ON (FWD).
18. Set Gyroscopic Heading & Vertical Reference System Control Selector – GM (Gyromagnetic Compass Heading).
19. Set Emergency *(Secours)* Gyromagnetic Compass Switch – MARCHE/ON (FWD).
20. Full alignment of the Heading and Vertical Reference System takes approximately 1 to 2 minutes. Once gyro alignment is complete, the CAP warning light extinguishes and the failure flag disappears on the Spherical Indicator *(Indicateur Sphérique / Boule)*.
21. Uncage the Standby Artificial Horizon by scrolling mousewheel on the caging knob. Once uncaged, the failure flag will disappear on the Standby Artificial Horizon.





Mirage F1EE Only

Standby Artificial Horizon Uncage & Aircraft Symbol Adjustment Control



C – AFTER START-UP

Mirage F1EE Only

5 – UNI/INS (Unité de Navigation Inertielle / Inertial Navigation System) Alignment

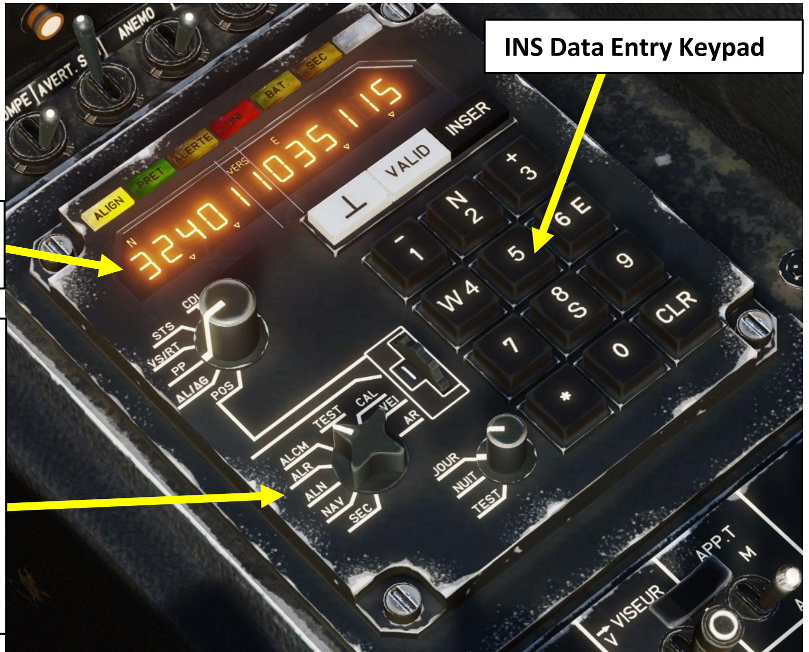
The INS (Inertial Navigation System) requires an initial alignment, which can be performed in three ways:

- **Normal alignment (*ALN* – *Alignment normal*)** is required at each cold start if the aircraft has been moved since the last time it stopped. This alignment **lasts 8 minutes** and provides the best performance and position accuracy. If the "INS start position always correct" option is enabled via the Mission Editor, the aircraft coordinates are already set correctly in Waypoint 1. Otherwise, aircraft coordinates may need to be re-entered manually.

- **Stored heading alignment (*ALCM* – *Alignment sur cap mémorisé*)** is a fast alignment method that can be used if the aircraft has not been moved since the last time its INS was stopped. The INS save its last heading when it is stopped and if the aircraft has not been moved the gyroscopes won't have moved too far from their aligned position. This allows for less alignment phases resulting in a quicker procedure at the cost of increased drift rate due to gyroscope and accelerator errors not being canceled as well as in an ALN. This alignment **lasts 1 minute 30 seconds** and the resulting drift rate is dependent on the quality and time since the last normal alignment. Doing an ALCM just after a normal alignment or at the end of QRA (Quick Reaction Alert) duty will result a drift rate equivalent to the previous alignment rate.

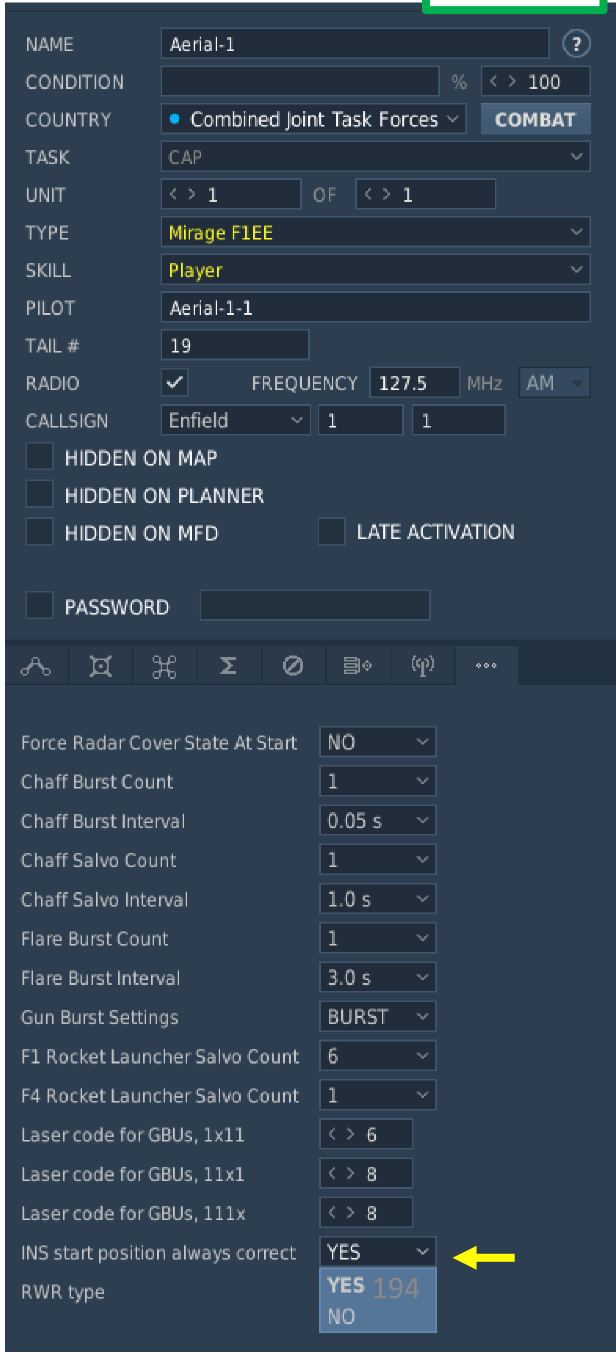
- **Fast alignment (*ALR* – *Alignment rapide*)** is basically an alignment method similar to the normal ALN alignment with the same limitations, but its alignment speed is faster. Fast alignment **lasts 3 minutes 30 seconds**, but it provides worse performance and a higher drift rate.

Important Note: The gyromagnetic system provides heading information to the INS in ALR and ALN modes to allow a faster alignment. It is therefore recommended to start the gyroscopic system before starting the INS for this reason.



PCN *(Poste de Contrôle de Navigation)* **/ Navigation Control Panel Mode Selector**

- *AR: Arrêt (OFF)*
- *VEI: Veille (Standby)*
- *CAL: Calibration (used for maintenance)*
- *TEST (used for maintenance)*
- *ALCM: Alignement sur Cap Mémorisé (Stored Heading Alignment) (duration: 1.5 minutes)*
- *ALR: Alignement Rapide (Fast Alignment) (duration: 3.5 minutes)*
- *ALN: Full Alignment (duration: 8 minutes)*
- *NAV: Navigation Mode*
- *SEC: Secours (Emergency) Mode*



C – AFTER START-UP

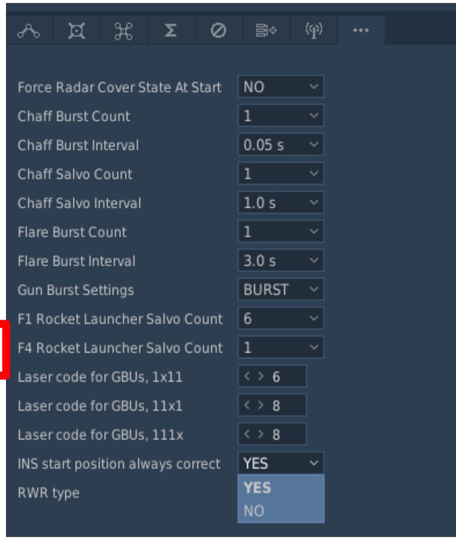
Mirage F1EE Only

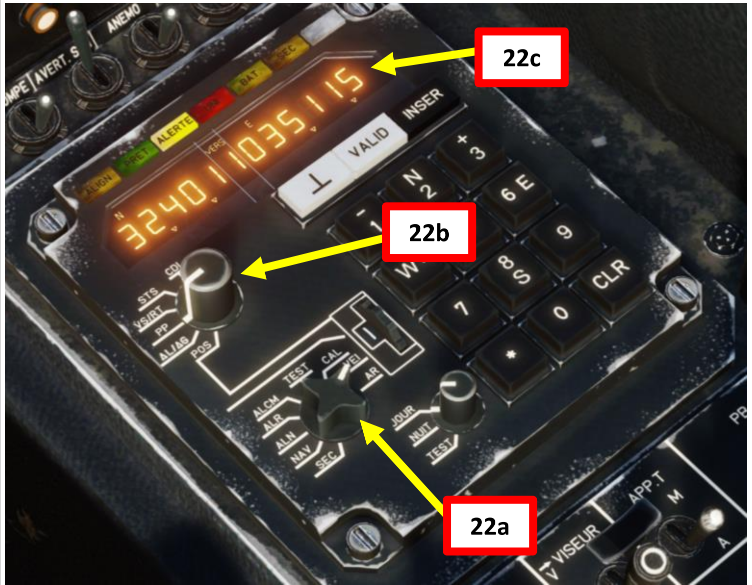
5 – UNI/INS (Unité de Navigation Inertielle / Inertial Navigation System) Alignment

Option 1: Stored Heading (*ALCM, Alignement sur Cap Mémorisé*)

Note: In this tutorial, we will assume the current stored aircraft coordinates and heading are correct.

22. Perform Stored Heading Alignment (***ALCM, Alignement sur Cap Mémorisé***)
    a) Set Navigation Control Panel Mode Selector – VEILLE (STANDBY).
    b) Set INS (Inertial Navigation System) Parameter Selector – PP (Present Position).
    c) Verify that aircraft coordinates on the Data Display Window are correct.
    d) Set Navigation Control Panel Mode Selector – ALCM *(Alignment sur Cap Mémorisé, Stored Heading).*
    e) On the INS Data Entry Keypad, press the Asterisk (*) button to start the stored heading alignment.
    f) Set INS (Inertial Navigation System) Parameter Selector – STS (Status).
    g) During alignment, the ALIGN status light will blink and the Data Display Window will show a counter that represents the percentage of the alignment that has been completed.
    h) When counter reaches 730 (73.0 %) and PRÊT (READY) status light is illuminated, the INS precision provided is sufficient and the alignment is completed.
    i) Set Navigation Control Panel Mode Selector – NAV.
    j) Set INS (Inertial Navigation System) Parameter Selector – PP (Present Position).





C – AFTER START-UP

Mirage F1EE Only

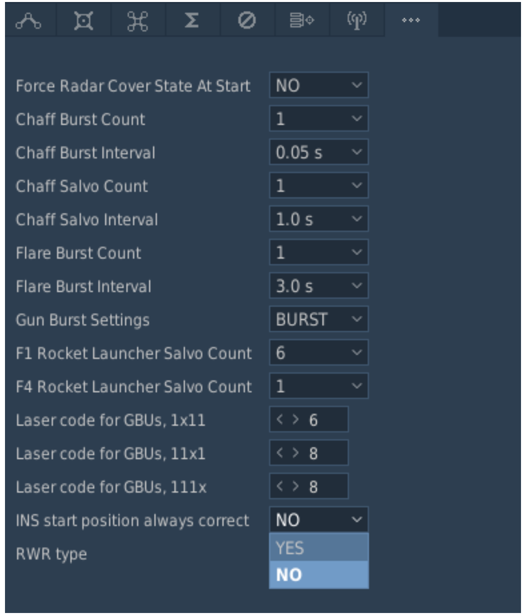
5 – UNI/INS (Unité de Navigation Inertielle / Inertial Navigation System) Alignment

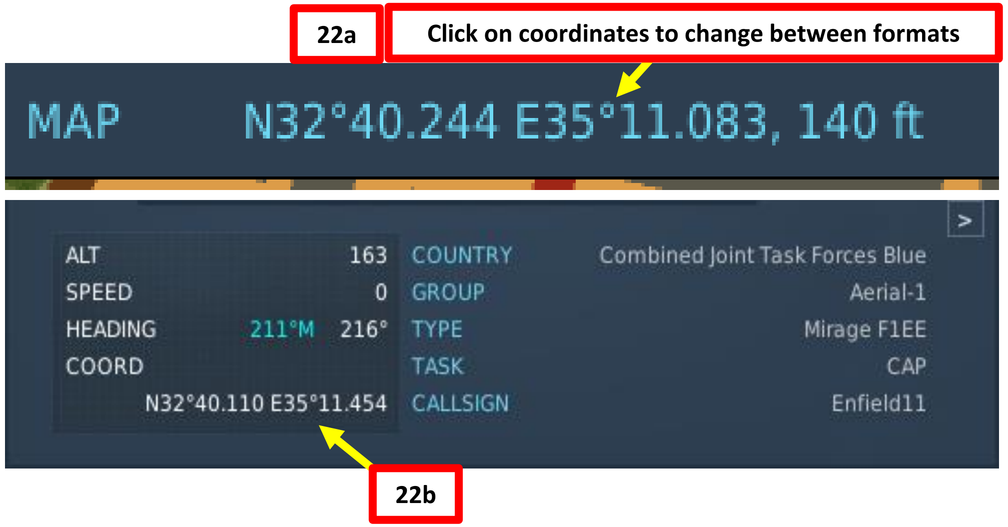
Option 2: Full Alignment

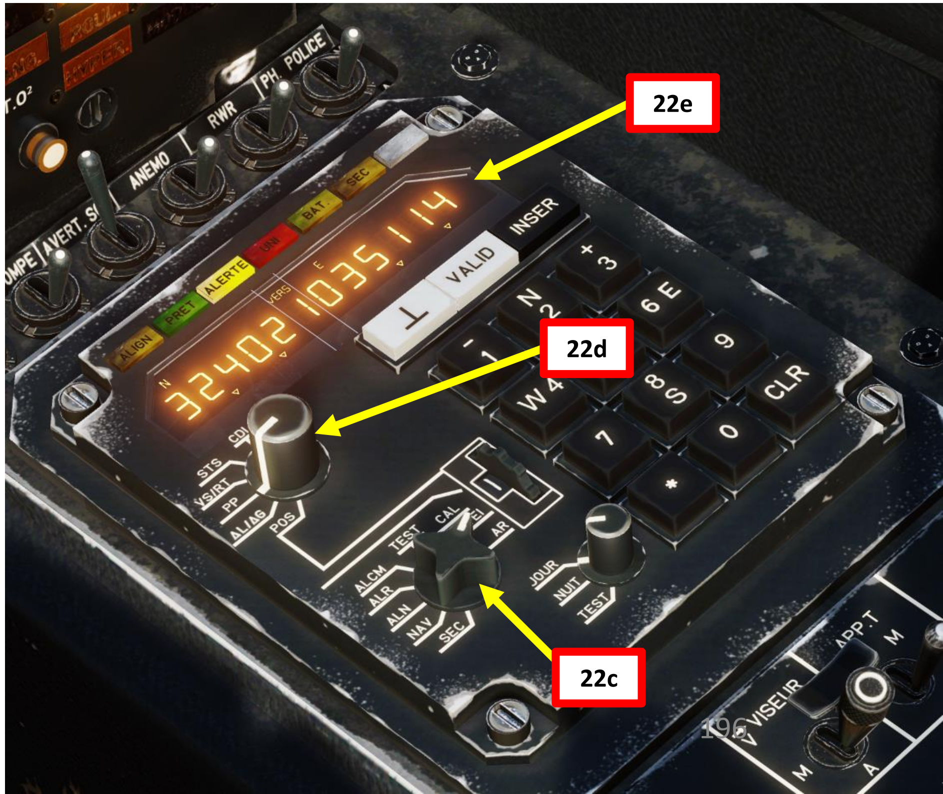
Note: In this tutorial, we will assume the current stored aircraft coordinates are incorrect and need to be re-entered.

- Aircraft Coordinates: **32°40.244 North** for Latitude and **035°11.454 East** for Longitude

22. Perform Full (Normal) Alignment (***ALN, Alignement Normal***)
    a) Find aircraft coordinates from the F10 map. If needed, click on the MAP COORDINATES field (top left) to set coordinates in the following format:
        - Degrees, Minutes, Tenths of Minutes.
    b) Our current aircraft coordinates are:
        - **32°40.244 North** for Latitude and **035°11.454 East** for Longitude
    c) Set Navigation Control Panel Mode Selector – VEILLE (STANDBY).
    d) Set INS (Inertial Navigation System) Parameter Selector – PP (Present Position).
    e) Verify if aircraft coordinates on the Data Display Window are correct.
        - If the coordinates are correct, you can go directly to step p) and start the alignment right away by setting the Navigation Control Panel Mode Selector to ALN and then pressing the Asterisk (*) button On the INS Data Entry Keypad.
        - However, for the purposes of this tutorial, we will assume the coordinates are incorrect and need to be updated.







C – AFTER START-UP

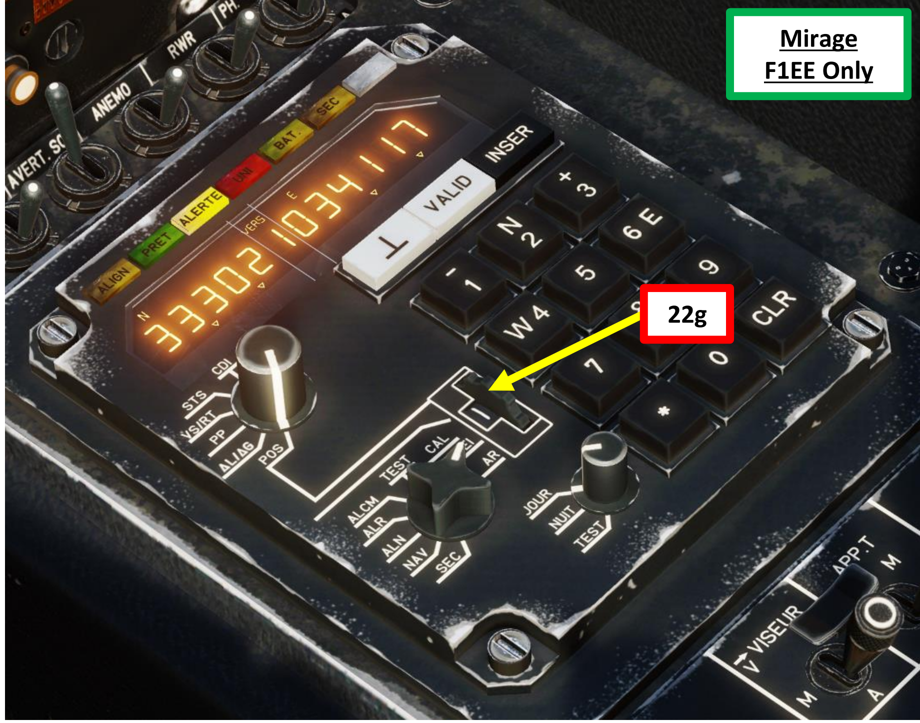
5 – UNI/INS (Unité de Navigation Inertielle / Inertial Navigation System) Alignment

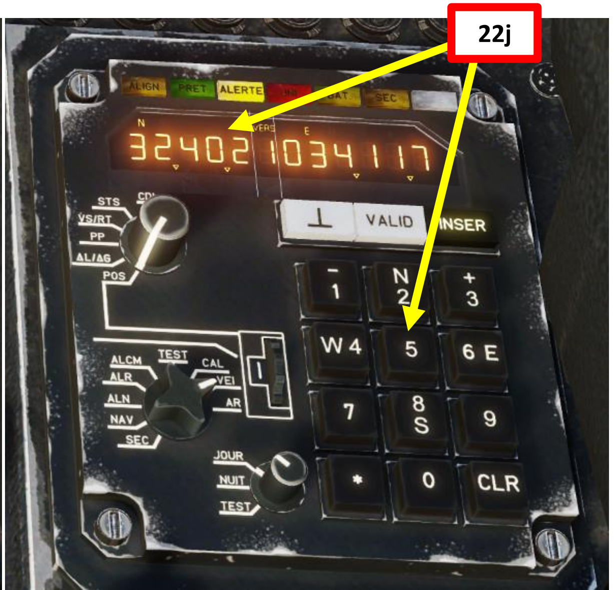
Option 2: Full Alignment

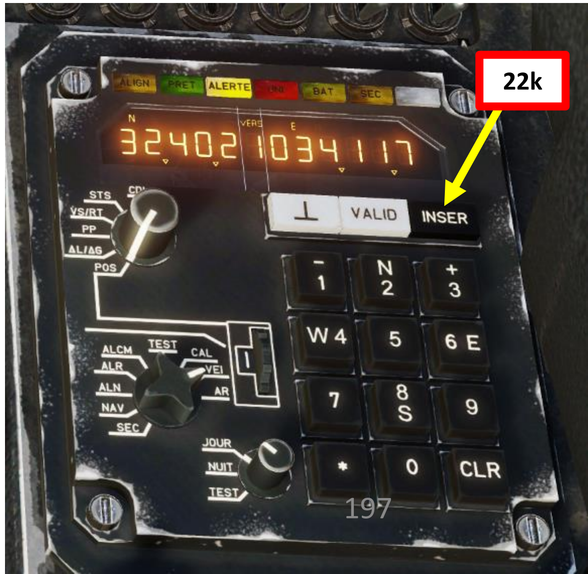
Note: In this tutorial, we will assume the current stored aircraft coordinates are incorrect and need to be re-entered.

- Aircraft Coordinates: **32°40.244 North** for Latitude and **035°11.454 East** for Longitude

22. Perform Full (Normal) Alignment (***ALN, Alignement Normal***)
    f) The INS can store up to 9 waypoints, numbered from 1 to 9. We have to program a waypoint with our alignment coordinates. We will use Waypoint 1, which is typically associated with the aircraft's starting position (Mission Editor's Waypoint 00). However, this could be done with any waypoint of your choosing.
       - Note: We will assume the coordinates of Waypoint 1 are also slightly off and need to be manually updated as well.
    g) Select Waypoint 1 with the Waypoint Selection Thumbwheel.
    h) Set INS (Inertial Navigation System) Parameter Selector – POS (Position of the waypoint selected).
    i) On the INS Data Entry Keypad, press "**2 (N)**" button to select **North** Latitude.
    j) On the INS Data Entry Keypad, press "**32402**" to enter Latitude coordinates for North **32°40.2**44.
    k) On the INS Data Entry Keypad, press INSER (Insert) button.







C – AFTER START-UP

Mirage F1EE Only

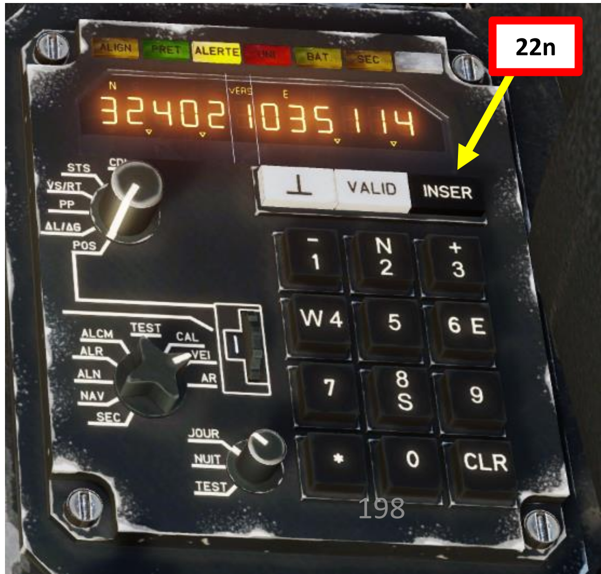
5 – UNI/INS (Unité de Navigation Inertielle / Inertial Navigation System) Alignment

Option 2: Full Alignment

Note: In this tutorial, we will assume the current stored aircraft coordinates are incorrect and need to be re-entered.

- Aircraft Coordinates: **32°40.244 North** for Latitude and **035°11.454 East** for Longitude

22. Perform Full (Normal) Alignment (***ALN, Alignement Normal***)
    l) On the INS Data Entry Keypad, press "**6 (E)**" button to select **East** Longitude.
    m) On the INS Data Entry Keypad, press "**035114**" to enter Latitude coordinates for East **035°11.4**54.
    n) On the INS Data Entry Keypad, press INSER (Insert) button.
    o) Waypoint 1 coordinates are now updated to the position we want to align the Inertial Navigation System to.



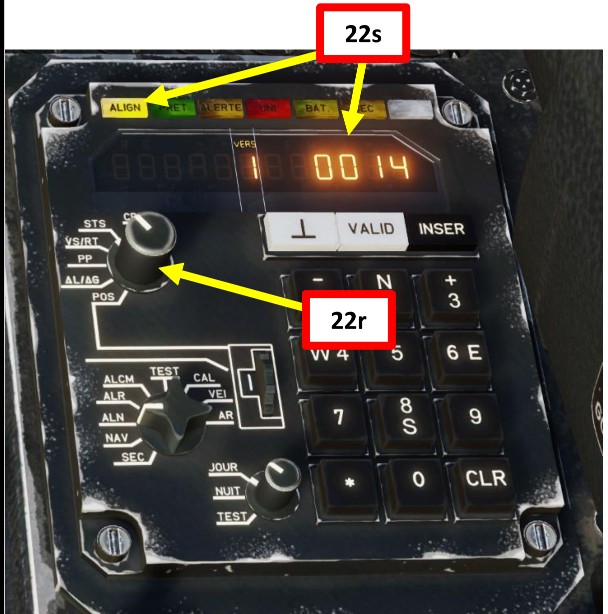
C – AFTER START-UP

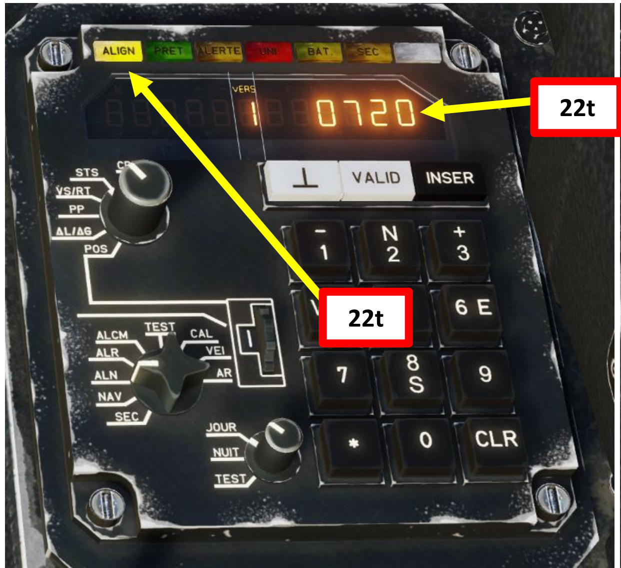
Mirage F1EE Only

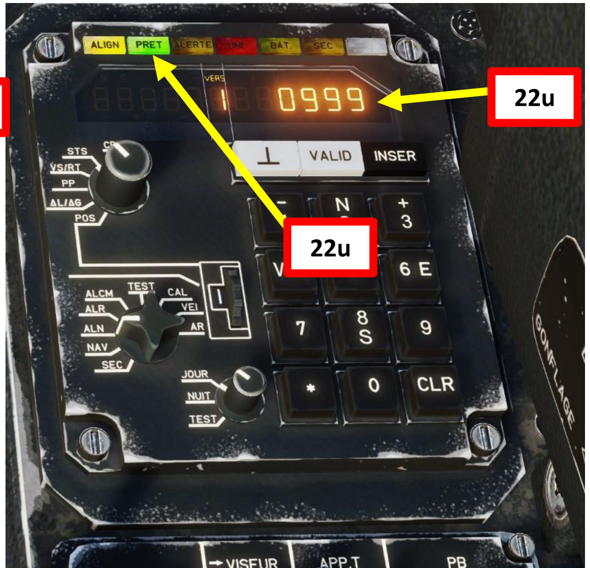
5 – UNI/INS (Unité de Navigation Inertielle / Inertial Navigation System) Alignment

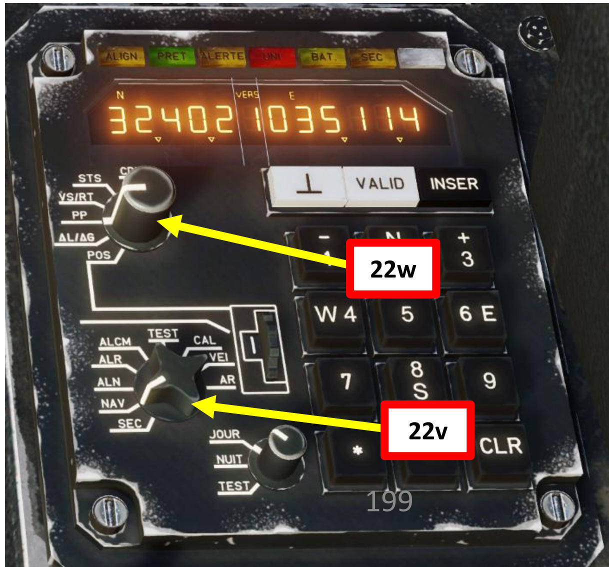
Option 2: Full Alignment

22. Perform Full (Normal) Alignment (***ALN, Alignement Normal***)
    - p) Set Navigation Control Panel Mode Selector – ALN (Normal Alignment).
        - If you are short on time and need to scramble as soon as possible, use ALR (*Alignement Rapide*, Fast Alignment) instead to shorten the alignment time (3.5 minutes) but degrade the INS performance.
    - q) On the INS Data Entry Keypad, press the Asterisk (*) button to start the full INS alignment.
    - r) Set INS (Inertial Navigation System) Parameter Selector – STS (Status).
    - s) During alignment, the ALIGN status light will blink and the Data Display Window will show a counter that represents the percentage of the alignment that has been completed.
    - t) When counter reaches 720 (72.0 %) and ALIGN status light stops blinking and becomes steady, a coarse INS precision is provided, but the precision phase of the alignment is not yet completed.
    - u) When counter reaches 999 (99.9 %) and PRÊT (READY) status light is illuminated, the precision phase is complete.
    - v) Set Navigation Control Panel Mode Selector – NAV.
    - w) Set INS (Inertial Navigation System) Parameter Selector – PP (Present Position).





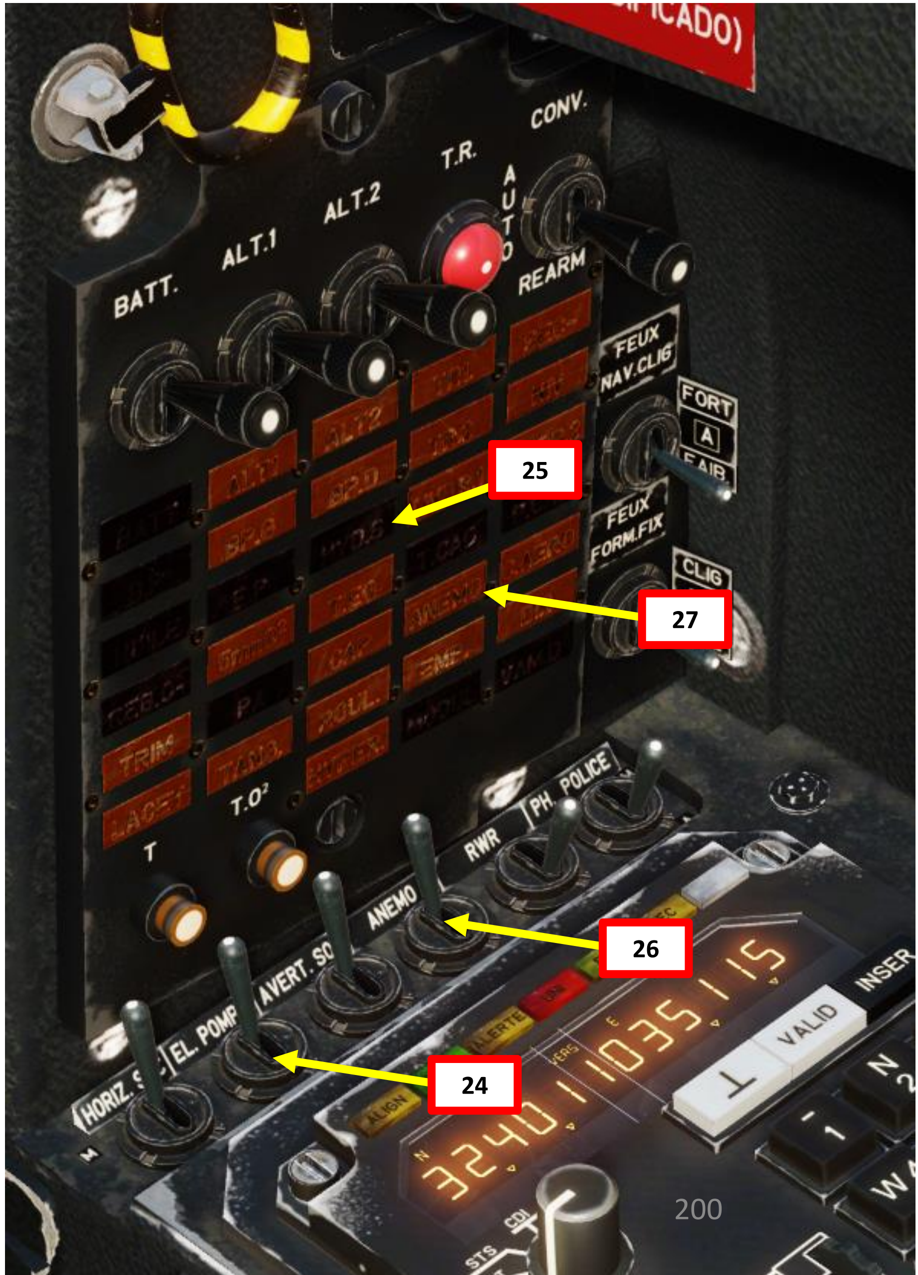




C – AFTER START-UP

6 – Navigation Systems & Sensors Setup

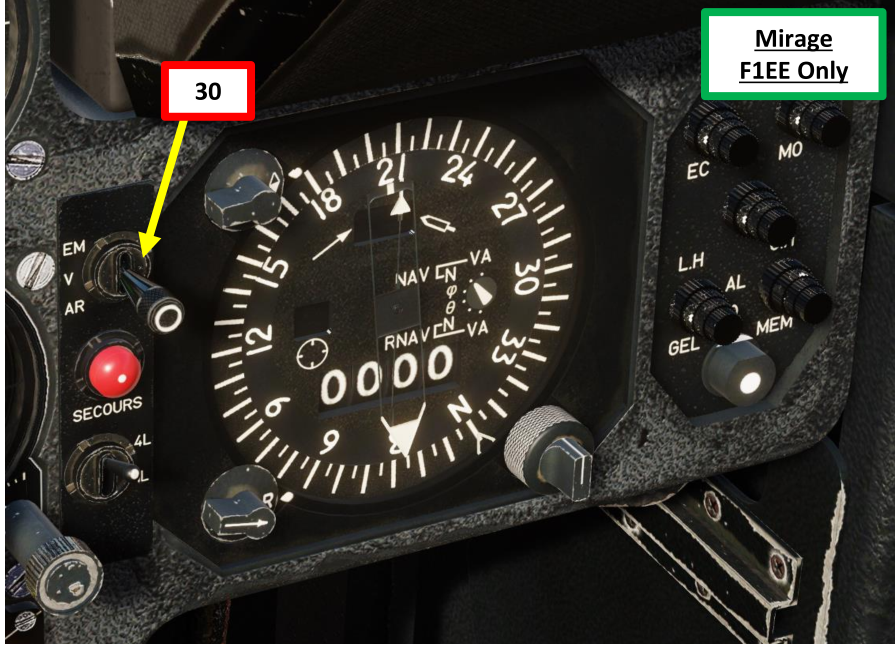
23. Set IDN (*Indicateur de Navigation*, Navigation Indicator) Mode Selector – As Required. We will select NAV N (Normal Navigation Mode).
24. Set Electro-Pump Switch – MARCHE/ON (FWD).
25. Confirm that HYD.S (Emergency Hydraulic System) Warning Light is extinguished.
26. Set Pitot Probe Heater *(Réchauffage Anémomètre-Incidence)* Switch – MARCHE/ON (FWD).
27. Confirm that ANEMO Warning Light is extinguished.

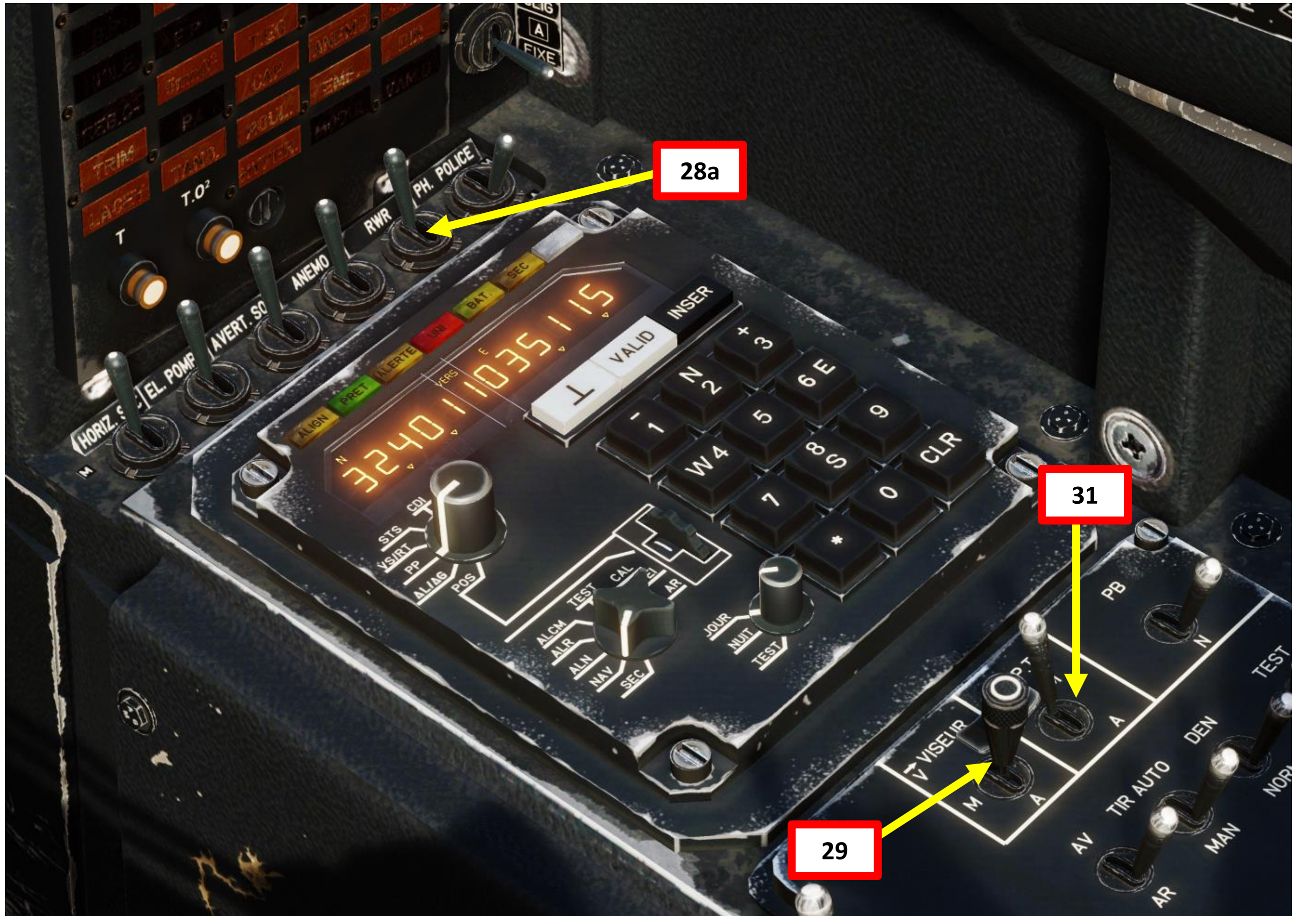


C – AFTER START-UP

6 – Navigation Systems & Sensors Setup

28. Set Radar Warning Receiver Switch – MARCHE/ON (FWD).
    - Note: the Mirage F1EE can equip either the “BF” Type or “AN/ALR-300” Type radar warning receiver, which is an option set in the Mission Editor.
29. Set Sight *(Viseur)* Selector Switch – MARCHE/ON (MIDDLE position).
30. Set Radar Operation Mode Selector Switch – VEILLE/STANDBY (MIDDLE position).
31. Set Firing Fuel Dipper Switch - MARCHE/ON (FWD).



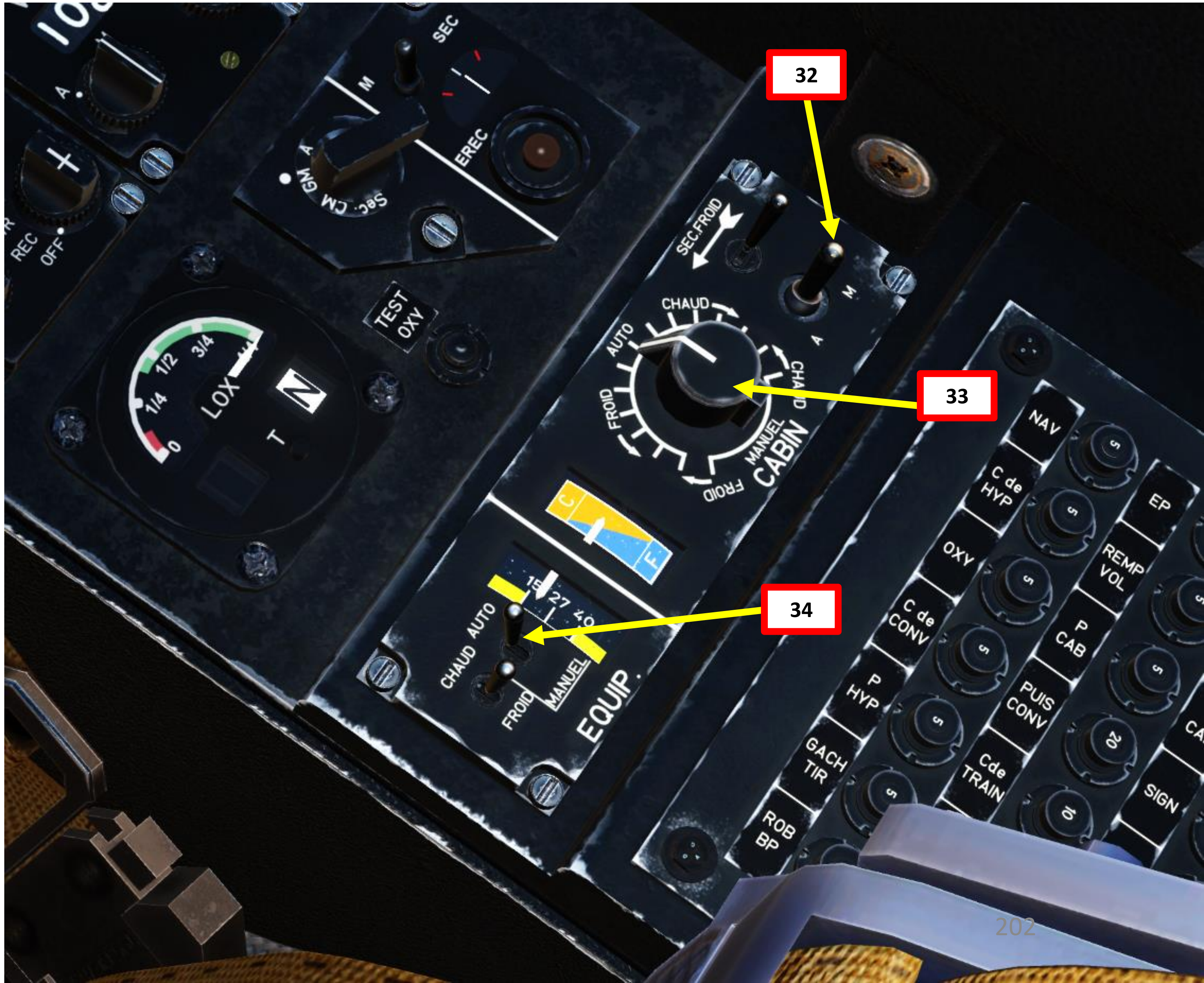


C – AFTER START-UP

Mirage F1EE Only

7 – Air Conditioning & Avionics Cooling Setup

32. Set Air Conditioning Master Valve Control Switch – MARCHE/ON (RIGHT).
33. Set Cabin Temperature Control – AUTO.
34. Set Air Conditioning Temperature Mode Switch – AUTO (FWD)

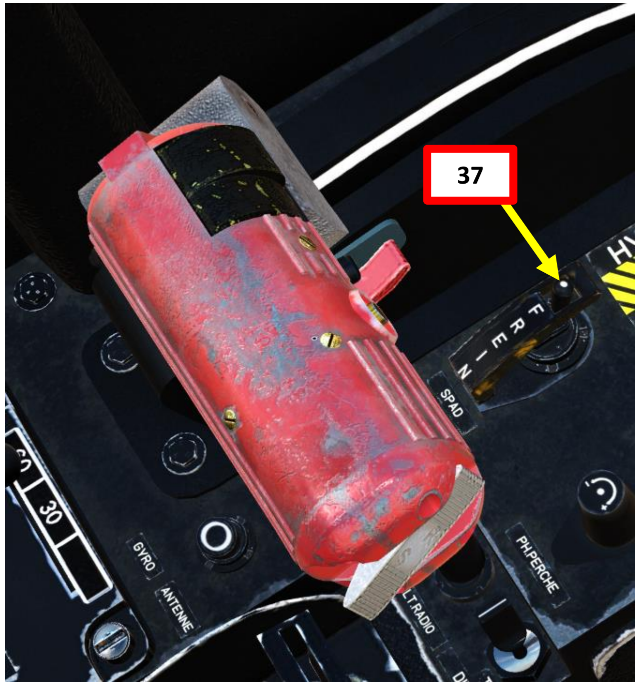


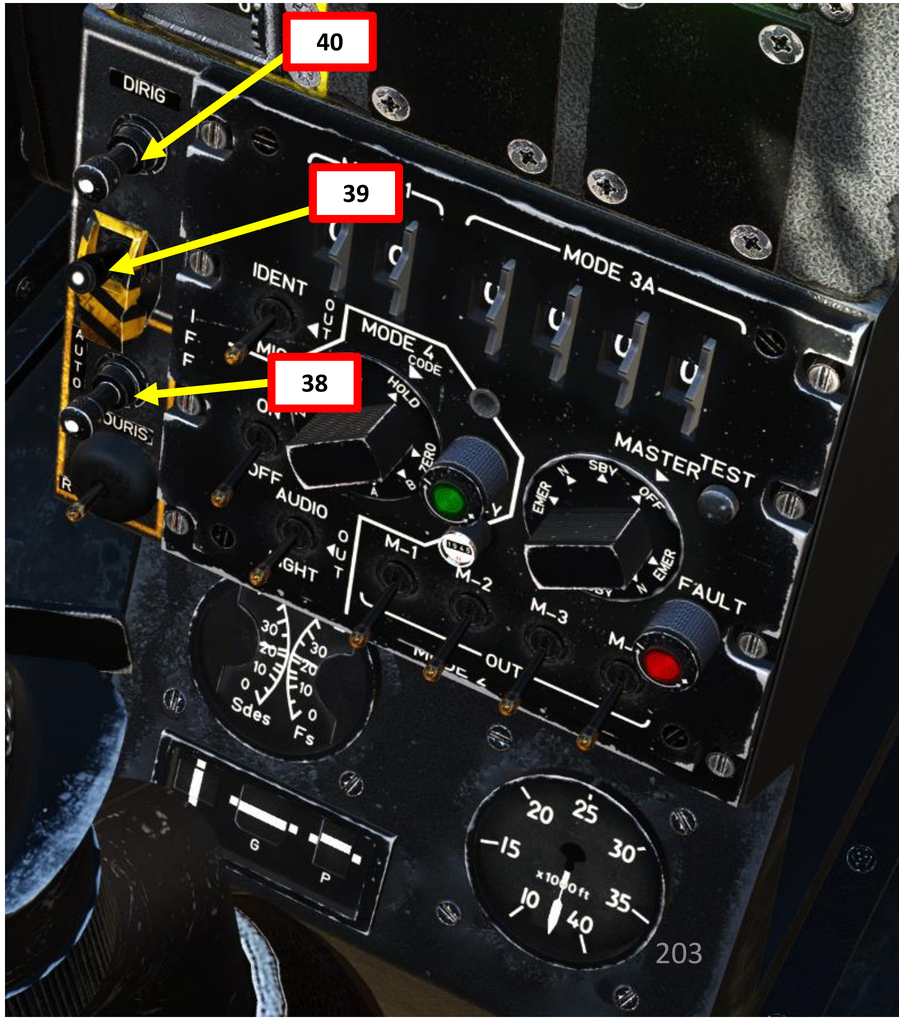
Mirage F1EE Only

C – AFTER START-UP

8 – Aircraft Controls Setup

35. Verify ARTHUR Selector Switch is set to AUTO (UP).
    - The ARTHUR (variable sensitivity crank bell) system adjusts the control stick sensitivity as a function of altitude and airspeed.
36. Verify Stick Uncouple Switch *(Débrayage Manche)* is set to OFF (UP).
37. Set Anti-Skid (SPAD, *Système Perfectionné Anti-Dérapant*) Switch – ON (FWD).
38. Set Engine Shock Cone *(Souris)* Pushbutton – ON/AUTOMATIC (PUSHED IN).
39. Set Nosewheel Steering *(DIRIG, Dirigeabilité Roue Avant)* Switch – ON (UP).
40. Set Nosewheel Steering High Sensitivity Selector Button – HIGH SENSITIVITY (PUSHED IN).



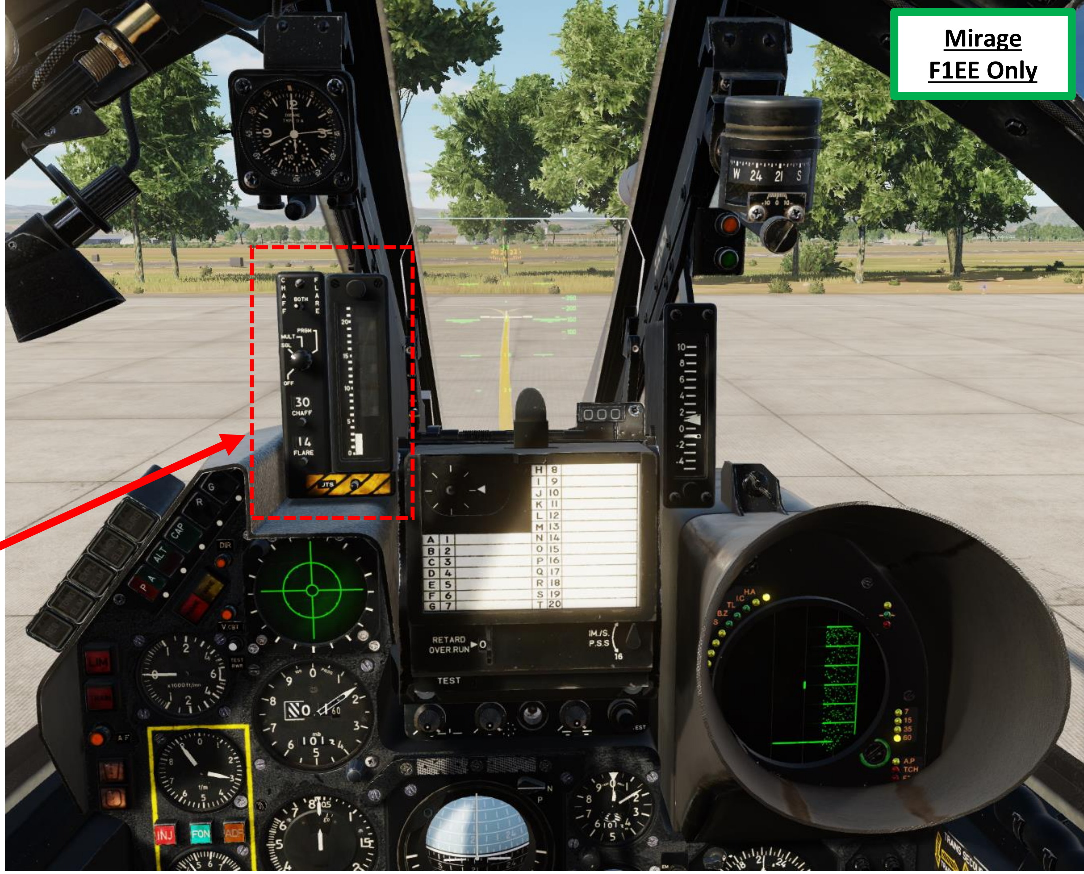


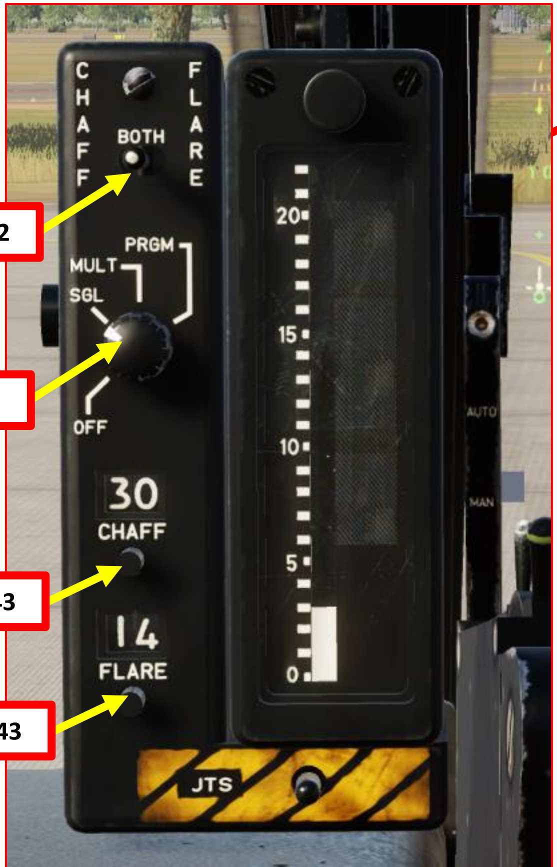
C – AFTER START-UP

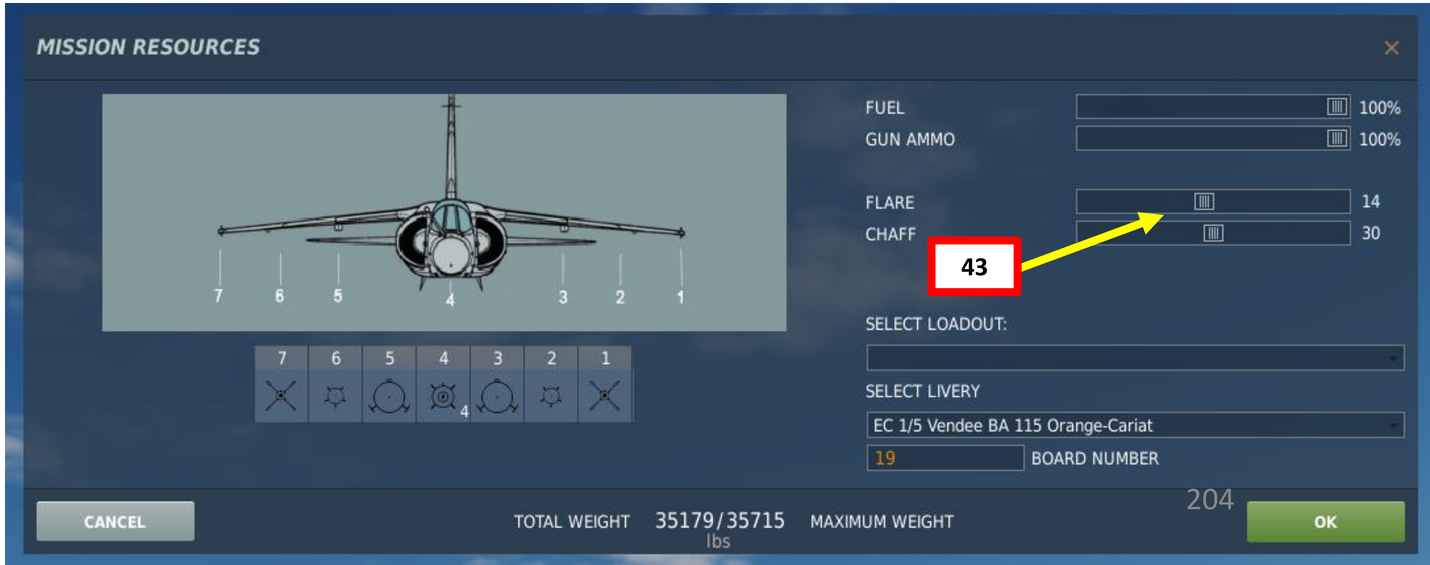
Mirage F1EE Only

9 – Countermeasures Setup

41. Select Countermeasure Program Selector – As desired.
42. Select Chaff/Flare Selector Switch – As desired.
43. Based on your countermeasure loadout, press the Chaff Counter & Reset Button and the Flare Counter & Reset Button (Below) to obtain the correct chaff and flare counter values.







C – AFTER START-UP

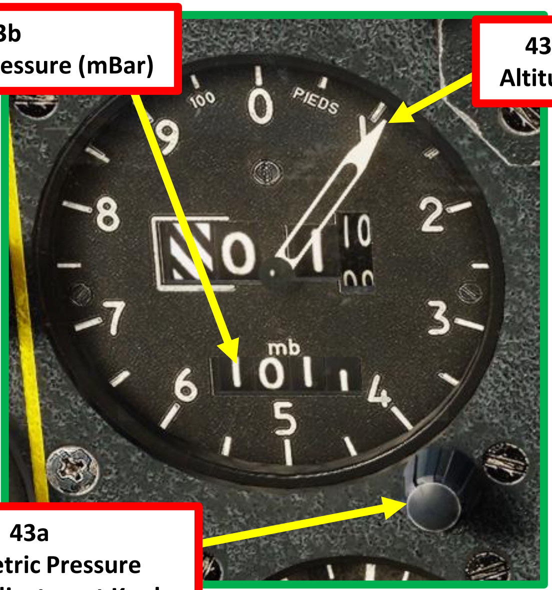
Mirage F1EE Only

10 – Last Interior Checks

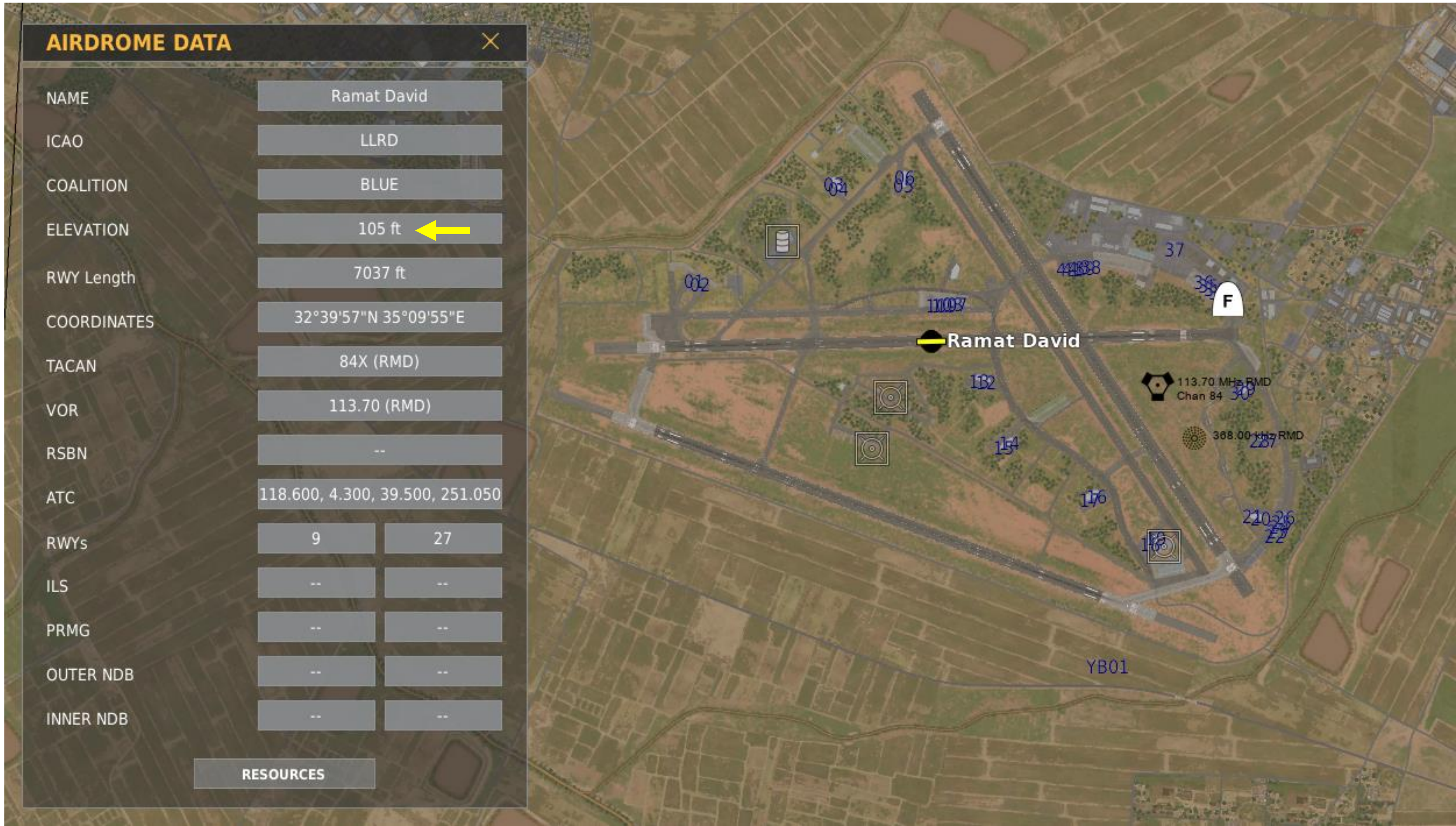
44. Set altimeter barometric pressure setting for both the **Slaved Altitude** *(Alticodeur/Altimètre)* Indicator and the **Standby Altimeter**.
    - If airfield elevation data is available, you can adjust the barometric pressure knobs to make the altimeter reading match the airfield elevation (which would be 105 ft in our case since we takeoff from Ramat David). However, you will have to keep in mind that your altitude reading will be AMSL (Above Mean Sea Level), not above ground level. This is important to remember when being directed by the ATC (Air Traffic Controller). For airfields with variable elevation, you might want to perform this step when lined up on the runway.
    - Alternatively, you can set the barometric pressure knob to make the altimeter reading match "0". In that case, the altitude reading will be AGL (Above Ground Level), not from sea level.

43b
Barometric Pressure (mBar)

43c
Altitude



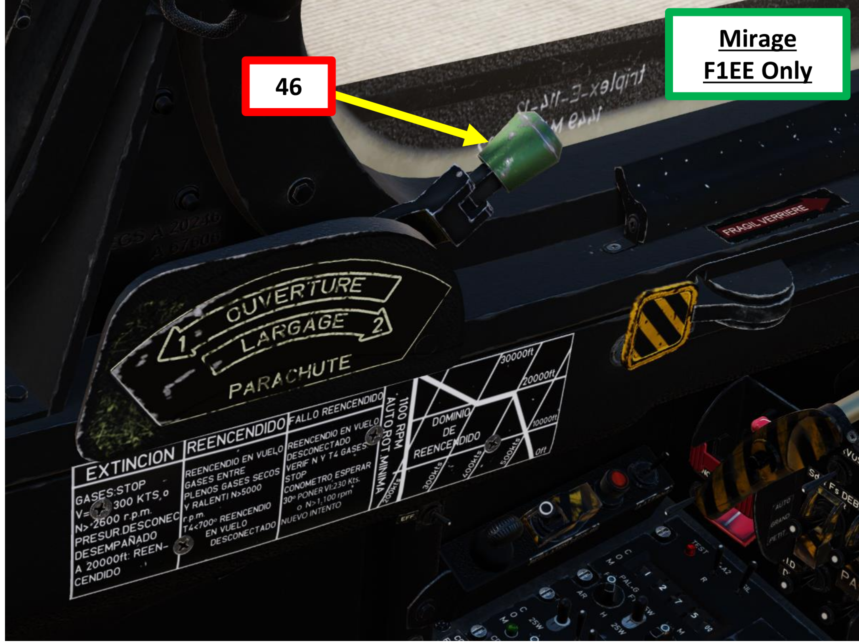
43a
Barometric Pressure
Setting Adjustment Knob

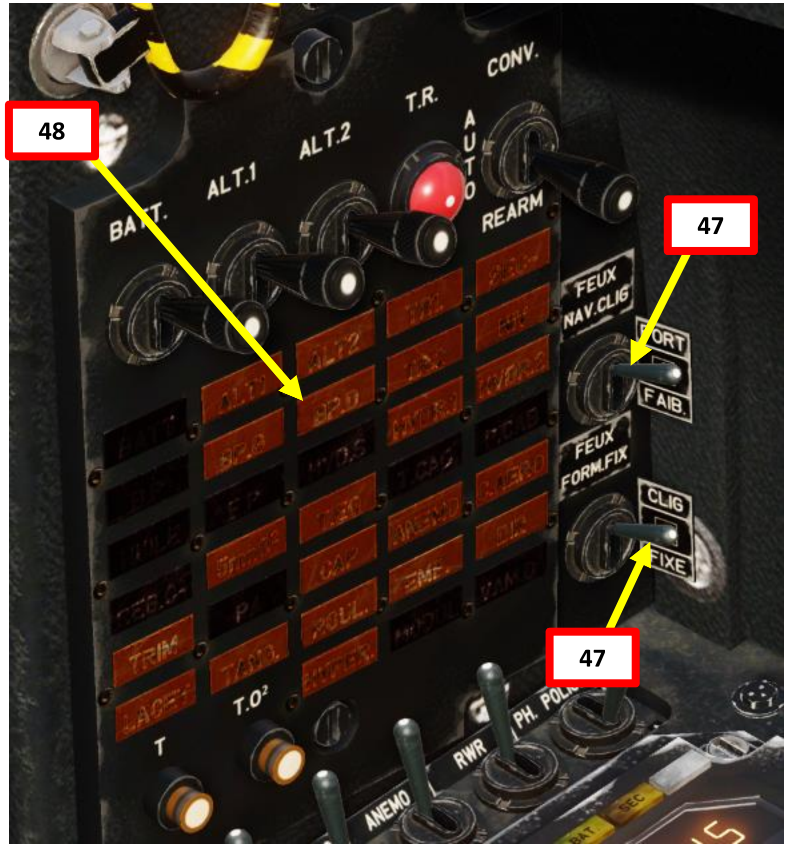


C – AFTER START-UP

10 – Last Interior Checks

45. Set IFF (Identify-Friend-or-Foe) Master Mode – SBY (Standby).
46. Verify Parachute (Brake Chute) Lever is set to LARGAGE/RELEASE position (FWD).
47. Set External Lights – As Required
    - Navigation Lights *(Feux de Navigation)* Control Switch - UP (Fort, Bright)
    - Formation Lights *(Feux de Formation)* Control Switch – UP (*Clignotant*/Blinking) or DOWN (*Fixe*/Steady)
    - Landing Light Control Switch – FWD (*ROUL (Roulage), Taxi Light*)
48. Verify that there are no more warning lights illuminated on the Warning Panel.

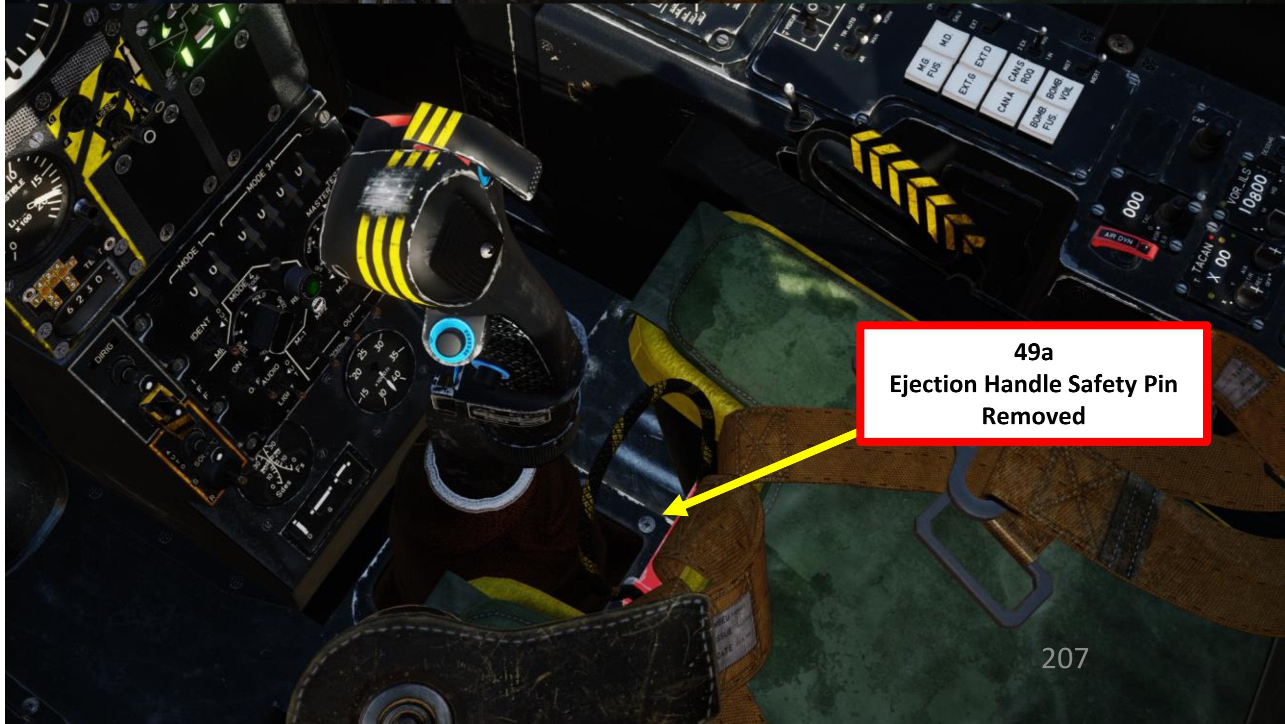




C – AFTER START-UP

10 – Last Interior Checks

49. Remove Ejection Handle Safety Pin (scroll mousewheel on ejection handle).
50. You are now ready to taxi.



PART 5 – START-UP PROCEDURE

Mirage F1EE Only


C.14-21

TAXI

1. If desired, the canopy can be partially opened for taxiing using the Canopy Hinged Handle. However, we will leave it closed, locked and pressurized to keep things simple.
2. Set Landing Light Control Switch – ROULAGE/TAXI (FWD).
3. Release Parking Brake – Push Parking Brake Lever IN.
4. Confirm FREIN (Brake Engaged) Light is extinguished.
   - Note: The "FREIN" light can be illuminated by either engaging the parking brake or using the toe brake pedals.

TAXI

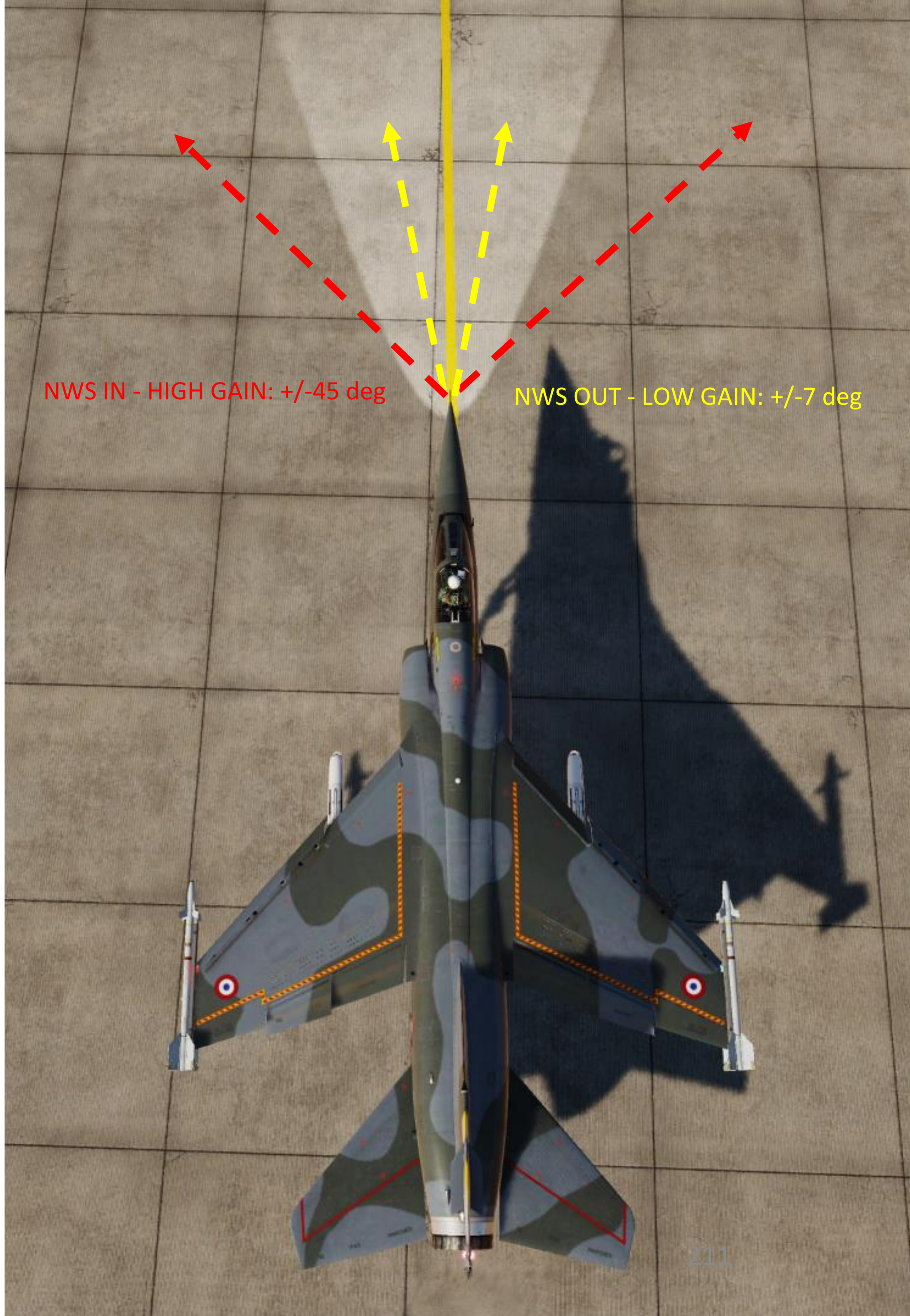
5. Set Nosewheel Steering High Sensitivity Selector Button – PUSHED IN (High Sensitivity). This will allow the aircraft +/- 45 deg of steering.
6. Advance throttle to maintain 6000 RPM, start rolling and then apply brakes with the pedal toe brakes to test them.

5b
Pulled OUT: Low Gain/Sensitivity

Nosewheel Steering High Sensitivity Selector Button
- *Pushed IN: High Sensitivity, 45 deg of steering*
- *Pulled OUT: Low Sensitivity, 7 deg of steering*

Note: The button is mechanically released (pushed OUT) automatically when there is no weight on the front wheel.

5b
Pushed IN: High Gain/Sensitivity

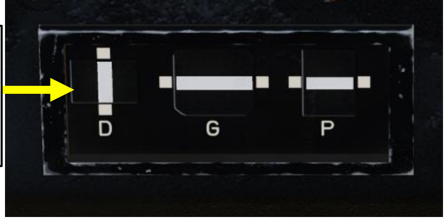


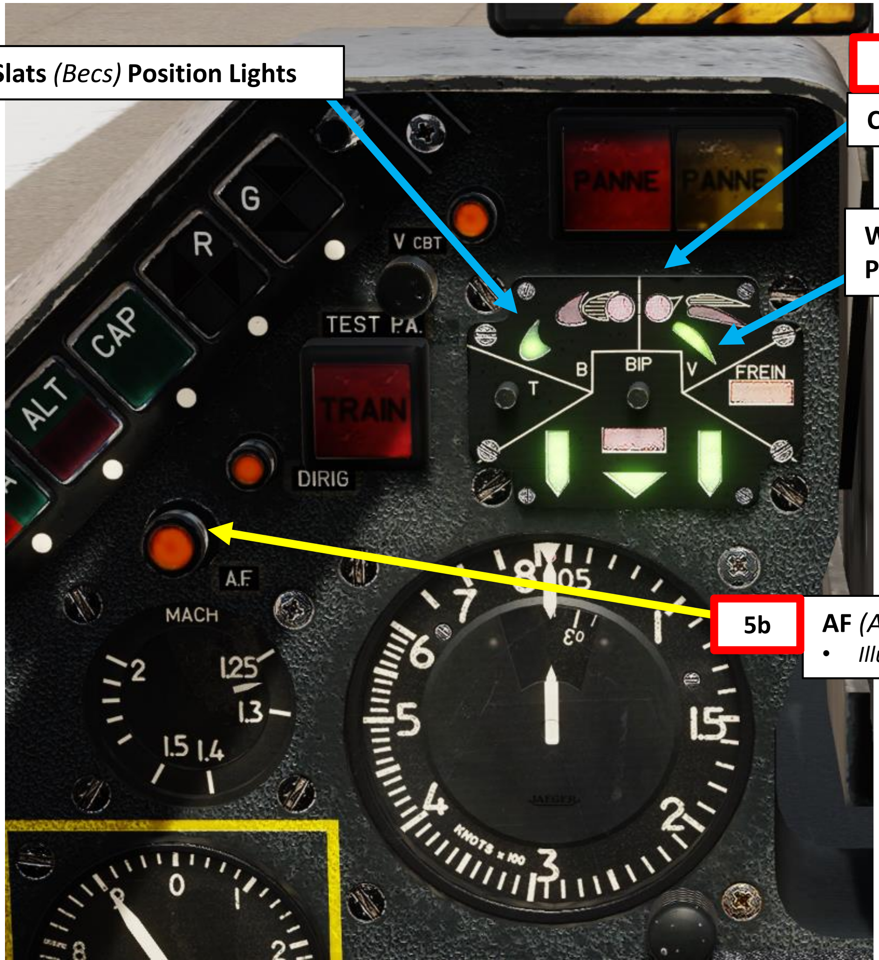
TAXI

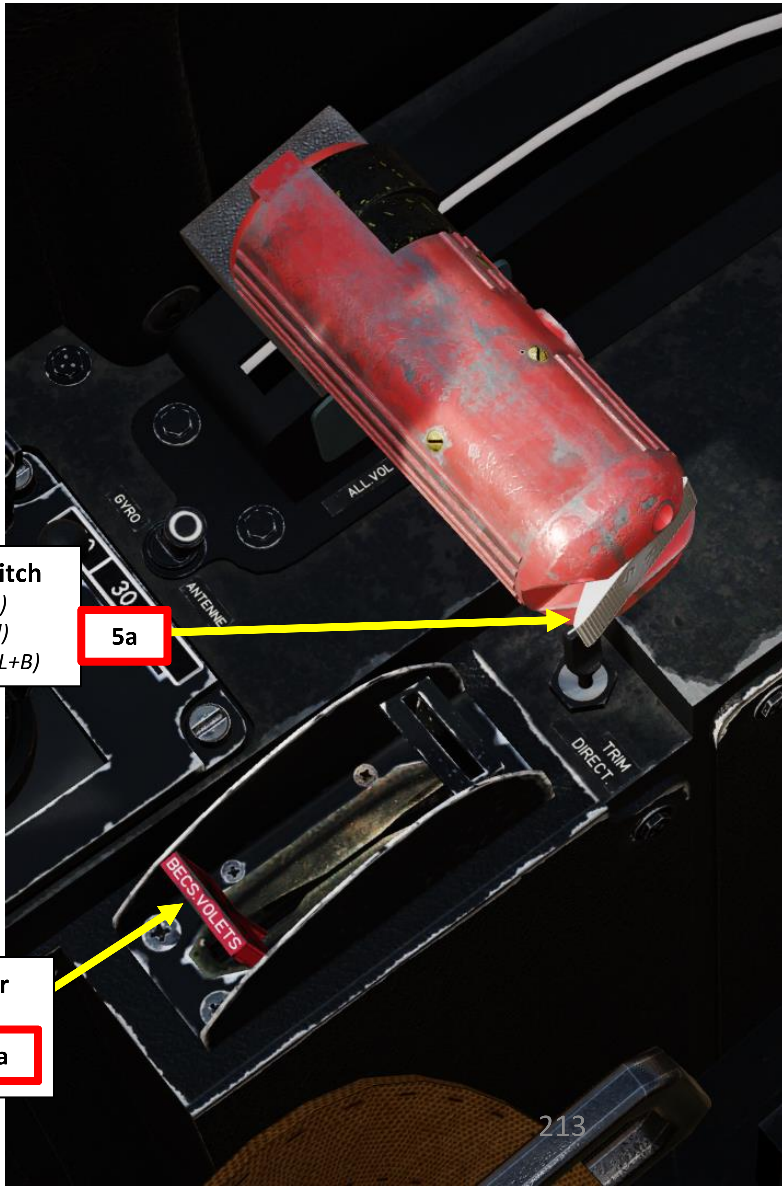
7. Release brakes and taxi to the runway.
8. Aircraft is steered gently with rudder pedals without assistance of brakes.
9. Avoid engine power settings between 5500 RPM and 6000 RPM (alternator gear change).
10. Do not exceed 20 kts on straight taxiways. Enter bends slowly.
11. If taxiing under hot conditions, the “T EQ” warning light (air temperature flowing into equipment bay is above 50 deg C) may come on.

TAKEOFF

1. Line up the aircraft with the runway centerline.
2. Set Wing Slats/Flaps *(Becs/Volets)* Control Lever – DEPLOYED (FULLY AFT).
   - Confirm deployment with the Configuration Indicator.
3. Center rudder pedals.
4. Confirm Pitch, Roll and Yaw trim tabs are NEUTRAL.
   - If trim tabs are not set correctly, adjust accordingly using the Trim Hat switch on the stick and the Rudder Trim *(Trim Directionnel)* Control Switch.
5. Verify Airbrakes (Aerofreins) are retracted.
   - Set Airbrakes *(Aérofreins)* Control Switch FWD to retract them.
   - Confirm airbrake retraction; the AF Light should be extinguished.





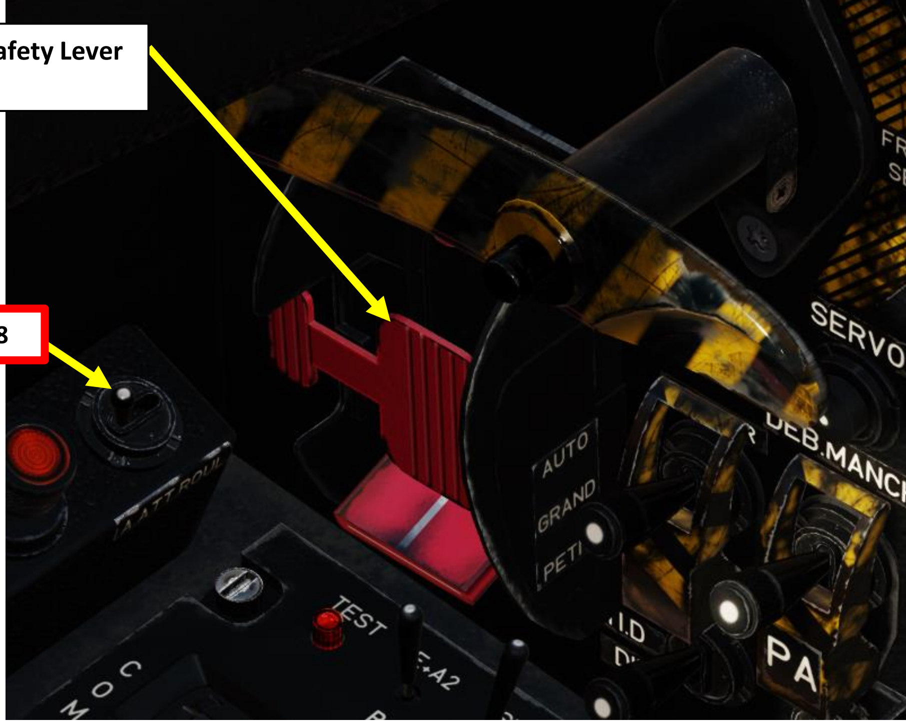


TAKEOFF

6. Set Radar Operation Mode Selector Switch – ÉMISSION (ON).
    - Mirage F1CE: set switch FWD.
    - Mirage F1EE: set switch UP.
7. Set Landing Gear Safety Lever – OPEN (Safety OFF). This will unlock the Landing Gear Control Lever (*Palette de Commande de Train d'Atterrissage)*.
8. Set Landing Light Control Switch – ARRÊT/OFF (AFT).

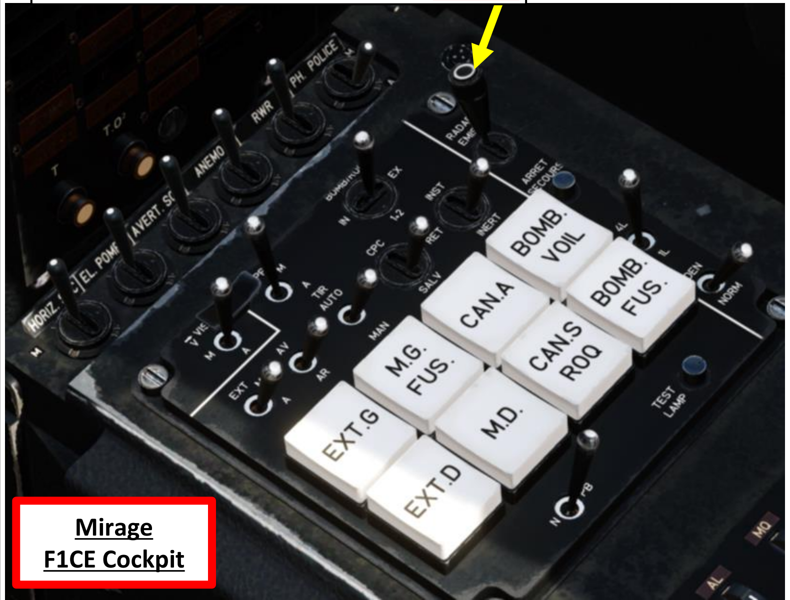
7a **Landing Gear Safety Lever SAFETY ON**

8



Radar Operation Mode Selector Switch
- *FWD: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *AFT: Arrêt (OFF)*

6



Mirage F1CE Cockpit

Radar Operation Mode Selector Switch
- *UP: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *DOWN: Arrêt (OFF)*

6

Mirage F1EE Cockpit

7b **Landing Gear Safety Lever SAFETY OFF**

TAKEOFF

9. Set Nosewheel Steering High Sensitivity Selector Button to low gain/sensitivity mode (pulled OUT).
10. Hold brakes by pressing the rudder pedal toe brakes.
11. Apply full power by smoothly moving the throttle fully forward.
12. Three seconds after engine RPM increases to 8100, red “INJ” (Injection) light comes on. A few seconds later, “INJ” light extinguishes, and green “FON” (*Fonctionnement Fusée*, Afterburner ON) illuminates, indicating proper afterburner (*PC, Post-Combustion*) operation.
13. Release brakes.
14. Avoid excessive action on rudder pedals or you risk veering off the runway; the nosewheel steering system is quite sensitive. Leave stick pitch control in neutral position.

9a
Nose Gear Weight On Wheels
Pushed IN: High Gain/Sensitivity

9b
Nose Gear Weight Off Wheels
Pulled OUT: Low Gain/Sensitivity

12a

12b

Afterburner *(PC, Post-Combustion)* **INJ (Injection) Light**

12c

Afterburner *(PC, Post-Combustion)* **ON Light**
- *“FON” stands for “Fonctionnement Fusée”*

TAKEOFF

15. At 120 kts, establish takeoff attitude (Incidence Angle 12 deg approx.) with the control stick.
    - Note: avoid incidence angles greater than 12 deg since a high angle means you risk scraping the aircraft's keel (ventral fin) on the runway surface… Not a great plan.
16. If the nosewheel has been left in high sensitivity mode by mistake, the Nosewheel Steering High Sensitivity Selector Button will pop out automatically when the nosewheel leaves the ground, setting the nosewheel steering in low gain/sensitivity mode.
17. Aircraft rotation should occur at approximately 150 kts.

16a
Nose Gear Weight On Wheels
Pushed IN: High Gain/Sensitivity

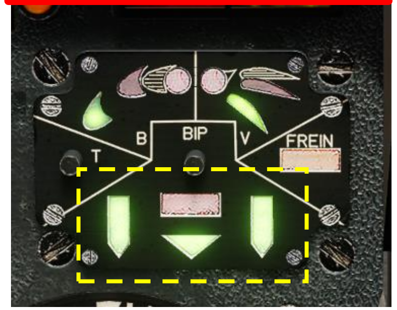
16b
Nose Gear Weight Off Wheels
Pulled OUT: Low Gain/Sensitivity

AoA (Angle of Attack) Incidence Indicator Tape
- *Red Range: 15.5 to 22 deg*
- *Yellow Range: 12.5 to 15.5 deg*
- *Green Range: 9.5 to 12.5 deg*
- *Unlighted Blue Range: 6 to 9.5 deg*

TAKEOFF

18. Once you are airborne with a positive rate of climb, set Landing Gear Control Lever *(Palette de Commande de Train d'Atterrissage)* – UP. This will retract the landing gear.
    - Confirm retraction with the Configuration Indicator.
    - Note: it is not necessary to use toe brakes to stop the wheels from spinning.

Landing Gear Down & Locked



Landing Gear In Transition

Landing Gear Up & Locked

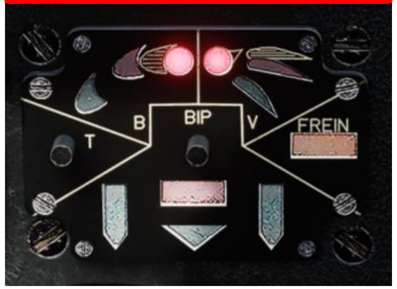
Landing Gear Control Lever *(Palette de Commande de Train d'Atterrissage)*
- *UP: Landing Gear Retracted*
- *DOWN: Landing Gear Deployed*

TAKEOFF

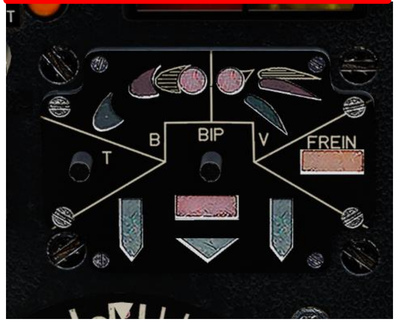
19. Set Wing Slats/Flaps *(Becs/Volets)* Control Lever – RETRACTED (FULLY FWD).
    - Confirm retraction with the Configuration Indicator.
    - Flaps should be retracted **before** accelerating beyond 200 kts.
20. Once aircraft has accelerated to 300 kts, disengage afterburner by throttling back to MIL (Military) power. Confirm green "FON" (*Fonctionnement Fusée*, Afterburner ON) is extinguished.

Flaps/Slats Deployed

Flaps/Slats In Transition

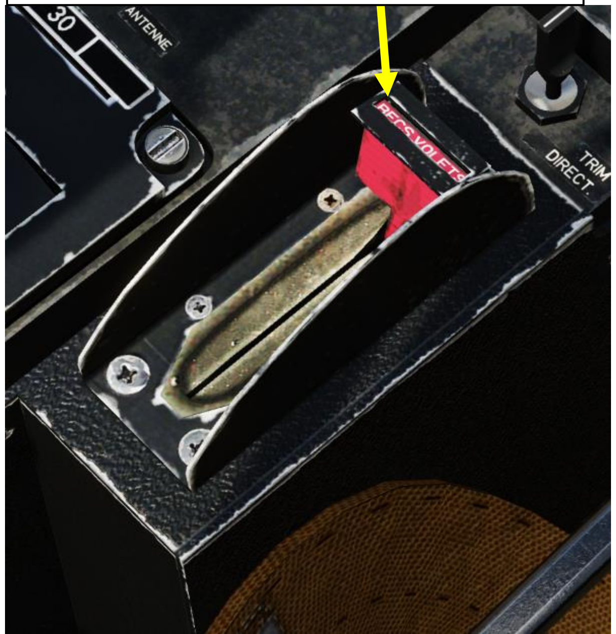


Flaps/Slats Retracted



Wing Slats/Flaps *(Becs/Volets)* **Control Lever**
- *FWD: Retracted*
- *MIDDLE: Half-Deployed*
- *AFT: Fully Deployed*

19



CLIMB

- ***Subsonic Climb Schedule***

  - *Configuration: Clean*
    - Military Thrust (afterburner OFF): 470 kts, Mach 0.92
    - Maximum Thrust (afterburner ON): 500 kts, Mach 0.95

  - *Configuration: Two RP35 (Réservoirs Pendulaires) 1200 L Drop Tanks or Air-to-Ground Stores*
    - Military Thrust (afterburner OFF): 422 kts, Mach 0.84
    - Maximum Thrust (afterburner ON): 475 kts, Mach 0.92

- ***Supersonic Climb Schedule***

  1. Follow subsonic climb schedule from takeoff up to an altitude of 30,000 ft
  2. At 30,000 ft, level off and accelerate to 610 kts in level flight.
  3. Climb at a constant airspeed of 610 kts up to 36,000 ft.
  4. At 36,000 ft, level off and accelerate up to Mach 1.8 in level flight.
  5. Climb at a constant airspeed of Mach 1.8 up to the desired altitude.

Note: aircraft service ceiling is limited to 50,000 ft.

CRUISE & COMBAT

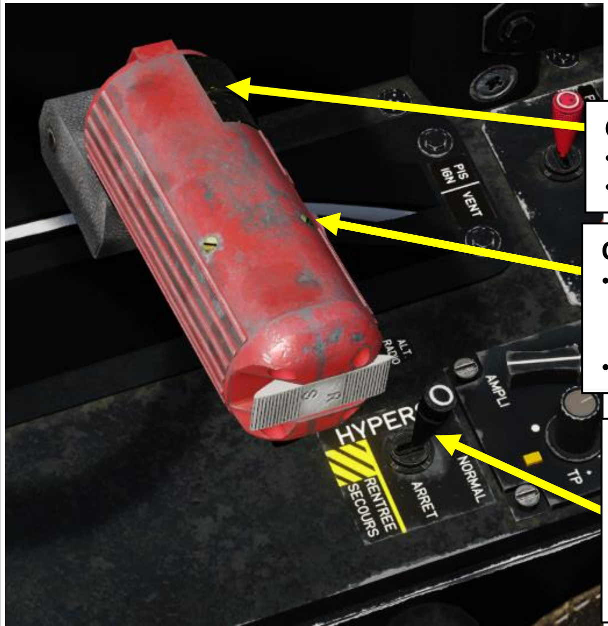
During **cruise**, adjust power based on navigation parameters (altitude and airspeed) required by the mission. Power settings impact flight time and fuel consumption.

During **combat**, the High-Lift Devices *(Volets Hypersustentateurs)* Mode Selector Switch should be left to NORMAL (FWD).

Combat flaps should only be employed in a specific flight envelope: **when flying at 300 kts / Mach 0.75 or below**. Slats are deployed automatically, while the flaps can be set to an "automatic combat mode" that will deploy them based on aircraft airspeed and angle of attack.

Pressing the **Combat Flaps Button** will arm flaps; they will automatically deploy or retract as needed to maximize aircraft lift during momentary manoeuvers. You should only use combat flaps preselection out of the airspeed envelope during momentary manoeuvers and never beyond Mach 0.9.

Pressing the **Combat Flaps Lever** will disarm combat flaps and retract them if deployed. Retract flaps when manoeuvering outside of the flight envelope, especially if airspeed exceeds Mach 0.9.



Combat Flaps Lever
- *When pressed, disarms combat flaps and retracts them if deployed.*
- *Binding: LCTRL+V*

Combat Flaps Button
- *When pressed, arms combat flaps, which will deploy automatically during momentary manoeuvers depending on airspeed and angle of attack.*
- *Binding: V*

High-Lift Devices *(Volets Hypersustentateurs)* **Mode Selector Switch**
- *FWD: Normal, wing slats (becs), flaps (volets) and combat flaps are controlled normally*
- *MIDDLE: Arrêt (OFF)*
- *AFT: Rentrés Secours (Retracted Emergency)*

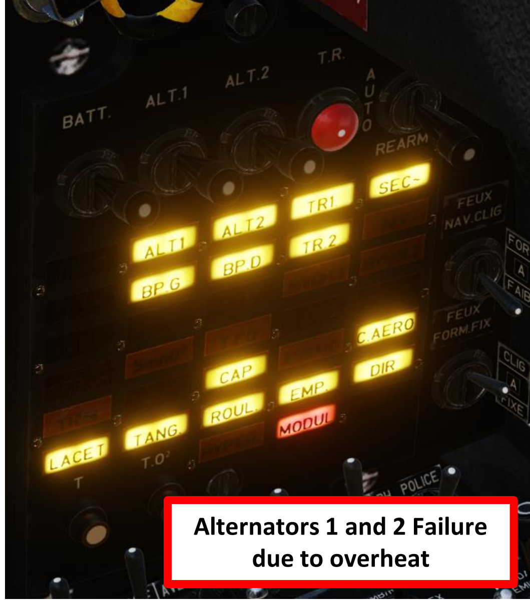
CRUISE & COMBAT

During **combat**, airbrakes *(aérofreins)* can be extended at any speed. This can be useful to decelerate momentarily to manoeuver for a shot, but keep in mind that being slow in the Mirage F1 leaves you very vulnerable.

Airbrakes *(Aérofreins)* **Control Switch**
- *AFT: Deployed/ON (Sortis) (LSHIFT+B)*
- *MIDDLE: Neutral (Unstable Deployed)*
- *FWD: Retracted/OFF (Rentrés) (LCTRL+B)*

ALTERNATORS VENTILATION: WHY AIRSPEED MATTERS

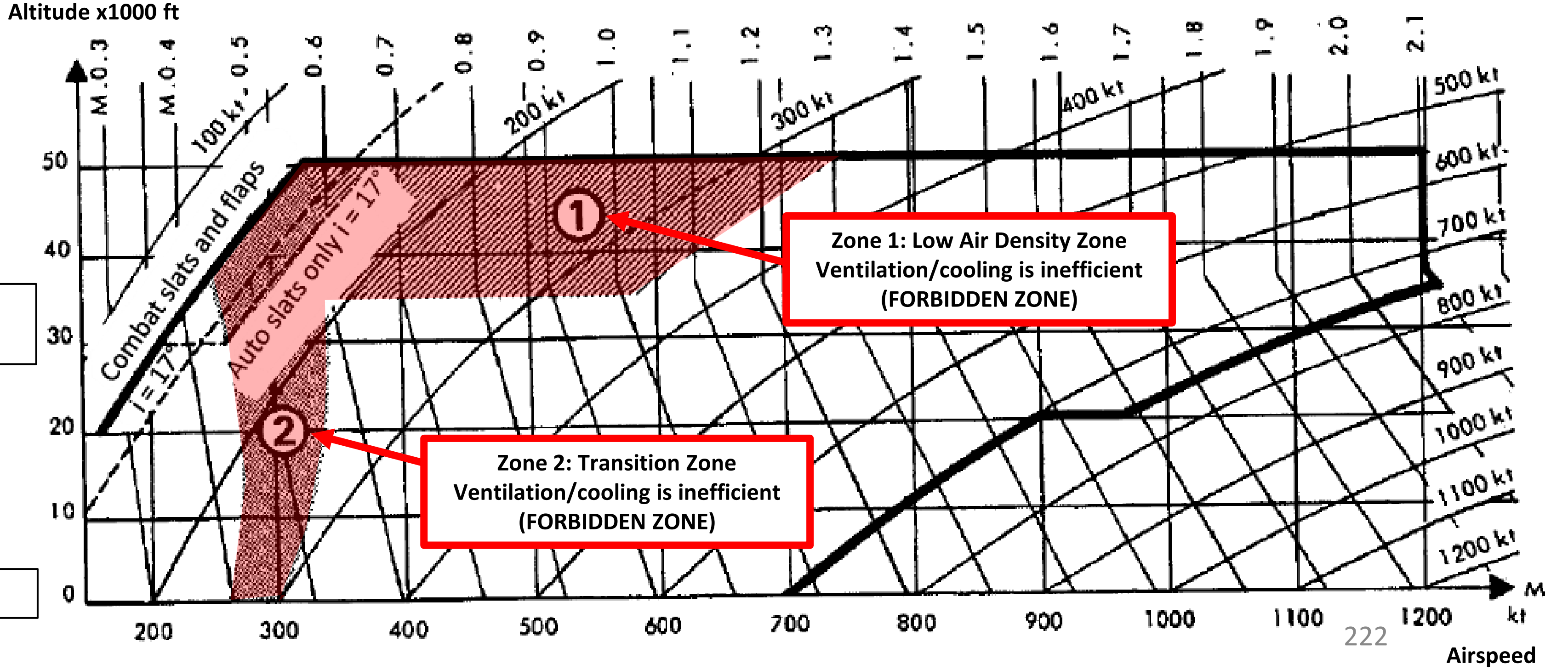
In the Mirage F1, you should **maintain an airspeed above 300-350 kts at all times during climb, cruise and combat phases of flight**. Why? Because the **alternators are ventilated by bleed air from the air intake duct**. The faster the aircraft flies, the more airflow enters the intake duct to cool down the alternators. A slower aircraft means less airflow available to ventilate the alternators. The higher the electrical load, the higher the heat that alternators have to dissipate. All this can lead to the **overheat failure of one or both alternators at certain conditions of speed, altitude and electrical load, indicated by the ALT1 and or ALT2 warning lights** (or even worse, a Christmas Tree's worth of failure lights, which include but are not limited to the **MODUL, LACET, TANG, ROUL, EMP and DIR** failure lights).



If an alternator overheat failure happens:

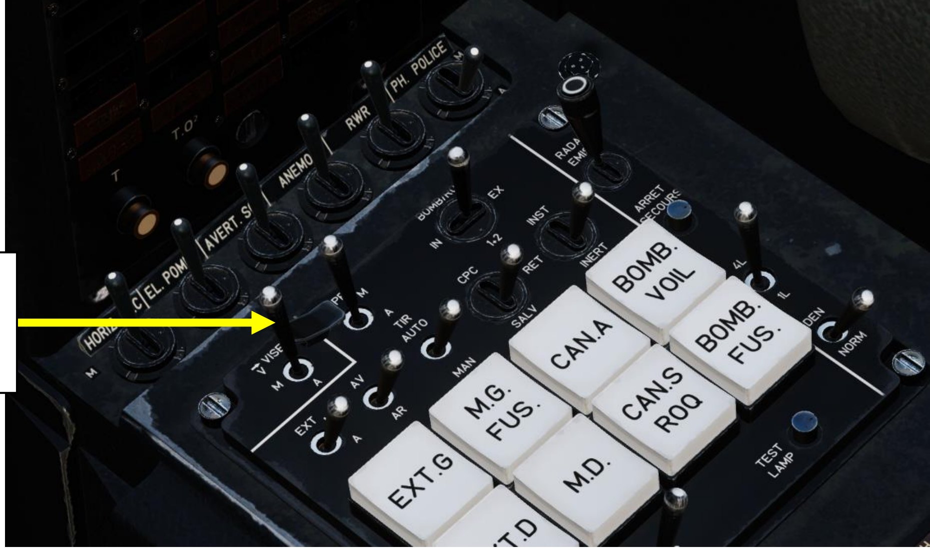
1. Fly aircraft outside of the forbidden zone (see Alternator Operation Envelope graph). This generally means to increase airspeed above 350 kts and decrease altitude. This will increase cooling airflow.
2. Turn OFF the corresponding failed alternator switch (DOWN).
3. Wait a few seconds to allow heat to dissipate from the alternators.
4. Turn back ON the corresponding failed alternator switch (UP).
5. If SEC~ light is ON, set the Inverter *(Convertisseur)* Selector Switch DOWN (RESET) momentarily, then release it. This should clear the SEC~ light warning light.

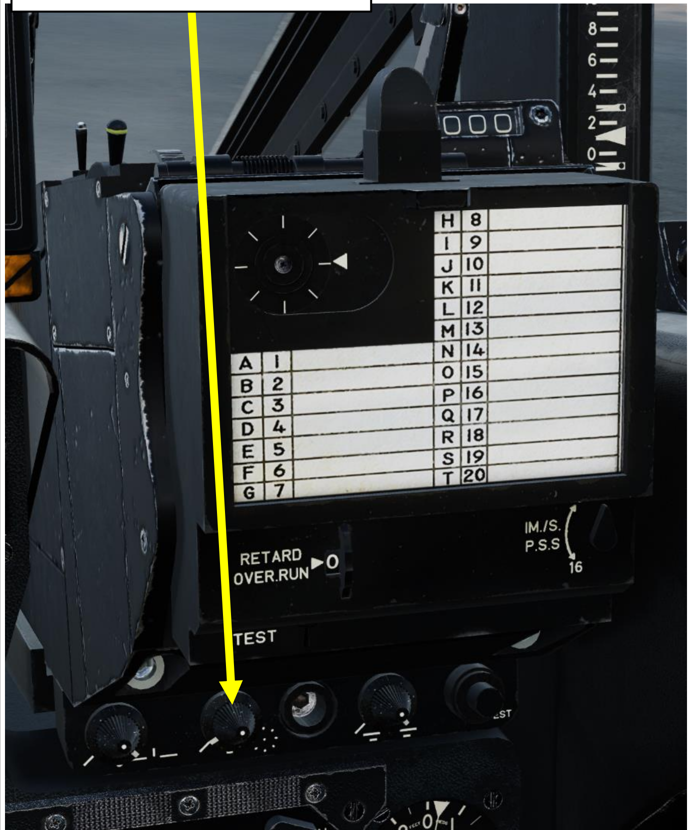
Alternator Operation Envelope

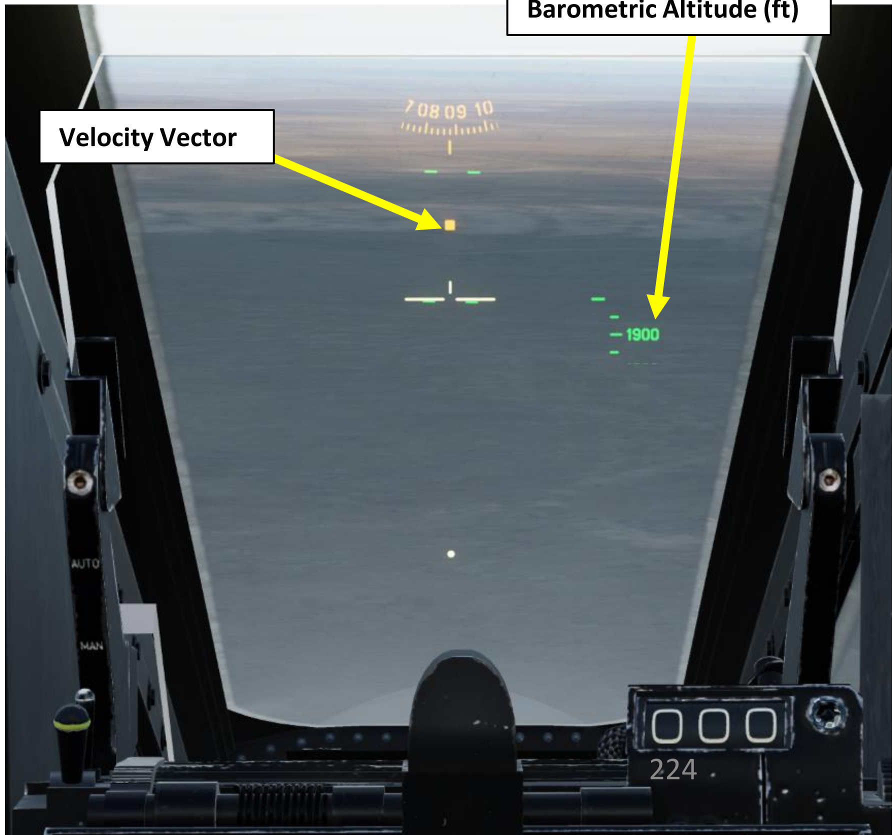


APPROACH

1. Set Sight (*Viseur*) Selector Switch – Approach Mode (FWD).
   - This will display the velocity vector, which should be use to line up the aircraft with the runway threshold during the final approach.
   - The altitude displayed on the sight is barometric, not a radar altitude. This means that the altitude displayed is AMSL (Above Mean Sea Level), not AGL (Above Ground Level).
   - If desired, you can reduce the intensity of the gunsight by turning the Moving & Target Reticles Intensity Rheostat.

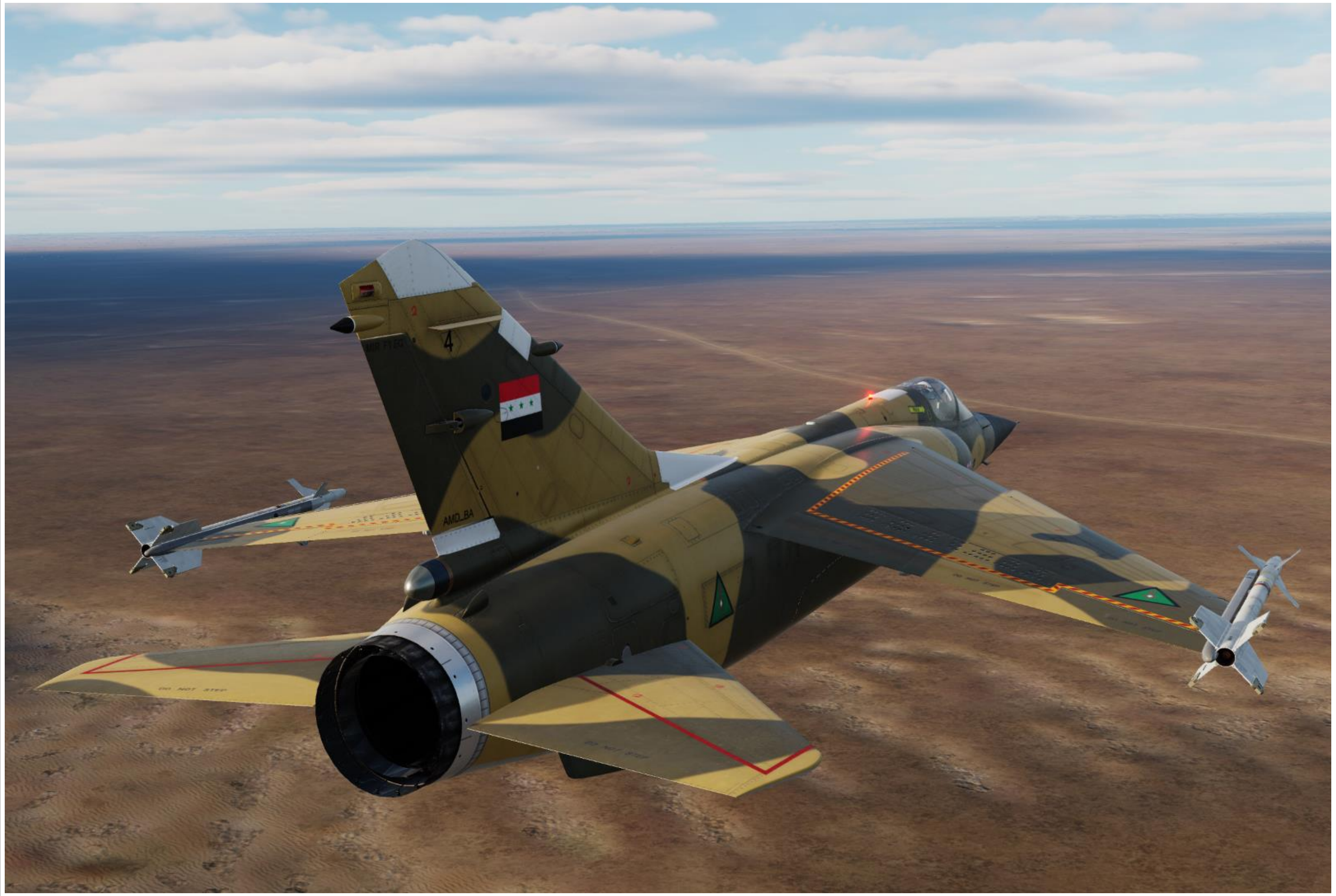






APPROACH

2. Perform descent and start approach 3 nm from airport at 1500 ft.



ECONOMICAL DESCENT	
RPM	6500
Airbrakes	retracted
IAS	300 kts
Demist switch	ON (no effect in DCS)
~1.5 NM and 2 liters per 1000 ft	

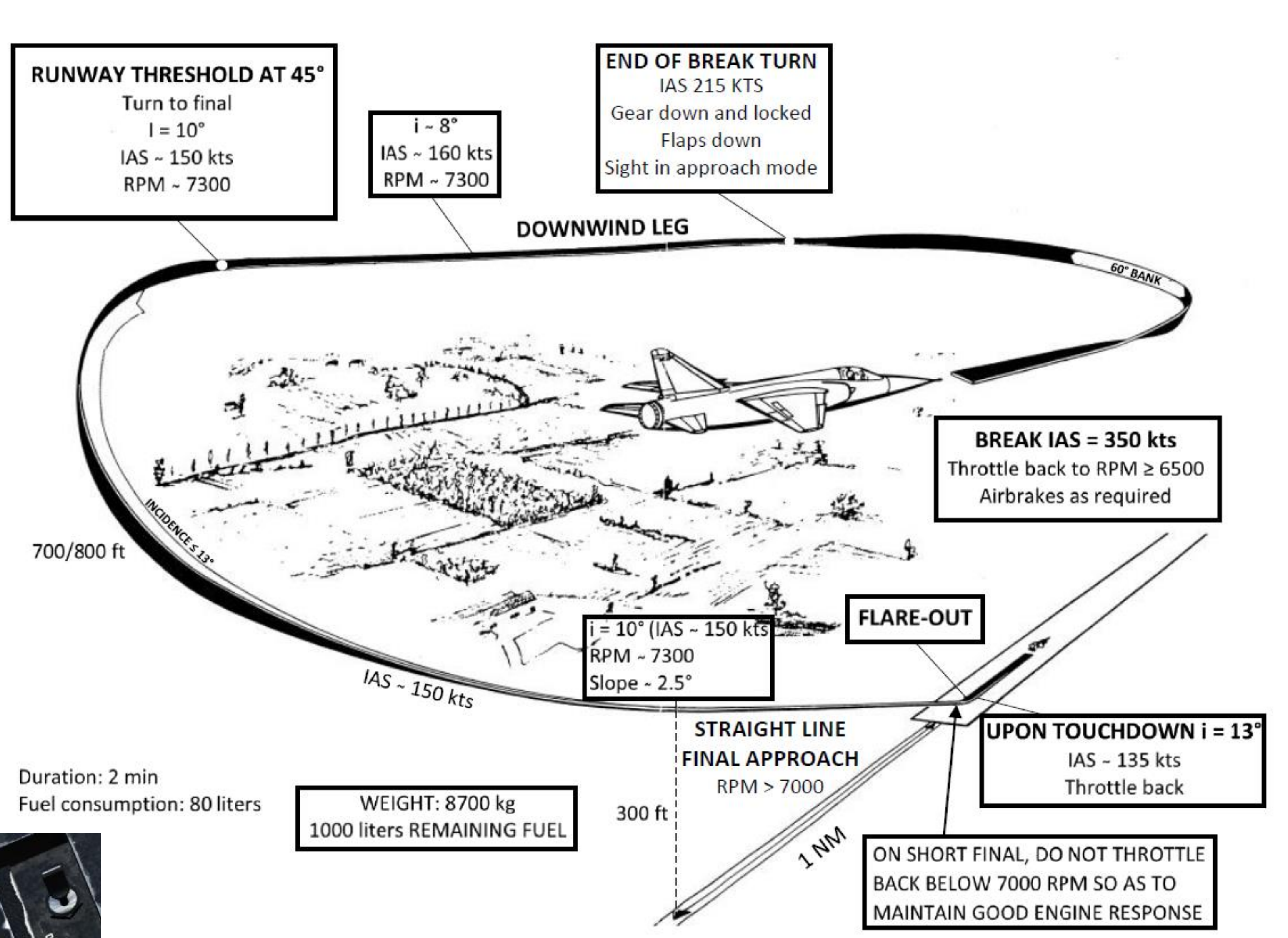
OPERATIONAL DESCENT	
RPM	~6500
Flight path slope	-10°
Airbrakes	retracted
Mach/IAS	0.92 then IAS 450 kts
Demist switch	ON (no effect in DCS)
~1 NM per 1000 ft	
FAST DESCENT	
RPM	6500
Airbrakes	extended
Attitude	-20°
Demist switch	ON (no effect in DCS)

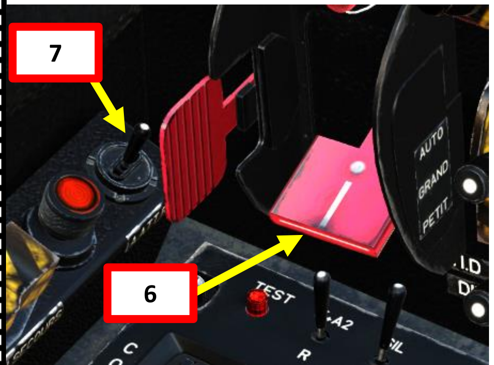
LETDOWN	
RPM	6500
Airbrakes	extended
IAS	300 kts
Demist switch	ON (no effect in DCS)
1 NM and 2 liters per 1000 ft	
Flight path slope -10°	

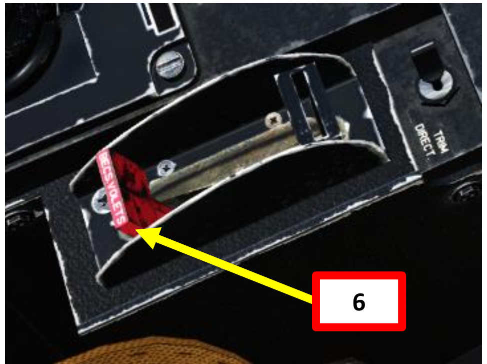
APPROACH

3. When overflying the runway, throttle back to 6500 RPM and deploy airbrakes as required to decelerate to 350 kts while maintaining 1500 ft.
4. Perform overhead break turn with a 60 deg bank angle.
5. At the end of the break turn, decelerate to 215 kts when entering the downwind leg.
6. When airspeed is below 215 kts, extend landing gear and deploy flaps and slats FULLY DOWN.
   - Extending landing gear and flaps above 215 kts may jam them in intermediate positions.
   - TRAIN warning light illuminates when airspeed is below 215 kts and throttle lever is set to an engine power setting less than 8100 RPM.
7. When airspeed is below 240 kts, set Landing Light Control Switch – ATTERRISSAGE/LANDING (MIDDLE position).
8. In the downwind leg, set throttle to 7300 RPM and decelerate to 160 kts while maintaining 1500 ft. Trim aircraft to set an incidence angle of 8 deg (blue zone).

Overhead Break Pattern

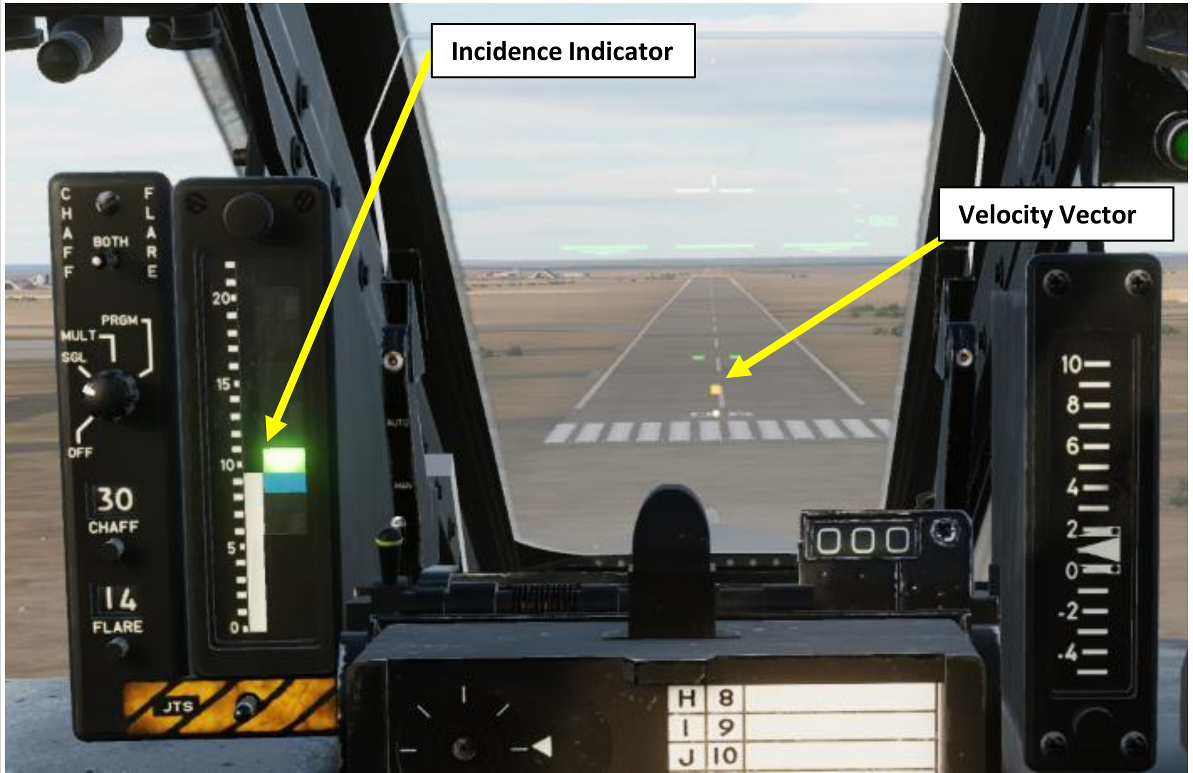






APPROACH

9. When you are 45 deg from the runway threshold, turn to final. Adjust power and trim aircraft pitch to maintain an Incidence Angle of 10 deg (green zone). Take note of the airspeed required to maintain this Incidence angle and adjust power to maintain this airspeed throughout the landing phase.
    - Consult Incidence Indicator Reference Table for an approximation of the airspeed you should expect for a given incidence angle and weight configuration.
10. Once you are 1 nm from the runway threshold on final approach, steer aircraft to place the velocity vector on the runway threshold. Adjust power as required to maintain the Incidence Angle in the green zone (between 9 and 11 deg).
    - Take a mental note of what the incidence angle means and what actions to take based on the color code:
        - Red: You are way too slow, increase power and trim the nose down.
        - Yellow: You are too slow, increase power and trim the nose down.
        - Green: Airspeed and incidence angle is optimal for landing.
        - Blue: You are too fast, slow down and trim the nose up.



Recommended Landing Parameters

Configuration	Weight	Rate of Descent
Normal Landing Weight	9000 kg / 19842 lbs	550 ft/min maximum
Exceptional Landing Weight	11000 kg / 24251 lbs	395 ft/min maximum
Emergency Landing	Above 11000 kg / 24251 lbs	Lowest possible below 300 ft/min

Incidence Indicator Reference Table

Relation between i and IAS at n=1 versus weight		Incidence readings	IAS versus weight * 8700 kg	** 11000 kg	*** ±100 kg
	BLUE	8			
	BLUE	9	156	177	
L/D max (all down)		9.5			
Optimum (all down)	GREEN	10	151	172	
	GREEN	11	146	167	
Watch rpm	GREEN	12	141	162	
		12.5			±0.85
Touchdown	YELLOW	13	136	157	
	YELLOW	14			
	YELLOW	15			
		15.5			
Keel limits	RED	16			
Limit	RED	17	117	138	
	RED	22			

* Without external stores and 1000 liters remaining
With drop tanks empty and 500 liters remaining
** Wing tanks empty (maximum landing weight)
*** ±100 kg = ±125 liters

LANDING

11. As a safety precaution, it is recommended to maintain engine RPM above 7000 RPM in order to keep a good engine response.
12. Descent rate should be determined based on weight configuration (550 ft/min for a normal landing weight configuration or 395 ft/min for heavy weight configurations) with a glide slope of approx. 2.5 deg.

LANDING

13. Fly the aircraft to keep the velocity vector on the runway threshold and the Incidence Indicator Green (10 deg) until touchdown.

LANDING

14. Upon touchdown, flare the aircraft to maintain a 13 deg Incidence Angle (yellow zone). Maintaining your angle of attack will perform an “aerobraking landing”; this manoeuver bleeds speed and significantly reduces runway length required to decelerate since your wing basically acts as a huge airbrake.
15. Once aircraft has slowed down to 120 kts, set the throttle fully back and let the nose gear touch the ground as the aircraft decelerates.

LANDING

16. Gently tap wheel brakes when you have slowed down under 100 kts.
17. If landing on a short runway, you may use the brake chute. Brake chute should not be deployed at airspeeds greater than 210 kts.
    a) Verify that brake chute lever is in the FORWARD position (ARMED).
    b) Deploy chute by pulling the drag chute lever AFT (*SORTIR PARACHUTE = DEPLOY CHUTE*).
    c) Once you are slowed down, push brake chute lever FORWARD to release the chute (*LARGAGE PARACHUTE = RELEASE CHUTE*).

Parachute (Brake Chute) Lever

- *AFT: Deploy chute (Sortie)*
- *FWD: Release chute (Largage Parachute)*

17a
Parachute Armed

17b
Parachute Deployed

17c
Parachute Released

LANDING

18. Once you are ready to depart the runway towards the parking area (preferably at 20 kts or below), set Nosewheel Steering High Sensitivity Selector Button – PUSHED IN (High Sensitivity). This will allow the aircraft +/- 45 deg of steering.
19. Taxi to the parking area.
20. Retract flaps and set Landing Gear Safety Lever – CLOSED (Safety ON). This will lock the Landing Gear Control Lever (*Palette de Commande de Train d'Atterrissage)*.

18a
Pulled OUT: Low Gain/Sensitivity

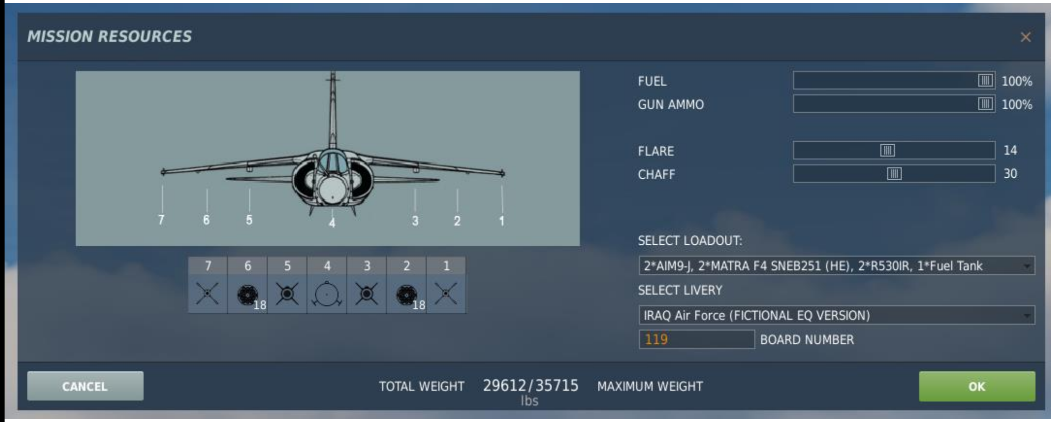
18b
Pushed IN: High Gain/Sensitivity

Nosewheel Steering High Sensitivity Selector Button
- *Pushed IN: High Sensitivity, 45 deg of steering*
- *Pulled OUT: Low Sensitivity, 7 deg of steering*

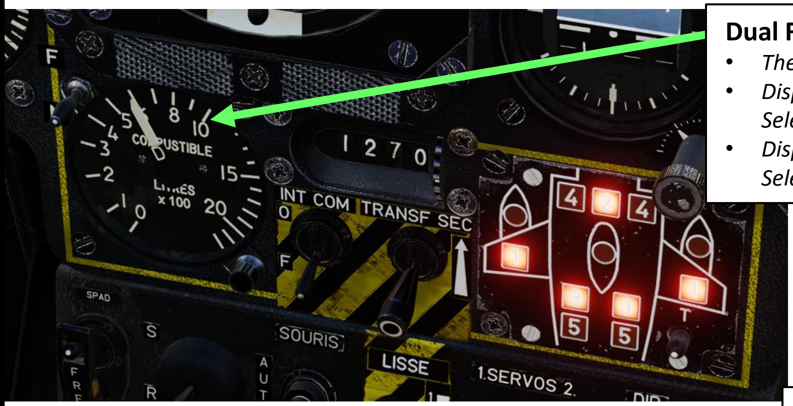
LANDING

REARMING & REFUELING

Once you are parked, you can contact the ground crew to **rearm and refuel.** The ground crew will reinstall **the brake chute** if you have used it and refuel the aircraft as well; the ground crew will also reset the **Fuel Remaining Indicator** to the correct value for you using the **Fuel Quantity Reset Thumbwheel**.



Parachute (Brake Chute)
- *Parachute released*



Dual Fuel *(Combustible)* **Indicator (x100 Liters)**
- *There are two needles: one for each side of the aircraft.*
- *Displays Fuselage Tank Quantity when Feeder/Fuselage Selector Switch is set to UP (Fuselage)*
- *Displays Feeder Tank Quantity when Feeder/Fuselage Selector Switch is set to DOWN (Nourrices/Feeder)*

Fuel Remaining Indicator (Liters)
- *Indicators needs to be set every time a refueling occurs using the Fuel Quantity Reset Thumbwheel.*

Fuel Quantity Reset Thumbwheel
- *Changes the Fuel Remaining Indicator Value; this needs to be used after refueling.*

Parachute (Brake Chute)
- *Parachute reinstalled*

AERODYNAMICS

The Mirage F1 was designed to be an interceptor first, with a secondary ground attack role. As a successor to the Mirage III, the F1 was optimized for speed. However, the flaps and slats provide good handling capabilities in dogfights. The controls of the aircraft are sensitive and you should avoid pulling excessive Gs or fly in high incidence angle attitudes; this bleeds off airspeed very rapidly and makes you vulnerable. It also puts the engine at a serious risk of flaming out. I would advise a new Mirage pilot to focus on staying fast rather than trying to out-turn enemy fighters.

AERODYNAMICS

Rolling the aircraft at high incidence (angle of attack) induces a sideslip and turn reversal that can end up in a spin. The pilot should relax the pressure on the control stick when there is a tendency to refuse to turn. **Turns at high angle of attack should be done with rudder only**, and **avoid using the roll control as much as possible**. Take note that both pitch and roll are quite sensitive in this aircraft.

Spin recovery procedure

- Release the control stick and rudder pedals
- Cut power
- Retract airbrakes
- Roll out
- Start pulling out above 200 kt IAS

Flat spin recovery procedure

- Release the control stick (pitch and roll neutral)
- Cut power
- Retract airbrakes
- Apply full rudder opposite to the direction of the aircraft nose movement on the landscape
- Roll out
- Start pulling out above 200 kt IAS
- Restart engine if required

PROHIBITED MANOEUVERS

- Fast roll maneuvers should be limited to avoid excessive skids (high Mach at low altitudes) and divergent flight conditions (high Mach at high altitudes)
- Do not go into inverted flight or perform negative G manoeuvers for more than 15 seconds due to engine fuel supply.
- In case of damper failure:
  - In subsonic flight, do not perform successive rolls.
  - In supersonic flight, half rolls are permitted in the following conditions:
    - Up to Mach 1.5 with full roll control travel if load factor is higher than 0 below 40,000 ft and higher than 1 above 40,000 ft
    - Beyond Mach 1.5, half roll with half roll travel if load factor is higher than 1
- Maximum Allowable Incidence Angle: 17° (15° when flying in transonic speed range)
- Maximum Allowable Crosswind: 25 kts
- In supersonic flight, do not perform dives at angles greater than 30°

FLIGHT LIMITATIONS

- Clean aircraft permissible load factor:
  - Subsonic Flight (Mach less than 0.95): - 3 G / + 7.2 G
  - Supersonic Flight (Mach greater than 1.0): -3 G / + 6 G
- Do-Not-Exceed Airspeed (V_{NE}):
  - From 0 to 20000 ft: 700 kts
  - Above 20000 ft: 750 kts
- Mach Number Limit: 2.1
- Brake chute should not be deployed at airspeeds greater than 210 kts
- Landing Light should not be extended at airspeeds greater than 240 kts
- Aircraft service ceiling: limited to 50,000 ft

Airspeed Limitations

COMBAT HIGH-LIFT DEVICES	IAS / MACH	LOAD FACTOR AND INCIDENCE
Auto slats only	470 kts / 1.1	-3 G +7.2 G or i < 17°
Combat slats and flaps	335 kts / 0.85	-3 G +7.2 G or i < 17°

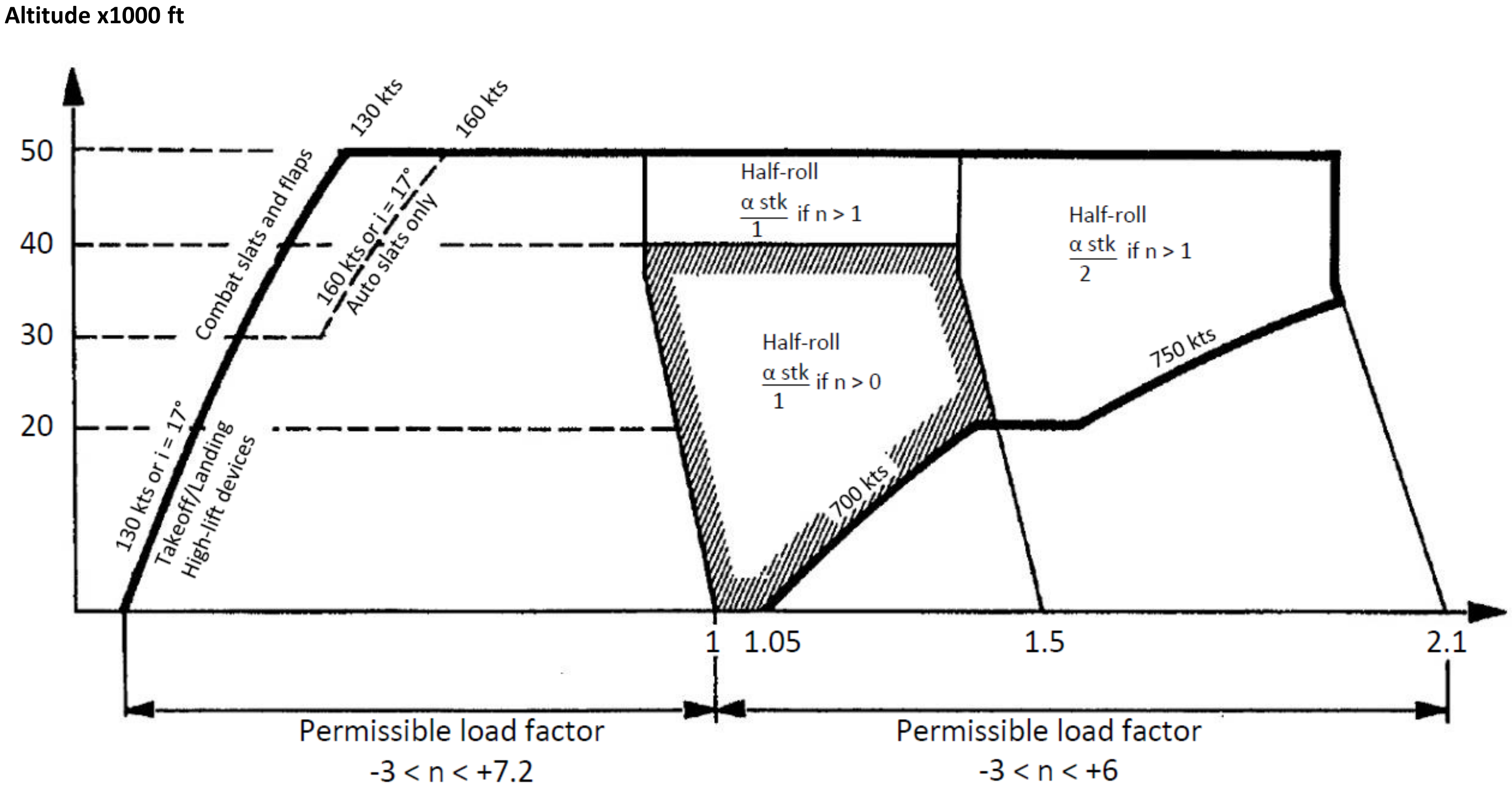
TAKEOFF/LANDING HIGH-LIFT DEVICES	IAS	LOAD FACTOR AND INCIDENCE
Half flaps	300 kts	i < 17°
Full flaps	225 kts	0 G +2.5 G or i < 17°

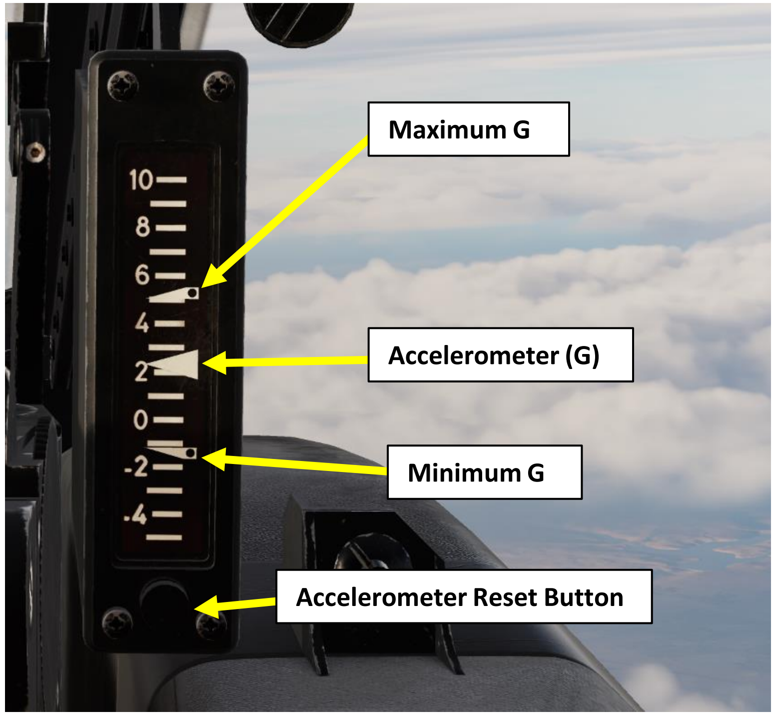
Landing Gear Limitations

Maximum takeoff weight	15200 kg (33510 lbs)	
Normal landing weight	9000 kg (19842 lbs)	Max R/D 550 ft/min
Exceptional landing weight	11000 kg (24251 lbs)	Max R/D 395 ft/min
Emergency landing	>11000 kg	Lowest possible R/D (< 300 ft/min)

FLIGHT LIMITATIONS

Clean Aircraft Configuration Permissible Load Factor (G)





FLIGHT LIMITATIONS

- **LIM** (Limit) warning light illuminates and warning horn is audible when airspeed is below 240 kts.
- **TRAIN** (*Train d'Atterrissage*, Landing Gear) warning light when airspeed is below 215 kts and throttle lever is set to an engine power setting less than 8100 RPM.

Limit Exceedance Conditions for "LIM" Light & Warning Horn

Full flap deflection	IAS > 225 Kt	Microswitch on left flap
½ flap deflection through slat/flap lever	IAS > 300 Kt	Microswitch on left flap
½ flap deflection in combat	IAS > 335 Kt or M > 0.85	Microswitch on right flap
Slats extended	IAS > 470 Kt or M > 1.1	Microswitch on left inboard and outboard slats
U/C down	IAS > 240 Kt	Nose U/C not uplocked or nose U/C door not locked in closed position
Total temperature 135°C	M = 2.1 in standard atmosphere above 36,000 ft	Total temperature probe
Note: The values indicated apply for increasing IAS. For decreasing IAS the values read will be lower by approximately 20 kt.		

TRAIN (Landing Gear) *(Train d'Atterrissage)* **Warning Light**
- *Illuminates when landing gear is retracted, indicated airspeed is below 215 kts and throttle lever is set to an engine RPM less than 8100.*
- *This basically reminds the pilot to deploy the landing gear when flying at low airspeed (i.e. when approaching the runway)*

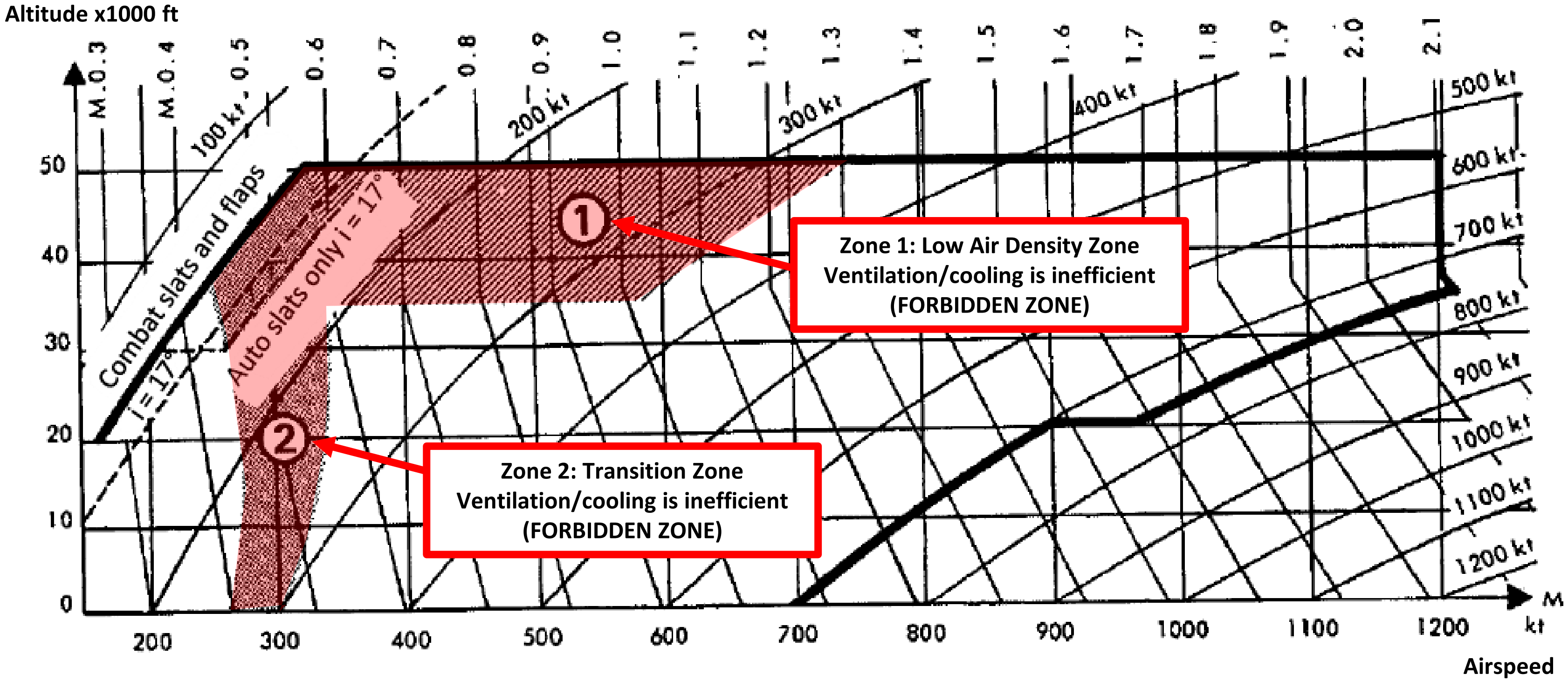
LIM (Limit) Warning Light
- *Illuminates when landing gear is deployed and indicated airspeed is above 240 kts. There is a high risk of jamming the landing gear due to overspeeding.*

FLIGHT LIMITATIONS

In the Mirage F1, you should **maintain an airspeed above 300-350 kts at all times during climb, cruise and combat phases of flight**. Why? Because the **alternators are ventilated by bleed air from the air intake duct**. The faster the aircraft flies, the more airflow enters the intake duct to cool down the alternators. A slower aircraft means less airflow available to ventilate the alternators. The higher the electrical load, the higher the heat that alternators have to dissipate.

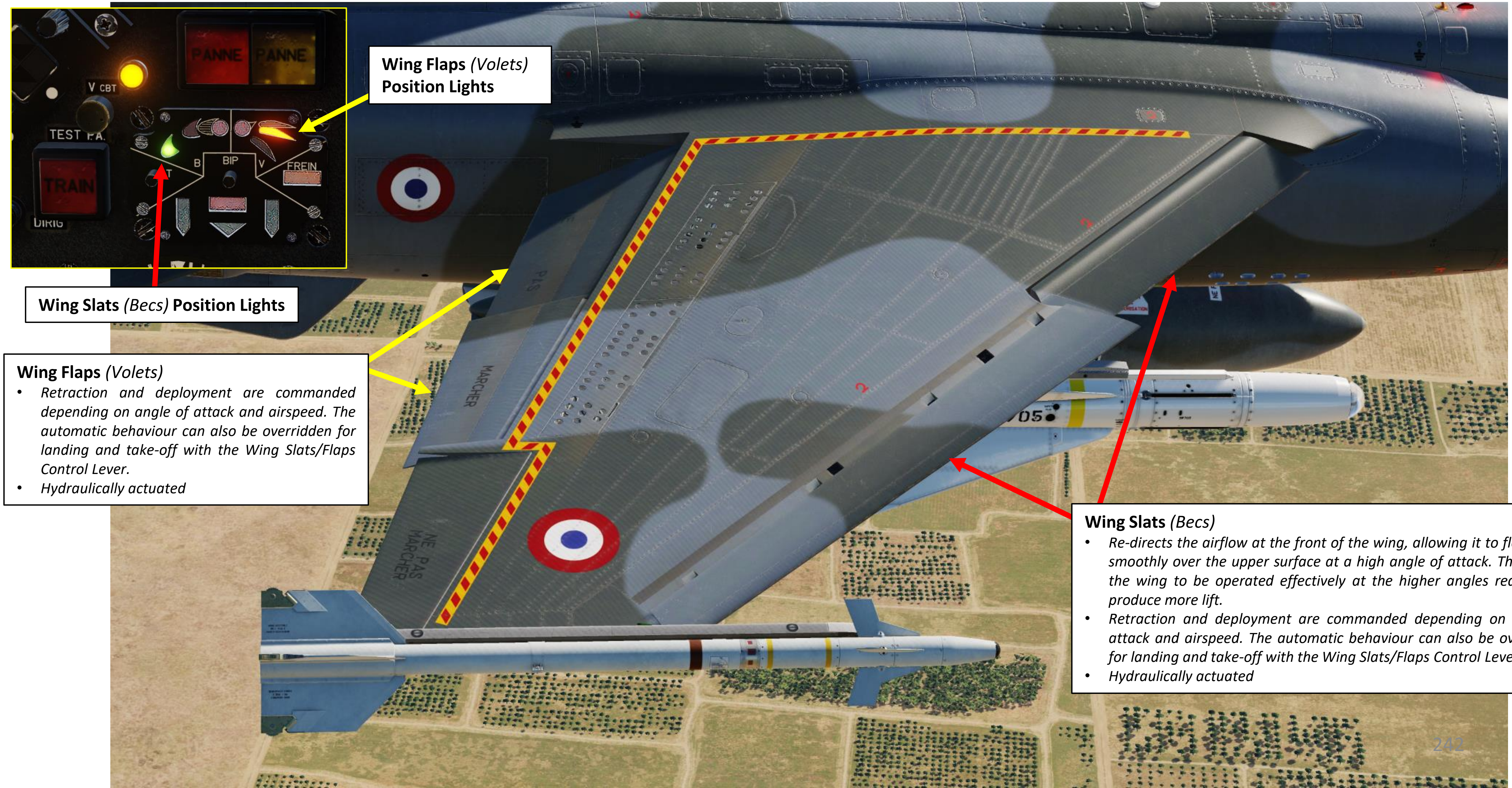
In other words, fly aircraft outside of the forbidden zone (see Alternator Operation Envelope graph).

Alternator Operation Envelope



HIGH LIFT DEVICES *(VOLETS HYPERSUSTENTATEURS)*: FLAPS *(VOLETS)* & SLATS *(BECS)*

High lift devices are comprised of flaps and slats, which, in turn, are subdivided into inboard (drooped) slats, and outboard (slotted) slats.



Wing Flaps *(Volets)* **Position Lights**

Wing Slats *(Becs)* **Position Lights**

Wing Flaps *(Volets)*

- *Retraction and deployment are commanded depending on angle of attack and airspeed. The automatic behaviour can also be overridden for landing and take-off with the Wing Slats/Flaps Control Lever.*
- *Hydraulically actuated*

Wing Slats *(Becs)*

- *Re-directs the airflow at the front of the wing, allowing it to flow more smoothly over the upper surface at a high angle of attack. This allows the wing to be operated effectively at the higher angles required to produce more lift.*
- *Retraction and deployment are commanded depending on angle of attack and airspeed. The automatic behaviour can also be overridden for landing and take-off with the Wing Slats/Flaps Control Lever.*
- *Hydraulically actuated*

HIGH LIFT DEVICES SCHEDULING

Slats Scheduling

- When **High-Lift Devices Mode Selector Switch** is set to **NORMAL** and **Wing Slats/Flaps Control Lever is set to RETRACT (FWD position)**, retraction and deployment of slats are automatically commanded depending on angle of attack and airspeed (see Configuration Table on the next page).
- The automatic scheduling of slats can be overridden for landing and take-off with the **Wing Slats/Flaps Control Lever** set to **HALF** (MIDDLE position) or **FULL** (AFT position).

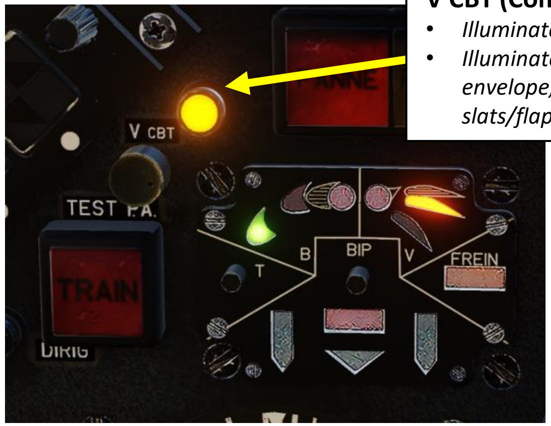
Flaps Scheduling

- When **High-Lift Devices Mode Selector Switch** is set to **NORMAL, Wing Slats/Flaps Control Lever is set to RETRACT (FWD position)**, and **Combat Mode** is **disarmed**, flaps are retracted.
    - Note: “Combat Mode” is disarmed by pressing the Combat Flaps Lever (“LCTRL+V” control binding).
- When **High-Lift Devices Mode Selector Switch** is set to **NORMAL, Wing Slats/Flaps Control Lever is set to RETRACT (FWD position)**, and **Combat Mode** is **armed**, retraction and deployment of flaps are automatically commanded depending on angle of attack and airspeed (see Configuration Table on the next page).
    - Note: “Combat Mode” is armed by pressing the Combat Flaps Button (“V” control binding).
- The automatic scheduling of flaps can be overridden for landing and take-off with the **Wing Slats/Flaps Control Lever** set to **HALF** (MIDDLE position) or **FULL** (AFT position).

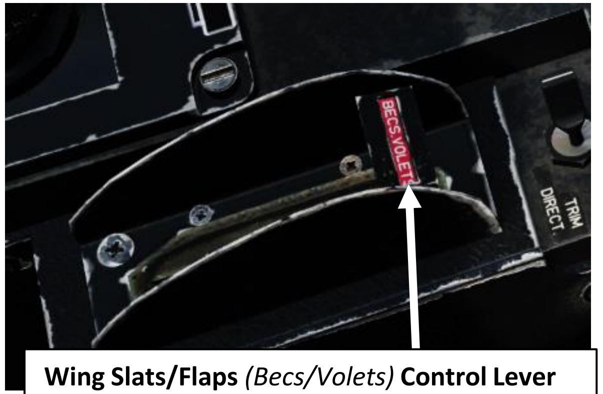
Important: “Combat flaps” refer to the normal flaps being deployed while in “combat mode”.

Combat Flaps Lever
- *When pressed, disarms combat flaps and retracts them if deployed.*
- *Binding: LCTRL+V*

Combat Flaps Button
- *When pressed, arms combat flaps, which will deploy automatically during momentary manoeuvers depending on airspeed and angle of attack.*
- *Binding: V*



V CBT (Combat Flaps) Light
- *Illuminated (steady): Combat flaps are extended within envelope*
- *Illuminated (flashing): Combat flaps are extended outside the envelope, or combat flaps are armed and flaps are extended with the slats/flaps lever*



Wing Slats/Flaps *(Becs/Volets)* **Control Lever**
- *FWD: Retracted*
- *MIDDLE: Half-Deployed*
- *AFT: Fully Deployed*

High-Lift Devices *(Volets Hypersustentateurs)* **Mode Selector Switch**
- *FWD: Normal, wing slats (becs), flaps (volets) and combat flaps are controlled normally*
- *MIDDLE: Arrêt (OFF)*
- *AFT: Rentrés Secours (Retracted Emergency)*

HIGH LIFT DEVICES SCHEDULING

Slats & Flaps Scheduling/Configuration Table					
Selected Configuration		**Slats**		**Flaps**	
		Inner	**Outer**	**Inner**	**Outer**
Automatic Mode • Wing Slats/Flaps *(Becs/Volets)* Control Lever – FWD • High-Lift Devices *(Volets Hypersustentateurs)* Mode Selector Switch – FWD (NORMAL) • Combat Flaps Lever – Pressed (Combat Mode Disarmed)	Automatic slats scheduling if: • Angle of Attack (Incidence) greater than 8 deg • Airspeed below 440 kts • Mach below 0.98 Flaps are retracted automatically	Full out	Half out	Retracted	Retracted
Combat Mode • Wing Slats/Flaps *(Becs/Volets)* Control Lever – FWD • High-Lift Devices *(Volets Hypersustentateurs)* Mode Selector Switch – FWD (NORMAL) • Combat Flaps Button – Pressed (Combat Mode Armed)	Flaps and slats scheduling in Combat Mode if: • Airspeed below 300 kts • Mach below 0.75 Position of flaps/slats is a function of Angle of Attack and Mach.	Full out	Full out	Half out	Half out
Takeoff/Landing Mode • Wing Slats/Flaps *(Becs/Volets)* Control Lever – AFT (Full Flaps) or MIDDLE (Half flaps) position • High-Lift Devices *(Volets Hypersustentateurs)* Mode Selector Switch – FWD (NORMAL)	Wing Slats/Flaps Lever – MIDDLE (Half Flaps) position	Full out	Full out	Half out	Half out
	Wing Slats/Flaps Lever – AFT (Full Flaps) position	Full out	Full out	Full out	Full out

PART 10 – ENGINE & FUEL MANAGEMENT

SECTION STRUCTURE

1 – POWERPLANT
1.1 – SNECMA Atar 9K-50 Engine

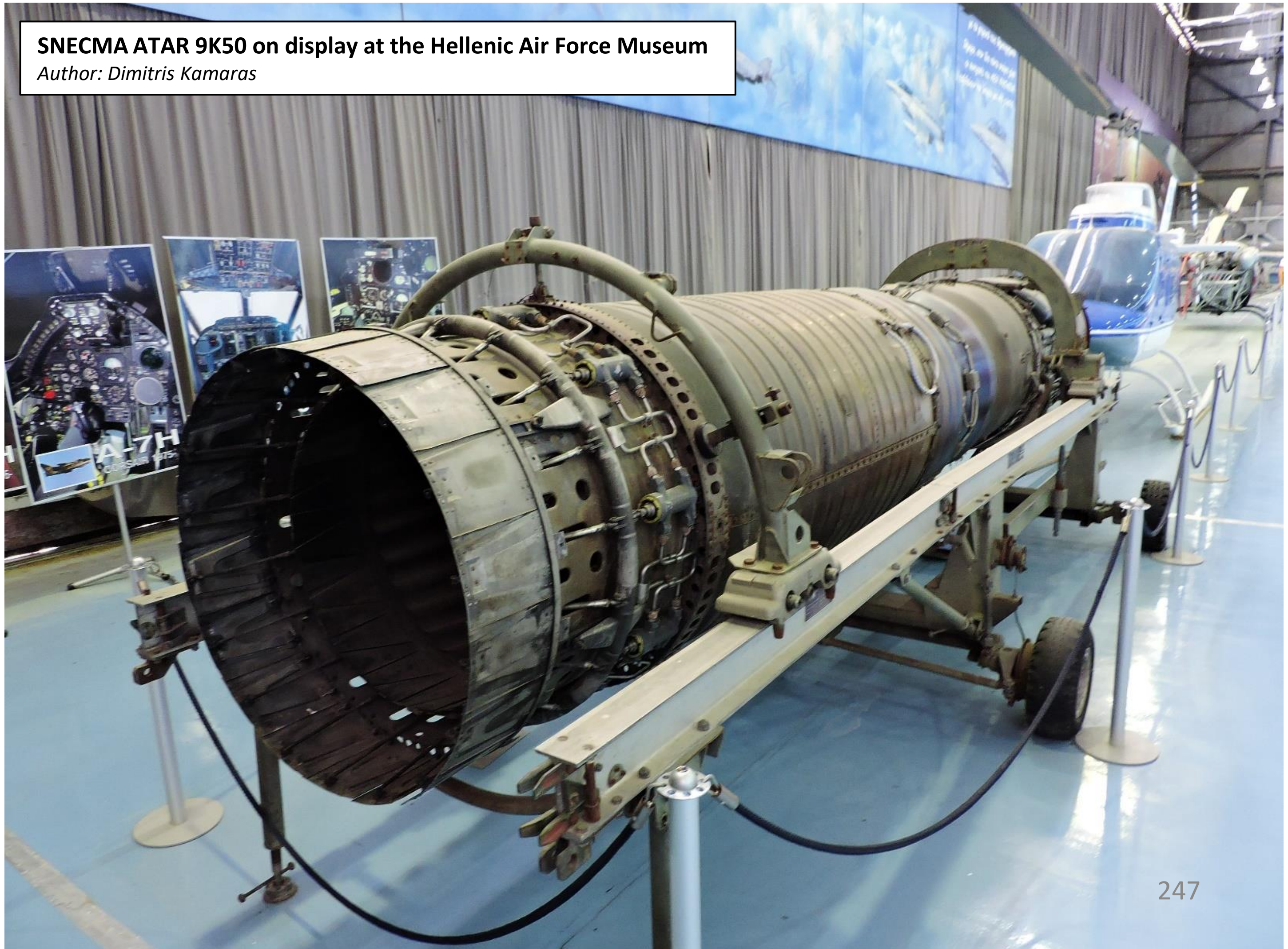
The Snecma Atar 9K-50 is a French axial-flow turbojet engine built by SNECMA (*Société Nationale d'Études et de Construction de Moteurs d'Aviation*, or "National Company for the Research and Construction of Aviation Engines"). It was derived from the German World War II BMW 018 design, and developed by ex-BMW engineers through a progression of more powerful models. The name is derived from its original design group, the "*Atelier Technique Aéronautique de Rickenbach"* (ATAR) near Lindau within the French Occupation Zone of Germany.

The engine has 9 stages in the compressor and 2 stages in the turbine. It also counts with a convergent-divergent adjustable nozzle. Supplementary valves open at the sides of the aircraft to increase airflow at low airspeeds and high thrust settings. Supersonic shock-cones also move to adjust the airflow at supersonic speeds and prevent the ingestion of shock waves.

At sea level, it is capable of delivering 10725 lbs of thrust in military power settings and up to 15355 lbs of thrust in afterburner mode. It can operate at speeds in excess of Mach 2.1.

Lubrication is provided by an oil deposit of 9 litres (an emergency oil deposit of 3.5 litres is also available). Consumption of oil limits the autonomy of the aircraft to 6 hours. In case of failure of the throttle or main oil system, an emergency regulation mode exists, in which the emergency oil deposit is used and engine power is adjusted by pulses.

The start-up of the engine occurs sequentially, with an electric motor (Microturbo "NOEL 015" turbo-starter) starting a gas generator, which, in turn, starts the engine.

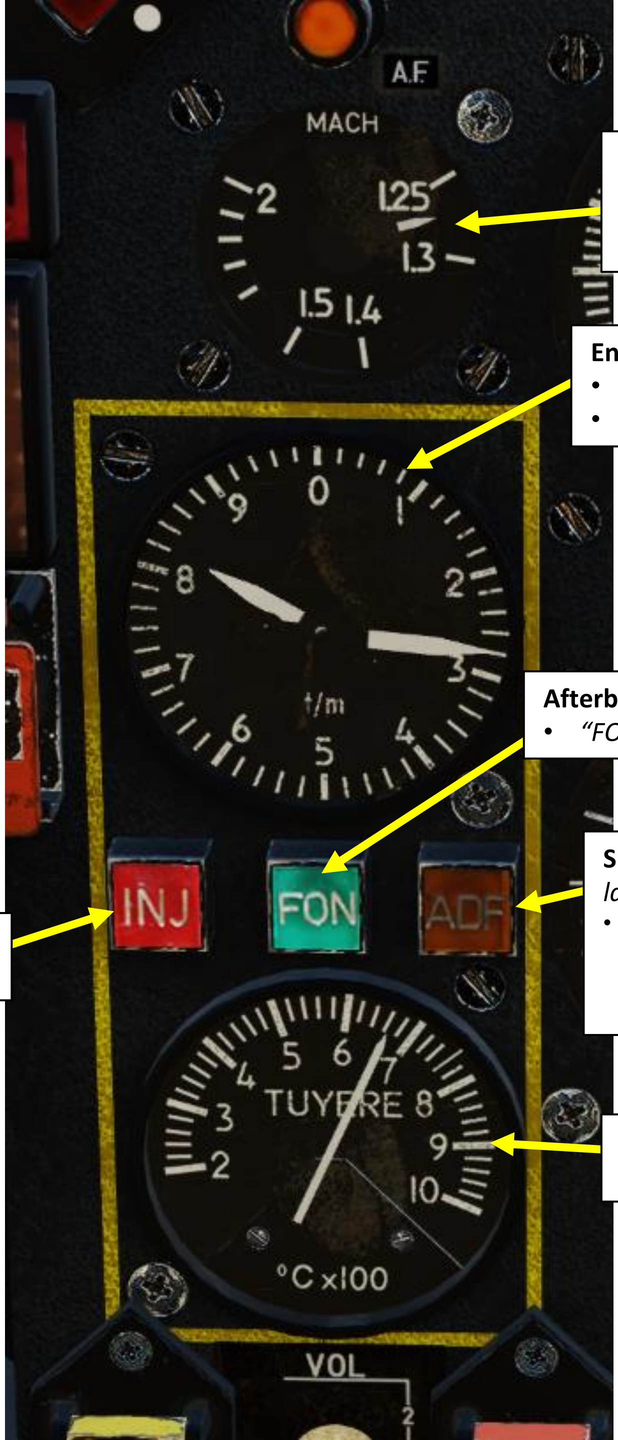


SNECMA ATAR 9K50 on display at the Hellenic Air Force Museum
Author: Dimitris Kamaras

1 – POWERPLANT
1.2 – Engine Indications

Here is an overview of the three primary engine parameters you can monitor:

- Engine RPM (x1000 RPM)
- JPT (Jet Pipe Temperature) in deg C
- Engine Shock Cone Position Indicator



Engine Shock Cone *(Souris)* **Position Indicator**
- *Needle indicates the position of the shock cone*
- *The Mach scale indicates the shock cone position recommended for a reference airspeed*

Engine RPM *(Compte-Tours)* **Indicator**
- **Short Needle: x1000 RPM**
- **Long Needle: x100 RPM**

Afterburner *(PC, Post-Combustion)* **ON Light**
- *"FON" stands for "Fonctionnement Fusée"*

SRL (Slam Relight Lighting) *(ADF, Allumage dans la Foulée)* **Warning Light**
- *The ADF/SRL system permits the throttle to be directly moved from any position of the "dry thrust" throttle quadrant to any position of the "afterburner" throttle quadrant.*

Afterburner *(PC, Post-Combustion)* **INJ (Injection) Light**

Jet Pipe Temperature (JPT), also referred as "T4" *(Température Tuyère)* **(x100 deg C)**

1 – POWERPLANT
1.3 – Engine Controls & Regulation Systems

Main Engine Controls

The engine is controlled primarily with the throttle.

- IDLE Power Setting: 2900 RPM
- MIL (Military) Thrust Power Setting: 8400 RPM
- Minimum PC/AB (*Post-Combustion*/Afterburner): 8400 RPM
- Maximum PC/AB (*Post-Combustion*/Afterburner) Afterburner: 8400 RPM
- Overspeed Mode: 8900 RPM

Emergency Regulation *(Régulation Secours)* **Switch**
- *FWD: ON, selects the emergency fuel regulation mode. In this mode (sometimes referred as "electric throttle"), the control the engine fuel flow is controlled manually with the Emergency Regulation Control Lever. This mode also provides 20 minutes of oil supply from a dedicated oil tank to the No. 1 engine bearing.*
- *AFT (Guarded): Emergency Regulation Mode OFF*

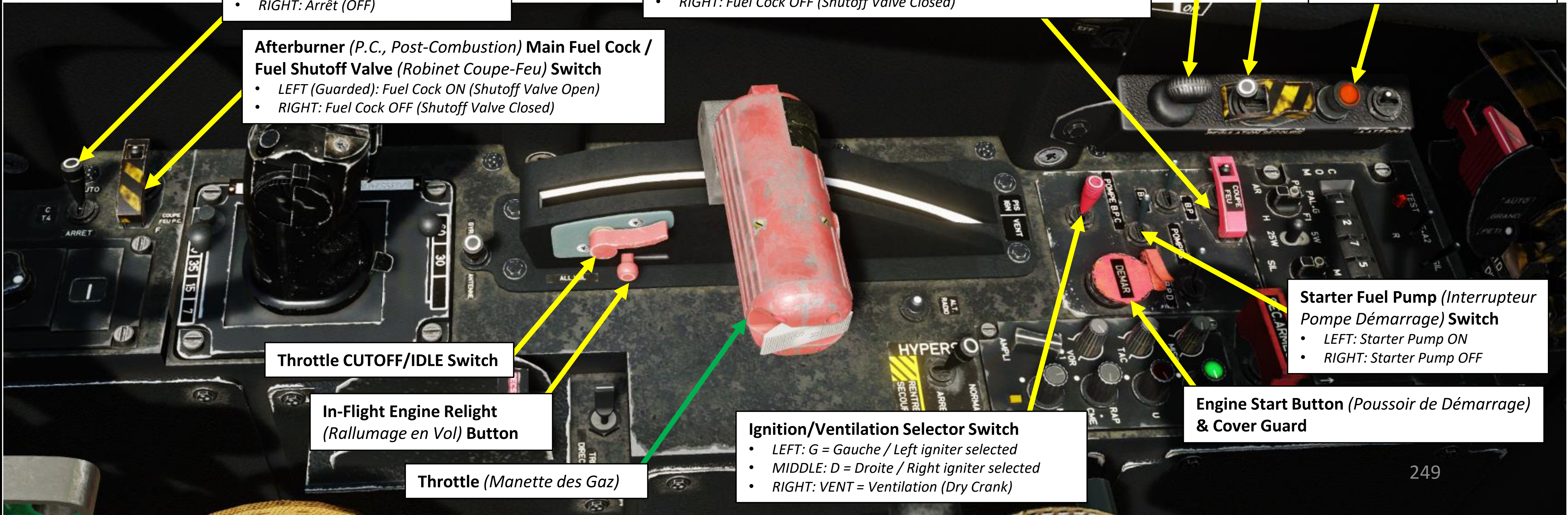
Emergency Regulation Control Lever ("Electric Throttle")
- *FWD: Increases fuel flow*
- *AFT: Decreases fuel flow*

JPT/T4 (Jet Pipe Temperature) Emergency Regulation Switch
- *LEFT: AUTO*
- *RIGHT: Arrêt (OFF)*

Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*

Emergency Regulation Light

Afterburner *(P.C., Post-Combustion)* **Main Fuel Cock / Fuel Shutoff Valve** *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*



Starter Fuel Pump *(Interrupteur Pompe Démarrage)* **Switch**
- *LEFT: Starter Pump ON*
- *RIGHT: Starter Pump OFF*

Throttle CUTOFF/IDLE Switch

In-Flight Engine Relight *(Rallumage en Vol)* **Button**

Engine Start Button *(Poussoir de Démarrage)* **& Cover Guard**

Ignition/Ventilation Selector Switch
- *LEFT: G = Gauche / Left igniter selected*
- *MIDDLE: D = Droite / Right igniter selected*
- *RIGHT: VENT = Ventilation (Dry Crank)*

Throttle *(Manette des Gaz)*

1 – POWERPLANT
1.3 – Engine Controls & Regulation Systems

Fuel Dipper

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.

Engine Shock Cone (*Souris*) Controls

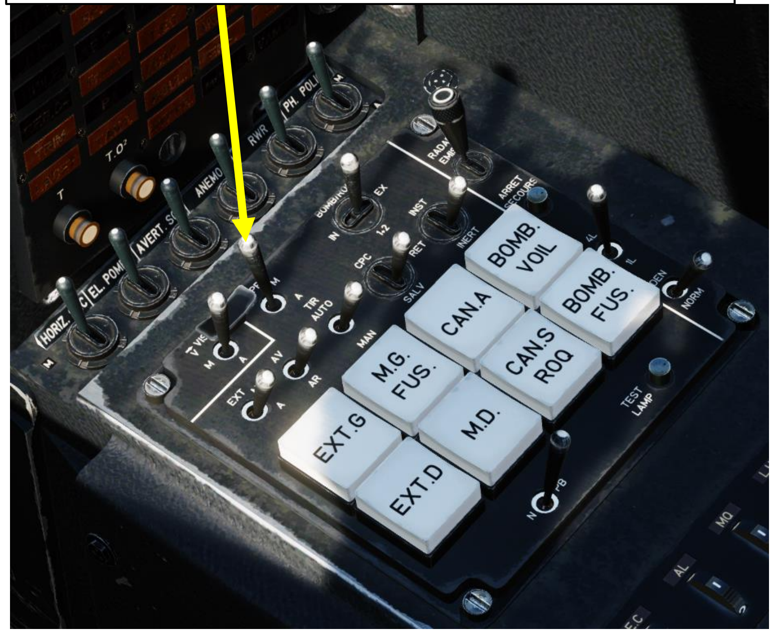
Shock cones are also called mice (“*souris*” in French). Their position is indicated as a function of Mach number. They normally operate in automatic mode, though can be controlled manually through the corresponding push-button and switch.

Engine Shock Cone *(Souris)* Manual Control Switch
- *UP: Sortis / Deployed*
- *DOWN: Rentrés / Retracted*

Engine Shock Cone *(Souris)* Pushbutton
- *Pushed IN: Automatic Control*
- *Pulled OUT: Manual Control Enabled (use the Shock Cone Manual Control Switch)*

Firing Fuel Dipper Switch

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*



1 – POWERPLANT
1.3 – Engine Controls & Regulation Systems

Main Regulation Systems

The primary function of the main regulation system is to provide for fuel supply to the combustion chamber. The main fuel control unit (FCU) is mechanically controlled by the speed selector, which receives commands through the throttle lever and governs the RPM regulation system. The main regulation system is composed of the following interdependent components:

- **Fuel Regulation System**
  - The fuel regulation system consists of a fuel metering valve (FMV) and a stop valve, controlled by throttle position through the speed selector. This allows metered fuel to flow through the pressurization and dump valve or to be bypassed to the return circuit. FMV movement is controlled by the RPM regulation system within limits determined by the stop regulation system.

- **RPM Regulation System**
  - The RPM regulation system controls the fuel metering valve to maintain a commanded engine RPM based on the selected power setting.
    - IDLE Power Setting: 2900 RPM (34.5 %)
    - MIL (Military) Thrust Power Setting: 8400 RPM (100 %)
    - Minimum and Maximum PC/AB (*Post-Combustion*/Afterburner): 8400 RPM (100 %)
    - Overspeed Mode: 8900 RPM (106 %), controlled by a Mach number signal.

- **Stop Regulation System**
  - Two stops acting on the fuel metering valve limit fuel flow in order to increase the surge margin due to throttle lever movements or certain flight conditions. The control of this dual stop is slaved to:
    - A RPM/P2 stop corrector (to regulate throttle lever movements)
    - A P2/P1 (pressure at engine sections 2 and 1) stop corrector (to regulate throttle lever movements)
    - A stop limiter solenoid valve, which operates according to barometric altitude, indicated airspeed, incidence angle and engine RPM under the conditions listed on the table to the right:

Normal Regulation System Characteristics

	Cockpit Instrument Readings		
Power Setting	**Engine RPM**	**JPT (Jet Pipe Temperature), deg C**	
		On Ground	**In Flight**
Idle (see note #1)	**2900**	**-**	**-**
MIL (Military) Thrust	**8400**	**Between 740 and 755**	**Below 760**
Minimum PC/AB (*Post-Combustion*/Afterburner)	**8400**	**Between 740 and 755**	**Below 760**
Maximum PC/AB (*Post-Combustion*/Afterburner)	**8400**	**Between 740 and 755**	**Below 760**
With Overspeed	**8900**	**-**	**Below 735**

Note #1: In certain cases like a cold engine start, although the throttle is set to IDLE, the engine RPM may be below nominal values or vary between 2600 and 3200 RPM with small JPT fluctuations. This phenomenon should disappear as soon as the engine is warmed up. In flight at idle power, JPT is below 200 deg C and cannot be read accurately by the pilot.

Stop Limiter Solenoid Valve Operation Conditions

Incidence (i)	Altitude (H)	Dry Thrust (no afterburner)	Afterburner
i > 14 deg Any indicated airspeed	H > 29000	Any RPM	RPM > 8100 or 96 %
	H < 29000	RPM < 8100 or 96 %	Without Afterburner
Any Incidence Angle Indicated airspeed > 242.5 kts	H > 29000	Any RPM	RPM > 8100 or 96 %

1 – POWERPLANT
1.3 – Engine Controls & Regulation Systems

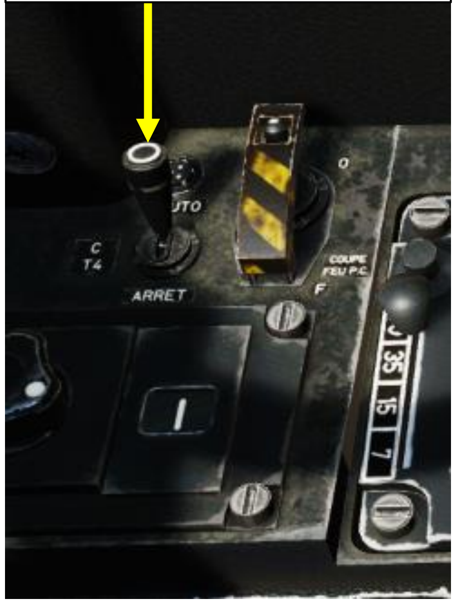
Main Regulation Systems

- **JPT (Jet Pipe Temperature) Regulation**
    - The purpose of JPT regulation is to control engine JPT in order to optimize engine fuel consumption and prevent JPT exceedance. The temperature regulator is governed by pressure sensors and controls the exhaust nozzle actuators. From full power, an electronic JPT regulation system associated with a JPT conformation box maintains the temperature constant regardless of flight conditions.
    - In practice, JPT regulation is automatic; the pilot is expected to set the JPT/T4 (Jet Pipe Temperature) Emergency Regulation switch to AUTO and let the JPT regulator system do its thing.
    - In certain failure cases of the JPT regulation system, the pilot can turn off the electronic JPT regulator by setting the JPT/T4 (Jet Pipe Temperature) Emergency Regulation switch *to ARRÊT (OFF)*. In the case where the regulator is OFF, a JPT decrease can be expected for a same engine RPM.
    - The exhaust nozzle flaps' hydraulic system has a solenoid valve actuated by the Emergency Regulation Control and the fuel dipper control. Energizing this solenoid valve controls the opening of the exhaust nozzle flaps.
    - A mechanical valve controlling bleed air flow is associated to the pressure regulator. This valve is also controlled by the throttle, and is adjusted to vent pressure at low engine RPM, causing the exhaust nozzle to open in case of a RPM decrease below 6800 RPM (or 81 %).

- **Overspeed System**
    - The overspeed system is controlled by a signal from the ADC (Air Data Computer) at Mach 1.4 or above. It acts on the RPM governing system through the speed selector. The engine RPM increases to 8900 (106 %), which improves engine performance by increasing the air flow. Simultaneously, the JPT regulation system commands a JPT decrease in order to maintain an identical turbine inlet temperature to the expected JPT during normal operation at full (military) power.
    - Changes to throttle input in "overspeed" mode will result in an engine stall or flameout; airspeed has to be reduced by using airbrakes, manoeuvering or ascending in that situation.

- **Bleed-Off Valve System**
    - Bleed air valves divert part of the air compressed by the first four stages of the compressor. This bleed air prevents partial compressor stalls and engine flameouts, which can cause decreases in engine RPM or even a complete engine shutdown. The valves are controlled by springs, which hold them open up to approx. 4000 RPM (47.5 %), and by an electronic box which opens or closes them according to the following logic:
        - RPM < 6700 (80%): Bleed Valves OPEN
        - RPM > 7000 (83.5%): Bleed Valves CLOSED
    - To avoid directing very hot air into the engine compartment, the electronic box prevents the opening of the bleed valves at engine speeds greater than 8100 RPM (96%).

JPT/T4 (Jet Pipe Temperature) Emergency Regulation Switch
- *LEFT: AUTO*
- *RIGHT: Arrêt (OFF)*

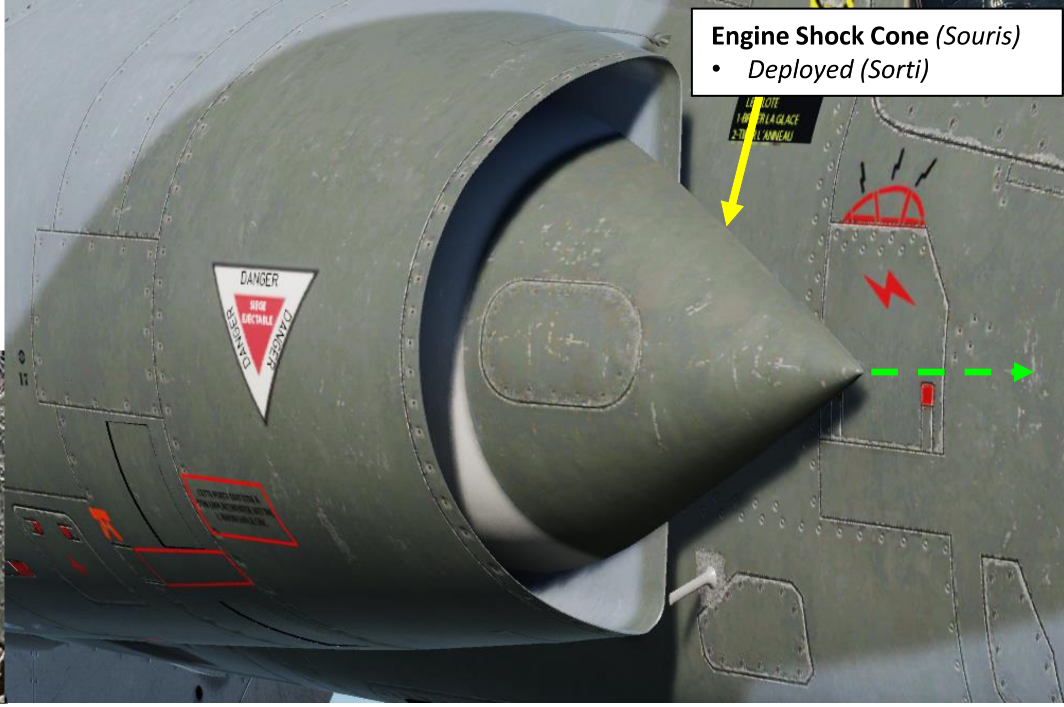


1 – POWERPLANT
1.4 – Engine Shock Cones *(Souris)*

Engine shock cones slow the flow of air from supersonic flight speed to a subsonic speed before it enters the engine to prevent ingestion of shock waves. Shock cones, also nicknamed “mice” (“*souris*” in French), can be controlled either automatically or manually; their position is indicated as a function of Mach number. If set to an incorrect position, this can disrupt the airflow to the engine and cause an engine failure or compressor stall.

Normally, shock cones operate in automatic mode if the Engine Shock Cone Pushbutton is pushed IN.

If automatic mode has failed, shock cones can be controlled manually by:
1. Pulling the Engine Shock Cone Pushbutton OUT
2. Holding the Engine Shock Cone Manual Control Switch UP or DOWN in order to deploy or retract them, then release the switch once the shock cone position indicator’s needle matches the current Mach number the aircraft is flying at.

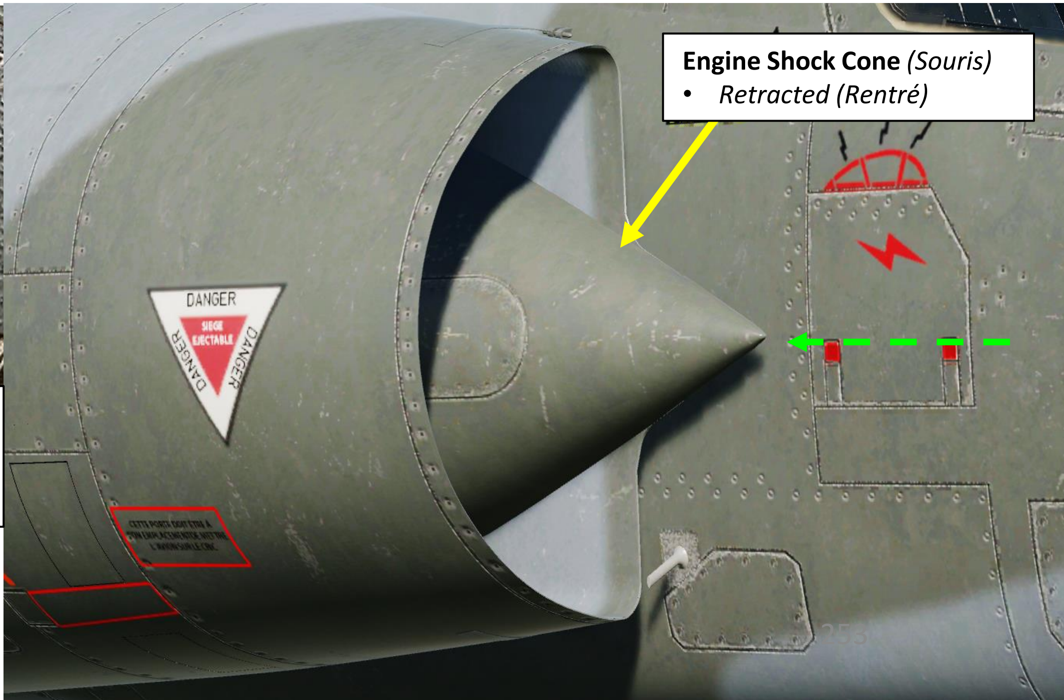


Engine Shock Cone *(Souris)*
- *Deployed (Sorti)*

Engine Shock Cone *(Souris)* **Manual Control Switch**
- *UP: Sortis / Deployed*
- *DOWN: Rentrés / Retracted*

Engine Shock Cone *(Souris)* **Pushbutton**
- *Pushed IN: Automatic Control*
- *Pulled OUT: Manual Control Enabled (use the Shock Cone Manual Control Switch)*

Engine Shock Cone *(Souris)* **Position Indicator**
- *Needle indicates the position of the shock cone*
- *The Mach scale indicates the shock cone position recommended for a reference airspeed*



Engine Shock Cone *(Souris)*
- *Retracted (Rentré)*

1 – POWERPLANT
1.5 – Engine Auxiliary Intakes / Blow-In Doors

Engine Auxiliary Intakes / Blow-In Doors open automatically under spring pressure at low airspeed to allow additional air into the engine intake, which is very useful during high angle-of-attack manoeuvers. The doors are automatically controlled by a signal from the air data computer (ADC) in order to provide additional air to the engine for added thrust during takeoff and low-speed flight (low dynamic pressure).

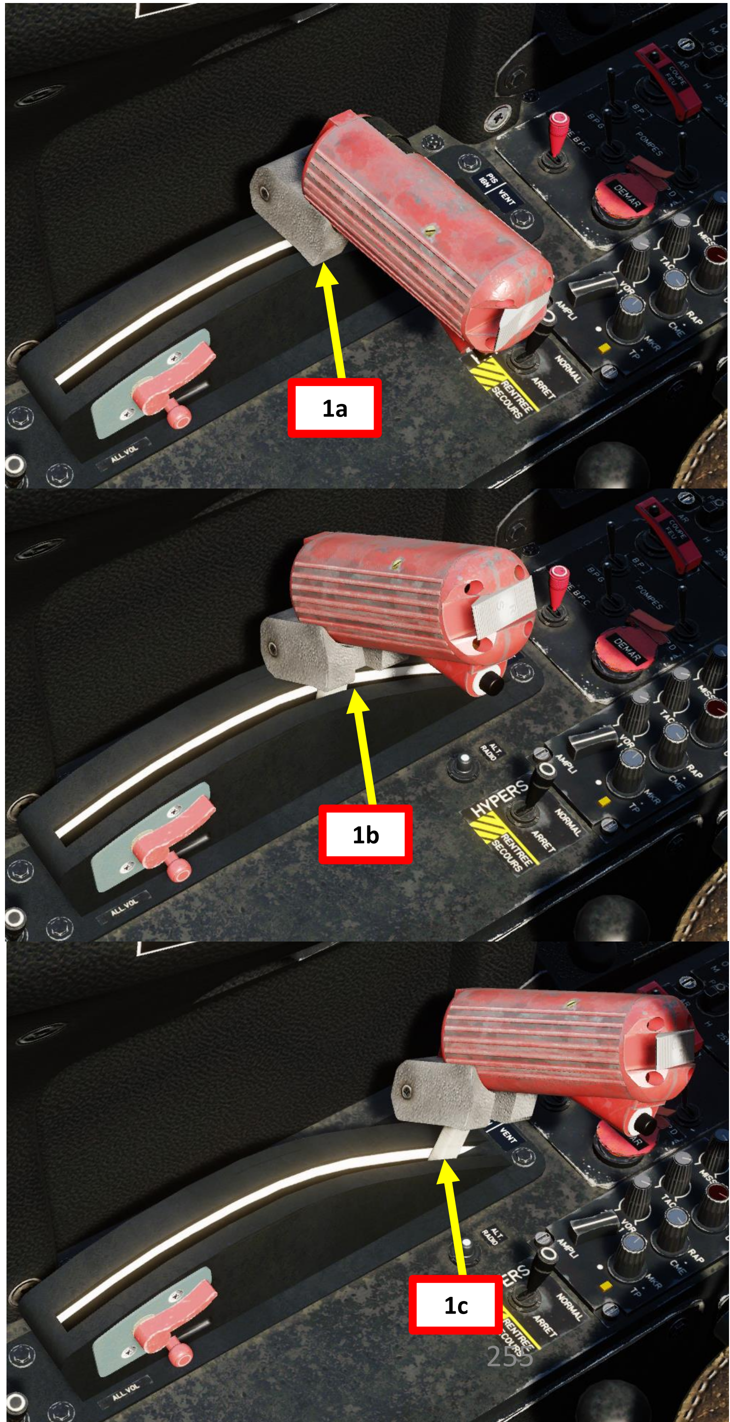
1 – POWERPLANT
1.6 – Afterburner *(Post-Combustion)*

The afterburner is designed to operate only when the engine is at its maximum power setting.

1. The afterburner is engaged by throttling past the afterburner detent.
2. When engaging the afterburner, the INJ (Injection) light illuminates momentarily, indicating that fuel is being injected and ignited through the afterburner nozzles.
3. When the ionization probe detects afterburner ignition, the INJ light extinguishes and the FON (*Fonctionnement Fusée*, Afterburner ON) light illuminates.
4. If the INJ light remains ON for more than 10 seconds, throttle back mid-travel and shut off the afterburner.

- Note 1: There is an afterburner overboost system that automatically kicks in above 27500 ft. Fuel mixture is enriched and temperature increases in the afterburner section based on an Air Data Computer (ADC) signal.
- Note 2: In case of afterburner malfunction or fire, you can use the Afterburner Main Fuel Cock Shutoff Valve Switch.

Afterburner *(P.C., Post-Combustion)* **Main Fuel Cock / Fuel Shutoff Valve** *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*



Afterburner *(PC, Post-Combustion)* **INJ (Injection) Light**

Afterburner *(PC, Post-Combustion)* **ON Light**
- *"FON" stands for "Fonctionnement Fusée"*

1 – POWERPLANT

1.6 – Afterburner *(Post-Combustion)*

1 – POWERPLANT
1.7 – SRL (Slam Relight Lighting) / *ADF (Allumage dans la Foulée)*

The SRL (Slam Relight Lighting) *(ADF, Allumage dans la Foulée)* system permits the throttle to be directly moved from any position of the "dry thrust" throttle quadrant to any position of the "afterburner" throttle quadrant. This may seem like a simple feature, but in order to understand why SRL is useful, we have to go back in time to the days of the Mirage III, the Mirage F1's ancestor.

The Mirage III's Atar 9C engine had an afterburner, but in order to engage it, the pilot had to first select military power, wait for the RPM to stabilize with a specific Jet Pipe Temperature above a certain threshold, and once these two parameters were met, only then could the afterburner be engaged. Failure to do so by slamming the throttle directly into afterburner without waiting for engine parameters to stabilize resulted in a nasty compressor stall, which is the last thing you want when you want as much power as possible.

With the Atar 9K-50, the SRL system allows the pilot to set the throttle in afterburner without having to wait for engine parameters to stabilize; the system monitors engine parameters and controls the afterburner light-up sequence automatically in the pilot's stead.

In summary, SRL operation goes as follows:
1. The pilot slams the throttle into Afterburner
2. When engine power setting is greater than 8100 RPM for more than 3 seconds, the afterburner regulation unit authorizes the afterburner light-up sequence.
3. Once the afterburner is lit up and the "FON" light illuminates, the SRL circuit is closed.

Take note that the **ADF/SRL Warning light** indicates to the pilot that the SRL system is inoperative and that he must then revert to manual afterburner light up, meaning that before slamming the throttle into the afterburner region, he has to ensure that **engine RPM is above 8100 RPM for at least 3 seconds** and that **Jet Pipe Temperature (JPT) is above 660 deg C**. Failing to do so may result in a compressor stall, as stated before.

SRL (Slam Relight Lighting) *(ADF, Allumage dans la Foulée)* **Warning Light**

1 – POWERPLANT
1.8 – Engine Limits

Engine parameters (mainly RPM and Jet Pipe Temperature) are controlled by the engine regulation systems to avoid parameter exceedance.

Important: Inverted flight should not exceed 15 seconds, otherwise the engine might flameout.

In order to **avoid compressor stalls or engine damage**, avoid flying outside the Engine Operation Envelope, as shown in this graph.

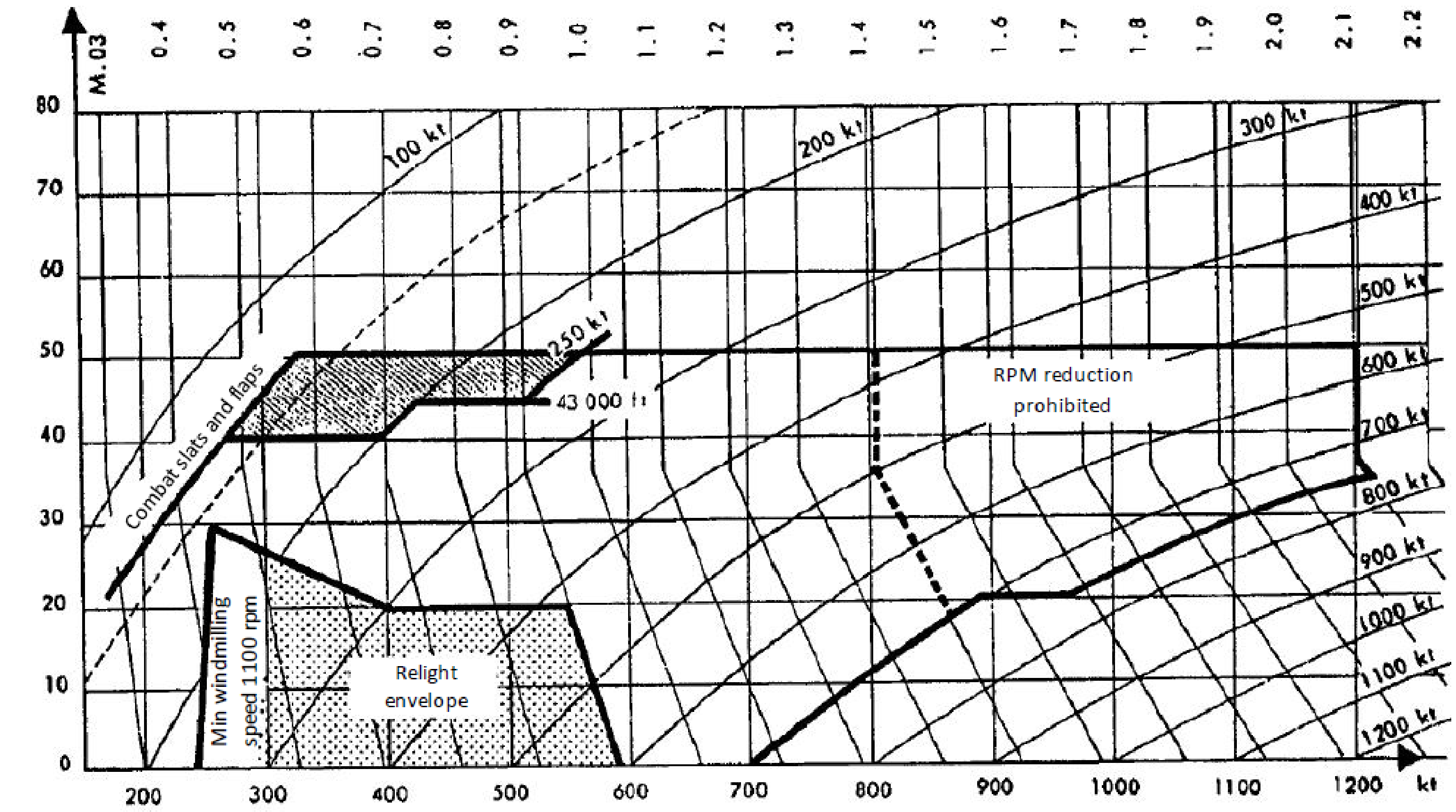
JPT (Jet Pipe Temperature) Limits:
- In Idle, Military and Afterburner power settings:
    - 740-755 deg C Maximum when on ground
    - 760 deg C Maximum when in flight
- With Overspeed mode:
    - 735 deg C Maximum when in flight

Engine RPM Limits:
- In Idle power setting:
    - 2900 RPM Maximum
    - Note: In certain cases like a cold engine start, although the throttle is set to IDLE, the engine RPM may be below nominal values or vary between 2600 and 3200 RPM with small JPT fluctuations. This phenomenon should disappear as soon as the engine is warmed up.
- In Military and Afterburner power settings:
    - 8400 RPM Maximum
- With Overspeed mode:
    - 8900 RPM Maximum
- Maximum Continuous Limit: 9000 RPM
- Maximum Instantaneous Peak (Transient) Limit: 9250 RPM

Engine Operation Envelope

Envelope valid in standard atmosphere ±10°

Altitude x1000 ft



1 – POWERPLANT
1.9 – Emergency Regulation Mode

The Emergency Regulation System (*Régulation Secours*) is used to compensate for oil pump failures and engine RPM fluctuation or RPM "freezing" malfunctions. In other words, once Emergency Regulation you can manually adjust engine RPM through the Fuel Control Unit (FCU) with an alternate control lever ("Electric Throttle"), but within a reduced envelope.

To use the Emergency Regulation System:
1. Make sure the overspeed system is not operating (in Overspeed, engine RPM increases to 8900).
2. Set Emergency Regulation Switch FWD (ON).
3. Confirm Emergency Regulation Light illuminates.
4. Increase or decrease fuel flow using the Emergency Regulation Control Lever ("Electric Throttle"), which will affect engine RPM accordingly.
5. The Control Lever should be used in small steps since there is no RPM regulation in Emergency Mode. A relay prevents the pilot from engaging the afterburner.
6. To revert into Normal Regulation Mode, set Emergency Regulation Switch AFT (OFF).

Note: use of the Emergency Regulation Mode is prohibited in case of compressor stall or during overspeed system operation.

Emergency Regulation *(Régulation Secours)* **Switch**
- *FWD: ON, selects the emergency fuel regulation mode. In this mode (sometimes referred as "electric throttle"), the control the engine fuel flow is controlled manually with the Emergency Regulation Control Lever. This mode also provides 20 minutes of oil supply from a dedicated oil tank to the No. 1 engine bearing.*
- *AFT (Guarded): Emergency Regulation Mode OFF*

2c

Emergency Regulation Light

Emergency Regulation Control Lever ("Electric Throttle")
- *FWD: Increases fuel flow*
- *AFT: Decreases fuel flow*

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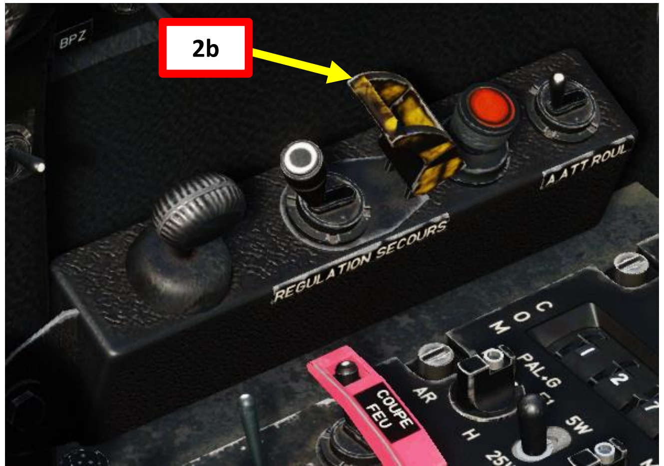


1 – POWERPLANT
1.10 – Compressor Surge/Stall

Compressor stalls may occur when you move the throttle too quickly. You will notice a sudden loss in engine RPM. The Atar 9K-50 turbojet engine is slow to respond to throttle input, so it should be treated gently. In case of compressor stall, pull back the throttle to IDLE and slowly throttle up. Major compressor failure may result in an engine flameout.

A **compressor stall** is a local disruption of the airflow in the compressor of a gas turbine or turbocharger. A stall that results in the complete disruption of the airflow through the compressor is referred to as a **compressor surge**. The severity of the phenomenon ranges from a momentary power drop barely registered by the engine instruments to a complete loss of compression in case of a surge, requiring adjustments in the fuel flow to recover normal operation.

Compressor stall was a common problem on early jet engines with simple aerodynamics and manual or mechanical fuel control units, but has been virtually eliminated by better design and the use of hydromechanical and electronic control systems such as Full Authority Digital Engine Control (FADEC). Modern compressors are carefully designed and controlled to avoid or limit stall within an engine's operating range.

The compressor stall sensitivity of an engine is increased by foreign object damage, high angles of attack at low airspeeds and high altitudes, abrupt yaw impulses at low airspeeds (below approximately 150 KIAS), temperature distortion, and ice formation on the engine inlet ducts or inlet guide vanes. Compressor stalls can also be caused by component malfunctions; engine rigged out of limits; throttle bursts to MIL or MAX power at high altitude and low airspeed; hot gas ingestion from other aircraft or during gun firing at high altitudes and negative g conditions; and maneuvering flight with landing gear down at altitudes above 30,000 feet.

Keep in mind that compressor stall still can be caused by combination of adverse conditions.

To **recover from a partial compressor stall** reduce engine power to idle and pitch down to increase air flow to the engine. The procedure is as follows:
1. Set Throttle at Idle
2. Pitch aircraft nose down to get an airspeed greater than 300 kts
3. When jet pipe temperature (T4) returns to approx. 200°C and buffet ceases, advance the throttle and check that the engine accelerates normally.
- Note: If T4 values increase above permissible values, shut down the engine.

1 – POWERPLANT
1.11 – Engine Flameout – Relight Procedure

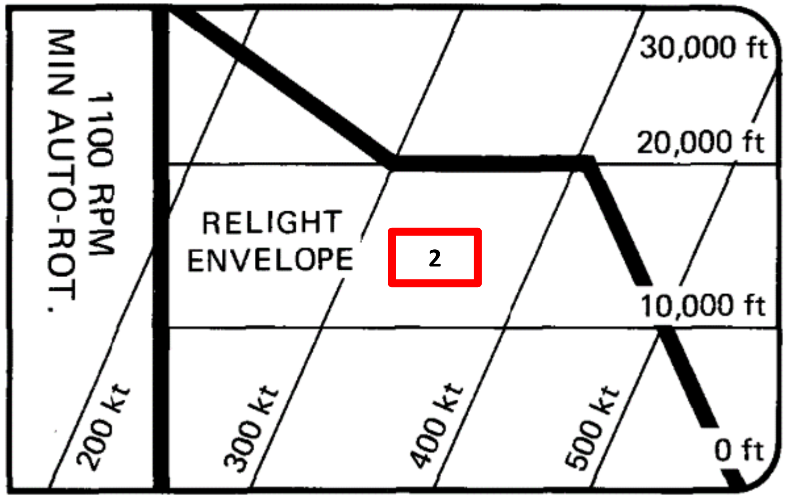
In case of an engine flameout, here is the procedure to relight the engine.

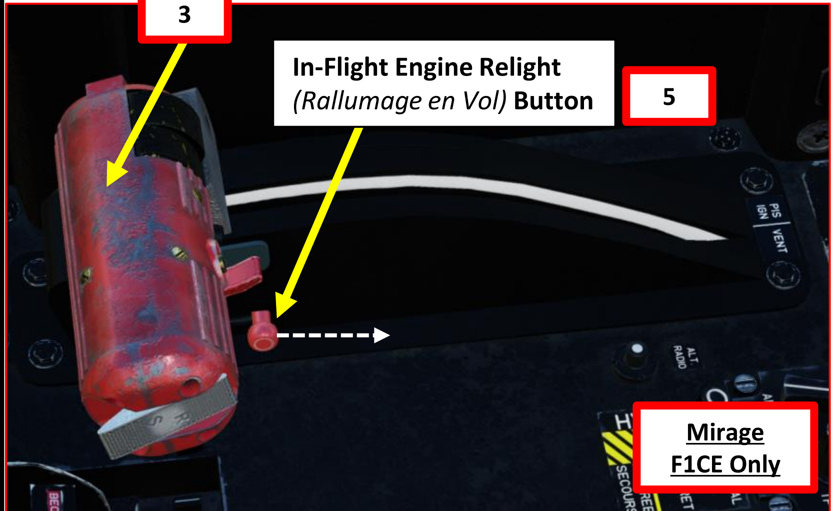
1. When the engine shuts down, a loss of alternator power means the Slaved Altitude *(Alticodeur/Altimètre)* Indicator needle will likely "freeze" in position and become unusable. Use the Standby Altimeter instead for altitude reference.
2. Perform a dive to increase airspeed and provide enough airflow to the engine to perform a windmilling start (compressor and turbine blades are driven by the flow of air going through the engine intake). Make sure the aircraft airspeed and altitude are within the "In-Flight Relight Envelope" (a general rule of thumb is to fly at an airspeed greater than 200 kts).
3. Move throttle back to IDLE position.
4. Set Air Conditioning Master Valve Control Switch – ARRÊT/OFF (AFT). This ensure maximum airflow is available for the turbine.
5. Relight the engine by setting the In-Flight Engine Relight Button/Switch ON (FWD).
    - Note: the button/switch is difficult to access; you can use the control binding "LALT+E".
6. An increase in engine RPM and Jet Pipe Temperature indicates a successful engine restart. The In-Flight Engine Relight Button/Switch will automatically reset to the OFF position after 30 seconds.

Slaved Altitude *(Alticodeur/Altimètre)* **Indicator (x1000 ft)**
- *The slaved altimeter repeats the altitude computed by the air data computer (ADC)*

Standby Altimeter
- *Long Thin Needle: x10000 ft*
- *Short Thick Needle: x1000 ft*
- *Long Thick Needle: x100 ft*

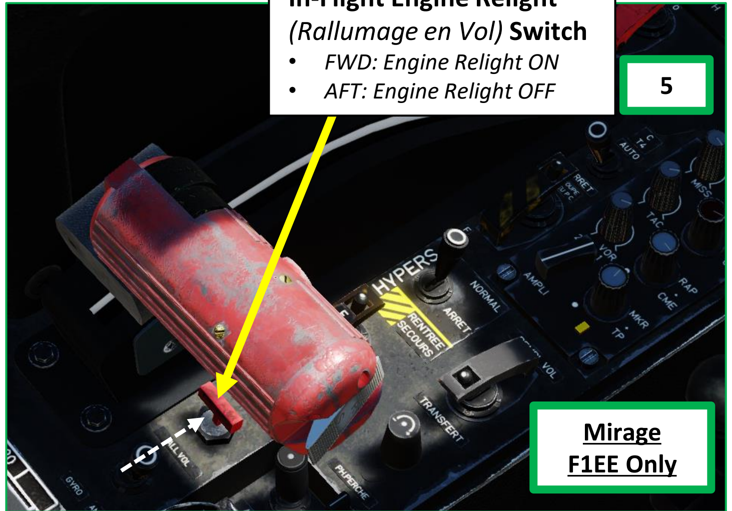
Engine In-Flight Relight Envelope





In-Flight Engine Relight *(Rallumage en Vol)* **Button**

Mirage F1CE Only



In-Flight Engine Relight *(Rallumage en Vol)* **Switch**
- *FWD: Engine Relight ON*
- *AFT: Engine Relight OFF*

Mirage F1EE Only

1 – POWERPLANT
1.11 – Engine Flameout – Relight Procedure

7. If engine restart is successful:
    - Set Air Conditioning Master Valve Control Switch – MARCHE/ON (FWD).
    - Gradually increase throttle to required power setting.
    - If the SEC~ warning light is illuminated, set the Inverter *(Convertisseur)* Selector Switch DOWN (RESET) momentarily, then release it. The switch will automatically be spring-loaded to the AUTO (MIDDLE) position.
8. If engine restart is not successful:
    - Allow 30 seconds for the In-Flight Engine Relight Button/Switch to return to the OFF position.
    - Return throttle to IDLE position.
    - Re-attempt engine relight by setting the In-Flight Engine Relight Button/Switch ON (FWD).
    - If subsequent engine relight attempts fail, eject as soon as possible.

Air Conditioning Master Valve Control Switch
- FWD: M (Marche) / ON
- AFT: A (Arrêt) / OFF

Restart not successful

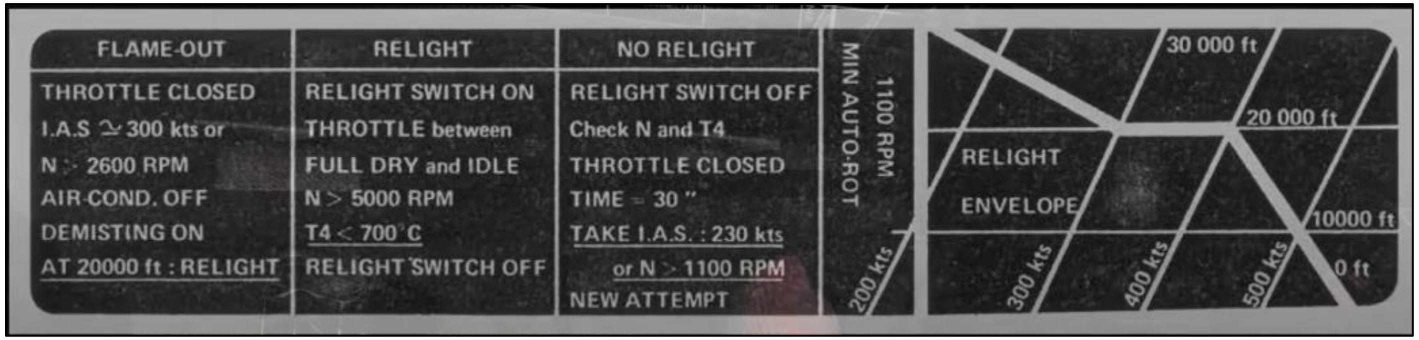
Restart successful

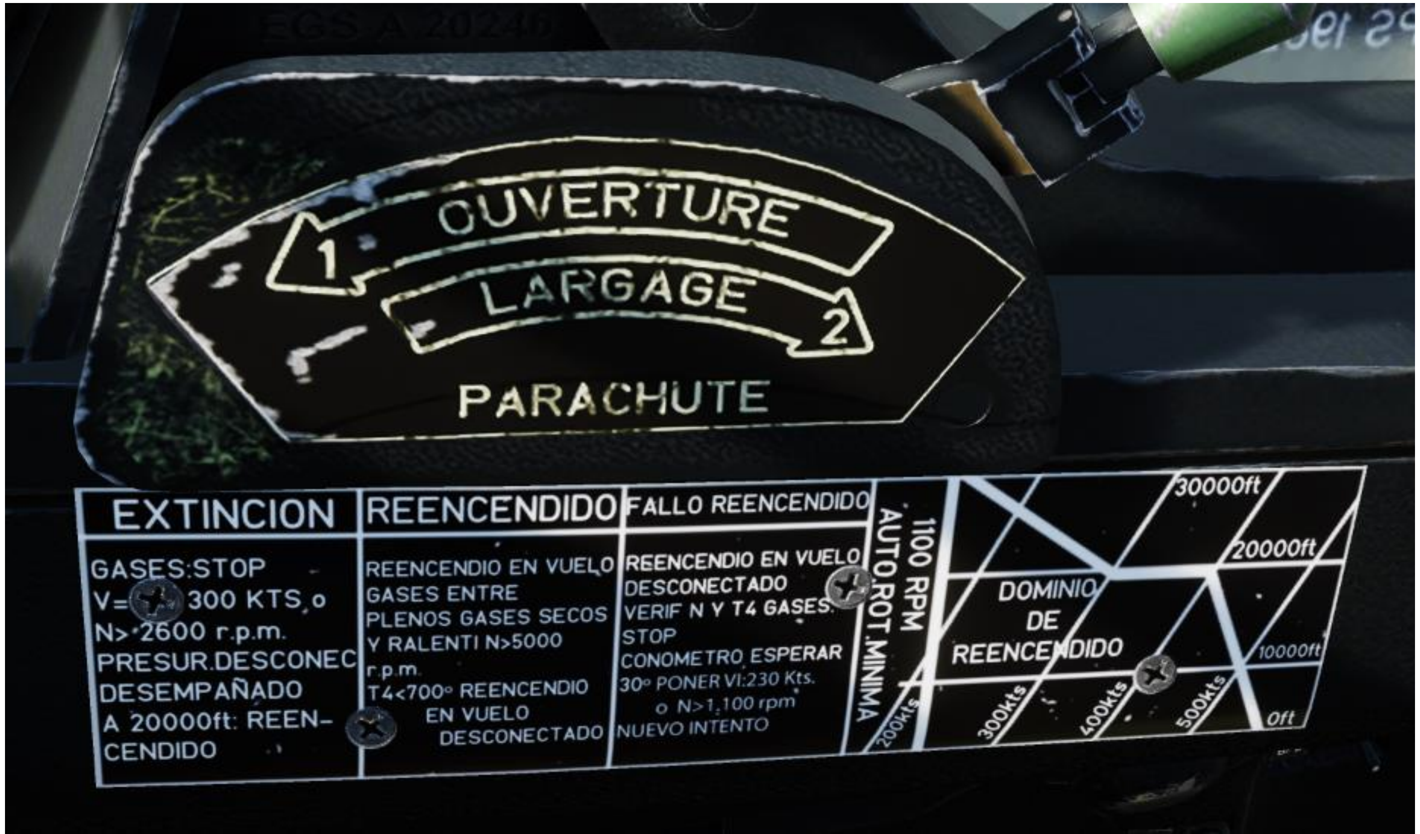
SEC~ warning light

Inverter *(Convertisseur)* Selector Switch

1 – POWERPLANT
1.11 – Engine Flameout – Relight Procedure

A placard is installed in the cockpit to remind you of the relight procedure.





1 – POWERPLANT
1.12 – Engine Fire
Case 1: REAC (Réacteur, Engine) Light

1. If an engine fire is detected, the REAC Fire Warning Light will illuminate.
2. Immediately cut throttle (set lever to CUTOFF/STOP position).
3. Close the engine fuel cock by setting the Main Fuel Cock / Fuel Shutoff Valve Switch RIGHT (Fuel Shutoff Valve Closed).
4. If the REAC Fire Warning Light extinguishes, restart the engine.
    - Note: If attempting to relight the engine, don't forget to open the engine fuel cock by setting the Main Fuel Cock / Fuel Shutoff Valve Switch LEFT (Fuel Shutoff Valve Open).
5. If the REAC Fire Warning Light remains illuminated, eject as soon as possible.

Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*

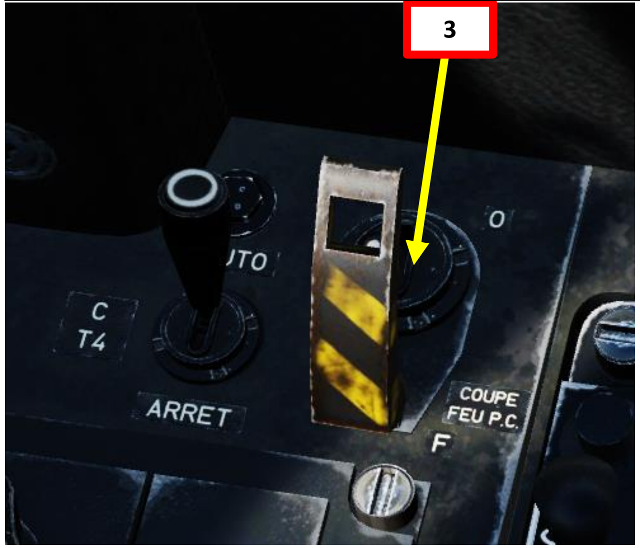
1 – POWERPLANT

1.12 – Engine Fire

Case 2: P/C (Post-Combustion, Afterburner) Light

1. If a fire is detected in the afterburner section of the engine, the P/C Fire Warning Light will illuminate.
2. Immediately throttle back to turn off afterburner. Confirm FON (*Fonctionnement Fusée*, Afterburner ON) light is extinguished.
3. Close the afterburner engine fuel cock by setting the Afterburner Main Fuel Cock / Fuel Shutoff Valve Switch RIGHT (Fuel Shutoff Valve Closed).
    - “O” stands for “*Ouvert*” (Shutoff Valve Open)
    - “F” stands for “*Fermé*” (Shutoff Valve Closed)
4. If the P/C Fire Warning Light extinguishes, stay off the afterburner for the rest of the flight.
5. If the P/C Fire Warning Light remains illuminated, eject as soon as possible.

Afterburner *(P.C., Post-Combustion)* **Main Fuel Cock / Fuel Shutoff Valve** *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*



2 – FUEL
2.1 – Fuel System Overview

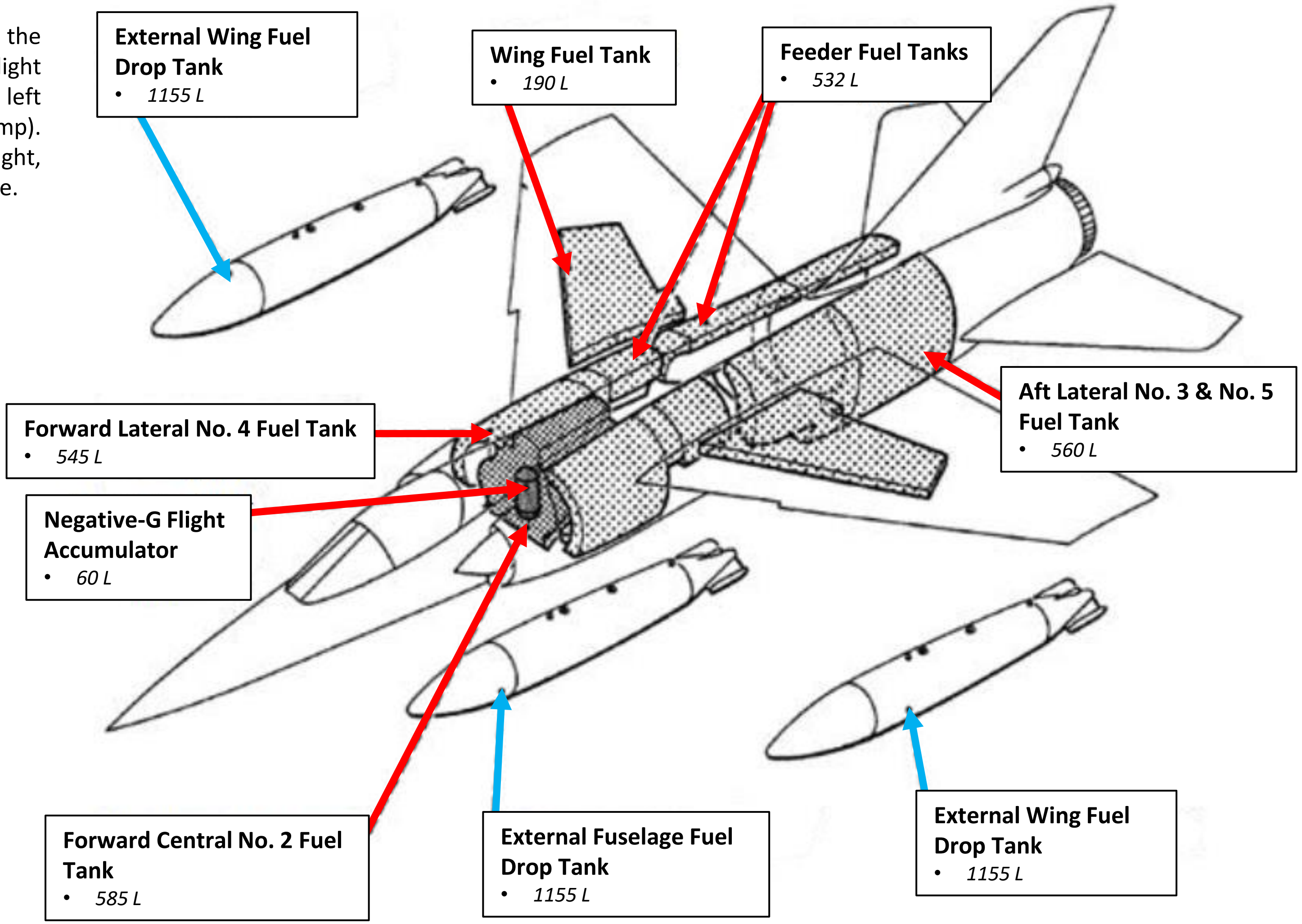
2 – FUEL
2.1 – Fuel System Overview

The aircraft has a total of 9 internal fuel tanks plus a negative-g flight accumulator to allow for inverted flying and capability of carrying three RP-35 external fuel drop tanks.

All fuel tanks transfer fuel to the feeder tanks, which then transfer it to the engine. This process is automatic. The engine and the negative-g flight accumulator are fed by three pumps from the feeder tanks: one in the left feeder and 2 in the right one (the extra pump in the right is the starter pump). The negative-g flight accumulator allows for 10-15 seconds of inverted flight, but exceeding this can result in either fuel starvation or damage to the engine.

Fuel Capacity:

- Total (with 3 x External Drop Tanks): 7650 Liters
    - Each RP-35 External Fuel Drop Tank: 1155 Liters
- Total (Internal): 4240 Liters
- Internal Fuel Tanks:
    - Wings:
        - **Left Wing (No. 1):** 190 Liters
        - **Right Wing (No. 1):** 190 Liters
    - Fuselage:
        - **Forward Left Lateral (No. 4):** 545 Liters
        - **Forward Right Lateral (No. 4):** 545 Liters
        - **Left Feeder Tank *(Nourrices)*:** 532 Liters
        - **Right Feeder Tank *(Nourrices)*:** 532 Liters
        - **Aft Left Lateral Tanks (No. 3 + No. 5):** 560 Liters
            - **No. 3 Tank:** 374 Liters
            - **No. 5 Tank:** 186 Liters
        - **Aft Right Lateral Tanks (No. 3 + No. 5):** 560 Liters
            - **No. 3 Tank:** 374 Liters
            - **No. 5 Tank:** 186 Liters
- Negative G Flight Accumulator: 60 Liters



2 – FUEL
2.1 – Fuel System Overview

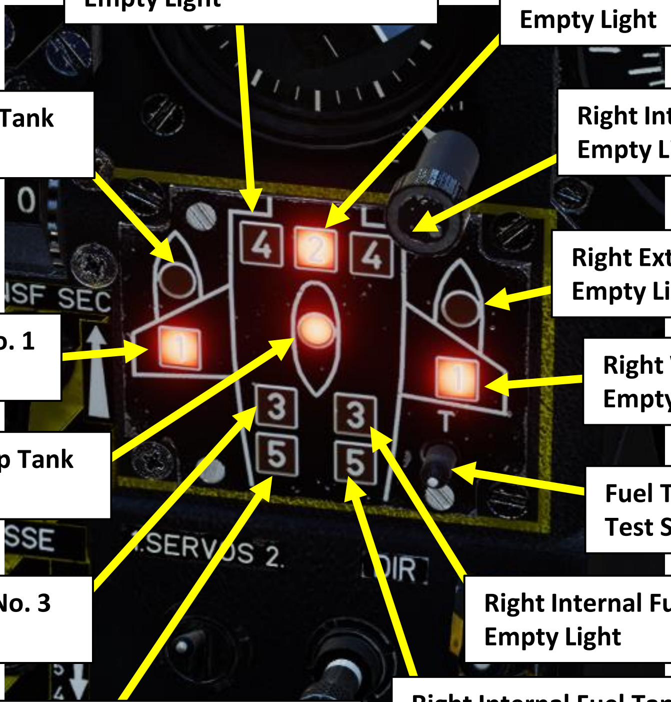
Fuel Indications

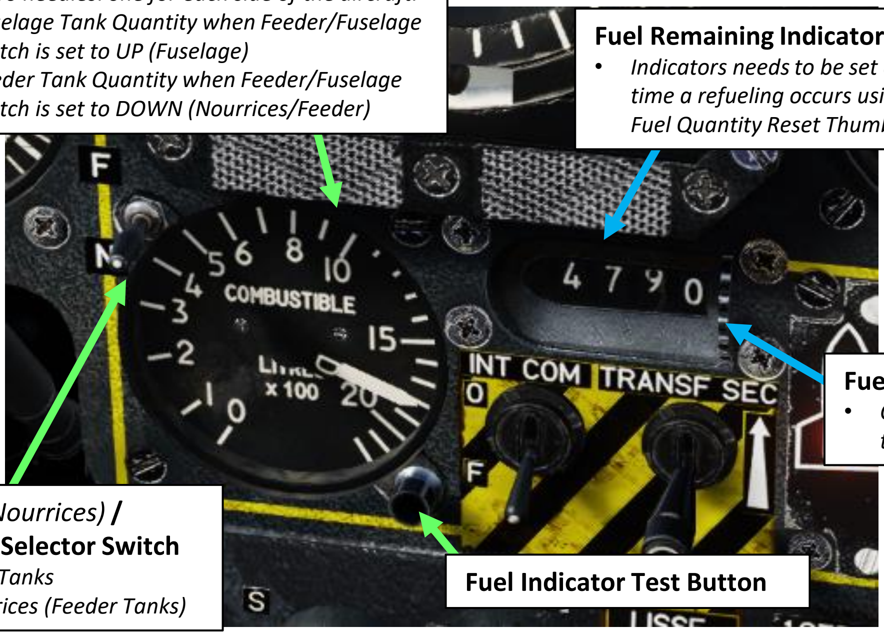
The Dual Fuel Indicator allows you to monitor fuel quantity based on the position of the Feeder Tank / Fuselage Tank Selector switch.

The Fuel Remaining Indicator can be adjusted manually, but the ground crew can do it for you each time you request refueling in DCS. Take note that there is a repeating “clicking” sound when the Fuel Remaining Indicator decrements, just like in real life.

“Empty Lights” give the pilot a status of each fuel tank except the feeder tanks. As a quick reminder:

- No. 1 Tank Empty Light ON: 3860 Liters remaining
- No. 2 Tank Empty Light ON: 3275 Liters remaining
- No. 3 Tank Empty Light ON: 2211 Liters remaining
- No. 4 Tank Empty Light ON: 1121 Liters remaining
- No. 5 Tank Empty Light ON: 0 Liters remaining





2 – FUEL
2.1 – Fuel System Overview

Fuel Indications

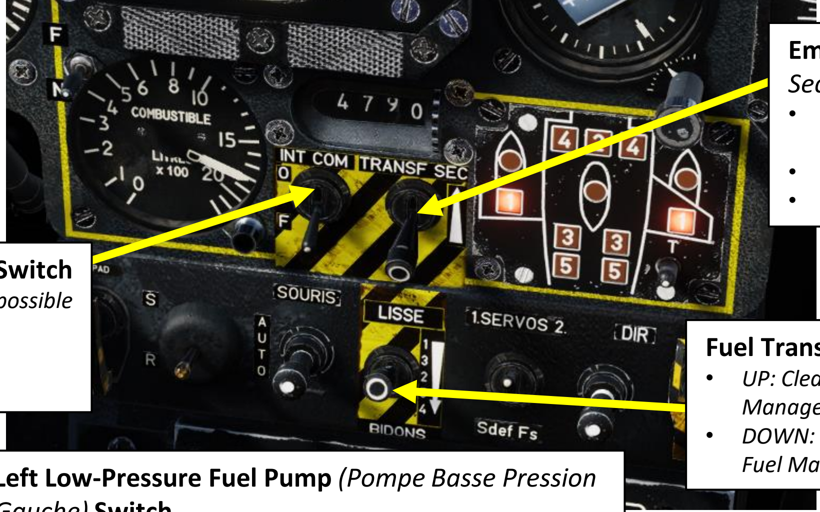
The Mirage F1CE and F1EE fuel indications are slightly different, but the logic behind it remains the same.

Mirage F1CE Only

Mirage F1EE Only

2 – FUEL
2.1 – Fuel System Overview

Fuel Controls



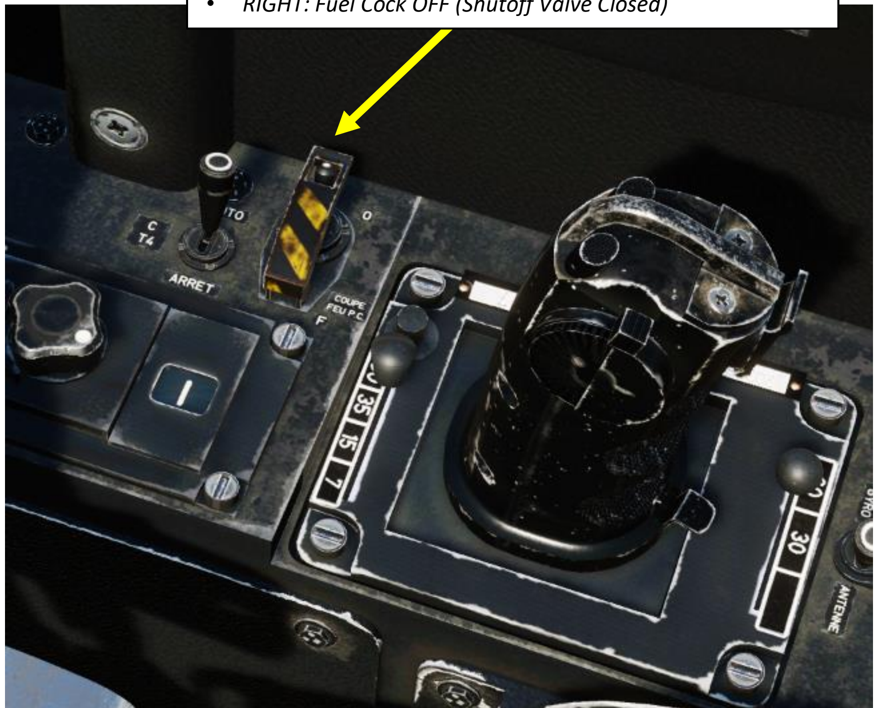
Emergency Fuel Transfer *(Transfert de Secours)* **Switch**
- *Enables an emergency transfer by gravity of fuel from the aft lateral tanks to the feeder tanks.*
- *UP: Emergency Transfer ON*
- *DOWN: Emergency Transfer OFF*

Fuel Crossfeed Valve *(Robinet Intercommunication)* **Switch**
- *Allows the transfer between feeder tanks to correct any possible fuel imbalance in the aircraft.*
- *UP: Ouvert (Open)*
- *DOWN: Fermé (Closed)*

Fuel Transfer Sequence Selector Switch
- *UP: Clean (Lisse) sequence (see Engine & Fuel Management Section)*
- *DOWN: External Tanks (Bidons) sequence (see Engine & Fuel Management Section)*

Left Low-Pressure Fuel Pump *(Pompe Basse Pression Gauche)* **Switch**
- *LEFT: Fuel Pump ON*
- *RIGHT: Fuel Pump OFF*

Afterburner *(P.C., Post-Combustion)* **Main Fuel Cock / Fuel Shutoff Valve** *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*



Main Fuel Cock / Fuel Shutoff Valve *(Robinet Coupe-Feu)* **Switch**
- *LEFT (Guarded): Fuel Cock ON (Shutoff Valve Open)*
- *RIGHT: Fuel Cock OFF (Shutoff Valve Closed)*

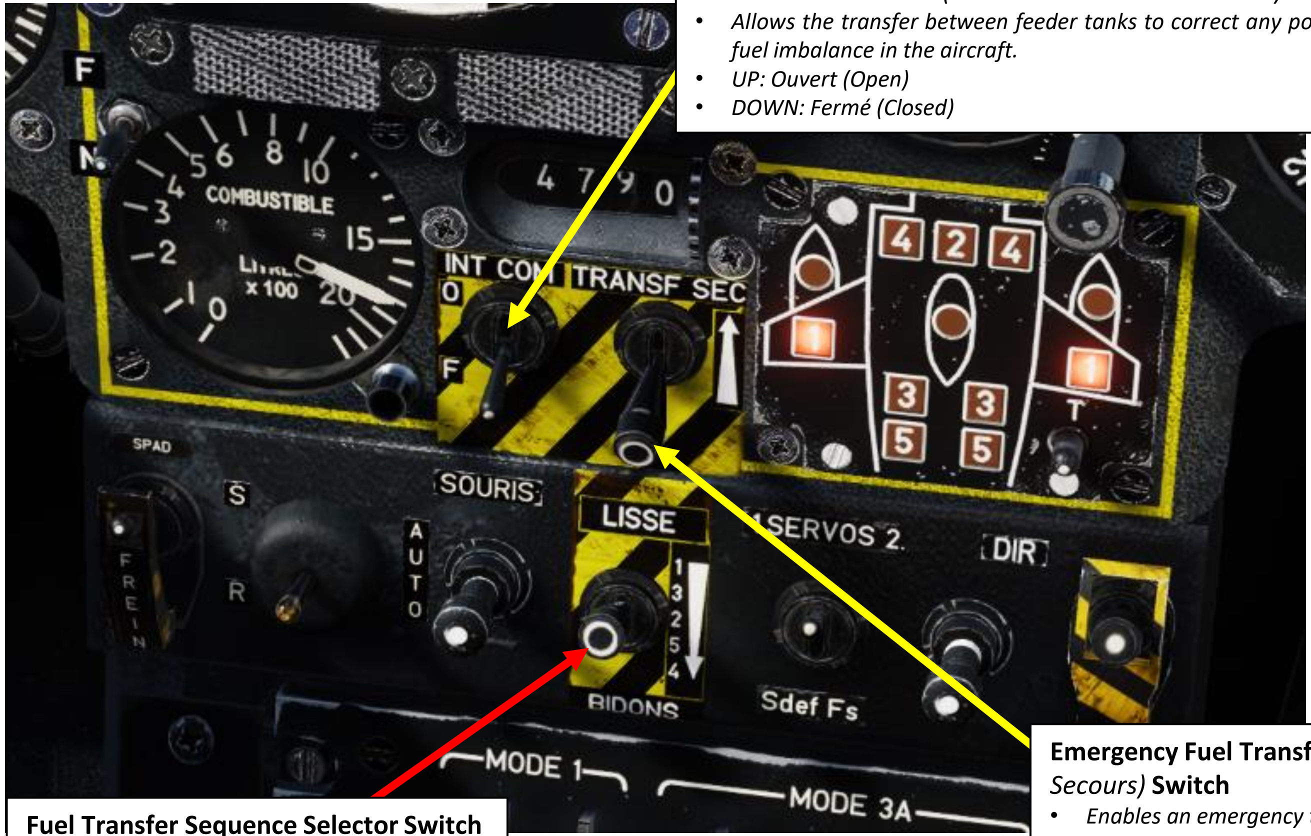
Right Low-Pressure Fuel Pump *(Pompe Basse Pression Droite)* **Switch**
- *LEFT: Fuel Pump ON*
- *RIGHT: Fuel Pump OFF*

2 – FUEL
2.2 – Fuel Management

Fuel management is pretty straightforward in the Mirage since it is automatically managed by the fuel system.

There are two draining order configurations for the aircraft, depending on if external fuel tanks are being carried or not. The mode is selected through a **fuel transfer sequence selector switch**. The level of the feeder tanks descends as the other tanks are emptied in such a way that, when a certain level is reached in the feeder tanks, fuel transfer starts from the next tank to be used by the feeder tanks (*nourrices*).

Fuel Crossfeed Valve *(Robinet Intercommunication)* **Switch**
- *Allows the transfer between feeder tanks to correct any possible fuel imbalance in the aircraft.*
- *UP: Ouvert (Open)*
- *DOWN: Fermé (Closed)*



Fuel Transfer Sequence (Clean/*Lisse*)
1. *Wing tanks*
2. *Central front*
3. *2/3 of laterals rear*
4. *Laterals front*
5. *Remaining 1/3 of laterals rear*
6. *Remaining at feeders*
7. *Negative-g flight accumulator*

Fuel Transfer Sequence (External Tanks/*Bidons*)
1. *External tanks and wing tanks*
2. *2/3 of laterals rear*
3. *Central front*
4. *Remaining 1/3 of laterals rear*
5. *Laterals front*
6. *Remaining at feeders*
7. *Negative-g flight accumulator*

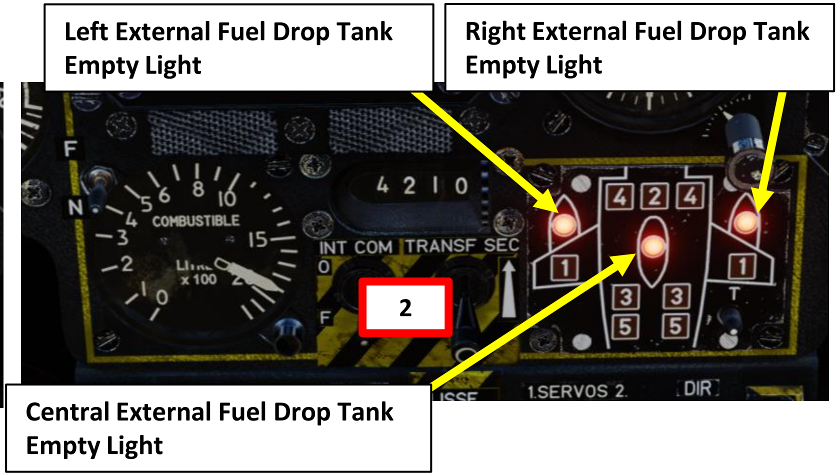
Fuel Transfer Sequence Selector Switch
- *UP: Clean (Lisse) sequence*
- *DOWN: External Tanks (Bidons) sequence*

Emergency Fuel Transfer *(Transfert de Secours)* **Switch**
- *Enables an emergency transfer by gravity of fuel from the aft lateral tanks to the feeder tanks.*
- *UP: Emergency Transfer ON*
- *DOWN: Emergency Transfer OFF*

2 – FUEL
2.3 – Fuel Drop Tank Operation

RP-35 external drop tanks are consumed automatically once installed.

There is no fuel quantity indicator for the external tanks themselves. Once external tanks are empty, Left/Right/Central External Fuel Drop Tank Empty lights illuminate.



2 – FUEL
2.4 – Fuel Drop Tank Jettison
2.4.1 – Selective Jettison Method

To use the Selective Jettison method:

1. Set Stores Jettison Selection Switch to select which stations the external drop tanks are installed on.
    - UP Position: Voilure 2, outer wing stores.
    - MIDDLE Position: Voilure 1, inner wing stores.
    - DOWN Position: Fuselage Stores.
2. Flip Selective Jettison *(Largage)* Button Cover Guard, then press button to jettison selected external tanks.

2 – FUEL
2.4 – Fuel Drop Tank Jettison
2.4.2 – Emergency Jettison Method

If external drop tanks are the only types of ordnance installed under the wings and fuselage, you can use the Emergency *(Détresse)* Jettison Button to jettison all underwing and fuselage stores. Keep in mind that this method may not be suitable for complex loadout configurations.

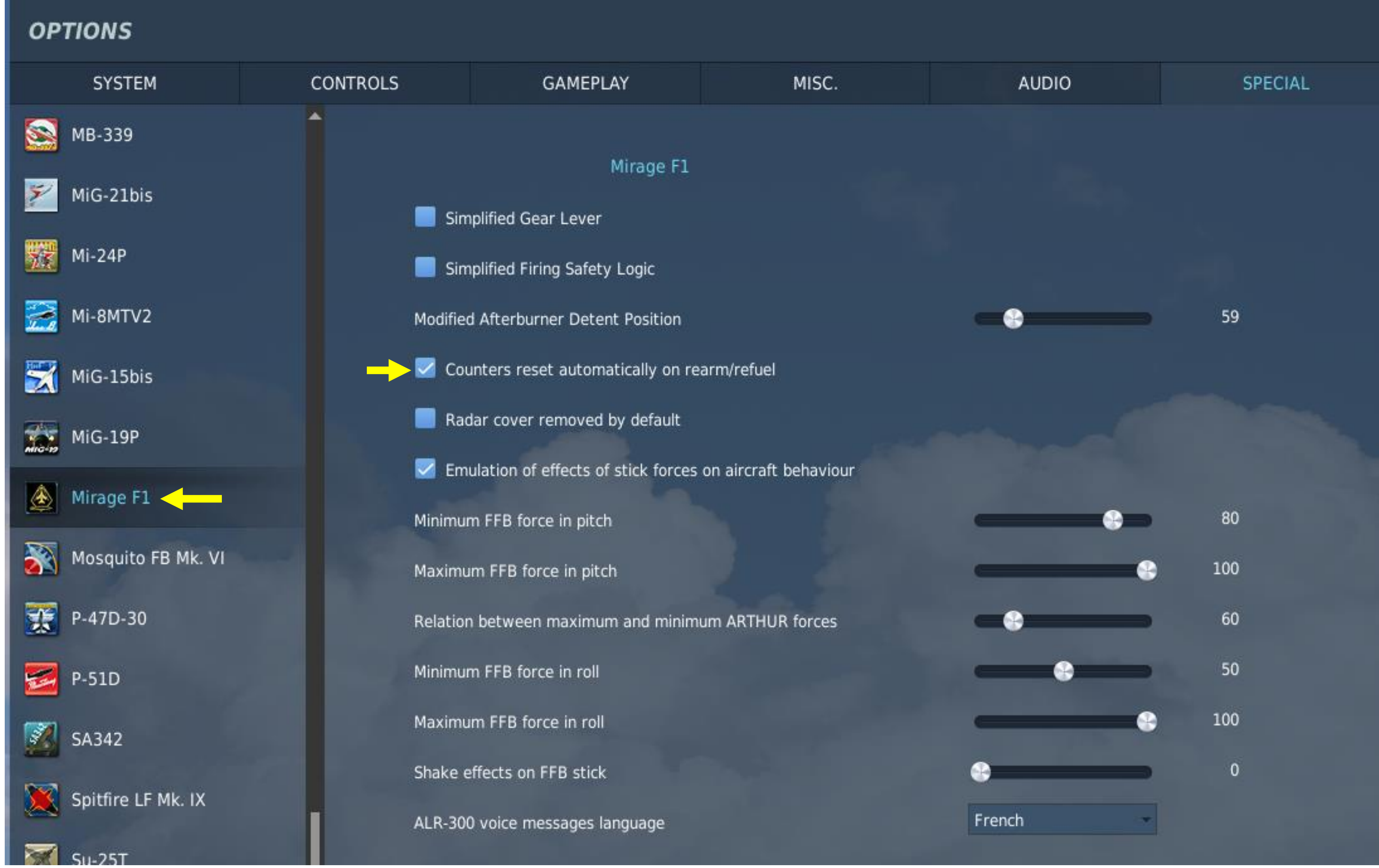
Emergency *(Détresse)* Jettison Button & Cover Guard
- *Commands the jettison of all underwing and fuselage stores.*

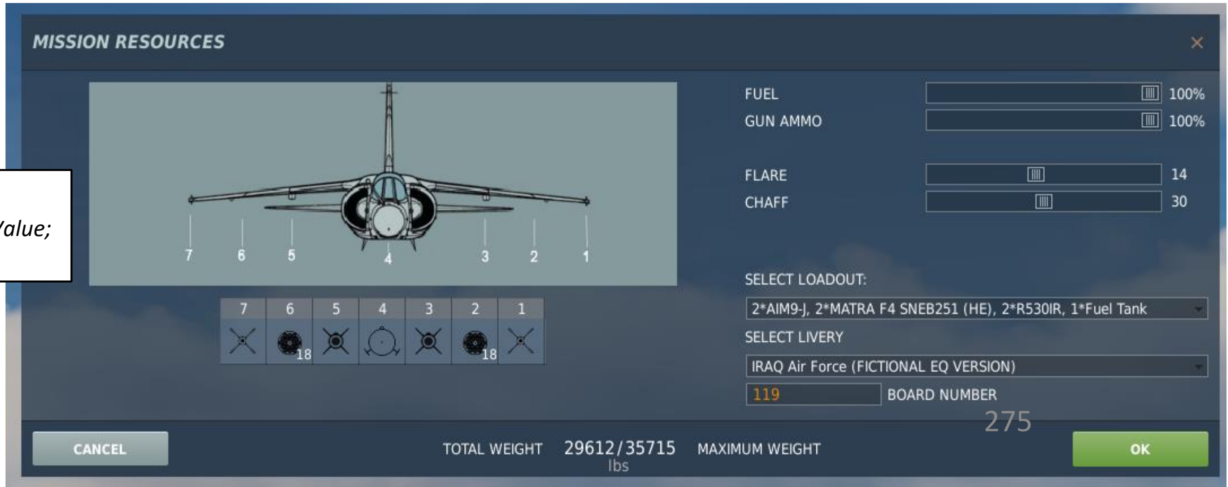
2 – FUEL
2.5 – Refueling On Ground

When you contact the ground crew to refuel, the ground crew will reset the **Fuel Remaining Indicator** to the correct value for you using the **Fuel Quantity Reset Thumbwheel** if the “**Counters reset automatically on rearm/refuel**” option is selected (ticked) in the Special Options tab.

If the Special Option is not selected (unticked), you will have to set the Fuel Remaining Indicator manually with the **Fuel Quantity Reset Thumbwheel**. As a rule of thumb:

- 50 % Internal Fuel, No External Tanks: **2120** L
- 100 % Internal Fuel, No External Tanks: **4230** L
- 100 % Internal Fuel, 1 x External Tank: **5380** L
- 100 % Internal Fuel, 2 x External Tanks: **6520** L
- 100 % Internal Fuel, 3 x External Tanks: **7650** L





SECTION STRUCTURE

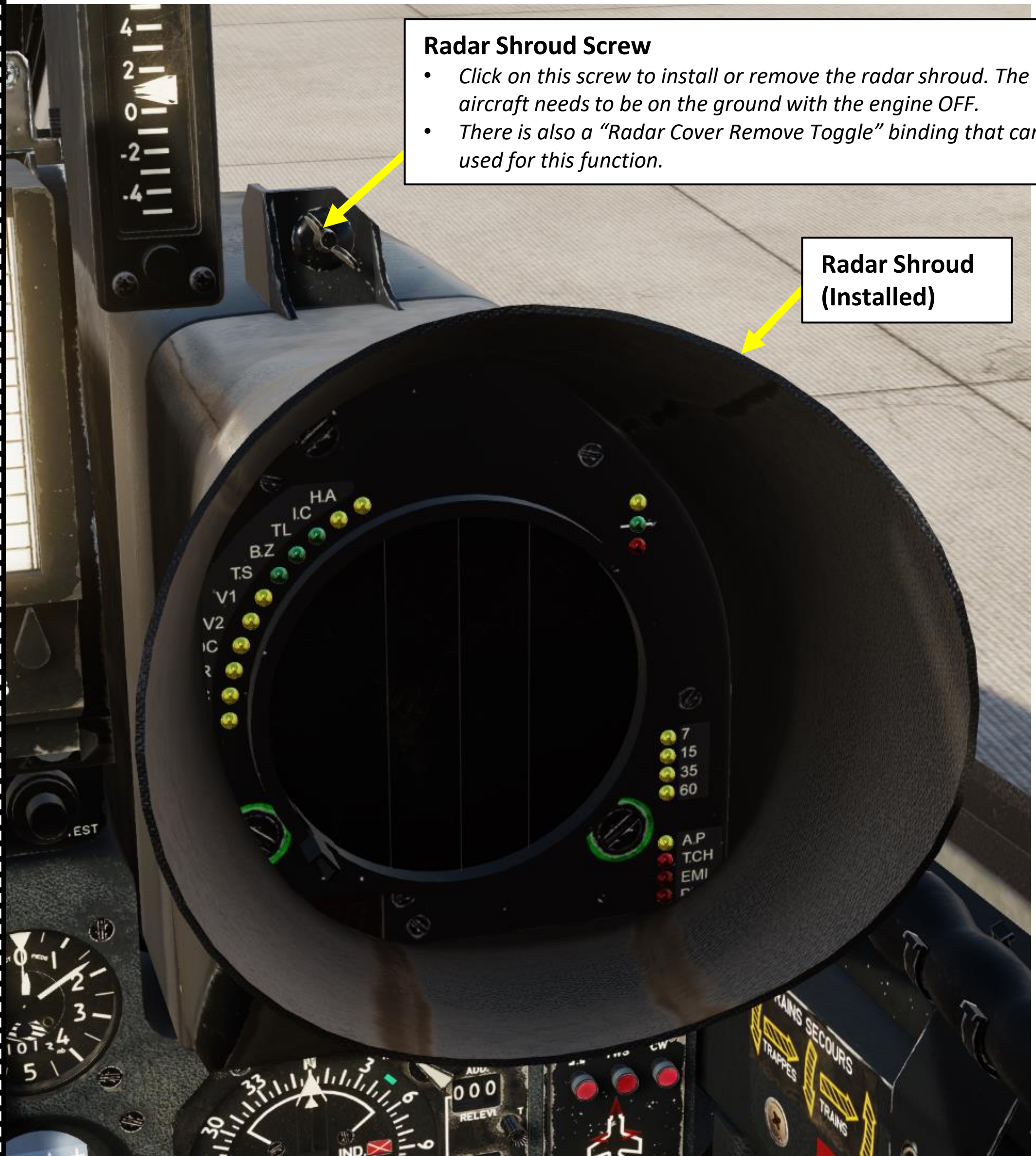
1 – CYRANO IV RADAR INTRODUCTION

The Mirage F1 is equipped with the Thomson-CSF (***C****ompagnie Générale de la Télégraphie* ***S****ans* ***F****il*) CYRANO IV monopulse on-board fire control radar. Designed in 1972, the CYRANO IV radar is used for interception of enemy aircraft and provides range finding information. It also provides air-to-ground terrain information/mapping.

The CYRANO IV was developed from the CYRANO II unit installed on the Mirage IIIE and serves as the main sensor. It operates in three different modes: air-target acquisition and tracking, ground mapping, and terrain avoidance. Mirage F1 pilots reported that the radar was prone to overheating, which reduced its efficiency.

1 – CYRANO IV RADAR INTRODUCTION

The radar shroud allows better visibility of the radar scope in sunlit conditions, but it restricts the pilot to a narrow field-of-view. The shroud can be uninstalled via either the Mission Editor, the "Special Options" tab or by clicking on the Radar Shroud Screw. The shroud is used because the radar scope is a CRT (Cathode Ray Tube) unit, which becomes difficult to see when sun rays illuminate it at certain angles.



2 – RADAR INTERFACE
2.1 – Radar Display

The radar display scope (“*écran*” in French) is the primary interface to detect air contacts.

Radar Function Indicator Lights
- *HA (Haute Altitude): High Altitude Interception*
- *IC (Impulsions Courtes): Short Pulse Interception*
- *TL (Télémétrie): Air-to-Air Mode*
- *BZ (Balayage par Zone): Area Scanning*
- *TS (Télémétrie Air-Sol): Air-to-Ground Ranging Mode*
- *V1 (Visualisation Terrain 1): Ground Visualization Mode 1*
- *V2 (Visualisation Terrain 2): Ground Visualization Mode 2*
- *DC (Découpe Terrain): Iso-Altitude Cutout / Ground Avoidance*
- *PR (Percée Radar): Blind Penetration*
- *AC: Anti-Collision*
- *DB (Détection Brouilleur): Jammer Detection*

*Note: Functions in **red** are not functional in the F1CE/F1EE/F1BE variant.*

Inoperative Lights

Elevation Tilt/Altitude Difference Display
- *E: Elevation*
- *D: Altitude Difference, sets the radar bar sweep to that differential altitude at the Alidade/Strobe's set range*
- *+: corresponds to a plane above the airplane*
- *–: corresponds to a plane below the airplane*
- *2 digits: always indicates the difference in altitude.*
  - *Displayable domain: ± 48,000 ft in 1,000 ft steps in Air-to-Air modes*
  - *Displayable domain: ± 4,800 ft in steps of 100 ft in Air-to-Ground modes*

Radar Status Lights
- *AP (Amplificateur Paramétrique): Parametric amplifier disabled*
- *TCH (Trop Chaud): Radar Overheat*
- *EMI: No Radar Emission*
- *PNE (Panne): Radar Failure*

Radar Test Button

Scope Erase Button *(Effacer)*

Radar Scope Brightness Intensity *(Luminosité)* **Control**

Radar Function Selector Knob

Radar Storage/Persistence Adjustment *(Rémanence)*

2 – RADAR INTERFACE
2.1 – Radar Display

The Cyrano IV radar display changes depending on what radar function is selected.

- B-Scope type display is used for most air-to-air modes. B-Scope shows a 2-D top down representation of a X-Y axis grid space.
- PPI (Plan Position Indicator) type display is used for most air-to-ground visualization modes. PPI shows a polar view of the radar.

B-Scope Display

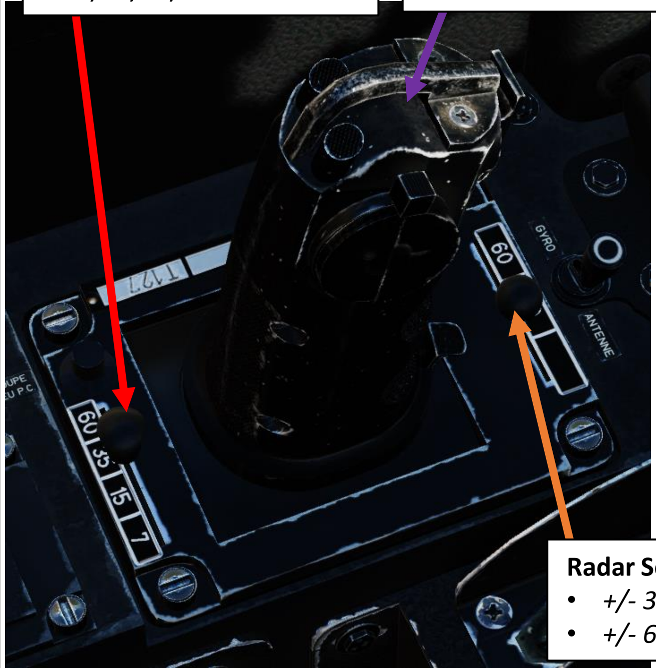
PPI Display

2 – RADAR INTERFACE
2.1 – Radar Display

Radar range scale and radar azimuth scan settings control with their respective levers next to the Radar Control Stick.

- Radar distance markers indicate range information depending on what scale setting is selected.
- Radar azimuth limits indicate scanning limits depending on what scan setting is selected.

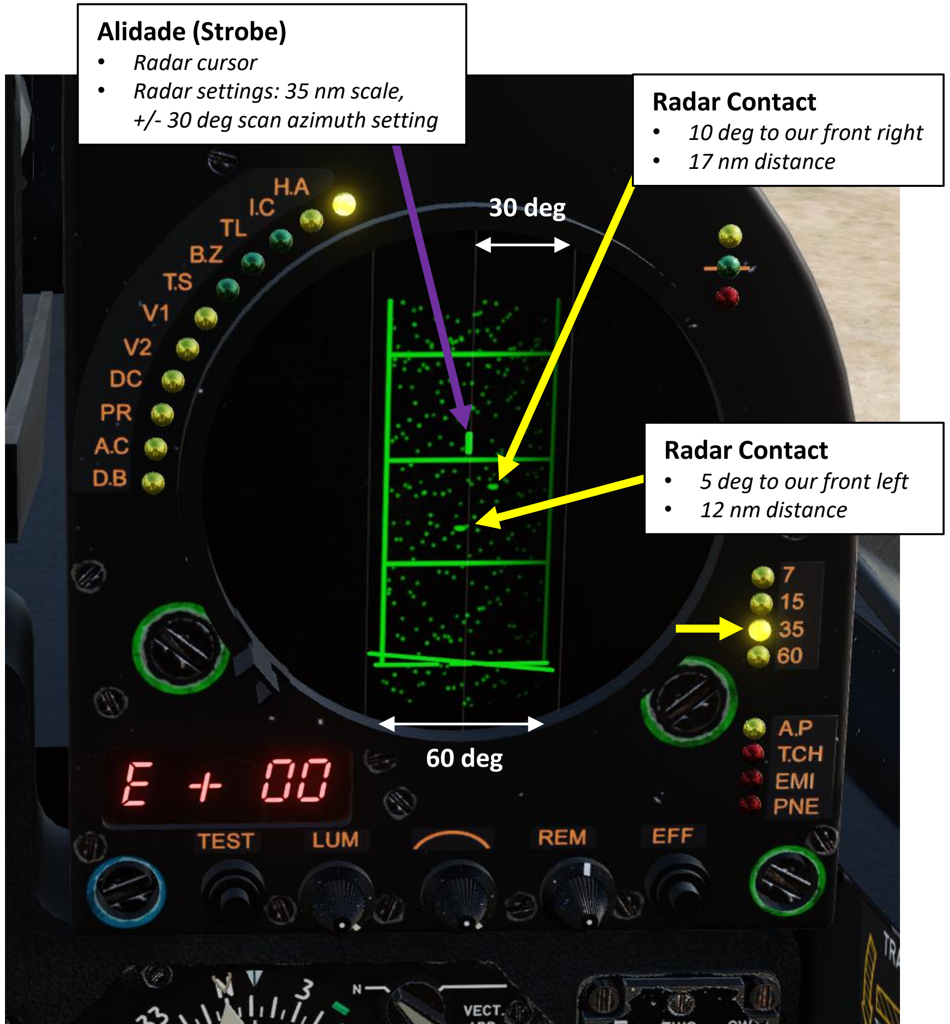
Note: the Alidade (Strobe) is used to lock radar contacts and can be moved to a maximum range of 35 nm, which is the maximum radar lock range.

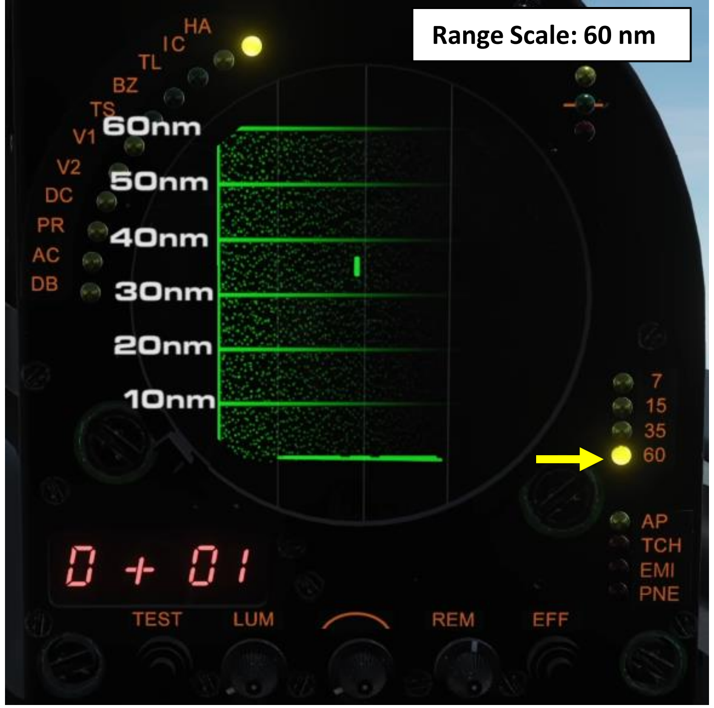


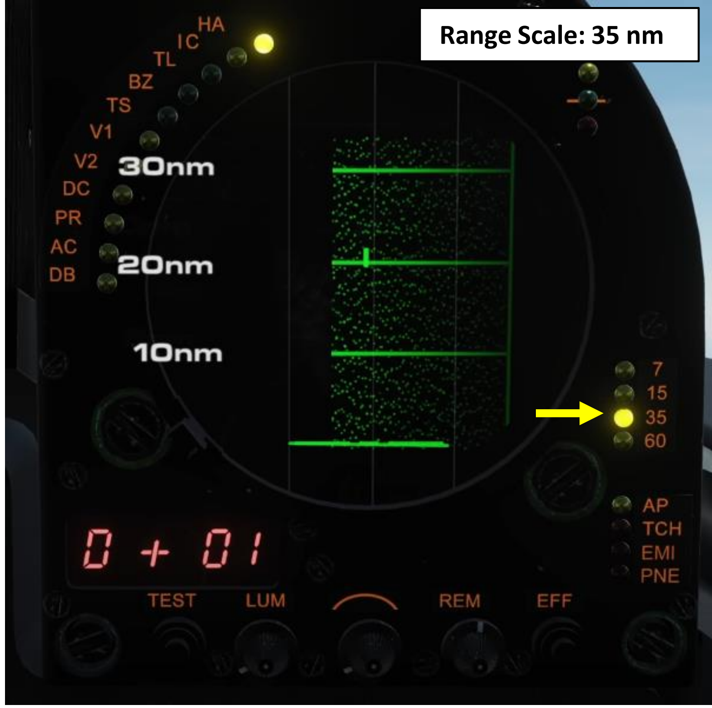
2 – RADAR INTERFACE
2.1 – Radar Display

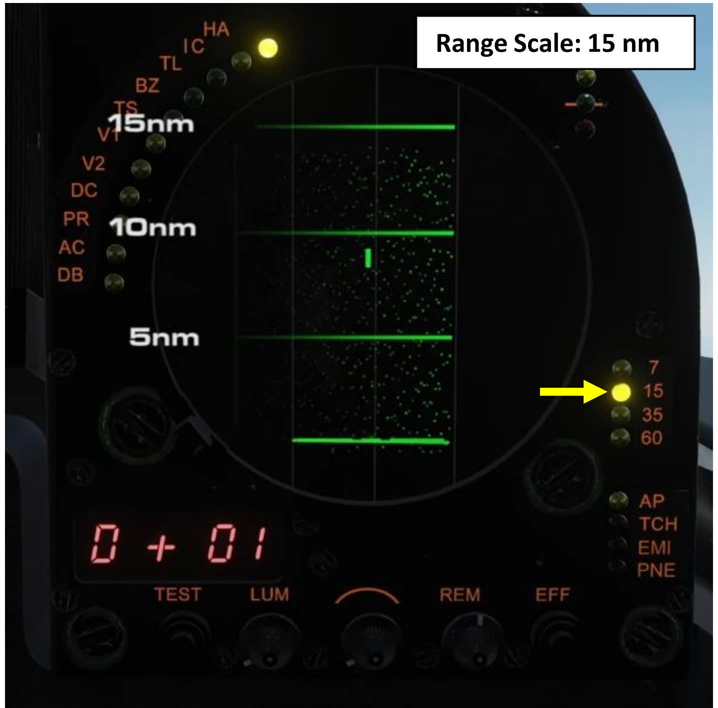
When searching for targets, radar contact information is displayed in terms of distance relative to the aircraft and bearing relative to the alidade (strobe).

Reference: **Redkite's DCS: Mirage F1CE Radar + A/A Weapons Tutorial**
https://youtu.be/OhQ8xV3F94w



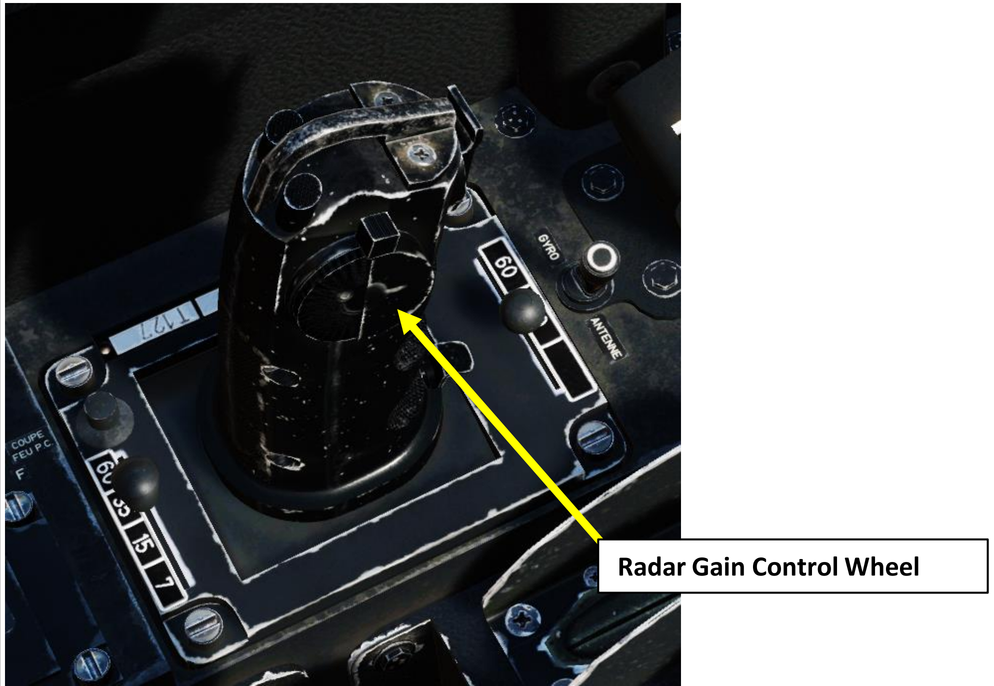






2 – RADAR INTERFACE
2.1 – Radar Display

The radar gain control wheel allows the pilot to adjust the visibility of radar contacts (also referred as “échos cibles”, or “target echoes”) against radar noise returns.



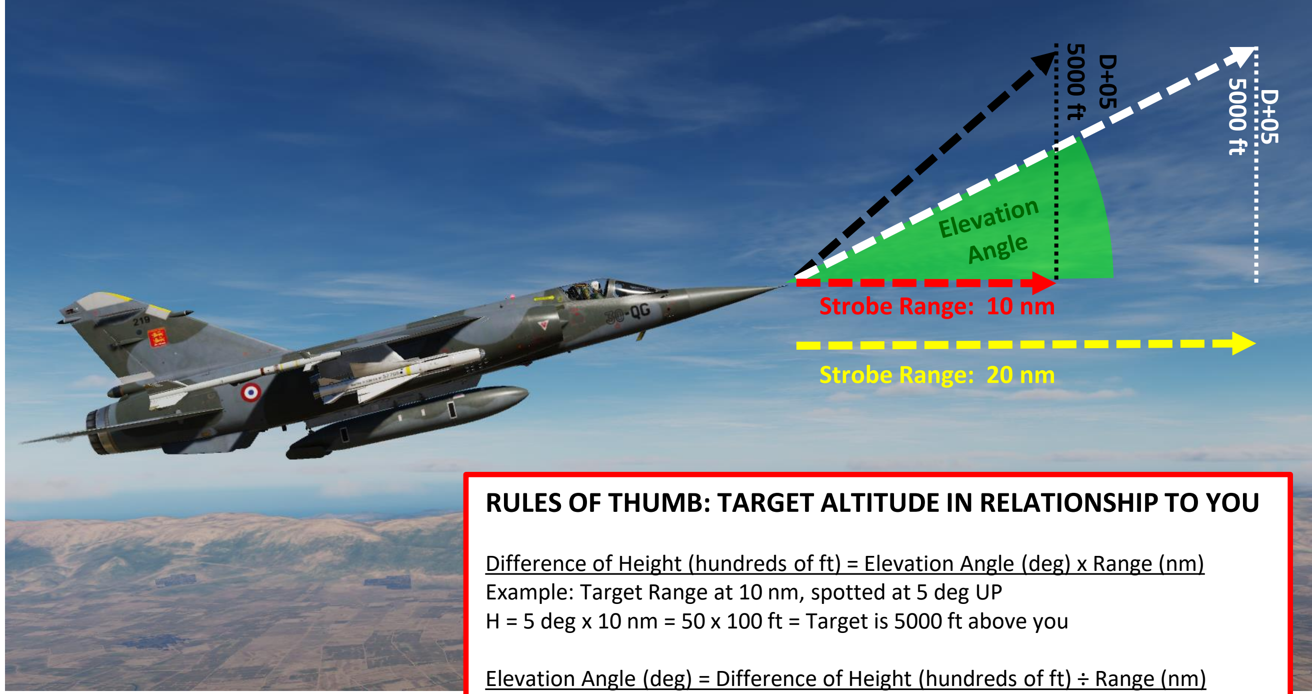
2 – RADAR INTERFACE
2.1 – Radar Display

When the **radar has locked a target**, closure speed information is visible on the radar display.

2 – RADAR INTERFACE
2.1 – Radar Display

The pilot can toggle antenna control modes between “Elevation” and “Altitude Difference” mode using a toggle button. On the radar scope, “E” indicates “Elevation” control while “D” indicates “Altitude Difference”.

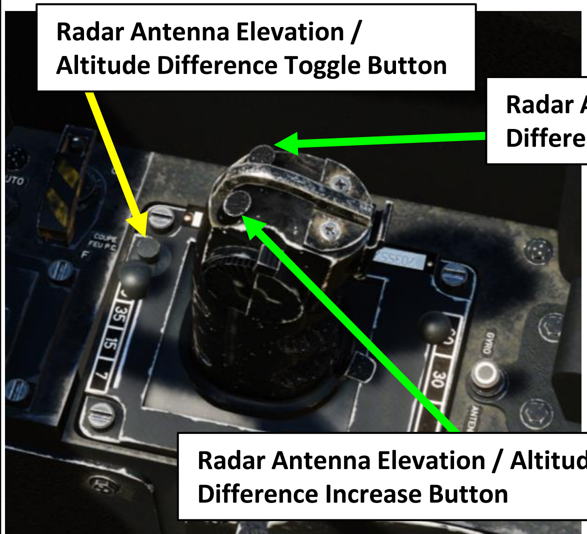
- **Antenna Elevation Tilt Angle (E):**
  - This mode is designed for a constant antenna selection angle. Once mode is selected, the antenna elevation is fixed. As you slew the Alidade out in range, the numbers displayed represent the altitude covered at that range for that fixed antenna elevation. It so works out that **if you set the Alidade to 10 nm, then the numbers displayed equate to Antenna elevation in degrees**.
  - As an example, “E+03” for a 10 nm setting means the centre of the selected scan pattern (4 bars or 1 bar) is scanning 3000 ft above (and, coincidentally 3 degrees) above the earth’s horizon, and is pitch stabilized.
  - Elevation Mode is useful if target range is unreliable due to radar jamming; you can calculate mentally the range with elevation angle and altitude differential information.
- **Antenna Altitude Difference (D):**
  - This mode controls the antenna’s elevation indirectly by setting the centre of the selected radar scan differential altitude at the range set by the strobe. The physical antenna’s tilt is pitch stabilized and will vary as the strobe range varies.
  - As an example, “D+05” with an alidade/strobe range of 10 nm means that the scan center is at 5000 above your altitude at 10 nm.



RULES OF THUMB: TARGET ALTITUDE IN RELATIONSHIP TO YOU

<u>Difference of Height (hundreds of ft) = Elevation Angle (deg) x Range (nm)</u>
Example: Target Range at 10 nm, spotted at 5 deg UP
H = 5 deg x 10 nm = 50 x 100 ft = Target is 5000 ft above you

<u>Elevation Angle (deg) = Difference of Height (hundreds of ft) ÷ Range (nm)</u>
Example: Target spotted at 5000 ft above you at a range of 5 nm
Elevation Angle = 5000 ft ÷ 5 nm = 50 ÷ 5 deg = 10 deg above you



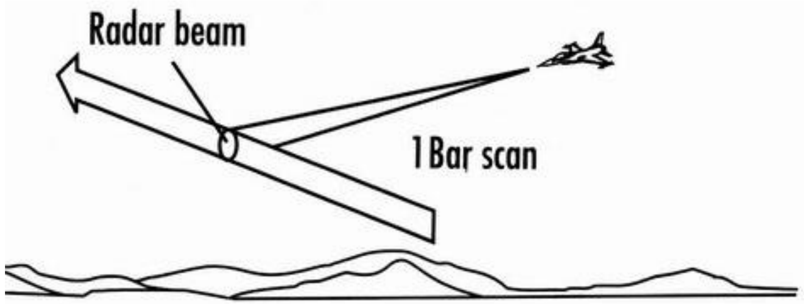
Elevation Tilt/Altitude Difference Display
- *E: Elevation*
- *D: Altitude Difference, sets the radar bar sweep to that differential altitude at the Alidade/Strobe's set range*
- *+: corresponds to a plane above the airplane*
- *–: corresponds to a plane below the airplane*
- *2 digits: always indicates the difference in altitude.*
  - *Displayable domain: ± 48,000 ft in 1,000 ft steps in Air-to-Air modes*
  - *Displayable domain: ± 4,800 ft in steps of 100 ft in Air-to-Ground modes*

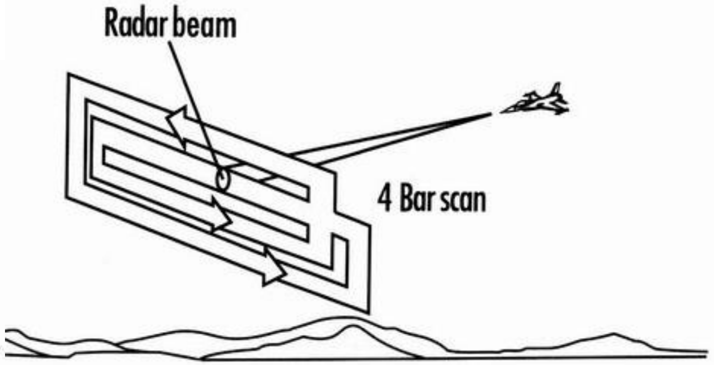
E: Radar Antenna Elevation
- *Shown: 3000 ft Above Aircraft*
- *Elevation: 3 deg UP (for 10 nm)*

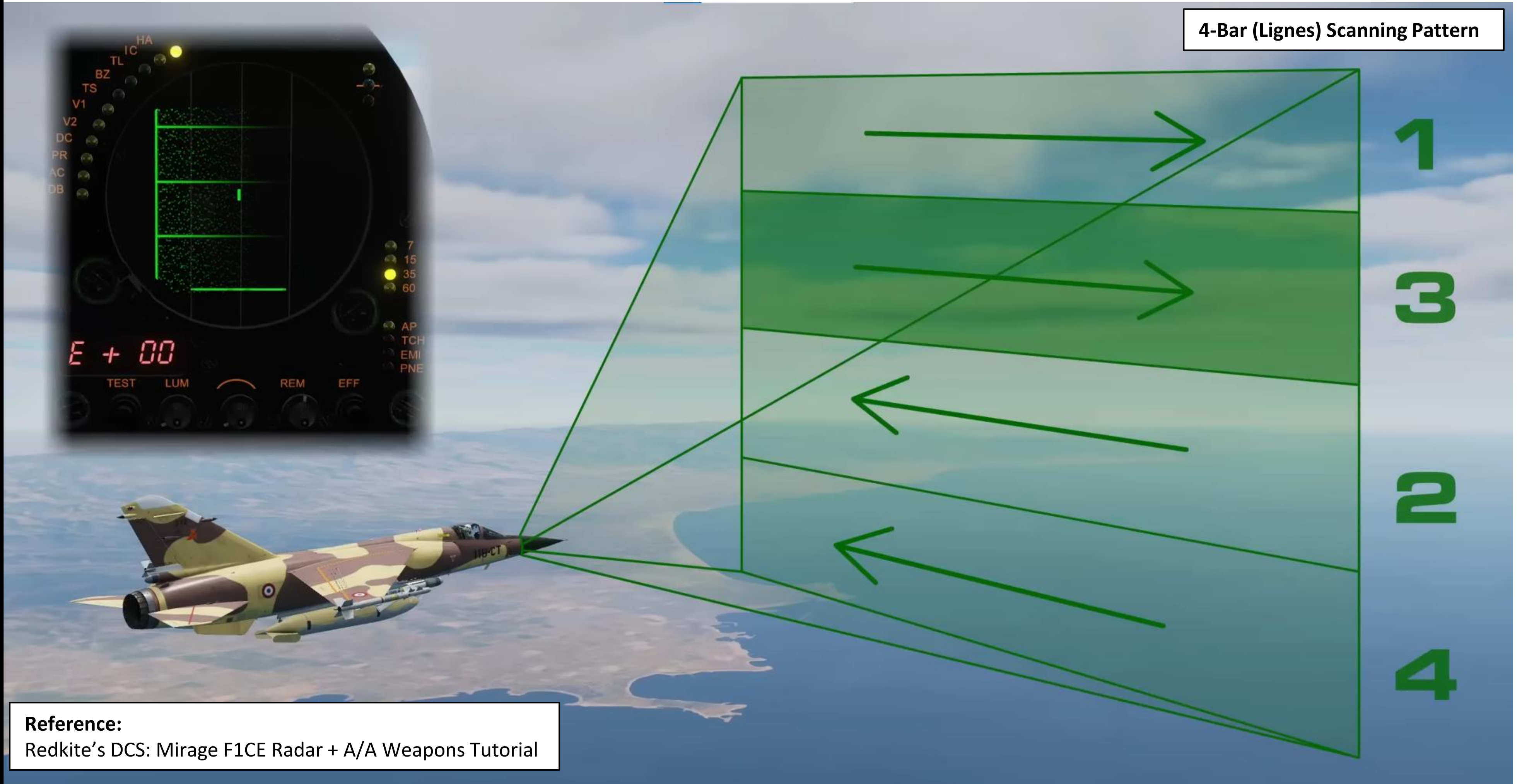
D: Radar Altitude Difference
- *Shown: 5000 ft Below Aircraft*

2 – RADAR INTERFACE
2.1 – Radar Display

In practice, bar (*lignes*) setting is typically left to 4 bars while in search mode in order to maximize the area of the search pattern.







Reference:
Redkite's DCS: Mirage F1CE Radar + A/A Weapons Tutorial

Radar Bar (*Lignes*) Scan Selector Switch
- *FWD: 4 Lignes (4 Bars)*
- *AFT: 1 Ligne (1 Bar)*

2 – RADAR INTERFACE
2.1 – Radar Display

Display brightness controls allow the pilot to adjust scope luminosity settings as desired.

EC (*Écran*) Control – Low Brightness

EC (*Écran*) Control – High Brightness

Radar Indicator Scope Controls

- ***EC*** *(Écran): Radar Display Indicator Lights Brightness Control*
- ***AL*** *(Alidade): Strobe (Target Designation Caret, also called "RLO" for Range-Lock-On Marker) Brightness Control*
- ***MQ*** *(Marqueurs): Distance Markers Brightness Control*
- ***LH*** *(Luminosité Horizon): Horizon & Radial Velocity Marker Brightness Control*
- ***CH*** *(Contrôle Horizon): Horizon Symbol Vertical Position Control*

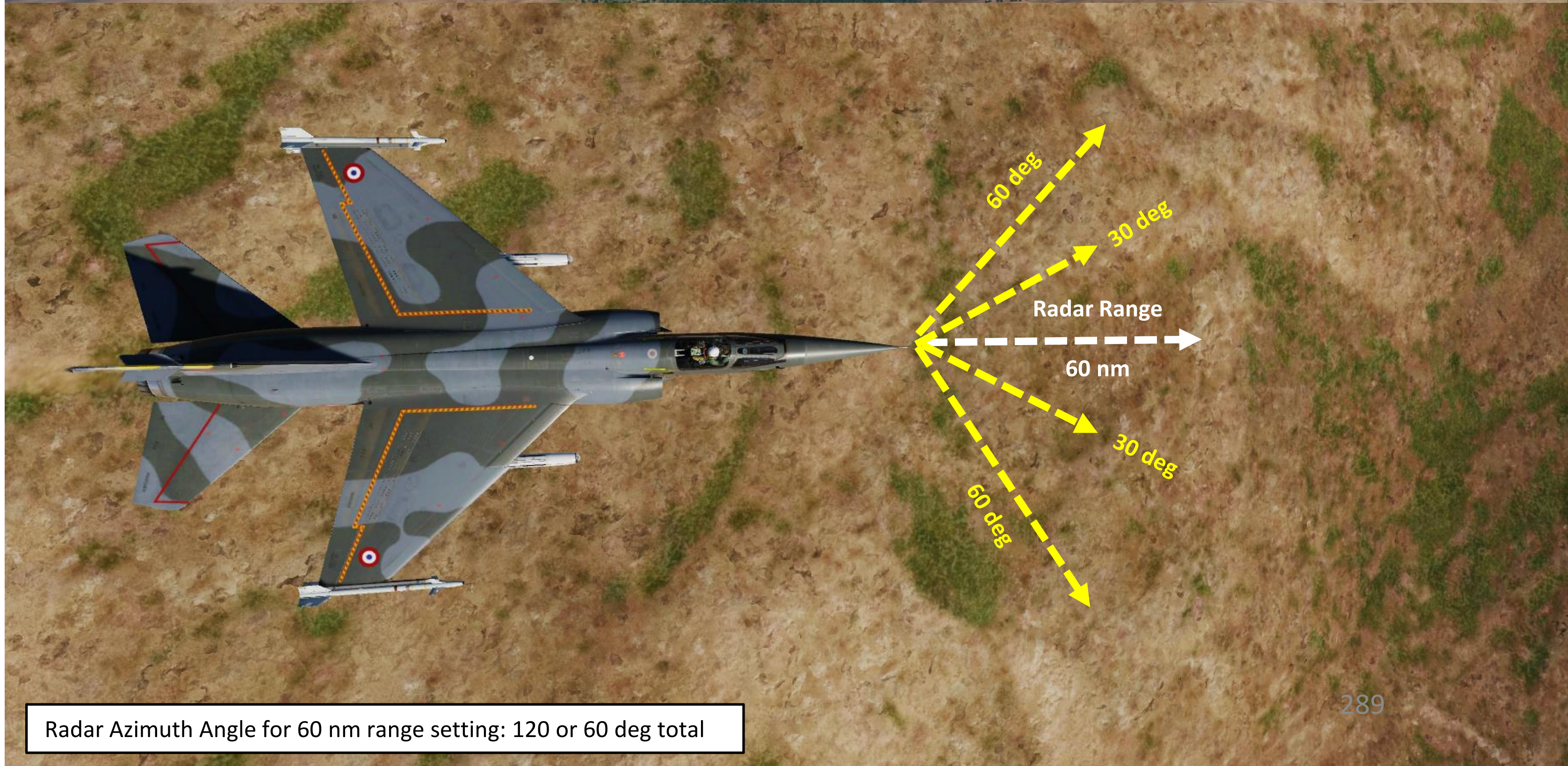
2 – RADAR INTERFACE
2.2 – Radar Performance

The radar has a maximum range of 60 nm in search mode, and 35 nm in lock-on mode. It incorporates anti-jamming circuits for passive directional tracking.

The antenna platform is slaved to the horizontal position, provided that the aircraft roll angle is less than ±80°.

The radar elevation angle can be controlled by tilting the radar antenna. However, your radar scanning cone only covers a definite azimuth and elevation angle as shown below. Distances and angles are not to scale. In search mode, the radar performs a 4-bar scan.

Radar Elevation Angle for 60 nm range setting: 8 deg total



Radar Azimuth Angle for 60 nm range setting: 120 or 60 deg total

2 – RADAR INTERFACE
2.2 – Radar Performance

Radar Functions
- HA (*Haute Altitude*): High Altitude Interception
- IC (*Impulsions Courtes*): Short Pulse Interception
- TL (*Télémétrie*): Air-to-Air Mode
- BZ (*Balayage par Zone*): Area Scanning
- TS (*Télémétrie Air-Sol*): Air-to-Ground Mode
- V1 (*Visualisation Terrain 1*): Ground Visualization Mode 1
- V2 (*Visualisation Terrain 2*): Ground Visualization Mode 2

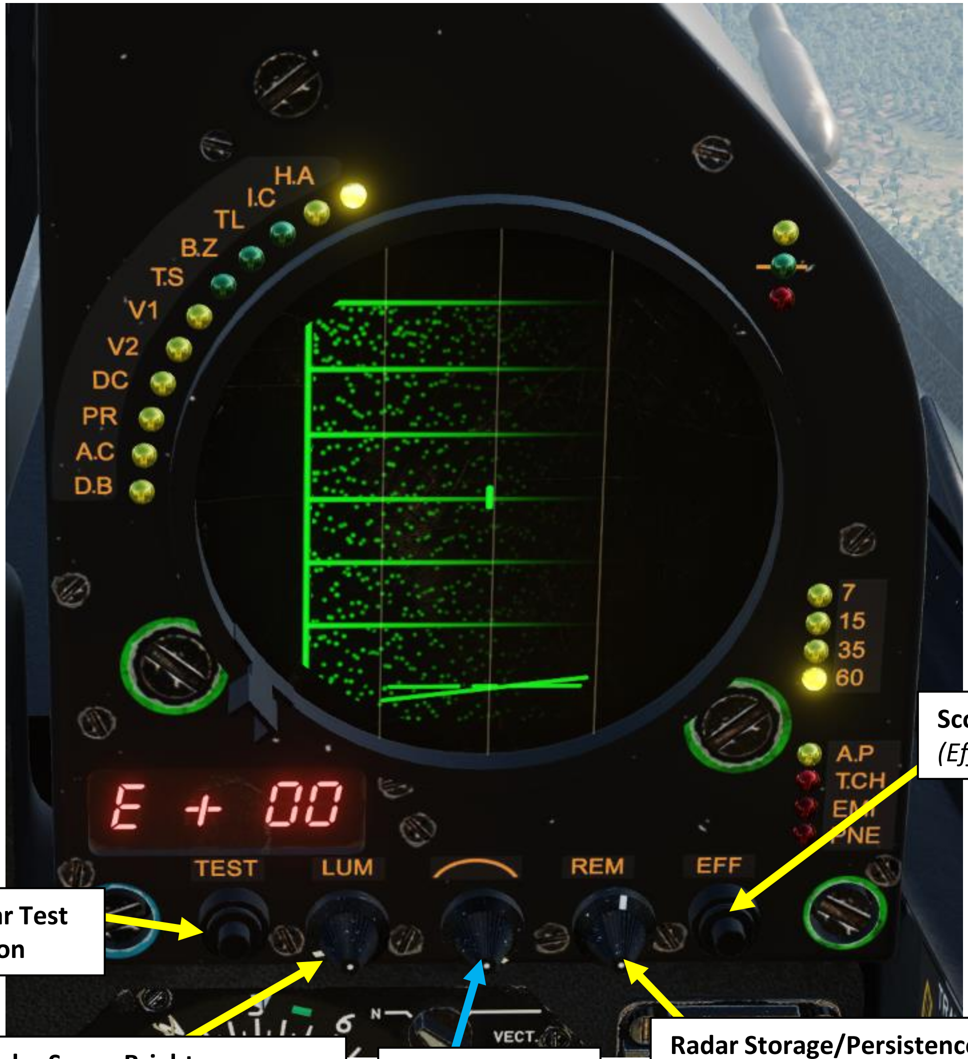
Radar Operation Characteristics

Selection		Range Scale (nm)	Actual Azimuth Scan (deg)	Pulse	Gain Control	Observations
Function	Azimuth Scanning (deg)					
HA	60 30	60 35 15 7	60 30	Long	Automatic	On the 15 and 7 nm range scales, the DATEP (interference echo attenuation device) is in service only when the gain control is at maximum. By reducing, the gain control becomes manual.
IC	60 30	60 35 15 7	60 30	Short	Automatic	On the 15 and 7 nm range scales, the DATEP (interference echo attenuation device) is in service only when the gain control is at maximum. By reducing, the gain control becomes manual.
TL	60 30	60 35 15 7	In the axis	Short	Automatic	Air-to-air telemetry if the radar is not in « APS » (*Autorisation Pré-Sélectionnée*, Pre-selection Authorization) or in « APC » (*Autorisation de Poursuite Continue,* Continuous Pursuit Authorization). The range scale changes to 7 nm.
BZ	60 30	60 35 15 7	Area Scanning 20	Short	Automatic	Scan by area if the radar is not in « APS » (*Autorisation Pré-Sélectionnée*, Pre-selection Authorization) or in « APC » (*Autorisation de Poursuite Continue,* Continuous Pursuit Authorization). The range scale changes to 7 nm.
V1	60	60 35	60	Short	Manual	2 elevation lines scan
	30	17 7	30			1 elevation line scan

2 – RADAR INTERFACE
2.3 – Radar Controls

Mirage F1CE Only

Radar modes/functions are primarily selected by rotating the Radar Function Selector knob below the scope. The radar is powered using the Radar Operation Mode Selector Switch.



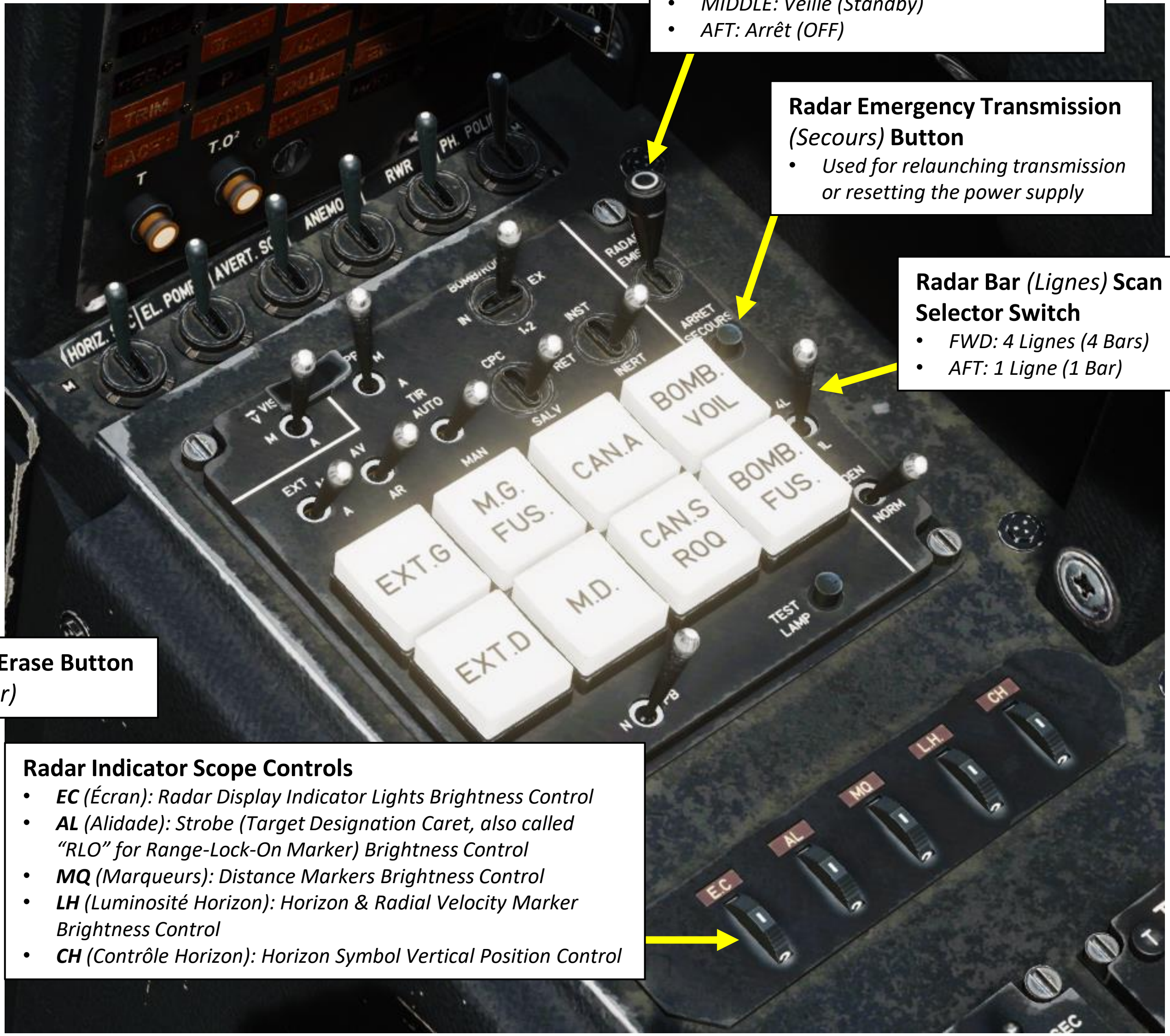
Radar Test Button

Radar Scope Brightness Intensity *(Luminosité)* **Control**

Radar Function Selector Knob

Radar Storage/Persistence Adjustment *(Rémanence)*

Scope Erase Button *(Effacer)*



Radar Operation Mode Selector Switch
- *FWD: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *AFT: Arrêt (OFF)*

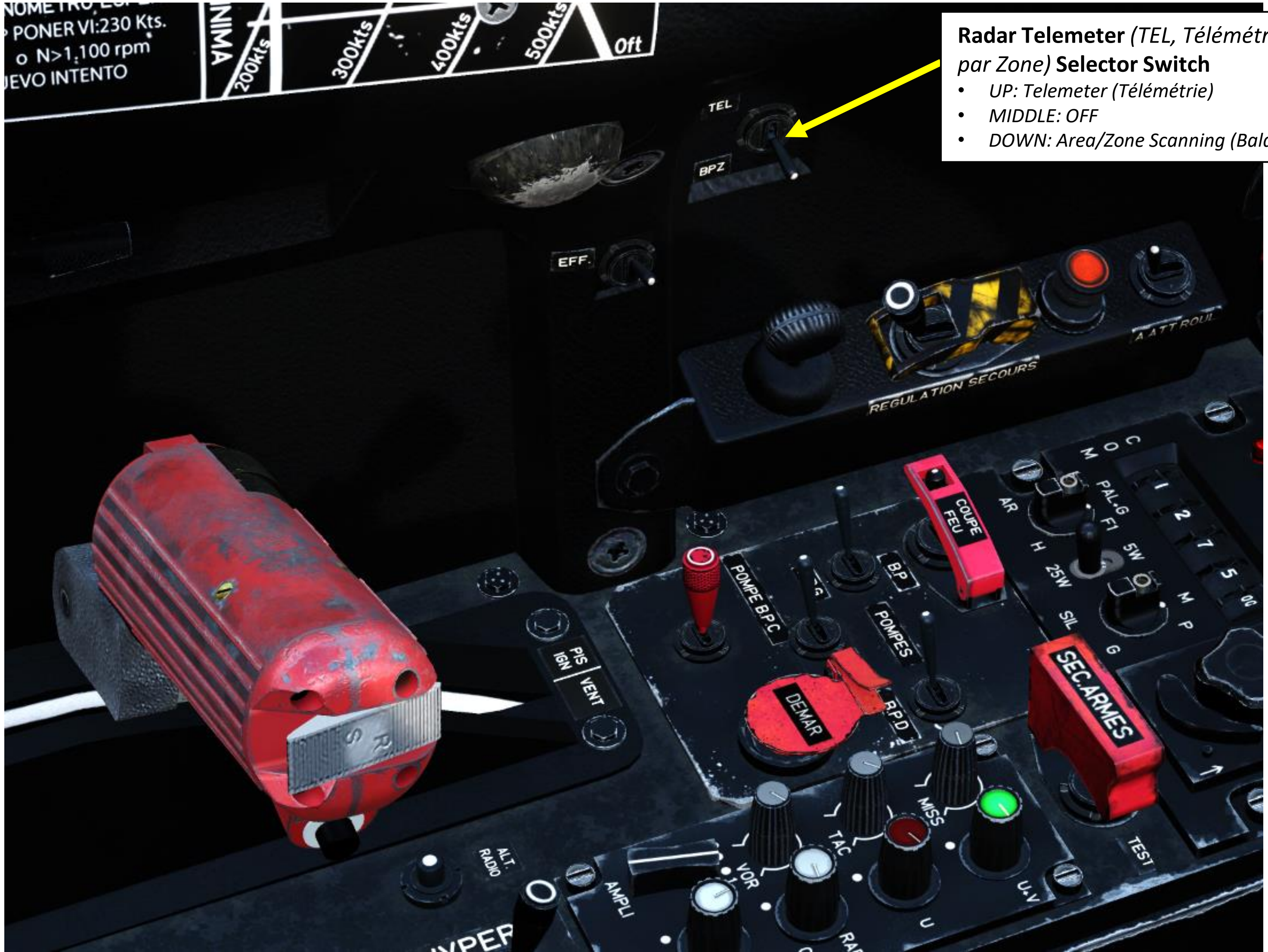
Radar Emergency Transmission *(Secours)* **Button**
- *Used for relaunching transmission or resetting the power supply*

Radar Bar *(Lignes)* **Scan Selector Switch**
- *FWD: 4 Lignes (4 Bars)*
- *AFT: 1 Ligne (1 Bar)*

Radar Indicator Scope Controls
- ***EC*** *(Écran): Radar Display Indicator Lights Brightness Control*
- ***AL*** *(Alidade): Strobe (Target Designation Caret, also called "RLO" for Range-Lock-On Marker) Brightness Control*
- ***MQ*** *(Marqueurs): Distance Markers Brightness Control*
- ***LH*** *(Luminosité Horizon): Horizon & Radial Velocity Marker Brightness Control*
- ***CH*** *(Contrôle Horizon): Horizon Symbol Vertical Position Control*

2 – RADAR INTERFACE
2.3 – Radar Controls

The Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch is used to select Close Combat Radar modes, which allow the radar to lock automatically a target located at a distance of less than 7 km (approximately 3.8 nm).



Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

2 – RADAR INTERFACE
2.3 – Radar Controls

The radar is primarily controlled using the Radar Control Stick *(Manche Radar)*.

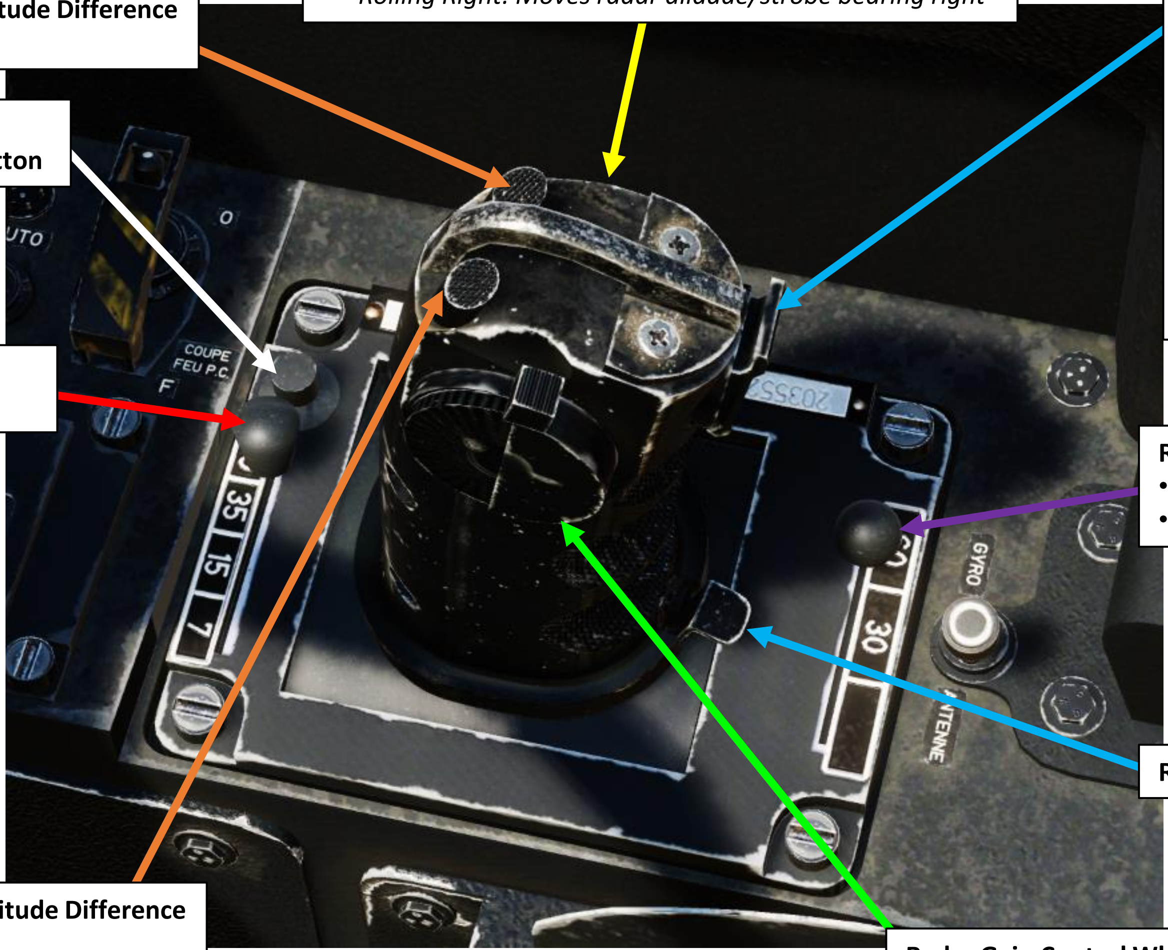
Radar Control Stick *(Manche Radar)*
- *Twist Left: Decreases radar alidade/strobe range*
- *Twist Right: Increases radar alidade/strobe range*
- *Rolling Left: Moves radar alidade/strobe bearing left*
- *Rolling Right: Moves radar alidade/strobe bearing right*

Radar Antenna Elevation / Altitude Difference Decrease Button

Radar Antenna Elevation / Altitude Difference Toggle Button

Radar Scale Selector Lever
- *7/15/35/60 nm*

Radar APS/APC Selection Lever
- ***Pressed UP: APS*** *(Autorisation Pré-Sélectionnée), Pre-selection Authorization. Use of radar-guided missiles is not possible in this mode. APS is a radar mode that allows the pursuit of a target with discontinuous radar information, meaning that the radar pursues a target while maintaining its sweep. This mode is similar to "Track While Scan" (TWS) on modern fighter jets.*
- *Neutral (MIDDLE) position: Radar in search mode.*
- ***Pressed DOWN: APC*** *(Autorisation de Poursuite Continue), Continuous Pursuit Authorization. Radar locks target and allows use of missile guidance with radar. This mode is similar to "Single Target Track" (STT) on modern fighter jets.*



Radar Scan Selector Lever
- *+/- 30 deg*
- *+/- 60 deg*

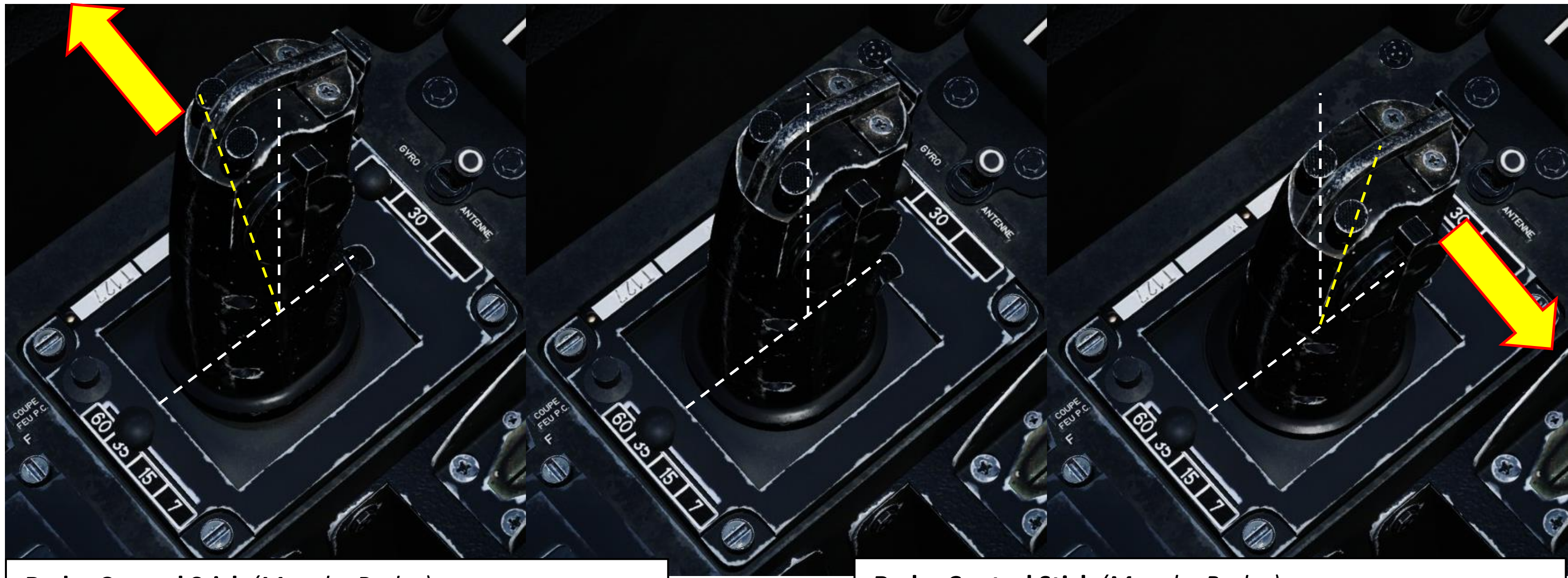
Radar Stick Unlocking Control Lever

Radar Antenna Elevation / Altitude Difference Increase Button

Radar Gain Control Wheel

2 – RADAR INTERFACE
2.3 – Radar Controls

Here is an example of the effect of the Radar Control Stick on the Alidade (Strobe), which is used to lock up targets.



Radar Control Stick *(Manche Radar)*
- *Rolling Left: Moves radar alidade/strobe bearing left*

Radar Control Stick *(Manche Radar)*
- *Rolling Right: Moves radar alidade/strobe bearing right*

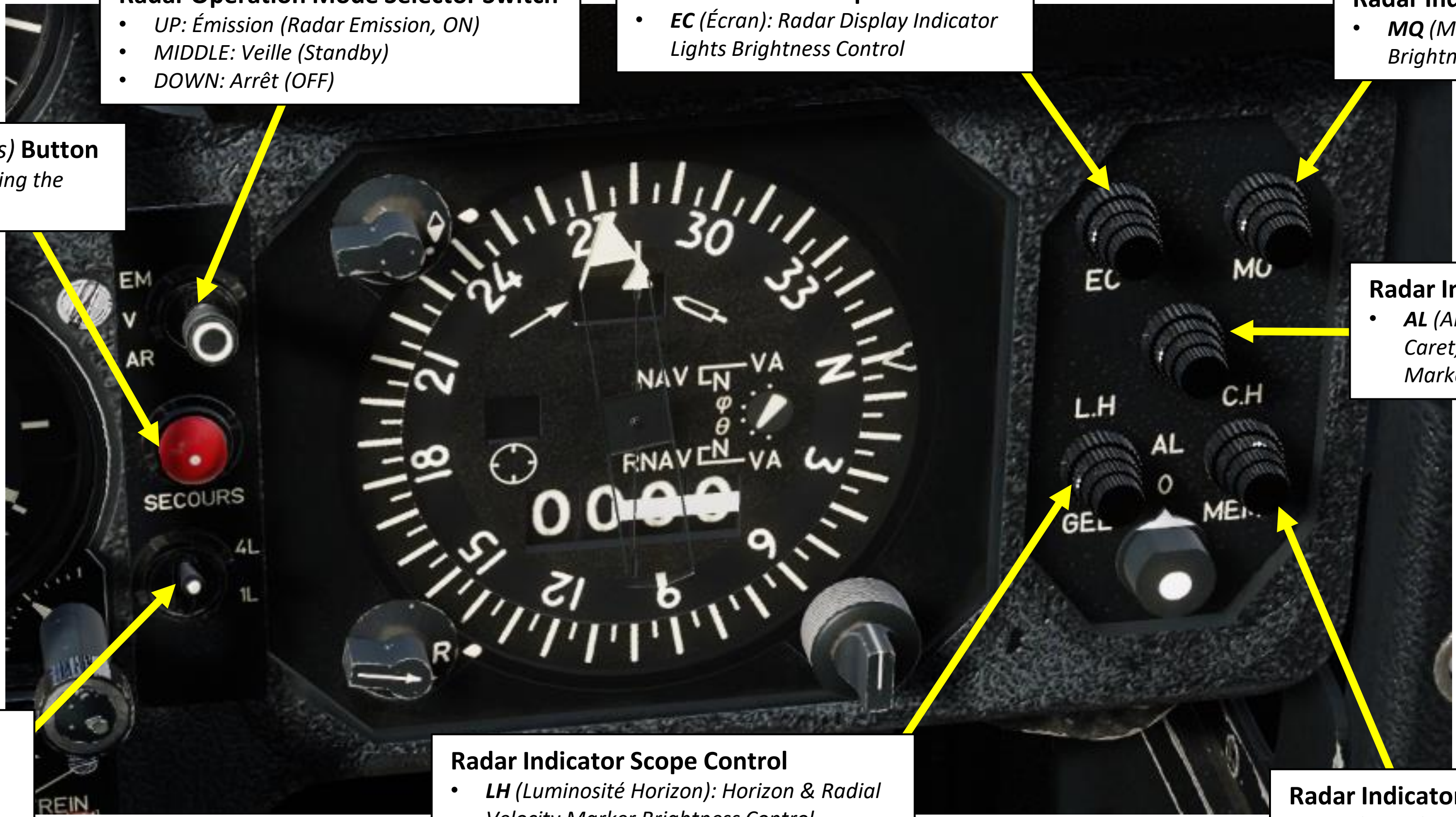
Radar Control Stick *(Manche Radar)*
- *Twist Left: Decreases radar alidade/strobe range*

Radar Control Stick *(Manche Radar)*
- *Twist Right: Increases radar alidade/strobe range*

2 – RADAR INTERFACE
2.3 – Radar Controls

Mirage F1EE Only

The Mirage F1EE radar controls are mainly the same as the Mirage F1CE, except for the following controls.



Radar Operation Mode Selector Switch
- *UP: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *DOWN: Arrêt (OFF)*

Radar Indicator Scope Control
- ***EC** (Écran): Radar Display Indicator Lights Brightness Control*

Radar Indicator Scope Control
- ***MQ** (Marqueurs): Distance Markers Brightness Control*

Radar Emergency Transmission ***(Secours)*** **Button**
- *Used for relaunching transmission or resetting the power supply*

Radar Indicator Scope Control
- ***AL** (Alidade): Strobe (Target Designation Caret, also called "RLO" for Range-Lock-On Marker) Brightness Control*

Radar Bar ***(Lignes)*** **Scan Selector Switch**
- *UP: 4 Lignes (4 Bars)*
- *DOWN: 1 Ligne (1 Bar)*

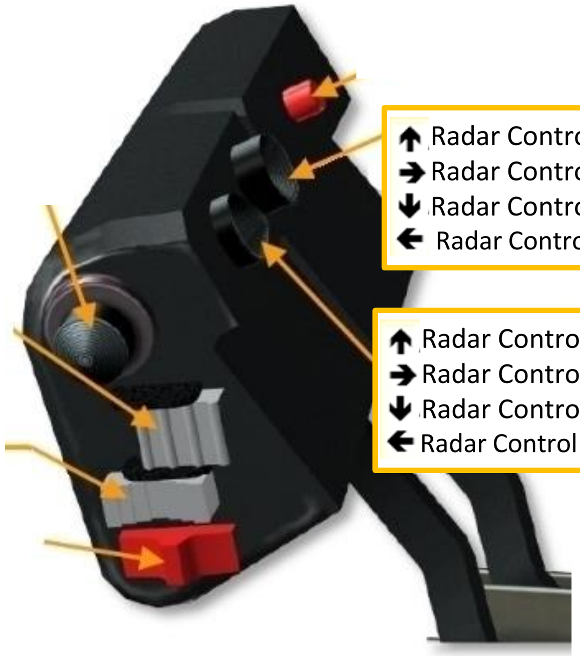
Radar Indicator Scope Control
- ***LH** (Luminosité Horizon): Horizon & Radial Velocity Marker Brightness Control*

Radar Indicator Scope Control
- ***CH** (Contrôle Horizon): Horizon Symbol Vertical Position Control*

2 – RADAR INTERFACE
2.4 – My Radar Controls Setup

🡡 Radar Control Stick APS/APC – Lock-On (APC/DOWN)
🡢 Radar Control Stick Unlocking Control
🡣 Radar Control Stick APS/APC – TWS (APS/UP)
🡠

🡡
🡢 Telemeter/Zone Scanning Switch TEL – UP (LALT+LSHIFT+Z)
🡣
🡠 Telemeter/Zone Scanning Switch BPZ – DOWN
P Telemeter/Zone Scanning Switch CENTER (LALT+LWIN+Z)



🡡 Radar Control Stick – Range/Velocity Control Axis (Y)
🡢 Radar Control Stick – Bearing Control Axis (X)
🡣 Radar Control Stick – Range/Velocity Control Axis (Y)
🡠 Radar Control Stick – Bearing Control Axis (X)

🡡 Radar Control Stick Elevation (Antenna) Increase
🡢 Radar Control Stick Gain Control Wheel Increase
🡣 Radar Control Stick Elevation (Antenna) Decrease
🡠 Radar Control Stick Gain Control Wheel Decrease

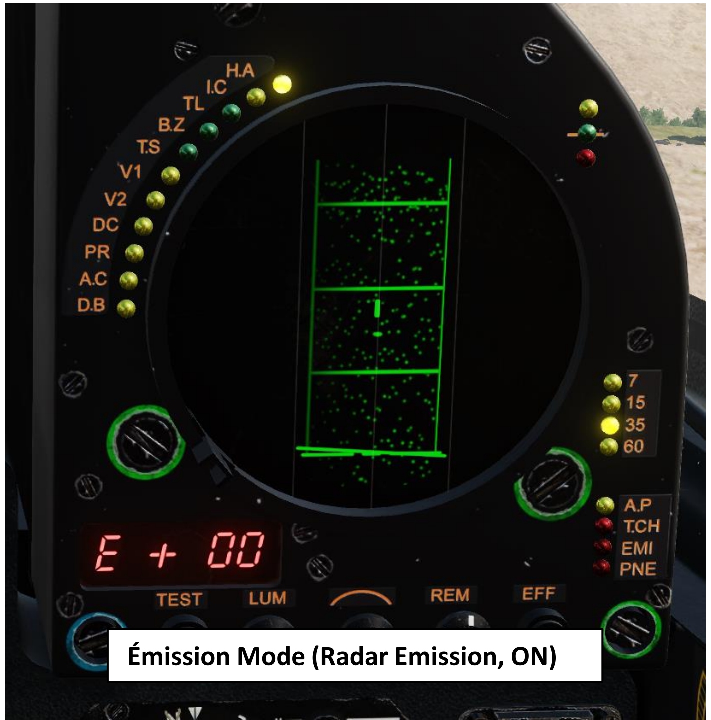
2 – RADAR INTERFACE
2.5 – Radar Power Modes

In practice, the radar requires a warm-up time of 3 minutes. There are three radar power modes:

- ***Arrêt*** **(OFF)**: The radar is not powered.
- ***Veille*** **(Standby):** The radar tubes warm-up sequence starts and lasts for 35 seconds. Once warm-up is complete, Standby Mode does not emit radar waves.
- ***Émission*** **(Radar Emission, ON):** radar is emitting after a 3-minute warm-up period. This is the normal operation mode.

Radar Operation Mode Selector Switch
- *FWD: Émission (Radar Emission, ON)*
- *MIDDLE: Veille (Standby)*
- *AFT: Arrêt (OFF)*

Arrêt Mode (OFF)



Émission Mode (Radar Emission, ON)

3 – RADAR AIR-TO-AIR MODES
3.1 – Radar Air-to-Air Modes Overview

Here is an overview of various air-to-air radar modes.

Air-to-Air Interception Search Modes

- **HA *(Haute Altitude):* High Altitude Interception**
    - When in High Altitude mode, the radar searches for a target in either a 60 or 30 deg azimuth scanning mode. In this mode, the radar has a maximum detection range of 60 nm.
    - This mode has a longer pulse duration than Short Pulse mode. A longer pulse provides slightly greater detection range, but to the detriment of target position accuracy.

- **IC *(Impulsions Courtes):* Short Pulse Interception**
    - When in Short Pulse mode, the radar functions very similarly to the High Altitude mode. Short Pulse mode searches for a target in either a 60 or 30 deg azimuth scanning mode. In this mode, the radar has a maximum detection range of 60 nm.
    - This mode has a shorter pulse duration than High Altitude mode. A shorter pulse provides slightly lesser detection range, but it increases target position accuracy.

Air-to-Air Close Combat Modes

- **TL *(Télémétrie):* Air-to-Air Mode**
    - When in TL mode, the radar can lock automatically a target at a distance between 400 m and 7 km. This function has priority over all other radar functions. Gain control is automatic.
    - In this scan mode, the antenna scans a 5° x 5° square. The area explored represents a 9.5° x 9.5°square.
    - Only the 7 nm range scale is available.

- **BZ *(Balayage par Zone):* Area Scanning**
    - When in BZ mode, the radar scans a 20° x 20° area, which can be slewed with the Radar Control Stick +/- 15 deg about the centerline. This mode can lock automatically a target at a distance between 400 m and 7 km. This function has priority over all other radar functions. Gain control is automatic.
    - In this scan mode, the antenna is referenced in relation to the aircraft, and is therefore not stabilized in roll and pitch. BZ searches in an area of 20° in elevation and 20° in bearing.
    - Only the 7 nm range scale is available.

3 – RADAR AIR-TO-AIR MODES
3.1 – Radar Air-to-Air Modes Overview

Here is an overview of various air-to-air radar modes.

Air-to-Air Other Modes & Devices

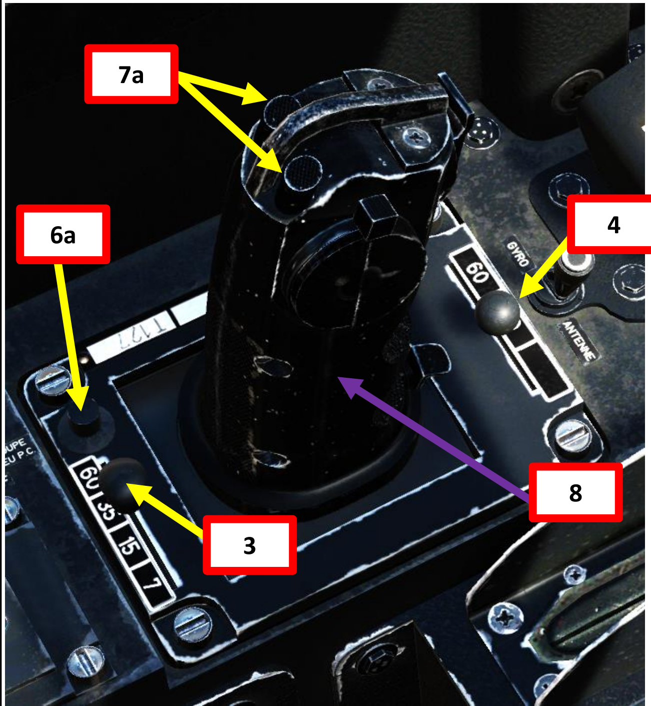
- **DATEP (Interference Echo Attenuation Device)**
  - The DATEP is used in air-to-air modes in conjunction with the HA, lC, TL, and BZ modes.
  - The purpose of the device is to limit the harmful effects of diffuse echoes of various origins (clouds, ground clutter, sea return, etc.) by providing a better contrast of the useful echoes on the scope during search, and avoiding inopportune engagement of parasitic echoes during tracking.
  - In HA and lC, on the 15 and 7 nm scales, the DATEP is in service only when the gain control is maximum.

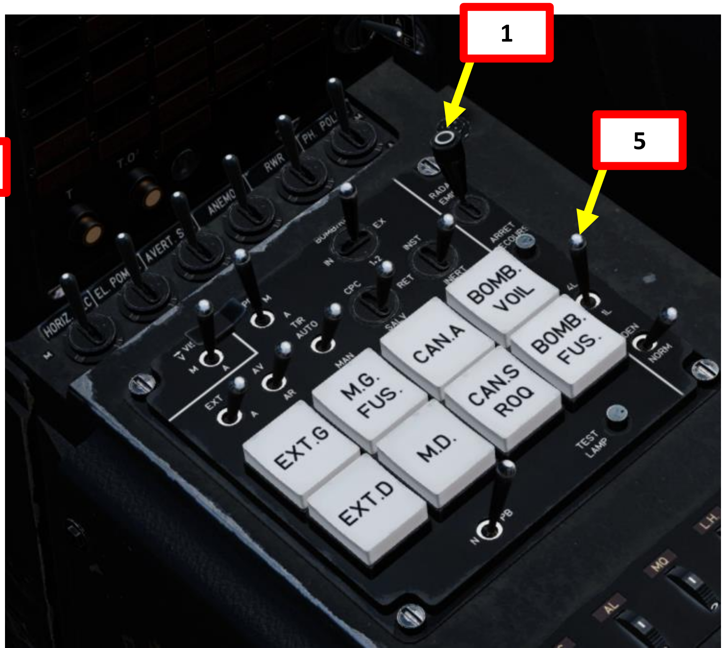
- **DB *(Détection Brouilleur):* Jammer Detection**
  - **Not functional in the Mirage F1CE/F1EE/F1BE variant.**

3 – RADAR AIR-TO-AIR MODES
3.2 – Air-to-Air Interception Search Modes
3.2.1 – HA (*Haute Altitude*): High Altitude Interception

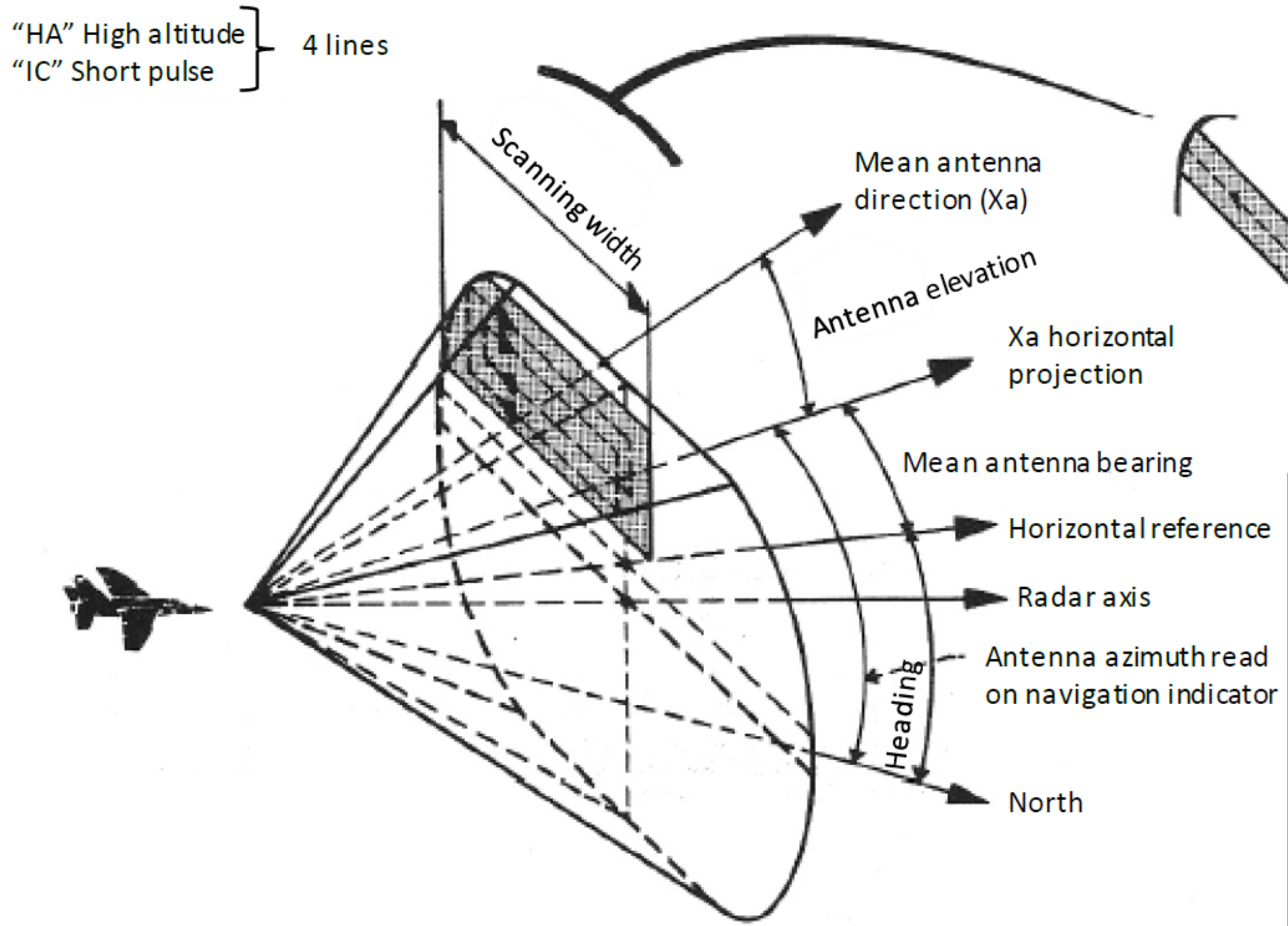
HA is used as one of the two primary search modes. This mode has a greater range than IC.

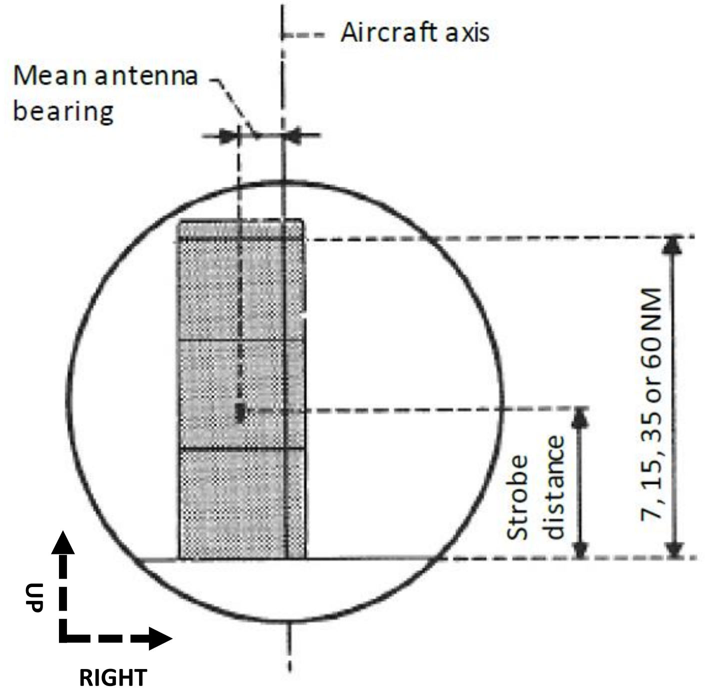
1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Turn Radar Function Selector Knob until HA radar function light illuminates.
3. Set Radar Scale Selector Lever – As desired (7/15/35/60 nm).
4. Set Radar Scan Selector Lever – As desired (+/- 30 or +/- 60 deg).
5. Set Radar Bar (Lignes) Scan Selector Switch – 4 Bars.
6. Toggle Radar Antenna Elevation / Altitude Difference mode – As desired.
    - "E" is for "Antenna Elevation Angle", "D" is for "Altitude Difference".
7. Use the Radar Antenna Elevation / Altitude Difference Increase or Decrease Button to tilt the radar antenna – As desired. This radar function is useful if a ground controller gives you a target's altitude.
8. Use Radar Control Stick to move radar alidade/strobe.

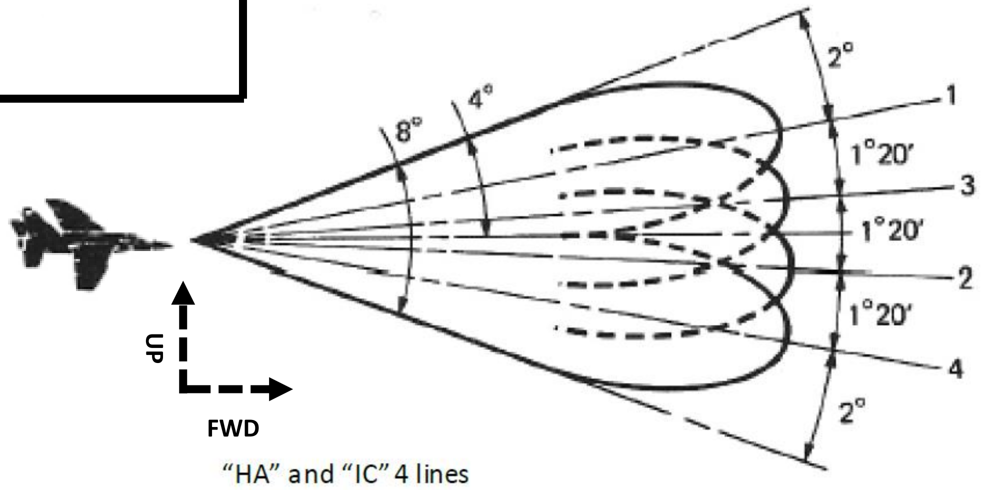




3 – RADAR AIR-TO-AIR MODES
3.2 – Air-to-Air Interception Search Modes
3.2.1 – HA (*Haute Altitude*): High Altitude Interception



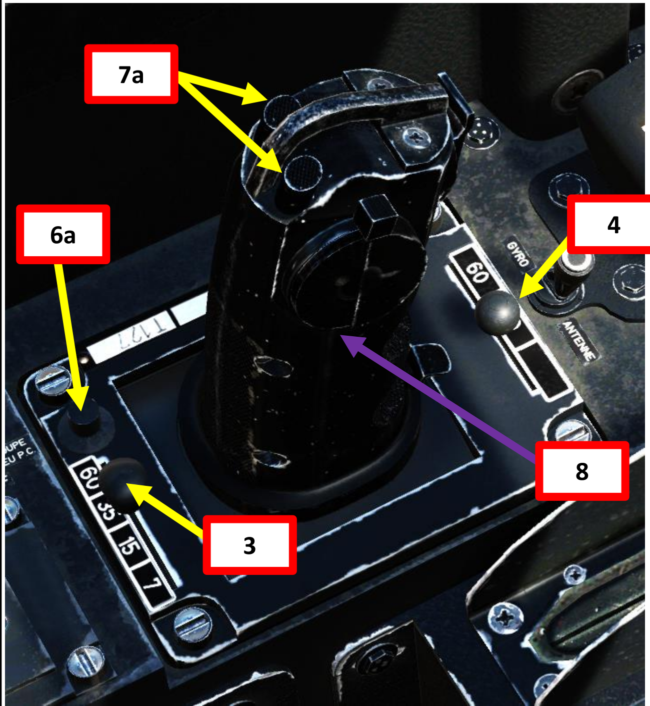


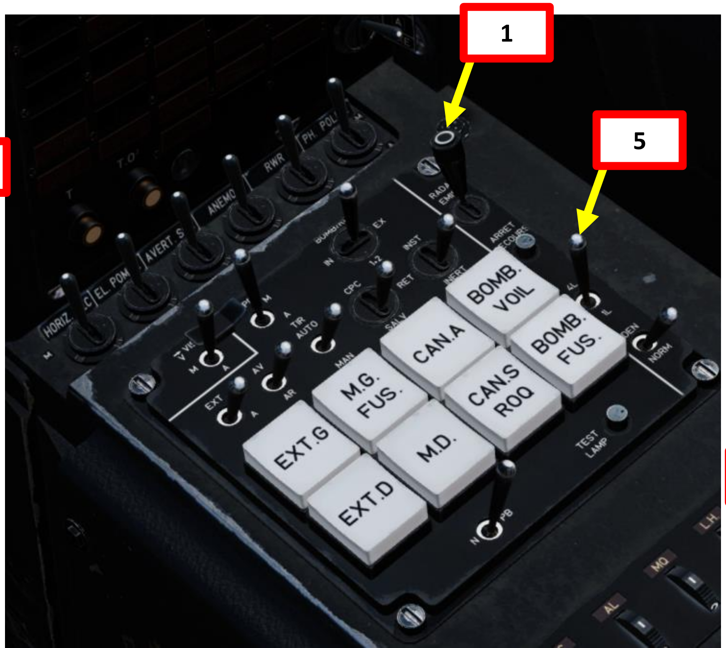


3 – RADAR AIR-TO-AIR MODES
3.2 – Air-to-Air Interception Search Modes
3.2.2 – IC (*Impulsions Courtes*): Short Pulse Interception

IC is used as one of the two primary search modes. This mode has a lesser range than HA.

1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Turn Radar Function Selector Knob until IC radar function light illuminates.
3. Set Radar Scale Selector Lever – As desired (7/15/35/60 nm).
4. Set Radar Scan Selector Lever – As desired (+/- 30 or +/- 60 deg).
5. Set Radar Bar (Lignes) Scan Selector Switch – 4 Bars.
6. Toggle Radar Antenna Elevation / Altitude Difference mode – As desired.
    - "E" is for "Antenna Elevation Angle", "D" is for "Altitude Difference".
7. Use the Radar Antenna Elevation / Altitude Difference Increase or Decrease Button to tilt the radar antenna – As desired. This radar function is useful if a ground controller gives you a target's altitude.
8. Use Radar Control Stick to move radar alidade/strobe.





3 – RADAR AIR-TO-AIR MODES
3.3 – Air-to-Air Close Combat Modes
3.3.1 – TL (*Télémétrie*): Air-to-Air Mode

The TL radar mode is used for close combat and allows the pilot to quickly lock a target roughly 7 km in front of him.

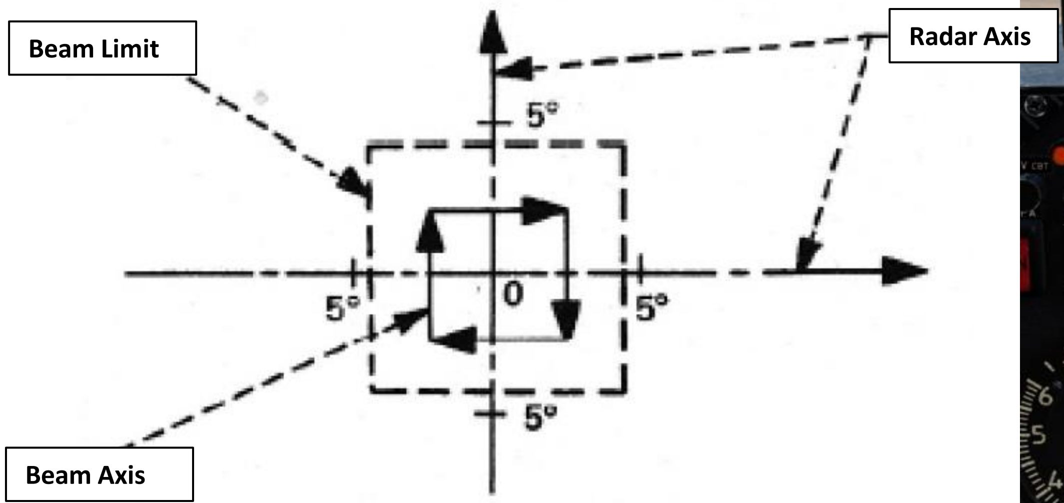
1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch – UP (TELEMETER).
3. Confirm TL radar function light illuminates. All other radar functions are overridden.
4. In TL, only the 7 nm range scale is available.
5. Gain control is automatic.

Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

2

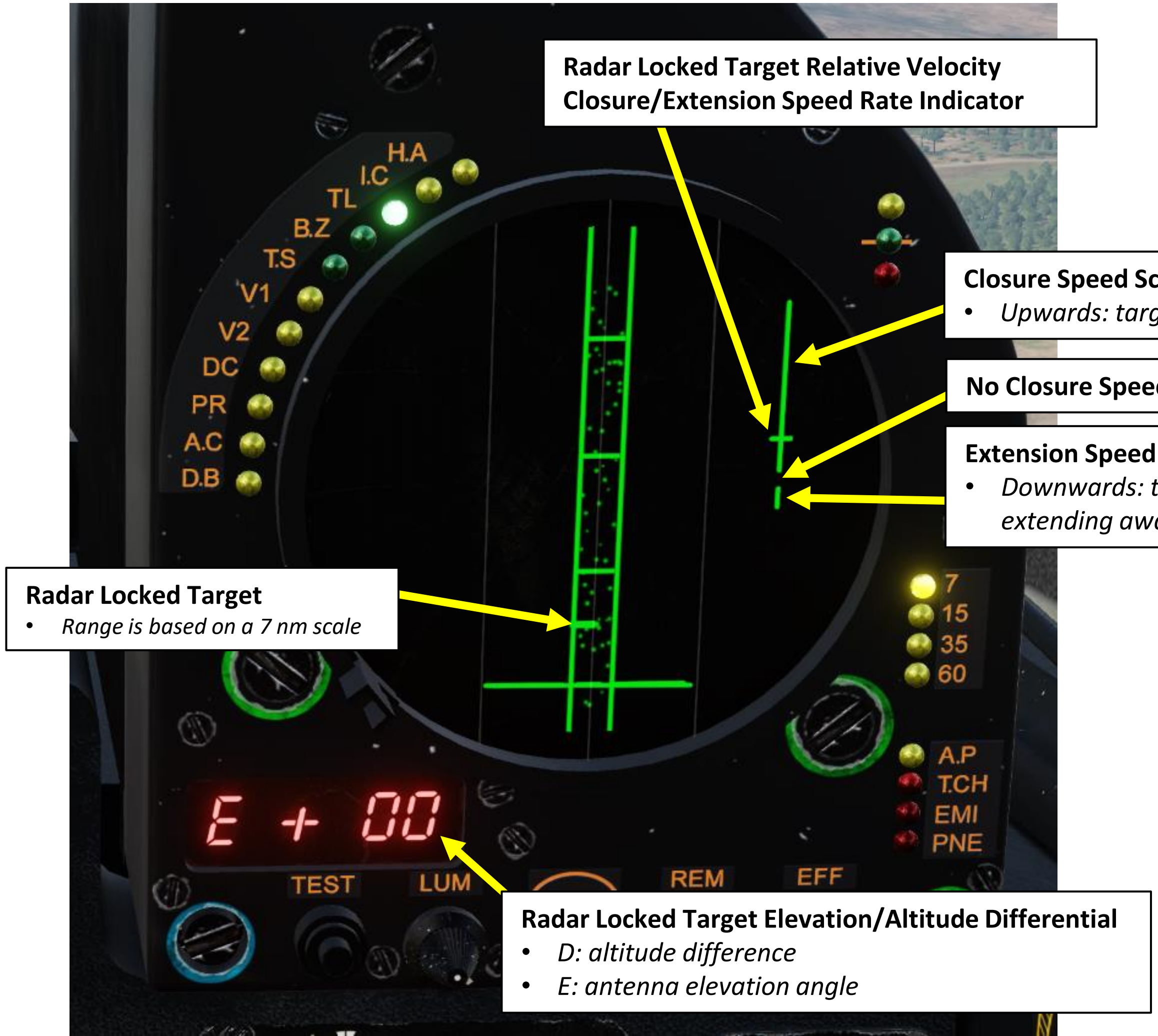
3 – RADAR AIR-TO-AIR MODES
3.3 – Air-to-Air Close Combat Modes
3.3.1 – TL (*Télémétrie*): Air-to-Air Mode

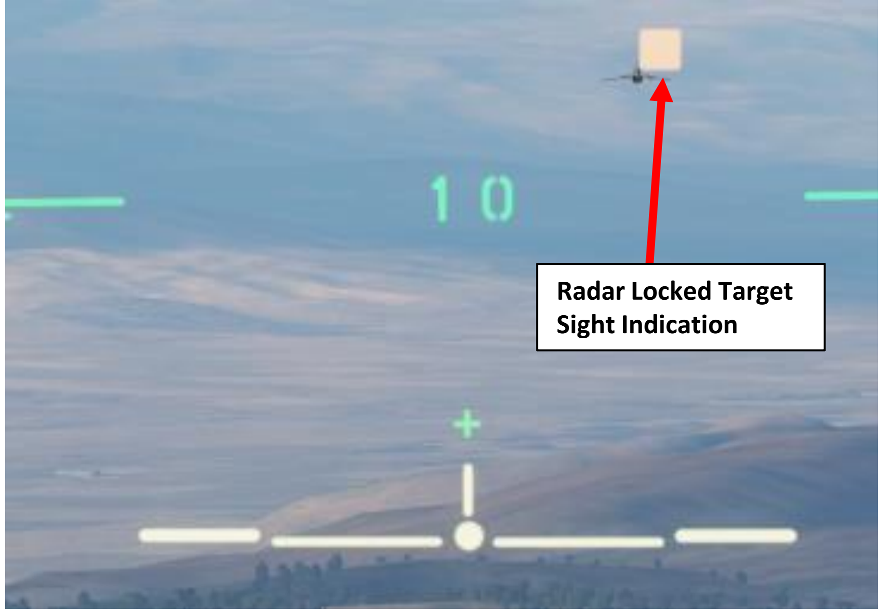
6. The radar antenna scans a 5° x 5° square. The scanned area should roughly fit within the sight glass.



3 – RADAR AIR-TO-AIR MODES
3.3 – Air-to-Air Close Combat Modes
3.3.1 – TL (*Télémétrie*): Air-to-Air Mode

7. When in TL mode, the radar will automatically lock a target at a distance between 400 m and 7 km.
8. Once radar lock is achieved, the radar scope will display target range and velocity closure rate information. Additionally, a square on the sight glass will indicate the position of the target.
9. To exit Telemeter Mode, set Radar Telemeter / Area Zone Scanning Selector Switch – MIDDLE position (OFF).



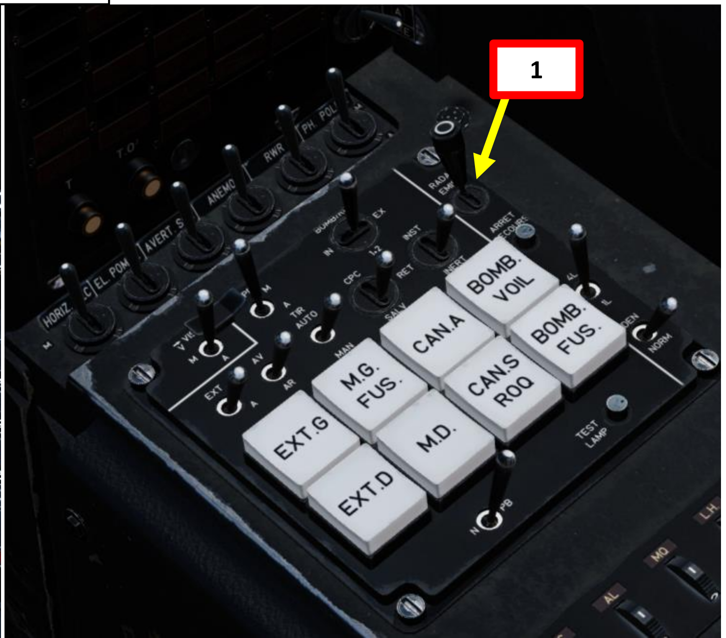


3 – RADAR AIR-TO-AIR MODES
3.3 – Air-to-Air Close Combat Modes
3.3.2 – BZ (*Balayage par Zone*): Area Scanning

The BZ radar mode is used for close combat and allows the pilot to quickly lock a target roughly 7 km in front of him by slewing a 20 x 20 deg scanning area with the Radar Control Stick.

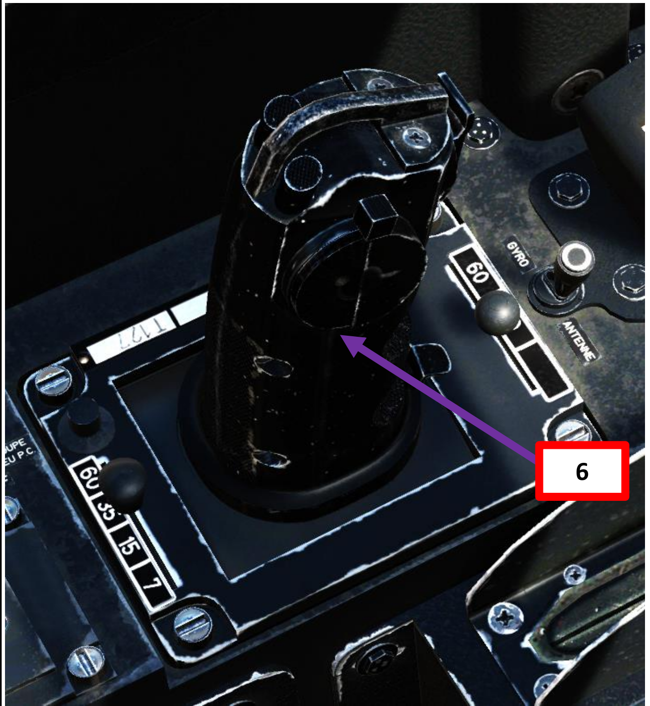
1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch – DOWN (AREA/ZONE SCANNING).
3. Confirm BZ radar function light illuminates. All other radar functions are overridden.
4. In BZ, only the 7 nm range scale is available.
5. Gain control is automatic.

Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

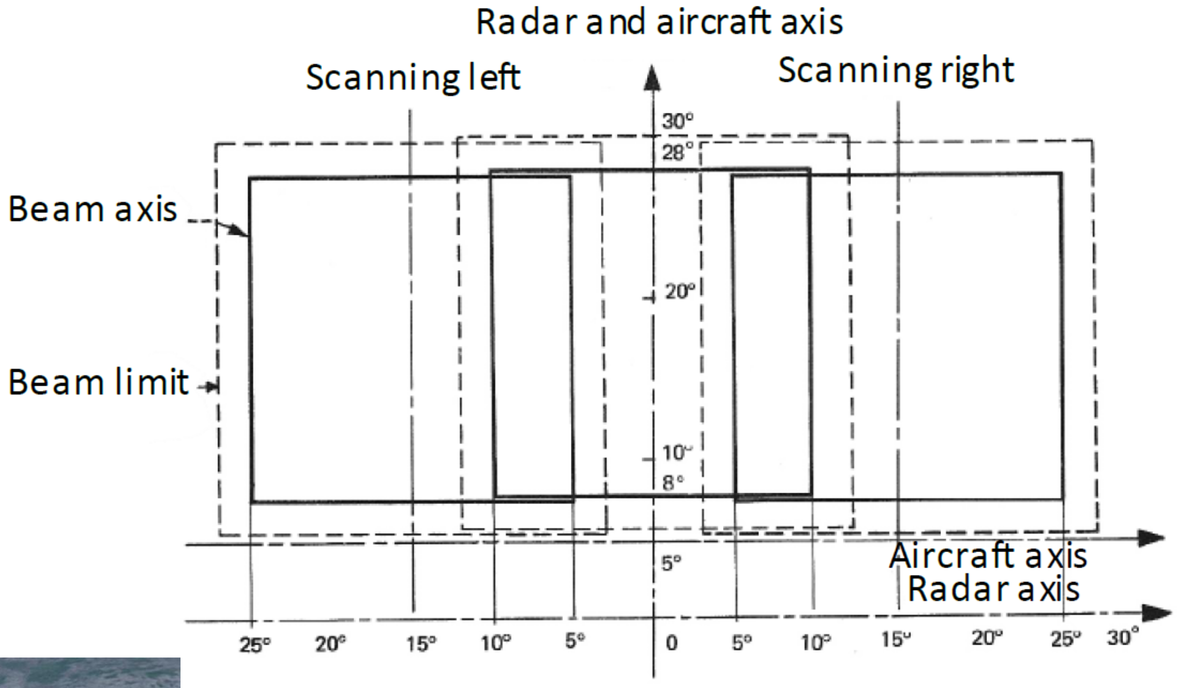


3 – RADAR AIR-TO-AIR MODES
3.3 – Air-to-Air Close Combat Modes
3.3.2 – BZ (*Balayage par Zone*): Area Scanning

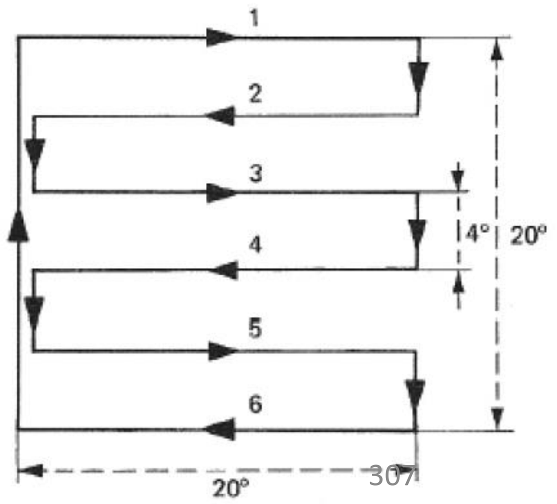
6. The radar antenna scans a 20° x 20° area, which can be slewed with the Radar Control Stick +/- 15 deg about the centerline. The antenna is referenced in relation to the aircraft, and is therefore not stabilized in roll and pitch.



Covered Zone

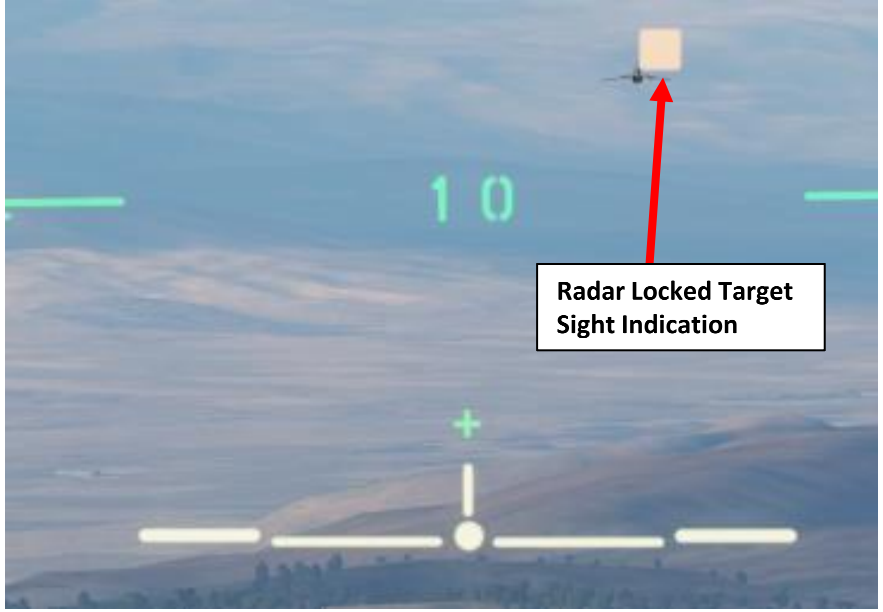


Scan Shape



3 – RADAR AIR-TO-AIR MODES
3.3 – Air-to-Air Close Combat Modes
3.3.2 – BZ (*Balayage par Zone*): Area Scanning

7. When in BZ mode, the radar will automatically lock a target at a distance between 400 m and 7 km.
8. Once radar lock is achieved, the radar scope will display target range and velocity closure rate information. Additionally, a square on the sight glass will indicate the position of the target.
9. To exit Area Scanning Mode, set Radar Telemeter / Area Zone Scanning Selector Switch – MIDDLE position (OFF).



3 – RADAR AIR-TO-AIR MODES
3.4 – Air-to-Air Other Modes
3.4.1 – DB (*Détection Brouilleur*): Jammer Detection

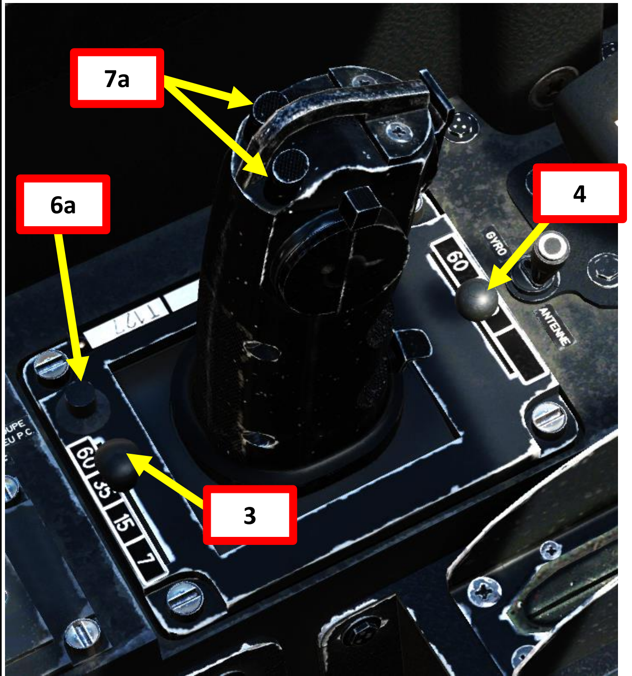
This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.

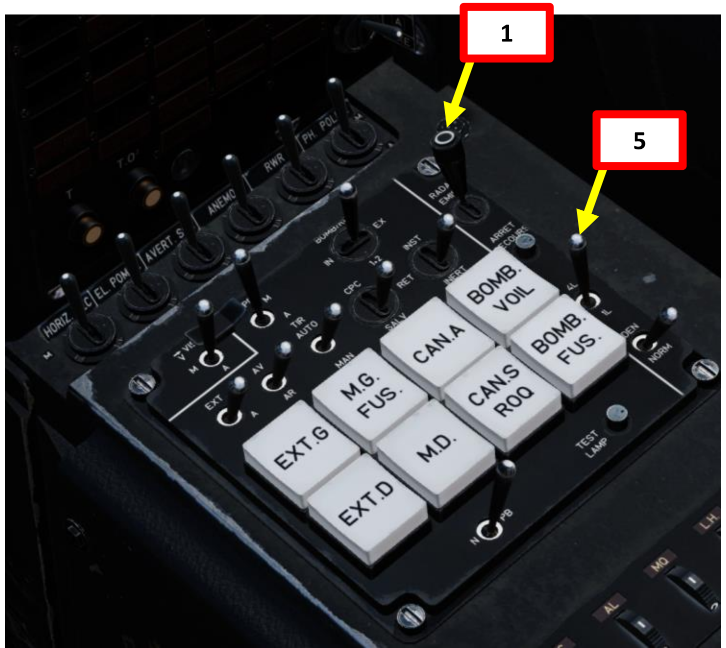
3 – RADAR AIR-TO-AIR MODES
3.5 – Radar Operation Tutorial
3.5.1 – Manual Radar Lock

A – APC (Autorisation de Poursuite Continue/Continuous Pursuit Authorization)

APC is a radar mode that locks a target and allows use of missile guidance with radar. This mode is similar to "Single Target Track" (STT) on modern fighter jets.

1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Turn Radar Function Selector Knob until HA (or IC) radar function light illuminates.
3. Set Radar Scale Selector Lever – As desired (7/15/35/60 nm).
4. Set Radar Scan Selector Lever – As desired (+/- 30 or +/- 60 deg).
5. Set Radar Bar (Lignes) Scan Selector Switch – 4 Bars.
6. Toggle Radar Antenna Elevation / Altitude Difference mode – As desired.
    - "E" is for "Antenna Elevation Angle", "D" is for "Altitude Difference".
7. Use the Radar Antenna Elevation / Altitude Difference Increase or Decrease Button to tilt the radar antenna – As desired. This radar function is useful if a ground controller gives you a target's altitude.





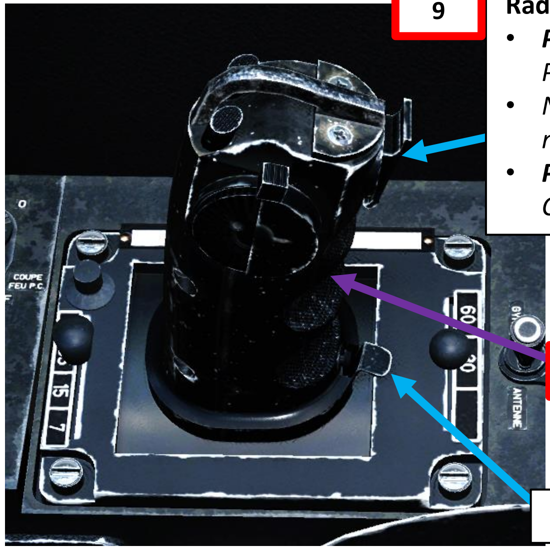
3 – RADAR AIR-TO-AIR MODES

3.5 – Radar Operation Tutorial

3.5.1 – Manual Radar Lock

A – APC (Autorisation de Poursuite Continue/Continuous Pursuit Authorization)

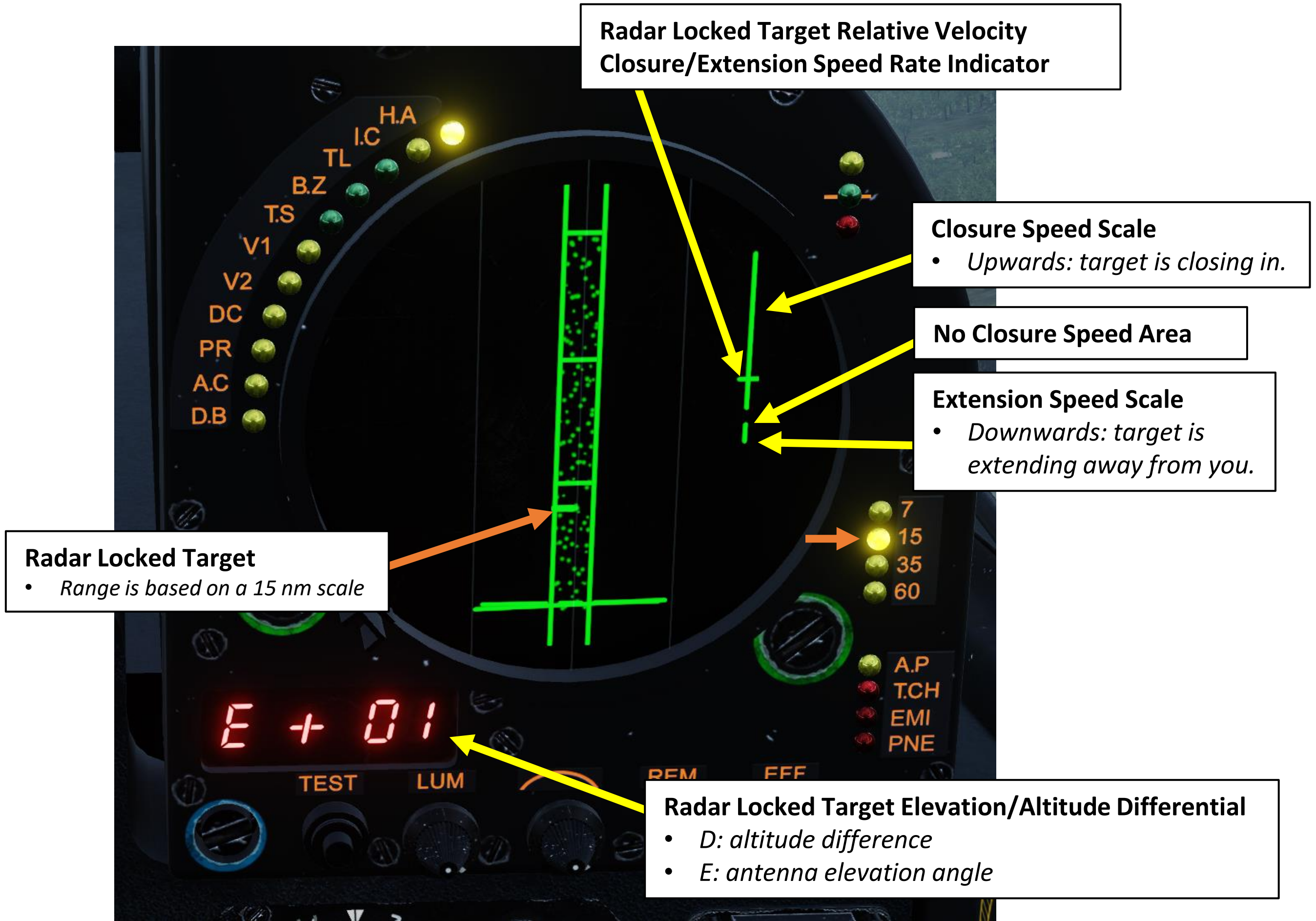
8. Use Radar Control Stick to move radar alidade/strobe over the target.
9. Once target is closer than 35 nm, press the Radar APS/APC Selection Lever DOWN (APC, Lock-On) to attempt a radar lock.
    - Note: To unlock target, press the Radar Stick Unlocking Control Lever.



3 – RADAR AIR-TO-AIR MODES
3.5 – Radar Operation Tutorial
3.5.1 – Manual Radar Lock

A – APC (Autorisation de Poursuite Continue/Continuous Pursuit Authorization)

10. Once radar lock is achieved, the radar switches to automatic tracking and the pilot can release the Radar APS/APC Selection Lever.
11. The radar scope will display target range and velocity closure rate information. Additionally, a square on the sight glass will indicate the position of the target.
12. If desired, you can adjust the Radar Scale Selector Lever to have a better view of the target range.



3 – RADAR AIR-TO-AIR MODES
3.5 – Radar Operation Tutorial
3.5.1 – Manual Radar Lock
B – APS (Autorisation Pré-Sélectionnée/Pre-Selection Authorization)

APS is a radar mode that allows the pursuit of a target with discontinuous radar information, meaning that the radar pursues a target while maintaining its sweep. This mode is similar to "Track While Scan" (TWS) on modern fighter jets. Use of radar-guided missiles is not possible in this mode.

Not implemented yet.

3 – RADAR AIR-TO-AIR MODES
3.5 – Radar Operation Tutorial
3.5.2 – Automatic Radar Lock

The radar can automatically lock a target when in either TL or BZ Close Combat Mode.

1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch – UP (TELEMETER) or DOWN (AREA/ZONE SCANNING).
3. Confirm TL (or BZ) radar function light illuminates. All other radar functions are overridden.
4. In TL or BZ, only the 7 nm range scale is available.
5. Gain control is automatic.

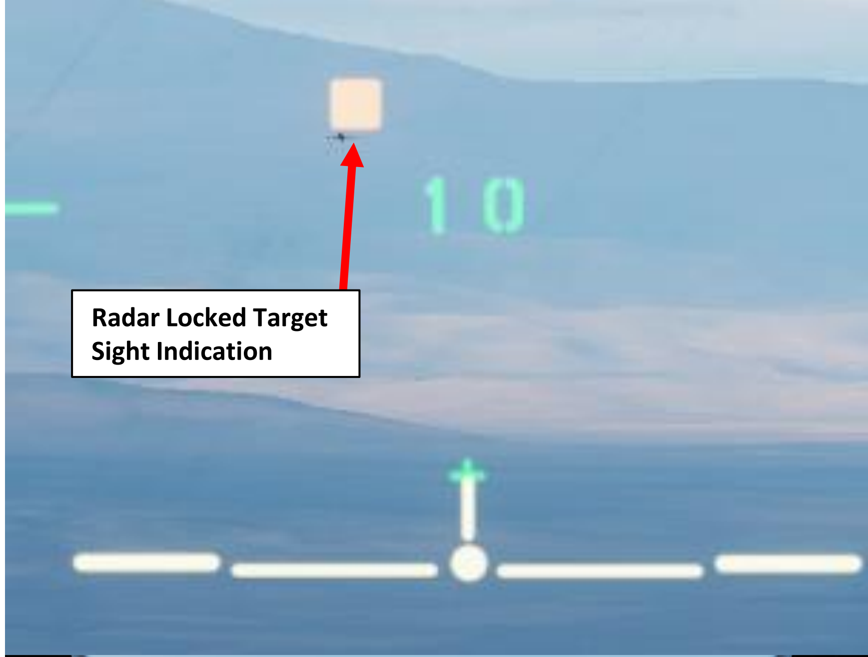
Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

3 – RADAR AIR-TO-AIR MODES
3.5 – Radar Operation Tutorial
3.5.2 – Automatic Radar Lock

6. Steer the aircraft to have the target roughly in the middle of your sight glass. At these ranges, the target is usually acquired visually.
7. The radar will automatically lock a target at a distance between 400 m and 7 km.

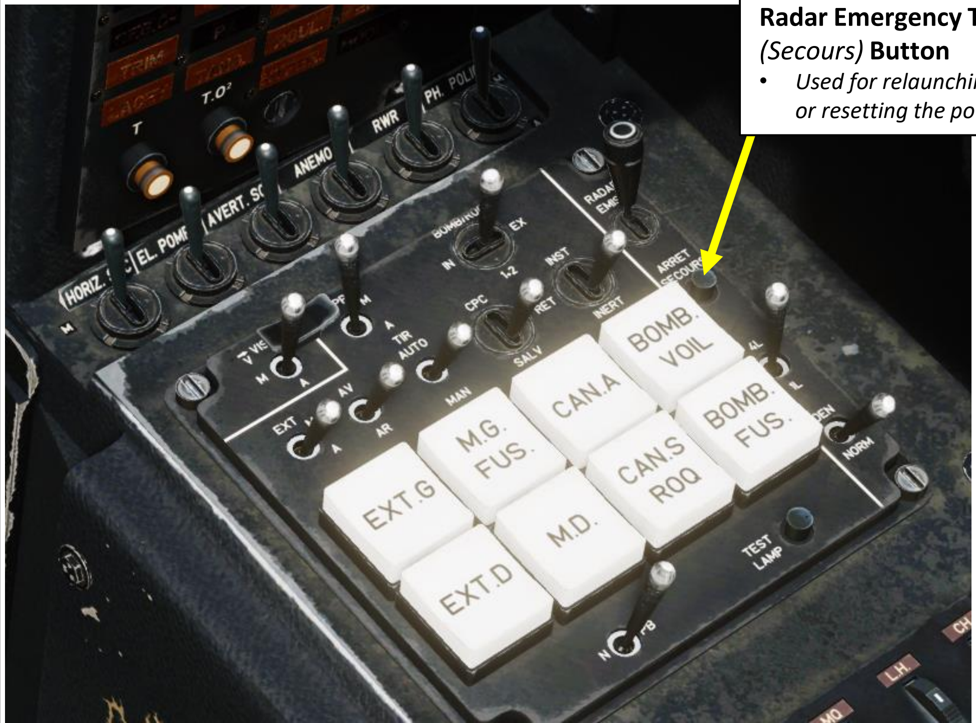
3 – RADAR AIR-TO-AIR MODES
3.5 – Radar Operation Tutorial
3.5.2 – Automatic Radar Lock

8. Once radar lock is achieved, the radar scope will display target range and velocity closure rate information. Additionally, a square on the sight glass will indicate the position of the target.
9. To exit Telemeter or Area/Zone Scanning Mode, set Radar Telemeter / Area Zone Scanning Selector Switch – MIDDLE position (OFF).



3 – RADAR AIR-TO-AIR MODES
3.6 – Radar Emergency *(Secours)* Button

If the "PNE" (*Panne*, Radar Failure) or the "EMI" (No Radar Emission) warning lights illuminate, you can press the **Radar Emergency Transmission** *(Secours)* **Button** to immediately reconnect the power supply and resume radar transmission. It is recommended to switch to IC Radar Mode for resetting.



Radar Emergency Transmission *(Secours)* **Button**
- *Used for relaunching transmission or resetting the power supply*

IC Radar Mode Selected

Radar Status Lights
- *AP (Amplificateur Paramétrique): Parametric amplifier disabled*
- *TCH (Trop Chaud): Radar Overheat*
- *EMI: No Radar Emission*
- *PNE (Panne): Radar Failure*

Radar Function Selector Knob

3 – RADAR AIR-TO-AIR MODES
3.7 – Radar & IFF (Identify-Friend-or-Foe)

The Mirage F1 has no interrogator, therefore you cannot send interrogation signals to other aircraft to see whether they are friendly or not. This means that locking a radar target will give you information on its location… but it won't tell you if you should shoot at it or not. Identifying a target is of prime importance to avoid "friendly fire". To do so, you still have a few tools at your disposal:

- Surveillance aircraft (AWACS, Airborne Warning and Control System) can give you a picture and tell you if an aircraft is friendly or not.
- Ground radar and EWR (Early Warning Radar) stations can also give you a picture.
- Friendly aircraft equipped with IFF interrogators can relay their findings via the radio.
- If no friendly assets are available, you will have to verify visually with your good old Mark I Eyeball.

4 – RADAR AIR-TO-GROUND MODES

4.1 – Radar Air-to-Ground Modes Overview

Radar Air-to-Ground Modes

- **TS *(Télémétrie Air-Sol):* Air-to-Ground Ranging Mode**
  - **This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.**

- **V1 *(Visualisation Terrain 1):* Ground Visualization Mode 1**
  - The indicator scope presents the radar map of the terrain in front of the aircraft. When viewing the ground, the electrical beam of the antenna explores the terrain in front of the aircraft by sweeping 60° or 30° on either side of the radar axis. This scan can be in two or one elevation lines depending on the scale selection.
  - Four distance scales are available: 60, 35, 15 and 7 nm.
  - The radar echo density is changed using manual gain control.

- **V2 *(Visualisation Terrain 2):* Ground Visualization Mode 2**
  - **This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.**

- **DC *(Découpe Terrain):* Iso-Altitude Cutout / Ground Avoidance**
  - **This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.**

- **PR *(Percée Radar):* Blind Penetration**
  - **This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.**

- **AC*:* Anti-Collision**
  - **This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.**

4 – RADAR AIR-TO-GROUND MODES

4.2 – TS (*Télémétrie Air-Sol*): Air-to-Ground Ranging Mode

This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.

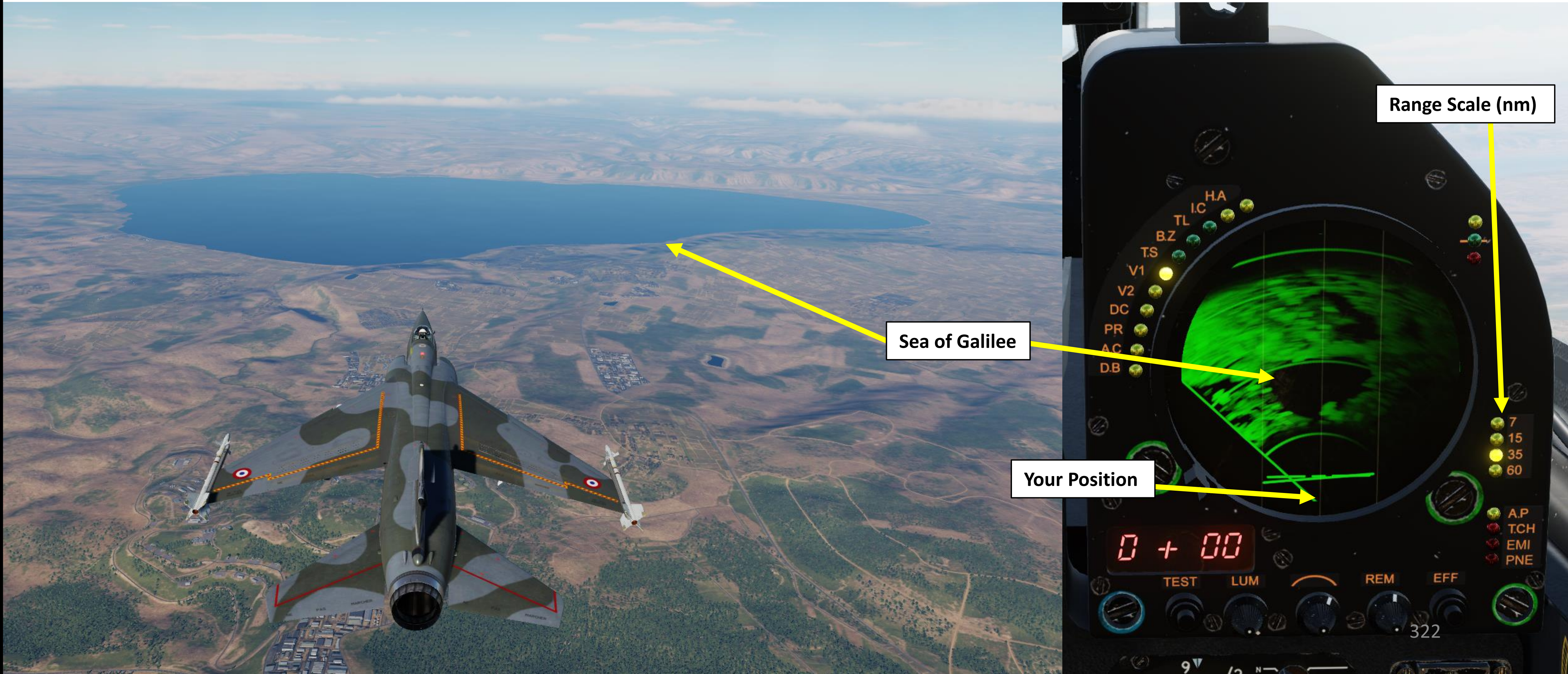
4 – RADAR AIR-TO-GROUND MODES
4.3 – V1 (*Visualisation Terrain 1*): Ground Visualization Mode 1

The V1 ground visualization mode is a PPI (Plan Position Indicator) 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.

Note: V1 mode does not have ground target designation capabilities. It is used strictly as a means to see the terrain topography and facilitate navigation.

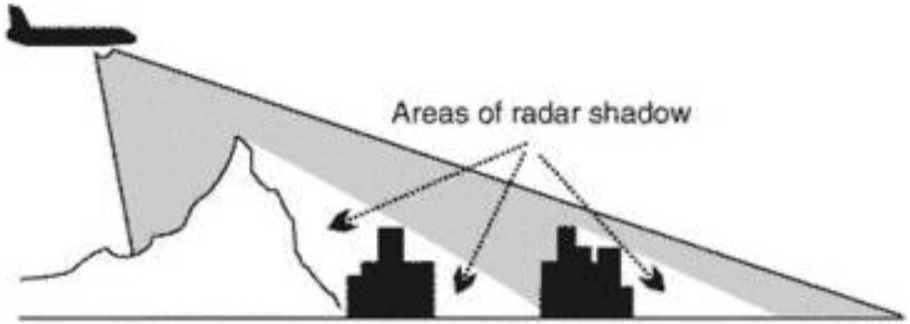
4 – RADAR AIR-TO-GROUND MODES
4.3 – V1 (*Visualisation Terrain 1*): Ground Visualization Mode 1

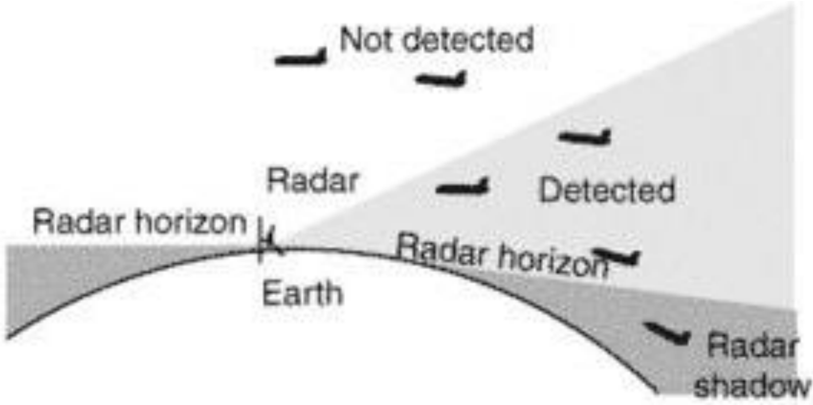
Regions that do not provide radar returns are black (such as water). The bright/green regions are generally man-made structures (buildings, power lines, roads, etc.) or mountains.



4 – RADAR AIR-TO-GROUND MODES
4.3 – V1 (*Visualisation Terrain 1*): Ground Visualization Mode 1

Some of the black areas on the V1 scope are part of the radar shadow, which are regions behind hills or mountains that the radar cannot see behind.

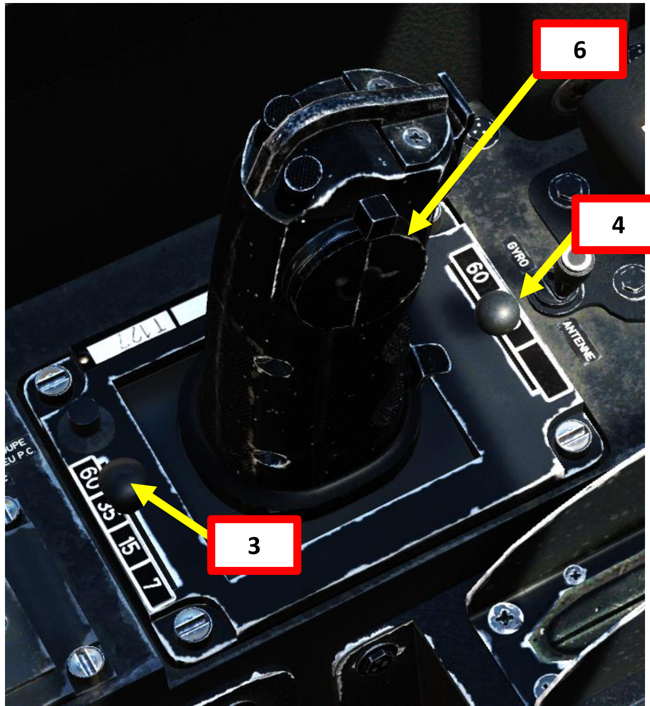




4 – RADAR AIR-TO-GROUND MODES
4.3 – V1 (*Visualisation Terrain 1*): Ground Visualization Mode 1

To use the radar's V1 mode:

1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Turn Radar Function Selector Knob until V1 radar function light illuminates.
3. Set Radar Scale Selector Lever – As desired (7/15/35/60 nm).
4. Set Radar Scan Selector Lever – As desired (+/- 30 or +/- 60 deg).
5. Adjust Radar Storage/Persistence Adjustment *(Rémanence)* – As desired. This will affect the fading rate of the image on the scope.
6. Adjust Gain using the Radar Gain Control Wheel – As desired.



4 – RADAR AIR-TO-GROUND MODES

4.4 – V2 (*Visualisation Terrain 2*): Ground Visualization Mode 2

This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.

4 – RADAR AIR-TO-GROUND MODES

4.5 – DC (*Découpe Terrain*): Iso-Altitude Cutout / Ground Avoidance

This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.

4 – RADAR AIR-TO-GROUND MODES
4.6 – PR (*Percée Radar*): Blind Penetration

This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.

4 – RADAR AIR-TO-GROUND MODES
4.7 – AC (Anti-Collision)

This mode is not functional in the Mirage F1CE/F1EE/F1BE variant.

5 – 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 (Super S530F + R530F + 27R/ER + AIM-7)
- FOX 2: heat-seeking infrared missile (R550 Magic I + R550 Magic II + 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

FOX1
Semi-active radar homing missile
e.g. AIM-7, AA-10,
Super S530F, R530F

FOX2
Passive IR homing missile
e.g. AIM-9, AA-11, IRIS-T,
R550 Magic I, R550 Magic II

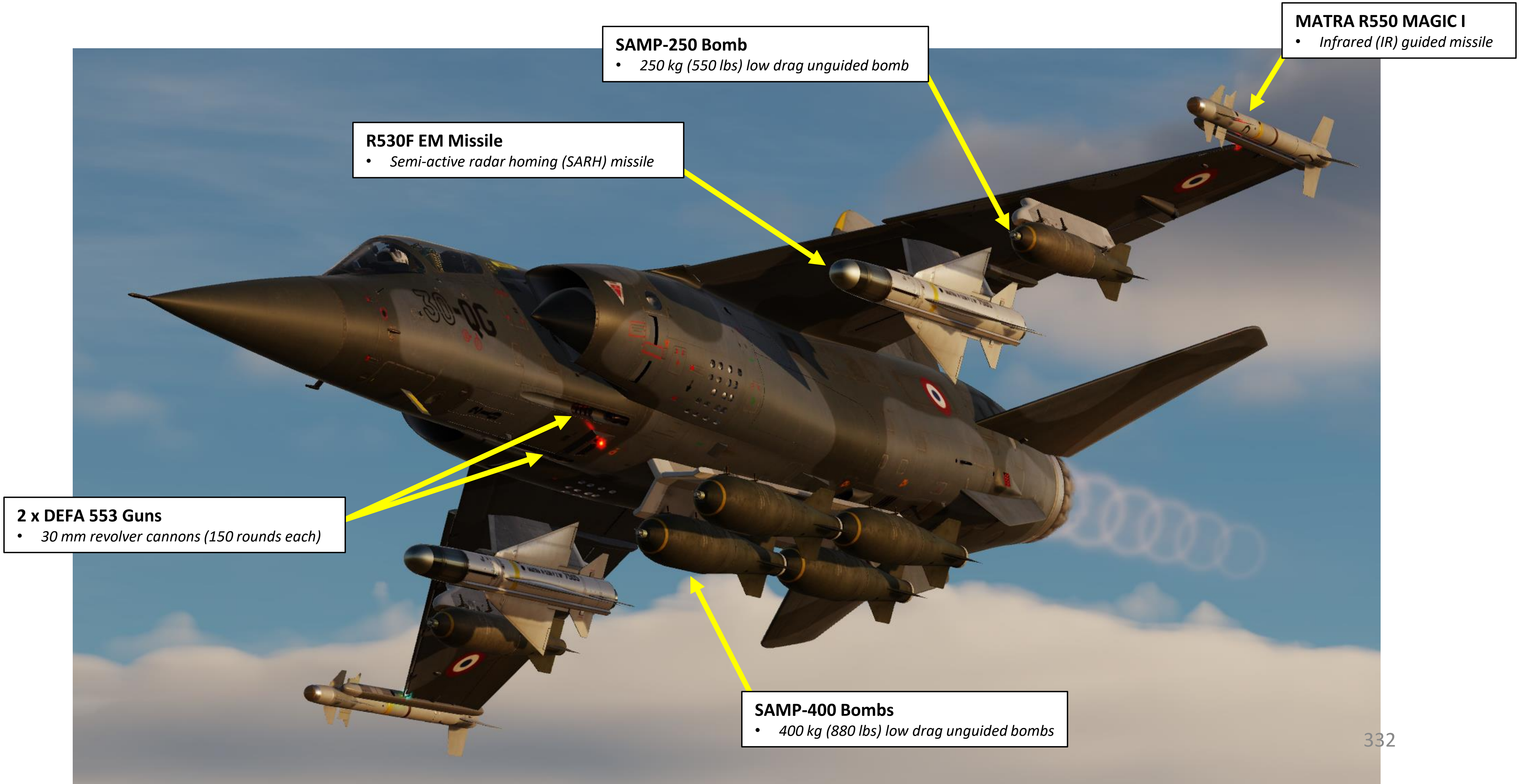
FOX3
Active radar homing missile IR homing missile
e.g. AIM-120, AA-12, Meteor

No equipment for Mirage F1

SECTION STRUCTURE

1 – INTRODUCTION
1.1 – Armament Overview

The Mirage F1 can equip SARH (Semi-Active Radar Homing) and IR (Infrared Seeker) missiles. It has two 30 mm cannons as well, which can be used for air-to-air and air-to-ground engagements. Rockets and bombs are employed for most air-to-ground attacks. The Mirage can also use Durandal anti-runway bombs and Belouga anti-runway cluster bombs.



1 – INTRODUCTION

1.1 – Armament Overview

MISSILES		
WEAPON	STATION	TYPE
MATRA R550 MAGIC I	Outer	Infrared (IR) guided missile, rear aspect. MATRA stands for the "Mécanique Aviation Traction"company.
MATRA R550 MAGIC II	Outer	Infrared (IR) guided missile, all aspect.
MATRA R530F IR	Inner & Fuselage	Infrared (IR) guided missile, rear aspect.
AIM-9B	Outer	Infrared (IR) guided missile, rear aspect.
AIM-9J	Outer	Infrared (IR) guided missile, rear aspect.
AIM-9JULI	Outer	Infrared (IR) guided missile, all aspect. • Note: The AIM-9JULI is an autochthonous variant of the AIM-9N/P that substitutes the seeker and control units by those of the AIM-9L. Therefore, it is the only of these missiles with all-aspect capability.
AIM-9P	Outer	Infrared (IR) guided missile, all aspect.
MATRA R530F EM	Inner & Fuselage	Semi-active radar homing (SARH) missile, all aspect.
MATRA SUPER S530F	Inner	Semi-active radar homing (SARH) missile, all aspect. Evolution of the R530 EM missile. • Note: The "Supermatra" was never used by the Spanish Air Force (except on its Mirage F1EDA aircraft acquired from Qatar) but all the Mirage F1 types used by Spain had the capability to employ it.

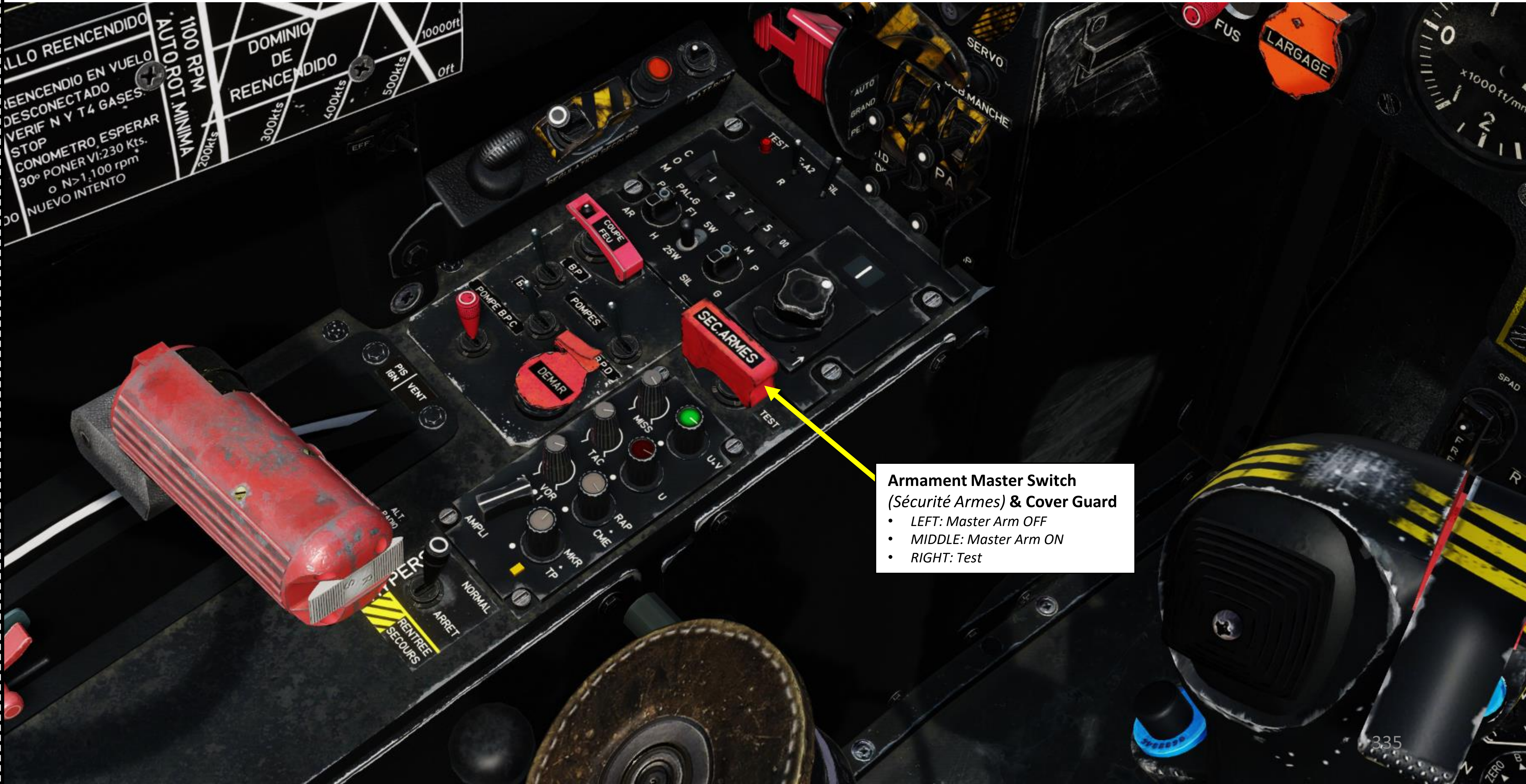
GUNS/CANNONS	
WEAPON	TYPE
2 x *DEFA* 553	30 mm revolver internal cannons (150 rounds each). DEFA stands for "Direction des Études et Fabrications d'Armement".
DEFA 550 CC420 Gun Pods	30 mm revolver external cannon pods.

1 – INTRODUCTION
1.1 – Armament Overview

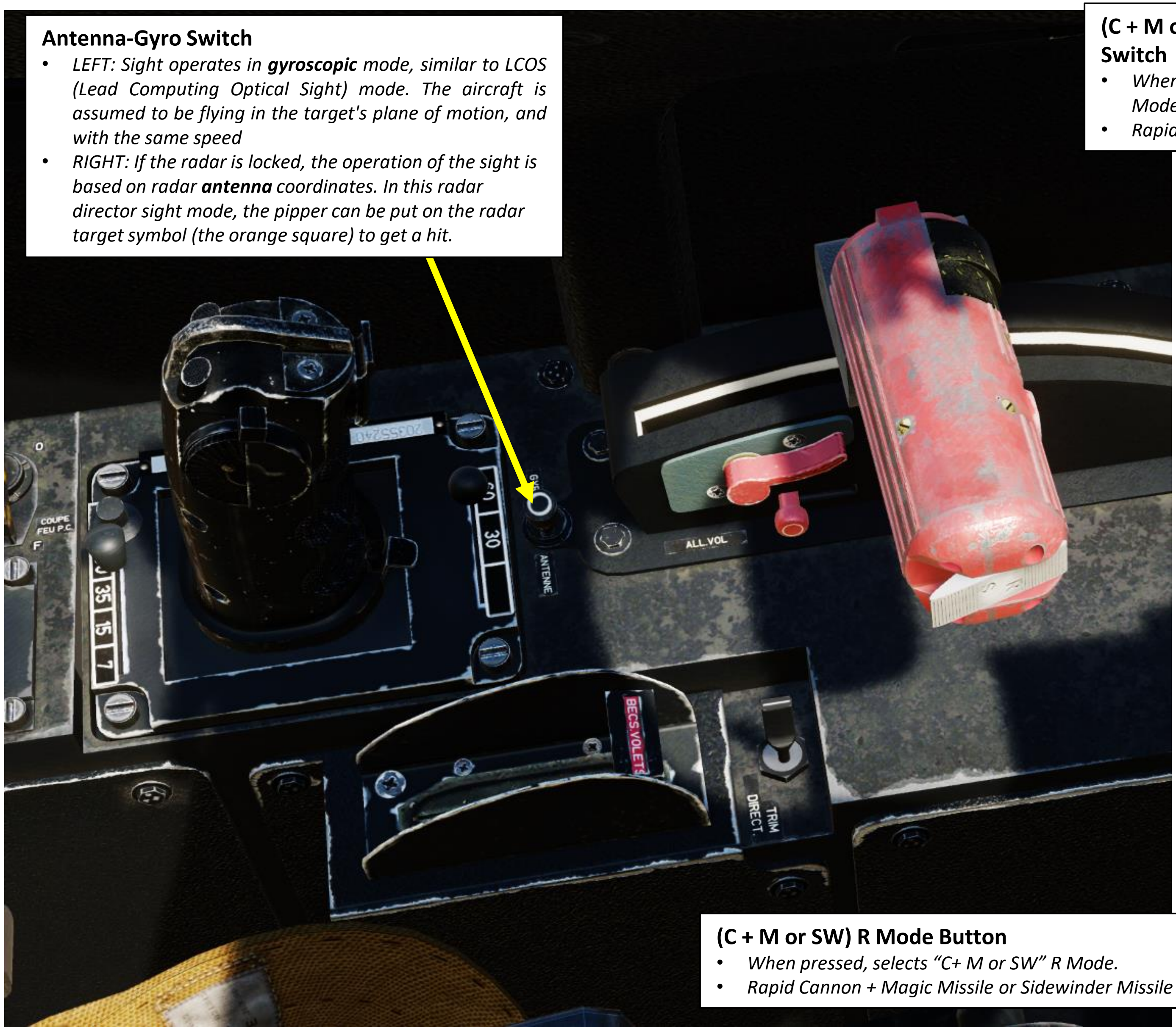
BOMBS					
WEAPON	TYPE	WEAPON	TYPE	WEAPON	TYPE
SAMP-125	125 kg (275 lbs) low drag unguided bomb by the *Société des Ateliers Mécanique de Port-sur-Sambre* (SAMP). Used by France.	BR-250	250 kg (550 lbs) low drag unguided bomb. Used by Spain.	MK-82	500 lbs unguided low-drag bomb.
SAMP-250 LD	250 kg (550 lbs) low drag unguided bomb.	BR-500	500 kg (1100 lbs) low drag unguided bomb.	MK-83	1000 lbs unguided low-drag bomb.
SAMP-250 HD	250 kg (550 lbs) high drag unguided bomb, retarded with a chute.	GBU-10	2000 lbs laser guided bomb.	*MATRA* BLG-66 Belouga	Unguided low-drag anti-runway cluster bomb.
SAMP-400 LD	400 kg (880 lbs) low drag unguided bomb.	GBU-12	500 lbs laser guided bomb.	*MATRA* BLU-107/B Durandal	Unguided very-high-drag anti-runway bomb.
SAMP-400 HD	400 kg (880 lbs) high drag unguided bomb, retarded with a chute.	GBU-16	1000 lbs laser guided bomb.		

ROCKETS	
WEAPON	TYPE
MATRA SNEB F1 rocket pod	36 x 68 mm unguided rockets per pod. SNEB stands for the “Société Nouvelle des Établissements Edgar Brandt” company. • Type 250 f1B TP-SM: Target Practice (TP) & Smoke Marker (SM) Rocket, used for training. • Type 251 F1B HE: High Explosive (HE) Rocket, used against soft targets like infantry or lightly armored vehicles. • Type 252 F1B TP: Target Practice (TP) Rocket, used for training. • Type 253 F1B HEAT: High Explosive Anti-Tank (HEAT) Rocket, used against armored vehicles. • Type 254 F1B SM Green/Red/Yellow: Smoke Marker (SM) Rocket, used to visually mark targets. • Type 256 F1B HE/Frag: High Explosive/Fragmentation Rocket, used against infantry. • Type 257 F1B HE/Frag Lg Whd: High Explosive/Fragmentation Rocket with a large warhead, used against infantry. • Type 259E F1B IL: Illumination Rocket, used to visually mark targets during night.
MATRA SNEB F4 rocket pod	18 x 68 mm unguided rockets per pod

1 – INTRODUCTION
1.2 – Weapon Control Interface

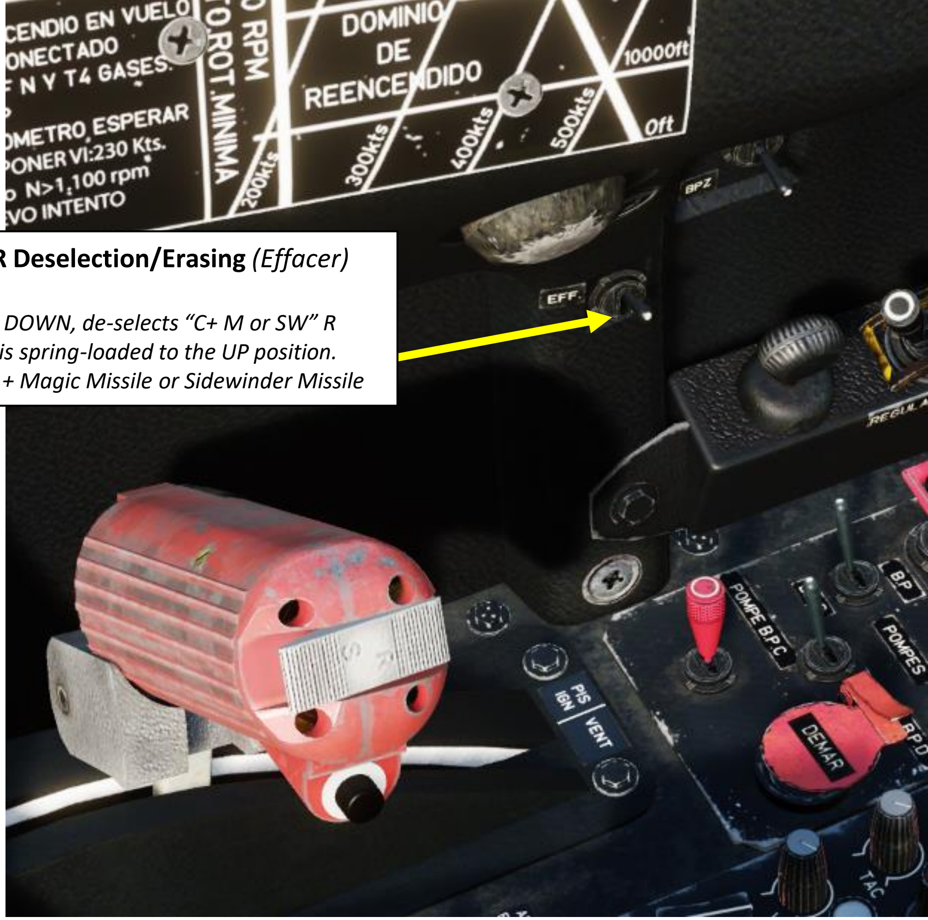


1 – INTRODUCTION
1.2 – Weapon Control Interface



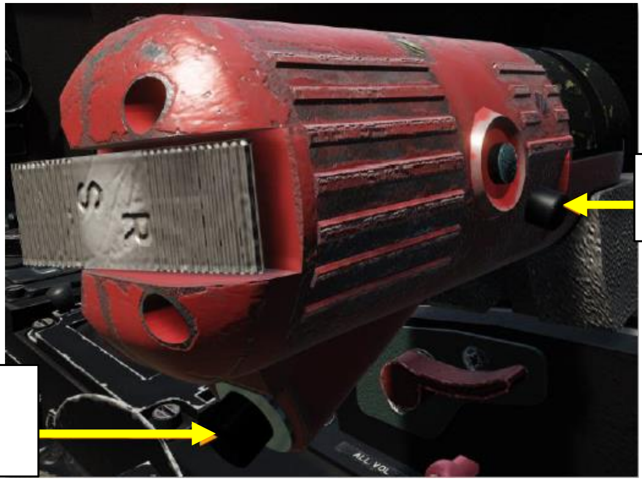
Antenna-Gyro Switch

- *LEFT: Sight operates in **gyroscopic** mode, similar to LCOS (Lead Computing Optical Sight) mode. The aircraft is assumed to be flying in the target's plane of motion, and with the same speed*
- *RIGHT: If the radar is locked, the operation of the sight is based on radar **antenna** coordinates. In this radar director sight mode, the pipper can be put on the radar target symbol (the orange square) to get a hit.*



(C + M or SW) R Deselection/Erasing *(Effacer)* Switch

- *When pressed DOWN, de-selects "C+ M or SW" R Mode. Switch is spring-loaded to the UP position.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

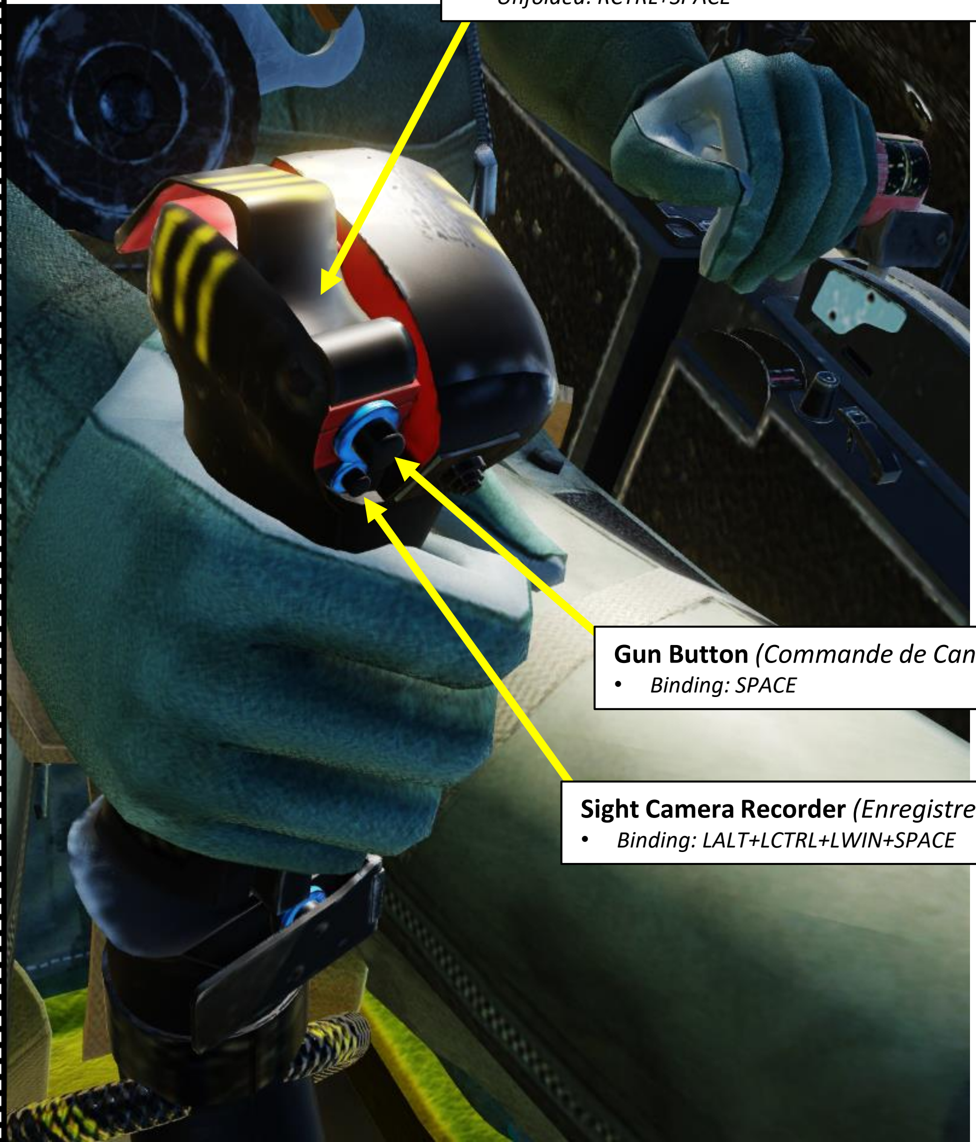


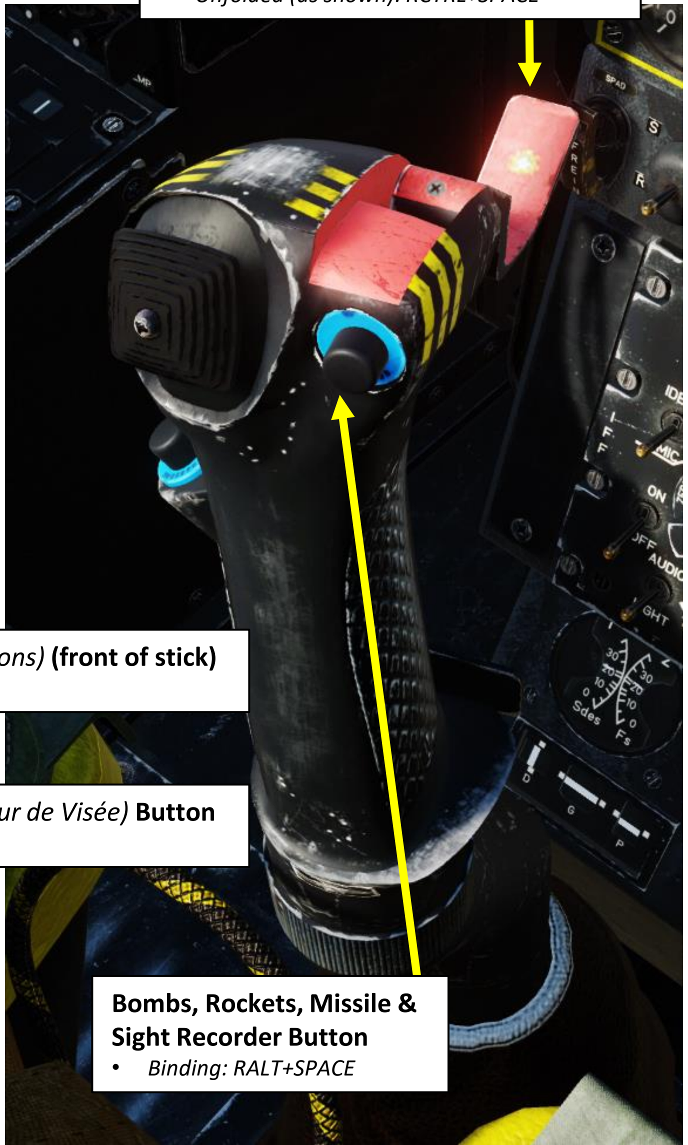
Cannon 300-600 m and Missile Lock/Unlock Button

(C + M or SW) R Mode Button

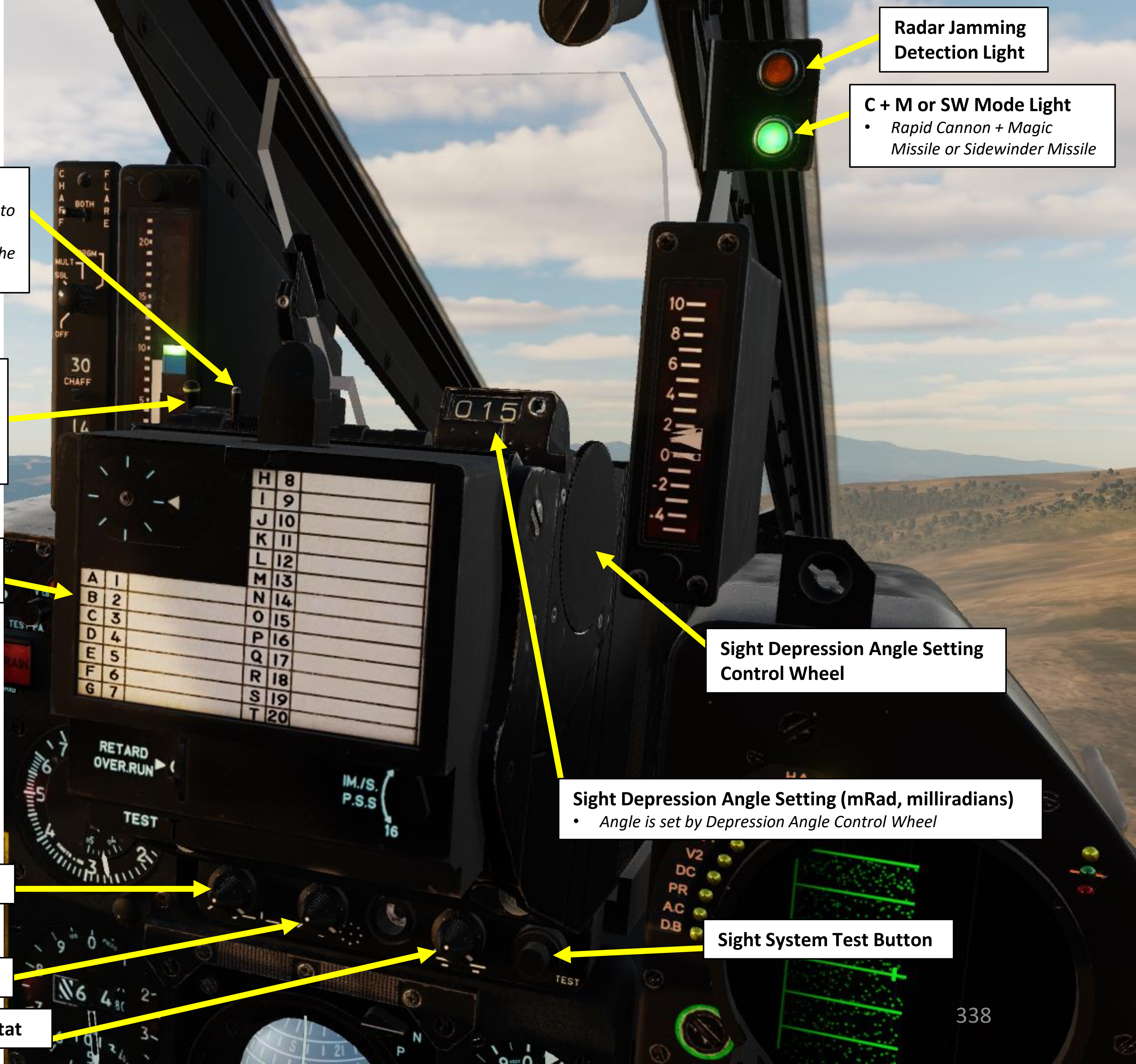
- *When pressed, selects "C+ M or SW" R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

1 – INTRODUCTION
1.2 – Weapon Control Interface





1 – INTRODUCTION
1.2 – Weapon Control Interface



Sight Auto/Manual Intensity Selector Switch
- *FWD: AUTO, brightness set by the pilot varies automatically according to external luminosity to maintain a constant contrast*
- *AFT: MANUAL, brightness of the reticles is regulated, with a fixed value, by the pilot through brightness rheostats below the sight head*

Sight Lighting Selector Switch
- *FWD: A (Arrêt), OFF*
- *MIDDLE: N (Normal) Operation*
- *AFT: S (Secours), Emergency operation. This mode is used when the sight reticle goes out (burnt bulb)*

Sight Camera
(Enregistreur de Visée)

Fixed Reticle Intensity Rheostat

Moving & Target Reticles Intensity Rheostat

Attitude Reticle Intensity Rheostat

Radar Jamming Detection Light

C + M or SW Mode Light
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

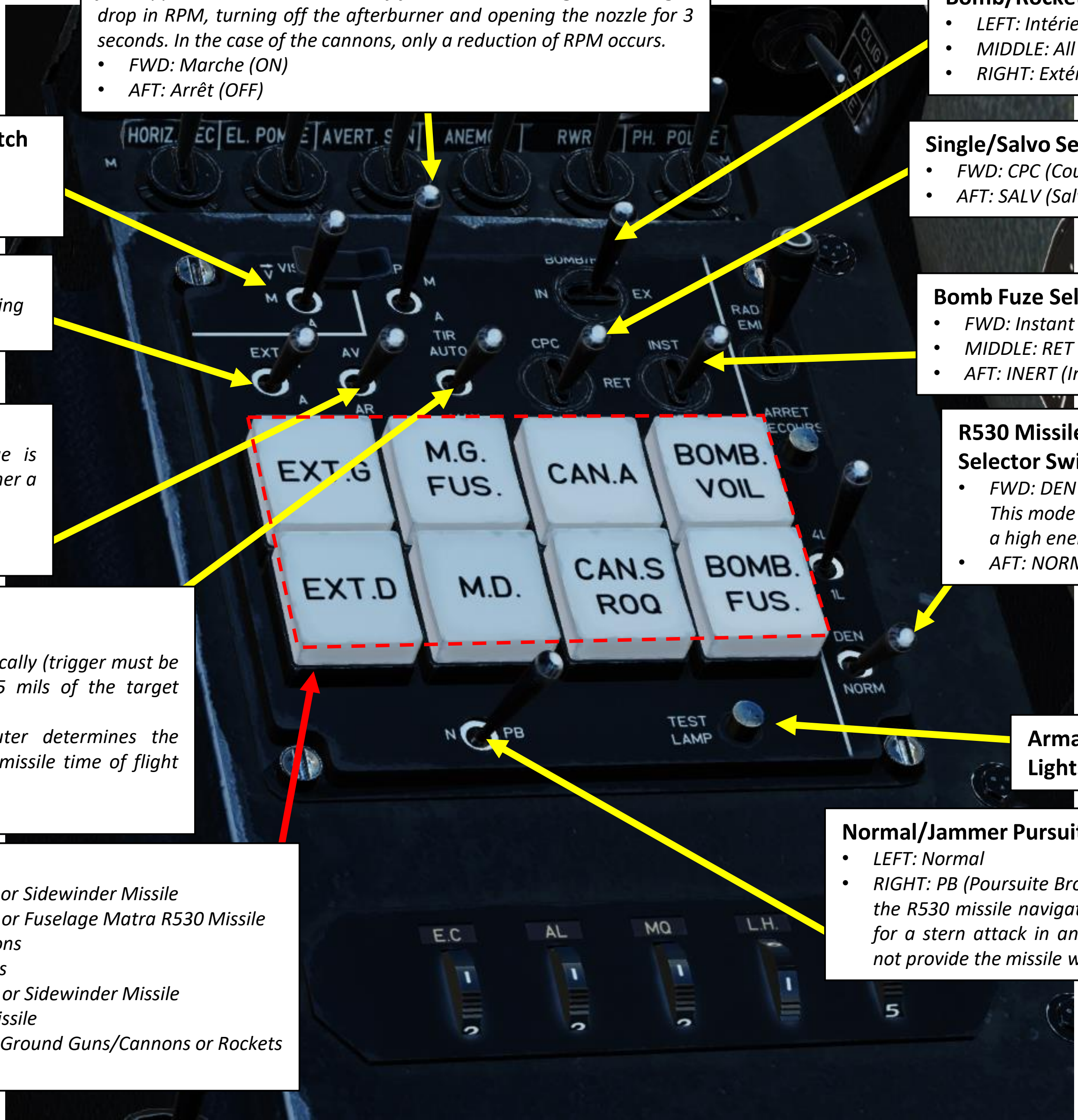
Sight Depression Angle Setting Control Wheel

Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*

Sight System Test Button

1 – INTRODUCTION
1.2 – Weapon Control Interface

Mirage F1CE Only



Firing Fuel Dipper Switch

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Sight *(Viseur)* Selector Switch
- *FWD: APP (Approach)*
- *MIDDLE: Marche (ON)*
- *AFT: Arrêt (OFF)*

Missile Preparation Switch
- *FWD: Marche (ON), enables missile seeker cooling*
- *AFT: Arrêt (OFF)*

Fore/Aft Selector Switch
- *Use in a jamming environment where no target range is available. Missile detonation fuze delay is optimized for either a forward aspect engagements or a stern (aft) engagement.*
- *FWD: Avant (Forward)*
- *AFT: Arrière (Aft)*

Automatic/Manual Firing *(Tir)* Mode Selector Switch
- *FWD: Automatic*
    - *If Gyro/Ant switch in ANT, guns can fire automatically (trigger must be held down) but only when pipper is within 15 mils of the target designation square.*
    - *For R530F and S530F missiles, firing computer determines the ideal/optimum firing point based on computed missile time of flight and fires when that is achieved.*
- *AFT: Manual*

Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

Bomb/Rocket Selector Switch
- *LEFT: Intérieur (Inner) Pylons*
- *MIDDLE: All Pylons*
- *RIGHT: Extérieur (Outer) Pylons*

Single/Salvo Selector Switch
- *FWD: CPC (Coup par coup), Single*
- *AFT: SALV (Salve), Salvo*

Bomb Fuze Selector Switch
- *FWD: Instant Fuze*
- *MIDDLE: RET (Retardé), Delayed Fuze*
- *AFT: INERT (Inerte), Fuze OFF*

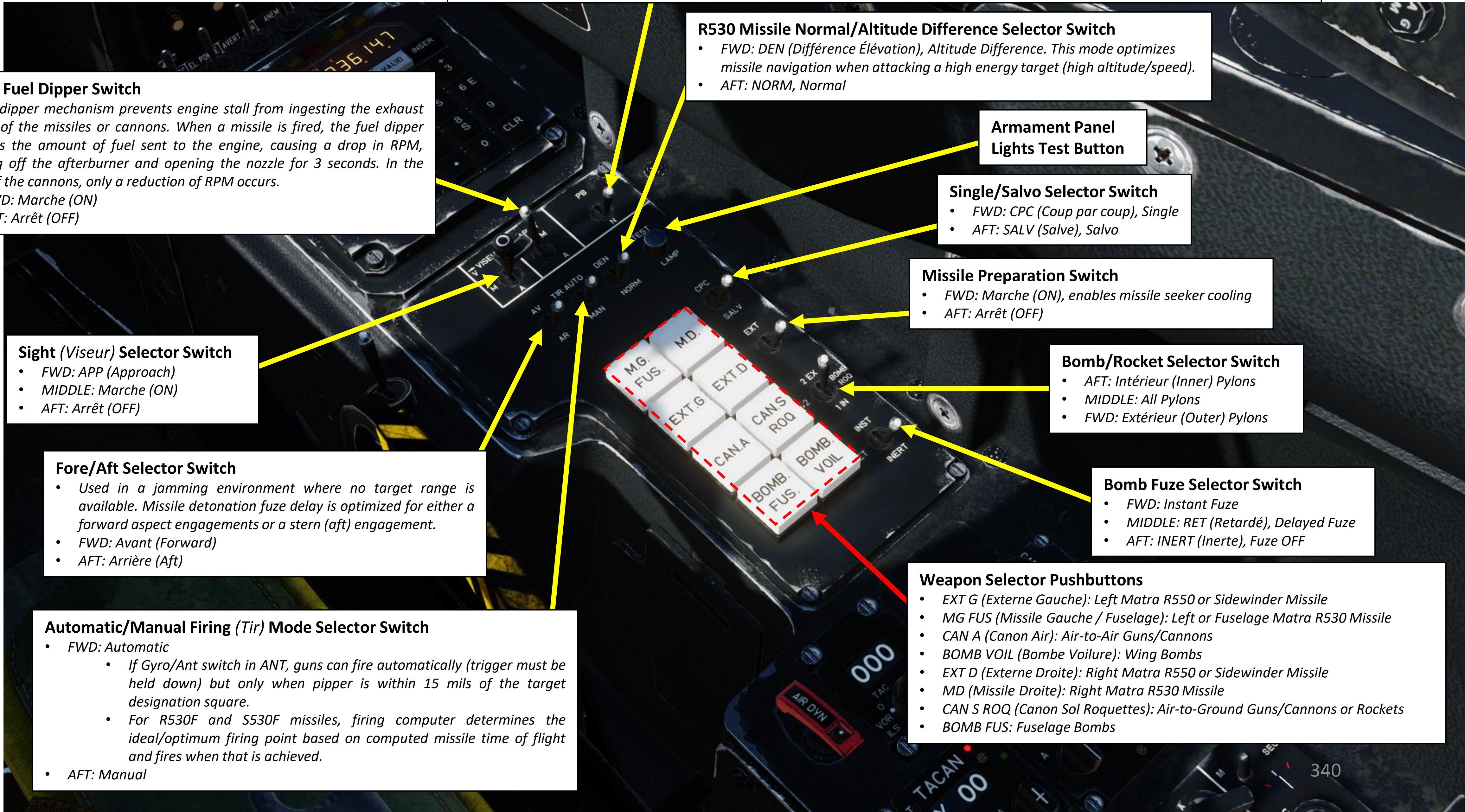
R530 Missile Normal/Altitude Difference Selector Switch
- *FWD: DEN (Différence Élévation), Altitude Difference. This mode optimizes missile navigation when attacking a high energy target (high altitude/speed).*
- *AFT: NORM, Normal*

Armament Panel Lights Test Button

Normal/Jammer Pursuit Switch
- *LEFT: Normal*
- *RIGHT: PB (Poursuite Brouilleur), Jammer Pursuit. This mode forces the R530 missile navigation and detonation delay to be optimized for a stern attack in an environment where radar jamming does not provide the missile with range of range rate information.*

1 – INTRODUCTION
1.2 – Weapon Control Interface

Mirage F1EE Only



Normal/Jammer Pursuit Switch
- *AFT: Normal*
- *FWD: PB (Poursuite Brouilleur), Jammer Pursuit. This mode forces the R530 missile navigation and detonation delay to be optimized for a stern attack in an environment where radar jamming does not provide the missile with range of range rate information.*

R530 Missile Normal/Altitude Difference Selector Switch
- *FWD: DEN (Différence Élévation), Altitude Difference. This mode optimizes missile navigation when attacking a high energy target (high altitude/speed).*
- *AFT: NORM, Normal*

Firing Fuel Dipper Switch

A fuel dipper mechanism prevents engine stall from ingesting the exhaust fumes of the missiles or cannons. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. In the case of the cannons, only a reduction of RPM occurs.
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Armament Panel Lights Test Button

Single/Salvo Selector Switch
- *FWD: CPC (Coup par coup), Single*
- *AFT: SALV (Salve), Salvo*

Missile Preparation Switch
- *FWD: Marche (ON), enables missile seeker cooling*
- *AFT: Arrêt (OFF)*

Sight *(Viseur)* Selector Switch
- *FWD: APP (Approach)*
- *MIDDLE: Marche (ON)*
- *AFT: Arrêt (OFF)*

Bomb/Rocket Selector Switch
- *AFT: Intérieur (Inner) Pylons*
- *MIDDLE: All Pylons*
- *FWD: Extérieur (Outer) Pylons*

Fore/Aft Selector Switch
- *Used in a jamming environment where no target range is available. Missile detonation fuze delay is optimized for either a forward aspect engagements or a stern (aft) engagement.*
- *FWD: Avant (Forward)*
- *AFT: Arrière (Aft)*

Bomb Fuze Selector Switch
- *FWD: Instant Fuze*
- *MIDDLE: RET (Retardé), Delayed Fuze*
- *AFT: INERT (Inerte), Fuze OFF*

Automatic/Manual Firing *(Tir)* Mode Selector Switch
- *FWD: Automatic*
  - *If Gyro/Ant switch in ANT, guns can fire automatically (trigger must be held down) but only when pipper is within 15 mils of the target designation square.*
  - *For R530F and S530F missiles, firing computer determines the ideal/optimum firing point based on computed missile time of flight and fires when that is achieved.*
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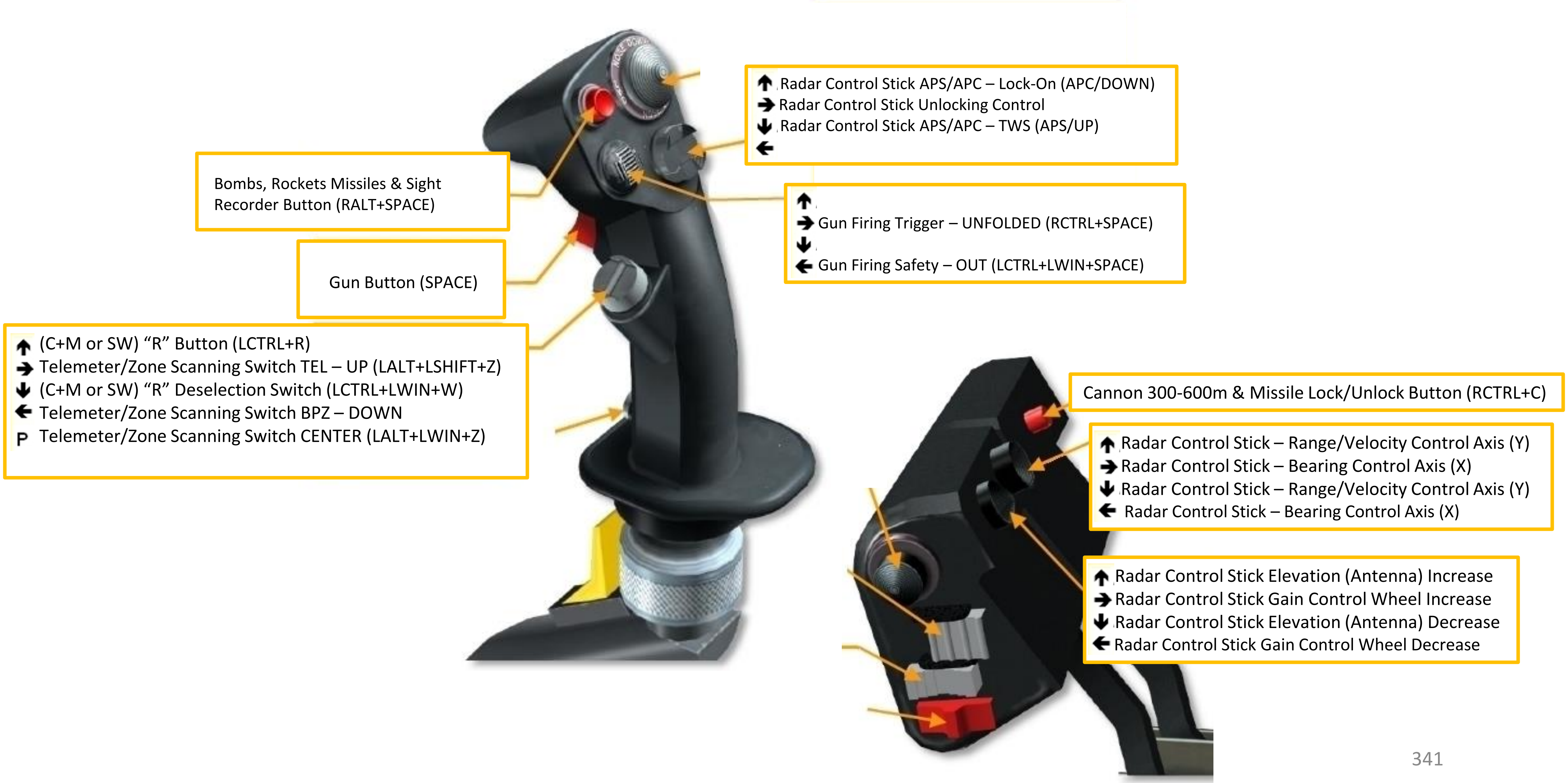
Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

1 – INTRODUCTION
1.3 – My Weapons Control Setup



1 – INTRODUCTION
1.4 – QFE & Altitude Accuracy for Air-to-Ground

<u>*Introduction to QFE and QNH*</u>

Unlike modern planes, the Mirage F1 does not have terrain elevation data available. It is not equipped with a radar altimeter either, which means that air-to-ground weapon release is based on attack profile tables, which require pitch angle, airspeed and altitude data (based on barometric pressure readings derived from the pitot tube). Releasing a bomb from an incorrect altitude means that the bomb could fall short or long; this is why it's important to have an altimeter reading with an accurate "altimeter barometric setting".

An **Altimeter setting** is the value of the atmospheric pressure used to adjust the scale of a pressure altimeter so that it indicates the height of an aircraft <u>above a known reference surface</u>. This reference can be the mean sea level pressure, or the barometric pressure at the nearby surface airport or the pressure level of 1,013.25 hectopascals (29.92 inches of Hg, Mercury) which gives the standard flight levels.

QNH is the **"sea-level pressure".** It's used to cause the altimeter to register height above sea level. When sitting on the ground at an airport, dialing QNH into the altimeter will cause it to display the airport's altitude above sea level.

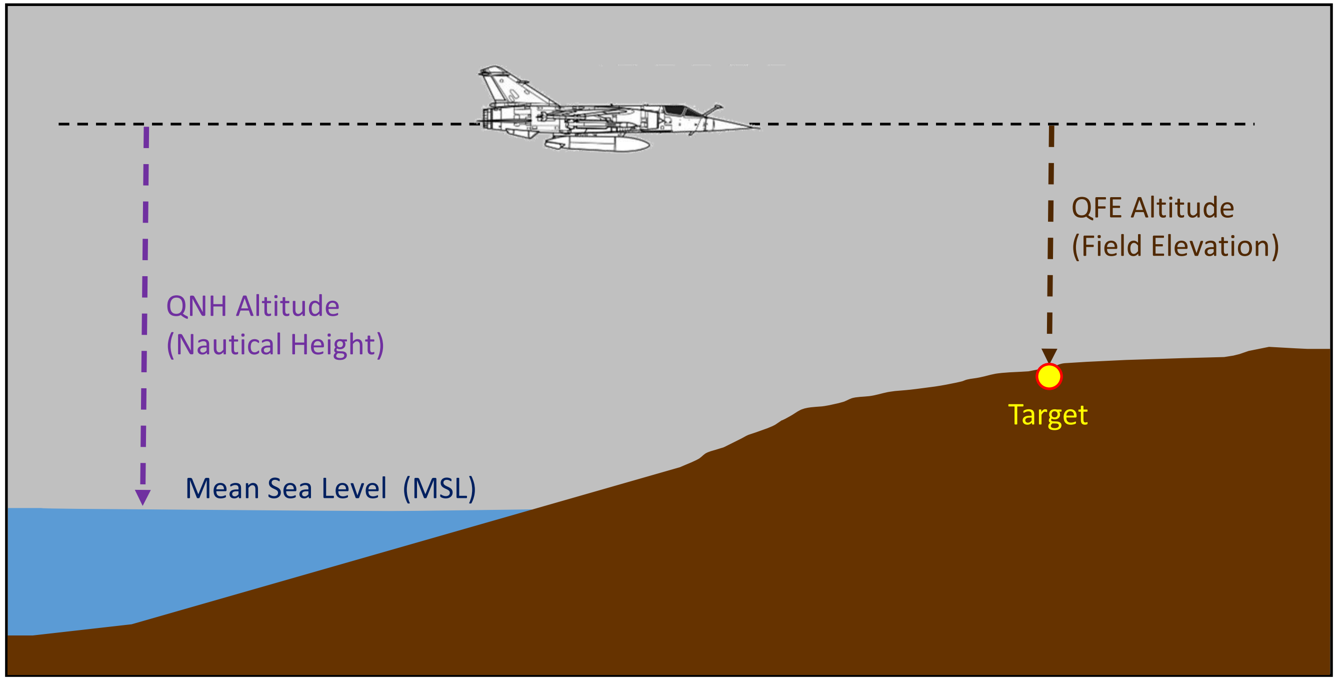
- Note: A barometric altitude with a QNH altimeter setting is sometimes referred to as "Nautical Height".

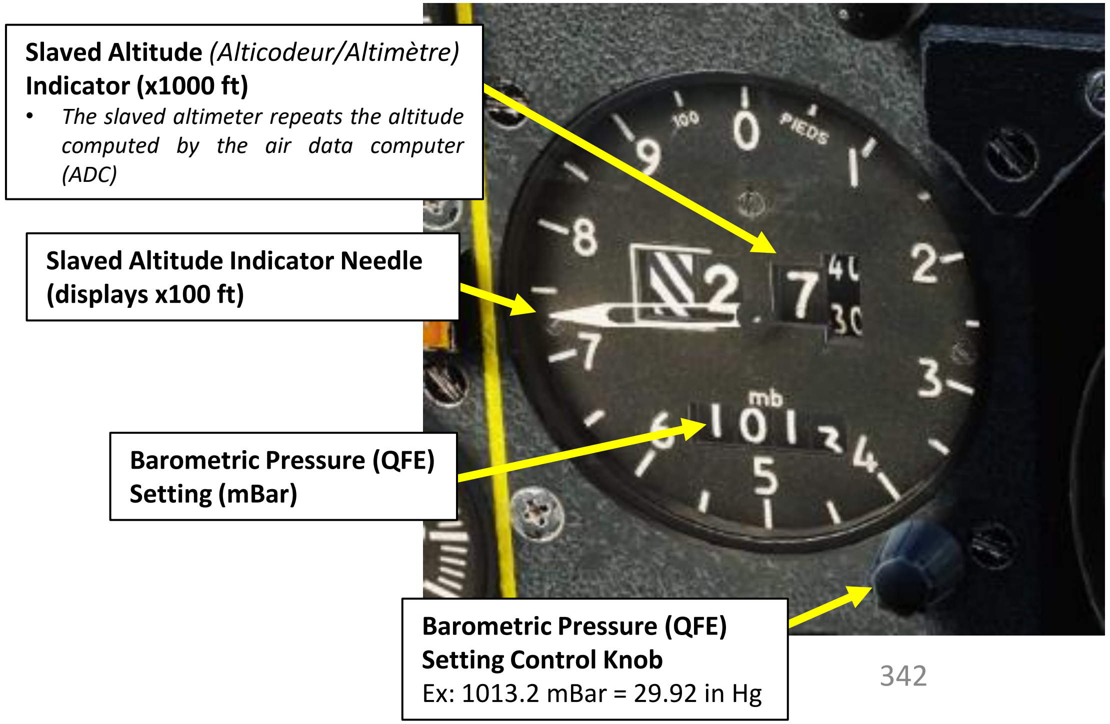
QFE is the **"air pressure at the current ground level".** It's used to cause the altimeter to register height above the ground (for a certain area). When sitting on the ground at an airport, dialing QFE into the altimeter will cause it to display zero feet.

- Note: A barometric altitude with a QFE altimeter setting is sometimes referred to as "Field Elevation".

Western countries largely standard on using QNH during takeoff and landing. It allows you to accurately know your height above sea level, but you must know the height of the local terrain to know if you are at risk of impacting terrain.

Eastern countries have sometimes standardized on using QFE, which allows you to know your height above the airport by just reading the altimeter.

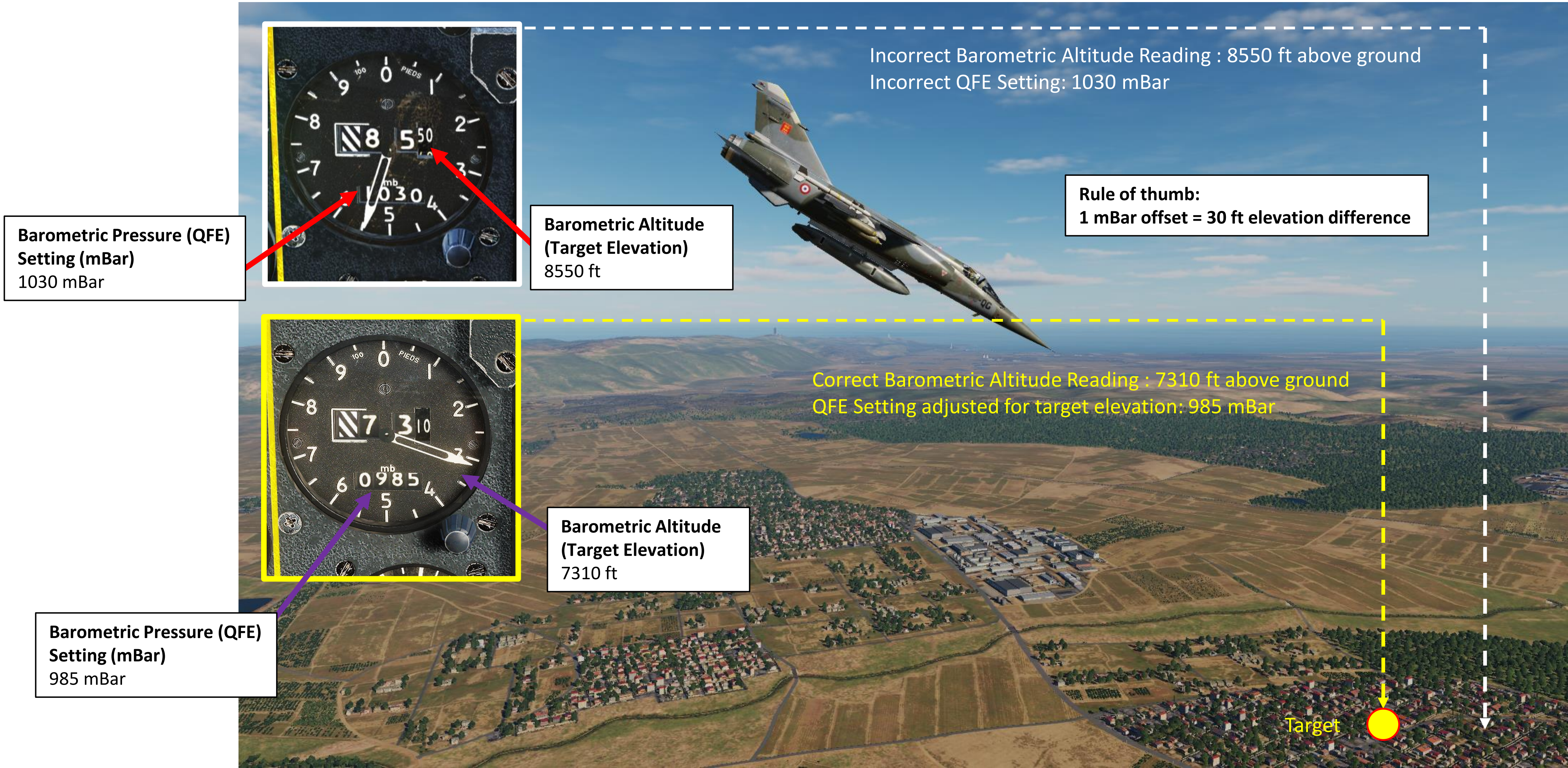




1 – INTRODUCTION
1.4 – QFE & Altitude Accuracy for Air-to-Ground

QFE Problems

Having a QFE set incorrectly means that the barometric altitude read on your altimeter may not give you the real elevation above target. This can throw off your aim when following attack profiles. In the example below, both altimeter readings are taken at the same time, but for different QFE settings for illustrative purposes.



1 – INTRODUCTION
1.4 – QFE & Altitude Accuracy for Air-to-Ground

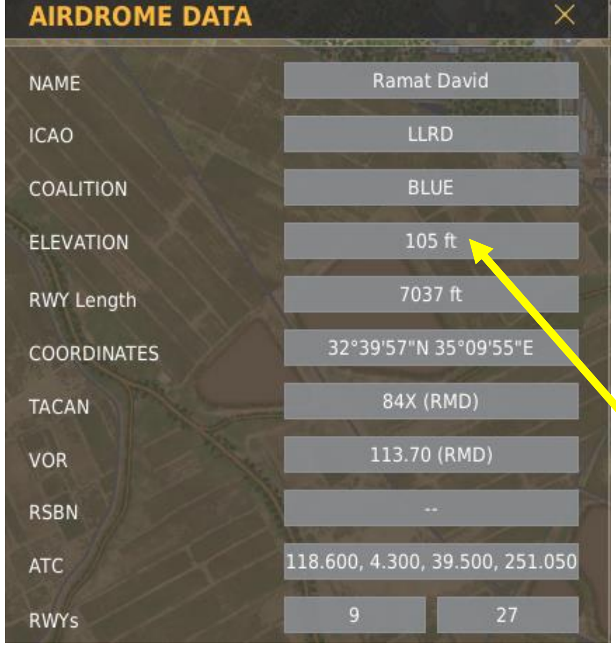
Using F10 map terrain elevation with airfield QNH

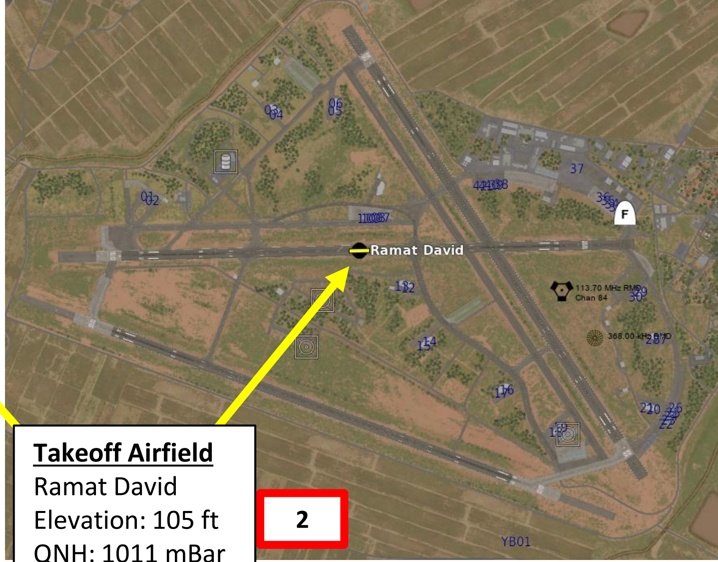
This method requires a bit of math and the location of the target. We will calculate the QFE value with the QNH value from the starting airfield (assuming it is not too far and that the weather does not change too much).

1. When you are on your takeoff airfield, find the airfield elevation, which is available in the F10 map.
2. In our case, we takeoff from Ramat David, which has an elevation of 105 ft.
3. Adjust the Altimeter Pressure Setting knob to match the altitude indicated by the altimeter with the airfield elevation (105 ft). In our case, we get an elevation of 105 ft by setting the altimeter setting knob to 1011 mBar.
4. Therefore, from the airfield elevation, we calculated that the airfield **QNH** (barometric pressure at sea level) is **1011 mBar**.
5. In the F10 map, hover the mouse over the target and write down the **target elevation** (772 ft in our case).
6. $$QFE = QNH - \frac{(Target\ Elevation\ in\ ft)}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(772\ ft)}{30\ \frac{ft}{mBar}} = 985{,}27\ mBar$$

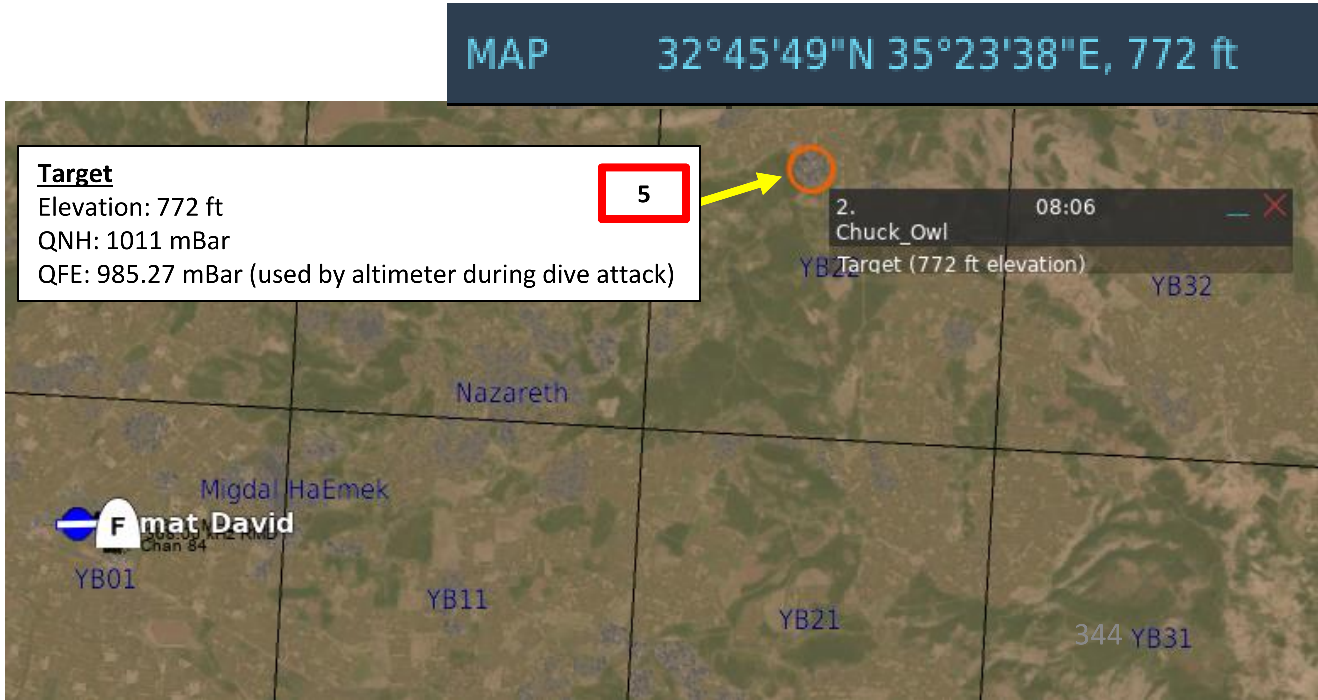
7. Therefore, the **QFE expected at a target** of an elevation of 772 ft is approx. **985,27 mBar**.





Takeoff Airfield
Ramat David
Elevation: 105 ft
QNH: 1011 mBar

2



Target
Elevation: 772 ft
QNH: 1011 mBar
QFE: 985.27 mBar (used by altimeter during dive attack)

5

3

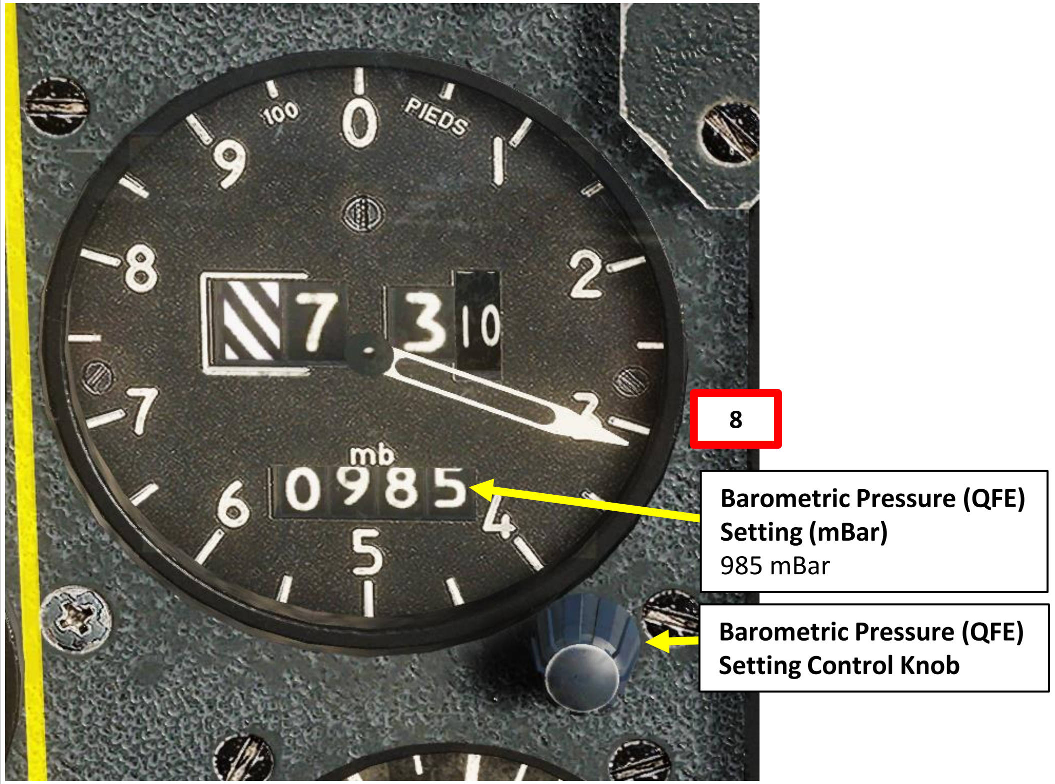
Barometric Pressure (QFE) Setting (mBar)
1011 mBar

Barometric Pressure (QFE) Setting Control Knob

1 – INTRODUCTION
1.4 – QFE & Altitude Accuracy for Air-to-Ground

Using F10 map terrain elevation with airfield QNH

8. Adjust the Altimeter Pressure Setting knob to 985 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.



1 – INTRODUCTION
1.5 – Air-to-Ground Attack Profiles/Parameters

SAMP-250 LD (Low-Drag) Bombs

Airspeed (kts)	Dive Angle (deg)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
400	10	1000	100
400	10	1500	140
400	10	2000	170
420	20	2000	110
420	20	3000	140
420	20	4000	170
500	20	5000	144

BLG-66 Belouga Cluster Bombs

Dive Attack Profiles

Airspeed (kts)	Dive Angle (deg)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
500	30	3000	70
500	30	5000	148
450	40	8000	176

Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
500	1000	168

SAMP-250/400 HD (High-Drag) Bombs Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
400	200	130

Note: After bomb release, perform a 4-G pull-up to avoid frag damage.

MK-82 LD (Low-Drag) Bombs Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
400	800	127

Note: After bomb release, perform a 4-G pull-up to avoid frag damage.

GBU-10/12/16 Laser-Guided Bombs

Airspeed (kts)	Dive Angle (deg)	Attack Profile (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
350-450	20	From 15000 to 30000	180
400-450	Level	From 10000	180

BLU-107/B Durandal Anti-Runway Bombs Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
500	300	125

Note: The attack profiles listed are based on the profiles published by Aerges (official developer). However, as of 2023/07/28, using these profiles with the currently modelled bomb, rocket and gun physics in DCS results in the aiming being off. Therefore, I suggest adding an additional 25 to 35 mils to the depression angle settings listed in these tables for better accuracy.

1 – INTRODUCTION
1.5 – Air-to-Ground Attack Profiles/Parameters

DEFA 553 Cannons (Air-to-Ground)

Airspeed (kts)	Dive Angle (deg)	Firing Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
350+	5	1000	14
350+	10	1500	10
350+	15	2000	7
350+	25	3000	9

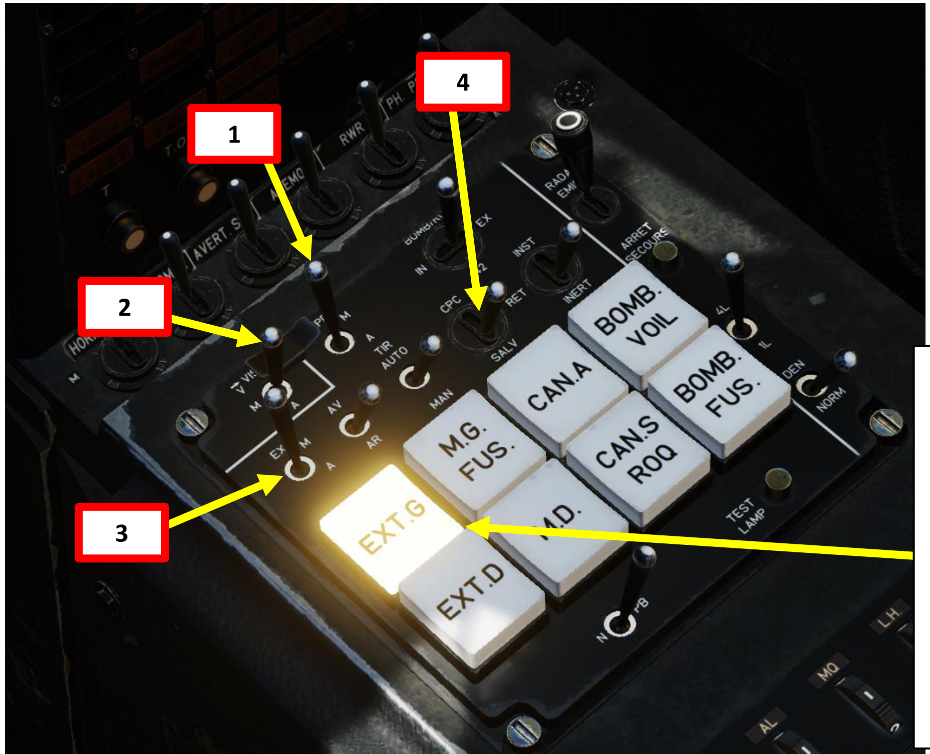
SNEB F4 Rockets Dive Attack Profiles

Airspeed (kts)	Dive Angle (deg)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
320	10	1000	0
320	10	2000	30
320	10	4000	65
320	10	6000	100
450	15	2000	0
450	15	4000	25
450	15	6000	50

Note: The attack profiles listed are based on the profiles published by Aerges (official developer). However, as of 2023/07/28, using these profiles with the currently modelled bomb, rocket and gun physics in DCS results in the aiming being off. Therefore, I suggest adding an additional 25 to 35 mils to the depression angle settings listed in these tables for better accuracy.

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.1 – MATRA R550 Magic I IR Missile (No Radar)

1. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Missile Preparation Switch – FWD (Marche/ON)
4. Set Single/Salvo Selector Switch – FWD (CPC/Single, *Coup par coup*)
5. Flip Armament Master Switch (Sécurité Armes) guard – UP.
6. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
7. Press (C + M or SW) R Mode (Rapid Cannon + Magic Missile or Sidewinder Missile) Button to select Magic missiles.
8. (Optional) If you want to select a specific missile priority press either the EXT D (Externe Droite, Outer Right) or EXT G (Externe Gauche, Outer Left) buttons. You can leave these buttons unselected to keep things simple.
    - In (C + M or SW) R mode, if both are locked on a target, the left one is launched first.



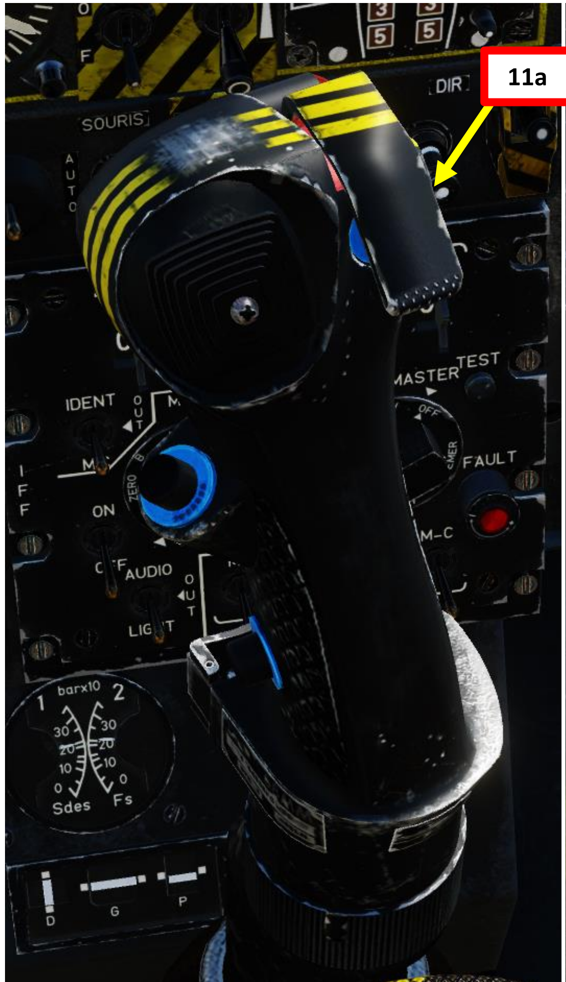
Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

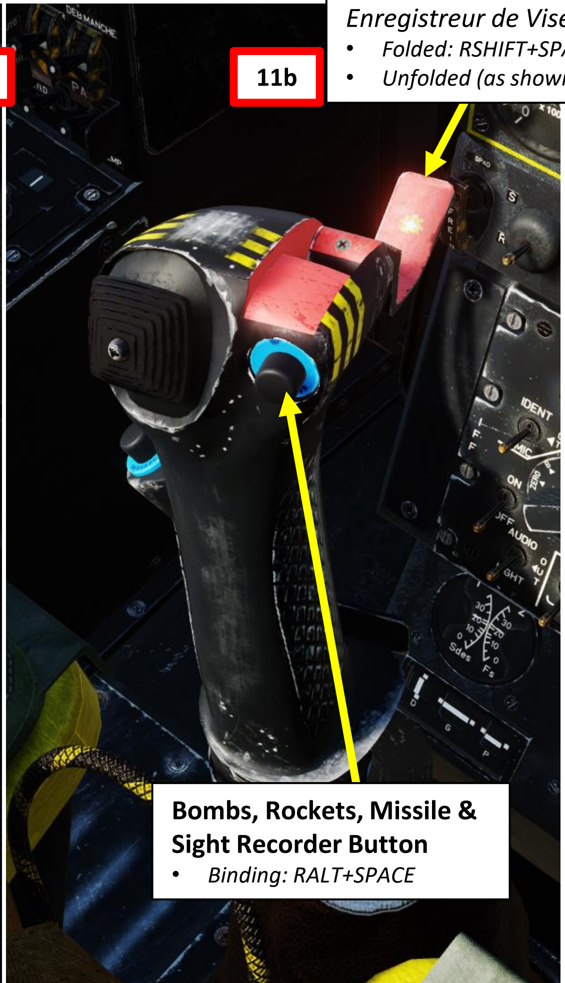
(C + M or SW) R Mode Button
- *When pressed, selects "C+ M or SW" R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

Armament Master Switch *(Sécurité Armes)* **& Cover Guard**
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.1 – MATRA R550 Magic I IR Missile (No Radar)

9. Missile cooling time can take up to 20 seconds. Once seeker head is cooled and ready for use, the cooling liquid lasts for about 20 minutes.
10. Once missiles are ready, selection symbols (triangle) are visible on the sight.
11. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.

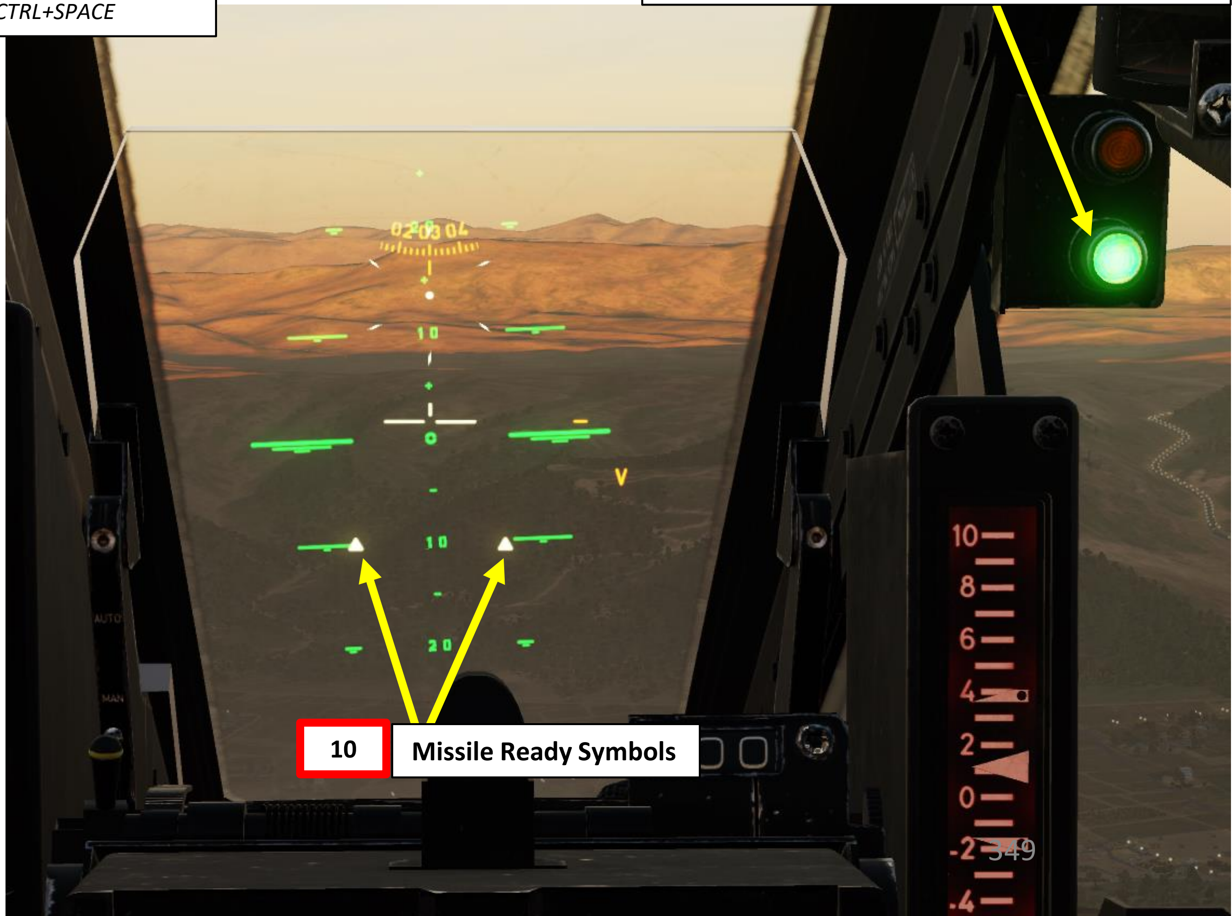




Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Bombs, Rockets, Missile & Sight Recorder Button
- *Binding: RALT+SPACE*

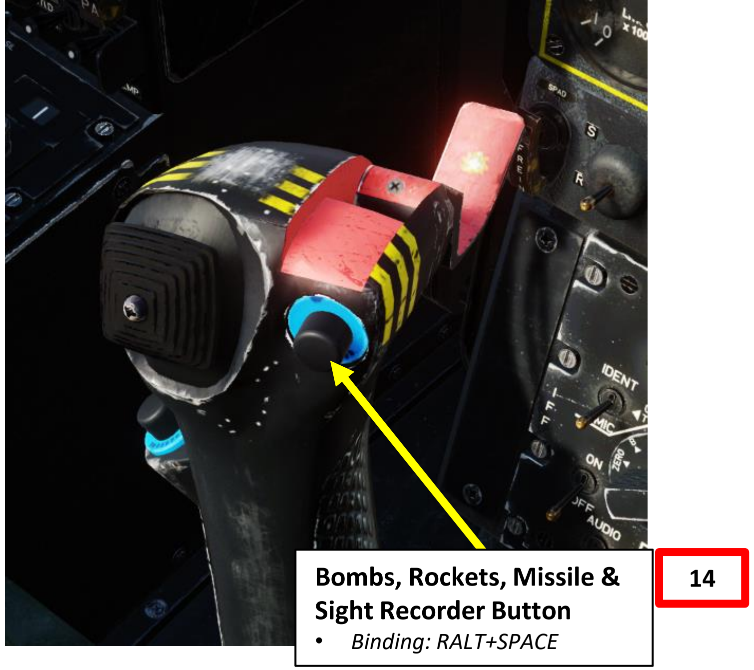
C + M or SW Mode Light
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

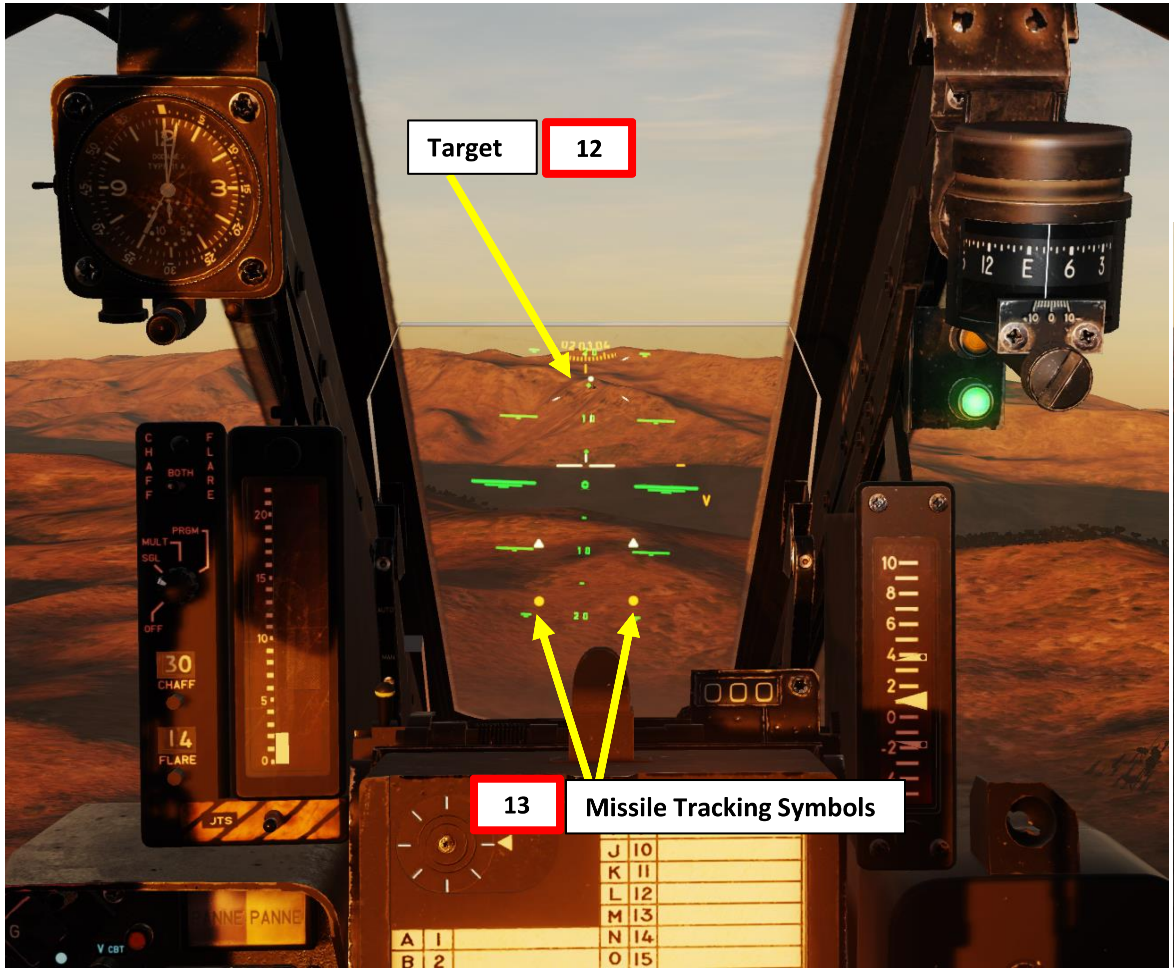


Missile Ready Symbols

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.1 – MATRA R550 Magic I IR Missile (No Radar)

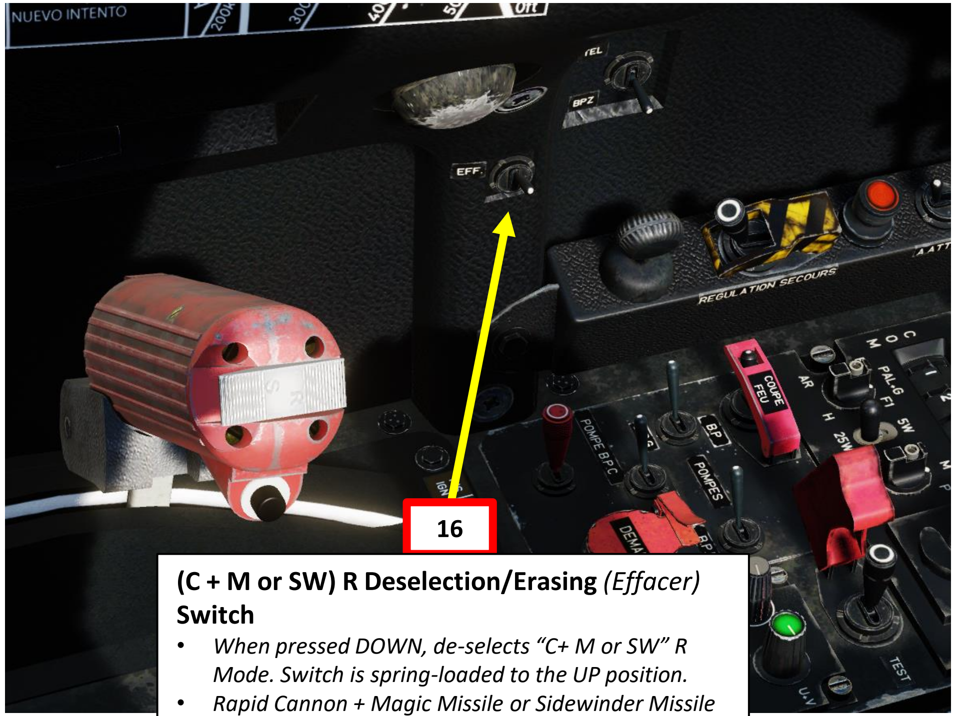
12. Fly behind the target to align its **rear** with the upper area of the sight glass.
13. Once a valid infrared signature is detected and tracked by the missile seeker, a high-pitch tone is audible and tracking circles are visible on the sight.
14. Press and hold Bombs, Rockets, Missile & Sight Recorder Button to launch the missile (RALT+SPACE).
15. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. This prevents engine flameout due to smoke ingestion.





2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.1 – MATRA R550 Magic I IR Missile (No Radar)

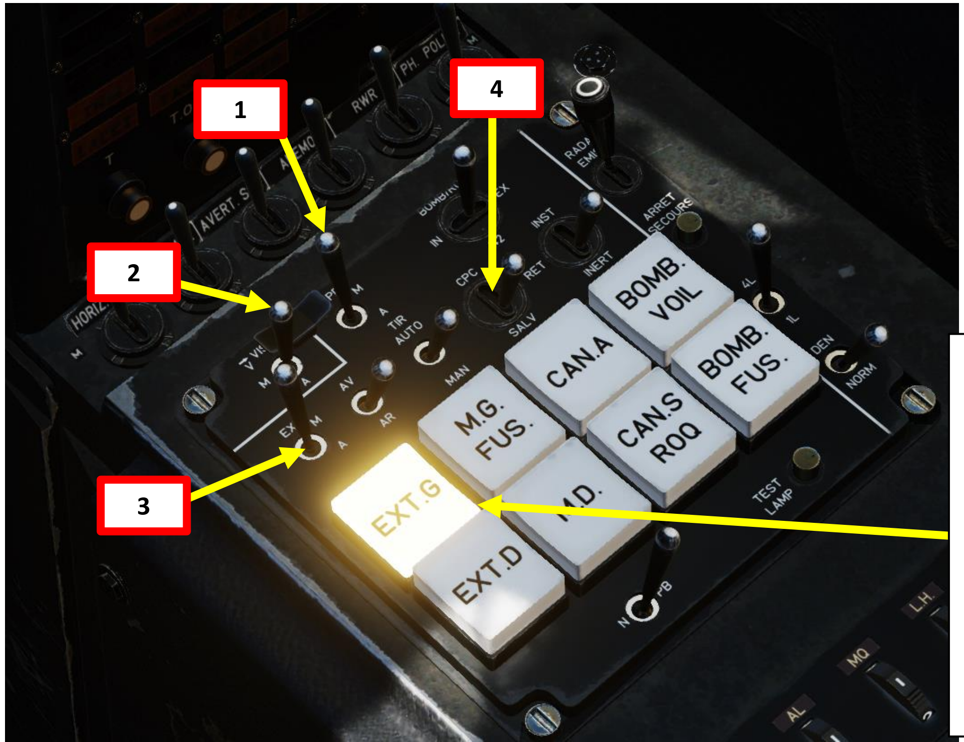
16. To un-select missiles, press (C + M or SW) R Deselection/Erasing *(Effacer)* Switch DOWN, then back to UP.



(C + M or SW) R Deselection/Erasing *(Effacer)* Switch
- *When pressed DOWN, de-selects "C+ M or SW" R Mode. Switch is spring-loaded to the UP position.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.2 – AIM-9JULI Sidewinder IR Missile (No Radar)

1. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Missile Preparation Switch – FWD (Marche/ON)
4. Set Single/Salvo Selector Switch – FWD (CPC/Single, *Coup par coup*)
5. Flip Armament Master Switch (Sécurité Armes) guard – UP.
6. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
7. Press (C + M or SW) R Mode (Rapid Cannon + Magic Missile or Sidewinder Missile) Button to select AIM-9 missiles.
8. (Optional) If you want to select a specific missile priority press either the EXT D (Externe Droite, Outer Right) or EXT G (Externe Gauche, Outer Left) buttons. You can leave these buttons unselected to keep things simple.
    - In (C + M or SW) R mode, if both are locked on a target, the left one is launched first.



(C + M or SW) R Mode Button
- *When pressed, selects "C+ M or SW" R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

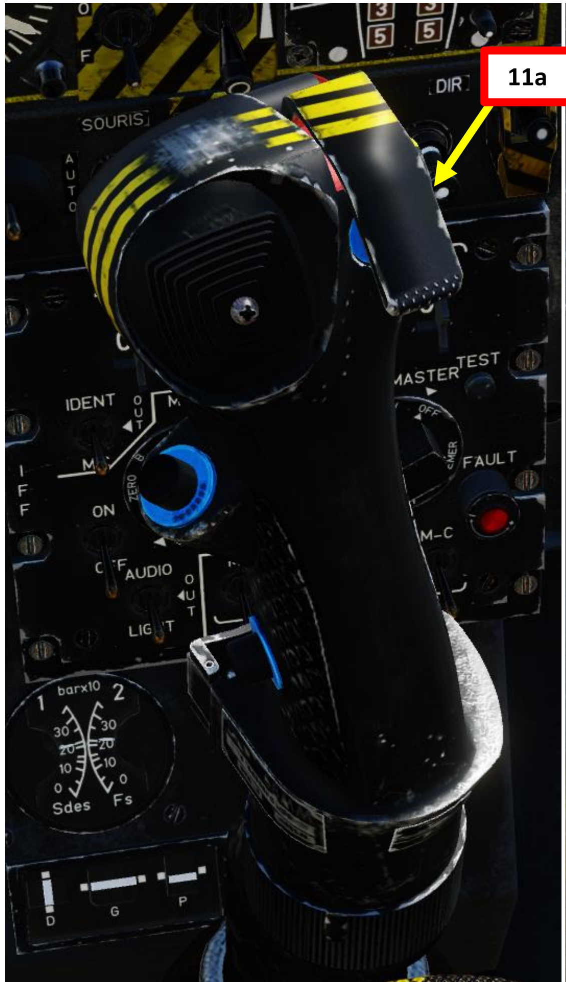
Armament Master Switch *(Sécurité Armes)* **& Cover Guard**
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

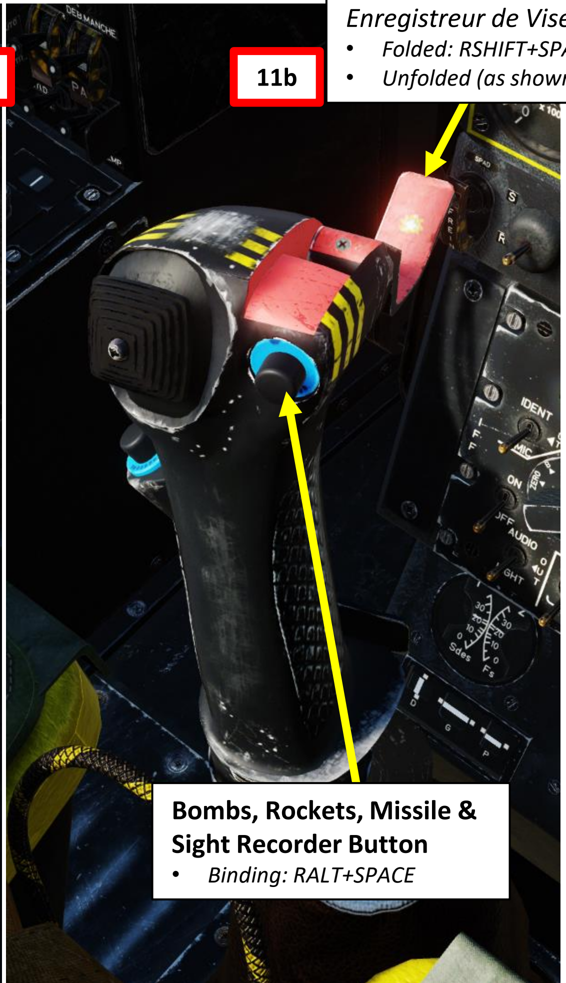
Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

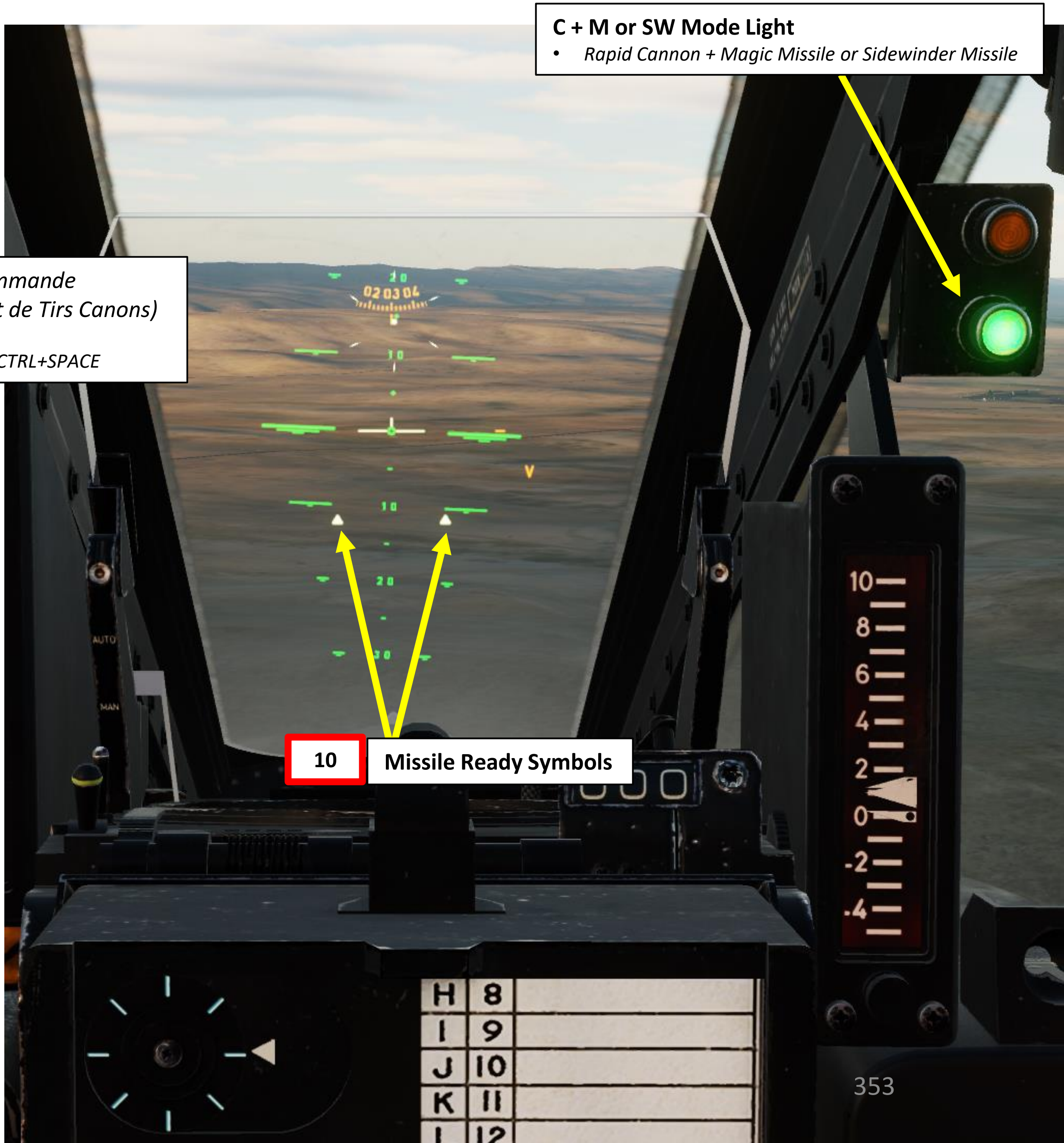
8

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.2 – AIM-9JULI Sidewinder IR Missile (No Radar)

9. Missile cooling time can take up to 20 seconds. Once seeker head is cooled and ready for use, a low-pitch growling sound is audible. The cooling liquid lasts for about 20 minutes.
10. Once missiles are ready, selection symbols (triangle) are visible on the sight.
11. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.

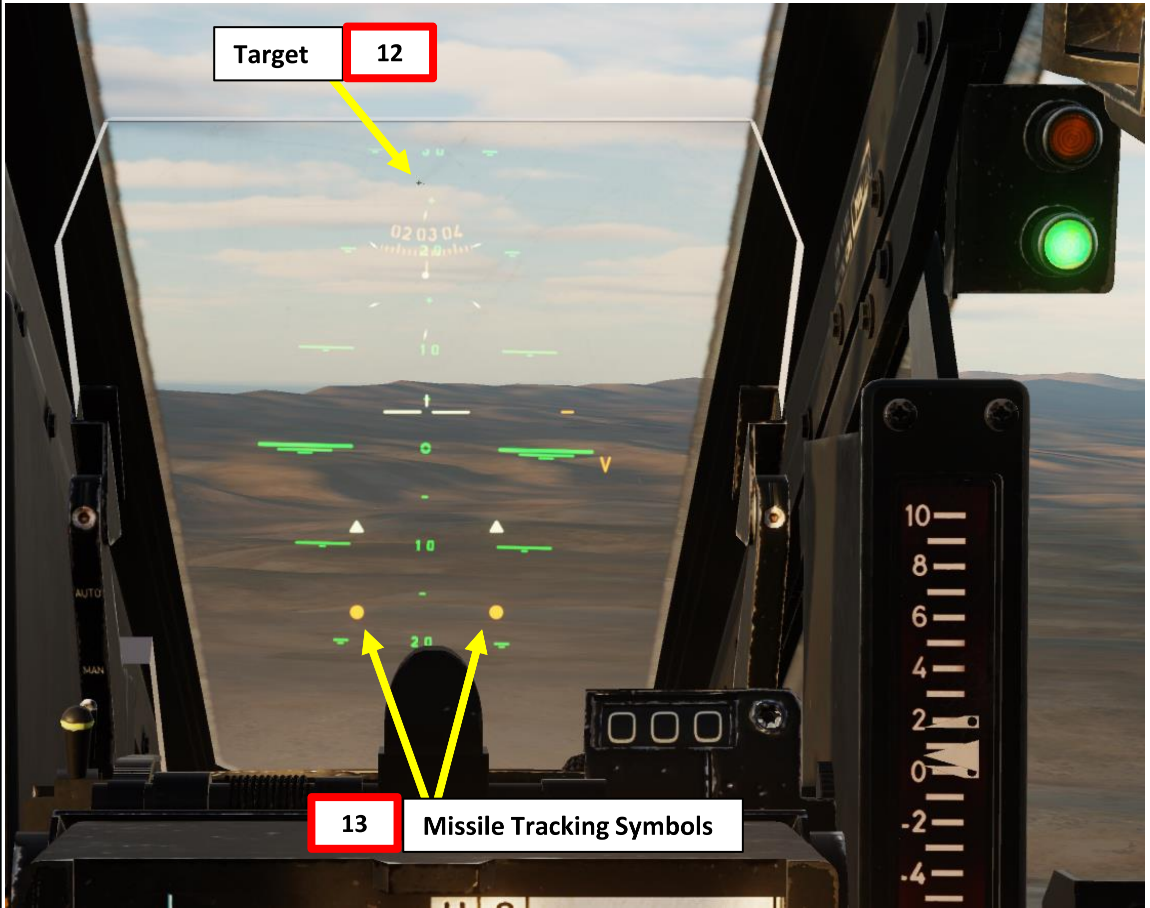






2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.2 – AIM-9JULI Sidewinder IR Missile (No Radar)

12. Fly towards the target and align it with the upper area of the sight glass.
    - Take note that the AIM-9JULI is an all-aspect missile.
    - AIM-9P is all-aspect as well, while AIM-9B and AIM-9J missile variants available are rear-aspect only.
13. Once a valid infrared signature is detected and tracked by the missile seeker, the low-pitch growling sound of the seeker changes to a high-pitch tone. Tracking circles also become visible on the sight.
14. Press and hold Bombs, Rockets, Missile & Sight Recorder Button to launch the missile (RALT+SPACE).
15. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. This prevents engine flameout due to smoke ingestion.

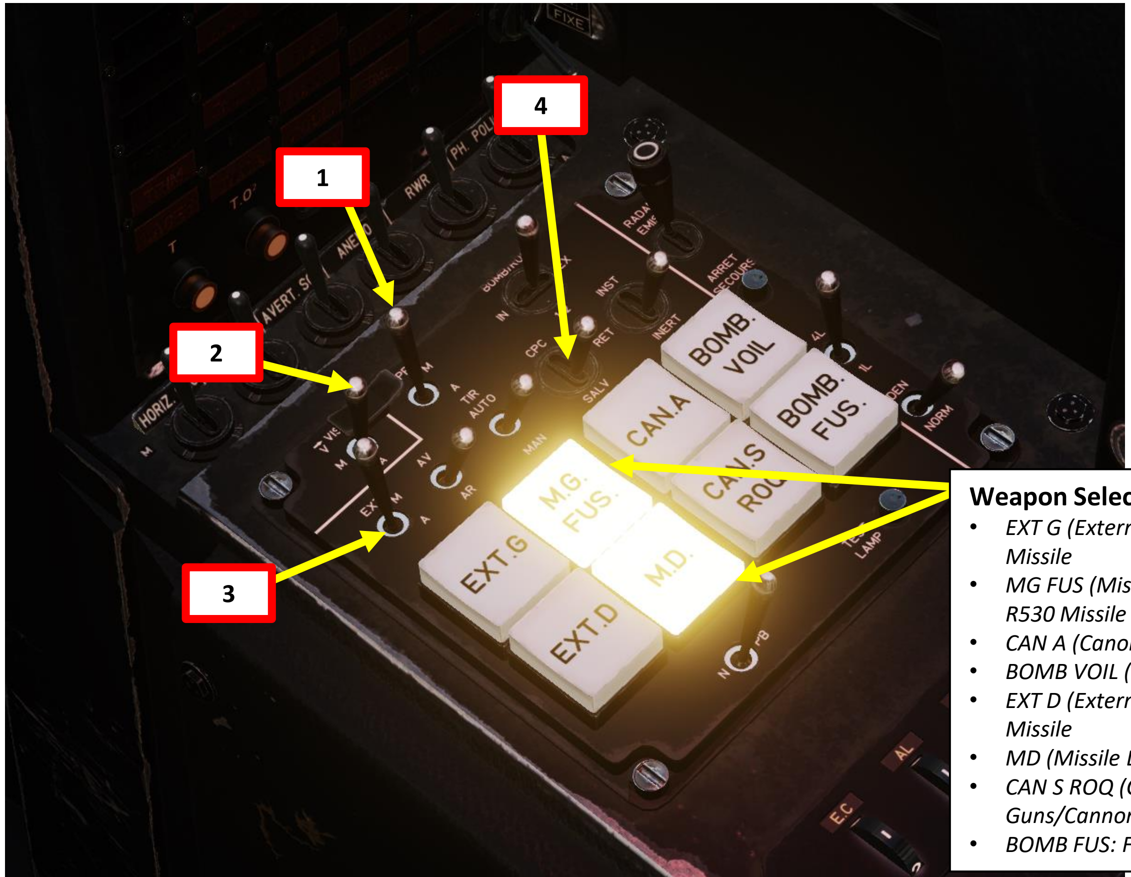


2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.2 – AIM-9JULI Sidewinder IR Missile (No Radar)

16. To un-select missiles, press (C + M or SW) R Deselection/Erasing *(Effacer)* Switch DOWN, then back to UP.

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.3 – MATRA R530F IR Missile (No Radar)

1. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Missile Preparation Switch – FWD (Marche/ON)
4. Set Single/Salvo Selector Switch – FWD (CPC/Single, *Coup par coup*)
5. Flip Armament Master Switch (Sécurité Armes) guard – UP.
6. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
7. Select inner stations equipped with 530F IR missiles by pressing either the MG FUS (Missile Gauche / Fuselage, Left Missile / Fuselage) and/or MD (Missile Droite, Right Missile) buttons.



Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

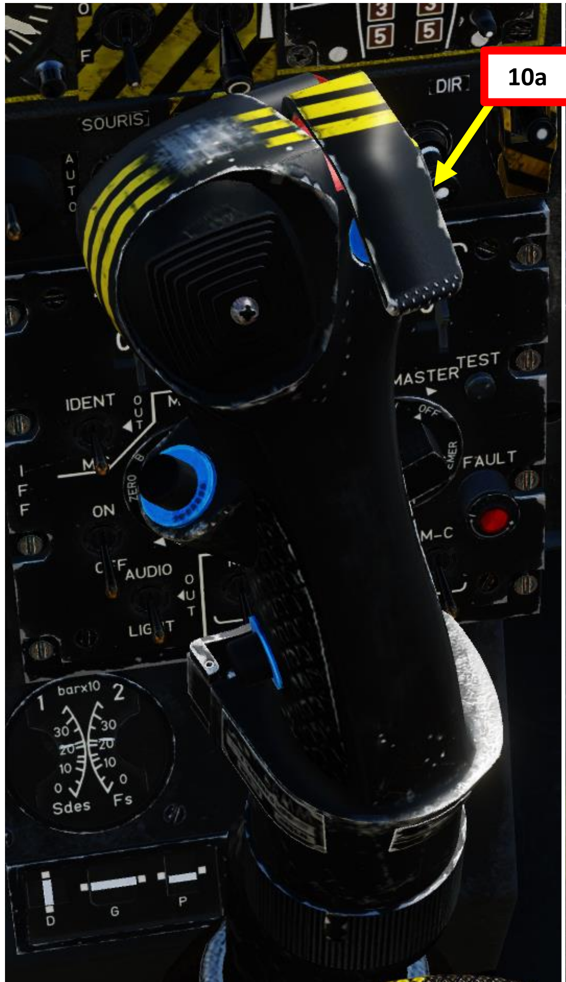
7

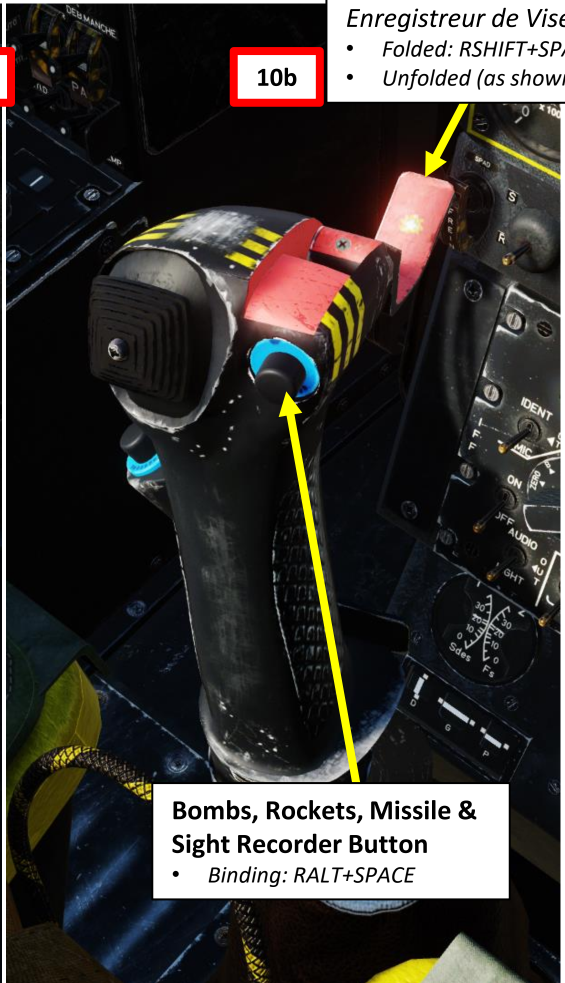
6

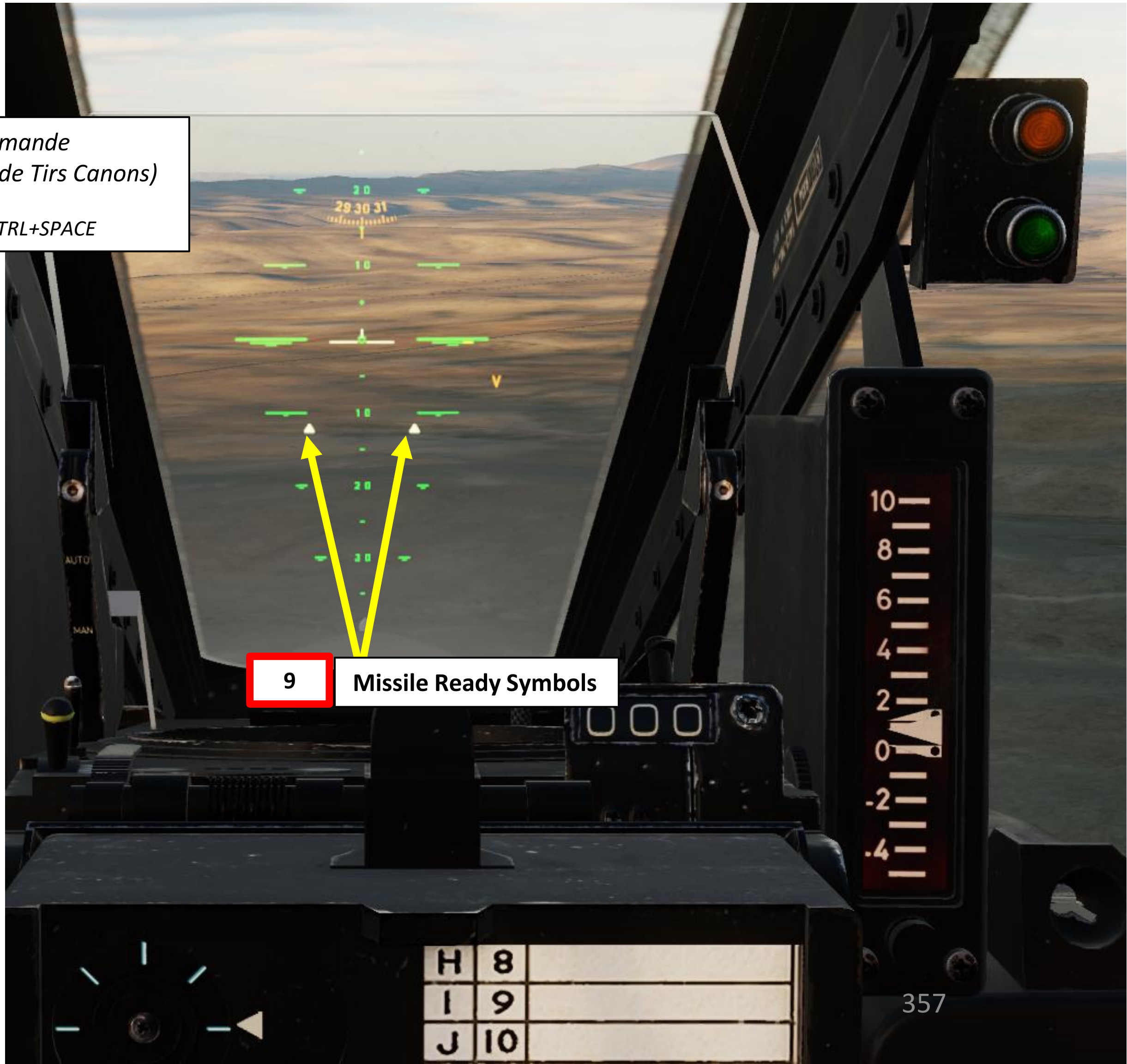
Armament Master Switch *(Sécurité Armes)* **& Cover Guard**
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.3 – MATRA R530F IR Missile (No Radar)

8. Missile cooling time can take up to 20 seconds. Once seeker head is cooled and ready for use, the cooling liquid lasts for about 20 minutes.
9. Once missiles are ready, selection symbols (triangle) are visible on the sight.
10. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.

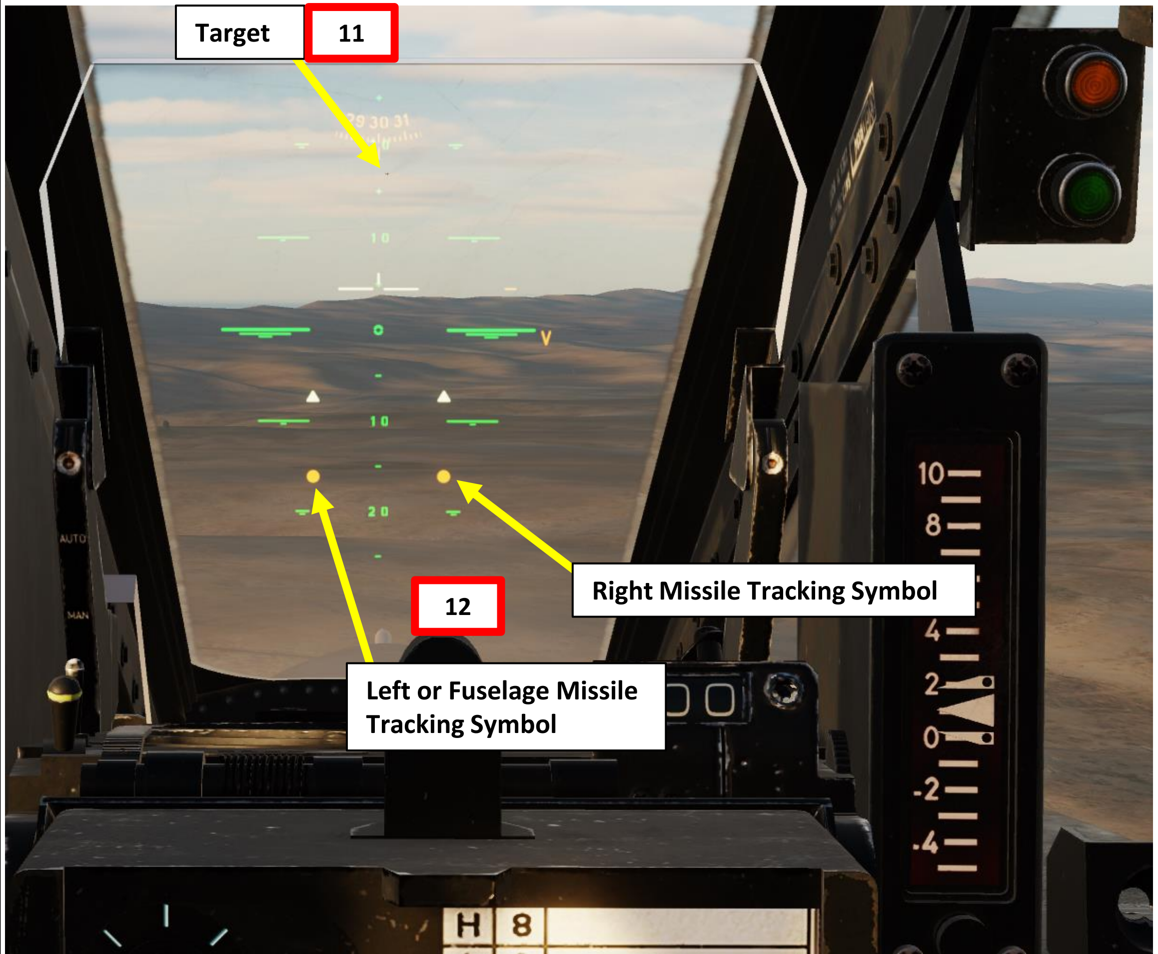


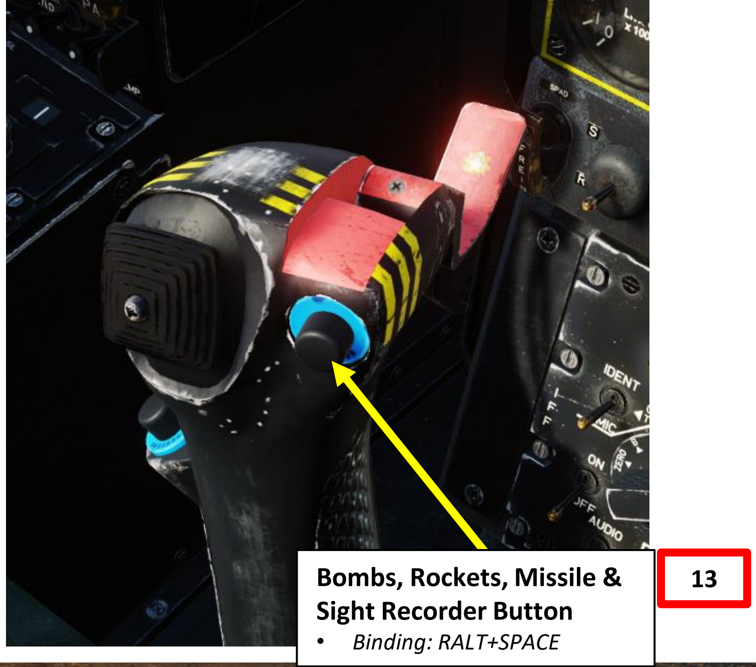




2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.3 – MATRA R530F IR Missile (No Radar)

11. Fly behind the target to align its **rear** with the upper area of the sight glass.
12. Once a valid infrared signature is detected and tracked by the missile seeker, a high-pitch tone is audible and tracking circles become visible on the sight.
13. Press and hold Bombs, Rockets, Missile & Sight Recorder Button to launch the missile (RALT+SPACE).
14. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. This prevents engine flameout due to smoke ingestion.

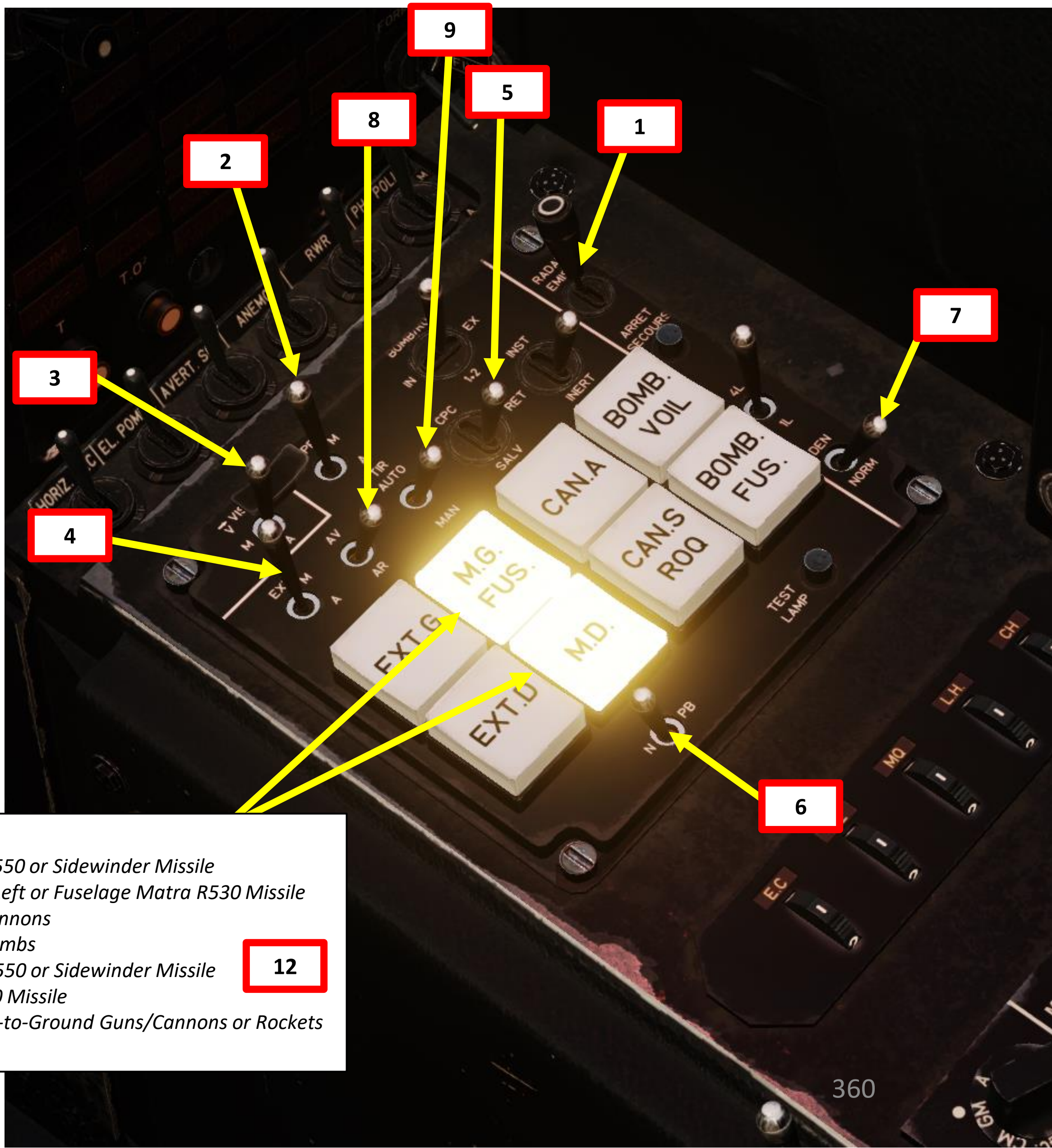




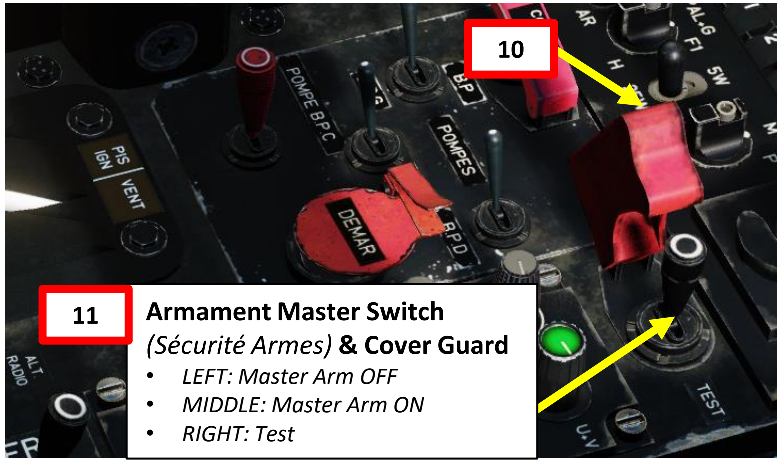
2 – AIR-TO-AIR WEAPONS
2.1 – Infrared Seeker Missiles
2.1.3 – MATRA R530F IR Missile (No Radar)

2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.1 – MATRA R530F EM Missile (With Auto Radar Lock)

1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
3. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
4. Set Missile Preparation Switch – FWD (Marche/ON)
5. Set Single/Salvo Selector Switch – FWD (CPC/Single, *Coup par coup*)
6. Set Normal/Jammer Pursuit Switch – LEFT (NORMAL)
    - Note: Jammer Pursuit (PB) mode forces the R530 missile navigation and detonation delay to be optimized for a stern attack in an environment where radar jamming does not provide the missile with range of range rate information.
7. Set R530 Missile Normal/Altitude Difference Selector Switch – AFT (Normal).
    - Note: Using DEN (Différence Élévation, Altitude Difference) mode optimizes missile navigation when attacking a high energy target (high altitude/speed).
8. Set Fore/Aft Selector Switch – AFT (Arrière/AFT)
    - Note: This switch is used in a jamming environment where no target range is available. Missile detonation fuze delay is optimized for either a forward aspect engagements or a stern (aft) engagement.
9. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
10. Flip Armament Master Switch (Sécurité Armes) guard – UP
11. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
12. Select inner stations equipped with 530F EM missiles by pressing either the MG FUS (Missile Gauche / Fuselage, Left Missile / Fuselage) and/or MD (Missile Droite, Right Missile) buttons.



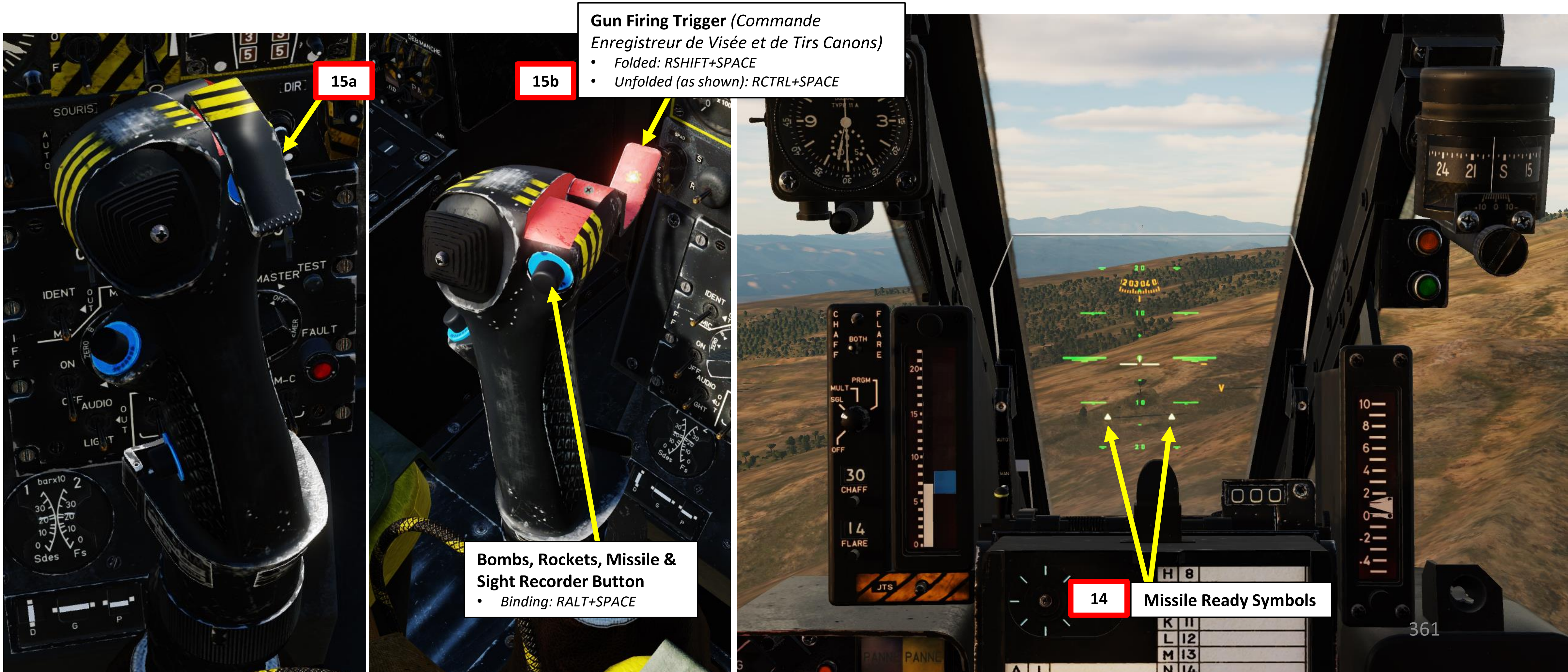
Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*



Armament Master Switch ***(Sécurité Armes)*** **& Cover Guard**
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.1 – MATRA R530F EM Missile (With Auto Radar Lock)

13. Missile cooling time can take up to 20 seconds. Once seeker head is cooled and ready for use, the cooling liquid lasts for about 20 minutes.
14. Once missiles are ready, selection symbols (triangle) are visible on the sight.
15. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.



2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.1 – MATRA R530F EM Missile (With Auto Radar Lock)

The R530F EM missile can be used with any air-to-air radar mode such as HA, IC, TL or BZ. In this example, we will use a close combat mode to demonstrate how the radar can automatically lock a target when in either TL or BZ Close Combat Mode. Keep in mind that we could also use HA or IC as well for longer ranges.

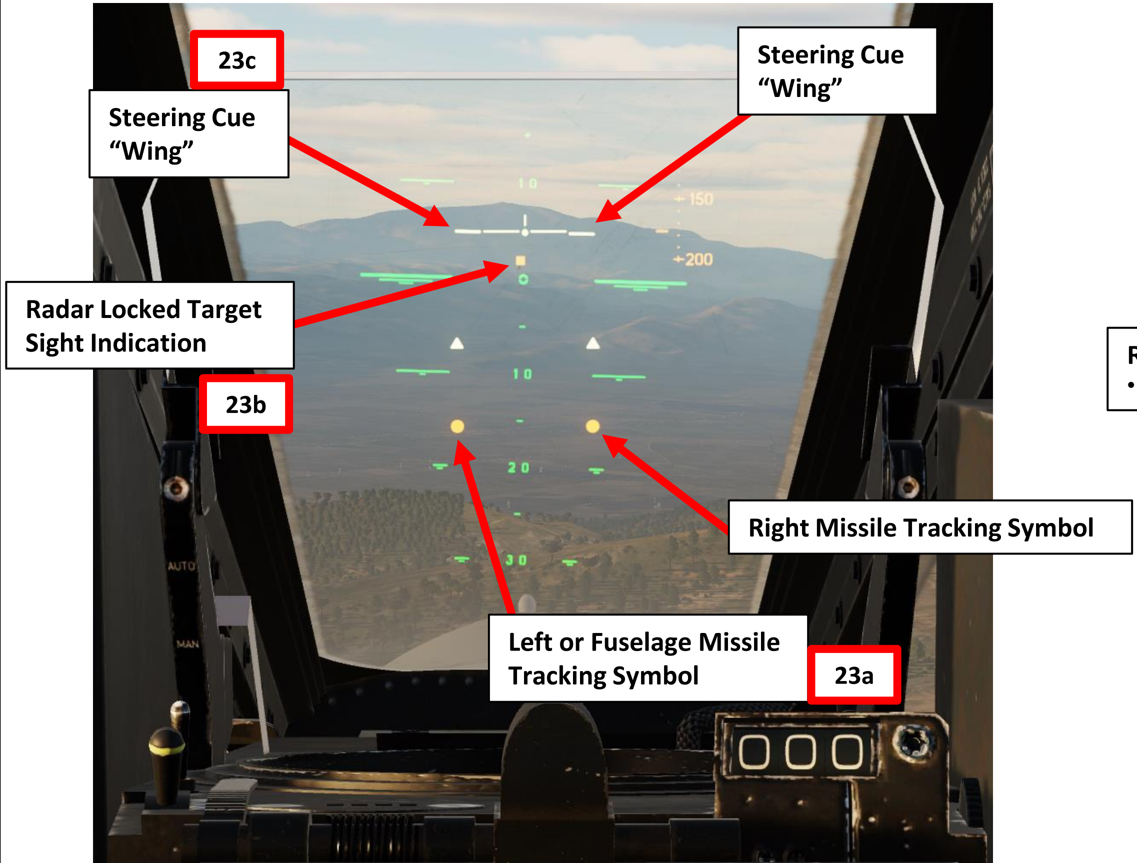
16. Set Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch – UP (TELEMETER) or DOWN (AREA/ZONE SCANNING).
17. Confirm TL (or BZ) radar function light illuminates. All other radar functions are overridden.
18. In TL or BZ, only the 7 nm range scale is available.
19. Gain control is automatic.

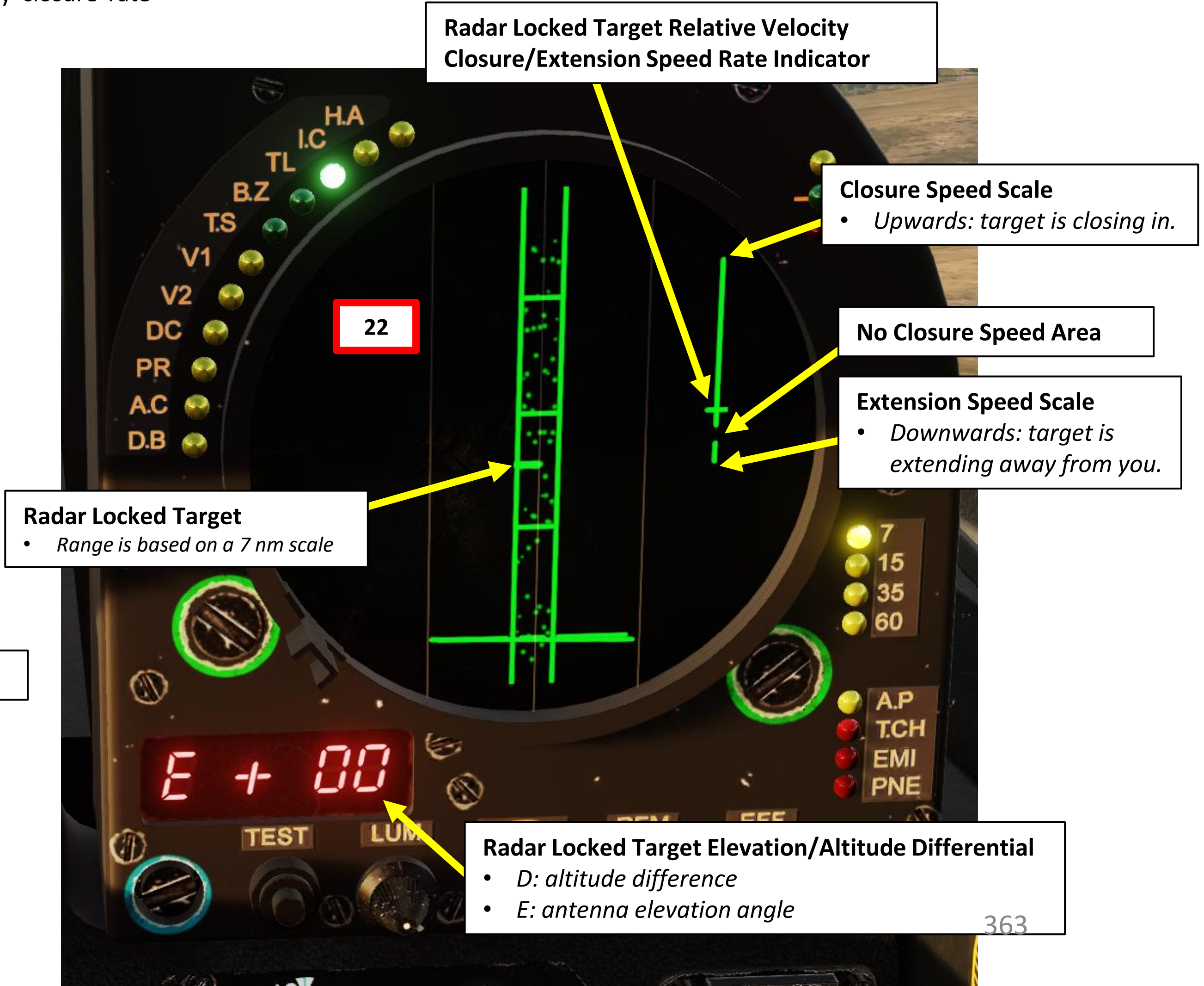
Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

16

2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.1 – MATRA R530F EM Missile (With Auto Radar Lock)

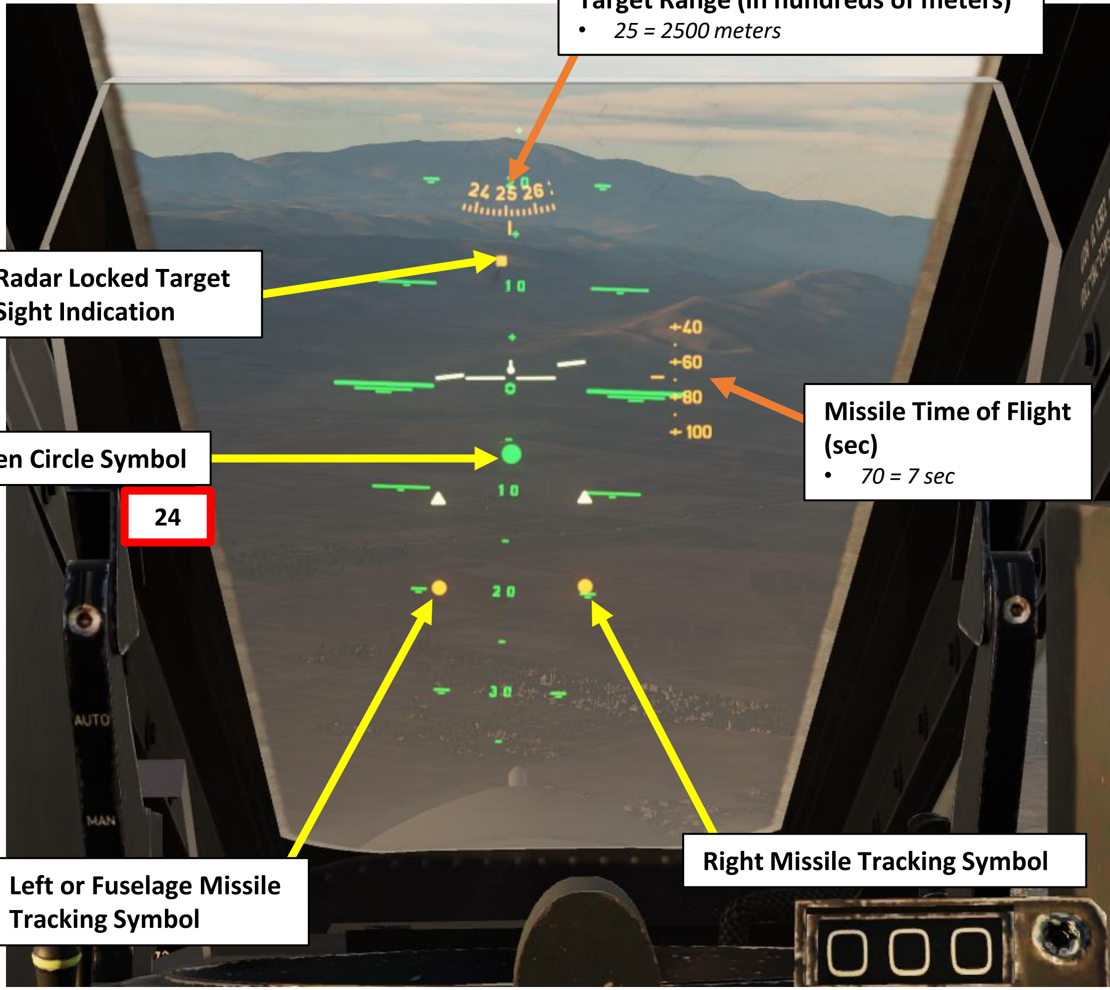
20. Steer the aircraft to have the target roughly in the middle of your sight glass. At these ranges, the target is usually acquired visually.
21. The radar will automatically lock a target at a distance between 400 m and 7 km.
22. Once radar lock is achieved, the radar scope will display target range and velocity closure rate information.
23. Once a target is radar locked and missiles are tracking the target as well:
    a) Tracking circles become visible on the sight
    b) Target is designated with a square
    c) Steering cues indicate how to steer the aircraft to intercept the target.





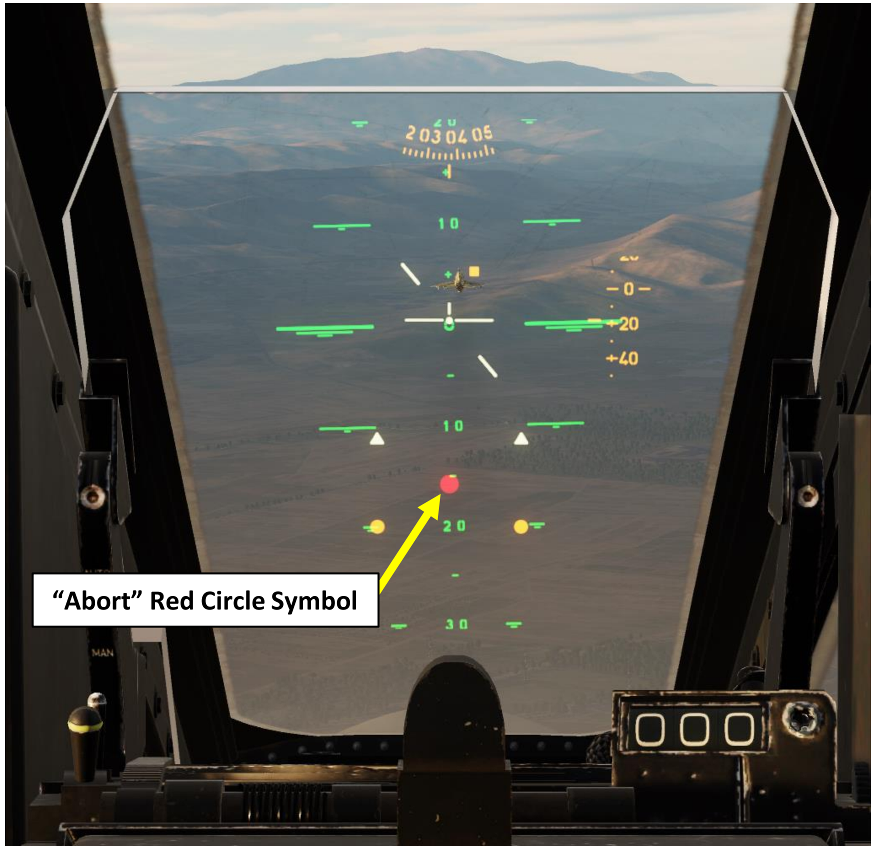
2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.1 – MATRA R530F EM Missile (With Auto Radar Lock)

24. Once you are within good firing range, a green circle is displayed on the sight.
25. Identify target visually or via AWACS and **verify it is hostile** since the Mirage F1 has no IFF (Identify-Friend-or-Foe) capability. Then, press and hold Bombs, Rockets, Missile & Sight Recorder Button to launch the missile (RALT+SPACE).
26. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. This prevents engine flameout due to smoke ingestion.
27. Keep the target within the sight; the missile requires continuous radar lock guidance until impact



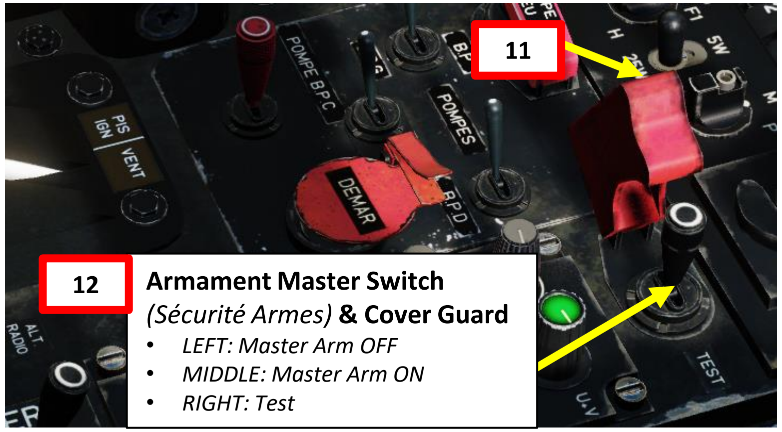
2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.1 – MATRA R530F EM Missile (With Auto Radar Lock)

28. If you are too close to the target to fire a missile, a steady red “Abort” circle is displayed on the sight, indicating missile launch parameters have been exceeded. Launch parameters are exceeded if:
    - Excessive Roll Angle is greater than 80 deg
    - Acceleration is below -1 G or above +4G
    - Aircraft is in a negative pitch angle when flying below 8000 ft.
    - Note: the red “Abort” circle flashes when range to target is too short for missile launch (below 500 meters).
29. To exit Telemeter or Area/Zone Scanning Mode, set Radar Telemeter / Area Zone Scanning Selector Switch – MIDDLE position (OFF).

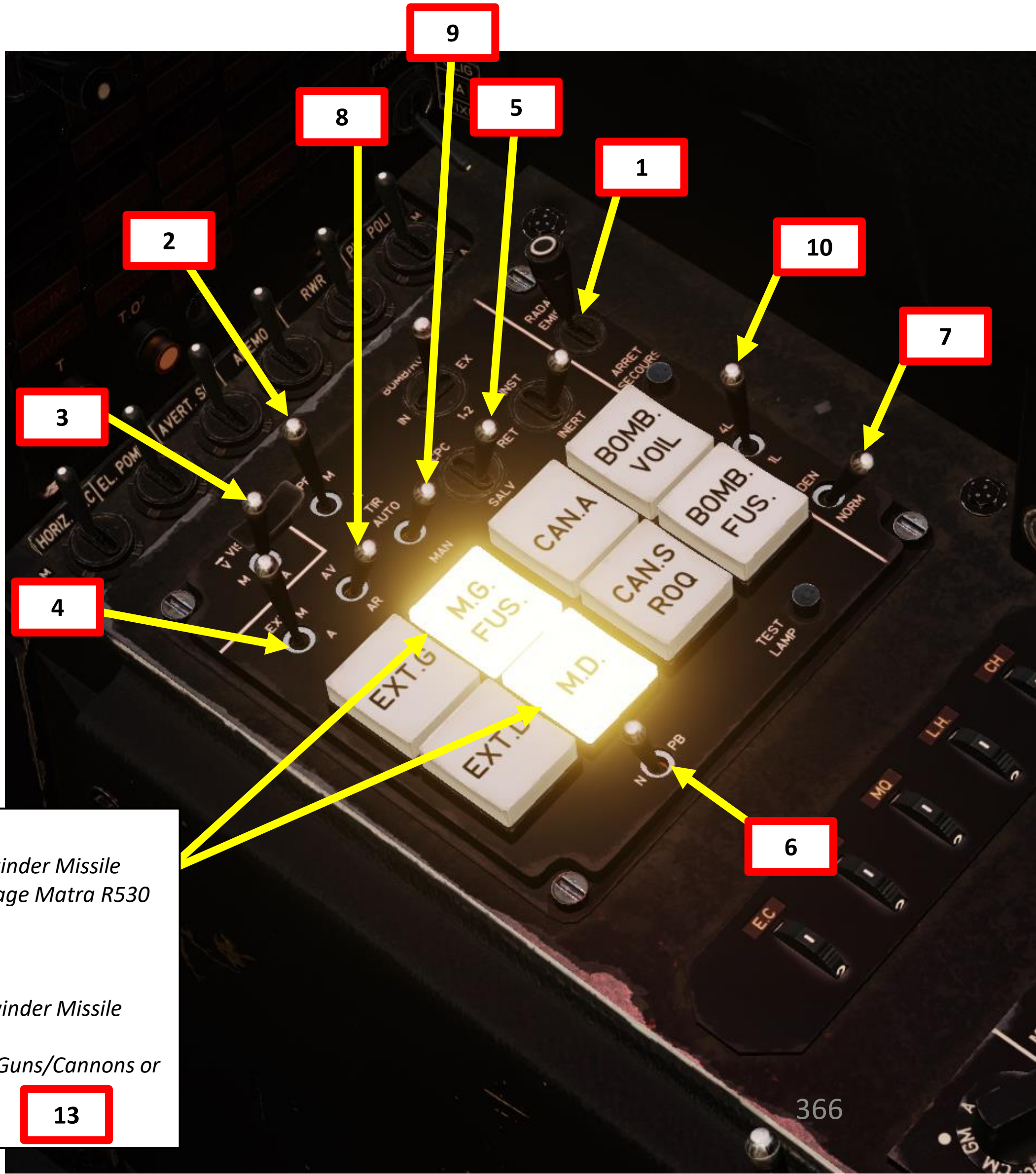


2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
3. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
4. Set Missile Preparation Switch – FWD (Marche/ON)
5. Set Single/Salvo Selector Switch – FWD (CPC/Single, *Coup par coup*)
6. Set Normal/Jammer Pursuit Switch – LEFT (NORMAL)
    - Note: Jammer Pursuit (PB) mode forces the R530 missile navigation and detonation delay to be optimized for a stern attack in an environment where radar jamming does not provide the missile with range of range rate information.
7. Set R530 Missile Normal/Altitude Difference Selector Switch – AFT (Normal).
    - Note: Using DEN (Différence Élévation, Altitude Difference) mode optimizes missile navigation when attacking a high energy target (high altitude/speed).
8. Set Fore/Aft Selector Switch – AFT (Arrière/AFT)
    - Note: This switch is used in a jamming environment where no target range is available. Missile detonation fuze delay is optimized for either a forward aspect engagements or a stern (aft) engagement.
9. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
10. Set Radar Bar *(Lignes)* Scan Selector Switch – FWD (4 Lignes)
11. Flip Armament Master Switch (Sécurité Armes) guard – UP.
12. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
13. Select inner stations equipped with Super S530F missiles by pressing either the MG FUS (Missile Gauche / Fuselage, Left Missile / Fuselage) and/or MD (Missile Droite, Right Missile) buttons.



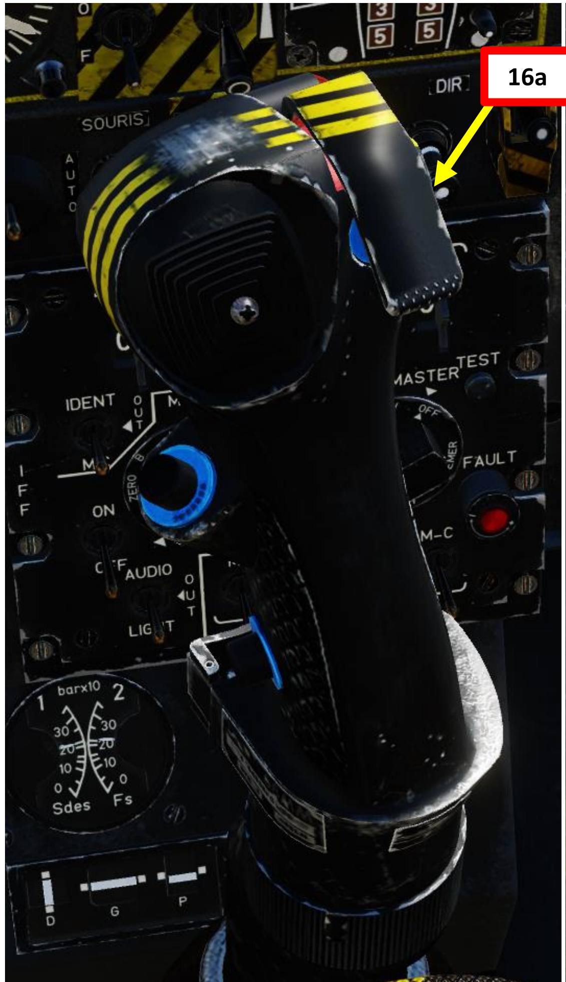
Armament Master Switch *(Sécurité Armes)* & Cover Guard
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

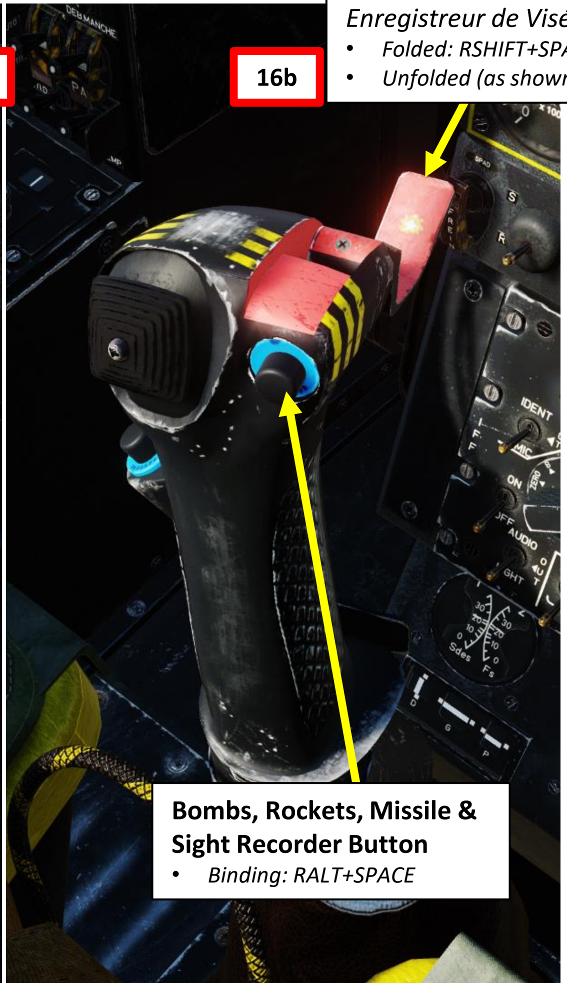


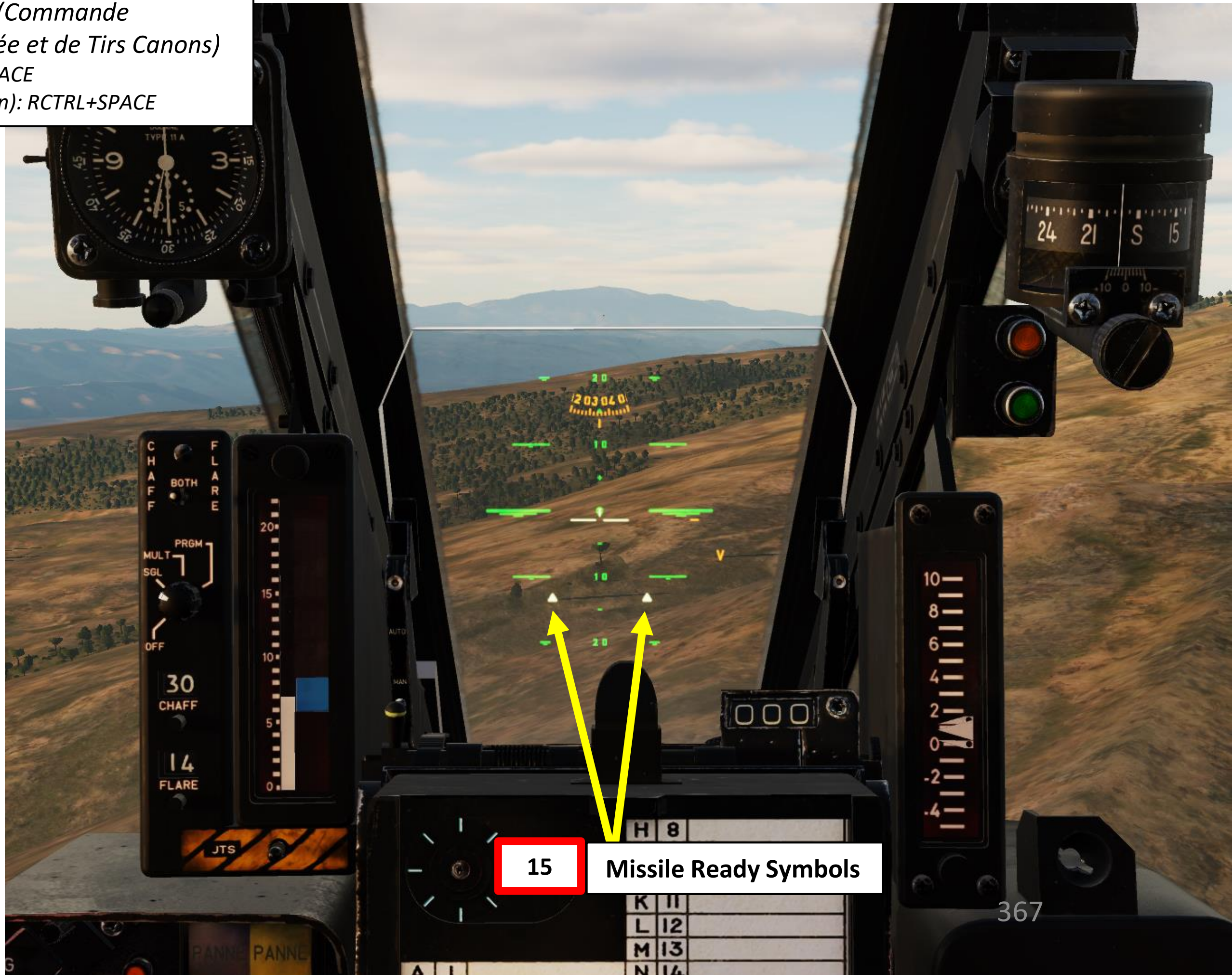
Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

14. Missile cooling time can take up to 20 seconds. Once seeker head is cooled and ready for use, the cooling liquid lasts for about 20 minutes.
15. Once missiles are ready, selection symbols (triangle) are visible on the sight.
16. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.



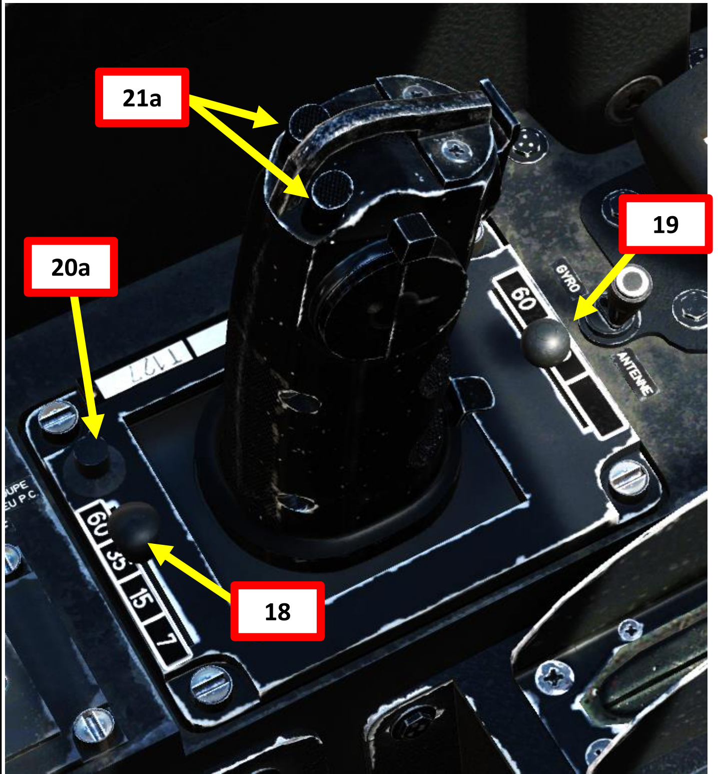




2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

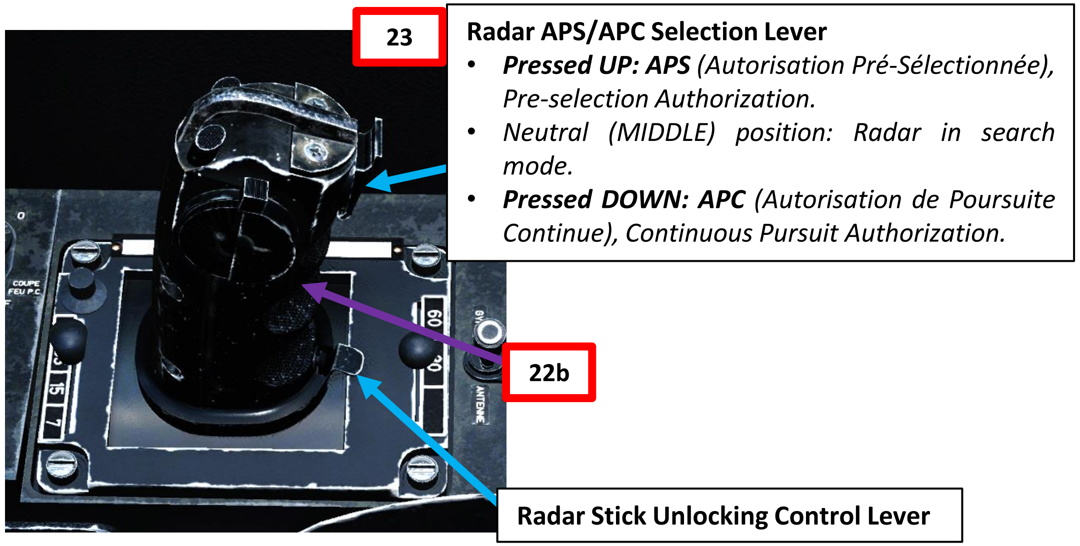
The Super S530F missile can be used with any air-to-air radar mode such as HA, IC, TL or BZ. In this example, we will use a medium-range interception mode to demonstrate how to manually lock a target when in either HA or IC Interception Mode. Keep in mind that we could also use TL or BZ as well for shorter ranges.

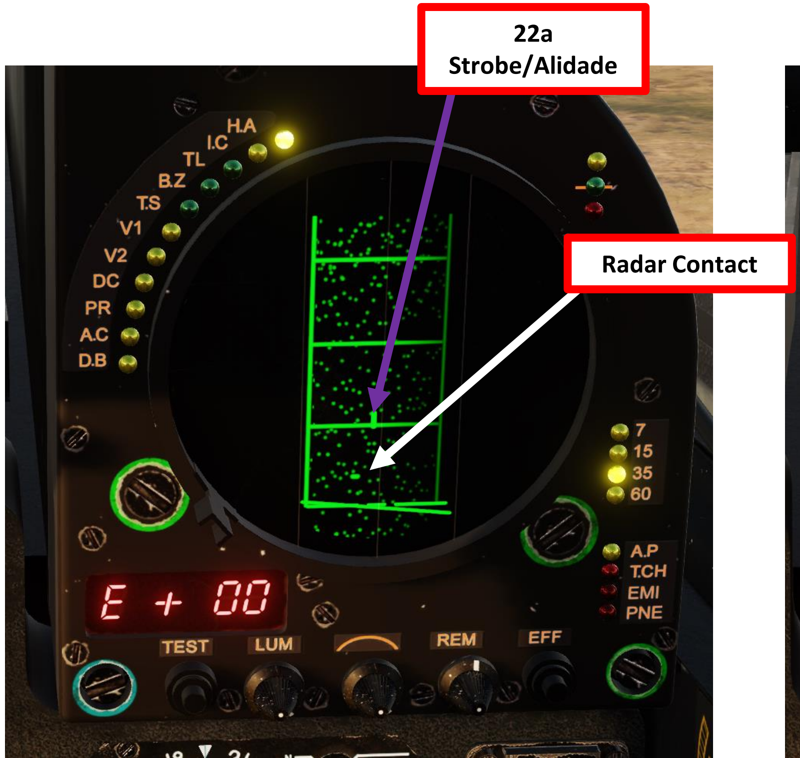
17. Turn Radar Function Selector Knob until HA (or IC) radar function light illuminates.
18. Set Radar Scale Selector Lever – As desired (7/15/35/60 nm).
19. Set Radar Scan Selector Lever – As desired (+/- 30 or +/- 60 deg).
20. Toggle Radar Antenna Elevation / Altitude Difference mode – As desired.
    - "E" is for "Antenna Elevation Angle", "D" is for "Altitude Difference".
21. Use the Radar Antenna Elevation / Altitude Difference Increase or Decrease Button to tilt the radar antenna – As desired. This radar function is useful if a ground controller gives you a target's altitude.



2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

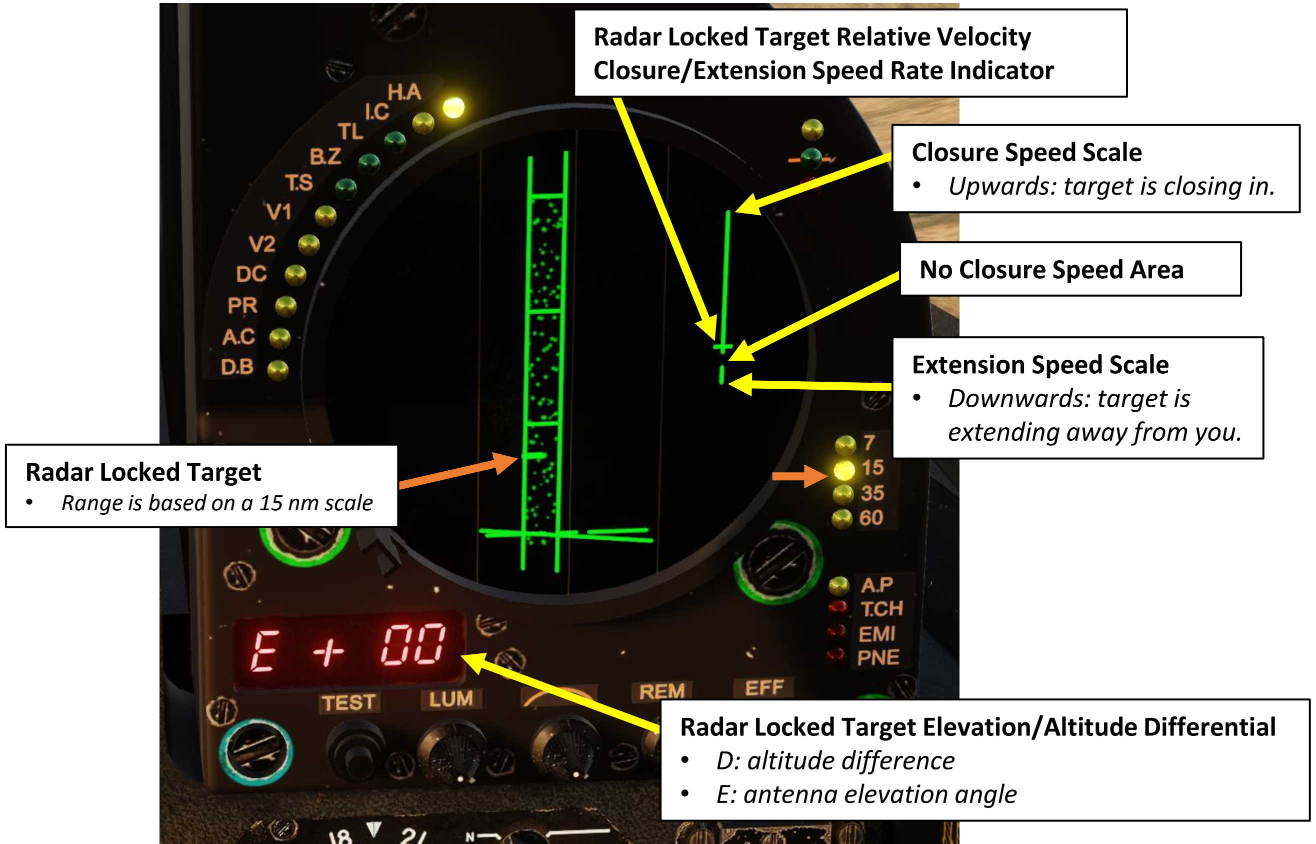
22. Use Radar Control Stick to move radar alidade/strobe over the target.
23. Once target is closer than 35 nm, press the Radar APS/APC Selection Lever DOWN (APC, Lock-On) to attempt a radar lock.
    - Note: To unlock target, press the Radar Stick Unlocking Control Lever.

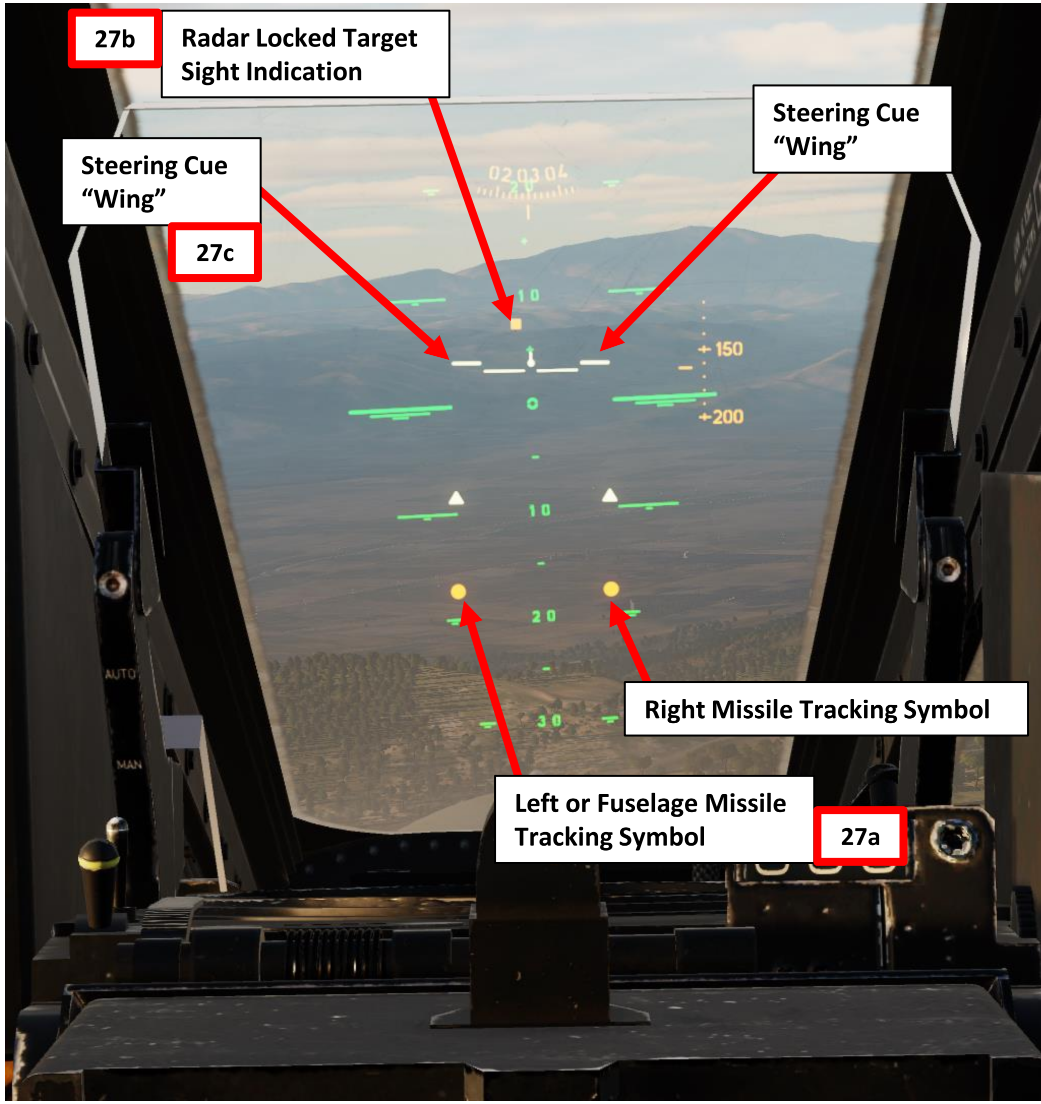




2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

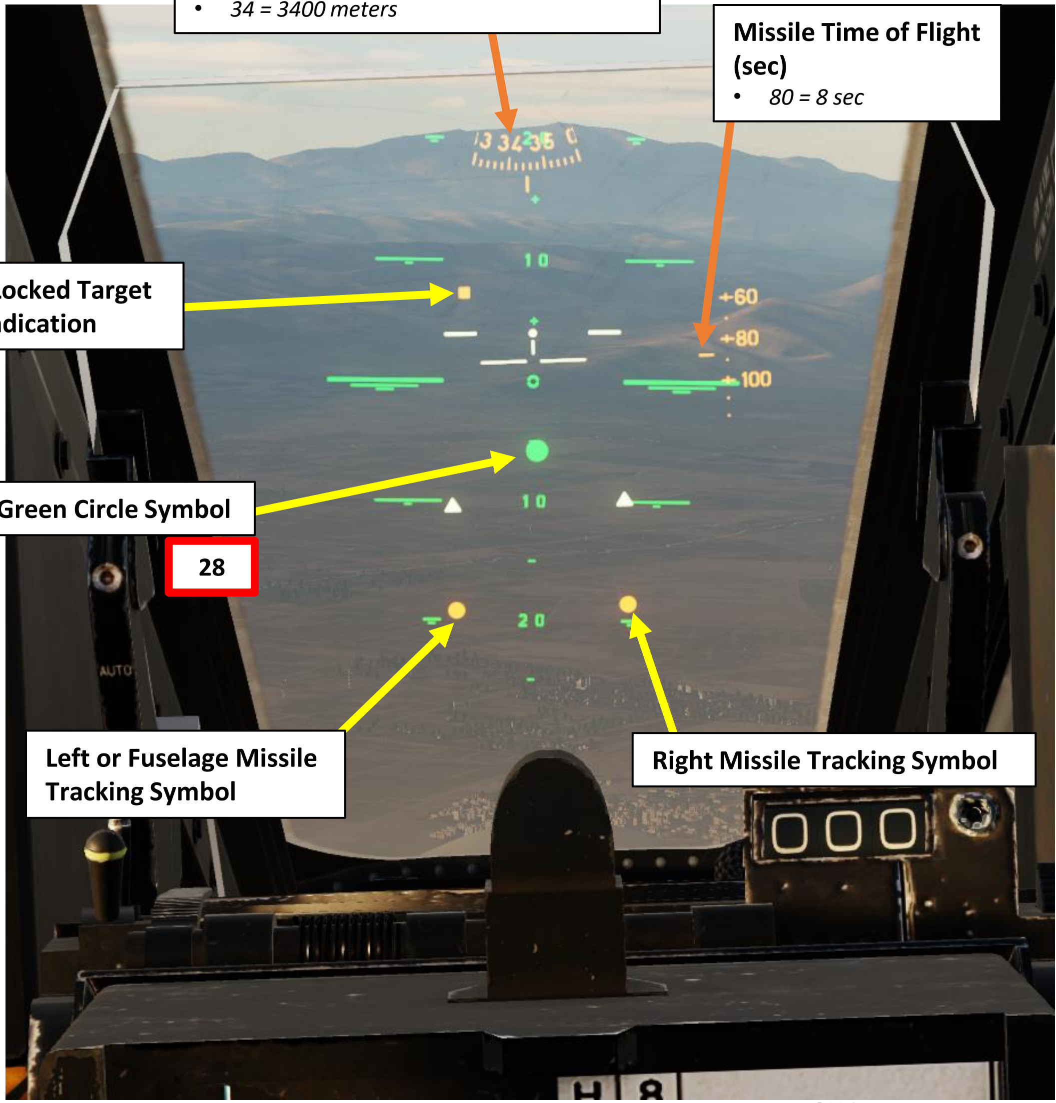
24. Once radar lock is achieved, the radar switches to automatic tracking and the pilot can release the Radar APS/APC Selection Lever.
25. The radar scope will display target range and velocity closure rate information. Additionally, a square on the sight glass will indicate the position of the target.
26. If desired, you can adjust the Radar Scale Selector Lever to have a better view of the target range.
27. Once a target is radar locked and missiles are tracking the target as well:
    a) Tracking circles become visible on the sight
    b) Target is designated with a square
    c) Steering cues indicate how to steer the aircraft to intercept the target.





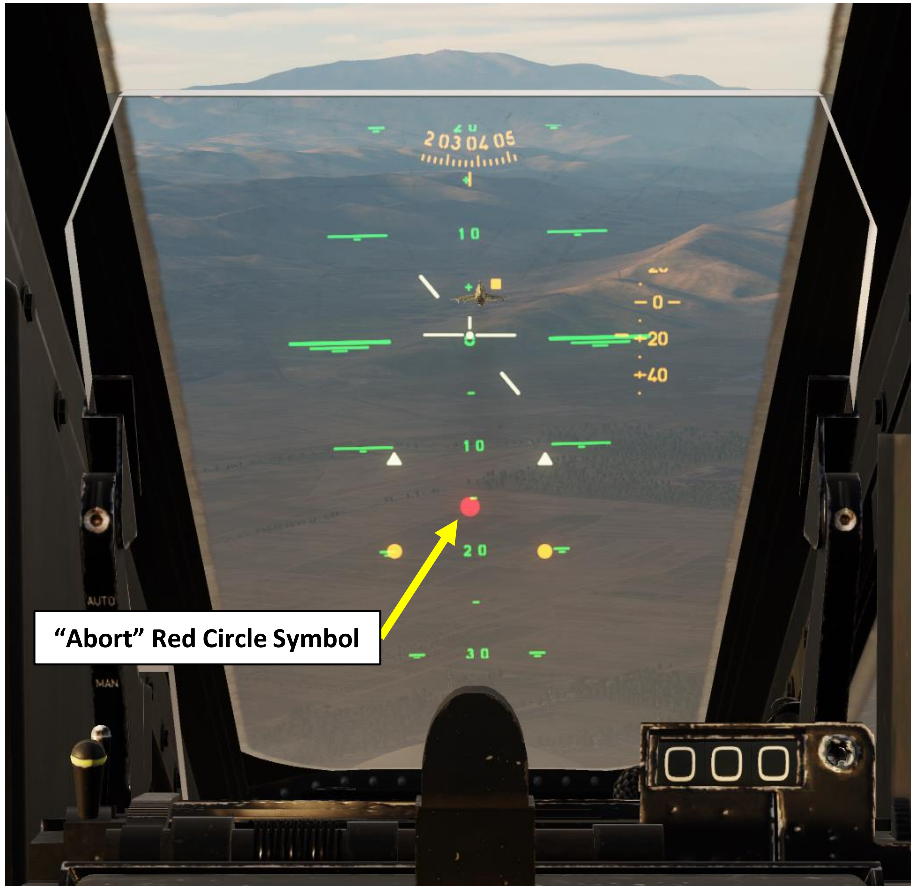
2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

28. Once you are within good firing range, a green circle is displayed on the sight.
29. Identify target visually or via AWACS and **verify if it is hostile** since the Mirage F1 has no IFF (Identify-Friend-or-Foe) capability.
30. Press and hold Bombs, Rockets, Missile & Sight Recorder Button to launch the missile (RALT+SPACE).
31. When a missile is fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM, turning off the afterburner and opening the nozzle for 3 seconds. This prevents engine flameout due to smoke ingestion.
32. Keep the target within the sight; the missile requires continuous radar lock guidance until impact.



2 – AIR-TO-AIR WEAPONS
2.2 – Semi-Active Radar-Guided Missiles
2.2.2 – MATRA SUPER S530F Missile (With Manual Radar Lock)

33. If you are too close to the target to fire a missile, a steady red “Abort” circle is displayed on the sight, indicating missile launch parameters have been exceeded. Launch parameters are exceeded if:
    - Excessive Roll Angle is greater than 80 deg
    - Acceleration is below -1 G or above +4G
    - Aircraft is in a negative pitch angle when flying below 8000 ft.
    - Note: the red “Abort” circle flashes when range to target is too short for missile launch (below 500 meters).
34. To unlock target, press the Radar Stick Unlocking Control Lever.



2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.1 – Introduction

The DEFA 553 cannon (Direction des Études et Fabrications d'Armement) is a French-made aircraft revolver cannon firing 30 mm caliber NATO standard rounds. It has three primary modes of operation:

Gyroscopic Mode:
- **Without a radar lock**: the sight displays lead correction based on the aircraft's own body acceleration rates sensed by gunsight gyro. The gun sight can be adjusted for a fixed 300 m or 600 m range.
- **With a radar lock**: the sight displays lead correction based on the aircraft's own body acceleration rates sensed by gunsight gyro. Sight range input is fed from the radar. The gyro sight with radar range requires a certain "sight solution time" (in other words, a steady target tracking for about 2 seconds) before the firing solution is deemed valid.

Radar Antenna Mode:
- The sight displays lead correction based on radar antenna sensed rates and range input as fed by the radar. This then means "sight solution time" is effectively zero. This implies its a "real time" sight, so tracking is effectively not really required. As long as the sight transits through the target, hits should be achieved. This allows "autofiring" to occur if selected (Automatic/Manual Firing (Tir) Mode Selector Switch – FWD, Automatic). Since the system knows the reticle position and the target position (the target designation square) it can initiate firing at pipper and target designation square coincidence, provided the gun trigger is depressed and the reticle is within 15 mils of the target designation square. Once the error is over 15 mils, "autofire" will cease.

Antenna-Gyro Switch
- *LEFT: Sight operates in **gyroscopic** mode, similar to LCOS (Lead Computing Optical Sight) mode. The aircraft is assumed to be flying in the target's plane of motion, and with the same speed*
- *RIGHT: If the radar is locked, the operation of the sight is based on radar **antenna** coordinates. In this radar director sight mode, the pipper can be put on the radar target symbol (the orange square) to get a hit.*

Automatic/Manual Firing *(Tir)* **Mode Selector Switch**
- *FWD: Automatic*
  - *If Gyro/Ant switch in ANT, guns can fire automatically (trigger must be held down) but only when pipper is within 15 mils of the target designation square.*
- *AFT: Manual*

Cannon 300-600 m and Missile Lock/Unlock Button

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.1 – Introduction

Salvo vs Single Mode

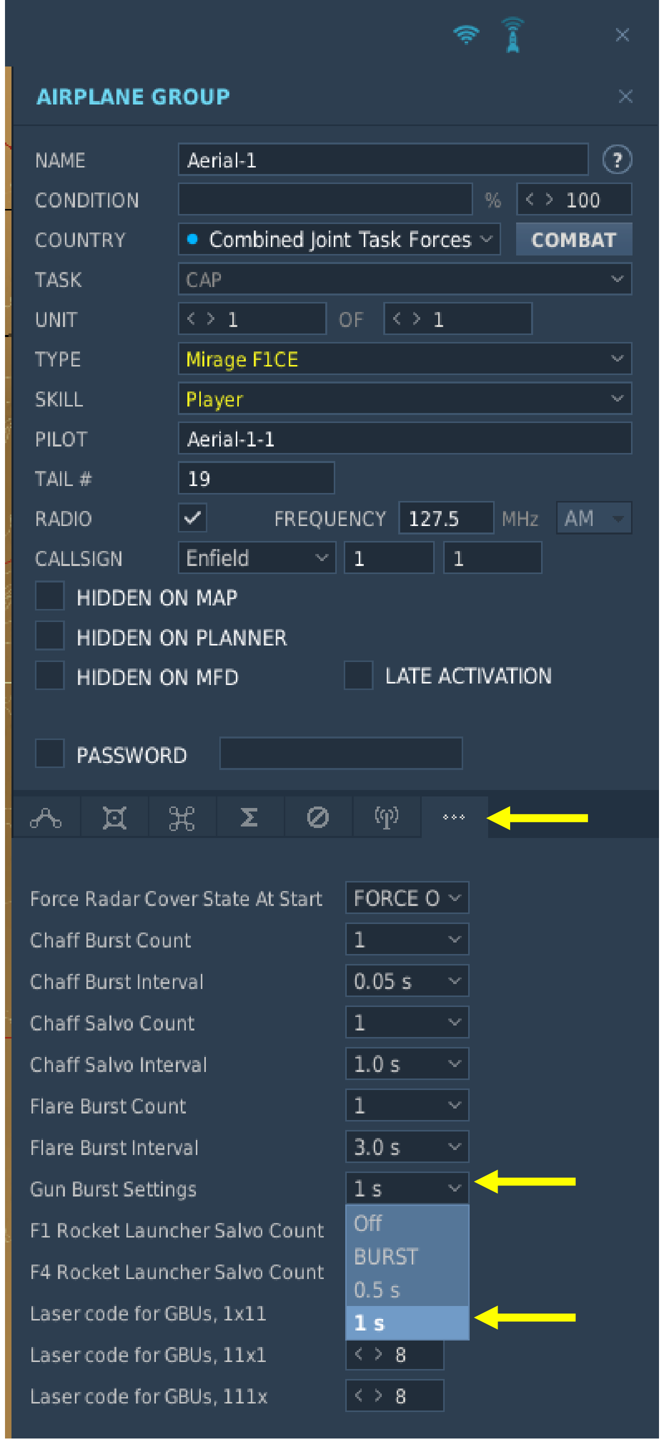
If the Single/Salvo Selector switch is in **CPC/SINGLE**, gun firing is **controlled by the burst limiter**, which is set on the ground as a maintenance function. In DCS, this maintenance function is simulated through the Mission Editor in the "Gun Burst Settings" option.

If the Single/Salvo Selector switch is in **SALVO**, rounds are **fired out the gun for as long as the trigger is squeezed**.

In practical terms, in air-to-air you should in most cases want rounds out the gun as long the trigger is depressed. The only real time one would consider burst limiting might be in air-to-ground strafes, and then probably only in training.

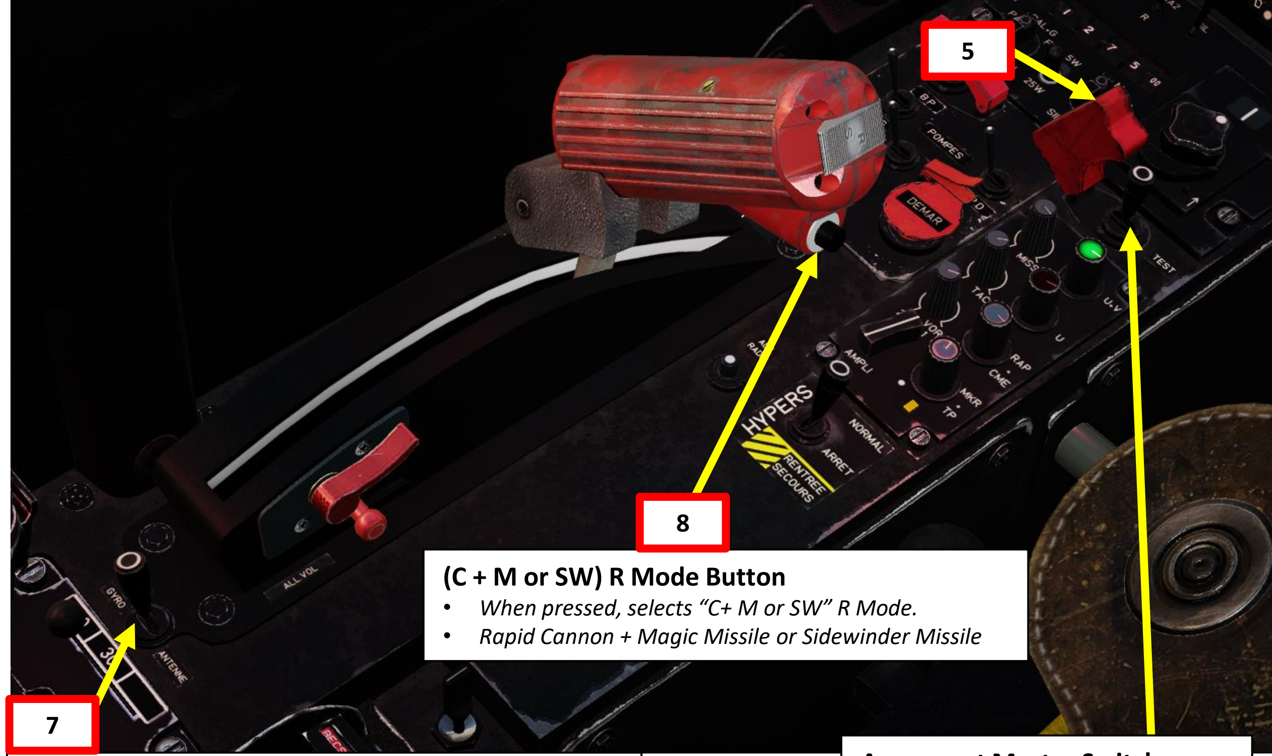
- If the Burst Setting is set to OFF, then with the Single/Salvo switch in CPC/SINGLE the gun wont fire at all.
- A recommended setting is to use the maximum setting of a "1 sec burst" and set the Single/Salvo switch to SALVO. This way, if set the Single/Salvo switch to CPC/SINGLE by mistake, you still get rounds out the gun and get at least a 1 sec burst.

Single/Salvo Selector Switch
- *FWD: CPC (Coup par coup), Single*
- *AFT: SALV (Salve), Salvo*



2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.2 – Tutorial with Gyroscopic Mode (No Radar)

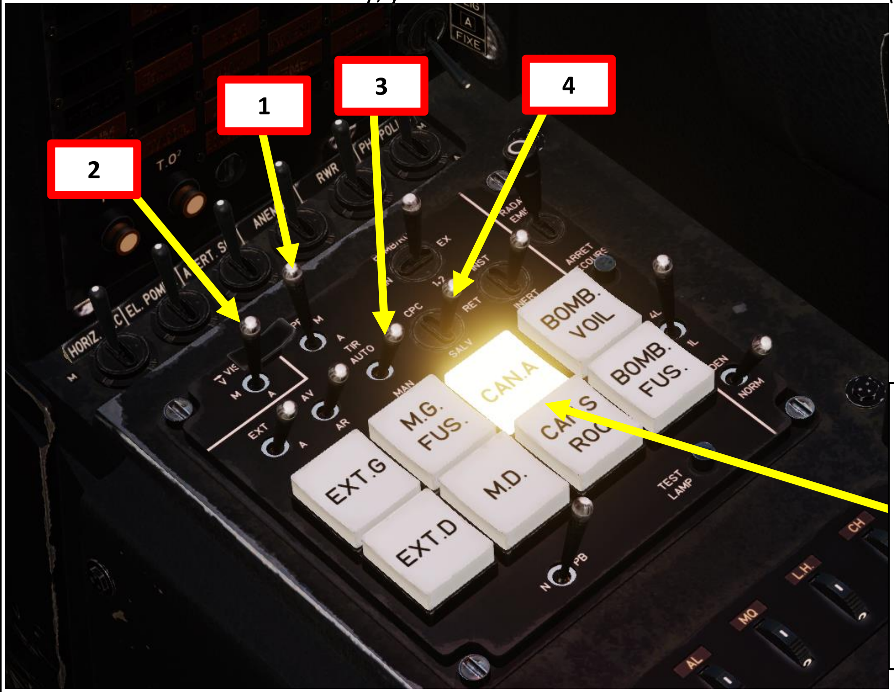
1. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
4. Set Single/Salvo Selector Switch – As desired.
   - FWD: CPC (Coup par coup), Single. Firing the gun will use the "gun burst setting" programmed in the Mission Editor.
   - AFT: SALV (Salve), Salvo. Gun is firing as long as the gun trigger is squeezed.
5. Flip Armament Master Switch (Sécurité Armes) guard – UP
6. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
7. Set Antenna-Gyro Switch – LEFT (Gyroscopic Mode).
   - Note: if no target is tracked with a radar lock, the sight reverts to Gyroscopic Mode automatically regardless of the Antenna-Gyro Switch position.
8. Press (C + M or SW) R Mode (Rapid Cannon + Magic Missile or Sidewinder Missile) Button to select Cannons.
   - Alternatively, you can also select cannons with the *CAN A (Canon Air)* button.



(C + M or SW) R Mode Button
- *When pressed, selects "C+ M or SW" R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

Antenna-Gyro Switch
- *LEFT: Sight operates in **gyroscopic** mode, similar to LCOS (Lead Computing Optical Sight) mode. The aircraft is assumed to be flying in the target's plane of motion, and with the same speed*
- *RIGHT: If the radar is locked, the operation of the sight is based on radar **antenna** coordinates. In this radar director sight mode, the pipper can be put on the radar target symbol (the orange square) to get a hit.*

Armament Master Switch *(Sécurité Armes)* & Cover Guard
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

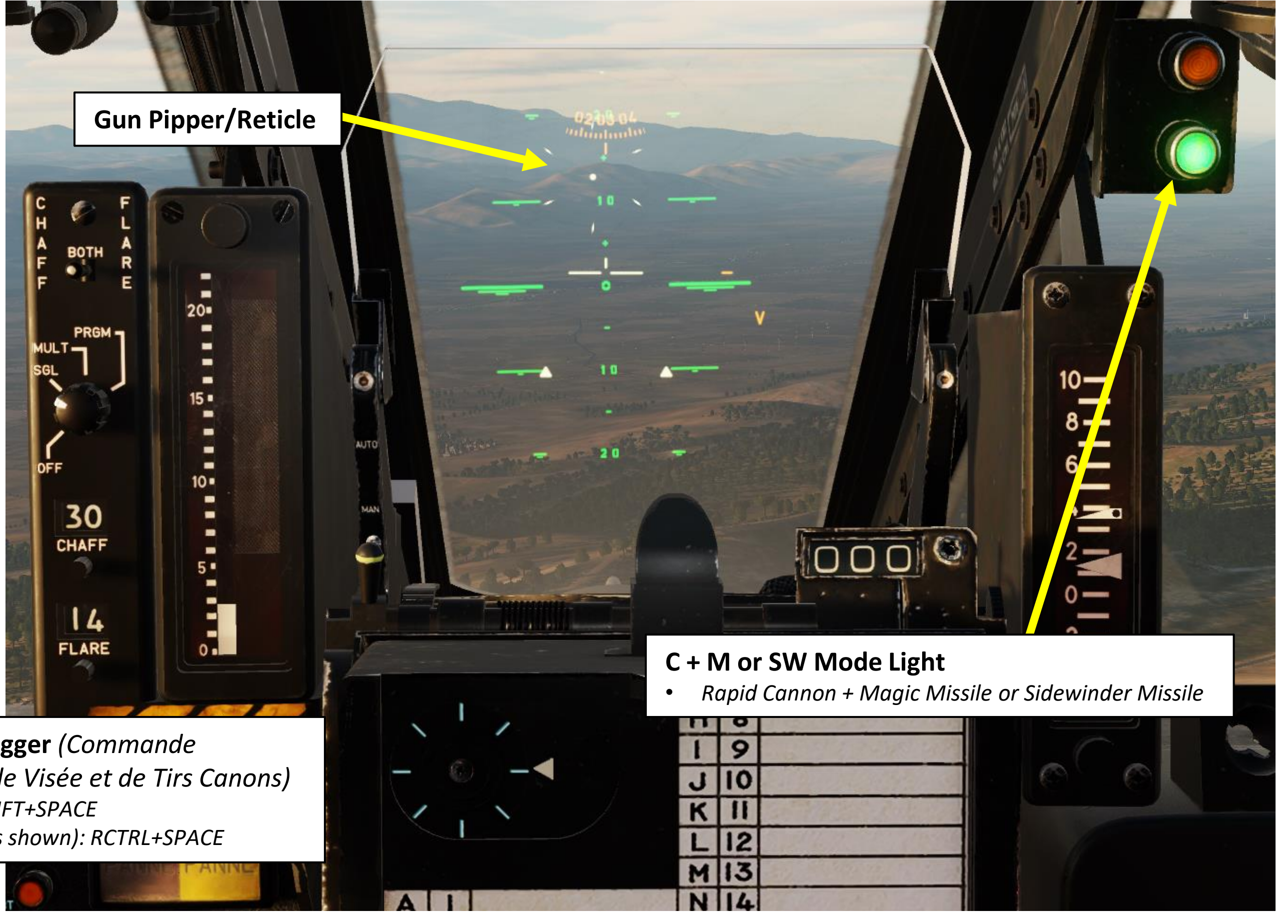


Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

8

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.2 – Tutorial with Gyroscopic Mode (No Radar)

9. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.
10. Set Gun Firing Safety OUT (ARMED) by using the “LCTRL+LWIN+SPACE” binding.
11. The guns’ gyroscopic mode works as a classical LCOS (Lead Computing Optical Sight), assuming that the shooter is maneuvered to be in the target's plane of motion, preferably flying with the same airspeed as the target. The reticle must be kept on the target for some amount of time (up to 2 seconds) to achieve a successful shot.
    - Without radar lock, the gyroscopic mode has no range nor range rate information.
12. Without a radar lock on the target, the sight pipper/reticle is initially set at a fixed range of 300 m. If you want to adjust the reticle for a range of 600 m, press and hold the “Cannon 300-600 m and Missile Lock/Unlock Button”. In this tutorial, we will leave the sight for a 300 m range setting.



2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.2 – Tutorial with Gyroscopic Mode (No Radar)

13. Fly the aircraft to place the pipper on the target.
14. Once the target wingspan fits within the pipper, press the Gun Button (Commande de Canons) (“SPACE” binding) to fire guns.
15. When cannons are fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM. This prevents engine flameout due to smoke ingestion.

13

Gun Pipper/Reticle

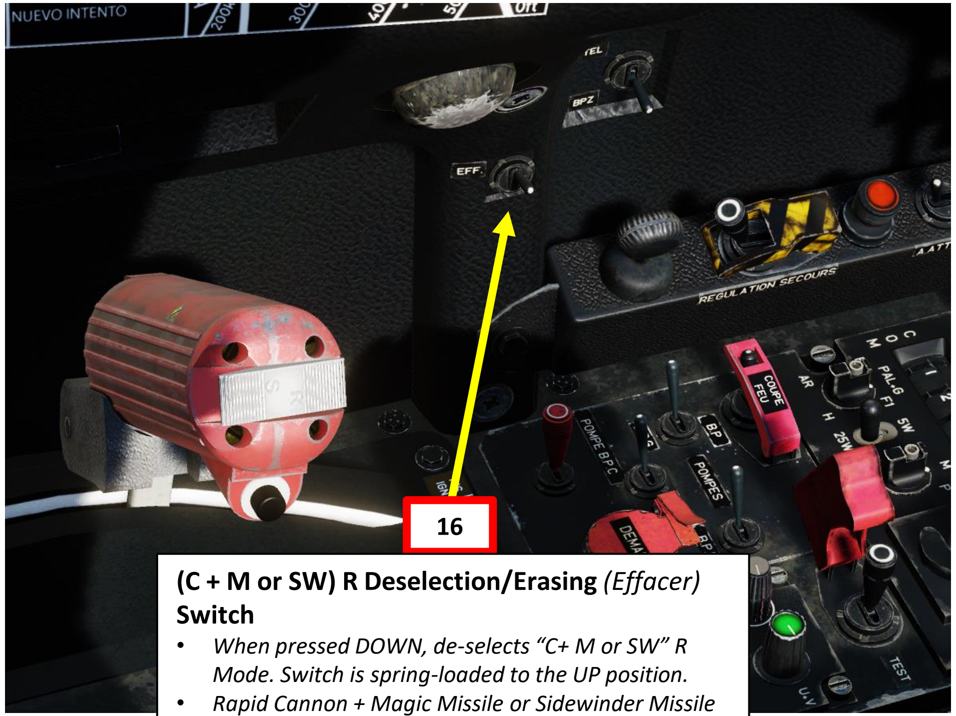
Gun Button *(Commande de Canons)* (front of stick)

- *Binding: SPACE*

14

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.2 – Tutorial with Gyroscopic Mode (No Radar)

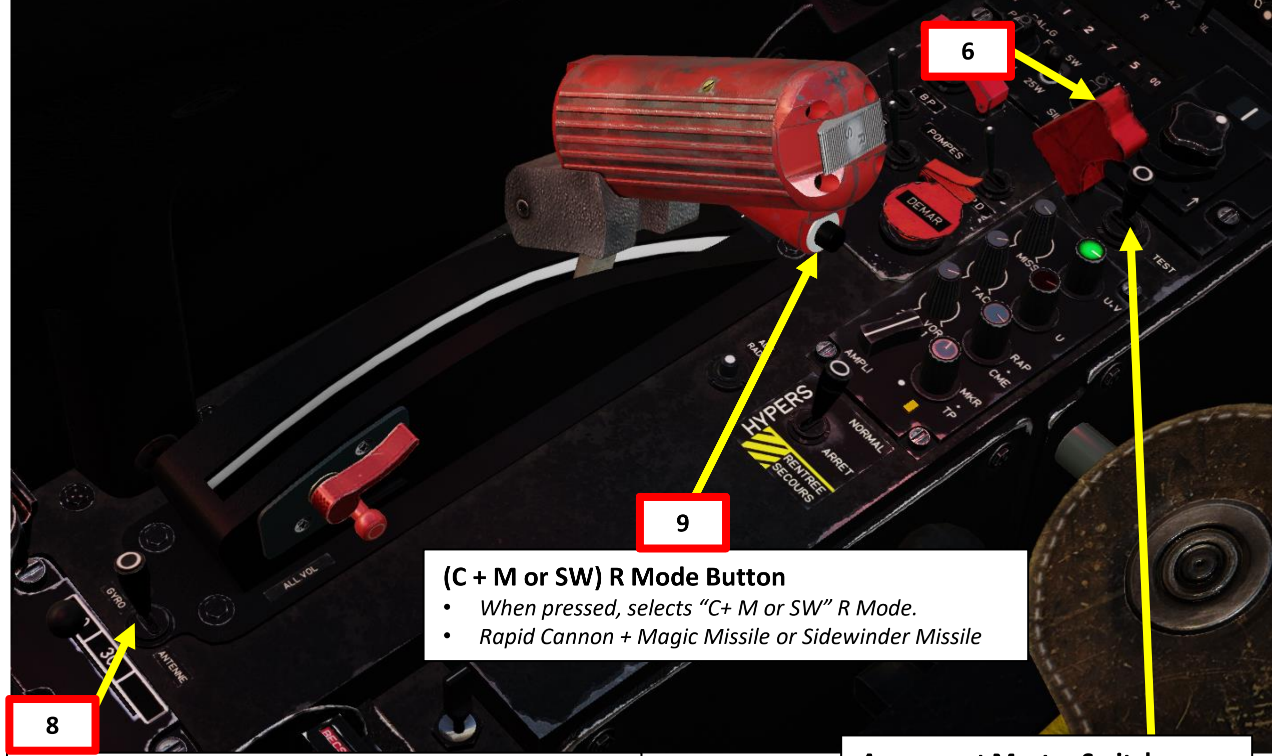
16. To un-select guns, press (C + M or SW) R Deselection/Erasing *(Effacer)* Switch DOWN, then back to UP.



(C + M or SW) R Deselection/Erasing *(Effacer)* Switch
- *When pressed DOWN, de-selects "C+ M or SW" R Mode. Switch is spring-loaded to the UP position.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.3 – Tutorial with Gyroscopic Mode (With Radar)

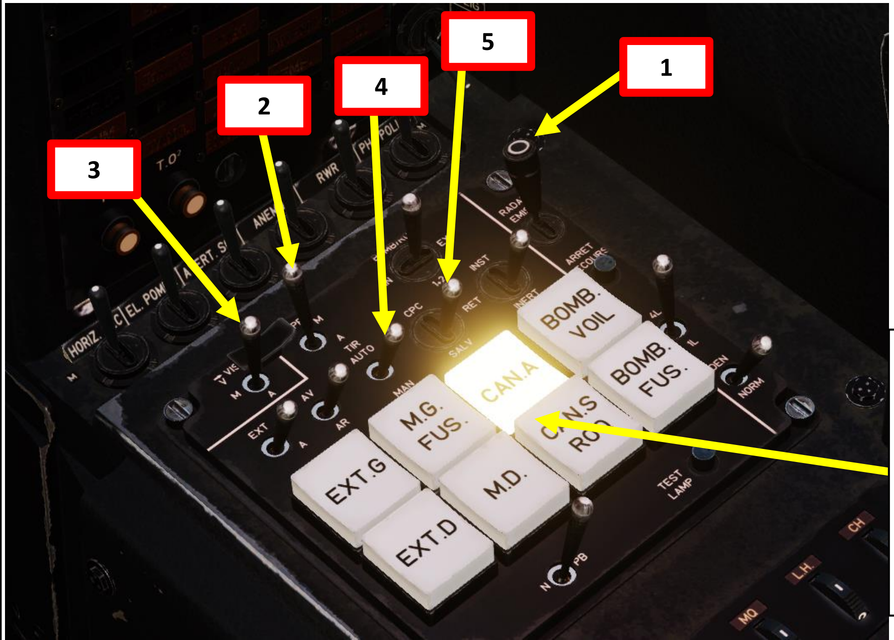
1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
3. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
4. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
5. Set Single/Salvo Selector Switch – As desired.
   - FWD: CPC (Coup par coup), Single. Firing the gun will use the “gun burst setting” programmed in the Mission Editor.
   - AFT: SALV (Salve), Salvo. Gun is firing as long as the gun trigger is squeezed.
6. Flip Armament Master Switch (Sécurité Armes) guard – UP
7. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
8. Set Antenna-Gyro Switch – LEFT (Gyroscopic Mode).
   - Note: if no target is tracked with a radar lock, the sight reverts to Gyroscopic Mode automatically regardless of the Antenna-Gyro Switch position.
9. Press (C + M or SW) R Mode (Rapid Cannon + Magic Missile or Sidewinder Missile) Button to select Cannons.
   - Alternatively, you can also select cannons with the *CAN A (Canon Air)* button.



(C + M or SW) R Mode Button
- *When pressed, selects “C+ M or SW” R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

Antenna-Gyro Switch
- *LEFT: Sight operates in **gyroscopic** mode, similar to LCOS (Lead Computing Optical Sight) mode. The aircraft is assumed to be flying in the target's plane of motion, and with the same speed*
- *RIGHT: If the radar is locked, the operation of the sight is based on radar **antenna** coordinates. In this radar director sight mode, the pipper can be put on the radar target symbol (the orange square) to get a hit.*

Armament Master Switch *(Sécurité Armes)* & Cover Guard
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*

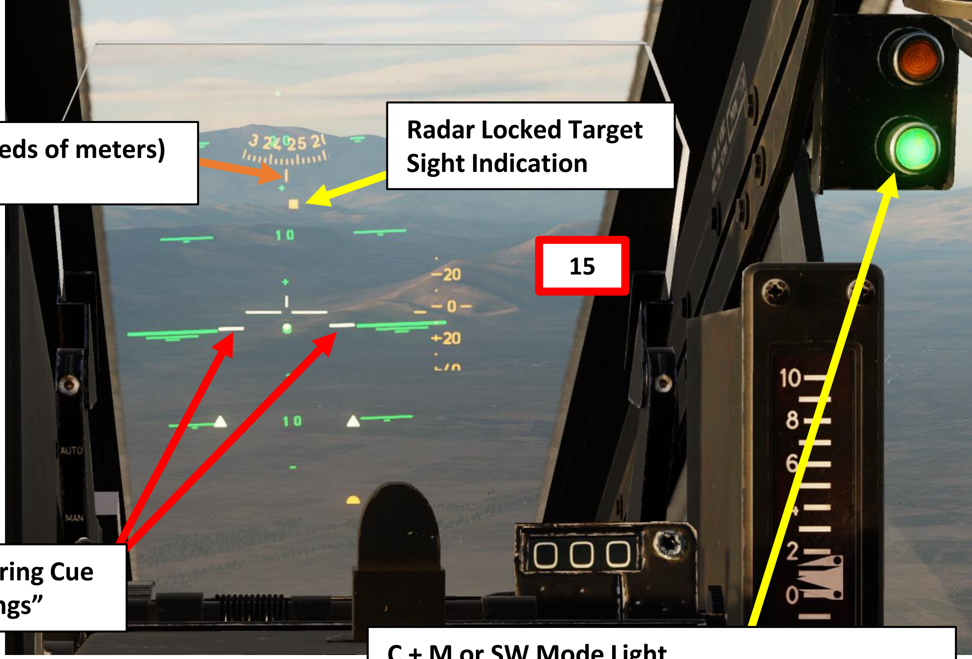


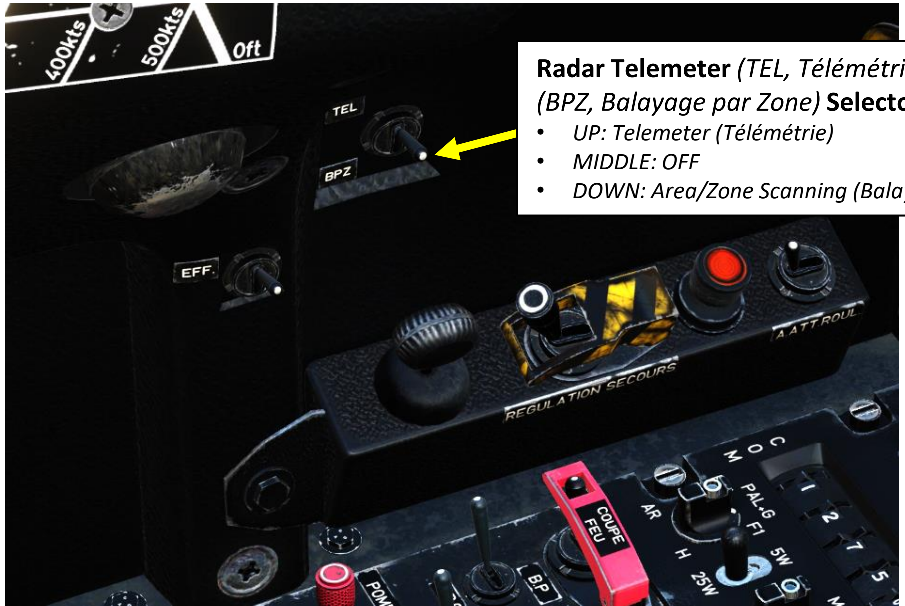
Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.3 – Tutorial with Gyroscopic Mode (With Radar)

We will use a close combat mode to demonstrate how the radar can automatically lock a target when in either TL or BZ Close Combat Mode. Keep in mind that we could also use HA or IC as well for longer ranges.

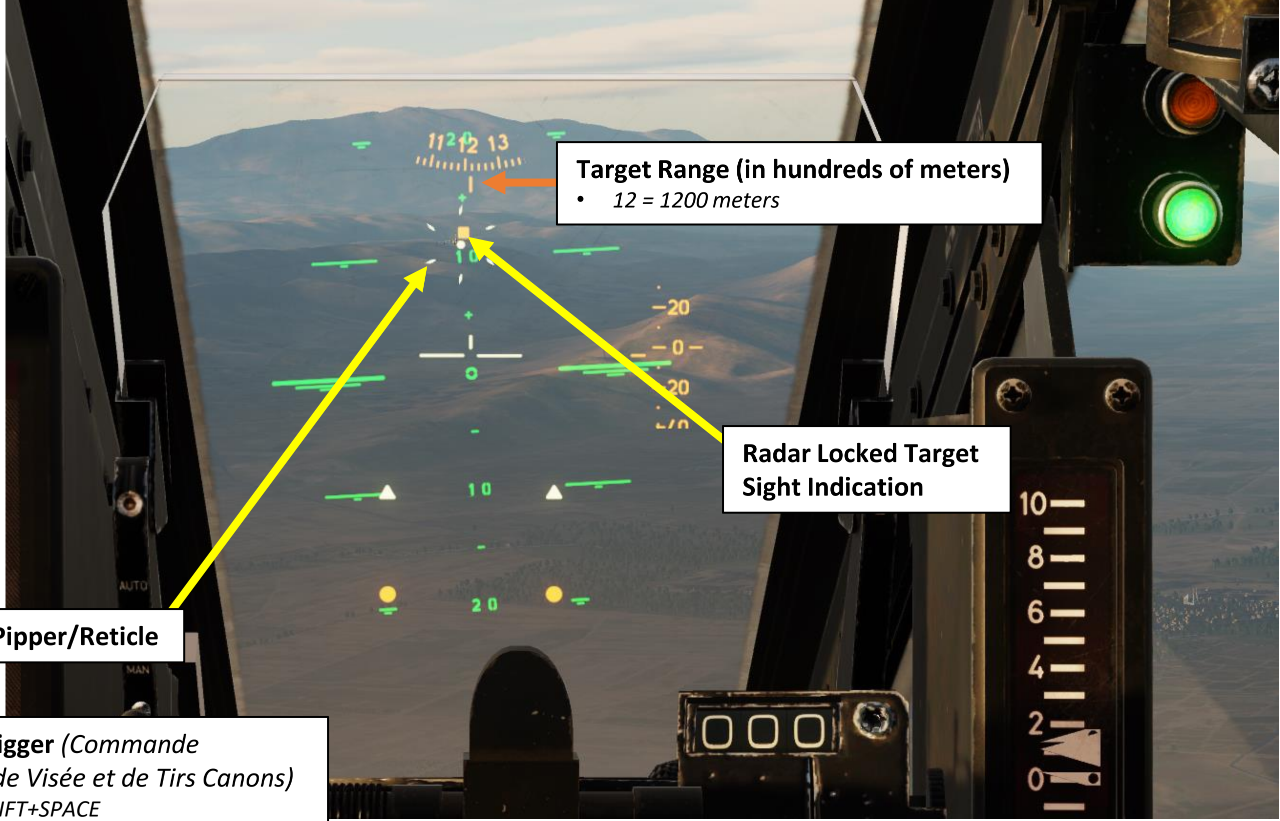
10. Set Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch – UP (TELEMETER) or DOWN (AREA/ZONE SCANNING).
11. Confirm TL (or BZ) radar function light illuminates. All other radar functions are overridden.
12. Steer the aircraft to have the target roughly in the middle of your sight glass. At these ranges, the target is usually acquired visually.
13. The radar will automatically lock a target at a distance between 400 m and 7 km.
14. Once radar lock is achieved, the radar scope will display target range and velocity closure rate information.
15. Once a target is radar locked and missiles are tracking the target as well:
    a) Tracking circles become visible on the sight
    b) Target is designated with a square
    c) Steering cues indicate how to steer the aircraft to intercept the target.





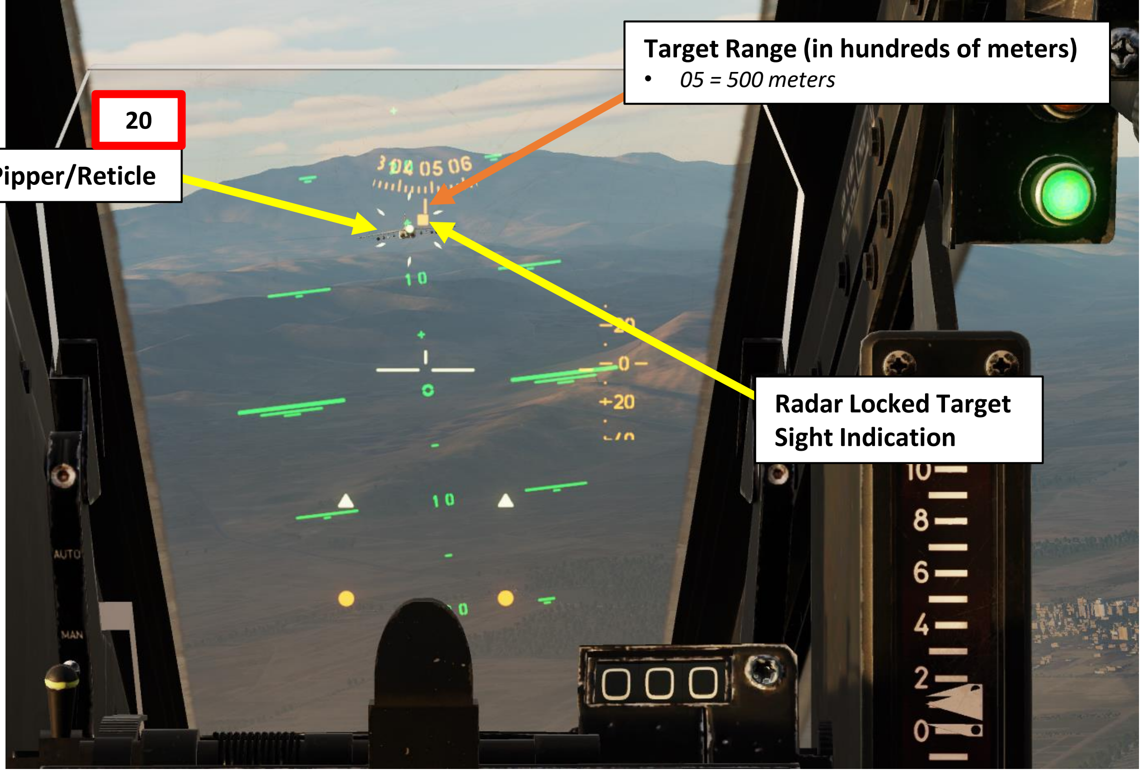
2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.3 – Tutorial with Gyroscopic Mode (With Radar)

16. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.
17. Set Gun Firing Safety OUT (ARMED) by using the “LCTRL+LWIN+SPACE” binding.
18. The guns’ gyroscopic mode works as a classical LCOS (Lead Computing Optical Sight), assuming that the shooter is maneuvered to be in the target's plane of motion, preferably flying with the same airspeed as the target. The reticle must be kept on the target for some amount of time (up to 2 seconds) to achieve a successful shot.
    - Note: if a target is tracked with a radar lock, the gyroscopic mode is provided with actual target range and range rate.
19. At ranges greater than 2000 m, the gun pipper/reticle is not visible on the sight. The pipper will appear when range is below 2000 m.



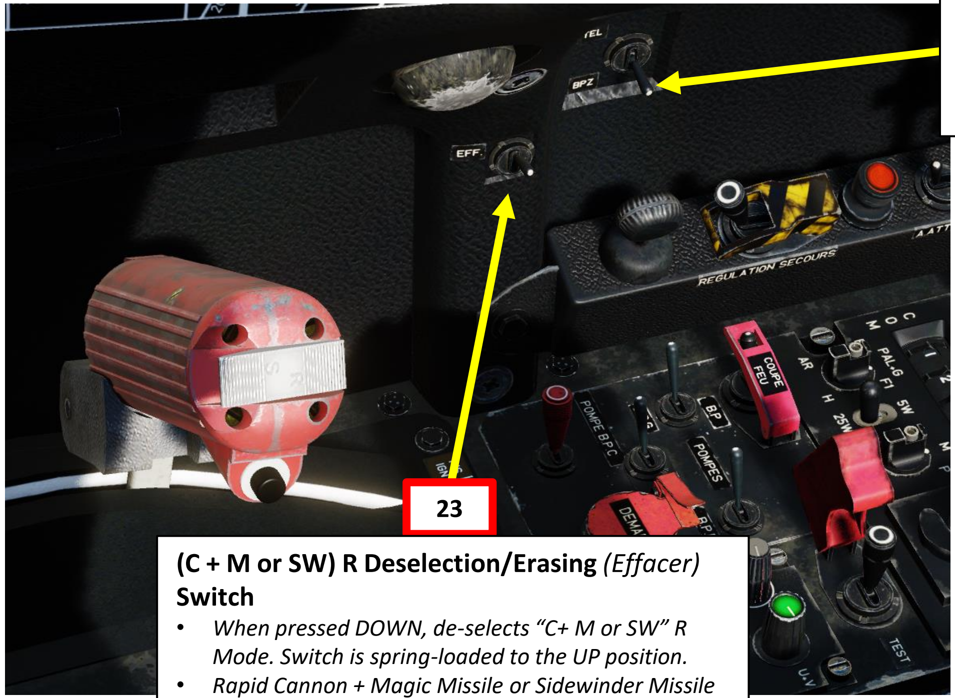
2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.3 – Tutorial with Gyroscopic Mode (With Radar)

20. Fly the aircraft to place the pipper on the target.
    - If a radar lock tracks the target, it provides range information and range rate information.
    - Effective use of the gunsight is possible starting from a 1200 to 1300 meters range. Maximum range used by the reticle is 1600 m, but precision is significantly worse.
21. Once the target wingspan fits within the pipper, press the Gun Button (Commande de Canons) (“SPACE” binding) to fire guns.
22. When cannons are fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM. This prevents engine flameout due to smoke ingestion.



2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.3 – Tutorial with Gyroscopic Mode (With Radar)

23. To un-select guns, press (C + M or SW) R Deselection/Erasing *(Effacer)* Switch DOWN, then back to UP.
24. To exit Telemeter or Area/Zone Scanning Mode, set Radar Telemeter / Area Zone Scanning Selector Switch – MIDDLE position (OFF).



Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**
- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

24

23

(C + M or SW) R Deselection/Erasing *(Effacer)* **Switch**
- *When pressed DOWN, de-selects "C+ M or SW" R Mode. Switch is spring-loaded to the UP position.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

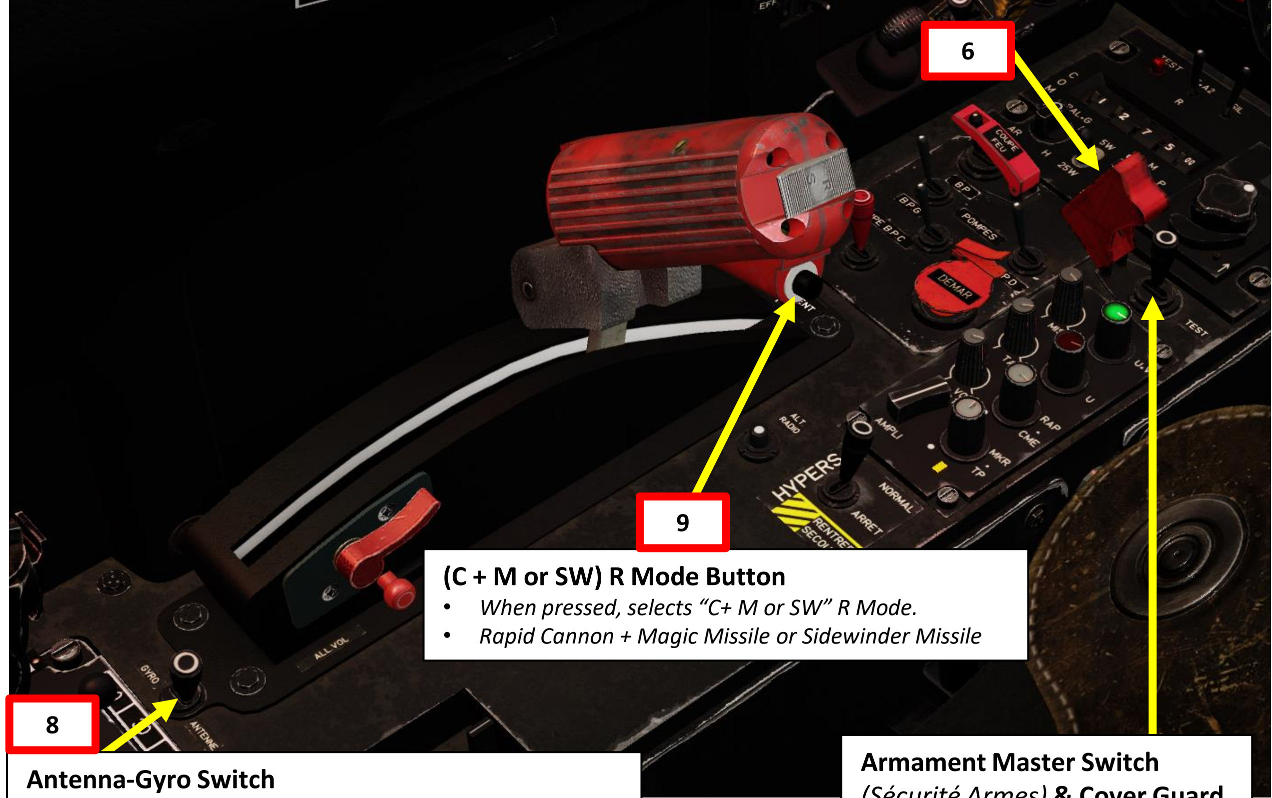
23a

23b

23c

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.4 – Tutorial with Radar Antenna Mode

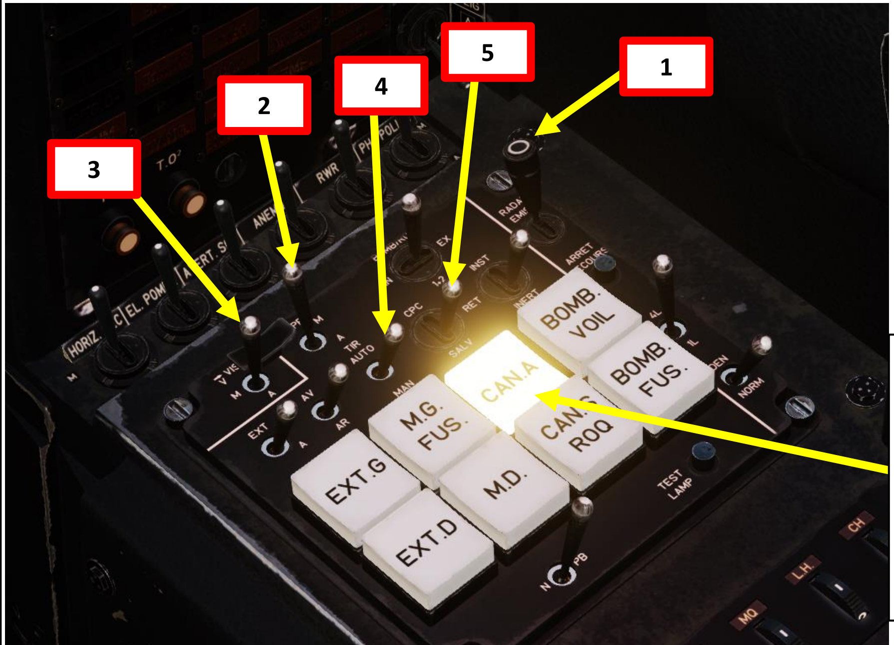
1. Set Radar Operation Mode Selector Switch – FWD (Radar Emission, ON).
2. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
3. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
4. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
5. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single. Firing the gun will use the “gun burst setting” programmed in the Mission Editor.
    - AFT: SALV (Salve), Salvo. Gun is firing as long as the gun trigger is squeezed.
6. Flip Armament Master Switch (Sécurité Armes) guard – UP
7. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
8. Set Antenna-Gyro Switch – RIGHT (Antenna Mode).
    - Note: if no target is tracked with a radar lock, the sight reverts to Gyroscopic Mode automatically regardless of the Antenna-Gyro Switch position.
9. Press (C + M or SW) R Mode (Rapid Cannon + Magic Missile or Sidewinder Missile) Button to select Cannons.
    - Alternatively, you can also select cannons with the *CAN A (Canon Air)* button.



(C + M or SW) R Mode Button
- *When pressed, selects “C+ M or SW” R Mode.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

Antenna-Gyro Switch
- *LEFT: Sight operates in **gyroscopic** mode, similar to LCOS (Lead Computing Optical Sight) mode. The aircraft is assumed to be flying in the target's plane of motion, and with the same speed*
- *RIGHT: If the radar is locked, the operation of the sight is based on radar **antenna** coordinates. In this radar director sight mode, the pipper can be put on the radar target symbol (the orange square) to get a hit.*

Armament Master Switch *(Sécurité Armes)* **& Cover Guard**
- *LEFT: Master Arm OFF*
- *MIDDLE: Master Arm ON*
- *RIGHT: Test*



Weapon Selector Pushbuttons
- *EXT G (Externe Gauche): Left Matra R550 or Sidewinder Missile*
- *MG FUS (Missile Gauche / Fuselage): Left or Fuselage Matra R530 Missile*
- *CAN A (Canon Air): Air-to-Air Guns/Cannons*
- *BOMB VOIL (Bombe Voilure): Wing Bombs*
- *EXT D (Externe Droite): Right Matra R550 or Sidewinder Missile*
- *MD (Missile Droite): Right Matra R530 Missile*
- *CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets*
- *BOMB FUS: Fuselage Bombs*

2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.4 – Tutorial with Radar Antenna Mode

We will use a close combat mode to demonstrate how the radar can automatically lock a target when in either TL or BZ Close Combat Mode. Keep in mind that we could also use HA or IC as well for longer ranges.

10. Set Radar Telemeter *(TEL, Télémétrie)* / Area Zone Scanning *(BPZ, Balayage par Zone)* Selector Switch – UP (TELEMETER) or DOWN (AREA/ZONE SCANNING).
11. Confirm TL (or BZ) radar function light illuminates. All other radar functions are overridden.
12. Steer the aircraft to have the target roughly in the middle of your sight glass. At these ranges, the target is usually acquired visually.
13. The radar will automatically lock a target at a distance between 400 m and 7 km.
14. Once radar lock is achieved, the radar scope will display target range and velocity closure rate information.
15. Once a target is radar locked and missiles are tracking the target as well:
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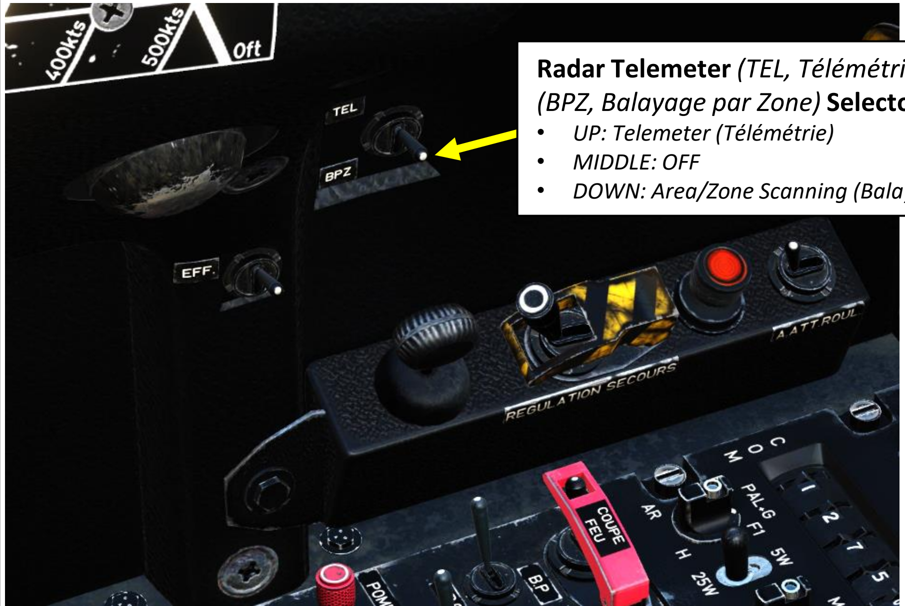
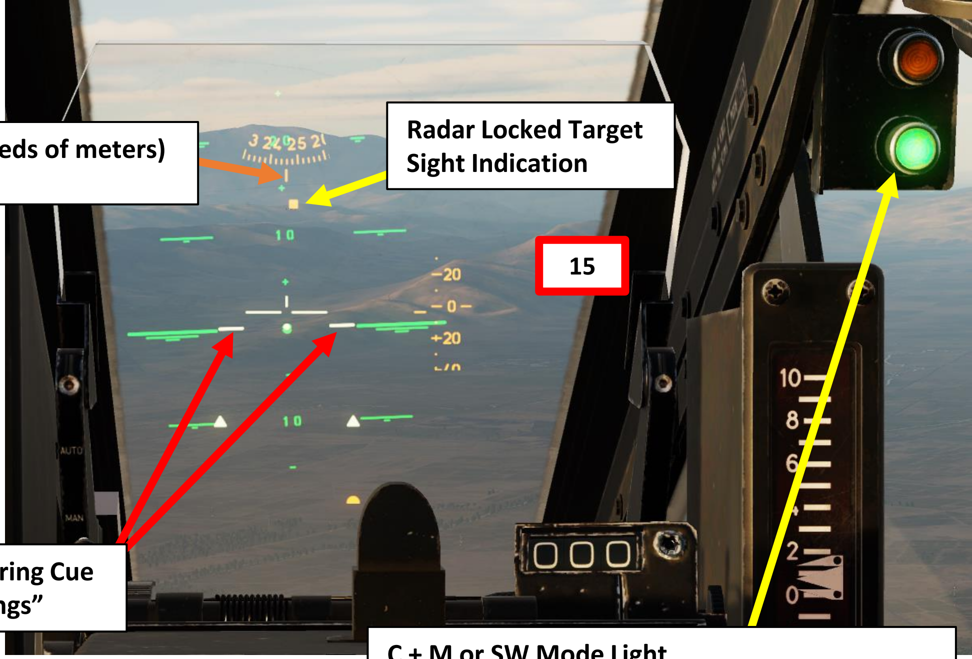
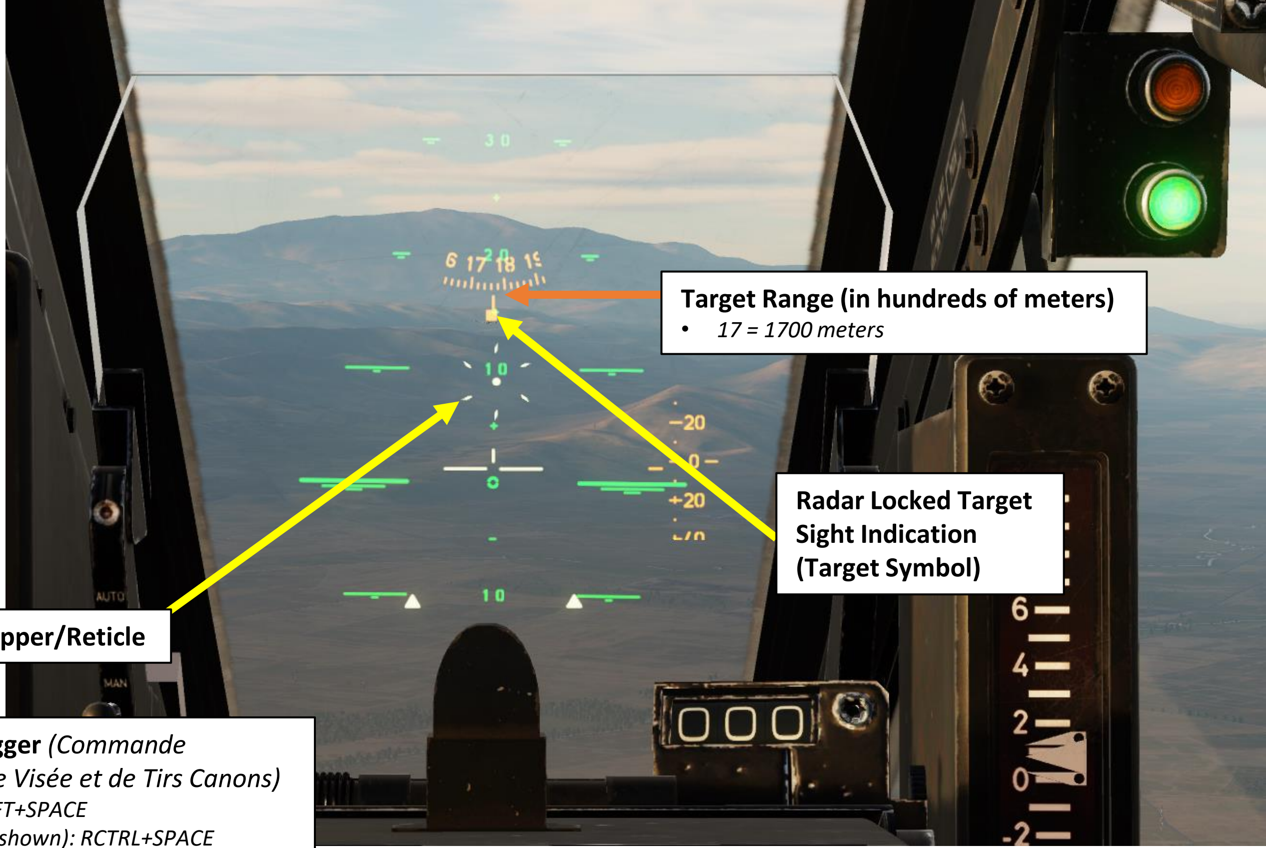




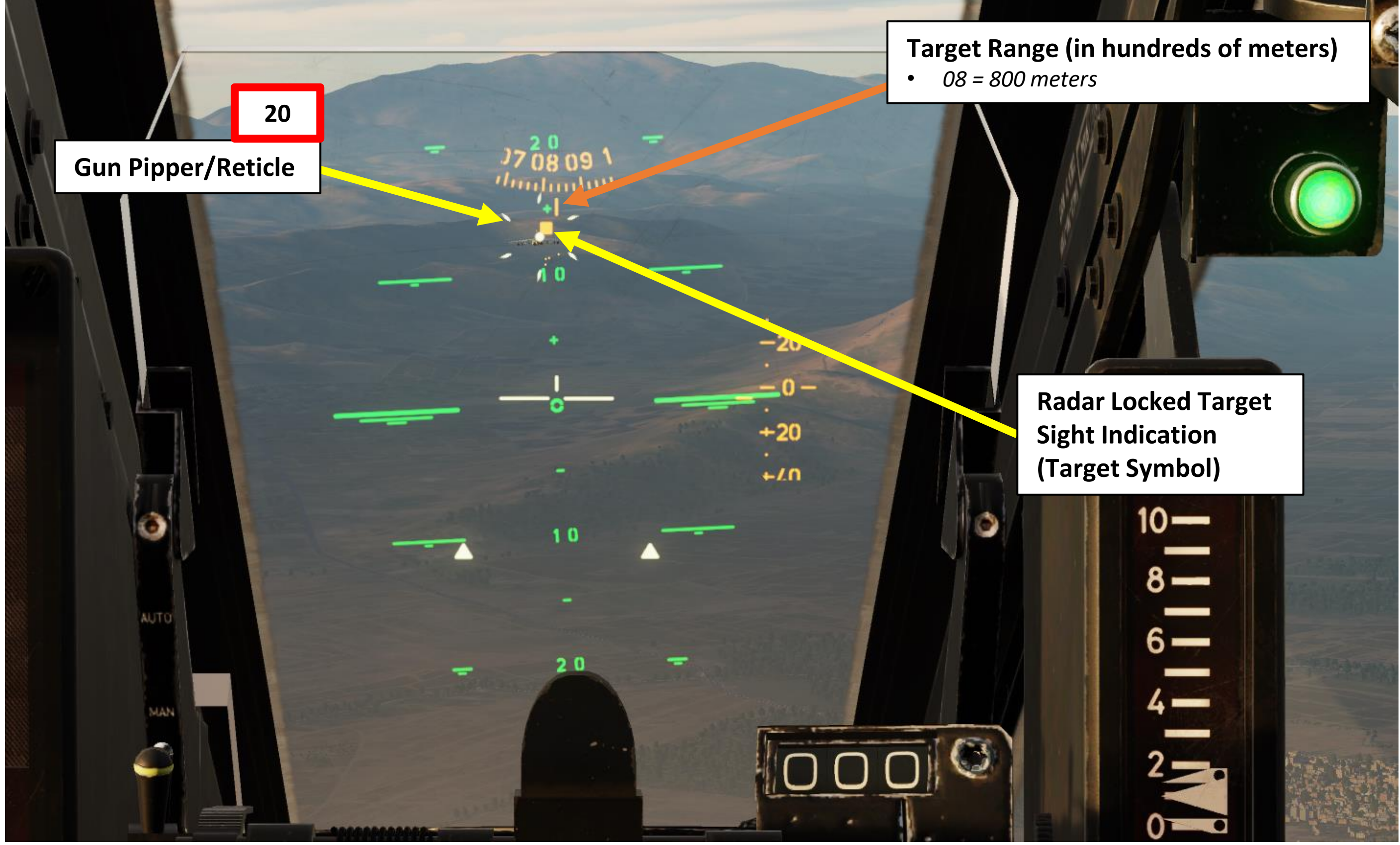
2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.4 – Tutorial with Radar Antenna Mode

16. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.
17. Set Gun Firing Safety OUT (ARMED) by using the “LCTRL+LWIN+SPACE” binding.
18. In Antenna mode, the tracked target position and velocity are provided to the gunsight, allowing to shoot the target from any aspect angle (not necessarily being in the target plane of motion). In general, the Antenna Mode is referred as “*Tir à l’Aveugle*” (Blind Shooting) since the pilot can put the shooting pipper/reticle on the target symbol in order to get a successful shot.
19. At ranges greater than 2000 m, the gun pipper/reticle is not visible on the sight. The pipper will appear when range is below 2000 m.



2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.4 – Tutorial with Radar Antenna Mode

20. Fly the aircraft to place the pipper on the target's square symbol.
    - Since using Antenna mode requires a radar lock to track the target, the sight provides range information and range rate information.
    - Effective use of the gunsight is possible starting from a 1200 to 1300 meters range. Maximum range used by the reticle is 1600 m, but precision is significantly worse.
21. Once the target wingspan fits within the pipper, press the Gun Button (Commande de Canons) ("SPACE" binding) to fire guns.
22. When cannons are fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM. This prevents engine flameout due to smoke ingestion.



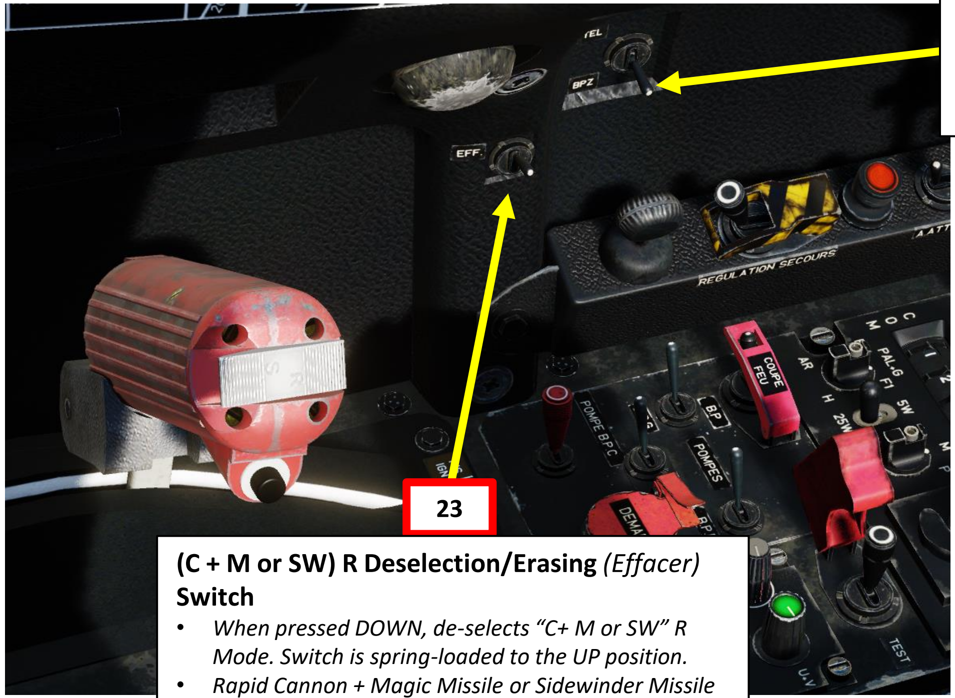
2 – AIR-TO-AIR WEAPONS
2.3 – DEFA 553 (30 mm) Guns (Air-to-Air)
2.3.4 – Tutorial with Radar Antenna Mode

23. To un-select guns, press (C + M or SW) R Deselection/Erasing *(Effacer)* Switch DOWN, then back to UP.
24. To exit Telemeter or Area/Zone Scanning Mode, set Radar Telemeter / Area Zone Scanning Selector Switch – MIDDLE position (OFF).

Radar Telemeter *(TEL, Télémétrie)* **/ Area Zone Scanning** *(BPZ, Balayage par Zone)* **Selector Switch**

- *UP: Telemeter (Télémétrie)*
- *MIDDLE: OFF*
- *DOWN: Area/Zone Scanning (Balayage par Zone)*

24

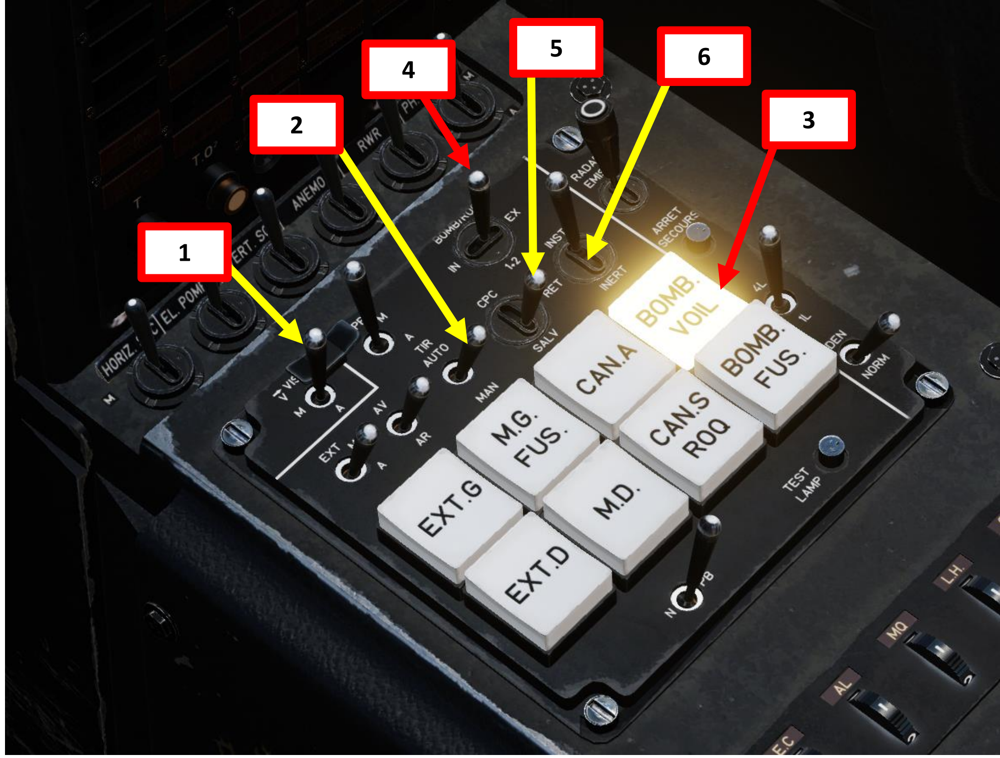


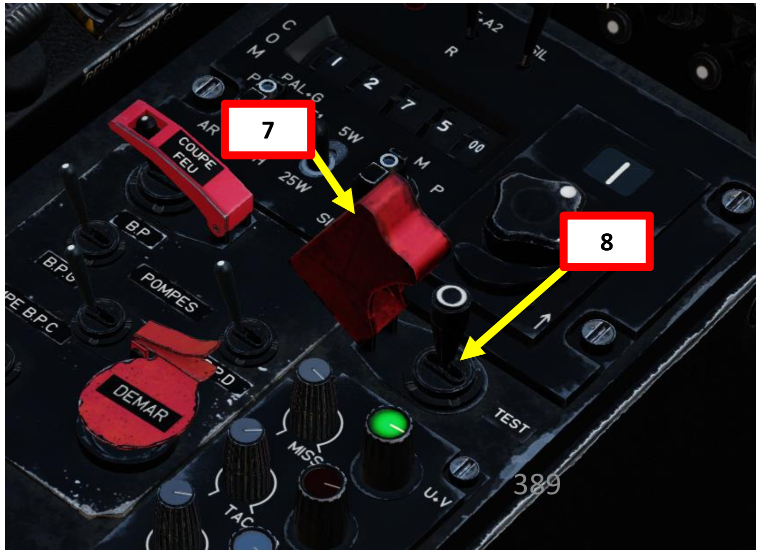
(C + M or SW) R Deselection/Erasing *(Effacer)* **Switch**

- *When pressed DOWN, de-selects "C+ M or SW" R Mode. Switch is spring-loaded to the UP position.*
- *Rapid Cannon + Magic Missile or Sidewinder Missile*

3 – AIR-TO-GROUND WEAPONS
3.1 – Low Drag Unguided Bombs (SAMP-250 LD)

1. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
2. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
3. Select desired pylons with the Weapon Selector Pushbuttons.
    - BOMB VOIL (Bombe Voilure): Wing Bombs
    - BOMB FUS: Fuselage Bombs
4. Set Bomb/Rocket Selector Switch – As desired.
    - LEFT position: Intérieur (Inner) Pylons
    - MIDDLE position: All Pylons
    - RIGHT position: Extérieur (Outer) Pylons
5. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single
    - AFT: SALV (Salve), Salvo
6. Set Bomb Fuze Selector to FWD position (Instant Fuze).
7. Flip Armament Master Switch (Sécurité Armes) guard – UP
8. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)





3 – AIR-TO-GROUND WEAPONS
3.1 – Low Drag Unguided Bombs (SAMP-250 LD)

9. Select an attack profile. In this tutorial, we will select the following:
   - **Dive Speed: 500 kts**
   - **Dive Angle: 10 deg**
   - **Bomb Release Height: 2000 ft**
   - **Sight Depression Angle Setting: 150 mRad**
10. Based on the selected profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

Pipper/Reticle

Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*

Sight Depression Angle Setting Control Wheel

SAMP 250 LD BOMBS	
11000 Kg 400 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	145
1500	185
2000	215

SAMP 250 LD BOMBS	
11000 Kg 500 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	100
1500	125
2000	150
3000	185
4000	220

SAMP 250 LD BOMBS	
11000 Kg 420 KTS DIVE -20°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	110
1500	130
2000	155
3000	185
4000	215

SAMP 250 LD BOMBS	
11000 Kg 500 KTS DIVE -20°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	80
1500	100
2000	115
3000	145
4000	170

3 – AIR-TO-GROUND WEAPONS

3.1 – Low Drag Unguided Bombs (SAMP-250 LD)

11. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

$$QFE = QNH - \frac{(\textit{Target Elevation in ft})}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

12. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
13. The Standby Altimeter Altimeter Pressure can be left as is for reference.

12
Altimeter

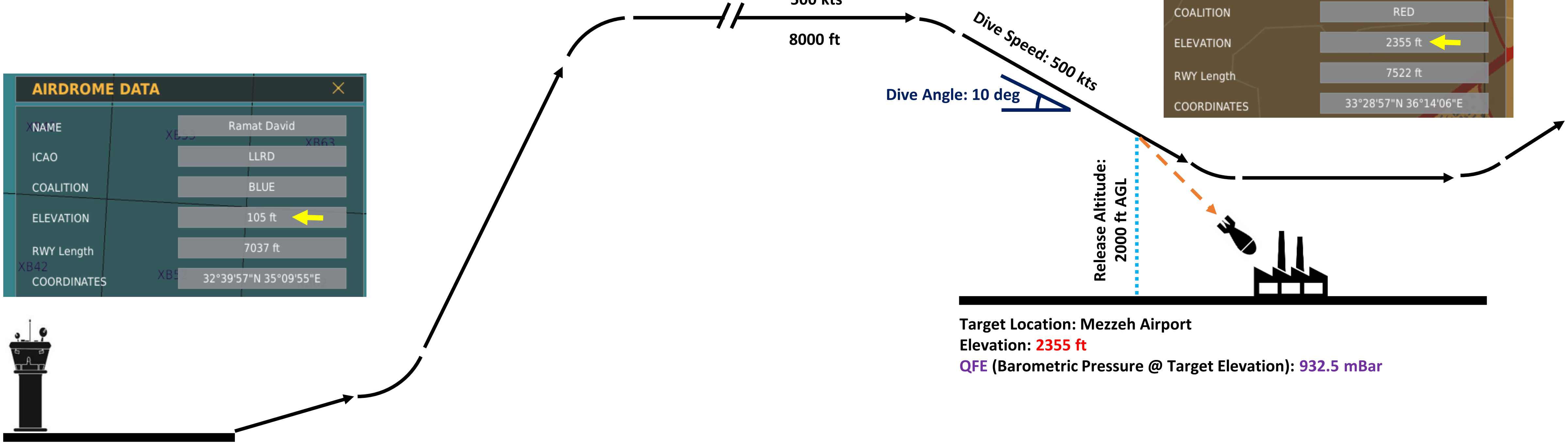
13
Standby Altimeter

AIRDROME DATA

NAME	Mezzeh
ICAO	OS67
COALITION	RED
ELEVATION	2355 ft
RWY Length	7522 ft
COORDINATES	33°28'57"N 36°14'06"E

AIRDROME DATA

NAME	Ramat David
ICAO	LLRD
COALITION	BLUE
ELEVATION	105 ft
RWY Length	7037 ft
COORDINATES	32°39'57"N 35°09'55"E



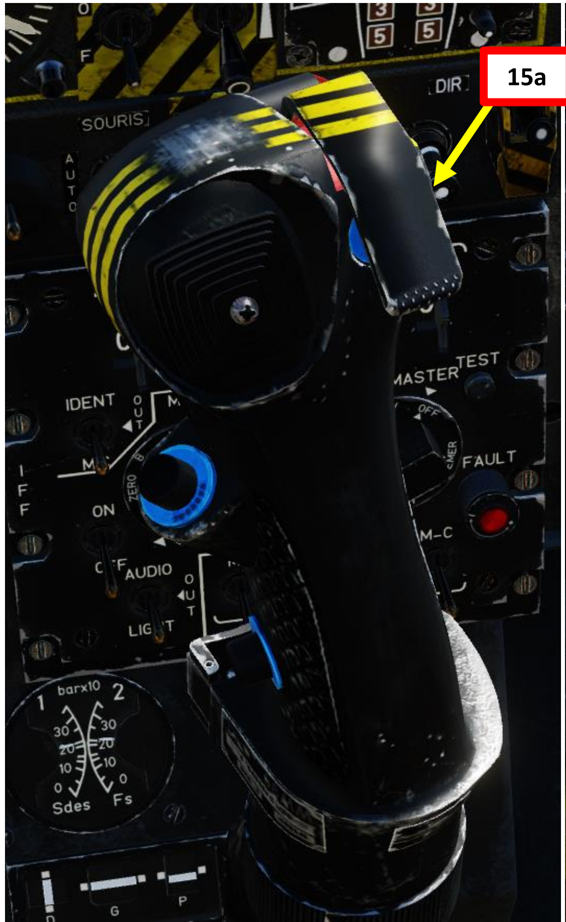
Target Location: Mezzeh Airport
Elevation: 2355 ft
QFE (Barometric Pressure @ Target Elevation): 932.5 mBar

Departure Airfield – Ramat David
Elevation: 105 ft
QNH (Barometric Pressure @ Sea Level): 1011 mBar

Sea Level
Elevation: 0 ft

3 – AIR-TO-GROUND WEAPONS
3.1 – Low Drag Unguided Bombs (SAMP-250 LD)

14. Adjust Seat Height to have a good visibility of the sight's pipper.
15. Unfold the Gun Firing Trigger Safety by using the "RCTRL+SPACE" binding.
16. Approach the target and maintain it to your aircraft's 10 o'clock position. Fly level at an altitude of approx. 8000 ft.
17. For a 10 deg bomb run dive, throttle back and roll in on the target. Dive should be initiated from 8000 ft at 500 kts.
18. Use your altimeter, speed indicator and pitch indicator to fly with correct bombing parameters.
    - **Dive Speed: 500 kts**
    - **Dive Angle: 10 deg**
    - **Bomb Release Height: 2000 ft**
    - **Sight Depression Angle Setting: 150 mRad**



15a

15b

Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Bombs, Rockets, Missile & Sight Recorder Button
- *Binding: RALT+SPACE*

Pipper/Reticle

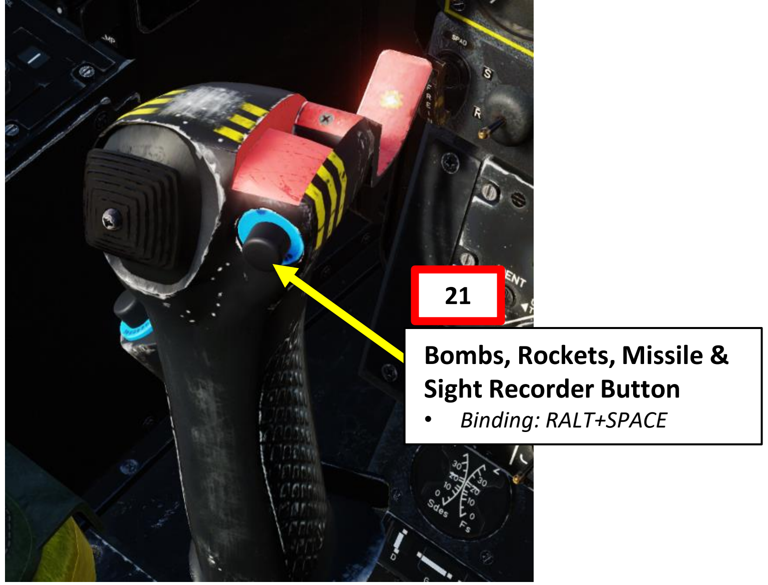
Seat Adjustment Control Switch
- *FWD: Seat DOWN*
- *AFT: Seat UP*

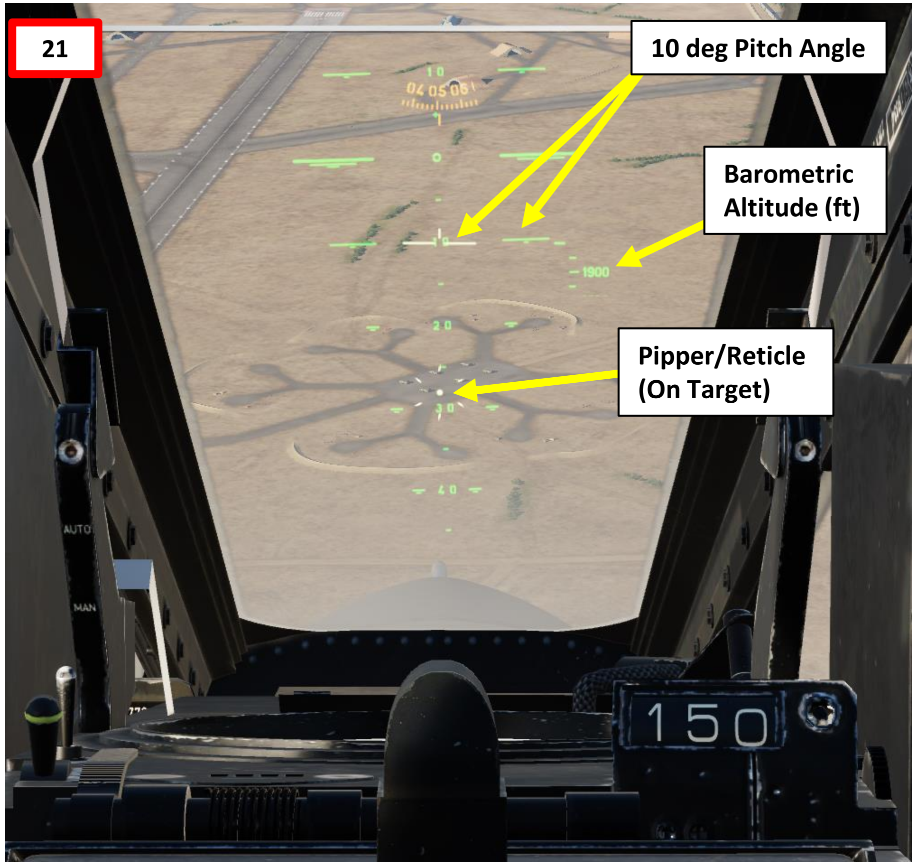
14

3 – AIR-TO-GROUND WEAPONS

3.1 – Low Drag Unguided Bombs (SAMP-250 LD)

19. Keep gunsight pipper slightly below target as you dive.
20. Align target with sight pipper before bomb release (2000 ft above ground level). Maintain a dive speed of 500 kts as per the selected attack profile.
21. Release bombs 2000 ft above ground level by pressing and holding the Bombs, Rockets, Missile & Sight Recorder Button (RALT+SPACE).
22. After bomb release, recover from the dive with a 4 G pull up. This pull up must happen within 2 seconds after weapon release or the blast radius may damage your aircraft.

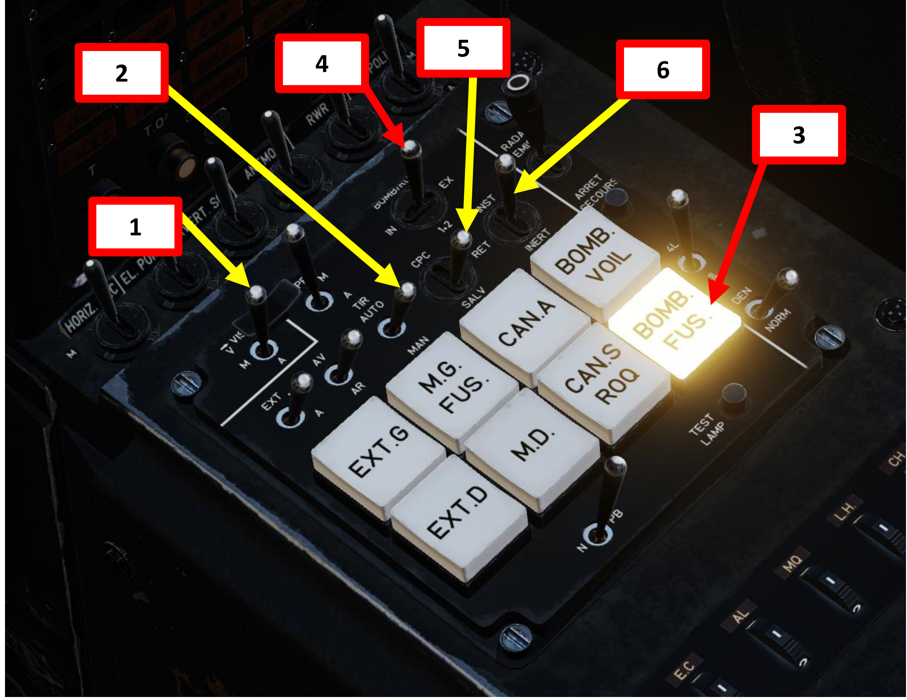


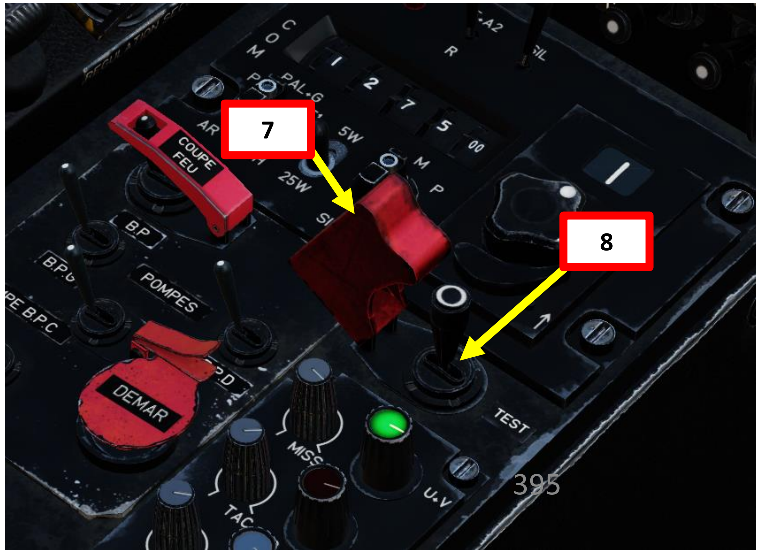


3 – AIR-TO-GROUND WEAPONS
3.1 – Low Drag Unguided Bombs (SAMP-250 LD)

3 – AIR-TO-GROUND WEAPONS
3.2 – Chute Retarded Unguided Bombs (SAMP-250 HD)

1. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
2. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
3. Select desired pylons with the Weapon Selector Pushbuttons.
    - BOMB VOIL (Bombe Voilure): Wing Bombs
    - BOMB FUS: Fuselage Bombs
4. Set Bomb/Rocket Selector Switch – As desired.
    - LEFT position: Intérieur (Inner) Pylons
    - MIDDLE position: All Pylons
    - RIGHT position: Extérieur (Outer) Pylons
5. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single
    - AFT: SALV (Salve), Salvo
6. Set Bomb Fuze Selector to MIDDLE position (RETARDÉ, Delayed Fuze).
7. Flip Armament Master Switch (Sécurité Armes) guard – UP
8. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)



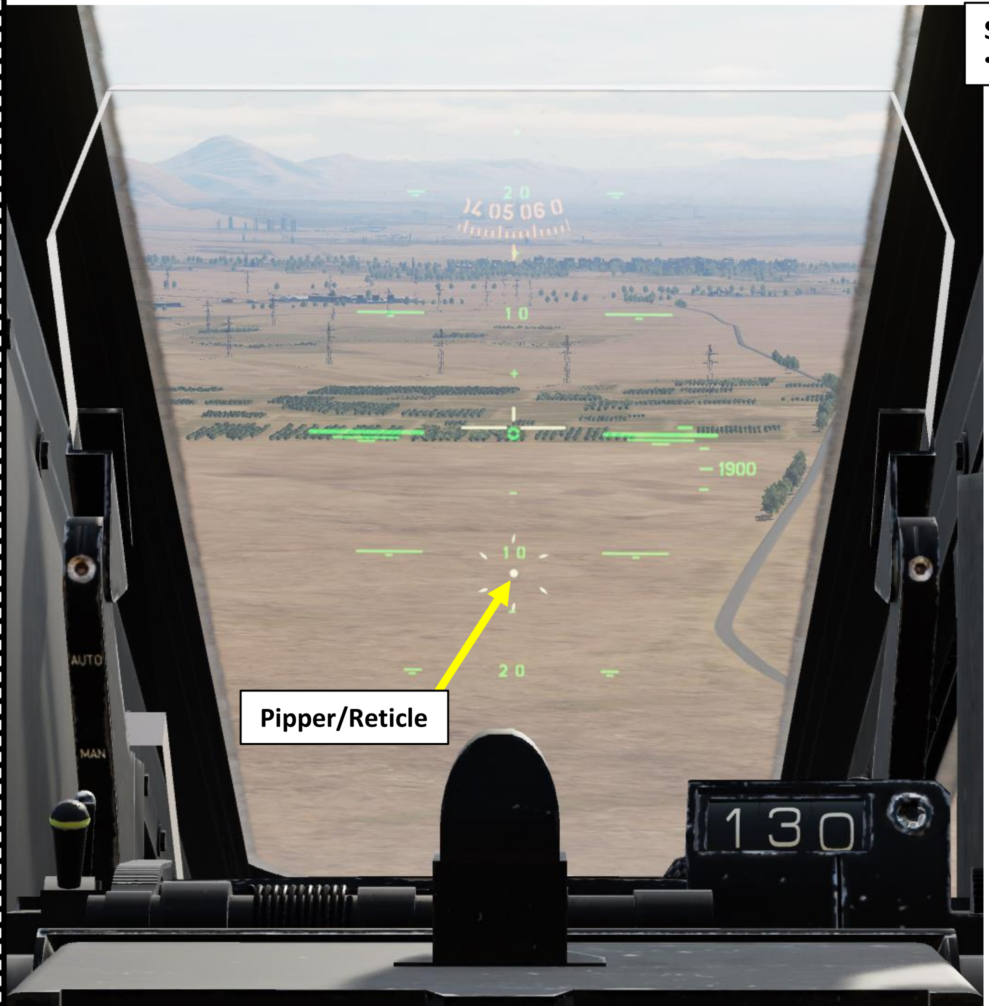


3 – AIR-TO-GROUND WEAPONS
3.2 – Chute Retarded Unguided Bombs (SAMP-250 HD)

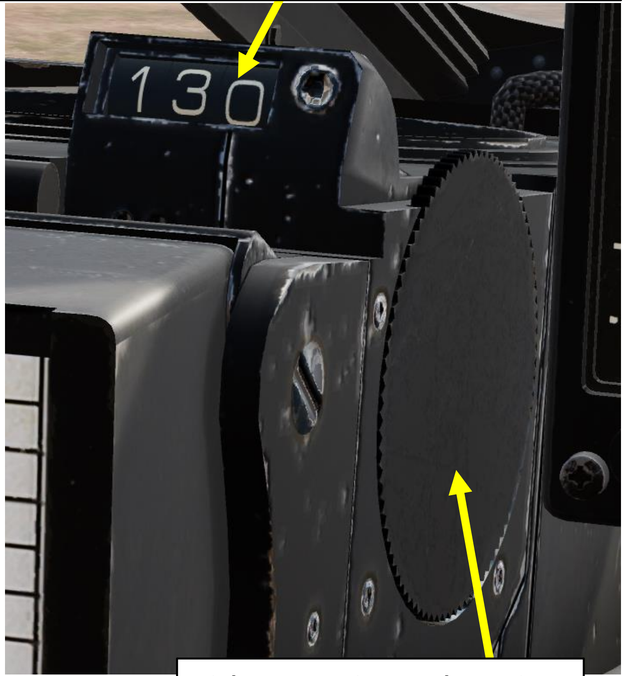
9. In this tutorial, we will use the following attack profile:
    - **Approach Speed: 400 kts**
    - **Level Attack**
    - **Bomb Release Height: 200 ft**
    - **Sight Depression Angle Setting: 130 mRad**
10. Based on the attack profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

SAMP-250/400 HD (High-Drag) Bombs Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
400	200	130
Note: After bomb release, perform a 4-G pull-up to avoid frag damage.		

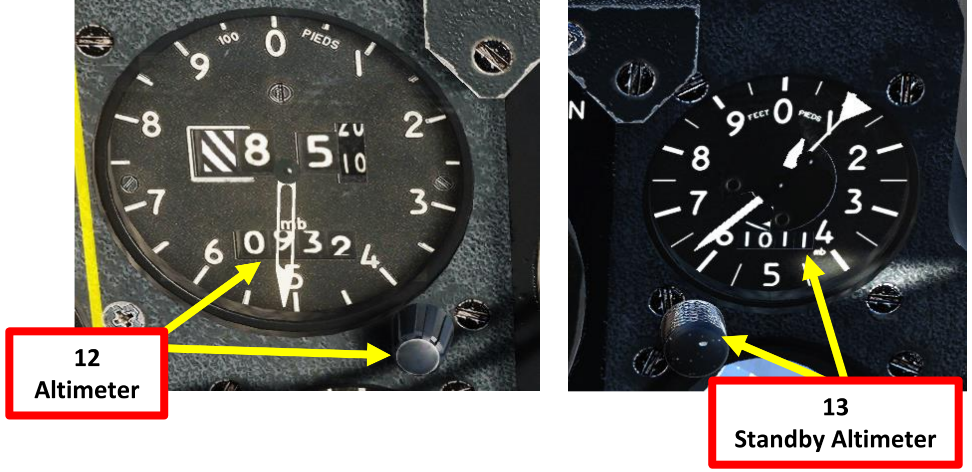


Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*



Sight Depression Angle Setting Control Wheel

3 – AIR-TO-GROUND WEAPONS
3.2 – Chute Retarded Unguided Bombs (SAMP-250 HD)

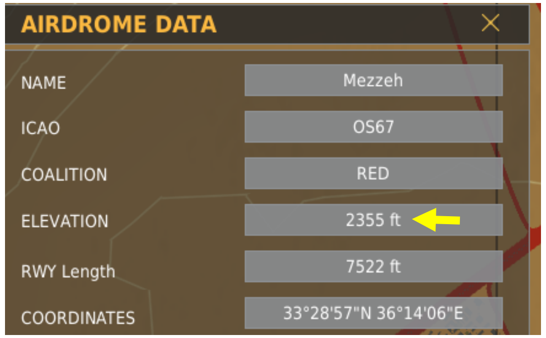


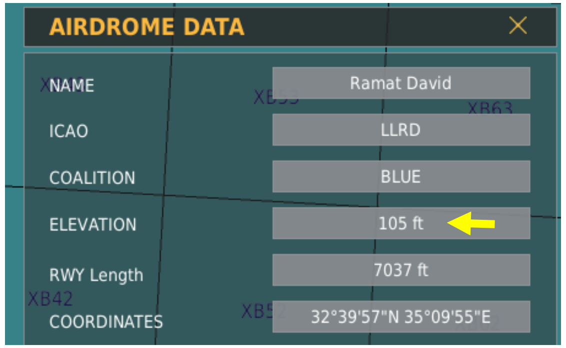
11. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

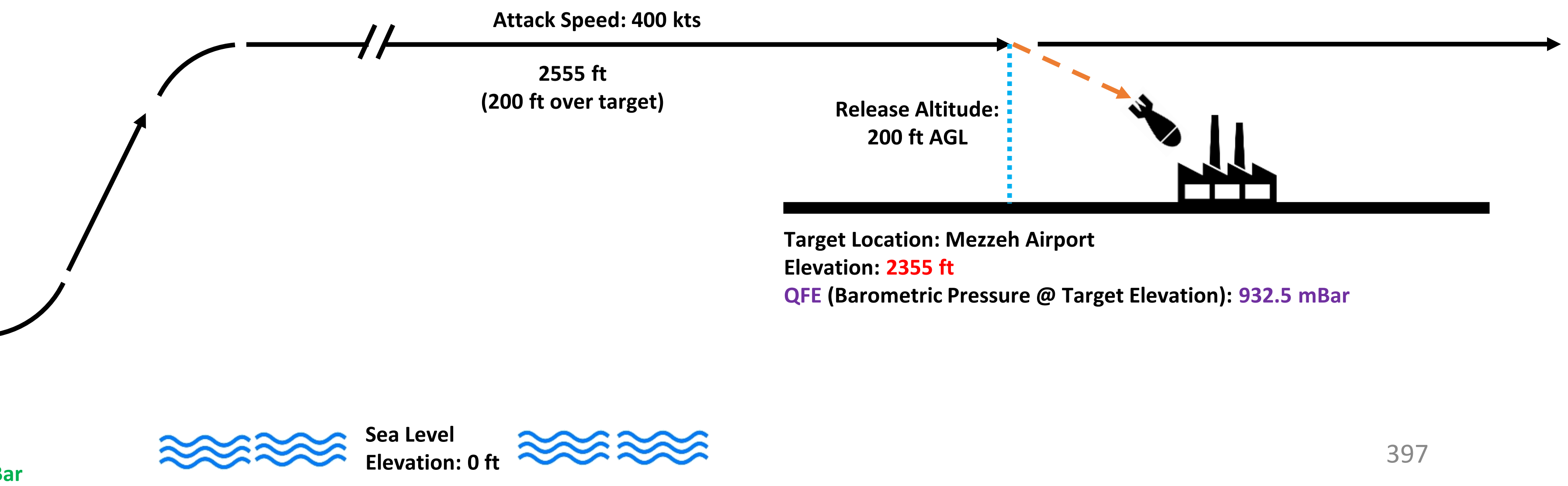
$$QFE = QNH - \frac{(\textit{Target Elevation in ft})}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

12. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
13. The Standby Altimeter Altimeter Pressure can be left as is for reference.

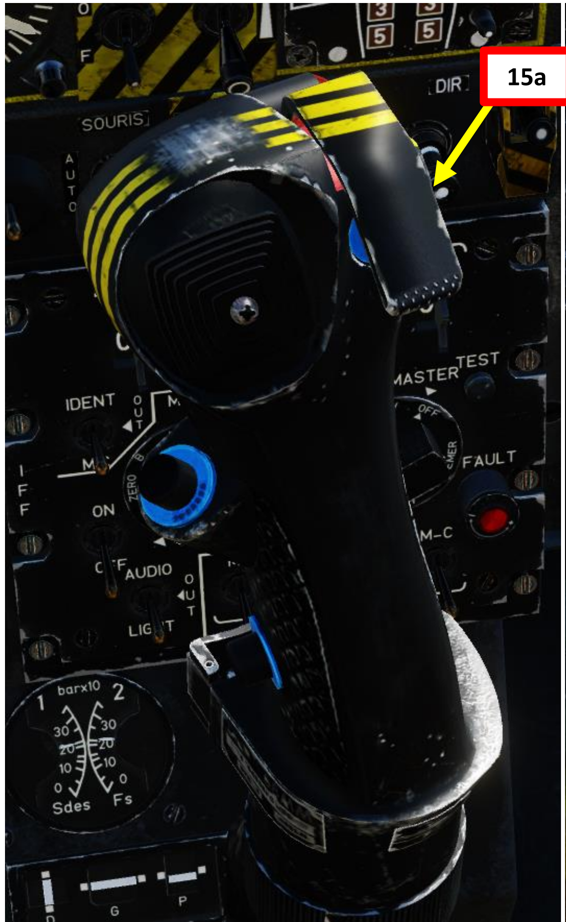


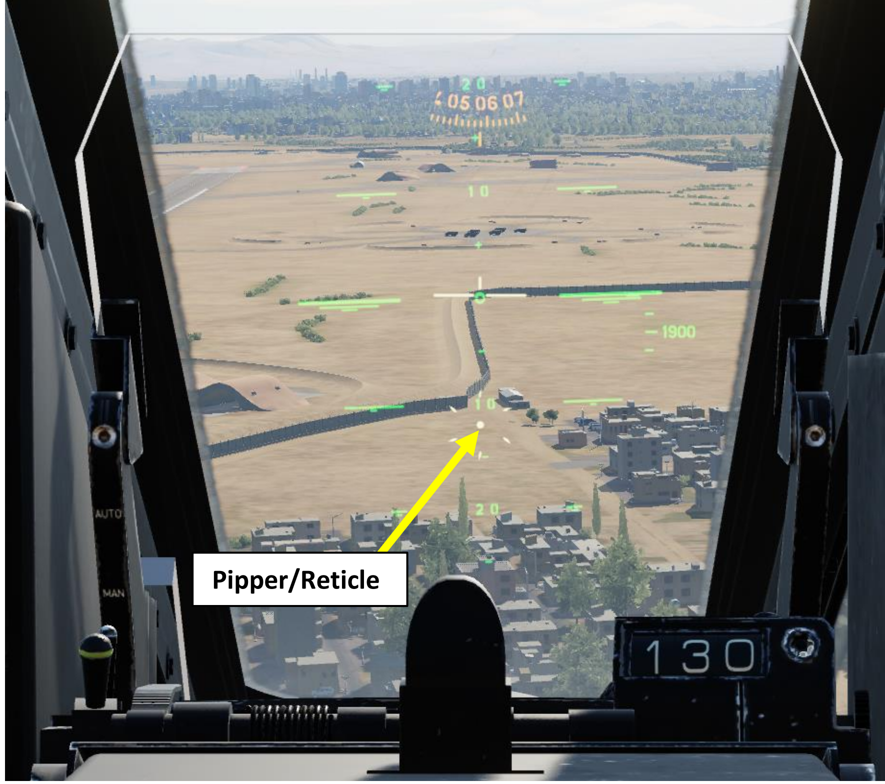




3 – AIR-TO-GROUND WEAPONS
3.2 – Chute Retarded Unguided Bombs (SAMP-250 HD)

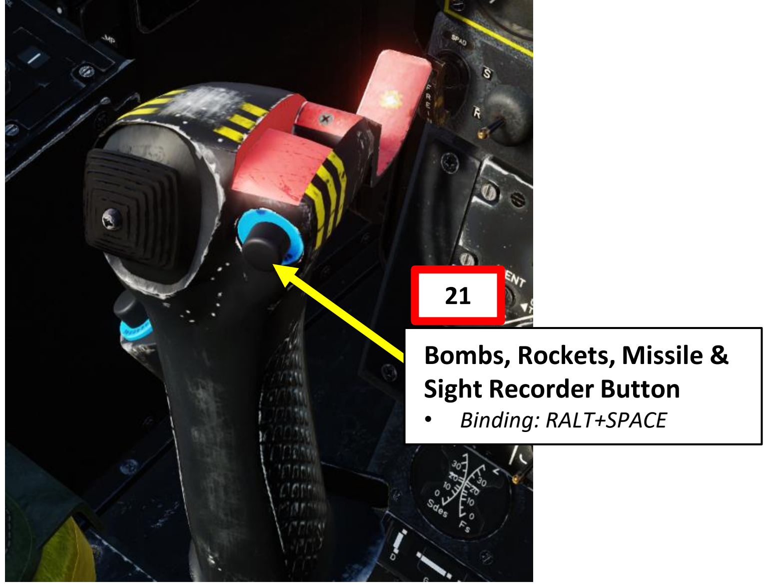
14. Adjust Seat Height to have a good visibility of the sight's pipper.
15. Unfold the Gun Firing Trigger Safety by using the "RCTRL+SPACE" binding.
16. For a level bomb run, approach the target low and fast. Attack should be initiated from 200 ft AGL (above ground level) at 400 kts.
17. Use your altimeter, speed indicator and pitch indicator to fly with correct bombing parameters.
    - **Attack Speed: 400 kts**
    - **Pitch Angle: 0 deg (level)**
    - **Bomb Release Height: 200 ft**
    - **Sight Depression Angle Setting: 130 mRad**

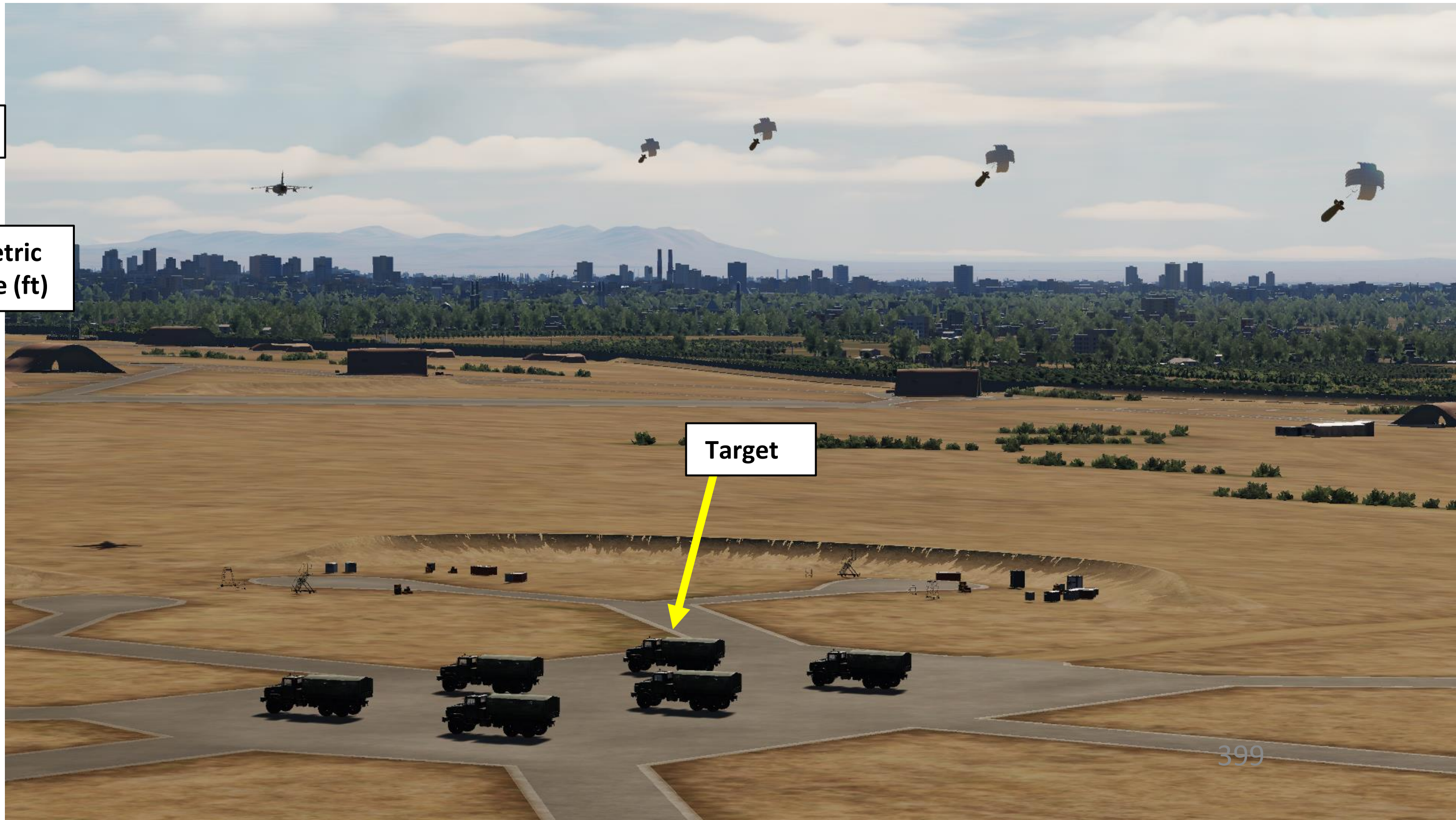




3 – AIR-TO-GROUND WEAPONS
3.2 – Chute Retarded Unguided Bombs (SAMP-250 HD)

19. Keep gunsight pipper slightly below target.
20. Align target with sight pipper while maintaining release altitude (200 ft above ground level). Maintain an attack speed of 400 kts as per the attack profile.
21. Release bombs 200 ft above ground level by pressing and holding the Bombs, Rockets, Missile & Sight Recorder Button (RALT+SPACE).

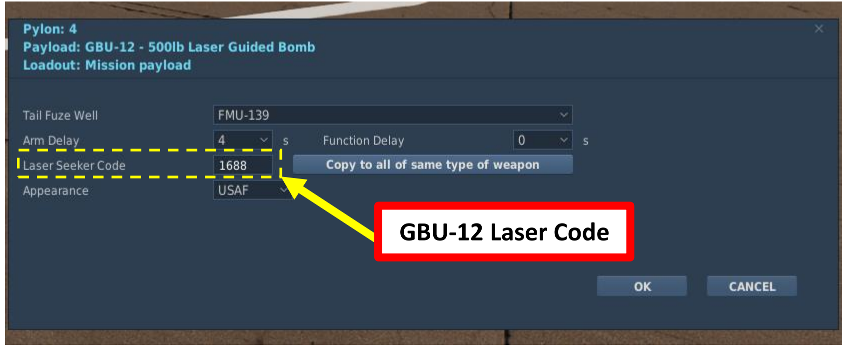




3 – AIR-TO-GROUND WEAPONS

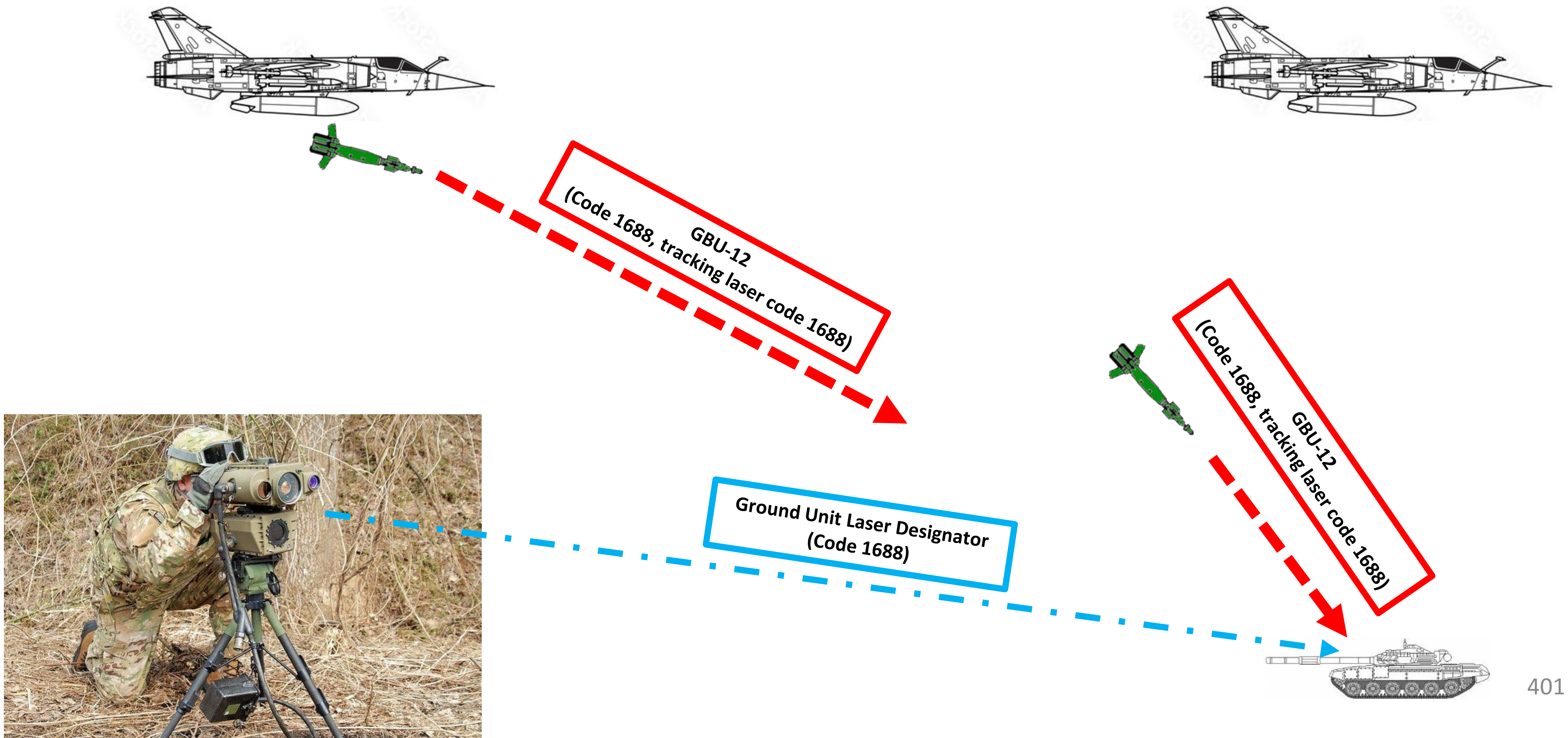
3.2 – Chute Retarded Unguided Bombs (SAMP-250 HD)

3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs



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.

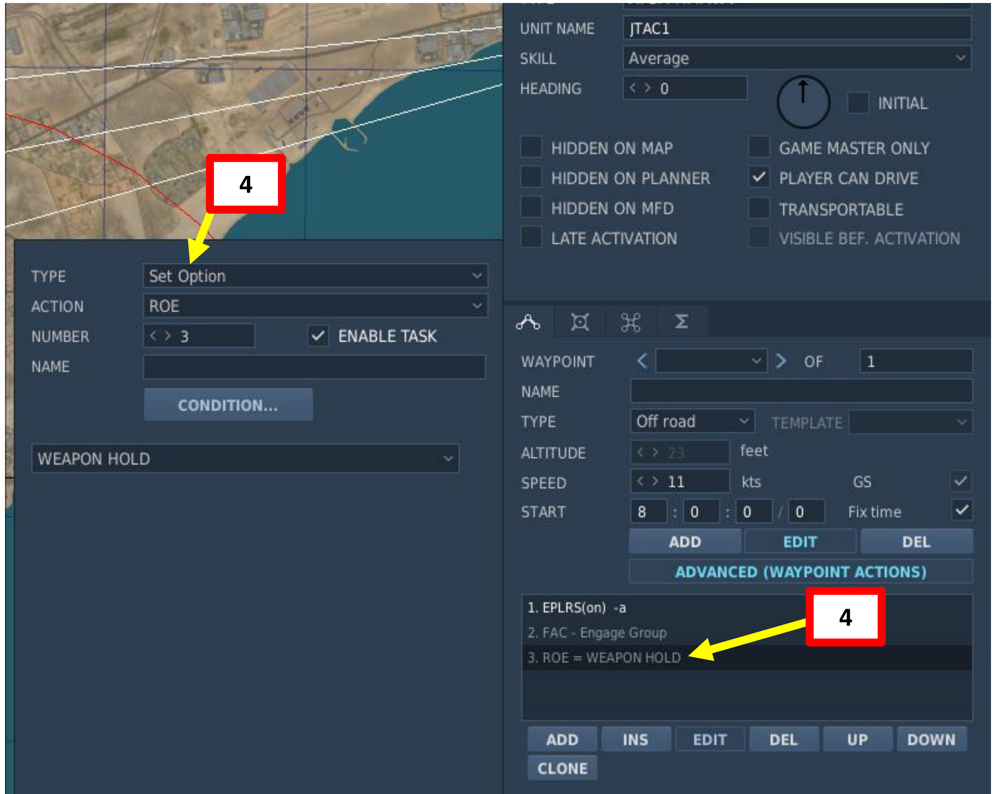
Contrary to modern multirole jets with targeting pods capable of designating and lasing a target by itself, the Mirage F1 must rely on a ground unit (or a friendly aircraft equipped with a targeting pod with its own laser designator) to lase the target. The laser code of the GBU-12 must be the same as the laser code of the laser designator.

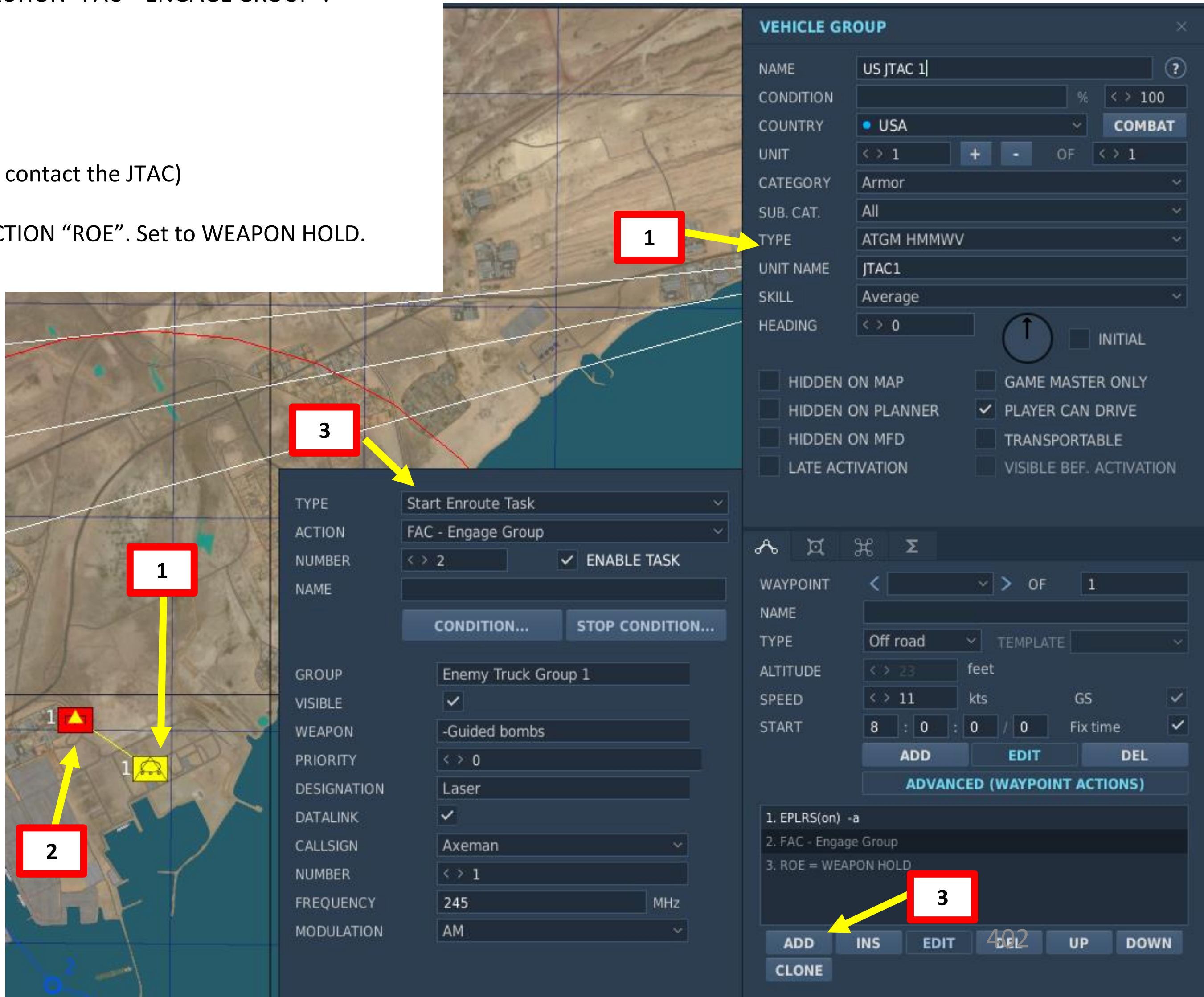


3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

A – Creation of a JTAC (Joint Terminal Attack Controller) to lase a target for you

1. In the mission editor, insert a friendly “ATGM M1045 HMMWV TOW” unit. He will be your JTAC.
2. Make sure that you have enemy units placed in the map and that you have given them a name (example: “ENEMY UNITS”)
3. Select your JTAC unit, click “ADD”, and select TYPE “START ENROUTE TASK” and ACTION “FAC – ENGAGE GROUP”.
    a) GROUP = “ENEMY UNITS” (the group we just created)
    b) VISIBLE = CHECKED
    c) WEAPON = GUIDED BOMBS
    d) DESIGNATION = LASER
    e) CALLSIGN = AXEMAN (or whatever you prefer)
    f) FREQUENCY = 245 MHz (this will be the radio frequency you will use to contact the JTAC)
    g) MODULATION = AM
4. Select your JTAC unit, click “ADD” again and select TYPE = “SET OPTION” and ACTION “ROE”. Set to WEAPON HOLD.
5. You can also set the unit to INVISIBLE and IMMORTAL.

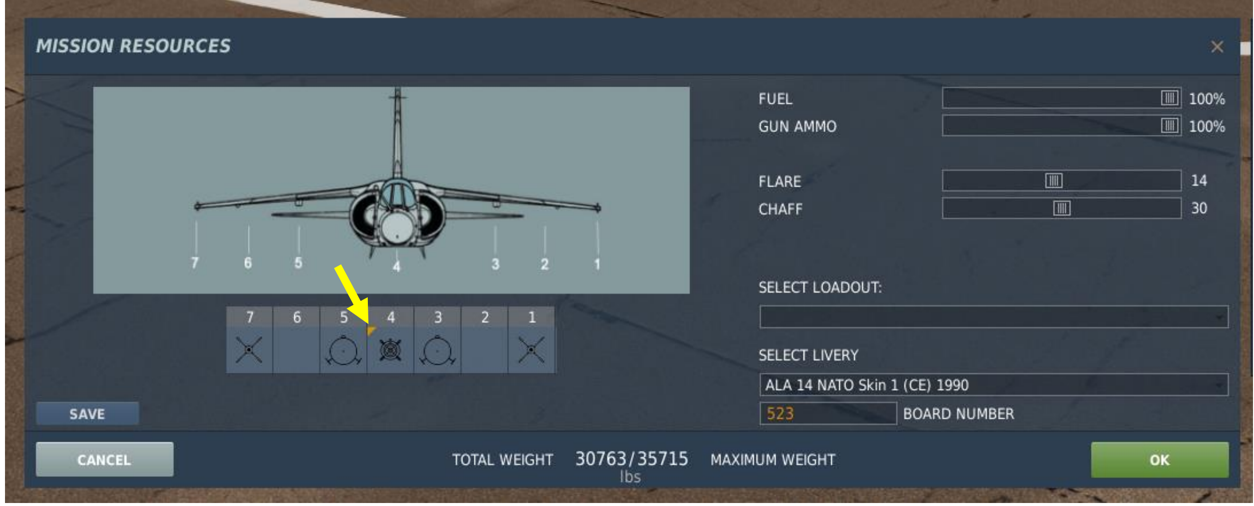


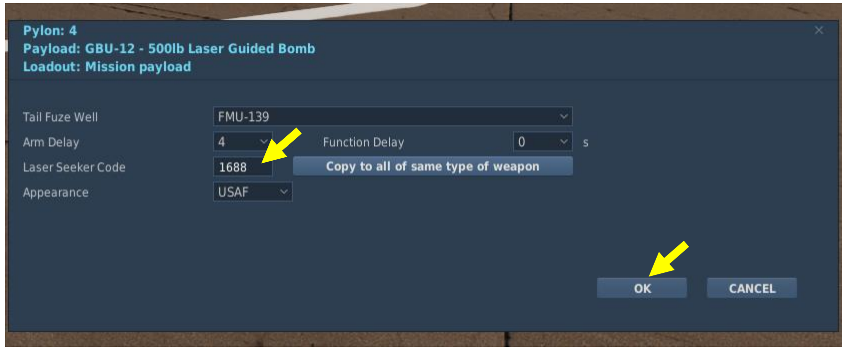


3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

B – Setting GBU-12 Laser Code

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.

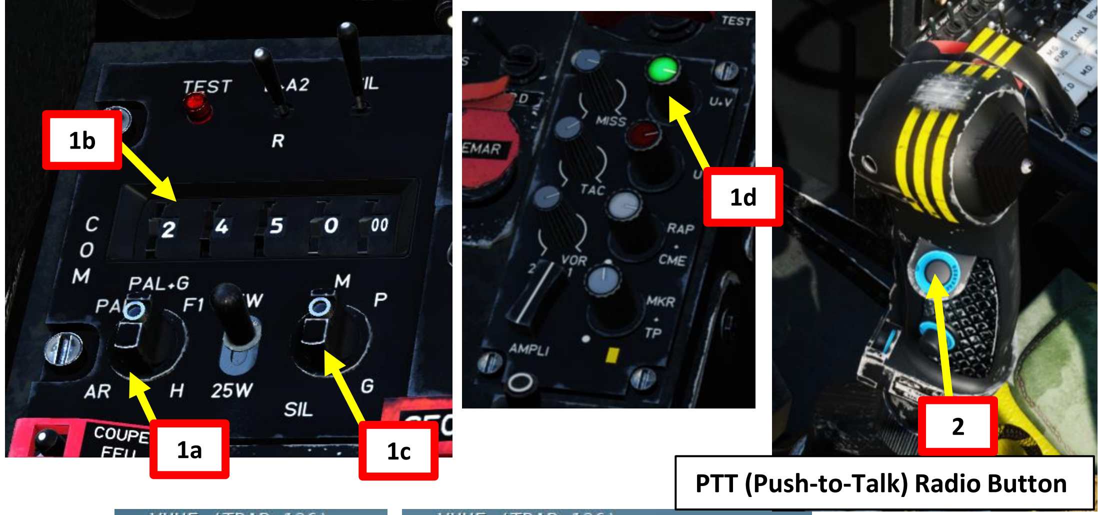


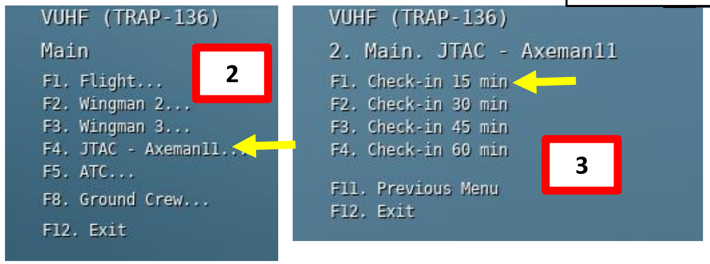


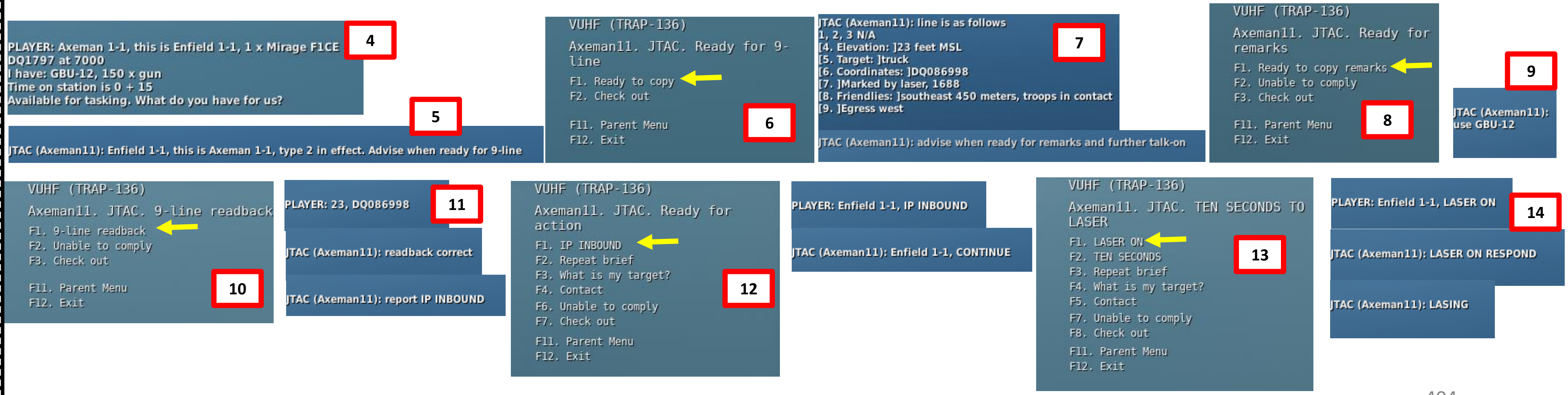
3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

C – Contacting a JTAC (Joint Terminal Attack Controller) to request target lasing

1. Set JTAC frequency to 245.00 MHz on the V/UHF TRAP 136 radio.
2. Press "\" (Communication Menu, Radio Microphone Push-to-Talk Button) to communicate and select JTAC – AXEMAN (F4) in radio menu.
3. Select "CHECK-IN 15 MIN" (F1)
4. You will contact the JTAC and give him your altitude and ordnance available, plus your time available on station.
5. JTAC will answer "Type 2 in effect" and ask you when you are ready to receive a 9-liner.
6. Select "READY TO COPY" (F1) to receive 9-liner.
7. The JTAC will give you the 9-liner and ask you when you are ready for remarks.
8. Select "READY TO COPY REMARKS" (F1)
9. JTAC will give you remarks.
10. Select "9-LINE READBACK" to repeat the information you have been given and confirm it with the JTAC.
11. JTAC will confirm your readback and request you to tell him when you are inbound.
12. Select "IP INBOUND" (F1), the JTAC will tell you to CONTINUE or ABORT.
13. Select "LASER ON" to request the JTAC to lase targets.
14. Once targets are lased, you may now go on your bomb run.







3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

C – Contacting a JTAC (Joint Terminal Attack Controller) to request target lasing

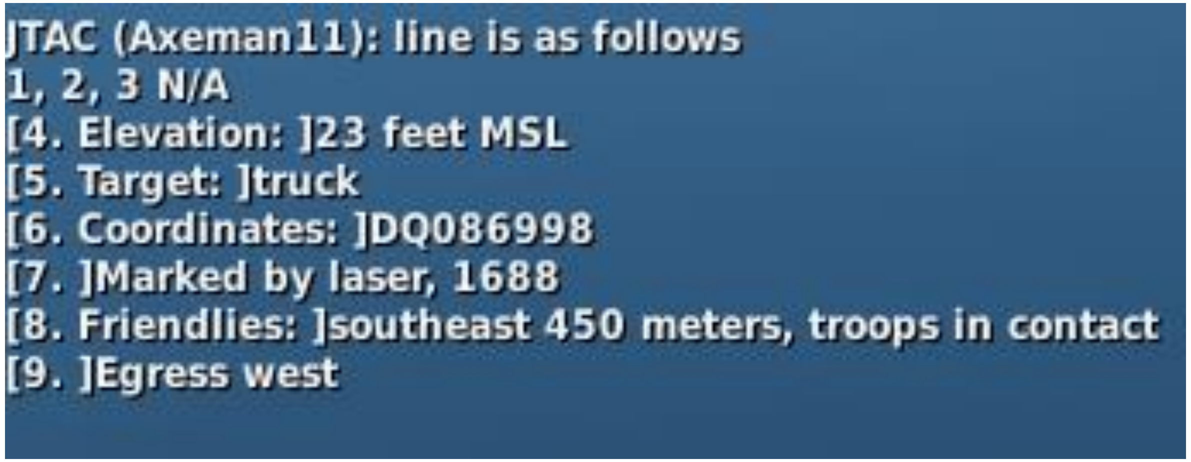
What is a CAS (Close Air Support) 9-liner and why is it important? The goal of a 9-liner is to provide you as much information as concisely as possible.

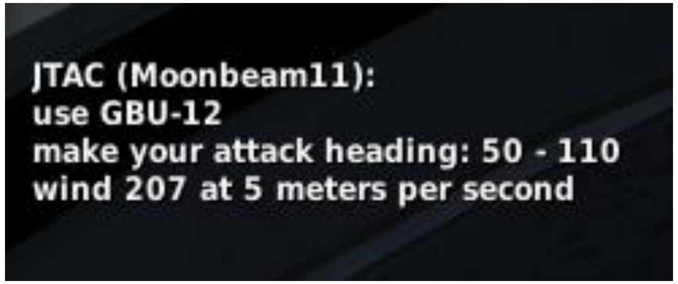
9-Liner

Line 1: IP/BP – Initial Point/Battle Position (N/A in our case)
Line 2: Heading from the IP to the Target (N/A in our case)
Line 3: Distance from the IP/BP to target (N/A in our case)
Line 4: Target elevation – 23 feet over Mean Sea Level (MSL)
Line 5: Target description: Truck.
Line 6: Target location: Grid coordinates of target
Line 7: Target Mark Type: Marked by laser on laser code 1688
Line 8: Location of Friendlies: JTAC located 450 meters Southeast of Target
Line 9: Egress semi-cardinal direction when departing from target: West

Remarks

Remarks generally include information about troops in contact or danger close, SEAD support in effect, hazards, weather or other threats. In our case, the JTAC wants us to use GBU-12s .

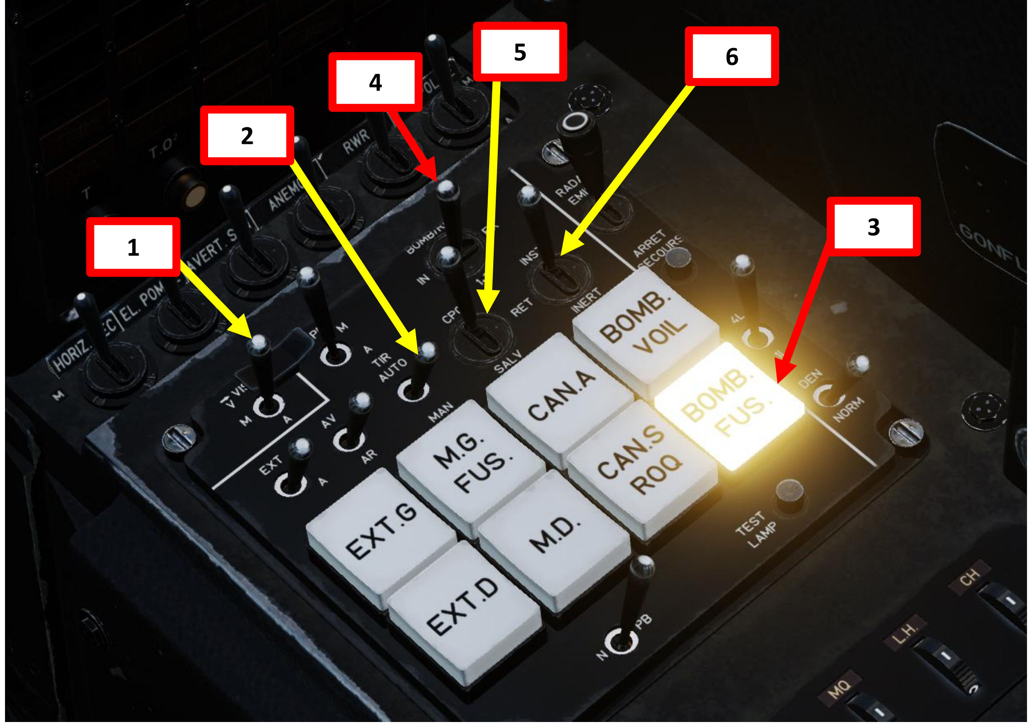


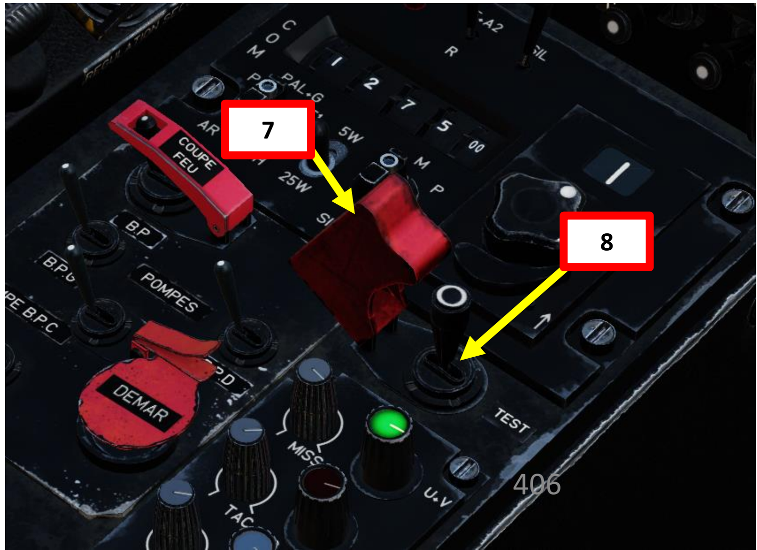


3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

D – Perform Attack

1. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
2. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
3. Select desired pylons with the Weapon Selector Pushbuttons.
    - BOMB VOIL (Bombe Voilure): Wing Bombs
    - BOMB FUS: Fuselage Bombs
4. Set Bomb/Rocket Selector Switch – As desired.
    - LEFT position: Intérieur (Inner) Pylons
    - MIDDLE position: All Pylons
    - RIGHT position: Extérieur (Outer) Pylons
5. Set Single/Salvo Selector Switch – FWD (Single)
    - CPC (Coup par coup): Single
6. Set Bomb Fuze Selector to FWD position (Instant Fuze).
7. Flip Armament Master Switch (Sécurité Armes) guard – UP
8. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)





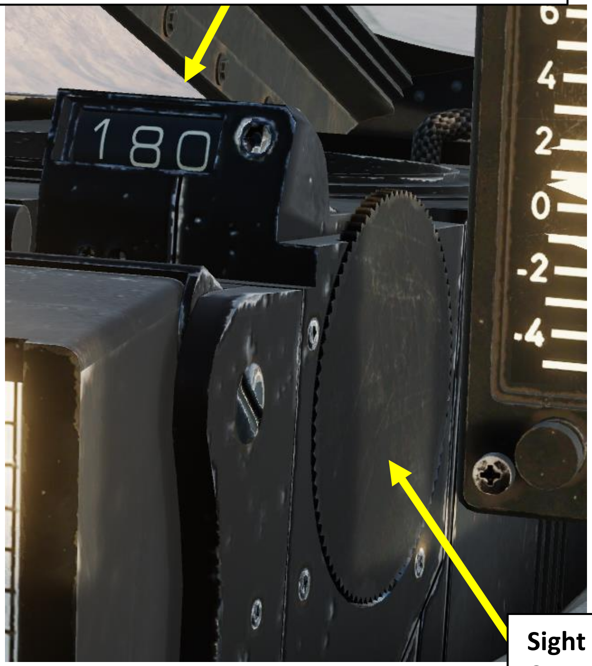
3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

D – Perform Attack

9. Select an attack profile. In this tutorial, we will select the following:
    - **Dive Speed: 350 kts to 450 kts**
    - **Dive Angle: 20 deg**
    - **Bomb Release Height: 15000 ft**
    - **Sight Depression Angle Setting: 180 mRad**
10. Based on the selected profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

GBU-10/12/16 Laser-Guided Bombs

Airspeed (kts)	Dive Angle (deg)	Attack Profile (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
350-450	20	From 15000 to 30000	180
400-450	Level	From 10000	180



3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

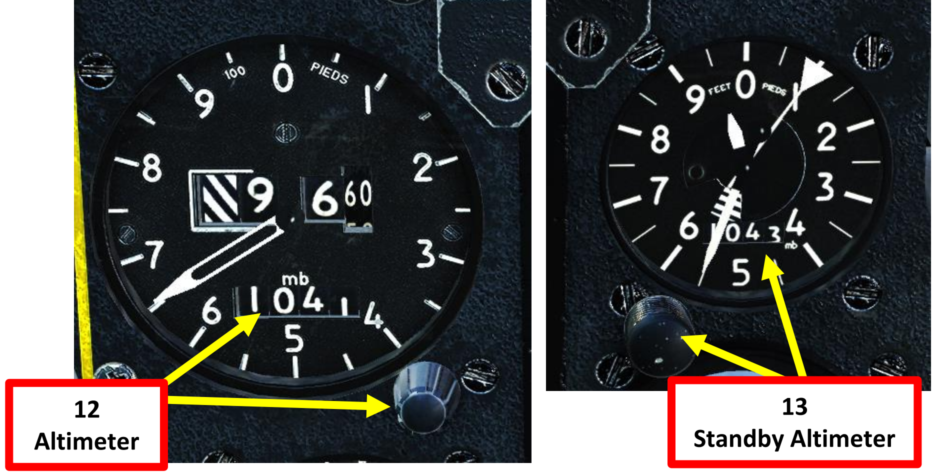
D – Perform Attack

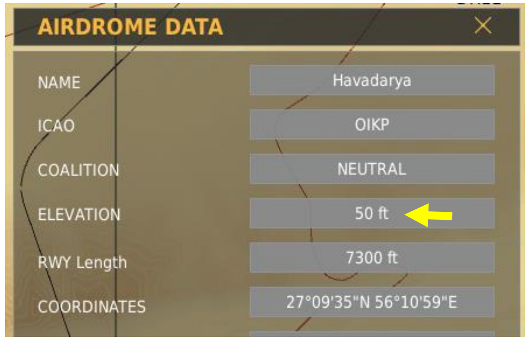
11. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1043 mBar in this tutorial) to compute the target's QFE. See this section for reference.

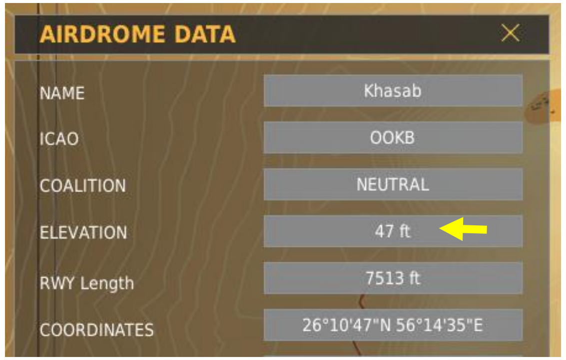
$$QFE = QNH - \frac{(\textit{Target Elevation in ft})}{30\ ft/mBar}$$

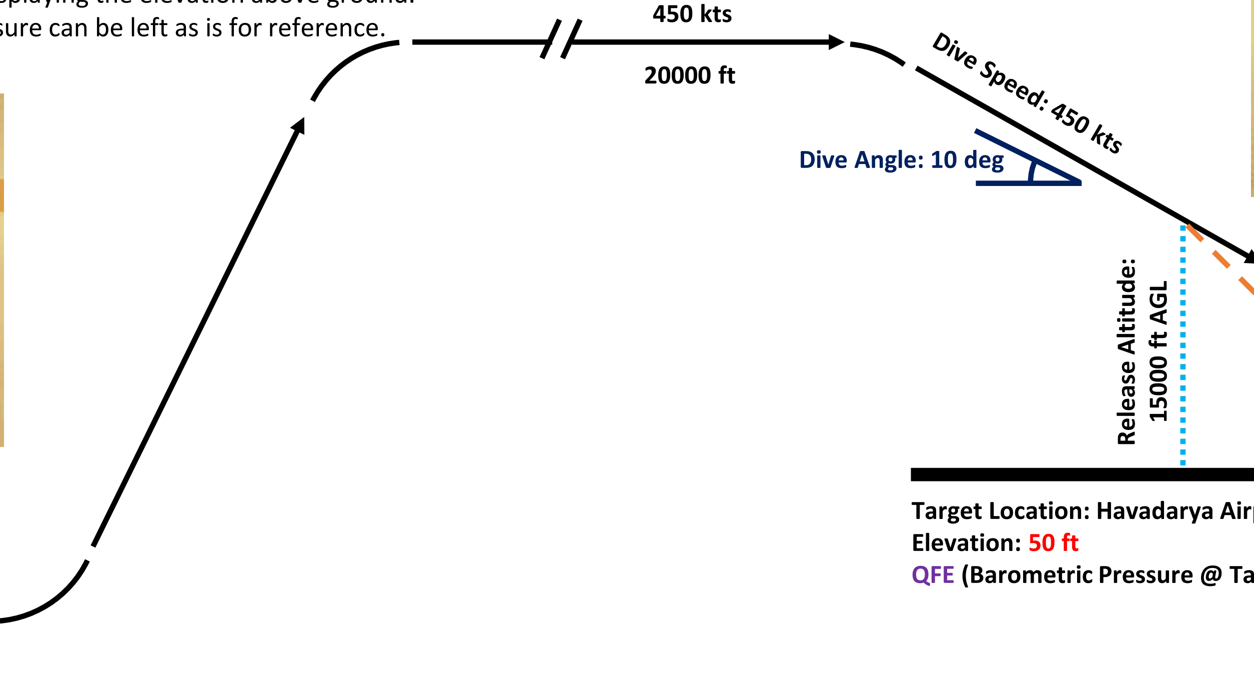
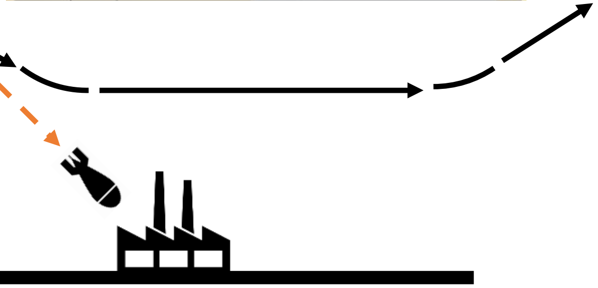
$$QFE = 1043\ mBar - \frac{(50\ ft)}{30 \frac{ft}{mBar}} = 1041{,}3\ mBar$$

12. Adjust the Altimeter Pressure Setting knob to 1041.3 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
13. The Standby Altimeter Altimeter Pressure can be left as is for reference.







Target Location: Havadarya Airport
Elevation: 50 ft
QFE (Barometric Pressure @ Target Elevation): 1041.3 mBar

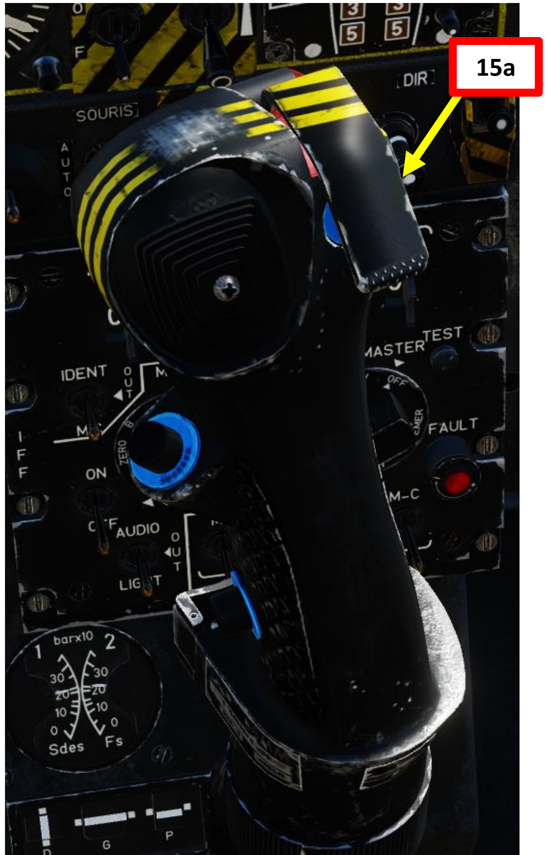
Departure Airfield – Khasab
Elevation: 47 ft
QNH (Barometric Pressure @ Sea Level: 1043 mBar

Sea Level
Elevation: 0 ft

3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

D – Perform Attack

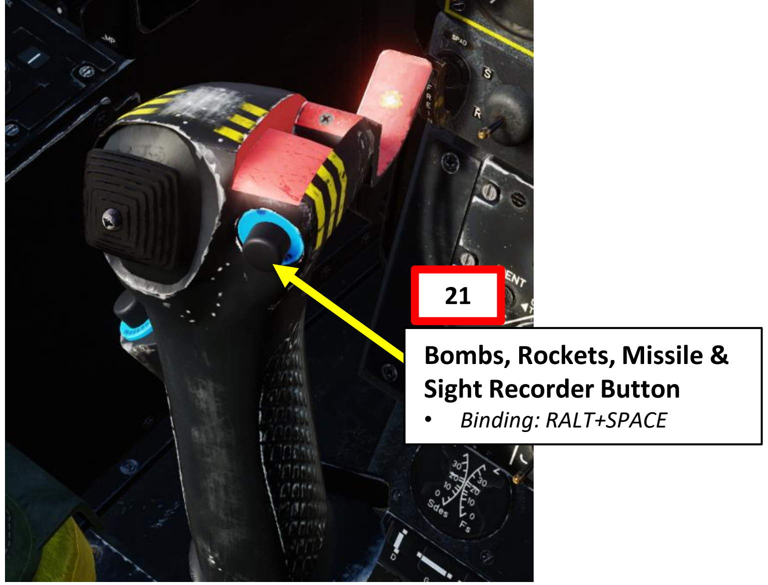
14. Adjust Seat Height to have a good visibility of the sight's pipper.
15. Unfold the Gun Firing Trigger Safety by using the "RCTRL+SPACE" binding.
16. Approach the target and maintain it to your aircraft's 10 o'clock position. Fly level at an altitude of approx. 20000 ft.
17. For a 20 deg bomb run dive, throttle back and roll in on the target. Dive should be initiated from 20000 ft at 450 kts.
18. Use your altimeter, speed indicator and pitch indicator to fly with correct bombing parameters.
    - **Dive Speed: 350 kts to 450 kts**
    - **Dive Angle: 20 deg**
    - **Bomb Release Height: 15000 ft**
    - **Sight Depression Angle Setting: 180 mRad**

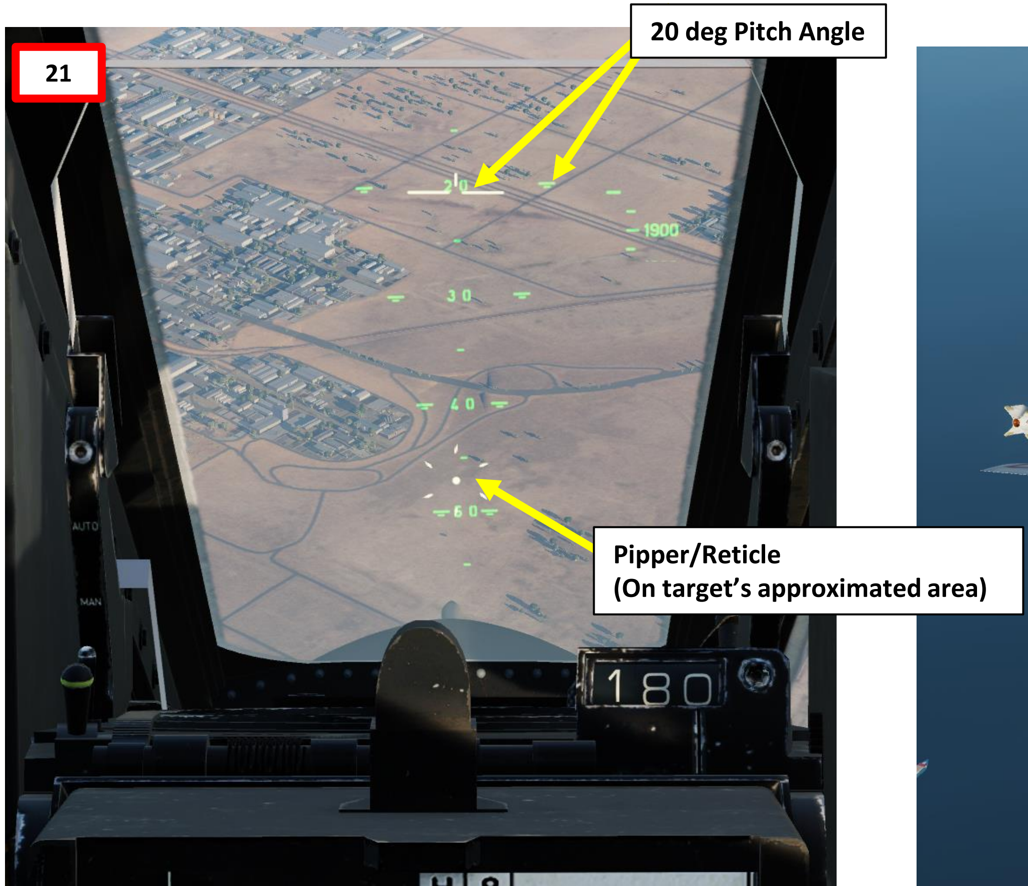


3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

D – Perform Attack

19. Keep gunsight pipper slightly below target as you dive.
20. Align target with sight pipper before bomb release (15000 ft above ground level). Maintain a dive speed between 350 and 450 kts as per the selected attack profile.
21. Release bomb 15000 ft above ground level by pressing and holding the Bombs, Rockets, Missile & Sight Recorder Button (RALT+SPACE).





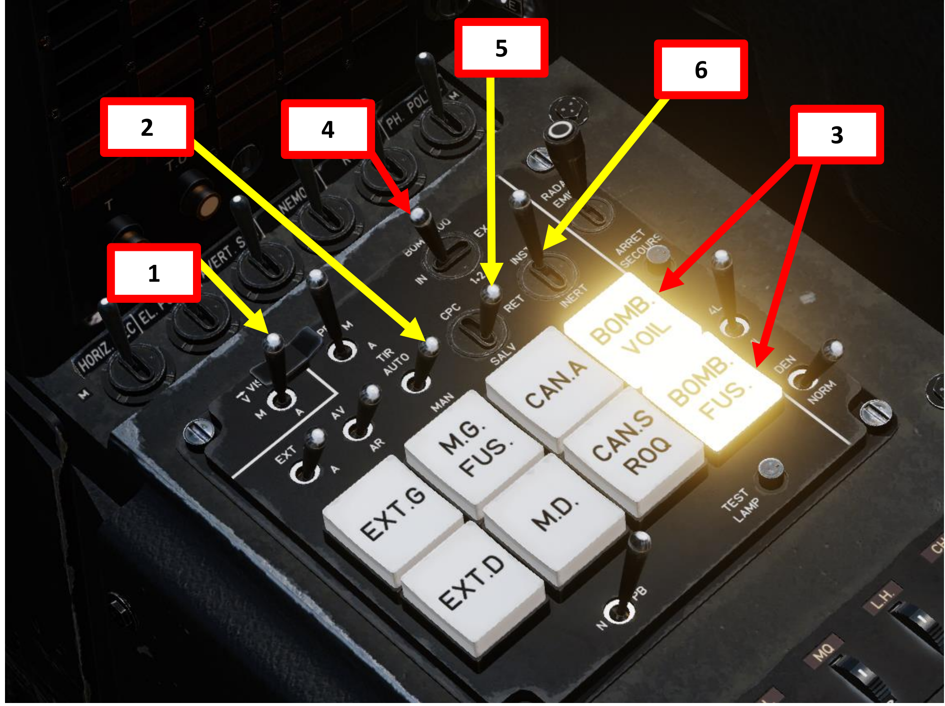
3 – AIR-TO-GROUND WEAPONS
3.3 – GBU-12 Paveway II Laser-Guided Bombs

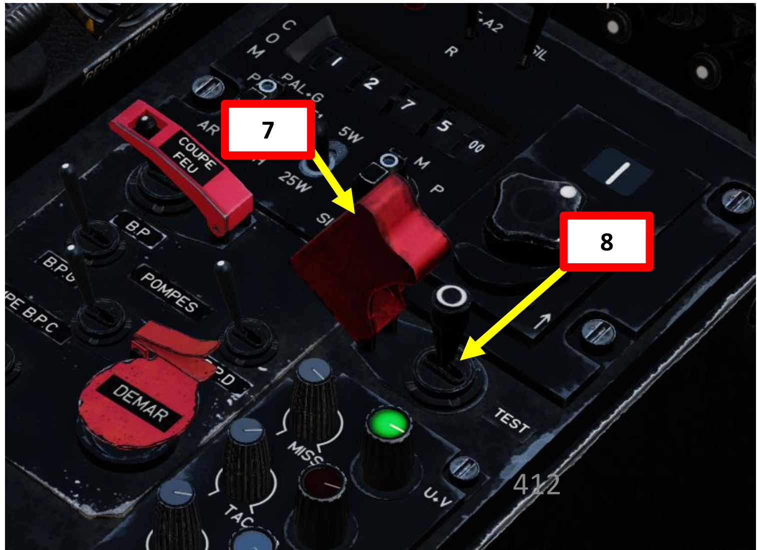
D – Perform Attack

22. Once GBU-12 is falling, it will track the laser of the JTAC designating the target until impact.
23. After bomb release, recover from the dive with a 4 G pull up. This pull up must happen within 2 seconds after weapon release or the blast radius may damage your aircraft.

3 – AIR-TO-GROUND WEAPONS
3.4 – BLG-66 Belouga Cluster Bombs

1. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
2. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
3. Select desired pylons with the Weapon Selector Pushbuttons.
   - BOMB VOIL (Bombe Voilure): Wing Bombs
   - BOMB FUS: Fuselage Bombs
4. Set Bomb/Rocket Selector Switch – As desired.
   - LEFT position: Intérieur (Inner) Pylons
   - MIDDLE position: All Pylons
   - RIGHT position: Extérieur (Outer) Pylons
5. Set Single/Salvo Selector Switch – As desired.
   - FWD: CPC (Coup par coup), Single
   - AFT: SALV (Salve), Salvo
6. Set Bomb Fuze Selector to FWD position (Instant Fuze).
7. Flip Armament Master Switch (Sécurité Armes) guard – UP
8. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)





3 – AIR-TO-GROUND WEAPONS
3.4 – BLG-66 Belouga Cluster Bombs

9. In this tutorial, we will use the following attack profile:
   - **Approach Speed: 500 kts**
   - **Level Attack**
   - **Bomb Release Height: 1000 ft**
   - **Sight Depression Angle Setting: 168 mRad**
10. Based on the attack profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

BLG-66 Belouga Cluster Bombs

Dive Attack Profiles

Airspeed (kts)	Dive Angle (deg)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
500	30	3000	70
500	30	5000	148
450	40	8000	176

Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
500	1000	168

Pipper/Reticle

Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*

Sight Depression Angle Setting Control Wheel

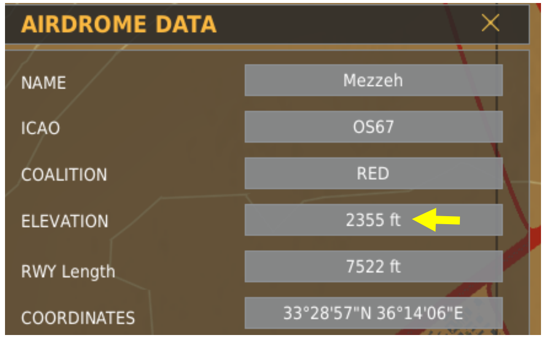
3 – AIR-TO-GROUND WEAPONS
3.4 – BLG-66 Belouga Cluster Bombs

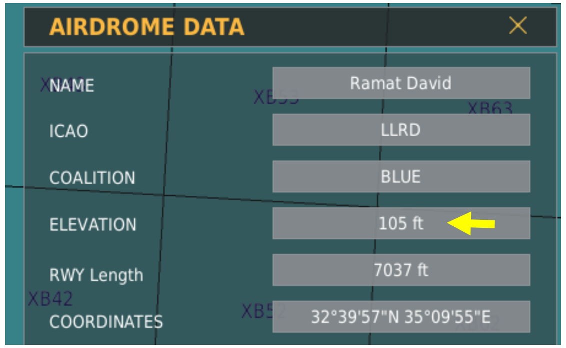
11. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

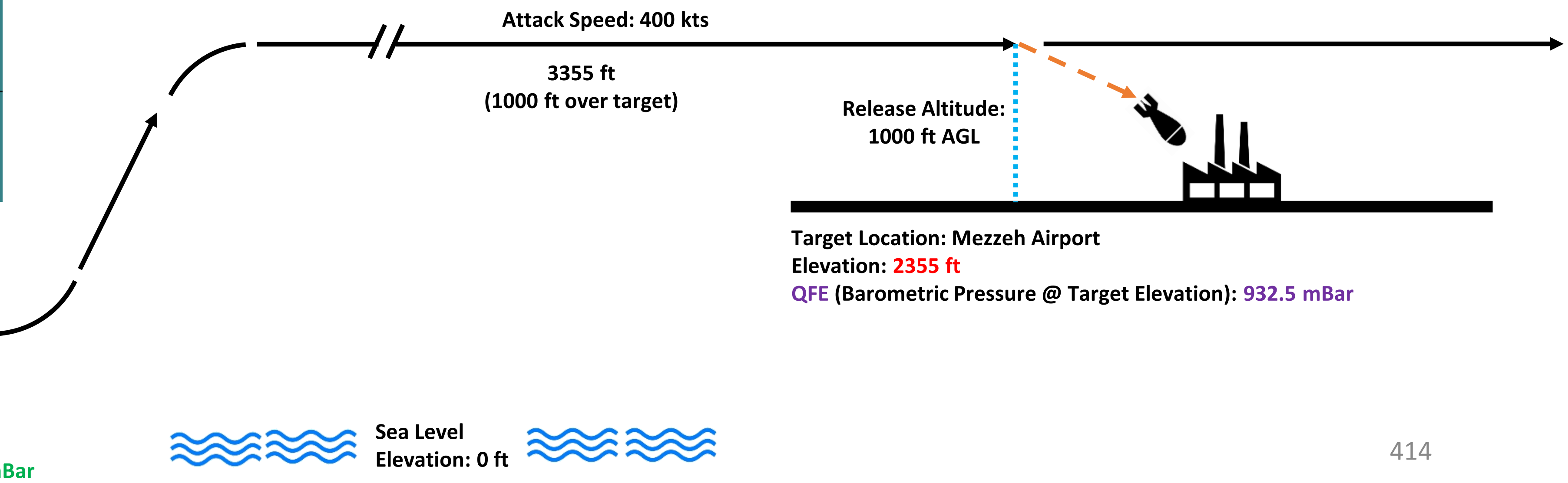
$$QFE = QNH - \frac{(Target\ Elevation\ in\ ft)}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

12. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
13. The Standby Altimeter Altimeter Pressure can be left as is for reference.

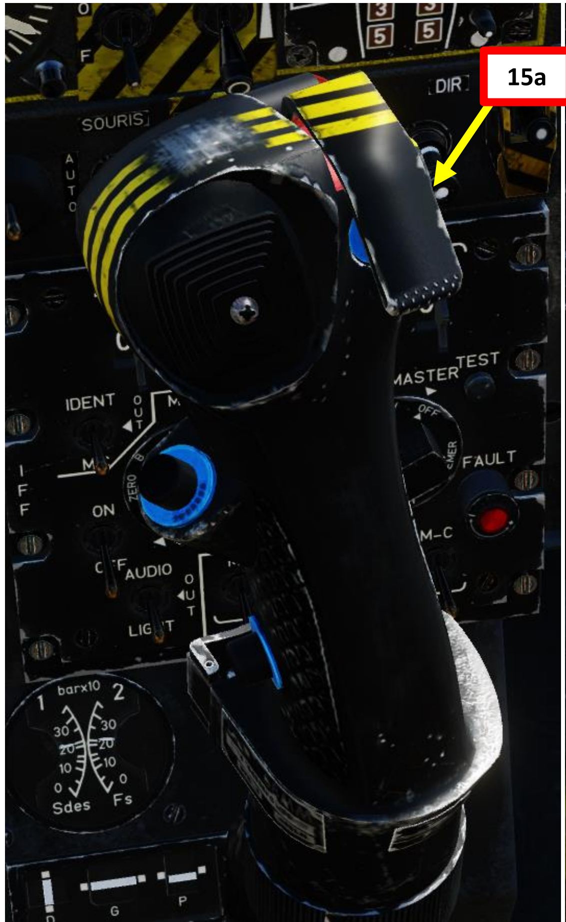






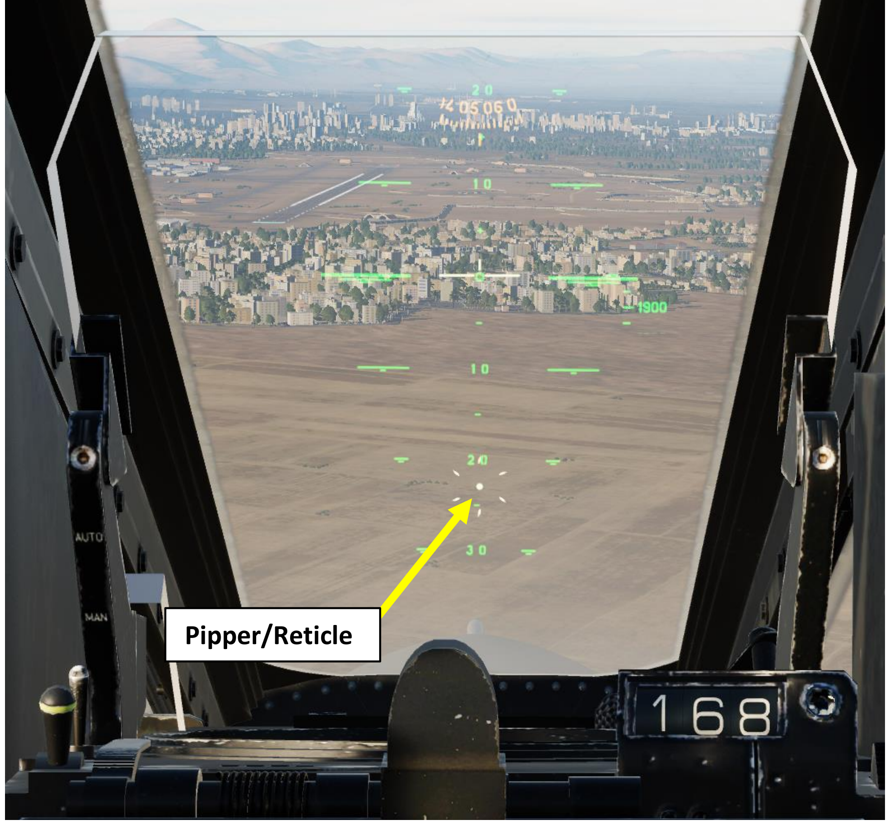
3 – AIR-TO-GROUND WEAPONS
3.4 – BLG-66 Belouga Cluster Bombs

14. Adjust Seat Height to have a good visibility of the sight's pipper.
15. Unfold the Gun Firing Trigger Safety by using the "RCTRL+SPACE" binding.
16. For a level bomb run, approach the target low and fast. Attack should be initiated from 1000 ft AGL (above ground level) at 500 kts.
17. Use your altimeter, speed indicator and pitch indicator to fly with correct bombing parameters.
    - **Approach Speed: 500 kts**
    - **Level Attack**
    - **Bomb Release Height: 1000 ft**
    - **Sight Depression Angle Setting: 168 mRad**



Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Bombs, Rockets, Missile & Sight Recorder Button
- *Binding: RALT+SPACE*

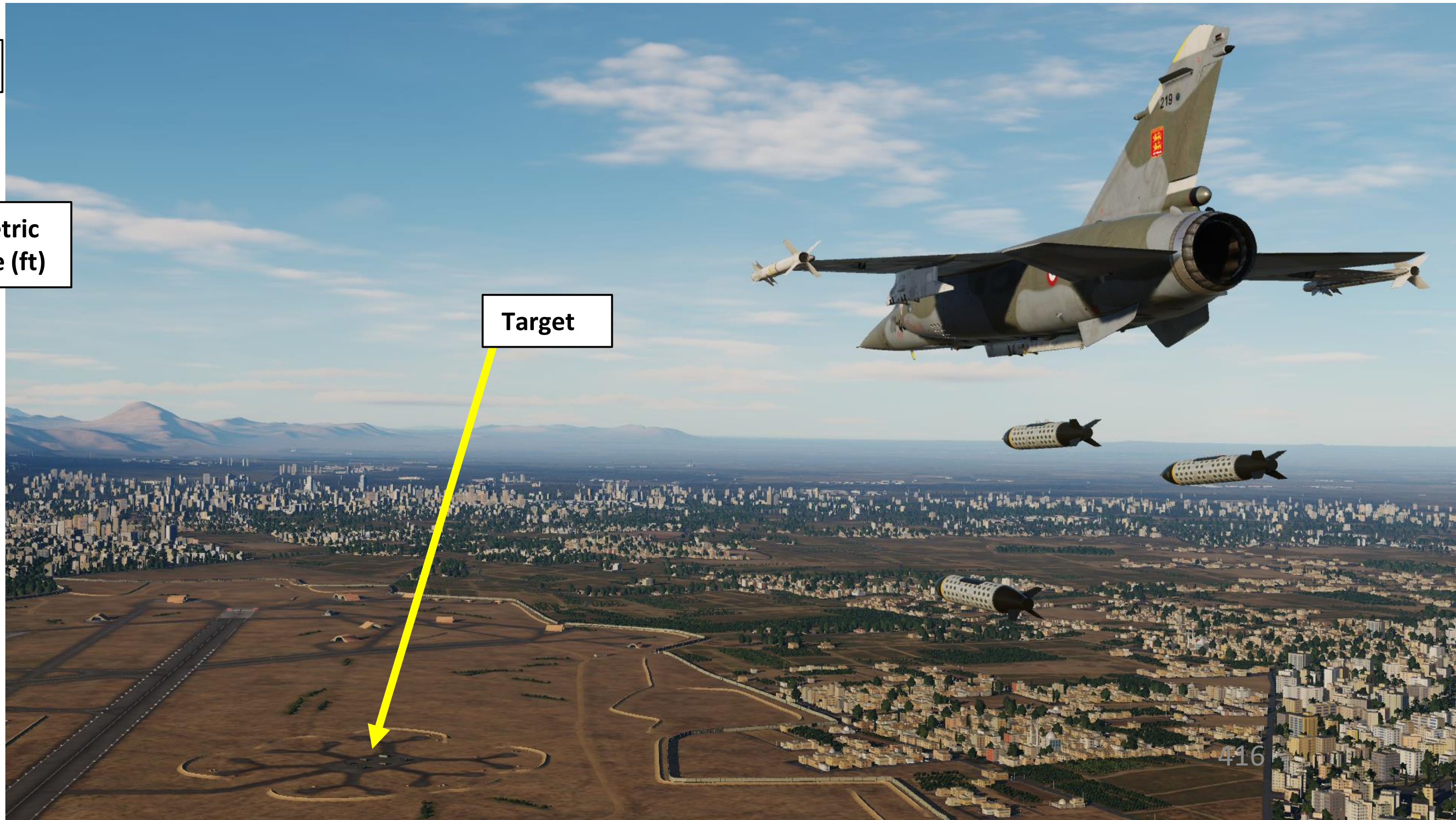


Pipper/Reticle

Seat Adjustment Control Switch
- *FWD: Seat DOWN*
- *AFT: Seat UP*

3 – AIR-TO-GROUND WEAPONS
3.4 – BLG-66 Belouga Cluster Bombs

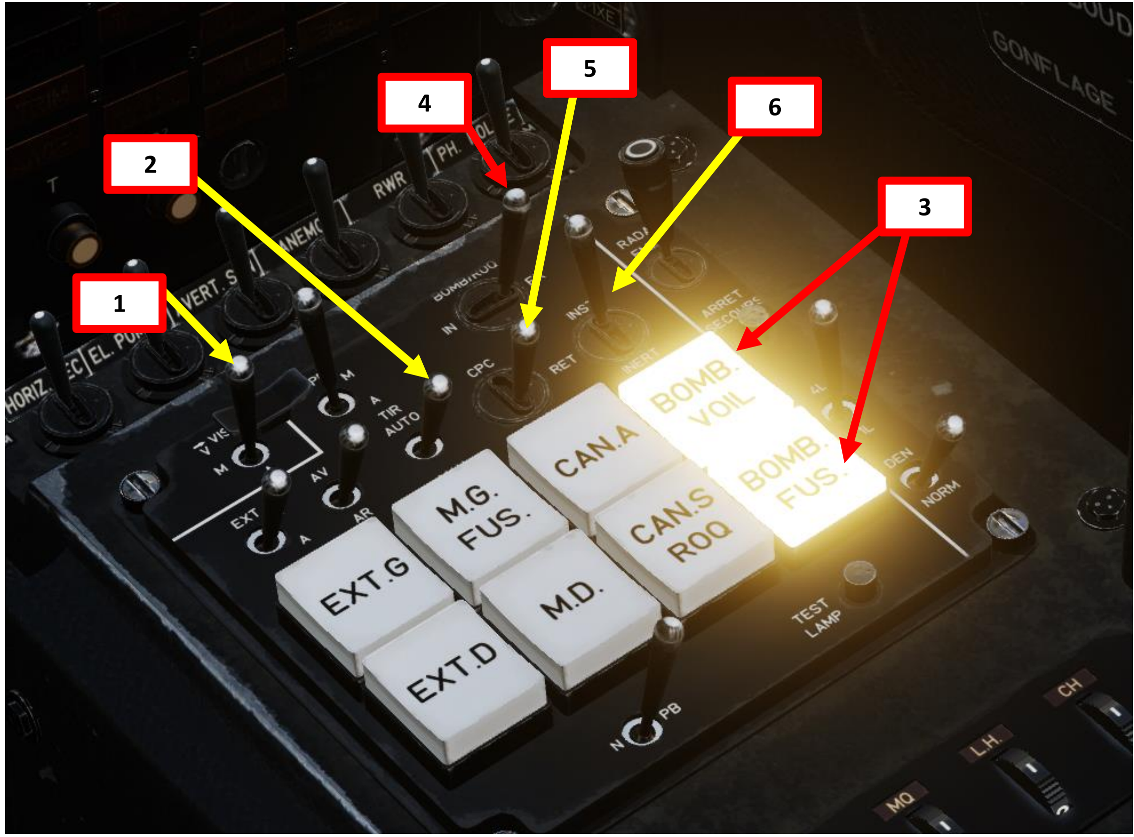
19. Keep gunsight pipper slightly below target.
20. Align target with sight pipper while maintaining release altitude (1000 ft above ground level). Maintain an attack speed of 500 kts as per the attack profile.
21. Release bombs 1000 ft above ground level by pressing and holding the Bombs, Rockets, Missile & Sight Recorder Button (RALT+SPACE).

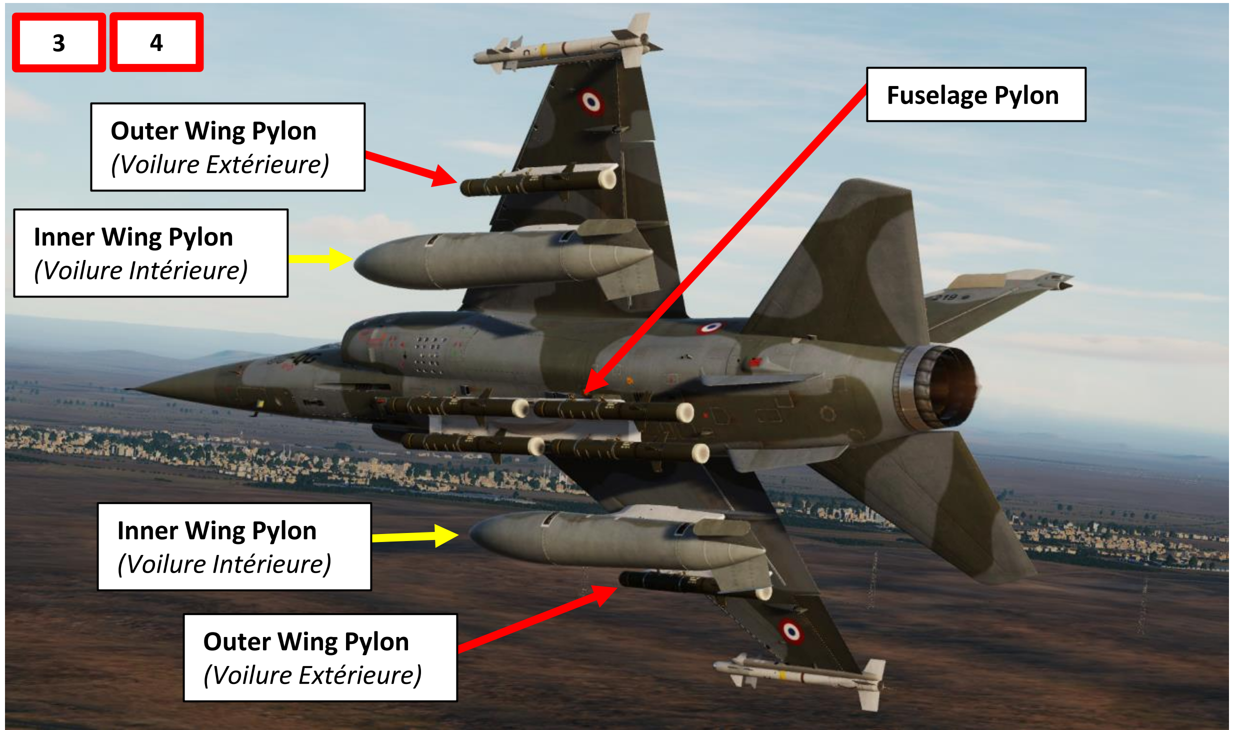


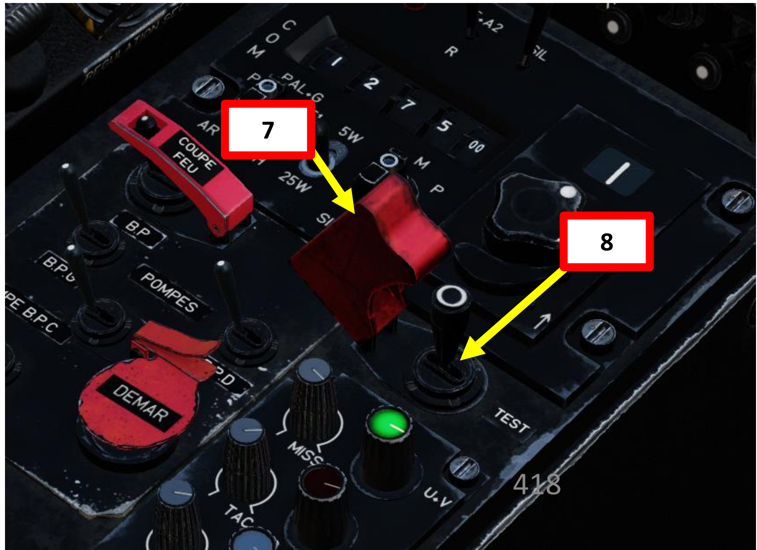
3 – AIR-TO-GROUND WEAPONS
3.4 – BLG-66 Belouga Cluster Bombs

3 – AIR-TO-GROUND WEAPONS
3.5 – BLU-107/B Durandal Anti-Runway Bombs

1. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
2. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
3. Select desired pylons with the Weapon Selector Pushbuttons.
    - BOMB VOIL (Bombe Voilure): Wing Bombs
    - BOMB FUS: Fuselage Bombs
4. Set Bomb/Rocket Selector Switch – As desired.
    - LEFT position: Intérieur (Inner) Pylons
    - MIDDLE position: All Pylons
    - RIGHT position: Extérieur (Outer) Pylons
5. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single
    - AFT: SALV (Salve), Salvo
6. Set Bomb Fuze Selector to FWD position (Instant Fuze).
7. Flip Armament Master Switch (Sécurité Armes) guard – UP
8. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)







3 – AIR-TO-GROUND WEAPONS
3.5 – BLU-107/B Durandal Anti-Runway Bombs

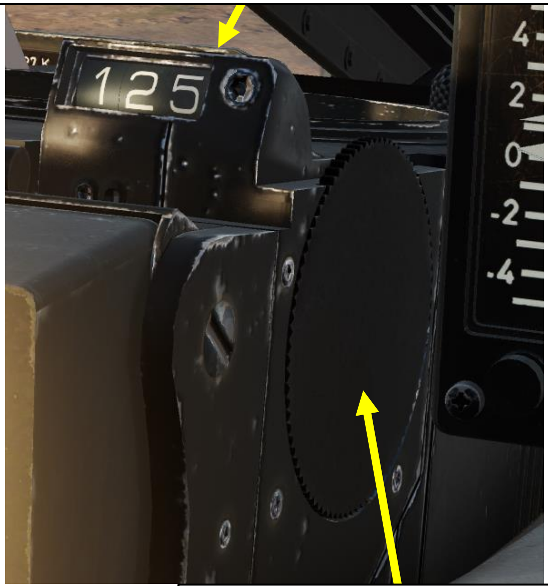
9. In this tutorial, we will use the following attack profile:
   - **Approach Speed: 500 kts**
   - **Level Attack**
   - **Bomb Release Height: 300 ft**
   - **Sight Depression Angle Setting: 125 mRad**
10. Based on the attack profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

BLU-107/B Durandal Anti-Runway Bombs Level Attack Profile

Airspeed (kts)	Release Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
500	300	125

Pipper/Reticle

Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*



Sight Depression Angle Setting Control Wheel

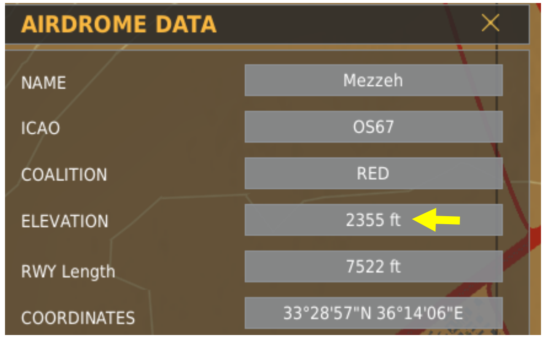
3 – AIR-TO-GROUND WEAPONS
3.5 – BLU-107/B Durandal Anti-Runway Bombs

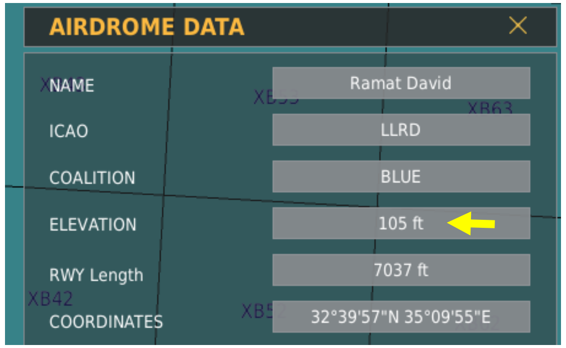
11. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

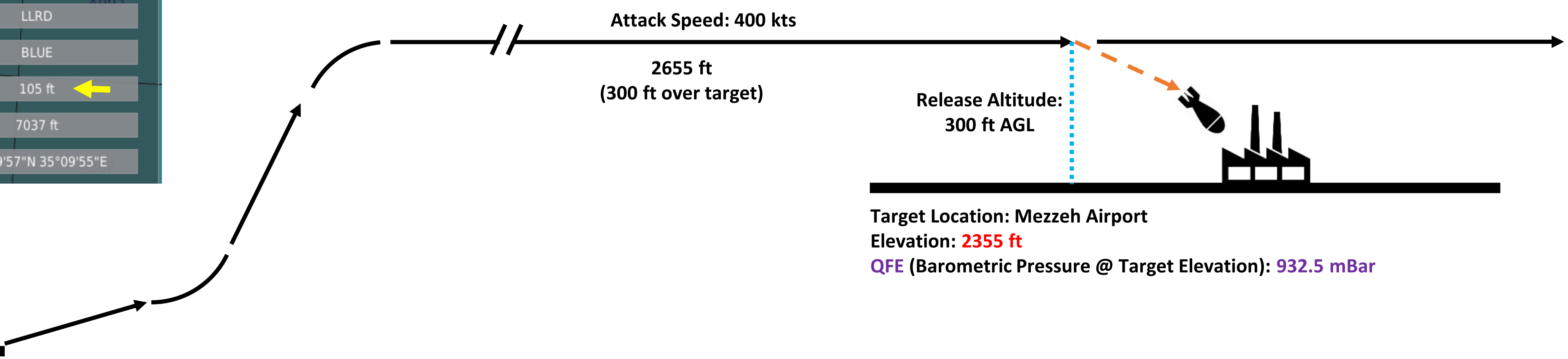
$$QFE = QNH - \frac{(\textit{Target Elevation in ft})}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

12. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
13. The Standby Altimeter Altimeter Pressure can be left as is for reference.

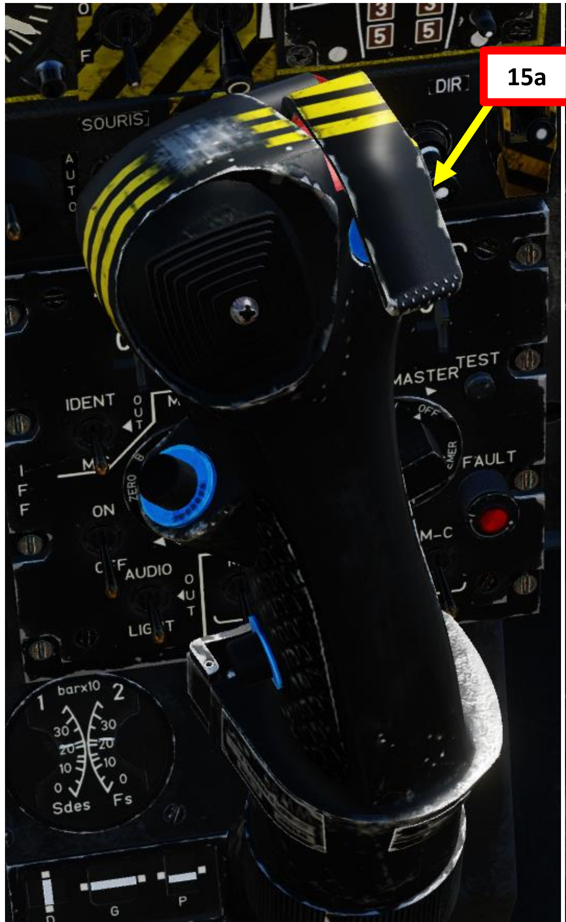


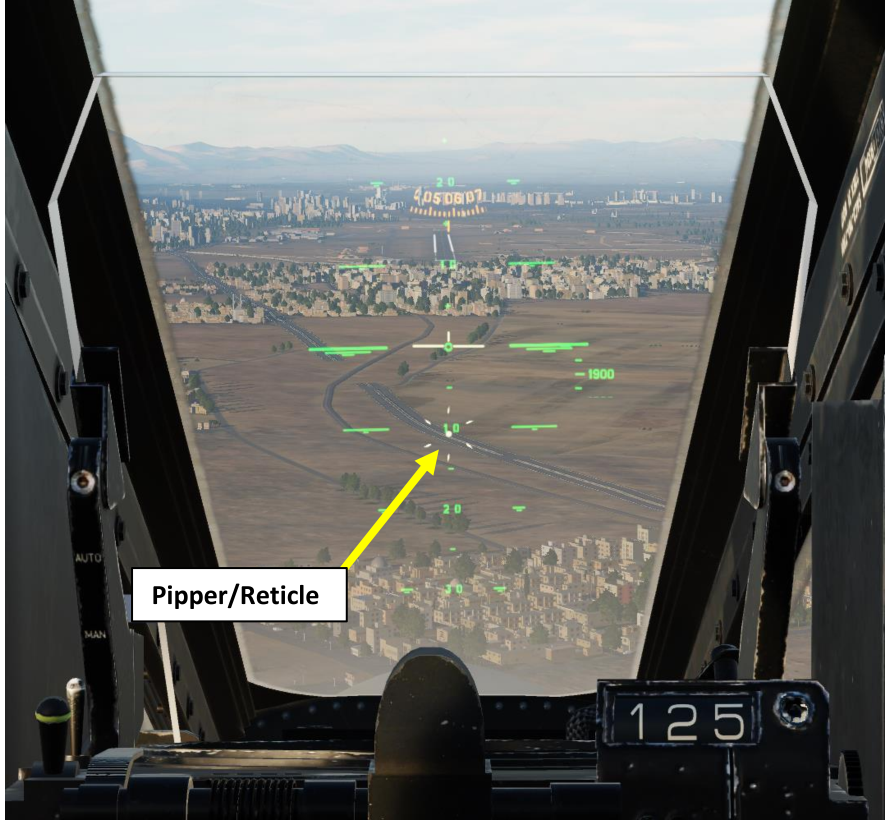




3 – AIR-TO-GROUND WEAPONS
3.5 – BLU-107/B Durandal Anti-Runway Bombs

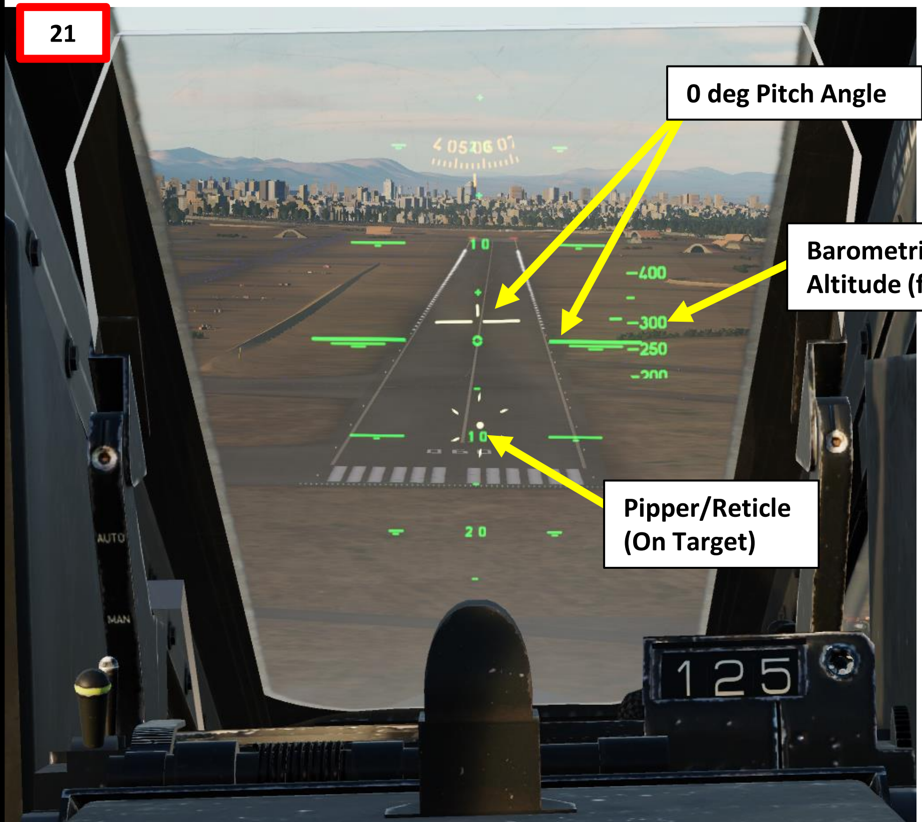
14. Adjust Seat Height to have a good visibility of the sight's pipper.
15. Unfold the Gun Firing Trigger Safety by using the "RCTRL+SPACE" binding.
16. For a level bomb run, approach the target low and fast. Attack should be initiated from 300 ft AGL (above ground level) at 500 kts.
17. Use your altimeter, speed indicator and pitch indicator to fly with correct bombing parameters.
    - **Approach Speed: 500 kts**
    - **Level Attack**
    - **Bomb Release Height: 300 ft**
    - **Sight Depression Angle Setting: 125 mRad**





3 – AIR-TO-GROUND WEAPONS
3.5 – BLU-107/B Durandal Anti-Runway Bombs

19. Keep gunsight pipper slightly below target.
20. Align target with sight pipper while maintaining release altitude (300 ft above ground level). Maintain an attack speed of 500 kts as per the attack profile.
21. Release bombs 300 ft above ground level by pressing and holding the Bombs, Rockets, Missile & Sight Recorder Button (RALT+SPACE).



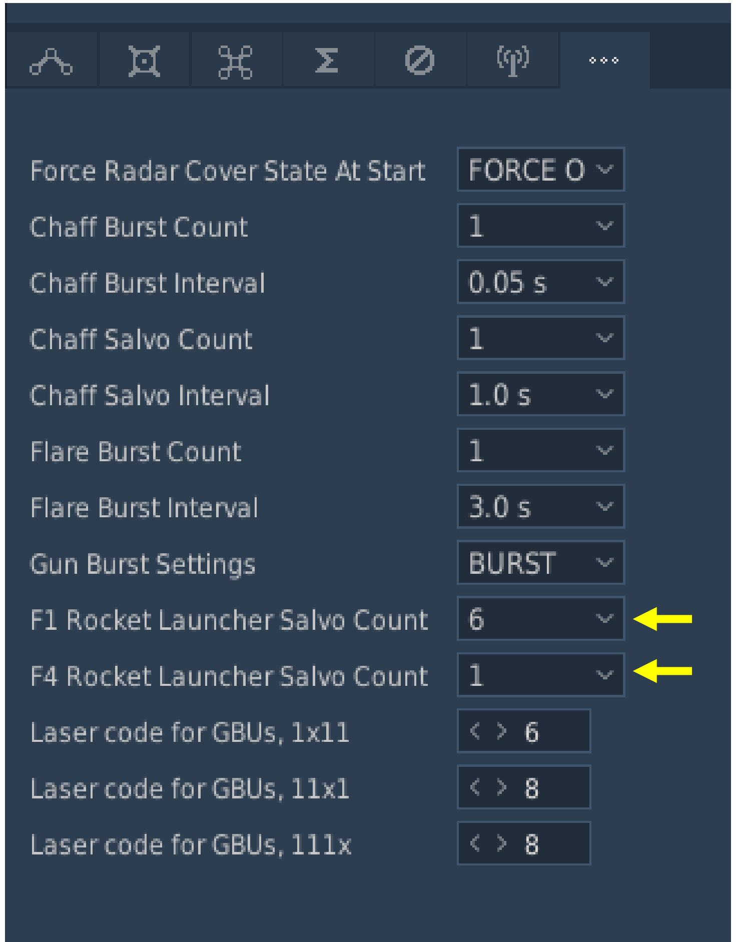
3 – AIR-TO-GROUND WEAPONS
3.5 – BLU-107/B Durandal Anti-Runway Bombs

22. Durandals are used against hard/reinforced targets like runways. The forward half of the bomb holds the explosives, the penetrator and the fuse. The aft half contains the booster, the 4 stabilizing fins and the deployable chute. Just after the bomb is released, the parachute is deployed, separating the bomb from the aircraft and slowing it down. A short delay after, the parachute is jettisoned and the booster rocket is fired, accelerating the bomb into the ground. After penetration is achieved, the bomb explodes… creating a crater.

3 – AIR-TO-GROUND WEAPONS
3.5 – Durandal Anti-Runway Bombs

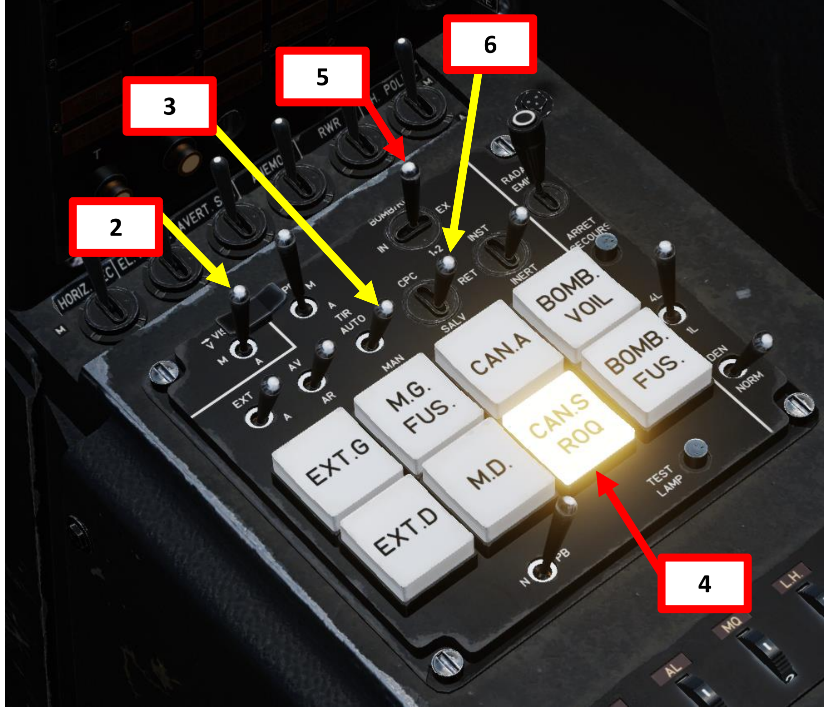
3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

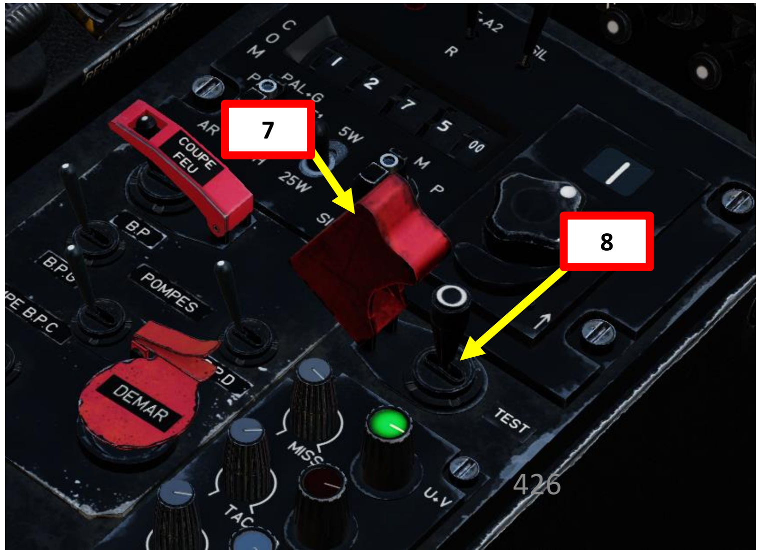
1. In real life, rocket salvo settings are preset by maintenance crews on the ground. In DCS, rocket salvo settings are preset via the Mission Editor. Take note that « F4 » and « F1 » refer to the rocket pod types. The F4 pod carries 18 rockets, while the F1 pod carries 36 rockets.



3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
4. Select rocket pylons with the appropriate Weapon Selector Pushbutton.
    - CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets
5. Set Bomb/Rocket Selector Switch – As desired.
    - LEFT position: Intérieur (Inner) Pylons
    - MIDDLE position: All Pylons
    - RIGHT position: Extérieur (Outer) Pylons
6. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single
    - AFT: SALV (Salve), Salvo. Take note that rocket salvo settings are preset via the Mission Editor.
7. Flip Armament Master Switch (Sécurité Armes) guard – UP
8. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)





3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

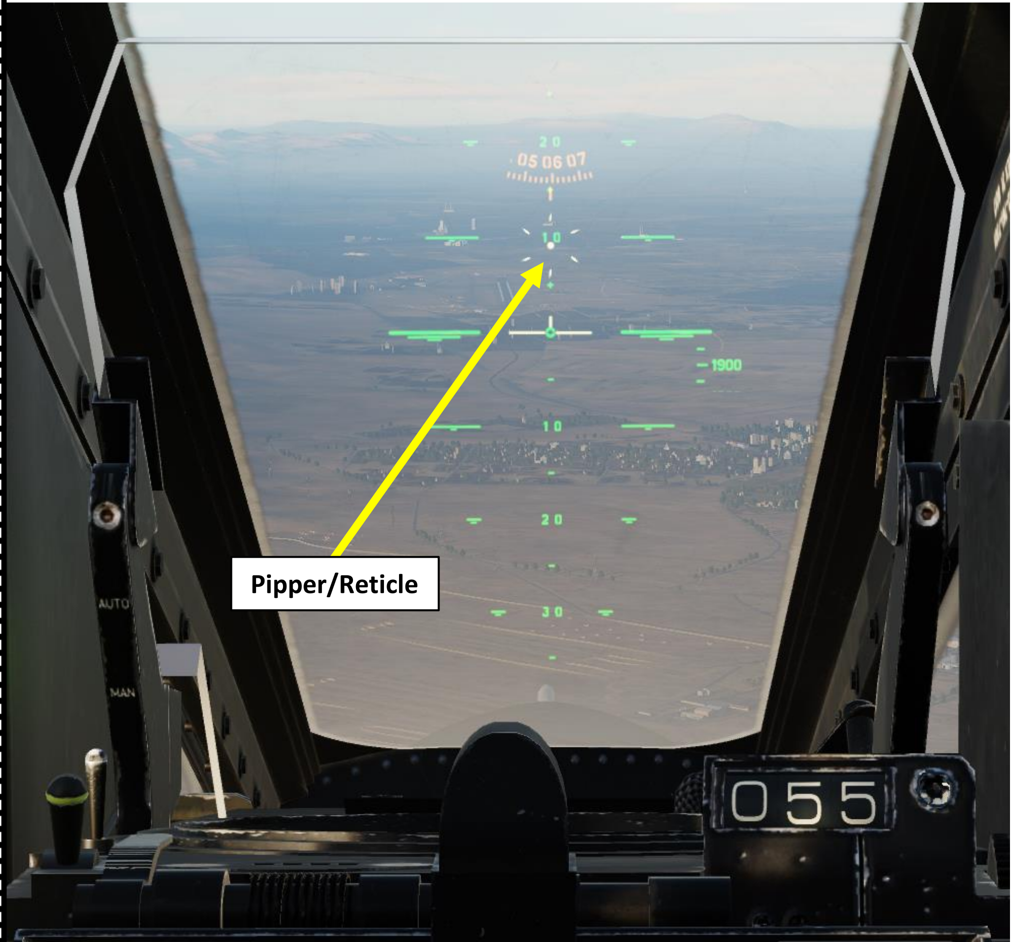
9. Select an attack profile. In this tutorial, we will select the following:
    - **Dive Speed: 450 kts**
    - **Dive Angle: 10 deg**
    - **Rocket Firing Height: 2000 ft**
    - **Sight Depression Angle Setting: 55 mRad**
10. Based on the selected profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

MATRA F4	
11000 Kg 320 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	60
1500	65
2000	75
3000	85
4000	105
5000	120
6000	140

MATRA F4	
11000 Kg 450 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	40
1500	50
2000	55
3000	65
4000	85
5000	100
6000	115

MATRA F4	
11000 Kg 420 KTS DIVE -10°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	40
1500	50
2000	55
3000	70
4000	90
5000	105
6000	125

MATRA F4	
11000 Kg 400 KTS DIVE -15°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	50
1500	55
2000	55
3000	65
4000	75
5000	90
6000	100



Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*

Sight Depression Angle Setting Control Wheel

MATRA F4	
11000 Kg 450 KTS DIVE -15°	
HEIGHT (ft)	DEPRESSION ANGLE (mrad)
1000	45
1500	45
2000	45
3000	55
4000	70
5000	85
6000	95

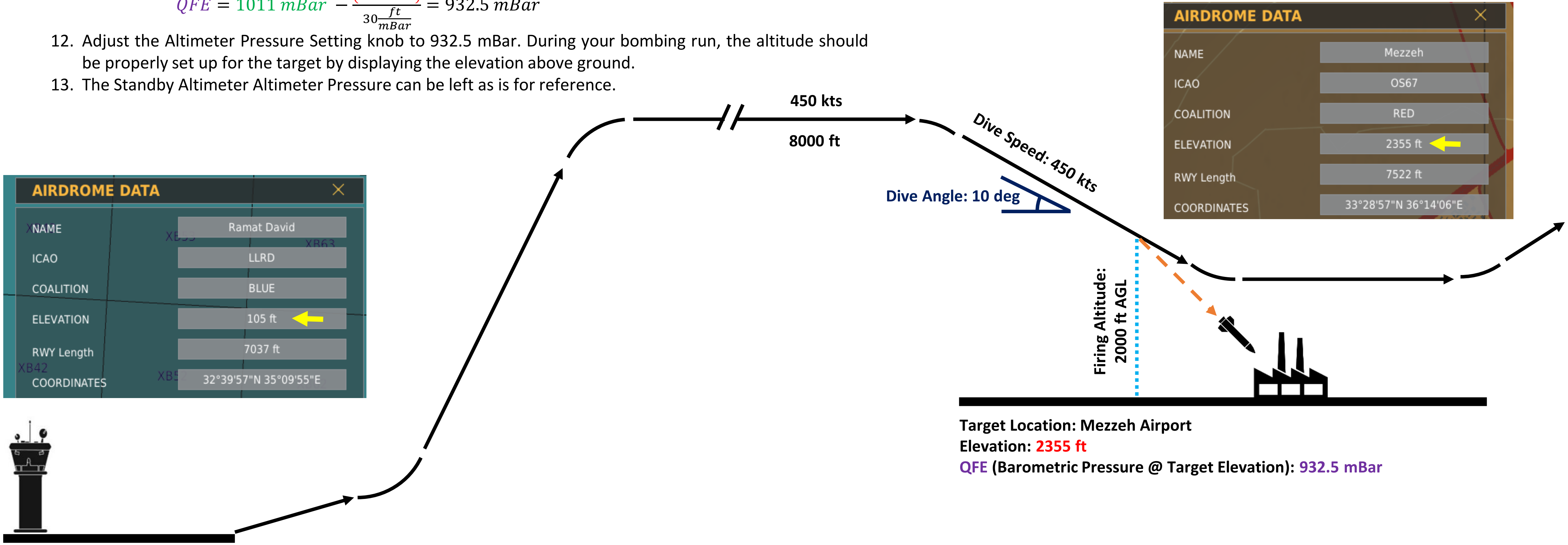
3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

11. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

$$QFE = QNH - \frac{(Target\ Elevation\ in\ ft)}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

12. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
13. The Standby Altimeter Altimeter Pressure can be left as is for reference.



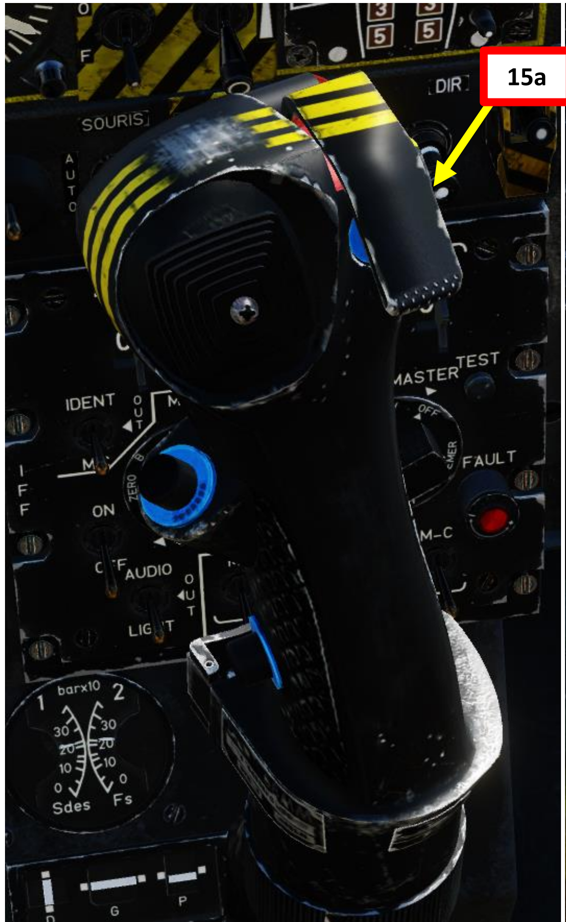
Target Location: Mezzeh Airport
Elevation: 2355 ft
QFE (Barometric Pressure @ Target Elevation): 932.5 mBar

Departure Airfield – Ramat David
Elevation: 105 ft
QNH (Barometric Pressure @ Sea Level): 1011 mBar

Sea Level
Elevation: 0 ft

3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

14. Adjust Seat Height to have a good visibility of the sight's pipper.
15. Unfold the Gun Firing Trigger Safety by using the "RCTRL+SPACE" binding.
16. Approach the target and maintain it to your aircraft's 10 o'clock position. Fly level at an altitude of approx. 8000 ft.
17. For a 10 deg rocket run dive, throttle back and roll in on the target. Dive should be initiated from 8000 ft at 450 kts.
18. Use your altimeter, speed indicator and pitch indicator to fly with correct attack parameters.
    - **Dive Speed: 450 kts**
    - **Dive Angle: 10 deg**
    - **Rocket Firing Height: 2000 ft**
    - **Sight Depression Angle Setting: 55 mRad**



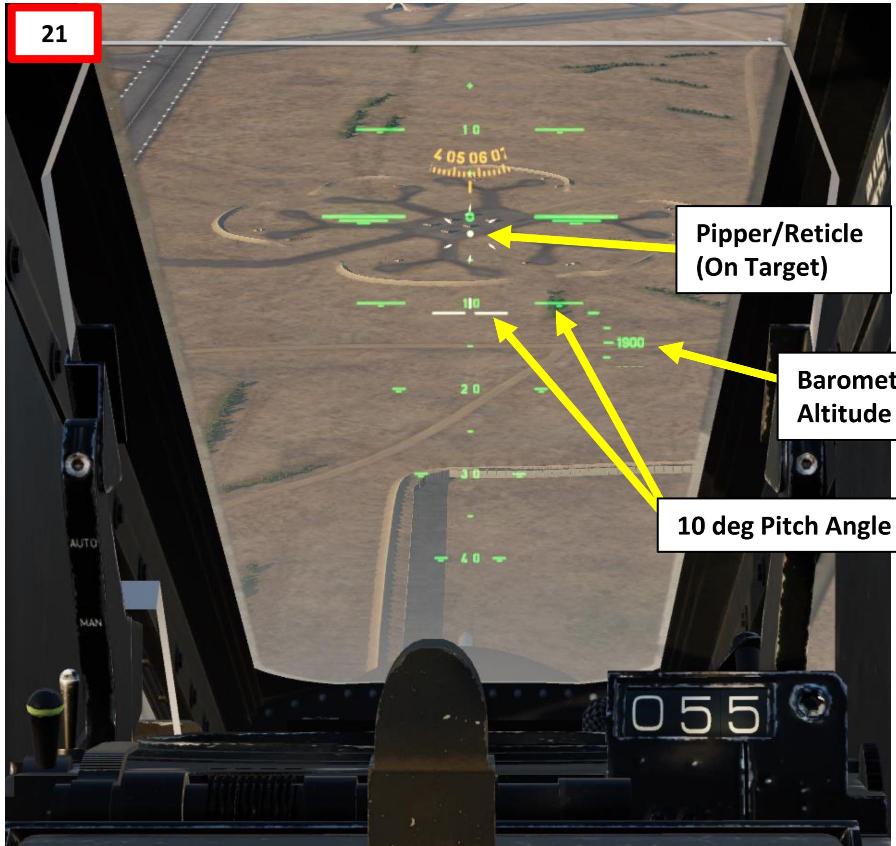
Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Bombs, Rockets, Missile & Sight Recorder Button
- *Binding: RALT+SPACE*

Seat Adjustment Control Switch
- *FWD: Seat DOWN*
- *AFT: Seat UP*

3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

19. Keep gunsight pipper slightly below target as you dive.
20. Align target with sight pipper before firing rockets (2000 ft above ground level). Maintain a dive speed of 450 kts as per the selected attack profile.
21. Fire rockets 2000 ft above ground level by pressing and holding the Bombs, Rockets, Missile & Sight Recorder Button (RALT+SPACE).
22. After rockets are fired, recover from the dive with a 4 G pull up. This pull up must happen within 2 seconds after weapon release or the blast radius may damage your aircraft.



3 – AIR-TO-GROUND WEAPONS
3.6 – SNEB (68 mm) Rockets

3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

Salvo vs Single Mode

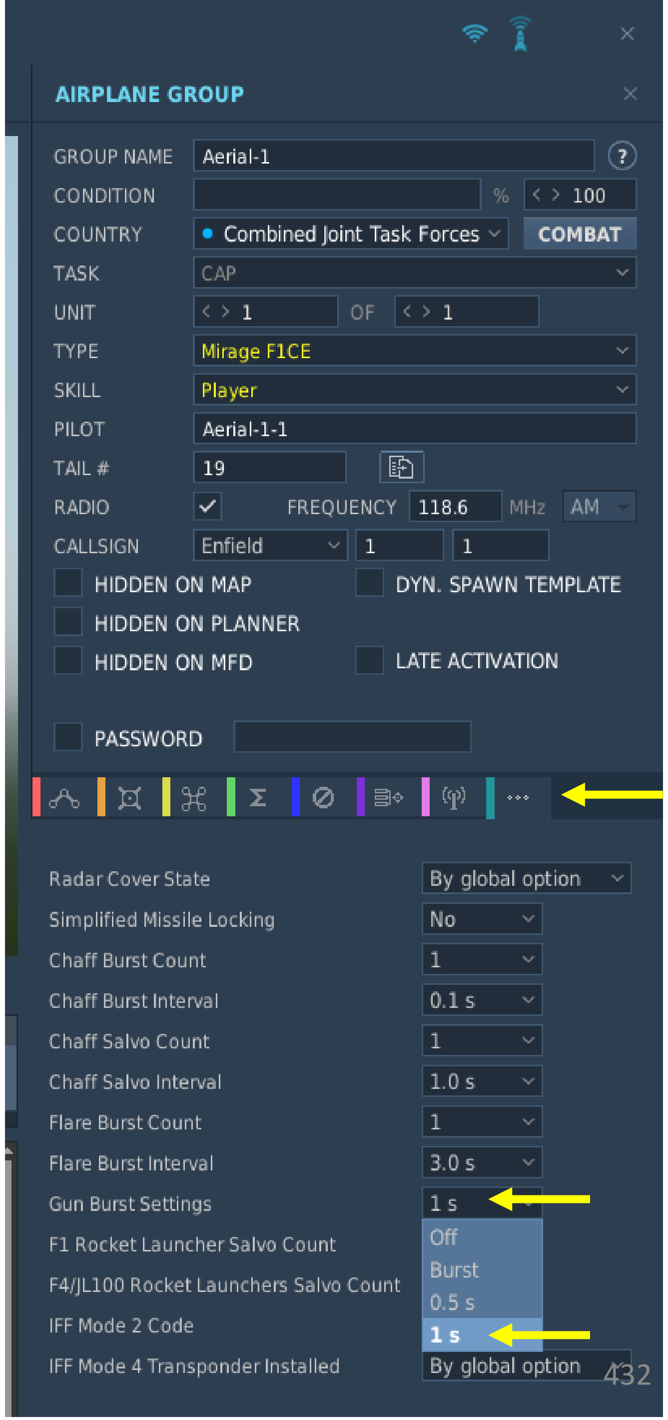
If the Single/Salvo Selector switch is in **CPC/SINGLE**, gun firing is **controlled by the burst limiter**, which is set on the ground as a maintenance function. In DCS, this maintenance function is simulated through the Mission Editor in the "Gun Burst Settings" option.

If the Single/Salvo Selector switch is in **SALVO**, rounds are **fired out the gun for as long as the trigger is squeezed**.

In practical terms, in air-to-air you should in most cases want rounds out the gun as long the trigger is depressed. The only real time one would consider burst limiting might be in air-to-ground strafes, and then probably only in training.

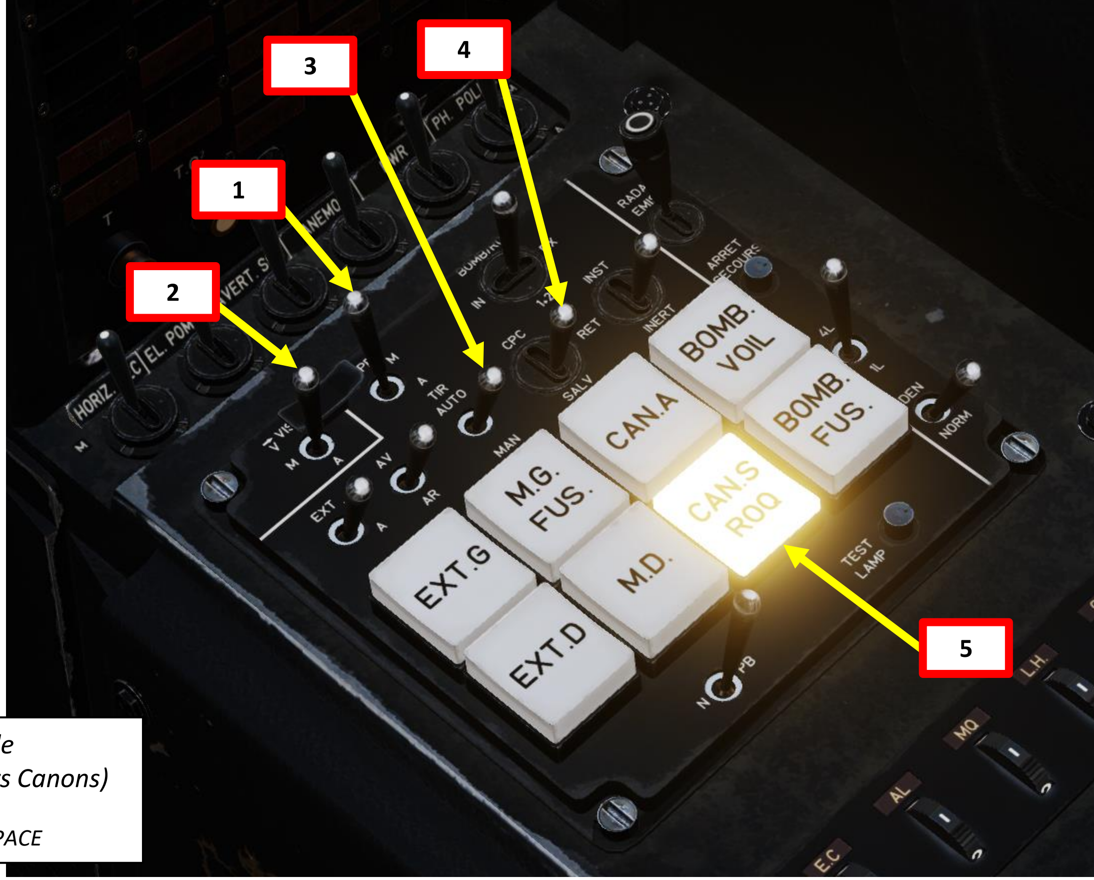
- If the Burst Setting is set to OFF, then with the Single/Salvo switch in CPC/SINGLE the gun wont fire at all.
- A recommended setting is to use the maximum setting of a "1 sec burst" and set the Single/Salvo switch to SALVO. This way, if set the Single/Salvo switch to CPC/SINGLE by mistake, you still get rounds out the gun and get at least a 1 sec burst.

Single/Salvo Selector Switch
- *FWD: CPC (Coup par coup), Single*
- *AFT: SALV (Salve), Salvo*



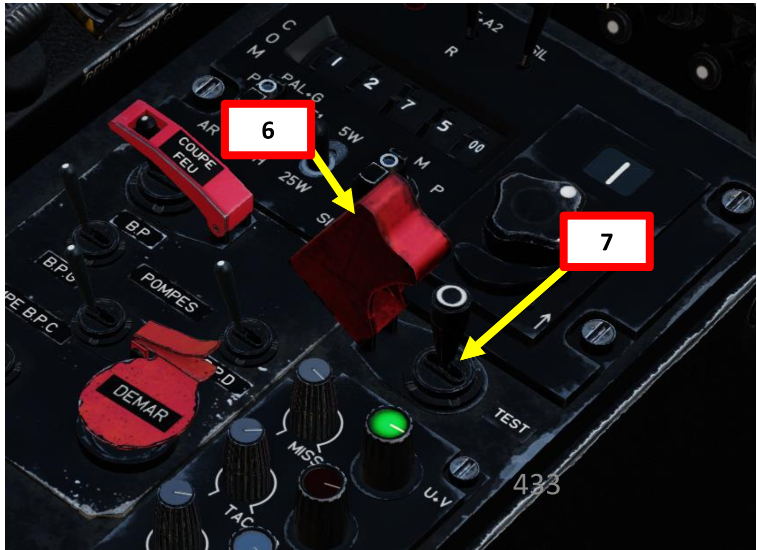
3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

1. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
4. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single. Firing the gun will use the “gun burst setting” programmed in the Mission Editor.
    - AFT: SALV (Salve), Salvo. Gun is firing as long as the gun trigger is squeezed.
5. Select guns in air-to-ground mode with the appropriate Weapon Selector Pushbutton.
    - CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets
6. Flip Armament Master Switch (Sécurité Armes) guard – UP
7. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
8. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.
9. Set Gun Firing Safety OUT (ARMED) by using the “LCTRL+LWIN+SPACE” binding.



Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Gun Firing Safety
- *Safety IN (Safe): LSHIFT+LWIN+SPACE*
- *Safety OUT (Armed): LCTRL+LWIN+SPACE*



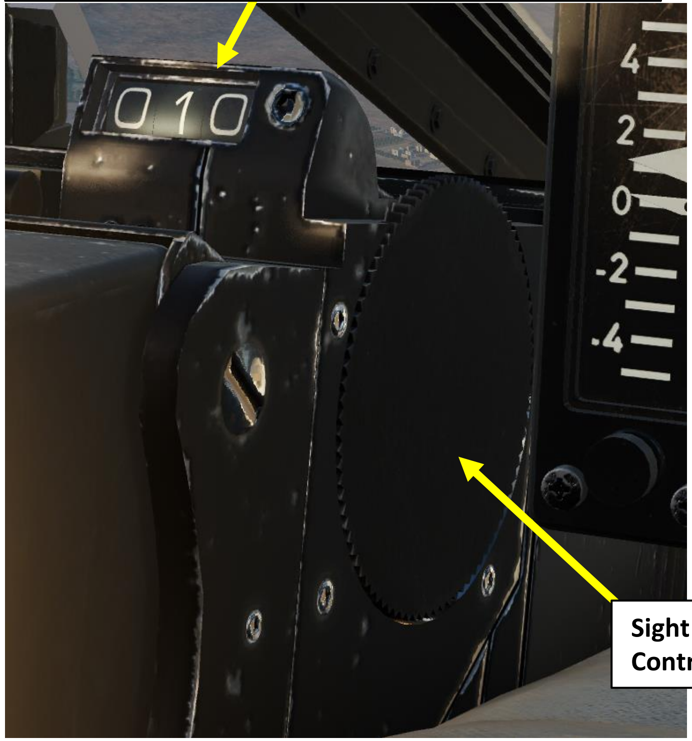
3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

10. Select an attack profile. In this tutorial, we will select the following:
    - **Dive Speed: 350+ kts**
    - **Dive Angle: 10 deg**
    - **Gun Firing Height: 1500 ft**
    - **Sight Depression Angle Setting: 10 mRad**
11. Based on the selected profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

DEFA 553 Cannons (Air-to-Ground)

Airspeed (kts)	Dive Angle (deg)	Firing Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
350+	5	1000	14
350+	10	1500	10
350+	15	2000	7
350+	25	3000	9

Sight Depression Angle Setting (mRad, milliradians)
- *Angle is set by Depression Angle Control Wheel*



Sight Depression Angle Setting Control Wheel

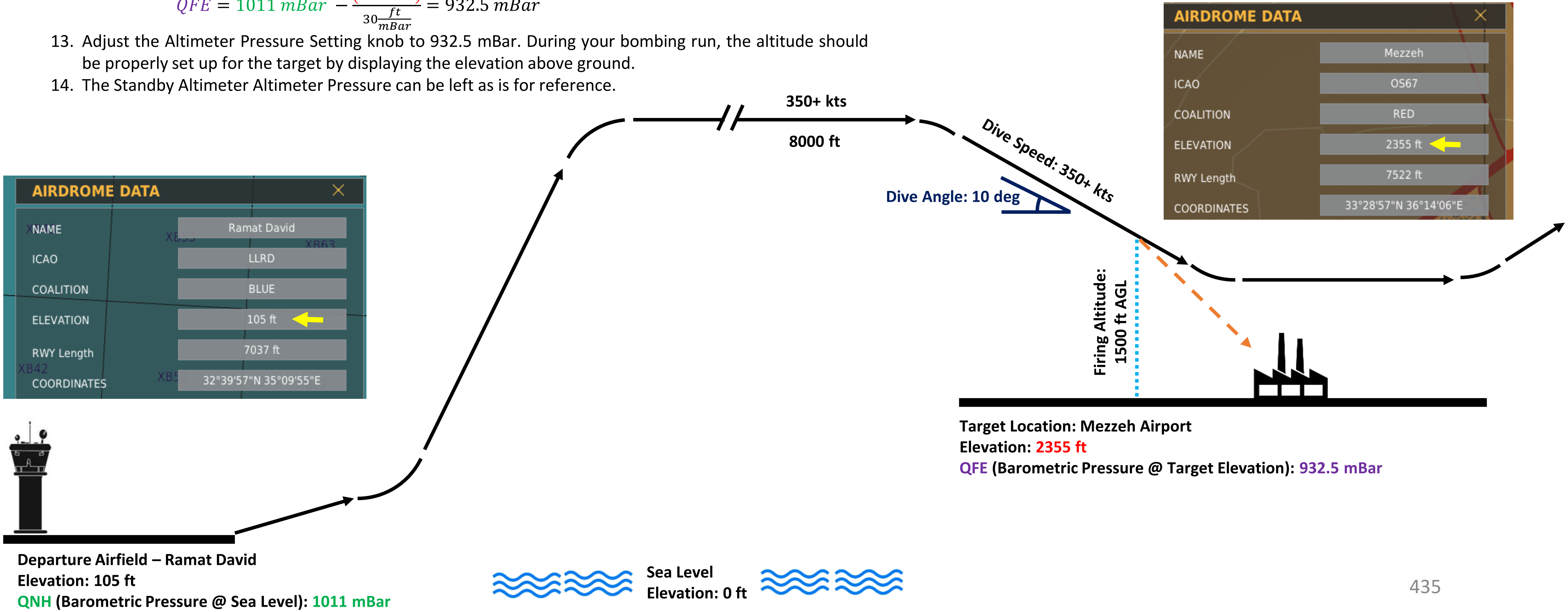
3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

12. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

$$QFE = QNH - \frac{(\text{Target Elevation in ft})}{30\ ft/mBar}$$

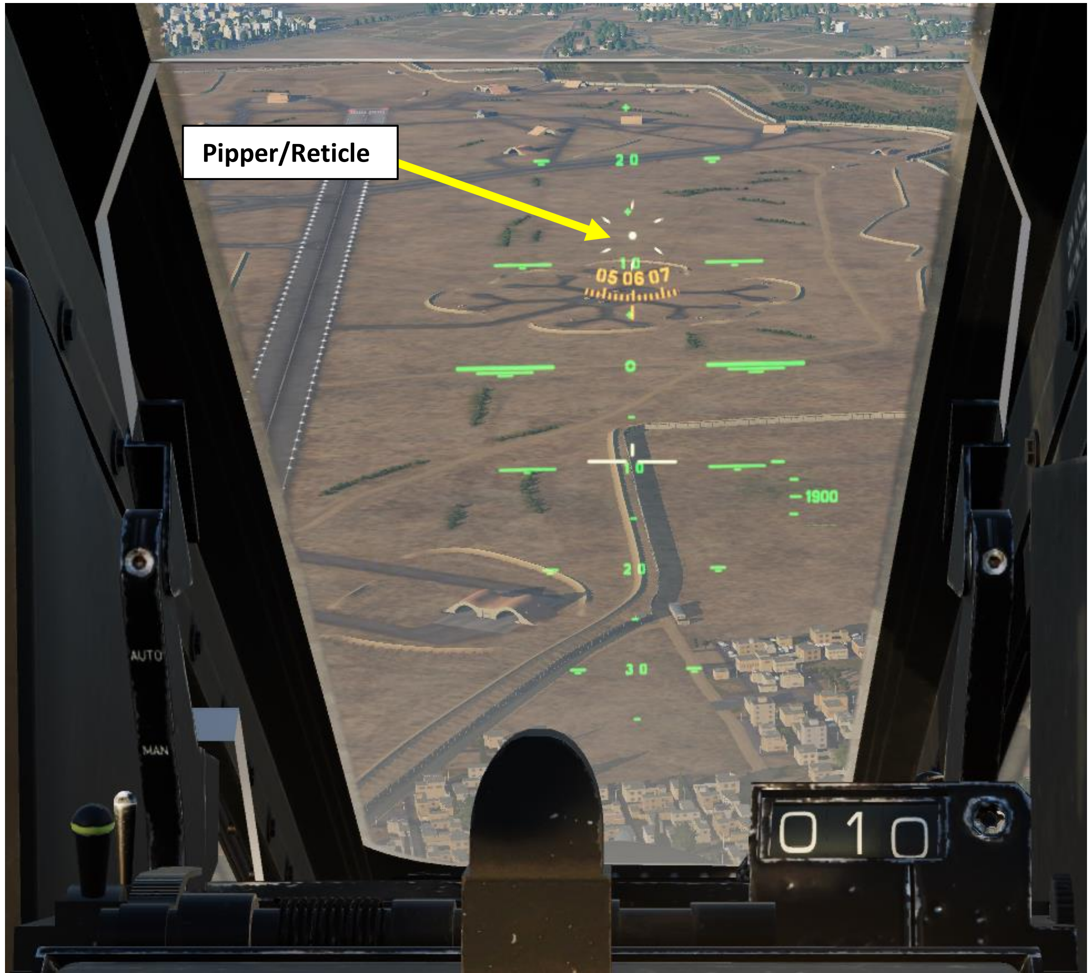
$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

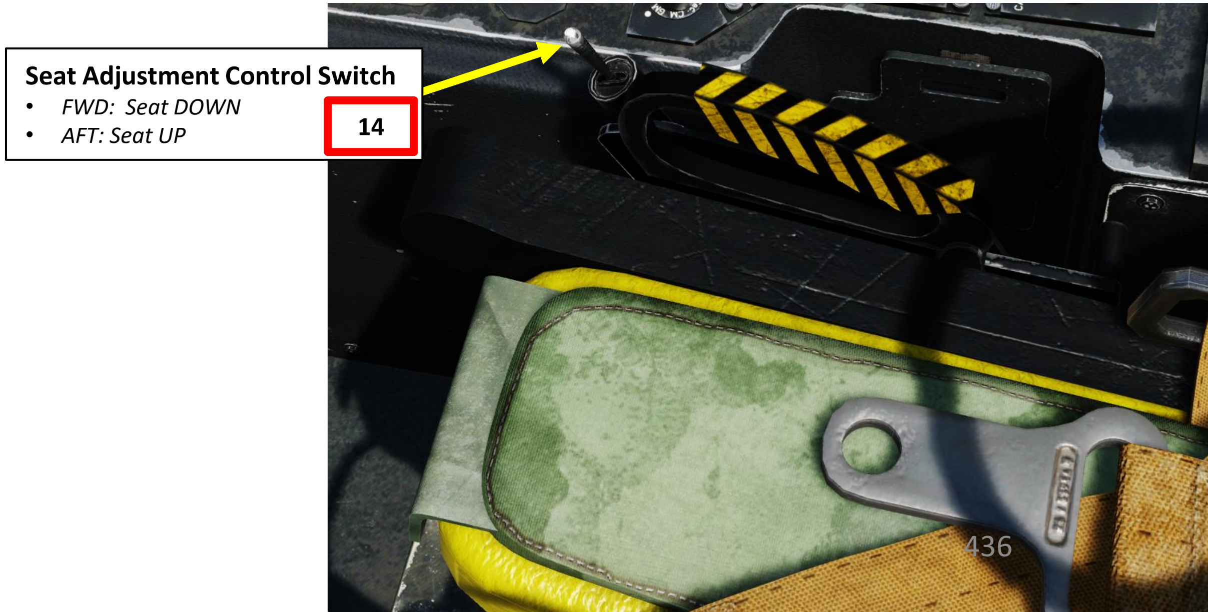
13. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
14. The Standby Altimeter Altimeter Pressure can be left as is for reference.



3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

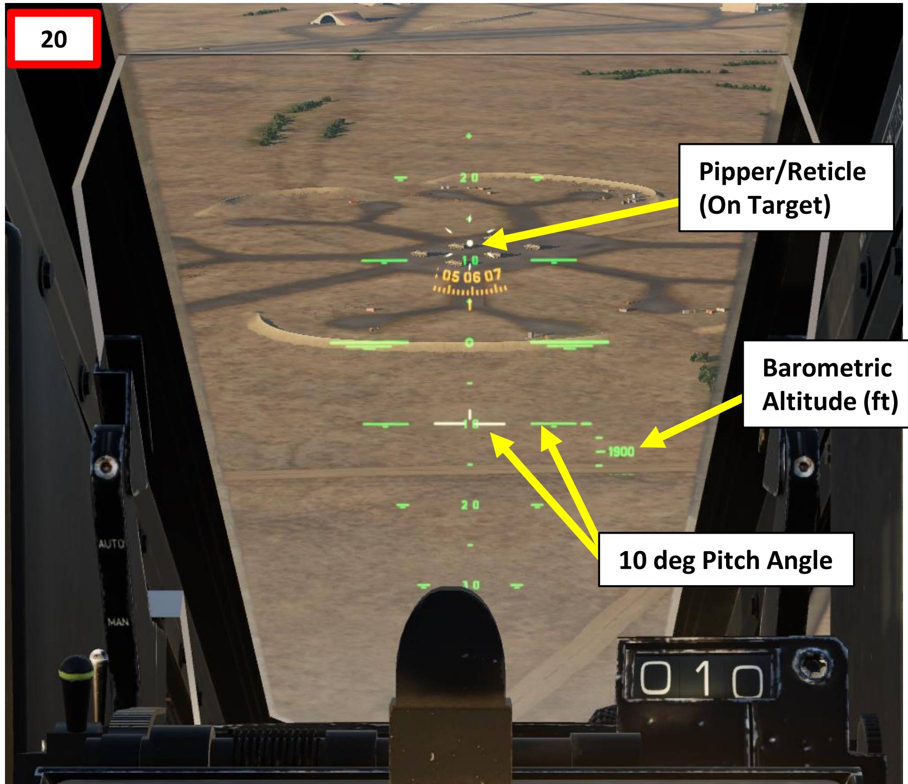
15. Adjust Seat Height to have a good visibility of the sight's pipper.
16. Approach the target and maintain it to your aircraft's 10 o'clock position. Fly level at an altitude of approx. 8000 ft.
17. For a 10 deg gun run dive, throttle back and roll in on the target. Dive should be initiated from 8000 ft at 350+ kts.
18. Use your altimeter, speed indicator and pitch indicator to fly with correct attack parameters.
    - **Dive Speed: 350+ kts**
    - **Dive Angle: 10 deg**
    - **Gun Firing Height: 1500 ft**
    - **Sight Depression Angle Setting: 10 mRad**





3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

19. Keep gunsight pipper slightly below target as you dive.
20. Align target with sight pipper before firing guns (1500 ft above ground level). Maintain a dive speed of 350+ kts as per the selected attack profile.
21. Fire guns 1500 ft above ground level by pressing the Gun Button (Commande de Canons) ("SPACE" binding).
22. When cannons are fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM. This prevents engine flameout due to smoke ingestion.



3 – AIR-TO-GROUND WEAPONS
3.7 – DEFA 553 (30 mm) Guns (Air-to-Ground)

3 – AIR-TO-GROUND WEAPONS
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

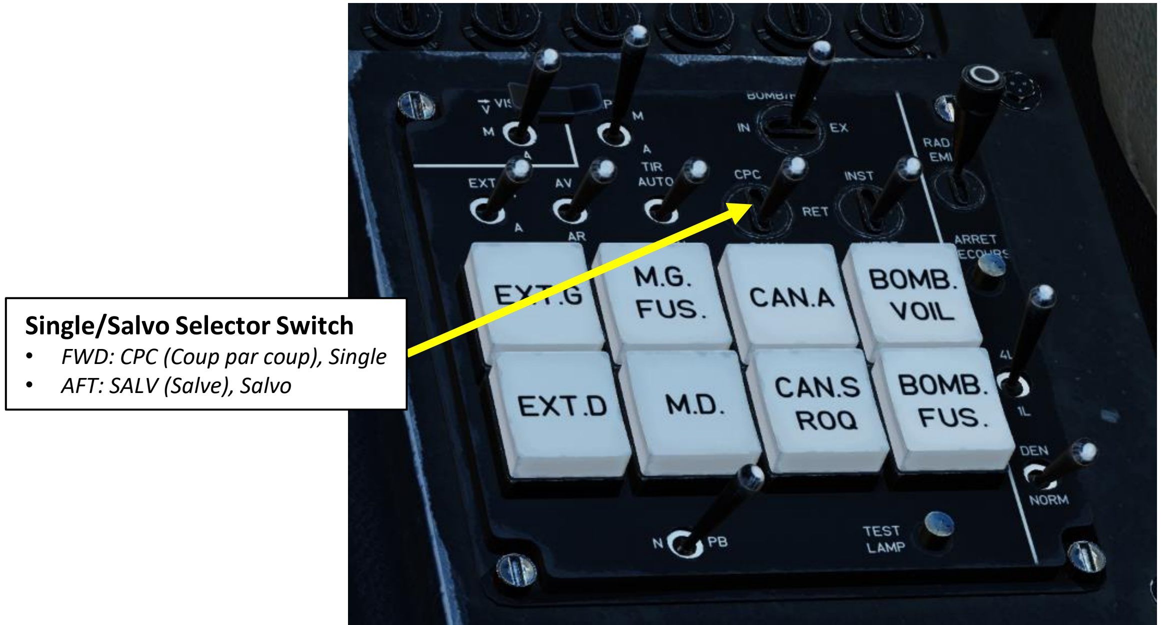
Salvo vs Single Mode

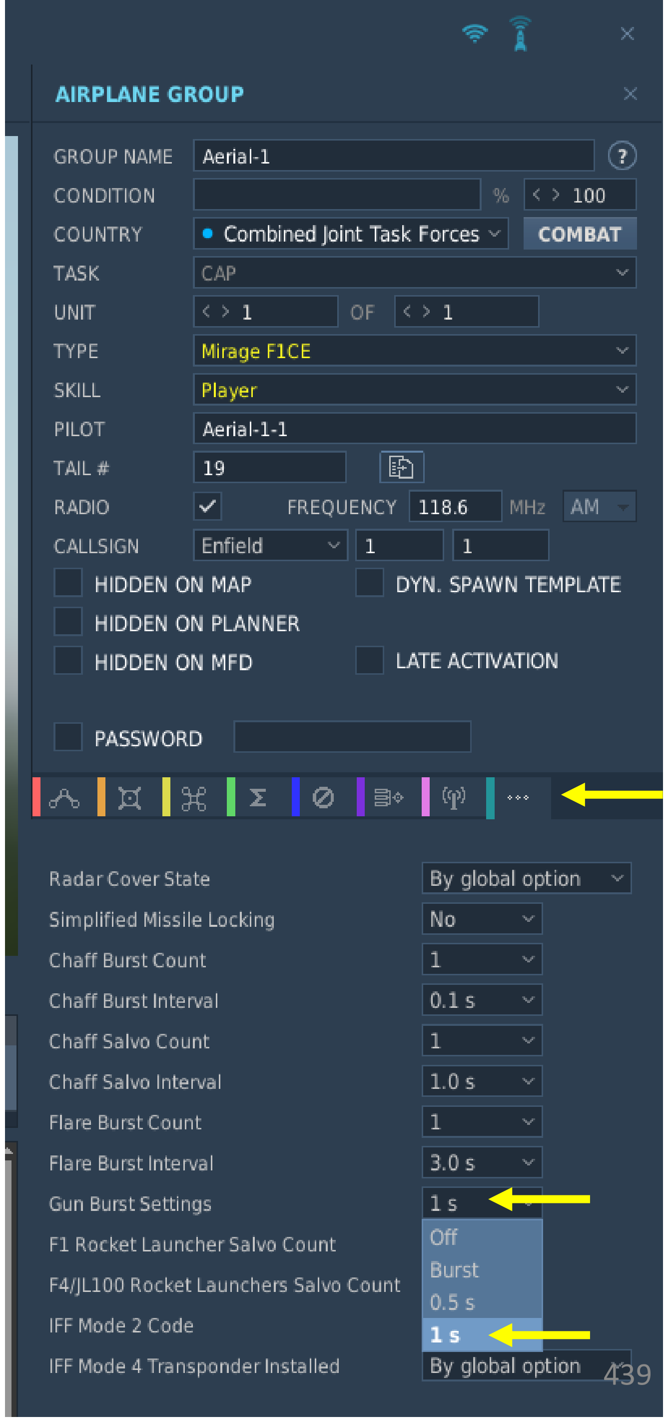
If the Single/Salvo Selector switch is in **CPC/SINGLE**, gun firing is **controlled by the burst limiter**, which is set on the ground as a maintenance function. In DCS, this maintenance function is simulated through the Mission Editor in the “Gun Burst Settings” option.

If the Single/Salvo Selector switch is in **SALVO**, rounds are **fired out the gun for as long as the trigger is squeezed**.

In practical terms, in air-to-air you should in most cases want rounds out the gun as long the trigger is depressed. The only real time one would consider burst limiting might be in air-to-ground strafes, and then probably only in training.

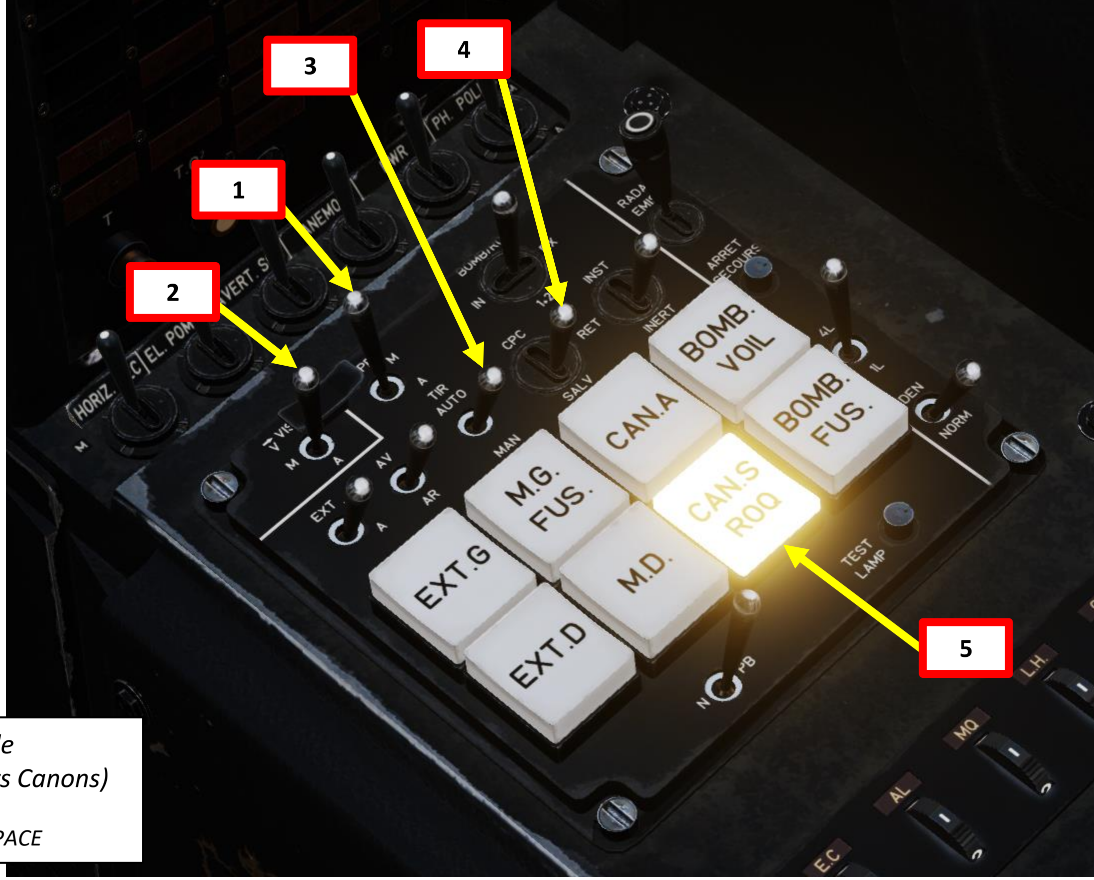
- If the Burst Setting is set to OFF, then with the Single/Salvo switch in CPC/SINGLE the gun wont fire at all.
- A recommended setting is to use the maximum setting of a “1 sec burst” and set the Single/Salvo switch to SALVO. This way, if set the Single/Salvo switch to CPC/SINGLE by mistake, you still get rounds out the gun and get at least a 1 sec burst.





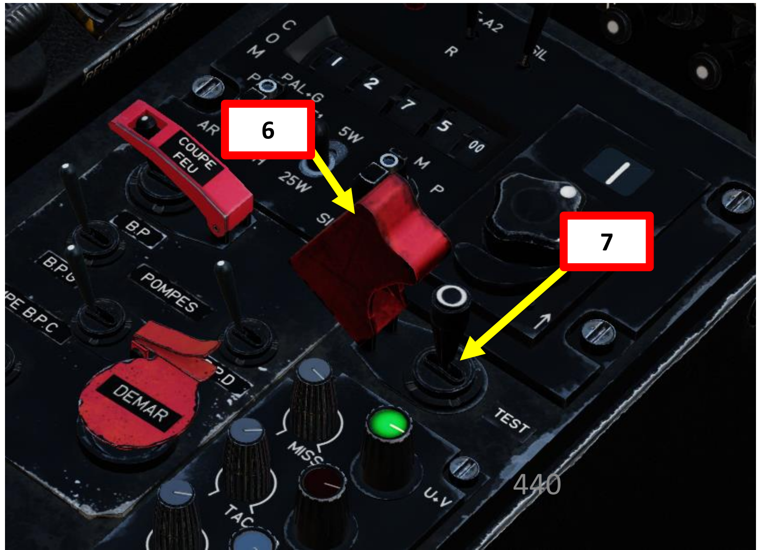
3 – AIR-TO-GROUND WEAPONS
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

1. Set Firing Fuel Dipper Switch – FWD (Marche/ON).
2. Set Sight (Viseur) Selector Switch – MIDDLE (Marche/ON)
3. Set Automatic/Manual Firing (Tir) Mode Selector Switch – AFT (Manual)
4. Set Single/Salvo Selector Switch – As desired.
    - FWD: CPC (Coup par coup), Single. Firing the gun will use the “gun burst setting” programmed in the Mission Editor.
    - AFT: SALV (Salve), Salvo. Gun is firing as long as the gun trigger is squeezed.
5. Select guns in air-to-ground mode with the appropriate Weapon Selector Pushbutton.
    - CAN S ROQ (Canon Sol Roquettes): Air-to-Ground Guns/Cannons or Rockets
    - Note: Both Internal Cannons and External Gun Pods will be selected.
6. Flip Armament Master Switch (Sécurité Armes) guard – UP
7. Set Armament Master Switch (Sécurité Armes) – MIDDLE (Master Arm ON)
8. Unfold the Gun Firing Trigger Safety by using the “RCTRL+SPACE” binding.
9. Set Gun Firing Safety OUT (ARMED) by using the “LCTRL+LWIN+SPACE” binding.



Gun Firing Trigger *(Commande Enregistreur de Visée et de Tirs Canons)*
- *Folded: RSHIFT+SPACE*
- *Unfolded (as shown): RCTRL+SPACE*

Gun Firing Safety
- *Safety IN (Safe): LSHIFT+LWIN+SPACE*
- *Safety OUT (Armed): LCTRL+LWIN+SPACE*

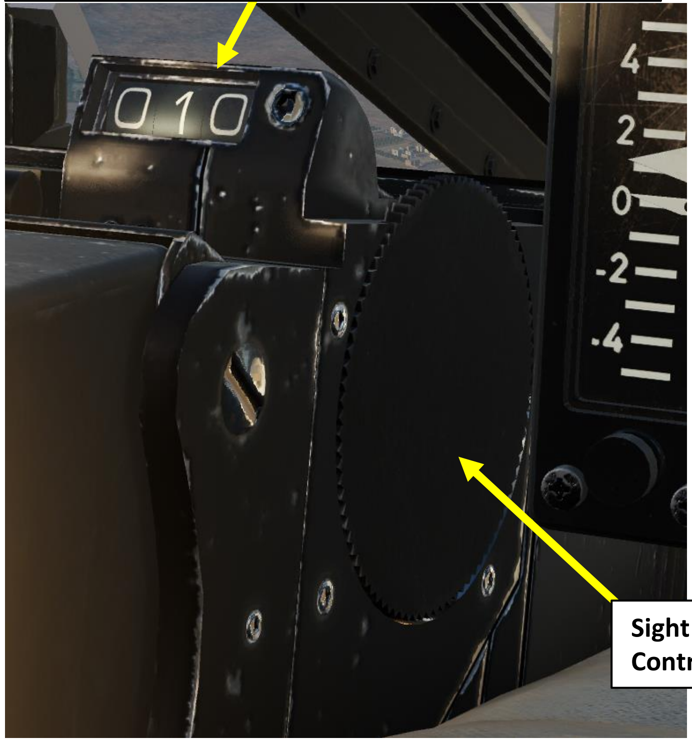


3 – AIR-TO-GROUND WEAPONS
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

10. Select an attack profile. In this tutorial, we will select the following:
    - **Dive Speed: 350+ kts**
    - **Dive Angle: 10 deg**
    - **Gun Firing Height: 1500 ft**
    - **Sight Depression Angle Setting: 10 mRad**
11. Based on the selected profile, turn the Sight Depression Angle Setting Control Wheel to set the Sight Depression Angle as required by the attack profile.

DEFA 550 Cannons (Air-to-Ground)

Airspeed (kts)	Dive Angle (deg)	Firing Altitude (ft AGL, Above Ground Level)	Sight Depression Setting (mRads)
350+	5	1000	14
350+	10	1500	10
350+	15	2000	7
350+	25	3000	9



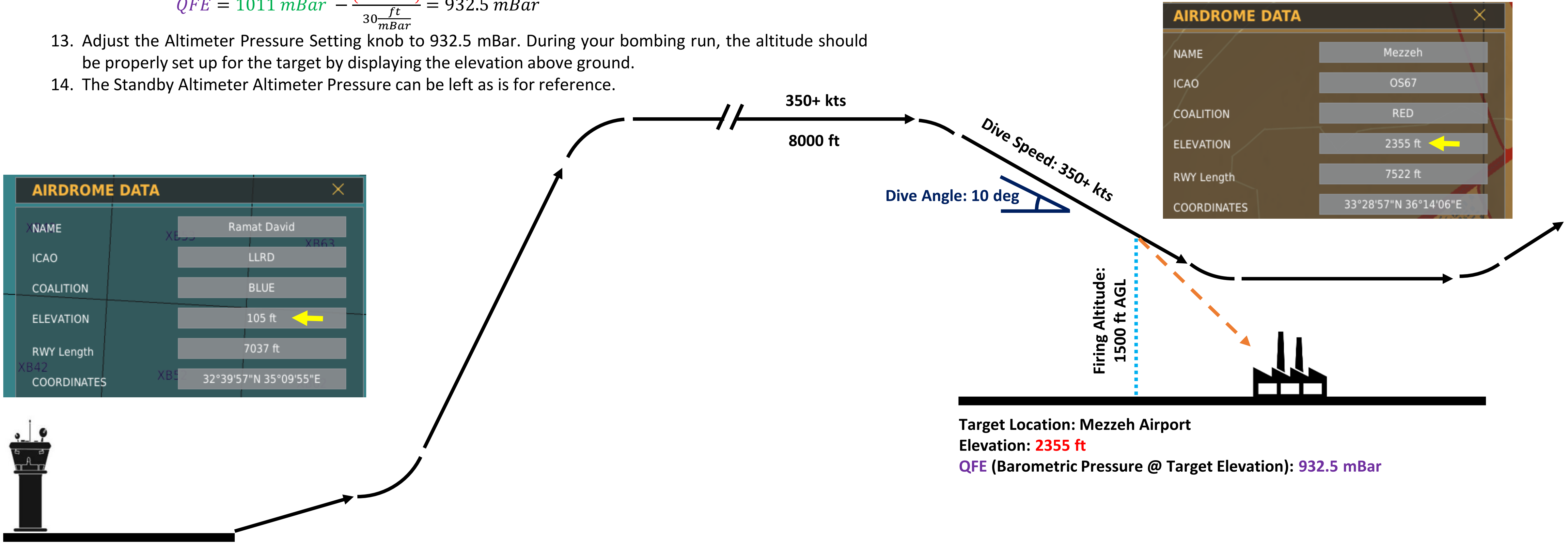
3 – AIR-TO-GROUND WEAPONS
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

12. Compute the required QFE barometric pressure setting for the target's elevation. It is important to set it correctly since barometric altitude is the only way we have to estimate the release altitude since the Mirage F1 does not have a radar altimeter. Since the target is relatively close to our departure airfield (Ramat David), we can use Ramat David's QNH (which is 1011 mBar in this tutorial) to compute the target's QFE. See this section for reference.

$$QFE = QNH - \frac{(\textit{Target Elevation in ft})}{30\ ft/mBar}$$

$$QFE = 1011\ mBar - \frac{(2355\ ft)}{30\frac{ft}{mBar}} = 932.5\ mBar$$

13. Adjust the Altimeter Pressure Setting knob to 932.5 mBar. During your bombing run, the altitude should be properly set up for the target by displaying the elevation above ground.
14. The Standby Altimeter Altimeter Pressure can be left as is for reference.



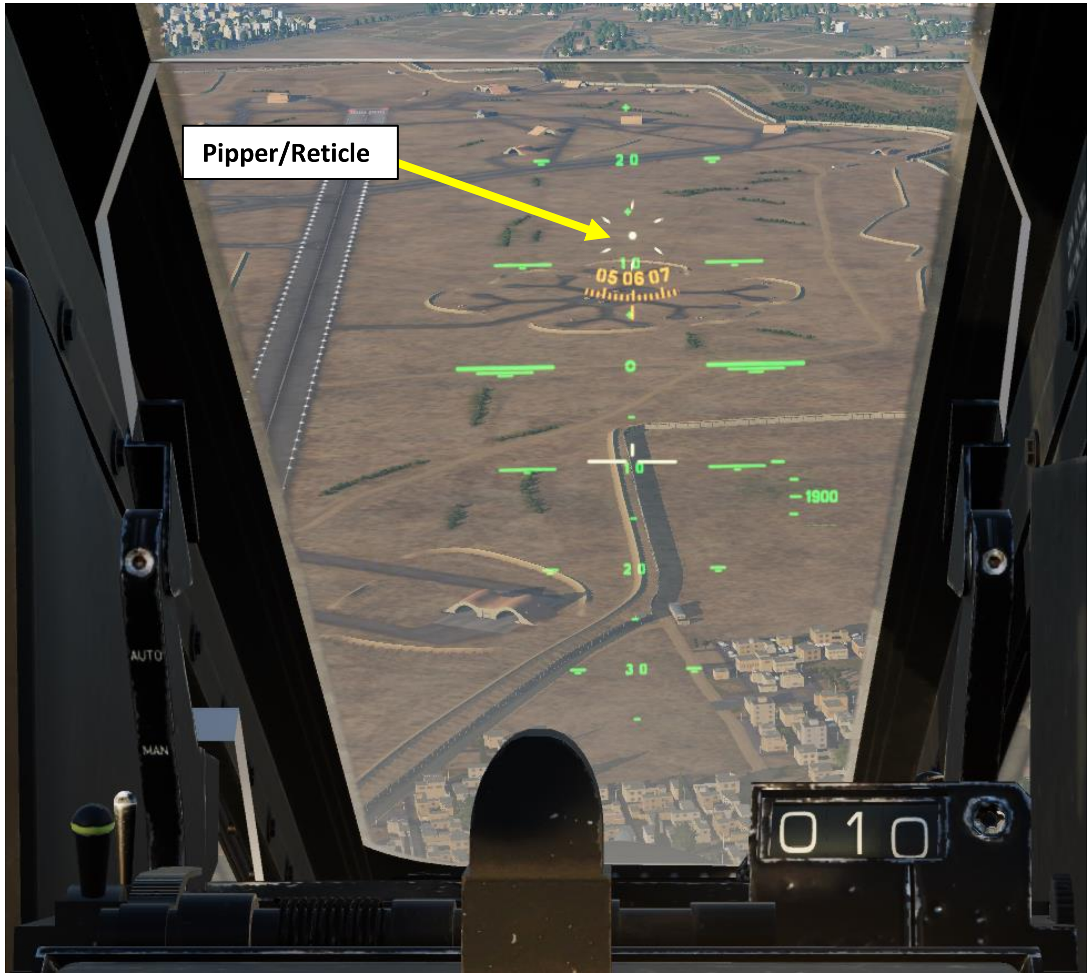
Target Location: Mezzeh Airport
Elevation: 2355 ft
QFE (Barometric Pressure @ Target Elevation): 932.5 mBar

Departure Airfield – Ramat David
Elevation: 105 ft
QNH (Barometric Pressure @ Sea Level): 1011 mBar

Sea Level
Elevation: 0 ft

3 – AIR-TO-GROUND WEAPONS
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

15. Adjust Seat Height to have a good visibility of the sight's pipper.
16. Approach the target and maintain it to your aircraft's 10 o'clock position. Fly level at an altitude of approx. 8000 ft.
17. For a 10 deg gun run dive, throttle back and roll in on the target. Dive should be initiated from 8000 ft at 350+ kts.
18. Use your altimeter, speed indicator and pitch indicator to fly with correct attack parameters.
    - **Dive Speed: 350+ kts**
    - **Dive Angle: 10 deg**
    - **Gun Firing Height: 1500 ft**
    - **Sight Depression Angle Setting: 10 mRad**



Seat Adjustment Control Switch
- *FWD: Seat DOWN*
- *AFT: Seat UP*

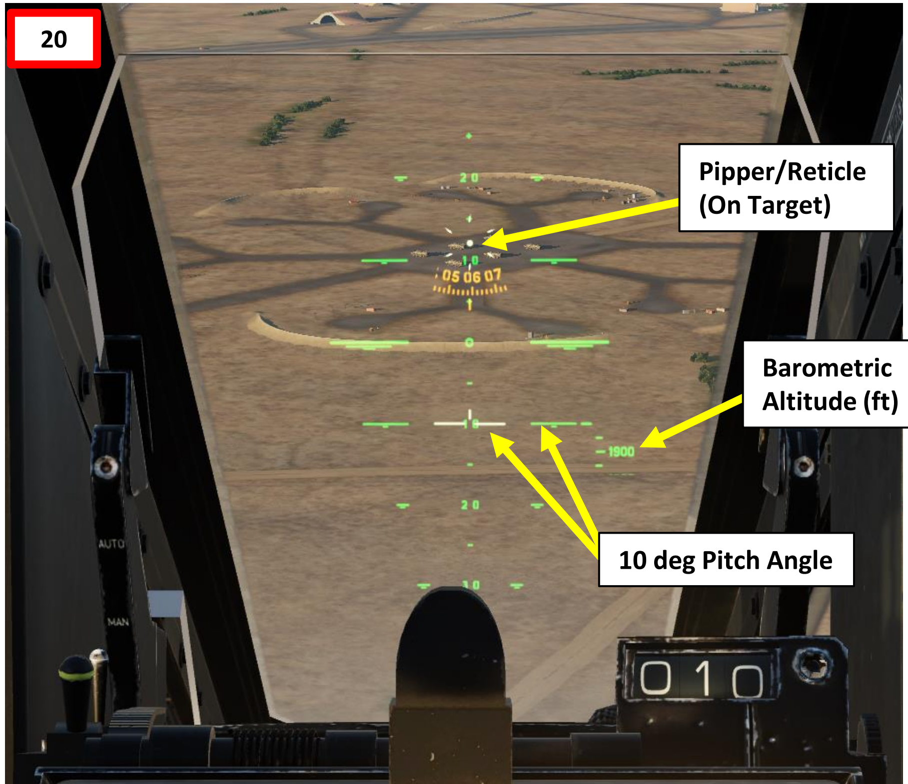
14

3 – AIR-TO-GROUND WEAPONS
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

19. Keep gunsight pipper slightly below target as you dive.
20. Align target with sight pipper before firing guns and gun pods (1500 ft above ground level). Maintain a dive speed of 350+ kts as per the selected attack profile.
21. Fire guns and gunpods 1500 ft above ground level by pressing the Gun Button (Commande de Canons) (“SPACE” binding).
22. When cannons and gun pods are fired, the fuel dipper reduces the amount of fuel sent to the engine, causing a drop in RPM. This prevents engine flameout due to smoke ingestion.

Gun Button *(Commande de Canons)* **(front of stick)**
- *Binding: SPACE*

21



20

Pipper/Reticle (On Target)

Barometric Altitude (ft)

10 deg Pitch Angle

Target

3 – AIR-TO-GROUND WEAPONS

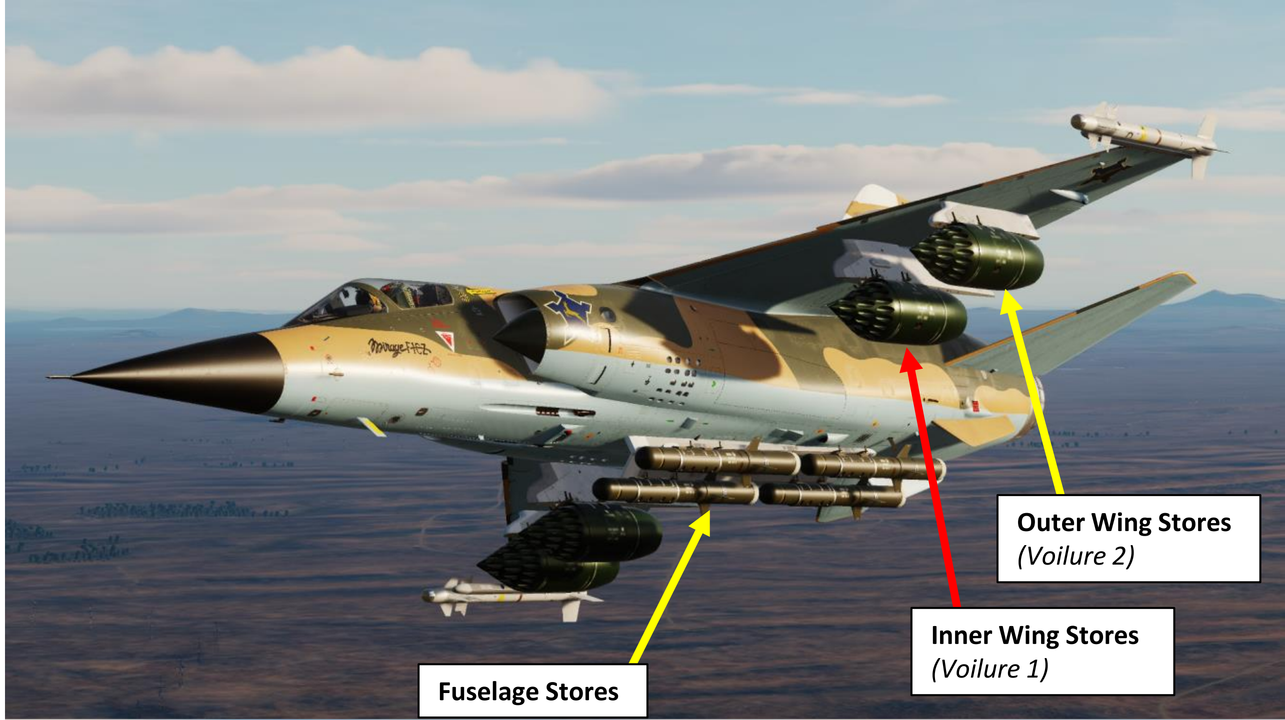
3.8 – DEFA 550 CC420 (30 mm) Gun Pods (Air-to-Ground)

4 – MISCELLANEOUS

4.1 – Selective Jettison

To use the Selective Jettison method:

1. Set Stores Jettison Selection Switch to select which stations you want to jettison. In this example, we will jettison inner wing stores (switch in MIDDLE position).
    - UP Position: Voilure 2, outer wing stores.
    - MIDDLE Position: Voilure 1, inner wing stores.
    - DOWN Position: Fuselage Stores.
2. Flip Selective Jettison *(Largage)* Button Cover Guard, then press button to jettison selected external tanks.



4 – MISCELLANEOUS
4.2 – Emergency Jettison

If you need to jettison all ordnance installed under the wings and fuselage in a hurry, you can use the Emergency *(Détresse)* Jettison Button to jettison all underwing and fuselage stores. Keep in mind that this method is mostly use in emergency situations where you need to lose weight quickly in order to manoeuver.

Emergency *(Détresse)* **Jettison Button & Cover Guard**
- *Commands the jettison of all underwing and fuselage stores.*


30-QG

SECTION STRUCTURE

1 – INTRODUCTION TO DEFENSIVE SYSTEMS

Countermeasures are very simple to use. You have two countermeasure types at your disposal: flares and chaff. We will explore together what is used against what, and how.

Missiles can generally track you using 2 things: radar signature (radar waves are sent on you and you reflect them, which is called a “radar signature”) and heat signature (like the exhaust of your engine). 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.

Mirage F1EE Only

1 – INTRODUCTION TO DEFENSIVE SYSTEMS

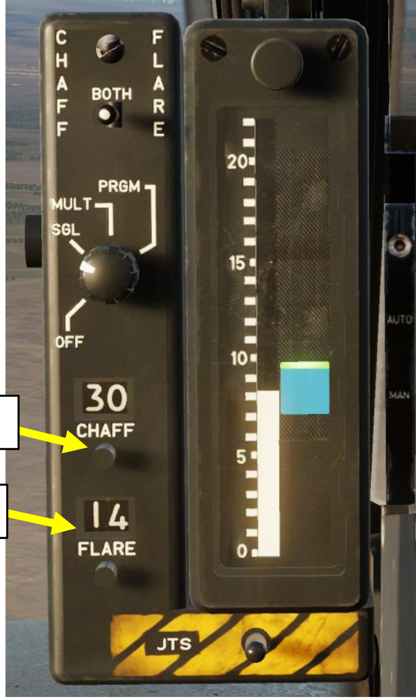
The **BARAX radar jammer pod** is sometimes referred as a Electronic Countermeasure (**ECM**) system. The BARAX is **only available on the Mirage F1EE variant**. It is a form of "continuous" jamming, also called "active" or "transmitted" jamming. This device transmits its own synchronized radar waves 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.

2 – AN/ALE-40 CHAFF & FLARE DISPENSER SYSTEM

2.1 – Dispensers

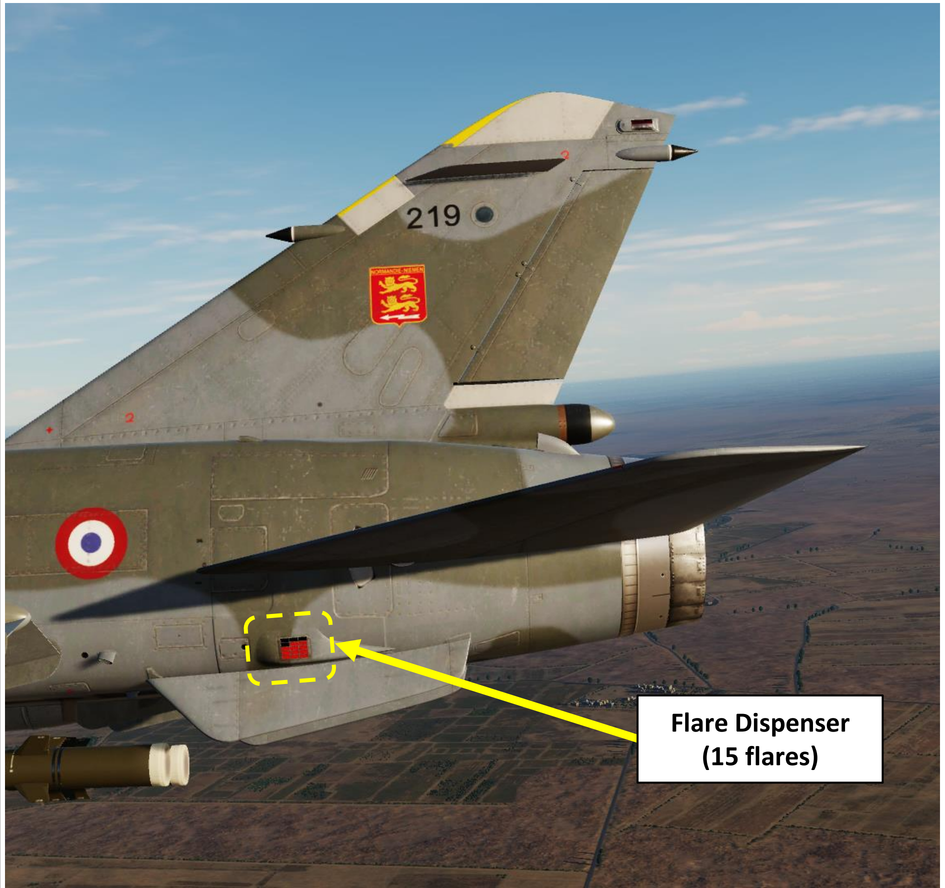
The AN/ALE-40 system provides the capability of dispensing flare or chaff payloads as a means of defense against hostile radar or IR missile attack. You can load up to 60 chaff cartridges or up to 30 flare cartridges. You can also equip a combination of 30 chaff and 15 flares. The chaff/flare loadout can be set via the Mission Editor or from the Ground Crew Menu.

Note: Flare and Chaff counters need to be set manually.

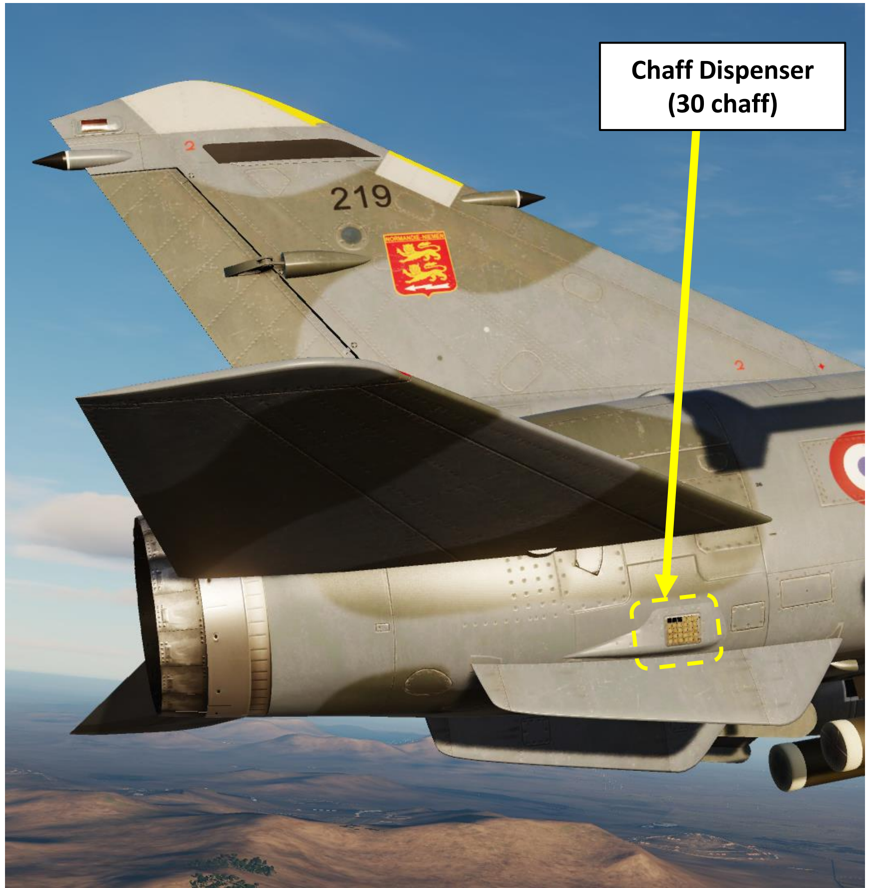


Chaff Counter & Reset Button (Below)

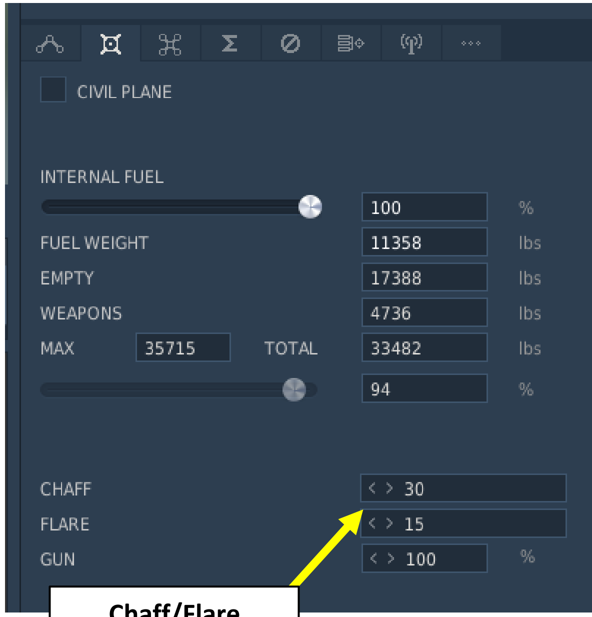
Flare Counter & Reset Button (Below)



Flare Dispenser (15 flares)



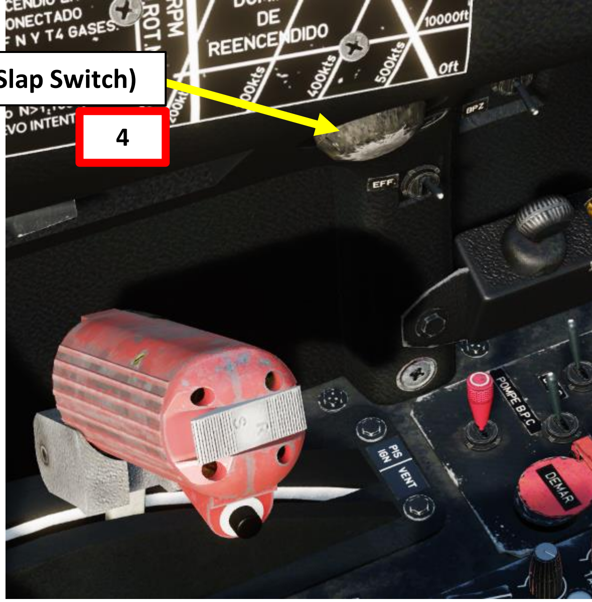
Chaff Dispenser (30 chaff)



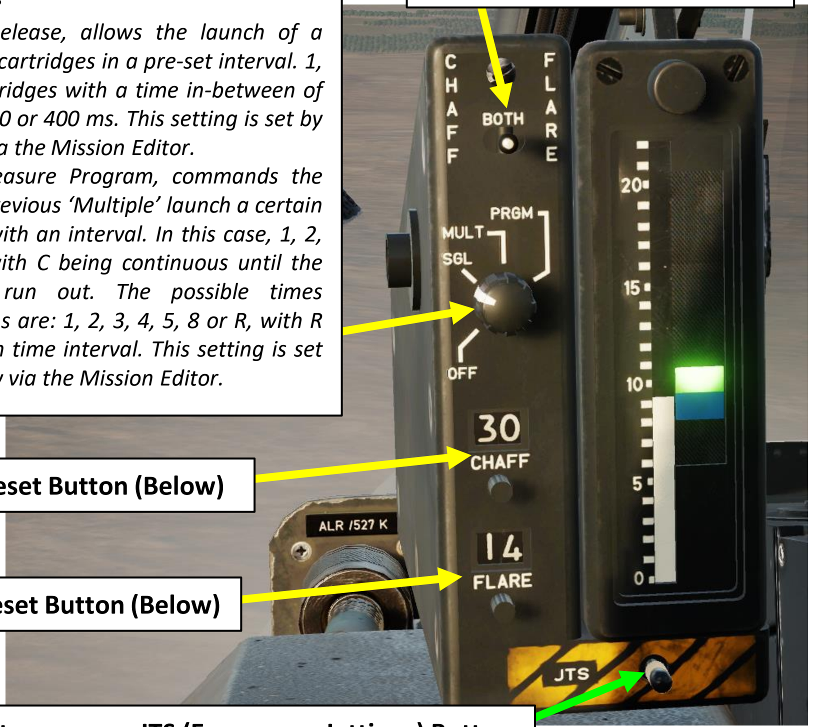
Chaff/Flare Loadout Setting

2 – AN/ALE-40 CHAFF & FLARE DISPENSER SYSTEM
2.2 – Manual (Single) Dispensing Procedure

1. Set Chaff/Flare Selector Switch – As desired. Let's select BOTH to dispense both chaff and flares.
2. Set Countermeasure Program Selector – SGL (Single).
3. Based on your countermeasure loadout, press the Chaff Counter & Reset Button and the Flare Counter & Reset Button (Below) to obtain the correct chaff and flare counter values.
4. Dispense a single chaff and flare by pressing the "Chaff/Flares Release Button" ("D" binding by default).



Chaff/Flares Release Button (Slap Switch) 4



Chaff/Flare Selector Switch 1
- *LEFT: Chaff Only*
- *MIDDLE: Both*
- *RIGHT: Flare Only*

Countermeasure Program Selector 2
- *OFF*
- *SGL: Single Release*
- *MULT: Multiple Release, allows the launch of a certain number of cartridges in a pre-set interval. 1, 2, 3, 4, 6 or 8 cartridges with a time in-between of either 100, 200, 300 or 400 ms. This setting is set by the ground crew via the Mission Editor.*
- *PRGM: Countermeasure Program, commands the repetition of the previous 'Multiple' launch a certain number of times with an interval. In this case, 1, 2, 4, 8 or C times, with C being continuous until the countermeasures run out. The possible times between repetitions are: 1, 2, 3, 4, 5, 8 or R, with R meaning a random time interval. This setting is set by the ground crew via the Mission Editor.*

Chaff Counter & Reset Button (Below)

3

Flare Counter & Reset Button (Below)

Countermeasure JTS (Emergency Jettison) Button

2 – AN/ALE-40 CHAFF & FLARE DISPENSER SYSTEM
2.3 – Countermeasure Program Dispensing Procedure

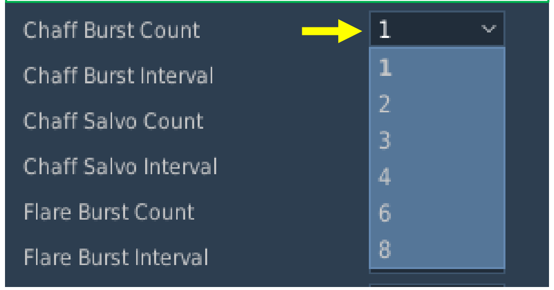
Countermeasure programs are preset via the Mission Editor. There are two **primary program release modes**:

- **MULT**: Multiple Release, allows the launch of a certain number of cartridges in a pre-set interval. 1, 2, 3, 4, 6 or 8 cartridges with a time in-between of either 100, 200, 300 or 400 ms. This setting is set by the ground crew via the Mission Editor.

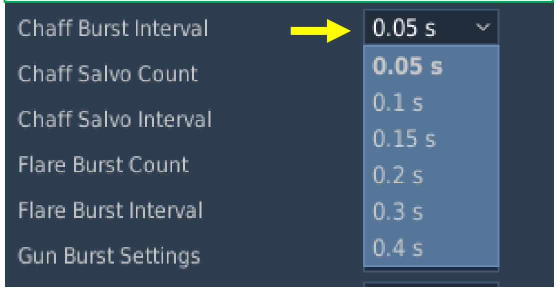
- **PRGM**: Countermeasure Program, commands the repetition of the previous MULT (Multiple) launch a certain number of times with an interval. In this case, 1, 2, 4, 8 or C times, with C being continuous until the countermeasures run out. The possible times between repetitions are: 1, 2, 3, 4, 5, 8 or R, with R meaning a random time interval. This setting is set by the ground crew via the Mission Editor.

Example: With PRGM Mode selected, pressing the “Chaff/Flares Release Button” will dispense a single chaff, wait for 3 sec and dispense another chaff for a second time. Four flares will be dispensed at 3-second intervals between each flare.
- Chaff Settings: Burst Count 1, Burst Interval 0.05 sec, Salvo Count 2, Salvo Interval 3.0 sec
- Flare Settings: Burst Count 4, Burst Interval 3.0 sec

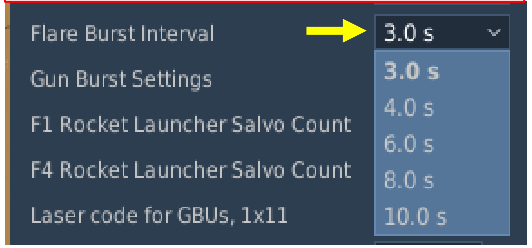
Chaff Burst Count Settings



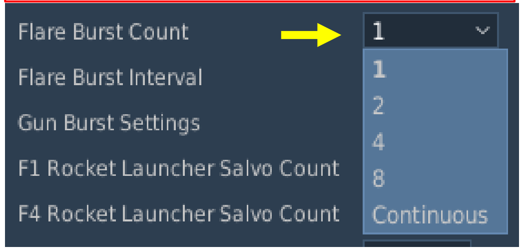
Chaff Burst Interval Settings



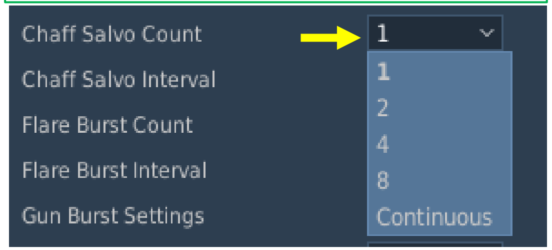
Flare Burst Interval Settings



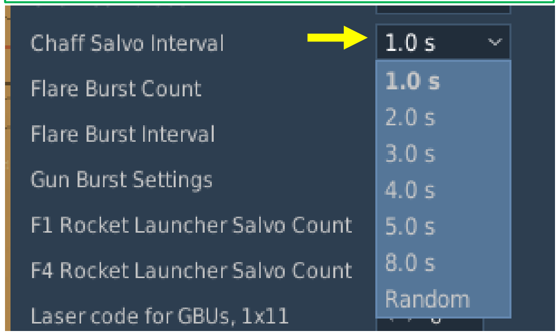
Flare Burst Count Settings

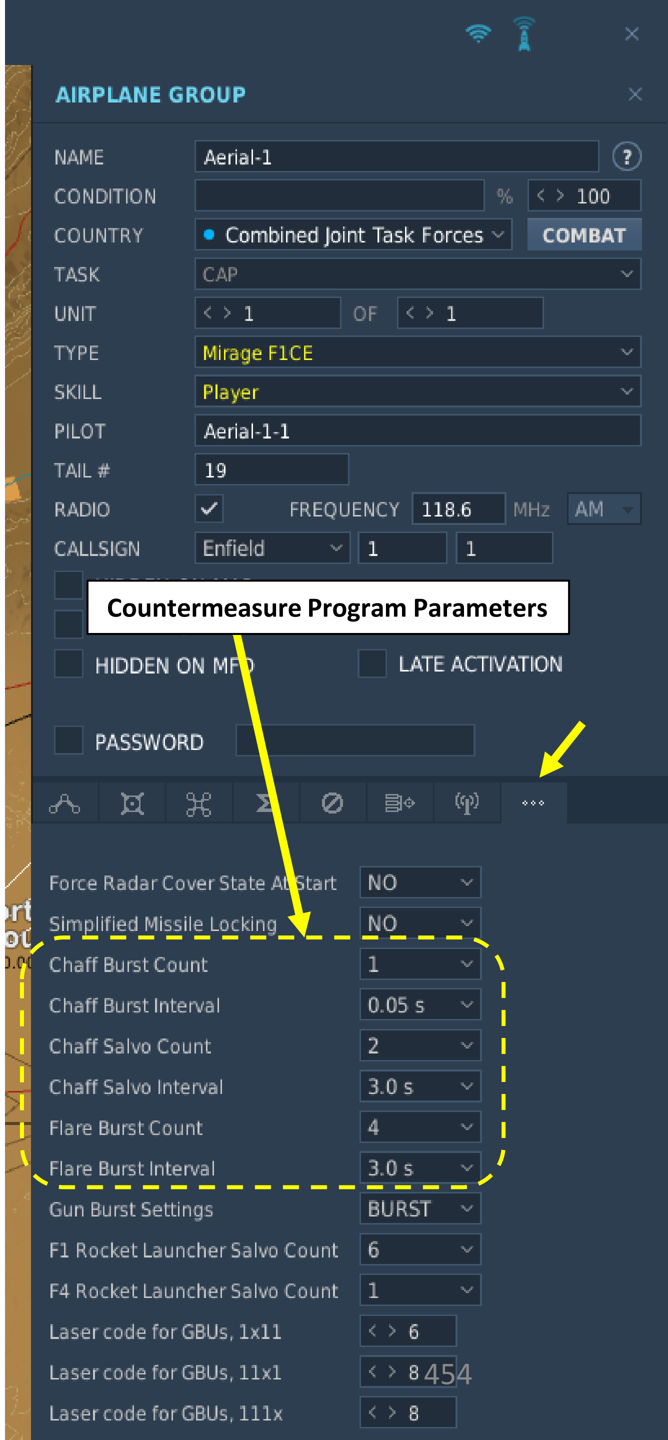


Chaff Salvo Count Settings



Chaff Salvo Interval Settings



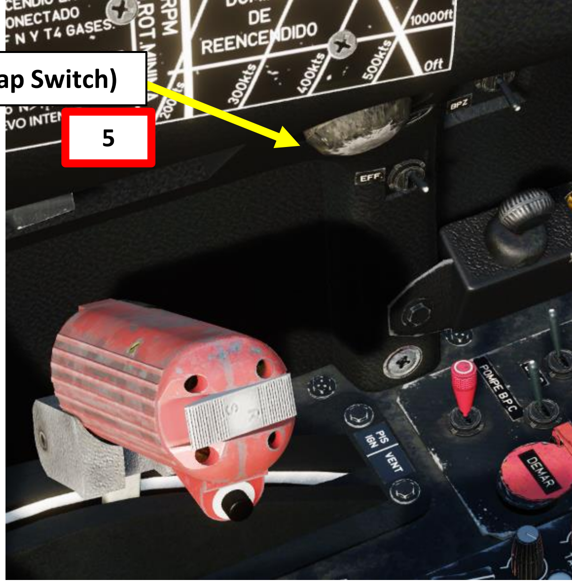


2 – AN/ALE-40 CHAFF & FLARE DISPENSER SYSTEM
2.3 – Countermeasure Program Dispensing Procedure

1. The chaff and flare program settings are preset in the Mission Editor (see previous page).
2. Set Chaff/Flare Selector Switch – As desired. Let's select BOTH to dispense both chaff and flares.
3. Set Countermeasure Program Selector – PRGM (Program).
4. Based on your countermeasure loadout, press the Chaff Counter & Reset Button and the Flare Counter & Reset Button (Below) to obtain the correct chaff and flare counter values.
5. Dispense a countermeasure program by pressing the "Chaff/Flares Release Button" ("D" binding by default).

Chaff/Flares Release Button (Slap Switch)

5

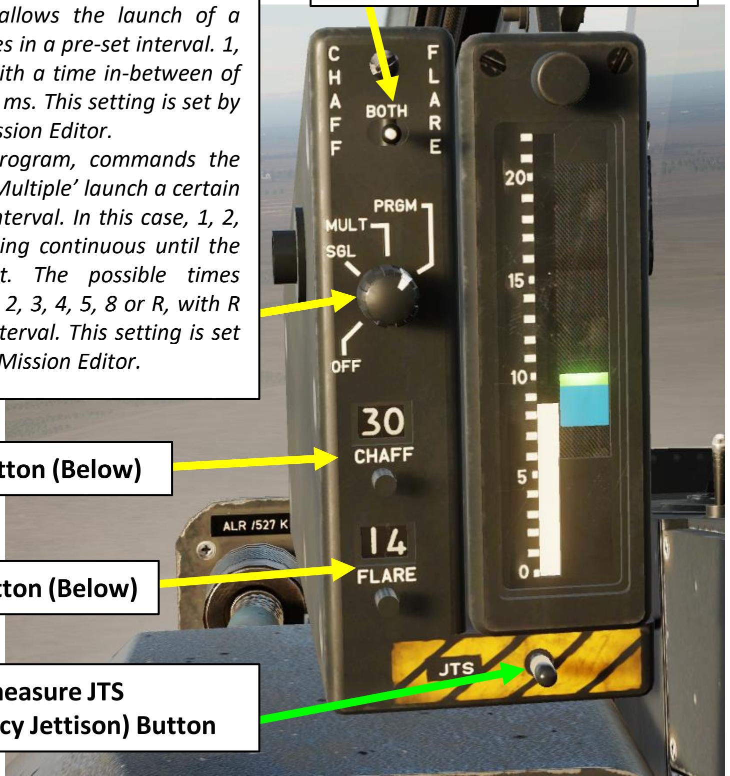


Countermeasure Program Selector
- *OFF*
- *SGL: Single Release*
- *MULT: Multiple Release, allows the launch of a certain number of cartridges in a pre-set interval. 1, 2, 3, 4, 6 or 8 cartridges with a time in-between of either 100, 200, 300 or 400 ms. This setting is set by the ground crew via the Mission Editor.*
- *PRGM: Countermeasure Program, commands the repetition of the previous 'Multiple' launch a certain number of times with an interval. In this case, 1, 2, 4, 8 or C times, with C being continuous until the countermeasures run out. The possible times between repetitions are: 1, 2, 3, 4, 5, 8 or R, with R meaning a random time interval. This setting is set by the ground crew via the Mission Editor.*

3

Chaff/Flare Selector Switch
- *LEFT: Chaff Only*
- *MIDDLE: Both*
- *RIGHT: Flare Only*

2



Chaff Counter & Reset Button (Below)

4

Flare Counter & Reset Button (Below)

Countermeasure JTS (Emergency Jettison) Button

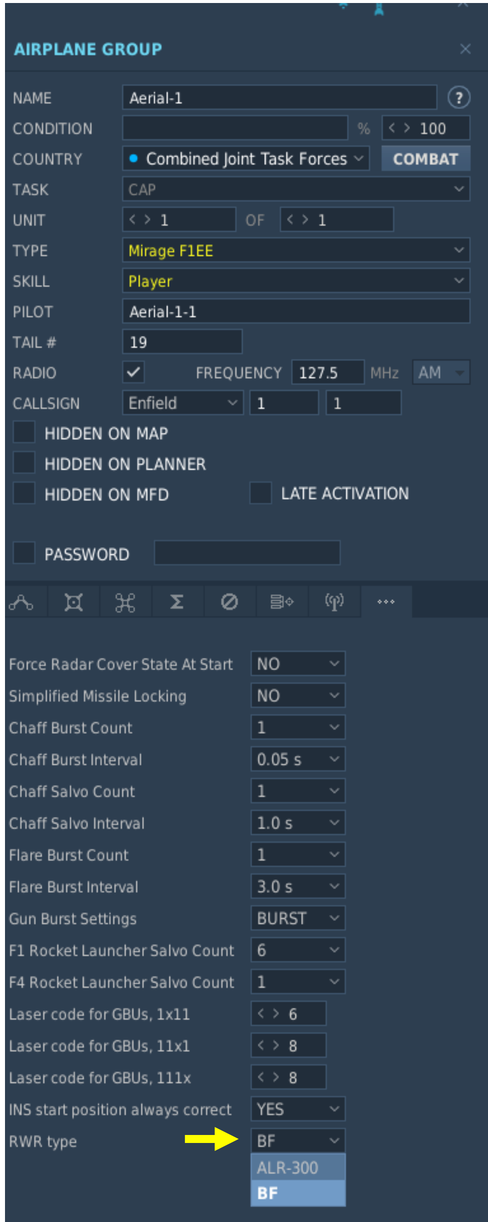
Mirage F1CE Compatible

Mirage F1EE Compatible

3 – RADAR WARNING RECEIVER
3.1 – BF Type Radar Warning Receiver (RWR)

The Mirage F1CE is equipped with the Thomson-CSF ("*Compagnie Générale de Télégraphie Sans Fil*") BF Type Radar Warning Receiver (RWR), also referred as "Radar Detector".

The Mirage F1EE can equip either the BF Type or the AN/ALR-300 Type Radar Warning Receiver, which is determined by the “RWR TYPE” setting selected via the Mission Editor.



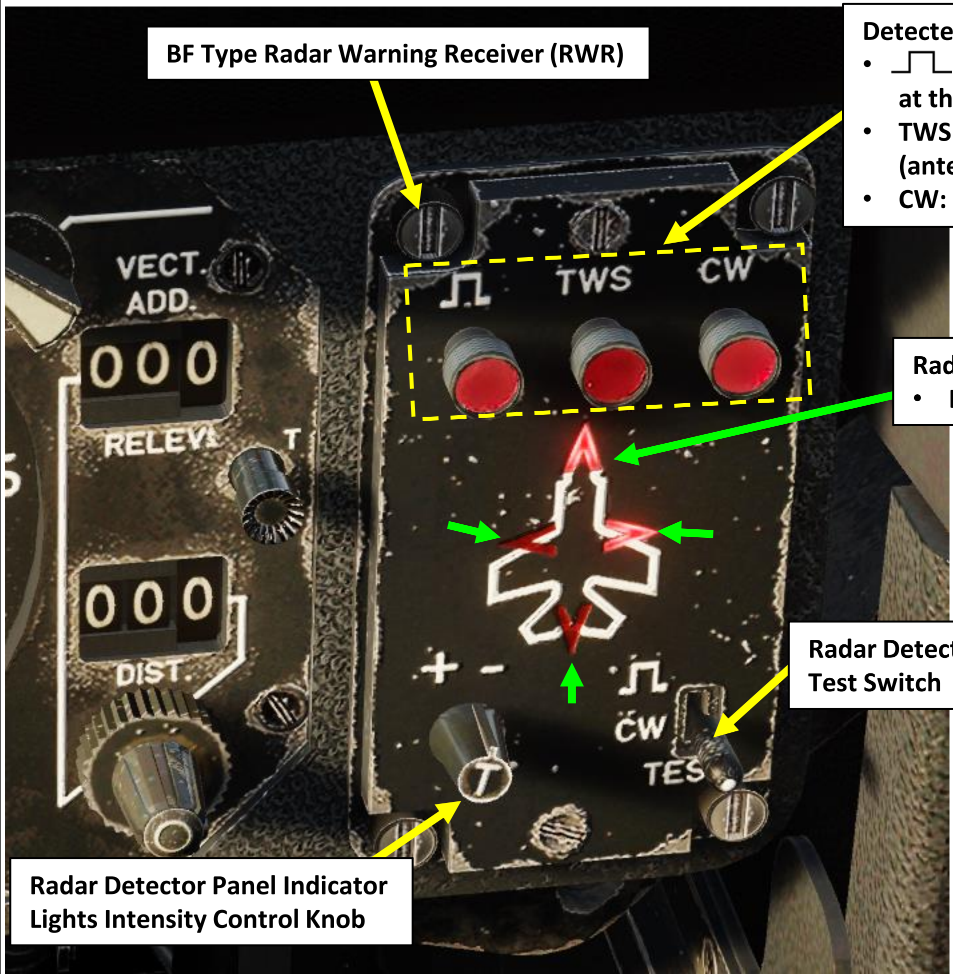
Mirage F1CE Compatible

Mirage F1EE Compatible

3 – RADAR WARNING RECEIVER
3.1 – BF Type Radar Warning Receiver (RWR)

The Radar Warning Receiver is basically a top-down view of your aircraft. The aircraft in the upper quadrants are to your front while the aircraft on the lower quadrants are to your rear. The radar detector provides the pilot an omnidirectional alert (visual and aural), an indication on the direction and on the nature of the threat when the aircraft is illuminated by a tracking or fire control radar. The RWR cannot differentiate between air or ground radars, nor between friendly or enemy radars. If multiple radars are painting the aircraft, the RWR will only display the strongest radar signal and filter the weaker ones.

- To **power up the BF Type RWR**, set the **Radar Detector Switch – FWD (Marche/ON).**
- You can **adjust the RWR volume by pushing and turning the RAP + CME Pushbutton.**



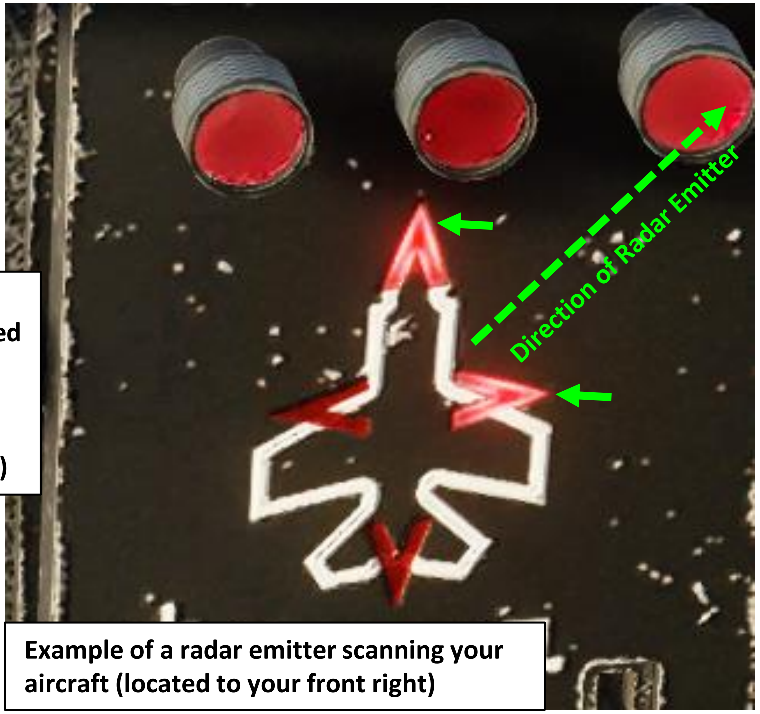
BF Type Radar Warning Receiver (RWR)

Detected Radar Transmission Lights (Nature of Threat)
- **⎍ : Aimed Pulse Modulated Radar Detected (antenna aimed at the target during tracking).**
- **TWS: Track While Scan Pulse Modulated radar Detected (antenna keeps scanning during tracking)**
- **CW: Continuous Wave Radar (surface-to-air missile guidance)**

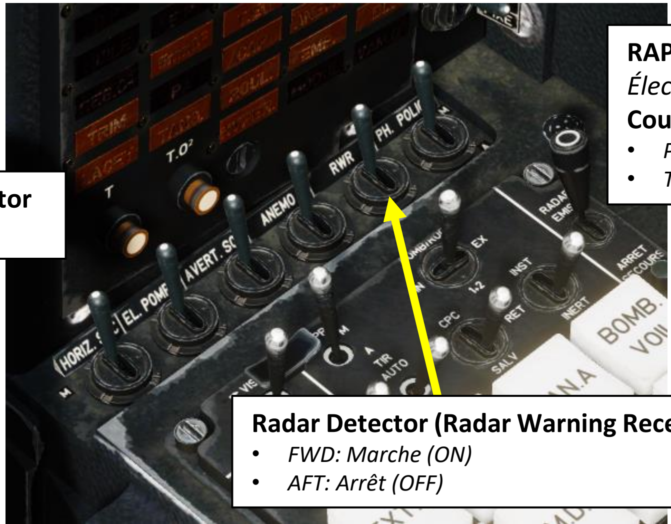
Radar Detector (Radar Warning Receiver)
- **Red Arrows: Detection Sectors**

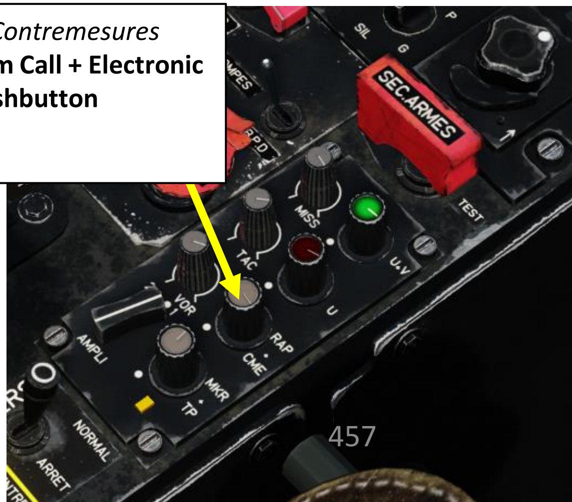
Radar Detector Test Switch

Radar Detector Panel Indicator Lights Intensity Control Knob



Example of a radar emitter scanning your aircraft (located to your front right)





RAP + CME *(Rappel + Contremesures Électroniques,* **Intercom Call + Electronic Countermeasures***)* **Pushbutton**
- *Push to select*
- *Turn to adjust volume*

Radar Detector (Radar Warning Receiver) Switch
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*

Mirage F1CE Compatible

Mirage F1EE Compatible

3 – RADAR WARNING RECEIVER

3.1 – BF Type Radar Warning Receiver (RWR)

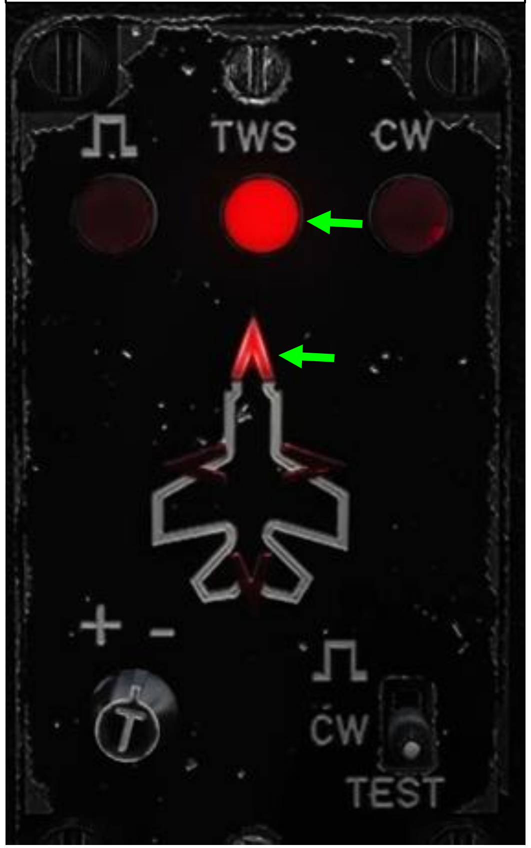
Detected Radar Transmission Lights Legend (Nature of Threat)

- **⎍:** Aimed Pulse Modulated Radar Detected (antenna aimed at the target during tracking).
- **TWS:** Track While Scan Pulse Modulated radar Detected (antenna keeps scanning during tracking)
- **CW:** Continuous Wave Radar (surface-to-air missile guidance)

Scenario 1
Search Radar is painting the aircraft.

Scenario 2
Pulse modulated radar lock, you are locked by a radar, possibly a fighter aircraft using STT (Single Target Track) mode. Expect a missile shortly.

Scenario 3
Track While Scan pulse modulated radar lock, you are locked by a radar, possibly a fighter aircraft using TWS mode.



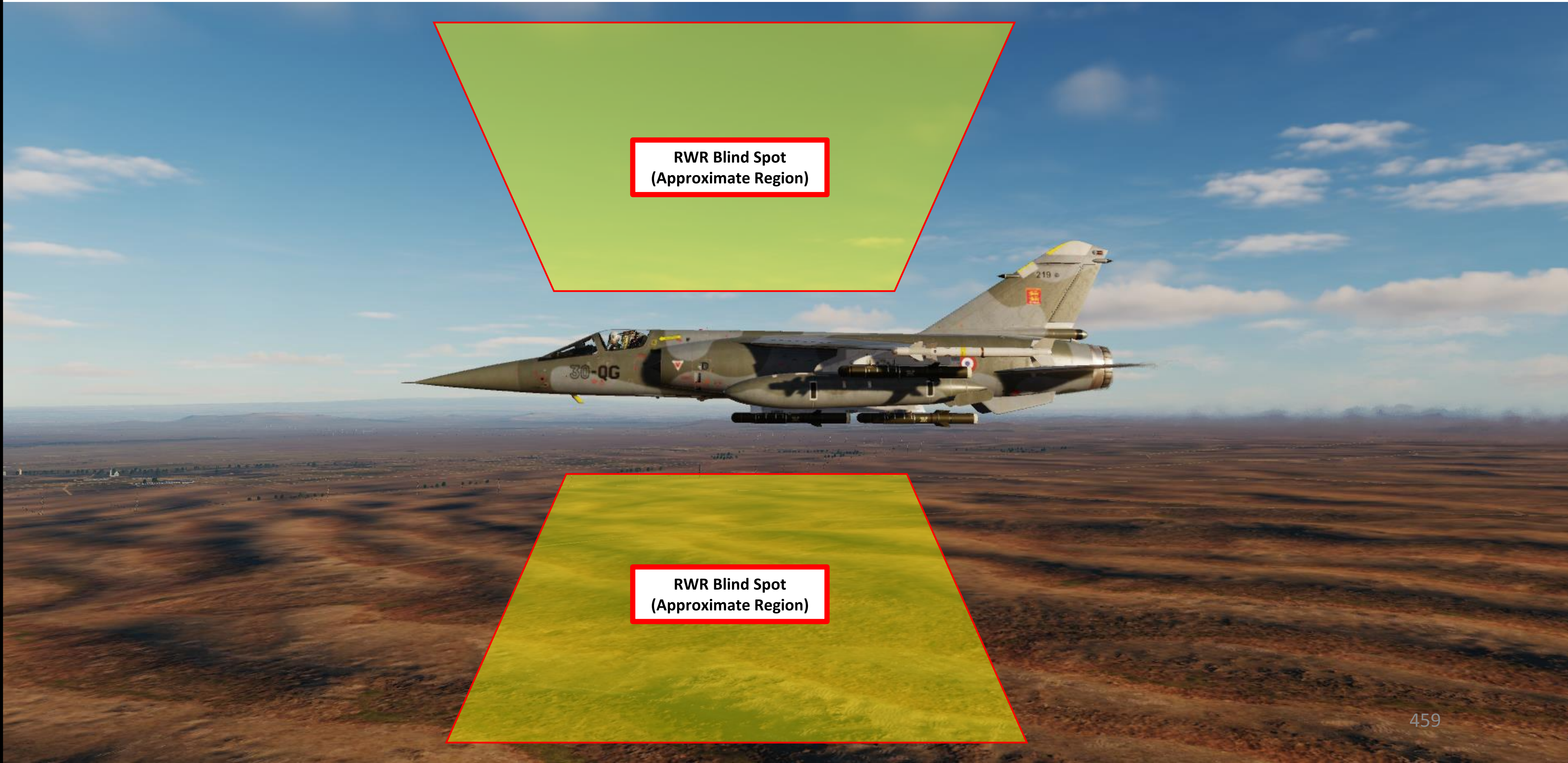
Scenario 4
Continuous wave radar lock, you are locked by a radar which is guiding a missile towards you.

3 – RADAR WARNING RECEIVER
3.1 – BF Type Radar Warning Receiver (RWR)

Mirage F1CE Compatible

Mirage F1EE Compatible

Keep in mind that there are two blind spots on the BF Type RWR. Therefore, you cannot rely completely on the RWR to detect radar locks.



3 – RADAR WARNING RECEIVER
3.2 – AN/ALR-300 Radar Warning Receiver (RWR)

Mirage F1EE Only

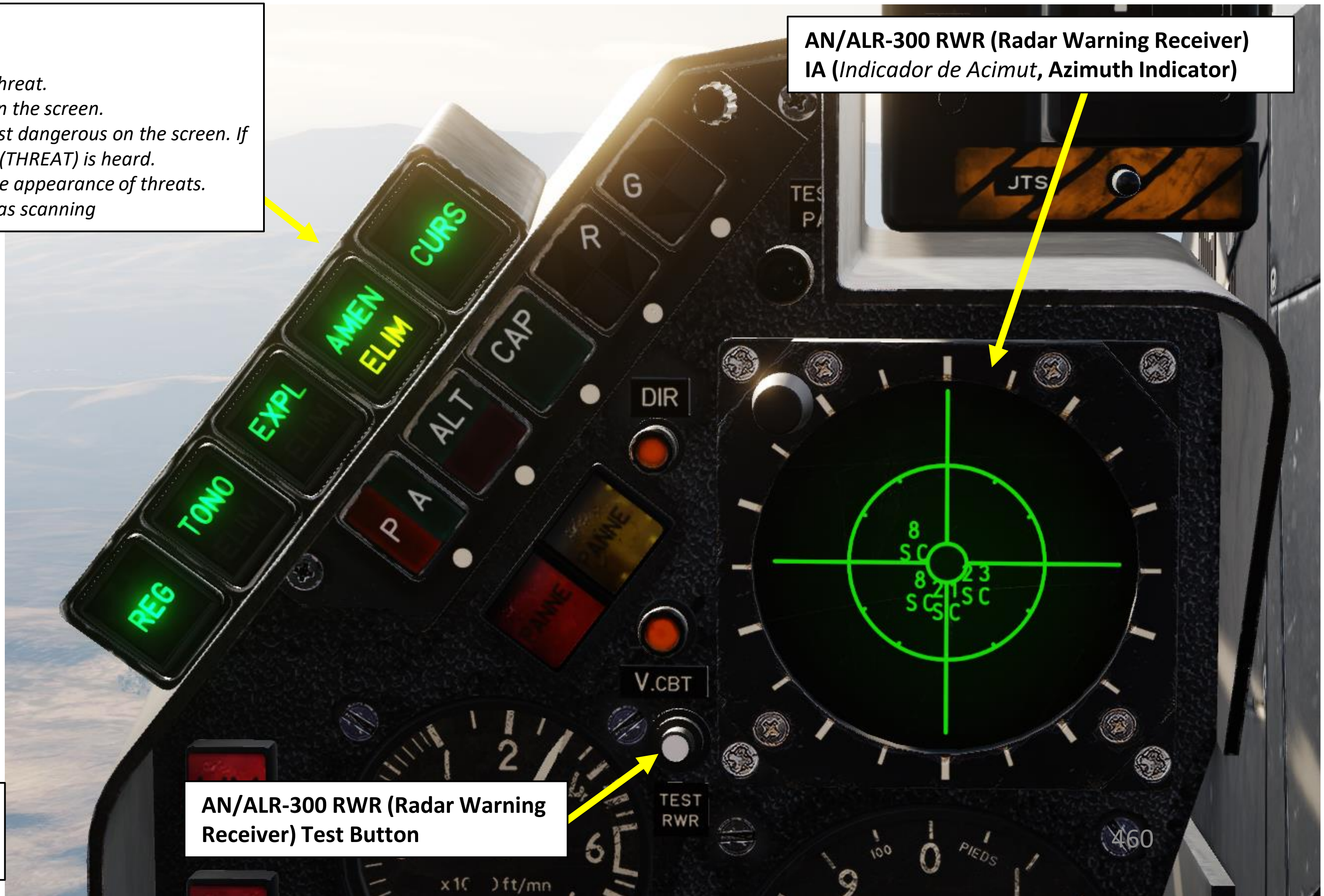
RAP + CME *(Rappel + Contremesures Électroniques,* **Intercom Call + Electronic Countermeasures***)* **Pushbutton**
- *Push to select*
- *Turn to adjust volume*

The AN/ALR-300 V2 is the standard RWR (Radar Warning Receiver) in the Spanish Mirage F1 fleet since the modernization, it was incorporated into the Mirage F1 EE in the 1990's. The controls and indicators in the cockpit consist of an UCC (*Unidad de Control de Cabina*, Cockpit Control Unit) and an IA (*Indicador de Acimut*, Azimuth Indicator).

- To **power up the AN/ALR-300 RWR**, set the **Radar Detector Switch – FWD (Marche/ON).**
- You can **adjust the RWR volume by pushing and turning the RAP + CME Pushbutton.**

AN/ALR-300 RWR (Radar Warning Receiver) Control Panel
UCC (*Unidad de Control de Cabina,* **Cockpit Control Unit)**
- ***CURS*** **(Cursor):** *Provides more accurate information on the status of the threat.*
- ***REG*** **(Recording):** *Allows the recording of the parameters of the threats on the screen.*
- ***AMEN ELIM*** **(Threat Removal):** *Leaves the five (5) threats considered most dangerous on the screen. If the criterion changes, the substitute appears and the warning AMENAZA (THREAT) is heard.*
- ***TONO ELIM*** **(Tone Removal):** *Removes the tones that come along with the appearance of threats.*
- ***EXPL ELIM*** **(Scan Removal):** *Deletes from the screen the radars classified as scanning*

Radar Detector (Radar Warning Receiver) Switch
- *FWD: Marche (ON)*
- *AFT: Arrêt (OFF)*



AN/ALR-300 RWR (Radar Warning Receiver)
IA (*Indicador de Acimut***, Azimuth Indicator)**

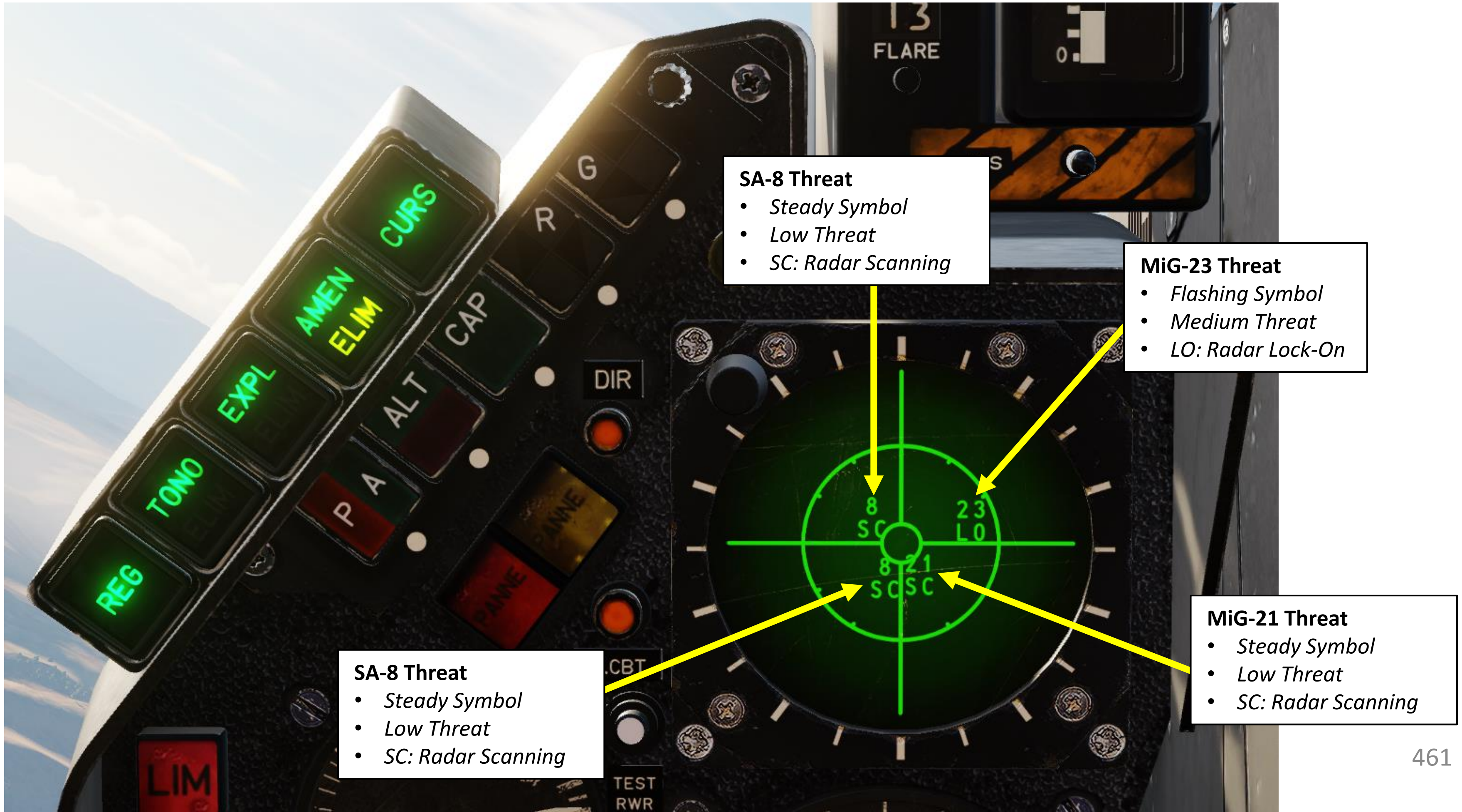
AN/ALR-300 RWR (Radar Warning Receiver) Test Button

Mirage F1EE Only

3 – RADAR WARNING RECEIVER
3.2 – AN/ALR-300 Radar Warning Receiver (RWR)

The AN/ALR-300 system can represent up to 16 threats simultaneously, classified by danger index out of the 100 included in the library. Unknown threats are depicted with an "U". Radar emitters in the C/D band have no azimuth and are placed in the center circle. The more critical a threat is considered (received signal strength criteria and parameters entered in the library), the more towards the outside of the screen they are placed, giving a rough idea of the distance at which it is located and also providing a better indication of the arrival angle.

Notes:
- If the AMEN (Threat) korry (button) is pressed and more than 5 threats are radar-locking your airplane, the ELIM (Removal) light flashes.
- If the EXPL (Scan) korry is pressed and at least 1 search radar is painting your aircraft, ELIM (Removal) light flashes.
- If the TONO (Tone) korry is pressed, ELIM (Removal) light illuminates steady; this function only deletes voice warnings, not PRF (Pulse Repetition Frequency) tones.

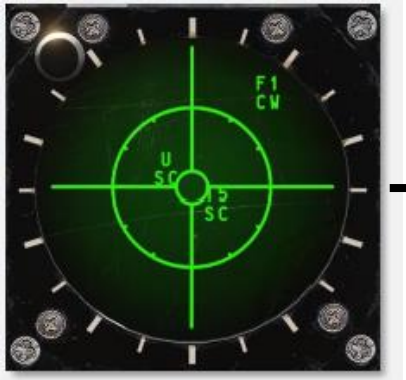


3 – RADAR WARNING RECEIVER
3.2 – AN/ALR-300 Radar Warning Receiver (RWR)

Here are a few examples of AN/ALR-300 symbology.

F1 **SC**	Steady	Mirage F1 radar Scanning Low Threat
15 **SC**	Steady	SA-15 SAM system Radar Scanning Low Threat
U **SC**	Steady	Unknown Radar Scanning Low Threat

F1 **LO**	Flashing	Mirage F1 radar Radar Lock-On Medium Threat
15 **SC**	Steady	SA-15 SAM system Radar Scanning Low Threat
U **SC**	Steady	Unknown Radar Scanning Low Threat



F1 **CW**	Flashing	Mirage F1 radar Missile launch (continuous wave radar) High Threat
15 **SC**	Steady	SA-15 SAM system Radar Scanning Low Threat
U **SC**	Steady	Unknown Radar Scanning Low Threat

Symbol	Identification
	Ground-to-Air Radars
A	Gepard and ZSU-23-4 Shilka self-propelled antiaircraft guns
S6	2S6 Tunguska self-propelled antiaircraft gun
3	S-125 Neva (SA-3) surface-to-air missile system
6	Kub (SA-6) surface-to-air missile system
8	Osa (SA-8) surface-to-air missile system
10	Acquisition radar of S-300 (SA-10) surface-to-air missile system
CS	Low-altitude acquisition radar (Clam Shell) of S-300 (SA-10) surface-to-air missile system
BB	Acquisition radar (Big Bird) of S-300 (SA-10) surface-to-air missile system
11	Acquisition radar of Buk (SA-11/17) self-propelled, medium-range surface-to-air missile systems
SD	Search radar (Snow Drift) of Buk (SA-11/17) self-propelled, medium-range surface-to-air missile systems
13	Strela-10 (SA-13) surface-to-air missile system
DE	Search radar of Sborka mobile reconnaissance and command center (Dog Ear)
15	Tor (SA-15) surface-to-air missile system
RO	Roland surface-to-air missile system
PA	Patriot surface-to-air missile system
HA	Hawk surface-to-air missile system
S	Ground-based early warning systems
	Air-to-air radars
E3	E-3A airborne early warning and control aircraft
E2	E-2C airborne early warning and control aircraft
50	A-50U airborne early warning and control aircraft
21	MiG-21
23	MiG-23ML
25	MiG-25PD
29	MiG-29, Su-27, and Su-33
31	MiG-31
30	Su-30
34	Su-34
M2	Mirage 2000-5
F4	F-4
F5	F-5
14	F-14
15	F-15
16	F-16
18	F/A-18

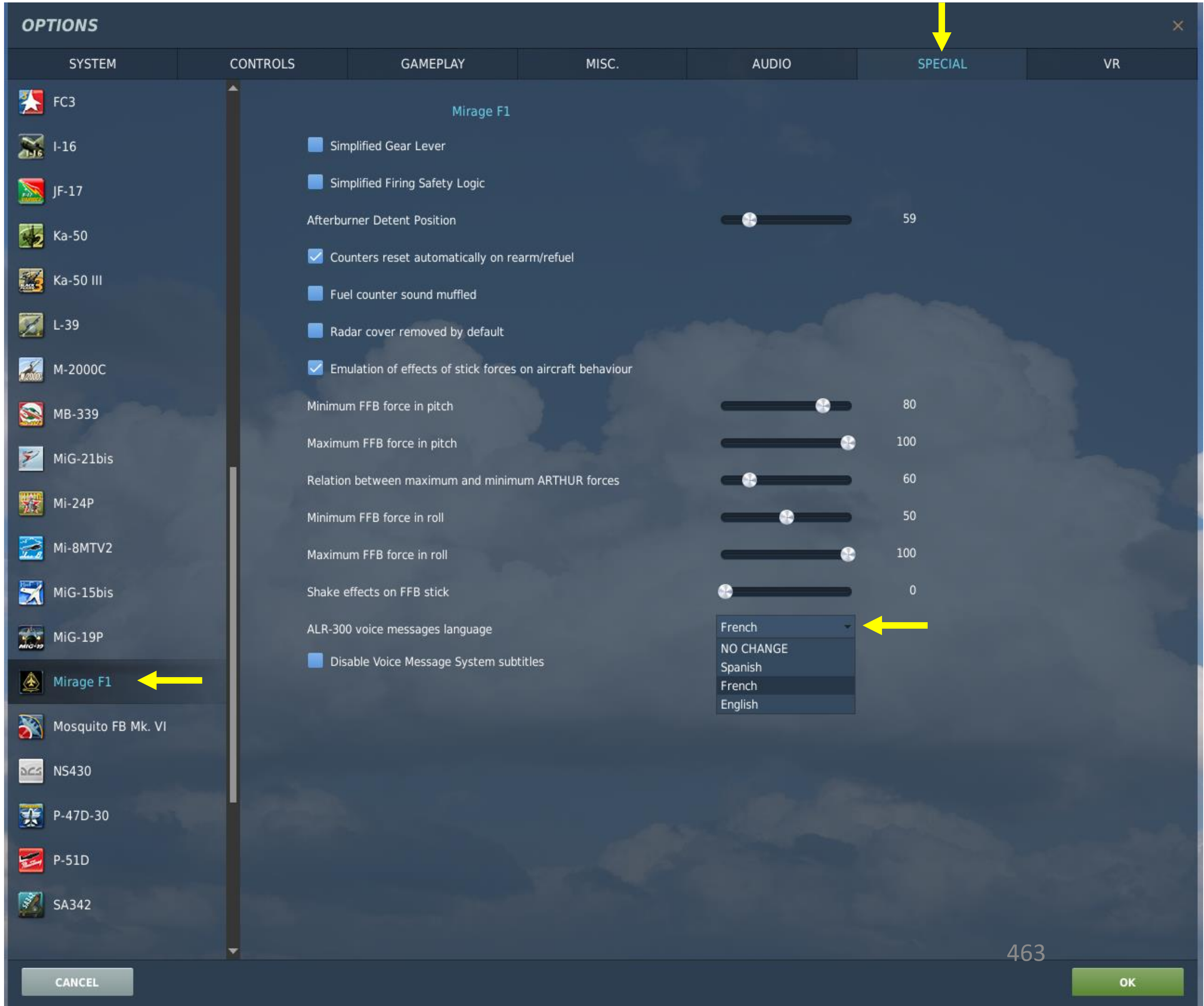
3 – RADAR WARNING RECEIVER

3.2 – AN/ALR-300 Radar Warning Receiver (RWR)

The equipment provides sound warnings associated with the threats that are the PRF (Pulse Repetition Frequency), accompanied by the following voices in the Spanish cockpit:

- ALERTA (ALERT in English, *ALERTE* in French): sounds when a track is detected.
- AMENAZA (THREAT in English, *MENACE* in French): sounds when a new threat, that is not an airplane or gun, is detected.
- AVIÓN (AIRPLANE in English, *AVION* in French): sounds when an airplane is detected.
- MISIL (MISSILE in English and French): sounds when a missile launch is detected.
- CAÑÓN (CANNON in English, *CANON* in French): sounds when a radar linked to a gun (on ground or sea) is detected.

Take note that voice warnings can be set to Spanish, French or English in the Mirage F1 Special Options tab.



3 – RADAR WARNING RECEIVER
3.2 – AN/ALR-300 Radar Warning Receiver (RWR)

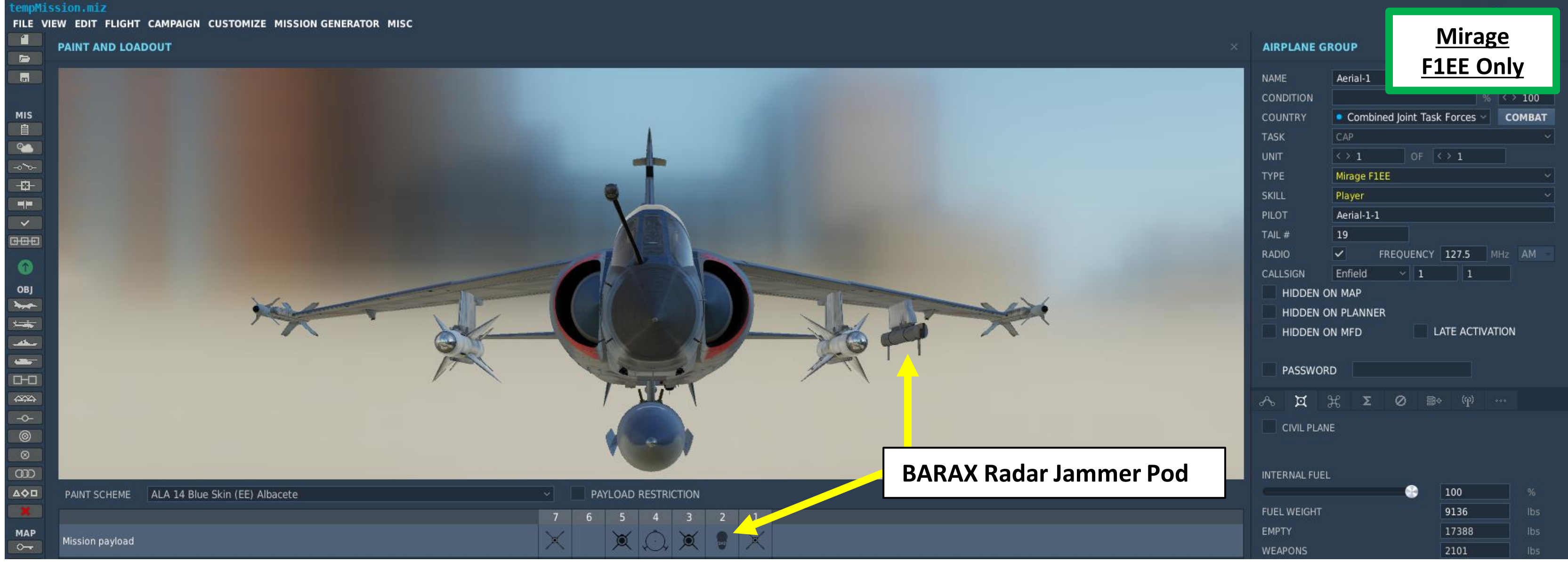
Mirage F1EE Only

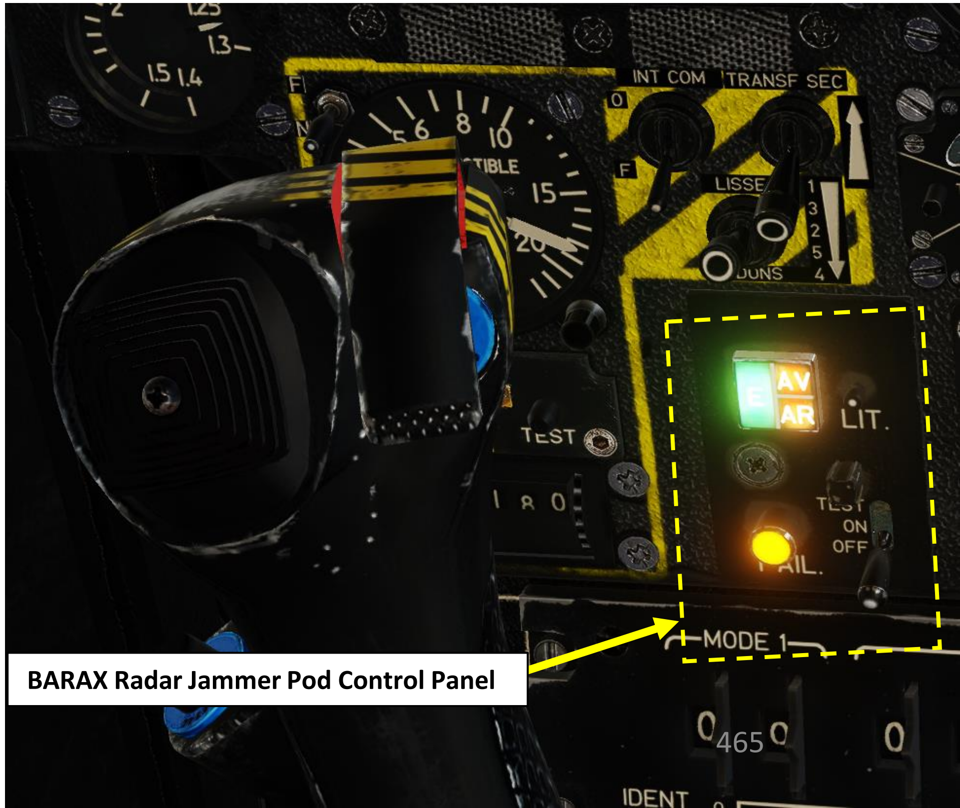
Keep in mind that there are two blind spots on the AN/ALR-300 RWR. Therefore, you cannot rely completely on the RWR to detect radar locks.

4 – BARAX RADAR JAMMER POD

The BARAX system permits an active jamming self-protection against ground or airborne fire-control radar threats.

The system consists of a BARAX pod that can be installed in the left or right outboard hardpoints and a control unit located in the front instruments panel.



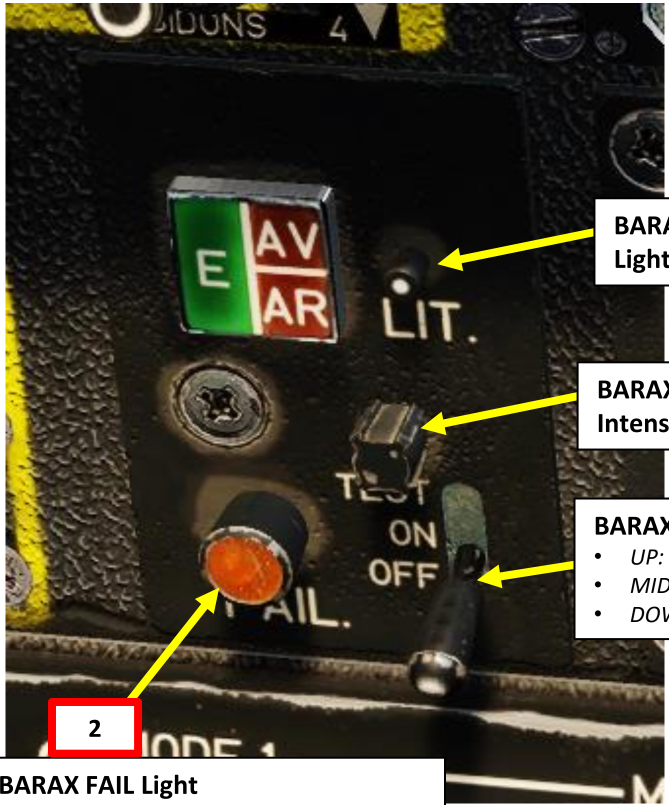


Mirage F1EE Only

4 – BARAX RADAR JAMMER POD

To operate the BARAX pod:

1. Set BARAX State Selector Switch – ON (MIDDLE)
2. When switching on the system, a warming period of approximately 150 seconds is required. The duration of this preheating period depends on the equipment temperature. The FAIL light will illuminate and will go out when the equipment is warm.
3. Adjust BARAX Pod Control Panel Lighting – As desired.
4. Adjust BARAX Pod Emission Intensity – As desired.
5. When a radar emitter is detected, the AV (Avant/Front) or AR (Arrière/Rear) lights will illuminate depending on the radar emitter's position in relationship to the pod.
6. To start jamming, press the BARAX Emission Button. Once BARAX pod is jamming, the "E" (Emission) light is illuminated.
7. To stop jamming, press the BARAX Emission Button once again.



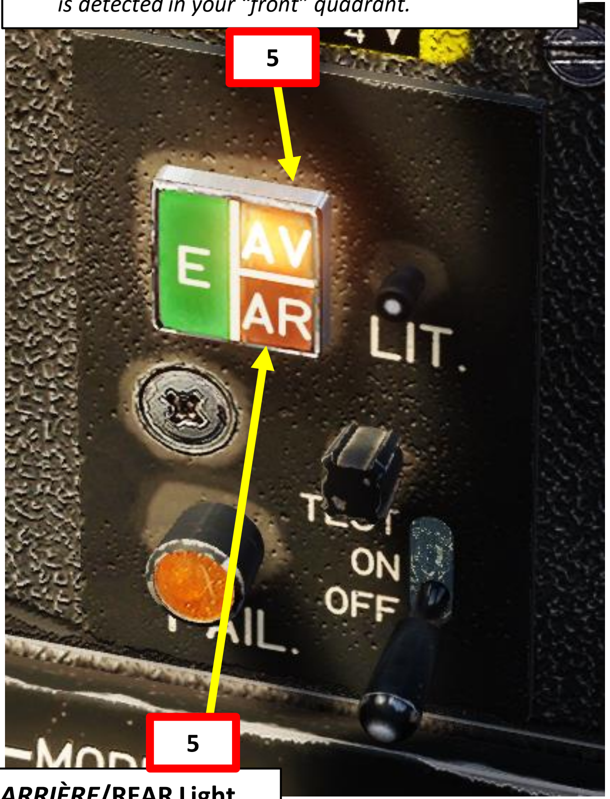
BARAX Pod Control Panel Lighting (LIT) Control Knob 3

BARAX Pod Emission Intensity Control Knob 4

BARAX Pod State Selector Switch 1
- *UP: TEST*
- *MIDDLE: ON*
- *DOWN: OFF*

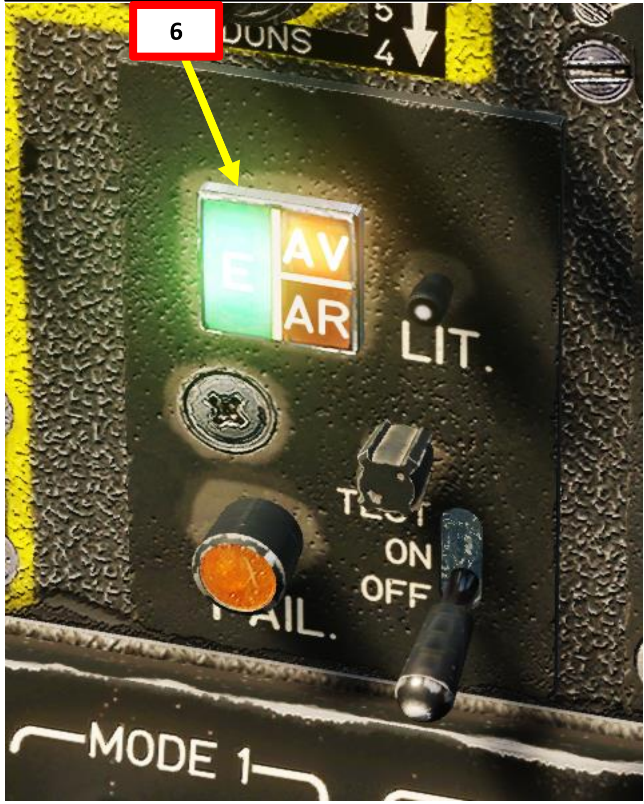
2 **BARAX FAIL Light**
- *Illuminates in amber color when there is a system failure, while warming up the system or when the test light is pressed.*

Radar Emitter Detection *AVANT*/FRONT Light 5
- *"AV" (Avant) light illuminates when a radar emitter is detected in your "front" quadrant.*

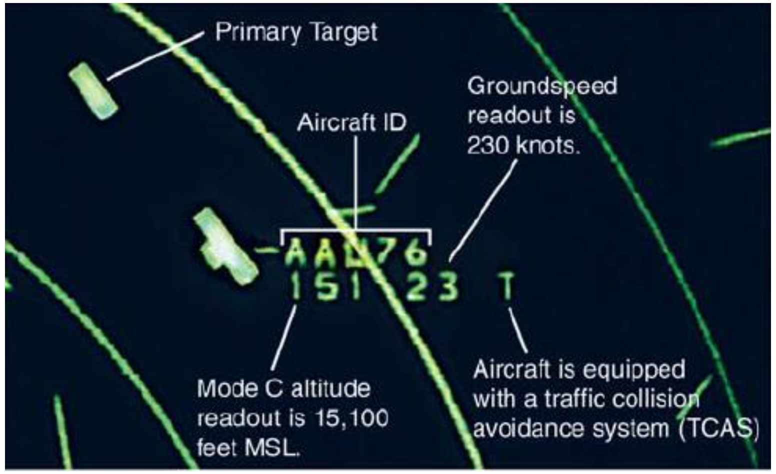


5 **Radar Emitter Detection *ARRIÈRE*/REAR Light**
- *"AR" (Arrière) light illuminates when a radar emitter is detected in your "rear" quadrant.*

BARAX Emission Button 6
- *Illuminated: Pod is actively jamming*



IFF (IDENTIFY-FRIEND-OR-FOE) INTRODUCTION



An IFF (Identify-Friend-or-Foe) system usually consists of an **INTERROGATOR** component and a **TRANSPONDER** component.

The **interrogator** component broadcasts an interrogation signal with a specific “code” (pulse frequency).

A **transponder** equipped on another aircraft will receive the interrogation signal and broadcast a reply signal with its own “code” (pulse frequency) as well. The information sent from this reply signal will vary based on the transponder mode selected.

Your own aircraft transponder will then see if the interrogation code and reply codes match, which in some cases can be used to determine whether the other aircraft is a friendly contact. The nature of the information determined will vary based on the transponder mode.

Take note that **the Mirage F1CE and F1EE have no interrogator**, therefore you cannot send interrogation signals to other aircraft to see whether they are friendly or not. However, you do have a transponder, which is very important. If you set an incorrect transponder code, friendly contacts may not be able to identify you as a friendly, which can be a big problem.

IFF MODES

In its simplest form, a IFF "Mode" or interrogation type is generally determined by pulse spacing between two or more interrogation pulses. Various modes exist from Mode 1 to 5 for military use, to Mode A, C, and Mode S for civilian use. The takeaway from this table should be:

- **Mode 4 is the preferred mode in a combat** scenario because it is highly secure (encrypted). Encrypted interrogation codes cannot be detected by an enemy transponder, and your transponder will not broadcast a reply signal to the other team.
- **Mode 4 invalid/lack of reply cannot guarantee that an aircraft is hostile**, but a **valid reply is a guarantee of a friendly contact** (within DCS)
- **Modes 1, 2, and 3 are not secure to use** since any other aircraft from the opposing team could find what your Interrogator code is and set his transponder to it, fooling you into thinking he is a friendly contact. These modes also easily give away your position since every time your transponder broadcasts an answer, this signal can be intercepted by an enemy transponder, which can send your position to other enemy fighters via datalink.

Military Interrogation Mode	Civilian Interrogation Mode	Description
1		Provides 2-digit 5-bit mission code
2		Provides 4-digit octal unit code (set on ground for fighters, can be changed in flight by transport aircraft)
3	A	Provides a 4-digit octal identification code for the aircraft, set in the cockpit but assigned by the air traffic controller. Mode 3/A is often combined with Mode C to provide altitude information as well.
	C	Provides the aircraft's pressure altitude and is usually combined with Mode 3/A to provide a combination of a 4-digit octal code and altitude as Mode 3 A/C, often referred to as Mode A and C
4		Provides a 3-pulse reply, delay is based on the encrypted challenge
5		Provides a cryptographically secured version of Mode S and ADS-B GPS position
S		Mode S (Select) is designed to help avoiding overinterrogation of the transponder (having many radars in busy areas) and to allow automatic collision avoidance. Mode S transponders are compatible with Mode A and Mode C Secondary Surveillance Radar (SSR) systems. This is the type of transponder that is used for TCAS or ACAS II (Airborne Collision Avoidance System) functions

IFF TRANSPONDER COMPONENTS

IFF (Identify-Friend-or-Foe) Mode 4 Code Selector
- *Zero*
- *A*
- *B*
- *Hold*

IFF Mode 1 Code Selectors

IFF Mode 3A Code Selectors

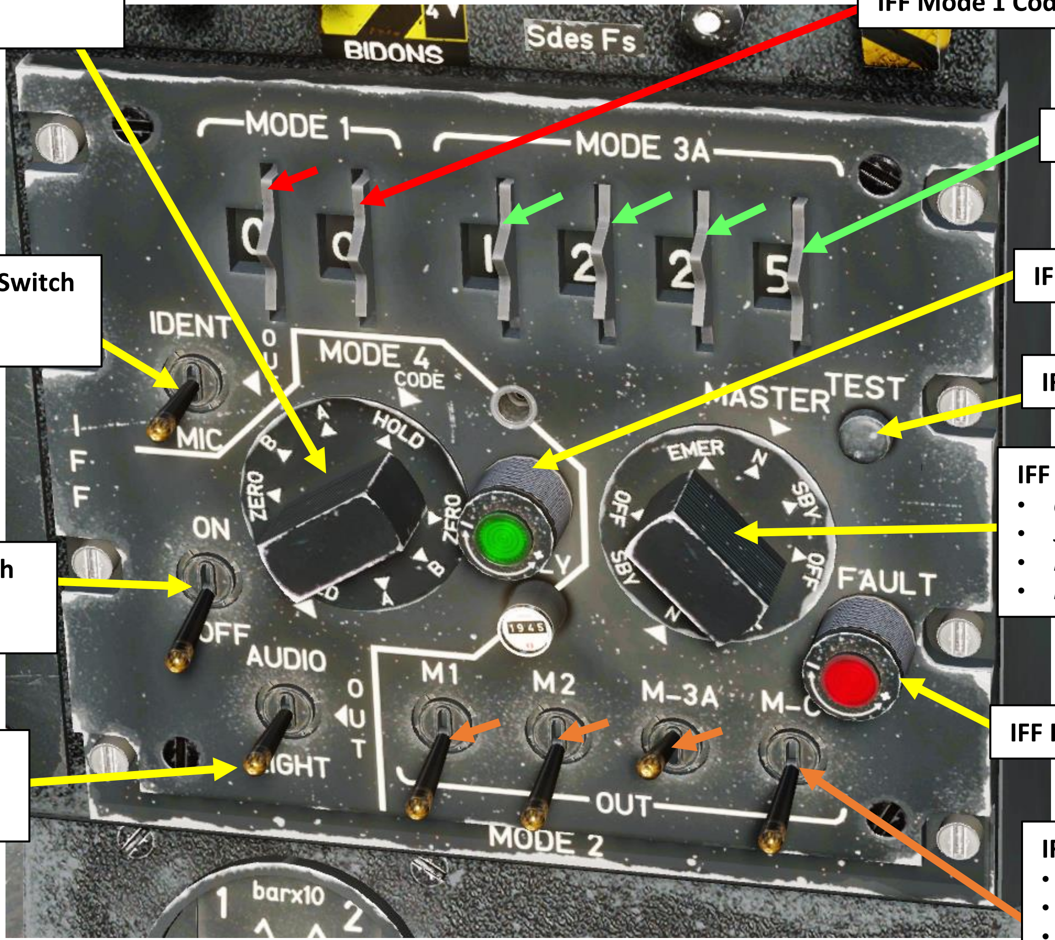
IFF Position Identification Switch
- *UP: Identification (Ident)*
- *DOWN: Microphone*

IFF Mode 4 Reply Light

IFF Test Button

IFF (Identify-Friend-or-Foe) Master Mode Selector
- *OFF*
- *SBY: Standby*
- *N: Normal*
- *EMER: Emergency*

IFF Mode 4 Switch
- *UP: ON*
- *DOWN: OFF*



IFF Fault Light

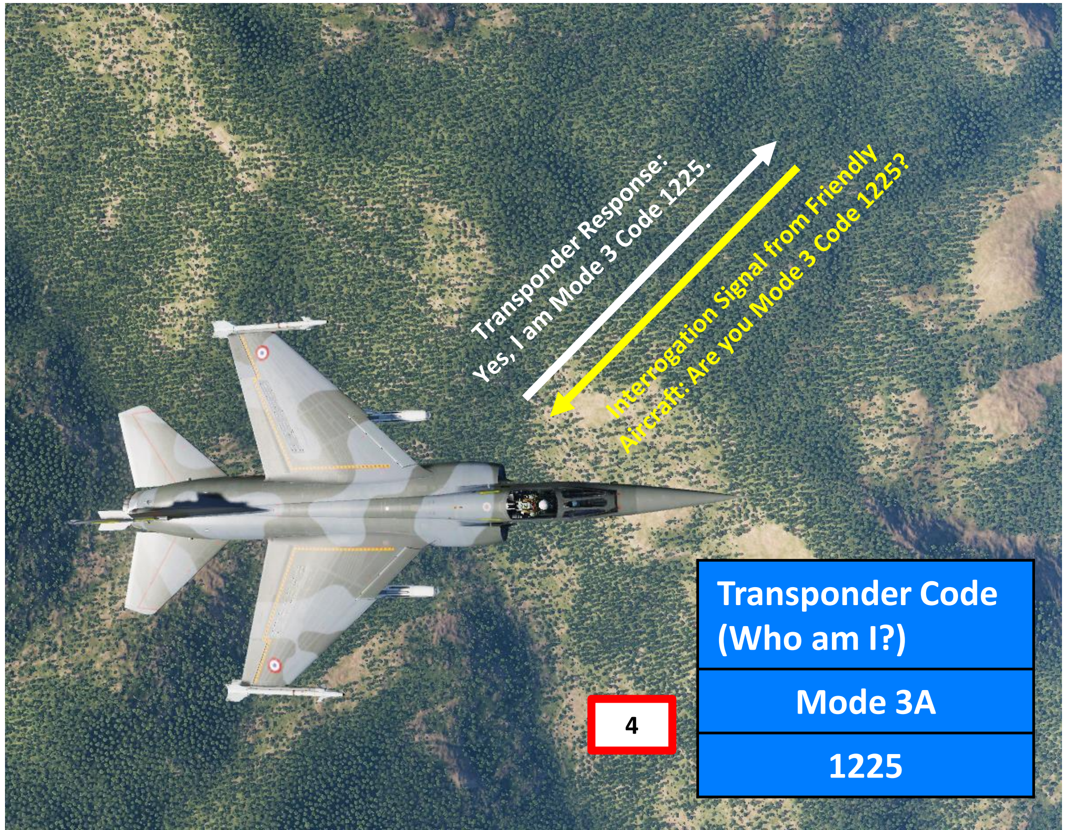
IFF Audio-Light Switch
- *UP: Audio*
- *DOWN: Light*

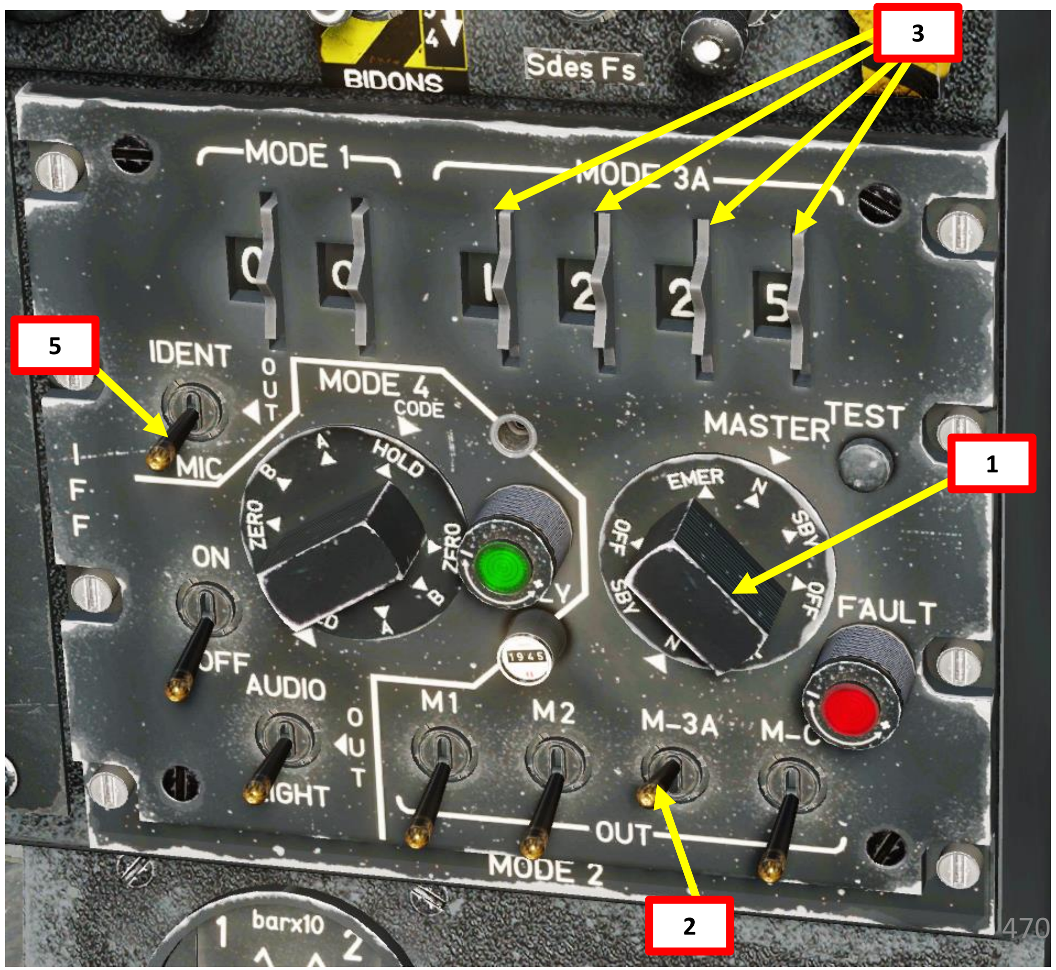
IFF Mode Selector Switches
- *UP: ON / DOWN: OFF*
- *M-1: Mode 1*
- *M-2: Mode 2*
- *M-3: Mode 3*
- *M-4: Mode 4*

SETTING UP THE IFF TRANSPONDER

As an example, let's say that the mission briefing needs us to set the IFF transponder to **Mode 3A with a code of 1225**.

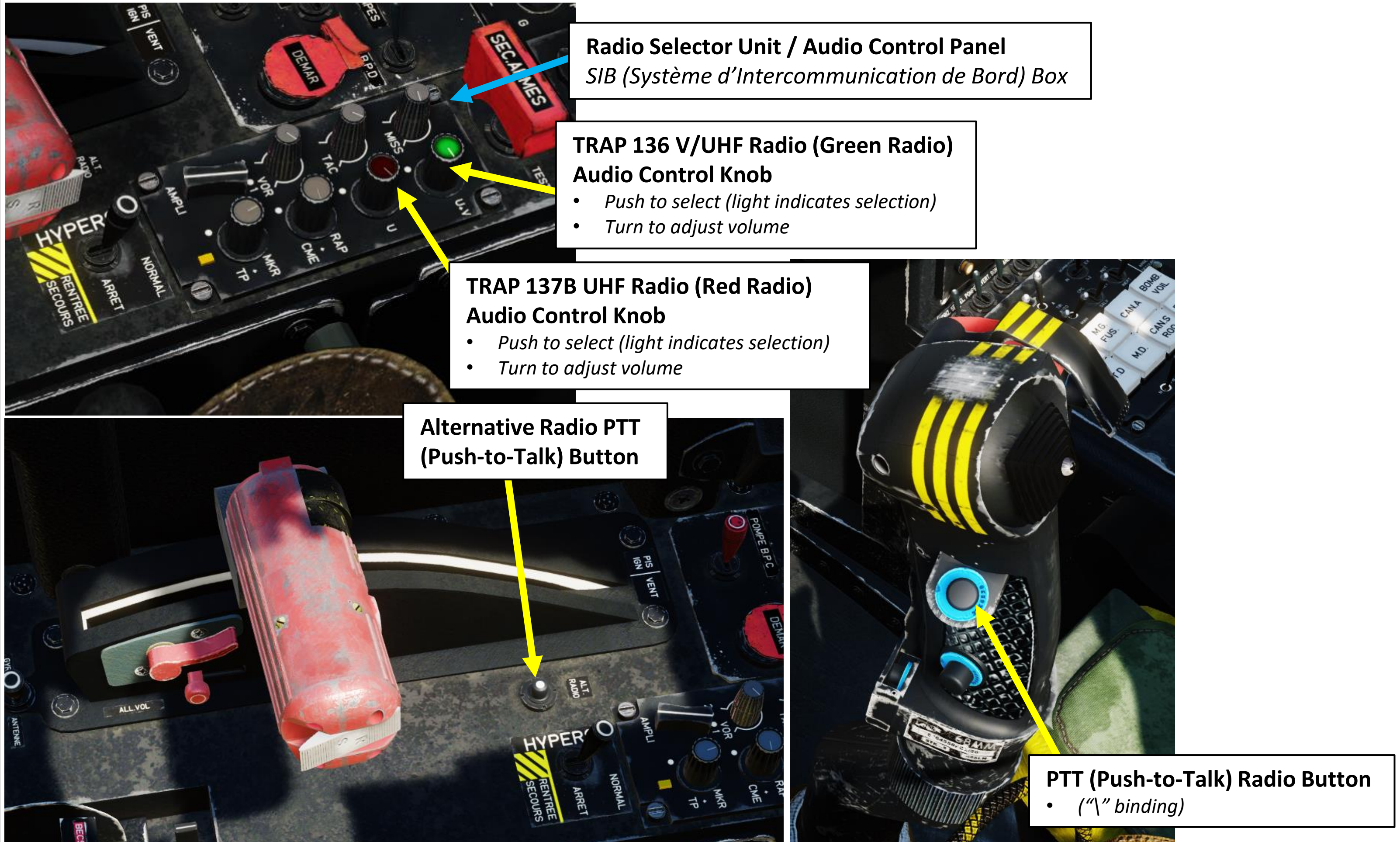
1. Set IFF Master Switch to NORMAL
2. Set IFF Mode 3/A Switch – UP (ON)
3. Set IFF MODE 3/A Channel Wheel Selectors to "1225".
4. If you are interrogated with mode 3A with a code set to 1225, the transponder will then send a response signal (reply) to the interrogator with the transponder code you entered previously.
5. If the tower wants to know your position, they are likely to send you a specific IFF mode and code, then ask you to "*Identify*". This requires you to press the IFF Identification/Microphone Switch to IDENT (UP), which will allow the tower to know where you are from your transponder's identification signal/transmission.





RADIO OVERVIEW

- You have two radios available: a "**Green**" TRAP 136 V/UHF radio (COM1) and a "**Red**" TRAP 137B UHF secure voice com radio (COM2) . Most encryption functions are not implemented.
- The **TRAP 136 V/UHF COM1** radio is used for communications between two ranges: 118.000 to 149.975 MHz (VHF Range) and 225.000 to 399.975 MHz (UHF Range). It can use both custom and preset channels as well (preset channels can be changed in the mission editor). Preset channel frequencies should be available in mission briefing.
- The **TRAP 137B UHF COM2** radio is used for communications between 225.000 and 399.975 MHz. It can **only** use preset channels (preset channels can be changed in the mission editor). Preset channel frequencies should be available in mission briefing.
- Radio transmission is done by using the **V/UHF or UHF Audio Control Knobs** to select which radio to transmit on, then pressing the **PTT (Push-to-Talk) Radio button** on the stick. You can also use the **Alternative Radio PTT Button** to transmit as well.
- TACAN and VOR/ILS radio beacons will be further explained in the Air Refueling section and the ILS Landing section.



RADIO PRESETS

TRAP-136

Channel	Frequency	Unit	Mode
Channel 1	127.5	MHz	AM
Channel 2	119.25	MHz	AM
Channel 3	122	MHz	AM
Channel 4	126.5	MHz	AM
Channel 5	127	MHz	AM
Channel 6	129	MHz	AM
Channel 7	131	MHz	AM
Channel 8	133	MHz	AM
Channel 9	141	MHz	AM
Channel 10	250.5	MHz	AM
Channel 11	251	MHz	AM
Channel 12	253	MHz	AM
Channel 13	254	MHz	AM
Channel 14	257	MHz	AM
Channel 15	260	MHz	AM
Channel 16	261	MHz	AM
Channel 17	262	MHz	AM
Channel 18	263	MHz	AM
Channel 19	267	MHz	AM
Channel 20	270	MHz	AM

TRAP-137B

Channel	Frequency	Unit	Mode
Channel 1	225	MHz	AM
Channel 2	230	MHz	AM
Channel 3	240	MHz	AM
Channel 4	250.5	MHz	AM
Channel 5	251	MHz	AM
Channel 6	256	MHz	AM
Channel 7	257	MHz	AM
Channel 8	262	MHz	AM
Channel 9	263	MHz	AM
Channel 10	267	MHz	AM
Channel 11	270	MHz	AM
Channel 12	254	MHz	AM
Channel 13	264	MHz	AM
Channel 14	266	MHz	AM
Channel 15	265	MHz	AM
Channel 16	252	MHz	AM
Channel 17	268	MHz	AM
Channel 18	271	MHz	AM
Channel 19	275	MHz	AM
Channel 20 (N/A in 'Easy Comms')	360	MHz	AM

RADIO OVERVIEW
TRAP 136 V/UHF (GREEN) RADIO

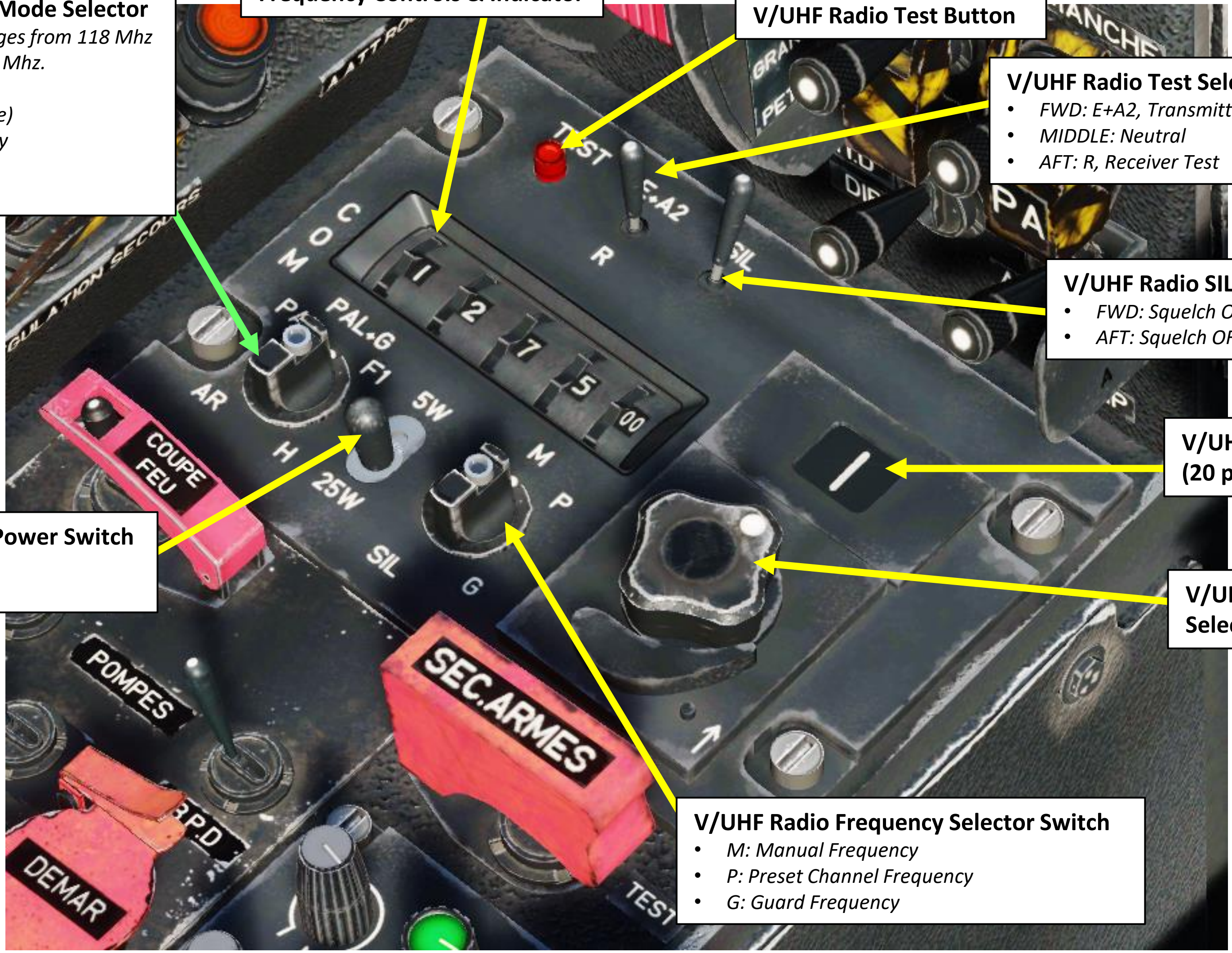
TRAP 136 V/UHF Radio (Green Radio) Mode Selector
V/UHF radio can operate in the frequency ranges from 118 Mhz to 143,975 Mhz and from 225 Mhz to 399.975 Mhz.
- *AR: Arrêt (OFF)*
- *PAL: Main Frequency (Fréquence Principale)*
- *PAL+G: Main Frequency + Guard Frequency*
- *F1: Not used.*
- *H: Not used.*

V/UHF Radio Manual Frequency Controls & Indicator

V/UHF Radio Test Button

V/UHF Radio Test Selector Switch
- *FWD: E+A2, Transmitter Test*
- *MIDDLE: Neutral*
- *AFT: R, Receiver Test*

V/UHF Radio SIL ***(Silence)*** **/ Squelch Switch**
- *FWD: Squelch ON*
- *AFT: Squelch OFF*



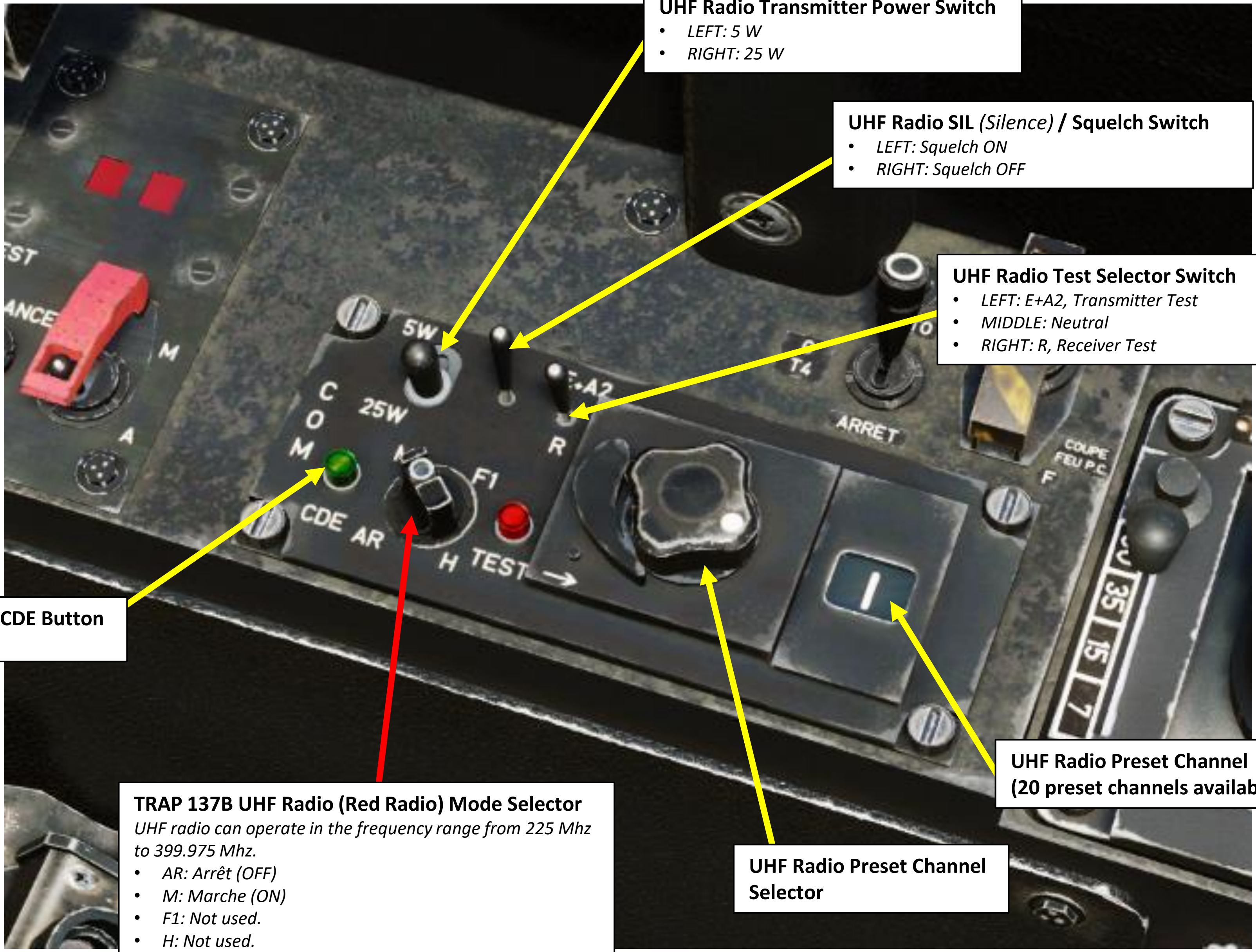
V/UHF Radio Transmitter Power Switch
- *FWD: 5 W*
- *AFT: 25 W*

V/UHF Radio Preset Channel (20 preset channels available)

V/UHF Radio Preset Channel Selector

V/UHF Radio Frequency Selector Switch
- *M: Manual Frequency*
- *P: Preset Channel Frequency*
- *G: Guard Frequency*

RADIO OVERVIEW
TRAP 137B UHF (RED) RADIO



UHF Radio Transmitter Power Switch
- *LEFT: 5 W*
- *RIGHT: 25 W*

UHF Radio SIL *(Silence)* **/ Squelch Switch**
- *LEFT: Squelch ON*
- *RIGHT: Squelch OFF*

UHF Radio Test Selector Switch
- *LEFT: E+A2, Transmitter Test*
- *MIDDLE: Neutral*
- *RIGHT: R, Receiver Test*

UHF Radio CDE Button
- *Not used.*

TRAP 137B UHF Radio (Red Radio) Mode Selector
UHF radio can operate in the frequency range from 225 Mhz to 399.975 Mhz.
- *AR: Arrêt (OFF)*
- *M: Marche (ON)*
- *F1: Not used.*
- *H: Not used.*

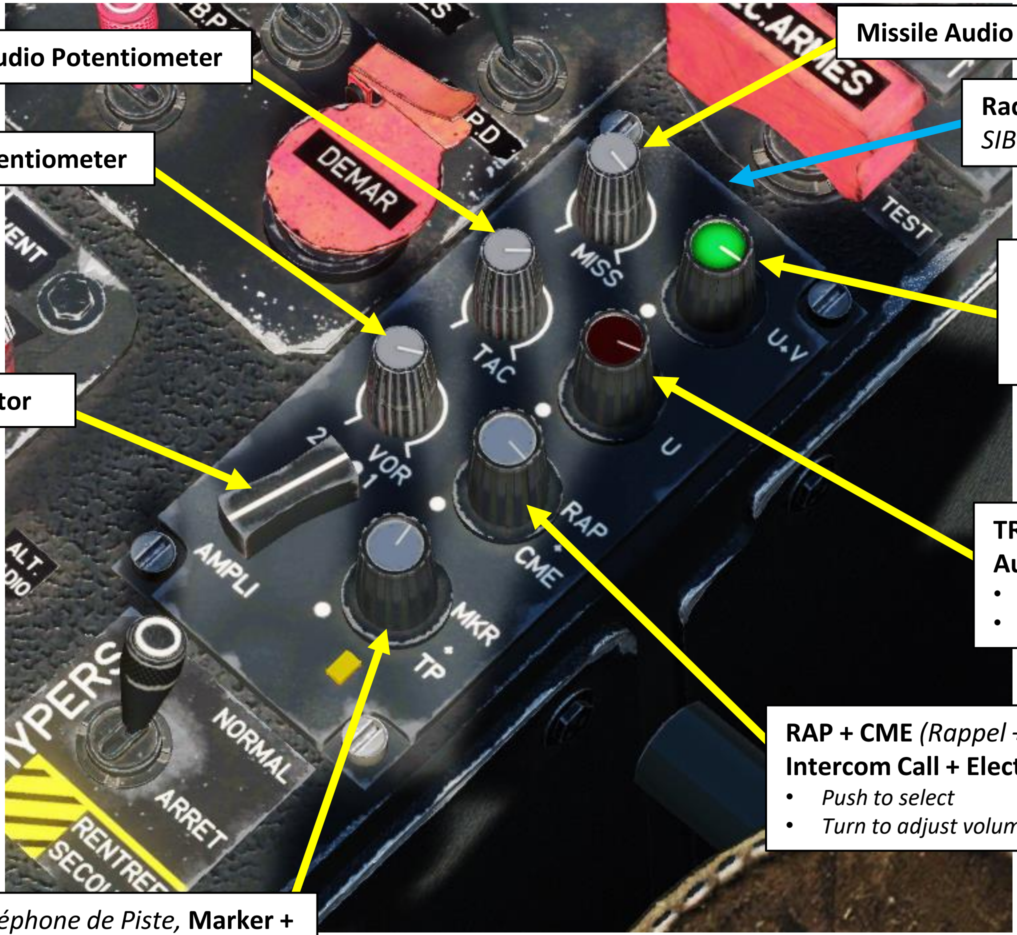
UHF Radio Preset Channel Selector

UHF Radio Preset Channel (20 preset channels available)

RADIO OVERVIEW – RADIO SELECTOR UNIT / AUDIO CONTROL PANEL

SIB (Système d'Intercommunication de Bord) Box

The SIB *(Système d'Intercommunication de Bord)* Box is used as an audio control panel, mainly to select which radio to transmit on.



TACAN Audio Potentiometer

VOR Audio Potentiometer

Radio Audio Amplifier Selector

Missile Audio Potentiometer

Radio Selector Unit / Audio Control Panel
SIB (Système d'Intercommunication de Bord) Box

TRAP 136 V/UHF Radio (Green Radio) Audio Control Knob
- *Push to select (light indicates selection)*
- *Turn to adjust volume*

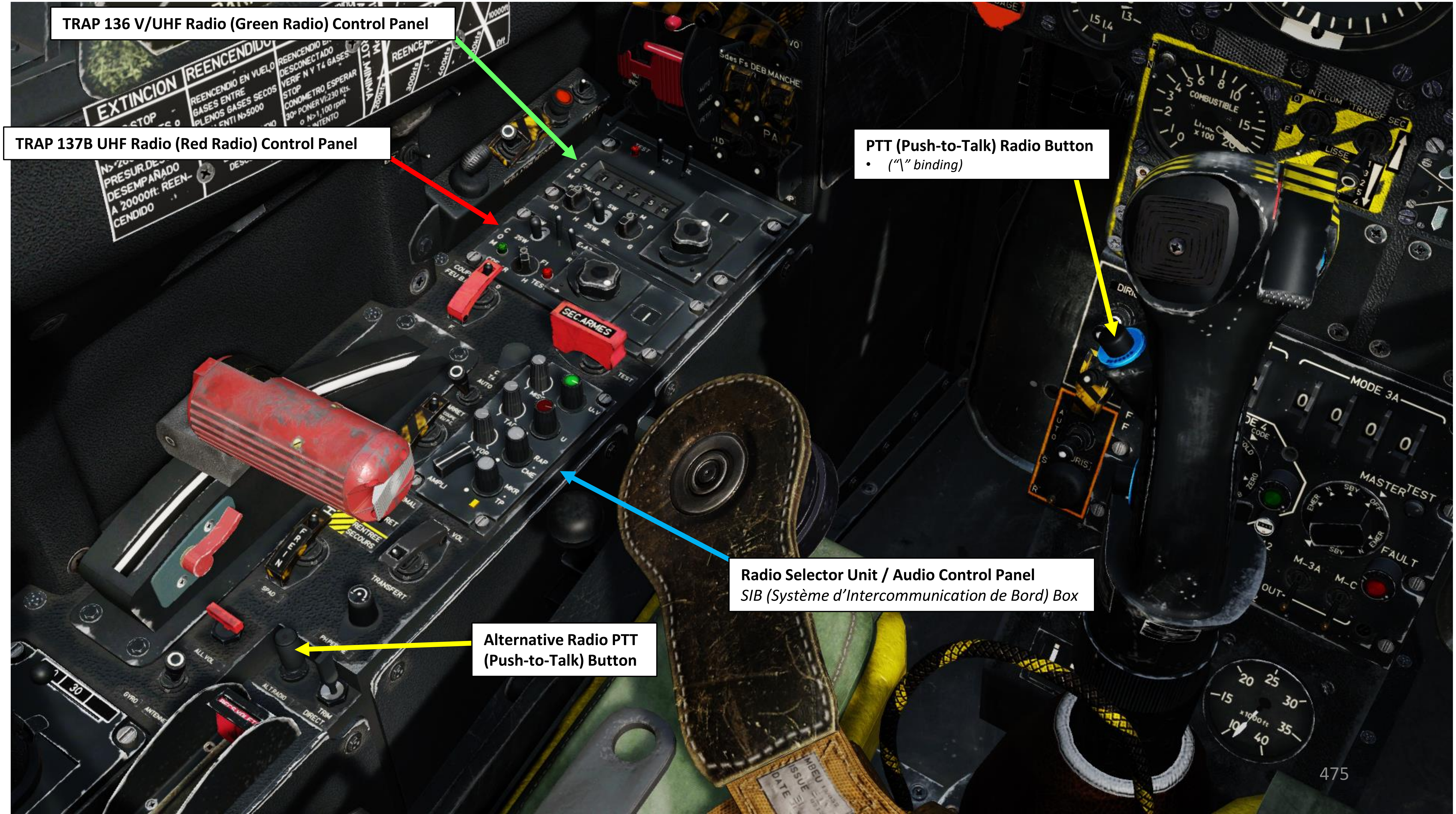
TRAP 137B UHF Radio (Red Radio) Audio Control Knob
- *Push to select (light indicates selection)*
- *Turn to adjust volume*

RAP + CME *(Rappel + Contremesures Électroniques,* **Intercom Call + Electronic Countermeasures***)* **Pushbutton**
- *Push to select*
- *Turn to adjust volume*

MKR + TP *(Marqueur + Téléphone de Piste,* **Marker + Ground Communications***)* **Pushbutton**
- *Push to select*
- *Turn to adjust volume*

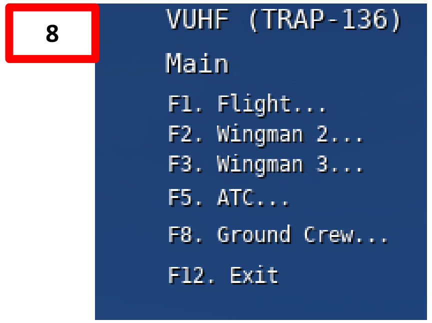
RADIO OVERVIEW – MIRAGE F1EE CONFIGURATION

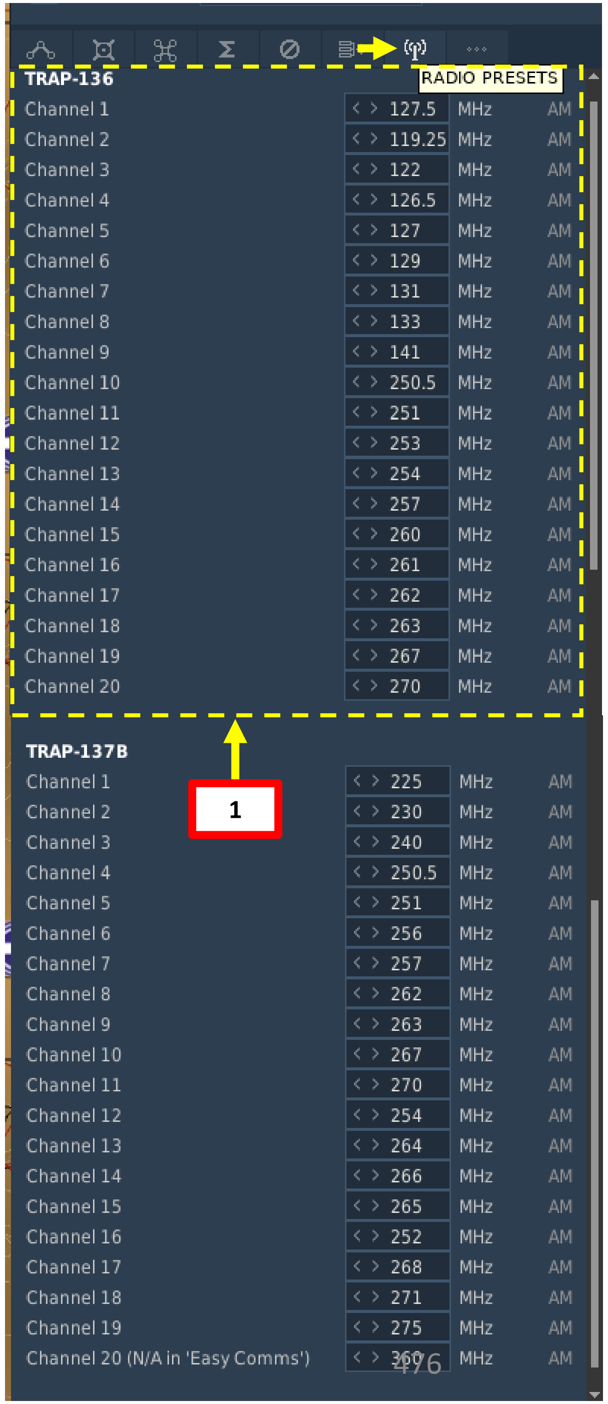
Mirage F1EE Only



HOW TO USE TRAP 136 V/UHF (GREEN) RADIO

1. Preset radio frequencies are set via the Mission Editor.
2. Set TRAP 136 V/UHF Radio (Green Radio) Mode Selector – PAL (*Fréquence Principale*, Main Frequency).
3. Set V/UHF Radio Transmitter Power Switch – 5 W (FWD).
4. Set V/UHF Radio SIL *(Silence)* / Squelch Switch – ON (FWD).
5. Set V/UHF Radio Frequency Selector – As required (Manual Frequency or Preset Channel Frequency).
6. Set V/UHF Radio Manual Frequency or Preset Channel – As required.
7. Push TRAP 136 V/UHF Radio (Green Radio) Audio Control Knob (left click) to select TRAP 136 radio for transmission. Rotate knob (scroll mousewheel) to adjust volume.
8. Press "\" (Communication Menu, Radio Microphone Push-to-Talk Button) to transmit.



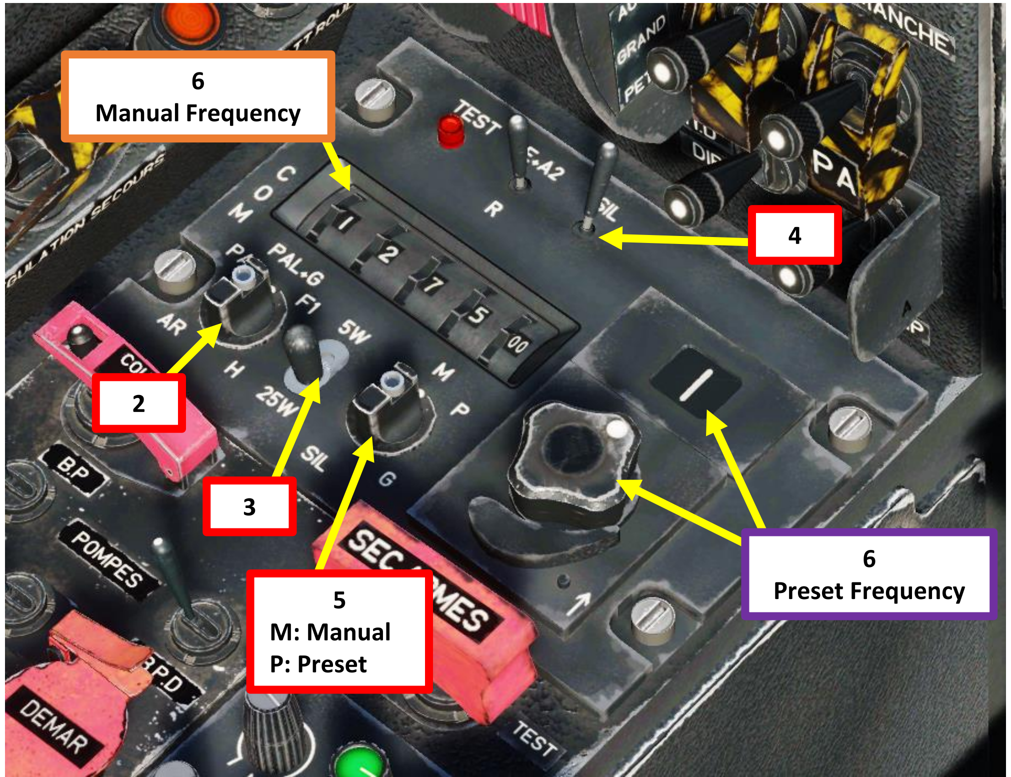


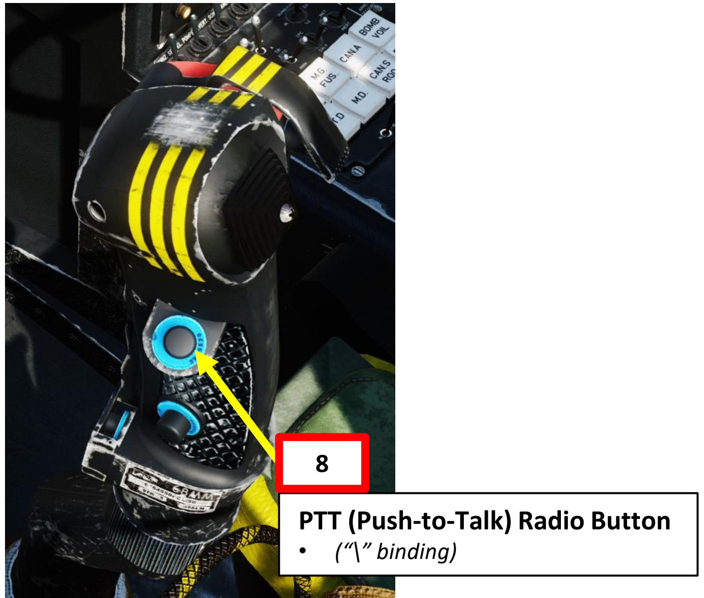
TRAP-136

Channel 1	127.5	MHz	AM
Channel 2	119.25	MHz	AM
Channel 3	122	MHz	AM
Channel 4	126.5	MHz	AM
Channel 5	127	MHz	AM
Channel 6	129	MHz	AM
Channel 7	131	MHz	AM
Channel 8	133	MHz	AM
Channel 9	141	MHz	AM
Channel 10	250.5	MHz	AM
Channel 11	251	MHz	AM
Channel 12	253	MHz	AM
Channel 13	254	MHz	AM
Channel 14	257	MHz	AM
Channel 15	260	MHz	AM
Channel 16	261	MHz	AM
Channel 17	262	MHz	AM
Channel 18	263	MHz	AM
Channel 19	267	MHz	AM
Channel 20	270	MHz	AM

TRAP-137B

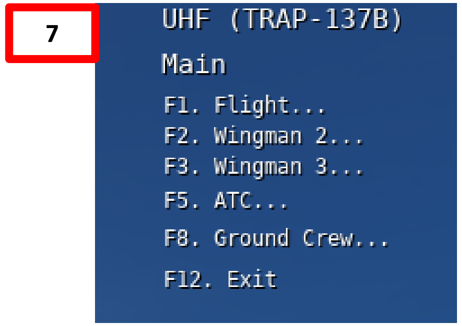
Channel 1	225	MHz	AM
Channel 2	230	MHz	AM
Channel 3	240	MHz	AM
Channel 4	250.5	MHz	AM
Channel 5	251	MHz	AM
Channel 6	256	MHz	AM
Channel 7	257	MHz	AM
Channel 8	262	MHz	AM
Channel 9	263	MHz	AM
Channel 10	267	MHz	AM
Channel 11	270	MHz	AM
Channel 12	254	MHz	AM
Channel 13	264	MHz	AM
Channel 14	266	MHz	AM
Channel 15	265	MHz	AM
Channel 16	252	MHz	AM
Channel 17	268	MHz	AM
Channel 18	271	MHz	AM
Channel 19	275	MHz	AM
Channel 20 (N/A in 'Easy Comms')	360	MHz	AM

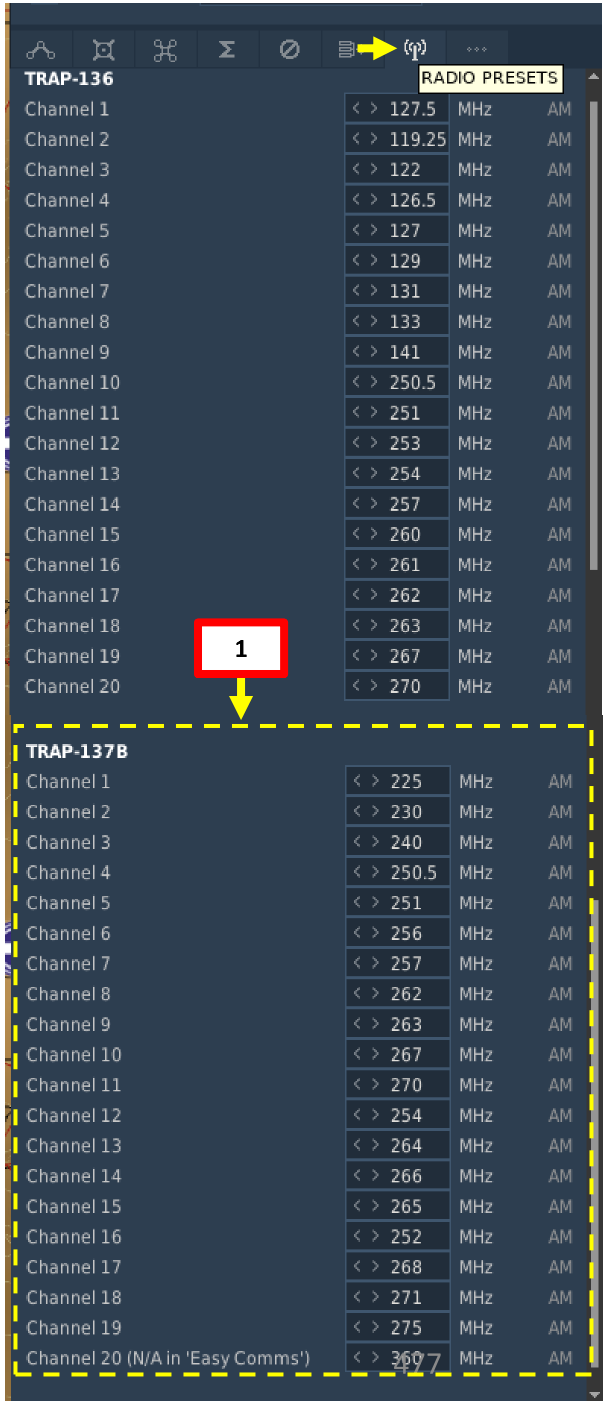


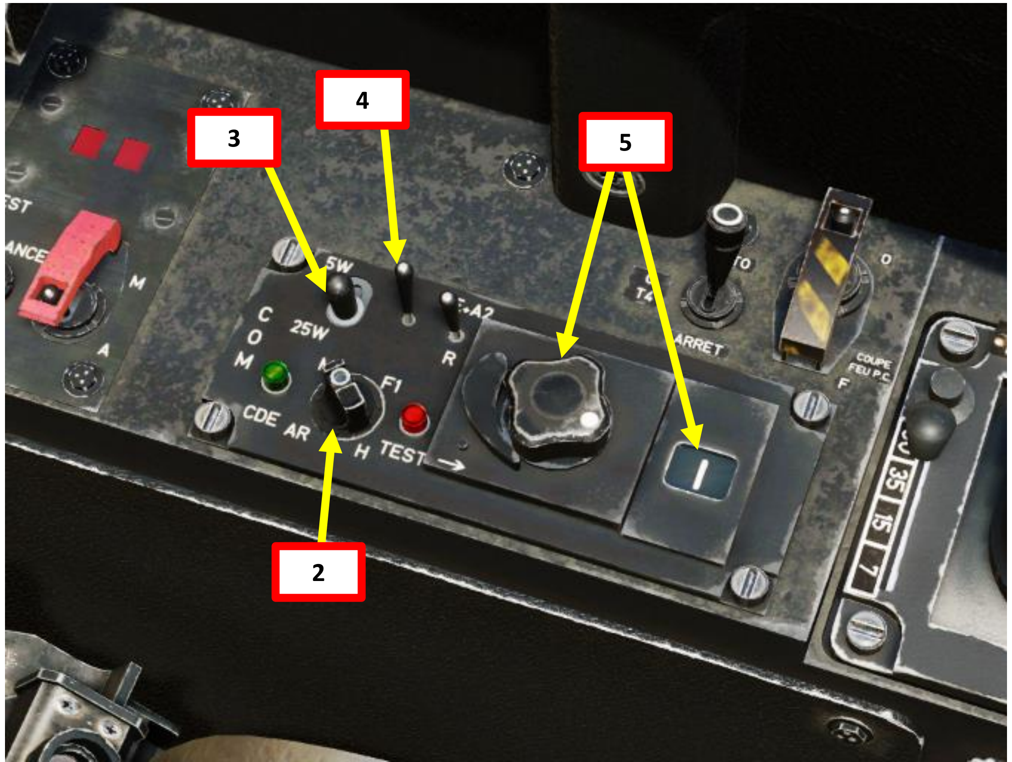


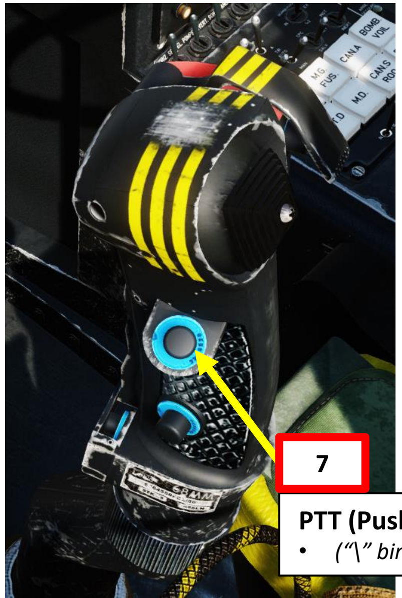
HOW TO USE TRAP 137B UHF (RED) RADIO

1. Preset radio frequencies are set via the Mission Editor.
2. Set TRAP 137B UHF Radio (Red Radio) Mode Selector – MARCHE/ON.
3. Set UHF Radio Transmitter Power Switch – 5 W (LEFT).
4. Set UHF Radio SIL *(Silence)* / Squelch Switch – ON (LEFT).
5. Set UHF Radio Preset Channel – As required.
6. Push TRAP 137B UHF Radio (Red Radio) Audio Control Knob (left click) to select TRAP 136 radio for transmission. Rotate knob (scroll mousewheel) to adjust volume.
7. Press “\” (Communication Menu, Radio Microphone Push-to-Talk Button) to transmit.





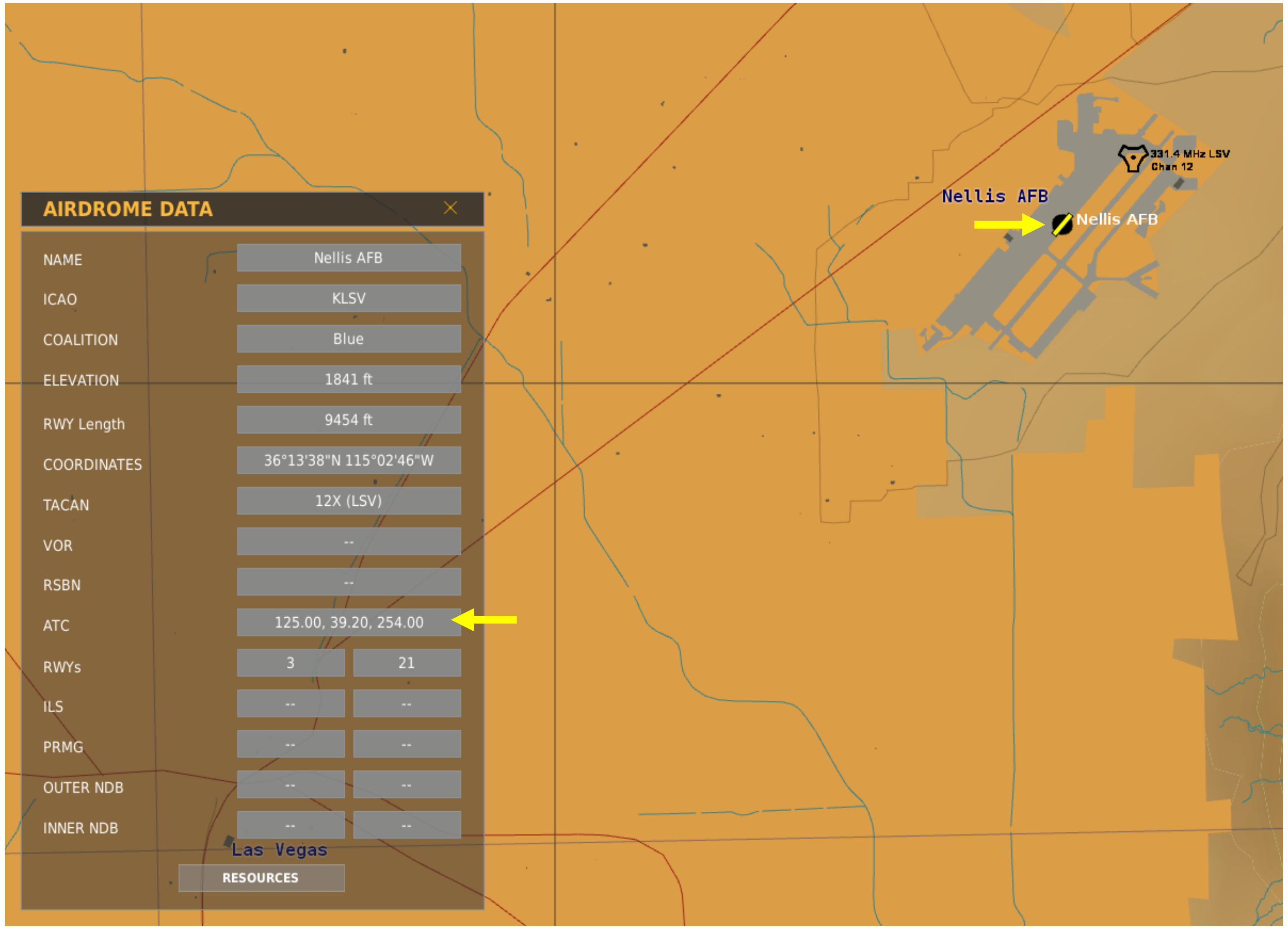




PTT (Push-to-Talk) Radio Button
- *(“\” binding)*

AIRFIELD FREQUENCIES

You can find airfield ATC frequencies by clicking on their icons in the map (press F10 to show the map).



RADIO FREQUENCIES – AIRFIELDS

LOCATION	FREQUENCY
Anapa	121.0
Batumi	131.0
Beslan	141.0
Gelendzhik	126.0
Gudauta	130.0
Kobuleti	133.0
Kutaisi	134.0
Krasnodar Center	122.0
Krasnodar Pashkovsky	128.0
Krymsk	124.0
Maykop	125.0
Mineral'nye Vody	135.0
Mozdok	137.0
Nalchik	136.0
Novorossiysk	123.0
Senaki	132.0
Sochi	127.0
Soganlug	139.0
Sukhumi	129.0
Tblisi	138.0
Vaziani	140.0

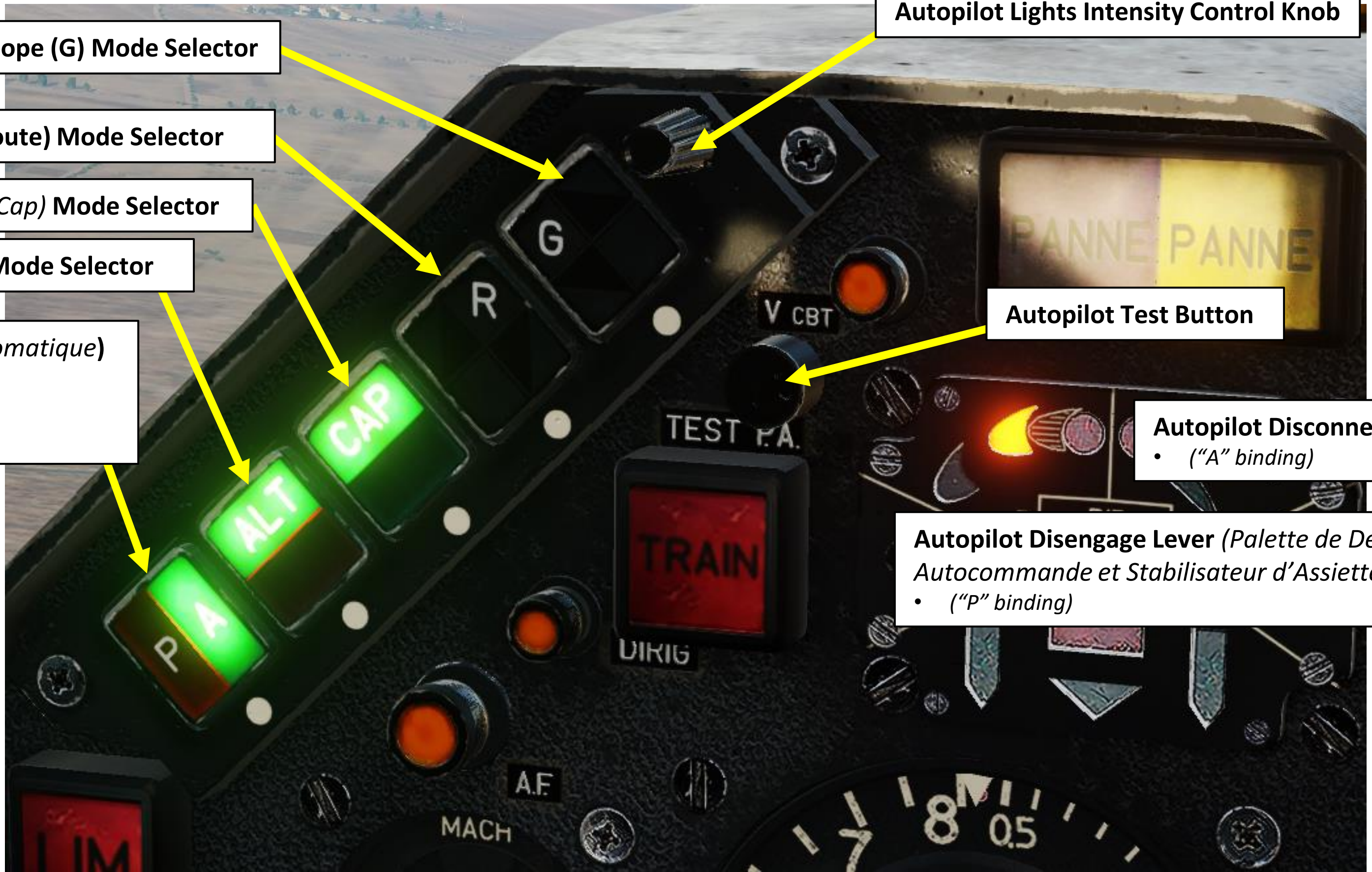
AUTOPILOT MODES OVERVIEW

These are the PA (*Pilote Automatique*) autopilot modes on the Mirage F1.

- **Attitude Hold Mode**: Autopilot maintains current aircraft pitch and roll attitude. This basic mode is engaged by depressing the "PA" pushbutton.
- **Altitude Hold Mode**: Autopilot maintains current aircraft altitude when mode is engaged.
- **Heading (Cap) Mode**: Autopilot steers aircraft to selected heading set with the Heading Selection *(Cap Affiché)* Control Knob.
- **Localizer (R, Route) Mode**: Autopilot steers aircraft to line itself up laterally (minimize localizer deviation) for an ILS (Instrument Landing System) approach in low visibility conditions. This mode can also track a VOR or a TACAN station.
- **Glide Slope (G) Mode**: Autopilot steers aircraft to line itself up vertically (minimize glide slope deviation) for an ILS (Instrument Landing System) approach in low visibility conditions.
  - See ILS (Instrument Landing System) tutorial in Navigation section.

Trim Hat
- *UP: Trim Nose DOWN*
- *DOWN: Trim Nose UP*
- *LEFT: Trim Roll LEFT*
- *RIGHT: Trim Roll RIGHT*

Note: Pitch Trim is "Profondeur", Roll Trim is "Gauchissement"



Autopilot Glide Slope (G) Mode Selector

Autopilot Localizer (R, Route) Mode Selector

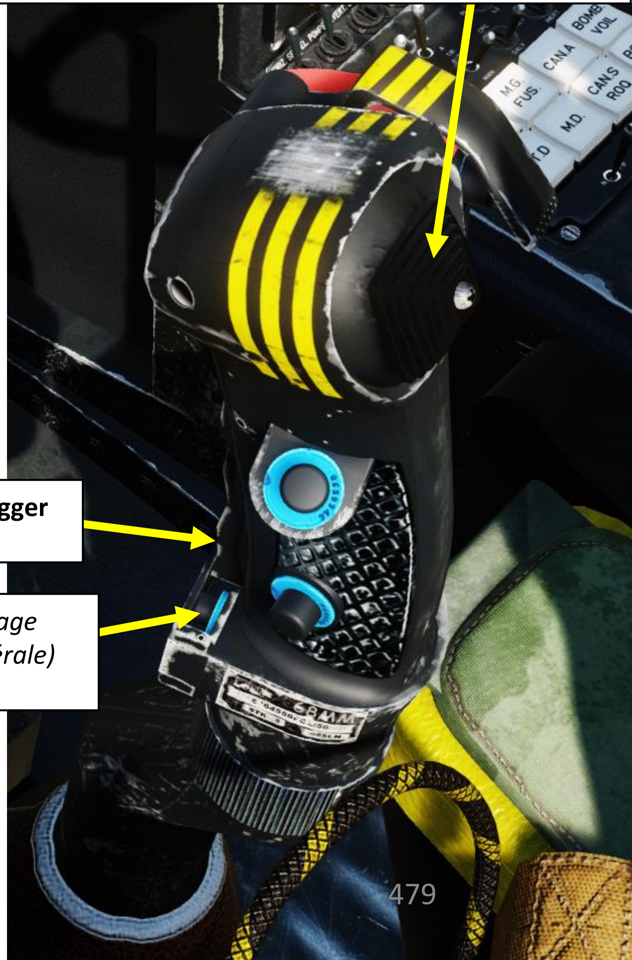
Autopilot Heading *(Cap)* Mode Selector

Autopilot Altitude Hold Mode Selector

Autopilot (PA, *Pilote Automatique*) Master Control Button
- *Green: Autopilot engaged*
- *Amber: Disconnected*

Autopilot Lights Intensity Control Knob

Autopilot Test Button



Autopilot Disconnect Trigger
- *("A" binding)*

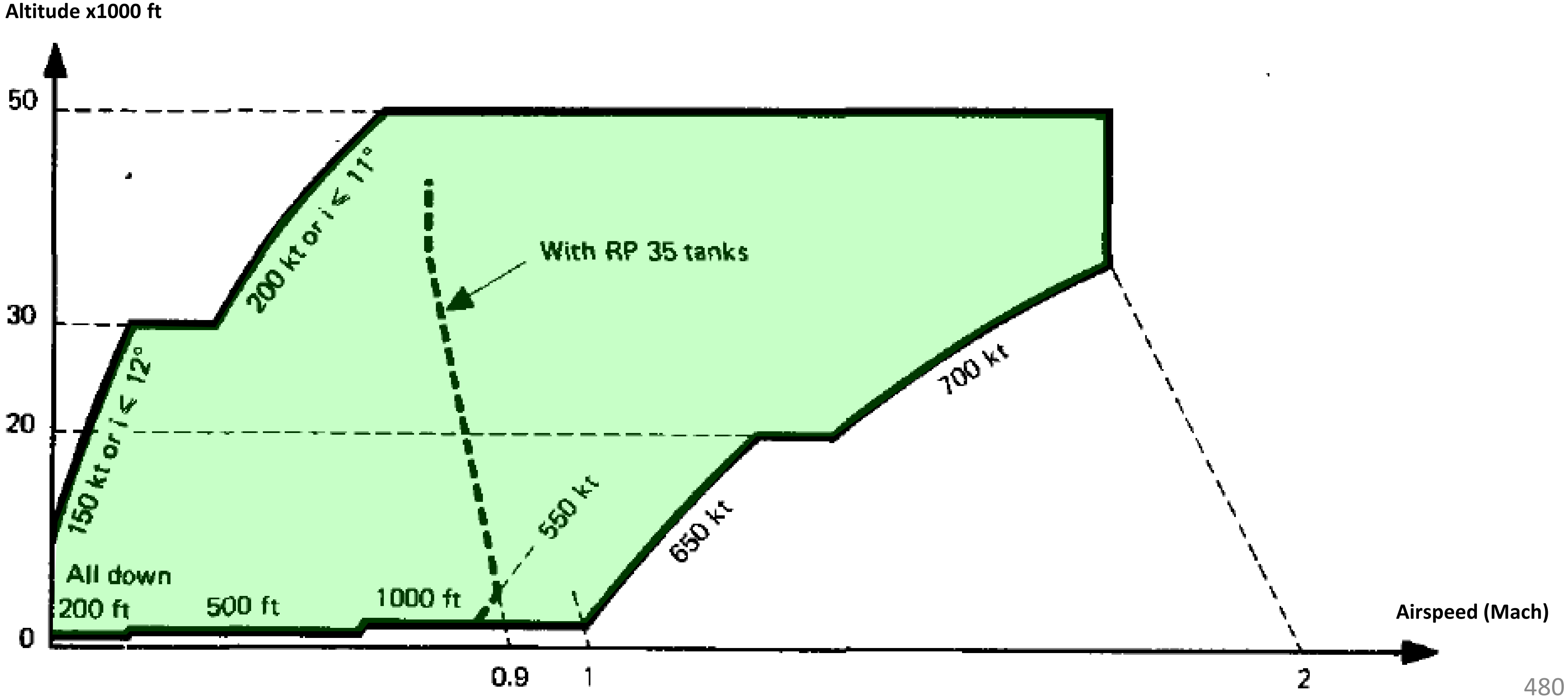
Autopilot Disengage Lever *(Palette de Débrayage Autocommande et Stabilisateur d'Assiette Latérale)*
- *("P" binding)*

AUTOPILOT ENGAGEMENT LIMITS

The autopilot can be engaged only while flying within the autopilot operation envelope. Here is a short list of these limitations:

- The autopilot will not engage at bank angles exceeding 60 deg
- The autopilot will not engage at pitch angles exceeding 30 deg.
- Below 1000 ft altitude, the autopilot will not engage at speeds above 450 kts.
- Between 1000 ft and 20000 ft altitude, the autopilot maximum autopilot engagement speed increases to 650 kts.
- Between 20000 ft and 36000 ft altitude, the maximum autopilot engagement speed increases to 700 kts.
- Over 36000 ft altitude, the autopilot will not engage when flying at airspeeds greater than Mach 2.0.

Autopilot Operation Envelope (Green Zone)



AUTOPILOT BASIC EMPLOYMENT / ATTITUDE HOLD MODE

1. Engage the autopilot by pressing the **Autopilot (PA, *Pilote Automatique*) Master Control Button**. Once PA green button illuminates, the autopilot is engaged. If the bank attitude during the autopilot connection is less than 10°, the autopilot will keep current heading.
   - Note: It is recommended to engage the autopilot while holding the Autopilot Disconnect trigger depressed on the control stick grip in order to avoid a potential unwanted reaction of the autopilot.
2. The autopilot connects initially in basic functions (pitch/roll attitude hold). Other functions can then be engaged as well subsequently (see next tutorials for more details).
3. Keeping the **Autopilot Disconnect Trigger pressed** the pilot can control the airplane pitch and roll with the control stick while keeping the autopilot armed. When Autopilot Disconnect trigger is released, the autopilot will keep the last attitude recorded prior to trigger release.
4. The "**BIP trim**" is a device which permits to modify the current pitch attitude and heading that the autopilot maintains while in basic functions. It is controlled with pitch and roll trim pulses by using the **Trim Hat controls**.
   - A pulse in pitch modifies the attitude by 0.8° in pitch, and a pulse in roll modifies the current heading by 2°.
   - The number of pulses is limited to ±10 in pitch and ±15 in roll, which translates into a maximum change in pitch attitude and heading of ±8° and to ±30° respectively.
   - The reset of the pulse counters is done by disengaging the autopilot.

Autopilot (PA, *Pilote Automatique*) Master Control Button
- *Green: Autopilot engaged*

1

Trim Hat
- *UP: Trim Nose DOWN*
- *DOWN: Trim Nose UP*
- *LEFT: Trim Roll LEFT*
- *RIGHT: Trim Roll RIGHT*

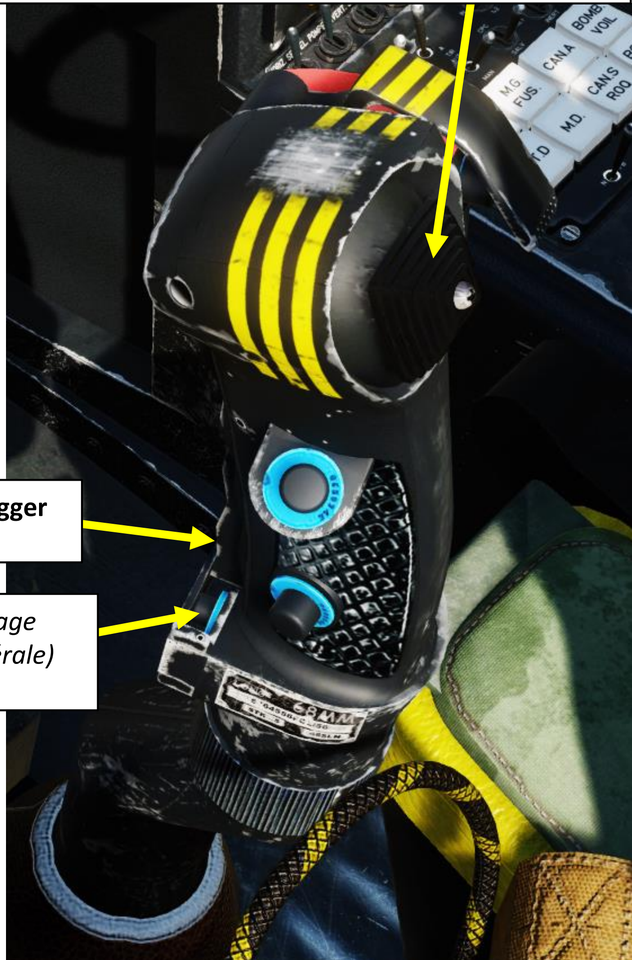
Note: Pitch Trim is "Profondeur", Roll Trim is "Gauchissement"

4

3

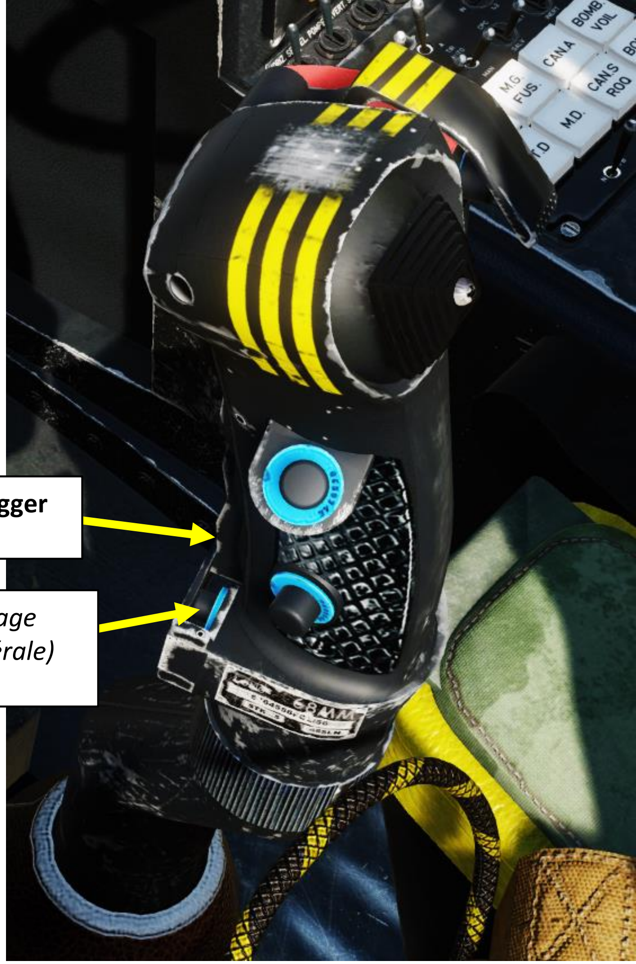
Autopilot Disconnect Trigger
- *("A" binding)*

Autopilot Disengage Lever *(Palette de Débrayage Autocommande et Stabilisateur d'Assiette Latérale)*
- *("P" binding)*



AUTOPILOT BASIC EMPLOYMENT / ATTITUDE HOLD MODE

5. Note transonic flight: When passing through the transonic range, the autopilot keeps connected, though it reverts to basic functions.
6. Pressing the **Autopilot Disconnect Trigger** (“A” binding) will make the autopilot revert to basic functions.
7. To **disengage the autopilot**, you can use any of the following methods:
   a) Press the **Autopilot Disengage Lever** (“P” binding).
   b) Press the **Autopilot (PA, *Pilote Automatique*) Master Control Button** again while autopilot is engaged.
   c) The autopilot will disengage automatically when exerting a certain force on the control stick in pitch or roll.
8. When autopilot is disengaged, the PA red light illuminates in the failure warning panel. A warning sound is also audible.
9. Pressing the **Autopilot Disconnect Trigger** (“A” binding) also resets the autopilot warning sound.



Autopilot Disconnect Trigger
- *(“A” binding)*

Autopilot Disengage Lever *(Palette de Débrayage Autocommande et Stabilisateur d’Assiette Latérale)*
- *(“P” binding)*

Autopilot (PA, *Pilote Automatique*) Master Control Button
- *Amber: Disconnected*

(PA, *Pilote Automatique*) Warning Light

AUTOPILOT HEADING *(CAP)* MODE

1. Engage the autopilot by pressing the **Autopilot (PA, *Pilote Automatique*) Master Control Button**. Once PA green button illuminates, the autopilot is engaged. If the bank attitude during the autopilot connection is less than 10°, the autopilot will keep current heading.
    - Note: It is recommended to engage the autopilot while holding the Autopilot Disconnect trigger depressed on the control stick grip in order to avoid a potential unwanted reaction of the autopilot.
2. The autopilot connects initially in basic functions (pitch/roll attitude hold).
3. Set desired autopilot heading using the **Heading Selection** *(Cap Affiché)* **Control Knob** and the **Selected Heading Indicator for Autopilot** on the IDN *(Indicateur de Navigation)* Navigation Indicator.
4. Press **Autopilot Heading *(Cap)* Mode Selector** to engage Heading Select.
    - Note: if desired, you can engage the ALT (Altitude Hold) Mode as well to combine both modes.
5. "CAP" (Heading) light will illuminate and aircraft autopilot will steer the aircraft towards the selected heading.

4 **Autopilot Heading *(Cap)* Mode Selector**

Autopilot (PA, *Pilote Automatique*) Master Control Button
- *Green: Autopilot engaged*
- *Amber: Disconnected*

1

3b **Selected Heading for Autopilot** *(Cap Affiché)*

Current Heading Index (Lubber Line)

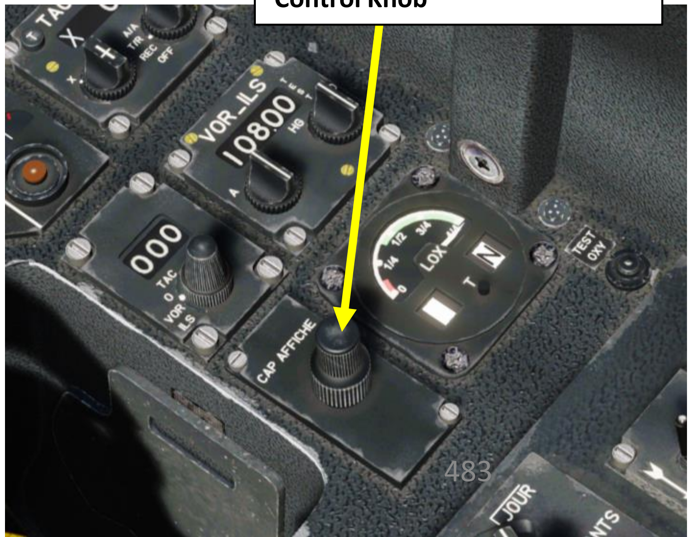
Mirage F1CE

3b **Selected Heading for Autopilot** *(Cap Affiché)*

Current Heading Index (Lubber Line)

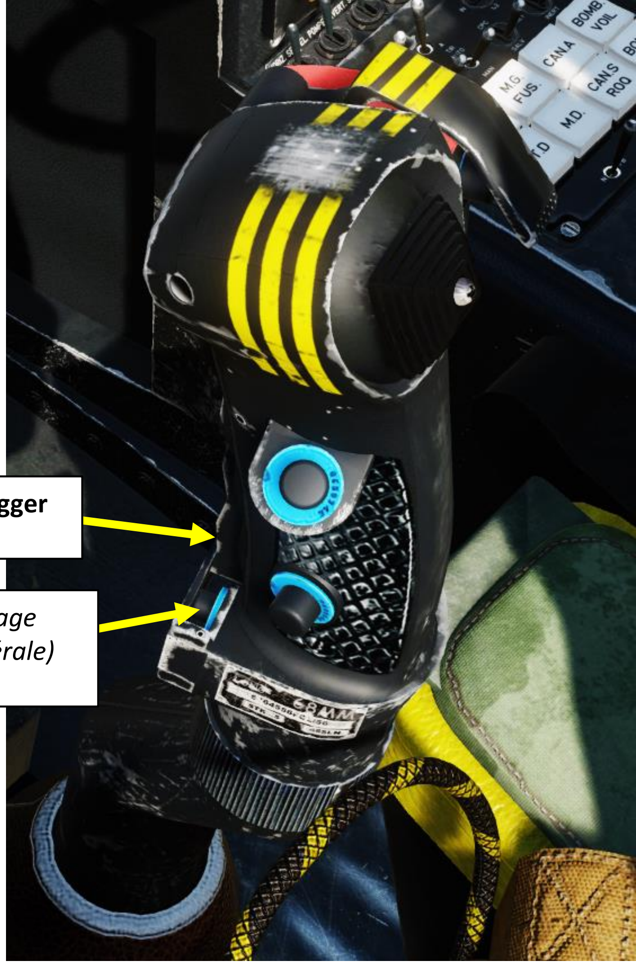
Mirage F1EE

3a **Heading Selection** *(Cap Affiché)* **Control Knob**



AUTOPILOT HEADING *(CAP)* MODE

6. Pressing the **Autopilot Disconnect Trigger** (“A” binding) will make the autopilot revert to basic functions.
7. To **disengage the autopilot**, you can use any of the following methods:
    a) Press the **Autopilot Disengage Lever** (“P” binding).
    b) Press the **Autopilot (PA, *Pilote Automatique*) Master Control Button** again while autopilot is engaged.
    c) The autopilot will disengage automatically when exerting a certain force on the control stick in pitch or roll.
8. When autopilot is disengaged, the PA red light illuminates in the failure warning panel. A warning sound is also audible.
9. Pressing the **Autopilot Disconnect Trigger** (“A” binding) also resets the autopilot warning sound.



Autopilot Disconnect Trigger
- *(“A” binding)*

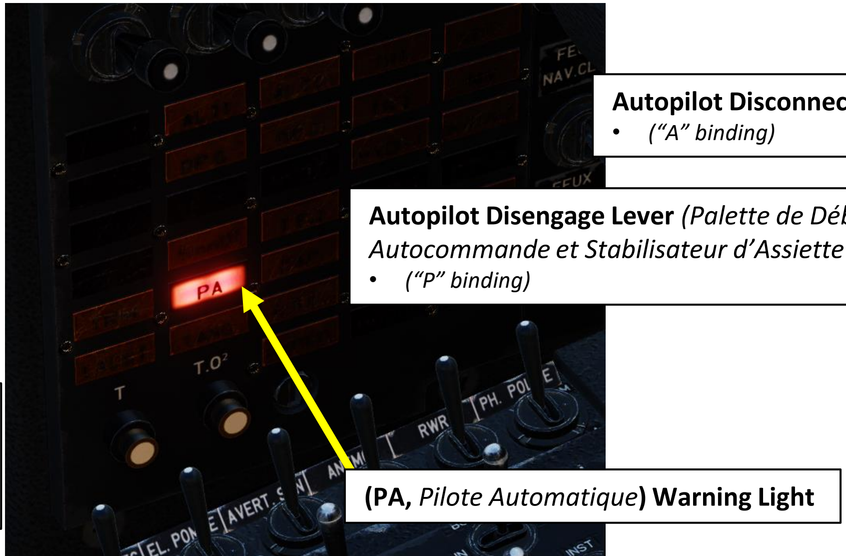
Autopilot Disengage Lever *(Palette de Débrayage Autocommande et Stabilisateur d’Assiette Latérale)*
- *(“P” binding)*

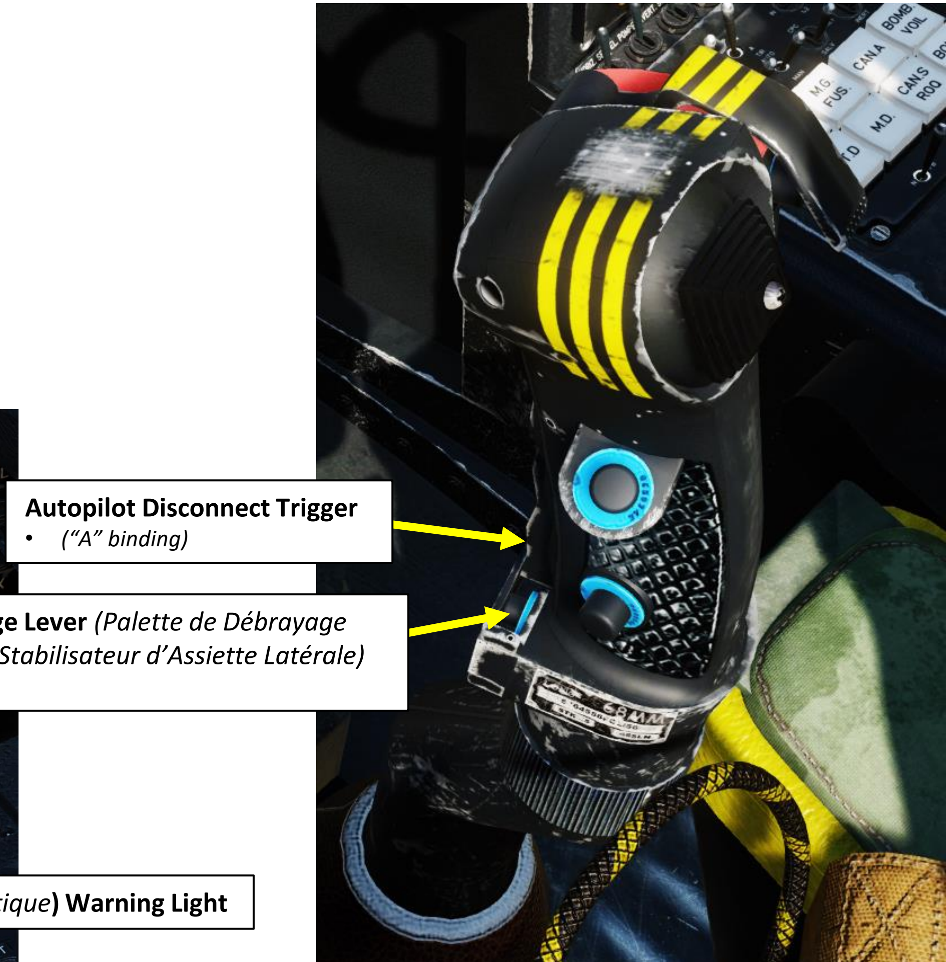
Autopilot (PA, *Pilote Automatique***) Master Control Button**
- *Amber: Disconnected*

(PA, *Pilote Automatique***) Warning Light**

AUTOPILOT ALTITUDE HOLD (ALT) MODE

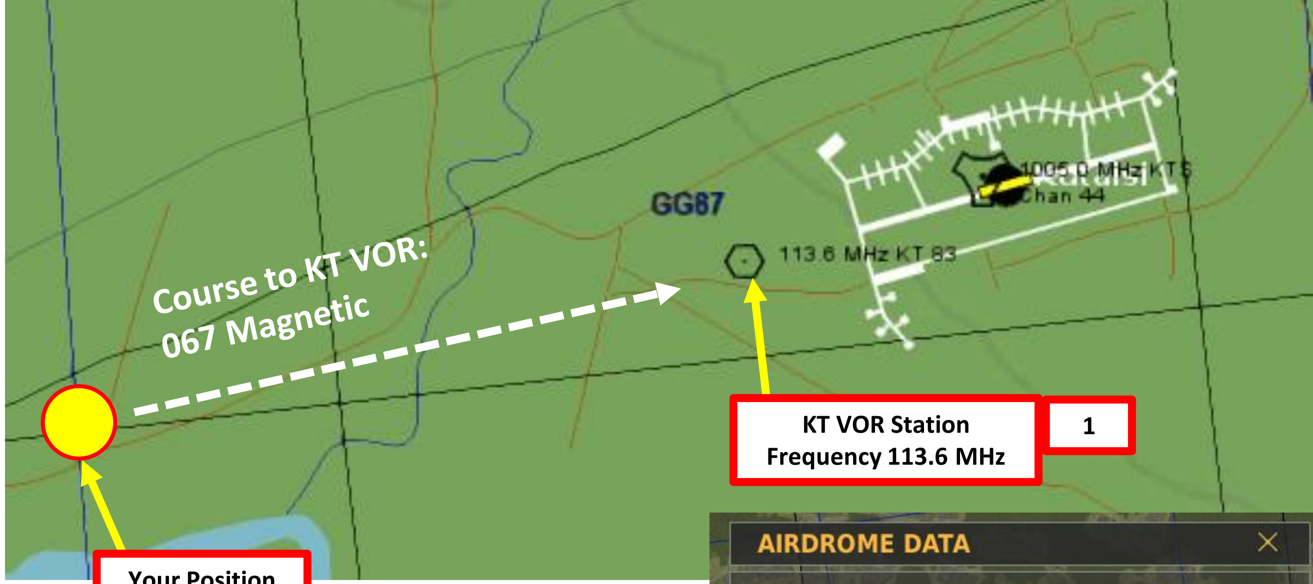
1. Engage the autopilot by pressing the **Autopilot (PA, *Pilote Automatique*) Master Control Button**. Once PA green button illuminates, the autopilot is engaged. If the bank attitude during the autopilot connection is less than 10°, the autopilot will keep current heading.
    - Note: It is recommended to engage the autopilot while holding the Autopilot Disconnect trigger depressed on the control stick grip in order to avoid a potential unwanted reaction of the autopilot.
2. The autopilot connects initially in basic functions (pitch/roll attitude hold).
3. Press **Autopilot Altitude Hold Mode Selector** to engage Altitude Hold.
    - Note: The autopilot ALT mode will not engage if aircraft has a vertical speed greater than 5000 ft/min.
4. “ALT” light will illuminate and aircraft autopilot will maintain current altitude.
5. Note transonic flight: When passing through the transonic range, the autopilot keeps connected, though it reverts to basic functions. “ALT” light will keep flashing until the transonic range is fully surpassed. When trying to connect the autopilot Altitude Hold mode while in the transonic region, the red part of the ALT pushbutton will flash.
6. Pressing the **Autopilot Disconnect Trigger** (“A” binding) will make the autopilot revert to basic functions.
7. To **disengage the autopilot**, you can use any of the following methods:
    a) Press the **Autopilot Disengage Lever** (“P” binding).
    b) Press the **Autopilot (PA, *Pilote Automatique*) Master Control Button** again while autopilot is engaged.
    c) The autopilot will disengage automatically when exerting a certain force on the control stick in pitch or roll.
8. When autopilot is disengaged, the PA red light illuminates in the failure warning panel. A warning sound is also audible.
9. Pressing the **Autopilot Disconnect Trigger** (“A” binding) also resets the autopilot warning sound.

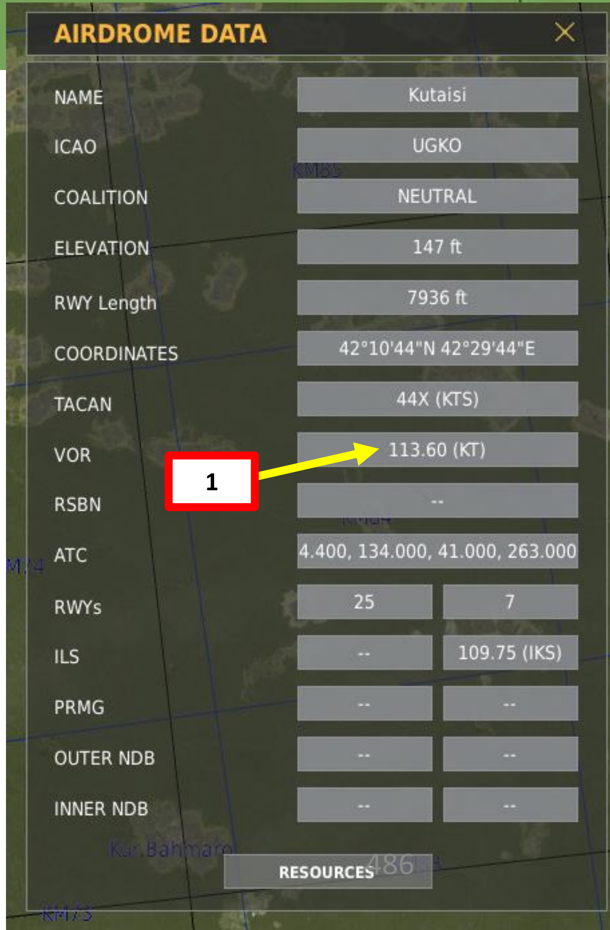


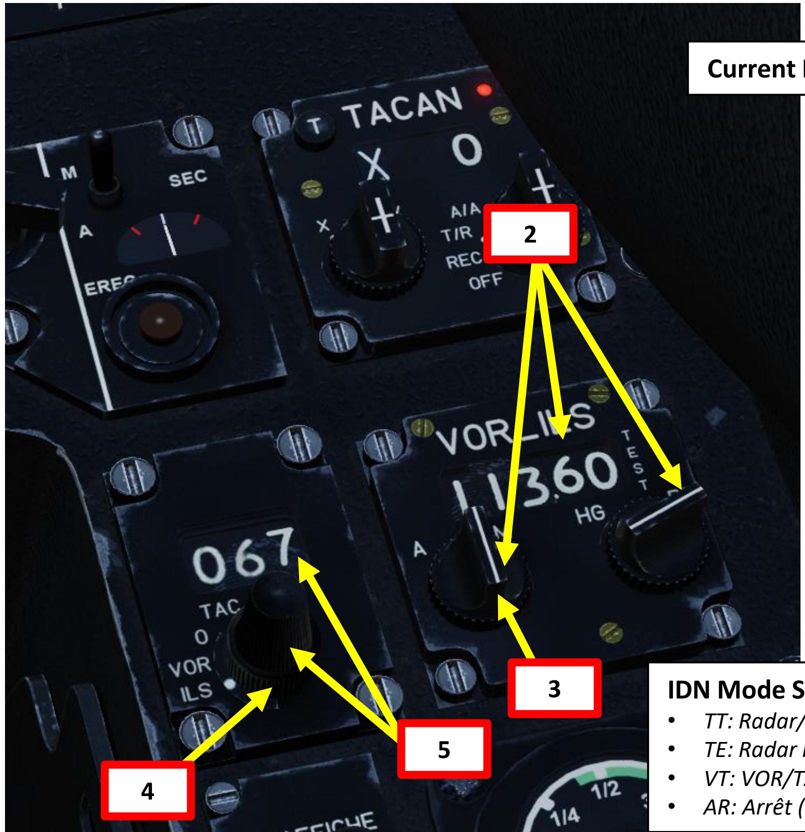


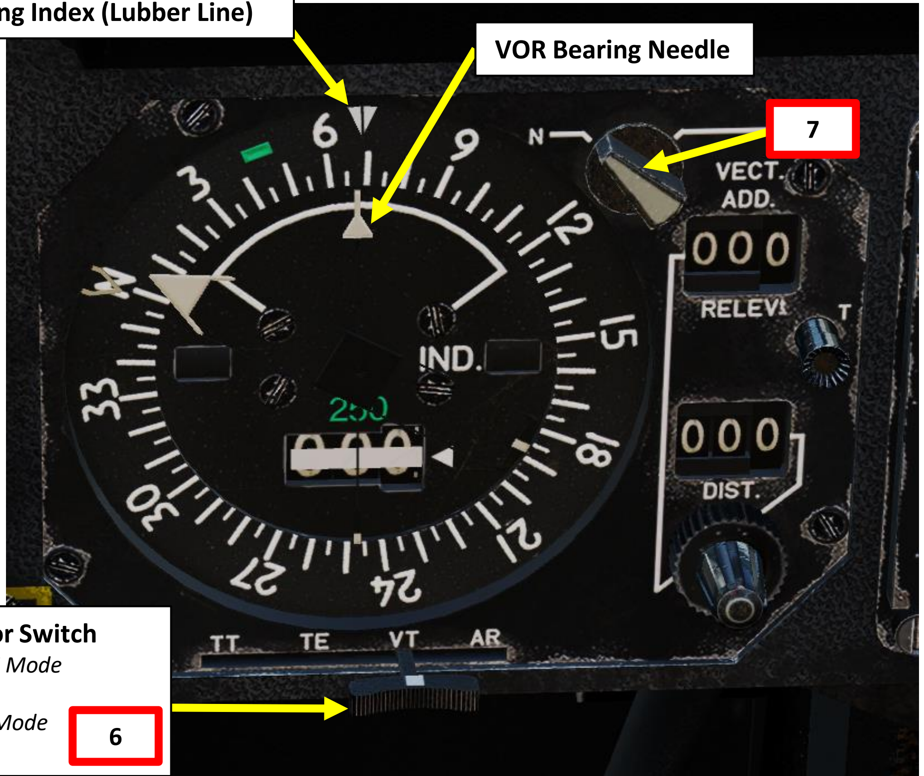
AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH VOR STATION

1. In this example, we will use the autopilot to track a VOR station with a course of 067 Magnetic.
2. Set VOR Frequency to 113.6 MHz – Scroll Mousewheel.
3. Set VOR-ILS Outer Control Knob to M (Marche, ON) – Mouse Click.
4. Set Navigation Aid (TACAN, VOR-ILS) Outer Knob Selector – VOR-ILS, Mouse Click.
5. Set Navigation Aid (TACAN, VOR-ILS) Inner Knob Selector (also referred as the "Omnibearing Selector") to the course we want to intercept the VOR station with, which is course 067. Scroll mousewheel to rotate knob.
6. Set IDN Mode Selector Switch – VT (VOR/TACAN) Mode.
7. Set IDN Normal/Additional Vector Selector – N (Normal)





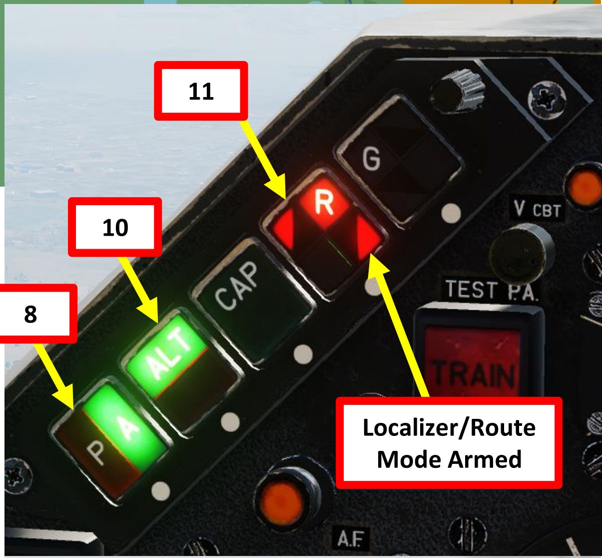


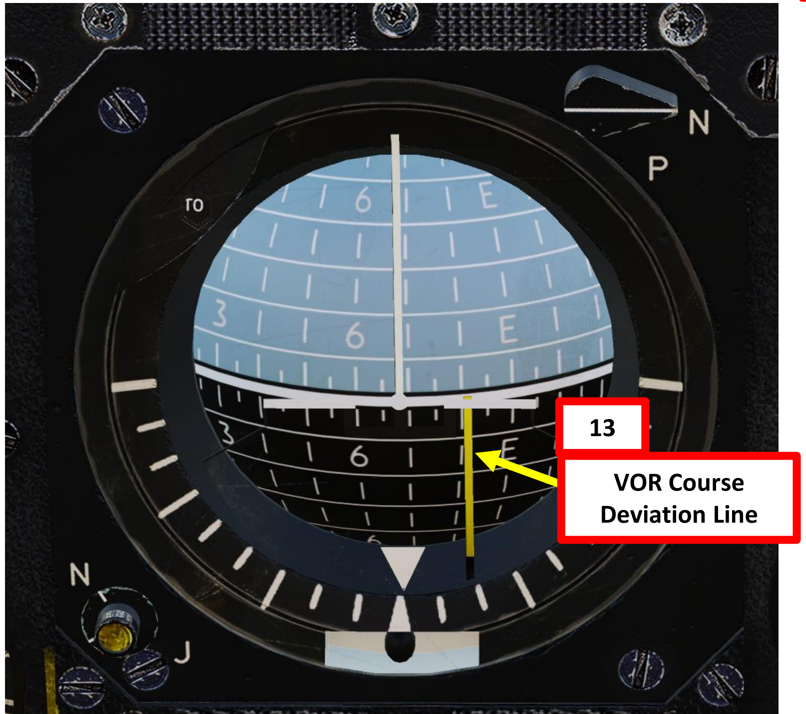


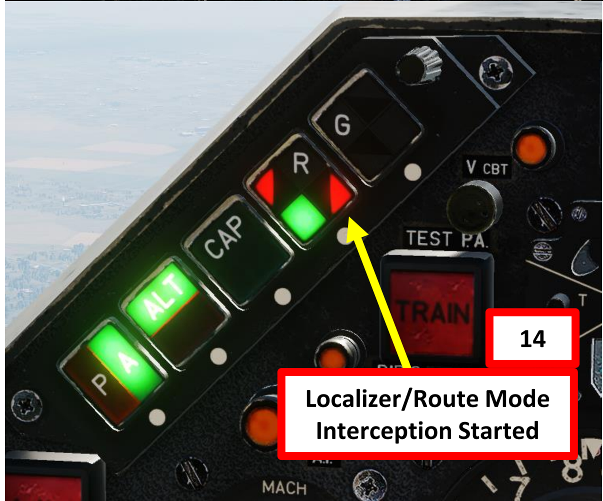
AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH VOR STATION

8. Engage the autopilot by pressing the **Autopilot (PA, *Pilote Automatique*) Master Control Button**. Once PA green button illuminates, the autopilot is engaged. If the bank attitude during the autopilot connection is less than 10°, the autopilot will keep current heading.
9. The autopilot connects initially in basic functions (pitch/roll attitude hold).
10. If desired, press **Autopilot Altitude Hold Mode Selector** to engage Altitude Hold. This will help you keep the aircraft level while intercepting the course to the navigation aid.
11. Press the "R" (Route) Mode Selector to Engage Route (Localizer) Mode.
12. If the aircraft is too far from the localizer, three red lights indicate that the Localizer/Route Mode is armed.
13. Once the VOR station is detected:
    a) Bearing to VOR station is available on the IDN *(Indicateur de Navigation)* Navigation Indicator. A morse code signal should be audible.
    b) The yellow line on the Spherical Indicator *(Indicateur Sphérique / Boule)* indicates deviation form the interception course to the VOR station.
14. Once VOR course interception has started, a green light and two red lights are visible on the R button. The autopilot will steer the aircraft to intercept the VOR station with the desired course (067 Magnetic).

- Note: The VOR station will not provide distance information.

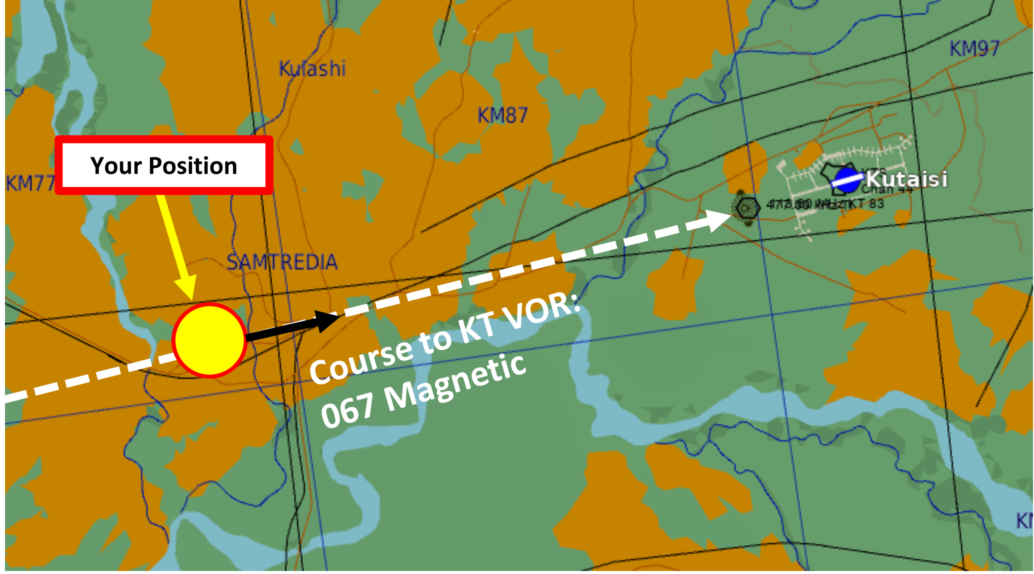


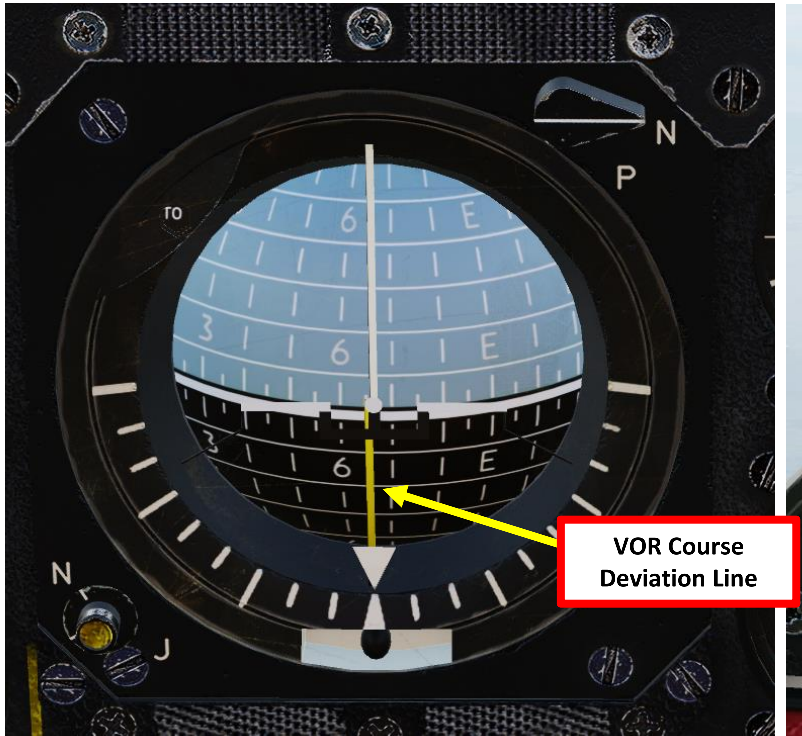




AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH VOR STATION

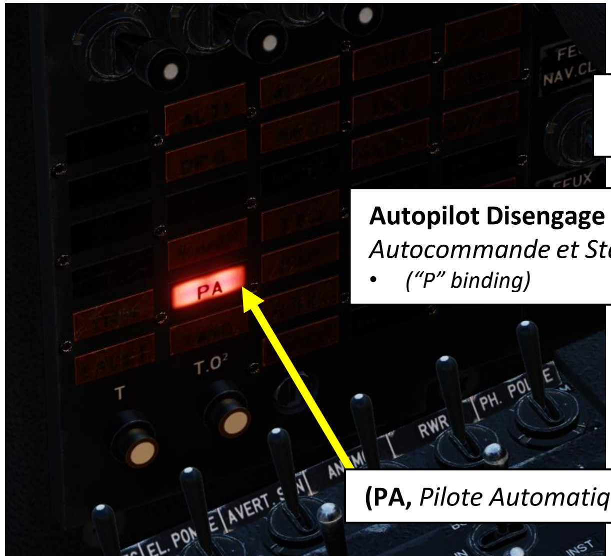
15. Once VOR course interception is complete, only a green light is visible on the R button. The autopilot will now keep the aircraft on the selected course towards the VOR station.

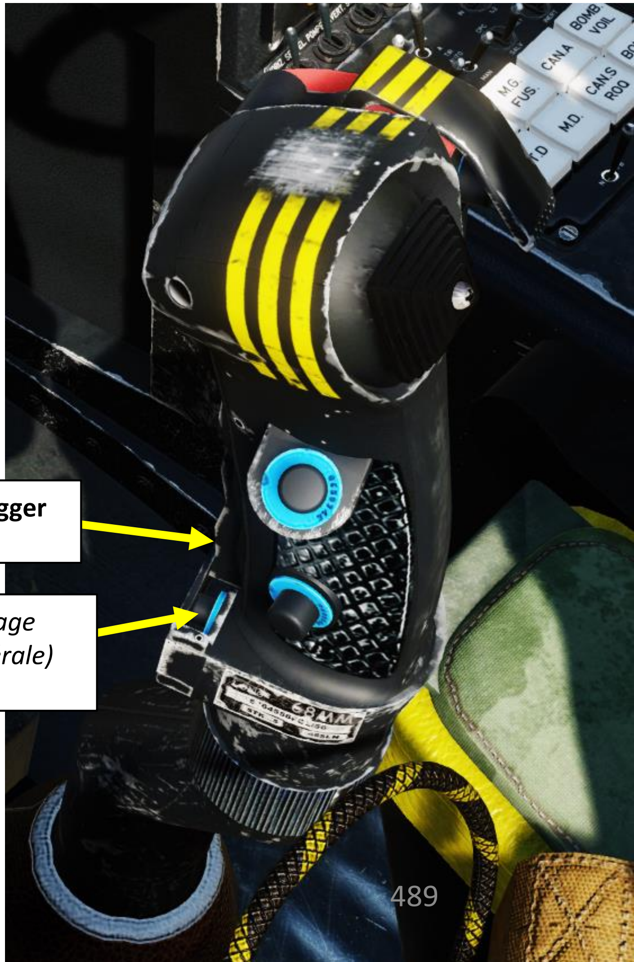




AUTOPILOT LOCALIZER (“R”, ROUTE) MODE EXAMPLE WITH VOR STATION

16. Pressing the **Autopilot Disconnect Trigger** (“A” binding) will make the autopilot revert to basic functions.
17. To **disengage the autopilot**, you can use any of the following methods:
    a) Press the **Autopilot Disengage Lever** (“P” binding).
    b) Press the **Autopilot (PA, *Pilote Automatique*) Master Control Button** again while autopilot is engaged.
    c) The autopilot will disengage automatically when exerting a certain force on the control stick in pitch or roll.
18. When autopilot is disengaged, the PA red light illuminates in the failure warning panel. A warning sound is also audible.
19. Pressing the **Autopilot Disconnect Trigger** (“A” binding) also resets the autopilot warning sound.





AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH VOR STATION (DIFFERENCES WITH MIRAGE F1EE)

In the Mirage F1EE, the process is very similar. The only practical difference comes with the IDN *(Indicateur de Navigation)* Navigation Indicator setup.

1. The **VOR/Radar Narrow Needle Selector** needs to be set to "V" (VOR).
2. The Narrow Needle on the IDN indicates the bearing to the VOR station.

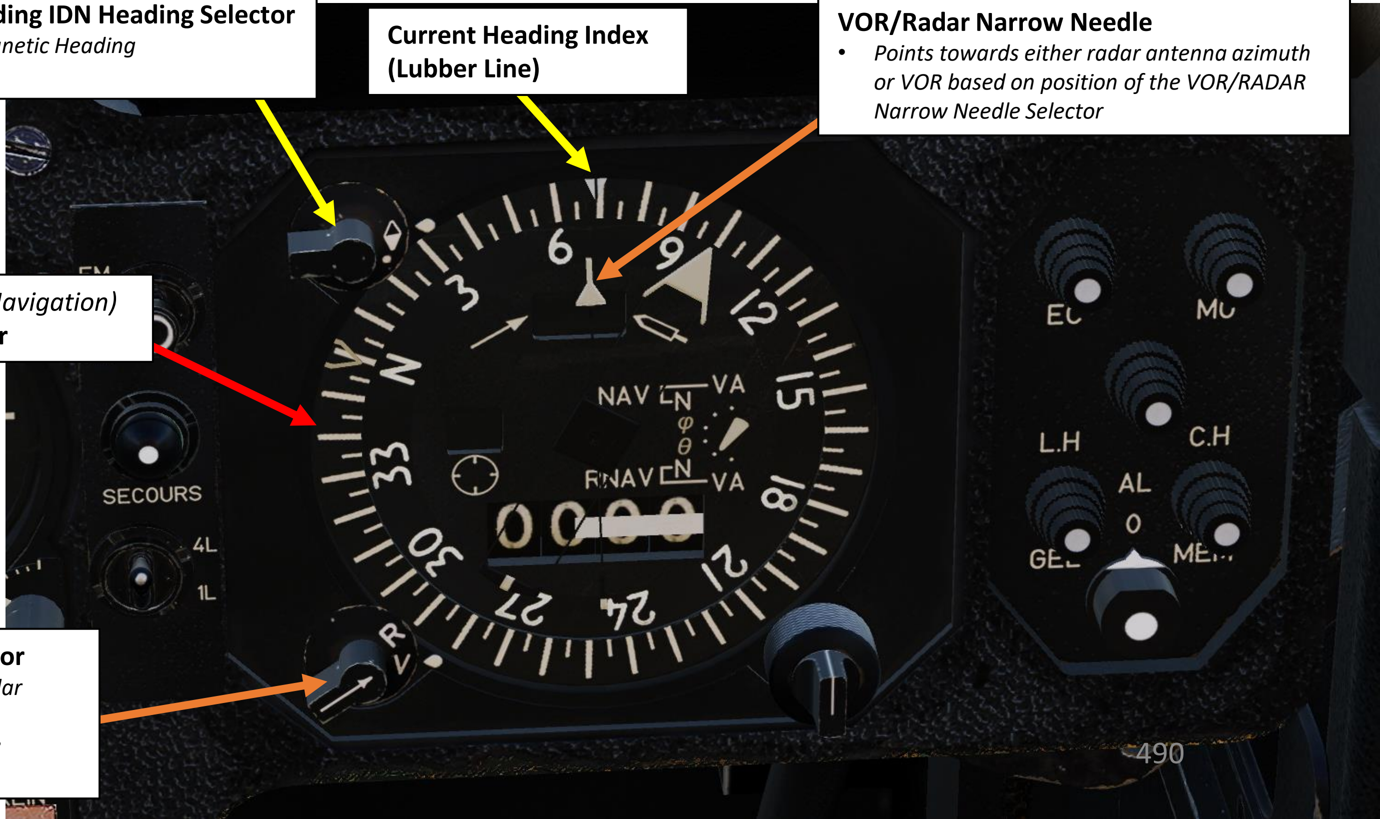
Mirage F1EE Only

Gyromagnetic / True Heading IDN Heading Selector
- *Diamond Symbol: Gyromagnetic Heading*
- *Dot Symbol: True Heading*

Current Heading Index (Lubber Line)

VOR/Radar Narrow Needle
- *Points towards either radar antenna azimuth or VOR based on position of the VOR/RADAR Narrow Needle Selector*

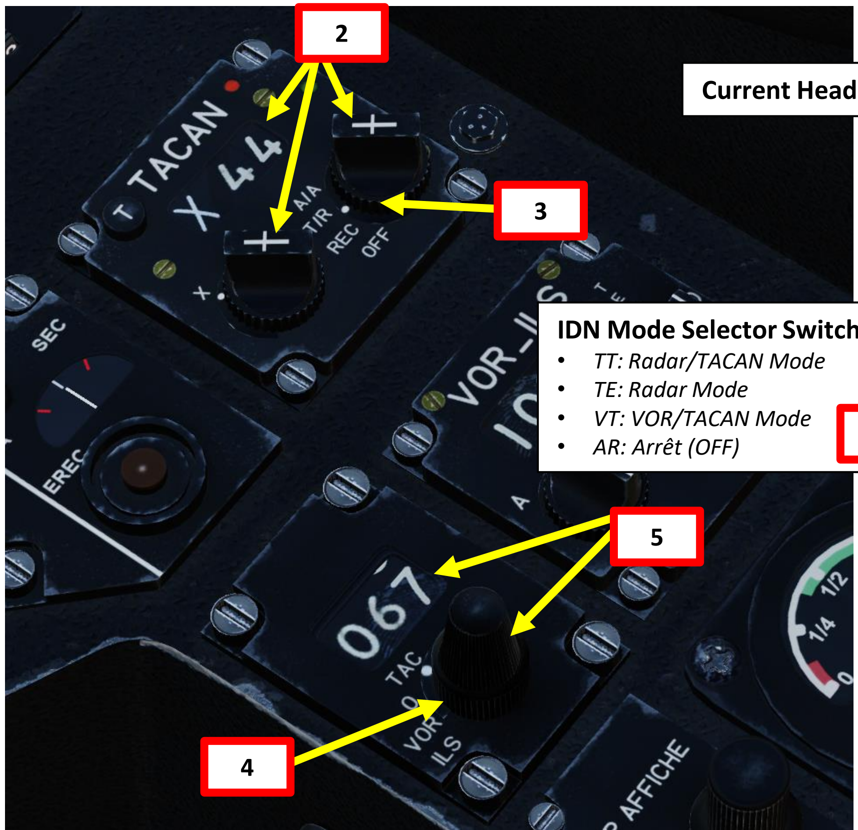
IDN *(Indicateur de Navigation)* **Navigation Indicator**

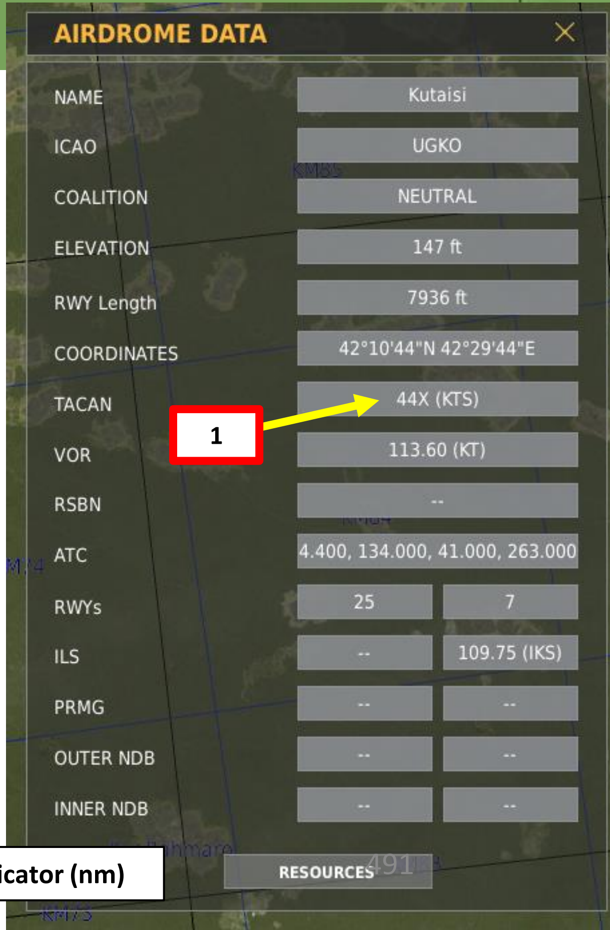


VOR/Radar Narrow Needle Selector
- *R: Narrow needle points towards radar antenna azimuth*
- *V: Narrow needle points towards the selected VOR*

AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH TACAN STATION

1. In this example, we will use the autopilot to track a TACAN station with a course of 067 Magnetic.
2. Set TACAN Station to 44X – Scroll mousewheel for channel numbers (44), click left knob for X/Y channel.
3. Set TACAN Mode to T/R (Transmit/Receive) – Mouse Click.
4. Set Navigation Aid (TACAN, VOR-ILS) Outer Knob Selector – TAC (TACAN), Mouse Click.
5. Set Navigation Aid (TACAN, VOR-ILS) Inner Knob Selector (also referred as the "Omnibearing Selector") to the course we want to intercept the TACAN station with, which is course 067. Scroll mousewheel to rotate knob.
6. Set IDN Mode Selector Switch – VT (VOR/TACAN) Mode.
7. Set IDN Normal/Additional Vector Selector – N (Normal)

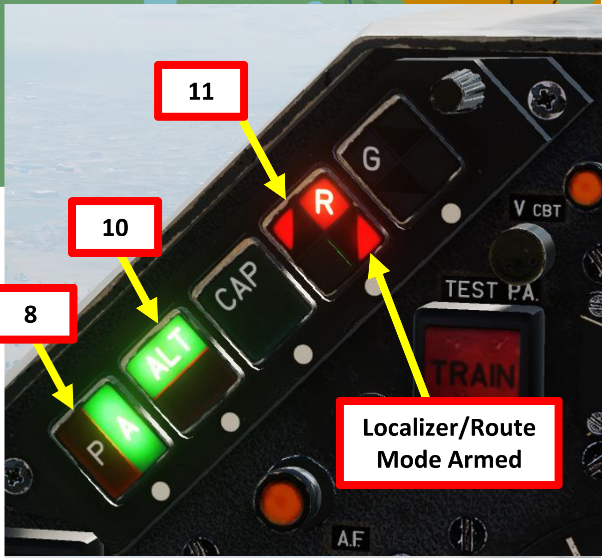


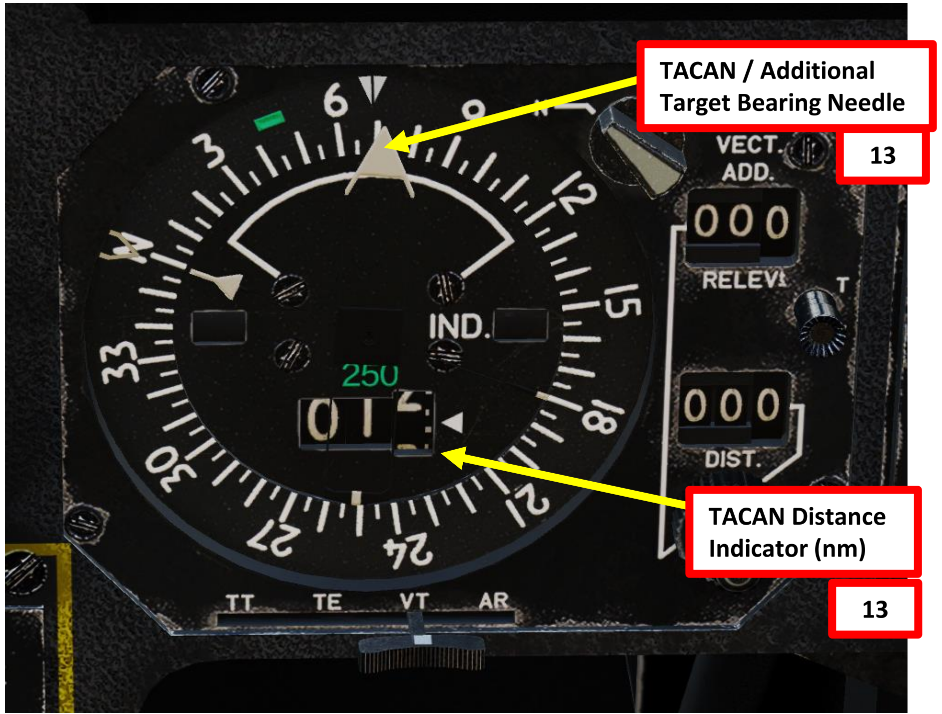


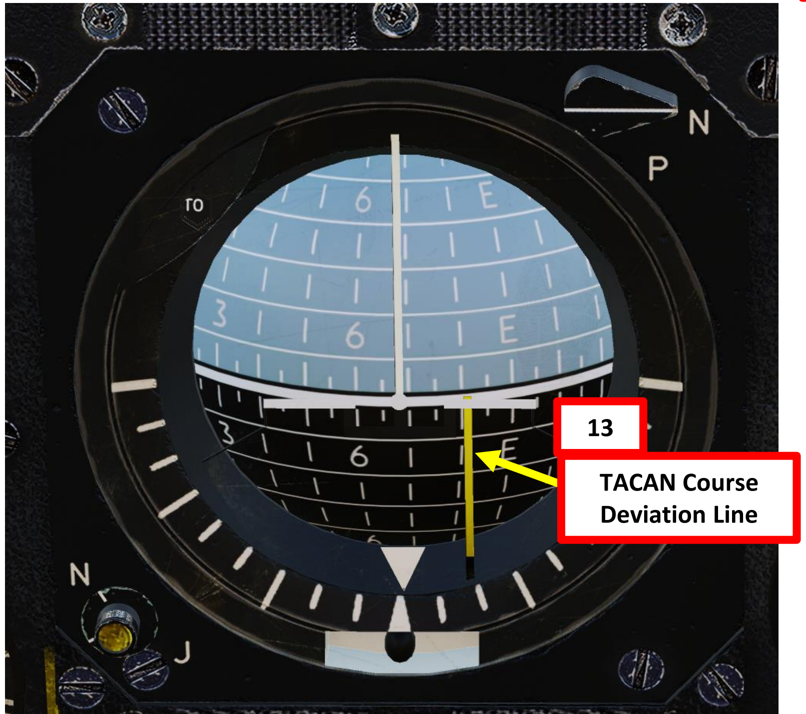
NAME	Kutaisi
ICAO	UGKO
COALITION	NEUTRAL
ELEVATION	147 ft
RWY Length	7936 ft
COORDINATES	42°10'44"N 42°29'44"E
TACAN	44X (KTS)
VOR	113.60 (KT)
RSBN	--
ATC	4.400, 134.000, 41.000, 263.000
RWYs	25 / 7
ILS	-- / 109.75 (IKS)
PRMG	-- / --
OUTER NDB	-- / --
INNER NDB	-- / --

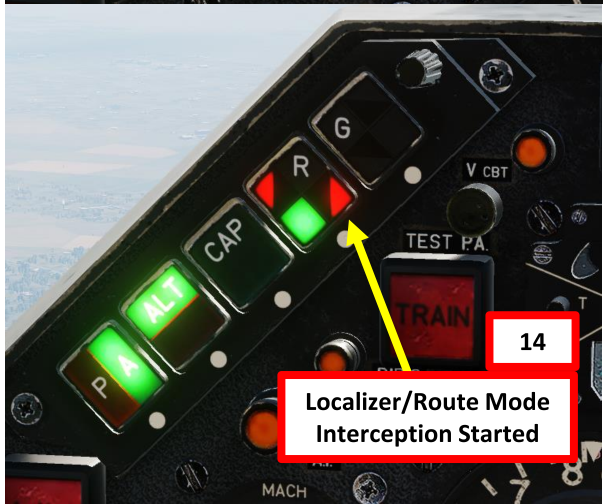
AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH TACAN STATION

8. Engage the autopilot by pressing the **Autopilot (PA, *Pilote Automatique*) Master Control Button**. Once PA green button illuminates, the autopilot is engaged. If the bank attitude during the autopilot connection is less than 10°, the autopilot will keep current heading.
9. The autopilot connects initially in basic functions (pitch/roll attitude hold).
10. If desired, press **Autopilot Altitude Hold Mode Selector** to engage Altitude Hold. This will help you keep the aircraft level while intercepting the course to the navigation aid.
11. Press the "R" (Route) Mode Selector to Engage Route (Localizer) Mode.
12. If the aircraft is too far from the localizer, three red lights indicate that the Localizer/Route Mode is armed.
13. Once the TACAN station is detected:
    a) Bearing to TACAN station and distance to TACAN information is available on the IDN *(Indicateur de Navigation)* Navigation Indicator. A morse code signal should be audible.
    b) The yellow line on the Spherical Indicator *(Indicateur Sphérique / Boule)* indicates deviation form the interception course to the TACAN station.
14. Once TACAN course interception has started, a green light and two red lights are visible on the R button. The autopilot will steer the aircraft to intercept the TACAN station with the desired course (067 Magnetic).



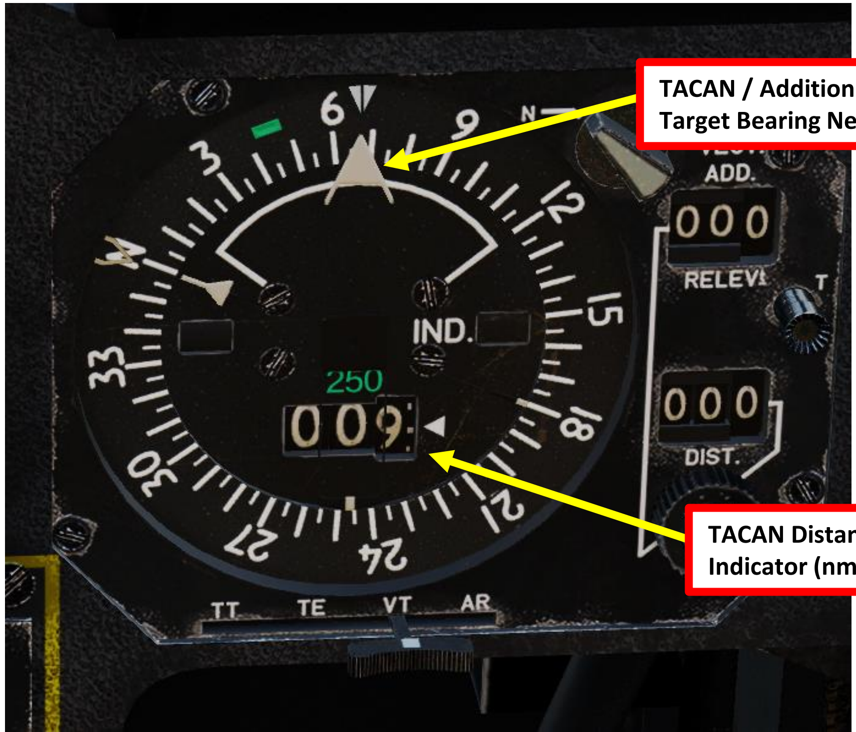


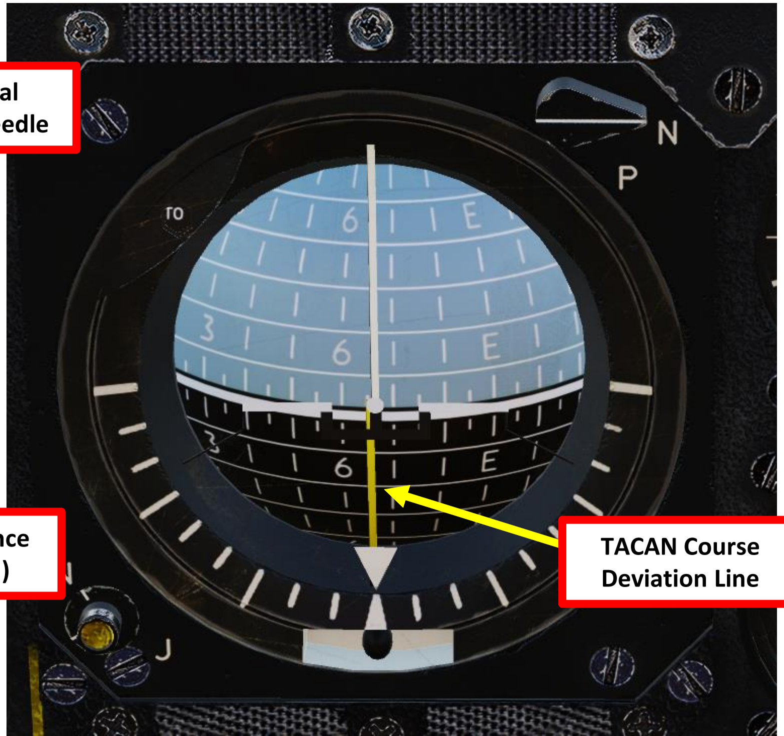




AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH TACAN STATION

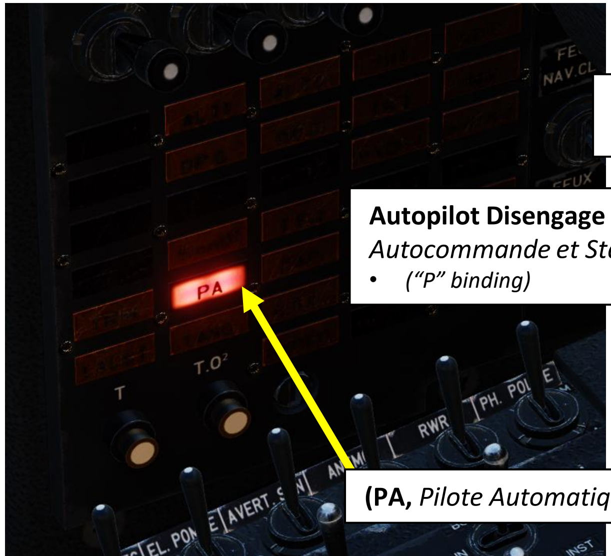
15. Once TACAN course interception is complete, only a green light is visible on the R button. The autopilot will now keep the aircraft on the selected course towards the TACAN station.



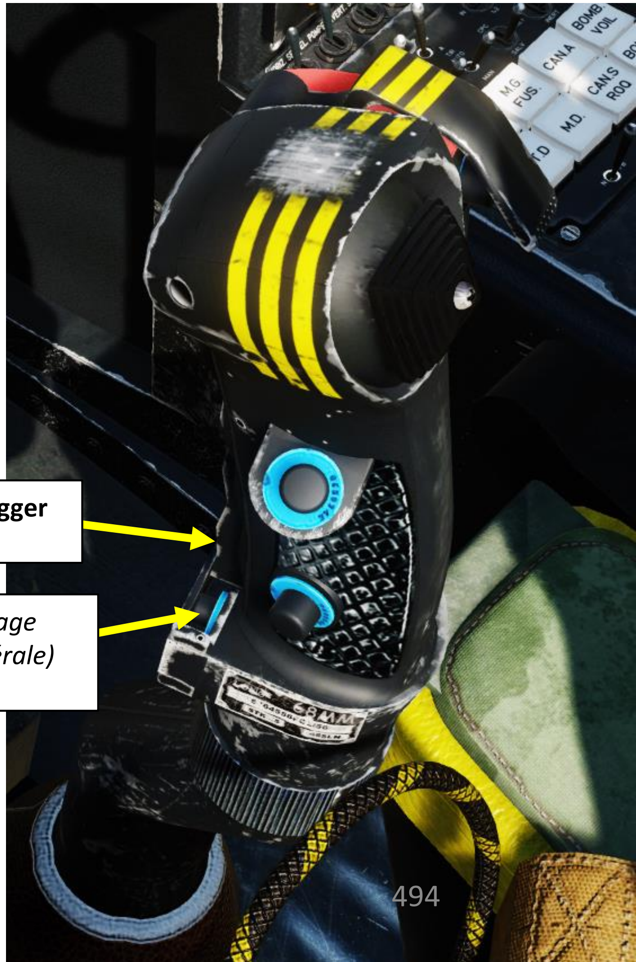


AUTOPILOT LOCALIZER ("R", ROUTE) MODE
EXAMPLE WITH TACAN STATION

16. Pressing the **Autopilot Disconnect Trigger** ("A" binding) will make the autopilot revert to basic functions.
17. To **disengage the autopilot**, you can use any of the following methods:
    a) Press the **Autopilot Disengage Lever** ("P" binding).
    b) Press the **Autopilot (PA, *Pilote Automatique*) Master Control Button** again while autopilot is engaged.
    c) The autopilot will disengage automatically when exerting a certain force on the control stick in pitch or roll.
18. When autopilot is disengaged, the PA red light illuminates in the failure warning panel. A warning sound is also audible.
19. Pressing the **Autopilot Disconnect Trigger** ("A" binding) also resets the autopilot warning sound.



(PA, *Pilote Automatique*) Warning Light



Autopilot Disconnect Trigger
- *("A" binding)*

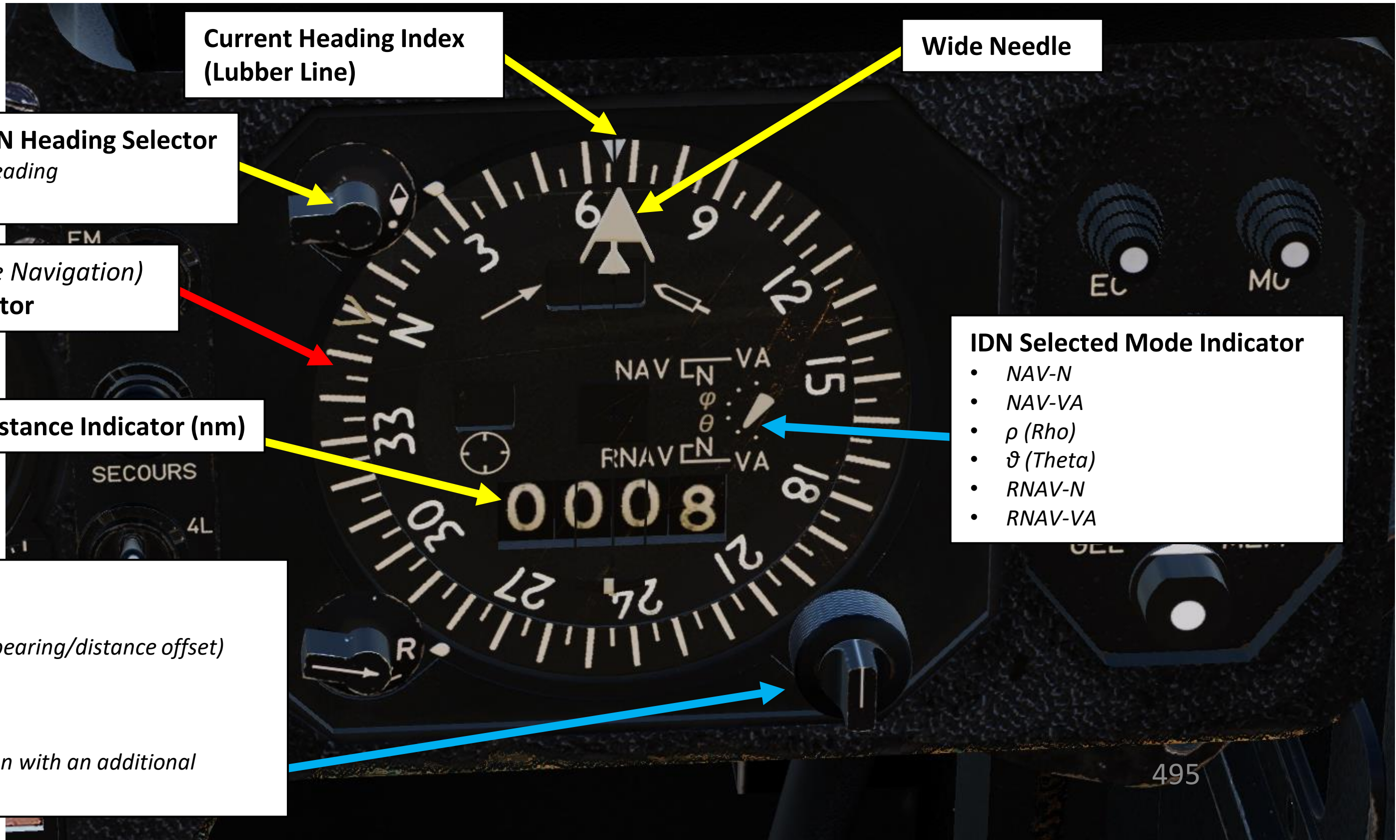
Autopilot Disengage Lever *(Palette de Débrayage Autocommande et Stabilisateur d'Assiette Latérale)*
- *("P" binding)*

AUTOPILOT LOCALIZER ("R", ROUTE) MODE EXAMPLE WITH TACAN STATION (DIFFERENCES WITH MIRAGE F1EE)

Mirage F1EE Only

In the Mirage F1EE, the process is very similar. The only practical difference comes with the IDN *(Indicateur de Navigation)* Navigation Indicator setup.

1. The **IDN Mode Selector** must be set to **RNAV-N** in order to display TACAN navigation information.
2. The Wide Needle on the IDN indicates the bearing to the TACAN station.



Current Heading Index (Lubber Line)

Wide Needle

Gyromagnetic / True Heading IDN Heading Selector
- *Diamond Symbol: Gyromagnetic Heading*
- *Dot Symbol: True Heading*

IDN *(Indicateur de Navigation)* **Navigation Indicator**

Distance Indicator (nm)

IDN Selected Mode Indicator
- *NAV-N*
- *NAV-VA*
- *ρ (Rho)*
- *ϑ (Theta)*
- *RNAV-N*
- *RNAV-VA*

IDN Mode Selector
- ***NAV-N**: Normal Navigation (from aircraft to a selected waypoint)*
- ***NAV-VA**: Navigation Vecteur Additionnel (from aircraft to a waypoint with an additional bearing/distance offset)*
- ***ρ (Rho)**: Additional Vector Distance Display*
- ***ϑ (Theta):** Additional Vector Azimuth Display*
- ***RNAV-N**: Normal RNAV Navigation (from aircraft to a selected TACAN station)*
- ***RNAV-VA**: Navigation RNAV Vecteur Additionnel (from aircraft to a selected TACAN station with an additional bearing/distance offset)*

SECTION STRUCTURE

1 – NAVIGATION INTRODUCTION

Navigation is an extensive subject. You can check chapter 16 of FAA manual for more details on navigation.

Link: https://www.faa.gov/sites/faa.gov/files/18_phak_ch16.pdf

- "NDB" is what we call a non-directional beacon. It transmits radio waves on a certain frequency on long distances. These waves are read by an ADF (automatic direction finder) system. NDBs are typically used for radio navigation.

- "VOR" is what we call a VHF Omnidirectional Range system. It transmits radio waves on a certain frequency. These waves are read by a VOR receiver. VOR systems, just like NDBs, can be used for radio navigation. A VOR station on the ground only provides bearing.

NDBs and VORs are used just like lighthouses were used to guide ships. This way, air corridors and airways are created to help control an increasingly crowded sky.

- ILS (Instrument Landing System) allows an aircraft find their way to an airstrip (provided it is equipped with a VOR or NDB) despite bad visibility conditions.

- TACAN is a Tactical Air Navigation System used by the military. TACAN beacons can be placed on ground stations, airfields or even aircraft themselves like tankers. The TACAN station equipment on the ground has two parts, one provides bearing and the other one distance.

The Mirage F1CE and F1EE variants can only use VOR, TACAN and ILS navigation aids.

1 – NAVIGATION INTRODUCTION

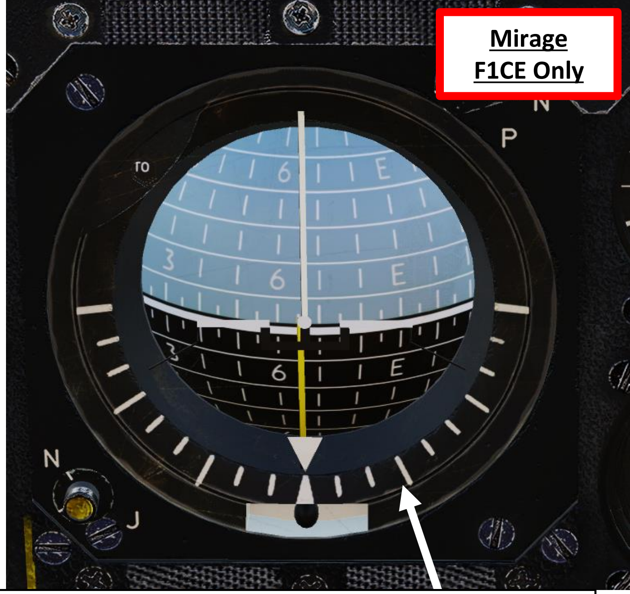
Navigation in the **Mirage F1CE** is primarily done in VFR (Visual Flight Rules) conditions, which means that you navigate by using a map and landmarks to orient yourself. The IDN (*Indicateur de Navigation*), or "Navigation Indicator", is the main instrument at your disposal to orient yourself, which is complemented with a Standby Magnetic Compass. The aircraft orientation/attitude is determined with gyros and indicated by the "Spherical Indicator", which acts as an artificial horizon.

To fly in IFR (Instrument Flight Rules) conditions which include low visibility and night flying, the following navigation aids are available:

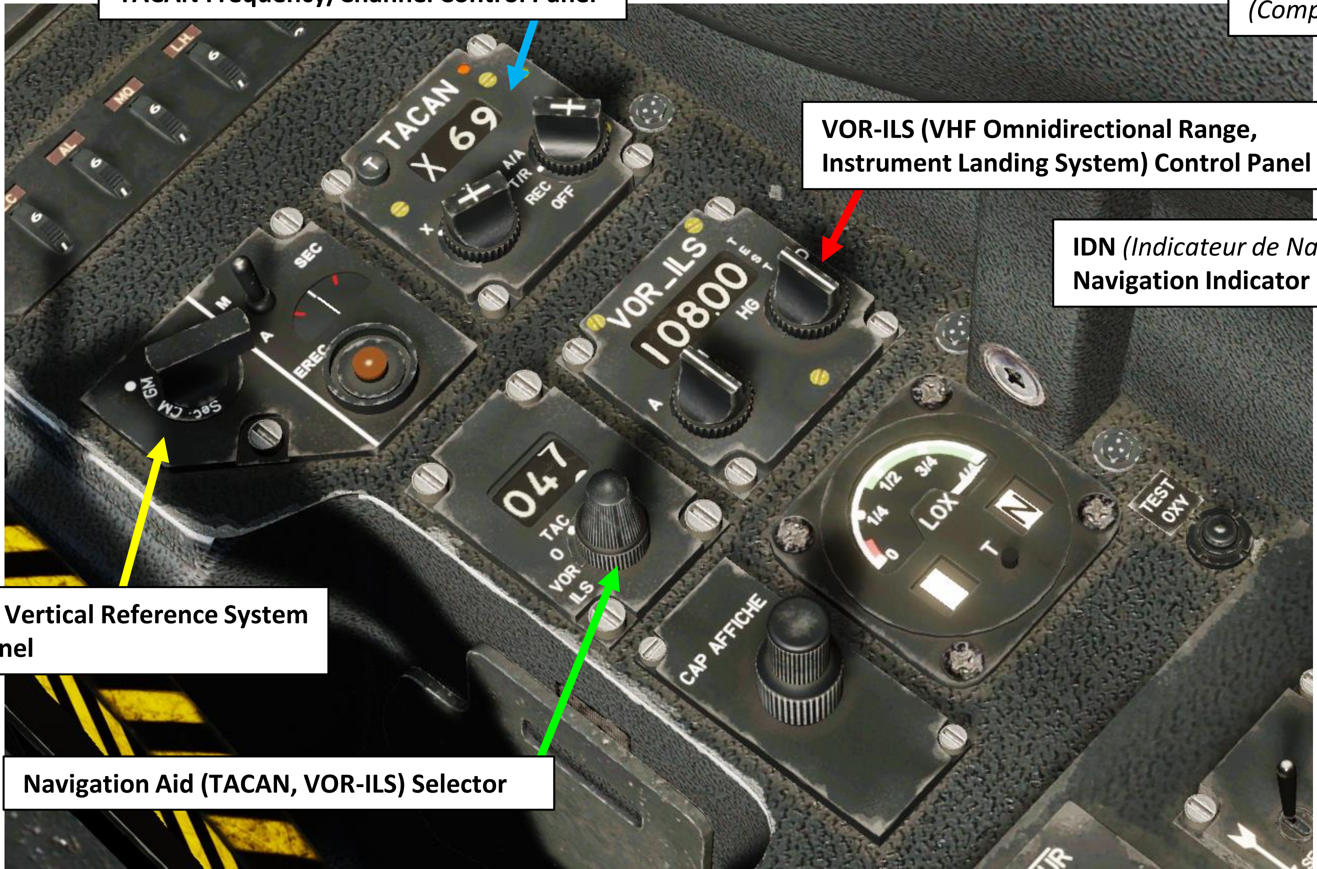
- **VORs** (VHF Omnidirectional Range) stations
- **TACAN** (Tactical Air Navigation) stations
- **ILS** (Instrument Landing System)

Standby Magnetic Compass
(Compas de Secours)

Mirage F1CE Only



Spherical Indicator *(Indicateur Sphérique / Boule)*
- *Artificial Horizon (Main Attitude Indicator)*



TACAN Frequency/Channel Control Panel

VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Control Panel

Heading & Vertical Reference System Control Panel

Navigation Aid (TACAN, VOR-ILS) Selector

IDN *(Indicateur de Navigation)*
Navigation Indicator

Mirage F1EE Only

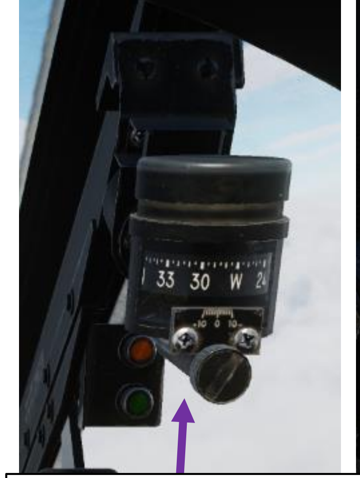
1 – NAVIGATION INTRODUCTION

Navigation in the Mirage F1EE is slightly different than in the F1CE variant since it includes an Inertial Navigation System (INS), referred as "UNI" (*Unité de Navigation Inertielle*) in French. The INS allows you to work with longitude/latitude coordinates, but it accumulates drift error over time and needs to be "re-aligned" after flying for a while. A specific section is dedicated to this system.

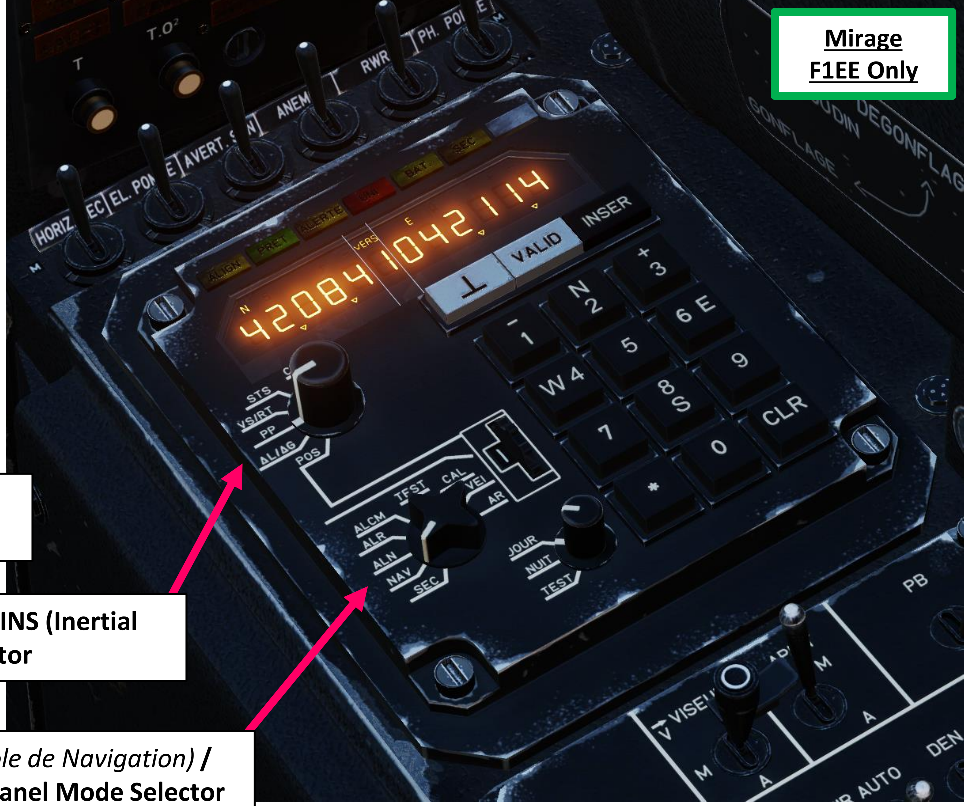
Keep in mind that the basic functionalities of the F1CE are still available in the F1EE as well. The IDN (*Indicateur de Navigation*), Standby Magnetic Compass and "Spherical Indicator" are still used as the primary navigation instruments; they are simply integrated with some of the upgraded INS capabilities.

To fly in IFR (Instrument Flight Rules) conditions which include low visibility and night flying, the following navigation aids are available:

- **VORs** (VHF Omnidirectional Range) stations
- **TACAN** (Tactical Air Navigation) stations
- **ILS** (Instrument Landing System)

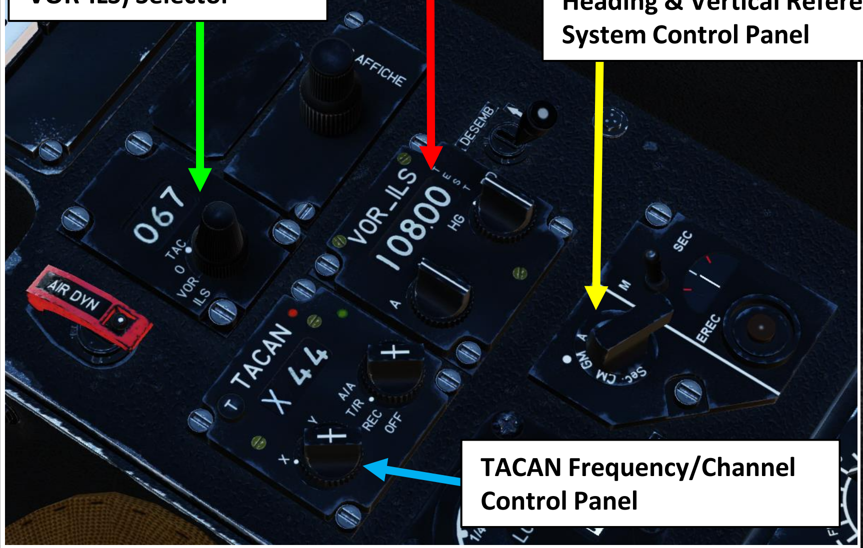


Standby Magnetic Compass
(Compas de Secours)



UNI (*Unité de Navigation Inertielle*) **/ INS (Inertial Navigation System) Parameter Selector**

PCN *(Poste de Contrôle de Navigation)* **/ Navigation Control Panel Mode Selector**



Navigation Aid (TACAN, VOR-ILS) Selector

VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Control Panel

Heading & Vertical Reference System Control Panel

TACAN Frequency/Channel Control Panel

Spherical Indicator *(Indicateur Sphérique / Boule)*

- *Artificial Horizon (Main Attitude Indicator)*

IDN *(Indicateur de Navigation)*
Navigation Indicator

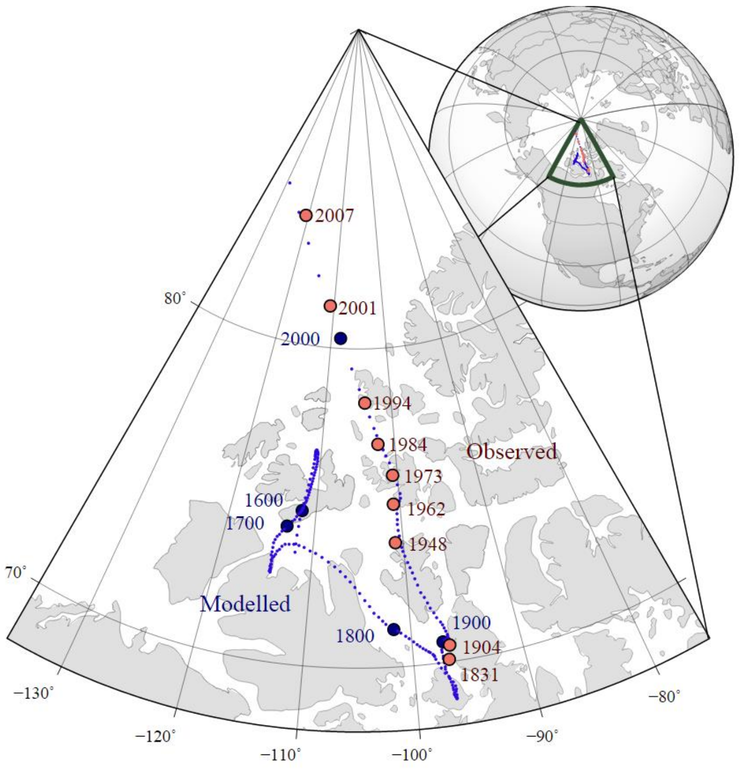
2 – MAGNETIC VARIATION

The direction in which a compass needle points is known as magnetic north. In general, this is not exactly the direction of the North Magnetic Pole (or of any other consistent location). Instead, the compass aligns itself to the local geomagnetic field, which varies in a complex manner over the Earth's surface, as well as over time. The local angular difference between magnetic north and true north is called the magnetic variation. Most **map coordinate** systems are based on **true north**, and magnetic variation is often shown on map legends so that the direction of true north can be determined from north as indicated by a compass. This is the reason why in DCS the course to a runway needs to be "adjusted" to take into account this magnetic variation of the magnetic North pole (actually modelled in the sim, which is pretty neat).

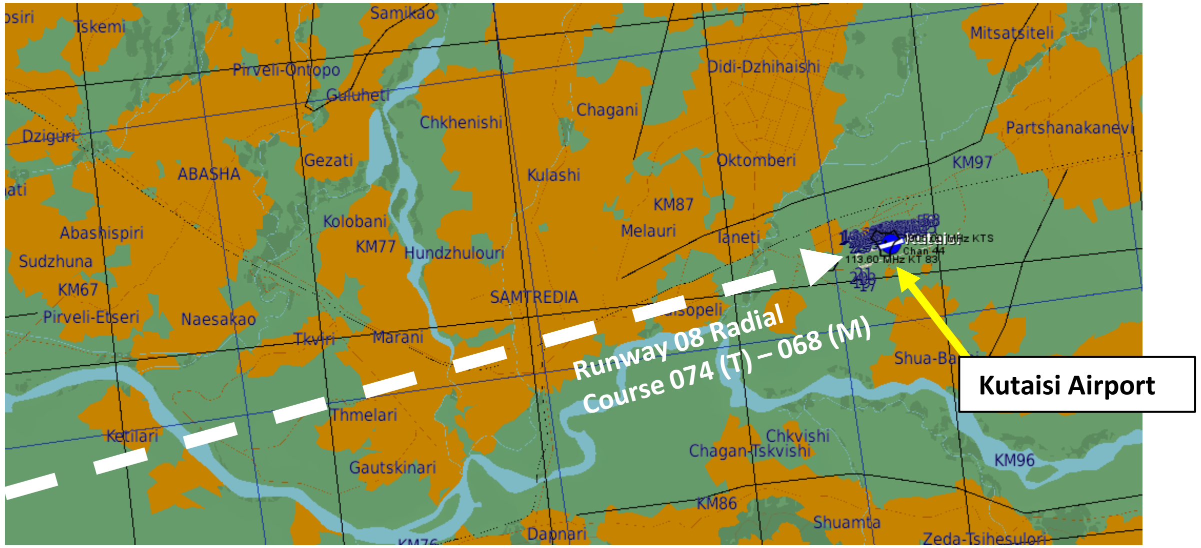
True Heading = Magnetic Heading + Magnetic Variation

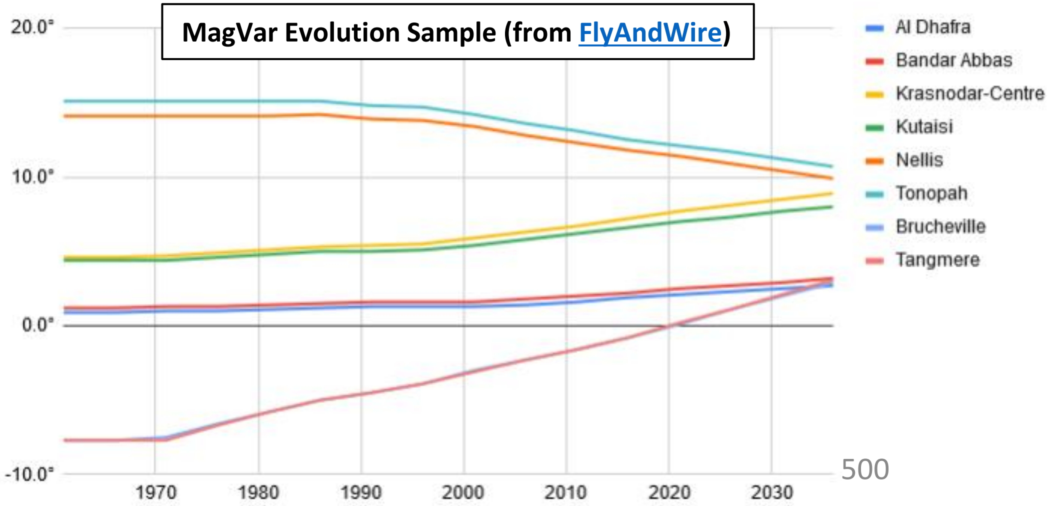
As an example, if the runway heading that you read on the F10 map in Kutaisi is 074 (True Heading), then the direction you should take with your magnetic compass course should be 074 subtracted with the Magnetic Variation (+6 degrees), or 068. In other words, you would need to use a course of 068 (M) with your compass.

Magnetic variation varies from place to place, but it also changes with time. This means this value will be highly dependent on the mission time and map.



The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007.





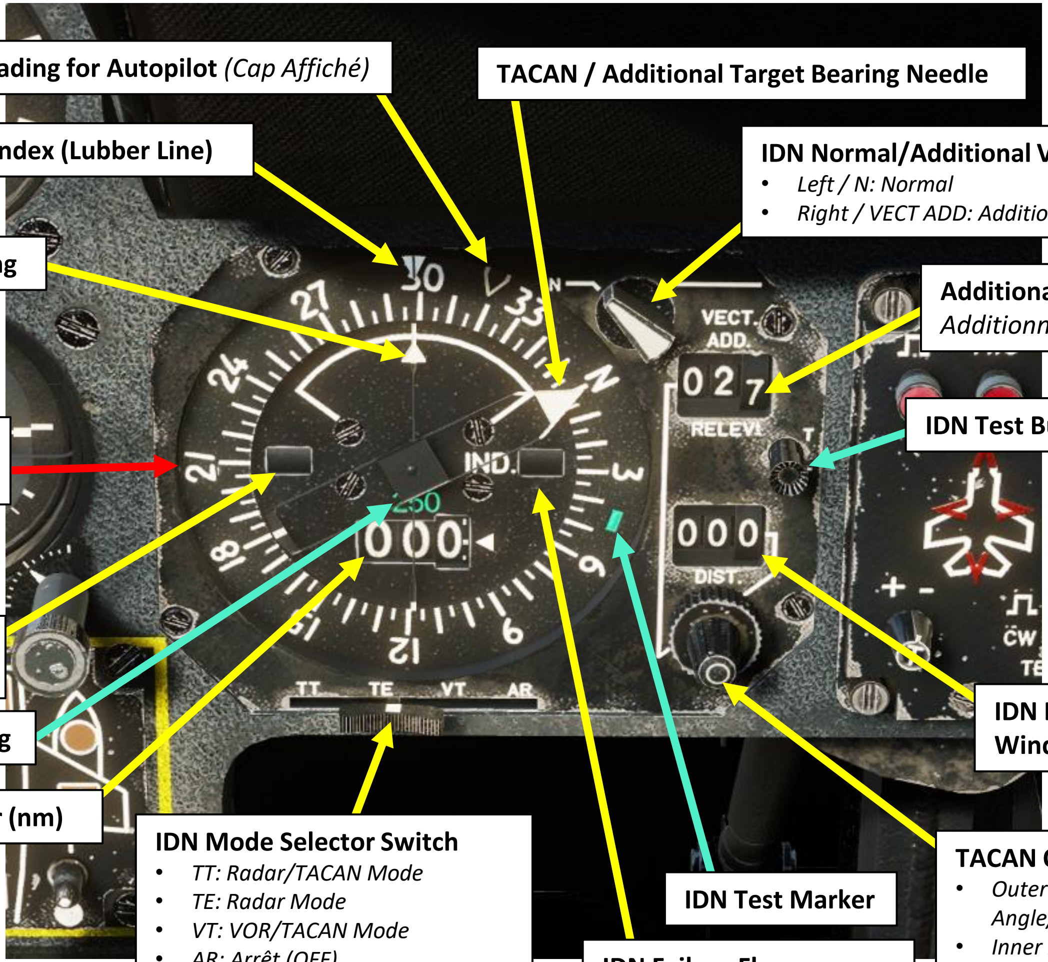
2 – MAGNETIC VARIATION

Checking the magnetic variation is now very easy: you can access it directly from the F10 map, shown with the Compass Rose.

Mirage F1CE Only

3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.A – Mirage F1CE Variant
3.A.1 – Overview

The IDN (*Indicateur de Navigation*), or “Navigation Indicator”, is the main interface used to navigate. The Lubber Line indicates the aircraft heading and some bearing information in regards to some of the navigation aids.

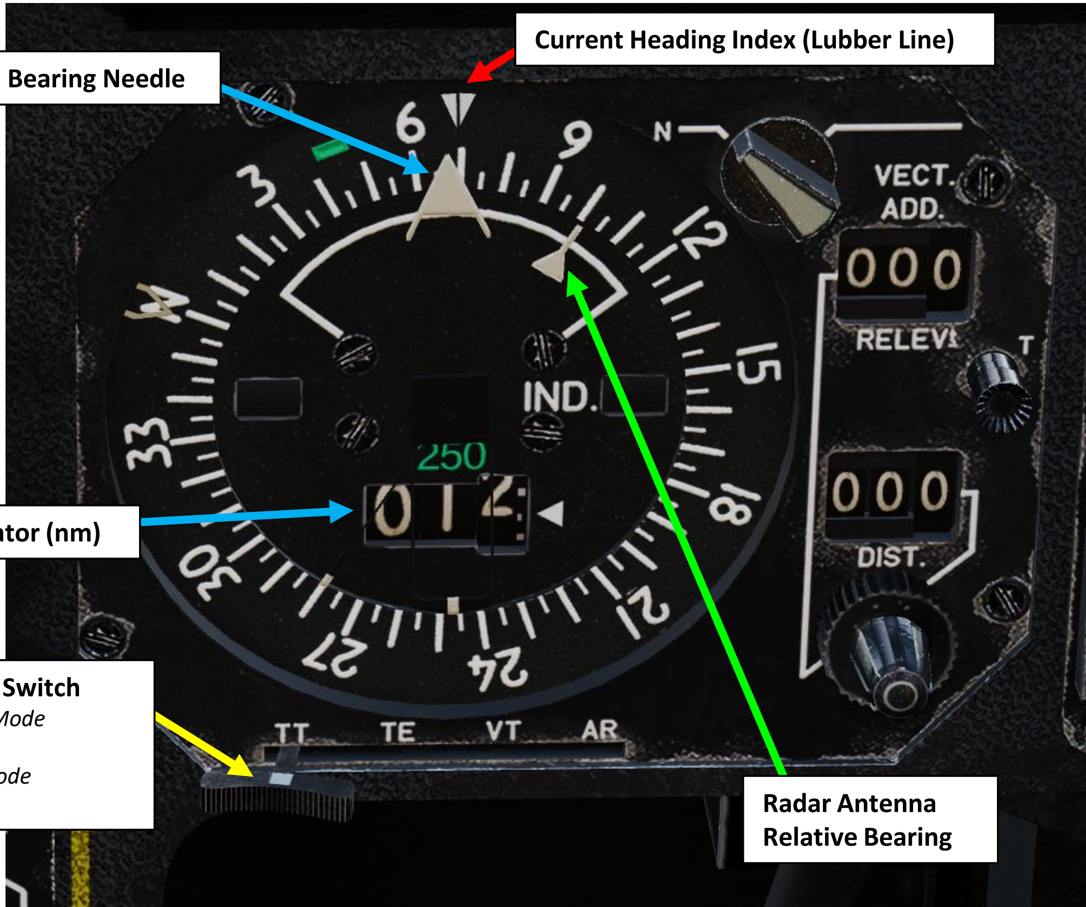


3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.A – Mirage F1CE Variant
3.A.2 – TT (Radar/TACAN) Mode

Mirage F1CE Only

If the IDN Mode is selected to "TT" (Radar Telemetry / TACAN):

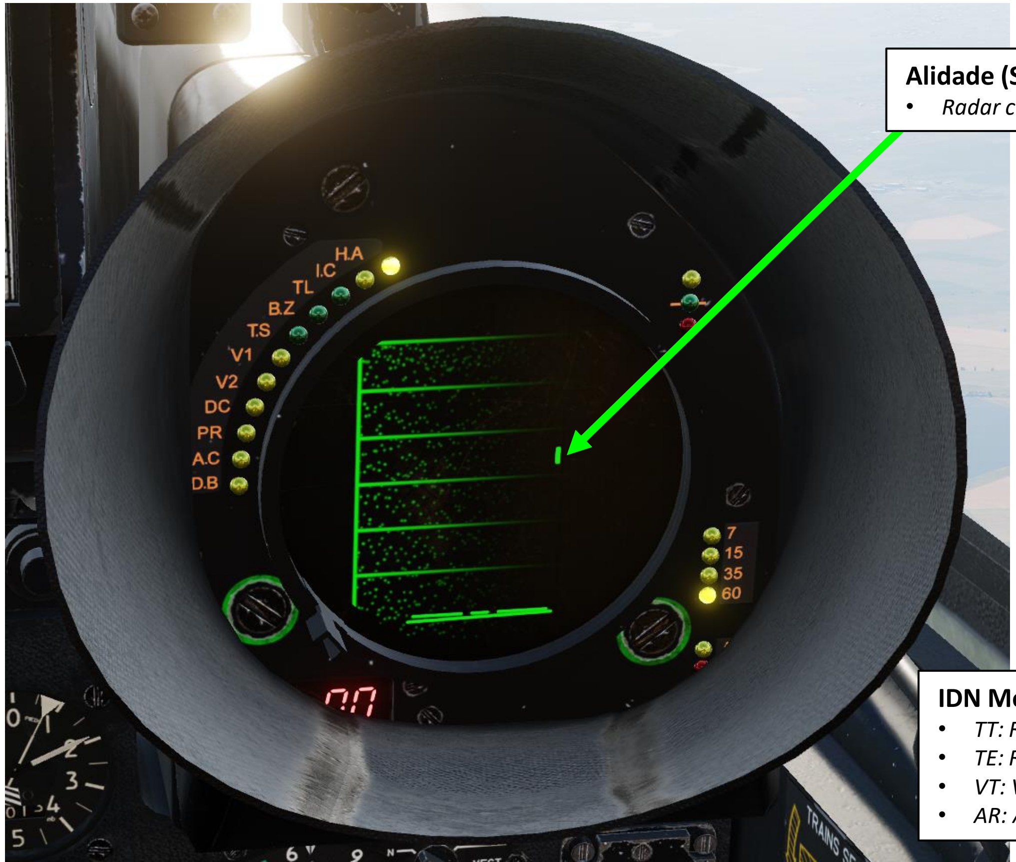
- The **large needle** points to the tuned **TACAN** station DME (Distance Measuring Equipment).
- The **small needle** indicates radar **Strobe/Alidade** azimuth.

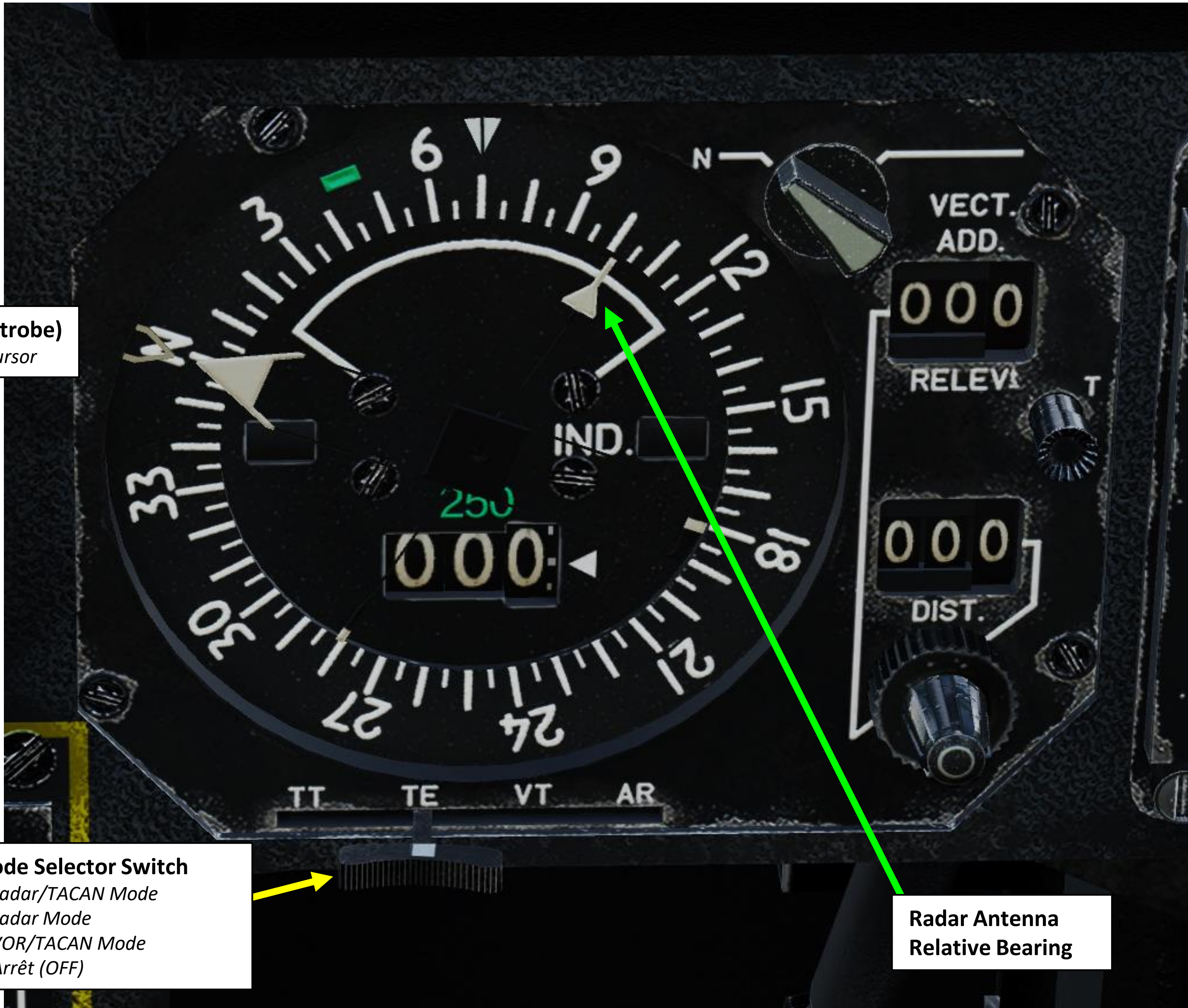


3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.A – Mirage F1CE Variant
3.A.3 – TE (Radar) Mode

If the IDN Mode is selected to "TE" (Radar Telemetry):

- The **large needle** is inactive and is not used.
- The **small needle** indicates radar **Strobe/Alidade** azimuth.

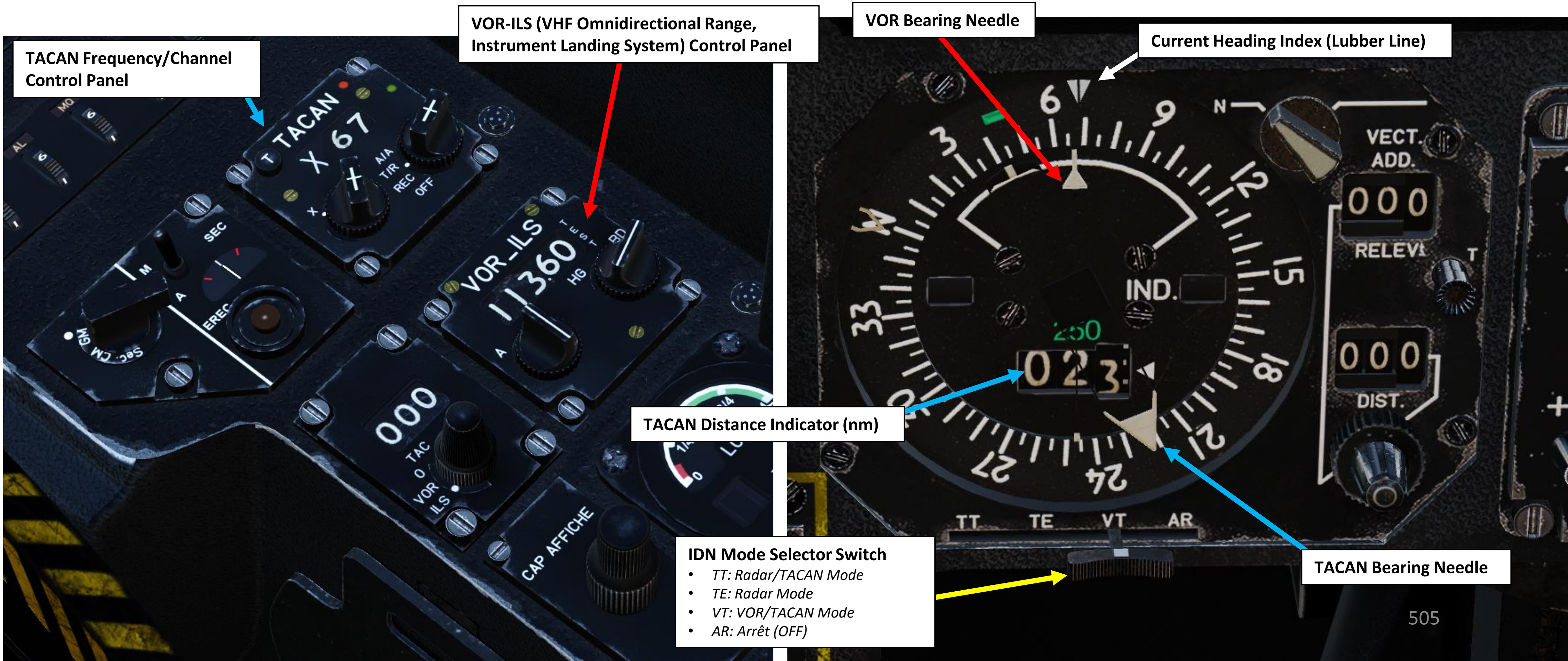




3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.A – Mirage F1CE Variant
3.A.4 – VT (VOR/TACAN) Mode

Mirage F1CE Only

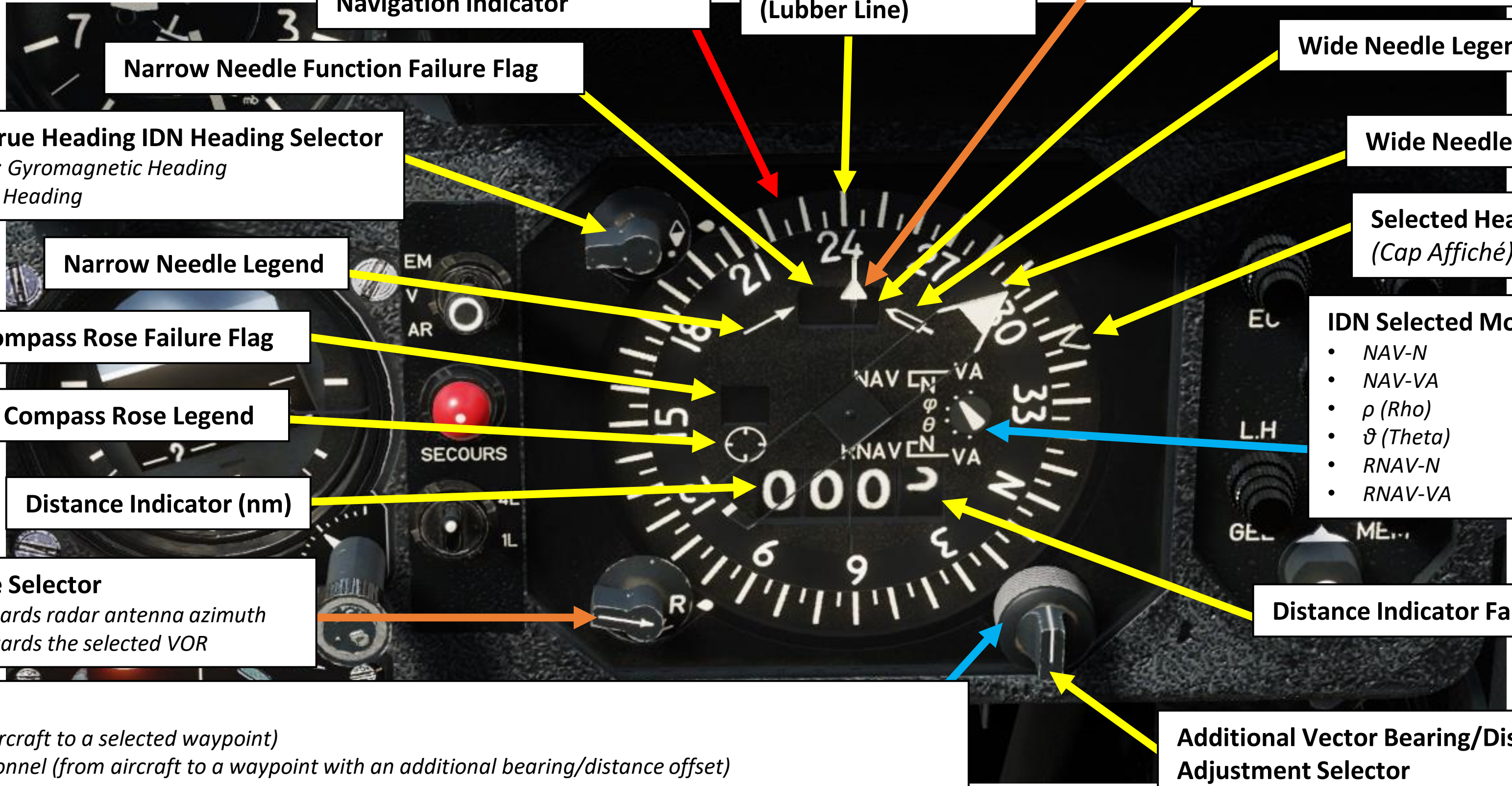
If the IDN Mode is selected to "VT" (VOR / TACAN):
- The **large needle** points to the tuned **TACAN** station DME (Distance Measuring Equipment).
- The **small needle** points to the tuned **VOR** (VHF Omnidirectional Range) station, which provides bearing information but no distance information.



Mirage F1EE Only

3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.1 – Overview

The IDN (*Indicateur de Navigation*), or “Navigation Indicator”, is the main interface used to navigate. The Lubber Line indicates the aircraft heading and some bearing information in regards to some of the navigation aids or INS (Inertial Navigation System) navigation points.



3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.1 – Overview

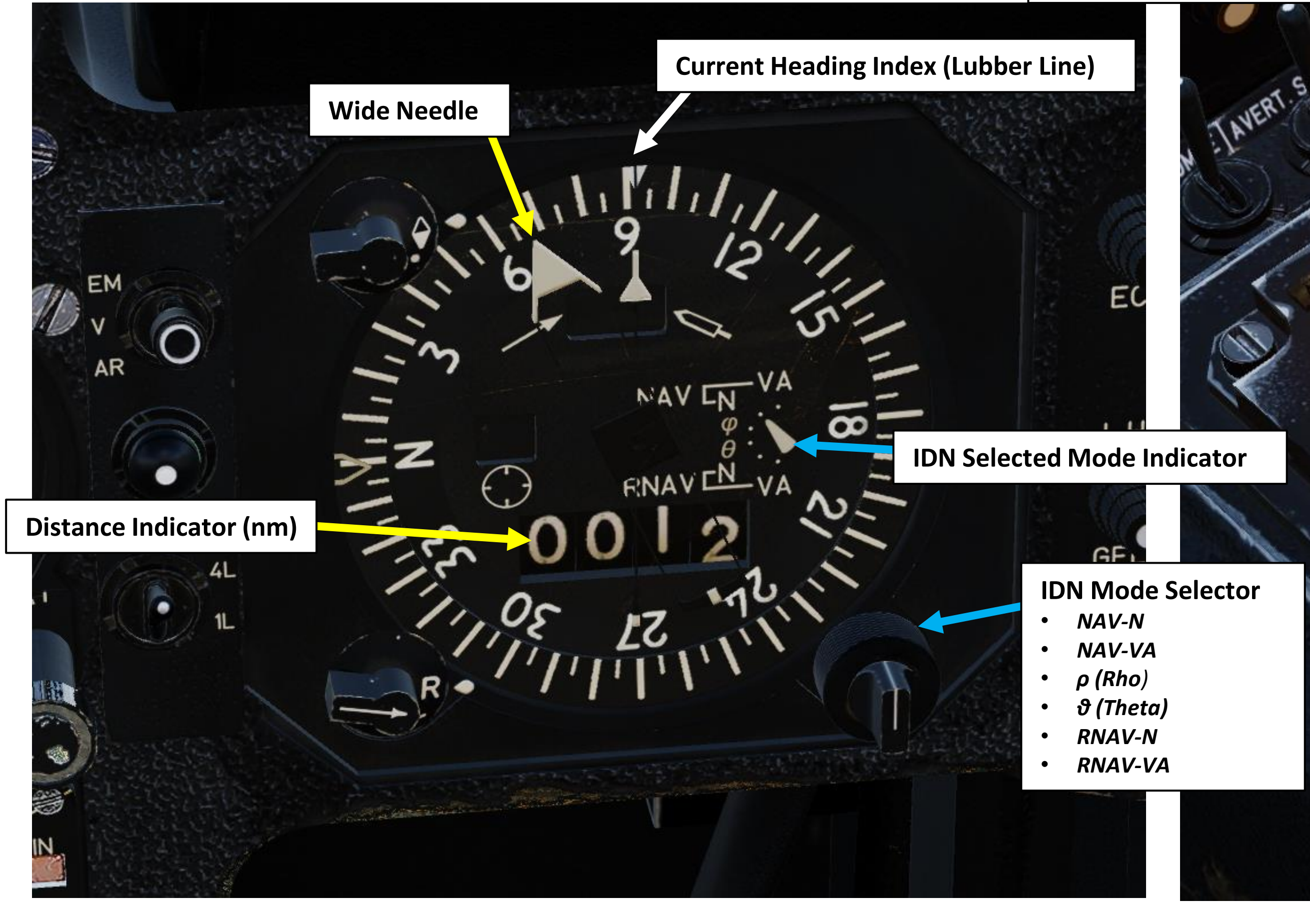
Here is an overview of various IDN operation modes:

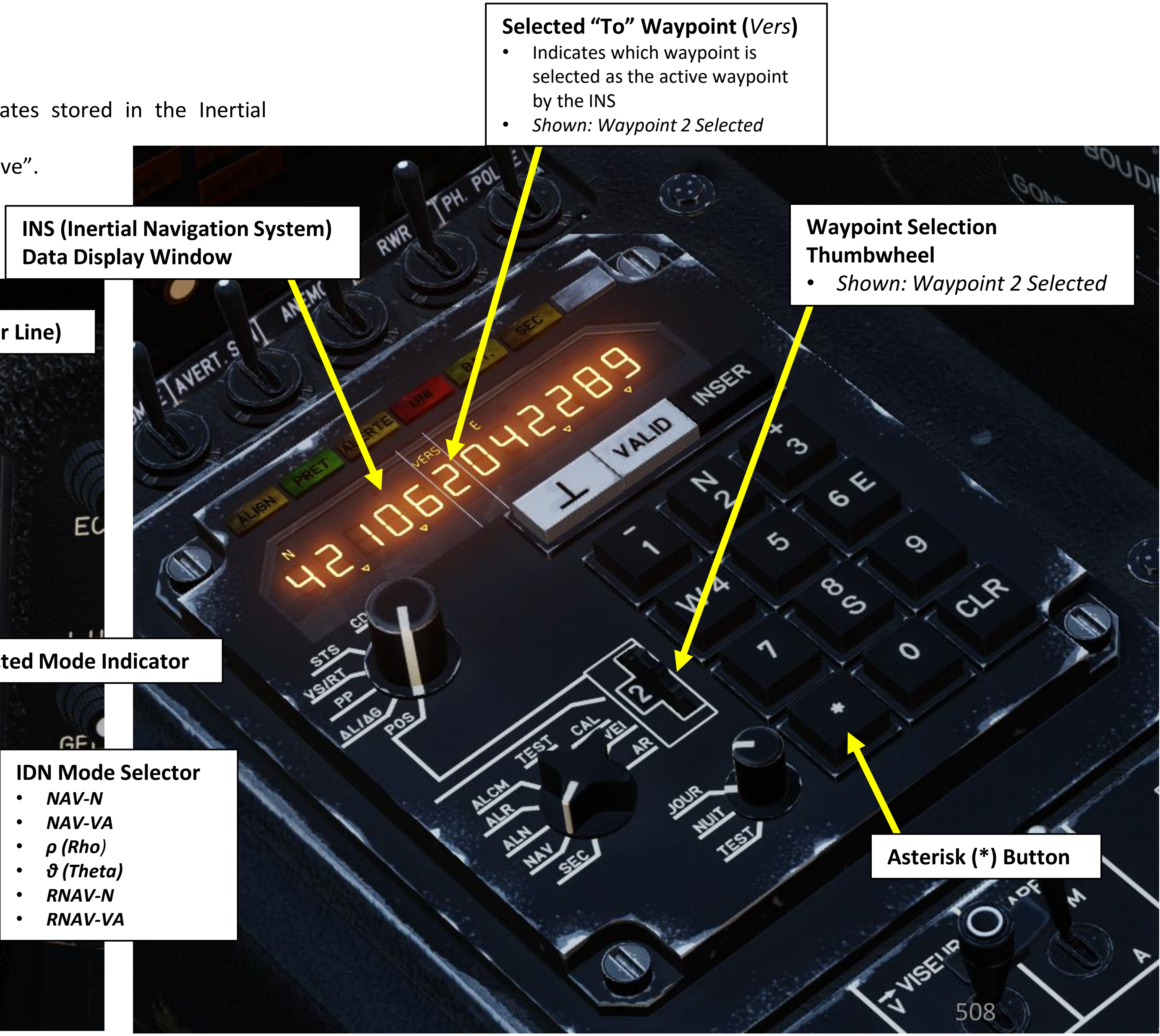
DISPLAY \ MODE	"NAV-N"	"NAV-VA"	"ρ"	"θ"	"RNAV-N"	"RNAV-VA"
Rose	Pilot selected heading		Zeroized		Pilot selected heading	
Wide needle	Route difference (θ - Rv)		Additional vector D display	Additional vector azimuth display	TACAN azimuth	TACAN additional point azimuth
Distance counter	D airplane - selected point	D airplane - NAV additional point			D airplane - TACAN station	D airplane - TACAN additional point
Narrow needle	Radar antenna azimuth in VOR azimuth					
Heading bug	Selected heading for autopilot					
Flag	Compass rose function failure					
Flag	Wide needle function failure					
Distance counter flag	IRS failure		Flag hidden		TACAN D failure	
Flag	Narrow needle function failure					

Mirage F1EE Only

3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.2 – NAV-N Mode

If the IDN Mode is selected to "NAV-N" (Normal Navigation with INS):
- The **wide needle** points to the bearing of the selected waypoint coordinates stored in the Inertial Navigation System (INS).
    - Note: Press the Asterisk (*) button to set the selected waypoint as "active".





3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR

3.B – Mirage F1EE Variant

3.B.2 – NAV-N Mode

- The **narrow needle** points to the navigation source selected by the **VOR/Radar Narrow Needle Selector:**
  - **R**: Narrow needle points towards radar antenna azimuth
  - **V**: Narrow needle points towards the selected VOR

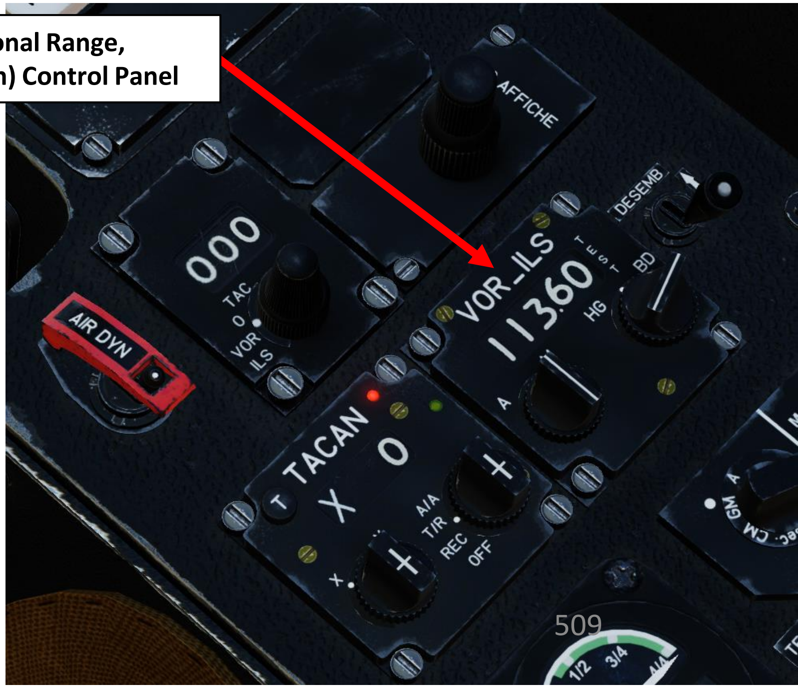
Current Heading Index (Lubber Line)

VOR/Radar Narrow Needle
- *Points towards either radar antenna azimuth or VOR based on position of the VOR/RADAR Narrow Needle Selector*

VOR/Radar Narrow Needle Selector
- *R: Narrow needle points towards radar antenna azimuth*
- *V: Narrow needle points towards the selected VOR*

Mirage F1EE Only

Alidade (Strobe)
- *Radar cursor*

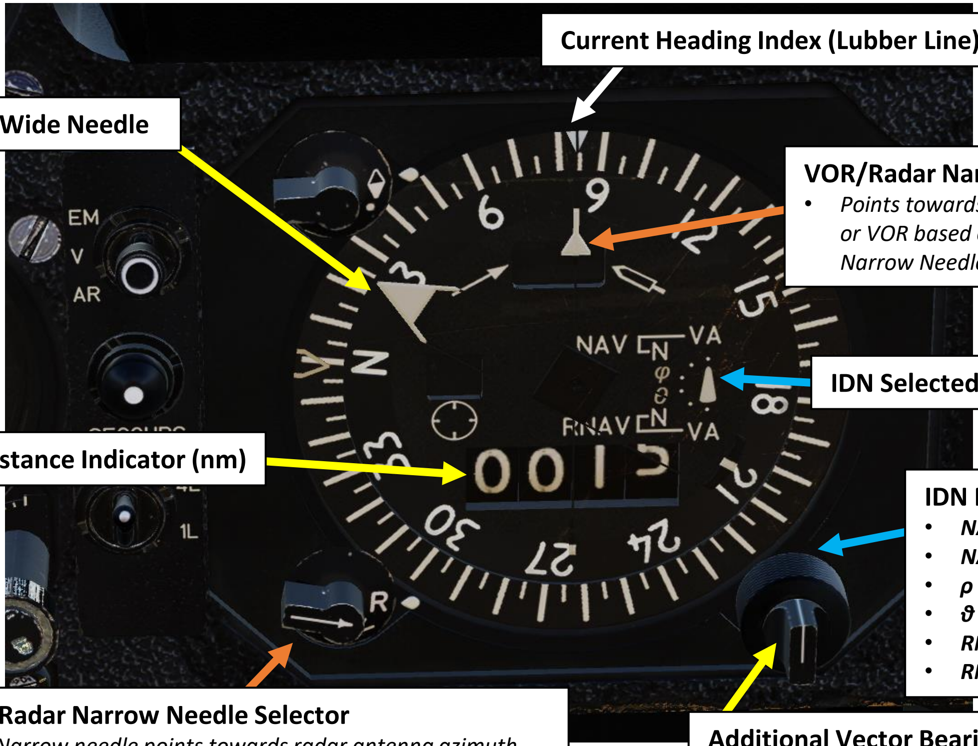


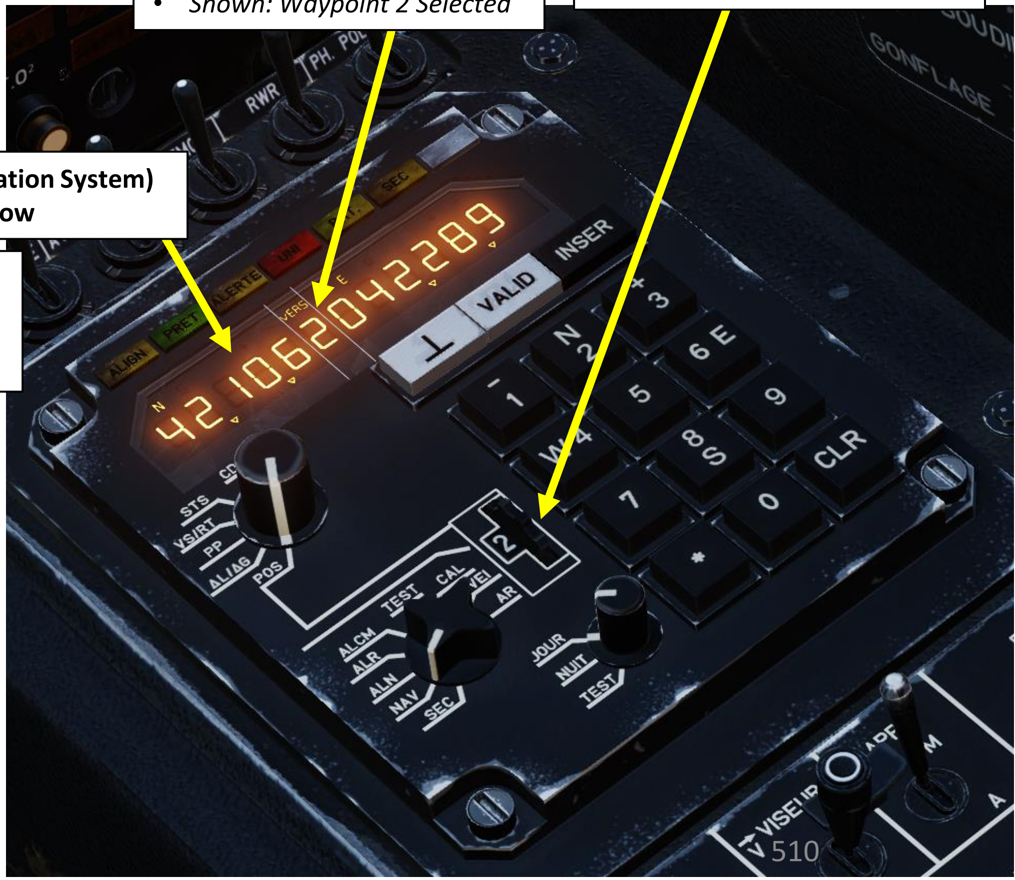
VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Control Panel

3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.3 – NAV-VA Mode

If the IDN Mode is selected to "NAV-VA" (Normal Navigation with INS with Additional Vector):

- The **wide needle** points to the bearing of the selected waypoint coordinates stored in the Inertial Navigation System (INS), but **with a distance and bearing angle offset** entered via the ρ (Rho) and θ (Theta) modes. The waypoint offset is referred as a *VA* (*Vecteur Additionnel*, or "Additional Vector" in english).
  - ρ (Rho) represents a distance offset from the selected waypoint.
  - θ (Theta) represents an angle offset from the selected waypoint.
  - Waypoint offset data (ρ and θ) needs to be manually entered prior to selecting the NAV-VA mode. This process is explained in **section 6.2.3 – Waypoint Offset (Additional Vector).**
- The **narrow needle** points to the navigation source selected by the **VOR/Radar Narrow Needle Selector:**
  - **R**: Narrow needle points towards radar antenna azimuth
  - **V**: Narrow needle points towards the selected VOR





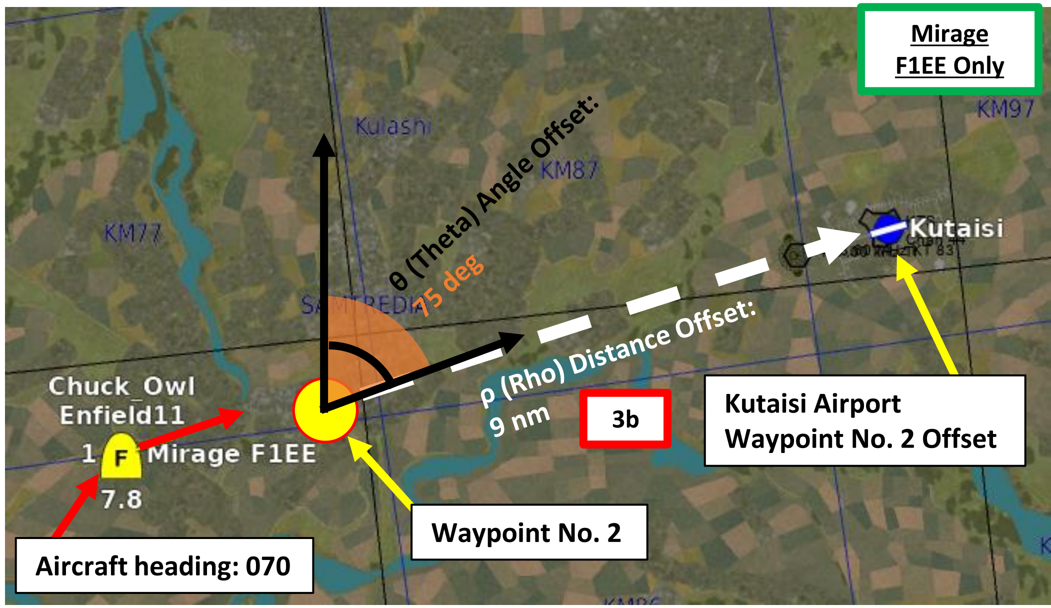
3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.4 – ρ (Rho) Mode

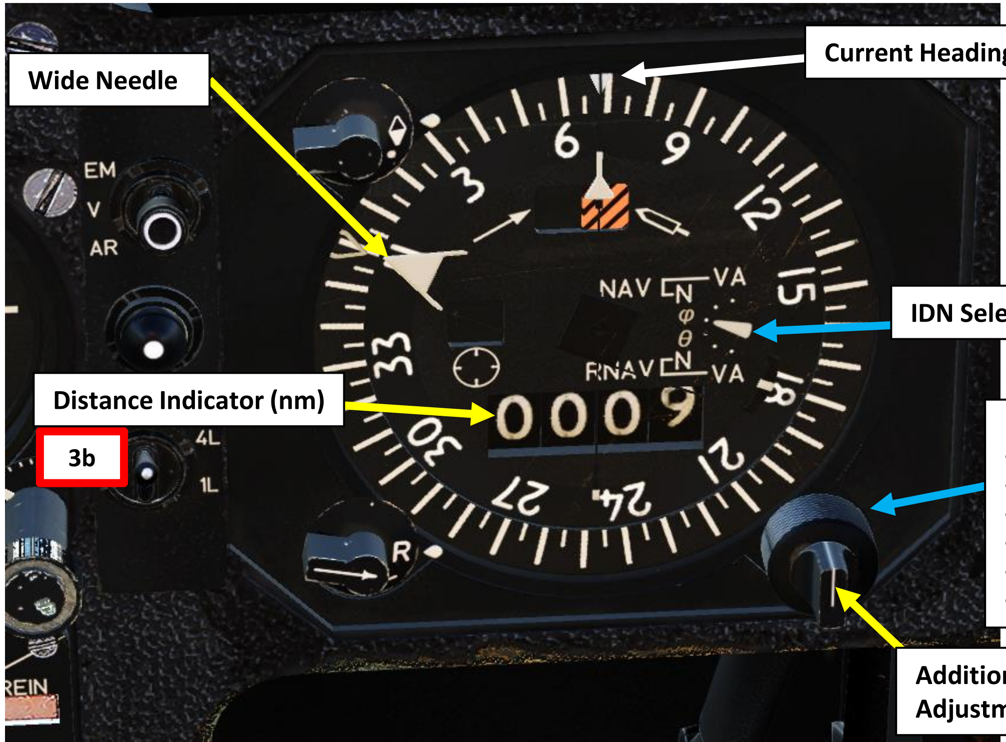
When using the IDN Mode "NAV-VA" (Normal Navigation with INS with Additional Vector) or "RNAV-VA" (Radio Navigation with Additional Vector), the additional vector requires two parameters:

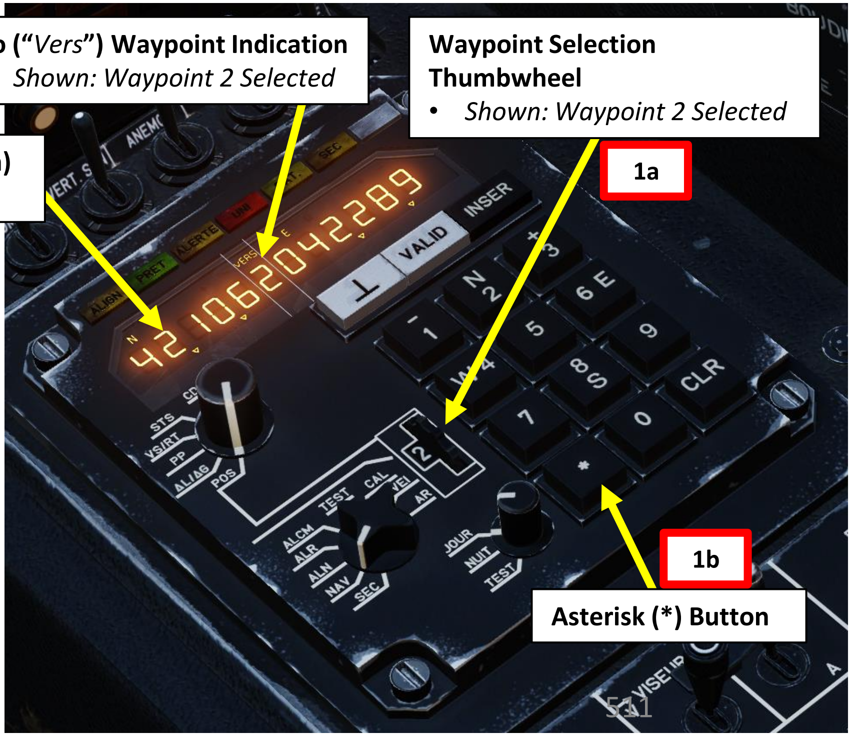
- **ρ (Rho)**: Distance offset from the selected waypoint/TACAN
- **θ (Theta):** Angle offset from the selected waypoint/TACAN

In order to input the distance (**ρ, Rho**) parameter for a **waypoint**:

1. Waypoint needs to be selected with the Waypoint Selection Thumbwheel and Asterisk Button.
2. IDN Mode Selector needs to be set to ρ (Rho) by turning the IDN Mode **Outer** knob
3. Distance offset parameter is set by by turning the IDN Mode **Inner** knob
4. The distance offset parameter is now memorized. However, an angle offset θ (Theta) also needs to be entered as well. See next sub-section to see how this is done.
5. When **both Distance ρ and Angle θ offset parameters are set**, using the **IDN Mode "NAV-VA"** makes the Wide Needle point towards the coordinates of the offset waypoint.







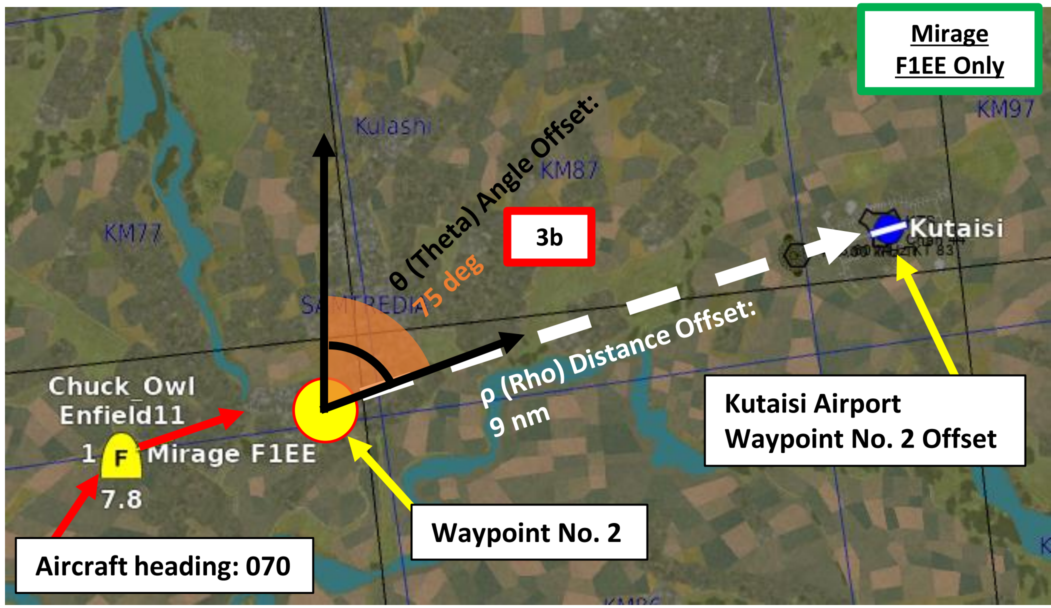
3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.5 – θ (Theta) Mode

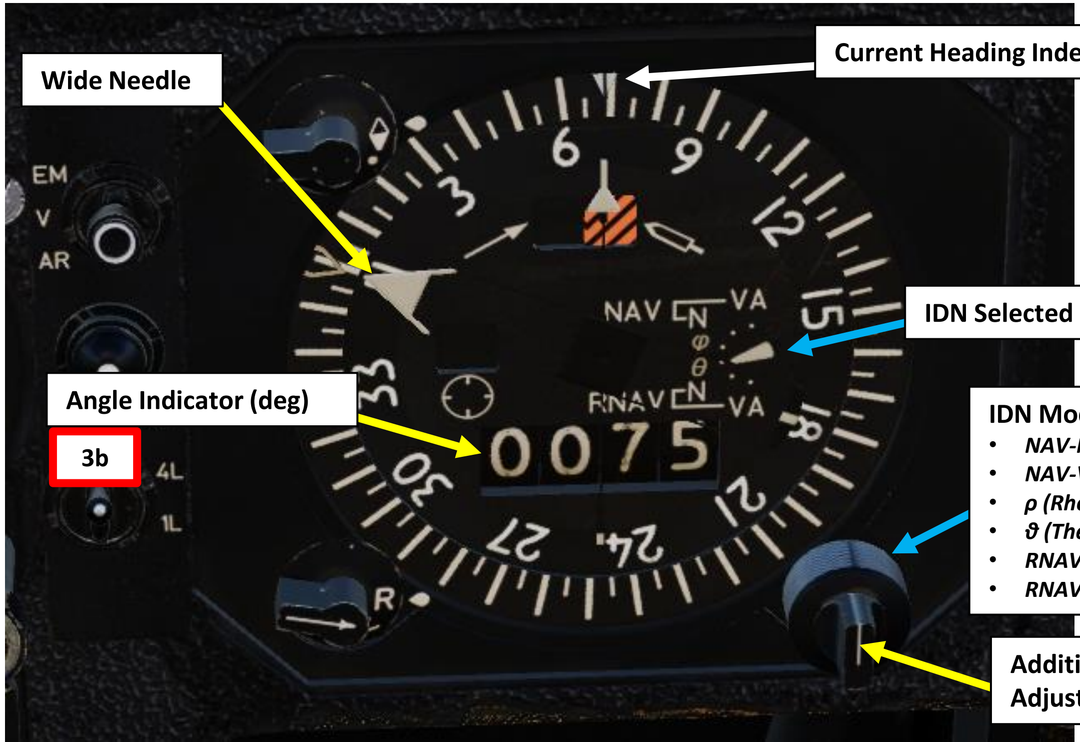
When using the IDN Mode "NAV-VA" (Normal Navigation with INS with Additional Vector) or "RNAV-VA" (Radio Navigation with Additional Vector), the additional vector requires two parameters:

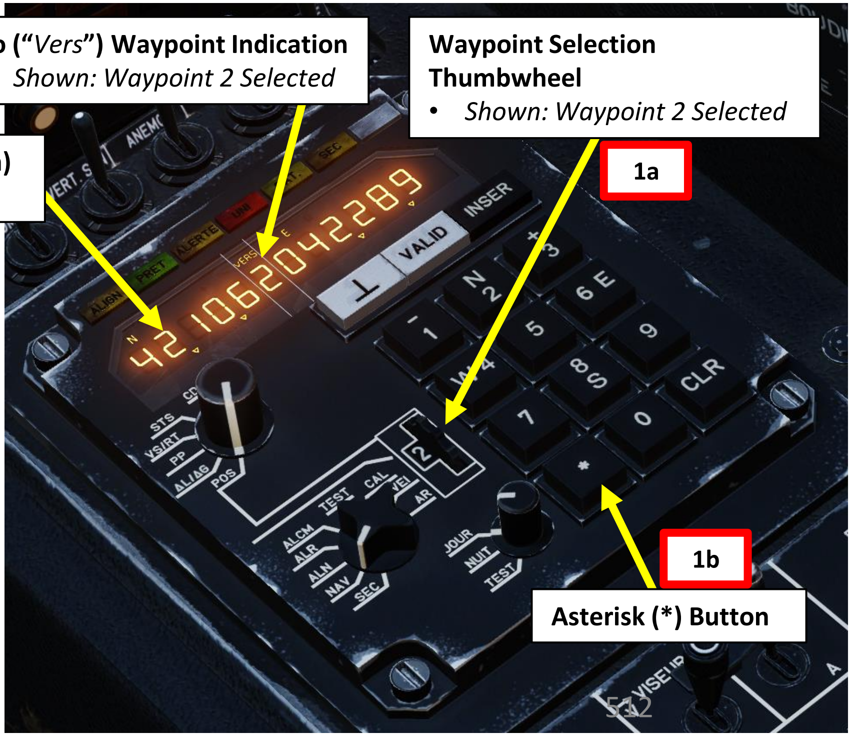
- **ρ (Rho)**: Distance offset from the selected waypoint/TACAN
- **θ (Theta):** Angle offset from the selected waypoint/TACAN

In order to input the angle (**θ, Theta**) parameter for a **waypoint**:

1. Waypoint needs to be selected with the Waypoint Selection Thumbwheel and Asterisk Button
2. IDN Mode Selector needs to be set to θ (Theta) by turning the IDN Mode **Outer** knob.
3. Angle offset parameter is set by by turning the IDN Mode **Inner** knob
4. The angle offset parameter is now memorized. However, a distance offset **ρ** (Rho) also needs to be entered as well. See previous sub-section to see how this is done.
5. When **both Distance ρ and Angle θ offset parameters are set**, using the **IDN Mode "NAV-VA"** makes the Wide Needle point towards the coordinates of the offset waypoint.







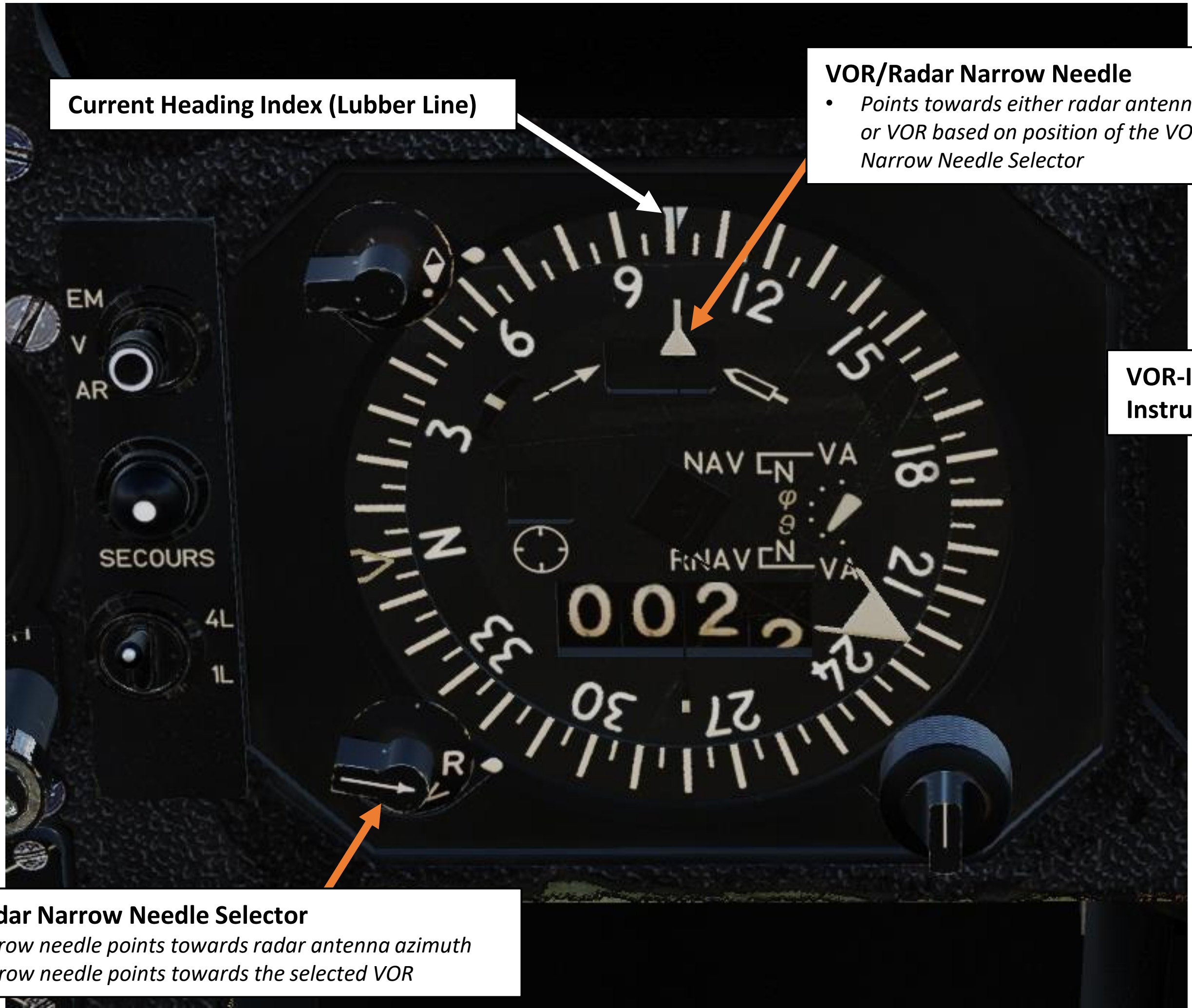
3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.6 – RNAV-N Mode

If the IDN Mode is selected to "RNAV-N" (Area Navigation – Normal):
- The **wide needle** points to the tuned **TACAN** station DME (Distance Measuring Equipment).

3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.6 – RNAV-N Mode

Mirage F1EE Only

- The **narrow needle** points to the navigation source selected by the **VOR/Radar Narrow Needle Selector:**
  - **R**: Narrow needle points towards radar antenna azimuth
  - **V**: Narrow needle points towards the selected VOR



Current Heading Index (Lubber Line)

VOR/Radar Narrow Needle
- *Points towards either radar antenna azimuth or VOR based on position of the VOR/RADAR Narrow Needle Selector*

VOR/Radar Narrow Needle Selector
- *R: Narrow needle points towards radar antenna azimuth*
- *V: Narrow needle points towards the selected VOR*

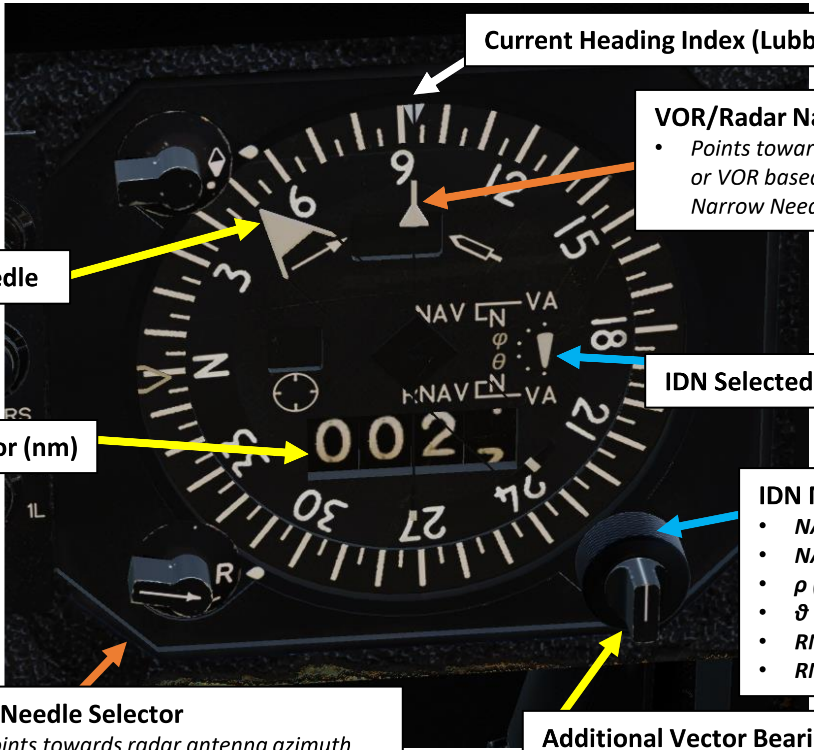
Alidade (Strobe)
- *Radar cursor*

VOR-ILS (VHF Omnidirectional Range, Instrument Landing System) Control Panel

3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.7 – RNAV-VA Mode

If the IDN Mode is selected to “RNAV-VA” (Area Navigation with Additional Vector):

- The **wide needle** points to the tuned **TACAN** station DME (Distance Measuring Equipment), but **with a distance and bearing angle offset** entered via the ρ (Rho) and θ (Theta) modes. The TACAN offset is referred as a *VA* (*Vecteur Additionnel*, or “Additional Vector” in english).
    - ρ (Rho) represents a distance offset from the selected TACAN station.
    - θ (Theta) represents an angle offset from the selected TACAN station.
    - TACAN offset data (ρ and θ) needs to be manually entered prior to selecting the RNAV-VA mode. This process is explained in **section 5.2 – TACAN Offset (Additional Vector).**
- The **narrow needle** points to the navigation source selected by the **VOR/Radar Narrow Needle Selector:**
    - **R**: Narrow needle points towards radar antenna azimuth
    - **V**: Narrow needle points towards the selected VOR

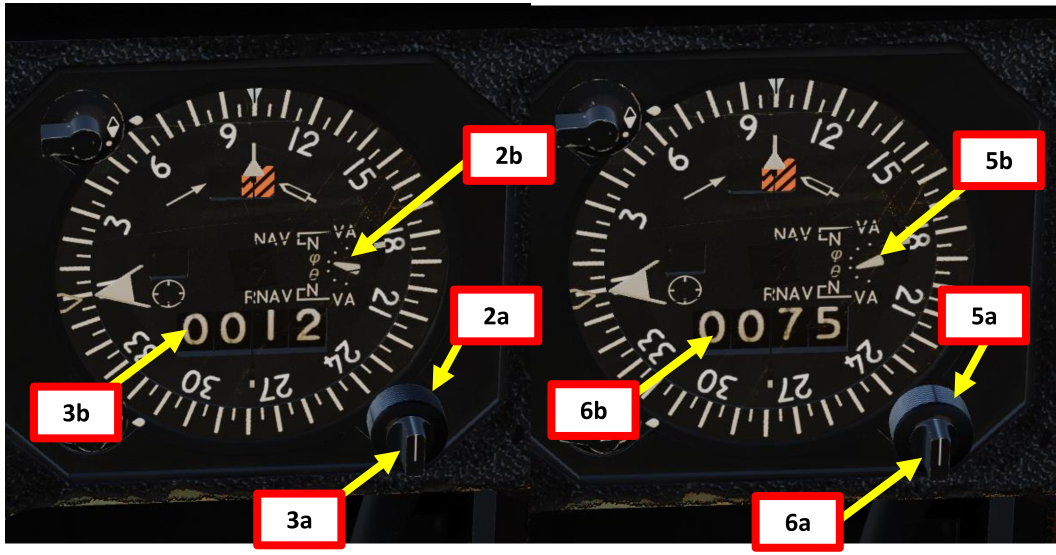


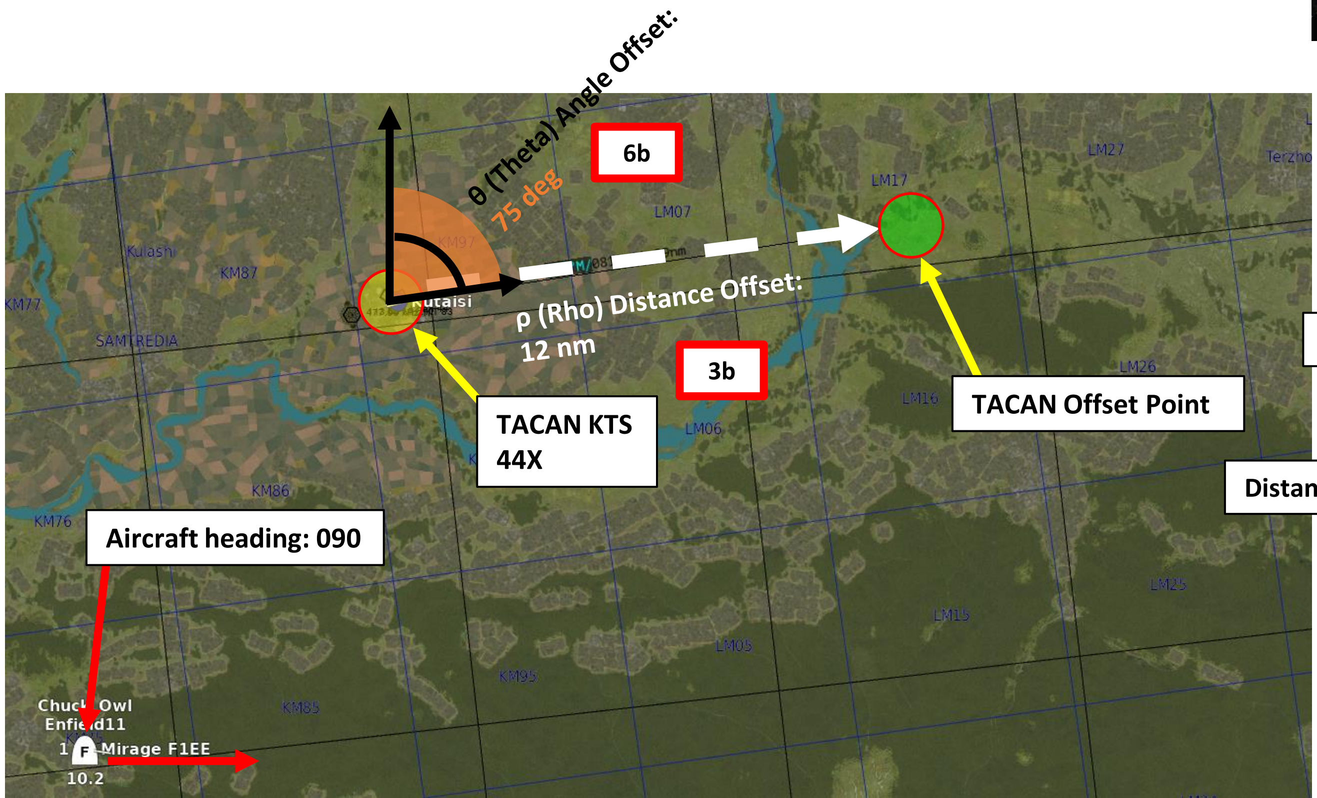
Mirage F1EE Only

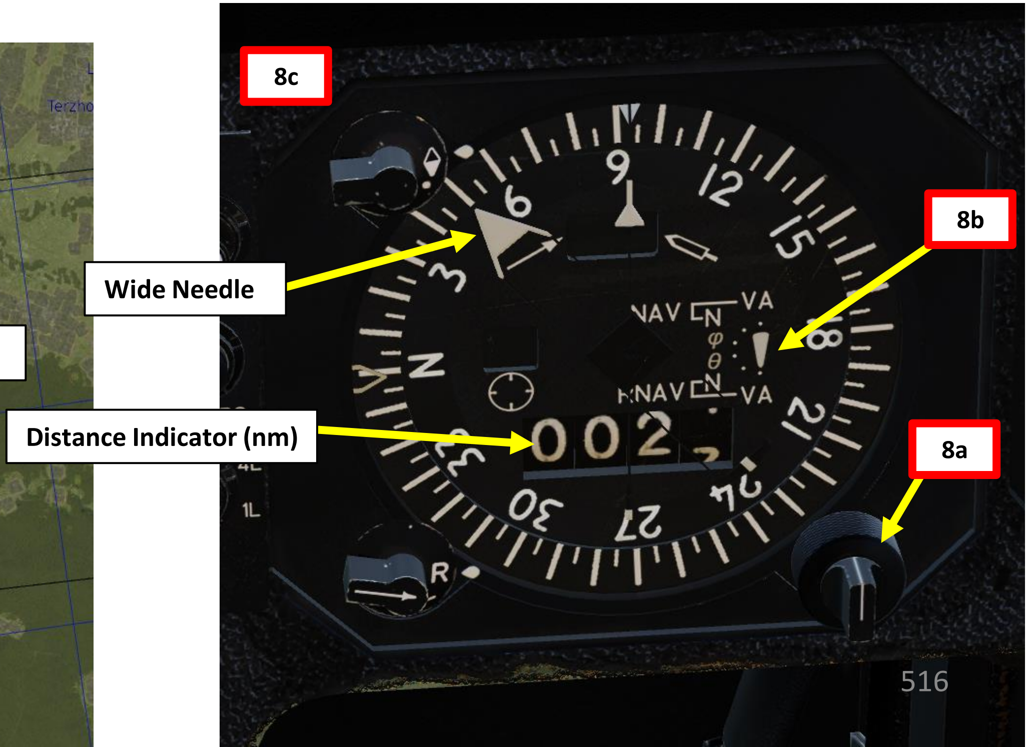
3 – IDN (INDICATEUR DE NAVIGATION) NAVIGATION INDICATOR
3.B – Mirage F1EE Variant
3.B.7 – RNAV-VA Mode

In order to input the distance (**ρ, Rho**) and angle (**θ, Theta**) parameters for a **TACAN offset**:

1. TACAN station needs to be set using the **TACAN Frequency/Channel Control Panel.**
2. Set IDN Mode Selector to **ρ (Rho)** by turning the IDN Mode **Outer** knob
3. **Distance offset** parameter is set by by turning the IDN Mode **Inner** knob
4. The distance offset parameter is now memorized. However, an angle offset θ (Theta) also needs to be entered as well.
5. Set IDN Mode Selector to **θ (Theta)** by turning the IDN Mode **Outer** knob.
6. **Angle offset** parameter is set by by turning the IDN Mode **Inner** knob
7. The angle offset parameter is now memorized.
8. When **both Distance ρ and Angle θ offset parameters are set**, using the **IDN Mode "RNAV-VA"** makes the Wide Needle point towards the TACAN offset point.

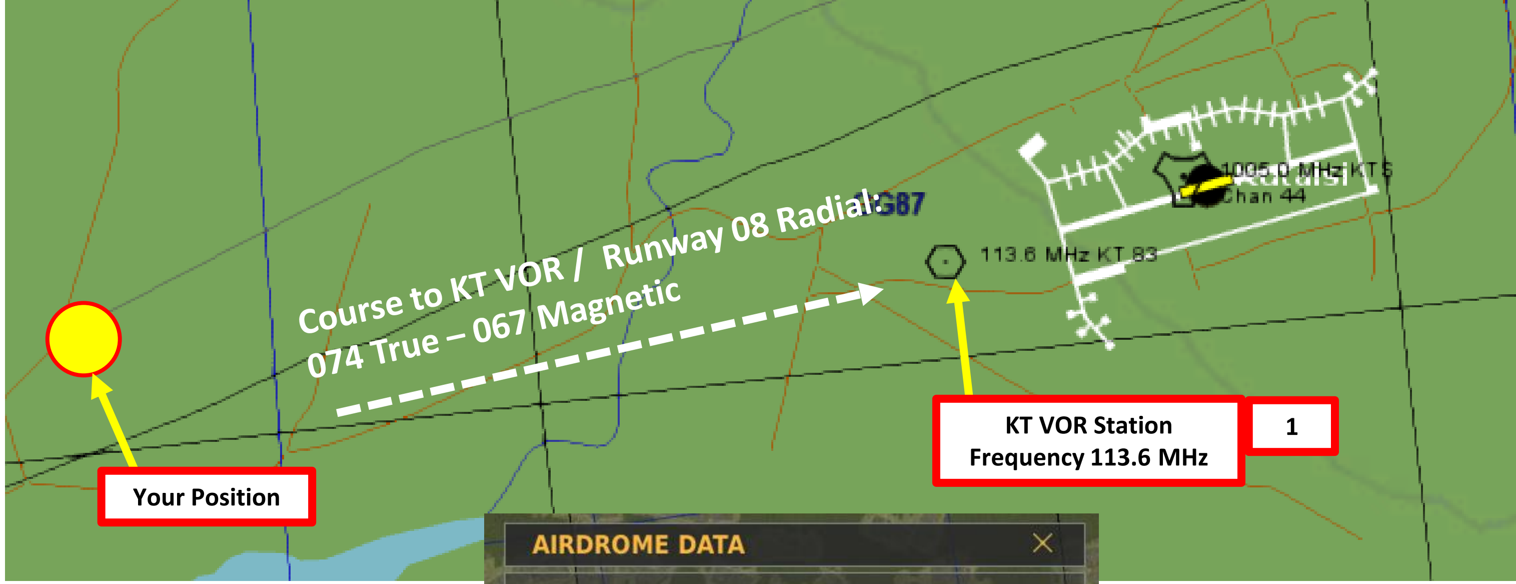


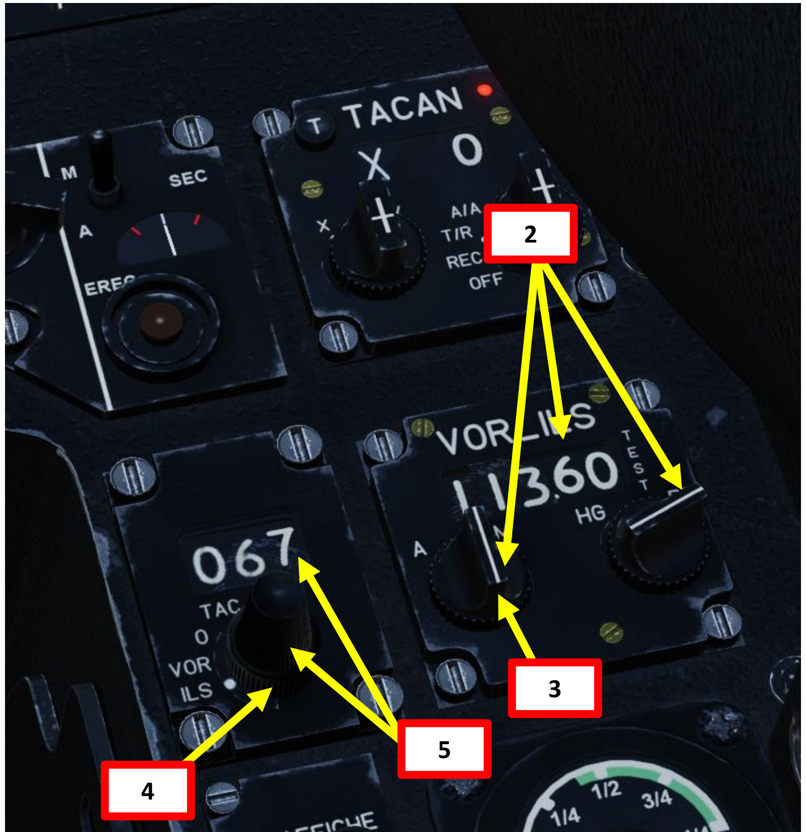


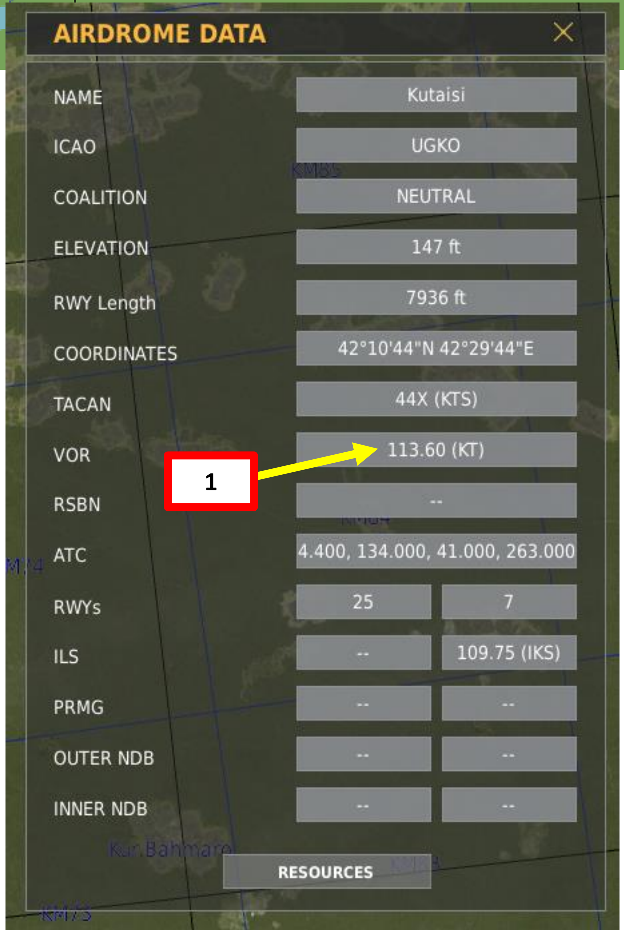


4 – VOR NAVIGATION

1. In this example, we will track a VOR station with a radial course of 067 Magnetic.
2. Set VOR Frequency to 113.6 MHz – Scroll Mousewheel.
3. Set VOR-ILS Outer Control Knob to M (Marche, ON) – Mouse Click.
4. Set Navigation Aid (TACAN, VOR-ILS) Outer Knob Selector – VOR-ILS, Mouse Click.
5. Set Navigation Aid (TACAN, VOR-ILS) Inner Knob Selector (also referred as the "Omnibearing Selector") to the course we want to intercept the VOR station with, which is course 067. Scroll mousewheel to rotate knob.

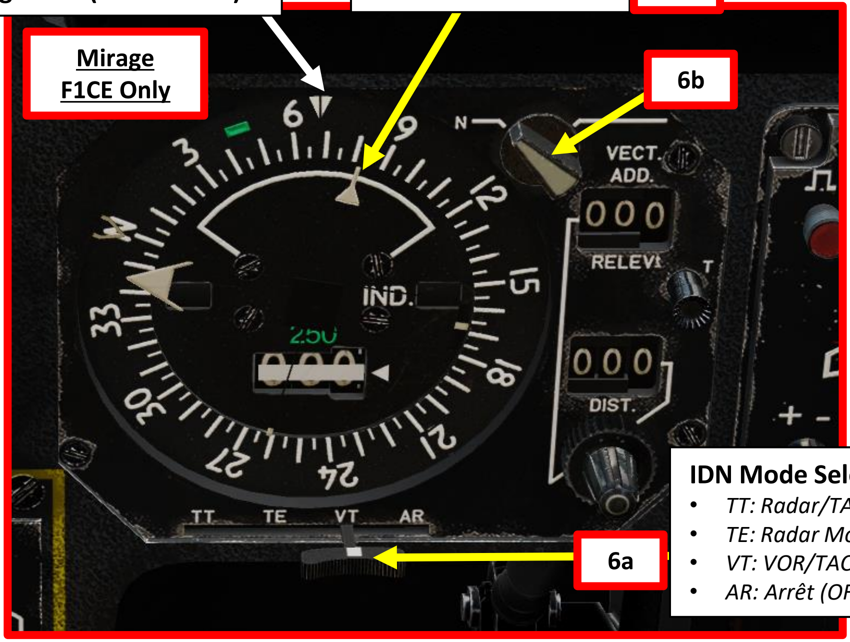


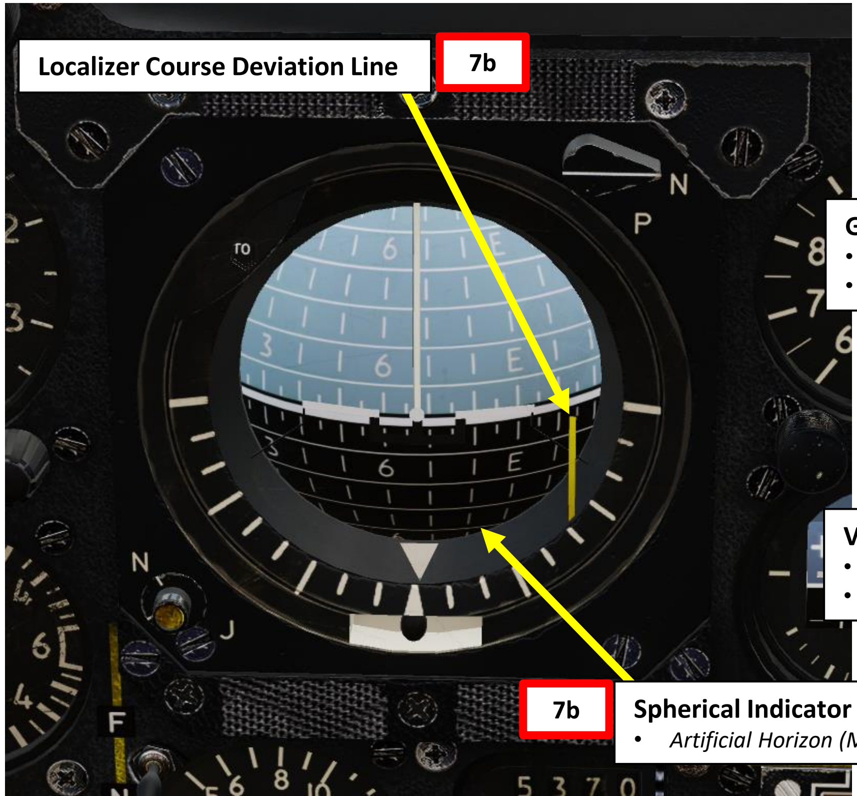


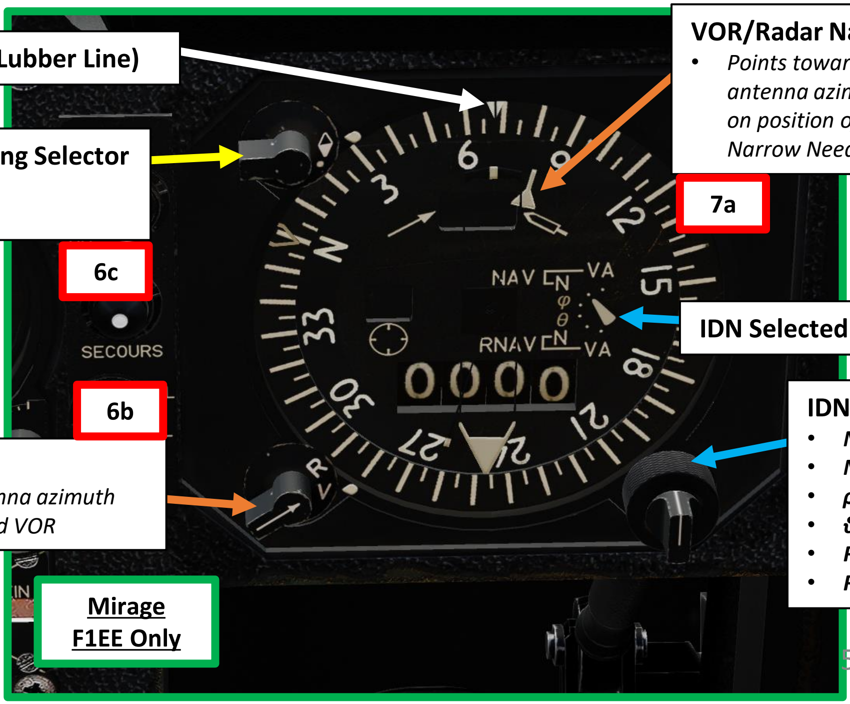


4 – VOR NAVIGATION

6. Set IDN (Navigation Indicator) – As Required.
   - For Mirage F1CE:
     a) Set IDN Mode Selector Switch – VT (VOR/TACAN) Mode.
     b) Set IDN Normal/Additional Vector Selector – N (Normal).
   - For Mirage F1EE:
     a) Set IDN Mode is selected to "NAV-N" (Normal Navigation with INS).
     b) Set VOR/Radar Narrow Needle Selector – V (VOR).
     c) Set Gyromagnetic / True Heading IDN Heading Selector – Diamond Symbol (Gyromagnetic Heading).
7. Once the VOR station is detected:
   a) Bearing to VOR station is available on the IDN *(Indicateur de Navigation)* Navigation Indicator. A morse code signal should be audible.
   b) The yellow line on the Spherical Indicator *(Indicateur Sphérique / Boule)* indicates deviation from the interception course to the VOR station.
   - Note: The VOR station will not provide distance information.

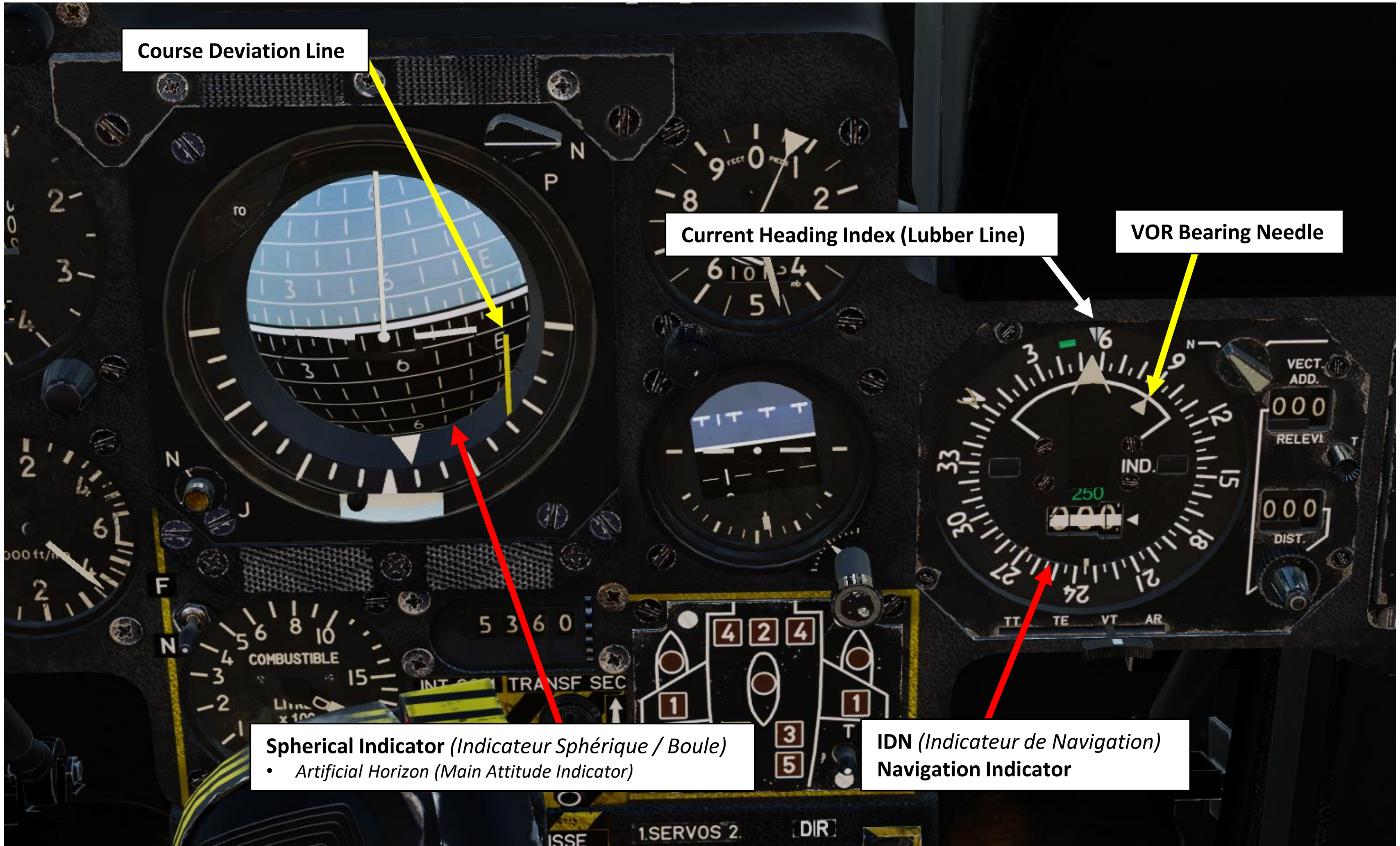




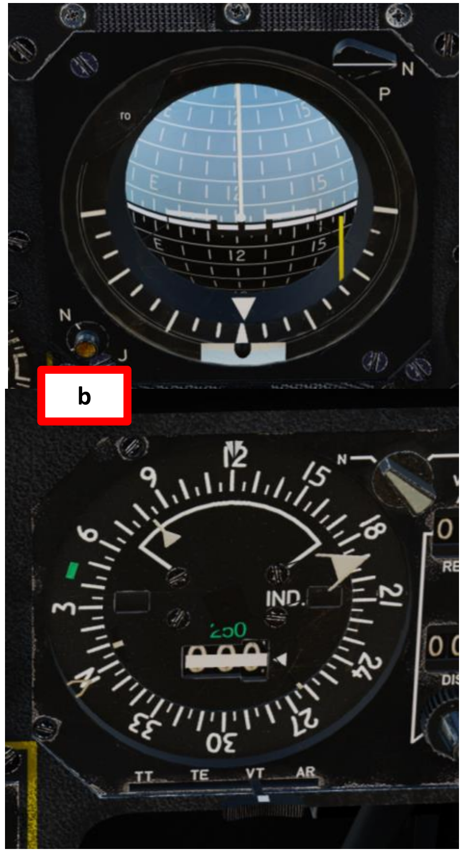


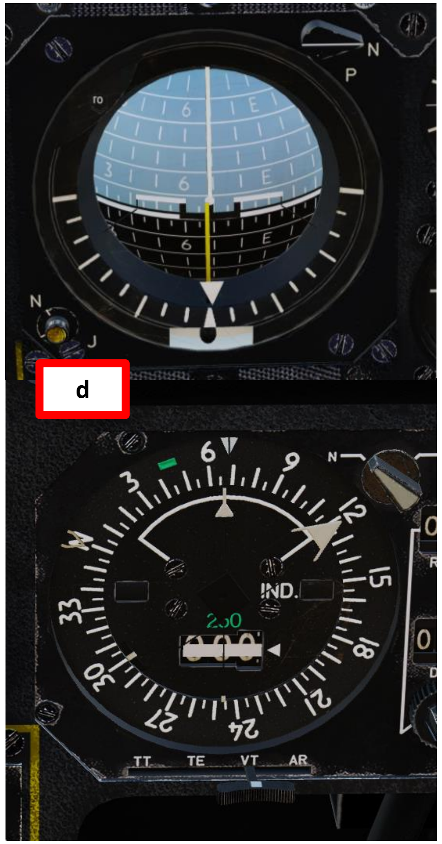
4 – VOR NAVIGATION

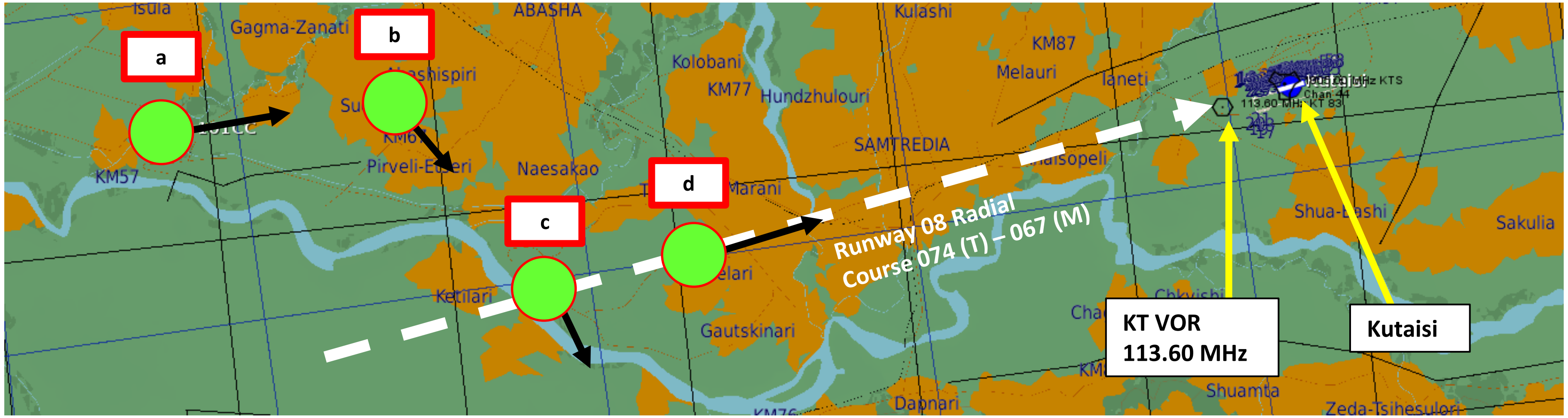
8. Steer the aircraft towards the VOR Radial Course Deviation Line. As you approach the radial, the line deviation with the vertical centerline of the Spherical Indicator will gradually diminish.
9. When Course Deviation Line is centered, this means you are on the 067 radial.
10. Turn towards the VOR Bearing Needle to follow the radial to the runway.



4 – VOR NAVIGATION





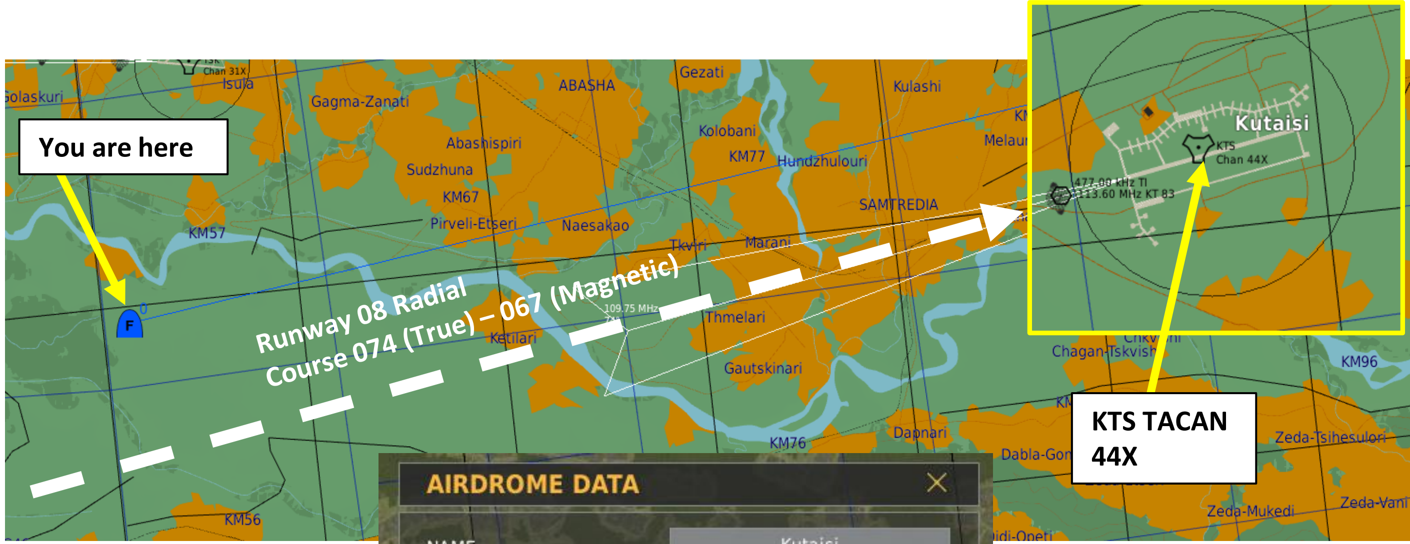


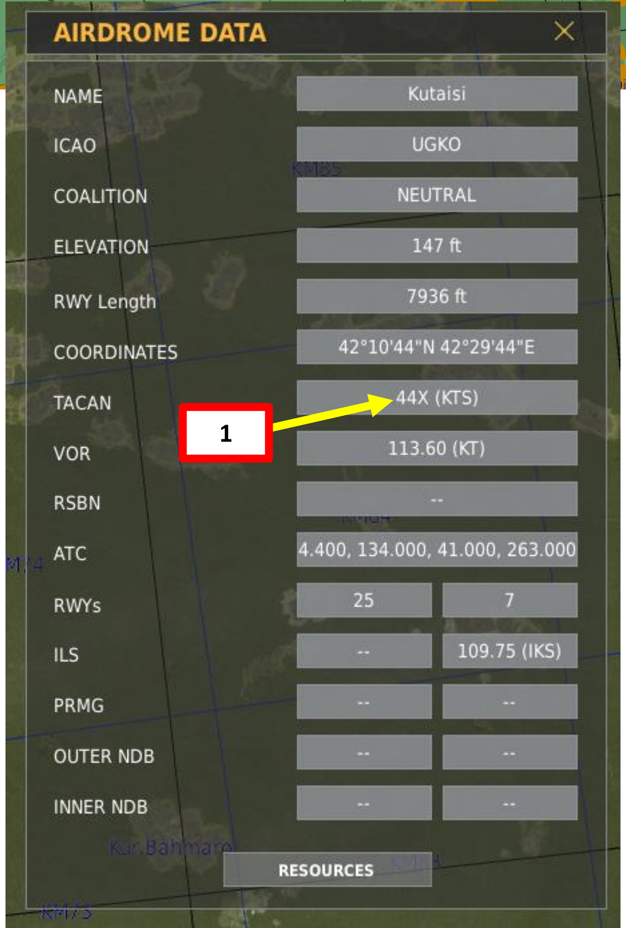
4 – VOR NAVIGATION

11. We are now aligned with the "KT" VOR for Kutaisi airport, following a radial course of 067 Magnetic.

5 – TACAN NAVIGATION
5.1 – TACAN Navigation Example

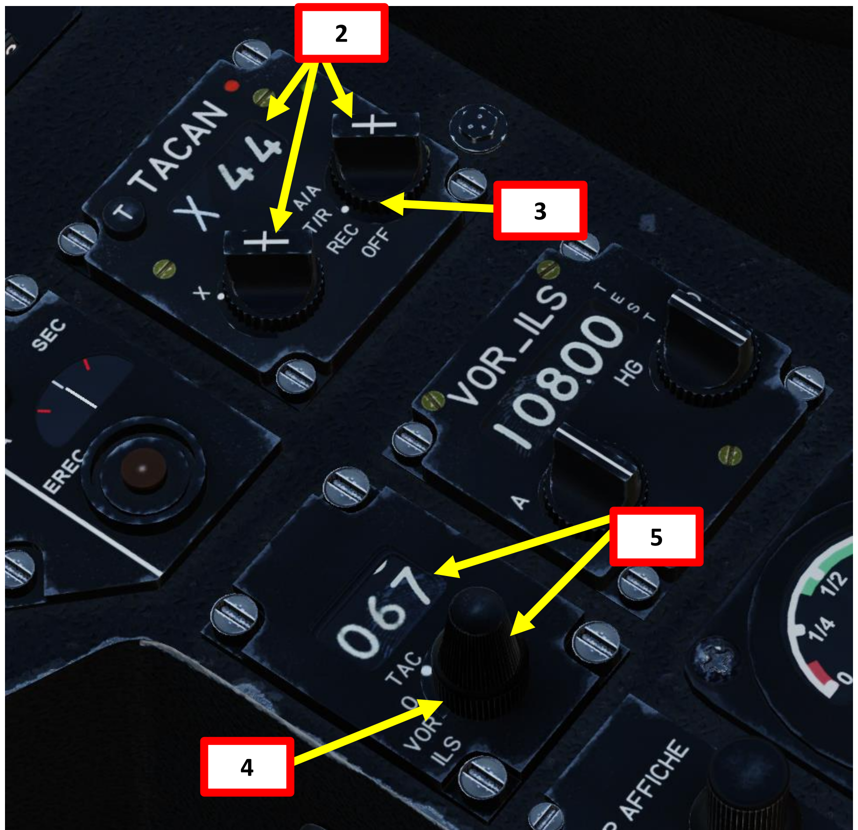
1. In this example, we will track the KTS TACAN (44X channel) station with a radial course of 067 Magnetic.
2. Set TACAN Station to 44X – Scroll mousewheel for channel numbers (44), click left knob for X/Y channel.
3. Set TACAN Mode to T/R (Transmit/Receive) – Mouse Click.
4. Set Navigation Aid (TACAN, VOR-ILS) Outer Knob Selector – TAC (TACAN), Mouse Click.
5. Set Navigation Aid (TACAN, VOR-ILS) Inner Knob Selector (also referred as the “Omnibearing Selector”) to the course we want to intercept the TACAN station with, which is course 067. Scroll mousewheel to rotate knob.




AIRDROME DATA

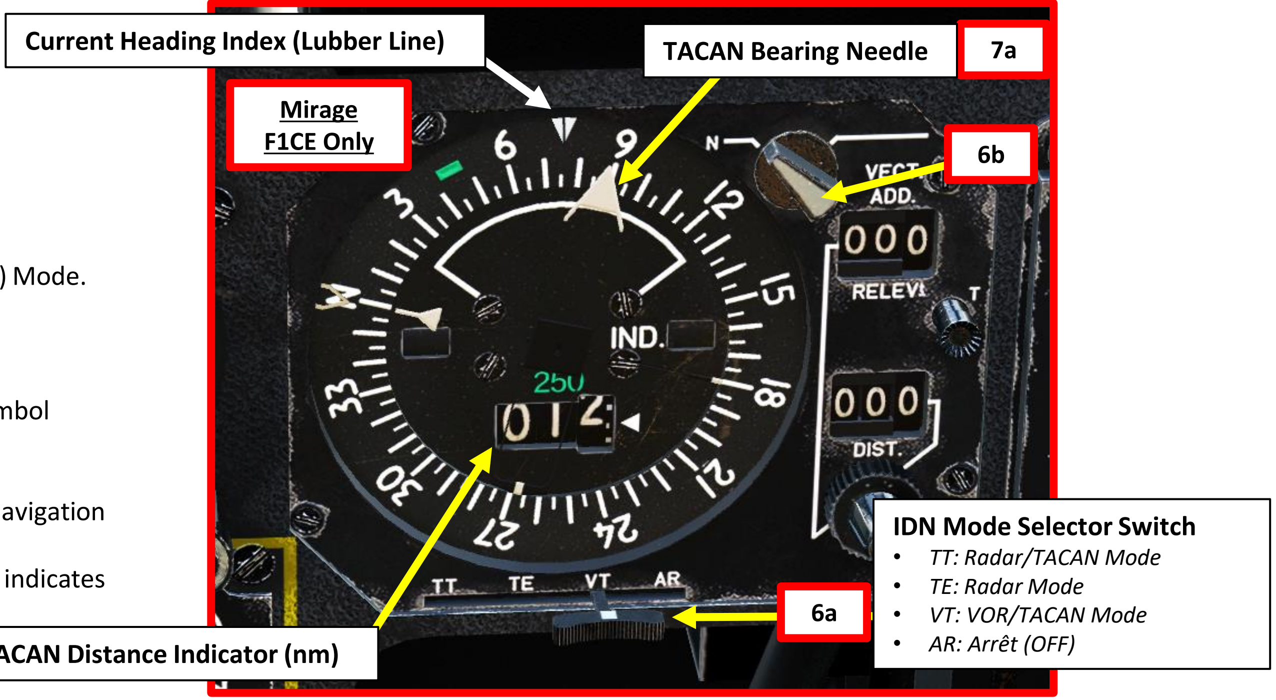
NAME	Kutaisi	
ICAO	UGKO	
COALITION	NEUTRAL	
ELEVATION	147 ft	
RWY Length	7936 ft	
COORDINATES	42°10'44"N 42°29'44"E	
TACAN	44X (KTS)	
VOR	113.60 (KT)	
RSBN	--	
ATC	4.400, 134.000, 41.000, 263.000	
RWYs	25	7
ILS	--	109.75 (IKS)
PRMG	--	--
OUTER NDB	--	--
INNER NDB	--	--

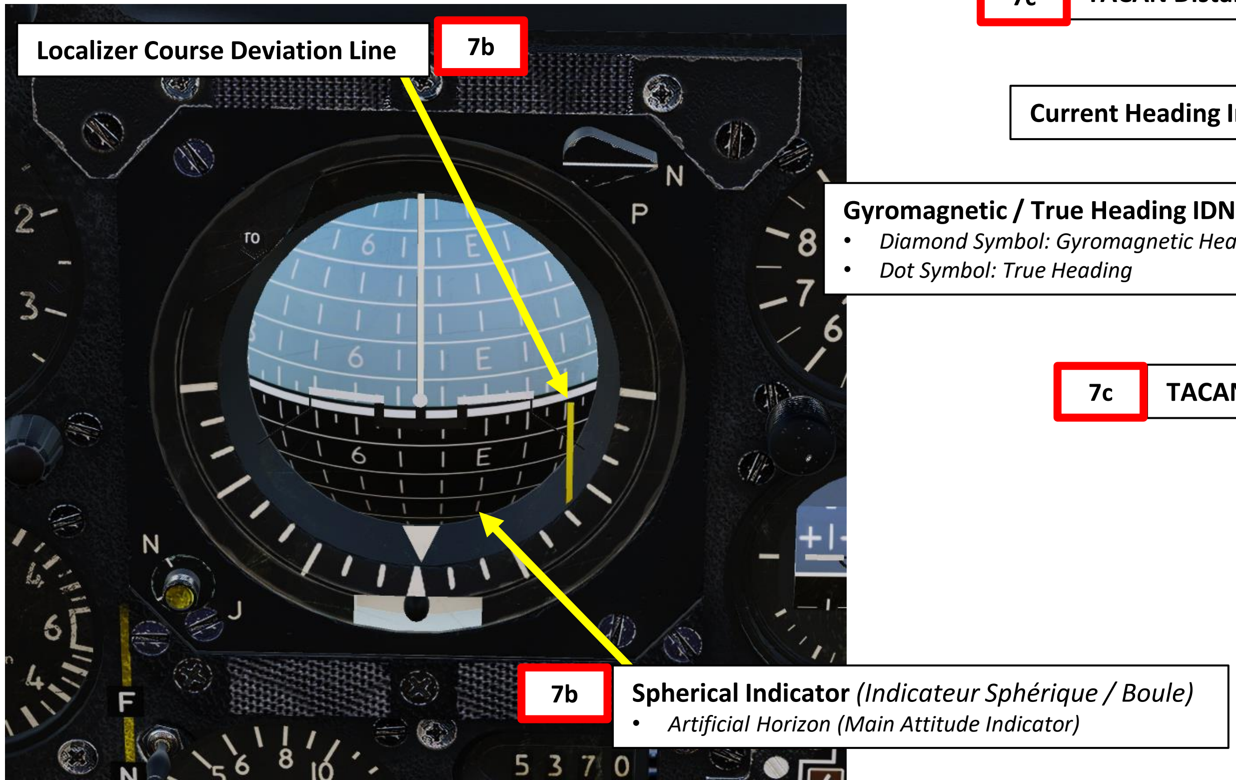
RESOURCES

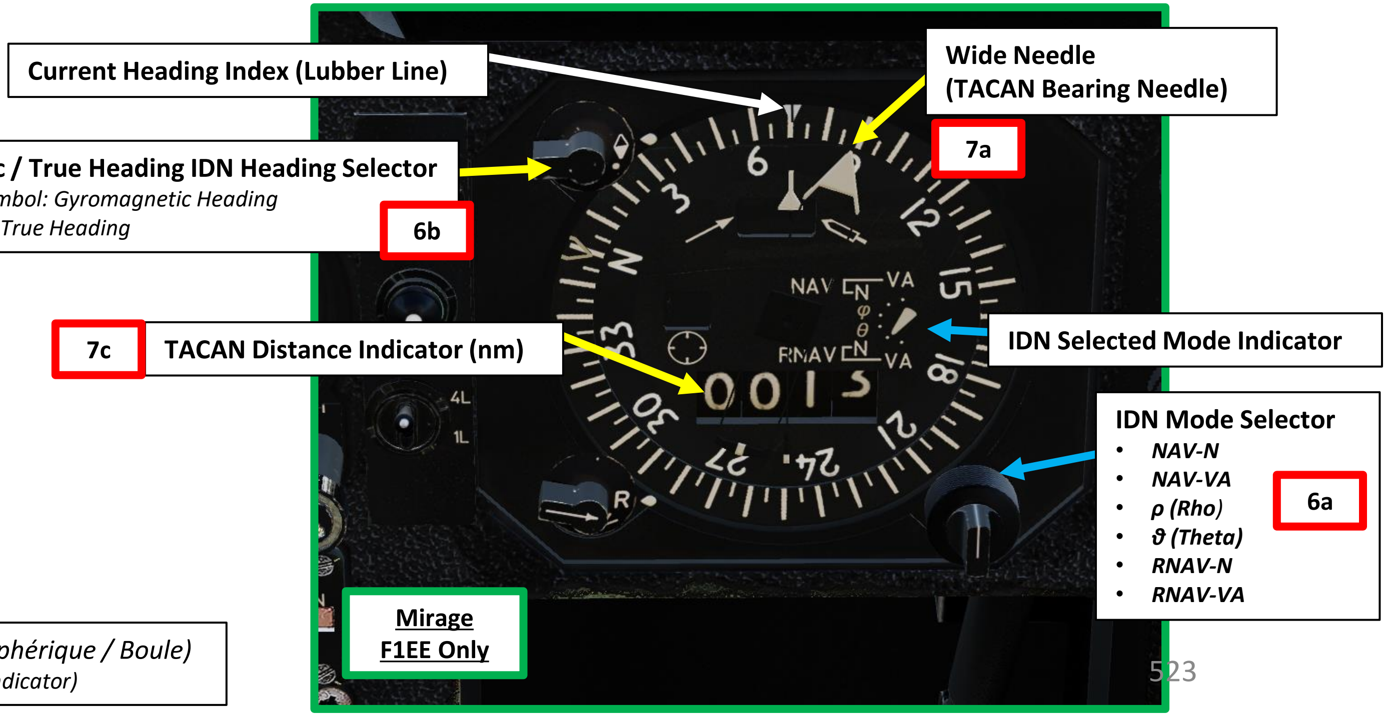


5 – TACAN NAVIGATION
5.1 – TACAN Navigation Example

6. Set IDN (Navigation Indicator) – As Required.
   - For Mirage F1CE:
     a) Set IDN Mode Selector Switch – TT (Radar/TACAN) or VT (VOR/TACAN) Mode.
     b) Set IDN Normal/Additional Vector Selector – N (Normal)
   - For Mirage F1EE:
     a) Set IDN Mode is selected to "RNAV-N" (Radio Navigation – Normal)
     b) Set Gyromagnetic / True Heading IDN Heading Selector – Diamond Symbol (Gyromagnetic Heading)
7. Once the TACAN station is detected:
   a) Bearing to TACAN station is available on the IDN *(Indicateur de Navigation)* Navigation Indicator. A morse code signal should be audible.
   b) The yellow line on the Spherical Indicator *(Indicateur Sphérique / Boule)* indicates deviation from the interception course to the TACAN station.
   c) Distance to TACAN is displayed in nm.

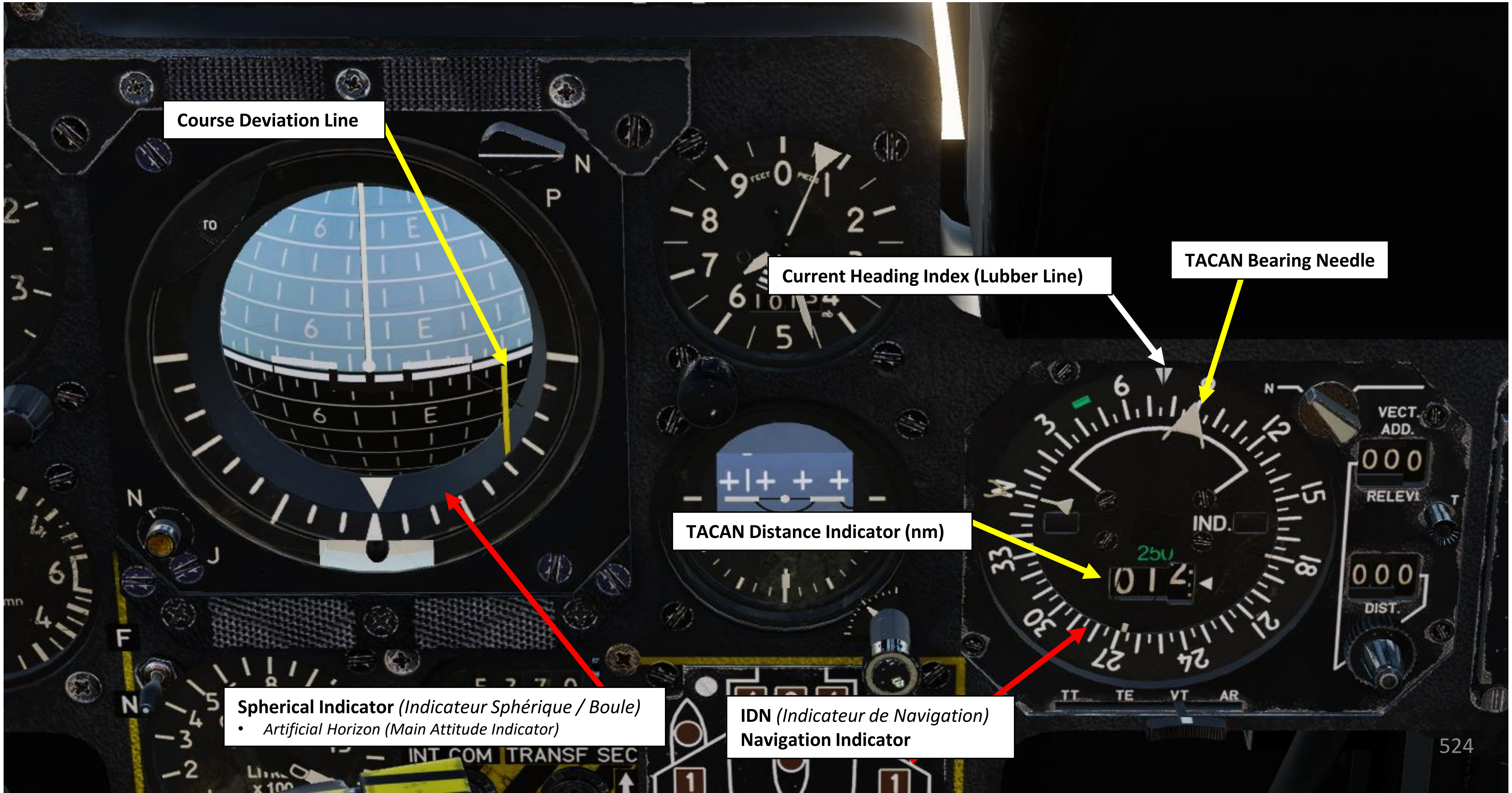






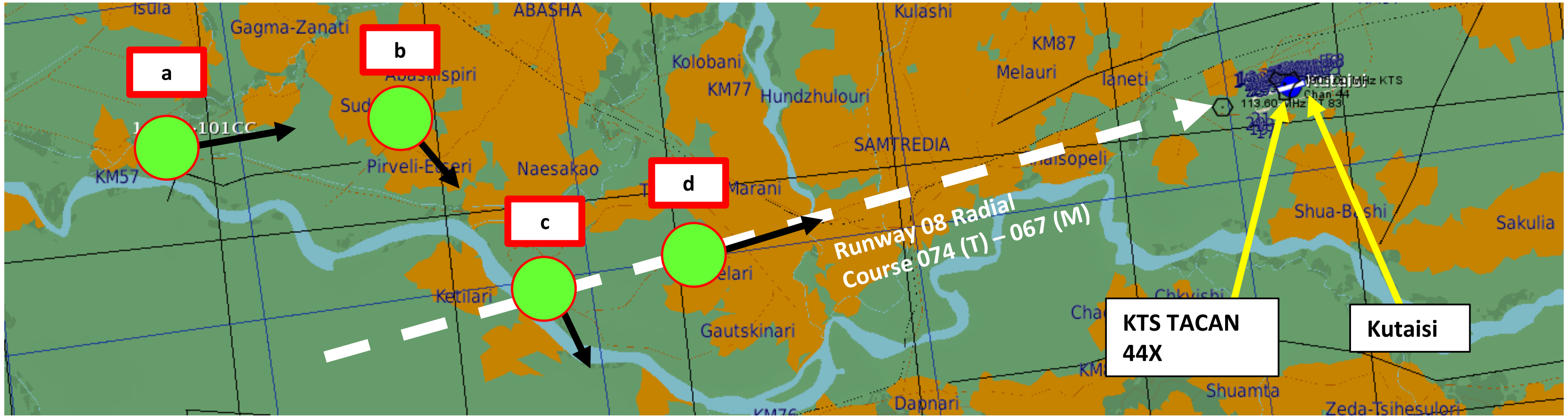
5 – TACAN NAVIGATION
5.1 – TACAN Navigation Example

8. Steer the aircraft towards the TACAN Radial Course Deviation Line. As you approach the radial, the line deviation with the vertical centerline of the Spherical Indicator will gradually diminish.
9. When Course Deviation Line is centered, this means you are on the 067 radial.
10. Turn towards the TACAN Bearing Needle to follow the radial to the runway.



5 – TACAN NAVIGATION

5.1 – TACAN Navigation Example



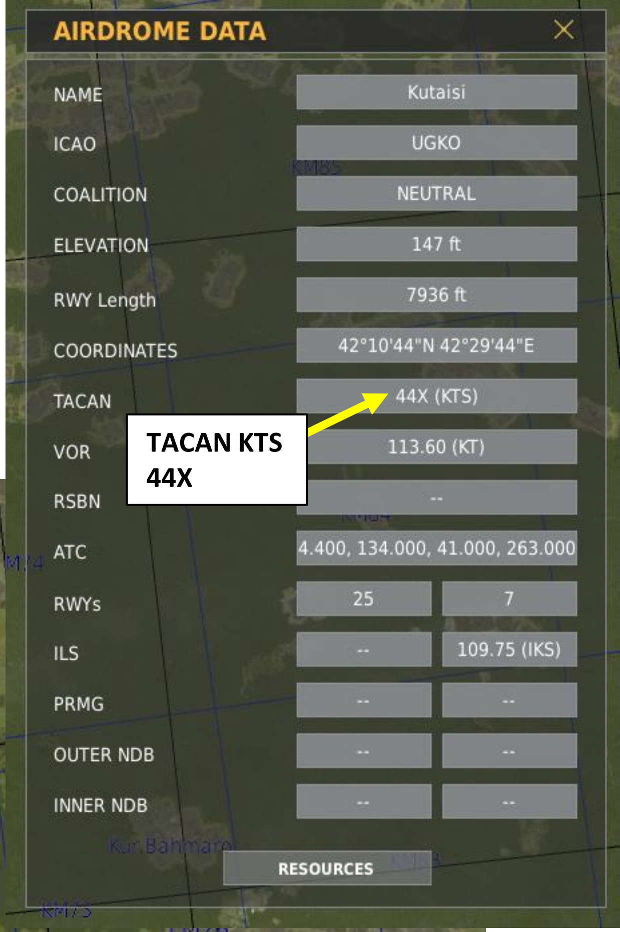
5 – TACAN NAVIGATION
5.1 – TACAN Navigation Example

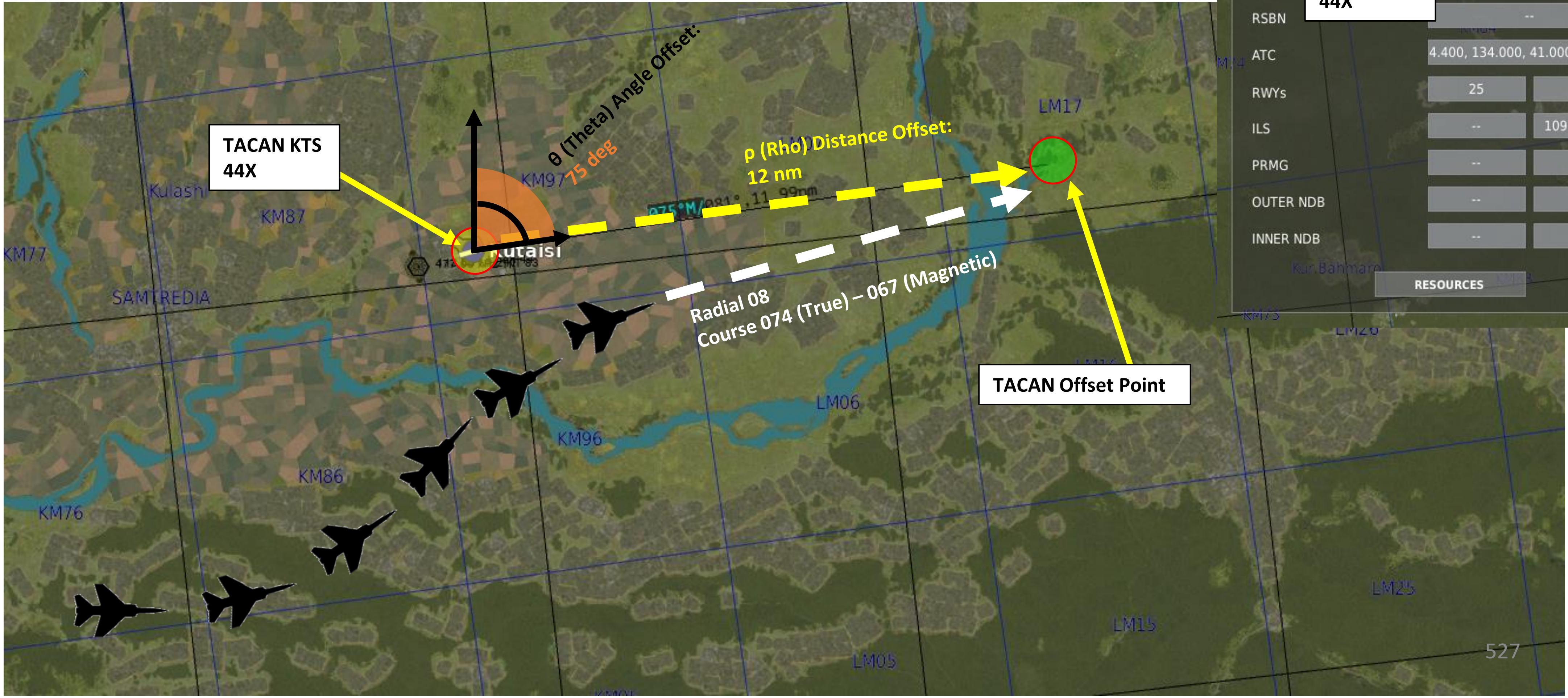
11. We are now aligned with the "KTS" TACAN 44X for Kutaisi airport, following a radial course of 067 Magnetic.

5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

A TACAN Offset is a reference point created from an existing TACAN station with two parameters:
A distance (**ρ, Rho**) offset and an angle (**θ, Theta**) offset from the **TACAN station.**

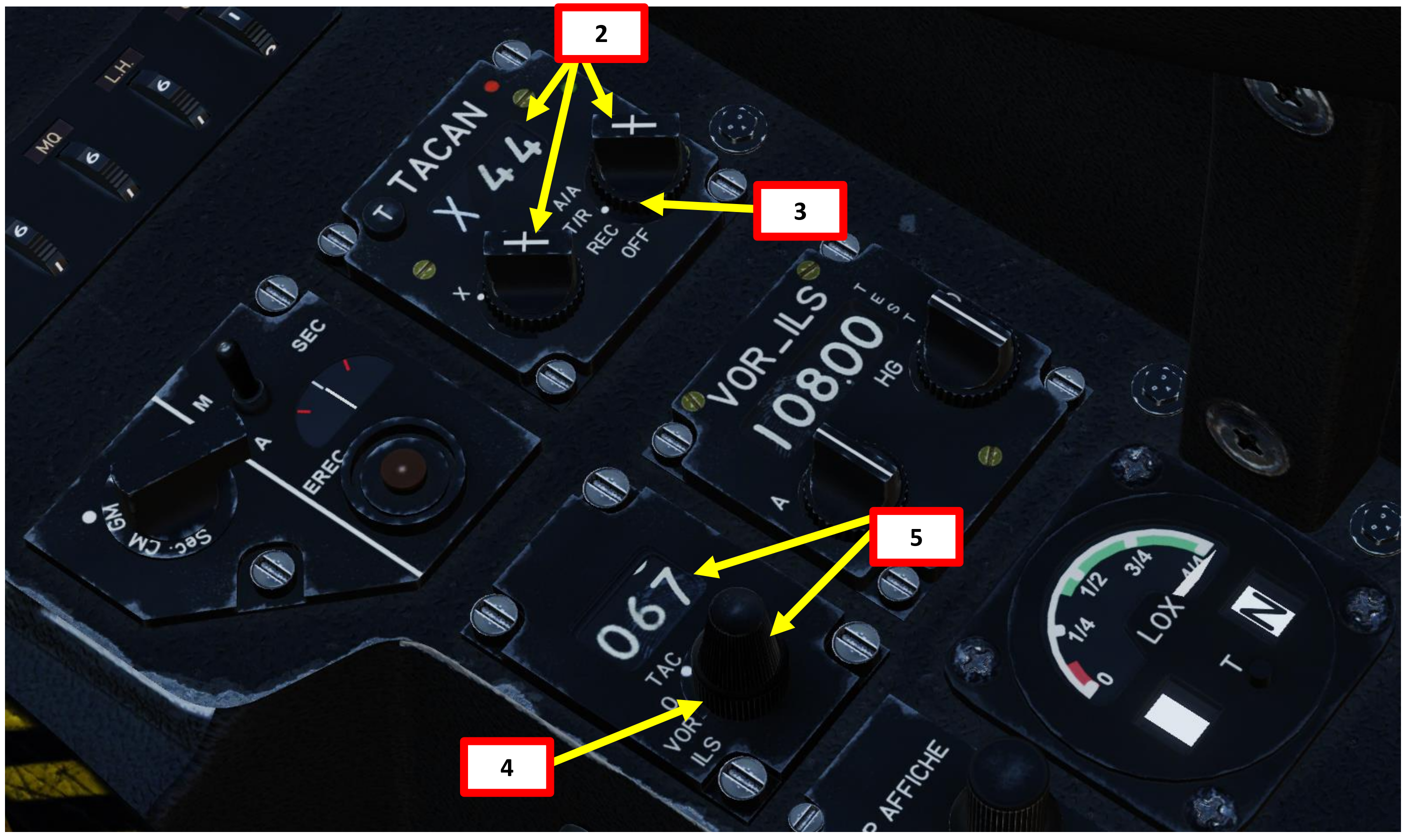
1. In this example, the **TACAN offset is set for a distance of 12 nm (Rho) and an angle of 75 deg (Theta).** The KTS TACAN (44X channel) station is used as a reference for the offset point. We will track the TACAN offset point by following a radial course of 067 Magnetic.





5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

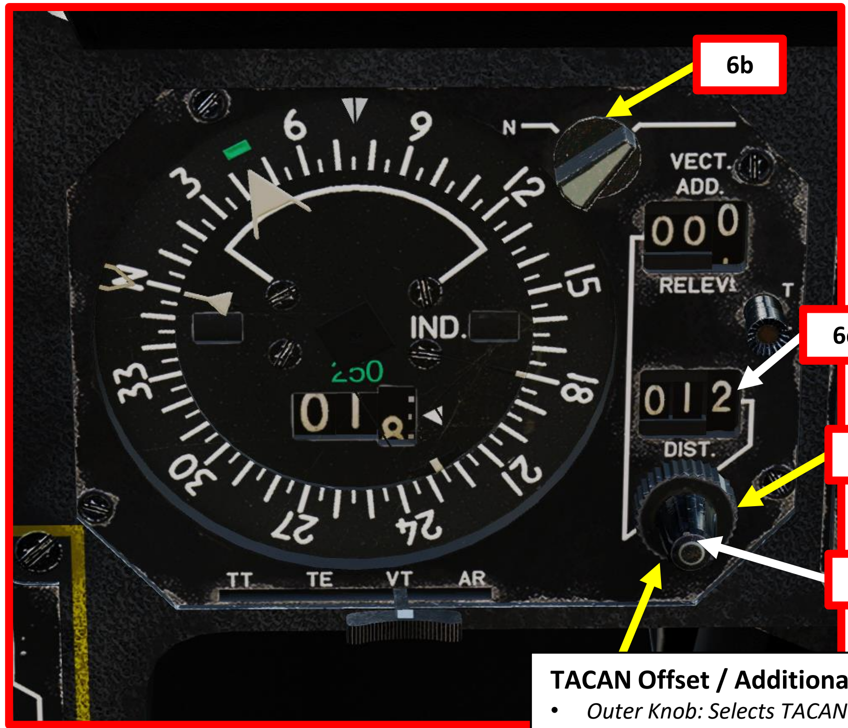
2. Set TACAN Station to 44X – Scroll mousewheel for channel numbers (44), click left knob for X/Y channel.
3. Set TACAN Mode to T/R (Transmit/Receive) – Mouse Click.
4. Set Navigation Aid (TACAN, VOR-ILS) Outer Knob Selector – TAC (TACAN), Mouse Click.
5. Set Navigation Aid (TACAN, VOR-ILS) Inner Knob Selector (also referred as the “Omnibearing Selector”) to the course we want to intercept the TACAN station with, which is course 067. Scroll mousewheel to rotate knob.



5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

Mirage F1CE Only

6. Set IDN (Navigation Indicator) – As Required.
- For Mirage F1CE:
  - a) Set IDN Mode Selector Switch – TT (Radar/TACAN) or VT (VOR/TACAN) Mode.
  - b) Set IDN Normal/Additional Vector Selector – VECT ADD (Additional Vector)
  - c) Set TACAN Offset / Additional Vector Parameter **Outer Knob to DIST** (use white line on the outer knob as a reference).
  - d) Rotate TACAN Offset / Additional Vector Parameter Inner Knob to adjust the DIST (Distance) parameter. We will set it to 12 nm.
  - e) Set TACAN Offset / Additional Vector Parameter **Outer Knob to R ELEV (Radius, Bearing Angle)** (use white line on the outer knob as a reference).
  - f) Rotate TACAN Offset / Additional Vector Parameter Inner Knob to adjust the R ELEV (Radius, Bearing Angle) parameter. We will set it to 75 deg.



TACAN Offset / Additional Vector Parameter Controls
- *Outer Knob: Selects TACAN Offset Additional Vector Angle/Bearing or Distance Parameter*
- *Inner Knob: Bearing/Distance Offset Tuning Knob*

5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

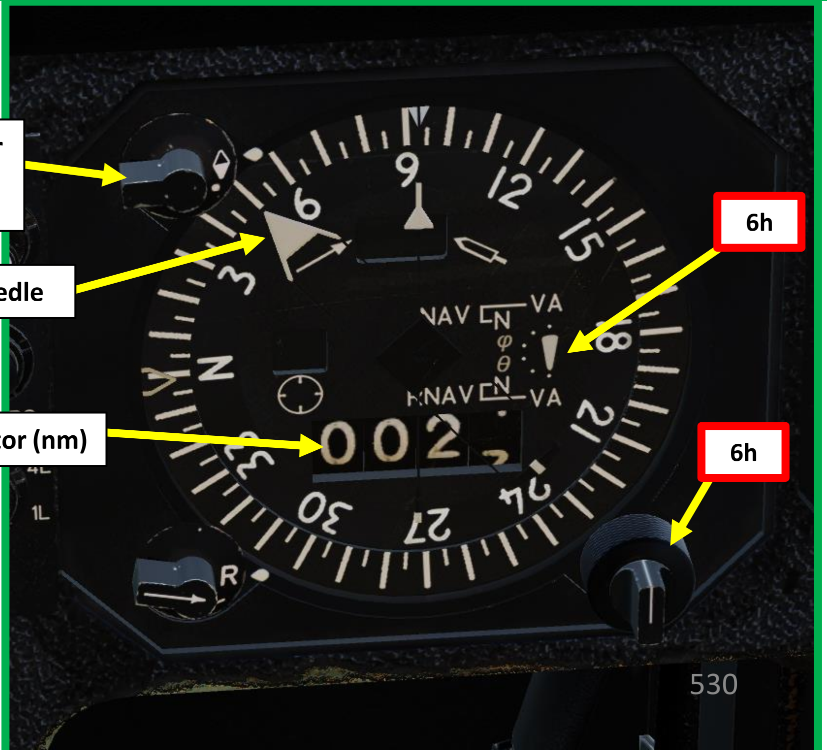
Mirage F1EE Only

6. Set IDN (Navigation Indicator) – As Required.
- For **Mirage F1EE**:
  - a) Set Gyromagnetic / True Heading IDN Heading Selector – Diamond Symbol (Gyromagnetic Heading)
  - b) Set IDN Mode Selector to **ρ (Rho)** by turning the IDN Mode **Outer** knob
  - **c)** **Distance offset** parameter is set by by turning the IDN Mode **Inner** knob
  - d) The distance offset parameter is now memorized. However, an angle offset θ (Theta) also needs to be entered as well.
  - e) Set IDN Mode Selector to **θ (Theta)** by turning the IDN Mode **Outer** knob.
  - **f)** **Angle offset** parameter is set by by turning the IDN Mode **Inner** knob
  - g) The angle offset parameter is now memorized.
  - h) When **both Distance ρ and Angle θ offset parameters are set**, set the **IDN Mode "RNAV-VA"**. This will make the Wide Needle point towards the TACAN offset point.

6a **Gyromagnetic / True Heading IDN Heading Selector**
- *Diamond Symbol: Gyromagnetic Heading*
- *Dot Symbol: True Heading*

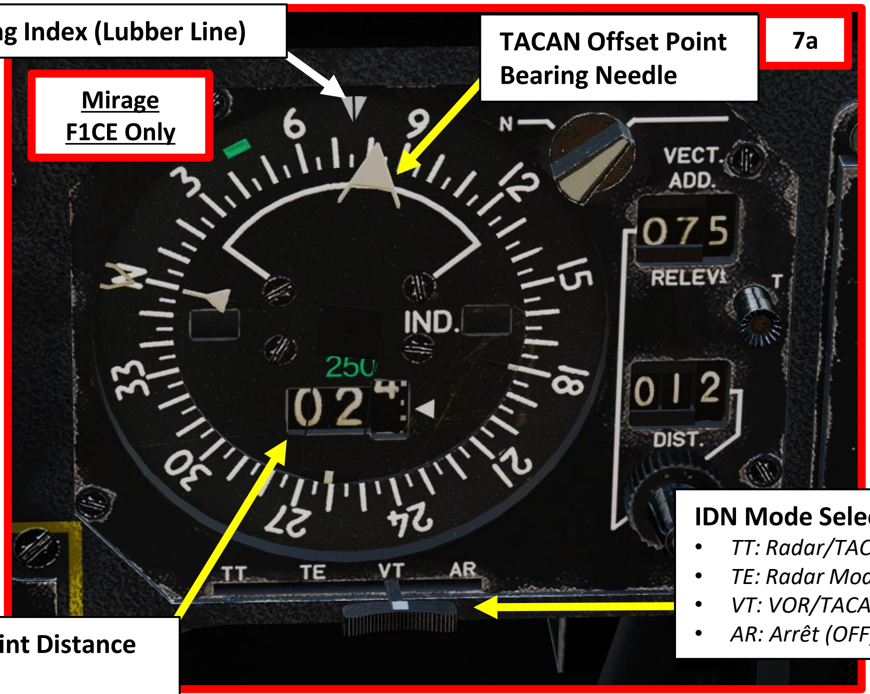
Wide Needle

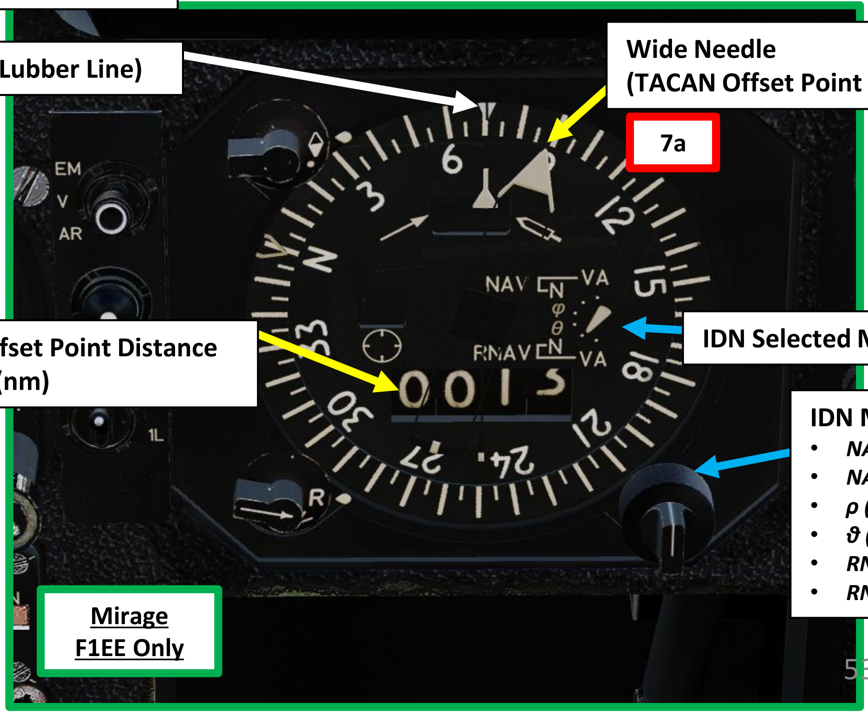
Distance Indicator (nm)

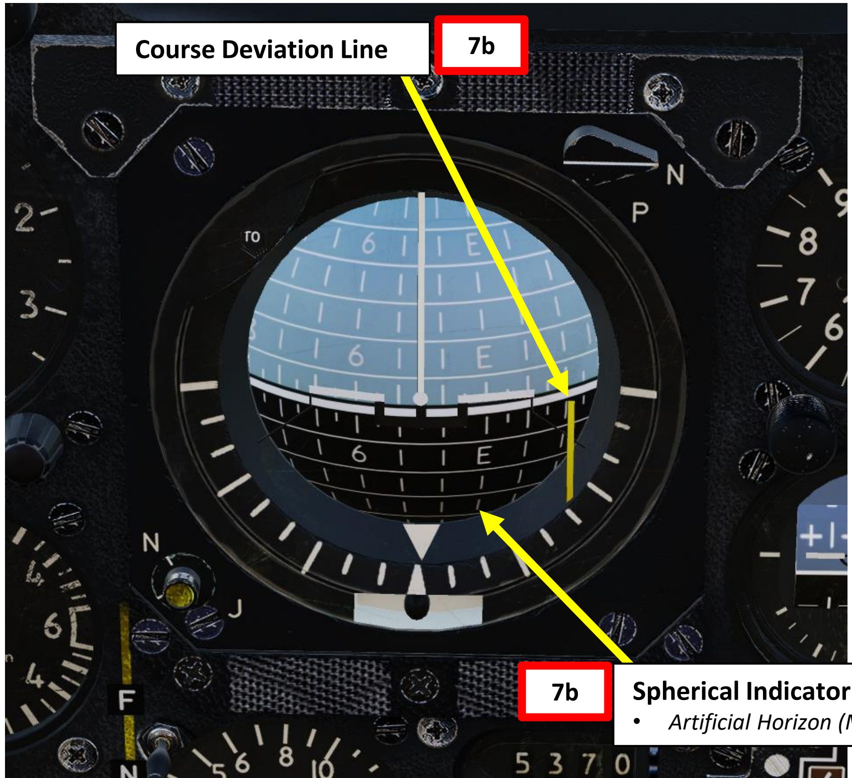


5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

7. Once the TACAN station is detected:
   a) Bearing to TACAN station offset point is available on the IDN *(Indicateur de Navigation)* Navigation Indicator. A morse code signal should be audible.
   b) The yellow line on the Spherical Indicator *(Indicateur Sphérique / Boule)* indicates deviation from the interception course to the TACAN station offset point.
   c) Distance to TACAN offset point is displayed in nm.

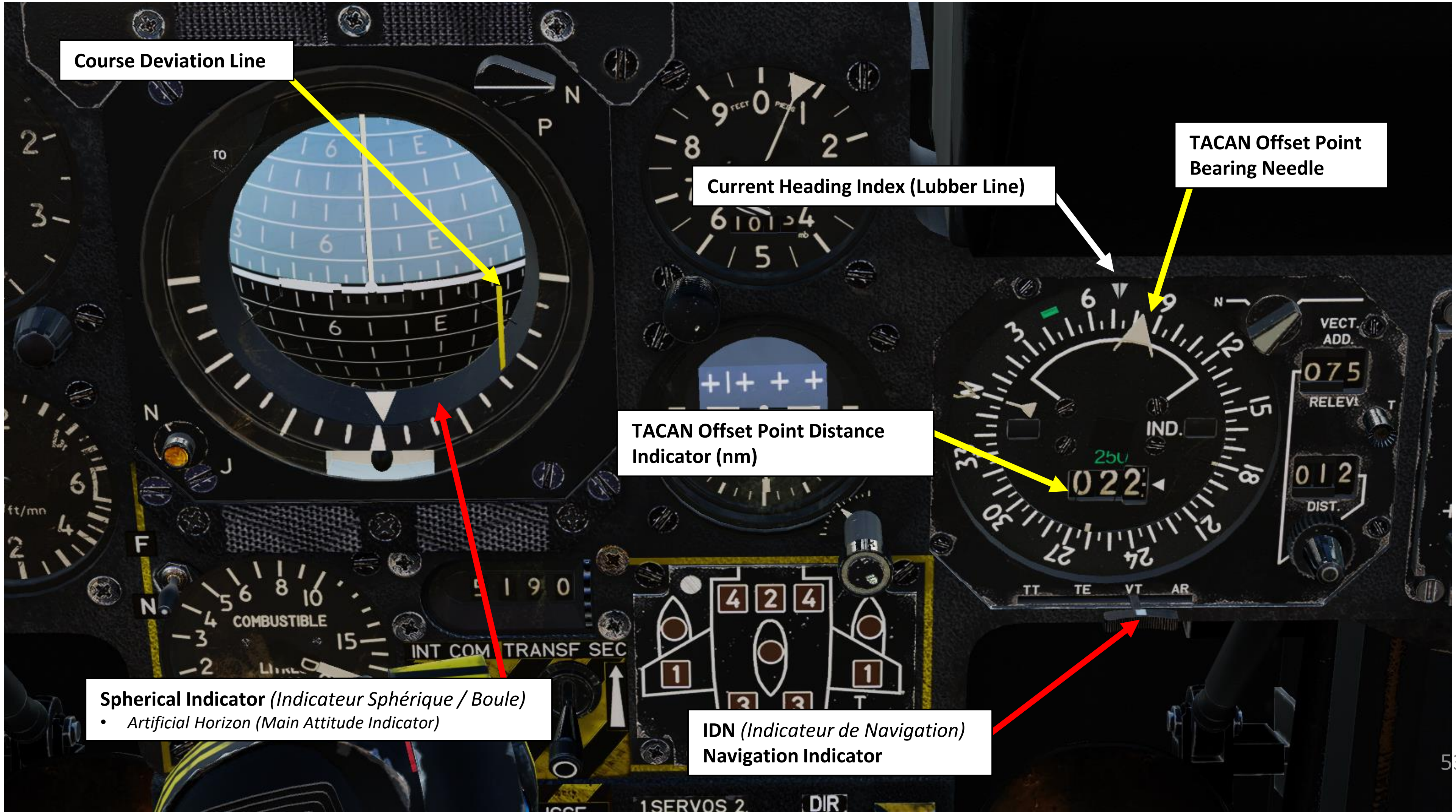






5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

8. Similarly to the TACAN tutorial, steer the aircraft towards the TACAN Offset Point Radial Course Deviation Line. As you approach the radial, the line deviation with the vertical centerline of the Spherical Indicator will gradually diminish.
    - The difference between this tutorial and the TACAN tutorial is that we are tracking a fictional point offset from the TACAN station.
9. When Course Deviation Line is centered, this means you are on the 067 radial. See previous TACAN tutorial to see a detailed radial interception process.
10. Turn towards the TACAN Offset Point Bearing Needle to follow the radial to the runway.



5 – TACAN NAVIGATION
5.2 – TACAN Offset (Additional Vector)

11. We are now aligned with the TACAN Offset Point (12 nm away from “KTS” TACAN 44X with a 75 deg bearing), following a radial course of 067 Magnetic.

6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)

6.1 – INS Introduction

The Inertial Navigation System (INS), referred as *Unité de Navigation Inertielle* (UNI) in French, is an autonomous navigation system that is composed mainly of three gyroscopes, three accelerometers, a platform, three servomotors and a computer. The principle of operation consists in measuring the aircraft acceleration, integrating that signal to get its velocity and integrating the latter to get the distance travelled.

In order to compute this data, a stable and horizontal platform (in other words, a platform that is constantly perpendicular to the aircraft's current position in relation to the Earth) is required in addition to the aircraft's initial position. The INS platform incorporates three orthogonal gyroscopes and three orthogonal accelerometers in the three coordinate axis, meaning that they are all perpendicular to each other. It also incorporates three orthogonal servomotors that stabilize the platform according to the feedback signal from the gyroscopes.

The INS is able to know by itself its current latitude since it detects the vertical and horizontal components of the earth rotation vector. However, the INS does not know its longitude. In order to align the INS after power-up, the INS needs the initial aircraft position. The initial position can be the last memorized position or it can be also introduced manually. Simply put, the INS needs to be "aligned" on a position prior to flying, which can be done with a few different methods based on the urgency of the mission, quality of the position precision and other factors.

There are three alignment methods, which are covered in the start-up procedure section:

- Normal alignment (ALN – *Alignment normal*)
- Stored heading alignment (ALCM – *Alignment sur cap mémorisé*)
- Fast alignment (ALR – *Alignment rapide*)

The PCN (Navigation Control Panel, *Poste de Contrôle Navigation* in French) is powered by the emergency AC system. The INU (Inertial Navigation Unit) is supplied by the AC system 1. In case of failure of both alternators, the INU is powered by a converter powered by the DC main system.

INS (Inertial Navigation System) Data Display Window

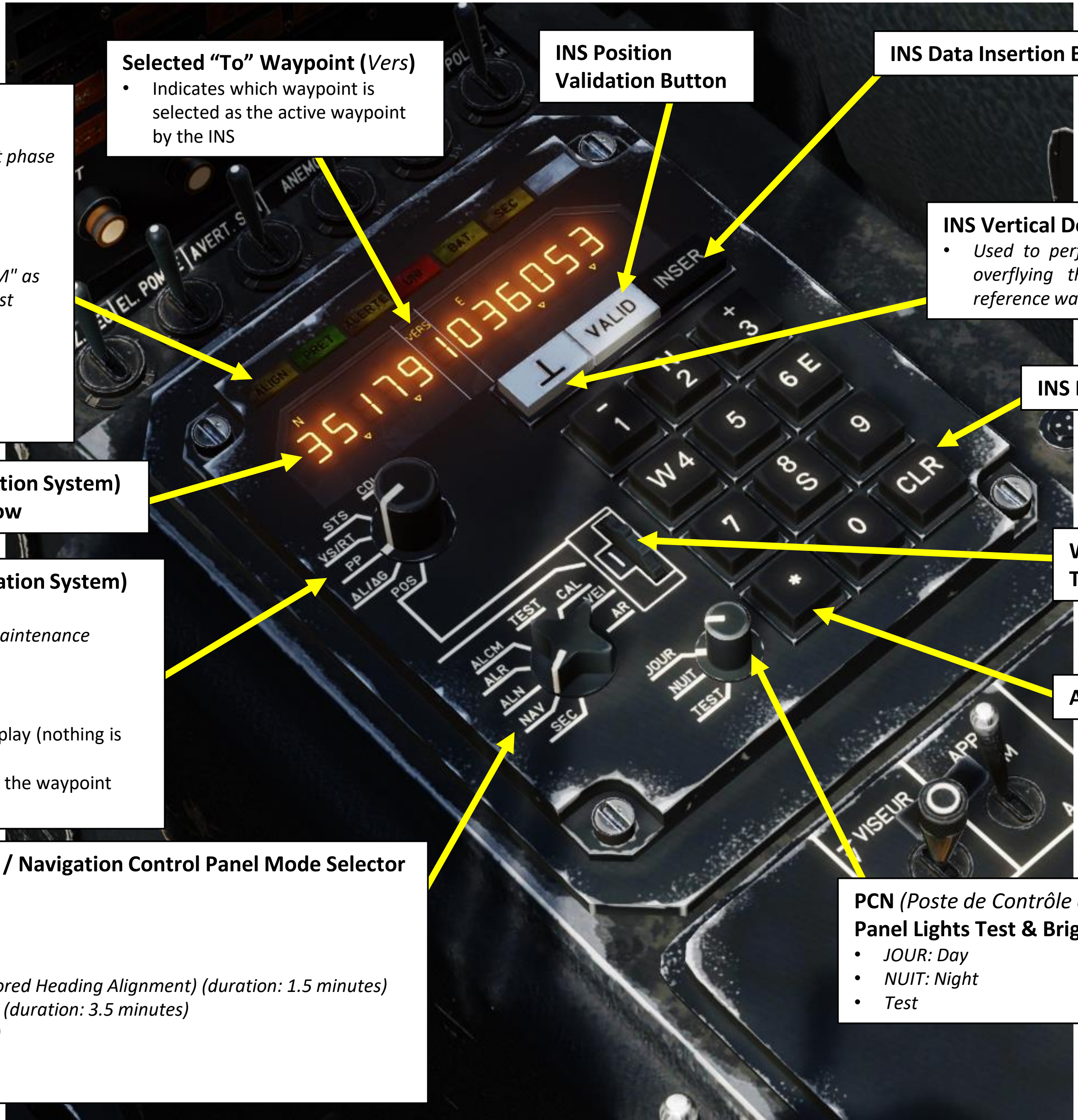
PCN *(Poste de Contrôle de Navigation)* **/ Navigation Control Panel**

<table>
<tr><th colspan="2">INS Operation Envelope</th></tr>
<tr><td>Altitude</td><td>0 to 70,000 ft</td></tr>
<tr><td>Ground speed</td><td>0 to 1,800 kt</td></tr>
<tr><td>Latitude</td><td rowspan="2">No limitation</td></tr>
<tr><td>Attitude angle</td></tr>
</table>

Mirage F1EE Only

6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)

6.1 – INS Introduction



INS (Inertial Navigation System) Status Lights

- *ALIGN (amber):*
  - *Blinking: in Standby (VEILLE) Mode or in the initial INS alignment phase*
  - *Steady: last phase of INS alignment (precision phase)*
  - *OFF: INS alignment complete*
- *PRÊT (green): INS alignment is complete and ready*
- *ALERTE (amber):*
  - *Blinking: in Standby (VEILLE) Mode, or on "ALN", "ALR" or "ALCM" as long as "*" has not been pressed, or at the end of the INU self-test ("TEST" position of the mode selector)*
  - *Steady: PCN failure or anomaly in information sharing*
- *UNI (red): INS Failure*
- *BAT (amber): Operation of the INU on the protected 28 V DC battery bus*
- *SEC (amber): Mode selector is set to Secours (Emergency) Mode*

Selected "To" Waypoint (*Vers*)

- Indicates which waypoint is selected as the active waypoint by the INS

INS Position Validation Button

INS Data Insertion Button

INS Vertical Designation (⊥) Button

- *Used to perform a navigation fix while overflying the expected position of a reference waypoint*

INS Data Entry Keypad

INS (Inertial Navigation System) Data Display Window

Waypoint Selection Thumbwheel

Asterisk (*) Button

UNI (*Unité de Navigation Inertielle*) **/ INS (Inertial Navigation System) Parameter Selector**

- *CDI: Données Codées Inertielles (INS codes & data), used for maintenance*
- *STS: Status*
- *VS/RT:* Ground Speed / True Heading (*Vitesse au Sol / Route*)
- *PP: Present Position*
- ΔL/ΔG: display shows distance to next waypoint in the left display (nothing is shown in the right display)
- POS: display shows the position of the waypoint selected with the waypoint selection wheel

PCN *(Poste de Contrôle de Navigation)* **/ Navigation Control Panel Mode Selector**

- *AR: Arrêt (OFF)*
- *VEI: Veille (Standby)*
- *CAL: Calibration (used for maintenance)*
- *TEST (used for maintenance)*
- *ALCM: Alignement sur Cap Mémorisé (Stored Heading Alignment) (duration: 1.5 minutes)*
- *ALR: Alignement Rapide (Fast Alignment) (duration: 3.5 minutes)*
- *ALN: Full Alignment (duration: 8 minutes)*
- *NAV: Navigation Mode*
- *SEC: Secours (Emergency) Mode*

PCN *(Poste de Contrôle de Navigation)* **Panel Lights Test & Brightness Selector**

- *JOUR: Day*
- *NUIT: Night*
- *Test*

Mirage F1EE Only

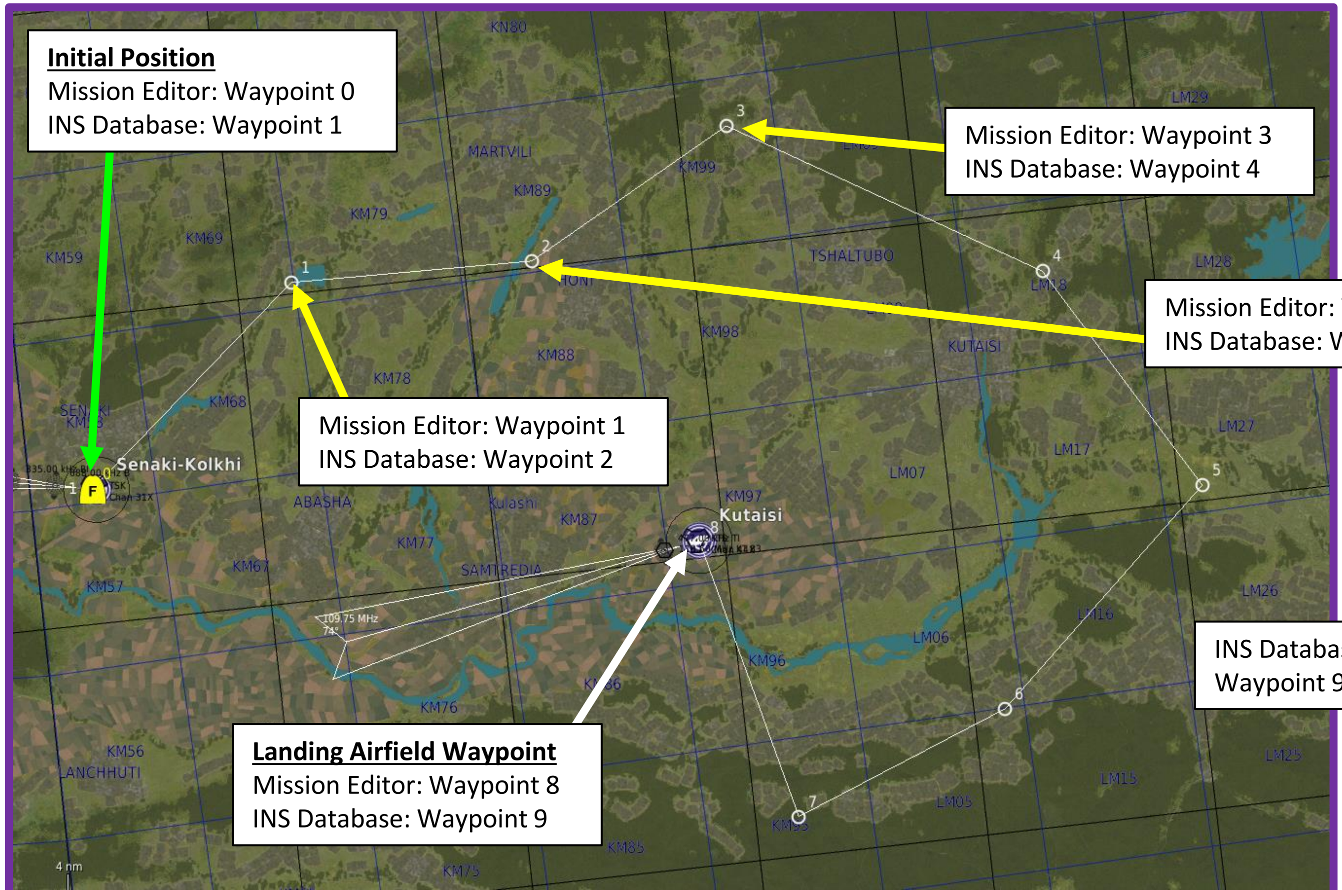
6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.1 – Waypoint Creation/Editing

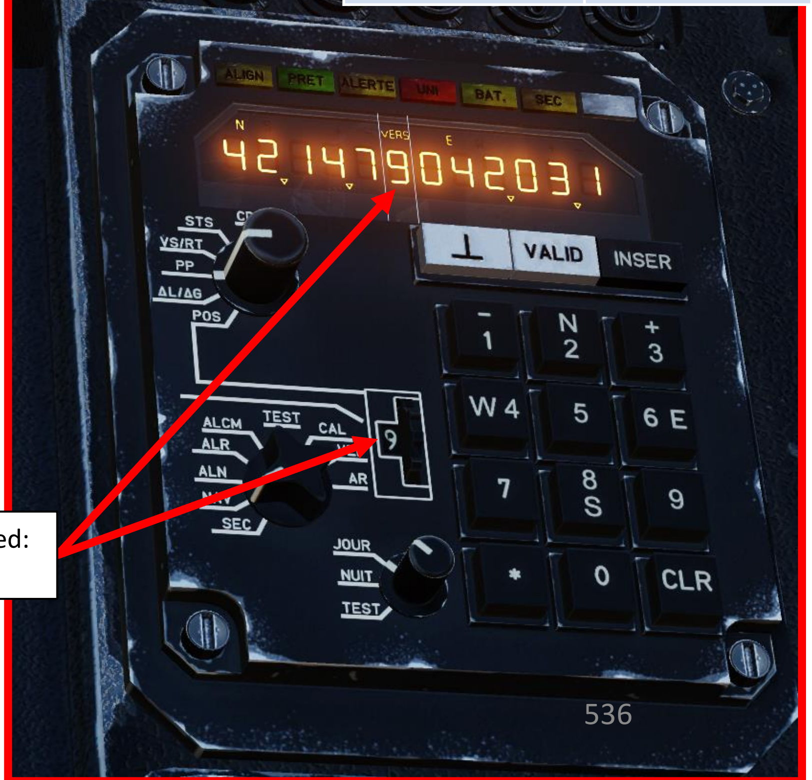
The INS database of the Mirage F1EE can memorize up to 9 waypoints, numbered from 1 to 9. Waypoint No. 1 is set to the initial position of the aircraft. For complex flight plans that have more than 9 waypoints, the pilot would need to manually change/overwrite coordinates of existing waypoints to the ones listed in the flight plan.

Keep in mind that in the Mission Editor, the initial aircraft position is referred as “Waypoint 0”, but the INS database waypoint index only begins from “Waypoint 1”. This means that a **Mission Editor waypoint** No. 0 corresponds a **INS waypoint** No. 1, a Mission Editor waypoint No. 1 corresponds to a INS waypoint No. 2, and so on and so forth.

INS Waypoints are represented in **degrees, minutes and tenths of minutes**.

Waypoint No. in Mission Editor	Waypoint No. in INS Database
0	1
1	2
2	3
3	4
4	5
5	6
6	7
7	8
8	9



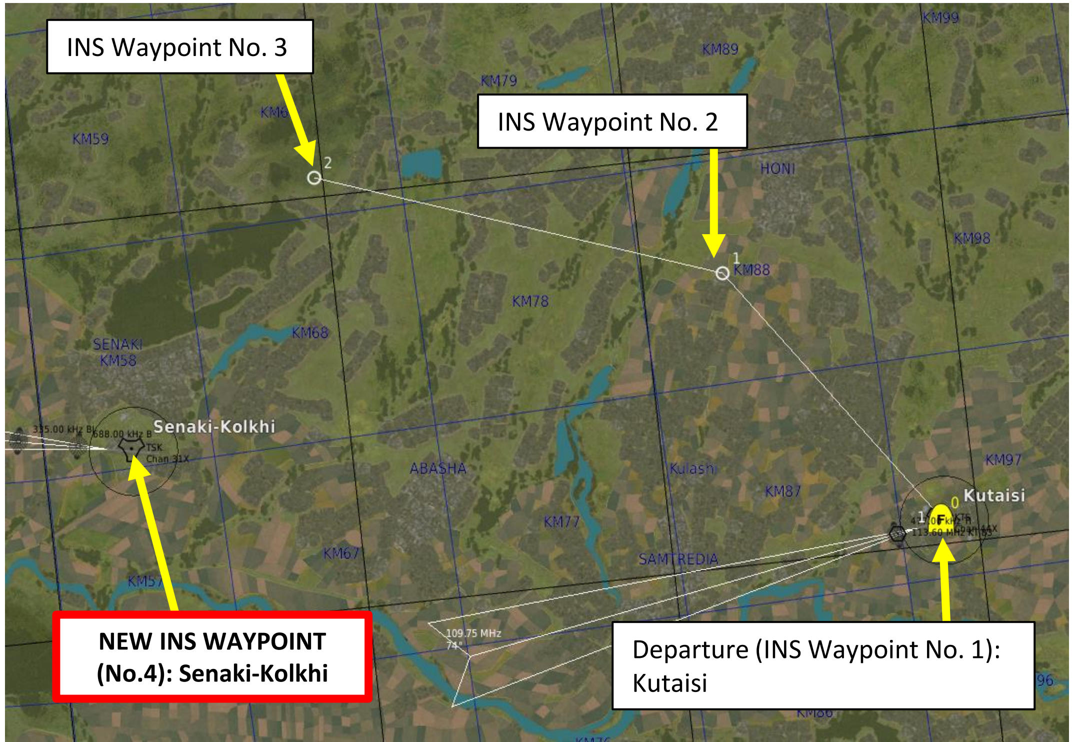


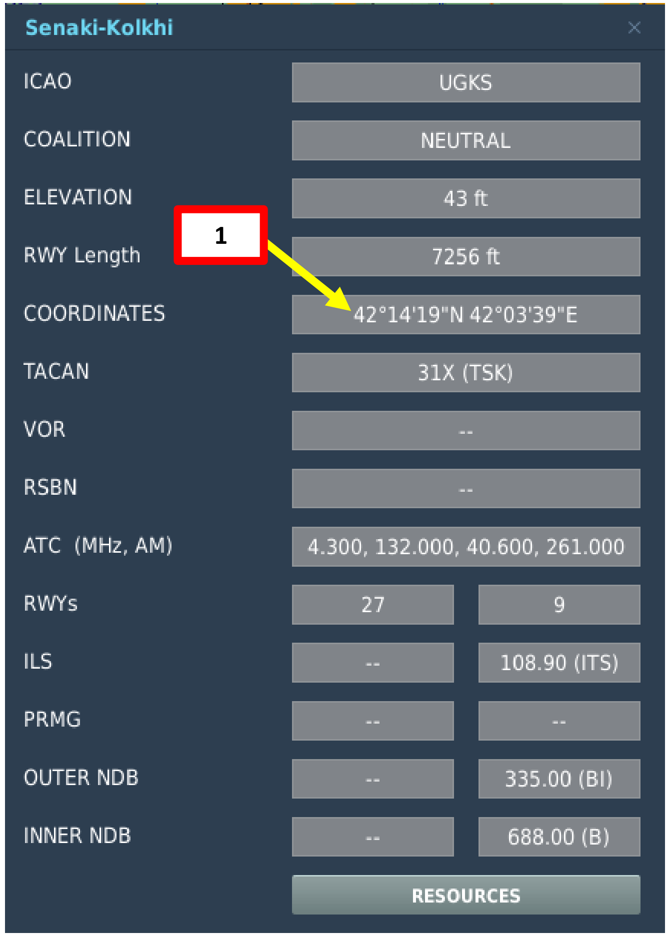
Mirage F1EE Only

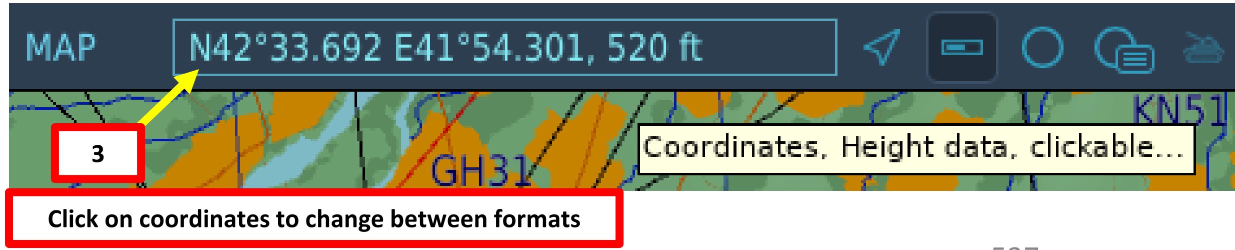
6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.1 – Waypoint Creation/Editing

Note: In this tutorial, we already have three waypoints set in the INS via the mission editor. We will add a fourth waypoint located at Senaki-Kolkhi. Keep in mind that to add Waypoint No. 4, we need to have at least three existing waypoints already.

1. Note the LAT-LONG coordinates and ground elevation of the waypoint you want to add. By pressing "F10" and selecting the map, we find: Senaki-Kolkhi Coordinates (Deg, Min, Sec): 42°14'19'' **N**ORTH 42°03'39''**E**AST
2. The INS system in the Mirage needs coordinates to be entered in a **degrees, minutes, decimal-minutes format**. You can either convert the coordinates yourself (see example below) or you can click on the MAP COORDINATES data field on the F10 map to switch between coordinate formats directly.
3. New Waypoint No. 4 Coordinates (Conversion from degree, minutes, seconds (") format to **degrees, minutes, decimal-minutes format**):
   42°14'**19**'' NORTH = 42°14.**317** NORTH (Mirage INS Format)
   317 = 19 x 1000 / 60 since there are 60 seconds in a minute
   42°03'**39**''EAST = 042°03.**650** EAST (Mirage INS Format)
   650 = 39 x 1000 / 60 since there are 60 seconds in a minute







6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)

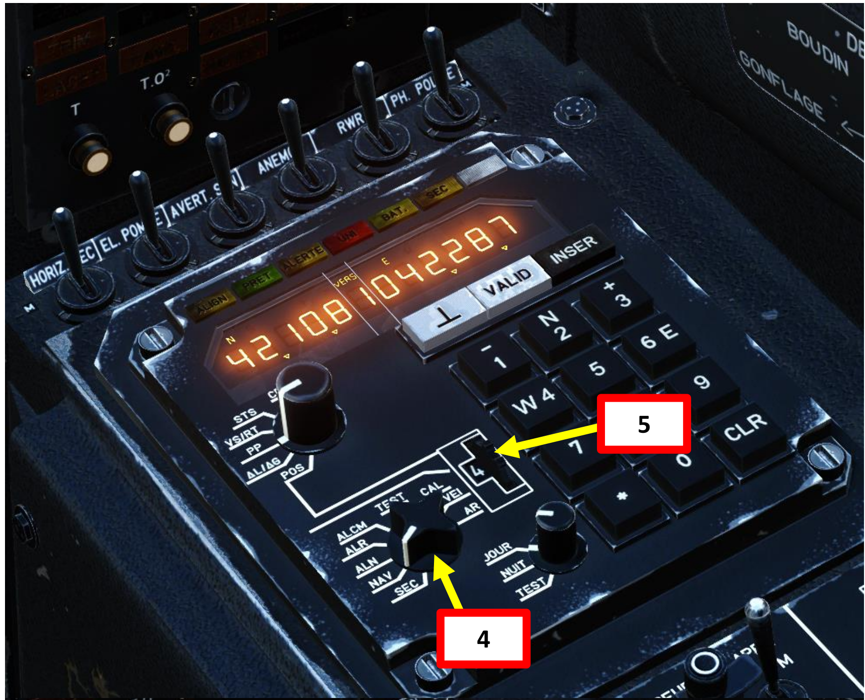
6.2 – Waypoints

6.2.1 – Waypoint Creation/Editing

Mirage F1EE Only

Waypoint 4 Coordinates (degrees, minutes, decimal-minutes format): 42°14.317 NORTH 042°03.650 EAST

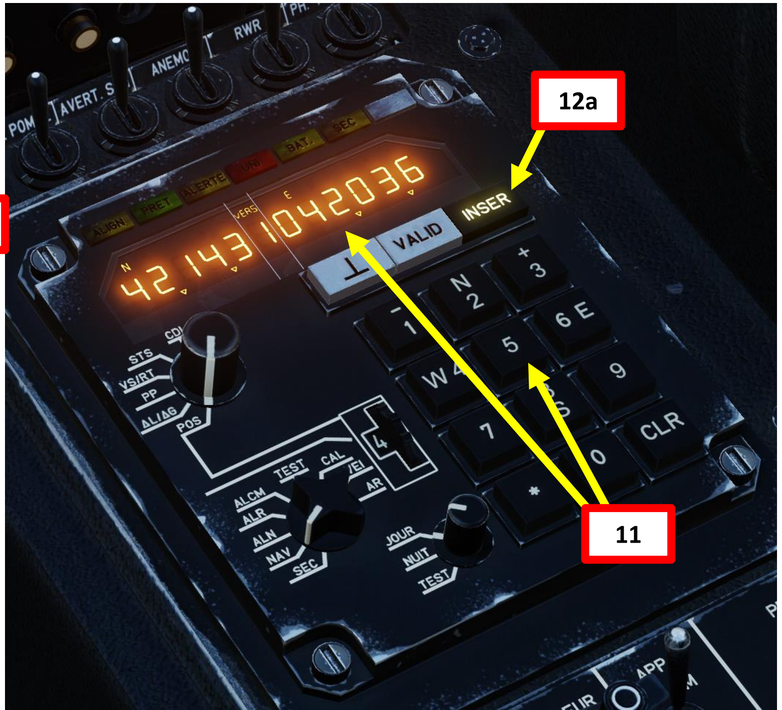
4. Verify Navigation Control Panel Mode Selector is set to NAV (Navigation).
5. Select Waypoint 4 with the Waypoint Selection Thumbwheel.
6. Set INS (Inertial Navigation System) Parameter Selector – POS (Position of the waypoint selected).
7. On the INS Data Entry Keypad, press “**2 (N)**” button to select **North** Latitude.
8. On the INS Data Entry Keypad, press “**42143**” to enter Latitude coordinates for North **42°14.3**17.
9. On the INS Data Entry Keypad, press INSER (Insert) button.



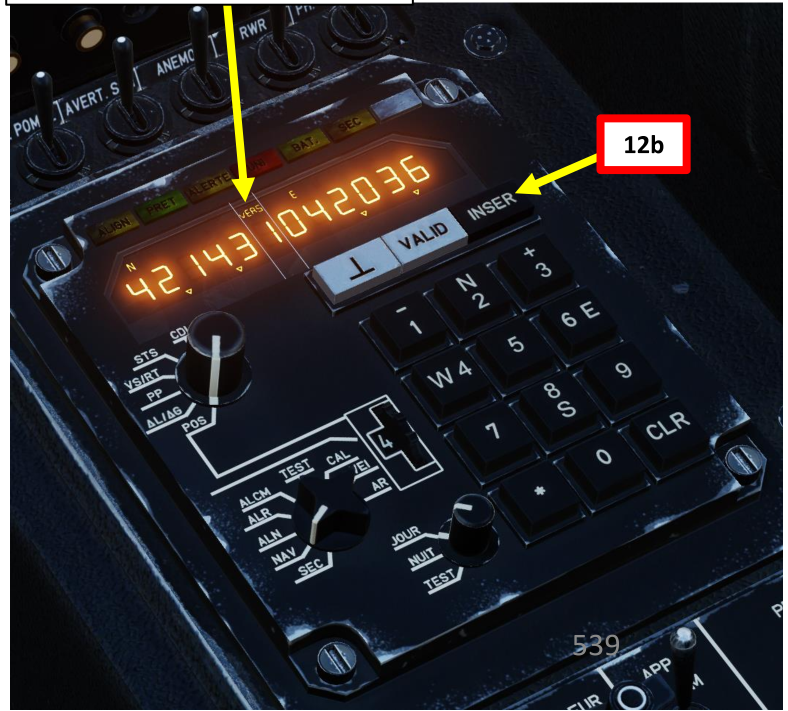
6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.1 – Waypoint Creation/Editing

Waypoint 4 Coordinates (degrees, minutes, decimal-minutes format): 42°14.317 NORTH 042°03.650 EAST

10. On the INS Data Entry Keypad, press "**6 (E)**" button to select **East** Longitude.
11. On the INS Data Entry Keypad, press "**042036**" to enter Latitude coordinates for East **042°03.6**50.
12. On the INS Data Entry Keypad, press INSER (Insert) button.
13. Waypoint 4 coordinates are now updated, but keep in mind that Waypoint 4 is not set to the active waypoint yet. See next section to navigate to this waypoint.



Selected "To" Waypoint (*Vers*)
- Indicates which waypoint is selected as the active waypoint by the INS



Mirage F1EE Only

6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)

6.2 – Waypoints

6.2.2 – Waypoint Navigation

In this example, we will navigate to Waypoint No. 4, which we created in the previous tutorial.

1. Set Navigation Control Panel Mode Selector – NAV.
2. Set IDN (*Indicateur de Navigation*, Navigation Indicator) Mode Selector – NAV N (Normal Navigation Mode).
3. Select Waypoint 4 with the Waypoint Selection Thumbwheel.
4. On the INS Data Entry Keypad, press the Asterisk (*) button to set Waypoint 4 as the active waypoint.
5. Confirm that the Selected “To” Waypoint (*Vers*) indication shows “4”.

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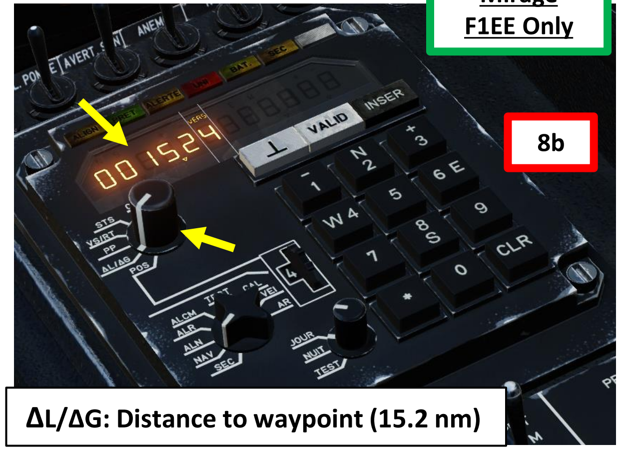
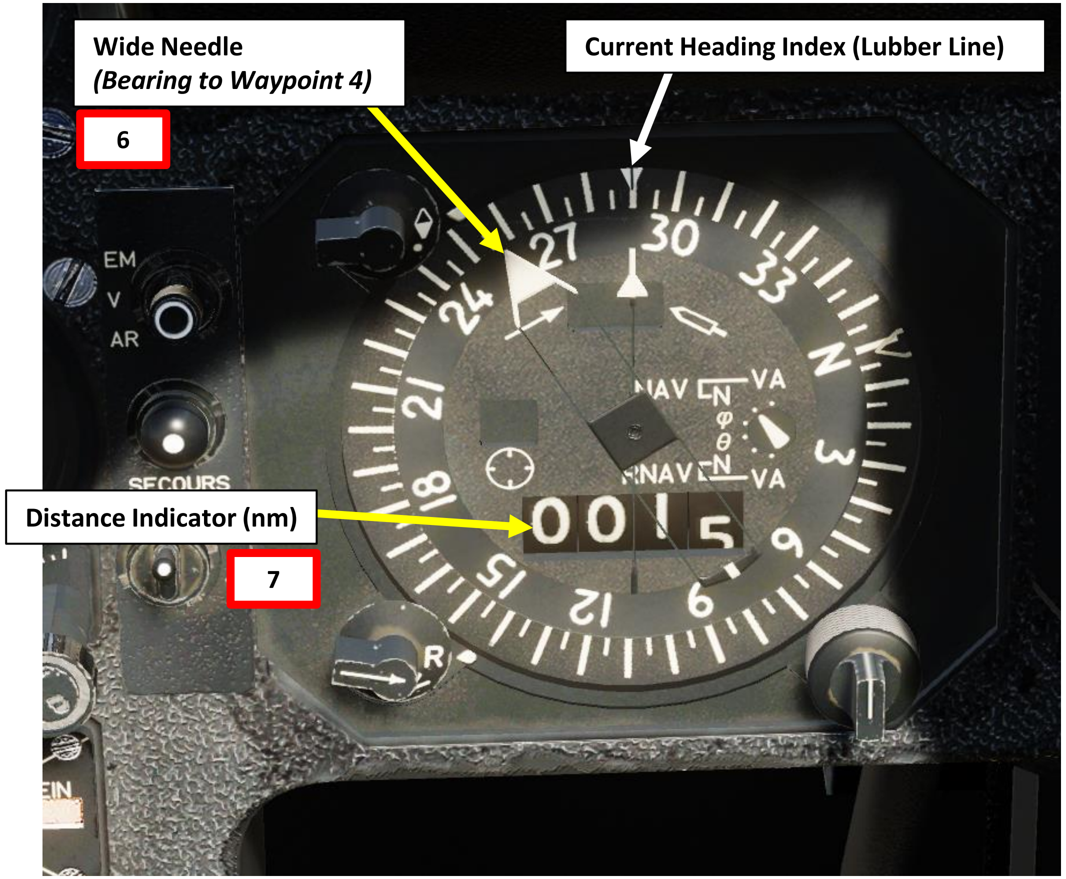
6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.2 – Waypoint Navigation

6. On the IDN, the **wide needle** points to the bearing of the selected waypoint.
7. Distance to waypoint is indicated in the Distance Indicator window.
8. You can monitor the following data with the INS (Inertial Navigation System) Parameter Selector
   a) POS: display shows the position coordinates of the waypoint selected with the waypoint selection wheel
   b) ΔL/ΔG: display shows distance to next waypoint in the left display (nothing is shown in the right display)
   c) *VS/RT:* Aircraft Ground Speed / True Heading (*Vitesse au Sol / Route*)
   d) PP: Aircraft Present Position Coordinates



ΔL/ΔG: Distance to waypoint (15.2 nm)



POS: Waypoint Coordinates

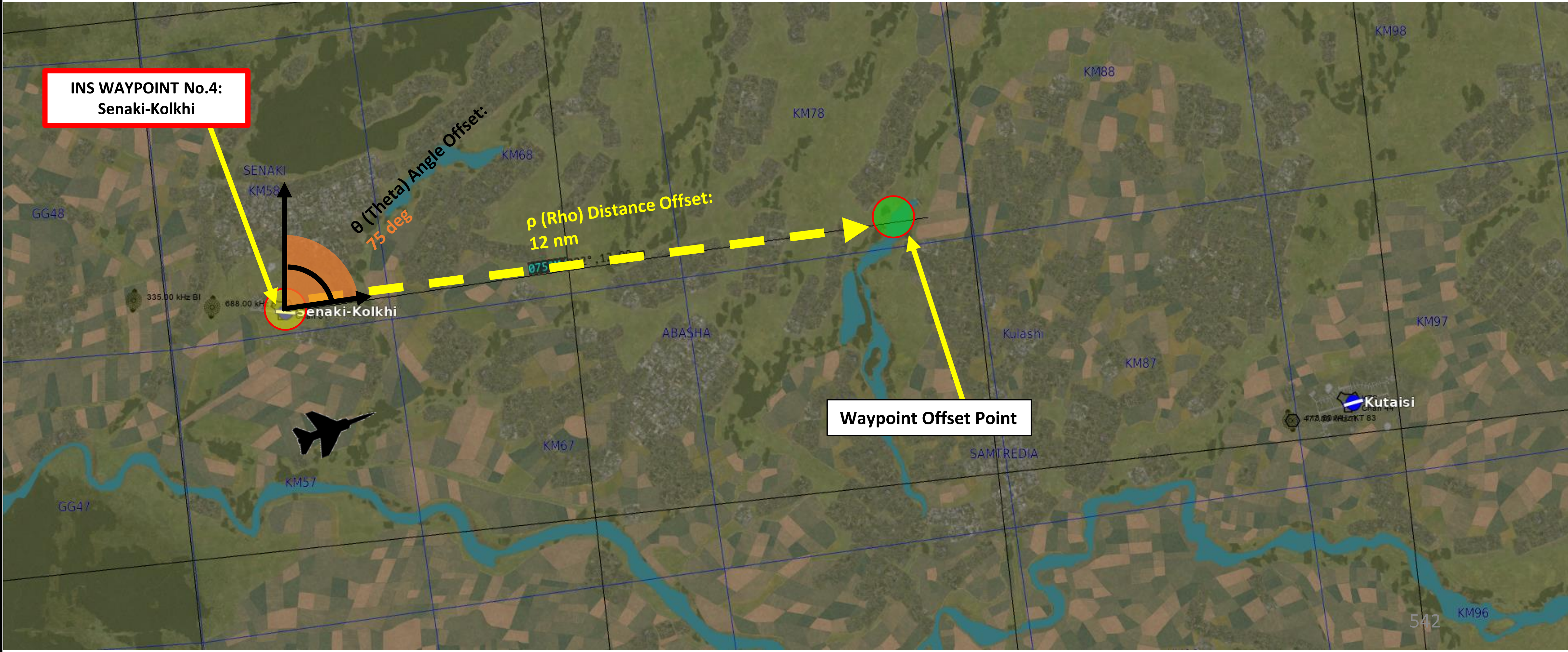
VS/RT: 365 kts Ground Speed, True Heading 295

PP: Aircraft Present Position Coordinates

6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.3 – Waypoint Offset (Additional Vector)

A Waypoint Offset is a reference point created from an existing waypoint with two parameters:
A distance (**ρ, Rho**) offset and an angle (**θ, Theta**) offset from the **waypoint.**

1. In this example, the **waypoint offset is set for a distance of 12 nm (Rho) and an angle of 75 deg (Theta).** Waypoint 4 (which coincides with Senaki-Kolkhi) is used as a reference for the offset point.



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6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.3 – Waypoint Offset (Additional Vector)

2. Set Navigation Control Panel Mode Selector – NAV.
3. Select Waypoint 4 with the Waypoint Selection Thumbwheel.
4. On the INS Data Entry Keypad, press the Asterisk (*) button to set Waypoint 4 as the active waypoint.
5. Confirm that the Selected "To" Waypoint (*Vers*) indication shows "4".

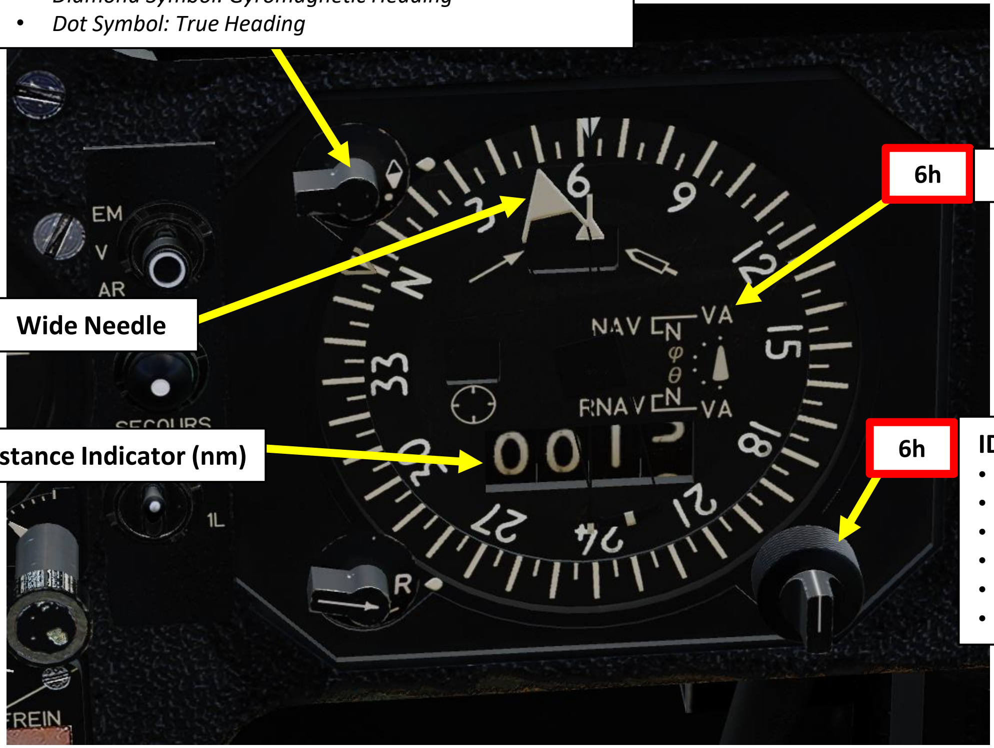
Selected "To" Waypoint (*Vers*)
- Indicates which waypoint is selected as the active waypoint by the INS

6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.3 – Waypoint Offset (Additional Vector)

Mirage F1EE Only

6. Set IDN (Navigation Indicator) – As Required.
   a) Set Gyromagnetic / True Heading IDN Heading Selector – Diamond Symbol (Gyromagnetic Heading)
   b) Set IDN Mode Selector to **ρ (Rho)** by turning the IDN Mode **Outer** knob
   c) **Distance offset** parameter is set by by turning the IDN Mode **Inner** knob
   d) The distance offset parameter is now memorized. However, an angle offset θ (Theta) also needs to be entered as well.
   e) Set IDN Mode Selector to **θ (Theta)** by turning the IDN Mode **Outer** knob.
   f) **Angle offset** parameter is set by by turning the IDN Mode **Inner** knob
   g) The angle offset parameter is now memorized.
   h) When **both Distance ρ and Angle θ offset parameters are set**, set the **IDN Mode “NAV-VA”** (Normal Navigation with INS with Additional Vector). This will make the Wide Needle point towards Waypoint 4’s offset point.

6a **Gyromagnetic / True Heading IDN Heading Selector**
- *Diamond Symbol: Gyromagnetic Heading*
- *Dot Symbol: True Heading*



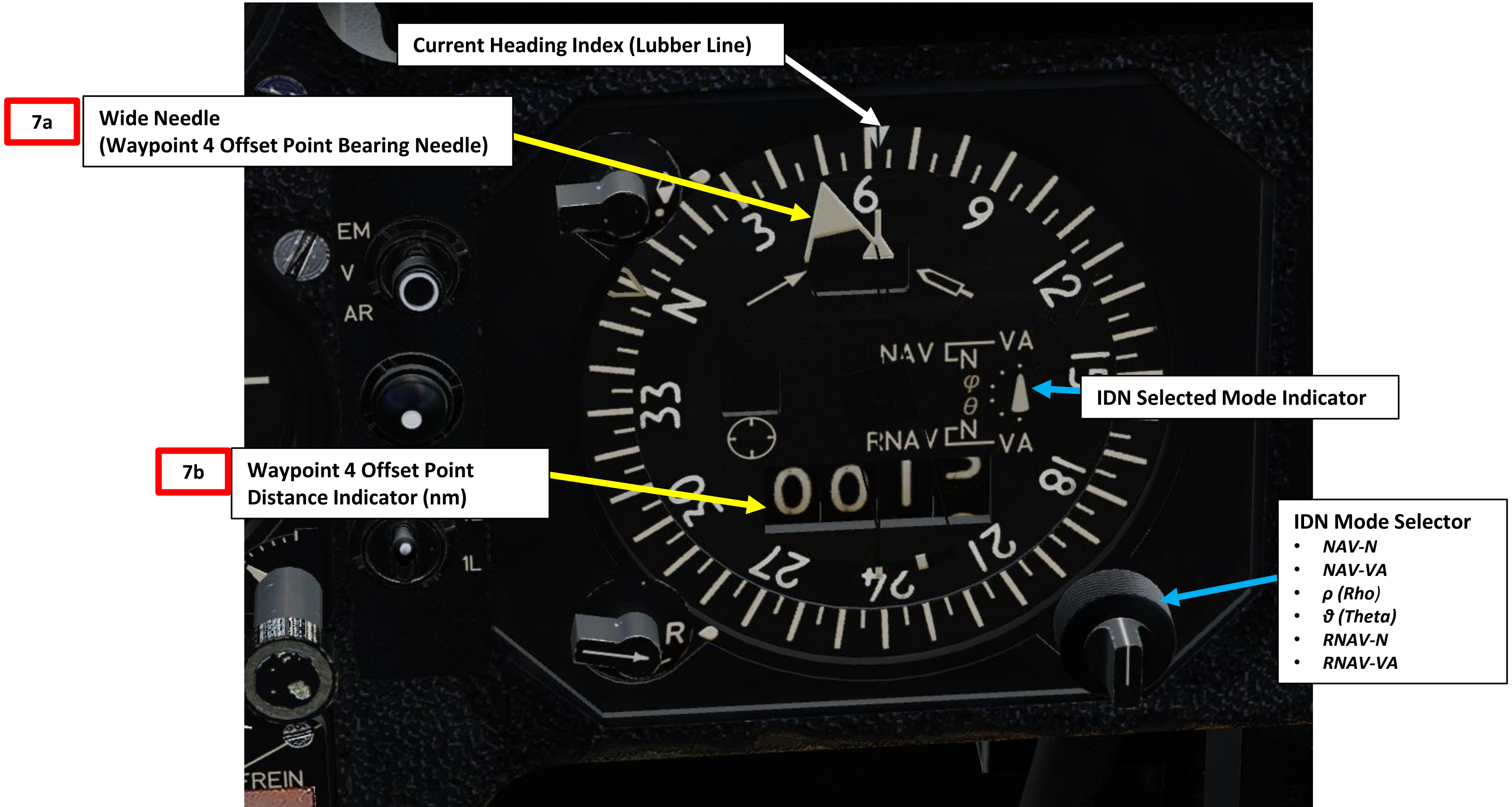
6h **IDN Selected Mode Indicator**

6h **IDN Mode Selector**
- *NAV-N*
- *NAV-VA*
- *ρ (Rho)*
- *ϑ (Theta)*
- *RNAV-N*
- *RNAV-VA*

Mirage F1EE Only

6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.2 – Waypoints
6.2.3 – Waypoint Offset (Additional Vector)

7. To navigate to the offset point generated from Waypoint 4:
   a) Bearing to waypoint 4's offset point is available on the IDN *(Indicateur de Navigation)* Navigation Indicator.
   b) Distance to waypoint 4's offset point is displayed in nm.



6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)

6.3 – INS Drift & Navigation Fix

6.3.1 – INS Drift

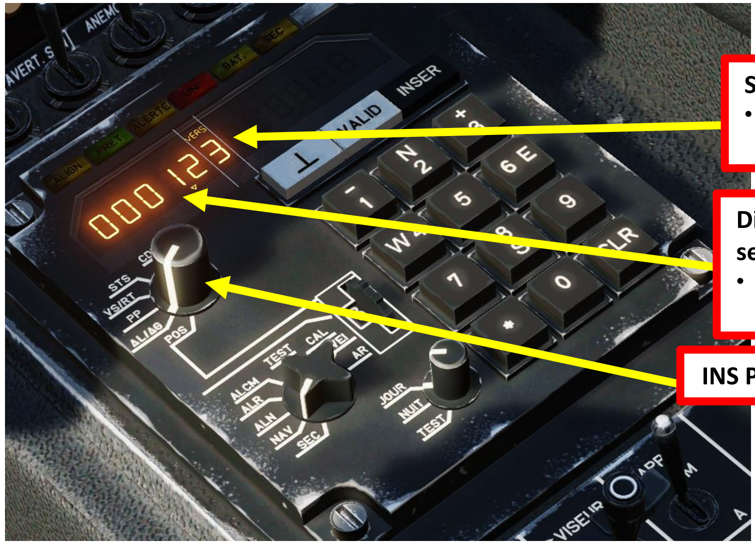
The INS suffers drift due to measurement errors that accumulate with time. due to imprecise sensors (gyroscopes and accelerometers) and due to the limitations of calculation methods. A cumulative error in coordinate calculations can be up to a few nautical miles after 1 hour of flight. Errors in coordinate calculations will affect flight path and determination of target locations, especially if the pilot uses waypoints to navigate. To compensate for these errors, they need to be corrected. You will start noticing inertial drift once the coordinates of your waypoints do not seem to match what you see outside the cockpit.

In order to update/re-align the INS position in-flight, a pilot uses reference points such as known landmark, TACAN station or something easy to spot visually. These reference points are called **fixed points (or "fix")**, Fixed points, which are similar in nature to waypoints (basically, a set of coordinates for a navigation point), are used to re-align your INS. Typically, you want to have these fixed points set up before entering a combat zone.

How do you know when to re-align, though? Well, one quick way is to select an existing waypoint as a navigation fix point; its coordinates should set on a visual landmark. When overflying this landmark, setting the INS Parameter Selector to ΔL/ΔG indicates the INS-computed distance between the aircraft and selected waypoint.

- If the INS drift is minimal (high accuracy), overflying the expected position of this waypoint should result in a small ΔL/ΔG distance reading, meaning that the geographic coordinates match the INS coordinates.
- If the INS drift is high (low accuracy), overflying the expected position of this waypoint should result in a significantly greater ΔL/ΔG distance reading, meaning that the geographic coordinates do not match the INS coordinates.

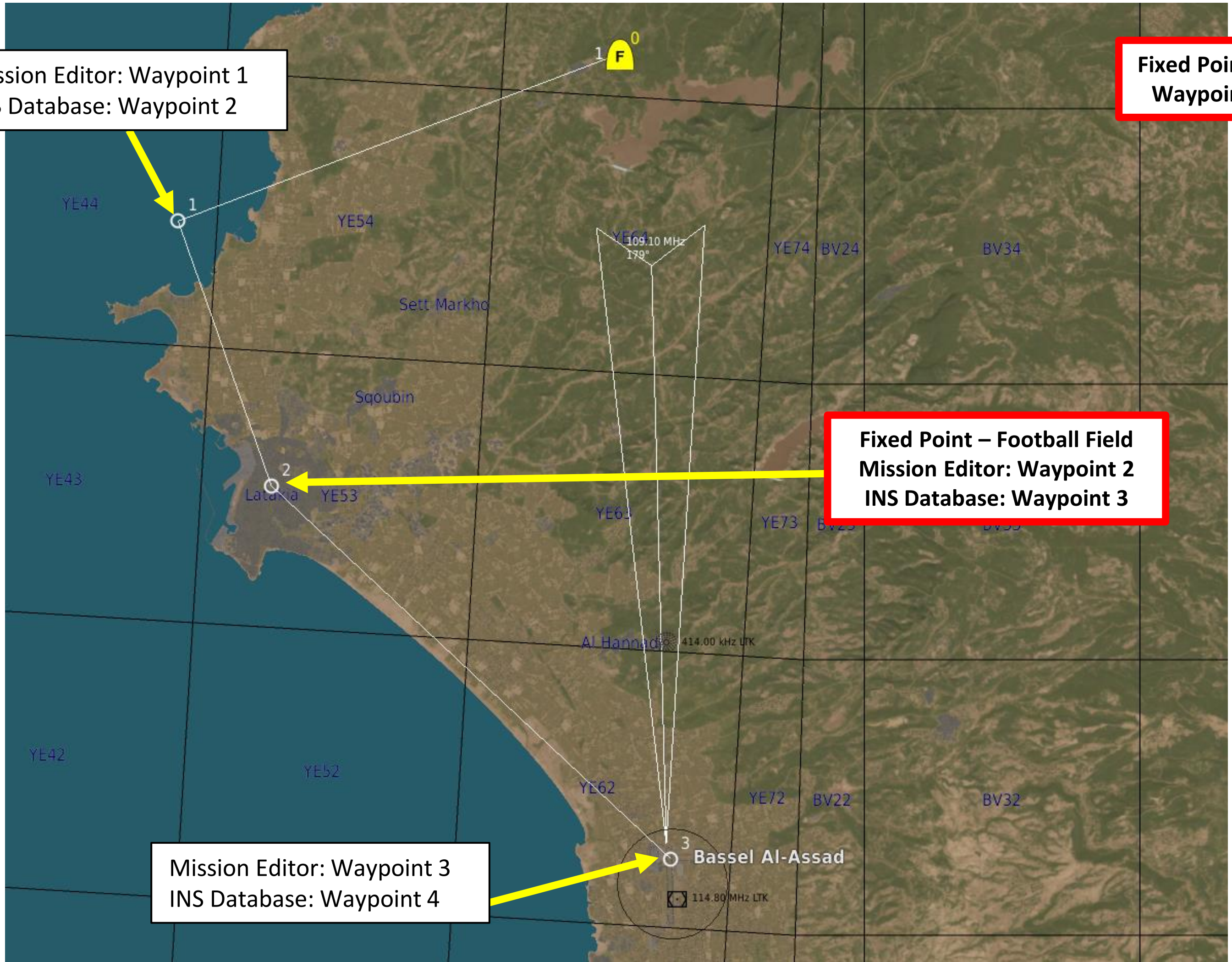
Another method of estimating INS drift this is to use a TACAN station as a reference point and compare the TACAN distance displayed on the IDN (Indicateur de Navigation) Distance Window with the ΔL/ΔG value computed for a waypoint set on the TACAN station.



6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.3 – INS Drift & Navigation Fix
6.3.2 – Coordinate Correction Using Overfly Fix (Vertical Designation) Method

For fixed points, it is recommended to use locations that stand out in the terrain – buildings, towers, bridges, road crossings, and river merge points that are easily located along the route. In this example, our Fix Point coordinates are already entered in Waypoint 3, which is set over a visual landmark (football field).

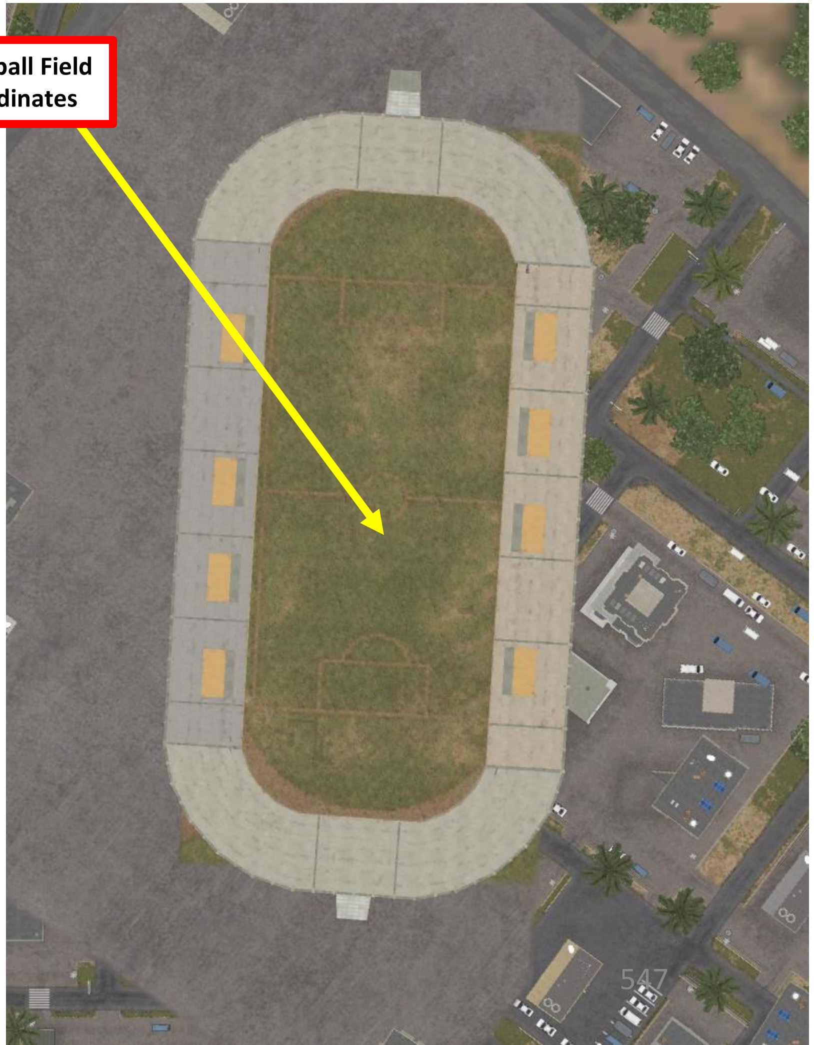
Mission Editor: Waypoint 1
INS Database: Waypoint 2



Fixed Point – Football Field
Mission Editor: Waypoint 2
INS Database: Waypoint 3

Mission Editor: Waypoint 3
INS Database: Waypoint 4

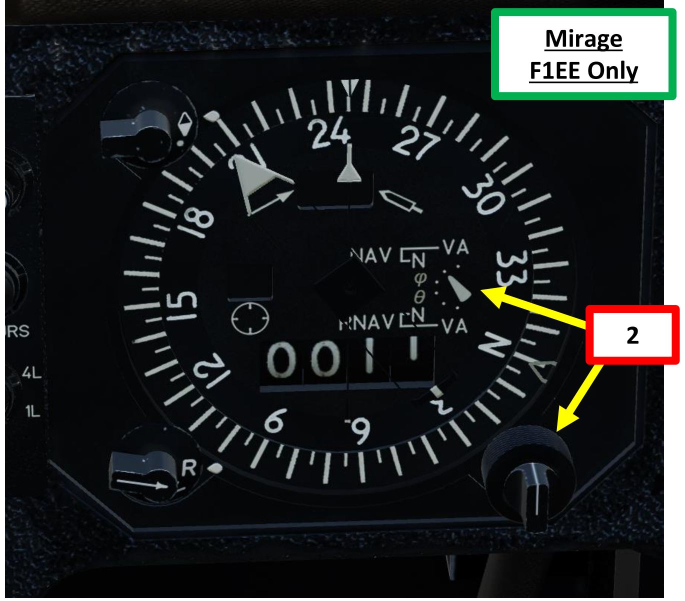
Fixed Point – Football Field
Waypoint 3 Coordinates

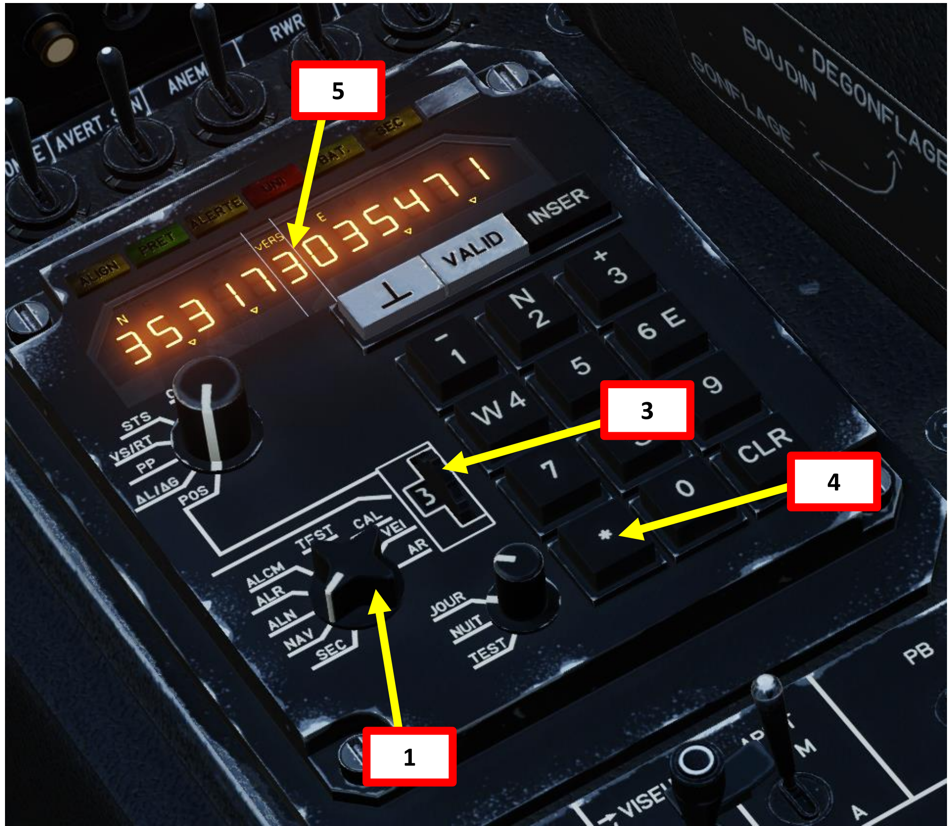


6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.3 – INS Drift & Navigation Fix
6.3.2 – Coordinate Correction Using Overfly Fix (Vertical Designation) Method

Mirage F1EE Only

1. Set Navigation Control Panel Mode Selector – NAV.
2. Set IDN (*Indicateur de Navigation*, Navigation Indicator) Mode Selector – NAV N (Normal Navigation Mode).
3. Select Waypoint 3 with the Waypoint Selection Thumbwheel. We will use Waypoint 3 as the “fixed point”.
4. On the INS Data Entry Keypad, press the Asterisk (*) button to set Waypoint 3 as the active waypoint.
5. Confirm that the Selected “To” Waypoint (*Vers*) indication shows “3”.
6. Set INS Parameter Selector to ΔL/ΔG. This will indicate the distance to the waypoint’s INS coordinates.



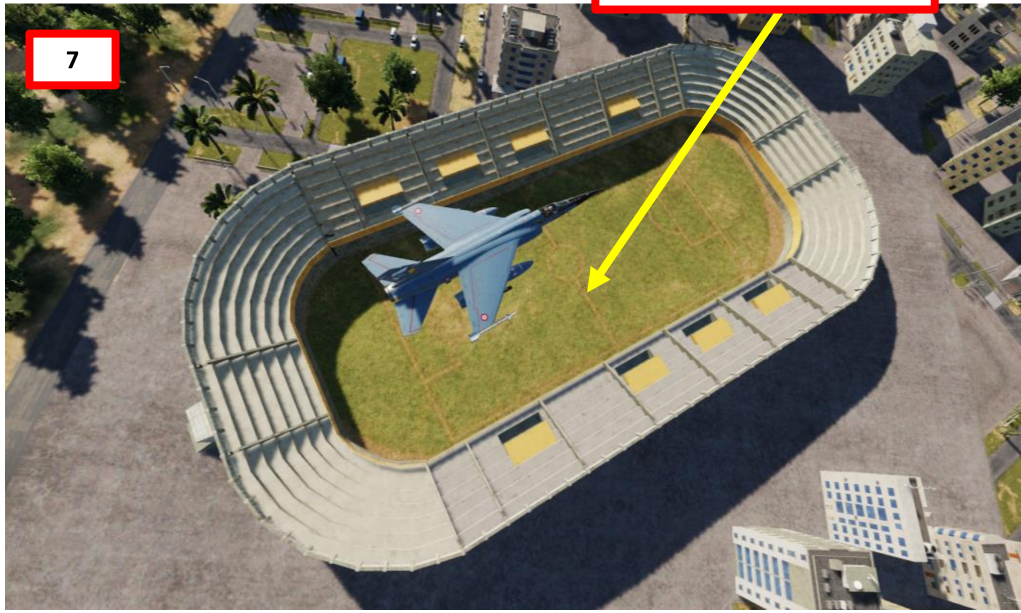


6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.3 – INS Drift & Navigation Fix
6.3.2 – Coordinate Correction Using Overfly Fix (Vertical Designation) Method

Mirage F1EE Only

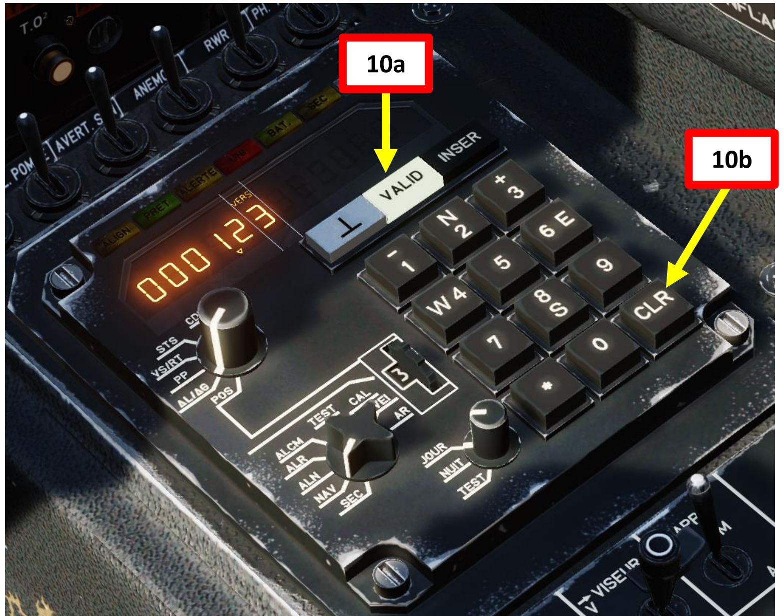
7. Fly directly over the fixed point's geographic position (football field).
8. Once you are over the fixed point, press the INS Vertical Designation (⊥) Button.
9. Check the ΔL/ΔG INS Data Field, which will indicate the accumulated error.
10. Based on the value of the accumulated error, you can decide to either accept or reject the update.
    a) If the accumulated error is reasonable, accept the update by pressing the VALID button.
    b) If the accumulated error does not make sense, then reject the update by pressing the CLR (Clear) button.

Fixed Point – Football Field Waypoint 3 Coordinates



Distance to the waypoint's INS Coordinates
- *In this case, we are flying directly over the fixed point, therefore an INS with minimal position error should display a distance value close to 0 nm.*
- *In this example, we see that the INS position has drifted by about 1.2 nm.*

9



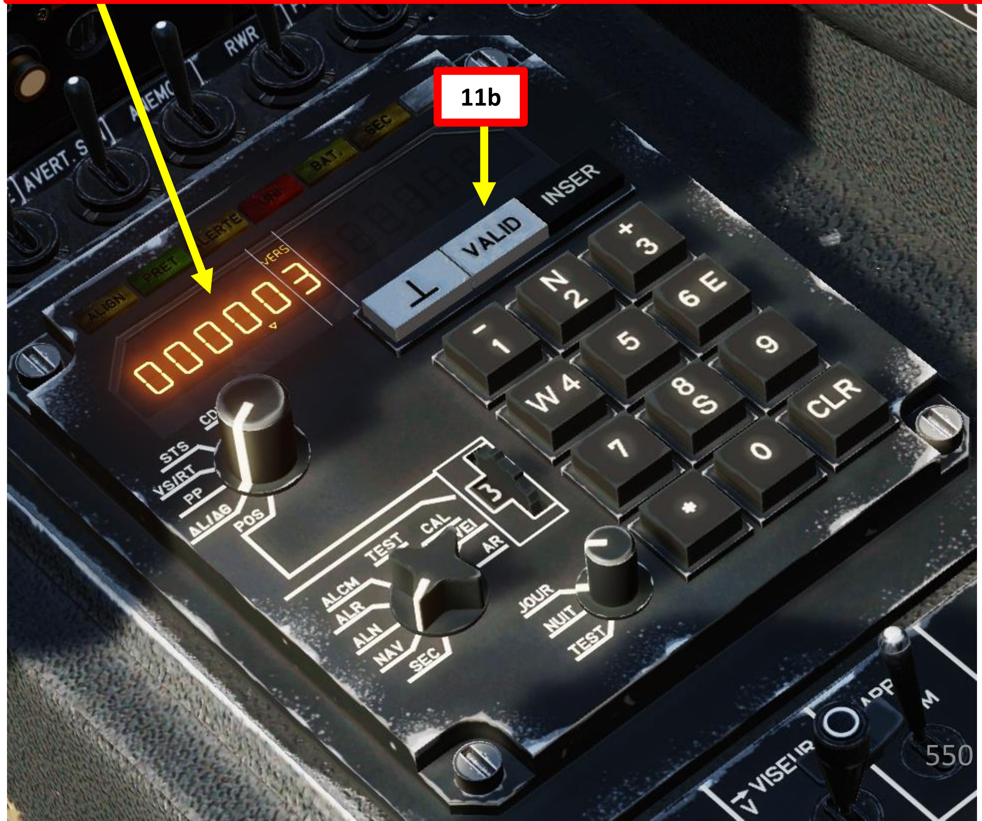
6 – UNI (UNITÉ DE NAVIGATION INERTIELLE) / INS (INERTIAL NAVIGATION SYSTEM)
6.3 – INS Drift & Navigation Fix
6.3.2 – Coordinate Correction Using Overfly Fix (Vertical Designation) Method

11. Pressing the VALID button will synchronize the aircraft's coordinates with the coordinates of the reference point.
12. That's it, you have corrected the INS drift!

Important Note:
- A blind validation can screw up your whole INS position easily since it will modify the whole INS waypoint database and aircraft position. It will also affect INS bias calculations, which will degrade the quality of the INS over multiple flights. INS bias calculations are used to tune the INS, improving its precision… that is until the INS bias values are zeroed when pressing the VALID button.

Distance to the waypoint's INS Coordinates
- *VALID button has not been pressed yet.*
- *We see that the INS position drift is about 1.2 nm.*

Distance to the waypoint's INS Coordinates
- *VALID button has been pressed. INS position is updated to correct accumulated position error.*
- *We see that the INS position drift is close to 0 nm.*



7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

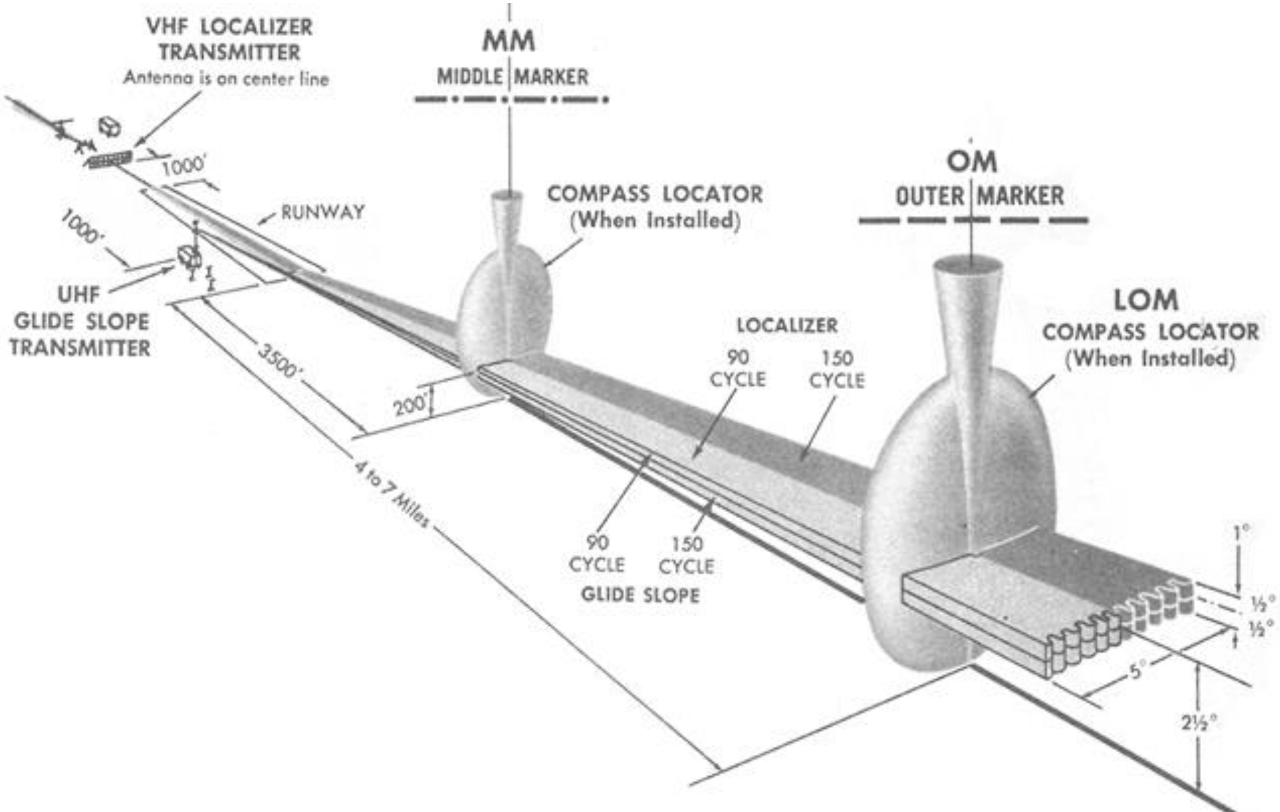
The ILS (Instrument Landing System) exists to guide you during your approach in low-visibility conditions.

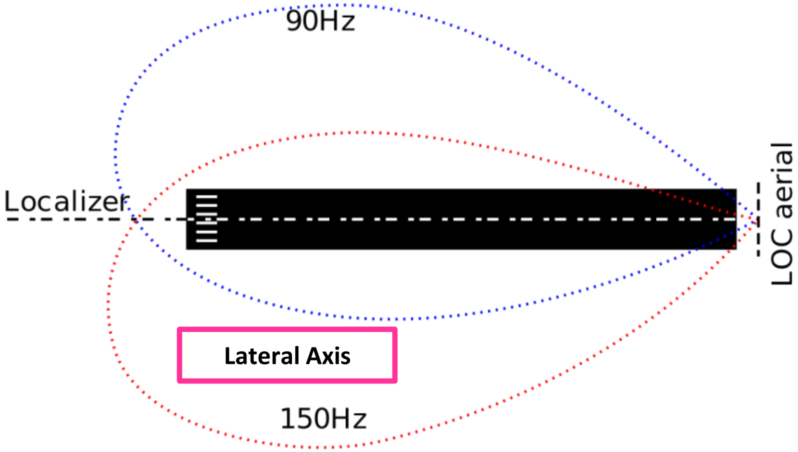
- The Localizer is generally an array of antennas that will give you a lateral reference to the center of the runway.
- The Glide Slope station will help you determine the descent speed you need in order to not smack the runway in a smoldering ball of fire.


Localizer Array Station at Hannover

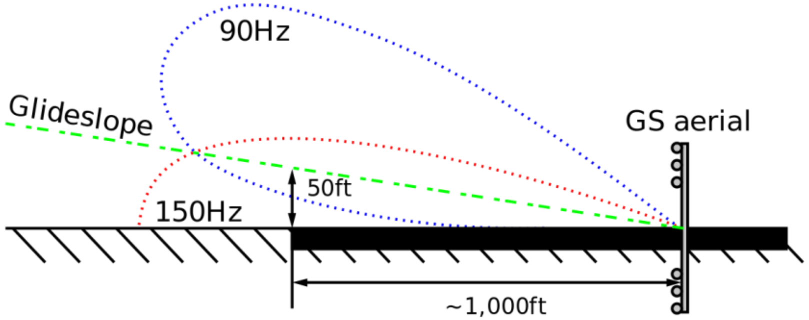

Glide Slope Station at Hannover

Great video explanation of ILS
https://www.youtube.com/watch?v=KVtEfDcNMO8





Lateral Axis

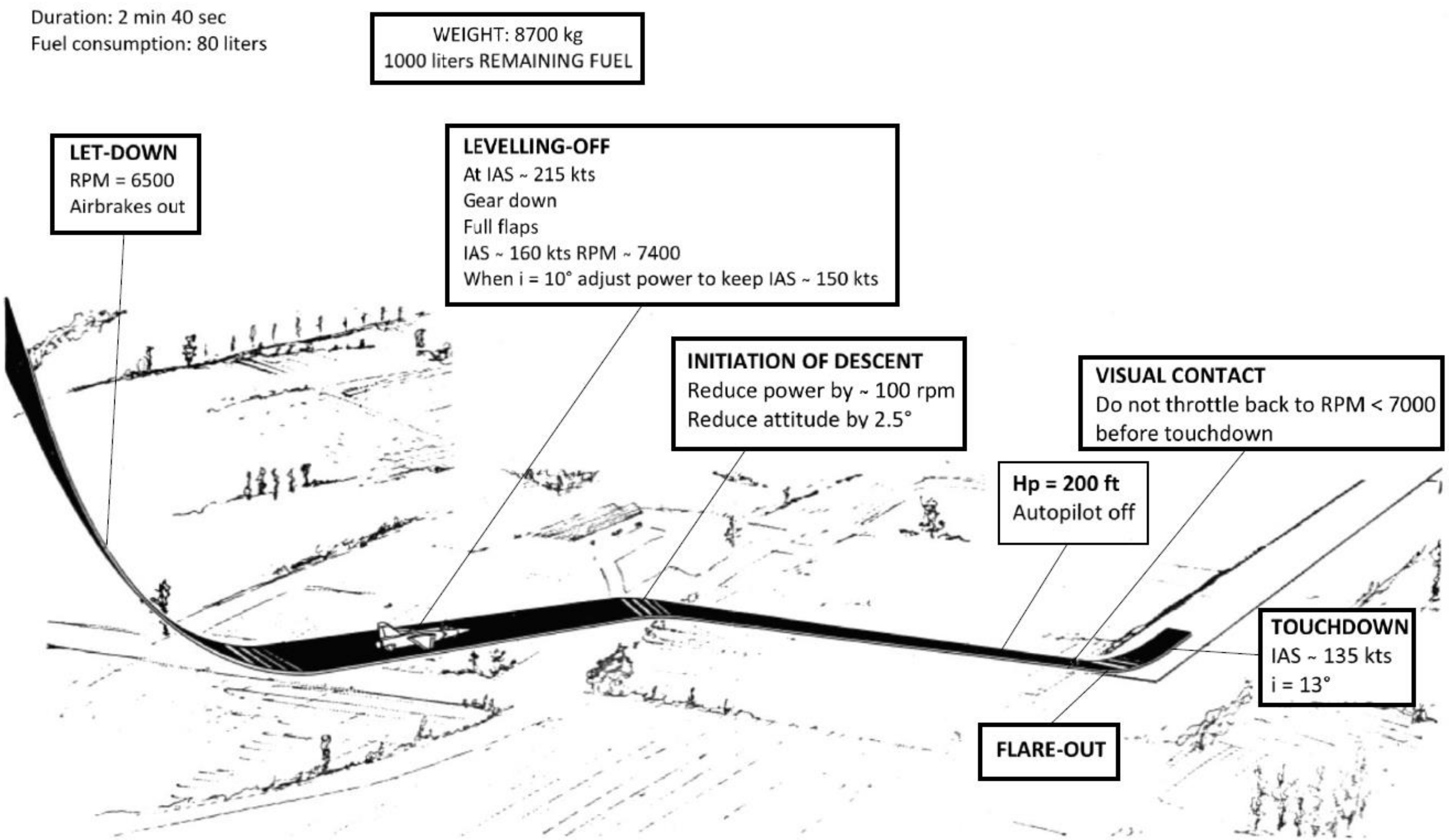


Vertical Axis

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

Here are the general concepts behind a ground-controlled approach or an ILS approach.

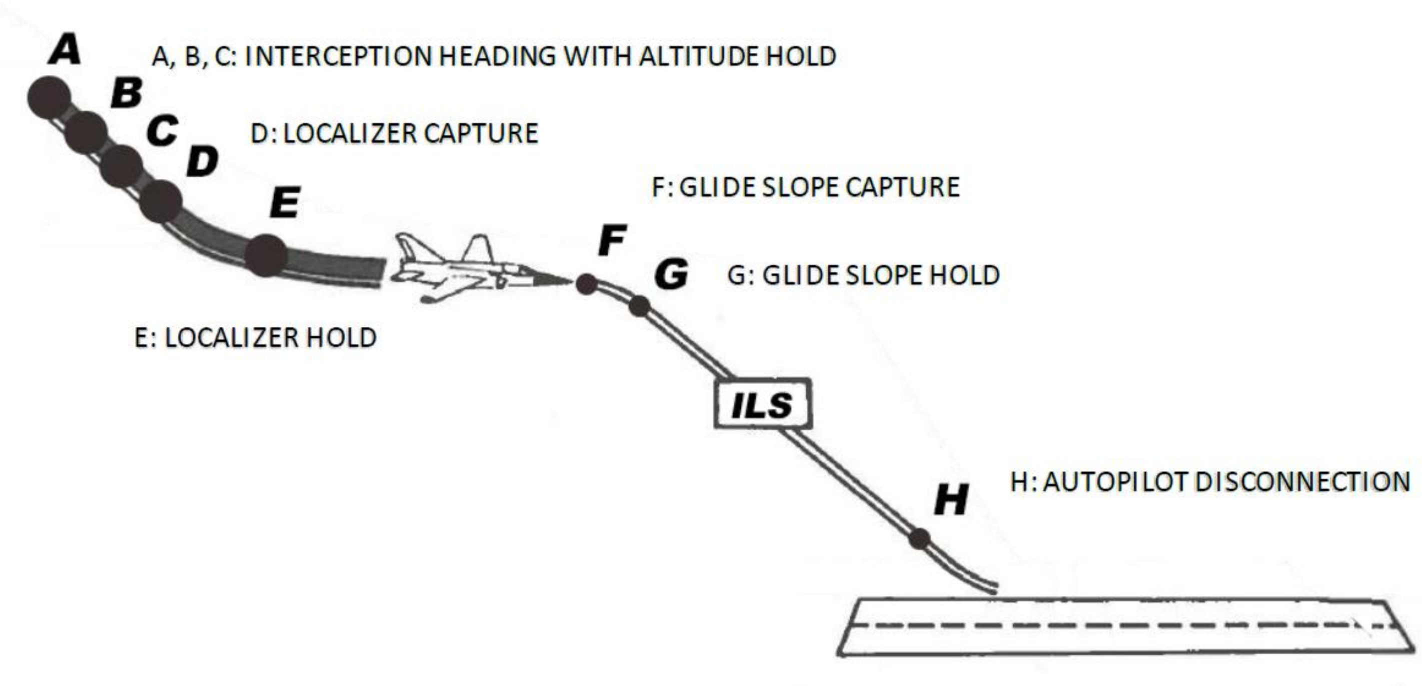
GCA (Ground-Controlled Approach) or ILS (Instrument Landing System) Pattern

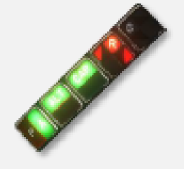
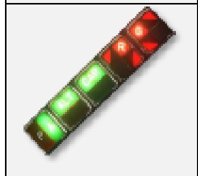
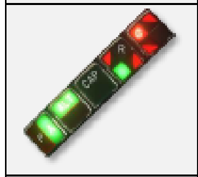
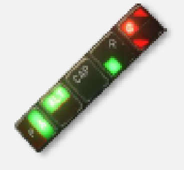
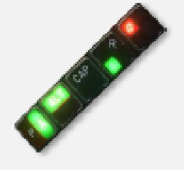
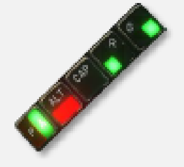
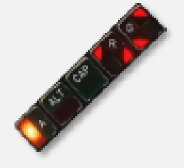


7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

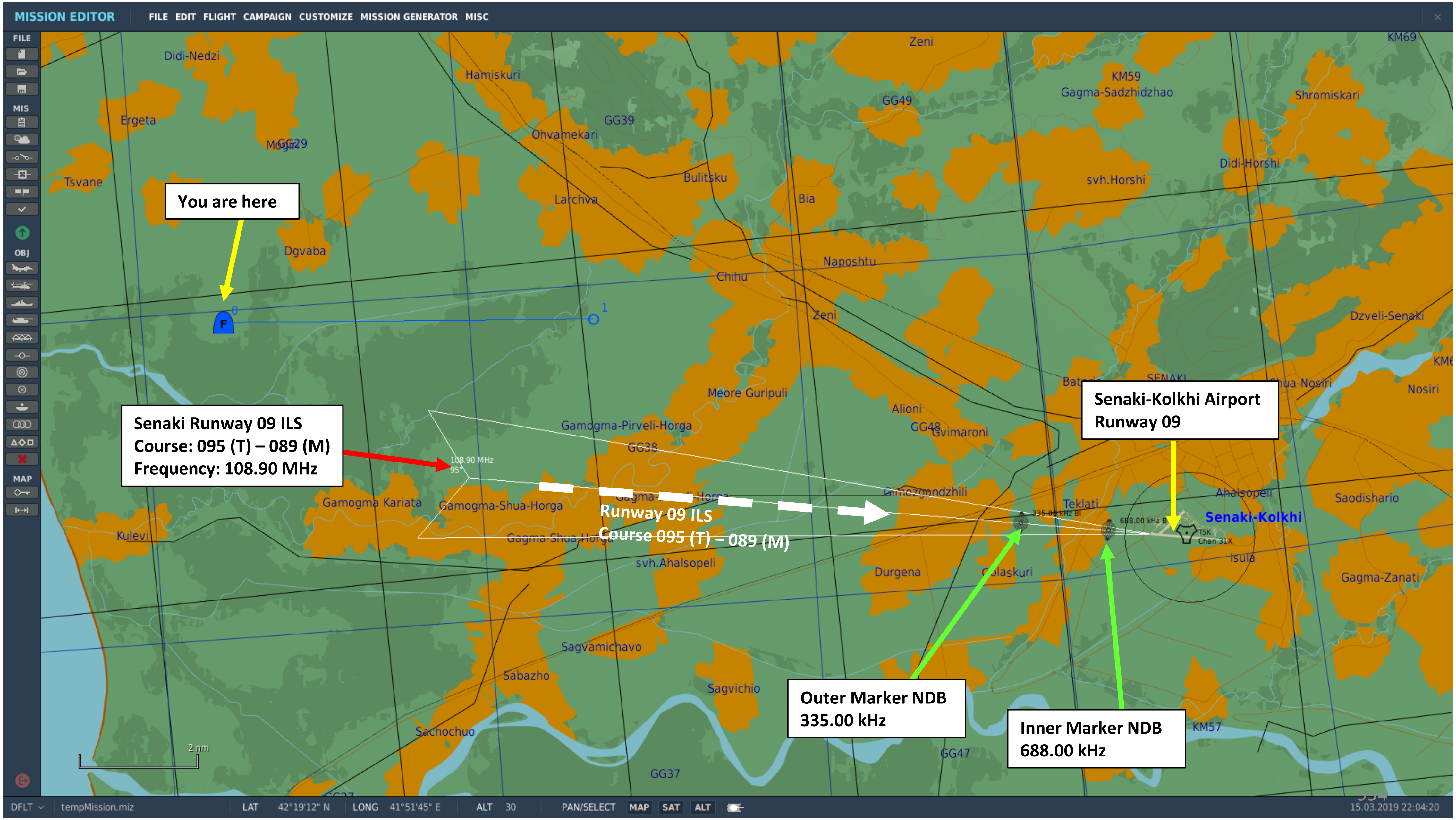
An ILS landing can be used with or without the autopilot.

ILS Interception and Hold with Autopilot Engaged



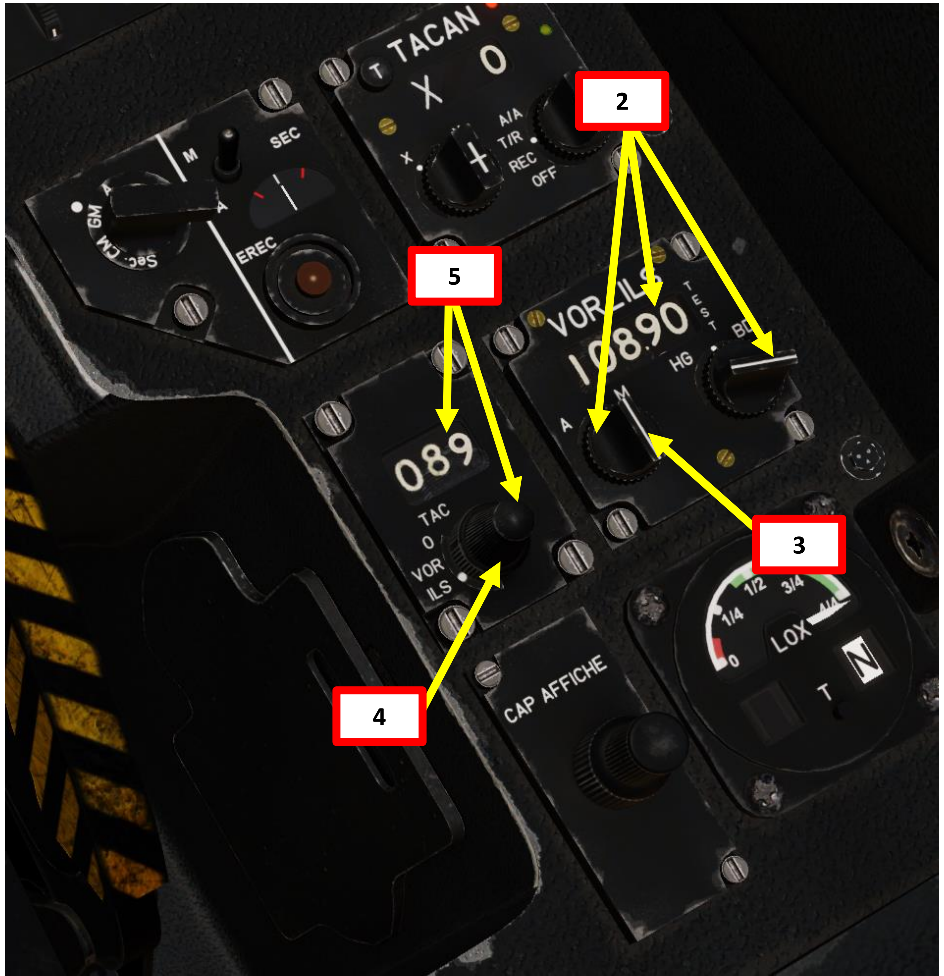
AUTOPILOT INDICATIONS DURING VOR, TACAN OR ILS INTERCEPT AND HOLD		
	A	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode engaged
	B	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode engaged
		Radial or localizer mode armed
	C	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode engaged
		Radial or localizer mode armed
		Glide slope mode armed
	D	Autopilot engaged
		Altitude hold mode engaged
		Heading hold mode disengaged
		Radial or localizer interception started
		Glide slope mode armed
	E	Autopilot engaged
		Altitude hold mode engaged
		Radial or localizer intercepted
		Glide slope mode armed
	F	Autopilot engaged
		Altitude hold mode engaged
		Radial or localizer intercepted
		Glide slope interception started
	G	Autopilot engaged
		Altitude hold mode disengaged (flashing red for 5 sec)
		Radial or localizer intercepted
		Glide slope intercepted
	H	Autopilot disengaged (flashing amber)
		Flashing red for 10 sec
		Flashing red for 10 sec

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING



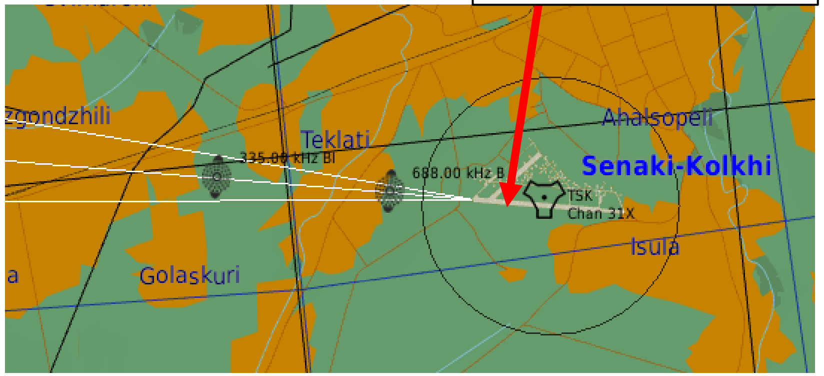
7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

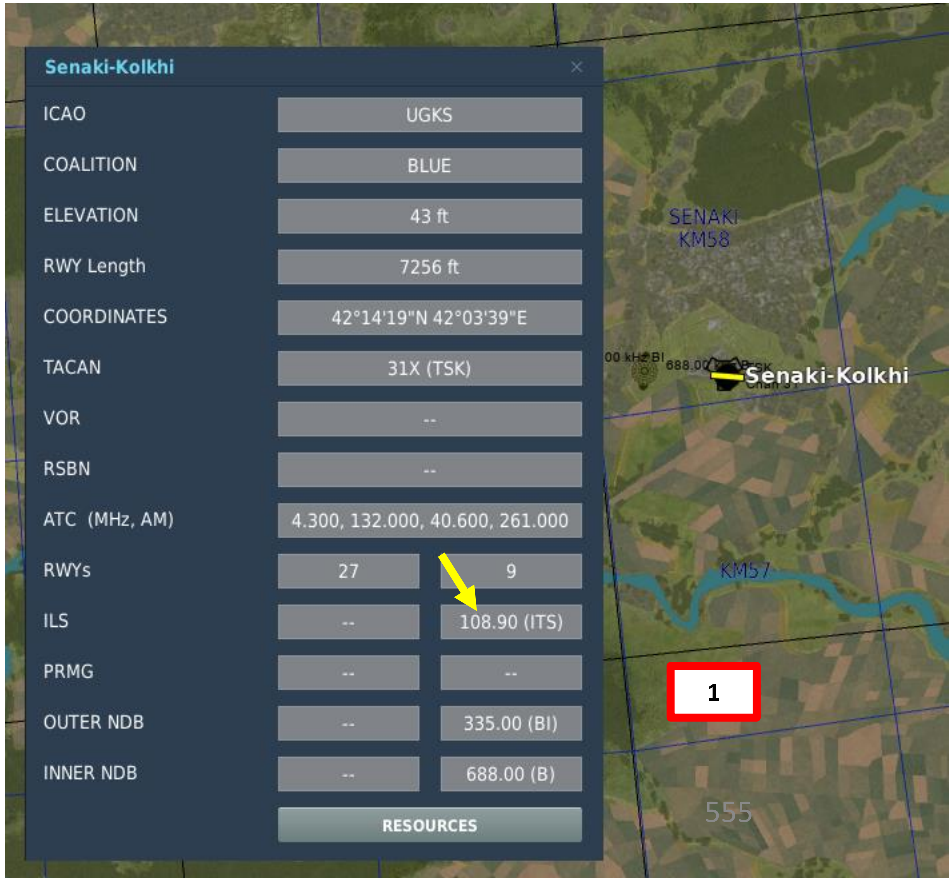
1. We will track Senaki's Runway 09 ILS (108.90 MHz) with a radial course of 089 Magnetic.
2. Set ILS Frequency to 108.90 MHz – Scroll Mousewheel.
3. Set VOR-ILS Outer Control Knob to M (Marche, ON) – Mouse Click.
4. Set Navigation Aid (TACAN, VOR-ILS) Outer Knob Selector – VOR-ILS, Mouse Click.
5. Set Navigation Aid (TACAN, VOR-ILS) Inner Knob Selector (also referred as the "Omnibearing Selector") to the course we want to intercept the ILS with, which is course 089. Scroll mousewheel to rotate knob.



1

Senaki Runway 09 ILS
Course: 095 (T) – 089 (M)
Frequency: 108.90 MHz

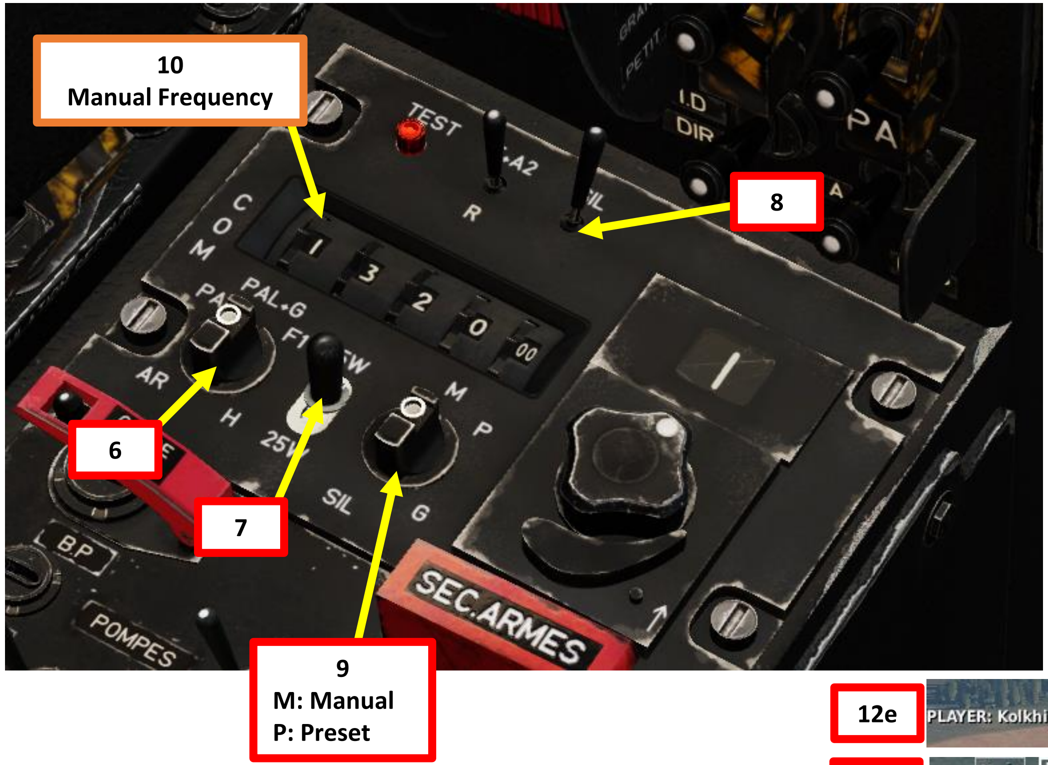


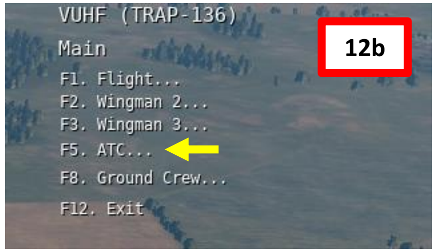


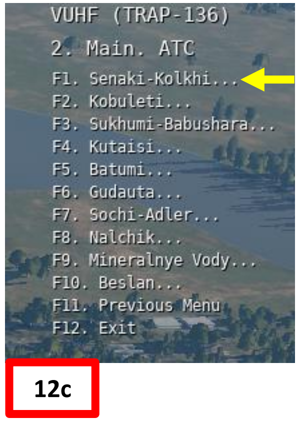
7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

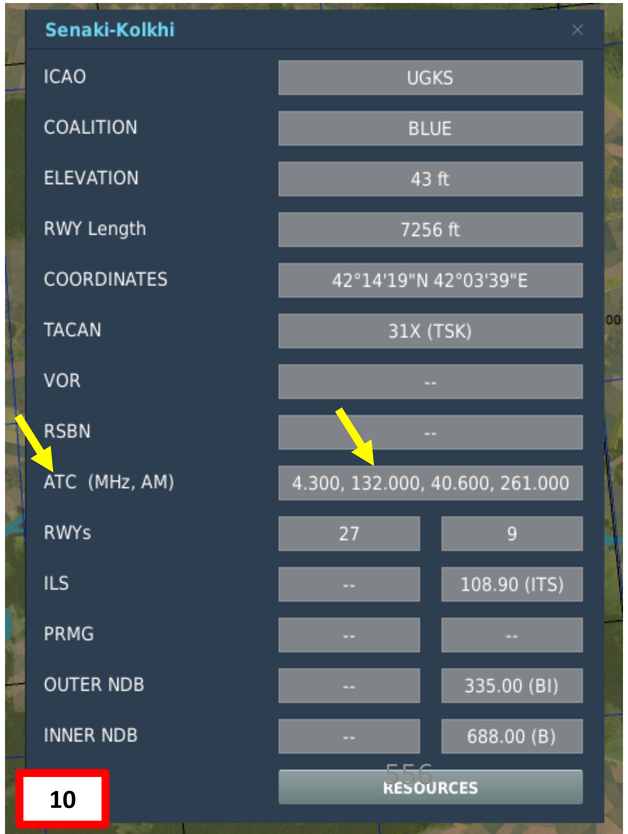
6. Set TRAP 136 V/UHF Radio (Green Radio) Mode Selector – PAL (*Fréquence Principale*, Main Frequency).
7. Set V/UHF Radio Transmitter Power Switch – 5 W (FWD).
8. Set V/UHF Radio SIL *(Silence)* / Squelch Switch – ON (FWD).
9. Set V/UHF Radio Frequency Selector – Manual Frequency
10. Set V/UHF Radio Manual Frequency to the Senaki tower: 132.000 MHz.
11. Push TRAP 136 V/UHF Radio (Green Radio) Audio Control Knob (left click) to select TRAP 136 radio for transmission. Rotate knob (scroll mousewheel) to adjust volume.
12. Call the tower for inbound request. Press "\" (Communication Menu, Radio Microphone Push-to-Talk Button) to transmit.

PTT (Push-to-Talk) Radio Button
- *("\" binding)*







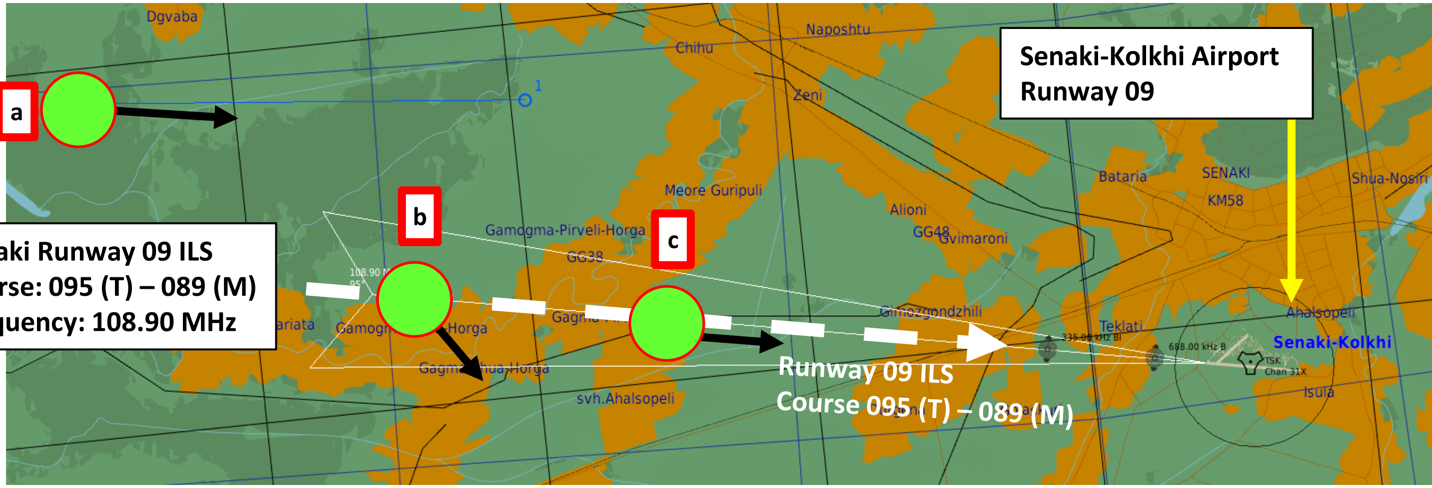


12e

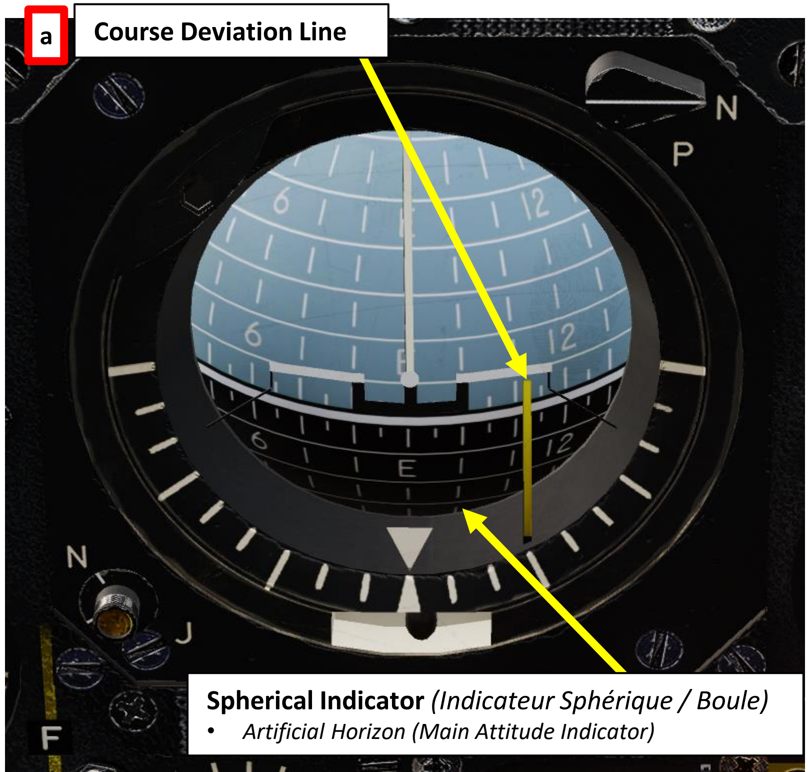

12f


7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

13. Once the ILS localizer is detected (about 15 nm from Senaki), the yellow line on the Spherical Indicator *(Indicateur Sphérique / Boule)* indicates lateral deviation from the interception course to the ILS localizer.
14. Steer the aircraft laterally to capture the localizer. When localizer is "captured" (you are lined up with the runway axis), the Course Deviation Line should be centered.
15. Fly the aircraft to capture the glide slope by using the Glide Slope Deviation bar (vertical deviation), which should be centered. The glide slope bar should come alive when you are about 10 nm from Senaki.
16. When you are approaching the airport, the ATC will contact you. You can now request landing clearance.

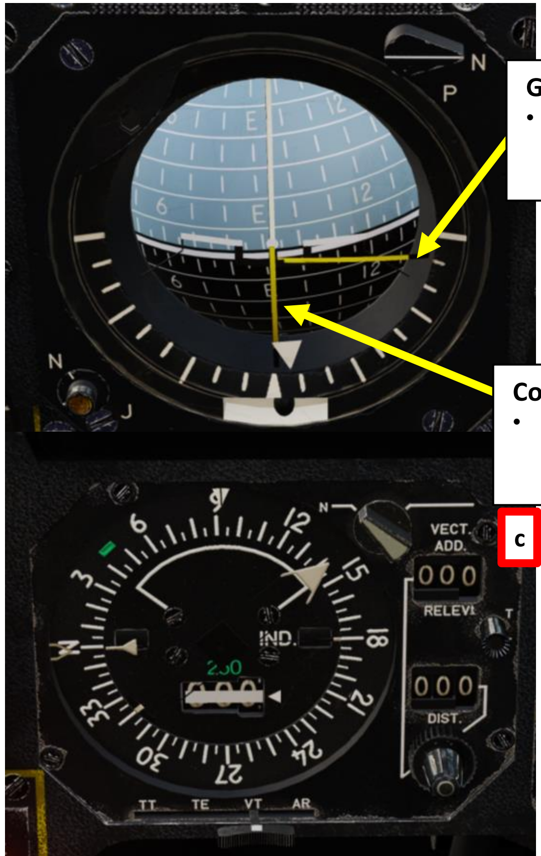


a
Course Deviation Line



Spherical Indicator *(Indicateur Sphérique / Boule)*
- *Artificial Horizon (Main Attitude Indicator)*

b



15

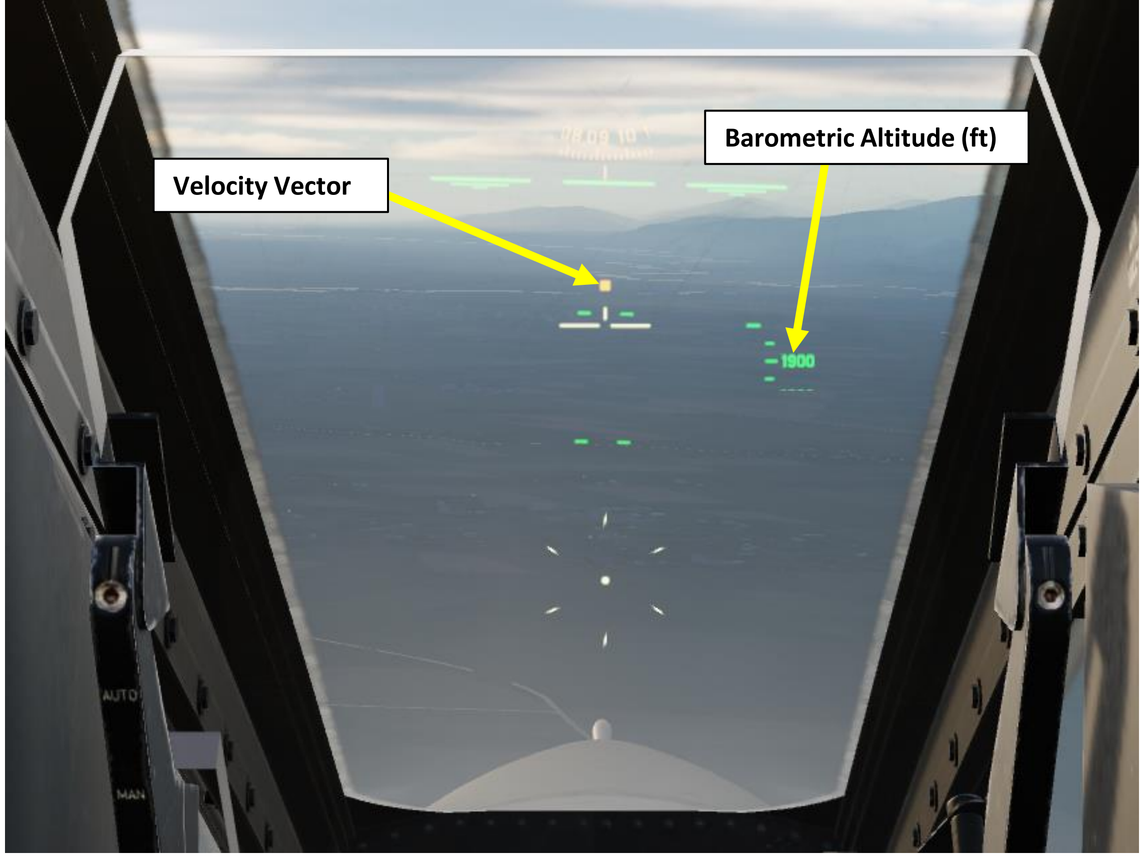
Glide Slope Deviation Line
- *Centered = Glide Slope is captured, are descending on the correct vertical glide path*

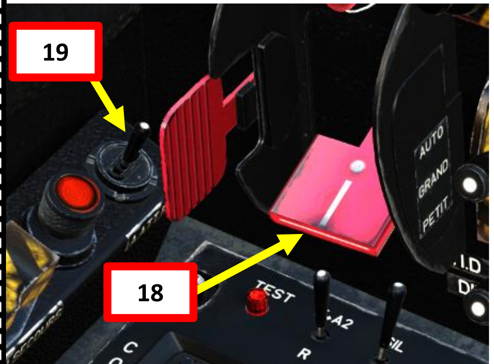
Course Deviation Line
- *Centered = Localizer is captured, we are following radial 089*

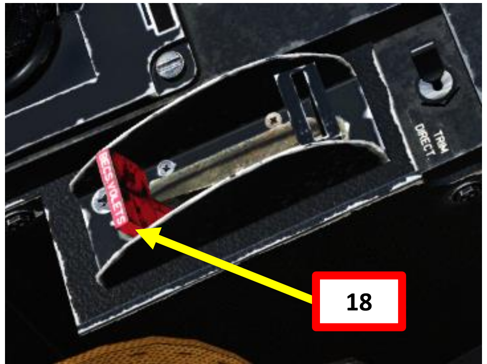
c

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

17. Set Sight (*Viseur*) Selector Switch – Approach Mode (FWD).
    - This will display the velocity vector, which should be use to line up the aircraft with the runway threshold during the final approach.
    - The altitude displayed on the sight is barometric, not a radar altitude. This means that the altitude displayed is AMSL (Above Mean Sea Level), not AGL (Above Ground Level).
18. When airspeed is below 215 kts, extend landing gear and deploy flaps and slats FULLY DOWN.
    - Extending landing gear and flaps above 215 kts may jam them in intermediate positions.
    - TRAIN warning light illuminates when airspeed is below 215 kts and throttle lever is set to an engine power setting less than 8100 RPM.
19. When airspeed is below 240 kts, set Landing Light Control Switch – ATTERRISSAGE/LANDING (MIDDLE position).







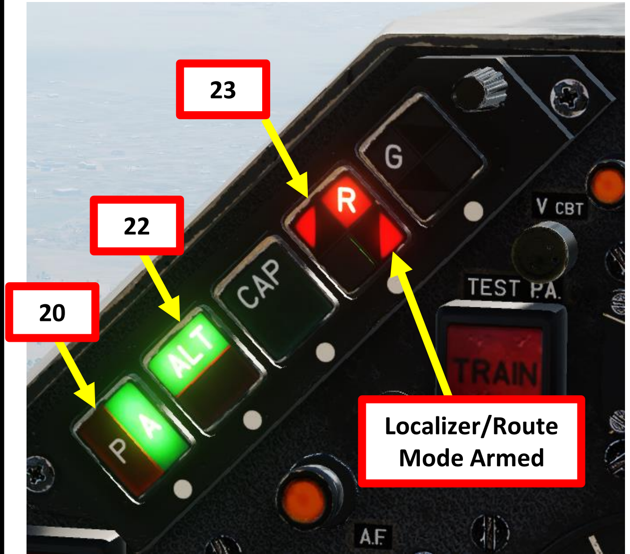
17

Sight (*Viseur*) Selector Switch
- *FWD: APP (Approach)*
- *MIDDLE: Marche (ON)*
- *AFT: Arrêt (OFF)*

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

OPTIONAL: Engaging Autopilot Localizer Route & Glide Slope Modes

20. If desired, engage the autopilot by pressing the **Autopilot (PA, *Pilote Automatique*) Master Control Button**. Once PA green button illuminates, the autopilot is engaged. If the bank attitude during the autopilot connection is less than 10°, the autopilot will keep current heading.
21. The autopilot connects initially in basic functions (pitch/roll attitude hold).
22. If desired, press **Autopilot Altitude Hold Mode Selector** to engage Altitude Hold. This will help you keep the aircraft level while intercepting the course to the ILS localizer.
23. Press the **"R" (Route) Mode Selector** to Engage Route (Localizer) Mode.
24. If the aircraft is too far from the localizer, three red lights indicate that the Localizer/Route Mode is armed.
25. Once localizer course interception has started, a green light and two red lights are visible on the R button. The autopilot will steer the aircraft to intercept the ILS localizer with the desired course (089 Magnetic).
26. Once localizer course interception is complete, only a green light is visible on the R button. The autopilot will now keep the aircraft on the selected course towards the runway's localizer.
27. Press the **"G" (Glide Slope) Mode Selector** to Engage Glide Slope Mode.
28. If Autopilot Altitude Hold Mode was previously engaged, it will automatically disengage (red light) and the autopilot will pitch the aircraft up or down to capture the glide slope. Adjust throttle as required to keep a good airspeed and incidence angle.
29. Once glide slope interception has started, only a red light is visible on the G button.
30. Once glide slope interception is complete, only a green light is visible on the G button.

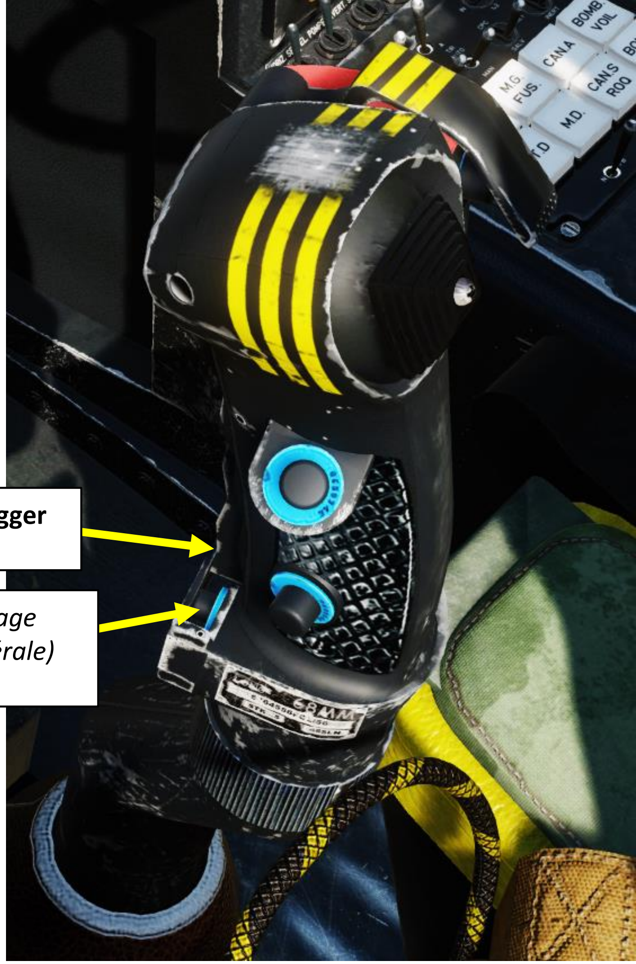


7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

31. Once localizer (lateral deviation) and glide slope (vertical deviation) are both captured, fly the aircraft to keep both deviation lines centered. This will ensure you are on the correct flight path towards the runway.

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

32. When you are 200 ft above ground level (AGL), disconnect the autopilot if you have engaged it previously. The autopilot is useful to guide the aircraft towards the runway threshold but is not designed to land the aircraft per se. The last phase of the landing should be flown manually.
33. To **disengage the autopilot**, you can use any of the following methods:
    a) Press the **Autopilot Disengage Lever** (“P” binding).
    b) Press the **Autopilot (PA, *Pilote Automatique*) Master Control Button** again while autopilot is engaged.
34. When autopilot is disengaged, the PA red light illuminates in the failure warning panel. A warning sound is also audible.
35. Pressing the **Autopilot Disconnect Trigger** (“A” binding) also resets the autopilot warning sound.



Autopilot Disconnect Trigger
- *(“A” binding)*

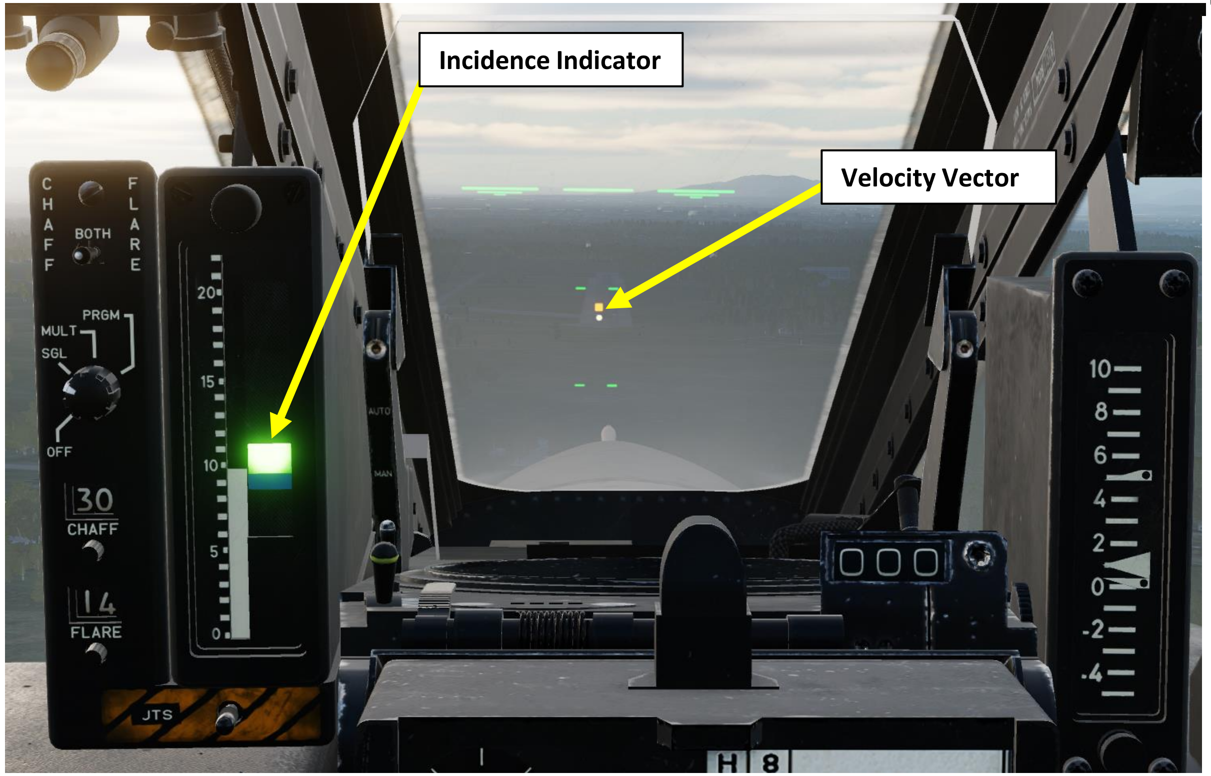
Autopilot Disengage Lever *(Palette de Débrayage Autocommande et Stabilisateur d’Assiette Latérale)*
- *(“P” binding)*

Autopilot (PA, *Pilote Automatique*) Master Control Button
- *Amber: Disconnected*

(PA, *Pilote Automatique*) Warning Light

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

36. Once you are 1 nm from the runway threshold on final approach, steer aircraft to place the velocity vector on the runway threshold. Adjust power as required to maintain the Incidence Angle in the green zone (between 9 and 11 deg).
    - Take a mental note of what the incidence angle means and what actions to take based on the color code:
        - **Red**: You are way too slow, increase power and trim the nose down.
        - **Yellow**: You are too slow, increase power and trim the nose down.
        - **Green**: Airspeed and incidence angle is optimal for landing.
        - **Blue**: You are too fast, slow down and trim the nose up.



Recommended Landing Parameters

Configuration	Weight	Rate of Descent
Normal Landing Weight	9000 kg / 19842 lbs	550 ft/min maximum
Exceptional Landing Weight	11000 kg / 24251 lbs	395 ft/min maximum
Emergency Landing	Above 11000 kg / 24251 lbs	Lowest possible below 300 ft/min

Incidence Indicator Reference Table

Relation between i and IAS at n=1 versus weight		Incidence readings	IAS versus weight * 8700 kg	** 11000 kg	*** ±100 kg
	BLUE	8			
	BLUE	9	156	177	
L/D max (all down)		9.5			
Optimum (all down)	GREEN	10	151	172	
	GREEN	11	146	167	
Watch rpm	GREEN	12	141	162	
		12.5			
Touchdown	YELLOW	13	136	157	±0.85
	YELLOW	14			
	YELLOW	15			
		15.5			
Keel limits	RED	16			
Limit	RED	17	117	138	
	RED	22			

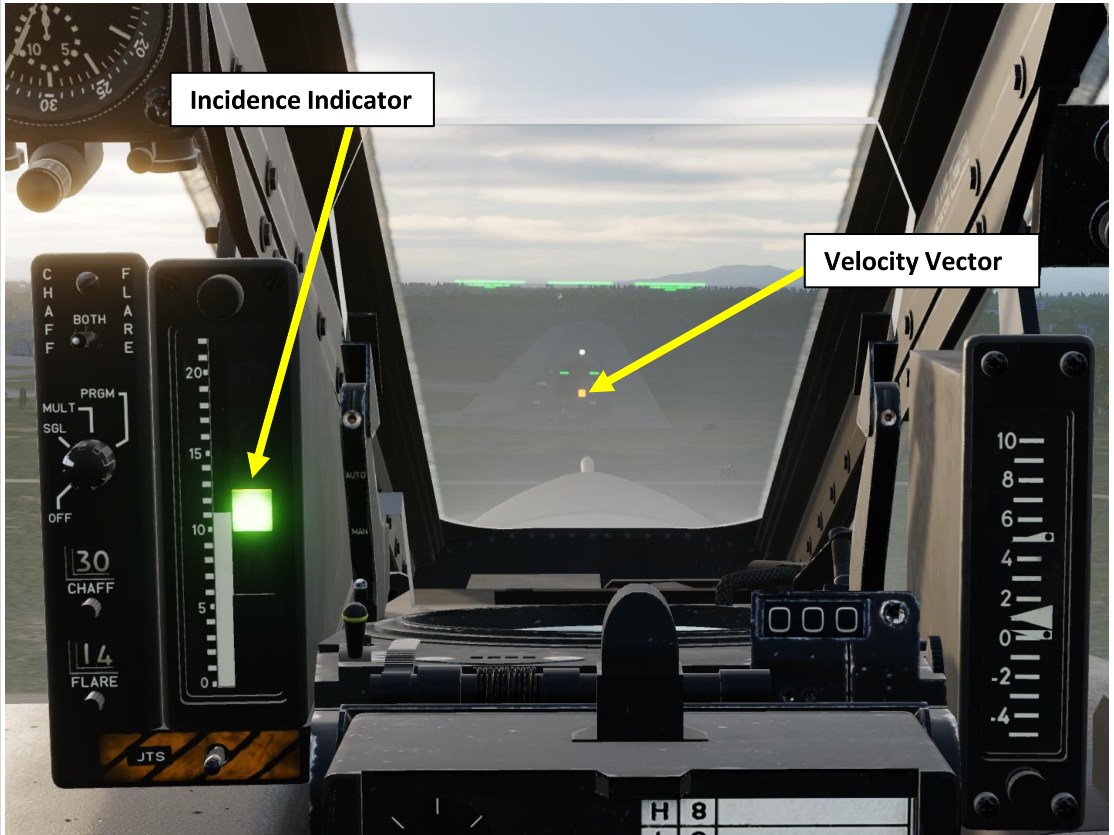
* Without external stores and 1000 liters remaining
With drop tanks empty and 500 liters remaining
** Wing tanks empty (maximum landing weight)
*** ±100 kg = ±125 liters

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

37. As a safety precaution, it is recommended to maintain engine RPM above 7000 RPM in order to keep a good engine response.
38. Descent rate should be determined based on weight configuration (550 ft/min for a normal landing weight configuration or 395 ft/min for heavy weight configurations) with a glide slope of approx. 2.5 deg.

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

39. Fly the aircraft to keep the velocity vector on the runway threshold and the Incidence Indicator Green (10 deg) until touchdown.
40. Upon touchdown, flare the aircraft to maintain a 13 deg Incidence Angle (yellow zone). Maintaining your angle of attack will perform an “aerobraking landing”; this manoeuver bleeds speed and significantly reduces runway length required to decelerate since your wing basically acts as a huge airbrake.
41. Once aircraft has slowed down to 120 kts, set the throttle fully back and let the nose gear touch the ground as the aircraft decelerates.



7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

42. Gently tap wheel brakes when you have slowed down under 100 kts.
43. If landing on a short runway, you may use the brake chute. Brake chute should not be deployed at airspeeds greater than 210 kts.
    a) Verify that brake chute lever is in the FORWARD position (ARMED).
    b) Deploy chute by pulling the drag chute lever AFT (*SORTIR PARACHUTE = DEPLOY CHUTE*).
    c) Once you are slowed down, push brake chute lever FORWARD to release the chute (*LARGAGE PARACHUTE = RELEASE CHUTE*).

Parachute (Brake Chute) Lever
- *AFT: Deploy chute (Sortie)*
- *FWD: Release chute (Largage Parachute)*

43a
Parachute Armed

43b
Parachute Deployed

43c
Parachute Released

43b

43c

7 – ILS (INSTRUMENT LANDING SYSTEM) LANDING

44. Once you are ready to depart the runway towards the parking area (preferably at 20 kts or below), set Nosewheel Steering High Sensitivity Selector Button – PUSHED IN (High Sensitivity). This will allow the aircraft +/- 45 deg of steering.
45. Taxi to the parking area.
46. Retract flaps and set Landing Gear Safety Lever – CLOSED (Safety ON). This will lock the Landing Gear Control Lever (*Palette de Commande de Train d'Atterrissage)*.

44a
Pulled OUT: Low Gain/Sensitivity

44b
Pushed IN: High Gain/Sensitivity

Nosewheel Steering High Sensitivity Selector Button
- *Pushed IN: High Sensitivity, 45 deg of steering*
- *Pulled OUT: Low Sensitivity, 7 deg of steering*

PART 18 – AIR-TO-AIR REFUELING

Mirage F1EE Only

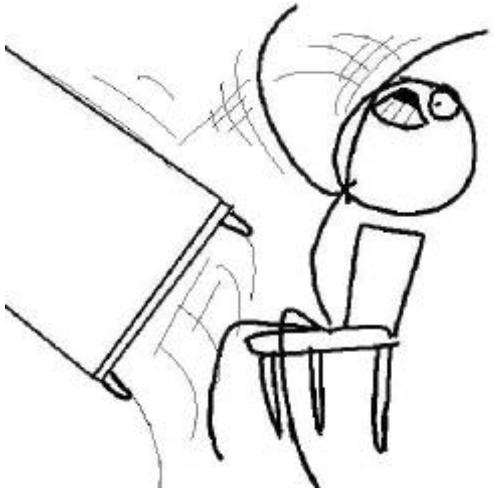
INTRODUCTION

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.

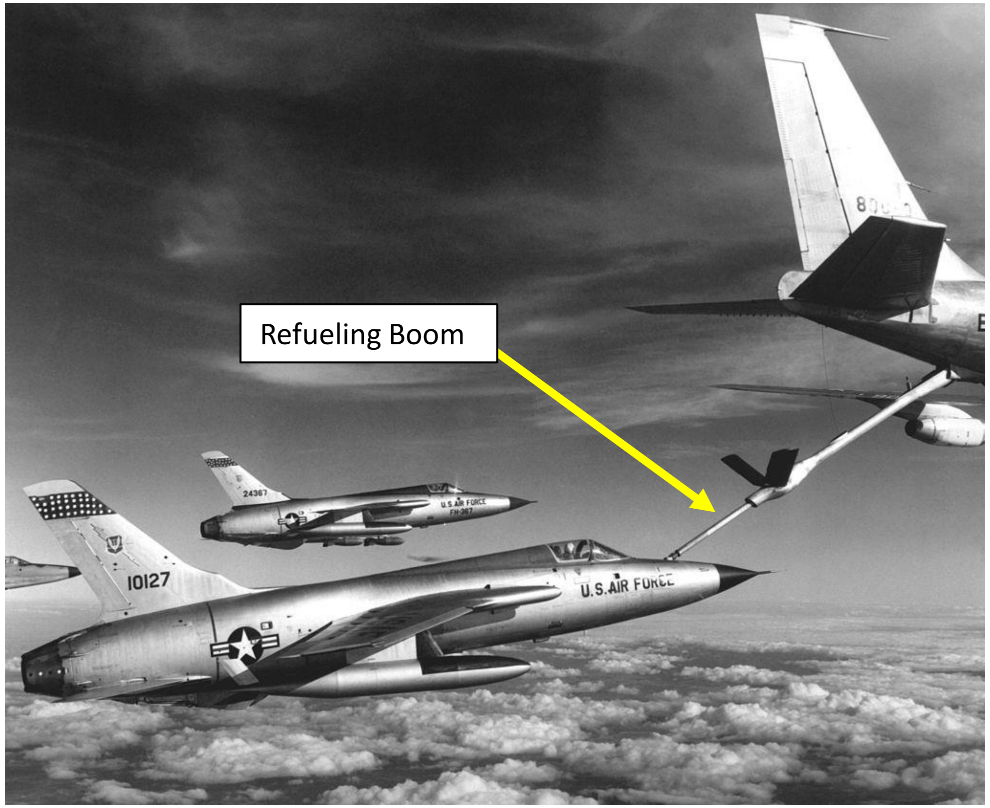


INTRODUCTION

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.

While the Mirage **F1CE** has **no air-to-air refueling capability**, the Mirage **F1EE** is equipped with a **Probe-and-Drogue system**, so air-to-air refueling will only be performed from either an Il-78M, a KC-130, a KC-135 MPRS or a S-3B tanker.

Mirage F1EE Only

KC-135 MPRS

KC-135 Stratotanker


Il-78M

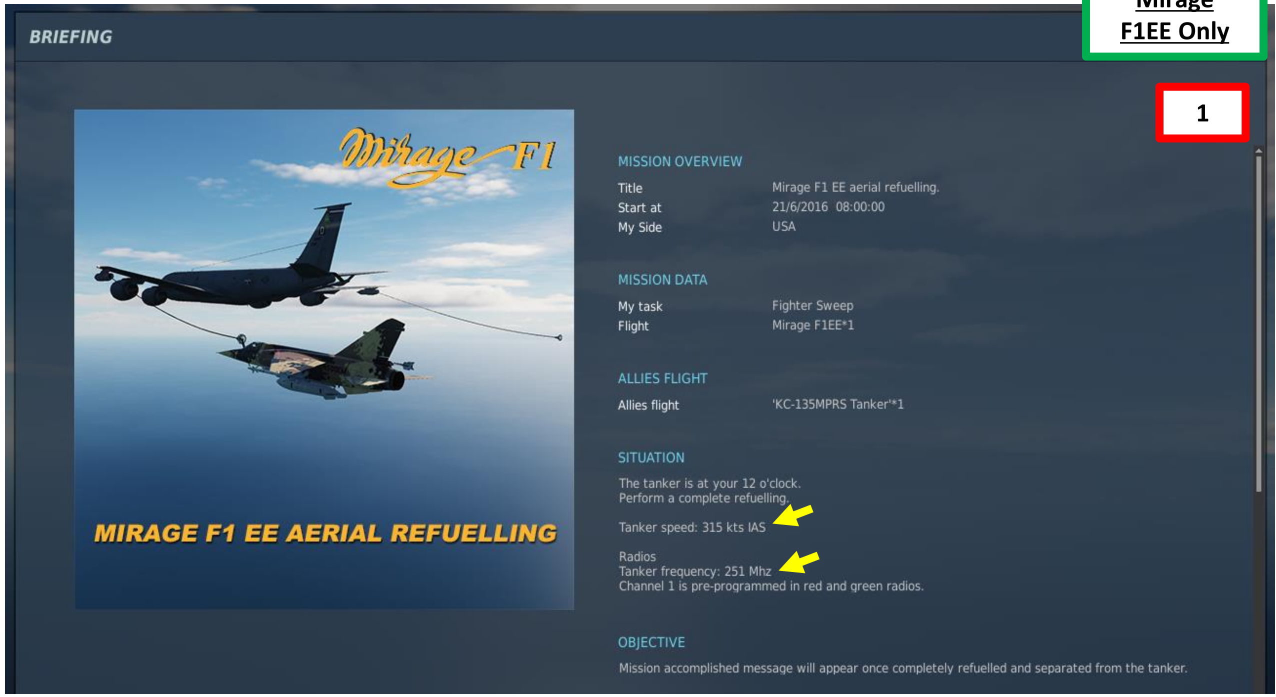

KC-130

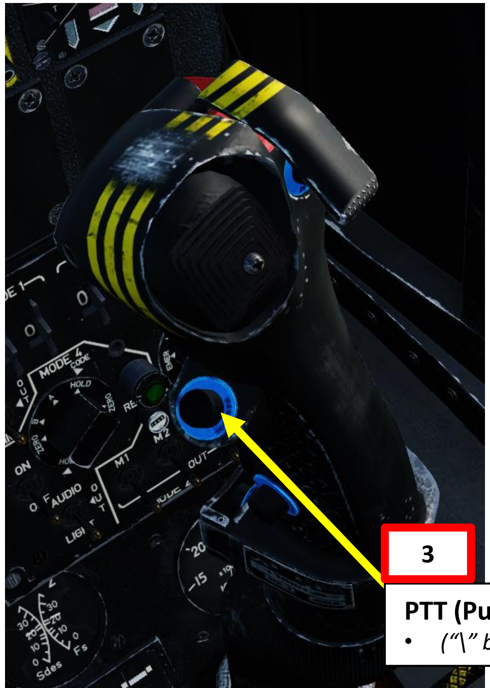
S-3B Viking

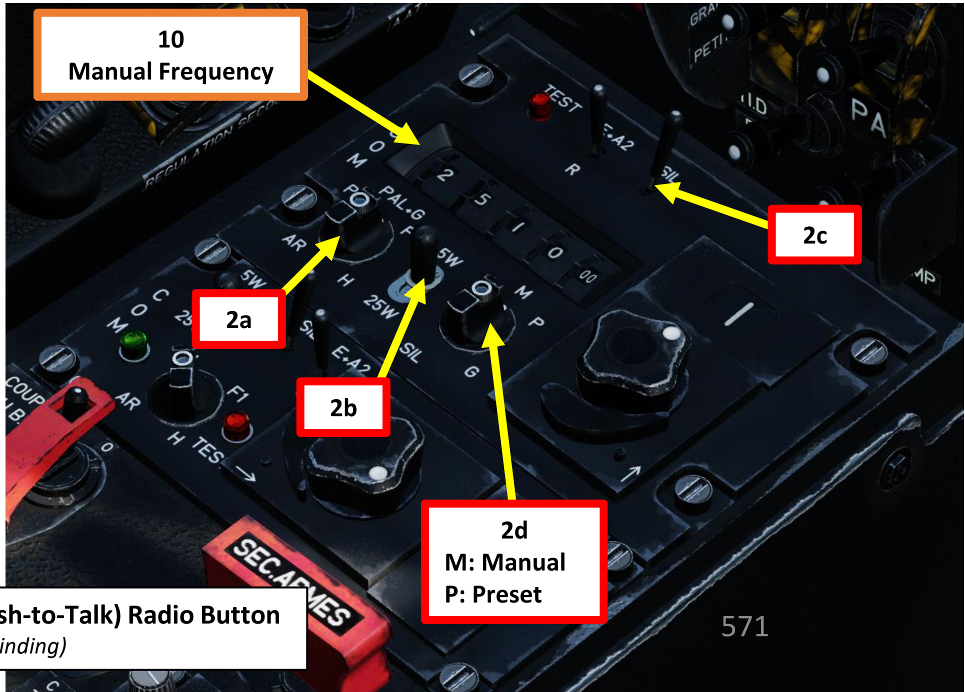
AIR-TO-AIR REFUELING DEMO

Mirage F1EE Only

1. Consult mission briefing to know on which radio frequency you need to contact the tanker.
2. Set up radio to communicate with the tanker.
    a) Set TRAP 136 V/UHF Radio (Green Radio) Mode Selector – PAL (*Fréquence Principale*, Main Frequency).
    b) Set V/UHF Radio Transmitter Power Switch – 5 W (FWD).
    c) Set V/UHF Radio SIL *(Silence)* / Squelch Switch – ON (FWD).
    d) Set V/UHF Radio Frequency Selector – Manual Frequency
    e) Set V/UHF Radio Manual Frequency to the tanker's frequency: 251.000 MHz.
    f) Push TRAP 136 V/UHF Radio (Green Radio) Audio Control Knob (left click) to select TRAP 136 radio for transmission. Rotate knob (scroll mousewheel) to adjust volume.
3. Communicate with TEXACO (tanker callsign). Press "\" (Communication Menu, Radio Microphone Push-to-Talk Button) to transmit.



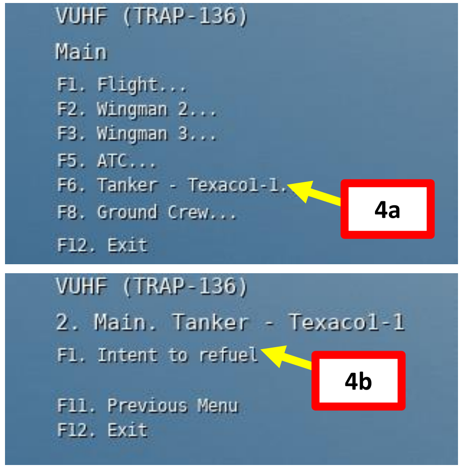


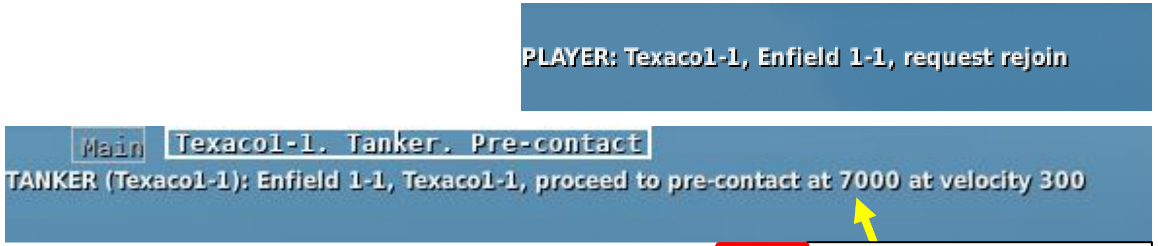


Mirage F1EE Only

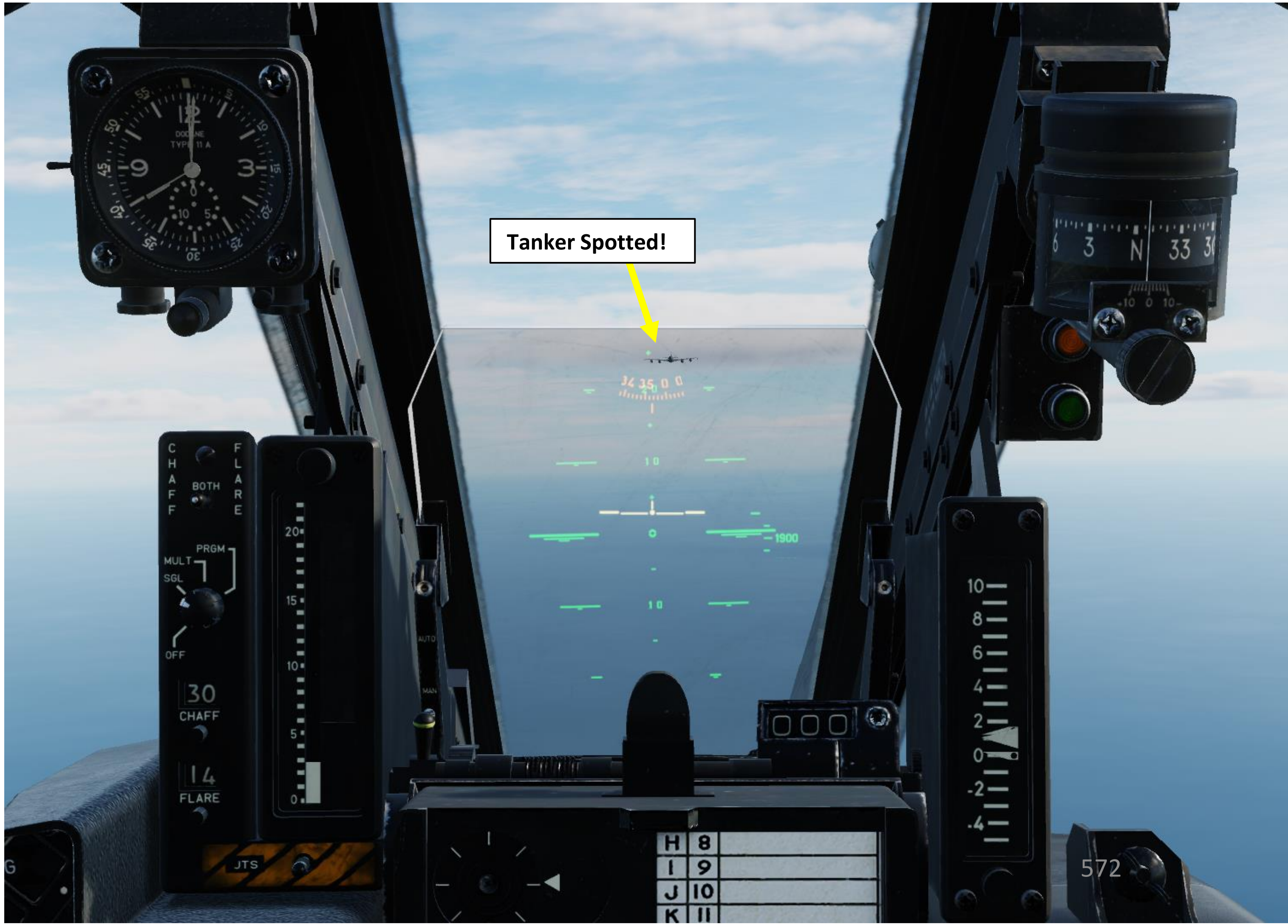
AIR-TO-AIR REFUELING DEMO

4. Select Tanker – Texaco (F6) communication menu, and then select "Intent to Refuel"
5. TEXACO should give you a pre-contact altitude (in our case 7,000 ft).





5 Pre-contact information: rendez-vous at 7,000 ft



AIR-TO-AIR REFUELING DEMO

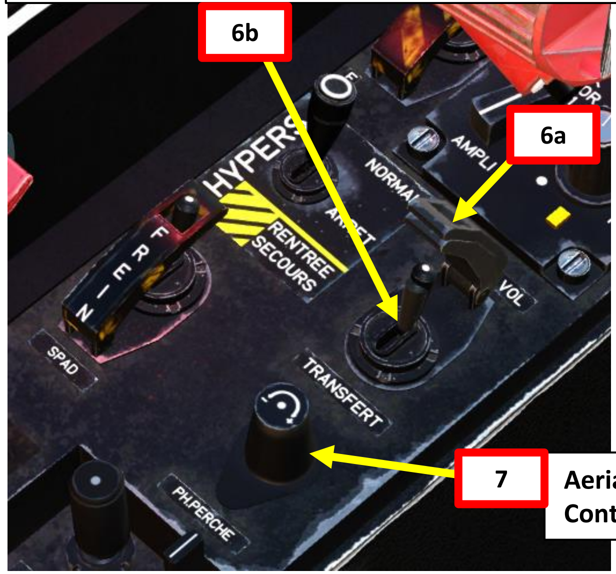
Mirage F1EE Only

6. Flip safety cover, then set Fuel Transfer/Filling Switch FWD – FWD (Aerial Refueling Fuel Filling ON).
7. Turn Aerial Refueling Light (Phare de Perche) Control Potentiometer Knob to deploy the refueling light if required in low visibility conditions.
   - **Important Note**: Make sure aircraft airspeed is below 375 kts. Flying any faster risks jamming the aerial refueling light.

Aerial Refueling Light *(Phare de Perche)*
- *The stowable aerial refueling light is unstowed when setting the Fuel Transfer/Filling Switch FWD (Filling ON).*
- *The light is turned on or off by using the Aerial Refueling Light Control Potentiometer.*
- *Note: Do not attempt to deploy/un-stow the light when flying above 375 kts; it may damage it or jam it in a stowed position.*

Refueling Probe *(Perche)*
- *Allows air-to-air refueling. Probe (male part) must be inserted into a drogue (female part) of a tanker.*

Fuel Transfer/Filling Switch
- *FWD: Aerial Refueling Fuel **Filling ON** (Remplissage en Vol), fuel tanks depressurize and the fuel transfer indicator lights illuminate*
- *AFT (Guarded): Fuel **Transfer** (Transfert), aerial refueling disabled*

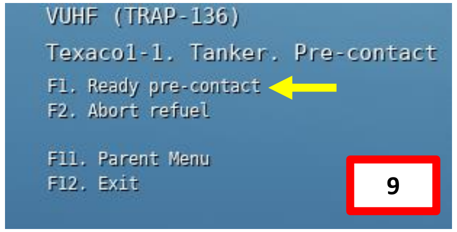


Aerial Refueling Light *(Phare de Perche)* **Control Potentiometer**

AIR-TO-AIR REFUELING DEMO

Mirage F1EE Only

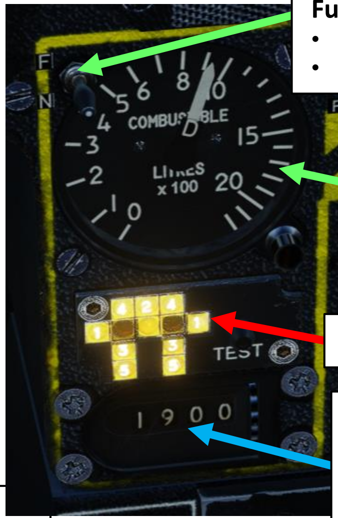
8. When you are less than 0.1 nm away from tanker, position yourself as shown on picture.
9. When in position, use your radio menu to select “Ready Pre-Contact” (F1).
10. The tanker’s pilot should answer you with “Cleared Contact” and should deploy his drogue basket and start to accelerate to cruising speed.
11. Fly formation with the tanker and approach the drogue basket very slowly (make sure you remain about 2-3 kts faster than the tanker) with very gentle inputs. Use stick for big corrections, but keep trimming constantly for small corrections.
12. Keep the aircraft **trimmed at ALL TIMES**. Approaching untrimmed is living hell. Be careful with the throttle since it has a long response time. Use airbrake if you need to slow down quickly while maintaining altitude.



AIR-TO-AIR REFUELING DEMO

Mirage F1EE Only

13. Insert your probe into the drogue basket by using your reference points. The **sight's upper section should be lined up vertically with the drogue basket for vertical movements**, and the **middle of the sight glass should be aligned with the left-most refueling pod for lateral movements**
14. Additional drag should be generated by the drogue once you have contact with the drogue: your aircraft will slightly decelerate. Throttle up a little to keep the probe in. Once the probe is taking fuel, the tanker pilot should tell you "You're taking fuel" and a green light should illuminate on the tanker's refueling pod.
15. Keep formation with the tanker until your refueling is complete. Fuel state is visible on the fuel panel. Don't look at the basket, look at the tanker's refueling pod.
16. As the aircraft gets heavier due too the added fuel, you will need to keep trimming the aircraft in the pitch axis to ensure the aircraft stays stable.

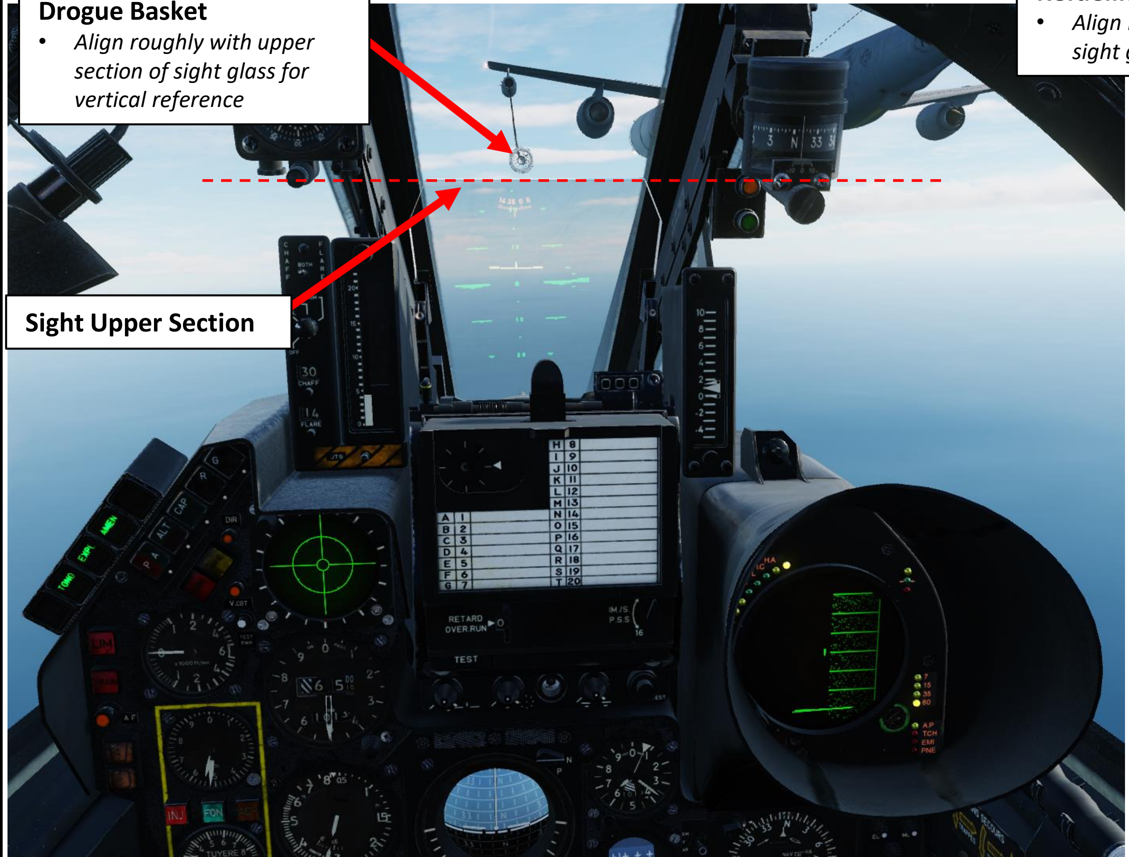


Feeder Tank *(Nourrices)* **/ Fuselage Tank Selector Switch**
- *UP: Fuselage Tanks*
- *DOWN: Nourrices (Feeder Tanks)*

Dual Fuel *(Combustible)* **Indicator (x100 Liters)**
- *There are two needles: one for each side of the aircraft.*
- *Displays Fuselage Tank Quantity when Feeder/Fuselage Selector Switch is set to UP (Fuselage)*
- *Displays Feeder Tank Quantity when Feeder/Fuselage Selector Switch is set to DOWN (Nourrices/Feeder)*

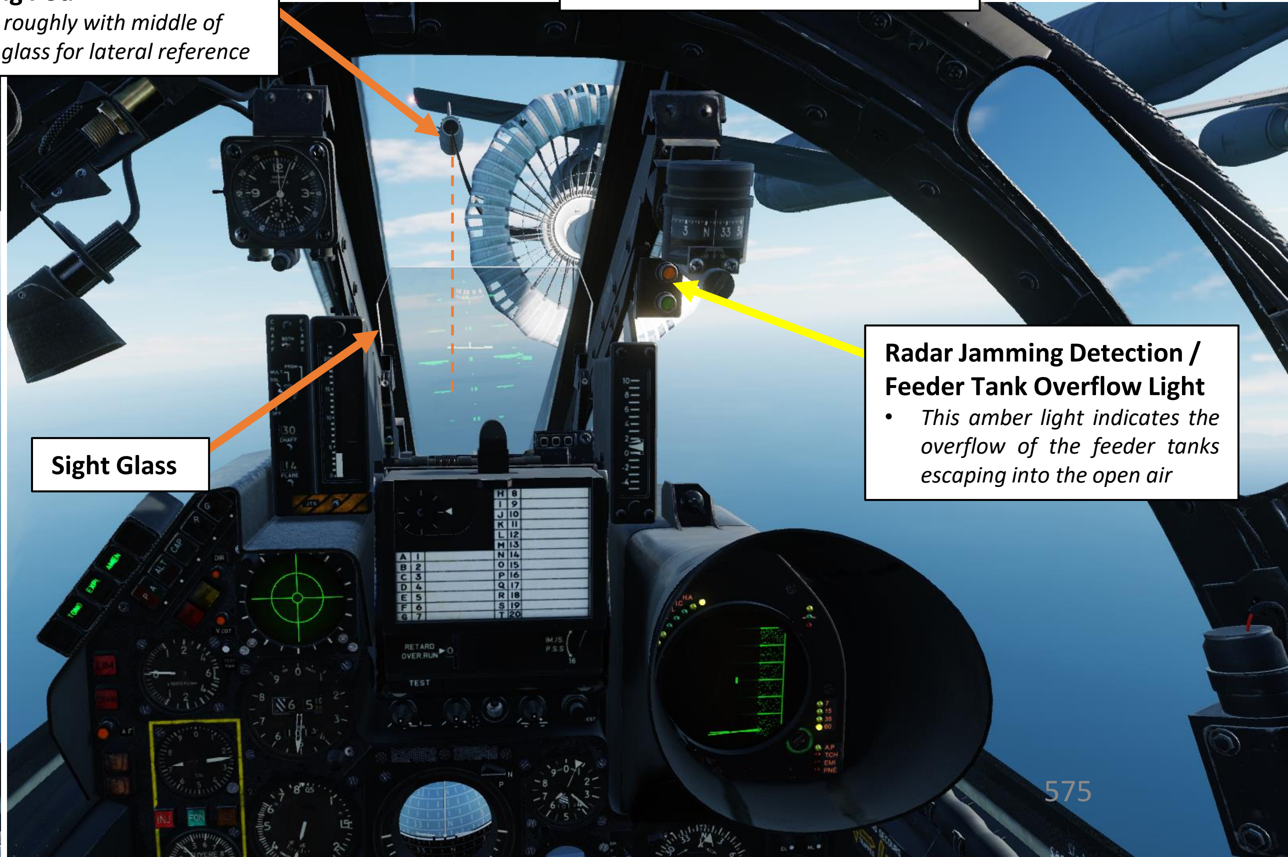
Fuel Tank Empty Lights

Fuel Remaining Indicator (Liters)
- *Indicators needs to be set every time a refueling occurs using the Fuel Quantity Reset Thumbwheel.*



Drogue Basket
- *Align roughly with upper section of sight glass for vertical reference*

Sight Upper Section



Refueling Pod
- *Align roughly with middle of sight glass for lateral reference*

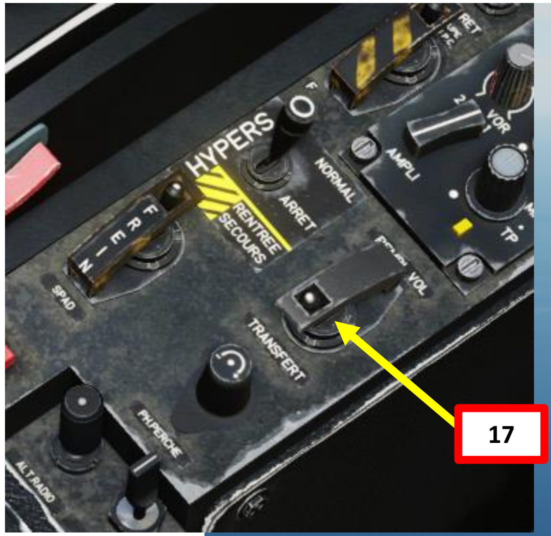
Sight Glass

Radar Jamming Detection / Feeder Tank Overflow Light
- *This amber light indicates the overflow of the feeder tanks escaping into the open air*

AIR-TO-AIR REFUELING DEMO

Mirage F1EE Only

17. When refueling is complete, detach your probe from the basket by throttling down and set Fuel Transfer/Filling Switch FWD – AFT (Aerial Refueling Fuel Filling OFF).



AIR-TO-AIR REFUELING DEMO

In real life, the pilot has to reset the **Fuel Remaining Indicator** to the correct value using the **Fuel Quantity Reset Thumbwheel after refueling process is complete.** As a rule of thumb:

- 50 % Internal Fuel, No External Tanks: **2120** L
- 100 % Internal Fuel, No External Tanks: **4230** L
- 100 % Internal Fuel, 1 x External Tank: **5380** L
- 100 % Internal Fuel, 2 x External Tanks: **6520** L
- 100 % Internal Fuel, 3 x External Tanks: **7650** L

If the "**Counters reset automatically on rearm/refuel**" option is selected (ticked) in the Special Options tab, the simulation automatically updates the Fuel Remaining Indicator value for you.

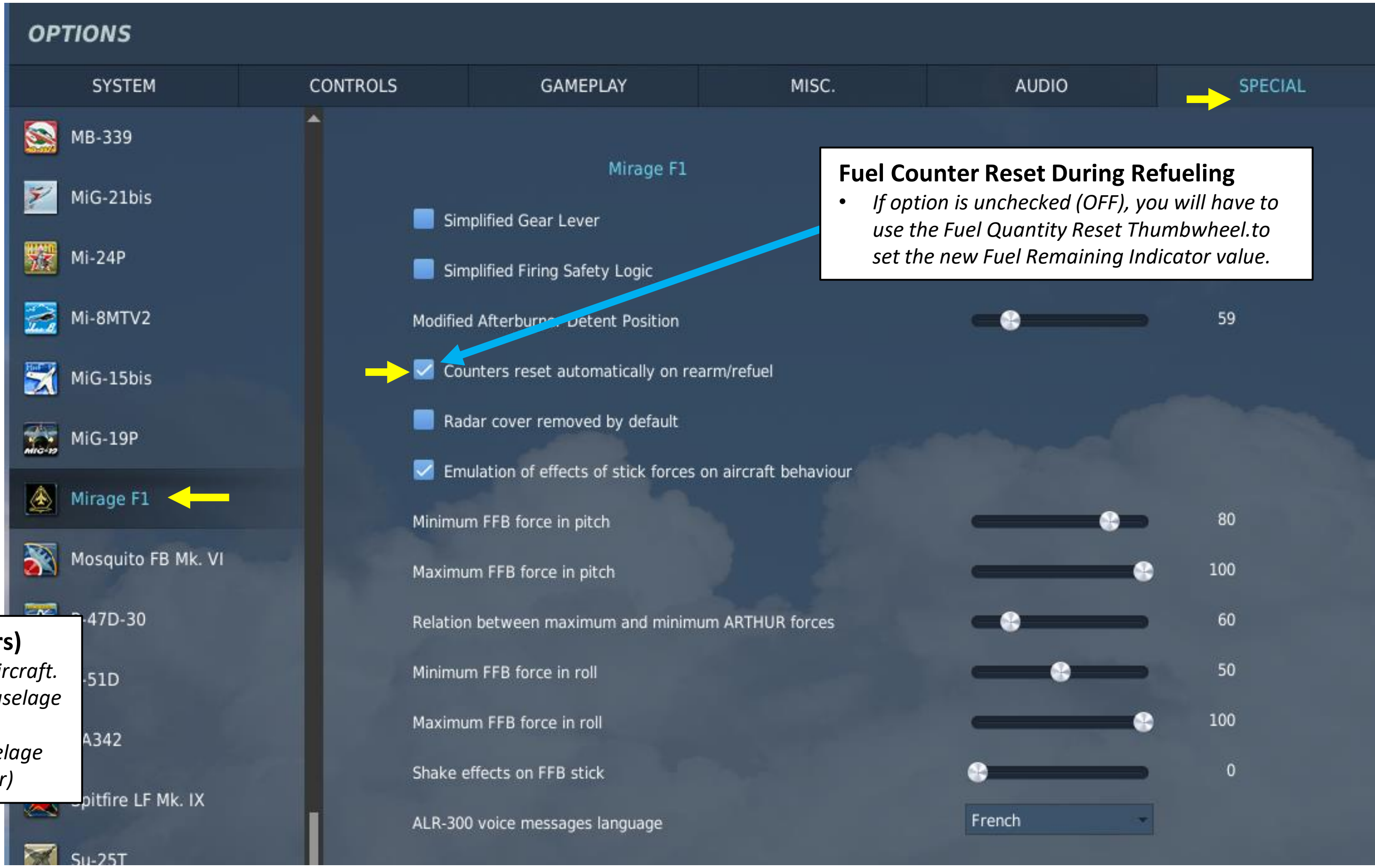
Feeder Tank *(Nourrices)* **/ Fuselage Tank Selector Switch**
- *UP: Fuselage Tanks*
- *DOWN: Nourrices (Feeder Tanks)*

Dual Fuel *(Combustible)* **Indicator (x100 Liters)**
- *There are two needles: one for each side of the aircraft.*
- *Displays Fuselage Tank Quantity when Feeder/Fuselage Selector Switch is set to UP (Fuselage)*
- *Displays Feeder Tank Quantity when Feeder/Fuselage Selector Switch is set to DOWN (Nourrices/Feeder)*

Fuel Tank Empty Lights

Fuel Quantity Reset Thumbwheel
- *Changes the Fuel Remaining Indicator Value; this needs to be used after refueling.*

Fuel Remaining Indicator (Liters)
- *Indicators needs to be set every time a refueling occurs using the Fuel Quantity Reset Thumbwheel.*



Fuel Counter Reset During Refueling
- *If option is unchecked (OFF), you will have to use the Fuel Quantity Reset Thumbwheel.to set the new Fuel Remaining Indicator value.*

AIR-TO-AIR REFUELING DEMO

Of course, all of this seems much easier said than done. You will very likely do following mistakes:

- Approach too fast and miss the basket
- Oscillate vertically without being able to line up with the basket
- Keep going either too fast or too slow
- Drift left or right
- Overcompensate control inputs

Mirage F1EE Only

AIR-TO-AIR REFUELING DEMO

Here is a demo of aerial refueling by Commander Steinsch
- https://youtu.be/5nD9_jslQDo

The next slide will give you a couple of tips to help you catch that basket and slurp that delicious jet fuel like a crack addict.

Mirage F1EE Only

AIR-TO-AIR REFUELING TIPS & TRICKS

Mirage F1EE Only

- Remaining **CALM is key** for a successful refueling. If you lose your cool, take a break and try again once you are relaxed. Silk hands and a clear head are needed for that part.
- If you overshoot (or are about to fly past) the tanker, you can bleed speed very fast by deploying your airbrakes. You can go from 400 kts to 300 kts in a matter of seconds.
- **Avoid combining roll, pitch and yaw movements at the same time** when you are tracking the basket. Failing to do so will make you drift vertically and horizontally, which doesn't help at all and may induce PIO (Pilot induced oscillations). Try to stay in the same horizontal plane as much as possible.
- It is easier if you try to "break down" your control inputs in **separate movements**. I try to avoid gunning my throttle, pitching up/down, rolling and using my rudder at the same time. I generally avoid using the rudder and instead focus on using small pitch and roll inputs only in order to make the **aircraft's response predictable**. Combining different control inputs can make the aircraft react in a way that makes it all very difficult for your brain to predict and process. I tend to make sure my plane is **straight and level at first** and that I am more or less lined up with the basket.
- Once I have a satisfying attitude and that the basket is placed approximately as shown on the picture below, **I gradually throttle up** and increase speed to **match the tanker's speed**.
- Once my speed matches the tanker's, I can gradually accelerate to a speed that is 2-3 kts faster, **approaching the basket very slowly**. At that part, the ONLY two things I am watching are my **AIRSPEED** and the **BASKET**. Nothing else matters.
- Once I am approaching the basket, I make sure to avoid inducing yawing motion with the rudder pedals. I displace myself with roll and pitch (vertical) stick input only.

RESOURCES

AERGES' DCS Mirage F1 Flight Manual (Work In Progress)
https://www.digitalcombatsimulator.com/en/files/3324917/

Minky7's Mirage F1 Kneeboard Checklists
https://www.digitalcombatsimulator.com/en/files/3325093/

Bailey's Mirage F1 Kneeboard Checklists and Weapon Tables
https://www.digitalcombatsimulator.com/en/files/3325088/

Redkite's Mirage F1 Tutorial Series (Youtube)
Playlist: https://www.youtube.com/watch?v=q3L7K-4A2qU&list=PLml_c09ciuctWJG0X8DCMjHrZYJ85rjuD&ab_channel=RedKite
- DCS: Mirage F1CE Expedited Cold Start Tutorial: https://youtu.be/2C1E-AkCjNg
- DCS: Mirage F1CE Take off, Landing, Flight Tutorial: https://youtu.be/FtwMoDd5PEI
- DCS: Mirage F1CE Engine Relight Tutorial: https://youtu.be/6NwLIsXl64I
- DCS: Mirage F1CE TACAN Navigation Tutorial: https://youtu.be/EY38f1jx2PA
- DCS: Mirage F1CE Rockets, Bombs and Guns Ground Attack Tutorial: https://youtu.be/8zwQUCCLVYw
- DCS: Mirage F1CE Radar + A/A Weapons Tutorial: https://youtu.be/OhQ8xV3F94w
- DCS: Mirage F1CE RWR and Countermeasures Tutorial: https://youtu.be/qZsDm3WBjTU

DCS Heinlein's Mirage F1 Tutorials (Youtube)
Playlist: https://www.youtube.com/playlist?list=PLLnxK6CJYwVcpFm-2LN97qSeTuAwvRmys

Iain Christie's (aka Sidekick65) Mirage F1 Bomb/Rocket Tutorials (Youtube)
- The Mirage F1 Hits The Target https://youtu.be/f6DEwh2UMXU
- The Mirage F1 Hits The Target with Science https://youtu.be/DOaIwBgswuQ
- Mirage F1 - Weapons Tutorial - High Drag Bombs https://youtu.be/tWOOSptus1s
- Mirage F1 - Some Applied Rocket Science https://youtu.be/t0K2ntvb5D4

Commander Steinsch's Mirage F1EE Tutorial (Youtube)
Mirage F1EE Aerial Refueling Tutorial: https://youtu.be/5nD9_jslQDo

DCS WORLD: The Giraffe – Movie by Hornet Productions (Youtube)
https://youtu.be/up6KB95abHQ


À la chasse, bordel!

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:

- Federico “Cyborg” Franceschi
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- David “Scooliosis”
- Ben “Hangry Raccoon”
- ChazFlyz


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