DCS GUIDE
Mirage 2000C

By Chuck

LAST UPDATED: 13/09/2020

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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 Mirage 2000 evolved from a series of Dassault design efforts performed from 1965 to 1975. The first in this series was a collaborative project known as the Anglo-French Variable Geometry (AFVG) swing-wing aircraft, begun in 1965. The collaboration was a fiasco, and the French pulled out in 1967. The British stayed with the concept and formed another collaboration with the Germans and Italians, which eventually produced the Panavia Tornado.

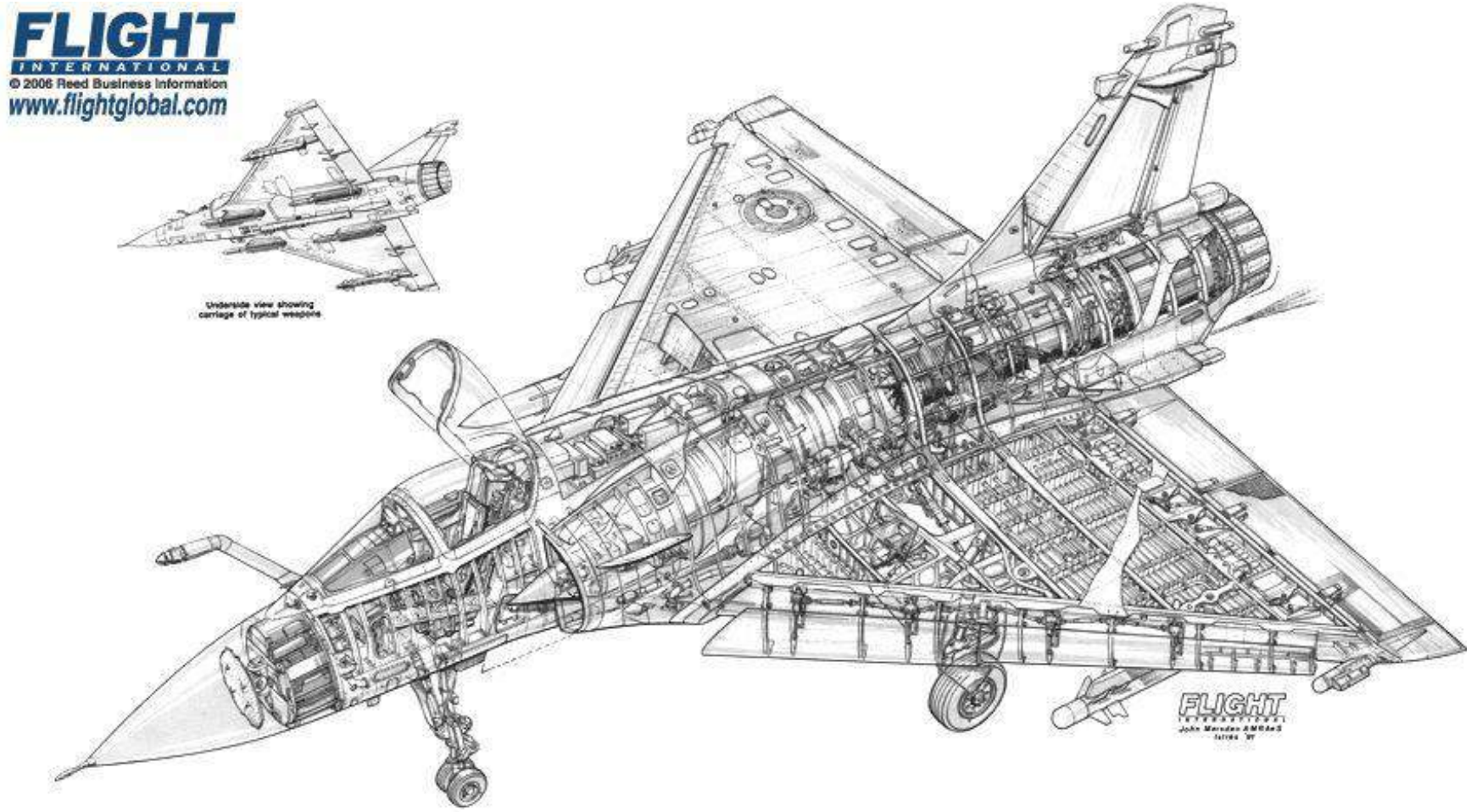
Dassault then worked on several new aircraft concepts evolved from their Mirage G variable-geometry experimental prototype, resulting in a sophisticated design with the designation Avion de Combat Futur (ACF), or Future Combat Aircraft. The ACF prototype was almost complete when the French government cancelled it in 1975. The ACF was simply too big and expensive. However, Dassault had been considering other fighter options in the meantime, partly because of limited export potential. These alternatives were smaller, simpler, and cheaper than the ACF, and took the form of a number of "Mini-Mirage", or "Mimi"; concepts developed beginning in 1972 as a "back-bumer" project. These concepts congealed into an aircraft known at first as the Super Mirage III, then the Delta 1000, Delta 2000, and finally Super Mirage 2000.

A number of different versions of the Mirage 2000 have been developed. The “C” stands for “Chasseur” (Fighter), the “B” stands for “Biplace” (two-seater), the “D” stands for “Diversifié” (Multipurpose) and the “N” for “Nucléaire” (nuclear).

When the ACF was cancelled, Dassault was able to immediately offer the Mirage 2000 as an alternative, and the French Defense Council accepted it. It wasn't exactly an even trade, since the ACF was a strike aircraft first and an interceptor second, while the Mirage 2000 was exactly the reverse. However, the Mirage 2000 was much more affordable. There was another reason for Dassault to push the Mirage 2000. In 1975, four European nations selected the General Dynamics F-16 as their new first-line fighter, rejecting an updated Mirage Fl.

Marcel Dassault was disgusted with the choice, and felt his company could build a better aircraft. Using the delta wing configuration seemed to many like a backward step. The company had used that configuration on the Mirage III and 5, but abandoned it for the Mirage F1. A delta wing tends to be a good choice in terms of high-speed flight characteristics, simplicity of aircraft construction, relatively low radar signature, and internal volume. It tends to be a poor choice in terms of maneuverability, low-altitude flight, and length of take-off and landing run.

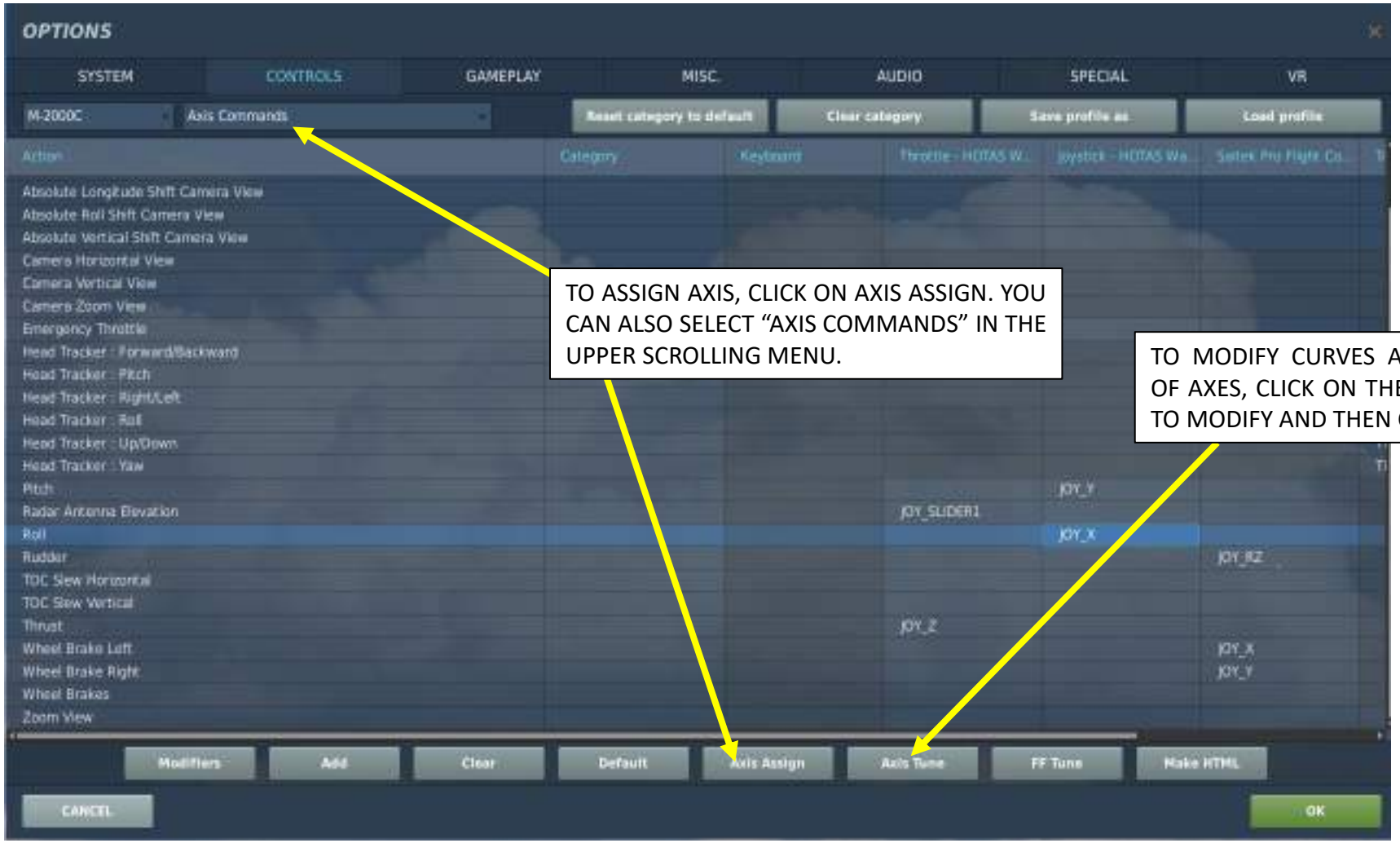
While the delta wing was outdated by that time, Dassault modified the aerodynamics of the new aircraft to ensure a degree of inherent instability, obtained by moving the aircraft's center of lift in front of its center of gravity. Control was maintained by a fly-by-wire control system and automatic, full length, two-segment leading-edge flaps. This gave the Mirage 2000 a level of agility that the Mirage III and 5 lacked, and the aircraft would become known for its handling. A noticeably taller tail allowed the pilot to retain control at higher angles of attack, assisted by small strakes mounted along each air intake.



CONTROLS SETUP

ASSIGNING PROPER AXIS IS IMPORTANT. HERE ARE A COUPLE OF TIPS.

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.



CONTROLS SETUP

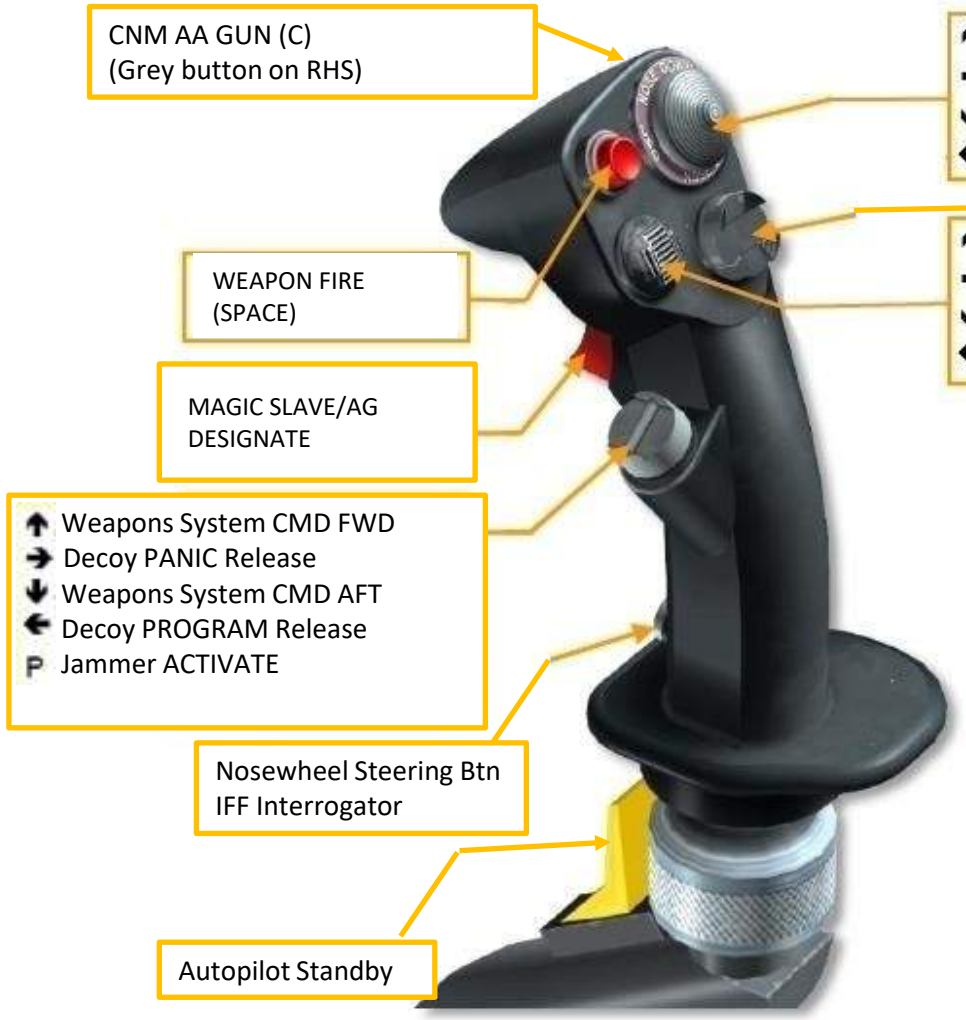
BIND THE FOLLOWING AXES

- PITCH (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- ROLL (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 10)
- THROTTLE – CONTROLS ENGINE RPM
- WHEEL BRAKE LEFT / RIGHT

- NOTES:
    1. To turn on the ground, make sure nosewheel steering (DIRAV) is engaged (grey nosewheel steering button on your HOTAS, where your pinky finger should be)
    2. The Airbrake key must be mapped to “AIRBRAKE” (B by default) and will act as a toggle switch.
    3. There are no flaps on the Mirage 2000C… so don’t waste your time looking for them ☺

WHAT YOU NEED MAPPED

HOTAS: **"Hands On Throttle-And-Stick"**
3M: **"Main sur Manche et Manette"**



CNM AA GUN (C)
(Grey button on RHS)

WEAPON FIRE
(SPACE)

MAGIC SLAVE/AG
DESIGNATE

↑ Weapons System CMD FWD
→ Decoy PANIC Release
↓ Weapons System CMD AFT
← Decoy PROGRAM Release
P Jammer ACTIVATE

Nosewheel Steering Btn
IFF Interrogator

Autopilot Standby

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

↑ TDC UP (I)
→ TDC RIGHT (L)
↓ TDC DOWN (K)
← TDC LEFT (J)

↑ ZOOM IN SLOW
→ STT/TWS TOGGLE
↓ ZOOM OUT SLOW
← Weapons System CMD DEPRESS

↑ AUX UHF RADIO SELECT
→
↓ MAIN U/VHF RADIO SELECT
← COMMUNICATION MENU

TDC Depress (Lock Target)

← Nav Update / Magic Unlock

→ AIRBRAKE (B)

↑ Radar Antenna UP
→ Radar Range Increase
↓ Radar Antenna DOWN
← Radar Range Decrease

← CNM NEUTRAL (PCA SELECT)

→ CNM MAGIC

+ TOE BRAKES (MAPPED ON PEDALS)

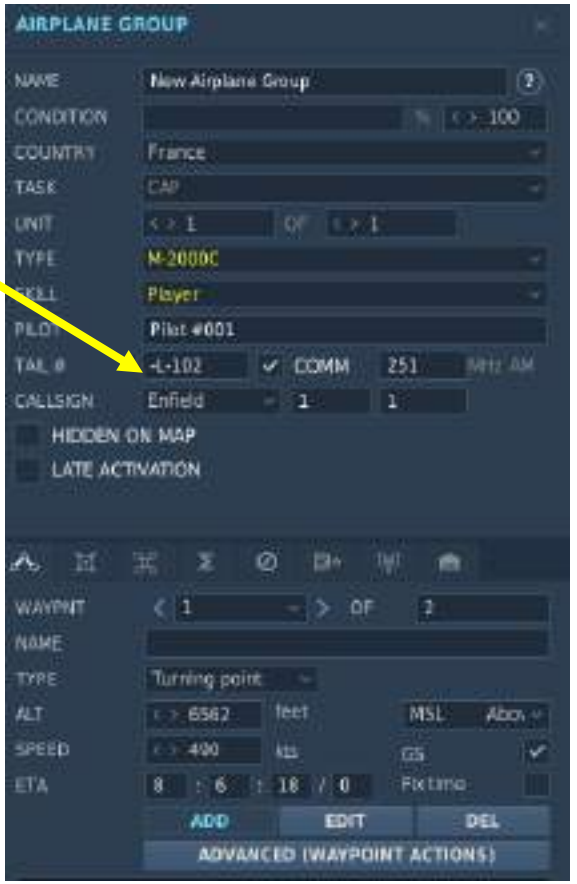
PART 3 – COCKPIT & GAUGES

TIP: Pilot body can be toggled ON/OFF with "RSHIFT+P".

Aircraft Designation

The Tail Number you enter in the Mission Editor TAIL # should be as follows:
***Example**: -L-102 (dash ONE_LETTER dash THREE_DIGITS)*

The one letter will be displayed on the side of the cockpit, as the unique letter of the aircraft registration (no digit here!): 2-LL is correct, 2-L1 is not). And the 3 digits will display as the aircraft serial number (manufacturer number, unique across the whole fleet).



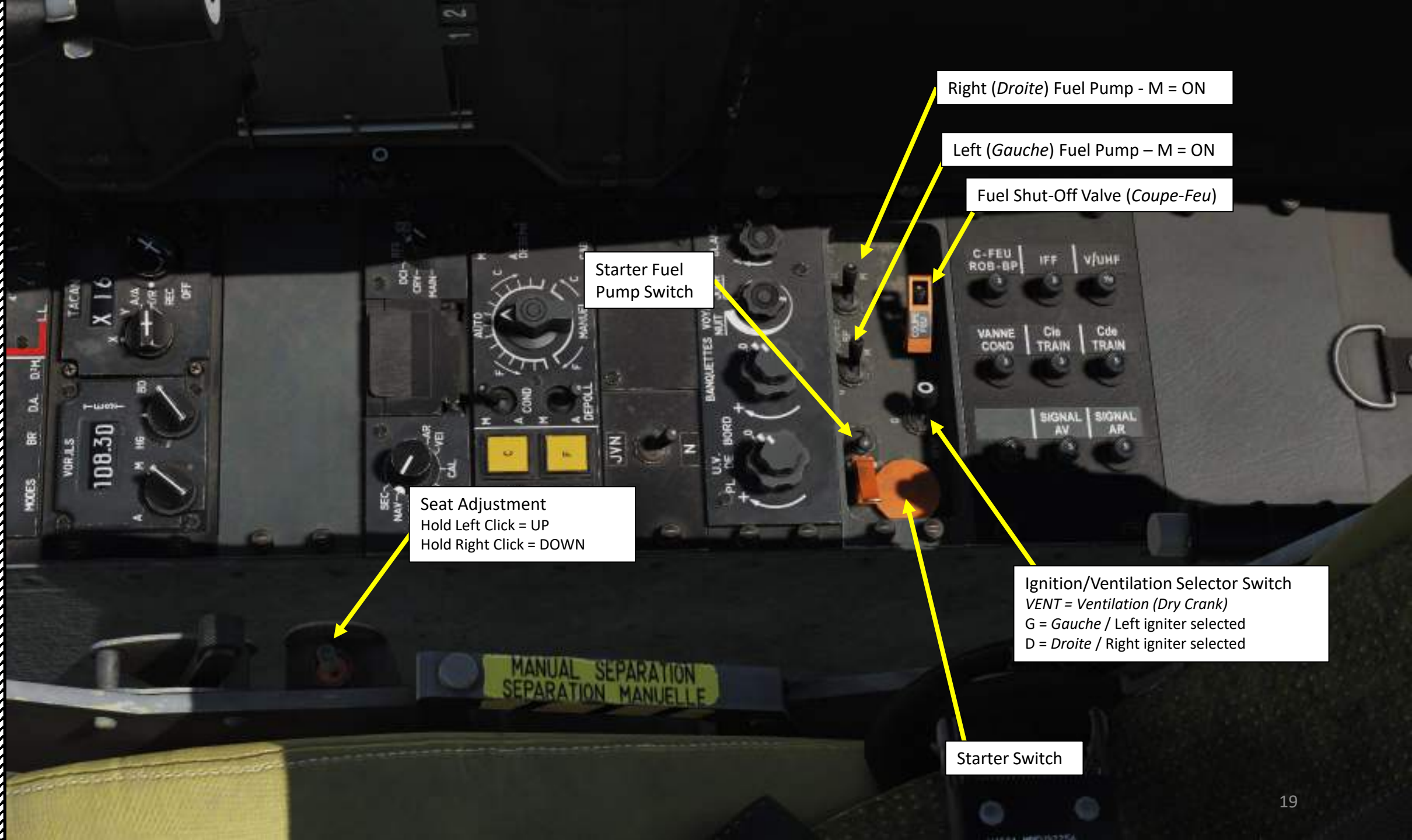

VTH Control Panel: *Visualisation Tête Haute*
Litt.: HUD (Heads-Up Display) Control Panel
PCA: *Poste de Commande Armement*
Litt.: Weapon Control Panel
PPA: *Poste de Préparation Armement*
Litt.: Weapons Configuration Panel
PCN: *Poste de Commande Navigation*
Litt.: Navigation Control Panel
VTB Radar Control Panel: Radar *Visualisation Tête Basse*
Litt.: HDD (Heads-Down Display) Radar Control Panel
PSM: *Poste de Sélecteur de Modes*
Litt.: Mode Selector Panel

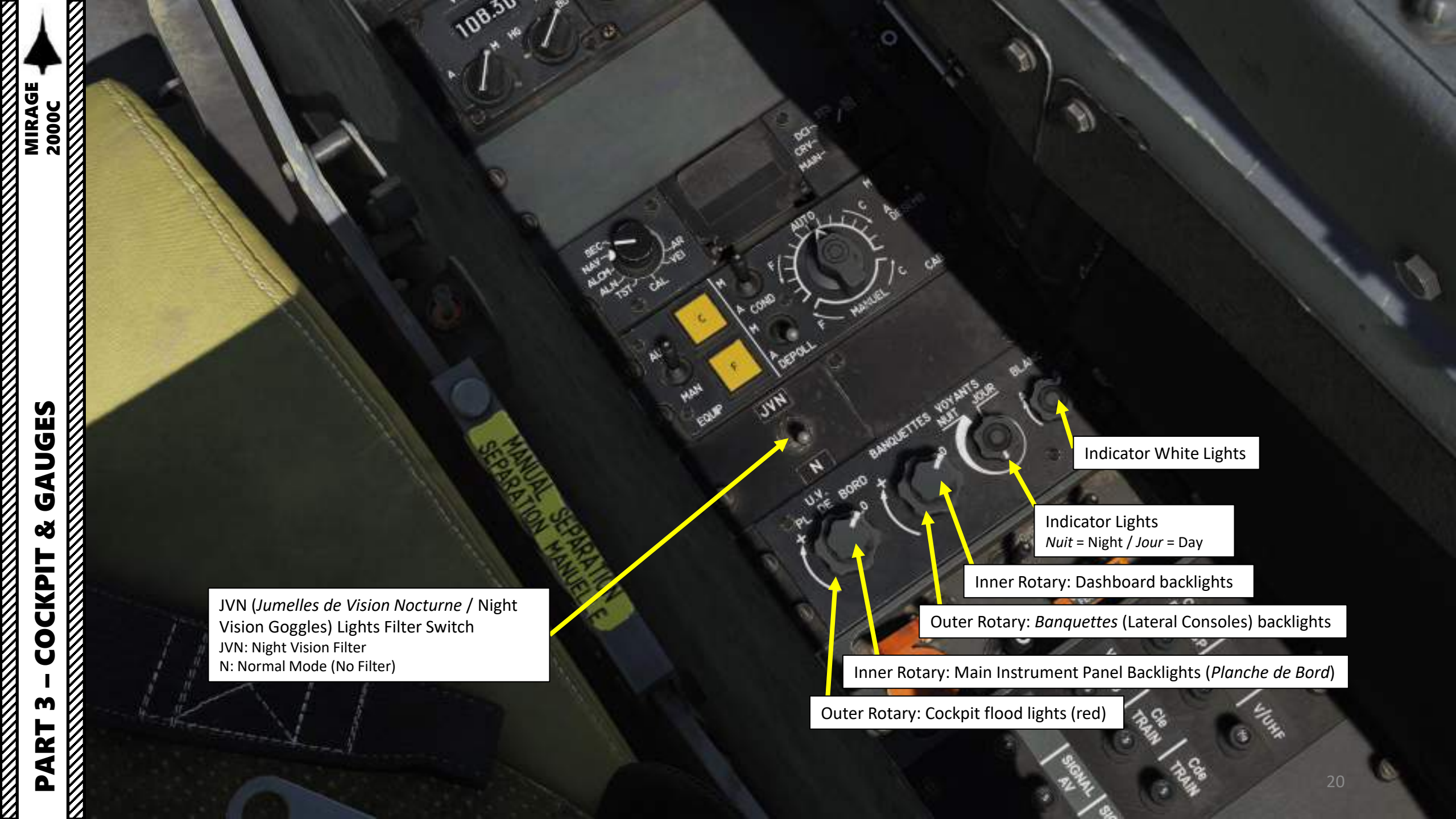

Canopy Handle
Canopy Lever
➔ *OUVERTURE* (OPEN) | *DESCENTE* (DOWN)
➔ *VERROUILLAGE VERRIÈRE* (LOCK CANOPY)


Emergency Compass
(Left Click to Show or Hide)


Canopy Holding Handle
(used to hold the canopy half-open)


Parking Brake
UP = ENGAGED
DOWN = DISENGAGED


Right (*Droite*) Fuel Pump - M = ON
Left (*Gauche*) Fuel Pump – M = ON
Fuel Shut-Off Valve (*Coupe-Feu*)
Starter Fuel Pump Switch
Seat Adjustment
Hold Left Click = UP
Hold Right Click = DOWN
Ignition/Ventilation Selector Switch
VENT = Ventilation (Dry Crank)
G = *Gauche* / Left igniter selected
D = *Droite* / Right igniter selected
Starter Switch
C-FEU ROB-BP
IFF
V/UHF
VANNE COND
Cie TRAIN
Cde TRAIN
SIGNAL AV
SIGNAL AR
MANUAL SEPARATION
SEPARATION MANUELLE



JVN (*Jumelles de Vision Nocturne* / Night Vision Goggles) Lights Filter Switch
JVN: Night Vision Filter
N: Normal Mode (No Filter)

Indicator White Lights

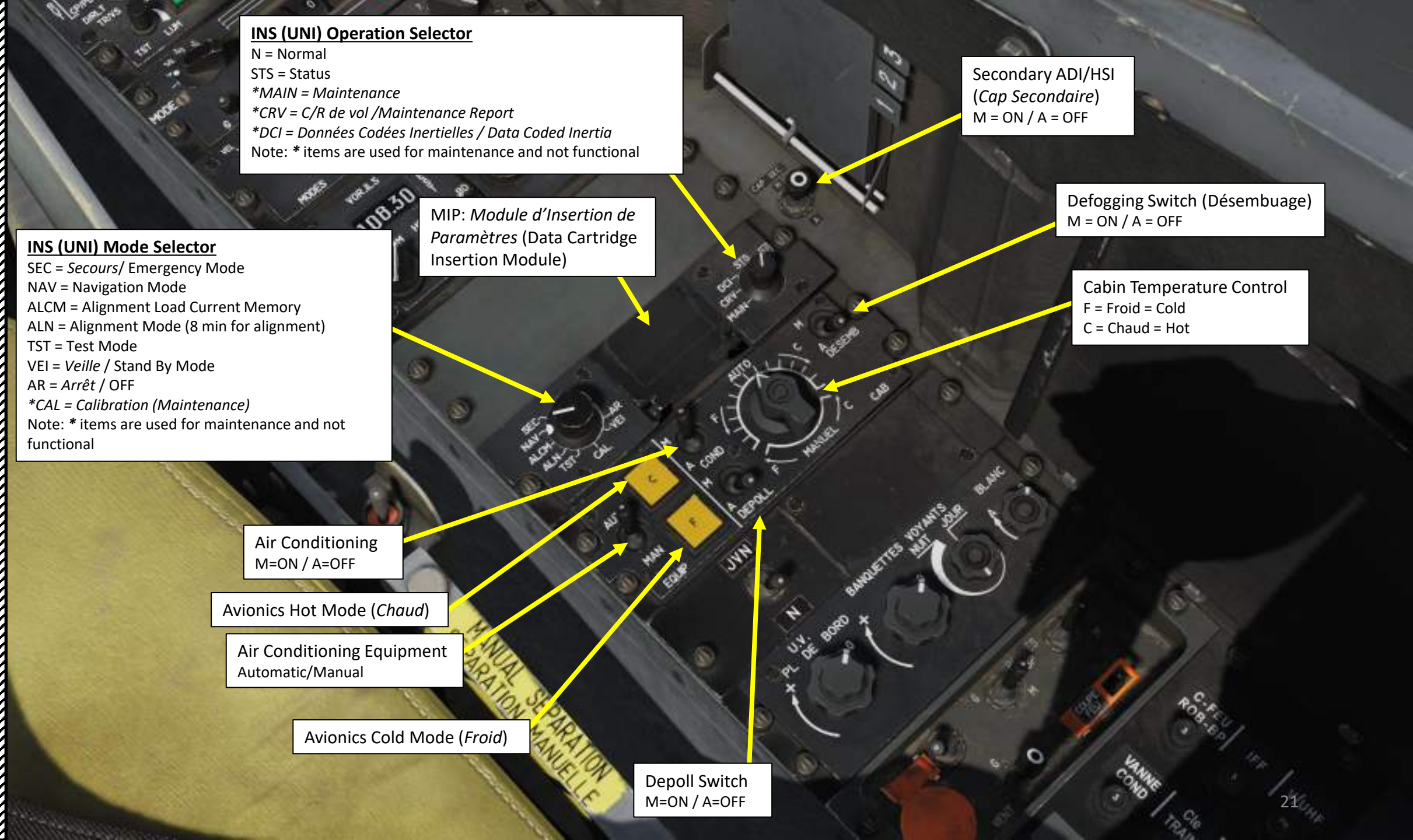
Indicator Lights
Nuit = Night / *Jour* = Day

Inner Rotary: Dashboard backlights

Outer Rotary: *Banquettes* (Lateral Consoles) backlights

Inner Rotary: Main Instrument Panel Backlights (*Planche de Bord*)

Outer Rotary: Cockpit flood lights (red)



INS (UNI) Operation Selector
N = Normal
STS = Status
**MAIN = Maintenance*
**CRV = C/R de vol /Maintenance Report*
**DCI = Données Codées Inertielles / Data Coded Inertia*
Note: ***** items are used for maintenance and not functional

INS (UNI) Mode Selector
SEC = *Secours*/ Emergency Mode
NAV = Navigation Mode
ALCM = Alignment Load Current Memory
ALN = Alignment Mode (8 min for alignment)
TST = Test Mode
VEI = *Veille* / Stand By Mode
AR = *Arrêt* / OFF
**CAL = Calibration (Maintenance)*
Note: ***** items are used for maintenance and not functional

MIP: *Module d'Insertion de Paramètres* (Data Cartridge Insertion Module)

Secondary ADI/HSI (*Cap Secondaire*)
M = ON / A = OFF

Defogging Switch (Désembuage)
M = ON / A = OFF

Cabin Temperature Control
F = Froid = Cold
C = Chaud = Hot

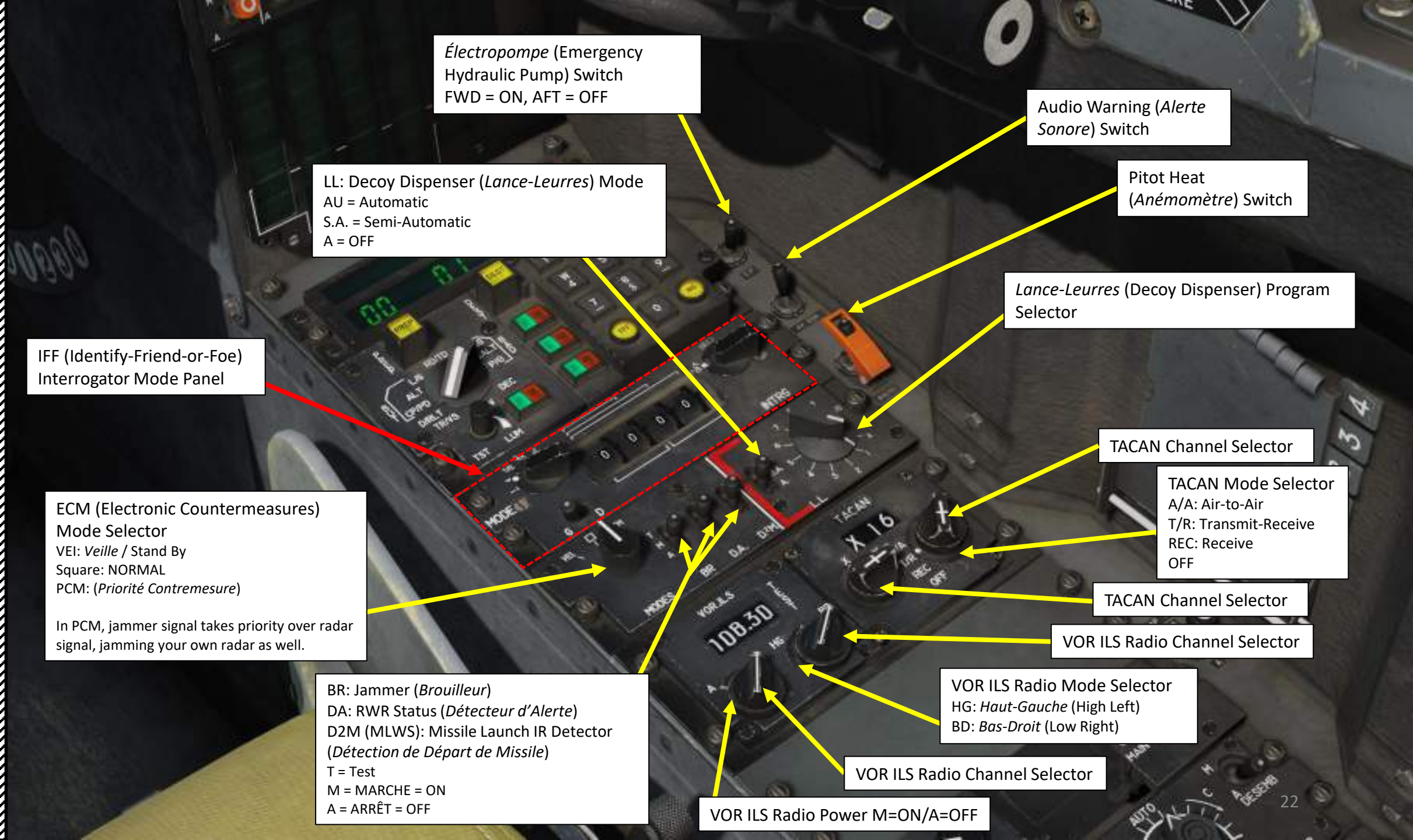
Air Conditioning
M=ON / A=OFF

Avionics Hot Mode (*Chaud*)

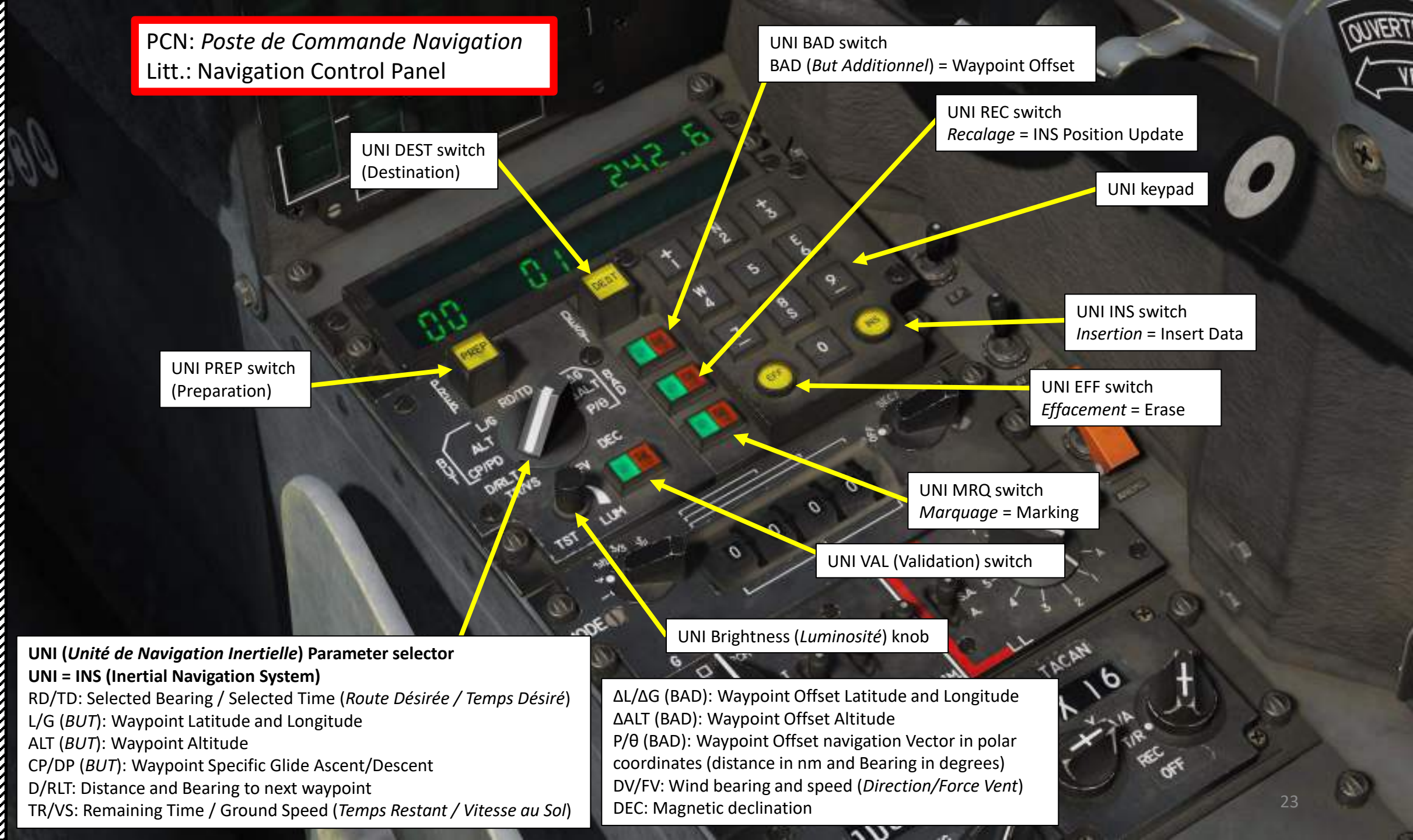
Air Conditioning Equipment
Automatic/Manual

Avionics Cold Mode (*Froid*)

Depoll Switch
M=ON / A=OFF

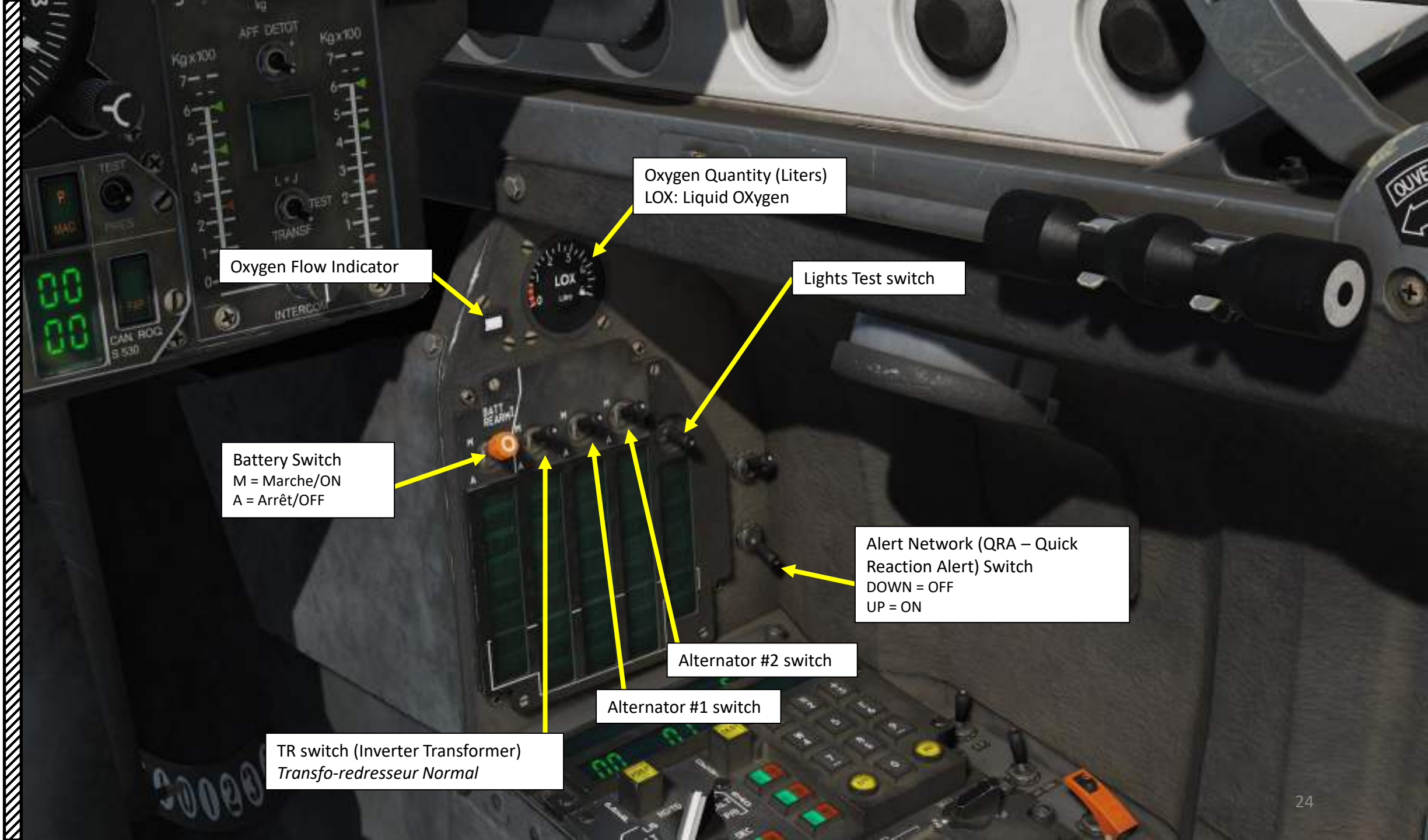

Électropompe (Emergency Hydraulic Pump) Switch
FWD = ON, AFT = OFF
Audio Warning (*Alerte Sonore*) Switch
Pitot Heat (*Anémomètre*) Switch
LL: Decoy Dispenser (*Lance-Leurres*) Mode
AU = Automatic
S.A. = Semi-Automatic
A = OFF
Lance-Leurres (Decoy Dispenser) Program Selector
IFF (Identify-Friend-or-Foe) Interrogator Mode Panel
TACAN Channel Selector
TACAN Mode Selector
A/A: Air-to-Air
T/R: Transmit-Receive
REC: Receive
OFF
ECM (Electronic Countermeasures) Mode Selector
VEI: *Veille* / Stand By
Square: NORMAL
PCM: (*Priorité Contremesure*)
In PCM, jammer signal takes priority over radar signal, jamming your own radar as well.
TACAN Channel Selector
VOR ILS Radio Channel Selector
BR: Jammer (*Brouilleur*)
DA: RWR Status (*Détecteur d'Alerte*)
D2M (MLWS): Missile Launch IR Detector (*Détection de Départ de Missile*)
T = Test
M = MARCHE = ON
A = ARRÊT = OFF
VOR ILS Radio Mode Selector
HG: *Haut-Gauche* (High Left)
BD: *Bas-Droit* (Low Right)
VOR ILS Radio Channel Selector
VOR ILS Radio Power M=ON/A=OFF

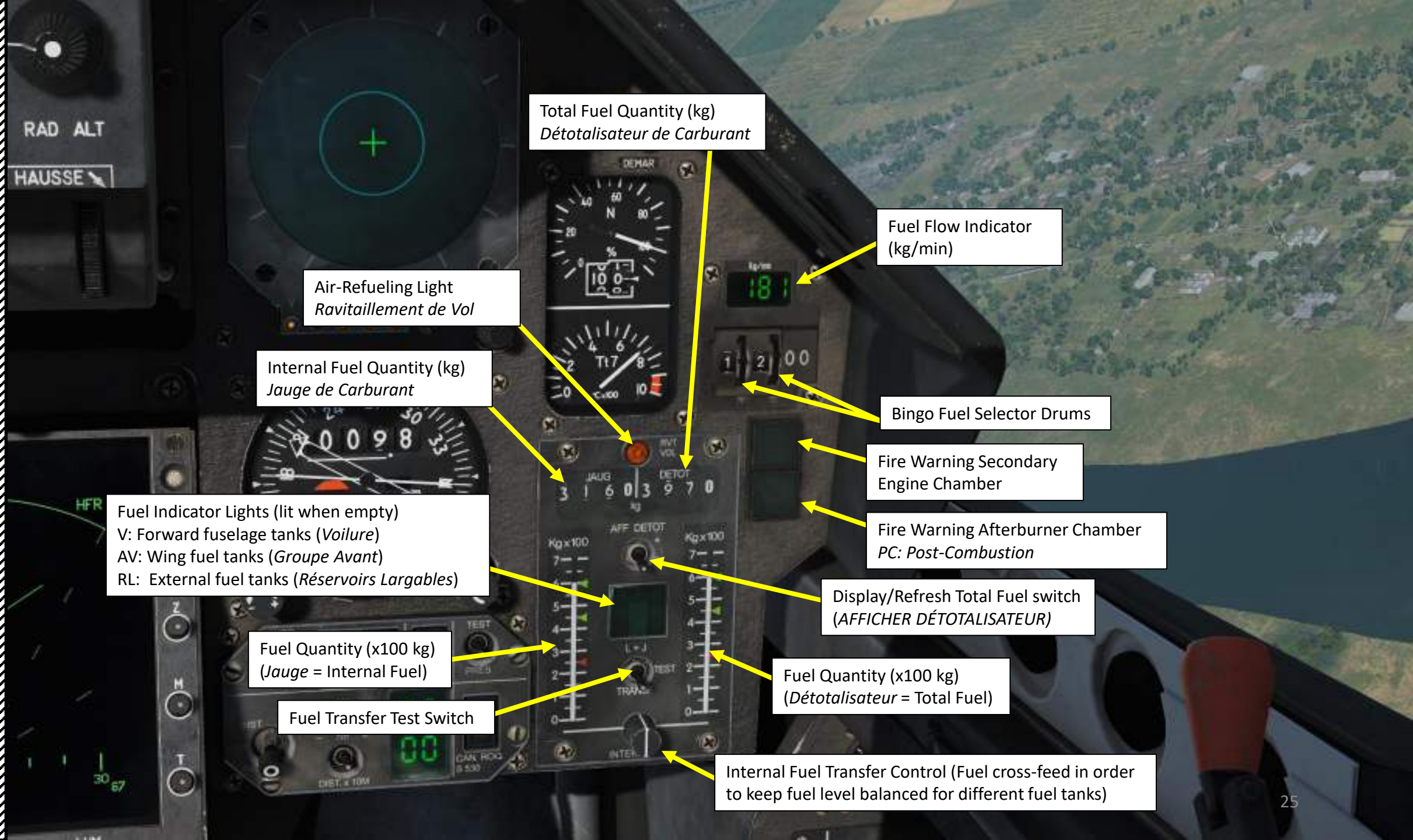
PCN: *Poste de Commande Navigation*
Litt.: Navigation Control Panel

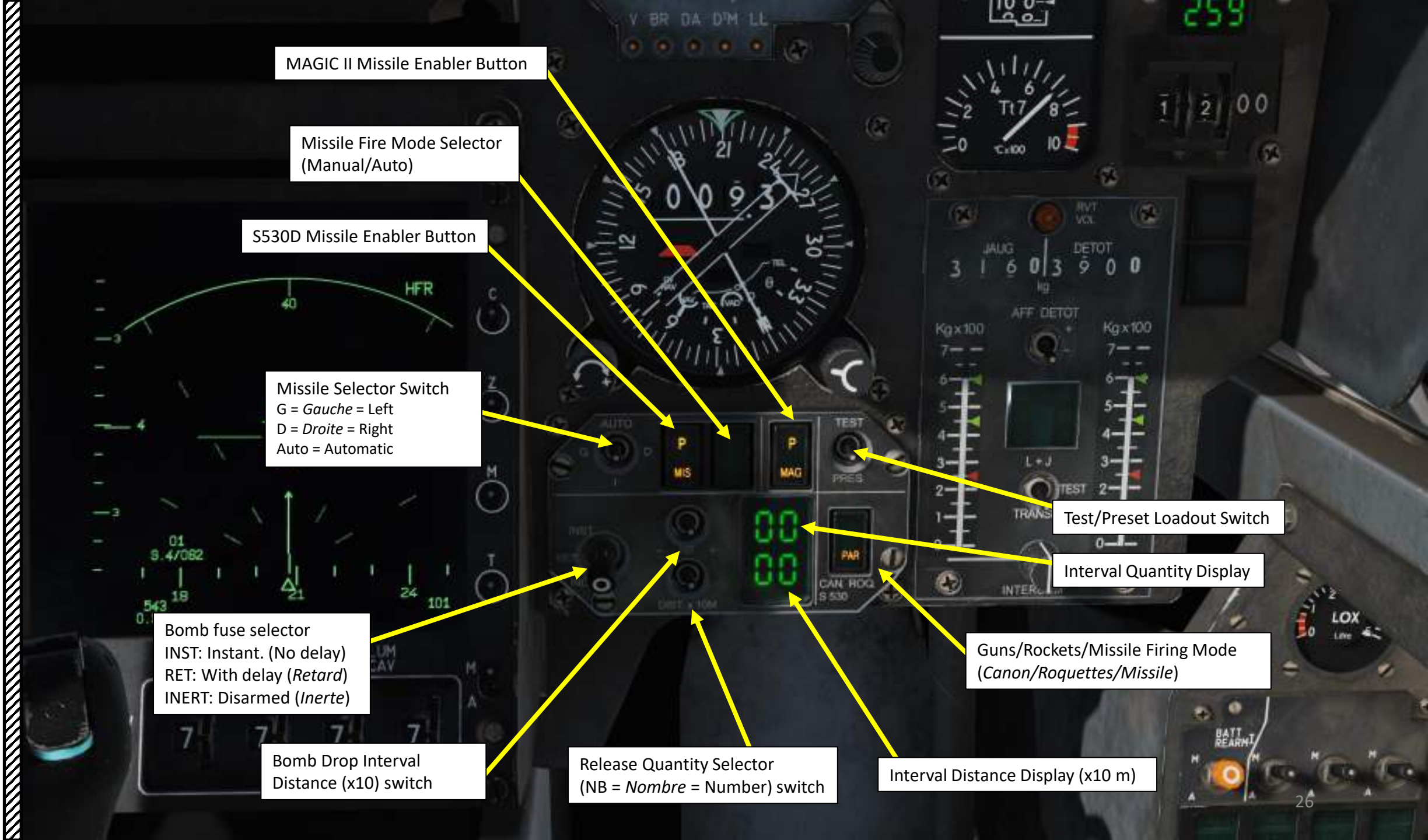


UNI (*Unité de Navigation Inertielle*) Parameter selector
UNI = INS (Inertial Navigation System)
RD/TD: Selected Bearing / Selected Time (*Route Désirée / Temps Désiré*)
L/G (*BUT*): Waypoint Latitude and Longitude
ALT (*BUT*): Waypoint Altitude
CP/DP (*BUT*): Waypoint Specific Glide Ascent/Descent
D/RLT: Distance and Bearing to next waypoint
TR/VS: Remaining Time / Ground Speed (*Temps Restant / Vitesse au Sol*)

ΔL/ΔG (BAD): Waypoint Offset Latitude and Longitude
ΔALT (BAD): Waypoint Offset Altitude
P/θ (BAD): Waypoint Offset navigation Vector in polar coordinates (distance in nm and Bearing in degrees)
DV/FV: Wind bearing and speed (*Direction/Force Vent*)
DEC: Magnetic declination

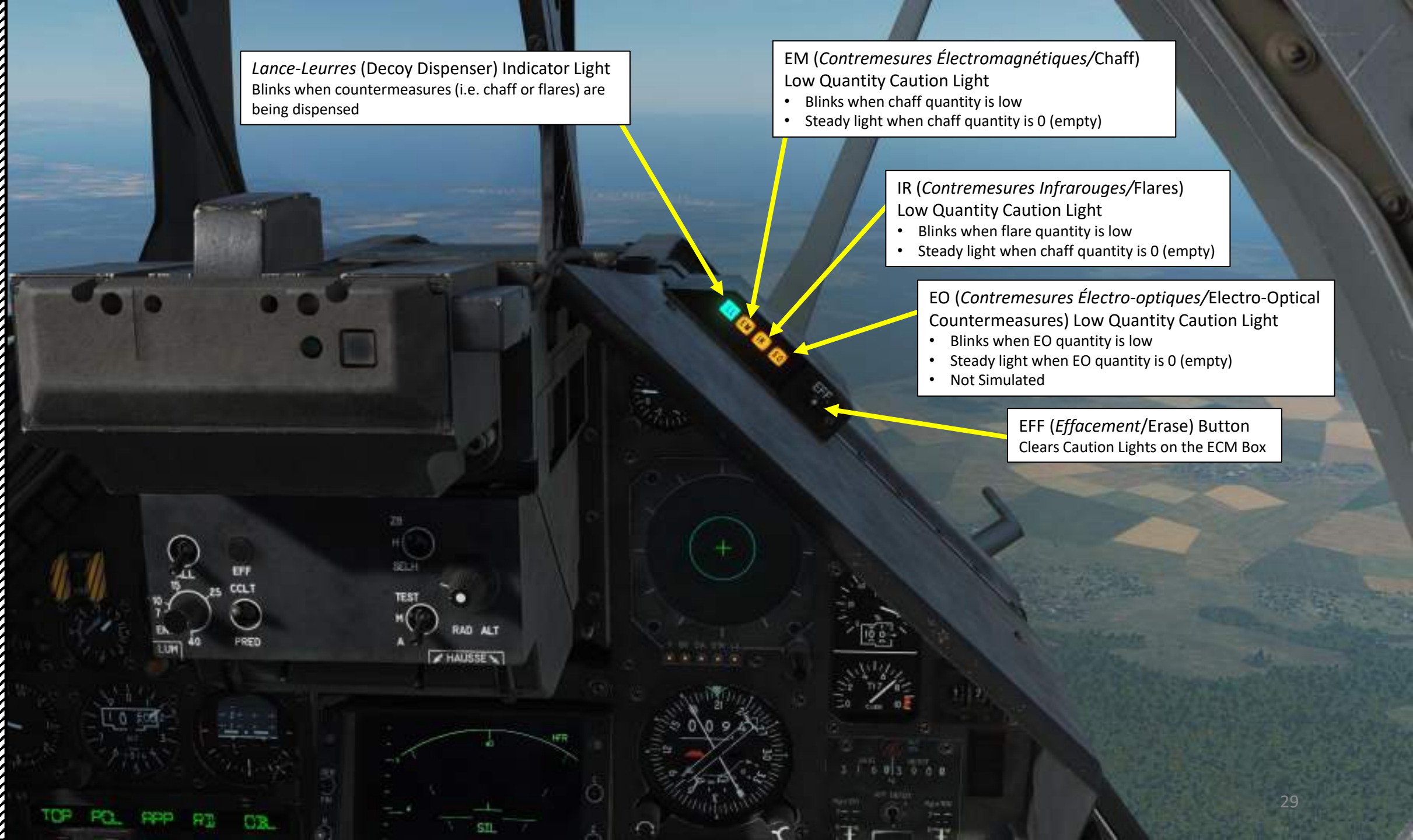

Oxygen Quantity (Liters)
LOX: Liquid OXygen
Oxygen Flow Indicator
Lights Test switch
Battery Switch
M = Marche/ON
A = Arrêt/OFF
Alert Network (QRA – Quick Reaction Alert) Switch
DOWN = OFF
UP = ON
Alternator #2 switch
Alternator #1 switch
TR switch (Inverter Transformer)
Transfo-redresseur Normal


RAD ALT
HAUSSE
DEMAR
JAUG
DETOT
AFF DETOT
TEST
INTER
Total Fuel Quantity (kg)
Détotalisateur de Carburant
Fuel Flow Indicator
(kg/min)
Air-Refueling Light
Ravitaillement de Vol
Internal Fuel Quantity (kg)
Jauge de Carburant
Bingo Fuel Selector Drums
Fire Warning Secondary
Engine Chamber
Fire Warning Afterburner Chamber
PC: Post-Combustion
Fuel Indicator Lights (lit when empty)
V: Forward fuselage tanks (Voilure)
AV: Wing fuel tanks (Groupe Avant)
RL: External fuel tanks (Réservoirs Largables)
Display/Refresh Total Fuel switch
(AFFICHER DÉTOTALISATEUR)
Fuel Quantity (x100 kg)
(Jauge = Internal Fuel)
Fuel Quantity (x100 kg)
(Détotalisateur = Total Fuel)
Fuel Transfer Test Switch
Internal Fuel Transfer Control (Fuel cross-feed in order
to keep fuel level balanced for different fuel tanks)

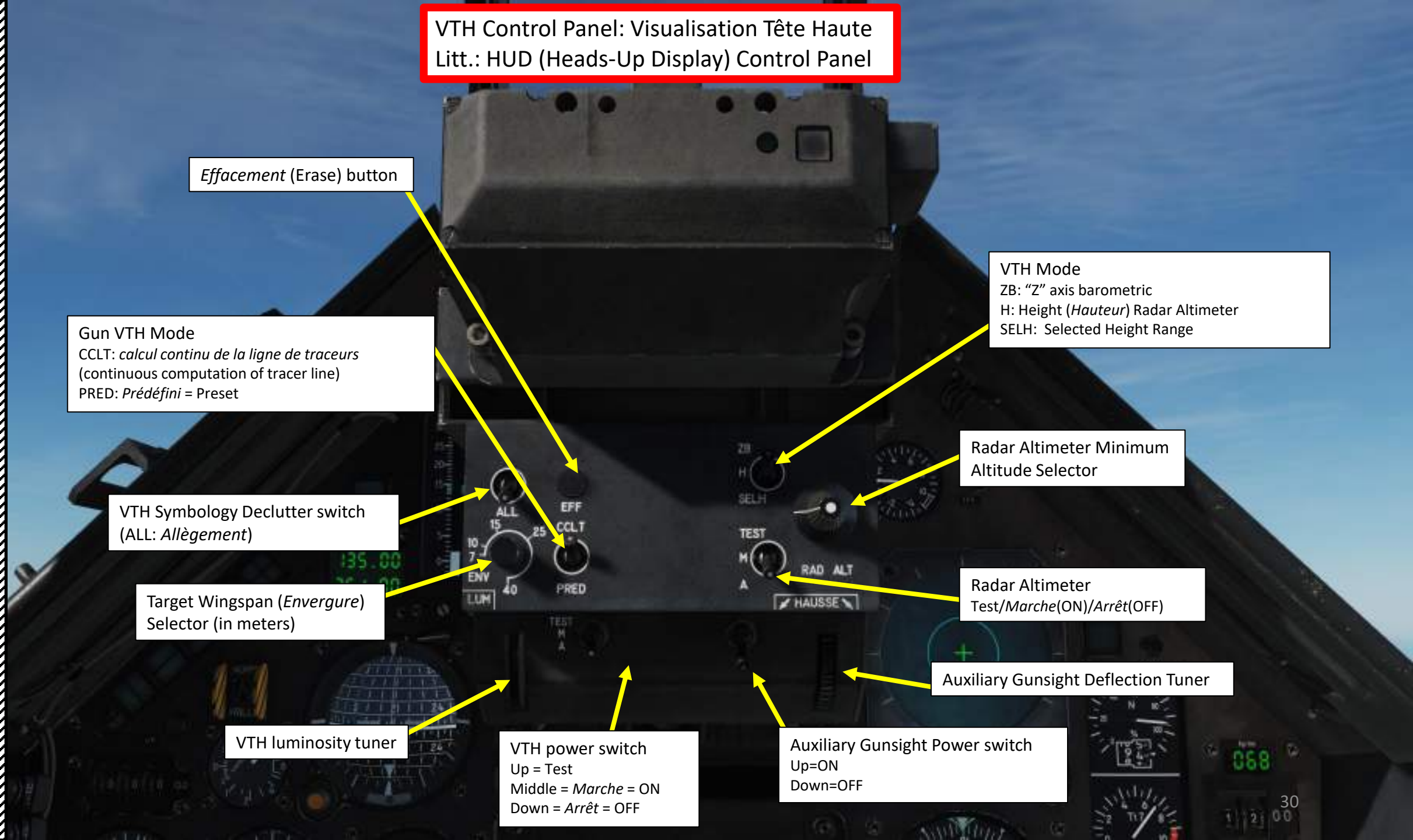

MAGIC II Missile Enabler Button
Missile Fire Mode Selector (Manual/Auto)
S530D Missile Enabler Button
Missile Selector Switch
G = *Gauche* = Left
D = *Droite* = Right
Auto = Automatic
Test/Preset Loadout Switch
Interval Quantity Display
Guns/Rockets/Missile Firing Mode (*Canon/Roquettes/Missile*)
Bomb fuse selector
INST: Instant. (No delay)
RET: With delay (*Retard*)
INERT: Disarmed (*Inerte*)
Bomb Drop Interval Distance (x10) switch
Release Quantity Selector (NB = *Nombre* = Number) switch
Interval Distance Display (x10 m)


HSI (Horizontal Situation Indicator)
IDN (Indicateur de Navigation)
HSI Modes
Cv NAV: Cap Vrai = True (Inertial)
Cm: Cap Magnétique = Magnetic Heading
NAV: Navigation
TAC: TACAN Direction
VAD: Alternate Goal Direction
ρ (Rho): VAD sub-mode, enters distance in nm from TACAN station to offset point
Θ (Theta): VAD sub-mode, enters magnetic bearing from TACAN station to offset point
TEL: Téléaffichage = Remote Guidance (not implemented)
HSI Course Selector
HSI Mode Selector


Accelerometer (G-Meter)
IFF (Identify-Friend-or-Foe) Response Light
SERVAL (RWR): *Système Électronique de Reconnaissance et Visualisation d'Alertes*
RWR: Radar Warning Receiver
PC (*Post-Combustion* = Afterburners) Indicator Light
Start-Up Indicator Light (*Démarrage* = Start-Up)
Engine RPM (%)
Tt7: Engine Turbine Exit Temperature (deg C x 100)
Counter-Measure Status Lights (Active when lit)
V = *Veille* = Standby
BR = *Brouilleur* = Jamming
DA = *Détecteur d'Alerte* = RWR Status
D2M = *Détection de Départ de Missile* = Missile Launch IR Detector
LL = *Lance-Leurres* = Flares


Lance-Leurres (Decoy Dispenser) Indicator Light
Blinks when countermeasures (i.e. chaff or flares) are being dispensed
EM (*Contremesures Électromagnétiques*/Chaff) Low Quantity Caution Light
• Blinks when chaff quantity is low
• Steady light when chaff quantity is 0 (empty)
IR (*Contremesures Infrarouges*/Flares) Low Quantity Caution Light
• Blinks when flare quantity is low
• Steady light when chaff quantity is 0 (empty)
EO (*Contremesures Électro-optiques*/Electro-Optical Countermeasures) Low Quantity Caution Light
• Blinks when EO quantity is low
• Steady light when EO quantity is 0 (empty)
• Not Simulated
EFF (*Effacement*/Erase) Button
Clears Caution Lights on the ECM Box
EFF
CCLT
PRED
TEST
RAD ALT
HAUSSE

VTH Control Panel: Visualisation Tête Haute
Litt.: HUD (Heads-Up Display) Control Panel



Effacement (Erase) button

Gun VTH Mode
CCLT: *calcul continu de la ligne de traceurs*
(continuous computation of tracer line)
PRED: *Prédéfini* = Preset

VTH Mode
ZB: "Z" axis barometric
H: Height (*Hauteur*) Radar Altimeter
SELH: Selected Height Range

Radar Altimeter Minimum Altitude Selector

VTH Symbology Declutter switch
(ALL: *Allègement*)

Target Wingspan (*Envergure*) Selector (in meters)

Radar Altimeter
Test/*Marche*(ON)/*Arrêt*(OFF)

Auxiliary Gunsight Deflection Tuner

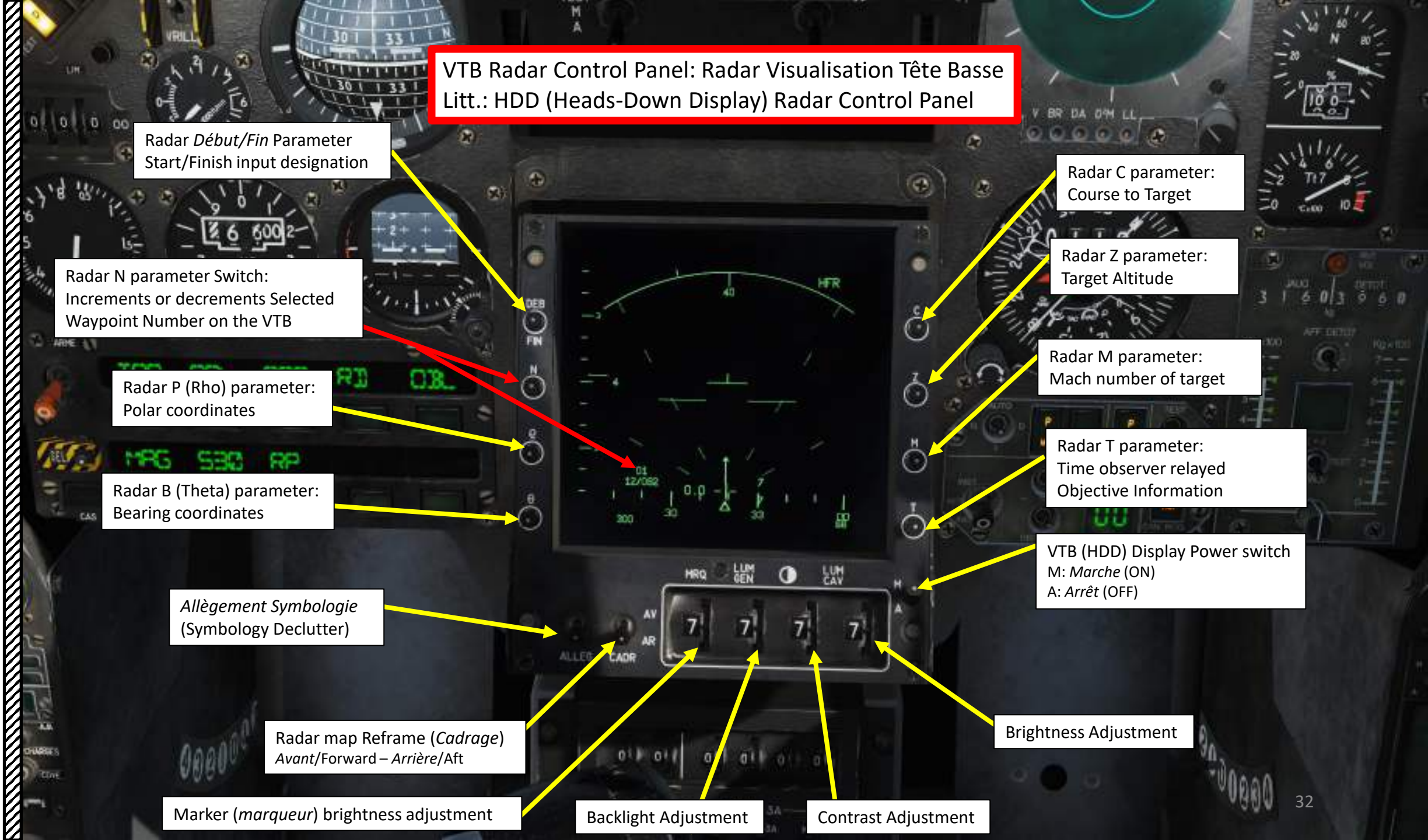
VTH luminosity tuner

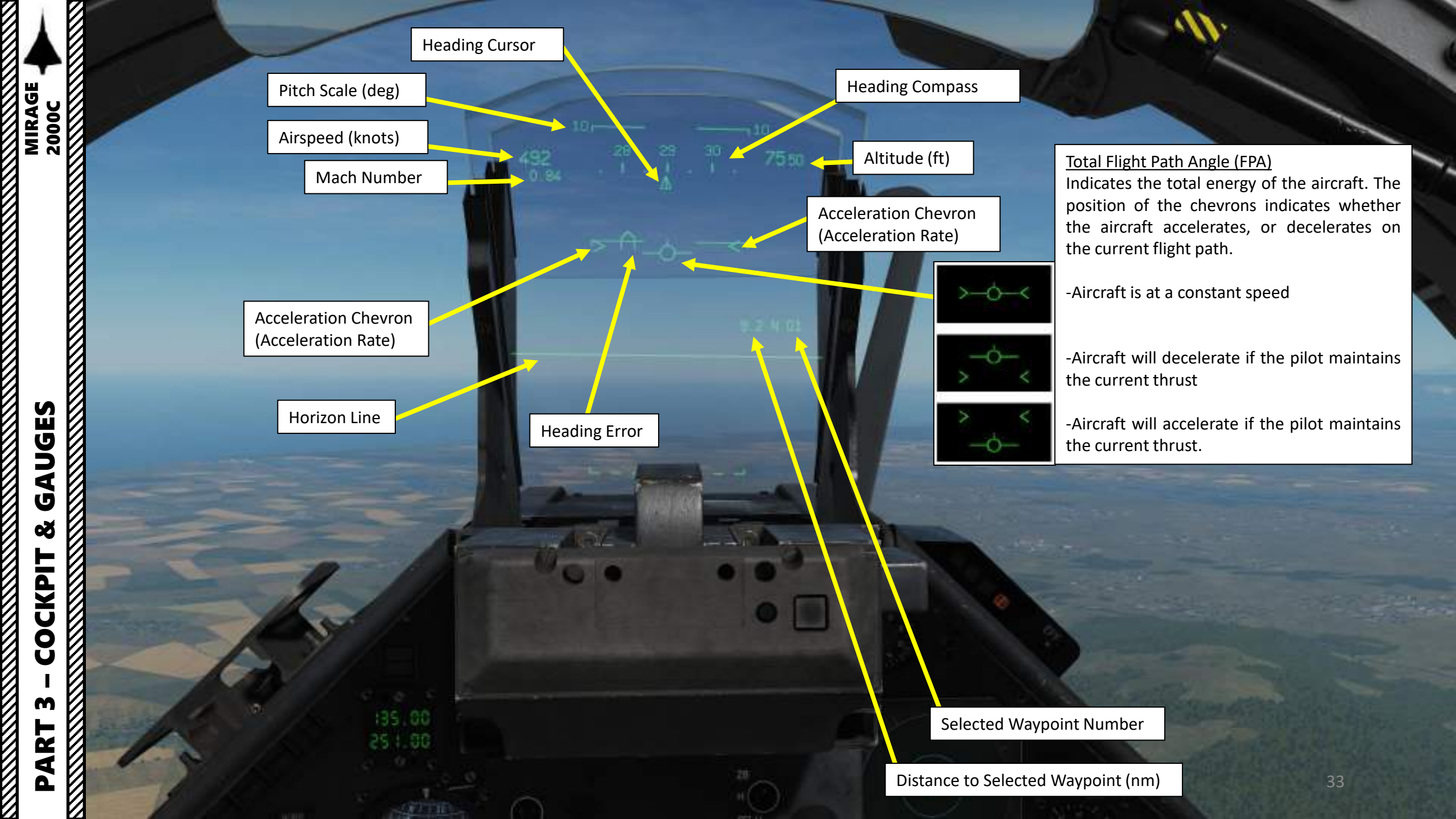
VTH power switch
Up = Test
Middle = *Marche* = ON
Down = *Arrêt* = OFF

Auxiliary Gunsight Power switch
Up=ON
Down=OFF


RALLUMAGE EN VOL

VTB Radar Control Panel: Radar Visualisation Tête Basse
Litt.: HDD (Heads-Down Display) Radar Control Panel





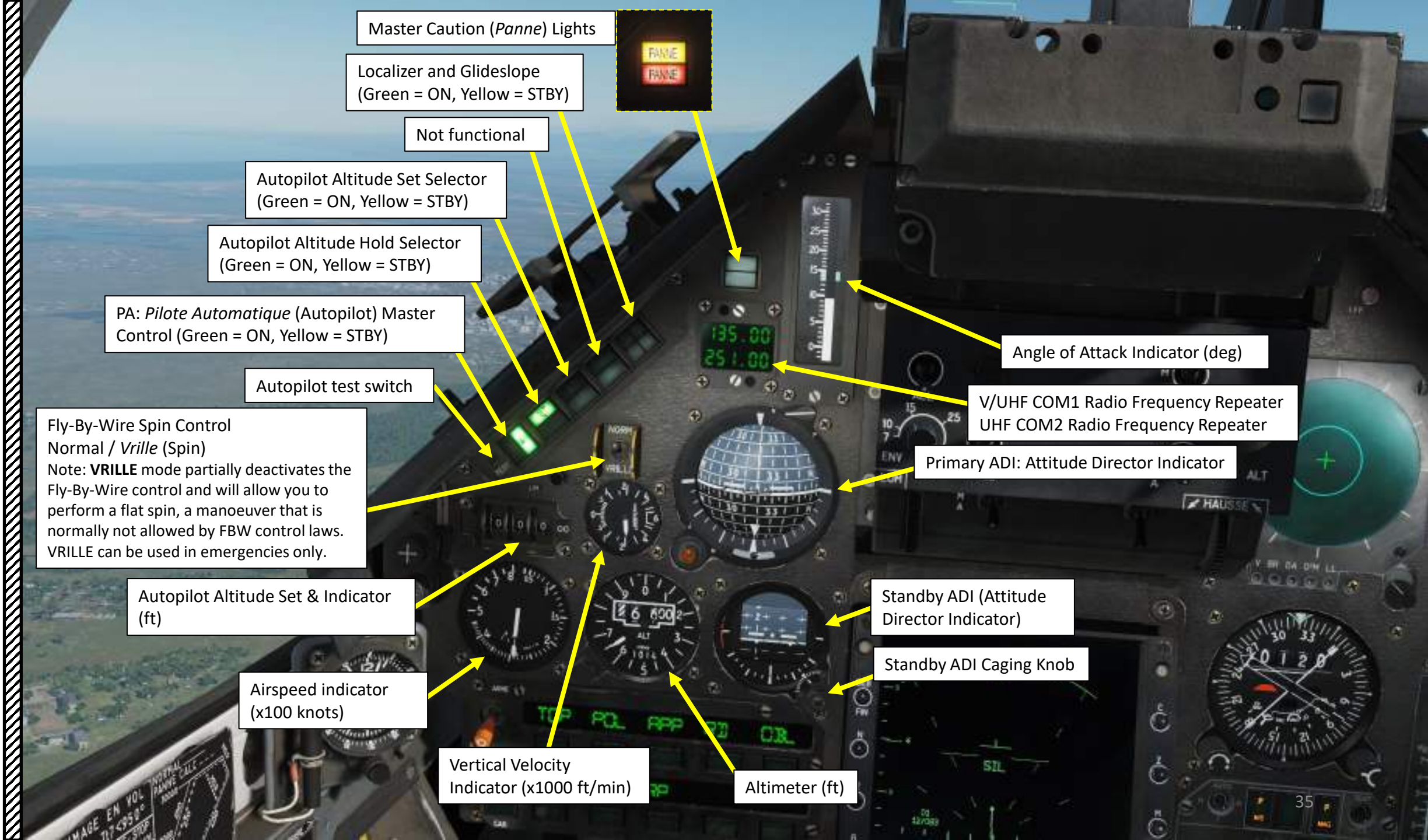
<u>Total Flight Path Angle (FPA)</u>
Indicates the total energy of the aircraft. The position of the chevrons indicates whether the aircraft accelerates, or decelerates on the current flight path.

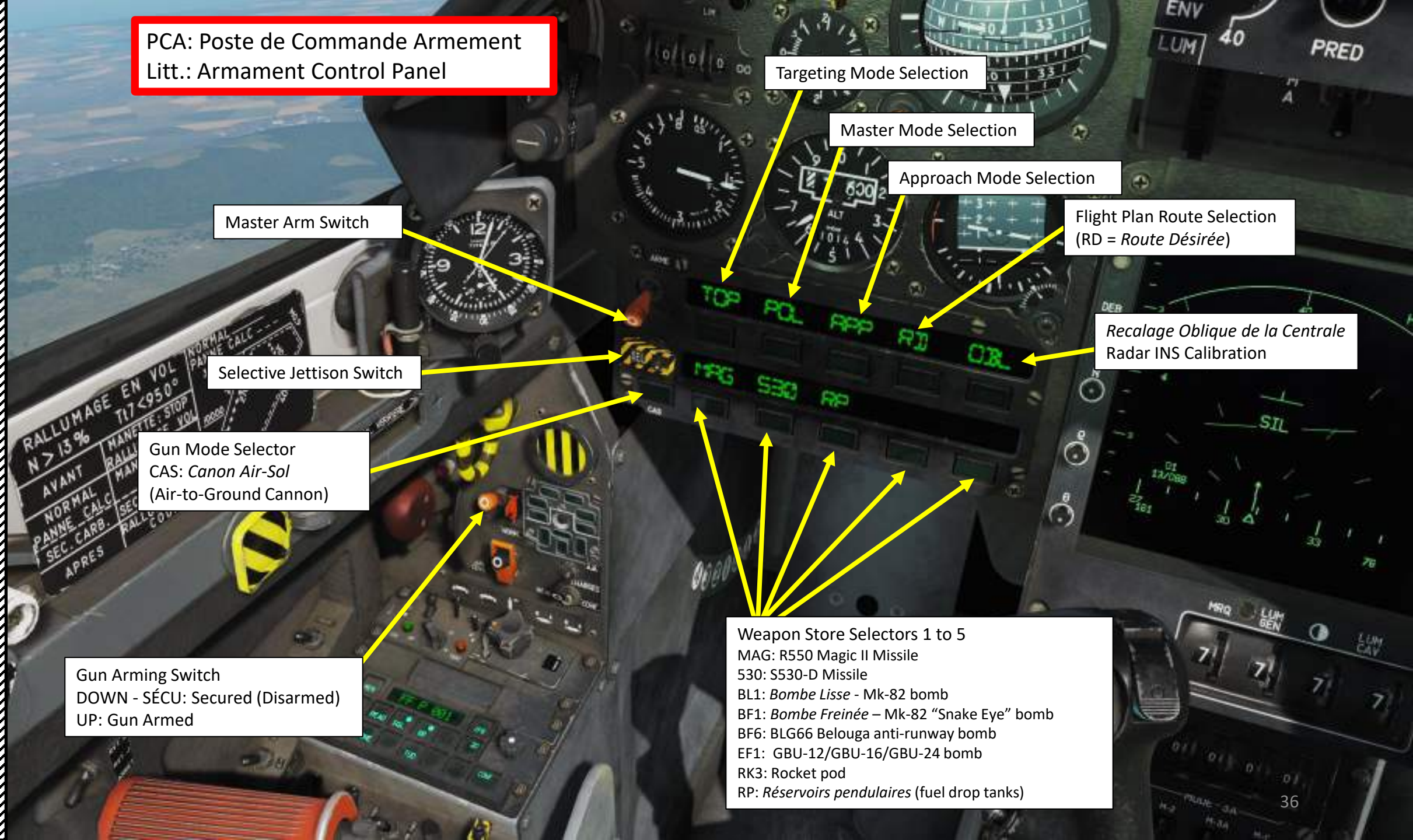
-Aircraft is at a constant speed

-Aircraft will decelerate if the pilot maintains the current thrust

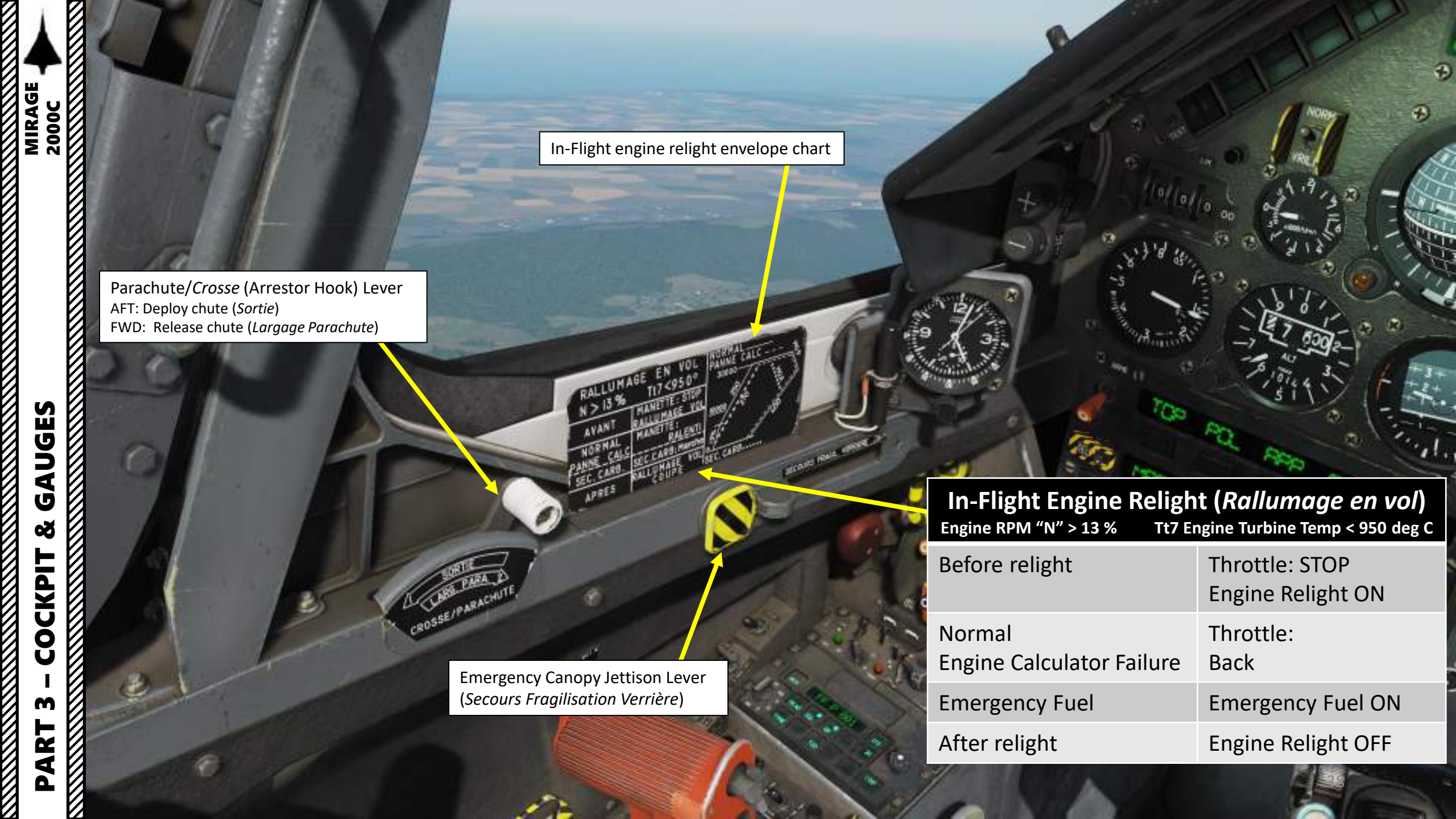
-Aircraft will accelerate if the pilot maintains the current thrust.


Weapon Selected
CAN: Cannon
MAG: Magic II missile
530: Super 530D missile
G acceleration
Angle of Attack (degrees)


Master Caution (*Panne*) Lights
PANNE
PANNE
Localizer and Glideslope (Green = ON, Yellow = STBY)
Not functional
Autopilot Altitude Set Selector (Green = ON, Yellow = STBY)
Autopilot Altitude Hold Selector (Green = ON, Yellow = STBY)
PA: *Pilote Automatique* (Autopilot) Master Control (Green = ON, Yellow = STBY)
Autopilot test switch
Fly-By-Wire Spin Control
Normal / *Vrille* (Spin)
Note: **VRILLE** mode partially deactivates the Fly-By-Wire control and will allow you to perform a flat spin, a manoeuver that is normally not allowed by FBW control laws. VRILLE can be used in emergencies only.
Autopilot Altitude Set & Indicator (ft)
Airspeed indicator (x100 knots)
Vertical Velocity Indicator (x1000 ft/min)
Altimeter (ft)
Standby ADI (Attitude Director Indicator)
Standby ADI Caging Knob
Angle of Attack Indicator (deg)
V/UHF COM1 Radio Frequency Repeater
UHF COM2 Radio Frequency Repeater
Primary ADI: Attitude Director Indicator


PCA: Poste de Commande Armement
Litt.: Armament Control Panel
Targeting Mode Selection
Master Mode Selection
Approach Mode Selection
Master Arm Switch
Flight Plan Route Selection
(RD = *Route Désirée*)
Recalage Oblique de la Centrale
Radar INS Calibration
Selective Jettison Switch
Gun Mode Selector
CAS: *Canon Air-Sol*
(Air-to-Ground Cannon)
Gun Arming Switch
DOWN - SÉCU: Secured (Disarmed)
UP: Gun Armed
Weapon Store Selectors 1 to 5
MAG: R550 Magic II Missile
530: S530-D Missile
BL1: *Bombe Lisse* - Mk-82 bomb
BF1: *Bombe Freinée* – Mk-82 "Snake Eye" bomb
BF6: BLG66 Belouga anti-runway bomb
EF1: GBU-12/GBU-16/GBU-24 bomb
RK3: Rocket pod
RP: *Réservoirs pendulaires* (fuel drop tanks)

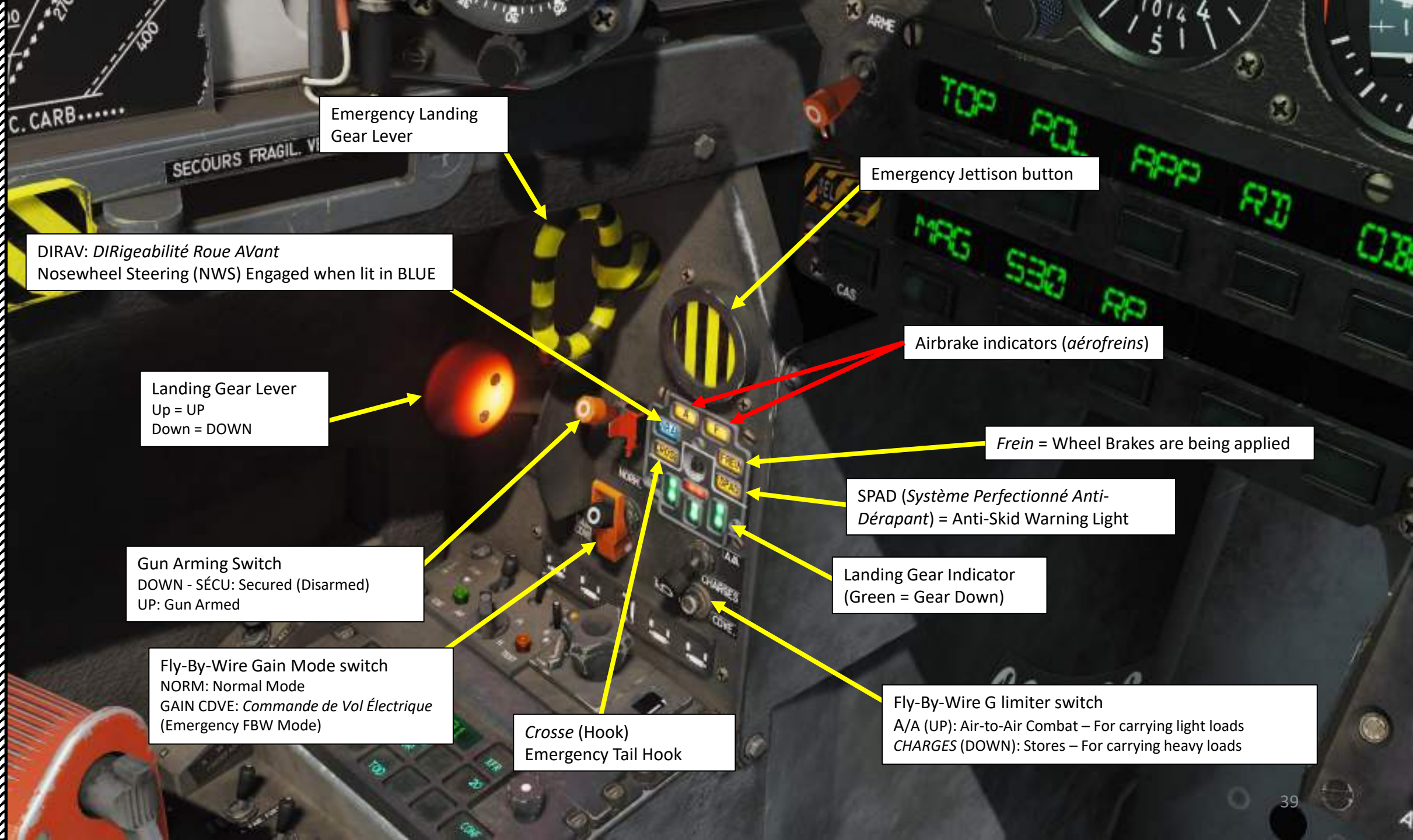

Clock
INS (Inertial Navigation System) Next Waypoint Button
INS (Inertial Navigation System) Previous Waypoint Button



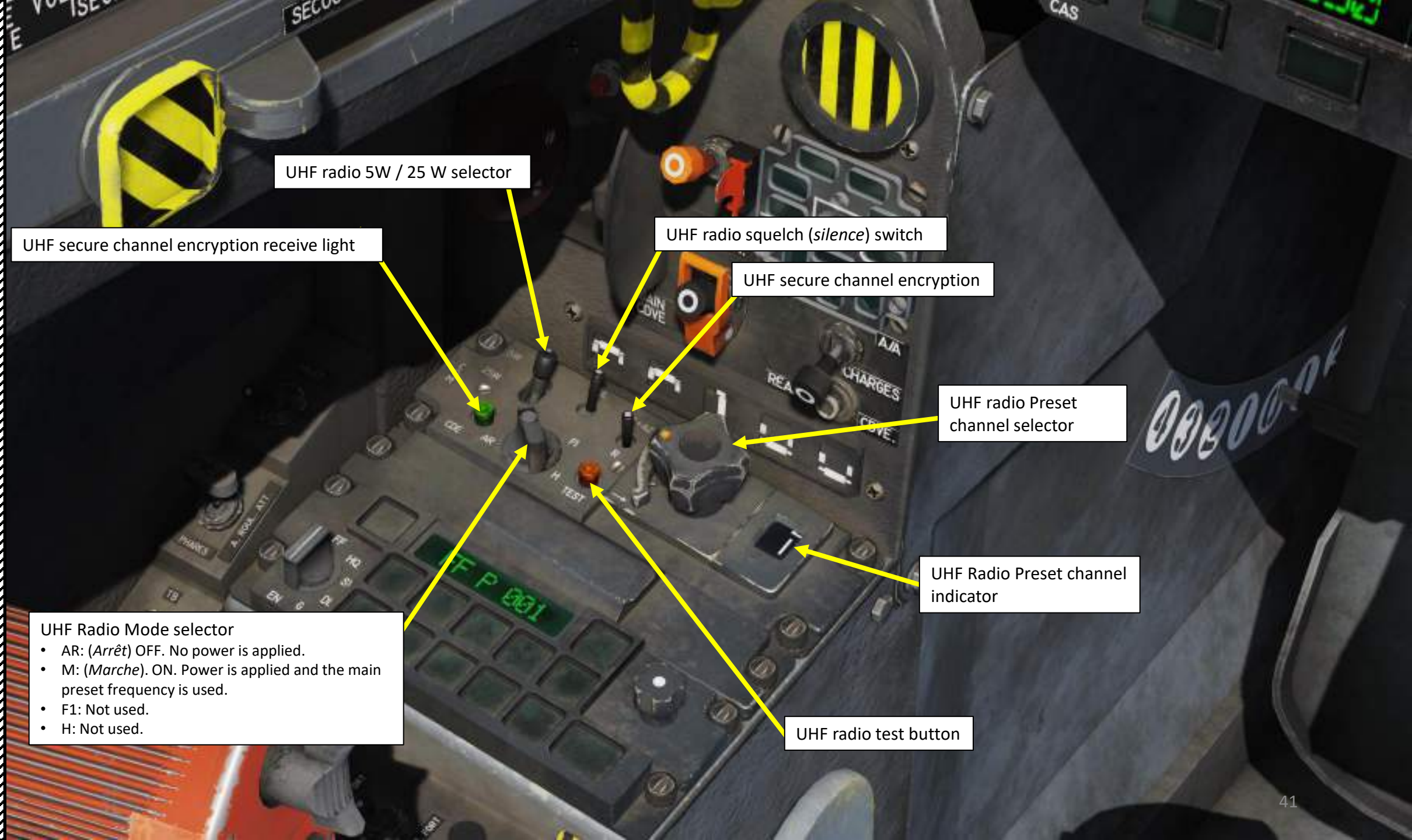
In-Flight Engine Relight (*Rallumage en vol*)

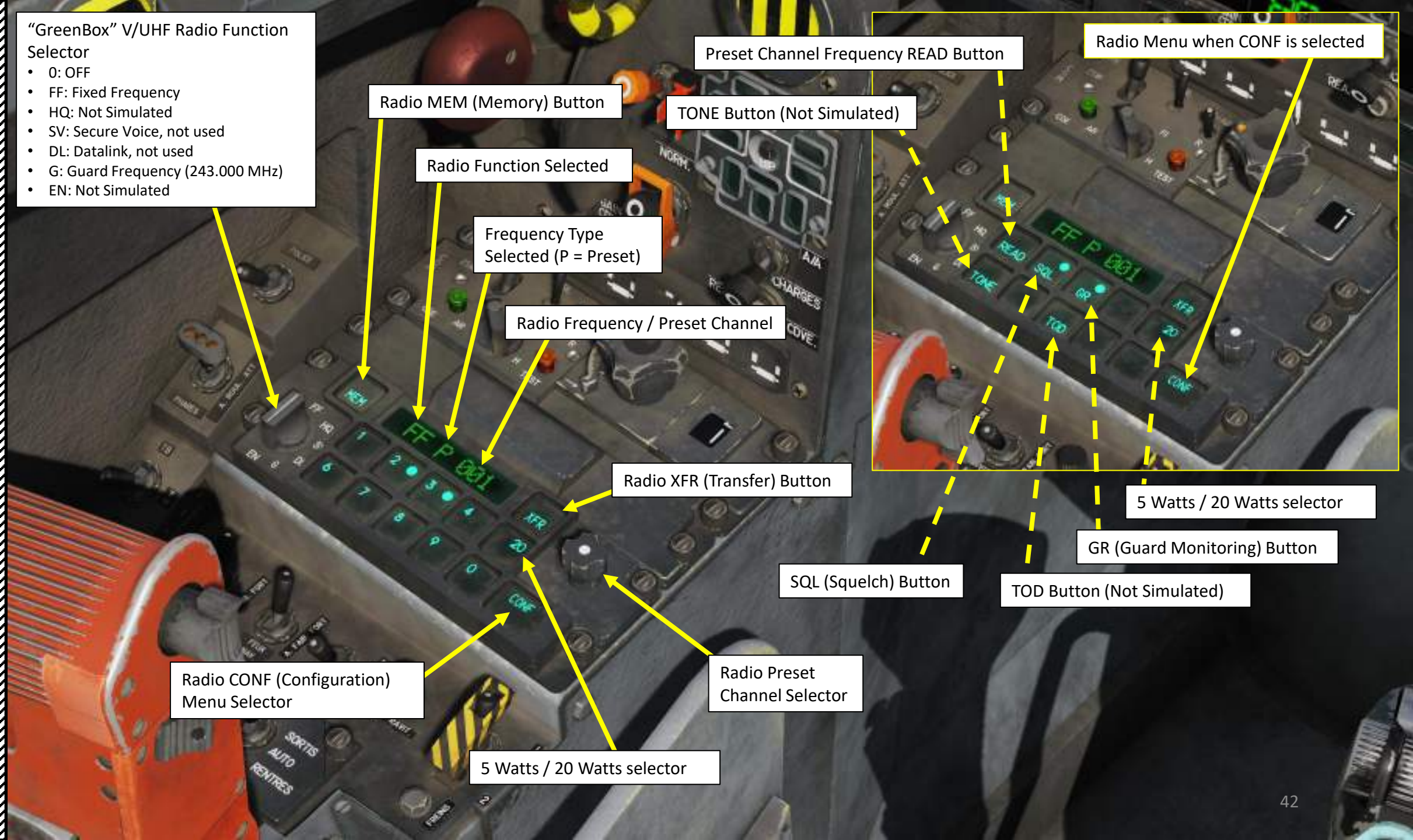
Engine RPM "N" > 13 % **Tt7 Engine Turbine Temp < 950 deg C**

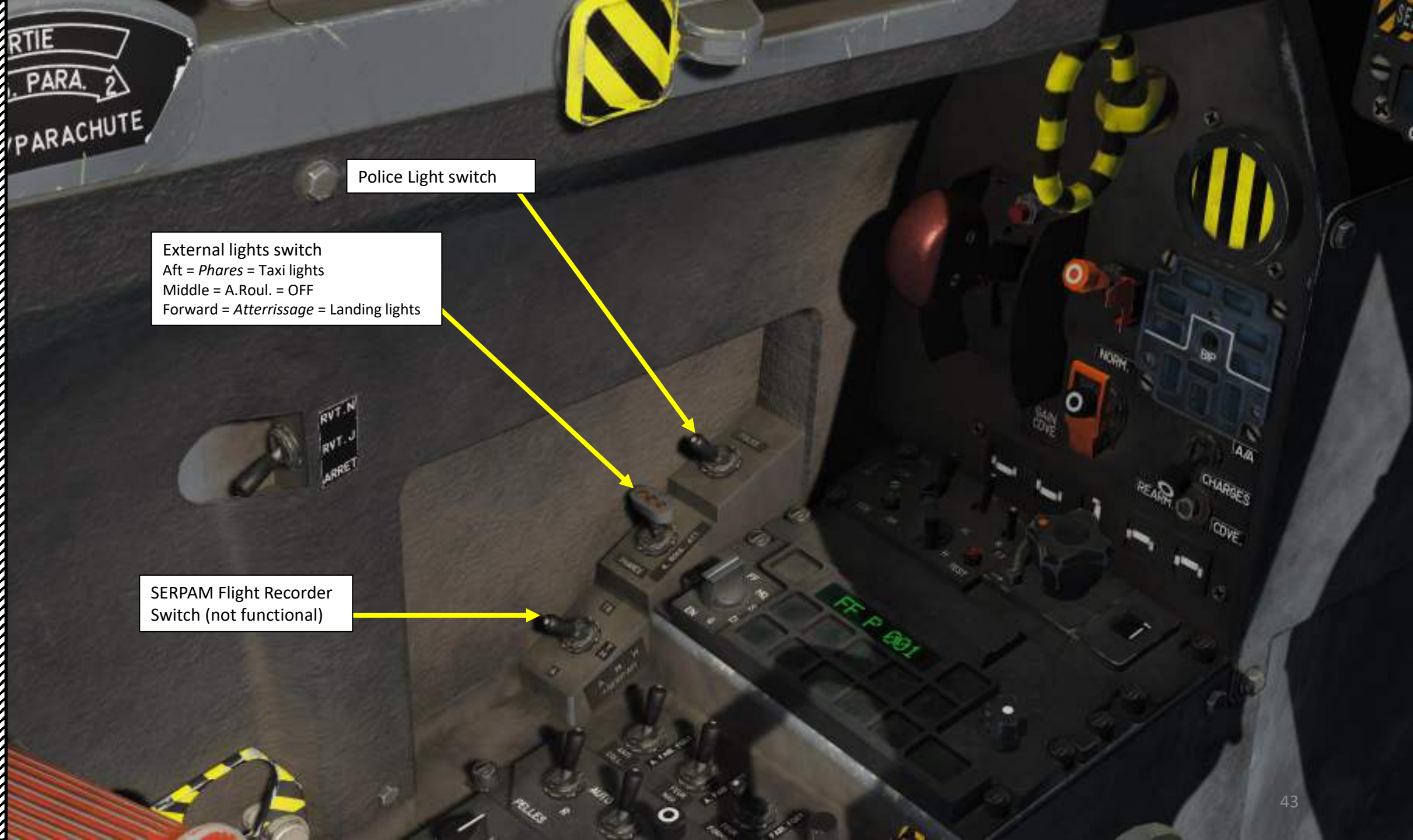
Before relight	Throttle: STOP Engine Relight ON
Normal Engine Calculator Failure	Throttle: Back
Emergency Fuel	Emergency Fuel ON
After relight	Engine Relight OFF


Emergency Landing Gear Lever
Emergency Jettison button
DIRAV: *DIRigeabilité Roue AVant*
Nosewheel Steering (NWS) Engaged when lit in BLUE
Airbrake indicators (*aérofreins*)
Landing Gear Lever
Up = UP
Down = DOWN
Frein = Wheel Brakes are being applied
SPAD (*Système Perfectionné Anti-Dérapant*) = Anti-Skid Warning Light
Gun Arming Switch
DOWN - SÉCU: Secured (Disarmed)
UP: Gun Armed
Landing Gear Indicator
(Green = Gear Down)
Fly-By-Wire Gain Mode switch
NORM: Normal Mode
GAIN CDVE: *Commande de Vol Électrique*
(Emergency FBW Mode)
Crosse (Hook)
Emergency Tail Hook
Fly-By-Wire G limiter switch
A/A (UP): Air-to-Air Combat – For carrying light loads
CHARGES (DOWN): Stores – For carrying heavy loads

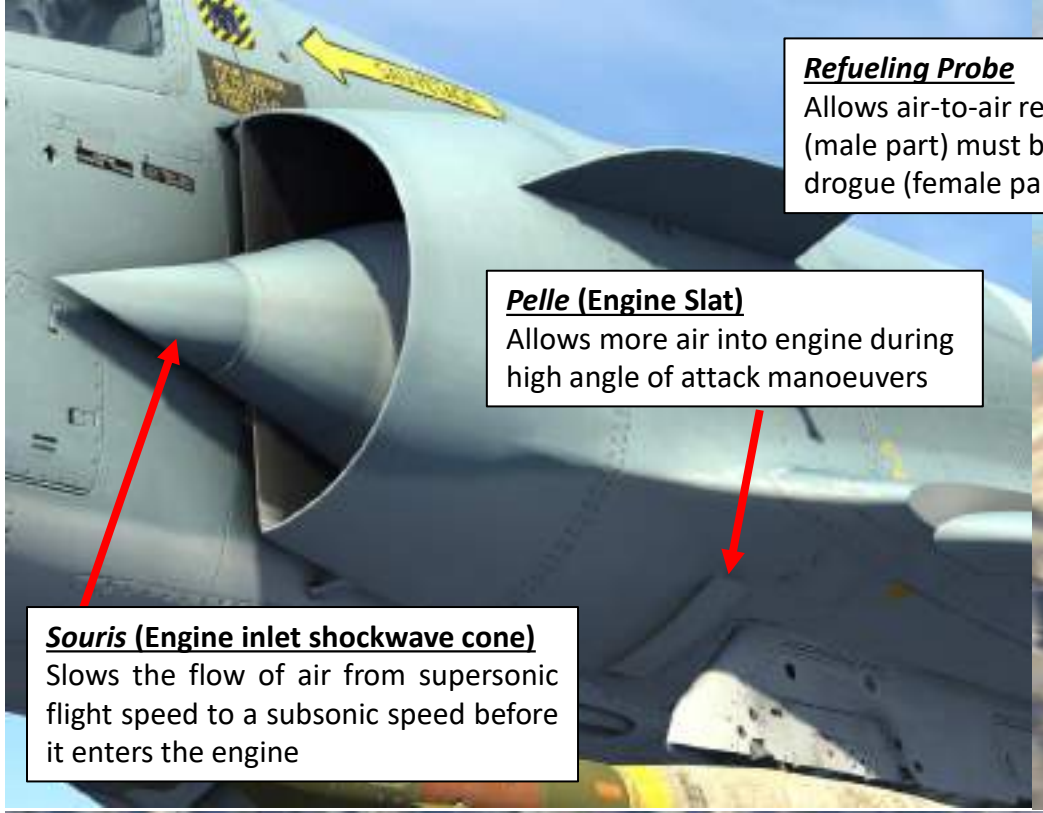

SECOURS FRAGIL. VERRIERE
SEC. CARB.....
MAG
530
AP
CAS
NORM
AA
CHARGES
COVE.
Control Surface Deflexions


UHF radio 5W / 25 W selector
UHF secure channel encryption receive light
UHF radio squelch (*silence*) switch
UHF secure channel encryption
UHF radio Preset channel selector
UHF Radio Preset channel indicator
UHF Radio Mode selector
• AR: (*Arrêt*) OFF. No power is applied.
• M: (*Marche*). ON. Power is applied and the main preset frequency is used.
• F1: Not used.
• H: Not used.
UHF radio test button


"GreenBox" V/UHF Radio Function Selector
• 0: OFF
• FF: Fixed Frequency
• HQ: Not Simulated
• SV: Secure Voice, not used
• DL: Datalink, not used
• G: Guard Frequency (243.000 MHz)
• EN: Not Simulated
Radio MEM (Memory) Button
Radio Function Selected
Frequency Type Selected (P = Preset)
Radio Frequency / Preset Channel
Radio XFR (Transfer) Button
Radio CONF (Configuration) Menu Selector
Radio Preset Channel Selector
5 Watts / 20 Watts selector
Preset Channel Frequency READ Button
TONE Button (Not Simulated)
Radio Menu when CONF is selected
SQL (Squelch) Button
TOD Button (Not Simulated)
GR (Guard Monitoring) Button
5 Watts / 20 Watts selector


Police Light switch
External lights switch
Aft = *Phares* = Taxi lights
Middle = A.Roul. = OFF
Forward = *Atterrissage* = Landing lights
SERPAM Flight Recorder
Switch (not functional)

Air Refueling (*Ravitaillement*) Switch
Up = Open/ON - Night/*Nuit* Refueling (lights off)
Middle = Open/ON - Day/*Jour* Refueling (lights on)
Down = Closed/OFF



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

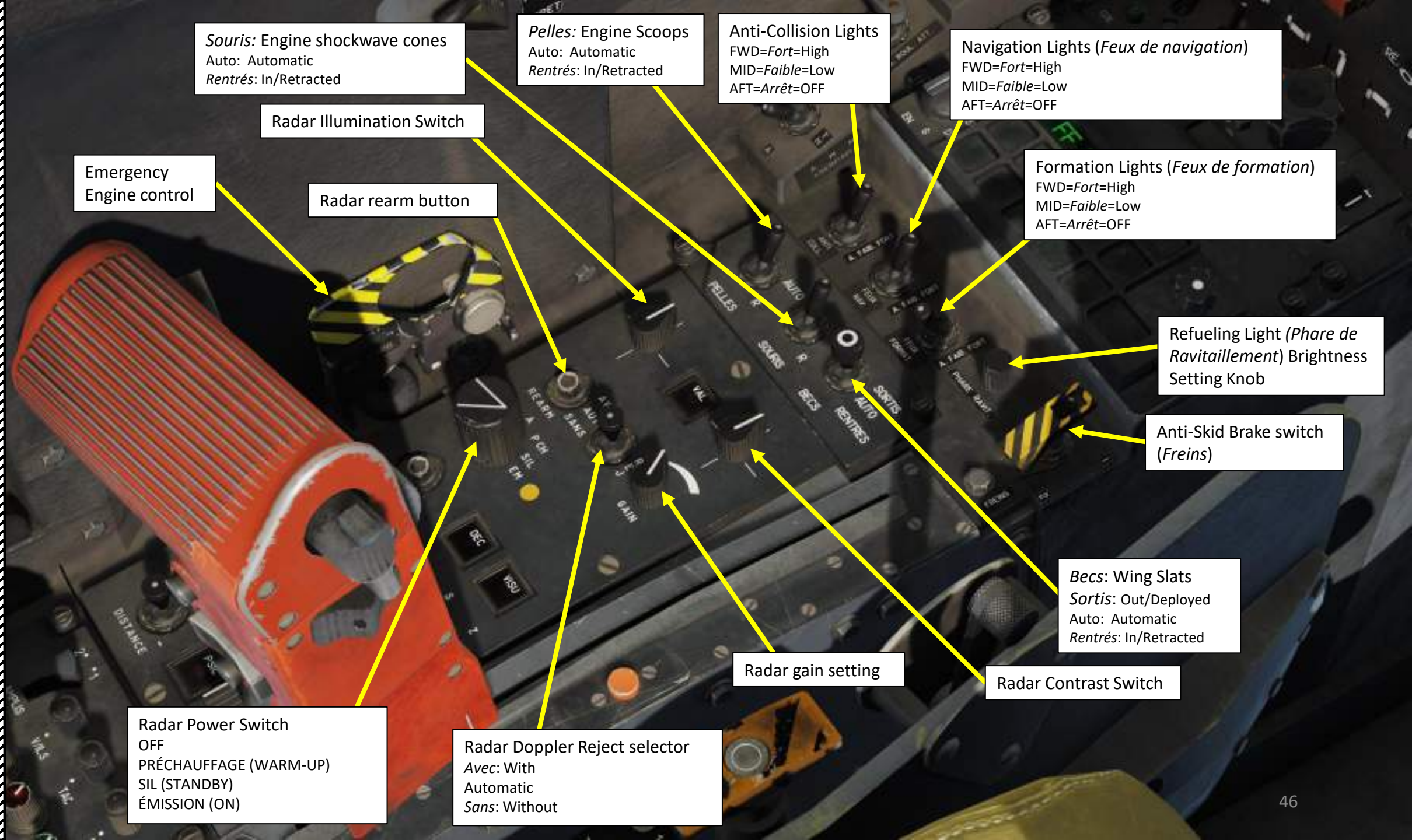
***Pelle* (Engine Slat)**
Allows more air into engine during high angle of attack manoeuvers

***Souris* (Engine inlet shockwave cone)**
Slows the flow of air from supersonic flight speed to a subsonic speed before it enters the engine

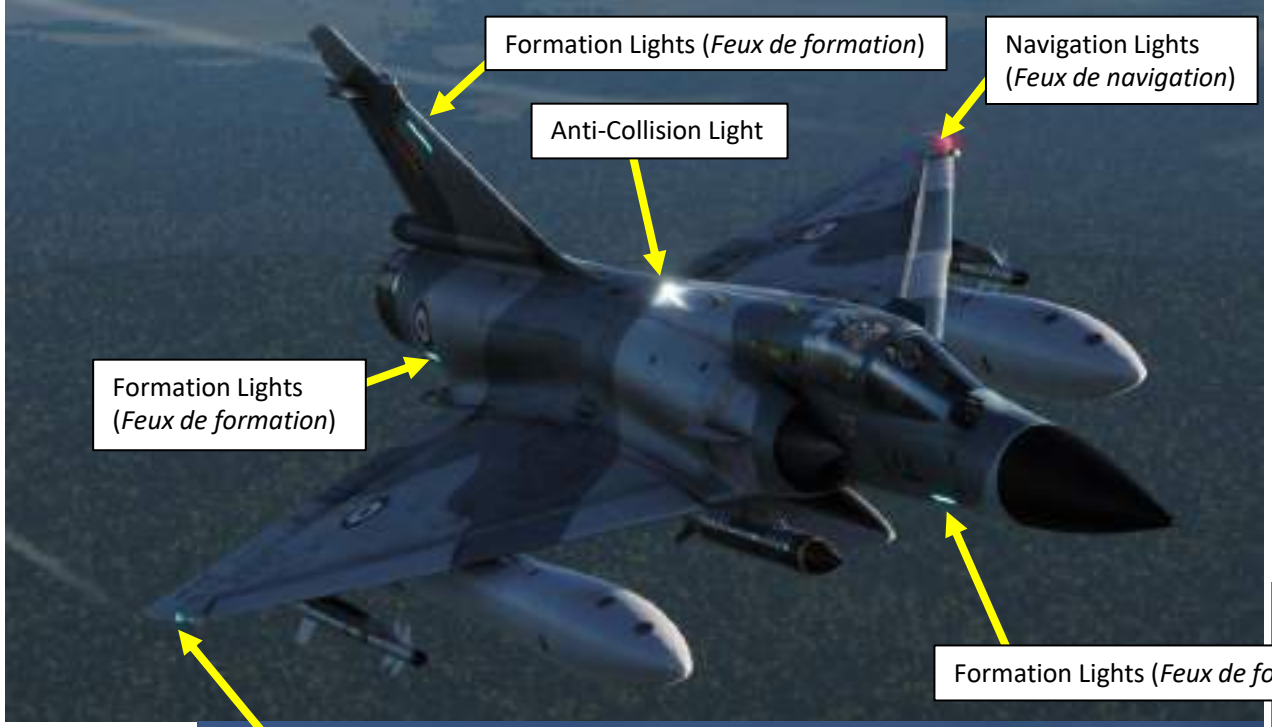
***Palonnier* (Rudder)**

***Bec* (Wing Slat)**
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.

Elevon
Control surface that acts as both an aileron and an elevator. Elevon position is controlled by the flight computer, which translates the pilot stick input into **control laws** that dictate how elevons will behave in order to move the aircraft as commanded by the joystick. We will touch this subject more in detail in the FLY-BY-WIRE chapter.


Souris: Engine shockwave cones
Auto: Automatic
Rentrés: In/Retracted
Pelles: Engine Scoops
Auto: Automatic
Rentrés: In/Retracted
Anti-Collision Lights
FWD=*Fort*=High
MID=*Faible*=Low
AFT=*Arrêt*=OFF
Navigation Lights (*Feux de navigation*)
FWD=*Fort*=High
MID=*Faible*=Low
AFT=*Arrêt*=OFF
Radar Illumination Switch
Emergency Engine control
Radar rearm button
Formation Lights (*Feux de formation*)
FWD=*Fort*=High
MID=*Faible*=Low
AFT=*Arrêt*=OFF
Refueling Light *(Phare de Ravitaillement*) Brightness Setting Knob
Anti-Skid Brake switch (*Freins*)
Becs: Wing Slats
Sortis: Out/Deployed
Auto: Automatic
Rentrés: In/Retracted
Radar gain setting
Radar Contrast Switch
Radar Power Switch
OFF
PRÉCHAUFFAGE (WARM-UP)
SIL (STANDBY)
ÉMISSION (ON)
Radar Doppler Reject selector
Avec: With
Automatic
Sans: Without

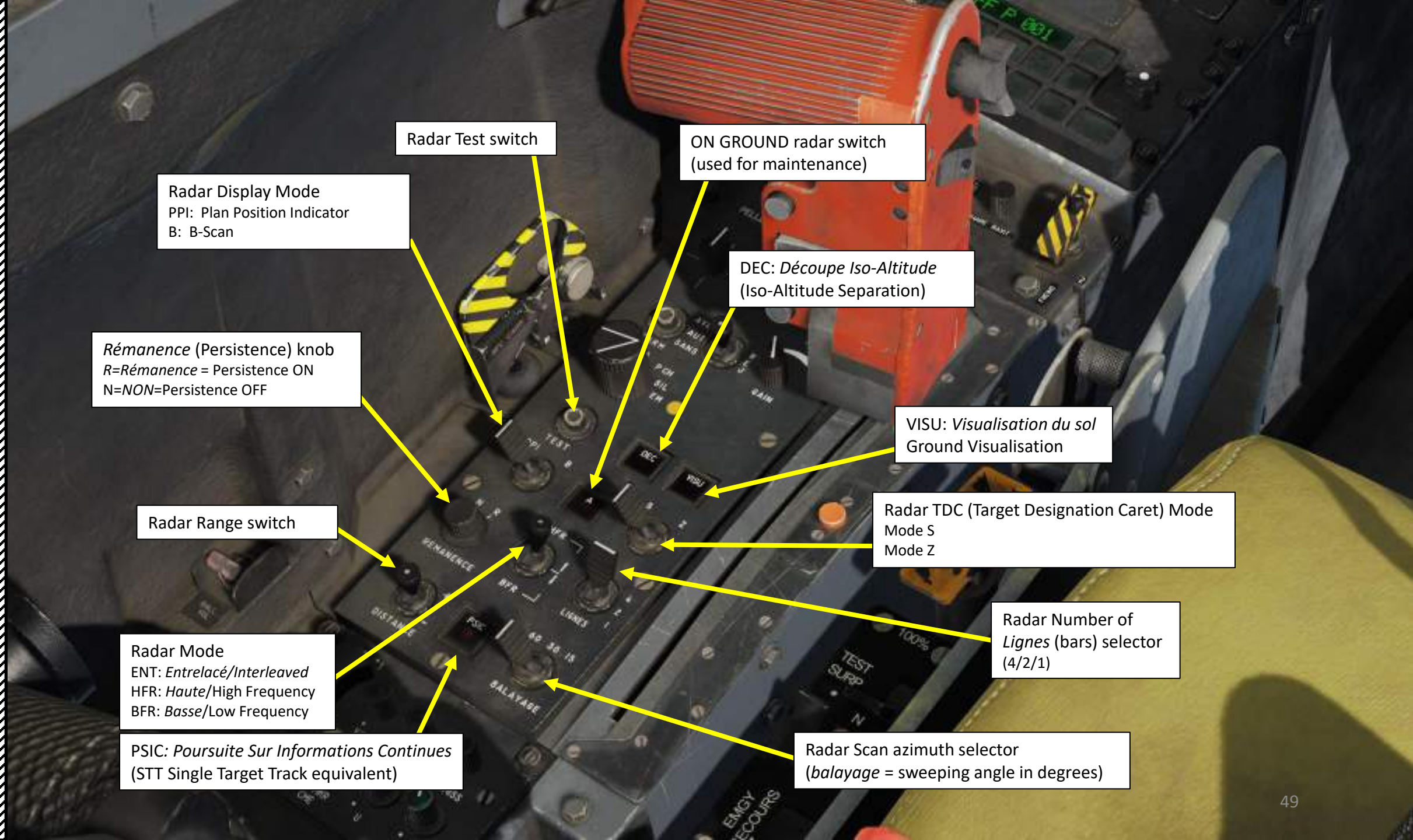

Engine Shutdown switch
Throttle

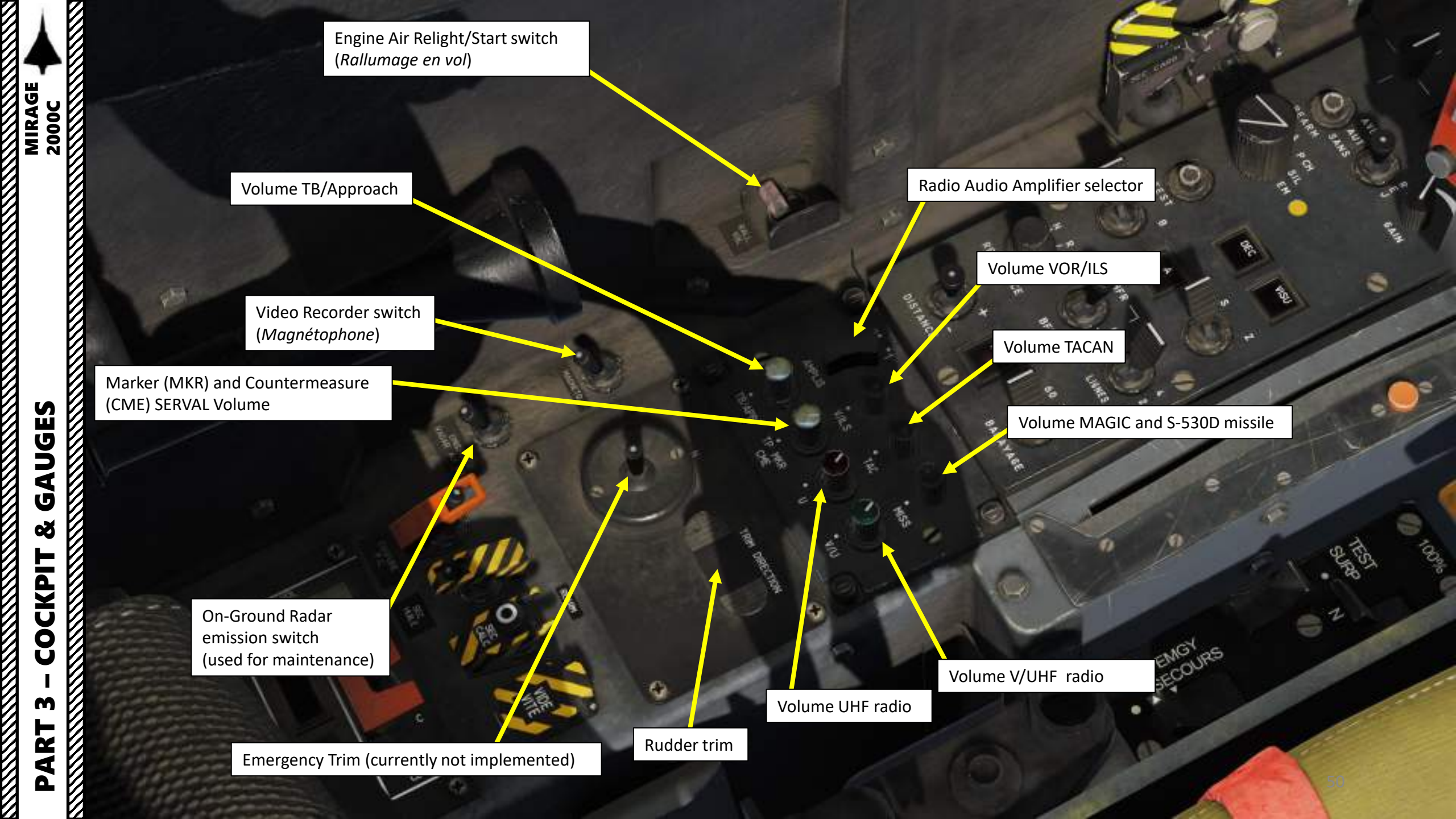

Formation Lights (*Feux de formation*)
Navigation Lights (*Feux de navigation*)
Anti-Collision Light
Formation Lights (*Feux de formation*)

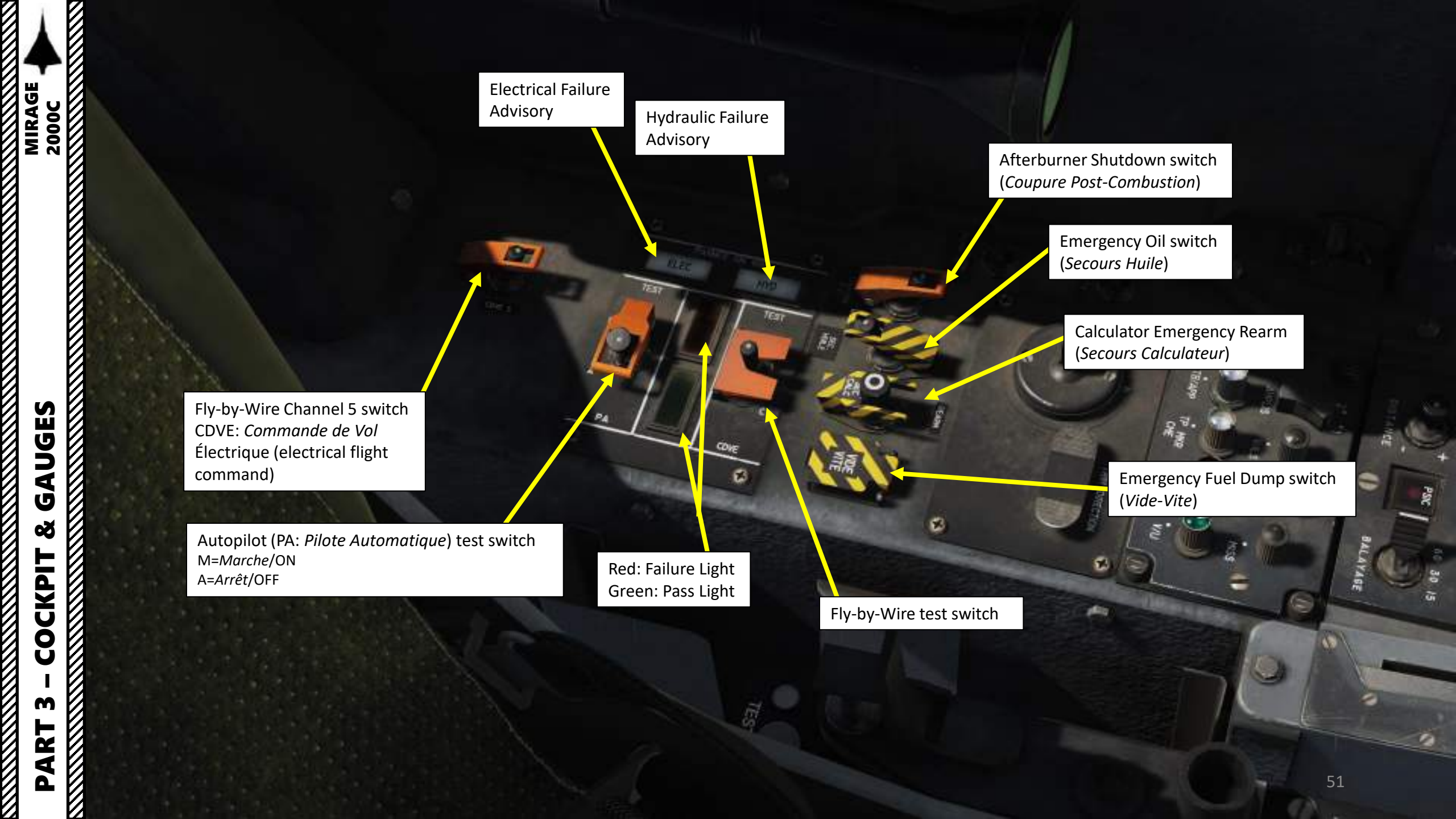

Refueling Lights (*Phares de Ravitaillement*)
Light switch must be set to *RVT N*


Formation Lights (*Feux de formation*)
Navigation Lights (*Feux de navigation*)
Landing Lights

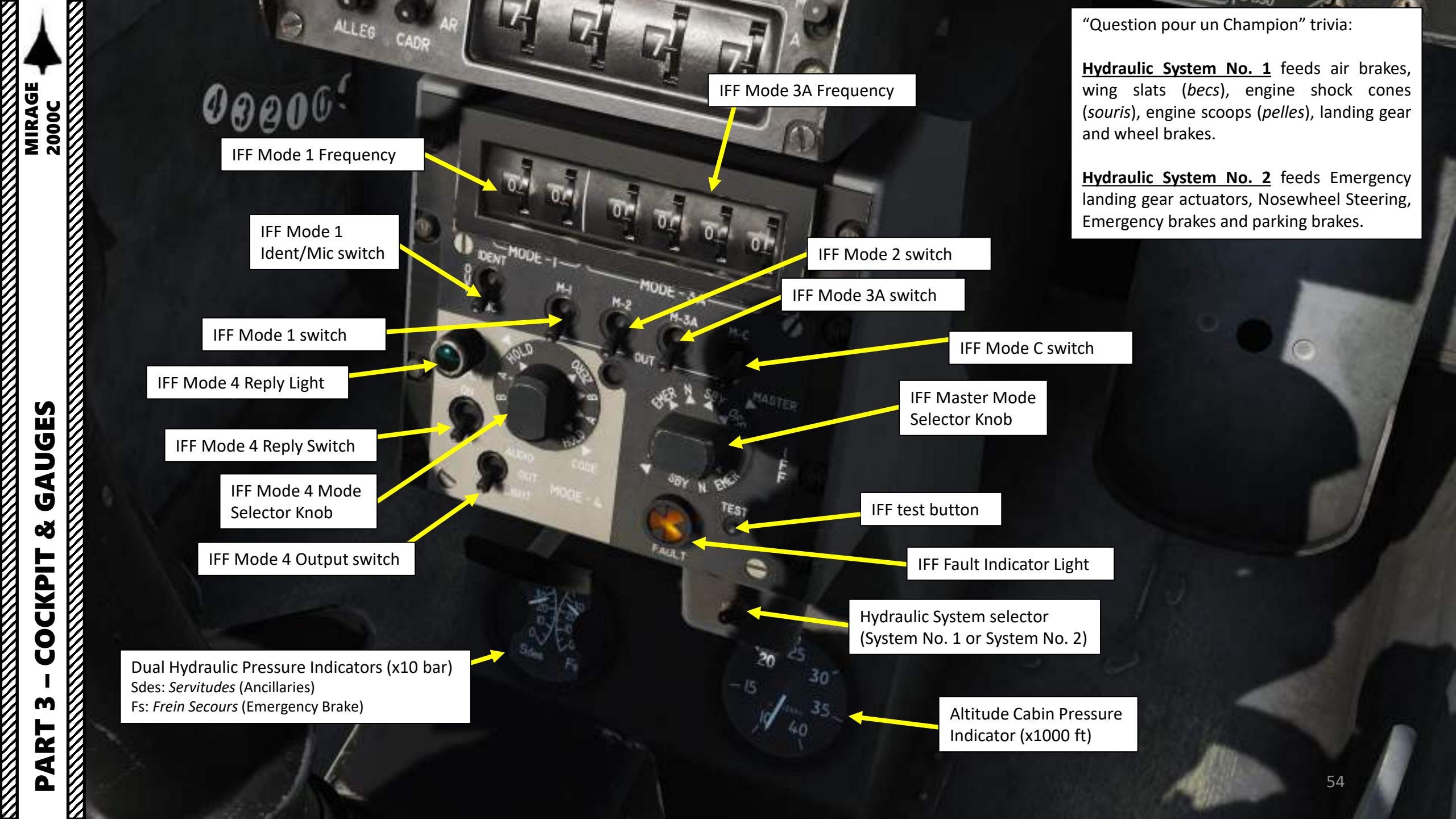

Anti-Collision Light


Radar Test switch
ON GROUND radar switch
(used for maintenance)
Radar Display Mode
PPI: Plan Position Indicator
B: B-Scan
DEC: *Découpe Iso-Altitude*
(Iso-Altitude Separation)
Rémanence (Persistence) knob
R=Rémanence = Persistence ON
N=*NON*=Persistence OFF
VISU: *Visualisation du sol*
Ground Visualisation
Radar Range switch
Radar TDC (Target Designation Caret) Mode
Mode S
Mode Z
Radar Number of
Lignes (bars) selector
(4/2/1)
Radar Mode
ENT: *Entrelacé/Interleaved*
HFR: *Haute*/High Frequency
BFR: *Basse*/Low Frequency
PSIC*: Poursuite Sur Informations Continues*
(STT Single Target Track equivalent)
Radar Scan azimuth selector
(*balayage* = sweeping angle in degrees)


Engine Air Relight/Start switch (*Rallumage en vol*)
Volume TB/Approach
Video Recorder switch (*Magnétophone*)
Marker (MKR) and Countermeasure (CME) SERVAL Volume
On-Ground Radar emission switch (used for maintenance)
Emergency Trim (currently not implemented)
Rudder trim
Volume UHF radio
Volume V/UHF radio
Radio Audio Amplifier selector
Volume VOR/ILS
Volume TACAN
Volume MAGIC and S-530D missile


Electrical Failure Advisory
Hydraulic Failure Advisory
Afterburner Shutdown switch (*Coupure Post-Combustion*)
Emergency Oil switch (*Secours Huile*)
Calculator Emergency Rearm (*Secours Calculateur*)
Fly-by-Wire Channel 5 switch
CDVE: *Commande de Vol Électrique* (electrical flight command)
Emergency Fuel Dump switch (*Vide-Vite*)
Autopilot (PA: *Pilote Automatique*) test switch
M=*Marche*/ON
A=*Arrêt*/OFF
Red: Failure Light
Green: Pass Light
Fly-by-Wire test switch


RALLUMAGE EN VOL
N > 13 %
Tt7 < 950°
AVANT
MANETTE: STOP
RALLUMAGE VOL
MANETTE
RALENTI
SEC. CARB: Marche
RALLUMAGE VOL COUPE
NORMAL
PANNE CALC
SEC. CARB.
APRES
CROSSE/PARACHUTE
Cockpit Flood Light Lamp



"Question pour un Champion" trivia:

Hydraulic System No. 1 feeds air brakes, wing slats (*becs*), engine shock cones (*souris*), engine scoops (*pelles*), landing gear and wheel brakes.

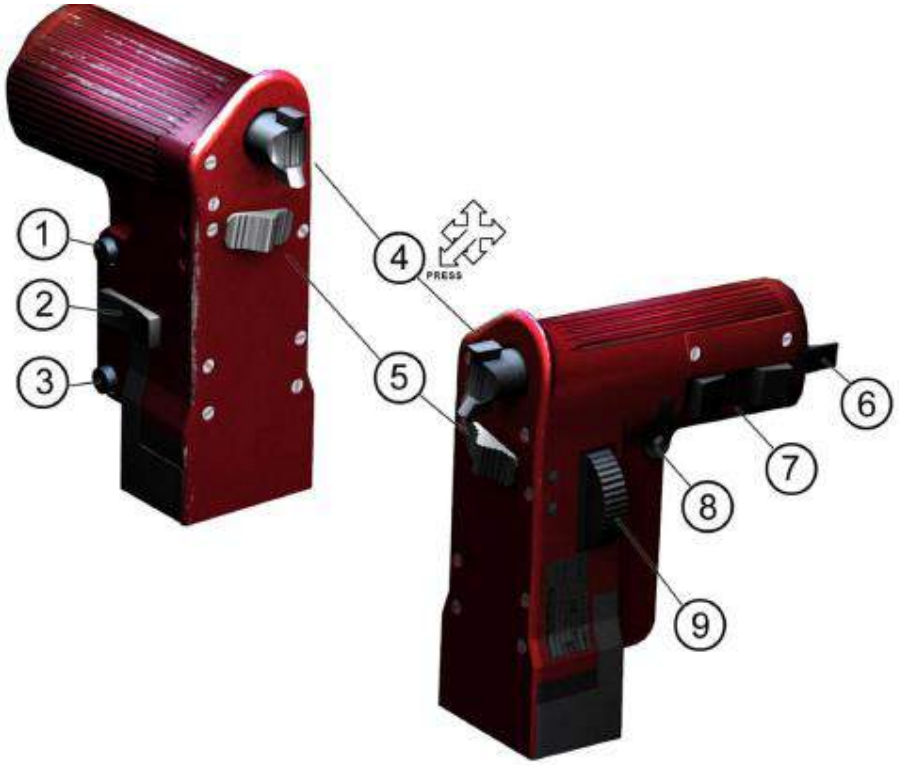
Hydraulic System No. 2 feeds Emergency landing gear actuators, Nosewheel Steering, Emergency brakes and parking brakes.


MANUAL SEPARATION
SEPARATION MANUELLE

HOTAS (Hands-On-Throttle-and-Stick)

No.	Control Name	Description	Action in Options	Default key
1	**Trigger Safety Indicator**	When visible, the trigger is activated to fire weapons. Automatically shows when master arm switch is set to ON.	NONE	NONE
2	**Navigation Update / Magic II Unlock / Air-to-Ground Designation Switch**	Depending on the selected navigation or attack mode, this switch enables: • Ground target designation for ordnance release • INS position update by designating a ground reference point • Magic II missile target unlock and returns seeker to search mode	NAV Update / Magic Unlock	NONE
3	**Trim Control**	Trims the aircraft in roll and pitch. When autopilot is engaged, it is use to control the aircraft by setting desired heading and adjusting the flight path.	Trim DOWN Trim LEFT Trim RIGHT Trim UP	RCTRL + W RCTRL + A RCTRL + D RCTRL + S
4	**Countermeasure Switch**	Activates countermeasures (chaff and/or flares and/or jammer).	Decoy Program release	DELETE
5	**Weapons System CMD Switch** *FWD/AFT/DEPRESSED*	In air-to-air mode: • FWD: toggles between close combat vertical / horizontal radar modes. • Depressed: Unlock Target • AFT: activates the close combat boresight radar mode In air-to-ground mode (A/G weapon selected): • FWD: sets HUD in air-to-ground Mode	Weapons System CMD FWD Weapons System CMD Depressed Weapons System CMD AFT	NONE NONE NONE
6	**Trigger**	When activated (safety indicator visible), fires weapon or releases bombs.	Weapons FIRE / Bomb Release	SPACEBAR
7	**AP Override Switch**	When autopilot is engaged, maintaining the switch down enables to override the autopilot without setting it off and control manually the aircraft. Releasing the switch re-engages the autopilot.	Autopilot Standby Mode	LALT+A
8	**AA Radar Modes**	• With a locked AA target: toggles between STT/TWS tracking modes (same as before). • With the radar on SCAN and no locked AA target, it selects the default lock mode for AA targets: STT or TWS.	STT/TWS Toggle	NONE
9	**NWS/IFF Interrogator**	On ground, toggles ON/OFF the nosewheel steering. In the air (gear up), triggers radar target identification.	Nosewheel steering / IFF Interrogate	S
10	**AP Disconnect Switch**	Disconnects the autopilot	AP Disconnect / Exceed Elastic Limit	LSHIFT + A

Throttle



No.	Control Name	Description	Action in Options	Default key
1	**Jammer Control Switch**	Activates/deactivates the jammer when in manual mode	Jammer ACTIVATE / Standby Toggle	E
2	**Radio Selection Switch**	Selects the radio used for transmission	Main U/VHF Radio SELECT Aux. UHF Radio SELECT	LSHIFT + Num+ LALT + Num+
3	**Panic Pushbutton**	Releases the emergency chaff/flare program (Program O)	Decoy PANIC release	INSERT
4	**Radar Designator Control**	Controls up, down, left and right the radar screen designation cross. Target radar lock is obtained by pushing in (depressing) the control.	TDC UP TDC DOWN TDC LEFT TDC RIGHT TDC DEPRESS (LOCK TARGET)	; | RALT+ UP . | RALT+ DN , | RALT+ LT / | RALT+ RT NONE
5	**Airbrake Control**	This three position sliding switch controls the speedbrakes. Extends (aft, spring-loaded position) or retracts (FWD) the airbrakes.	Airbrake TOGGLE Airbrake ON Airbrake OFF	B LSHIFT + B LCTRL + B
6	**Police Light Control Switch**	Toggles ON/OFF the police searchlight.	Police Light Toggle	NONE
7	**Quick Weapon Select Switch**	Left: Air-to-Air Gun Quick Selection (CAN) Center: Weapon Control Panel Selection (PCA) RIGHT: Magic II Missile Quick Selection	AA Gun SELECT PCA Select MAGIC SELECT	C NONE NONE
8	**Air-to-Ground Designate / Magic Slave Switch**	In air-to-ground, designates a chosen ground target. In air-to-air, slaves the Magic II seeker on a target locked on radar.	Magic Slave / AG Designate / INS Position Update	NONE
9	**Antenna Elevation Wheel**	This rotating wheel with a center detent adjusts radar antenna elevation.	Radar Antenna UP Radar Antenna DOWN Radar Antenna CENTER	NONE NONE NONE

PART 3 – COCKPIT & GAUGES

NVGs with JVN Lights Filter switch to JVN

NVGs with JVN Lights Filter switch to N (Normal)

SUN VISOR

ON/OFF: LSHIFT+HOME

NIGHT VISION GOGGLES

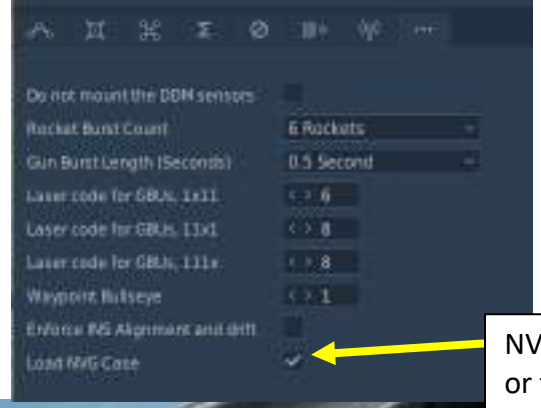
ON/OFF: LALT+HOME

Note: NVGs or a Helmet-Mounted Visor need to be requested from the ground crew and equipped prior to takeoff.

JVN (*Jumelles de Vision Nocturne* / Night Vision Goggles) Lights Filter Switch
JVN: Night Vision Filter
N: Normal Mode (No Filter)

FLASHLIGHT

ON/OFF: LALT+L



NVG Case needs to be equipped via Mission Editor or from the Ground Crew

Martin Baker Mk 10

Zero-Zero Ejection Seat

A **zero-zero ejection seat** is designed to safely extract upward and land its occupant from a grounded stationary position (i.e., **zero** altitude and **zero** airspeed), specifically from aircraft cockpits. The zero-zero capability was developed to help aircrews escape upward from unrecoverable emergencies during low-altitude and/or low-speed flight, as well as ground mishaps. Before this capability, ejections could only be performed above minimum altitudes and airspeeds.

Zero-zero technology uses small rockets to propel the seat upward to an adequate altitude and a small explosive charge to open the parachute canopy quickly for a successful parachute descent, so that proper deployment of the parachute no longer relies on airspeed and altitude.

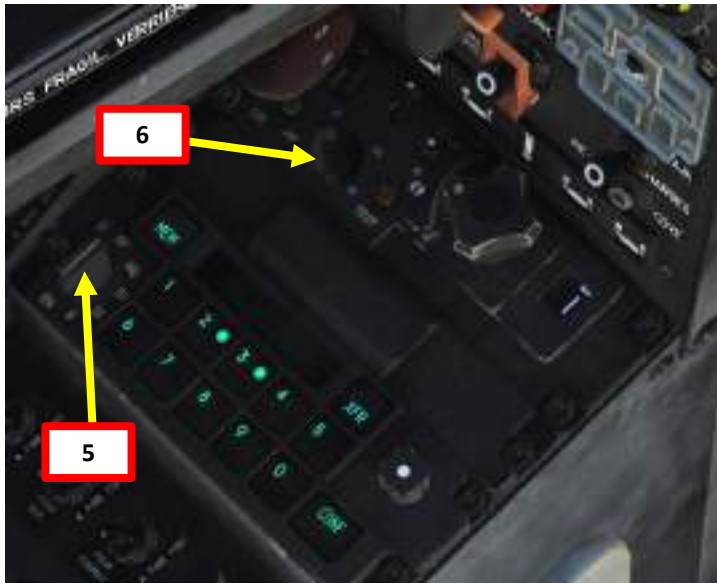
Controls

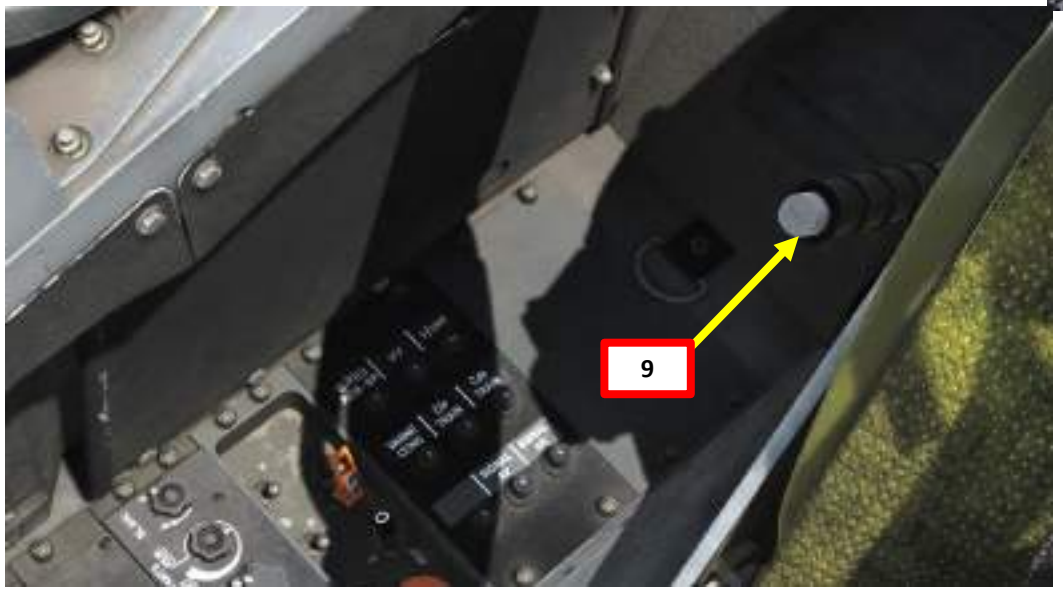
Seat Adjustment UP: L_SHIFT+S
Seat Adjustment DOWN: L_SHIFT+L_ALT+S

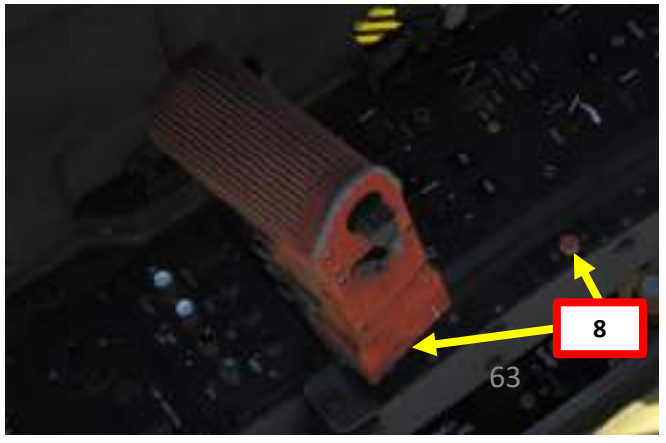
PRE-FLIGHT

PRE-FLIGHT

1. Fly-By-Wire Gain switch - NORMAL
2. Fly-By-Wire G Limiter Switch – As required
   - AA (UP) for Anti-Air missions (light payload)
   - CHARGES (DOWN) for bombing missions (heavy payload)
3. Fly-By-Wire NORM/VRILLE switch - NORMAL
4. *Pelles*, *Souris*, *Becs* switches – AUTO
5. V/UHF Green Box radio – FF (ON)
6. UHF radio – **M**ARCHE (ON)
7. Parachute/Hook lever – FORWARD
8. Set throttle to STOP position by pressing the “Engine Shutdown” button
9. Parking Brake – ENGAGED (UP)
10. BINGO Selector – Insert BINGO FUEL value
    - Fuel quantity required to return to base
    - Typically 1000-1200 kg

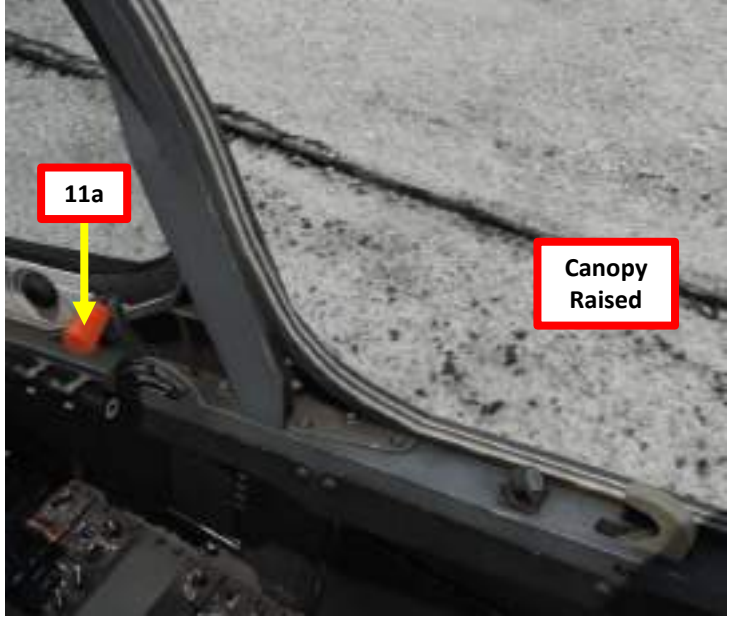


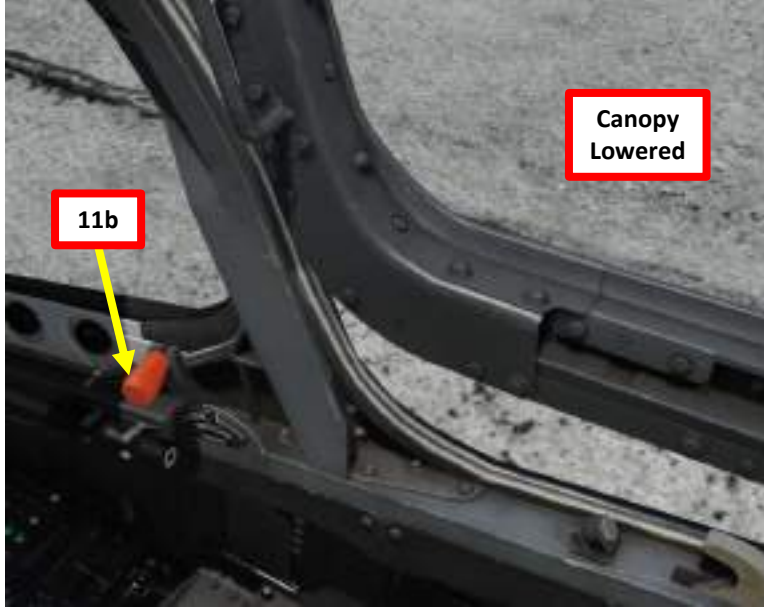




PRE-FLIGHT

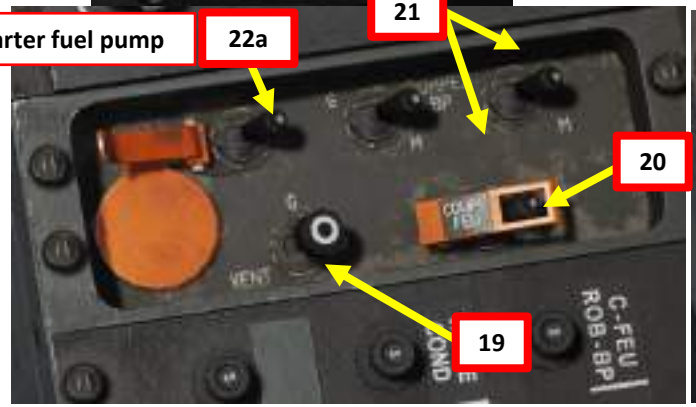
11. Lower Canopy – LEVER AFT (Right Click)
12. Close Canopy – PULL CANOPY REST HANDLE (Left Click on yellow hashed square on handle)
13. Lock and Seal Canopy – LEVER FWD (Left Click)

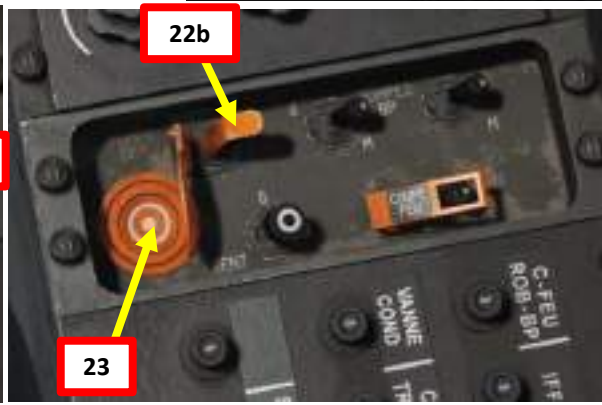


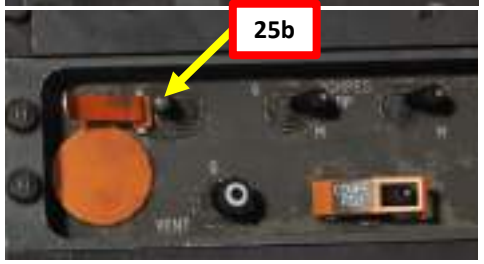


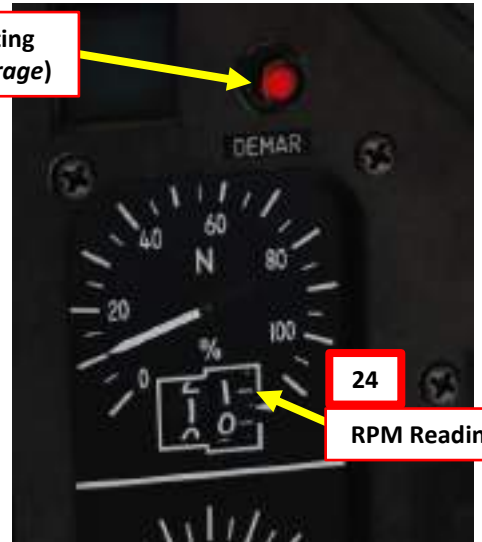
START-UP PROCEDURE

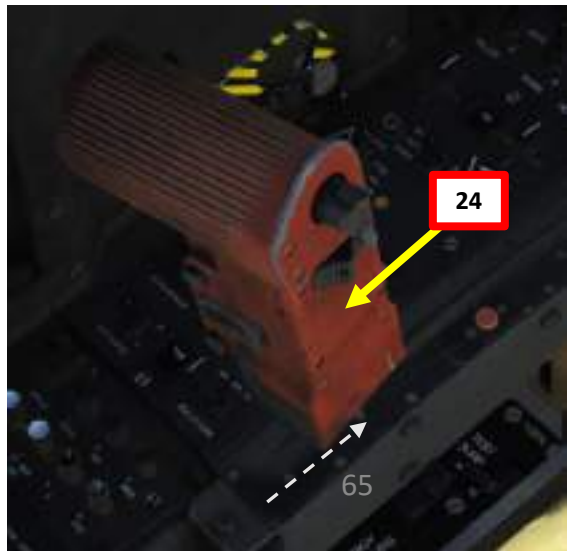
14. Set Battery to **M**ARCHE (ON) and ensure Alternator #1, Alternator #2 and TR switches are set to **M**ARCHE (ON) as well.
15. Adjust Caution/Advisory Brightness as required
16. Start INS alignment procedure (see next page).
17. Press the PANNE Warning switch to reset audio warning
18. Emergency Hydraulic Pump (*Électropompe*) switch – ON (FWD). Confirm that HYD SYS caution disappears.
19. Ignition/Ventilation selector – set to either **G**AUCHE (left) or **D**ROITE (right)
20. Fuel Shut-Off Valve (*Coupe-Feu*) – OPEN (switch to the right & cover closed)
21. Left and Right Low-Pressure Fuel Pumps (*Pompe Basse-Pression Gauche et Droite*) – Set to MARCHE (ON)
22. Set starter fuel pump (*POMPE DÉMARRAGE*) to **M**ARCHE (ON)
    - Left click on the Ignition switch orange cover to ensure starter fuel pump is ON
23. Press ignition switch and wait for engine to spool up
24. When engine RPM reaches 10 %, move throttle at IDLE position. Confirm RPM, Fuel Flow and T7 (Turbine Exit Temperature) increase.
25. Once RPM reaches 60%, set starter fuel pump (POMPE DÉMARRAGE) to OFF. First left click on the Ignition switch orange cover, then left click on the starter fuel pump switch.







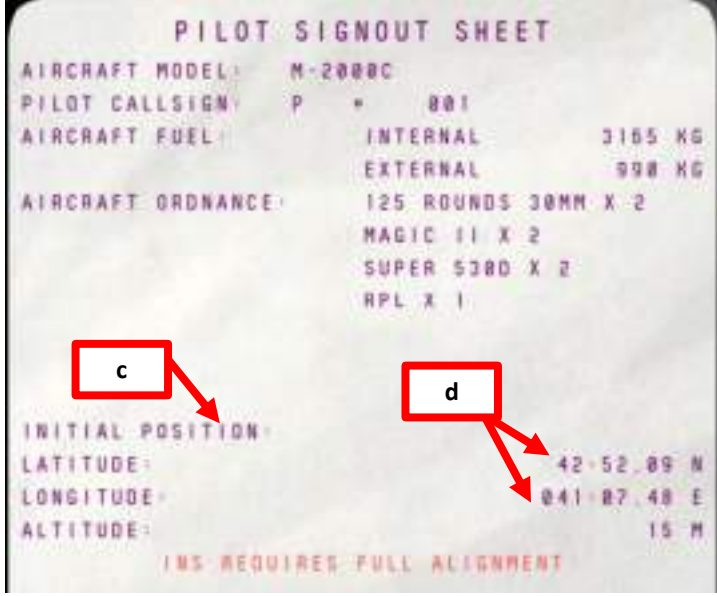


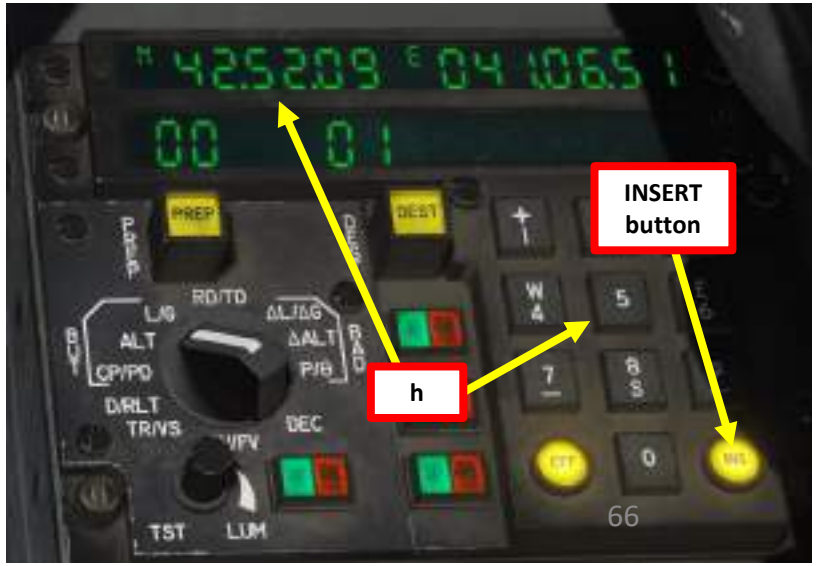


START-UP PROCEDURE

INS ALIGNMENT PROCESS

a) On PSM (*Poste Sélecteur de Modes* = Mode Selector Panel), set INS mode to *VEILLE* (Standby) to automatically select PREP Waypoint 00 (current aircraft position).
b) Set INS operation mode to "N" (Normal) to monitor remaining alignment time.
c) Open up your kneeboard using "RSHIFT+K" and cycle through pages using the "[" and "]" (kneeboard previous/next page bindings) to find the PILOT SIGNOUT SHEET and the aircraft's initial position.
d) In our case, our initial position is **42:52.09 North** for Latitude and **041:07.48 East** for Longitude, with an **airport elevation of 15 meters**.
e) On PCN (*Poste de Commande de Navigation* = Navigation Control Panel), set INS parameter selector to L/G.
f) Press "1" (+) button on keypad to select Latitude field
g) Press "2" (**N**orth) button on keypad to select North
h) Enter "425209" on keypad and press "INS" (Insert) button to enter the aircraft latitude coordinates (42:52.09 North) as specified on kneeboard. If you made a mistake, press the EFF (*Effacer*/Erase) button.

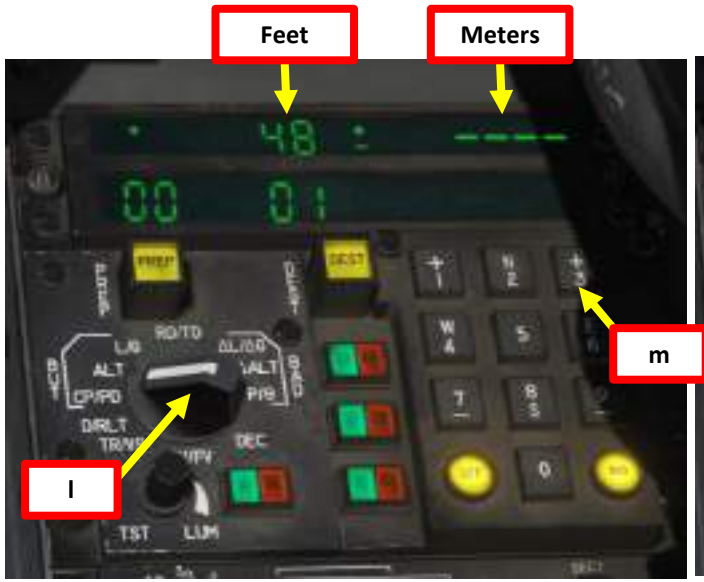


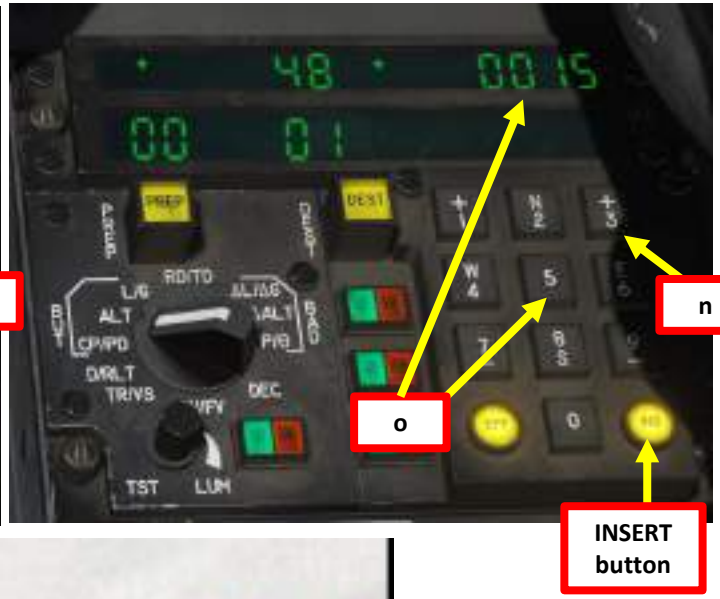


START-UP PROCEDURE

INS ALIGNMENT PROCESS

i) Press “3” (+) button on keypad to select Longitude field
j) Press “6” (**E**ast) button on keypad to select East
k) Enter “0410748” on keypad and press “INS” (Insert) button to enter the aircraft latitude coordinates (041:07.48 East) as specified on kneeboard. If you made a mistake, press the EFF (*Effacer*/Erase) button.
l) On PCN (*Poste de Commande de Navigation* = Navigation Control Panel), set INS parameter selector to ALT (Altitude).
m) Press “3” (+) button on keypad to select right Altitude field (meters). Left Altitude field is for feet.
n) Press “3” (+) to select a positive altitude value.
o) Enter “0015” as the airport elevation (15 meters). Don’t forget to add enough zeroes to have the right data format. Press “INS” (Insert) button to enter the aircraft. If you made a mistake, press the EFF (*Effacer*/Erase) button.





START-UP PROCEDURE

INS ALIGNMENT PROCESS

p) On PSM (*Poste Sélecteur de Modes* = Mode Selector Panel), set INS mode to ALN (Alignment) to start alignment procedure of inertial systems. **VAL** button will illuminate.

q) Press **VAL** button to validate data entry of the MIP (*Module d'Insertion de Paramètres* = Data Cartridge Insertion Module).

r) Set INS operation mode to "STS" (Status) to monitor remaining alignment time.
- First alignment phase Class 4 (Coarse Alignment) will last 4 minutes.
- Second, Third, Fourth and Fifth alignment phases (Precision alignment) will last another 4 minutes.
- Total alignment process should take 8 min.

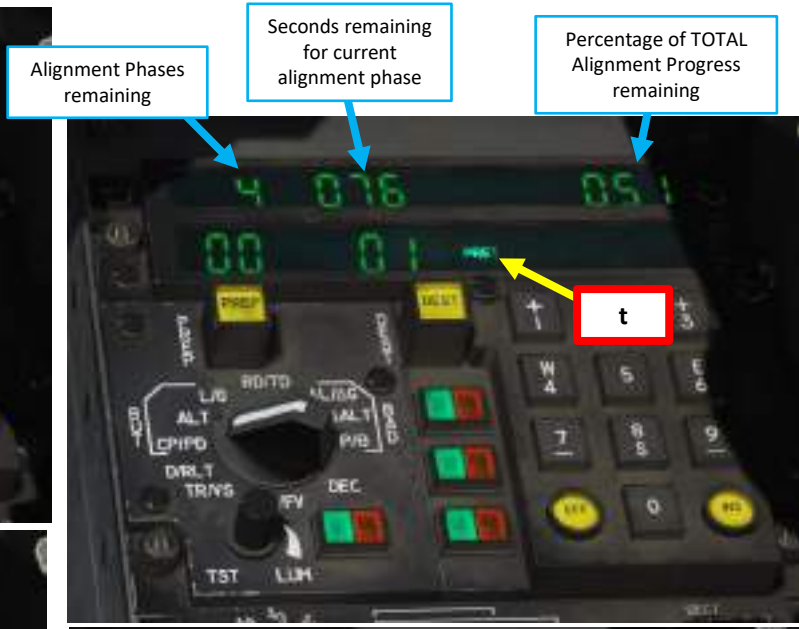
s) A yellow ALN (Alignment) caution will blink during the **first** alignment phase (Class 4, coarse alignment).

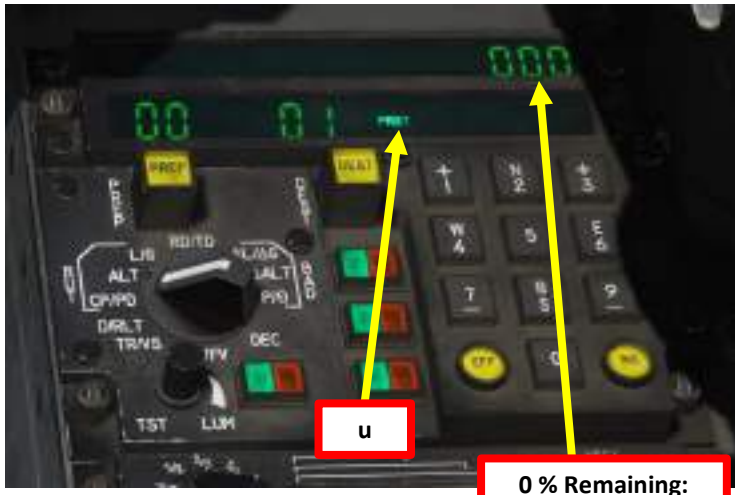
t) "*PRÊT*" (Ready) caution will blink when **first** alignment phase is complete after 4 minutes.

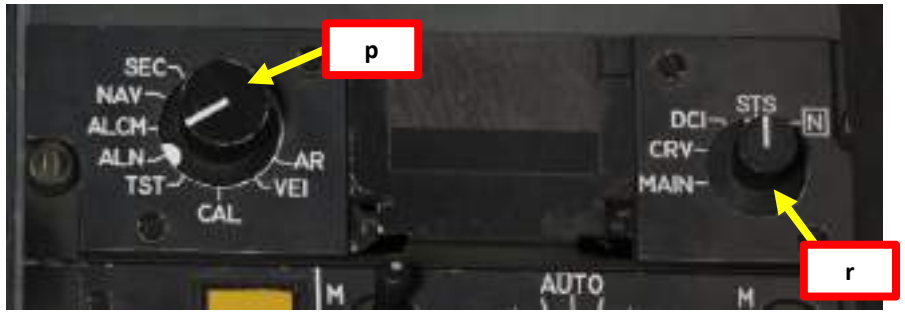
u) "*PRÊT*" (Ready) caution will remain illuminated when all remaining phases are complete after another 4 minutes.

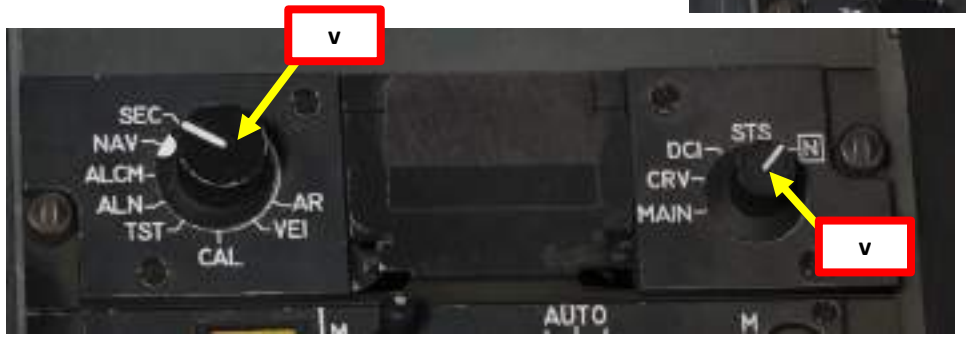
v) Set INS operation mode to "N" (Normal) when alignment phase is complete and set INS mode selector to "NAV". <u>This step can be done right before you start taxiing.</u>

NOTE: During the alignment phase, you can add or modify waypoint entries at the same time. Waypoint entry and editing will be explained in Section 13 (NAVIGATION).



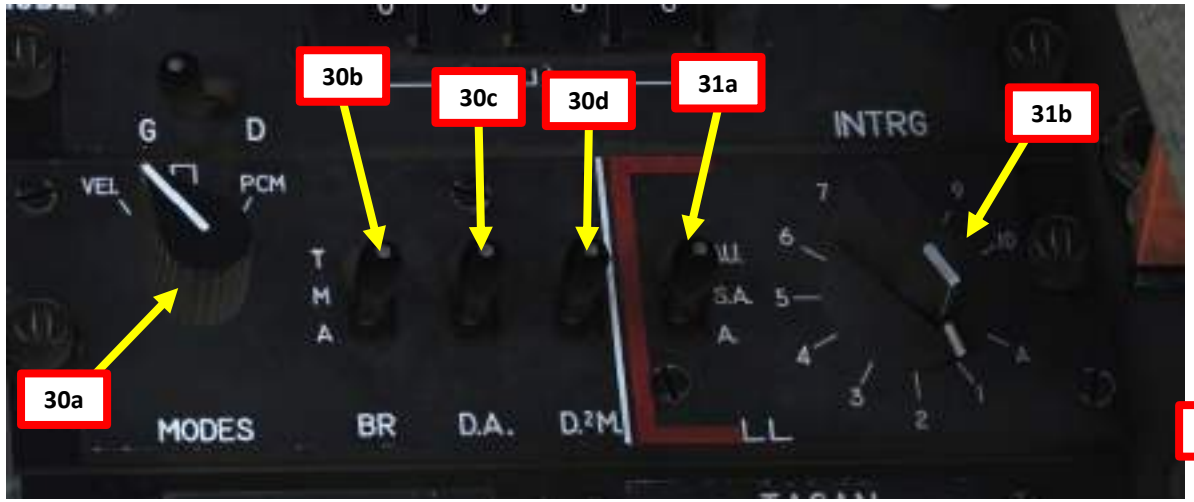






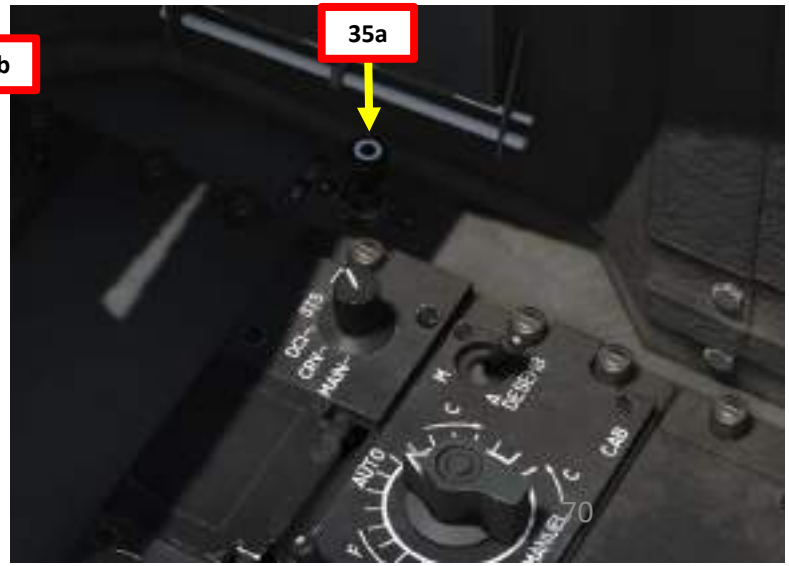
START-UP PROCEDURE

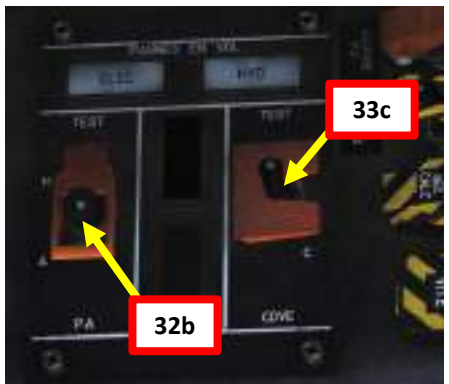
26. Power up your displays
    a) VTH/HUD (Heads-Up Display) power switch – **M**ARCHE (ON) (Middle Position)
    b) VTB/HDD (Heads-Down Display) power switch – **M**ARCHE (ON)
27. Set Radar Switch - **P**rechauffage (Warm-Up)
28. Radar Altimeter Power switch - **M**ARCHE (ON). Then, set HUD Altimeter Switch to **H**eight (Hauteur), or the middle position.
29. HSI Mode – set to NAV (Cm for Magnetic Heading or Cv for True Heading, as desired)
30. On Electronic Warfare (EW) panel, set:
    a) Set EW mode to **VEI**LLE (Standby)
    b) Set Jammer (*Brouilleur*) to **M**ARCHE (ON)
    c) Set RWR (*Détecteur d'Alertes*) to **M**ARCHE (ON)
    d) Set MLWS (*Détection de Départ de Missile* – Missile Launch IR Warning Detector) to **M**ARCHE (ON)
31. Set Flare Dispenser Mode (*Lance-Leurres*) to S.A. (Semi-Automatic) or AU (Automatic), as desired. Then, set Countermeasure Program as desired.



START-UP PROCEDURE

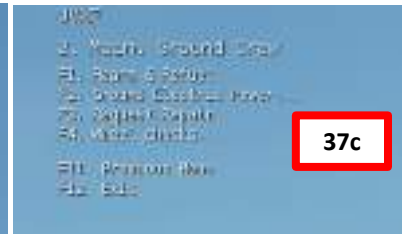
32. Test Autopilot system by flipping the PA test switch cover, setting switch to “M”, waiting for the green light and then setting the test switch back to “A” and closing the cover.
33. Test Fly-by-Wire system by flipping FBW test switch cover, setting switch to “C”, waiting for the green light, repeat for “L”, and then setting the test switch back to TEST and closing the cover.
34. Set PITOT HEAT switch FWD (ON) and set orange cover switch to SAFETY position (as shown). ANEMOmeter caution will extinguish.
35. Set Auxiliary ADI (Attitude Director Indicator) Power switch (CAP SEC) – Middle Position (Energized). Then, uncage the Auxiliary ADI by pressing on the caging knob. The orange flag should disappear. Rotate the caging knob to align the ADI.
36. Set IFF Power Switch to either SECT (Sectoral, middle position) or FULL (rightmost position), as required.

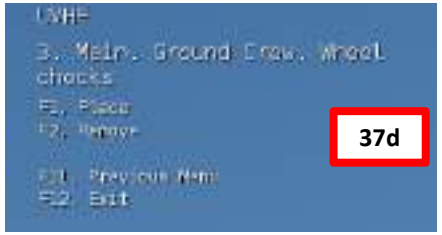


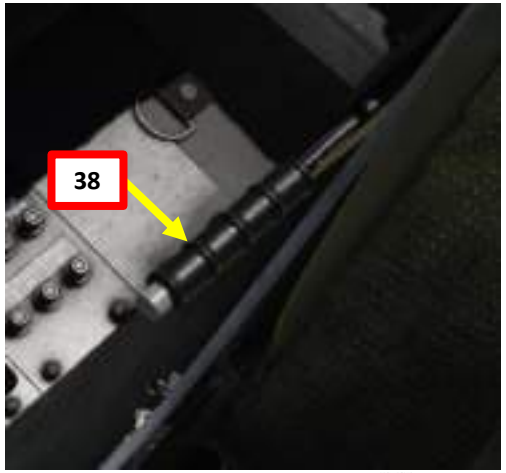


START-UP PROCEDURE

37. Remove Wheel Chocks by contacting ground crew
    ("/" –> F8 –> F4 –> F2)
    Note: Make sure the canopy is open when contacting the ground crew of the chief will not be able to hear your command.
38. Release Parking Brake (DOWN)
39. Engage DIRAV Nosewheel Steering – Press S
    - DIRAV blue light means NWS is engage
40. When INS alignment process is complete (see INS ALIGNMENT section), start taxiing.

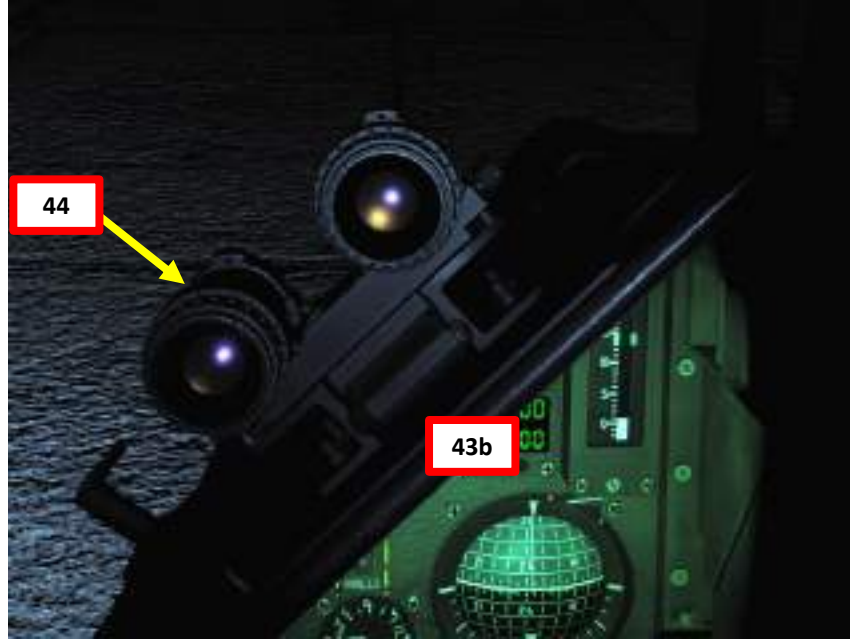


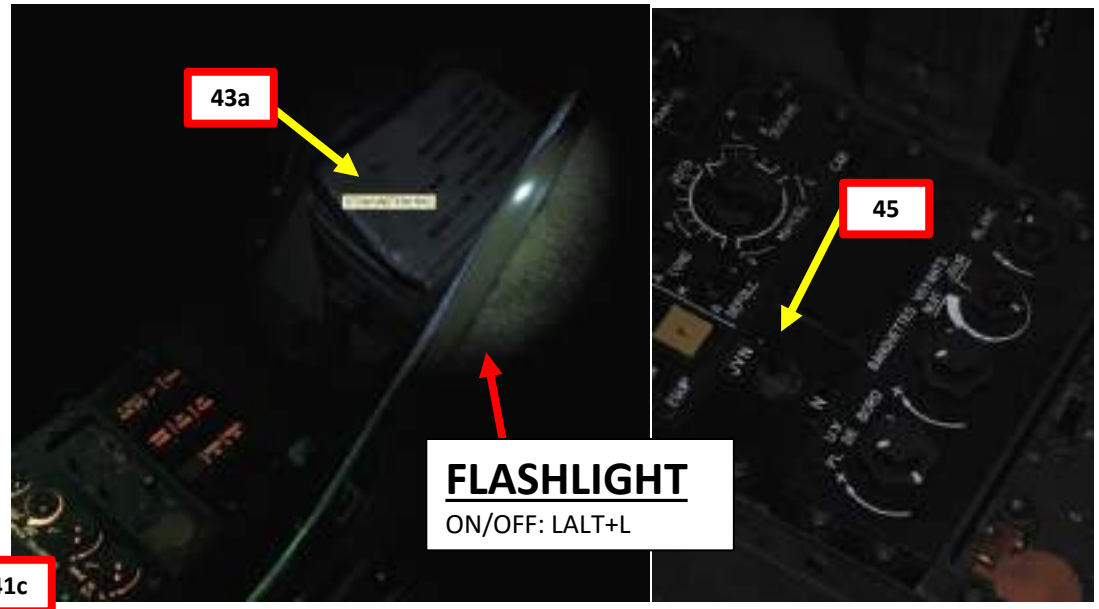




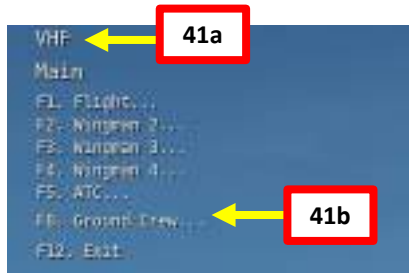
START-UP PROCEDURE

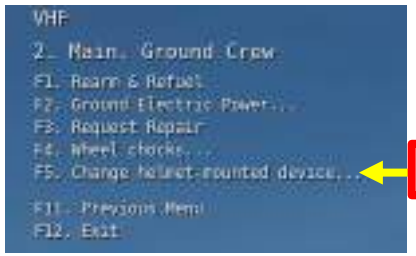
41. If required, you can equip NVGs (Night Vision Goggles) by requesting them from the ground crew
    a) Press "/" to open the communication menu
    b) Press F8 to contact the ground crew
    c) Press F5 to request to Change helmet-mounted device
    d) Press F1 to load night vision goggles. They will appear in a NVG case next to the parking brake lever.
42. You can use the flashlight by pressing « LALT+L »
43. Click on the NVG Case to install NVGs on the glareshield rack.
44. Install NVGs on your helmet by clicking on them.
45. Set JVN (*Jumelles de Vision Nocturne* / Night Vision Goggles) Filter Switch to JVN (FWD) for night operations.
46. Turn on NVGs by pressing "LALT+HOME"

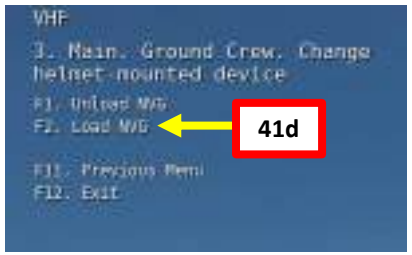


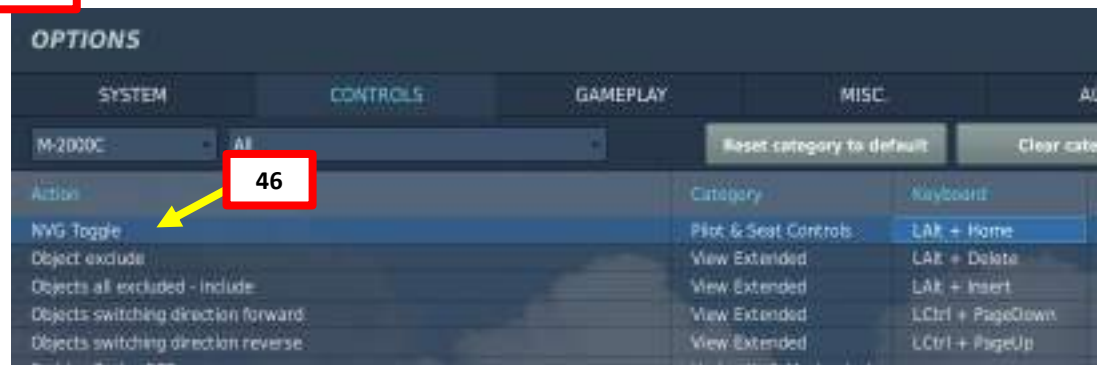


FLASHLIGHT
ON/OFF: LALT+L



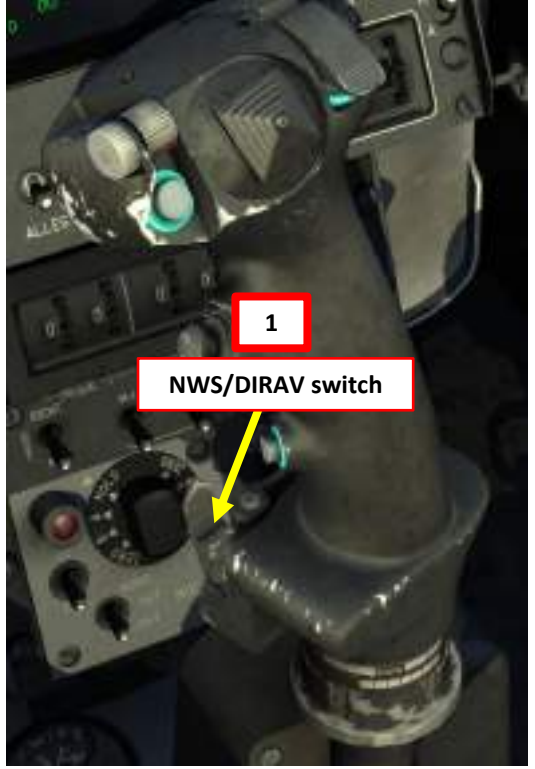


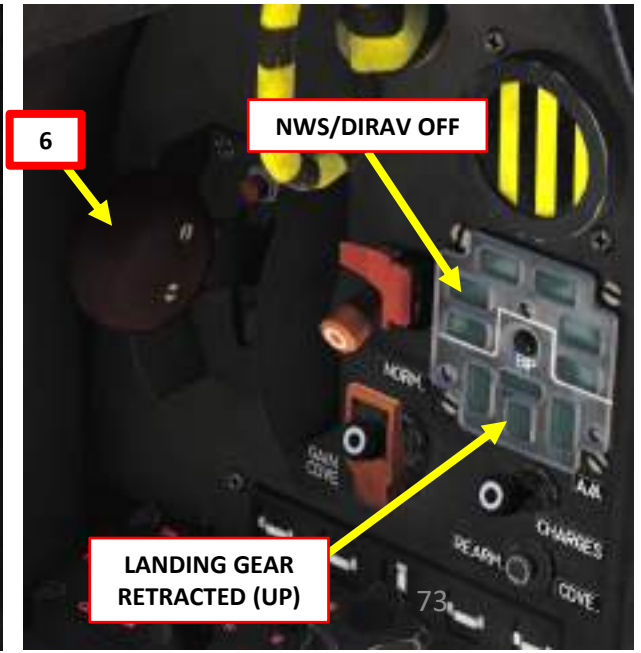




TAKEOFF

1. Taxi to the runway by using rudder pedals and toe brakes
   - Make sure your nosewheel steering (DIRAV) is engaged when taxiing
2. Once lined up on the runway, disengage nosewheel steering (DIRAV) by pressing S.
3. Hold Brakes, and apply 100% Throttle to check if engine spools up correctly and if TT7 is within safe range
4. Apply Full throttle (with Post-Combustion / Afterburner)
5. As you accelerate, keep the Inverted T Line on the horizon to achieve a takeoff pitch angle of 13 deg. This will help you avoid tail strikes on rotation.
6. Retract landing gear before you reach 260 kts





TAKEOFF

TAKE OFF - ISA METEOROLOGICAL CONDITIONS

Configuration	Fuel (t)	GW (t)	Expected Jx	Vmaxrto (kt)	Vr (kt)	Vlof (kt)
CLEAN AIRCRAFT	3.1	11.0	0.68	145	120	155
STANDARD AIR TO AIR	4.1	13.2	0.55	140	125	155
STANDARD AIR-TO-GROUND	6.3	16.0 or 15.7	0.44 - 0.46	130	150	175

Remarks: *Vmaxrto is the go/no-go speed, i.e. the max speed up to which it it still possible to reject take off. Above Vmaxrto the pilot must either take off or eject.*

Vmaxrto is not called V1 because it may occur above Vr on this aircraft. Vmaxrto values above assume a dry standard NATO runway (2400m) without brake chute use.

CLIMB - BEST EFFICIENCY

		Economic (MIL thrust)		High performances (Max AB thrust)	
Configuration	Climb up to	Best CAS (kt)	Best Mach	Best CAS (kt)	Best Mach
CLEAN AIRCRAFT	FL400	500	0.90	600	0.95
STANDARD AIR TO AIR	FL350	460	0.85	550	0.90
STANDARD AIR-TO-GROUND	FL300	440	0.80	550	0.90

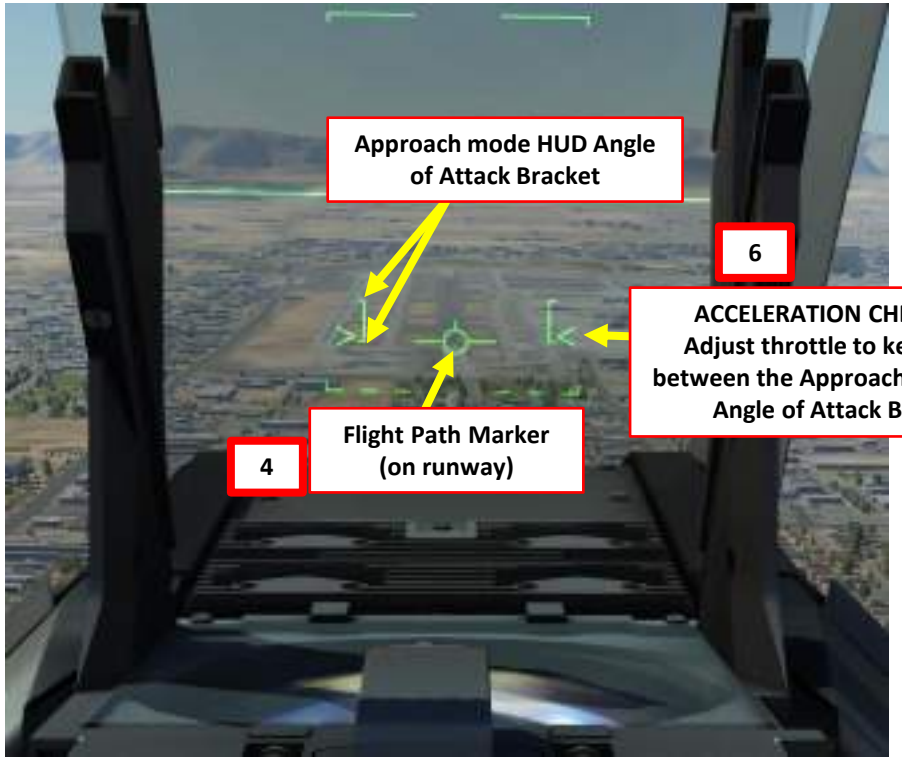
Remarks: *use best CAS (IAS) until best Mach is reached; then use best Mach for the remaining of the climb*

For MIL climb, cut AB off at 300kt after take off (AB is mandatory for all take offs with this aircraft, as per SOPs / safety consideration)

TAKEOFF

NORMAL LANDING APPROACH

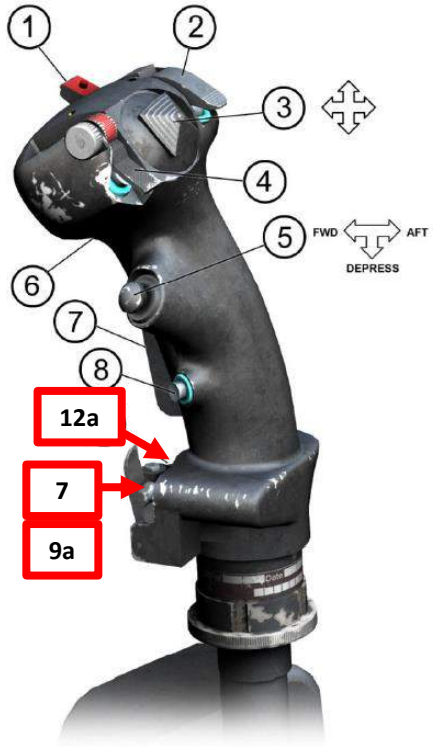
1. Adjust seat height
2. Select APPROACH mode on PCA (yellow “S” caution when engaged)
3. Deploy landing gear below 230 kts
4. Keep flight path marker where you want to touchdown
5. Trim the aircraft to about 14 deg AoA (Angle of Attack)
6. Line up flight path marker and acceleration chevrons within the Approach mode HUD Angle of Attack bracket by adjusting throttle and stick.
7. During touchdown, maintain your Angle of Attack to perform an aerobraking landing and set throttle to IDLE. This manoeuver will bleed speed in the process (your delta wing will act as a huge airbrake).

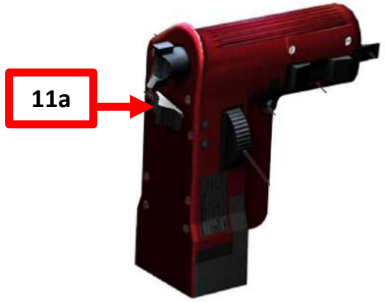


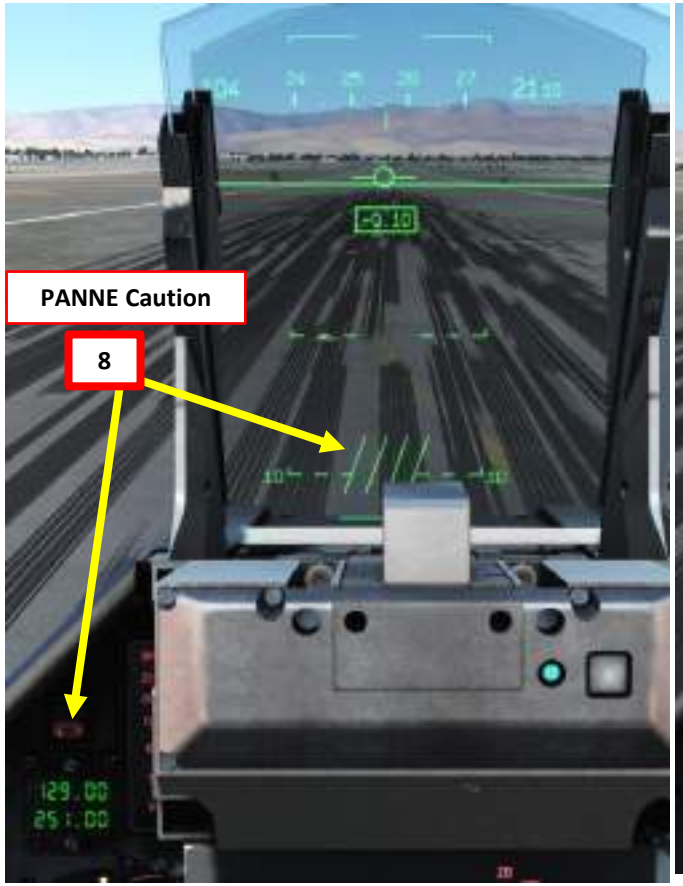
NORMAL LANDING APPROACH

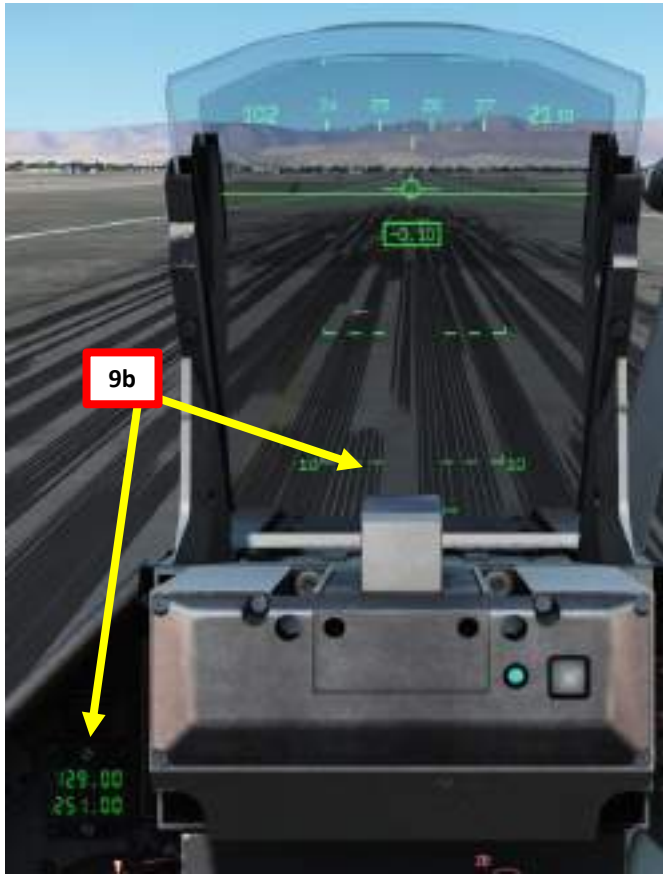
NORMAL LANDING APPROACH

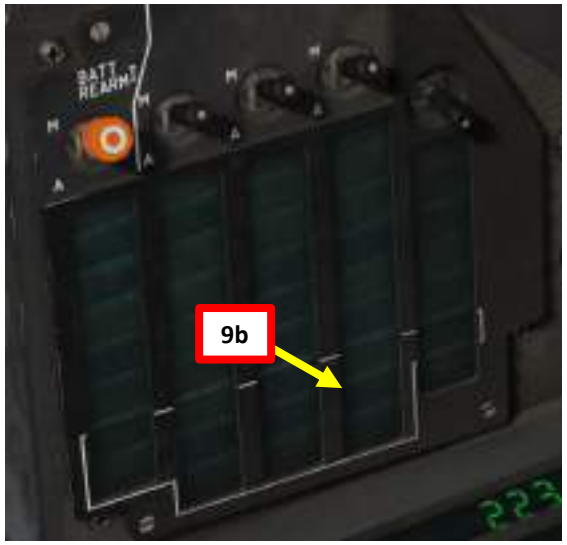
7. Once slowing down to 110 kts, press the Autopilot Standby Mode (AP Disconnect) switch on the stick to reset trim to allow the nosewheel to descend. An aural sound will be heard when trim is reset.
8. Once the nosewheel touches the ground, the PANNE and DECOL (*Décollage*, Takeoff) cautions will illuminate since the aircraft trim is not set to Neutral.
9. Press the Autopilot Standby Mode (AP Disconnect) switch on the stick to reset trim. The PANNE and DECOL cautions should extinguish, and an aural sound will be heard when trim is reset.
10. Gently apply brakes when you have slowed down under 100 kts.
11. Retract airbrakes (A & F lights out).
12. Engage Nosewheel Steering (DIRAV) when you slowed down under 40 kts.

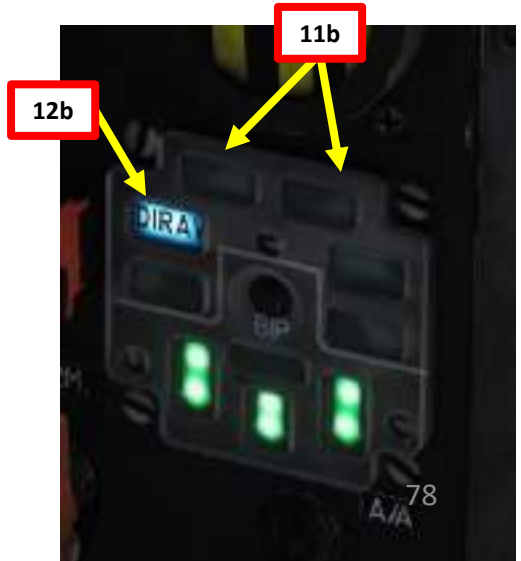












NORMAL LANDING APPROACH

VIDEO LANDING TUTORIALS

If you are having difficulties with landing, here are a couple of excellent landing tutorials for various conditions made by Slundal.

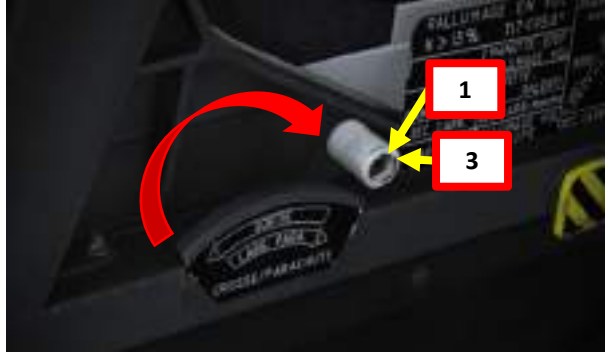
1. Landing Tutorial 1/3 - Visual Approach
   https://www.youtube.com/watch?v=XJq4eNgZ-vU

2. Landing Tutorial 2/3 - Using ILS and TACAN
   https://www.youtube.com/watch?v=P0VCssCQ0S4

3. Landing Tutorial 3/3 - Zero Visibility Landing
   https://www.youtube.com/watch?v=a_ixQHO-vpw

HOW TO USE THE DRAG CHUTE

1. Verify that drag chute lever is in the FORWARD position (ARMED).
2. Deploy chute (preferably when you are wheels down) by pulling the drag chute lever AFT (*SORTIR PARACHUTE = DEPLOY CHUTE*).
3. Once you are slowed down, push drag chute lever FORWARD to release the chute (*LARGAGE PARACHUTE = RELEASE CHUTE*).



NOTE

The slot where the parachute container is equipped can have either the drop chute OR the ÉCLAIR countermeasure pod. In other words, if you have the ÉCLAIR equipped, you will not be able to deploy your chute since it will not fit on your aircraft.

The French *Armée de l'Air* procedures do not use a drop chute in a standard landing unless an emergency requires it, unlike other aircraft like the MiG-21bis which routinely land while deploying their drop chute. The Mirage having a very small amount of flares without the ÉCLAIR pod, I would recommend equipping the ÉCLAIR instead and gain precious countermeasures instead of a one-use drag chute that will hamper your combat effectiveness..

SNECMA M53-P2 TURBOFAN ENGINE

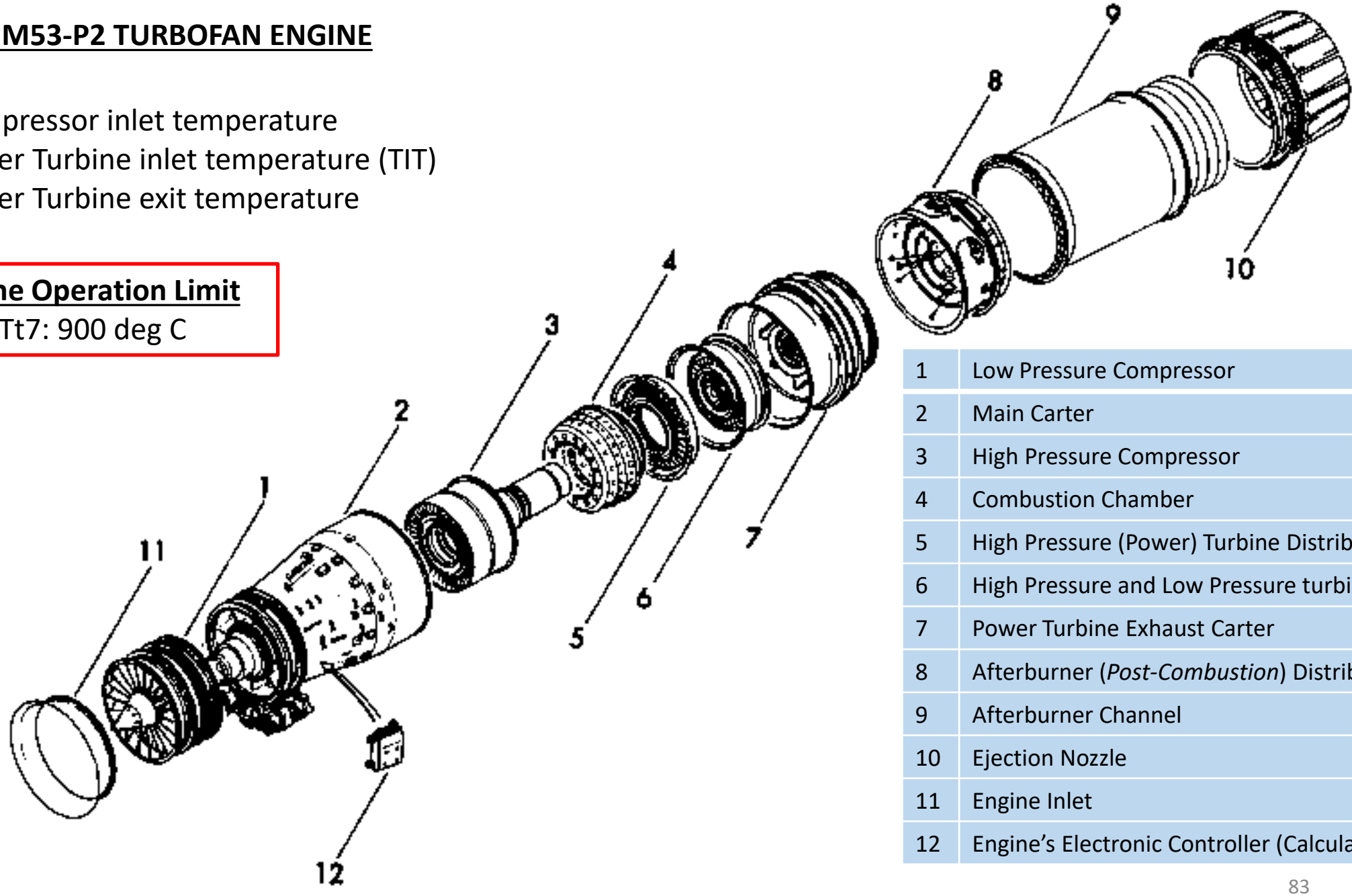
Originally called the “Super Atar”, the M53 was first developed between 1967 and 1969 in order to provide an upgraded version of the Atar engine. The Super Atar was meant to be a cheaper and less complex engine than the SNECMA TF306, which was derived from the Pratt & Whitney TF30. The low operation and maintenance cost of the engine was a priority for the french *Armée de l’Air*. Initially built to be installed on an upgraded version of the Mirage F1 (which was in competition with the F-16 for a NATO contract at the time), a second version of the engine (M53 P-2) was eventually developed and installed on the Mirage 2000C in July 1983.

General Characteristics of the M53-P2	
Type	Afterburning single-shaft turbofan
Dry weight	1,515 kg (3,340 lbs)
Compressor	8-stage axial compressor
Combustors	Annular
Turbine	2-stage axial turbine
Dry thrust	64.7 kN (14,500 lbf / 6,600 kgp)
Afterburning Thrust	95.1 kN (21,400 lbf / 9,700 kgp)

SNECMA M53-P2 TURBOFAN ENGINE

TT2: Compressor inlet temperature
TT5: Power Turbine inlet temperature (TIT)
TT7: Power Turbine exit temperature

Engine Operation Limit
Max Tt7: 900 deg C



1	Low Pressure Compressor
2	Main Carter
3	High Pressure Compressor
4	Combustion Chamber
5	High Pressure (Power) Turbine Distributor
6	High Pressure and Low Pressure turbine
7	Power Turbine Exhaust Carter
8	Afterburner (*Post-Combustion*) Distributor
9	Afterburner Channel
10	Ejection Nozzle
11	Engine Inlet
12	Engine's Electronic Controller (Calculator)

CAUTION PANEL

BATT Main Battery is disconnected or failed	**TR** Main or Auxiliary Transformer is disconnected or failed
HUILE Low Oil Pressure	**T7** Turbine Temperature Overheat
B.P. Fuel Pumps Failure	**BP.G** Left Fuel Pump OFF
HYD.1 Hydraulic System 1 pressure is below 195 bars	**HYD.2** Hydraulic System 2 pressure is below 195 bars
P.CAB Cockpit Open or Canopy Not Pressurized	**TEMP** N/A
ANEMO Pitot tube heating disabled	**CC** Battery is discharging, only 30 min of DC power remaining
PA Autopilot system problem	**MAN** Damage of Manoeuverability (control gyros, servos, etc.)
ALPHA Damage to AoA sensors	**GAIN** Emergency FBW computer in use

CAUTION PANEL

ALT.1 **Alternator 1 is disconnected or failed**	**ALT.2** **Alternator 2 is disconnected or failed**
CALC **Engine Controller (Calculateur) functionality compromised**	**SOURIS** **Engine Shockwave Cones functionality compromised**
BP.D **Right Fuel Pump OFF**	**TRANSF** **Fuel transfer stopped (loss of useable fuel or fuel jettison in progress)**
HYD.S **Hydraulic System 2 pressure is below 140 bars or EP switch OFF**	**EP** **Reserve pump (EP) is active**
REG.O2 **N/A**	**5mn.O2** **5 minutes Oxygen remaining**
DSV **N/A**	**CONDIT** **N/A**
DOM **Damage to flight control surfaces or any system restricting flight envelope (*Domaine de vol*)**	**BECS** **Slats functionality compromised**
RPM **Turbine RPM abnormal**	**DECOL** **Take-Off *(Décollage)* configuration incorrect**

CAUTION PANEL

PELLE
Engine scoop functionality compromised

NIVEAU
Fuel remaining falls below 500 kg

BINGO
Fuel remaining falls below BINGO level

O2HA
N/A

CONF
FBW Gain switch is in incorrect position

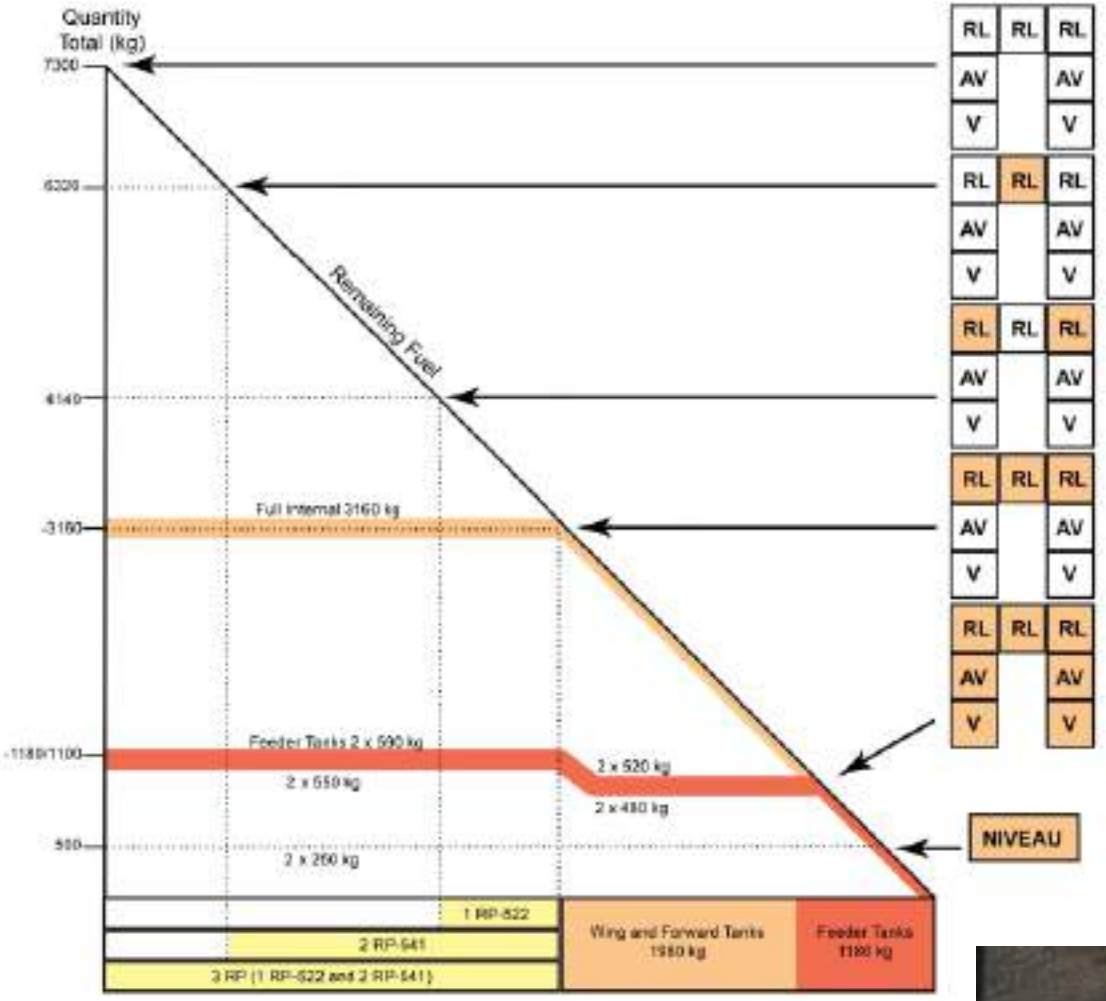
U.S.EL
LAST EMERGENCY enabled for elevons
(Ultime Secours Élevons)

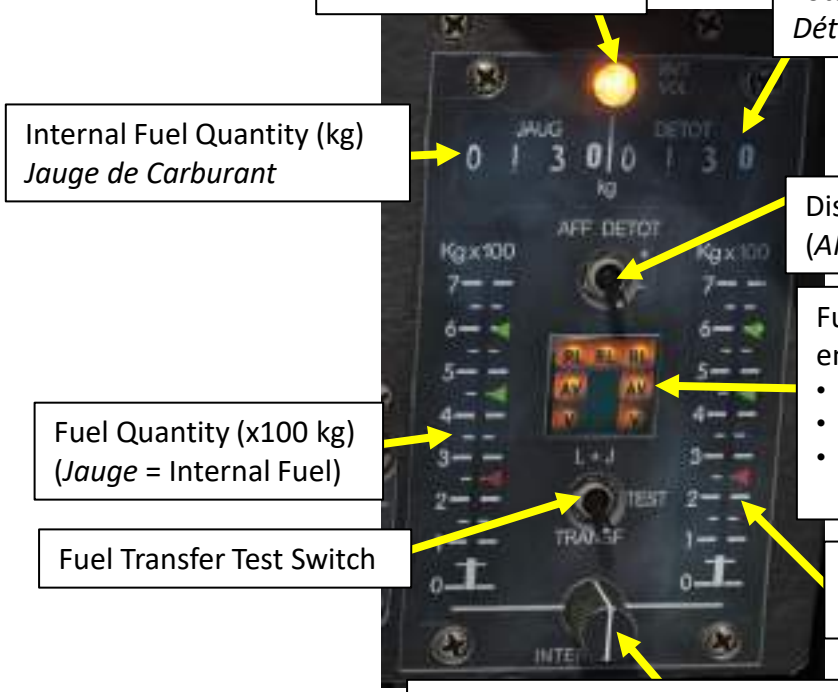
PARK.
Parking Brake Engaged

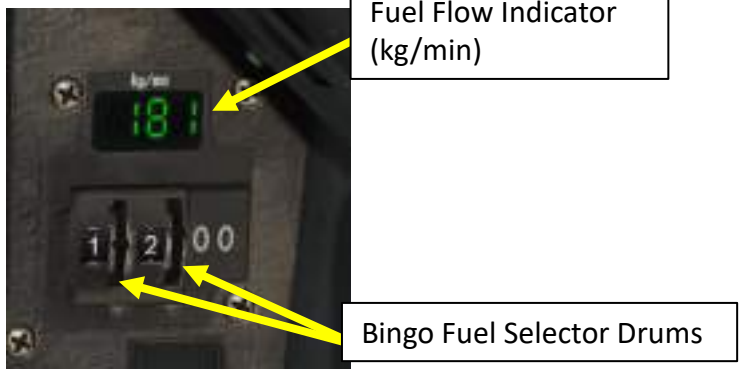
Fuel System

	Description	Kg	Lbs	US Gals	Liters
1	Right group forward tank	304.0	670.0	101.7	385.0
2	Right group wing tank	523.0	1154.0	175.0	662.5
3	Right group feeder tank	592.5	1306.0	198.1	750.0
4	Left group feeder tank	592.5	1306.0	198.1	750.0
5	Center tank	320.0	705.0	107.0	405.0
6	Left group forward tank	304.0	670.0	101.7	385.0
7	Left group wing tank	523.0	1154.0	175.0	662.5
	Total internal fuel	3160.0	6966.0	1056.6	4000.0
	RP-522 centerline tank	990.0	2182.6	343.4	1300.0
	Total internal + RP-522 fuel	4150.0	9146.6	1400	5260.0
	RP-541 wing tank (each)	1580.0	3482.3	528.6	1700.0
	Total internal + 3 ext. fuel	7310.0	16111.2	2457.2	8660.0

Fuel System


Quantity
Total (kg)
7300
6220
4140
3160
1180/1100
550
Remaining Fuel
Full internal 3160 kg
Feeder Tanks 2 x 590 kg
2 x 550 kg
2 x 520 kg
2 x 480 kg
2 x 260 kg
RL
AV
V
NIVEAU
1 RP-522
2 RP-541
3 RP (1 RP-522 and 2 RP-541)
Wing and Forward Tanks
1980 kg
Feeder Tanks
1180 kg

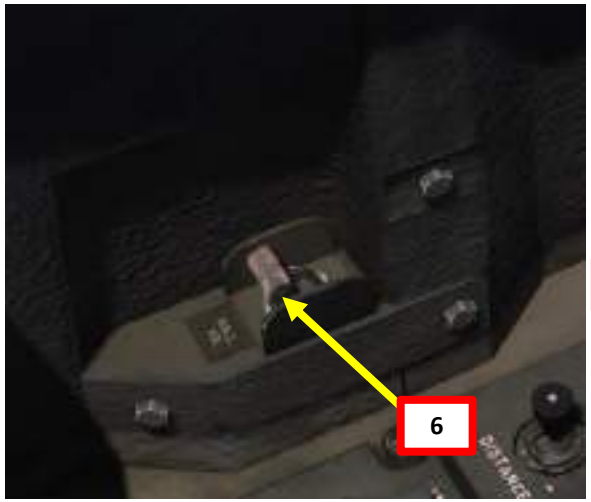

Air-Refueling Light
Ravitaillement de Vol
Total Fuel Quantity (kg)
Détotalisateur de Carburant
Internal Fuel Quantity (kg)
Jauge de Carburant
Display/Refresh Total Fuel switch
(*AFFICHER DÉTOTALISATEUR)*
Fuel Indicator Lights (lit when empty)
• V: Forward fuselage tanks (*Voilure*)
• AV: Wing fuel tanks (*Groupe Avant*)
• RL: External fuel tanks (*Réservoirs Largables*)
Fuel Quantity (x100 kg)
(*Jauge* = Internal Fuel)
Fuel Transfer Test Switch
Fuel Quantity (x100 kg)
(*Détotalisateur* = Total Fuel)
Internal Fuel Transfer Control (Fuel cross-feed in order to keep fuel level balanced for different fuel tanks)

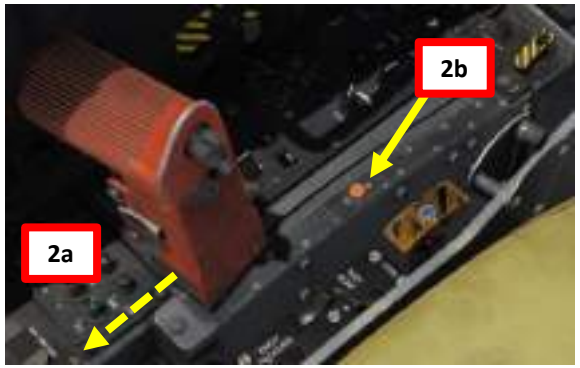

Fuel Flow Indicator
(kg/min)
Bingo Fuel Selector Drums

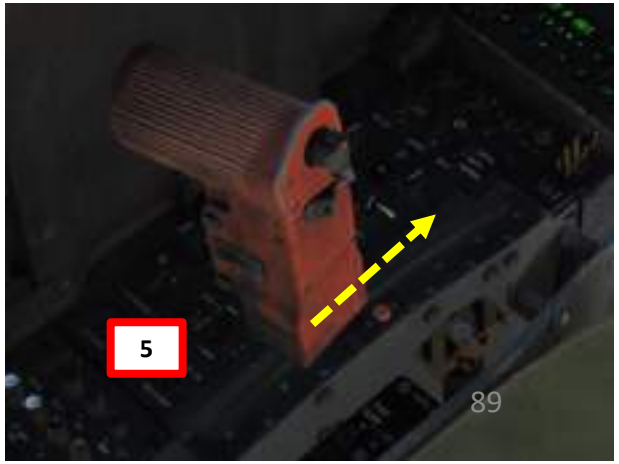

NIVEAU
BINGO

Engine Flameout – AIR ENGINE RESTART PROCEDURE

1. An engine flameout may occur if you are flying inverted for more than 15 seconds (engine will be starved of fuel because of gravity) or suffer an engine malfunction. You will notice a sudden loss in RPM, Tt7 and fuel flow.
2. Set throttle to IDLE (fully aft) and click the ENGINE SHUTDOWN button to set throttle to OFF position. Ensure that ignition switch is set to either G or D.
3. Set the aircraft in a 20-degree dive to gain airspeed (until around 300 KIAS).
4. Once RPM (N) increases to 13 % due to windmilling (air flow drives compressor blades), set the ENGINE RELIGHT switch to ON (FWD).
5. Slowly push throttle forward until RPM reaches 50 % N1 or more.
6. When engine is relit, ENGINE RELIGHT switch will reset to OFF (AFT) by itself.
7. Once RPM (N) has increased to approx. 54 %, move throttle forward and pull up to recover from the dive.

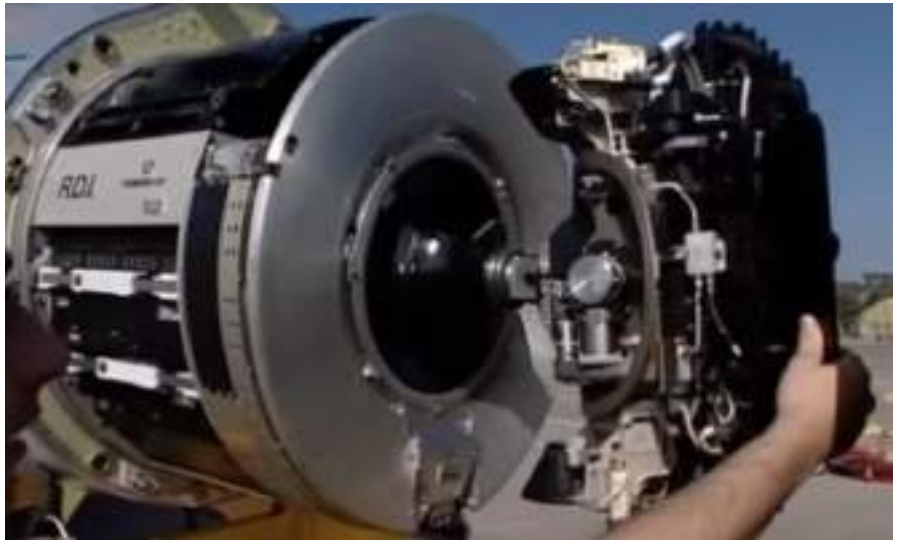






RDI RADAR - INTRODUCTION

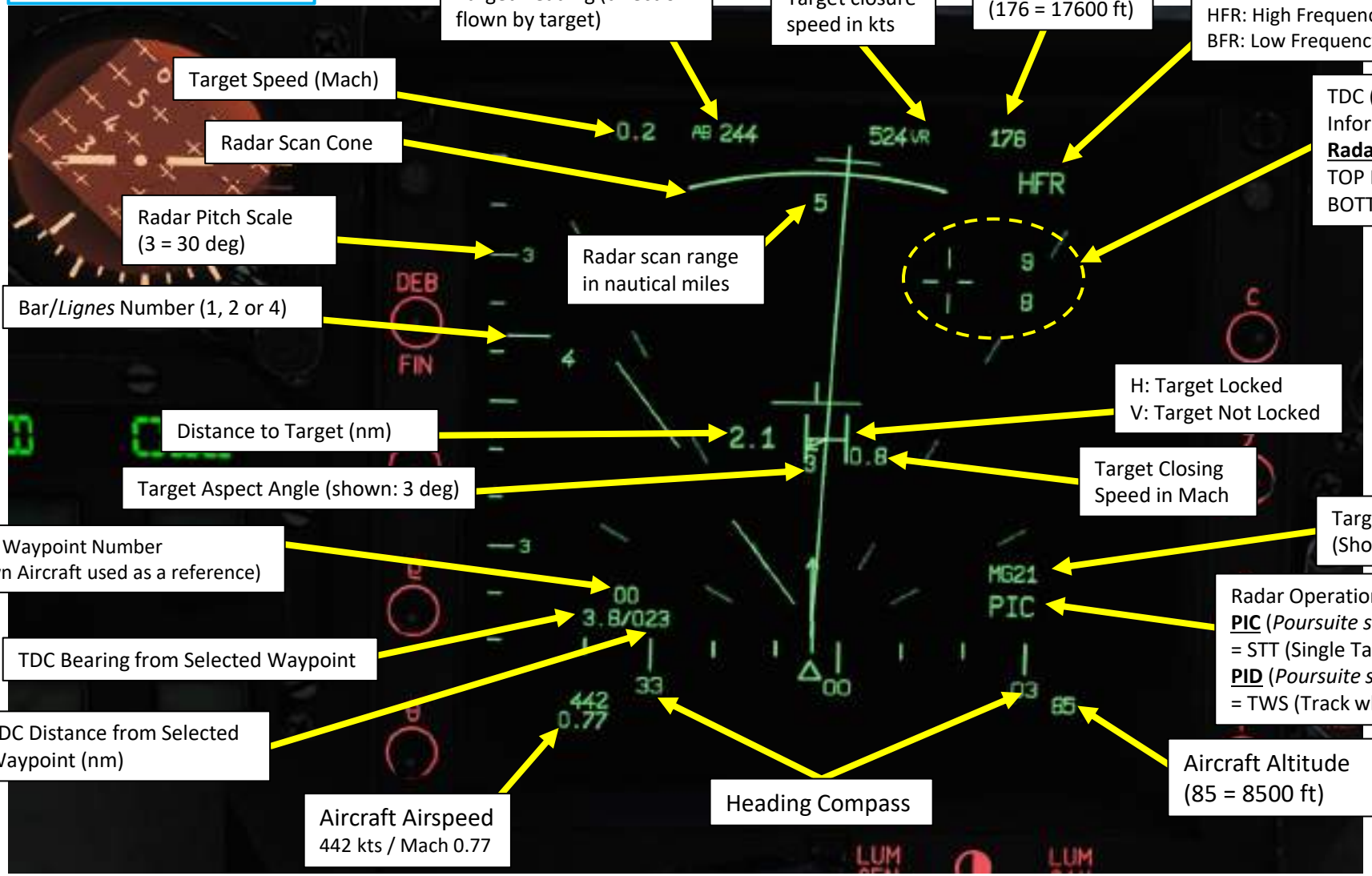
The radar installed on the Mirage 2000C is the RDI (*Radar Doppler à Impulsions*) developed by Thomson-CSF (now known as Thales).



RDI RADAR - DISPLAY

The picture below shows the VTB (*Visualisation Tête-Basse* = Heads-Down Display) Radar Screen in PPI display mode. Take note that the **PIC** (*Poursuite sur Information Continue*) mode, also known as **STT** (Single Target Track), is active on this screenshot.

PIC (STT) Mode



- Target Heading (direction flown by target)
- Target closure speed in kts
- Target altitude (176 = 17600 ft)
- Pulse Repetition Frequency
  ENT: Interleaved
  HFR: High Frequency
  BFR: Low Frequency
- Target Speed (Mach)
- Radar Scan Cone
- TDC (Target Designation Caret) Information
  Radar Cone Altitudes
  TOP RIGHT: 9 = 9000 ft
  BOTTOM RIGHT: 8 = 8000 ft
- Radar Pitch Scale (3 = 30 deg)
- Radar scan range in nautical miles
- Bar/*Lignes* Number (1, 2 or 4)
- H: Target Locked
  V: Target Not Locked
- Distance to Target (nm)
- Target Closing Speed in Mach
- Target Aspect Angle (shown: 3 deg)
- Target Type (Shown: MiG-21)
- Selected Waypoint Number (00 = Own Aircraft used as a reference)
- Radar Operation Mode
  PIC (*Poursuite sur Information Continue*) = STT (Single Target Track)
  PID (*Poursuite sur Information Discontinue*) = TWS (Track while scan)
- TDC Bearing from Selected Waypoint
- TDC Distance from Selected Waypoint (nm)
- Aircraft Altitude (85 = 8500 ft)
- Aircraft Airspeed
  442 kts / Mach 0.77
- Heading Compass

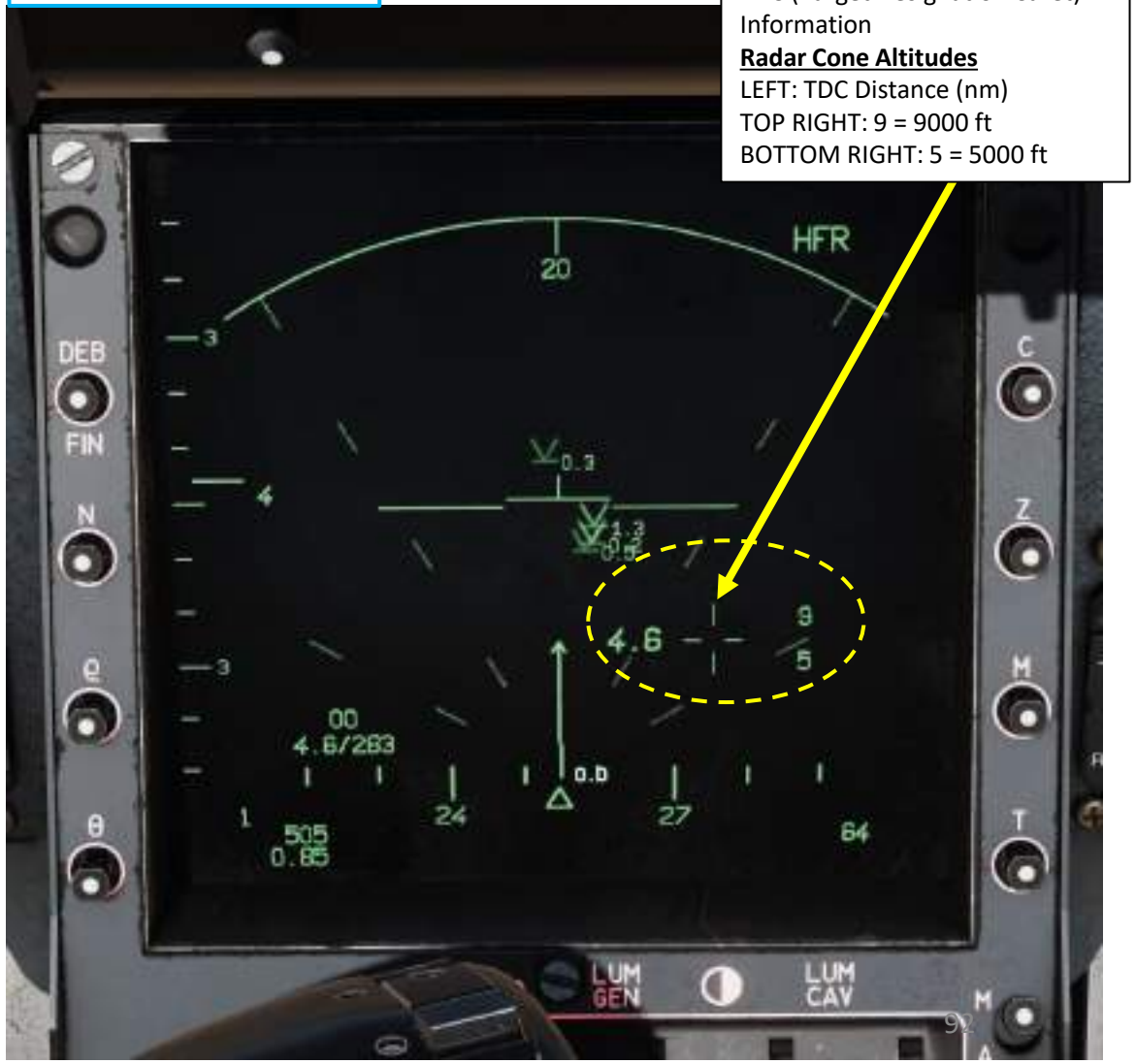
RDI RADAR - DISPLAY

The picture below shows the VTB (*Visualisation Tête-Basse* = Heads-Down Display) Radar Screen in PPI display mode. Take note that the **PID** (*Poursuite sur Information Discontinue*) mode, also known as **TWS** (Track while scan), is active on the left screenshot, while **RWS** (Range While Search) mode is active on the right screenshot.

PID (TWS) Mode

TDC (Target Designation Caret) Information
Radar Cone Altitudes
TOP RIGHT: 12 = 12000 ft
BOTTOM RIGHT: 7 = 7000 ft

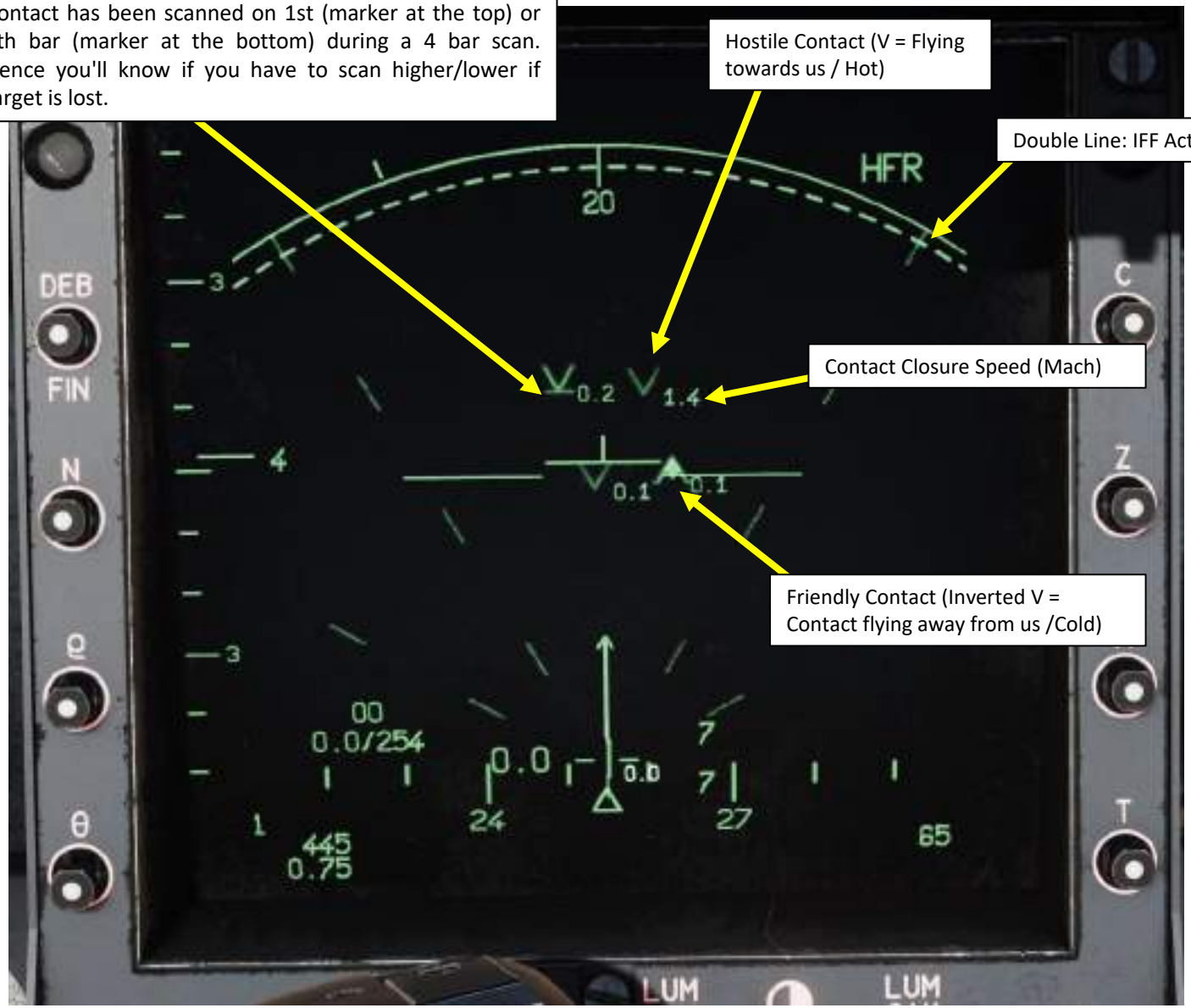
RWS Mode



TDC (Target Designation Caret) Information
Radar Cone Altitudes
LEFT: TDC Distance (nm)
TOP RIGHT: 9 = 9000 ft
BOTTOM RIGHT: 5 = 5000 ft

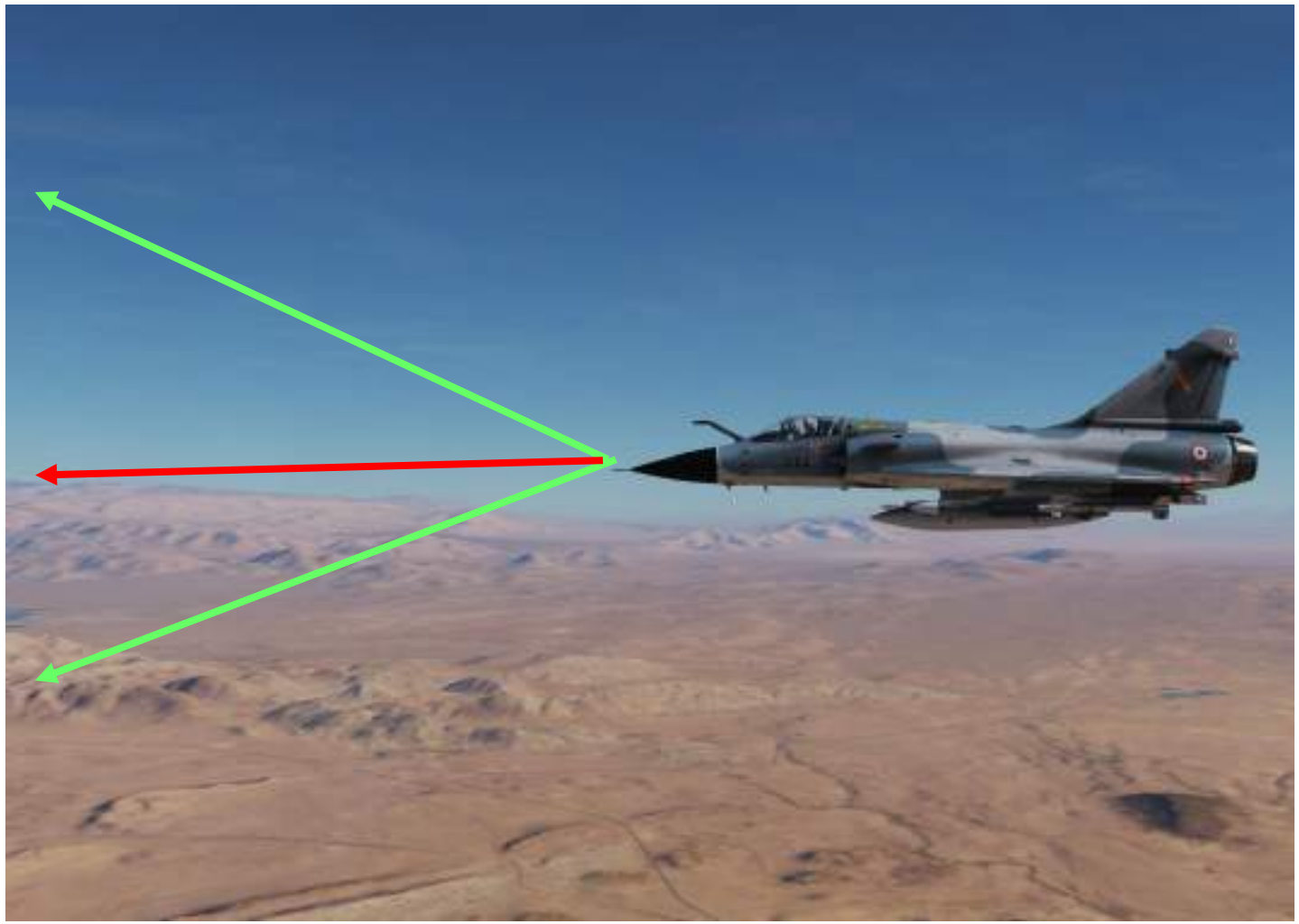
RDI RADAR - DISPLAY

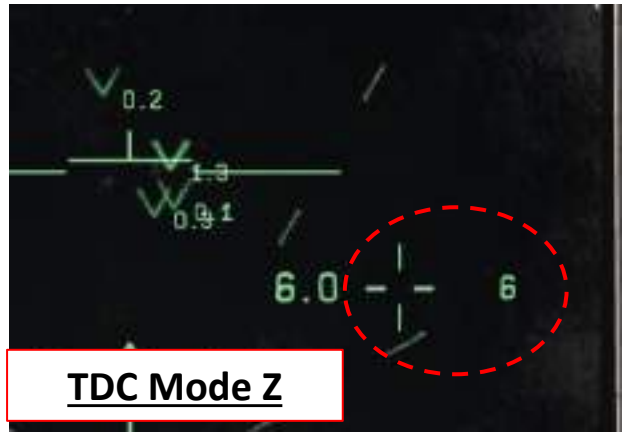
Lower Bar Marker:
Contact has been scanned on 1st (marker at the top) or 4th bar (marker at the bottom) during a 4 bar scan. Hence you'll know if you have to scan higher/lower if target is lost.



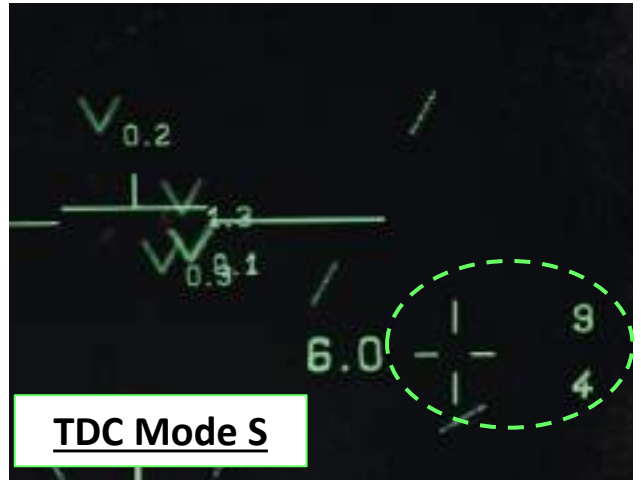
RDI RADAR - DISPLAY

Radar TDC (Target Designation Caret) Mode
- Mode S: Radar Cone Minimum and Maximum Altitudes are displayed next to TDC (x1000 ft)
- Mode Z: Radar Cone Center Altitude is displayed next to TDC (x1000 ft)





TDC Mode Z

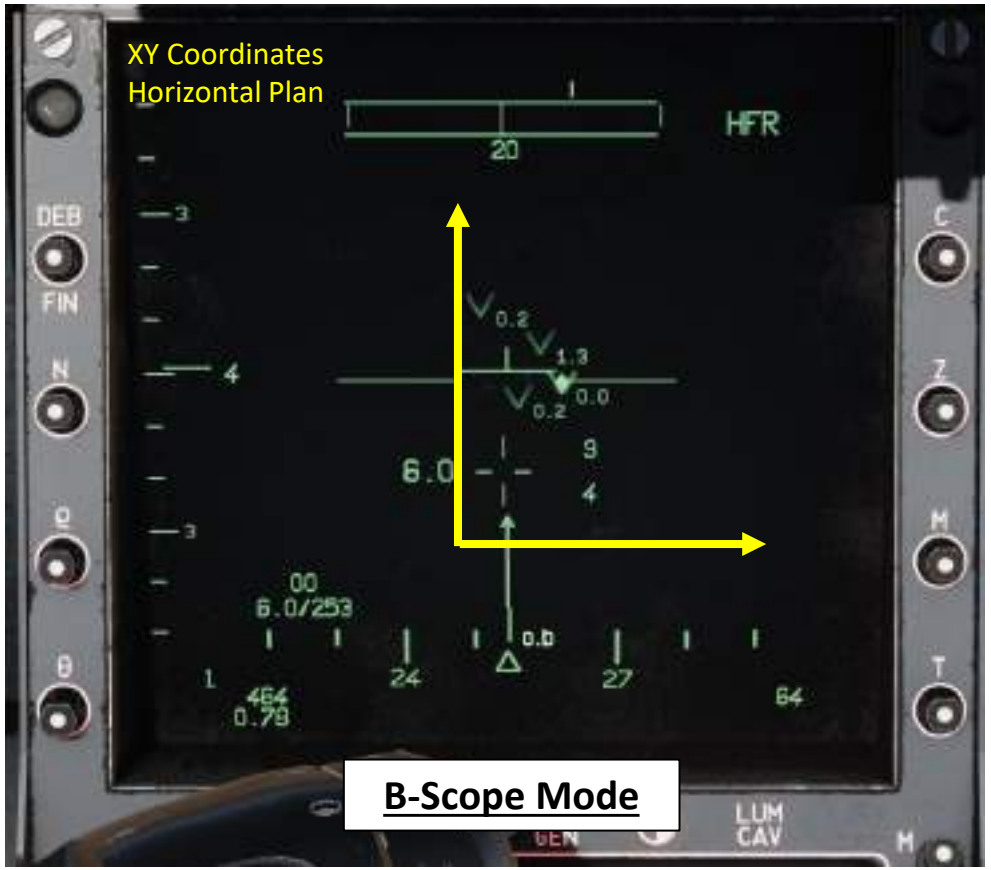


TDC Mode S

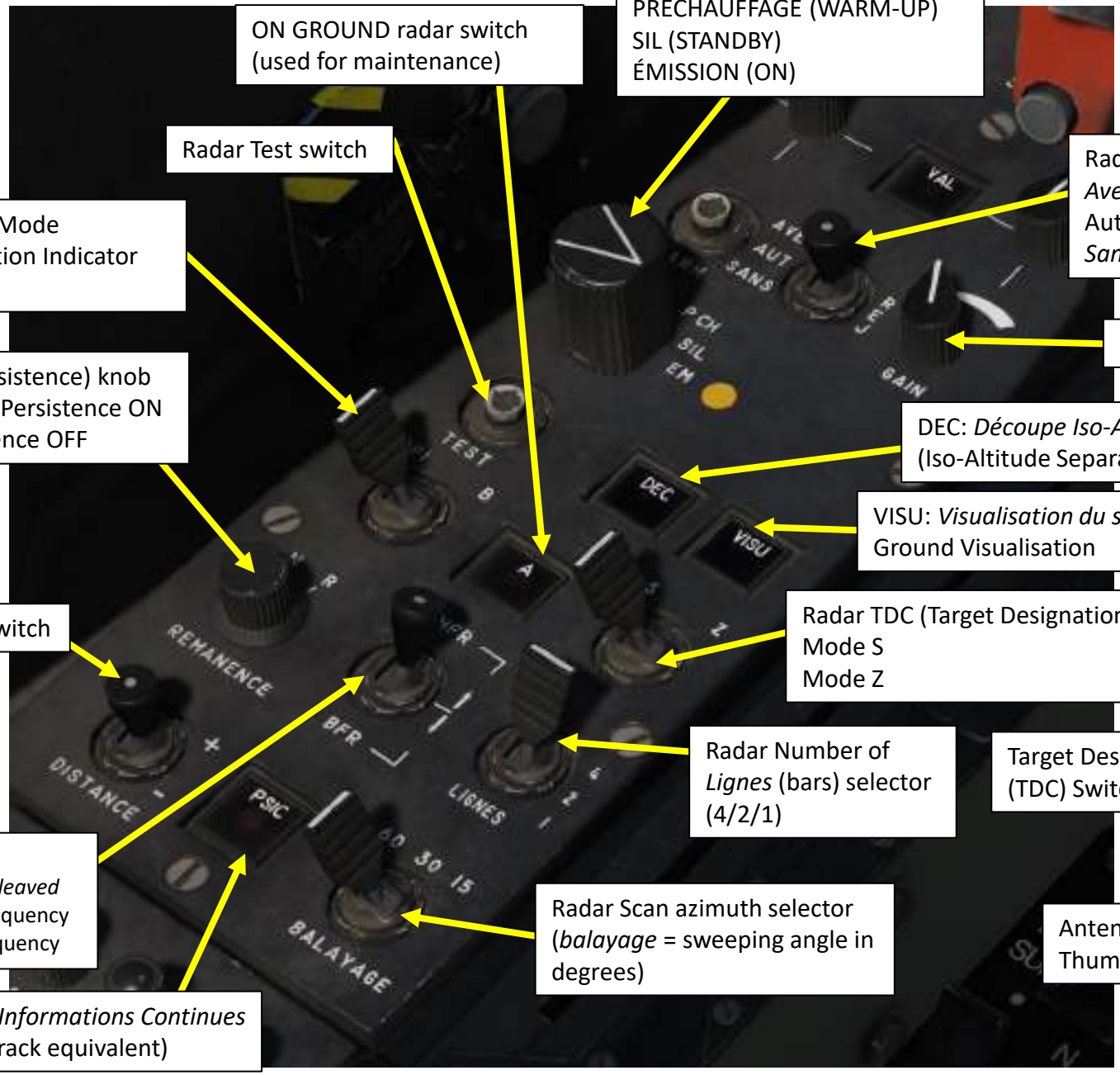
RADAR DISPLAY MODES

The RDI radar has two display modes: PPI (Plan Position Indicator) and B-Scope.

- PPI is typically used on the Su-27 and shows a polar view of the radar.
- B-Scope is typically used on US fighters like the F-15 and shows a 2-D top down representation of a X-Y axis grid space.



RDI RADAR CONTROLS



Radar Power Switch
OFF
PRÉCHAUFFAGE (WARM-UP)
SIL (STANDBY)
ÉMISSION (ON)

ON GROUND radar switch
(used for maintenance)

Radar Test switch

Radar Doppler Reject selector
Avec: With
Automatic
Sans: Without

Radar Display Mode
PPI: Plan Position Indicator
B: B-Scan

Radar Gain Control

Rémanence (Persistence) knob
R=Rémanence = Persistence ON
N=*NON*=Persistence OFF

DEC: *Découpe Iso-Altitude*
(Iso-Altitude Separation)

VISU: *Visualisation du sol*
Ground Visualisation

Radar Range switch

Radar TDC (Target Designation Caret) Mode
Mode S
Mode Z

Radar Number of *Lignes* (bars) selector (4/2/1)

Target Designator Caret (TDC) Switch

Radar Mode
ENT: *Entrelacé/Interleaved*
HFR: *Haute*/High Frequency
BFR: *Basse*/Low Frequency

Radar Scan azimuth selector (*balayage* = sweeping angle in degrees)

Antenna Elevation Thumbwheel

PSIC*: Poursuite Sur Informations Continues*
(STT Single Target Track equivalent)

MY RADAR CONTROL SETUP

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

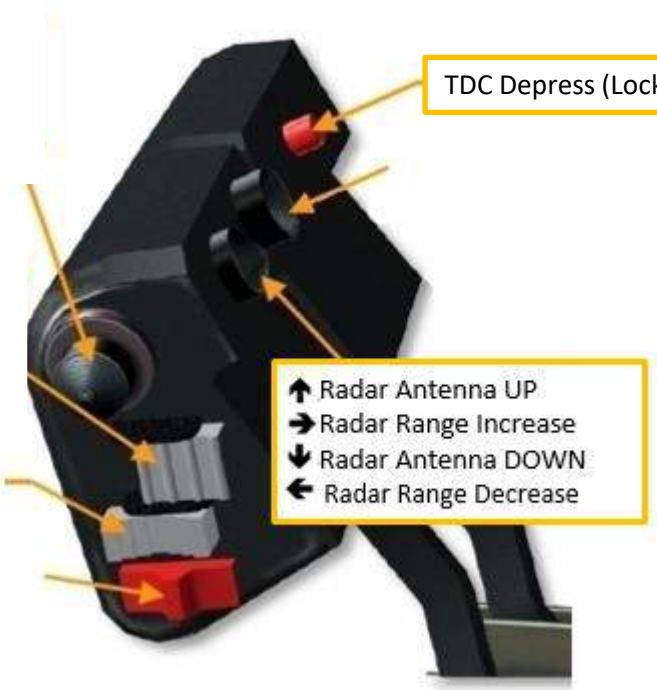
↑
→ STT/TWS Toggle
↓
← Weapons System CMD DEPRESS

↑ Weapons System CMD FWD
→
↓ Weapons System CMD AFT
←
P

Nosewheel Steering Btn
IFF Interrogator

Target Designator Caret (TDC) Switch

Antenna Elevation Thumbwheel



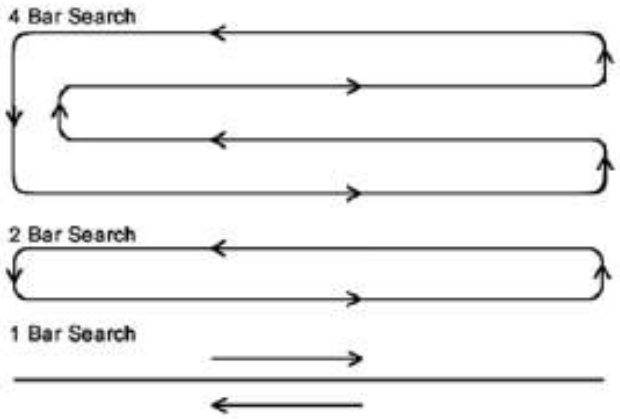
TDC Depress (Lock Target)

↑ Radar Antenna UP
→ Radar Range Increase
↓ Radar Antenna DOWN
← Radar Range Decrease

RADAR PERFORMANCE

The RDI radar has a range of 80 nautical miles, a horizontal arc of 120 degrees and a vertical arc of 120 degrees. You can also control the radar scan pattern (*Lignes*=bars). As you can see in the image below, while the RDI radar manages to cover the entire horizontal arc with the 60 deg azimuth aperture, in the vertical it barely manages to cover 12 degrees out of the 120 deg arc. It is very possible that your radar will not detect contacts that are far and higher or lower than you.

RDI Radar Search Patterns



Note: Each line represents a 3° diameter cone.

Figure 24 RDI radar antenna search pattern.

RDI Radar Apertures

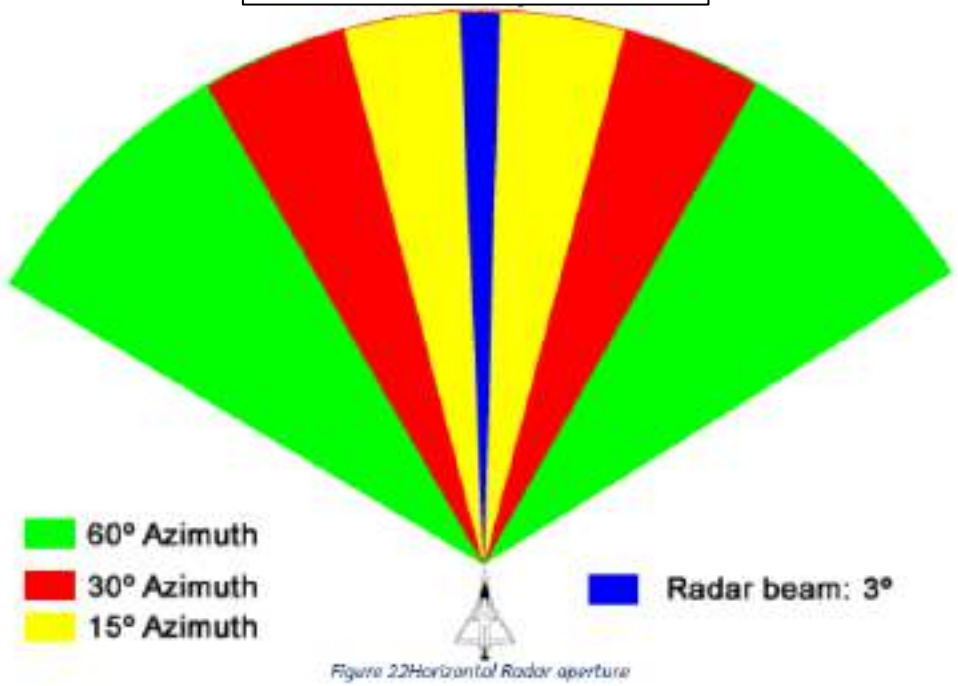


Figure 22Horizontal Radar aperture

Radar Cone Angle on Elevation

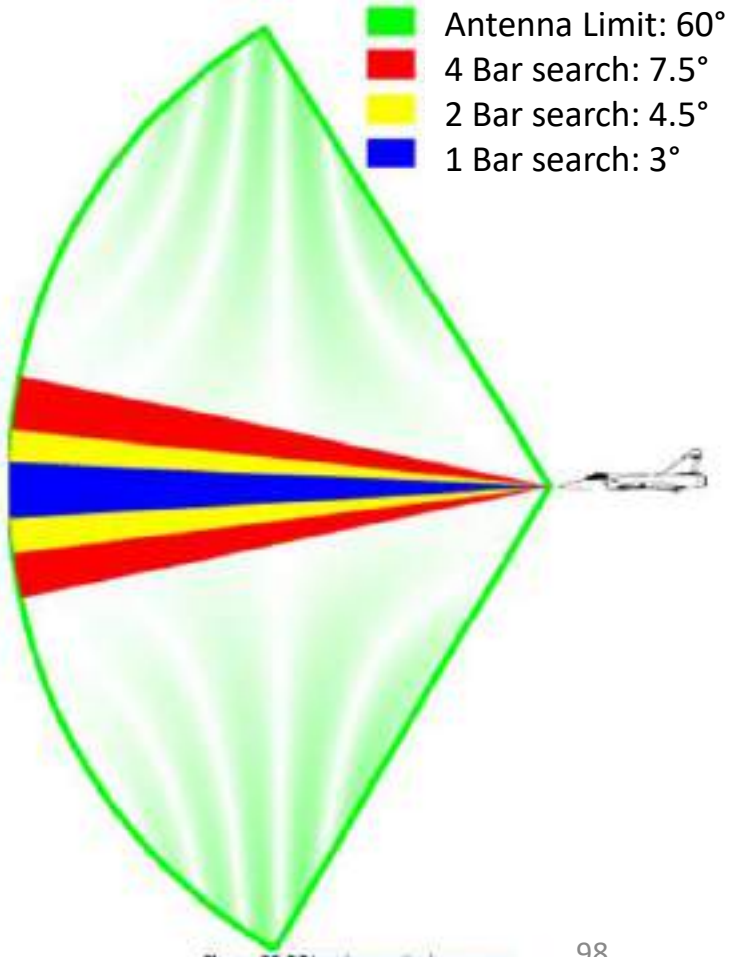
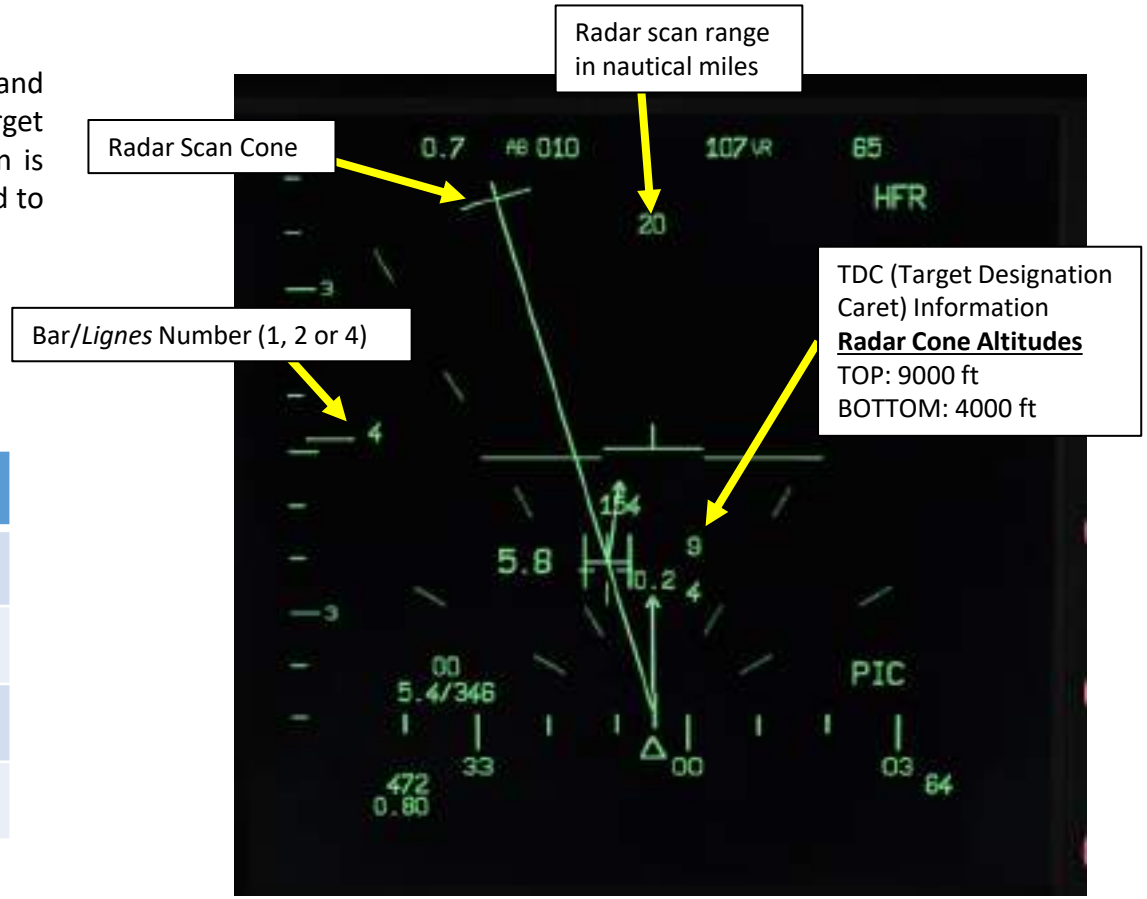


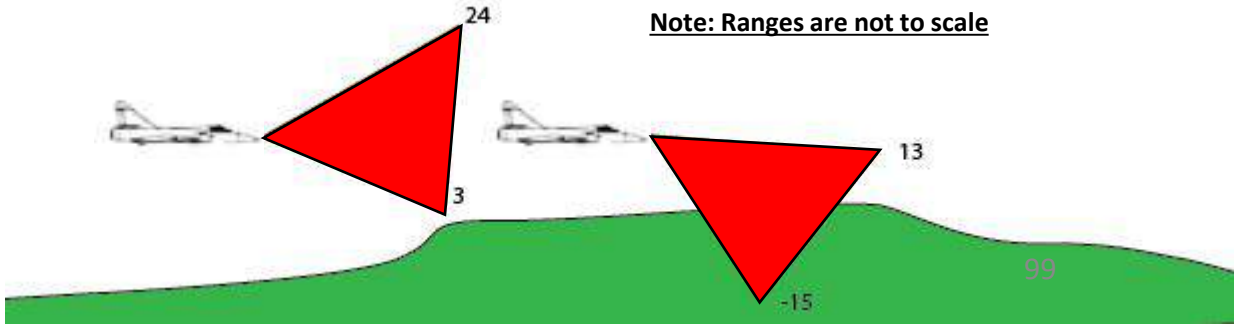
Figure 23 RDI radar vertical coverage

RADAR PERFORMANCE

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



Radar Mode	Max Ranges (nm)		Lock Type		Doppler
	Search	**Lock**	**TWS**	**STT**	**Filter**
High PRF	80	50	Yes	Yes	100 %
Interleaved PRF	45	20	Yes	No	50 %
Low PRF	25	N/A	No	No	0 %



RADAR POWER MODES

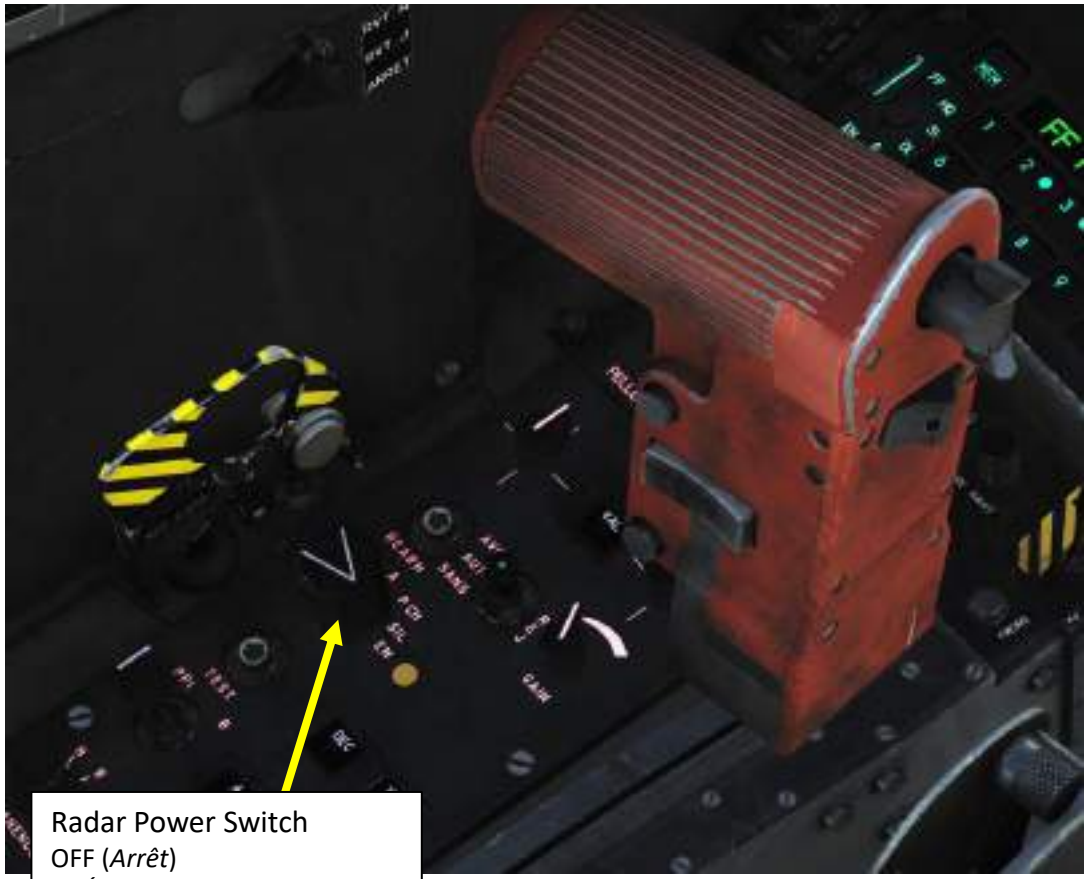
In practice, the radar requires a warm-up time of 3 minutes. There are four radar power modes: OFF, WARM-UP, STANDBY and EMIT.

OFF Mode

WARM-UP Mode

STANDBY Mode

EMISSION Mode



Radar Power Switch
OFF (*Arrêt*)
PRÉCHAUFFAGE (WARM-UP)
SIL (STANDBY)
ÉMISSION (ON - EMIT)

RADAR SCAN MODES
OVERVIEW

Normal Radar Modes

- RWS (Range While Search)
- PID/TWS (Track While Scan)
- PIC/STT (Single Target Track)

Visible on VTB (Heads-Down Display)

Special Close Combat Radar Modes

- Horizontal Modes – BAH
  – BA2
- Boresight Mode
- Vertical Mode
- HUD (SVI/Spirale) Mode
- Flood Mode

Visible on VTH (Heads-Up Display)

RADAR SCAN MODES
RWS VS **TWS** VS **STT**

RWS: stands for "Range While Search". The antenna follows the designated search pattern and informs you of all the tracks discovered in one sweep. One sweep meaning completing its search pattern as indicated by the bars selection. The RDI only provides the following information: range, azimuth and closing velocity in Mach number.

TWS: stands for "Track While Scan". The radar will provide you with more information specific to the locked track (heading, speed, altitude) but the antenna will move exactly as if it were in RWS mode in order to follow all the other unselected tracks. Because the antenna is moving away from the locked track, it is not possible to guide weapons in this mode. You will see PID *(Poursuite sur Informations Discontinues)* on your radar screen. When the radar is in TWS:

- The radar bar lines are set at 1.
- The radar antenna elevation does track the locked target elevation. This means that all other contacts not at the same elevation of the locked target will be lost.
- If the radar search arc is 30 or less, the radar will try to keep the locked target inside the search arc.
- While TWS is trying to get more information on the target, **it will sometimes intentionally lose target acquisition** in order to not flood the target (therefore avoiding telling the target is has been hard locked on its respective Radar Warning Receiver).

STT: stands for "Single Target Track". The radar dismisses all other tracks and redefines the locked track as weapons target. The antenna is locked to the position of the selected target in order to provide continuous tracking information to guide weapons. Be aware that while you can engage bandits in this mode, you are also blind to the other bandits in the area. You will see PIC (Poursuite sur Informations Continues) on your radar screen.

RWS (Range While Search)

↓ *Press TDC switch DEPRESSED to Radar Lock once TDC is on a target. Mode will switch from RWS to PID/TWS.*

PID/TWS (Track While Scan)

↕ *Press STT/TWS Toggle switch to switch mode from PID/TWS to PIC/STT.*

PIC/STT (Single Target Track)

↓ *Press Weapons System CMD Switch DEPRESSED*

Radar Unlock (if desired)

RADAR SCAN MODES
RWS VS **TWS** VS **STT**

In conclusion:

- If you scan your radar normally and haven't locked any contact, you will be in **RWS** mode. You will see everyone on your radar, but your missile will not track anything.
- If you have locked a contact ONCE, you will be in **TWS** mode. You will see everyone on your radar, but your missile will not track anything.
- If you have locked a contact ONCE, and locked it AGAIN, you will be in **STT** mode. You will only see one target on your radar, but your missile will track the target you have locked.

RADAR IN RWS (Range While Search) MODE
No target locked
All targets visible, ranged and scanned

RADAR IN TWS (Track While Scan)/PID MODE
One target locked
All targets visible, ranged and scanned

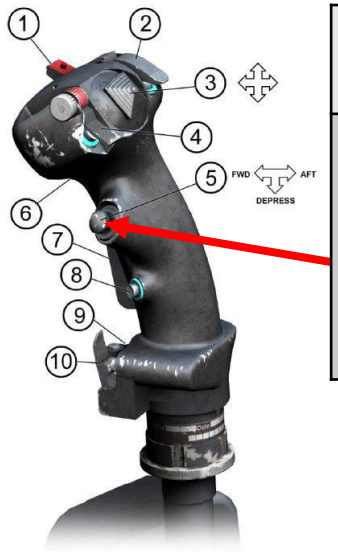
RADAR IN STT (Single Target Track)/PIC MODE
One target locked
Only locked target is visible, ranged and scanned

RADAR SPECIAL CLOSE COMBAT MODES:
BORESIGHT

BORESIGHT scan: Cages the radar antenna looking at the front of the aircraft in line with the waterline. Basically, you get a 3 degree search cone. This is the narrowest search pattern and it just turns the RDI into a gunnery radar.

- **HOW TO:**
  a) If the Super 530D is selected (Quick Weapon Select switch set to NEUTRAL/CENTER and 530 switch on the PCA is engaged), pressing the Weapons System CMD switch FWD will toggle between BORESIGHT and SVI (HUD *Spirale Viseur* Scan) mode.
  b) If Air-to-Air Cannon, POL (Police) or a Magic II missile is selected, pressing the Weapons System CMD switch FWD will toggle between this BORESIGHT and and Vertical mode.
- The radar will be set at a range of 10 nautical miles and it will automatically STT lock on the closest contact it can detect.

RADAR IN BORESIGHT SPECIAL MODE



Weapons System CMD Switch FWD/AFT/DEPRESSED

In air-to-air mode (AA weapon selected):
- FWD: toggles between boresight and vertical (or HUD SVI) radar modes.
- DEPRESSED: Unlock Target

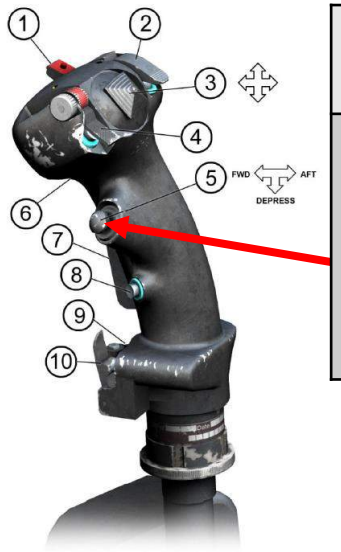
In air-to-ground mode (A/G weapon selected):
- FWD: sets HUD in air-to-ground Mode

Quick Weapon Select Switch
- **LEFT: CNM AA Gun Select**
- **CENTER: CNM Neutral (PCA Select)**
- **RIGHT: CNM Magic Select**

RADAR SPECIAL CLOSE COMBAT MODES:
VERTICAL

VERTICAL scan: The antenna moves vertically with 60 degrees elevation and 3 degrees of azimuth (the antenna does not move laterally on its own). The 60 degrees elevation provides coverage from -10 to +50 degrees. This mode is basically a specialized MAGIC II search mode, since it is usually used in conjunction with the MAGIC II missiles (or air-to-air cannon) by slaving their seekers to the antenna.

- **HOW TO:**
  - While Magic II is selected (Quick Weapon Select switch set to MAGIC SELECT/RIGHT), press Weapons System CMD switch FWD to toggle between this mode and Boresight mode.
- The radar will be set at a range of 10 nautical miles and it will automatically STT lock on the closest contact it can detect.

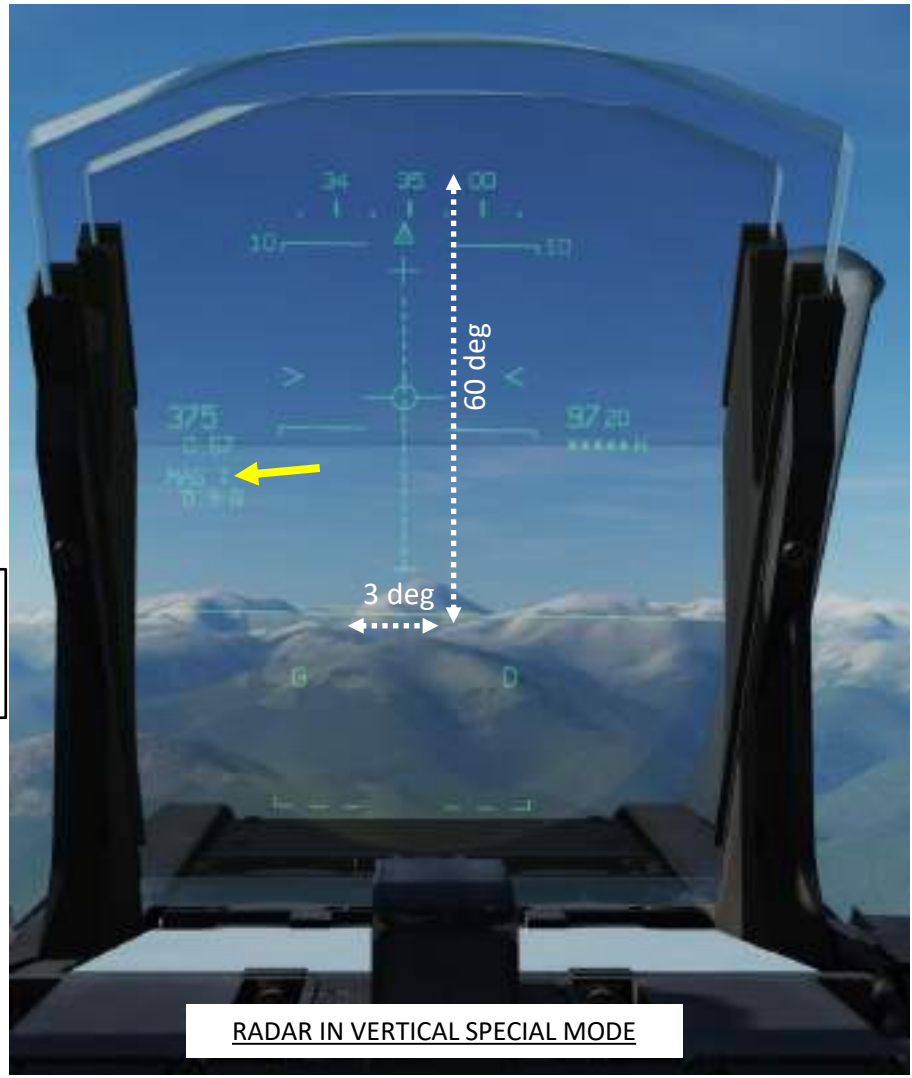


Weapons System CMD Switch FWD/AFT/DEPRESSED

In air-to-air mode (Magic II/AA Cannon selected):
- FWD: toggles between boresight and vertical radar modes.
- DEPRESSED: Unlock Target

In air-to-ground mode (A/G weapon selected):
- FWD: sets HUD in air-to-ground Mode

Quick Weapon Select Switch
- **LEFT: CNM AA Gun Select**
- **CENTER: CNM Neutral (PCA Select)**
- **RIGHT: CNM Magic Select**

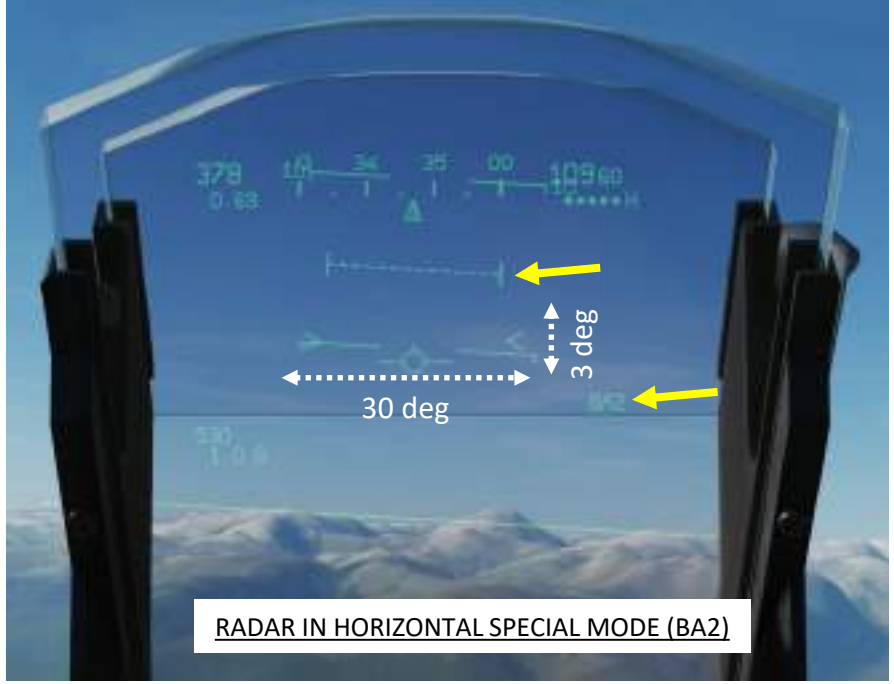


RADAR IN VERTICAL SPECIAL MODE

RADAR SPECIAL CLOSE COMBAT MODES:
HORIZONTAL

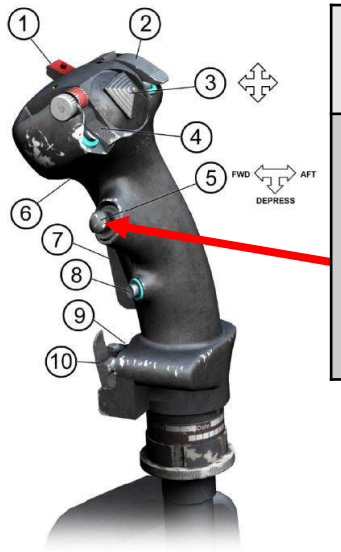
HORIZONTAL scan: Sets the radar at 15 degrees azimuth (30 degrees cone) and 1 bar (3 degrees aperture) search pattern. This is the fastest search pattern for the RDI. You have two sub-modes: **BA2** (uses **MPRF**, or Medium Pulse Repetition Frequency) and **BAH** (uses **HPRF** or High Pulse Repetition Frequency).

- **HOW TO**:
  - Horizontal modes are cycled by using the Weapons System CMD Switch AFT
- The radar will be set at a range of 10 nautical miles and it will automatically STT lock on the closest contact it can detect.



RADAR IN HORIZONTAL SPECIAL MODE (BA2)

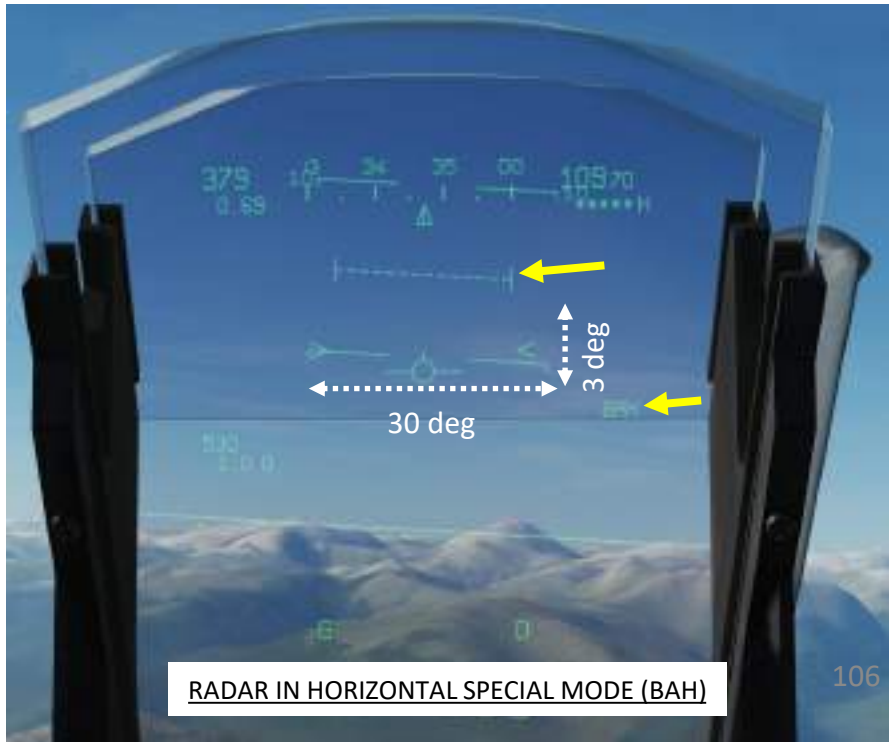
Link to know more about PRF: https://en.wikipedia.org/wiki/Pulse_repetition_frequency



Weapons System CMD Switch FWD/AFT/DEPRESSED

In air-to-air mode (AA weapon selected):
- AFT: toggles between Horizontal BAH and BA2 modes
- DEPRESSED: Unlock Target

In air-to-ground mode (A/G weapon selected):
- FWD: sets HUD in air-to-ground Mode

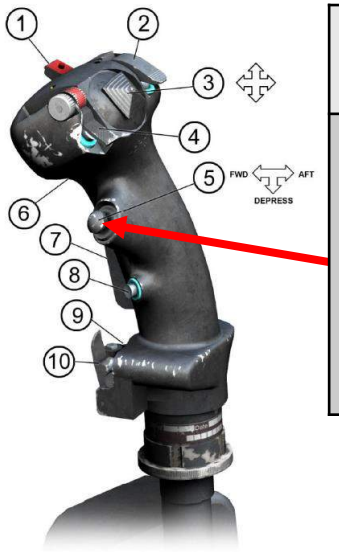


RADAR IN HORIZONTAL SPECIAL MODE (BAH)

RADAR SPECIAL CLOSE COMBAT MODES:
HUD SCAN (SPIRALE) - SUPER S530D MISSILE ONLY

HUD (SPIRALE) scan: HUD Scan is available only when the 530 or POL Master missiles have been selected. The radar covers the entire HUD area, a 20º wide cone. "SVI" (*Spirale Viseur*) label is displayed on right side of the HUD.

- **HOW TO**:
  - While Super S530D missile is selected, press Weapons System CMD switch FWD to select this mode
- The radar will be set at a range of 10 nautical miles and it will automatically STT lock on the closest contact it can detect.



Weapons System CMD Switch FWD/AFT/DEPRESSED

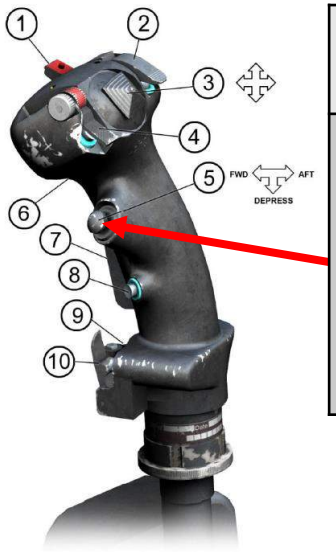
In air-to-air mode (Super S530D selected):
- FWD: activates HUD SVI mode
- DEPRESSED: Unlock Target
- AFT: toggles between Horizontal BAH and BA2 modes

In air-to-ground mode (A/G weapon selected):
- FWD: sets HUD in air-to-ground Mode

RADAR SPECIAL CLOSE COMBAT MODES:
FLOOD SCAN - SUPER S530D MISSILE ONLY

FLOOD scan: HUD FLOOD mode is only available after firing the Super 530 missile, to try to guide the missile on a target that succeeded to break your radar lock, by visually placing it inside a 3° circle in the middle of the HUD. “SVI” label is displayed on right side of the HUD

- HOW TO: While Super S530D missile is selected, press Weapons System CMD switch FWD to select SVI mode first, then fire the missile. Once missile is fired, SVI mode will automatically switch to FLOOD.



Weapons System CMD Switch FWD/AFT/DEPRESSED

In air-to-air mode (Super S530D selected):

- FWD: activates HUD SVI mode
- DEPRESSED: Unlock Target
- AFT: toggles between Horizontal BAH and BA2 modes

In air-to-ground mode (A/G weapon selected):

- FWD: sets HUD in air-to-ground Mode

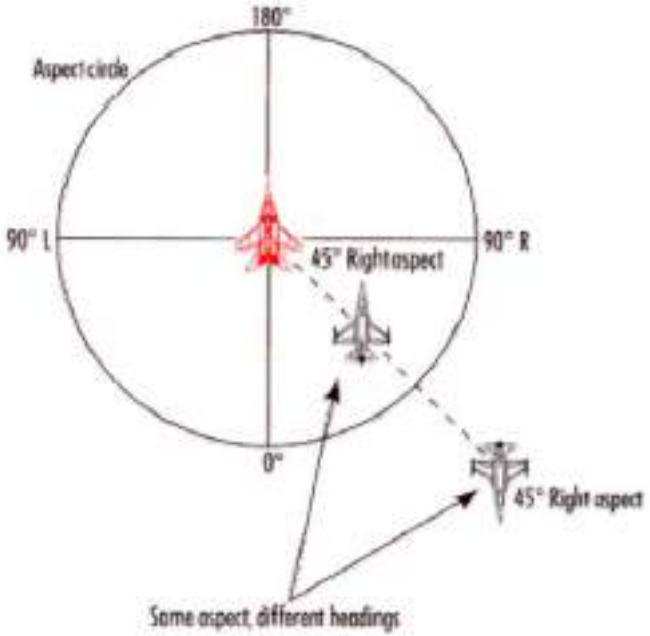
RADAR LOCK: TARGET ASPECT

During a radar lock, the VTB displays the Target Aspect Angle (TAA), while the VTH (HUD) displays the Aspect Angle (AA).

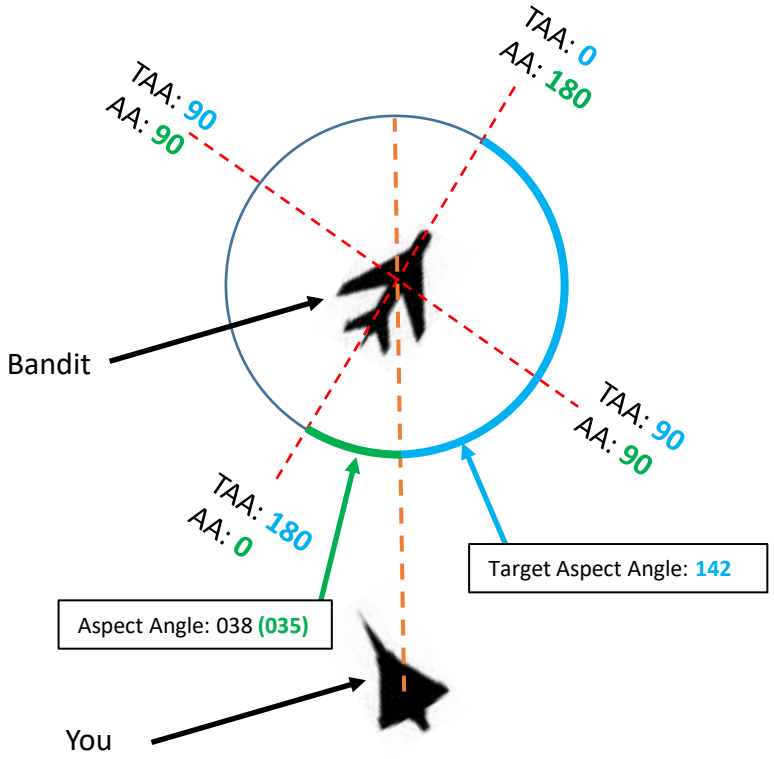
In this example:

- **035** (VTH) is the rounded Aspect Angle (AA) relative to the bandit's tail as 0 deg.
- **142** (VTB) is the Target Aspect Angle (TAA) relative to bandit nose as 0 deg.

TAA and AA refer to your position relative to a line from the bandit's tail to nose. The only difference between the two is that TAA (VTB) uses the nose as zero degrees reference, and AA (VTH) uses the tail as zero degrees reference. TAA is simply 180 minus the AA value.



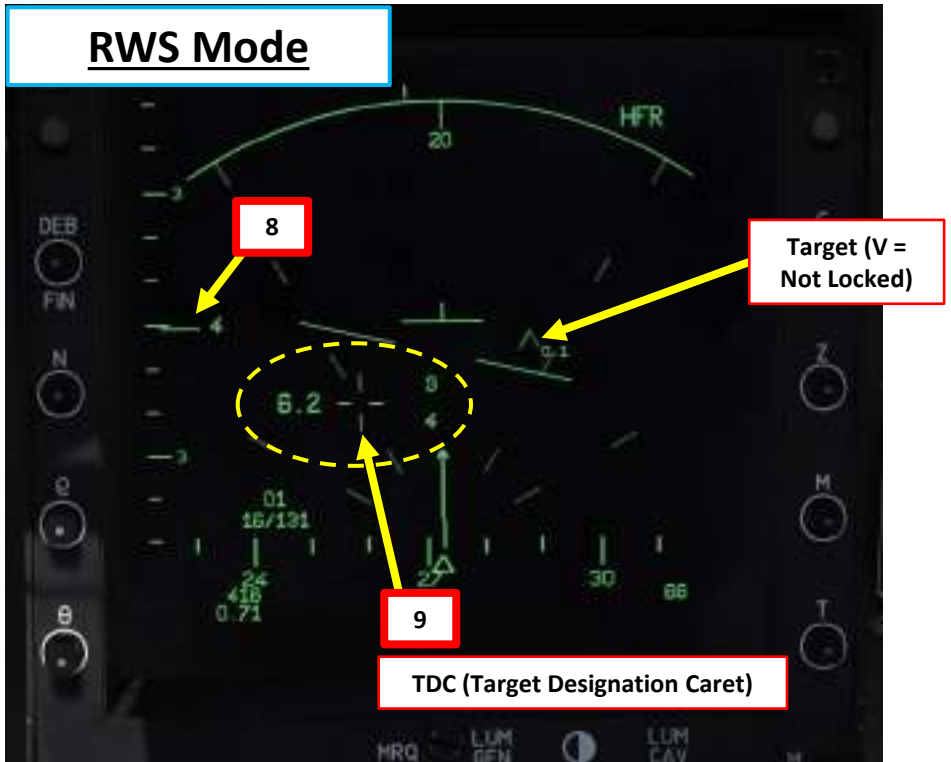
Aspect Angle Definition

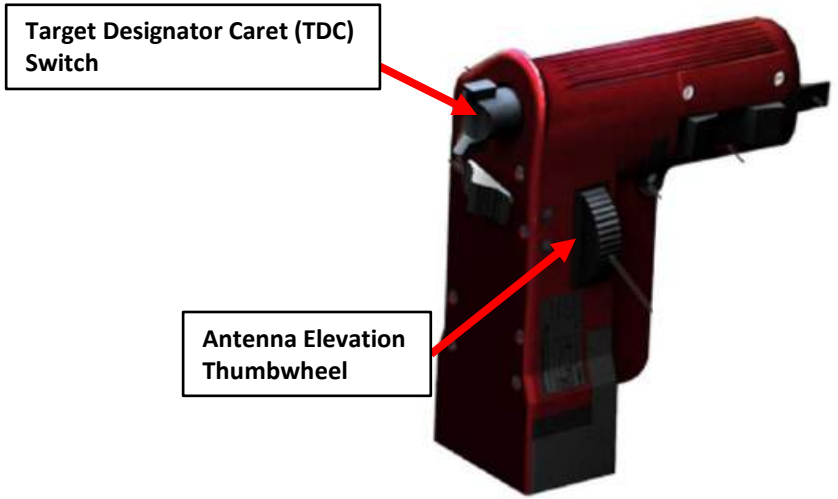


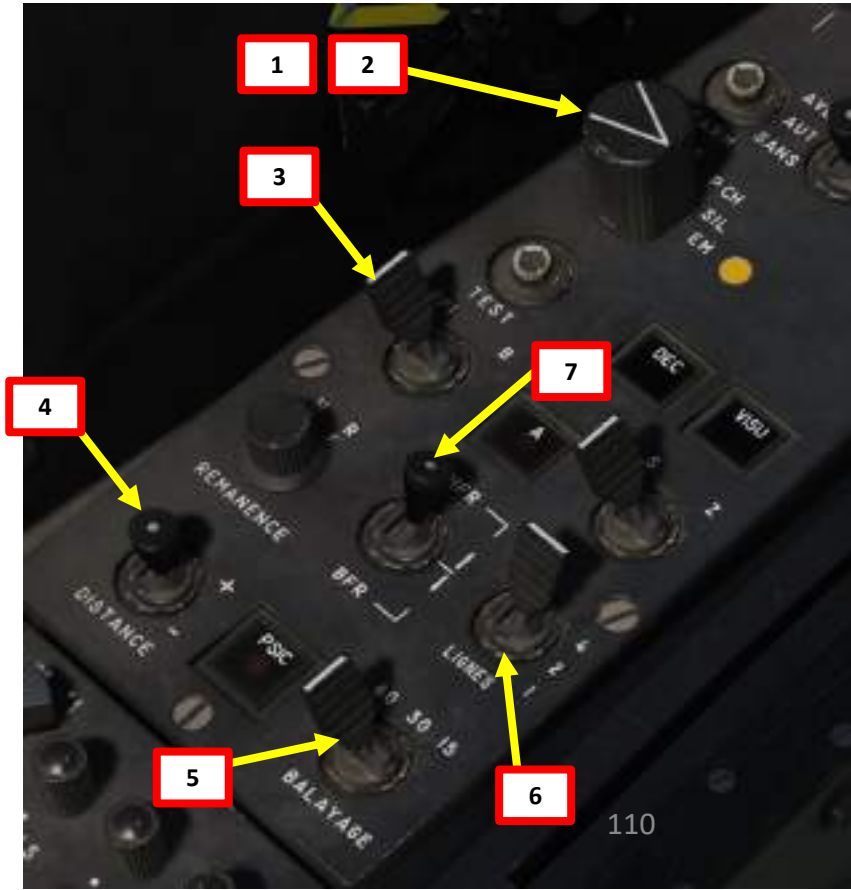
RADAR OPERATION TUTORIAL

This short tutorial will show you how to turn on your radar and lock a target.

1. ON GROUND: Set Radar Power switch to PCH (Warm-Up) for 3 minutes. “P” letter on the VTB screen will blink during warm-up phase. When “P” letter remains illuminated, this means warm-up is complete. Set Radar Power switch to SIL (Standby).
2. Set Radar Power switch to ***EM****ISSION* (ON).
3. Select desired Display Mode
   - I typically take PPI (personal preference)
4. Select desired radar scan range (*distance*).
5. Select desired radar sweep angle (*balayage*).
6. Select desired radar scan pattern (*Lignes*).
   - Set to “4” to cover the biggest vertical volume. Scanning the whole region will be slower.
   - Set to “1” to cover the smallest vertical volume. Scanning the smaller region will be faster.
7. Select High Pulse Repetition Frequency (HFR) for maximal detection range available.
8. Move Radar Antenna UP or DOWN to scan desired airspace area.
9. Move TDC (target designation caret) over spotted contact on radar.
   - Default controls are I = UP, J=LEFT, L=RIGHT, K=DOWN







RADAR OPERATION TUTORIAL

10. Radar lock by using the TDC DEPRESSED control. Radar will enter TWS (Track While Scan, or PID) mode. If you press the STT/TWS Toggle button, you will switch from TWS to STT (Single Target Track, PIC) mode.
11. You now have a radar lock! Note: A square should also appear on your HUD on your locked target.
12. You can unlock target using the "Weapons System CMD DEPRESSED" switch.

PID (TWS) Mode

PIC (STT) Mode

RDI Doppler System Limitations

Doppler System

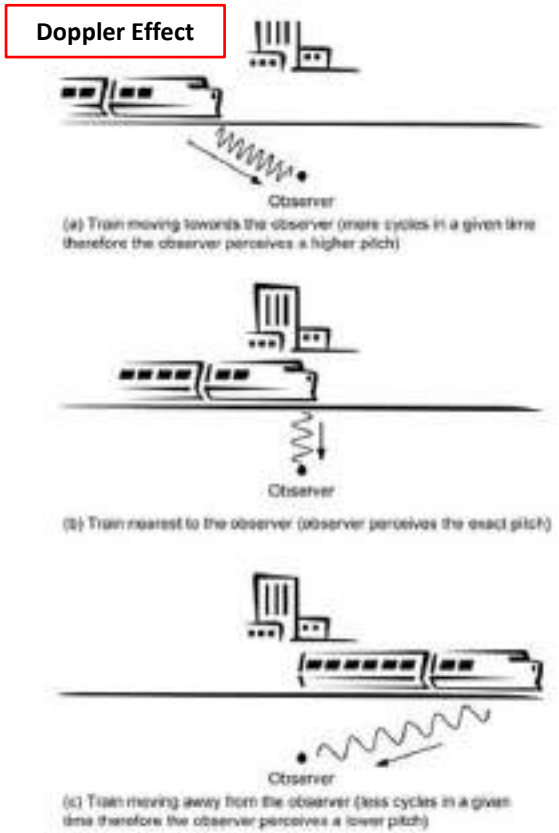
The RDI (*Radar Doppler à Impulsions*) Doppler radar has a number of limitations the pilot needs to work with.

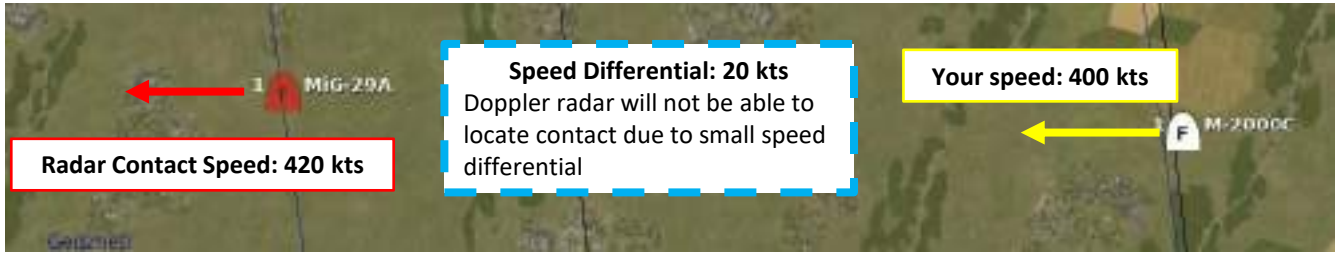
The **Doppler Effect** is probably that boring phenomenon you heard about in high school and didn't care about at the time. Basically, the Doppler Effect is the reason why airplane fly-bys in airshows are so awesome to listen to: a moving object (like a plane) is emitting waves (like sound waves) that are received by an observer (you), and the frequency of this wave (like the sound pitch) will change the closer or farther the aircraft comes to you.

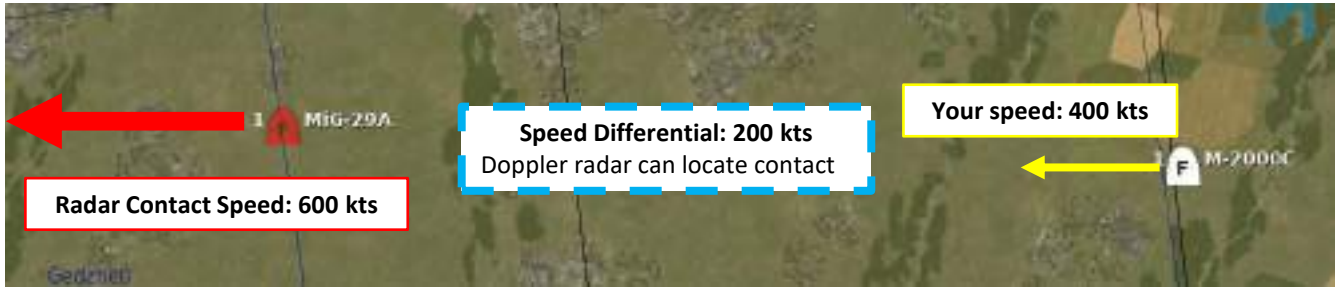
The received frequency is higher (compared to the emitted frequency) during the approach, it is identical at the instant of passing by, and it is lower during the recession. This variation of frequency also depends on the direction the wave source is moving with respect to the observer; it is maximum when the source is moving directly toward or away from the observer and diminishes with increasing angle between the direction of motion and the direction of the waves, until when the source is moving at right angles to the observer, there is no shift.

Where am I going with this? Well, the RDI radar is affected by the Doppler Effect. How? Hang on, I'm getting there.

The TLDR version is this: **A bogey will be more easily detected if there is a greater speed differential between you (radar emitter/observer) and this contact (moving object). If the speed differential between a radar contact and you is too small (less than approx. 50 kts), the radar will not be able to locate it.**







RDI Radar Scanning Pattern, Data Processing & Display

The Infamous Radar Contact Blink

The RDI radar simulated by RAZBAM has interesting intricacies, such as the fact that radar contacts "blink" on the VTB display. From a technical standpoint, there is a certain lag between:

1. The moment where the radar antenna swipes in its scanning pattern/circuit (which is a function of the Bar Search (*Lignes*) and the Azimuth (*Balayage*) settings selected)
2. The analog signal processing
3. The digital signal processing to the fire control system
4. … and the moment where the radar contact is displayed on the VTB display.

Using more bars and a greater azimuth range means a better coverage, but also a much longer scanning refresh time. These delays mean that depending on where the radar antenna is pointing at a certain time, a contact may or may not be displayed on the VTB since radar data isn't processed as a single group of contacts but four information sub-groups; one for each bar. This means that radar contacts will "blink" in "2 Bar" and "4 Bar" search patterns based on a number of factors, including differential speed, relative aspect, bar setting and azimuth setting.

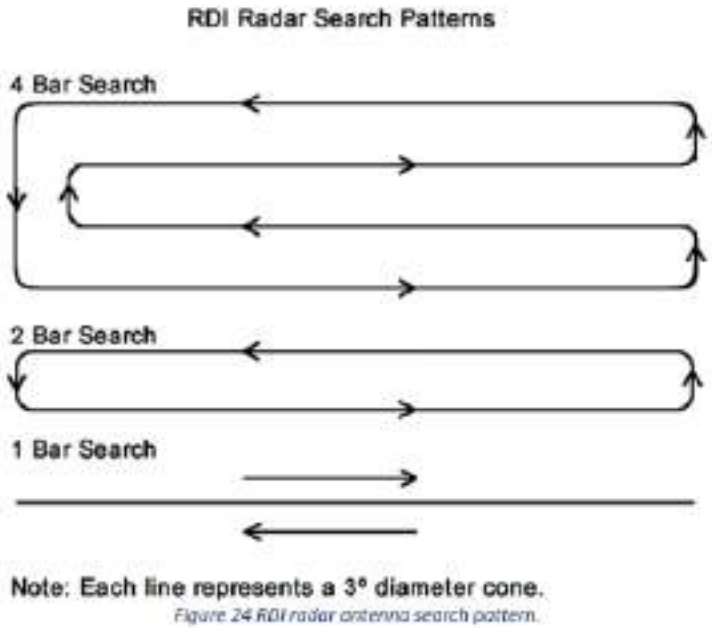


Figure 24 RDI radar antenna search pattern.

RDI Radar Scanning Pattern, Data Processing & Display

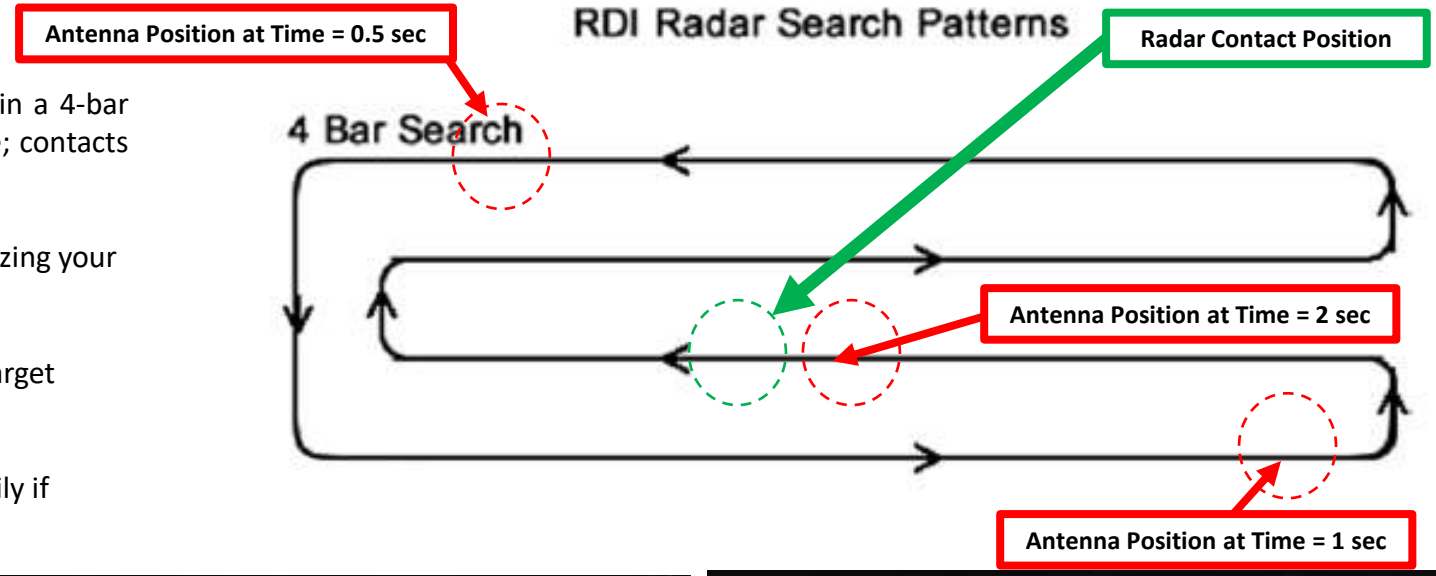
The Infamous Radar Contact Blink

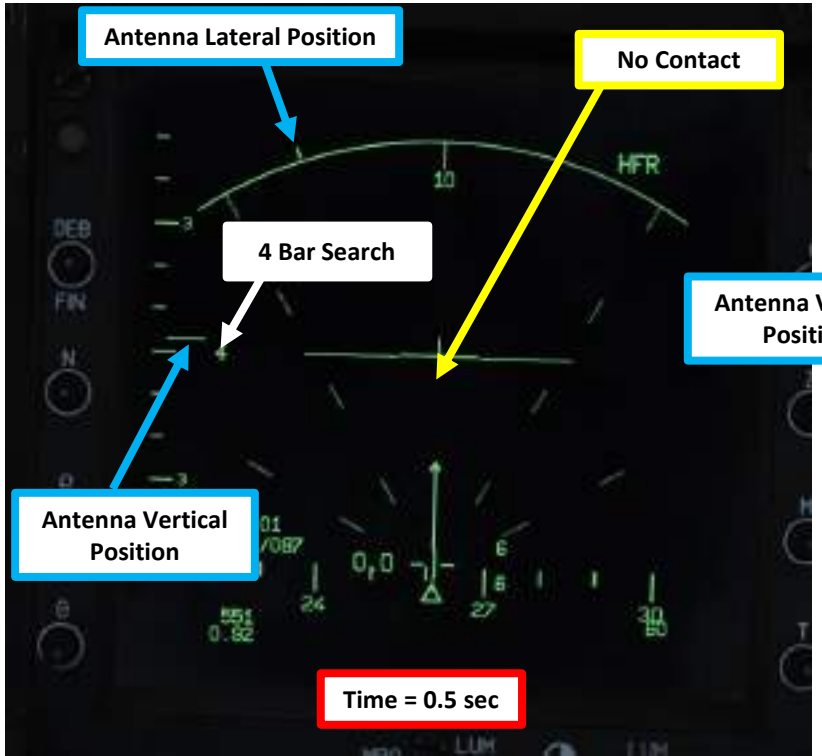
Here is an illustrative example of why the radar contacts "blink" in a 4-bar search pattern. The VTB screen is cleared at each new radar swipe; contacts are not memorized.

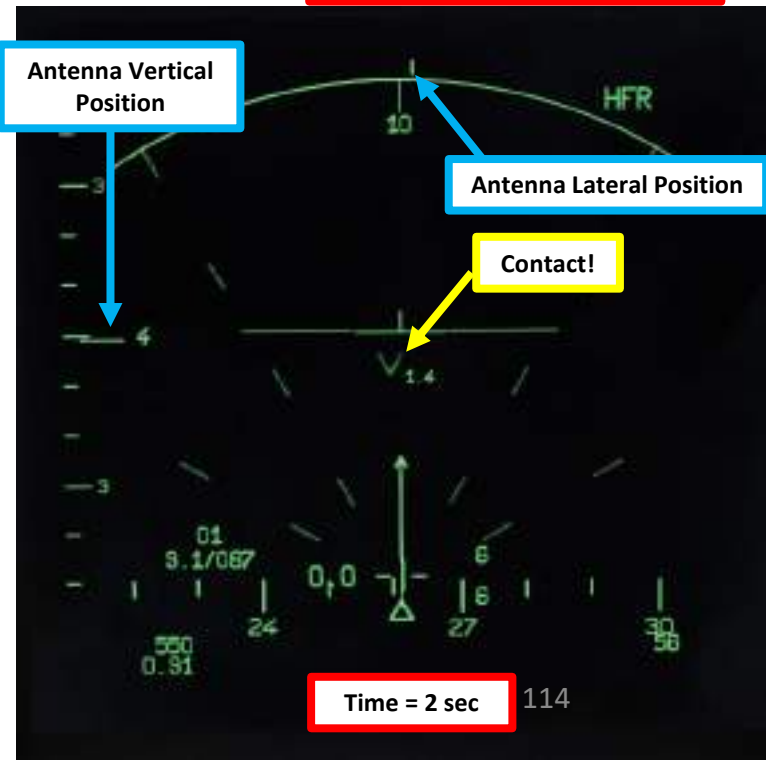
4-bar search patterns are best used for large searches while minimizing your own detection due to enemy radar warning receivers.

2-bar search patterns are best used when locking a target (Single Target Track) or using Track While Scan.

1-bar search pattern is optimal for radar locks but will lose lock easily if contact deviates rapidly from its initial position.





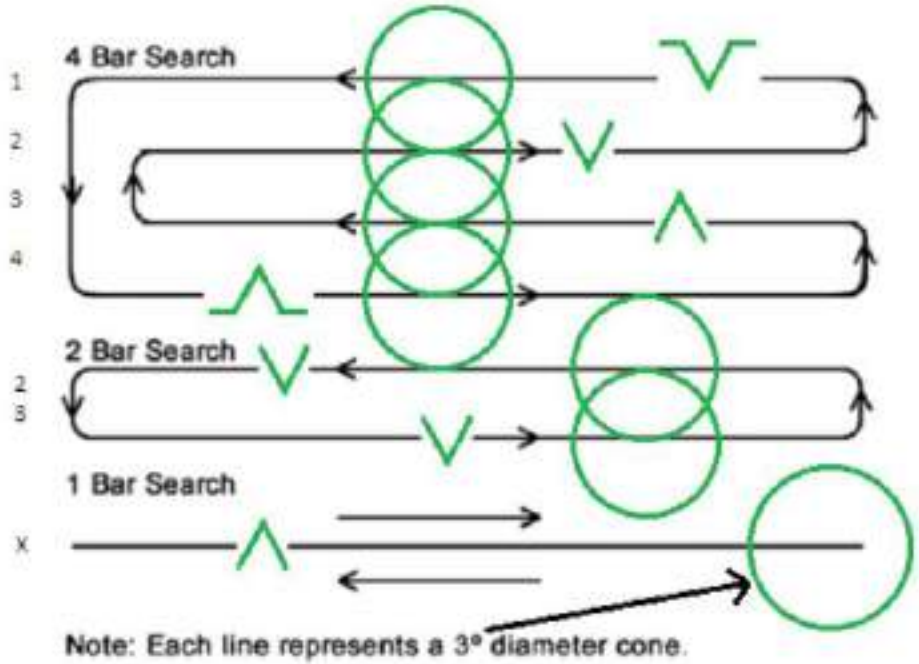


RDI Radar Scanning Pattern, Data Processing & Display

The Infamous Radar Contact Blink

The nature of the scanning pattern can also cause contacts to "duplicate" or "overlap" if contacts are detected by one bar or two (if overlapped) but not by others.

Note: V symbols just tell you the bar at which the target was detected, NOT the target's relative altitude to you.

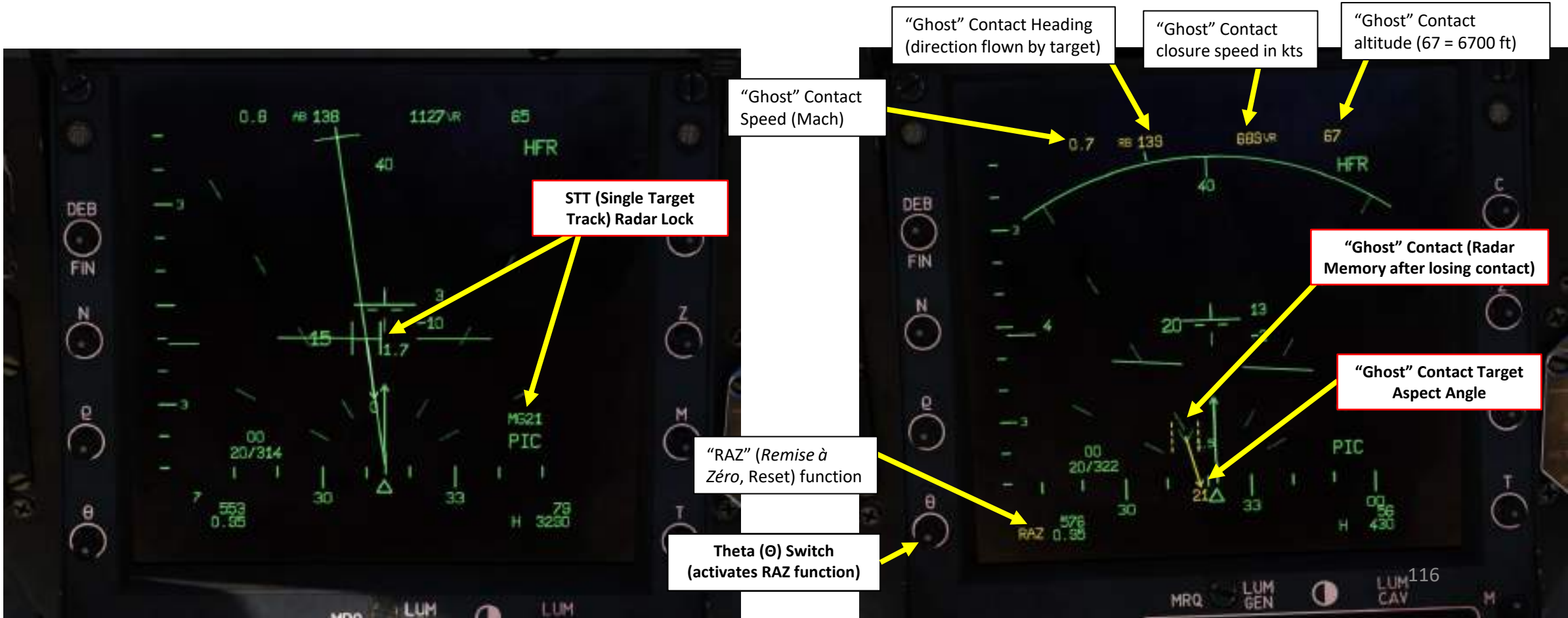


Radar DO (*Désignation Objectif*/Target Pursuit)

Radar Lost Contact Memory
Introduction

The Radar Memory function is always active and saves the last locked contact to memory. Therefore, if you radar lock a target and the contact is lost for any reason (manually unlocked, target breaks lock, target is destroyed, etc.) a **yellow "ghost" contact** is displayed, which is an extrapolation of where the target "should" be if it keeps the same heading and speed as when it was last memorized by the radar system.

This ghost contact will then move in the last known vector direction. When a ghost contact is created, a **yellow "RAZ" (*Remise à Zéro*, Reset) function** becomes available, which deletes the ghost contact from the radar screen. This RAZ function is activated by left clicking the **"Theta" (Θ) switch** DOWN next to the VTB screen.

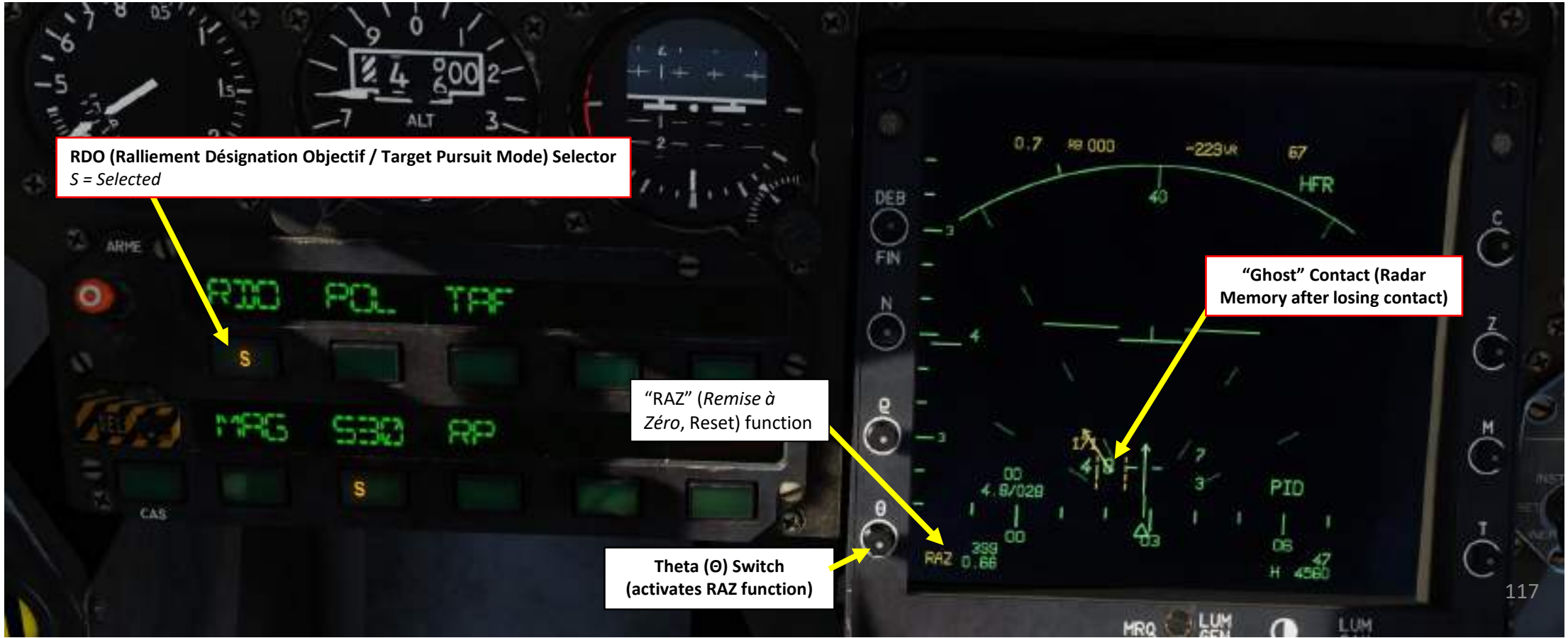


Radar DO (*Désignation Objectif*/Target Pursuit)

Radar Lost Contact Memory
RDO (Ralliement Désignation Objectif/ Target Pursuit Mode)

The RDO (Ralliement Désignation Objectif / Target Pursuit Mode) function is automatically activated when performing a radar lock. It creates the "ghost" contact mentioned earlier when a radar lock is performed.

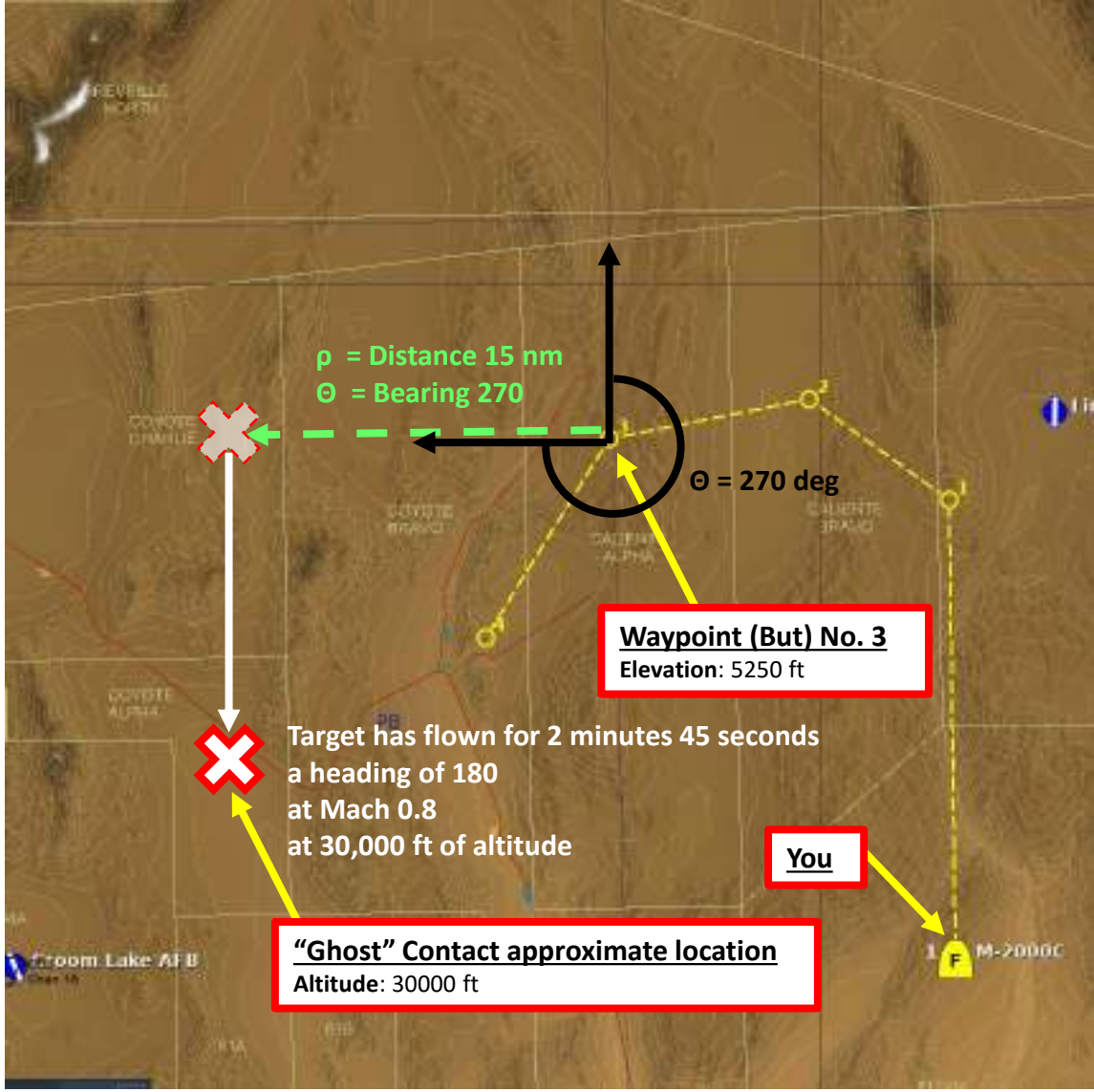
Pressing the **RDO button enables ("S" = selected) or disables DO (Radar Memory)**, but only for cases where you manually unlocked a radar contact using the **Weapons System CMD Switch DEPRESSED**. If you lose radar lock by other means, the ghost contact will still persist even if you turn off RDO. In that case, the way to erase the ghost contact would be to activate the **"RAZ" (Remise à Zéro, Reset) function** is by left clicking the **"Theta" (Θ) switch** DOWN next to the VTB screen.



Radar DO (*Désignation Objectif*/Target Pursuit)

***Désignation Objectif*/Objective Designation Input Parameters**

The Objective Designation function is used for when AWACS/Forward controllers coordinate targets for the Mirage 2000C in the theatre of operations. The AWACS/Forward controller will designate specific information to the pilot to manually input into the VTB to designate the target. This function will create a fictional radar contact on your VTB with parameters given to you by the AWACS in relationship to either yourself or an existing waypoint. This is useful for situational awareness in cases where you do not see the target on your radar or if you want to approach a target with your radar off to avoid detection.



Radar DO (*Désignation Objectif*/Target Pursuit)

***Désignation Objectif*/Objective Designation Input Parameters**

Contact Report: *"Report is 2 minutes 45 seconds ago, waypoint #3 saw a hostile flying at Mach 0.8 at 30000 ft, 15 nm from waypoint #3 in direction 270. He was heading for 180."*

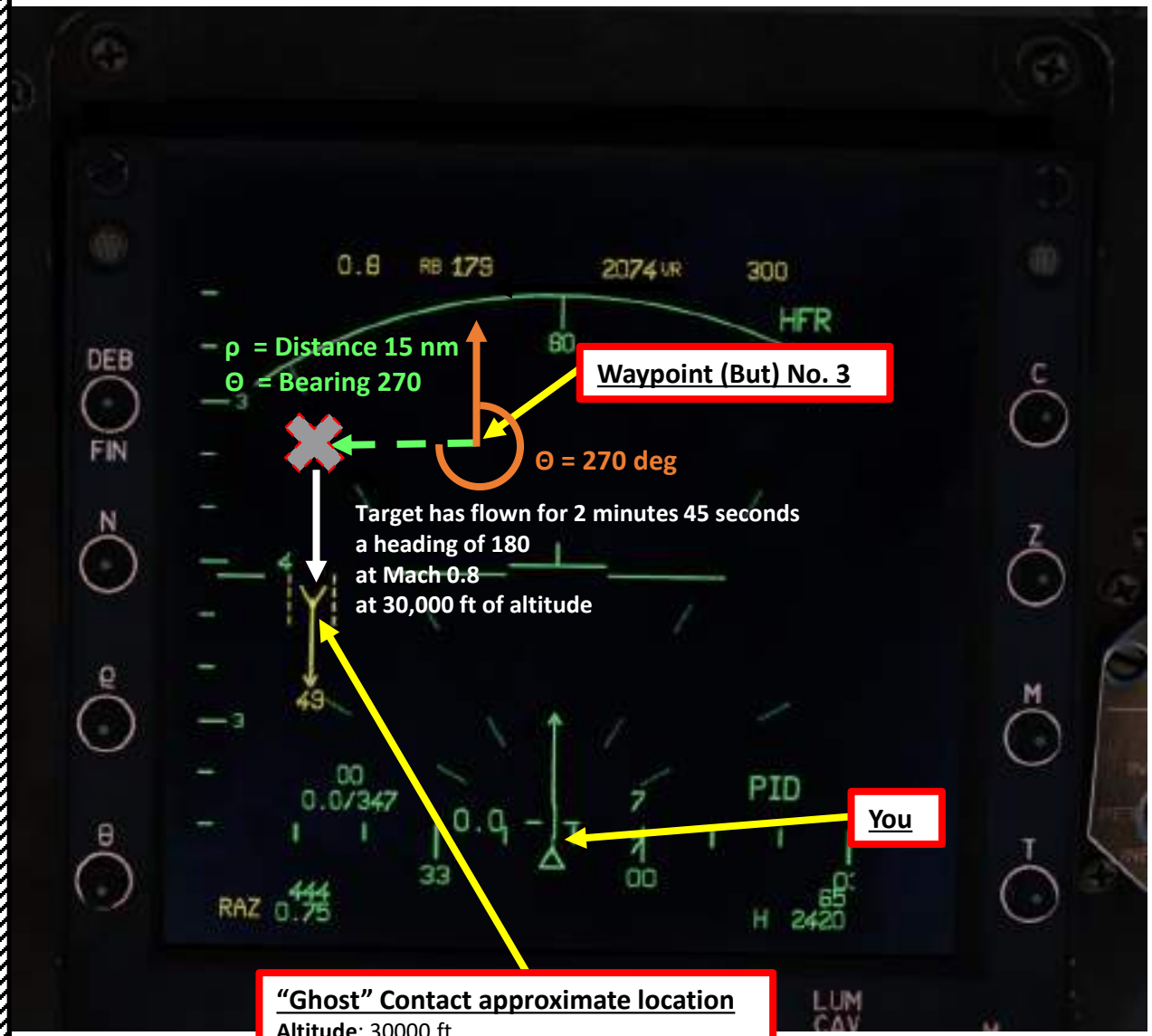
To input Objective Designation parameters:

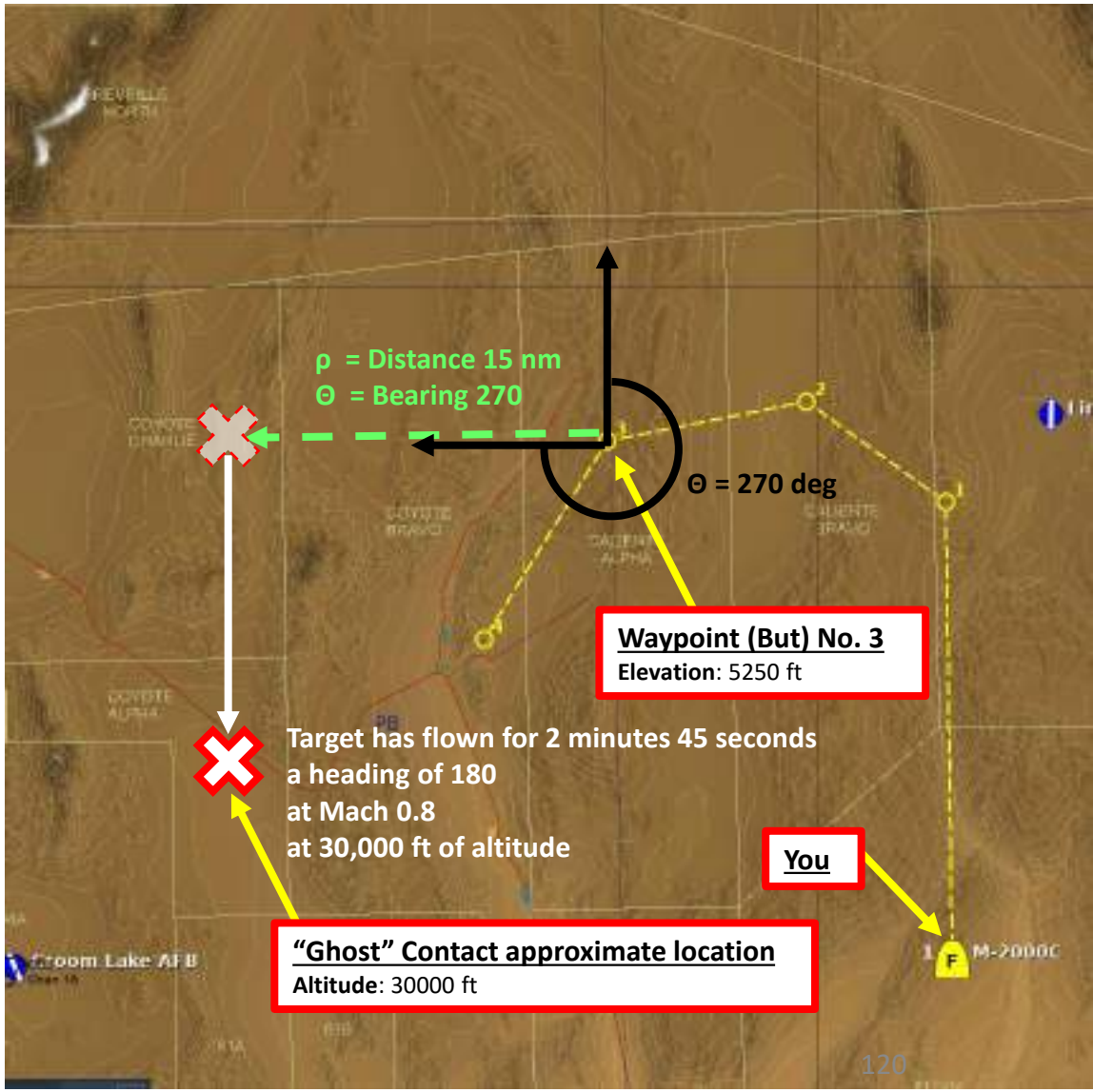
1. Right click on DEB (*Début*, Start) switch (UP)
2. Toggle "N" switch to set Waypoint 3 to be used as a reference (00 would be "you" as a reference)
3. Toggle Rho (ρ) switch to set distance from reference waypoint in nm (15)
4. Toggle Theta (Θ) switch to set bearing from reference waypoint in degrees (270)
5. Toggle C switch (*Cap*, Heading) to set target heading in degrees (180).
6. Toggle Z switch (Altitude) to set target altitude in hundreds of feet (300 = 30000 ft)
7. Toggle M switch (Mach) to set target speed in Mach (0.8)
8. Toggle T switch (Time) to set age of the report in minutes.seconds (2.45).
9. Left click on FIN (End) switch (DOWN) to create the ghost contact and designate the objective.

"Ghost" Contact approximate location
Altitude: 30000 ft, Target Aspect Angle 049 deg

Radar DO (*Désignation Objectif*/Target Pursuit)

***Désignation Objectif*/Objective Designation Input Parameters**





IFF: IDENTIFY-FRIEND-OR-FOE

How do you recognize friend from foe? Follow these three easy steps and you'll be good to go.

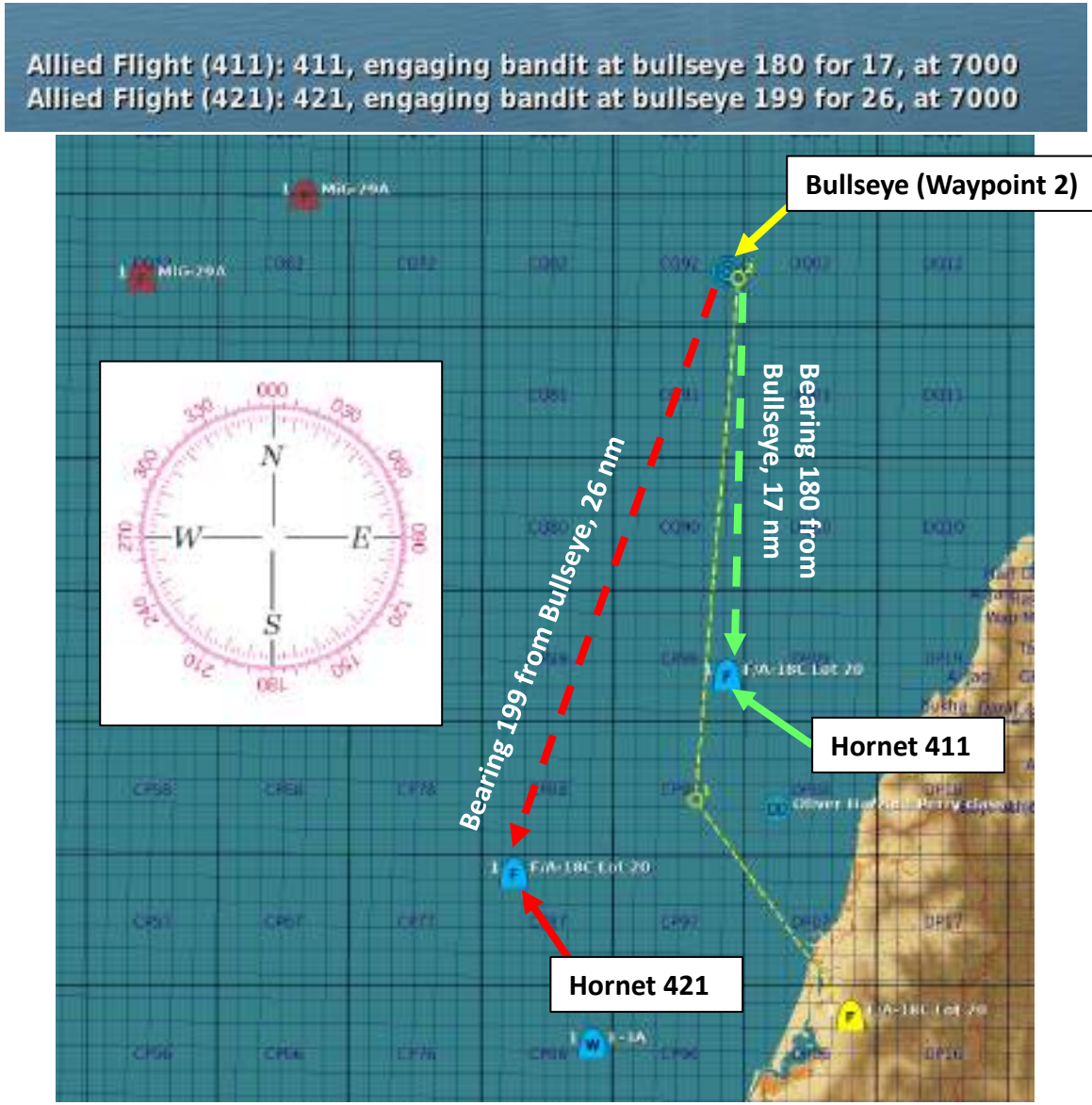
1. Set IFF Power Switch to either SECT (Sectoral, middle position) or FULL (rightmost position), as required. The only difference between FULL and SECTORAL is that Sectoral IFF is centered on the radar TDC.
2. Press the NWS/IFF button (keyboard shortcut: "S") to interrogate.
3. Assuming your radar is ON and warmed up, you will see a green diamond on friendly contacts. Enemy contacts will not have this green diamond.

BULLSEYE

A “Bullseye” is a fictional point in space used as a reference to locate yourself, friendly contacts and enemy contacts. If you know where the bullseye is and the enemy doesn’t, it gives you a way to communicate positions without the enemy knowing where to look from. Your wingmen and AWACS will often refer to “bulls” or “bullseye” on the radio. A bullseye call, used to communicate your position, is done in the following format:

- Bearing from bullseye
- Range to bullseye
- Altitude

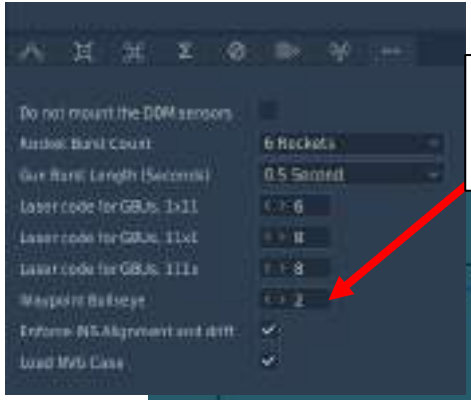
Bullseye Explanation by JediLinks: https://youtu.be/vgcXcfeGb2M

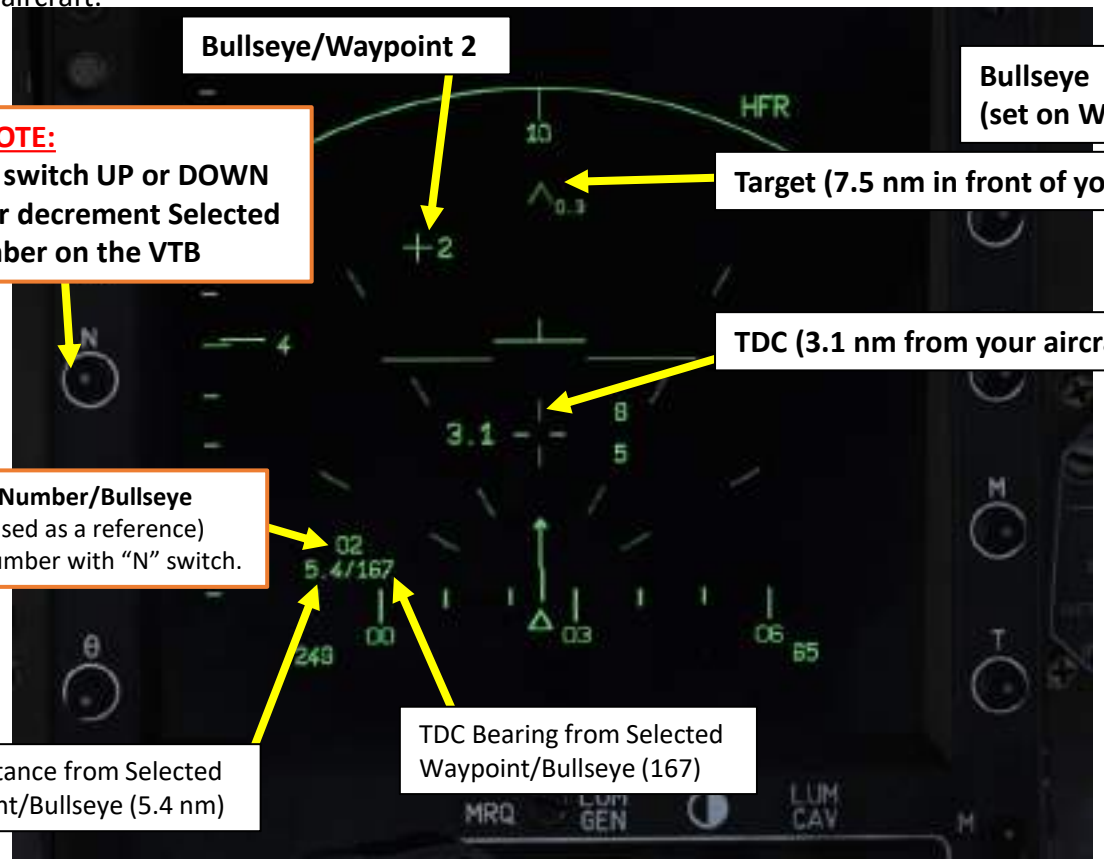


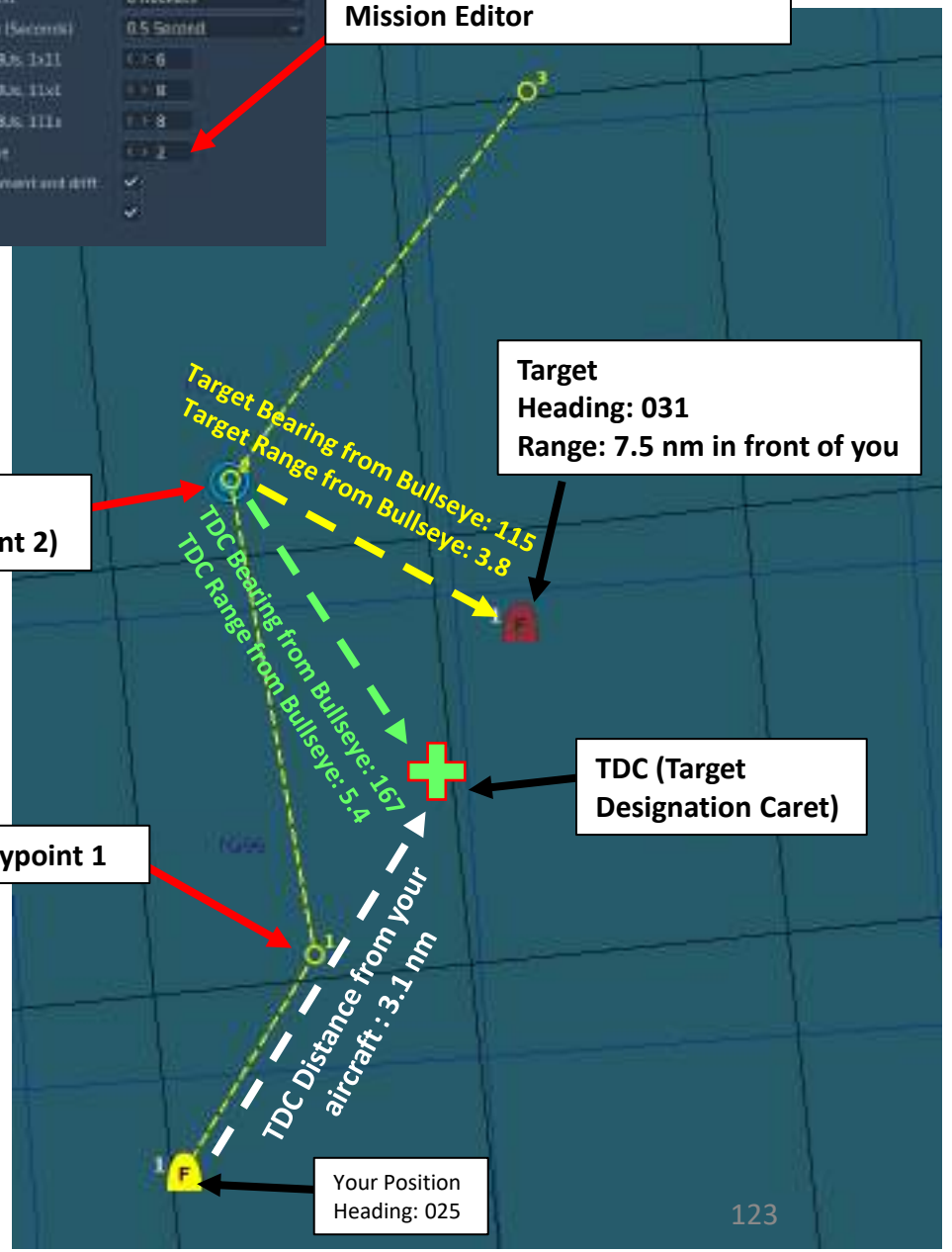
BULLSEYE

When an AWACS calls out a target using a BRA call (i.e. “Enemy bandit at bullseye 115 for 3.8, at 7000 ft”), there is an indication on the lower left corner of the VTB that tells you the TDC (Target Designation Caret) distance and bearing from any waypoint selected. If a particular waypoint is set on the Bullseye location, you can use this indication as a TDC Bearing/Distance indication from Bullseye. Therefore, you could find the target by simply moving the TDC while using the TDC Distance and Bearing from Waypoint/Bullseye indications.

Keep in mind that the Waypoint Number used as a Bullseye reference must be set in the mission editor first (it can be modified with the « N » switch on the VTB. In the case where the Selected Waypoint number is 00, this means that the TDC indications are in relationship to your own aircraft.







RADAR LINGO AND 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 S530D + 27R/ER + AIM-7)
- FOX 2: heat-seeking infrared missile (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

SECTION STRUCTURE

- **1 - Introduction**
  - 1.1 – Armament Overview
  - 1.2 – Armament Restrictions
  - 1.3 – VTB Weapon Loadout Display
  - 1.4 – Weapon Controls (Real Aircraft)
  - 1.5 – Weapon Controls (My Setup)
  - 1.6 – Tips on Weapon Employment
  - 1.7 – Bomb Delivery Mode – CCRP vs CCIP
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  - 2.2 – Magic II Missile
    - 2.2.1 – Search Modes
    - 2.2.2 – Tutorial Without Radar
    - 2.2.3 – Tutorial With Short Range Radar
  - 2.3 – Air-to-Air Guns
    - 2.3.1 – Tutorial With Radar
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  - 3.2 – Unguided Bomb (MK-82SE – CCIP)
  - 3.3 – Unguided Bomb (MK-82 – MANUAL CCRP)
  - 3.4 – Unguided Bomb (MK-82 – INS Precision Bombing with CCRP)
  - 3.5 – Cluster Bomb (BLG-66 Belouga – CCIP)
  - 3.6 – Laser-Guided Bomb (GBU-12 Paveway II)
  - 3.7 – Air-to-Ground Guns
- **4 – Miscellaneous**
  - 4.1 – Selective Stores Jettison
  - 4.2 – Emergency Stores Jettison
  - 4.3 – Combat Tactics

1.1 – ARMAMENT OVERVIEW

The Mirage 2000C can use a good variety of weapons.

MISSILES			
WEAPON	TYPE	RANGE	COMPARABLE TO
MATRA R550 MAGIC II	Infrared guided missile	0.25 to 8 nautical miles (500 m to 15 km)	AIM-9M Sidewinder
MATRA SUPER S530D	Semi-Active radar homing	10 nautical miles @ Sea Level 23 nautical miles @ 40,000 ft	AIM-7 Sparrow

BOMBS			
WEAPON	TYPE	WEAPON	TYPE
MK-82	500 lbs unguided low-drag bomb	GBU-12	500 lbs laser guided bomb
MK-82SE (Snake Eye)	500 lbs unguided low-drag retarded bomb	GBU-16	1,000 lbs laser guided bomb
BLG-66 (BELOUGA)	Unguided low-drag anti-runway cluster bomb	GBU-24	2,000 lbs laser guided bomb
BAP-100	Unguided low-drag anti-runway cluster bomb (*Bombe Anti-Piste*)		

GUNS	
WEAPON	TYPE
2 x *DEFA* 554	30 mm revolver cannons (125 rounds each)

ROCKETS	
WEAPON	TYPE
MATRA SNEB rocket pod	18 x 68mm unguided rockets per pod

1.2 – ARMAMENT RESTRICTIONS

The Mirage 2000C can load a number of different air-to-air missiles and air-to-ground munitions. However, due to limitations of the targeting computer, it is not possible to mix Super S530D missiles with air-to-ground weapons, and not possible either to mix different kinds of air-to-ground weapons. Doing so (for instance rockets and bombs, Mk-82s and Belougas etc.) may result in system not being able to handle the configuration and thus not work properly.

Remember this: **Do not mix air-to-ground weapon types - use only one type for the mission. Failing to do so may result in the inability to deliver any munitions.**

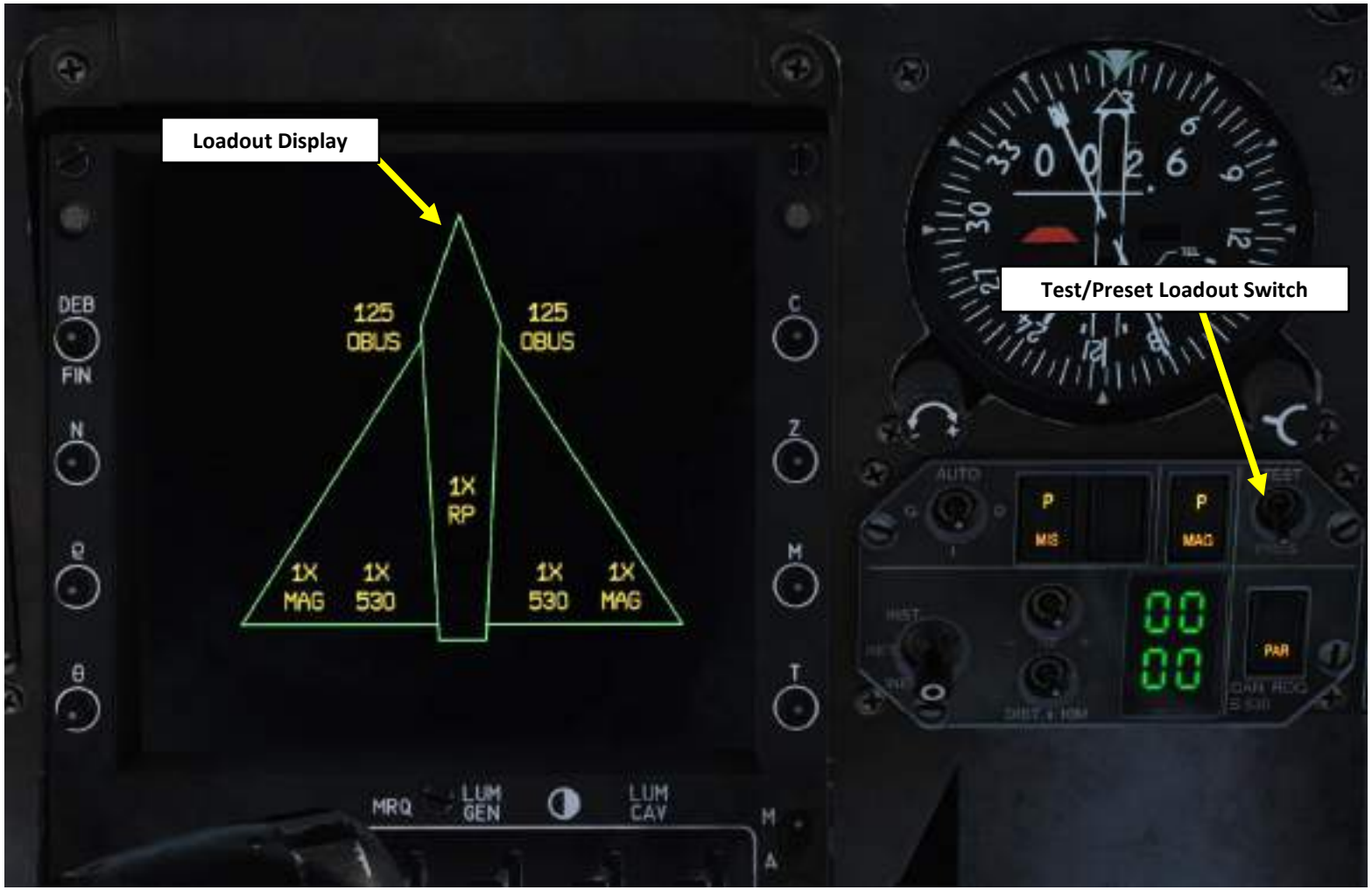
STANDARD CONFIGURATIONS

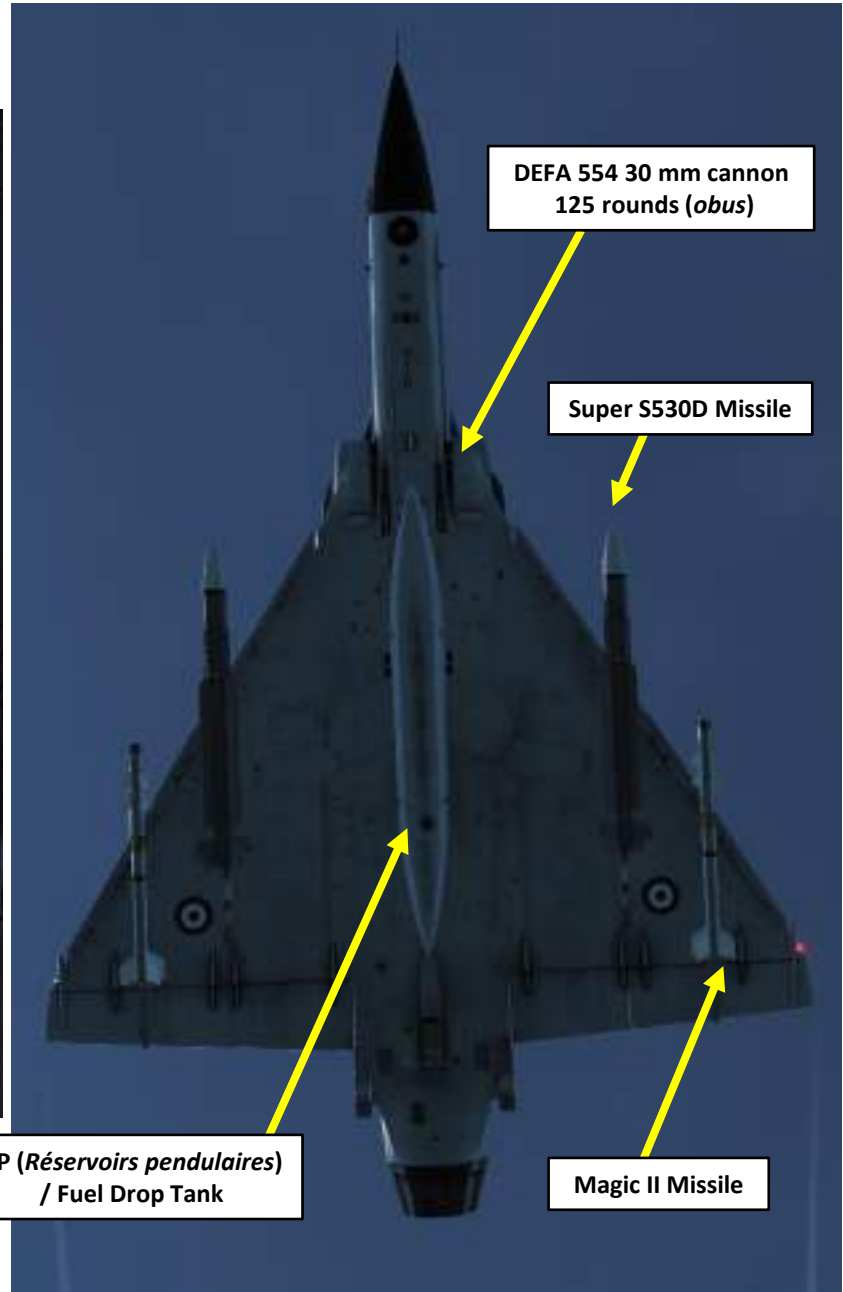
Configuration	Detailed Payload
CLEAN AIRCRAFT	Full internal fuel; guns, brake chute and countermeasures (no extra Eclair pod) loaded
STANDARD AIR TO AIR	Clean + 2x Fox2 + 2x Fox1 + Center fuel tank
STANDARD AIR-TO-GROUND	Clean + 2x Fox2s + 4x Mk-82s + Wings fuel tanks or Clean + 2x Fox2s + 2x GBU-12s (center pylon+adapter) + Wings fuel tanks

Fox 1: Super S530D Semi-Active Radar Homing Missile
Fox 2: Magic II Infrared-Guided Missile

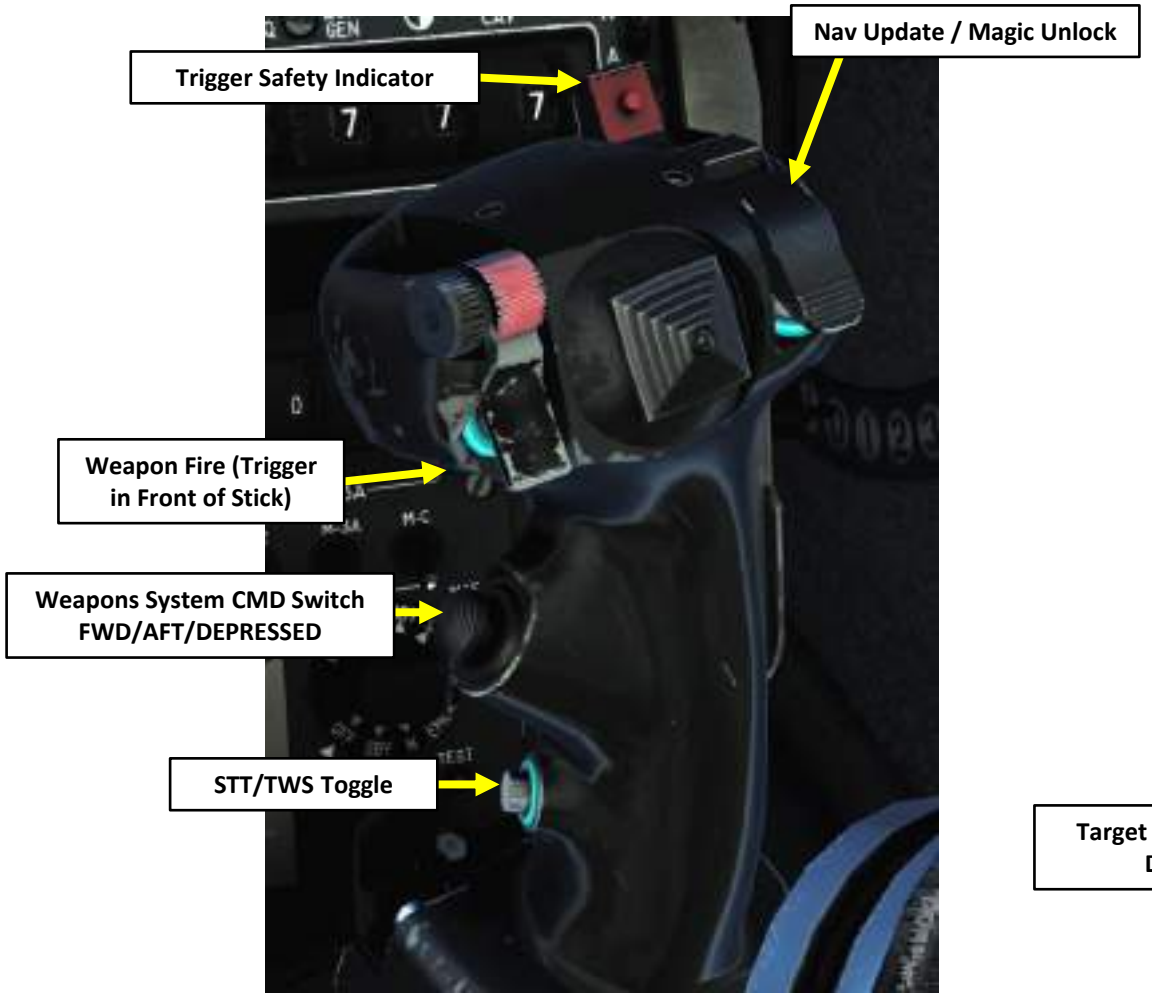
1.3 – VTB Weapon Loadout Display

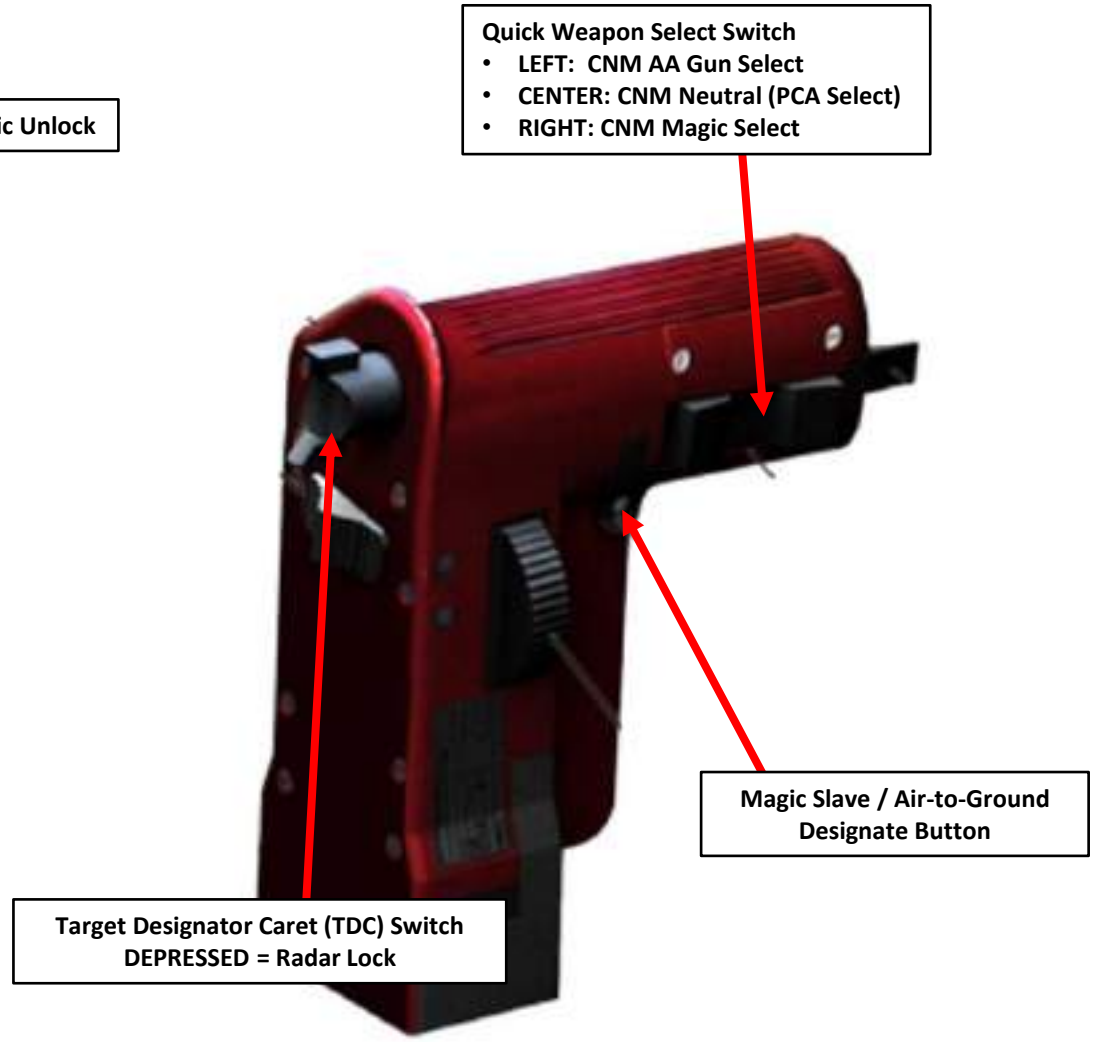
Setting the Test/Preset Loadout switch to the PRES position displays an aircraft Loadout page, which shows the armament and fuel tanks loaded on the aircraft.



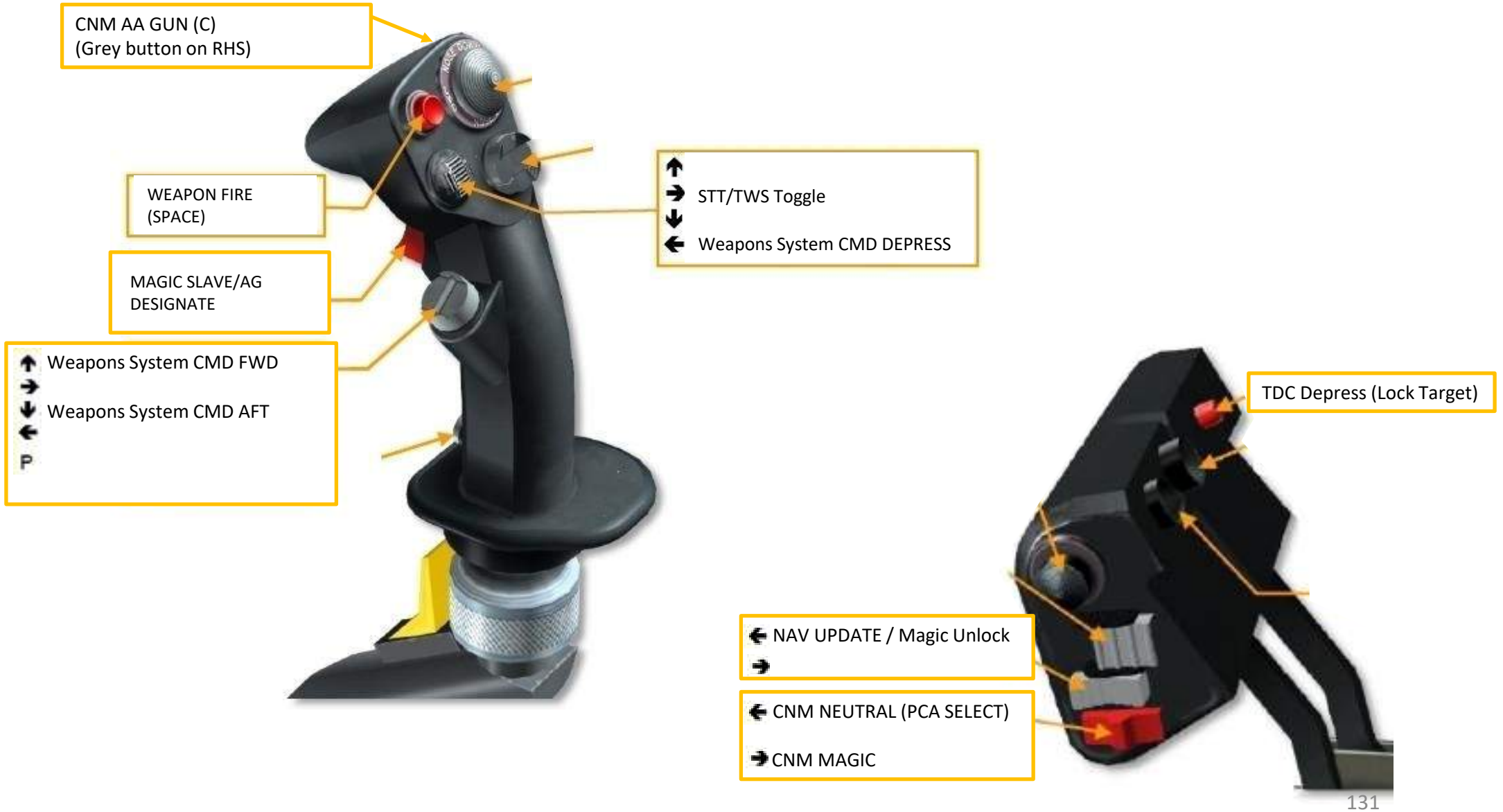


1.4 – Weapon Controls (Real Aircraft)





1.5 – Weapon Controls (My Setup)



1.6 – Tips on Weapon Employment

The Mirage 2000C is a fly-by-wire aircraft. You should always know what FBW mode you are using. Being in the wrong FBW mode could make you lose a dogfight or rip your wings off during a bomb run. This tip is all the more relevant when employing weapons.

The FBW G limiter switch has two positions:

- **A/A** (UP) is used for an air combat configuration (2 x MAGIC II missiles + 2 x SUPER S530D missiles). This FBW mode will allow you to pull the maximal allowable number of Gs during a dogfight. In other words, the manoeuverability of your aircraft is maximal at this FBW setting.

- **CHARGES** (DOWN) is used for a heavy payload configuration (which includes any number of bombs and external fuel tanks). This FBW mode will restrict the number of Gs you can pull in comparison to the A/A mode. In other words, you will not be as manoeuverable. The reason for this mode is that structural damage can occur if you pull many Gs, which is caused by the heavy payload fixed to the hardpoints. The CHARGES (stores) mode is here to prevent your aircraft from ending in a smoldering ball of flames. When doing dive bomb runs, keep in mind that you will not be able to pull up as much as you would expect when flying in the A/A mode.

A/A:
- Limits load factor for the elevator elastic stop to 9 g (± 0.5 g).
- Limits AOA to 29° or 27° when speeds are under 100 knots
- Limits the roll speed and angular acceleration to 270°/sec.
- Audio warning when alpha ≥29°, or stick at full aft position, or indicated air speed below 100 knots.

CHARGES:
- Limits load factor for the elevator elastic stop to 5.5 g (± 0.5 g).
- Audio warning when alpha >= 20°. The pilot must abide to this limit by himself.
- Limits pilot roll command based on load factor.
- Limits roll angular speed to 150°/sec.

Fly-By-Wire limiter switch
A/A (UP): Air-to-Air Combat – For carrying light loads
CHARGES (DOWN): Stores – For carrying heavy loads

1.7 – Bomb Delivery Mode - CCRP VS CCIP

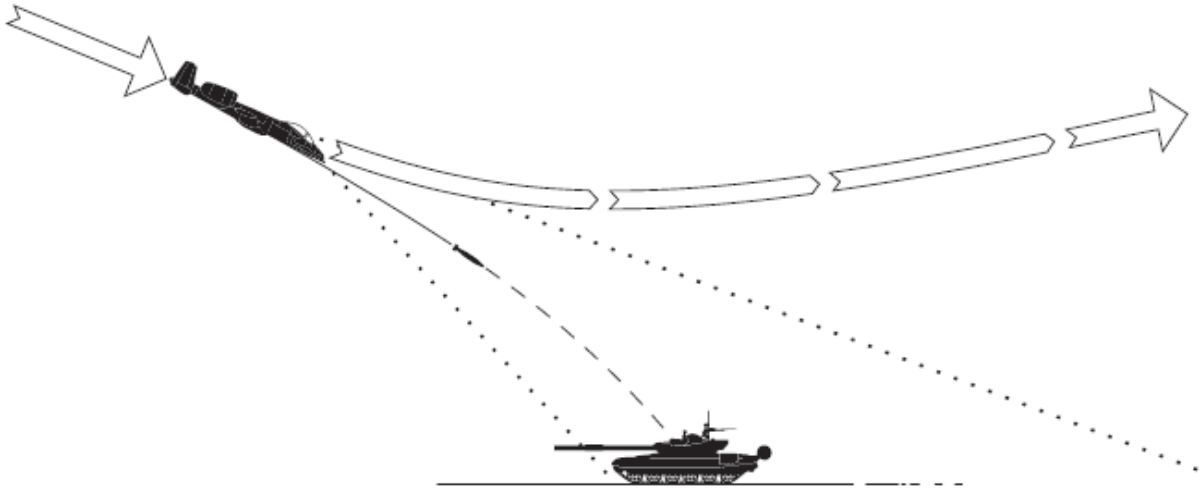
There are 2 ways to deliver a weapon: CCRP or CCIP modes.

CCIP mode is the traditional dive bombing approach: you dive on target and the reticle will tell you where the bomb will impact.

However, dive bombing is a risky business, especially if anti-air defences are surrounding your target. The lower you go, the more vulnerable you are. This is why CCRP release mode was invented.

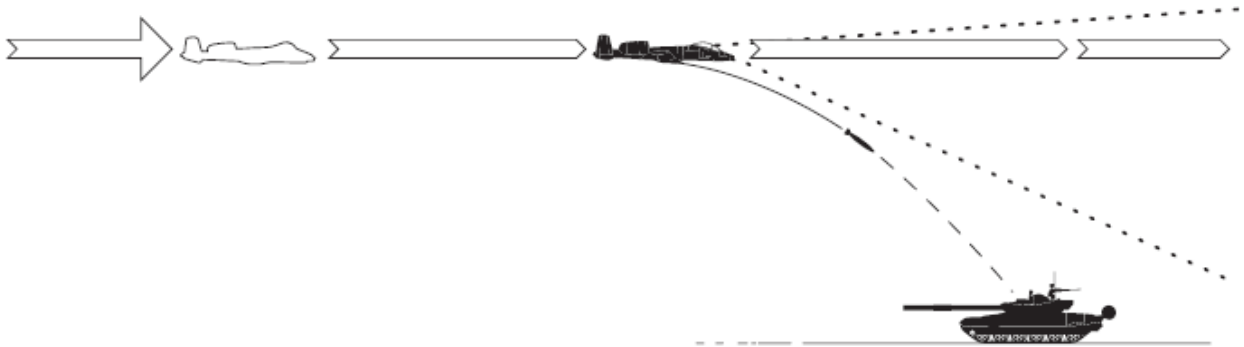
CCRP mode allows you to fly straight and level without having to dive down. The HUD will tell you when to release your bomb for the target you have designated with your radar. It is a much safer way to release a bomb, but as you may have guessed already, it is less precise. The Mirage 2000C being an interceptor first and foremost, the level of precision achievable has much to be desired. The Mirage 2000D, on the other hand, is much better suited and has the appropriate systems for precision bombing.

Take note that the delivery mode of bombs will be automatically "decided" for you: the Mirage 2000 is designed this way. You cannot choose how your ordnance will be dropped: a MK-82 (low drag) bomb will automatically engage CCRP mode while a MK-82 Snake Eye (high drag) bomb will engage CCIP mode.



CCIP: Continuously Computed Impact Point
CCPI: Calcul Continu du Point d'Impact

BOMBS USING CCIP: MK-82 SNAKE EYES, BLG-66, BAP-100



CCRP: Continuously Computed Release Point
CCPL: Calcul Continu du Point de Largage

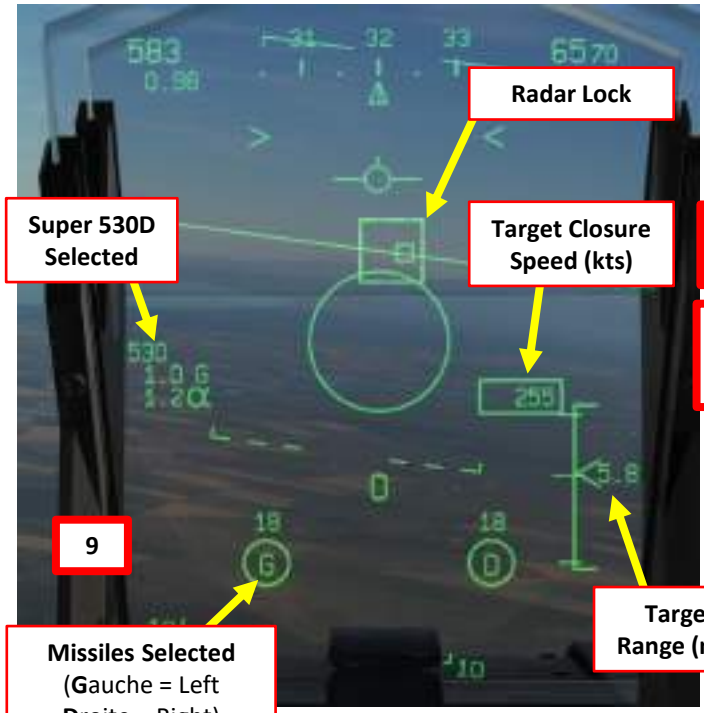
BOMBS USING CCRP: MK-82, GBU-12, GBU-16, GBU-24

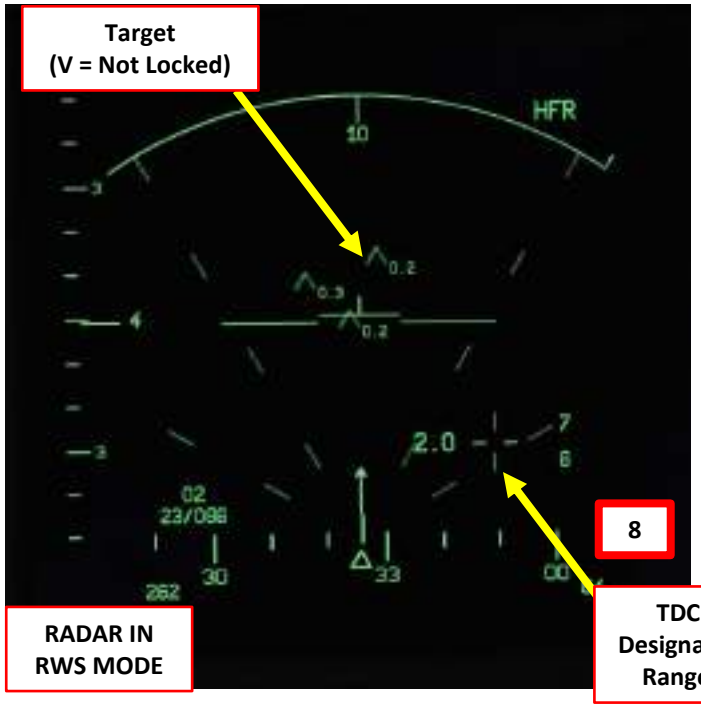
2.1 – SUPER S530D MISSILE

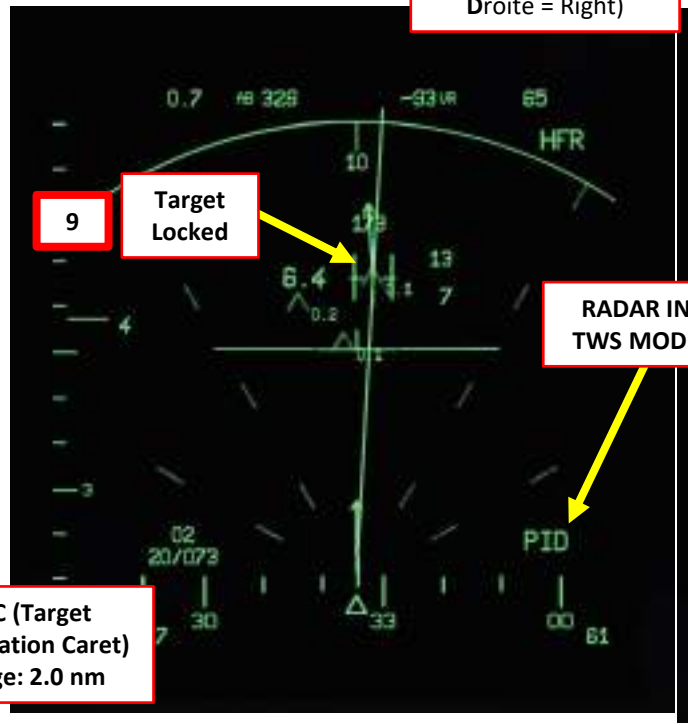
1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the S530D missile via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA (*Poste de Préparation Armement*, Weapon Configuration Panel), press the S530 warm-up button. "P" (*Prêt*/Ready) will blink during warm-up process (30 s) and remain illuminated when warm-up is complete.
3. On PPA, select which missile to fire (G = Left, I = AUTO, R = Right)
4. On PPA, set S530 launch mode (TOT = 2 missiles per trigger press, PAR = 1 missile per trigger press)
5. On the PCA, turn Master Arm switch to ARME (UP)
6. Select 530 missile by pressing the "530" button. A "S" indication shows that the missile is selected.
7. Turn on Radar Power by setting switch to **EM**ISSION.
   - Consult previous chapter for radar operation parameters

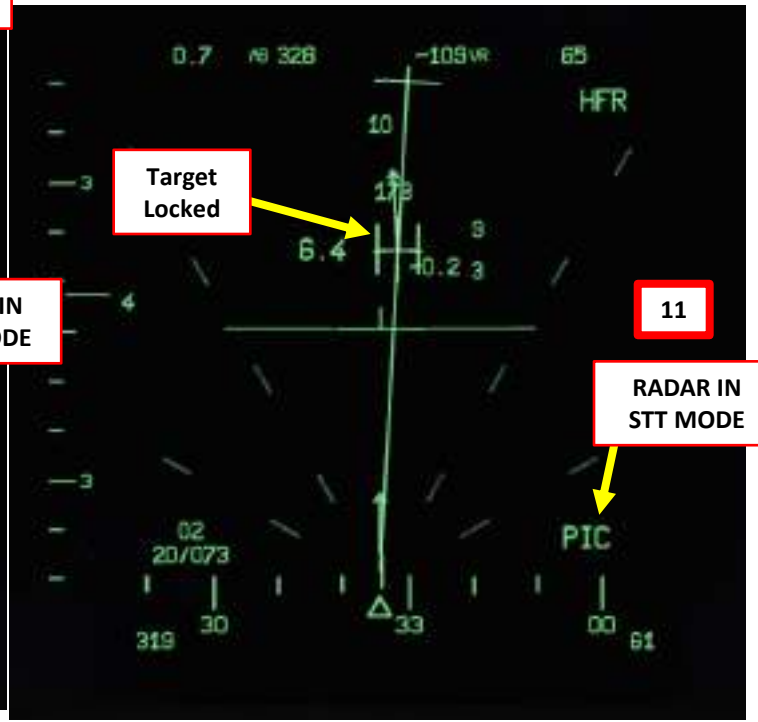
2.1 – SUPER S530D MISSILE

8. Detect target using vertical antenna and radar range controls. Radar will be in RWS (Range While Search) mode.
9. Put TDC on designated target (I, J, K, L) and lock it by using the TDC DEPRESS control. Target will have a square on it on the HUD and radar will enter TWS (Track While Scan) mode.
10. Press and hold Weapon Fire key for at least 2 seconds (SPACE by default) when missile is within KILL (no escape) range.
11. There is a time delay between the moment the trigger is pressed to the instant the missile is launched; this is both a security measure and a time needed to feed the missile computer with data for launch. **When pressing Weapon Fire trigger from TWS (PID) mode, the radar will automatically switch to STT (PIC) mode, and only then the missile will launch**.
12. Once missile is fired, the engine RPM will automatically decrease to prevent an engine flameout, which could be caused by ingestion of the smoke released by the missile launch. RPM will increase back to normal values a few seconds later.
13. Maintain radar lock for as long as the missile is in the air: the Super S530 will be guided by your radar. As soon as you lose lock, the missile will stop tracking the target.
14. You can unlock target with the HOTAS Weapons System CMD switch DEPRESSED on the stick.

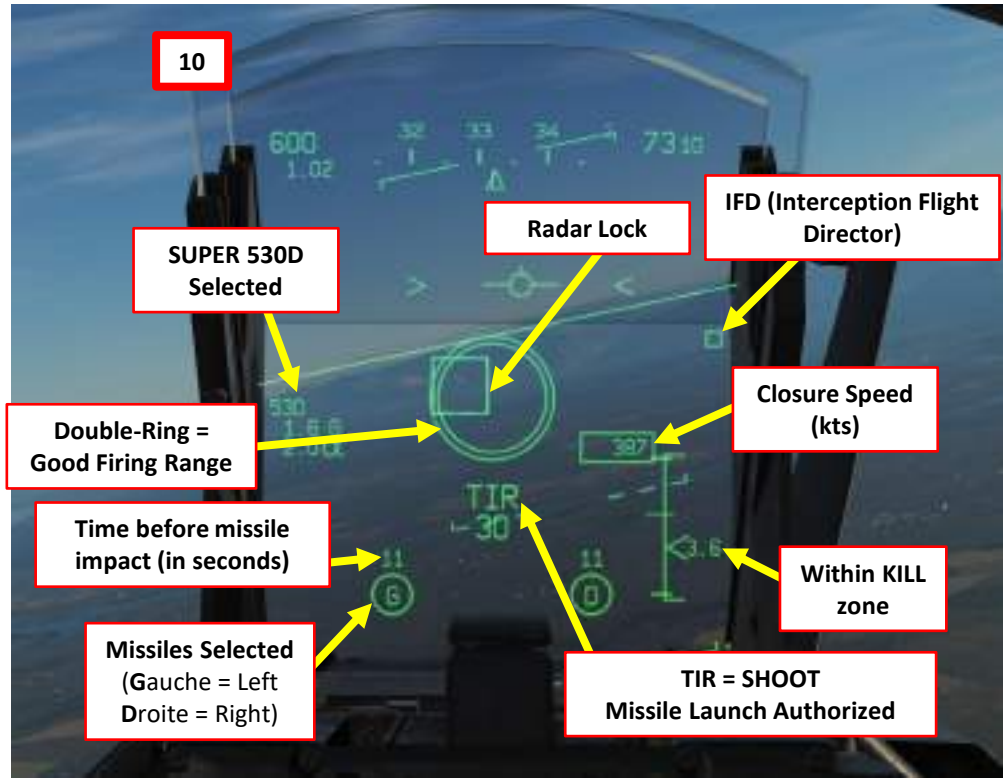


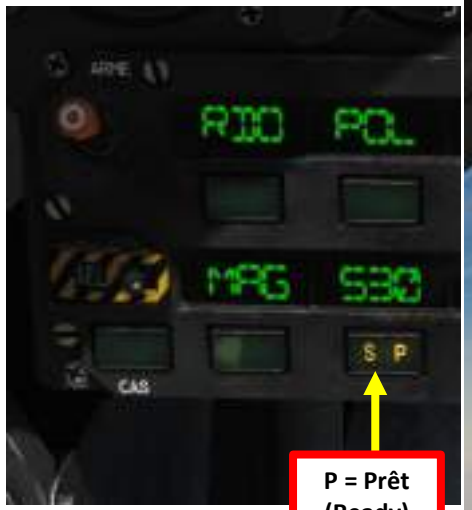






2.1 – SUPER S530D MISSILE





2.2.1 – MAGIC II MISSILE SEARCH MODES

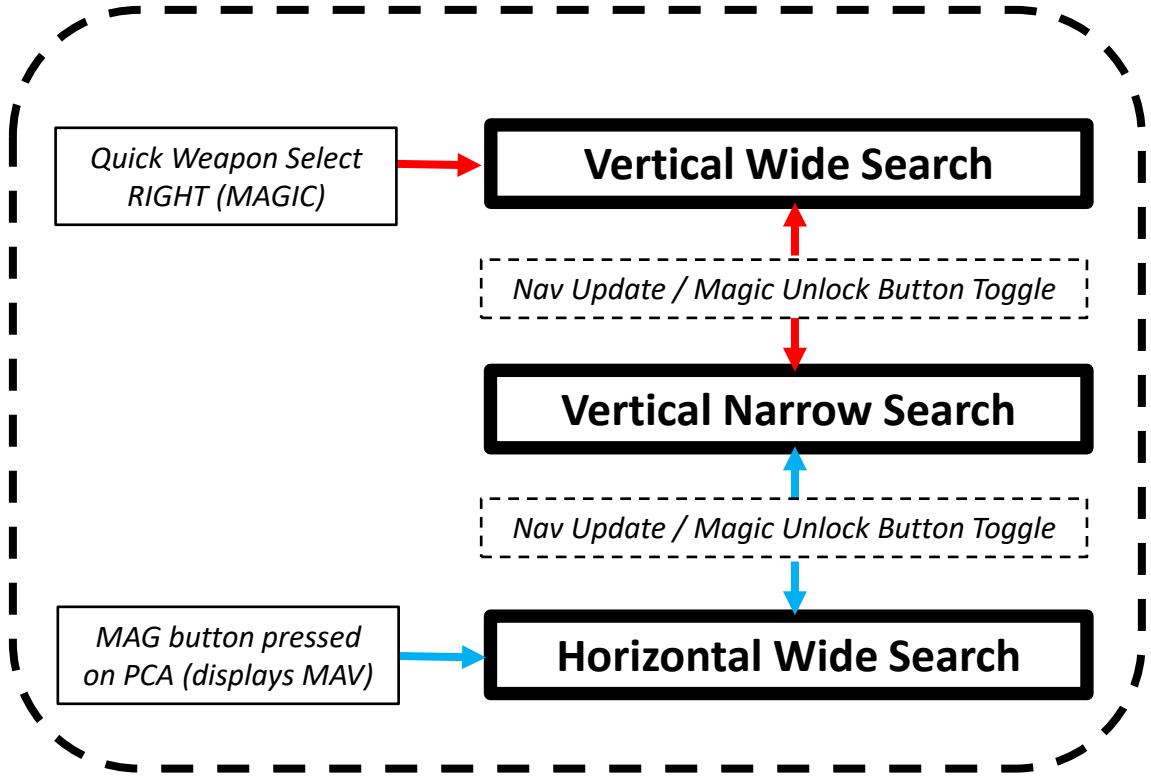
The MAGIC II missile can use different search modes. These mods are not to be confused with radar modes; the search patterns we will explore here are based on the MAGIC missile's seeker head.

- If MAGIC missile is selected with the Quick Weapon Select (CNM) switch RIGHT, the Magic seeker will **default** to the **Vertical Wide Search** mode. Pressing the **Nav Update / Magic Unlock** button will toggle search mode to **Vertical Narrow Search** mode.

- If MAG PCA (Armament Control Panel) button is selected (MAGIC missile is not required to be selected with CNM), the Magic seeker will **default** to the **Horizontal Wide Search** mode. Pressing the **Nav Update / Magic Unlock** button will toggle search mode to **Vertical Narrow Search** mode.

Depending on the selected search pattern, acquiring lock may take a few seconds, as the seeker has to complete the whole pattern. The larger the search zone, the longer it may last. Vertical Narrow Search allows for the shortest lock time.

Magic II Missile Search Modes



Visible on VTH (Heads-Up Display)

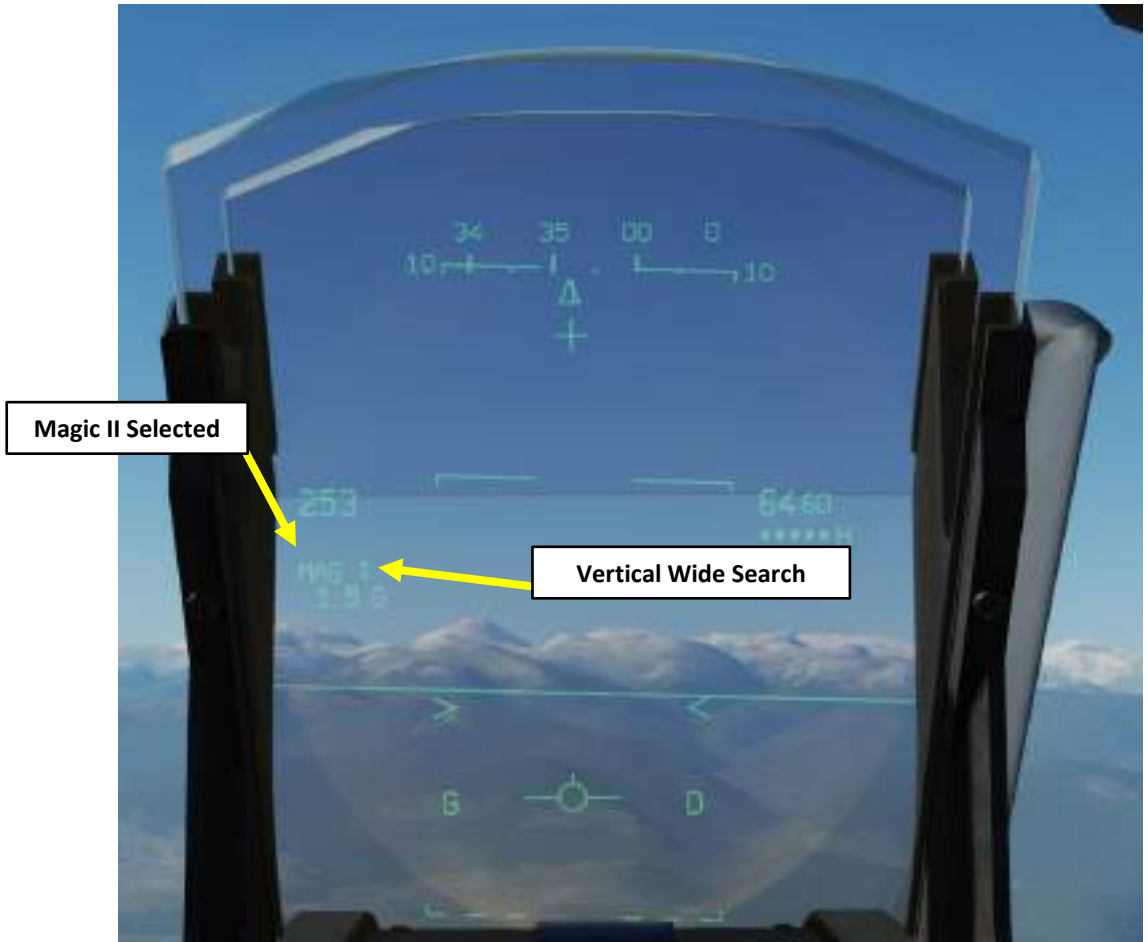
2.2.1 – MAGIC II MISSILE SEARCH MODES

Vertical Wide Search

Vertical Wide Scan is a 20° x 40° tall search (bottom is 10° below the gun cross), very similar to the radar Vertical Scan. This is the default mode whenever Magic II missile is selected with the CNM (Quick Missile Select) switch. Note that part of the search zone is extending above the HUD.

SELECTION METHOD

1. On the throttle, set Quick Weapon Select Switch to RIGHT position (MAGIC SELECT). This will select the Magic II missile.
2. By default, the Magic II missile's Vertical Wide Search mode will be selected.



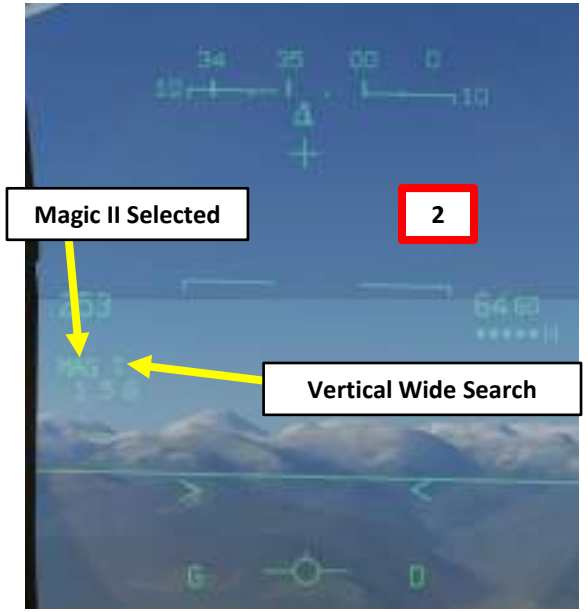
2.2.1 – MAGIC II MISSILE SEARCH MODES

Vertical Narrow Search (from Vertical Wide Search)

Vertical Narrow Search is a 6° wide x 6° tall box cantered around the gun cross, similar to the radar SVI Scan. A box is displayed indicating the HUD area where the seeker is searching, and is removed upon missile lock.

SELECTION METHOD 1:

1. On the throttle, set Quick Weapon Select Switch to RIGHT position (MAGIC SELECT). This will select the Magic II missile.
2. By default, the Magic II missile's Vertical Wide Search mode will be selected.
3. Press the Nav Update/ Magic Unlock button to toggle the Magic II missile's search mode to Vertical Narrow Search.



Quick Weapon Select Switch
- LEFT: CNM AA Gun Select
- CENTER: CNM Neutral (PCA Select)
- RIGHT: CNM Magic Select

1

Nav Update / Magic Unlock 3a

3b
Vertical Narrow Search

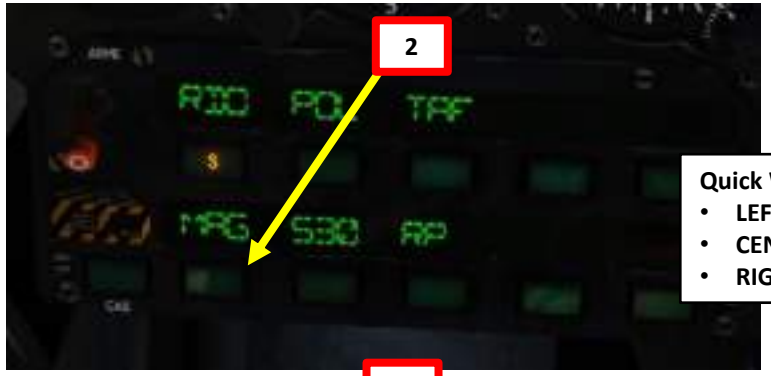
2.2.1 – MAGIC II MISSILE SEARCH MODES

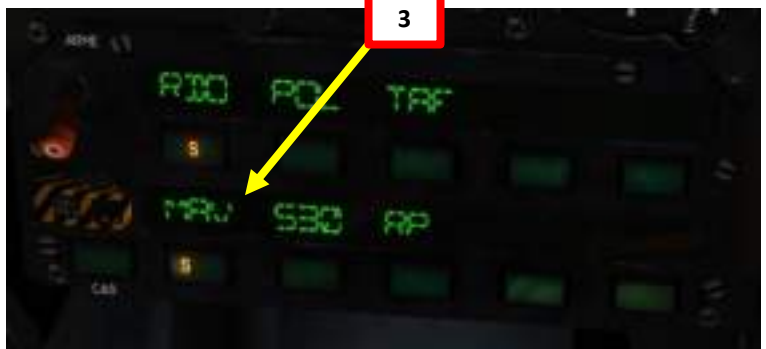
Vertical Narrow Search *(from Horizontal Wide Search)*

Vertical Narrow Search is a 6° wide x 6° tall box cantered around the gun cross, similar to the radar SVI Scan. A box is displayed indicating the HUD area where the seeker is searching, and is removed upon missile lock.

SELECTION METHOD 2:

1. MAGIC missile is **not required** to be selected with CNM (Quick Weapon Select) switch.
2. On PCA, press the MAG button.
3. Once MAG is selected, the MAG indication will turn to MAV.
4. By default, Horizontal Wide Search Mode will be selected.
5. Press the Nav Update/ Magic Unlock button to toggle the Magic II missile's search mode to Vertical Narrow Search.





Quick Weapon Select Switch
- LEFT: CNM AA Gun Select
- CENTER: CNM Neutral (PCA Select)
- RIGHT: CNM Magic Select

1

5a

Nav Update / Magic Unlock

Vertical Narrow Search

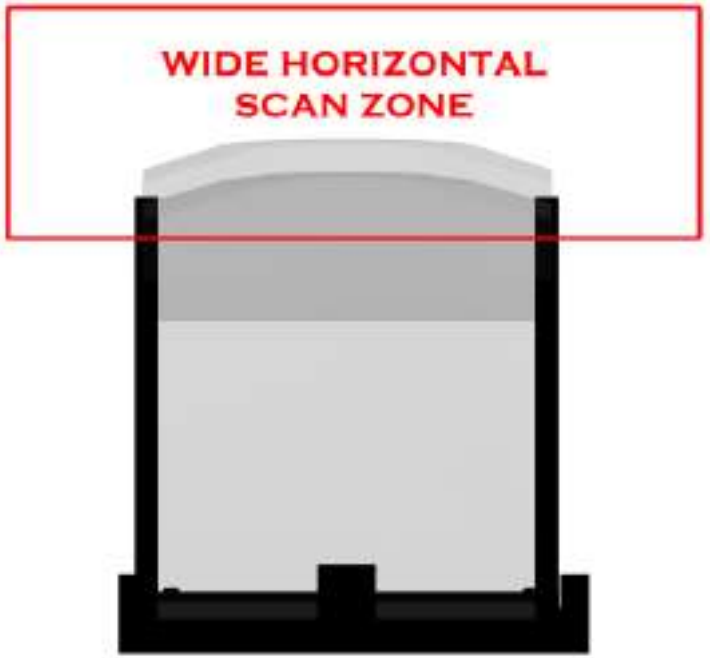
2.2.1 – MAGIC II MISSILE SEARCH MODES

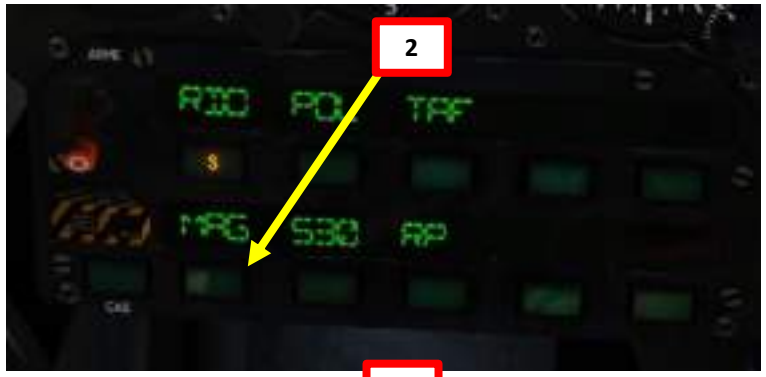
Horizontal Wide Search

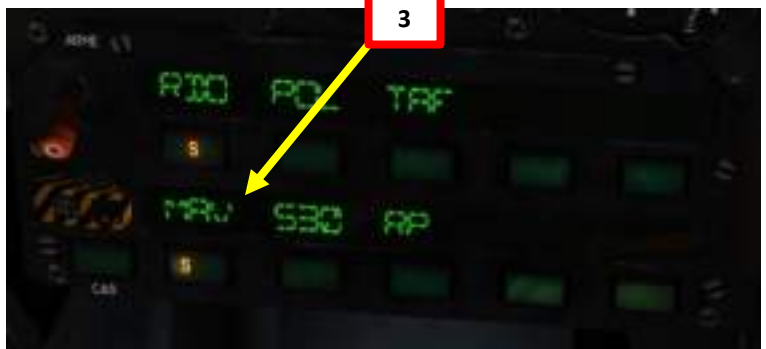
Vertical Wide Scan is a 70° wide and 15° tall search zone. With only one missile available, the search zone is smaller: 40° wide and 15° tall. It is similar to the radar BAH Scan. This is the default mode whenever MAG PCA button is selected. Note that parts of the zone extend beyond the HUD on both sides.

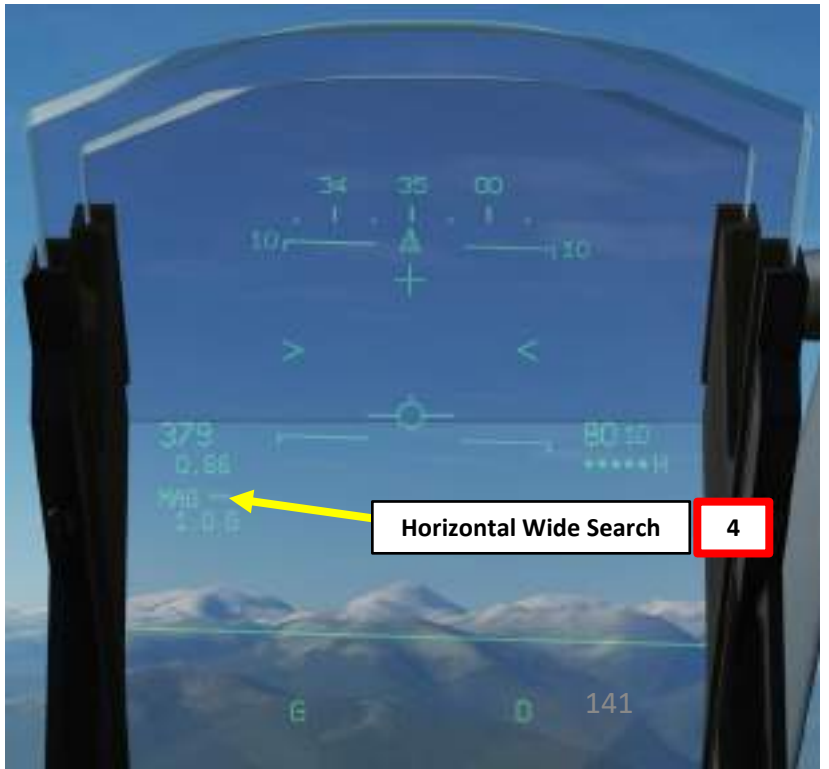
SELECTION METHOD

1. MAGIC missile is **not required** to be selected with CNM (Quick Weapon Select) switch.
2. On PCA, press the MAG button.
3. Once MAG is selected, the MAG indication will turn to MAV.
4. By default, Horizontal Wide Search Mode will be selected.



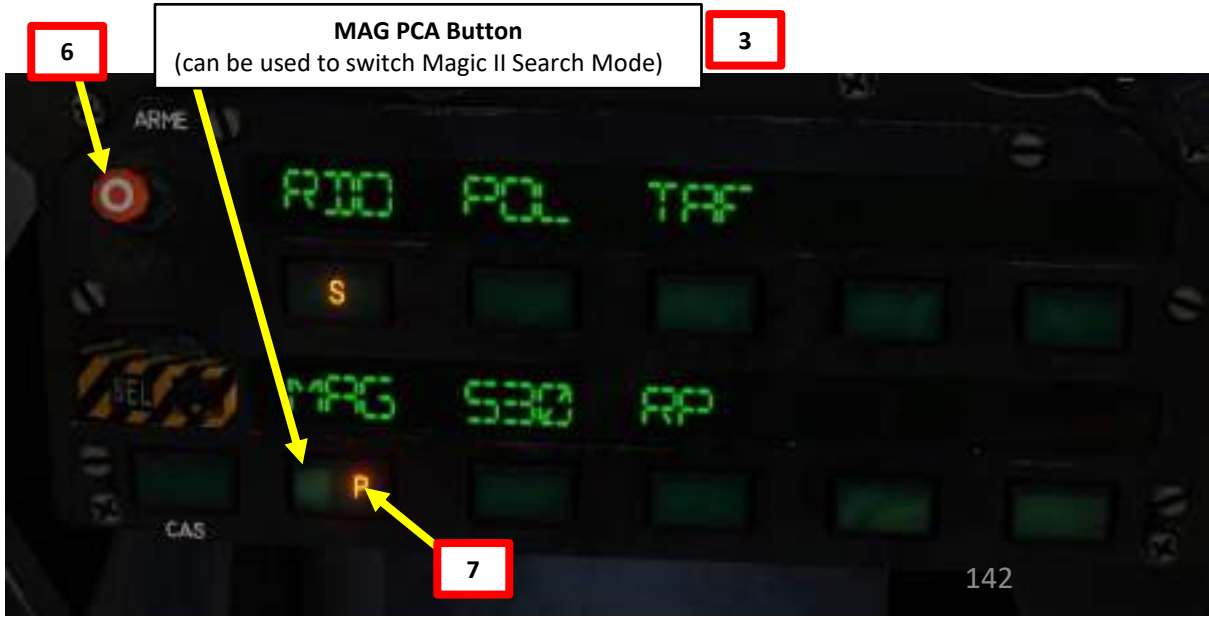






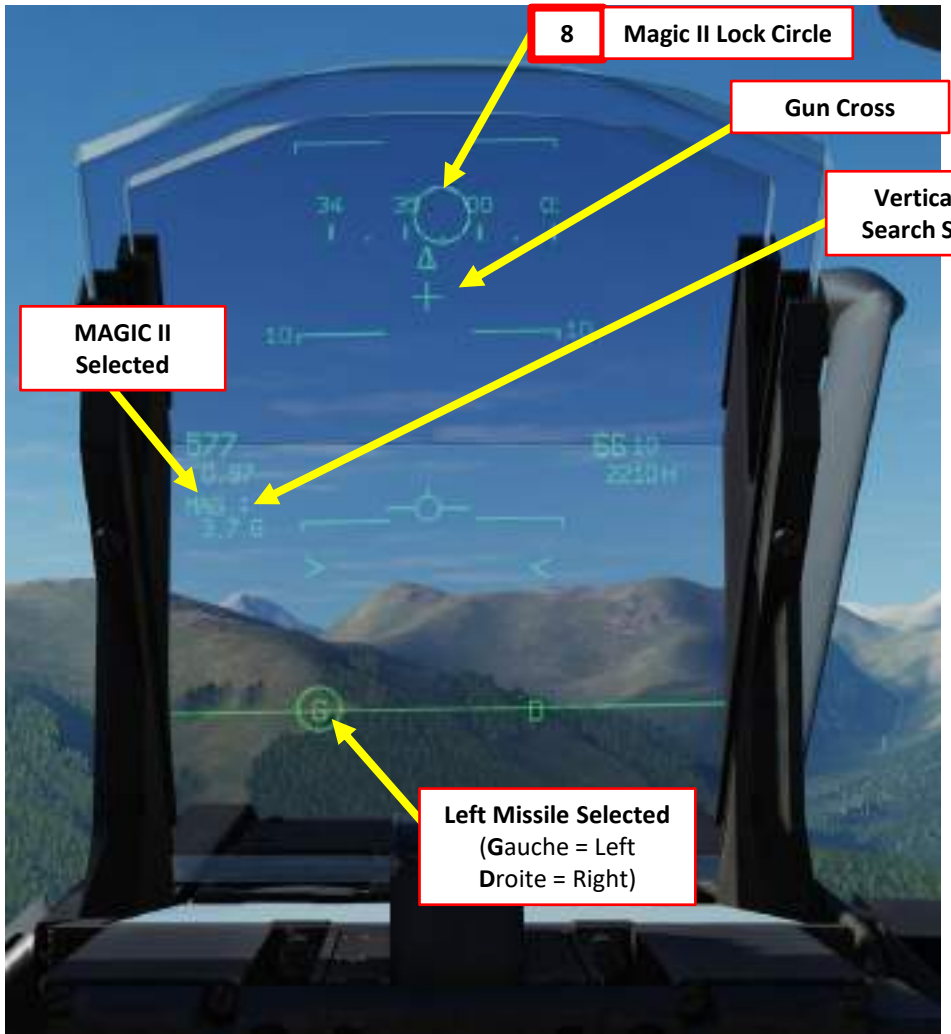
2.2.2 – MAGIC II MISSILE (NO RADAR)

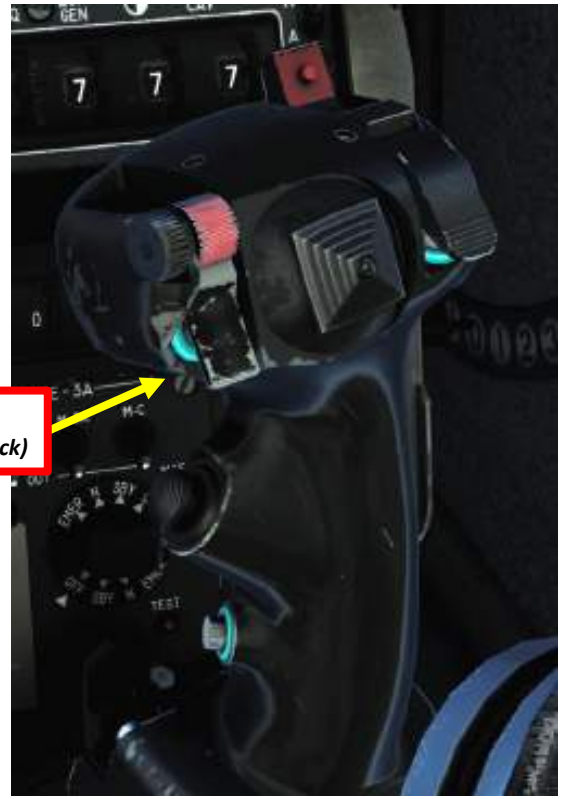
1. On the throttle, set Quick Weapon Select Switch to RIGHT position (MAGIC SELECT). This will select the Magic II missile.
2. By default, the Magic II missile's Vertical Wide Search mode will be selected.
3. (Optional) If desired, select another Magic II Search Mode as per section 2.2.1 (NAV Update / Magic Unlock button and PCA MAG button can be used to that effect). This is as per your own personal preference.
4. On PPA, press the MAG warm-up button. "P" (*Prêt*/Ready) will blink during warm-up process (30 s) and remain illuminated when warm-up is complete. A warmed-up MAGIC missile seeker consumes coolant supply (nitrogen). There is enough supply to keep the seeker heads active for 90 minutes, after that time the seekers become warm rendering the missiles useless. Each time the preparation is reactivated (switched On) will shorten the coolant supply by 10 minutes.
5. On PPA, select which missile to fire (G = Left, I = AUTO, R = Right)
6. On the PCA, turn Master Arm switch to ARME (UP)
7. Confirm that MAGIC II missile is selected properly: a "P" indication on the PCA "MAG" button shows that the missile is Ready (*Prêt*).



2.2.2 – MAGIC II MISSILE (NO RADAR)

8. When selected, the missile seeker is caged and looks straight ahead. To lock the seeker, place the HUD gun cross on the target. If the infra-red signature is sufficient, the seeker will automatically lock. Missile tone will be heard when missile is tracking IR signature. Target will be marked and tracked by a small circle on HUD.
9. Fire missile (Press and hold Weapon Fire key, SPACE by default).
10. Once missile is fired, the engine RPM will automatically decrease to prevent an engine flameout, which could be caused by ingestion of the smoke released by the missile launch. RPM will increase back to normal values a few seconds later.
11. To de-select Magic, on the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select other weapons via the PCA or with the Quick Weapon Select switch.





2.2.2 – MAGIC II MISSILE (NO RADAR)

2.2.3 – MAGIC II MISSILE (WITH SHORT RANGE RADAR)

1. On the throttle, set Quick Weapon Select Switch to RIGHT position (MAGIC SELECT). This will select the Magic II missile and set the HUD (Heads-Up Display) in the appropriate mode.
2. By default, the Magic II missile's Vertical Wide Search mode will be selected.
3. (Optional) If desired, select another Magic II Search Mode as per section 2.2.1 (NAV Update / Magic Unlock button and PCA MAG button can be used to that effect). This is as per your own personal preference.
4. On PPA, press the MAG warm-up button. "P" (*Prêt*/Ready) will blink during warm-up process (30 s) and remain illuminated when warm-up is complete. A warmed-up MAGIC missile seeker consumes coolant supply (nitrogen). There is enough supply to keep the seeker heads active for 90 minutes, after that time the seekers become warm rendering the missiles useless. Each time the preparation is reactivated (switched On) will shorten the coolant supply by 10 minutes.
5. On PPA, select which missile to fire (G = Left, I = AUTO, R = Right)
6. On the PCA, turn Master Arm switch to ARME (UP)
7. Turn on Radar Power by setting switch to **EM**ISSION.
   - Consult previous chapter for radar operation parameters

3

Nav Update / Magic Unlock Button
(can be used to switch Magic II Search Mode)

6

MAG PCA Button
(can be used to switch Magic II Search Mode)

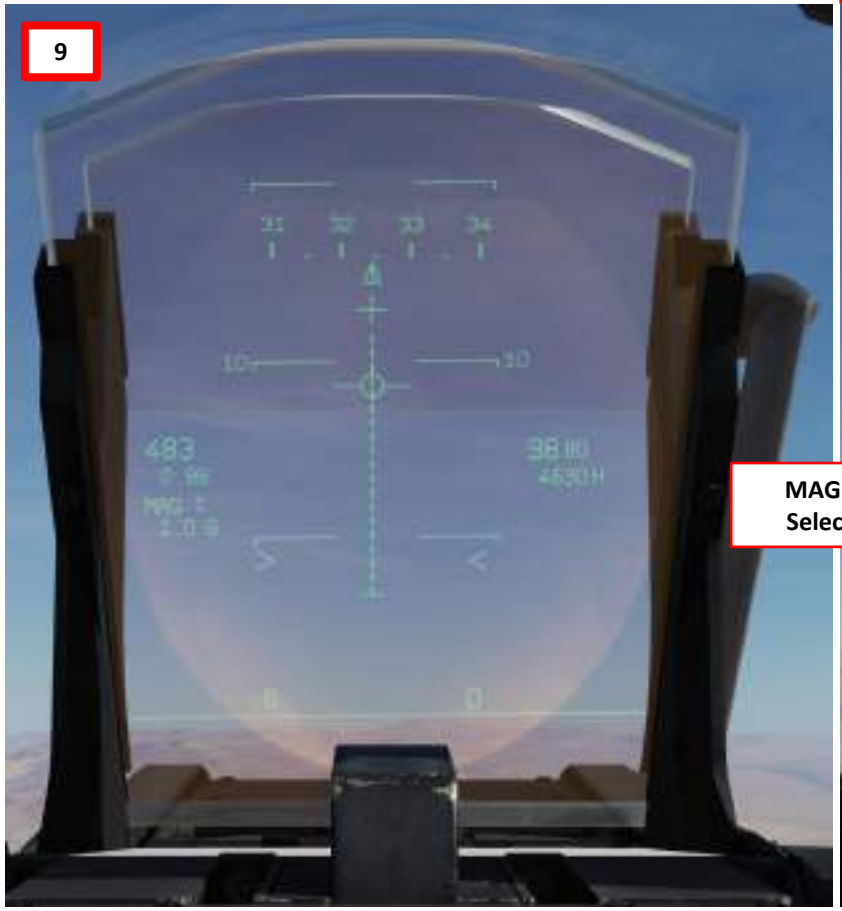
3

2.2.3 – MAGIC II MISSILE (WITH SHORT RANGE RADAR)

8. Select radar "Special Close Combat Mode" by pressing "Weapons System CMD FWD or AFT" switch on your HOTAS. You can choose between three modes: Horizontal, Vertical or Boresight.
   - Magic II missile is selected, pressing the Weapons System CMD switch FWD will toggle between this BORESIGHT and and Vertical mode..
   - Horizontal modes (BA2 and BAH) are cycled by using the Weapons System CMD Switch AFT
9. The radar will be set at a range of 10 nautical miles and it will automatically STT lock on the closest contact it can detect. You can also lock using the long-range radar modes by using TDC DEPRESS control. A square will appear on locked target.
10. The seeker for Magic II missile is not visible until you get a solid lock. The same is true for the growling sound - it can only be heard after acquiring a lock and not during the search phase.

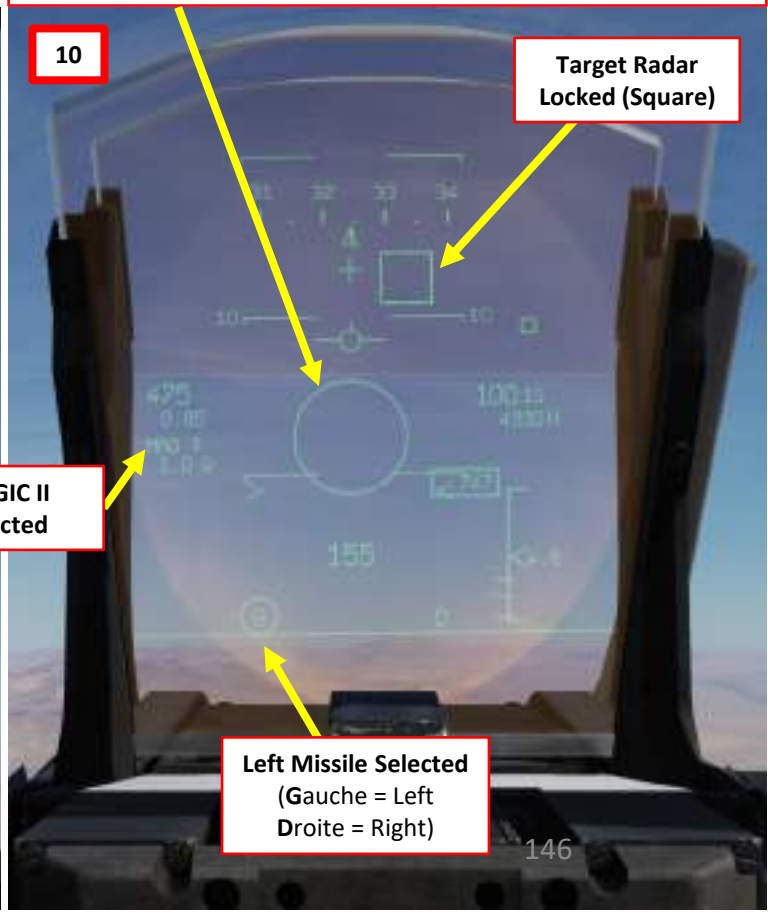
Note about Step 10: Cycle through Special Radar Modes by pressing "Weapons System CMD FWD or AFT" switch on your HOTAS.

8
Weapons System CMD Switch



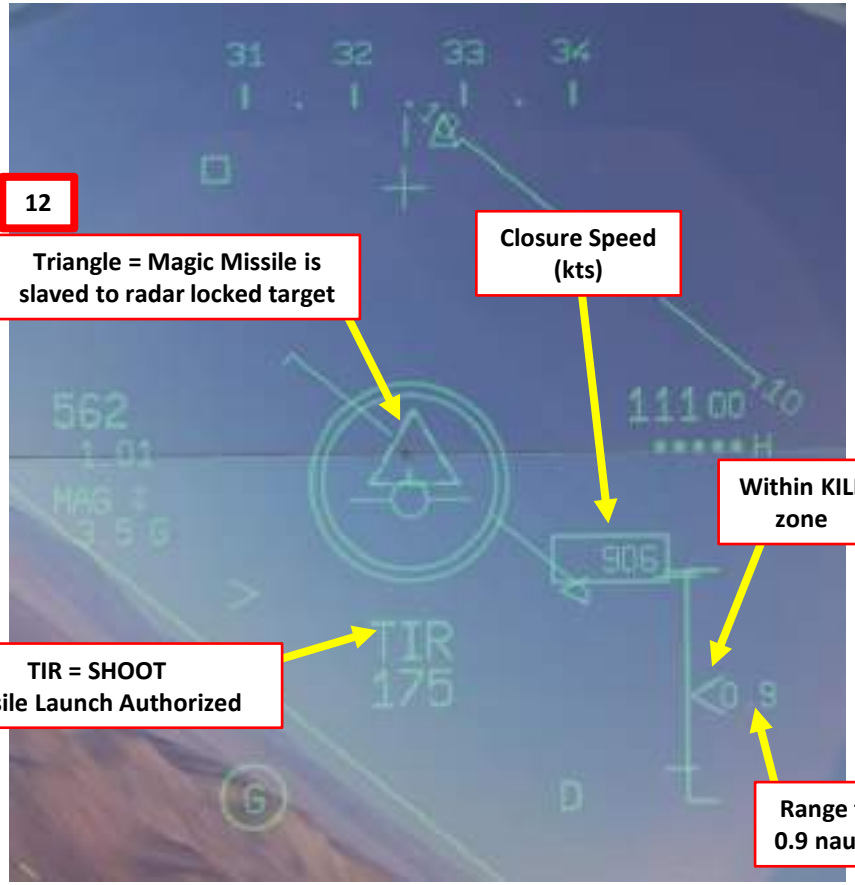
MAGIC II Selected

Flight Director Ring
Contrary to many other aircraft, it is not used to attain the lock in M-2000C (as stated above, you use gun cross for that).



2.2.3 – MAGIC II MISSILE (WITH SHORT RANGE RADAR)

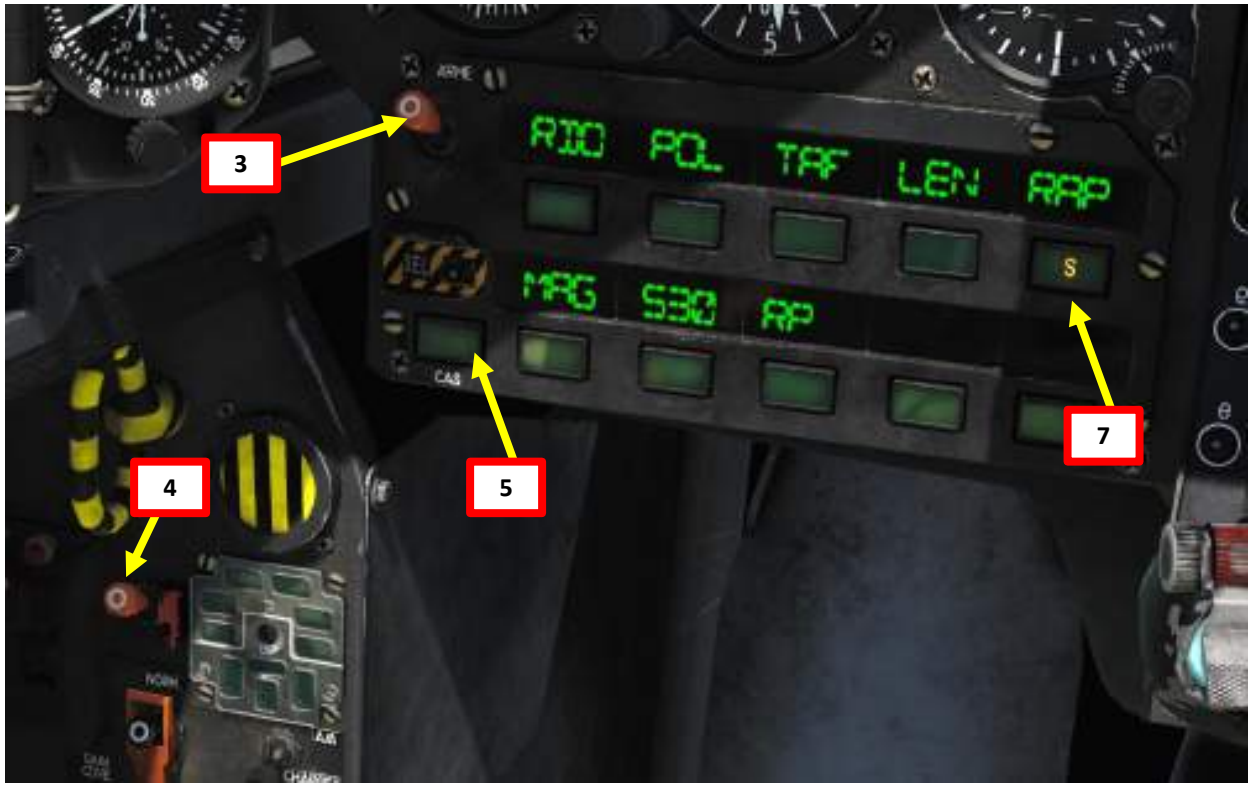
11. Press the Air-to-Ground Designate / Magic Slave Switch to slave the Magic II seeker to the target locked on radar. The seeker uncages and looks in the same direction as the radar, providing IR lock on the target.
12. When the Magic's seeker head is tracking a heat signature, a continuous sound is heard in the helmet. The Magic's circle will then switch to a triangle, indicating that the Magic Missile is slaved to a radar locked target.
13. Confirm that MAGIC II missile is selected properly: a "P" indication on the PCA "MAG" button shows that the missile is Ready (*Prêt*).
14. Fire missile (Press and hold Weapon Fire key, SPACE by default) when missile is within KILL (no escape) range
    - When in KILL zone, you will see a double circle + TIR (fire) message on the HUD
15. Once missile is fired, the engine RPM will automatically decrease to prevent an engine flameout, which could be caused by ingestion of the smoke released by the missile launch. RPM will increase back to normal values a few seconds later.
16. To de-select Magic, on the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select other weapons via the PCA or with the Quick Weapon Select switch.



2.2.3 – MAGIC II MISSILE (WITH SHORT RANGE RADAR)

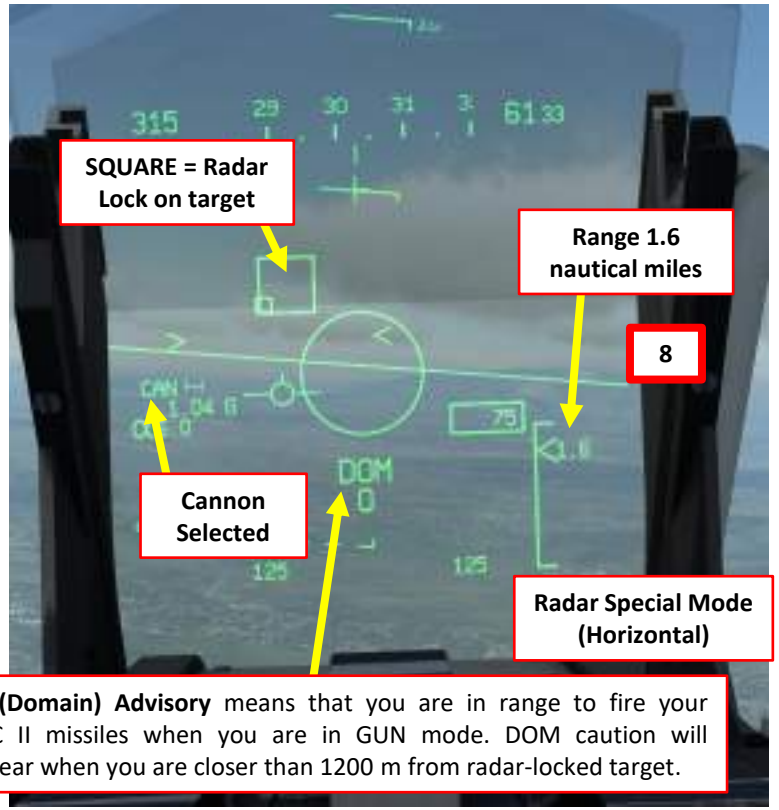
2.3.1 – AIR-TO-AIR GUNS TUTORIAL (WITH RADAR)

1. On the throttle, set Quick Weapon Select Switch to LEFT position (AA GUN SELECT). This will select the cannon in Air-to-Air Mode.
2. On PPA, select gun firing mode (PAR = 8 round burst, TOT = continuous fire)
3. Set Master Arm switch to ARME (UP)
4. Arm Cannon Switch (UP)
5. Verify the cannon is in Air-to-Air mode; CAS (Canon Air-Sol / Air-to-Ground) button on the PCA should **NOT** display P (Air-to-Ground Ready) Mode.
6. Turn on Radar Power by setting switch to EMISSION.
7. Select desired fire rate. "S" indicates the fire rate selected.
   - RAP = *Rapide* (High Rate of Fire) / LEN = *Lent* (Slow Rate of Fire)

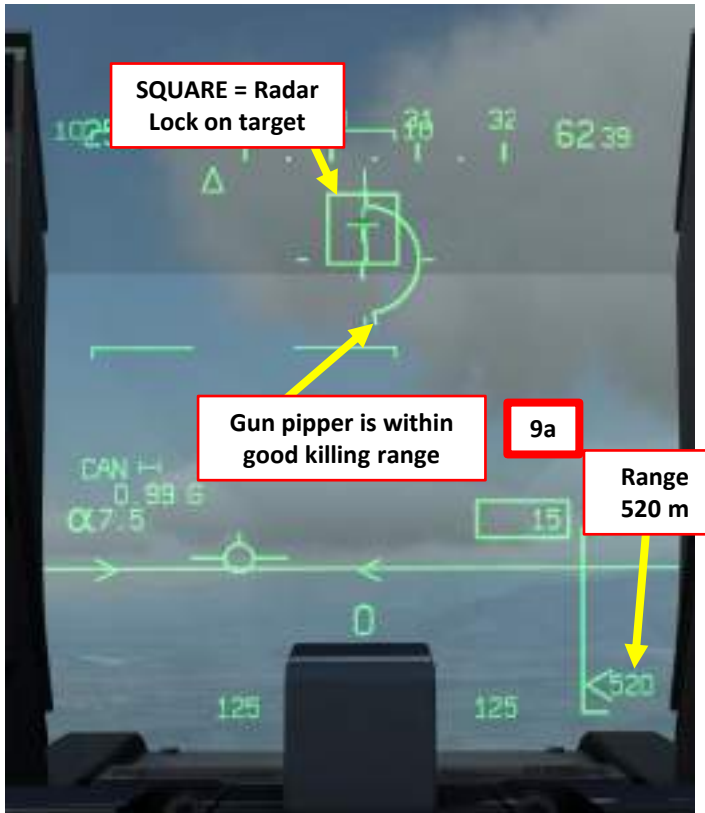


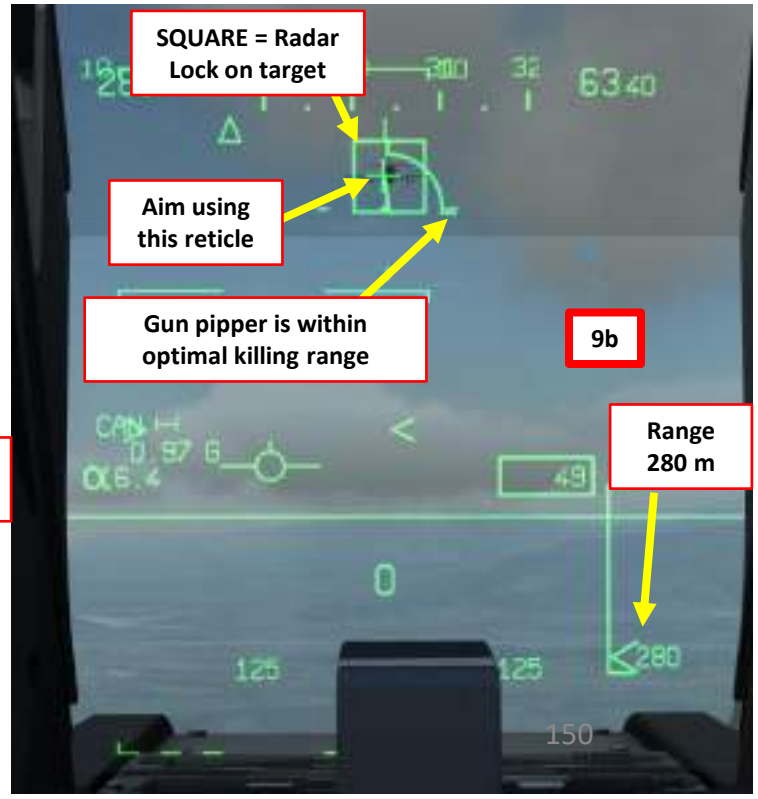
2.3.1 – AIR-TO-AIR GUNS TUTORIAL (WITH RADAR)

8. Select radar "Special Mode" by pressing "Weapons System CMD FWD or AFT" switch on your HOTAS. You can choose between three modes as shown previously (H, V or B).
9. Lock your radar by pressing using TDC DEPRESS control once target circle is within radar tracking circle/line. A square will appear on locked target.
10. Fire guns (Weapon Fire key, SPACE by default) when you are within kill range (gun pipper will change when you are 300-600 meters from target) and your center reticle is on target.
11. You can unlock target with the HOTAS Weapons System CMD DEPRESSED switch on the stick.
12. To de-select guns, on the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select other weapons via the PCA or with the Quick Weapon Select switch.



DOM (Domain) Advisory means that you are in range to fire your MAGIC II missiles when you are in GUN mode. DOM caution will disappear when you are closer than 1200 m from radar-locked target.

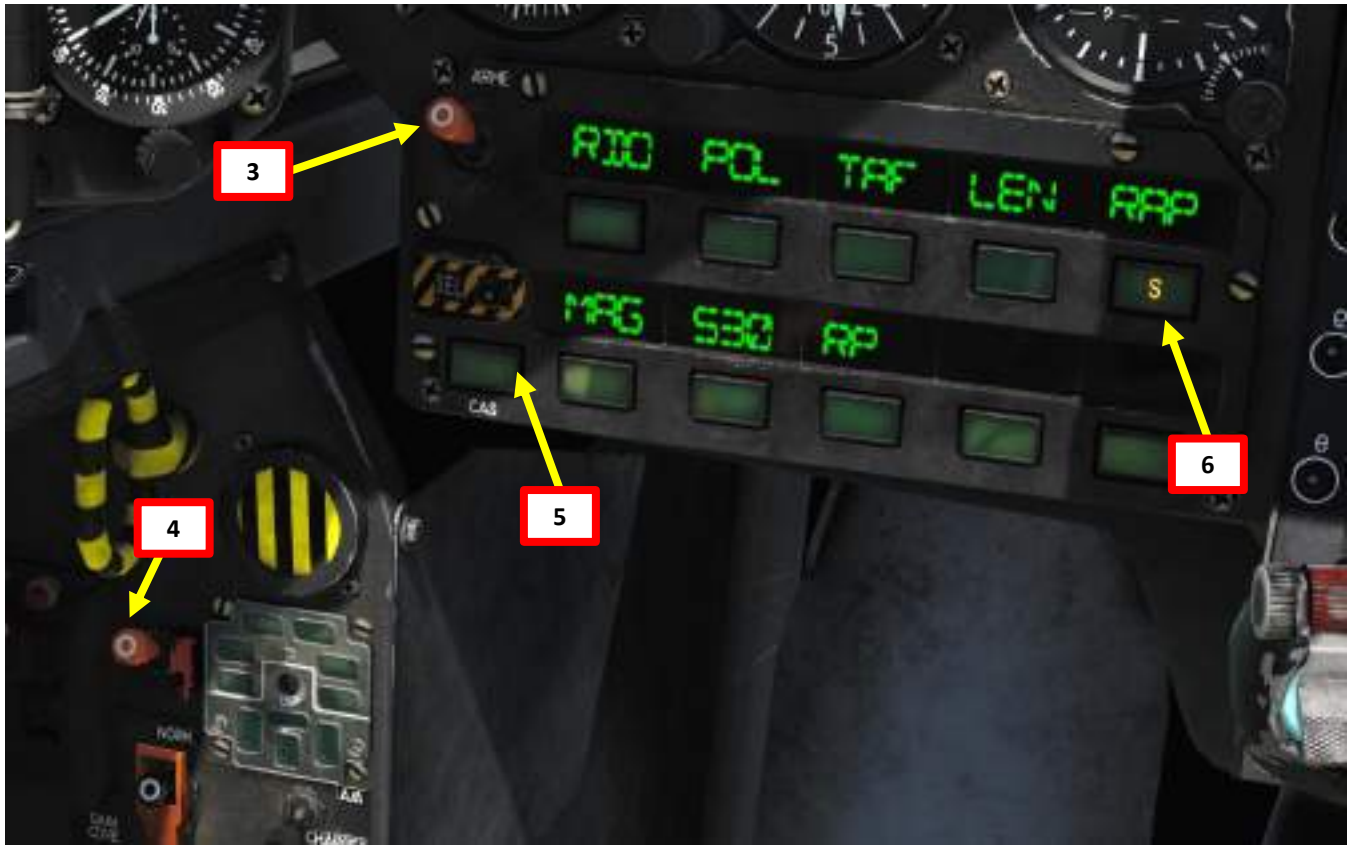




2.3.1 – AIR-TO-AIR GUNS TUTORIAL (WITH RADAR)

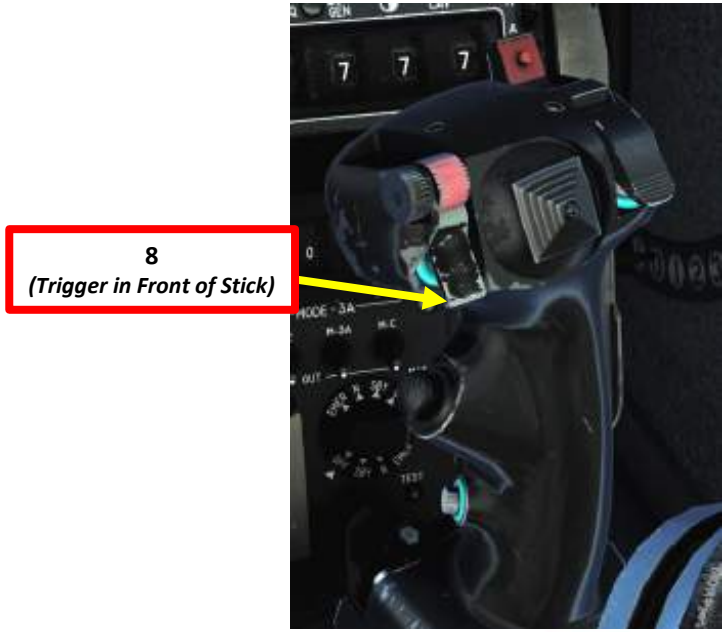
2.3.2 – AIR-TO-AIR GUNS TUTORIAL (NO RADAR)

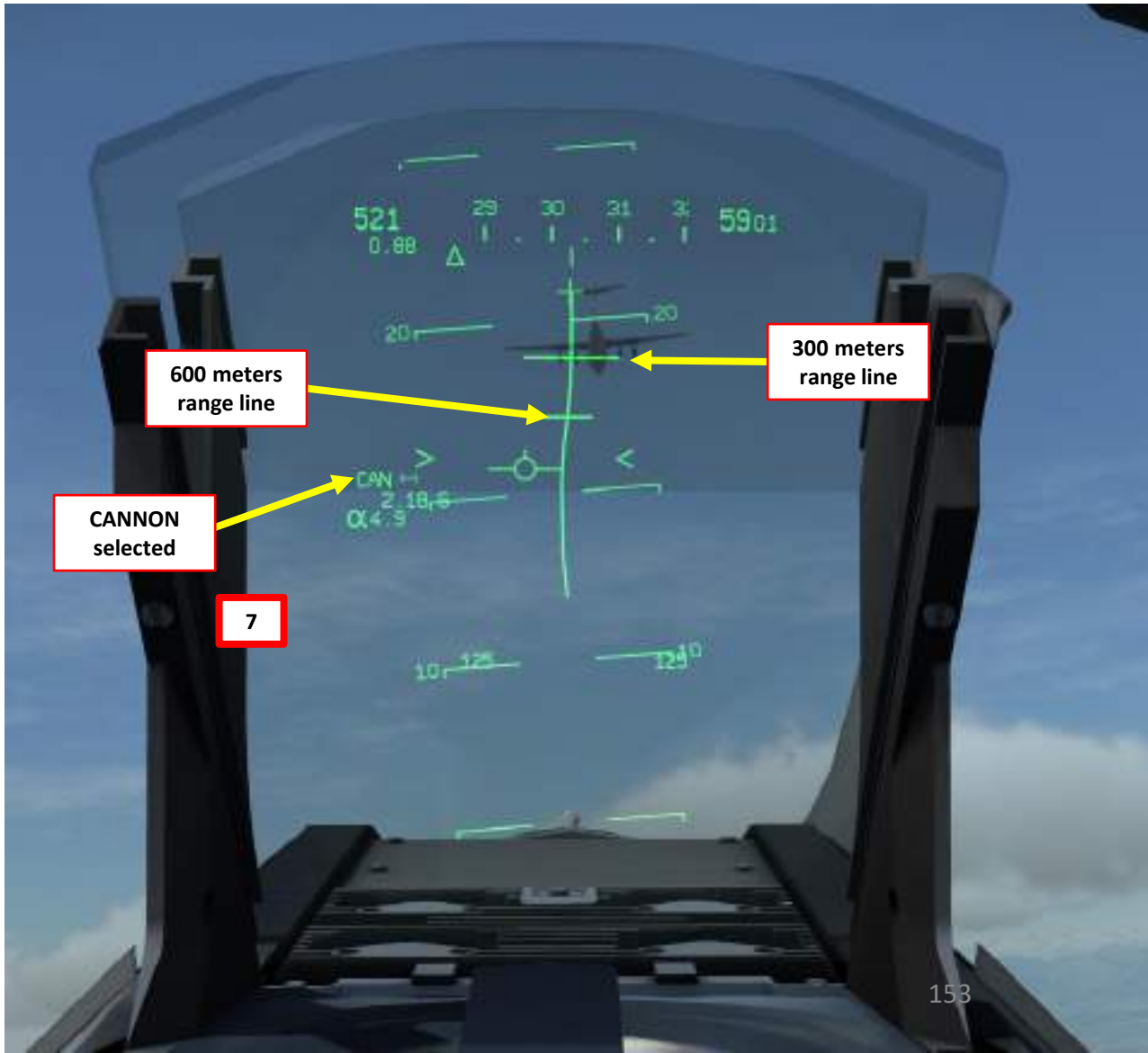
1. On the throttle, set Quick Weapon Select Switch to LEFT position (AA GUN SELECT). This will select the cannon in Air-to-Air Mode.
2. On PPA, select gun firing mode (PAR = 8 round burst, TOT = continuous fire)
3. Set Master Arm switch to ARME (UP)
4. Arm Cannon Switch (UP)
5. Verify the cannon is in Air-to-Air mode; CAS (Canon Air-Sol / Air-to-Ground) button on the PCA should **NOT** display P (Air-to-Ground Ready) Mode.
6. Select desired fire rate. "S" indicates the fire rate selected.
   - RAP = *Rapide* (High Rate of Fire) / LEN = *Lent* (Slow Rate of Fire)



2.3.2 – AIR-TO-AIR GUNS TUTORIAL (NO RADAR)

7. Align gun pipper on target. Use longest bar for shots from 300 meters and shortest bar for shots from 600 meters.
8. Fire guns (Weapon Fire key, SPACE by default).
9. To de-select guns, on the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select other weapons via the PCA or with the Quick Weapon Select switch.

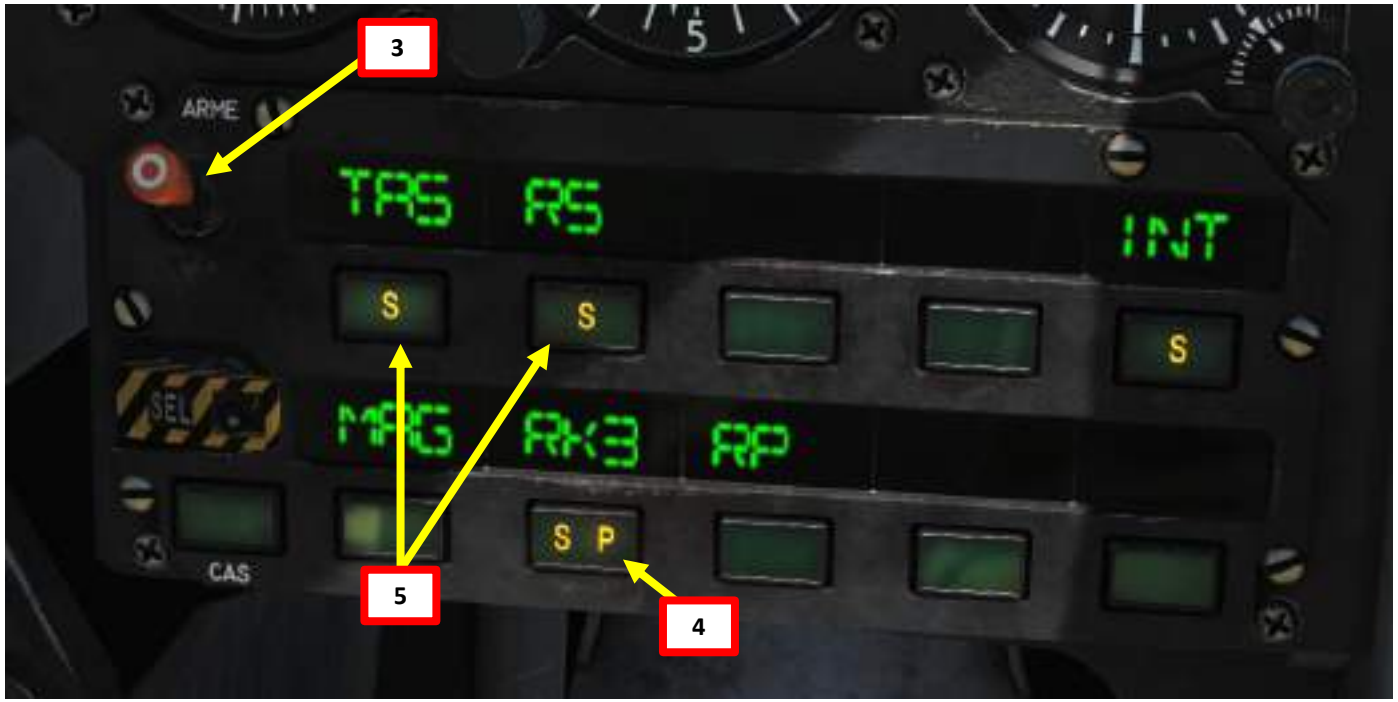




2.3.2 – AIR-TO-AIR GUNS TUTORIAL (NO RADAR)

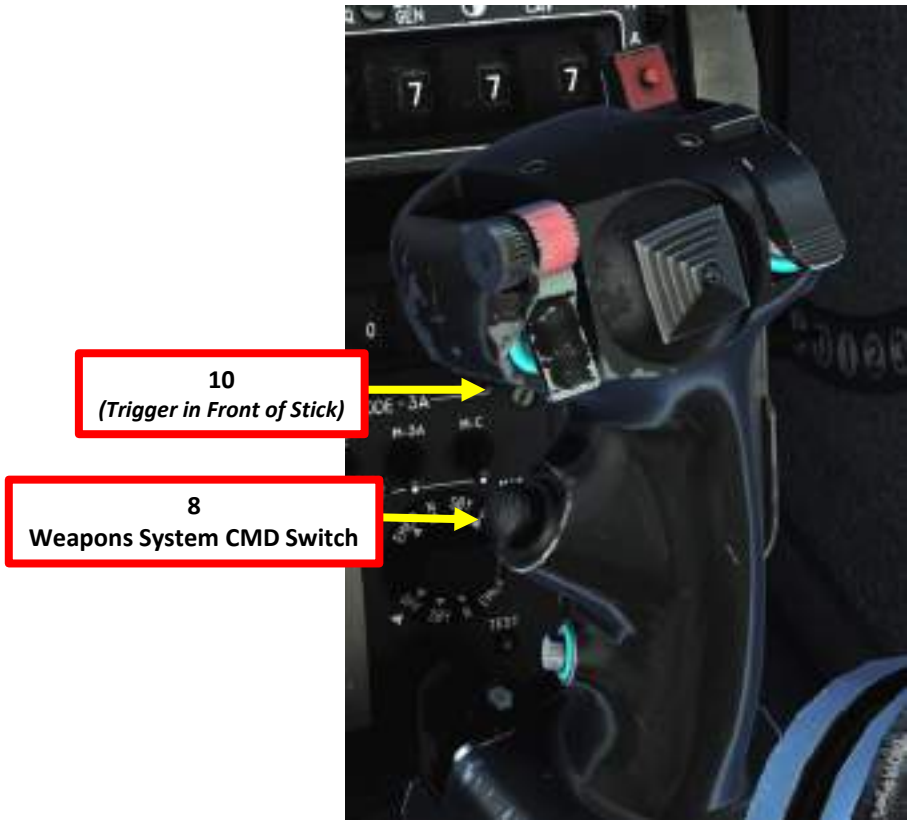
3.1 – ROCKETS TUTORIAL

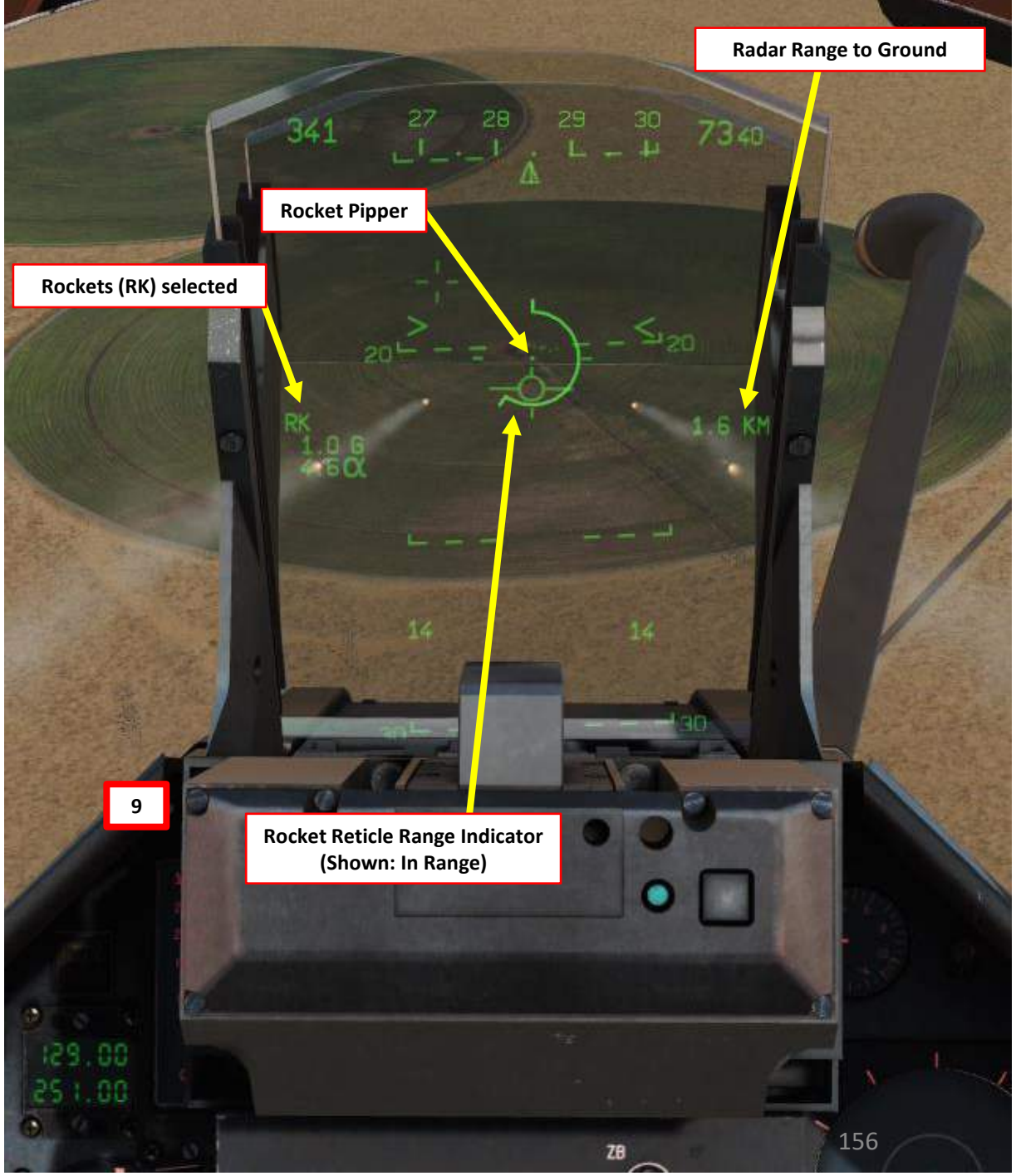
1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the air-to-ground armament via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA, set firing mode to either PAR (fires single rocket salvo) or TOT (fires all rockets in pods).
3. Set Master Arm switch to ARME (UP)
4. Select RK3 (Rocket) on PCA
5. Ensure TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) and RS (*Radio-Sonde*, Altitude Above Ground) buttons are selected (S) on the PCA.
6. Set Radar Altimeter Power switch to **M**ARCHE
7. Turn on Radar Power by setting switch to **EM**ISSION.



3.1 – ROCKETS TUTORIAL

8. Set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
9. Align rocket pipper on target at a dive angle of 20-25 degrees. You will be within firing range when the gun reticle range indicator starts decreasing. The pipper will be a full circle at maximum range and starts to disappear going from left to right as soon as target gets into range of 2400 meters. The 9 o'clock caret depicts the range of 1800 meters, 6 o'clock of 1200 meters and 3 o'clock of 600 meters.
10. When rocket pipper is aligned, press and hold WEAPON RELEASE button (SPACE by default).
11. You can set Heads-Up Display (HUD) mode back to NAV (Navigation) by pressing the Weapons System CMD AFT switch on the stick.



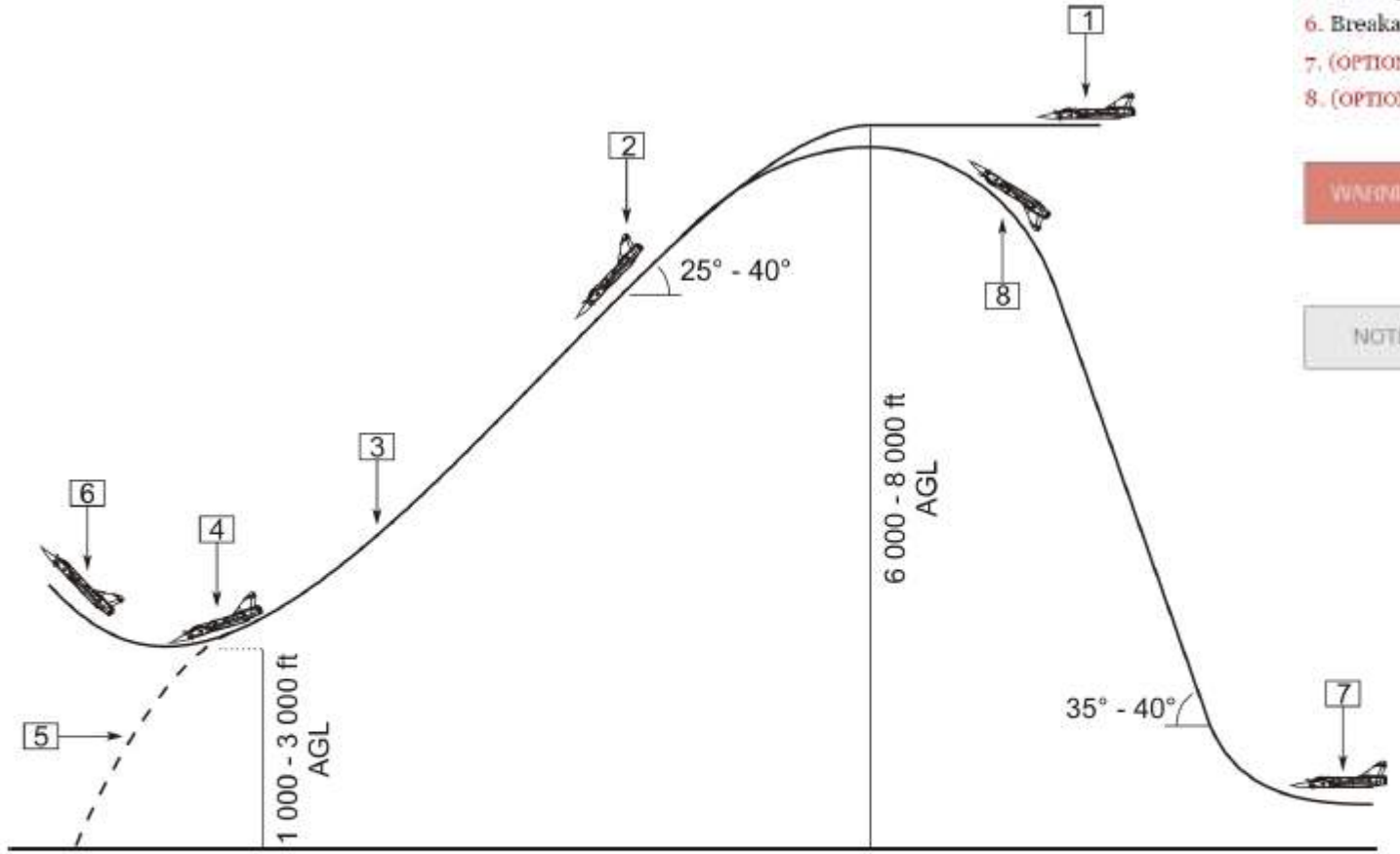


3.1 – ROCKETS TUTORIAL

3.1 – ROCKETS TUTORIAL

Note:
Rocket pods can be mounted on inner (*intérieur*) and/or outer (*extérieur*) pylons. They need to be selected manually on the PCA (S = Selected) with the EXT and INT buttons.

3.2 – MK-82SE "SNAKE EYE" BOMBS
CCIP TUTORIAL



1. Level start. ~ 350 kias. Idle thrust when diving.
2. Target designation. Trigger held down. Follow guidance cues.
3. Start of pull up. Follow guidance cues.
4. Bomb release.
5. Bomb path.
6. Breakaway. Thrust as required.
7. (OPTIONAL) Low-level start ~ 450 to 520 kias. Full dry thrust at climb start.
8. (OPTIONAL) Reversion towards dive. Idle thrust at top of trajectory.

WARNING — The lower the bomb release, the more the impact point is precise, but the closer is the aircraft to the enemy units and their AAA defences. Moreover, if MANPADS are suspected, preventive flare release may be necessary during dive/climb and breakaway.

NOTE — Bombs will not be dropped if at the moment of the release the load factor is below +0.4 G. This is a safety to prevent flying into the bomb(s). For this reason, pull up must be initiated before reaching the release point.

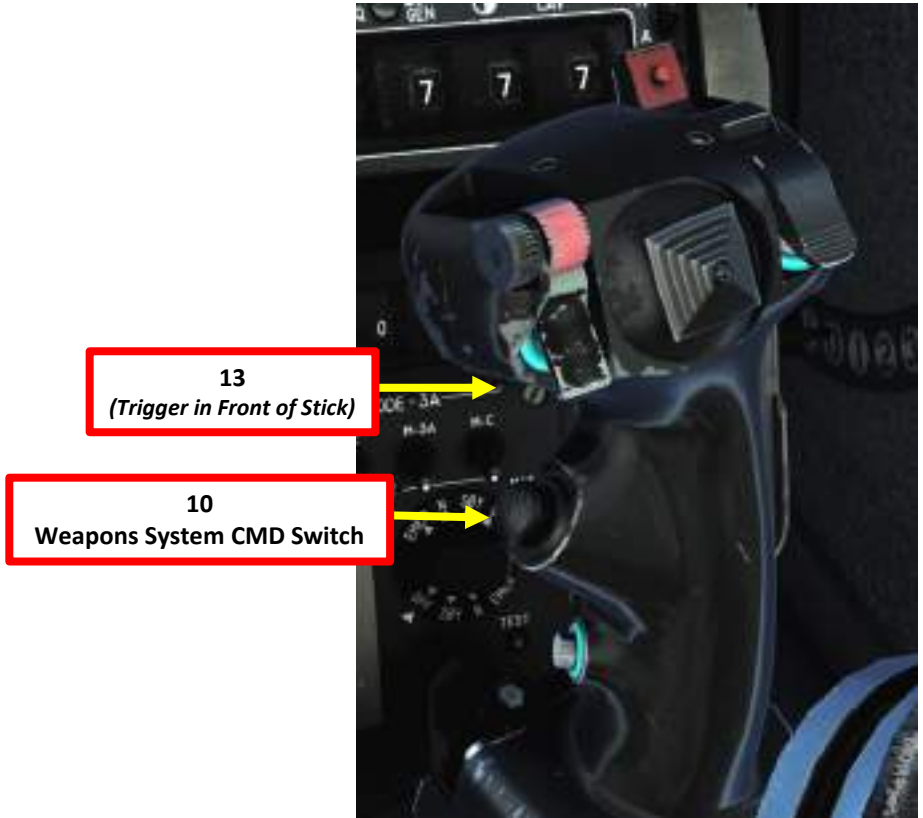
BEFORE ATTACK RUN
Radar: ON
Radio Altimeter: ON and selected (PCA RS)
Bomb quantity, interval and fusing - Set (PPA).
Master Arm - On.
Bombs - Selected (PCA).

3.2 – MK-82SE "SNAKE EYE" BOMBS
CCIP TUTORIAL

1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the air-to-ground armament via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
3. On PPA, set number of bombs to be released (04 = 4 bombs). Take note that 00 will not release any bombs.
4. On PPA, set distance between bomb release (02 = 20 m)
5. Adjust seat to see lower part of HUD better.
6. Set Master Arm switch to ARME (UP)
7. Select BF1 (*Bombe Freinée* – High-drag MK-82SE) on PCA
8. Ensure TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) and RS (*Radio-Sonde*, Altitude Above Ground) buttons are selected (S) on the PCA.
9. Set Radar Altimeter Power switch to **M**ARCHE

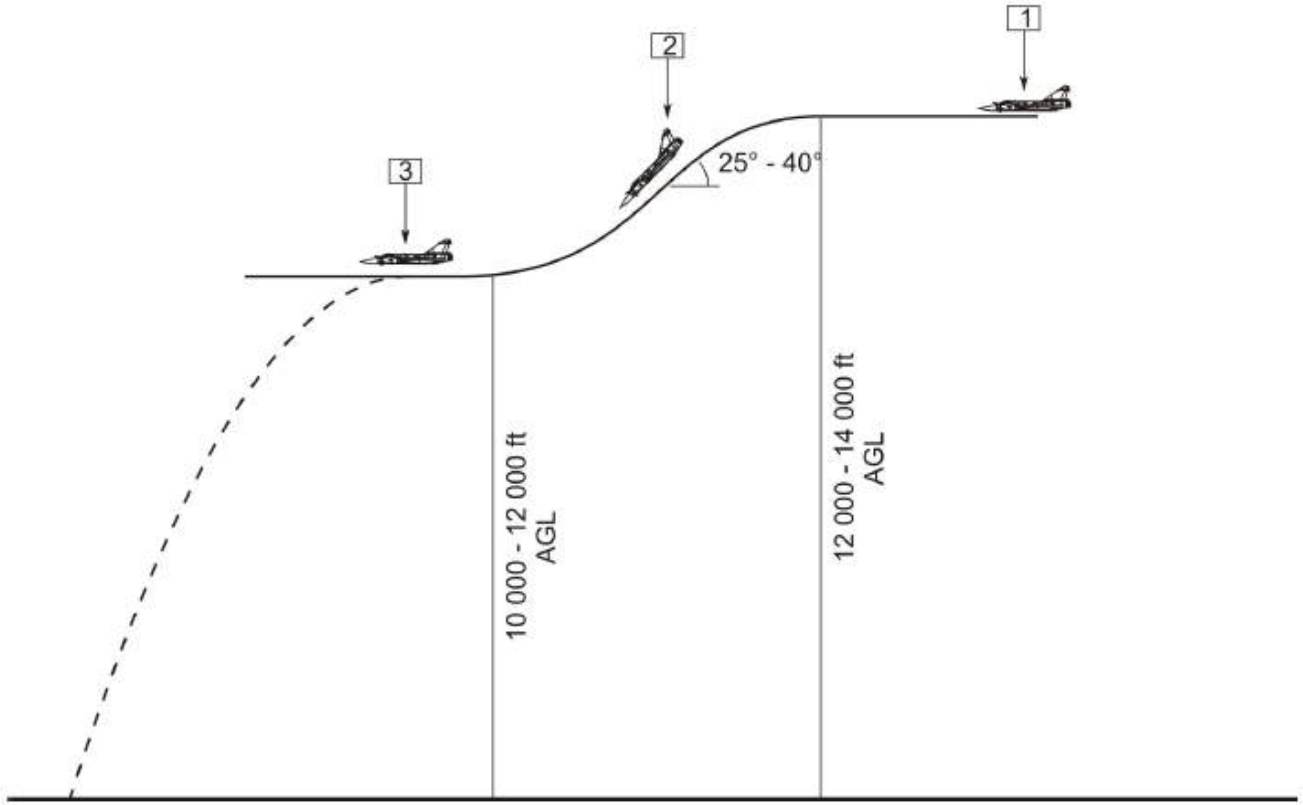
3.2 – MK-82SE "SNAKE EYE" BOMBS CCIP TUTORIAL

10. Set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
11. Ensure you are at least 3000 ft above ground level (AGL) and enter a 20-25 deg dive towards target at a speed of 400 kts minimum.
12. CCIP pipper will appear from the lower part of the HUD. Align CCIP pipper on target by manoeuvering the aircraft.
13. When CCIP pipper is aligned, press and hold WEAPON RELEASE button (SPACE by default).
14. Pull up to avoid smacking yourself into the ground and watch the fireworks.
15. You can set Heads-Up Display (HUD) mode back to NAV (Navigation) by pressing the Weapons System CMD AFT switch on the stick.



3.2 – MK-82SE "SNAKE EYE" BOMBS
CCIP TUTORIAL

3.3 – MK-82 BOMBS - MANUAL CCRP TUTORIAL



BEFORE ATTACK RUN
Radar - On.
Bomb fusing - Set (PPA).
Master Arm - On.
Bomb - Selected (PCA EF1).
Laser code set (only possible on the ground before the flight)

1. Level start. 520 kias max. Idle thrust when diving. Request for laser targeting.

2. Target designation. Trigger held pressed. Start of pull up. Follow guidance cues. Adjust thrust when level.

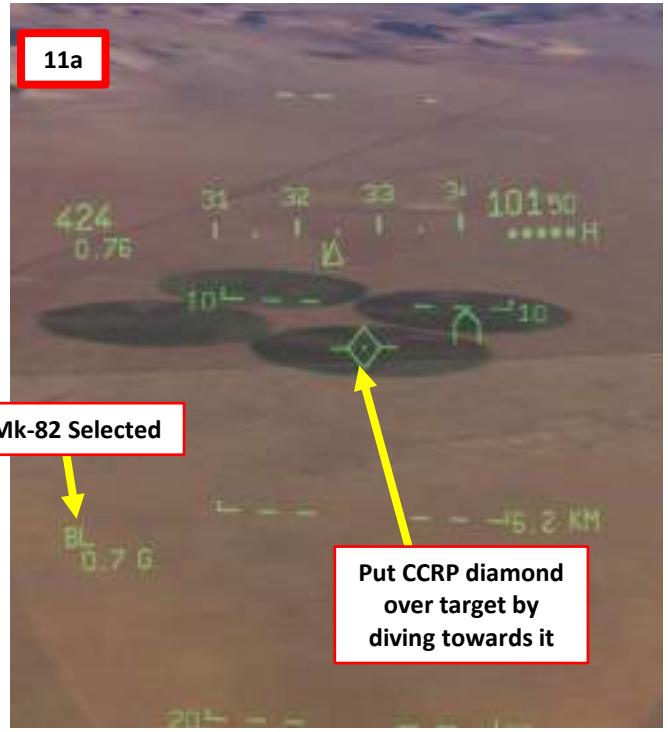
3. Automatic bomb release in level flight.

3.3 – MK-82 BOMBS - MANUAL CCRP TUTORIAL

1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the air-to-ground armament via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
3. On PPA, set number of bombs to be released (00 = single, 04 = 4 bombs). Take note that 00 will not release any bombs.
4. On PPA, set distance between bomb release (02 = 20 m)
5. Adjust seat to see lower part of HUD better.
6. Set Master Arm switch to ARME (UP)
7. Select BL1 (*Bombe Lisse* – Low-drag MK-82) on PCA
8. Make sure TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) mode is selected on PCA
9. Turn radar power ON (**EM**ISSION)

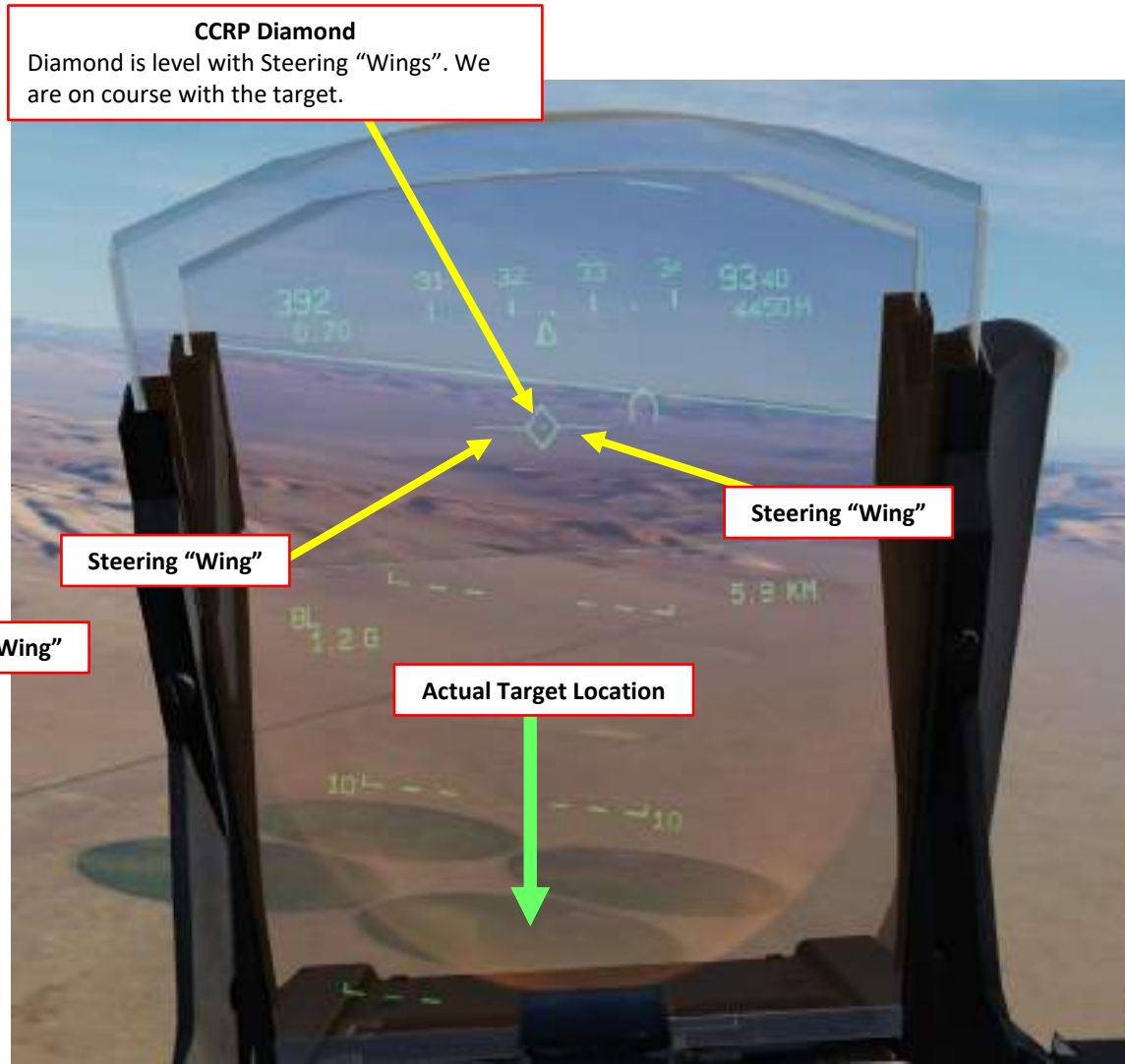
3.3 – MK-82 BOMBS - MANUAL CCRP TUTORIAL

10. Set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
11. Fly to position the CCRP diamond on target and press the "MAGIC SLAVE/AG DESIGNATE" button on your HOTAS to designate the target. When target is designated, steering wings will appear over the CCRP diamond.
    - Keep in mind that unlike most modern aircraft, the Mirage has no HUD indication to show where the designated/locked ground target is. You will have to make sure the designation with the CCRP diamond is precise enough and use the CCRP cues (CCRP line, steering wings, distance to target) accordingly.



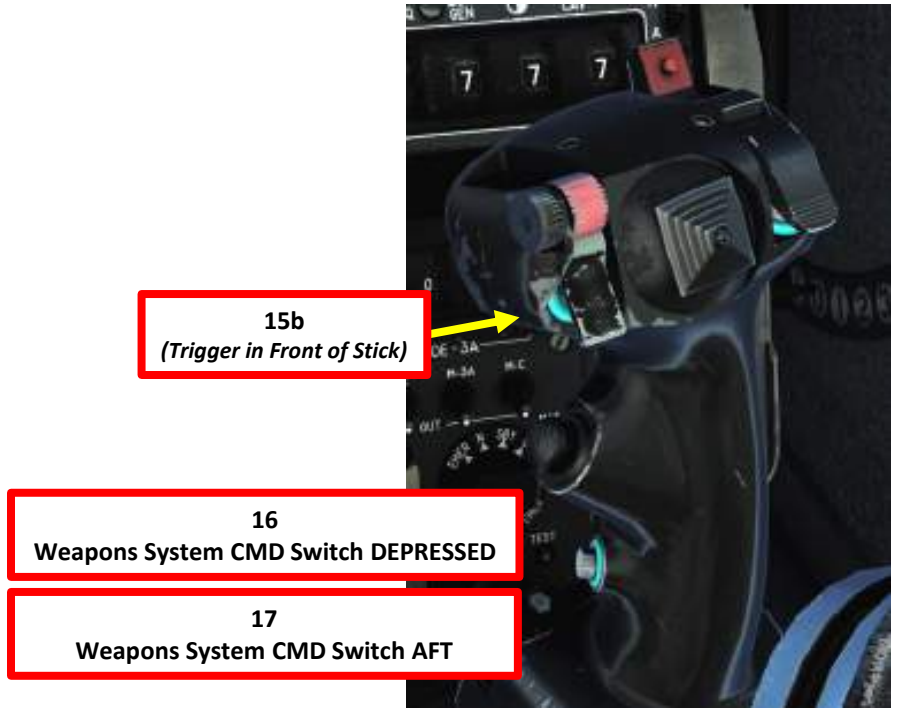
3.3 – MK-82 BOMBS - MANUAL CCRP TUTORIAL

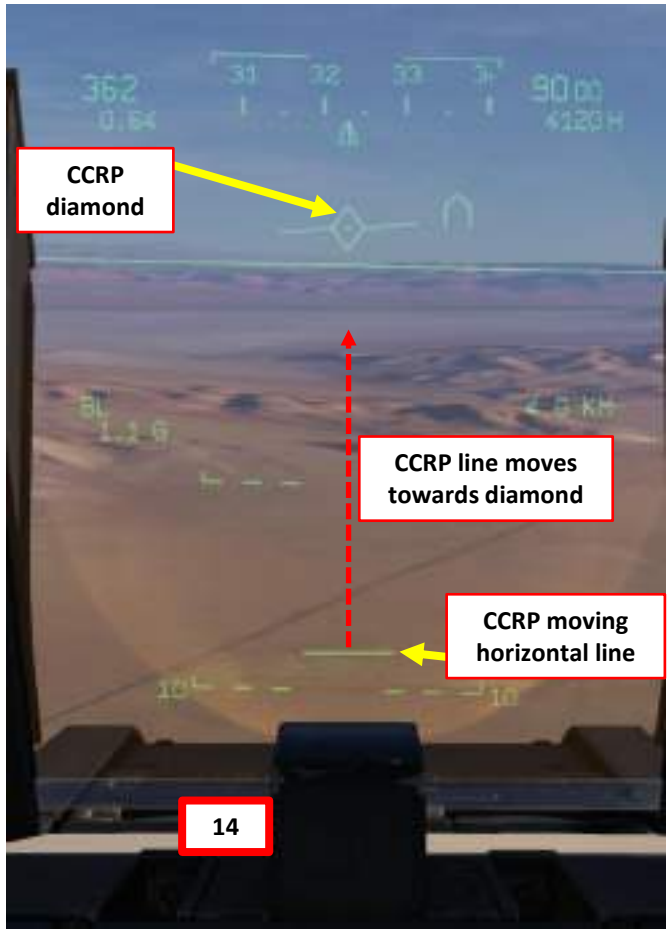
12. Once target is designated, steering wings will appear on the CCRP diamond. They will provide steering cues towards the designated target. Radar range will display the range to target.
13. Fly level towards target (make sure you have at least 2000 ft of clearance).



3.3 – MK-82 BOMBS - MANUAL CCRP TUTORIAL

14. Horizontal CCRP line will show up when you are 15 seconds from target.
15. When CCRP release cue (horizontal line) appears, press and hold WEAPON RELEASE button (SPACE by default) until CCRP line is lined up with the diamond reticle. The bombs will automatically be released. In this example, four bombs will be released per trigger press.
16. Observe damage and unlock target (Weapons System CMD DEPRESSED switch on the stick). Unfortunately, CCRP is not very precise.
17. You can set Heads-Up Display (HUD) mode back to NAV (Navigation) by pressing the Weapons System CMD AFT switch on the stick.





3.3 – MK-82 BOMBS - MANUAL CCRP TUTORIAL

3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)

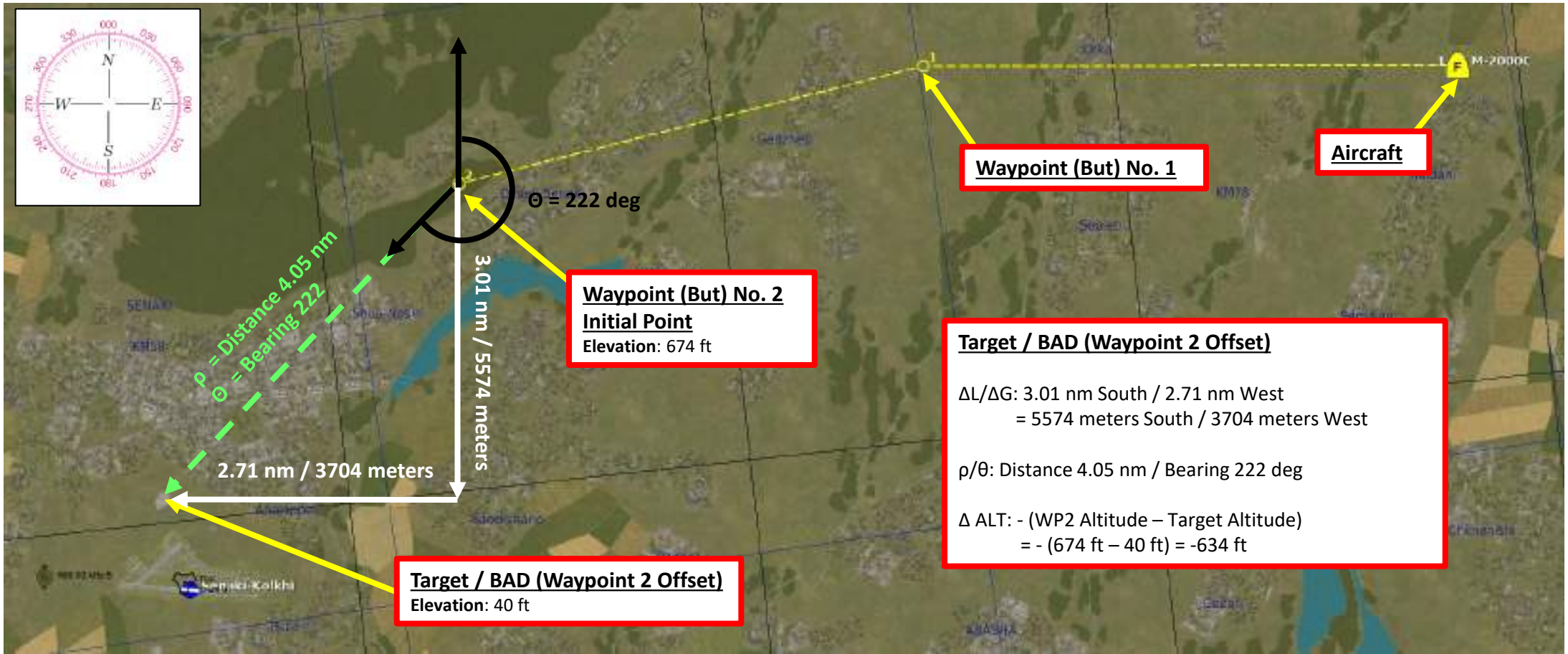
INS Precision bombing is a kind of attack that requires longer and more careful planning and preparation.

However, you don't need to manually designate the target by entering a shallow dive. Moreover, it is not necessary to obtain a visual on the place you want to bomb. The drawback is that the position of the target must be known precisely and inserted as a Waypoint Offset/BAD (*But Additionnel)*, and the INS requires having enough precision. To achieve INS precision, a landmark can be inserted as the waypoint to which the BAD relates and the INS position updated on it during the attack run. This waypoint is called Initial Point (IP).

Selecting IP (Initial Point) on the PCA triggers the appearance of the INS update symbol. It disappears and is replaced by the guidance cues when passing the IP.

Offsets are defined in two ways:

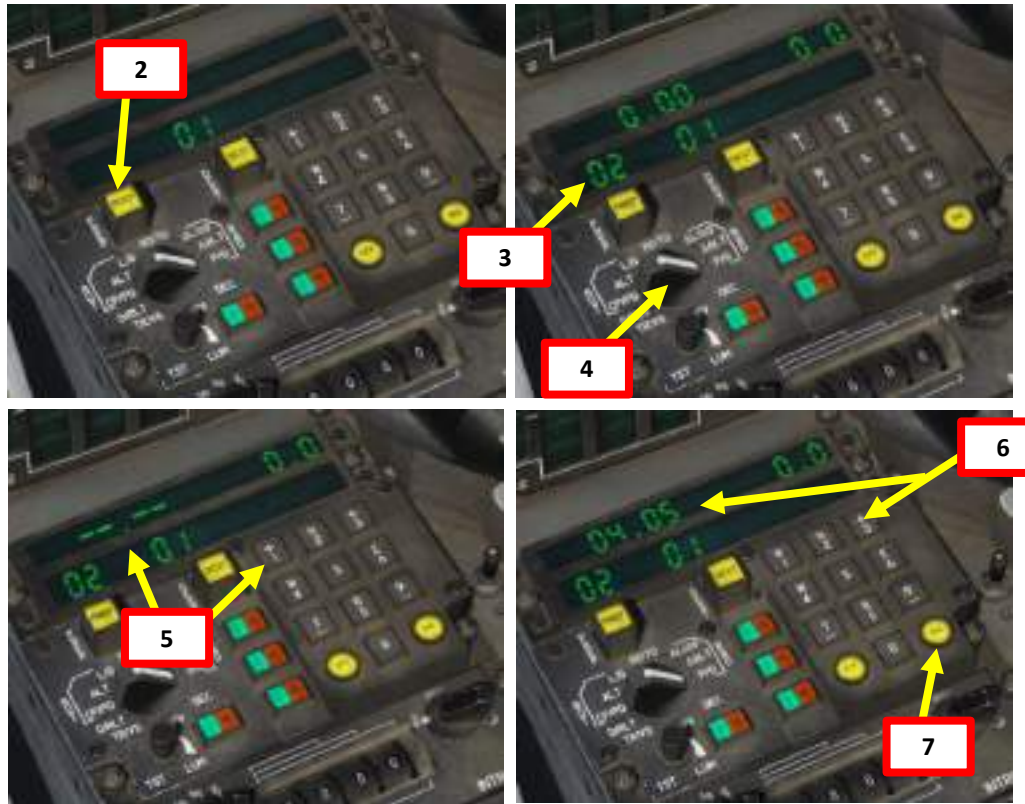
- Entering Longitude (North/South) and Latitude (East/West) offsets (**ΔL/ΔG**) in **meters** with an altitude offset Δ ALT (can be entered in meters or ft as desired).
- Entering Polar Coordinate offsets (**ρ** for distance in nautical miles, **θ** for bearing angle) with an altitude offset Δ ALT (can be entered in meters or ft as desired).

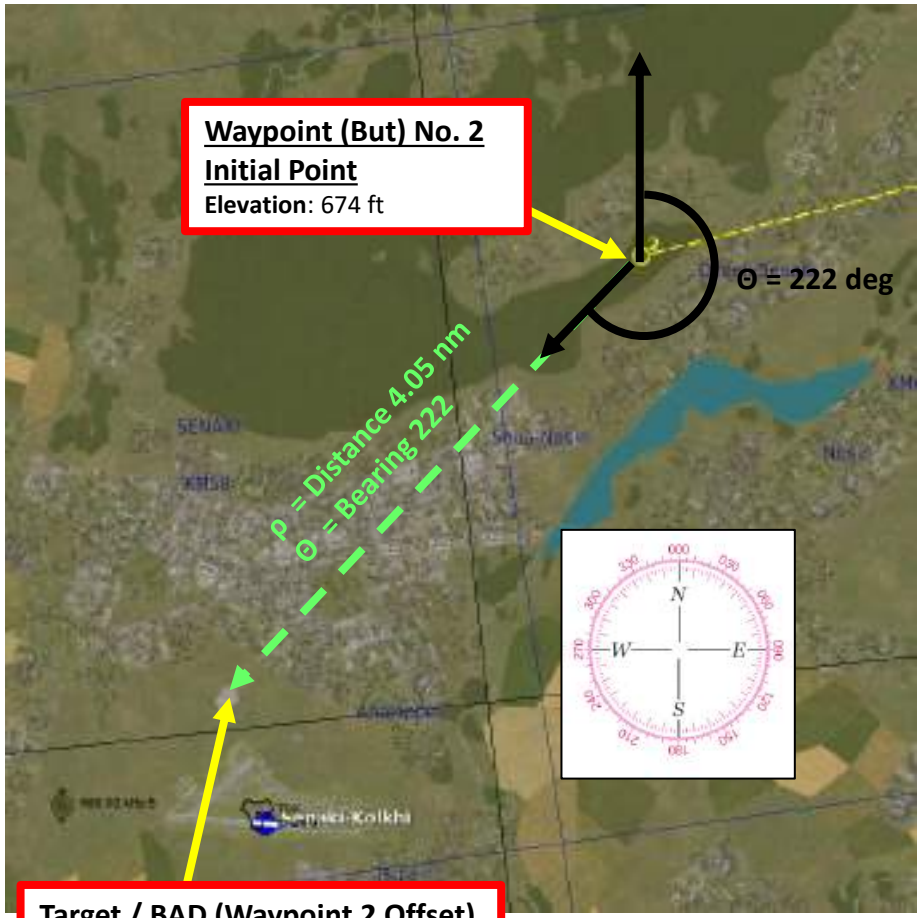


3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)
WAYPOINT OFFSET (*BAD*) CREATION WITH ρ/θ

In this tutorial, we already have two waypoints set the MIP (Module d'Insertion de Paramètres: Data Cartridge Insertion Module) via the mission editor. Make sure Waypoint 2 coordinates are already entered.

1. Note Distance **(ρ in nautical miles)** and Bearing **(θ in degrees)** offsets**,** with the altitude offset Δ ALT (in ft).
   - **ρ Distance Offset: 4.05 nautical miles FROM Waypoint 2**
   - **θ Bearing Offset: 222 degrees FROM Waypoint 2**
   - **Altitude Offset: -634 ft**
2. Press "PREP" (Preparation) button to edit a waypoint.
3. Press "0" and "2" (04) on the INS numpad to select Waypoint Number 2.
4. Set UNI Parameter Selector Switch to ρ/θ
5. Press "+1" on numpad to select the ρ distance field (left)
6. Press **0405** on numpad to enter ρ distance offset of 4.05 nautical miles
7. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).





Target / BAD (Waypoint 2 Offset)

ρ/θ: Distance 4.05 nm / Bearing 222 deg

Δ ALT: WP2 Altitude – Target Altitude
= 674 ft – 40 ft = 634 ft

3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)
WAYPOINT OFFSET (*BAD*) CREATION WITH ρ/θ

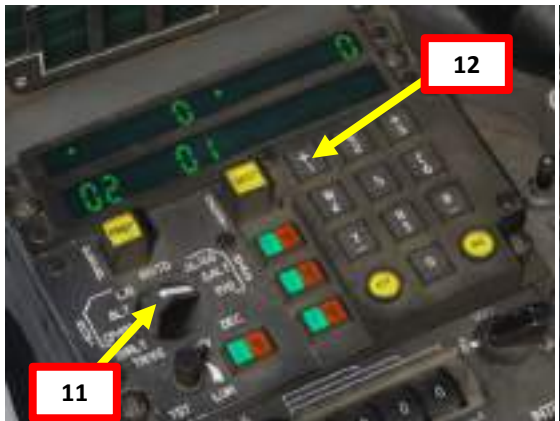
Target / BAD (Waypoint 2 Offset)

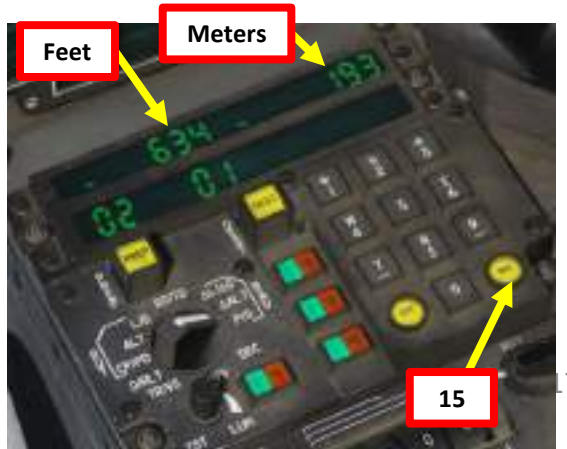
ρ/θ: Distance 4.05 nm / Bearing 222 deg

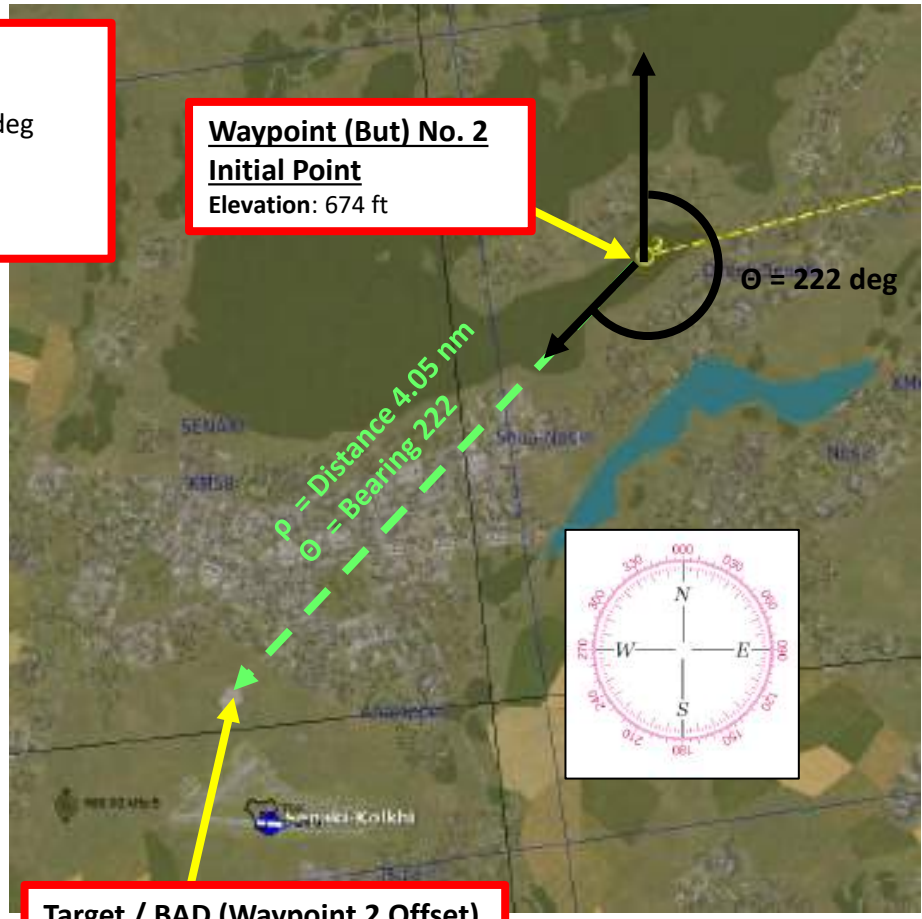
Δ ALT: WP2 Altitude – Target Altitude
= 674 ft – 40 ft = 634 ft

- **ρ Distance Offset: 4.05 nautical miles FROM Waypoint 2**
- **θ Bearing Offset: 222 degrees FROM Waypoint 2**
- **Altitude Offset: -634 ft**

8. Press "+3" on numpad to select the θ bearing field (right)
9. Press **2220** on numpad to enter a θ bearing offset of 222.0 degrees
10. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).
11. Set UNI Parameter Selector Switch to ΔALT
12. Press "+1" on numpad to select the FEET field (left). Right field is deserved for METERS.
13. Press "– " (7) on numpad to select NEGATIVE altitude offset
14. Press **00634** on numpad to enter ALTITUDE offset of -634 meters
15. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).





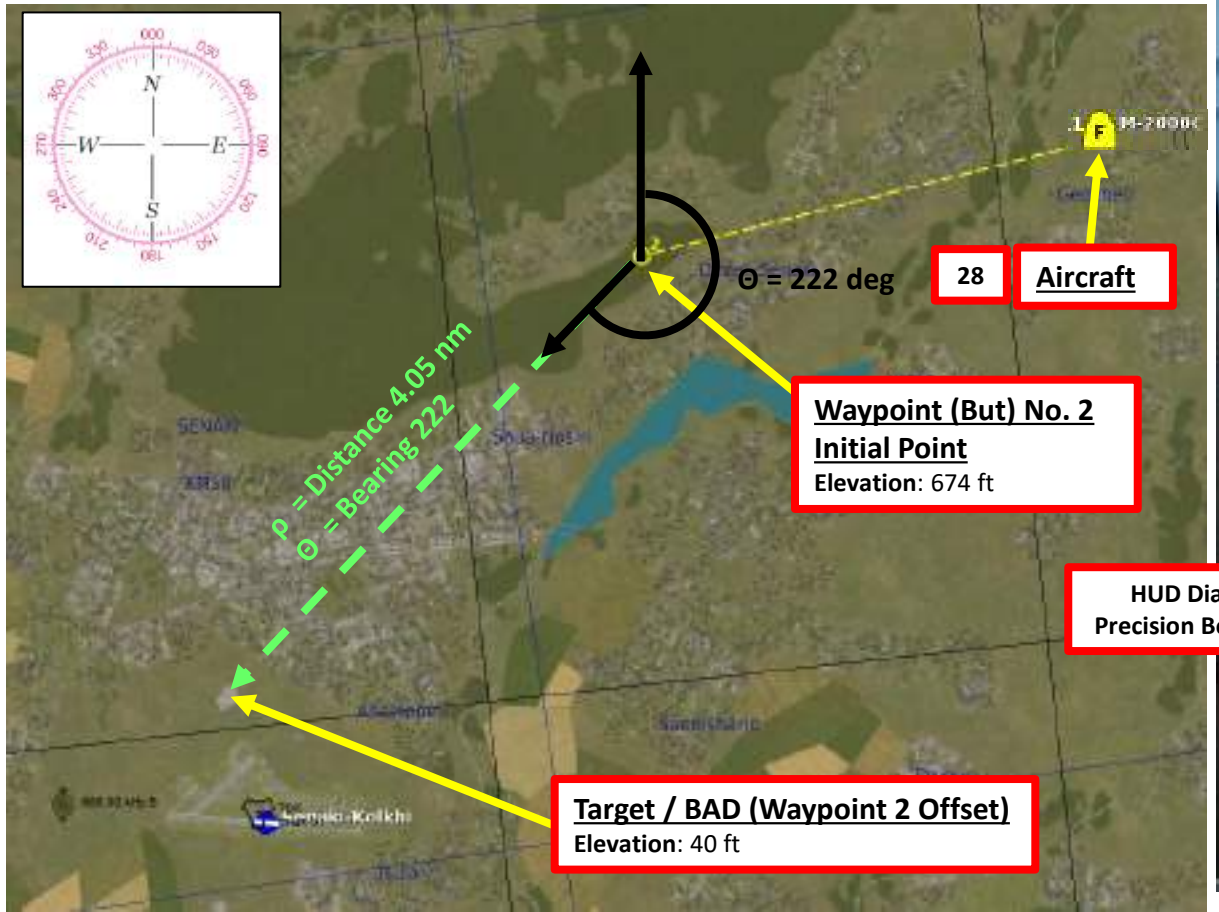


3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)
BOMBING

16. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the air-to-ground armament via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
17. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
18. On PPA, set number of bombs to be released (00 = no bombs, 08 = 8 bombs)
19. On PPA, set distance between bomb release (02 = 20 m)
20. Adjust seat to see lower part of HUD better.
21. Set Master Arm switch to ARME (UP)
22. Select BL1 (*Bombe Lisse* – Low-drag MK-82) on PCA
23. Select PI (Point Initial/Initial Point) Mode on PCA
24. Make sure TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) mode is selected on PCA
25. Turn radar power ON (**EM**ISSION)

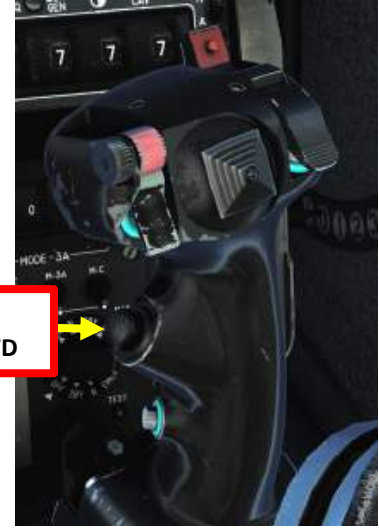
3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)
BOMBING

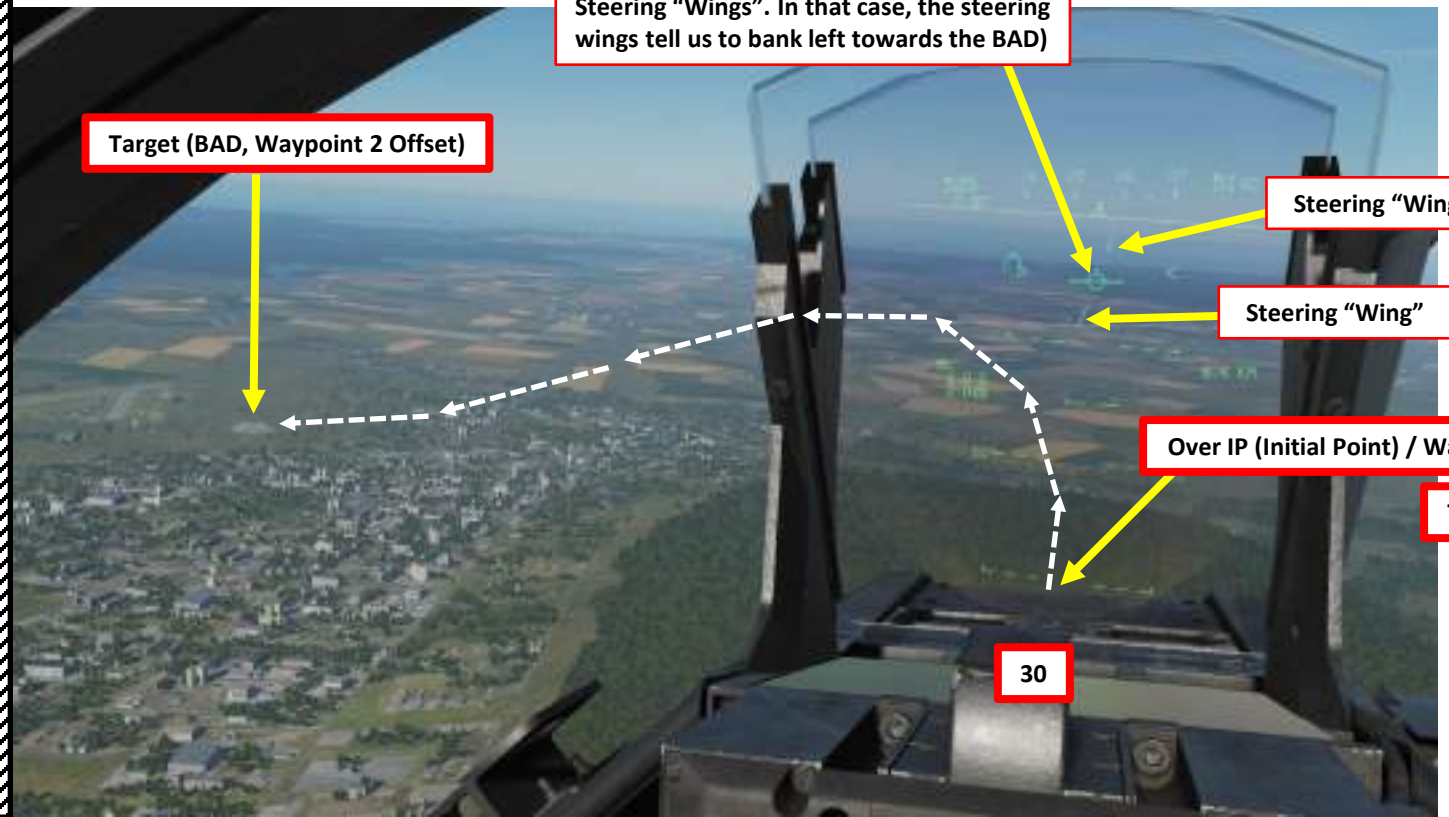
26. Press “DEST” (Destination) button .
27. Press “0” and “2” (02) on the INS numpad to select Waypoint Number 2 (Reference Waypoint for Initial Point).
28. Fly to Waypoint 2 (Initial Point). Use HUD steering cues and HSI as a reference.



3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)
BOMBING

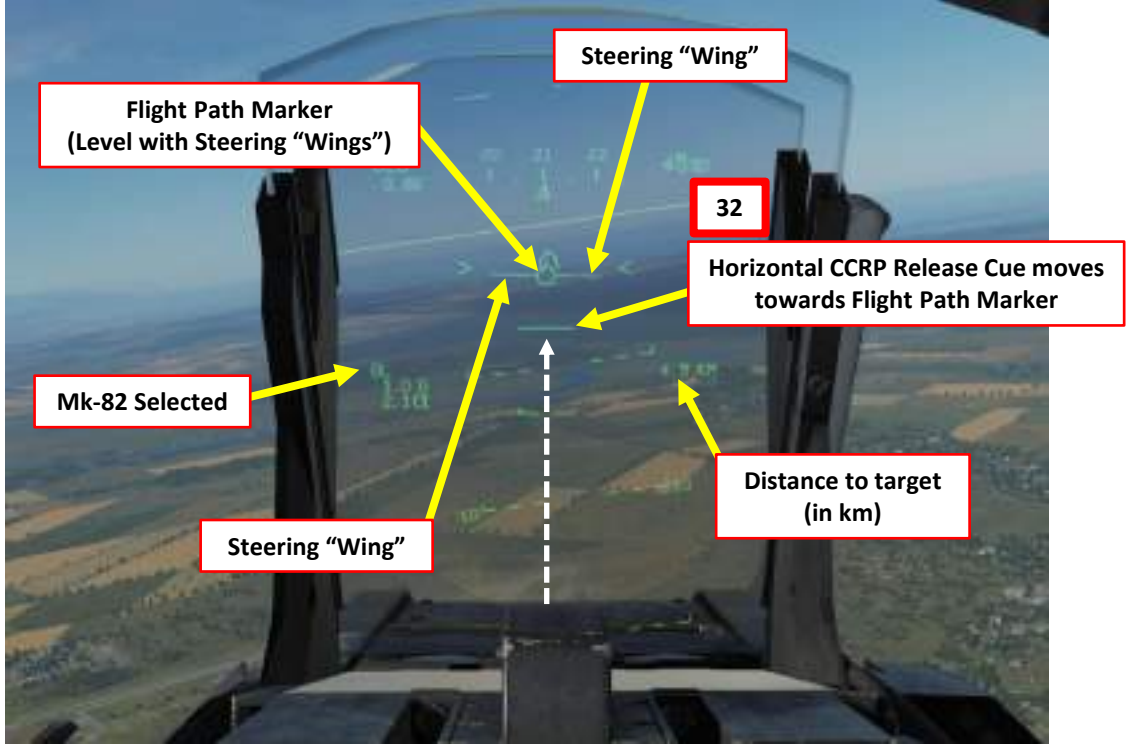
29. When you are about less than 1 nm from Waypoint 2, set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
30. Once you are over the IP, HUD diamond will disappear and wings will appear on the Flight Path Marker (FPM). They will provide steering cues towards the BAD (Waypoint Offset). Radar range will display the range to target, nav cues will shift to BAD position and HSI will display bearing and distance to BAD.
31. As you are almost directly over the IP, follow the navigation cues and turn towards the offset point. Try to keep the wings on your FPM level as you approach your target.

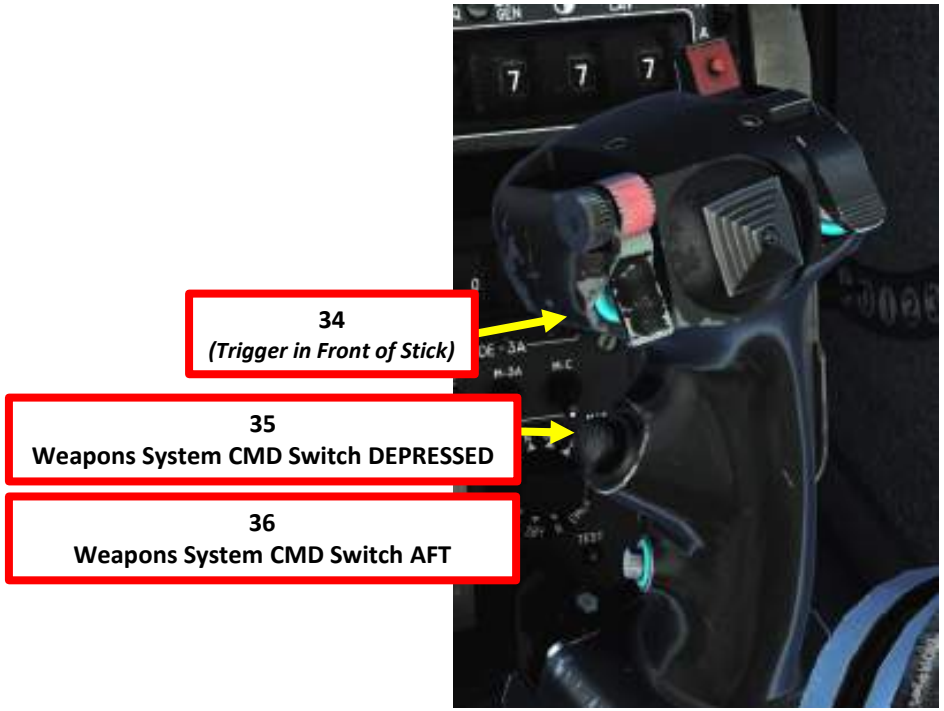




3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)
BOMBING

32. When you are in range for pull up, release cues appear in the HUD.
33. Fly level towards target (make sure you have at least 2000 ft of clearance).
34. When release cue appears, press and hold WEAPON RELEASE button (SPACE by default) until CCRP line is lined up with the diamond reticle. The bombs will automatically be released. In this example, eight bombs will be released per trigger press.
35. Observe damage and unlock target (Weapons System CMD DEPRESSED switch on the stick). Unfortunately, CCRP is not very precise.
36. You can set Heads-Up Display (HUD) mode back to NAV (Navigation) by pressing the Weapons System CMD AFT switch on the stick.



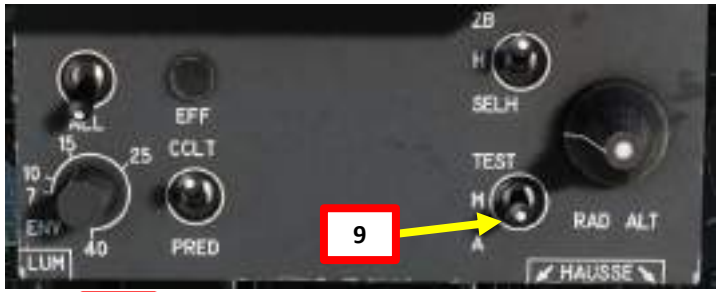


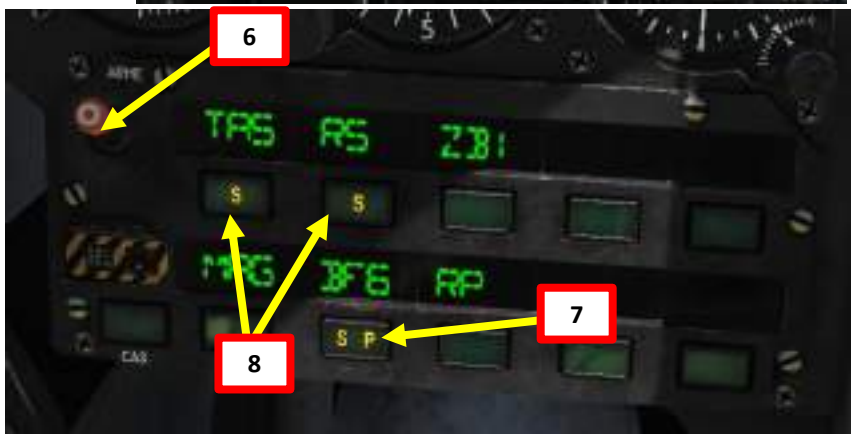
3.4 – MK-82 BOMBS
INS PRECISION BOMBING TUTORIAL (CCRP)

3.5 – BLG-66 "BELOUGA" CLUSTER BOMBS CCIP TUTORIAL

Basically, the Belouga cluster bombs are used just like Snake Eyes and use the CCIP release mode by default. The Belougas are used against soft targets (non-protected or lightly armoured). After release, the bomb ejects a large amount of small sub-munitions that cover a large area and detonate on impact. Therefore, they must be dropped high enough to permit sub-munitions deployment.

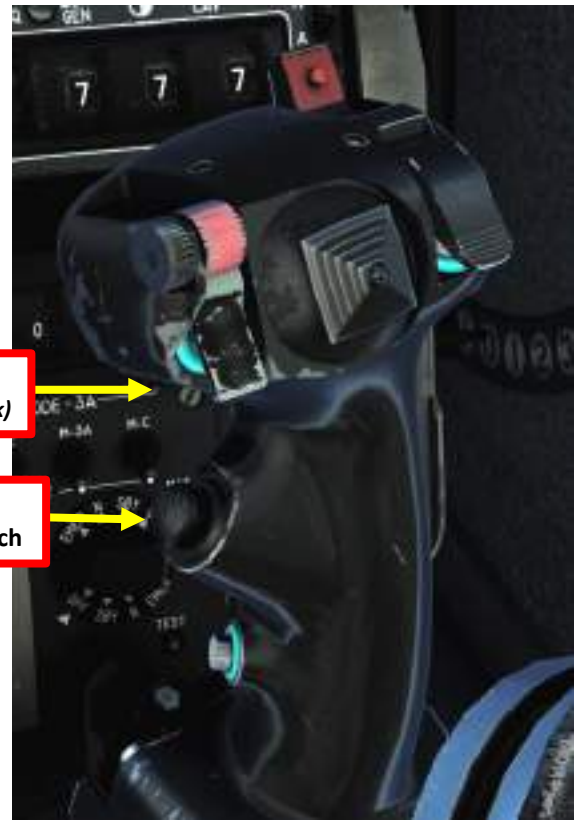
1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the air-to-ground armament via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
3. On PPA, set number of bombs to be released (04 = 4 bombs). 00 will not drop any bombs.
4. On PPA, set distance between bomb release (02 = 20 m)
5. Adjust seat to see lower part of HUD better.
6. Set Master Arm switch to ARME (UP)
7. Select BF6 (*Bombe Freinée* – High-drag BLG-66 Belouga) on PCA
8. Ensure TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) and RS (*Radio-Sonde*, Altitude Above Ground) buttons are selected (S) on the PCA.
9. Set Radar Altimeter Power switch to **M**ARCHE

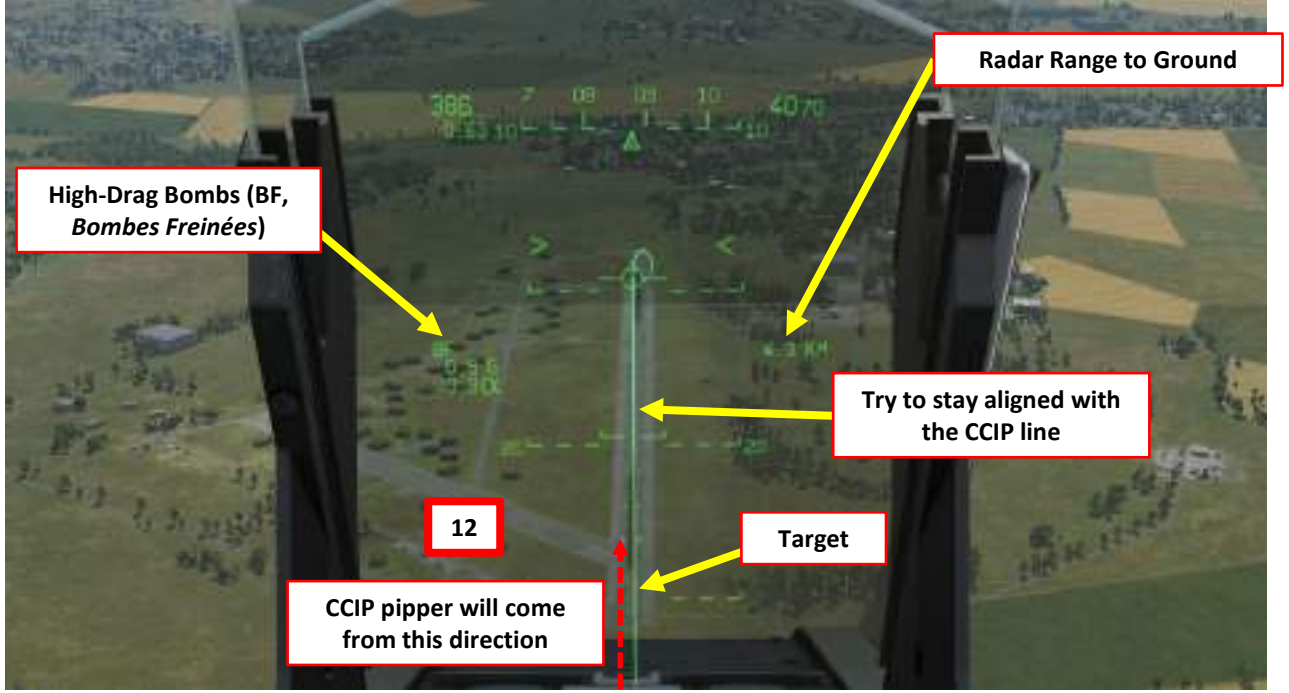


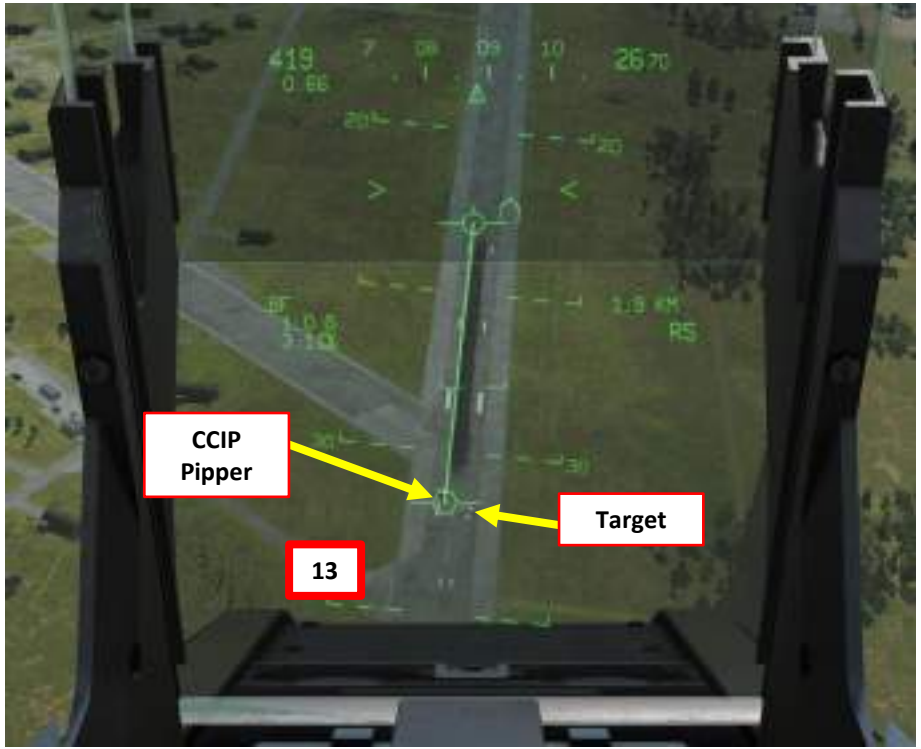


3.5 – BLG-66 "BELOUGA" CLUSTER BOMBS CCIP TUTORIAL

10. Set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
11. Ensure you are at least 3000 ft above ground level (AGL) and enter a 20-25 deg dive towards target at a speed of 400 kts minimum.
12. CCIP pipper will appear from the lower part of the HUD. Align CCIP pipper on target by manoeuvering the aircraft.
13. When CCIP pipper is aligned, press and hold WEAPON RELEASE button (SPACE by default).
14. Pull up to avoid smacking yourself into the ground and watch the fireworks.
15. You can set Heads-Up Display (HUD) mode back to NAV (Navigation) by pressing the Weapons System CMD AFT switch on the stick.







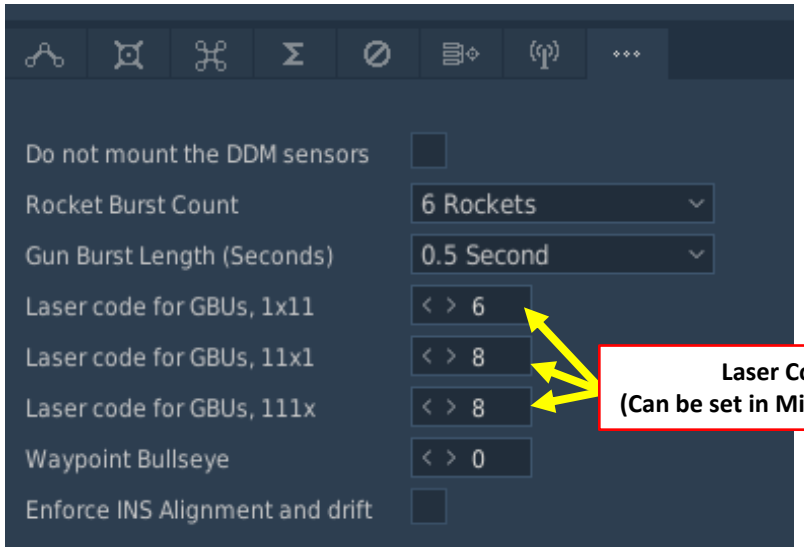
3.5 – BLG-66 "BELOUGA" CLUSTER BOMBS CCIP TUTORIAL

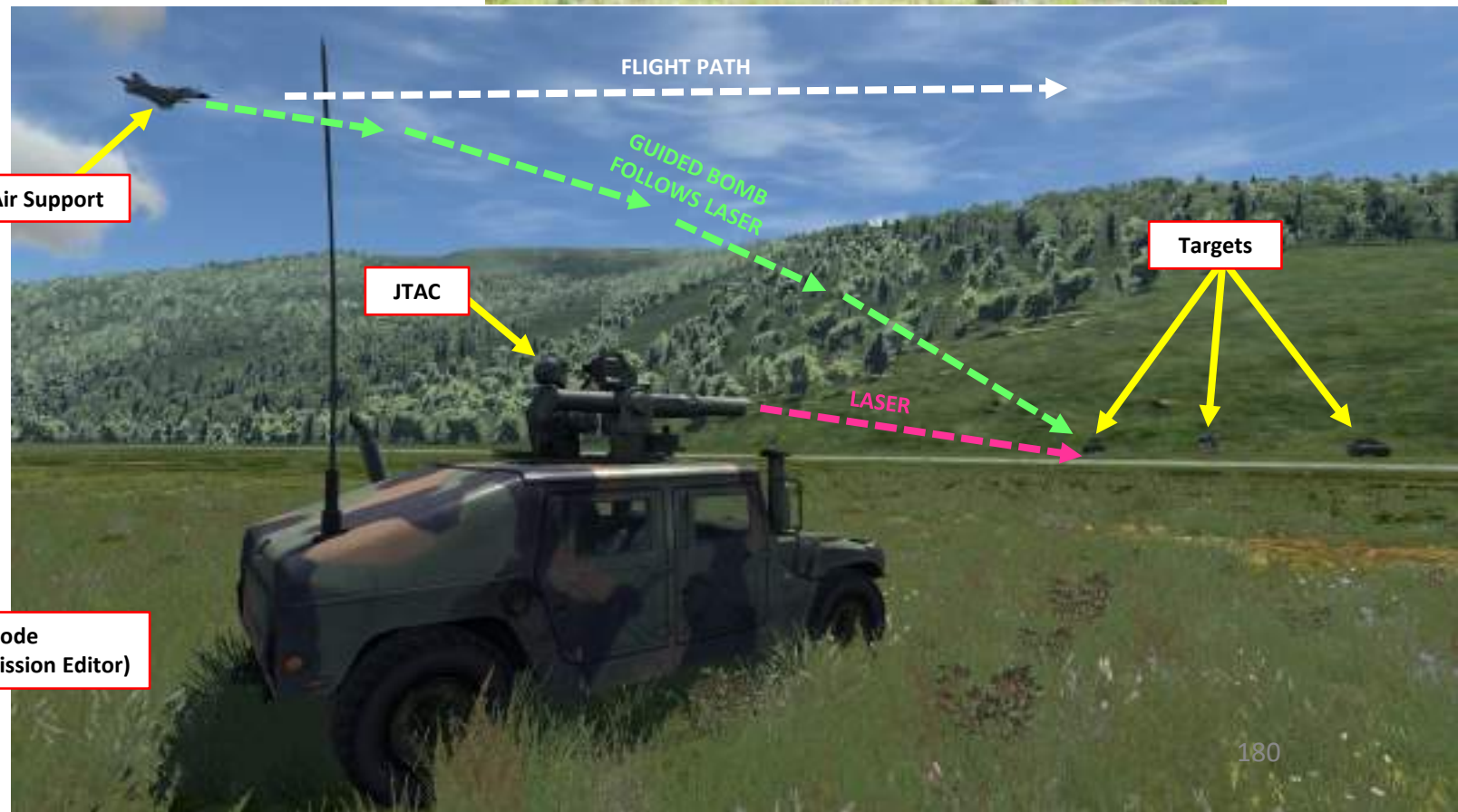
3.6 – GBU-12 LASER-GUIDED BOMBS
BUDDY LASING & JTAC

The Mirage is not only a fighter jet: it can also help support troops on the ground. A JTAC (Joint Terminal Attack Controller) or an aircraft equipped with a Targeting Pod (like an A-10C) can use a laser designator to "paint" a target for you to bomb.

This BUDDY LASING bombing tutorial will be done in 3 steps:

1. Creating the JTAC via the Mission Editor
2. Using proper radio procedures to contact JTAC and get him to paint the target for you with a laser designator
3. Drop the ordnance using a CCRP release mode since we will be using the GBU-12 guided bomb.



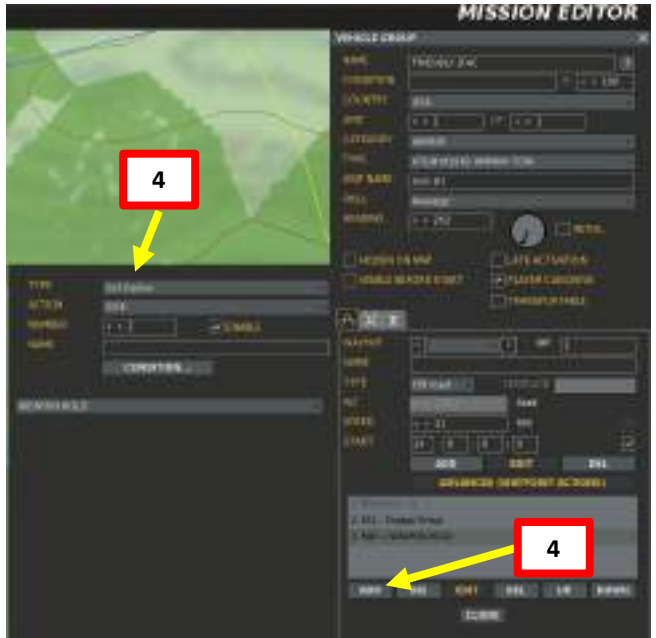


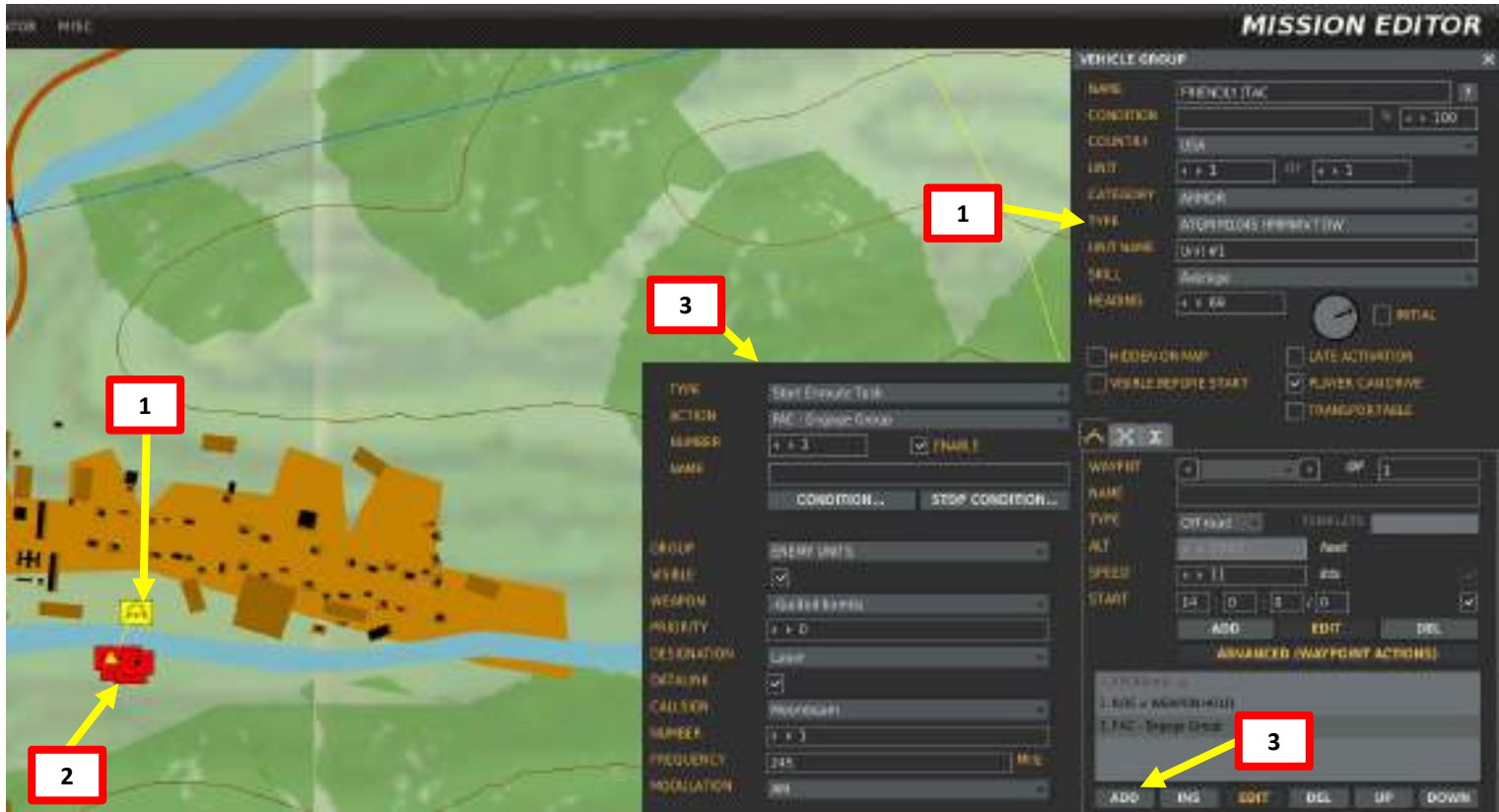
3.6 – GBU-12 LASER-GUIDED BOMBS

BUDDY LASING TUTORIAL - MISSION EDITOR

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”.
    1. GROUP = “ENEMY UNITS” (the group we just created)
    2. VISIBLE = CHECKED
    3. WEAPON = GUIDED BOMBS
    4. DESIGNATION = LASER
    5. CALLSIGN = MOONBEAM (or whatever you prefer)
    6. FREQUENCY = 245 MHz (this will be the radio frequency you will use to contact the JTAC)
    7. MODULATION = AM
4. Select your JTAC unit, click “ADD” again and select TYPE = “SET OPTION” and ACTION “ROE”.
    1. Set to WEAPON HOLD
5. You can also set the unit to INVISIBLE and IMMORTAL as shown in RLAXOXO’s tutorial.

RLAXOXO’s JTAC tutorial for the Mirage
https://www.youtube.com/watch?v=ep7MH3Rmic8

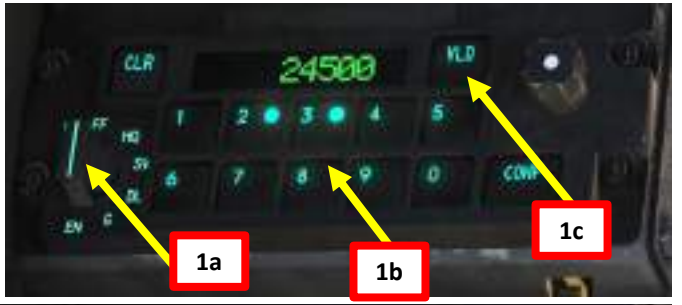


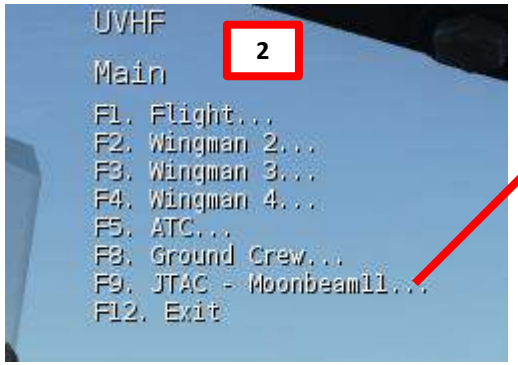


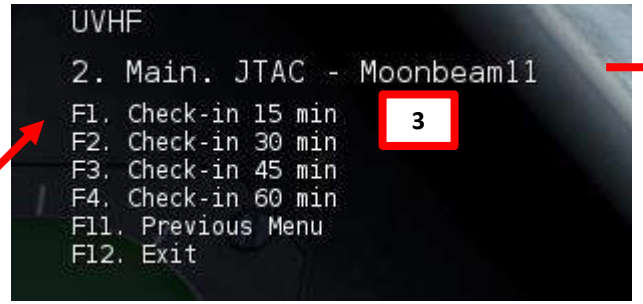
3.6 – GBU-12 LASER-GUIDED BOMBS

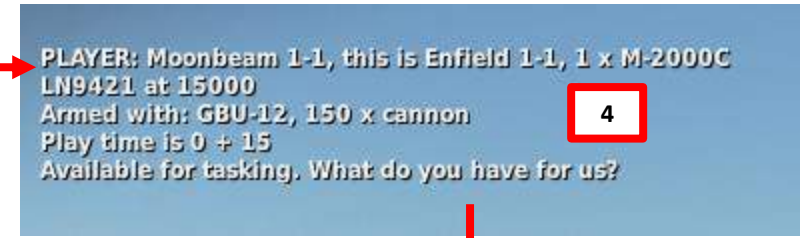
BUDDY LASING TUTORIAL - CONTACTING THE JTAC

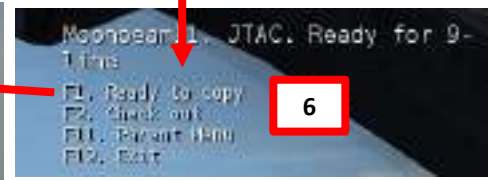
1. Set V/UHF Greenbox Mode switch to **FF (Fixed Frequency)** and set JTAC frequency to 245.00 MHz (enter 24500 on keypad, then press VLD (Validate)).
2. Press "/" to communicate and select JTAC – MOONBEAM (F9) in radio menu.
3. Select "CHECK-IN 15 MIN" (F1)
4. You will contact the JTAC and give him 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.

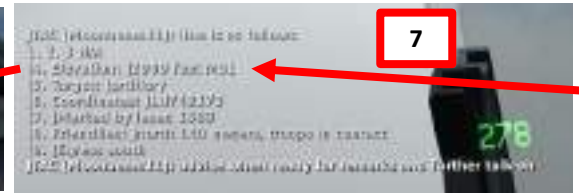


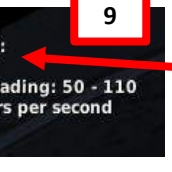


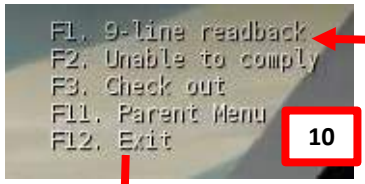


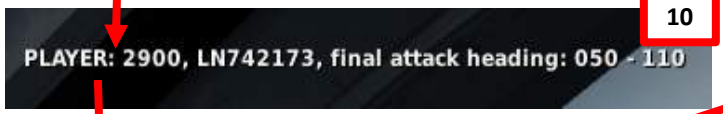


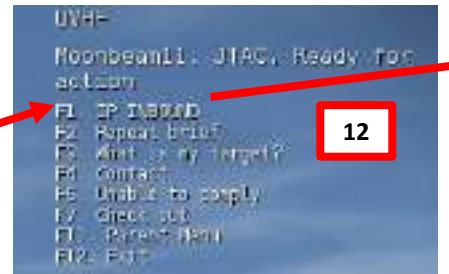


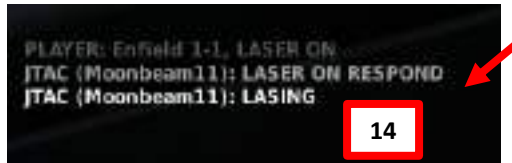


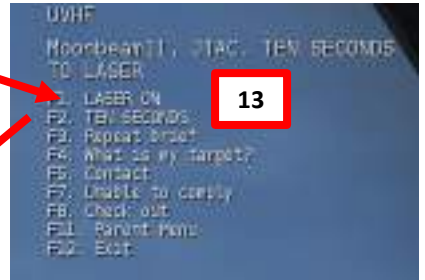






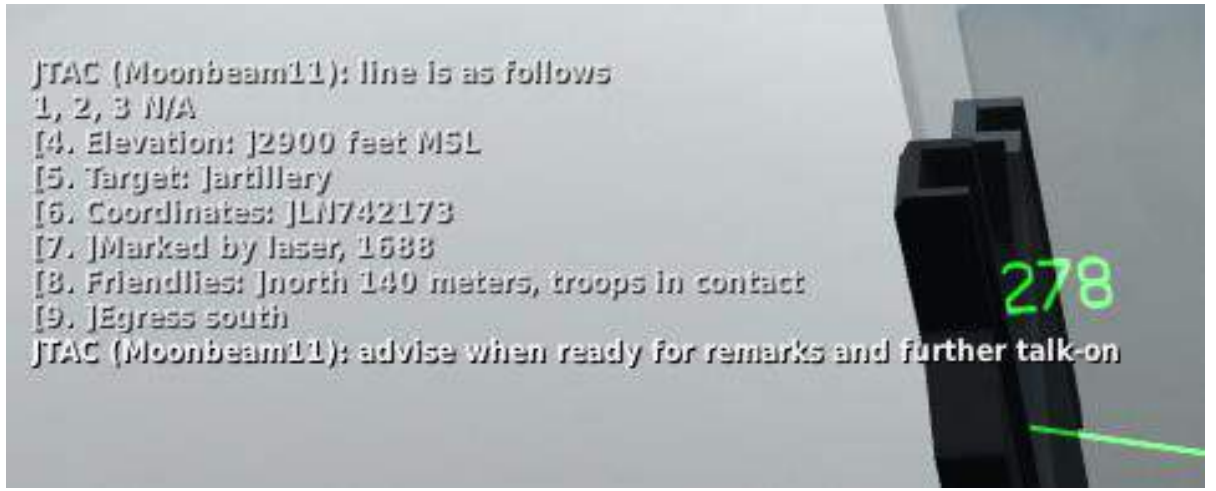






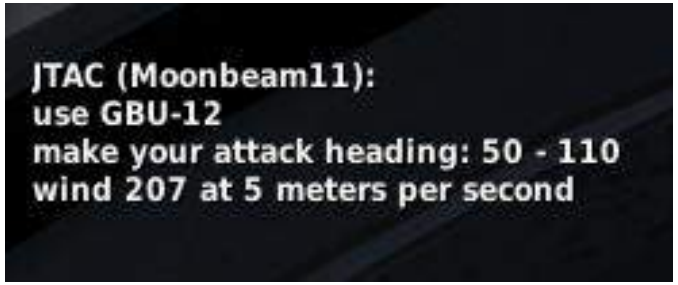
3.6 – GBU-12 LASER-GUIDED BOMBS
BUDDY LASING TUTORIAL - CONTACTING THE JTAC

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 – 2900 feet over Mean Sea Level (MSL)
Line 5: Target description: Artillery.
Line 6: Target location: Grid coordinates of target
Line 7: Target Mark Type: Marked by laser on laser code 1688 (this code can be used by the A-10C to lase the target for you)
Line 8: Location of Friendlies: JTAC located 140 meters North of Target
Line 9: Egress semi-cardinal direction when departing from target: South



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

3.6 – GBU-12 LASER-GUIDED BOMBS

RELEASING BOMBS

While you are on the ground, and the engine is OFF, you can modify the GBU-12's laser code (the laser code it will attempt to track).

If you are flying in multiplayer and do not know your GBU-12 code, you can open the WEAPON Kneeboard page by pressing "RSHIFT+K". This will show you the laser code set on your GBU-12 laser-guided bomb.

Laser-guided bomb laser codes is programmable on ground by using the following commands:

- **RSHIFT** + **RALT** + **9** : Changes Laser Code (Hundreds)
- **RSHIFT** + **RALT** + **-** : Changes Laser Code (Ones)
- **RSHIFT** + R**ALT**+ **0** : Changes Laser Code (Tens)

3.6 – GBU-12 LASER-GUIDED BOMBS

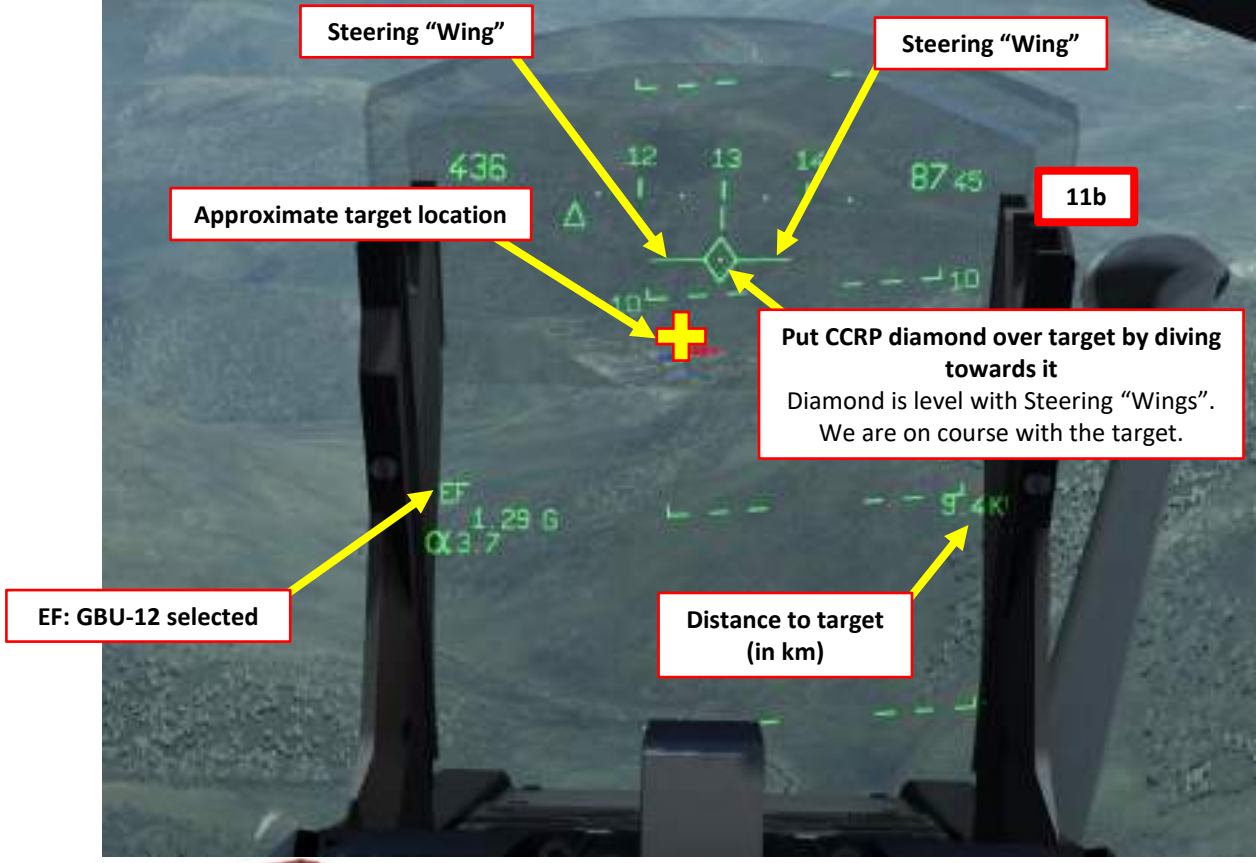
RELEASING BOMBS

1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the air-to-ground armament via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
3. On PPA, set number of bombs to be released (01 = single)
4. On PPA, there is no need to set distance between bomb release since GBU drops are generally done with a single bomb
5. Adjust seat to see lower part of HUD better.
6. Set Master Arm switch to ARME (UP)
7. Select EF1 (GBU-12) on PCA
8. Select TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) mode on PCA
9. Turn radar power ON (**EM**ISSION)

3.6 – GBU-12 LASER-GUIDED BOMBS

RELEASING BOMBS

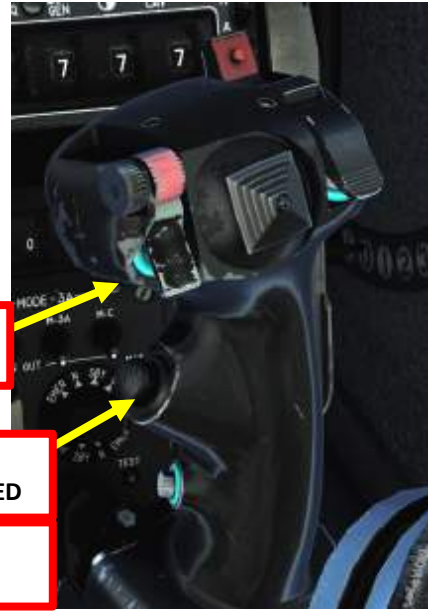
10. Set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
11. Put diamond relatively close to the target (it is usually marked with smoke or the target area) and press the "MAGIC SLAVE/AG DESIGNATE" button on your HOTAS. When approximate location of target is designated, steering wings will appear over the CCRP diamond.
    - Keep in mind that unlike most modern aircraft, the Mirage has no HUD indication to show where the designated/locked ground target is. You will have to make sure the designation with the CCRP diamond is precise enough and use the CCRP cues (CCRP line, steering wings, distance to target) accordingly.
    - While the point you designate is not necessarily on the target itself, the point should be somewhat close to the actual target. The bomb itself will track the laser spot lased by the JTAC independently to your aircraft; the CCRP cues will give you a rough idea of when to launch the GBU-12s, but keep in mind that if you designate way off the bomb will likely not pick up the laser.

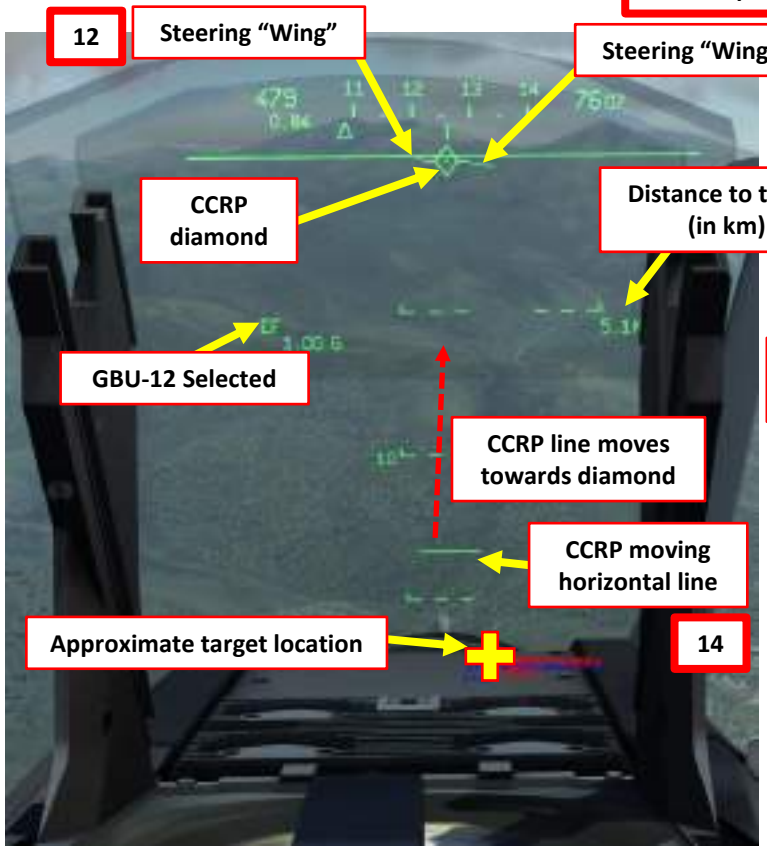


3.6 – GBU-12 LASER-GUIDED BOMBS

RELEASING BOMBS

12. Once target is designated, steering wings will appear on the CCRP diamond. They will provide steering cues towards the designated target. Radar range will display the range to target.
13. Fly level towards target (make sure you have at least 2000 ft of clearance).
14. Horizontal CCRP line will show up when you are 15 seconds from target.
15. When CCRP line is lined up with the diamond reticle, press and hold WEAPON RELEASE button (SPACE by default).
16. Once GBU-12 is released, the bomb will try to find the JTAC's laser and track it towards the target. The guidance of the GBU-12 now relies on the laser.
17. Observe damage and unlock target (Weapons System CMD DEPRESSED switch on the stick).
18. You can set Heads-Up Display (HUD) mode back to NAV (Navigation) by pressing the Weapons System CMD AFT switch on the stick.





3.6 – GBU-12 LASER-GUIDED BOMBS

RELEASING BOMBS

Note 1: Usually, CCRP is not very precise… but with the help of a JTAC and guided bombs, you can perform very precise airstrikes since the bombs is guided by a laser.

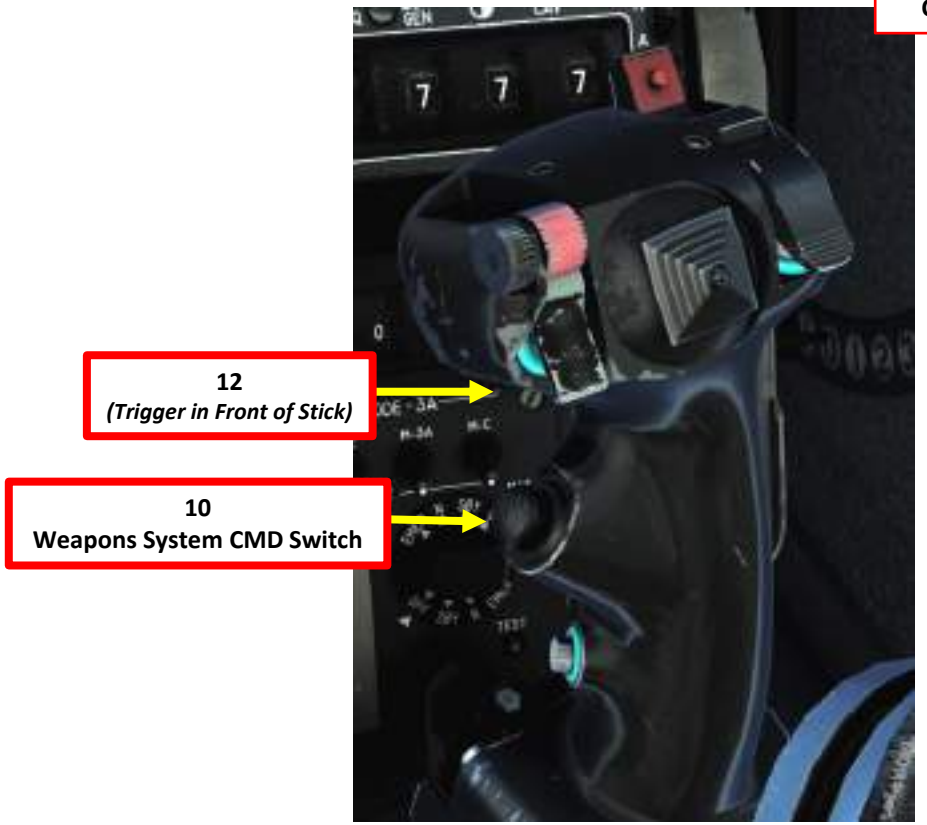
Note 2: You can do the same thing in multiplayer with a player in an A-10C or an aircraft equipped with a targeting pod. The Laser Code he will need to use is 1688.

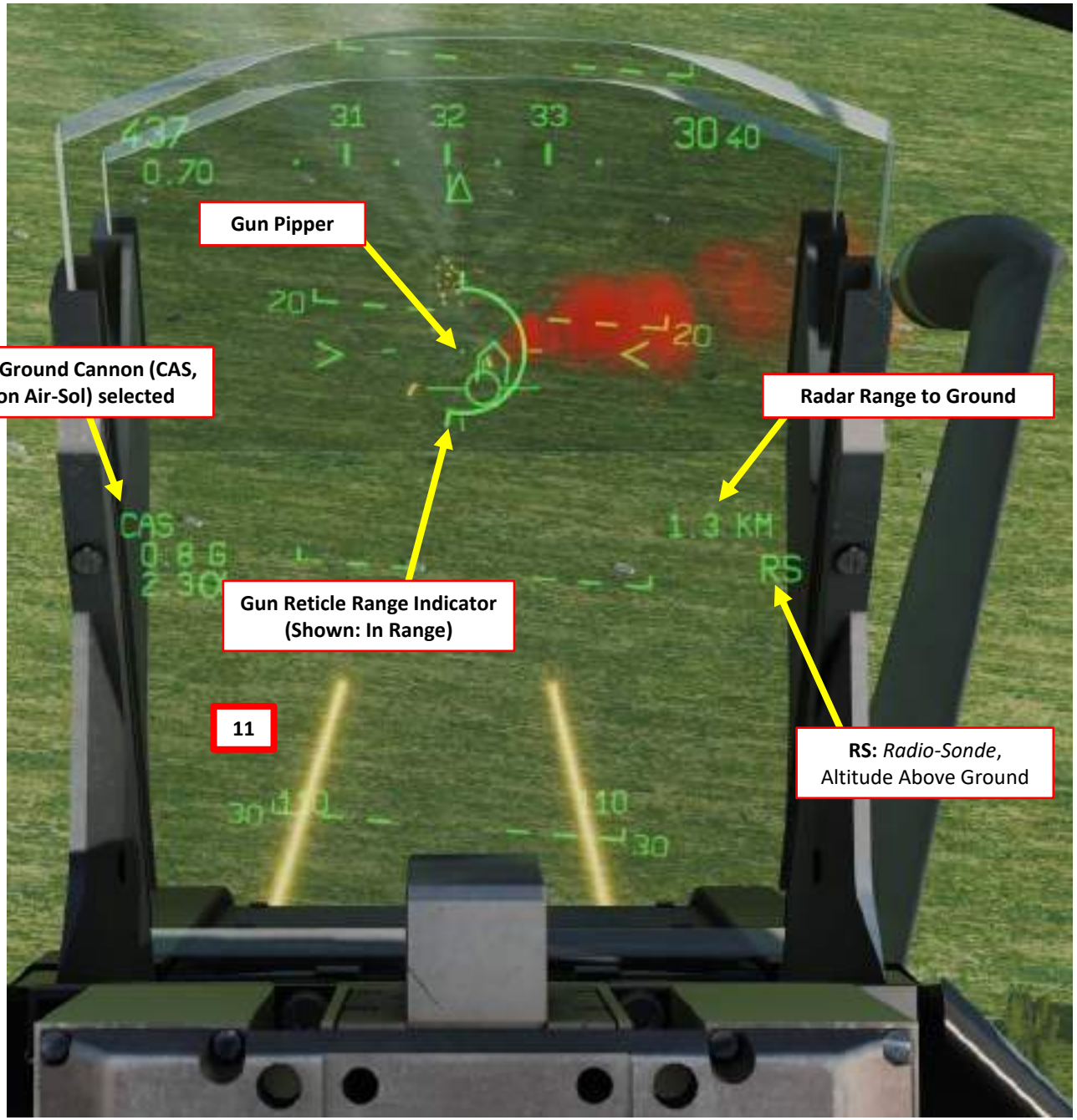
3.7 – AIR-TO-GROUND GUNS TUTORIAL

1. On the throttle, set Quick Weapon Select Switch to NEUTRAL/CENTER position (PCA). This will allow you to select the Cannon in Air-to-Ground Mode via the PCA (*Poste de Commande Armement*, Weapon Control Panel) panel.
2. On PPA, select gun firing mode (PAR = 8 round burst, TOT = continuous fire)
3. Set Master Arm switch to ARME (UP)
4. Arm Cannon Switch (UP)
5. Press the CAS (Canon Air-Sol / Air-to-Ground) button on the PCA to set gun in Air-to-Ground mode. Verify that P (Air-to-Ground Ready) indication is illuminated.
6. Ensure TAS (*Télémétrie Air-Sol*, Air-to-Ground Radar Ranging) and RS (*Radio-Sonde*, Altitude Above Ground) buttons are selected (S) on the PCA.
7. Set Radar Altimeter Power switch to **M**ARCHE
8. Turn on Radar Power by setting switch to **EM**ISSION.
9. Select desired fire rate. "S" indicates the fire rate selected.
   - RAP = *Rapide* (High Rate of Fire) / LEN = *Lent* (Slow Rate of Fire)

3.7 – AIR-TO-GROUND GUNS TUTORIAL

10. Set Heads-Up Display (HUD) mode to A/G (Air-to-Ground) by pressing the Weapons System CMD FWD switch on the stick. Make sure you have your weapon selected before performing this step or the HUD will switch in Special Air-to-Air Mode.
11. Align gun pipper on target. You will be within firing range when the gun reticle range indicator starts decreasing. The pipper will be a full circle at maximum range and starts to disappear going from left to right as soon as target gets into range of 2400 meters. The 9 o'clock caret depicts the range of 1800 meters, 6 o'clock of 1200 meters and 3 o'clock of 600 meters.
12. When in range, fire guns (Weapon Fire key, SPACE by default).
13. To de-select guns, press the CAS (Canon Air-Sol / Air-to-Ground) button on the PCA again. Verify that P (Air-to-Ground Ready) indication extinguishes.





3.7 – AIR-TO-GROUND GUNS TUTORIAL

4.1 – SELECTIVE STORES JETTISON

In order to jettison a certain store (an external fuel tank, for instance), proceed as follows:

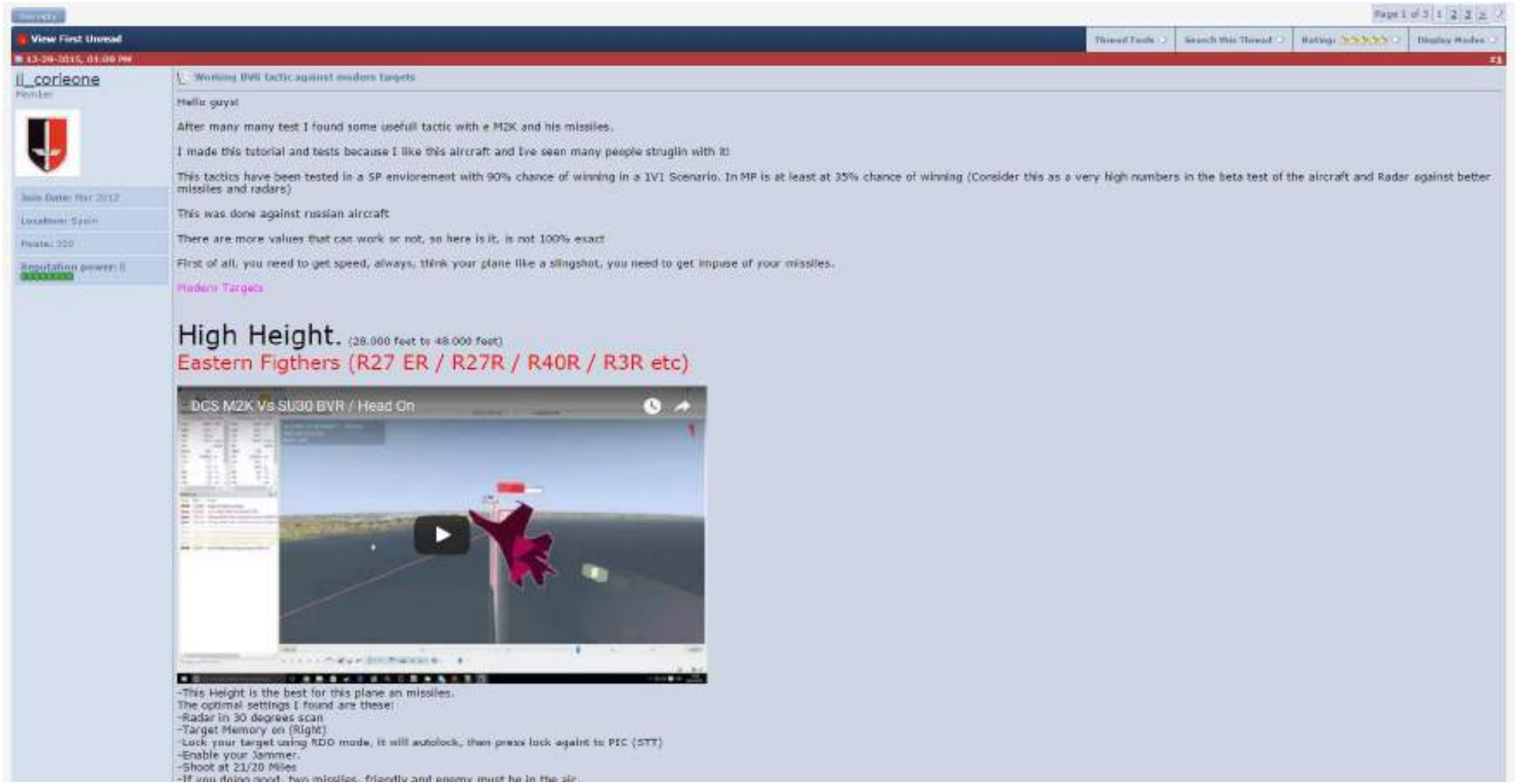
1. Set Master Arm switch to ARME (UP)
2. Click on Selective Jettison safety cover and set Selective Jettison switch to the left position
3. Click on the store you want to jettison on the PCA (we will select the external fuel tank RP). When selected, a yellow "S" caution will appear.
4. Press the Weapon Fire key, which is SPACE by default. Store will be dropped.
5. Set the Selective Jettison switch to the right and put the safety cover back on.
6. Set Master Arm switch to OFF (DOWN)

4.2 – EMERGENCY STORES JETTISON

The Emergency Jettison button will jettison every store you have (including these expensive SUPER S530D missiles!) except for your two MAGIC II missiles.

4.3 – COMBAT TACTICS

I highly recommend that you check this thread by il_Corleone in order to learn about combat tactics in the Mirage.
Link: http://forums.eagle.ru/showthread.php?t=157097



COUNTERMEASURES – INTRODUCTION

Countermeasures are very simple to use. You have three countermeasure types at your disposal: flares, chaff and an ECM (Electronic Countermeasure) jammer. We will explore together what is used against what, and how.

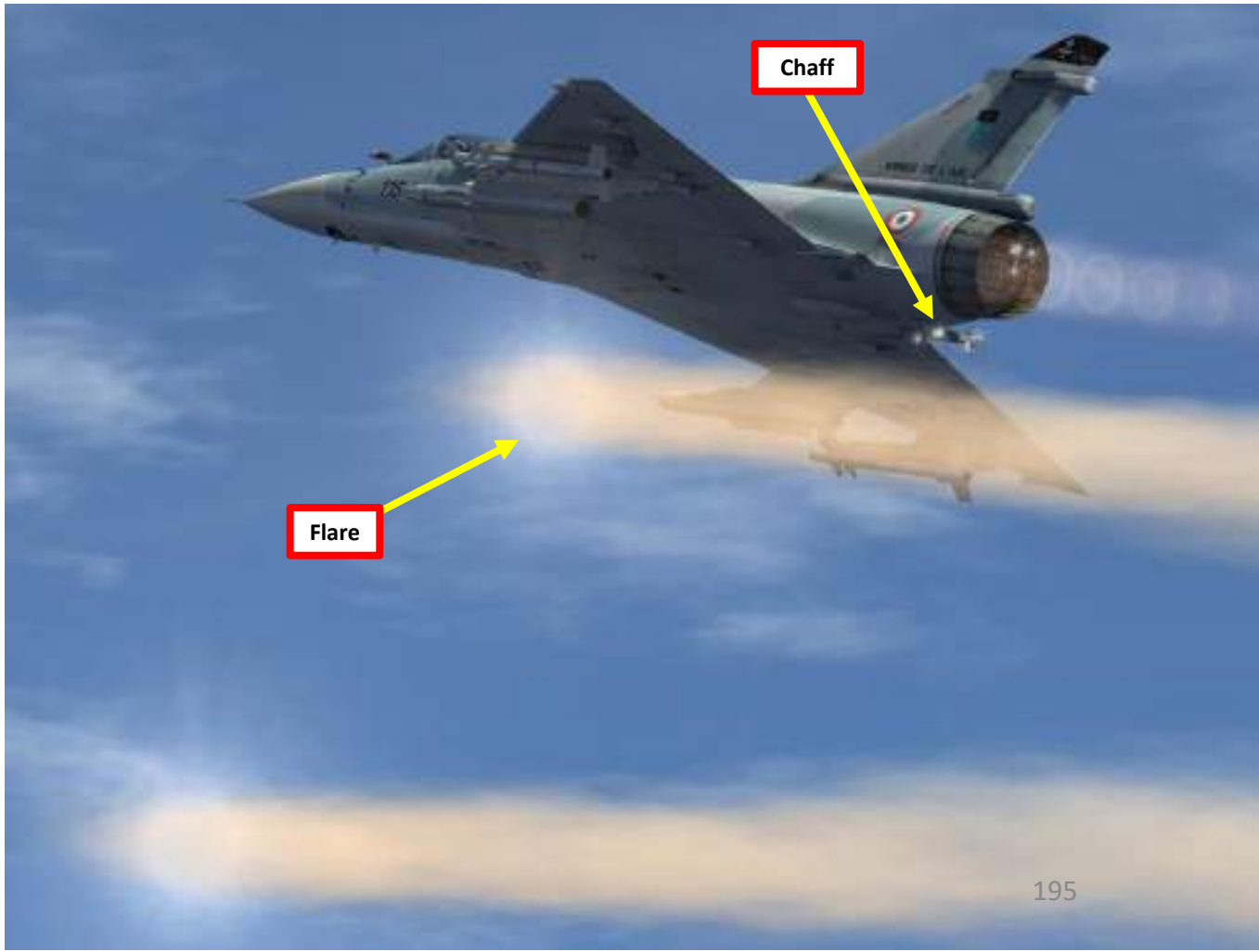
Missiles can generally track you using 2 things: radar signature (radar waves are sent on you and you reflect them, which is called a "radar signature") and heat signature (like the exhaust of your engines). Countermeasures will only be effective against the kind of weapon it was meant to counter; a heat-seeking missile will not care if you deploy electronic countermeasures against it since it tracks heat, not radar signatures. This is why it is important to know what is attacking you in order to counter it properly. This is what the SERVAL (*Système Électronique de Reconnaissance et Visualisation d'Alertes)* or RWR (Radar Warning Receiver) is for: to help you know what is firing at you so you can take the adequate action to counter it.

Flares are used against missiles that track heat (infrared or IR) signatures. Instead of going for the heat signature generated by your engines, a missile will go for a hotter heat source like flares.

Chaff is a form of "passive" jamming. Passive (reflected) jamming is when a deceptive object or device reflects radar waves. Chaff is simply a bundle of small pieces of metal foil with reflective coating, which creates clusters of radar signatures that prevent a radar to get a solid lock on the aircraft itself.

The Mirage is equipped with a powerful jammer. 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. Interestingly, certain jammer modes are so powerful that they also drown your own radar in white noise.

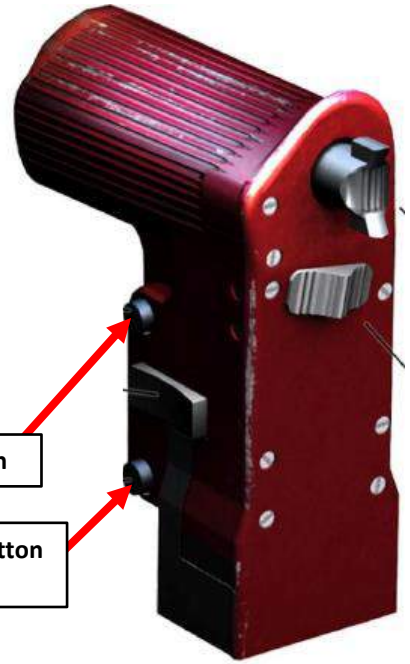
Last but not least, there is also a DDM/D2M, also known as the "*Détection de Départ de Missile*" (Missile Launch Warning System). While not installed on the French Mirage 2000C in real life (but they were installed on the Mirage 2000D), Razbam decided to include it as an optional kit.



COUNTERMEASURES – FLARES & CHAFF CONTROLS

Real Aircraft Controls

Decoy PROGRAM Release Switch (Delete)



Jammer Activate Pushbutton

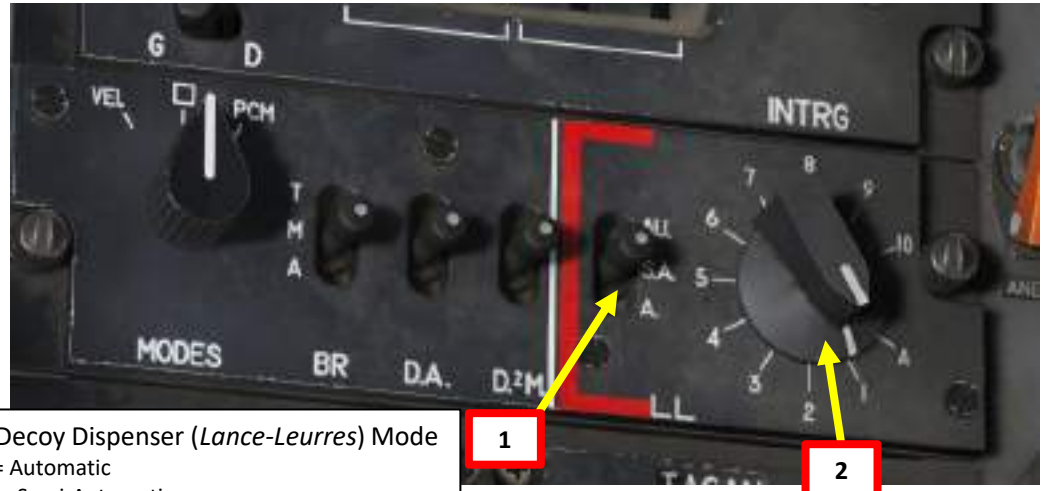
Decoy PANIC Release Pushbutton (Insert)

My Controls

COUNTERMEASURES – FLARES & CHAFF TUTORIAL

Keep in mind that you have very few flares: use them sparingly. The ÉCLAIR pod allows more flares to be equipped.

1) Select decoy release mode (Automatic, Semi-Automatic, OFF (A))
2) Select decoy release program using the program selector knob.
3) Deploy countermeasures using either the Decoy Program Release Switch ("Delete" binding) or the Decoy Panic Release Switch ("Insert" binding). These two functions are elaborated in the next page.



LL: Decoy Dispenser (*Lance-Leurres*) Mode
AU = Automatic
S.A. = Semi-Automatic
A = OFF

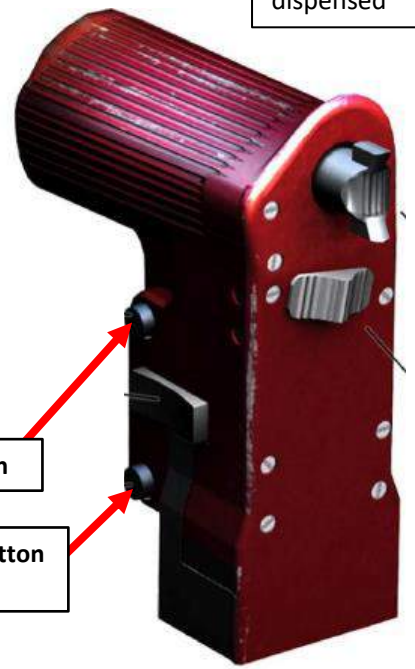
1

2

Lance-Leurres (Decoy dispenser) Program Selector

Decoy PROGRAM Release Switch (Delete)

3

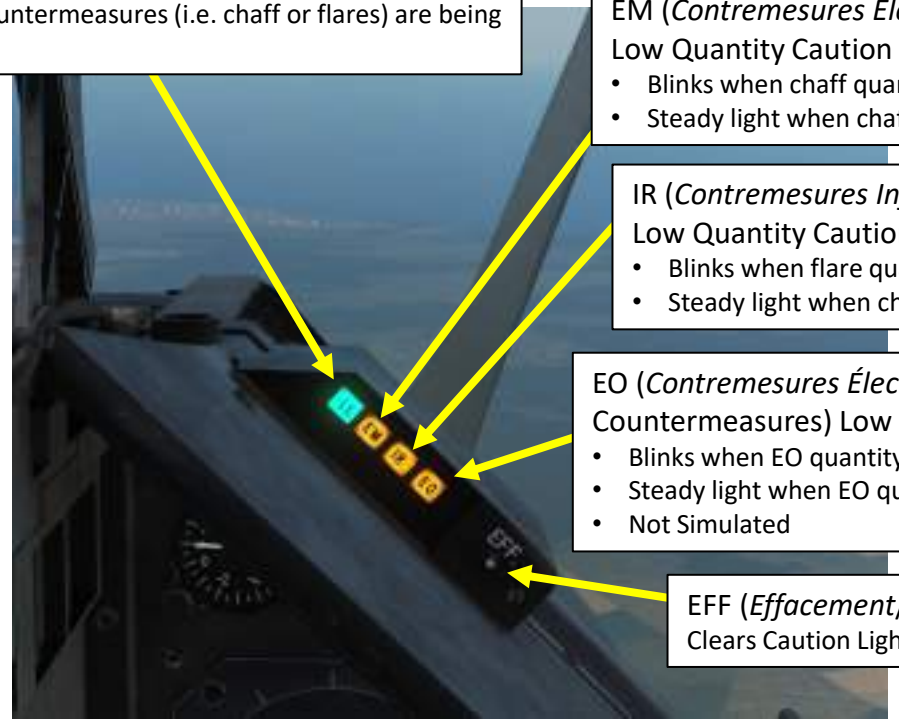


Jammer Activate Pushbutton

3

Decoy PANIC Release Pushbutton (Insert)

Lance-Leurres (Decoy Dispenser) Indicator Light
Blinks when countermeasures (i.e. chaff or flares) are being dispensed



EM (*Contremesures Électromagnétiques*/Chaff) Low Quantity Caution Light
- Blinks when chaff quantity is low
- Steady light when chaff quantity is 0 (empty)

IR (*Contremesures Infrarouges*/Flares) Low Quantity Caution Light
- Blinks when flare quantity is low
- Steady light when chaff quantity is 0 (empty)

EO (*Contremesures Électro-optiques*/Electro-Optical Countermeasures) Low Quantity Caution Light
- Blinks when EO quantity is low
- Steady light when EO quantity is 0 (empty)
- Not Simulated

EFF (*Effacement*/Erase) Button
Clears Caution Lights on the ECM Box

COUNTERMEASURES – FLARES & CHAFF TUTORIAL

These programs have been created by RAZBAM and do not represent real-life countermeasure programs used by the French Air Force. All the programs, including PANIC are not based on any real life decoy release program. Razbam created them by trying to maximize the use of the available chaff and flare stores.

PANIC program as it name implies is to be used when you are unexpectedly attacked. It releases a fixed mix of chaff and flares to deal with either IR or Radar threats. The mix in **PANIC** program cannot be modified by the user. It is designed for air-to-air threats.

BVR 1 to **BVR 3** programs are to be used when engaging in BVR combat. Since the threat will come from radar guided missiles, only chaff will be released. Depending on the expected threat, from SARH to ARH you can select between 1 to three cycles of chaff launch. There is a 2 second interval between each release cycle in **BVR 2** and **BVR 3**, to allow time for you to clear the threat zone.

SAM 1 is to be used against old technology SAMs like the SA-2 or SA-6.
SAM 2 is to be used against new technology SAMs like the SA-10 and higher.

IR SAM is to be used when the threats come from any type of IR guided missile. But it is specially tailored to deal with MANPADs and mobile SAM sites.

AG Mix is designed to be used during the insertion phase in a bombing run when the target is heavily defended.

Flare Jettison: releases all the flares in a short timed burst.

ECM Panel		HOTAS Buttons		Status Light
DRM	DRP	DECOY Release	PANIC Release	LL
A	Any	None	None	Off
SA	A	None	PANIC	On
AU				
SA	1 to 10	Selected Program		
AU				
Malfunction or No chaff and no flares				Blink

A = Off
SA = Semi Automatic Release
AU = Automatic Release

DECOY RELEASE PROGRAM							
Button	Program	Name	Chaff	Flare	Interval*	Cycles	Cycle Int.
DECOY	1	BVR 1	6		0.500	1	
	2	BVR 2	6		0.500	2	2.000
	3	BVR 3	6		0.500	3	2.000
	4	CCM 1		1		1	
	5	CCM 2	1	1		1	
	6	SAM 1	12		0.750	1	
	7	SAM 2	20		0.250	1	
	8	IR SAM		6	0.250	1	
	9	AG Mix	20	6	0.250	1	
	10	Flare Jettison*		32	0.050	1	
EMERG	PANIC	PANIC	6	3	0.500	1	

COUNTERMEASURES – ÉCLAIR POD

The ÉCLAIR countermeasure pod can be equipped on the Mirage, which allows the Mirage to carry 32 flares and 130 chaff instead of the standard 16 flares and 112 chaff installed by default.

SERVAL (RWR), *SABRE* ECM JAMMER

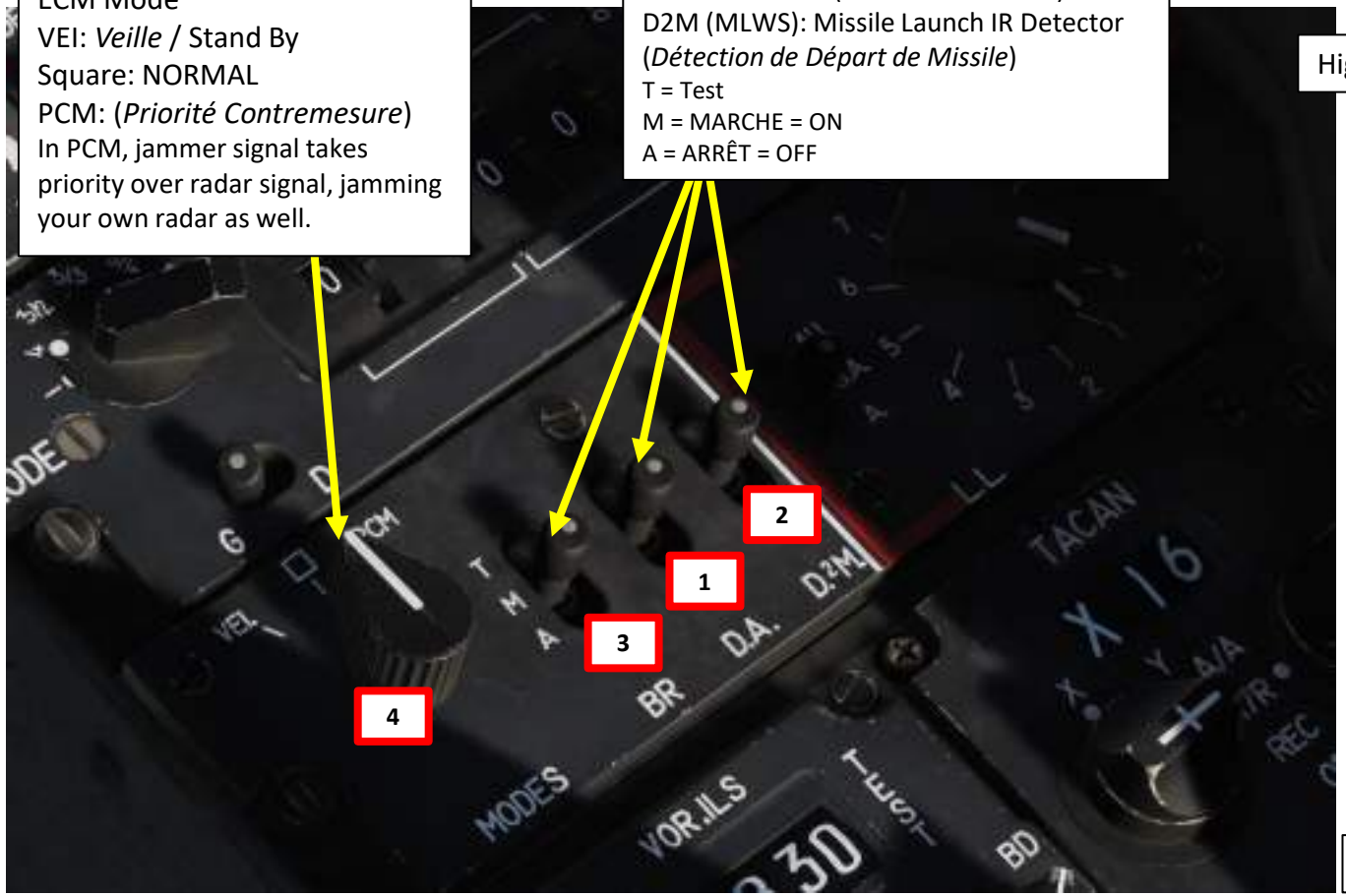
1. The SERVAL (*Système Électronique de Reconnaissance et Visualisation d'Alertes)* or RWR (Radar Warning Receiver) will show you targets that have you on their radar. Turn it on by setting the DA (*Détecteur d'Alertes*) switch to **M**ARCHE.
2. The D2M Missile Launch IR Detector is explained on the next pages.
3. The *Brouilleur* (Jammer) can be turned on by setting the BR switch to **M**ARCHE.
4. The *Brouilleur* (Jammer) mode can be set to Square for normal operation or VEILLE (Standby) when you do not want to use your jammer. The PCM mode is not currently implemented).

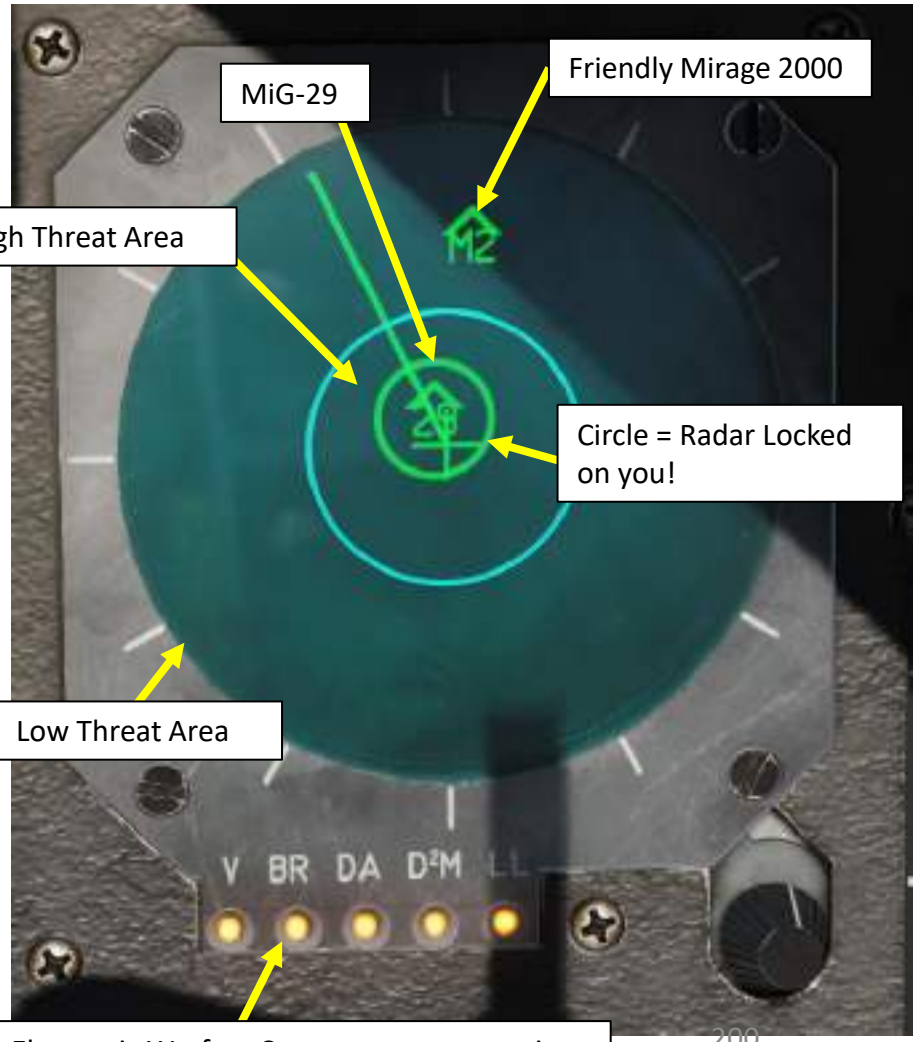
NOTE: Press the JAMMER ACTIVATE button on your HOTAS to activate jammer (BR light on RWR).

The RWR has an internal library that allows it to identify the category and type of radar. There are three categories: Airborne, ground and missile radars. Each category has its own symbol that identifies it.

ECM Mode
VEI: *Veille* / Stand By
Square: NORMAL
PCM: (*Priorité Contremesure*)
In PCM, jammer signal takes priority over radar signal, jamming your own radar as well.

BR: Jammer (*Brouilleur*)
DA: RWR Status (*Détecteur d'Alerte*)
D2M (MLWS): Missile Launch IR Detector (*Détection de Départ de Missile*)
T = Test
M = MARCHE = ON
A = ARRÊT = OFF



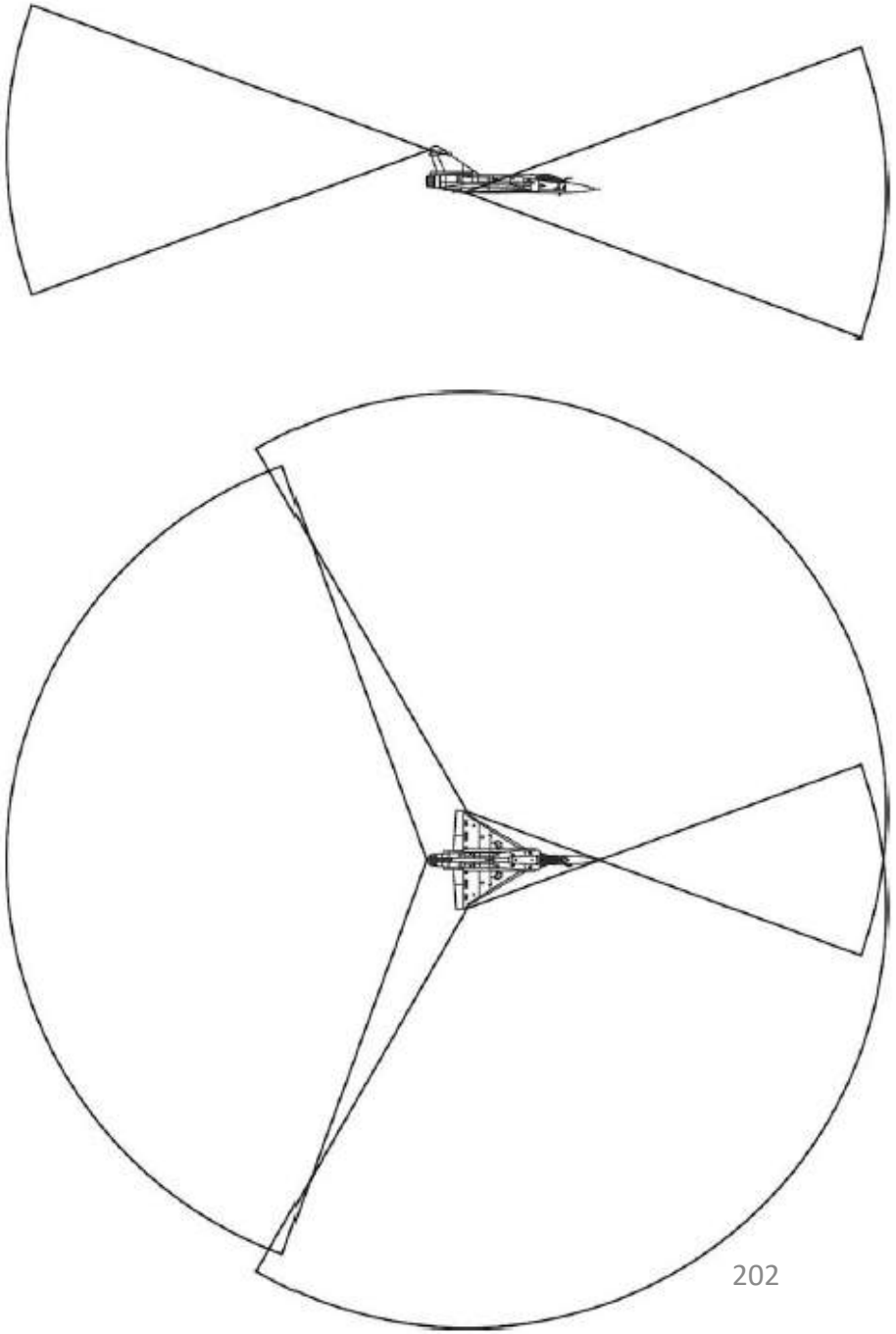


SERVAL (RWR), *SABRE* ECM JAMMER

SERVAL (RWR), *SABRE* ECM JAMMER

RWR THREAT CODES		
CODE	THREAT	
0	S-300	(SA-10 "Grumble")
1	BUK	(SA-11 "Gadfly")
2	S-300V	(SA-12 "Gladiator")
3		
4	F-14	
5	9K330 Tor	(SA-15 "Gauntlet")
6	2K12 KUB	(SA-6 "Gainful")
7		
8	9K33 OSA	(SA-8 "Gecko")
9	2K22 TUNGUSKA	(SA-19 "Grison")
A	AAA	(Anti-Aircraft Artillery Radar)
B	Su-24, Su-39, Tu-22, Tu-95, Tu-142, Tu-160, B-1, B-52, S-3, A-6, EA-6B, F-5E, F-4, F-111, Tornado IDS, AJS 37	
C	Early Warning ground radars (EWR-1L13, EWR-55G6)	
D	DOG EAR: 9K35 Strela System Search Radar.	(SA-13 "Gopher") ATTENTION: SA-13 is IR Guided.
E		
F		
G	Flakpanzer Gepard	
H	Hawk System (Guidance and Search)	
I	Mirage 2000C	
J	NOT USED	
K		
L		
M	MIG-29	
N	NAVY (SHIP RADAR)	
O	NOT USED	
P	Patriot System (Guidance and Search)	
Q	KJ-2000, JF-17	
R	Roland System (Guidance and Search)	
S	Su-27, Su-33, J-11	
T	Tornado GR.4	
U	UNKNOWN	
V	M-163 Vulcan ADS	
W	WEAPON (MISSILE)	
X	Su-30	
Y	Mirage 2000-5	
Z	ZSU-23-4 Shilka	
+	F-15, F-15E	
-	F-18C	
*	F-16	
•	F-18, AV-8B Plus	
°	Airborne Warning radars (AWACS): E-2C, A-50, E-3	

Sensor coverage:



SERVAL (RWR), *SABRE* ECM JAMMER

RWR THREAT CODES	
CODE	THREAT
Ш	Su-34
▲	MiG-21
⎍	MiG-23/27
⊥	MiG-25
⎍	MiG-31

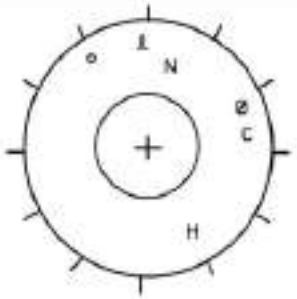
RWR THREAT SYMBOLS	
V	Radar Lock. Symbol appears below threat code.
^	Radar Guiding (Weapons Launch). Symbol appears above threat code. Both V and ^ will blink.

RWR SOUND WARNINGS	
Single Beep	New RWR Threat
Continuous Beep	Radar Locked or Radar Locked and Guiding.

NOTES:

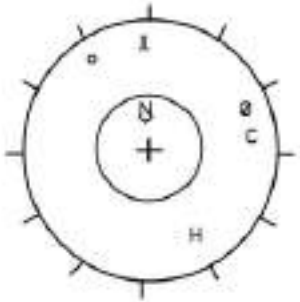
- Threat codes can be modified by editing the */Cockpit/Scripts/SERVAL.lua* file.
- Threat Codes marked in grey with white letters cannot be used.
- Threat Codes marked in red with yellow letters cannot be modified.
- The sound warning is the same regardless of threat type.
- MIG-19P and F-86F gunnery radars do not have RWR codes. They will be shown as U (unknown).
- U code can be either Airborne, Ground or Sea threat.

RWR Display Samples



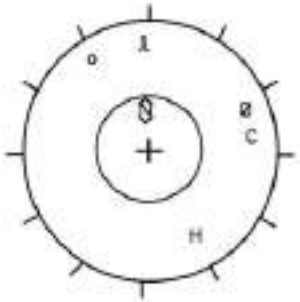
RWR Threats detected:

- AWACS
- MiG-23
- Navy
- SA-10
- EWR
- Hawk



RWR Threats detected:

- AWACS
- MiG-23
- Navy (Locked)
- SA-10
- EWR
- Hawk



RWR Threats detected:

- AWACS
- MiG-23
- Navy (Locked and Guiding)
- SA-10
- EWR
- Hawk

Notes:

- Detected Threats that are in search mode will be displayed in the outer ring.
- Detected Threats that are either Locked or Locked and Guiding will be displayed in the inner ring.

SERVAL (RWR), *SABRE* ECM JAMMER

The following table describes the jammer operation depending on switch selection:

Switch Position			Jammer Status	Status Lights	
BR	Mode	HOTAS		V	BR
A	Any	N/A	Off	Off	Off
M	VEI	N/A	Standby	ON	Off
M	[]	Standby	Standby	ON	Off
M	[]	Emitting	Emitting	ON	ON
M	PCM	N/A	Emitting	ON	ON
T	Any	N/A	Standby	BLINK	BLINK
Malfunction			Off	ON	BLINK

The table above gives an overview of SABRE operations depending on the setting of the Jammer Master Switch and Jammer Operational Mode Switch, as well as the use of HOTAS controls.

Fields marked with RED mean that the jammer is not operational or the relevant status light is off.

Fields marked with YELLOW mean that the jammer is in standby mode (waiting for input) or the status light is blinking.

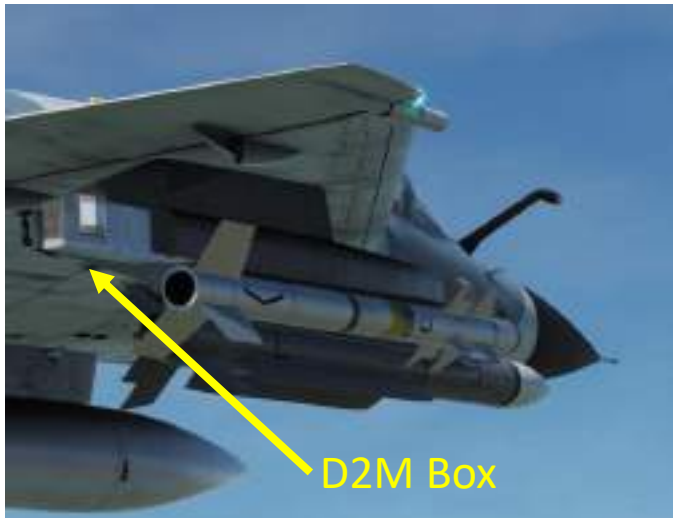
Fields marked with GREEN mean that the jammer is operational or the relevant status light is ON.

Fields marked with GREY mean that either given option is not available or specific HOTAS input is required from the pilot. In this case pressing the Jammer Control Switch on the throttle will toggle the jammer between listening-standby and listening+emitting modes.

DÉTECTION DE DÉPART DE MISSILE (D2M), MISSILE LAUNCH WARNING

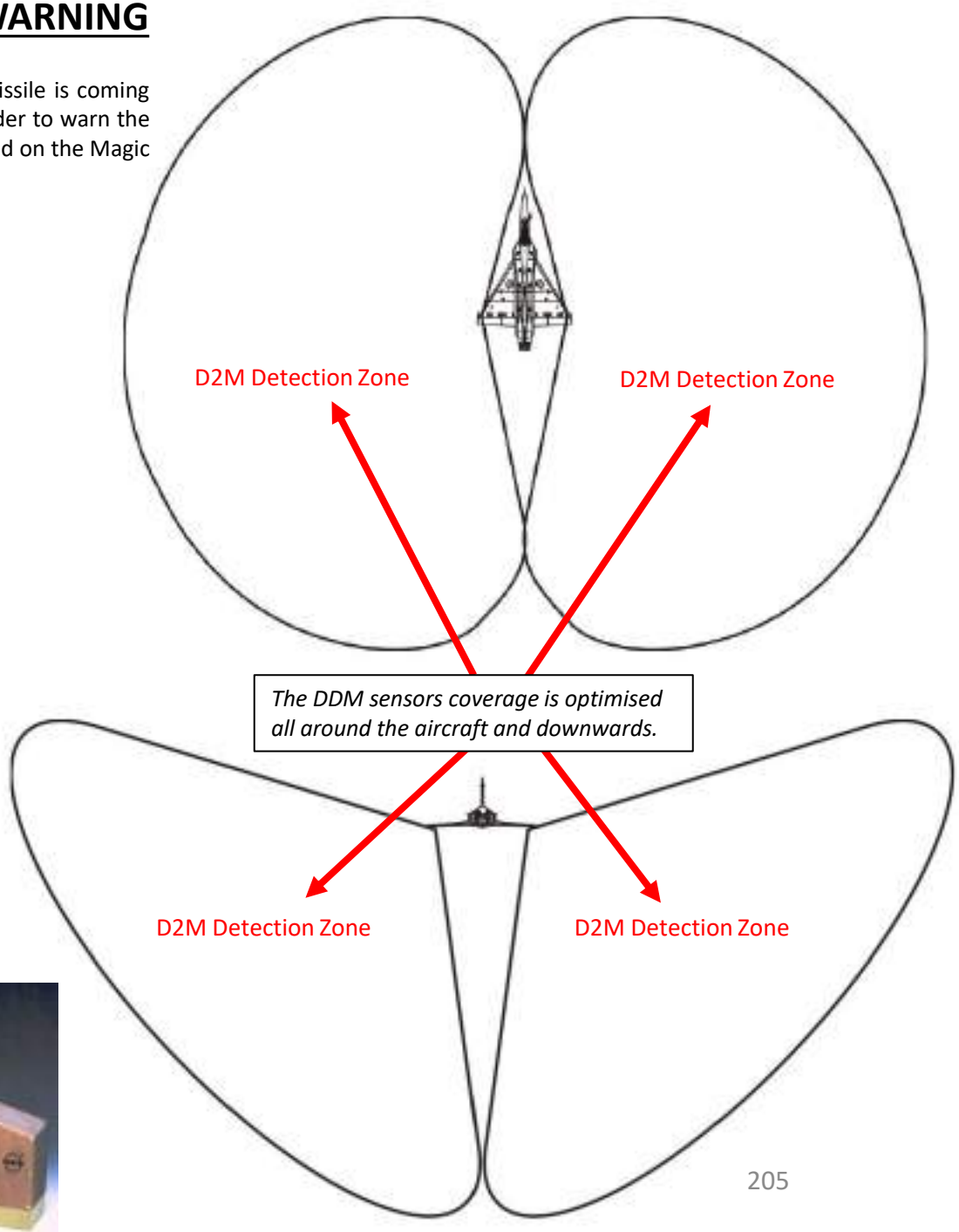
1. The D2M Missile Launch IR detects missile launches and will show you a direction from which the missile is coming (azimuth) on the *SERVAL* (RWR). The D2M is mainly used to detect the IR signature of MANPADs in order to warn the pilot of a missile threat that cannot be detected by the RWR. These missile launch detectors are installed on the Magic II missile pylons, therefore you need to have Magic II missiles installed in order to use the D2M system.
2. The D2M is not infaillible: it has blind spots.
3. The D2M can be turned on by setting the D2M switch to **M**ARCHE.

Here is a video tutorial of the D2M in action: https://www.youtube.com/watch?v=pAbmw4R7Dg4



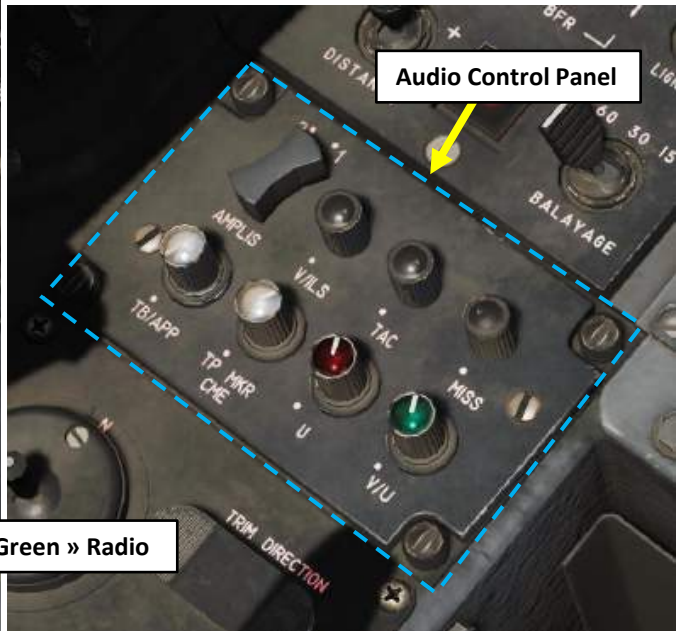
D2M (MLWS): Missile Launch IR Detector
(*Détection de Départ de Missile*)
T = Test
M = MARCHE = ON
A = ARRÊT = OFF

3

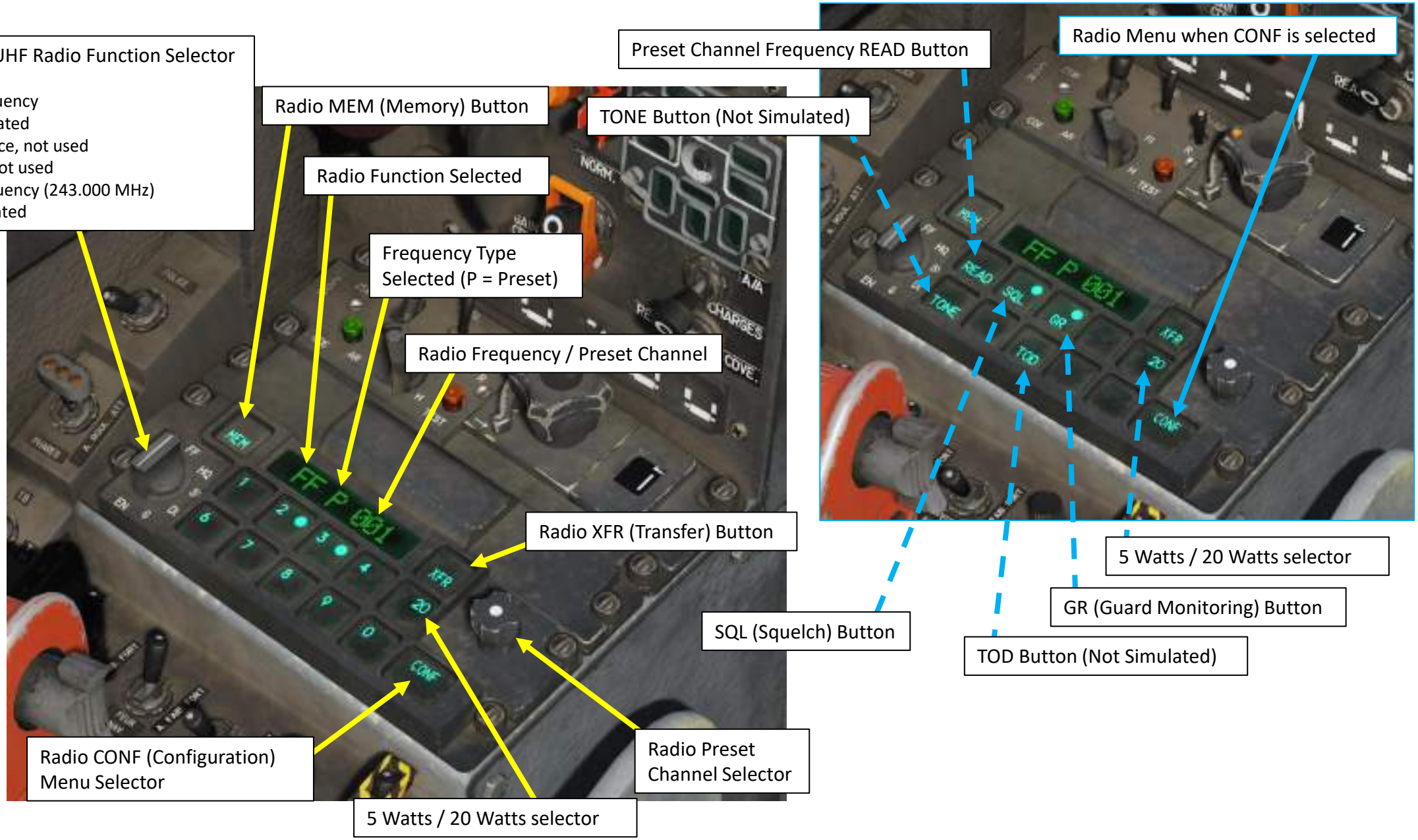


RADIO OVERVIEW

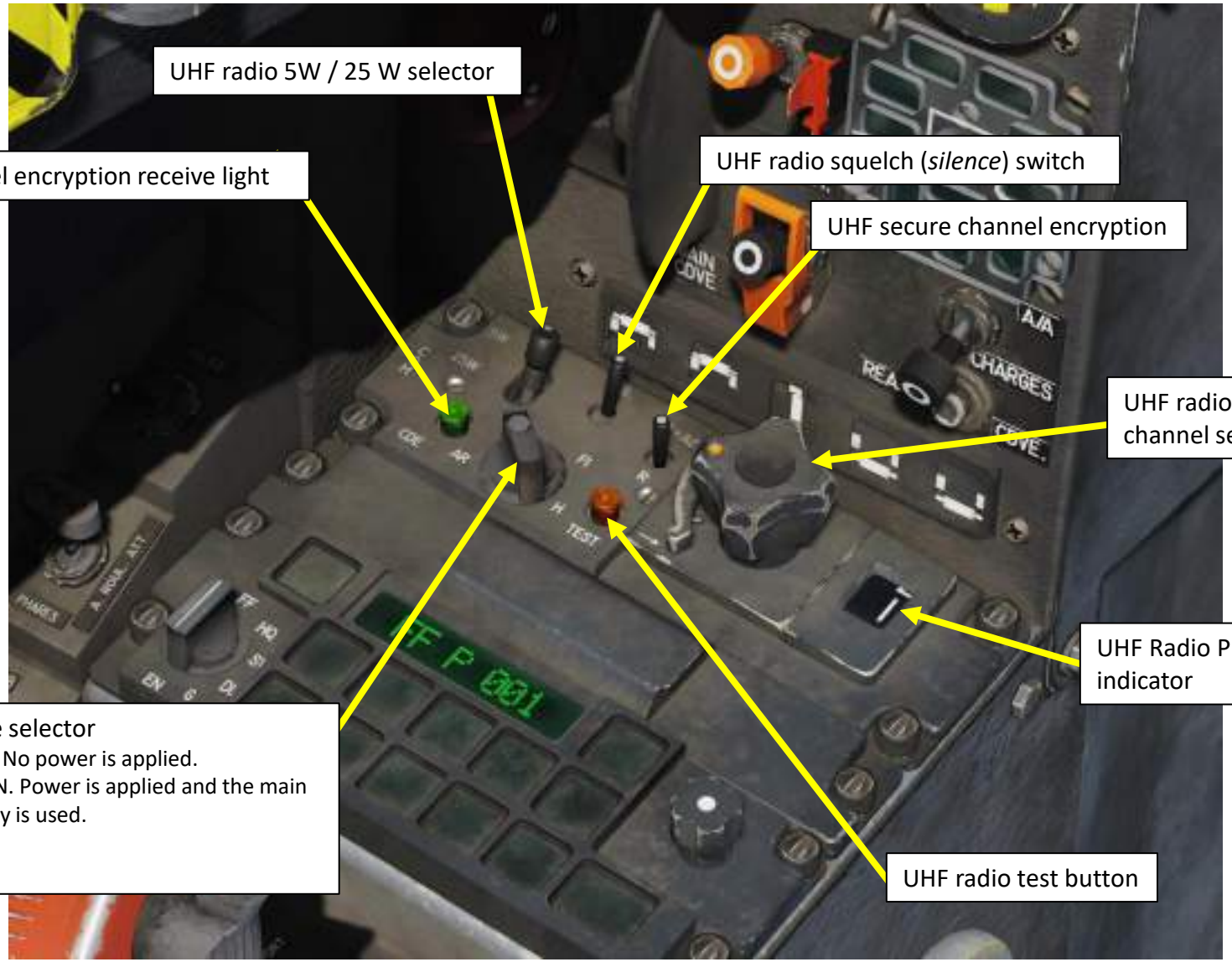
- You have two radios available: a "**Green**" V/UHF radio (COM1) and a "**Red**" TRT ERA 7200 UHF secure voice com radio (COM2) . Most encryption functions are not implemented.
- V/UHF COM1 radio is used for communications between two ranges: 118.000 to 149.970 MHz (VHF Range) and 225.000 to 400.000 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 and on the kneeboard.
- UHF COM2 radio is used for communications between 225.000 and 400.000 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.
- TACAN and VOR/ILS radio beacons will be further explained in the Air Refueling section and the ILS LANDING section.



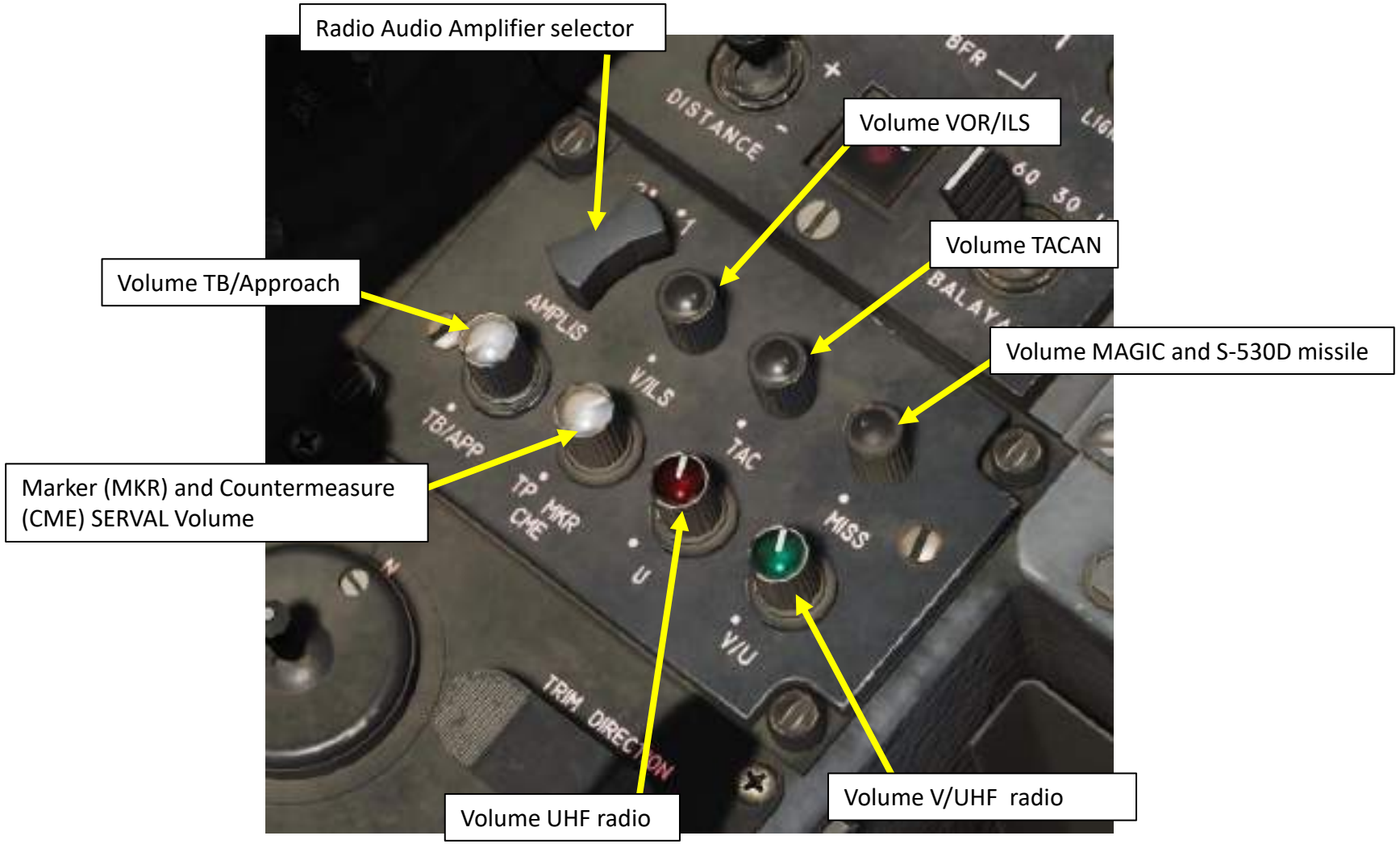
RADIO OVERVIEW (V/UHF COM1)



RADIO OVERVIEW (UHF COM2)

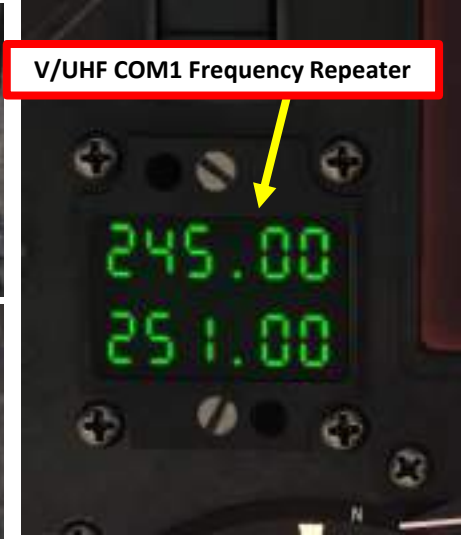


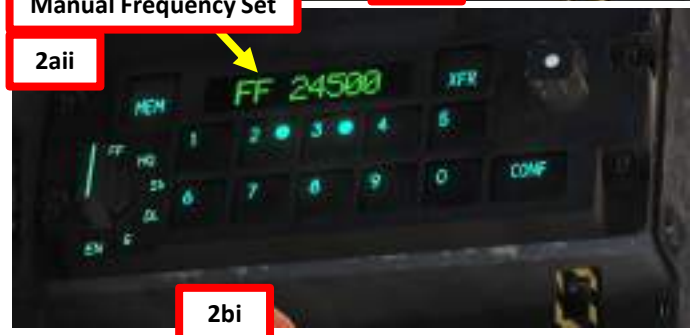
RADIO OVERVIEW (AUDIO CONTROL PANEL)

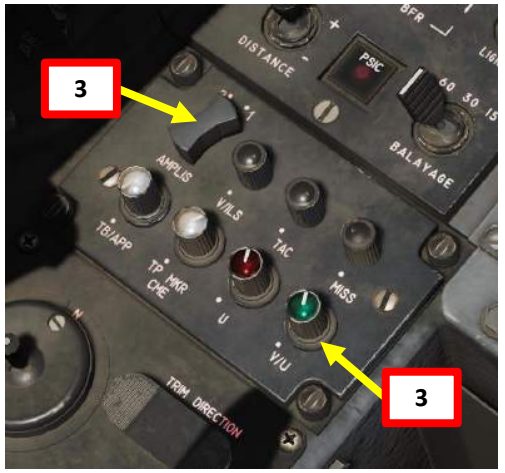


HOW TO USE V/UHF COM1 "GREENBOX" RADIO

1. Set V/UHF Radio Function Selector to FF (*Fixed Frequency*) to turn on the radio.
2. Select desired radio frequency. You can verify frequencies on the COM frequency display.
   a) To choose a manual radio frequency:
      i. Enter frequency on keypad ("24500" would be used for 245.000 MHz)
      ii. Press the VLD (Validate) button.
   b) To choose a preset radio frequency:
      i. Set frequency with the Preset Frequency Tuning knob. "P" means a Preset frequency is selected.
      ii. You can check the frequency by checking the V/UHF COM1 Frequency Repeater. Alternatively, you can also do so by pressing the CONF button, then the READ button (the frequency will then be shown).
3. Select desired audio power amplifier (AMPLIS). Ampli #1 is used by default. Adjust volume as required.
4. To communicate, press the MAIN V/UHF RADIO SELECT button (**LSHIFT** + **NUMPAD+**)

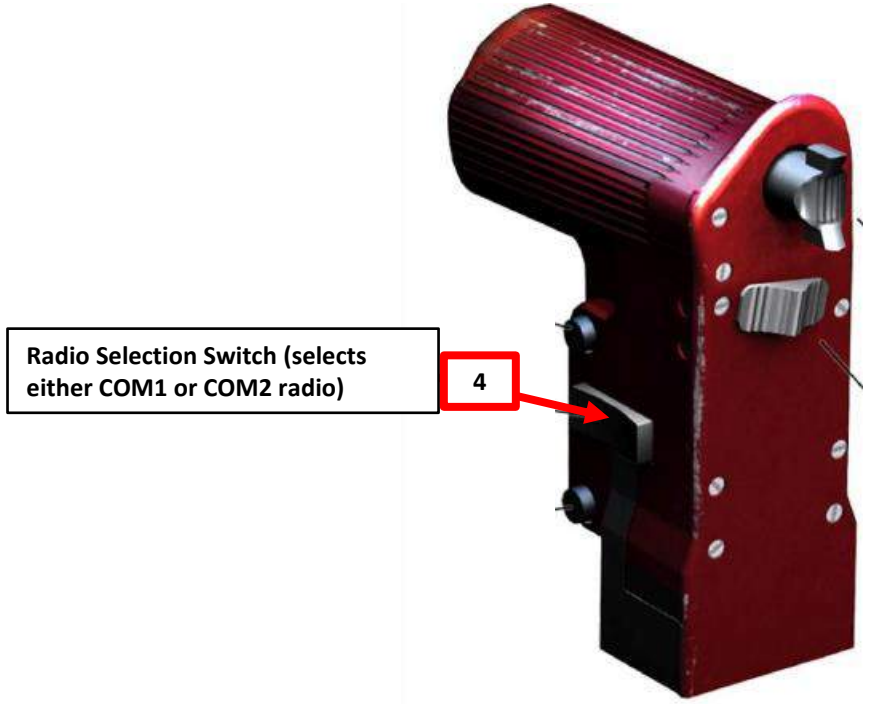


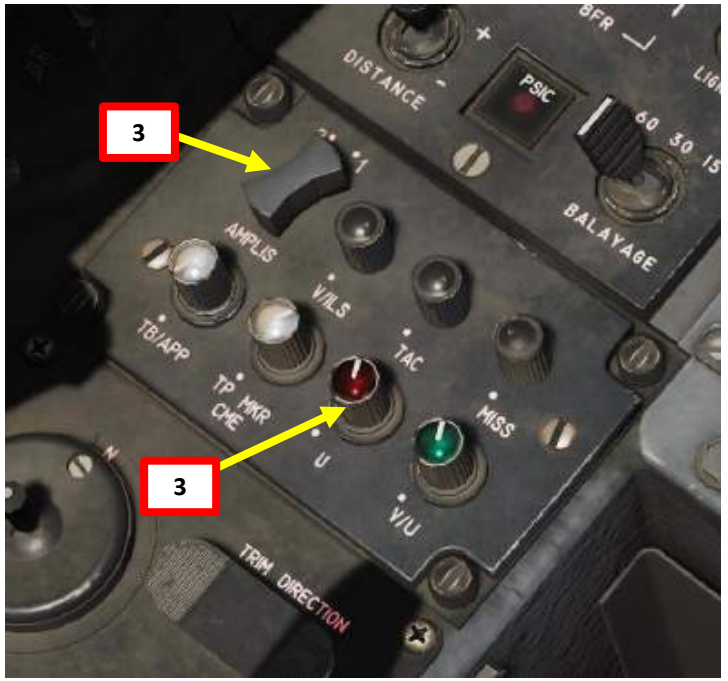


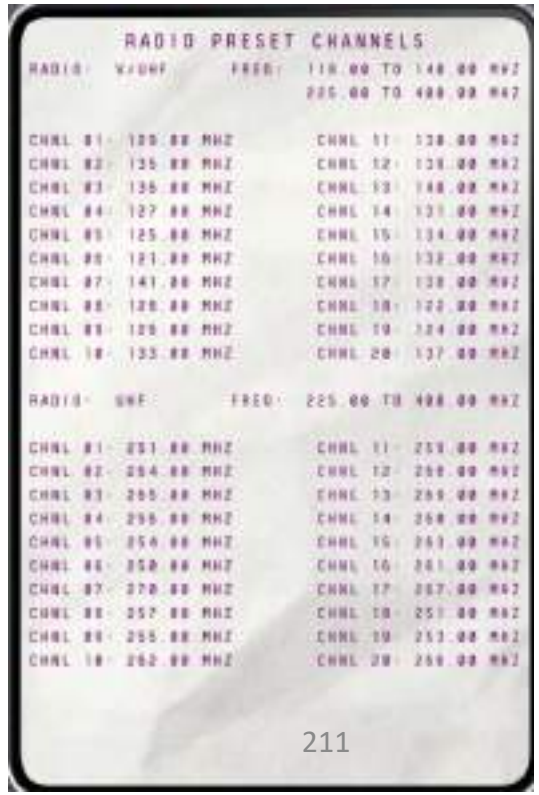


HOW TO USE UHF COM2 RADIO

1. Set UHF COM2 radio to **M**ARCHE (ON)
2. Select desired radio preset frequency. You can verify frequencies on the COM frequency display.
3. Select desired audio power amplifier (AMPLIS). Ampli #1 is used by default. Adjust volume as required.
4. To communicate, press the AUX UHF RADIO SELECT button (**LALT** + **NUMPAD-**)

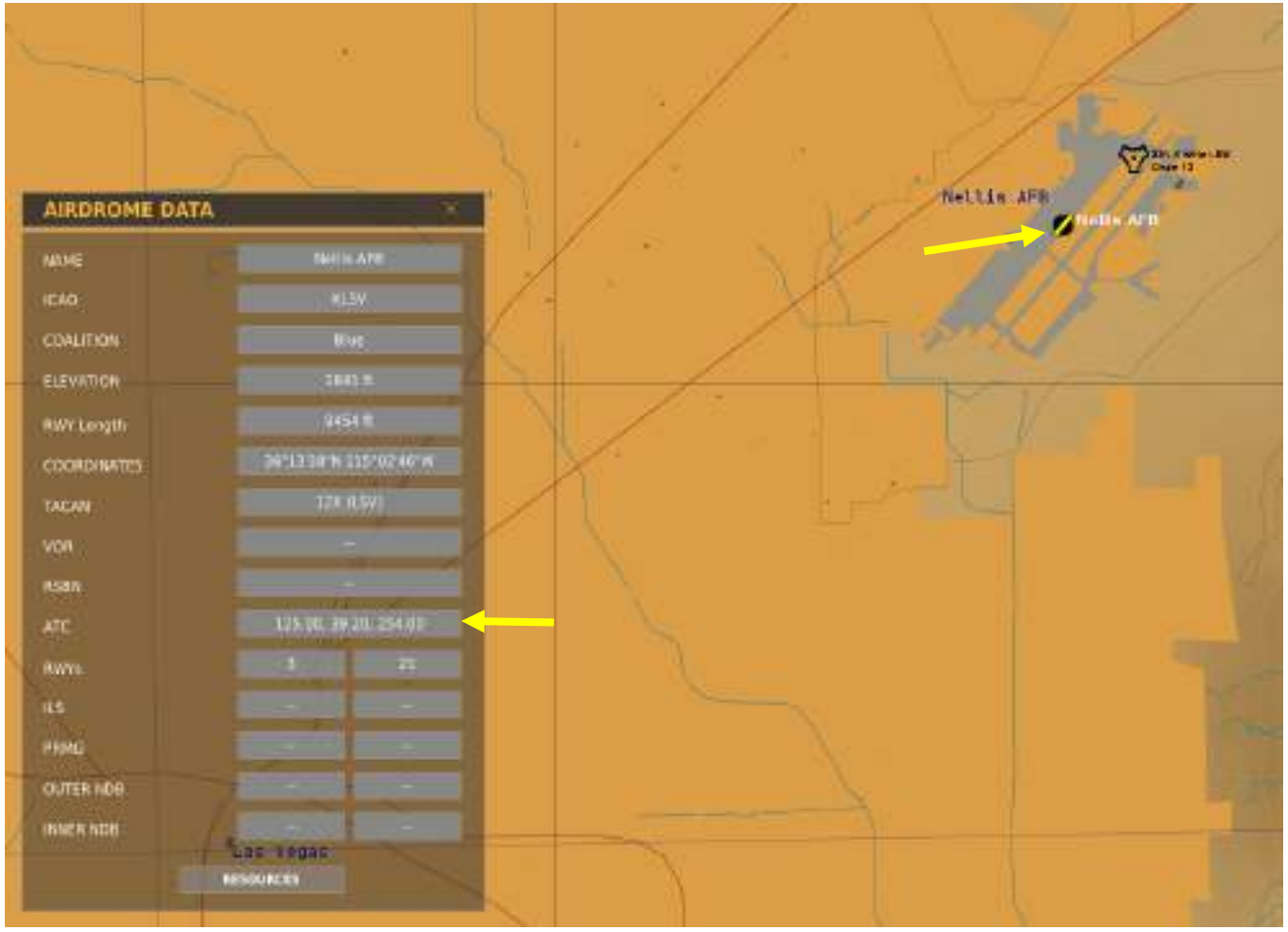






AIRFIELD FREQUENCIES

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

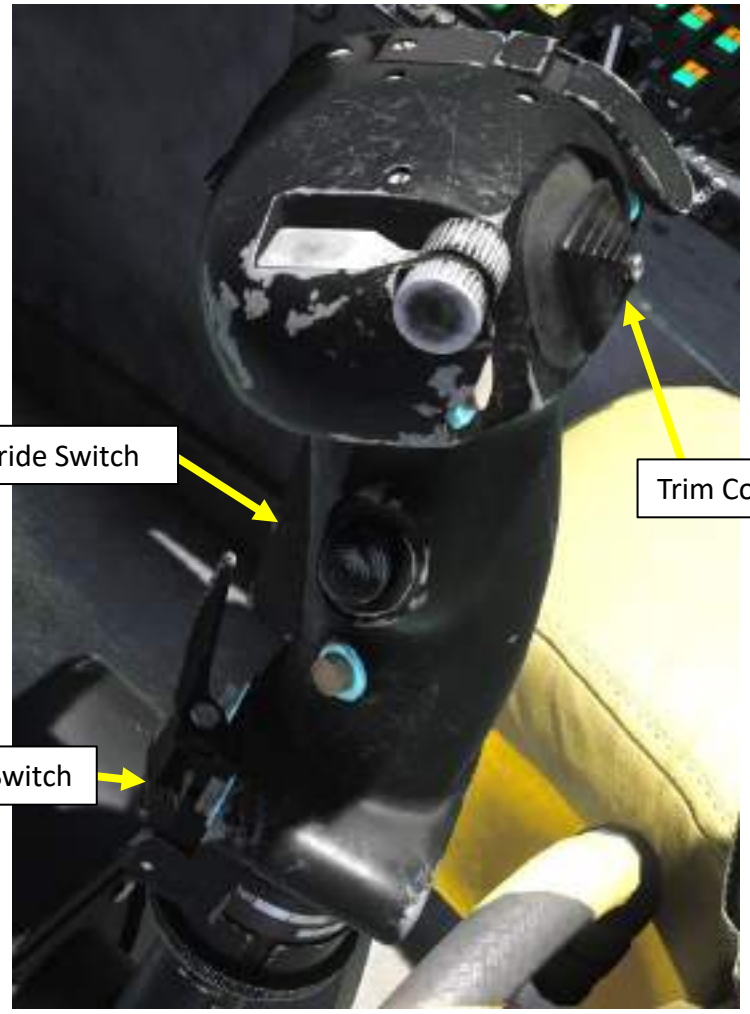
AUTOPILOT OVERVIEW

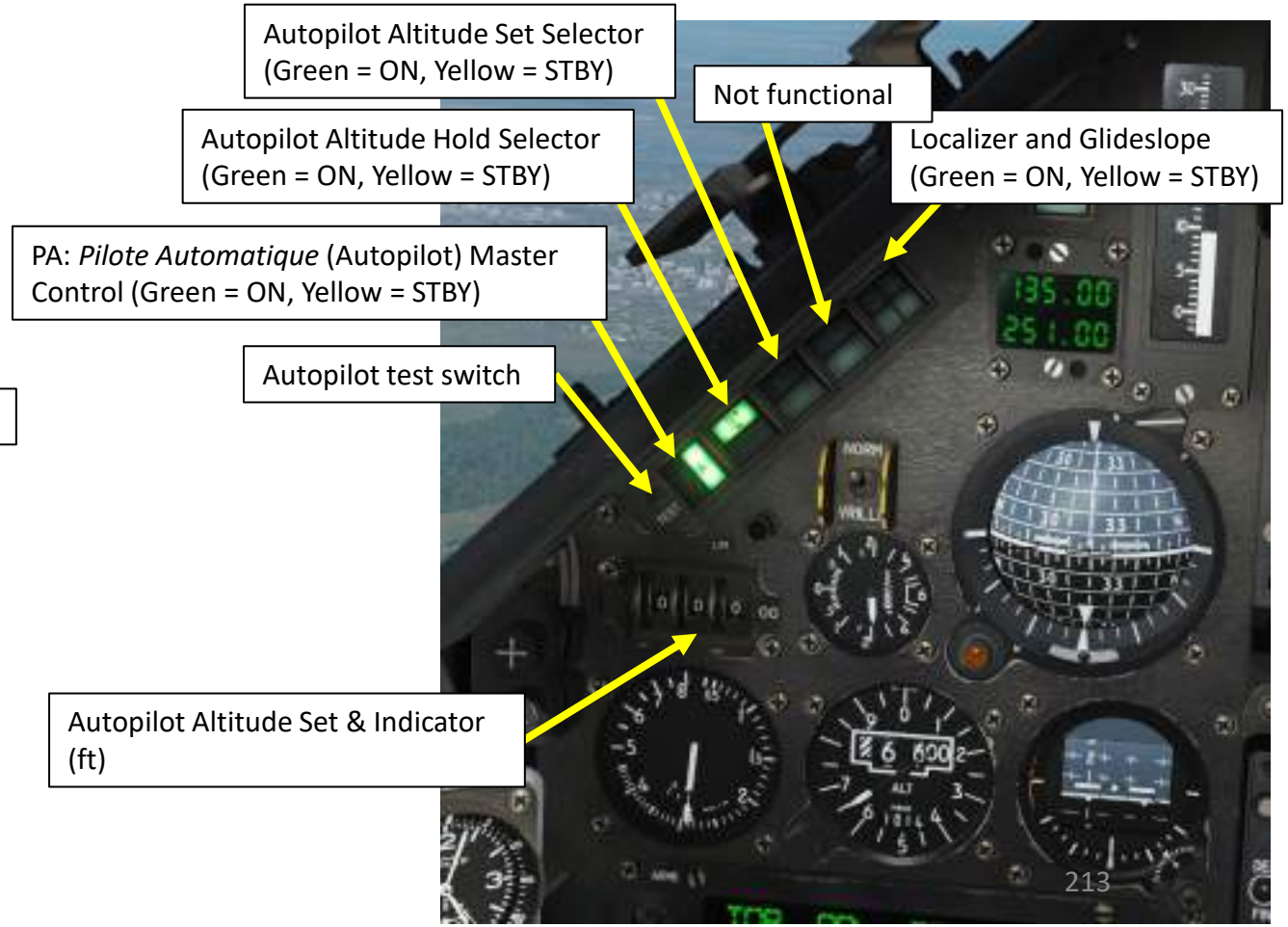
There are three PA (*Pilote Automatique*) auto-pilot modes on the Mirage 2000C.

- HOLD CURRENT ALTITUDE
- HOLD SELECTED ALTITUDE
- LOCALIZER AND GLIDESLOPE HOLD (See ILS Tutorial)

Operational limits

Max altitude	50,000 feet	
Max pitch	40	
Max AOA	18°	
Max Roll	60° (will return to 60° when enabled)	
Minimum speed	200 KIAS	
Minimum altitude	Normal mode:	500 feet
	Localizer and Glideslope hold	200 feet
	Selected altitude hold	1,000 feet

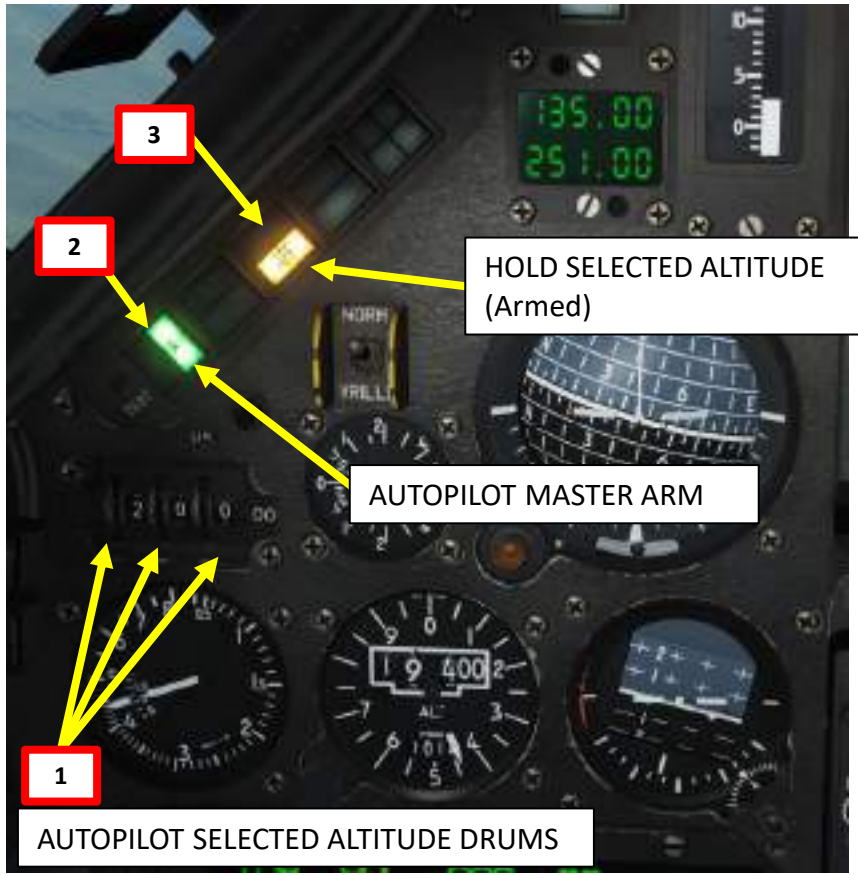


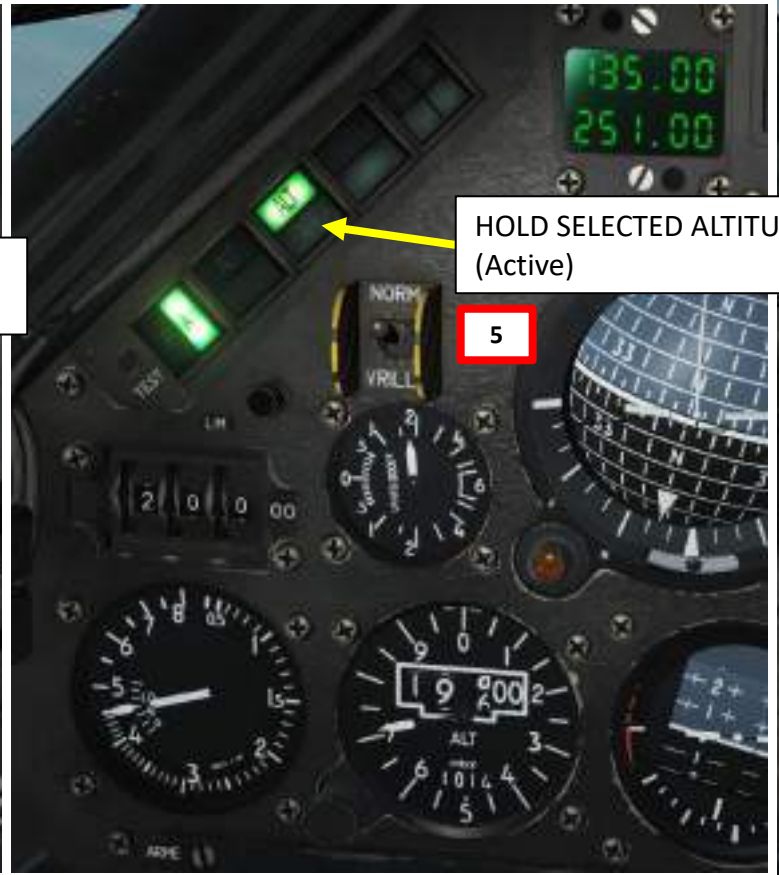


AUTOPILOT TUTORIAL

HOLD SELECTED ALTITUDE (ALTITUDE CAPTURE) MODE

1) Click on autopilot selected altitude drums to set your desired holding altitude. The altitude entered is in meters (selected altitude is 5,000 ft on picture).
2) Click on the autopilot master ARM button (light will turn to green (ARMED).
3) Press the HOLD SELECTED ALTITUDE button (AFF amber caution will illuminate).
4) Set the desired flight path angle towards the desired altitude with the trim control hat or by overriding the AP. The autopilot then holds this pitch.
5) When approaching the target altitude, the AP takes flight path angle control for capture (green ALT annunciator lights up)
6) Aircraft will climb/dive to selected altitude and level out once selected altitude has been reached. HOLD CURRENT ALTITUDE button will then turn to green (ACTIVE).





NOTE
To disengage autopilot, click on the autopilot master ARM button.

AUTOPILOT TUTORIAL

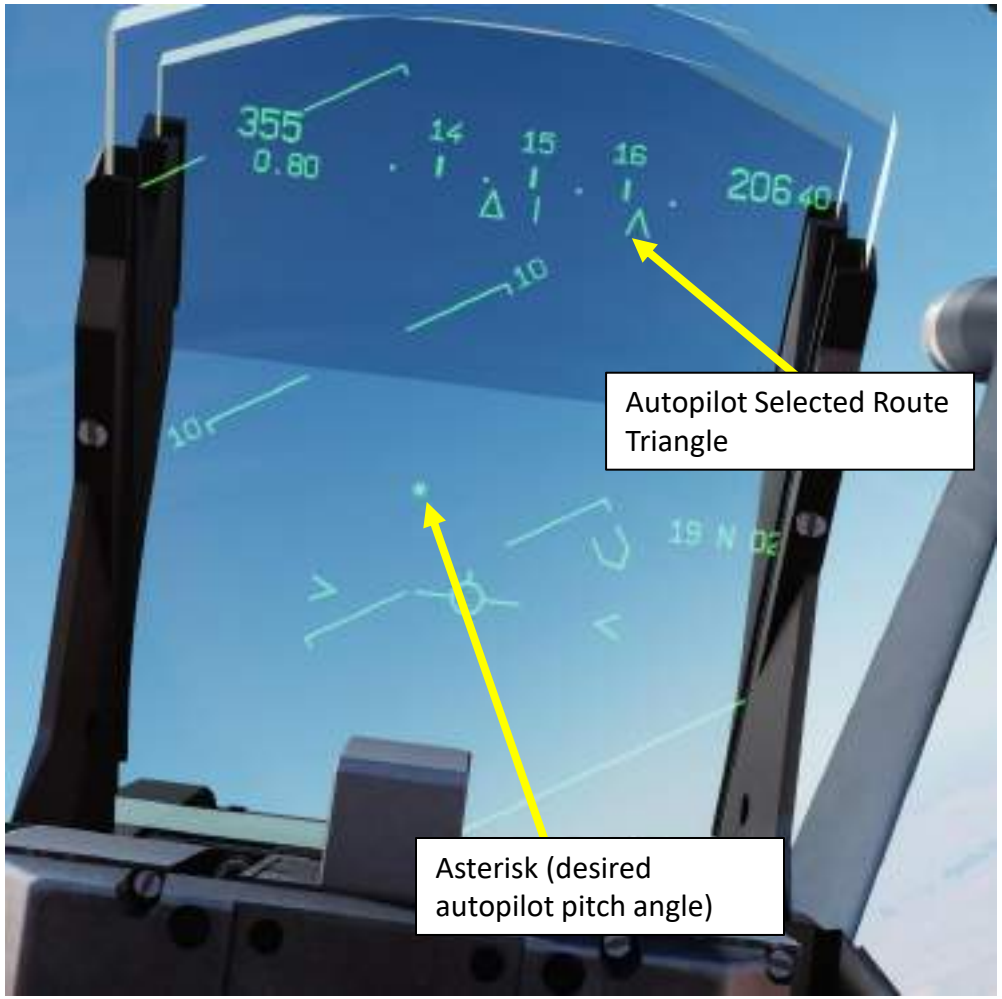
HOLD CURRENT ALTITUDE MODE

1) Click on the autopilot master ARM button (light will turn to green (ARMED).
2) Click on the HOLD CURRENT ALTITUDE button (light will turn to green (ARMED).
3) Aircraft will level out and maintain current altitude

AUTOPILOT EMPLOYMENT

The Mirage uses a specific way of controlling the aircraft: normally, the pilot engages the autopilot soon after reaching operational limits (passing 200 kts) and then uses the trim hat for navigating, adjusting flight parameters, etc. When the AP is engaged, control stick movements will have no effect unless the AP is deactivated, overridden or stick is moved more than half of its full displacement in any direction.

Trim DOWN	HOTAS	RCtrl + W	JOY_BTN_POV1_U
Trim LEFT	HOTAS	RCtrl + A	JOY_BTN_POV1_L
Trim RIGHT	HOTAS	RCtrl + D	JOY_BTN_POV1_R
Trim RUDDER LEFT	Flight Control	RCtrl + Z	
Trim RUDDER RIGHT	Flight Control	RCtrl + X	
Trim UP	HOTAS	RCtrl + S	JOY_BTN_POV1_D

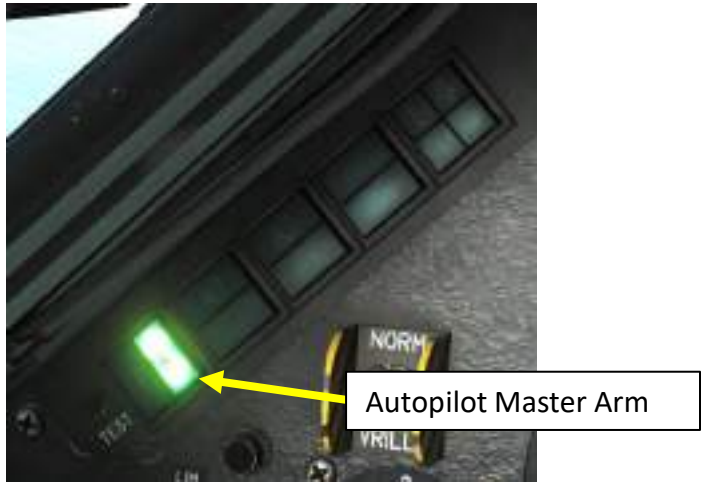


AUTOPILOT EMPLOYMENT

Pressing the **AP Engagement/Master Arm** pushbutton activates the autopilot. Pressing the pushbutton again disengages (deactivates) the AP. Disengagement can also be accomplished by pressing the **AP Disengagement/Disconnect** pushbutton on the control stick, or moving the control stick more than half of its maximum course in any direction.

The AP can be temporarily overridden (paused) by pressing and holding the **AP Standby/Override** pushbutton on the control stick. All active AP mode annunciators light up amber and the aircraft can then be flown manually with the AP in standby. When desired, the AP can be returned to previous operation by releasing the AP Standby/Override pushbutton.

When the AP is engaged, control stick movements will have no effect unless the AP is deactivated, overridden or stick is moved more than half of its full displacement in any direction.



No.	Control Name	Description	Action in Options	Default key
3	**Trim Control**	Trims the aircraft in roll and pitch. When autopilot is engaged, it is use to control the aircraft by setting desired heading and adjusting the flight path.	Trim DOWN Trim LEFT Trim RIGHT Trim UP	RCTRL + W RCTRL + A RCTRL + D RCTRL + S
7	**AP Override Switch**	When autopilot is engaged, maintaining the switch down enables to override the autopilot without setting it off and control manually the aircraft. Releasing the switch re-engages the autopilot.	Autopilot Standby Mode	LALT+A
10	**AP Disconnect Switch**	Disconnects the autopilot	AP Disconnect / Exceed Elastic Limit	LSHIFT + A

NAVIGATION SECTION STRUCTURE

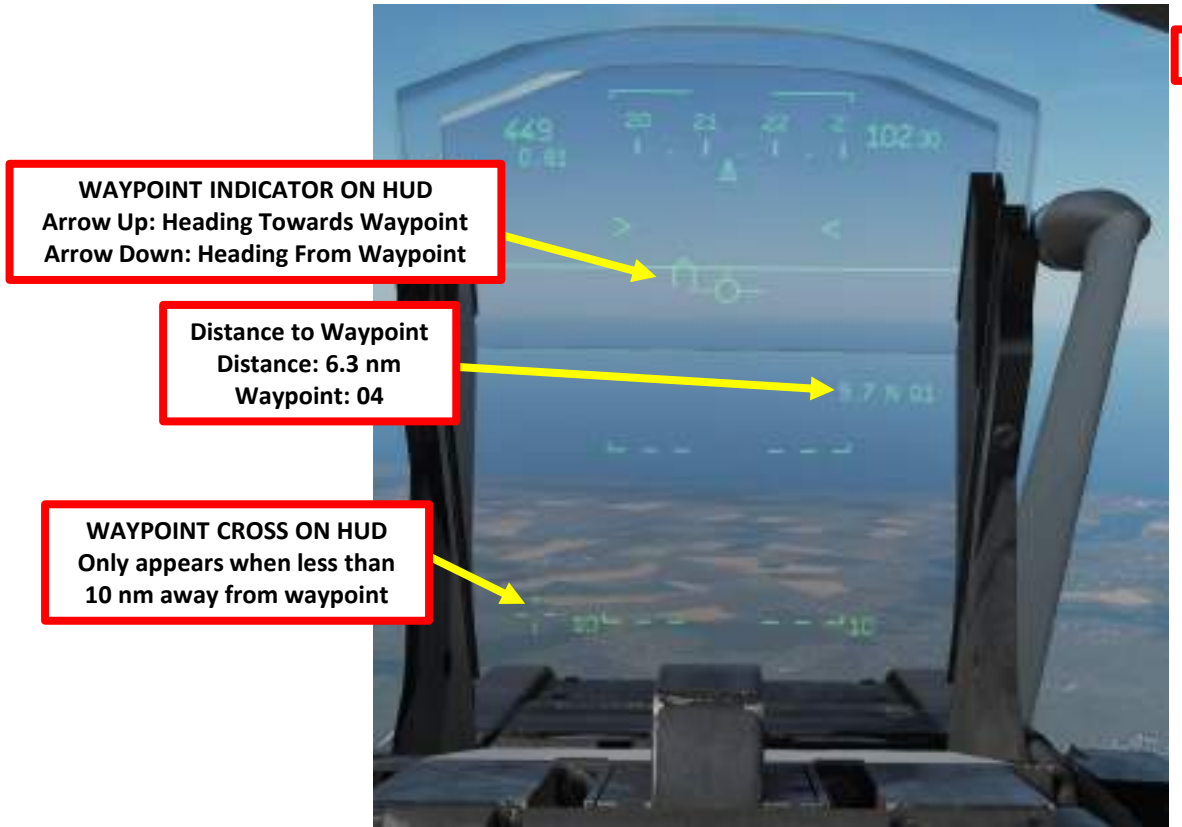
- 1 – Navigation Point Types
- 2 – UNI (INS) Introduction
- 3 – Waypoint (*BUT*)
  - 3.1 – Waypoint Creation
  - 3.2 – Waypoint Navigation
- 4 – Waypoint Offset (*BAD*)
  - Waypoint Offset Introduction
  - Waypoint Offset Creation with ΔL/ΔG
  - Waypoint Offset Creation with ρ/θ
  - Waypoint Offset Navigation
- 5 – Markpoints (*Marqueurs*)
  - 5.1 – How to Add Markpoints
  - 5.2 – Markpoint Navigation
- 6 – TACAN Navigation
  - 6.1 – TACAN Navigation
  - 6.2 – TACAN Offset (*VAD*)
- 7 – VOR Navigation
- 8 – ILS Landing (With Synthetic Runway)

1 – NAVIGATION POINT TYPES

There are two main navigation point types use in the Mirage:

- **Waypoints (But)**
  - Waypoints are pre-planned navigational points of reference for you to follow on route to your area of operation. You can create new ones, edit their coordinates and even create "Waypoint Offsets" (***BAD,* or *But ADitionnel***) if a target location is given to you with range and bearing information in relationship to an existing waypoint (i.e. Bullseye). Bullseye is a pre-determined point in space used as a reference point for flights to relay positions, used as a bearing and distance from Bullseye. The PCN (*Poste de Commande de Navigation*, Navigation Control Panel) can store up to 20 waypoints.

- **Markpoints**
  - Markpoints are used to "mark" a point of interest, whether flying over an interesting area or an enemy sighting. They can be selected, modified and offset just like regular Waypoints.



1 – NAVIGATION POINT TYPES

UNI PREP and DEST Functions

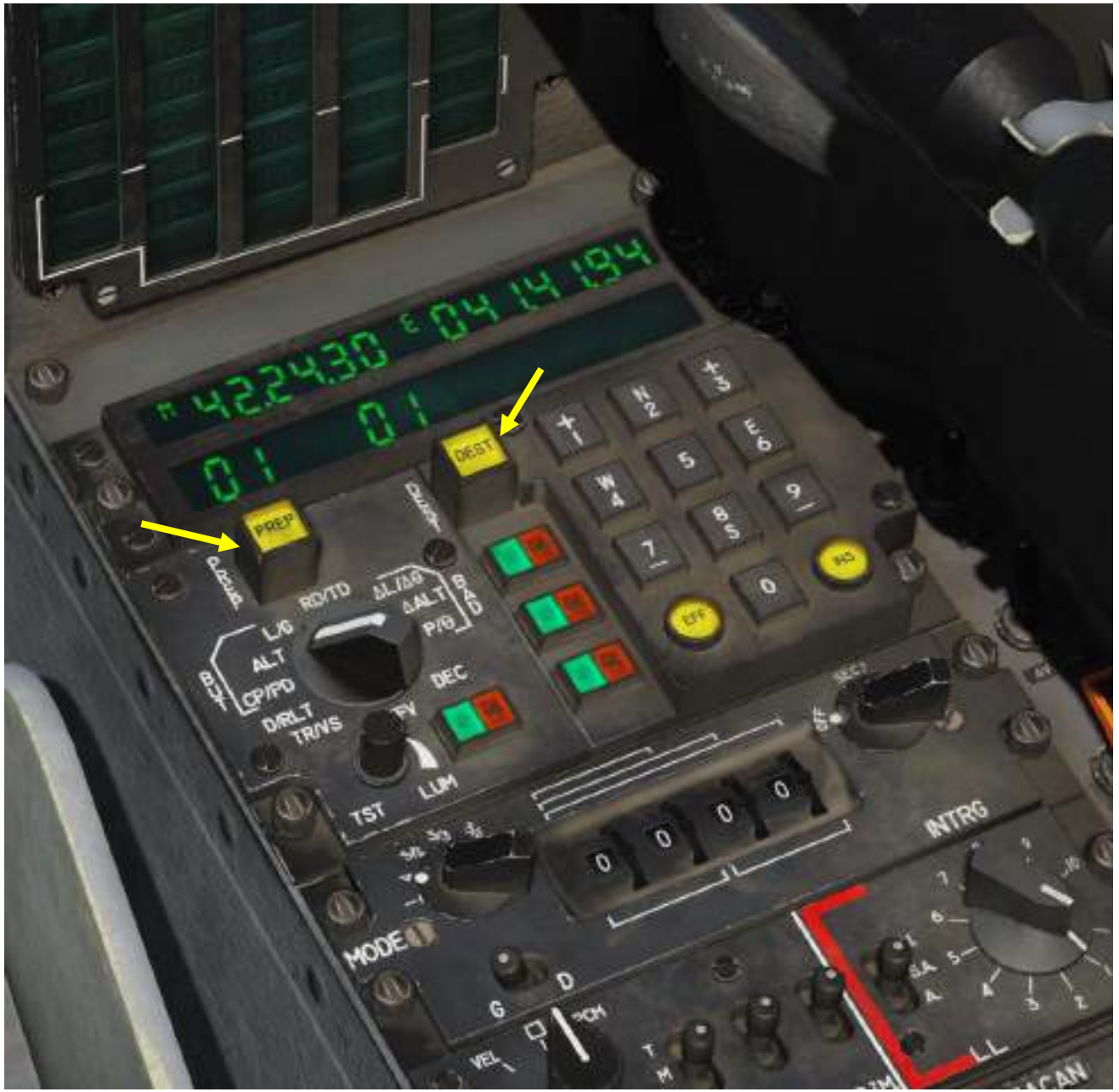
The most important thing to understand and remember is the difference between PREP and DEST functions, as well as Waypoint 00 (zero - zero, which always refers to current position of the aircraft) and other Waypoints. The main difference is as follows:

The **PREP** (preparation) waypoint is used for visualisation and editing. Whenever the PCN displays any waypoint-related data, those are always the data for the current PREP waypoint. In other words, whatever data you input or change there will not have any impact on any of the instruments used for navigating the airplane until the data prepared in PREP is transferred to DEST and hence used for navigation. So, in order to edit any of the waypoints you want to navigate to, you first have to do that in PREP mode before being able to use it as your destination.

The **DEST** (destination) waypoint is being used for navigation. The DEST waypoint data can only be visualised in the HUD, HDD, ADI and IDN. You can't display or edit the DEST data on the PCN, the DEST waypoint is used solely as a source of data for the instruments mentioned above.

Waypoint ZERO vs Waypoints 1 – 20

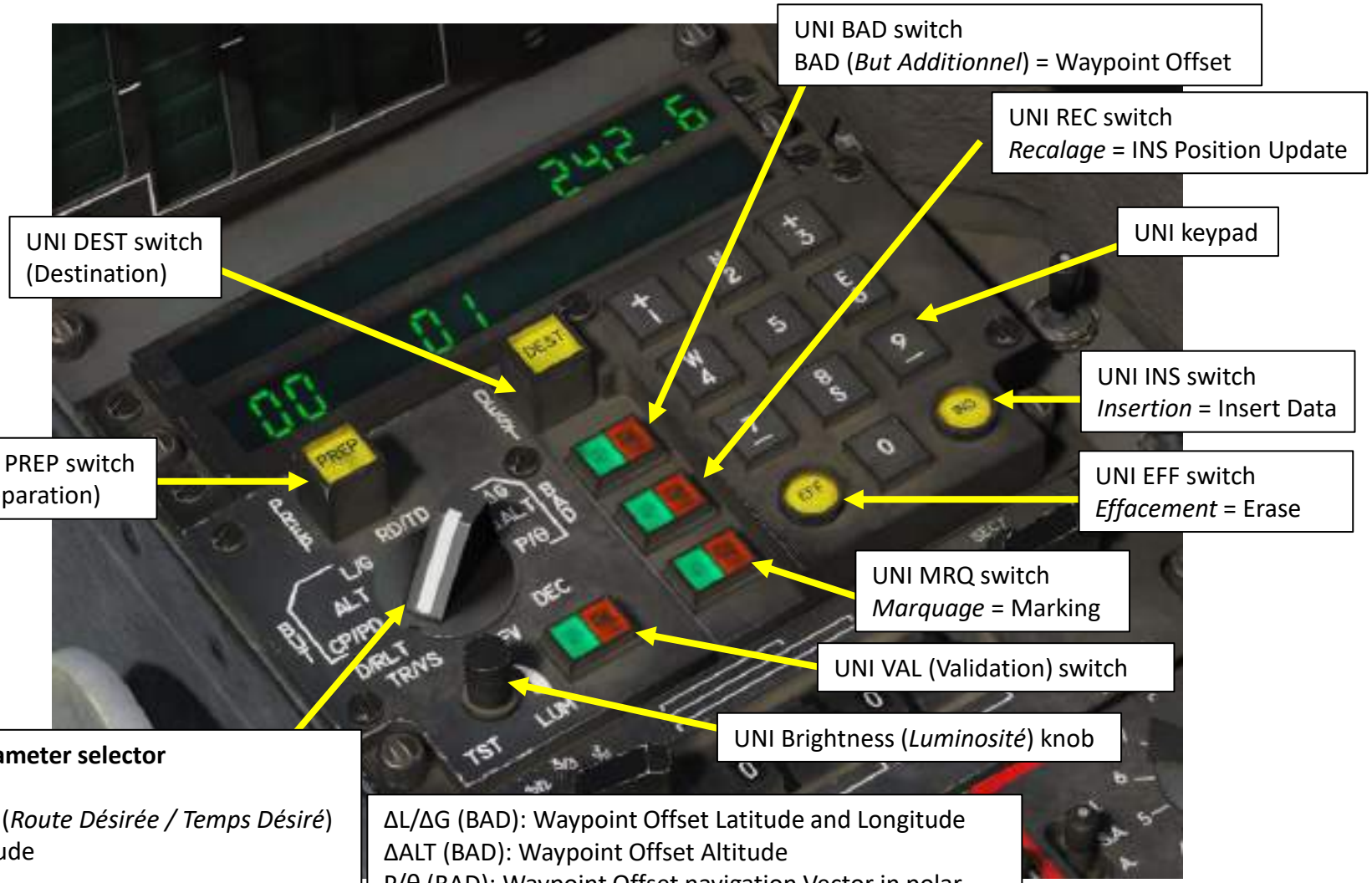
There is a similar difference between Waypoint 0 and all the other Waypoints. **Waypoint ZERO is not a real waypoint, but in fact the current position of your aircraft**. Which means that not all of the data that normally is visible on the PCN can be viewed in WP 00 mode. Also, it is important to remember that WP 00 can only be set in the PREP Window, and never in the DEST window. Other Waypoints are normal Waypoints that can be selected as DEST to navigate to them, and/or as PREP to edit/display data about them on the PCN, such as their position (LAT / LONG), elevation, time to get there... etc.



2 – *UNI* (INS) INTRODUCTION

The UNI (*Unité de Navigation Inertielle*) or INS (Inertial Navigation System) system is used by the aircraft to know its position in the world. The INS system installed on the Mirage is powerful and flexible enough to allow you to navigate anywhere you want. The INS tutorial will be done in two parts:

I. **INS WAYPOINT ENTRY**
II. **HOW TO NAVIGATE TO A WAYPOINT**



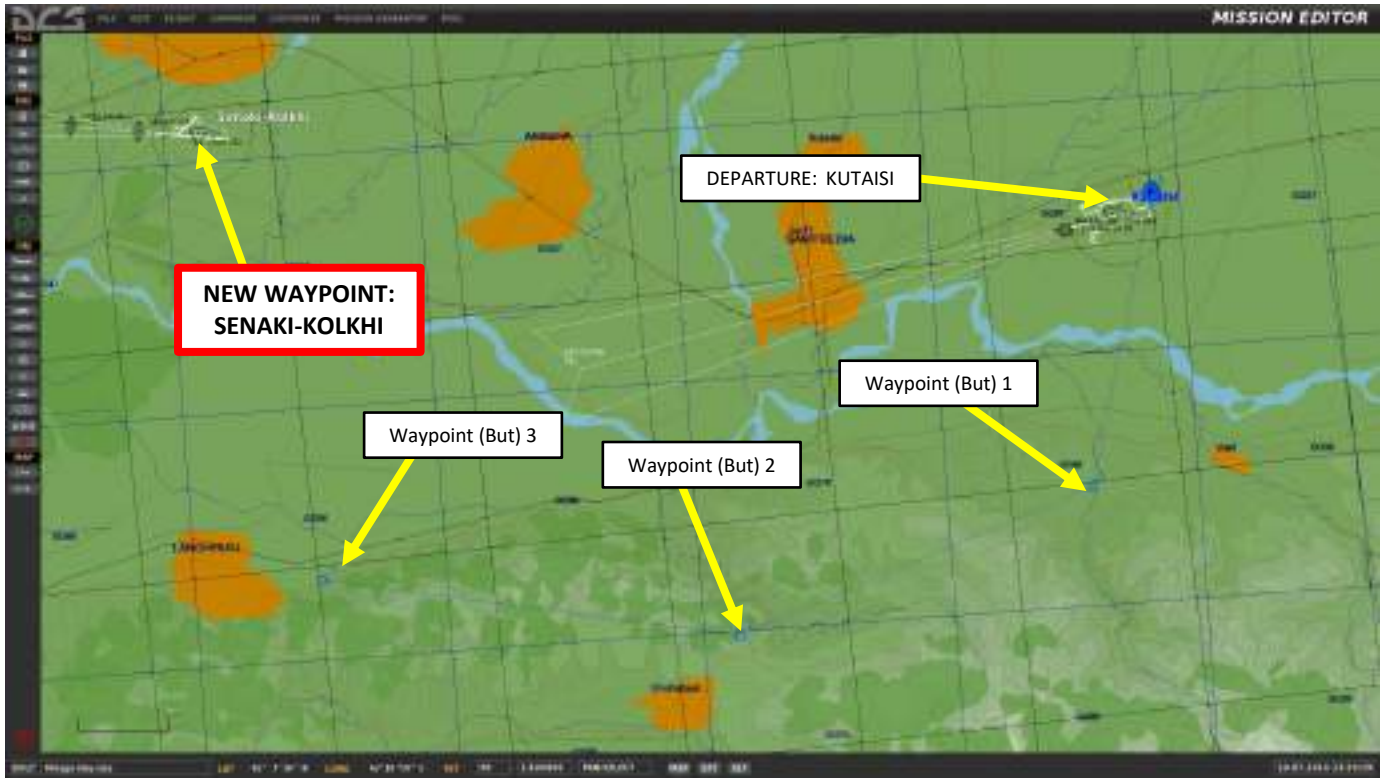
UNI (*Unité de Navigation Inertielle*) Parameter selector
UNI = INS (Inertial Navigation System)
RD/TD: Selected Bearing / Selected Time (*Route Désirée / Temps Désiré*)
L/G (*BUT*): Waypoint Latitude and Longitude
ALT (*BUT*): Waypoint Altitude
CP/DP (*BUT*): Waypoint Specific Glide Ascent/Descent
D/RLT: Distance and Bearing to next waypoint
TR/VS: Remaining Time / Ground Speed (*Temps Restant / Vitesse au Sol*)

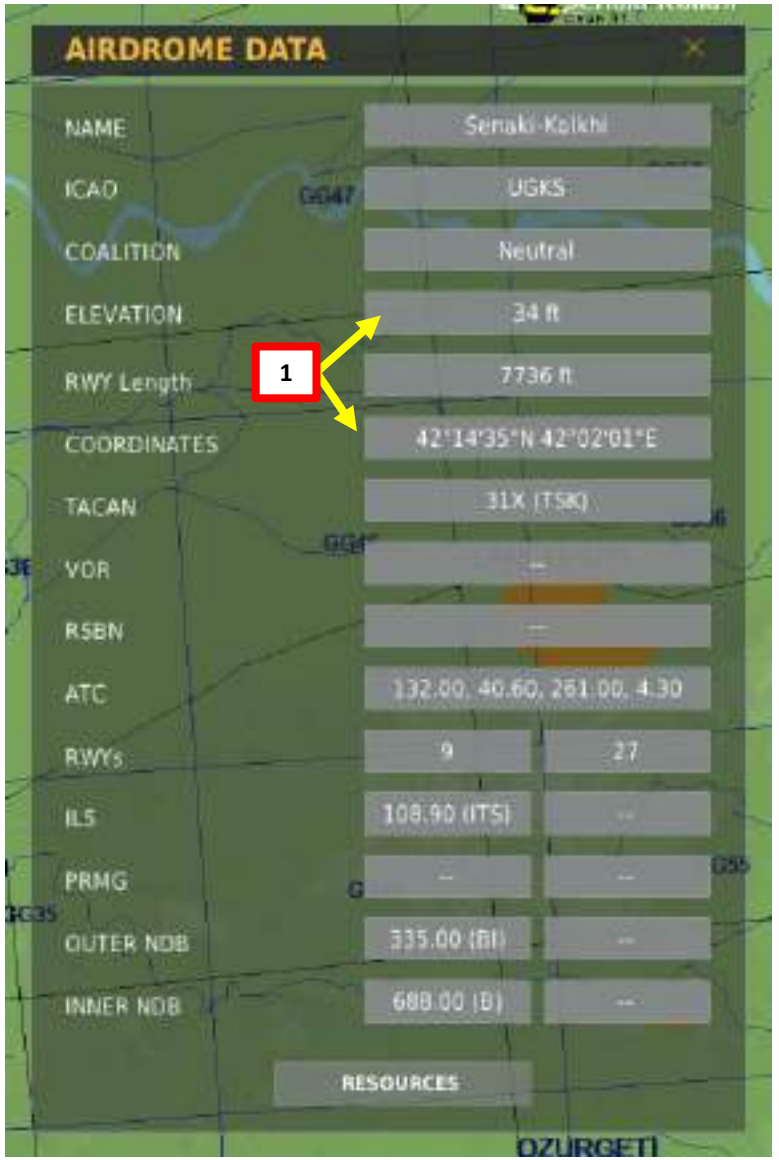
ΔL/ΔG (BAD): Waypoint Offset Latitude and Longitude
ΔALT (BAD): Waypoint Offset Altitude
P/θ (BAD): Waypoint Offset navigation Vector in polar coordinates (distance in nm and Bearing in degrees)
DV/FV: Wind bearing and speed (*Direction/Force Vent*)
DEC: Magnetic declination

3.1 – WAYPOINT (*BUT*) CREATION TUTORIAL

Note: In this tutorial, we already have three waypoints set the MIP (*Module d'Insertion de Paramètres*: Data Cartridge Insertion Module) via the mission editor. We will add a fourth waypoint located at Senaki-Kolkhi. Keep in mind that to add Waypoint #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 COODINATES: 42°14'25'' **N**ORTH 42°02'01''**E**AST.
   ELEVATION: 34 ft
2. The INS system in the Mirage needs the seconds (") coordinates entered in percentage format. As an example:
   42°14'**25**'' NORTH = 42:14.**42** NORTH (MIRAGE INS FORMAT)
   42 = 25 x 100 / 60 since there are 60 seconds in a minute
   42°02'**01**''EAST = 042:02.**02** EAST (MIRAGE INS FORMAT)
   02 ≈ 1.66 = 1 x 100 / 60 since there are 60 seconds in a minute





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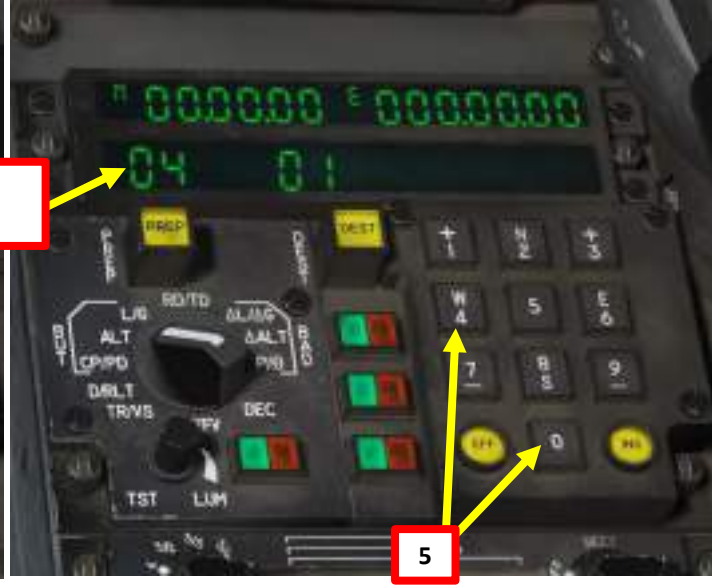
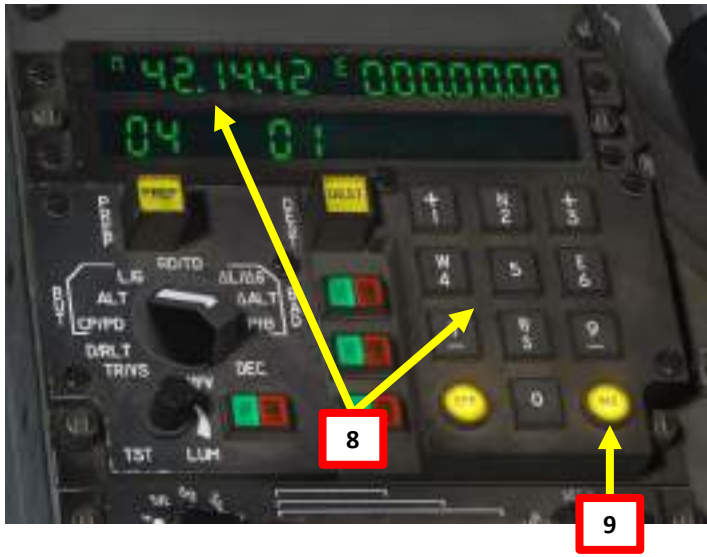
   42 = 25 x 100 / 60 since there are 60 seconds in a minute
   42°02'**01**''EAST = 042:02.**02** EAST (MIRAGE INS FORMAT)
   02 ≈ 1.66 = 1 x 100 / 60 since there are 60 seconds in a minute
3. Set UNI Parameter Selector Switch to L/G
4. Press "PREP" (Preparation) button to create a waypoint.
5. Press "0" and "4" (04) on the INS numpad to add Waypoint Number 4.
6. Press "+1" on numpad to select the North/South coordinate field (left)
7. Press "N" (2) on numpad to select NORTH coordinates
8. Press **421442** on numpad to enter NORTH coordinates
9. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).





3.1 – WAYPOINT (*BUT*) CREATION TUTORIAL

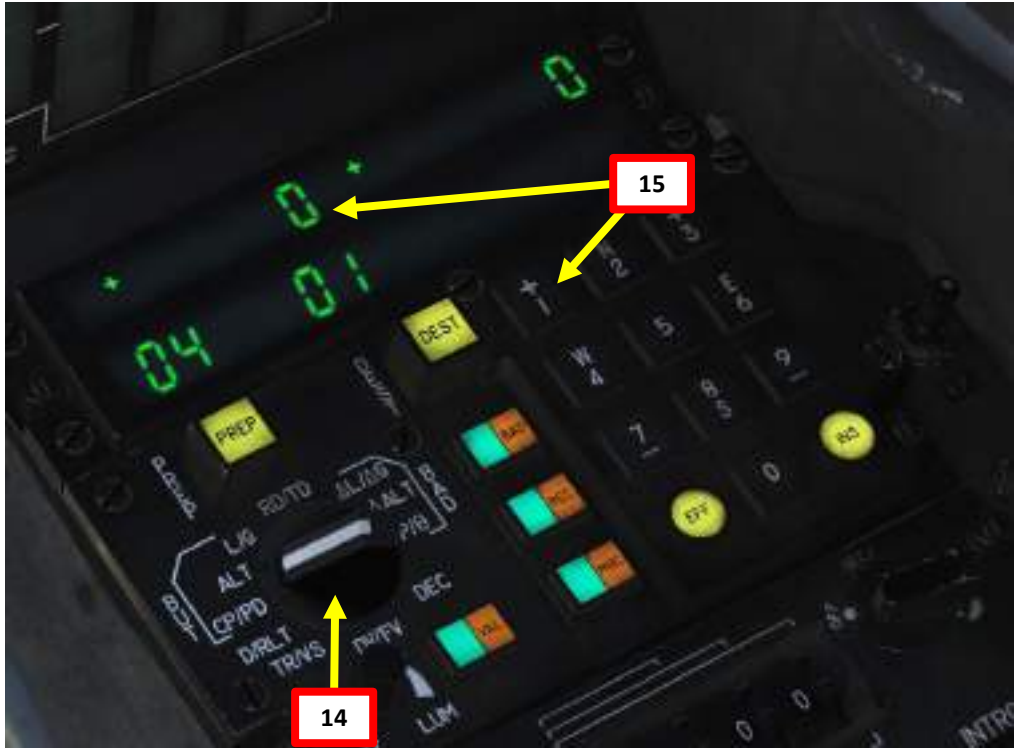
10. Press “+3” on numpad to select the East/West coordinate field (right)
11. Press “E" (6) on numpad to select EAST coordinates
12. Press **0420202** on numpad to enter EAST coordinates (don't forget 0 at beginning for EAST/WEST coordinates)
13. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).

There you go, you have now entered coordinates for a new Waypoint #4!

3.1 – WAYPOINT (*BUT*) CREATION TUTORIAL

14. Set UNI Parameter Selector Switch to ALT
15. To enter elevation in feet, select left field by pressing “+1”. To enter elevation in meters, select right field by pressing “+3”.
16. Press “+1” to enter positive elevation, or press “-7” to enter negative elevation.
17. Enter elevation as follows: “00034” for 34 ft.
18. Press INS (Insert) to enter elevation (or EFF to erase if you made a mistake and need to start over).

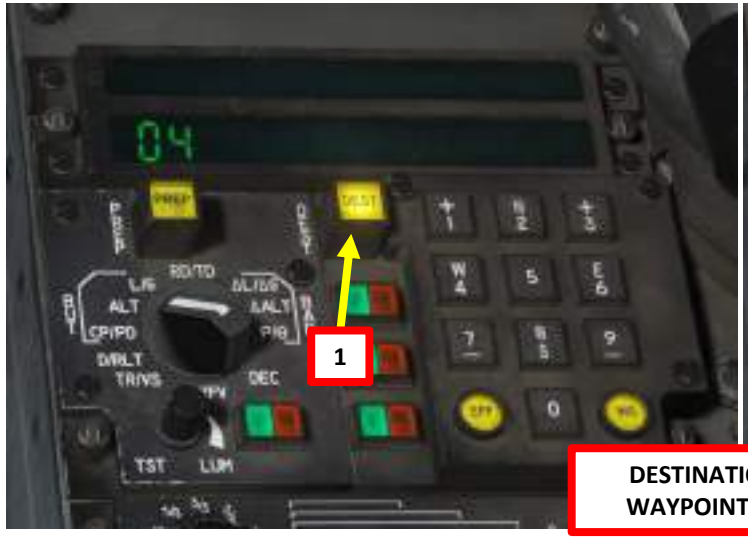
Note:
To edit waypoints, repeats step 3 to 18.

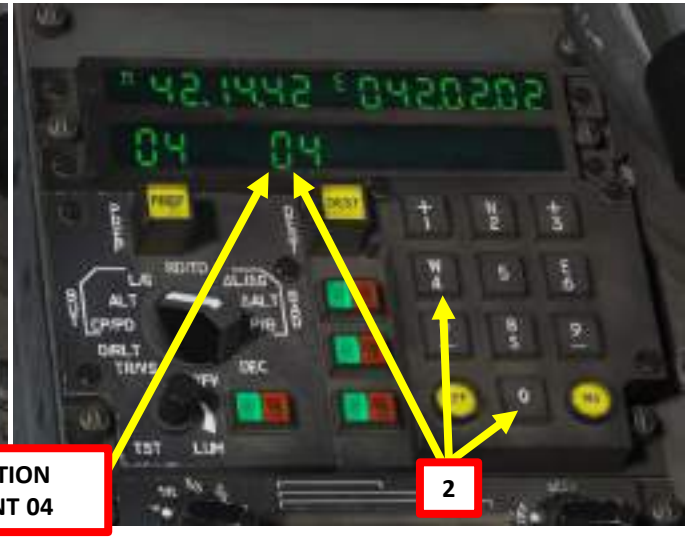


3.2 – WAYPOINT (*BUT*) NAVIGATION TUTORIAL

Note: With our fourth waypoint added in the previous tutorial, we will now navigate to Senaki-Kolkhi using the WAYPOINT (BUT) 04 we just created.

1. Press "DEST" (Destination) button to select a waypoint.
2. Press "0" and "4" (04) on the INS numpad to select Waypoint Number 4. Alternatively, you can use the INS Waypoint Next/Previous buttons.
3. Set the HSI (Horizontal Situation Indication) mode to either "CV" (*Cap Vrai*: True Heading) or "CM" (*Cap Magnétique: Magnetic Heading*)
4. Follow the HSI main needle to your waypoint.



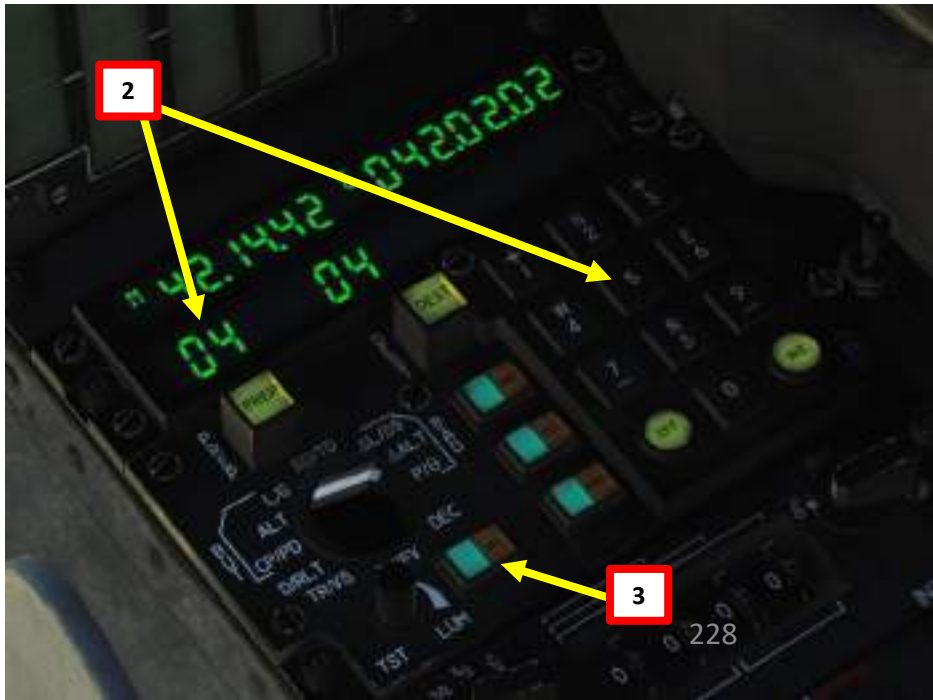


3.2 – WAYPOINT (*BUT*) NAVIGATION TUTORIAL

3.2 – WAYPOINT (*BUT*) NAVIGATION TUTORIAL

You can also visualize the waypoint on the VTB. Here's how:

1. Press "PREP" (Preparation) button .
2. Press "0" and "4" (04) on the INS numpad to select Waypoint Number 4.
3. Press the VAL button.
4. If the waypoint is in the selected radar display range and within radar aperture limits (+/- 60 degrees), you will see a number "4" with a "+" sign next to it to indicate the waypoint location. Up to five waypoints may be displayed at the same time.
5. You can remove all waypoints from the VTB by using the ALLEG switch.



4.1 – WAYPOINT OFFSET (*BAD*)

INTRODUCTION

Waypoint Offsets (also known as *BAD*, *But Additionnel)* are points on the ground (or in space) that are created by using another existing waypoint as a reference. They will be most commonly used for precision bombing or as points of reference given by the ground troops. Another and most widely known example is the use of bullseye call to create an offset point in order to locate your target, friendly units, landmarks etc.

Offsets are defined in two ways:

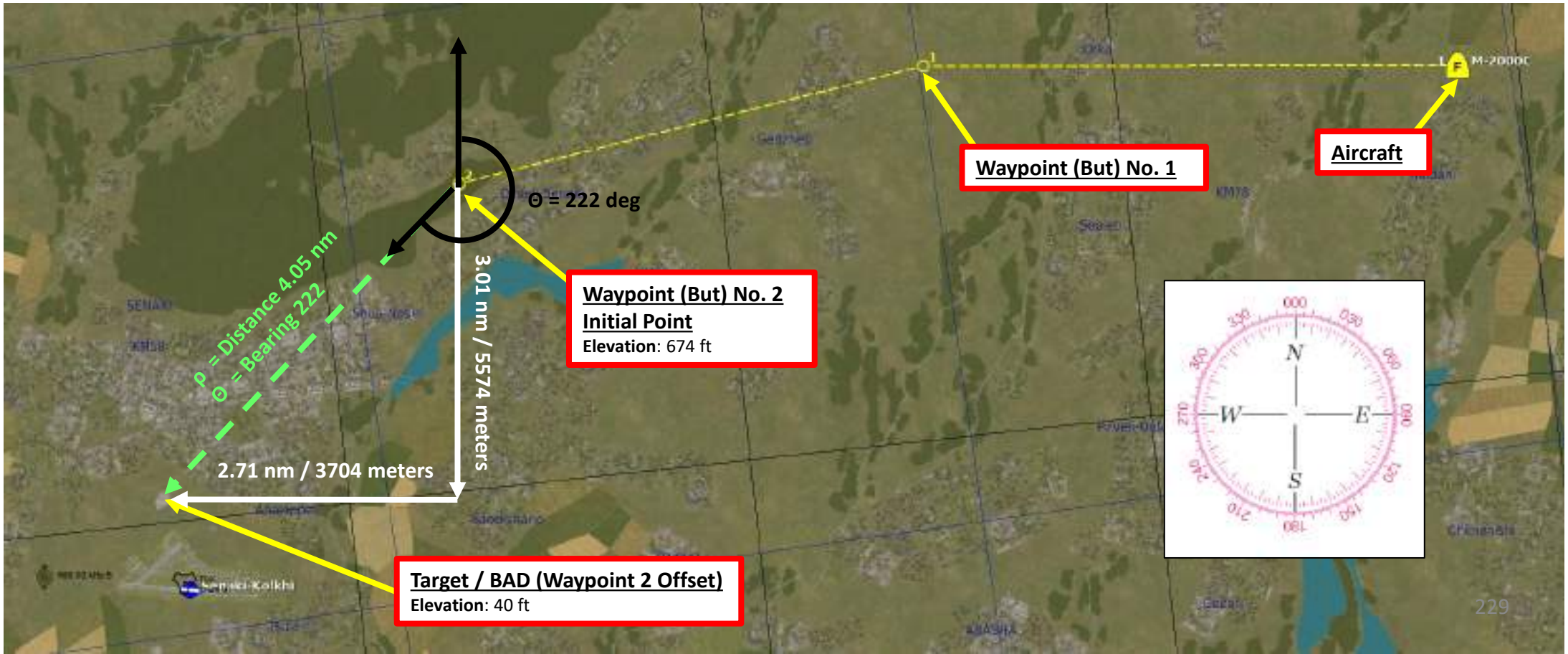
- Entering Longitude (North/South) and Latitude (East/West) offsets (**ΔL/ΔG**) in **meters** with an altitude offset Δ ALT (can be entered in meters or ft as desired).
- Entering Polar Coordinate offsets (**ρ** for distance in nautical miles, **θ** for bearing angle) with an altitude offset Δ ALT (can be entered in meters or ft as desired).

Target / BAD (Waypoint 2 Offset)

ΔL/ΔG: 3.01 nm South / 2.71 nm West
= 5574 meters South / 3704 meters West

ρ/θ: Distance 4.05 nm / Bearing 222 deg

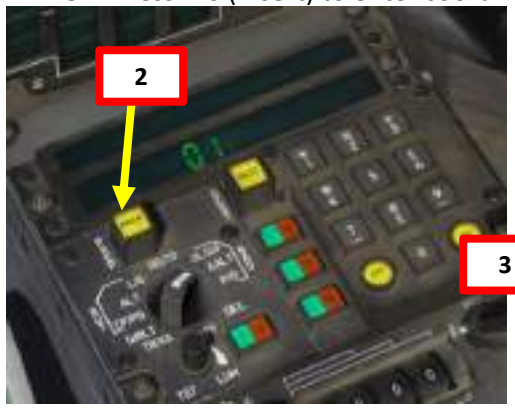
Δ ALT: - (WP2 Altitude – Target Altitude)
= - (674 ft – 40 ft) = -634 ft

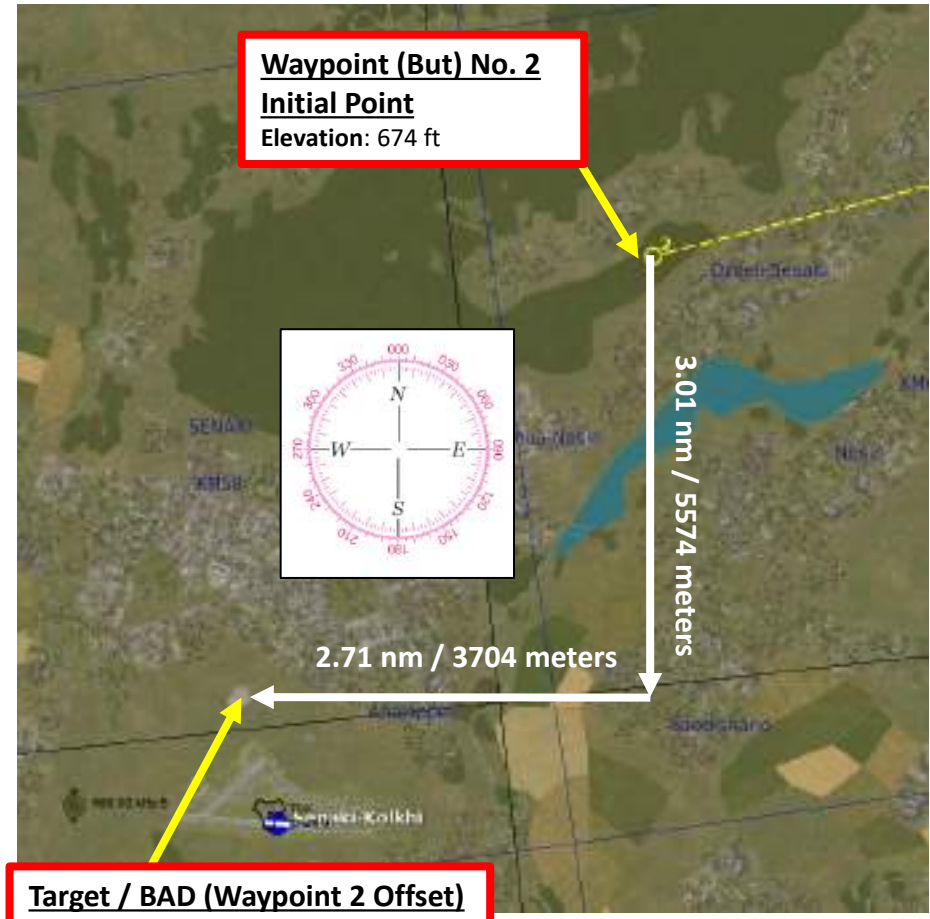


4.2 – WAYPOINT OFFSET (*BAD*) CREATION WITH ΔL/ΔG

In this tutorial, we already have two waypoints set the MIP (Module d'Insertion de Paramètres: Data Cartridge Insertion Module) via the mission editor. Make sure Waypoint 2 coordinates are already entered.

1. Note Longitude (North/South) and Latitude (East/West) offsets (**ΔL/ΔG**) in **meters** with the altitude offset Δ ALT (in ft).
   - **ΔL N/S Offset: 5574 meters South FROM Waypoint 2**
   - **ΔG E/W Offset: 3704 meters West FROM Waypoint 2**
   - **Altitude Offset: -634 ft**
2. Press "PREP" (Preparation) button to create a waypoint.
3. Press "0" and "2" (02) on the INS numpad to select Waypoint Number 2.
4. Set UNI Parameter Selector Switch to ΔL/ΔG
5. Press "+1" on numpad to select the North/South field (left)
6. Press "S" (8) on numpad to select SOUTH offset
7. Press **05574** on numpad to enter SOUTH offset of 5574 meters
8. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).





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ΔL/ΔG: 3.01 nm South / 2.71 nm West
= 5574 meters South / 3704 meters West

Δ ALT: - (WP2 Altitude – Target Altitude)
= - (674 ft – 40 ft) = -634 ft

4.2 – WAYPOINT OFFSET (*BAD*) CREATION WITH ΔL/ΔG

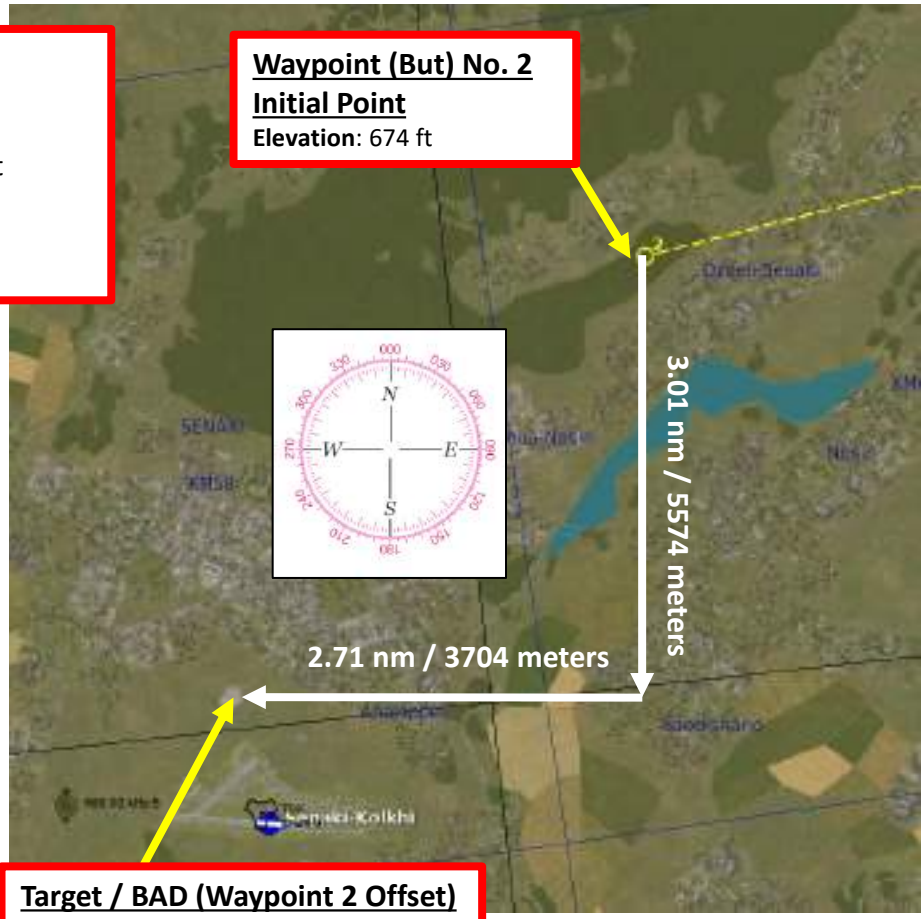
- **ΔL N/S Offset: 5574 meters South FROM Waypoint 2**
- **ΔG E/W Offset: 3704 meters West FROM Waypoint 2**
- **Altitude Offset: -634 ft**

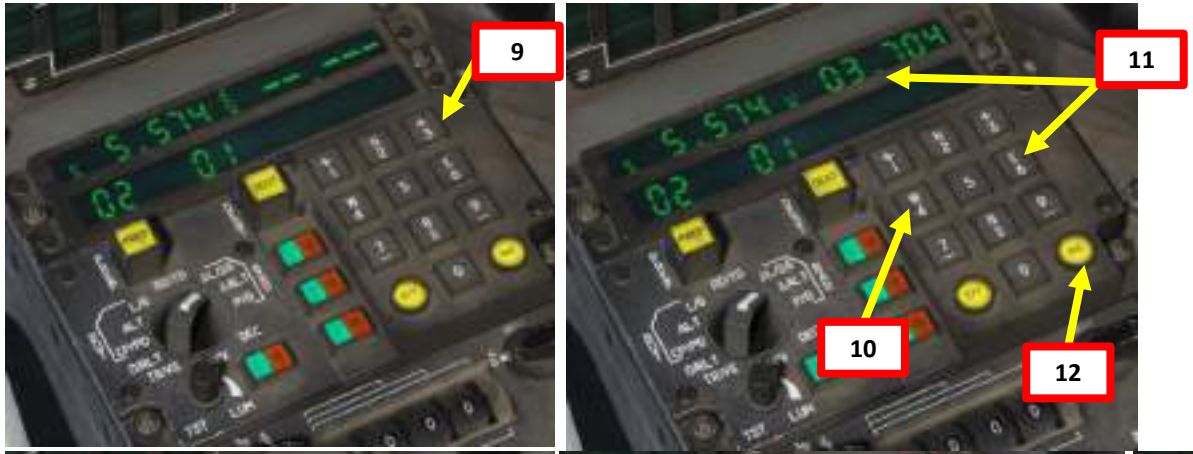
9. Press “+3” on numpad to select the East/West field (right)
10. Press “W" (4) on numpad to select WEST offset
11. Press **03704** on numpad to enter WEST offset of 3704 meters
12. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).
13. Set UNI Parameter Selector Switch to ΔALT
14. Press “+1” on numpad to select the FEET field (left). Right field is deserved for METERS.
15. Press “– " (7) on numpad to select NEGATIVE altitude offset
16. Press **00634** on numpad to enter ALTITUDE offset of -634 meters
17. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).

Target / BAD (Waypoint 2 Offset)

ΔL/ΔG: 3.01 nm South / 2.71 nm West
= 5574 meters South / 3704 meters West

Δ ALT: - (WP2 Altitude – Target Altitude)
= - (674 ft – 40 ft) = -634 ft

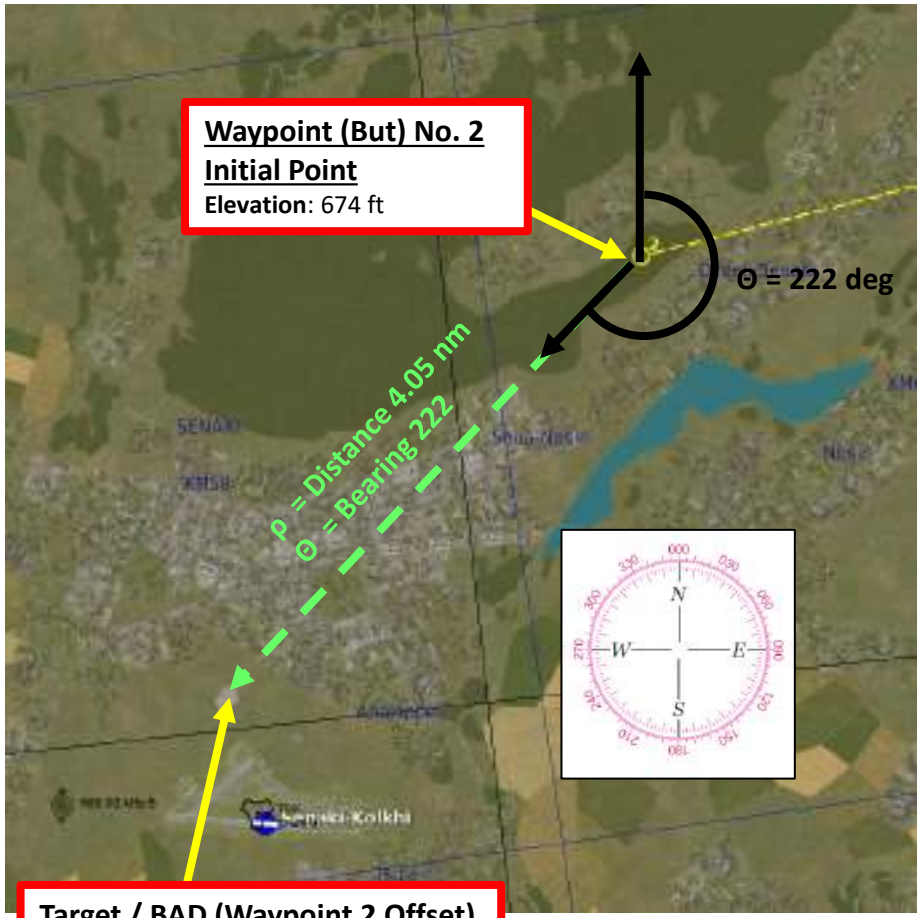




4.3 – WAYPOINT OFFSET (*BAD*) CREATION WITH ρ/θ

In this tutorial, we already have two waypoints set the MIP (Module d'Insertion de Paramètres: Data Cartridge Insertion Module) via the mission editor. Make sure Waypoint 2 coordinates are already entered.

1. Note Distance **(ρ in nautical miles)** and Bearing **(θ in degrees)** offsets**,** with the altitude offset Δ ALT (in ft).
   - **ρ Distance Offset: 4.05 nautical miles FROM Waypoint 2**
   - **θ Bearing Offset: 222 degrees FROM Waypoint 2**
   - **Altitude Offset: -634 ft**
2. Press "PREP" (Preparation) button to create a waypoint.
3. Press "0" and "2" (02) on the INS numpad to select Waypoint Number 2.
4. Set UNI Parameter Selector Switch to ρ/θ
5. Press "+1" on numpad to select the ρ distance field (left)
6. Press **0405** on numpad to enter ρ distance offset of 4.05 nautical miles
7. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).



Target / BAD (Waypoint 2 Offset)

ρ/θ: Distance 4.05 nm / Bearing 222 deg

Δ ALT: WP2 Altitude – Target Altitude
= 674 ft – 40 ft = 634 ft

4.3 – WAYPOINT OFFSET (*BAD*) CREATION WITH ρ/θ

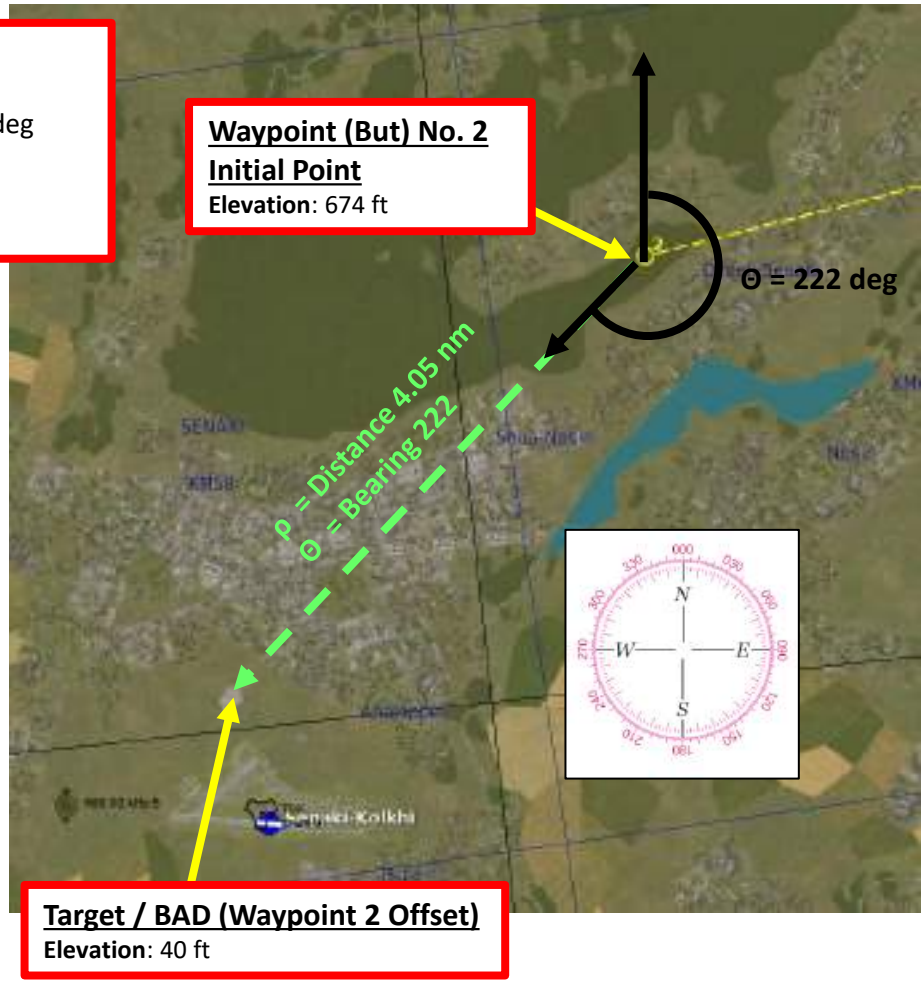
- **ρ Distance Offset: 4.05 nautical miles FROM Waypoint 2**
- **θ Bearing Offset: 222 degrees FROM Waypoint 2**
- **Altitude Offset: -634 ft**

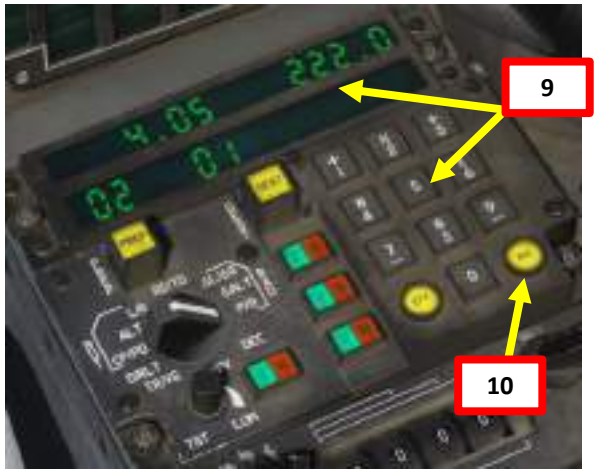
8. Press "+3" on numpad to select the θ bearing field (right)
9. Press **2220** on numpad to enter θ bearing offset of 222.0 degrees
10. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).
11. Set UNI Parameter Selector Switch to ΔALT
12. Press "+1" on numpad to select the FEET field (left). Right field is deserved for METERS.
13. Press "– " (7) on numpad to select NEGATIVE altitude offset
14. Press **00634** on numpad to enter ALTITUDE offset of -634 meters
15. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).

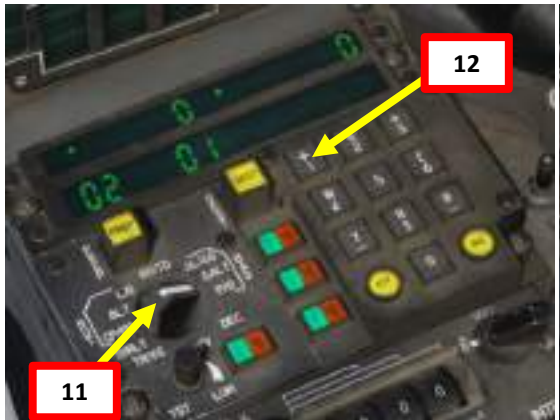
Target / BAD (Waypoint 2 Offset)

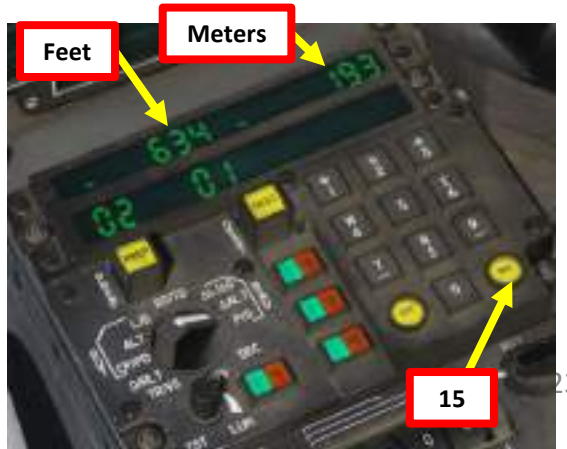
ρ/θ: Distance 4.05 nm / Bearing 222 deg

Δ ALT: WP2 Altitude – Target Altitude
= 674 ft – 40 ft = 634 ft





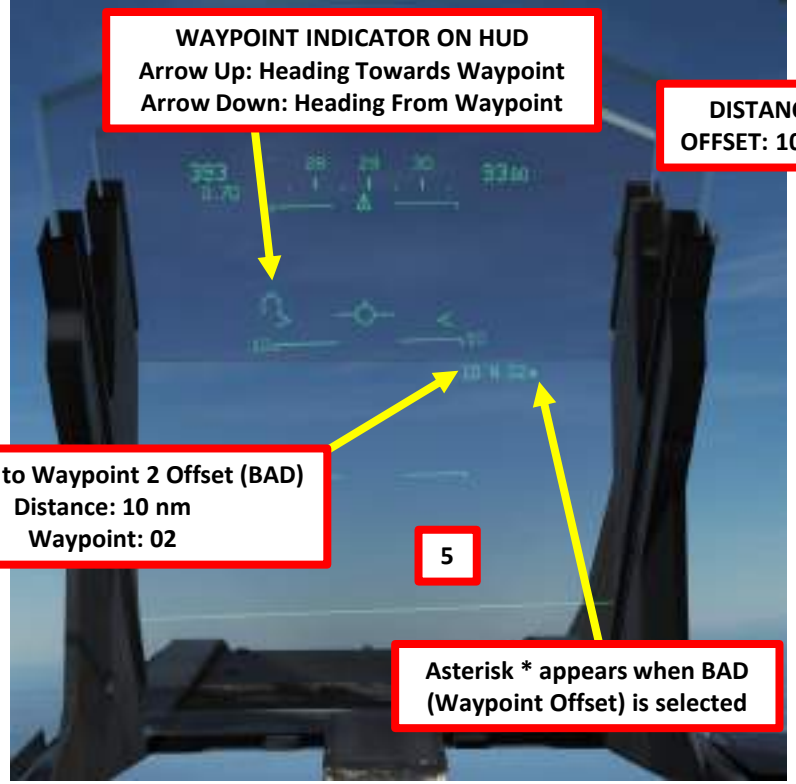


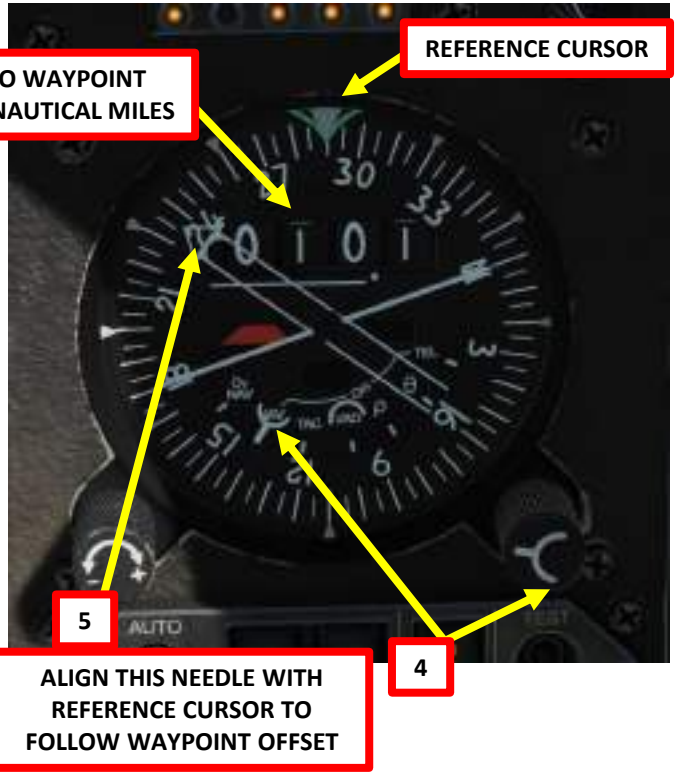


4.4 – WAYPOINT OFFSET (*BAD*) NAVIGATION TUTORIAL

Once Waypoint Offset is created, you can navigate

1. Press “DEST” (Destination) button .
2. Press “0” and “2” (02) on the INS numpad to select Waypoint Number 2 (Reference Waypoint).
3. Press the BAD button. Button will illuminate once selected.
4. Set the HSI (Horizontal Situation Indication) mode to either “CV” (*Cap Vrai*: True Heading) or “CM” (*Cap Magnétique: Magnetic Heading*)
5. Follow the HSI main needle to your waypoint.





5.1 – MARKPOINTS (*MARQUEURS*)
HOW TO ADD MARKPOINTS

Markpoints (*Marqueurs*) are used to "mark" a point of interest, whether flying over an interesting area or an enemy sighting. They can be selected just like regular Waypoints.

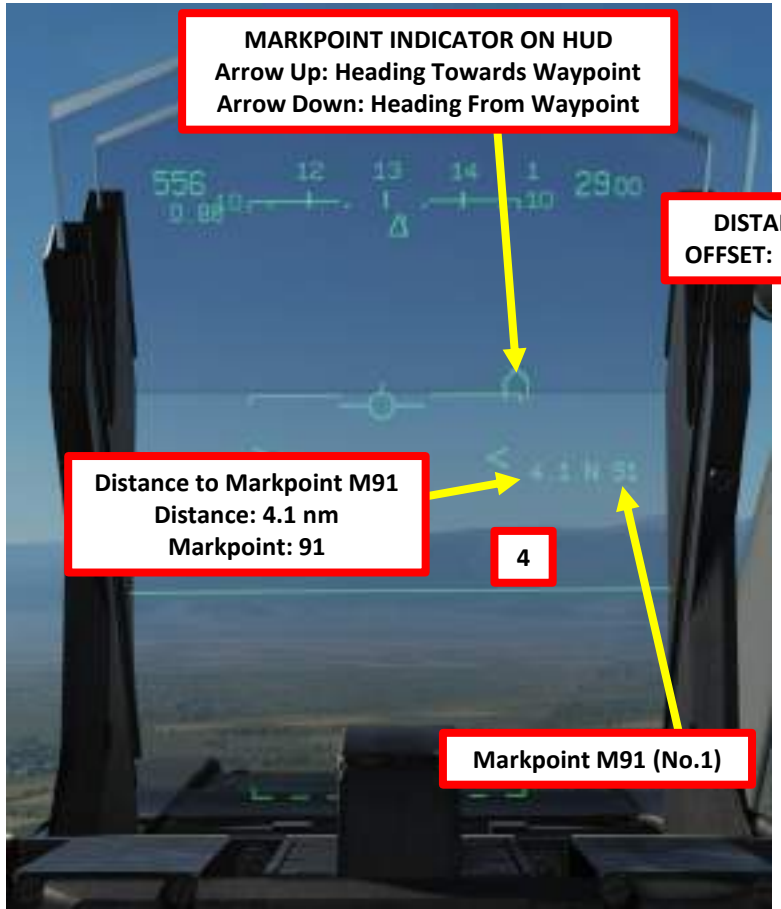
You can add a maximum of three markpoints, numbered 91, 92 and 93. Markpoints coordinates cannot be modified or deleted: choose wisely!

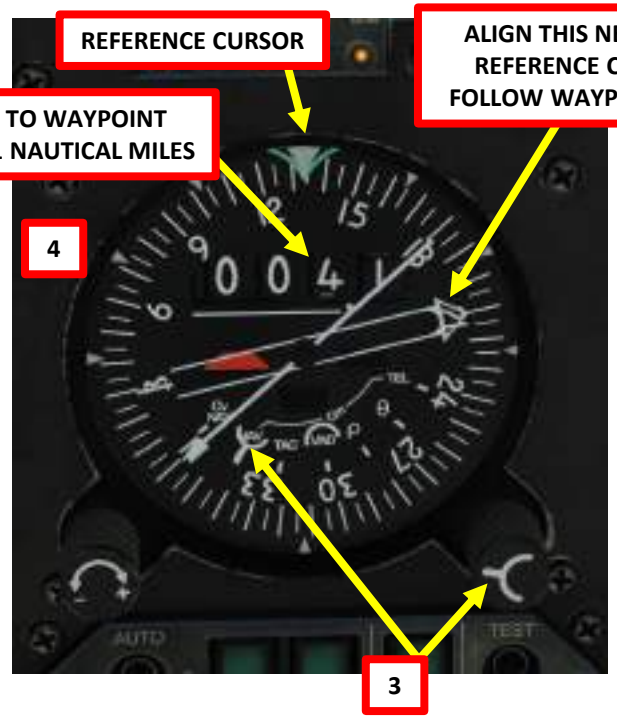
1. As you overfly a point of interest, press the MRQ button to temporarily save the current aircraft coordinates. Both the MRQ and VAL buttons will then illuminate.
2. Press the VAL button to validate the coordinates saved at the moment of the MRQ button press.
3. A new Markpoint will then be created. If no markpoints are created, the “M91” light will then illuminate to tell you that Markpoint No. 91 is now saved in the Inertial Navigation System.
4. Keep in mind that each markpoint you create cannot be deleted or edited. Your second markpoint will be labeled “M92” and your third markpoint will be labeled “M93”.

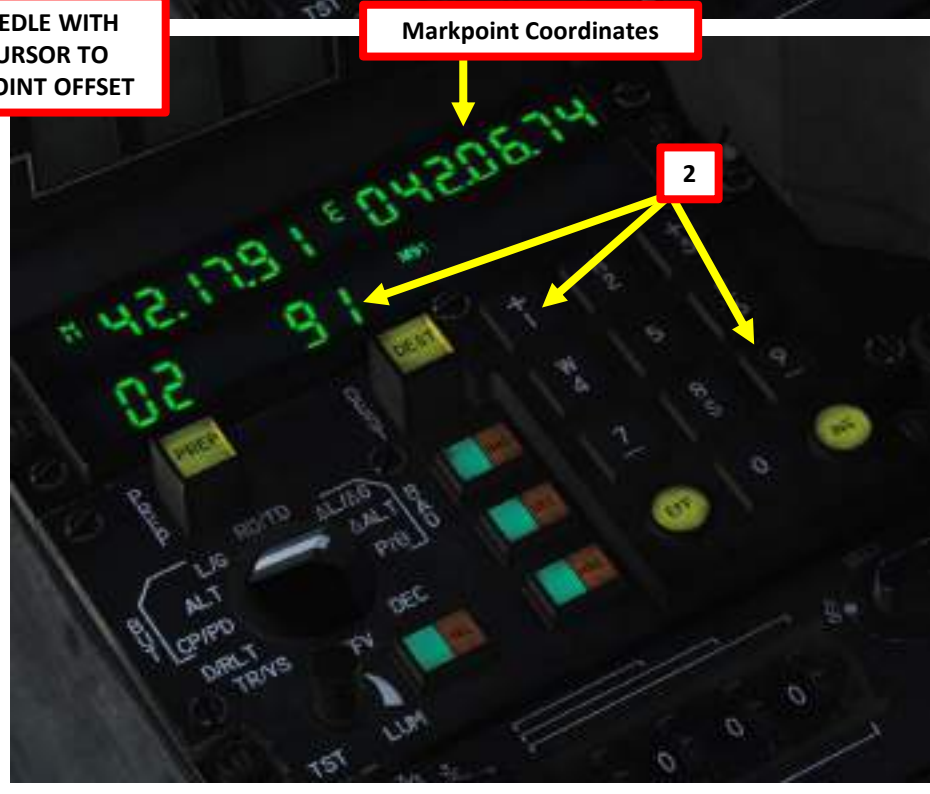
5.2 – MARKPOINTS (*MARQUEURS*)
MARKPOINT NAVIGATION TUTORIAL

You can use markpoints just like regular waypoints.

1. Press “DEST” (Destination) button .
2. To select Markpoint “M91” (Markpoint 1) press “9” and “1” (91) on the INS numpad to select Markpoint Number M91.
3. Set the HSI (Horizontal Situation Indication) mode to either “CV” (*Cap Vrai*: True Heading) or “CM” (*Cap Magnétique: Magnetic Heading*)
4. Follow the HSI main needle to your waypoint.

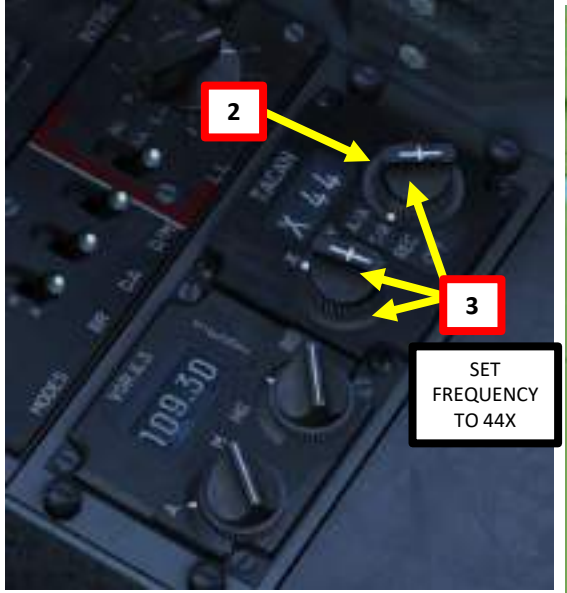


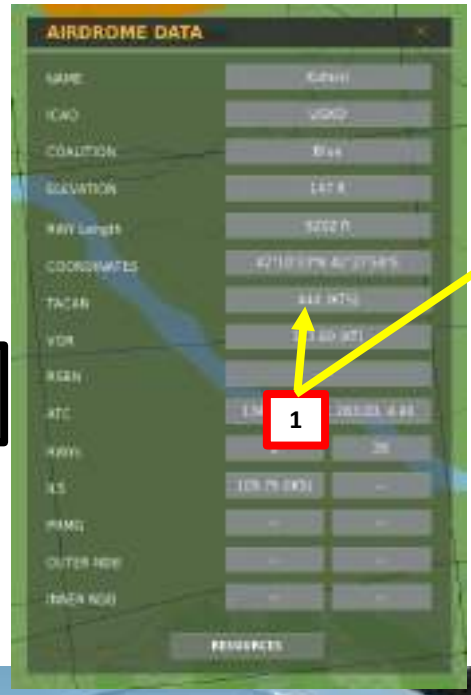




6.1 – TACAN NAVIGATION TUTORIAL

1. Press F10 to display the map, find the TACAN beacon that you want to track and note its frequency. In our case, we will track Kutaisi Airport's TACAN beacon. Its frequency is **44X**.
2. Set TACAN knob to **T/R** (Transmit-Receive)
3. Set TACAN frequency to 44X.
4. Set the HSI (Horizontal Situation Indication) mode to "TAC" (TACAN).
5. Follow HSI needle to the TACAN beacon. Both bearing and range information are available.

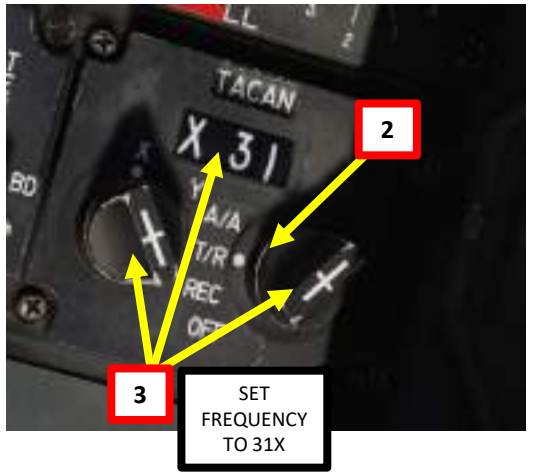


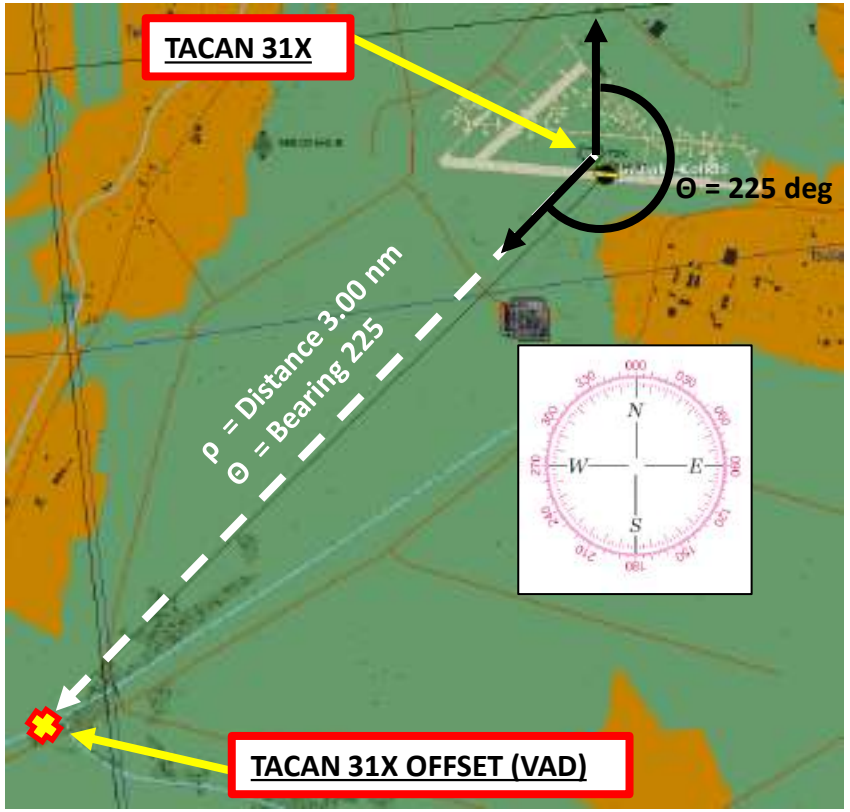


6.2 – TACAN OFFSET (VAD) TUTORIAL

The IDN (Indicateur de Navigation, or Horizontal Situation Indicator (HSI)) has a special navigation mode called VAD (*Vecteur Additionnel* / Additional Vector). The VAD is an offset point calculated from the position of the selected TACAN station.

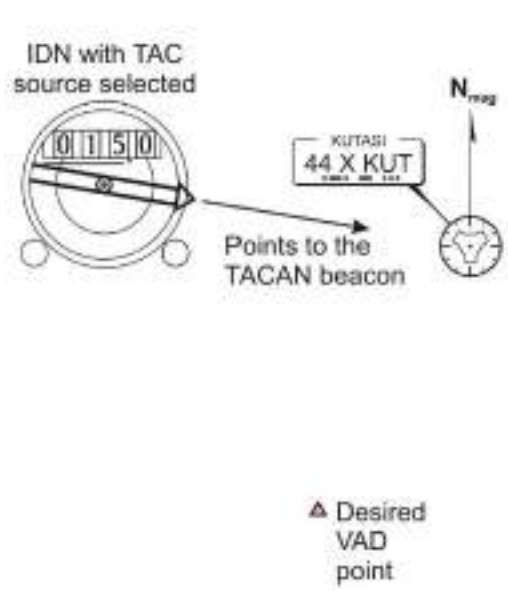
1. Press F10 to display the map, find the TACAN beacon that you want to track and note its frequency. In our case, we will track Kutaisi Airport's TACAN beacon. Its frequency is **31X**.
2. Set TACAN knob to **T/R** (Transmit-Receive)
3. Set TACAN frequency to 31X.
4. Set the HSI (Horizontal Situation Indication) mode to "TAC" (TACAN) and Check that it is receiving signal from the TACAN station (the DME and Needle 1 flags should not be shown)
5. Our desired TACAN offset VAD is:
   - **ρ Distance Offset: 3.00 nautical miles FROM TACAN 31X**
   - **θ Bearing Offset: 225 degrees FROM TACAN 31X**

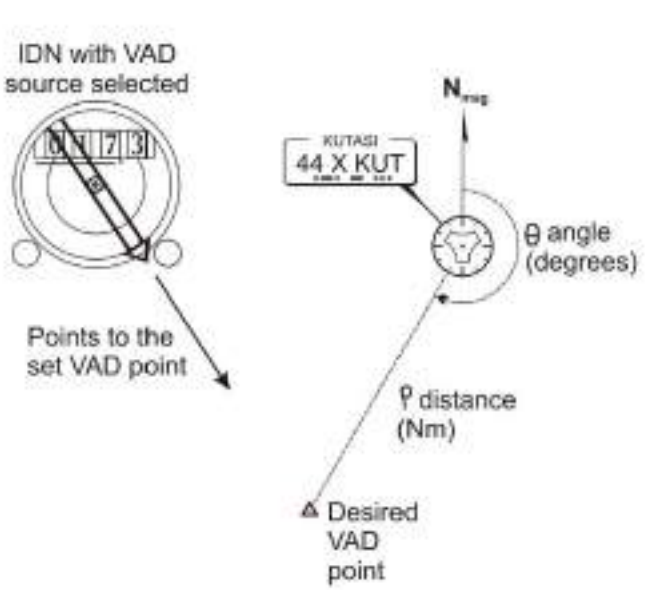


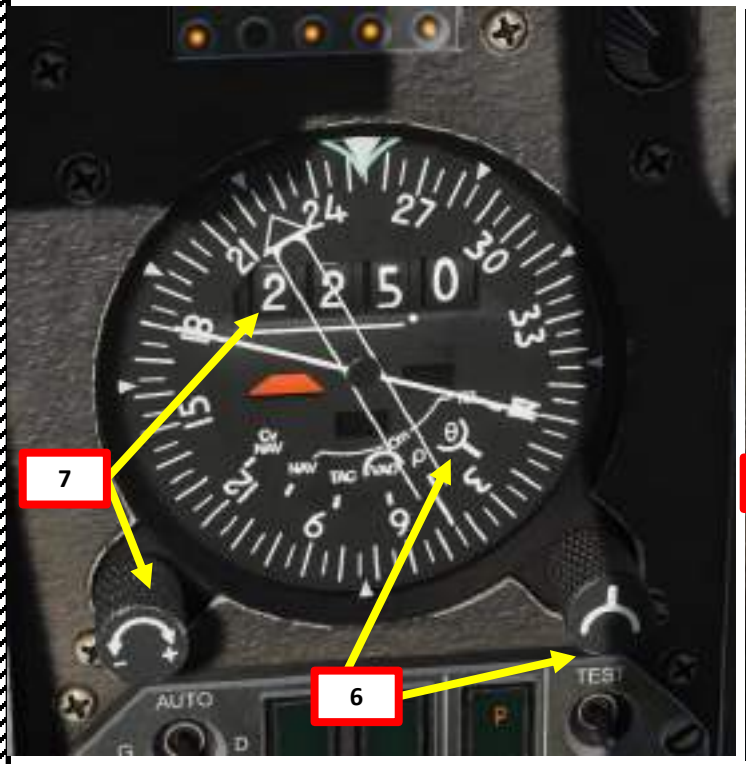


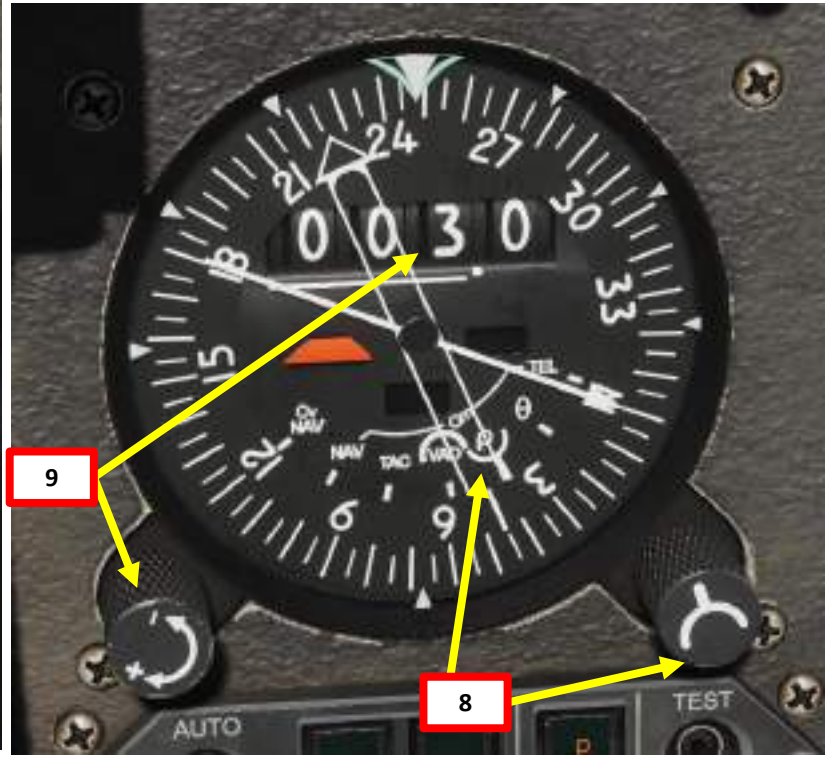
6.2 – TACAN OFFSET (VAD) TUTORIAL

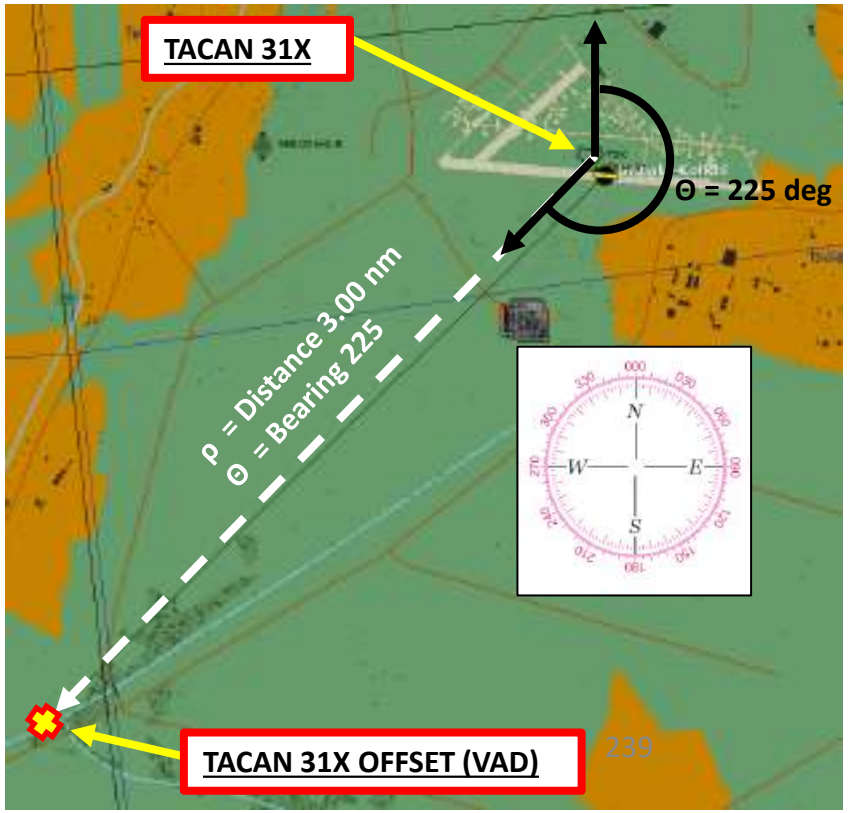
5. Our desired TACAN offset VAD is:
   - **ρ Distance Offset: 3.00 nautical miles FROM TACAN 31X**
   - **θ Bearing Offset: 225 degrees FROM TACAN 31X**
6. Set the HSI in θ (Theta) mode. We will enter offset bearing from TACAN (deg).
7. Enter the desired magnetic bearing (225) from the TACAN station to the VAD by rotating the VAD input knob
8. Set the HSI in ρ (Rho) mode. We will enter offset distance from TACAN (nm).
9. Enter the distance from the TACAN station (3.00 nm) to the VAD (offset point) by rotating the VAD input knob.





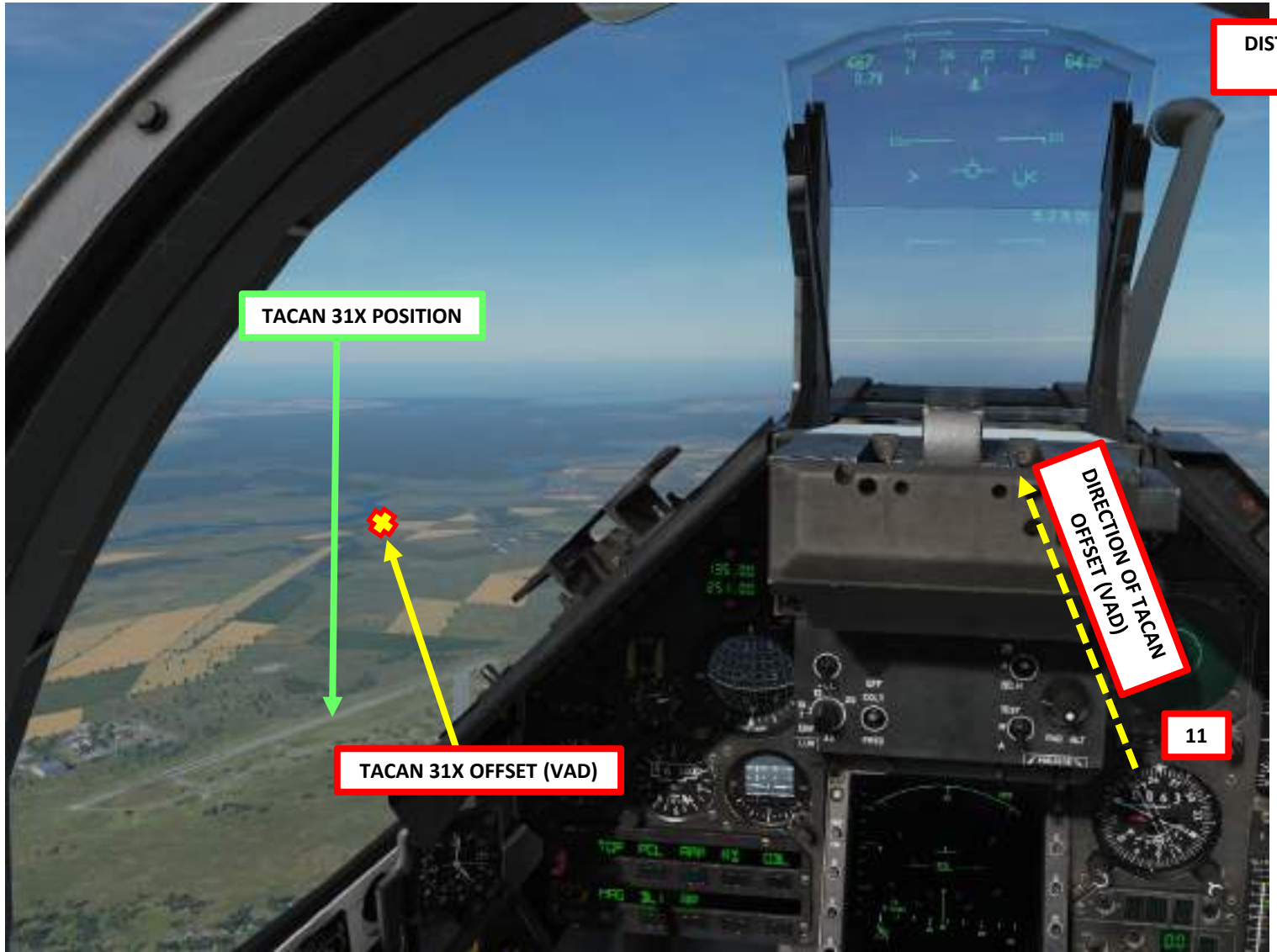


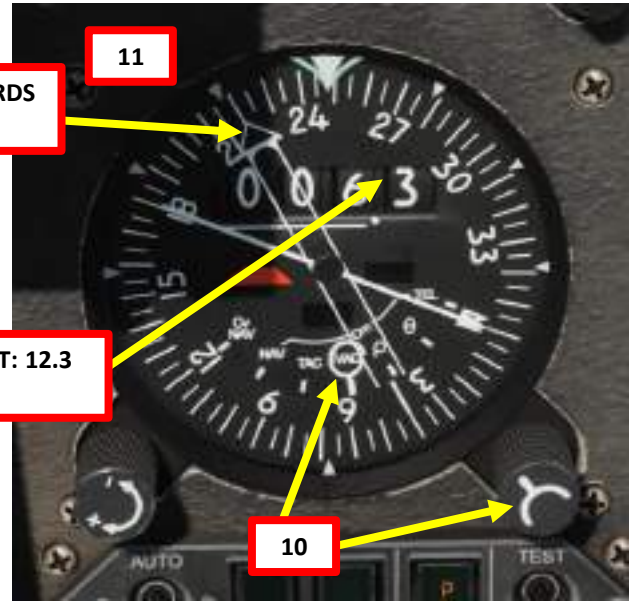


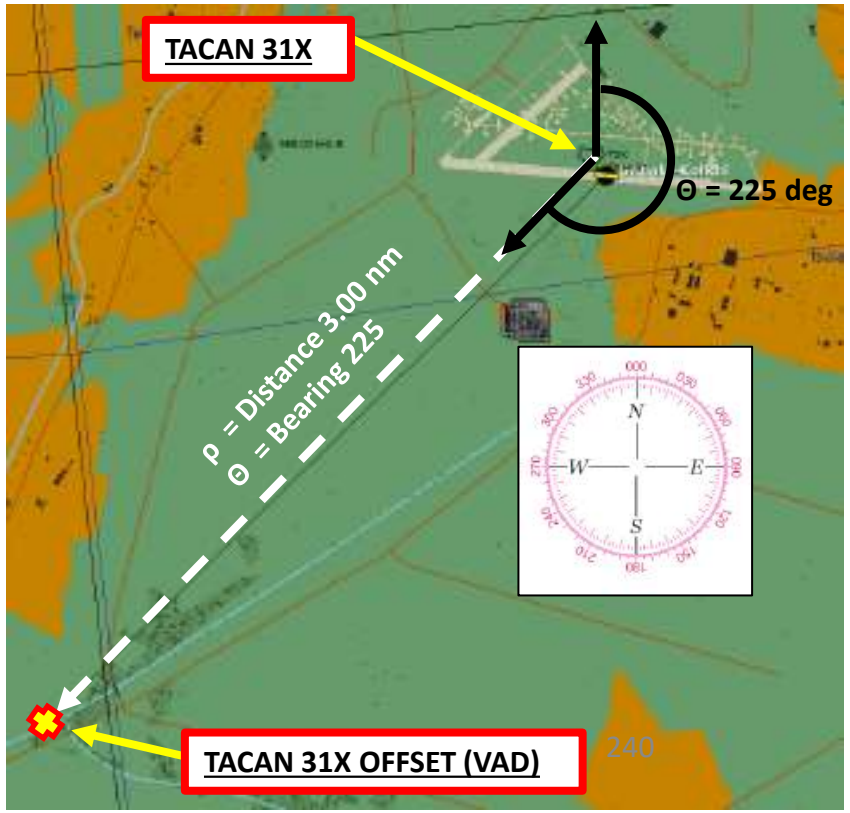


6.2 – TACAN OFFSET (VAD) TUTORIAL

10. Place the HSI in VAD mode. The system will calculate the geographical position of the offset point from the current aircraft position: The Needle 1 indicator will show the magnetic bearing to the Desired VAD point and the DME indicator will show the distance in nautical miles
11. Follow HSI needle to the TACAN beacon. Both bearing and range information are available.

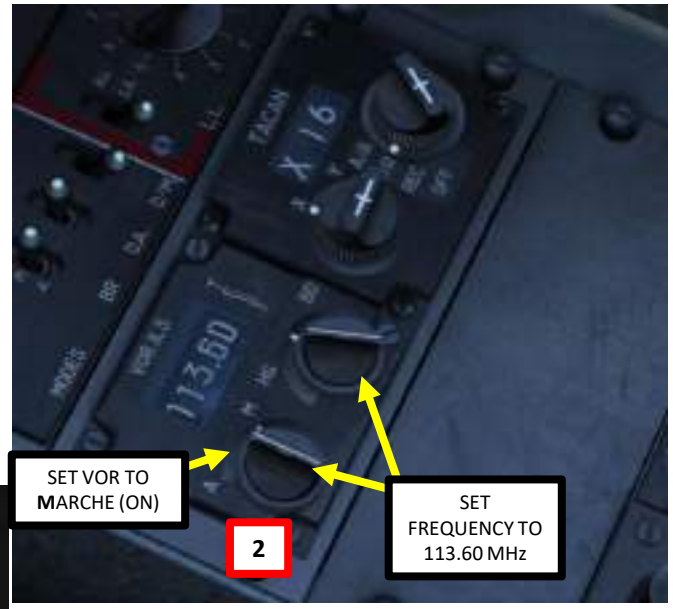


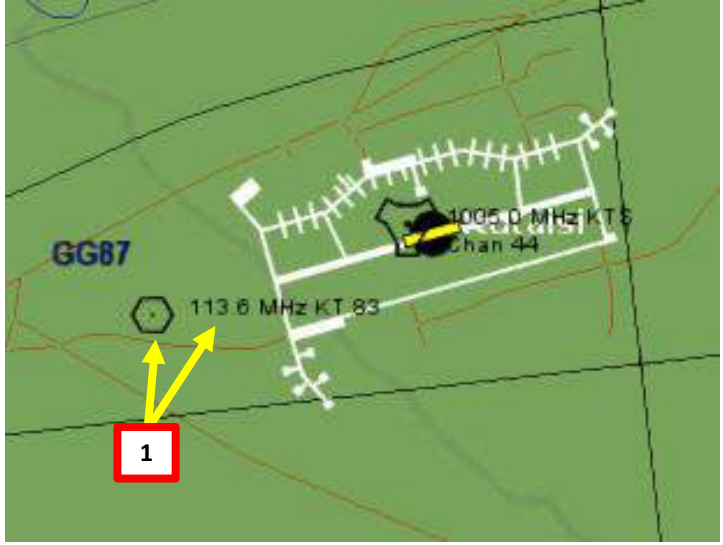




7 – VOR NAVIGATION TUTORIAL

1. Press F10 to display the map, find the VOR beacon that you want to track and note its frequency. In our case, we will track a VOR beacon near Kutaisi. Its frequency is **113.60 MHz**.
2. Set VOR/ILS to **M**ARCHE (ON) using left mouse button and set VOR frequency to 113.60.
3. Set the HSI (Horizontal Situation Indication) mode to either “Cv NAV” (True Heading) or “Cm NAV” (Magnetic Heading).
4. Follow the HSI thin needle to your VOR beacon. Bearing information is available, but no range information.



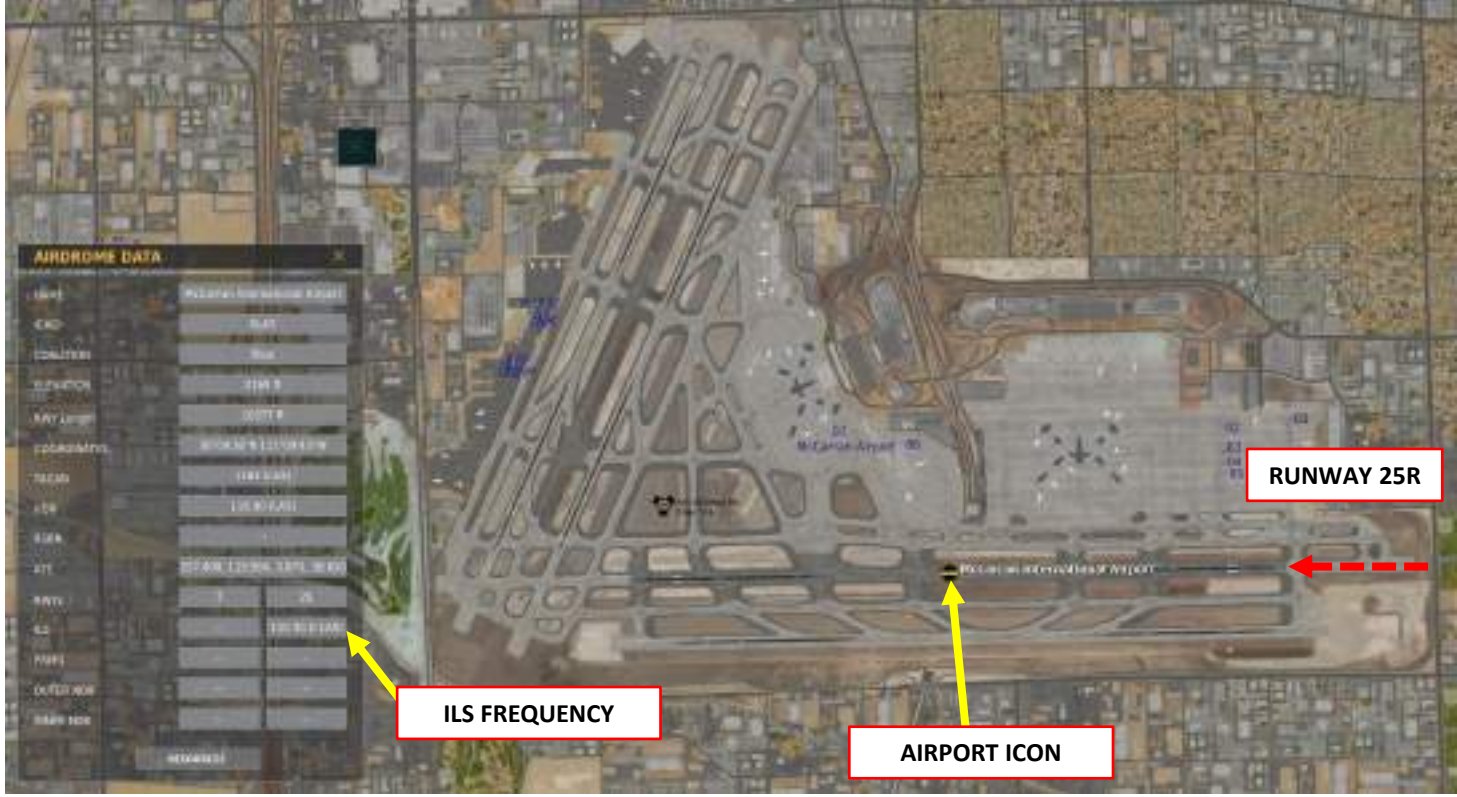


8 – ILS LANDING WITH SYNTHETIC RUNWAY

The ILS (Instrument Landing System) approach in the Mirage is pretty standard. In this short demo, we will be landing at McCarran International Airport.

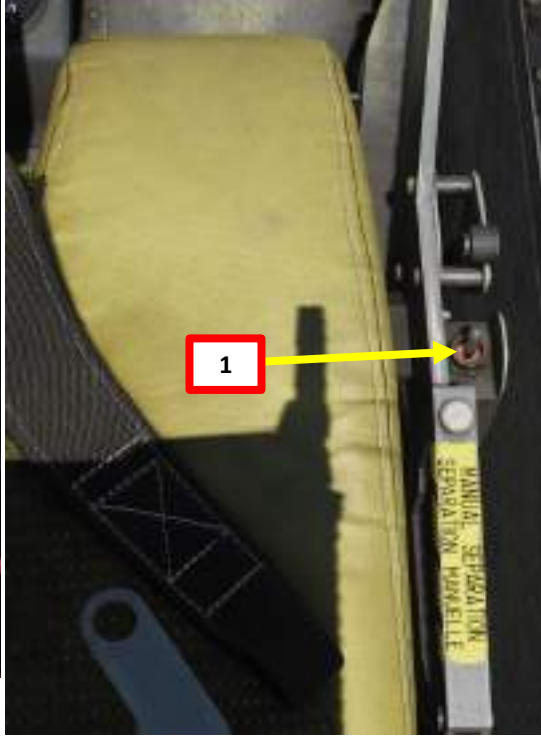
By pressing F10 and clicking on the airport icon, we can find the ILS beacon frequency. In our case, we will use an ILS frequency of **110.30** for runway 25R. We will approach from the east with a heading of 250.

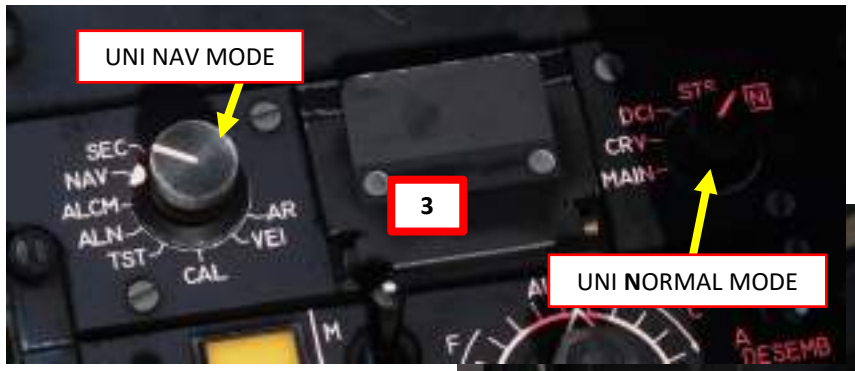
We will also use the Synthetic Runway system (which draws a runway on our HUD). A peculiarity of this system is that our HUD will use a LANDING waypoint as a reference. Therefore, a waypoint of LANDING type must be set in the mission editor on McCarran airport for us to be able to use the Synthetic Runway functionality.

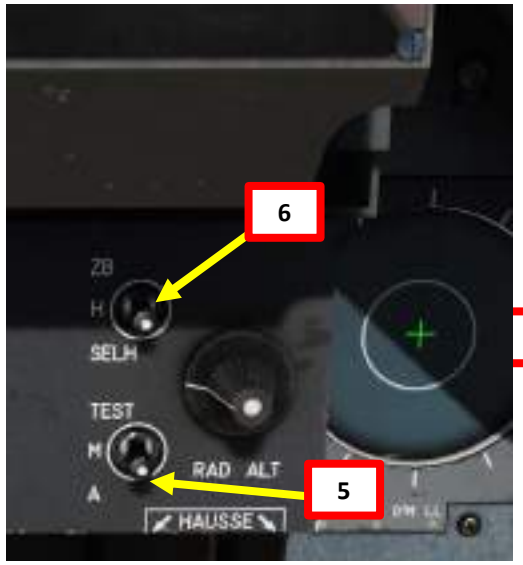


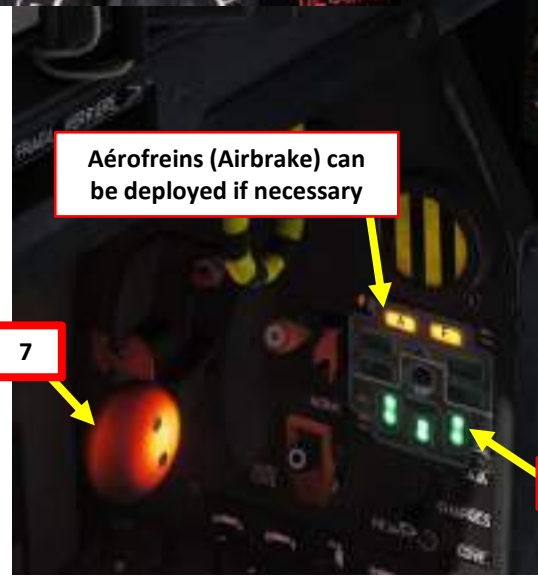
8 – ILS LANDING WITH SYNTHETIC RUNWAY

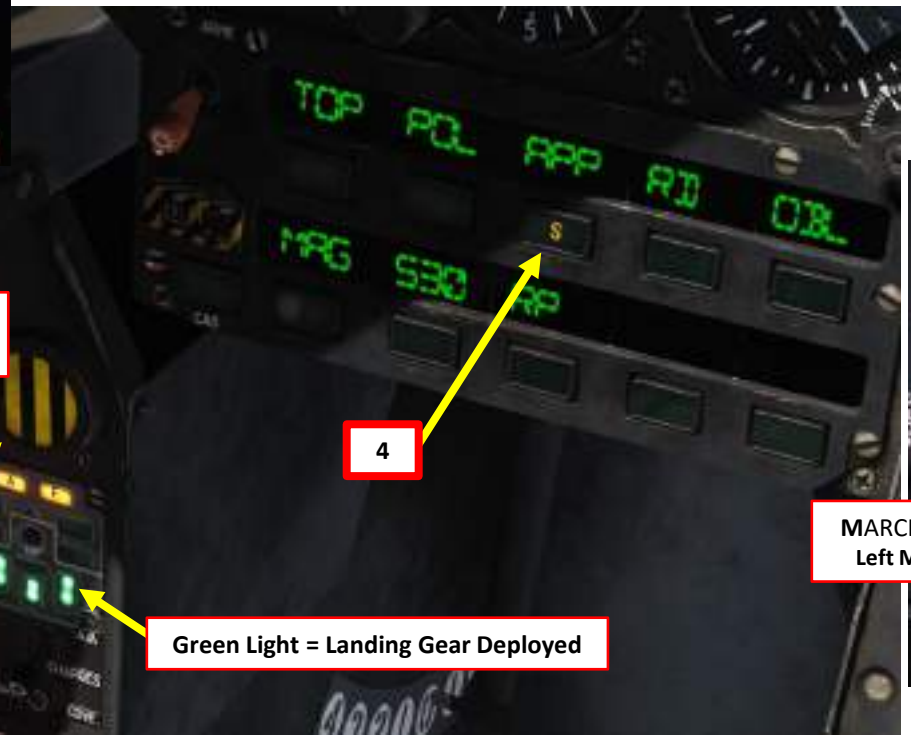
1. Adjust seat height
2. Set VOR/ILS to **M**ARCHE (ON) using left mouse button and set ILS frequency to 110.30.
3. Ensure UNI/INS Mode is set to “NAV” and “**N**ORMAL”, and that you are following the right waypoint (track WAYPOINT 1 by pressing “DEST” button on PCN and pressing “01” on the keypad as shown in the previous INS tutorials).
4. Select APPROACH mode on PCA (yellow “S” caution when engaged)
5. Set Radar Altimeter Power Switch to M (Marche/ON).
6. Set VTH Mode Switch to H (Height/Radar Altimeter)
7. Deploy landing gear below 230 kts

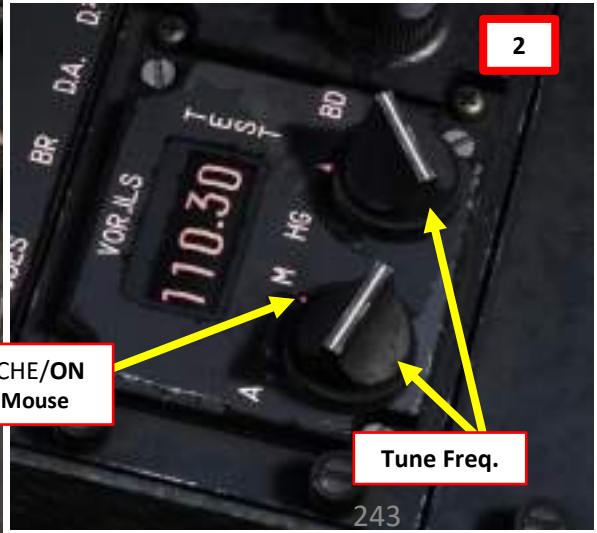






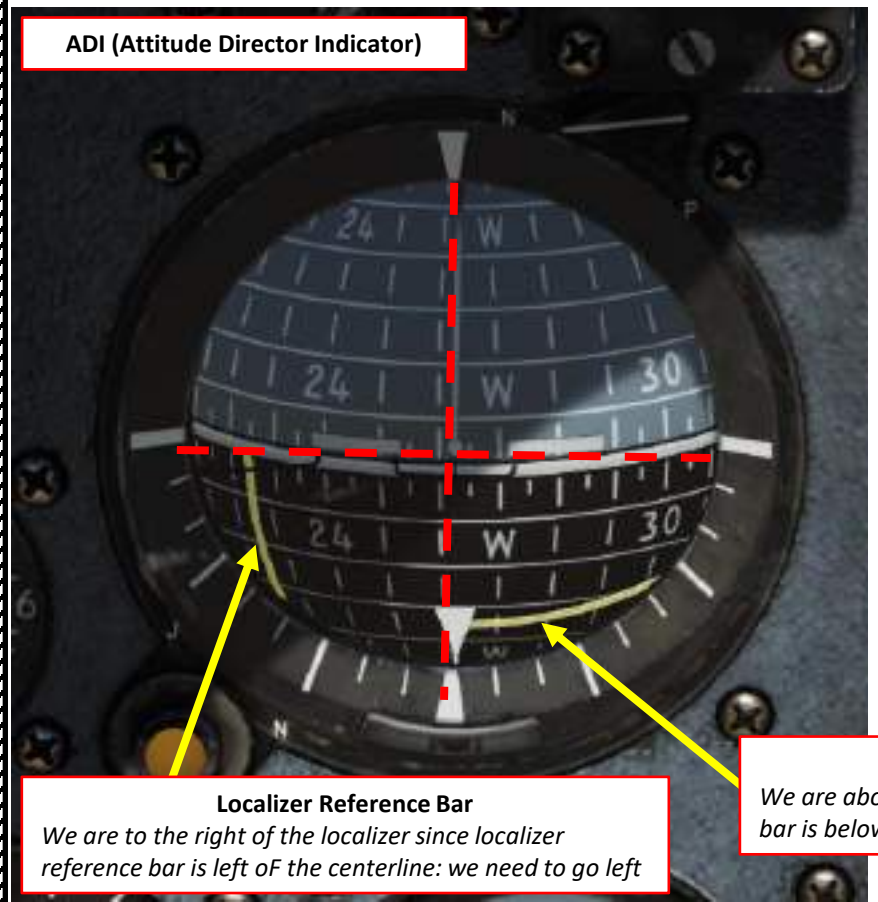


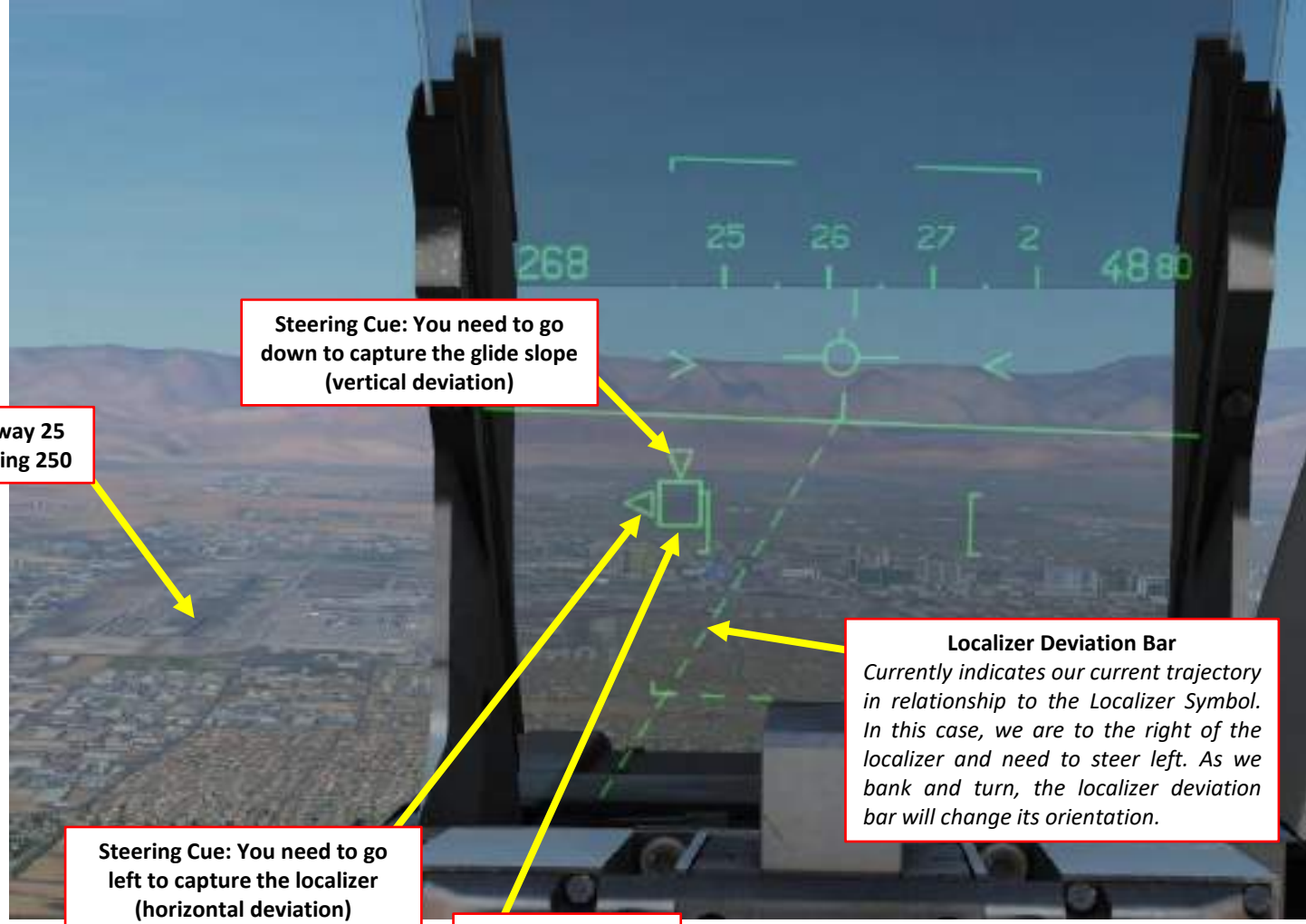




8 – ILS LANDING WITH SYNTHETIC RUNWAY

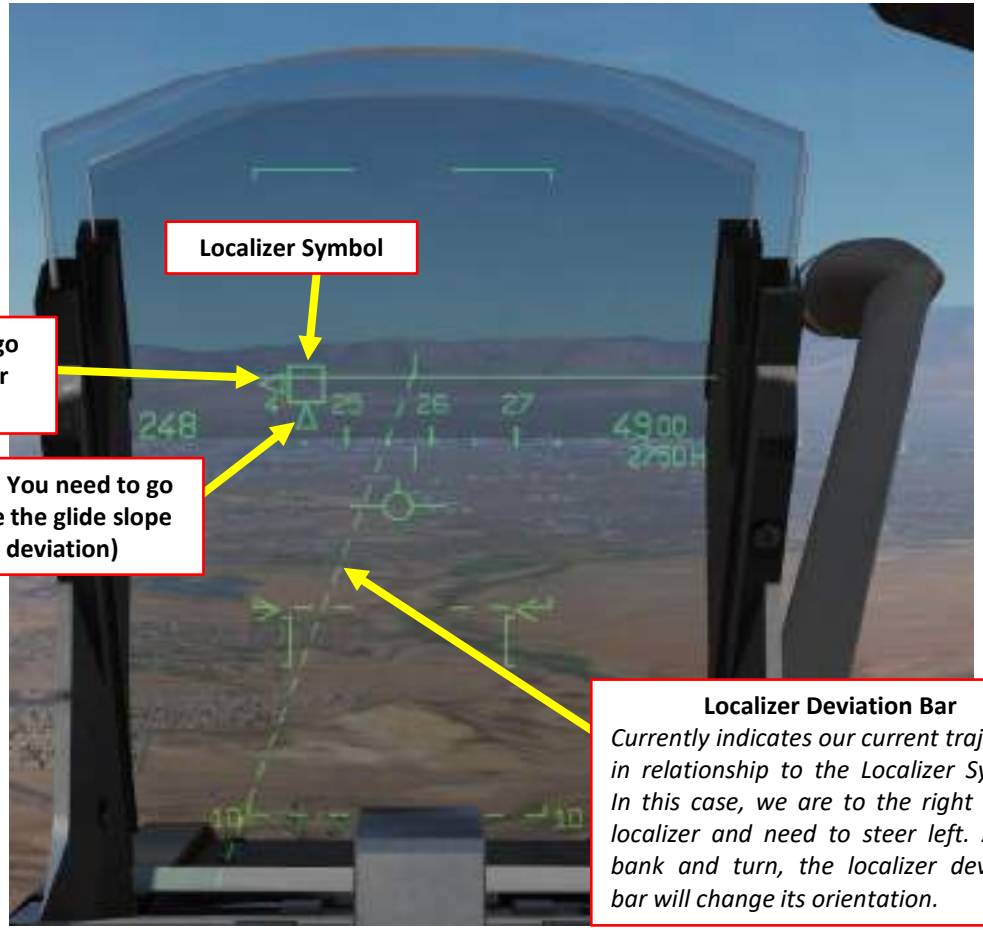
8. This picture displays the logic behind the HUD ILS symbology and the ADI localizer and glide slope deviation bars. Take note that the ILS HUD indications (as modelled) represent a **raw ILS error indication**, not a flight director - so if you don't anticipate it's motion, you'll over shoot the localizer/glide slope.

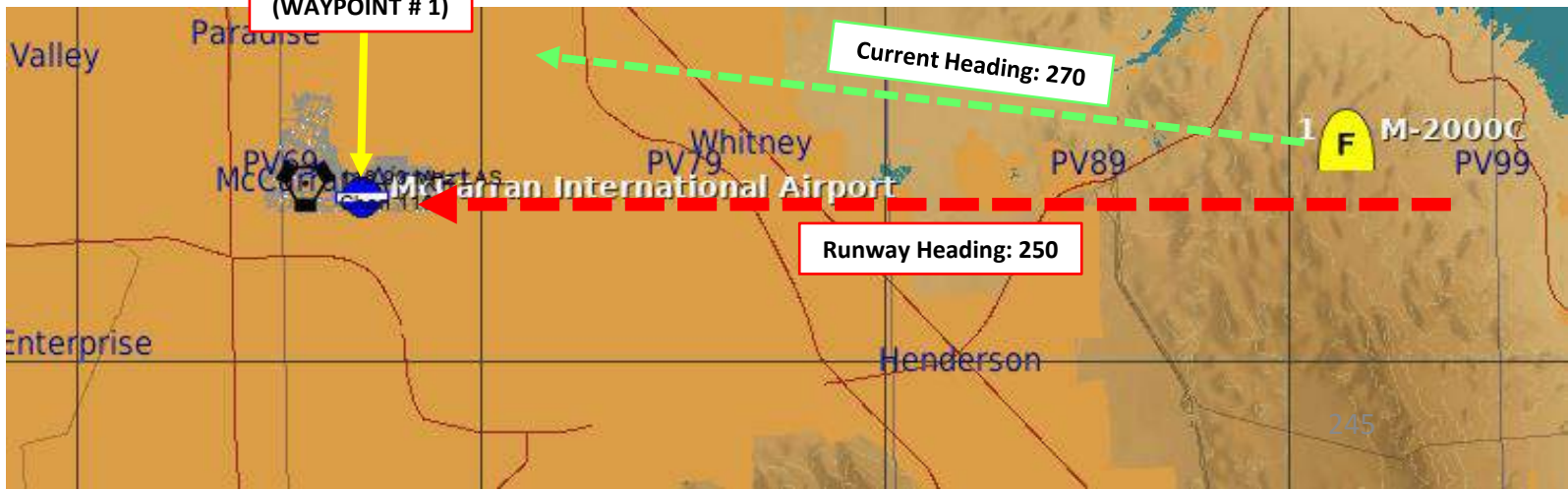




8 – ILS LANDING WITH SYNTHETIC RUNWAY

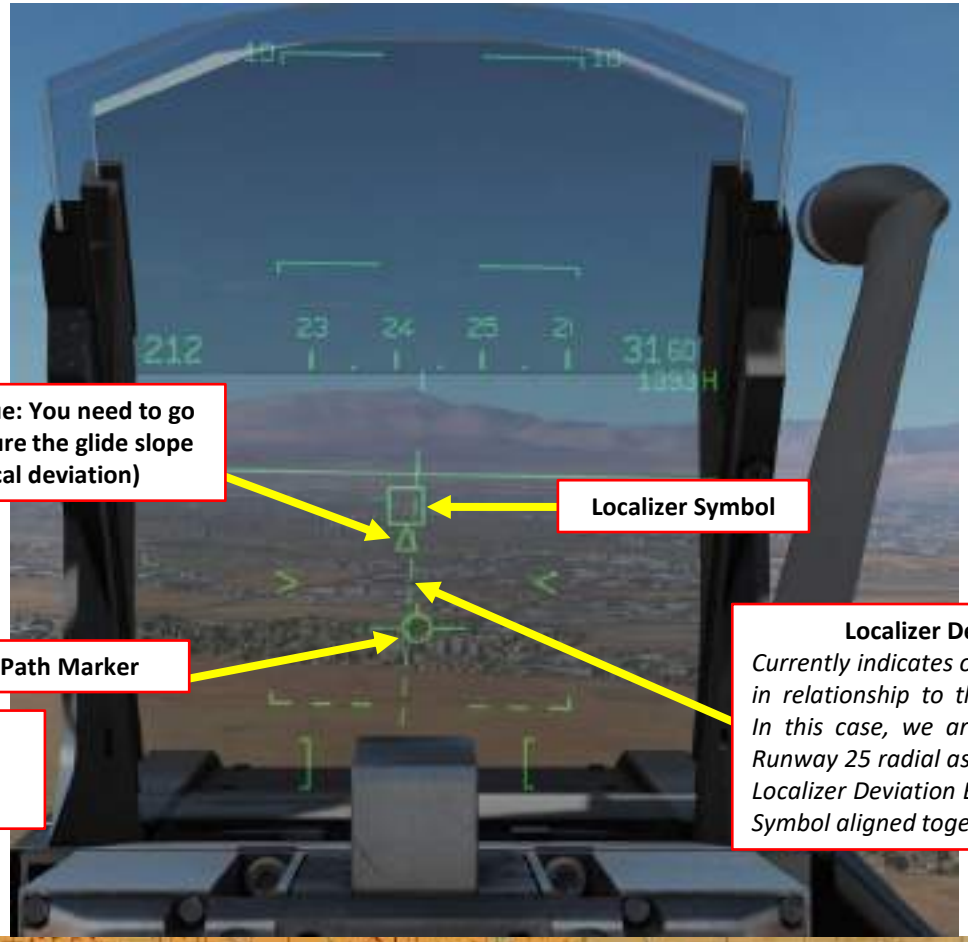
9. Once Approach Mode is selected on the PCA and correct ILS frequency is entered, we will first steer the aircraft to capture the localizer. This can be done by
   - Monitoring the Localizer Reference Bar on the ADI and
   - Monitoring the position of the Localizer Deviation Bar in relationship with the Localizer Symbol on the HUD.
   - Monitoring the steering cues on the localizer symbol
10. In our case, the Localizer Reference Bar on the ADI tells us to steer left. The HUD Localizer Deviation Bar is to the right of the Localizer Symbol, which also means that we need to steer left to intercept the radial to Runway 25.

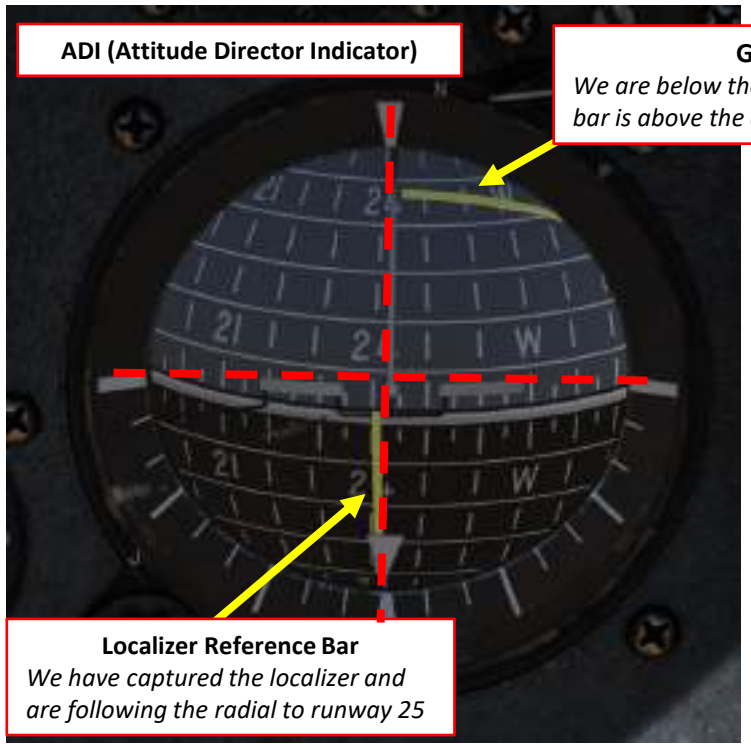


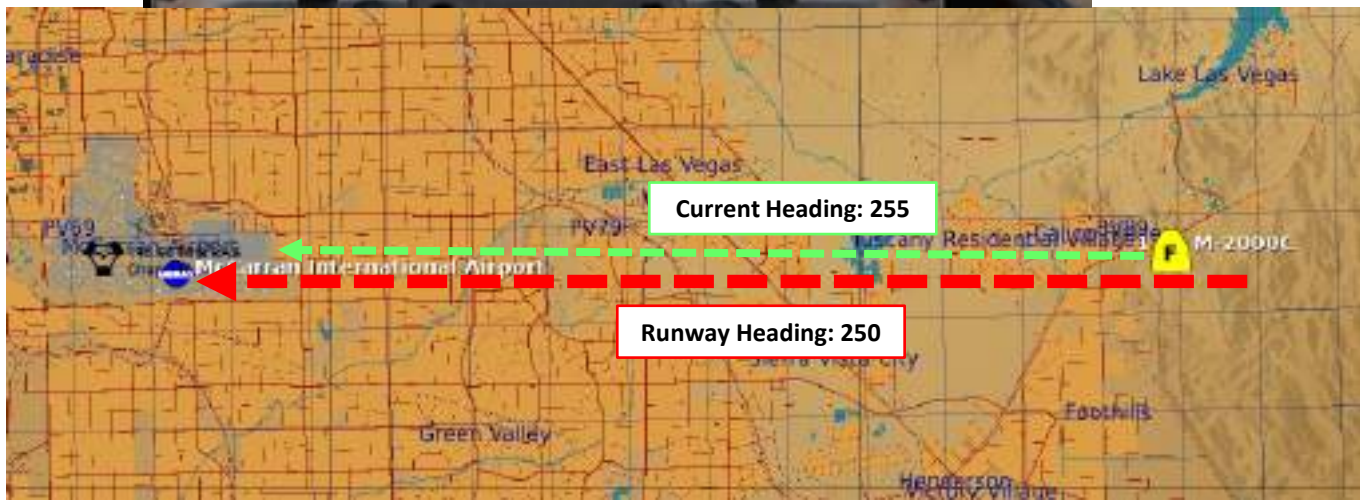


8 – ILS LANDING WITH SYNTHETIC RUNWAY

11. Once the localizer is captured and you are following the radial, the Localizer Deviation Bar and Localizer Symbol should be lined up on the HUD. The Localizer Reference Bar on the ADI should also be centered.
12. Use stick to adjust aircraft's vertical trajectory to align the Glide Slope Reference Bar on the ADI with the centerline. You should gradually start seeing the Flight Path Marker moving to the center of the Localizer Symbol on the HUD.

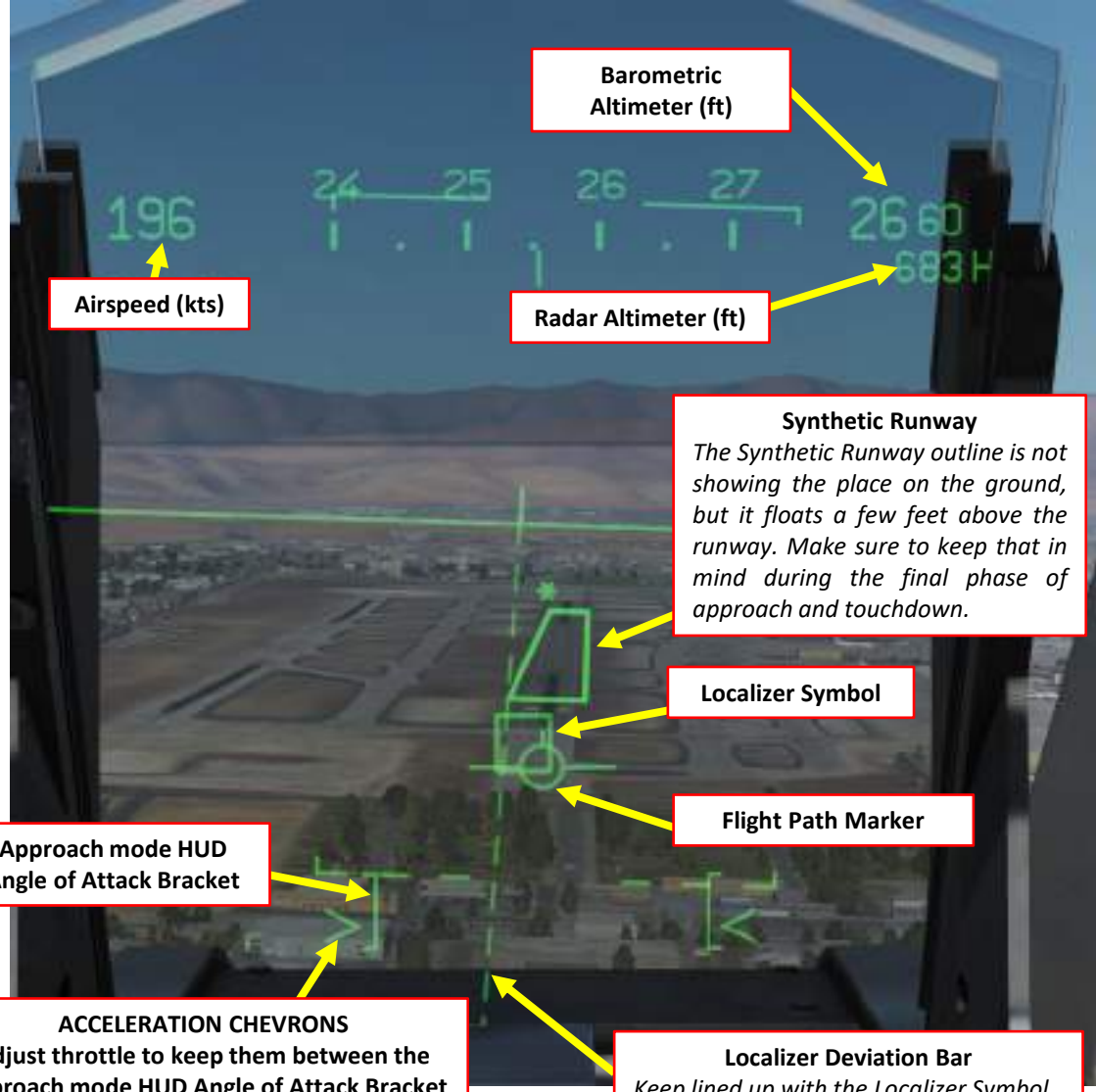


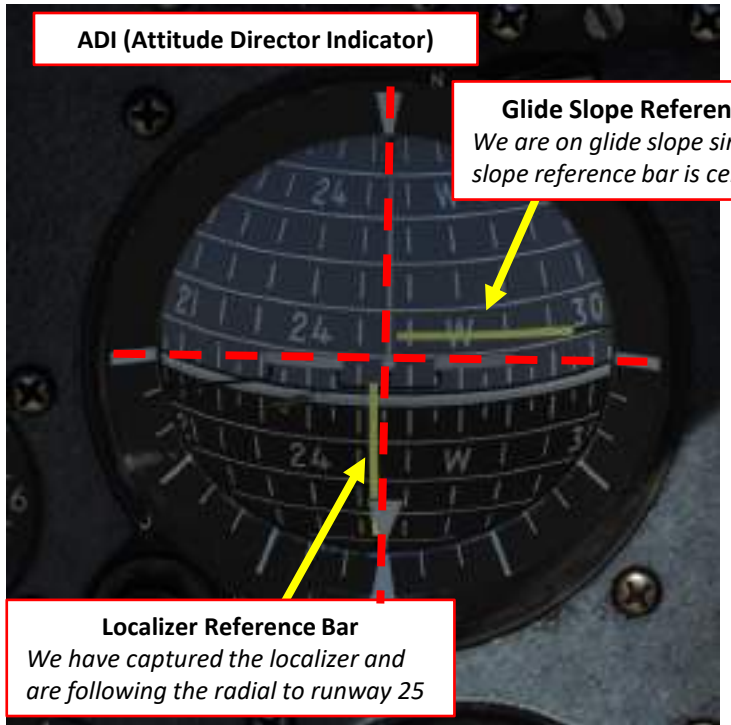




8 – ILS LANDING WITH SYNTHETIC RUNWAY

13. OPTIONAL: Once Localizer and Glide Slope are captured, you can press the Autopilot Master Control Switch, then press on the Autopilot ILS Localizer & Glideslope (L/G) Switch. If the aircraft is within 3 degrees of localizer deviation, the autopilot will then try to keep the aircraft on glide slope and on the localizer. Green means ON, yellow means STANDBY.
14. Adjust throttle to maintain an Angle of Attack between 12 and 14 deg. Keep the acceleration chevrons in the middle of the Approach mode HUD Angle of Attack Bracket.
15. The Synthetic Runway will appear on the HUD if:
    - The INS (Inertial Navigation System) is ON
    - The airport is the current fly-to waypoint
    - Both localizer and glide slope have been captured
    - Runway is less than 10 nm away
    - Lateral deviation is less than 7 deg



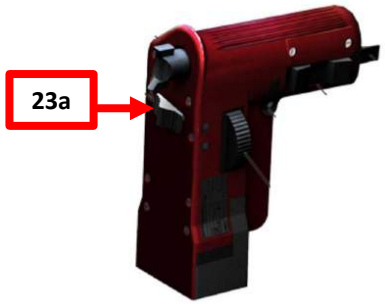


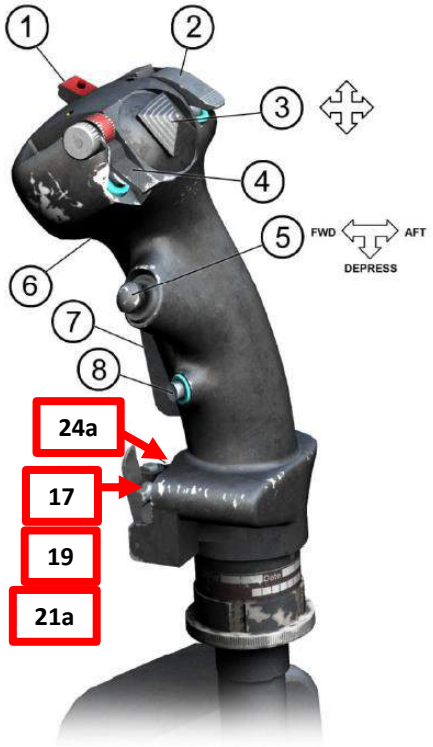
Note: when the L/G autopilot mode is engaged, the fly-by-wire system will try to keep the aircraft on glide slope by changing the aircraft's angle of attack. However, this change in angle of attack will cause the aircraft to slow down; you will need to make sure that the engine power setting is high enough for the aircraft to maintain an acceptable angle of attack (higher thrust will force the fly-by-wire system to decrease the angle of attack, therefore increasing airspeed in the process).

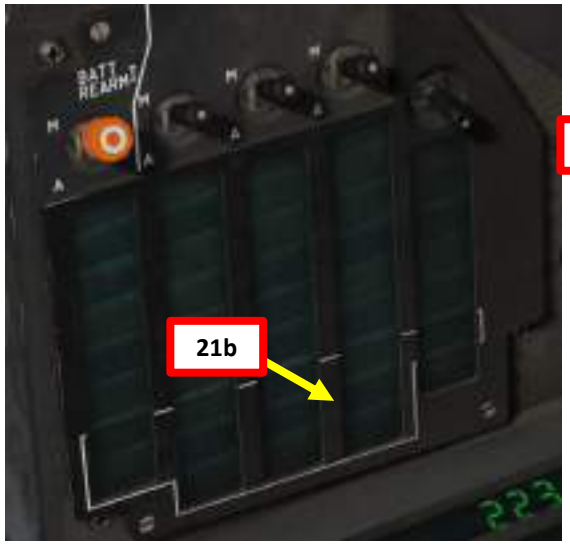
The TLDR version of this is: always keep your hand on the throttle to keep your AoA in check.

8 – ILS LANDING WITH SYNTHETIC RUNWAY

16. When in final approach, you should have your acceleration chevrons between the Approach mode HUD Angle of Attack Bracket and the Flight Path Marker centered in the Localizer Symbol square.
17. When the radar altimeter displays 200 ft AGL, press the Autopilot Standby Mode (AP Disconnect) switch on the stick to disconnect autopilot. **The ILS Autopilot Mode is NOT capable of performing an automatic landing: it is YOUR responsibility to land the plane.**
18. During touchdown, maintain your Angle of Attack to perform an aerobraking landing and set throttle to IDLE. This manoeuver will bleed speed in the process (your delta wing will act as a huge airbrake).
19. Once slowing down to 110 kts, press the Autopilot Standby Mode (AP Disconnect) switch on the stick again to reset trim to allow the nosewheel to descend. An aural sound will be heard when trim is reset.
20. Once the nosewheel touches the ground, the PANNE and DECOL (*Décollage*, Takeoff) cautions will illuminate since the aircraft trim is not set to Neutral.
21. Press the Autopilot Standby Mode (AP Disconnect) switch on the stick to reset trim. The PANNE and DECOL cautions should extinguish, and an aural sound will be heard when trim is reset.
22. Gently apply brakes when you have slowed down under 100 kts.
23. Retract airbrakes (A & F lights out).
24. Engage Nosewheel Steering (DIRAV) when you slowed down under 40 kts.







8 – ILS LANDING WITH SYNTHETIC RUNWAY

8 – ILS LANDING WITH SYNTHETIC RUNWAY

DCS Table of Frequencies

Airfield	ICAO Code	Reference	Runway(s)	Tower	ID	Alt	ILS	TACAN
Anapa	URKA	04°59'36"N, 37°20'19"E	04-22; 2900m	121.0	01	04		
Batumi	UGSB	41°36'58"N, 41°35'31"E	13-31; 2400m	131.0	11	13	**13**, 110.3	16X BTM (135.90 MHz)
Beslan	URMO	43°12'26"N, 44°35'19"E	10-28; 3000m	141.0	21	17		
Gelendzhik	URKG	44°33'54"N, 38°00'25"E	04-22; 1800m	126.0	06	03		
Gudauta	UG23	43°06'09"N, 40°34'01"E	15-33; 2500m	130.0	10	09		
Kobuleti	UG5X	41°55'36"N, 41°51'05"E	07-25; 2400m	133.0	13	12	**07**, 111.5	67X KBL (134.00 MHz)
Kutaisi	UGKO	42°10'30"N, 42°28'05"E	08-26; 2500m	134.0	14	12	**08**, 109.75	44X KTS (110.70 MHz)
Krasnodar C	URKI	45°05'03"N, 38°57'34"E	09-27; 2500m	122.0	02	08		
Krasnodar PKK	URKK	45°01'52"N, 39°08'38"E	05-23R; 3100m 05-23L; 2300m	128.0	08	02		
Krymsk	URKW	44°58'27"N, 38°00'37"E	04-22; 2600m	124.0	04	03		
Maykop	URKH	44°41'22"N, 40°03'08"E	04-22; 3200m	125.0	05	05		
Mineral'nye Vody	URMM	44°12'58"N, 43°06'13"E	12-30; 3900m	135.0	15	16	**12**, 111.7 **30**, 109.3	
Mozdok	XRMF	43°47'26"N, 44°34'44"E	08-27; 3100m	137.0	17	21		
Nalchik	URMN	43°30'29"N, 43°37'30"E	06-24; 2300m	136.0	16	15	**24**, 110.5	
Novoross.	URKN	44°39'36"N, 37°46'25"E	04-22; 1780m	123.0	03	06		
Senaki	UGKS	42°14'31"N, 42°02'08"E	09-27; 2400m	132.0	12	14	**09**, 108.90	31X TSK (109.40 MHz)
Sochi	URSS	43°06'17"N, 40°35'26"E	06-24; 3100m	127.0	07	10	**06**, 111.1	
Soganlug	UG24	41°39'26"N, 44°55'48"E	14-32; 2400m	139.0	19	18		
Sukhumi	UGSS	42°51'21"N ,41°09'17"E	12-30, 2500m	129.0	09	10		
Tblisi	UGTB	41°40'37"N, 44°56'37"E	13-31L; 3000m 13-31R; 2500m	138.0	18	20	**13**, 110.3 **31**, 108.9	
Vaziani	UG27	41°37'09"N, 45°02'10"E	14-32; 2500m	140.0	20	19	**14**, 108.75	22X VAS (108.50 MHz)

Runway = runway designations, west to east; runway length in meters
Alt = nearest alternate airfield ID
ILS = **runway designation**, ILS frequency
Credits: Shu77; HiJack; vJaBoG32

Like the F-16 and F/A-18, the Mirage 2000C is equipped with a fly-by-wire system. **Fly-by-wire** (FBW) is a system that replaces the conventional manual flight controls of an aircraft with an electronic interface. The movements of flight controls are converted to electronic signals transmitted by wires (hence the fly-by-wire term), and flight control computers determine how to move the actuators at each control surface to provide the ordered response. The fly-by-wire system also allows automatic signals sent by the aircraft's computers to perform functions without the pilot's input, as in systems that automatically help stabilize the aircraft, or prevent unsafe operation of the aircraft outside of its performance envelope.

Flying the Mirage feels different from other fighter jets like the F-15. Control surfaces are controlled by a computer: you merely tell the aircraft what you want it to do.

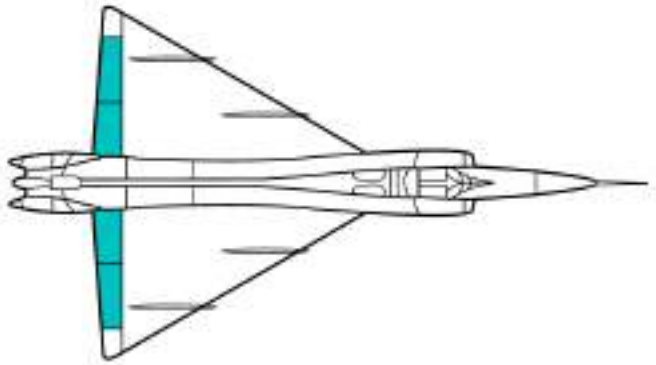
I highly recommend this article about the F-16's fly-by-wire system. It is very instructive and quite interesting.
http://www.ausairpower.net/AADR-FBW-CCV.html

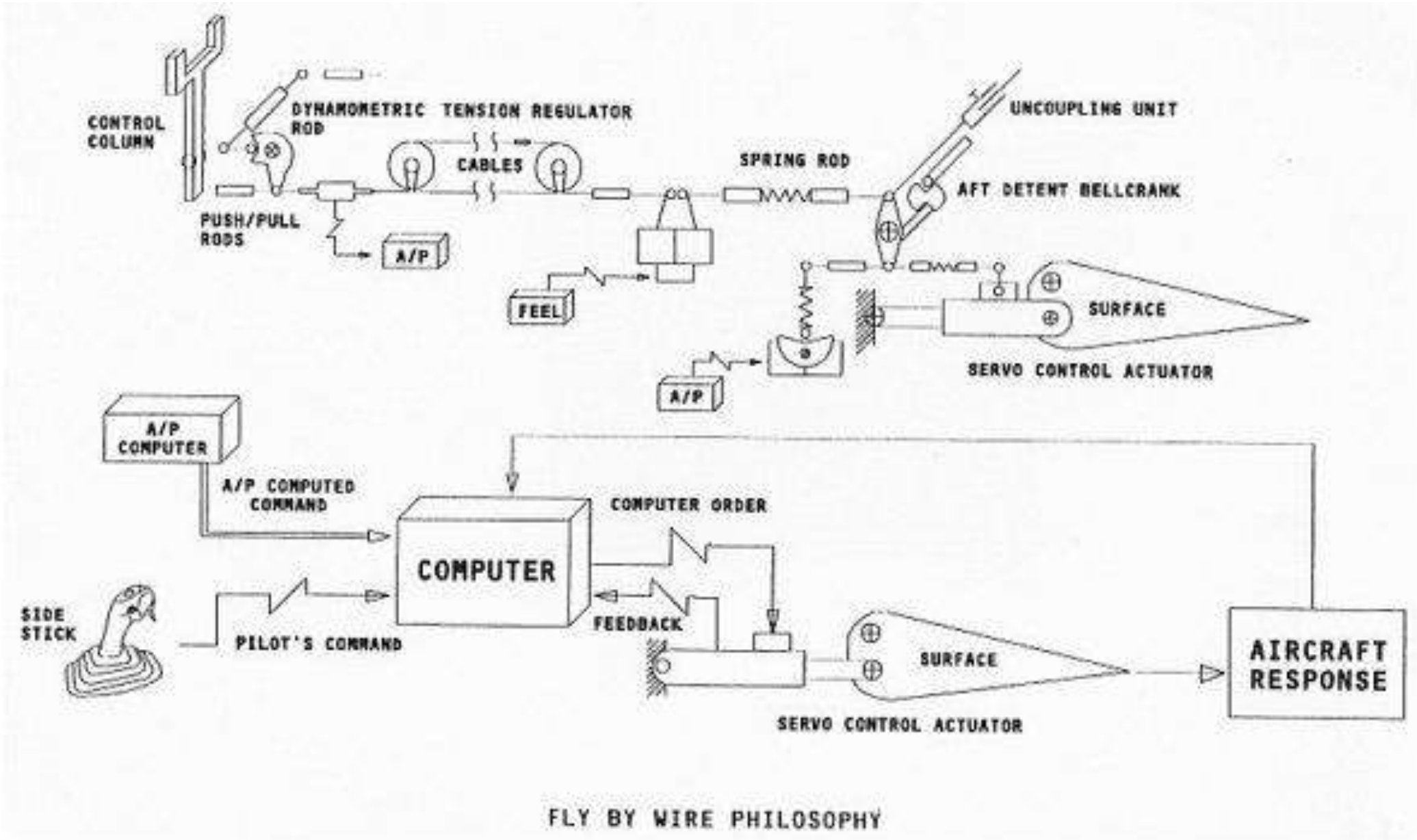
Pilot input on joystick

FLIGHT COMPUTER

Control Laws will determine how control surfaces must be moved in order to reproduce the movement dictated by pilot input on joystick

Electrical signal sent to actuators of control surfaces



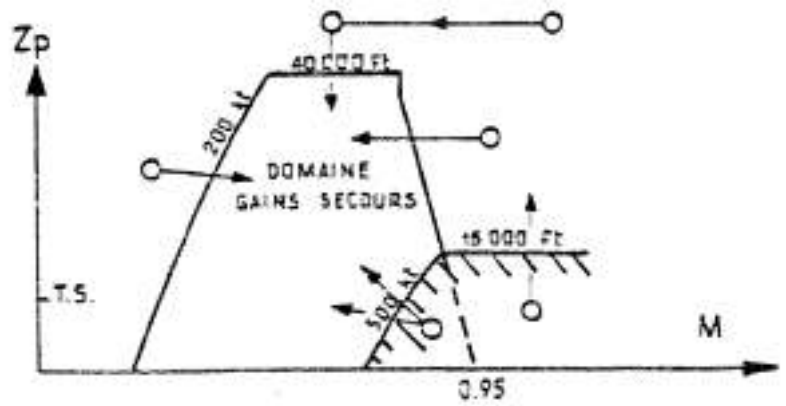


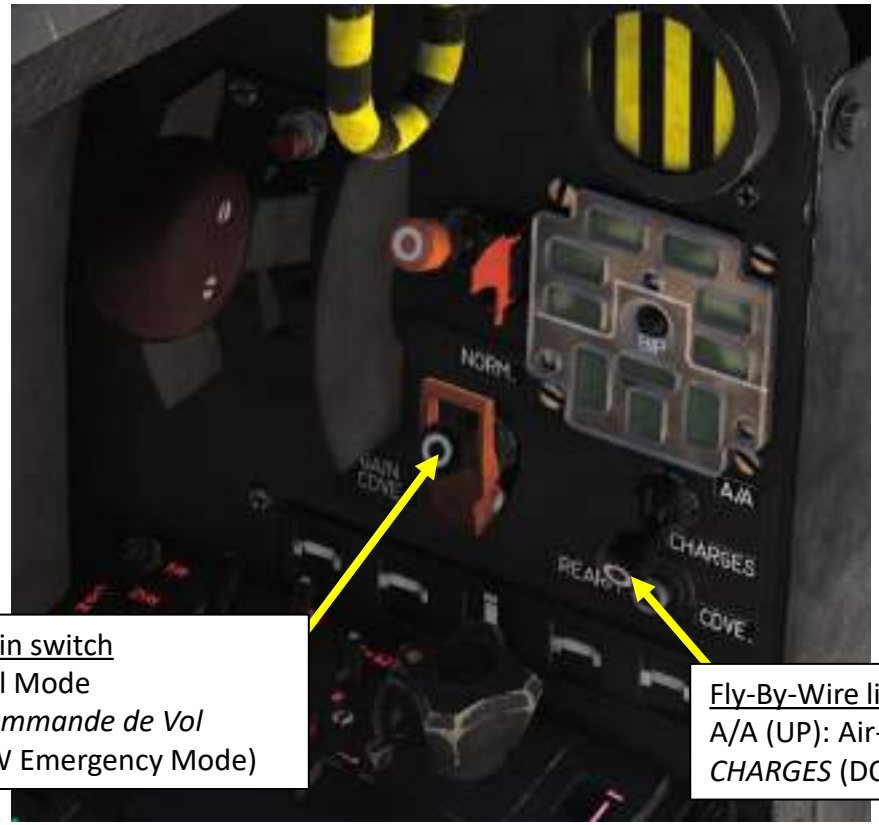
FLY BY WIRE PHILOSOPHY

The FBW G limiter switch has two positions:

- **A/A** (UP) is used for an air combat configuration (2 x MAGIC II missiles + 2 x SUPER S530D missiles). This FBW mode will allow you to pull the maximal allowable number of Gs during a dogfight. In other words, the manoeuverability of your aircraft is maximal at this FBW setting.
- **CHARGES** (DOWN) is used for a heavy payload configuration (which includes any number of bombs and external fuel tanks). This FBW mode will restrict the number of Gs you can pull in comparison to the A/A mode. In other words, you will not be as manoeuverable. The reason for this mode is that structural damage can occur if you pull many Gs, which is caused by the heavy payload fixed to the hardpoints. The CHARGES (stores) mode is here to prevent your aircraft from ending in a smoldering ball of flames. When doing dive bomb runs, keep in mind that you will not be able to pull up as much as you would expect when flying in the A/A mode.

NOTE:
The Fly-By-Wire Gain switch must remain to NORM at all times. If you set it to GAIN CDVE, you basically turn it into EMERGENCY mode. In most configurations, the aircraft will become unstable and you are very unlikely to be able to recover from that. If you are using the emergency FWB mode, you will only be able to control the aircraft in a very small flight envelope as shown on the graph to the right. Flying with FBW off outside this restricted flight envelope means certain death.

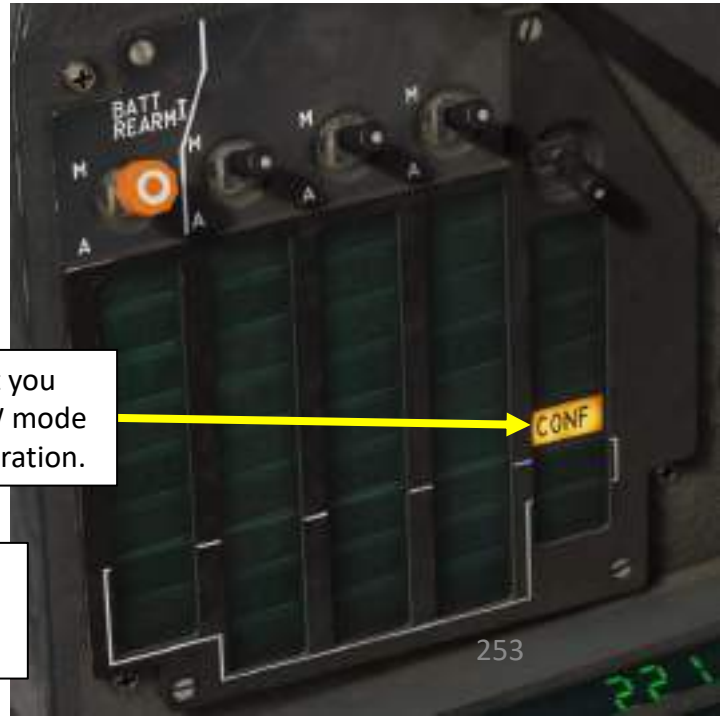




Fly-By-Wire Gain switch
NORM: Normal Mode
GAIN CDVE: *Commande de Vol Électrique* (FBW Emergency Mode)

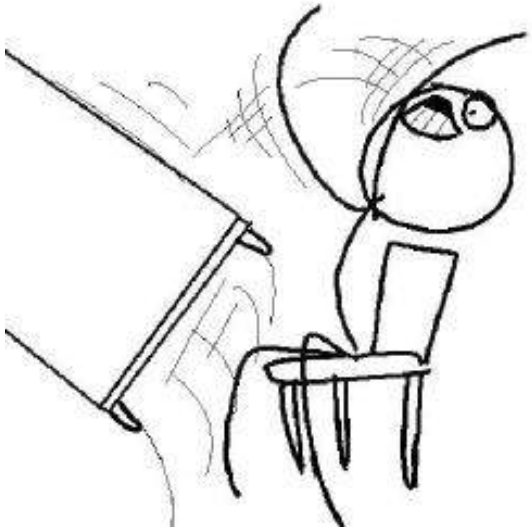
Fly-By-Wire limiter switch
A/A (UP): Air-to-Air Combat – For carrying light loads
CHARGES (DOWN): Stores – For carrying heavy loads

CONF Caution will indicate that you have selected an incorrect FBW mode for your current weight configuration.



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.