

DCS GUIDE *Mirage 2000C*



By Chuck

A detailed image of a fighter jet, possibly a Eurofighter Typhoon, flying in a steep climb against a clear blue sky. The jet is grey with red and white roundels on its wings. It is leaving a long, thick white smoke trail that extends across the lower half of the frame. The sun is visible in the background, creating a lens flare effect.

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PART 1 – INTRODUCTION

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.



TEXTE DE CHARLIER
DESSINS DE UDERZO

Une Aventure de **TANGUY et LAVERDURE**



DARGAUD S.A.
ÉDITEUR

PART 1 – INTRODUCTION

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).



Mirage 2000 C



Mirage 2000 B



Mirage 2000 D



Mirage 2000 N



Mirage 2000 5F

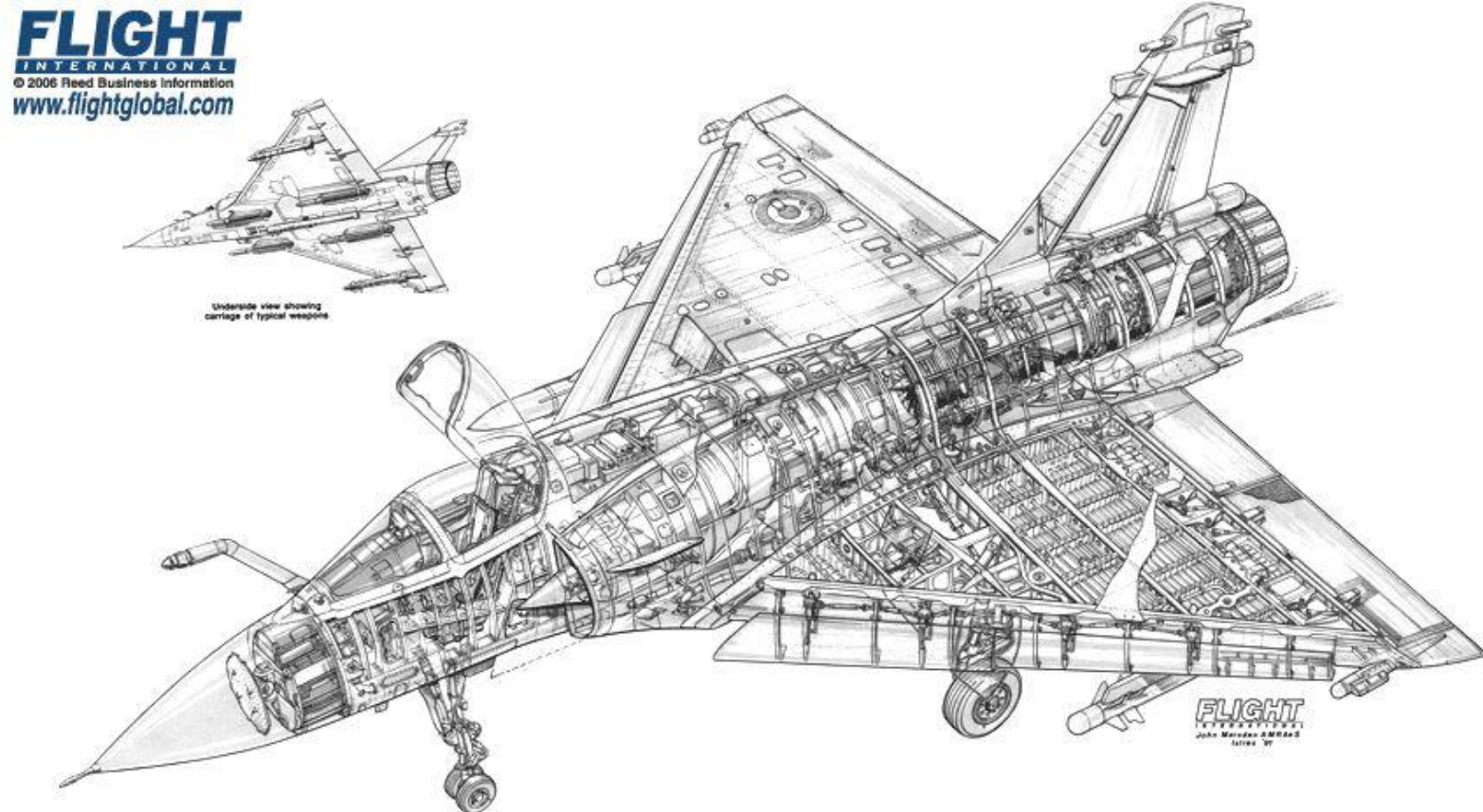


PART 1 – INTRODUCTION

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 FI.

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.



PART 1 – INTRODUCTION

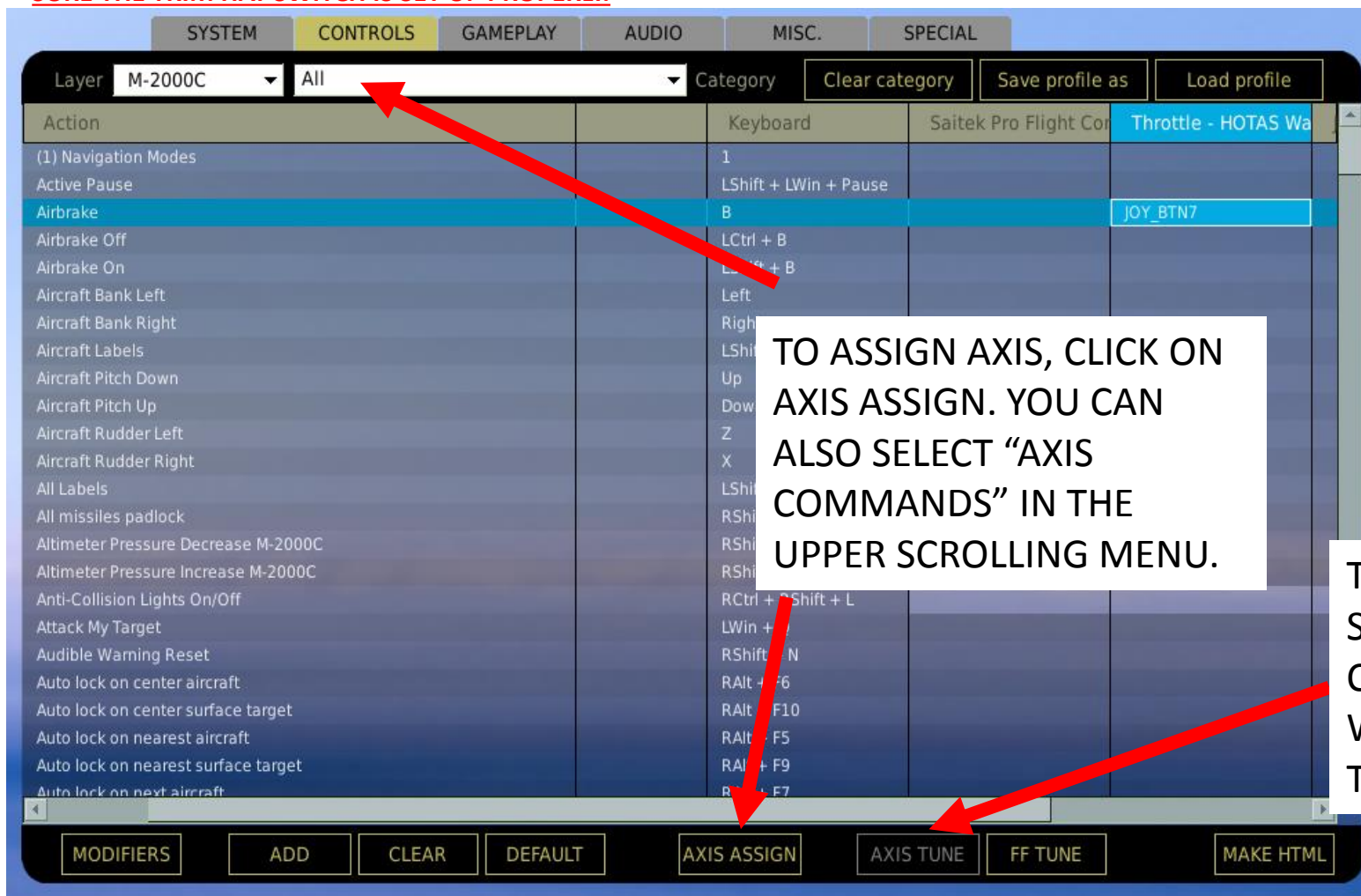


PART 2 – CONTROLS SETUP

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.



TO ASSIGN AXIS, CLICK ON
AXIS ASSIGN. YOU CAN
ALSO SELECT “AXIS
COMMANDS” IN THE
UPPER SCROLLING MENU.

TO MODIFY CURVES AND
SENSITIVITIES OF AXES,
CLICK ON THE AXIS YOU
WANT TO MODIFY AND
THEN CLICK AXIS TUNE

CONTROLS SETUP

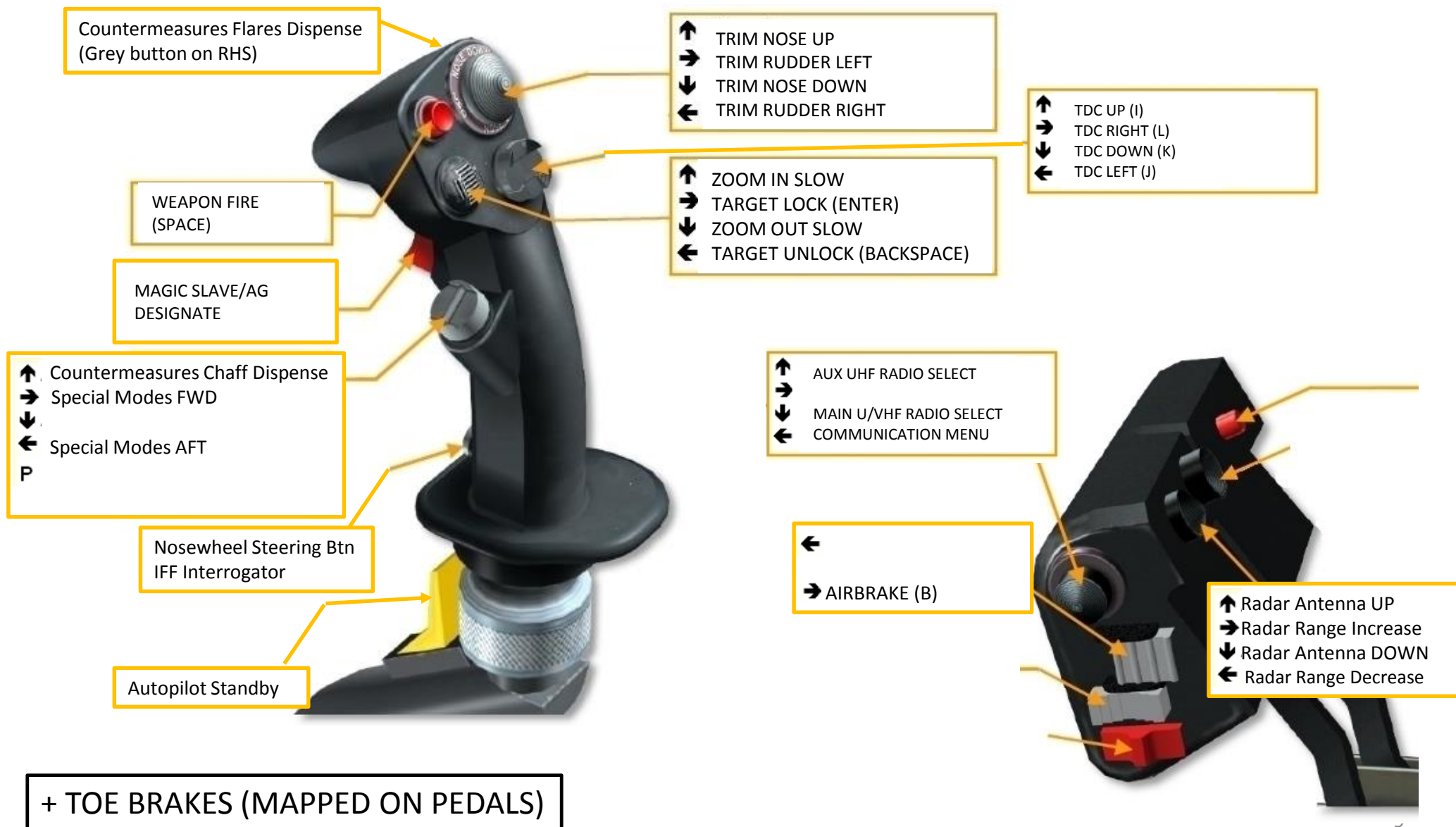
BIND THE FOLLOWING AXES

- 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 😊

PART 2 – CONTROLS SETUP

WHAT YOU NEED MAPPED

HOTAS: “Hands On Throttle-And-Stick”
3M: “Main sur Manche et Manette”



PART 3 – COCKPIT & GAUGES



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

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

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

PSM: *Poste de Sélecteur de Modes*
Litt.: Mode Selector Panel

PCA: *Poste de Commande Armement*
Litt.: Weapon Control Panel

PPA: *Poste de Préparation Armement*
Litt.: Weapons Configuration Panel

PART 3 – COCKPIT & GAUGES



Canopy Handle

Canopy Lever

→ OUVERTURE (OPEN) | DESCENTE (DOWN)
← VERROUILLAGE (LOCK CANOPY)

PART 3 – COCKPIT & GAUGES



Emergency Compass
(Left Click to Show or Hide)

PART 3 – COCKPIT & GAUGES



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

PART 3 – COCKPIT & GAUGES



Seat Adjustment
Hold Left Click = UP
Hold Right Click = DOWN

Starter Fuel Pump Switch

Starter Switch

Right (*Droite*) Fuel Pump - M = ON

Left (*Gauche*) Fuel Pump - M = ON

Fuel Shut-Off Valve (*Coupe-Feu*)

Ignition/Ventilation Selector Switch
VENT = Ventilation
G = *Gauche* / Left
D = *Droite* / Right

MANUAL SEPARATION SEPARATION MAN

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PART 3 – COCKPIT & GAUGES

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

Indicator White Lights
(not functional)

Indicator Lights (not functional)
Nuit = Night / Jour = Day

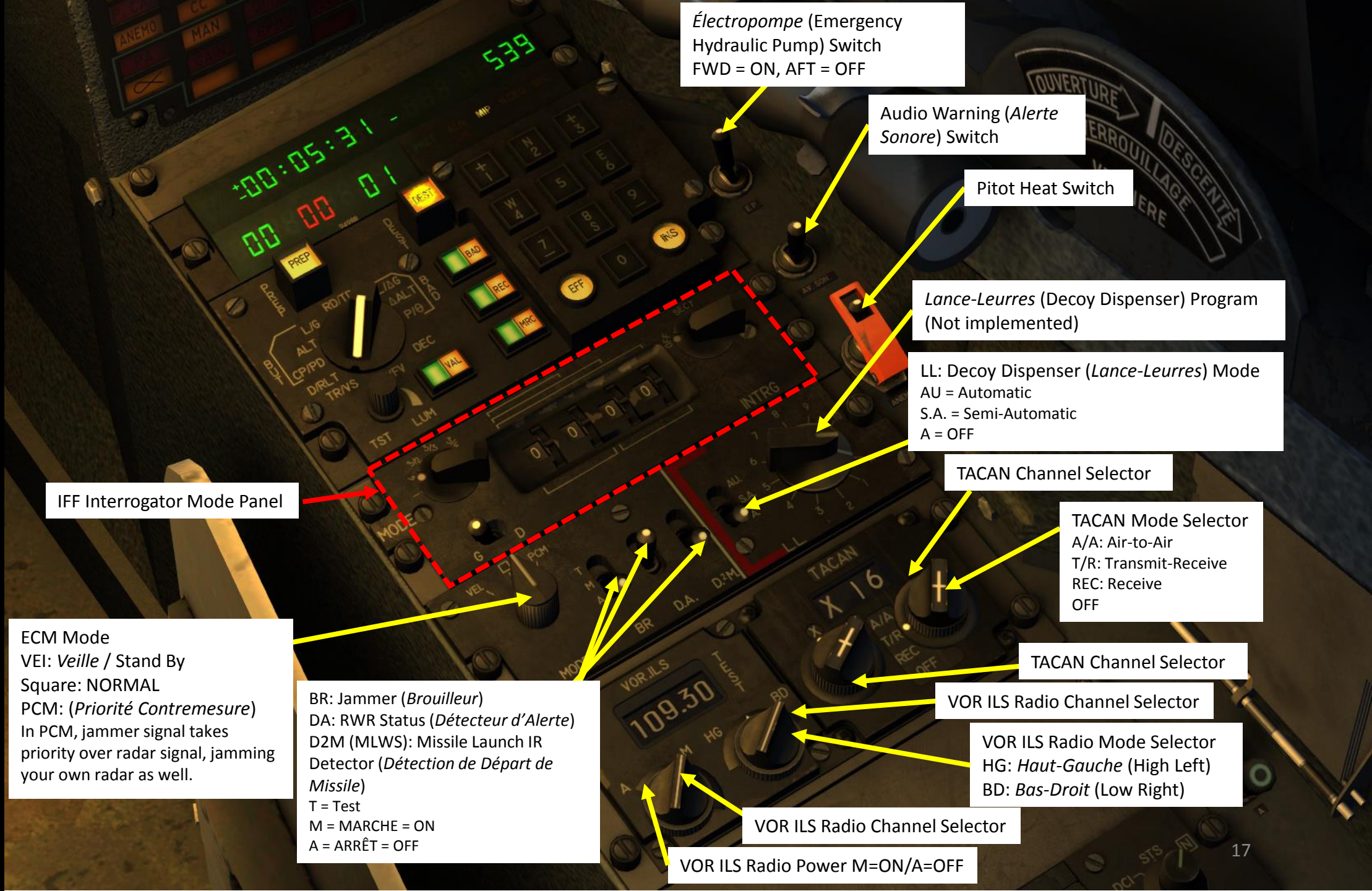
Inner Rotary: Dashboard backlights

Outer Rotary: Banquettes (Lateral Consoles) backlights

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

Outer Rotary: Cockpit flood lights (red)

PART 3 – COCKPIT & GAUGES



Électropompe (Emergency Hydraulic Pump) Switch
FWD = ON, AFT = OFF

Audio Warning (Alerte Sonore) Switch

Pitot Heat Switch

Lance-Leurres (Decoy Dispenser) Program (Not implemented)

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

TACAN Channel Selector

TACAN Mode Selector
A/A: Air-to-Air
T/R: Transmit-Receive
REC: Receive
OFF

TACAN Channel Selector

VOR ILS Radio Channel Selector

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

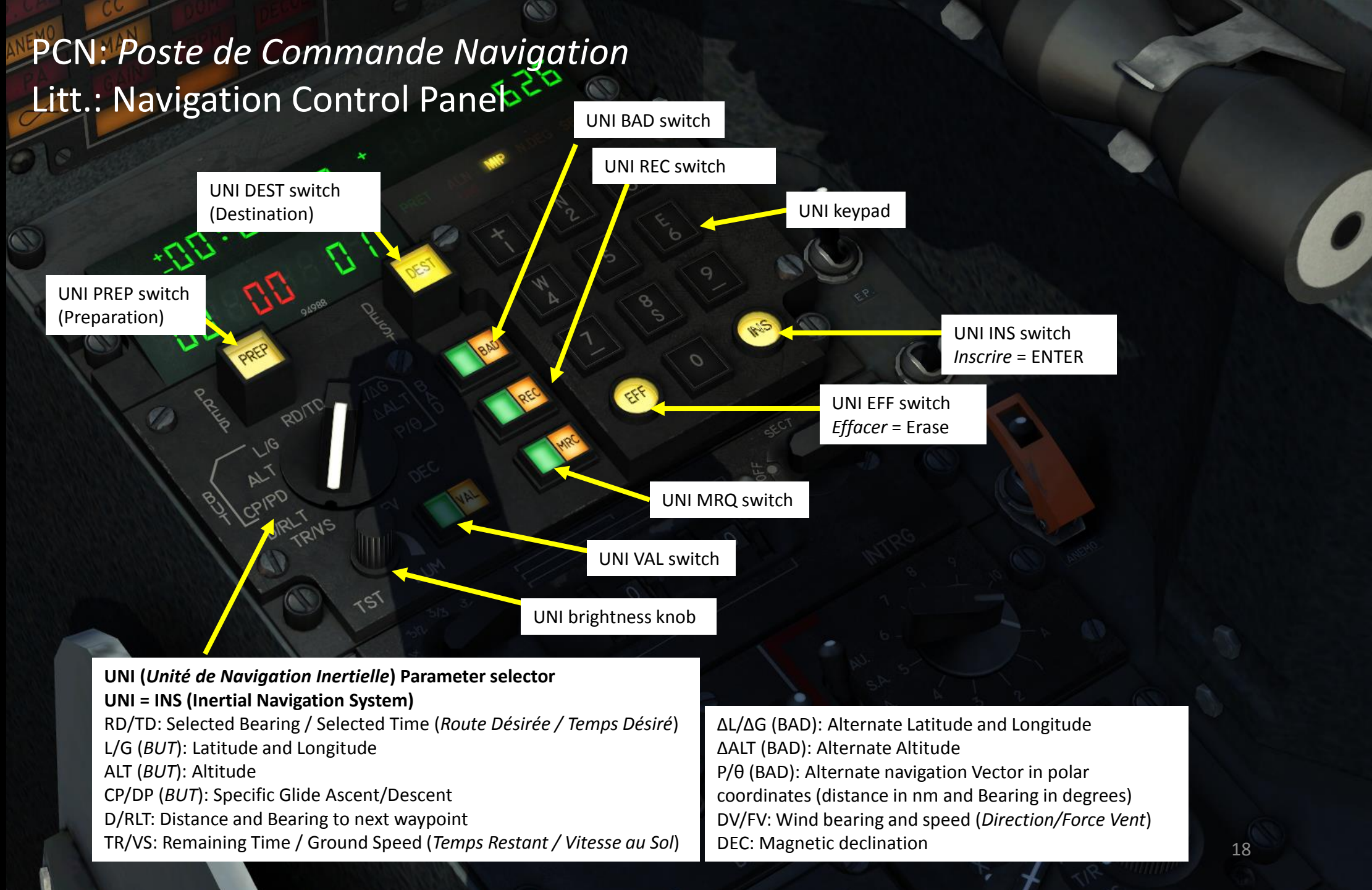
IFF Interrogator Mode Panel

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

PART 3 – COCKPIT & GAUGES

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*): Latitude and Longitude

ALT (*BUT*): Altitude

CP/DP (*BUT*): 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): Alternate Latitude and Longitude

ΔALT (BAD): Alternate Altitude

P/θ (BAD): Alternate navigation Vector in polar coordinates (distance in nm and Bearing in degrees)

DV/FV: Wind bearing and speed (*Direction/Force Vent*)

DEC: Magnetic declination

PART 3 – COCKPIT & GAUGES



Oxygen Flow Indicator

Oxygen Quantity (Liters)
LOX: Liquid OXYgen

Lights Test switch

Battery Switch
M = Marche/ON
A = Arrêt/OFF

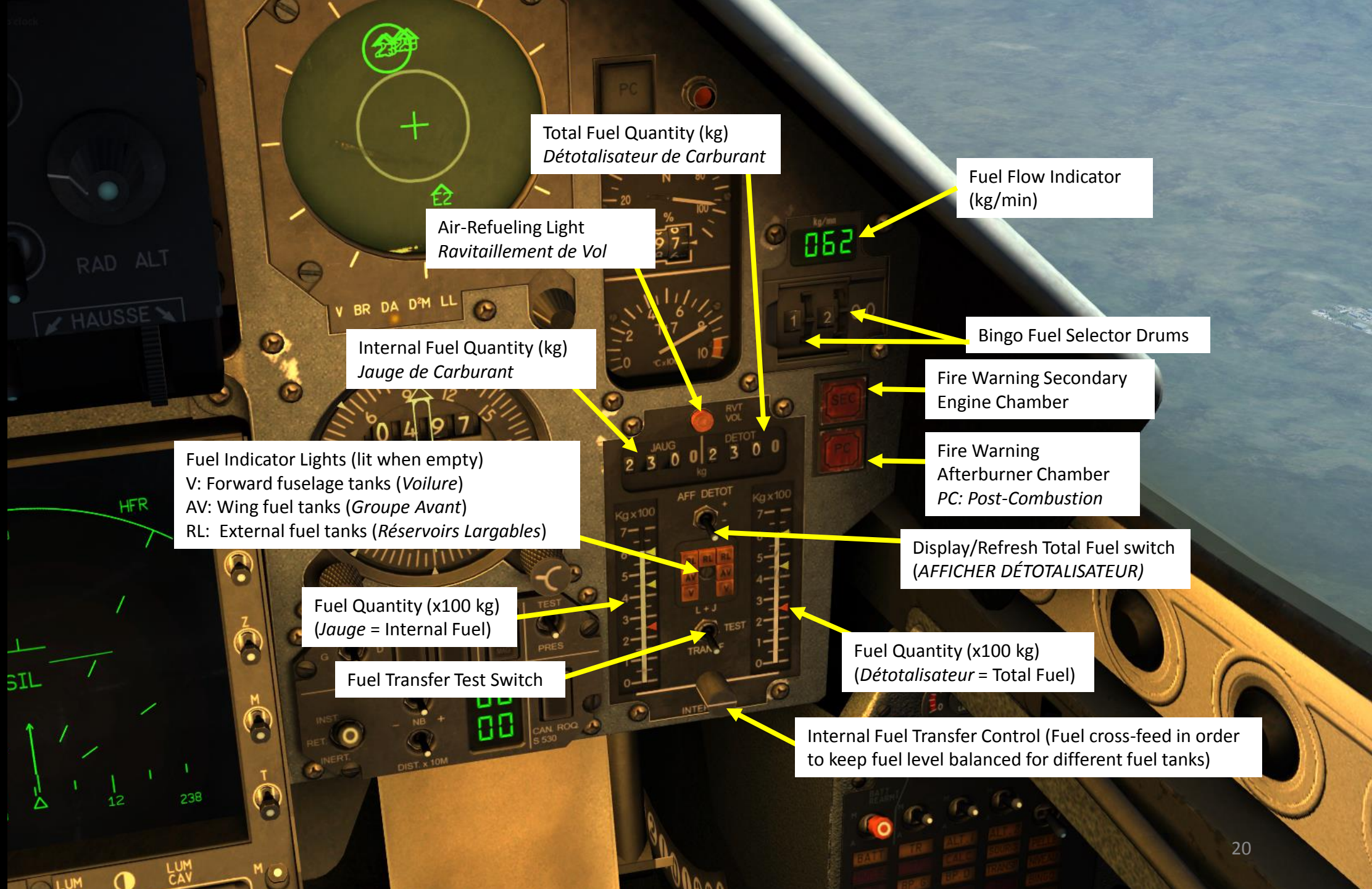
Alternator #2 switch

Alternator #1 switch

TR switch (Inverter Transformer)
Transfo-redresseur Normal

Alert Network (QRA – Quick
Reaction Alert) Switch
DOWN = OFF
UP = ON

PART 3 – COCKPIT & GAUGES



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

Fuel Indicator Lights (lit when empty)
V: Forward fuselage tanks (*Voilure*)
AV: Wing fuel tanks (*Groupe Avant*)
RL: External fuel tanks (*Réservoirs Largables*)

Fire Warning
Afterburner Chamber
PC: Post-Combustion

Fuel Quantity (x100 kg)
(*Jauge* = Internal Fuel)

Display/Refresh Total Fuel switch
(*AFFICHER DÉTOTALISATEUR*)

Fuel Transfer Test Switch

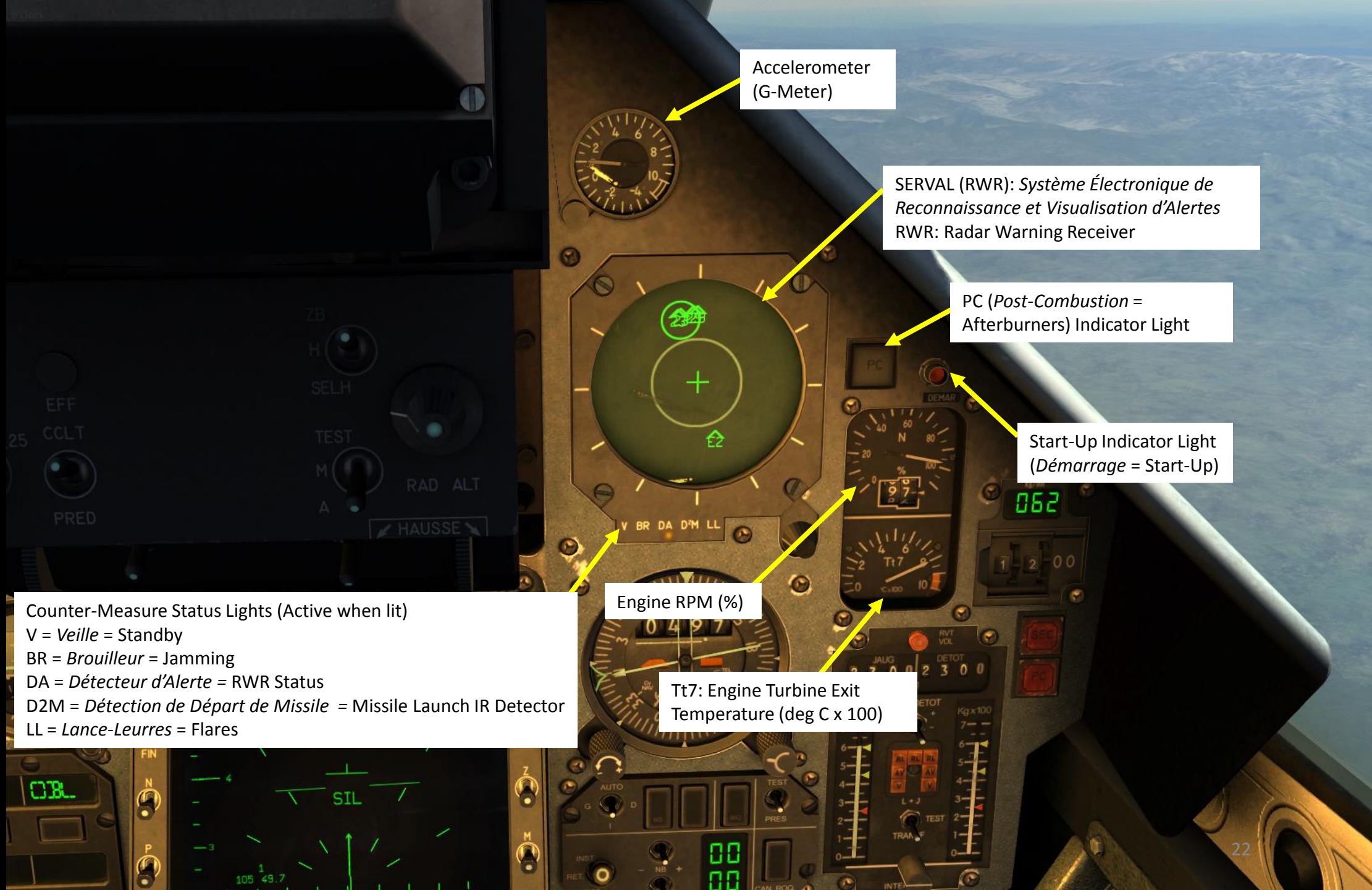
Fuel Quantity (x100 kg)
(*Détotalisateur* = Total Fuel)

Internal Fuel Transfer Control (Fuel cross-feed in order
to keep fuel level balanced for different fuel tanks)

PART 3 – COCKPIT & GAUGES



PART 3 – COCKPIT & GAUGES



Accelerometer
(G-Meter)

SERVAL (RWR): *Système Électronique de
Reconnaissance et Visualisation d'Alertes*
RWR: Radar Warning Receiver

PC (Post-Combustion =
Afterburners) Indicator Light

Start-Up Indicator Light
(Démarriage = 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

PART 3 – COCKPIT & GAUGES



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

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

Effacement (Erase) button

Radar Altimeter Minimum Altitude Selector

VTH Symbology Declutter switch (ALL: *Allègement*)

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

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

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

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

Radar *Début/Fin* Parameter
Start/Finish input designation

Radar N parameter:
Number of Objectives

Radar P parameter:
Polar coordinates

Radar B parameter:
Bearing coordinates

Allègement Symbologie
(Symbology Declutter)

Radar map Reframe (*Cadrage*)
Avant/Forward – Arrière/Aft

Marker (*marqueur*) brightness adjustment

Backlight Adjustment

Contrast Adjustment

Radar C parameter:
Course to Target

Radar Z parameter:
Target Altitude

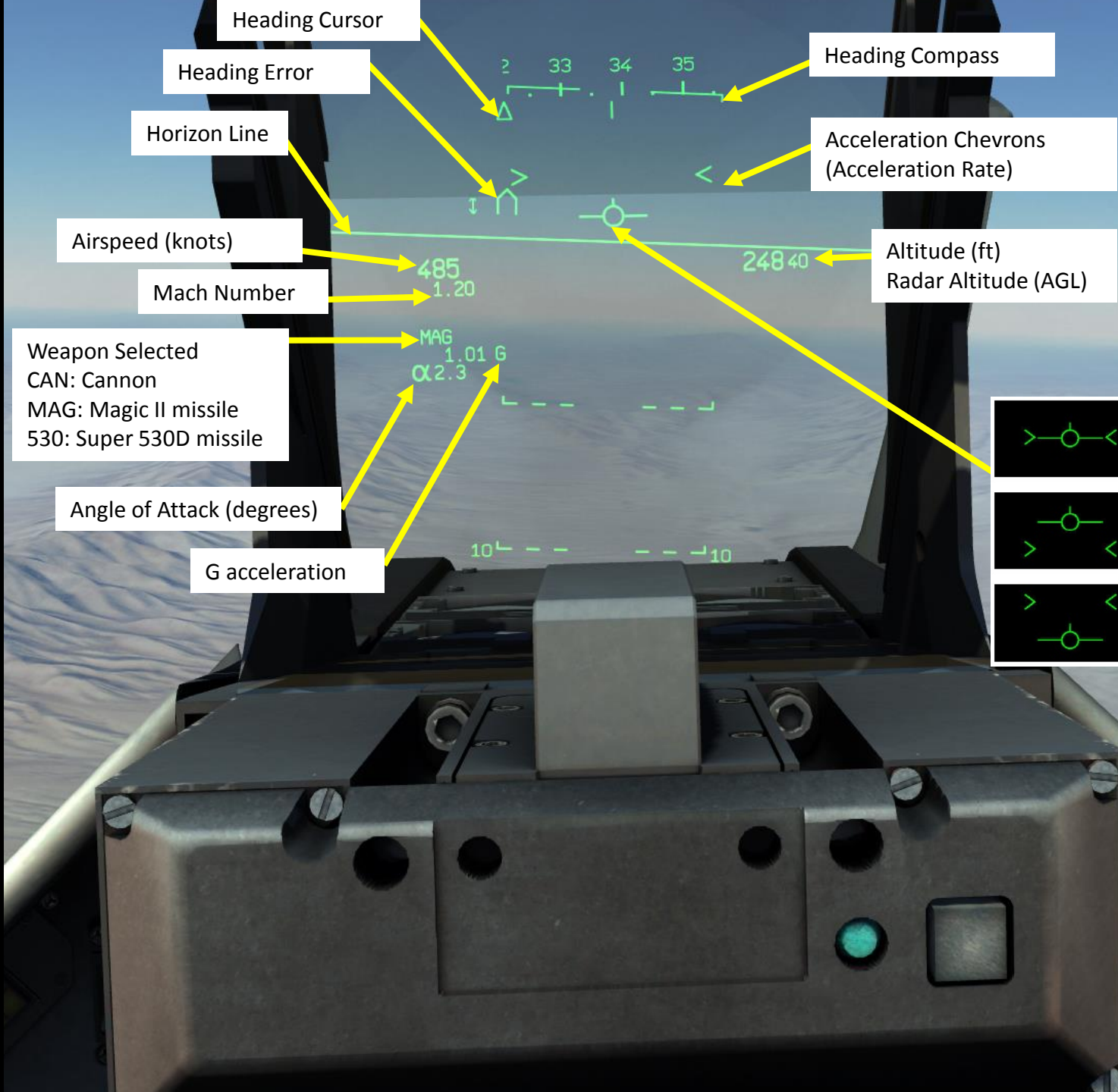
Radar M parameter:
Mach number of target

Radar T parameter:
Time observer relayed Objective Information

VTB (HDD) Display Power switch
M: *Marche* (ON)
A: *Arrêt* (OFF)

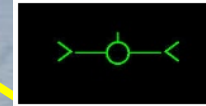
Brightness Adjustment

PART 3 – COCKPIT & GAUGES

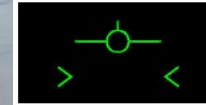


Total Flight Path Angle (FPA)

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

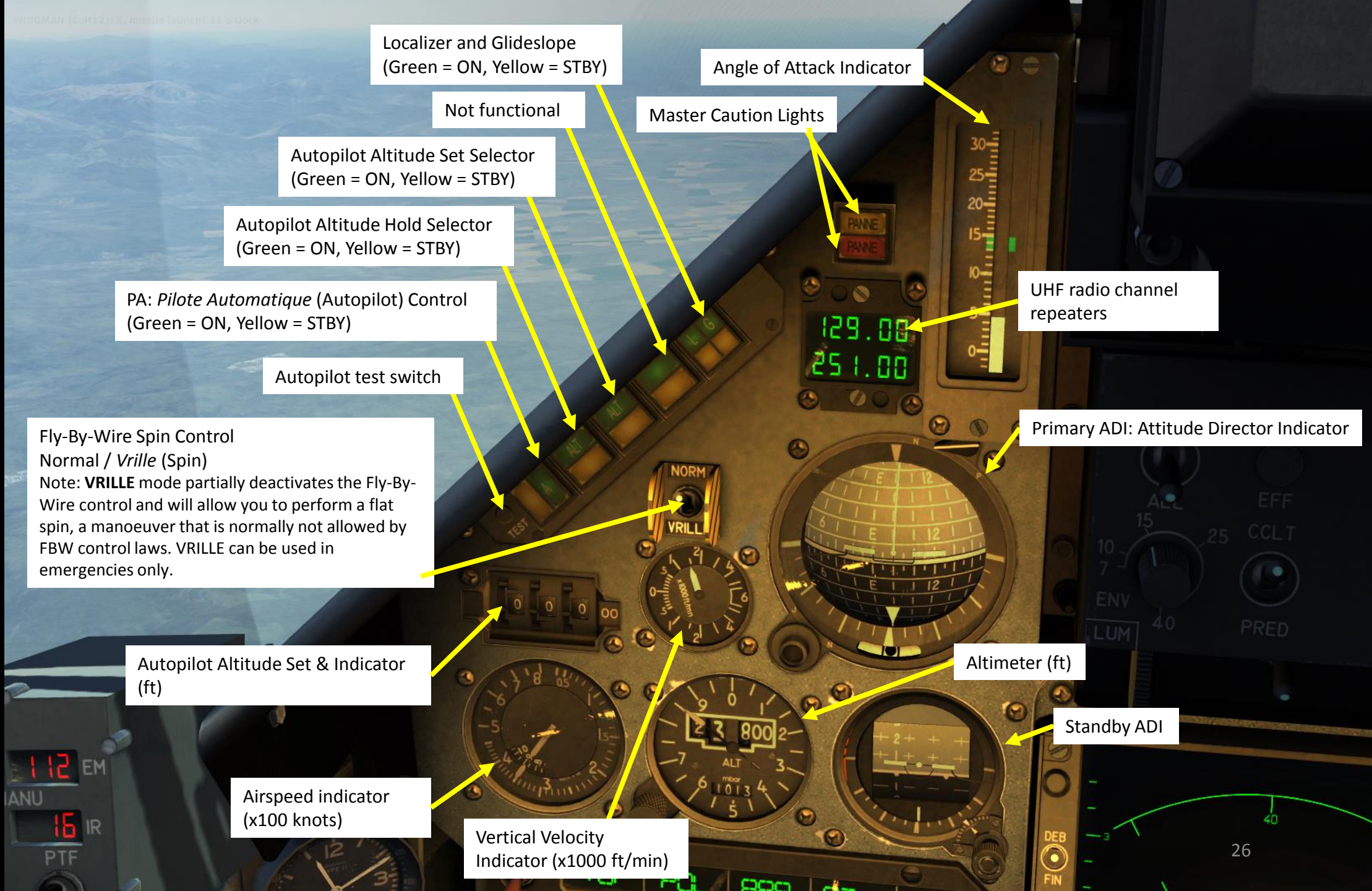


-Aircraft will decelerate if the pilot maintains the current thrust



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

PART 3 – COCKPIT & GAUGES



Localizer and Glideslope
(Green = ON, Yellow = STBY)

Angle of Attack Indicator

Not functional

Master Caution Lights

Autopilot Altitude Set Selector
(Green = ON, Yellow = STBY)

Autopilot Altitude Hold Selector
(Green = ON, Yellow = STBY)

PA: *Pilote Automatique* (Autopilot) Control
(Green = ON, Yellow = STBY)

UHF radio channel
repeaters

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 manoeuvre that is normally not allowed by
FBW control laws. VRILLE can be used in
emergencies only.

Primary ADI: Attitude Director Indicator

Autopilot Altitude Set & Indicator
(ft)

Altimeter (ft)

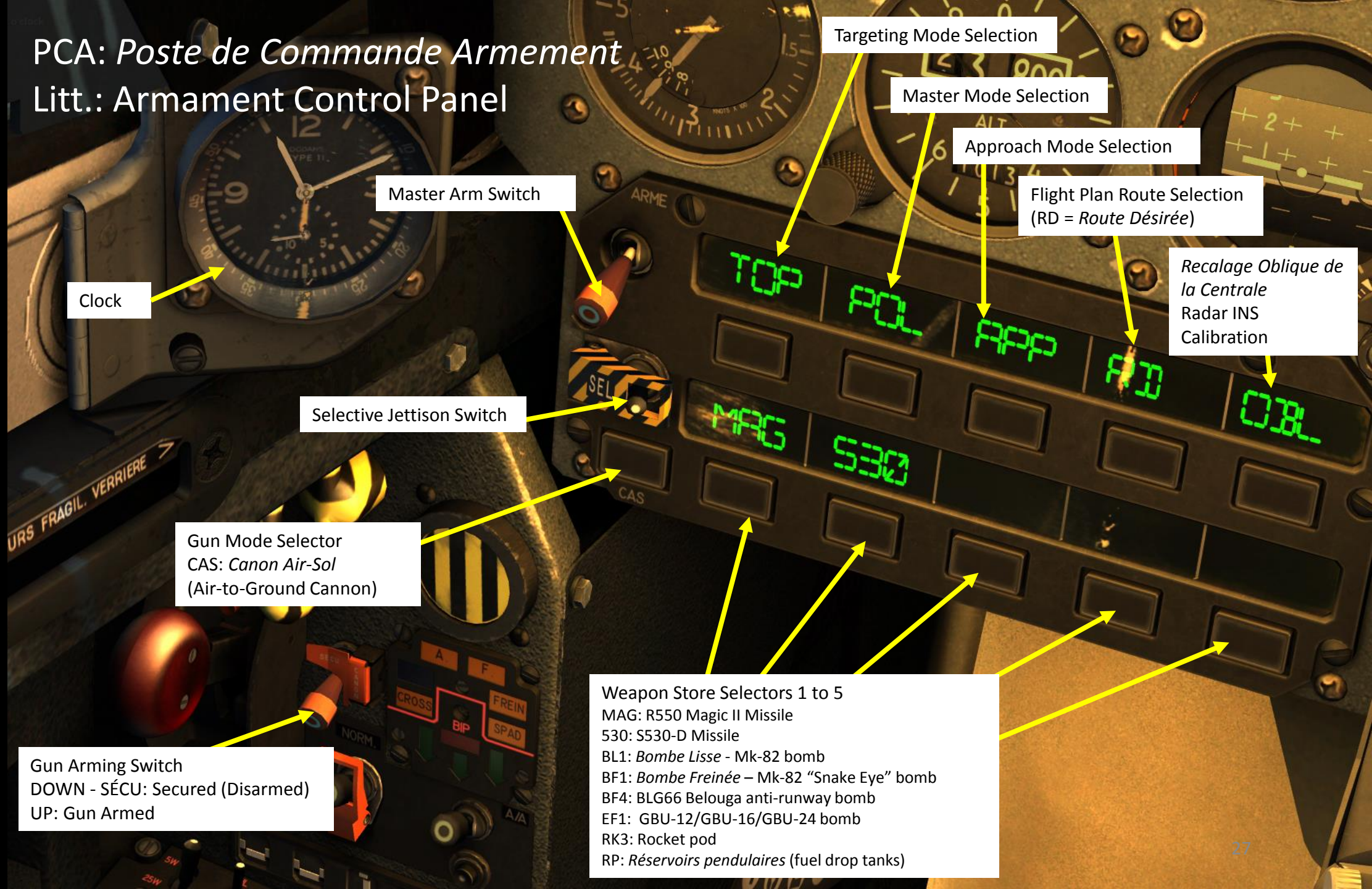
Standby ADI

Airspeed indicator
(x100 knots)

Vertical Velocity
Indicator (x1000 ft/min)

PART 3 – COCKPIT & GAUGES

PCA: *Poste de Commande Armement*
Litt.: Armament Control Panel



Clock

Master Arm Switch

Selective Jettison Switch

Gun Mode Selector
CAS: *Canon Air-Sol*
(Air-to-Ground Cannon)

Gun Arming Switch
DOWN - SÉCU: Secured (Disarmed)
UP: Gun Armed

Targeting Mode Selection

Master Mode Selection

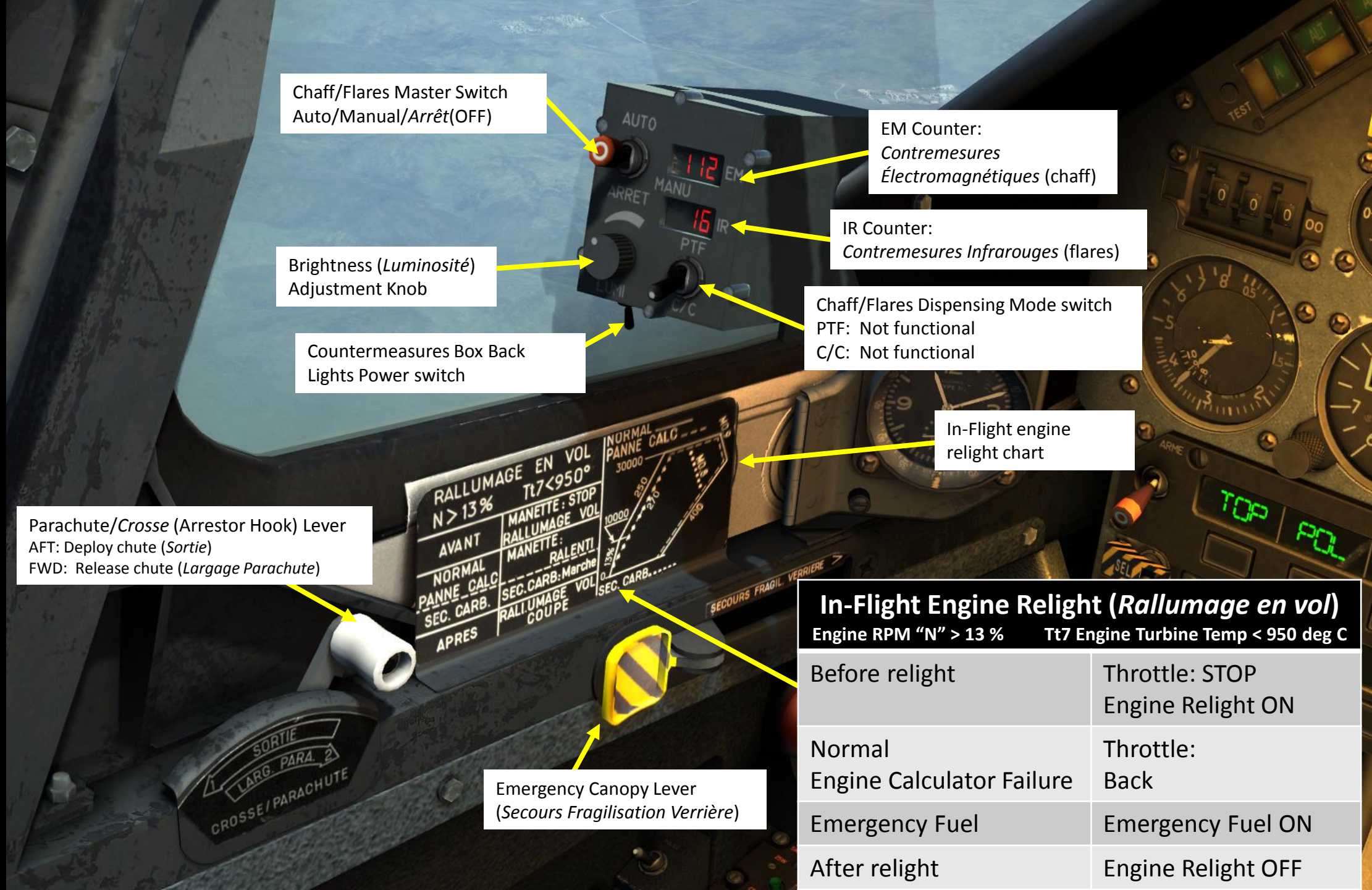
Approach Mode Selection

Flight Plan Route Selection
(RD = *Route Désirée*)

Recalage Oblique de
la Centrale
Radar INS
Calibration

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
BF4: BLG66 Belouga anti-runway bomb
EF1: GBU-12/GBU-16/GBU-24 bomb
RK3: Rocket pod
RP: *Réservoirs pendulaires* (fuel drop tanks)

PART 3 – COCKPIT & GAUGES



Chaff/Flares Master Switch
Auto/Manual/Arrêt(OFF)

EM Counter:
*Contremesures
Électromagnétiques (chaff)*

IR Counter:
Contremesures Infrarouges (flares)

Brightness (*Luminosité*)
Adjustment Knob

Chaff/Flares Dispensing Mode switch
PTF: Not functional
C/C: Not functional

Countermeasures Box Back
Lights Power switch

In-Flight engine
relight chart

Parachute/Crosse (Arrestor Hook) Lever
AFT: Deploy chute (*Sortie*)
FWD: Release chute (*Largage Parachute*)

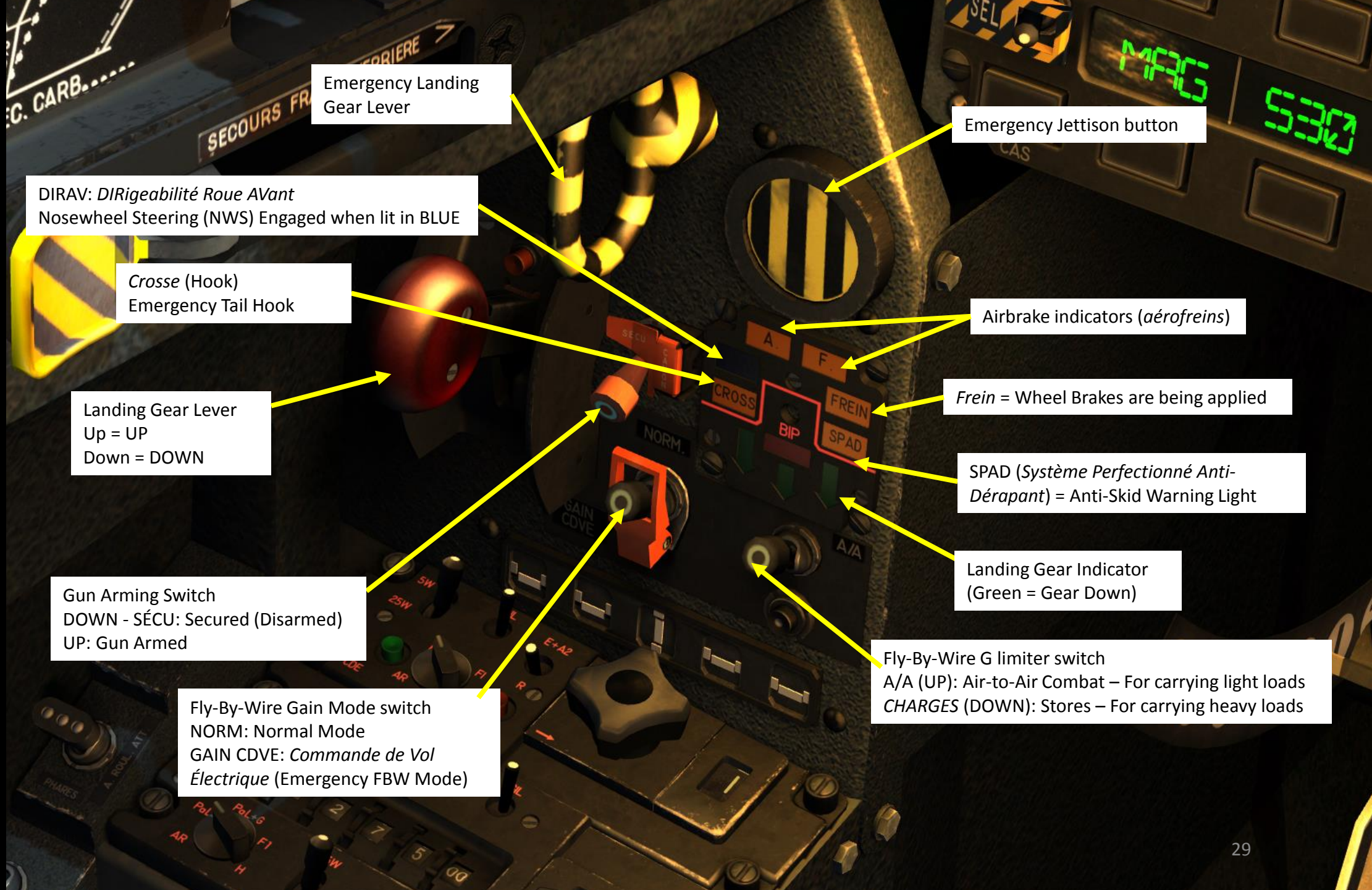


In-Flight Engine Relight (*Rallumage en vol*)
Engine RPM "N" > 13 % Tt7 Engine Turbine Temp < 950 deg C

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

Emergency Canopy Lever
(*Secours Fragilisation Verrière*)

PART 3 – COCKPIT & GAUGES



Emergency Landing Gear Lever

Emergency Jettison button

DIRAV: *DIR*igeabilité *ROU*e *AV*ant
Nosewheel Steering (NWS) Engaged when lit in BLUE

Crosse (Hook)
Emergency Tail Hook

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

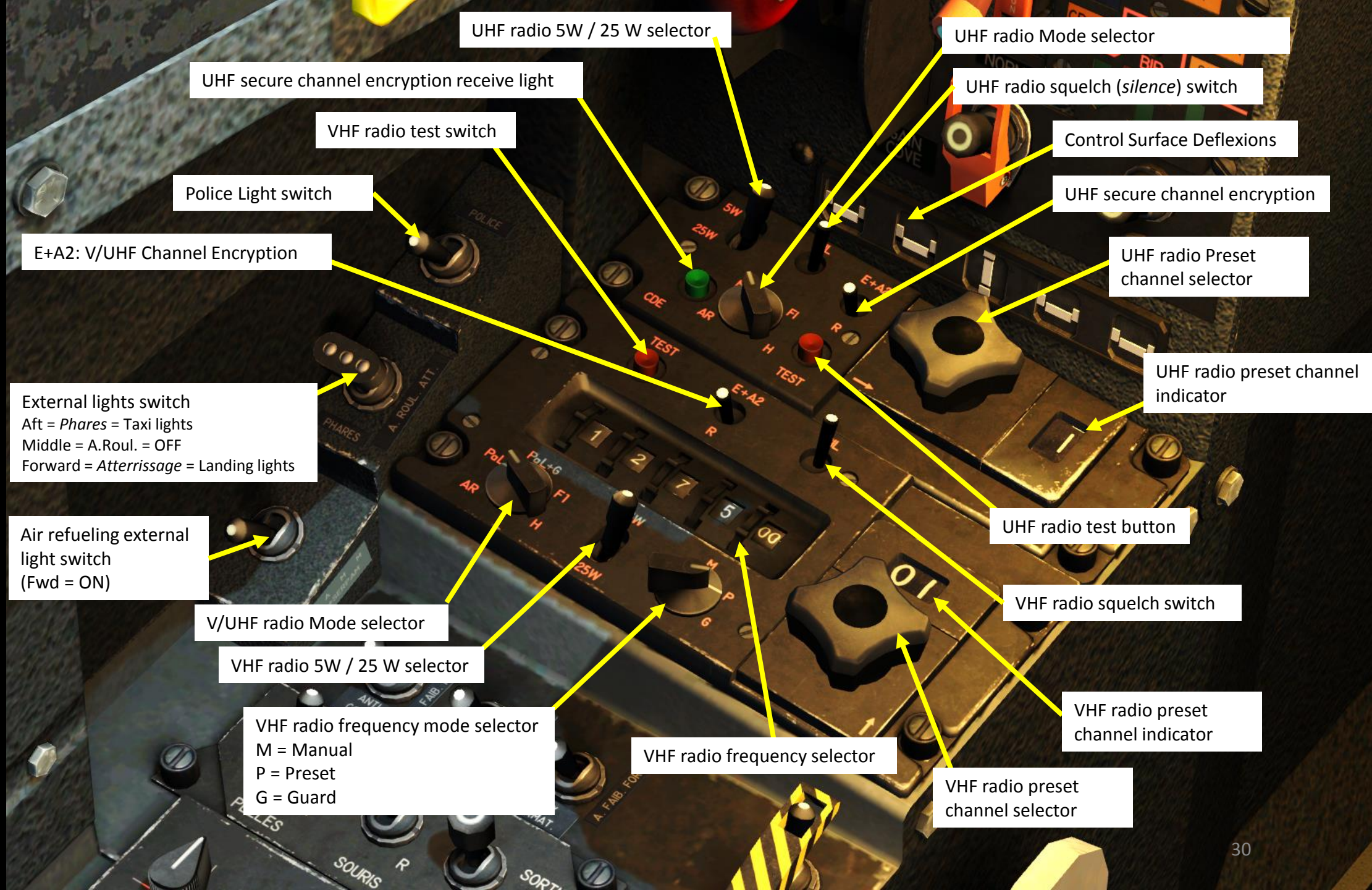
Gun Arming Switch
DOWN - SÉCU: Secured (Disarmed)
UP: Gun Armed

Landing Gear Indicator
(Green = Gear Down)

Fly-By-Wire Gain Mode switch
NORM: Normal Mode
GAIN CDVE: *Com*mande de *Vol É*lectrique (Emergency FBW Mode)

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

PART 3 – COCKPIT & GAUGES

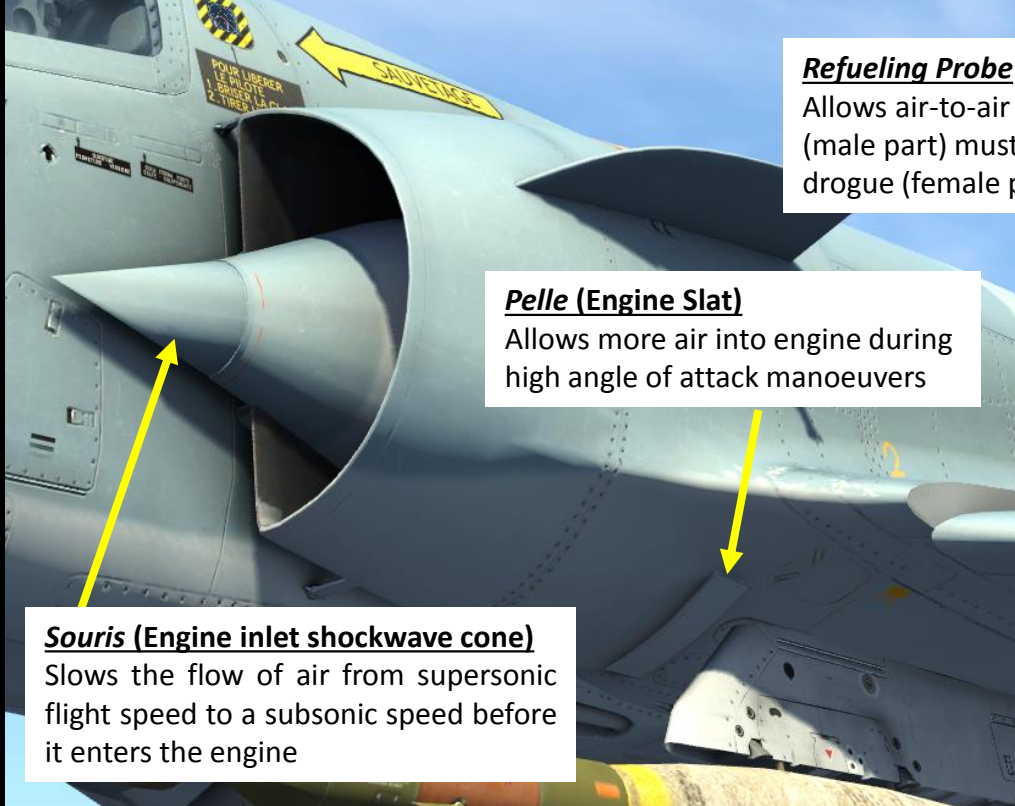


PART 3 – COCKPIT & GAUGES



Air Refueling Switch
Down = Closed/OFF
Up = Open/ON

PART 3 – COCKPIT & GAUGES



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 manoeuvres

Souris (Engine inlet shockwave cone)

Slows the flow of air from supersonic flight speed to a subsonic speed before it enters the engine



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.

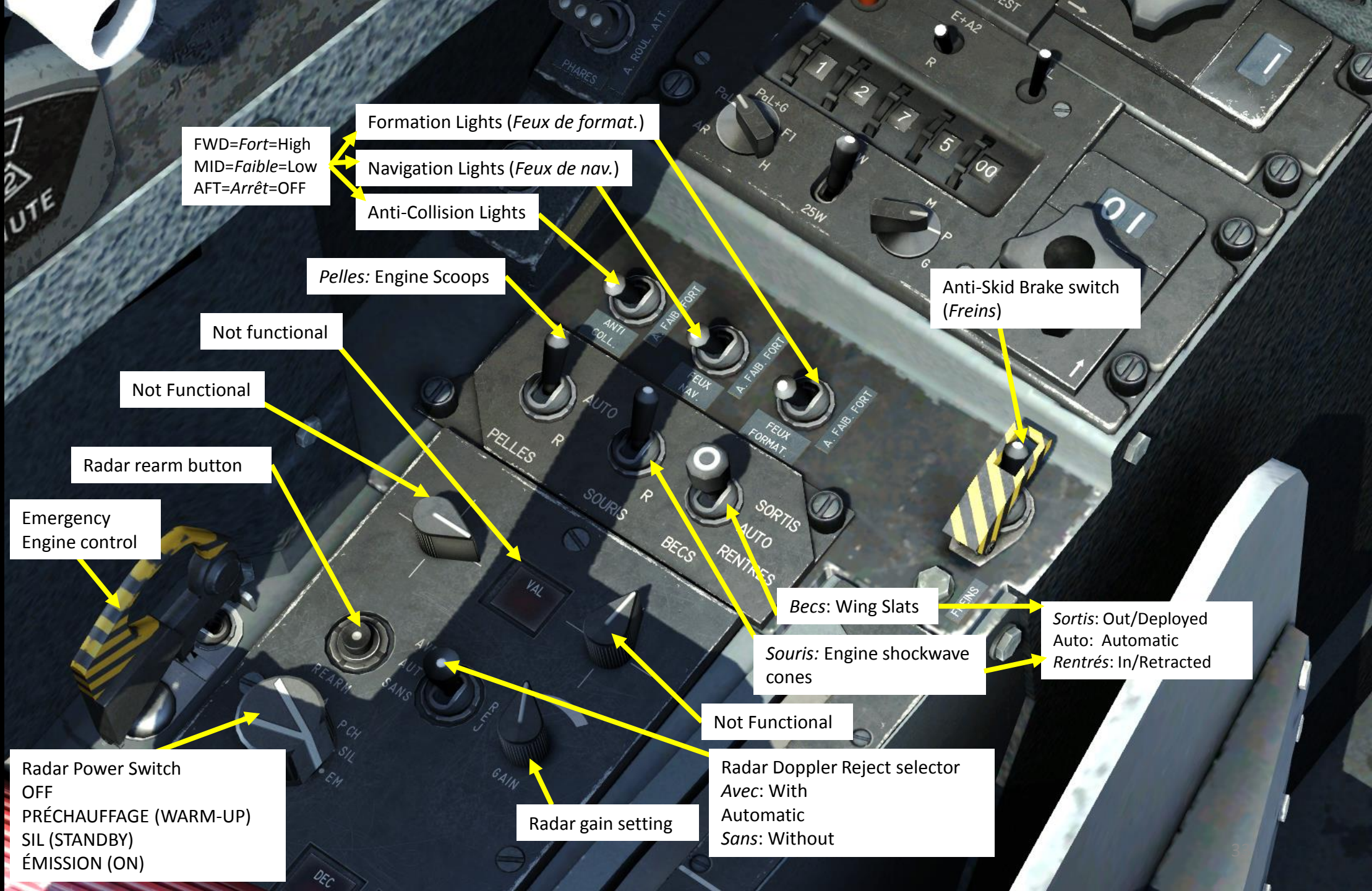


Palonnier (Rudder)

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.

PART 3 – COCKPIT & GAUGES



FWD=Fort=High
MID=Faible=Low
AFT=Arrêt=OFF

Formation Lights (*Feux de format.*)

Navigation Lights (*Feux de nav.*)

Anti-Collision Lights

Pelles: Engine Scoops

Not functional

Not Functional

Radar rearm button

Emergency
Engine control

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

Radar gain setting

Not Functional

Radar Doppler Reject selector
Avec: With
Automatic
Sans: Without

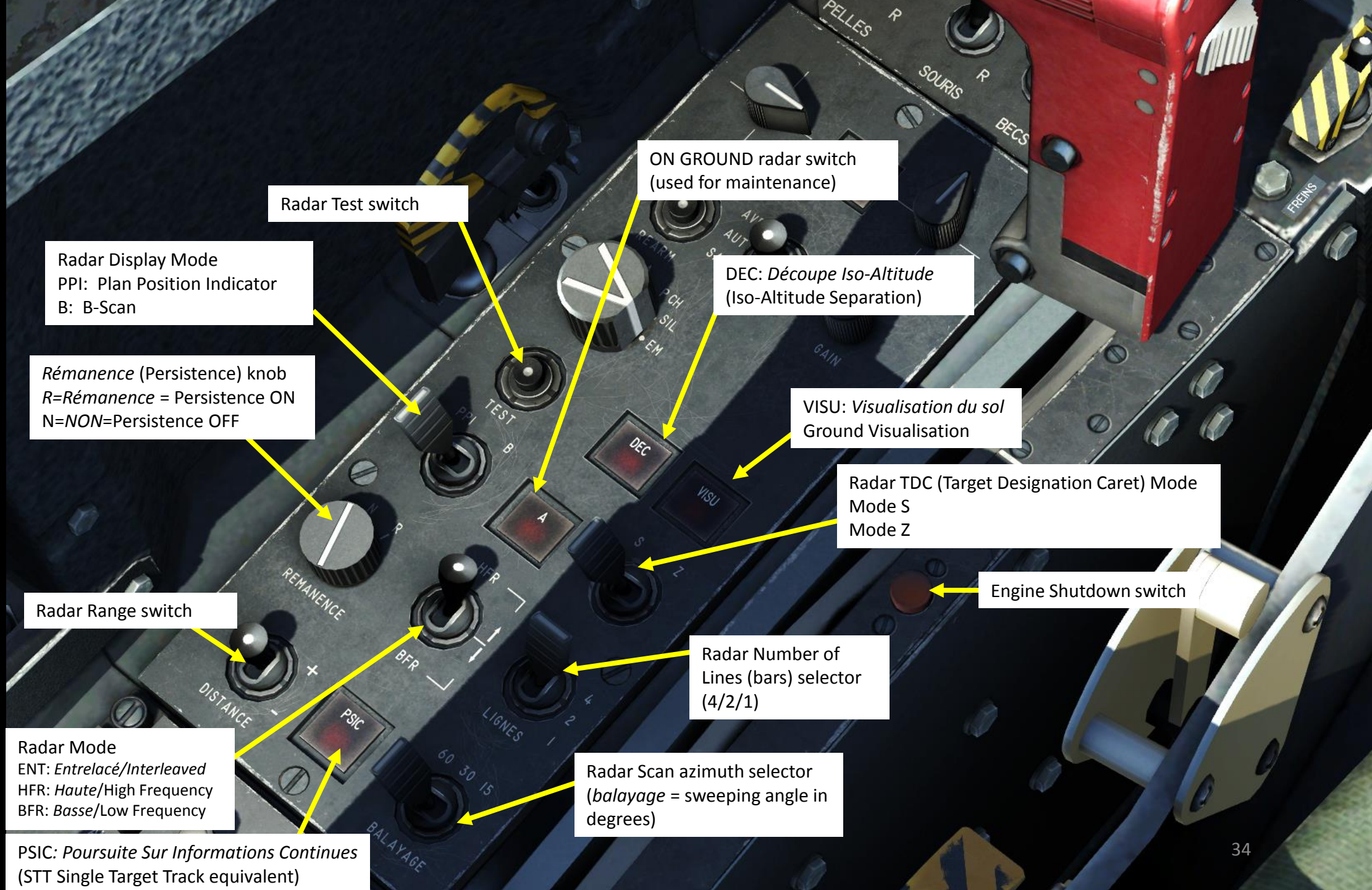
Becs: Wing Slats

Souris: Engine shockwave
cones

Anti-Skid Brake switch
(*Freins*)

Sortis: Out/Deployed
Auto: Automatic
Rentrés: In/Retracted

PART 3 – COCKPIT & GAUGES



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

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

Radar Range switch

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

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

Radar Test switch

ON GROUND radar switch
(used for maintenance)

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

VISU: Visualisation du sol
Ground Visualisation

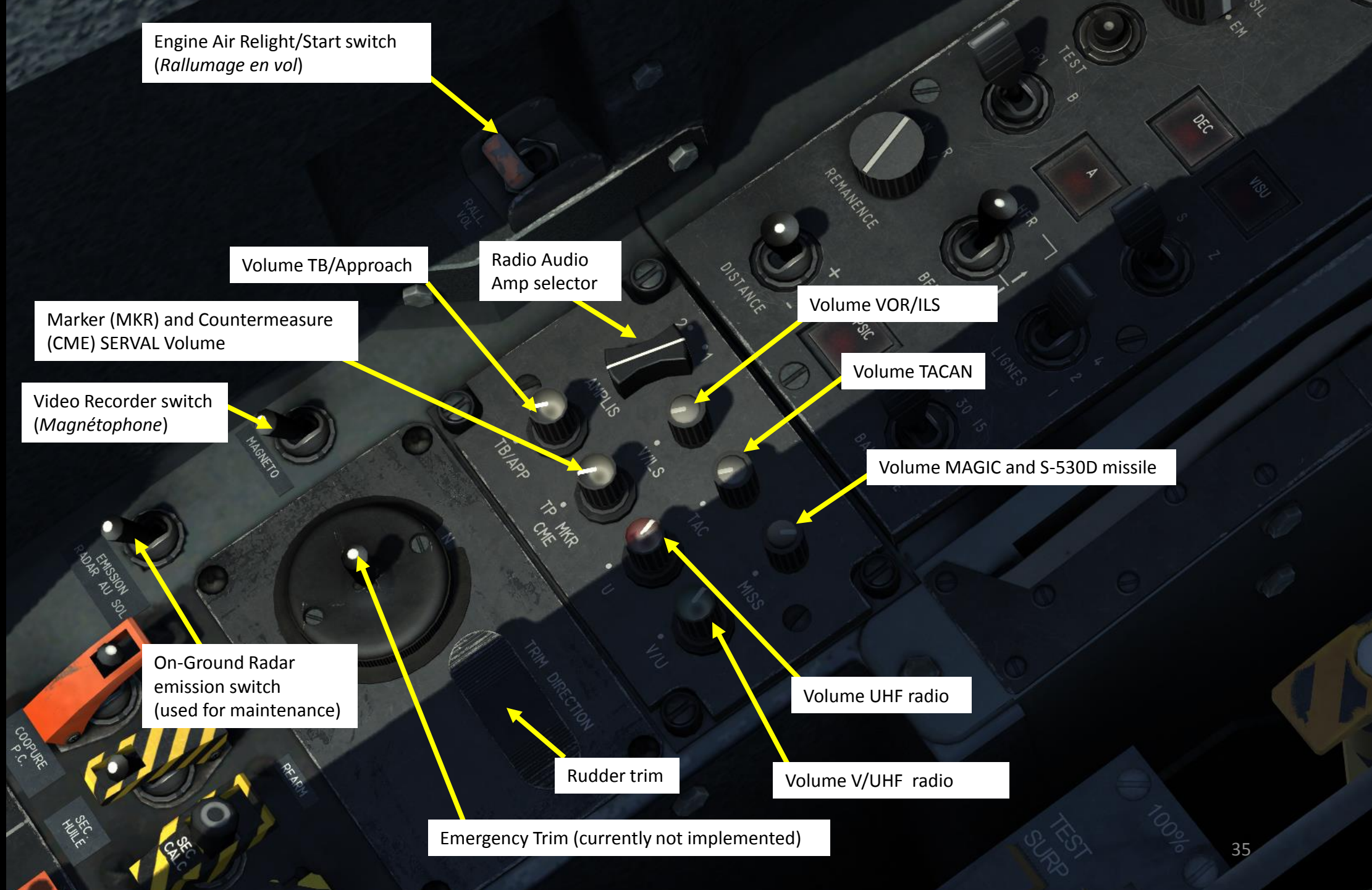
Radar TDC (Target Designation Caret) Mode
Mode S
Mode Z

Engine Shutdown switch

Radar Number of
Lines (bars) selector
(4/2/1)

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

PART 3 – COCKPIT & GAUGES



Engine Air Relight/Start switch
(Rallumage en vol)

Volume TB/Approach

Radio Audio
Amp selector

Marker (MKR) and Countermeasure
(CME) SERVAL Volume

Video Recorder switch
(Magnétophone)

Volume VOR/ILS

Volume TACAN

Volume MAGIC and S-530D missile

On-Ground Radar
emission switch
(used for maintenance)

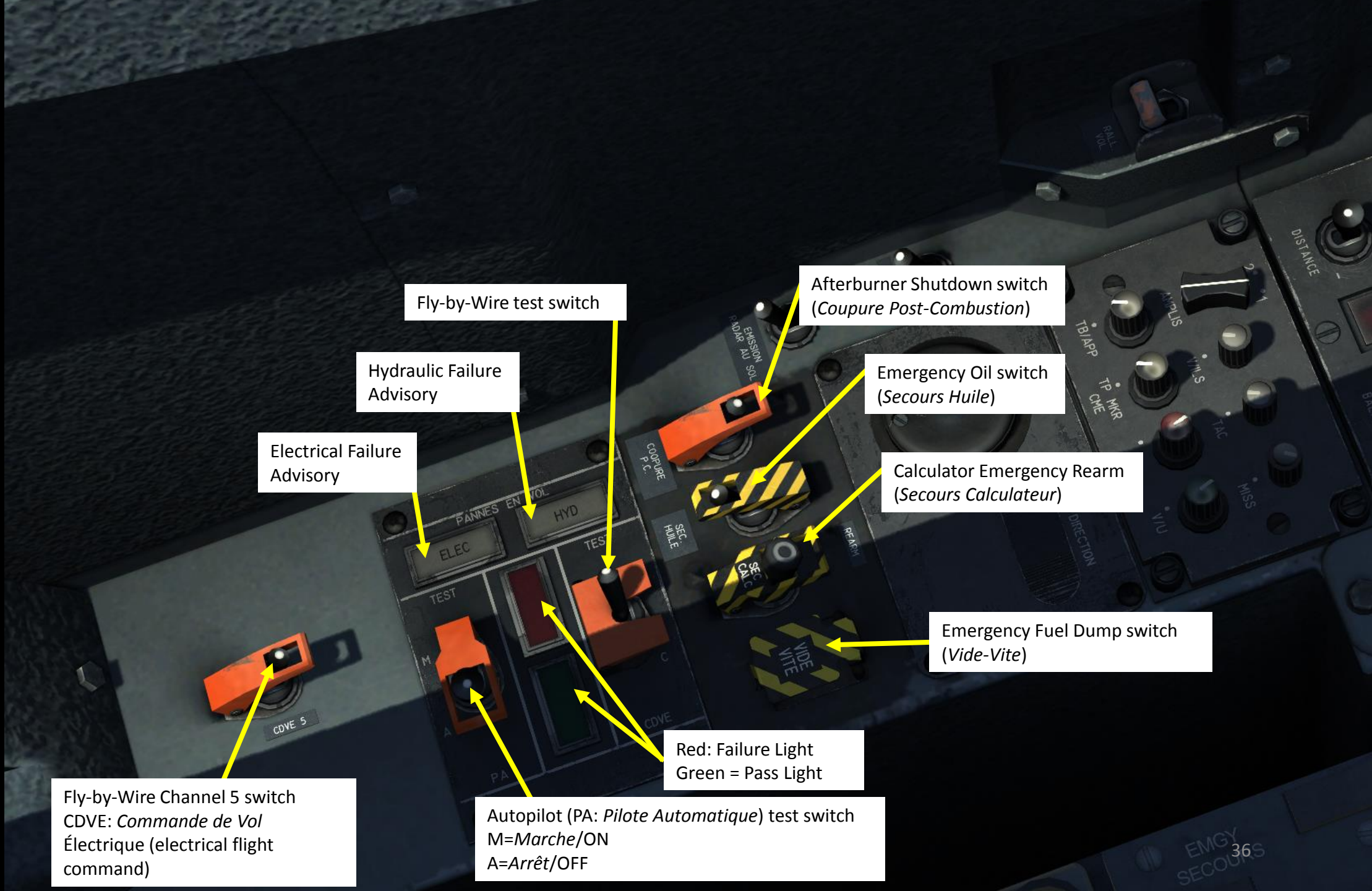
Volume UHF radio

Volume V/UHF radio

Rudder trim

Emergency Trim (currently not implemented)

PART 3 – COCKPIT & GAUGES



Fly-by-Wire test switch

Hydraulic Failure
Advisory

Electrical Failure
Advisory

Afterburner Shutdown switch
(*Coupure Post-Combustion*)

Emergency Oil switch
(*Secours Huile*)

Calculator Emergency Rearm
(*Secours Calculateur*)

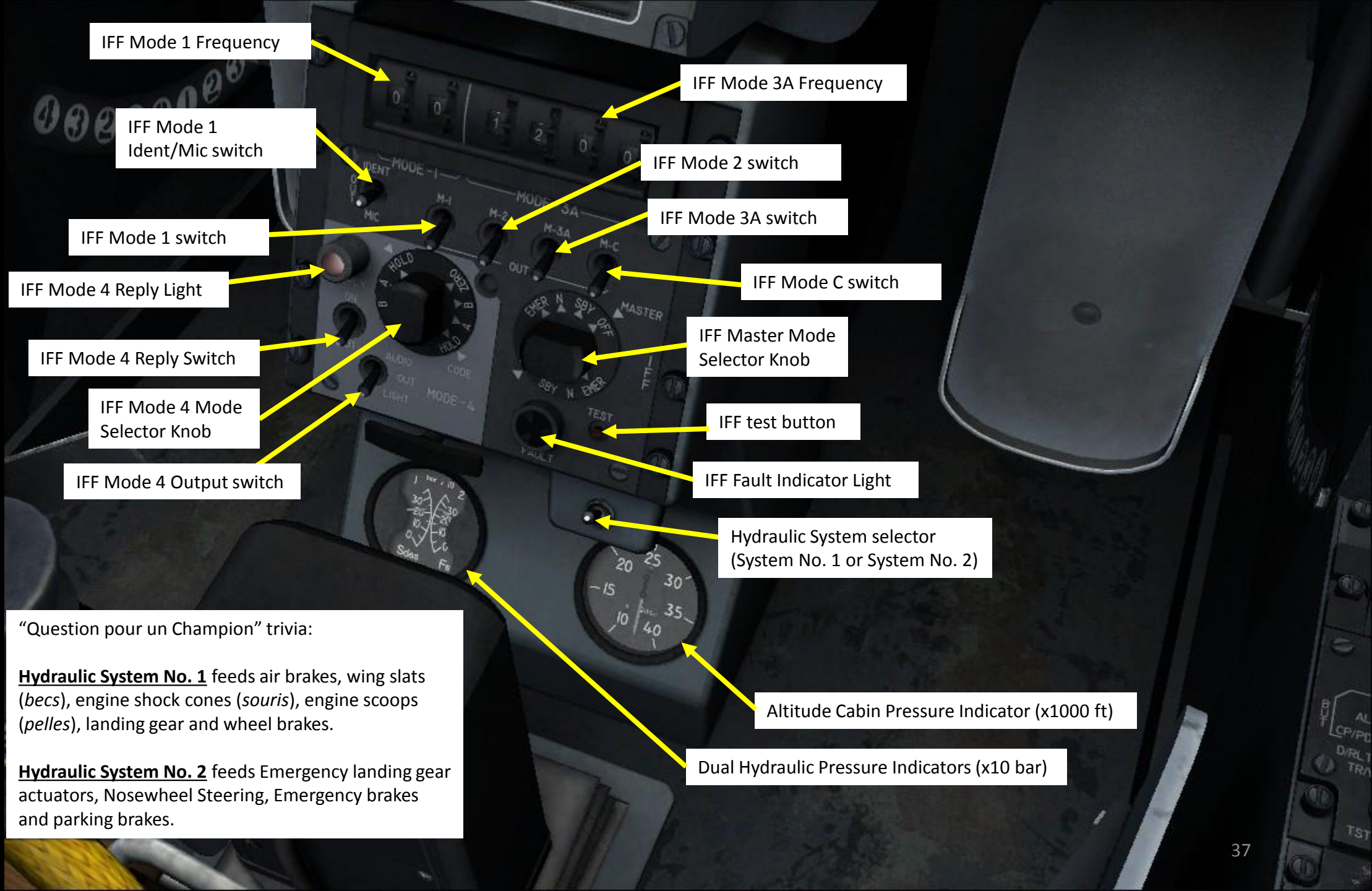
Emergency Fuel Dump switch
(*Vide-Vite*)

Red: Failure Light
Green = Pass Light

Autopilot (PA: *Pilote Automatique*) test switch
M=Marche/ON
A=Arrêt/OFF

Fly-by-Wire Channel 5 switch
CDVE: *Commande de Vol
Électrique* (electrical flight
command)

PART 3 – COCKPIT & GAUGES



IFF Mode 1 Frequency

IFF Mode 1
Ident/Mic switch

IFF Mode 1 switch

IFF Mode 4 Reply Light

IFF Mode 4 Reply Switch

IFF Mode 4 Mode
Selector Knob

IFF Mode 4 Output switch

IFF Mode 3A Frequency

IFF Mode 2 switch

IFF Mode 3A switch

IFF Mode C switch

IFF Master Mode
Selector Knob

IFF test button

IFF Fault Indicator Light

Hydraulic System selector
(System No. 1 or System No. 2)

Altitude Cabin Pressure Indicator (x1000 ft)

Dual Hydraulic Pressure Indicators (x10 bar)

“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.

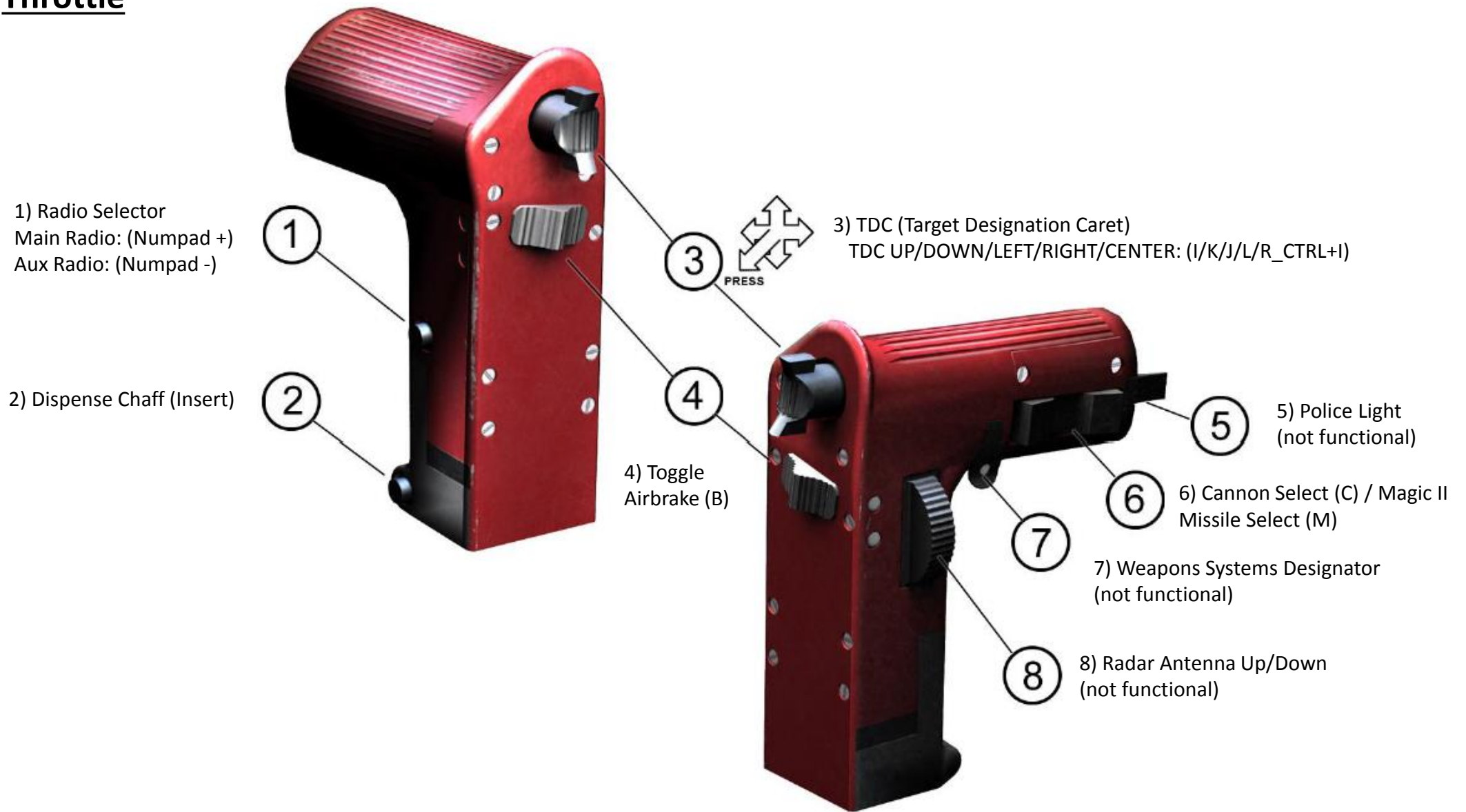
Hydraulic System No. 2 feeds Emergency landing gear actuators, Nosewheel Steering, Emergency brakes and parking brakes.

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



PART 3 – COCKPIT & GAUGES

Throttle



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

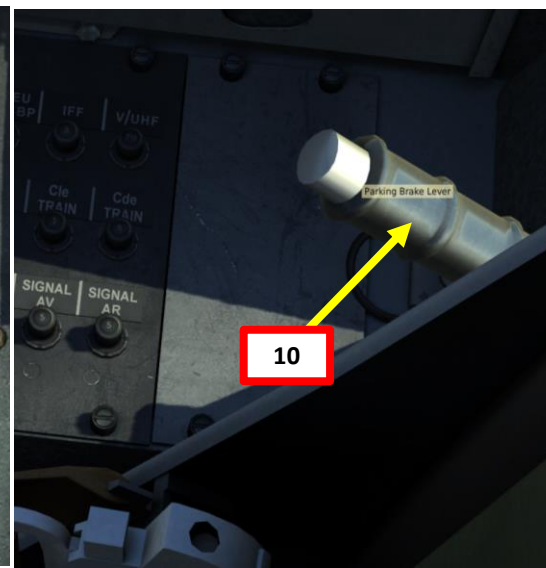
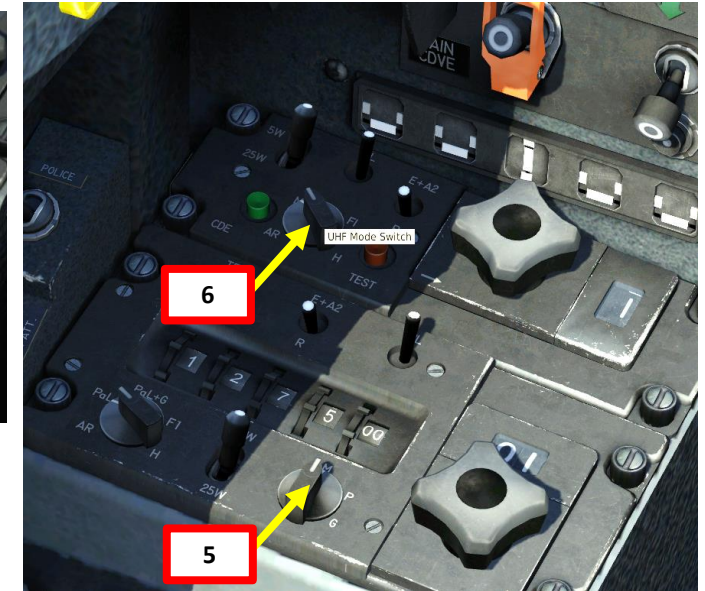
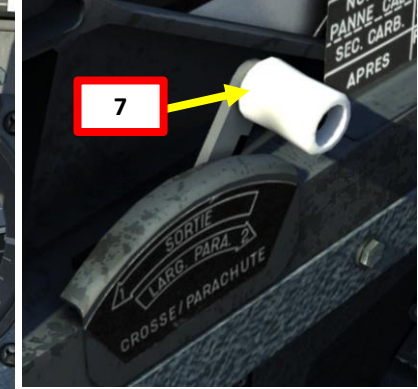
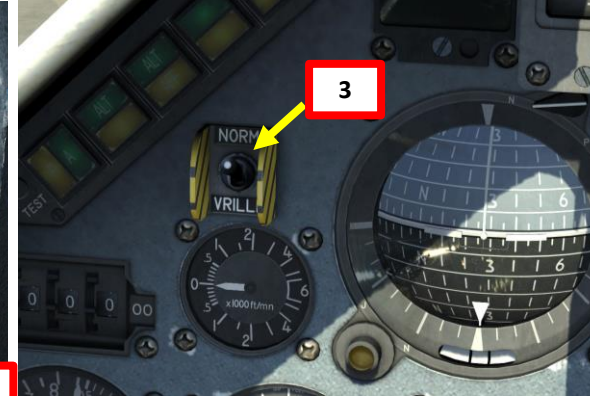
Seat Adjustment UP: L_SHIFT+S

Seat Adjustment DOWN: L_SHIFT+L_ALT+S

PART 4 – START-UP PROCEDURE

PRE-FLIGHT

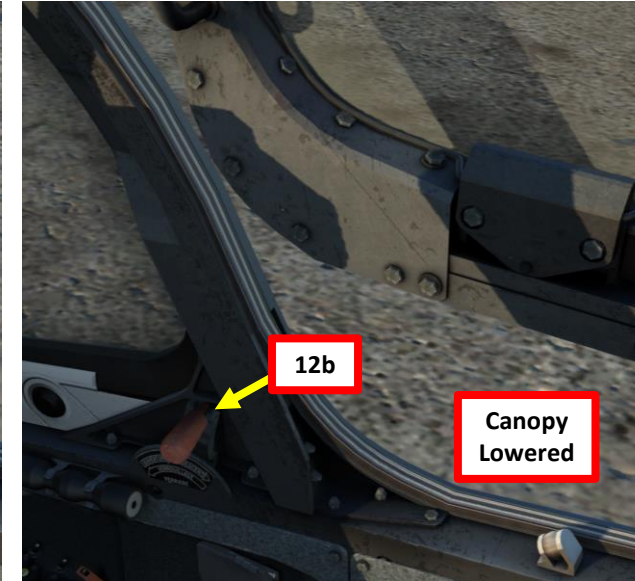
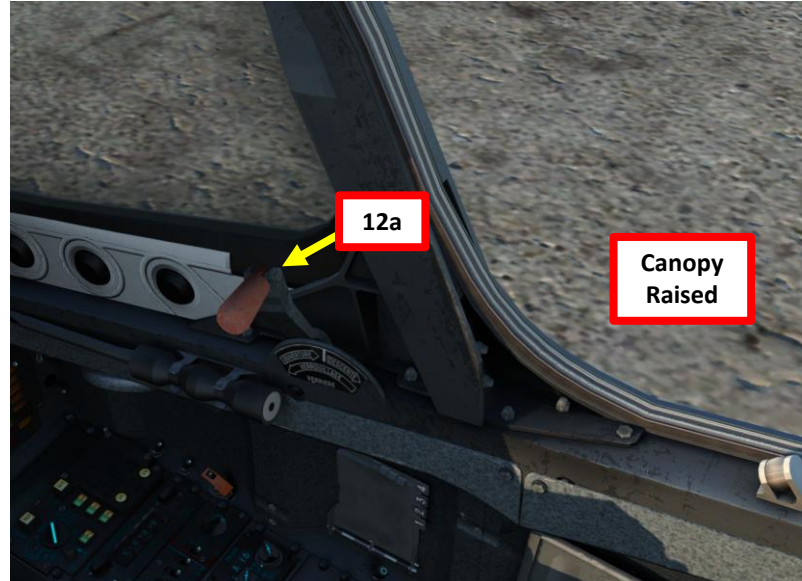
1. Fly-By-Wire Gain switch - NORMAL
2. Fly-By-Wire G Limiter Switch – As required
 - AA (UP) for Anti-Air missions (light payload)
 - CHARGES (DOWN) for bombing missions (heavy payload)
3. Fly-By-Wire NORM/VRILLE switch - NORMAL
4. *Pelles, Souris, Becs* switches – AUTO
5. V/UHF radio – **MARCHE** (ON)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



PART 4 – START-UP PROCEDURE

PRE-FLIGHT

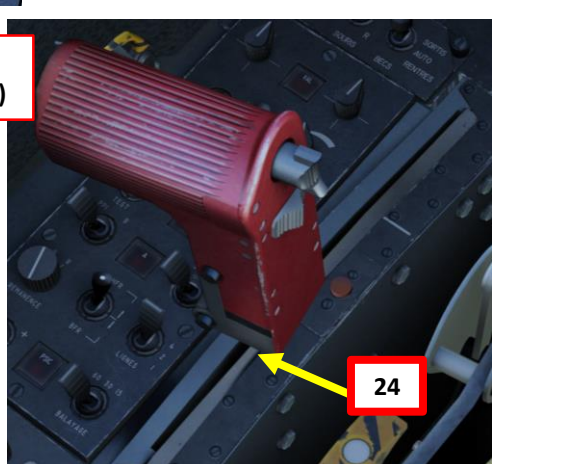
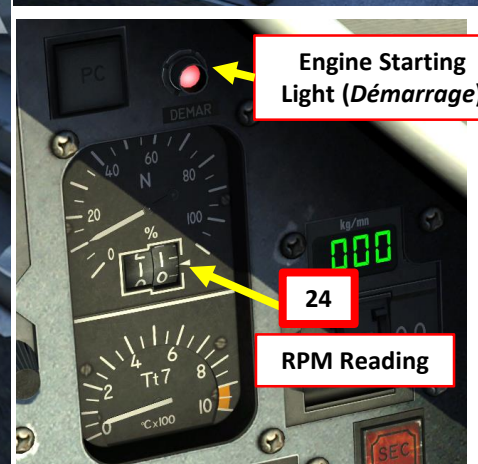
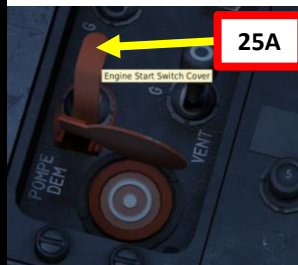
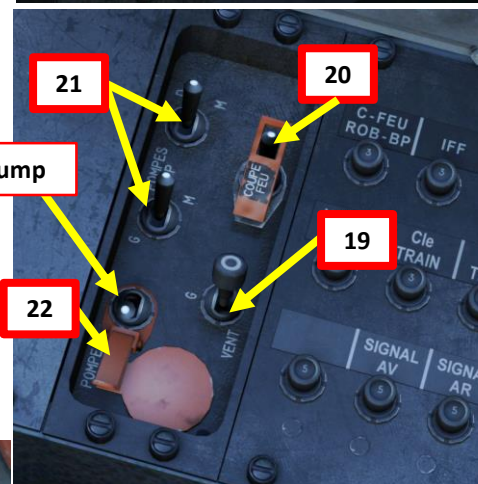
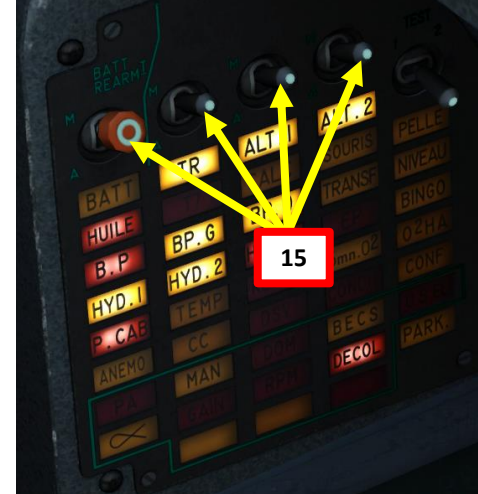
- 12. Lower Canopy – LEVER AFT (Right Click)
- 13. Close Canopy – PULL CANOPY REST HANDLE (Left Click on yellow hashed square on handle)
- 14. Lock and Seal Canopy – LEVER FWD (Left Click)



PART 4 – START-UP PROCEDURE

START-UP PROCEDURE

15. Set Battery to **MARCHE** (ON) and ensure Alternator #1, Alternator #2 and TR switches are set to **MARCHE** (ON) as well.
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)
19. Ignition/Ventilation selector – set to either **GAUCHE** (left) or **DROITE** (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 **MARCHE** (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.
25. Once RPM reaches 60%, set starter fuel pump (POMPE DÉMARRAGE)
 - A) Left click on the Ignition switch orange cover
 - B) Left click on the starter fuel pump switch



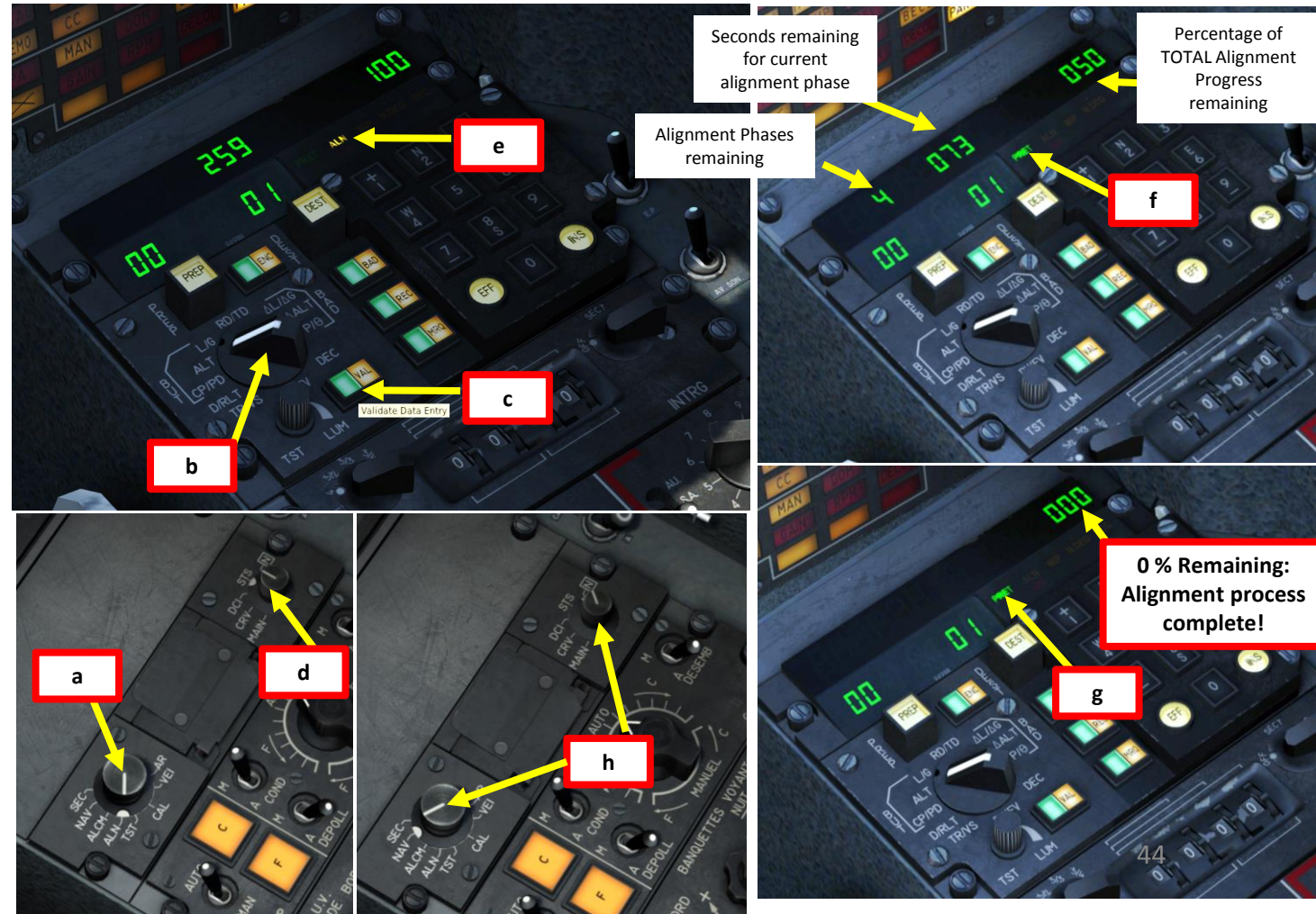
PART 4 – START-UP PROCEDURE

START-UP PROCEDURE

INS ALIGNMENT PROCESS

- On PSM (*Poste Sélecteur de Modes* = Mode Selector Panel), set INS mode to ALN (Alignment) to start alignment procedure of inertial systems.
- On PCN (*Poste de Commande de Navigation* = Navigation Control Panel), set INS parameter selector to L/G.
- press **VAL** button to validate data entry of the MIP (*Module d'Insertion de Paramètres* = Data Cartridge Insertion Module).
- 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.
- A yellow ALN (Alignment) caution will blink during the **first** alignment phase (Class 4, coarse alignment).
- "PRÊT" (Ready) caution will blink when **first** alignment phase is complete after 4 minutes.
- "PRÊT" (Ready) caution will remain illuminated when all remaining phases are complete after another 4 minutes.
- Set INS operation mode to "N" (Normal) when alignment phase is complete and set INS mode selector to "NAV". This step can be done right before you start taxiing.

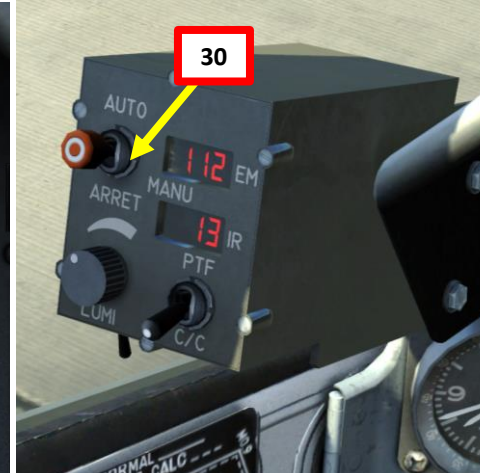
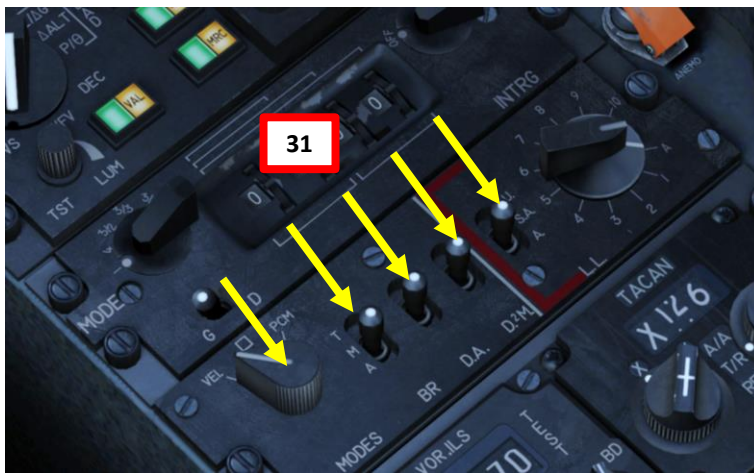
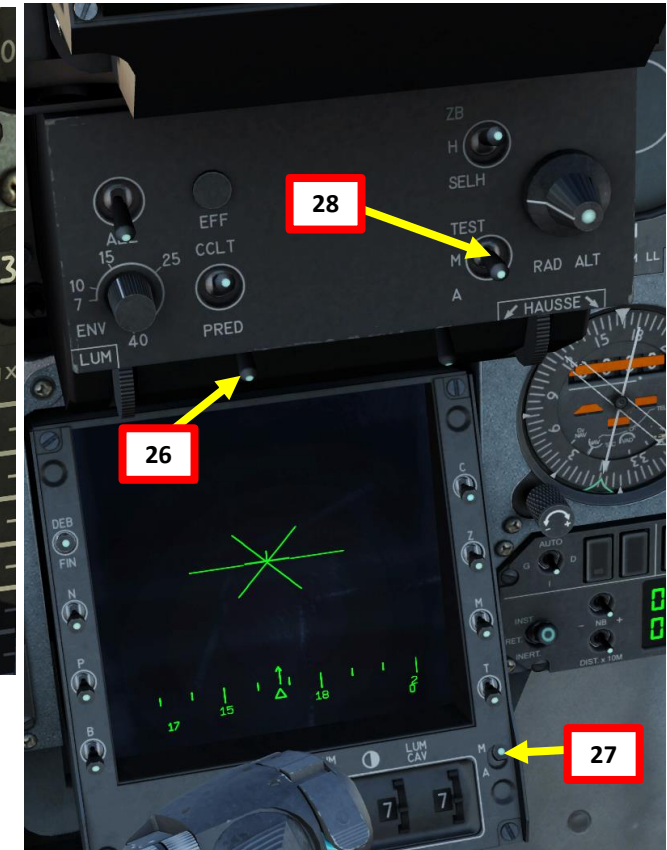
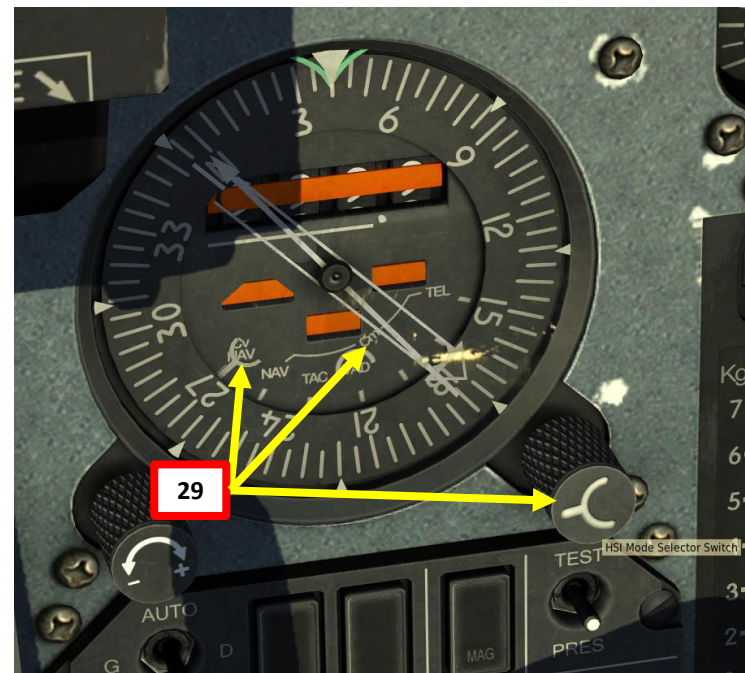
NOTE: During the alignment phase, you can enter or modify waypoint entries at the same time. Waypoint entry and editing will be explained in Section 13 (NAVIGATION).



PART 4 – START-UP PROCEDURE

START-UP PROCEDURE

26. VTH/HUD (Heads-Up Display) power switch – **MARCHE** (ON)
27. VTB/HDD (Heads-Down Display) power switch – **MARCHE** (ON)
28. Radar Altimeter Power switch - **MARCHE** (ON)
29. HSI Mode – set to NAV (Cm or Cv as desired)
30. Set countermeasures switch to **MANUAL** (middle)
31. On Electronic Warfare (EW) panel, set:
 - Set EW mode to **VEILLE** (Standby)
 - Set Jammer (*Brouilleur*) to **MARCHE** (ON)
 - Set RWR (*Détecteur d'Alertes*) to **MARCHE** (ON)
 - Set MLWS (*Détection de Départ de Missile* – Missile Launch IR Detector) to **MARCHE** (ON)
 - Set Flare Dispenser Mode (*Lance-Leurres*) to **MARCHE** (ON)



PART 4 – START-UP PROCEDURE

START-UP PROCEDURE

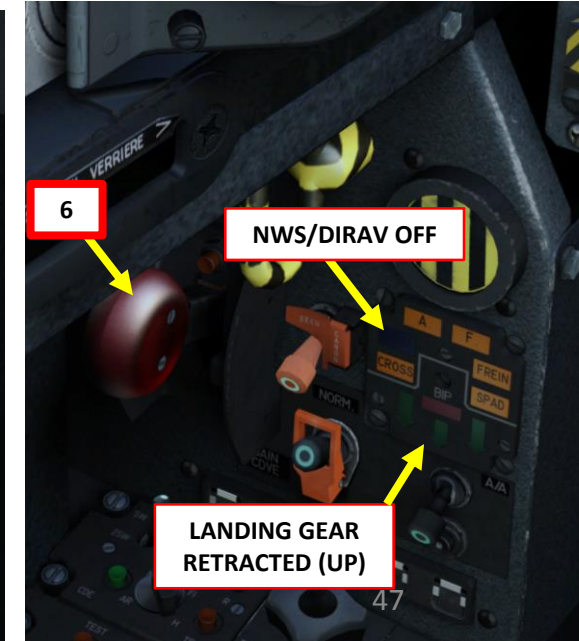
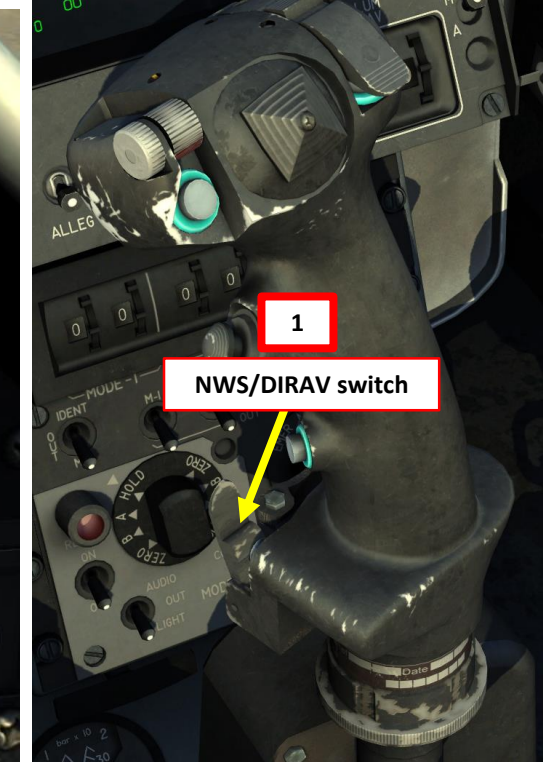
32. Test Autopilot system by flipping the PA test switch cover, setting switch to “M”, waiting for the green light and then setting the test switch back to “A” and closing the cover.
33. Test Fly-by-Wire system by flipping FBW test switch cover, setting switch to “C”, waiting for the green light, repeat 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. Release Parking Brake (DOWN)
36. Engage DIRAV Nosewheel Steering – Press S
 - DIRAV blue light means NWS is engaged
37. When INS alignment process is complete (see INS ALIGNMENT section), start taxiing.



PART 5 - TAKEOFF

TAKEOFF

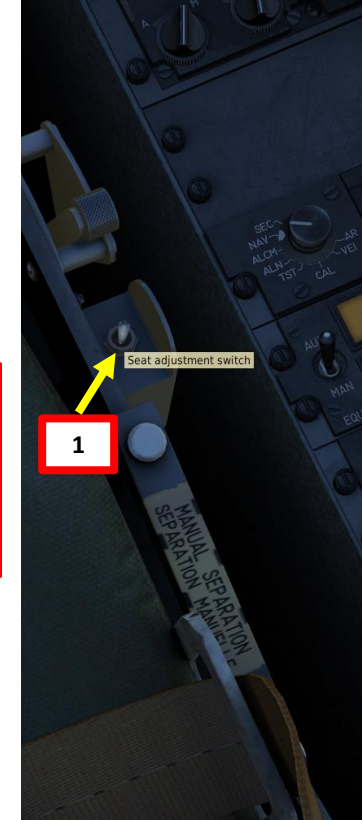
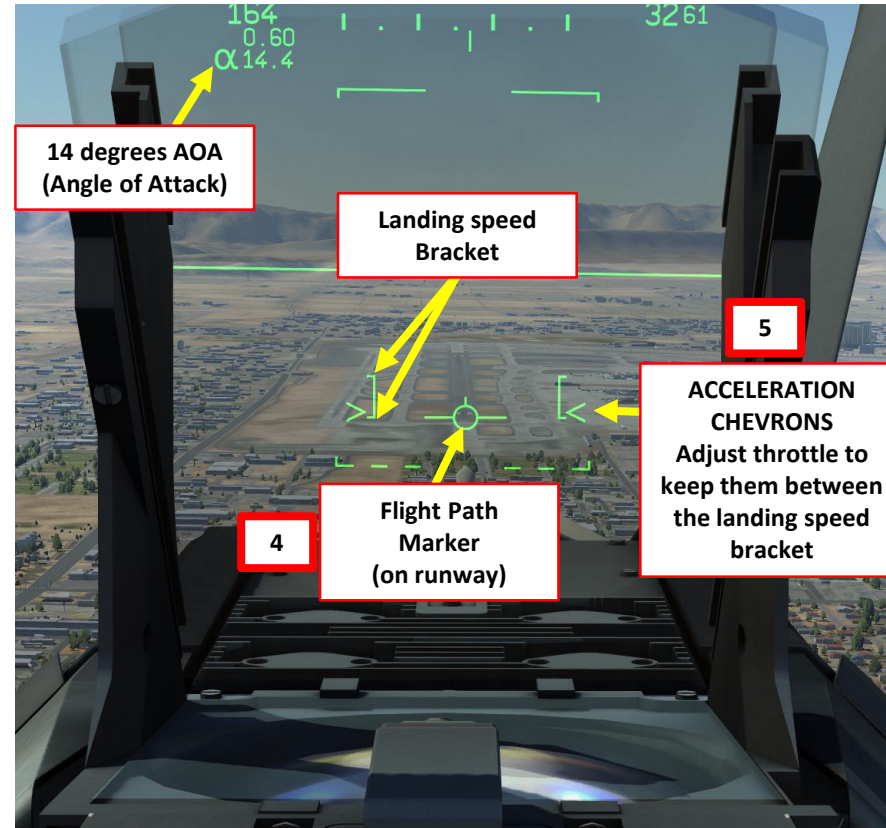
1. Taxi to the runway by using rudder pedals and toe brakes
 - Make sure your nosewheel steering (DIRAV) is engaged when taxiing
2. Once lined up on the runway, disengage nosewheel steering (DIRAV) by pressing S.
3. Hold Brakes, and apply 100% Throttle to check if engine spools up correctly and if TT7 is within safe range
4. Apply Full throttle (with Post-Combustion / Afterburner)
5. Rotate at 120 kts
6. Retract landing gear before you reach 260 kts



PART 6 – LANDING

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. Line up flight path marker and acceleration chevrons within the “landing speed” brackets by adjusting throttle and stick.
6. During touchdown, release stick to maintain your Angle of Attack and bleed speed in the process (your delta wing will act as a huge airbrake).
7. Apply brakes when you slowed down under 100 kts and push your nose down.
8. Engage Nosewheel Steering (DIRAV) when you slowed down under 40 kts.



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



PART 6 – LANDING

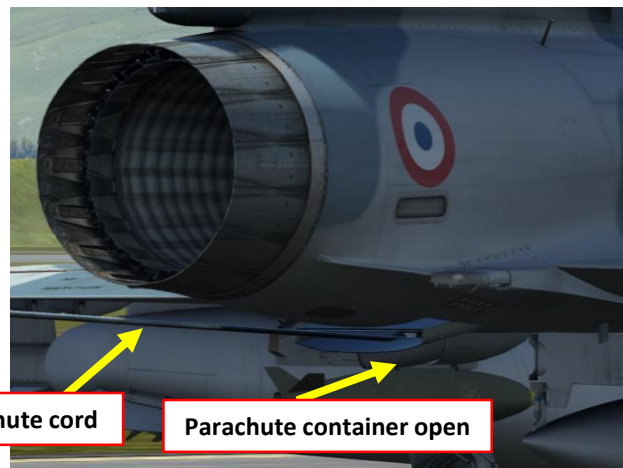
HOW TO USE THE DRAG CHUTE

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

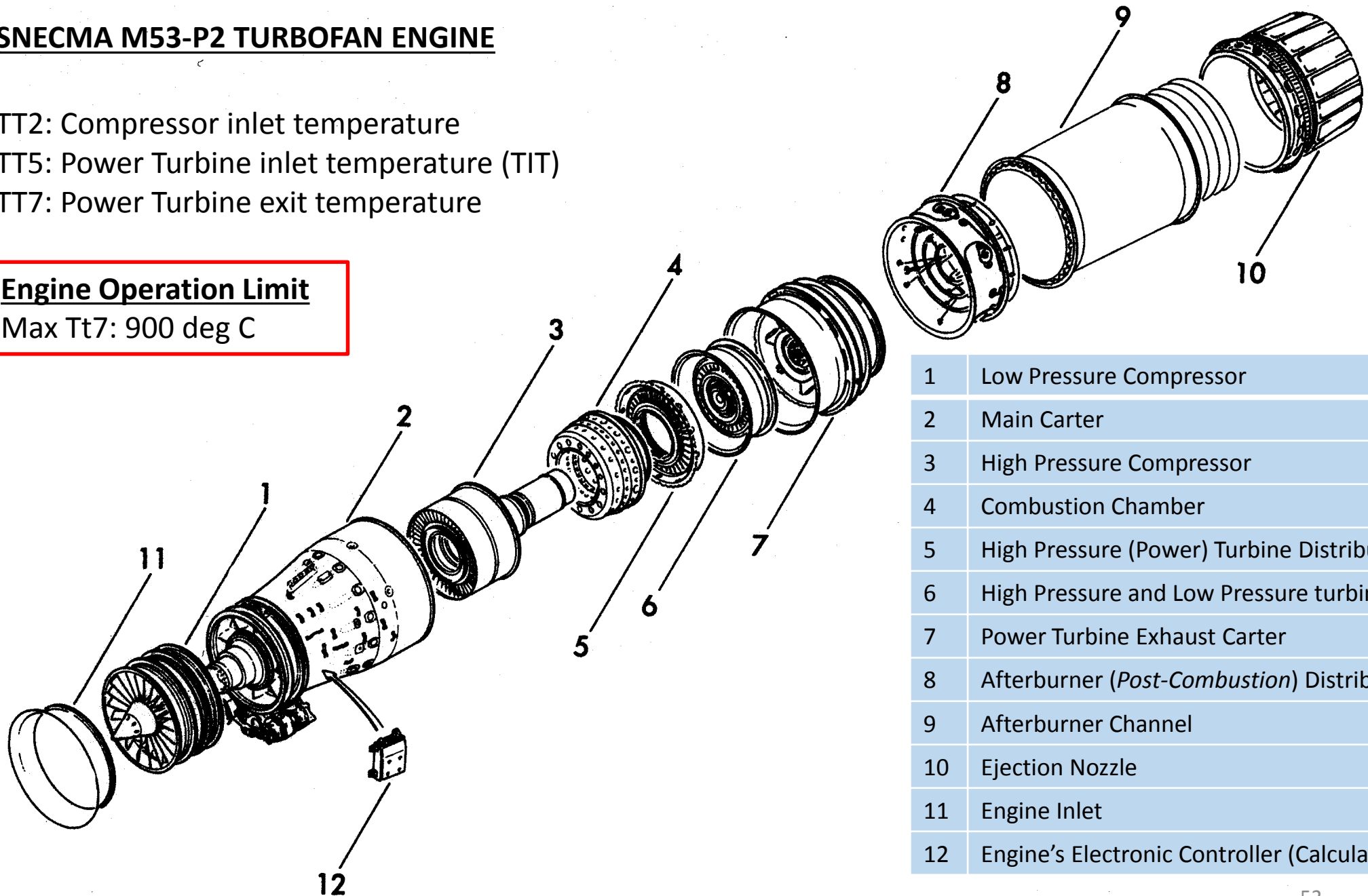
TT2: Compressor inlet temperature

TT5: Power Turbine inlet temperature (TIT)

TT7: Power Turbine exit temperature

Engine Operation Limit

Max Tt7: 900 deg C



PART 7 – ENGINE MANAGEMENT

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

PART 7 – ENGINE MANAGEMENT

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 (<i>Domaine de vol</i>)	BECS Slats functionality compromised
RPM Turbine RPM abnormal	DECOL Take-Off (<i>Décollage</i>) configuration incorrect

PART 7 – ENGINE MANAGEMENT

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)

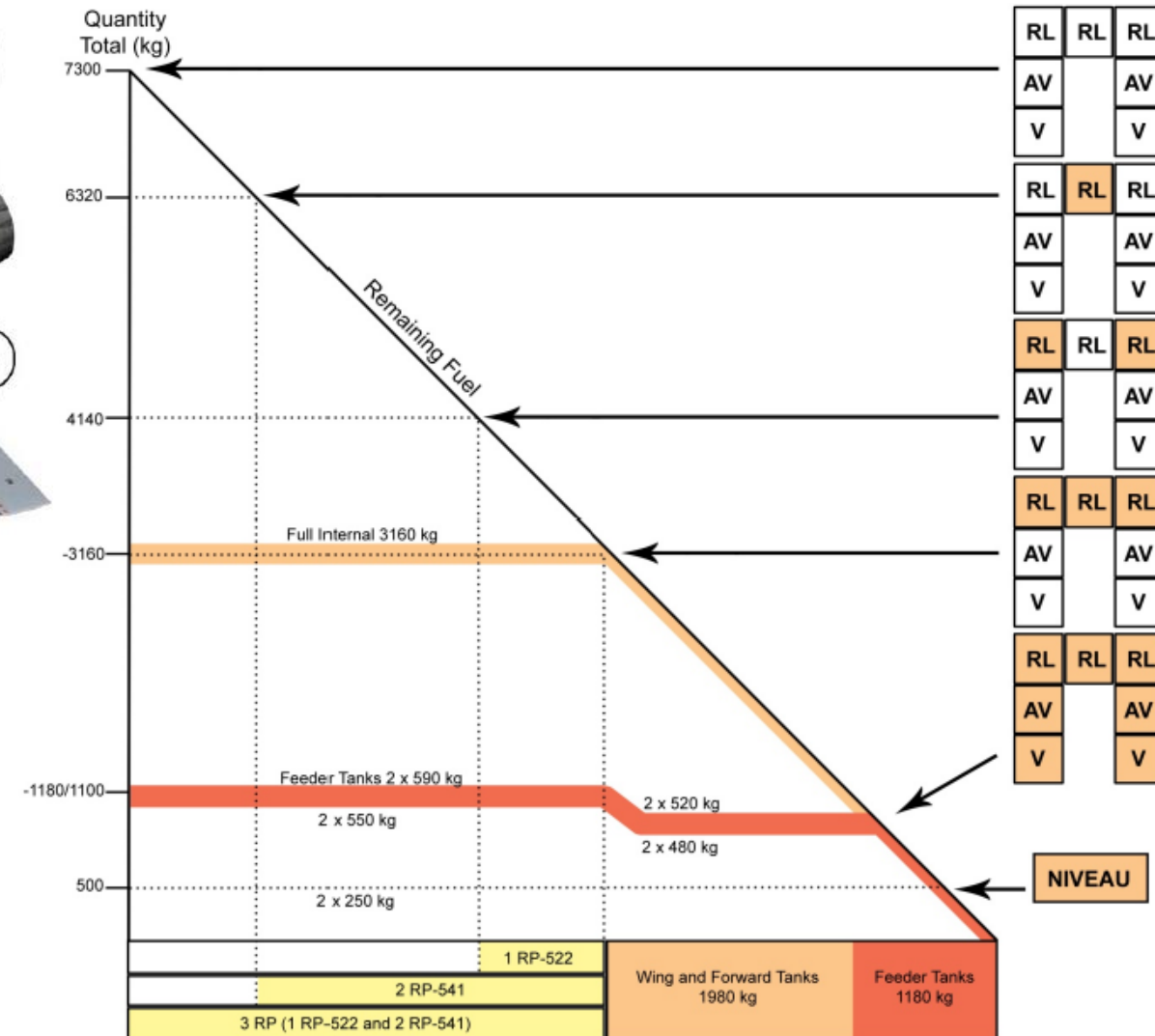
PARK.

Parking Brake Engaged

Fuel System

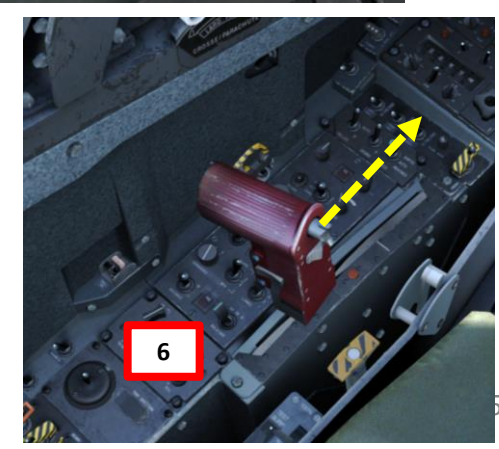
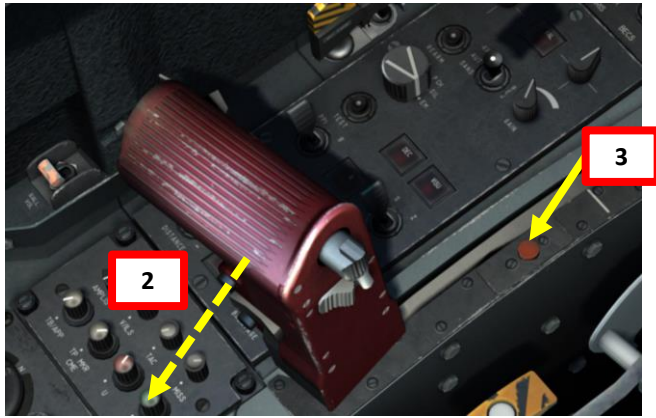
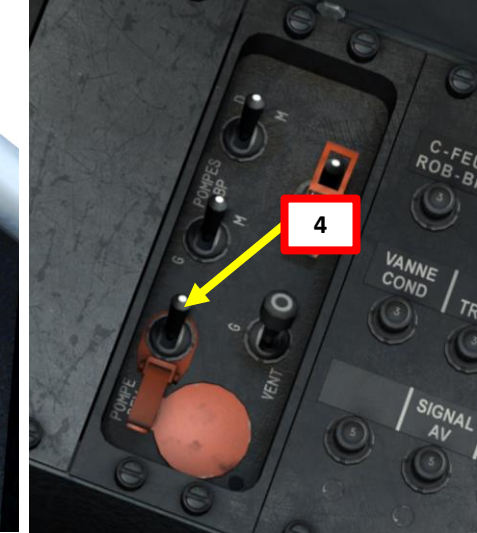


Description	Capacity			
	Kg	Lbs	US Gals	Liters
1 Right group forward tank	304.0	670.0	101.7	385.0
2 Right group wing tank	523.0	1154.0	175.0	662.5
3 Right group feeder tank	592.5	1306.0	198.1	750.0
4 Left group feeder tank	592.5	1306.0	198.1	750.0
5 Center tank	320.0	705.0	107.0	405.0
6 Left group forward tank	304.0	670.0	101.7	385.0
7 Left group wing tanks	523.0	1154.0	175.0	662.5
Total Internal fuel:	3160.0	6966.0	1056.6	4000.0
RP-522 centerline tank	995.0	2194.0	332.9	1300.0
Total Internal + RP-522 fuel:	4155.0	9160.0	1389.7	5260.0
RP-541 wing tank (each)	1580.0	3482.3	528.6	1700.0
Total Internal + 3 ext. fuel:	7315.0	16122.26	2446.9	8660.0



Engine Flameout – AIR ENGINE RESTART PROCEDURE

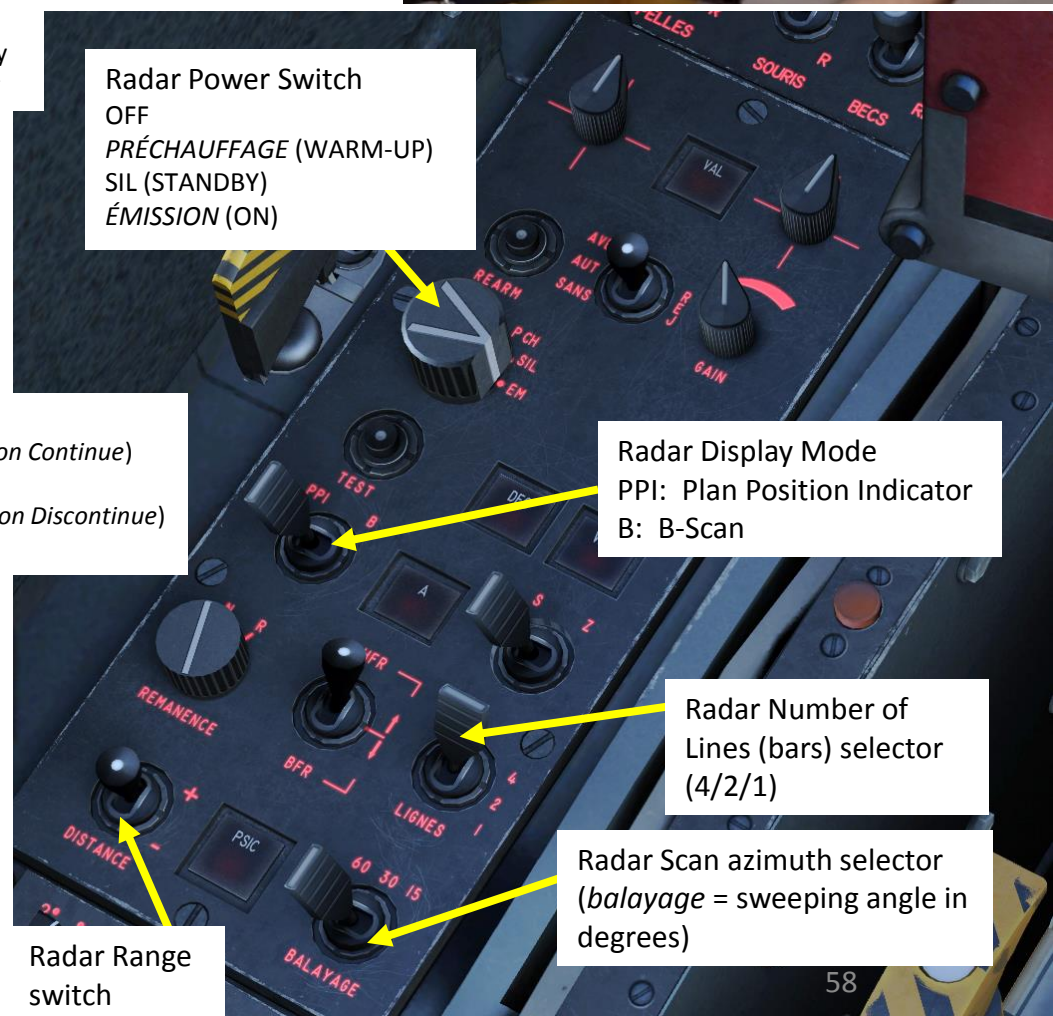
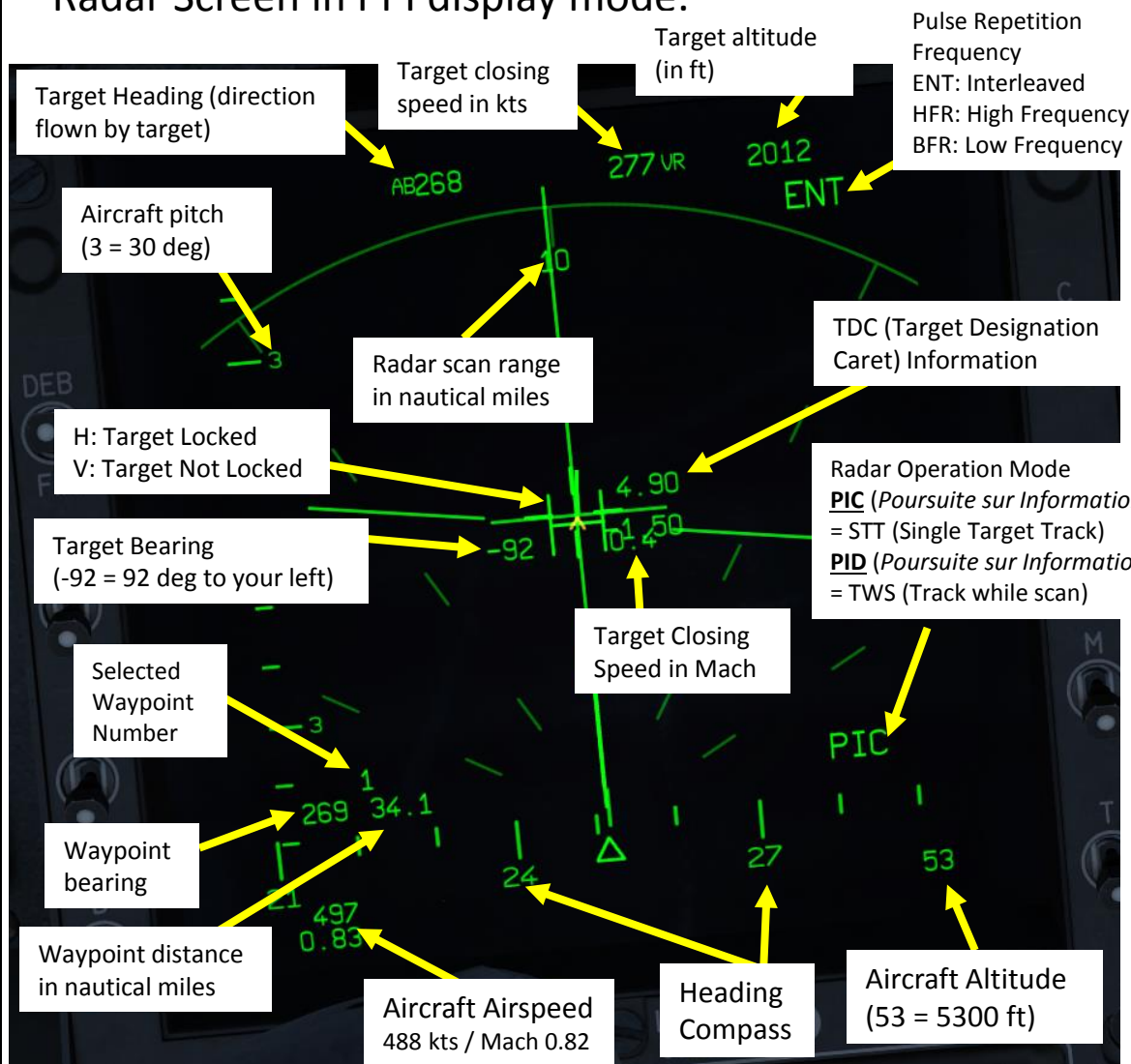
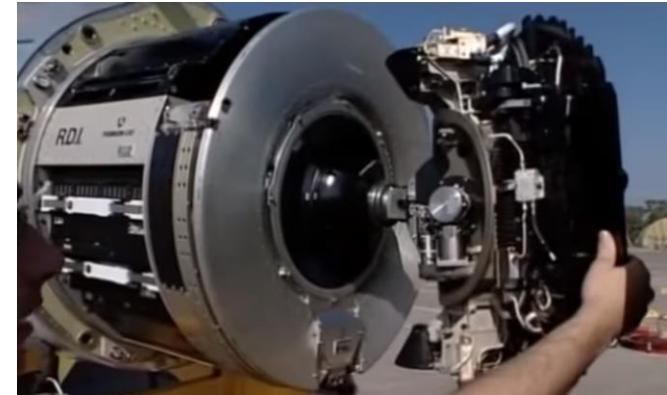
1. An engine flameout may occur if you are flying inverted for more than 15 seconds (engine will be starved of fuel because of gravity) or. You will notice a sudden loss in RPM and fuel flow.
2. Point the aircraft's nose down to gain airspeed, set throttle to IDLE (fully aft).
3. Click the ENGINE SHUTDOWN button to set throttle to OFF position.
4. Set the FUEL STARTER PUMP switch to **MARCHE** (ON).
5. Set the ENGINE RELIGHT switch to ON (FWD).
6. Slowly push throttle forward until RPM reaches 50 % N1 or more.
7. When engine is relit, set ENGINE RELIGHT switch to OFF (AFT).



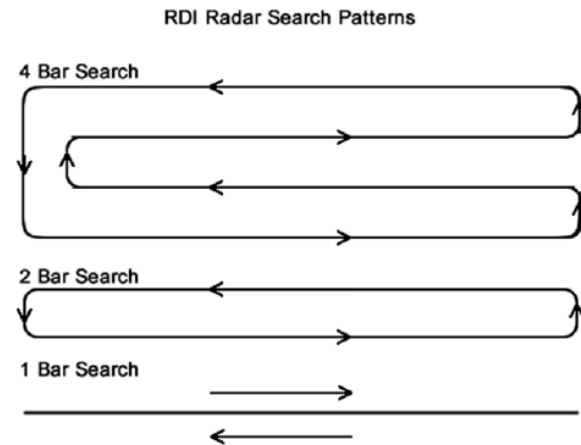
PART 8 – RADAR OPERATION

TDI RADAR INTRODUCTION

The radar installed on the Mirage 2000C is the RDI (*Radar Doppler à Impulsions*) developed by Thomson-CSF (now known as Thales). The picture below shows the VTB (*Visualisation Tête-Basse* = Heads-Down Display) Radar Screen in PPI display mode.



RADAR PERFORMANCE



Note: Each line represents a 3° diameter cone.
Figure 24 RDI radar antenna search pattern.

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.

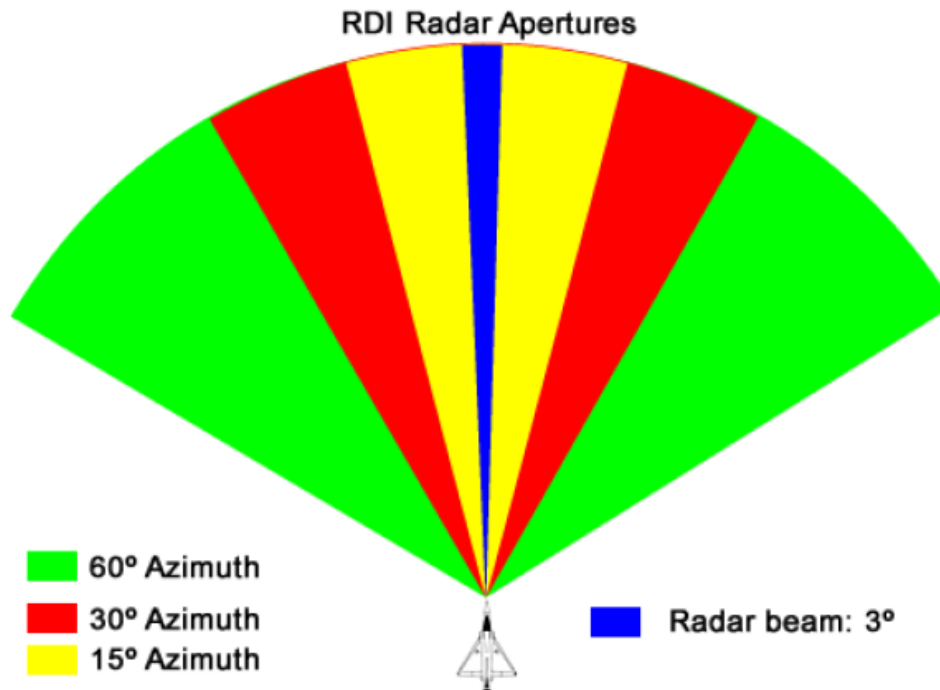


Figure 22 Horizontal Radar aperture

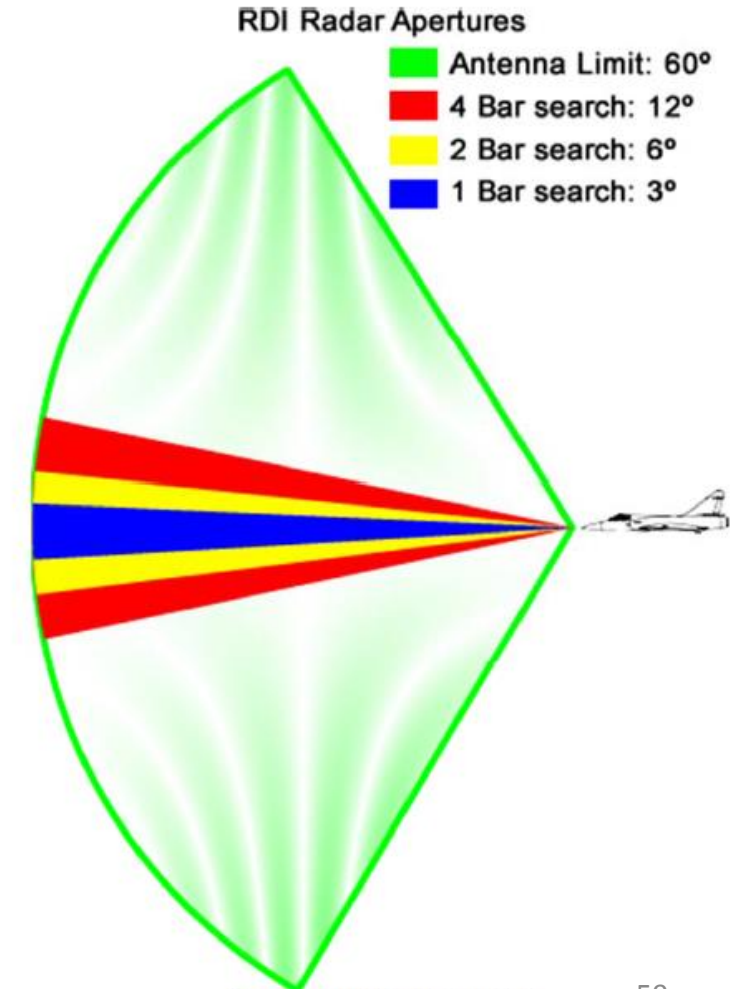


Figure 23 RDI radar vertical coverage

PART 8 – RADAR OPERATION

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



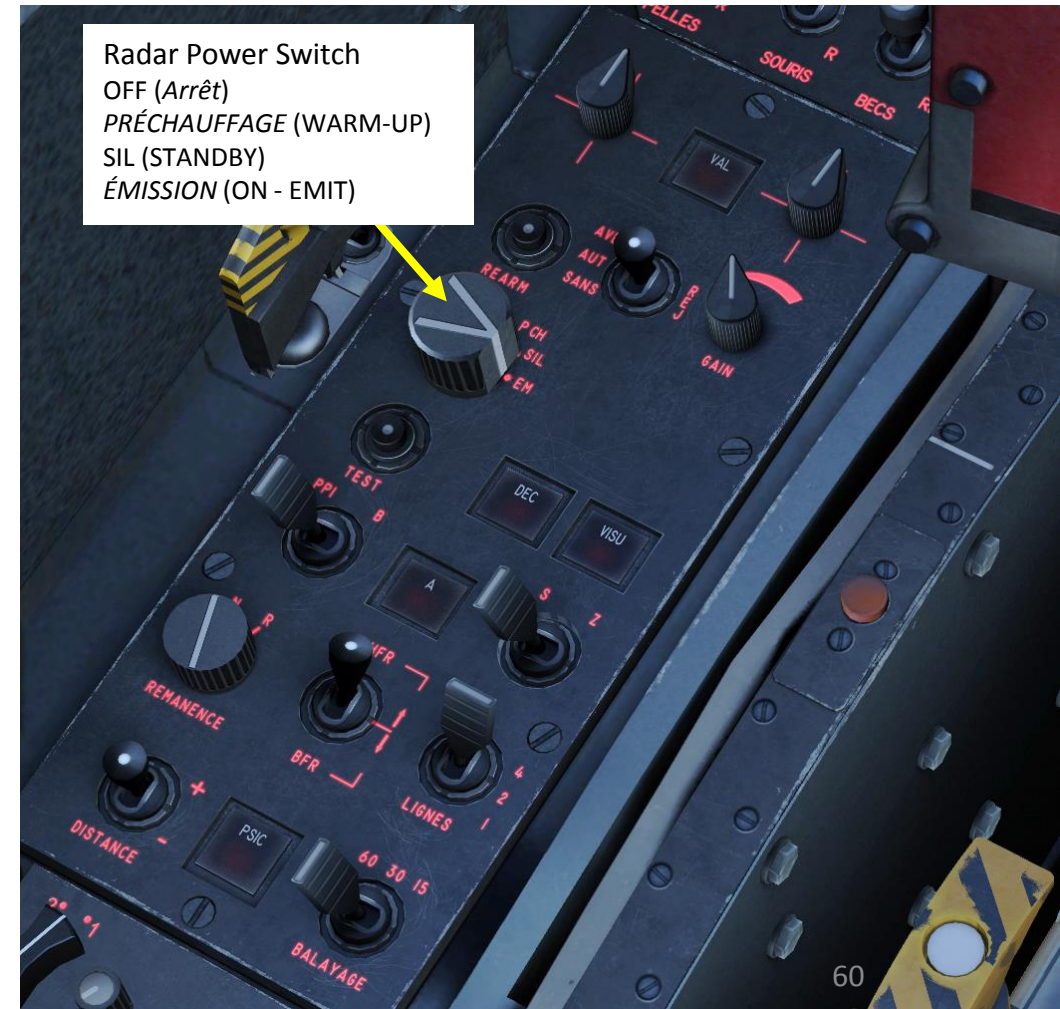
WARM-UP Mode



STANDBY Mode



EMISSION Mode



PART 8 – RADAR OPERATION

RADAR SCAN MODES RWS VS TWS VS STT

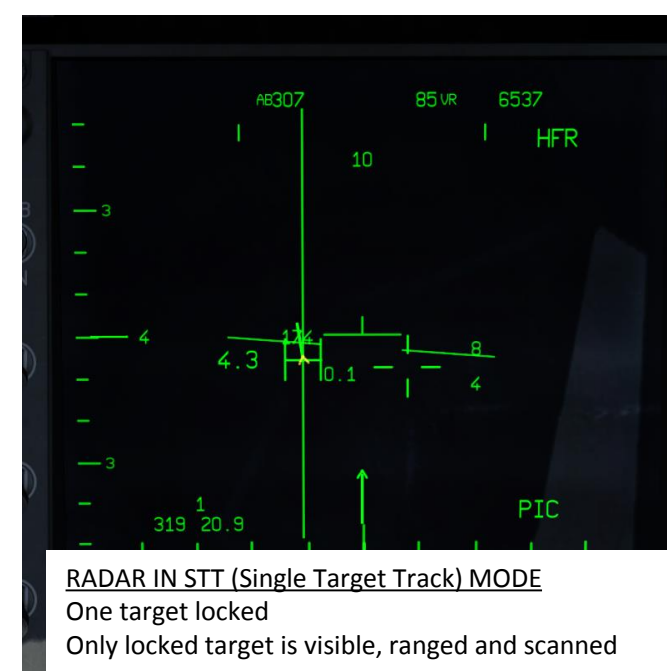
RWS: stands for “Range While Scan”. The antenna follows the designated search pattern and informs you of all the tracks discovered in one sweep. One sweep meaning completing its search pattern as indicated by the bars selection. The RDI only provides the following information: range, azimuth and closing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

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.

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.



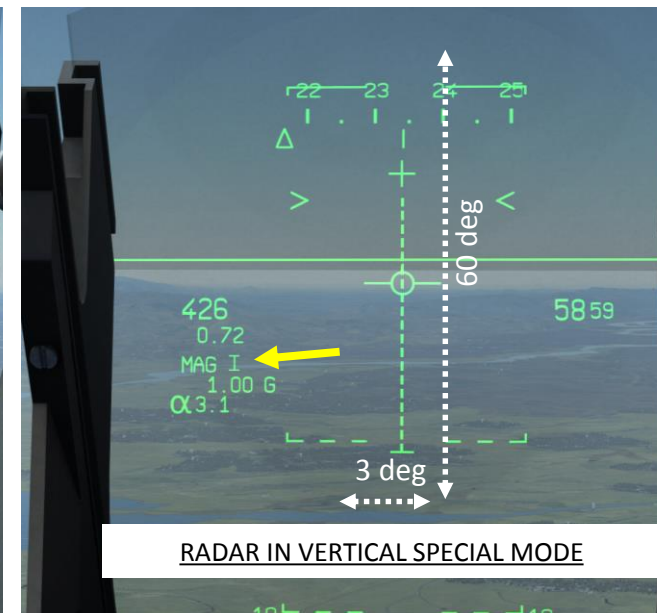
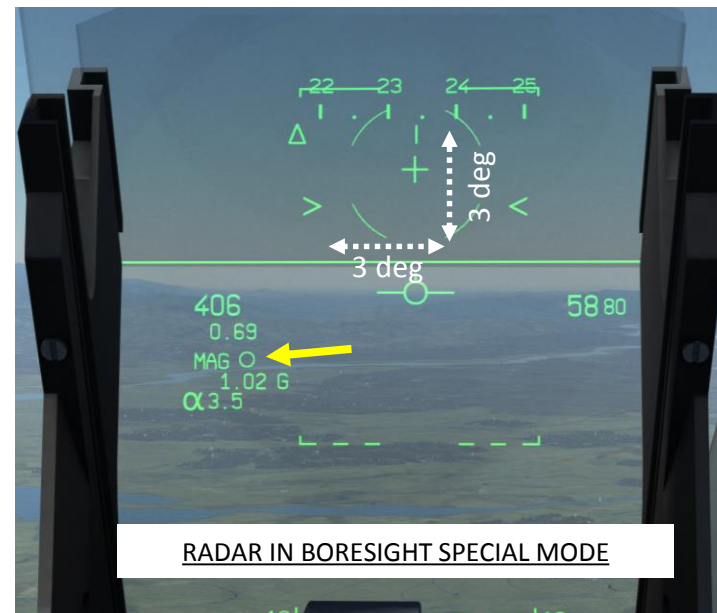
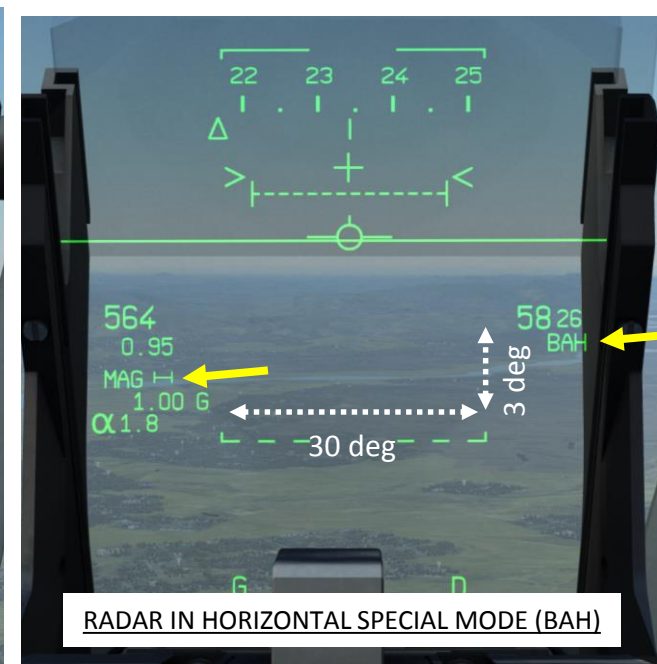
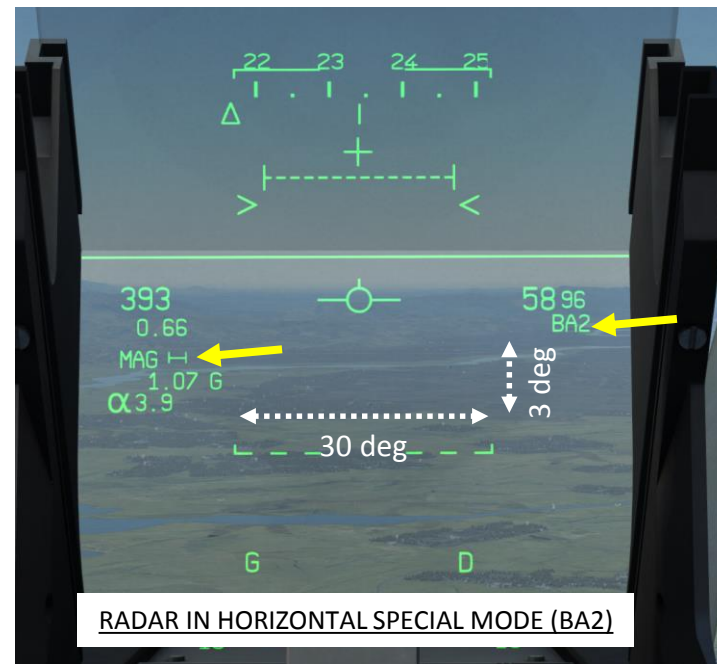
RADAR SPECIAL MODES: HORIZONTAL / VERTICAL /BORESIGHT

There are three “special radar modes” used for short range combat: **Horizontal**, **Vertical** and **Boresight**. You can cycle through them using the **SPECIAL MODES FWD/AFT** controls on your HOTAS.

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).

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 by slaving their seekers to the antenna.

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.

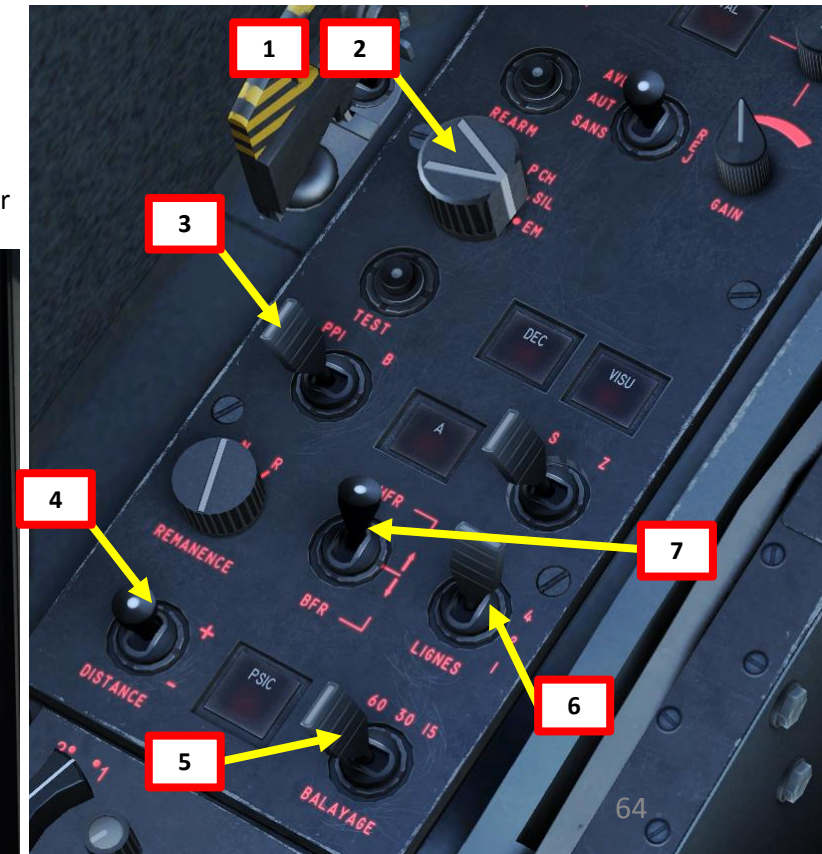


PART 8 – RADAR OPERATION

RADAR OPERATION TUTORIAL

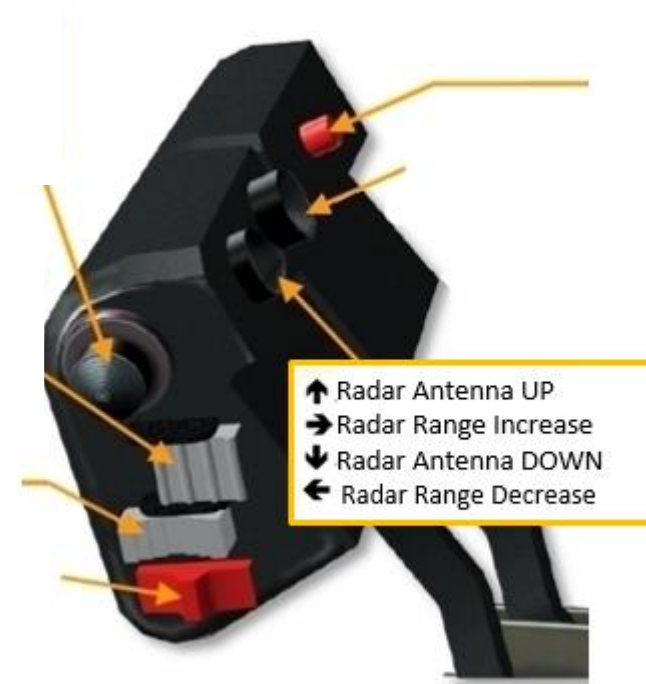
This short tutorial will show you how to turn on your radar and lock a target.

1. ON GROUND: Set Radar Power switch to PCH (Warm-Up) for 3 minutes. “P” letter on the VTH 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 **EMISSION** (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
10. Lock target using “Target Lock” control on joystick (ENTER) by default.
 - You can unlock target using the “Target Unlock” control on joystick (BACKSPACE).
11. Congratulations, you now have a radar lock! Note: A square should also appear on your HUD on your locked target.



PART 8 – RADAR OPERATION

MY RADAR CONTROL SETUP

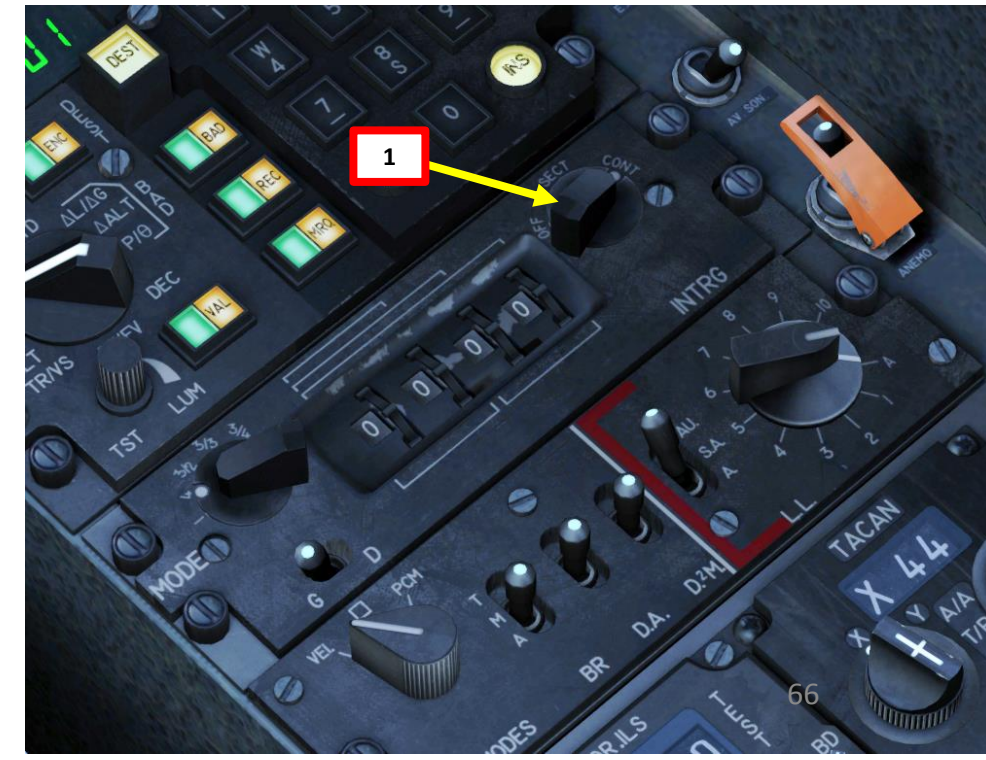
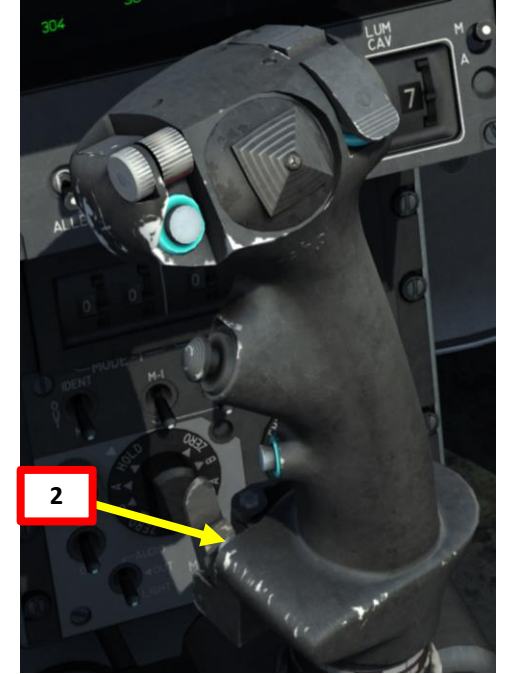


PART 8 – RADAR OPERATION

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 CONT (Middle position **between** OFF and SECT) as shown on picture.
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.



PART 8 – RADAR OPERATION

RADAR LINGO AND TERMINOLOGY

- BANDIT: Identified Enemy Aircraft
- BOGEY: Unidentified Aircraft
- SPIKE: Air-to-Air radar is locked on you
- MUDSPIKE: Ground-to-Air radar is locked on you (most likely a SAM site)
- BUDDY SPIKE: Friendly radar is locked on you
- NAILS: RWR contact, which emits radar waves but does not have a radar lock on you
- FOX 1: semi-active radar missile (27R/ER + AIM-7)
- FOX 2: heat-seeking infrared missile (27T/ET + AIM-9 + R-73/60)
- FOX 3: active radar missile, meaning the missile tracks to an aircraft's radar up to a certain distance, then it's 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

PART 9- OFFENCE WEAPONS & ARMAMENT



THE WEAPONS

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

MISSILES			
WEAPON	TYPE	RANGE	COMPARABLE TO
<i>MATRA</i> R550 MAGIC II	Infrared guided missile	0.25 to 8 nautical miles (500 m to 15 km)	AIM-9M Sidewinder
<i>MATRA</i> 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 (<i>Bombe Anti-Piste</i>)		

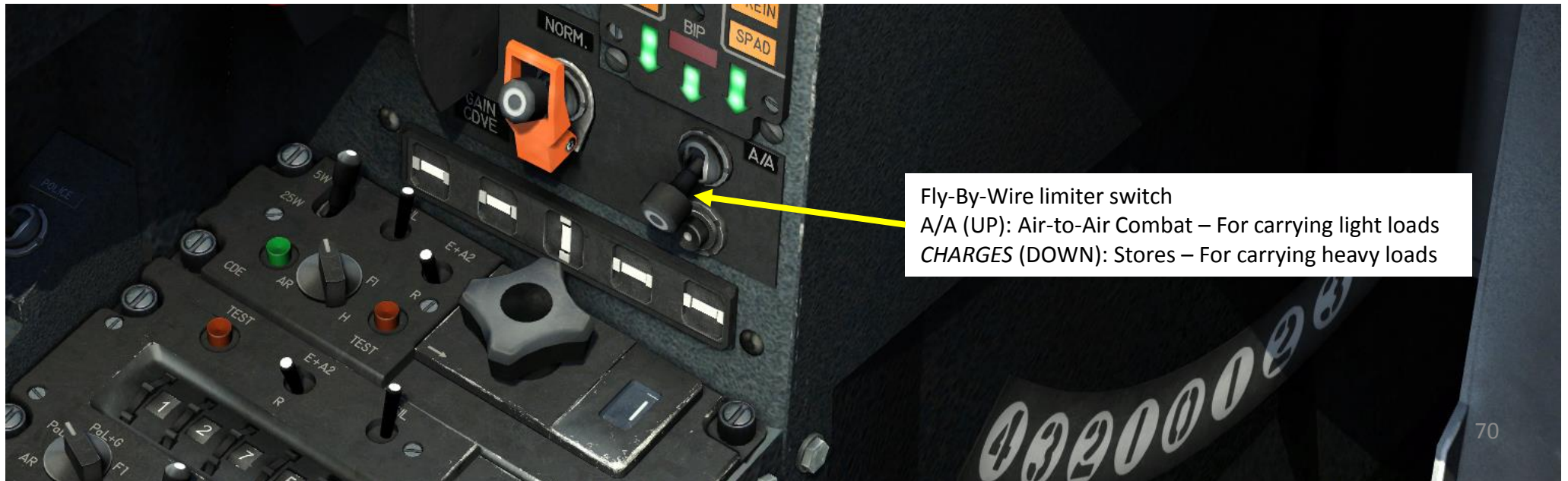
GUNS		ROCKETS	
WEAPON	TYPE	WEAPON	TYPE
2 x <i>DEFA</i> 554	30 mm revolver cannons (125 rounds each)	<i>MATRA</i> SNEB rocket pod	18 x 68mm unguided rockets per pod

SOME 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:

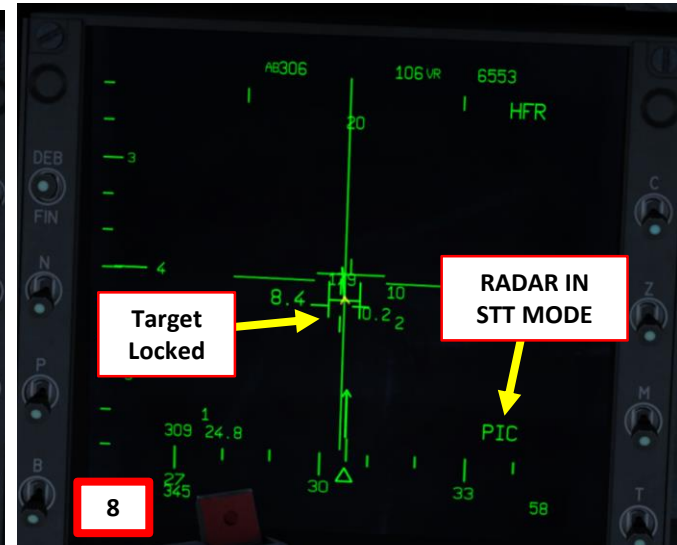
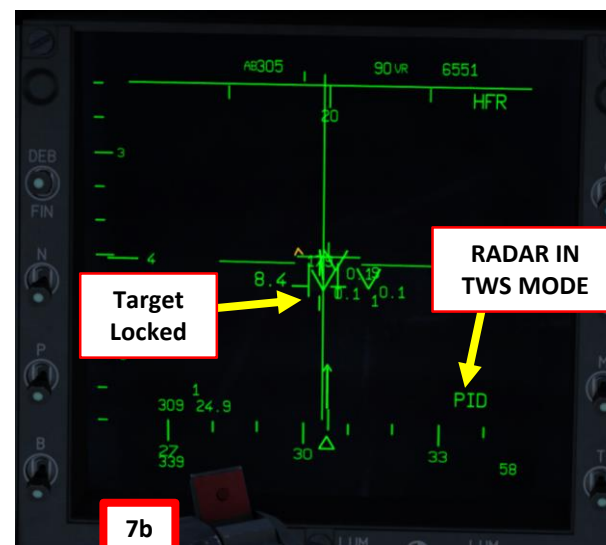
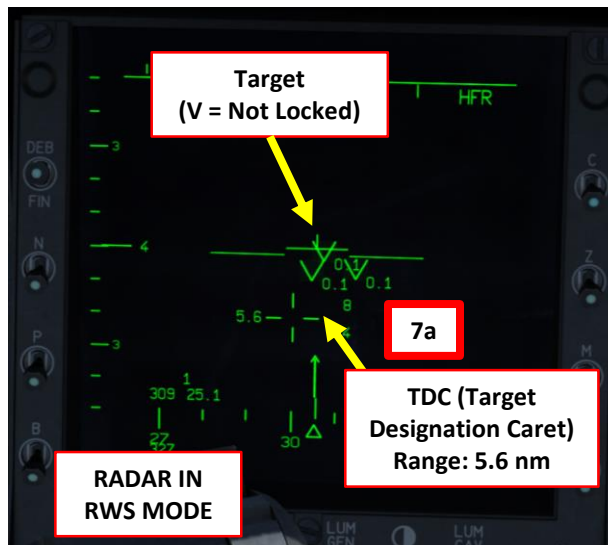
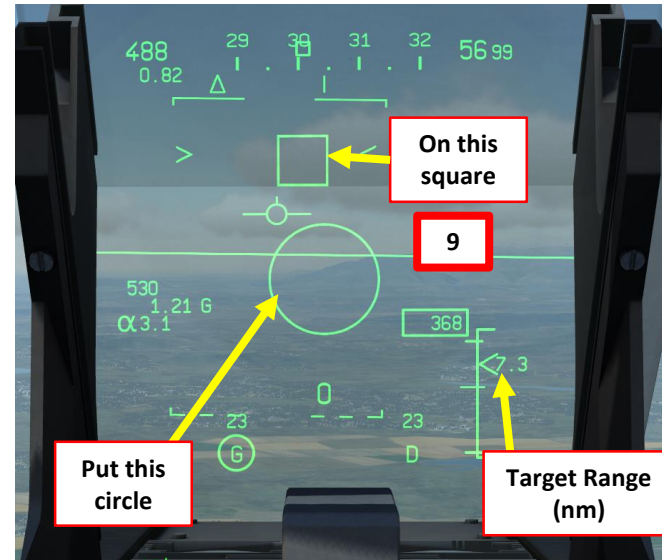
- **A/A** (UP) is used for an air combat configuration (2 x MAGIC II missiles + 2 x SUPER 530D missiles). This FBW mode will allow you to pull the maximal allowable number of Gs during a dogfight. In other words, the manoeuvrability of your aircraft is maximal at this FBW setting.
- **CHARGES** (DOWN) 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 manoeuvrable. 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.



PART 9—OFFENCE WEAPONS & ARMAMENT

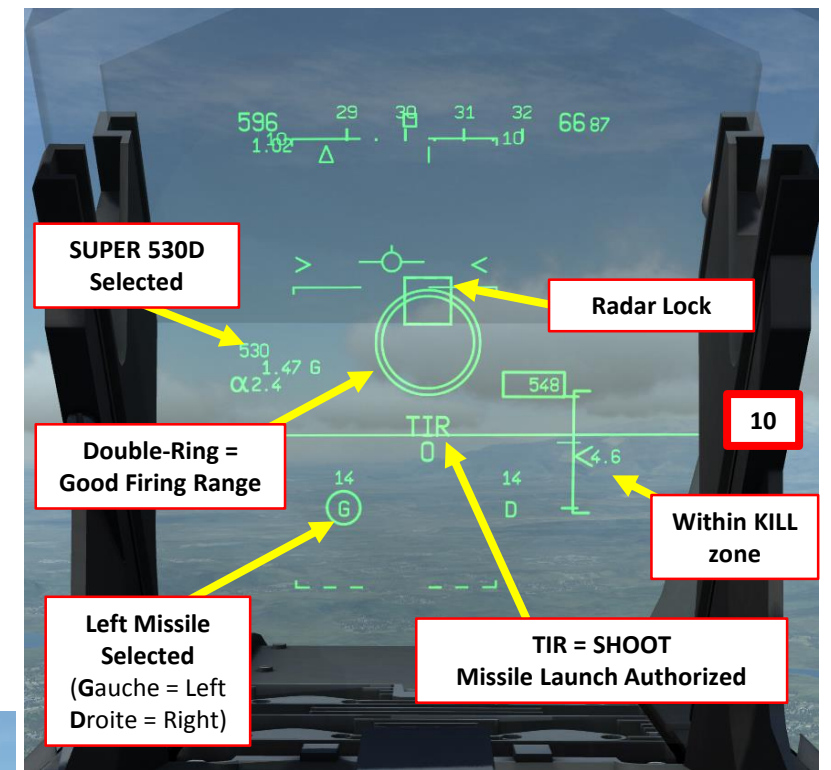
TUTORIAL - SUPER S530D MISSILE

1. On PPA, 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.
2. On PPA, select which missile to fire (G = Left, I = AUTO, R = Right)
3. On PPA, set S530 launch mode (TOT = 2 missiles per trigger press, PAR = 1 missile per trigger press)
4. On the PCA, turn Master Arm switch to ARME (UP)
5. Select 530 missile. A "S" caution shows that the missile is selected.
6. Turn on Radar Power by setting switch to **EMISSION**.
 - Consult previous chapter for radar operation parameters
7. Detect target using vertical antenna and radar range controls. Radar will be in RWS (Range While Scan) mode.
8. Put TDC on designated target (I, J, K, L) and lock it by pressing ENTER. Target will have a square on it on the HUD and radar will enter TWS (Track While Scan) mode.
9. Manoeuvre the aircraft to put the circle shown on the HUD on the square.
10. Lock your missile seeker head to the radar lock by pressing ENTER once circle and square are aligned. Radar will enter STT (Single Track Scan) mode.
11. Fire missile (Press and hold Weapon Fire key, SPACE by default) when missile is within KILL (no escape) range.



PART 9- OFFENCE WEAPONS & ARMAMENT

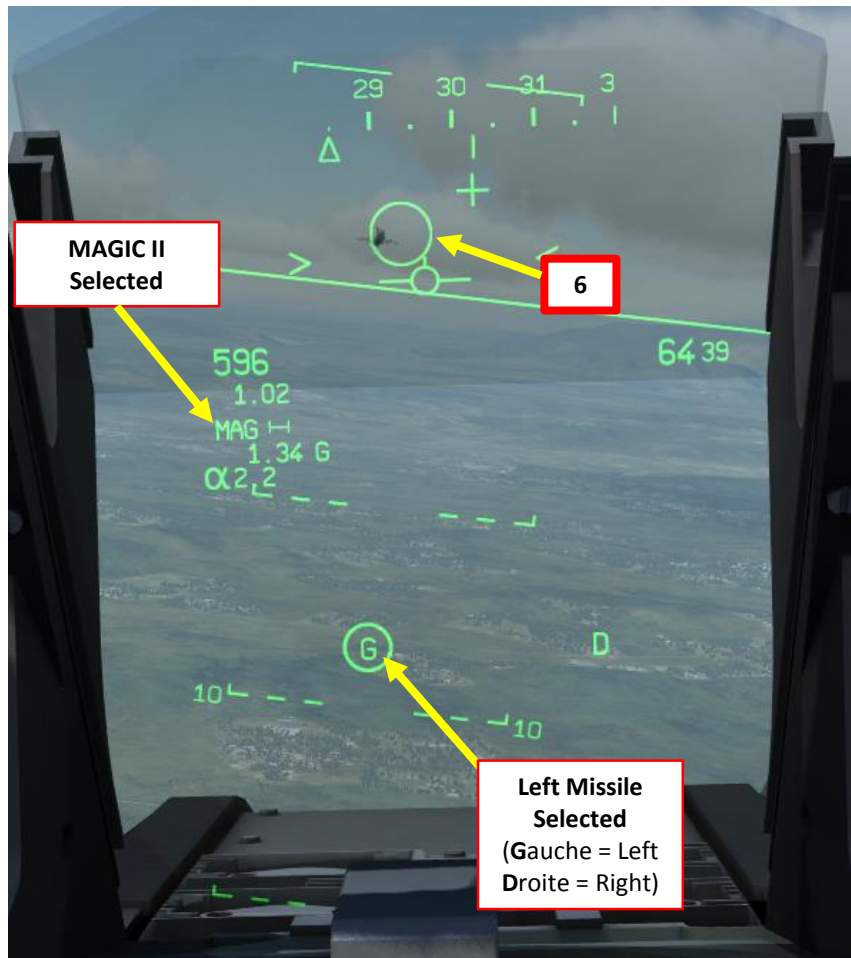
TUTORIAL - SUPER S530D MISSILE



PART 9— OFFENCE WEAPONS & ARMAMENT

TUTORIAL – MAGIC II MISSILE (NO RADAR)

1. 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.
2. On PPA, select which missile to fire (G = Left, I = AUTO, R = Right)
3. On the PCA, turn Master Arm switch to ARME (UP)
4. Select MAGIC II missile. A “S” caution shows that the missile is selected.
5. Low buzzing sound will be heard when missile is seeking IR signatures.
6. Louder buzzing sound will be heard when missile is tracking IR signature. Target will be marked and tracked by a small circle on HUD.
7. Fire missile (Press and hold Weapon Fire key, SPACE by default)



PART 9- OFFENCE WEAPONS & ARMAMENT

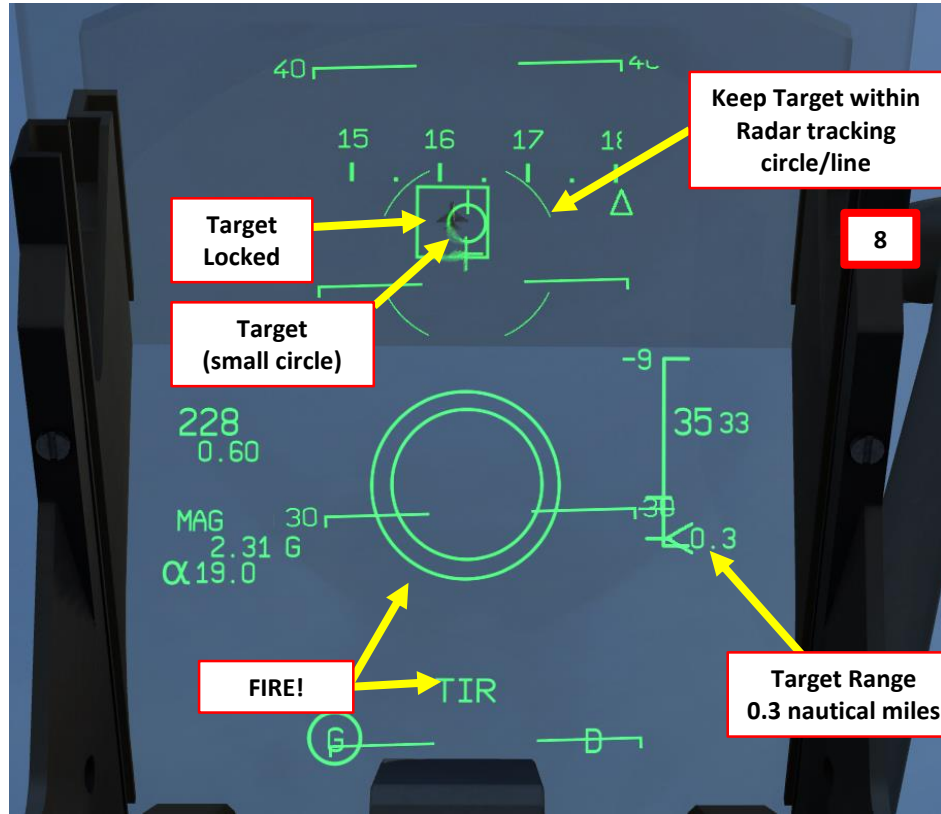
TUTORIAL – MAGIC II MISSILE (NO RADAR)



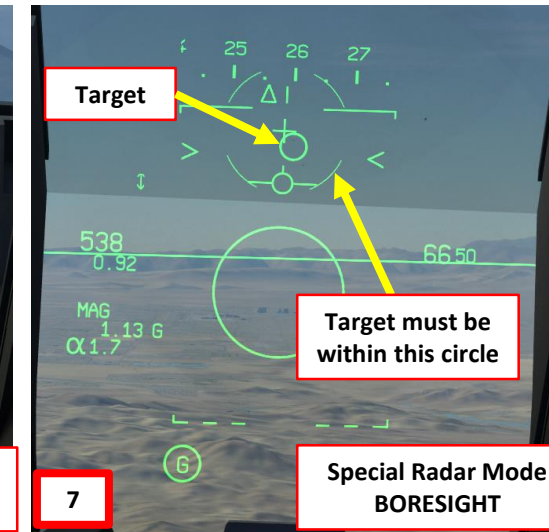
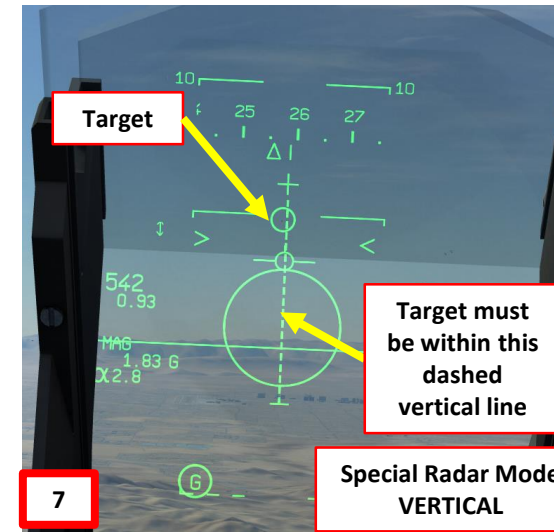
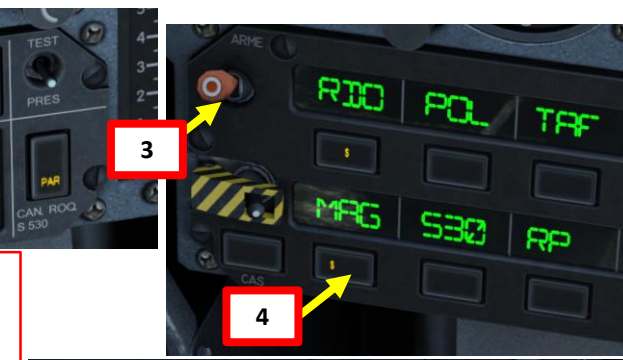
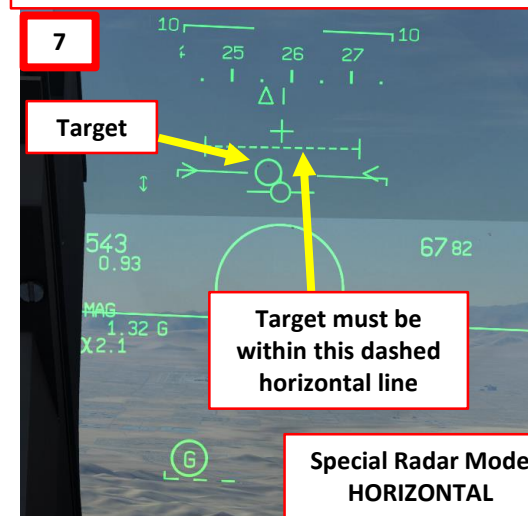
PART 9—OFFENCE WEAPONS & ARMAMENT

TUTORIAL – MAGIC II MISSILE (WITH SHORT RANGE RADAR)

- 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.
- On PPA, select which missile to fire (G = Left, I = AUTO, R = Right)
- On the PCA, turn Master Arm switch to ARME (UP)
- Select MAGIC II missile. A "S" caution shows that the missile is selected.
- Turn on Radar Power by setting switch to **EMISSION**.
 - Consult previous chapter for radar operation parameters
- Low buzzing sound will be heard when missile is seeking IR signatures.
- Select radar "Special Mode" by pressing "Special Modes FWD or AFT" switch on your HOTAS. You can choose between three modes: **Horizontal**, **Vertical** or **Boresight**. Target will have a circle on it on the HUD. Louder buzzing sound will be heard when missile is tracking IR signature.
- Lock your missile IR seeker head by pressing ENTER once target circle is within radar tracking circle/line. A square will appear on locked target.
- 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



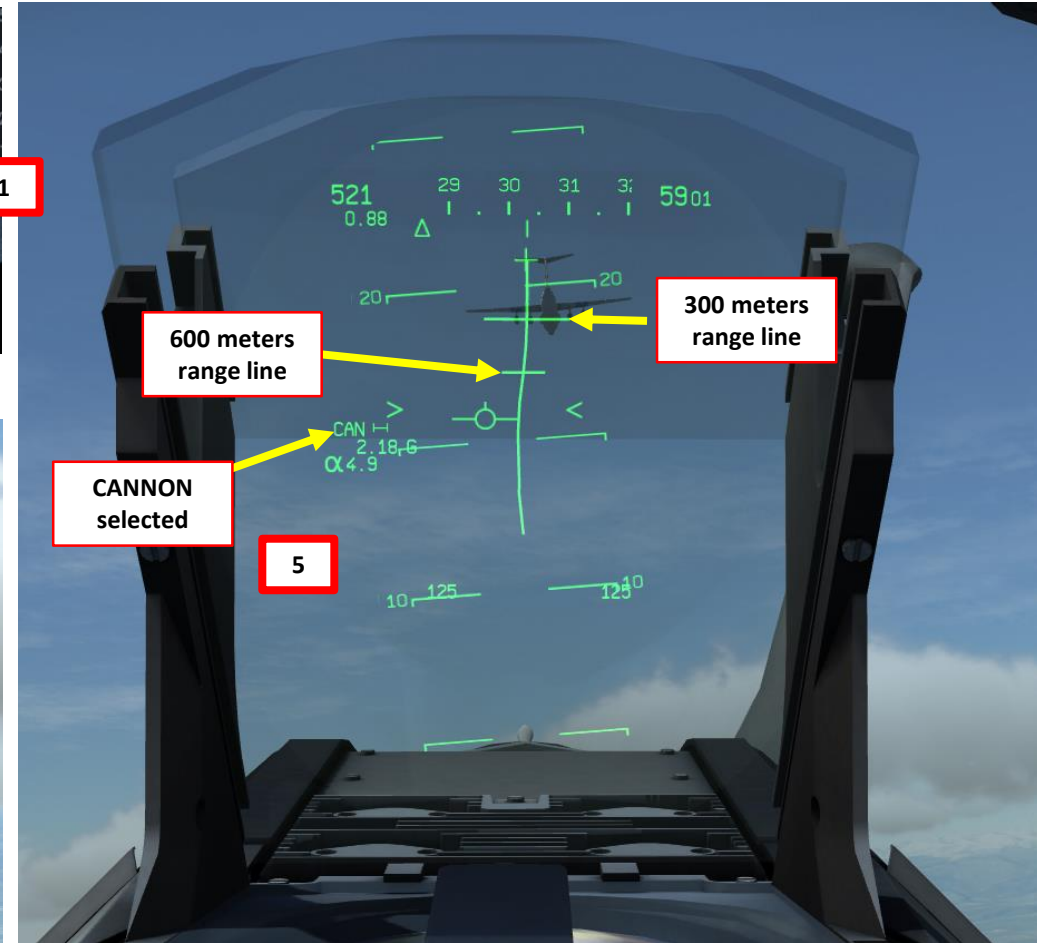
Note about 7) Cycle through Special Radar Modes by pressing "Special Modes FWD or AFT" switch on your HOTAS



PART 9— OFFENCE WEAPONS & ARMAMENT

GUNS TUTORIAL (NO RADAR)

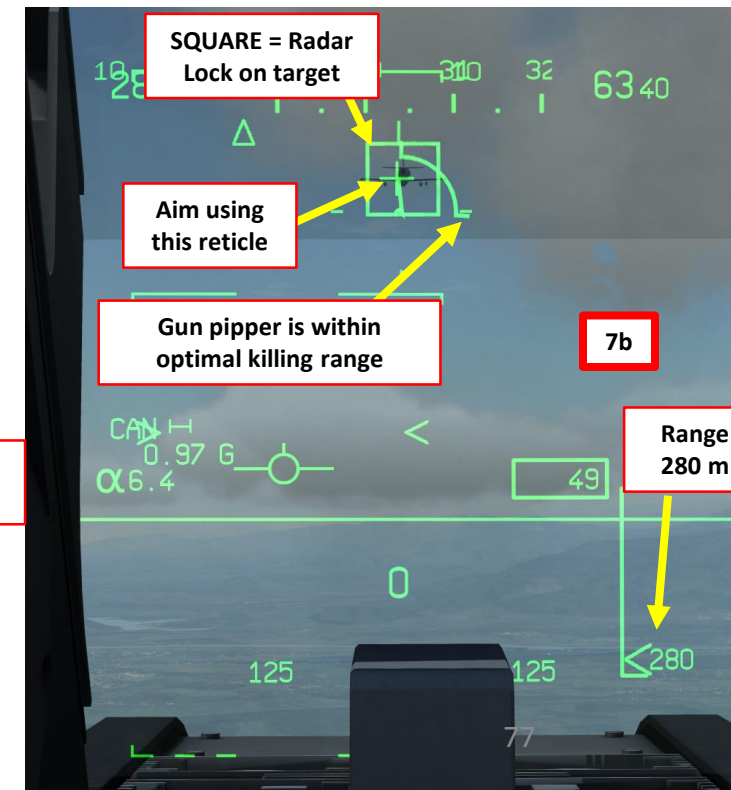
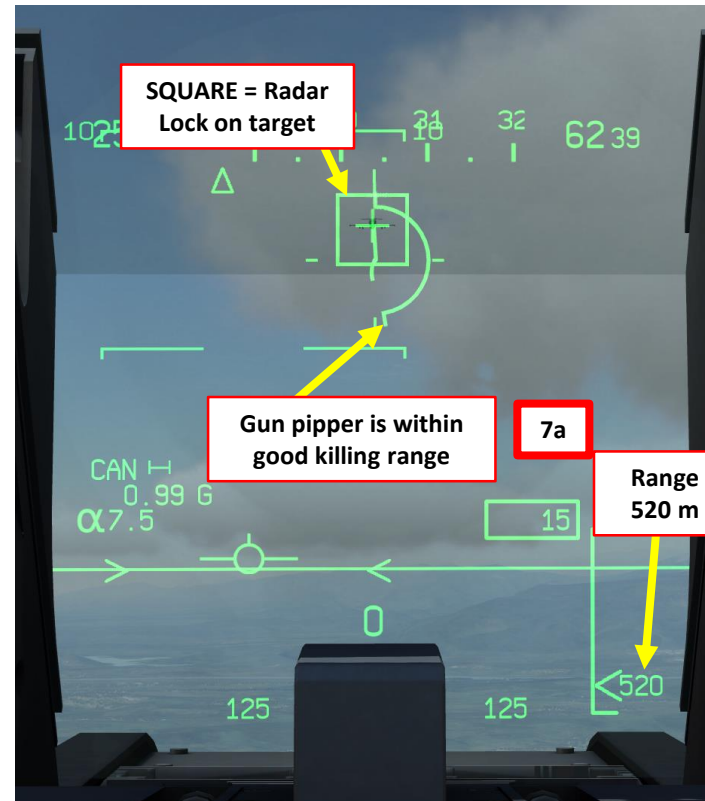
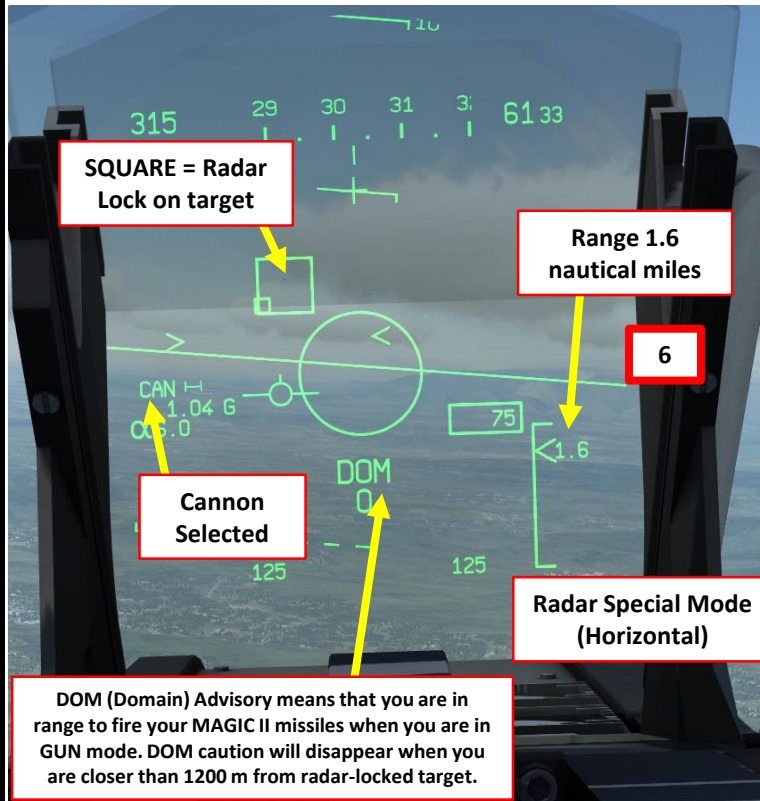
1. On PPA, select gun firing mode (PAR = 8 round burst, TOT = continuous fire)
2. Set Master Arm switch to ARME (UP)
3. Arm Cannon Switch (UP)
4. Select CAS (Canon Air-Sol / Air-to-Ground) and ensure it is in KL1 mode for Air-to-Air or KL2 for Air-to-Ground by pressing the CAS button on PCA.
5. Align gun piper on target. Use longest bar for shots from 300 meters and shortest bar for shots from 600 meters.
6. Fire guns (Weapon Fire key, SPACE by default).



PART 9— OFFENCE WEAPONS & ARMAMENT

GUNS TUTORIAL (WITH RADAR)

1. On PPA, select gun firing mode (PAR = 8 round burst, TOT = continuous fire)
2. Set Master Arm switch to ARME (UP)
3. Arm Cannon Switch (UP)
4. Select CAS (Canon Air-Sol / Air-to-Ground) and ensure it is in KL1 mode for Air-to-Air or KL2 for Air-to-Ground by pressing the CAS button on PCA.
5. Turn on Radar Power by setting switch to EMISSION.
6. Select radar "Special Mode" by pressing "Special Modes FWD or AFT" switch on your HOTAS. You can choose between three modes as shown previously (H, V or B).
7. Lock your radar by pressing ENTER once target is within radar tracking circle/line. A square will appear on locked target.
8. Fire guns (Weapon Fire key, SPACE by default) when you are within kill range (gun piper will change when you are 300-600 meters from target) and your center reticle is on target.



PART 9- OFFENCE WEAPONS & ARMAMENT

GUNS TUTORIAL (WITH RADAR)

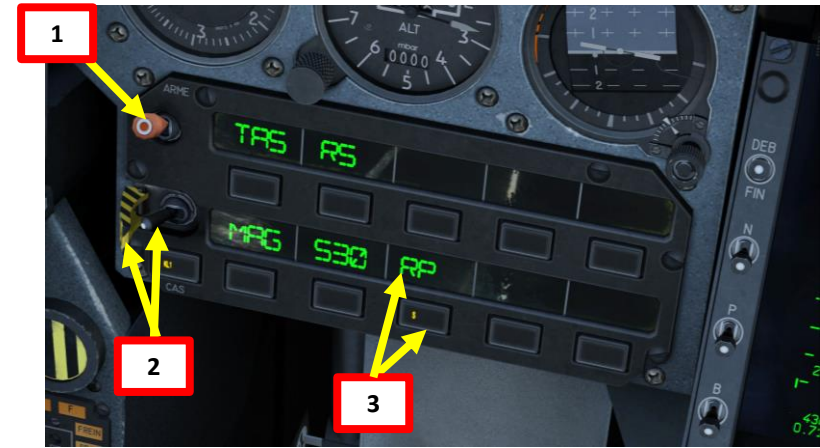


PART 9—OFFENCE WEAPONS & ARMAMENT

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)



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.



PART 9— OFFENCE WEAPONS & ARMAMENT

BOMB DELIVERY MODE - CCRP VS CCIP

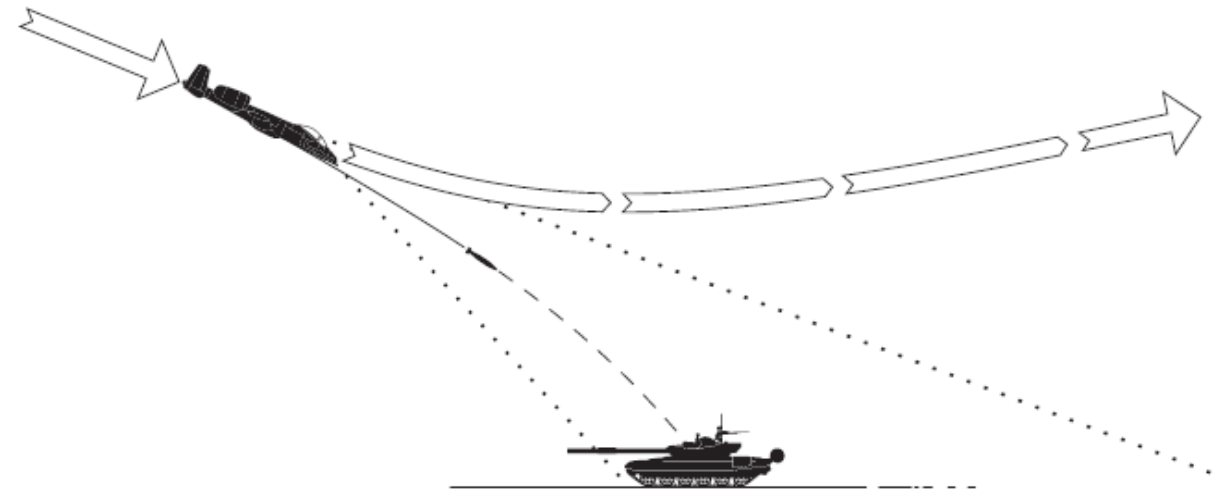
There are 2 ways to deliver a weapon: CCRP or CCIP modes.

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.

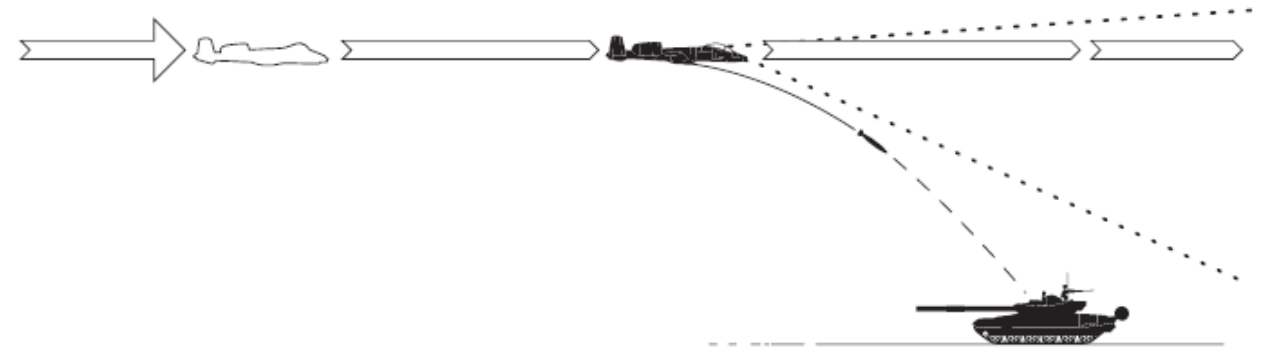
Take note that the delivery mode of bombs will be automatically “decided” for you: the Mirage 2000 is designed this way. You cannot choose how your ordnance will be dropped: a MK-82 (low drag) bomb will automatically engage CCRP mode while a MK-82 Snake Eye (high drag) bomb will engage CCIP mode.



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

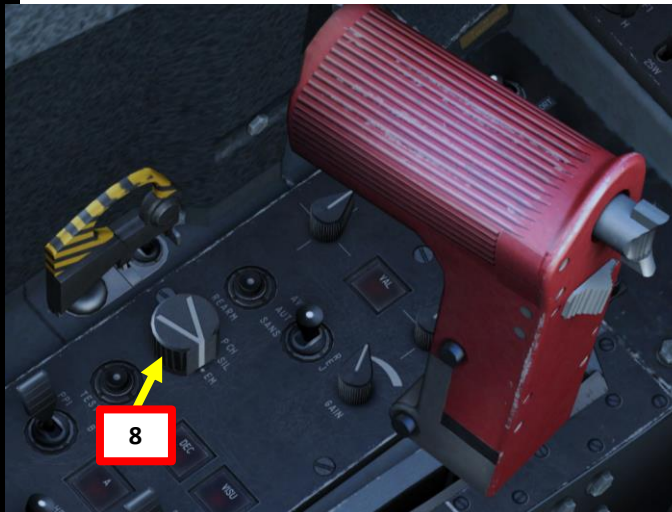
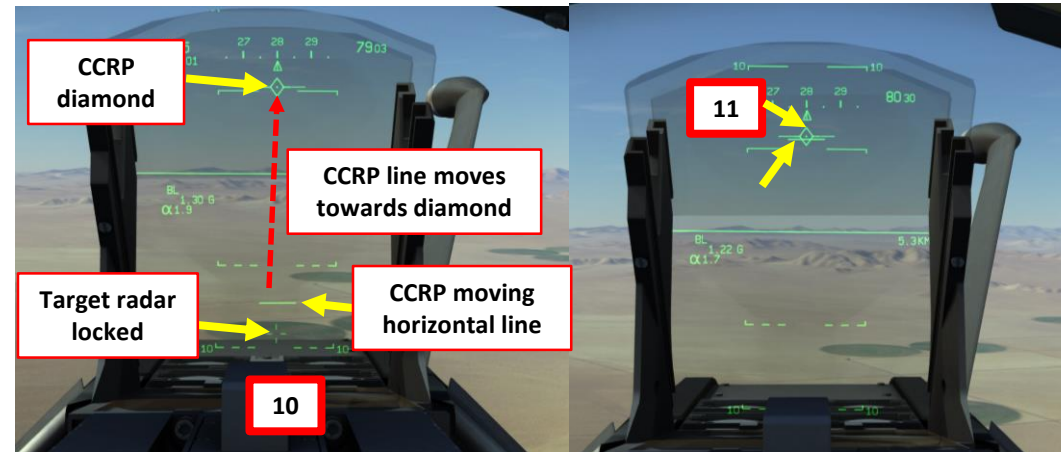
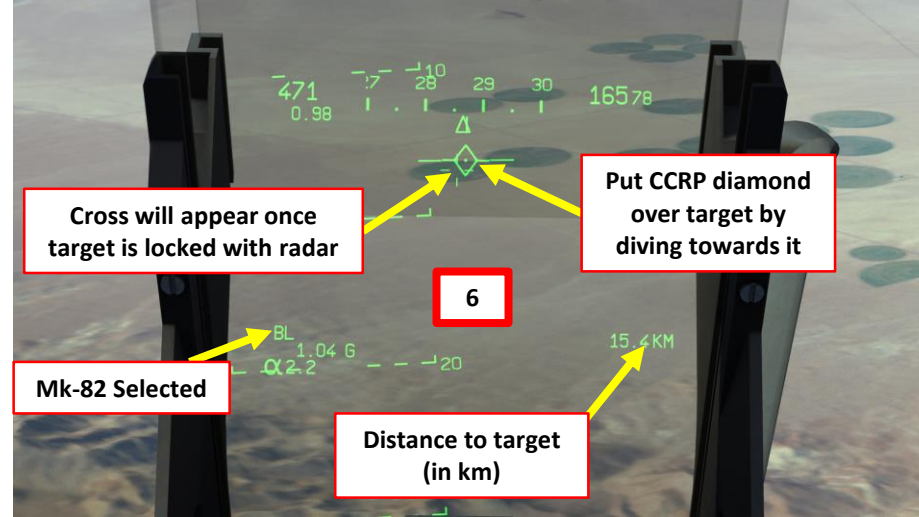
CCPL: Calcul Continu du Point de Largage

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

PART 9—OFFENCE WEAPONS & ARMAMENT

MK-82 BOMBS - CCRP TUTORIAL

1. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
2. On PPA, set number of bombs to be released (00 = single)
3. On PPA, set distance between bomb release (02 = 20 m)
4. Adjust seat to see lower part of HUD better.
5. Set Master Arm switch to ARME (UP)
6. Select BL1 (*Bombe Lisse* – Low-drag MK-82) on PCA
7. Select TAS mode on PCA
8. Turn radar power ON (EMISSION)
9. Put diamond on target and press the “MAGIC SLAVE/AG DESIGNATE” button on your HOTAS. Locked target will be marked with a cross.
10. Fly level towards target (make sure you have at least 2000 ft of clearance). Horizontal CCRP line will show up when you are 15 seconds from target.
11. When CCRP line is lined up with the diamond reticle, press and hold WEAPON RELEASE button (SPACE by default). In this example, one bomb will be released per trigger press.
12. Observe damage and unlock target (BACKSPACE by default). Unfortunately, CCRP is not very precise.



PART 9- OFFENCE WEAPONS & ARMAMENT

MK-82 BOMBS - CCRP TUTORIAL

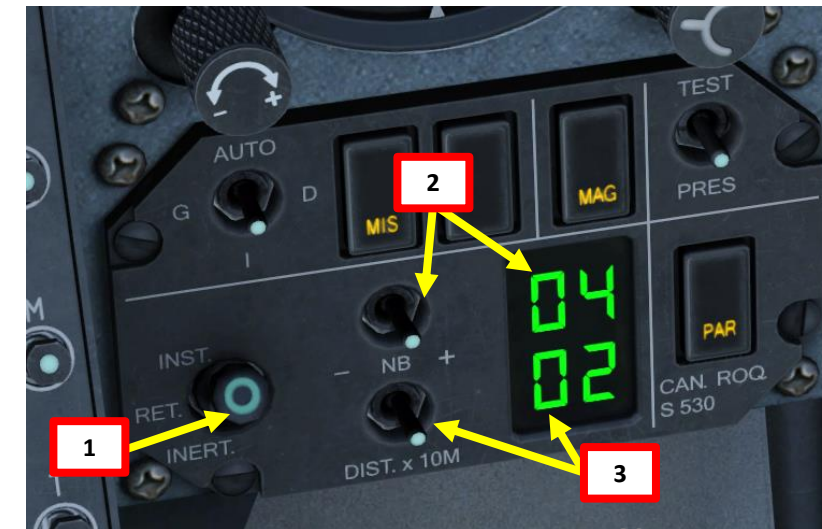
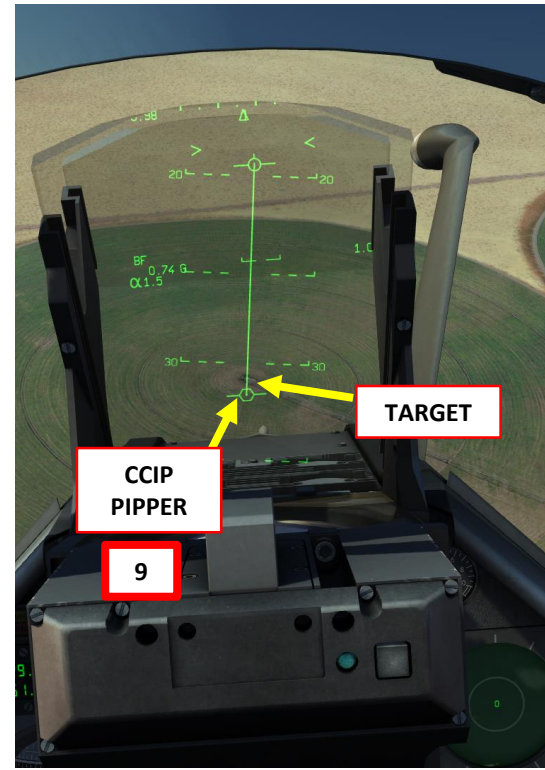
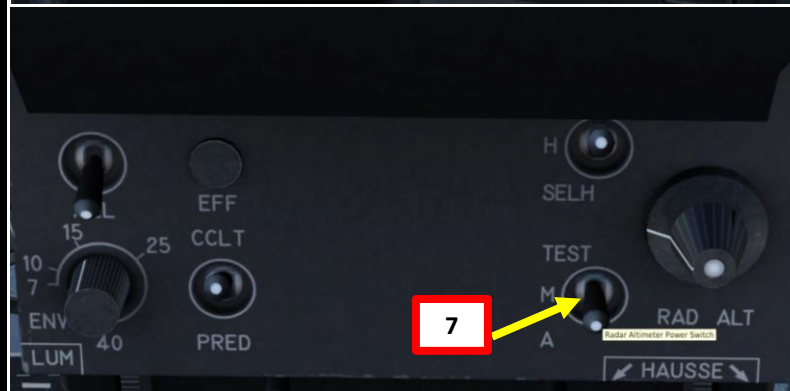
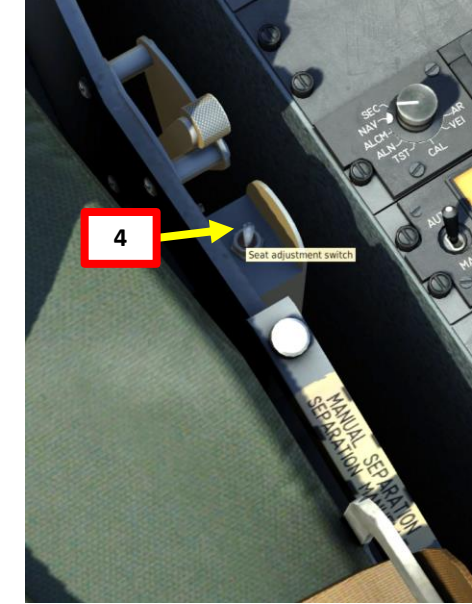


PART 9— OFFENCE WEAPONS & ARMAMENT

MK-82SE “SNAKE EYE” BOMBS

CCIP TUTORIAL

1. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
2. On PPA, set number of bombs to be released (04 = 4 bombs)
3. On PPA, set distance between bomb release (02 = 20 m)
4. Adjust seat to see lower part of HUD better.
5. Set Master Arm switch to ARME (UP)
6. Select BF1 (*Bombe Freinée* – High-drag MK-82SE) on PCA
7. Set Radar Altimeter Power switch to **MARCHE**
8. 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.
9. CCIP pipper will appear from the lower part of the HUD. Align CCIP pipper on target by manoeuvring the aircraft.
10. When CCIP pipper is aligned, press and hold WEAPON RELEASE button (SPACE by default).
11. Pull up to avoid smacking yourself into the ground and watch the fireworks.



PART 9- OFFENCE WEAPONS & ARMAMENT

MK-82SE "SNAKE EYE" BOMBS CCIP TUTORIAL



PART 9—OFFENCE WEAPONS & ARMAMENT

ROCKETS TUTORIAL

1. On PPA, set firing mode to either PAR (fires single rocket salvo) or TOT (fires all rockets in pods).
2. Set Master Arm switch to ARME (UP)
3. Select RK3 (Rocket) on PCA
4. Set Radar Altimeter Power switch to MARCHÉ
5. Align rocket pipper on target at a dive angle of 20-25 degrees.
6. When rocket pipper is aligned, press and hold WEAPON RELEASE button (SPACE by default).



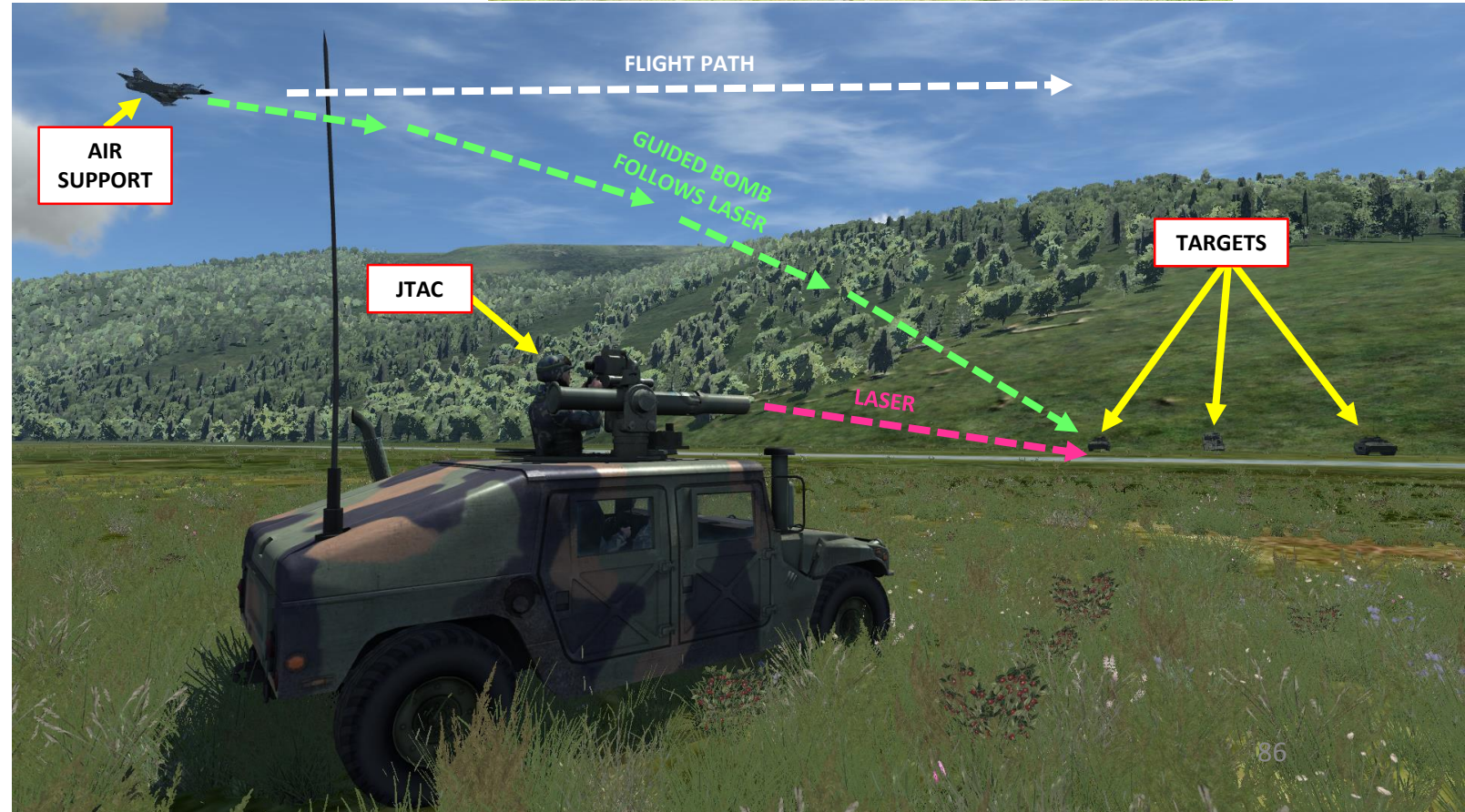
PART 9- OFFENCE WEAPONS & ARMAMENT

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.



PART 9—OFFENCE WEAPONS & ARMAMENT

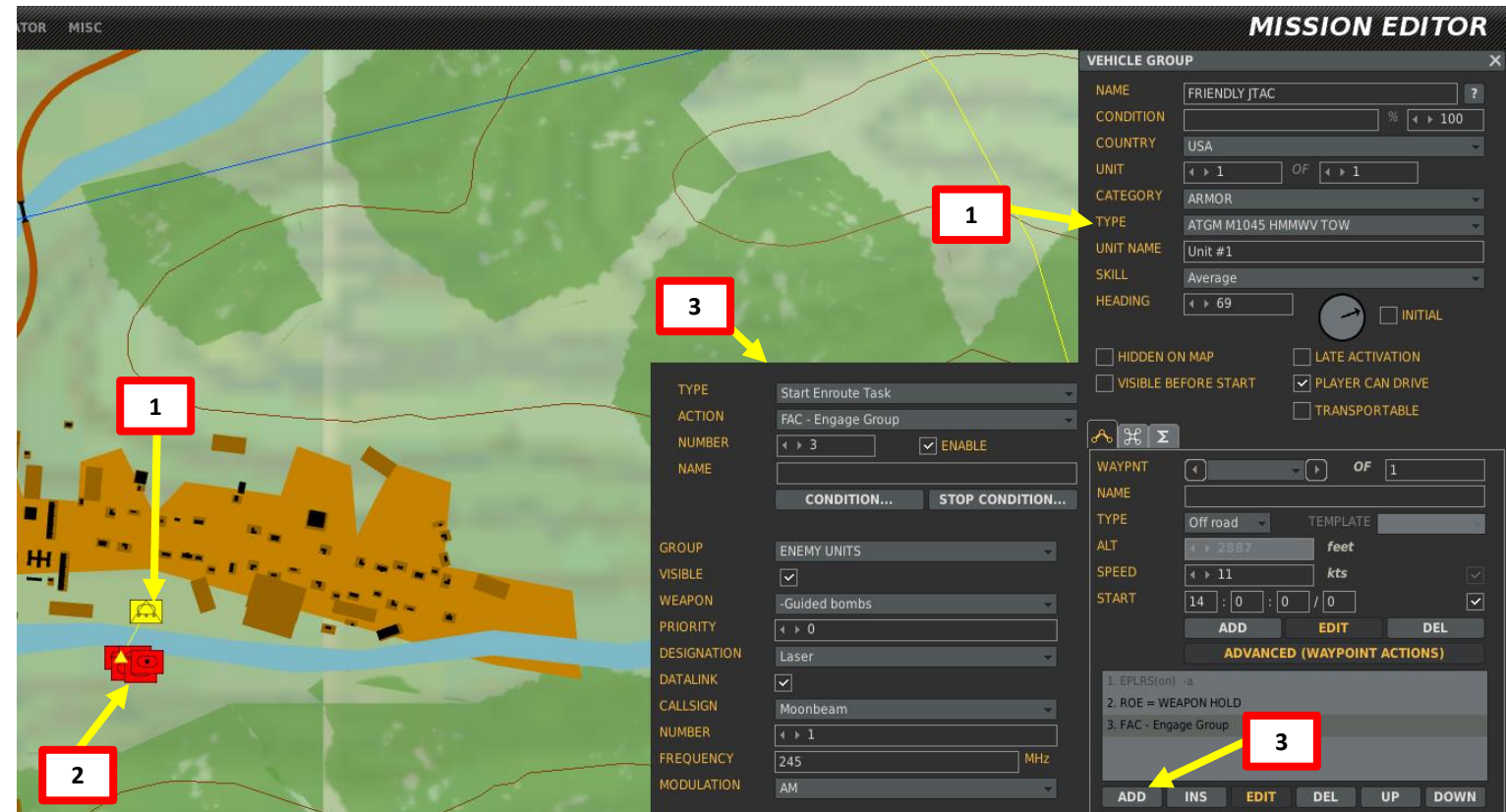
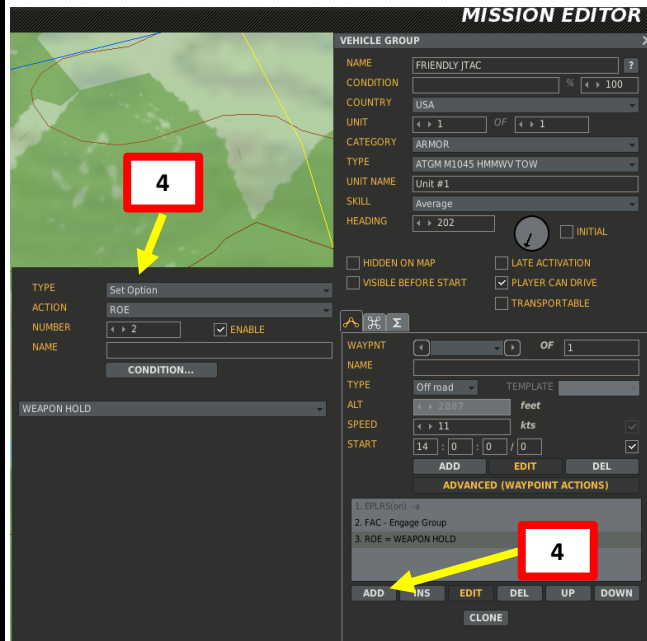
BUDDY LASING TUTORIAL (GBU-12 BOMBS)

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>

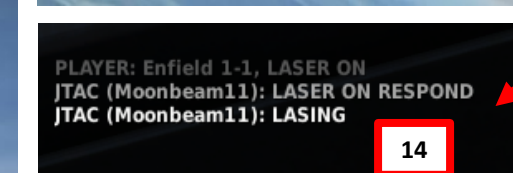
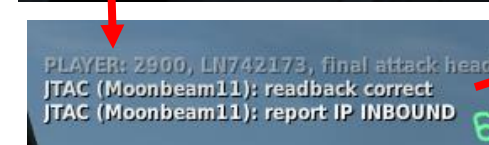
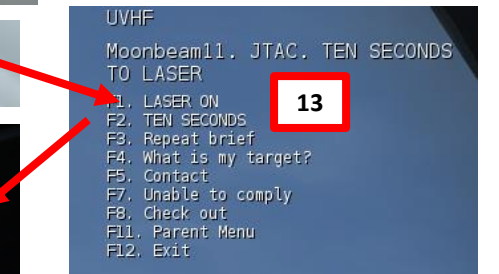
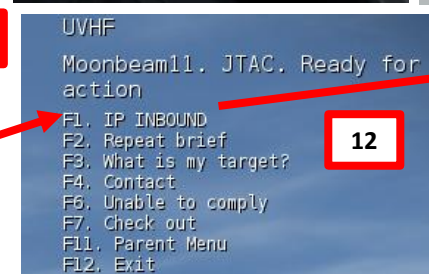
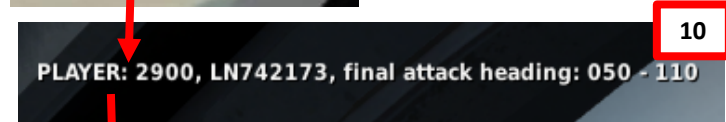
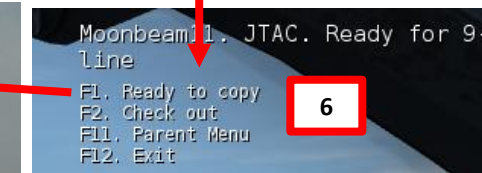
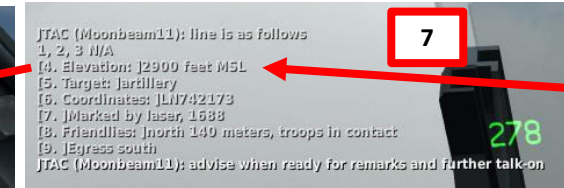
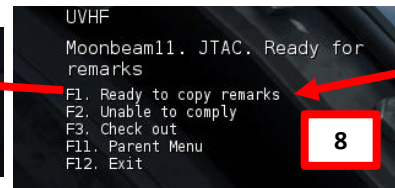
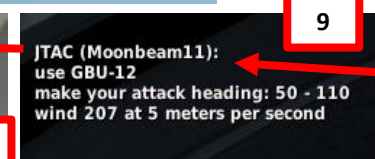
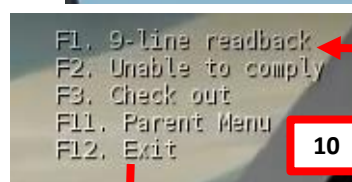
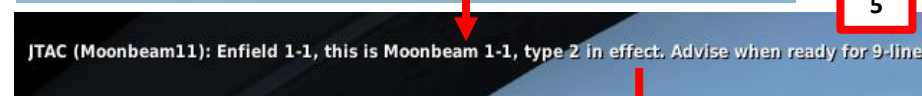
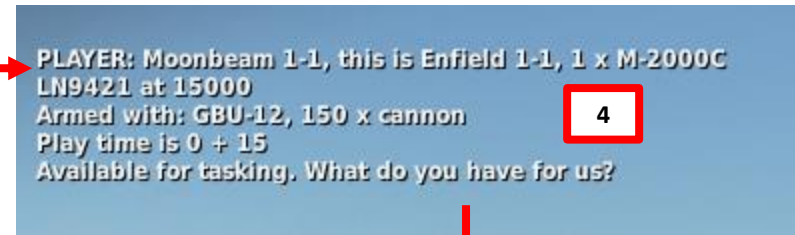
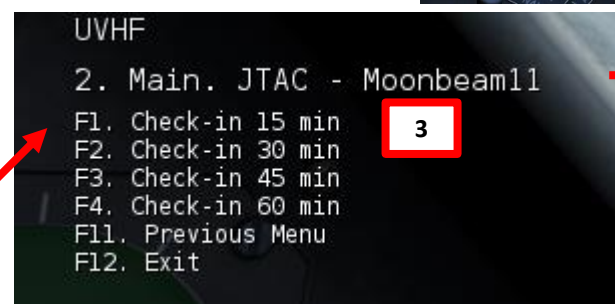
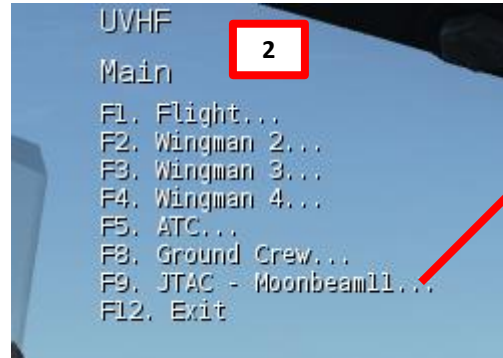
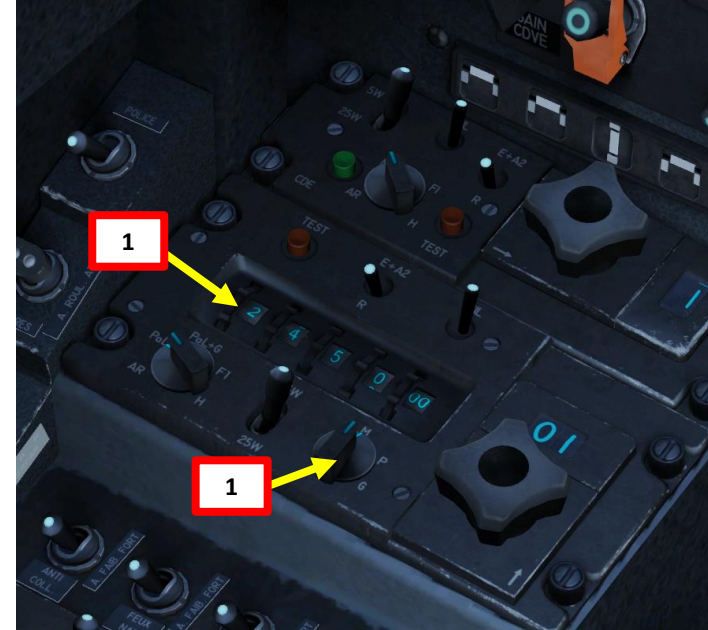


PART 9— OFFENCE WEAPONS & ARMAMENT

BUDDY LASING TUTORIAL (GBU-12 BOMBS)

CONTACTING THE JTAC

1. Set V/UHF Power switch to **MARCHE** (ON) and set JTAC frequency to 245 MHz.
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.



PART 9— OFFENCE WEAPONS & ARMAMENT

BUDDY LASING TUTORIAL (GBU-12 BOMBS)

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

JTAC (Moonbeam11): line is as follows

1, 2, 3 N/A

[4. Elevation:]2900 feet MSL

[5. Target:]artillery

[6. Coordinates:]LN742173

[7.]Marked by laser, 1688

[8. Friendlies:]north 140 meters, troops in contact

[9.]Egress south

JTAC (Moonbeam11): advise when ready for remarks and further talk-on

278

JTAC (Moonbeam11):

use GBU-12

make your attack heading: 50 - 110

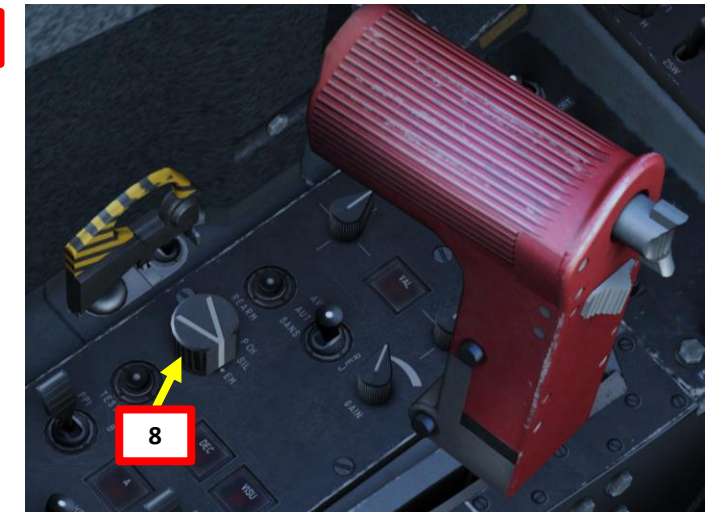
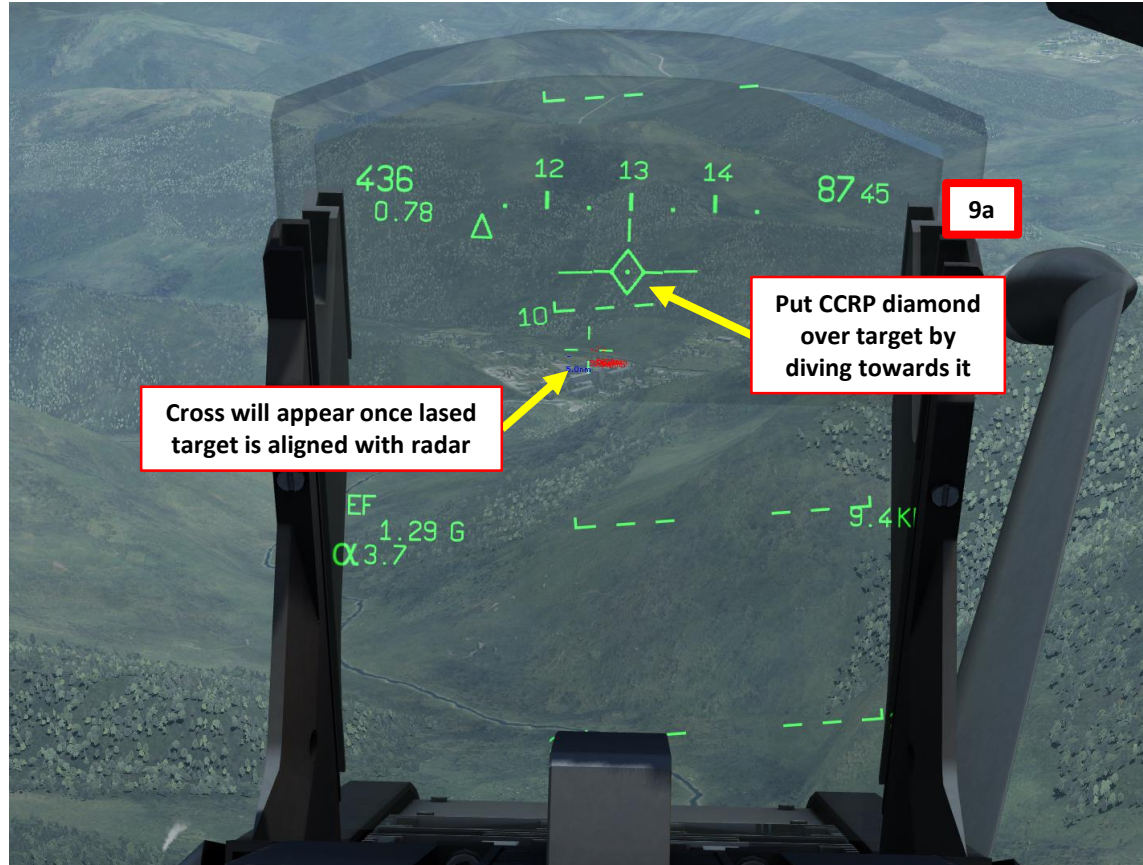
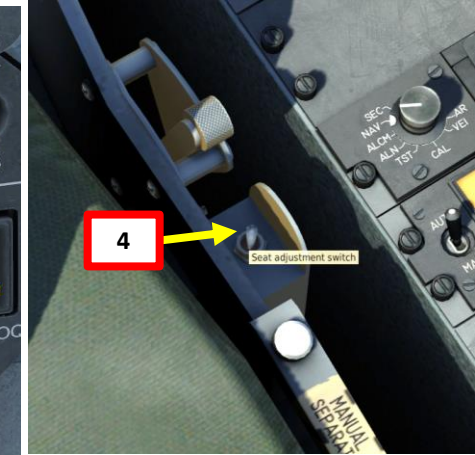
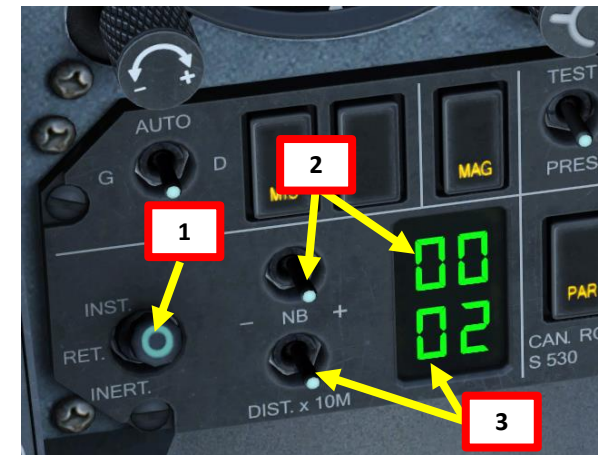
wind 207 at 5 meters per second

PART 9— OFFENCE WEAPONS & ARMAMENT

BUDDY LASING TUTORIAL (GBU-12 BOMBS)

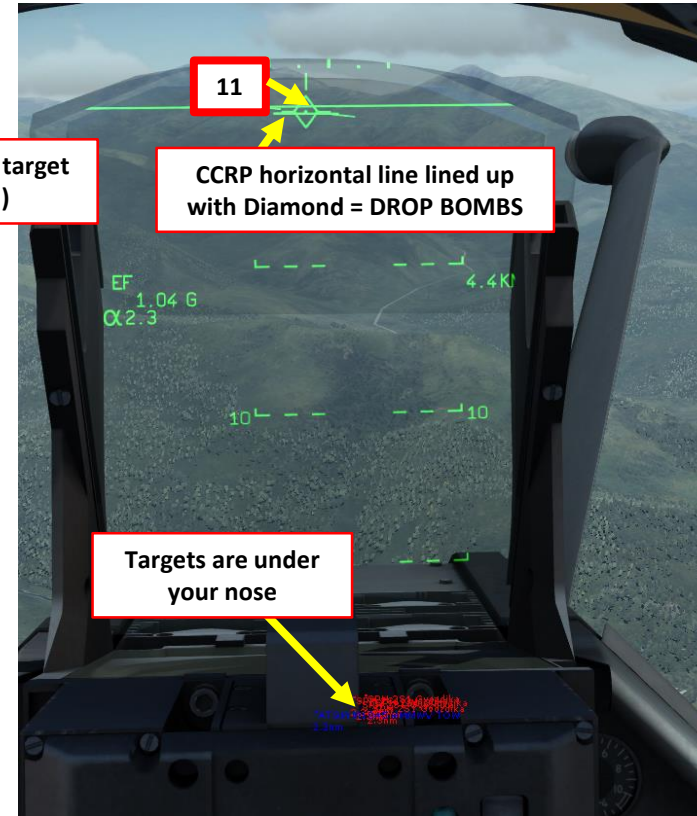
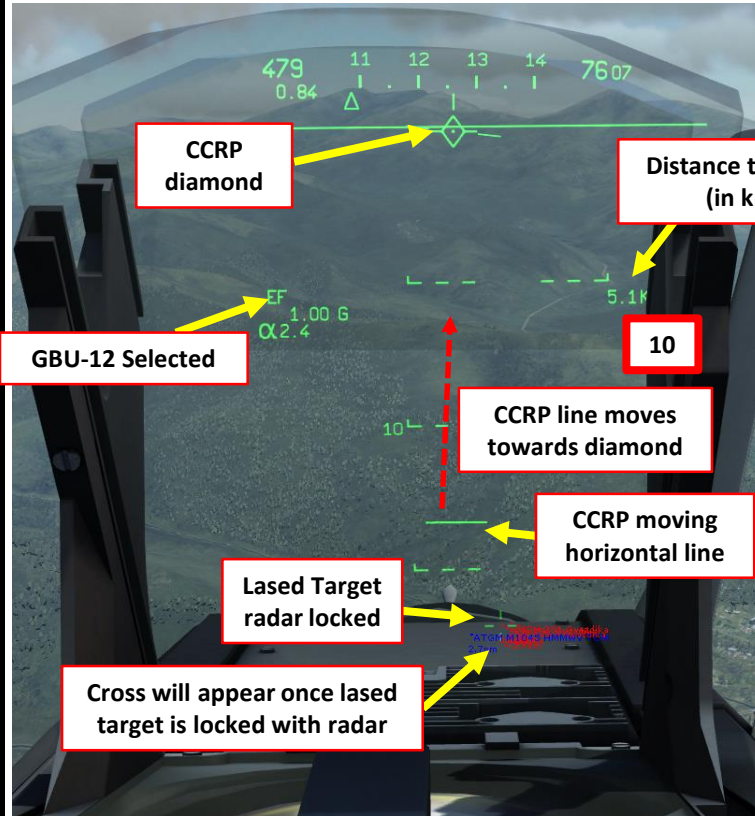
RELEASING BOMBS

1. On PPA, set fuze selector to either RET (*retardé*/delayed fuze) or INST (instantaneous fuze)
2. On PPA, set number of bombs to be released (00 = single)
3. On PPA, set distance between bomb release if using salvo (ex: 02 = 20 m)
4. Adjust seat to see lower part of HUD better.
5. Set Master Arm switch to ARME (UP)
6. Select EF1 (GBU-12) on PCA
7. Select TAS mode on PCA
8. Turn radar power ON (**EMISSION**)
9. Put diamond close to the target and press the “MAGIC SLAVE/AG DESIGNATE” button on your HOTAS. Target will be marked with a cross and will automatically be aligned to what is being lased by the JTAC.
10. Fly level towards target (make sure you have at least 2000 ft of clearance). Horizontal CCRP line will show up when you are 15 seconds from target.
11. When CCRP line is lined up with the diamond reticle, press and hold WEAPON RELEASE button (SPACE by default).
12. Observe damage and unlock target (BACKSPACE by default).



PART 9- OFFENCE WEAPONS & ARMAMENT

BUDDY LASING TUTORIAL (GBU-12 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.

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

PART 9— OFFENCE WEAPONS & ARMAMENT

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>

[new reply](#)


[View First Unread](#)

12-29-2015, 01:09 PM

[Thread Tools](#) [Search this Thread](#) [Rating: ★★★★★](#) [Display Modes](#)

[#1](#)


[il_corleone](#)
Member



Join Date: Mar 2012

Location: Spain

Posts: 350

Reputation power: 8


[Working BVR tactic against modern targets](#)

Hello guys!

After many many test I found some usefull tactic with e M2K and his missiles.

I made this tutorial and tests because I like this aircraft and Ive seen many people struglin with it!

This tactics have been tested in a SP enviorement with 90% chance of winning in a 1V1 Scenario. In MP is at least at 35% chance of winning (Consider this as a very high numbers in the beta test of the aircraft and Radar against better missiles and radars)

This was done against russian aircraft

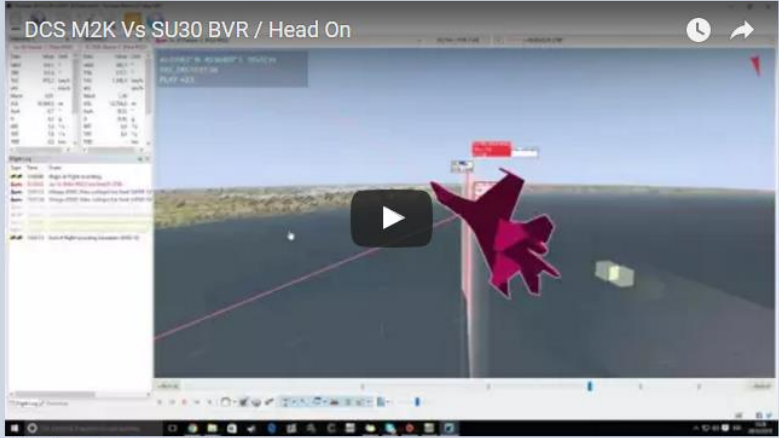
There are more values that can work or not, so here is it, is not 100% exact

First of all, you need to get speed, always, think your plane like a slingshot, you need to get impuse of your missiles.

Modern Targets

High Height. (28.000 feet to 48.000 feet)

Eastern Figthers (R27 ER / R27R / R40R / R3R etc)



-This Height is the best for this plane an missiles.
The optimal settings I found are these:
-Radar in 30 degrees scan
-Target Memory on (Right)
-Lock your target using RDO mode, it will autolock, then press lock again to PIC (STT)
-Enable your Jammer.
-Shoot at 21/20 Miles
-If you doing good, two missiles, friendly and enemy must be in the air.

PART 10 – DEFENCE RWR & COUNTERMEASURES

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.

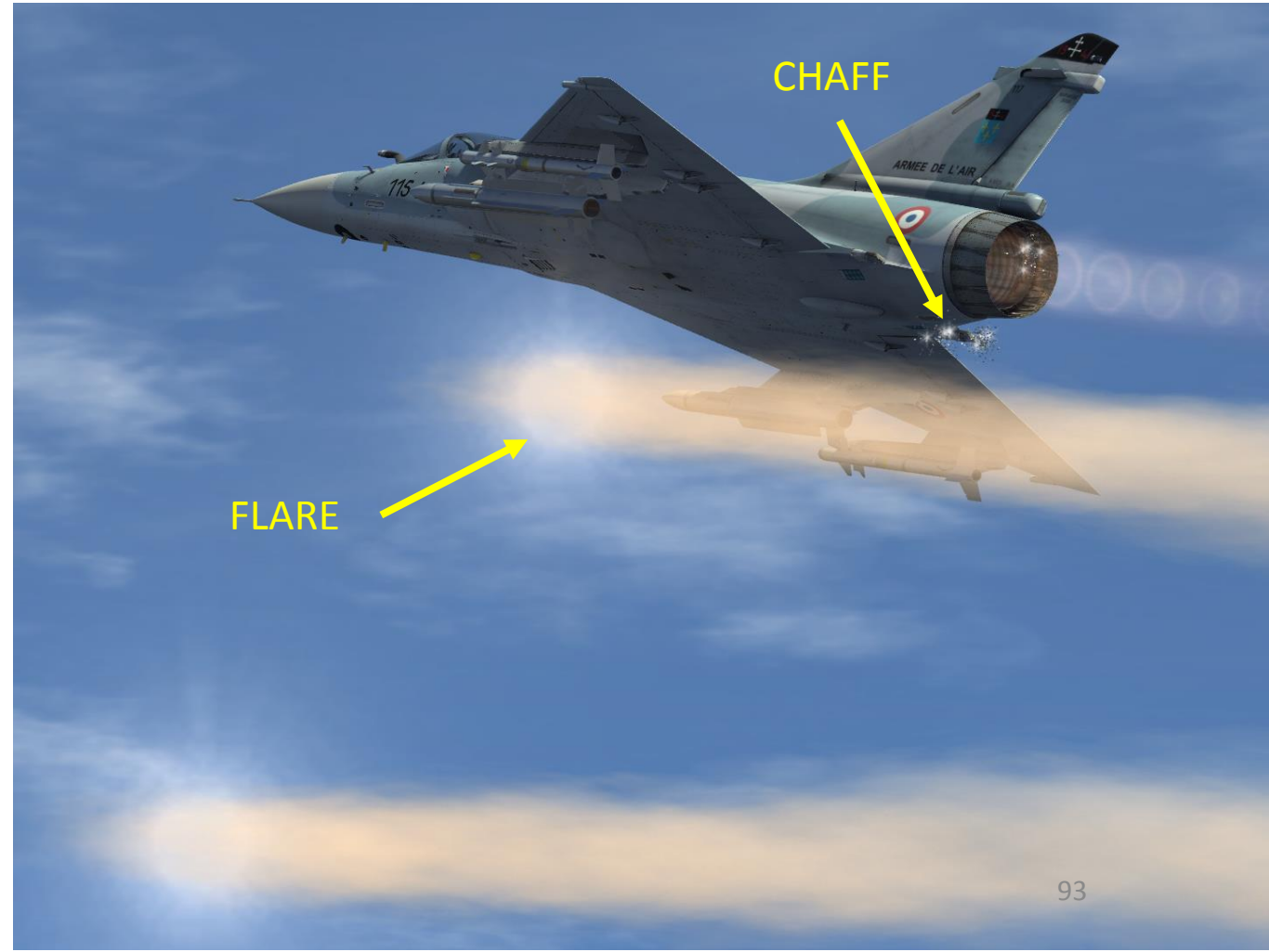
Missiles can generally track you using 2 things: radar signature (radar waves are sent on you and you reflect them, which is called a “radar signature”) and heat signature (like the exhaust of your engines). Countermeasures will only be effective against the kind of weapon it was meant to counter; a 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.

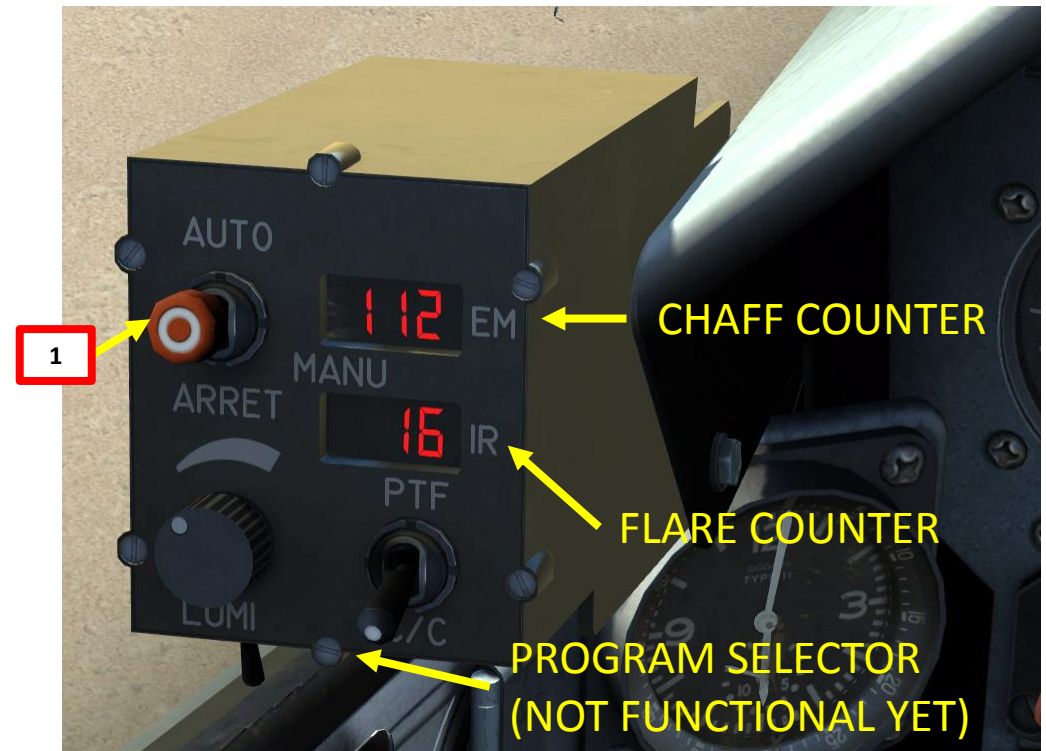


PART 10 – DEFENCE RWR & COUNTERMEASURES

COUNTERMEASURES – FLARES & CHAFF TUTORIAL

The countermeasures programs are not currently implemented yet, so manual deployment of flares and chaff will be used. Keep in mind that you have very few flares: use them sparingly. Once the ÉCLAIR pod is implemented by RAZBAM, more flares will be available.

- 1) Set Countermeasure power switch to either MANUAL or AUTO.
- 2) Deploy chaff using “«INSERT” or flares using “DELETE”. Flares and chaff are deployed independently.
- 3) Flares and chaff are released one at a time.



PART 10 – DEFENCE RWR & COUNTERMEASURES

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.



PART 10 – DEFENCE RWR & COUNTERMEASURES

SERVAL (RWR), 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 **MARCHE**.
2. The D2M Missile Launch IR Detector is currently not modelled.
3. The *Brouilleur* (Jammer) can be turned on by setting the BR switch to **MARCHE**.
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).
5. The LL (*Lance-Leurres* or Flare Dispenser) functionality is currently not modelled.

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*)

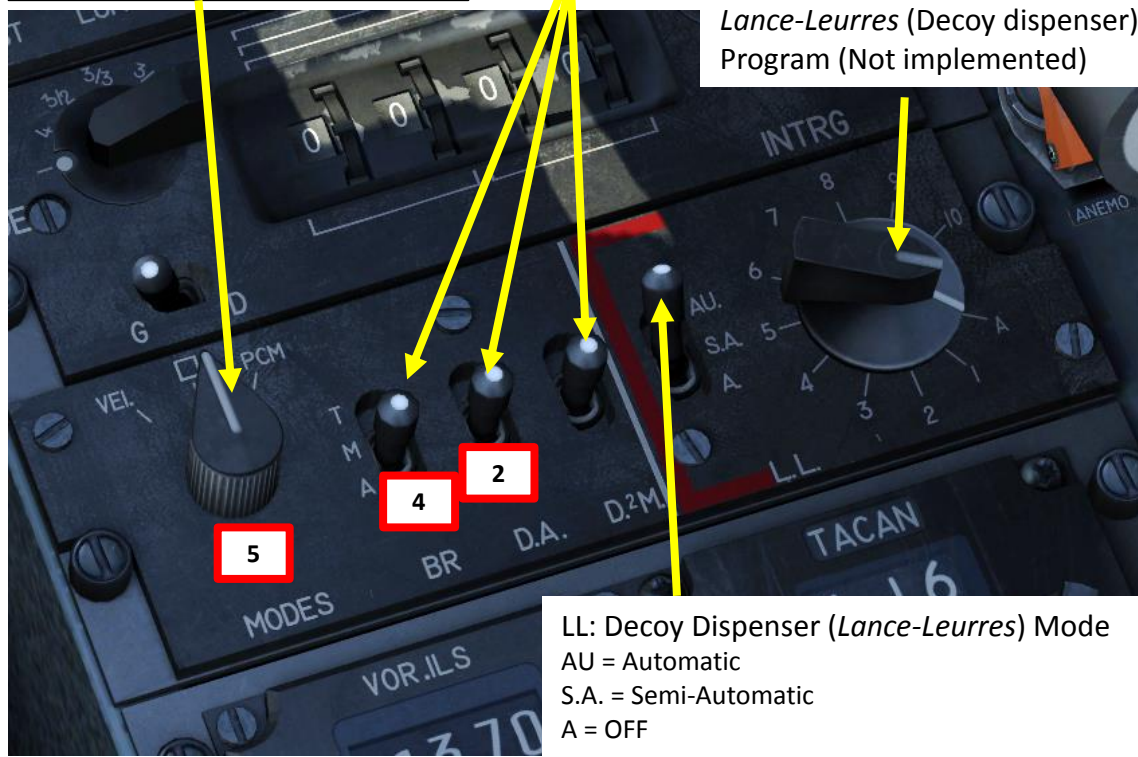
DA: RWR Status (*Détecteur d'Alerte*)

D2M (MLWS): Missile Launch IR Detector (*Détection de Départ de Missile*)

T = Test

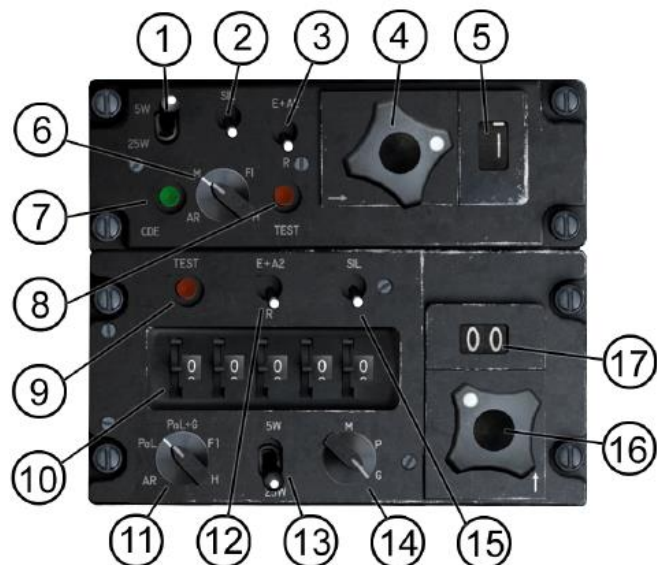
M = MARCHE = ON

A = ARRÊT = OFF



PART 11 – RADIO TUTORIAL

- You have two radios available: a TRT ERA 7000 V/UHF radio (COM1) and a TRT ERA 7200 UHF secure voice com radio (COM2) . Most encryption functions are not implemented.
- V/UHF COM1 radio is used for communications between 118 and 400 MHz. It can use both custom and preset channels as well (preset channels can be changed in the mission editor).
- UHF COM2 radio is used for communications between 225 and 400 Hz. 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.



- | | |
|---|-------------------------------------|
| 1.) UHF Receiver/Transmitter Inverse Selector. | 2.) UHF SIL/Mute Switch. |
| 3.) UHF Secure Channel Encryption. | 4.) UHF Channel Preset Selector. |
| 5.) UHF Channel Indicator. | 6.) UHF Operation Mode Selector. |
| 7.) UHF Secure Encryption Receive Light | 8.) UHF Test Button. |
| 9.) V/UHF Test Button. | 10.) V/UHF Frequency Selector. |
| 11.) V/UHF RX Mode Selector. | 12.) V/UHF Channel Encryption. |
| 13.) V/UHF Receiver/Transmitter Inverse Selector. | 14.) V/UHF TX Modes. |
| 15.) V/UHF SIL/Mute Switch. | 16.) V/UHF Channel Preset Selector. |
| 17.) V/UHF Preset Channel Indicator. | |



- | | |
|----------------------|------------------------|
| 1.) COMM Select. | 2.) ILS Volume. |
| 3.) TACAN Volume. | 4.) MAGIC Tone Volume. |
| 5.) Approach Volume. | 6.) Marker Volume. |
| 7.) UHF Volume. | 8.) V/UHF Volume. |

MISSION EDITOR

AIRPLANE GROUP

NAME: New Airplane Group #001

CONDITION: % < 100

COUNTRY: France

TASK: CAP

UNIT: < 1 OF < 1

TYPE: M-2000C

SKILL: Player

PILOT: Pilot #002

TAIL #: 010

CALLSIGN: Enfield

☐ HIDDEN ON MAP

☐ LATE ACTIVATION

UHF Radio

RADIO PRESETS

Channel 1	< 225	MHz	AM
Channel 2	< 264	MHz	AM
Channel 3	< 265	MHz	AM
Channel 4	< 256	MHz	AM
Channel 5	< 254	MHz	AM
Channel 6	< 250	MHz	AM
Channel 7	< 270	MHz	AM
Channel 8	< 257	MHz	AM
Channel 9	< 255	MHz	AM
Channel 10	< 262	MHz	AM
Channel 11	< 259	MHz	AM
Channel 12	< 268	MHz	AM
Channel 13	< 269	MHz	AM
Channel 14	< 260	MHz	AM
Channel 15	< 263	MHz	AM
Channel 16	< 261	MHz	AM
Channel 17	< 267	MHz	AM
Channel 18	< 251	MHz	AM
Channel 19	< 253	MHz	AM
Channel 20	< 400	MHz	AM

V/UHF Radio

Channel 1	< 118	MHz	AM
Channel 2	< 135	MHz	AM
Channel 3	< 136	MHz	AM
Channel 4	< 127	MHz	AM
Channel 5	< 125	MHz	AM
Channel 6	< 121	MHz	AM
Channel 7	< 141	MHz	AM
Channel 8	< 128	MHz	AM

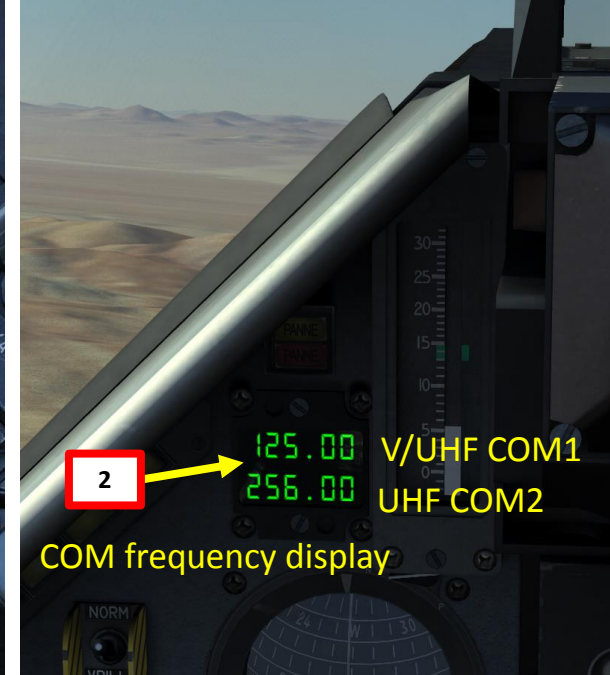
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PART 11 – RADIO TUTORIAL

HOW TO USE A RADIO

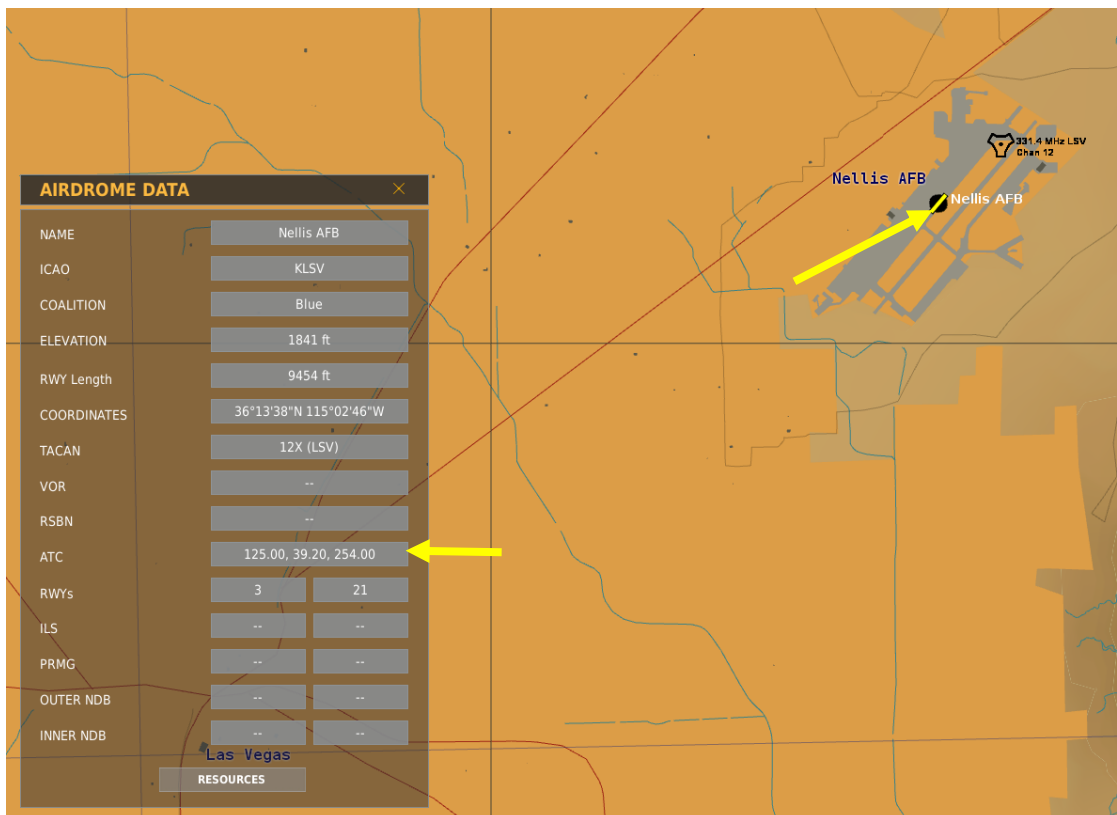
1. Set both radios to **MARCHE** (ON)
2. Select desired radio frequency. You can verify frequencies on the COM frequency display.
A) For COM1 radio (V/UHF), select preset radio channel or use the drums to manually choose your radio frequency.
B) For COM2 radio (UHF), select preset radio channel.
3. Select desired audio power amplifier (AMPLIS). Ampli #1 is used by default.
4. To communicate:
A) For COM1 radio (V/UHF), press the MAIN U/VHF RADIO SELECT button (**LSHIFT + NUMPAD+**)
B) For COM2 radio (UHF), press the AUX UHF RADIO SELECT button (**LALT + NUMPAD-**)



PART 11 – RADIO TUTORIAL

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

PART 12 -- AUTOPILOT

AUTOPILOT TUTORIAL

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

- HOLD CURRENT ALTITUDE
- HOLD SELECTED ALTITUDE
- LOCALIZER AND GLIDESLOPE HOLD (not implemented)

HOLD SELECTED ALTITUDE 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) Click on the HOLD CURRENT ALTITUDE button (light will go to yellow (AFF)).
- 4) 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 (ARMED).

HOLD CURRENT ALTITUDE MODE

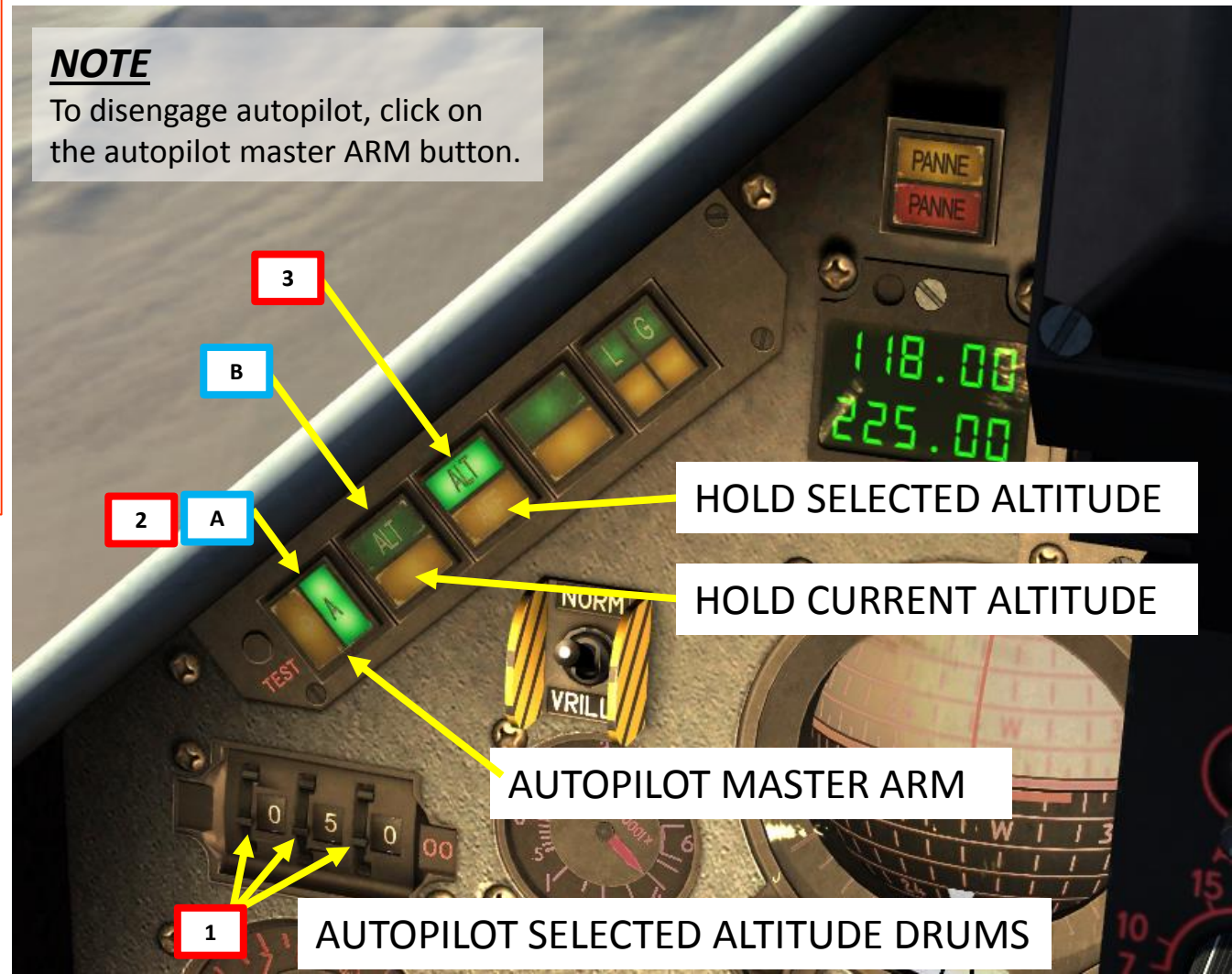
- A) Click on the autopilot master ARM button (light will turn to green (ARMED)).
- B) Click on the HOLD CURRENT ALTITUDE button (light will turn to green (ARMED)).
- C) Aircraft will level out and maintain current altitude

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

NOTE

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



PART 13 – NAVIGATION & ILS LANDING

NAVIGATION – THE *UNI* (INS)

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 three parts:

- I. INS ALIGNMENT PROCESS
- II. INS WAYPOINT ENTRY
- III. 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*): Latitude and Longitude of Waypoint

ALT (*BUT*): Altitude of Waypoint

CP/DP (*BUT*): Specific Glide Ascent/Descent

D/RLT: Distance and Bearing to next Waypoint (*BUT*)

TR/VS: Remaining Time / Ground Speed (*Temps Restant / Vitesse au Sol*)

$\Delta L/\Delta G$ (BAD): Alternate Latitude and Longitude

ΔALT (BAD): Alternate Altitude

P/ θ (BAD): Alternate navigation Vector in polar coordinates (distance in nm and Bearing in degrees)

DV/FV: Wind bearing and speed (*Direction/Force Vent*)

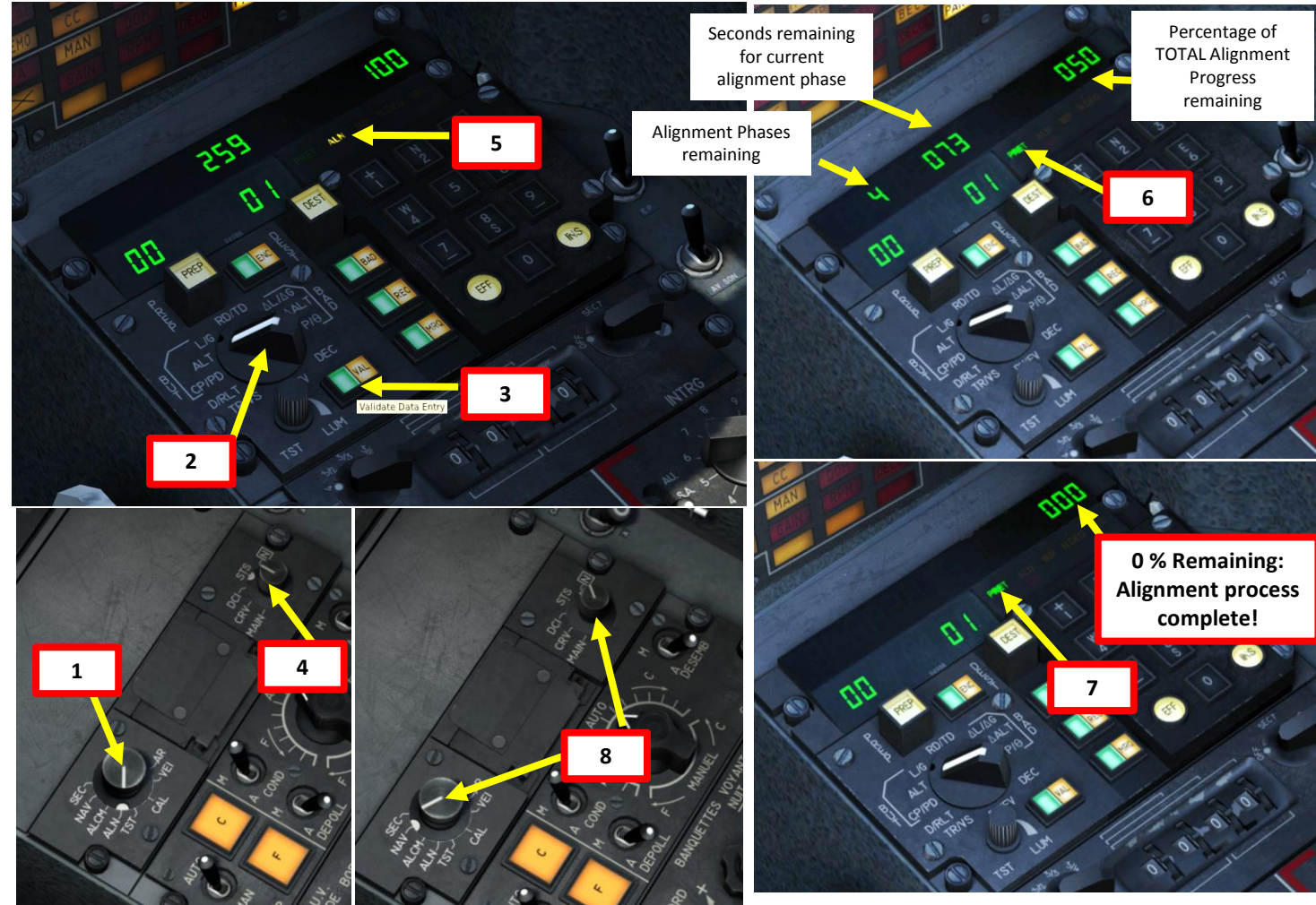
DEC: Magnetic declination

NAVIGATION TUTORIAL

I - UNI (INS) ALIGNMENT PROCESS

1. On PSM (*Poste Sélecteur de Modes* = Mode Selector Panel), set INS mode to ALN (Alignment) to start alignment procedure of inertial systems.
2. On PCN (*Poste de Commande de Navigation* = Navigation Control Panel), set INS parameter selector to L/G.
3. press **VAL** button to validate data entry of the MIP (*Module d'Insertion de Paramètres* = Data Cartridge Insertion Module).
4. 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.
5. A yellow ALN (Alignment) caution will blink during the **first** alignment phase (Class 4, coarse alignment).
6. "PRÊT" (Ready) caution will blink when **first** alignment phase is complete after 4 minutes.
7. "PRÊT" (Ready) caution will remain illuminated when all remaining phases are complete after another 4 minutes.
8. Set INS operation mode to "N" (Normal) when alignment phase is complete and set INS mode selector to "NAV".

NOTE: During the alignment phase, you can enter or modify waypoint entries at the same time.

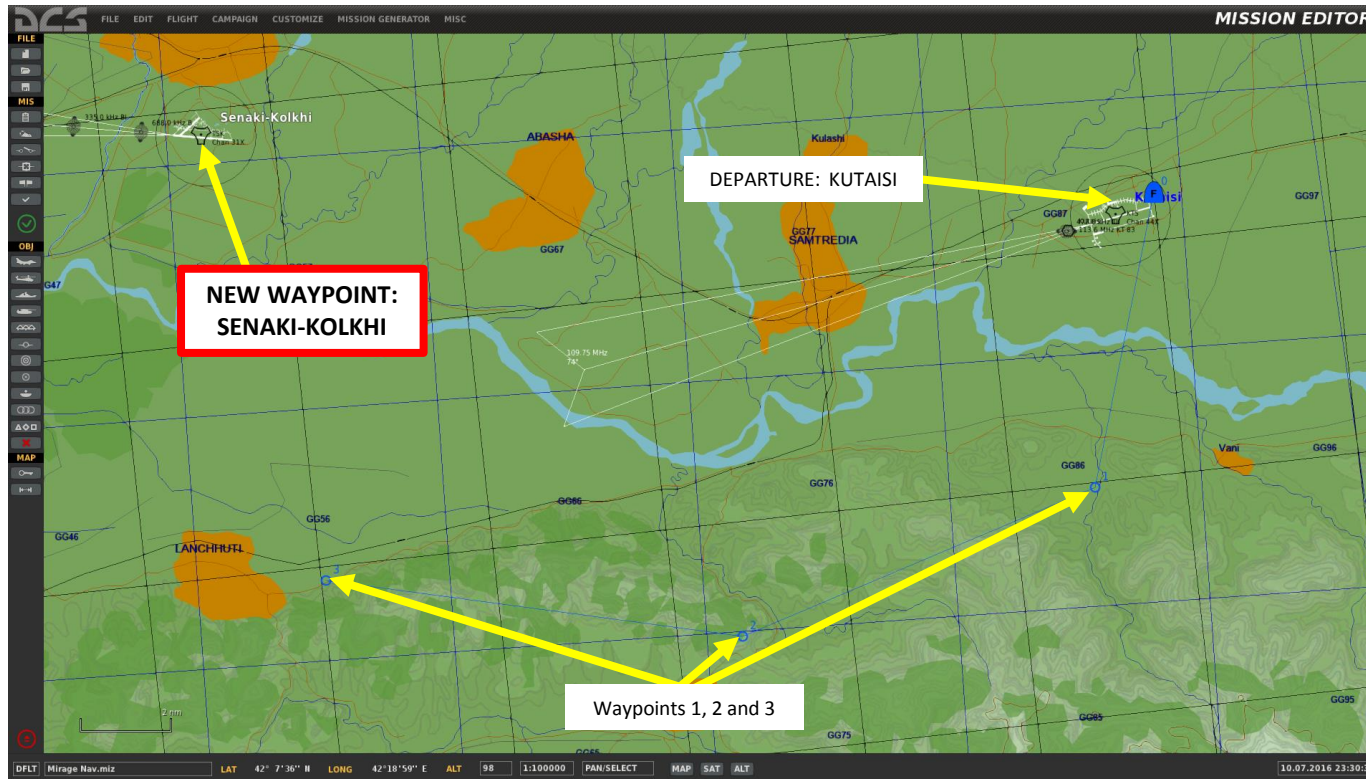


PART 13 – NAVIGATION & ILS LANDING

NAVIGATION TUTORIAL II - *UNI* (INS) WAYPOINT ENTRY

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.

1. Note the LAT-LONG coordinates of the waypoint you want to add. By pressing "F10" and selecting the map, we find:
SENAKI-KOLKHI COODINATES: 42°14'25" NORTH 42°02'01"EAST.
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



AIRDROME DATA

NAME	Senaki-Kolkhi
ICAO	UGKS
COALITION	Neutral
ELEVATION	34 ft
RWY Length	7736 ft
COORDINATES	1 42°14'35"N 42°02'01"E
TACAN	31X (TSK)
VOR	--
RSBN	--
ATC	132.00, 40.60, 261.00, 4.30
RWYs	9 27
ILS	108.90 (ITS) --
PRMG	-- --
OUTER NDB	335.00 (BI) --
INNER NDB	688.00 (B) --
RESOURCES	

PART 13 – NAVIGATION & ILS LANDING

NAVIGATION TUTORIAL II - *UNI* (INS) WAYPOINT ENTRY

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.

1. Note the LAT-LONG coordinates of the waypoint you want to add. By pressing "F10" and selecting the map, we find: SENAKI-KOLKHI COODINATES: 42°14'25" NORTH 42°02'01"EAST.
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)
 $42 = 25 \times 100 / 60$ since there are 60 seconds in a minute
42°02'01"EAST = 042:02.02 EAST (MIRAGE INS FORMAT)
 $02 \approx 1.66 = 1 \times 100 / 60$ since there are 60 seconds in a minute
3. Press "PREP" (Preparation) button to create a waypoint.
4. Press "0" and "4" (04) on the INS numpad to add Waypoint Number 4.
5. Press "+1" on numpad to select the North/South coordinate field (left)
6. Press "N" (2) on numpad to select NORTH coordinates
7. Press 421442 on numpad to enter NORTH coordinates
8. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).
9. Press "+3" on numpad to select the East/West coordinate field (right)
10. Press "E" (6) on numpad to select EAST coordinates
11. Press 0420202 on numpad to enter EAST coordinates (don't forget 0 at beginning for EAST/WEST coordinates)
12. Press INS (Insert) to enter coordinates (or EFF to erase if you made a mistake and need to start over).



PREPARING
WAYPOINT 04



THERE YOU GO,
YOU ENTERED A
NEW WAYPOINT!



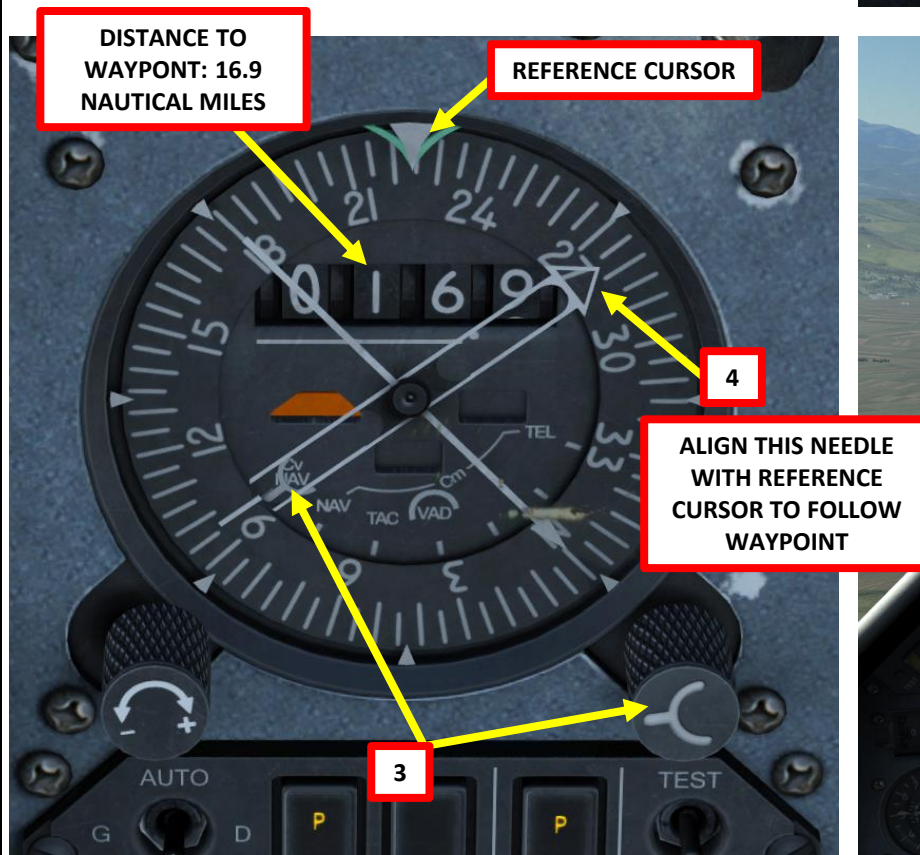
PART 13 – NAVIGATION & ILS LANDING

NAVIGATION TUTORIAL

III – HOW TO NAVIGATE TO A WAYPOINT

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.

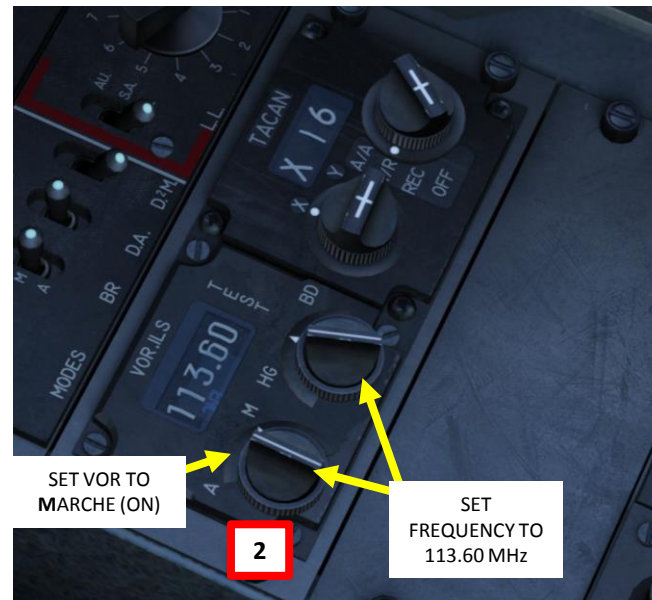
1. Press “DEST” (Destination) button to select a waypoint.
2. Press “0” and “4” (04) on the INS numpad to select Waypoint Number 4.
3. Set the HSI (Horizontal Situation Indication) mode to “CV” (Cap Vrai: True Heading)
4. Follow the HSI main needle to your waypoint.



PART 13 – NAVIGATION & ILS LANDING

NAVIGATION TUTORIAL HOW TO TRACK A VOR BEACON

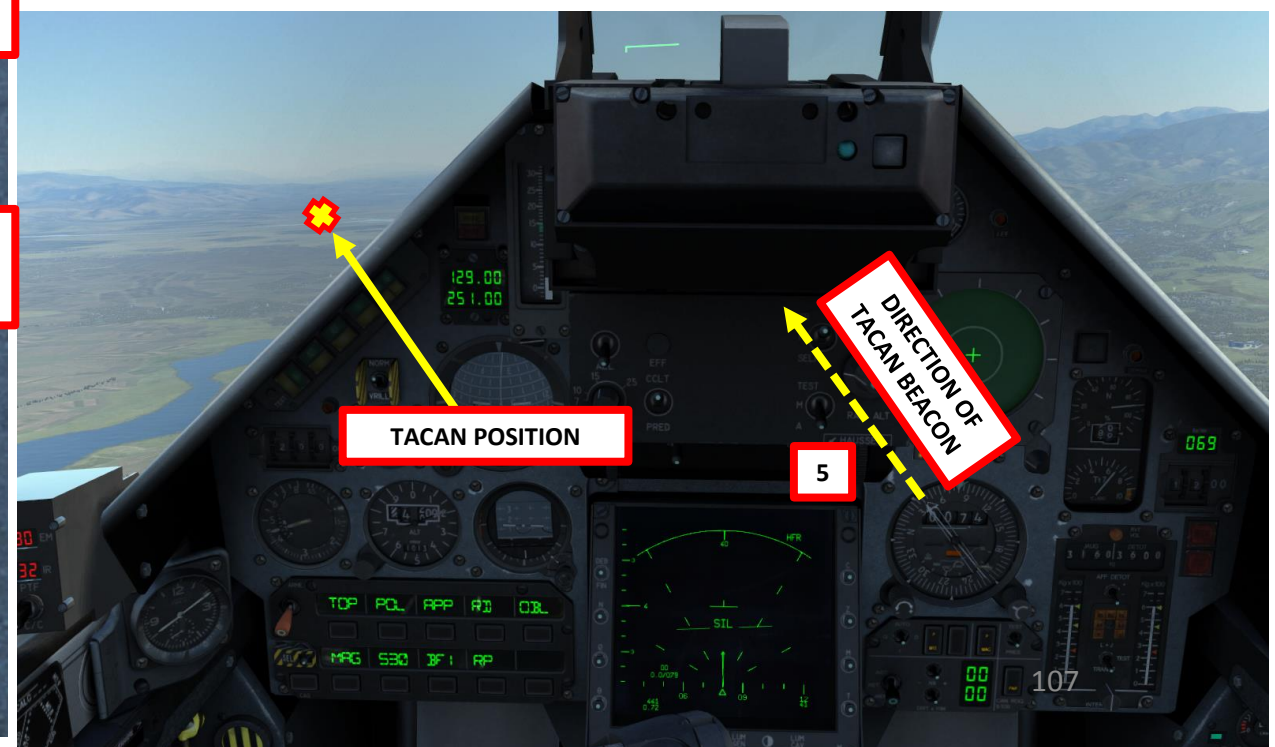
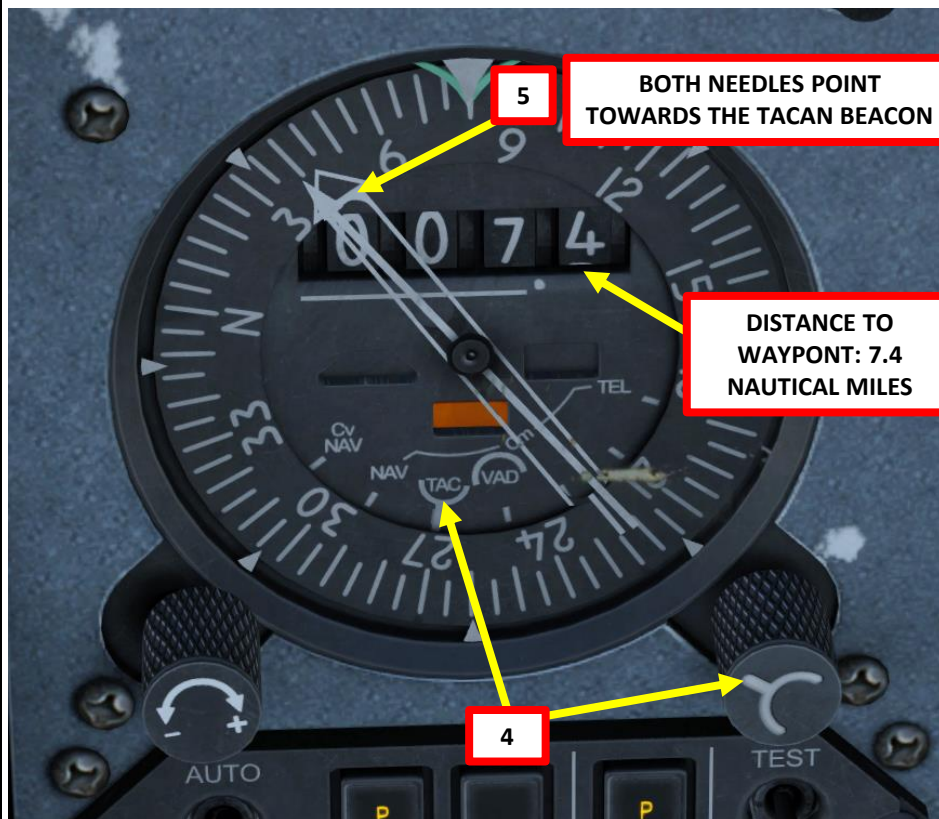
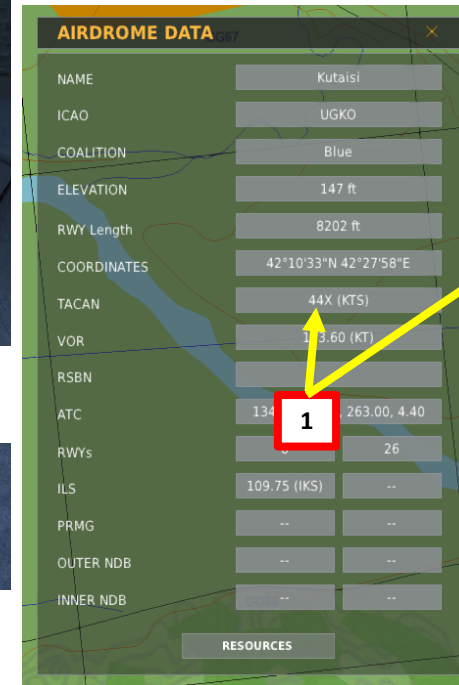
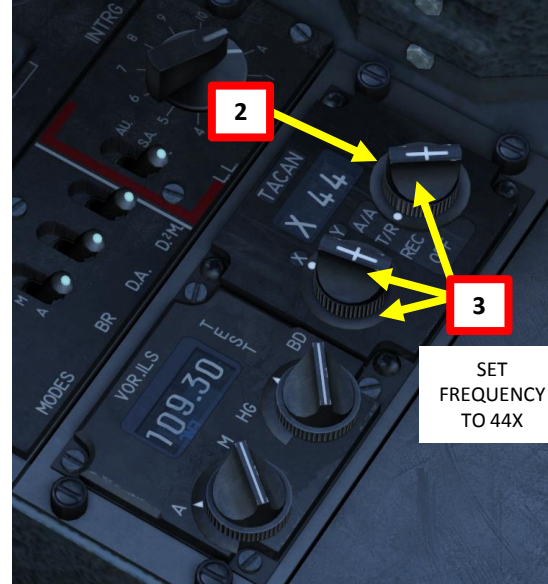
1. Press F10 to display the map, find the VOR beacon that you want to track and note its frequency. In our case, we will track a VOR beacon near Kutaisi. Its frequency is **113.60 MHz**.
2. Set VOR/ILS to **MARCHE** (ON) using left mouse button and set VOR frequency to 113.60.
3. Set the HSI (Horizontal Situation Indication) mode to “VAD” (*Vecteur Additionnel*: Alternate Waypoint).
4. Follow the HSI thin needle to your waypoint/VOR beacon.



PART 13 – NAVIGATION & ILS LANDING

NAVIGATION TUTORIAL HOW TO TRACK A TACAN BEACON

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 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 Indicator) mode to "TAC" (TACAN).
5. Follow both HSI needles to the TACAN beacon.



PART 13 – NAVIGATION & ILS LANDING

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 **111.75** for runway 25E. 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.

AIRDROME DATA

NAME	McCarran International Airport
ICAO	KLAS
COALITION	Blue
ELEVATION	2158 ft
RWY Length	10008 ft
COORDINATES	36°04'26"N 115°09'38"W
TACAN	116X (LAS)
VOR	116.90 (LAS)
RSBN	--
ATC	124.00, 39.00, 253.00
RWYS	7, 25
ILS	--, 111.75 (I-RL)
PRMG	--
OUTER NDB	--
INNER NDB	--

MISSION EDITOR

AIRPLANE GROUP

NAME: New Airplane Group #001
CONDITION: % < 100
COUNTRY: France
TASK: CAP
UNIT: < 1 OF < 1
TYPE: M-2000C
SKILL: Player
PILOT: Pilot #002
TAIL #: 010
CALLSIGN: Enfield 1 1
HIDDEN ON MAP: ☐
LATE ACTIVATION: ☐

LANDING WP TYPE

WAYPNT: 1 OF 2
NAME:
TYPE: Landing
ALT: 2110 feet
SPEED: 270 kts
ETA: 13:43:35 / 274
ADD EDIT DEL
ADVANCED (WAYPOINT ACTIONS)

APPROACH

LANDING WAYPOINT (WAYPOINT # 1)

ILS FREQUENCY

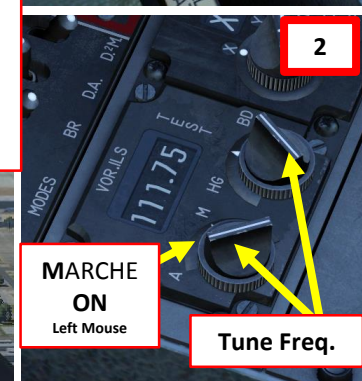
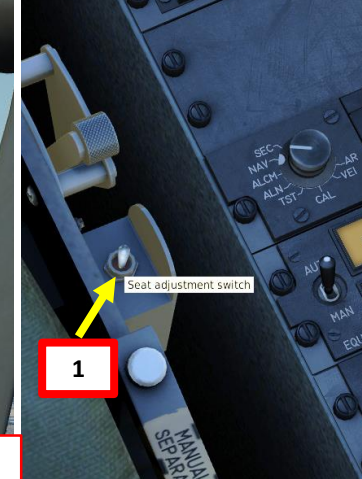
AIRPORT ICON

RUNWAY 25E

PART 13 – NAVIGATION & ILS LANDING

ILS LANDING (WITH SYNTHETIC RUNWAY)

1. Adjust seat height
2. Set VOR/ILS to **MARCHE (ON)** using left mouse button and set ILS frequency to 111.75.
3. Ensure UNI/INS Mode is set to “NAV” and “**NORMAL**”, 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. Deploy landing gear below 230 kts
6. Keep flight path marker where you want to touchdown
7. Line up flight path marker and acceleration chevrons within the “landing speed” brackets by adjusting throttle and stick.
8. Synthetic Runway will appear when runway is less than 10 miles away, glideslope is captured and there is less than 7 degrees of lateral deviation.
9. During touchdown, release stick to maintain your AoA and bleed speed in the process (your delta wing will act as a huge airbrake).
10. Apply brakes when you slowed down under 100 kts and push your nose down.
11. Engage Nosewheel Steering (DIRAV) when you slowed down to 40 kts.



PART 13 – NAVIGATION & ILS

LANDING

DCS Table of Frequencies

<i>Airfield</i>	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

PART 14 – FLY-BY-WIRE

Like the F-16, 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>

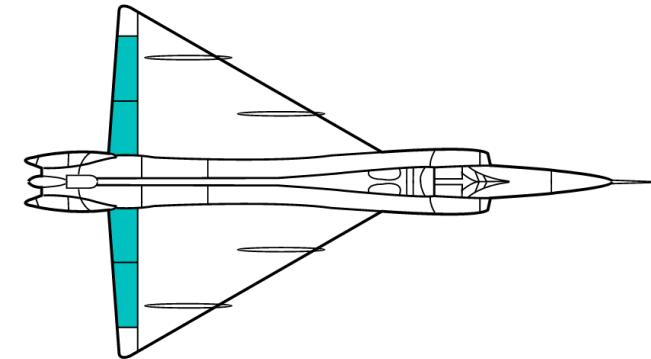


Pilot input on joystick

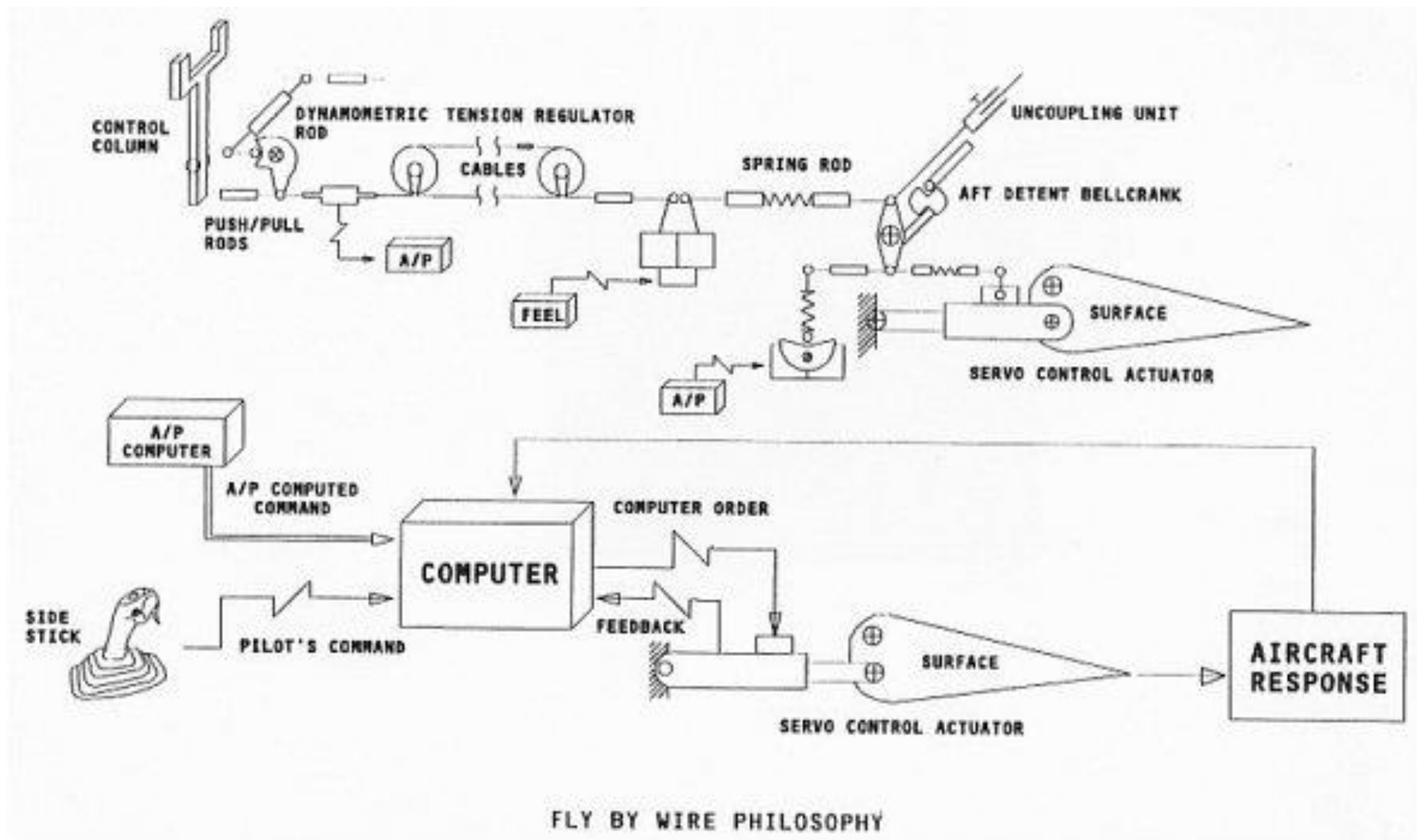
FLIGHT COMPUTER

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



PART 14 – FLY-BY-WIRE



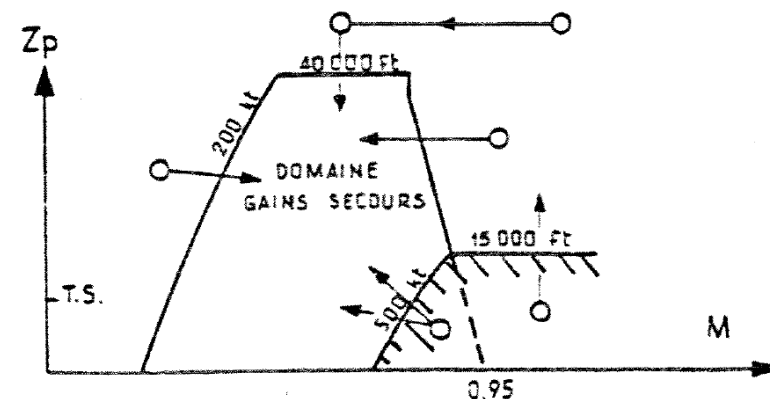
PART 14 – FLY-BY-WIRE

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 530D missiles). This FBW mode will allow you to pull the maximal allowable number of Gs during a dogfight. In other words, the manoeuvrability 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 manoeuvrable. 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.

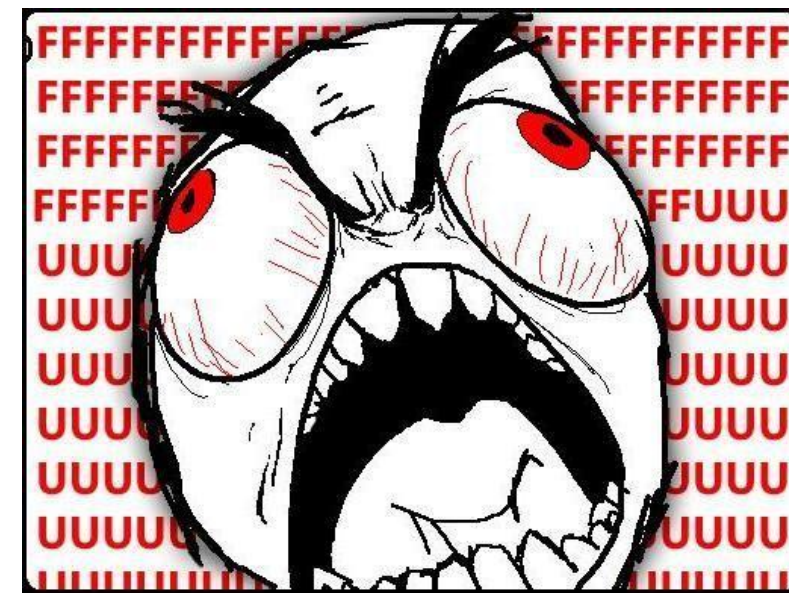
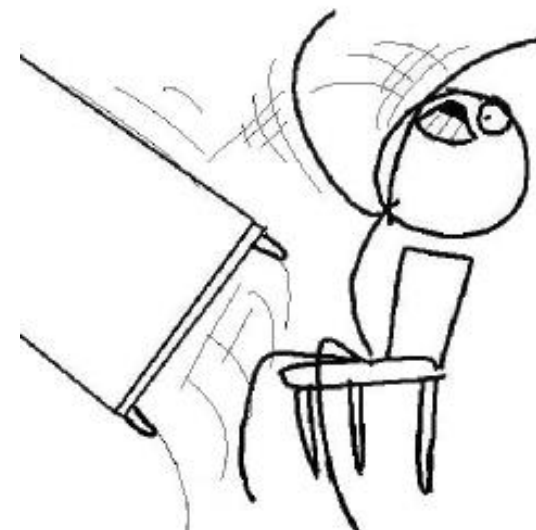


AIR-TO-AIR REFUELING – WHY WE ALL HATE IT

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.



TYPES OF AIR-TO-AIR REFUELING

- There are four main air-to-air refueling techniques used in military aviation:
 - Probe-and-drogue (refueling probe must be inserted in the tanker's drogue basket)
 - Flying Refueling Boom (guided by boom operator aboard the tanker)
 - Buddy Refueling (two fighters can refuel one another independently without a tanker)
 - Nose-Probe refueling
- The refueling aircraft available in DCS are:
 - The Ilyushin Il-78M "Midas", a russian **probe-and-drogue** tanker, which was developed from the Il-76
 - The Boeing KC-135 "Stratotanker", a US Air Force **flying boom** tanker, which was developed from the Boeing 767-80
 - The Lockheed S-3B "Viking", a US Navy **probe-and-drogue** tanker

The Mirage 2000C is equipped with a Probe-and-Drogue system, so air-to-air refueling will only be performed from either an Il-78M or a S-3B tanker. However, RAZBAM is planning on implementing the KC-135FR, which is a modified version of the KC-135 that is equipped with a probe-and-drogue system to accommodate French fighter aircraft like the Mirage.



F-105 Thunderchiefs being refueled by a Boom system during the Vietnam War



Tornado GR4 being refueling by a Probe-and-Drogue system



Il-78M



KC-135



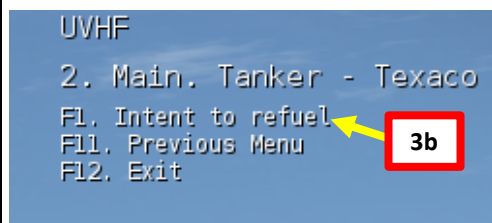
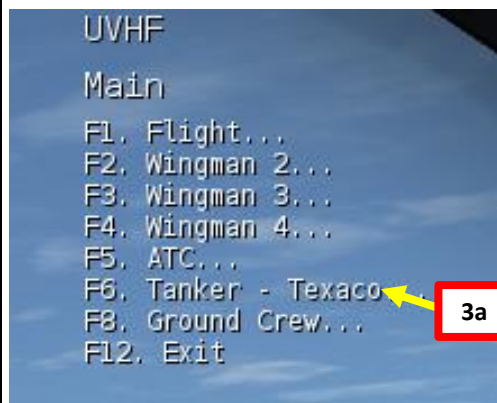
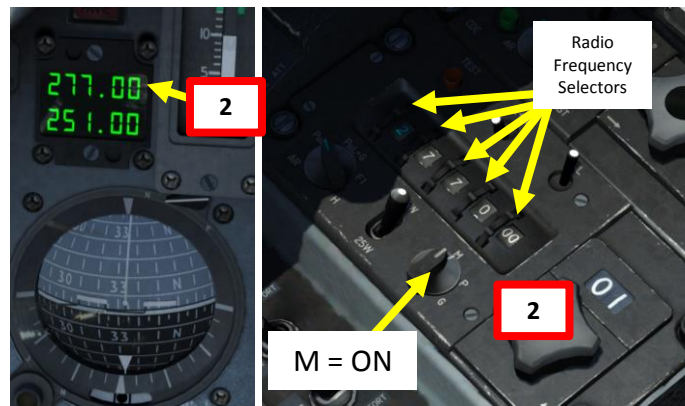
S-3B

PART 15 – AIR-TO-AIR REFUELING

AIR-TO-AIR REFUELING DEMO

1. Consult mission briefing to know on which radio frequency you need to contact the tanker. In our case, we will use the frequency 277 MHz on the V/UHF radio.
2. Set your radio to 277 MHz and **MARCHE** (ON) and press “/” to communicate with TEXACO (tanker callsign).
3. Select Tanker – Texaco (F6) communication menu, and then select “Intent to Refuel”
4. TEXACO should give you a pre-contact altitude (in our case 16,000 ft).

Note: Some tankers like the KC-135 are equipped with a TACAN beacon, which can give you a direction to find it easily. However, the S-3B Viking isn't equipped with this navigation beacon. Therefore, you will have to spot the tanker visually (or you could find him on your radar screen, but the aircrew is very likely to start freaking out once they realize they're being radar locked).



DETAILS



MISSION OVERVIEW

Title
Start at 1/6/2011 12:00:00
My Side France

MISSION DATA

My task CAP
Flight M-2000C*1

ALLIES FLIGHT

Allies flight 'S-3B Tanker'*1

SITUATION

Air-to-Air Refueling Mission
-Contact S-3B Tanker TEXACO on frequency 277 MHz
-Refueling Waypoint set to 16,000 ft

OBJECTIVE

THREATS

Threat N/A

PART 15 – AIR-TO-AIR REFUELING

AIR-TO-AIR REFUELING DEMO

5. Set the Refueling Transfer Switch UP (ON).
6. When you are less than 0.1 nm away from tanker, position yourself as shown on picture.
7. When in position, use your radio menu to select “Ready Pre-Contact” (F1).
8. The tanker’s pilot should answer you with “Cleared Contact” and should deploy his drogue basket and start to accelerate to cruising speed.
9. Fly formation with the tanker and approach the drogue basket very slowly (make sure you remain about 2-3 kts faster than the tanker) with gentle inputs.
10. Insert your probe into the drogue basket.
11. Additional drag should be generated by the drogue once you have contact with the drogue: your aircraft will slightly decelerate. Once the probe is taking fuel, the tanker pilot should tell you “You’re taking fuel”.
12. Keep formation with the tanker until your refueling is complete.
13. Detach your probe from the basket by throttling down and set the Refueling Transfer Switch DOWN (OFF).

Texaco. Tanker. Pre-contact

F1. Ready pre-contact
F2. Abort refuel
F11. Parent Menu
F12. Exit

7



8

6



10



9

AIR-TO-AIR REFUELING DEMO

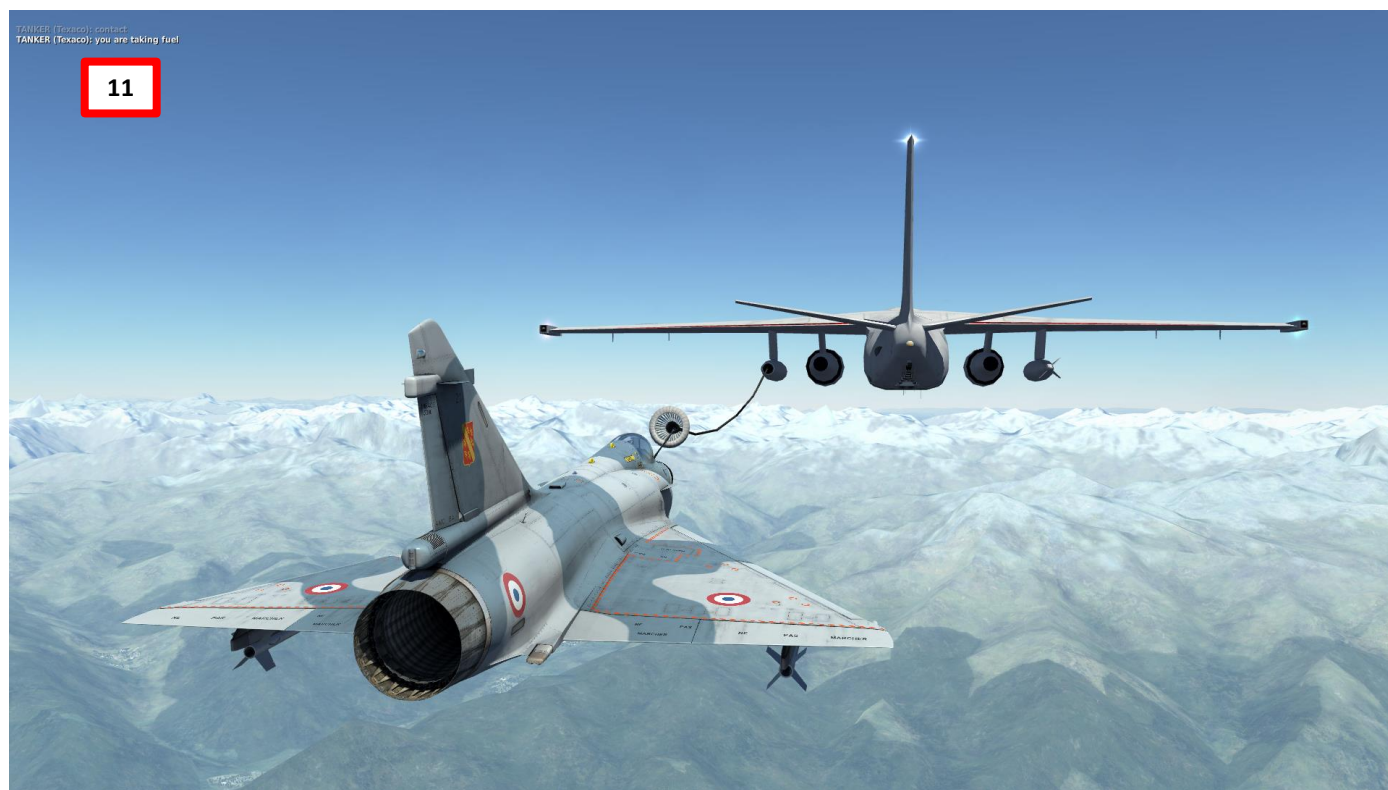
Of course, all of this seems much easier said than done. You will very likely do following mistakes:

- Approach too fast and miss the basket
- Oscillate vertically without being able to line up with the basket
- Keep going either too fast or too slow
- Drift left or right
- Overcompensate control inputs
- Fight the Fly-By-Wire system.

Here are various demos of air-to-air refueling.

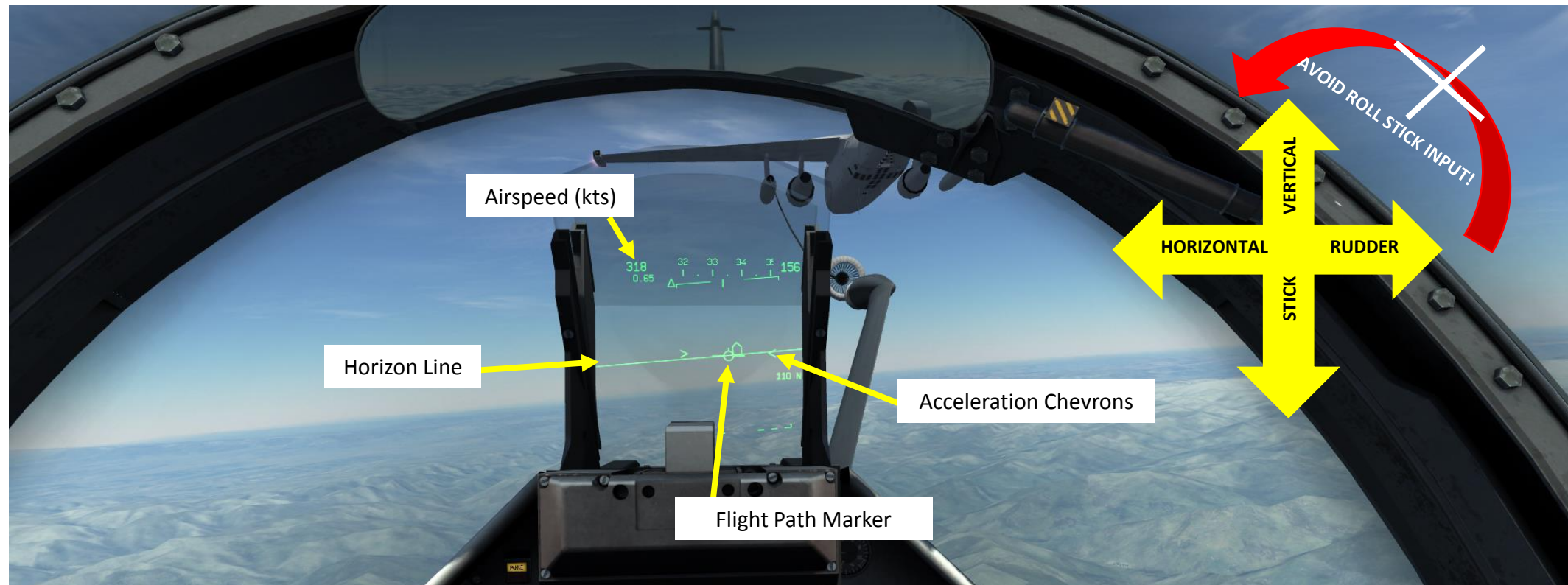
- <https://www.youtube.com/watch?v=mm6U2WJMZa8>
- <https://www.youtube.com/watch?v=cjImOHdq2Xk>
- <https://www.youtube.com/watch?v=7LLgCjUKBug>
- <https://www.youtube.com/watch?v=rw0mrkXXysw>

The next slide will give you a couple of tips to help you catch that basket and slurp that delicious jet fuel like a crack addict.



AIR-TO-AIR REFUELING DEMO – TIPS AND TRICKS

- Remaining **CALM is key** for a successful refueling. If you lose your cool, take a break and try again once you are relaxed. Silk hands and a clear head are needed for that part.
- If you overshoot (or are about to fly past) the tanker, you can bleed speed very fast by deploying your airbrakes. You can go from 400 kts to 300 kts in a matter of seconds.
- **Avoid rolling** your aircraft when you are tracking the basket: you will change the orientation of your lift vector and it will make you drift vertically and horizontally, which doesn't help at all. Try to stay in the same horizontal plane as much as possible.
- It is easier if you try to “break down” your control inputs in **separate movements**. I try to avoid gunning my throttle, pitching up/down and using my rudder at the same time. The aircraft reacts in a way that makes it all very difficult for your brain to predict and process. I tend to make sure my plane is **straight and level at first** and that I am more or less lined up with the basket.
- Once I have a satisfying attitude and that the basket is placed approximately as shown on the picture below, I **gradually throttle up** and increase speed to **match the tanker's speed**. In this case, the tanker's speed is 315 kts. Make sure that you keep a constant speed by checking if your **acceleration chevrons** are lined up horizontally with the Flight Path Marker.
- Once my speed matches the tanker's, I can gradually accelerate to a speed that is 2-3 kts faster (318 in our case), **approaching the basket very slowly**. At that part, the ONLY two things I am watching are my **AIRSPEED** and the **BASKET**. Nothing else matters.
- Once I am approaching the basket, I make sure to avoid inducing rolling motions while displacing myself with the rudder and the vertical stick input ONLY. This way, your aircraft stays straight and delicately drifts left or right based on the **rudder input**, while you can **fine-tune your vertical attitude** with your stick.



RESOURCES

Dassault Mirage 2000C Flight Manual

<http://air.felisnox.com/view.php?name=m2000c.pdf>

RAZBAM's DCS Mirage 2000C Flight Manual (Work In Progress)

<https://drive.google.com/open?id=0B-uSpZROuEd3b08zbkhTdlRaU2M>

Manudan93's Mirage 2000C Tutorial (Aircraft Start-Up + Radar Operation + Missile Usage + Landing)

https://www.youtube.com/watch?v=g9x3_PZ-Arw

ThePsbob's ILS Landing Tutorial (with Synthetic Runway)

<https://www.youtube.com/watch?v=W75A5nxhiUI>

Various Mirage 2000C Video Tutorials

<http://forums.eagle.ru/showthread.php?t=156825>

Le Mur du Son - Mirage 2000 Documentary (French)

<https://www.youtube.com/watch?v=YjI7Tg75MD8>

Firepower – Mirage Fighter Jet Documentary (English)

https://www.youtube.com/watch?v=-QAWIK_RgV0

BVR (Beyond Visual Range) Combat Tactics for the Mirage by il_corleone

<http://forums.eagle.ru/showthread.php?t=157097>

Les Chevaliers du Ciel movie by Gérard Pirès

Full of corny lines, nonsensical plot, wooden acting... but also full of Mirages!

https://en.wikipedia.org/wiki/Sky_Fighters



digital combat series



Chuck_Owl

DCS: M-2000C

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MISSION
CAMPAIGN
MULTIPLAYER

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Nevada
2.0.0



A-10C
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Bf 109 K-4
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CA
2.0.0



F-86F
2.0.0 beta



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2.0.0



Fw 190 D-9
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Hawk
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Ka-50
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L-39C
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M-2000C
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Mi-8MTV2
2.0.0 beta



MiG-15bis
2.0.0 beta



MiG-21bis
2.0.0



P-51D
2.0.0



Su-25T
2.0.0

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