

DCS GUIDE

F/A-18C HORNET LOT 20

BY CHUCK

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DISCLAIMER

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

The author of this document has never had access to restricted or classified documentation on the F/A-18C Hornet. The author has never had access to OEM (Original Equipment Manufacturer) data related to the F/A-18C Hornet, its armament systems nor its defensive systems. All the information within this document is taken from public documentation (i.e. F/A-18 Early Access Manual by Eagle Dynamics) and non-official tutorials (player-made videos on Youtube).

The procedures listed in this document are deliberately simplified for gameplay purposes due to the limitations of the DCS World simulation environment and the limitations of the DCS F/A-18C module by Eagle Dynamics.

This document is merely a free, personal project that is used for entertainment. This document is not meant nor designed to teach someone to fly a real F/A-18C Hornet.

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

The **McDonnell Douglas F/A-18 Hornet** is a twin-engine, supersonic, all-weather, carrier-capable, multirole combat jet, designed as both a fighter and attack aircraft (hence the F/A designation). Designed by McDonnell Douglas (now Boeing) and Northrop, the F/A-18 was derived from the latter's YF-17 in the 1970s for use by the United States Navy and Marine Corps.

The Hornet is highly maneuverable, owing to its good thrust-to-weight ratio, digital fly-by-wire control system, and leading-edge extensions, which allow the Hornet to remain controllable at high angles of attack. The trapezoidal wing has a 20-degree sweepback on the leading edge and a straight trailing edge. The wing has full-span, leading-edge flaps and the trailing edge has single-slotted flaps and ailerons over the entire span. The Hornet is also notable for having been designed to reduce maintenance, and as a result, has required far less downtime than its heavier counterparts, the F-14 Tomcat and the A-6 Intruder. Its mean time between failures is three times greater than any other Navy strike aircraft, and requires half the maintenance time. Its General Electric F404 engines were also innovative in that they were designed with operability, reliability, and maintainability first. The engine, while unexceptional in rated performance, demonstrates exceptional robustness under various conditions and is resistant to stall and flameout. The F404 engine connects to the airframe at only 10 points and can be replaced without special equipment; a four-person team can remove the engine within 20 minutes.





The F/A-18 has a top speed of Mach 1.8 (1,034 knots, 1,190 mph or 1,915 km/h at 40,000 ft or 12,200 m). It can carry a wide variety of bombs and missiles, including air-to-air and air-to-ground, supplemented by the 20-mm M61 Vulcan cannon. It is powered by two General Electric F404 turbofan engines, which give the aircraft a high thrust-to-weight ratio. The F/A-18 has excellent aerodynamic characteristics, primarily attributed to its leading-edge extensions (LEX). The fighter's primary missions are fighter escort, fleet air defense, suppression of enemy air defenses, air interdiction, close air support, and aerial reconnaissance. Its versatility and reliability have proven it to be a valuable carrier asset, though it has been criticized for its lack of range and payload compared to its earlier contemporaries, such as the Grumman F-14 Tomcat in the fighter and strike fighter role, and the Grumman A-6 Intruder and LTV A-7 Corsair II in the attack role.



The DCS Hornet we have at the moment is the “C” version, also known as “Legacy” or “Charlie” Hornet. As early access progresses and more weapons and sensors are integrated, the Hornet will become one of the most versatile aircraft, being able to precisely drop unguided bombs, fire short and long-range air-to-air missiles like the Sidewinder and the AMRAAM, and eventually use an ATFLIR targeting pod, HARMs, SLAM-ERs and other high-tech systems of the kind. The cockpit feels modern with its DDIs (Digital Display Indicator) AMPCD (Advanced Multi-Purpose Color Display), Moving Map and Heads-Up Display. There is a lot of functionality embedded in all of these pages and the UFC (Up-Front Controller) is instinctive enough to make even the most complicated tasks relatively straightforward. The Hornet seems to have been designed to be a Jack of all Trades that could be used in more or less any type of mission, which makes it a great choice for those who want to do different things.

The F/A-18C is an incredible product, even if it is still being developed. Carrier operations are stressful and require an ungodly amount of hours of practice before being any good at all. It is genuinely the most stressful thing I’ve ever done in DCS, air-to-air refueling included. The flight model by itself is something completely different. The FCS (Flight Control System) needs to be studied and understood if you want to fly “with it” instead of fighting “against it”. Yes, you will have to tame the beast. That’s part of its charm.

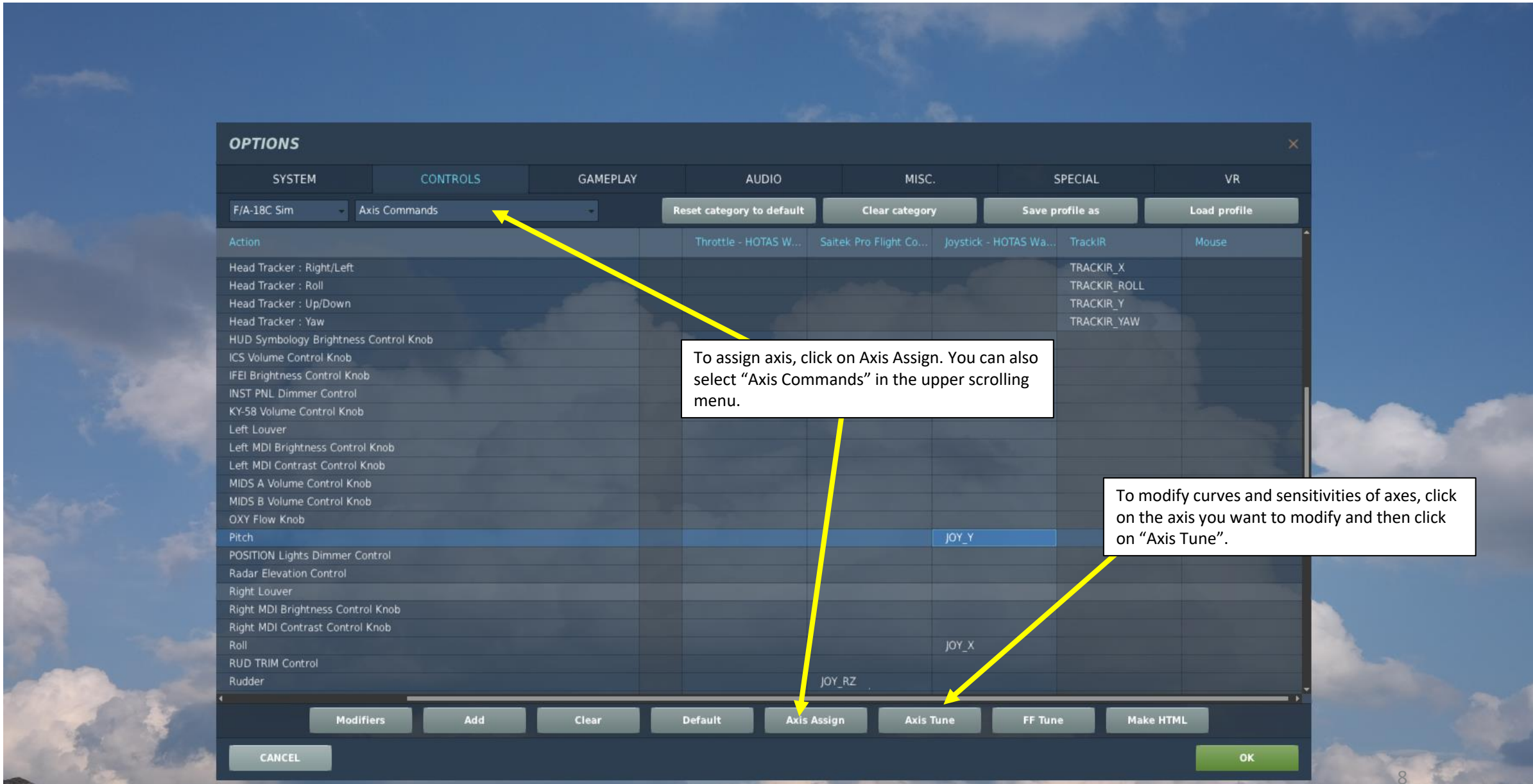
This aircraft gives you a great sense of power, purpose and achievement. Learning to fly it properly is no easy task but the aircraft has such character that it makes the whole experience very rewarding. Once you get that exhilarating feeling of catching the third wire during a difficult carrier landing… you’ll understand what I’m talking about.







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

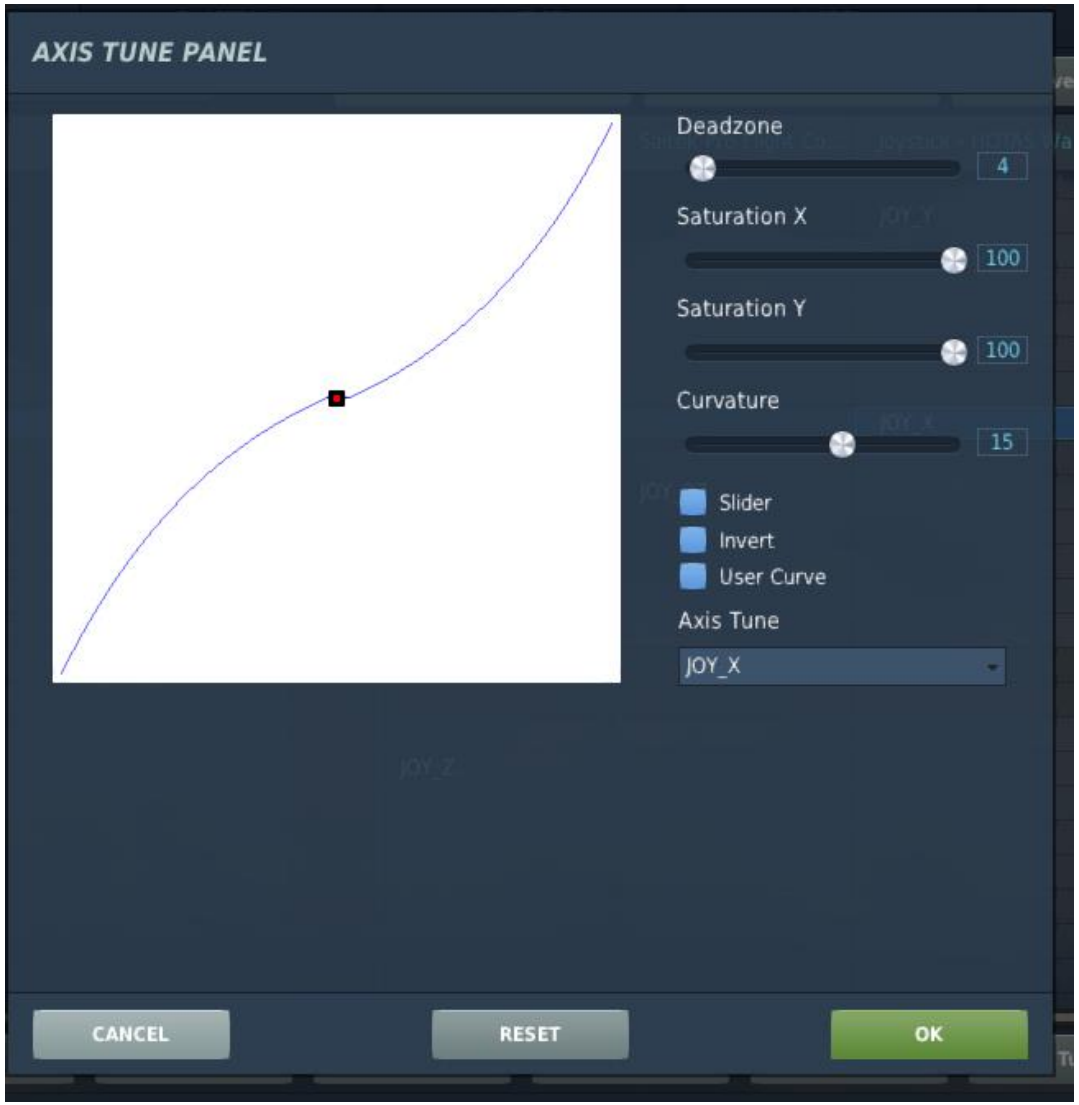


Bind the following axes:

- PITCH (DEADZONE AT 4, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 15)
- ROLL (DEADZONE AT 4, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 15)
- RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 10)
- THRUST – CONTROLS ENGINE RPM
- WHEEL BRAKE LEFT / RIGHT

NOTE

A small deadzone in the PITCH and ROLL axis must be set via the AXIS TUNE menu. Why? Because the autopilot will not be able to engage if the stick is not completely centered, and most sticks are not completely zeroed by definition (even the Thrustmaster Warthog). If you don't set a deadzone, you run into the risk of not being able to engage your autopilot since your stick will always be detected as "not completely centered" even if the position offset is negligible.



WHAT YOU NEED MAPPED



DISPENSE SWITCH (AFT)
(Grey button on RHS)

- ↑ TRIMMER PUSH
- → TRIMMER RIGHT WING DOWN
- ↓ TRIMMER PULL
- ← TRIMMER LEFT WING DOWN

- ↑ Select Sidewinder
- → Select Amraam
- ↓ Select Sparrow
- ← Select Gun

Weapon Release

- ↑ ZOOM IN SLOW
- → TDC - DEPRESS
- ↓ ZOOM OUT SLOW
- ← CAGE/UNCAGE BUTTON

Gun Trigger: Second Detent

- ↑ Sensor Control Sw. FWD
- → Sensor Control Sw. RIGHT
- ↓ Sensor Control Sw. AFT
- ← Sensor Control Sw. LEFT
- P Sensor Control Sw. DEPRESS

- ↑
- → COMM Switch: COMM 1
- ↓
- ← COMM Switch: COMM 2

HARM Target Sequence /RAID / FLIR Button

RADAR ELEVATION CONTROL AXIS

Undesignate / Nose Wheel Steer Button

- ← SPEED BRAKE RETRACT
- → SPEED BRAKE EXTEND

- ↑ TDC FORWARD
- → TDC RIGHT
- ↓ TDC AFT
- ← TDC LEFT

Autopilot / Nosewheel Steering Disengage (Paddle)

- ← ATC Engage/Disengage
- → Throttle Finger Lift (BOTH)

+ TOE BRAKES (MAPPED ON PEDALS)

WHAT YOU NEED MAPPED

Redkite also has a nice profile that you can use that is closer to the real Hornet stick and throttle setup. Link: https://youtu.be/iKLrnJpc8I4

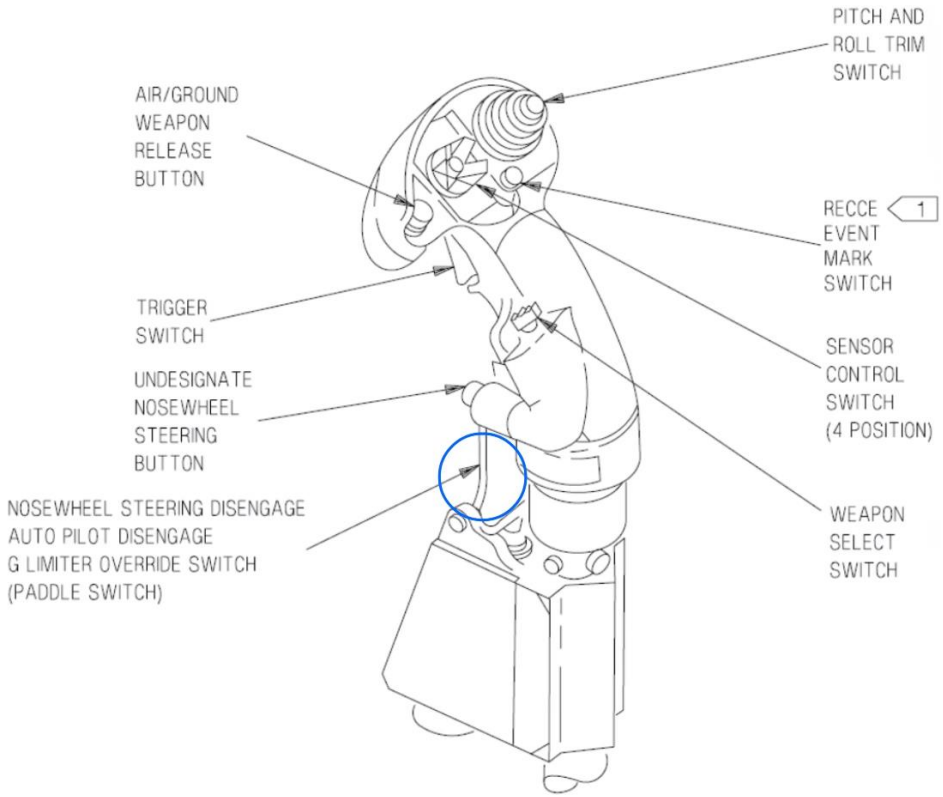
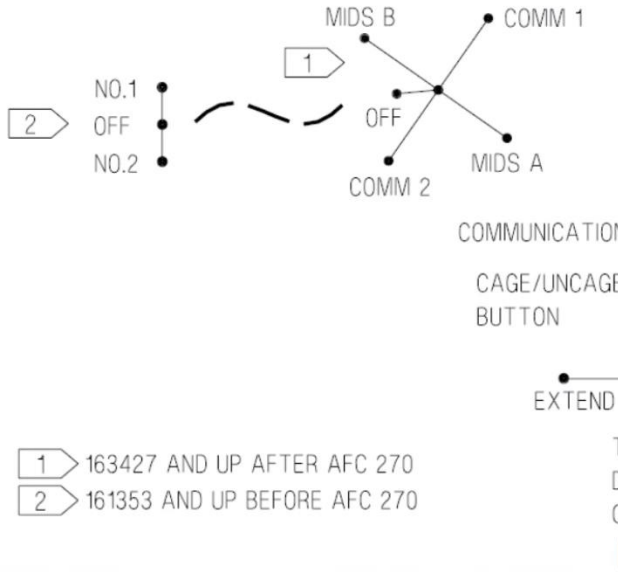


Figure 2-13. Control Stick



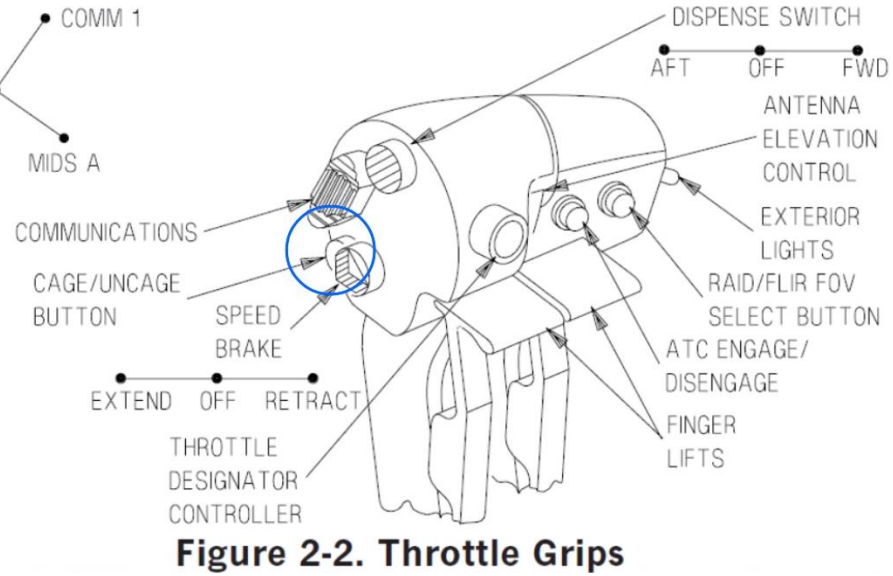
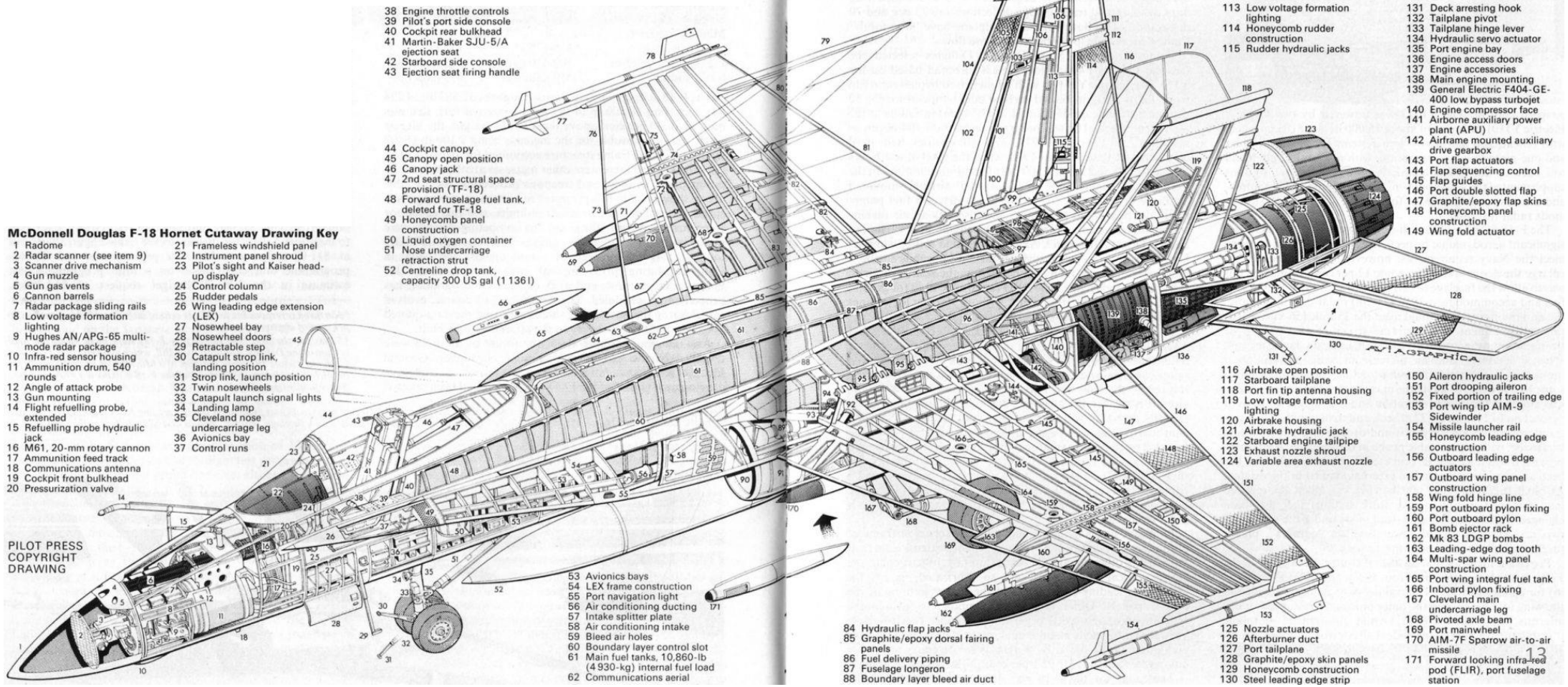


Figure 2-2. Throttle Grips

PART 3 – COCKPIT & EQUIPMENT





McDonnell Douglas F-18 Hornet Cutaway Drawing Key

1 Radome
2 Radar scanner (see item 9)
3 Scanner drive mechanism
4 Gun muzzle
5 Gun gas vents
6 Cannon barrels
7 Radar package sliding rails
8 Low voltage formation lighting
9 Hughes AN/APG-65 multi-mode radar package
10 Infra-red sensor housing
11 Ammunition drum, 540 rounds
12 Angle of attack probe
13 Gun mounting
14 Flight refuelling probe, extended
15 Refuelling probe hydraulic jack
16 M61, 20-mm rotary cannon
17 Ammunition feed track
18 Communications antenna
19 Cockpit front bulkhead
20 Pressurization valve
21 Frameless windshield panel
22 Instrument panel shroud
23 Pilot's sight and Kaiser head-up display
24 Control column
25 Rudder pedals
26 Wing leading edge extension (LEX)
27 Nosewheel bay
28 Nosewheel doors
29 Retractable step
30 Catapult strop link, landing position
31 Strop link, launch position
32 Twin nosewheels
33 Catapult launch signal lights
34 Landing lamp
35 Cleveland nose undercarriage leg
36 Avionics bay
37 Control runs
38 Engine throttle controls
39 Pilot's port side console
40 Cockpit rear bulkhead
41 Martin-Baker SJU-5/A ejection seat
42 Starboard side console
43 Ejection seat firing handle
44 Cockpit canopy
45 Canopy open position
46 Canopy jack
47 2nd seat structural space provision (TF-18)
48 Forward fuselage fuel tank, deleted for TF-18
49 Honeycomb panel construction
50 Liquid oxygen container
51 Nose undercarriage retraction strut
52 Centreline drop tank, capacity 300 US gal (1 136 l)
53 Avionics bays
54 LEX frame construction
55 Port navigation light
56 Air conditioning ducting
57 Intake splitter plate
58 Air conditioning intake
59 Bleed air holes
60 Boundary layer control slot
61 Main fuel tanks, 10,860-lb (4 930-kg) internal fuel load
62 Communications aerial
63 Bleed air outlet louvres
64 Starboard leading edge extension
65 External fuel tank, capacity 610 US gal (2 309 l)
66 Laser spot tracker pod (LST), starboard fuselage station
67 Starboard inboard wing pylon
68 Pylon mounting
69 Mk 83 low drag general purpose (LDGP) bombs (A-18)
70 Bomb ejector rack
71 Starboard outer wing pylon
72 Pylon fixing
73 Leading edge dog-tooth
74 Wing fold hinge line
75 Outboard leading edge actuator
76 Drooping leading edge
77 Starboard wing tip missile launcher rail
78 AIM-9L Sidewinder air-to-air missile
79 Outer wing panel folded position
80 Starboard drooping aileron
81 Starboard double slotted flap
82 Flap guides
83 Wing integral fuel tank
84 Hydraulic flap jacks
85 Graphite/epoxy dorsal fairing panels
86 Fuel delivery piping
87 Fuselage longeron
88 Boundary layer bleed air duct
89 Air conditioning plant
90 Port intake
91 Intake ducting
92 Leading edge flap hydraulic jack
93 Flap sequencing control unit
94 Control cable runs
95 Wing attachment pin joints
96 Rear fuselage fuel tank
97 APU exhaust duct
98 Starboard engine bay
99 Fin attachment fixing
100 Fin construction
101 Fuel jettison pipe
102 Graphite/epoxy skin
103 Anti-collision light
104 Steel leading edge strip
105 Honeycomb panel
106 Aerial tuners
107 Electronic countermeasures aerials (ECM)
108 Fin tip antenna housing
109 Communications aerial
110 Radar warning receiver
111 Tail navigation light
112 Fuel jettison
113 Low voltage formation lighting
114 Honeycomb rudder construction
115 Rudder hydraulic jacks
116 Airbrake open position
117 Starboard tailplane
118 Port fin tip antenna housing
119 Low voltage formation lighting
120 Airbrake housing
121 Airbrake hydraulic jack
122 Starboard engine tailpipe
123 Exhaust nozzle shroud
124 Variable area exhaust nozzle
125 Nozzle actuators
126 Afterburner duct
127 Port tailplane
128 Graphite/epoxy skin panels
129 Honeycomb construction
130 Steel leading edge strip
131 Deck arresting hook
132 Tailplane pivot
133 Tailplane hinge lever
134 Hydraulic servo actuator
135 Port engine bay
136 Engine access doors
137 Engine accessories
138 Main engine mounting
139 General Electric F404-GE-400 low bypass turbojet
140 Engine compressor face
141 Airborne auxiliary power plant (APU)
142 Airframe mounted auxiliary drive gearbox
143 Port flap actuators
144 Flap sequencing control
145 Flap guides
146 Port double slotted flap
147 Graphite/epoxy flap skins
148 Honeycomb panel construction
149 Wing fold actuator
150 Aileron hydraulic jacks
151 Port drooping aileron
152 Fixed portion of trailing edge
153 Port wing tip AIM-9 Sidewinder
154 Missile launcher rail
155 Honeycomb leading edge construction
156 Outboard leading edge actuators
157 Outboard wing panel construction
158 Wing fold hinge line
159 Port outboard pylon fixing
160 Port outboard pylon
161 Bomb ejector rack
162 Mk 83 LDGP bombs
163 Leading-edge dog tooth
164 Multi-spar wing panel construction
165 Port wing integral fuel tank
166 Inboard pylon fixing
167 Cleveland main undercarriage leg
168 Pivoted axle beam
169 Port mainwheel
170 AIM-7F Sparrow air-to-air missile
171 Forward looking infra-red pod (FLIR), port fuselage station

PILOT PRESS COPYRIGHT DRAWING

AVIAGRAPHICA



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


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


Mirror
Click to fold/unfold
Mirror
Click to fold/unfold
Mirror
Click to fold/unfold
Left DDI (Digital Display Indicator)
Right DDI (Digital Display Indicator)
AMPCD (Advanced Multipurpose Color Display)

“Towel Rack” Handles

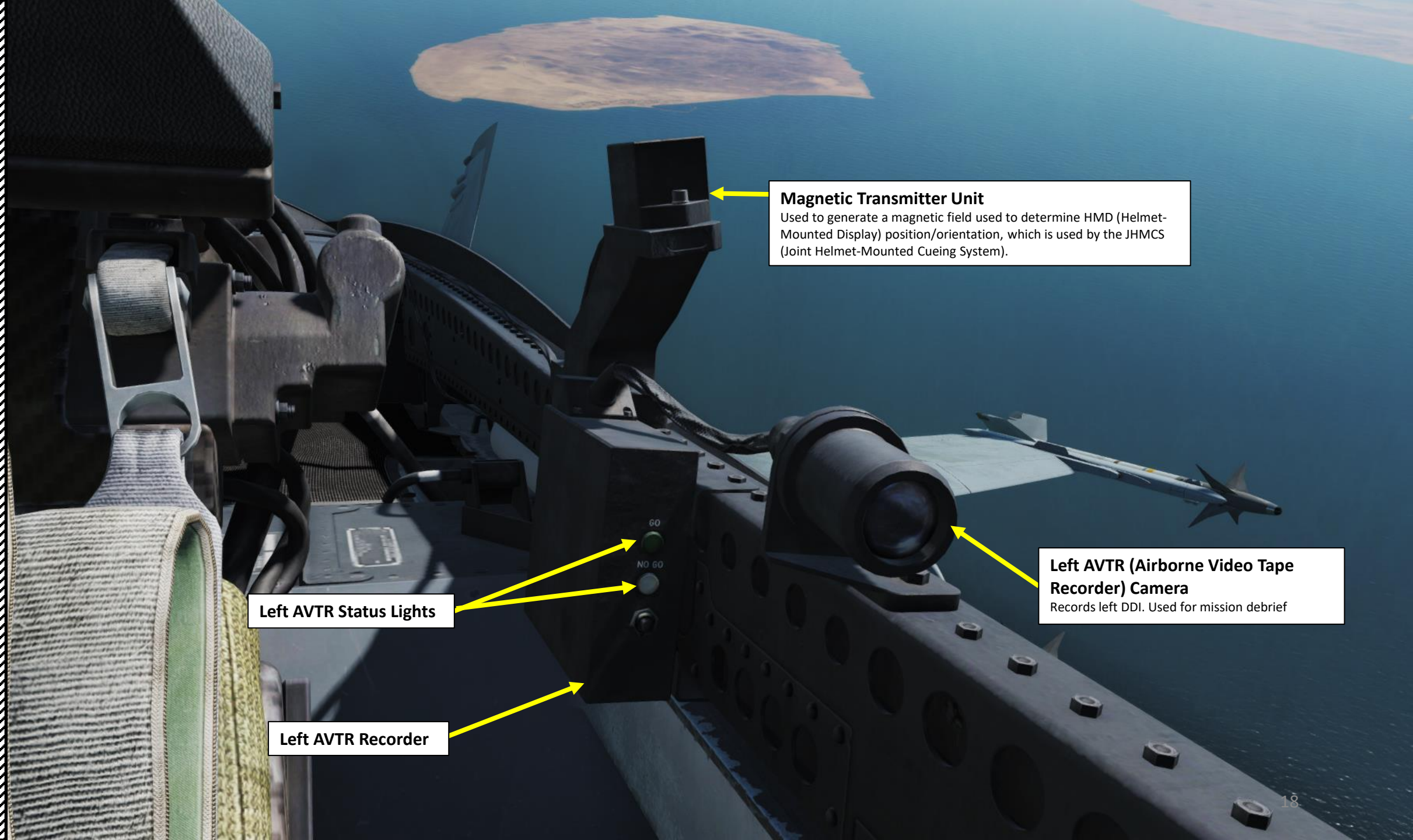
When the F-18 is catapulted from its carrier, the pilot doesn’t hold the flight stick yet; he grabs a handle instead nicknamed “towel rack” or “towel rail”.

The F/A-18 being the first fly-by-wire airplane to operate off the carrier, its flight control computers will seek the optimum angle-of-attack (8.1 alpha) off the catapult, which means that the pilot doesn’t have to touch anything during the catapult launch. Once the aircraft is airborne and the initial AOA is set, the pilot then grabs the stick.







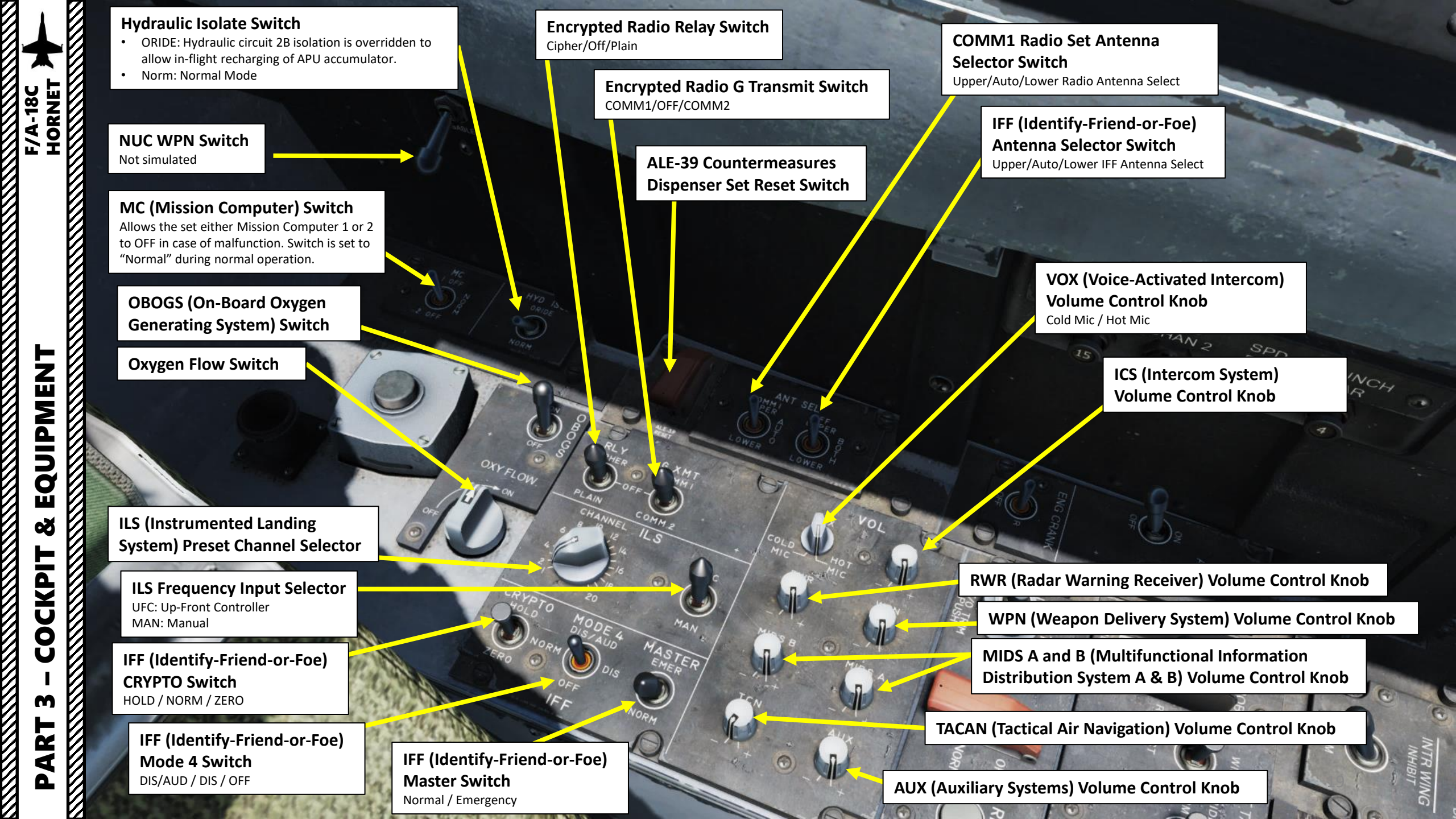


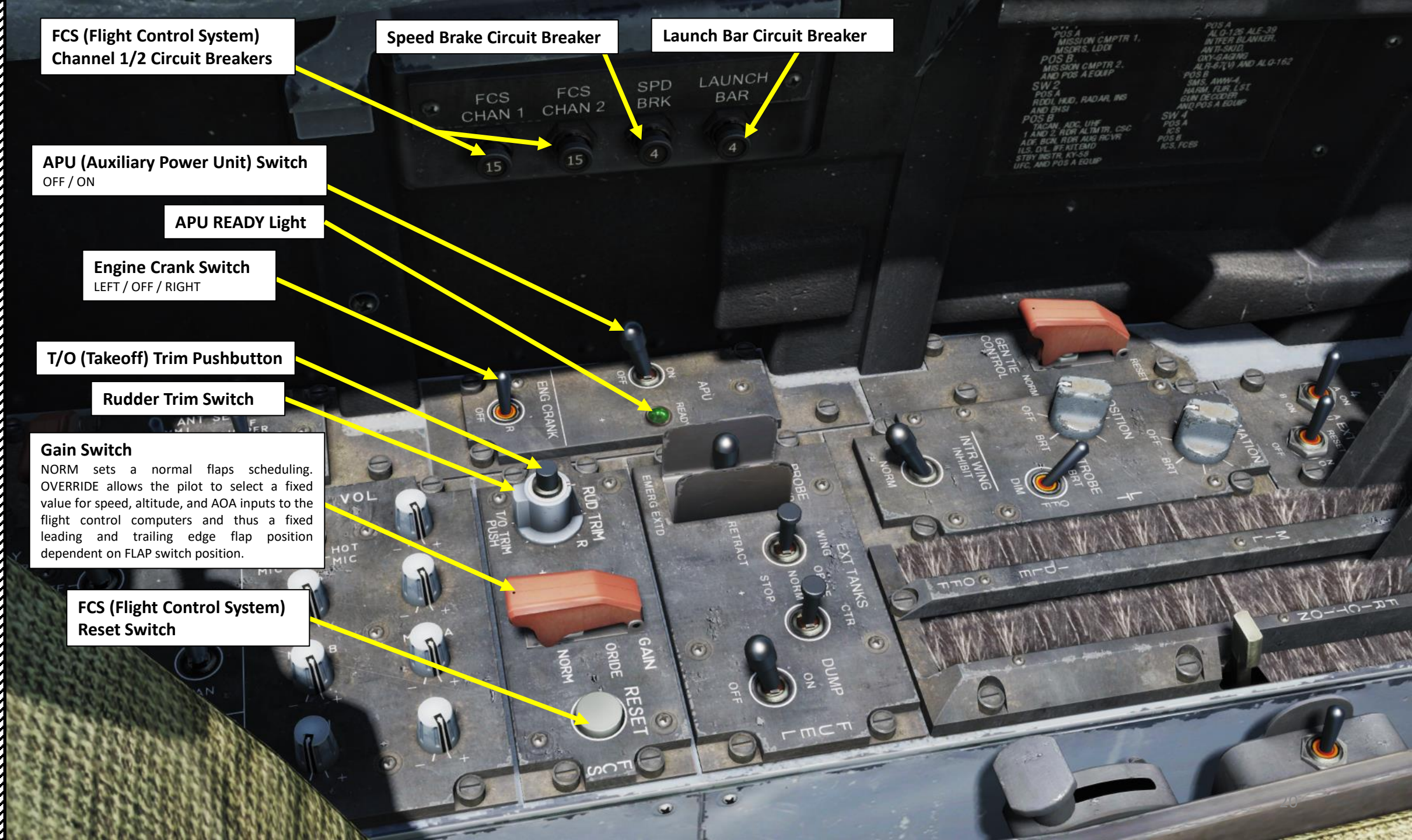
Magnetic Transmitter Unit
Used to generate a magnetic field used to determine HMD (Helmet-Mounted Display) position/orientation, which is used by the JHMCS (Joint Helmet-Mounted Cueing System).

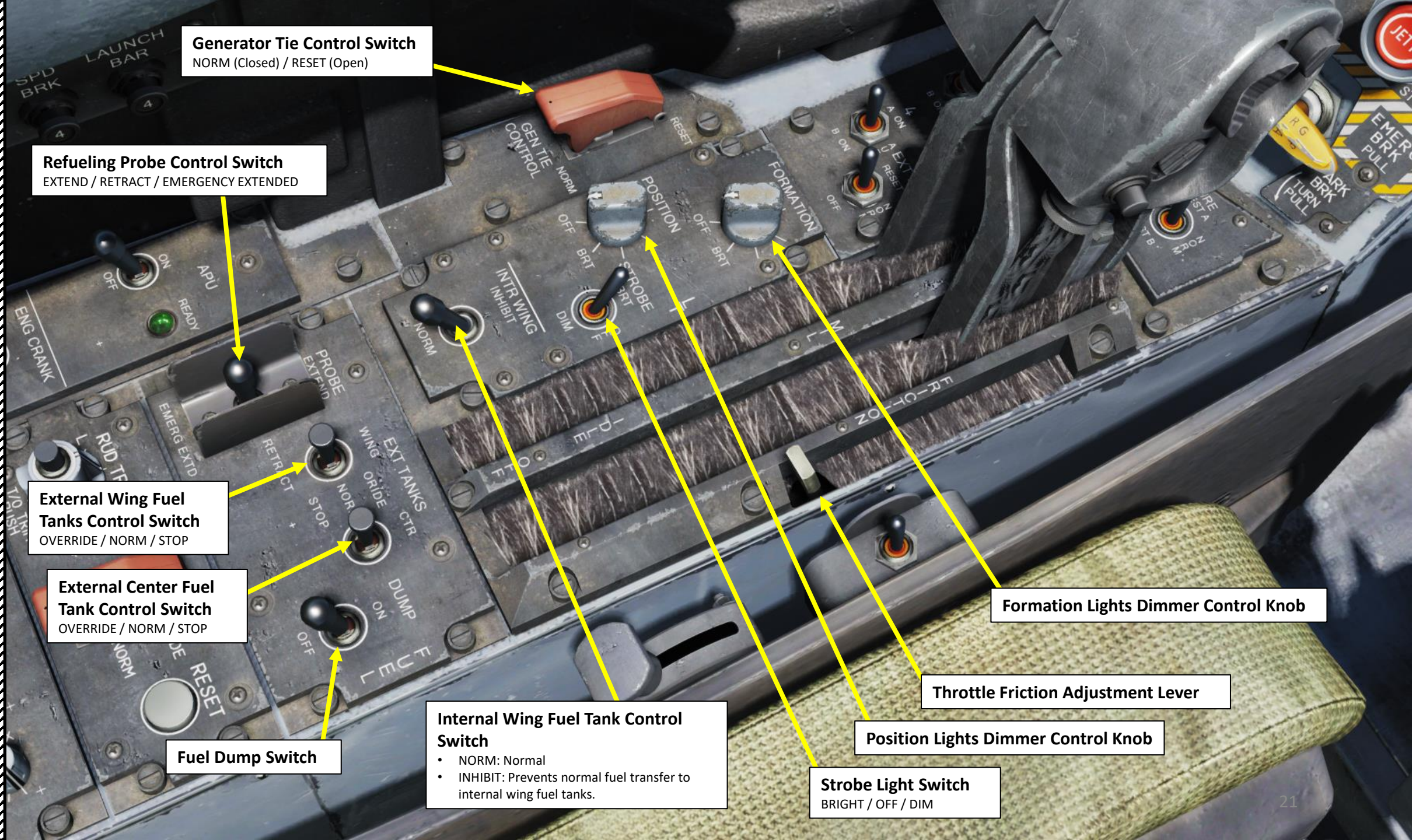
Left AVTR Status Lights

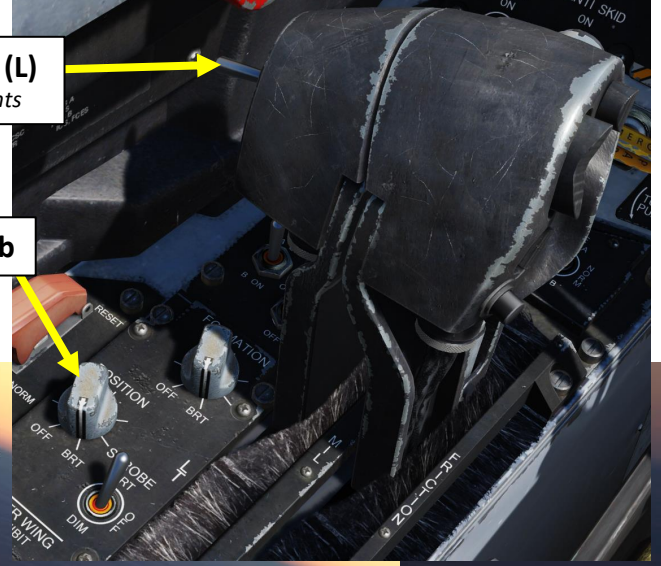
Left AVTR (Airborne Video Tape Recorder) Camera
Records left DDI. Used for mission debrief

Left AVTR Recorder


Hydraulic Isolate Switch
• ORIDE: Hydraulic circuit 2B isolation is overridden to allow in-flight recharging of APU accumulator.
• Norm: Normal Mode
Encrypted Radio Relay Switch
Cipher/Off/Plain
Encrypted Radio G Transmit Switch
COMM1/OFF/COMM2
COMM1 Radio Set Antenna Selector Switch
Upper/Auto/Lower Radio Antenna Select
IFF (Identify-Friend-or-Foe) Antenna Selector Switch
Upper/Auto/Lower IFF Antenna Select
NUC WPN Switch
Not simulated
ALE-39 Countermeasures Dispenser Set Reset Switch
MC (Mission Computer) Switch
Allows the set either Mission Computer 1 or 2 to OFF in case of malfunction. Switch is set to "Normal" during normal operation.
VOX (Voice-Activated Intercom) Volume Control Knob
Cold Mic / Hot Mic
OBOGS (On-Board Oxygen Generating System) Switch
Oxygen Flow Switch
ICS (Intercom System) Volume Control Knob
ILS (Instrumented Landing System) Preset Channel Selector
RWR (Radar Warning Receiver) Volume Control Knob
ILS Frequency Input Selector
UFC: Up-Front Controller
MAN: Manual
WPN (Weapon Delivery System) Volume Control Knob
IFF (Identify-Friend-or-Foe) CRYPTO Switch
HOLD / NORM / ZERO
MIDS A and B (Multifunctional Information Distribution System A & B) Volume Control Knob
TACAN (Tactical Air Navigation) Volume Control Knob
IFF (Identify-Friend-or-Foe) Mode 4 Switch
DIS/AUD / DIS / OFF
IFF (Identify-Friend-or-Foe) Master Switch
Normal / Emergency
AUX (Auxiliary Systems) Volume Control Knob

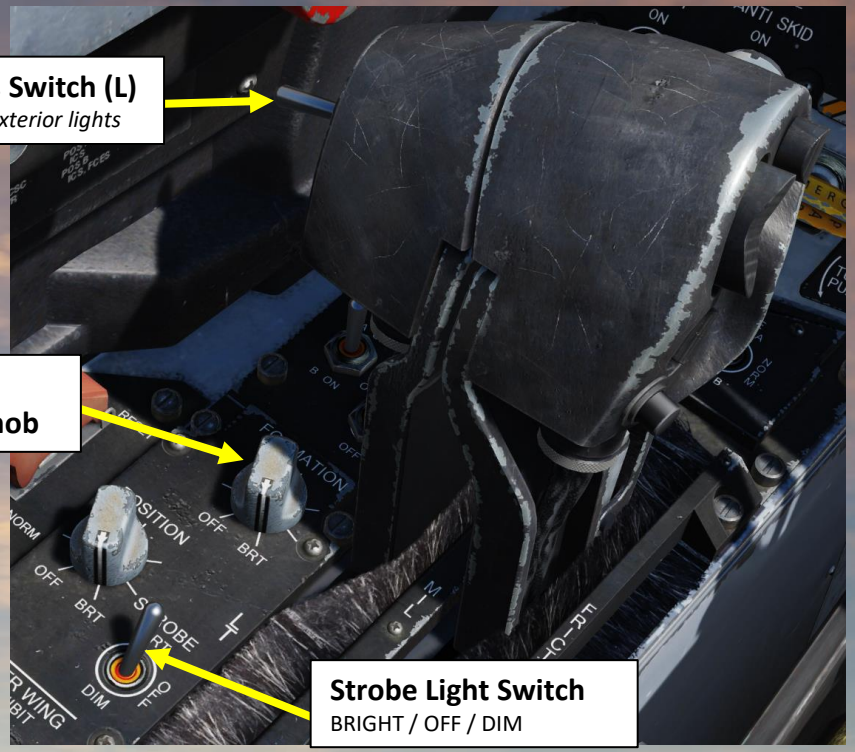

FCS (Flight Control System) Channel 1/2 Circuit Breakers
Speed Brake Circuit Breaker
Launch Bar Circuit Breaker
APU (Auxiliary Power Unit) Switch
OFF / ON
APU READY Light
Engine Crank Switch
LEFT / OFF / RIGHT
T/O (Takeoff) Trim Pushbutton
Rudder Trim Switch
Gain Switch
NORM sets a normal flaps scheduling. OVERRIDE allows the pilot to select a fixed value for speed, altitude, and AOA inputs to the flight control computers and thus a fixed leading and trailing edge flap position dependent on FLAP switch position.
FCS (Flight Control System) Reset Switch
FCS CHAN 1
FCS CHAN 2
SPD BRK
LAUNCH BAR
APU
ENG CRANK
RUD TRIM
T/O TRIM PUSH
GAIN
RESET
EXT TANKS
DUMP
PROBE
INTR WING
GEN TIE CONTROL


Generator Tie Control Switch
NORM (Closed) / RESET (Open)
Refueling Probe Control Switch
EXTEND / RETRACT / EMERGENCY EXTENDED
External Wing Fuel Tanks Control Switch
OVERRIDE / NORM / STOP
External Center Fuel Tank Control Switch
OVERRIDE / NORM / STOP
Fuel Dump Switch
Internal Wing Fuel Tank Control Switch
• NORM: Normal
• INHIBIT: Prevents normal fuel transfer to internal wing fuel tanks.
Strobe Light Switch
BRIGHT / OFF / DIM
Position Lights Dimmer Control Knob
Throttle Friction Adjustment Lever
Formation Lights Dimmer Control Knob


Exterior Lights Switch (L)
Used to toggle all exterior lights
Position Lights Dimmer Control Knob


Position Lights (Red on left hand side)
Position Lights (Green on right hand side)


Position Light (White)



Formation Light

Formation Light

Strobe

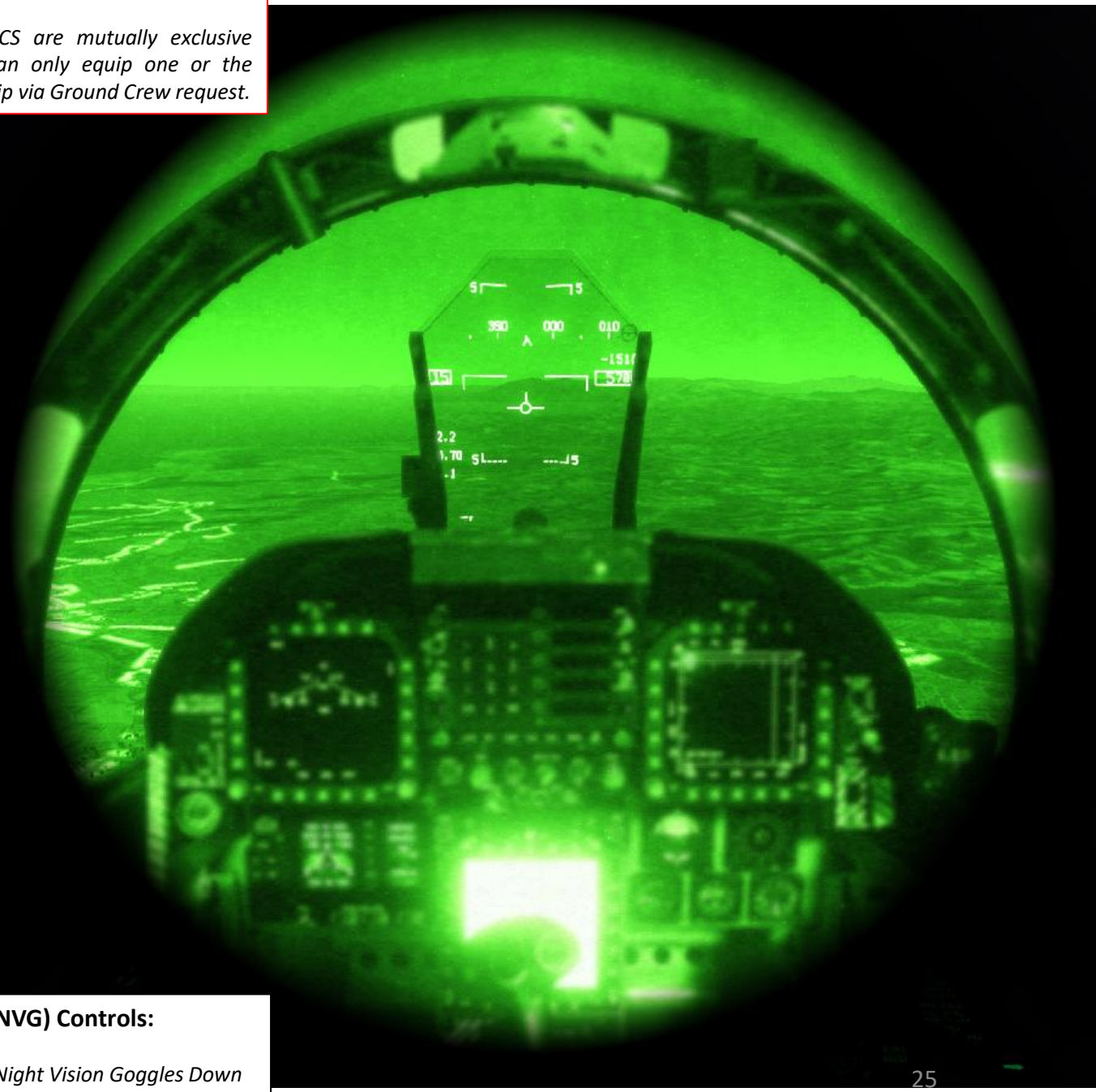
Formation Light

Formation Light


Landing/Taxi Light Switch
Landing/Taxi Light
LAUNCH
EXTEND
FULL
LDG/TAXI LIGHT
ON
OFF
ANTI SKID
ON
OFF

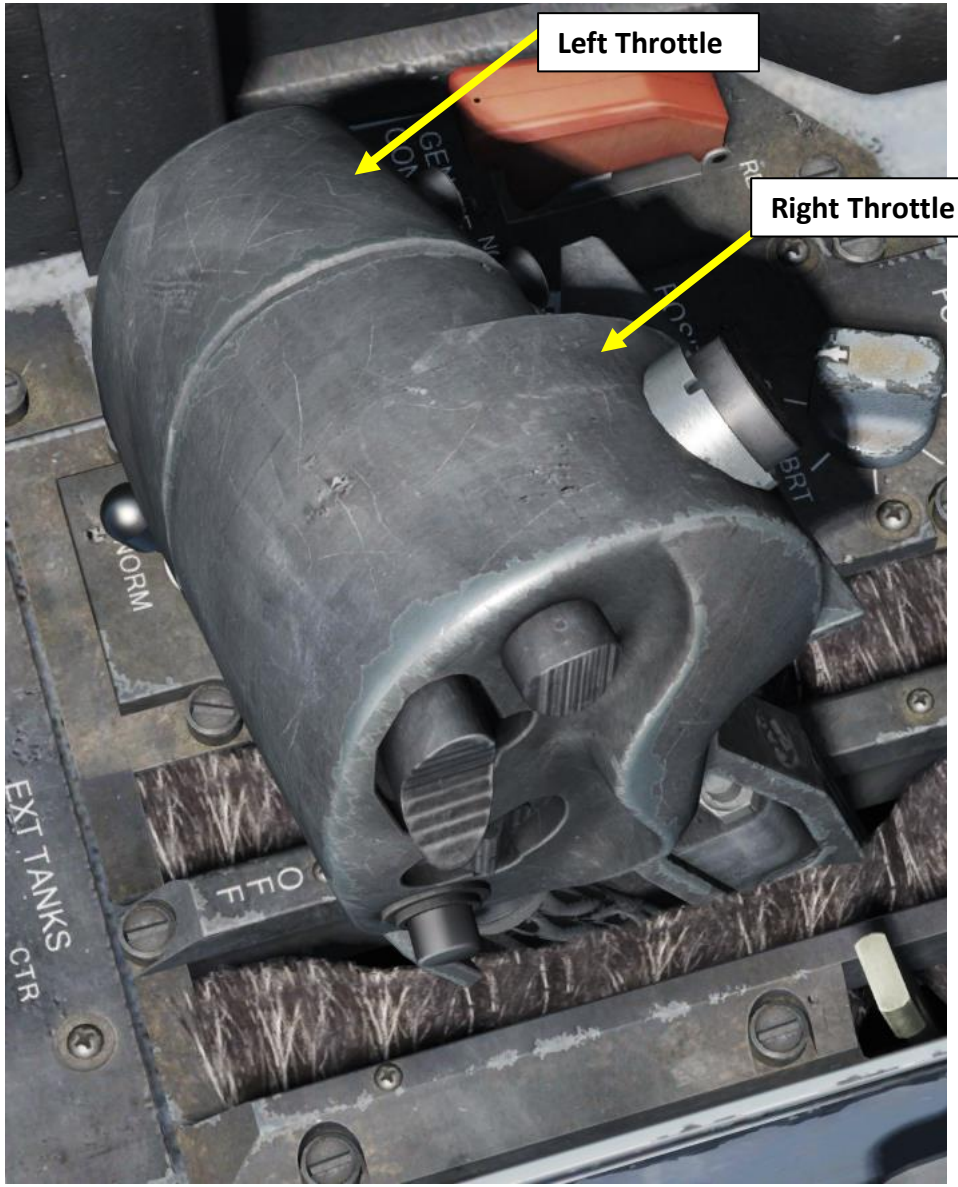
Note:
Night Vision Goggles and JHMCS are mutually exclusive helmet-mounted devices; you can only equip one or the other. You can select what to equip via Ground Crew request.

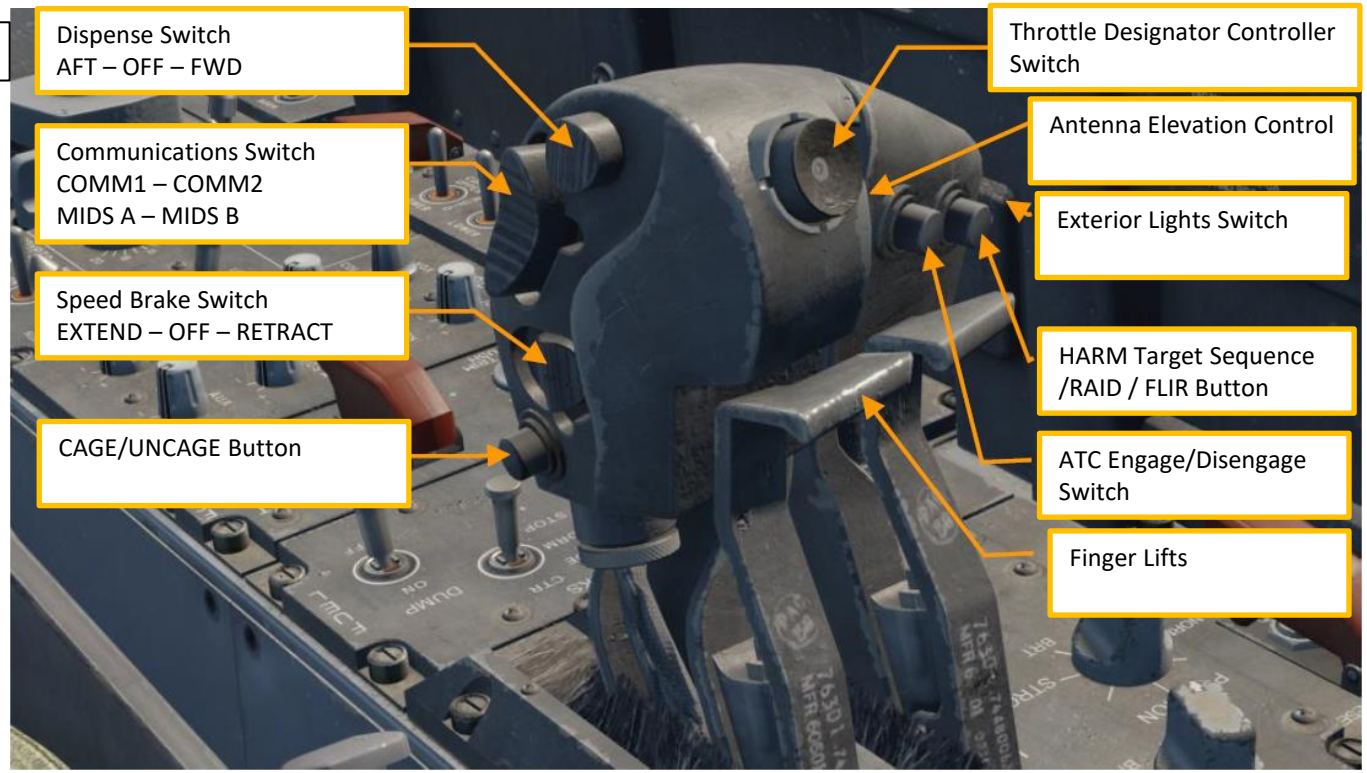




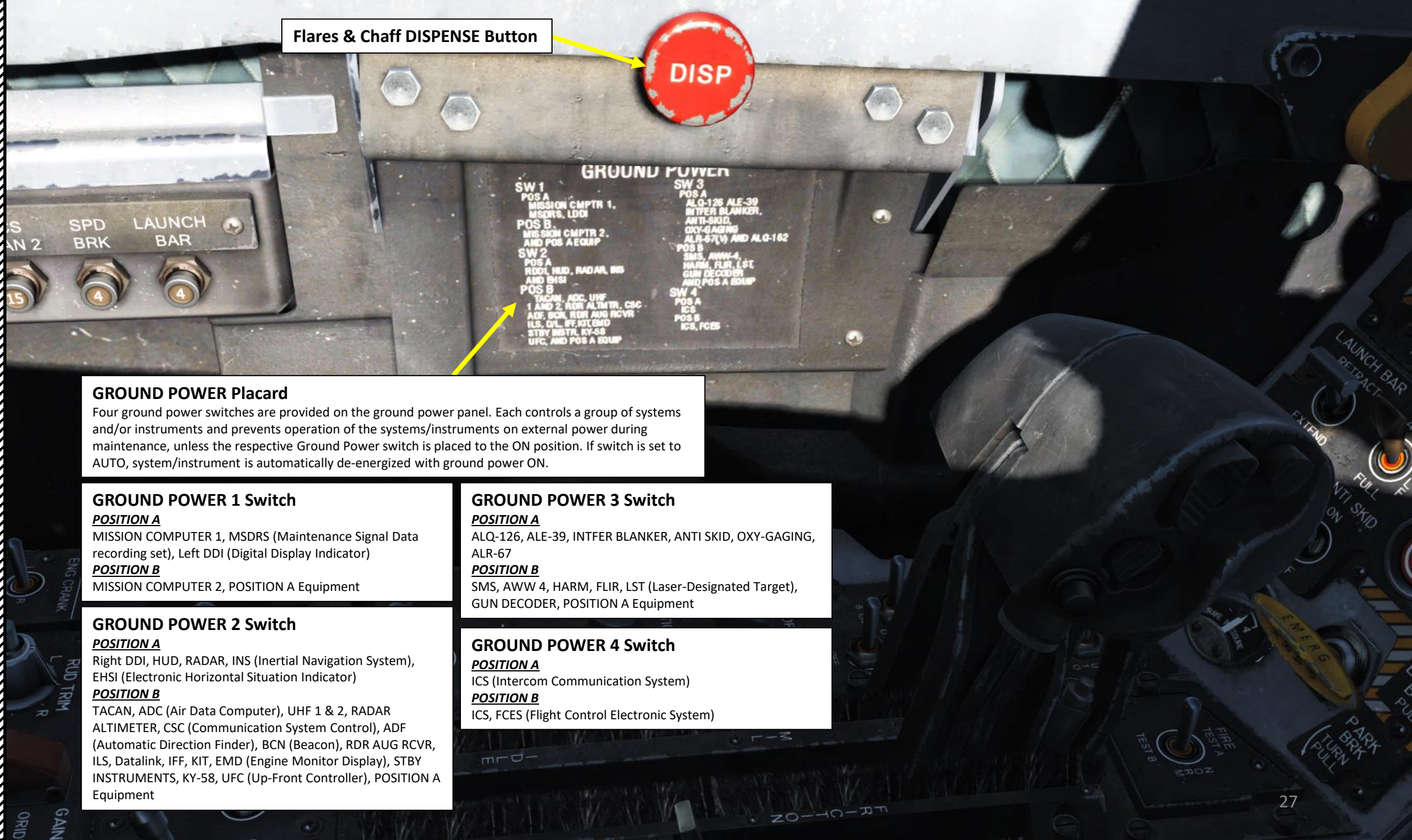
Night Vision Goggles (NVG) Controls:

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





Finger lifts act as a stopper that prevents throttles from accidentally going from IDLE to OFF once engines are started. In order to shut down an engine, finger lifts are raised by pressing “0” for right throttle and “9” for left throttle.



GROUND POWER Placard

Four ground power switches are provided on the ground power panel. Each controls a group of systems and/or instruments and prevents operation of the systems/instruments on external power during maintenance, unless the respective Ground Power switch is placed to the ON position. If switch is set to AUTO, system/instrument is automatically de-energized with ground power ON.

GROUND POWER 1 Switch

POSITION A

MISSION COMPUTER 1, MSDRS (Maintenance Signal Data recording set), Left DDI (Digital Display Indicator)

POSITION B

MISSION COMPUTER 2, POSITION A Equipment

GROUND POWER 2 Switch

POSITION A

Right DDI, HUD, RADAR, INS (Inertial Navigation System), EHSI (Electronic Horizontal Situation Indicator)

POSITION B

TACAN, ADC (Air Data Computer), UHF 1 & 2, RADAR ALTIMETER, CSC (Communication System Control), ADF (Automatic Direction Finder), BCN (Beacon), RDR AUG RCVR, ILS, Datalink, IFF, KIT, EMD (Engine Monitor Display), STBY INSTRUMENTS, KY-58, UFC (Up-Front Controller), POSITION A Equipment

GROUND POWER 3 Switch

POSITION A

ALQ-126, ALE-39, INTFER BLANKER, ANTI SKID, OXY-GAGING, ALR-67

POSITION B

SMS, AWW 4, HARM, FLIR, LST (Laser-Designated Target), GUN DECODER, POSITION A Equipment

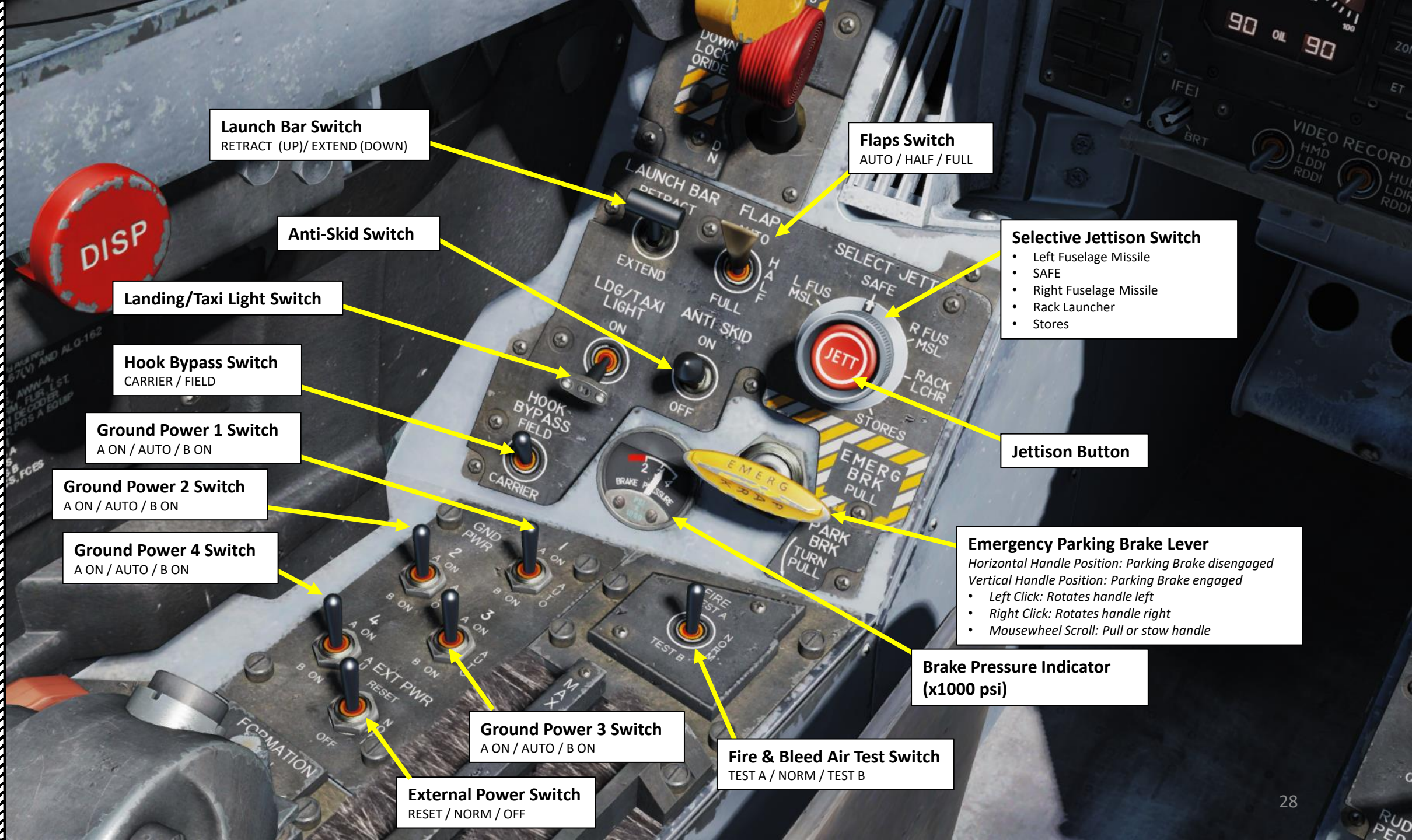
GROUND POWER 4 Switch

POSITION A

ICS (Intercom Communication System)

POSITION B

ICS, FCES (Flight Control Electronic System)



Launch Bar Switch
RETRACT (UP)/ EXTEND (DOWN)

Anti-Skid Switch

Landing/Taxi Light Switch

Hook Bypass Switch
CARRIER / FIELD

Ground Power 1 Switch
A ON / AUTO / B ON

Ground Power 2 Switch
A ON / AUTO / B ON

Ground Power 4 Switch
A ON / AUTO / B ON

Flaps Switch
AUTO / HALF / FULL

Selective Jettison Switch
- Left Fuselage Missile
- SAFE
- Right Fuselage Missile
- Rack Launcher
- Stores

Jettison Button

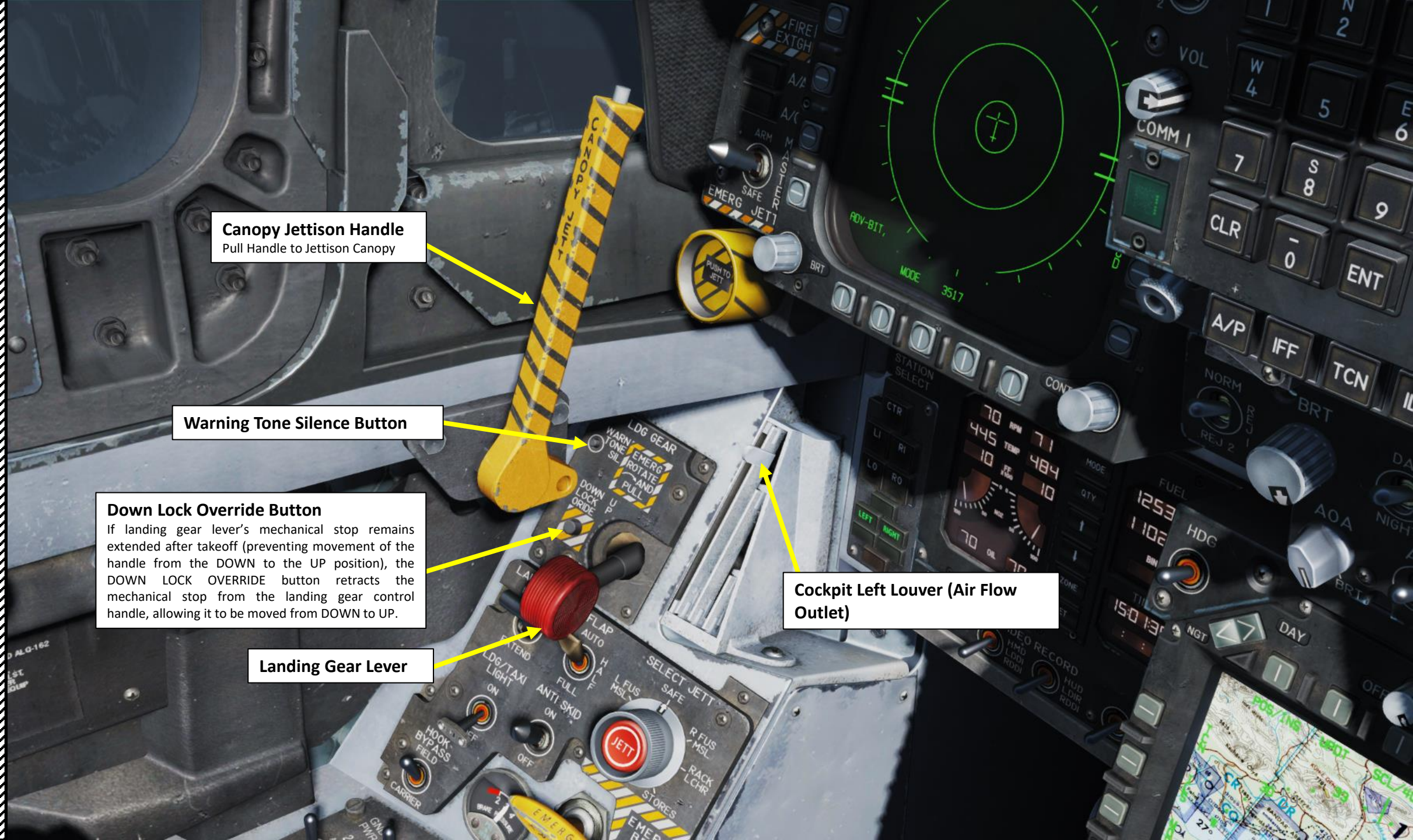
Emergency Parking Brake Lever
Horizontal Handle Position: Parking Brake disengaged
Vertical Handle Position: Parking Brake engaged
- *Left Click: Rotates handle left*
- *Right Click: Rotates handle right*
- *Mousewheel Scroll: Pull or stow handle*

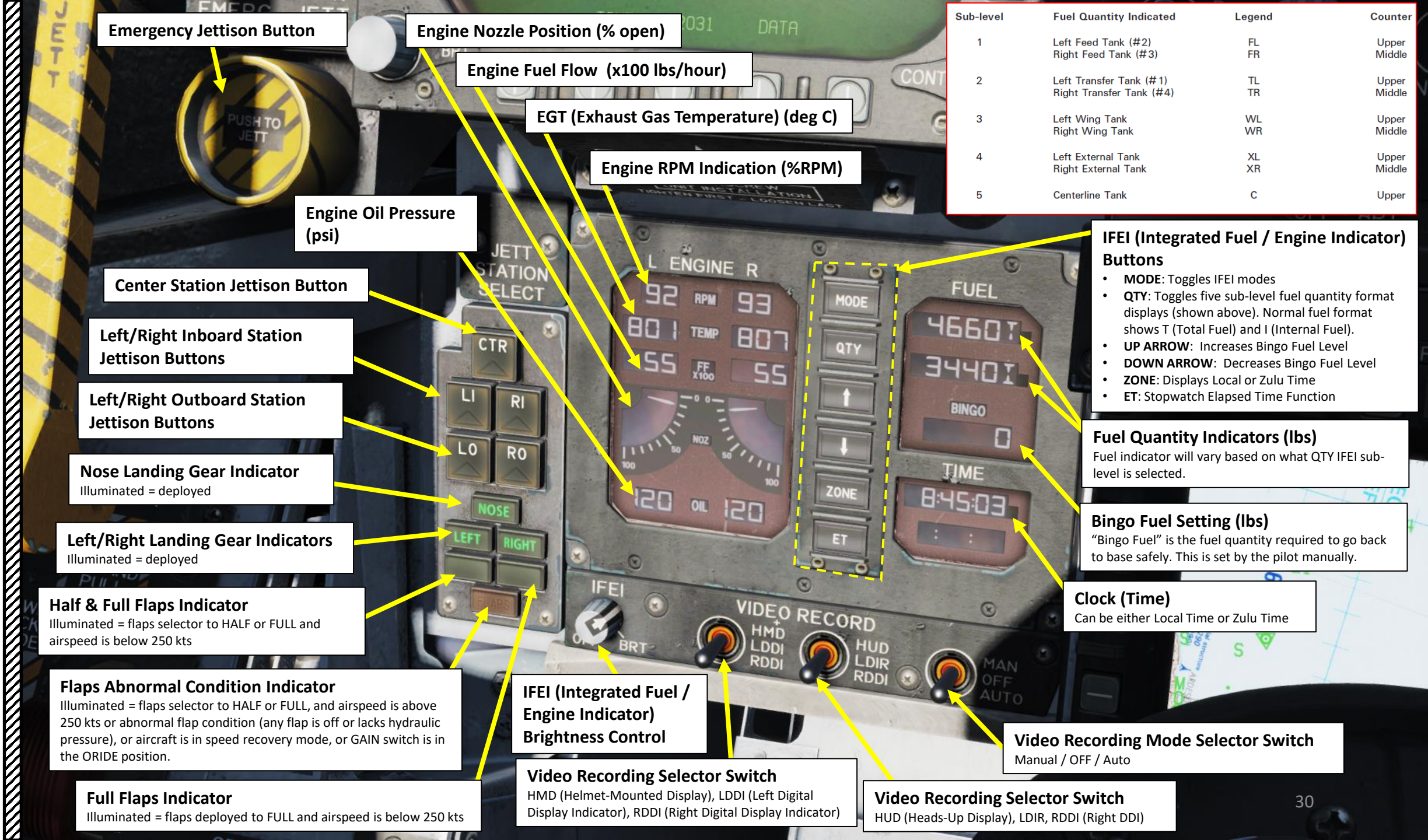
Brake Pressure Indicator (x1000 psi)

Ground Power 3 Switch
A ON / AUTO / B ON

Fire & Bleed Air Test Switch
TEST A / NORM / TEST B

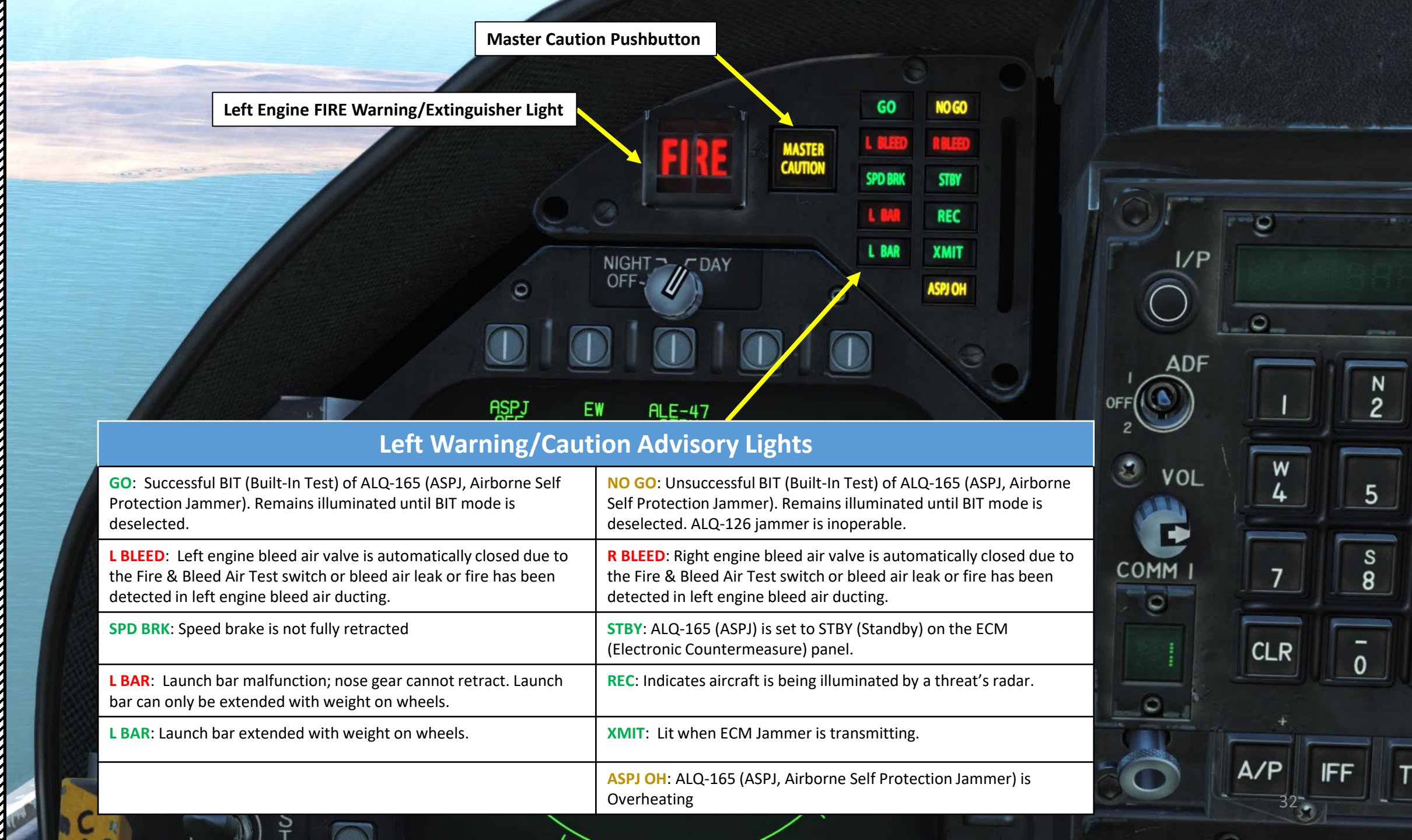
External Power Switch
RESET / NORM / OFF


Canopy Jettison Handle
Pull Handle to Jettison Canopy
Warning Tone Silence Button
Down Lock Override Button
If landing gear lever's mechanical stop remains extended after takeoff (preventing movement of the handle from the DOWN to the UP position), the DOWN LOCK OVERRIDE button retracts the mechanical stop from the landing gear control handle, allowing it to be moved from DOWN to UP.
Landing Gear Lever
Cockpit Left Louver (Air Flow Outlet)
CANOPY JETT
LDG GEAR
WARN TONE SIL
EMERG ROTATE AND PULL
DOWN LOCK ORIDE
UP
FLAP
AUTO
HALF
FULL
SELECT JETT
SAFE
JETT
L FUS MSL
R FUS MSL
RACK LCHR
STORES
LDG/TAXI LIGHT
ON
ANTI SKID
HOOK BYPASS FIELD
CARRIER
OFF
MASTER ARM
SAFE
EMERG JETT
PUSH TO JETT
STATION SELECT
COMM 1
VOL
CLR
ENT
A/P
IFF
TCN
HDG
AOA
NORM
BRT
DAY
NGT
FUEL



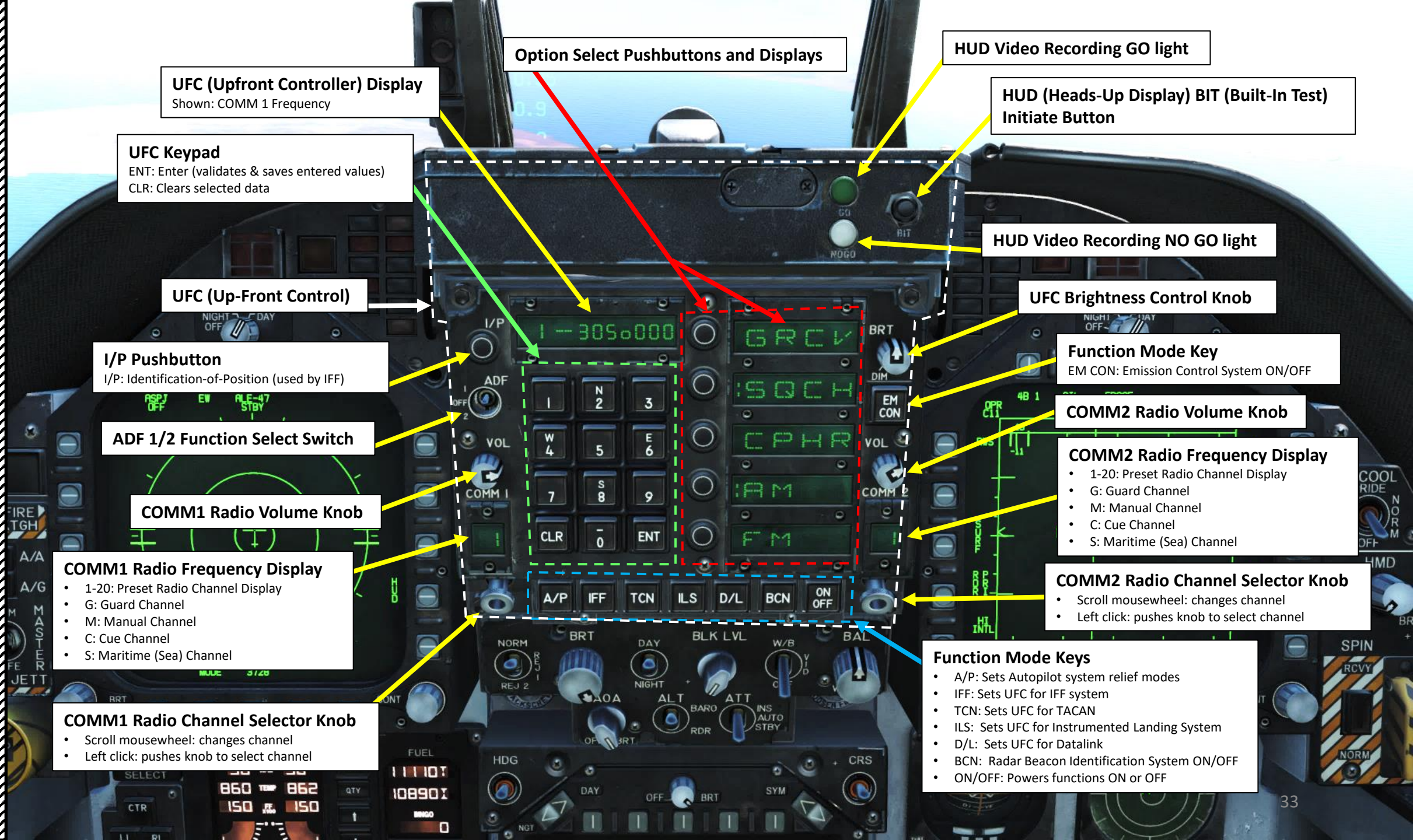
Sub-level	Fuel Quantity Indicated	Legend	Counter
1	Left Feed Tank (#2) Right Feed Tank (#3)	FL FR	Upper Middle
2	Left Transfer Tank (#1) Right Transfer Tank (#4)	TL TR	Upper Middle
3	Left Wing Tank Right Wing Tank	WL WR	Upper Middle
4	Left External Tank Right External Tank	XL XR	Upper Middle
5	Centerline Tank	C	Upper


A/G (Air-to-Ground) Master Mode Button
A/A (Air-to-Air) Master Mode Button
Fire Extinguisher Discharge Pushbutton
DDI (Digital Display Indicator) Power Switch
OFF / Night Mode / Day Mode
DDI OSBs (Option Select Buttons)
These buttons select different options and menus in various Tactical and Support pages
DDI Contrast Knob
Master Arm Switch
DDI Brightness Knob
NIGHT
OFF
DAY
FIRE EXTGH
A/A
A/G
ARM
SAFE
MASTER
EMERG JETT
ASPJ OFF
EW
ALE-47 STBY
ADV-BIT,
MODE
3721
HUD
BRT
CONT
STATION
I/P
ADF
OFF
COMM 1
CLR
ENT
A/P
IFF
TCN
ILS
NORM
BRT
DAY
NIGHT
BLK
ALT
BARO
RDR



Left Warning/Caution Advisory Lights

GO: Successful BIT (Built-In Test) of ALQ-165 (ASPJ, Airborne Self Protection Jammer). Remains illuminated until BIT mode is deselected.	**NO GO**: Unsuccessful BIT (Built-In Test) of ALQ-165 (ASPJ, Airborne Self Protection Jammer). Remains illuminated until BIT mode is deselected. ALQ-126 jammer is inoperable.
L BLEED: Left engine bleed air valve is automatically closed due to the Fire & Bleed Air Test switch or bleed air leak or fire has been detected in left engine bleed air ducting.	**R BLEED**: Right engine bleed air valve is automatically closed due to the Fire & Bleed Air Test switch or bleed air leak or fire has been detected in left engine bleed air ducting.
SPD BRK: Speed brake is not fully retracted	**STBY**: ALQ-165 (ASPJ) is set to STBY (Standby) on the ECM (Electronic Countermeasure) panel.
L BAR: Launch bar malfunction; nose gear cannot retract. Launch bar can only be extended with weight on wheels.	**REC**: Indicates aircraft is being illuminated by a threat's radar.
L BAR: Launch bar extended with weight on wheels.	**XMIT**: Lit when ECM Jammer is transmitting.
	ASPJ OH: ALQ-165 (ASPJ, Airborne Self Protection Jammer) is Overheating



Option Select Pushbuttons and Displays

HUD Video Recording GO light

UFC (Upfront Controller) Display
Shown: COMM 1 Frequency

HUD (Heads-Up Display) BIT (Built-In Test) Initiate Button

UFC Keypad
ENT: Enter (validates & saves entered values)
CLR: Clears selected data

HUD Video Recording NO GO light

UFC (Up-Front Control)

UFC Brightness Control Knob

I/P Pushbutton
I/P: Identification-of-Position (used by IFF)

Function Mode Key
EM CON: Emission Control System ON/OFF

ADF 1/2 Function Select Switch

COMM2 Radio Volume Knob

COMM2 Radio Frequency Display
- 1-20: Preset Radio Channel Display
- G: Guard Channel
- M: Manual Channel
- C: Cue Channel
- S: Maritime (Sea) Channel

COMM1 Radio Volume Knob

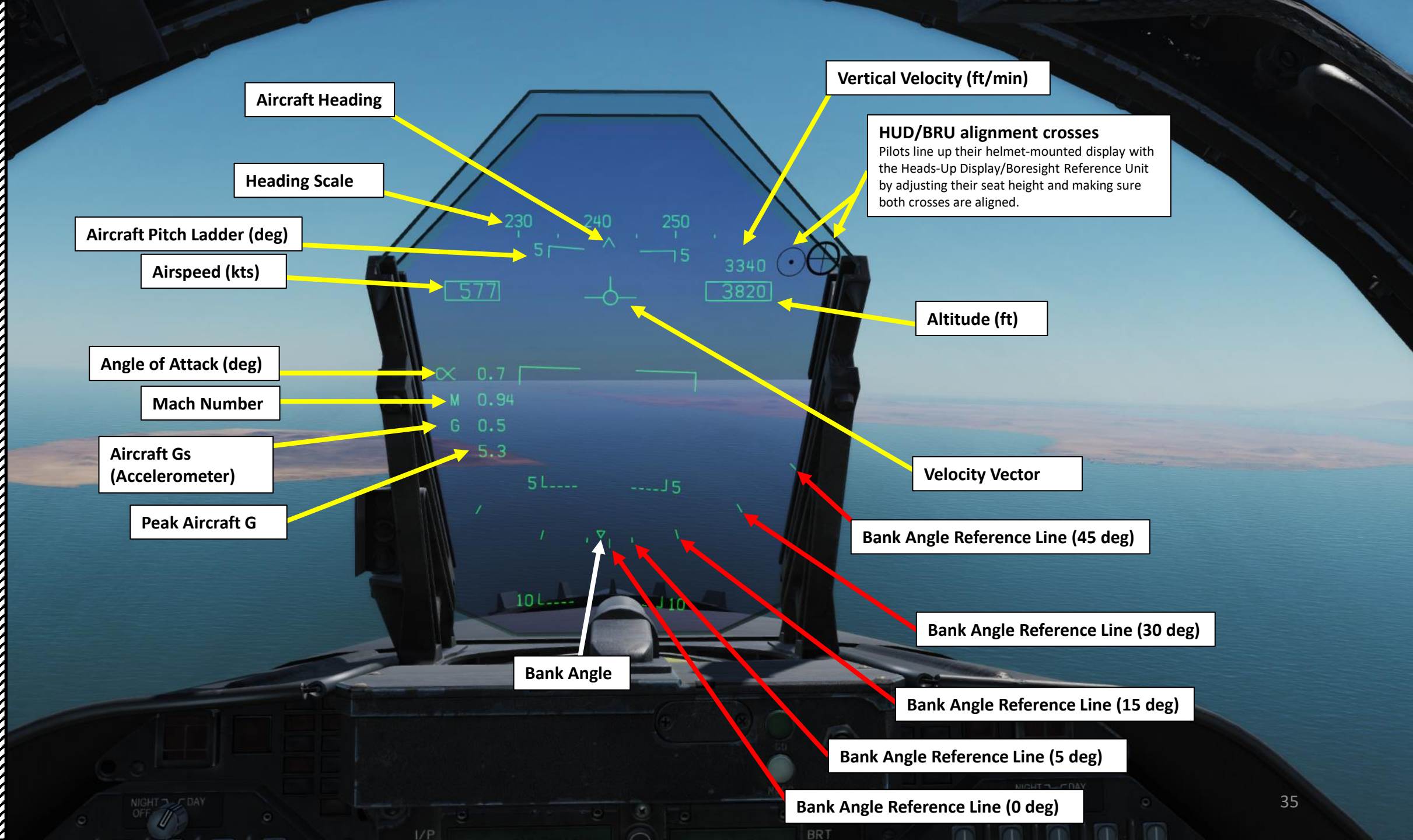
COMM1 Radio Frequency Display
- 1-20: Preset Radio Channel Display
- G: Guard Channel
- M: Manual Channel
- C: Cue Channel
- S: Maritime (Sea) Channel

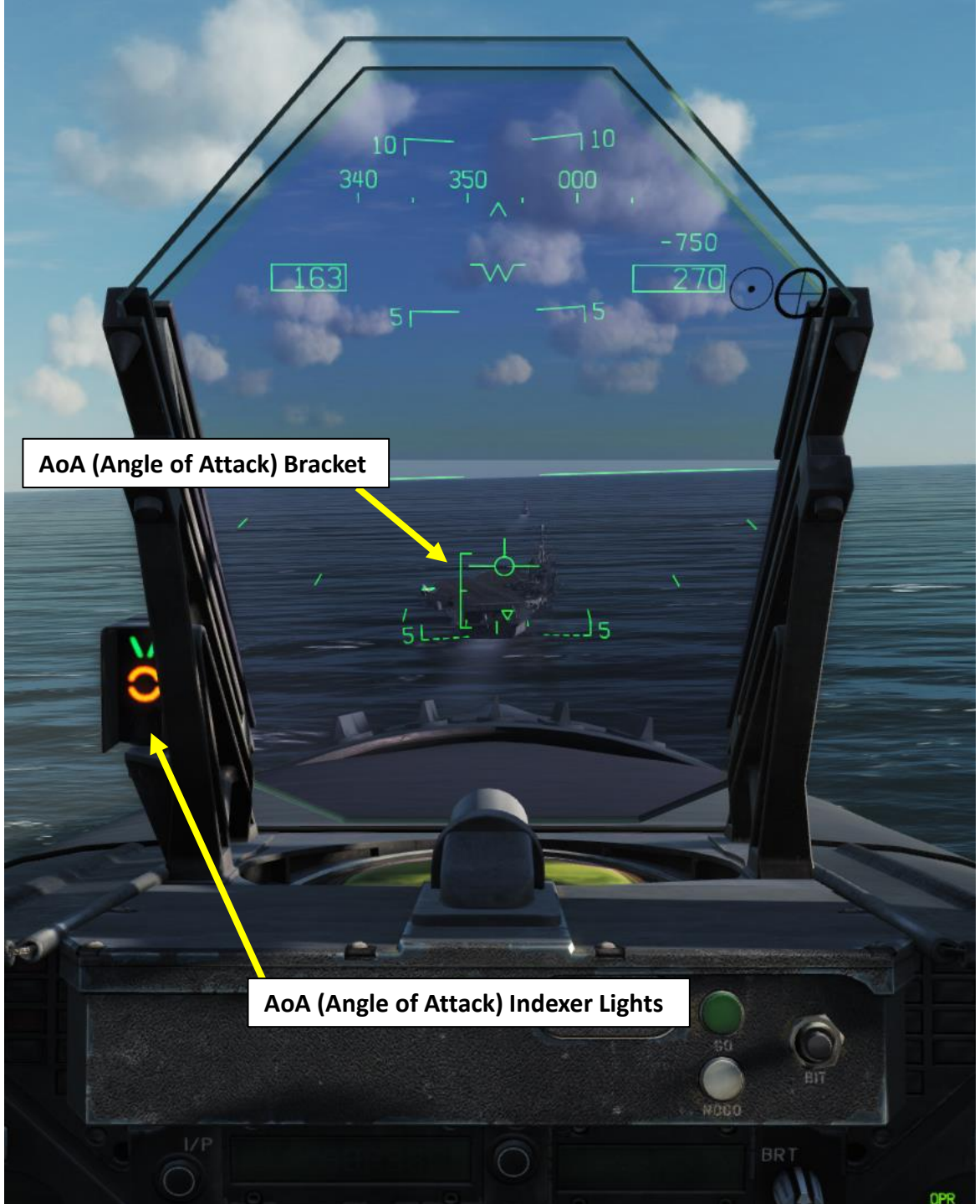
COMM2 Radio Channel Selector Knob
- Scroll mousewheel: changes channel
- Left click: pushes knob to select channel

Function Mode Keys
- A/P: Sets Autopilot system relief modes
- IFF: Sets UFC for IFF system
- TCN: Sets UFC for TACAN
- ILS: Sets UFC for Instrumented Landing System
- D/L: Sets UFC for Datalink
- BCN: Radar Beacon Identification System ON/OFF
- ON/OFF: Powers functions ON or OFF

COMM1 Radio Channel Selector Knob
- Scroll mousewheel: changes channel
- Left click: pushes knob to select channel


HUD Symbology Brightness Selector Knob
Day mode increases brightness, while night mode has reduced brightness
HUD Symbology Brightness Control
HUD Symbology Reject Switch
• REJ 1 removes aircraft Mach number, aircraft Gs, bank angle and pointer, airspeed box, altitude box, peak positive G and required ground speed cue from the HUD.
• REJ 2 removes all REJ 1 symbology plus heading scale, current heading indication, command heading marker, NAV/TACAN range, and ET/CD timer.
HUD (Heads-Up Display) Control Panel
AoA (Angle of Attack) Indexer Brightness Control
Altitude Switch
Selects whether barometric altimeter (BARO) or radar altimeter (RDR) altitude is displayed on the HUD
Black Level Control
Adjusts NFLR (or NAVFLIR, Navigation Forward-Looking Infrared) video plus or minus half a shade of gray per increment when rotated.
HUD Video Control Switch
• Enables NFLR (or NAVFLIR, Navigation Forward-Looking Infrared) video to be displayed on the HUD with selectable polarity (white hot / black hot)
• Modes: OFF / VIDEO / W/B (White/Black)
HUD Balance Control
Adjusts the HUD stroke brightness relative to the raster brightness.
Attitude Source Selector Knob
• Selects which source is used to determine aircraft attitude in the EADI (Electronic Attitude Display Indicator) DDI page.
• Modes: INS (Inertial Navigation System) / Automatic / Standby
NORM
REJ 2
BRT
DAY
NIGHT
BLK LVL
W/B
BAL
AOA
ALT
BARO
RDR
ATT
INS
AUTO
STBY
HDG
CRS
MODE
3728
CHAN
DATA
3930
80°
BRT
CONT
RCVY
NORM
HMD
IR COOL
ORIDE
OFF
A/P
TCN
ILS
D/L
ON
OFF
I/P
ADF
VOL
COMM 1
COMM 2
ENT
CLR
DIM
EM CON
FUEL
ENGINE
JETT


Aircraft Heading
Vertical Velocity (ft/min)
HUD/BRU alignment crosses
Pilots line up their helmet-mounted display with the Heads-Up Display/Boresight Reference Unit by adjusting their seat height and making sure both crosses are aligned.
Heading Scale
Aircraft Pitch Ladder (deg)
Airspeed (kts)
Altitude (ft)
Angle of Attack (deg)
Mach Number
Aircraft Gs (Accelerometer)
Peak Aircraft G
Velocity Vector
Bank Angle Reference Line (45 deg)
Bank Angle Reference Line (30 deg)
Bank Angle
Bank Angle Reference Line (15 deg)
Bank Angle Reference Line (5 deg)
Bank Angle Reference Line (0 deg)
230
240
250
3340
577
3820
0.7
M 0.94
G 0.5
5.3



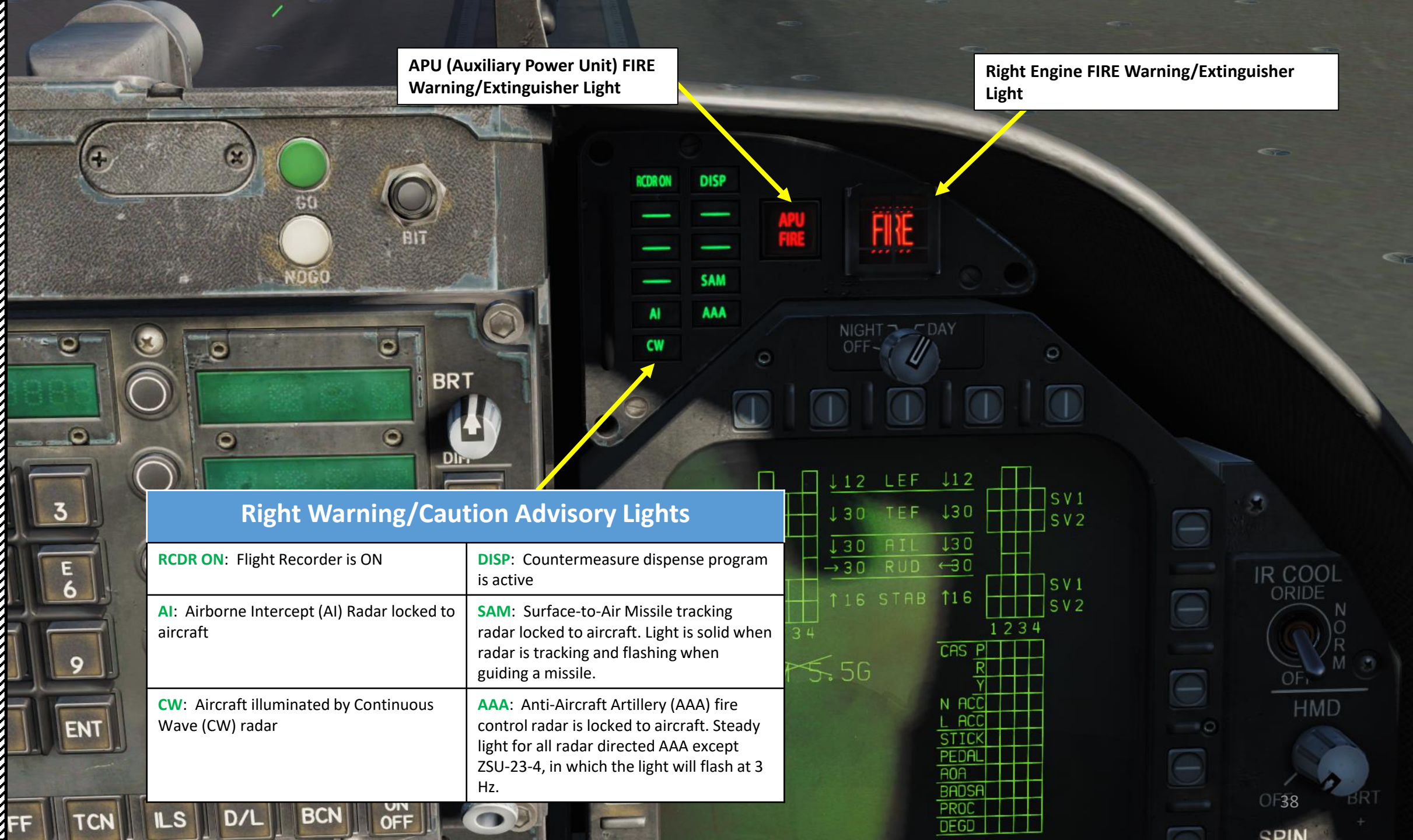
SYMBOL	AIRSPEED	AOA
	Slow	9.3° to 90.00°
	Slightly slow	8.8° to 9.3°
	On speed	7.4° to 8.8°
	Slightly fast	6.9° to 7.4°
	Fast	0° to 6.9°



LOCK light
Illuminates when radar has locked target. Single Target Track (STT) and target within Rmax range (maximal missile range).

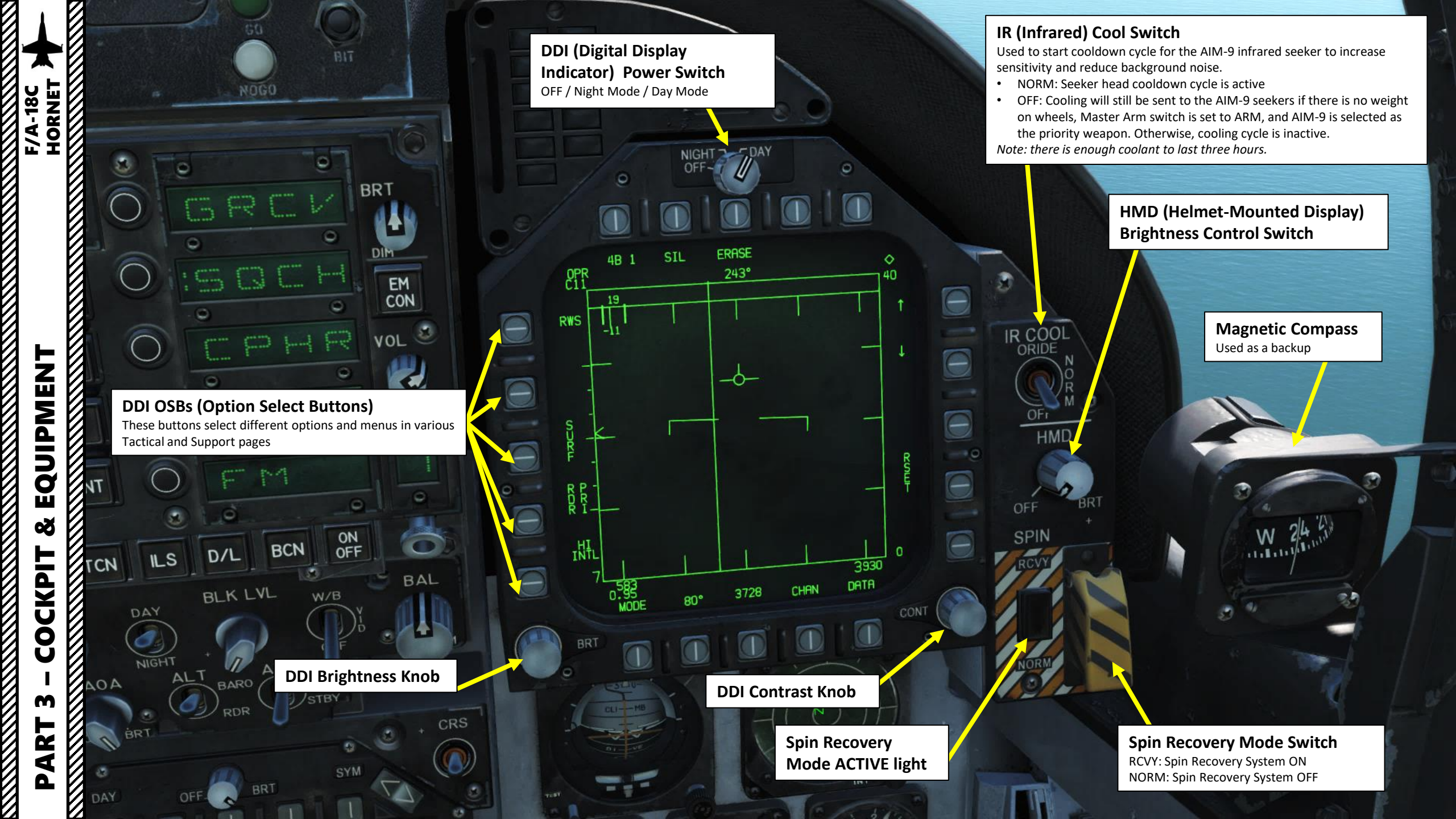
SHOOT light
Illuminates when weapon release interlocks are satisfied.
- Steady light: indicates that missile is within Rmax range, or that gun target is within a firing solution.
- Flashing light: indicates that missile is within Rne (No Escape missile range)

Strobe light
Flashes when missile shot is valid.



Right Warning/Caution Advisory Lights

RCDR ON: Flight Recorder is ON	**DISP**: Countermeasure dispense program is active
AI: Airborne Intercept (AI) Radar locked to aircraft	**SAM**: Surface-to-Air Missile tracking radar locked to aircraft. Light is solid when radar is tracking and flashing when guiding a missile.
CW: Aircraft illuminated by Continuous Wave (CW) radar	**AAA**: Anti-Aircraft Artillery (AAA) fire control radar is locked to aircraft. Steady light for all radar directed AAA except ZSU-23-4, in which the light will flash at 3 Hz.



DDI (Digital Display Indicator) Power Switch
OFF / Night Mode / Day Mode

IR (Infrared) Cool Switch
Used to start cooldown cycle for the AIM-9 infrared seeker to increase sensitivity and reduce background noise.
- NORM: Seeker head cooldown cycle is active
- OFF: Cooling will still be sent to the AIM-9 seekers if there is no weight on wheels, Master Arm switch is set to ARM, and AIM-9 is selected as the priority weapon. Otherwise, cooling cycle is inactive.

Note: there is enough coolant to last three hours.

HMD (Helmet-Mounted Display) Brightness Control Switch

Magnetic Compass
Used as a backup

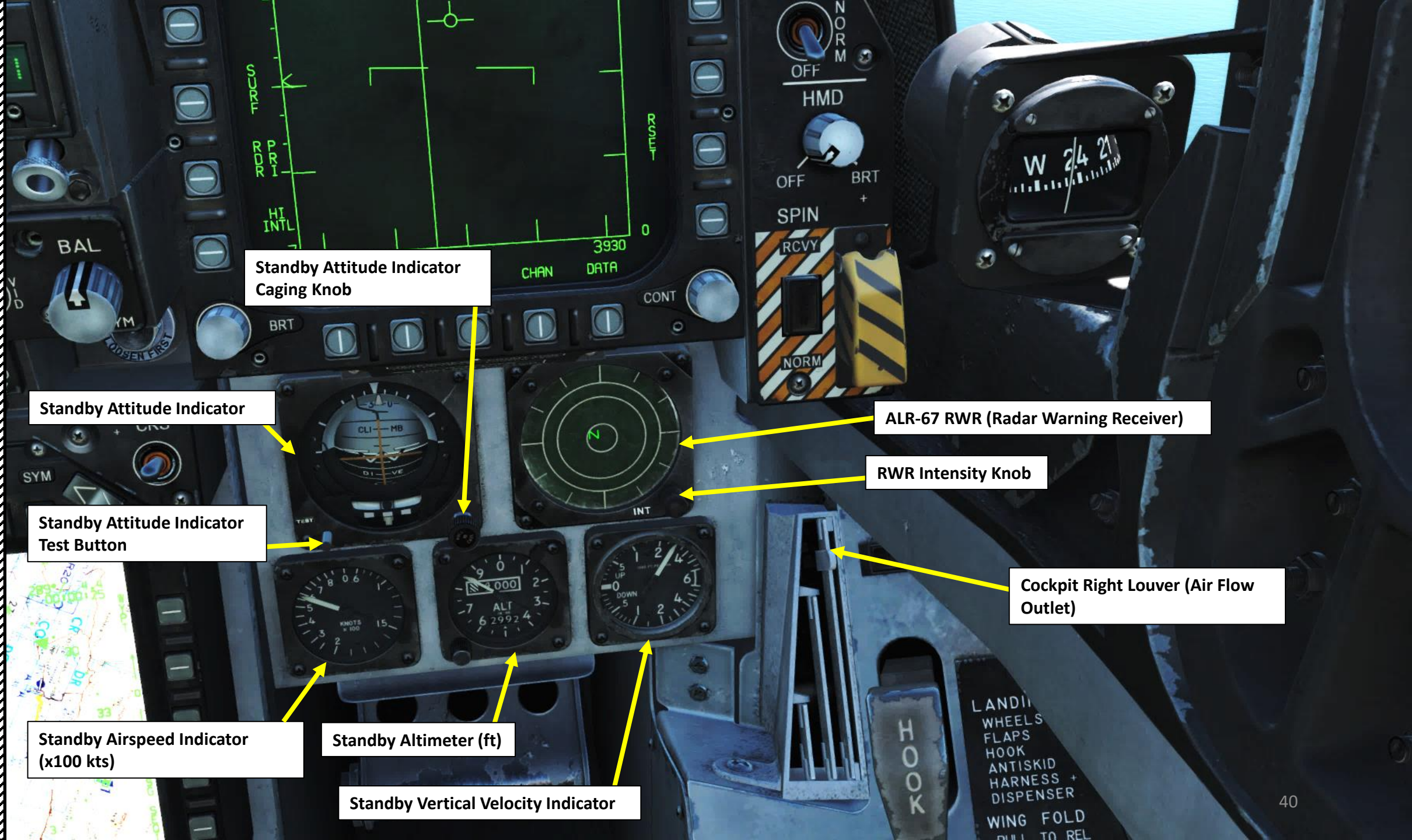
DDI OSBs (Option Select Buttons)
These buttons select different options and menus in various Tactical and Support pages

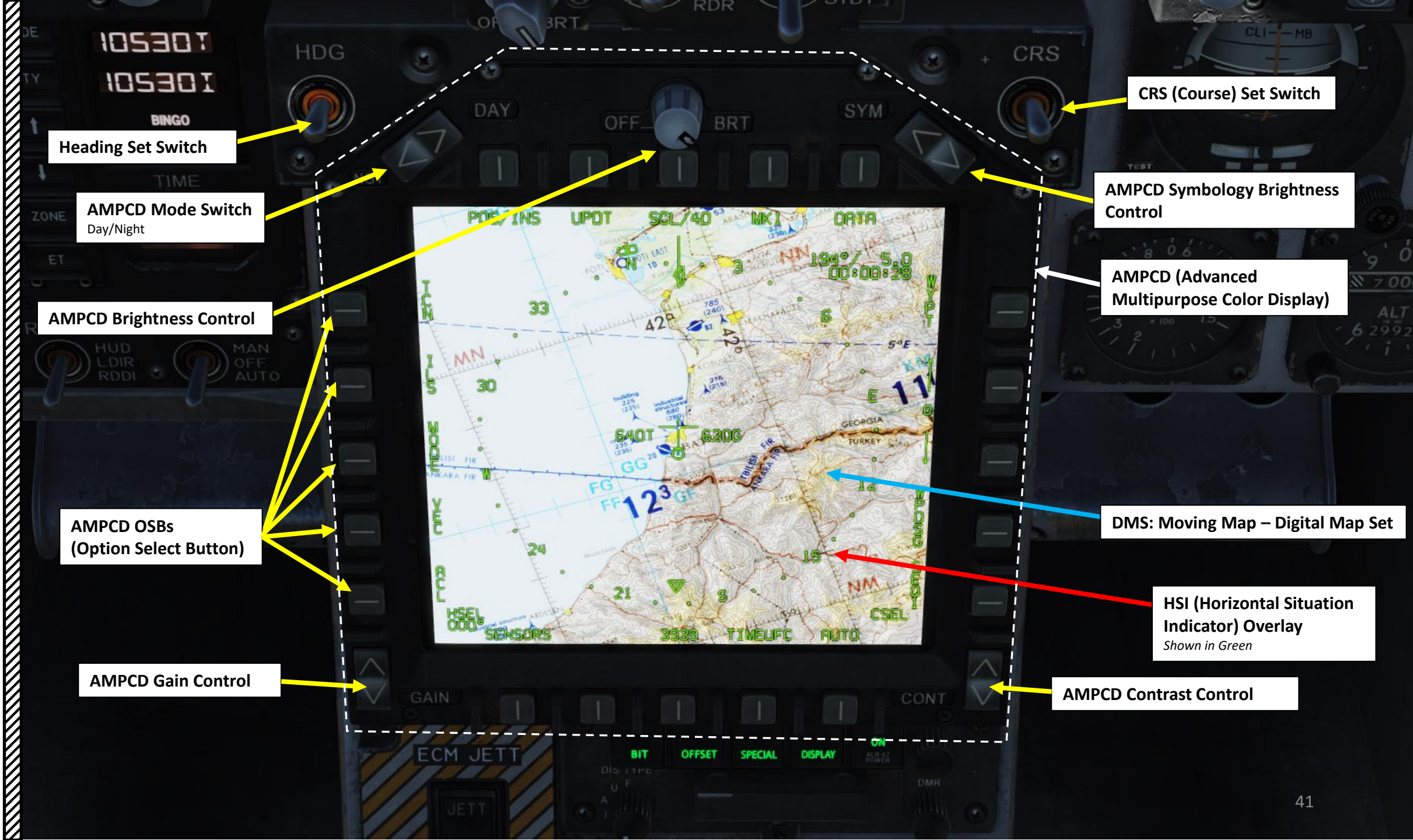
DDI Brightness Knob

DDI Contrast Knob

Spin Recovery Mode ACTIVE light

Spin Recovery Mode Switch
RCVY: Spin Recovery System ON
NORM: Spin Recovery System OFF


Standby Attitude Indicator Caging Knob
Standby Attitude Indicator
Standby Attitude Indicator Test Button
ALR-67 RWR (Radar Warning Receiver)
RWR Intensity Knob
Cockpit Right Louver (Air Flow Outlet)
Standby Airspeed Indicator (x100 kts)
Standby Altimeter (ft)
Standby Vertical Velocity Indicator
BAL
BRT
CONT
SYM
HMD
OFF
SPIN
RCVY
NORM
INT
HOOK
WHEELS
FLAPS
HOOK
ANTISKID
HARNESS
DISPENSER
WING FOLD



Heading Set Switch

AMPCD Mode Switch
Day/Night

AMPCD Brightness Control

AMPCD OSBs (Option Select Button)

AMPCD Gain Control

CRS (Course) Set Switch

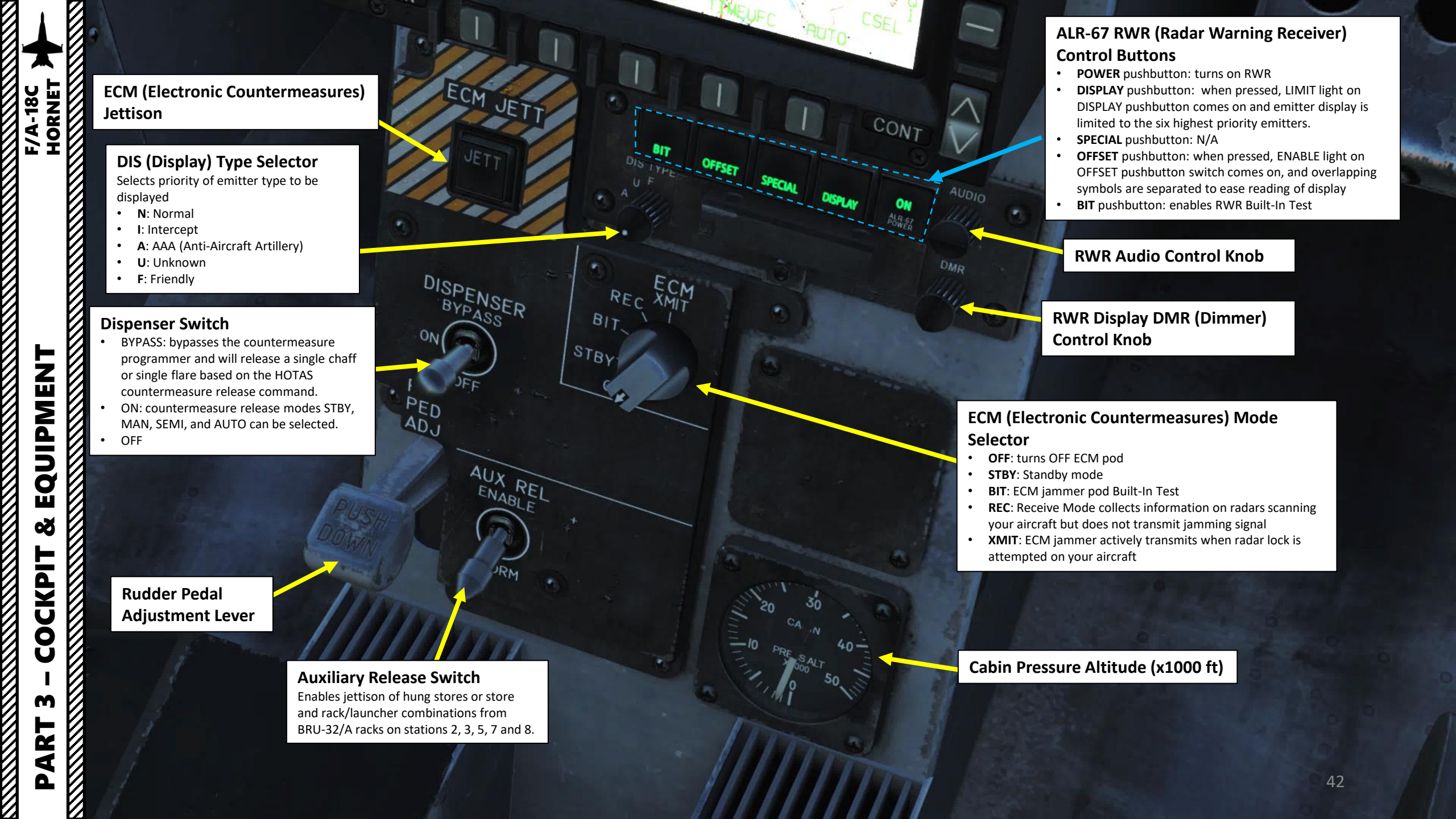
AMPCD Symbology Brightness Control

AMPCD (Advanced Multipurpose Color Display)

DMS: Moving Map – Digital Map Set

HSI (Horizontal Situation Indicator) Overlay
Shown in Green

AMPCD Contrast Control



ECM (Electronic Countermeasures) Jettison

DIS (Display) Type Selector

Selects priority of emitter type to be displayed

- **N**: Normal
- **I**: Intercept
- **A**: AAA (Anti-Aircraft Artillery)
- **U**: Unknown
- **F**: Friendly

Dispenser Switch

- BYPASS: bypasses the countermeasure programmer and will release a single chaff or single flare based on the HOTAS countermeasure release command.
- ON: countermeasure release modes STBY, MAN, SEMI, and AUTO can be selected.
- OFF

Rudder Pedal Adjustment Lever

Auxiliary Release Switch

Enables jettison of hung stores or store and rack/launcher combinations from BRU-32/A racks on stations 2, 3, 5, 7 and 8.

ALR-67 RWR (Radar Warning Receiver) Control Buttons

- **POWER** pushbutton: turns on RWR
- **DISPLAY** pushbutton: when pressed, LIMIT light on DISPLAY pushbutton comes on and emitter display is limited to the six highest priority emitters.
- **SPECIAL** pushbutton: N/A
- **OFFSET** pushbutton: when pressed, ENABLE light on OFFSET pushbutton switch comes on, and overlapping symbols are separated to ease reading of display
- **BIT** pushbutton: enables RWR Built-In Test

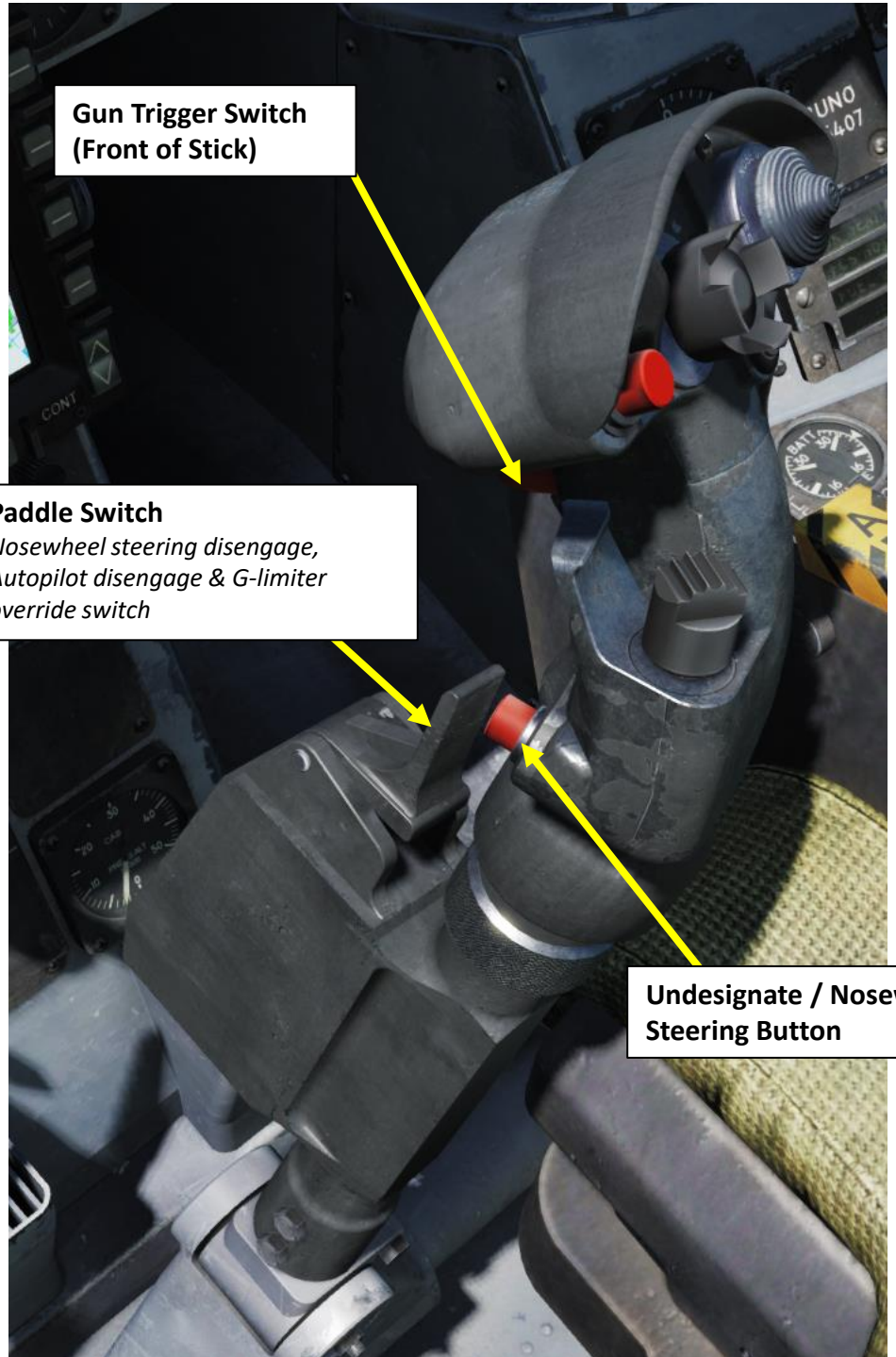
RWR Audio Control Knob

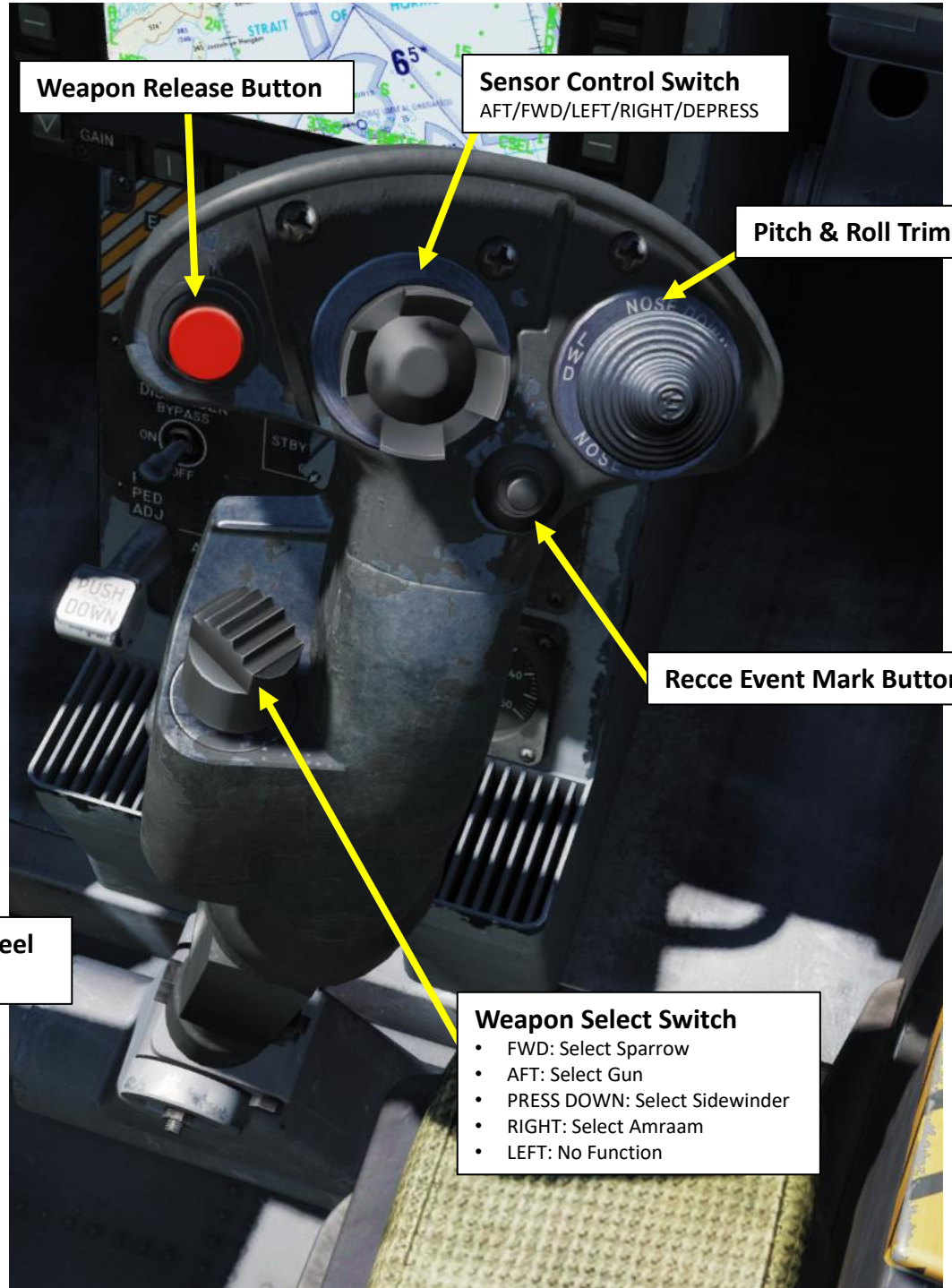
RWR Display DMR (Dimmer) Control Knob

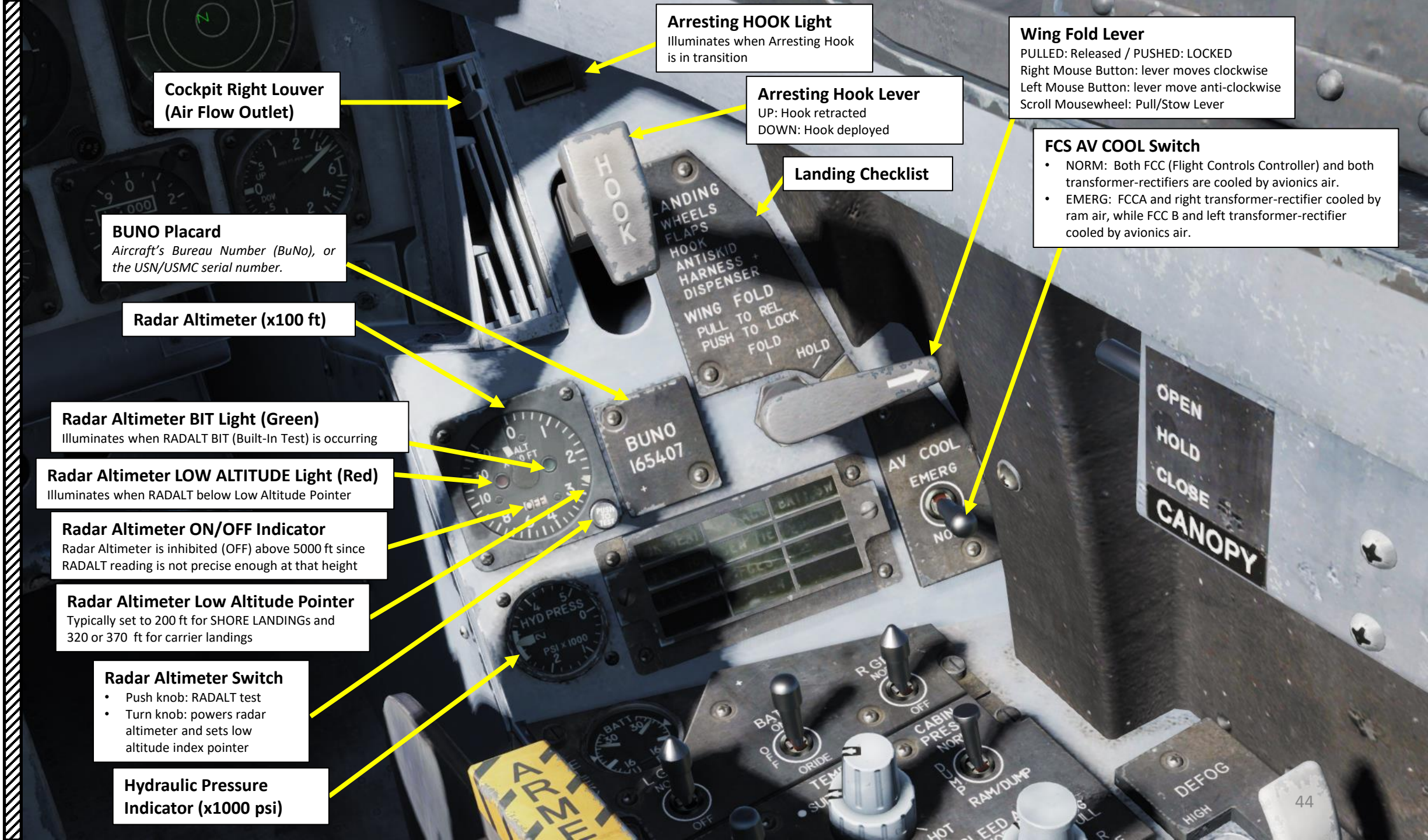
ECM (Electronic Countermeasures) Mode Selector

- **OFF**: turns OFF ECM pod
- **STBY**: Standby mode
- **BIT**: ECM jammer pod Built-In Test
- **REC**: Receive Mode collects information on radars scanning your aircraft but does not transmit jamming signal
- **XMIT**: ECM jammer actively transmits when radar lock is attempted on your aircraft

Cabin Pressure Altitude (x1000 ft)


Gun Trigger Switch (Front of Stick)
Paddle Switch
Nosewheel steering disengage, Autopilot disengage & G-limiter override switch
Undesignate / Nosewheel Steering Button


Weapon Release Button
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS
Pitch & Roll Trim Hat Switch
Recce Event Mark Button
Weapon Select Switch
• FWD: Select Sparrow
• AFT: Select Gun
• PRESS DOWN: Select Sidewinder
• RIGHT: Select Amraam
• LEFT: No Function



Arresting HOOK Light
Illuminates when Arresting Hook is in transition

Cockpit Right Louver (Air Flow Outlet)

Arresting Hook Lever
UP: Hook retracted
DOWN: Hook deployed

Wing Fold Lever
PULLED: Released / PUSHED: LOCKED
Right Mouse Button: lever moves clockwise
Left Mouse Button: lever move anti-clockwise
Scroll Mousewheel: Pull/Stow Lever

Landing Checklist

FCS AV COOL Switch
- NORM: Both FCC (Flight Controls Controller) and both transformer-rectifiers are cooled by avionics air.
- EMERG: FCCA and right transformer-rectifier cooled by ram air, while FCC B and left transformer-rectifier cooled by avionics air.

BUNO Placard
Aircraft's Bureau Number (BuNo), or the USN/USMC serial number.

Radar Altimeter (x100 ft)

Radar Altimeter BIT Light (Green)
Illuminates when RADALT BIT (Built-In Test) is occurring

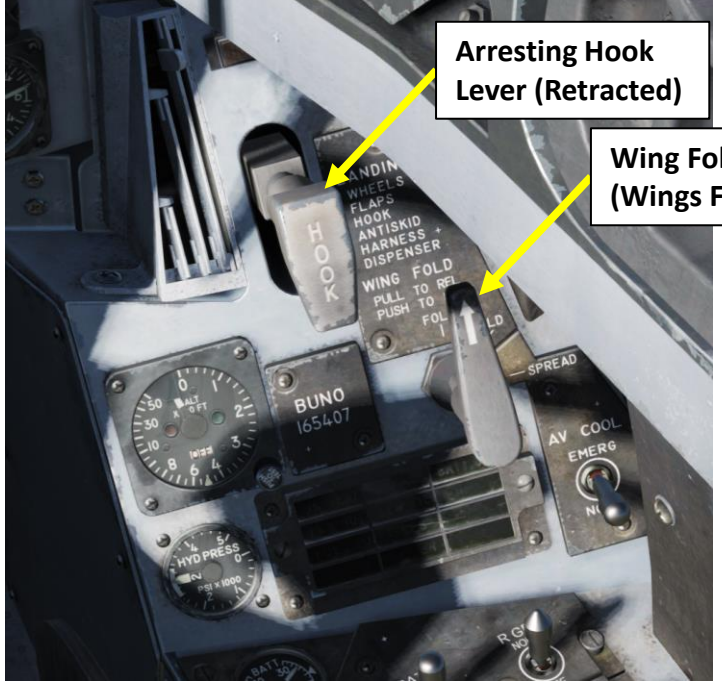
Radar Altimeter LOW ALTITUDE Light (Red)
Illuminates when RADALT below Low Altitude Pointer

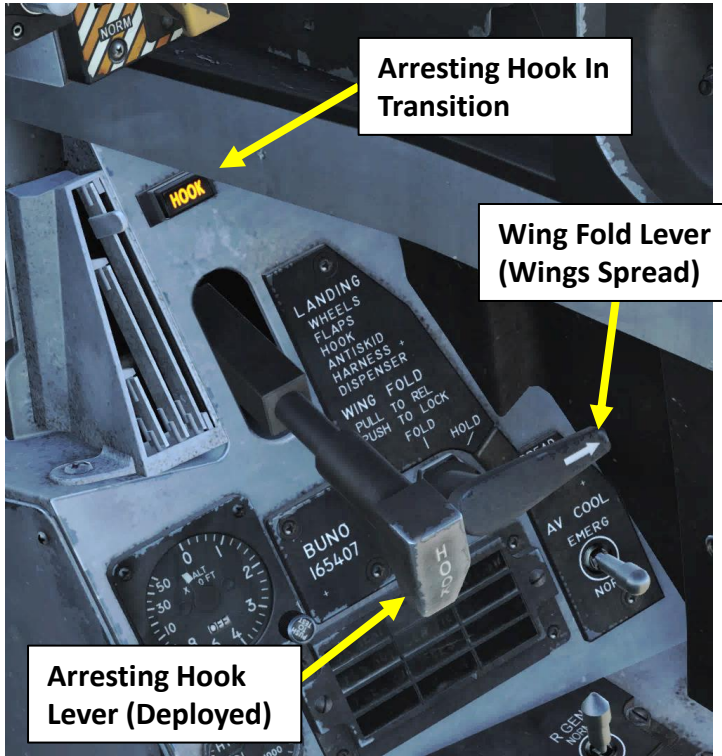
Radar Altimeter ON/OFF Indicator
Radar Altimeter is inhibited (OFF) above 5000 ft since RADALT reading is not precise enough at that height

Radar Altimeter Low Altitude Pointer
Typically set to 200 ft for SHORE LANDINGs and 320 or 370 ft for carrier landings

Radar Altimeter Switch
- Push knob: RADALT test
- Turn knob: powers radar altimeter and sets low altitude index pointer

Hydraulic Pressure Indicator (x1000 psi)

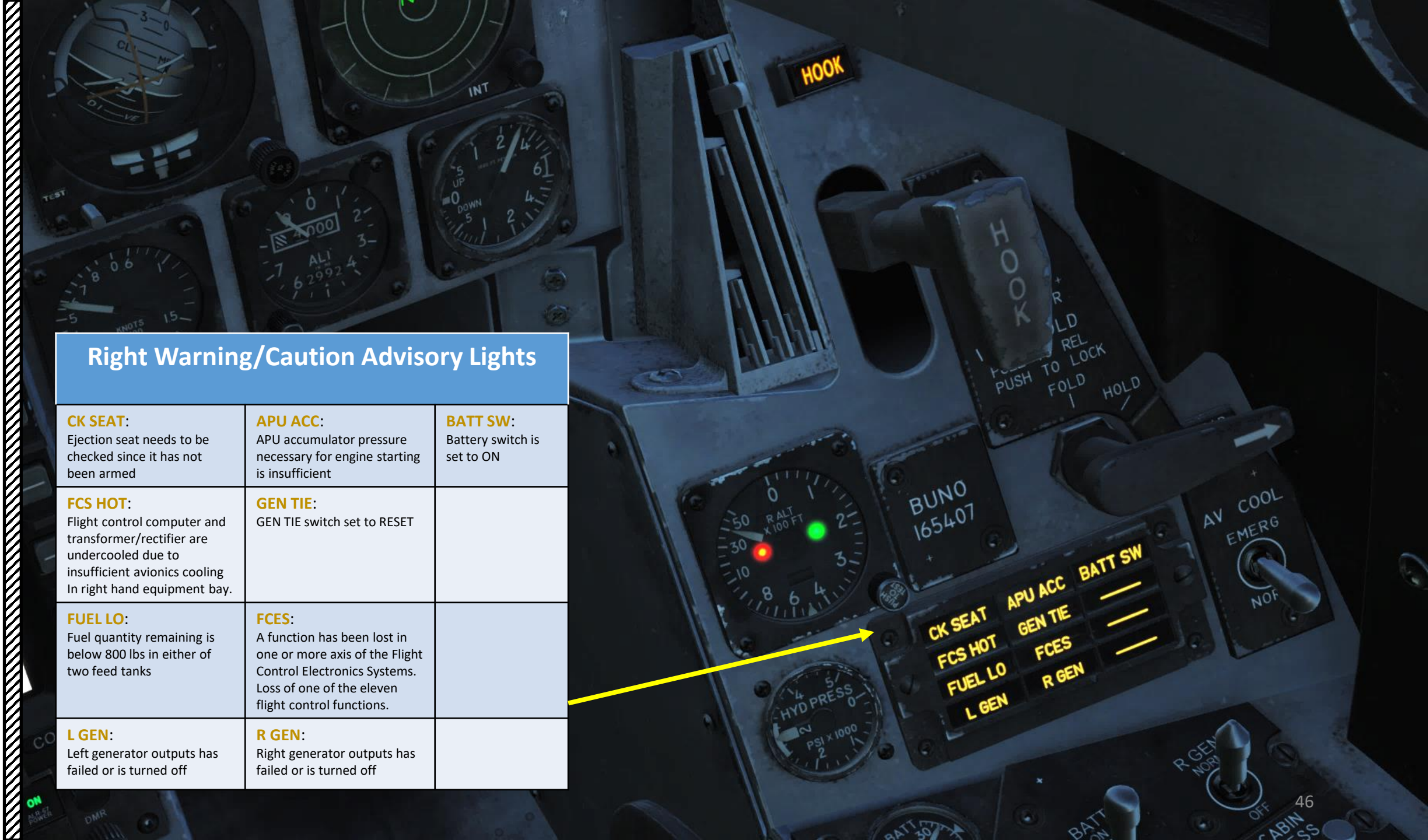






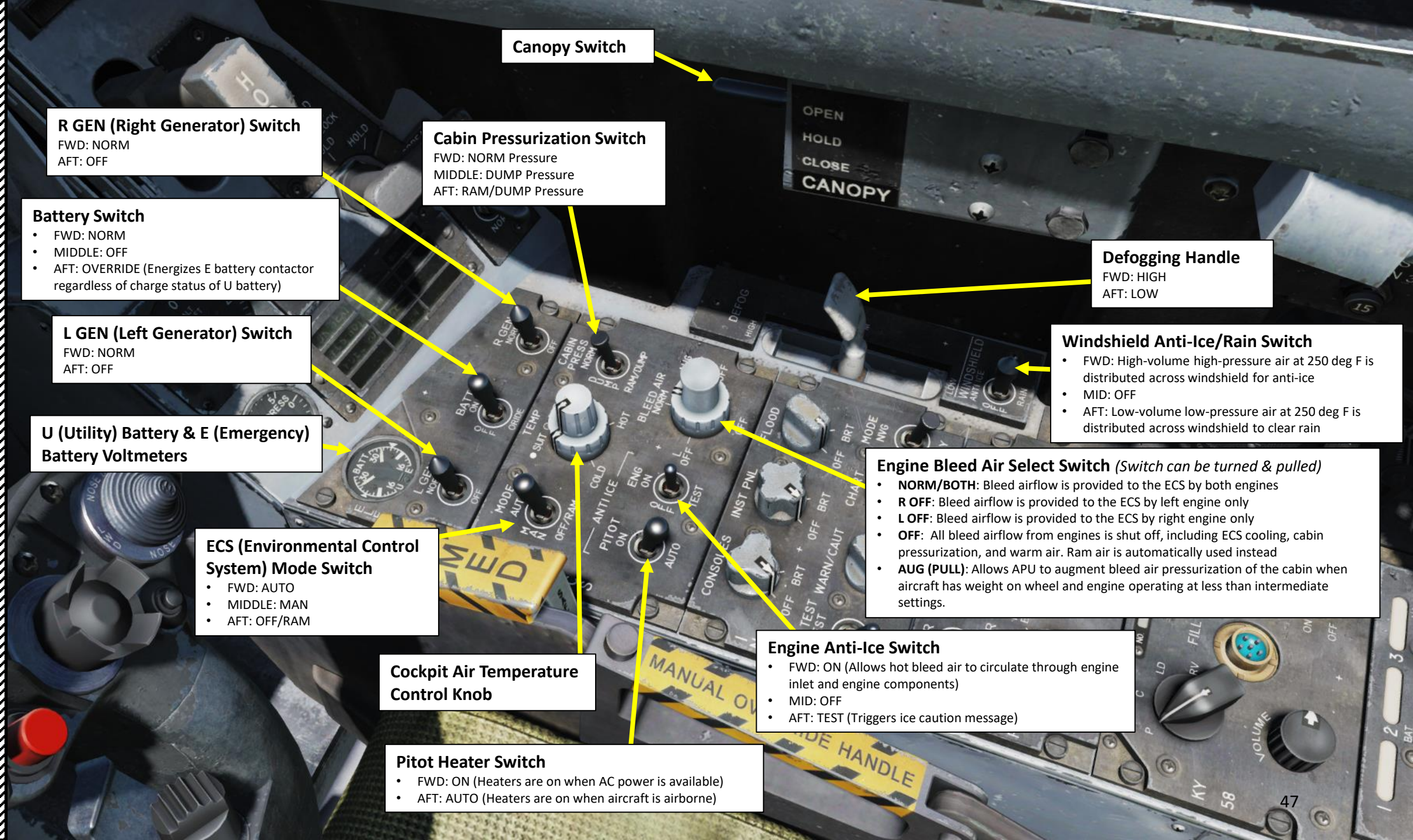
Wings (Folded)
On aircraft carriers, wing folding is used to save space on the hangar deck.





Right Warning/Caution Advisory Lights

CK SEAT: Ejection seat needs to be checked since it has not been armed	**APU ACC**: APU accumulator pressure necessary for engine starting is insufficient	**BATT SW**: Battery switch is set to ON
FCS HOT: Flight control computer and transformer/rectifier are undercooled due to insufficient avionics cooling In right hand equipment bay.	**GEN TIE**: GEN TIE switch set to RESET	
FUEL LO: Fuel quantity remaining is below 800 lbs in either of two feed tanks	**FCES**: A function has been lost in one or more axis of the Flight Control Electronics Systems. Loss of one of the eleven flight control functions.	
L GEN: Left generator outputs has failed or is turned off	**R GEN**: Right generator outputs has failed or is turned off	



Canopy Switch

R GEN (Right Generator) Switch
FWD: NORM
AFT: OFF

Cabin Pressurization Switch
FWD: NORM Pressure
MIDDLE: DUMP Pressure
AFT: RAM/DUMP Pressure

Battery Switch
- FWD: NORM
- MIDDLE: OFF
- AFT: OVERRIDE (Energizes E battery contactor regardless of charge status of U battery)

Defogging Handle
FWD: HIGH
AFT: LOW

L GEN (Left Generator) Switch
FWD: NORM
AFT: OFF

Windshield Anti-Ice/Rain Switch
- FWD: High-volume high-pressure air at 250 deg F is distributed across windshield for anti-ice
- MID: OFF
- AFT: Low-volume low-pressure air at 250 deg F is distributed across windshield to clear rain

U (Utility) Battery & E (Emergency) Battery Voltmeters

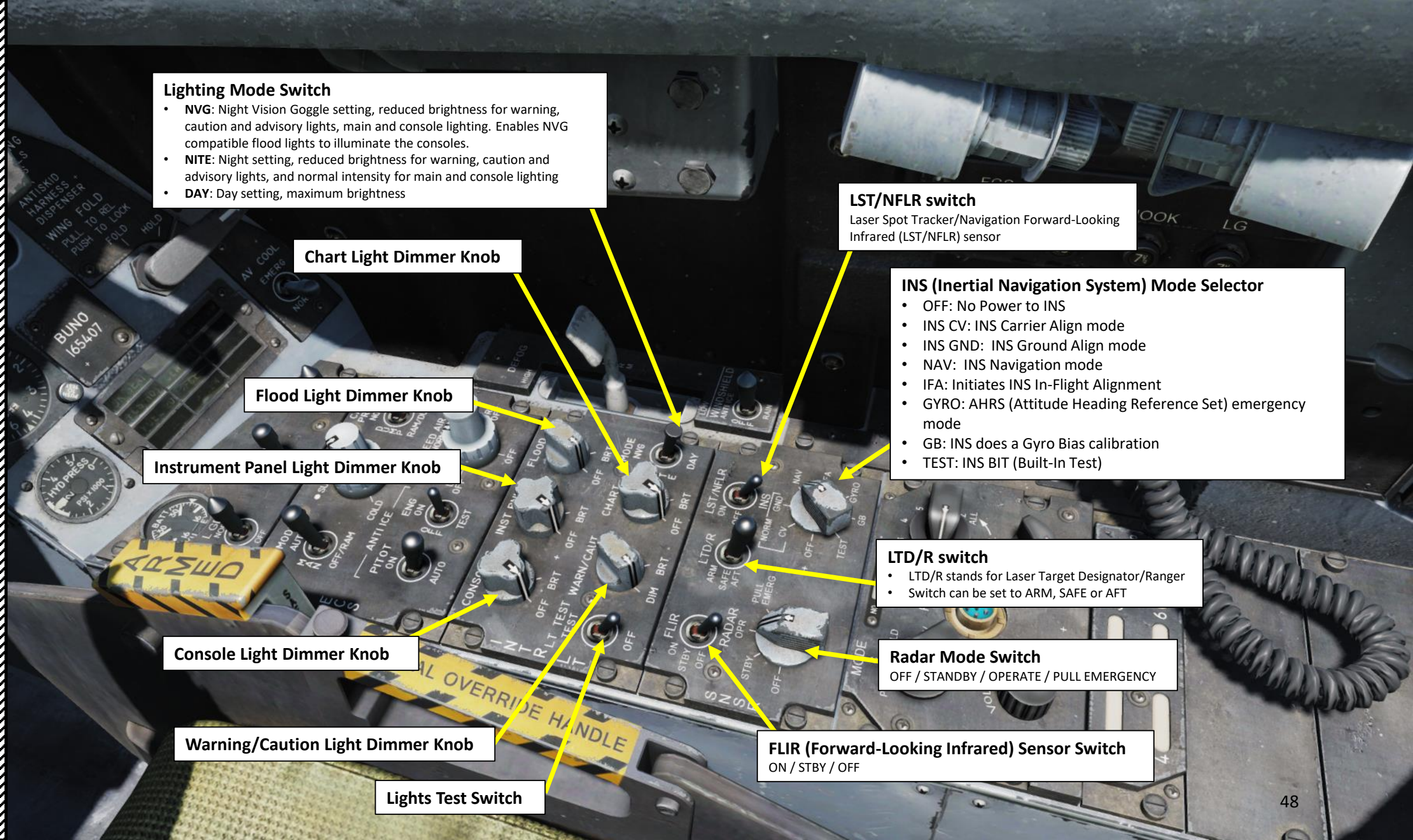
Engine Bleed Air Select Switch *(Switch can be turned & pulled)*
- **NORM/BOTH**: Bleed airflow is provided to the ECS by both engines
- **R OFF**: Bleed airflow is provided to the ECS by left engine only
- **L OFF**: Bleed airflow is provided to the ECS by right engine only
- **OFF**: All bleed airflow from engines is shut off, including ECS cooling, cabin pressurization, and warm air. Ram air is automatically used instead
- **AUG (PULL)**: Allows APU to augment bleed air pressurization of the cabin when aircraft has weight on wheel and engine operating at less than intermediate settings.

ECS (Environmental Control System) Mode Switch
- FWD: AUTO
- MIDDLE: MAN
- AFT: OFF/RAM

Engine Anti-Ice Switch
- FWD: ON (Allows hot bleed air to circulate through engine inlet and engine components)
- MID: OFF
- AFT: TEST (Triggers ice caution message)

Cockpit Air Temperature Control Knob

Pitot Heater Switch
- FWD: ON (Heaters are on when AC power is available)
- AFT: AUTO (Heaters are on when aircraft is airborne)



Lighting Mode Switch
- **NVG**: Night Vision Goggle setting, reduced brightness for warning, caution and advisory lights, main and console lighting. Enables NVG compatible flood lights to illuminate the consoles.
- **NITE**: Night setting, reduced brightness for warning, caution and advisory lights, and normal intensity for main and console lighting
- **DAY**: Day setting, maximum brightness

Chart Light Dimmer Knob

Flood Light Dimmer Knob

Instrument Panel Light Dimmer Knob

Console Light Dimmer Knob

Warning/Caution Light Dimmer Knob

Lights Test Switch

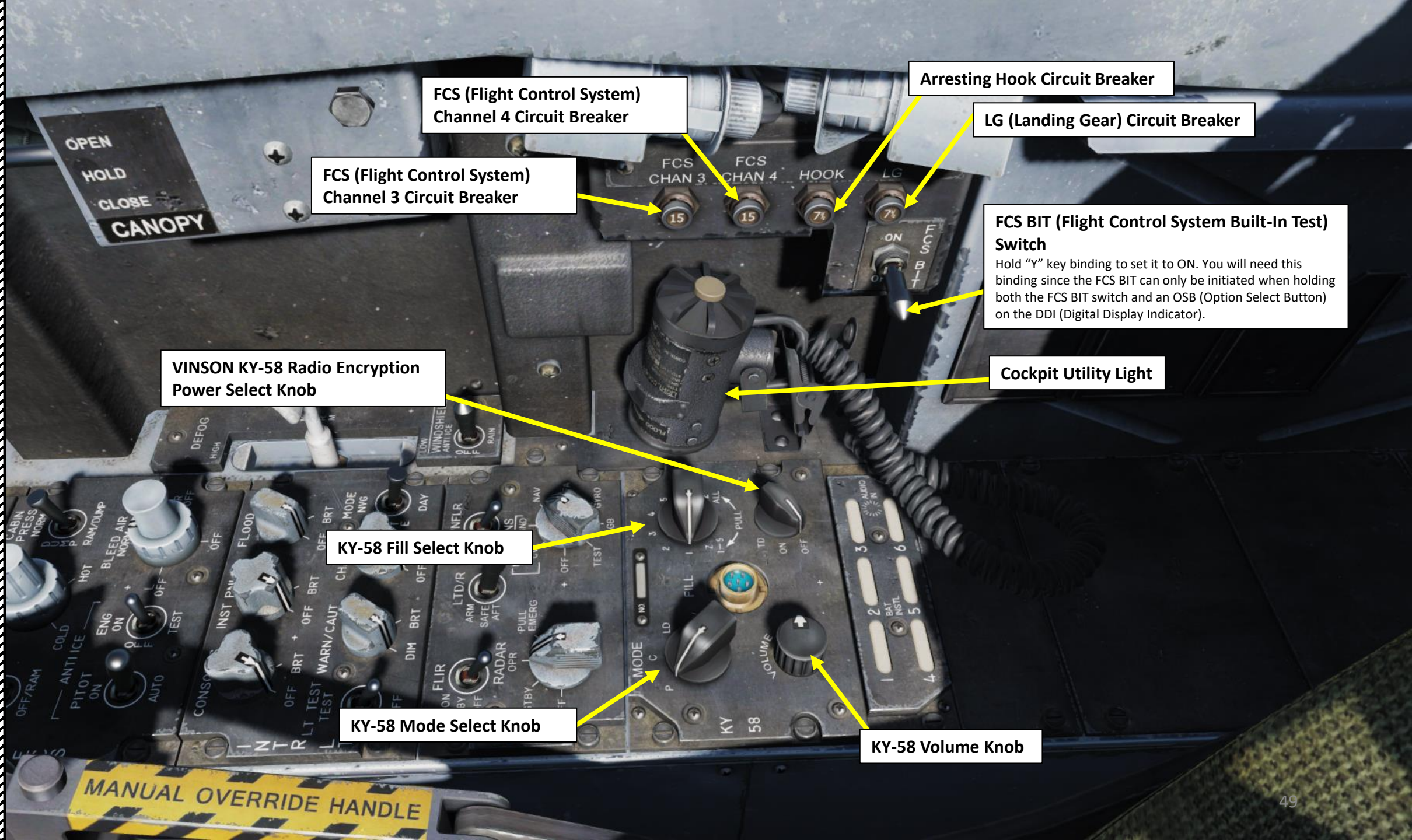
LST/NFLR switch
Laser Spot Tracker/Navigation Forward-Looking Infrared (LST/NFLR) sensor

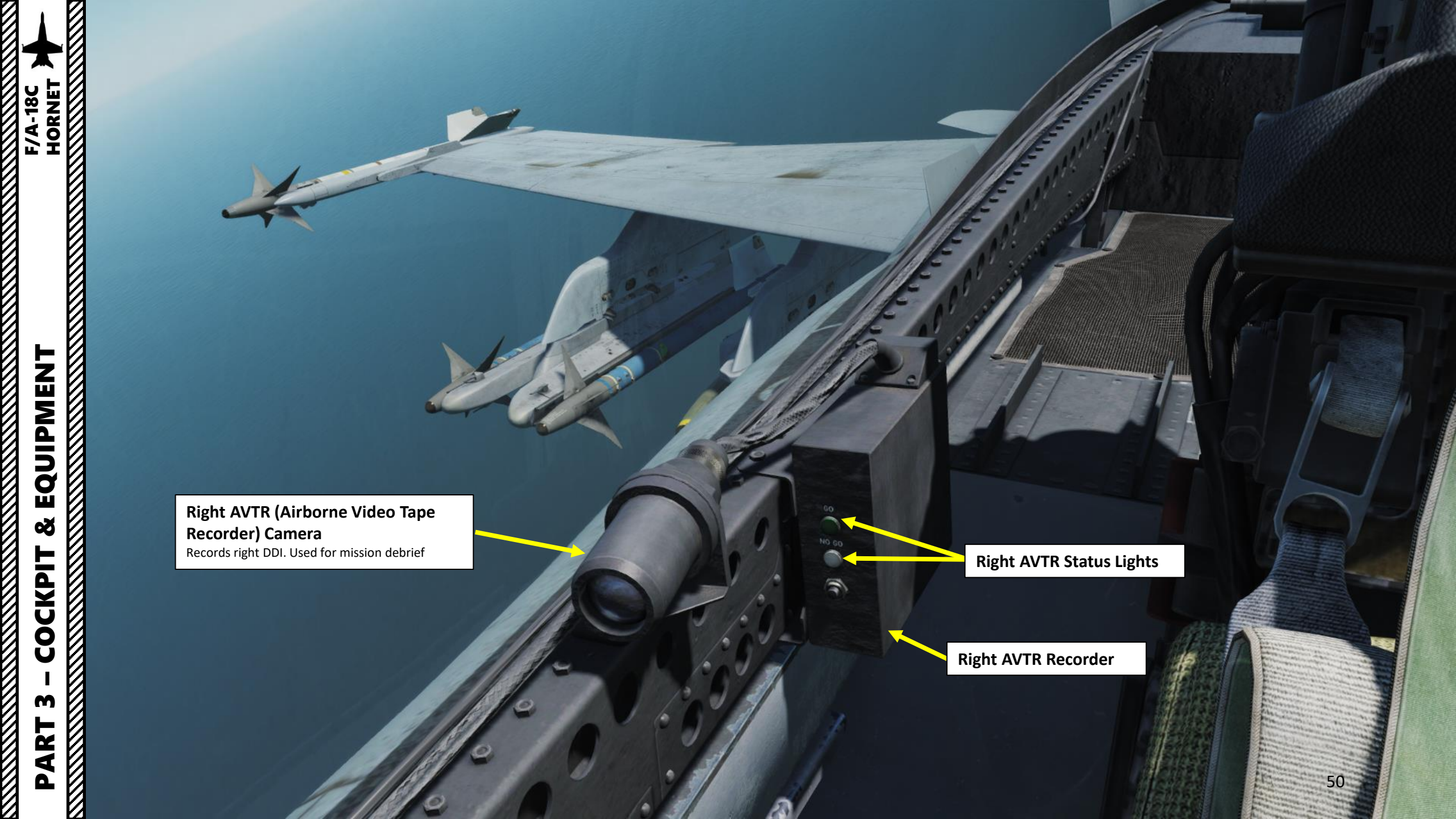
INS (Inertial Navigation System) Mode Selector
- OFF: No Power to INS
- INS CV: INS Carrier Align mode
- INS GND: INS Ground Align mode
- NAV: INS Navigation mode
- IFA: Initiates INS In-Flight Alignment
- GYRO: AHRS (Attitude Heading Reference Set) emergency mode
- GB: INS does a Gyro Bias calibration
- TEST: INS BIT (Built-In Test)

LTD/R switch
- LTD/R stands for Laser Target Designator/Ranger
- Switch can be set to ARM, SAFE or AFT

Radar Mode Switch
OFF / STANDBY / OPERATE / PULL EMERGENCY

FLIR (Forward-Looking Infrared) Sensor Switch
ON / STBY / OFF

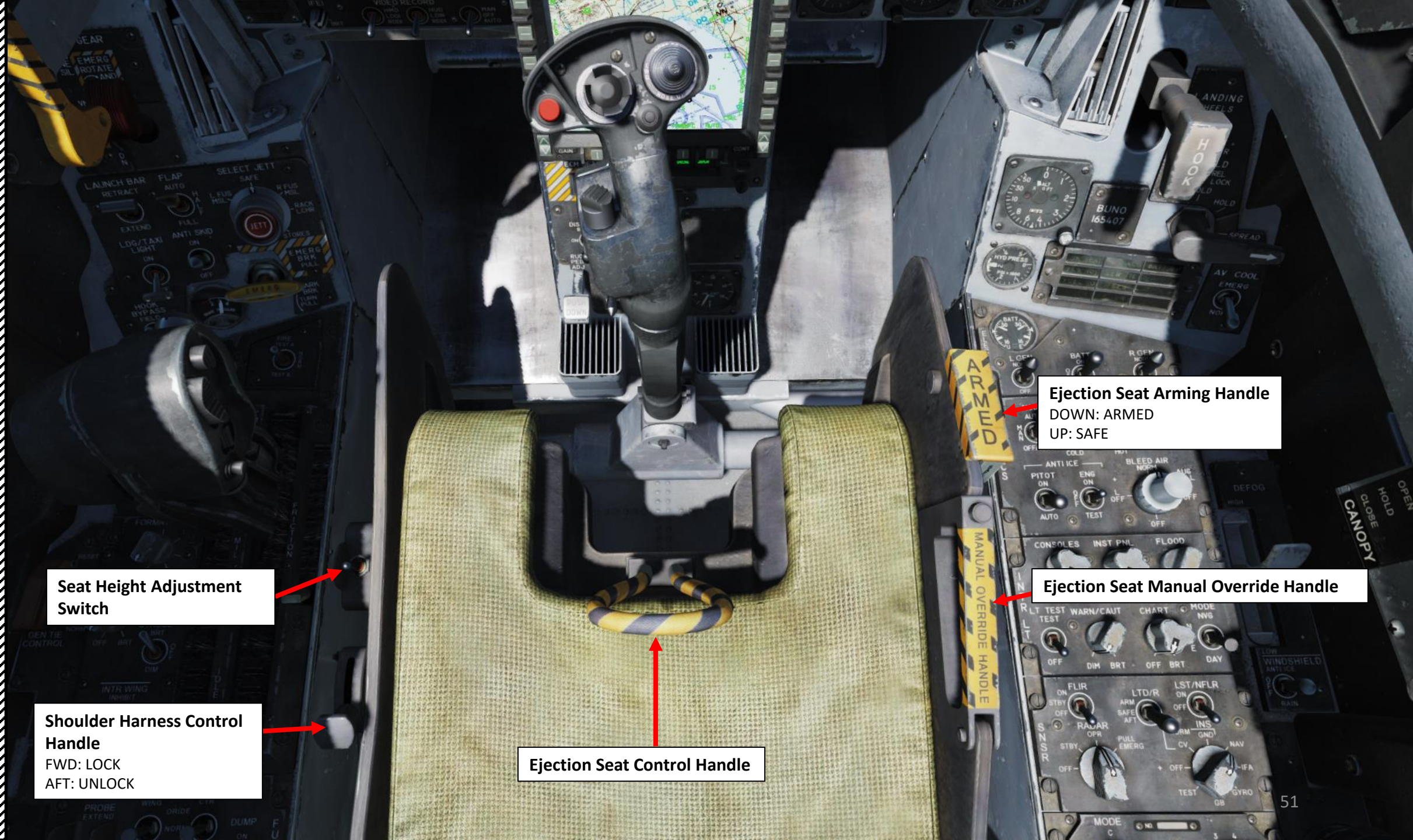

FCS (Flight Control System) Channel 4 Circuit Breaker
Arresting Hook Circuit Breaker
LG (Landing Gear) Circuit Breaker
FCS (Flight Control System) Channel 3 Circuit Breaker
FCS BIT (Flight Control System Built-In Test) Switch
Hold "Y" key binding to set it to ON. You will need this binding since the FCS BIT can only be initiated when holding both the FCS BIT switch and an OSB (Option Select Button) on the DDI (Digital Display Indicator).
VINSON KY-58 Radio Encryption Power Select Knob
Cockpit Utility Light
KY-58 Fill Select Knob
KY-58 Mode Select Knob
KY-58 Volume Knob
OPEN
HOLD
CLOSE
CANOPY
FCS CHAN 3
FCS CHAN 4
HOOK
LG
MANUAL OVERRIDE HANDLE



Right AVTR (Airborne Video Tape Recorder) Camera
Records right DDI. Used for mission debrief

Right AVTR Status Lights

Right AVTR Recorder



Ejection Seat Arming Handle
DOWN: ARMED
UP: SAFE

Ejection Seat Manual Override Handle

Seat Height Adjustment Switch

Shoulder Harness Control Handle
FWD: LOCK
AFT: UNLOCK

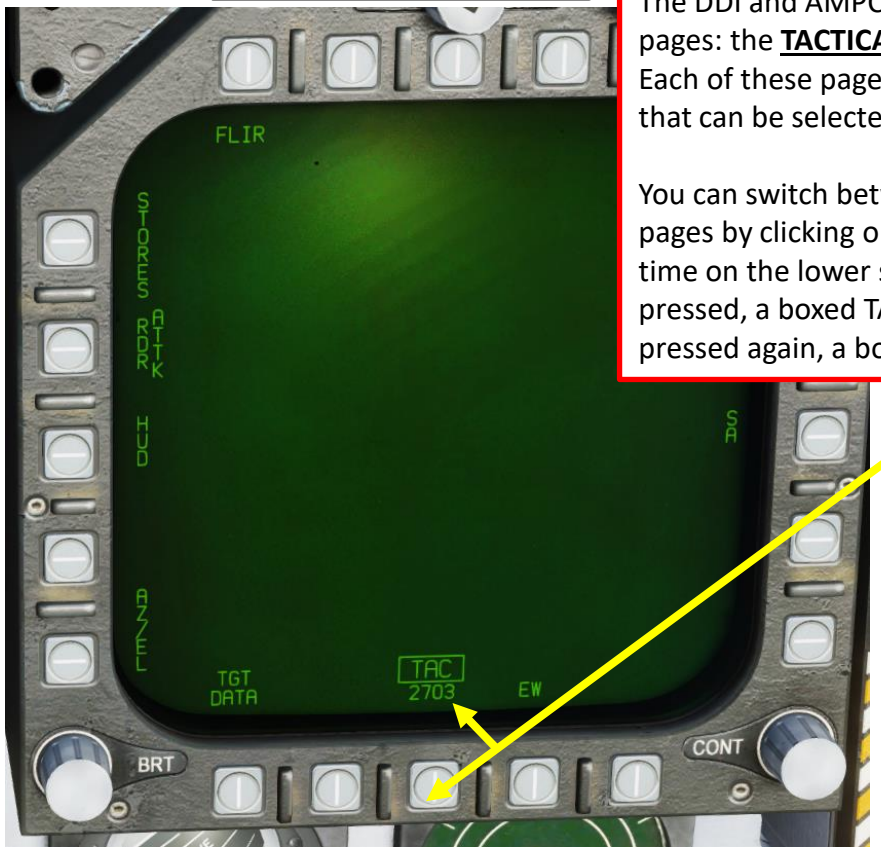
Ejection Seat Control Handle

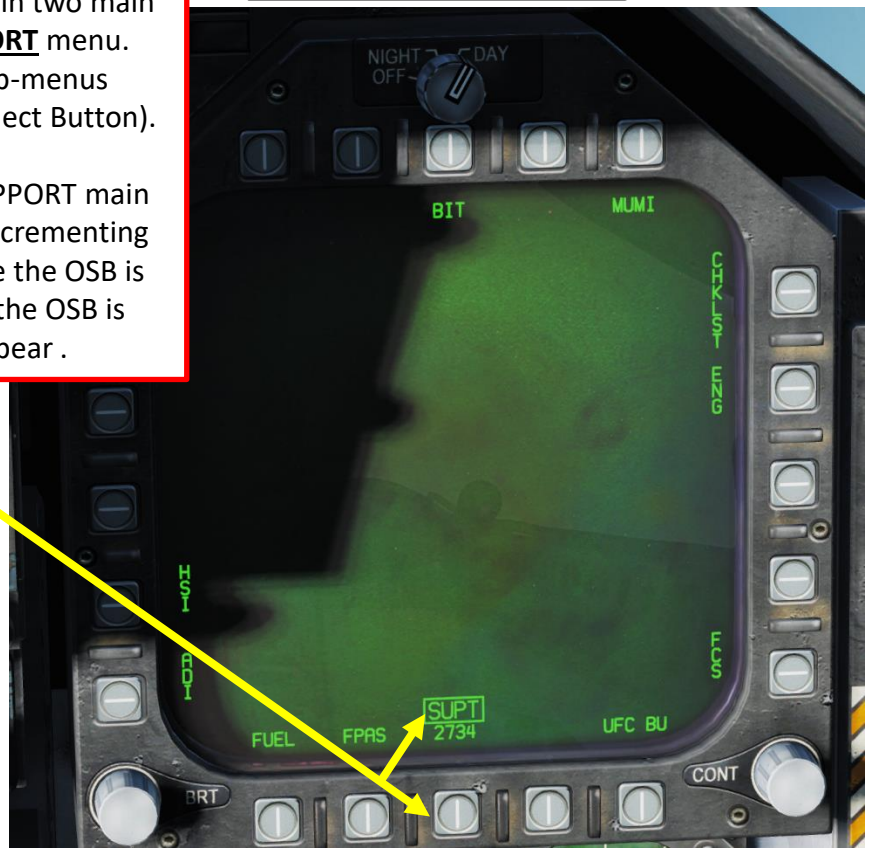
TACTICAL MENU

SUPPORT MENU

The DDI and AMPCD pages can be divided in two main pages: the **TACTICAL** menu and the **SUPPORT** menu. Each of these pages contains their own sub-menus that can be selected with OSBs (Option Select Button).

You can switch between TACTICAL and SUPPORT main pages by clicking on the OSB next to the incrementing time on the lower section of the DDI. Once the OSB is pressed, a boxed TAC menu will appear. If the OSB is pressed again, a boxed SUPT menu will appear .





STORES sub-menu
Showcases what stores & equipment is loaded on the aircraft

RDR ATTK sub-menu
Radar display page

TGT DATA sub-menu
Target Data page

HUD sub-menu
Heads-Up Display repeater page

AZ/EL sub-menu (N/A)
Azimuth/Elevation page

FLIR sub-menu
Targeting Pod feed page

EW sub-menu
Early Warning page (includes Radar Warning Receiver display)

SA sub-menu
Situational Awareness page

HSI sub-menu
Horizontal Situation Indicator

ADI sub-menu
EADI (Electronic Attitude Display Indicator) page

FUEL sub-menu
Fuel page

FPAS sub-menu
Flight Performance Advisory System

UFC BU sub-menu (N/A)
Up-Front Controller Back-up page

MIDS sub-menu
Multifunctional Information Distribution System page

ENG sub-menu
Engine Data page

CHKLST sub-menu
Checklist page

FCS sub-menu
Flight Control System page

MUMI sub-menu (N/A)
Memory Unit Mission Initialization page

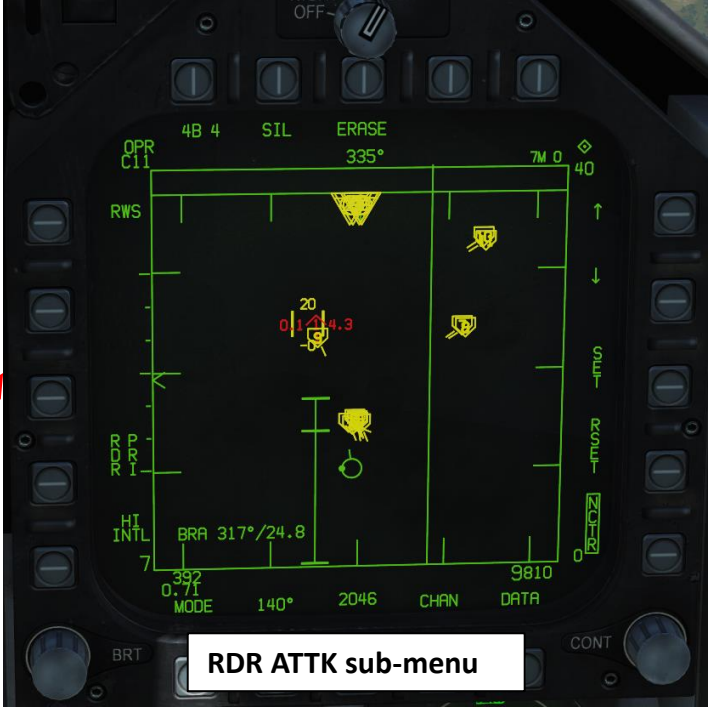
BIT sub-menu
Built-In Test page



STORES sub-menu



TACTICAL MENU



RDR ATTK sub-menu



HUD sub-menu



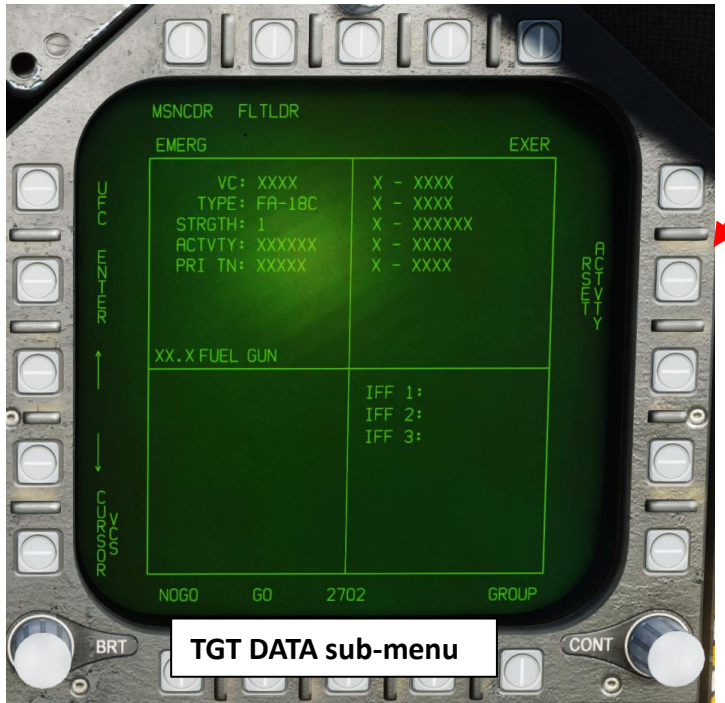
EW sub-menu


NIGHT
OFF
DAY
MAP
DCLTR
SCL/40
MK2
DCNTR
147/ 1.7
00:00:14
SENSR
TGT
33
30
N
W
3
0.6
18
24
6
0
21
E
C: 60
F: 30
01: 0
02: 0
S
12
15
UKN
369 / 155
BRA 328/16
SEQ 1
EXP
STEP
2039
TXDSG
AUTO
BRT
CONT
SA sub-menu


FLIR
STORES
RDR
A/TK
HUD
SA
AZEL
TGT
DATA
TAC
2703
EW
BRT
CONT
TACTICAL MENU



AZ/EL sub-menu



TGT DATA sub-menu



TACTICAL MENU



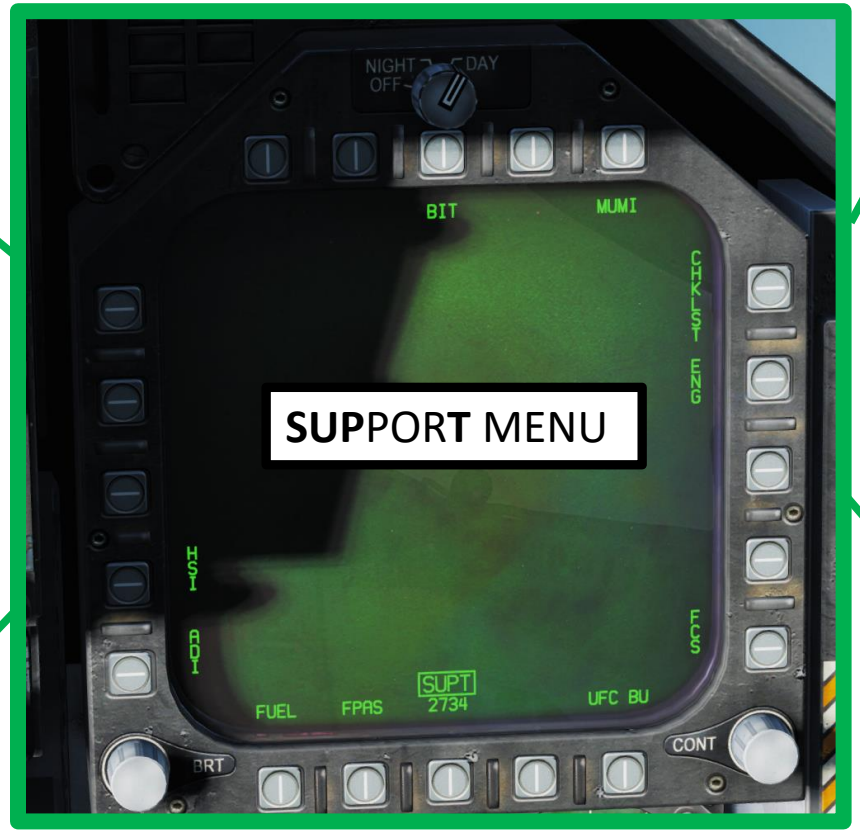
FLIR sub-menu



HSI sub-menu



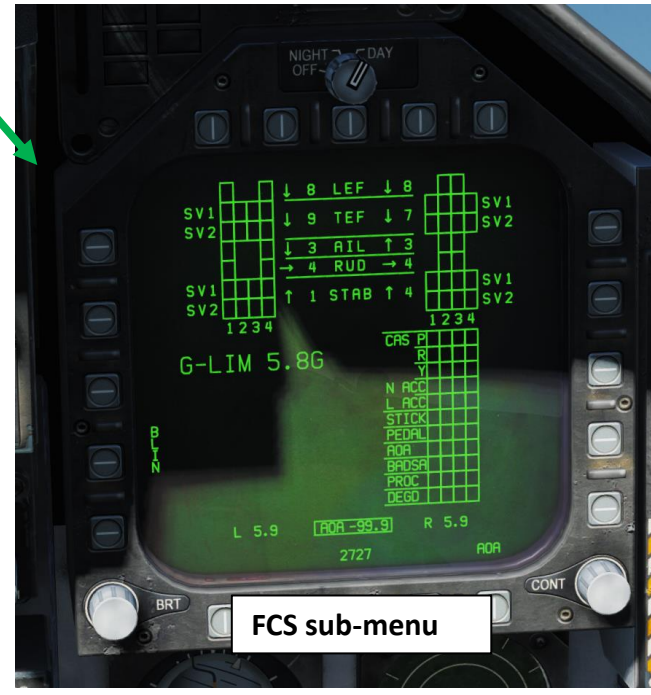
ADI sub-menu



SUPPORT MENU



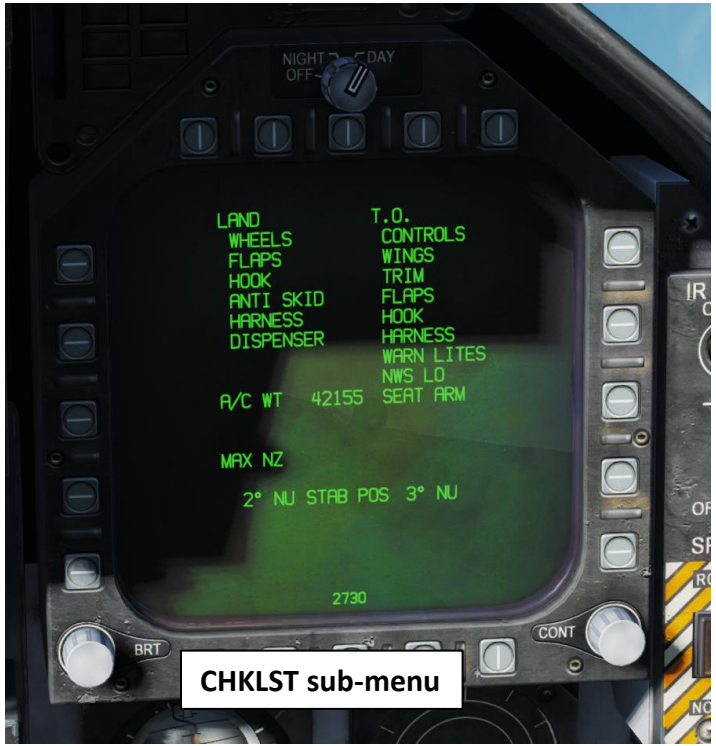
FUEL sub-menu



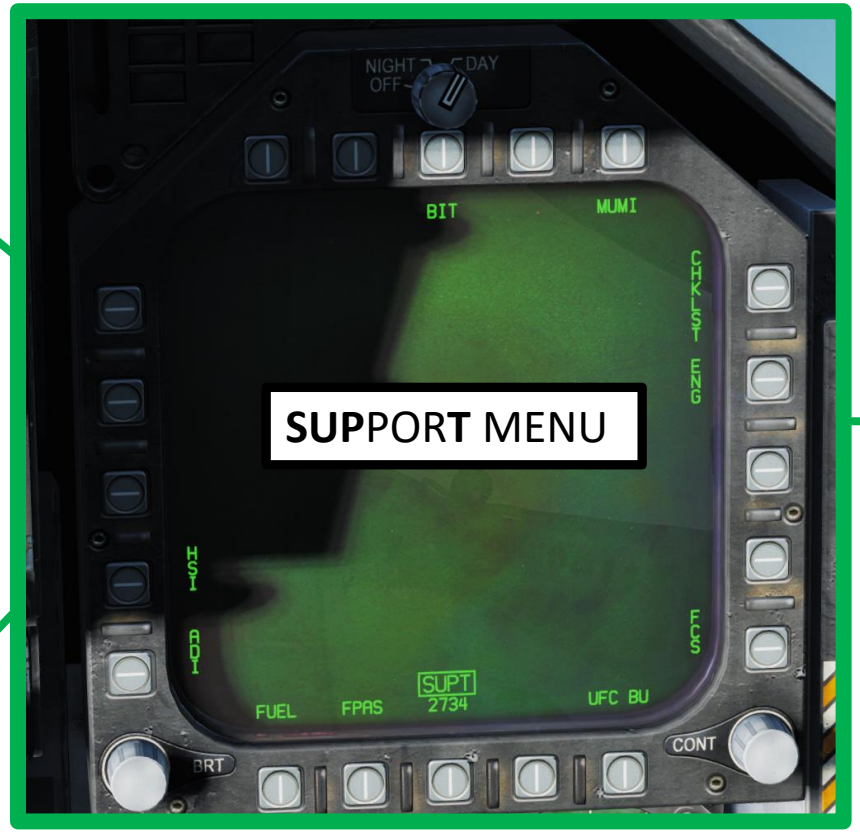
FCS sub-menu



ENG sub-menu



CHKLST sub-menu



SUPPORT MENU

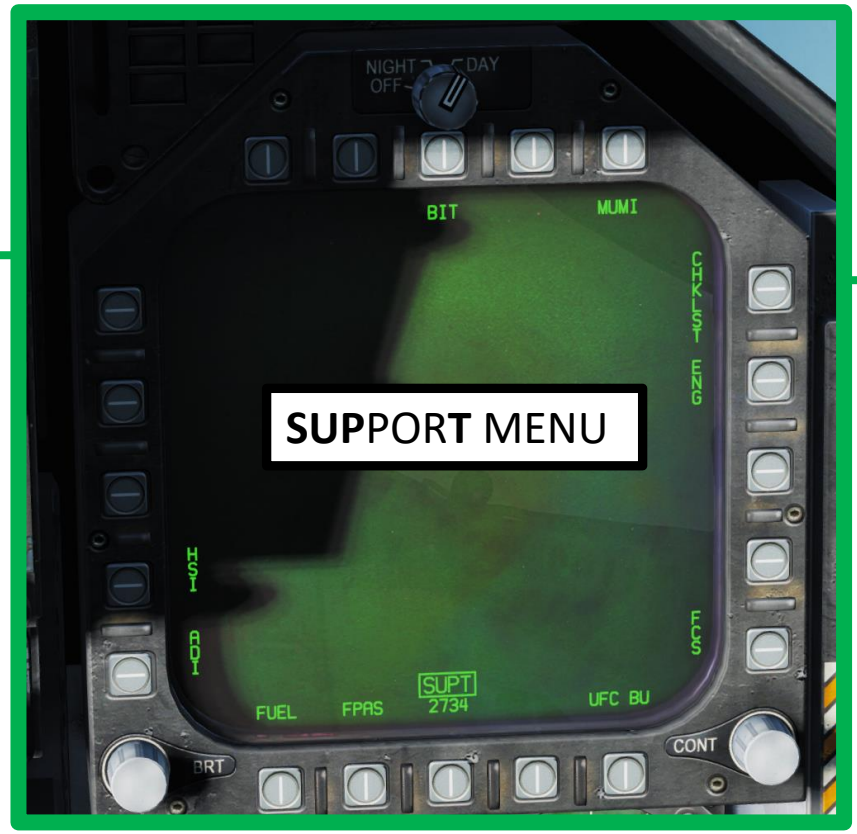


BIT sub-menu

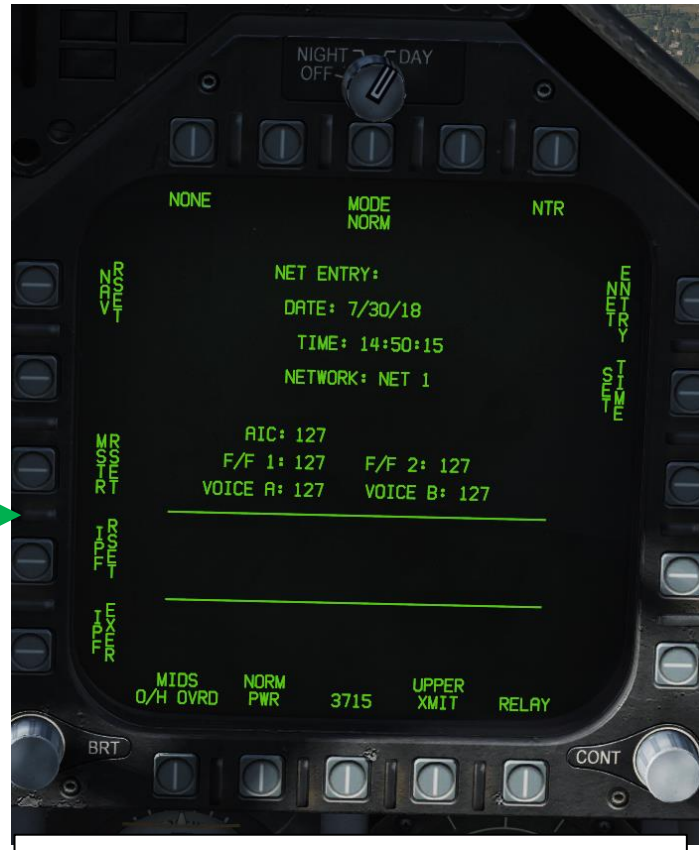


FPAS sub-menu

Flight Performance Advisory System (FPAS) Page. The FPAS advises the pilot of the altitude and airspeed corresponding to maximum inflight fuel efficiency based on current operating conditions. The range and airspeed data provided by FPAS appears on the FPAS DDI page from the SUPT menu.



SUPPORT MENU

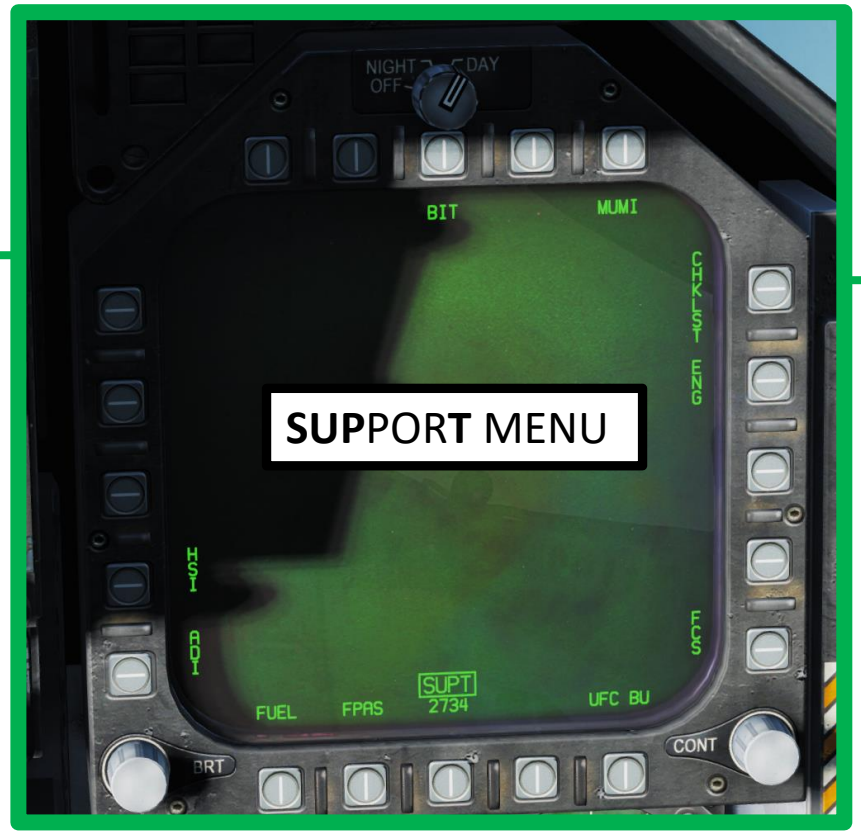


MIDS sub-menu

The Multifunctional Information Distribution System (MIDS) is the NATO name for the communication component of Link-16 Datalink System. MIDS is an advanced command, control, communications, computing and intelligence (C4I) system incorporating high-capacity, jam-resistant, digital communication links for exchange of near real-time tactical information, including both data and voice, among air, ground, and sea elements. MIDS is intended to support key theater functions such as surveillance, identification, air control, weapons engagement coordination and direction for all Services.



MUMI sub-menu



SUPPORT MENU



UFC BU sub-menu

For DDI, MPCD, UFC and HUD operation, Backy51 created a nice guide for it. It's a useful resource.

Forum link:
https://forums.eagle.ru/showthread.php?t=212389

Abbreviated Aircrew Checklist link:
https://www.digitalcombatsimulator.com/en/files/3300819/

The Question: How do I do that on the DDI/UFC?

Well my gouge has the answer for the following tasks:

- Waypoint Entry
- Waypoint Insert
- Waypoint Delete

- Coordinate Entry
- Designate Target Waypoint
- Convert Navigation Waypoint to Target

- Waypoint Elevation Change
- Carrier Night Lighting
- Catapult Launch

- Altimeter Settings
- TACAN Operation
- Active Pause

- COMM1/COMM2 Radio
- Checklists
- AOA Indexer Signals

- Setting Time Over Target (TOT)
- Setting Constant Groundspeed (GSPD) for Target Waypoint
- Display ZULU Time of Day (ZTOD) on DDI/HUD

- Display Six Minute Countdown (CD) timer on DDI/HUD
- Display Elapsed Time (ET) timer on DDI/HUD
- Set ZULU Date

I also included the "DASH-1" DDI Data Tree Extracts for the following:

- Waypoint Data Tree Extract
- GRID RDDI Data Tree Extract

- A/C Data Tree Extract
- HSI Data Tree Extract

As the F-18C develops, I hope to include more avionics goodness for your button pushing pleasure and in the process you'll learn to be a more effective Warfighter by mastering your systems!

Many of the tasks I've included above are undocumented as of now and may be changed, broken, etc., as future Hornet builds are released.

I included a Kneeboard folder to allow you to drop it straight into your Saved Games folder. Read the readme.txt file and you should be set.

Knowledge is Power in the fighter world, so start filling your clue bag today!
Comments, requests and feedback is always welcome.

Cheers,

Backy 51

DOWNLOAD LINK:
https://www.digitalcombatsimulator.c...files/3300819/

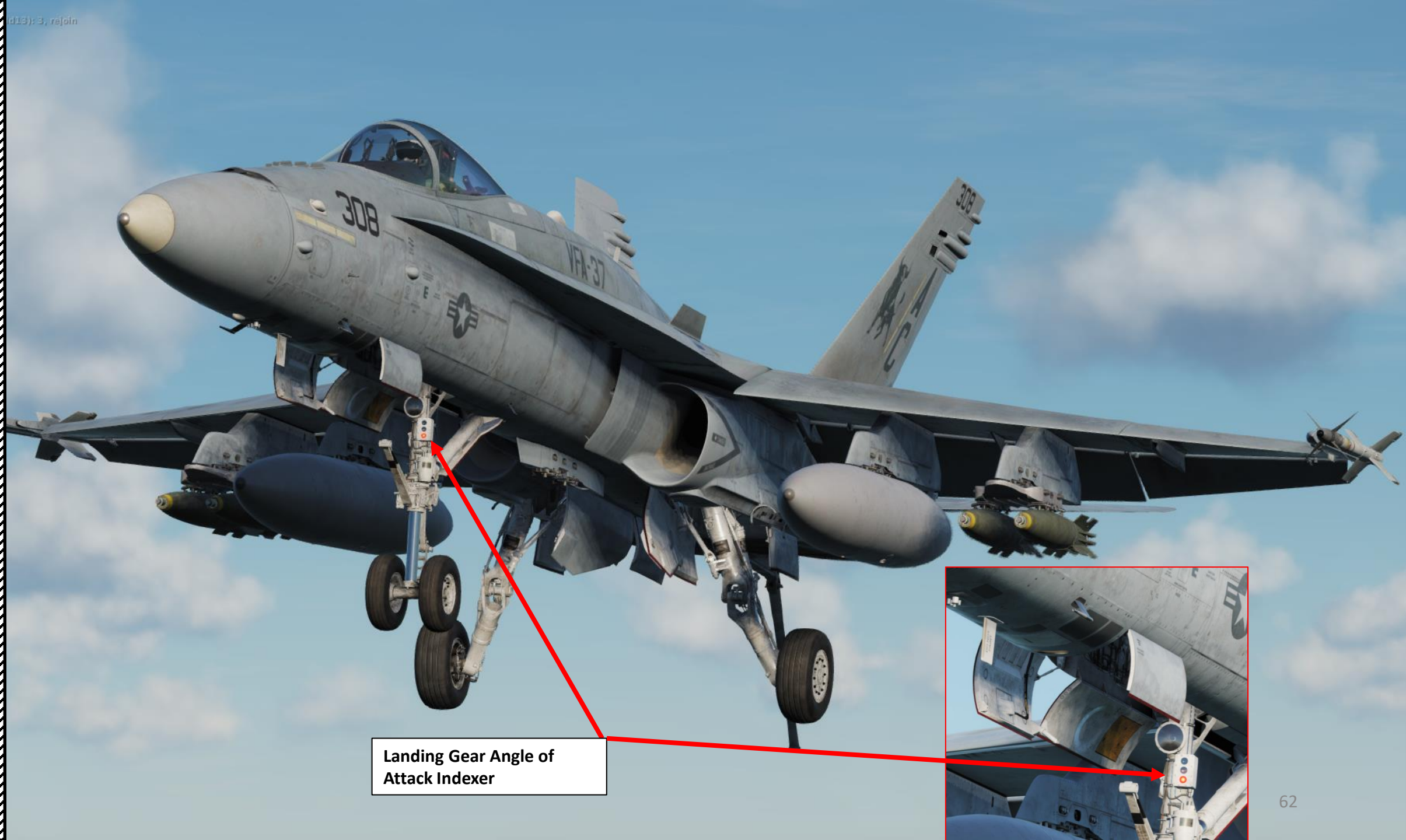
I don't need no stinkin' GPS!

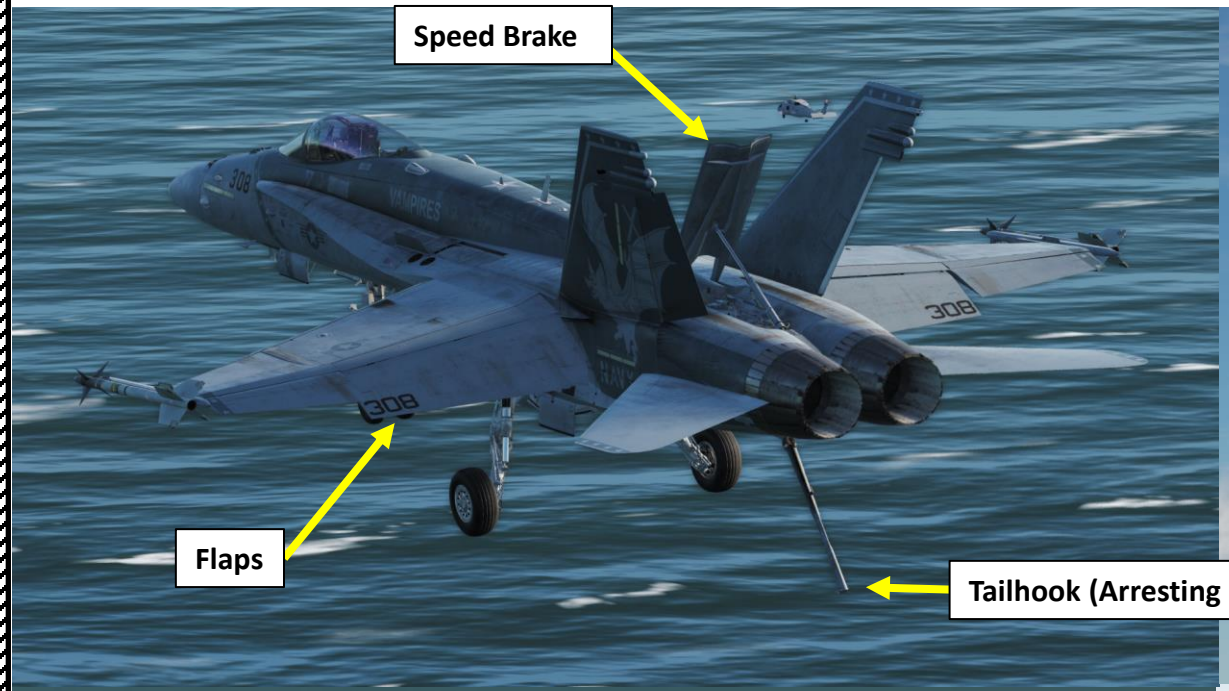




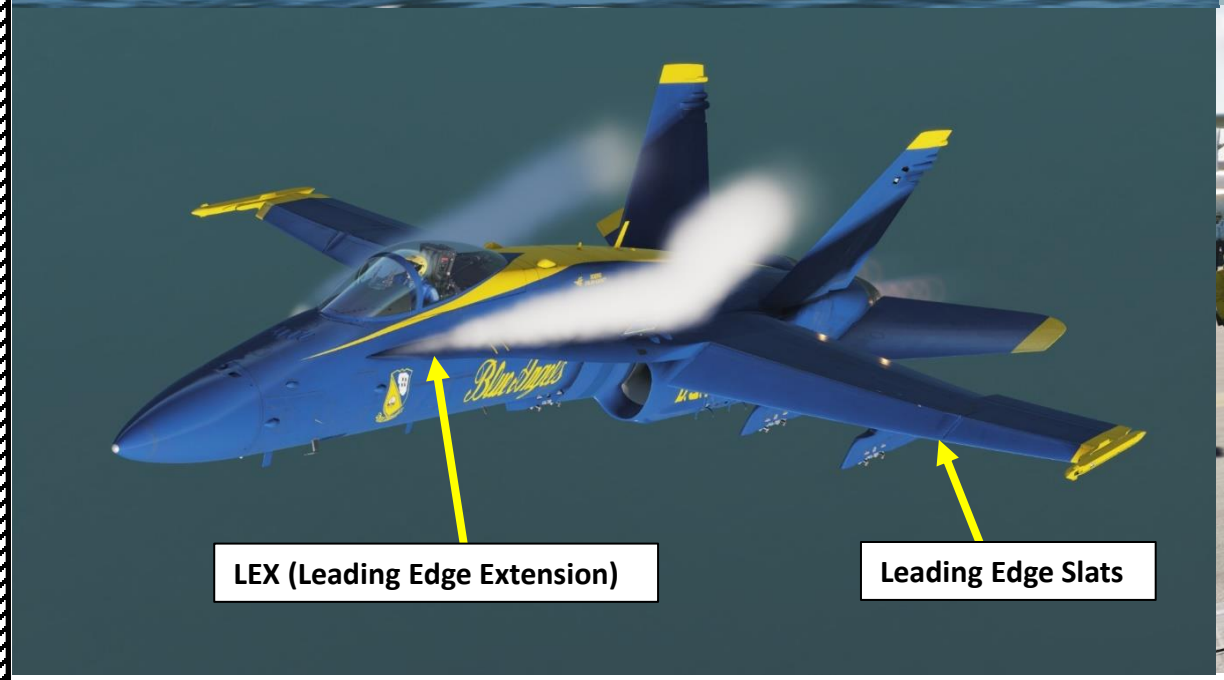


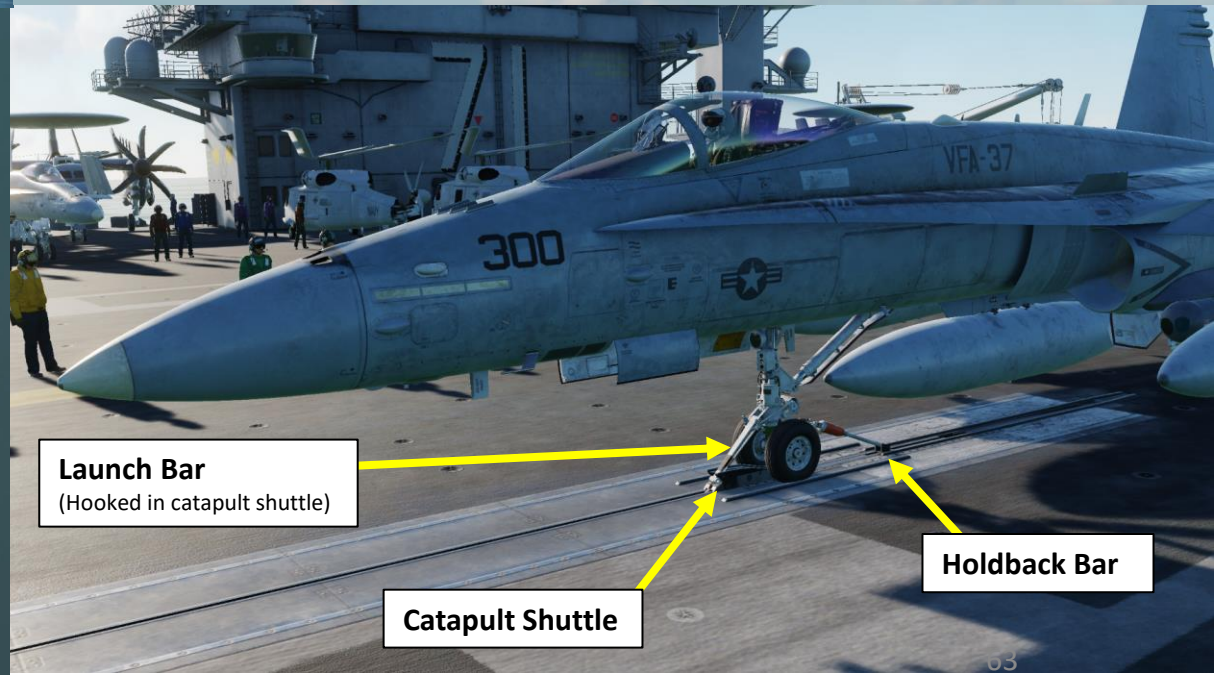

M61A2 Vulcan Gun
VFA-83
410

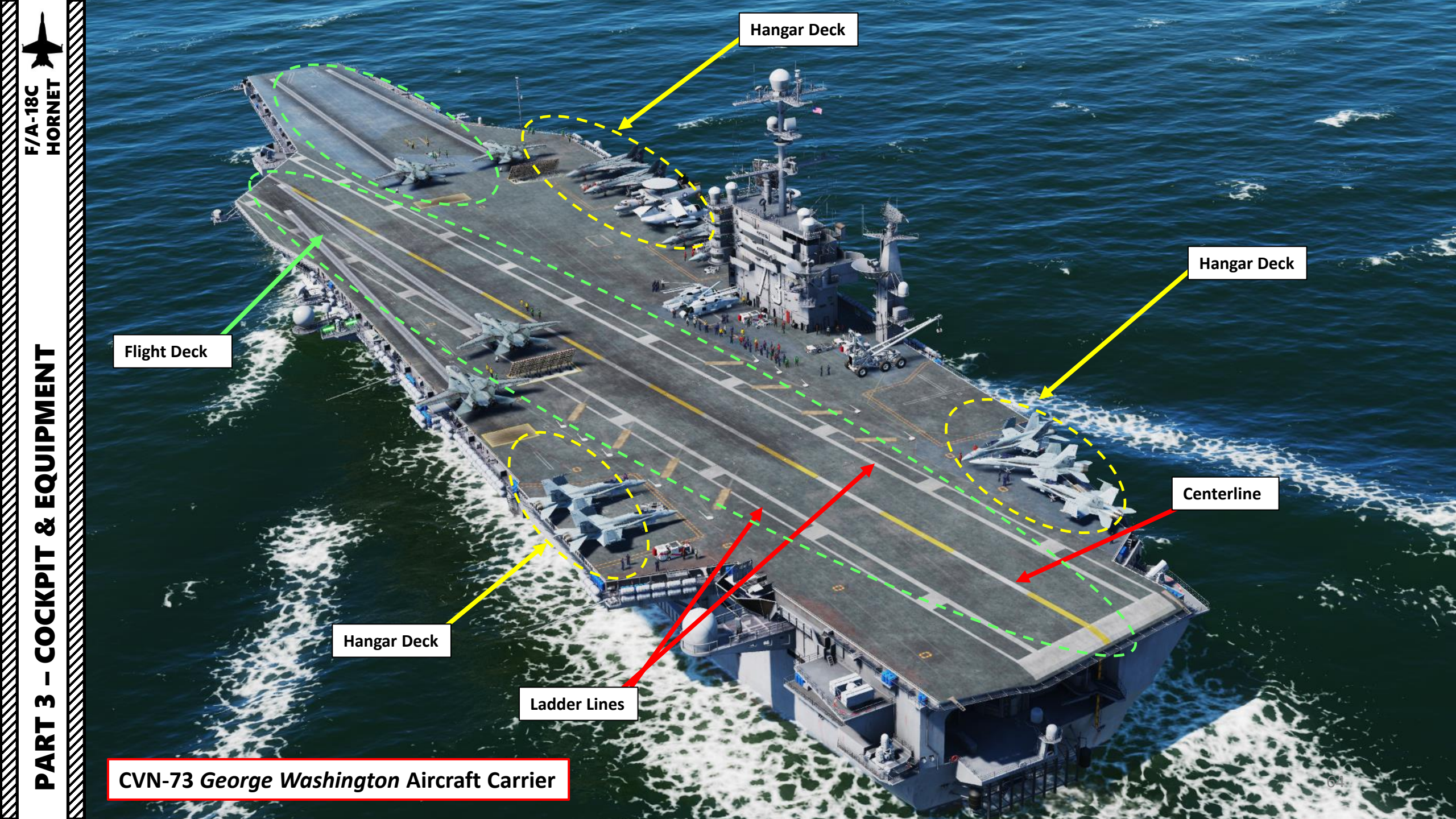

308
VFA-37
308
Landing Gear Angle of Attack Indexer


Speed Brake
Flaps
Tailhook (Arresting Hook)

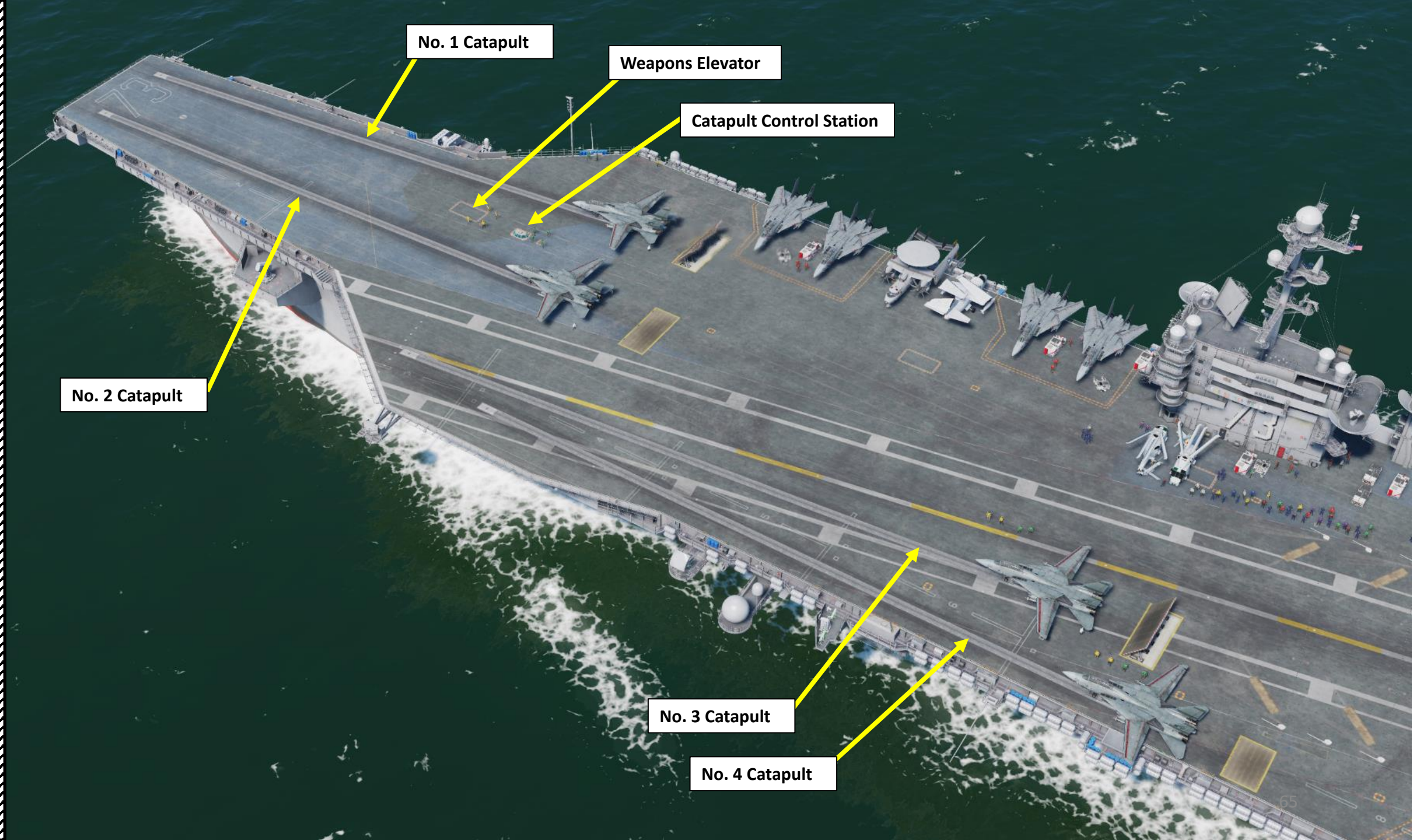

Launch Bar
(Retracted)


LEX (Leading Edge Extension)
Leading Edge Slats


Launch Bar
(Hooked in catapult shuttle)
Holdback Bar
Catapult Shuttle



CVN-73 *George Washington* Aircraft Carrier

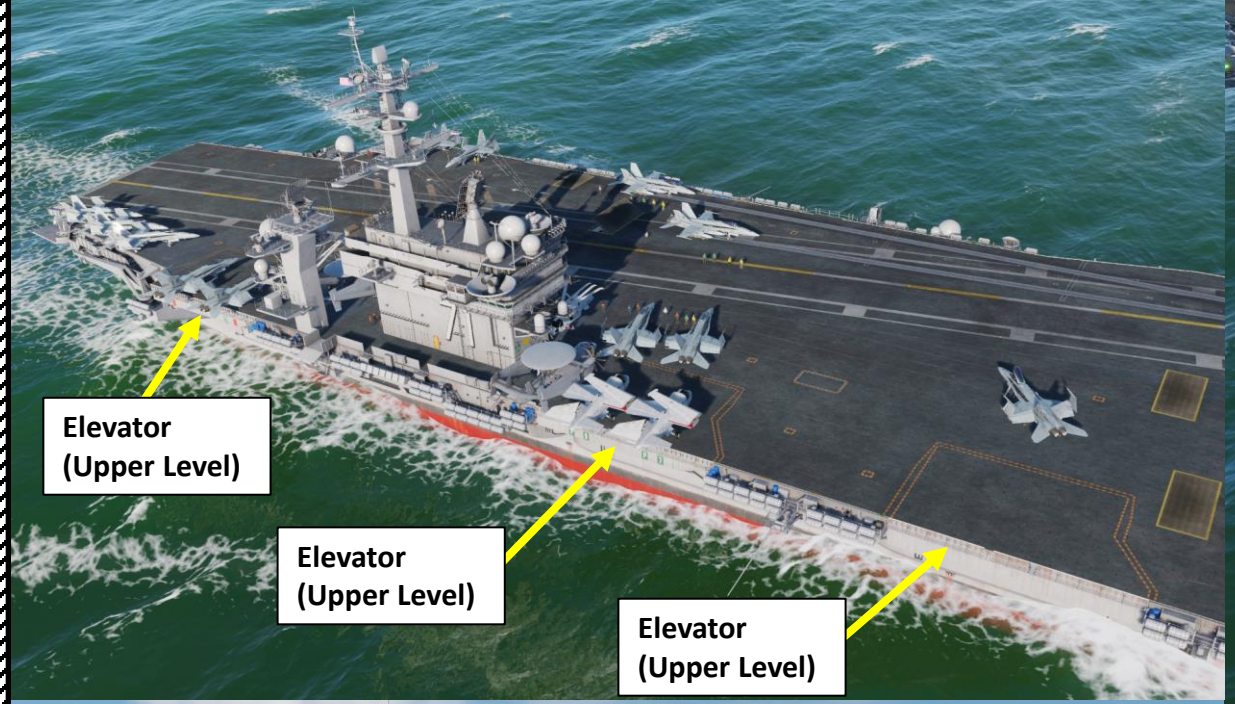

No. 1 Catapult
Weapons Elevator
Catapult Control Station
No. 2 Catapult
No. 3 Catapult
No. 4 Catapult

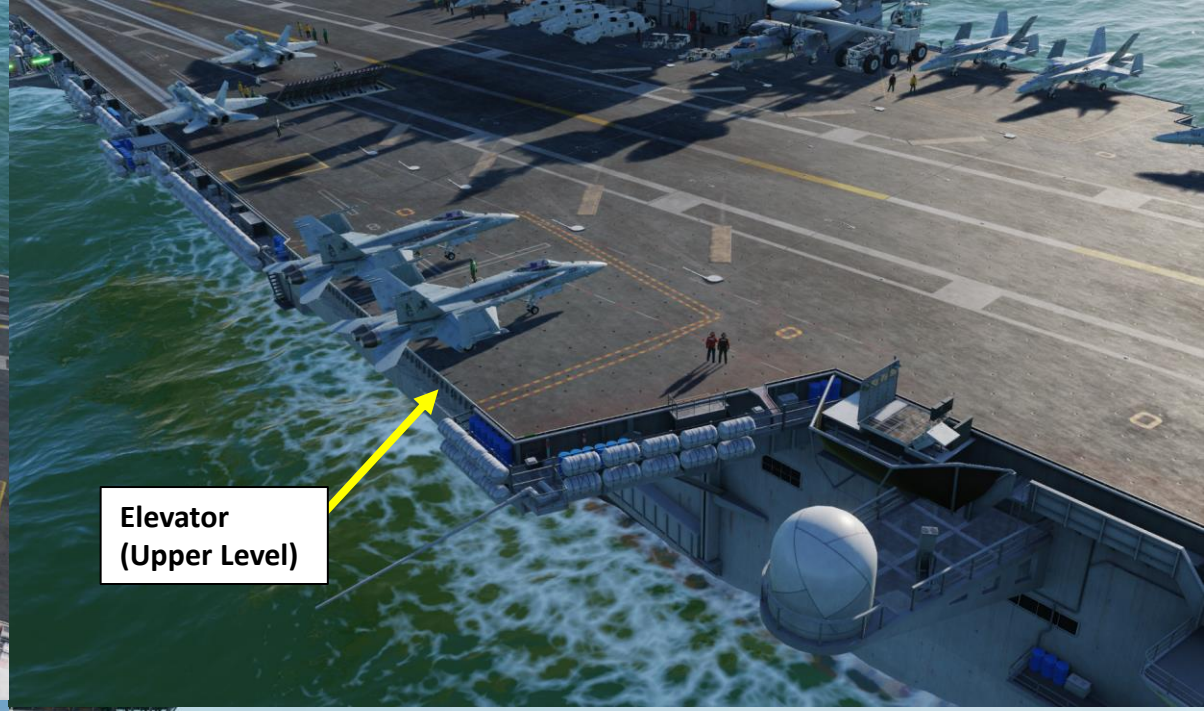

JBD (Jet Blast Deflector)
Deflects engine jet blast in order to not damage any aircraft or injure carrier crew. They also act as heat shields since many carrier-launched aircraft takeoff with afterburners on.
Steam Catapult Launch Rail

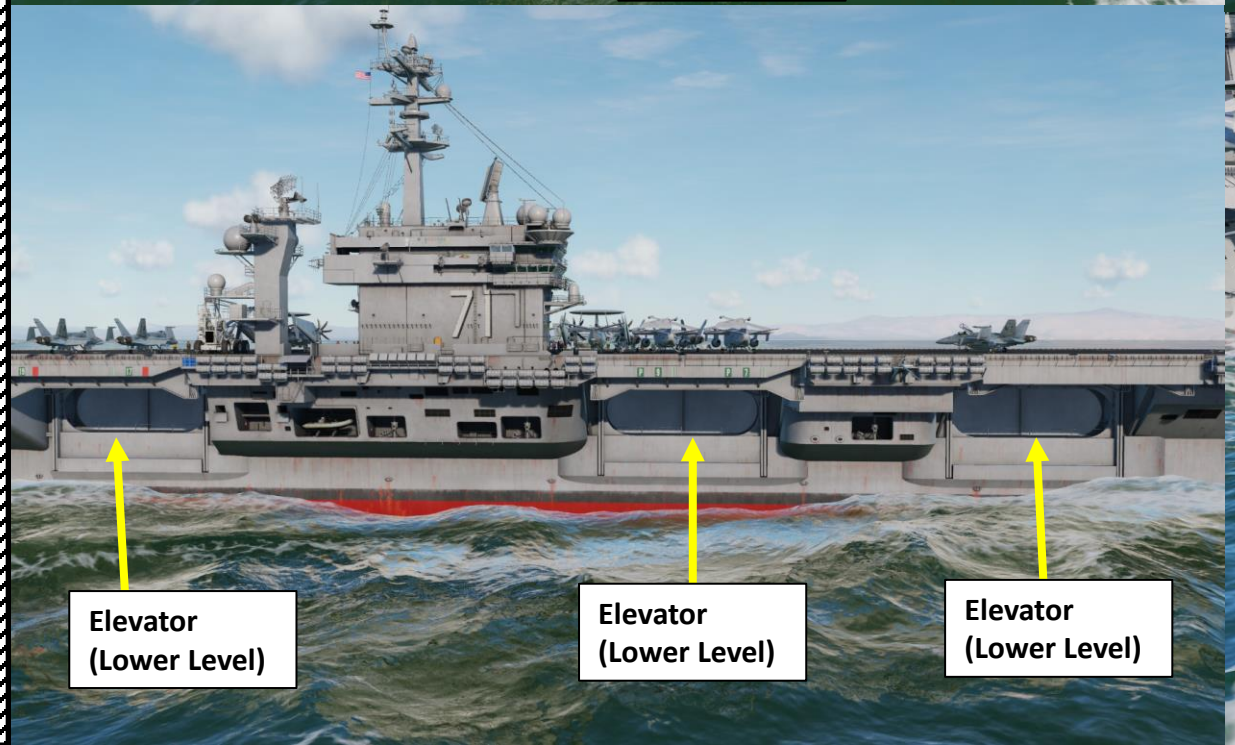


Integrated Catapult Control Station (ICCS), also called “The Bubble”.

PART 3 – COCKPIT & EQUIPMENT



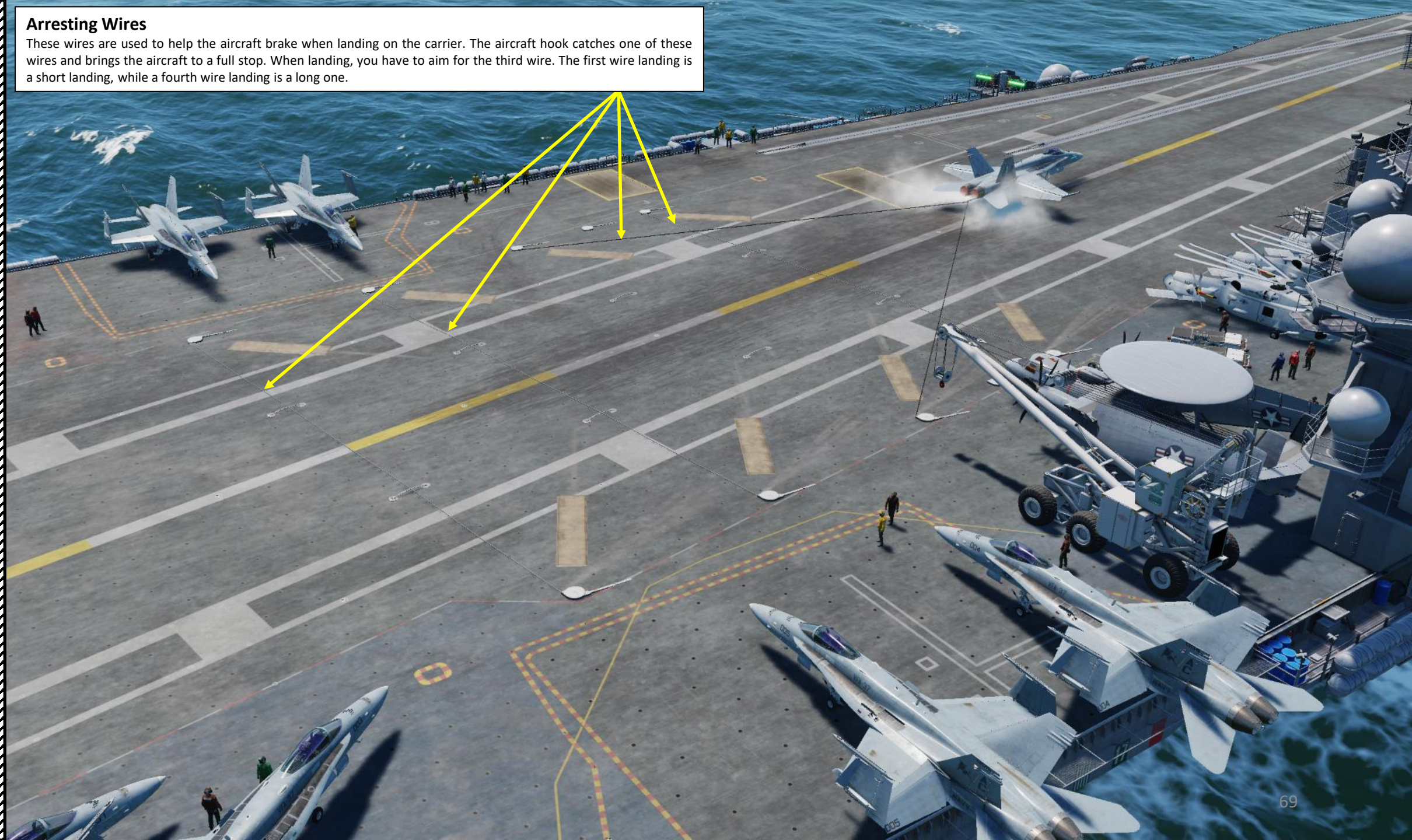


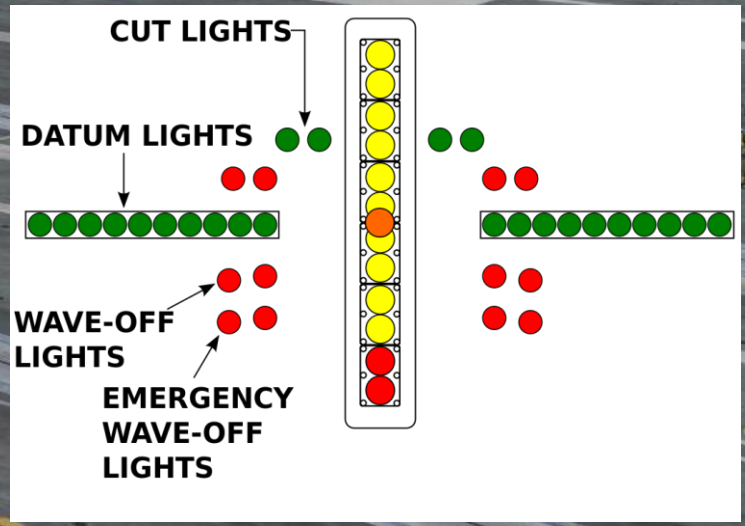




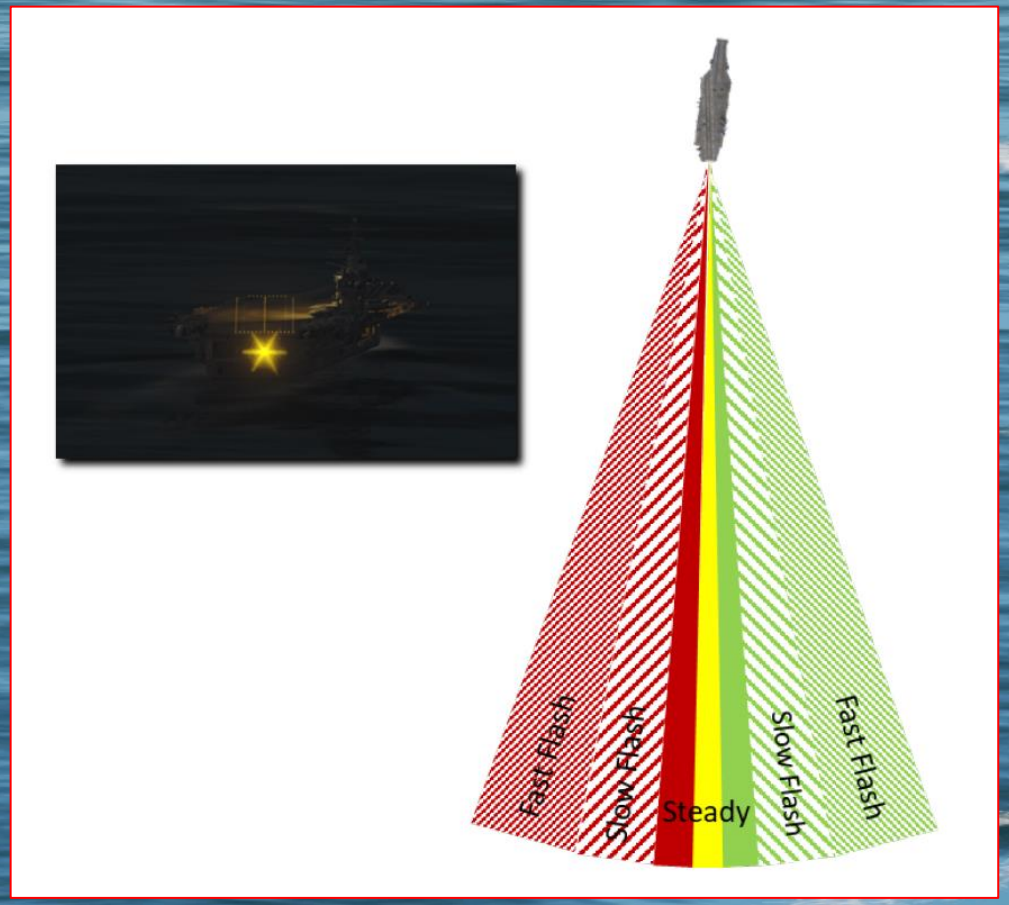
Arresting Wires

These wires are used to help the aircraft brake when landing on the carrier. The aircraft hook catches one of these wires and brings the aircraft to a full stop. When landing, you have to aim for the third wire. The first wire landing is a short landing, while a fourth wire landing is a long one.





IFLOLS (Improved Fresnel Lens Optical Landing System)
Also called as “the ball” or “meatball”, the IFLOLS is used as visual aid to land on the carrier.



LRLLS (Long Range Laser Lineup System)
Used for Case III recoveries to provide a visual cue to see the lateral deviation from the centerline.


“The Island”
Building used to direct flight operations


Primary Flight Control
Bridge
Flag Bridge



LSO (Landing Signal Officer) Station
Used for directing players in a multiplayer setting or observing aircraft in a single player setting.



Yellow Shirts

These include the **Plane Directors** who will guide you around the deck and into position for launch. All taxi guidance comes from these personnel.

Other yellow shirts include Flight Deck Officers, Arresting Gear Officers, Catapult Officers (Shooters), Catapult Spotters and Aircraft Handling Officers.



Green Shirts

You will encounter these personnel during launch as Catapult and Arresting Gear crews position the holdback bar and ensure proper attachment to the catapult shuttle. Maintenance personnel of various specialties may also be on hand to troubleshoot last minute problems with the aircraft.

Other green shirts include Helicopter Landing Signal Enlisted (LSE), Cargo-handling personnel, Ground support equipment troubleshooters, Hook runners and Photographers mates.



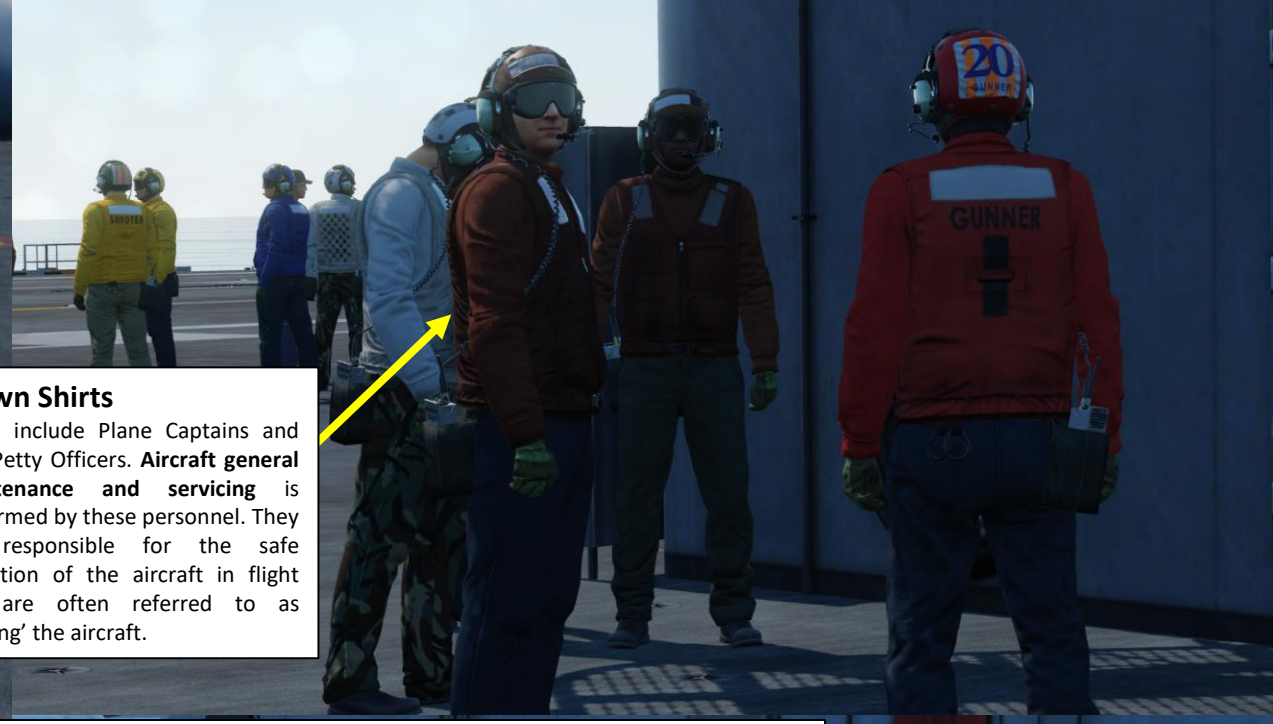
White Shirts

You will encounter these personnel during launch as **Final Checkers** give your aircraft a last-minute look for problems.
The Landing Signal Officers (LSO) are also white shirts.
Other white shirts include Safety personnel, Medical personnel, Quality Assurance personnel and Air Transfer Officers (ATO).



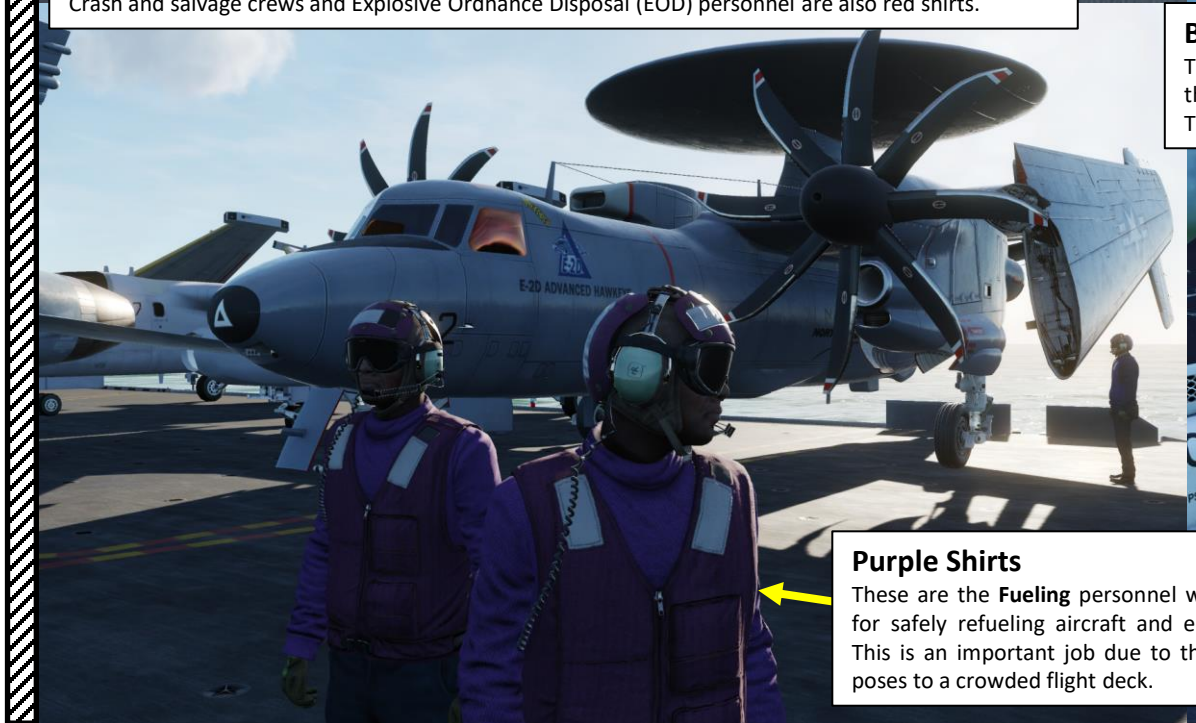
Red Shirts

These are the **Aviation Ordnancemen** who build, test, transport, and load **weapons** on the aircraft. They also test and maintain the aircraft gun systems, as well as avionics and release equipment used to employ weapons in the air.
Crash and salvage crews and Explosive Ordnance Disposal (EOD) personnel are also red shirts.



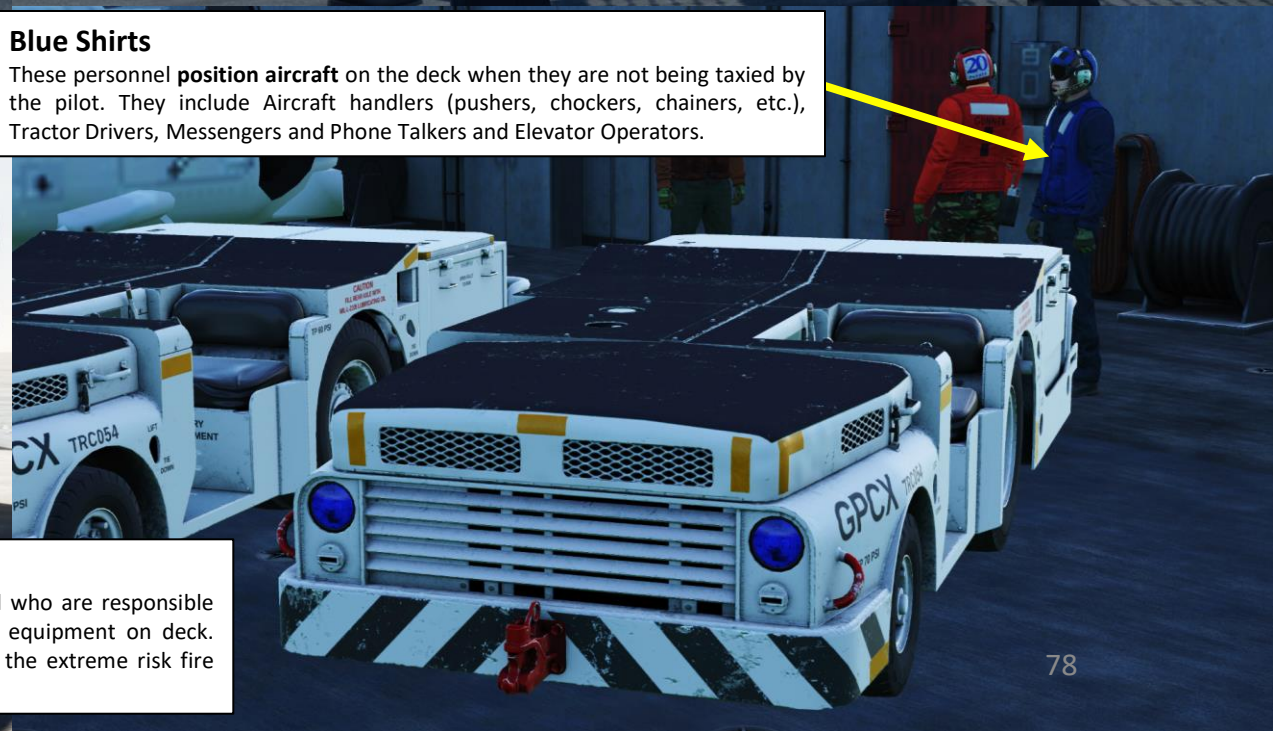
Brown Shirts

These include Plane Captains and Line Petty Officers. **Aircraft general maintenance and servicing** is performed by these personnel. They are responsible for the safe operation of the aircraft in flight and are often referred to as 'owning' the aircraft.



Purple Shirts

These are the **Fueling** personnel who are responsible for safely refueling aircraft and equipment on deck. This is an important job due to the extreme risk fire poses to a crowded flight deck.



Blue Shirts

These personnel **position aircraft** on the deck when they are not being taxied by the pilot. They include Aircraft handlers (pushers, chockers, chainers, etc.), Tractor Drivers, Messengers and Phone Talkers and Elevator Operators.

PART 3 – COCKPIT & EQUIPMENT

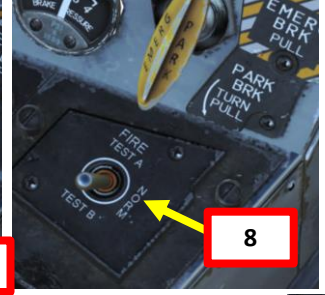

306
VFA-113
306

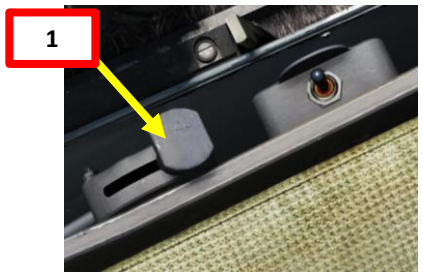
PART 4 – START-UP PROCEDURE

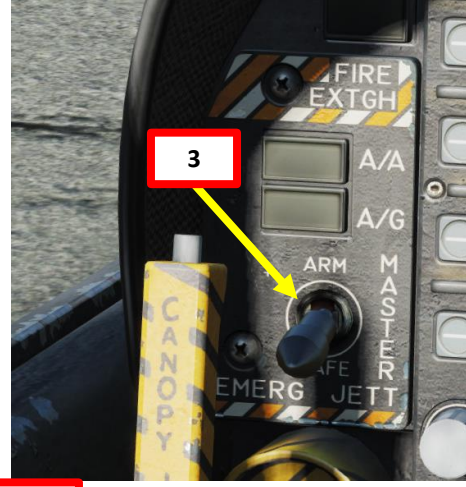
PRE-START-UP

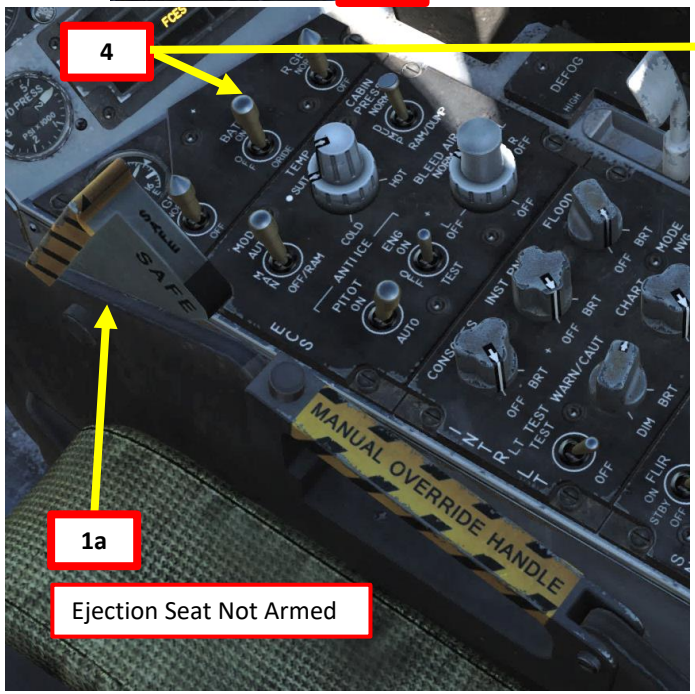
1. **Set Ejection Seat** Lever – **DOWN & ARMED**
   Set Harness Lever - FWD
2. **Parking Brake** Lever – **ENGAGED**
3. **MASTER ARM** switch – **SAFE**
4. **Battery** Switch – ON (Right Click)
   Note: This will power the engine igniters, canopy and IFEI (Integrated Fuel / Engine Indicator) panel.
5. Check that **hydraulic brake pressure** gauge displays at least **3000** psi
6. (Optional) Right click and hold **Fire & Bleed Air Test** switch to the "**Channel A**" (Forward) position to start the Fire/Bleed Air Test for Detection Loop A.
   - Wait for the aural warnings sequence to finish before releasing the switch. The switch will be sprung back to the middle position on release. You should hear "Engine Fire Left, Engine Fire Left, Engine Fire Right, Engine Fire Right, APU Fire, APU Fire, Bleed Air Left, Bleed Air Left, Bleed Air Right, Bleed Air Right!"
   - Left and right engine bleed air switches will be automatically closed during and after the test. We will have to re-open them later on.
7. (Optional) Cycle **Battery** switch to **OFF** (left click), then back to ON (right click) to rewind test audio tape. Alternatively, you can wait 10 seconds for the tape to rewind.
8. (Optional) Left click and hold **Fire & Bleed Air Test** switch to the "**Channel B**" (Aft) position to start the Fire/Bleed Air Test for Detection Loop B. Wait for the aural warnings sequence to finish before releasing the switch. The switch will be sprung back to the middle position.

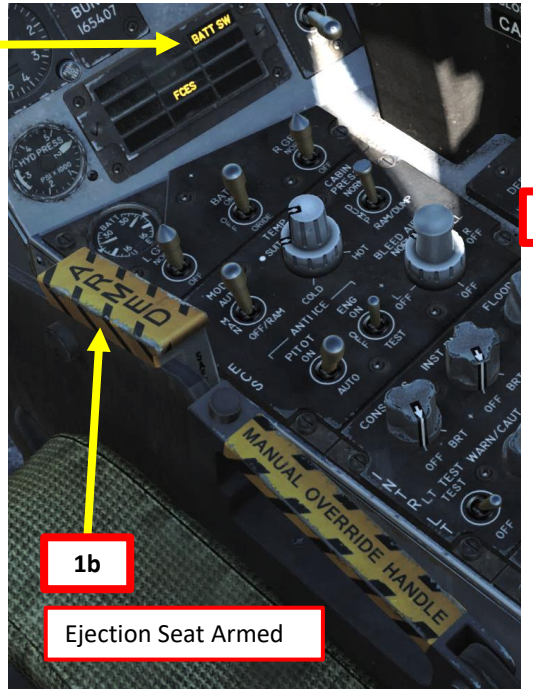


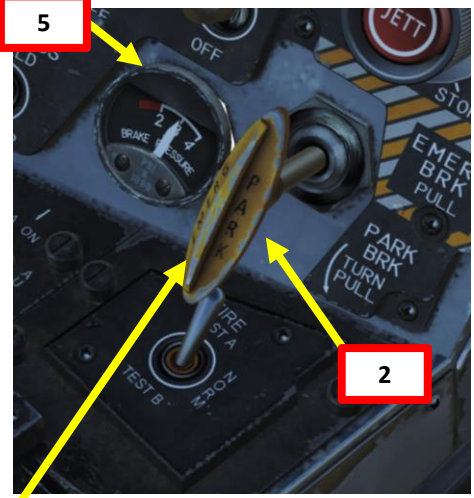


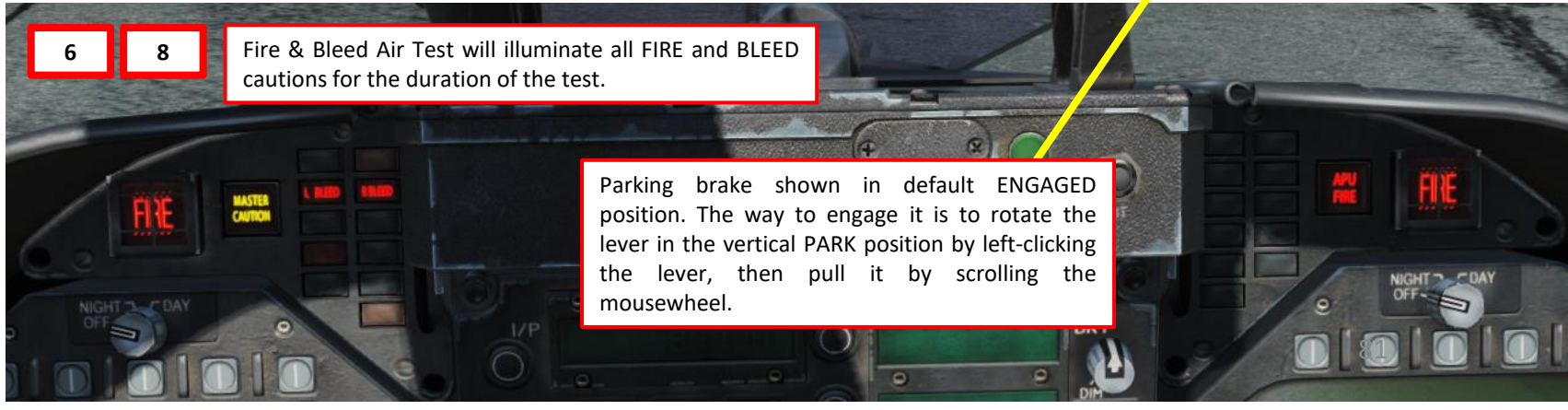






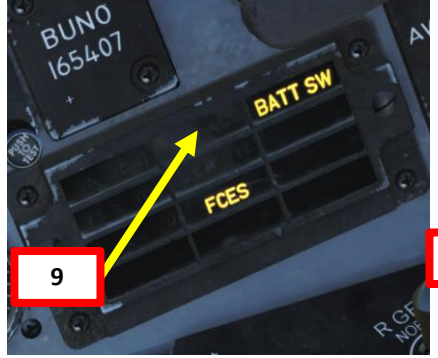


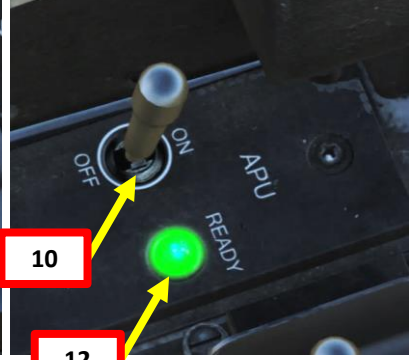




START-UP PROCEDURE

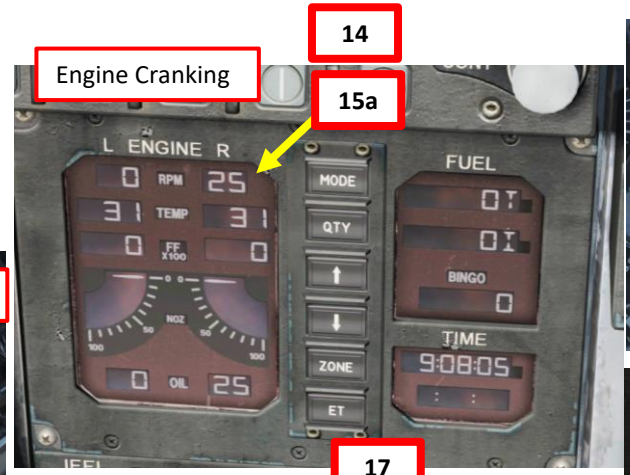
9. Verify that **no APU ACC** (Auxiliary Power Unit Accumulator) caution is visible on the Standby Caution Panel.
10. Left click on the **APU** switch to set it to **ON** (FWD) to start the APU (Auxiliary Power Unit)
11. Verify that the **APU ACC** caution is **visible** on the Standby Caution Panel and that the APU starts spooling up. In real life, the Plane Captain (PC) would give you this confirmation, but in DCS you can just listen for the APU spooling sound.
12. Once **APU green light** illuminates, the APU is now running. The APU will provides air pressure for the F404 engines' pneumatic ATS (Air Turbine Starter).
13. Start right engine first by setting **Engine Crank switch** – **R** (RIGHT) using right-click.
    Note: It's good practice to start the right engine since it provides most of the hydraulic pressure available for the brakes.
14. **Right Engine cranking** will begin as the AMAD (Airframe Mounted Accessory Drive), which is pneumatically connected to the APU's starter, transmits power from the ATS to the engine. Engine RPM will rise to approx. 25 % RPM.
15. When **Right Engine RPM reaches 25 %**, press **RSHIFT+HOME** to move the right throttle from the OFF detent to the IDLE detent to open the fuel valves and introduce fuel. Igniters will kick in and trigger an engine lightoff.
16. Verify that **EGT** (Exhaust Gas Temperature) **does not exceed 750** deg C until engine stabilizes.
17. Wait for **Right Engine RPM** to stabilize around **60-65 %** RPM. Confirm that right generator is running by checking that the **R GEN** caution is **extinguished**.
18. During engine start, the **GPWS** (Ground Proximity Warning System) and **Flight Controls voice alert system** will do a **BIT** (Built-In Test). Don't worry, that's normal. You will hear "Roll Left, Roll Left! Flight Controls, Flight Controls!" and a "Deedle deedle" sound.
19. **Reset MASTER CAUTION** pushbutton by pressing it.

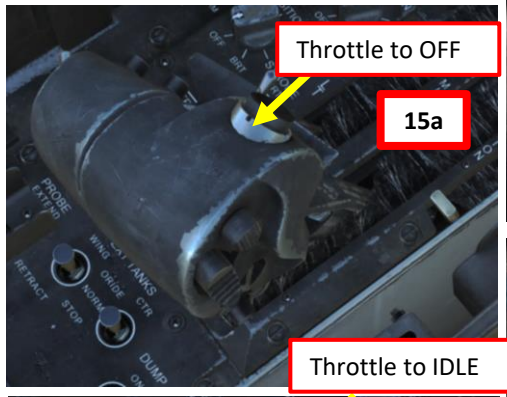


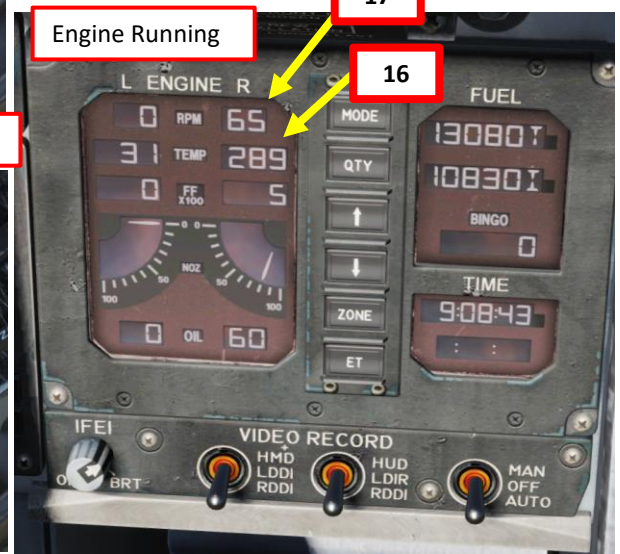




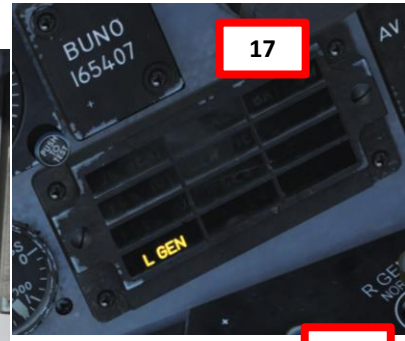




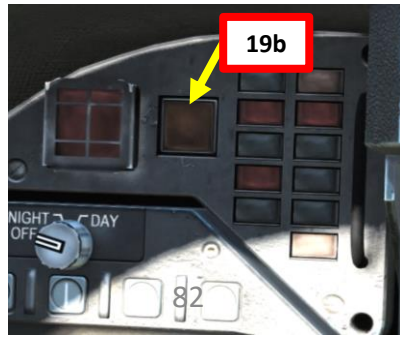






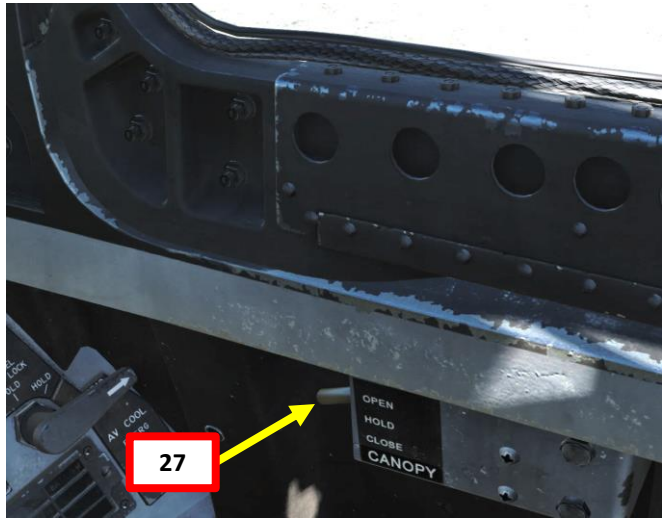


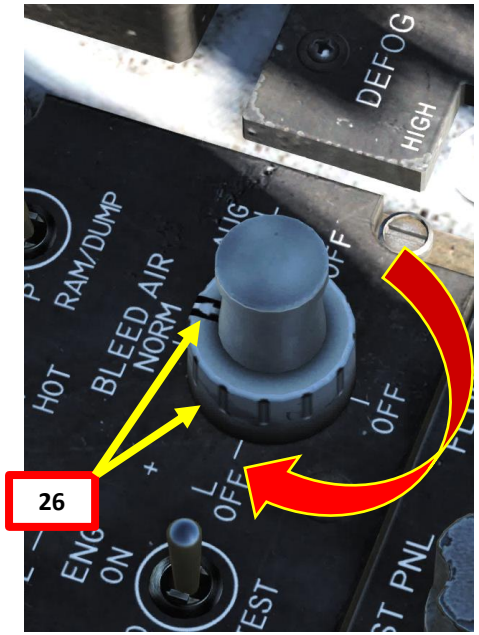


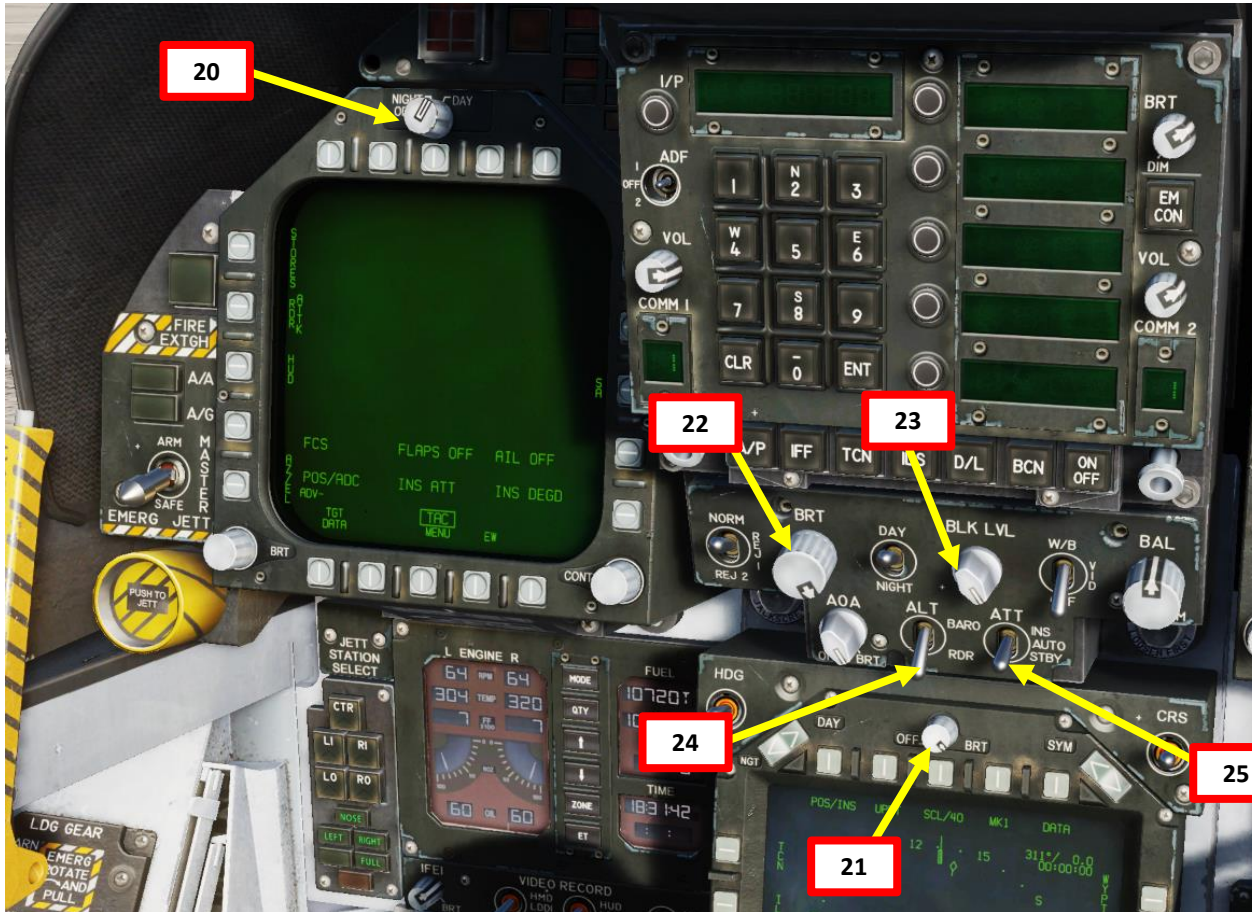


START-UP PROCEDURE

20. Power **Left and Right DDIs** (Digital Display Indicator) by setting each DDI knob to **DAY** (right click).
21. Turn on **AMPCD** (Advance Multi-Purpose Color Display) by setting its **Brightness knob to the right**
22. Turn **HUD brightness** control lever **right** to power Heads-Up Display.
23. Turn **BLK LVL** knob to the **right**
24. Set **ALT** switch to **RDR** to use the radar altimeter as an altitude reference
25. Set **ATT** switch to **AUTO**
26. Right-click **Bleed Air Switch** to rotate it **360 degrees clockwise from NORMAL back to NORMAL** to re-open engine bleed air valves. You should hear the ECS (Environmental Control System) kick in as engine bleed air valves open.
27. Left click and hold **CANOPY** switch to **CLOSE** to close canopy.







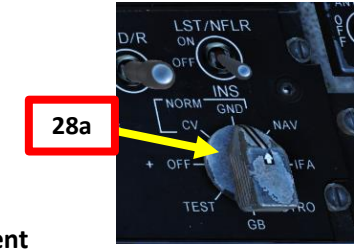
START-UP PROCEDURE

28. Start **INS** (Inertial Navigation System) **Alignment**.

INS GROUND ALIGNMENT PROCEDURE

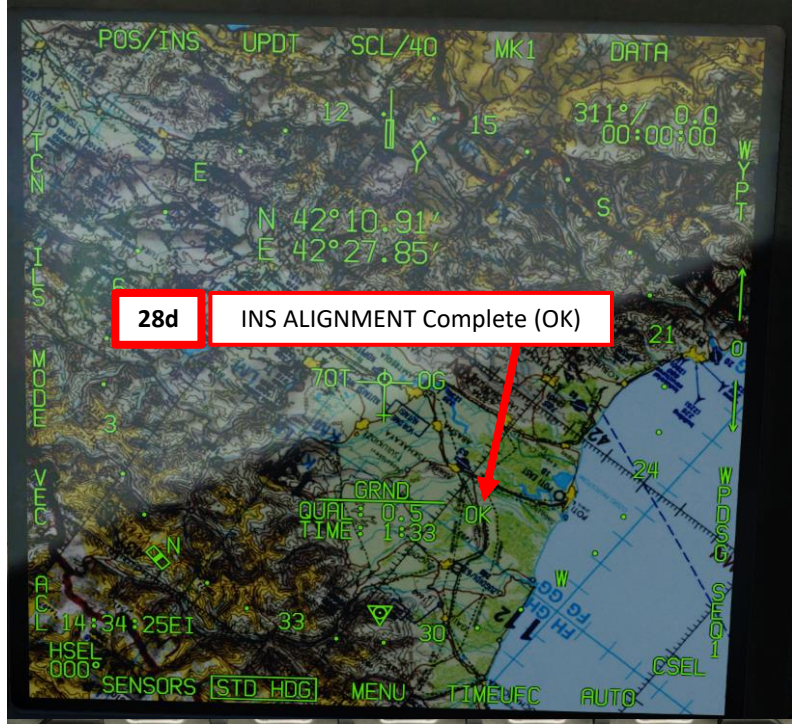
You can either use a **Normal alignment** (takes roughly 8 minutes) or a **Stored Heading alignment** (takes roughly 90 seconds), which results in a quicker alignment.

a) If on ground, set **INS Selector** switch to **GND** (Ground) to start the INS alignment phase.
b) If you wish to use a Stored Heading, from the HSI (Horizontal Situation Indicator) page, press the DDI button next to **STD HDG**, then the stored heading alignment will proceed and last for approx. 90 seconds. Otherwise, the normal alignment will proceed and last for 8 minutes.
c) The alignment will take a few seconds to start. You can monitor the INS (Inertial Navigation System) Ground Alignment progress on the AMPCD. The GRND QUAL timer displays the time remaining in seconds.
d) Once OK appears next to GRND QUAL, the INS alignment is complete.
e) Set the **INS selector** to **IFA (In-Flight Alignment)** if a GPS is available (any mission set during 1986 or later should have it). POS/AINS mode (Position/Assisted-INS) will be visible on the HSI (Horizontal Situation Indicator), meaning that the GPS is used in conjunction with INS to provide the position of the aircraft.
f) If no GPS is available (mission set before 1986), set **INS selector** to **NAV** instead.















START-UP PROCEDURE

28. Start **INS** (Inertial Navigation System) **Alignment**.

INS CARRIER (SEA) ALIGNMENT PROCEDURE

You can either use a **Normal alignment** (takes roughly 8 minutes) or a **Stored Heading alignment** (takes roughly 90 seconds), which results in a quicker alignment.

a) If on an aircraft carrier, set **INS Selector** switch to **CV** (Carrier) to start the INS alignment phase. With CV mode, the alignment will take its positional data directly from the carrier via a SINS (Ship Inertial Navigation System) cable or a datalink radio frequency, which is already set up.

b) If you wish to use a Stored Heading, from the HSI (Horizontal Situation Indicator) page, press the DDI button next to **STD HDG**, then the stored heading alignment will proceed and last for approx. 90 seconds. Otherwise, the normal alignment will proceed and last for 8 minutes.

c) The alignment will take a few seconds to start. You can monitor the INS (Inertial Navigation System) Ground Alignment progress on the AMPCD. The GRND QUAL timer displays the time remaining in seconds.

d) Once OK appears next to GRND QUAL, the INS alignment is complete.

e) Set the **INS selector** to **IFA (In-Flight Alignment)** if a GPS is available (any mission set during 1986 or later should have it). POS/AINS mode (Position/Assisted-INS) will be visible on the HSI (Horizontal Situation Indicator), meaning that the GPS is used in conjunction with INS to provide the position of the aircraft.

f) If no GPS is available (mission set before 1986), set **INS selector** to **NAV** instead.









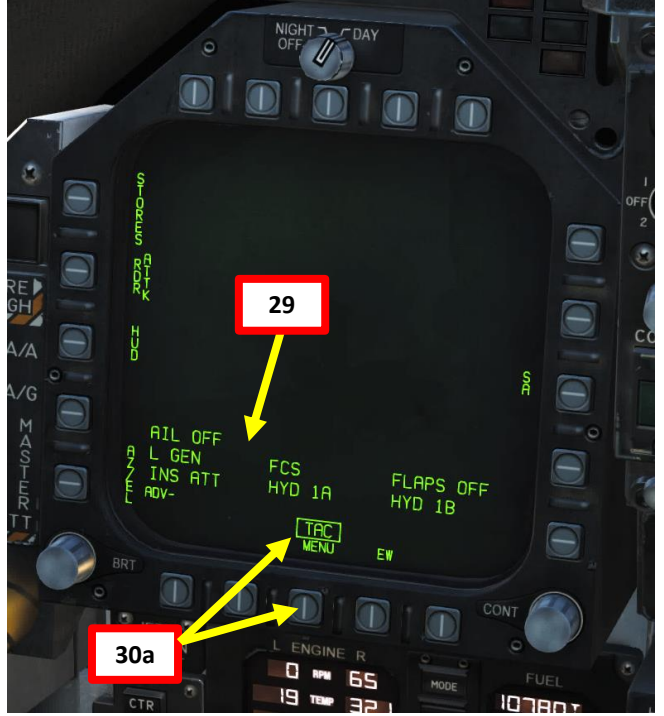






START-UP PROCEDURE

29. Verify that there are no **cautions for engine 2** (like HYD 2A, HYD 2B, R GEN)
30. Set left DDI (Digital Display Indicator) to the FCS (Flight Control System) page
    a) Press the OSB (Option Select Button) under **TAC (Tactical) MENU** to select the **SUPT (Support) MENU**
    b) Press the **OSB** next to **FCS**
31. Press the **MASTER CAUTION** pushbutton **two times** to re-stack the cautions and advisories together. The FCS page will then be more visible.
32. The "X"s on the FCS page indicate a FCS system error. In our case, the errors are probably due to wing droop caused by the aircraft being parked for too long.
33. Press the **FCS RESET** button to reset FCS faults. "X"s should disappear.
34. On the right DDI, the BIT FAILURES (Built-In Test) page is displayed. Press the **OSB** next to **STOP** to stop the indications from blinking.

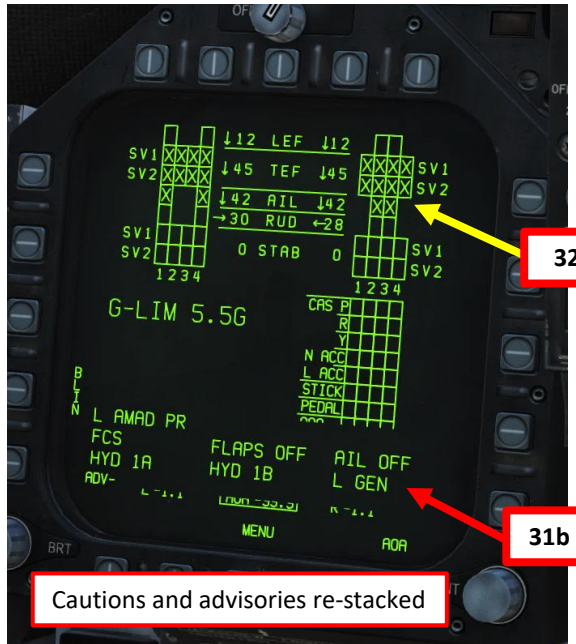




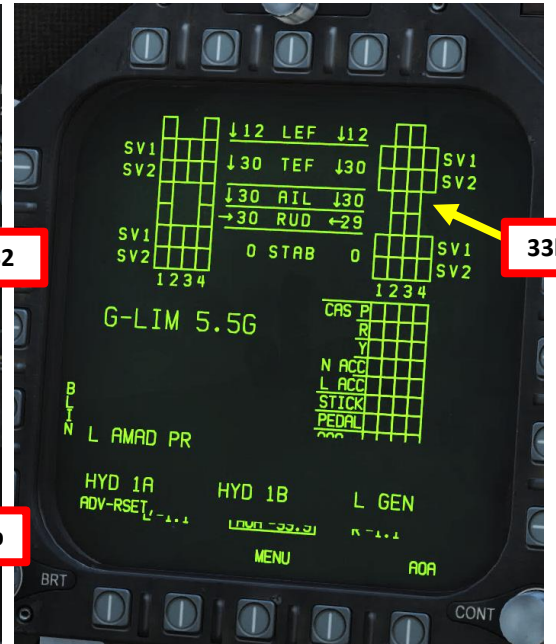




Cautions and advisories un-stacked



Cautions and advisories re-stacked



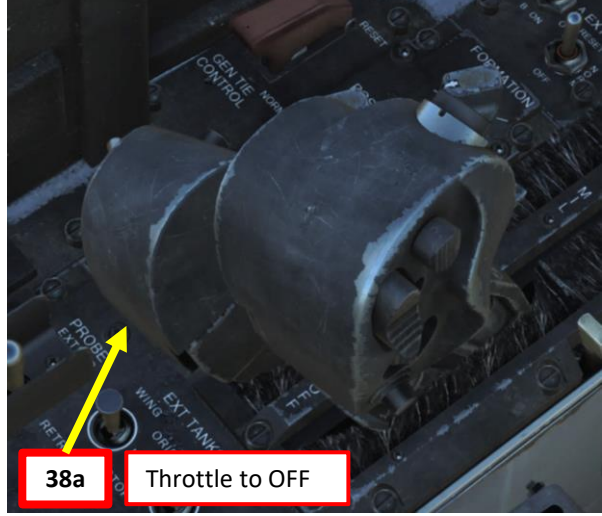


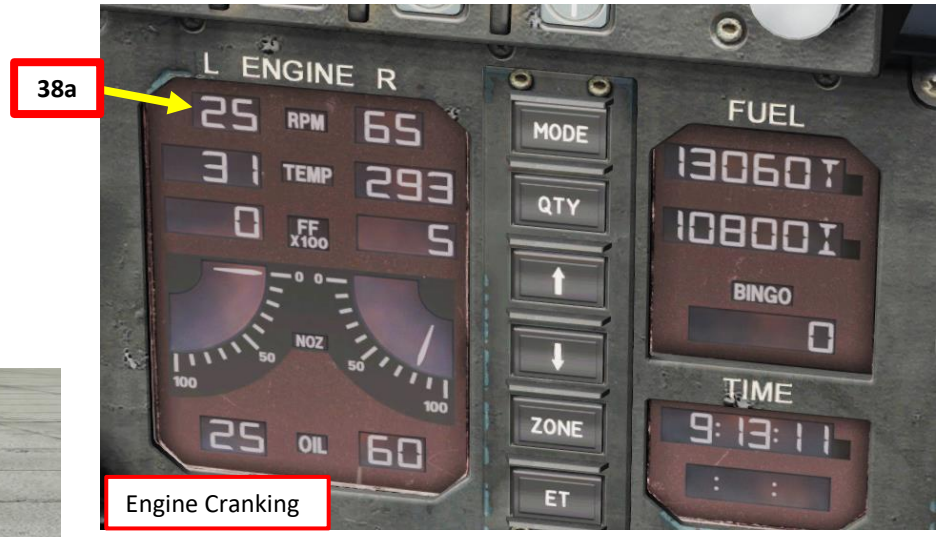
START-UP PROCEDURE

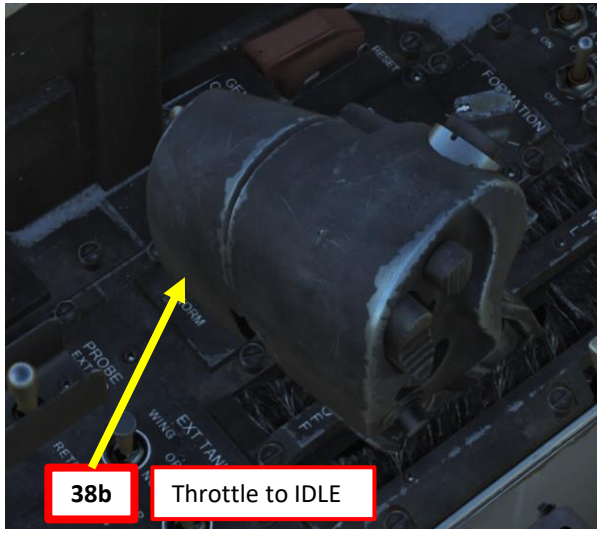
35. Hold the **LIGHTS TEST** switch to test lights. Make sure cautions illuminate properly, then release the switch.
36. Start left engine first by setting **Engine Crank switch** – **L** (LEFT) using left-click.
37. **Left Engine cranking** will begin as the AMAD (Airframe Mounted Accessory Drive), which is pneumatically connected to the APU's starter, transmits power from the ATS to the engine. Engine RPM will rise to approx. 25 % RPM.
38. When **Left Engine RPM reaches 25 %**, press **RALT+HOME** to move the left throttle from the OFF detent to the IDLE detent to open the fuel valves and introduce fuel. Igniters will kick in and trigger an engine lightoff.
39. Verify that **EGT** (Exhaust Gas Temperature) **does not exceed 750** deg C until engine stabilizes.
40. Wait for **Left Engine RPM** to stabilize around **60-65 %** RPM. Confirm that left generator is running by checking that the **L GEN** caution is **extinguished**.





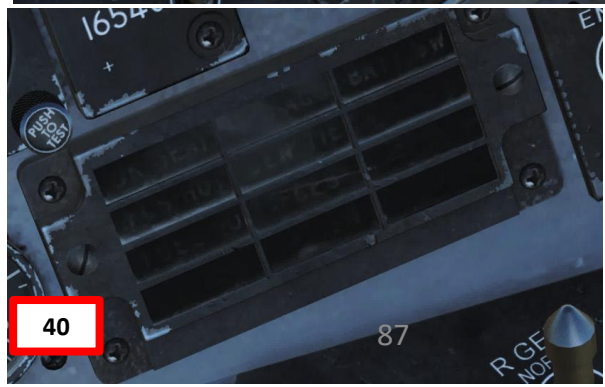










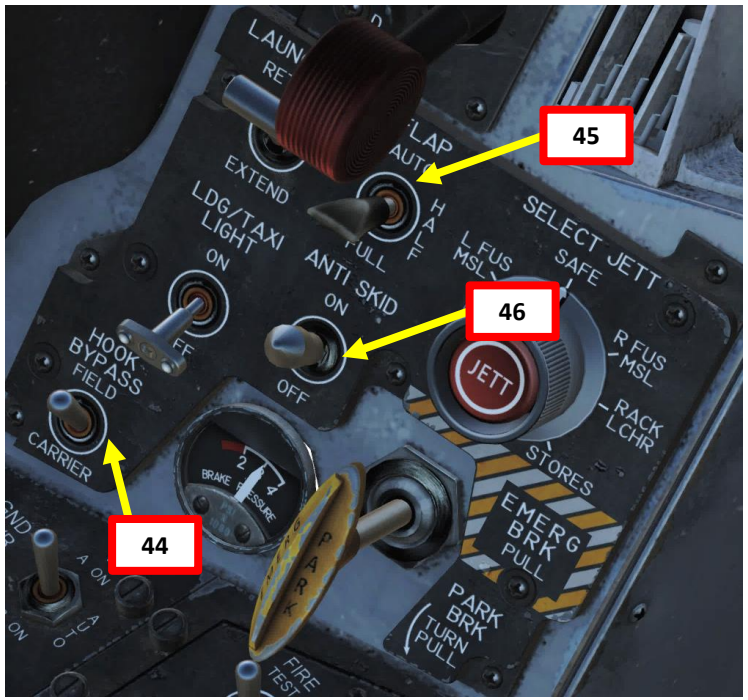


START-UP PROCEDURE

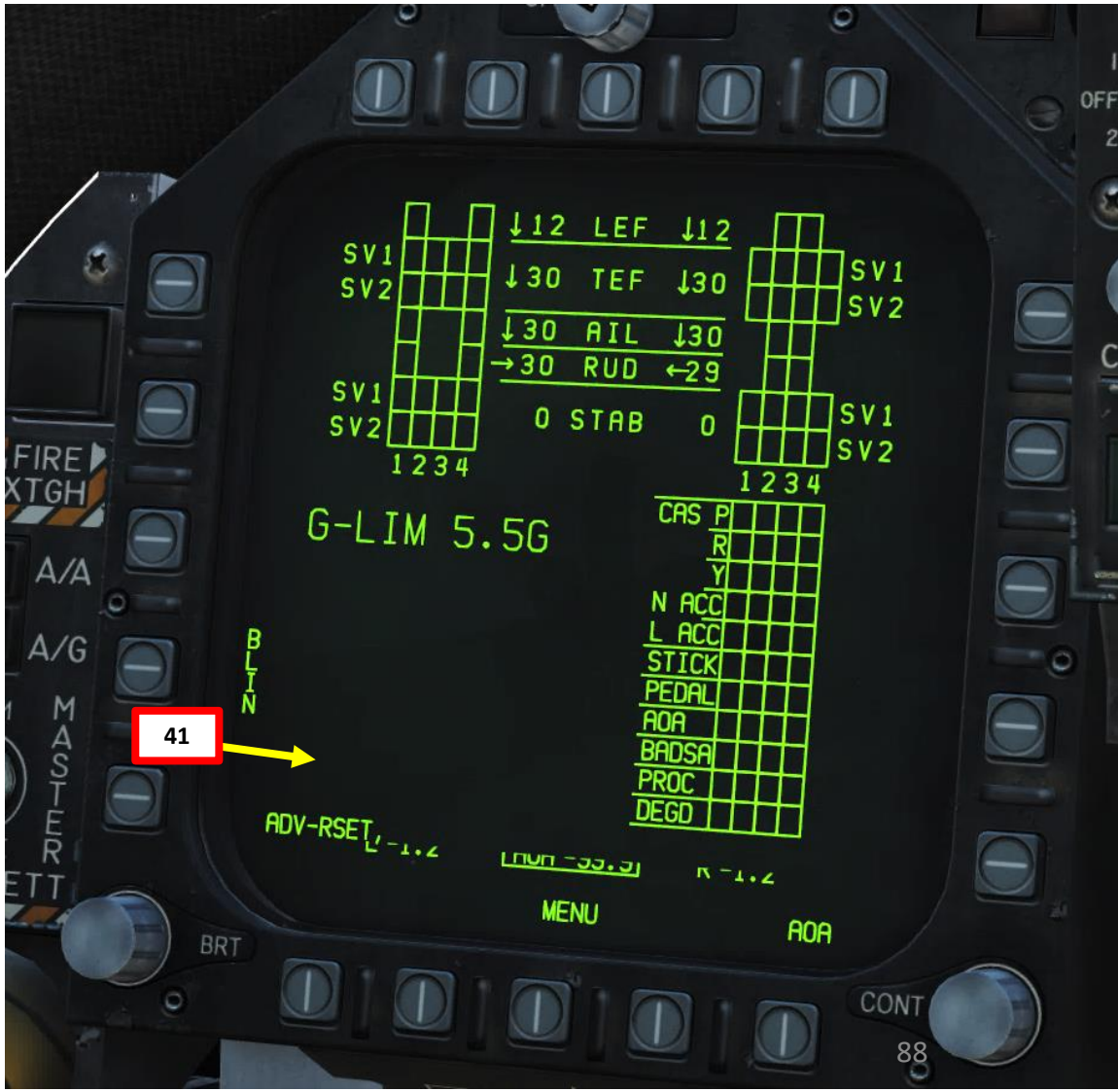
41. Verify that there are **no cautions for engine 1** (like HYD 1A, HYD 1B, L GEN)
42. Following the second engine start, the APU (Auxiliary Power Unit) will shutdown automatically approximately 1 minute after both engines are stabilized to IDLE.
43. Set **OBOGS** (On-Board Oxygen Generating System) switch – **ON**
44. Set **HOOK BYPASS** switch to **FIELD** if operating on an airfield or to **CARRIER** if operating on an aircraft carrier.
45. Set **FLAPS** lever to **HALF**
46. Set **ANTI-SKID** switch **ON** if operating on a **ground airfield**
    Set **ANTI-SKID** switch **OFF** if operating on a **carrier**
47. Set **RADAR** switch to **OPERATE**











START-UP PROCEDURE

48. Run FCS BIT Test
    a) On the BIT FAILURES page, click the OSB next to F**CS-MC** to enter the Flight Control System – Mission Computer Built-In Test page
    b) MC1 and MC2 status should be GO. FCSA and FCSB status should be PBIT GO. This means the FCS BIT Test needs to be performed.
    c) Press and **hold "Y"** key binding to hold the **FCS BIT** switch to ON (UP) position.
    d) While FCS BIT switch is held (Y), press **the OSB next to "FCS"** to start the FCS BIT test. FCSA and FCSB status will be "IN TEST" for the duration of the test.
49. Flight controls will move for the duration of the test. Test will be complete when the **FCSA and FCSB status will be GO**.









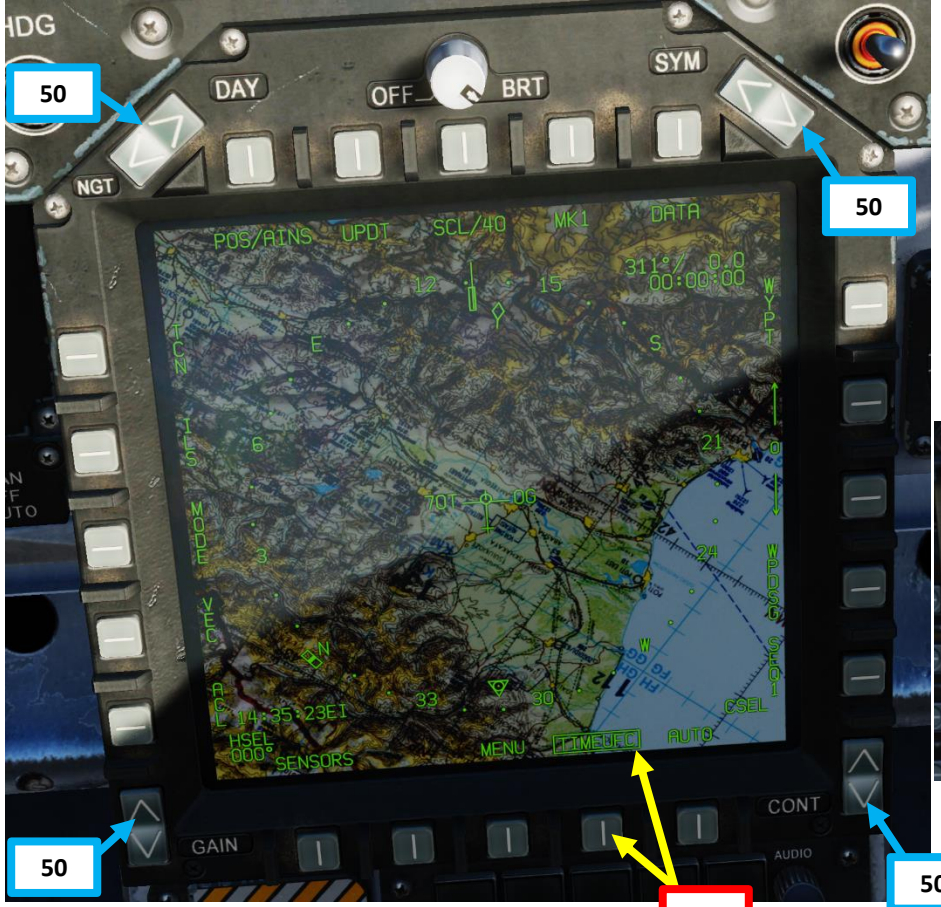


Flight control surfaces will move automatically during FCS BIT Test



START-UP PROCEDURE

50. Adjust AMPCD Gain, Contrast and Symbology brightness as required. This will greatly improve readability. For night operations, I would recommend setting AMPCD mode to NGT since the brightness of the moving map can easily blind you in low light conditions.
51. Set ZULU time in the cockpit. On the AMPCD, press the **OSB** next to the **TIMEUFC**.
52. Then, go on the UFC (Up-Front Controller) and press the **OSB** next to **ZTOD** to display ZULU time on the Heads-Up Display once the aircraft wheels are OFF the ground.
53. Press the **T/O TRIM** button to set the aircraft trim for takeoff configuration.
54. Set **PITOT HEAT** switch – **AUTO** (only use ON in case of icing conditions on ground since AUTO inhibits Pitot Heat on ground to maximize available power on takeoff)









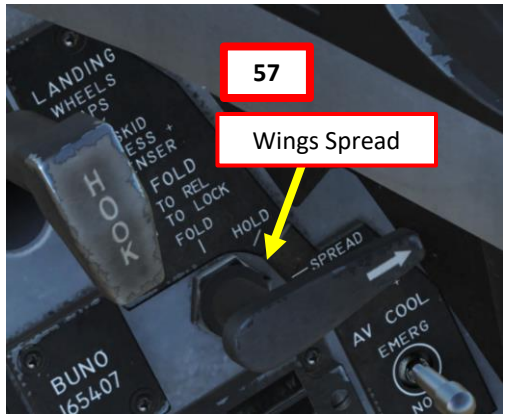
START-UP PROCEDURE

55. Set HUD repeater on the left DDI
    a) Press the OSB next to MENU to enter the TAC page
    b) Press the OSB next to HUD
56. Set FCS page on right DDI
    a) Press the OSB next to MENU twice to enter the FCS page
    b) Press the OSB next to FCS
57. If you are on the ground, verify that WINGS FOLD lever is in the SPREAD position (they may be folded if you start from an aircraft carrier). If wings are folded, right click on the lever to set it to SPREAD, wait for the wings to deploy all the way and confirm visually that the wings are deployed properly. Then, scroll mousewheel to push the WING FOLD lever IN (PUSHED). The WING UNLK caution should disappear on the HUD Repeater once wings are spread and locked. **Keep your wings folded if on an aircraft carrier**.











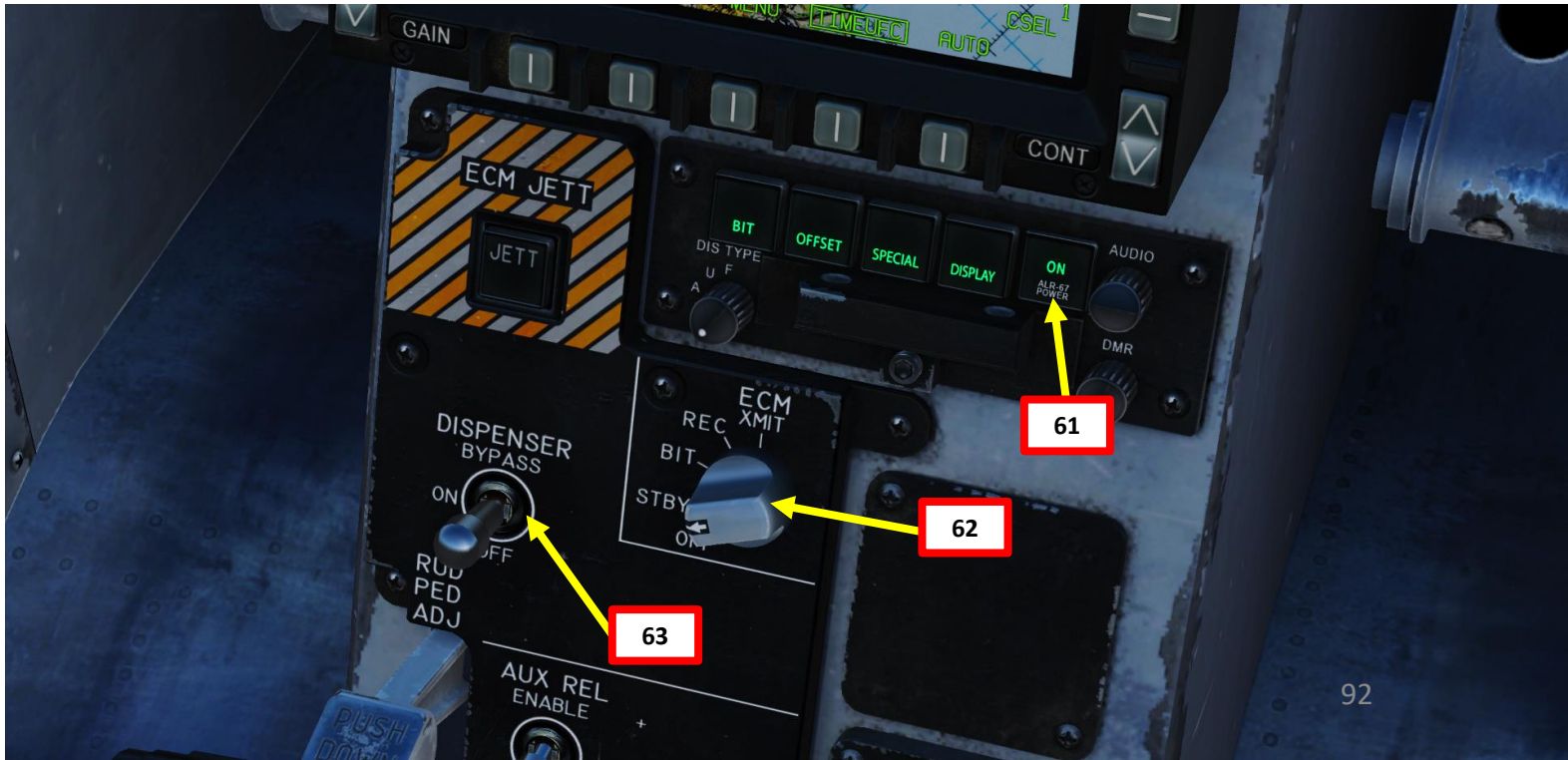
START-UP PROCEDURE

58. Set **Radar Altimeter** warning index to **200** ft if you intend to takeoff from a ground airfield (shore) or **80** ft from a carrier.
59. **Uncage Standby Attitude Indicator**. Red flag should be removed.
60. Set **BINGO FUEL** (minimum fuel needed to return to base) based on your mission profile by using the UP or DOWN arrow buttons on the IFEI panel. Usually I set 8000 lbs.
61. Press the **ALR-67 PWR** button to power the Radar Warning Receiver (RWR)
62. Set **ECM selector** to **STBY**.
63. Set **DISPENSER** switch to **ON** (Middle).





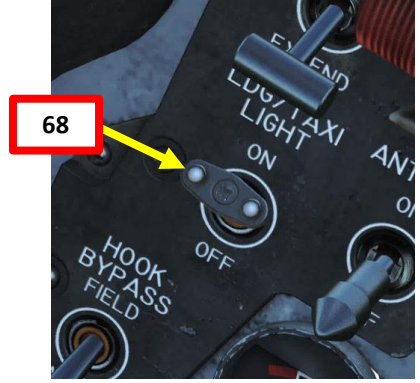


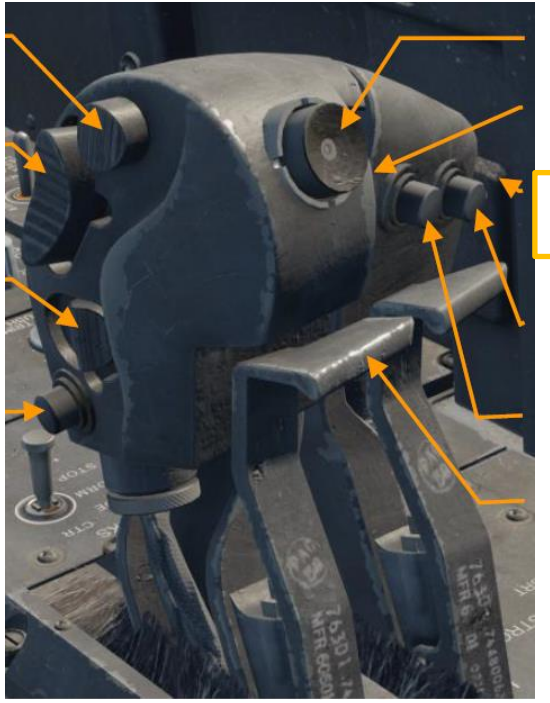


START-UP PROCEDURE

64. Set **STROBE** switch **ON**
65. Set **POSITION** LIGHTS switch to **BRT**
66. Set **FORMATION LIGHTS** to **BRT**
67. Turn on lights using the throttle Exterior Lights switch (“L”) as required.
68. Set **LANDING/TAXI** light switch – ON (UP)
69. Left click on **Parking Brake lever** to **disengage** it (PUSHED = DISENGAGED).





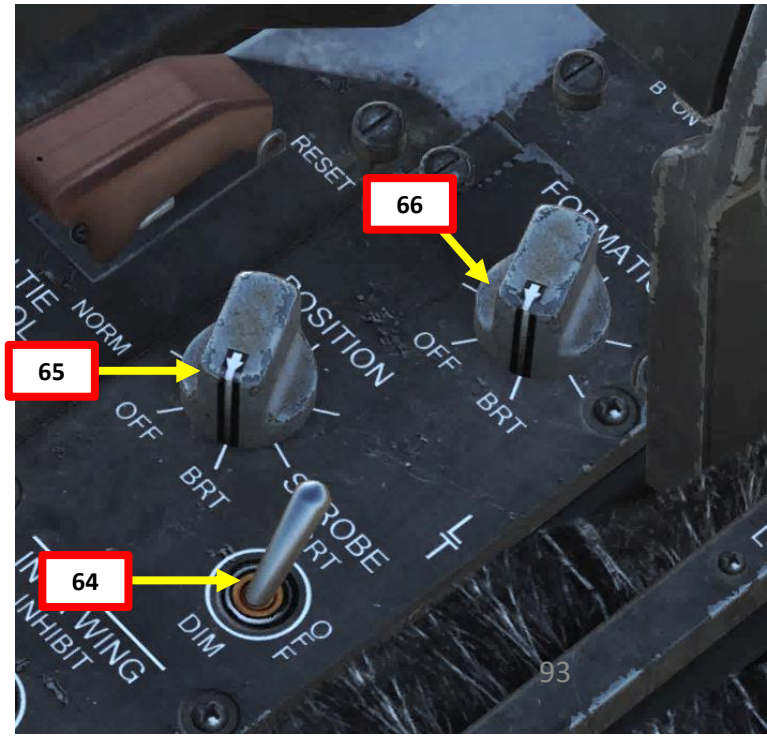




Parking Brake Engaged (Out/Pulled)

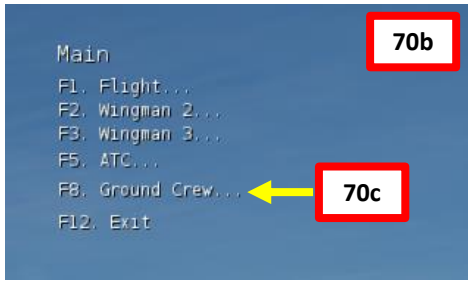


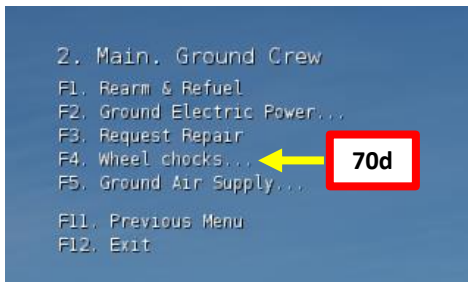
Parking Brake Disengaged (In/Pushed)

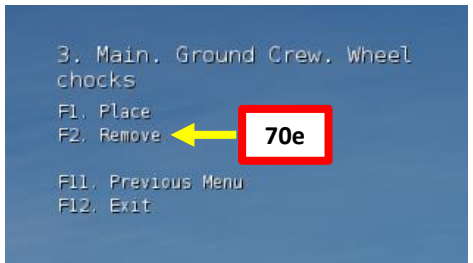


START-UP PROCEDURE

70. Remove **chocks** if installed (this is usually the case when operating on an aircraft carrier)
    a) Make sure your canopy is open to communicate to the ground crew
    b) Press "****" (communication menu binding) to contact ground crew
    c) Press "**F8**" to select "**Ground Crew"**
    d) Press "**F4**" to select "**Wheel Chocks**"
    e) Press "**F2**" to "**Remove** Wheel Chocks".





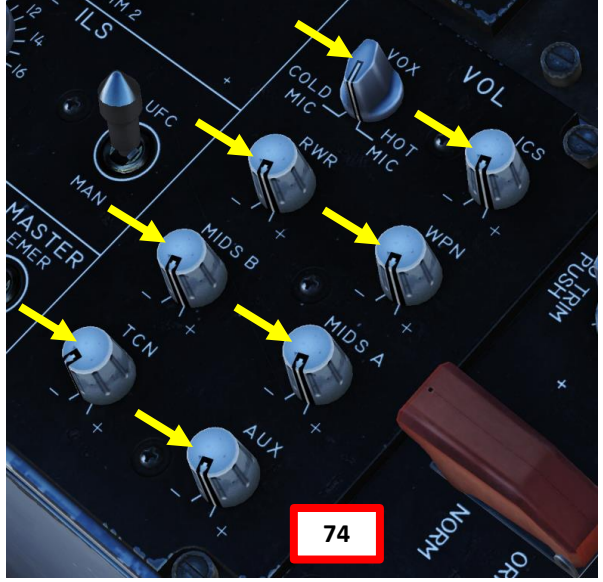




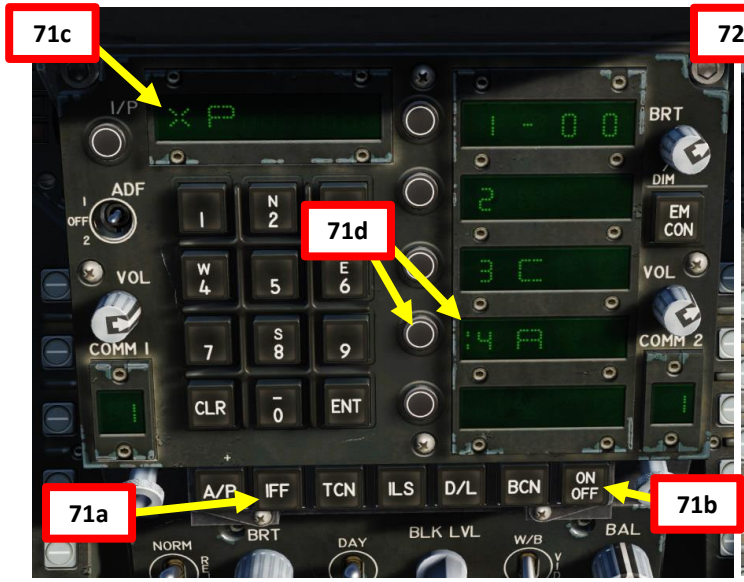


START-UP PROCEDURE

71. Power Up IFF (Identify-Friend-or-Foe) system by pressing the IFF Button, then holding the ON button on the UFC for a few seconds. When « ON » is displayed, the IFF has been powered up correctly. Verify that Mode 4A is selected (« : » means selected). If 4A is not selected, press OSB (Option Select Button) next to « 4A ».
72. Power Up Datalink system by pressing the D/L Button, then holding the ON button on the UFC for a few seconds. When « ON » is displayed, the Datalink has been powered up correctly.
73. On UFC, set desired Datalink Frequency by entering it on the scratchpad, then pressing « ENT ». 127 is used by default, you can keep it.
74. Adjust all volume knobs on the Audio Panel as required. Take special care to check that the MIDS A and MIDS B volume knobs are turned up (Multifunctional Information Distribution System).
75. Verify on MIDS SUPT page that Datalink information is correct (Network, AIC, F/F, Voice frequencies).
76. Equip either JHMCS (Joint Helmet-Mounted Cueing System) helmet or NVGs (Night Vision Goggles) as required.
    a) Press "****" (communication menu binding) to contact ground crew
    b) Press "**F8**" to select "**Ground Crew"**
    c) Press "**F8**" to "**Change helmet-mounted device**".
    d) Press either "F1" for JHMCS or "F2" for NVGs.
77. If you want to use the JHMCS, turn HMD brightness knob to BRT.

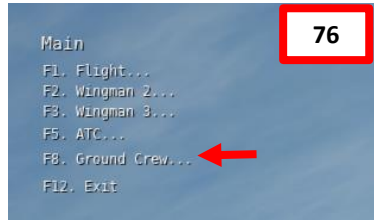


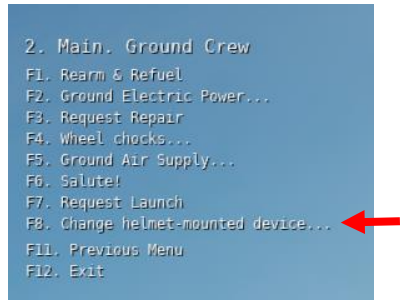


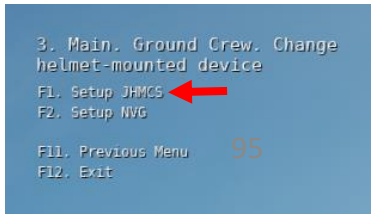










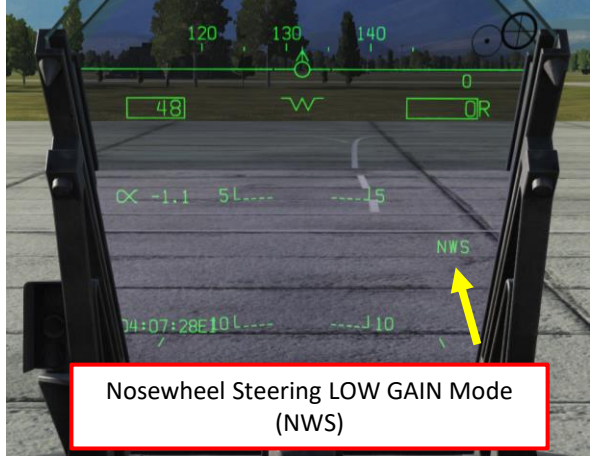


SHORE TAKEOFF

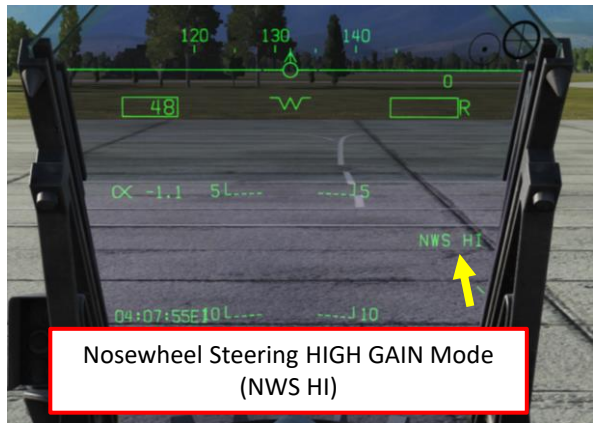


SHORE TAKEOFF

1. Ensure Anti-Skid Switch is set to ON (UP Position), and Flaps are HALF (MIDDLE position), chocks are removed, Launch Bar is RETRACTED and Parking Brake is released
2. Throttle up and start taxiing
3. Aircraft is steered using the nosewheel steering (NWS), controlled with rudder pedals.
    - The default **NWS LOW GAIN** Mode allows **+/- 16** deg and is displayed as **NWS** on the HUD.
    - The **NWS HIGH GAIN** Mode allows **+/- 75 deg** steering, which is useful on aircraft carriers or small spaces. You can activate it by pressing and holding the «Undesignate /Nosewheel Steer Switch» (key binding: « S ») button on your HOTAS. This steering mode is displayed as **NWS HI** on the HUD.



Nosewheel Steering LOW GAIN Mode (NWS)

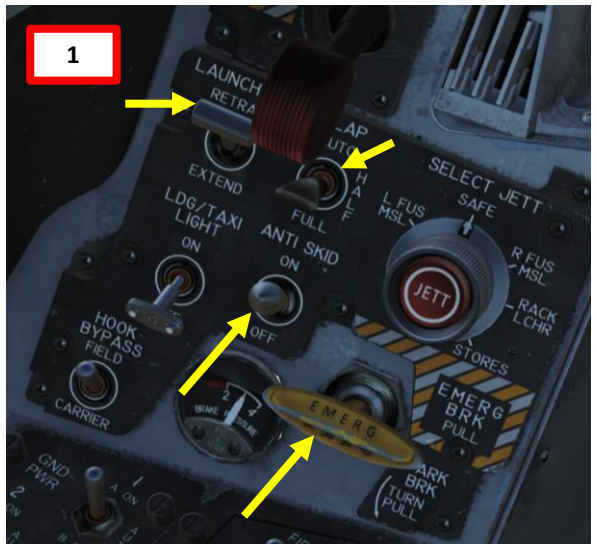


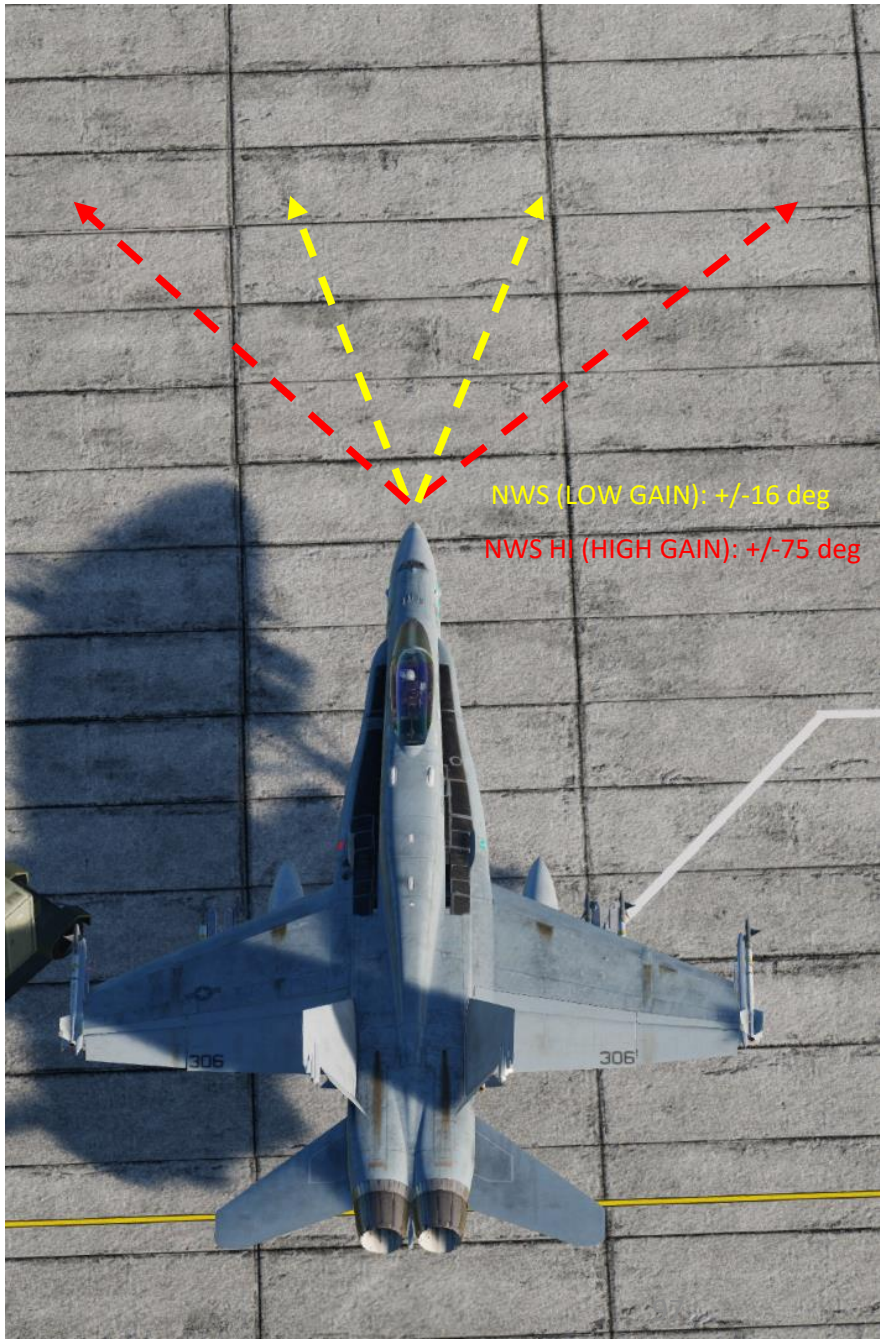
Nosewheel Steering HIGH GAIN Mode (NWS HI)



Paddle Switch
(Nosewheel steering disengage, Autopilot disengage & G-limiter override switch)

Undesignate / Nosewheel Steering Button





SHORE TAKEOFF

4. Once lined up on the runway, hold brakes and throttle up to 80 % RPM
5. Release brakes and set throttle fully forward to engage afterburners



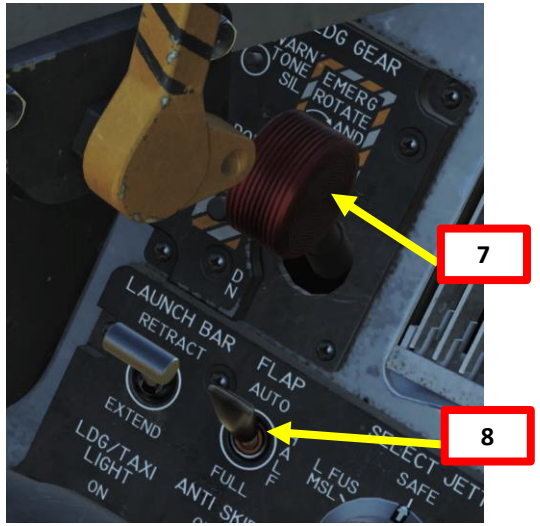




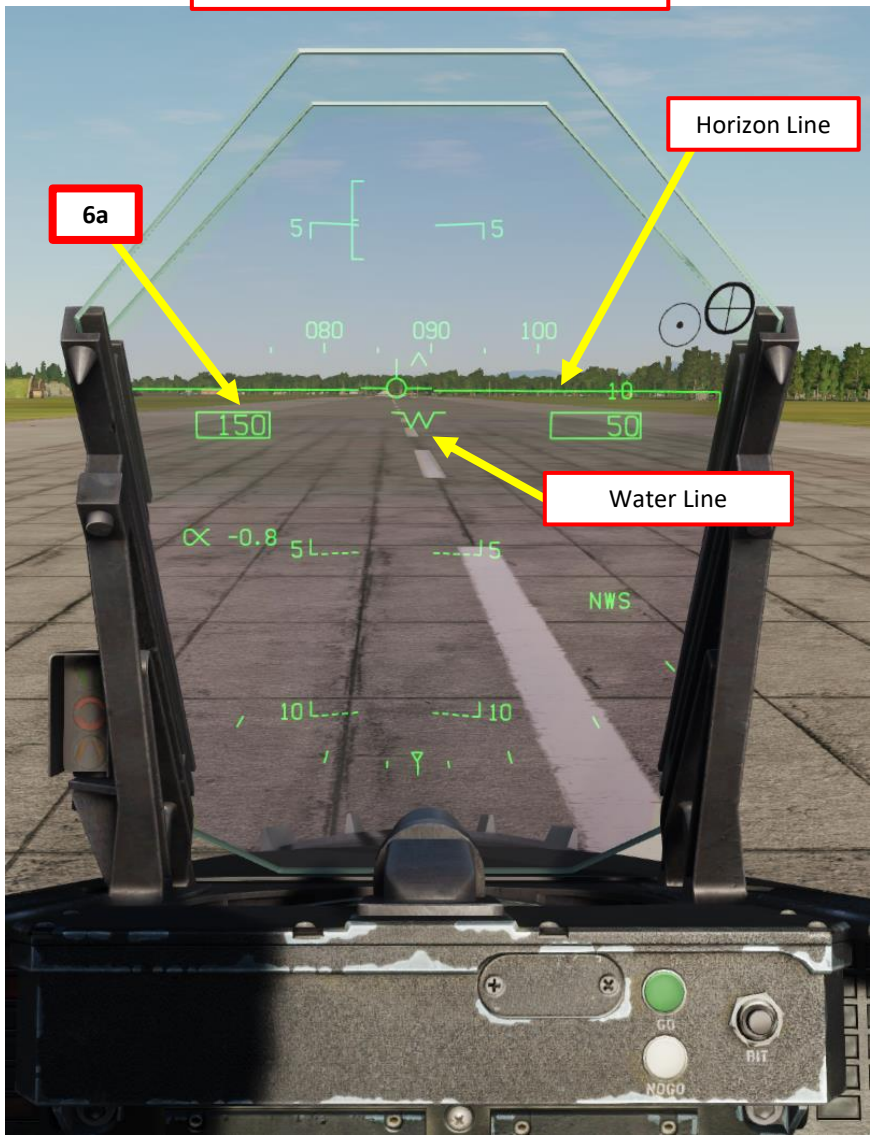
SHORE TAKEOFF

6. When reaching approx. 150 kts, hold stick back to set an aircraft pitch of 7 degrees AoA
7. Once you have a positive climb, raise landing gear up before reaching 240 kts
8. Set Flaps lever – AUTO
9. Set ALTITUDE Switch to BARO once reaching an altitude of 3000 ft to use Barometric Altitude as a reference for your HUD.





150 kts Airspeed, hold stick back to 7 deg AoA (Angle of Attack)



Maintain AoA until the HUD water line goes above the horizon line



SHORE TAKEOFF



CARRIER TAKEOFF

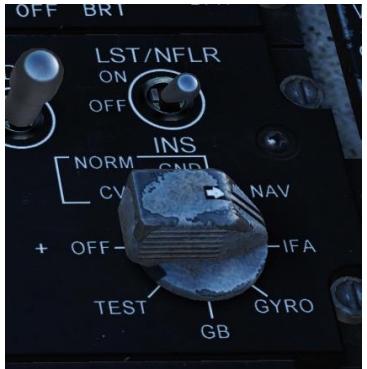


CARRIER TAKEOFF

1. Make sure the INS alignment was done with the INS Selector switch to CV. With CV mode, the alignment will take its positional data directly from the carrier via a SINS (Ship Inertial Navigation System) cable or a datalink radio frequency. Once alignment is finished, remember to verify that the INS Selector switch is set back to IFA (In-Flight Alignment) if a GPS is available (any mission set during 1986 or later should have it) or at NAV if no GPS is available.



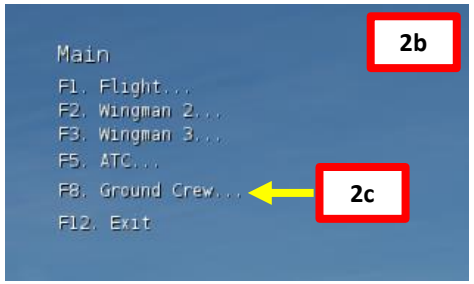


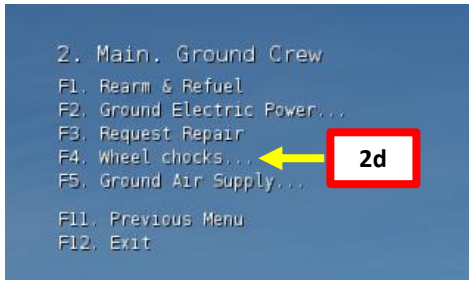


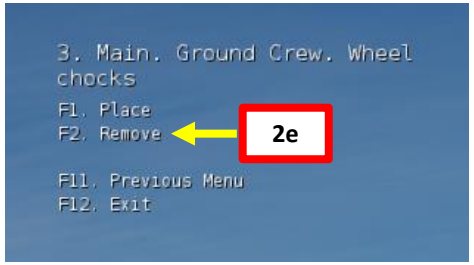


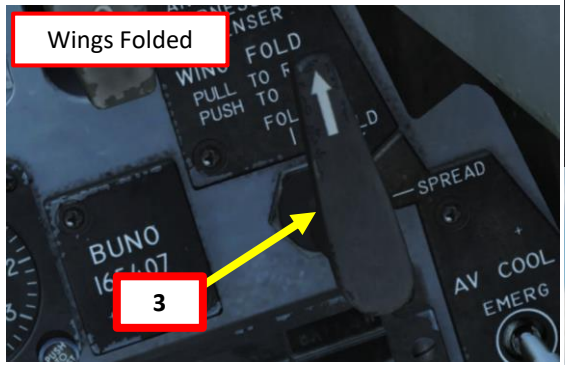
CARRIER TAKEOFF

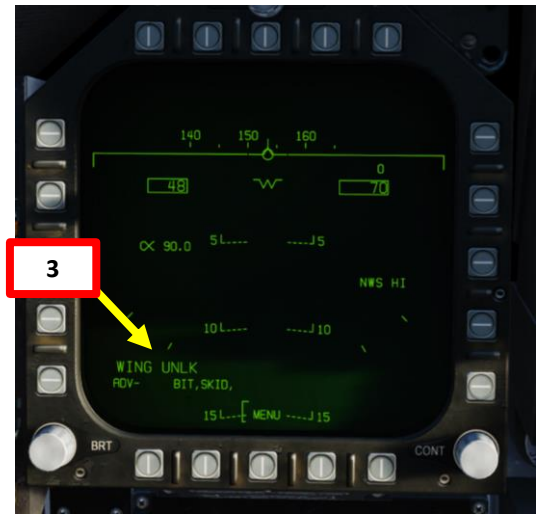
2. Remove **chocks** if installed (this is usually the case when operating on an aircraft carrier)
   a) Make sure your canopy is open to communicate to the ground crew
   b) Press "****" (communication menu binding) to contact ground crew
   c) Press "**F8**" to select "**Ground Crew"**
   d) Press "**F4**" to select "**Wheel Chocks**"
   e) Press "**F2**" to "**Remove** Wheel Chocks".
3. In a carrier environment, it is highly recommended to taxi with your wings folded to facilitate movement on the deck and minimize any risk of collision with obstacles or other aircraft.









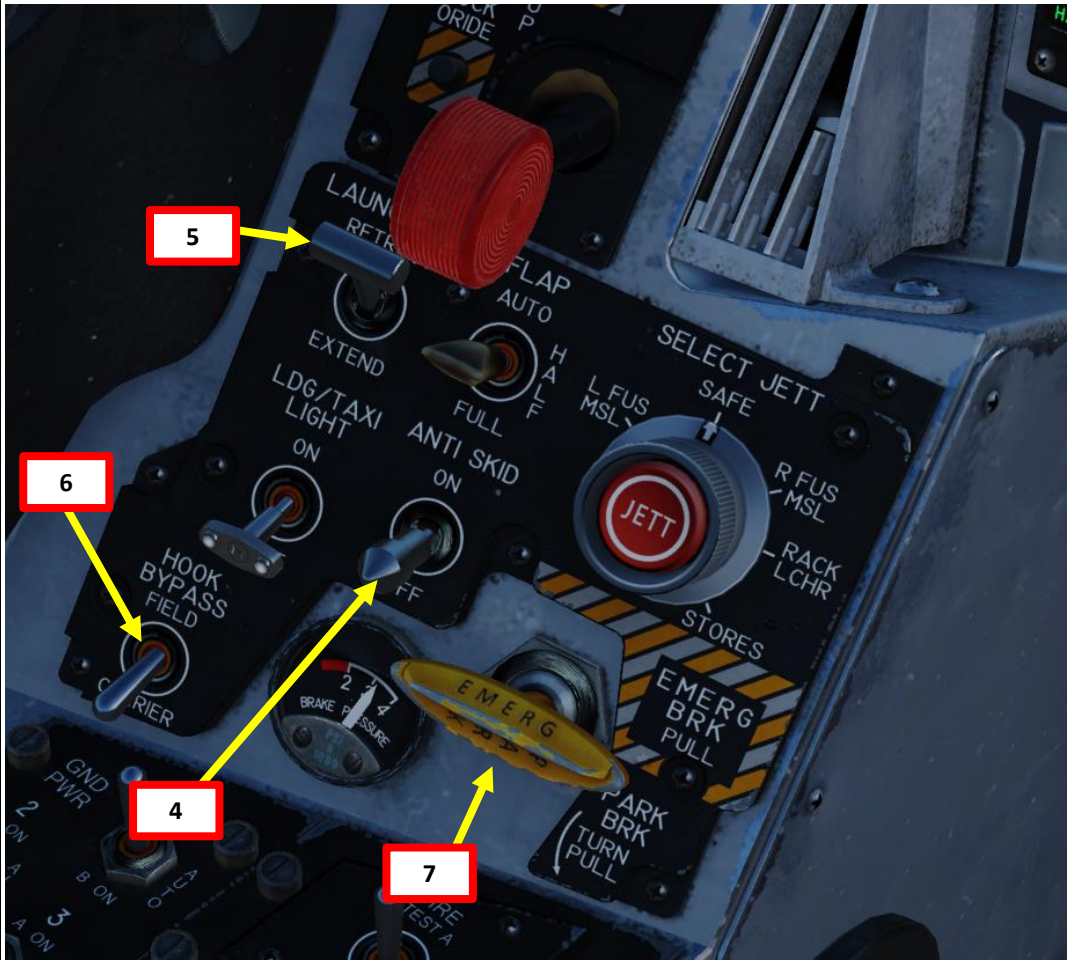






CARRIER TAKEOFF

4. Set Anti-Skid Switch to OFF (Down Position)
5. Set Launch Bar to RETRACT
6. Set HOOK BYPASS to CARRIER
7. Release Parking Brake (handle IN)
8. Throttle up and start taxiing



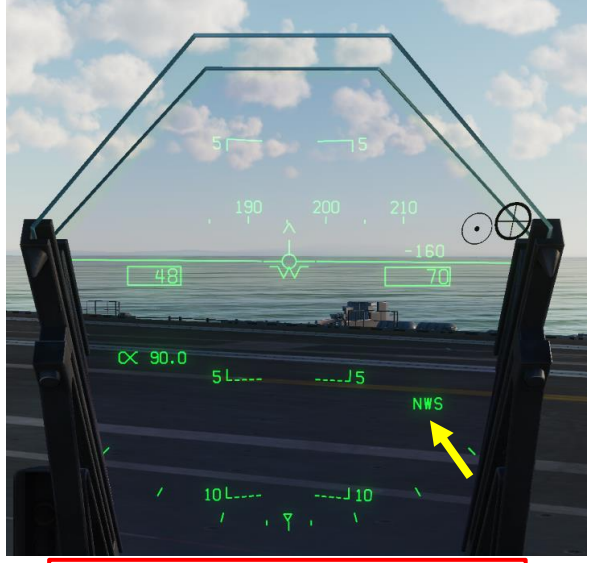




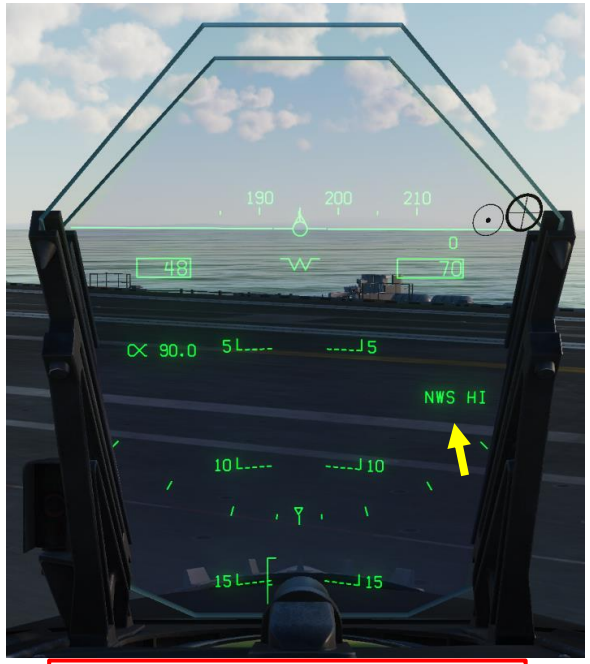
CARRIER TAKEOFF

9. Aircraft is steered using the nosewheel steering (NWS), controlled with rudder pedals.
    - The default **NWS LOW GAIN** Mode allows **+/- 16** deg and is displayed as **NWS** on the HUD.
    - The **NWS HIGH GAIN** Mode allows **+/- 75 deg** steering, which is useful on aircraft carriers or small spaces. You can activate it by pressing and holding the **«Undesignate /Nosewheel Steer Switch» (key binding: « S »)** button on your HOTAS. This steering mode is displayed as **NWS HI** on the HUD.
    - Note: If the Launch Bar is deployed, NWS is disengaged

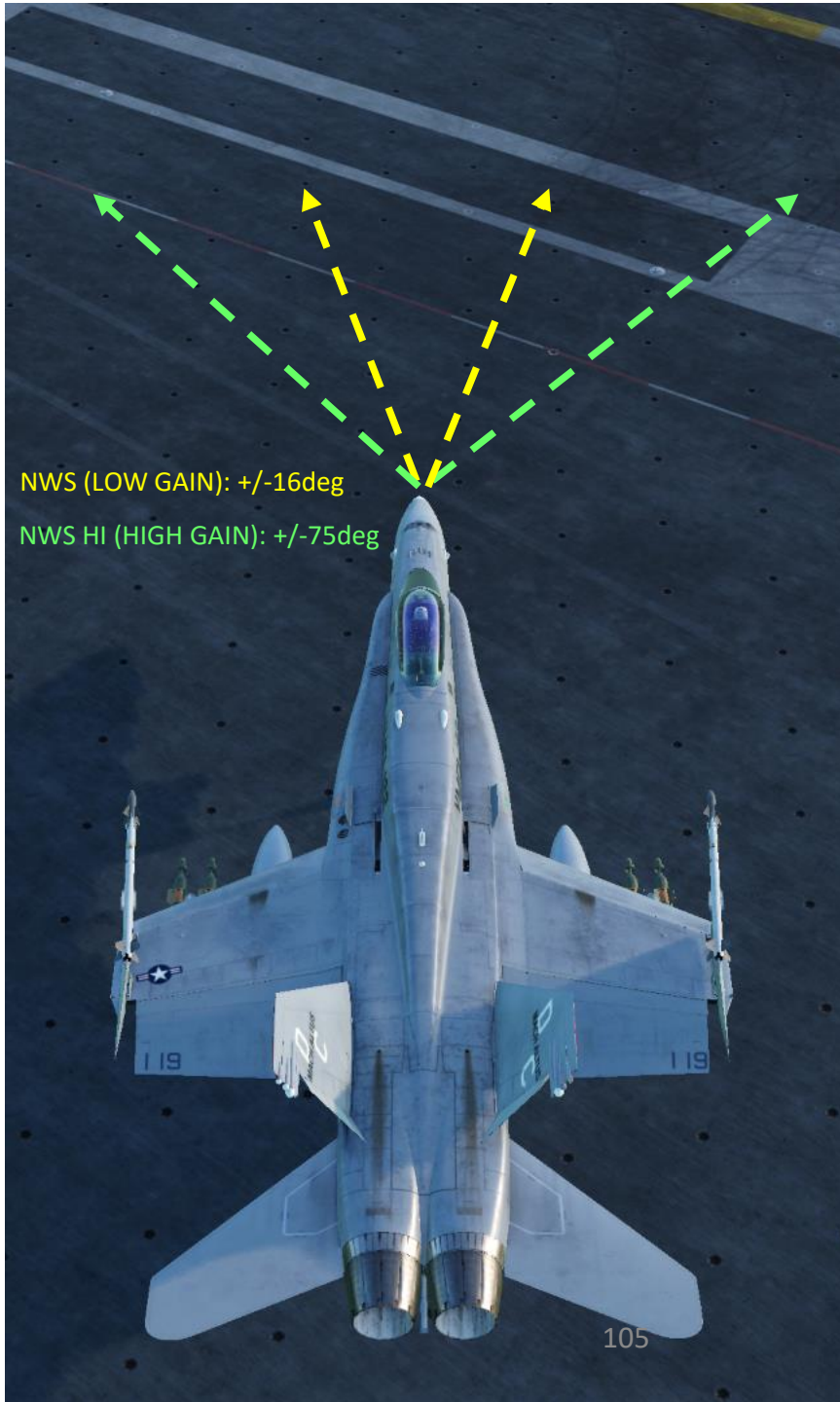




Nosewheel Steering LOW GAIN Mode (NWS)

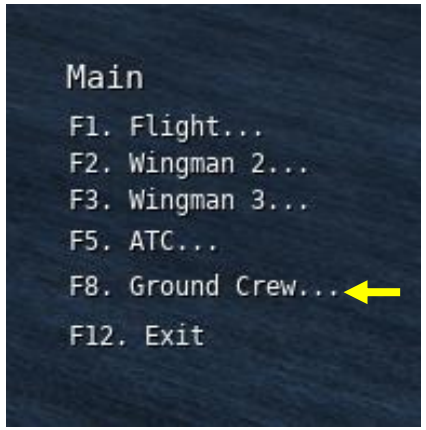


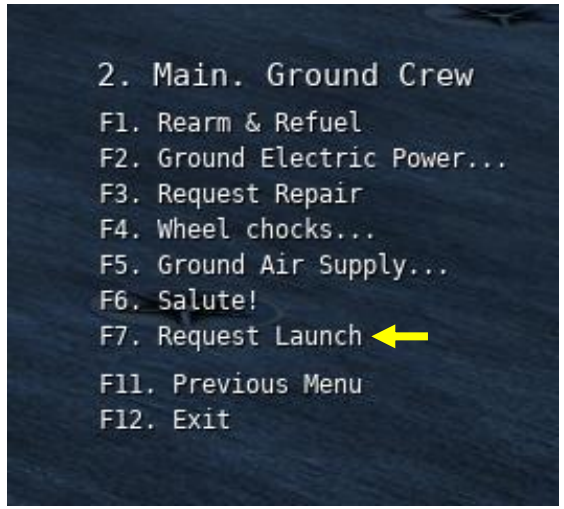
Nosewheel Steering HIGH GAIN Mode (NWS HI)



CARRIER TAKEOFF

10. Verify the way is clear to the catapult first. You wouldn't want someone to accidentally land on you while you line up on Catapult 3, eh?
11. Taxi to approach the catapult from directly behind it. If an aircraft is occupying the catapult, wait behind the JBD (Jet Blast Deflector).
12. If the Taxi Director (yellow shirt) is not present on the catapult, you can use the "Ground Crew" menu to request a launch.
    a) Press "\" (Communication Menu) and "F8" to select ground crew
    b) Select "Request Launch" by pressing "F8"









JBD (Jet Blast Deflector)
Deflects engine jet blast in order to not damage any aircraft or injure carrier crew. They also act as heat shields since many carrier-launched aircraft takeoff with afterburners on.

CARRIER TAKEOFF

13. When ready, advance on the retracted JBD (Jet Blast Deflector) and follow the Taxi Director's hand signals to align the aircraft on the catapult track.
14. When the Taxi Director closes his fists, gently stop the aircraft with the wheel brakes.



Turn Left



Taxi Forward



Turn Right





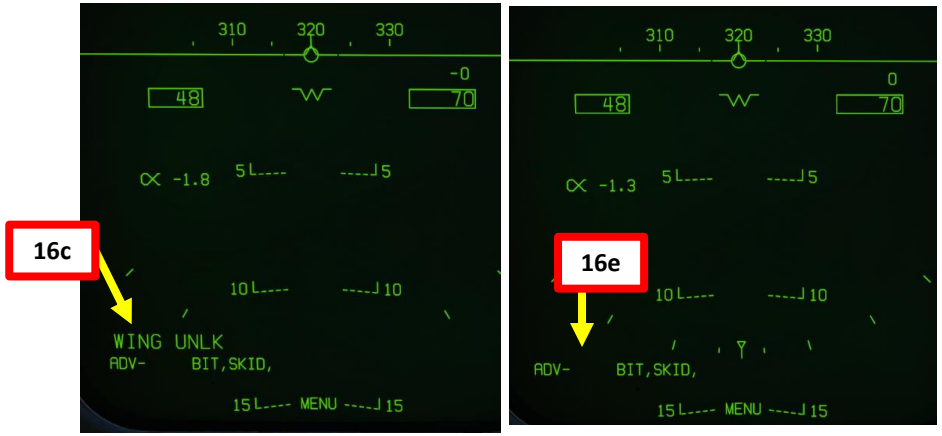


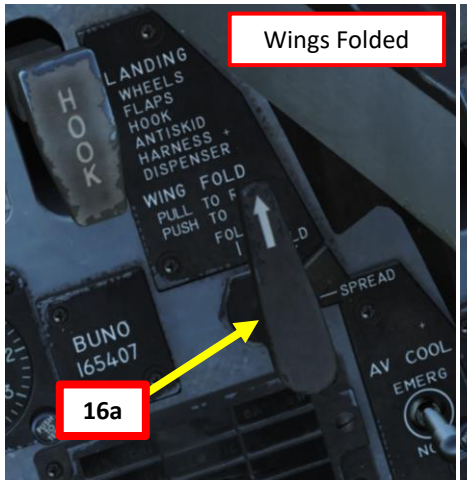


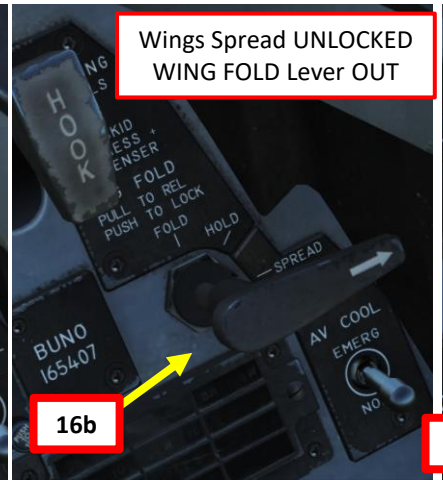
CARRIER TAKEOFF

15. When the Taxi Director extends his arms, he directs you to unfold (spread) your wings.
16. To spread wings:
    a) Right click on the WING FOLD lever and set it to SPREAD
    b) Wait for the wings to deploy properly
    c) On your HUD Repeater, you should see WING UNLK. This means that wings are spread out but not locked.
    d) Push the WING FOLD lever forward (scroll mousewheel) to lock the wing actuators.
    e) Verify that the WING UNLK caution has disappeared and you should be good to go.













CARRIER TAKEOFF

17. Set Flaps switch to HALF (MIDDLE position)
18. While all of this is going on, the flight crew raises the jet blast deflector (JBD) behind the aircraft.





CARRIER TAKEOFF

19. When the Taxi Director unfolds his arm, he directs you to extend your launch bar.
20. Set Launch Bar switch to EXTEND (DOWN) to extend the launch bar. Once launch bar is deployed, Nosewheel Steering will automatically disconnect.
21. The Catapult crew (Green Shirt) will install the holdback bar, which is used to maintain the aircraft in place until the steam catapult is fired.







Extend Launch Bar

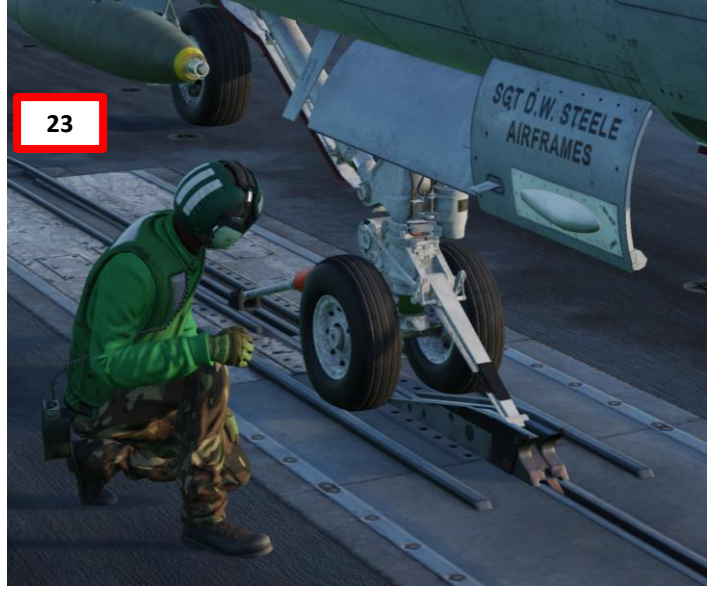






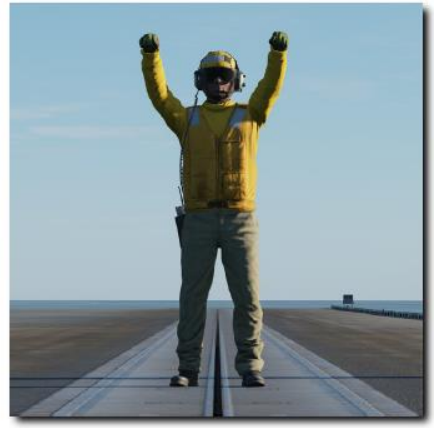
CARRIER TAKEOFF

22. When the Taxi Director moves his arms back and forth, he directs you to throttle up and move forward to hook the launch bar into the catapult shuttle. Significant power may be required.
    - **Note: If you do not own the Supercarrier, press "U" ("Catapult Hook Up" binding) to hook Launch Bar into the Catapult Shuttle.**
23. The catapult crew (green shirt) will monitor the catapult shuttle and tell the Taxi Director when you are hooked up.
24. When the launch bar drops over the shuttle, the aircraft will be stopped as the holdback engages the catapult buffer. Reduce power to idle.



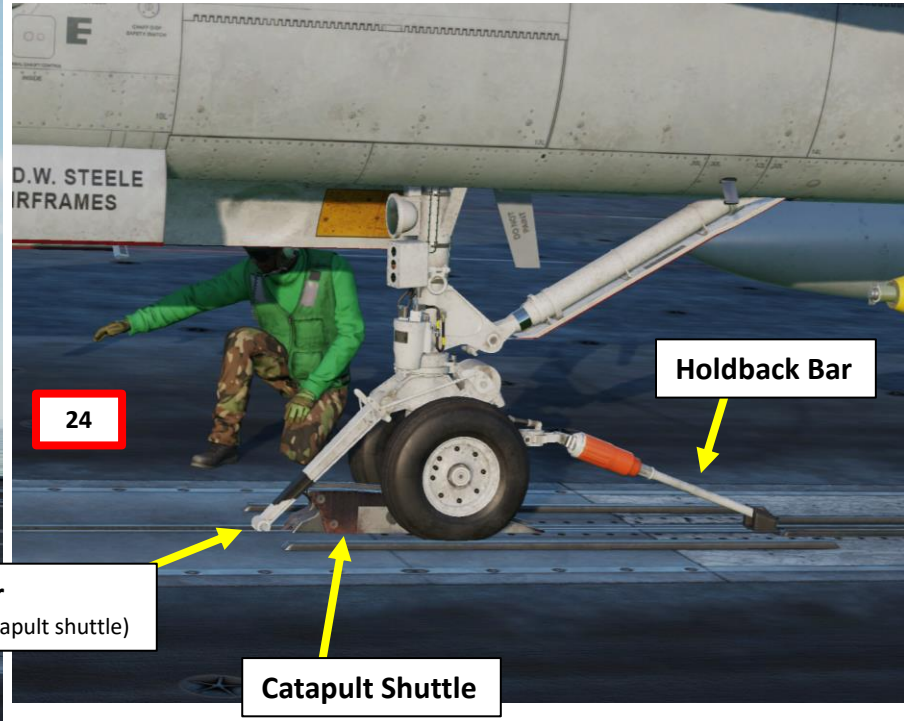


Taxi Forward



Stop





CARRIER TAKEOFF

25. The Catapult crew will verify that the aircraft launch bar is hooked into the catapult shuttle and that the holdback bar is installed properly.
26. When checks are complete, the crew located in the ICCS (Integrated Catapult Control Station), also called the “Bubble”, will apply tension to the catapult. You will see steam emanating from the catapult rail.



Integrated Catapult Control Station (ICCS), also called “The Bubble”.



CARRIER TAKEOFF

27. When the Taxi Director folds his arm, he directs you to raise the launch bar to seat it in the catapult shuttle.
28. Set Launch Bar switch to RETRACT (UP) to raise the launch bar. The hydraulic pressure sets the bar to stick the shuttle, and the shuttle holds it in place mechanically. A spring then allows the bar to flip as soon as the aircraft has left the shuttle and off the end of the deck.



Raise Launch Bar







CARRIER TAKEOFF

29. The Final Checkers (White Shirts) will inspect your aircraft for any last-minute problems.



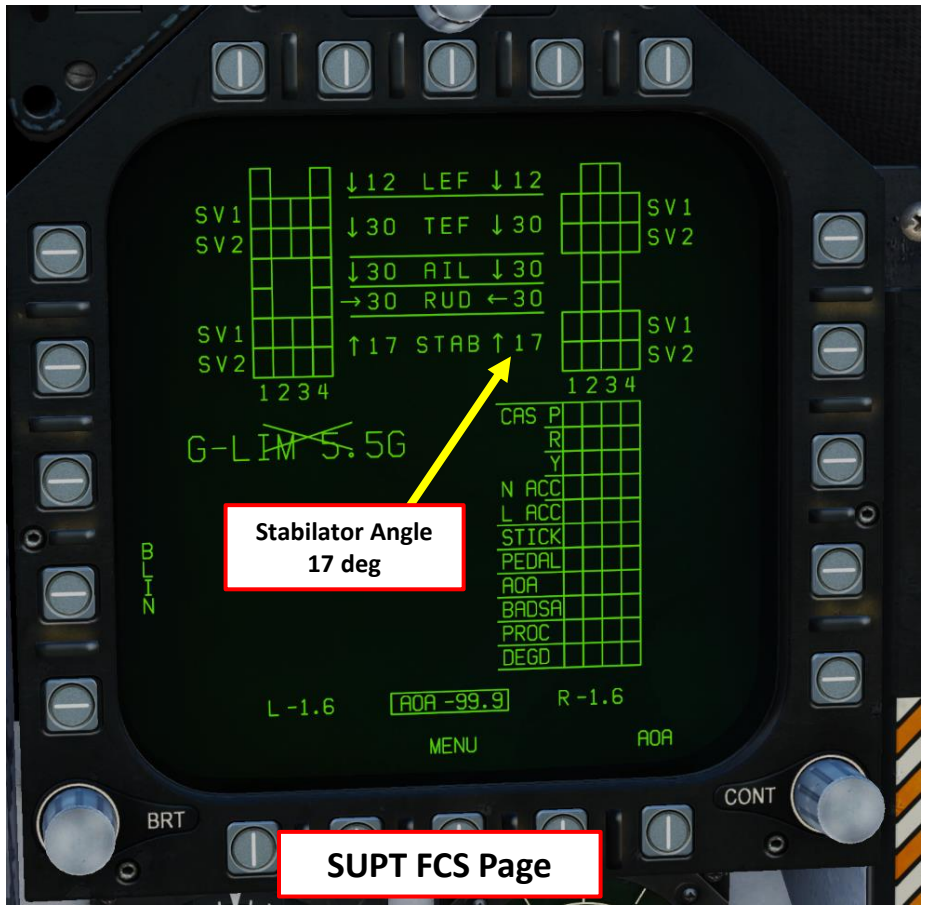
CARRIER TAKEOFF

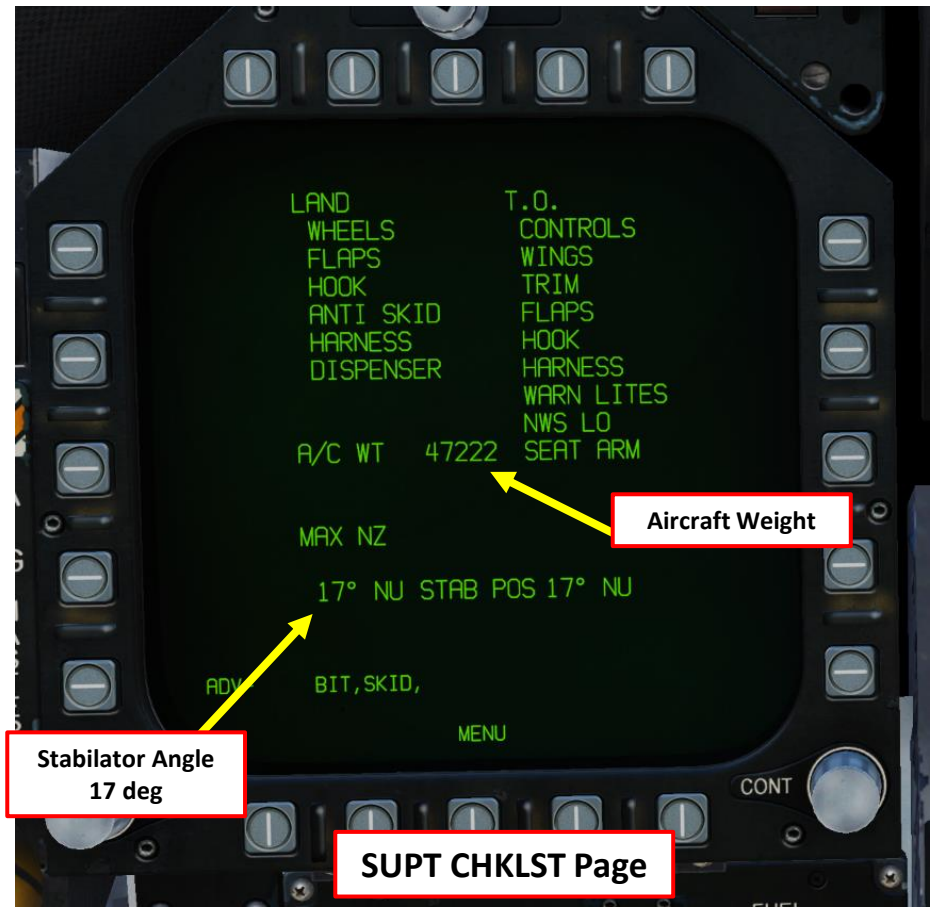
30. When operating from a carrier, the takeoff trim button set previously in the start-up procedure will have adjusted the stabilators at around 12 degrees nose up, which is not optimal for catapult takeoffs. Adjust takeoff trim with the **stabilator trim** on your HOTAS **as per the table shown to the right**. As an example, for a weight of 47222 lbs, we would set our stabilator to 17 deg nose up.
    - Note 1: You can consult your stabilator angle on the SUPT (Support) FCS (Flight Control System) page
    - Note 2: You can consult your weight on the SUPT (Support) CHKLST (Checklist) page
    - Note 3: The Max Takeoff Weight of the Hornet is 51,900 lbs

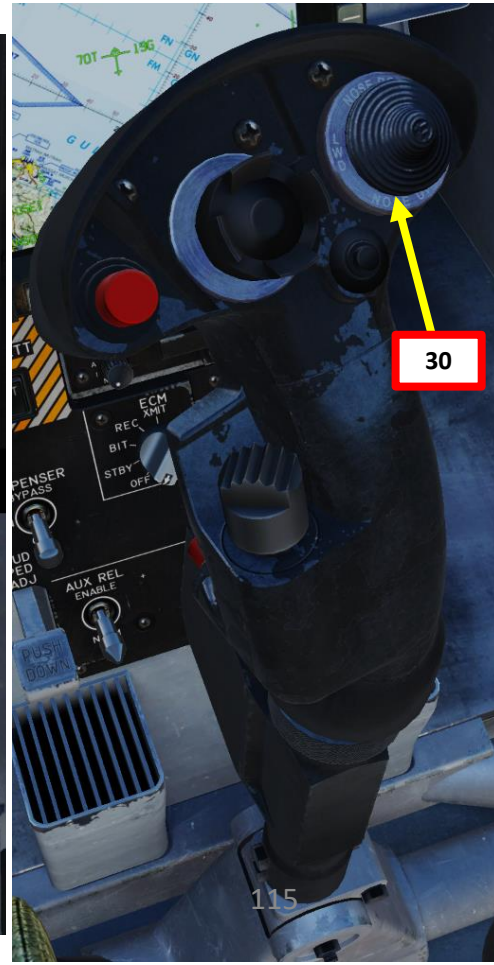
Catapult Longitudinal Trim

Weight Board	Nose Up Trim
44000 lbs and below	16 deg
45000 – 48000 lbs	17 deg
49000 lbs and above	19 deg

Note: Aircraft being launched at gross weights of 43000 lbs and above should trim by 3 deg nose up if advised to expect 10 knots or less excess endspeed.

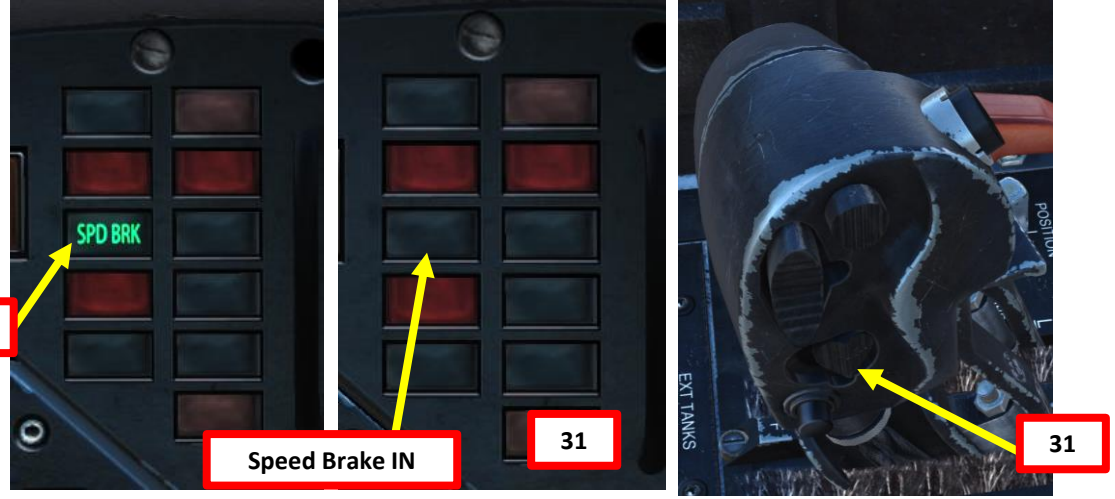






CARRIER TAKEOFF

31. Verify Speed Brake is retracted (IN).
32. Perform a control wipeout to check flight controls
    - Stick Full Forward
    - Stick Full Aft
    - Stick Full Left
    - Stick Full Right
    - Rudder Full Left
    - Rudder Full Right
33. When the Shooter gives you the « Engine Run Up » hand signal, throttle up to MAX Power and engage afterburners.



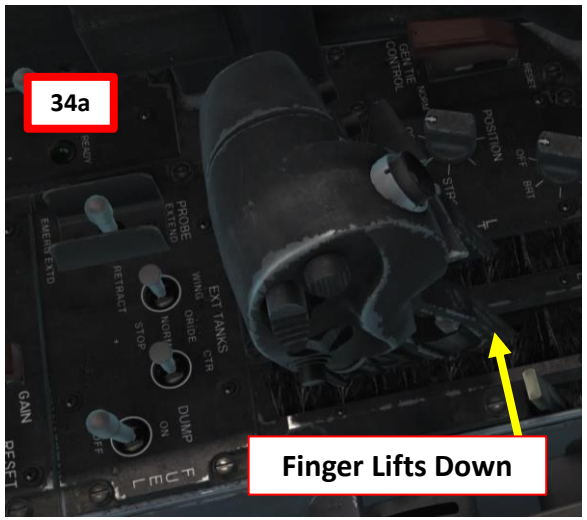


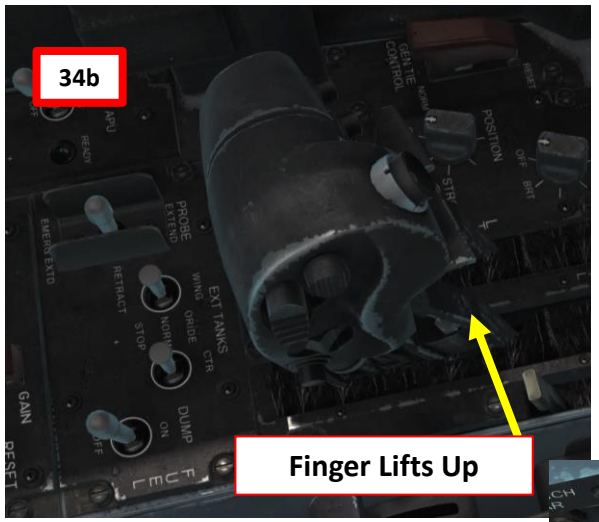


CARRIER TAKEOFF

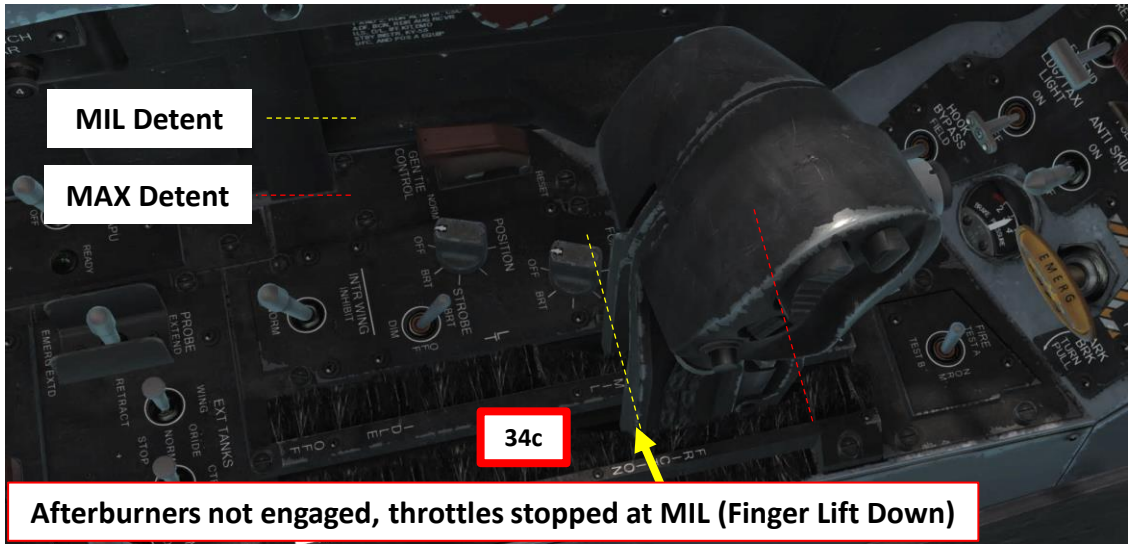
34. Throttle up fully forward to engage afterburners and let go of the flight stick. *Take note that **if the arrestor hook or launch bar is down**, an afterburner lockout system helps guard against inadvertent afterburner selection. The way to engage afterburners in that case is to either **raise the finger lifts (press 0 & 9)** and throttle up to MAX **OR** apply a **force of approximately 32 pounds** (not simulated) before the throttles can be moved to MAX. If finger lifts are not raised, the throttle will be stopped at MIL instead of MAX.*

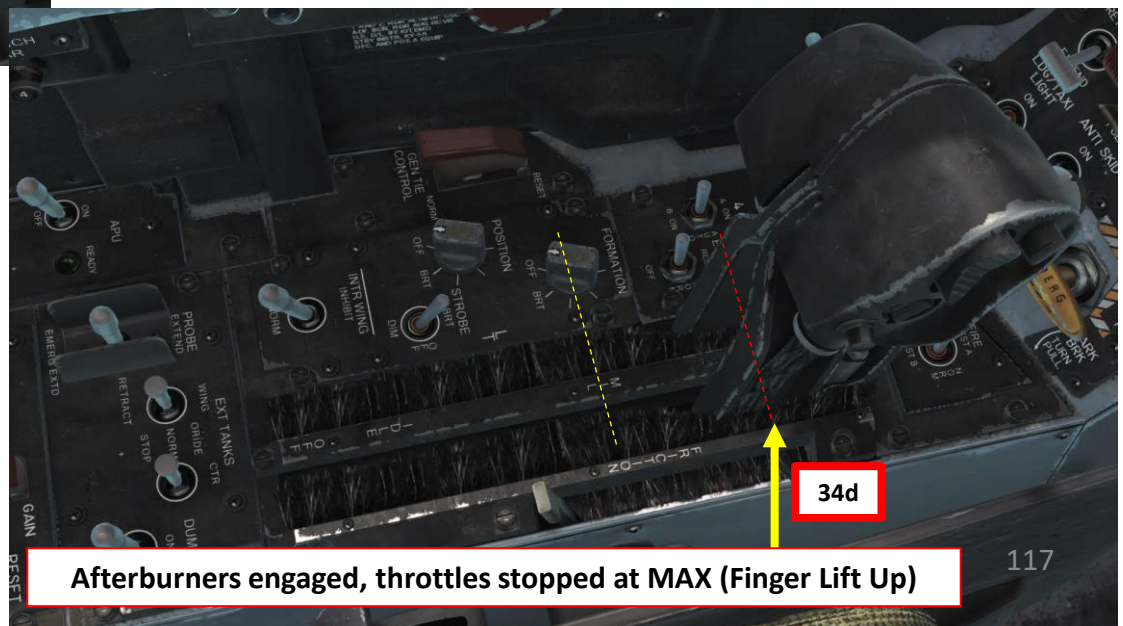










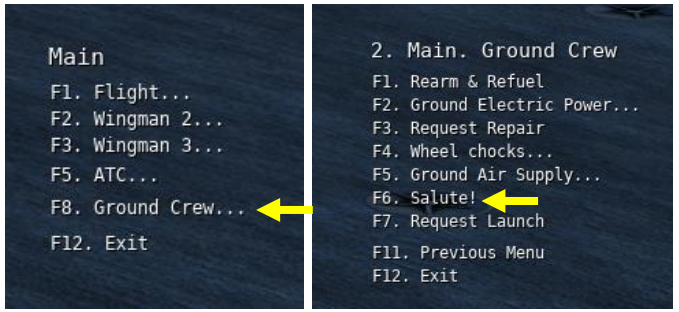


CARRIER TAKEOFF

35. Check the engine instruments and monitor the caution and warning lights.
36. Press “LCTRL+LSHIFT+S” to salute the Shooter. Alternatively, you can also do this through the ground crew menu.
    a) Press “\” (Communication Menu) and “F8” to select ground crew
    b) Select “Salute!” by pressing “F9”
37. All Final Checkers and crew will do a quick last check, then give a thumbs up.











CARRIER TAKEOFF

38. The Catapult Officer (Shooter) will make final checks, looking fore and aft, and then touch the deck.
39. The Shooter will then extend his arm, giving the signal to fire the catapult.
40. The aircraft will accelerate, reaching end speed in about two seconds.
41. The FCS (Flight Control System) will automatically set your flight control surfaces to the best climb attitude.
42. Once you have a positive climb, take back control of the flight stick.





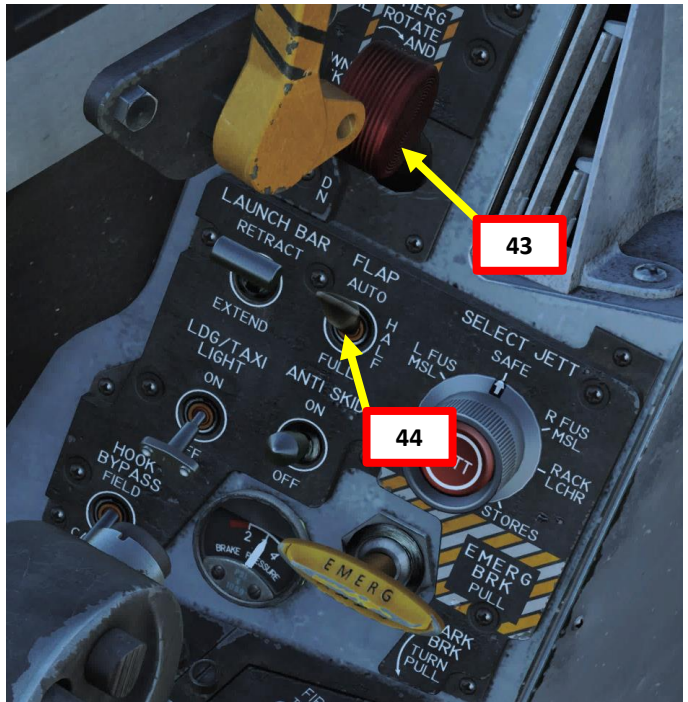




CARRIER TAKEOFF

43. Raise landing gear up before reaching 240 kts
44. Set Flaps lever – AUTO
45. After take off, perform Clearing Turn, which is 20 degree left and heading BRC (Base Recovery Course). Maintain 500 ft and 300 kts.
46. After away from carrier about 7 nm, you are cleared to climb more than 500 ft.
47. Set ALTITUDE Switch to BARO once reaching an altitude of 3000 ft to use Barometric Altitude as a reference for your HUD.







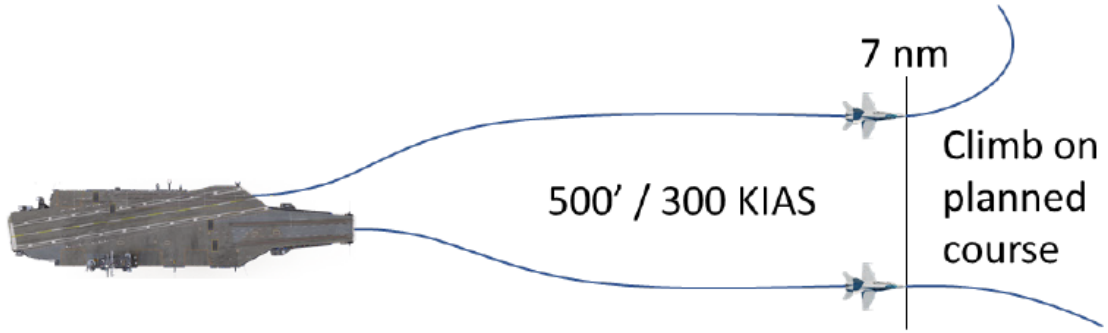


CARRIER TAKEOFF

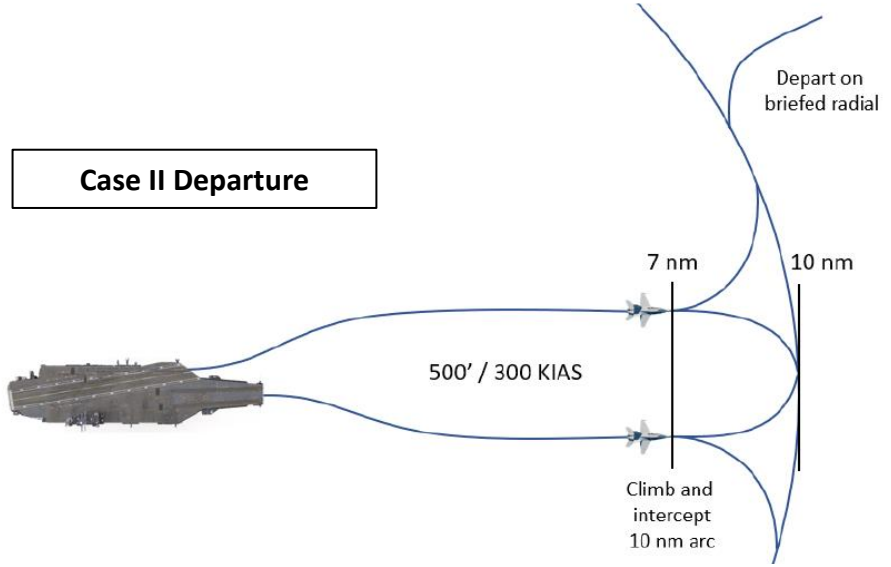


CARRIER TAKEOFF

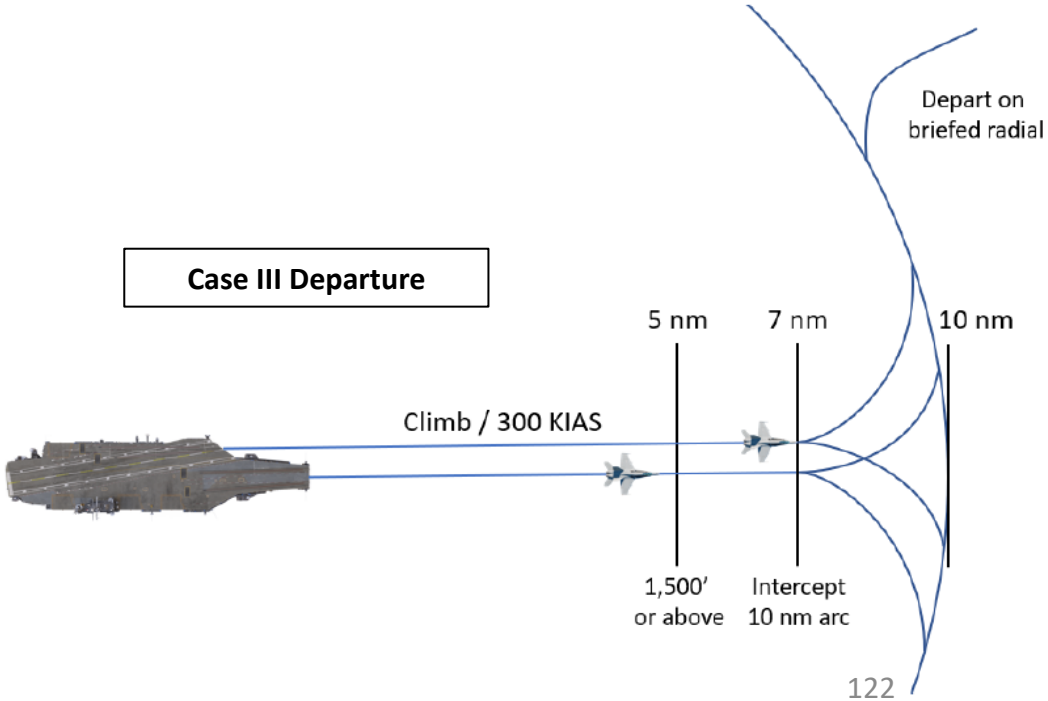
Case I Departure



Case II Departure

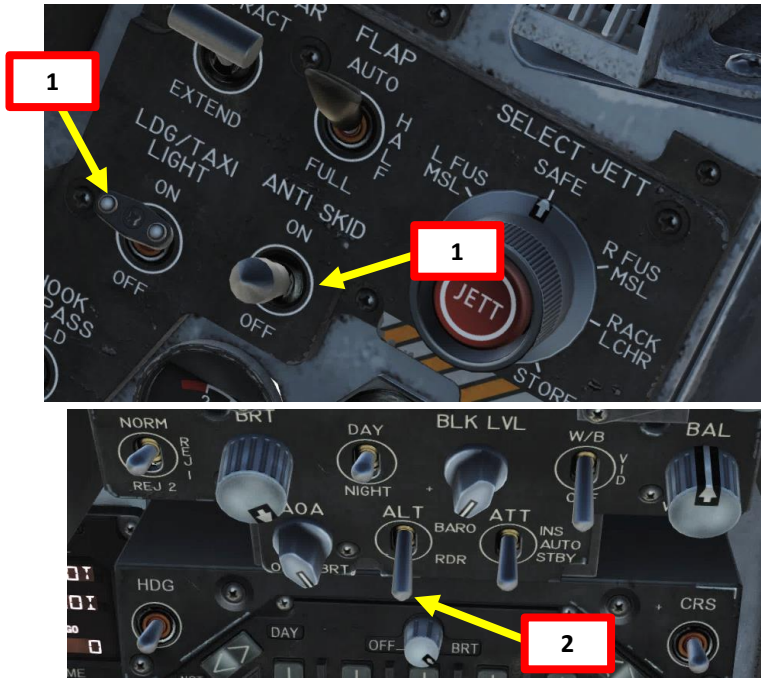


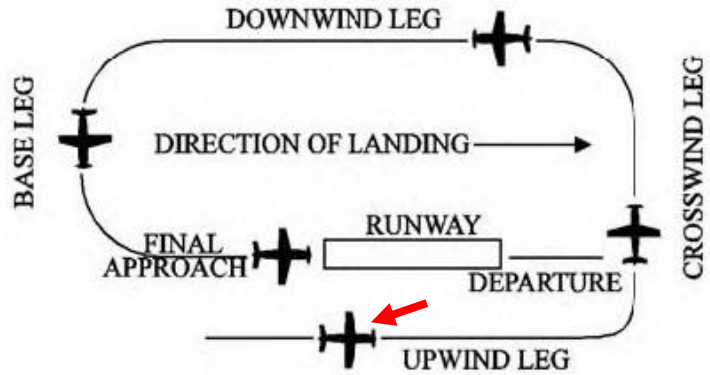
Case III Departure

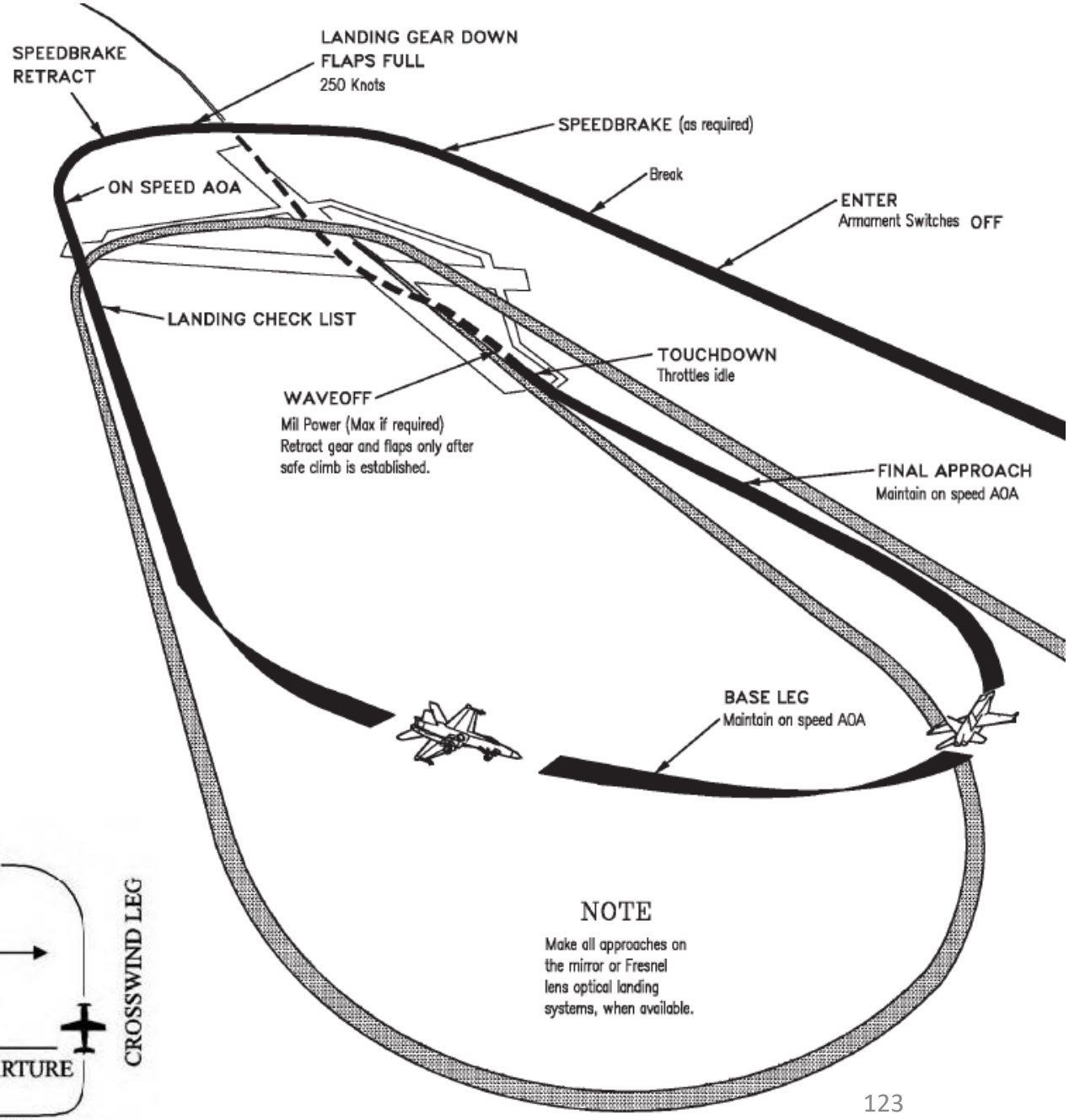


SHORE LANDING
VFR

1. Set Anti-Skid Switch to ON (UP Position) & Landing Lights ON
2. Set ALTITUDE Switch to RDR to use your radar altimeter as a reference for your HUD.
3. Enter upwind leg at approx. 350 kts at about 1000 ft altitude





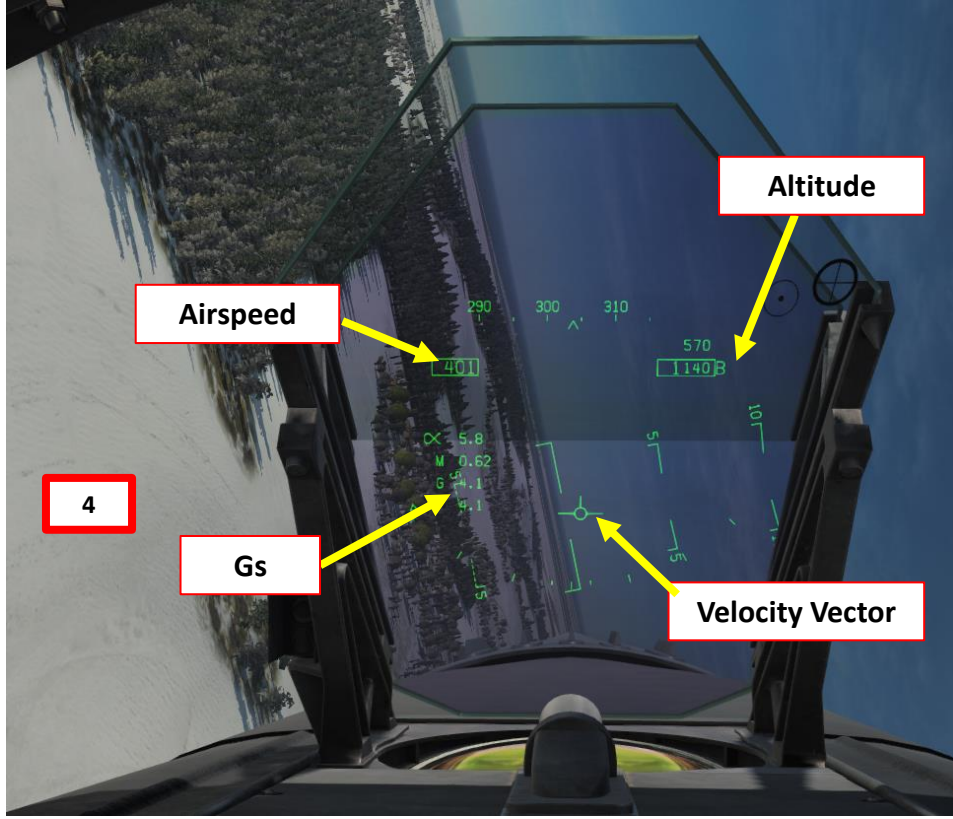


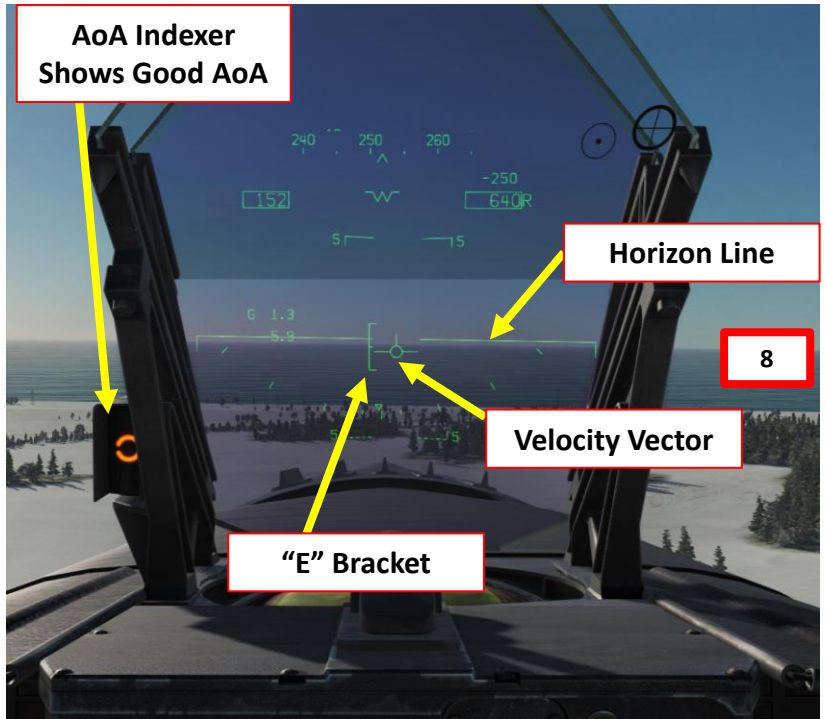
SHORE LANDING
VFR

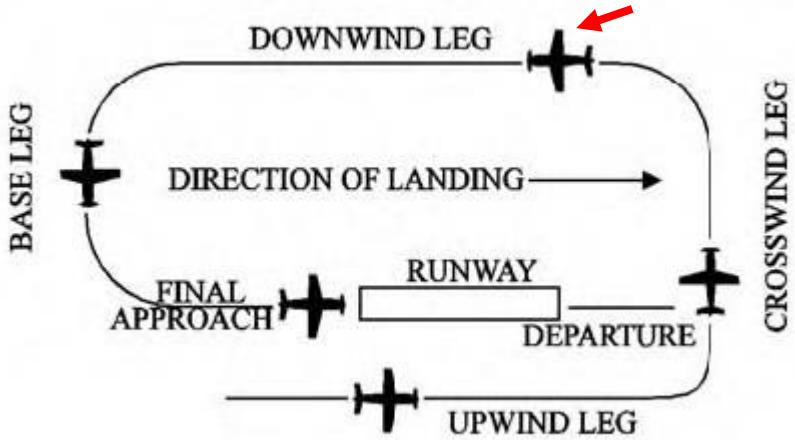


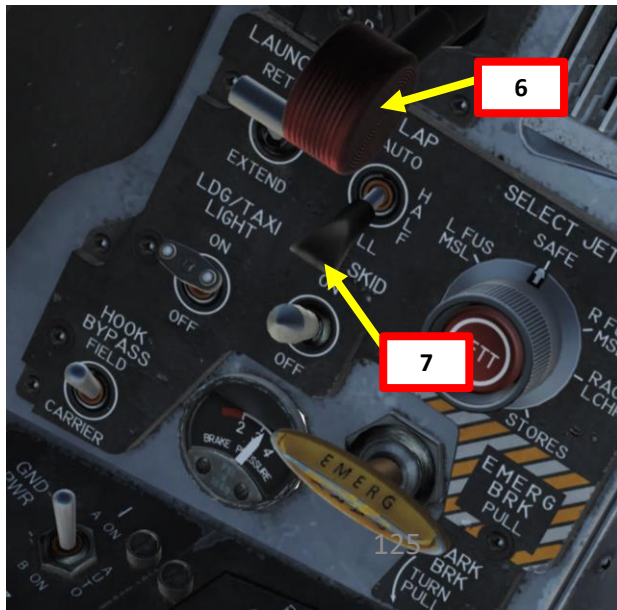
SHORE LANDING
VFR

4. When turning left from the upwind leg to the crosswind leg, try to pull a number of Gs that is 1 % of your airspeed (i.e. 3.5 G turn if going at 350 kts) while maintaining your velocity vector on the horizon line. This should line up your downwind leg to about 1.2 nm away from the runway.
5. Slow down to 250 kts and fly at 600 ft
6. Set Landing Gear Lever - DOWN
7. Flaps Lever – FULL (DOWN)
8. As you enter downwind leg, slow down to ON SPEED AOA by setting the velocity vector in the middle of the "E" bracket on the HUD using elevator trim and throttle input. You should reach an airspeed of about 140-150 kts for an AoA (Angle of Attack) to 8.1 deg approx. Make sure to maintain your 600 ft altitude by keeping the velocity vector on the horizon line. The AoA Indexer will also give you a good reference if you have the correct Angle of Attack or not.









SHORE LANDING
VFR

9. When turning to base leg, start a 30-degree bank while maintaining the Velocity Vector and the E bracket just below the horizon line. Maintaining the 600 ft altitude will require you to adjust the throttle constantly.
10. When lined up with the runway, set velocity vector on the runway and keep it there. Keep your velocity vector pointed on the runway with your flight stick, and control your glide slope and angle of attack with your throttle. That's called flying "pitch for speed, power for altitude".
11. Don't check your speed, if you have a good AoA and velocity vector, you'll be on speed.
12. Once AoA Indexer shows that you are ON SPEED (orange donut) and that your velocity vector is on the runway, just let yourself touchdown on the runway. It will feel like a controlled crash into the ground; that's normal.

SYMBOL	AIRSPEED	AOA
	Slow	9.3° to 90.00°
	Slightly slow	8.8° to 9.3°
	On speed	7.4° to 8.8°
	Slightly fast	6.9° to 7.4°
	Fast	0° to 6.9°







SHORE LANDING
VFR



CARRIER LANDING
CASE I RECOVERY

A “case 1 recovery” is simply a fancy term to qualify what kind of landing you perform.

CASE I: occurs when flights are anticipated to not encounter instrument conditions during daytime departure/recovery, and the ceiling and visibility around the carrier are no lower than 3000 ft and 5 nm.

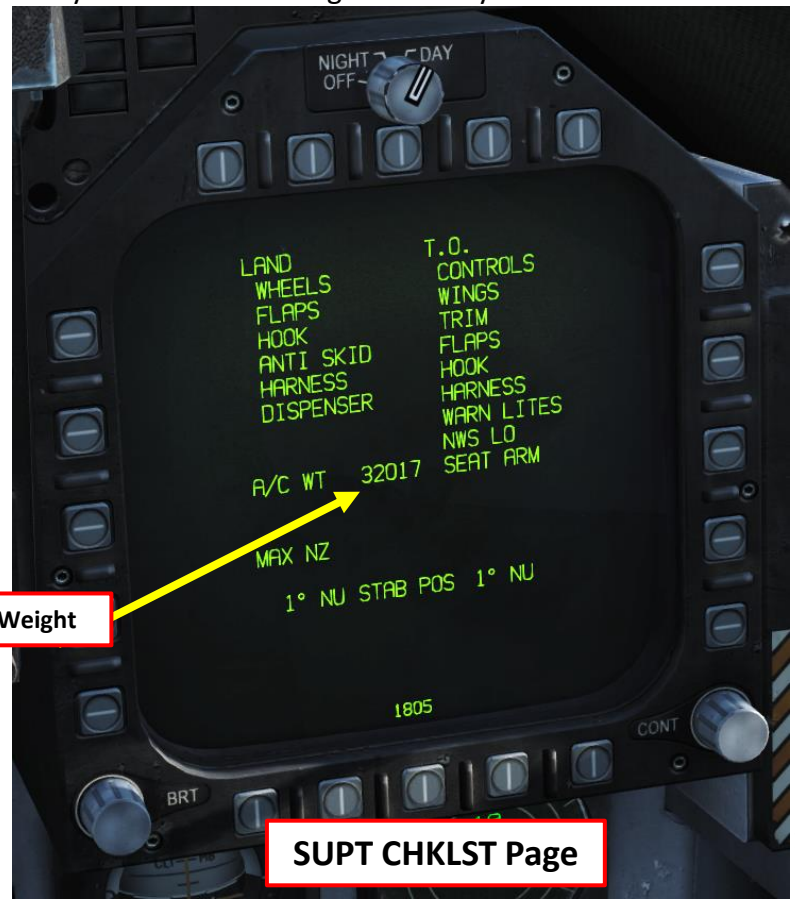
CASE II: occurs when flights may encounter instrument conditions during day time departure/recovery, and the ceiling and visibility in the carrier control zone are no lower than 1000 ft and 5 nm.

CASE III: occurs when flights are expected to encounter instrument conditions during a departure/recovery because the ceiling or visibility around the carrier is lower than 1000 ft and 5 nm, or for night departures/recoveries.

The procedure to land on a carrier is in fact quite similar to the procedure shown in the SHORE LANDING tutorial. The only things that change is that the runway is moving, may pitch up and down and is much smaller. Here is a couple of videos I recommend you watch before attempting a carrier landing:

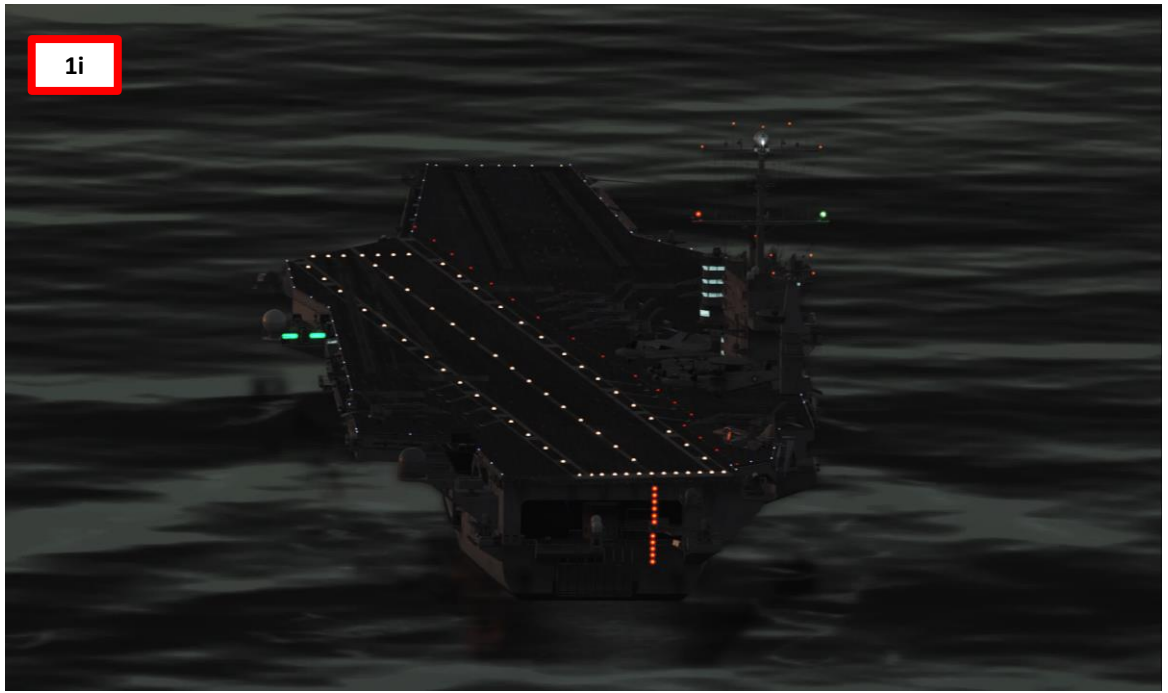
- **Carrier Landing Tutorial by Matt Wagner:** https://www.youtube.com/watch?v=TuigBLhtAH8
- **Carrier Landing Tutorial by Jabbers:** https://youtu.be/lm-M3VUy-_I
- **Carrier Landing Discussions by F/A-18 Pilot A.E.W.:** https://www.youtube.com/channel/UCNvV27UZkI8W-jvMA-iGqyQ
- **Carrier Ops Instructional by F/A-18 Pilot Lex Talionis:** https://youtu.be/bLOZJ0tpzRs
- **Carrier Operations by Redkite:** https://www.youtube.com/watch?v=LMJ1Y57qtjI

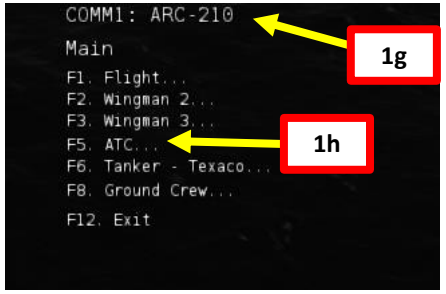
Note: The maximum weight allowable for a carrier landing is 33,000 lbs. If you are too heavy, you can either fly around to burn fuel, jettison fuel or jettison your ordnance. Your current weight is accessible through your Support CHKLST page.

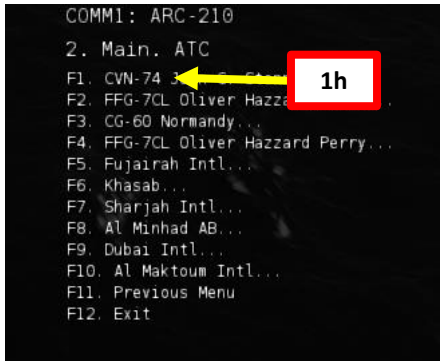


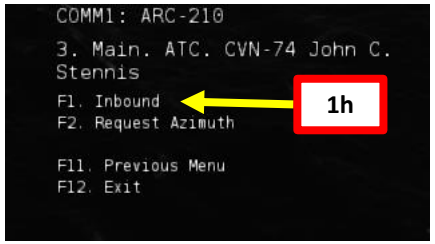
CARRIER LANDING
CASE I RECOVERY

1. Contact Carrier to turn on the lights
   a. Left click on the COMM1 knob to pull it and select COMM1 Radio
   b. Scroll mousewheel on COMM1 Radio Channel Selector to M (Manual) Mode
   c. Press the OSB next to AM or FM to select the FM frequency (":FM" will appear when selected)
   d. Press CLR on the UFC to clear current frequency
   e. Type "127500" on the UFC to set carrier radio frequency 127.5 MHz
   f. Press ENT on the UFC to enter this frequency
   g. Press the COMM switch – COMM1 on your throttle to contact the carrier (RALT+\)
   h. Go in F5 – AT5 menu, then to the CVN-74 menu, then to the F1 – Inbound menu.
   i. And that's it, the carrier is now illuminated.









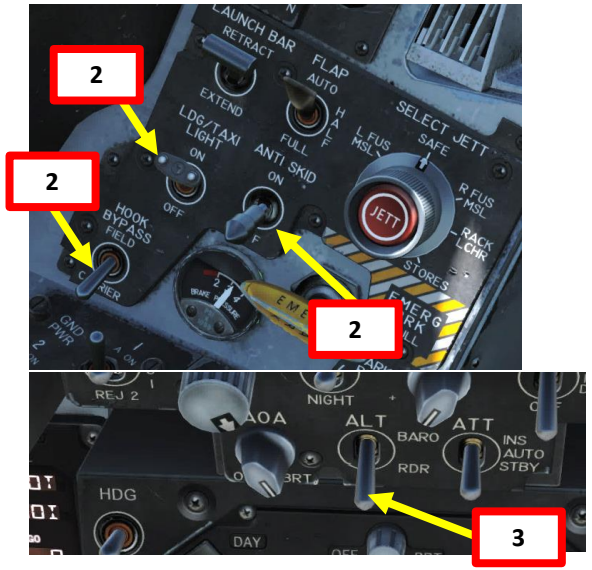


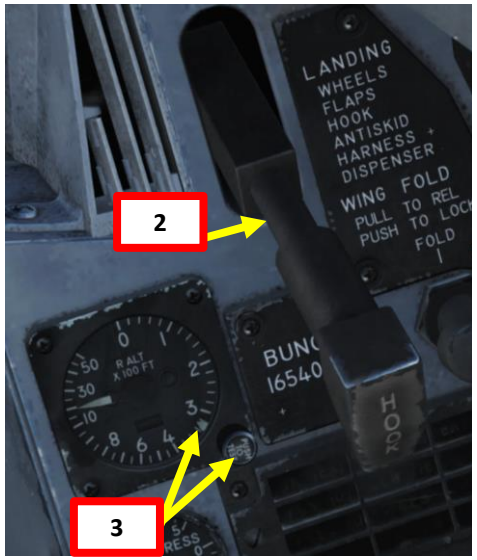




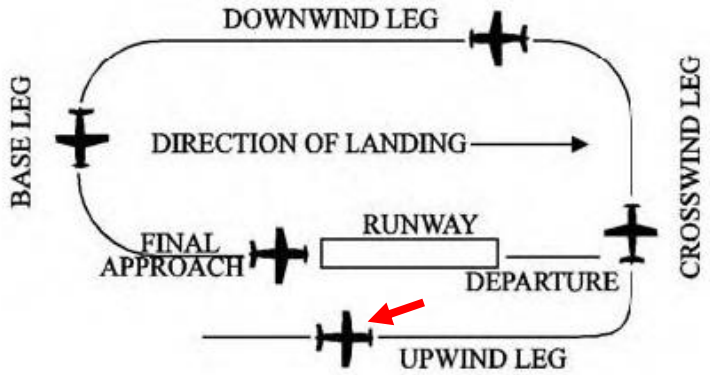
CARRIER LANDING
CASE I RECOVERY

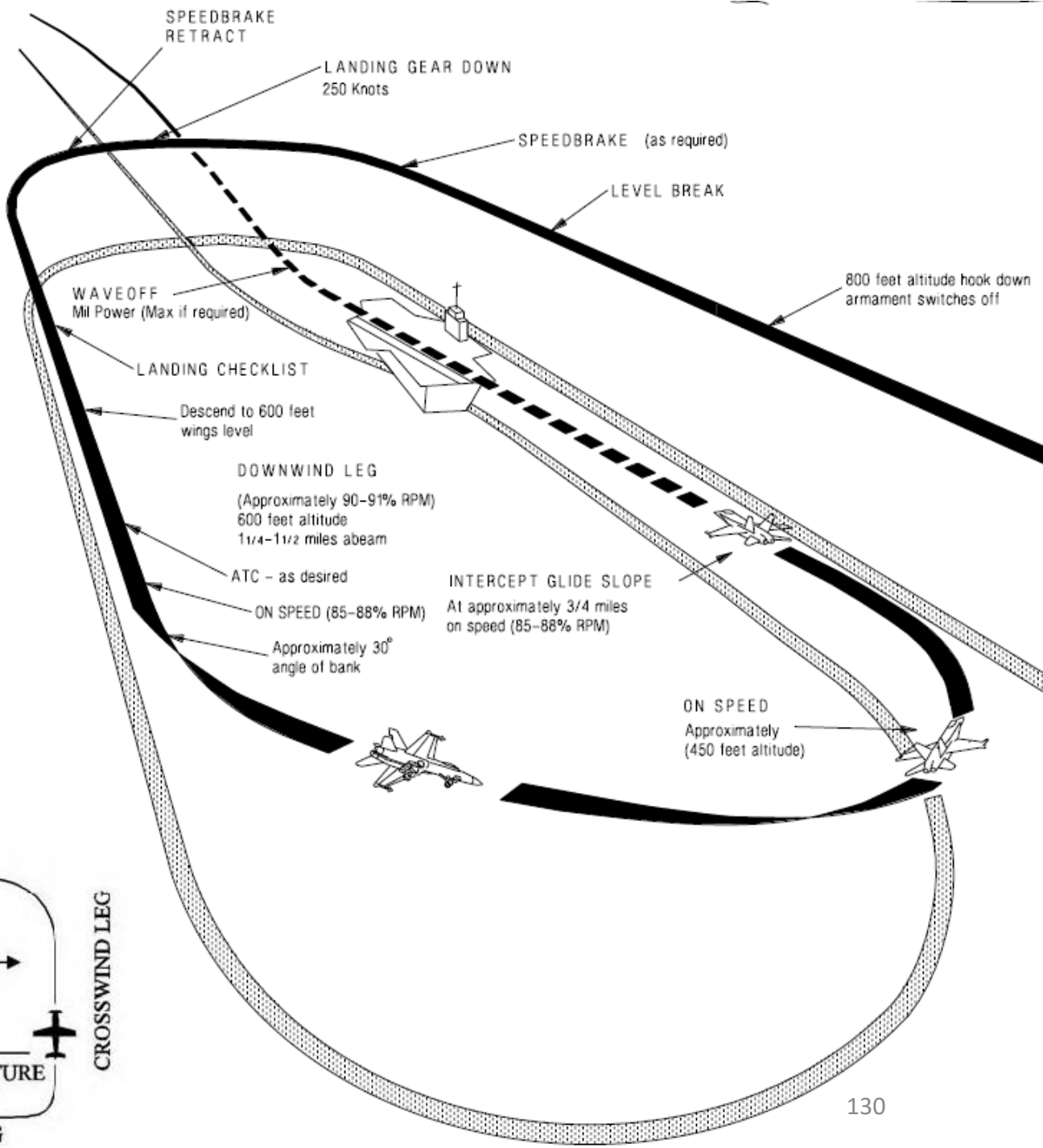
2. Set Anti-Skid Switch to OFF (Down Position), Hook Lever DOWN, Hook Bypass Switch to CARRIER, and Landing Lights ON
3. Set ALTITUDE Switch to RDR to use your radar altimeter as a reference for your HUD and set radar altimeter index to 370 ft or 320 (as you prefer). You use 370 ft to remind you that you need to make the ball call or 320 ft to make sure you have the proper altitude when 3/4 nm from the carrier.
4. Enter upwind leg at approx. 350 kts and 800 ft altitude









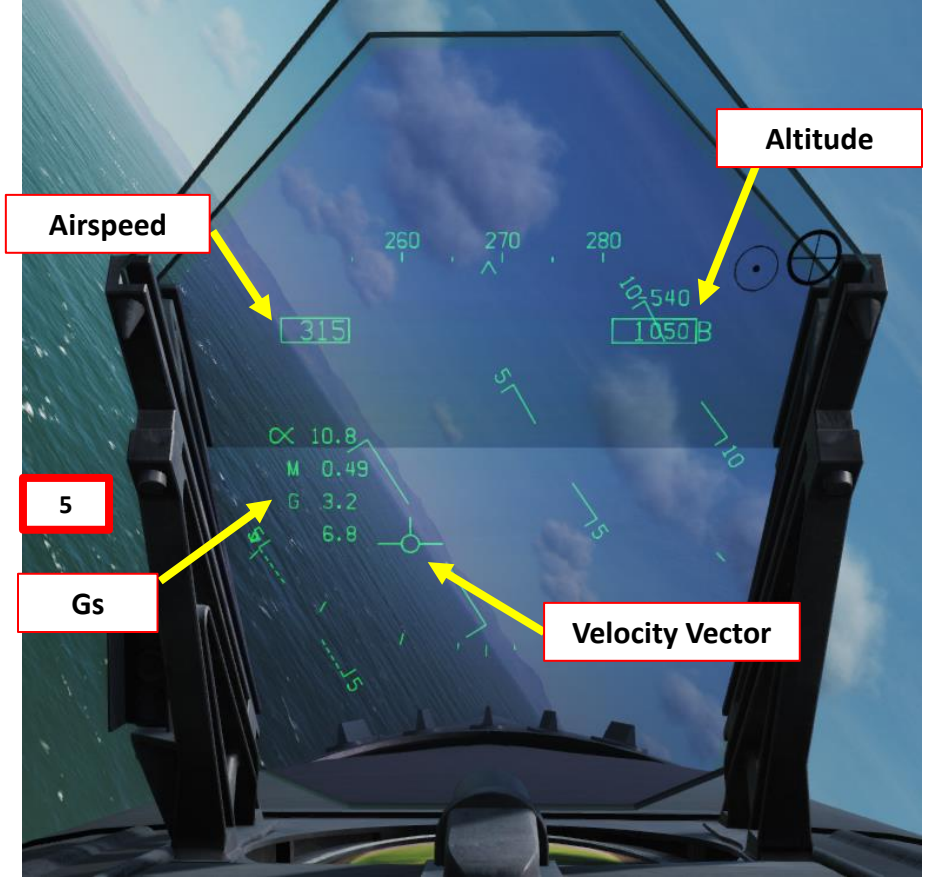


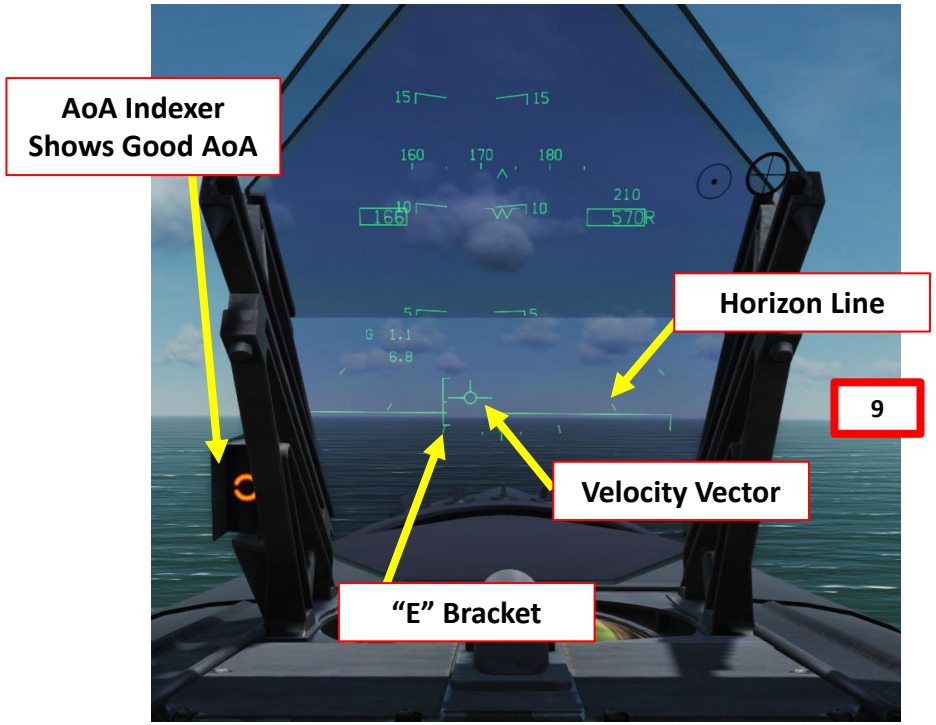
CARRIER LANDING
CASE I RECOVERY

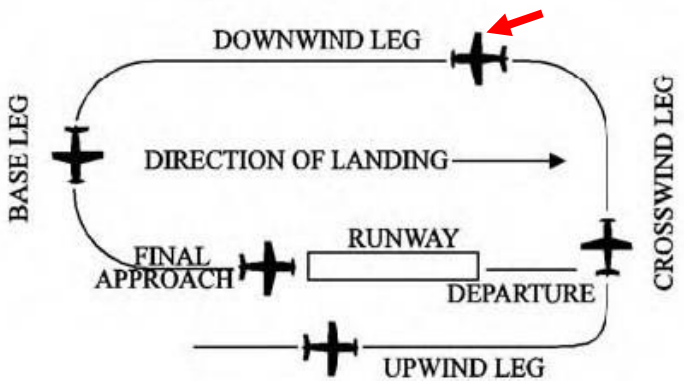


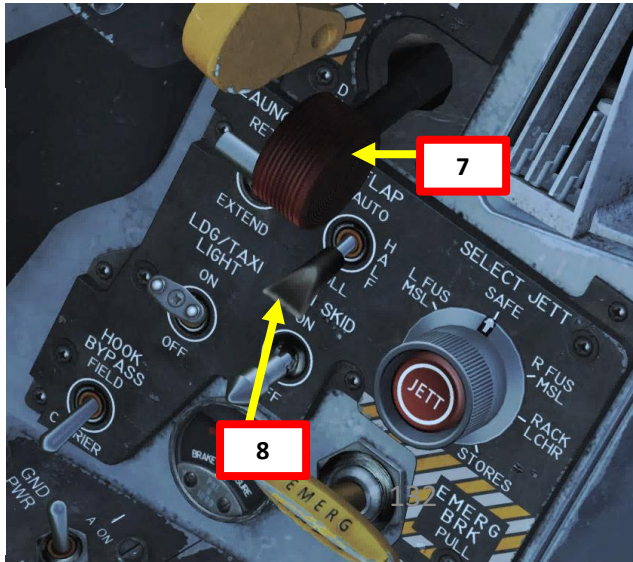
CARRIER LANDING
CASE I RECOVERY

5. When turning left from the upwind leg to the crosswind leg, try to do pull a number of Gs that is 1 % of your airspeed (i.e. 3.5 G turn if going at 350 kts) while maintaining your velocity vector on the horizon line. This should line up your downwind leg to about 1.2 nm away from the runway.
6. Slow down to 250 kts at fly at 600 ft
7. Set Landing Gear Lever - DOWN
8. Flaps Lever – FULL (DOWN)
9. As you enter downwind leg, slow down to ON SPEED AOA by setting the velocity vector in the middle of the "E" bracket on the HUD using **elevator trim** (super important) and throttle input. I cannot stress it enough: make sure you are properly trimmed. You should reach an airspeed of about 140-150 kts for an AoA (Angle of Attack) to 8.1 deg approx. If you fail to trim to 8 degrees, your AoA will be off and you will be fighting the fly-by-wire system all the way to landing. Make sure to maintain your 600 ft altitude by keeping the velocity vector on the horizon line. The AoA Indexer will also give you a good reference if you have the correct Angle of Attack or not.









CARRIER LANDING
CASE I RECOVERY

Once flying abeam the ship on the downwind leg, start your approach turn when your wing meets the ship's Rounddown.

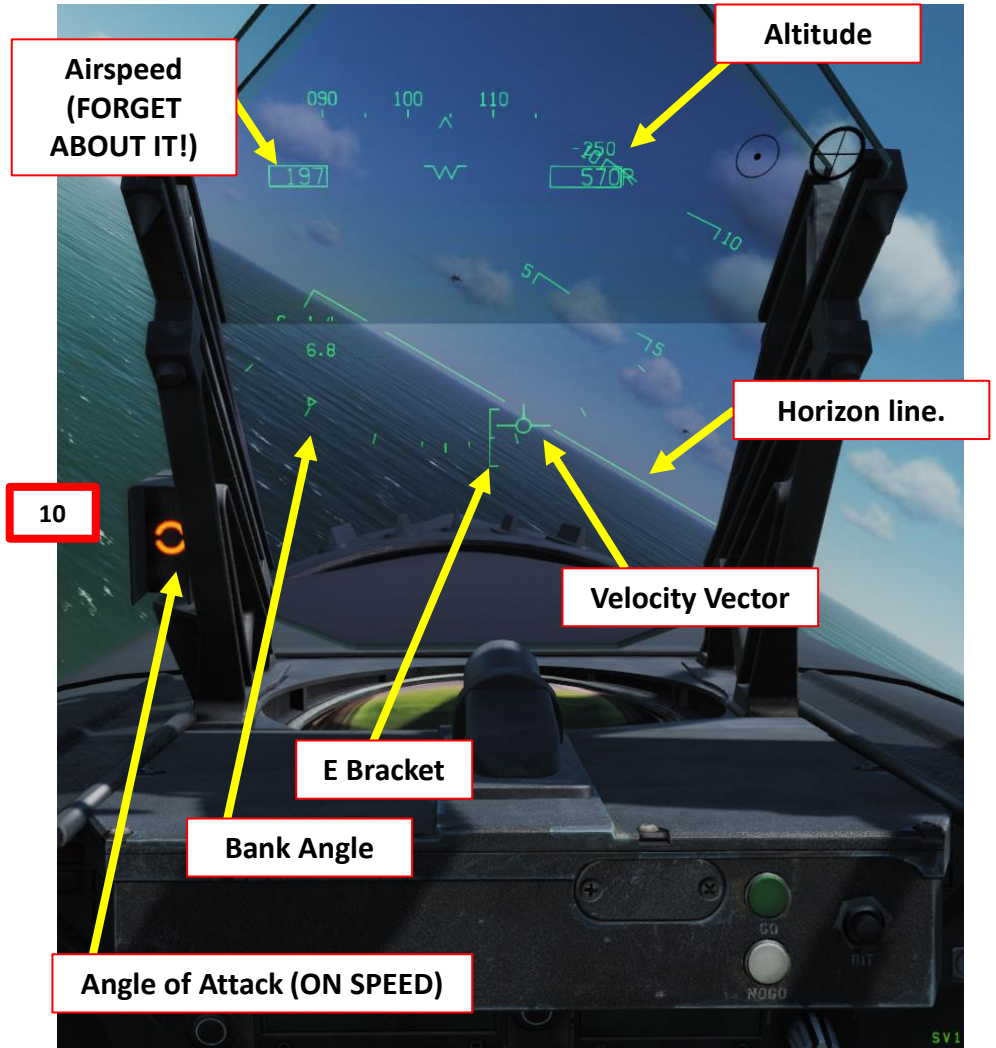


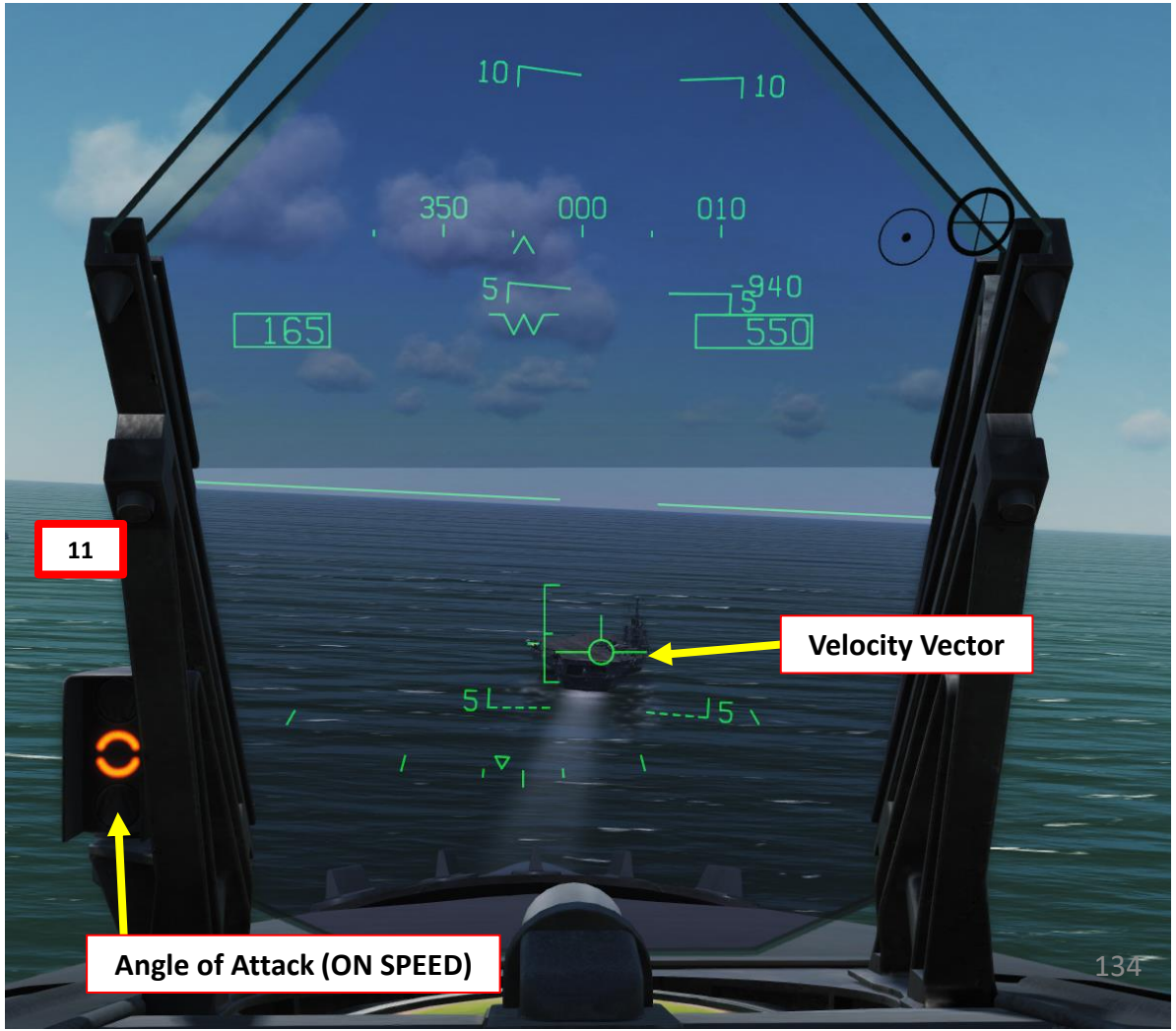
Groove (Short Final)

Approach Turn

CARRIER LANDING
CASE I RECOVERY

10. When turning to base leg, start a 30-degree bank while maintaining the Velocity Vector and the E bracket just below the horizon line. Maintaining the 600 ft altitude will require you to adjust the throttle constantly. Forget about your airspeed: just focus on maintaining altitude and bank angle.
11. When lined up with the ship, you will be entering the "groove" (short final).
12. Once wings are level, you would normally "call the ball". Example: "403, Hornet Ball, 3.0". (Side number of your Hornet, Aircraft Type, "Ball", Fuel State/Remaining in thousands of pounds). The LSO (Landing Signal Officer) would then respond with "Roger Ball" and then give you corrections to land properly.

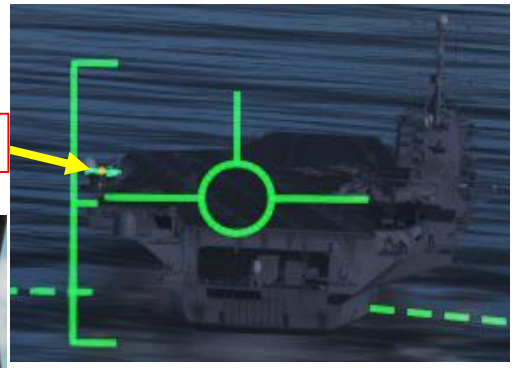


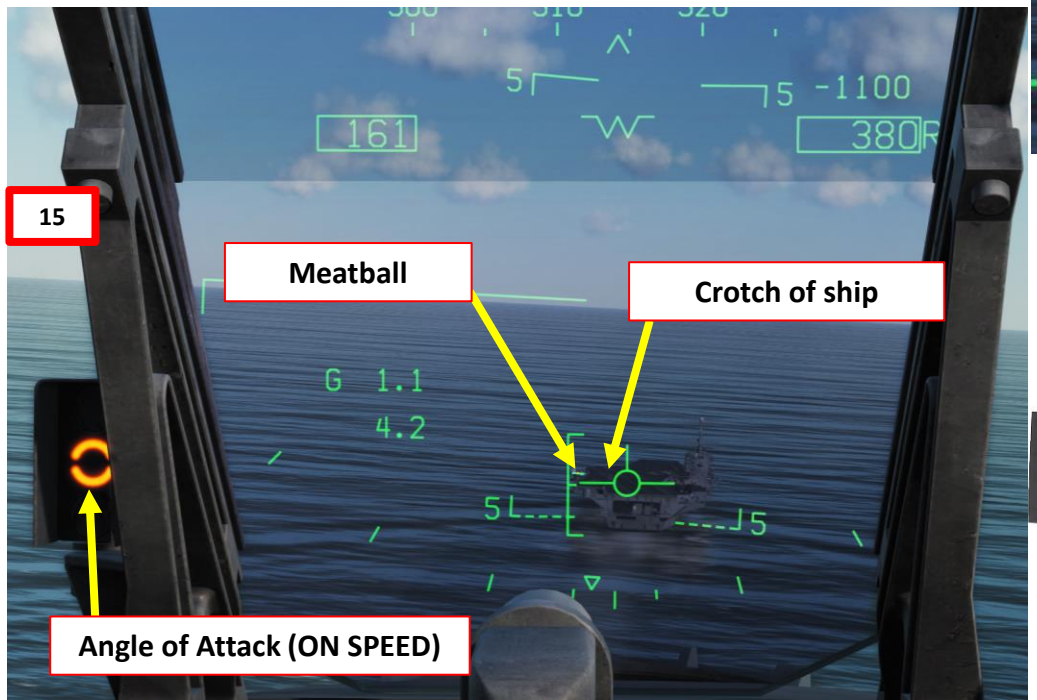


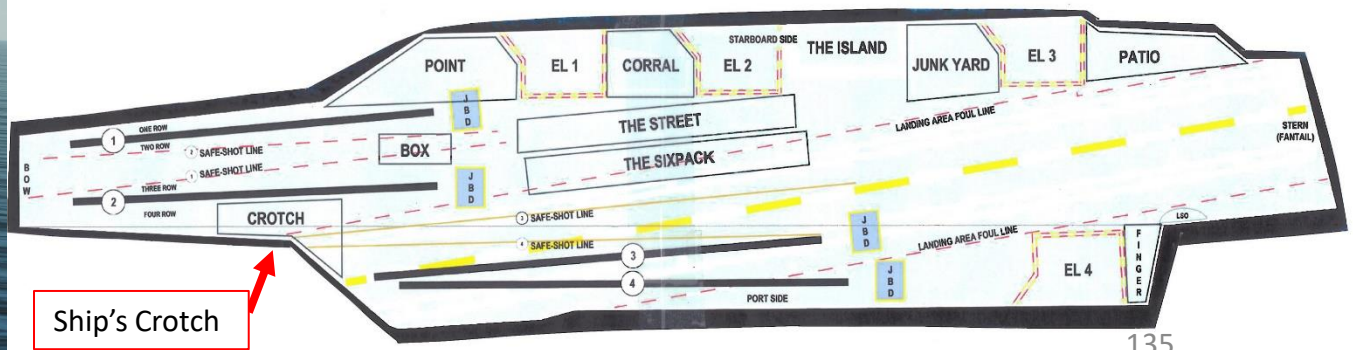
CARRIER LANDING
CASE I RECOVERY

13. When entering the groove (final), if you set up your turn correctly the velocity vector should be lined up with the crotch of the ship. This is called “Spotting the Deck”, and you should **NOT** use this as a reference to land. **Use the meatball, E bracket and the AoA Indexer instead as a reference** (see next page), and control your glide slope and angle of attack with your throttle. That’s called flying “pitch for speed, power for altitude”.
14. Don’t check your speed, if you have a good AoA, you’ll be on speed.
15. Once AoA Indexer shows that you are ON SPEED (orange donut) and that your velocity vector is on the runway, just let yourself touchdown on the carrier. **DO NOT FLARE**. Ever. It will feel like a controlled crash into the deck; that’s normal. **Don’t use brakes either**.

SYMBOL	AIRSPEED	AOA
	Slow	9.3° to 90.00°
	Slightly slow	8.8° to 9.3°
	On speed	7.4° to 8.8°
	Slightly fast	6.9° to 7.4°
	Fast	0° to 6.9°



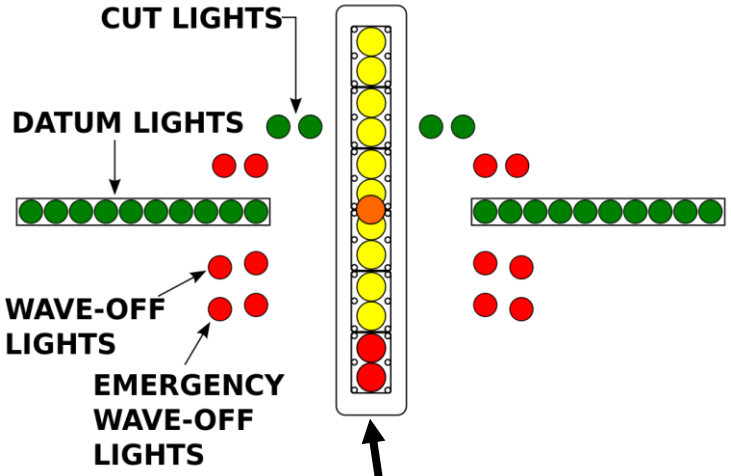




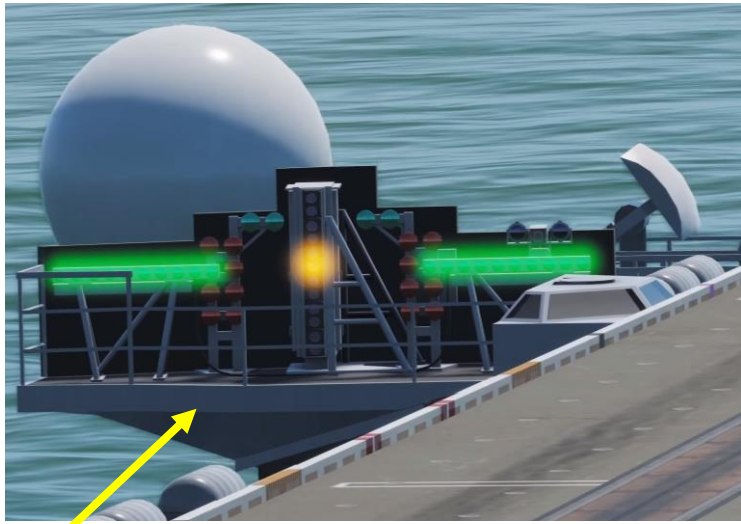
CARRIER LANDING
CASE I RECOVERY

But what is "**the ball**" (or "meatball"), exactly? In fact, it's the IFLOLS (Improved Fresnel Lens Optical Landing System), which acts a bit like PAPI lights but for aircraft carriers. The color of the lights you see will depend on what your angle with the lights and will tell you your glide slope, or in other words "if you need to add or reduce power". The lights that will matter the most are the vertical center lights.

- If you see the bottom red lights ("Atomic Sunrise"), you're about to hit the back of the ship. Throttle up and go around!
- If you see a centered orange light, you're on the ball and should catch a wire.
- If the ball is high, this means you should reduce power very slightly.
- If the ball is low, you need to add power
- Avoid making large power corrections and stay lined up as much as possible.
- Overall, keep your eyes glued to your AoA Indexer and the "ball". It will tell you what to do.



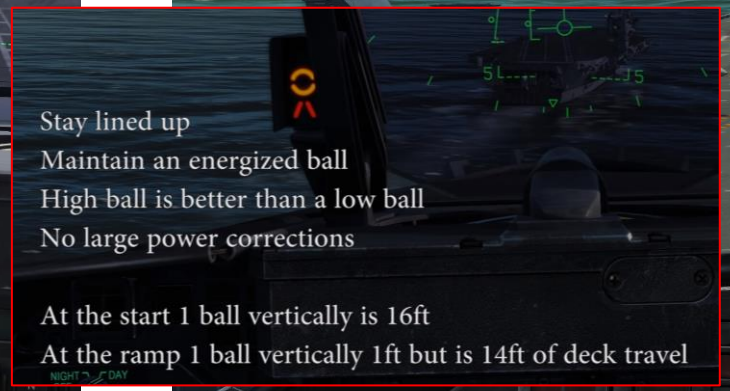
Vertical scale: This is what you should monitor throughout the whole landing.



IFLOLS (Improved Fresnel Lens Optical Landing System)
Also called as "the ball" or "meatball", the IFLOLS is used as visual aid to land on the carrier.



AoA Indexer: provides a similar function to the IFLOS.



That picture shows the AoA Indexer telling me that I am too fast and the meatball telling me I am too low. It will not tell me that I am too far left of lineup though.

CARRIER LANDING
CASE I RECOVERY



CARRIER LANDING
CASE I RECOVERY

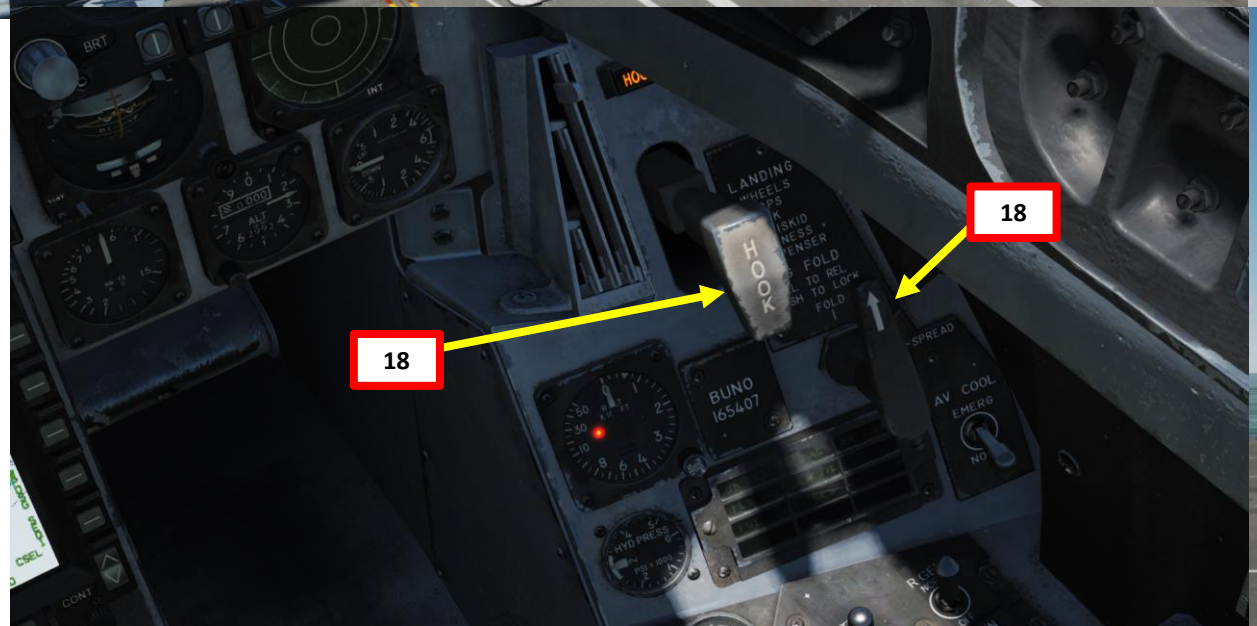
16. You should aim for the third arrestor wire. First and second wires indicate a short landing, while the fourth wire indicates a long landing.
17. Once you touch the deck, throttle up to MIL power (just before afterburner detent). This will make sure that you have enough power to go around if your hook misses an arrestor wire (this is what we call a “bolter”) or you catch a wire and it snaps.
18. Once the aircraft has come to a full stop, throttle down, raise arrestor hook, set flaps UP, fold wings and taxi to the nearest parking area. The WING FOLD lever needs to be pulled first (scroll mousewheel), then rotated left to FOLD (left click).



CARRIER LANDING
CASE I RECOVERY

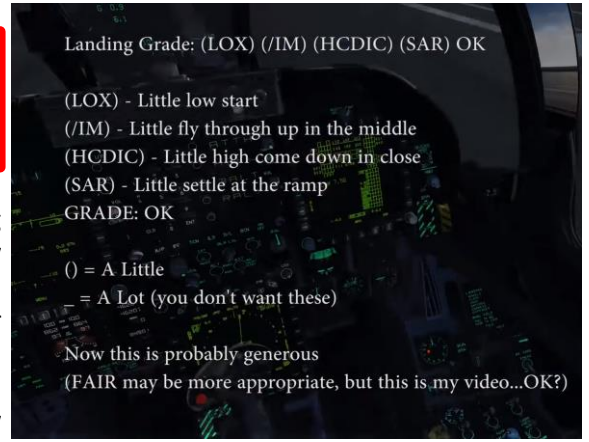








CARRIER LANDING
LSO (LANDING SIGNAL OFFICER)

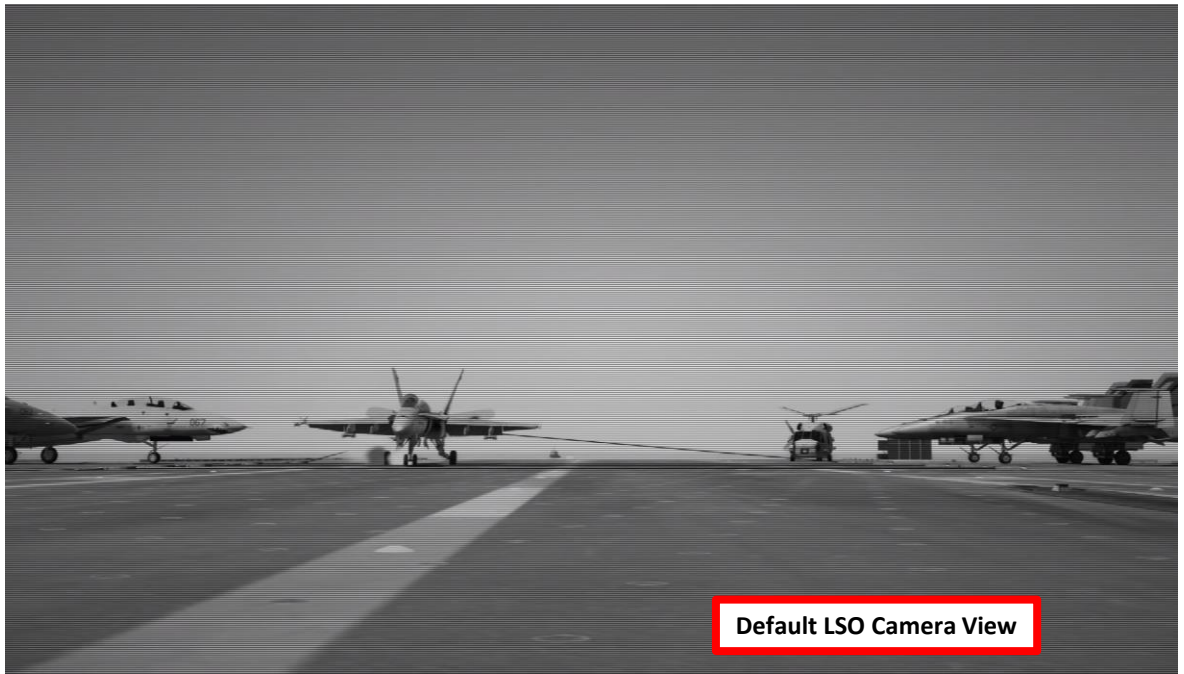


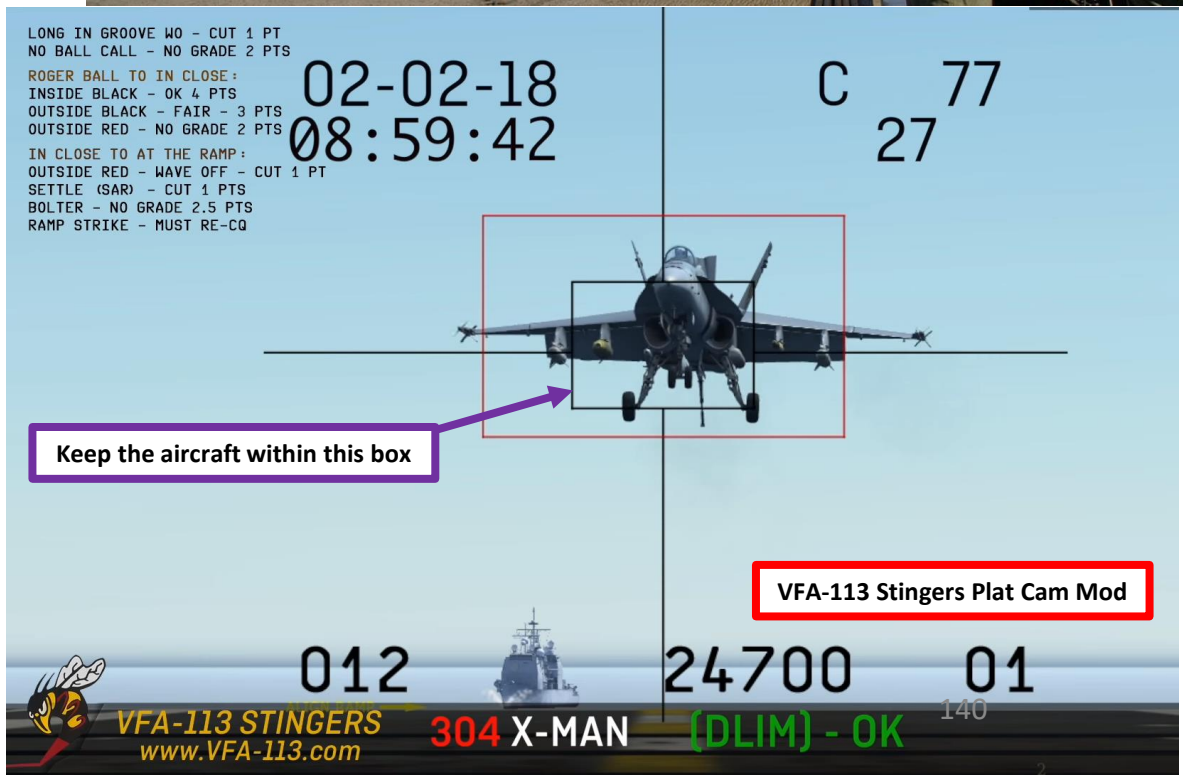
You can also roleplay in multiplayer as the "**LSO**" (Landing Signal Officer), you can! You can select the LSO camera by pressing "LALT+F9". The camera can be moved and zoomed in or out using LCTRL+[Numpad *] or LCTRL+[Numpad /]

You can help the pilot line up properly for landing by giving him corrective commands like "Come right for lineup, Come Left, You're high, (Add) Power". Once the pilot has landed, you can also give him a "grading" based on how he landed.



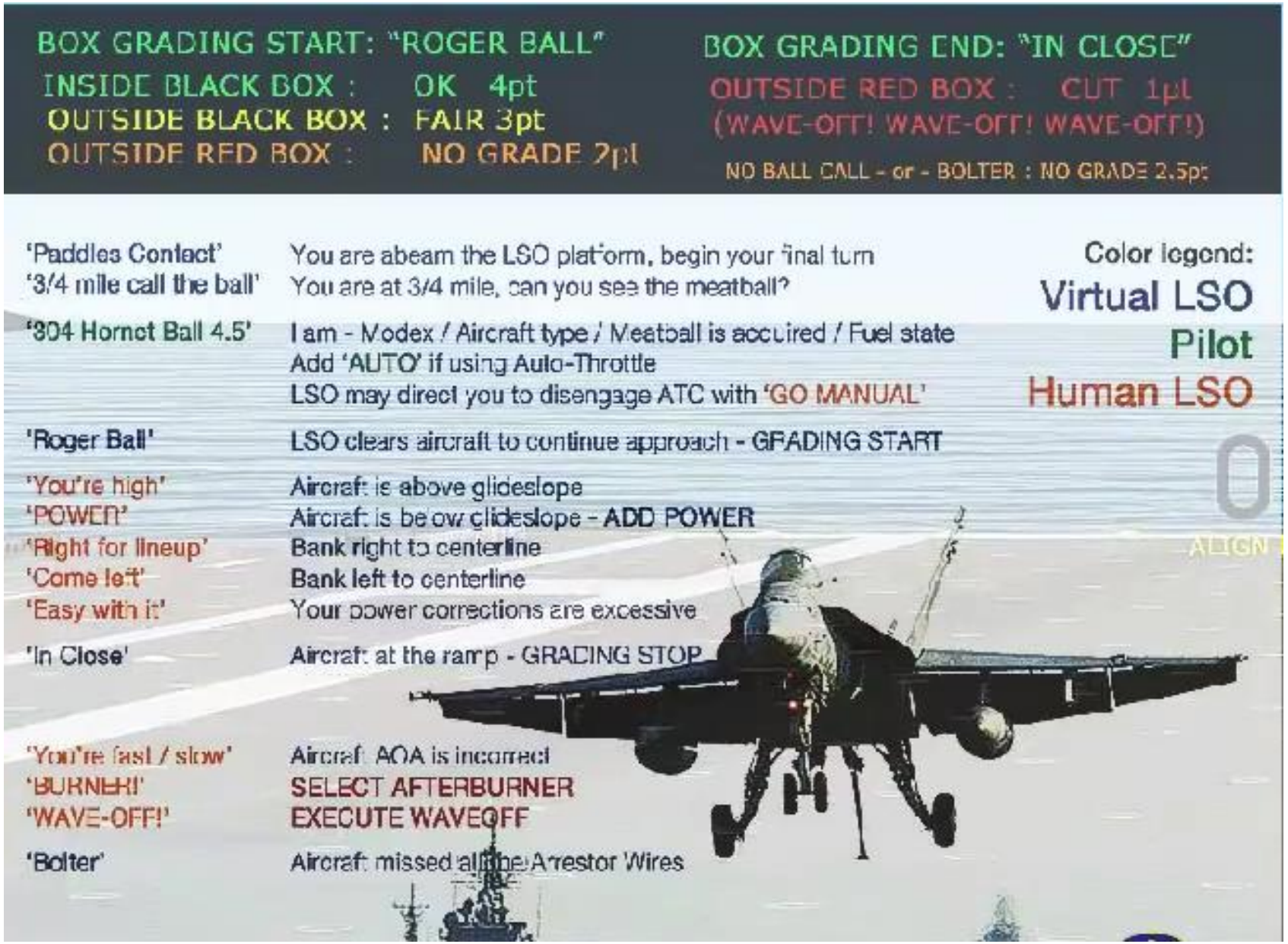
There is a cool LSO mod by the VFA-113 Stingers that gives you a slick overlay:
LSO Mod Link: www.VFA-113.com
LSO Mod Video: https://www.youtube.com/watch?v=vDG1_v1CJVI





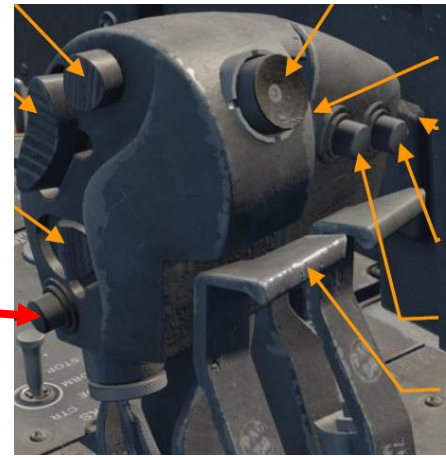
CARRIER LANDING
LSO COMMUNICATIONS & GRADING

The VFA-113 Stingers have a short course on LSO & Carrier Landing Grading
LSO Training Course Link: https://youtu.be/BbMw4PcvMyY



GENERAL LANDING TIPS
Caging the Velocity Vector

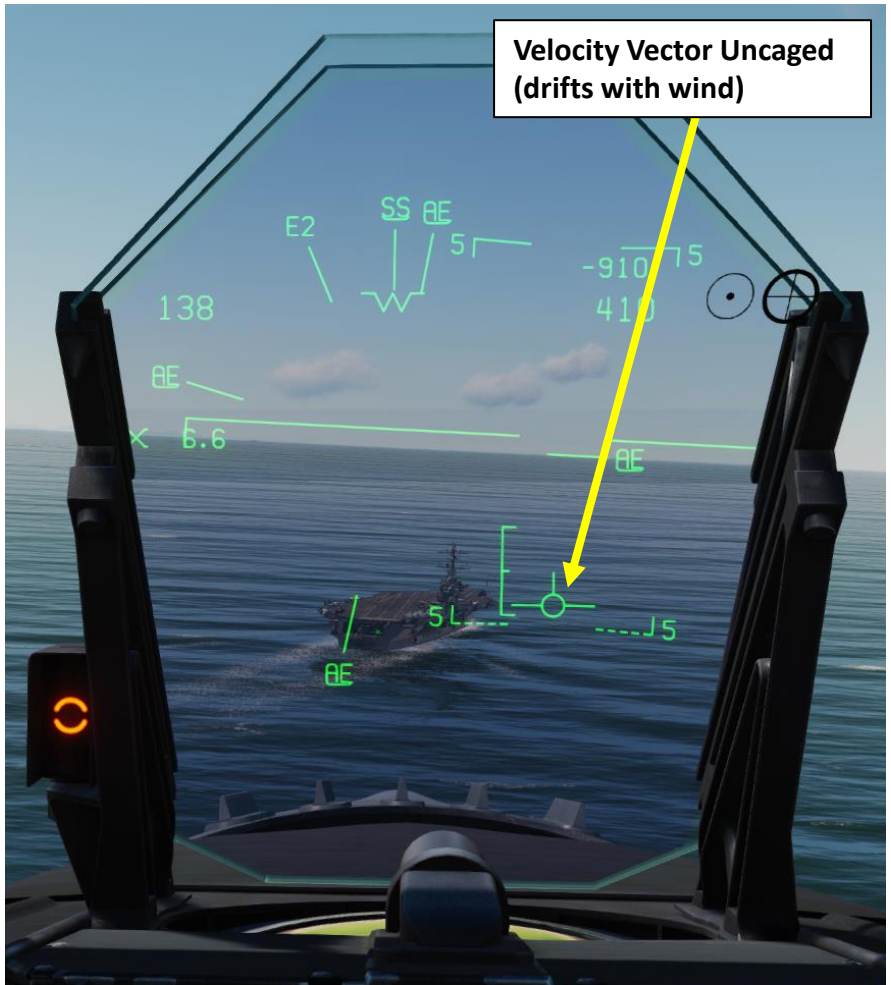
In **high crosswind conditions**, the velocity vector on your Heads-Up Display will drift away from the visible region of the HUD. The velocity vector represents the point toward which the aircraft is flying along the aircraft's actual flight path. You can "cage" the velocity vector (its lateral component will remain in the center of the HUD), which allows you to still get accurate vertical vector component, which is great for maintaining altitude or visualizing the angle of attack.



To cage or uncage the HUD:

a) Make sure you are in NAV Master Mode (A/A and A/G Master Mode buttons are both OFF)
b) Press the Cage/Uncage button on the Throttle ("C" binding) to toggle between Uncaged and Caged mode







GENERAL LANDING TIPS
HUD Declutter Function

The Heads-Up Display of the Hornet contains a lot of information, and during certain landing phases the amount of information may clutter up the HUD and make things harder to read than necessary. Thankfully, the HUD Symbology Reject Switch allows you to reject (de-clutter) superfluous information and leave you with only the stuff you really need.

Setting the HUD Symbology Reject switch to REJ 2 is very useful in Case III operations where you need to carefully track localizer and glide slope bars on the HUD.

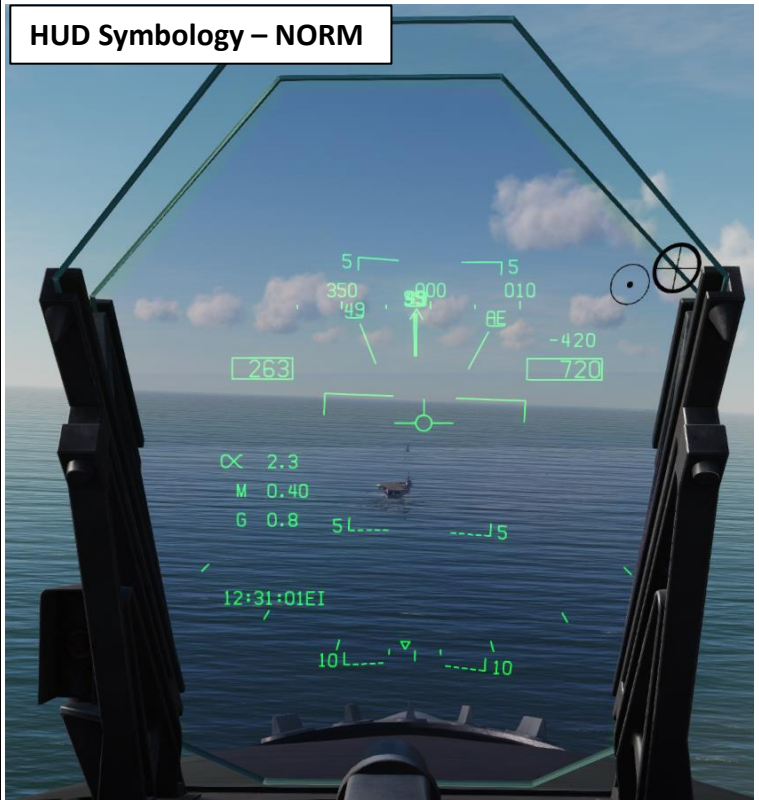




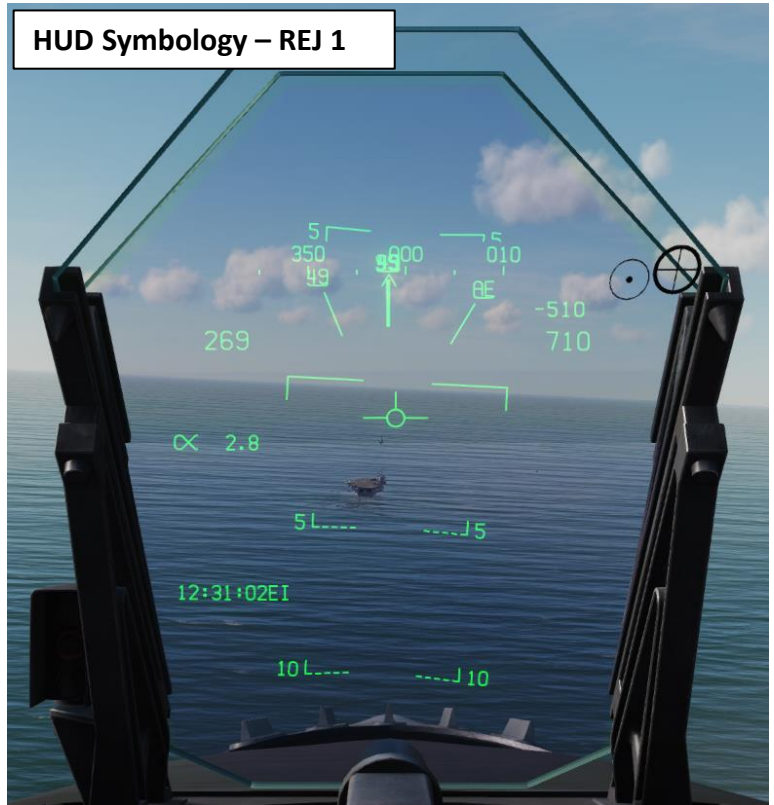
HUD Symbology Reject Switch

- REJ 1 removes aircraft Mach number, aircraft Gs, bank angle and pointer, airspeed box, altitude box, peak positive G and required ground speed cue from the HUD.
- REJ 2 removes all REJ 1 symbology plus heading scale, current heading indication, command heading marker, NAV/TACAN range, and ET/CD timer.

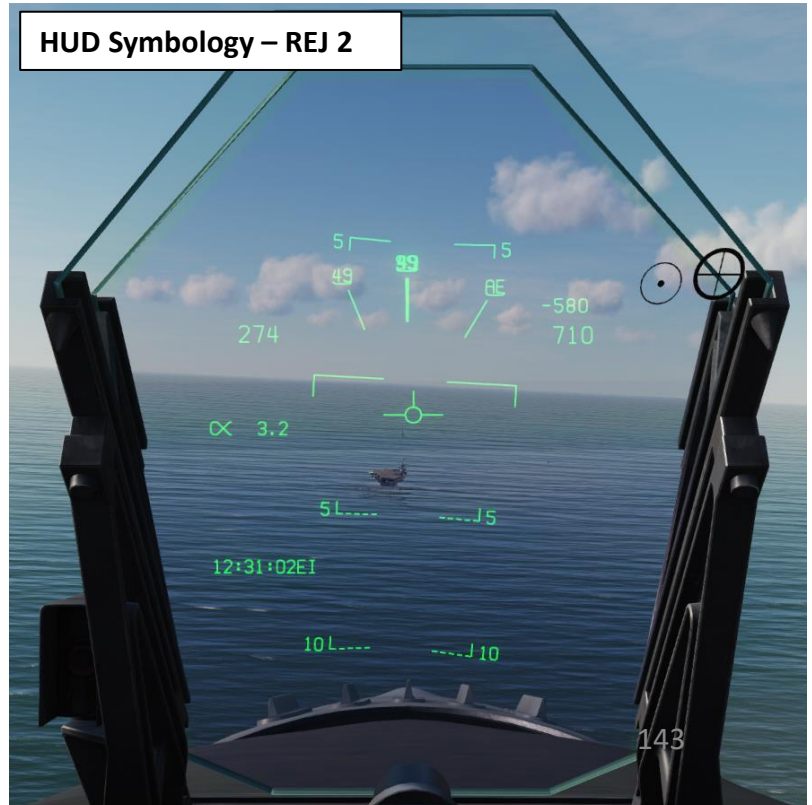
HUD Symbology – NORM



HUD Symbology – REJ 1



HUD Symbology – REJ 2



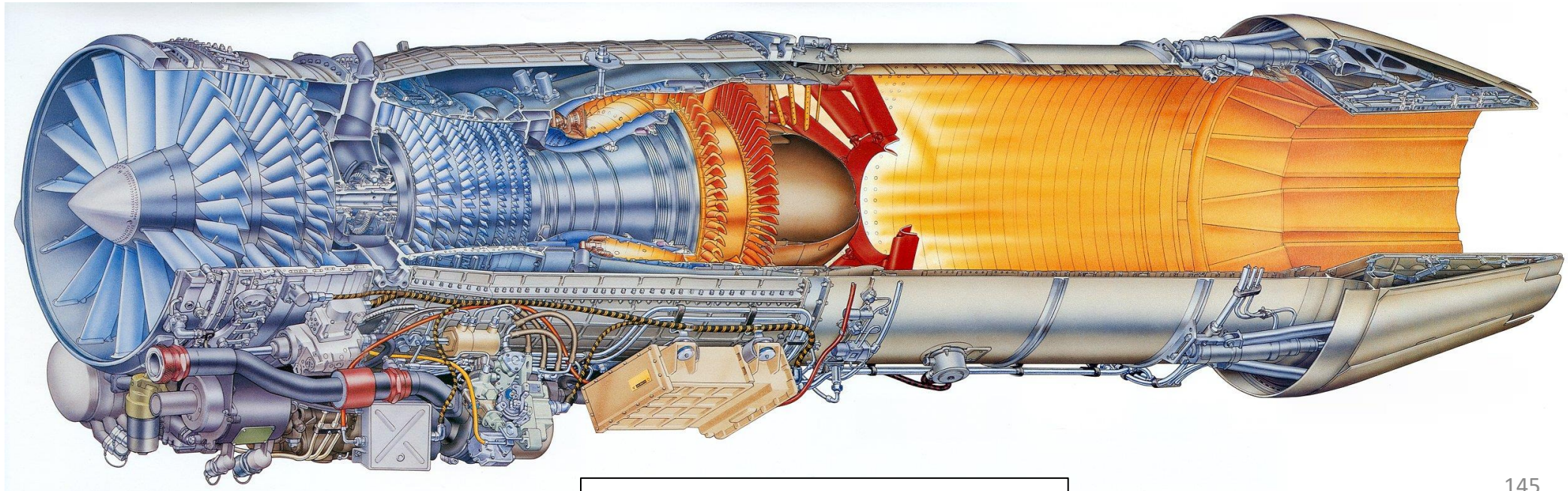


GENERAL ELECTRIC **F404**-GE-402 ENGINE

The Legacy “Charlie” Hornet is powered by two General Electric F404-GE-402 afterburning turbofan engines, which are able to provide 11,000 lbf (49 kN) of thrust each dry, 17,750 lbf (79.0 kN) with afterburner.

GE developed the F404 for the F/A-18 Hornet, shortly after losing the competition for the F-15 Eagle's engine to Pratt & Whitney, and losing the Lightweight Fighter (LWF) competition to the Pratt & Whitney F100 powered YF-16. For the F/A-18, GE based the F404 on the YJ101 engine they had developed for the Northrop YF-17, enlarging the bypass ratio from .20 to .34 to enable higher fuel economy. The engine was designed with a higher priority on reliability than performance. Cost was the main goal in the design of the engine.

GE also analyzed "throttle profiles" and found that pilots were changing throttle settings far more often than engineers previously expected; putting undue stress on the engines. GE also sought with the F404 a design that would avoid compressor stalls and other engine failures, and would respond quickly to control inputs; a common complaint of pilots converting from propeller planes to jets were that early turbojets were not responsive to changes in thrust input. Due to a fan designed to smooth airflow before it enters the compressor, the F404 has high resistance to compressor stalls, even at high angles of attack. It requires less than two shop visits per 1,000 flight hours and averages 6,500 hours between in-flight events. It also demonstrates high responsiveness to control inputs, spooling from idle to full afterburner in 4 seconds. The engine contains an in-flight engine condition monitoring system (IECMS) that monitors for critical malfunctions and keeps track of parts lifetimes.



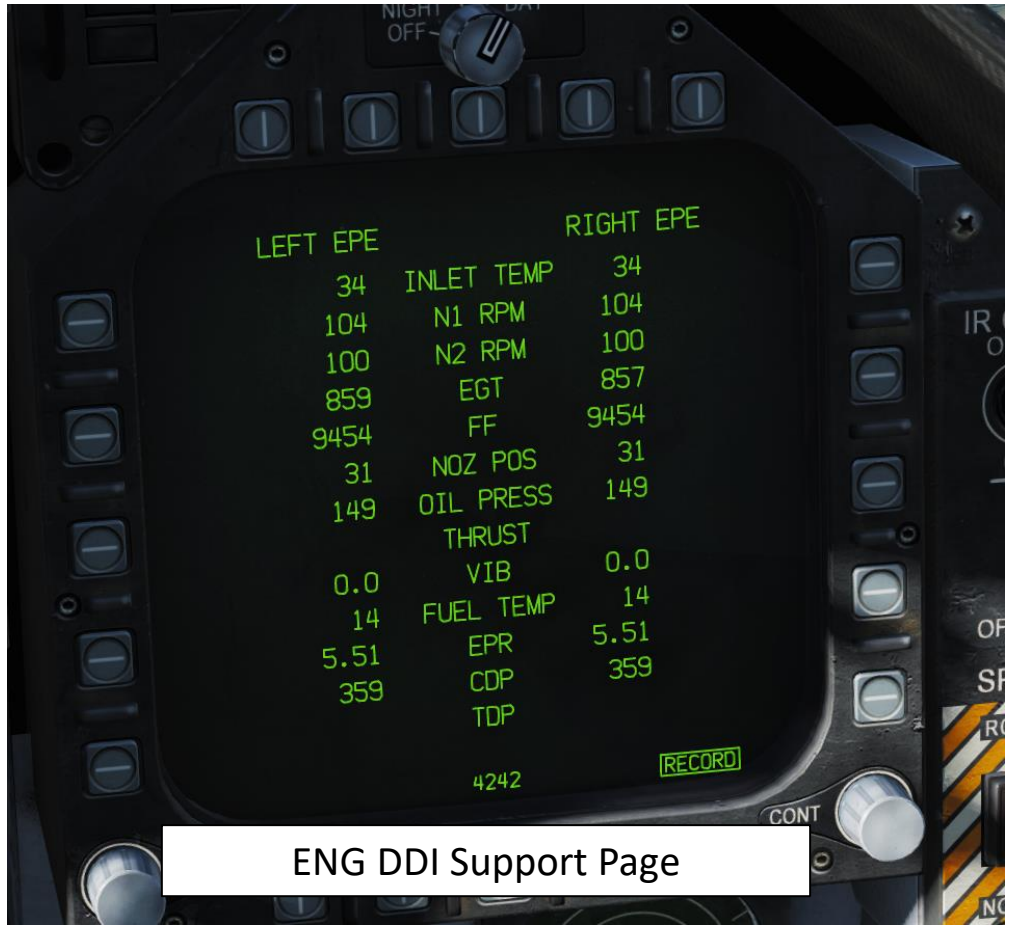
RM12 Variant of the F404 by Volvo

GENERAL ELECTRIC **F404**-GE-402 ENGINE

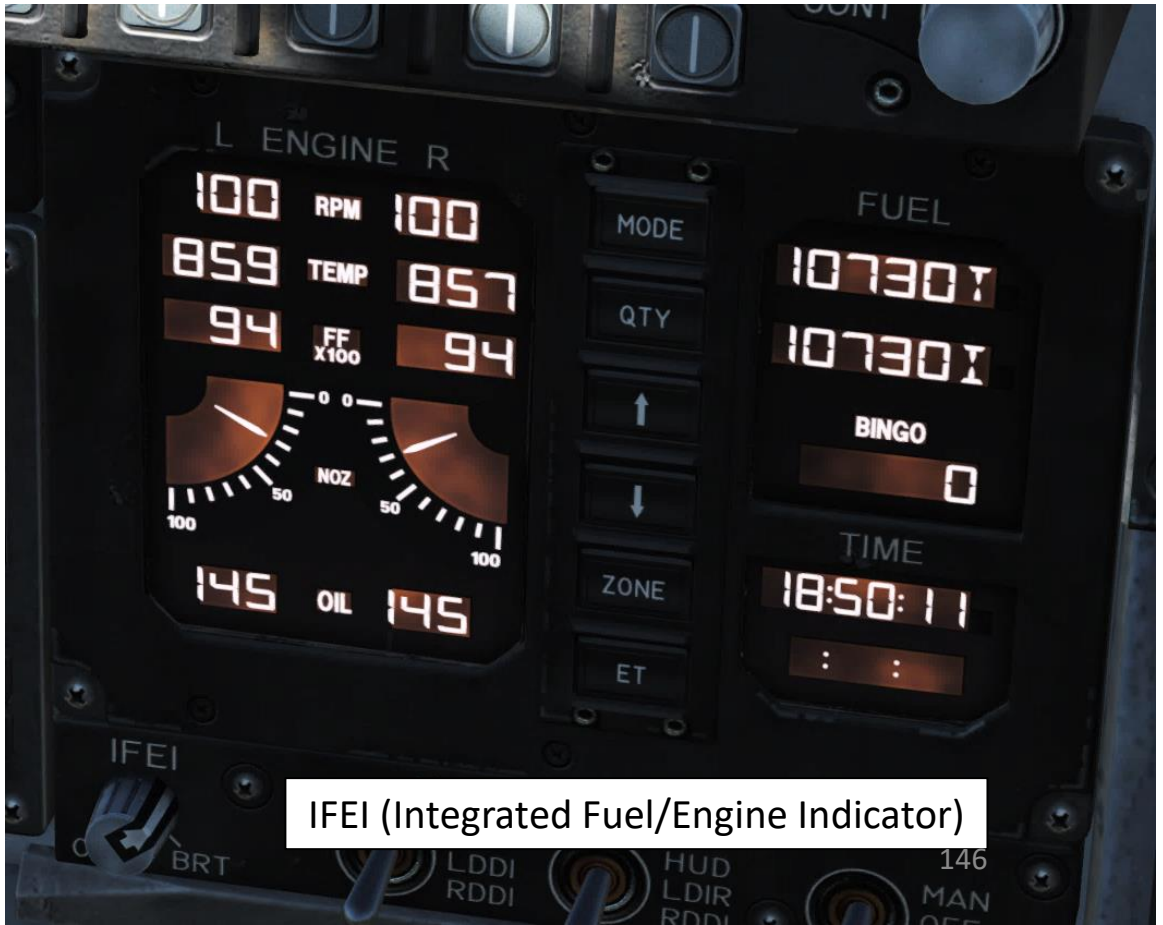
Keep in mind that even if the engine response is qualified as “quick” by modern standards, the engine spool time has a non-negligible lag time. This becomes apparent when landing on a carrier, where throttle input is critical in order to control your descent and glide slope.

Another peculiarity of the Hornet is that the reheaters (afterburners) can only be monitored with the nozzle angle and the afterburner sounds. The fuel flow indication does **not** give you the added fuel flow injected to the jet pipe downstream of (i.e. after) the turbine to the afterburner section. You can monitor engine parameters on the DDI ENG Support page and on the IFEI (Integrated Fuel/Engine Indicator) panel.

Additionally, the ATC (Automatic Throttle Control) system is a two-mode auto-throttle system that automatically maintains angle of attack (approach mode) or airspeed (cruise mode) by modulating engine thrust in the range of FLIGHT IDLE through MILITARY power. We will come back to the ATC in the « Autopilot » section of this guide.



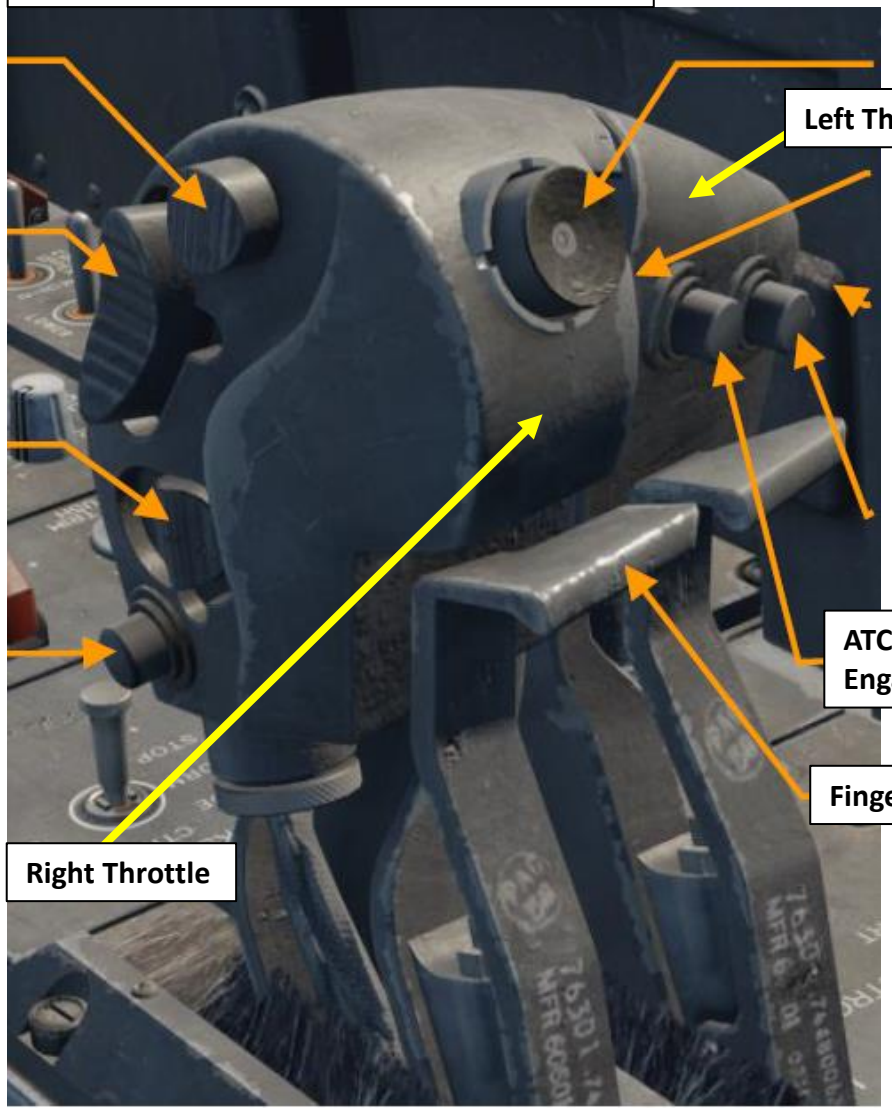
ENG DDI Support Page



IFEI (Integrated Fuel/Engine Indicator)

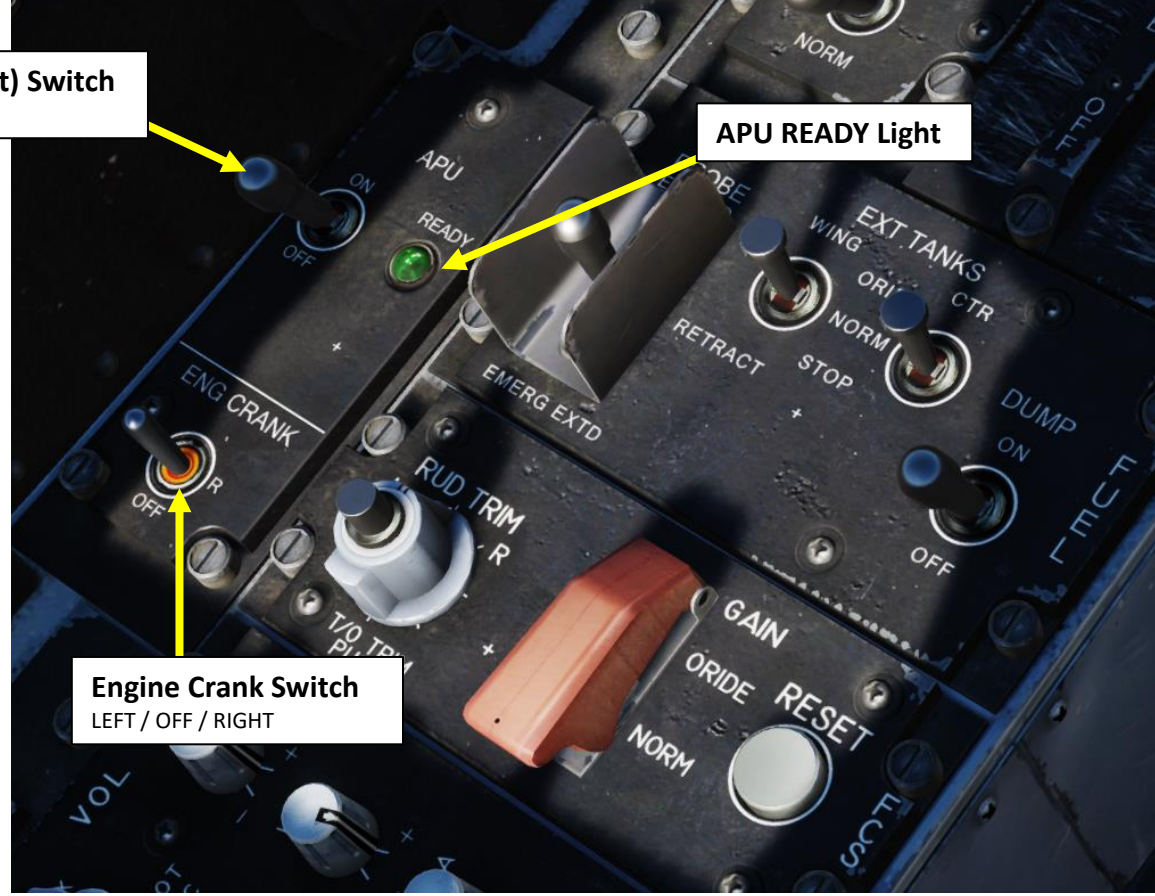
ENGINE CONTROLS

Finger lifts act as a stopper that prevents throttles from accidentally going from IDLE to OFF once engines are started. In order to shut down an engine, finger lifts are raised by pressing “0” for right throttle and “9” for left throttle.



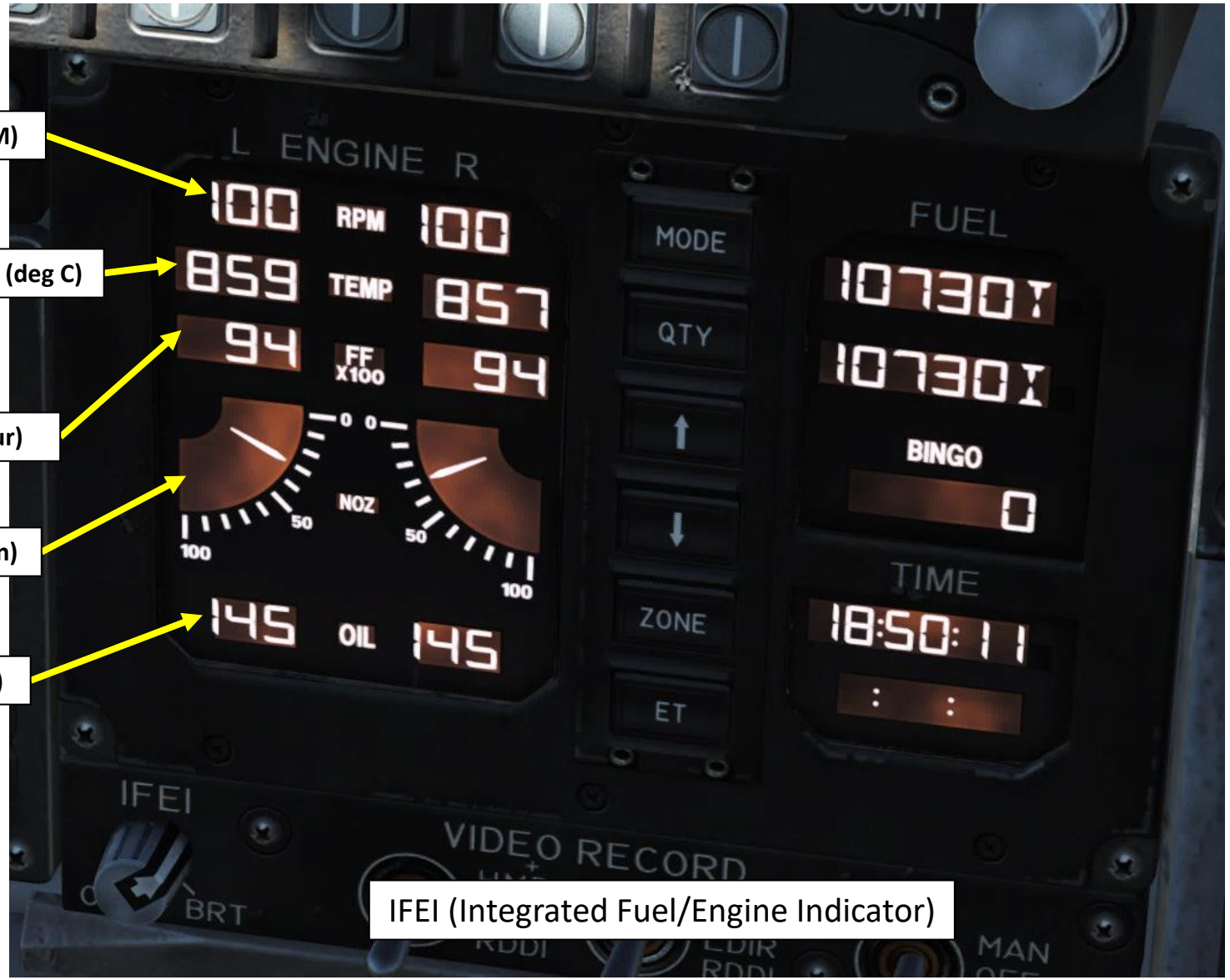
APU (Auxiliary Power Unit) Switch
OFF / ON

APU READY Light



Engine Crank Switch
LEFT / OFF / RIGHT

ENGINE INDICATIONS



Engine RPM Indication (%RPM)

EGT (Exhaust Gas Temperature) (deg C)

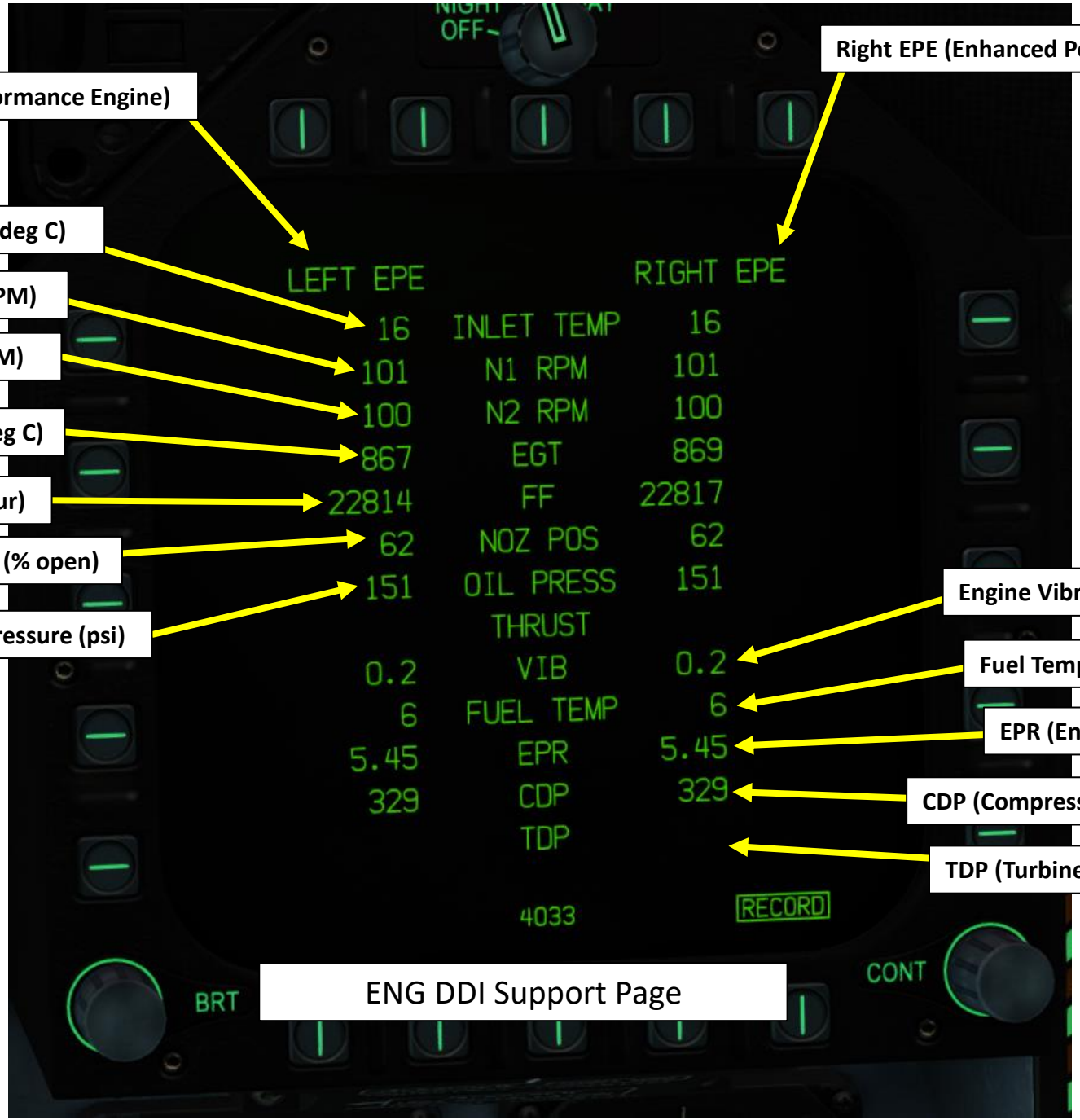
Engine Fuel Flow (x100 lbs/hour)

Engine Nozzle Position (% open)

Engine Oil Pressure (psi)

IFEI (Integrated Fuel/Engine Indicator)

ENGINE INDICATIONS



ENG DDI Support Page

Left EPE (Enhanced Performance Engine)

Right EPE (Enhanced Performance Engine)

Temperature at Engine Inlet (deg C)

Engine N1 (Fan) RPM Indication (%RPM)

Engine N2 (Compressor) RPM Indication (%RPM)

EGT (Exhaust Gas Temperature) (deg C)

Engine Fuel Flow (lbs/hour)

Engine Nozzle Position (% open)

Engine Oil Pressure (psi)

Engine Vibration Indication

Fuel Temperature (deg C)

EPR (Engine Pressure Ratio)

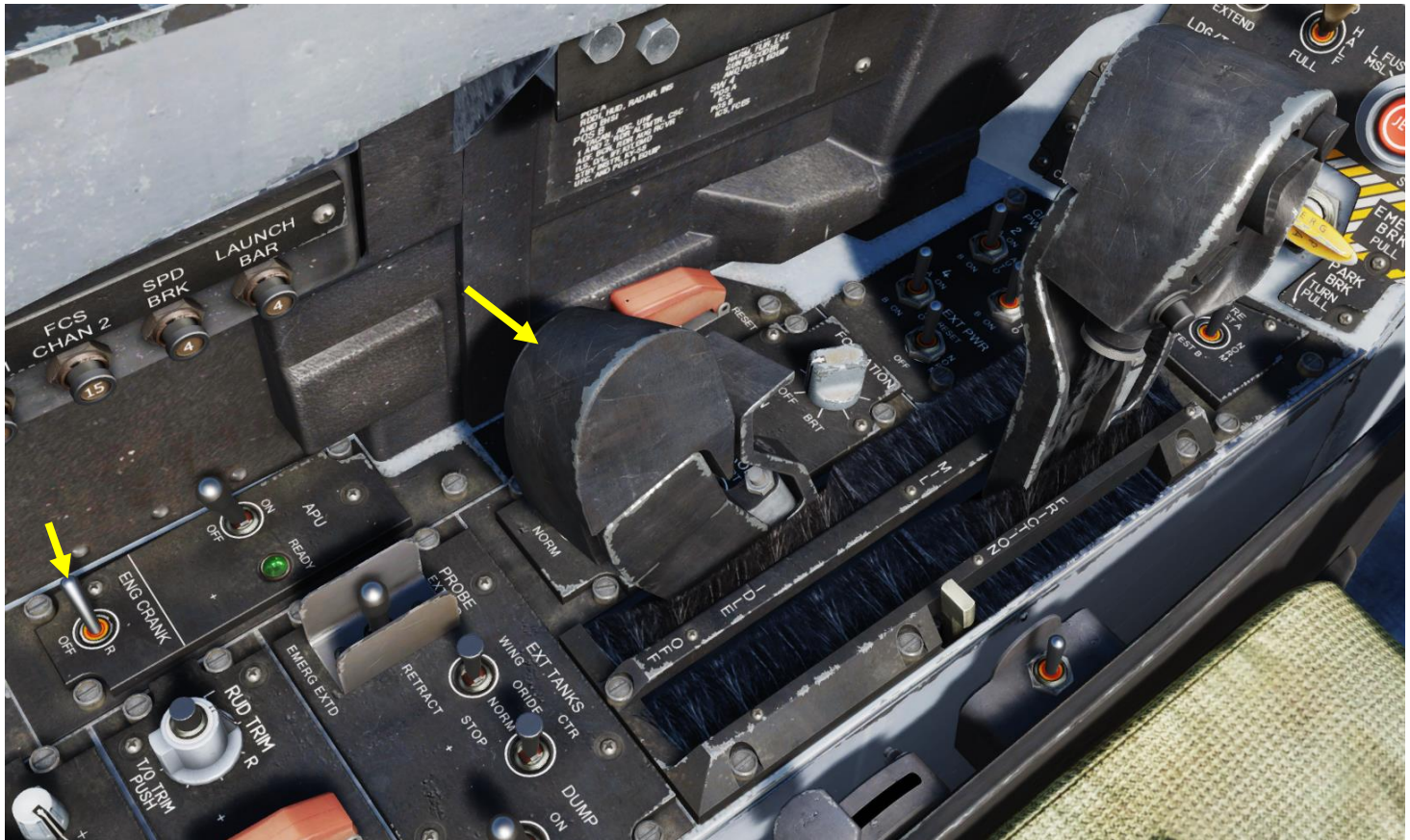
CDP (Compressor Discharge Pressure) (psi)

TDP (Turbine Discharge Pressure) (psi)

ENGINE RELIGHT PROCEDURE

If one of your engines happens to flame out during flight, you can restart it using a cross-bleed start. Bleed air is compressed air used for (among other things) engine start, and is normally provided for starting by the APU (Auxiliary Power Unit). Cross-bleed simply means air supplied across from one running engine to start the other.

1. Set flamed out engine throttle to IDLE or above.
2. Adjust aircraft airspeed to 350 kts or more. Maintaining a high airspeed will allow windmilling (air flow driving the engine compressor blades) to maintain an engine RPM between 12 % and 45 %, facilitating engine start. Windmill restart attempts made after RPM has degraded to 0 % may require up to 450 kts to obtain 12 % RPM for ignition.
3. Make sure that you are flying below 25000 ft.
4. Set ENG CRANK Switch to start flamed out engine
5. In case of a failed engine cross-bleed start, an engine restart with the APU as the bleed air source can be use as the last alternative.





FIRE DETECTION & SUPPRESSION SYSTEM

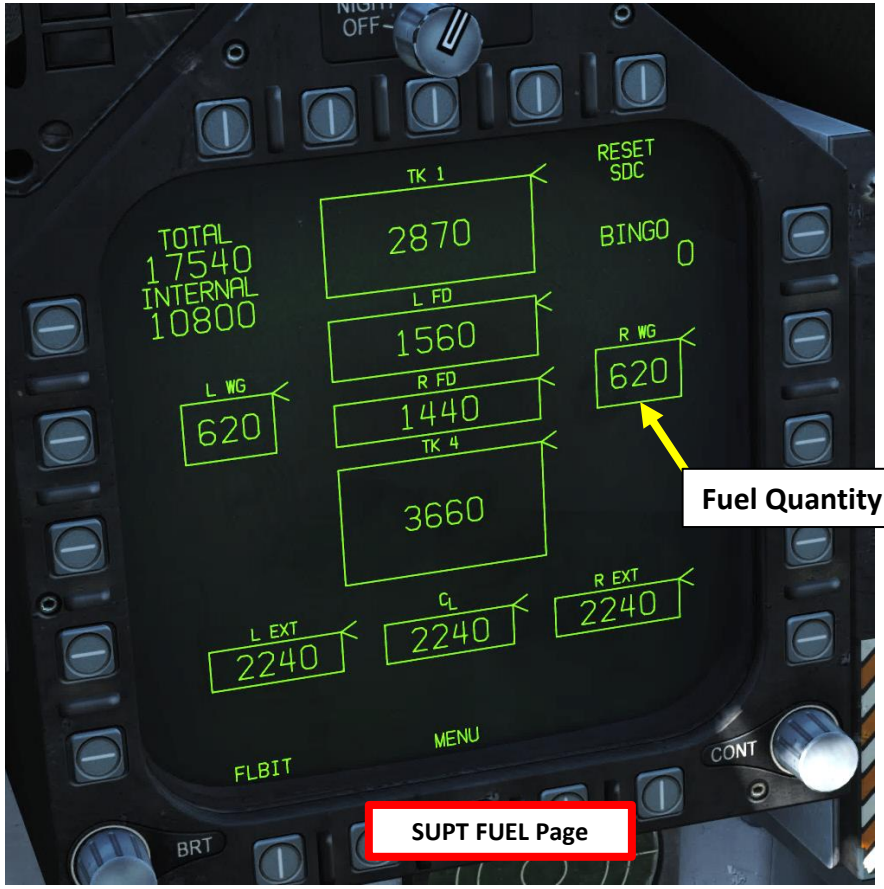
The fire detection and suppression system of the Hornet is pretty straightforward:

- When fire is detected, the FIRE Warning lights for the affected engine (or APU) will illuminate.
- The FIRE Warning lights are also pushlights as well. When pressing a FIRE pushlight, the corresponding engine feed shutoff valve at the feed tanks closes, the crossfeed valve closes and the system arms the corresponding engine fire or APU extinguisher system.
- When fuel shutoff valves are closed, press the Fire Extinguisher Discharge pushbutton. This will discharge a chemical agent to extinguish the fire.

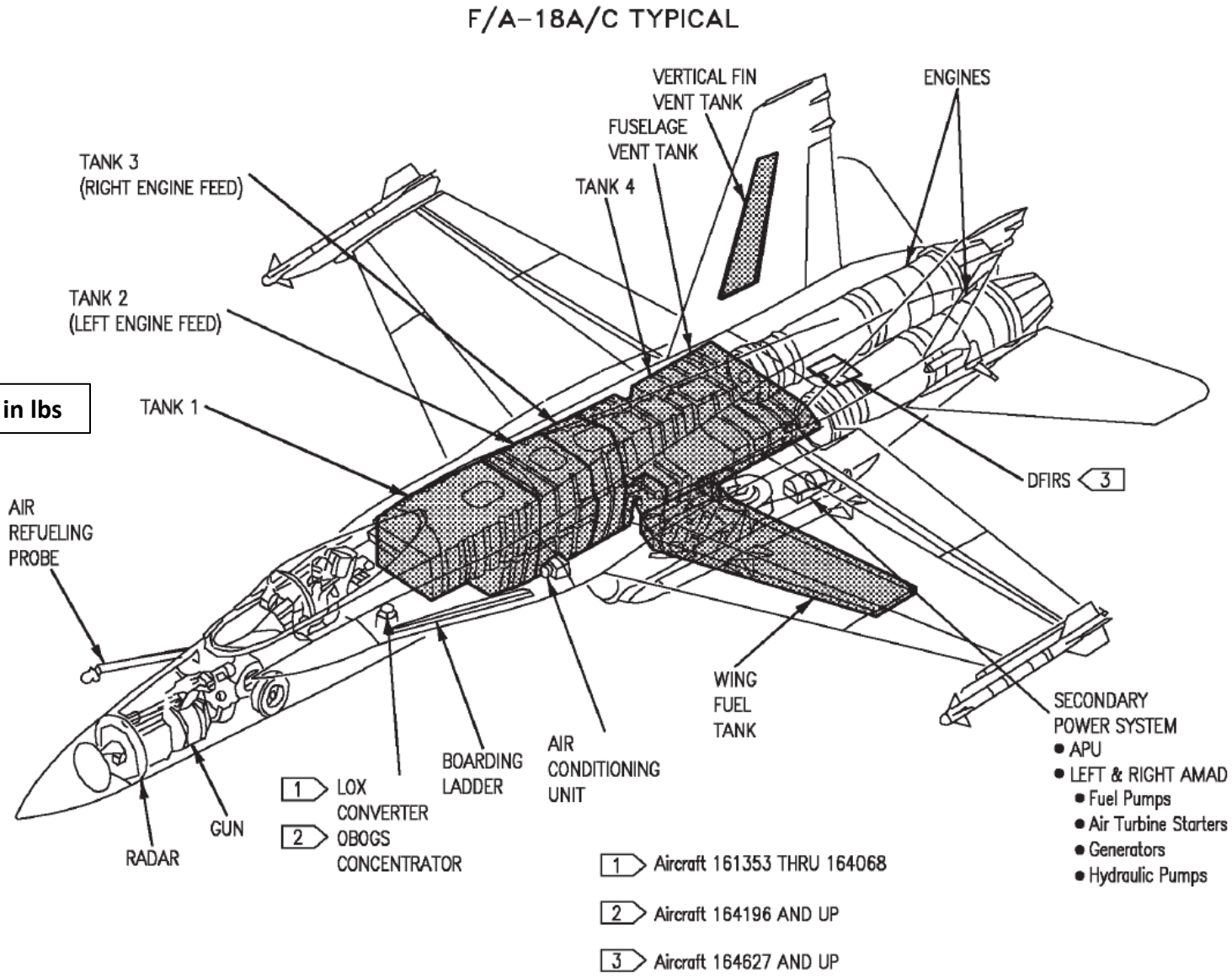




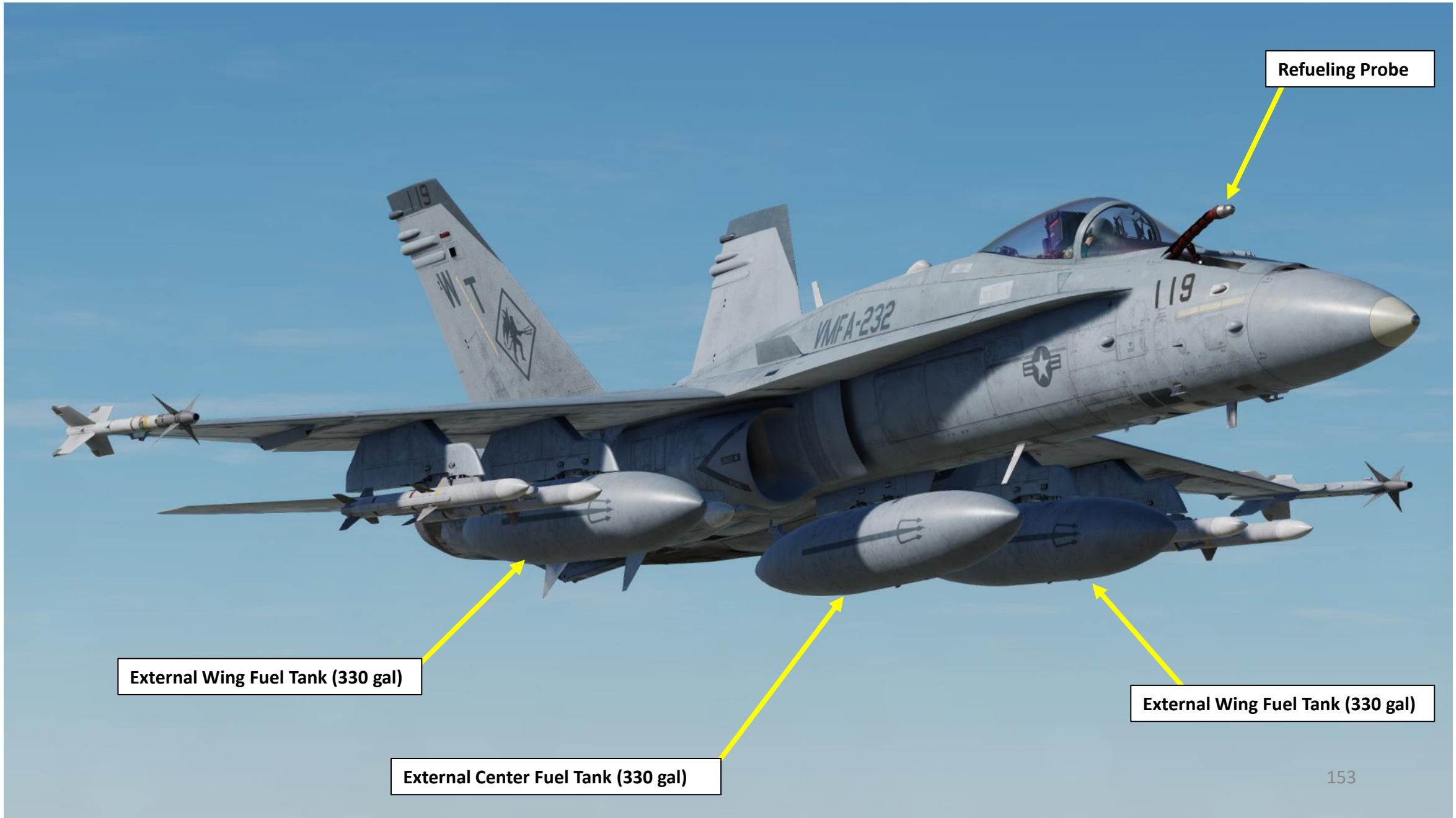
FUEL SYSTEM OVERVIEW



FUEL TANK	DESCRIPTION
TK 1	Fuselage Fuel Tank (No. 1)
L/R FD	Left/Right Fuselage Engine Feed Tanks (No. 2 & 3)
TK 4	Fuselage Fuel Tank (No. 4)
L/R WG	Left/Right Wing (Wet) Fuel Tank
L/R EXT	Left/Right External Fuel Tanks
CL	Centerline External Fuel Tank



FUEL SYSTEM OVERVIEW

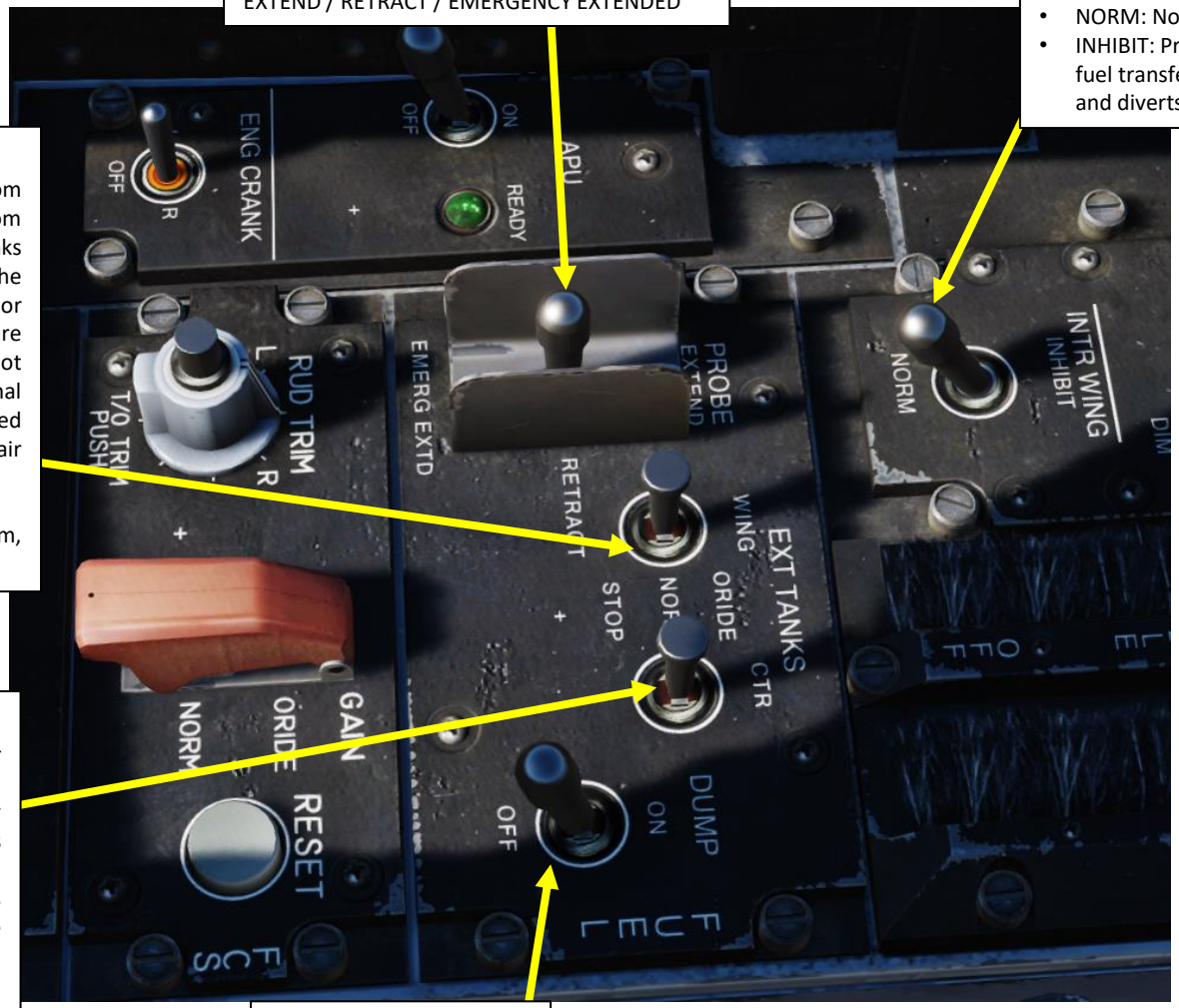


FUEL SYSTEM OVERVIEW

Refueling Probe Control Switch
EXTEND / RETRACT / EMERGENCY EXTENDED

Internal Wing Fuel Tank Control Switch
- NORM: Normal
- INHIBIT: Prevents refueling of the internal wing tanks, prevents fuel transfer from the internal wing tanks except by gravity, and diverts recirculated fuel to the engine feed tanks.

External Wing Fuel Tanks Control Switch
- OVERRIDE: Provides pressurization of and fuel transfer from all wing external tanks during refueling. Fuel transfer from the external tanks is accomplished by pressurizing the tanks with bleed air from the engines. This pressure pushes the fuel into the aircrafts fuel system. With weight-on-wheels, or when the fuel-probe is extended, the External tanks are unpressurized, therefore fuel transfer from the tanks is not possible. "Override" allows for pressurization of the external tanks, thus fuel transfer from the external tanks is enabled during weight-on-wheel conditions, and during air-to-air refueling.
- NORM: Normal allows refueling of selected external
- STOP: Shuts wing fuel tank(s) off from the fuel system, disabling fuel transfer and refueling.



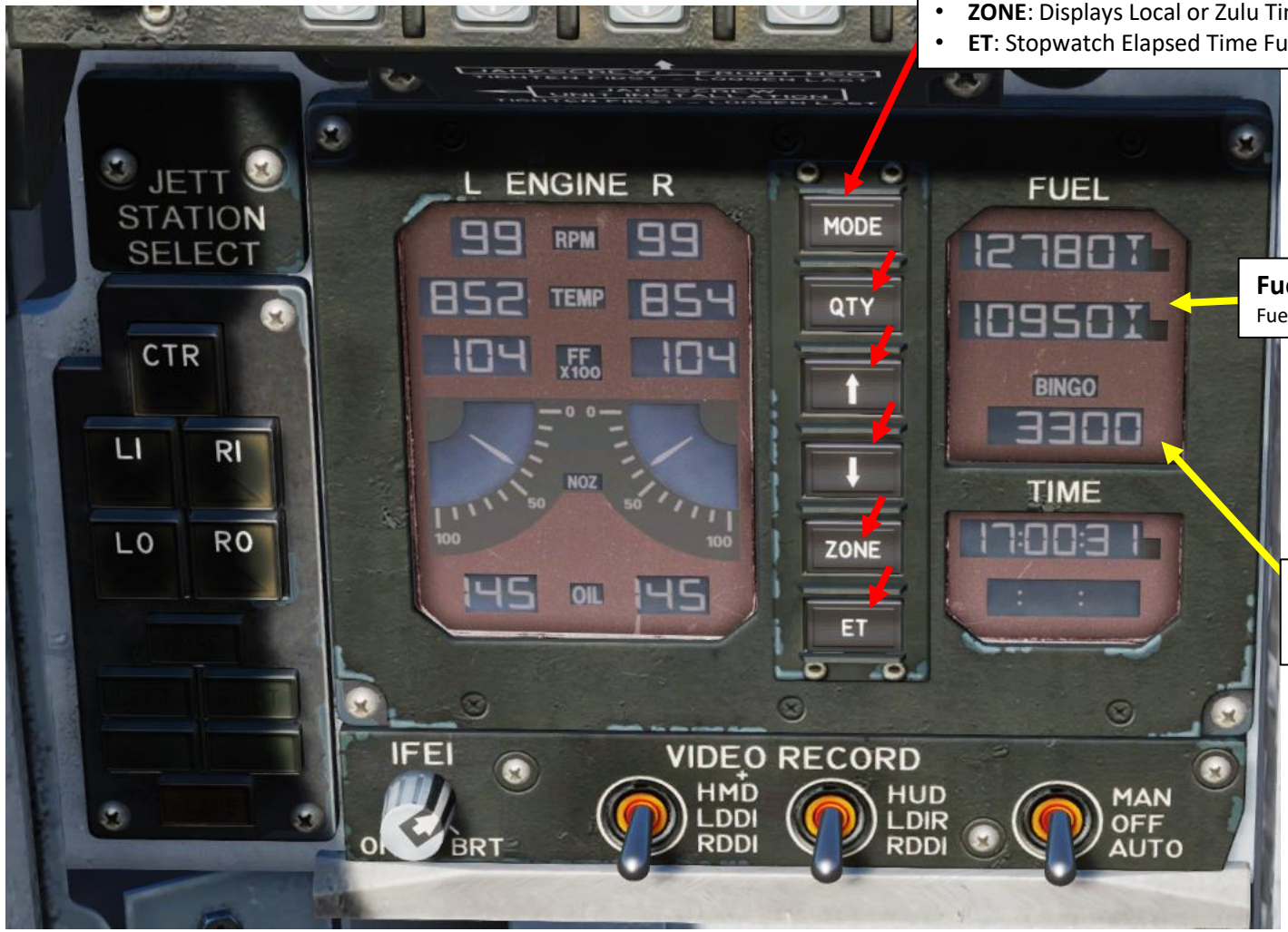
External Center Fuel Tank Control Switch
- OVERRIDE: Provides pressurization of and fuel transfer from all installed external tanks during refueling. Fuel transfer from the external tanks is accomplished by pressurizing the tanks with bleed air from the engines. This pressure pushes the fuel into the aircrafts fuel system. With weight-on-wheels, or when the fuel-probe is extended, the External tanks are unpressurized, therefore fuel transfer from the tanks is not possible. "Override" allows for pressurization of the external tanks, thus fuel transfer from the external tanks is enabled during weight-on-wheel conditions, and during air-to-air refueling.
- NORM: Normal allows refueling of selected external
- STOP: Shuts center fuel tank off from the fuel system, disabling fuel transfer and refueling.

Fuel Dump Switch

FUEL SYSTEM OVERVIEW

IFEI (Integrated Fuel / Engine Indicator) Buttons

- **MODE**: Toggles IFEI modes
- **QTY**: Toggles five sub-level fuel quantity format displays. Normal fuel format shows T (Total Fuel) and I (Internal Fuel).
- **UP ARROW**: Increases Bingo Fuel Level
- **DOWN ARROW**: Decreases Bingo Fuel Level
- **ZONE**: Displays Local or Zulu Time
- **ET**: Stopwatch Elapsed Time Function



Fuel Quantity Indicators (lbs)
Fuel indicator will vary based on what QTY IFEI sub-level is selected.

Bingo Fuel Setting (lbs)
"Bingo Fuel" is the fuel quantity required to go back to base safely. This is set by the pilot manually.

FUEL SYSTEM OVERVIEW

Pressing **QTY** button toggles five sub-level fuel quantity format displays (shown above). Normal fuel format shows T (Total Fuel) and I (Internal Fuel).

Sub-level	Fuel Quantity Indicated	Legend	Counter
1	Left Feed Tank (#2) Right Feed Tank (#3)	FL FR	Upper Middle
2	Left Transfer Tank (#1) Right Transfer Tank (#4)	TL TR	Upper Middle
3	Left Wing Tank Right Wing Tank	WL WR	Upper Middle
4	Left External Tank Right External Tank	XL XR	Upper Middle
5	Centerline Tank	C	Upper









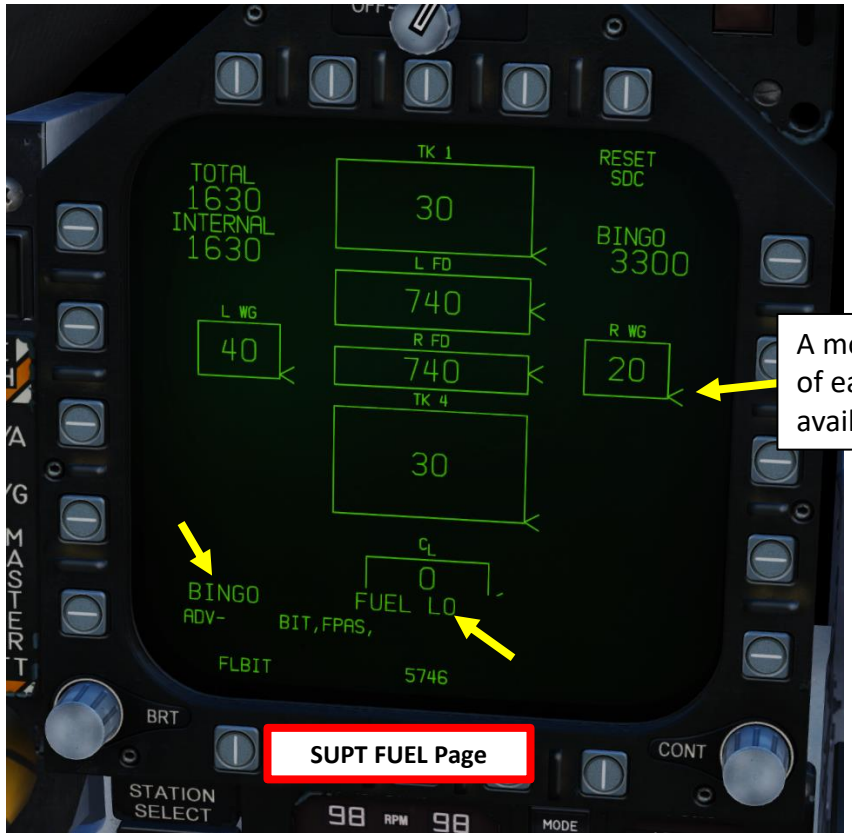




BINGO FUEL

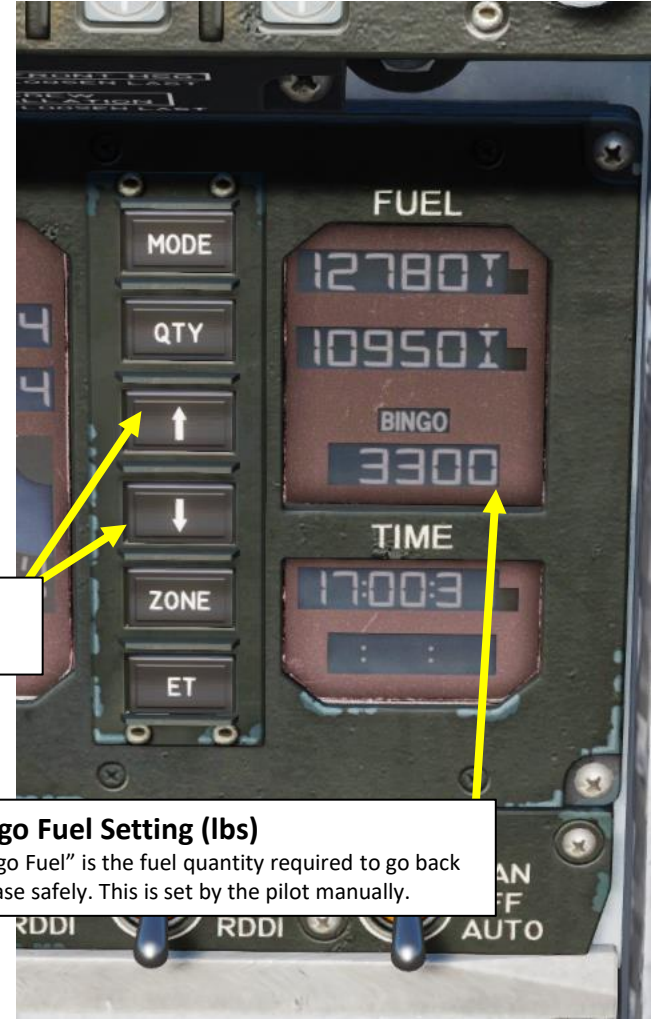
BINGO fuel is the amount of fuel that once reached triggers an immediate return to home plate (home base). It takes into account the fuel needed to fly the return leg of the flight, the fuel required to fly the briefed approach, the fuel to go to the alternate (if necessary) and the emergency fuel which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

- Your "BINGO FUEL" can be set by using the Bingo Fuel Setting Increase/Decrease Buttons on the IFEI panel
- When fuel state falls below BINGO fuel limit, an aural cue "Bingo" will be audible and a BINGO indication on your DDI pages will appear. MASTER CAUTION will illuminate as well.
- When fuel quantity remaining is below 800 pounds in either of the two feed tanks, an aural cue "Fuel Low" will be audible and a FUEL LO indication on your DDI pages will appear. MASTER CAUTION will illuminate as well.



SUPT FUEL Page

A moving caret is shown on the right side of each tank to indicate the ratio of fuel available to tank fuel capacity.



Bingo Fuel Setting Increase/Decrease Buttons

Bingo Fuel Setting (lbs)
"Bingo Fuel" is the fuel quantity required to go back to base safely. This is set by the pilot manually.



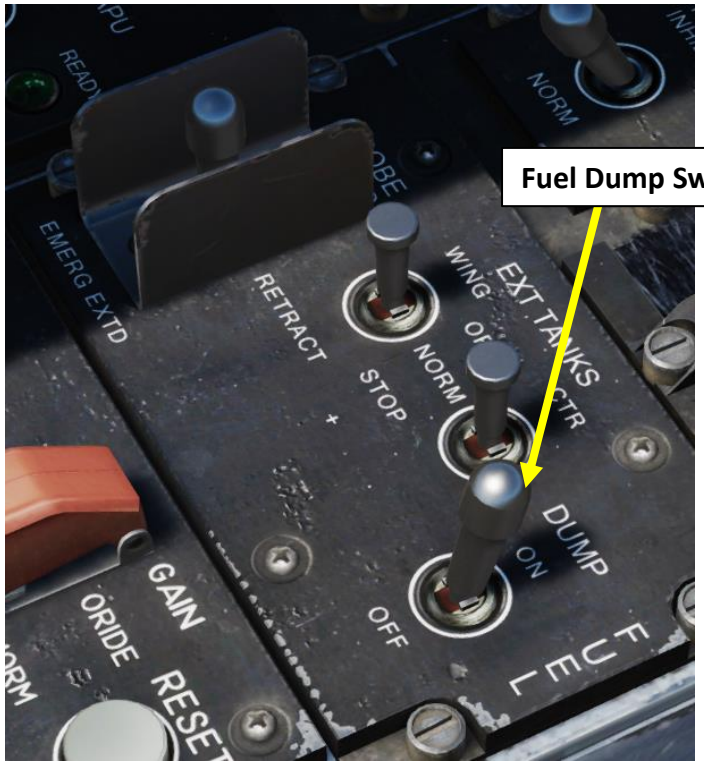
FUEL DUMPING

Fuel dumping is used when the aircraft is too heavy for aircraft carrier landing weight requiresments. Setting the **Fuel Dump Switch** on will electrically latch the switch in this position and allow the aircraft to jettison fuel in order to reduce its weight.

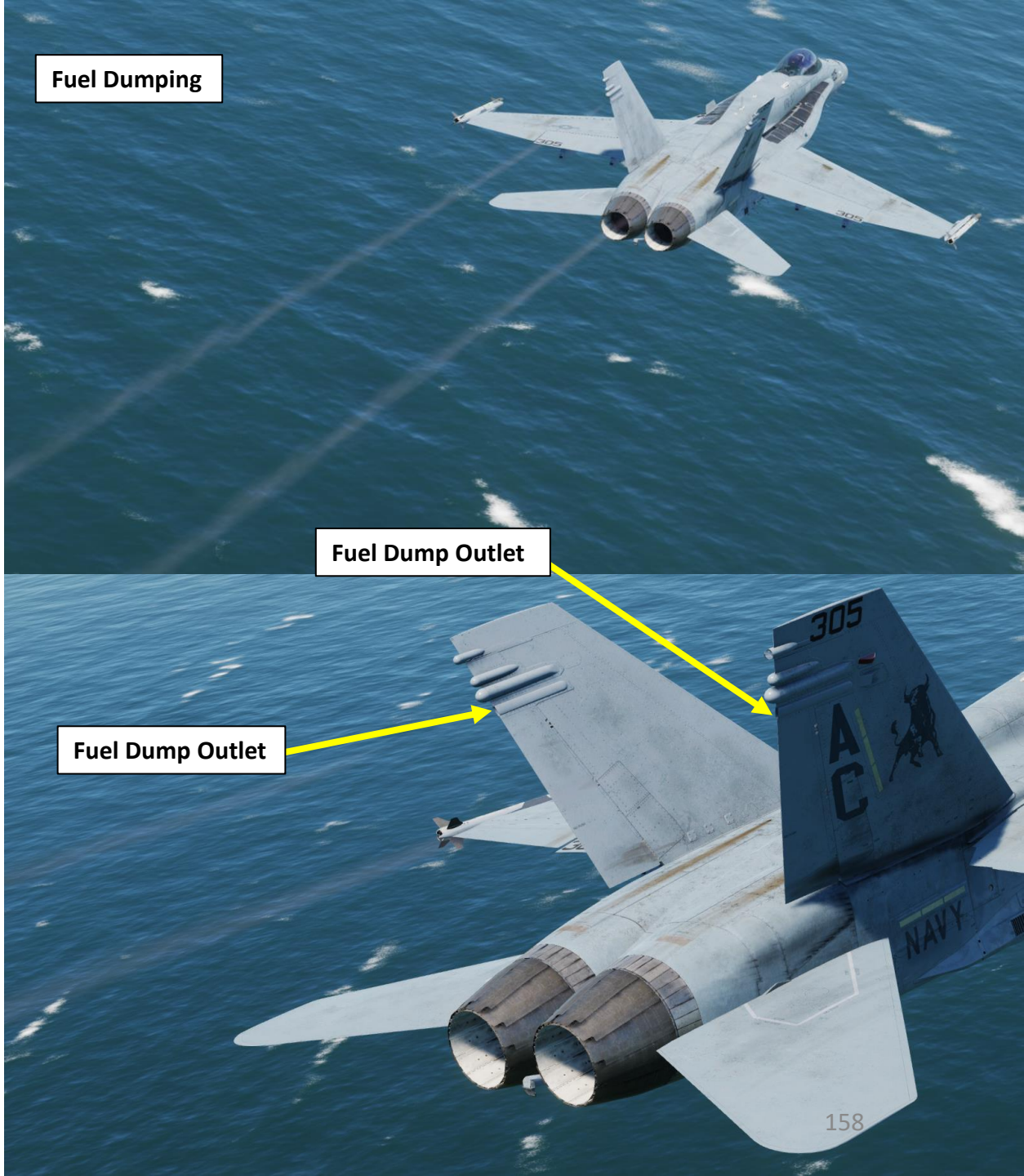
With the dump valve open, the ejector or pumps force fuel out through each vertical fin dump outlet.

Fuel Dumping continues until:

- Fuel Dump Switch is set to OFF, or
- BINGO fuel caution display comes on (fuel dumping automatically terminates)
- Either engine feed tank fuel drops below the FUEL LO level regardless of total internal fuel quantity







Performance Specifications

General Characteristics

- Crew: 1
- Length: 56 ft 1 in (17.1 m)
- Wingspan: 40 ft 4 in (12.3 m) with AIM-9 Sidewinders on wingtip LAU-7 launchers
- Width: 32 ft 7 in (9.94 m) wing folded
- Height: 15 ft 5 in (4.7 m)
- Wing area: 410 sq ft (38 m2)
- Aspect ratio: 4
- Airfoil:
    - root:NACA 65A005 mod,
    - tip: NACA 65A003.5 mod.
- Empty weight: 23,000 lb (10,433 kg)
- Gross weight: 36,970 lb (16,769 kg)
- Max takeoff weight: 51,900 lb (23,541 kg)
- Fuel capacity: 10,860 pounds (4,930 kg) internally
- Powerplant: 2 × General Electric F404-GE-402 afterburning turbofan engines, 11,000 lbf (49 kN) thrust each dry, 17,750 lbf (79.0 kN) with afterburner

Performance

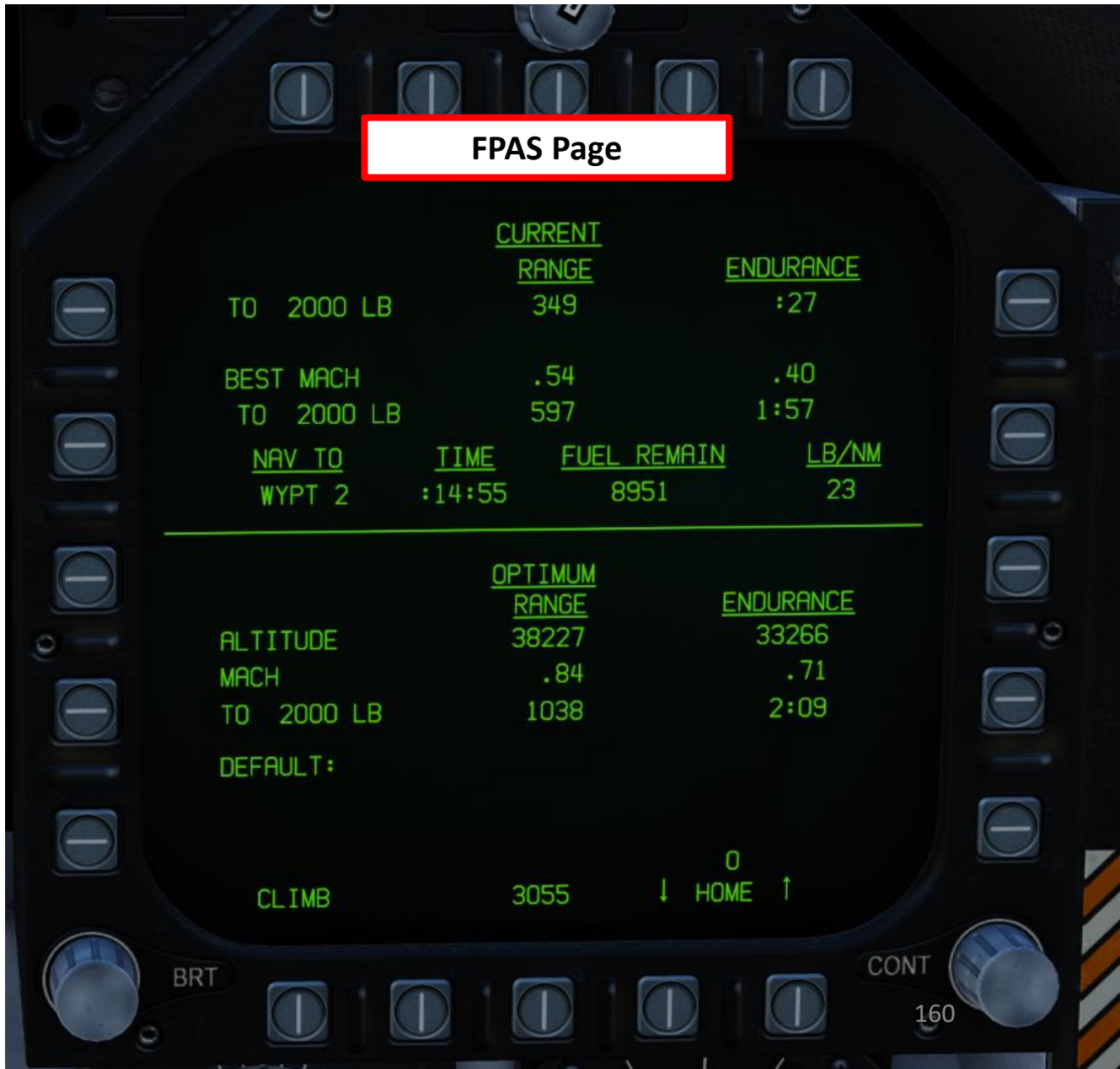
- Maximum speed: 1,034 kn (1,190 mph, 1,915 km/h) at 40,000 ft (12,000 m)
- Maximum speed: Mach 1.8
- Cruise speed: 570 kn (660 mph, 1,060 km/h)
- Range: 1,089 nmi (1,253 mi, 2,017 km)
- Combat range: 400 nmi (460 mi, 740 km) air-air mission
- Ferry range: 1,800 nmi (2,100 mi, 3,300 km)
- Service ceiling: 50,000 ft (15,000 m)
- Rate of climb: 50,000 ft/min (250 m/s)
- Wing loading: 93 lb/sq ft (450 kg/m2)
- Thrust/weight: 0.96 (1.13 with loaded weight at 50% internal fuel)

FPAS (Flight Performance Advisory System)

Flying the Hornet requires careful planning when it comes to fuel. The drag generated by the ordnance you are carrying means that the range of the Hornet is fairly limited if refueling options are limited.

However, there is a useful tool that cn be used to help you fly as fuel-efficiently as possible: the Flight Performance Advisory (FPAS) system. The FPAS advises the pilot of the altitude and airspeed corresponding to maximum inflight fuel efficiency based on current operating conditions. The range and airspeed data provided by FPAS appears on the FPAS DDI page from the SUPT menu.





FPAS (Flight Performance Advisory System)

The page is divided into five data areas and two select options.

Data Areas:

- ***Current Range***:
  - First Line: Current range of the aircraft until only 2,000 lbs. of fuel remains based on the current altitude and Mach.
  - Second Line: Best Mach to fly to extend range at the current altitude
  - Third Line: Calculated range if the aircraft is flown at the optimal Mach at the current altitude.
- ***Current Endurance***:
  - First Line: Time in hours:minutes the aircraft can fly at the current Mach and altitude.
  - Second Line: Optimal Mach to fly to maximize flight endurance time at the current altitude.
  - Third Line: Light endurance time if the aircraft is flown at best Mach at the current altitude.
- ***Optimal Range***:
  - Altitude and Mach at which to fly to achieve maximum range to 2,000 or 0 lbs. of fuel remaining.
- ***Optimal Endurance***:
  - Altitude and Mach to fly to achieve the maximum flight endurance time in hours:minutes to 2,000 or 0 lbs. of fuel remaining.
- ***TACAN and Waypoint Navigation To***:
  - Time to reach, fuel remaining in lbs, and fuel burn rate as lbs per nautical mile of a selected TACAN station or waypoint.



FPAS (Flight Performance Advisory System)

Note: To have data displayed in the NAV TO field, make sure you either have a valid WYPT (Waypoint) or a TCN (TACAN) selected (boxed).





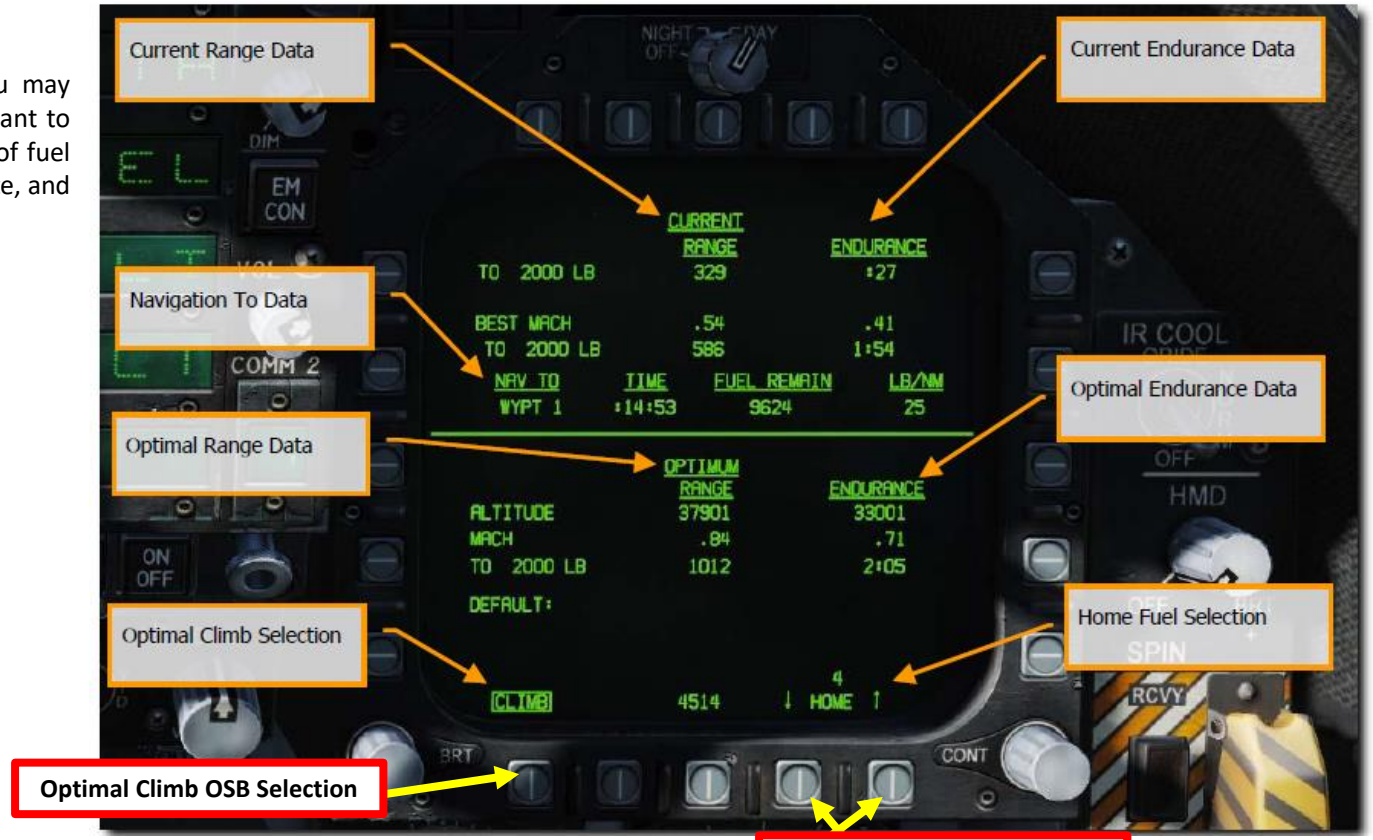


FPAS (Flight Performance Advisory System)

Options:

- ***Optimal Climb Selection***:
  - When the CLIMB option is boxed by pressing the OSB (Option Select Button) next to it, the optimal climb airspeed is displayed above the airspeed box on the HUD.
- ***Home Fuel Selection***:
  - Using the up and down arrows on OSBs next to HOME arrows, you may designate any waypoint as the HOME location. Generally, you would want to set this as your landing waypoint. When it is calculated that 2,000 lbs. of fuel would remain upon reaching the location, the Master Caution will activate, and the HOME FUEL caution is displayed on the DDI.





PART 9 – RADAR & SENSORS

SECTION STRUCTURE

- **1 - Sensors**
  - 1.1 – Introduction to Sensors
  - 1.2 – Master Modes
  - 1.3 – Sensors Display Selection
  - 1.4 – My Sensors Control Setup

- **2 - AN/APG-73 Radar**
  - 2.1 – Air-to-Air Modes
    - 2.1.1 – Radar Display
      - 2.1.1.1 – RDR ATTK Format
      - 2.1.1.2 – AZ/EL Format
    - 2.1.2 – Main Modes
    - 2.1.3 – RWS (Range While Search) Mode
    - 2.1.4 – TWS (Track While Scan) Mode
    - 2.1.5 – VS (Velocity Search) Mode
    - 2.1.6 – Radar Spotlight Option
    - 2.1.7 – ACM (Air Combat Maneuvering) Modes
      - 2.1.7.1 – ACM Mode Overview
      - 2.1.7.2 – BST (Boresight)
      - 2.1.7.3 – VACQ (Vertical Acquisition)
      - 2.1.7.4 – WACQ (Wide Acquisition)
      - 2.1.7.5 – GACQ (Gun Acquisition)
    - 2.1.8 – Radar Lock Acquisition
      - 2.1.8.1 – STT (Single Target Track)
      - 2.1.8.2 – AACQ (Automatic Acquisition)
      - 2.1.8.3 - JHMCS (Joint Helmet-Mounted Cueing System) Lock
  - 2.2 – Air-to-Ground Modes
    - 2.2.1 – Air-to-Ground Radar Operating Modes
    - 2.2.2 – MAP (Ground Mapping) Mode
    - 2.2.3 – EXP (Expanded) Modes
      - 2.2.3.1 – EXP1 (Sector Map)
      - 2.2.3.2 – EXP2 (Patch Map)
      - 2.2.3.3 – EXP3 (Synthetic-Aperture Radar/SAR Map)
      - 2.2.3.4 – Designation with EXP Mode
    - 2.2.4 – GMT (Ground Moving Target) Mode
    - 2.2.5 – TA (Terrain Avoidance) Mode
  - 2.3 – Air-to-Sea Modes
    - 2.3.1 – SEA Mode
  - 2.4 – Radar Lingo and Terminology

- **3 - AN/AAQ-28(V) LITENING II Targeting Pod**
  - 3.1 – Introduction
  - 3.2 – Displays
  - 3.3 – Controls
  - 3.4 – Start-Up & Lasing Procedure
  - 3.5 – Pointing Methods
    - 3.5.1 – Overview
    - 3.5.2 – VVSLV (Velocity Vector Slaved)
    - 3.5.3 – Snowplow
    - 3.5.4 – Waypoint Slave
    - 3.5.5 – Point & Area Track
    - 3.5.6 – Targeting Pod Offset
  - 3.6 – Laser Spot Tracker (LST) Mode
  - 3.7 – Laser Marking
  - 3.8 – Air-to-Air Operation
    - 3.8.1 – Operation Modes
    - 3.8.2 – Point Track
    - 3.8.3 – Air-to-Air Radar Slaving
  - 3.9 – Targeting Pod Tips

- **4 - AN/ASQ-228 ATFLIR Targeting Pod**
  - 4.1 – Introduction
  - 4.2 – Displays
  - 4.3 – Controls
  - 4.4 – Start-Up & Lasing Procedure
  - 4.5 – Pointing Methods
    - 4.5.1 – Overview
    - 4.5.2 – VVSLV (Velocity Vector Slaved)
    - 4.5.3 – Snowplow
    - 4.5.4 – Waypoint Slave
    - 4.5.5 – Scene Track & Auto Track
    - 4.5.6 – Targeting Pod Offset
  - 4.6 – Laser Spot Tracker (LST) Mode
  - 4.7 – Air-to-Air Operation
    - 4.7.1 – Operation Modes
    - 4.7.2 – Auto Track
    - 4.7.3 – Air-to-Air Radar Slaving (L+S Slave)

SECTION STRUCTURE

- **5 - JHMCS (Joint Helmet-Mounted Cueing System)**
  - 5.1 – Introduction
  - 5.2 – JHMCS Power-Up
  - 5.3 – HMD (Helmet-Mounted Display) Symbology
    - 5.3.1 – HMD Symbology
    - 5.3.2 – HMD Setup
  - 5.4 – JHMCS Controls
  - 5.5 – JHMCS Functions
    - 5.5.1 – Ground Target Designation
    - 5.5.2 – Air Target Radar Lock
  - 5.6 – HUD (Heads-Up Display) Designation Considerations

- **6 - AGM-65F/G Maverick Air-to-Ground Missile (IR-MAVF)**
  - 6.1 – Displays
  - 6.2 – Controls

1.1 - INTRODUCTION TO SENSORS

The F/A-18C Hornet is by definition one of the most versatile aircraft when it comes to armament and sensors. Sensors will come gradually as Early Access goes on, so this section will be fleshed out as updates from Eagle Dynamics come. Here is an overview of how the Hornet can "see" the outside world.

- **AN/APG-73 Radar**: pulse-Doppler, look-down/shoot-down radar with both BVR (Beyond Visual Range) and close in ACM (Air Combat Maneuvering) modes of operation.
    - Modes currently implemented are RWS (Range While Search), STT (Single Target Track) and ACM (Air Combat Maneuvering).

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

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



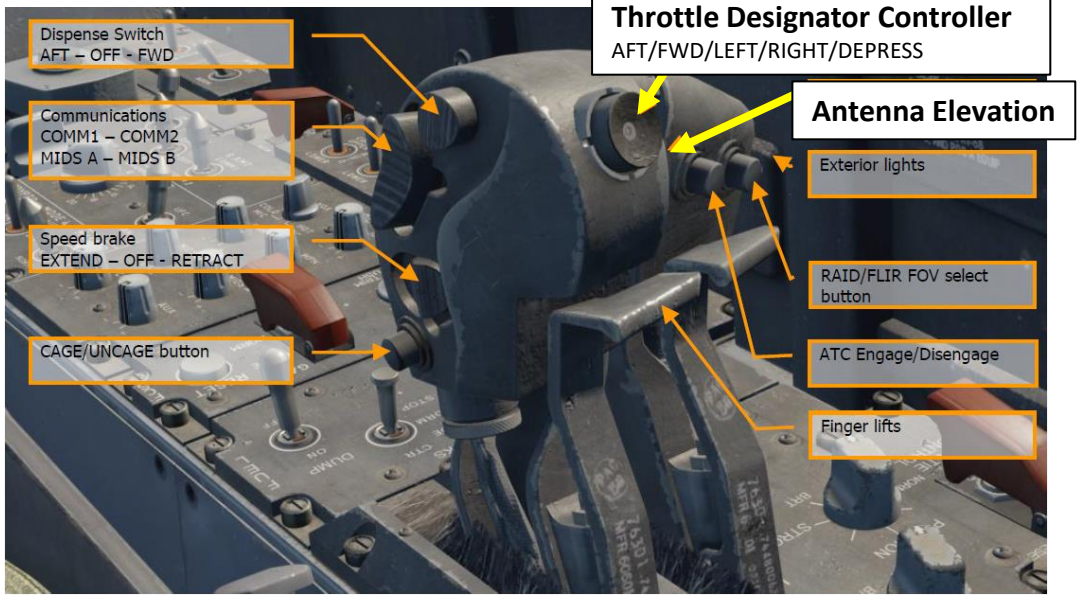


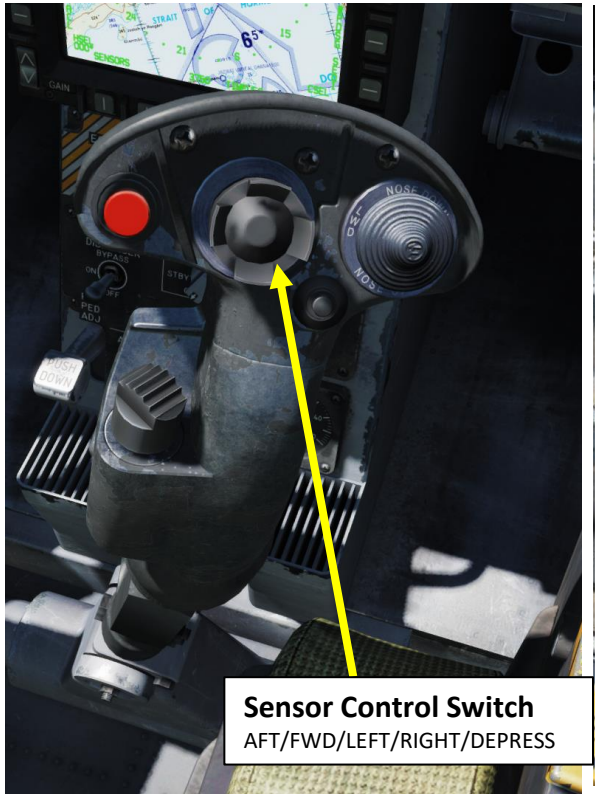


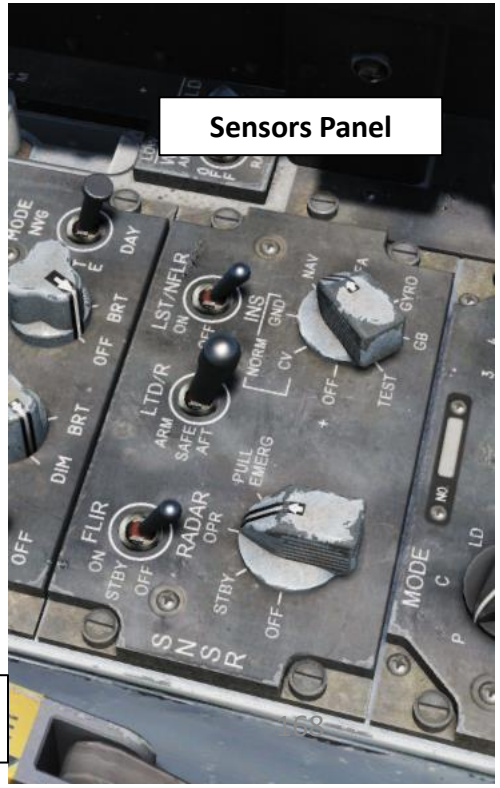
1.1 - INTRODUCTION TO SENSORS

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









1.1 - INTRODUCTION TO SENSORS



RDR ATTK (RADAR) TAC PAGE



1.2 - MASTER MODES

Controlled via two buttons left of the left DDI, the F/A-18's avionics system always operates in one of three master modes: Navigation (NAV), Air-to-Ground (A/G), or Air-to-Air (A/A). These master modes configure the avionics for one of these three purposes.

The master mode is changed via the two mentioned A/A and A/G buttons, which command A/A and A/G master mode respectively. A/A is also entered when selecting an air-to-air weapon via the Weapon Select Switch. NAV master mode is entered when neither A/A nor A/G are selected. Both buttons have a light indicating either A/A or A/G master mode. Accordingly, NAV is indicated by both lights being off.

- **Navigation (NAV):** NAV does not allow for any weapon-related symbology on the HUD, but does allow for selection and programming of air-to-ground weapons. In NAV, weapon release is inhibited. NAV is the only master mode that shows the vertical velocity and bank angle indications on the HUD and allows for the velocity vector to be either caged or uncaged.

- **Air-to-Ground (A/G):** A/G allows for the release of air-to-ground weaponry. It shows the appropriate symbology for the selected air-to-ground weapon on the HUD. The velocity vector is always uncaged in A/G. When A/G is entered, the STORES format is automatically brought up on the left DDI and the RDR ATTK in air-to-ground radar mode is on the right.

- **Air-to-Air (A/A):** A/A allows for the selection and release of air-to-air weapons, and shows the relevant HUD symbology for the current air-to-air weapon. The velocity vector is always caged in A/A. When A/A is entered, the STORES format is automatically brought up on the left DDI and the RDR ATTK in air-to-air radar mode is on the right.



Weapon Select Switch
- FWD: Select Sparrow
- AFT: Select Gun
- PRESS DOWN: Select Sidewinder
- RIGHT: Select Amraam
- LEFT: No Function

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

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



1.2 - MASTER MODES

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

A/A allows for the selection and release of air-to-air weapons, and shows the relevant HUD symbology for the current air-to-air weapon. The velocity vector is always caged in A/A. When A/A is entered, the STORES format is automatically brought up on the left DDI and the RDR ATTK in air-to-air radar mode is on the right.





1.2 - MASTER MODES

A/G (Air-to-Ground) Master mode

A/G allows for the release of air-to-ground weaponry. It shows the appropriate symbology for the selected air-to-ground weapon on the HUD. The velocity vector is always uncaged in A/G. When A/G is entered, the STORES format is automatically brought up on the left DDI and the RDR ATTK in air-to-ground radar mode is on the right.



1.2 - MASTER MODES

NAV (Navigation) Master mode

NAV does not allow for any weapon-related symbology on the HUD, but does allow for selection and programming of air-to-ground weapons. In NAV, weapon release is inhibited. NAV is the only master mode that shows the vertical velocity and bank angle indications on the HUD and allows for the velocity vector to be either caged or uncaged.

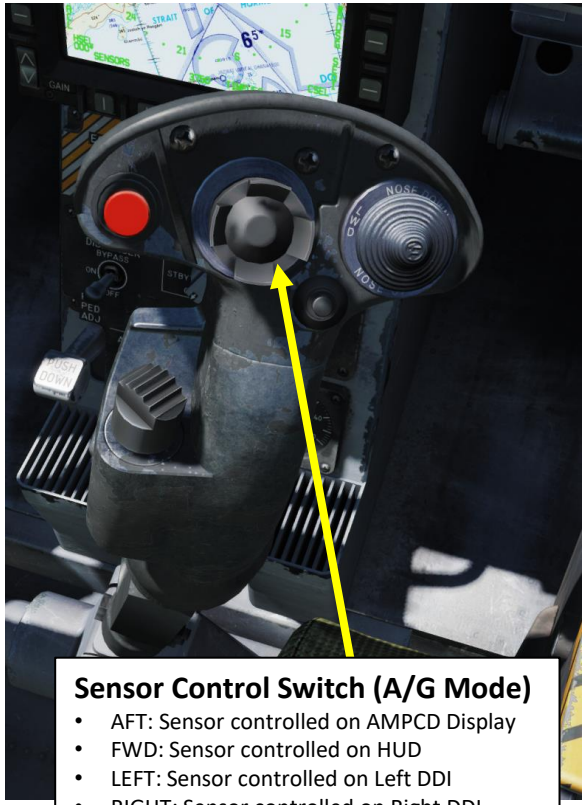


1.3 - SENSOR DISPLAYS SELECTION

For those familiar with the A-10C Warthog, the Sensor Control Switch is similar to setting a SOI (Sensor of Interest).

- In **A/G (Air-to-Ground) mode** the switch selects your primary sensor on the displays.
- In **A/A (Air-to-Air) Mode** it selects your acquisition type.

Selecting a particular display allows you to use the TDC cursor and you can tell that sensor is active by the little diamond that displays in the upper right corner of the DDIs



Sensor Control Switch (A/G Mode)

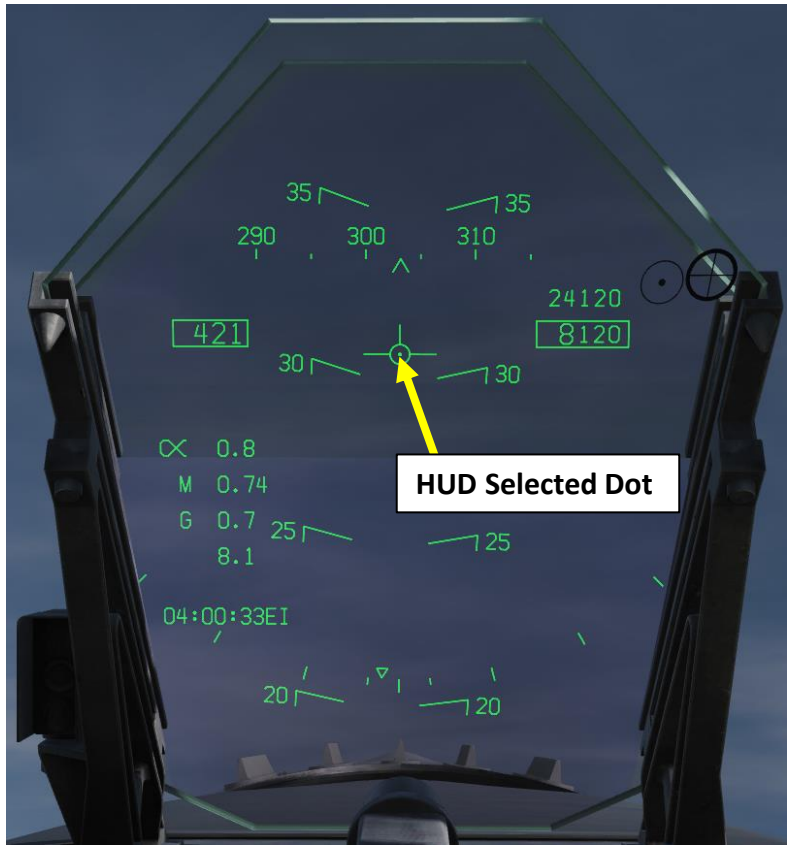
- AFT: Sensor controlled on AMPCD Display
- FWD: Sensor controlled on HUD
- LEFT: Sensor controlled on Left DDI
- RIGHT: Sensor controlled on Right DDI

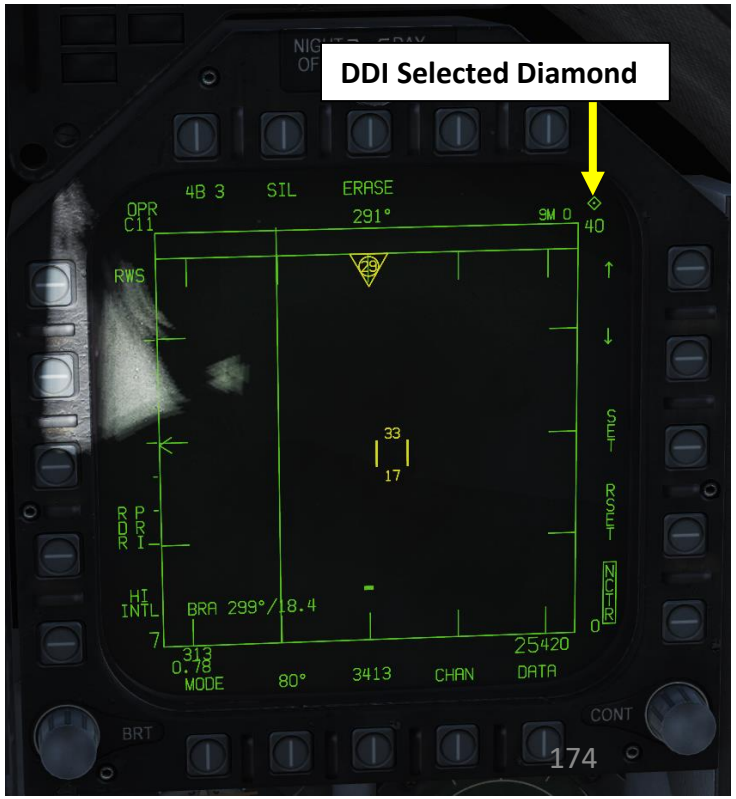
Sensor Control Switch (A/A Mode)

- AFT: VACQ Mode
- FWD: Bore Sight Mode
- LEFT: WACQ Mode
- RIGHT: AACQ Mode









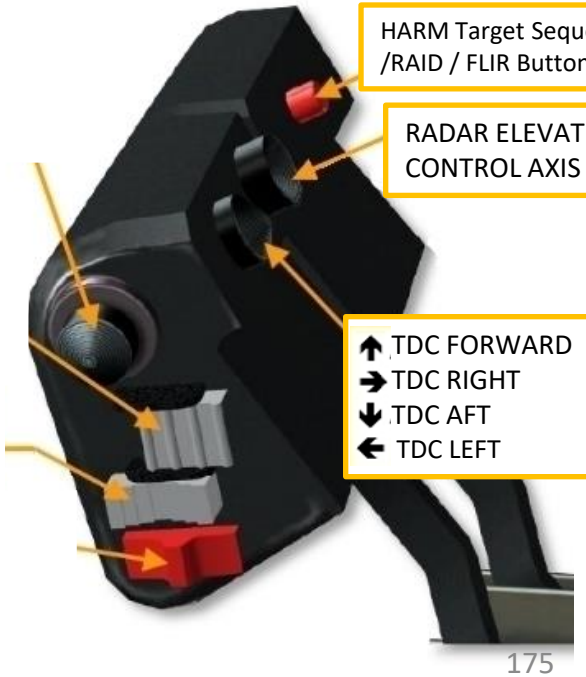
1.4 - MY SENSORS CONTROL SETUP



↑
→ TDC - DEPRESS
↓
← CAGE/UNCAGE BUTTON

↑ Sensor Control Sw. FWD
→ Sensor Control Sw. RIGHT
↓ Sensor Control Sw. AFT
← Sensor Control Sw. LEFT
P Sensor Control Sw. DEPRESS

Undesignate / Nose Wheel Steer Button



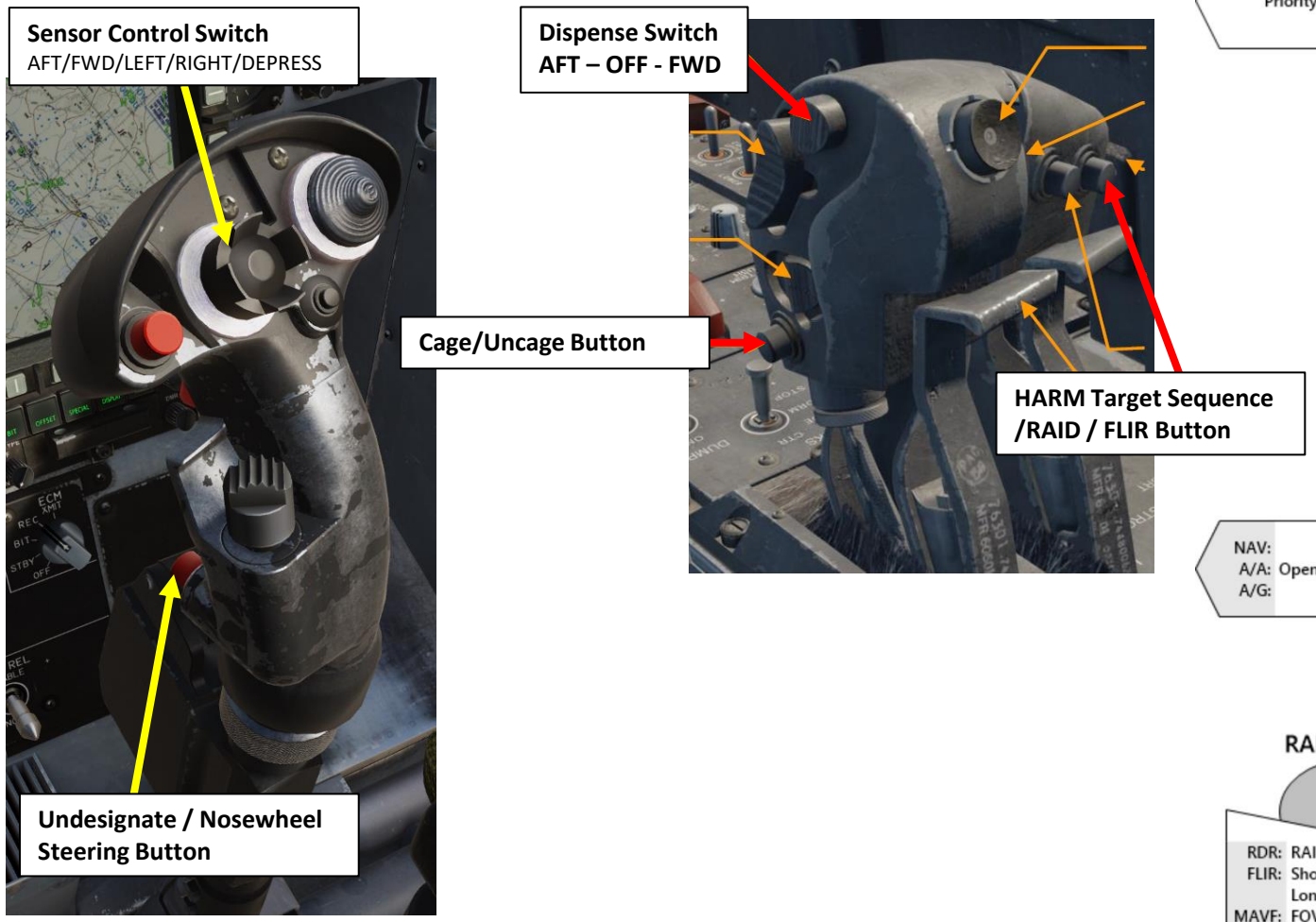
HARM Target Sequence /RAID / FLIR Button

RADAR ELEVATION CONTROL AXIS

↑ TDC FORWARD
→ TDC RIGHT
↓ TDC AFT
← TDC LEFT

1.5 - HOTAS

Here is an overview of the HOTAS (Hands On Throttle-and-Stick) functions.



F/A-18C HOTAS Reference

Sensor Control Switch

Priority to HUD / HMD
A/A: Enter ACM Mode

Priority to Left DDI

Priority to Right DDI

Priority to AMPCD

Press
IFF Interrogate

Sensor Control Switch ACM Mode

Short: Boresight / Helmet (HACQ)
Long: Long Range Helmet (LHAQ)

Wide Acquisition (WACQ)

Vertical (VACQ)
AIM-9X: UPLOOK
(When is HMD On: VACQ is only selectable from WACQ)

Sensor Control Switch Empty Action

Perform by pressing SCS in the direction of a page which cannot accept Priority

NAV:
A/A: Open AZ/EL Page
A/G:

NAV: Open RDR ATTK Page
A/A:
A/G: Open RDR ATTK Page

ALL: Open HSI Page

Sensor Control Switch Special Action

Perform by pressing SCS in the direction of the page while it has Priority.

RDR: Auto / Fast Acquisition
FLIR: ATRK / PTRK
SA: Switch to HSI
HSI: Switch to SA

RAID / FOV

RDR: RAID / EXP
FLIR: Short: FOV
Long: CCD / FLIR
MAVF: FOV
HARM: Cycle Boxed Emitter

Uncage

NAV: Cage / Uncage HUD
AIM-9: Uncage Seeker
AIM-7: Toggle Loft
AIM-120: Toggle Visual Mode
FLIR: Toggle LSS
MAVF: Uncage
HARM: HARM Handoff

Countermeasures Switch

Bypass: Release 2 Flares
Man: Run Selected Program

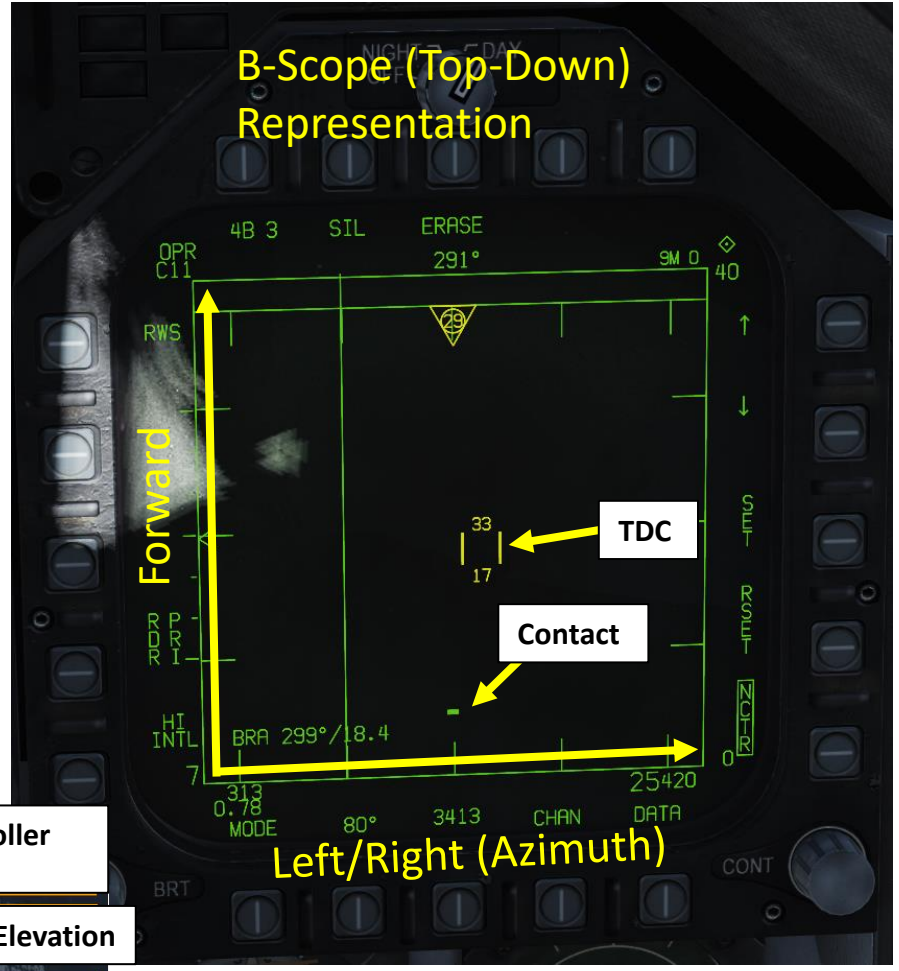
Bypass: Release 2 Chaff
Man: Run Program 5

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.1 – Radar Display: RDR ATTK Format

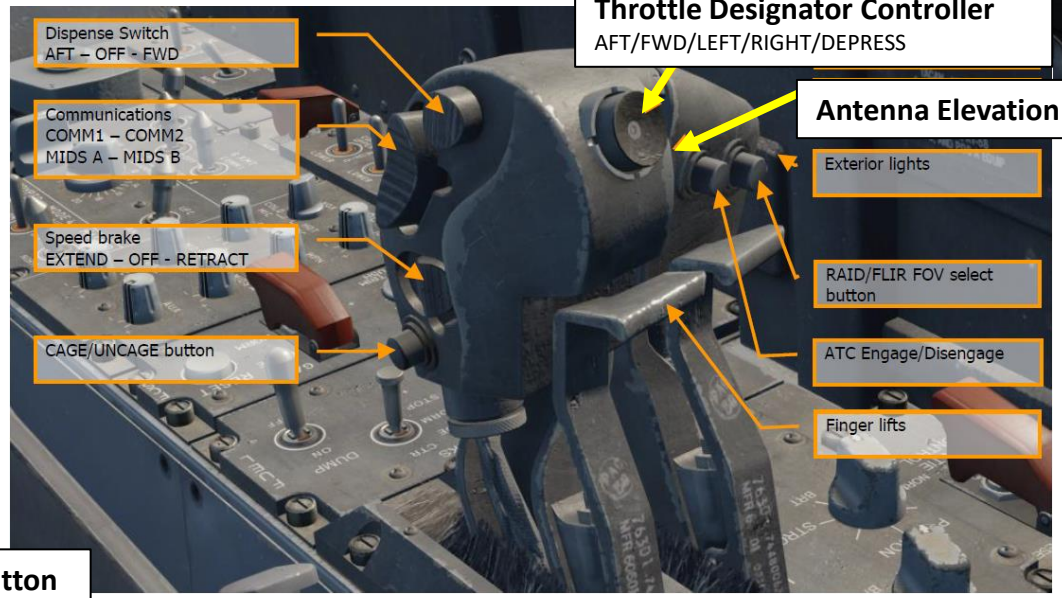
The air-to-air radar uses a B-Scope representation, which is a top-down view of what's in front of you.

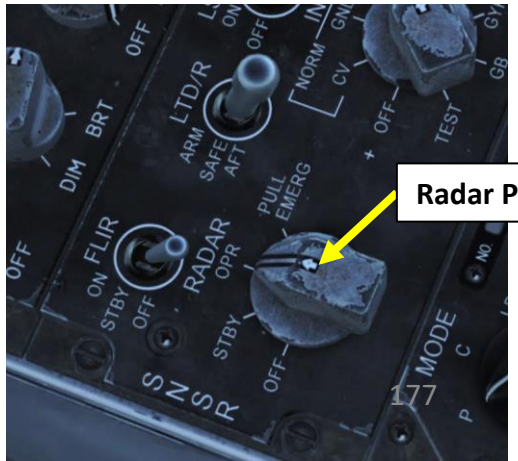
- You can slew your radar and lock a target using the TDC, or Throttle Designator Controller.
- Radar Data can be shown on the RDR ATTK TAC page and on the HUD (Heads-Up Display).
- The Sensor Control Switch is used to set up which display is selected (left DDI, right DDI, lower AMPCD or HUD) or which radar mode you will be using.







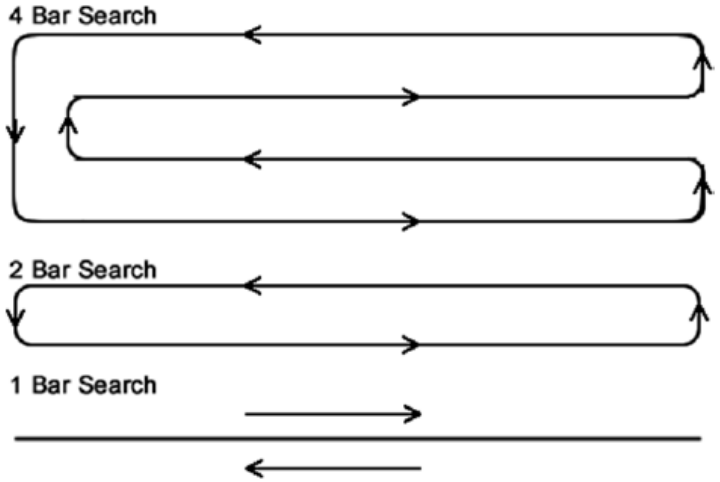




2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.1 – Radar Display: RDR ATTK Format

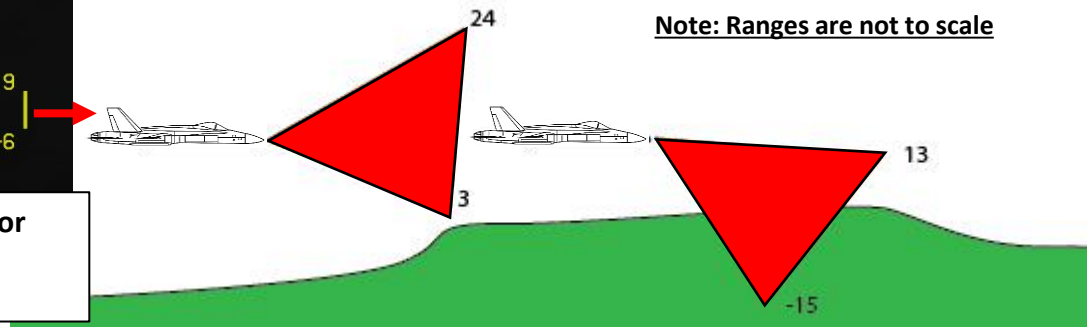
The Hornet's radar has a range of 160 nautical miles, a horizontal arc of 140 degrees and a variable vertical arc that is customizable. You can control the radar scan pattern (bars), which will give you a narrower or wider scanning area.

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



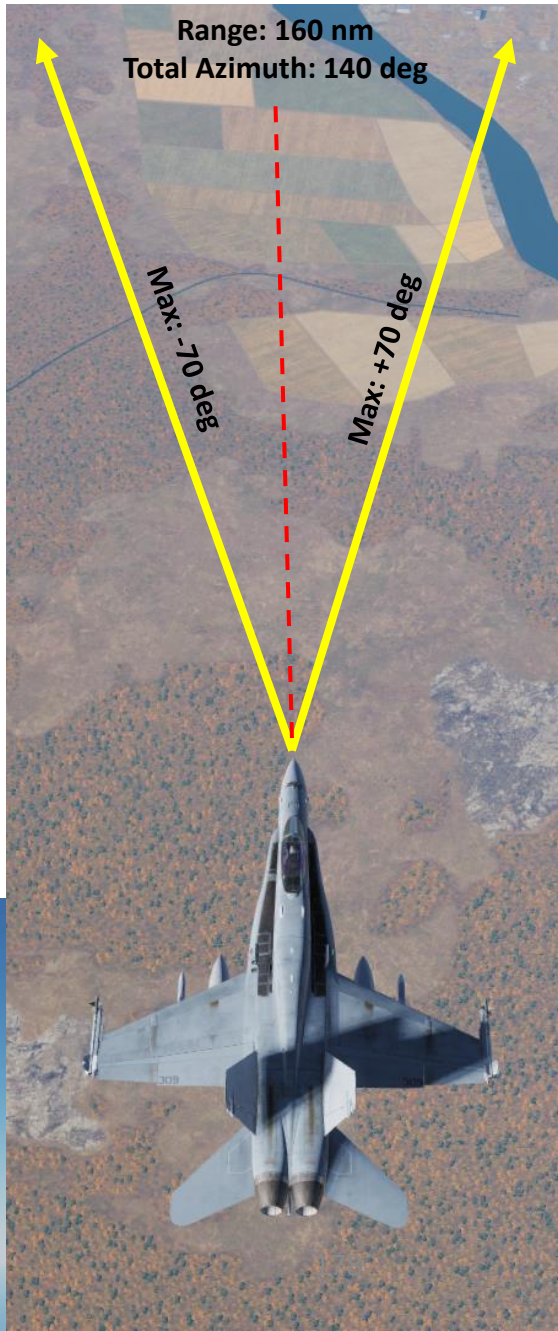


TDC (Throttle Designator Controller) Acquisition Cursor
Upper number: Upper altitude covered by radar (9000 ft)
Lower number: Lower altitude covered by radar (-6000 ft)

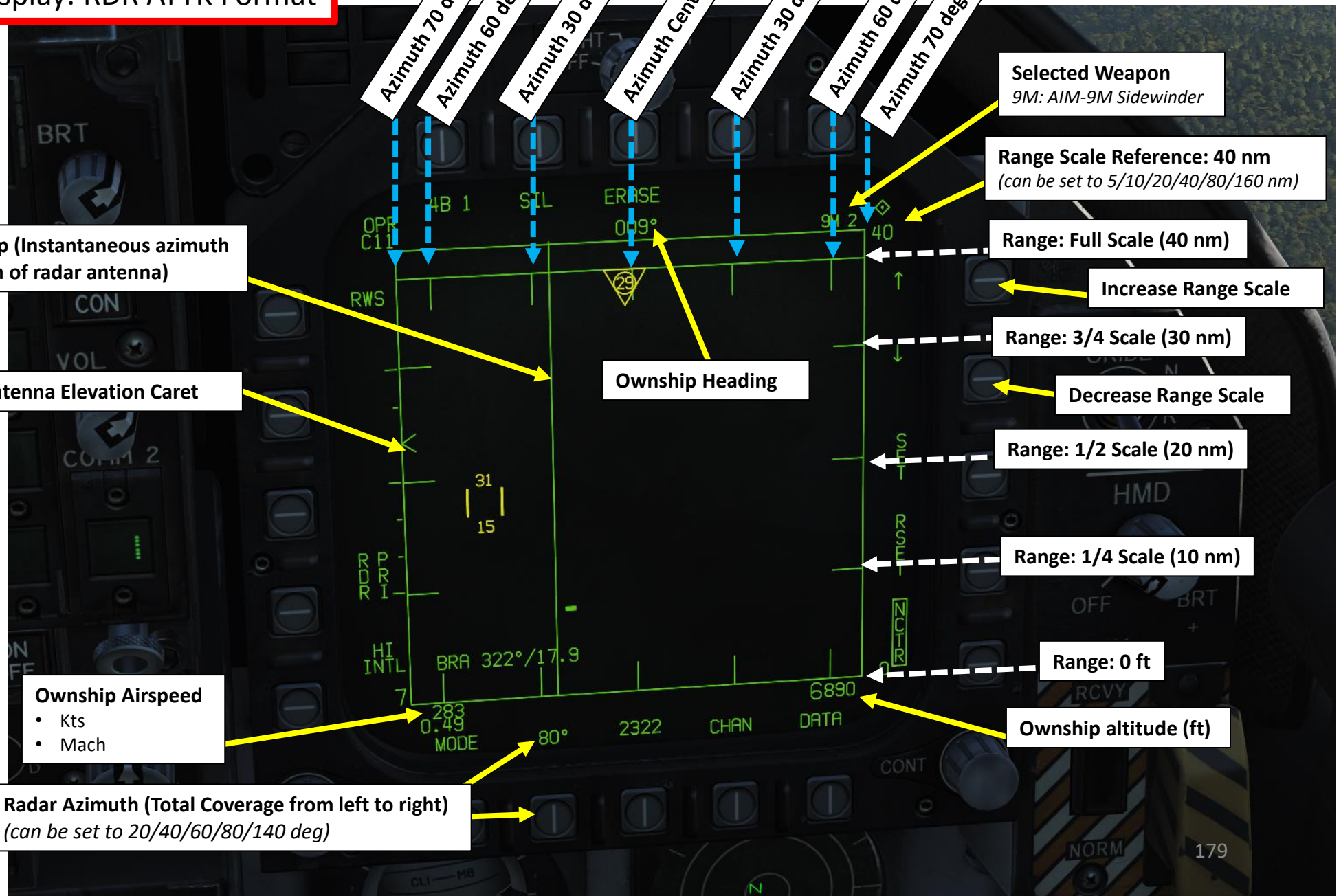


Note: Ranges are not to scale





2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.1 – Radar Display: RDR ATTK Format



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.1 – Radar Display: RDR ATTK Format

Radar Contact
Based on Azimuth and Range Scale, we can deduce that the contact is 45 nm in front of us, 10 degrees to our right

ACQ (Acquisition) Point Cue
Shows where the top priority track (radar contact) is if the HAFU (Hostile, Ambiguous, Friendly, Unknown) symbology is not being displayed. The ACQ Point cue is what will be acquired into STT (Single Target Track) lock if you command an AACQ (Automatic Acquisition) lock. The ACQ Point Cue should not be displayed if an L&S (Launch & Steering) Primary Target already exists.

TDC (Throttle Designator Controller) Acquisition Cursor
Upper number: Upper altitude covered by radar (17000 ft)
Lower number: Lower altitude covered by radar (2000 ft)



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.1 – Radar Display: RDR ATTK Format

Erase: all target history on radar display are removed.

Silent (SIL) Mode: Radar ceases operation and placed in STANDBY mode.

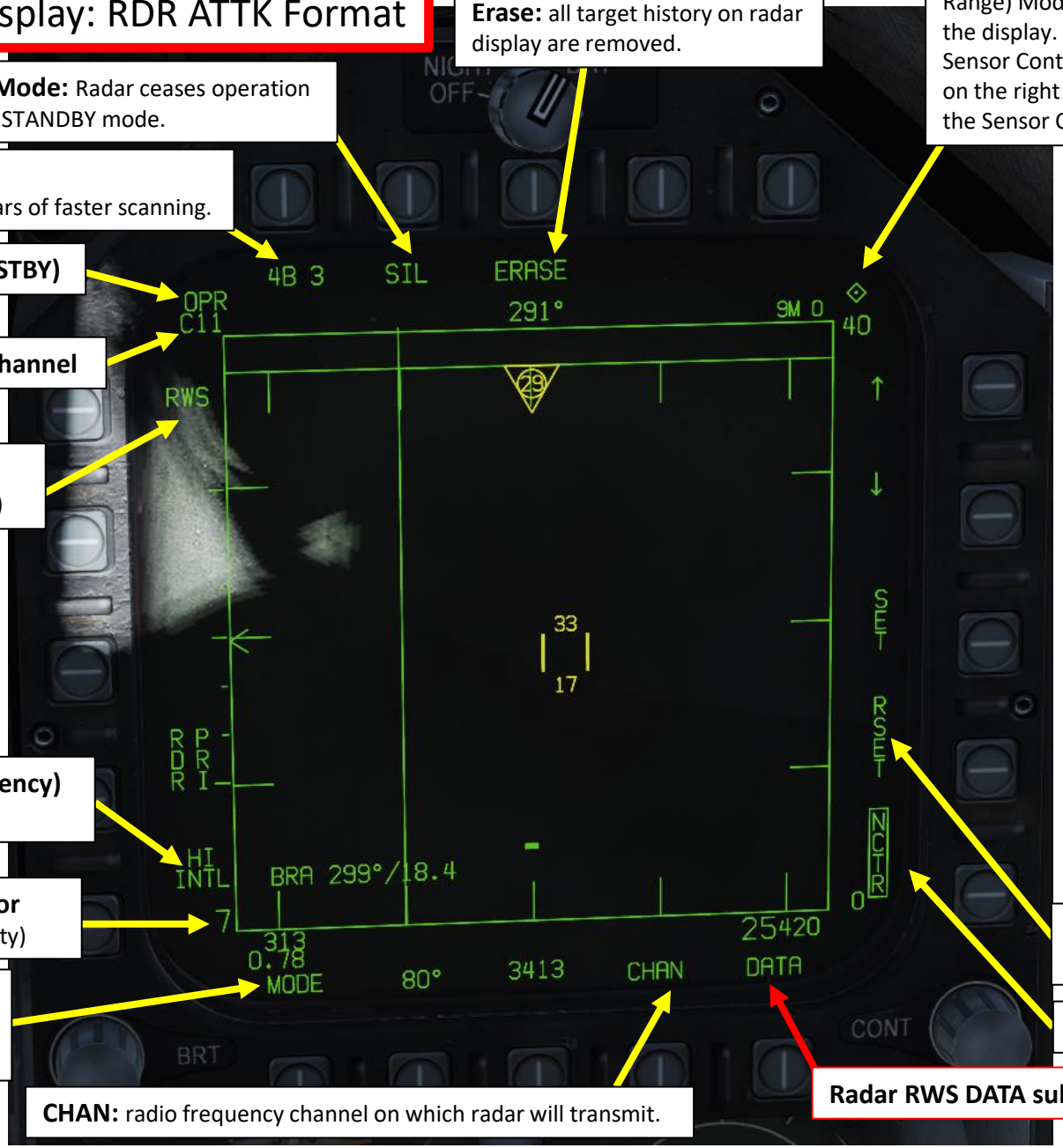
TDC Control Indication Diamond
When the RADAR display is selected for TDC control in a BVR (Beyond Visual Range) Mode, this diamond symbol is displayed in the top right corner of the display. Selecting the RADAR for TDC control is done by moving the Sensor Control Switch to the right. Note that the RADAR is normally placed on the right DDI. If your radar is placed on the left DDI, you'd need to set the Sensor Control Switch left to move TDC on the left DDI.

Elevation Bar Scan
Cycles between 1, 2, 4 and 6 bars of faster scanning.

Operational Mode (OPR/STBY)

Radar's Radio Frequency Channel

Radar Mode Selected (RWS/TWS/STT/ACM)



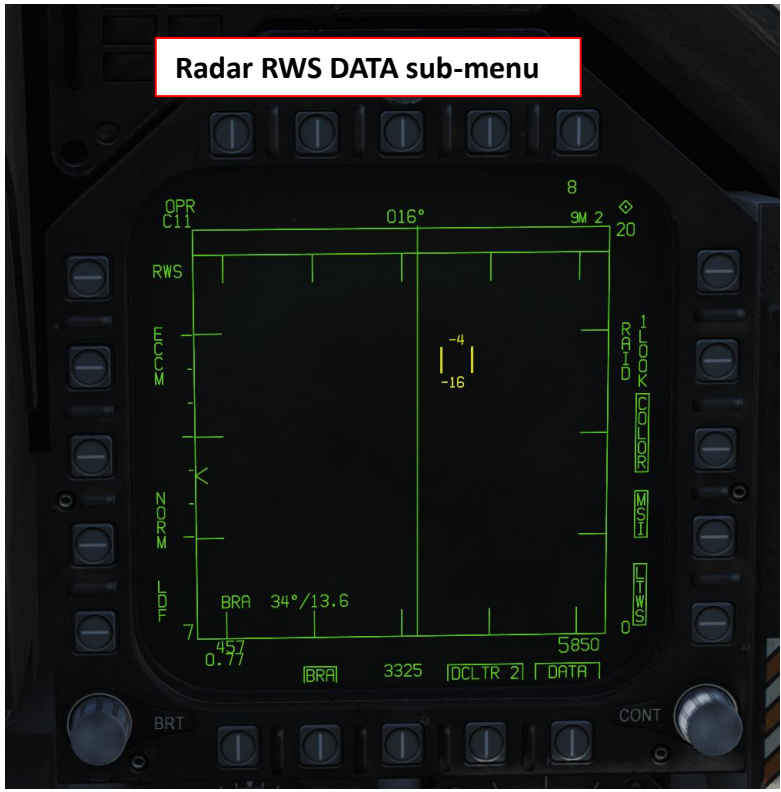
PRF (Pulse Repetition Frequency)
Medium/High/Interleaved

Radar Sensitivity Indicator
(high numbers, high sensitivity)

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

CHAN: radio frequency channel on which radar will transmit.

Radar RWS DATA sub-menu

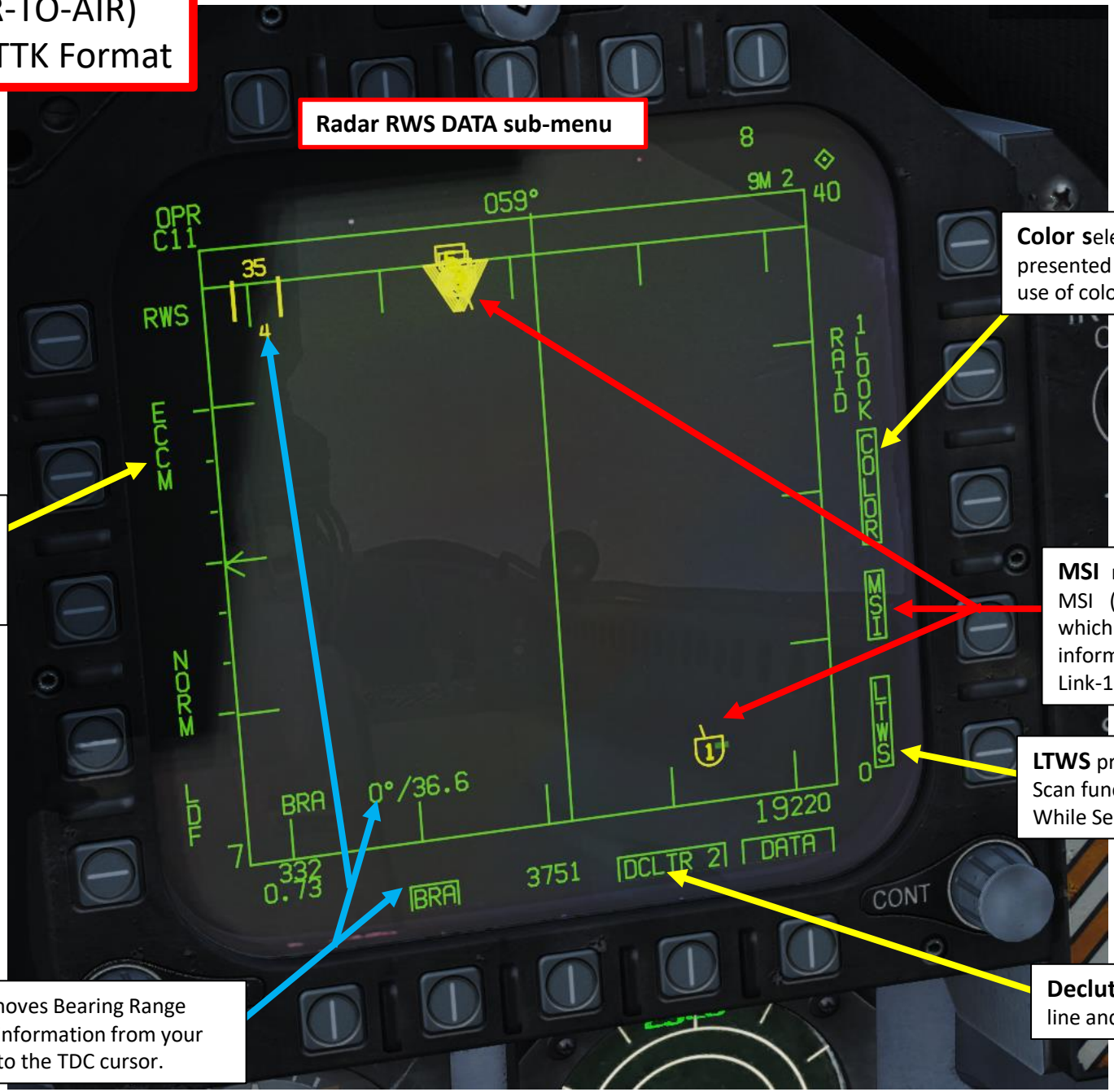


RESET: Radar settings are returned to default settings.

NCTR: Non-Cooperative Target Recognition

Radar RWS DATA sub-menu

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.1 – Radar Display: RDR ATTK Format



Color selects the RADAR display to be presented in monochrome or limited use of colors of three colors

ECCM enables or disables Electronic Counter-Counter Measures. When enabled, the jamming effects of hostile aircraft are less pronounced, but the sensitivity of the RADAR is reduced

MSI removes information from MSI (Multi-Sensor Integration), which is basically contact/target information gathered from the Link-16 Datalink

LTWS provides Latent Track While Scan function while in RWS (Range While Search) mode.

BRA removes Bearing Range Altitude information from your location to the TDC cursor.

Declutter removes horizon line and velocity vector

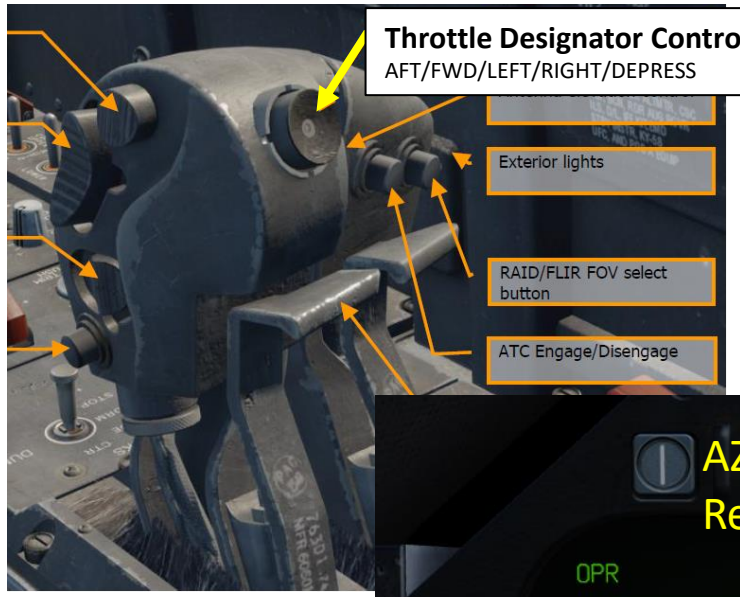
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

A – Introduction

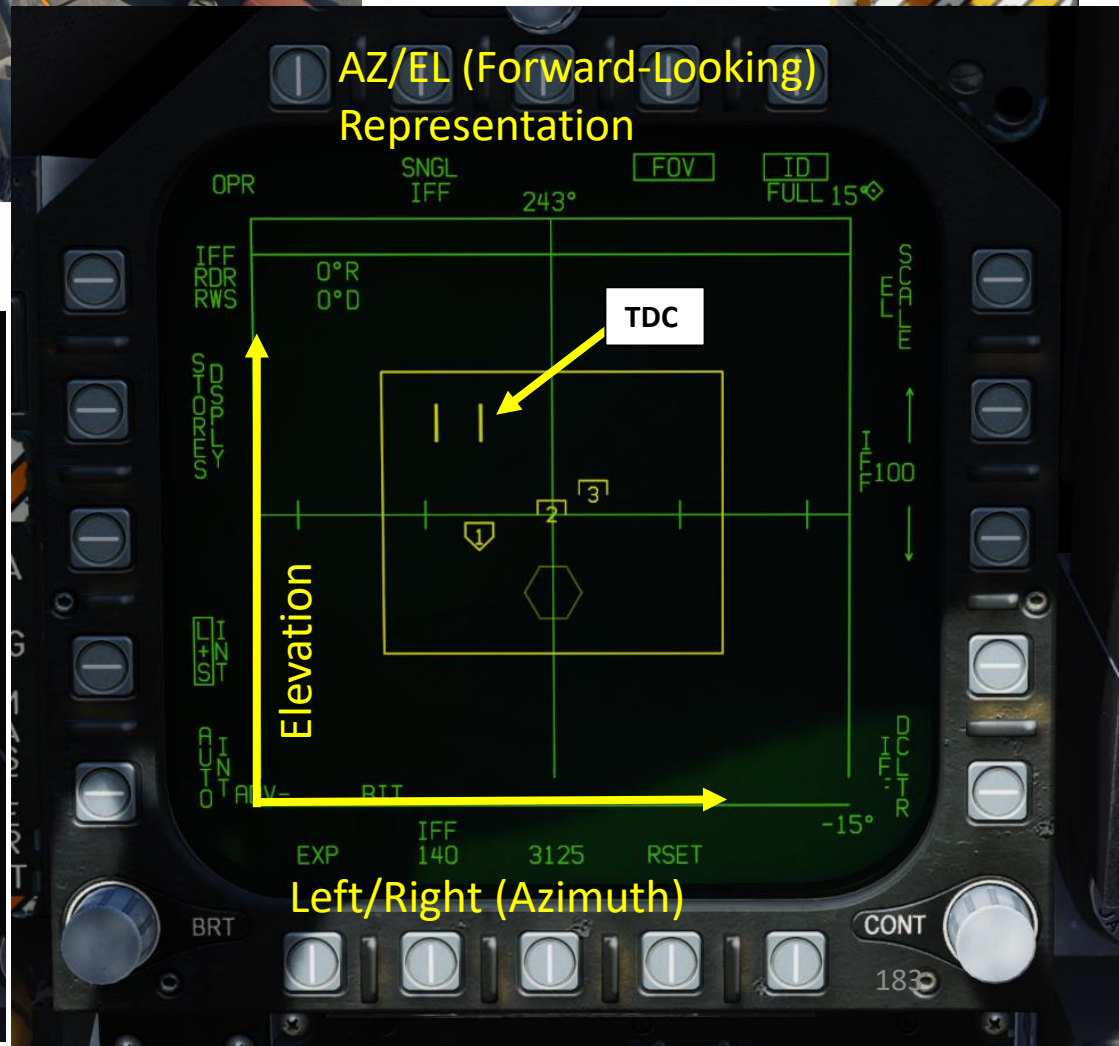
The Azimuth-Over-Elevation (AZ/EL) format page displays a forward-looking view of targets detected by the radar and other sensors. Unlike the normal Attack Radar (RDR ATTK) format, which is a top-down B-scope display, the AZ/EL format is a boresight display, showing the "view out the nose." The AZ/EL page combines HAFU (Hostile, Ambiguous, Friendly, Unknown) symbols from the multi-sensor integration (MSI) platform with returns detected by either the radar or the FLIR (Targeting Pod).

Important note: The Az/El format is only available in A/A Master Mode.

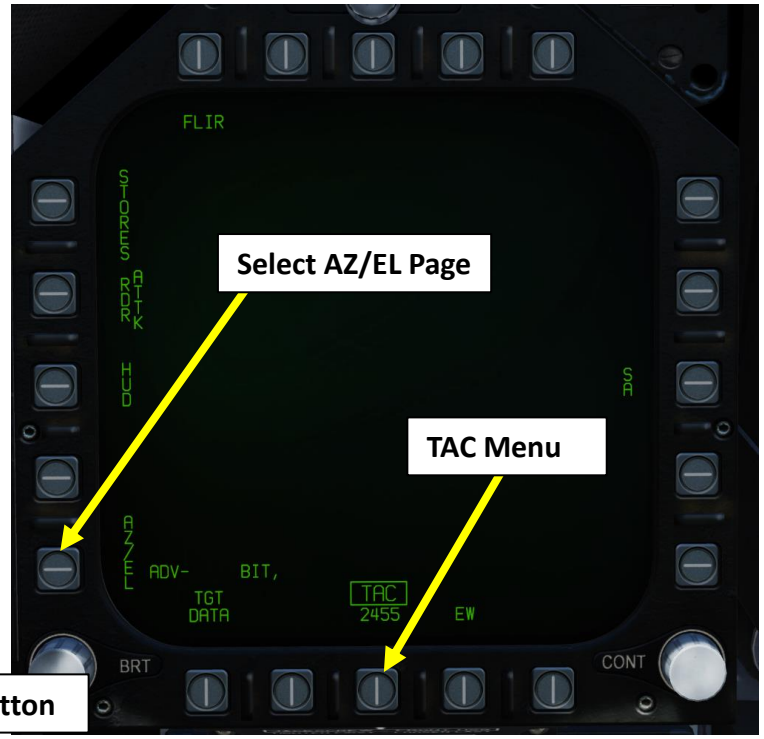
Relevant controls are similar to the RDR ATTK's page.











2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

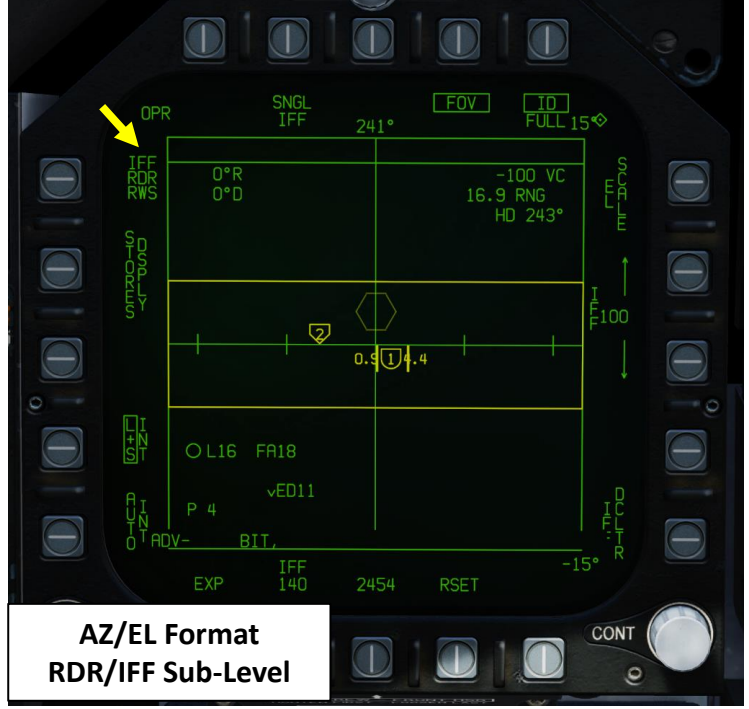
B – Function Breakdown

The AZ/EL has three main function categories embedded:

1. **Radar:**
   - The AZ/EL format displays an azimuth/elevation view similar to the RDR ATTK display but in the vertical plane.
     - It provides the pilot the ability to center the scan in both azimuth as well as elevation via the cursor as a more intuitive alternative to using the Antenna Elevation wheel and Attack format elevation caret.
     - The radar can also be commanded into Single Target Track (STT) from the Az/El (methodology is pretty much the same as with the RDR ATTK display). Furthermore, L&S/DT2 trackfile designation is available using the cursor or Undesignate button.

2. **IFF (Identify-Friend-or-Foe) Interrogator:**
   - Manual IFF functions are similar to the ones in the RDR ATTK page, but the AZ/EL page allows you to perform automatic identification (AUTO IFF) for a specific range and azimuth. AUTO IFF will be further explained in the PART 12 – DATALINK & IFF section.

3. **FLIR (Forward-Looking Infrared) Targeting Pod Sensor Mode:**
   - The FLIR sub-level allows you to slave your targeting pod to a radar-locked target and switch to the FLIR display. This is useful when you want to quickly perform a visual identification of a target if you cannot get a reliable IFF.



AZ/EL Format
RDR/IFF Sub-Level



AZ/EL Format
FLIR Sub-Level

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

C – Radar/IFF Sub-level

CIT Interrogation Type: changes the type of automatic interrogations initiated by the combined interrogator/transponder (CIT). Options are ALL (all IFF modes), SNGL (a selected IFF mode), and CC (correct-code, similar to SNGL but requires a specific SIF code).

Aircraft Heading

Scan Center Location Data: azimuth (degrees Right or Left) and elevation (degrees Down or Up) of the scan centerpoint

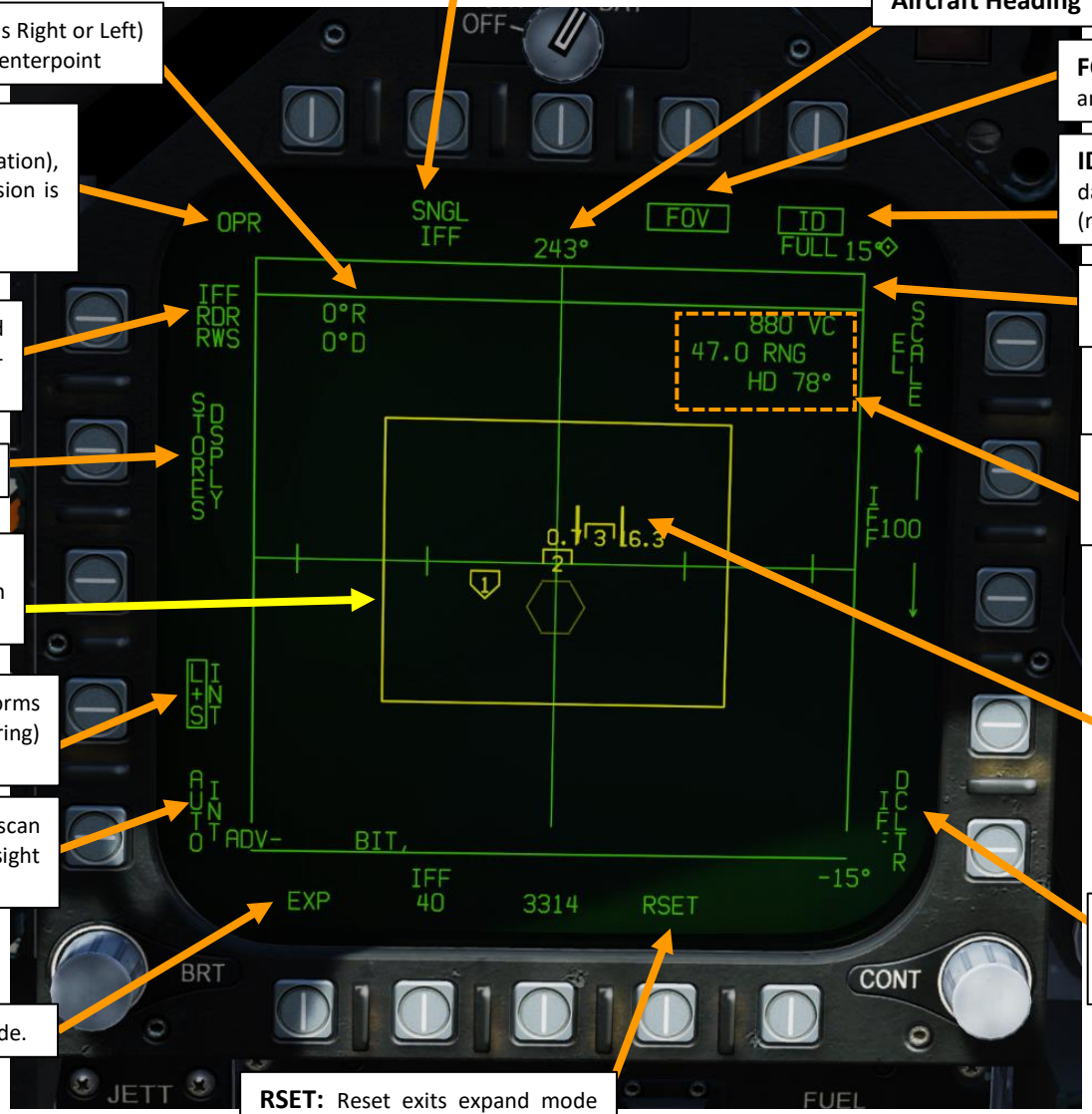
FOV (Field-of-View) Cue Toggle: Toggles on and off the radar and FLIR FOV cues

Sensor Status:
- For Radar: OFF, STBY (standby), OPER (operating), INT (Interrogation), SIL (silent), DEGD (BIT or MUX failure), EMCON (radar transmission is suspended due for Emissions Control), or TEST (self-test).
- For FLIR: OFF, STBY, OPER, DEGD, or TEST.

ID Option: Determines the type of data shown in the HAFU datablock. Toggles between FULL (radar and MSI data), RDR (radar data only), and unboxed (datablock hidden).

Azimuth-Only Contacts: Contacts without elevation data are shown here in the "dugout."

Selected Sensor & Mode: toggles between the radar and the FLIR as the active sensor. Underneath is the sensor sub-mode (RWS, TWS, or VS for RDR… PNT or TRACK for FLIR).



Display Stores: displays the STORES page when pressed.

Target Data: Data for the L&S Primary Target, or the track currently under the cursor. Includes closure velocity (V_C in kts), range to target (nm), and target heading.

Radar Field-of-View (FOV)
This FOV box can only change azimuth and elevation with the radar controls from the RDR ATTK page.

HAFU (Hostile, Ambiguous, Friendly, Unknown) Symbol

L&S Interrogation: when boxed, automatically performs continuous pointed CIT interrogations on the L&S (Launch & Steering) Primary Target (whenever a L&S is designated).

Auto Interrogation: when boxed, automatically performs scan interrogations at the selected azimuth centered about boresight every 10 seconds.

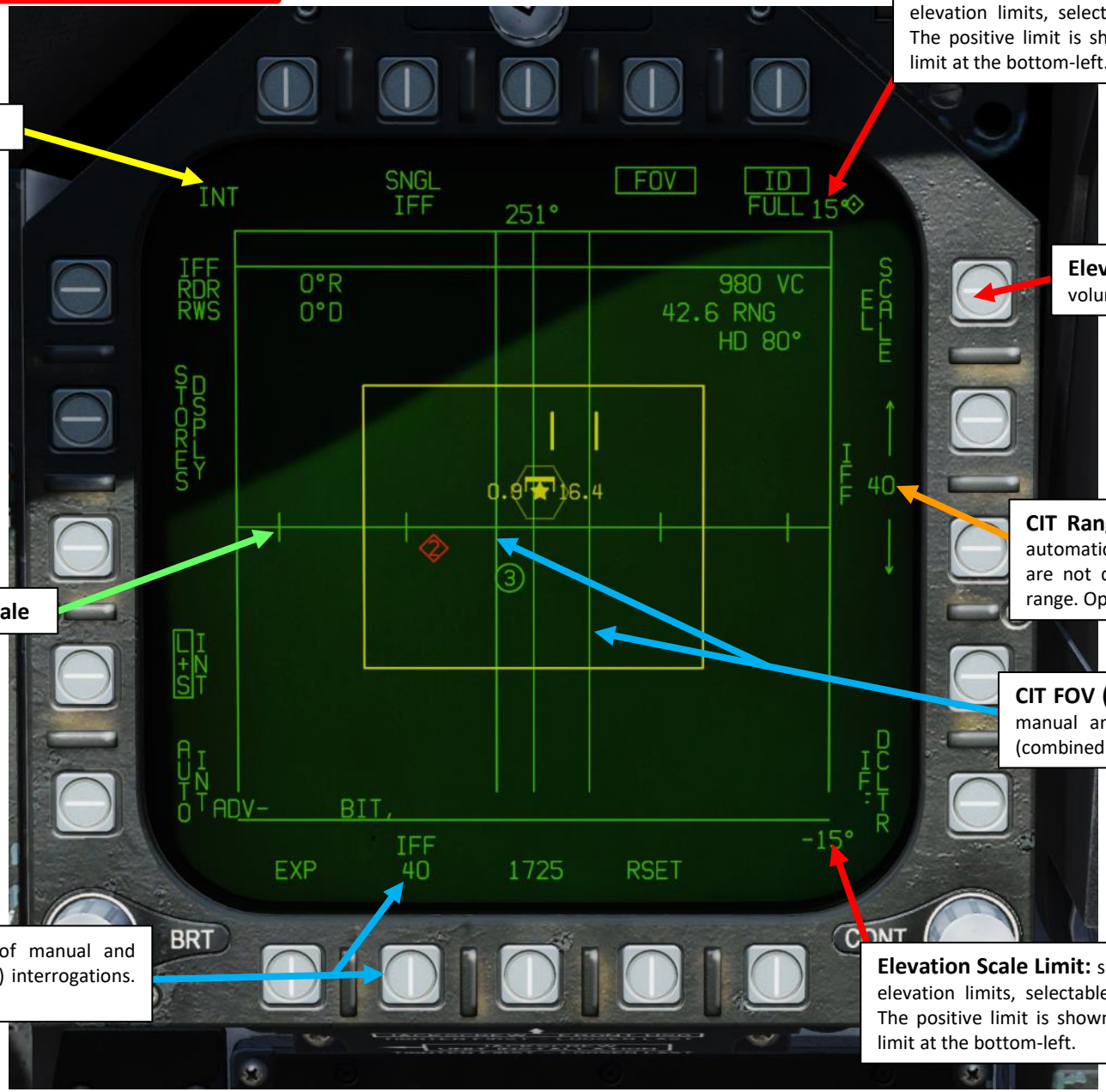
IFF (Identify-Friend-or-Foe) Declutter: when boxed, suppresses display of new CIT tracks, and allows existing tracks to age out.

Expand Mode: enters AZ/EL Expanded Mode.

RSET: Reset exits expand mode and re-prioritizes MSI trackfiles

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

C – Radar/IFF Sub-level



Sensor Status: INT (Interrogation) Mode

Elevation Scale Limit: shows the positive and negative elevation limits, selectable using EL SCALE pushbutton. The positive limit is shown at the top-left; the negative limit at the bottom-left.

Elevation Scale Toggle: Cycles between scan volumes: ±70°×±15°, ±70°×±30°, or ±70°×±70°.

CIT Range: shows the maximum range for manual (not automatic) CIT interrogations; returns beyond this range are not displayed. The up and down arrows change the range. Options are 5, 10, 20, 40, 80, and 100 NM.

Azimuth Scale

CIT FOV (Field-of-View): shows the azimuthal extent of manual and automatic interrogations made by the CIT (combined interrogator/transponder).

CIT Azimuth: changes the horizontal extent of manual and automatic CIT (combined interrogator/transponder) interrogations. Cycles between 20°, 40°, 80°, and 140°.

Elevation Scale Limit: shows the positive and negative elevation limits, selectable using EL SCALE pushbutton. The positive limit is shown at the top-left; the negative limit at the bottom-left.

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

C – Radar/IFF Sub-level

TDC Control Indication Diamond
When the AZ/EL display is selected for TDC control, this diamond symbol is displayed in the top right corner of the display. Selecting the AZ/EL for TDC control is done by moving the Sensor Control Switch to the left (if the AZ/EL page is displayed on the left DDI). If your AZ/EL is placed on the right DDI, you'd need to set the Sensor Control Switch left to move TDC on the right DDI.



Surveillance Data:
To obtain this data, slew the TDC (Throttle Designator Caret) over the desired target. In order to do so, press the Sensor Control Switch in the direction

This datablock displays information for each sensor that is contributing data to the multi-sensor integration target under the cursor. In this example:

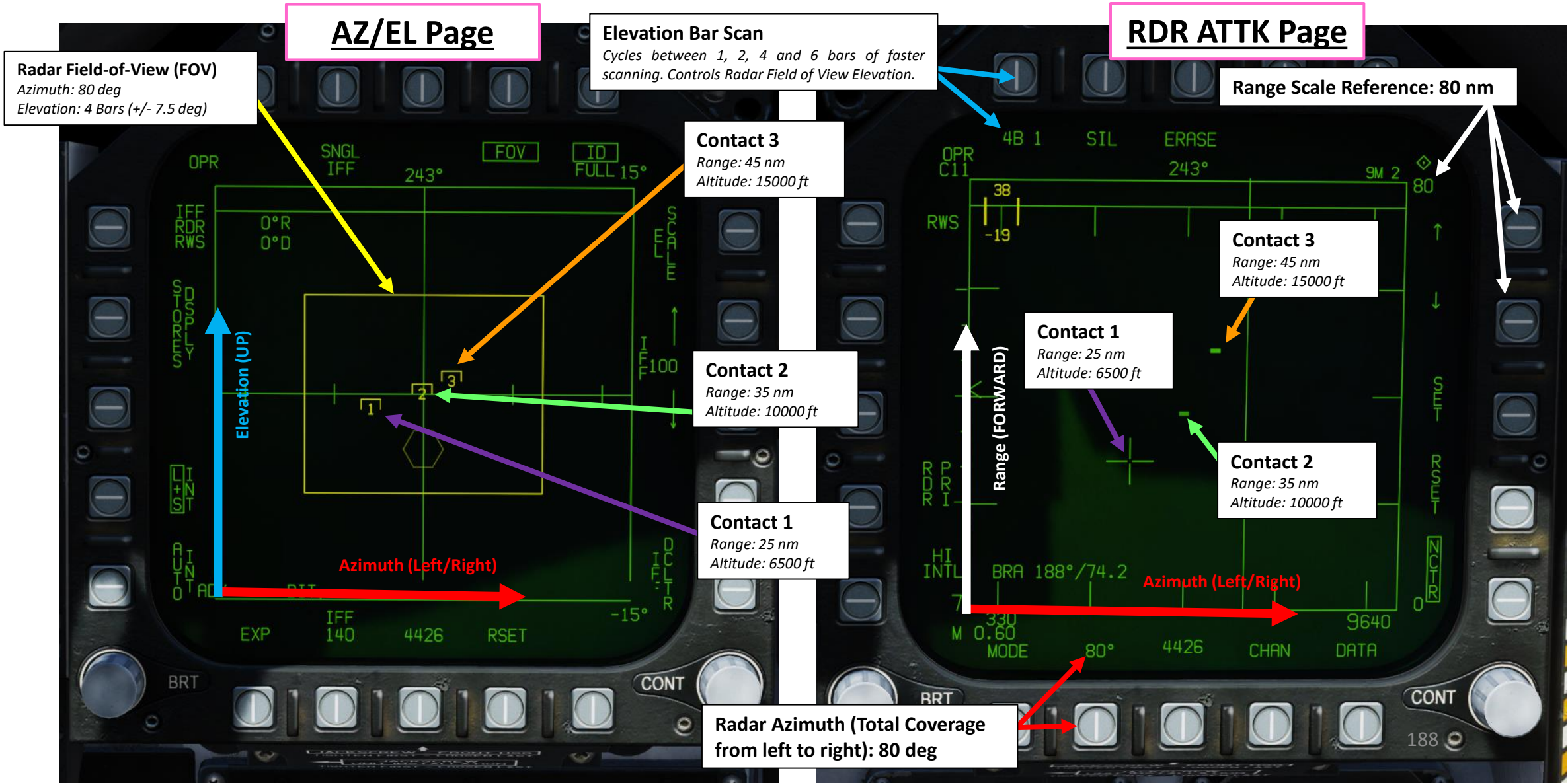
- The first line depicts a friendly HAFU symbol and aircraft type of F/A-18 provided by Link-16 datalink.
- The second line indicates the Link-16 pilot ID (ED11 for "ENFIELD1-1").
- The third line displays "P" indicating the presence of a PPLI (Precise Participant Location and Identification) track for this target, and "4" to indicate a friendly IFF (Identify-Friend-or-Foe) mode-4 reply.

Target Designated (TDC over symbol)

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

The RDR ATTK and AZ/EL pages complement each other: while the RDR ATTK displays a top-down view, the AZ/EL displays azimuth and elevation. Therefore, you can have a mental picture of the location of the contacts within a 3D space. Keep in mind that AZ/EL Radar Field-of-View can only be modified with radar controls from the RDR ATTK page.

C – Radar/IFF Sub-level



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

C – Radar/IFF Sub-level

CHANGING RADAR SCAN CENTERPOINT

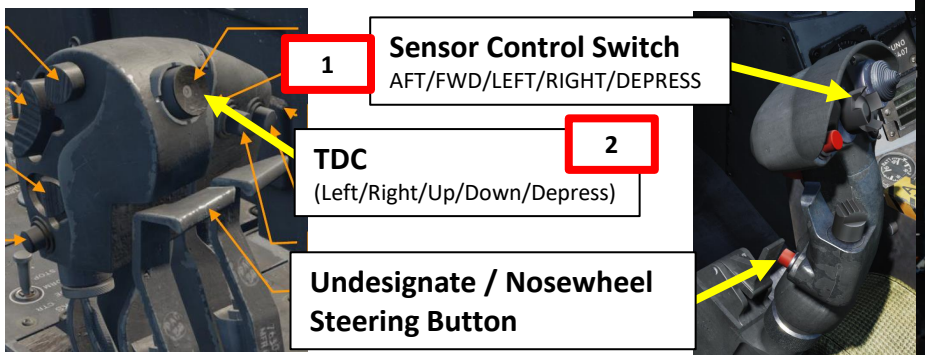
The Sensor Control Switch LEFT/RIGHT is used to set up which display is selected (left DDI, right DDI). Use it to select the AZ/EL page. The Selection Diamond indicates the page is selected.

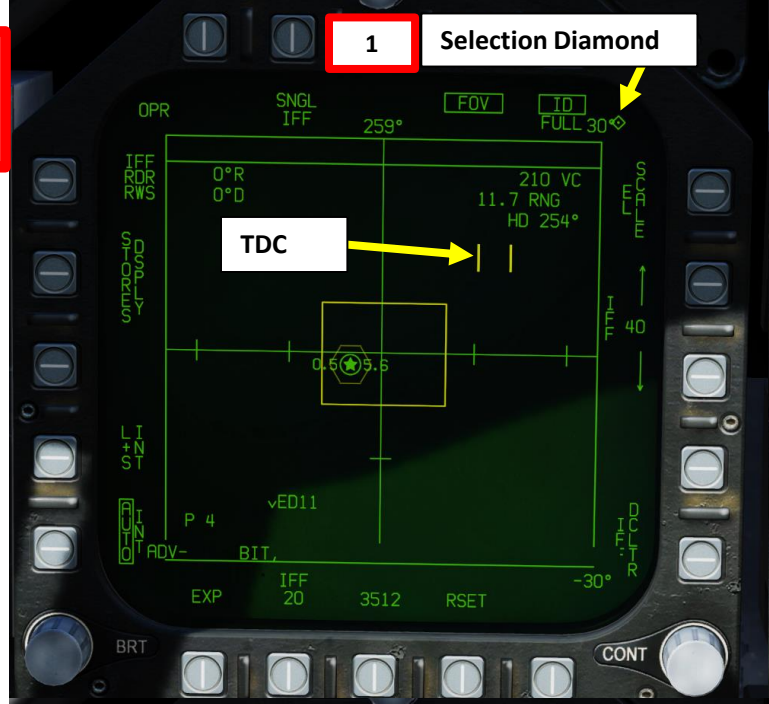
Pressing and holding TDC (Throttle Designation Controller) when the cursor is not over a HAFU symbol will change the cursor to a pointing cross, **which can be slewed using the TDC**.

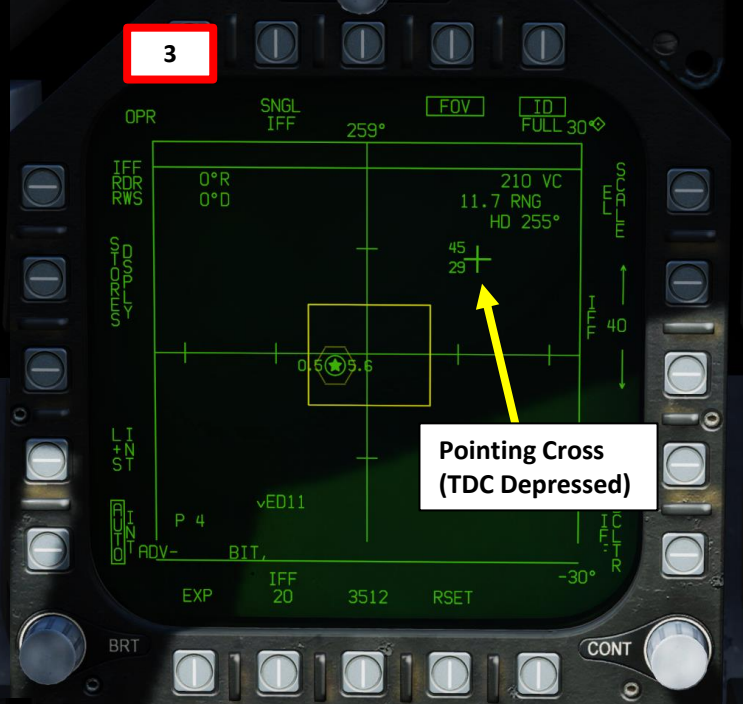
To the left of the pointing cross are the minimum and maximum altitudes (in thousands) for the radar scan volume at one-half the range selected on the Attack format. For example, if the radar range is currently 40 NM, the altitudes shown next to the pointing cross represent the minimum and maximum altitudes of the radar scan volume at 20 NM. If the active radar mode is VS (velocity search), the altitudes shown are at a fixed range of 40 NM.

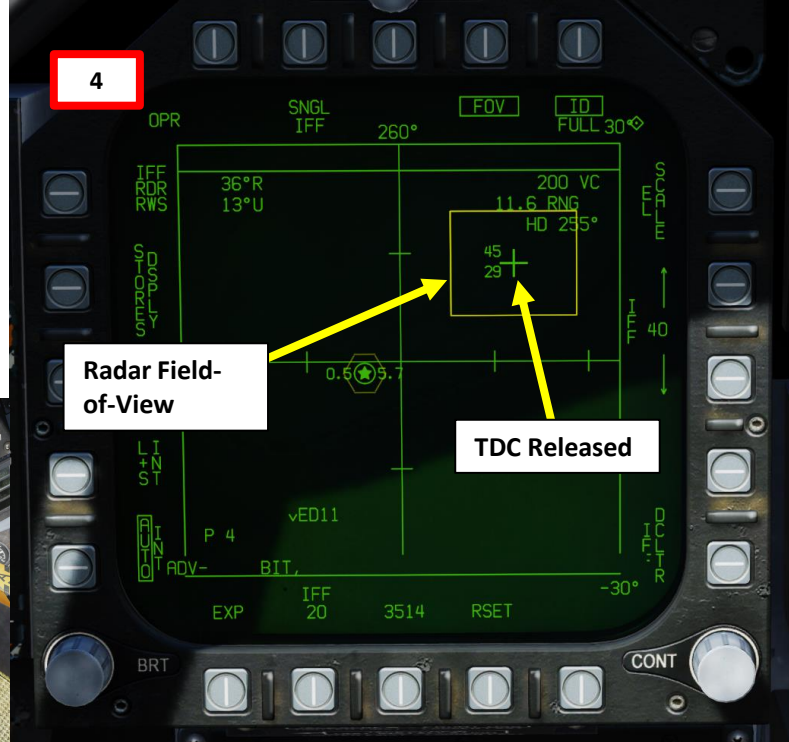
If FLIR (Targeting Pod) is the selected sensor, only one altitude is shown adjacent the pointing cross, representing the altitude along the FLIR line of sight at one-half the selected range on the Attack format.

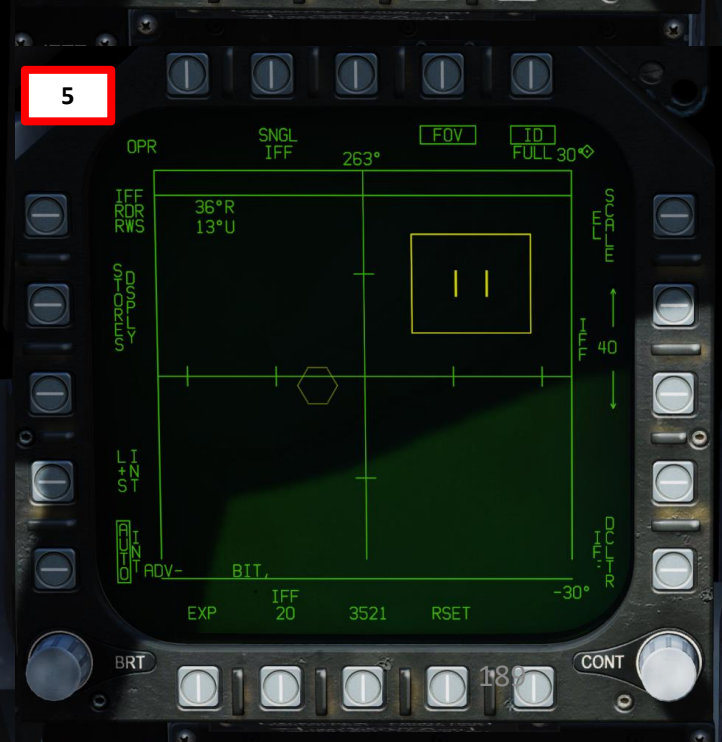
Releasing TDC Depress re-centers the radar scan volume in the location of the pointing cross and reverts the pointing cross back to a cursor.











2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

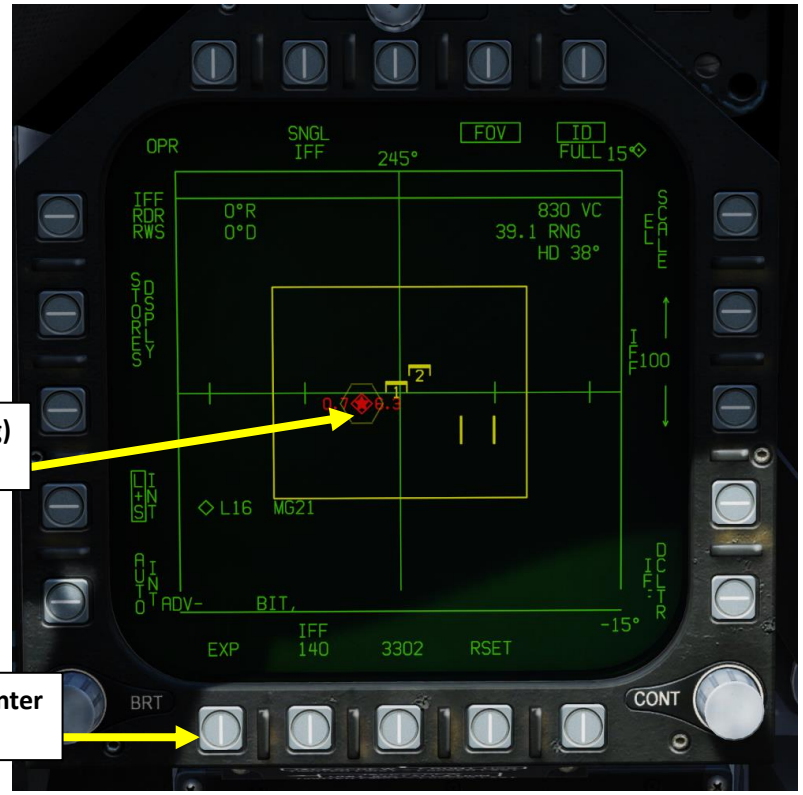
C – Radar/IFF Sub-level

EXPANDED MODE

The Expanded (EXP) AZ/EL format option can be seen as a "zoom in" function and can be selected any time a L&S (Launch & Steering) Primary Target exists. The EXP format represents a fixed-volume of 20 deg (+/- 10 deg) in azimuth by 10 deg (+/- 5 deg) in elevation, centered about the L&S target. The L&S target becomes centered in the display and other trackfiles are scaled relative to the L&S target.

When in EXP:

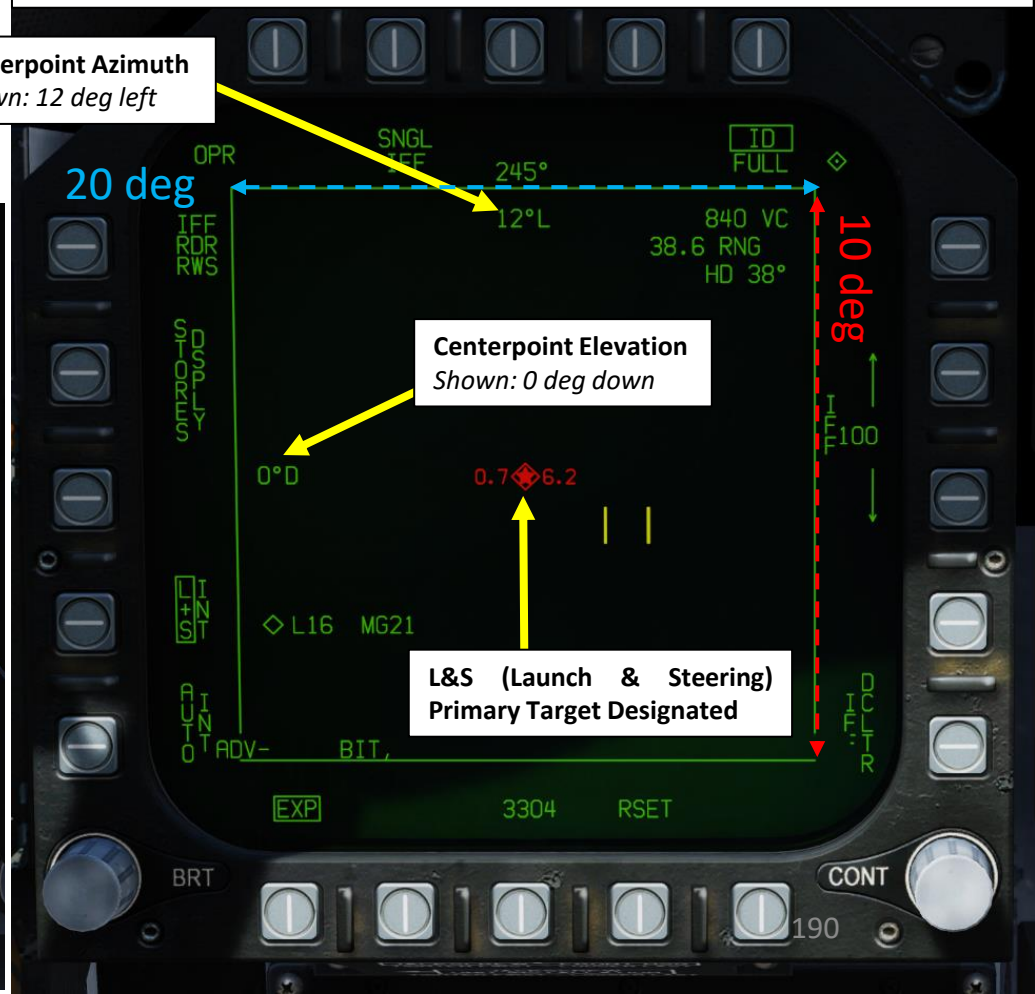
- Field-of-view option and associated cueing are removed
- Scan centering functions are inhibited
- Slewing functions are inhibited.



L&S (Launch & Steering) Primary Target Designated

Press this button to enter EXP (Expanded) Mode

EXP (Expanded) Mode



Centerpoint Azimuth
Shown: 12 deg left

Centerpoint Elevation
Shown: 0 deg down

L&S (Launch & Steering) Primary Target Designated

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

D – FLIR Sensor Mode Sub-level

The FLIR sub-level allows you to slave your targeting pod to a radar-locked target and switch to the FLIR display. Make sure the targeting pod is powered and the Master Mode is set to Air-to-Air.

Sensor Status:
- For Radar: OFF, STBY (standby), OPER (operating), INT (Interrogation), SIL (silent), DEGD (BIT or MUX failure), EMCON (radar transmission is suspended due for Emissions Control), or TEST (self-test).
- For FLIR: OFF, STBY, OPER, DEGD, or TEST.

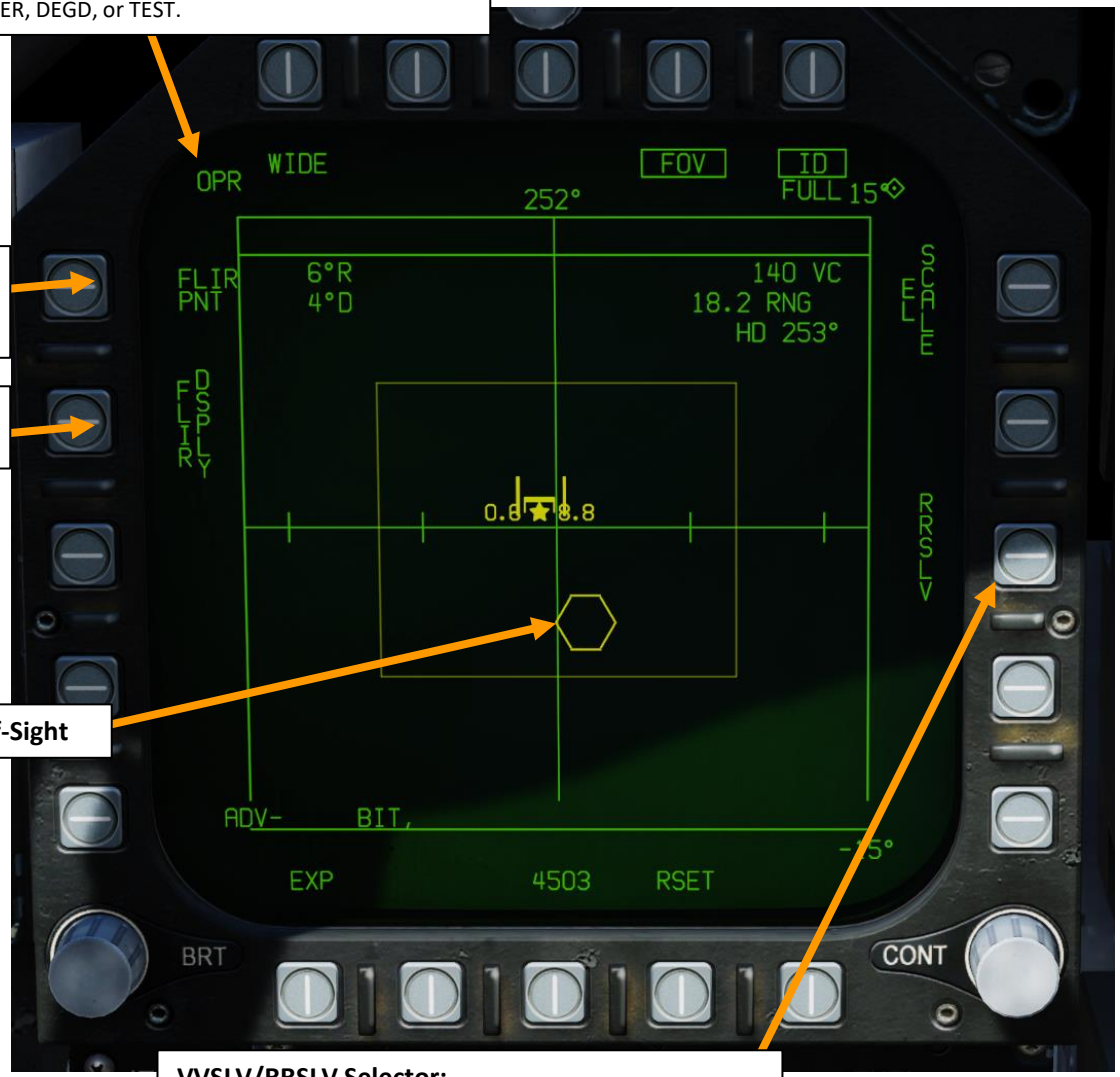
Selected Sensor & Mode: toggles between the radar and the FLIR as the active sensor. Underneath is the sensor sub-mode (RWS, TWS, or VS for RDR… PNT or TRACK for FLIR).

FLIR DSPLY:
Displays the FLIR (targeting pod) feed



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

FLIR Line-of-Sight



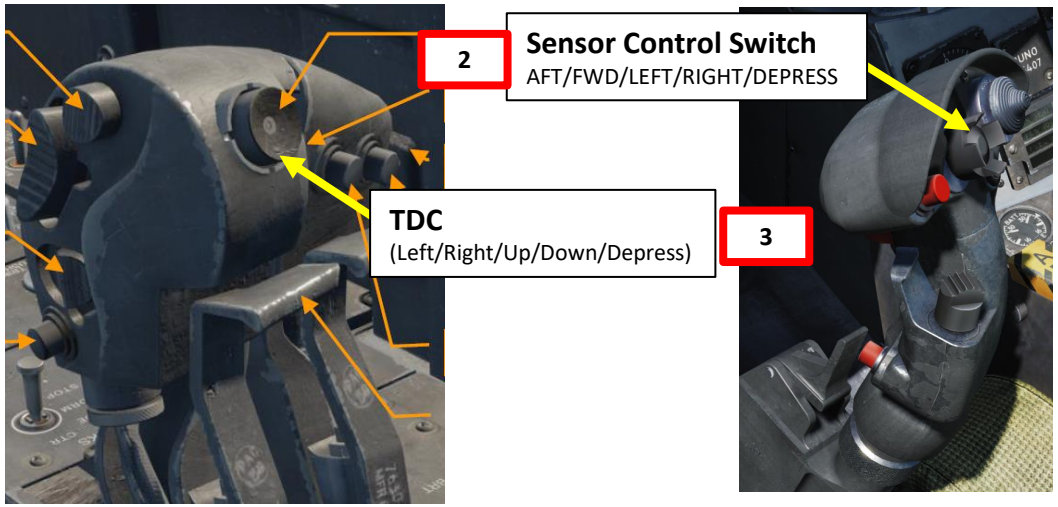
VVSLV/RRSLV Selector:
- VVSLV allows the targeting pod line-of-sight to be slaved to the velocity vector
- RRSLV: allows the targeting pod line-of-sight to be slaved to the radar

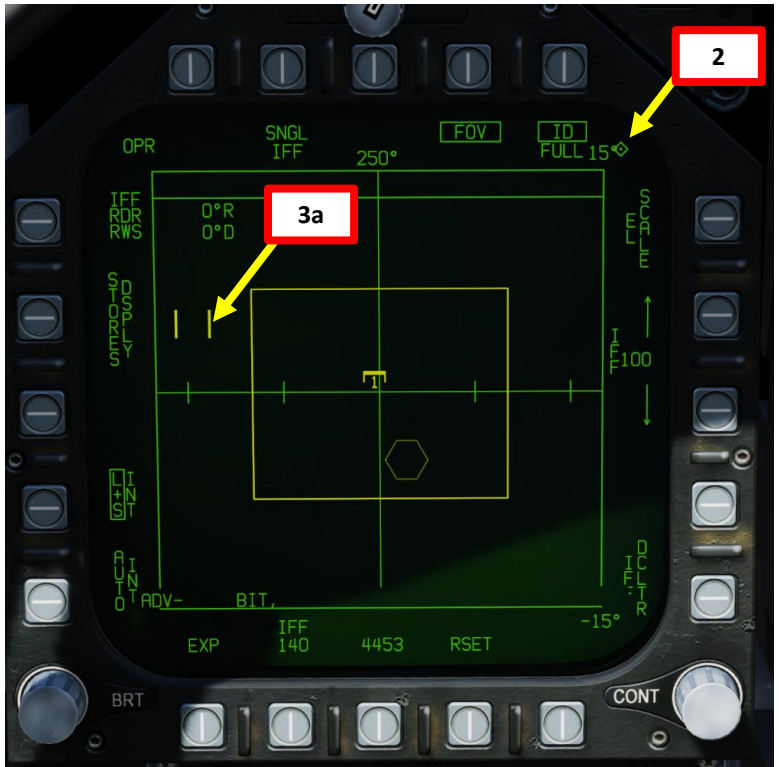
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

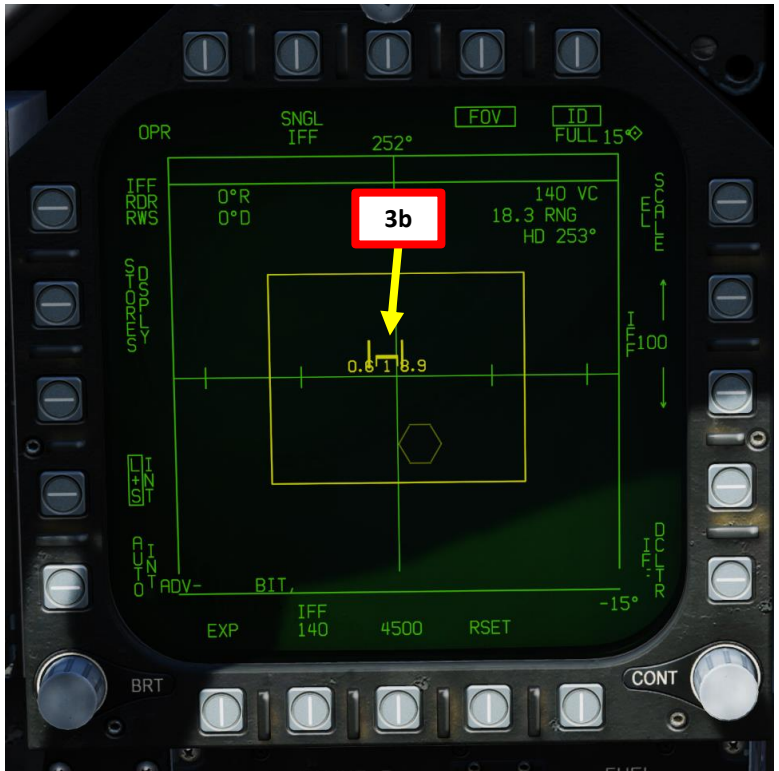
D – FLIR Sensor Mode Sub-level

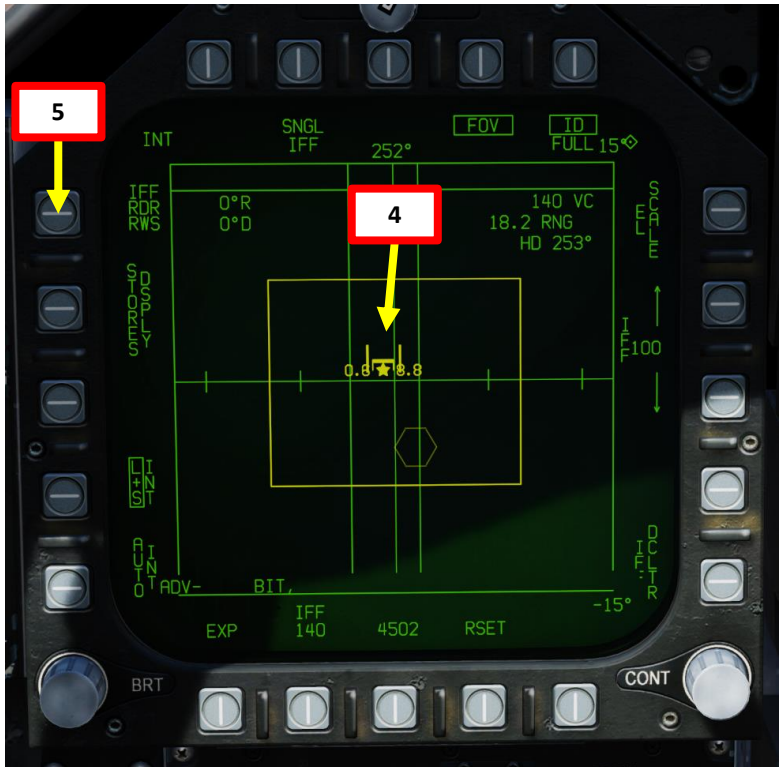
Here is an example on how to use the targeting pod in the AZ/EL FLIR sub-page.

1. Ensure FLIR is powered and A/A Master Mode is selected
2. Set AZ/EL page on any DDI (we will take the left one), then press Sensor Control Switch LEFT to select the left DDI. Selection Diamond should be visible.
3. Press and hold TDC (Throttle Designation Controller), then slew TDC over a HAFU symbol in the AZ/EL page.
4. When TDC is released, HAFU symbol will become the L&S (Launch & Steering) Primary Target designated by the target.
5. Press the OSB next to “IFF RDR” to select FLIR sub-page.





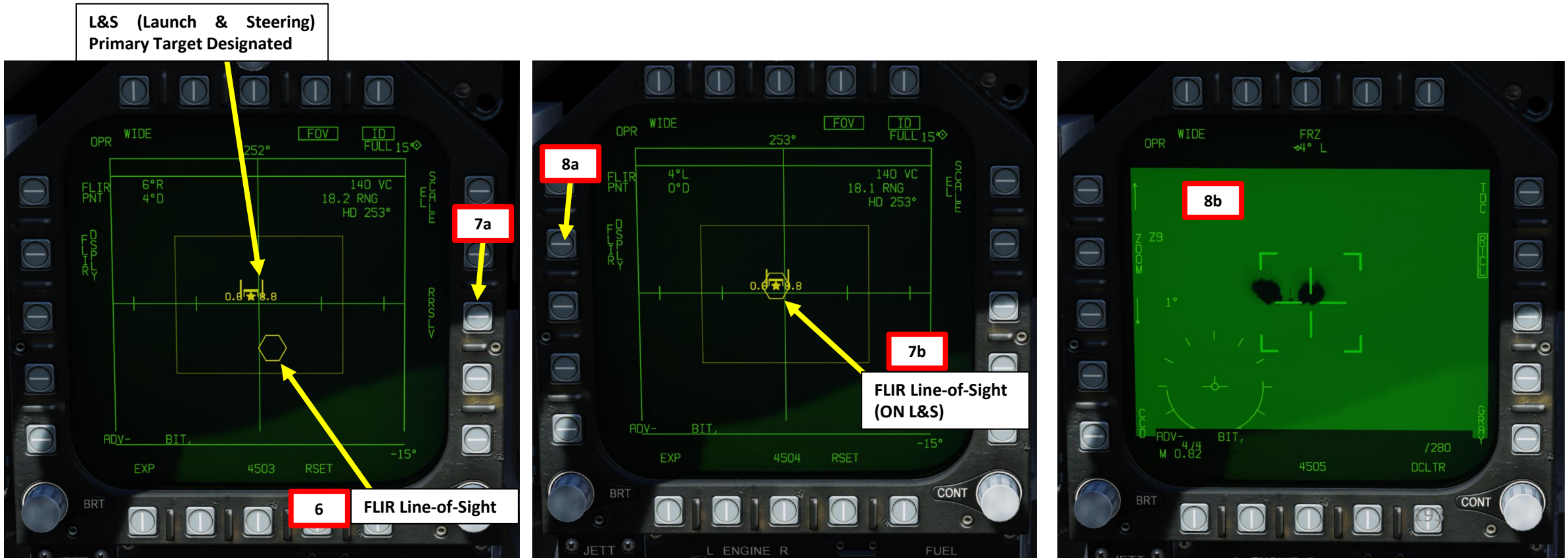




2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.1.2 – Radar Display: AZ/EL Format

D – FLIR Sensor Mode Sub-level

6. In this particular situation, the FLIR line-of-sight is currently not slaved to the target we have radar locked.
7. Press on the OSB next to RRSLV to slave the targeting pod to the radar locked target. The line-of-sight symbol should slew over the L&S.
8. Press FLIR DSPLY to access the FLIR feed, which will show the target through the targeting pod's sensor.



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.2 – Main Modes

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

BVR Search sub-modes include:

- **RWS** (Range While Search): RWS radar mode allows for detection of contacts in a large volume. It is the default search mode for air-to-air or when an air-to-air missile is placed in priority. RWS mode provides all-aspect (nose-on, tail-on) and all altitude (look-up, look-down) target detection. The display shows range as the vertical axis and azimuth angle on the horizontal. While in RWS mode, the RADAR can maintain up to 10 trackfiles.

- **LTWS** (Latent Track While Scan): LTWS provides a Track While Scan (TWS) function while in RWS mode. With LTWS enabled, placing the TDC over a target symbol will display Launch and Steer (L&S) track symbols. However, no “Shoot” cues are displayed. An LTWS target will have its airspeed in Mach displayed to the left and its altitude in thousands of feet to the right. Additionally, its range and closure information are displayed along the right tactical border.

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

- **VS** (Velocity Search): **Not Yet Implemented.** A high PRF (Pulse Repetition Frequency) Pulse Doppler waveform is used for long range detection primarily against nose aspect targets, giving velocity and azimuth information, but no range information. Although velocity search can work against tail-on targets, the Doppler return is weaker, consequently the maximum detection range is also much less. When the target is in the beam (flying perpendicular to the fighter), the closure (Doppler) is the same as ground return and target return is almost zero.

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.2 – Main Modes

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

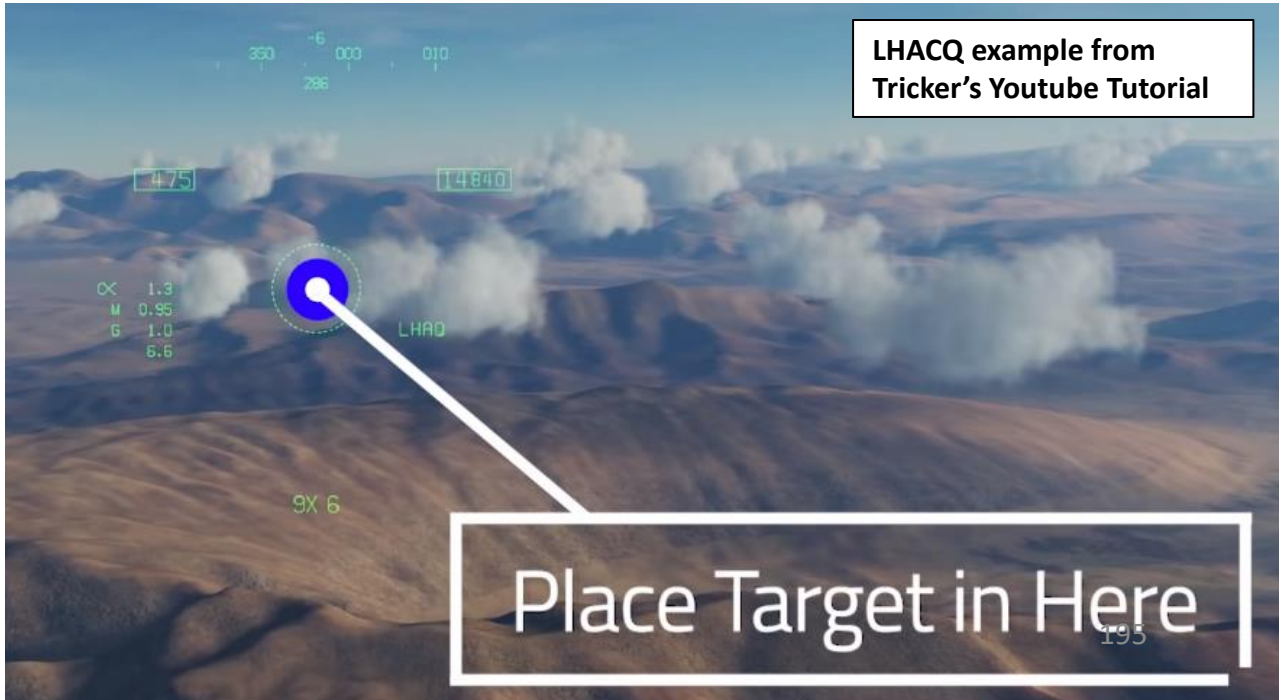
ACM sub-modes include:

- **GACQ** (Gun Acquisition): automatically enabled with air-to-air gun is selected
- **BST** (Boresight): searches targets out to 10 nm
- **VACQ** (Vertical Acquisition): vertical auto-acquisition search pattern covers from -13 deg to +46 deg, searches targets out to 5 nm
- **WACQ** (Wide Acquisition): space-stabilized mode that can be slewed using the TDC controller when uncaged, searches targets out to 10 nm

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If the JHMCS (Joint Helmet-Mounted Cueing System) is active:

- **HACQ** (Helmet Acquisition): if Sensor Control Switch is held for less than 800 ms (0.8 sec), this mode allows you to lock targets within 10 nm of the helmet reticle
- **LHACQ** (Long Range Helmet Acquisition): if Sensor Control Switch is held for more than 800 ms (0.8 sec), this mode allows you to lock targets within 40 nm of the helmet reticle



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.2 – Main Modes

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

AACQ:

AACQ (Automatic Acquisition): AACQ serves as a fast way of acquiring a track/contact into Single Target Track. It is entered by pressing the Sensor Control Switch right when the TDC is assigned to the RDR ATTK format, the A/A master mode is engaged, and the radar is not in an ACM mode. "AACQ" will be indicated on the RDR ATTK page and the HUD. If the TDC cursor is not over a contact/track, AACQ will place the closest presently detected contact/track in an STT. If the TDC cursor is over a contact/track, it will place it in STT.

STT

STT (Single Target Track): STT mode is a traditional radar "lock" where the radar continuously scans a single target, resulting in a very high update rate; this makes it the primary method of providing guidance to air-to-air weapons. STT maintains a trackfile for its target and automatically designates it as the L&S if it is not already. The radar is slaved to this trackfile; as such, manual antenna elevation control is inhibited and the B-sweep follows the trackfile. Only the trackfile that is placed in STT is visible and all onboard trackfiles are dropped. In STT, the RDR ATTK format is presented in azimuth along the horizontal axis and range along the vertical axis.

Single Target Track is obtained by:
- depressing the TDC while the cursor is over the Launch & Steering trackfile or while over any raw contact when in a mode where trackfiles are not displayed (e.g. RWS without LTWS)
- using Automatic Acquisition
- using an Air Combat Maneuvering mode

STT is exited by pressing the Undesignate button. The radar is returned to the last-entered search mode.

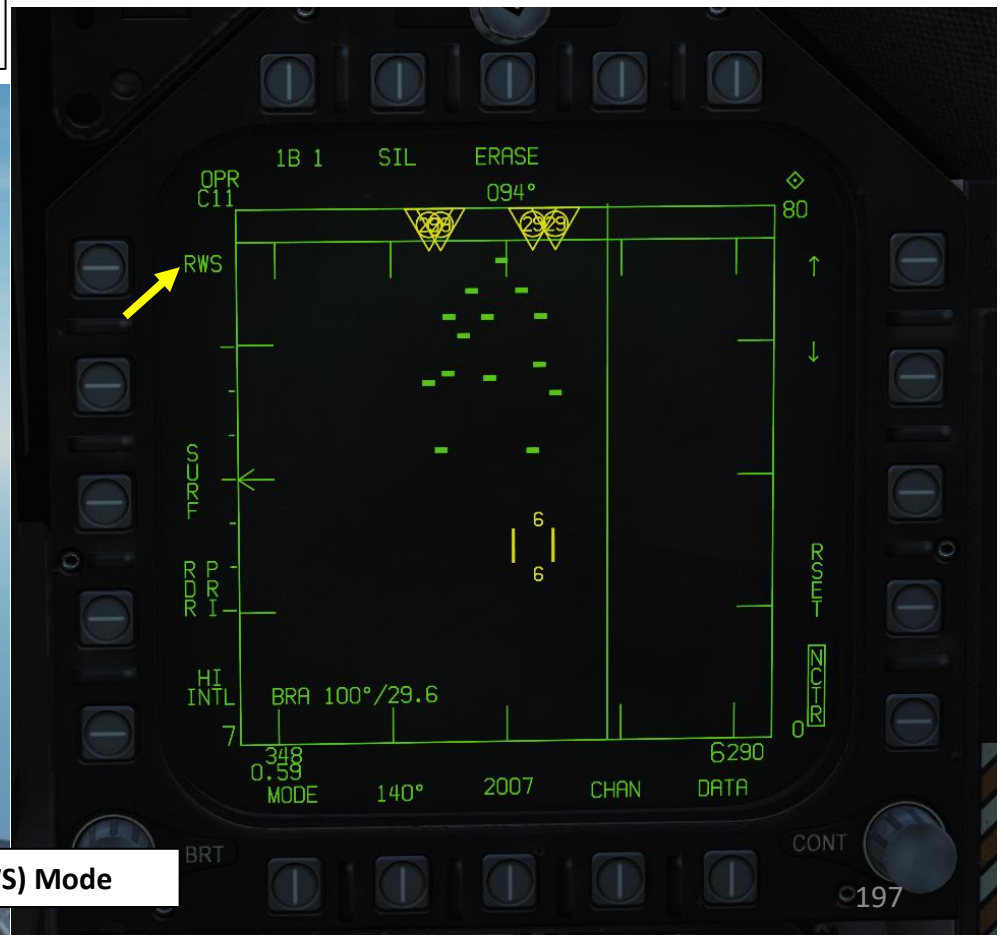
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.3 – RWS Mode

RWS (Range While Search) is the default search mode for air-to-air or when an air-to-air missile is placed in priority.



Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS





BVR (RWS) Mode

FOR LONG RANGE:

BVR Mode is also known as **RWS** (Range While Search). The antenna follows the designated search pattern and informs you of all the tracks discovered in one sweep. You can then select a specific track and lock it.

In BVR mode, the Sensor Control Switch has the following functions:

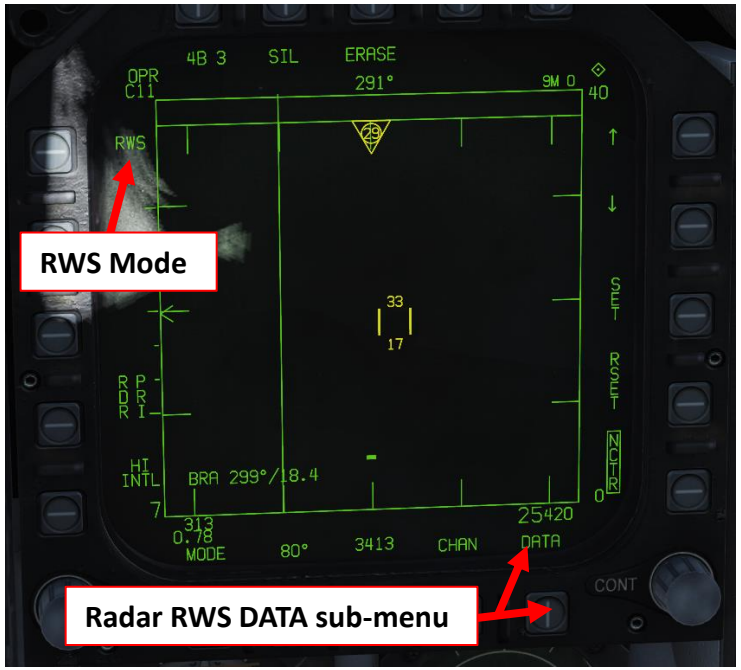
- FWD: Switch to ACM (Air Combat Maneuvering) mode with Boresight selected by default
- AFT: Assigns TDC to center AMPCD
- LEFT: Assigns TDC to left DDI
- RIGHT: Assigns TDC to right DDI

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.3 – RWS Mode: LTWS Option

Latent Track While Scan (LTWS) is a RWS option (you need to go in the DATA sub-menu of the RDR ATTK page) allowing for raw contacts to be displayed as trackfiles with HAFU (Hostile, Ambiguous, Friendly, Unknown) symbology and other information; with the Multi-sensor Integration (MSI) function, offboard trackfile information can also be shown in LTWS. It also allows for the designation of a Launch & Steering (L&S) and Secondary Designated Target (DT2) trackfile. Using the TDC "Depress" and "Slew" commands, you can designate up to three targets.

An onboard-only track is not displayed unless the TDC cursor is over the associated raw contact bricks (aka "target under cursor" or "TUC") or it is designated as the L&S or DT2. In these cases, the brick(s) will be replaced by a HAFU symbol representing the track. Note that since multiple raw radar contacts may be correlated to be a single aircraft and therefore one trackfile, a HAFU may replace multiple bricks.

Offboard-only tracks and tracks that are both onboard and offboard are always displayed as HAFUs and never show their corresponding raw contacts. Note that MSI must be enabled to display offboard trackfile information. We will further explore the HAFU symbology in the Datalink section.





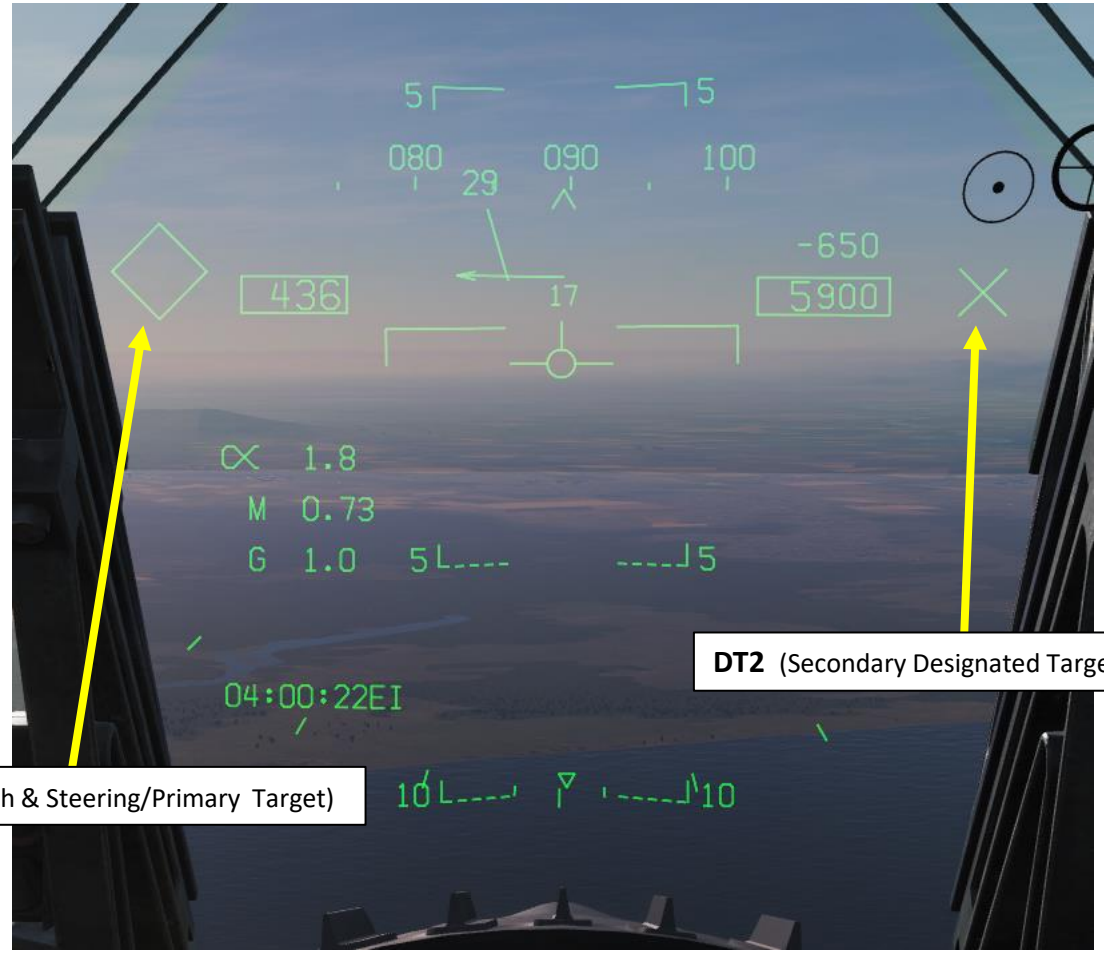
LTWS provides Latent Track While Scan function while in RWS (Range While Search) mode.

HAFU symbols in LTWS, whenever under the cursor or designated as the L&S or DT2, feature the track's Mach number on the left side and its altitude in thousands of feet on the right. A line also stems out to indicate a trackfile's horizontal velocity (this applies for all).

An IFF interrogation is automatically sent when a TUC is performed. Tracks in LTWS also have Launch Acceptable Region information displayed. Note that weapons cannot, however, be launched and guided from RWS.

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.3 – RWS Mode: LTWS Option

As you hover your TDC over the radar contacts in LTWS, there are two designations: the Launch & Steering target (L&S), and the Secondary Designated Target (DT2). These are essentially the "primary" and "secondary" targets, as assigned by the pilot (there cannot be a DT2 without an L&S). The L&S is also pertinent to air-to-air weapons delivery; launch information is displayed and, depending on the radar mode and weapon, weapons may be guided onto the L&S. The L&S and DT2 have target designators (TDs) superimposed on the HUD so that their position can be better visualized. A star (L&S) and diamond (DT2) is placed in the center of the trackfile's HAFU symbol.

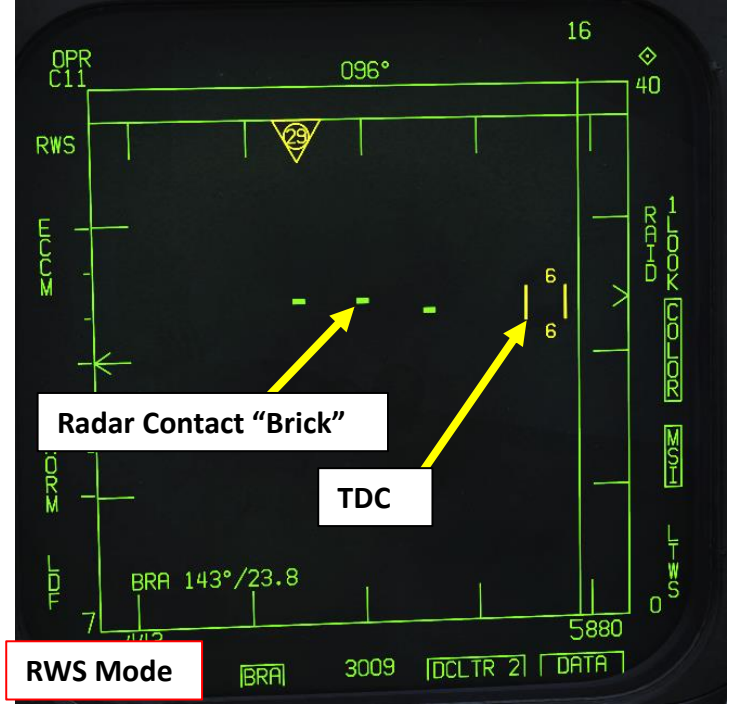


L&S (Launch & Steering/Primary Target)

DT2 (Secondary Designated Target)



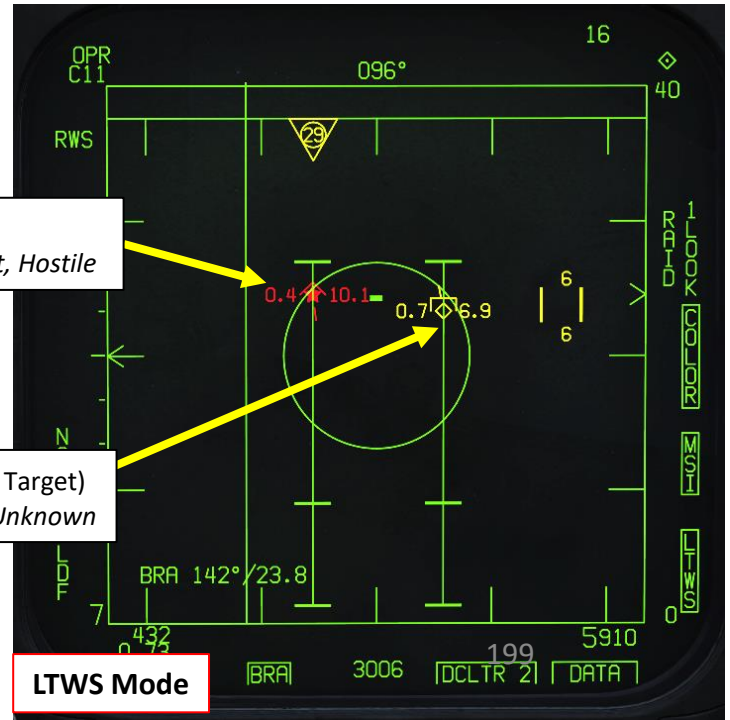
HAFU Symbol



Radar Contact "Brick"

TDC

RWS Mode



L&S
Flying at Mach 0.4, 10100 ft, Hostile

DT2 (Secondary Designated Target)
Flying at Mach 0.7, 6900 ft, Unknown

LTWS Mode

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

INTRODUCTION

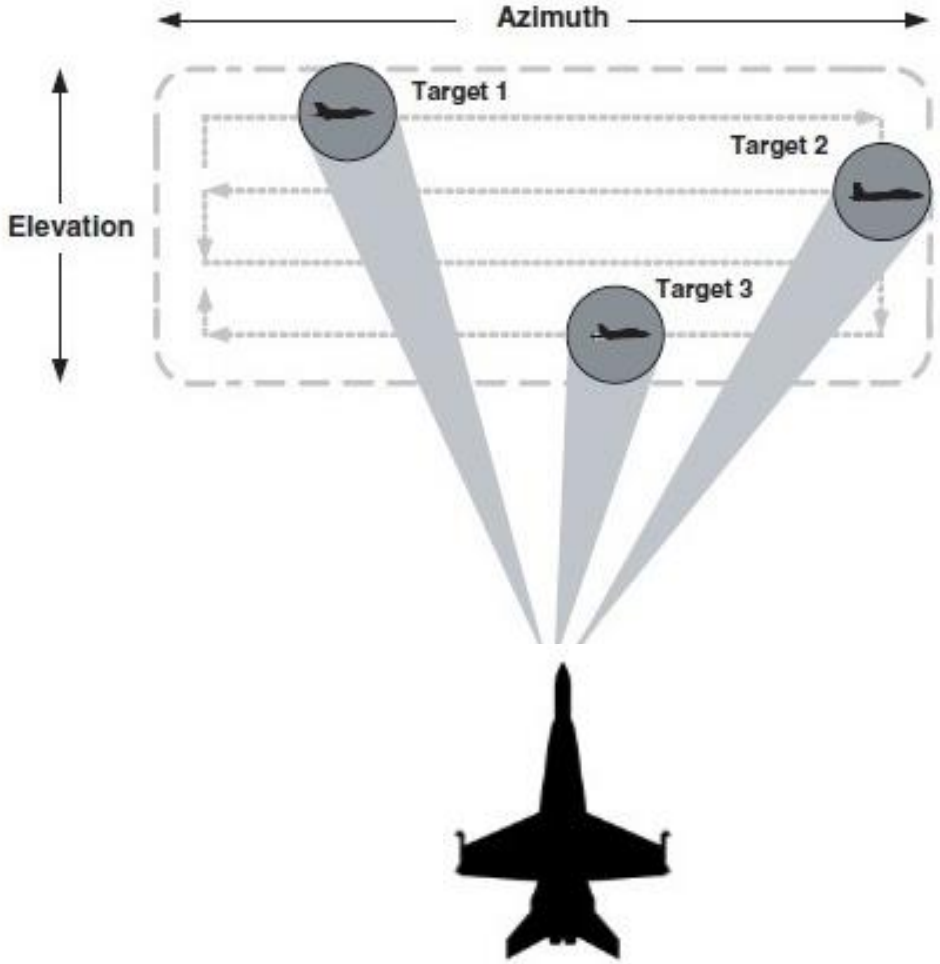
TWS (Track While Scan) mode combines the information unique to RWS and STT (Single Target Track) modes. Generally, the TWS display is very similar to the RWS display. TWS mode allows for trackfiles to be kept at a high update rate. To accomplish this, TWS artificially limits the scan volume (bars/azimuth)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

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

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

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

- **A: Information Display**
- **B: Symbology**
- **C: TWS Scanning**
- **D: TWS Designation**
- **E: Scan Centering Methods**
- **F: TWS Sub-Modes (SCAN RAID & EXP)**



TWS Tutorial by Eagle Dynamics Producer Matt Wagner
https://youtu.be/dQDH2gLYsGg

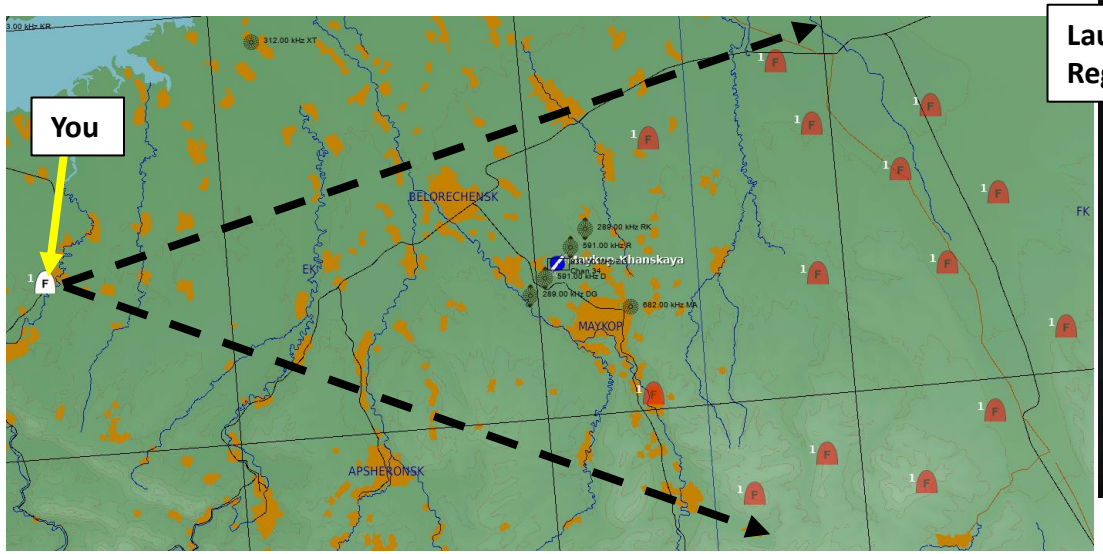
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

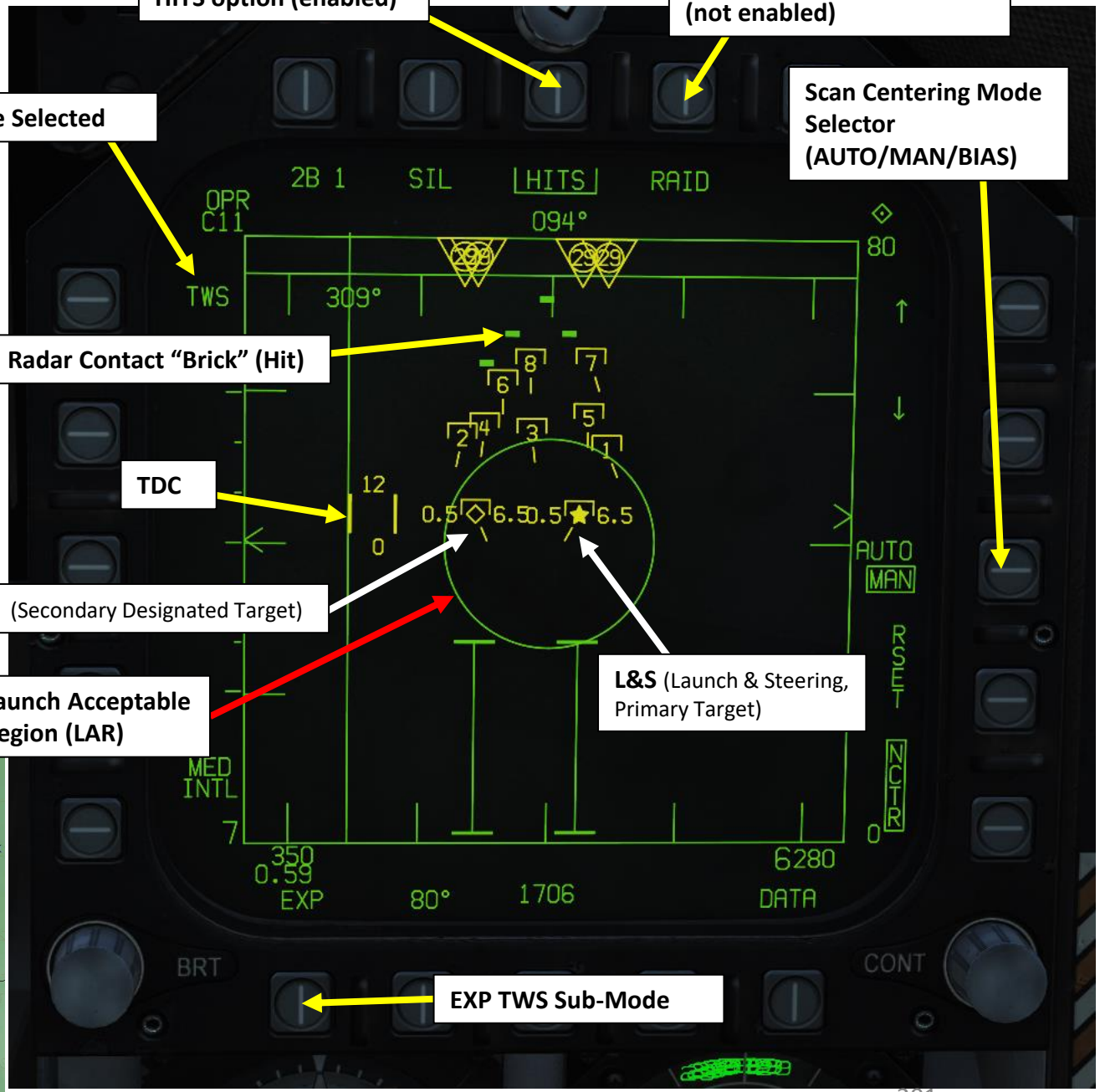
A – INFORMATION DISPLAY

In TWS, contacts are automatically displayed as HAFU (Hostile, Ambiguous, Friendly, Unknown) trackfile symbols if they are in the top 8 ranked or are the **Launch & Steering (L&S)** Primary Target and **Secondary Designated Target (DT2)**.

However, when there are more hits than the maximum amount of onboard trackfiles (10), TWS will display raw hits in the form of rectangular bricks. These bricks ("hits") are only displayed if the HITS option is enabled (boxed).

A **Launch Acceptable Region (LAR)** indication is displayed for the L&S and DT2, and any trackfile under the cursor.





2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

B – SYMBOLOGY

Trackfiles: Trackfiles are displayed as HAFU symbols. The altitude in thousands of feet on the right and Mach number on the left is displayed when cursored over or designated as L&S or DT2. HAFUs are displayed most of them time in TWS, specifically whenever:

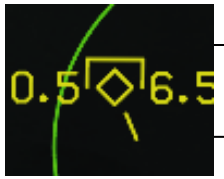
- It is one of the top 8 ranked trackfiles.
- It is an offboard-only trackfile.
- It is designated as the L&S or DT2. An L&S always exists in TWS.

Raw Bricks/Hits: When there are more hits than the maximum amount of onboard trackfiles (10), TWS will display raw hits in the form of rectangular bricks. These bricks ("hits") are only displayed if the HITS option is enabled (boxed).

Launch & Steering (L&S) Primary Target: primary trackfile which weapons will be guided against

Secondary Designated Target (DT2): secondary trackfile which weapons will be guided against

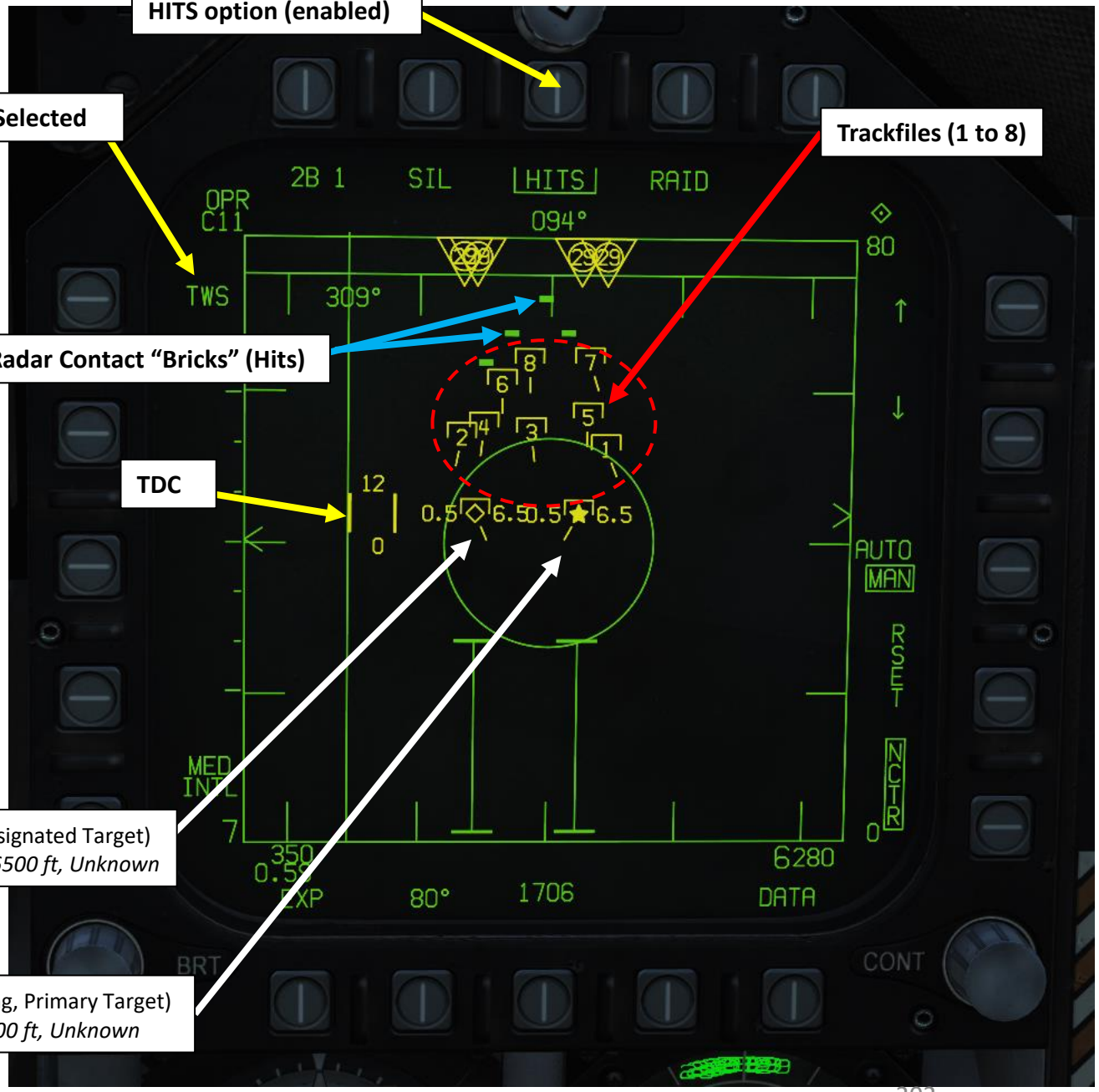




DT2 (Secondary Designated Target)
Flying at Mach 0.5, 6500 ft, Unknown



L&S (Launch & Steering, Primary Target)
Flying at Mach 0.5, 6500 ft, Unknown



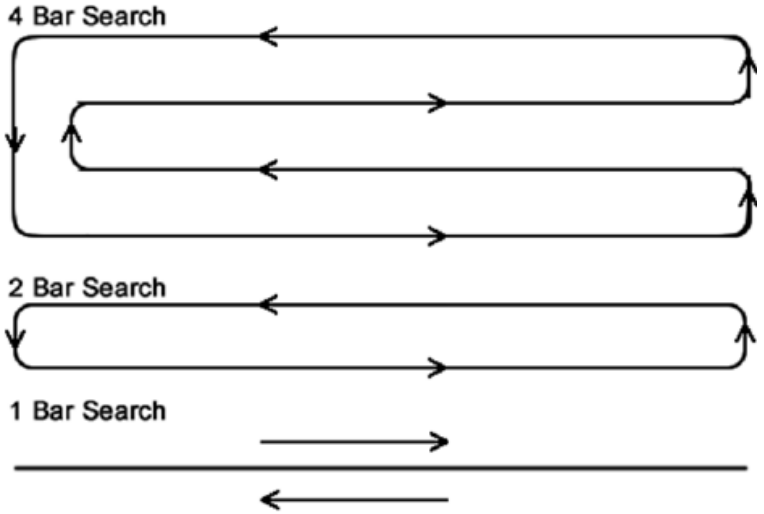
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

C – TWS SCANNING

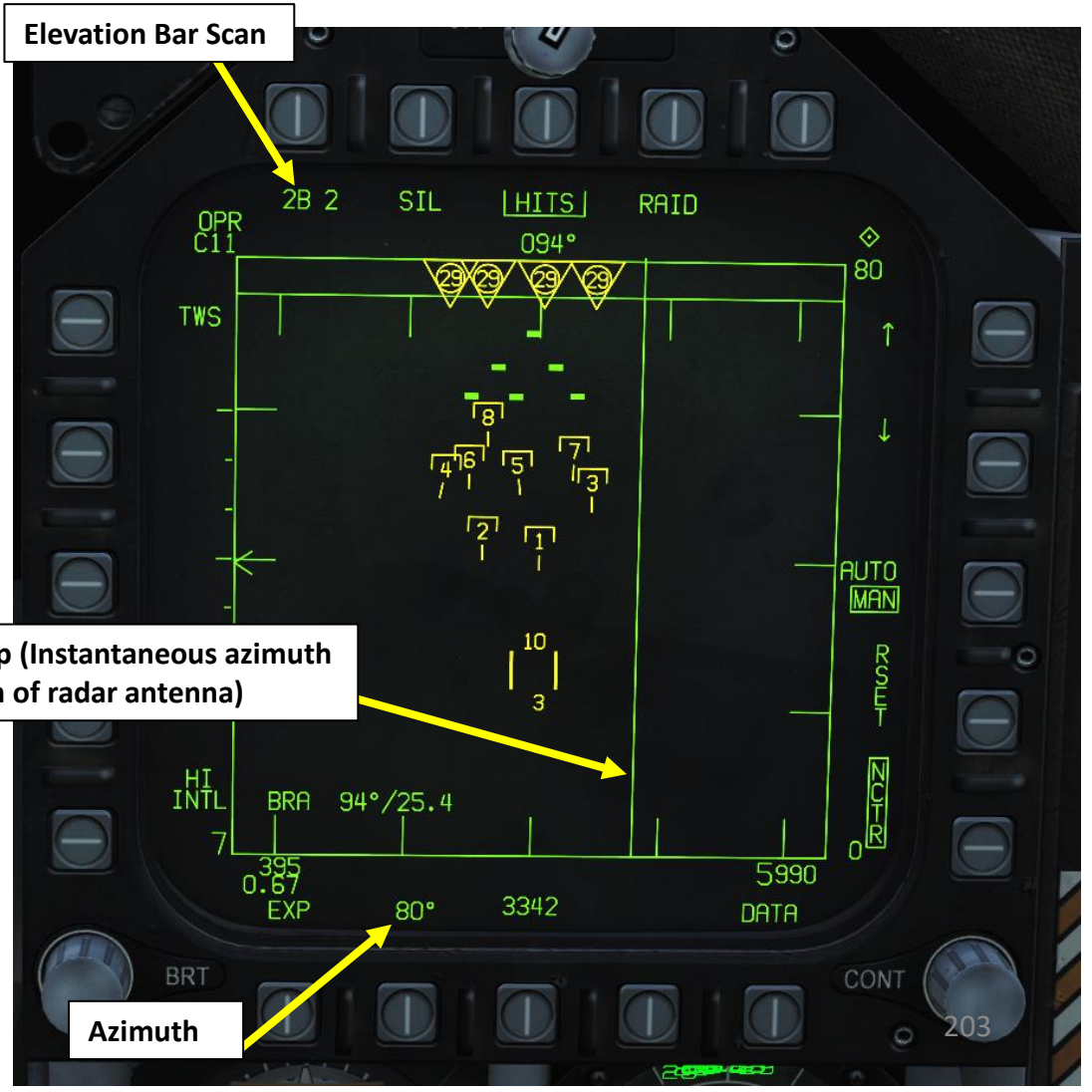
The TWS search mode artificially limits the radar to a scan volume (i.e. bar/azimuth setting) deemed adequate for AMRAAM guidance and in general to maintain relatively up-to-date trackfiles. This limit is enforced whenever the bar setting or azimuth setting is changed; when one is set to a higher setting, if necessary the other one will be decreased automatically.

- For example, if an 60° azimuth is selected and the bar setting is 4B or 6B, it will be reduced to 2B. Alternatively, if a 4B bar is selected while the azimuth is 60°, then the azimuth will be reduced to 40°.

- If TWS is entered from another mode and the scan volume has to be automatically decreased to comply with the limits, the bar setting will be kept (except if 1B, as explained below) and the azimuth will be decreased as necessary.
- TWS does not ever allow for a 120° scan azimuth, nor a 1 bar setting. TWS will automatically change to 80°/2B if entered from RWS/VS with 120°/1B.



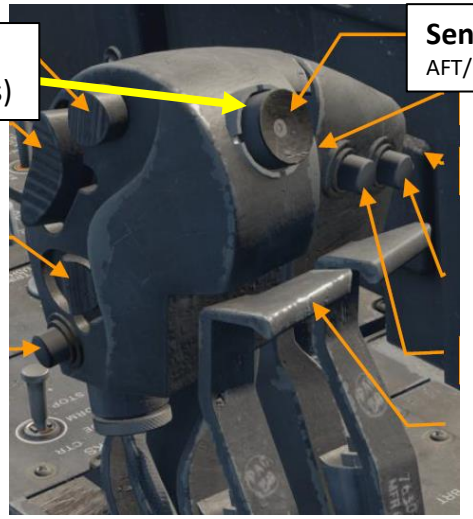
Max Bar	Max Azimuth (deg)
2	80
4	40
6	20

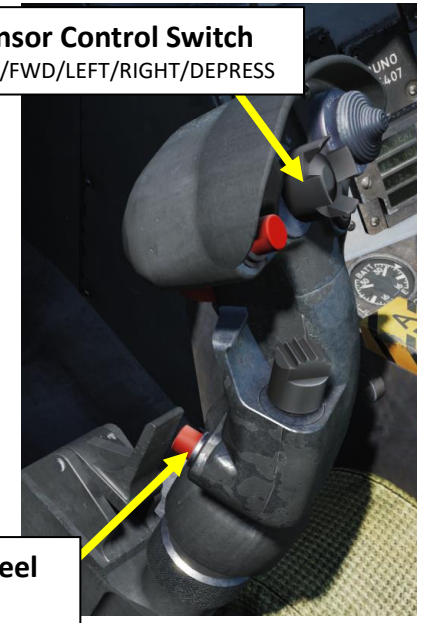


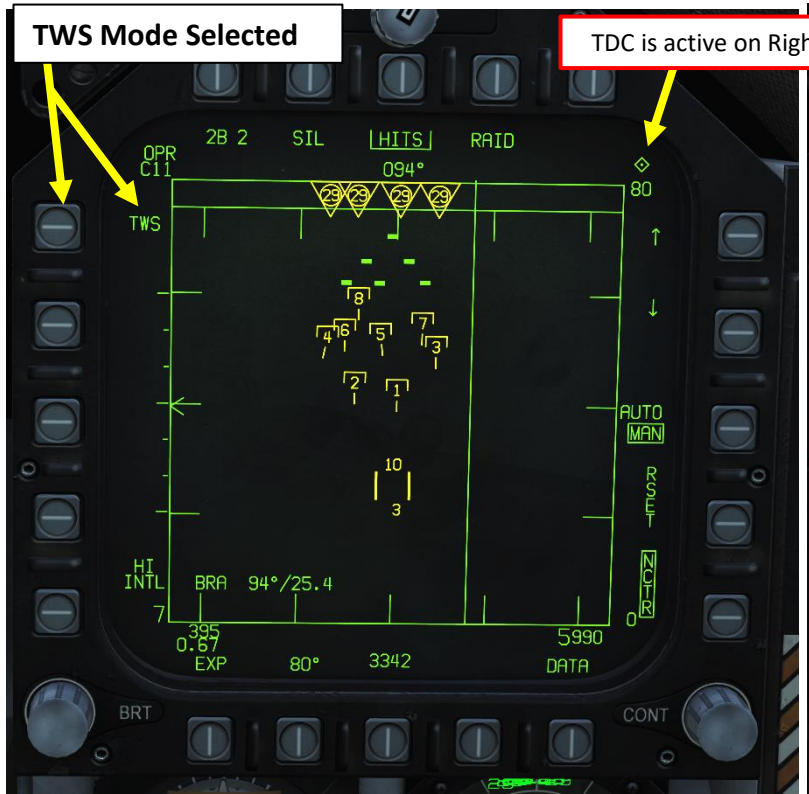
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

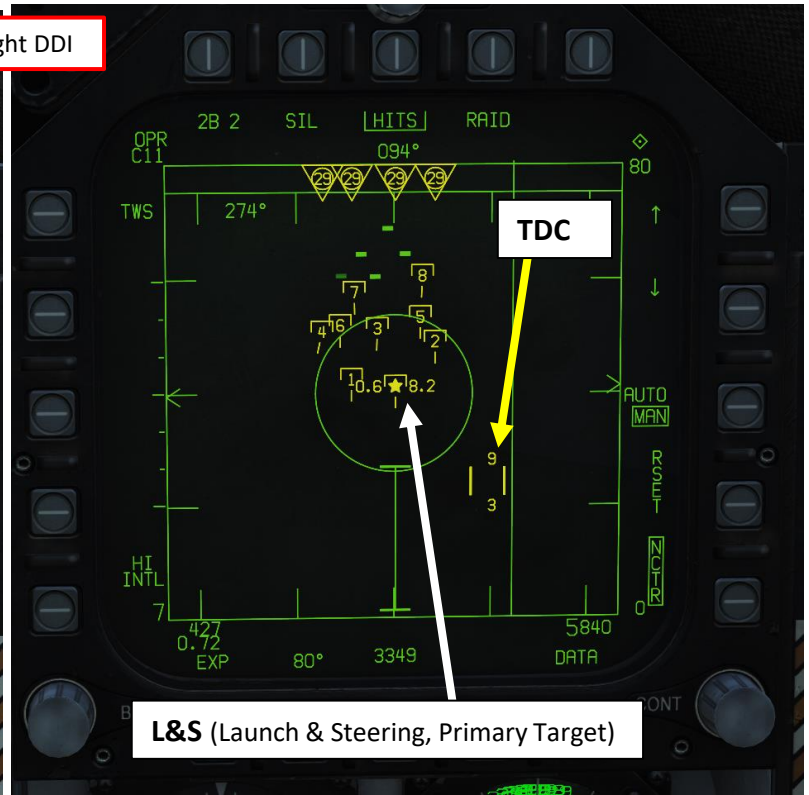
D – TWS DESIGNATION

- TWS mode can be selected with the OSB next to the radar mode selector.
- To designate a primary target (L&S, Launch & Steering), press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible). Then, slew the TDC on the desired trackfile using the TDC controls and **designate target by using the TDC DEPRESS control (« ENTER »)**. Keep in mind that this is NOT a radar lock.
- You can set the L&S on any trackfile you want by repeatingly pressing the « Undesignate » button on the stick. This will cycle between the 10 trackfiles available.
- To designate a secondary target, repeat the same steps for L&S once a primary target has been designated.







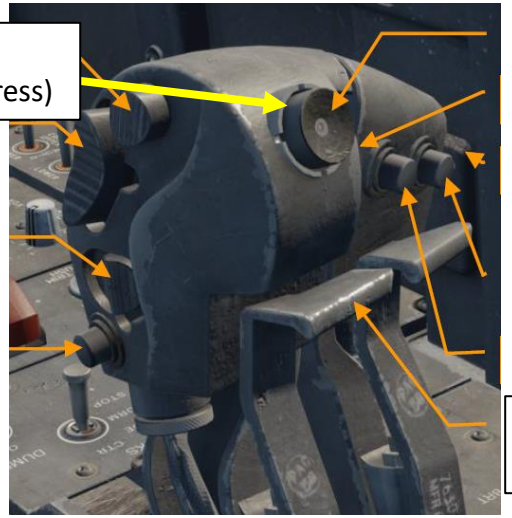


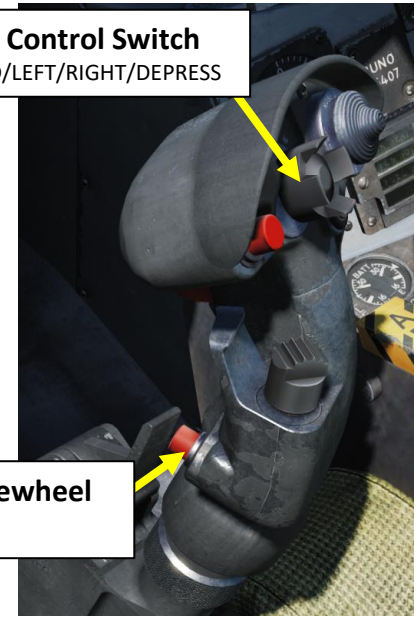


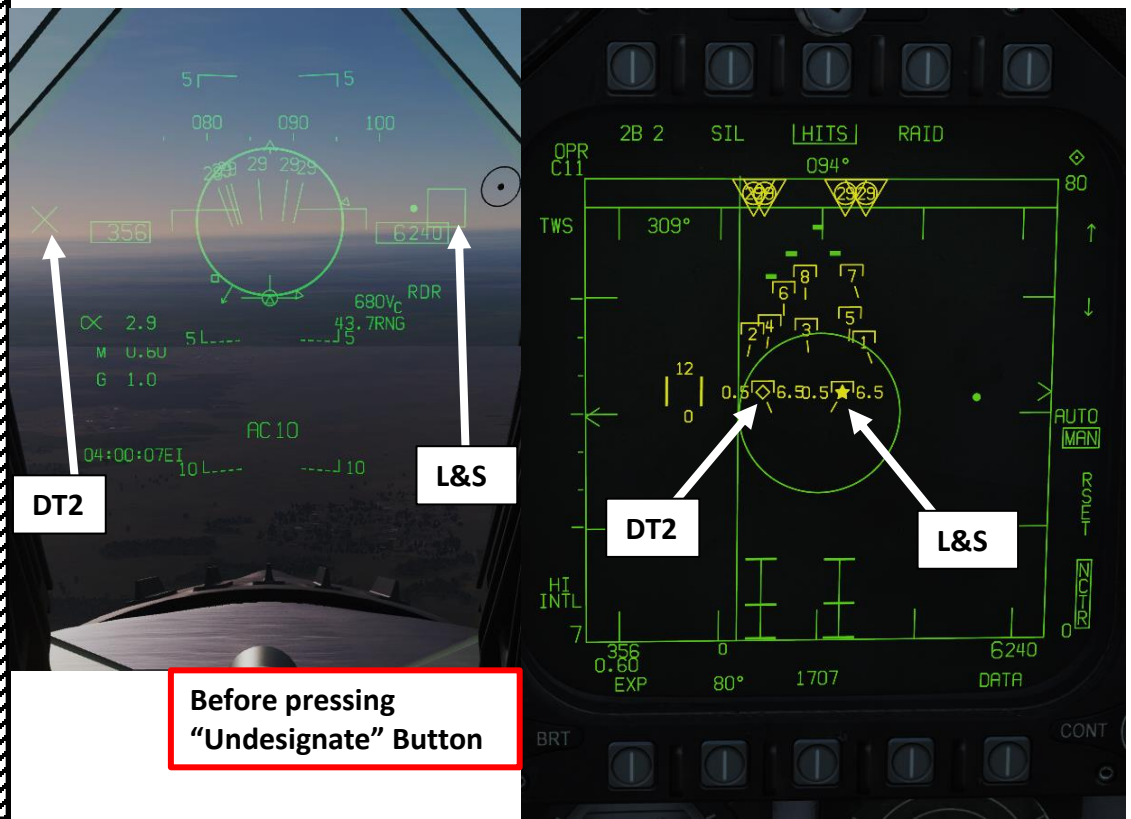
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

D – TWS DESIGNATION

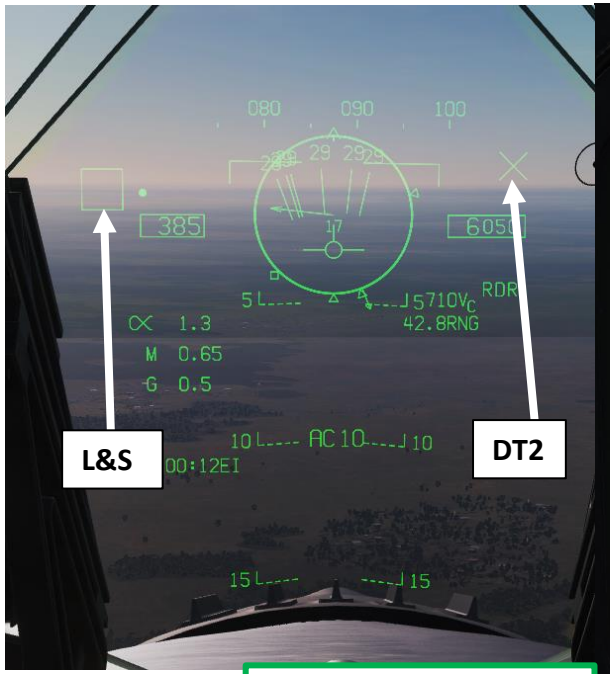
- You can swap L&S and DT2 by pressing the “Undesignate” button on the stick.
- L&S will be visible on the HUD as a square. DT2 will be visible as a “X”.
- You can transition into a proper radar “STT” (Single Target Track) lock by pressing the TDC DEPRESS control (« ENTER ») a second time when TDC is over the L&S trackfile.

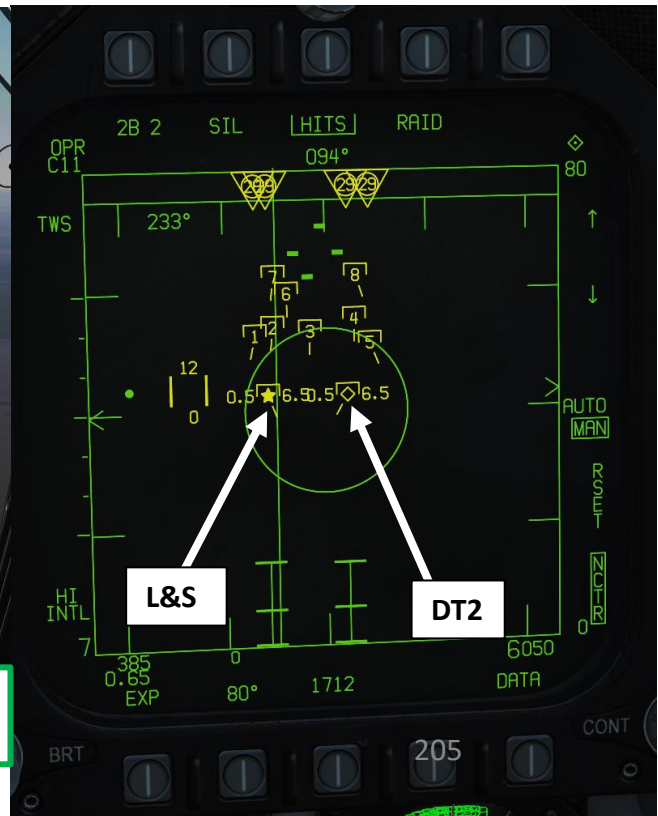






Before pressing “Undesignate” Button





After pressing “Undesignate” Button

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

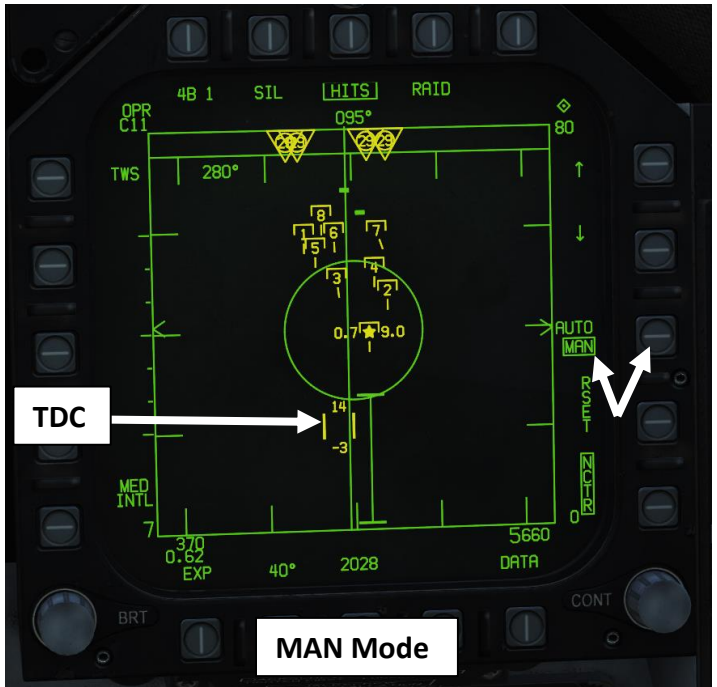
E – SCAN CENTERING METHODS

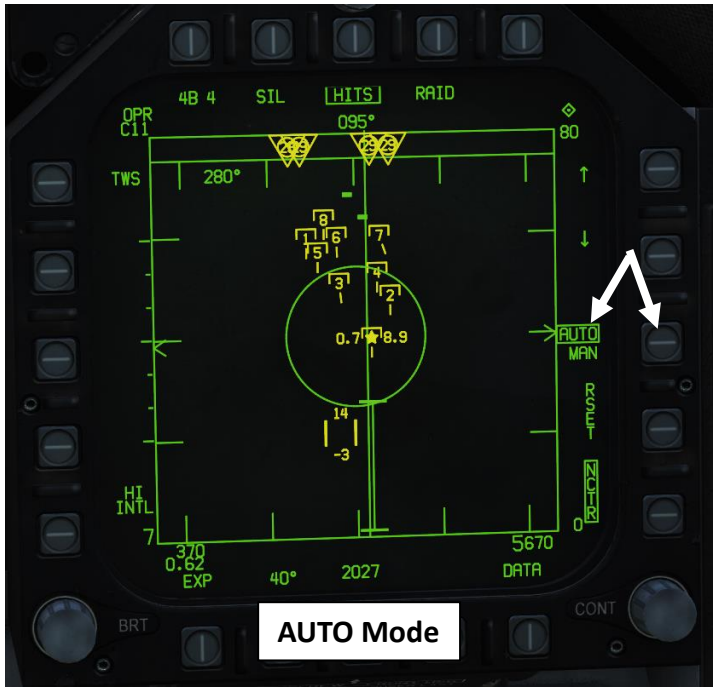
Multiple methods of scan centering are available to keep trackfiles in the scan volume, with respect to both elevation and azimuth. AUTO/MAN can be toggled with the option on the Attack Radar format, while BIAS is entered by slewing the TDC and using TDC DEPRESS in an empty area of the tactical region .

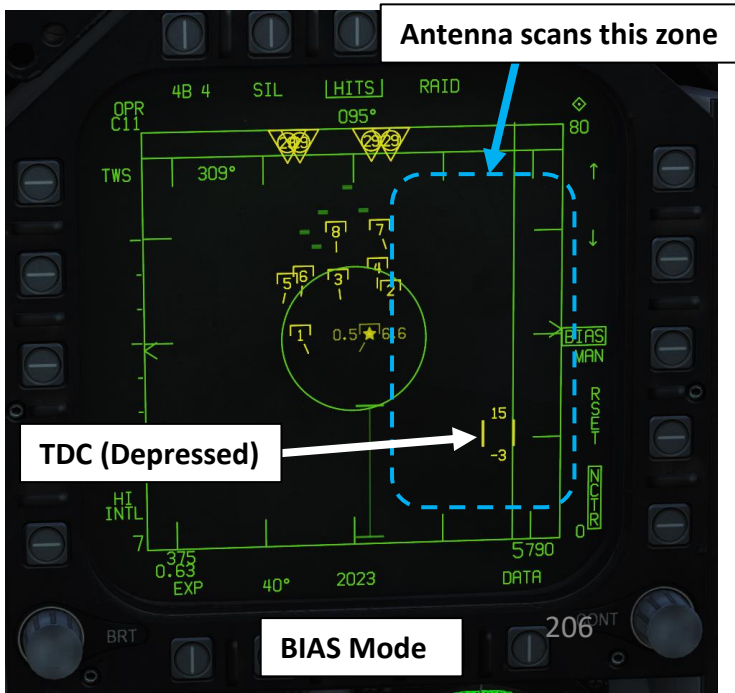
- **MAN**: Manual scan centering allows for the scan center to be set manually. The azimuth will be centered on the TDC cursor's present position. The antenna elevation can also be manually manipulated. MAN centering requires the TDC to be depressed over blank space to set the desired azimuth (scan center does not follow the TDC).

- **AUTO**: Automatic scan centering mode centers the azimuth scan on the Launch & Steering (L&S) trackfile. When the L&S is changed, or the current L&S moves, the azimuth center moves to keep it in the center. The antenna elevation is centered on the altitude of the L&S. If the L&S is lost/undesignated, MAN is automatically entered.

- **BIAS**: The TDC can be depressed on an empty area of the tactical region to enter bias scan centering mode. BIAS centering <u>can only be entered from AUTO (not MAN)</u>. This allows for manual antenna elevation control and will center the azimuth on the point where the TDC was depressed. Pressing the TDC over blank space will request to shift the automatic scan center towards the desired azimuth. The automatic scan center will be shifted towards the requested scan center as much as possible while keeping priority targets (L&S/DT2) within the scan volume.







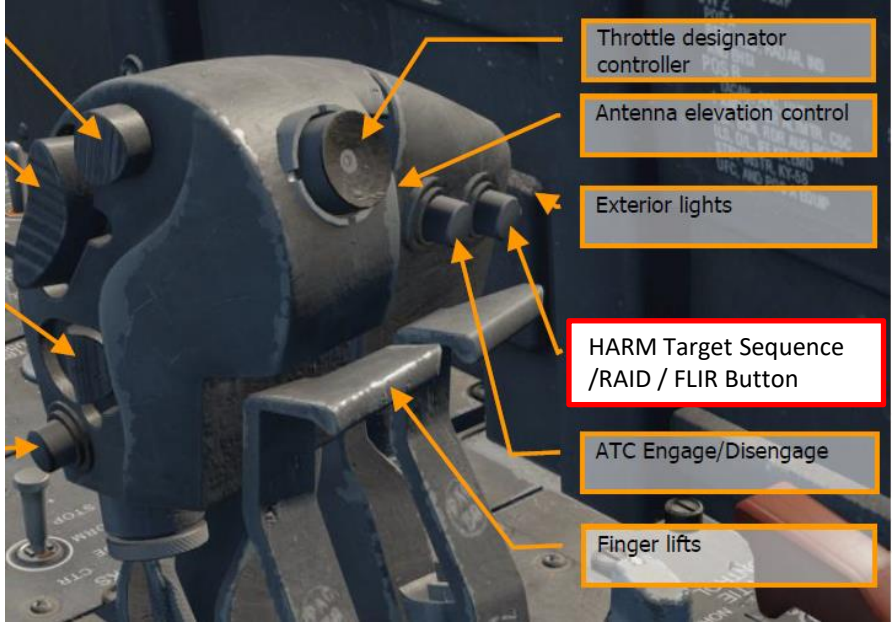
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

F – TWS SUB-MODES: SCAN RAID

SCAN RAID is a raid assessment mode.

- **When an L&S (Launch & Steering Primary Target) exists, selecting the RAID option or the RAID button on the throttle** will enter/exit SCAN RAID on the L&S trackfile.
- SCAN RAID is also exited if the RSET option or Undesignate button is pressed or the L&S is dropped.

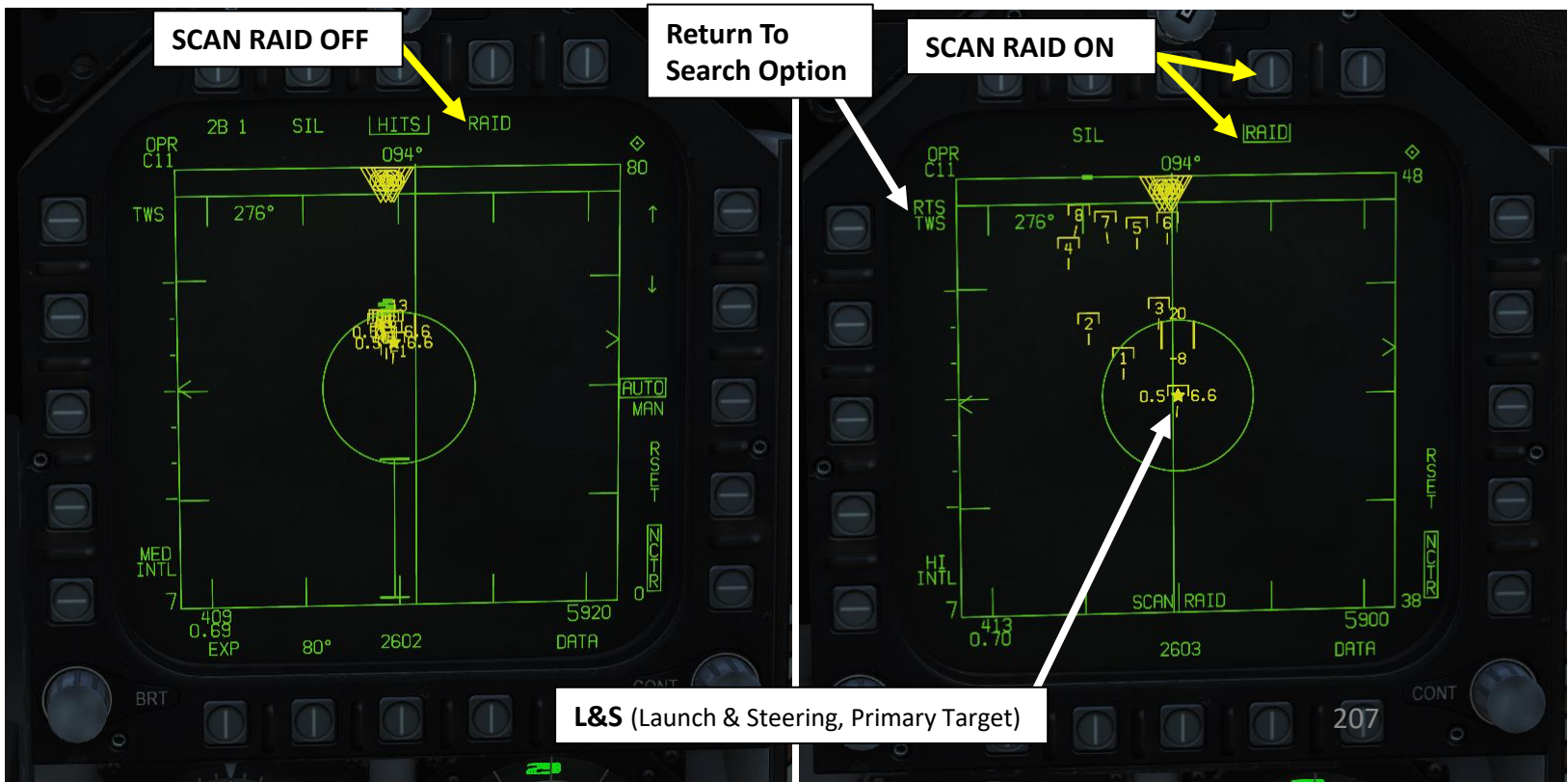
In SCAN RAID, the **radar commands a special 22° azimuth 3 bar scan centered on the L&S**. Doing what is called "raid assessment," the radar will attempt to detect multiple target out of what it "thought" was a single target. This "Doppler grouping" effect can occur when targets are in extremely close proximity and have the same closure rate. SCAN RAID is purposed to combats this.



The SCAN RAID display is **22° x 10 nm** centered on the L&S. A **Return to Search (RTS) option is displayed, as SCAN RAID entirely changes the radar operation and is not considered TWS**. "SCAN RAID" is indicated in the center of the format. Additionally, the B-sweep is frozen on the azimuth, relative to the regular 140° scale, where the L&S is (not relative to the 22° SCAN RAID scale).

Raw hits are always displayed in SCAN RAID when the trackfile limit is exceeded. Trackfiles/hits outside the display are shown relative to the L&S along the border of the tactical region. **The bar, azimuth, EXP, range scale, scan centering, and HITS options on the format are unavailable**.

AIM-120 launches can be supported in SCAN RAID. As with any non-STT launch, an AIM-7 shot will result in automatic acquisition of the L&S into Single Target Track.



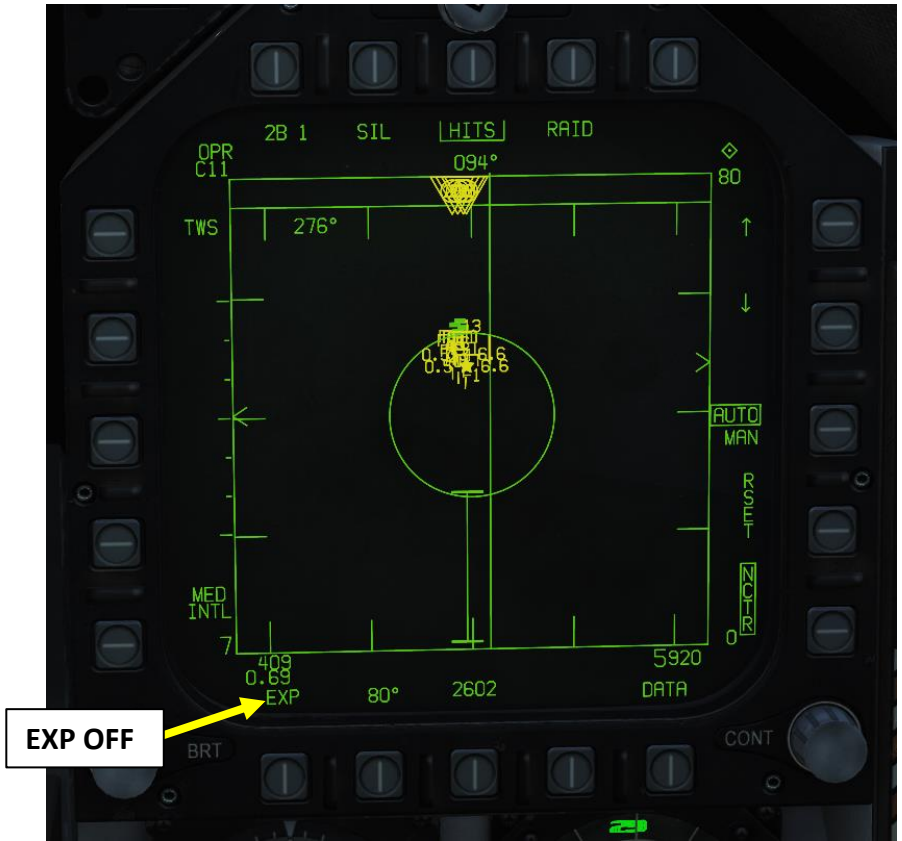
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.4 – TWS Mode

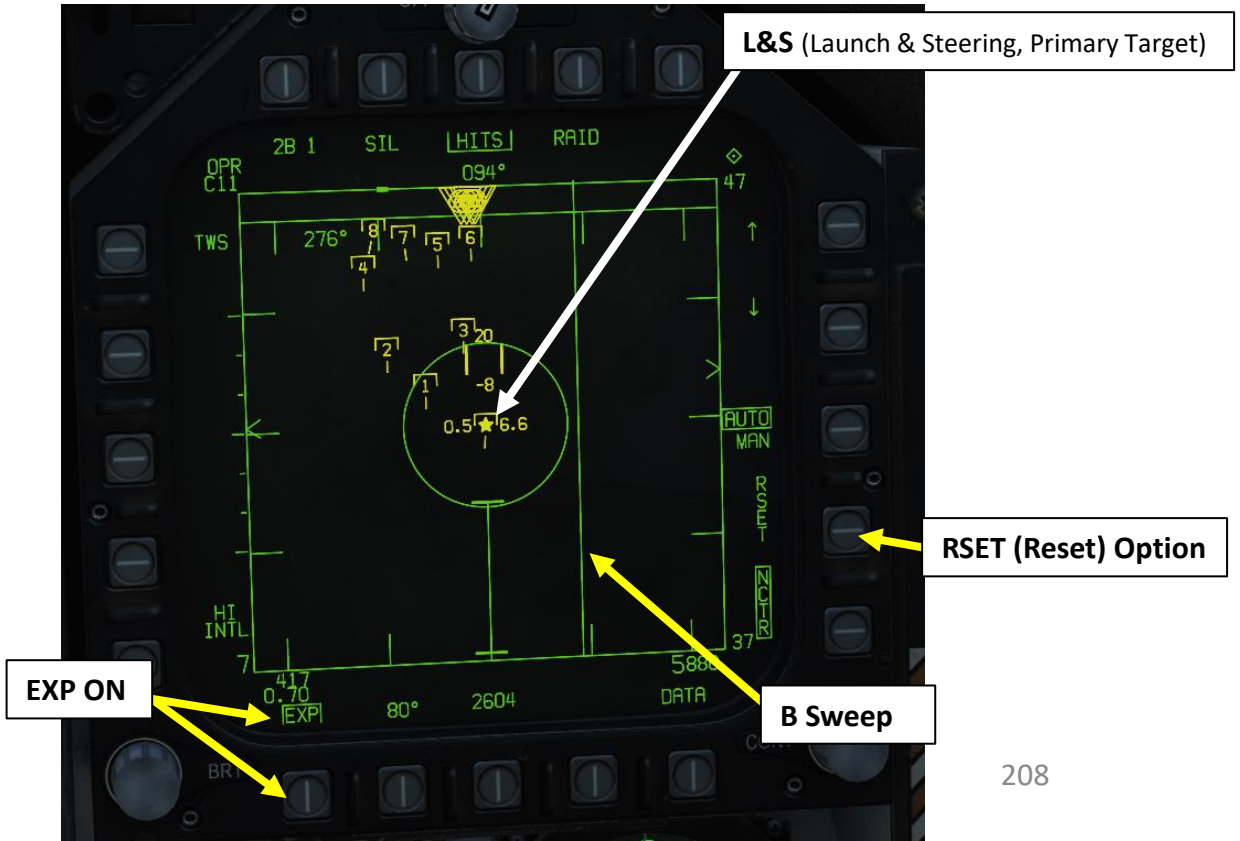
F – TWS SUB-MODES: EXP (EXPAND MODE)

The TWS Expand mode (EXP) provides a zoomed-in view of the tactical region centered around the L&S trackfile. No change to the scan is made.

- **EXP is entered by selecting the EXP option as long as an L&S exists**. If the L&S is changed while EXP is engaged, it will change to center on the new L&S.
- **EXP is exited via selecting EXP again or via the RSET option, or if the L&S is dropped**.

The EXP view is **10 nm x 20°**, centered on the L&S. **Manual range scale adjustment is not available** and the maximum/minimum range scale values on the top and bottom right of the format indicate the actual ranges shown while in EXP. The B-sweep remains "scaled" to the regular 140° view in EXP. Trackfiles outside the EXP view are shown relative to the L&S along the border of the tactical region.





2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.5 – VS (Velocity Search) Mode

Not available yet.



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.6 – Radar Spotlight Option

Spotlight (SPOT) is an air-to-air radar sub-mode that constrains the radar azimuth to a specific area under the TDC (22-degree wide scan centered on the TDC cursor). SPOT mode provides a very high update rate, and is used to discriminate between closely spaced targets and acquire the desired target within a group.

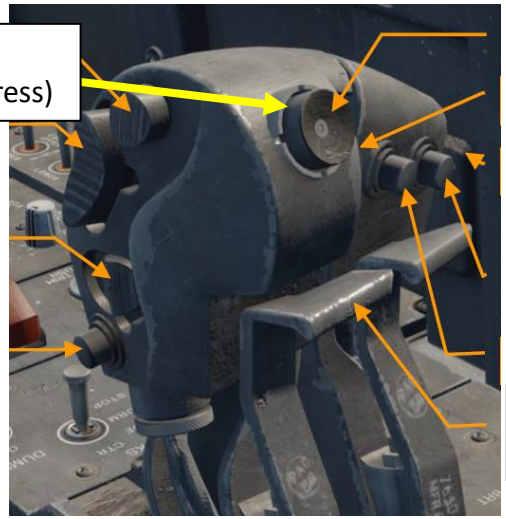
Spotlight mode may be entered from RWS or TWS by depressing the TDC over empty space longer than 0.8 seconds and releasing it. SPOT sub-mode can be activated from any air-to-air radar mode (RWS or TWS) except STT and STT RAID.

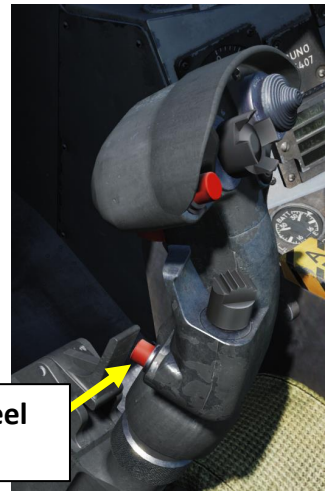
The scan azimuth center is space-stabilized while not being slewed. Lateral ownship maneuvers cause the scan center and cursor to be repositioned in the display to maintain the original azimuth center with respect to earth. The cursor is limited to the tactical area and modified to display a X within its symbol (not displayed when a HAFU is under the cursor).

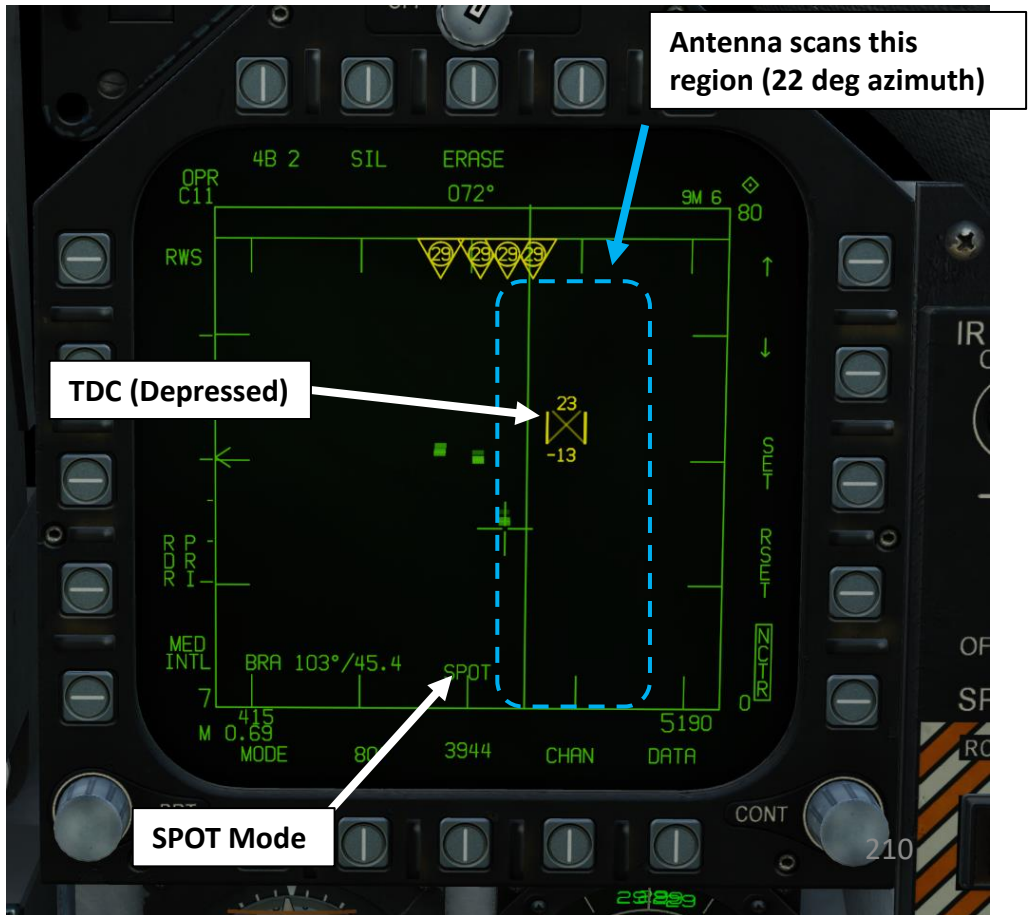
To enter SPOT sub-mode:

1. Position the TDC over the area you wish to spotlight
2. Press and hold the TDC for more than one second.
3. The radar azimuth indicator will drive to the TDC location and begin a scan centered on the cursor and constrained to 22° of azimuth.
4. The scan area can be slewed by pressing and holding the TDC while moving it left or right.
5. To exit Spotlight, depress and release the TDC. Alternatively, press Undesignate or assign TDC priority to another display.

Note: SPOT sub-mode can also be used with an AACQ mode. When SPOT sub-mode is activated from an AACQ mode, the radar will attempt to STT the first target detected while SPOT is active.







2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.1 – Overview

The radar's Air Combat Maneuvering (ACM) modes are search modes designed to place a target in Single Target Track (STT) at close range by acquiring it visually.

ACM mode is entered by:
- Pressing the Sensor Control Switch forward when the A/A master mode is engaged, or
- Selecting the air-to-air gun via Weapon Select Switch aft

ACM mode places the Sensor Control Switch in "ACM condition." A boxed "ACM" indication and an option to return to search (RTS) is then displayed on the RDR ATTK page. The TDC (Throttle Designation Controller) is automatically assigned to the RDR ATTK page. For the HACQ, LHAQ, and WACQ modes, said mode is indicated on the HUD.

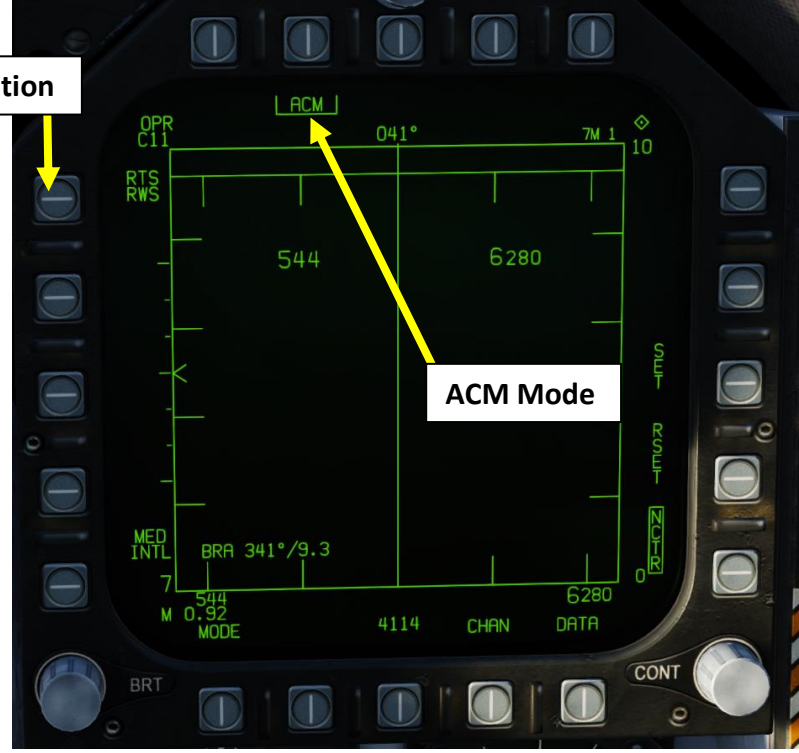
ACM mode is exited by:
- Pressing the Undesignate button on the stick, or
- Via the RTS (Return to Search) option on the RDR ATTK format

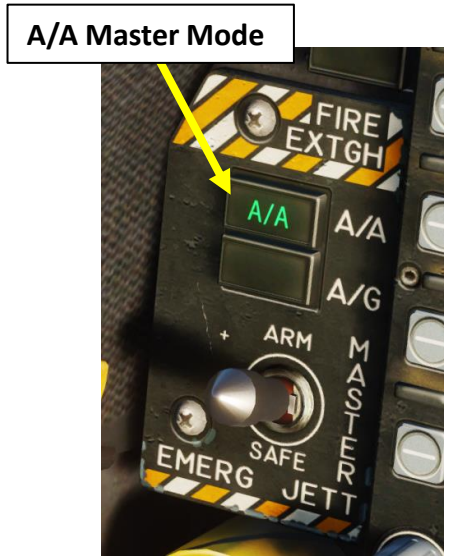
The radar returns to the last-entered search mode, except if the A/A gun is selected which will instead make the radar return to the Gun Acquisition ACM mode. If the radar is in STT, entering ACM will exit STT and exiting STT will exit STT and ACM mode; ACM mode remains engaged even when an STT is obtained.

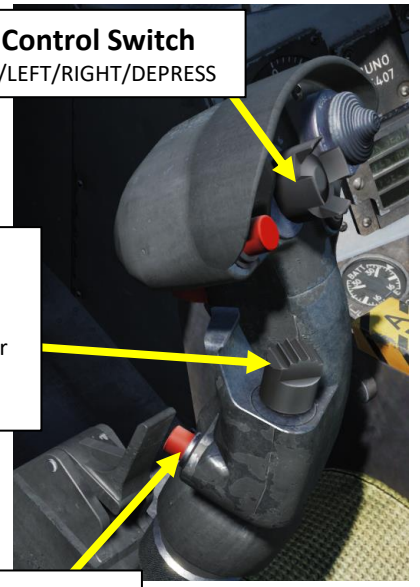
FOR CLOSE RANGE:

ACM (Air Combat Maneuvering) Mode has four sub-modes, which are all used for close combat:
- **GACQ** (Gun Acquisition): automatically enabled with air-to-air gun is selected
- **BST** (Boresight): searches targets out to 10 nm
- **VACQ** (Vertical Acquisition): vertical auto-acquisition search pattern covers from -13 deg to +46 deg, searches targets out to 5 nm
- **WACQ** (Wide Acquisition): space-stabilized mode that can be slewed using the TDC controller when uncaged, searches targets out to 10 nm

In ACM mode, the Sensor Control Switch has the following functions:
- FWD: selects Boresight ACM mode
- AFT: selects Vertical Acquisition ACM mode
- LEFT: selects Wide Acquisition ACM mode







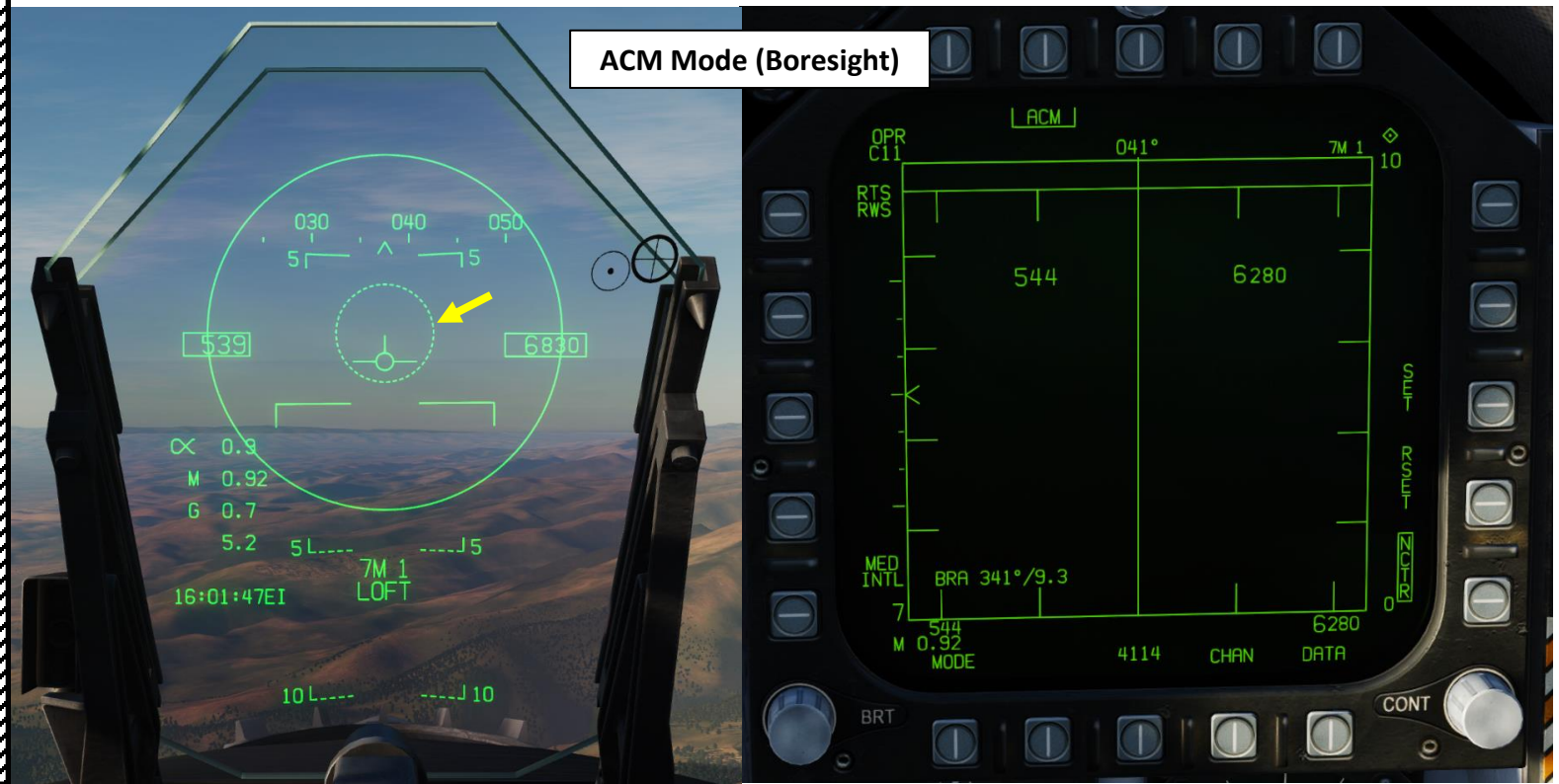
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.2 – BST (Boresight)

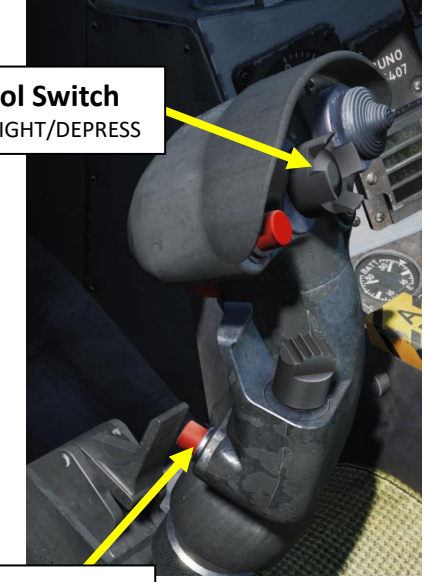
Boresight (BST) is a very small, circular scan on the aircraft nose which can be used whenever the nose can be brought onto a target. It scans in medium PRF, ±1.7° above and below the waterline, and 3.3° in azimuth, slaved to both pitch and roll. A small dashed circle on the HUD coincidental with the aircraft boresight indicates the Boresight Acquisition scan. It has a range of 10 nm.

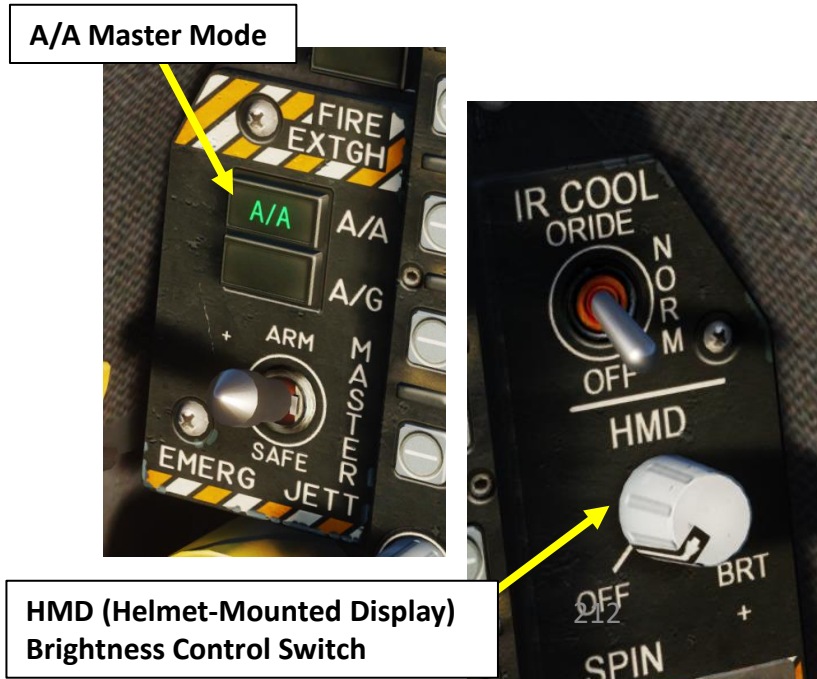
BST is entered by:

1. Setting A/A Master Mode
2. Making sure HMD (Helmet-Mounted Display) is OFF
3. Pressing the Sensor Control Switch forward (enters ACM mode and selects BST by default)
4. Radar will automatically attempt to lock on the nearest target

To **exit ACM mode**, press Undesignate Button.







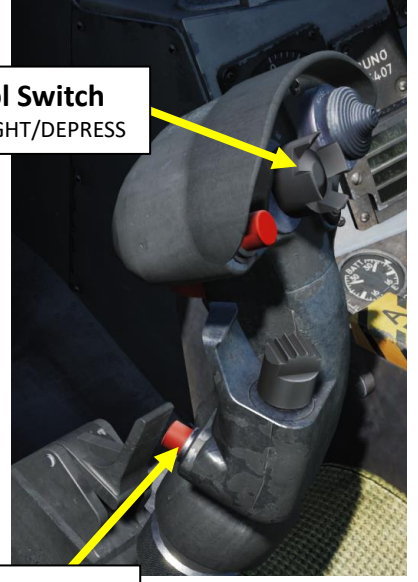
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.3 – VACQ (Vertical Acquisition)

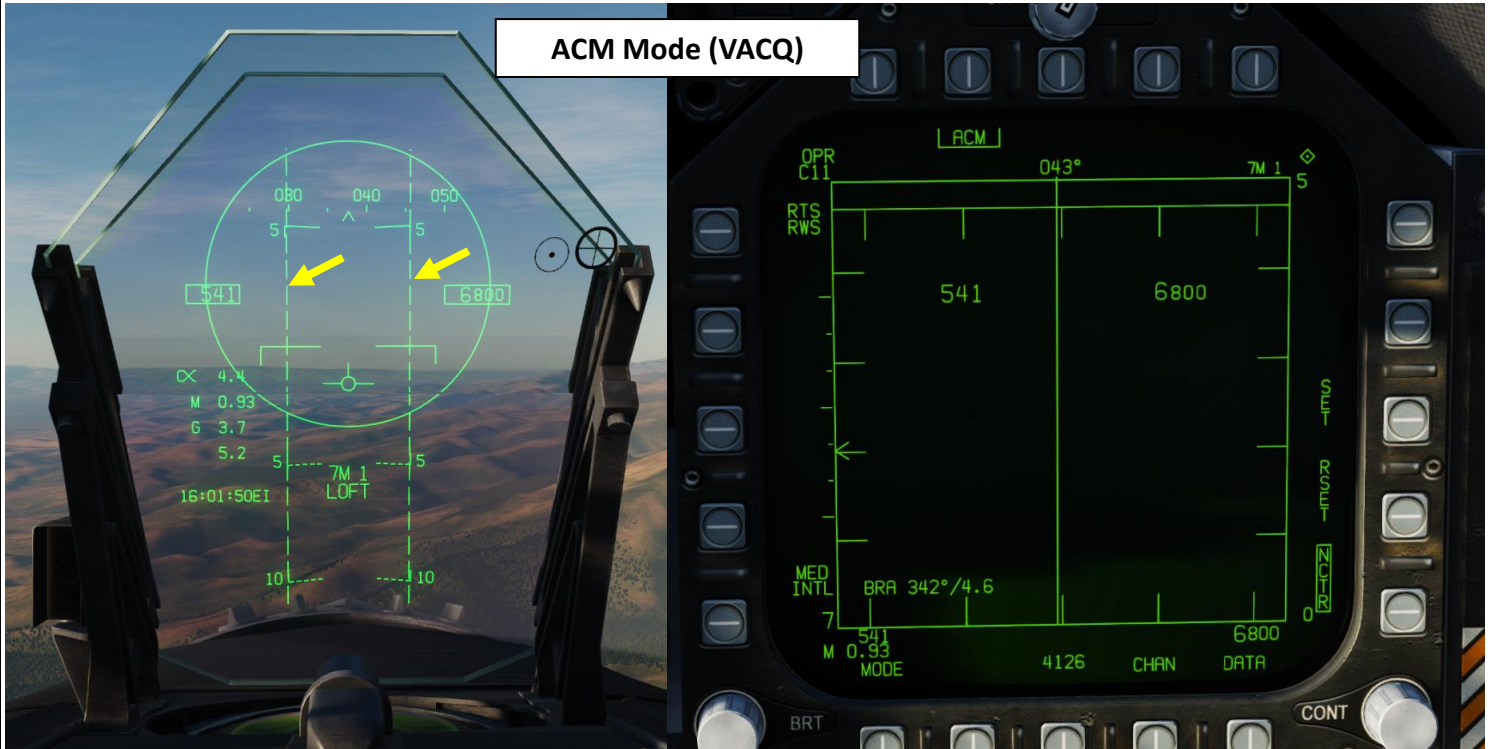
VACQ (Vertical Acquisition) mode is a very narrow and tall scan pattern, ideal for acquiring targets in a turn. Vertical Acquisition commands a scan of approximately 6° azimuth, -13° and +46° in elevation, and medium PRF from the aircraft waterline, slaved to both pitch and roll. A dashed rectangle on the HUD indicates the scan area. VACQ has a range of 5 nm.

VACQ is entered by:

1. Setting A/A Master Mode
2. Making sure HMD (Helmet-Mounted Display) is OFF
3. Pressing the Sensor Control Switch forward to enter ACM mode (selects BST by default)
4. Pressing the Sensor Control Switch aft to transfer ACM mode from BST to VACQ
5. Radar will automatically attempt to lock on the nearest target

To **exit ACM mode**, press Undesignate Button.









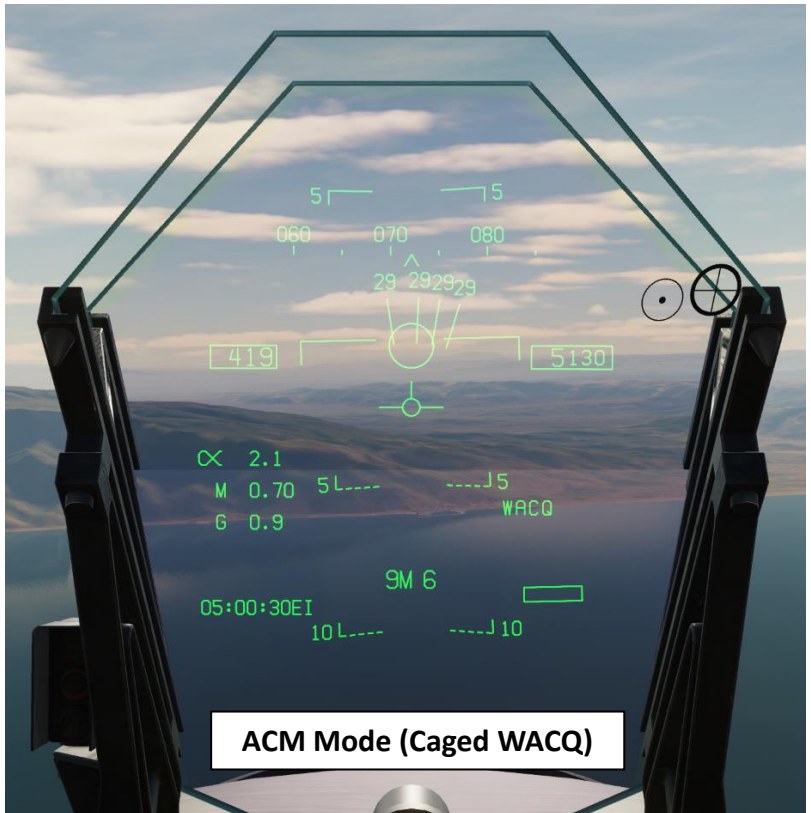
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.4 – WACQ (Wide Acquisition)

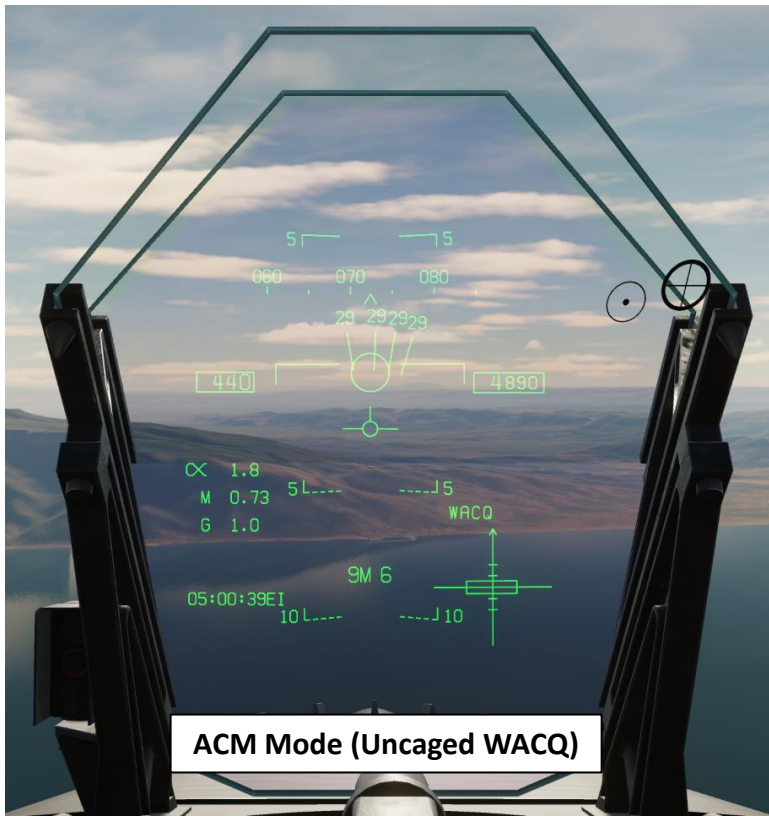
WACQ (Wide Acquisition) provides a wide, rectangular scan at 10 nm range. It has two modes, toggled with “TDC Depress” on the throttle.

- **Caged WACQ sub-mode**: Caged WACQ commands a 60° azimuth scan, +6° and -9° relative to the waterline, with medium PRF. Caged Wide Acquisition is slaved to the aircraft in pitch but is horizon-stabilized in roll. A representation of the rectangular-shaped scan is placed in the bottom-right corner of the HUD, which provides a visualization of the roll stabilization.

- **Uncaged WACQ sub-mode**: Uncaged WACQ mode may be entered by depressing the TDC while in caged WACQ mode. As with caged WACQ, the range limit is 10 miles, however the scan center is stabilized with respect to aircraft in azimuth and with respect to the horizon in elevation and roll. It can be slewed with the TDC. An uncaged WACQ grid is provided on the bottom right of the HUD to give visual feedback of the scan center.





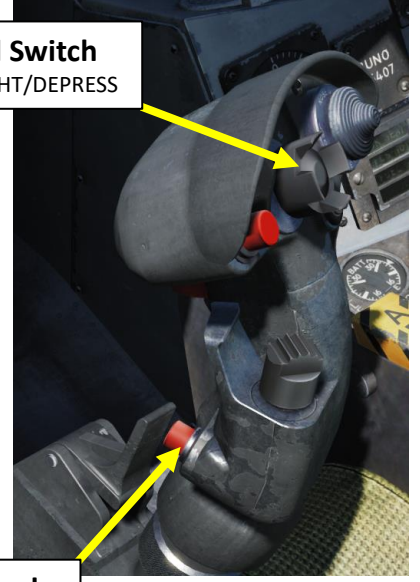


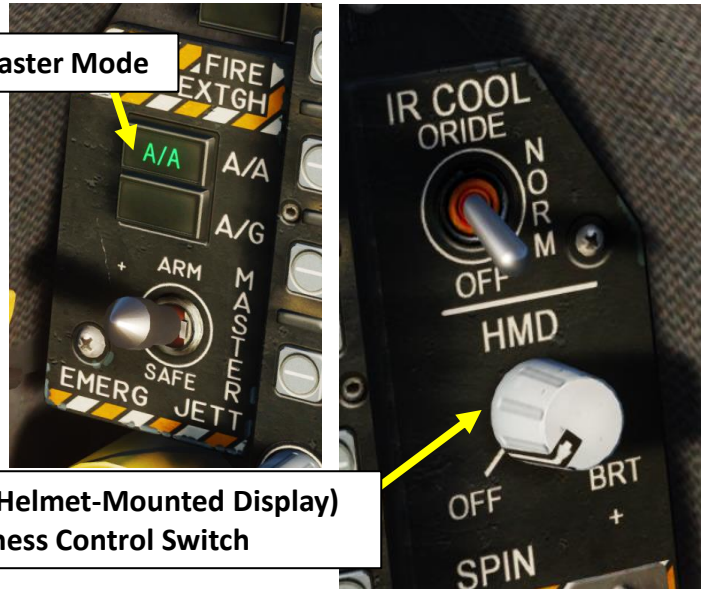
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.4 – WACQ (Wide Acquisition)

A - Caged WACQ is entered by:

1. Setting A/A Master Mode
2. Making sure HMD (Helmet-Mounted Display) is OFF
3. Pressing the Sensor Control Switch forward to enter ACM mode (selects BST by default)
4. Pressing the Sensor Control Switch left to transfer ACM mode from BST to WACQ
5. Radar will automatically attempt to lock on the nearest target

To **exit ACM mode**, press Undesignate Button.







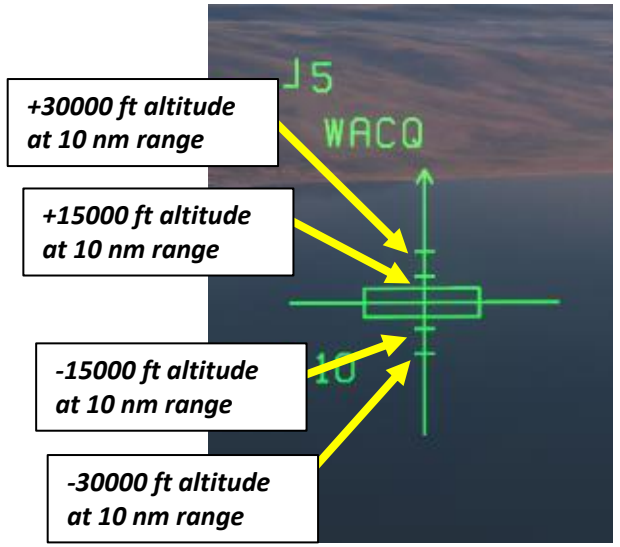


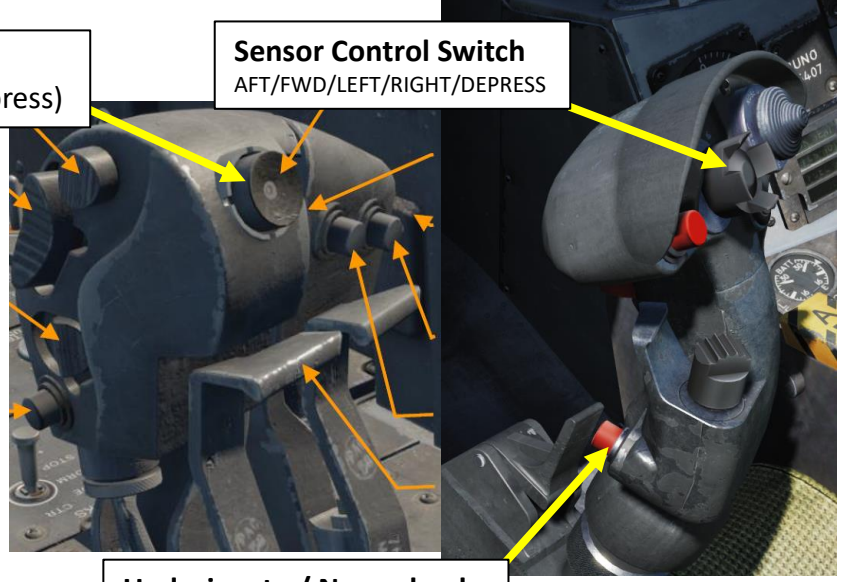
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.4 – WACQ (Wide Acquisition)

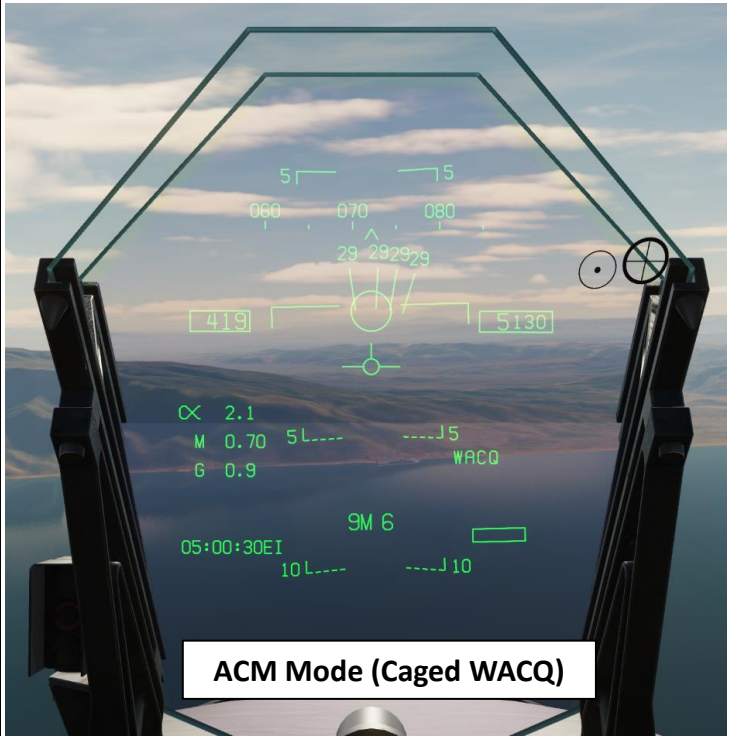
B - Uncaged WACQ is entered from Caged WACQ mode:

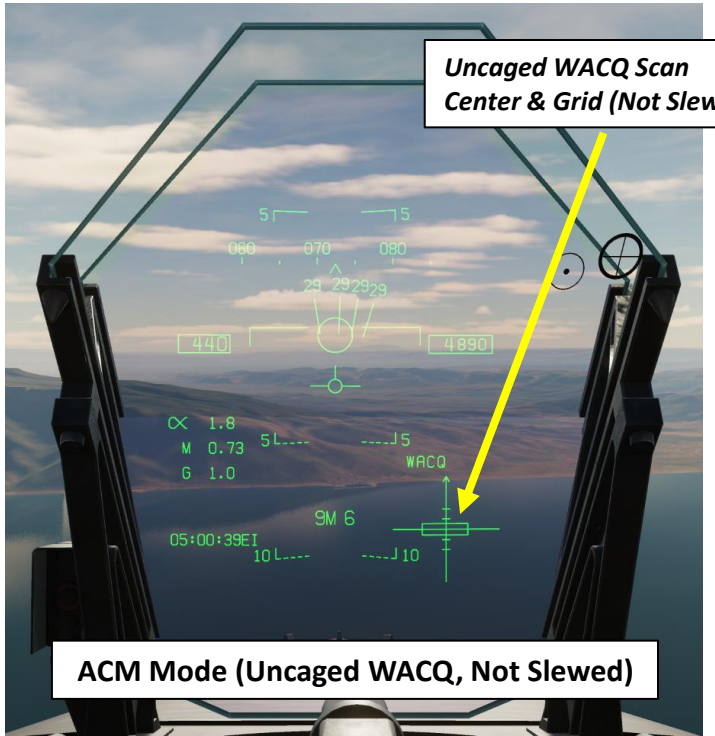
1. Make sure Caged WACQ mode is active (see previous page)
2. Toggle between WACQ sub-modes (Caged vs Uncaged WACQ mode) using TDC DEPRESS.
3. Use TDC LEFT/RIGHT/DOWN/UP controls to slew scan center.
4. The uncaged WACQ grid provides visual feedback of the scan center.
5. Radar will automatically attempt to lock on the nearest target near the scan center at a distance of 10 nm or less.

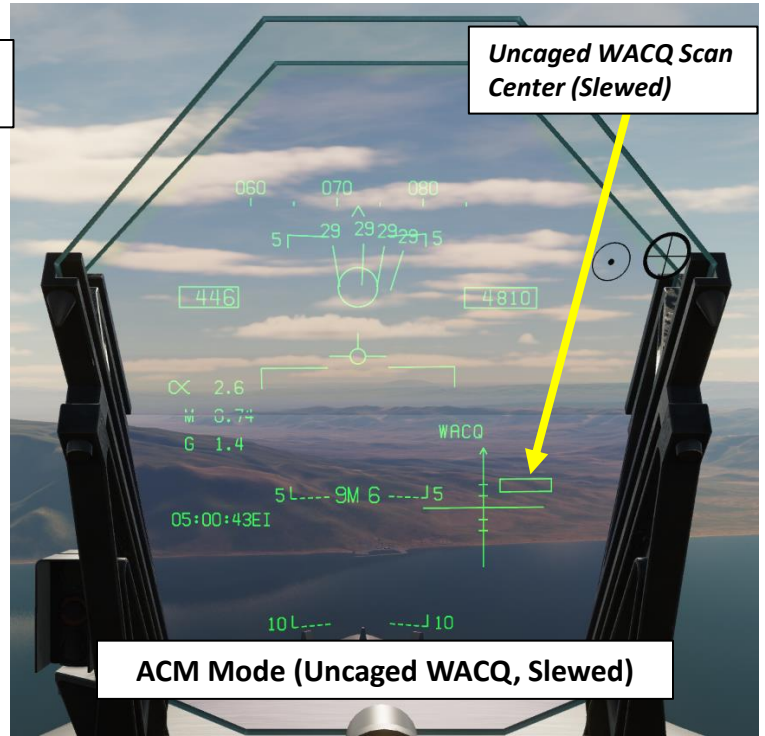
To **exit ACM mode**, press Undesignate Button.











2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.7 – ACM Modes
2.1.7.5 – GACQ (Gun Acquisition)

GACQ (Gun Acquisition) is a special ACM mode intended to acquire a target roughly within the HUD field of view while using the gun. GACQ commands a +6° and -14° scan from the aircraft waterline with medium PRF and 20° azimuth, slaved to pitch and roll. A dashed circle represents the scan shape on the HUD.

- Note 1: Unlike the other ACM modes, GACQ can only be used for gun.
- Note 2: GACQ searches for targets out to 5 miles.
- Note 3: the radar is always in either ACM or STT when the gun is selected and so it cannot be commanded to return to search from GACQ.

GACQ is entered by:

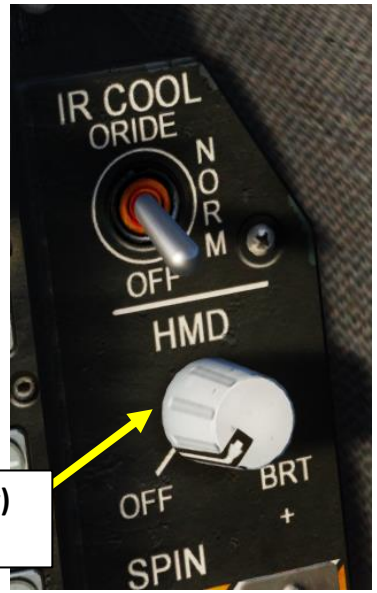
1. Setting A/A Master Mode
2. Making sure HMD (Helmet-Mounted Display) is OFF
3. Pressing the Weapon Control Switch aft to select Air-to-Air Gun and enter GACQ ACM mode.
    - Note: Make sure no other ACM mode or STT is commanded.
4. Radar will automatically attempt to lock on the nearest target

To **exit GACQ mode**:

- Use Weapon Select Switch to select another weapon, or
- Toggle the A/A Master Mode OFF and ON.



A/A Master Mode

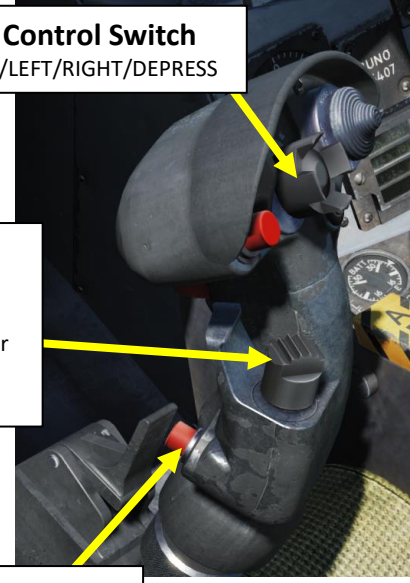


HMD (Helmet-Mounted Display) Brightness Control Switch

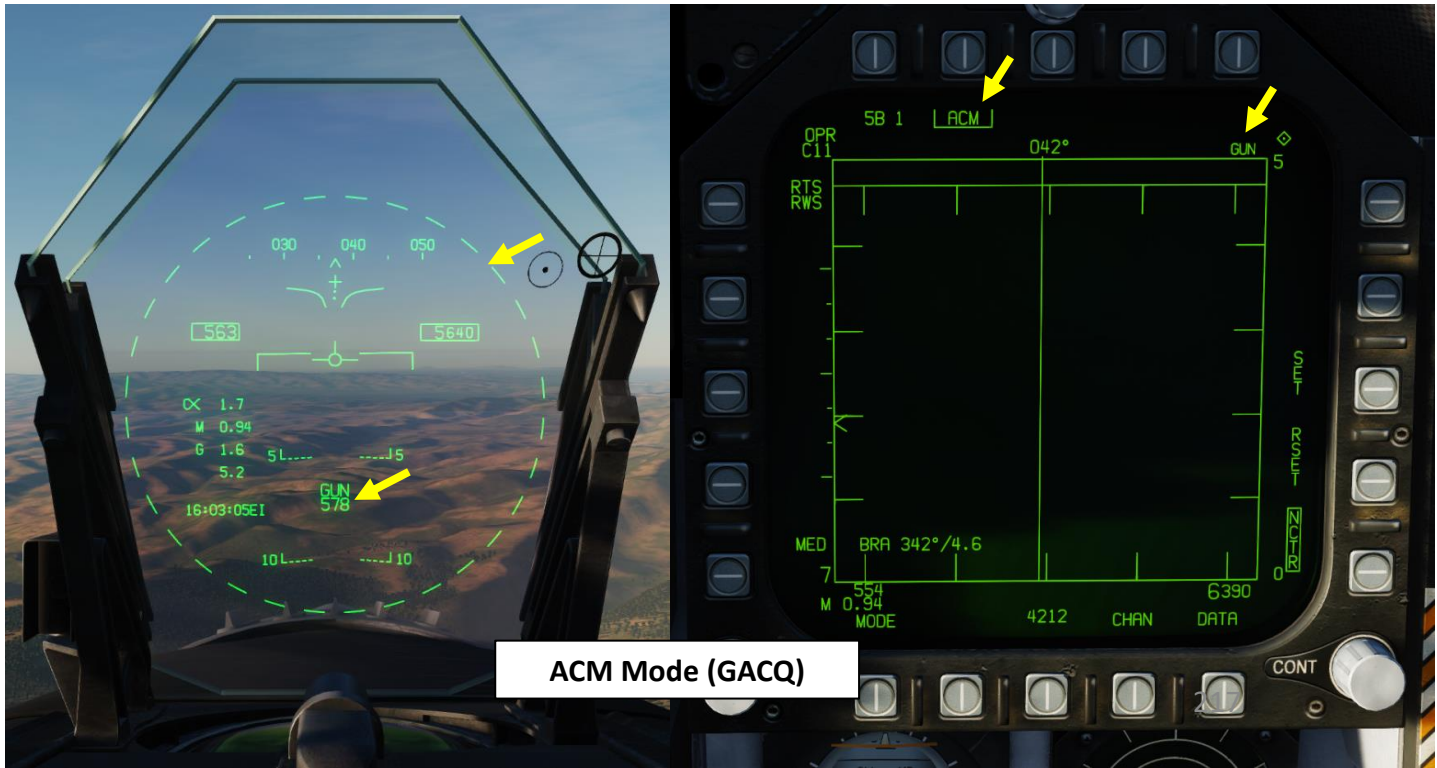
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS

Weapon Select Switch

- FWD: Select Sparrow
- AFT: Select Gun
- PRESS DOWN: Select Sidewinder
- RIGHT: Select Amraam
- LEFT: No Function



Undesignate / Nosewheel Steering Button



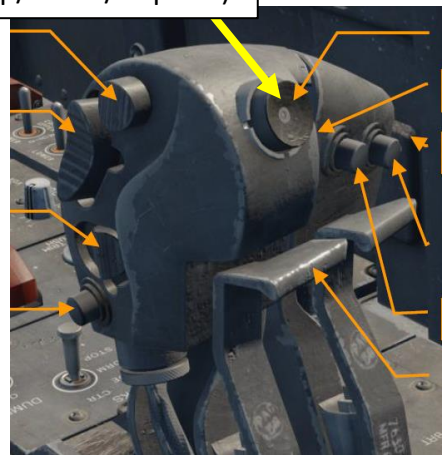
ACM Mode (GACQ)

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.1 – STT (Single Target Track)

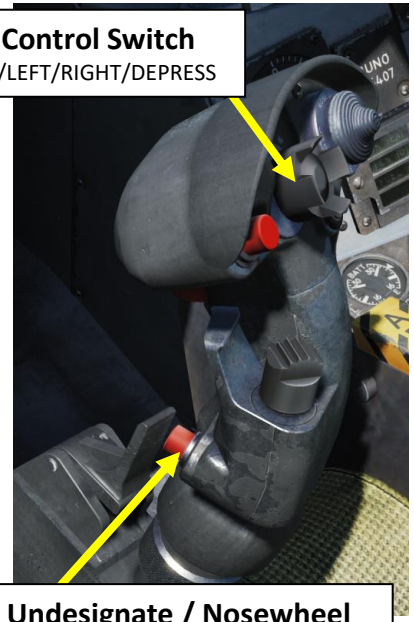
STT (Single Target Track) is a fancy way of calling a radar lock. The standard method of locking a target is:

1. Press A/A Master Mode
2. Press the Sensor Control Switch in the direction of the radar screen (RIGHT in our case) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
3. Slew the TDC on the desired spot you want to designate using the TDC controls.
4. Designate target by using the TDC DEPRESS control (« ENTER »).
    a) If using RWS (Range While Search), a single TDC DEPRESS will lock the target into STT mode.
    b) If LTWS (Latent Track While Scan) option is boxed/selected, the first TDC DEPRESS will designate a target as the L&S (Launch & Steering) Primary Target trackfile (soft lock), but a second TDC DEPRESS is required to lock the target into STT mode.
    c) If using TWS (Track While Scan), the first TDC DEPRESS will designate a target as the L&S (Launch & Steering) Primary Target trackfile (soft lock), but a second TDC DEPRESS is required to lock the target into STT mode.
5. **STT is exited** by pressing the Undesignate button. The radar is returned to the last-entered search mode.

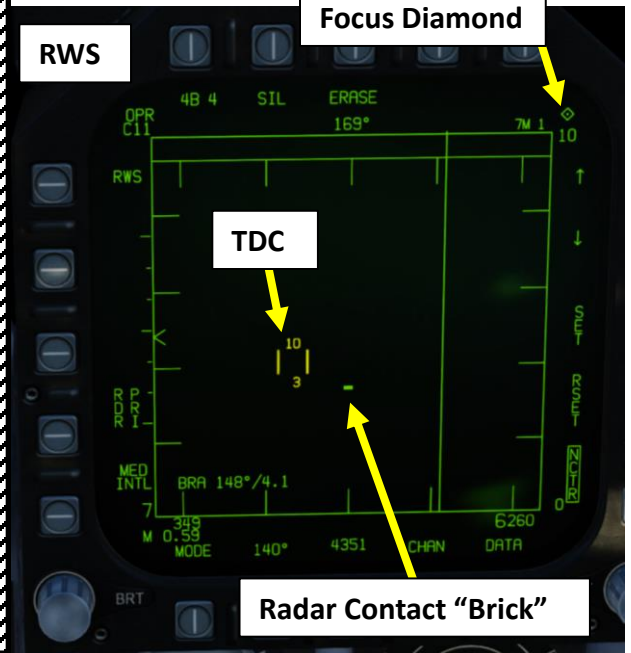
TDC
(Left/Right/Up/Down/Depress)



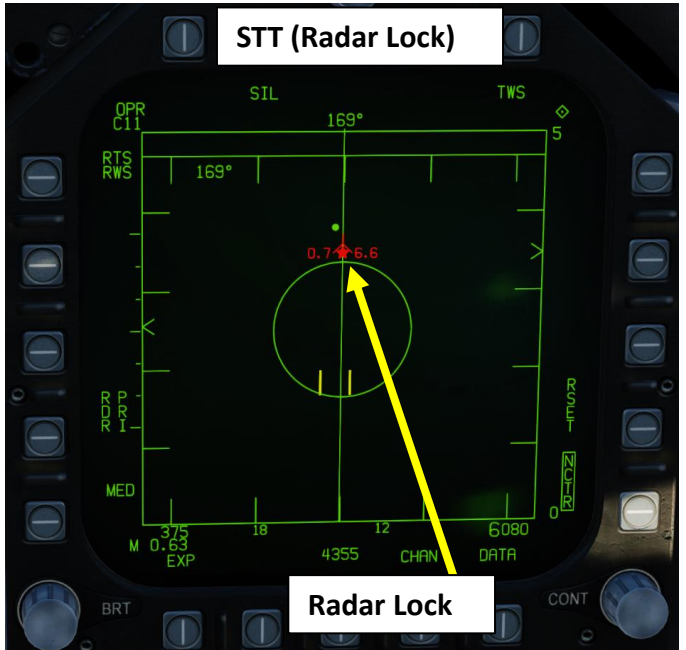
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS



Undesignate / Nosewheel Steering Button

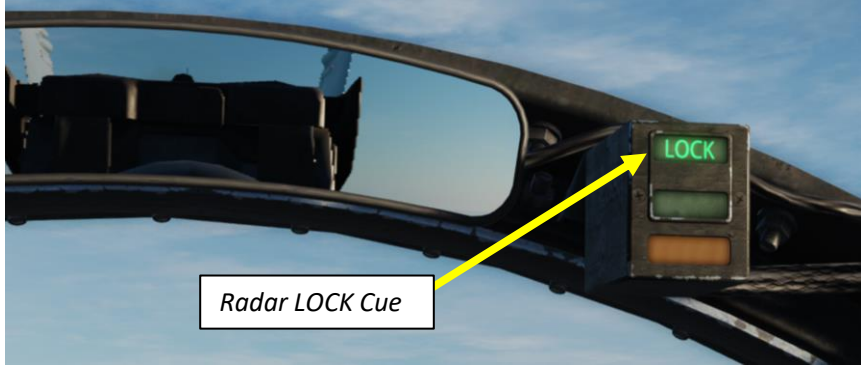






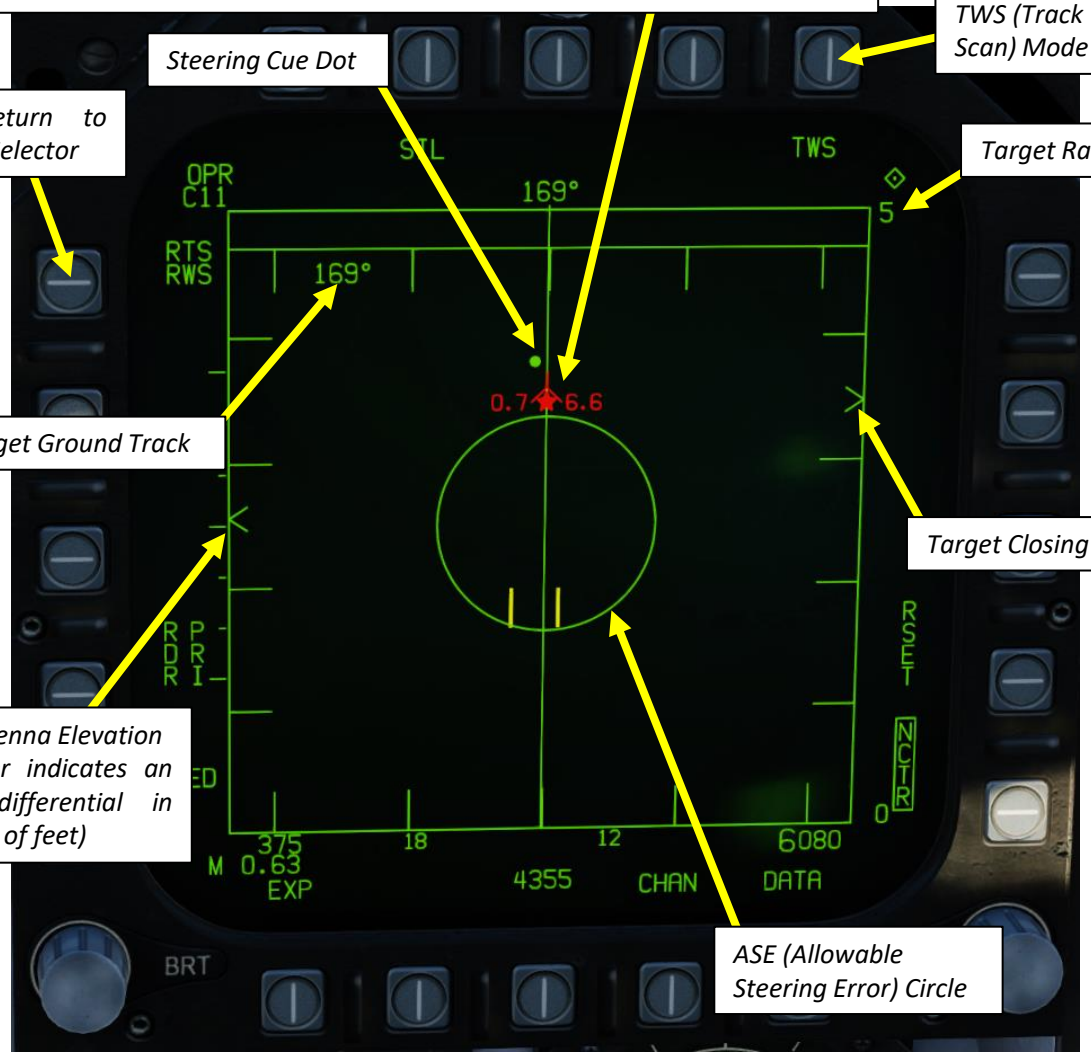


2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.1 – STT (Single Target Track)



Radar LOCK Cue

Target's HAFU (Hostile Ambiguous Friendly Unknown) symbol, with its Mach number on the left and altitude in thousands of feet on the right. Additionally displayed is the acceleration vector, perpendicular to the aspect stem, indicating observed acceleration in a different direction than previous. This is only displayed for STT.



Steering Cue Dot

TWS (Track While Scan) Mode Selector

RTS (Return to Search) Selector

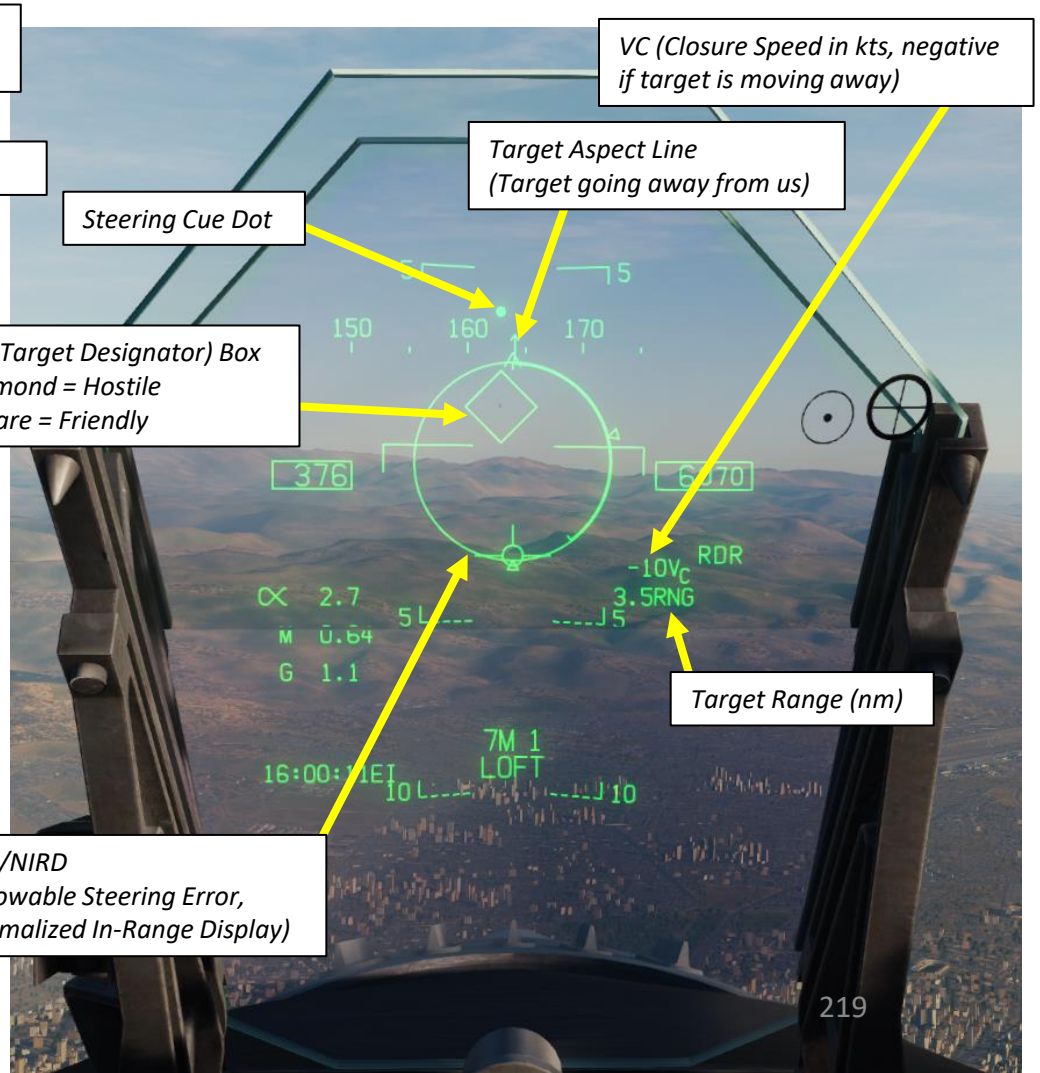
Target Range (nm)

Target Ground Track

Target Closing Speed

Radar Antenna Elevation (A number indicates an altitude differential in thousands of feet)

ASE (Allowable Steering Error) Circle



VC (Closure Speed in kts, negative if target is moving away)

Target Aspect Line (Target going away from us)

Steering Cue Dot

TD (Target Designator) Box
Diamond = Hostile
Square = Friendly

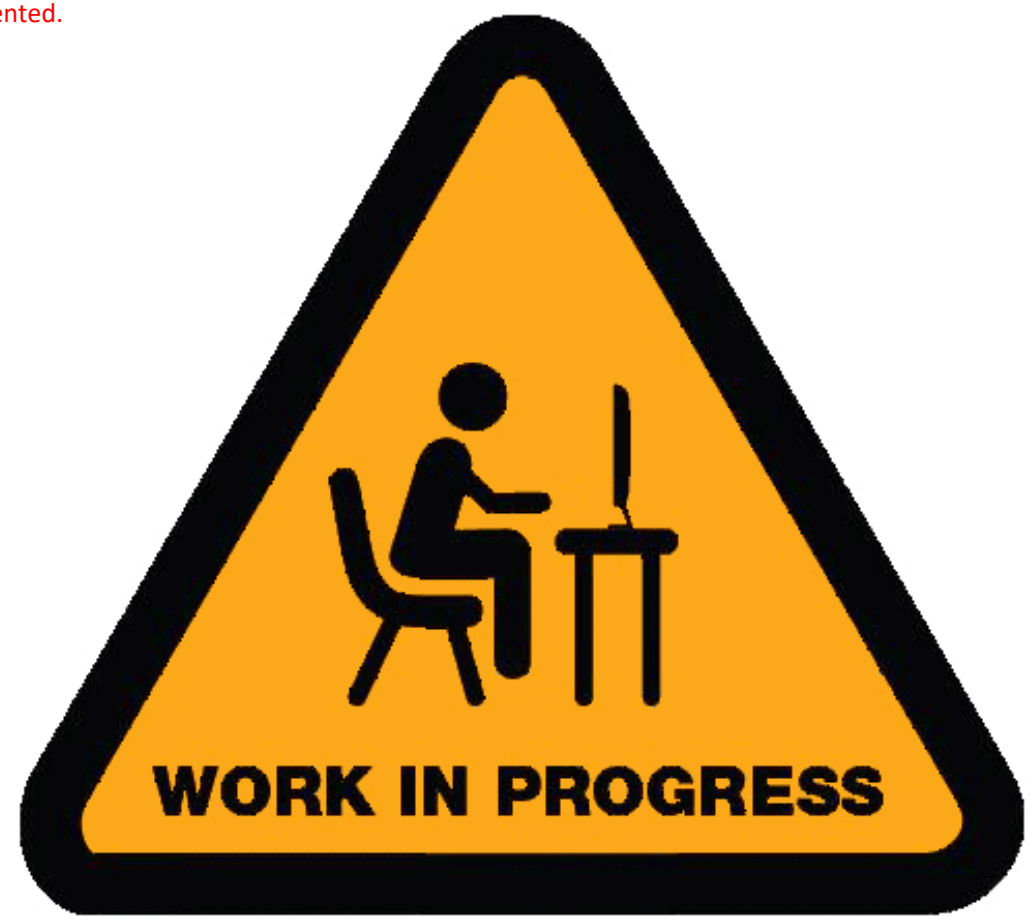
Target Range (nm)

ASE/NIRD
(Allowable Steering Error, Normalized In-Range Display)

2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.1 – STT (Single Target Track)

RAID STT (PAGE 1)

RAID STT (Single Target Track) is not yet implemented.



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.1 – STT (Single Target Track)

RAID STT (PAGE 2)

RAID STT (Single Target Track) is not yet implemented.



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.2 – AACQ (Automatic Acquisition)

AACQ (Automatic Acquisition) mode serves as a fast way of acquiring a track/contact into Single Target Track from a BVR (Beyond Visual Range) mode.

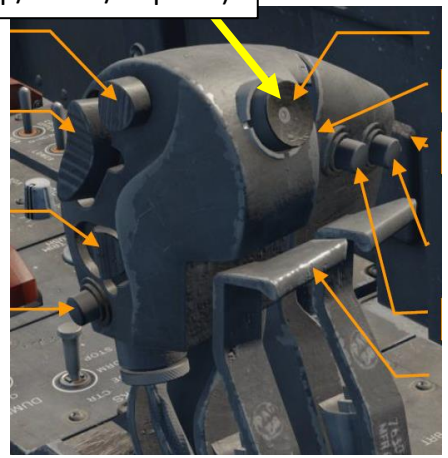
AACQ is entered by pressing the Sensor Control Switch right when all the following conditions are met:

- The TDC (Throttle Designation Controller) is assigned to the RDR ATTK format
- The A/A master mode is engaged
- The radar is not in an ACM (Air Combat Maneuvering) mode.

If the TDC if over a target symbol when AACQ is commanded, it will instruct the RADAR to lock on to that target. If AACQ is pressed with no target symbol under the acquisition symbol, then the RADAR will attempt to lock on to the closest target within the selected RADAR scan volume.

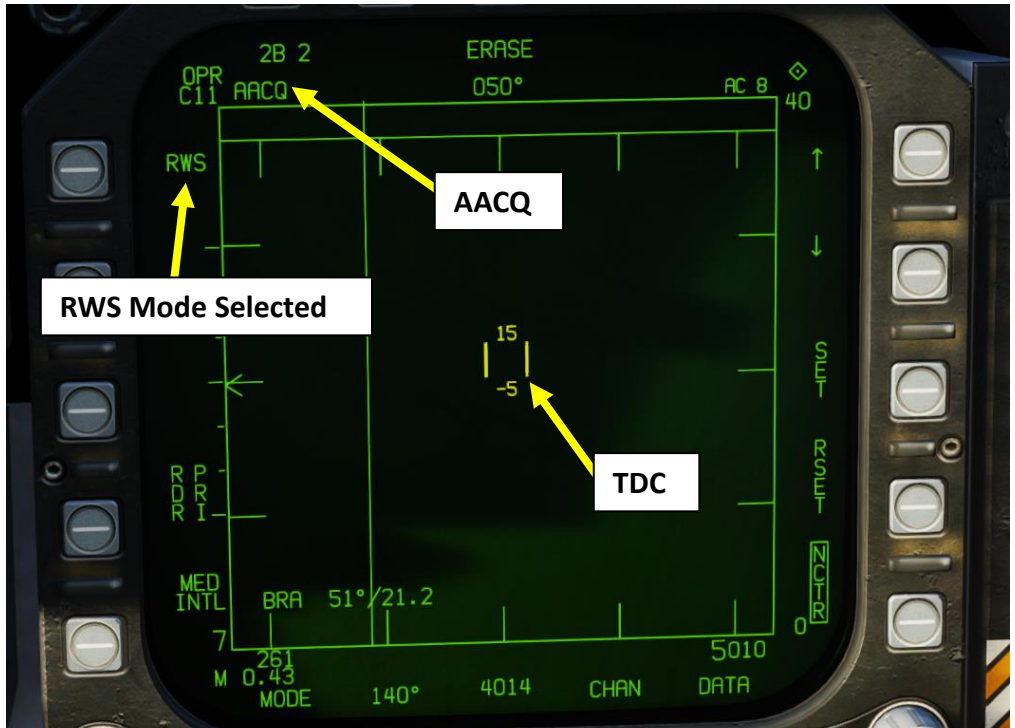
AACQ is exited by using Sensor Control Switch AFT or by toggling the A/A Master Mode OFF and ON.

TDC
(Left/Right/Up/Down/Depress)



Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS







A/A Master Mode



2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.3 – JHMCS (Joint Helmet-Cueing System) Lock

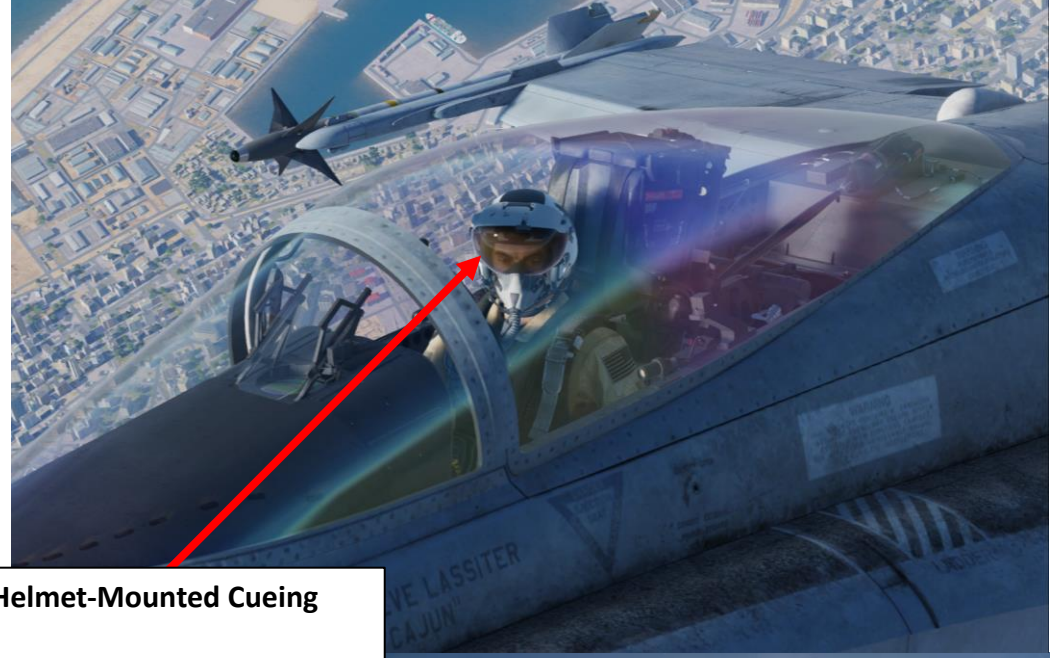
You can use the JHMCS (Joint Helmet Cueing System) to perform a radar lock. It works similarly to the ACM (Air Combat Maneuvering) close range radar mode, but it tracks wherever your head is looking instead (within its azimuth and elevation limits) .

You can use either HACQ (Helmet Acquisition) mode or LHACQ (Long Range Helmet Acquisition) mode based on how long you press the Sensor Control Switch forward.

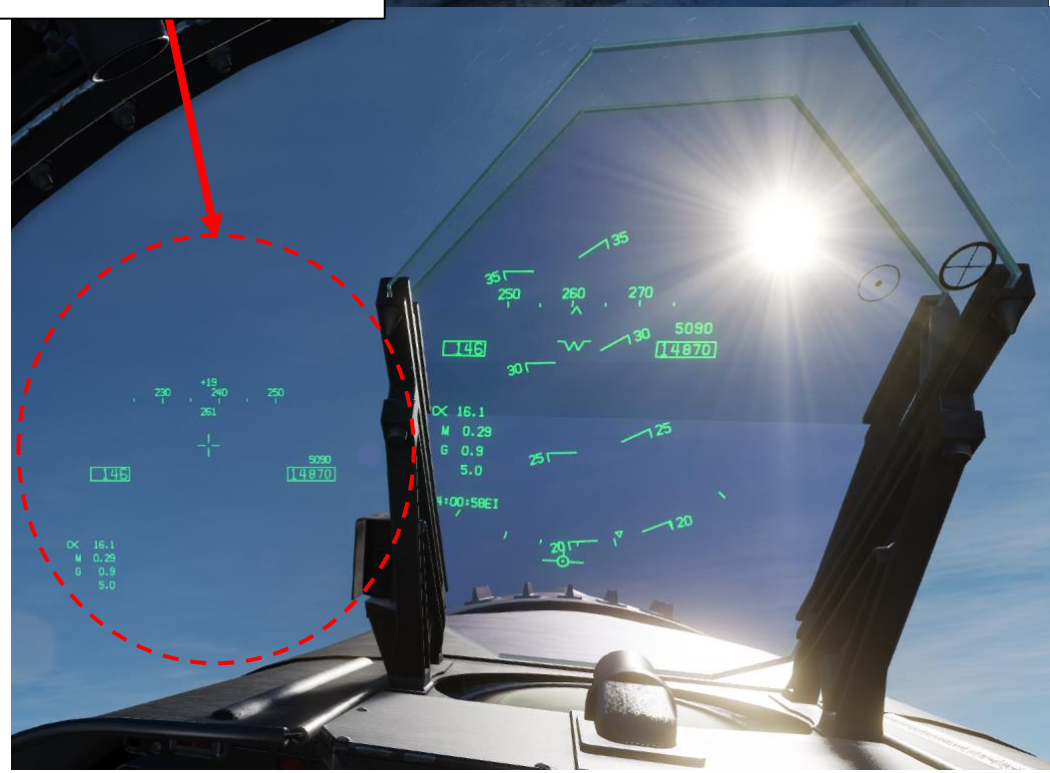
- HACQ has a range of 10 nm.
- LHAQ functions identically to HACQ, except it has a range of 40 nm.

The standard method of locking a target is:

1. Press A/A Master Mode
2. Turn HMD Brightness Control Switch to BRT
3. The HMD (Helmet-Mounted Display) overlay will appear over your helmet (except when looking at the Heads-Up Display).
    - When the HMD is looking at the HUD, it scans identically to Boresight Acquisition.
    - When the HMD is pointed elsewhere, it maintains the scan shape but is slaved to the HMD center.
    - When the radar scan limits are reached, the dashed circle will not move past the limits and will flash if the HMD moves farther than it can.



JHMCS (Joint Helmet-Mounted Cueing System)





HMD (Helmet-Mounted Display) Brightness Control Switch

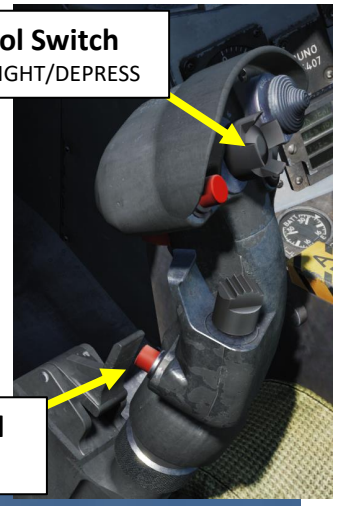
A/A Master Mode

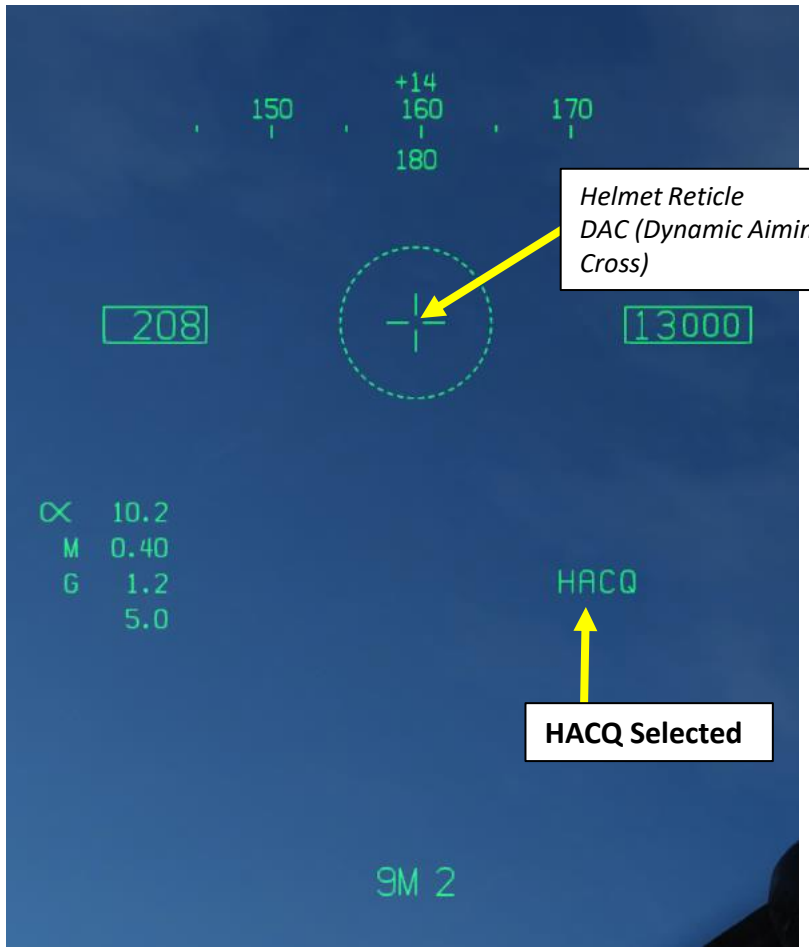


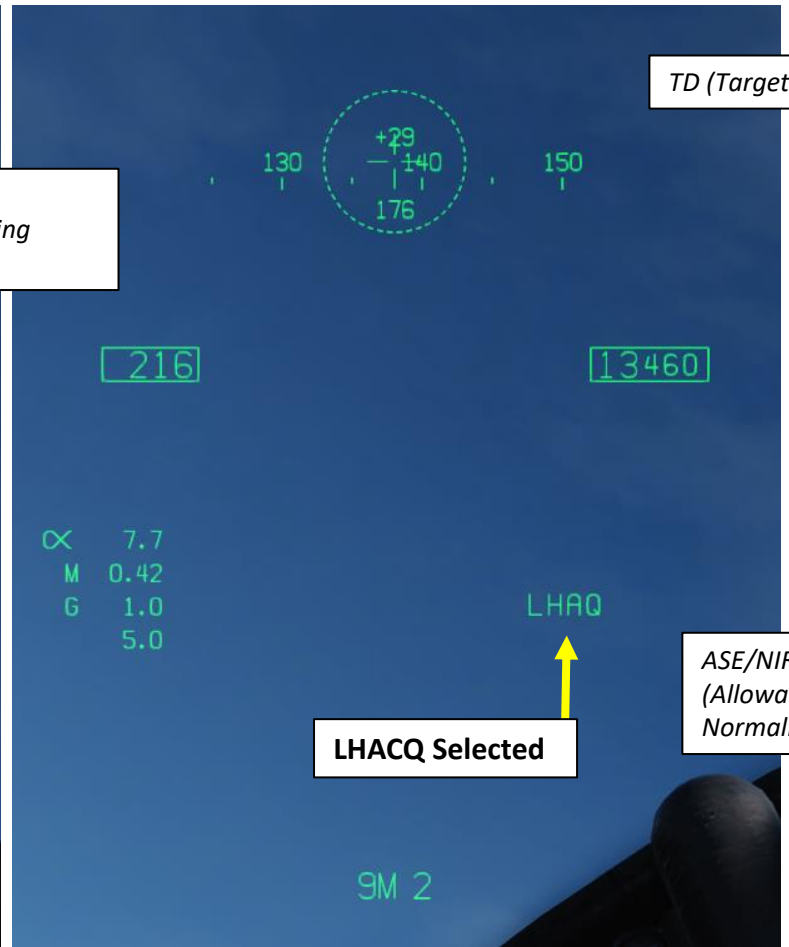
2.1 - AN/APG-73 RADAR (AIR-TO-AIR)
2.1.8 – Radar Lock Acquisition
2.1.8.3 – JHMCS (Joint Helmet-Cueing System) Lock

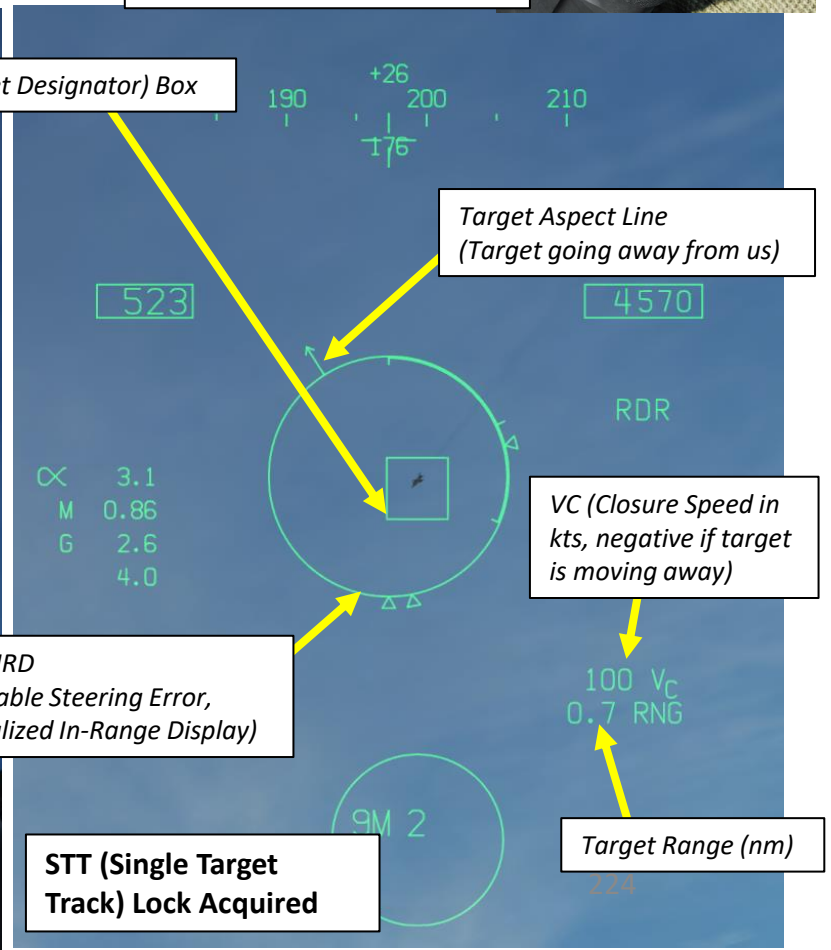
4. Press Sensor Control Switch Forward to enter desired acquisition mode
   - Holding it for more than 0.8 sec selects LHACQ (Long Range Helmet Acquisition) mode, which locks targets automatically within 40 nm of the helmet reticle
   - Holding it for less than 0.8 sec selects HACQ (Helmet Acquisition) mode, which locks targets automatically within 10 nm of the helmet reticle
5. A STT (Single Target Track) lock will be performed automatically when target comes on target reticle and is within acquisition range

To **exit ACM mode**, press Undesignate Button.







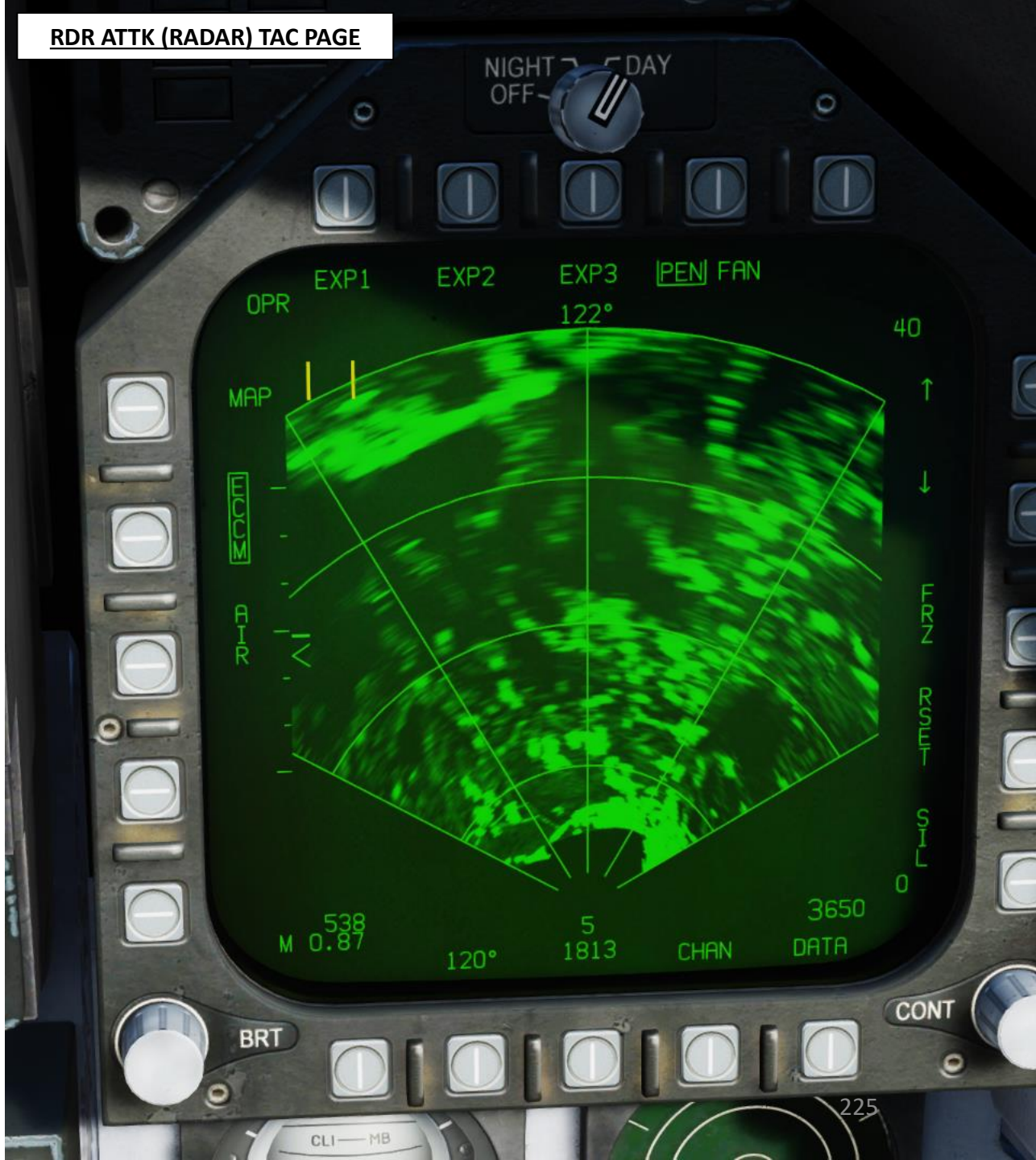


2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.1 – Air-to-Ground Operating Modes

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

Here is an overview of the different modes available:

- **Ground Mapping (MAP)**
    - **DBS (Doppler-Beam-Sharpened) Expanded Mapping Sub-Modes**
        - **EXP1 (Sector Map)**
        - **EXP2 (Patch Map)**
        - **EXP3 (Synthetic-Aperture Radar/SAR Map)**
- **Ground Moving Target (GMT)**
- **Terrain Avoidance (TA) Mode**
- **Sea Surface Search (SEA) Mode**



2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

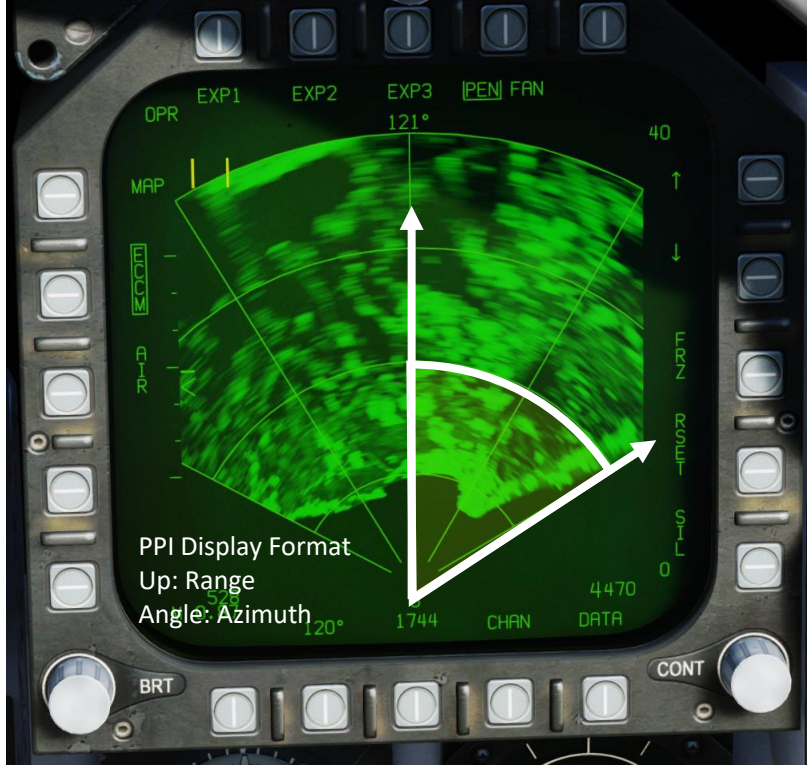
DISPLAY

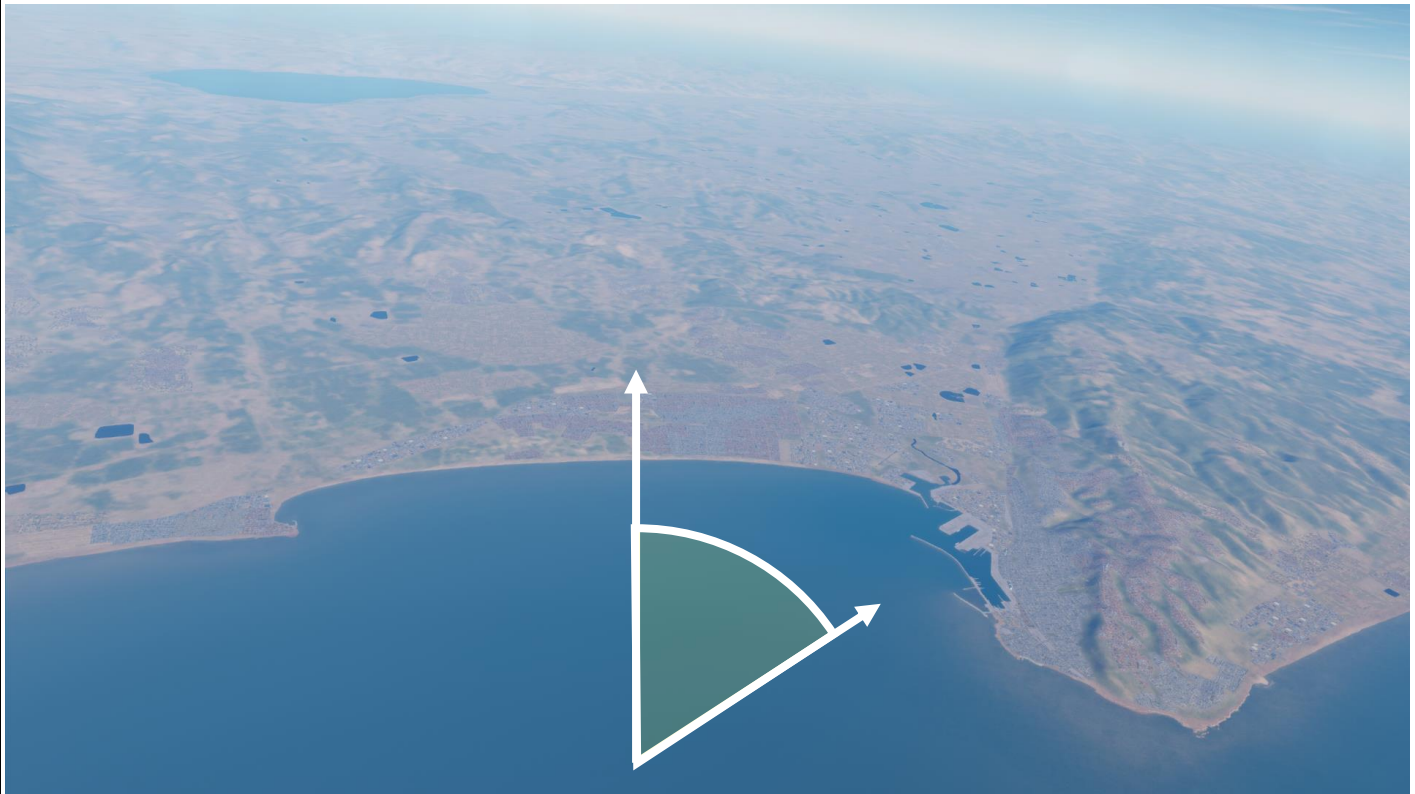
The radar Ground Mapping mode is quite useful when you need to navigate to a specific waypoint or target. With Real beam ground mapping (RBGM), you have a visualization of the terrain, raw ground and fixed target returns as seen by the radar. The display format is a range versus azimuth Plan-Position-Indicator (PPI), a format similar to the weather radar display on civilian aircraft. This mode has the lowest resolution since it has the largest coverage.

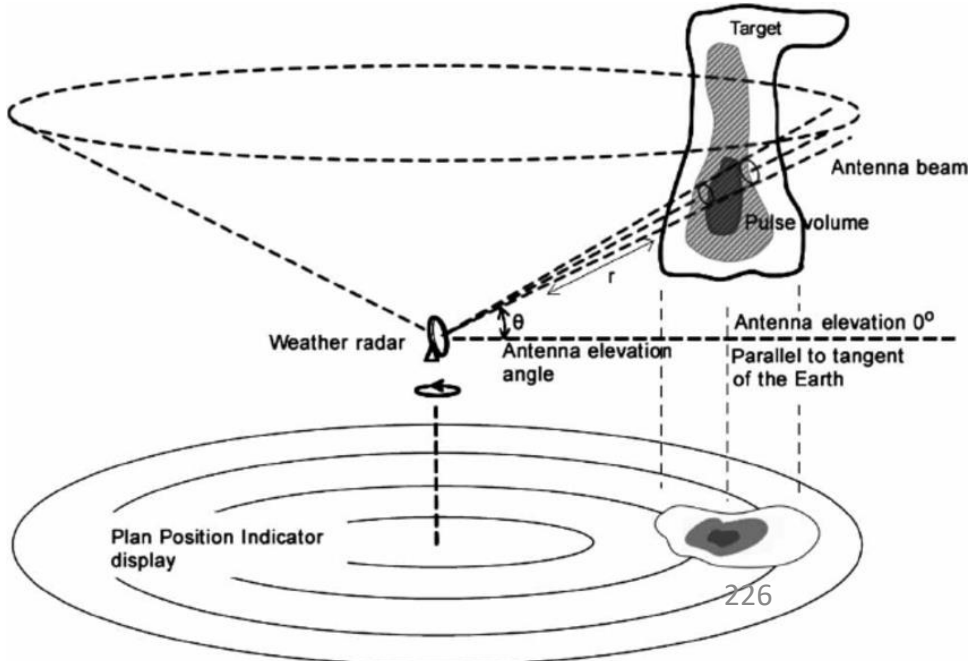
Keep in mind that the A/G Master Mode needs to be selected in order to have the air-to-ground radar overlay on the RDR ATTK TAC page.

A/G (Air-to-Ground) Master Mode Selected





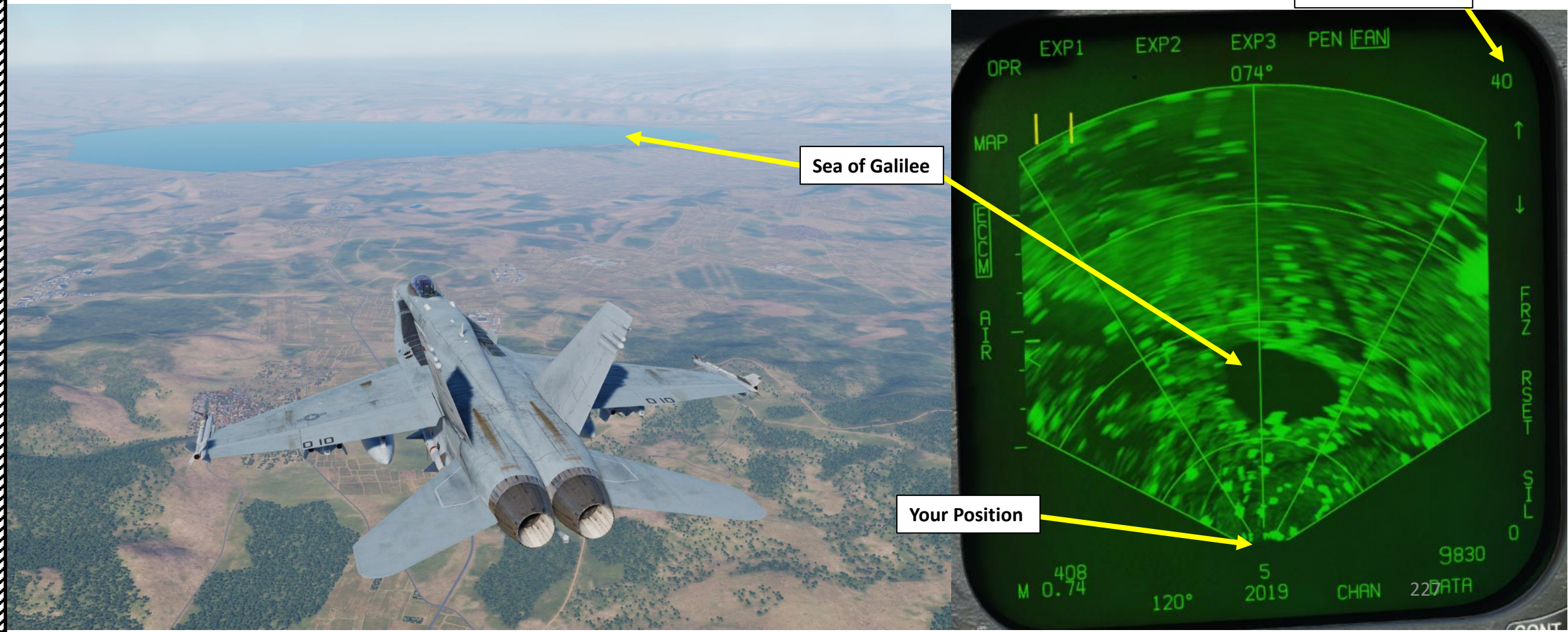




2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

DISPLAY

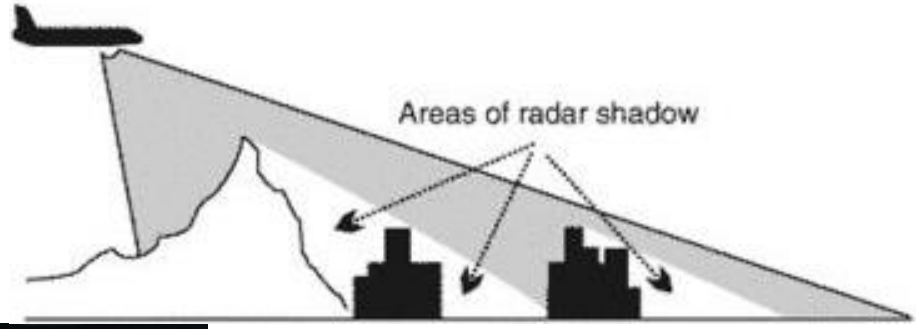
Regions that do not provide radar returns are black (such as water).The bright/white regions are generally man-made structures (buildings, power lines, roads, etc.) or mountains.

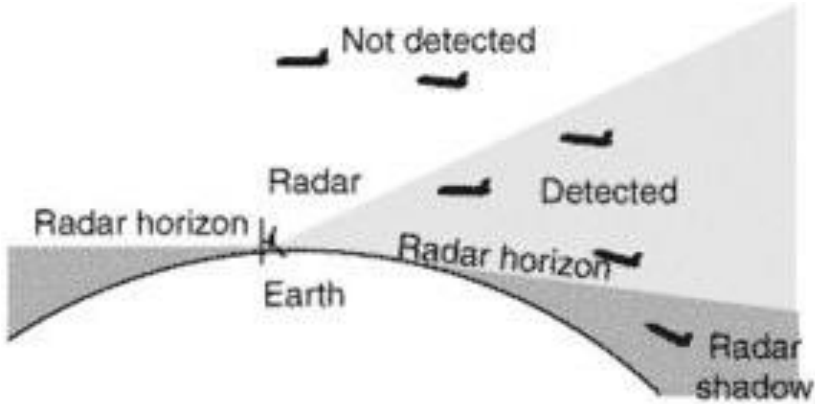


2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

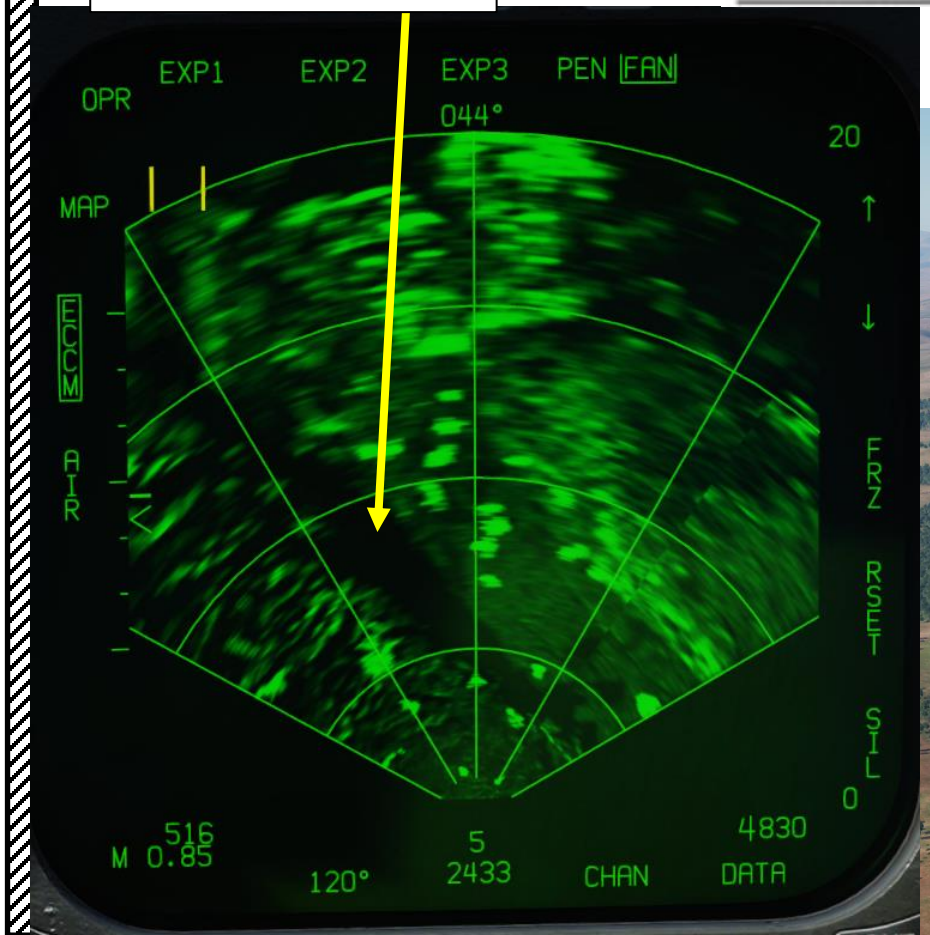
DISPLAY

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





Radar Shadow (behind hill)





2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

PEN (PENCIL) VS FAN RADAR BEAM

You can select either a « pen » (pencil) or a « fan » radar beam type.

- PEN (Pencil) beam mode scans a smaller area on the ground.
- FAN beam mode results in a broader/quicker scan but a less defined image. The beam is narrow in azimuth and broad in elevation.



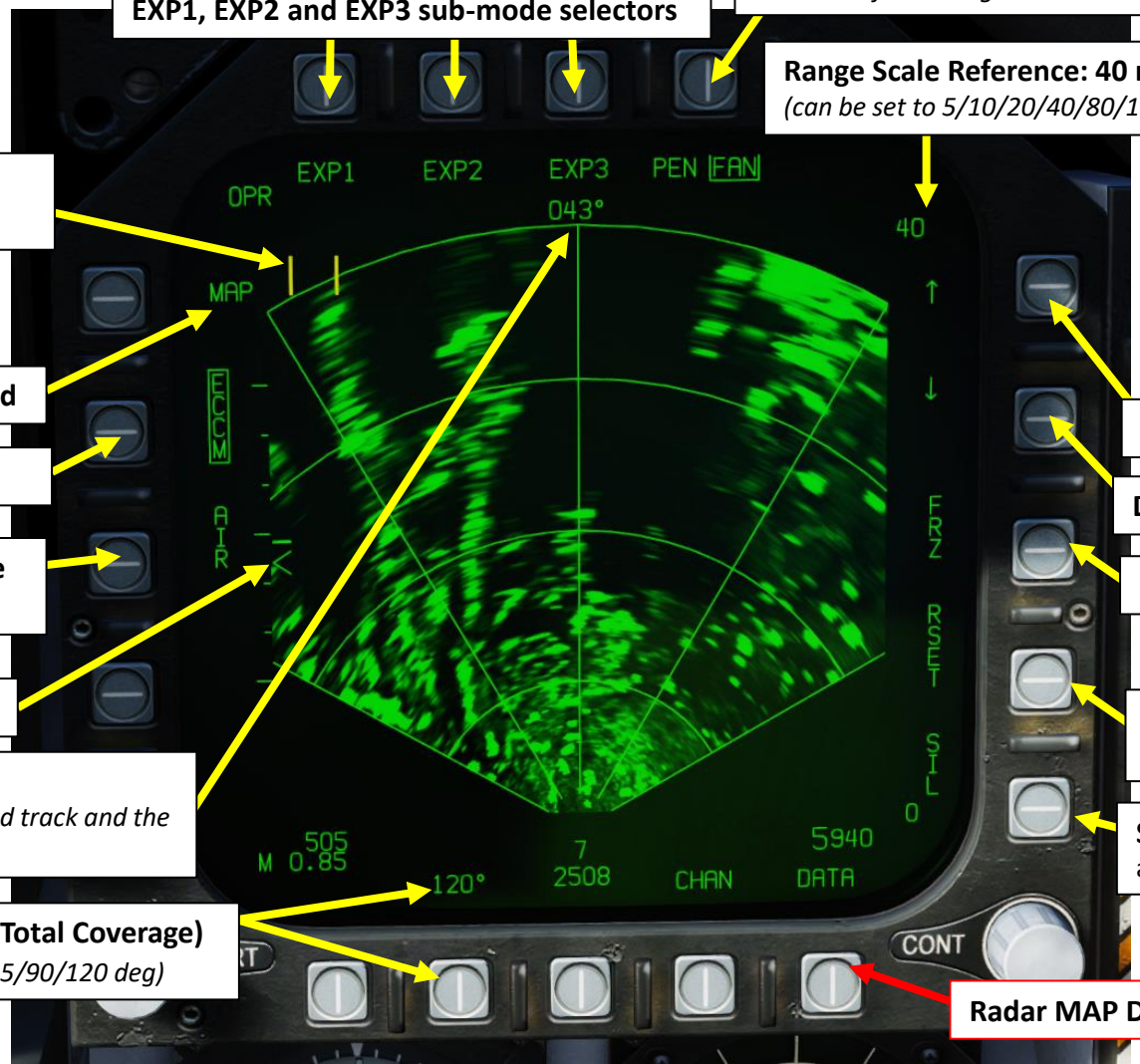
Radar Beam Width/Type Toggle
Pen / Fan



2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

CONTROLS (MAP PAGE)

Radar range and azimuth can be modified using the OSBs (Option Select Button). Keep in mind that the larger the region to scan, the slower the refresh rate and scanning cycle.



EXP1, EXP2 and EXP3 sub-mode selectors

Radar Beam Width/Type
Toggles the beam width between narrow (PENCIL) and wide (FAN). FAN will result in a broader/quicker scan but less defined image.

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

TDC (Throttle Designator Controller) Acquisition Cursor

Ground Mapping Mode Selected

ECCM (Not Implemented)

AIR returns radar page to air-to-air mode

Radar Antenna Elevation

Angle-Off-Track Indication
Degrees between ownship ground track and the azimuth scan center

Radar Azimuth (Total Coverage)
(can be set to 20/45/90/120 deg)



Radar MAP DATA sub-menu

Increase Range Scale

Decrease Range Scale

FREEZE: Radar image is "frozen"

RESET: Radar settings are returned to default settings.

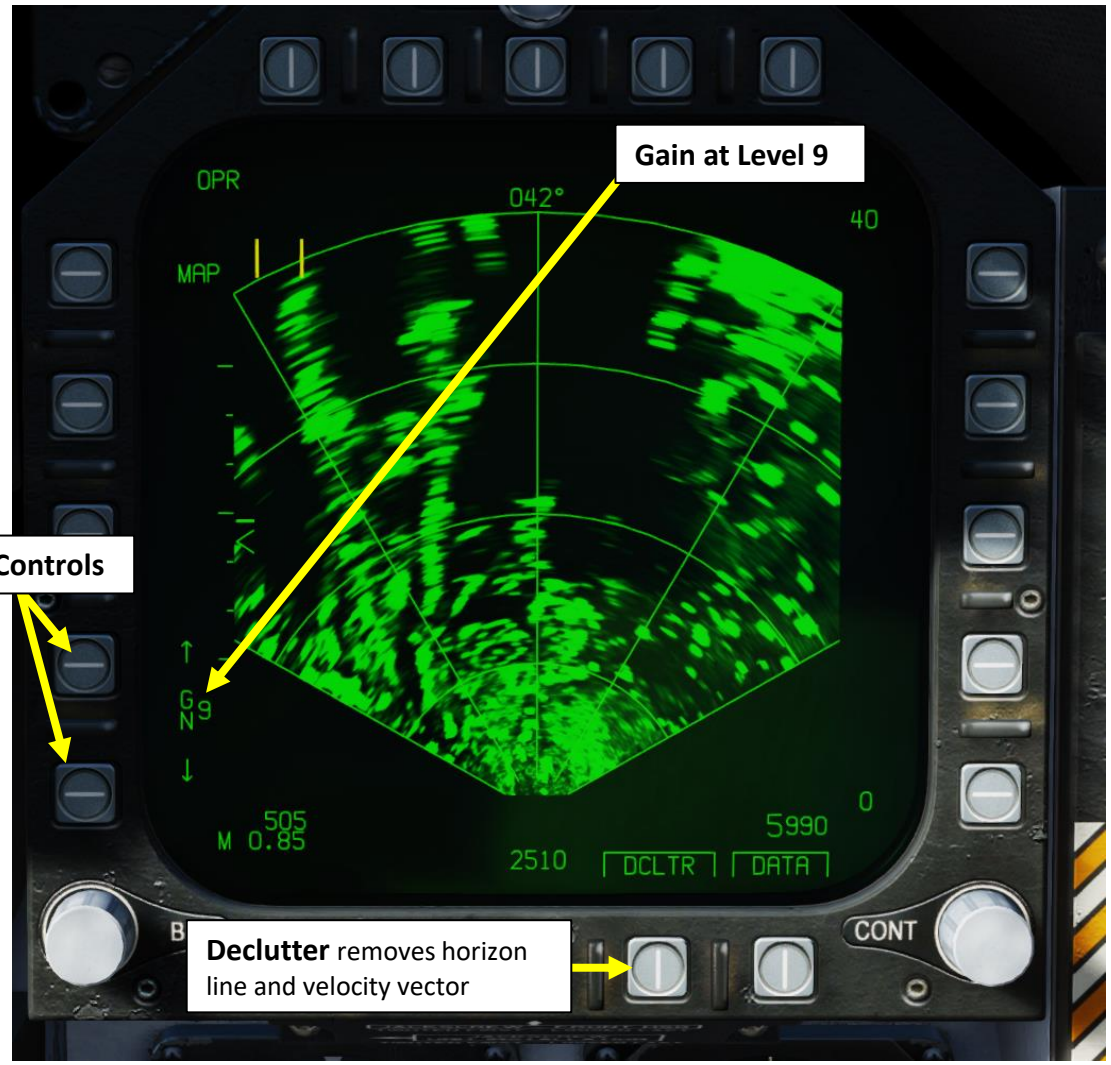
Silent (SIL) Mode: Radar ceases operation and FRZ option is selected.

Radar MAP DATA sub-menu

2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

CONTROLS (DATA PAGE)

You can access the MAP DATA sub-menu for more options. When accessing it, you can toggle the DCLTR (Declutter) option, which removes the horizon line and velocity vector (the option is ON by default). The Gain Control buttons (1 is low gain, 9 is high gain) are also very useful to fine tune the radar returns displayed on your screen.

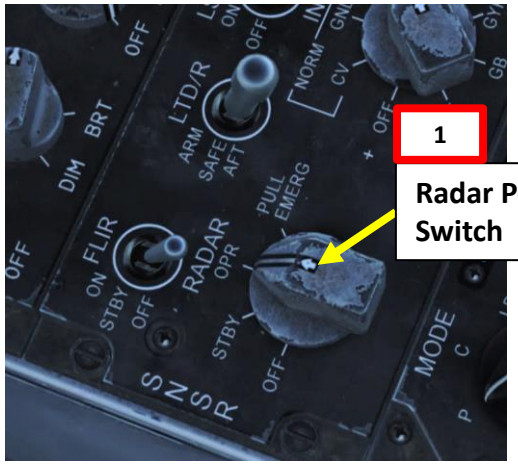




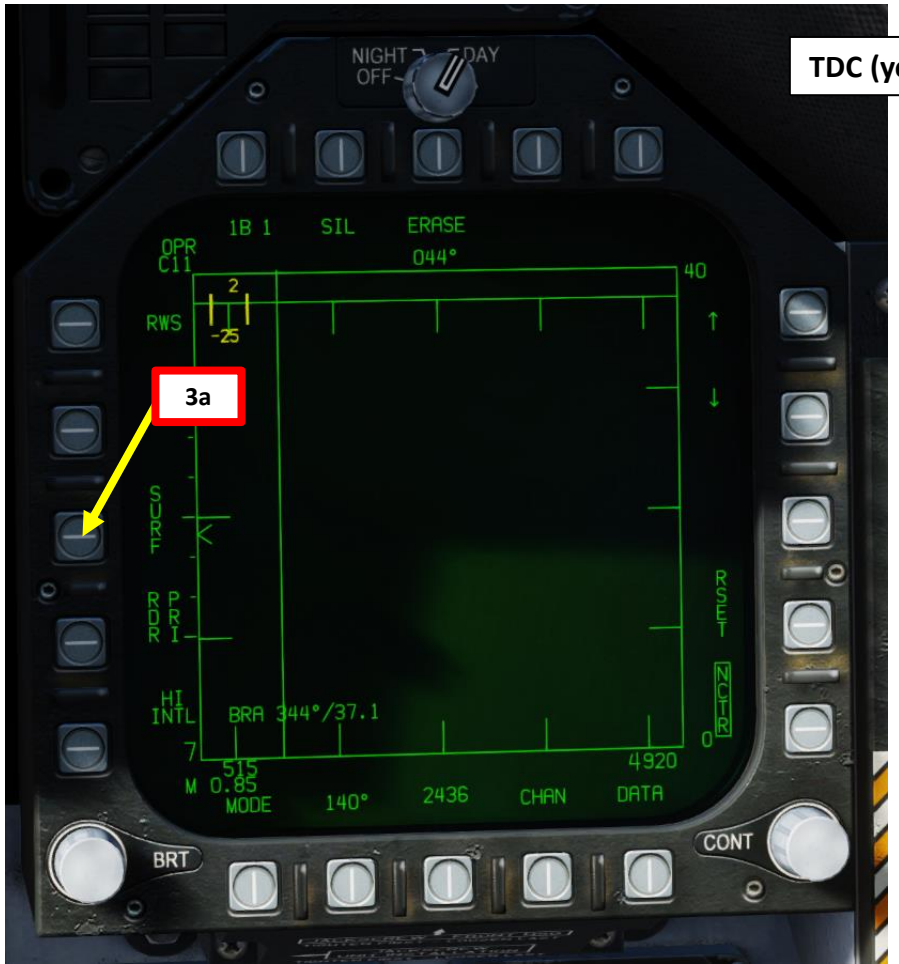
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

HOW TO SELECT MAP MODE

1. Make sure the Radar Power Switch is set to OPR (Operate).
2. Pressing the A/G Master Mode button will set the right DDI (Digital Display Indicator) to the radar A-G MAP page.
3. Alternatively, you could also select the RDR ATTK (Radar) TAC page, and press the OSB (Option Select Button) next to SURF (Air-to-Surface). The radar page will then switch from air-to-air to air-to-ground. This method works too, but it is longer than just pressing the A/G Master Mode button.





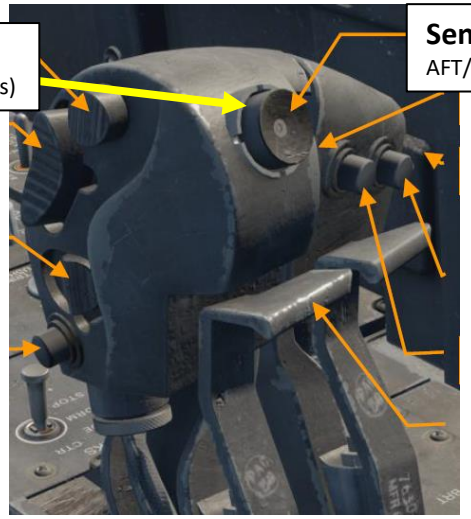


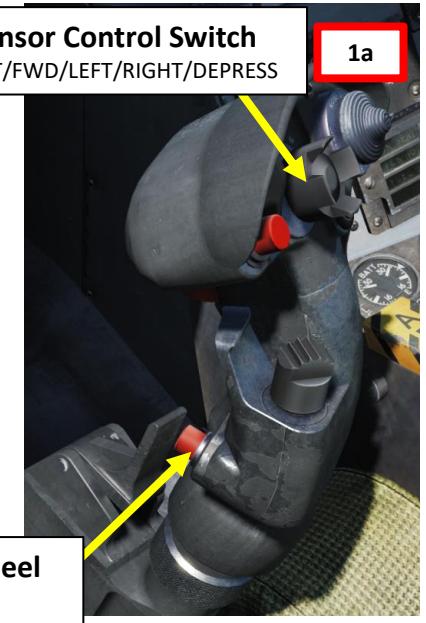


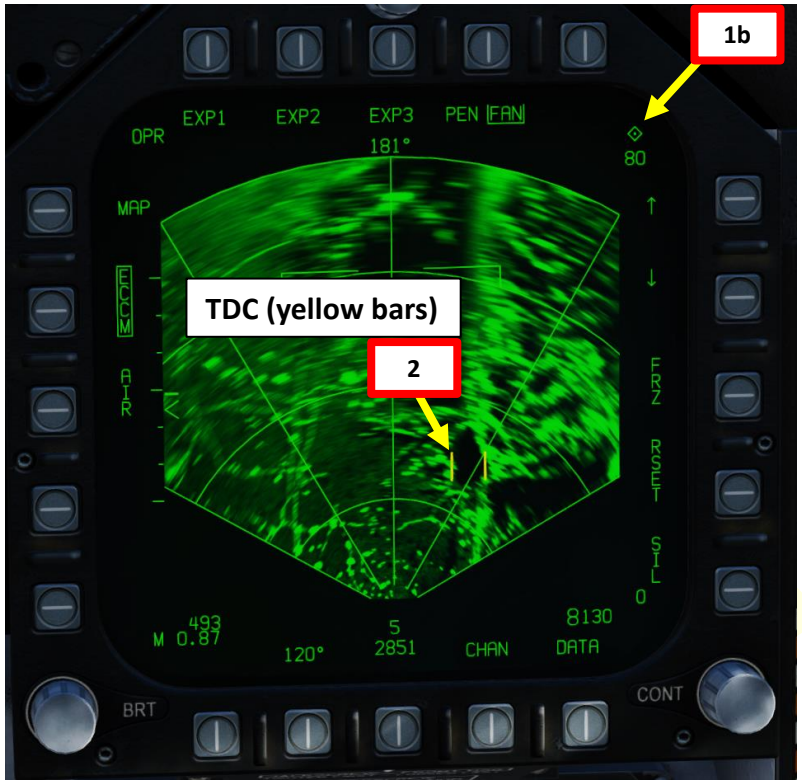
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.2 – MAP (Ground Mapping) Mode

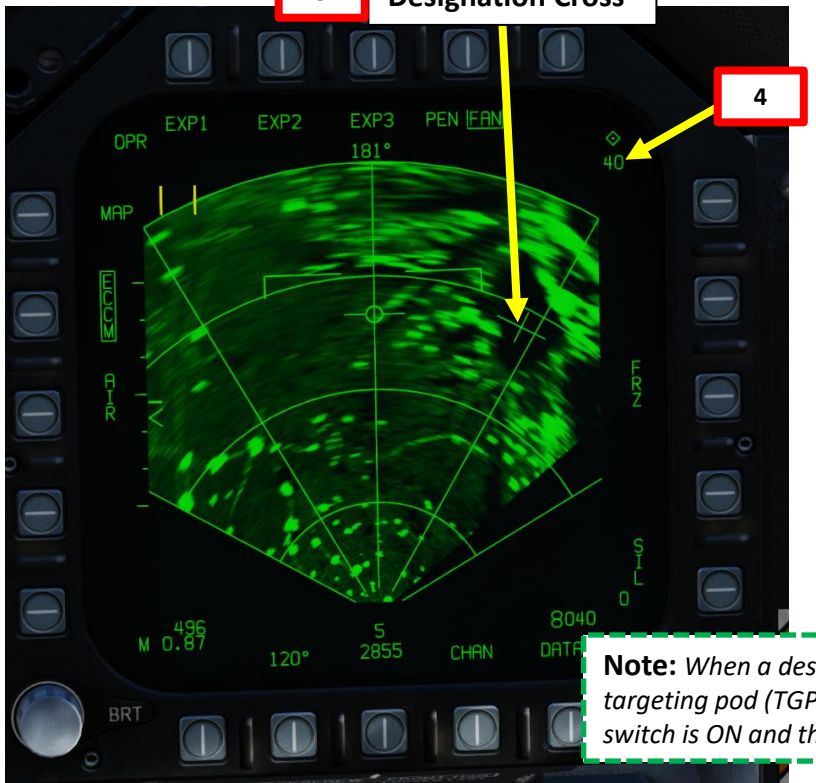
HOW TO DESIGNATE/UNDESIGNATE FROM THE A/G MAP MODE

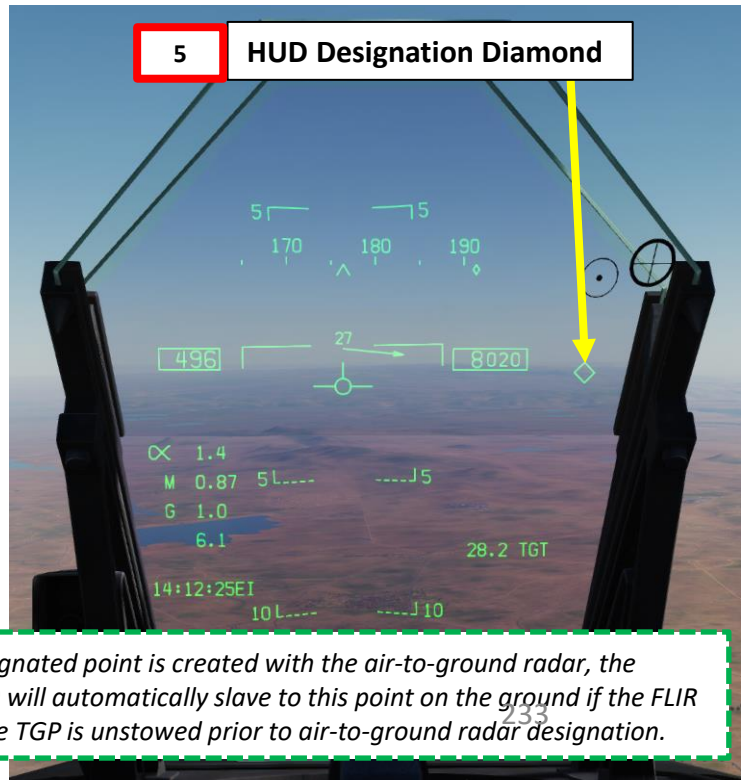
1. Once A-G MAP mode is selected, press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
2. Slew the TDC on the desired spot you want to designate using the TDC controls.
3. Designate target by using the TDC DEPRESS control (« ENTER »).
4. The air-to-ground radar will automatically adjust its range to give you a better view of the point you just designated.
5. On the Radar page, a cross will mark the designated point. On the HUD, a diamond will mark the designated point. This point can be used/slaved to by other sensors (like the targeting pod) if desired.
6. Note: you can zoom in using either the EXP1, EXP2 or EXP3 expanded modes.
7. Pressing the « Undesignate » button on the stick will delete the designation point.











Note: *When a designated point is created with the air-to-ground radar, the targeting pod (TGP) will automatically slave to this point on the ground if the FLIR switch is ON and the TGP is unstowed prior to air-to-ground radar designation.*

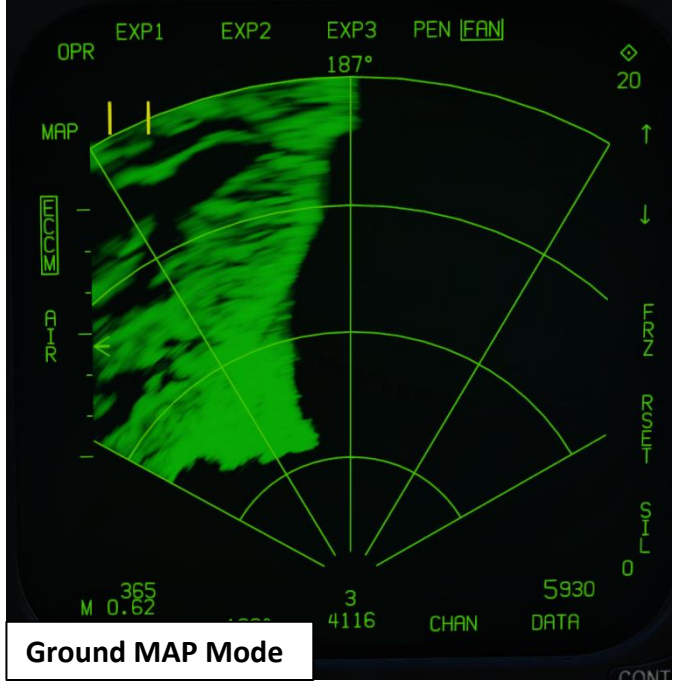
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.1 – EXP1 (Sector Map)

INTRODUCTION TO EXP MODES

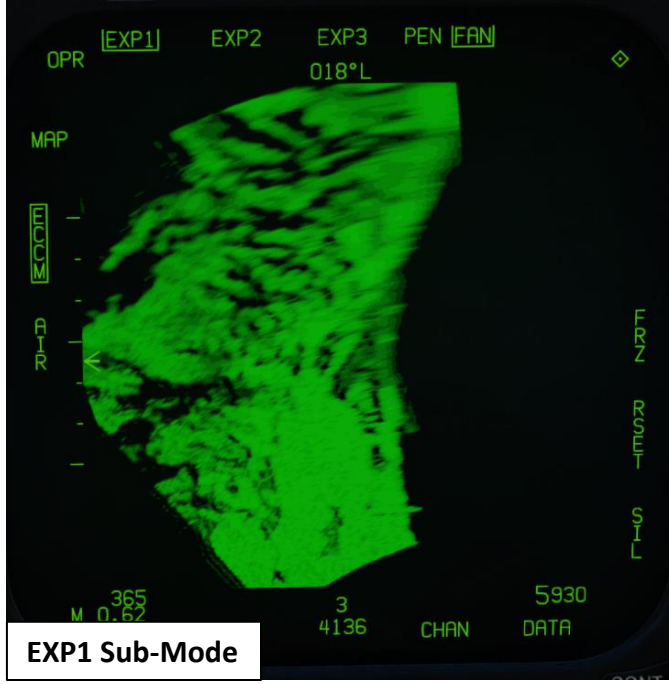
When air-to-ground mapping (MAP) mode is selected, you can select « expanded » sub-modes, which can be seen as a « zoom » feature that can be used to designate target points for weapons delivery. These modes are called « Doppler-Beam-Sharpened » (DBS) modes since they are high resolution mapping modes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

From the A-G MAP page or any expanded mode currently selected, you can access any of the three expanded sub-modes:

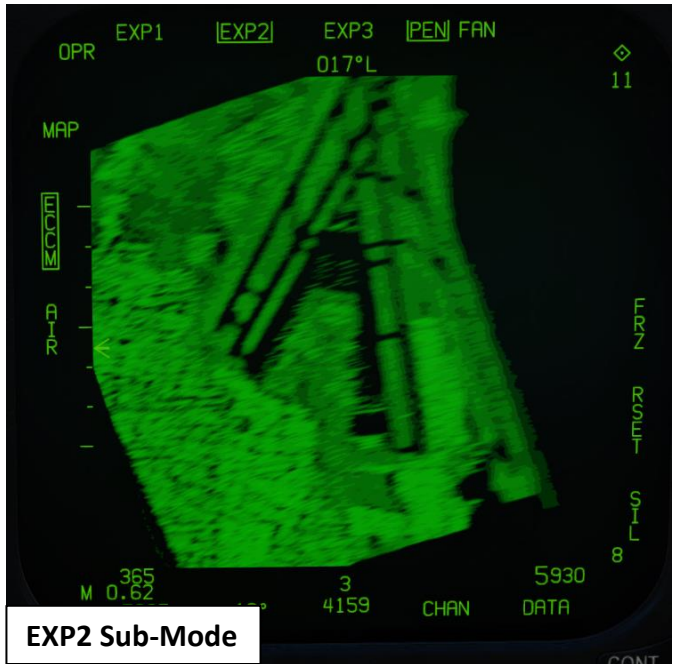
- **EXP1: Sector Map**
  - EXP1 is the lowest resolution expanded mode. The EXP1 format contains most of the same options and symbology described for the MAP mode.
  - Range: 40 nm
  - It is not a ground stabilized mode unless a designation exists within the tactical region of the format. Non-stabilized means that the area of expansion is always a fixed distance from ownship and the coverage area "snowplows" with the aircraft.
  - EXP1 has a fixed azimuth of 45°.
- **EXP2: Patch Map**
  - EXP2 is the next higher resolution mode up from EXP1.
  - Range: 40 nm
  - It is a ground stabilized mode regardless of whether a designated target exists or not. The Radar will continue to focus on the same geographic area, regardless of aircraft motion, unless or until the area being observed falls outside the radar's gimbals limits of 70°.
- **EXP3: Synthetic-Aperture Radar (SAR) Map**
  - EXP3 is the highest resolution expanded mode available.
  - Range: 30 nm
  - It is a ground stabilized mode regardless of whether a designated target exists or not. It has a fixed range perimeter coverage of approximately 1.2 x 1.2 nm, resulting in a constant area and resolution regardless of range.



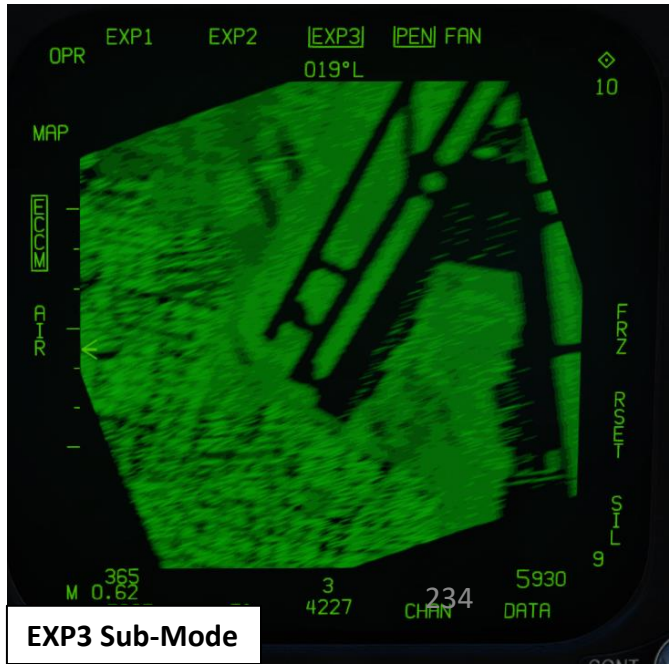
Ground MAP Mode



EXP1 Sub-Mode



EXP2 Sub-Mode

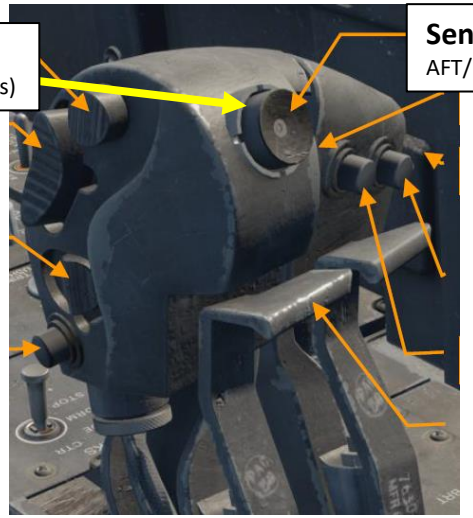


EXP3 Sub-Mode

2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.1 – EXP1 (Sector Map)

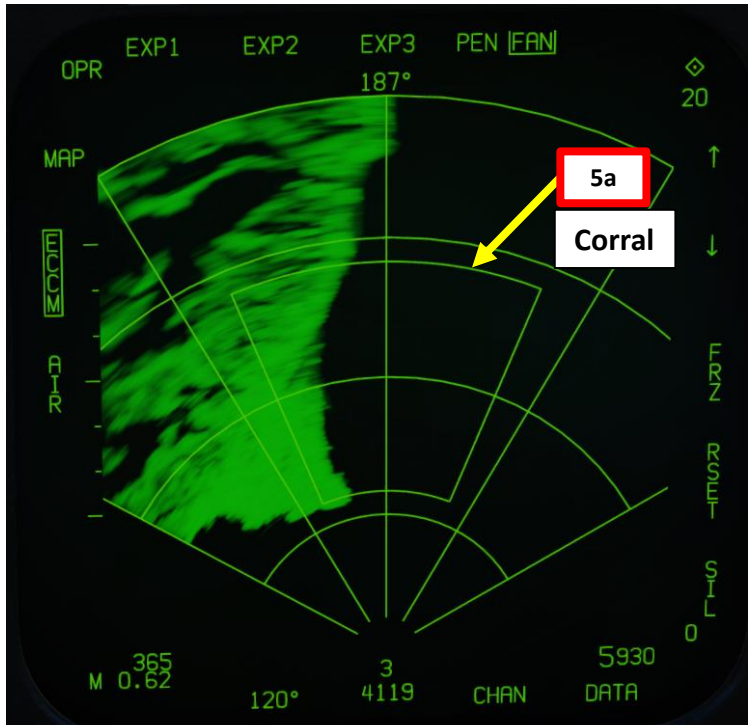
HOW TO SELECT EXP1 MODE

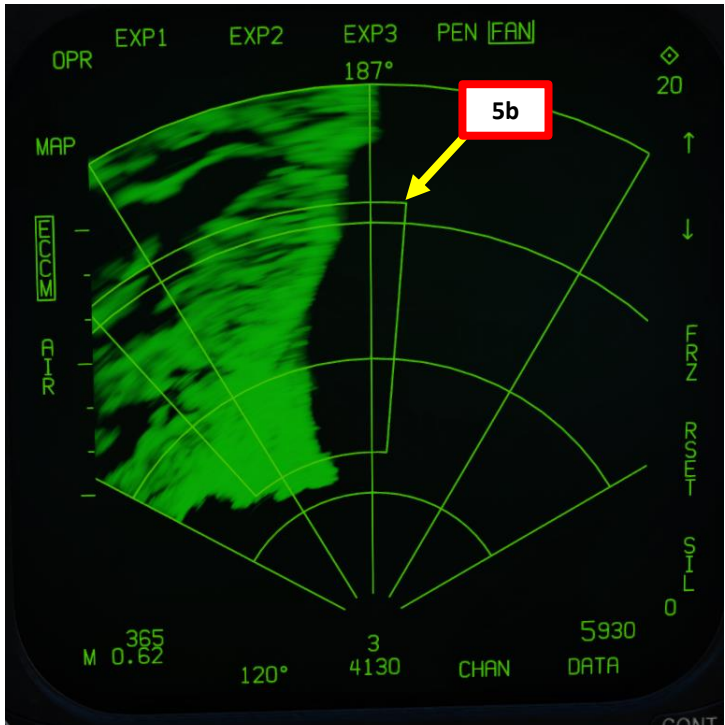
1. Make sure air-to-ground mapping (MAP) mode is selected (see section 2.2.2).
2. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
3. Press on the OSB (Option Select Button) next to EXP1.
4. **Press and hold** TDC DEPRESS control (« ENTER »).
5. While TDC DEPRESS is held, slew the trapezoidal corral over the desired region you want to set as a sector map (zoom) using the TDC controls.
6. Release the TDC DEPRESS control to enter EXP1 mode.











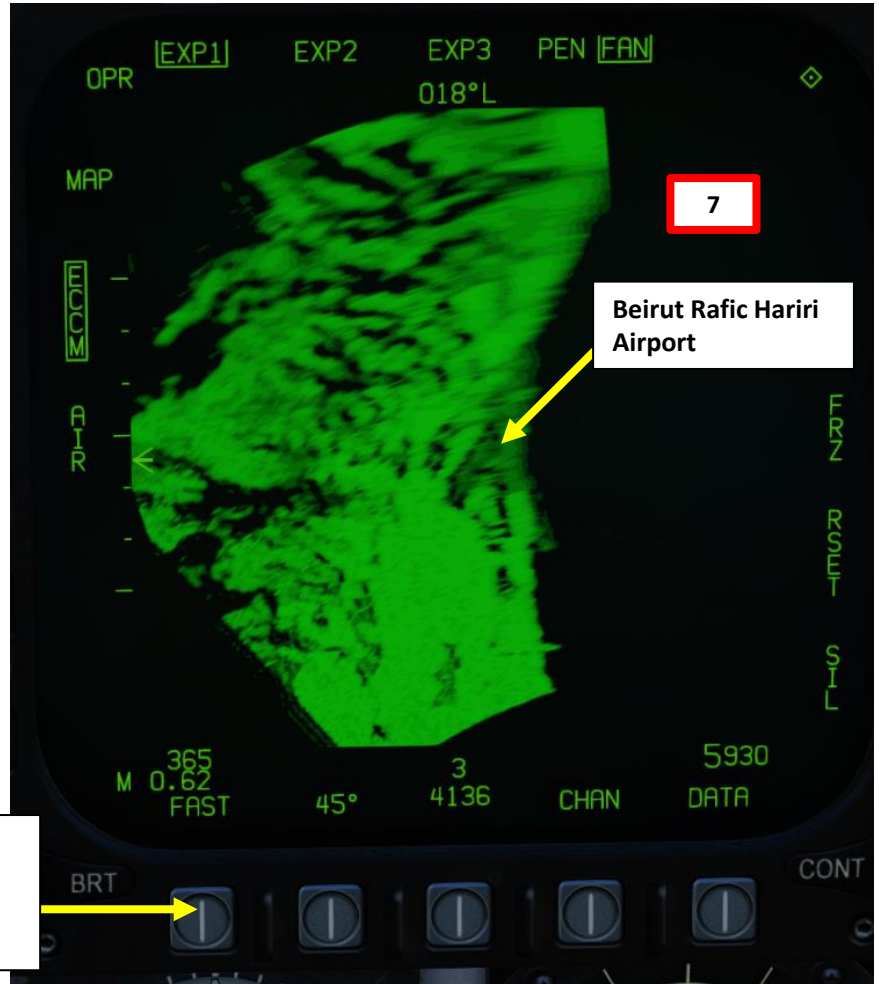
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.1 – EXP1 (Sector Map)

HOW TO SELECT EXP1 MODE

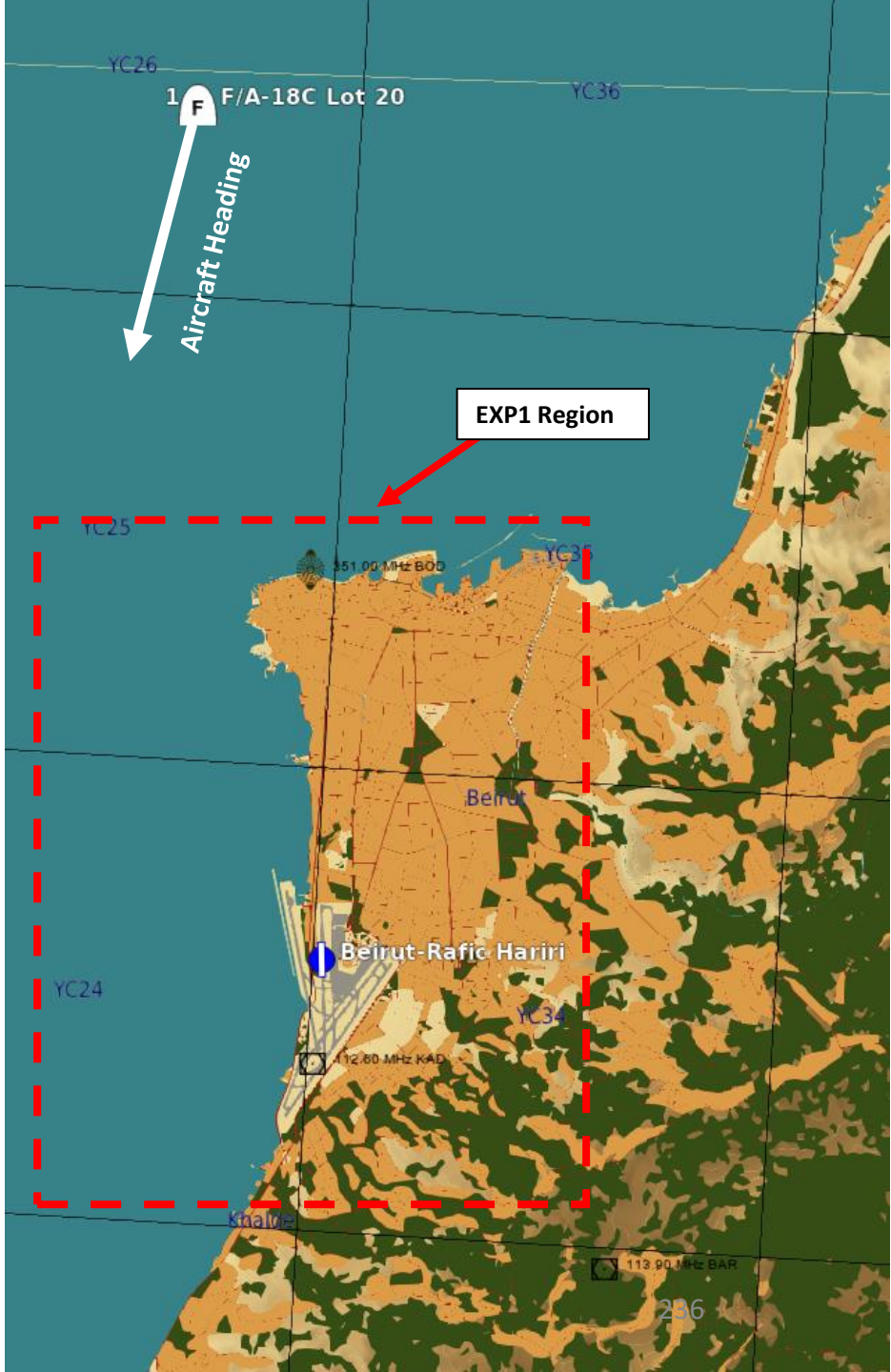
7. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded.
8. You can designate a target using the method described in section 2.2.3.4 (Designation with EXP mode).
9. Pressing the « Undesignate » button on the stick will exit EXP1 mode.



Undesignate / Nosewheel Steering Button



FAST Option
Boxing the FAST scan option doubles the radar's rate of scan for a reduction of approximately half the scan quality.



2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.1 – EXP1 (Sector Map)

THE "DOPPLER SHIFT" EFFECT

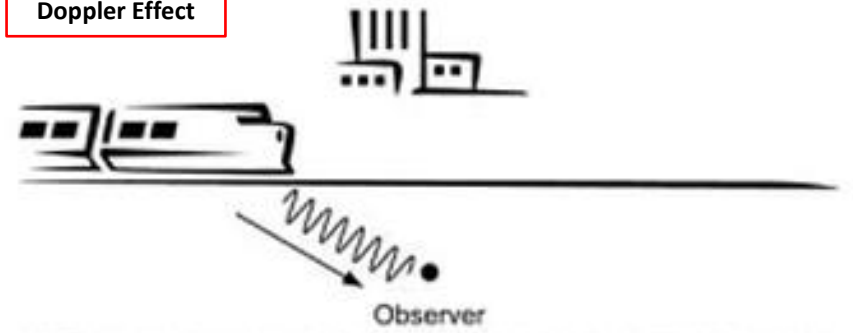
The **Doppler Effect** is probably that boring phenomenon you heard about in high school and didn't care about at the time. Basically, the Doppler Effect is the reason why airplane fly-bys in airshows are so awesome to listen to: a moving object (like a plane) is emitting waves (like sound waves) that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

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

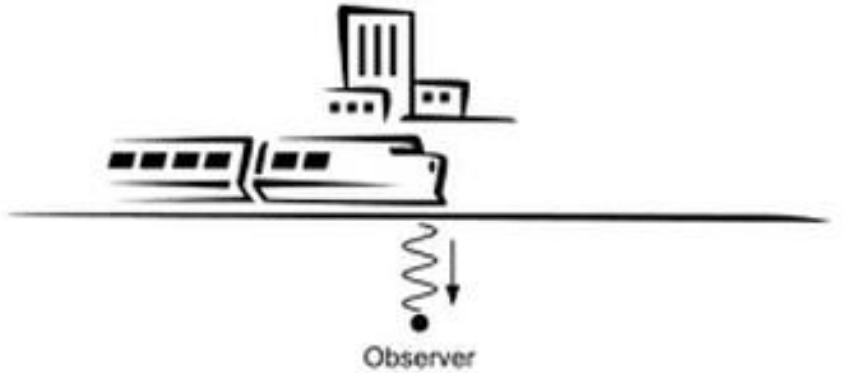
Where am I going with this? Well, the radar is affected by the Doppler Effect since it emits and receives radar waves, which will affect your doppler-beam-sharpened modes. How? Hang on, I'm getting there.



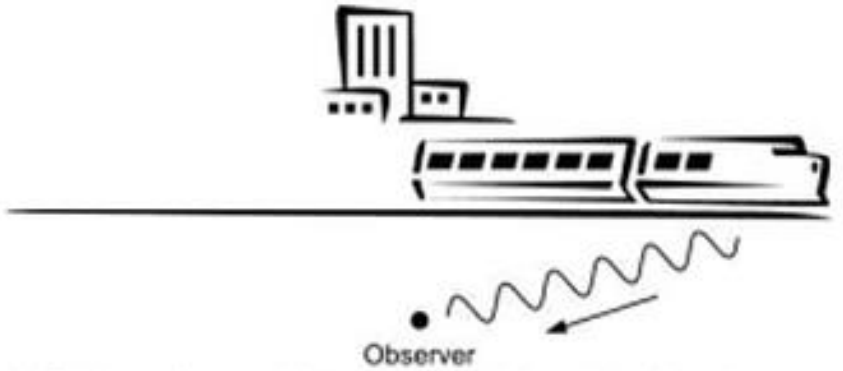
Doppler Effect



(a) Train moving towards the observer (more cycles in a given time therefore the observer perceives a higher pitch)



(b) Train nearest to the observer (observer perceives the exact pitch)



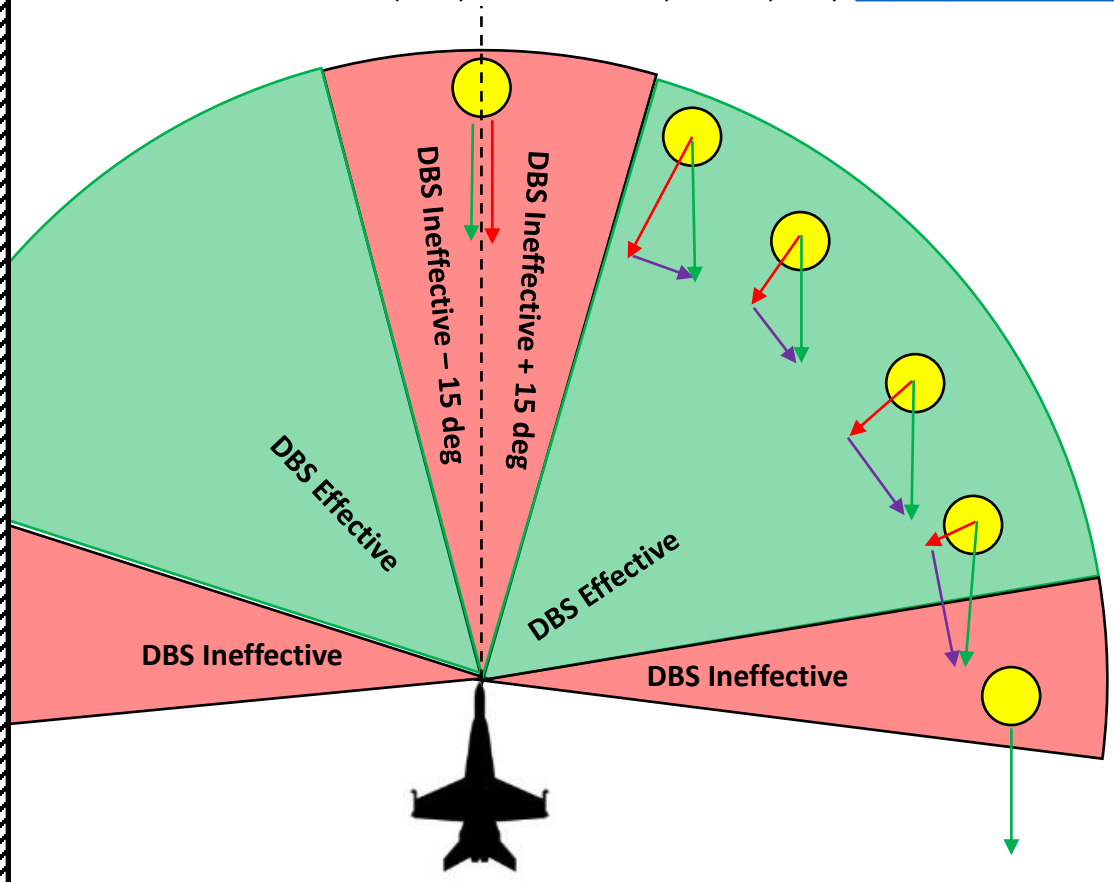
(c) Train moving away from the observer (less cycles in a given time therefore the observer perceives a lower pitch)

2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.1 – EXP1 (Sector Map)

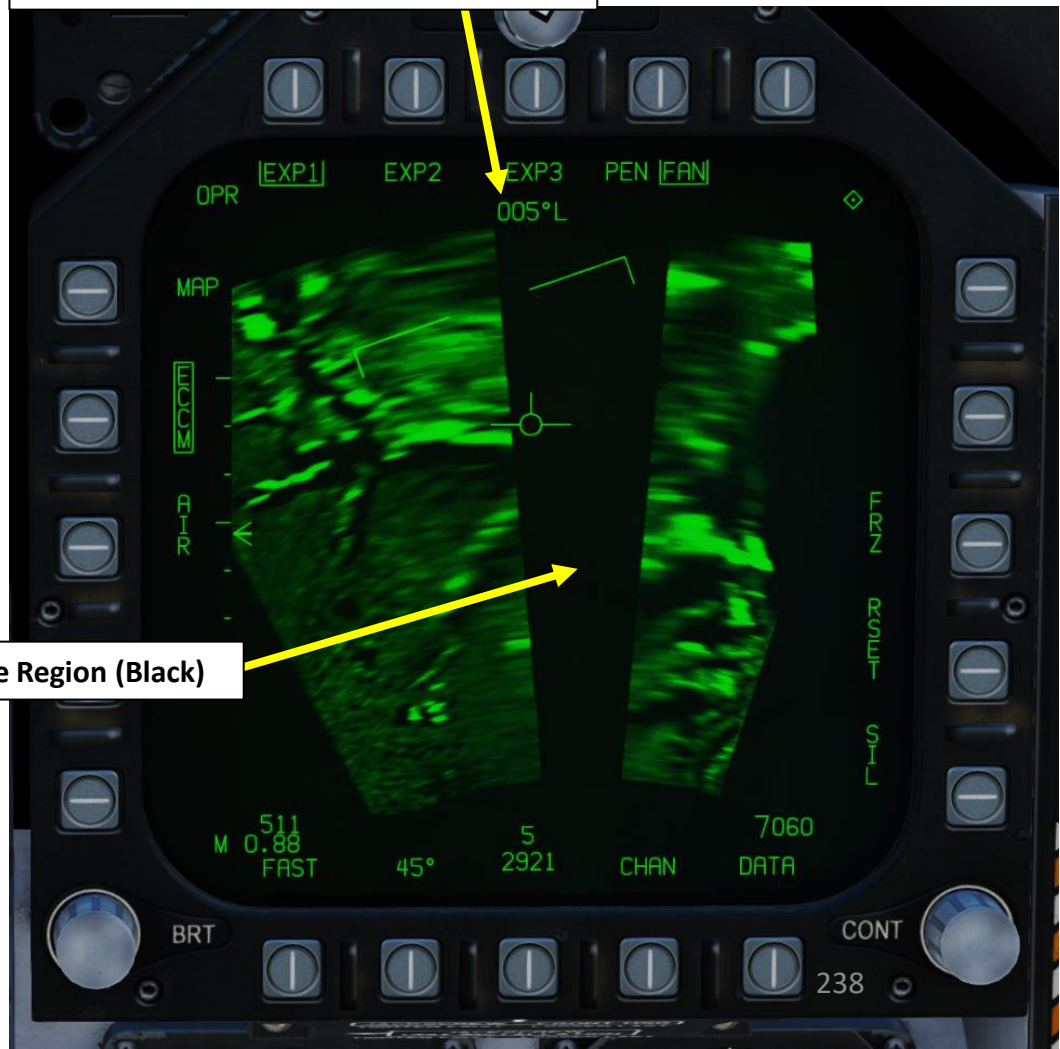
THE "DOPPLER SHIFT" EFFECT

Doppler beam sharpened (DBS) maps directly across the aircraft ground track become increasingly difficult to map because of the large shift in Doppler frequency within those regions. This means that certain regions will not be computed properly, creating these black regions in certain areas relative to your aircraft. To get the best coverage of an area, I would suggest that you fly at a 45 angle from it, not directly towards it.

This video showcases the frequency shift with sound pitch frequency: https://youtu.be/-P5J7XEwZIs



Angle-Off-Track Indication
Degrees between ownship ground track and the azimuth scan center

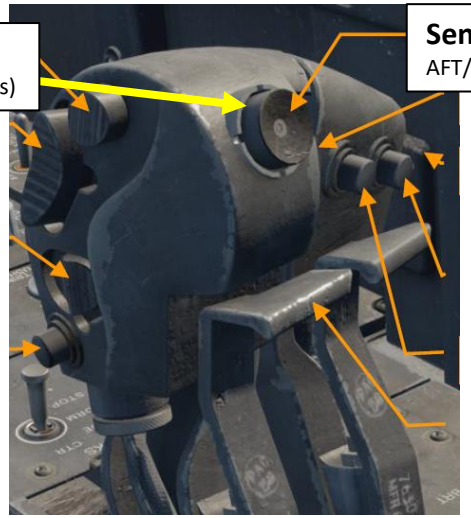


DBS Ineffective Region (Black)

2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.2 – EXP2 (Patch Map)

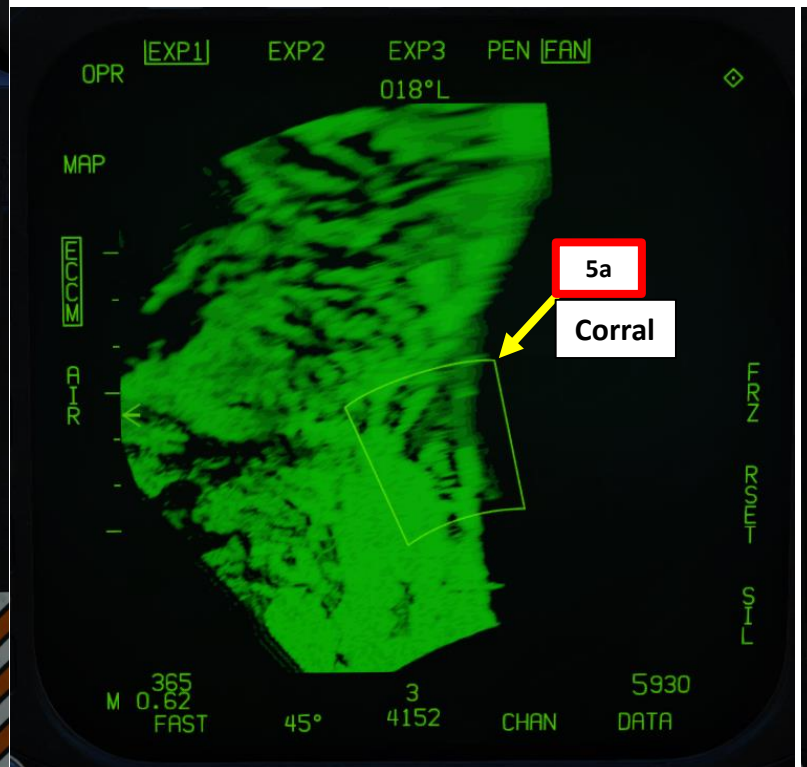
HOW TO SELECT EXP2 MODE

1. Make sure air-to-ground mapping (MAP) mode or EXP1 mode is selected (see previous sections).
2. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
3. Press on the OSB (Option Select Button) next to EXP2.
4. **Press and hold** TDC DEPRESS control (« ENTER »).
5. While TDC DEPRESS is held, slew the trapezoidal corral over the desired region you want to set as a patch map (zoom) using the TDC controls.
6. Release the TDC DEPRESS control to enter EXP2 mode.











2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.2 – EXP2 (Patch Map)

HOW TO SELECT EXP2 MODE

7. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded.
8. You can designate a target using the method described in section 2.2.3.4 (Designation with EXP mode).
9. Pressing the « Undesignate » button on the stick will exit EXP2 mode.



Undesignate / Nosewheel Steering Button



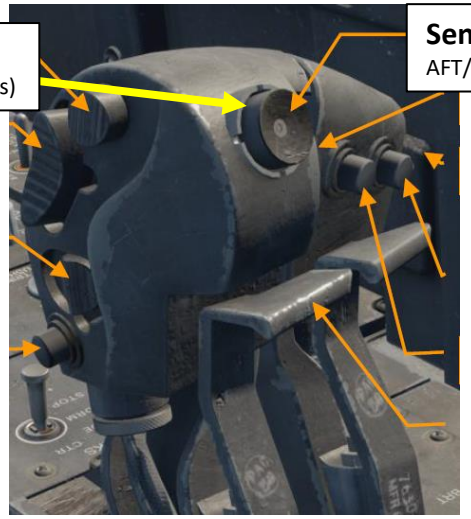
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.3 – EXP3 (SAR Map)

HOW TO SELECT EXP3 MODE

1. Make sure air-to-ground mapping (MAP) mode or EXP1/2 mode is selected (see previous sections).
2. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
3. Press on the OSB (Option Select Button) next to EXP3.
4. **Press and hold** TDC DEPRESS control (« ENTER »).
5. While TDC DEPRESS is held, slew the trapezoidal corral over the desired region you want to set as a **Synthetic-Aperture Radar (SAR)** map (zoom) using the TDC controls.
6. Release the TDC DEPRESS control to enter EXP3 mode.

4
5
6

TDC
(Left/Right/Up/Down/Depress)

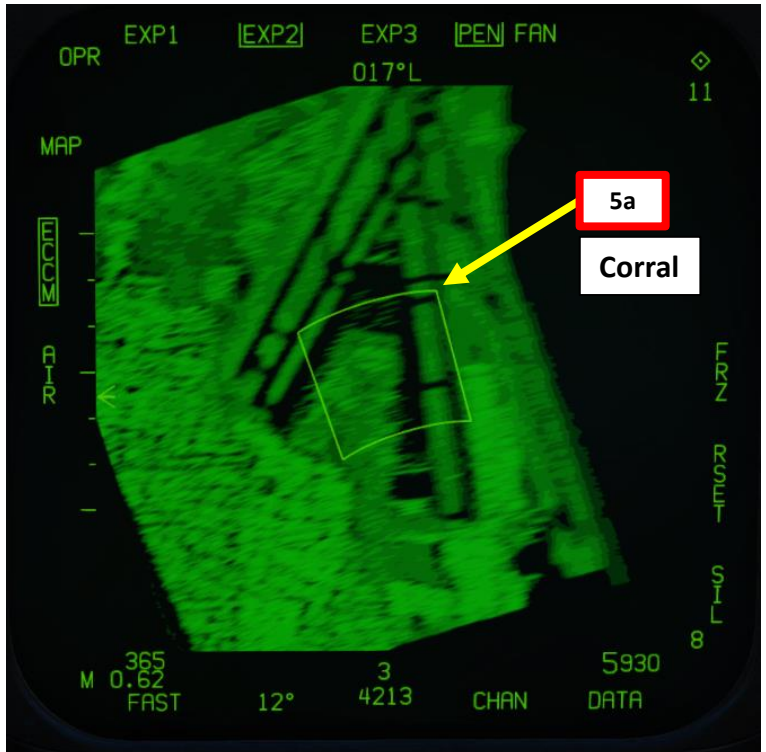


Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS

2a









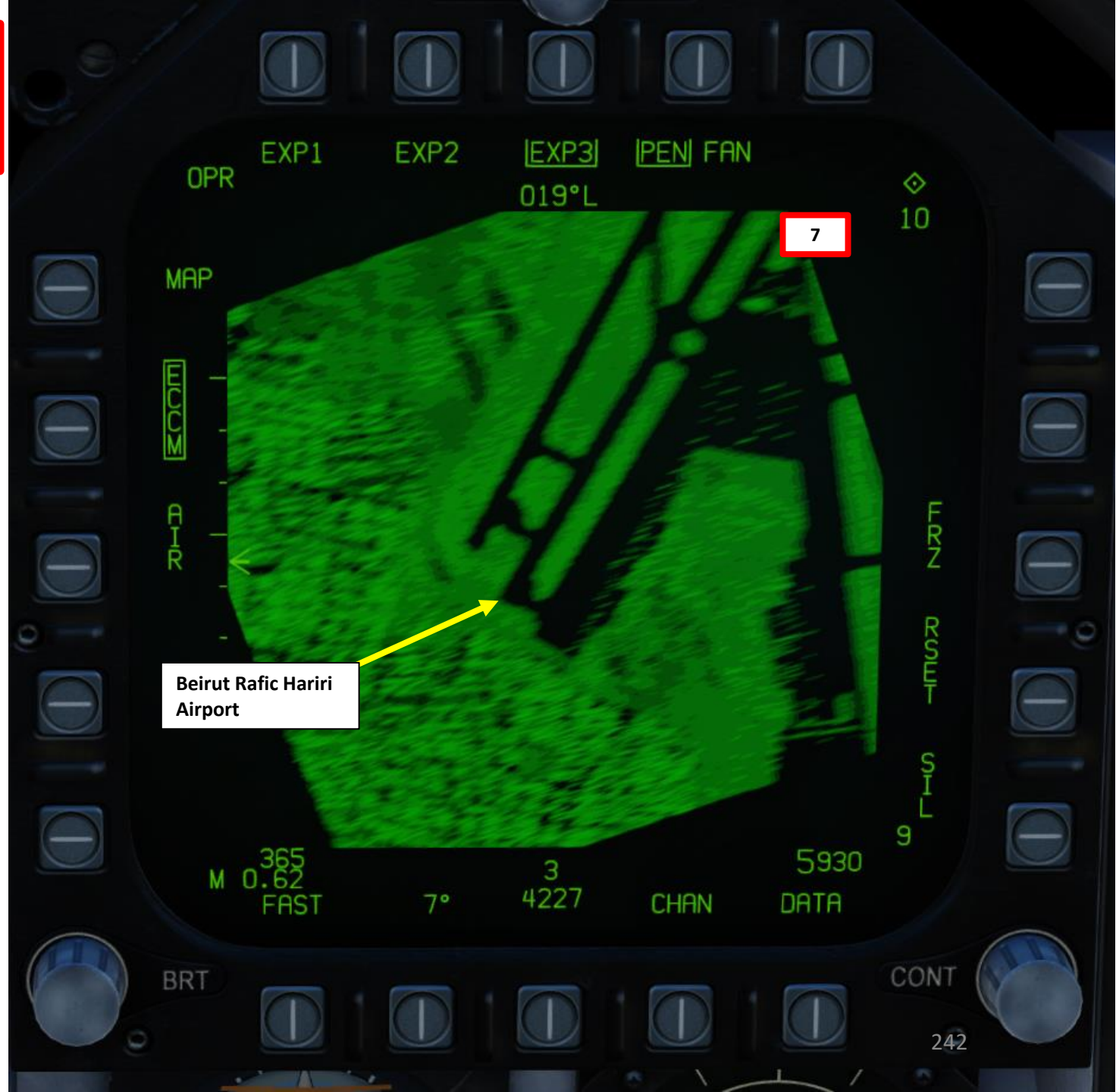
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.3 – EXP3 (SAR Map)

HOW TO SELECT EXP3 MODE

7. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded.
8. You can designate a target using the method described in section 2.2.3.4 (Designation with EXP mode).
9. Pressing the « Undesignate » button on the stick will exit EXP3 mode.

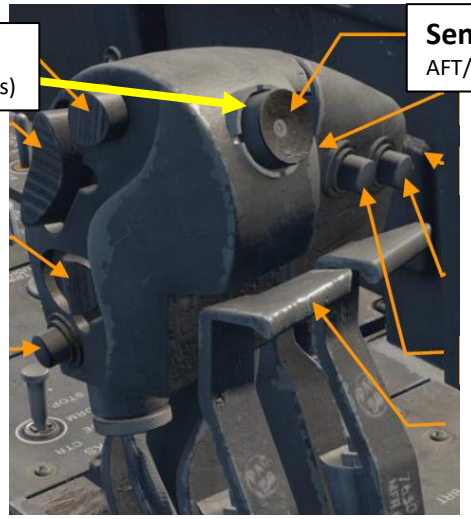


Undesignate / Nosewheel Steering Button



2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.4 – Designation with EXP Mode

3
4
5 **TDC**
(Left/Right/Up/Down/Depress)

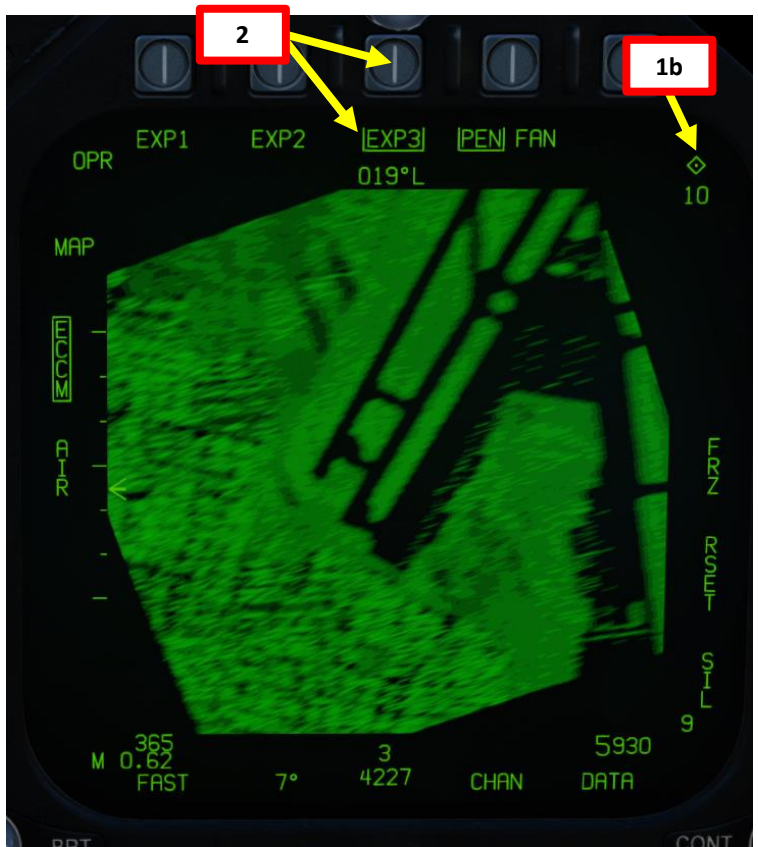


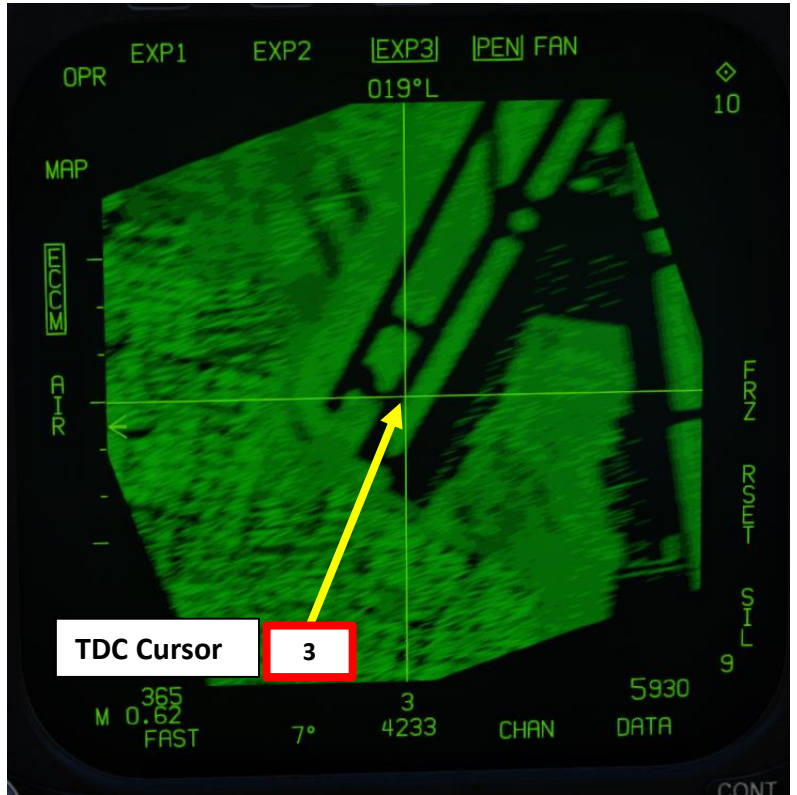
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS **1a**

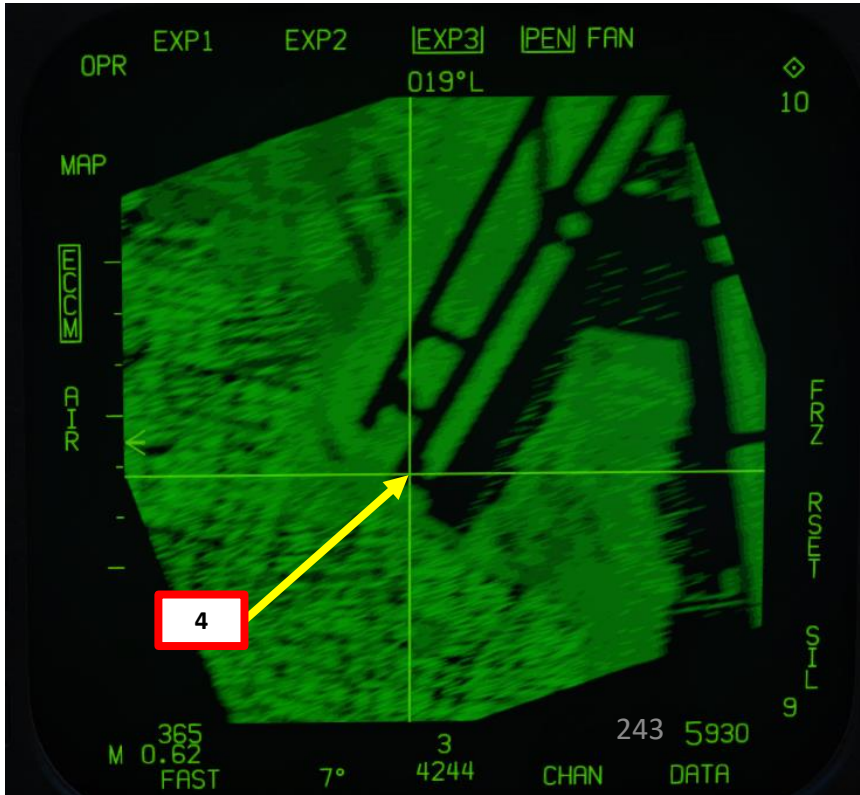


HOW TO DESIGNATE/UNDESIGNATE FROM THE A/G EXP MODE

1. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
2. Make sure one of the EXP mode is selected (see previous sections). EXP3 mode is recommended for best precision, but it can work with any other EXP mode.
3. **Press and hold** TDC DEPRESS control (« ENTER »).
4. While TDC DEPRESS is held, slew the TDC cursor on the desired spot you want to designate using the TDC controls.
5. Release the TDC DEPRESS control to designate target.







2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.3 – EXP (Expanded) Modes
2.2.3.4 – Designation with EXP Mode

HOW TO DESIGNATE/UNDESIGNATE FROM THE A/G EXP MODE

6. The air-to-ground radar will automatically adjust its range to give you a better view of the point you just designated.
7. On the Radar page, a cross will mark the designated point. On the HUD, a diamond will mark the designated point. This point can be used/slaved to by other sensors (like the targeting pod) if desired.
8. Pressing the « Undesignate » button on the stick will delete the designation point.

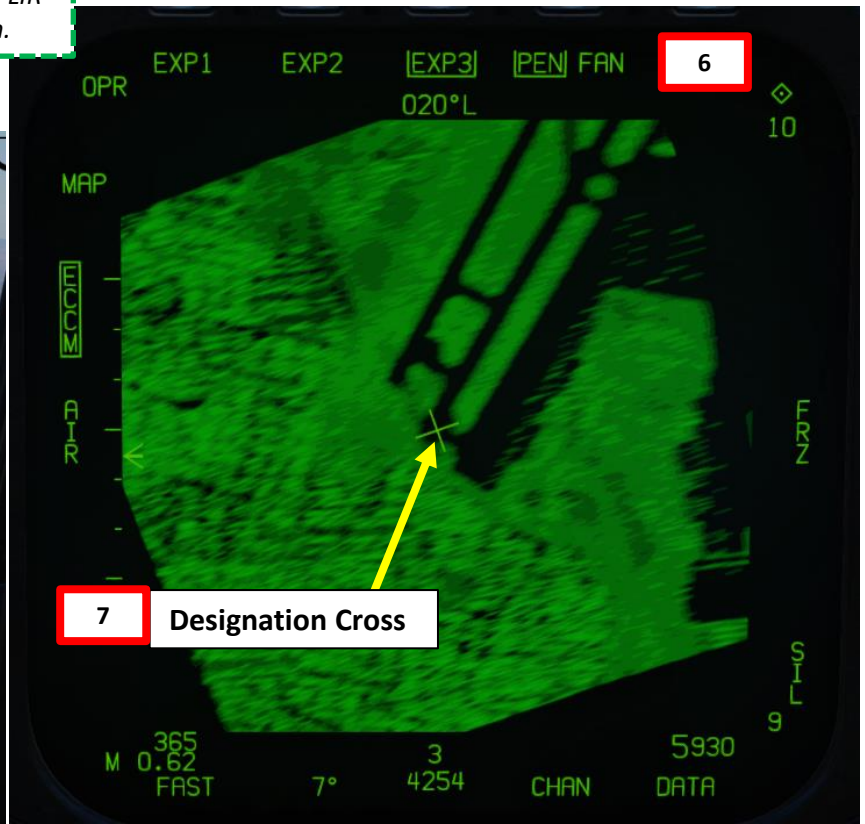
Note: *When a designated point is created with the air-to-ground radar, the targeting pod (TGP) will automatically slave to this point on the ground if the FLIR switch is ON and the TGP is unstowed prior to air-to-ground radar designation.*



8 **Undesignate / Nosewheel Steering Button**

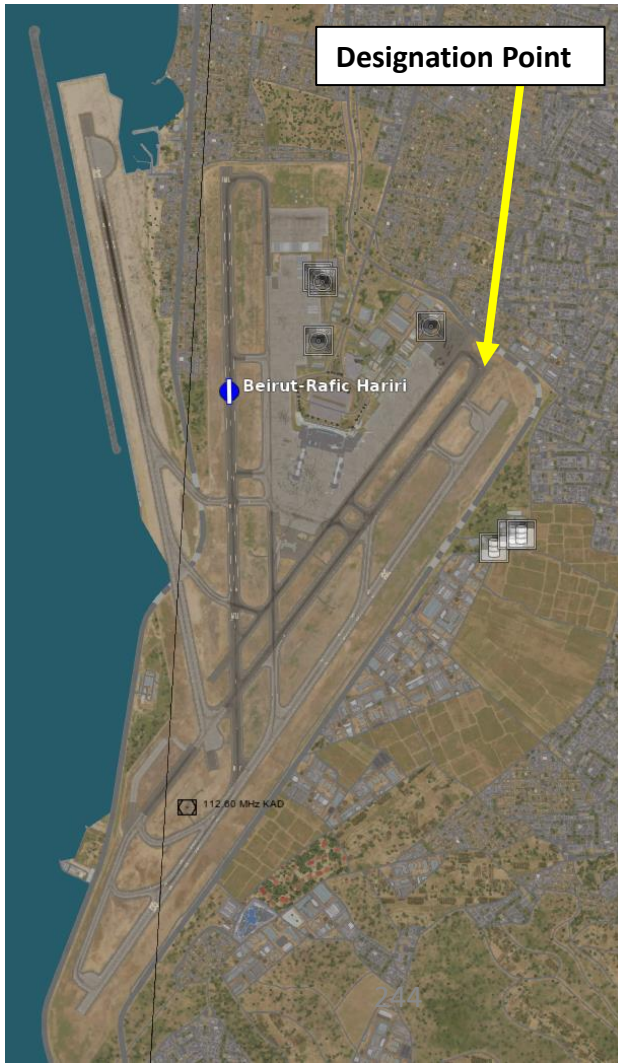


7 **HUD Designation Diamond**



6

7 **Designation Cross**



2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.4 – GMT (Ground Moving Target) Mode

DISPLAY

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

Keep in mind that the A/G Master Mode needs to be selected in order to have the air-to-ground radar overlay on the RDR ATTK TAC page. The default air-to-ground radar mode is MAP (Ground Mapping); the radar mode has to be toggled to GMT by pressing the Option Select Button next to MAP.

1

A/G (Air-to-Ground) Master Mode Selected



2



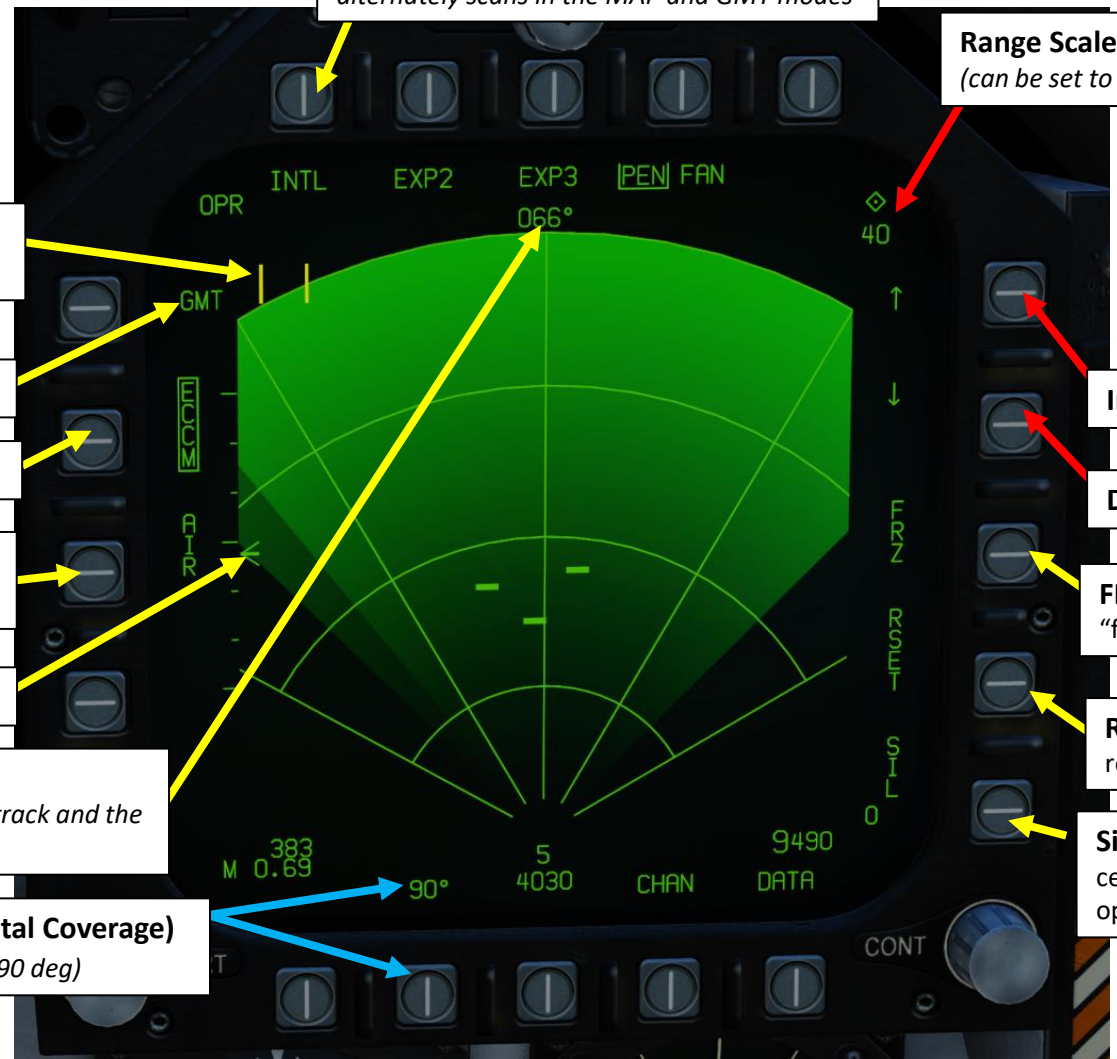
GMT (Ground Moving Target) Radar Mode Selected



2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.4 – GMT (Ground Moving Target) Mode

CONTROLS (GMT PAGE)

Radar range and azimuth can be modified using the OSBs (Option Select Button). Keep in mind that the larger the region to scan, the slower the refresh rate and scanning cycle.



Interleaved Option
When the INTL option is selected, radar alternately scans in the MAP and GMT modes

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

TDC (Throttle Designator Controller) Acquisition Cursor

Ground Moving Target Mode Selected

ECCM (Not Implemented)

AIR returns radar page to air-to-air mode

Radar Antenna Elevation

Angle-Off-Track Indication
Degrees between ownship ground track and the azimuth scan center

Radar Azimuth (Total Coverage)
(can be set to 20/45/90 deg)

Increase Range Scale

Decrease Range Scale

FREEZE: Radar image is "frozen"

RESET: Radar settings are returned to default settings.

Silent (SIL) Mode: Radar ceases operation and FRZ option is selected.

2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.4 – GMT (Ground Moving Target) Mode

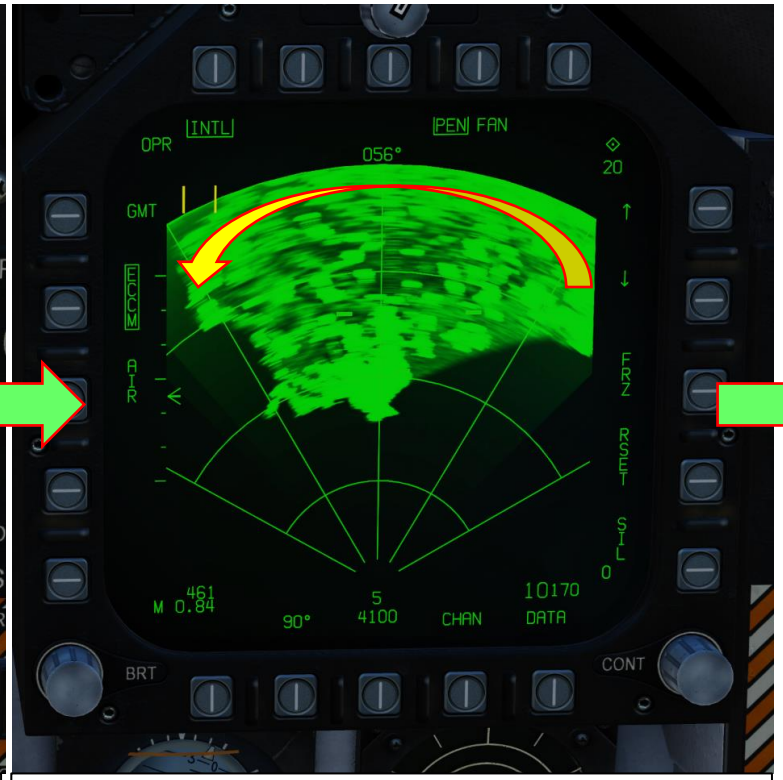
INTERLEAVED OPTION

The GMT (Ground Moving Target) and MAP (Ground Mapping) radar modes can be interleaved by pressing the INTL option select button. The mode will change to GMT/MAP, and the radar will alternate between MAP and GMT modes. Moving targets will be overlayed on the map.

Interleaved Option
When the INTL option is selected, radar alternately scans in the MAP and GMT modes



Interleaved Scanning – GMT Displayed



Interleaved Scanning – MAP Displayed



Interleaved Scanning – GMT Displayed

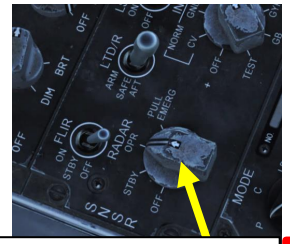
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.4 – GMT (Ground Moving Target) Mode

HOW TO TRACK A MOVING TARGET

1. Make sure the Radar Power Switch is set to OPR (Operate).
2. Pressing the A/G Master Mode button will set the right DDI (Digital Display Indicator) to the radar A-G MAP page.
3. Toggle A-G MAP mode to A-G GMT mode by pressing the OSB next to MAP.
4. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
5. Slew the TDC cursor on the desired target (brick) you want to track using the TDC controls.
6. Press the Sensor Control Switch in the direction of the DDI (right) to command acquisition of the target. When Sensor Control Switch is released, target tracking is commanded. The radar mode will change to Ground Moving Target Track (GMTT) and additional target information will be displayed.
    - Note: GMTT is effective out to about 10 nautical miles.

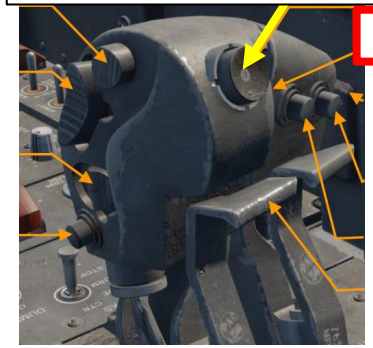
4a
6a
Sensor Control Switch
AFT/FWD/LEFT/RIGHT





Radar Power Switch 1

Throttle Designator Controller
AFT/FWD/LEFT/RIGHT/DEPRESS

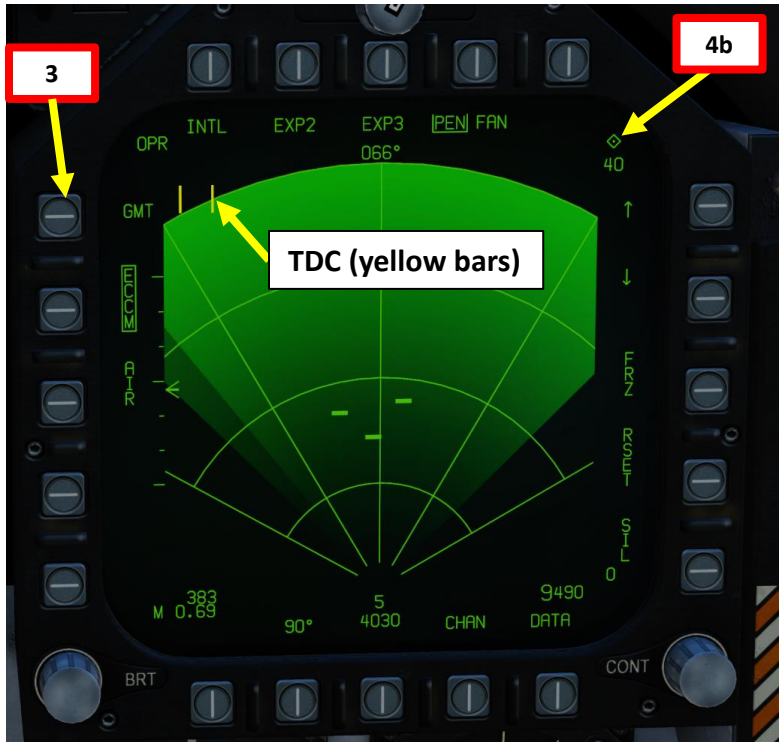


5a

A/G (Air-to-Ground) Master Mode Selected



2



3
4b
TDC (yellow bars)



GMT Mode

5b



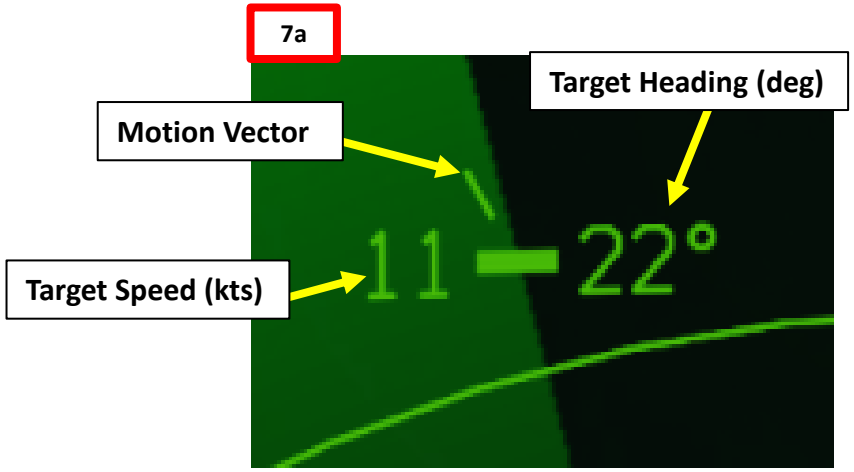
GMTT Mode

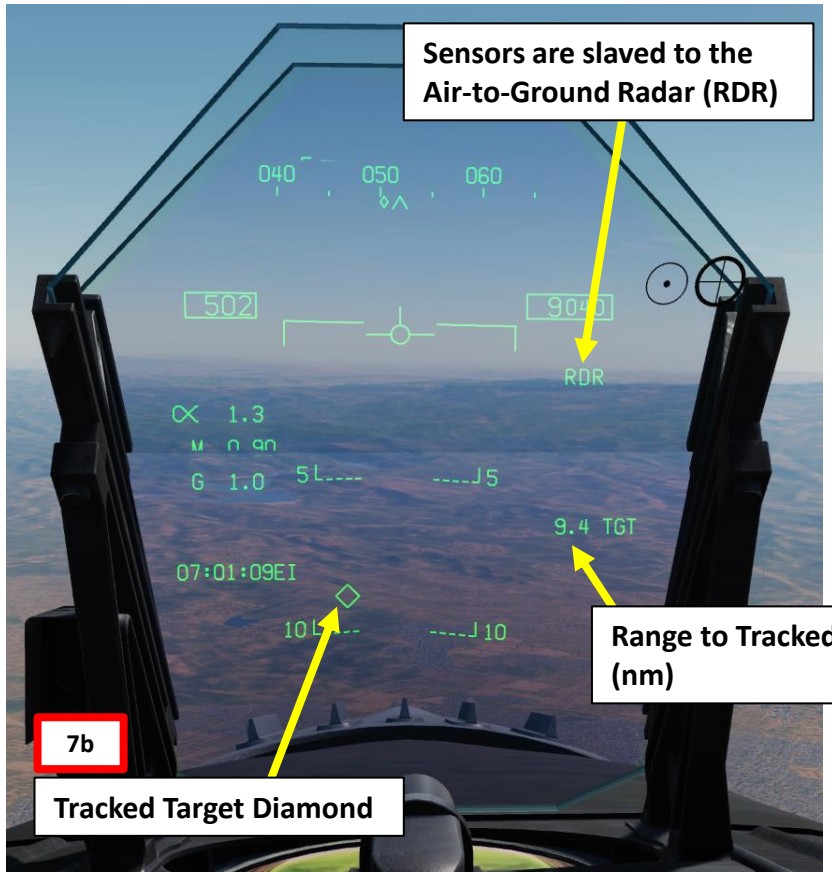
6b
Tracked Target

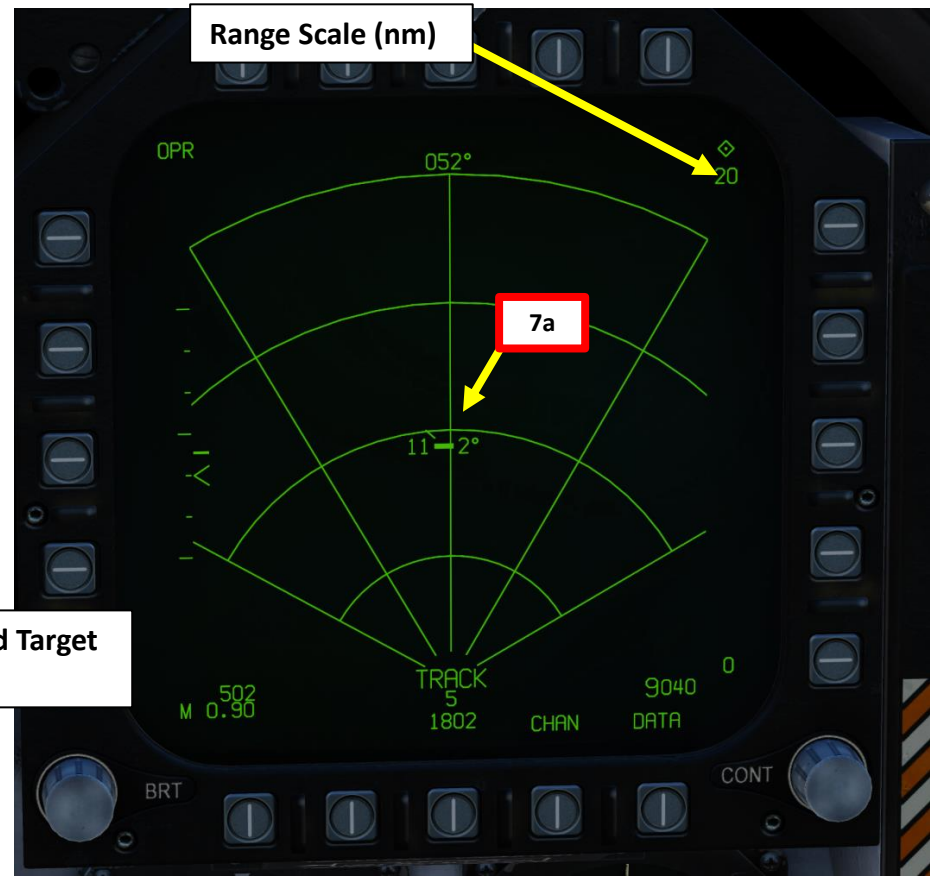
2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.4 – GMT (Ground Moving Target) Mode

HOW TO TRACK A MOVING TARGET

7. Once GMTT is engaged and target is tracked:
   a) On the Radar page, a brick with a motion vector, target speed and heading will be visible.
   b) On the HUD, a diamond will mark the tracked target.
   c) This point can be used/slaved to by other sensors (like the targeting pod) if desired.
8. Pressing the « Undesignate » button on the stick will return the radar to GMT mode and exit tracking mode.









8 Undesignate / Nosewheel Steering Button

2.2 - AN/APG-73 RADAR (AIR-TO-GROUND)
2.2.5 – TA (Terrain Avoidance) Mode



2.3 - AN/APG-73 RADAR (AIR-TO-SEA)
2.3.1 – SEA Mode

DISPLAY

The Sea radar mode scans for and highlights moving naval targets (ships), detected by their Doppler shift. Detected targets are displayed as bricks. The shaded area of the display shows antenna azimuth coverage. The SEA mode is suitable for detecting ships and small islands at low sea states. Filtering is applied, scan rate is reduced, and target integration time is lengthened to compensate for scattering caused by the sea surface.

Keep in mind that the A/G Master Mode needs to be selected in order to have the air-to-ground radar overlay on the RDR ATTK TAC page. The default air-to-ground radar mode is MAP (Ground Mapping); the radar mode has to be toggled to SEA by pressing the Option Select Button next to MAP.

1

A/G (Air-to-Ground) Master Mode Selected



2



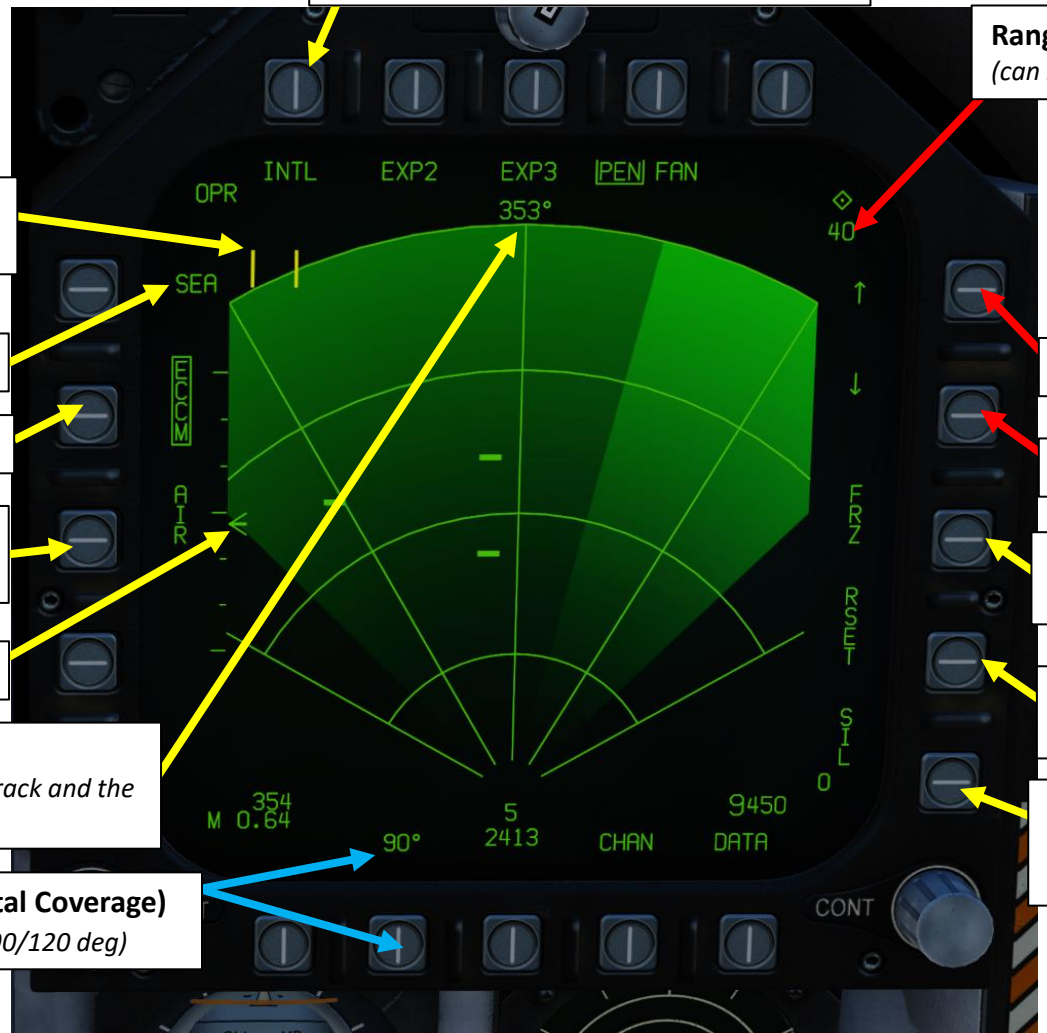
SEA Radar Mode Selected



2.3 - AN/APG-73 RADAR (AIR-TO-SEA)
2.3.1 – SEA Mode

CONTROLS (SEA PAGE)

Radar range and azimuth can be modified using the OSBs (Option Select Button). Keep in mind that the larger the region to scan, the slower the refresh rate and scanning cycle.



Interleaved Option
When the INTL option is selected, radar alternately scans in the MAP and SEA modes

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

TDC (Throttle Designator Controller) Acquisition Cursor

Sea Mode Selected

ECCM (Not Implemented)

AIR returns radar page to air-to-air mode

Radar Antenna Elevation

Angle-Off-Track Indication
Degrees between ownship ground track and the azimuth scan center

Radar Azimuth (Total Coverage)
(can be set to 20/45/90/120 deg)

Increase Range Scale

Decrease Range Scale

FREEZE: Radar image is "frozen"

RESET: Radar settings are returned to default settings.

Silent (SIL) Mode: Radar ceases operation and FRZ option is selected.

2.3 - AN/APG-73 RADAR (AIR-TO-SEA)
2.3.1 – SEA Mode

INTERLEAVED OPTION

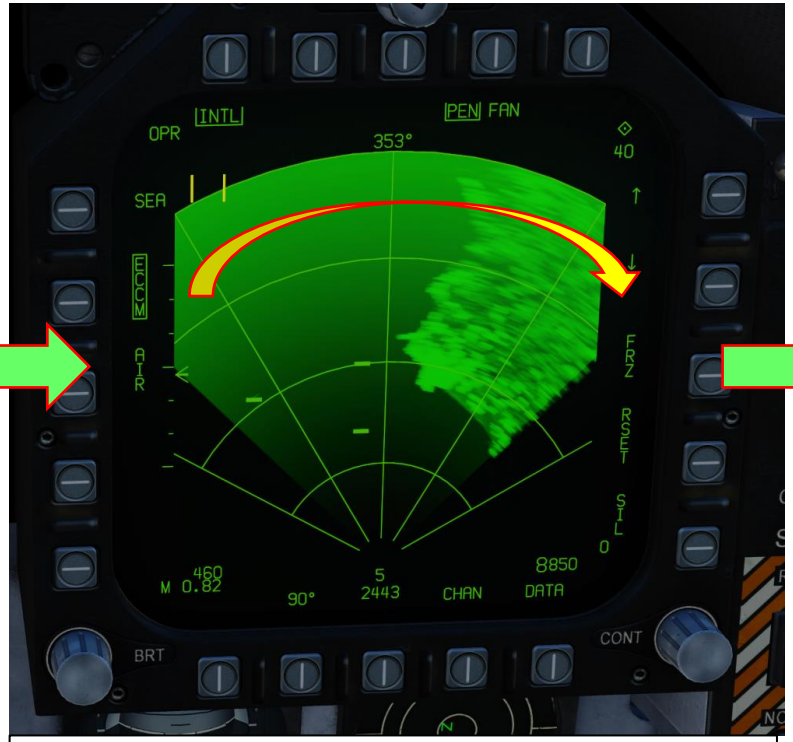
The SEA and MAP (Ground Mapping) radar modes can be interleaved by pressing the INTL option select button. The mode will change to GMT/MAP, and the radar will alternate between MAP and SEA modes. Moving targets will be overlayed on the map.

In SEA/MAP Interleaved mode, the 160 nm range is available for mapping, but seaborne targets will only be presented out to 80 nautical miles.

Interleaved Option
When the INTL option is selected, radar alternately scans in the MAP and SEA modes



Interleaved Scanning – SEA Displayed



Interleaved Scanning – MAP Displayed



Interleaved Scanning – SEA Displayed

2.3 - AN/APG-73 RADAR (AIR-TO-SEA)
2.3.1 – SEA Mode

HOW TO TRACK A MOVING TARGET

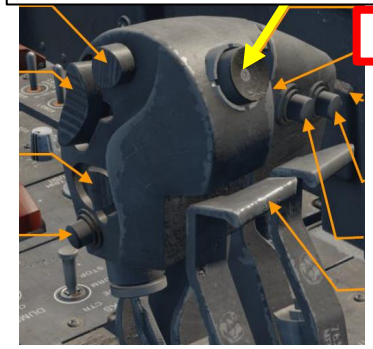
1. Make sure the Radar Power Switch is set to OPR (Operate).
2. Pressing the A/G Master Mode button will set the right DDI (Digital Display Indicator) to the radar A-G MAP page.
3. Toggle A-G MAP mode to A-G SEA mode by pressing the OSB next to MAP.
4. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
5. Slew the TDC cursor on the desired target (brick) you want to track using the TDC controls.
6. Press the Sensor Control Switch in the direction of the DDI (right) to command acquisition of the target. When Sensor Control Switch is released, target tracking is commanded. The radar mode will change to Tracking mode and additional target information will be displayed.

4a
6a

Sensor Control Switch
AFT/FWD/LEFT/RIGHT



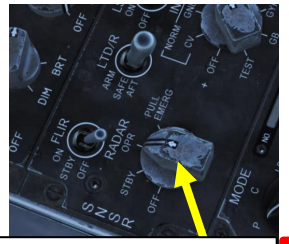
Throttle Designator Controller
AFT/FWD/LEFT/RIGHT/DEPRESS



A/G (Air-to-Ground) Master Mode Selected



2



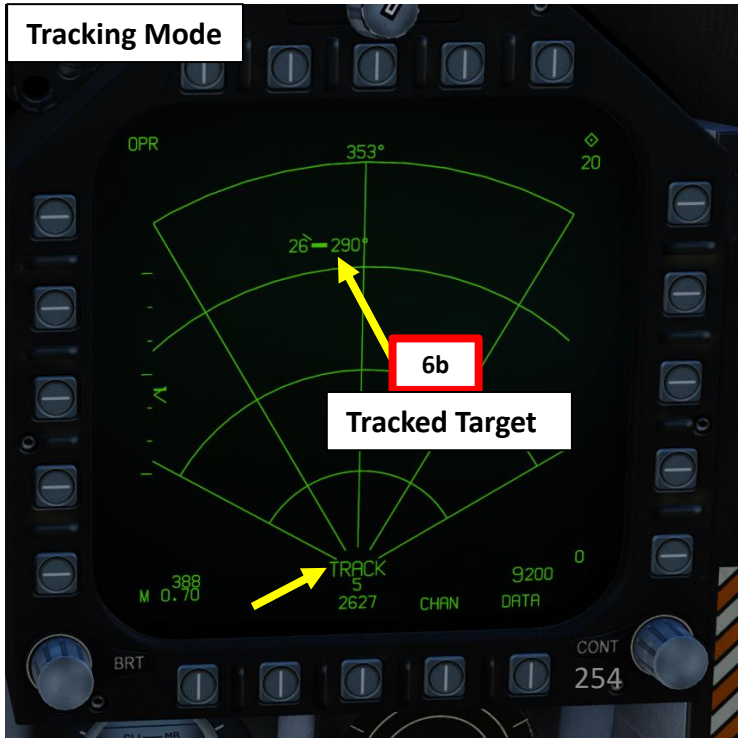
Radar Power Switch 1



SEA Mode



Tracking Mode

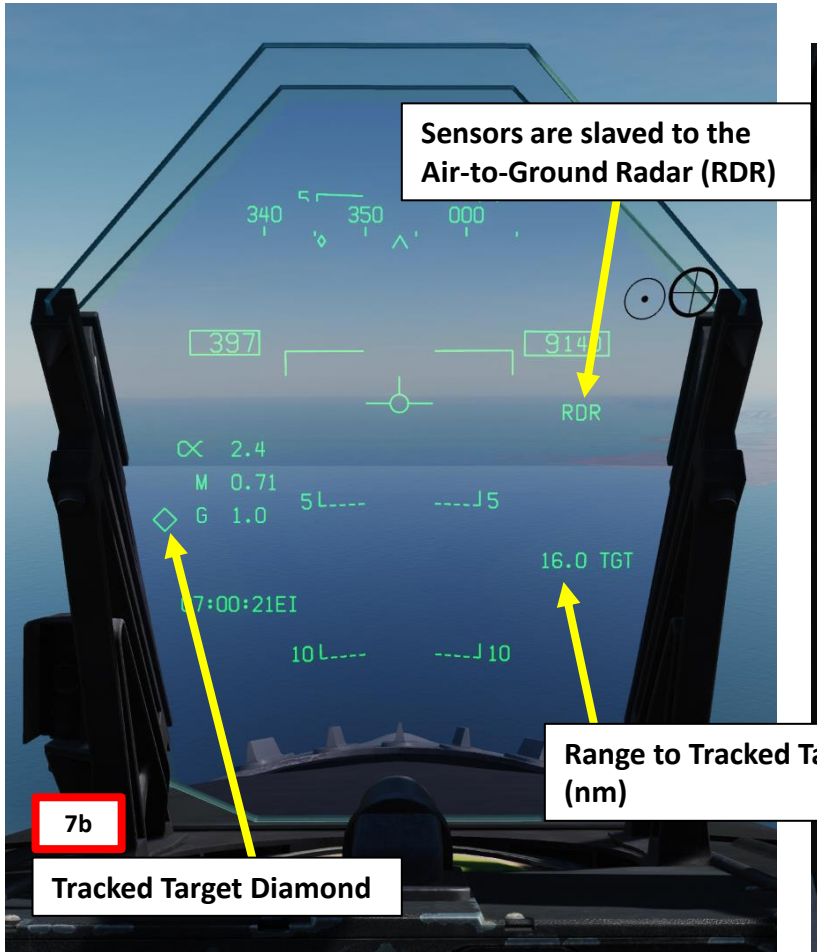


2.3 - AN/APG-73 RADAR (AIR-TO-SEA)
2.3.1 – SEA Mode

HOW TO TRACK A MOVING TARGET

7. Once target is tracked:
   a) On the Radar page, a brick with a motion vector, target speed and heading will be visible.
   b) On the HUD, a diamond will mark the tracked target.
   c) This point can be used/slaved to by other sensors (like the targeting pod) if desired.
8. Pressing the « Undesignate » button on the stick will return the radar to SEA mode and exit tracking mode.









8 Undesignate / Nosewheel Steering Button

2.4 - RADAR LINGO AND TERMINOLOGY

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



3 - AN/AAQ-28(V) LITENING II TGP
3.1 – INTRODUCTION

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



3 - AN/AAQ-28(V) LITENING II TGP
3.2 – DISPLAYS

The targeting pod feed can be displayed on either DDI (Digital Display Indicator) or on the AMPCD (Advanced Multi-Purpose Color Display). To display targeting pod feed, select TAC page, then click on the OSB next « FLIR ». Take note that the FLIR page on the AMPCD is displayed in white and black, while the FLIR page on the DDIs are in shades of black and green.

From the TAC page, you can access the targeting pod feed by pressing the OSB next to “FLIR”.



Targeting Pod View Direction (degrees Left/Right off of aircraft nose)

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

TDC (Throttle Designator Controller) Focus Diamond (TDC is active on this display)

Designation Point Data
- Coordinates (North/South)
- Coordinates (East/West)
- Mean Sea Level Altitude (ft)

Laser Mode
- L ARM: Laser Armed
- M ARM: Laser Marker Armed
- LTD/R: Laser Target Designator/Ranger
- Blank: Safe/Off

Targeting Pod Reticle

Targeting Pod View Relative Direction

Range to Designated Target (nm)

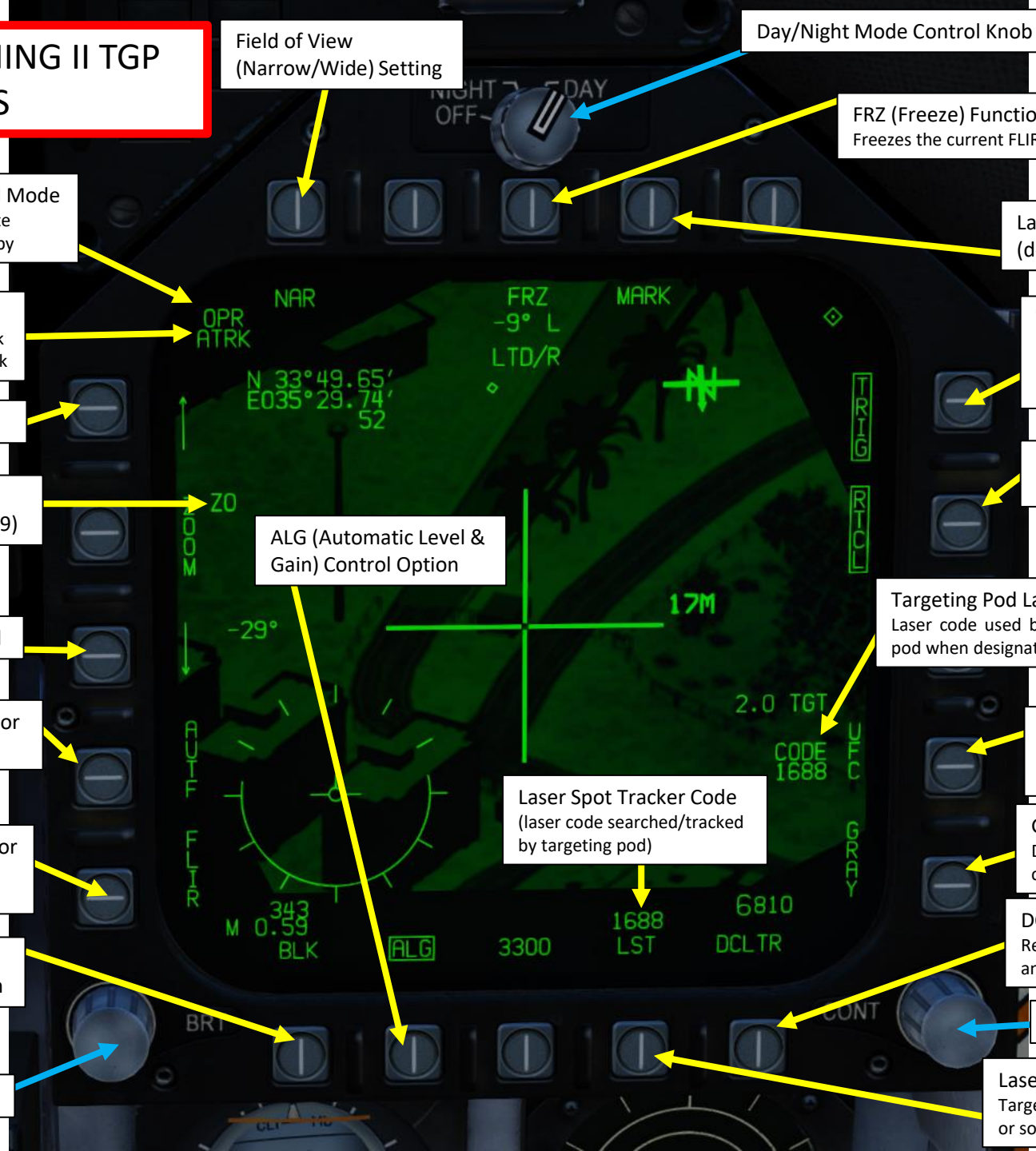
Targeting Pod View Elevation (deg)

Aircraft Airspeed (kts/Mach)

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

Aircraft Altitude (ft)

3 - AN/AAQ-28(V) LITENING II TGP
3.2 – DISPLAYS



Field of View (Narrow/Wide) Setting

Day/Night Mode Control Knob

FRZ (Freeze) Function
Freezes the current FLIR image

Targeting Pod Mode
- OPR: Operate
- STBY: Standby

Laser Marker Mode Selector
(does not guide laser weapons)

Tracking Mode
- ATRK: Area Track
- PTRK: Point Track

TRIG Option
When selected (boxed), pressing the second stage trigger will fire the laser. Also disables gun selection while enabled.

Increase Zoom Control

RTCL (Reticle) Option
Displays targeting pod reticle

Zoom Control and Setting (1 through 9)

ALG (Automatic Level & Gain) Control Option

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

Decrease Zoom Control

AUTF Mode Selector (Automatic Focus)

UFC (Up-Front Controller) Button
Allows you to change the laser code from the UFC.

Laser Spot Tracker Code
(laser code searched/tracked by targeting pod)

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

FLIR/CCD Camera Mode Selector
FLIR: Forward-Looking Infrared
CCD: Charged Coupled Device (TV)

DCLTR (Declutter) Button
Removes aircraft airspeed and altitude information.

FLIR WHT/BLK (White-Hot/Black-Hot) Option Button

Contrast Control

Brightness Control

Laser Spot Search (LSS) Mode Selector Button
Targeting pod searches for a laser code of either a JTAC or someone else's targeting pod laser (buddy lasing).

3 - AN/AAQ-28(V) LITENING II TGP
3.2 – DISPLAYS

Bank & Angle of Attack (AOA) Indicator

- Indicates current bank angle in the form of circular ticks with a half-circle indicating the current bank attitude.
- Angle of attack is indicated by the velocity vector in the center; when AOA exceeds 7° a triangle appears and increases its angle as the AOA increases

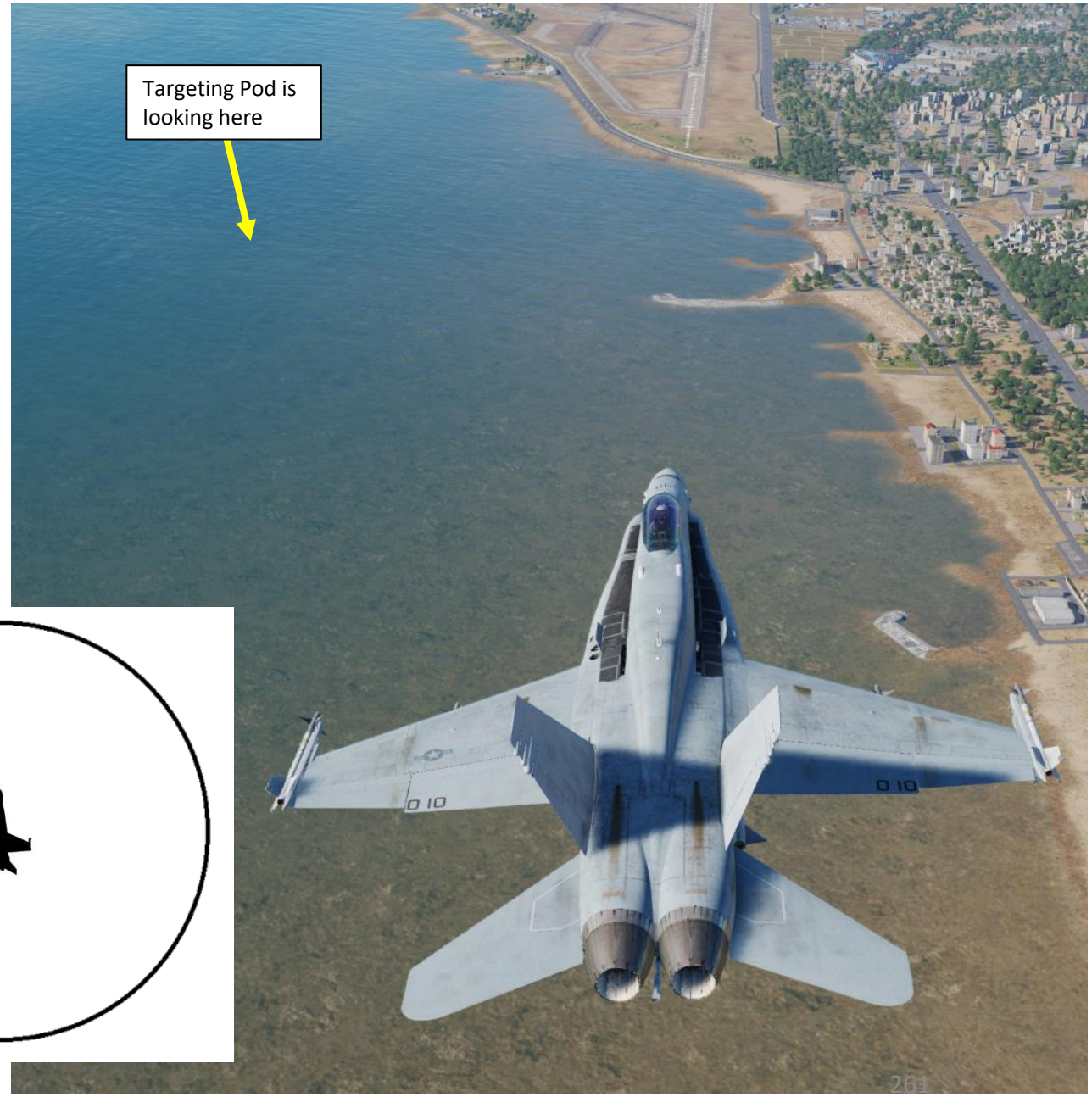




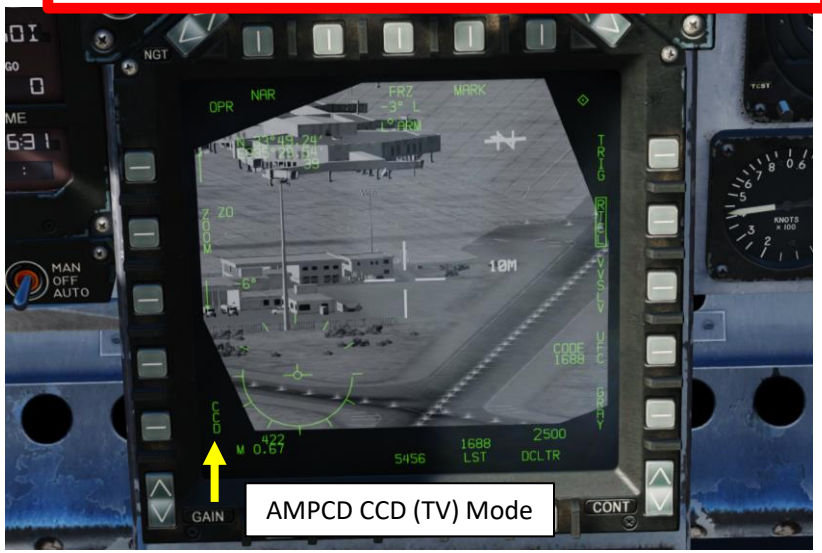
3 - AN/AAQ-28(V) LITENING II TGP
3.2 – DISPLAYS

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

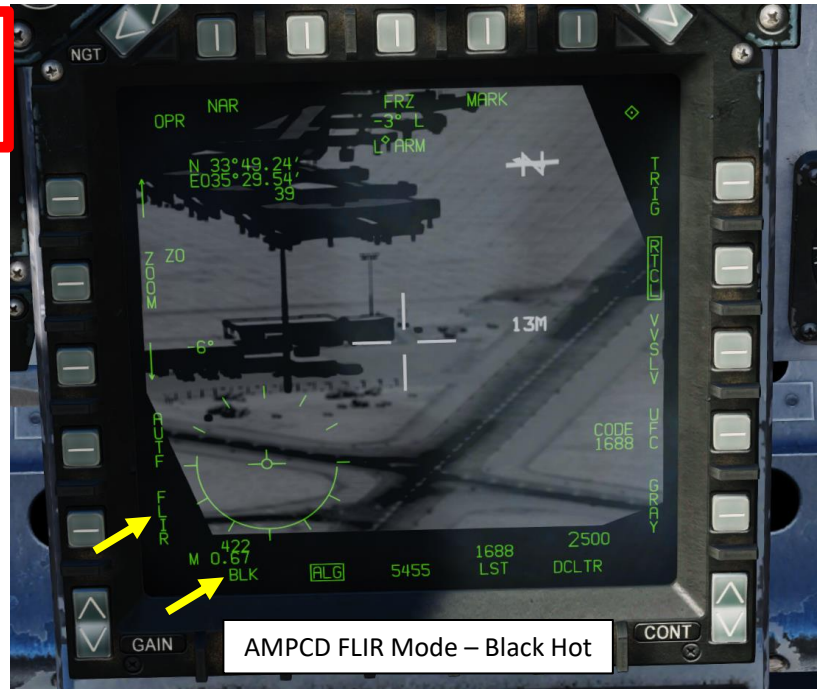




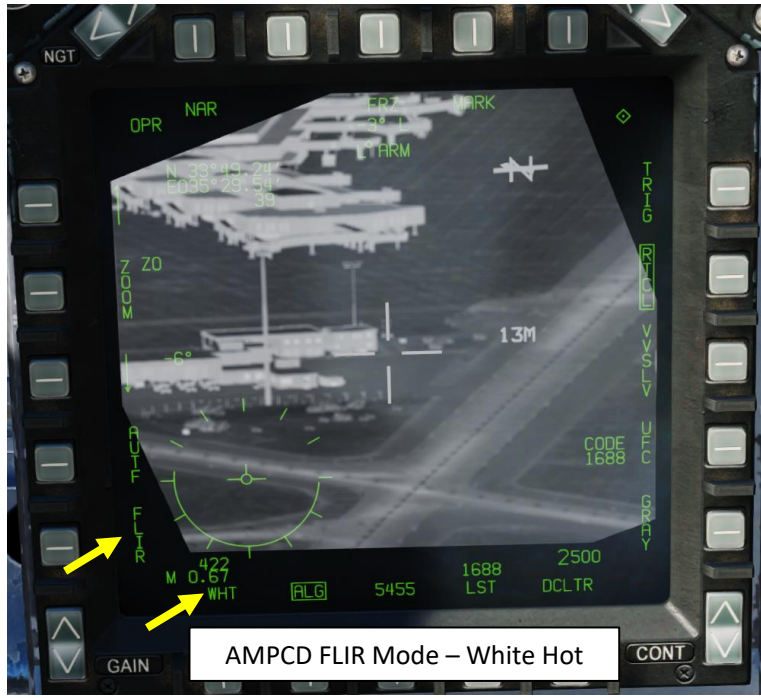
3 - AN/AAQ-28(V) LITENING II TGP
3.2 – DISPLAYS



AMPCD CCD (TV) Mode



AMPCD FLIR Mode – Black Hot



AMPCD FLIR Mode – White Hot



DDI CCD (TV) Mode



DDI FLIR Mode – Black Hot

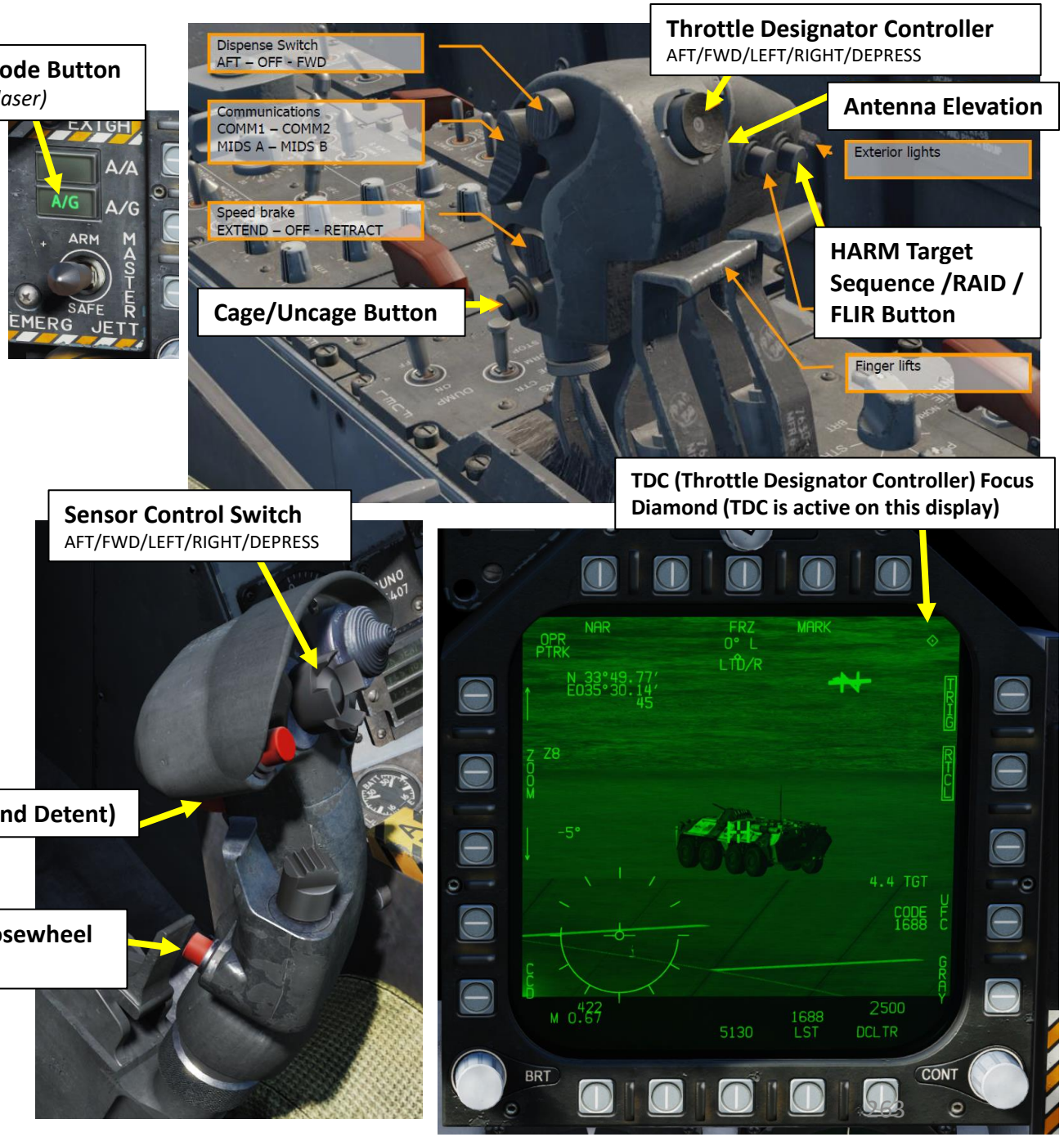


DDI FLIR Mode – White Hot

3 - AN/AAQ-28(V) LITENING II TGP
3.3 – CONTROLS

Some useful HOTAS functionalities when using the targeting pod:

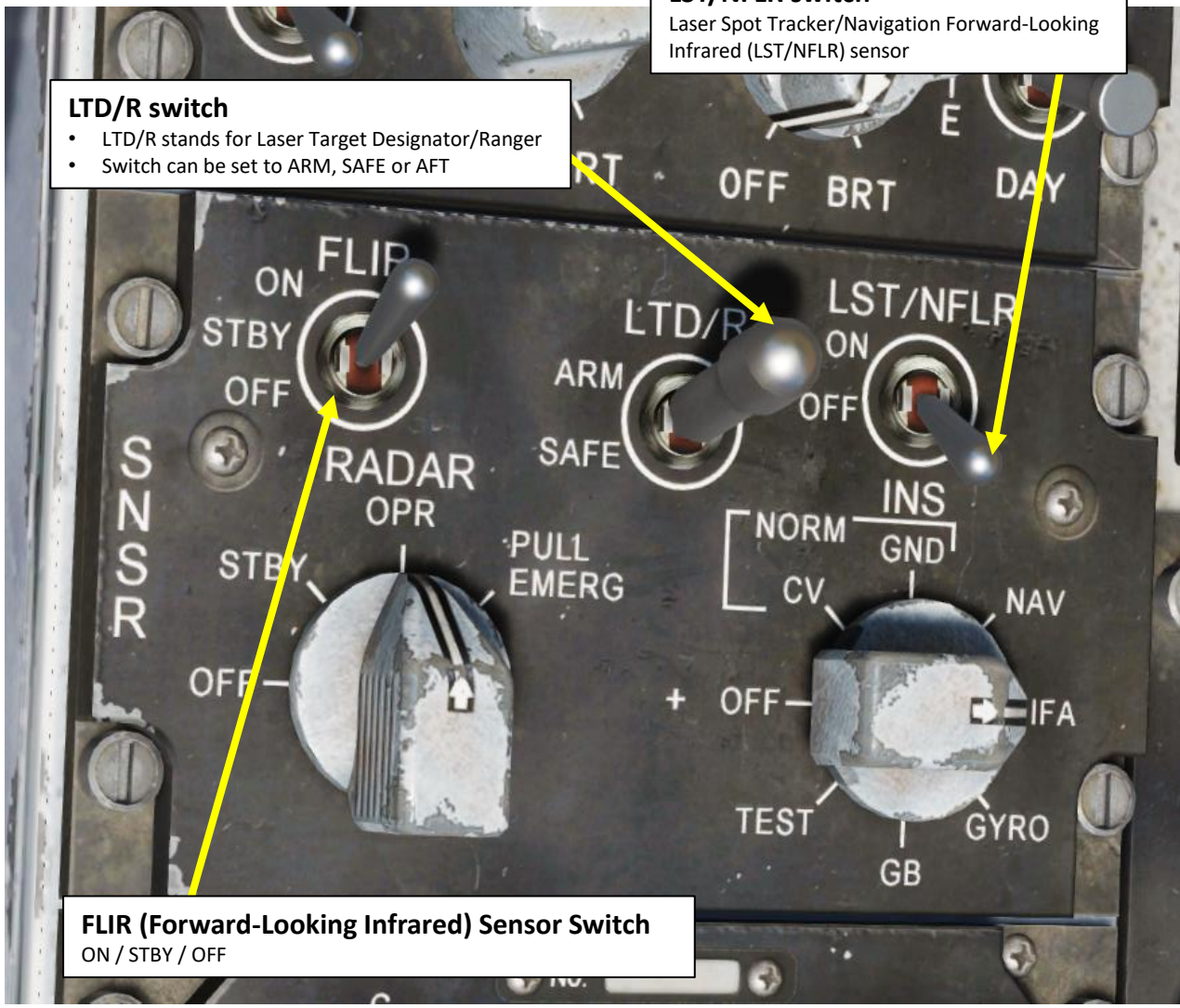
- **Sensor Control Switch Directions**: Selects which display is used to slew the targeting pod view with the TDC (Throttle Designator Controller). The Select Focus Diamond indicates what display is selected.
- **Sensor Control Switch Held Towards Selected Display**: Toggles between Point Track (PTRK, tracks an object like a high-contrast vehicle) and Area Track (ATRK).
- **Radar Elevation Control:** controls zoom (can also be controlled directly from the DDI/AMPCD FLIR page)
- **RAID/FLIR Field-of-View Select Button Short Hold**: Toggles Wide/Narrow field-of-view
- **RAID/FLIR Field-of-View Select Button Long Hold**: Toggles TV (CCD, Charged-coupled Device) and FLIR (Infrared) modes
- **Throttle Designator Controller (TDC) Up/Down/Left/Right**: Slews targeting pod reticle
- **Throttle Designator Controller (TDC) Depressed**: Designates the point under the targeting pod crosshairs as the target (used by weapons)
- **Nosewheel Steering Button**: Undesignates target, can toggle between VVSLV and Snowplow pointing modes
- **Cage/Uncage Button**: Toggles LST (Laser Spot Track) operation
- **Gun Trigger (Second Stage)**: Fires laser if TRIG mode is boxed on the FLIR page.



3 - AN/AAQ-28(V) LITENING II TGP
3.3 – CONTROLS



Targeting Pod Page
OSB (Option Select Buttons) can be used to select various options or settings



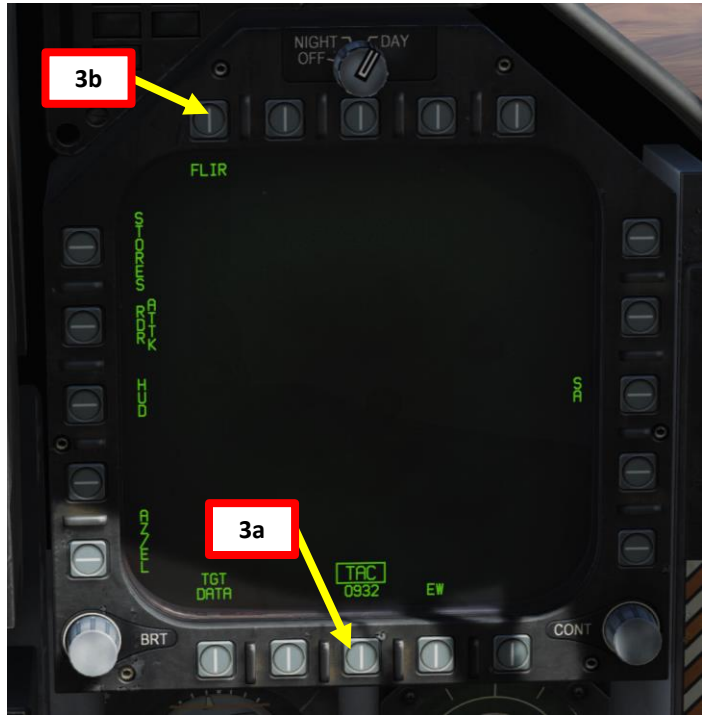
LST/NFLR switch
Laser Spot Tracker/Navigation Forward-Looking Infrared (LST/NFLR) sensor

LTD/R switch
- LTD/R stands for Laser Target Designator/Ranger
- Switch can be set to ARM, SAFE or AFT

FLIR (Forward-Looking Infrared) Sensor Switch
ON / STBY / OFF

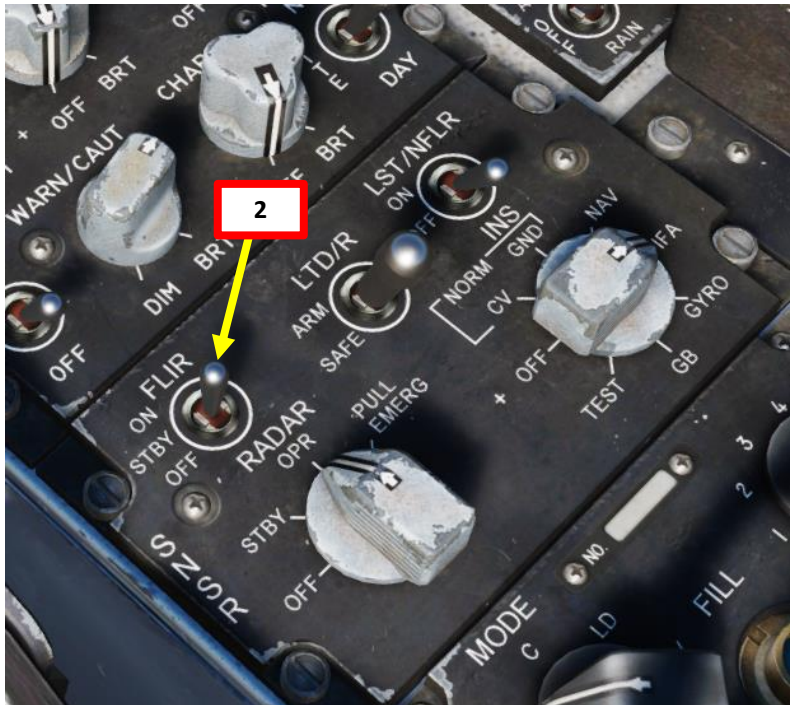
3 - AN/AAQ-28(V) LITENING II TGP
3.4 – START-UP & LASING PROCEDURE

1. Press A/G Master Mode. This will allow you to arm the laser designator.
2. To power up the targeting pod, set FLIR Sensor Switch to STBY (Right Click).
3. From the TAC page on either DDI or the AMPCD, press the OSB (Option Select Button) next to “FLIR” (Forward-Looking Infrared) to select the Targeting Pod feed page.
4. Monitor the warm-up process. Targeting pod warm-up process will take about 2 minutes.
5. When targeting pod is ready to be used, the pod status will switch from ~~RDY~~ – NOT TIMED OUT to STBY (Standby).









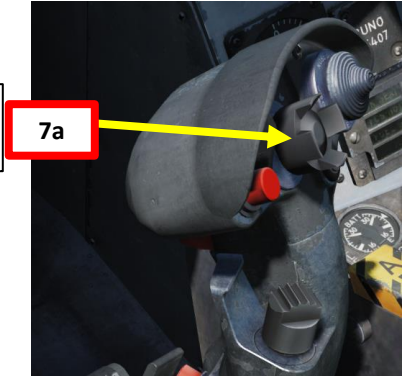


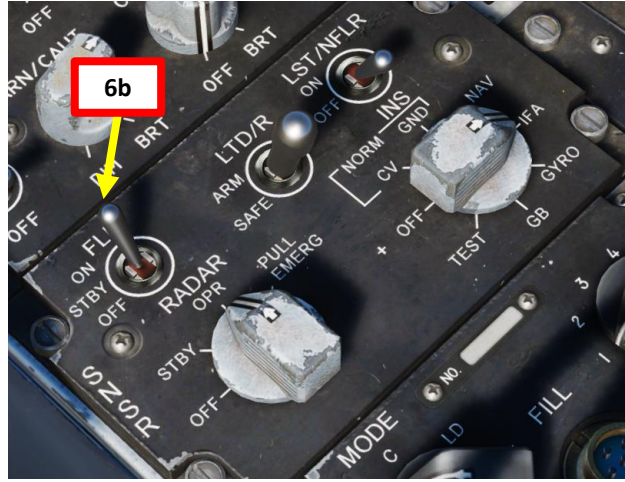
3 - AN/AAQ-28(V) LITENING II TGP
3.4 – START-UP & LASING PROCEDURE

6. Set FLIR Sensor Switch to ON (Right Click). Confirm that Targeting Pod mode switches from STBY to OPR (Operate).
7. Press the Sensor Control Switch in the direction of the selected DDI (Right for the Right DDI as an example). The Select Focus Diamond indicates what display is selected.

Sensor Control Switch
AFT/FWD/LEFT/RIGHT

7a







TDC (Throttle Designator Controller) Focus Diamond (TDC is active on this display)

7b



3 - AN/AAQ-28(V) LITENING II TGP
3.4 – START-UP & LASING PROCEDURE

8. Press the Undesignate button twice rapidly to select VVSLV (Velocity Vector Slaved) mode. This will un-stow the camera and slave the targeting pod to the velocity vector.
    - Alternatively, you can press the OSB next to VVSLV (boxed when selected).
9. Press the Undesignate button twice rapidly again to select Snowplow mode. When Snowplow mode is first entered, the FLIR is set to 0° left/right and -8° down.
    - Alternatively, you can press the OSB next to VVSLV to de-select VVSLV and use Snowplow mode (un-boxed when Snowplow is selected)
10. Adjust DDI (Digital Display Indicator) contrast and brightness as required
11. Set LTD/R (Laser Target Designator/Ranger) switch to ARM. This will arm the laser. Confirm that L ARM indication is displayed on the FLIR page.





Undesignate / Nosewheel Steering Button

8b 9a



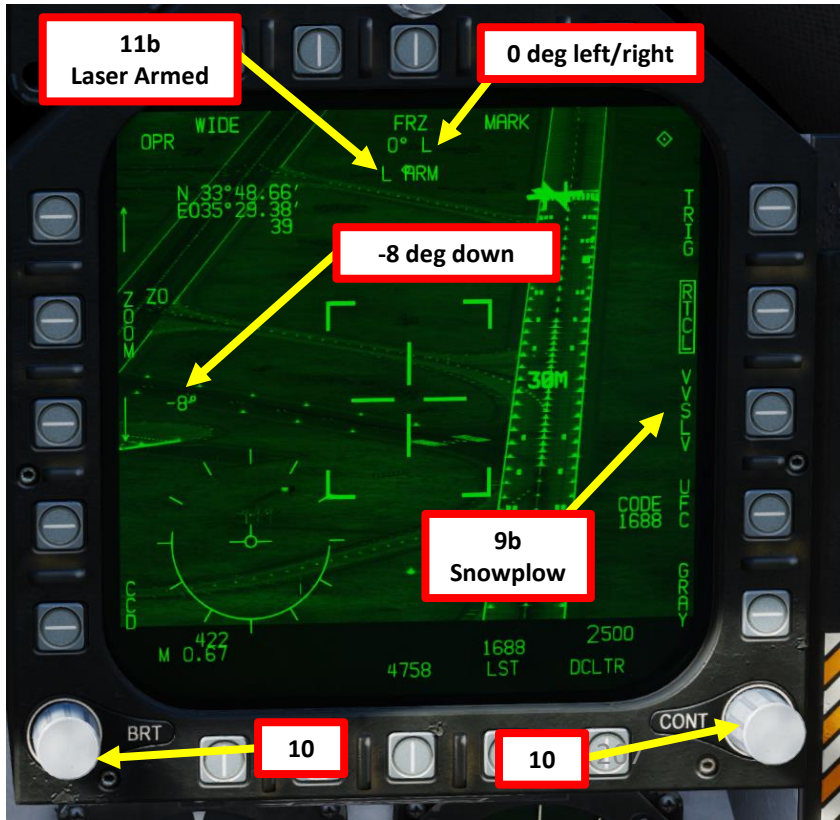
Pod Stowed



Pod Un-Stowed

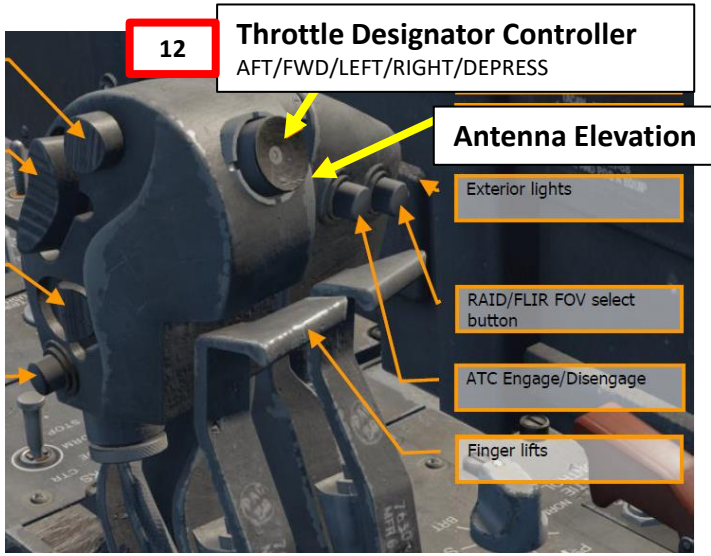




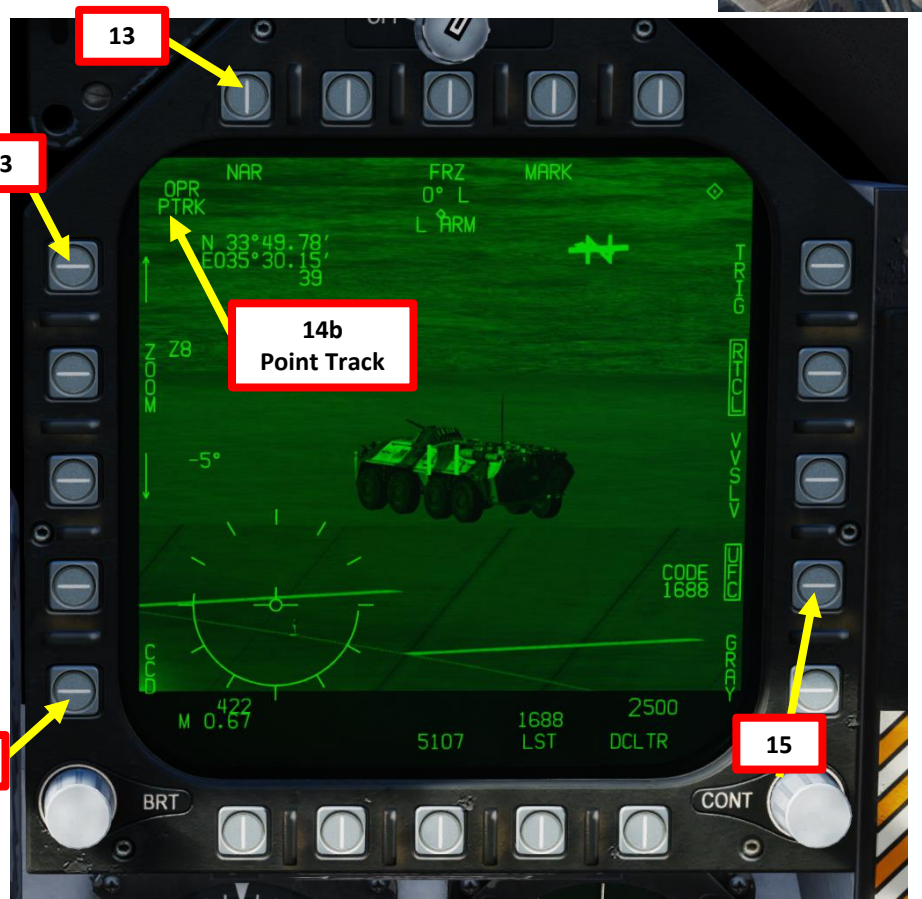


3 - AN/AAQ-28(V) LITENING II TGP
3.4 – START-UP & LASING PROCEDURE

12. Using the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls, slew the targeting pod reticle over the desired target.
13. Use appropriate zoom level, field of view (NARROW/WIDE) and camera mode (CCD/TV or FLIR) to identify the target.
14. Press the Sensor Control Switch Towards Selected Display (Right if our right DDI is selected) to toggle between Point Track (PTRK, tracks a moving object like a high-contrast vehicle) and Area Track (ATRK, used for a static target).
15. Press the OSB next to “UFC” to set the Targeting Pod laser code on the Up-Front Controller.
16. Press the button next to “LTDC” (Laser Target Designator Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose the default laser code 1688.



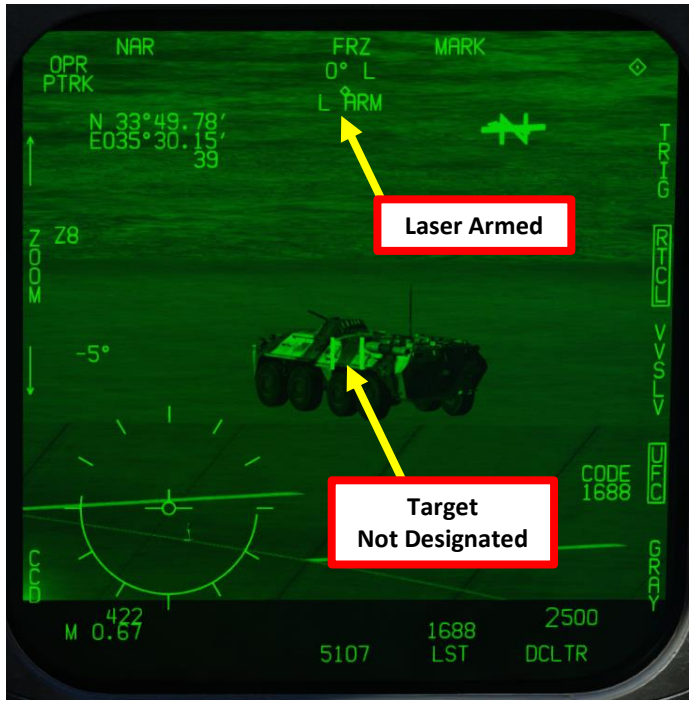


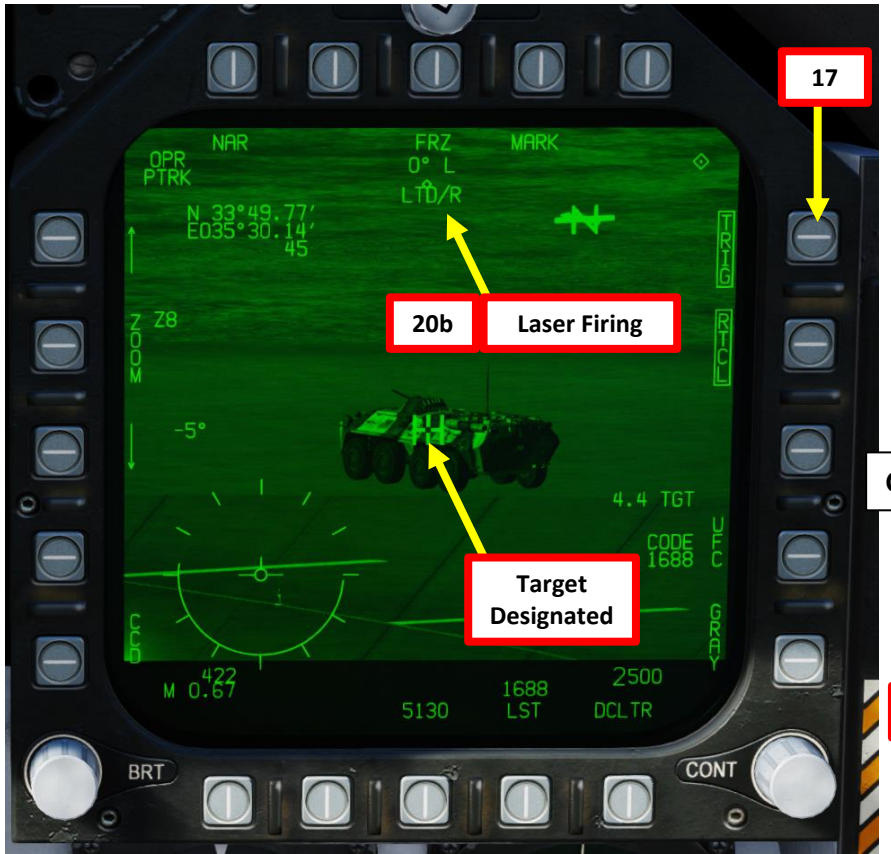


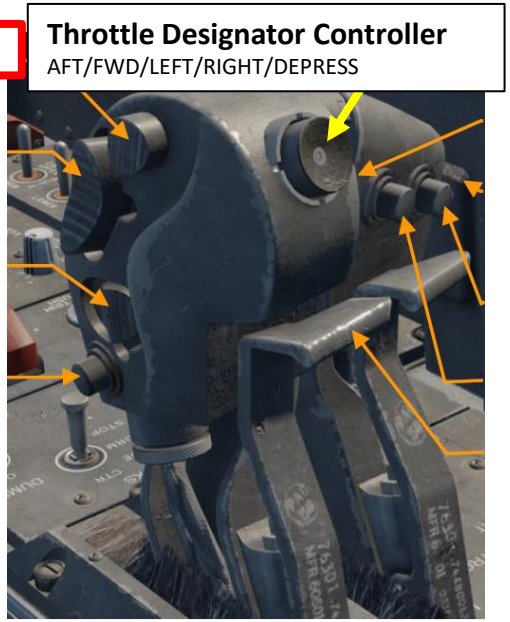


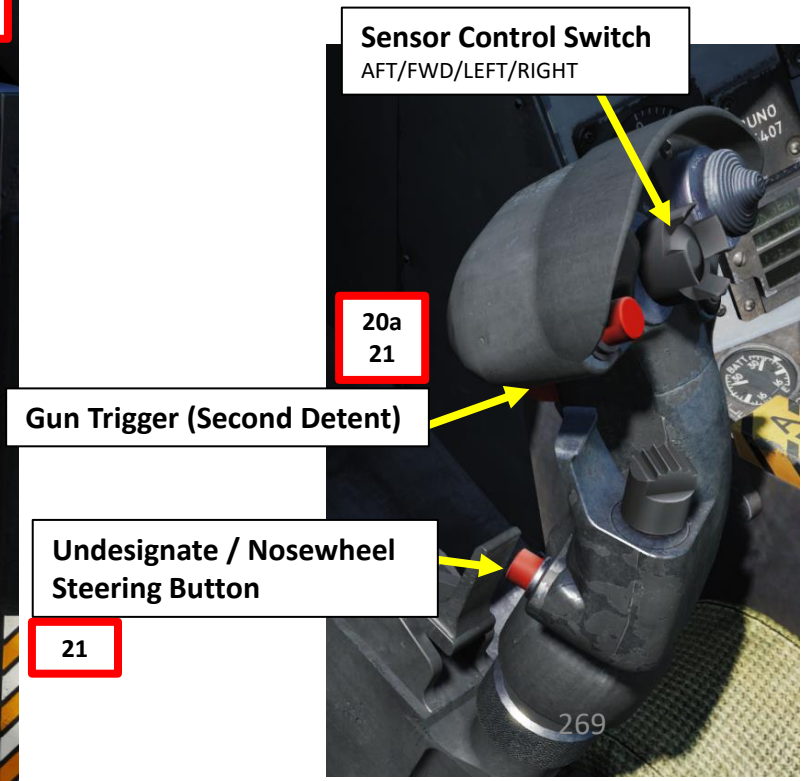
3 - AN/AAQ-28(V) LITENING II TGP
3.4 – START-UP & LASING PROCEDURE

17. Press the OSB next to “TRIG” if you want to use the laser manually. The indication will become boxed once selected, which means that a gun trigger press will fire the laser. This step is required if you are “buddy lasing” (using your own laser for someone else to use).
    - If TRIG remains unboxed, the laser is in Automatic mode. The laser will automatically fire a few seconds before the laser-guided ordnance reaches the target.
18. Use the TDC (Throttle Designator Controller) Depress button to designate the laser as the target point. This will slave selected air-to-ground weapons to where the laser is firing.
19. You may now launch laser-guided weapons as per their release procedure.
20. If TRIG option is selected (boxed), press and hold the gun trigger to fire laser. Once laser is firing, the laser mode will switch from L ARM to LTD/R. If TRIG option is not selected (unboxed, AUTO lasing), the laser will automatically fire a few seconds before the ordnance reaches the target.
21. When desired, press the Gun Trigger a second time to stop firing the laser. You can use the Undesignate/Nosewheel Steering button to undesignate the target.









3 - AN/AAQ-28(V) LITENING II TGP
3.4 – START-UP & LASING PROCEDURE





3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.1 - Overview

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

- **Velocity Vector Slaved** mode has the FLIR slaved to the line of sight to the velocity vector.
- **Snowplow** mode is the default mode when no Target designation exists.
- **Stabilized Pointing Mode** is entered when a Target is designated from Snowplow or is cycled from Auto Track or Point Track
- **Waypoint Slaving** (TGP snaps to a selected navigation waypoint) is available using the Horizontal Situation Indicator page (see relevant section).
- **Area Track** is used to keep track of a specific area. This is best used for buildings of fixed targets. Area Track can be set from any other pointing method.
- **Point Track** is used to keep track of a specific moving point. This is best used for moving targets. Point Track can be set from any other pointing method.





Slaved to Waypoint ← **Targeting Pod is Powered Up** → **VVSLV (Velocity Vector Slaved)**

1. *WYPT OSB (Option Select Button) selected on the HSI (Horizontal Situation Indicator)*
2. *Desired waypoint is selected*
3. *WPDSG (Waypoint Designate) OSB selected*

VVSLV OSB selected from FLIR page or Undesignate Button pressed twice within 1 sec

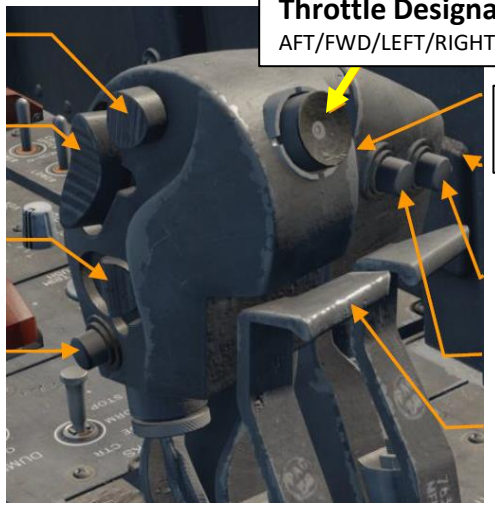
No Existing Target Designation or unselect VVSLV from FLIR page

Snowplow Mode

3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.2 - VVSLV (Velocity Vector Slaved)

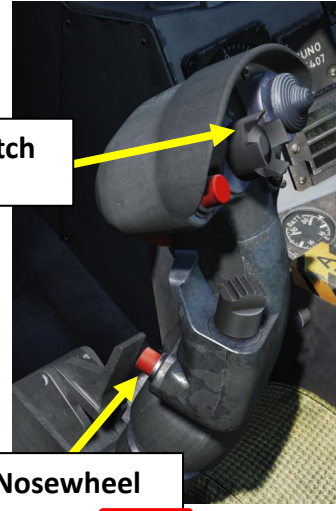
Velocity Vector Slaved mode has the FLIR slaved to the line of sight to the velocity vector.

- To select Velocity Vector Slaved mode:
  1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
  2. The Select Focus Diamond indicates what display is selected.
  3. Select VVSLV by either:
     a) Selecting the VVSLV pushbutton on the FLIR page, or;
     b) Pressing the Undesignate button twice within one second.
  4. Press OSB next to RTCL (boxed) to display the targeting pod's reticle
  5. To designate a target, fly the aircraft to set the velocity vector on the target, then use the TDC DEPRESS control ("ENTER"). A diamond will appear over the designated point on the FLIR page.



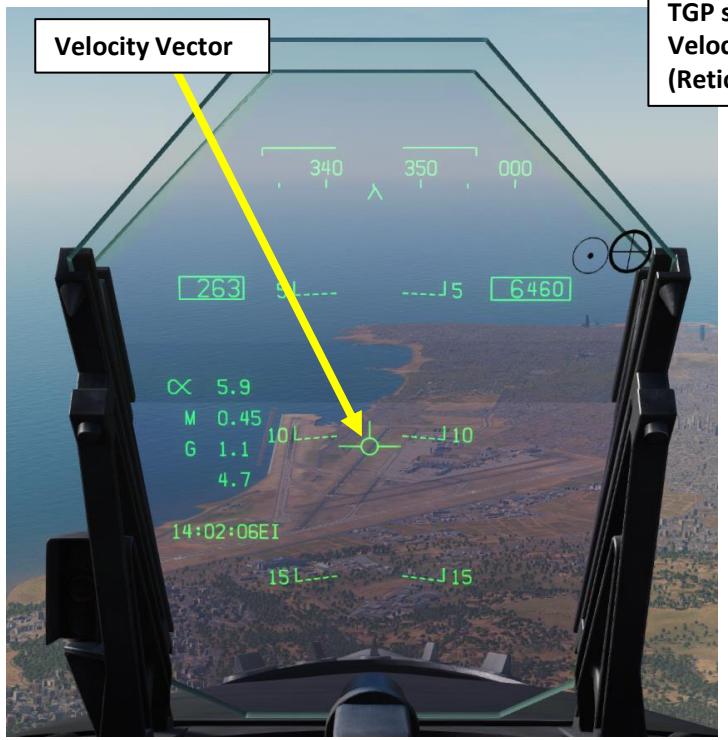
Throttle Designator Controller
AFT/FWD/LEFT/RIGHT/DEPRESS

Sensor Control Switch
AFT/FWD/LEFT/RIGHT



Undesignate / Nosewheel Steering Button

3b

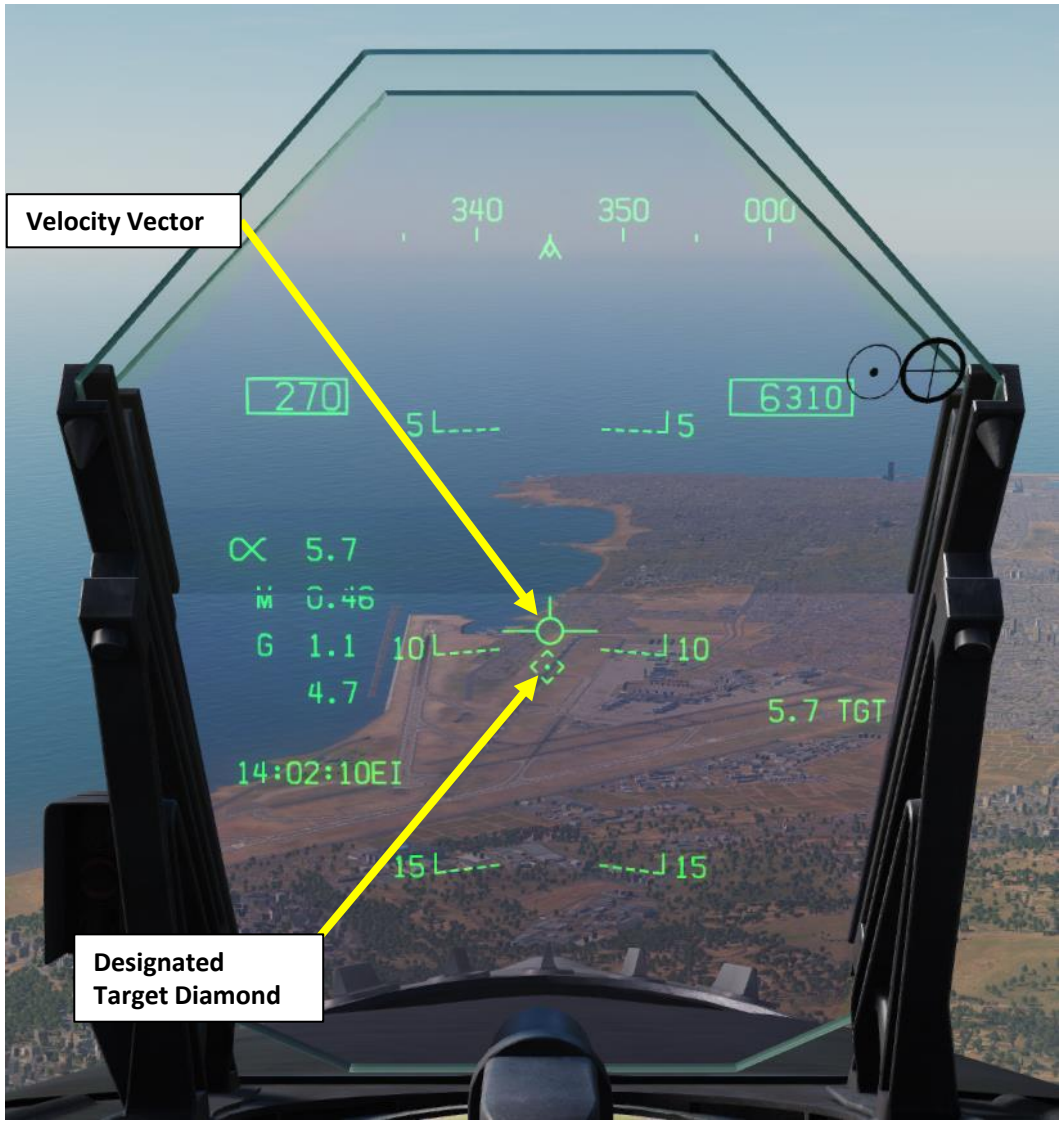






3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.2 - VVSLV (Velocity Vector Slaved)

When a target is designated, the targeting pod will track the designated point instead of the velocity vector. A designation diamond will then be visible on the Heads-Up Display.

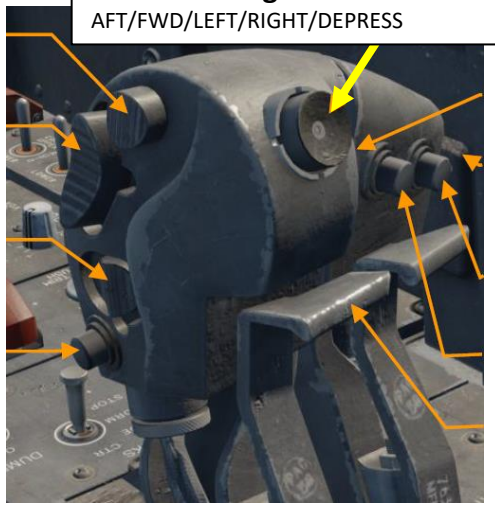




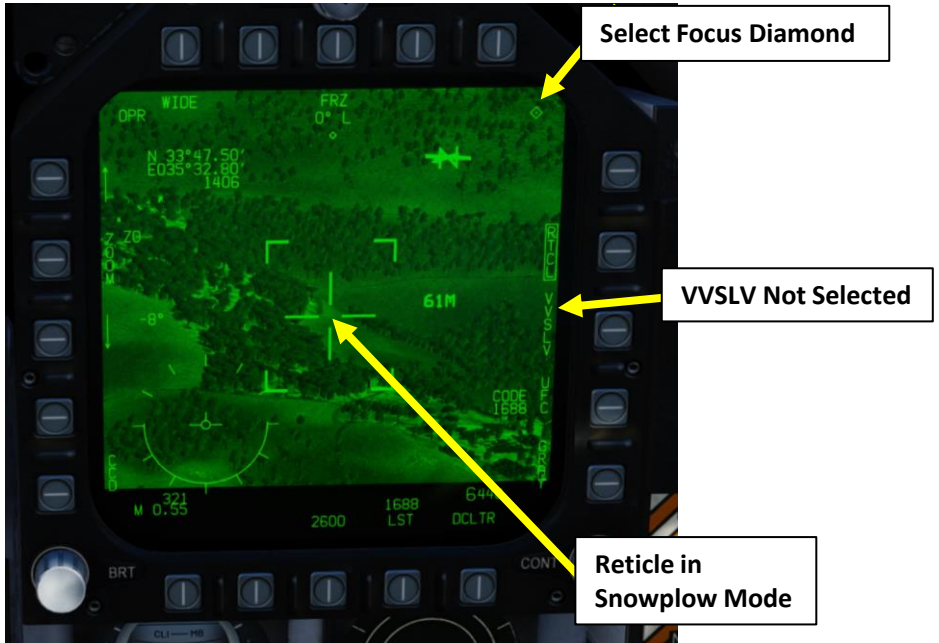
3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.3 - Snowplow

Snowplow mode is the default mode when no Target designation exists. However, when the targeting pod is first powered on, the VVSLV mode needs to be selected first, and only then can you switch to Snowplow. Snowplow mode is not stabilized to anything it is pointed at and slewing it changes the absolute position of the FLIR (Forward-Looking Infrared) relative to the pod.

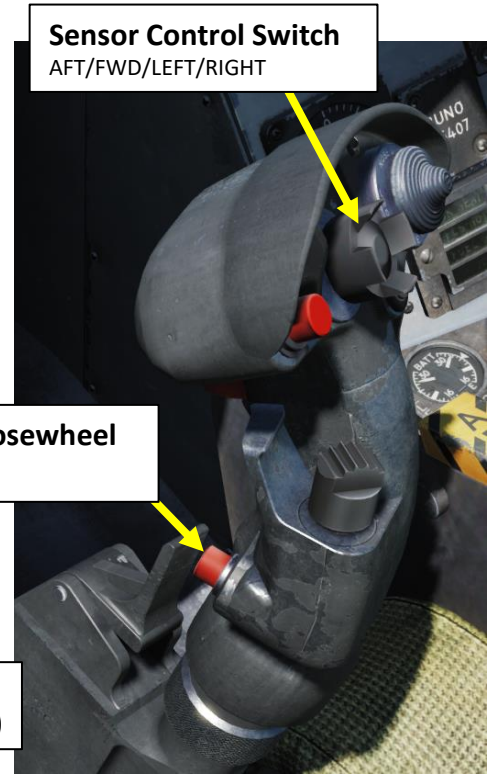
- To slew the targeting pod:
  1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
  2. The Select Focus Diamond indicates what display is selected.
  3. Press the Undesignate button twice to select VVSLV mode.
  4. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
  5. When Snowplow is first entered, the FLIR is set to 0° left/right and -8° down.
  6. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target
  7. To **designate a target from Snowplow mode**, use the TDC DEPRESS control (“ENTER”). A diamond will appear over the designated point on the FLIR page and on the Heads-Up Display as well.



Stabilized Pointing Mode is entered when a Target is designated from Snowplow (including from a source other than the FLIR itself) or is cycled from Auto Track or Point Track via the Sensor Control Switch. In this mode, the FLIR can be slewed freely and the designated target is constantly updated to its current location. When it is not being slewed, the FLIR stabilizes to whatever position on the ground it is pointed at.



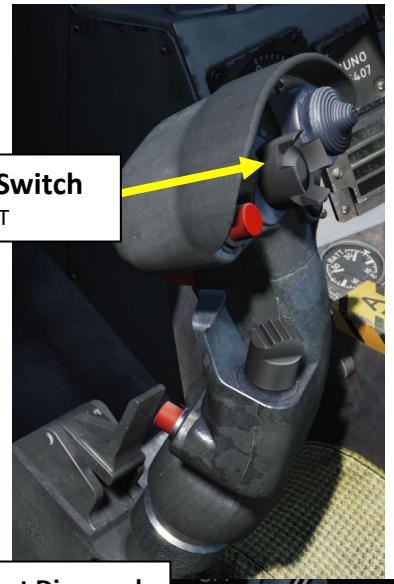




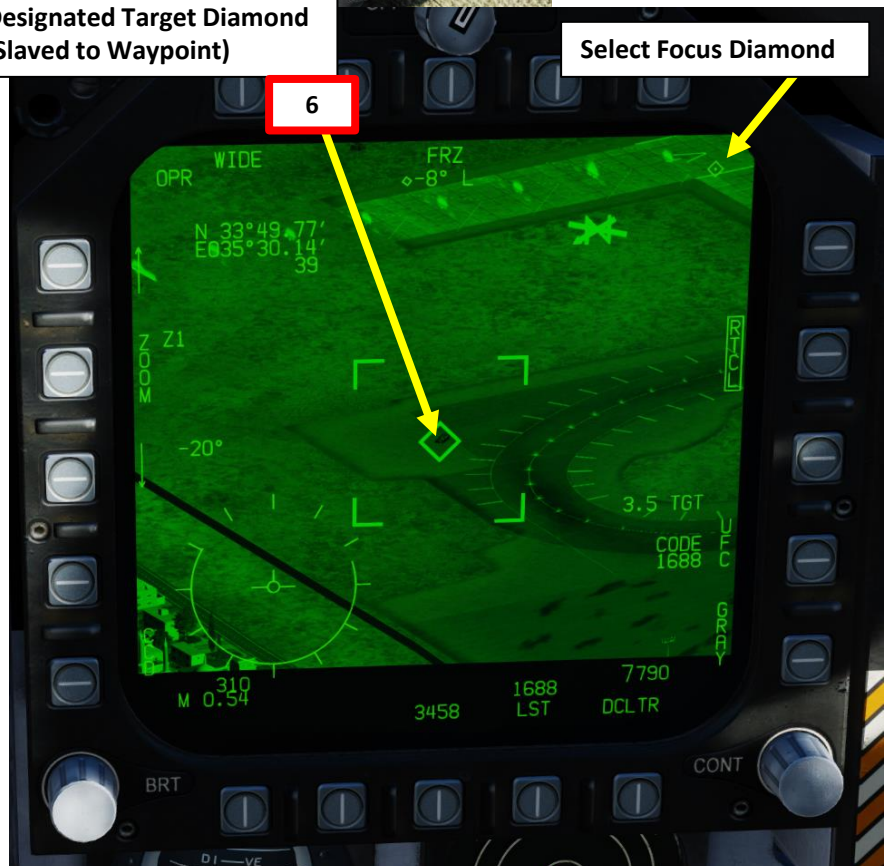
3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.4 - Waypoint Slaved

You can slave the targeting pod to an existing waypoint of your navigation database. Here's how:

1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
2. The Select Focus Diamond indicates what display is selected.
3. On HSI (Horizontal Situation Indicator) page, select desired waypoint using the OSBs (Option Select Button) next to UP or DOWN arrows.
4. Press OSB next to WYPT (boxed = selected)
5. Press on OSB next to WPSDG to designate waypoint as the target point (boxed = selected)
6. Targeting point will automatically slew to the selected waypoint.

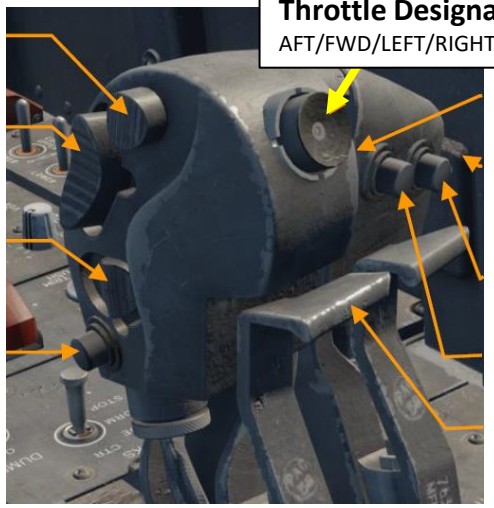






3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.4 - Waypoint Slaved

7. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target if adjustments are required.



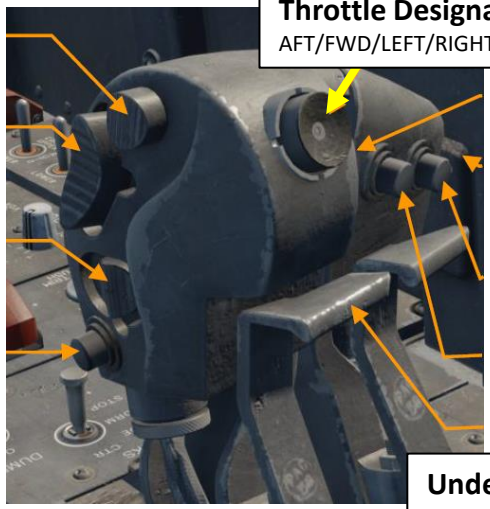


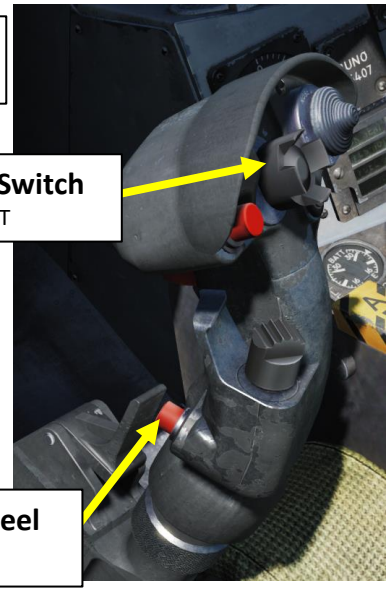


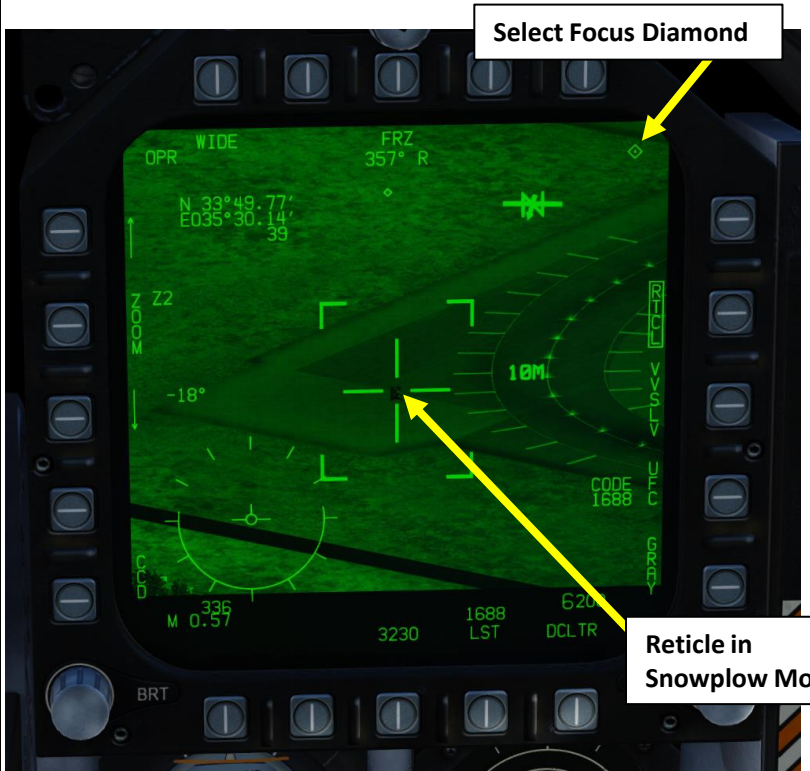
3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.5 - Point & Area Track

Area Track is entered by pressing the Sensor Control Switch in the direction of the FLIR format page. The FLIR is slaved to the location of the Target. To select Area Track:

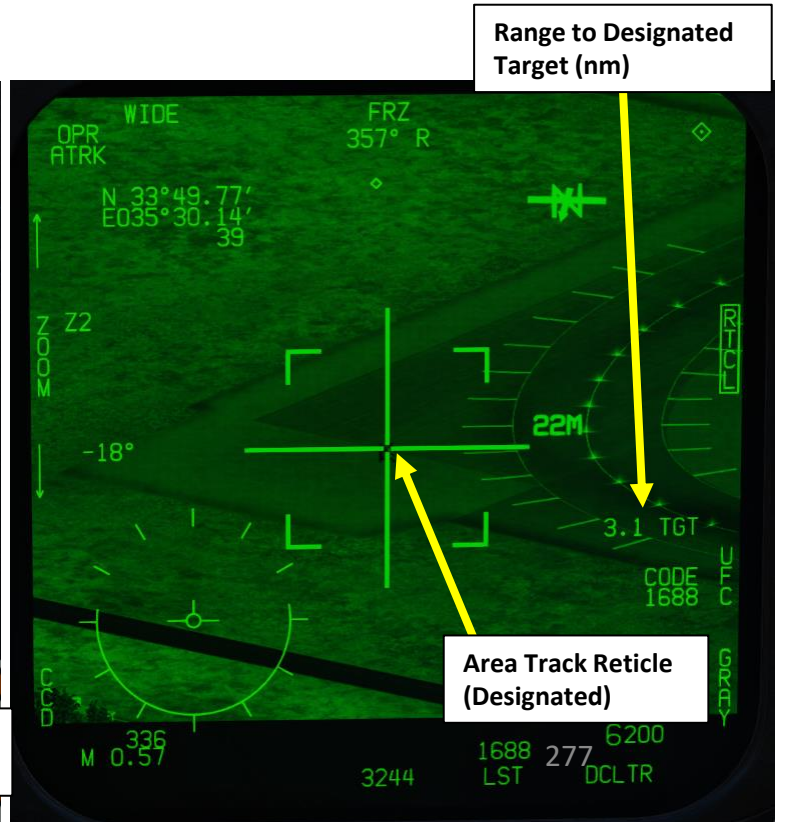
1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
2. The Select Focus Diamond indicates what display is selected.
3. Press the Undesignate button twice to select VVSLV mode.
4. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
5. Press the Sensor Control Switch in the direction of the FLIR format page to toggle between Area Track and Point Track.
6. In Area Track, the FLIR is slaved to the location of the Target and cannot be slewed.
7. Use the TDC DEPRESS control ("ENTER") to designate the target.
8. Pressing the Undesignate button once will revert back to Snowplow mode.







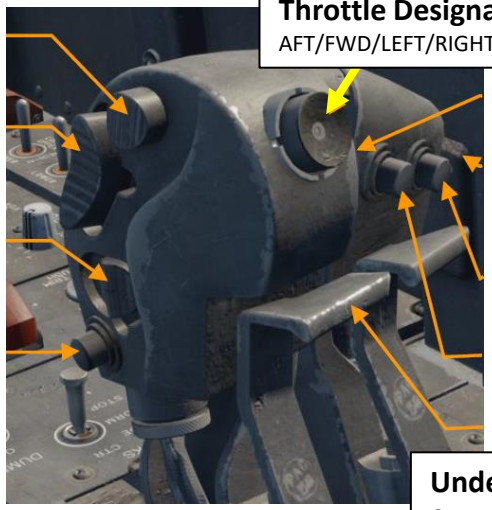


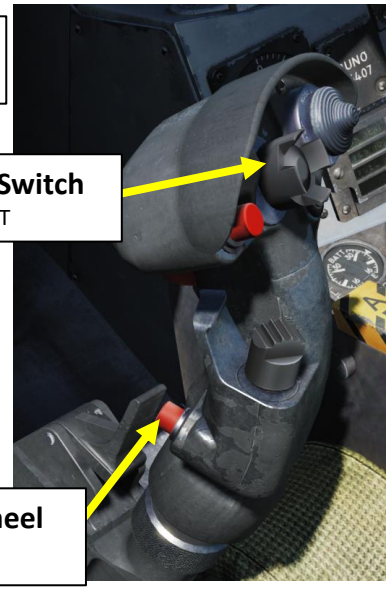


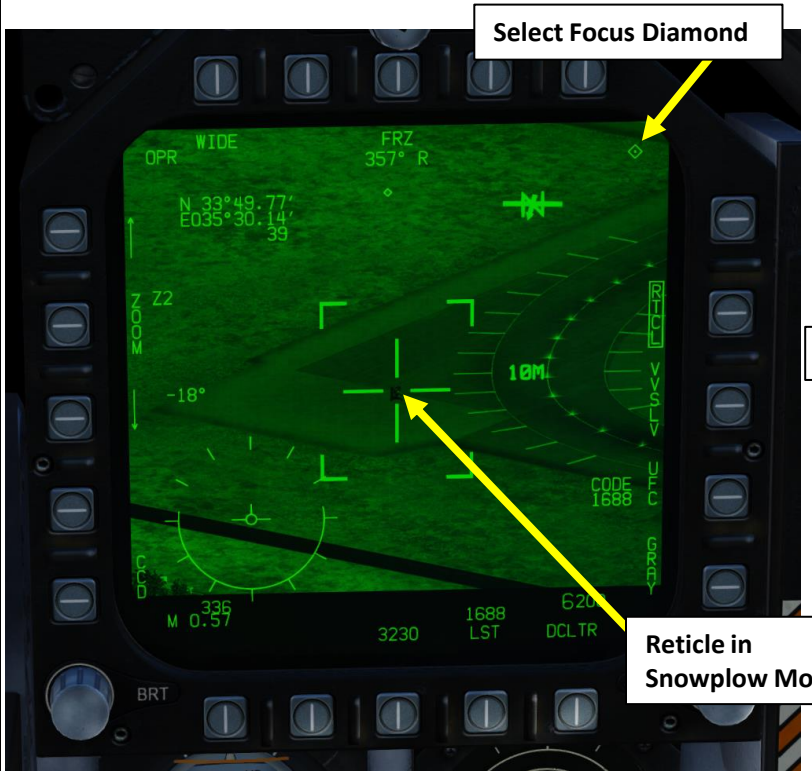
3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.5 - Point & Area Track

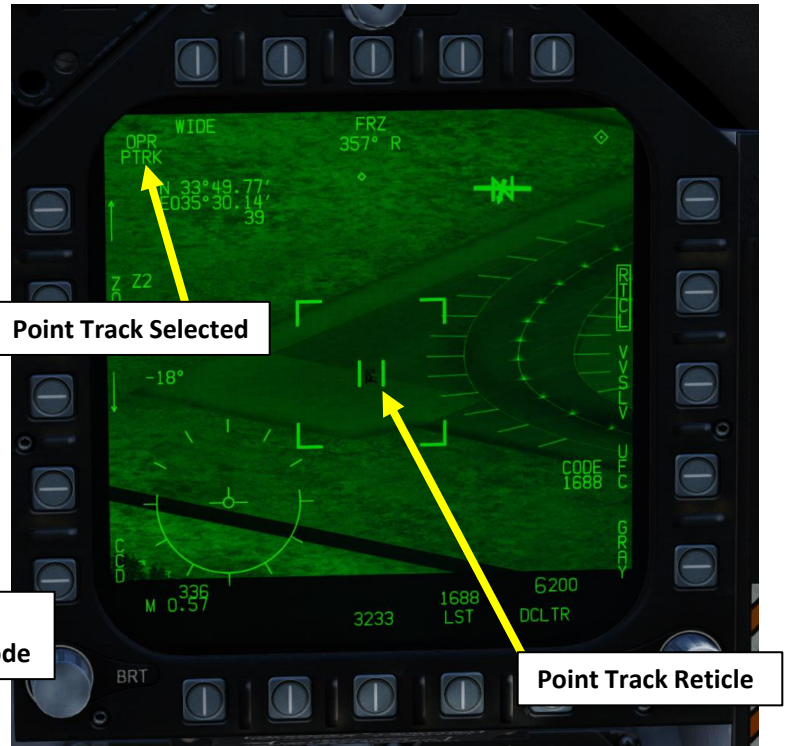
Point Track is entered by pressing the Sensor Control Switch in the direction of the FLIR format page. The FLIR tracks an object, including a moving one. To select Point Track:

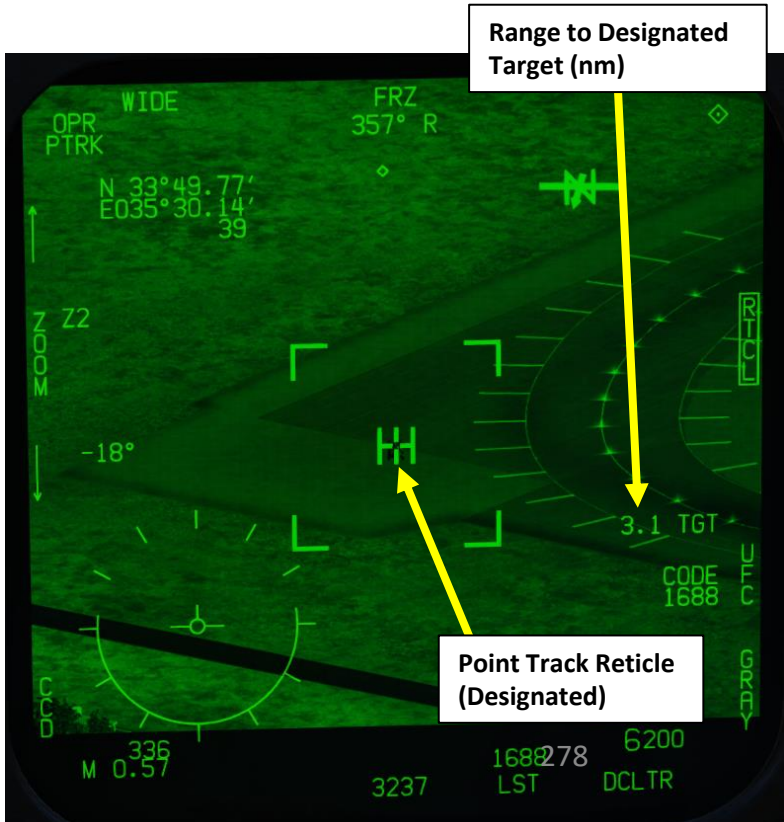
1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
2. The Select Focus Diamond indicates what display is selected.
3. Press the Undesignate button twice to select VVSLV mode.
4. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
5. Press the Sensor Control Switch in the direction of the FLIR format page to toggle between Area Track and Point Track.
6. In Point Track, the FLIR is slaved to the moving Target and cannot be slewed.
7. Use the TDC DEPRESS control (“ENTER”) to designate the target.
8. Pressing the Undesignate button once will revert back to Snowplow mode.



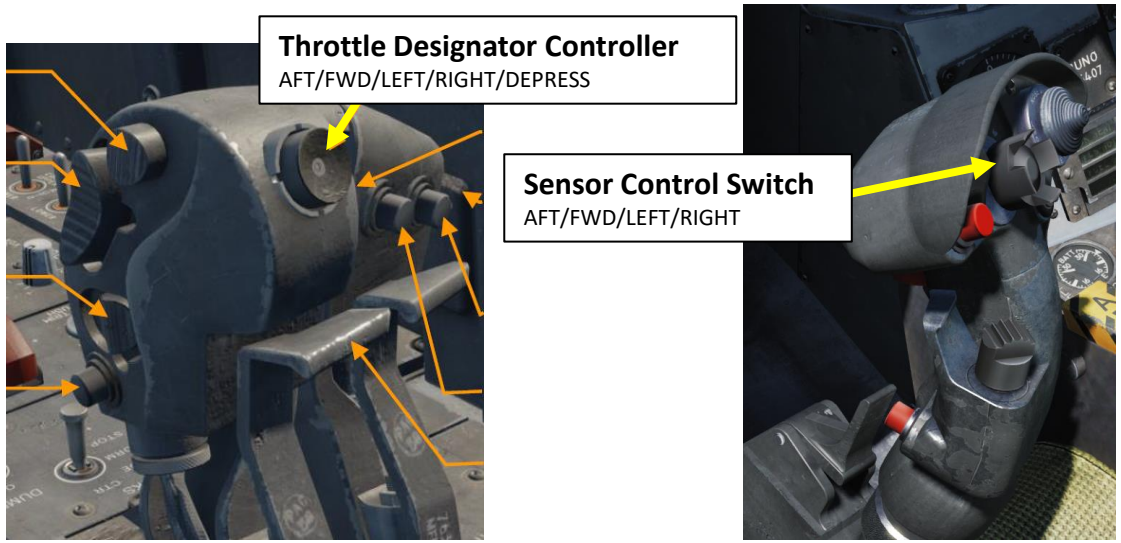








3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.6 - Targeting Pod Offset

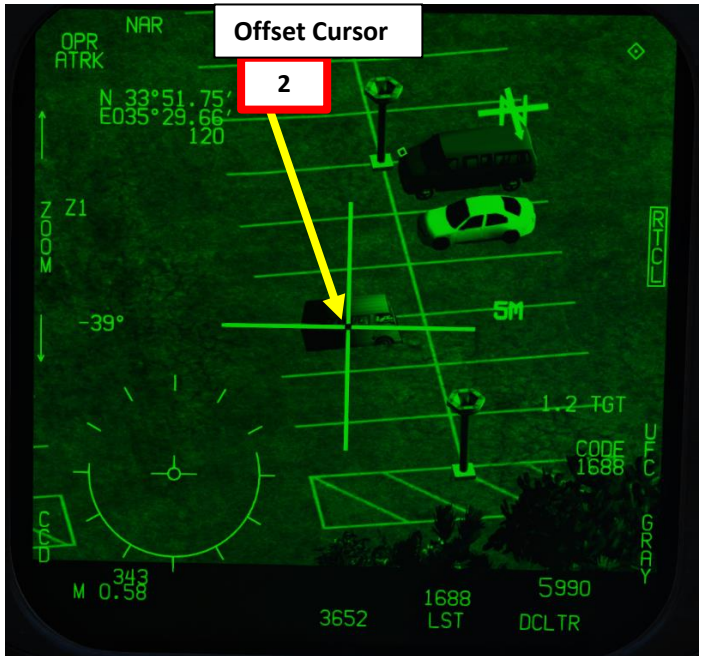


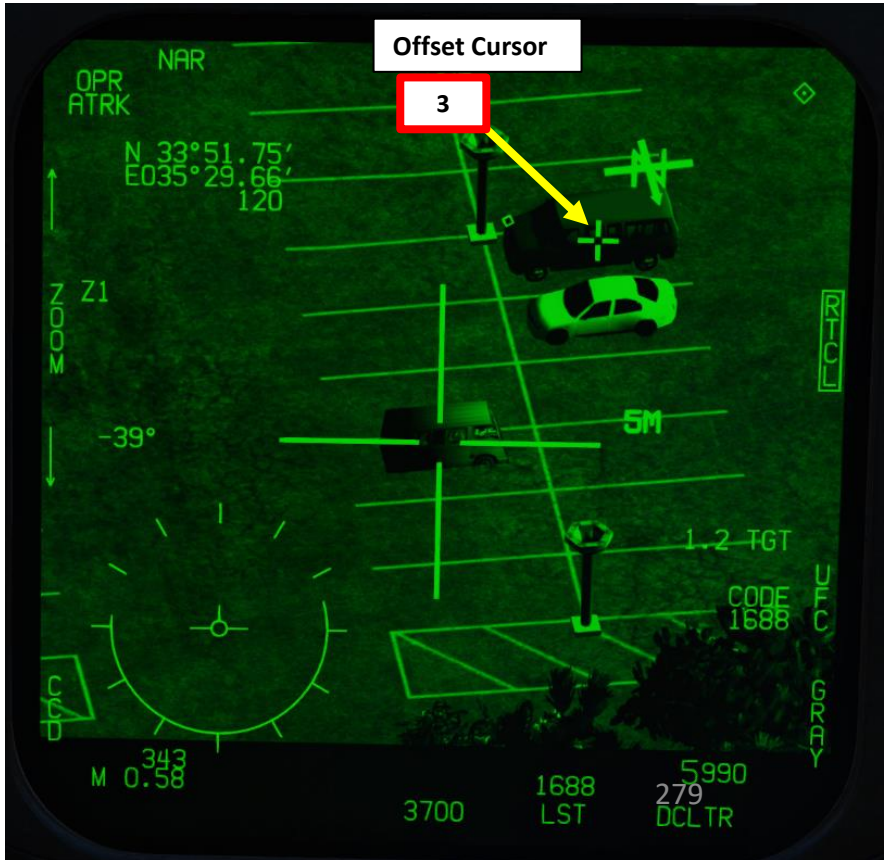
EXAMPLE 1

If the targeting pod is set in a Point Track or Area Track, the targeting pod cannot be slewed directly. In cases where you need to make an adjustment, this isn't very practical. Fortunately, the Targeting Pod Offset function allows you to create an offset/adjustment, and then designate it while maintaining the Area/Point Track you created initially.

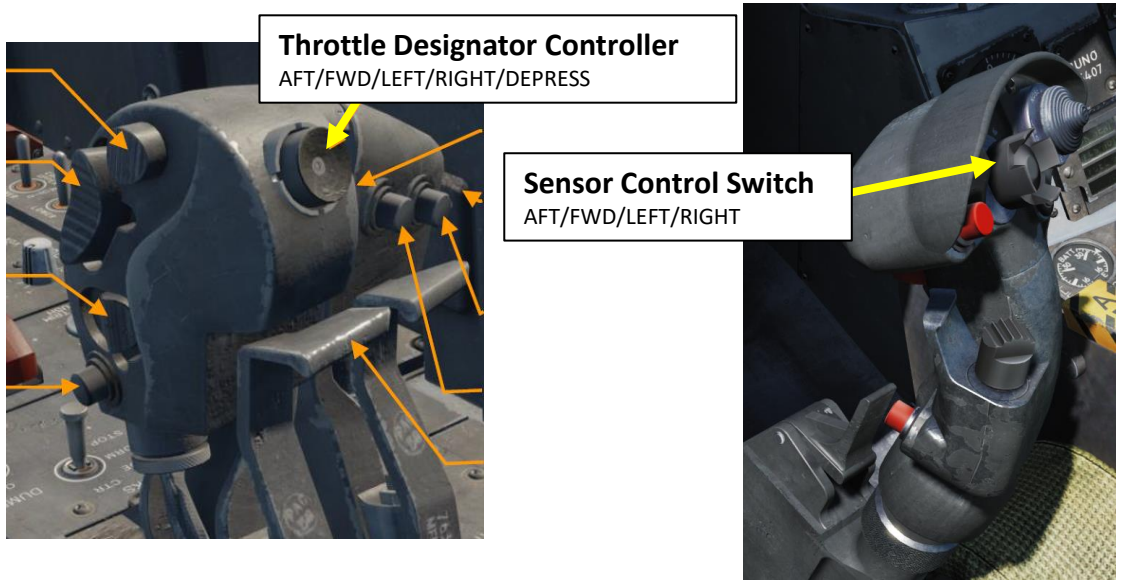
1. In this first example, we will start from an **Area Track (ATRK).** The targeting pod will be tracking a reference area.
2. Use the TDC DEPRESS control ("ENTER") to activate OFFSET function. A "+" cross (Offset Cursor) will appear at the center of the reticle.
3. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the Offset Cursor over the desired target.
4. Use the TDC DEPRESS control ("ENTER") to designate the location of the Offset Cursor as the new Target Designation point (TGT). This is quite useful for laser-guided bomb runs.







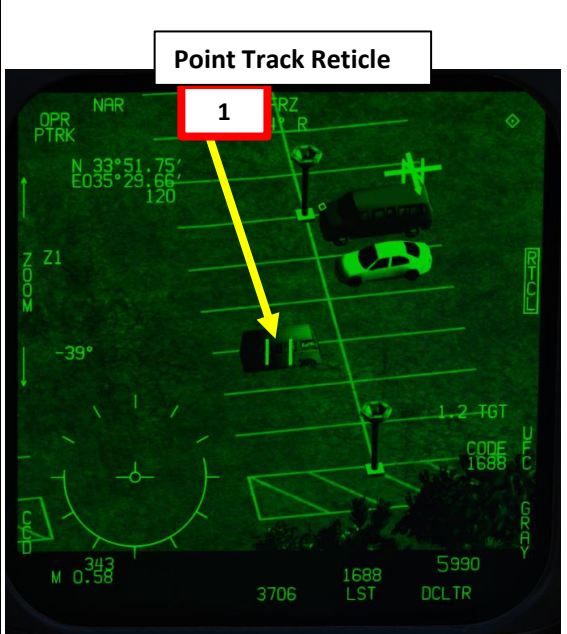
3 - AN/AAQ-28(V) LITENING II TGP
3.5 – POINTING METHODS
3.5.6 - Targeting Pod Offset

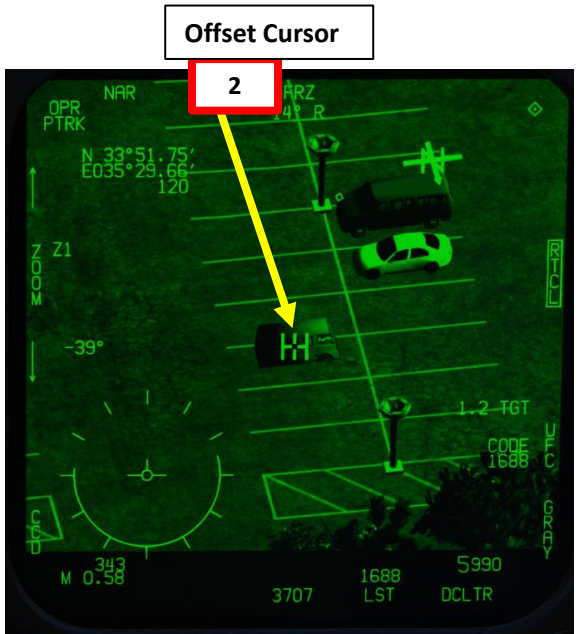


EXAMPLE 2

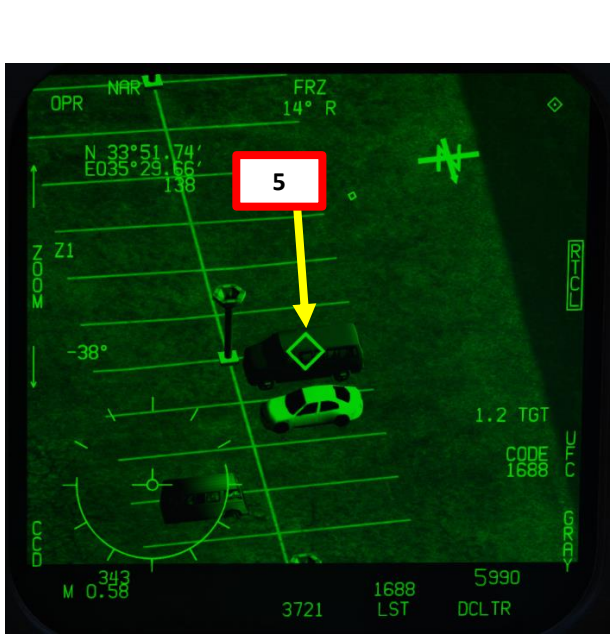
A useful offset function that comes with Point Track is that you can also "reset" the targeting pod to the Offset Cursor location. This allows you to not have to revert back to Snowplow mode and re-acquire the target, wasting precious time and situational awareness in the process.

1. In this second example, we will start from a **Point Track (PTRK).** The targeting pod will be tracking a reference object.
2. Use the TDC DEPRESS control ("ENTER") to activate OFFSET function. A "+" cross (Offset Cursor) will appear at the center of the reticle.
3. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the Offset Cursor over the desired target.
4. Use the TDC DEPRESS control ("ENTER") a second time to designate the location of the Offset Cursor as the new Target Designation point (TGT).
5. Press the Sensor Control Switch in the direction of the FLIR format page to move the targeting pod to the location of the Offset Cursor.



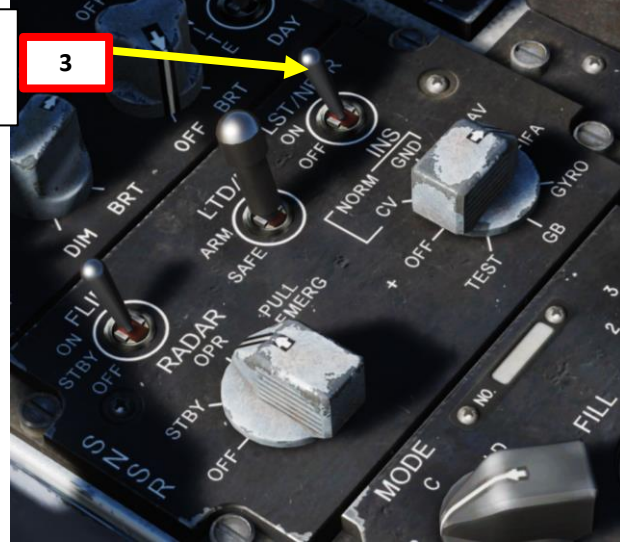






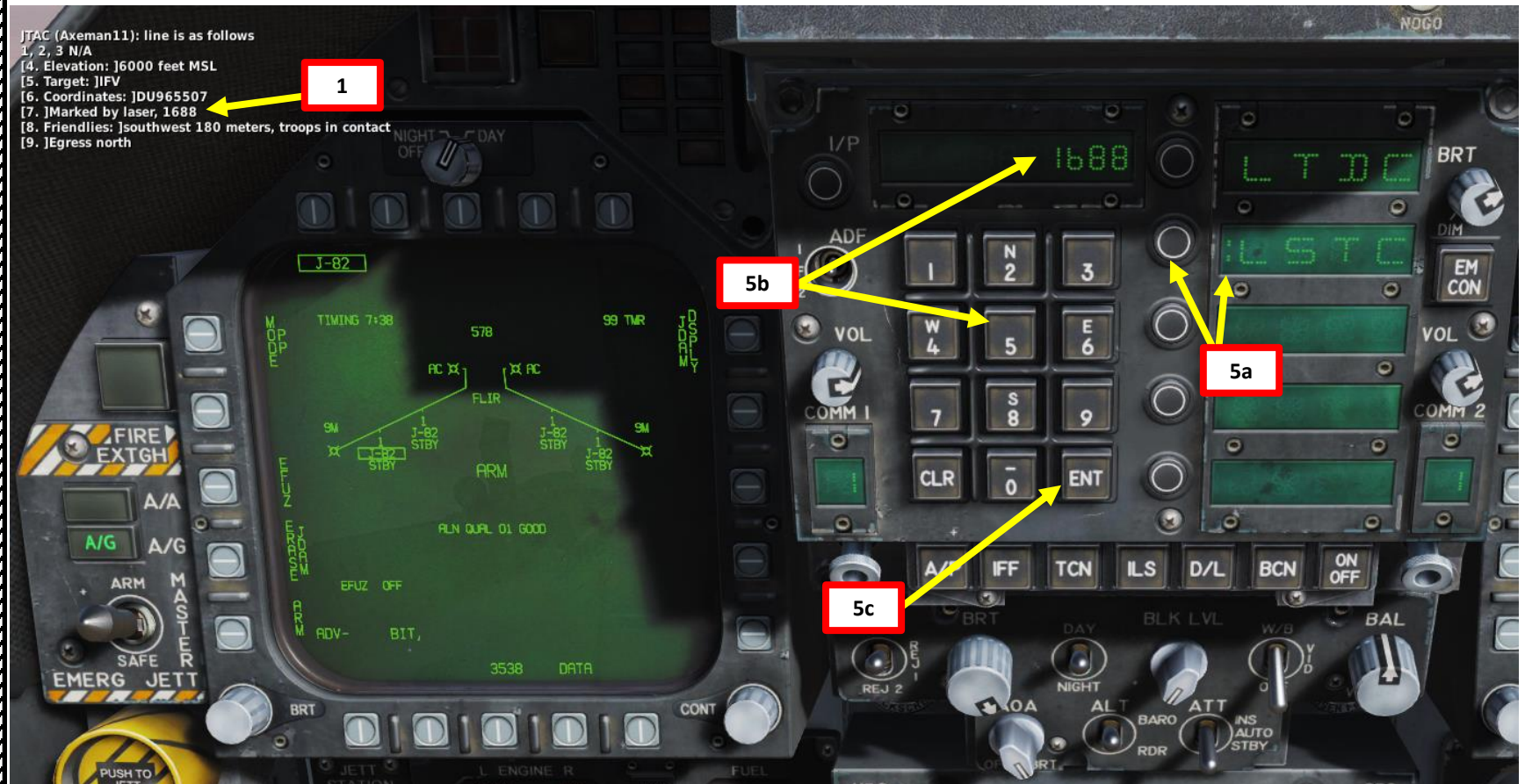
3 - AN/AAQ-28(V) LITENING II TGP
3.6 – LASER SPOT TRACKER (LST) MODE

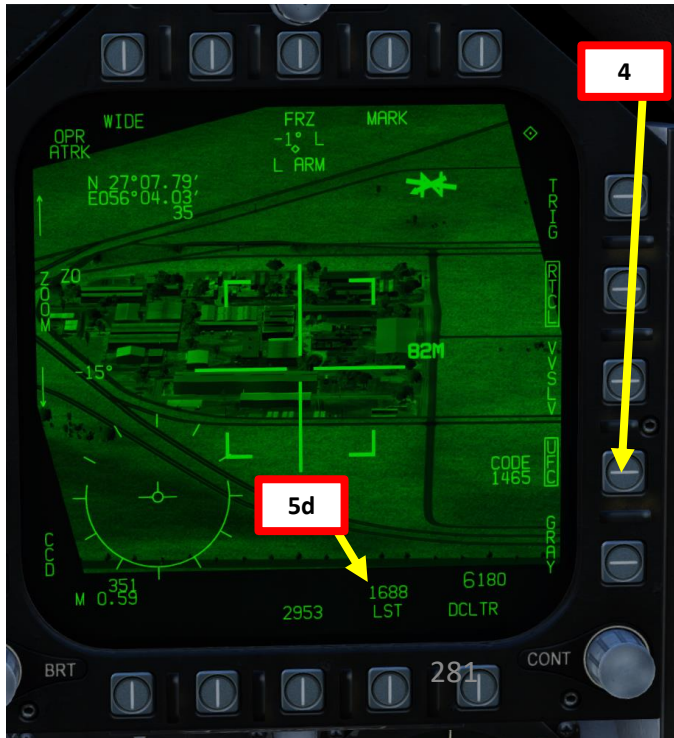
LST/NFLR switch
Laser Spot Tracker/Navigation Forward-Looking Infrared (LST/NFLR) sensor



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

1. Find out what the laser code used by the friendly is (in our case, the friendly JTAC uses code 1688). Make sure the friendly asset is lasing the target before attempting to track it.
2. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
3. Set the LST/NFLR (Laser Spot Tracker) switch to ON.
4. Press the OSB next to “UFC” to set the LSS (Laser Spot Search) code on the Up-Front Controller.
5. Press the button next to “LSTC” (Laser Spot Track Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose the default code used by the JTAC, which is 1688.

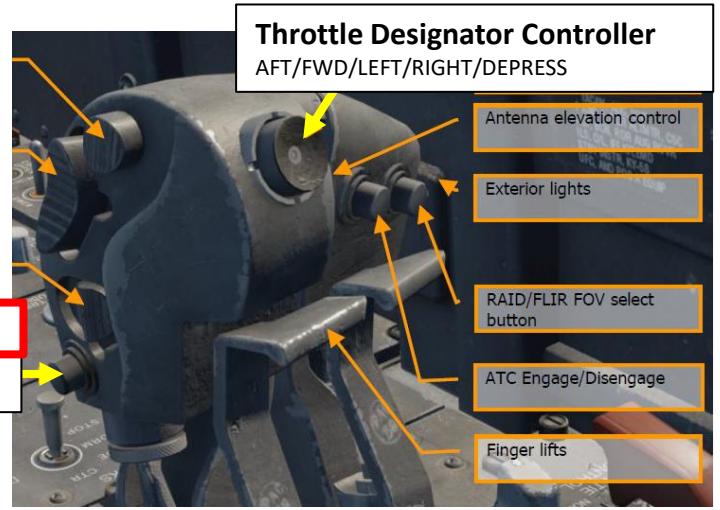


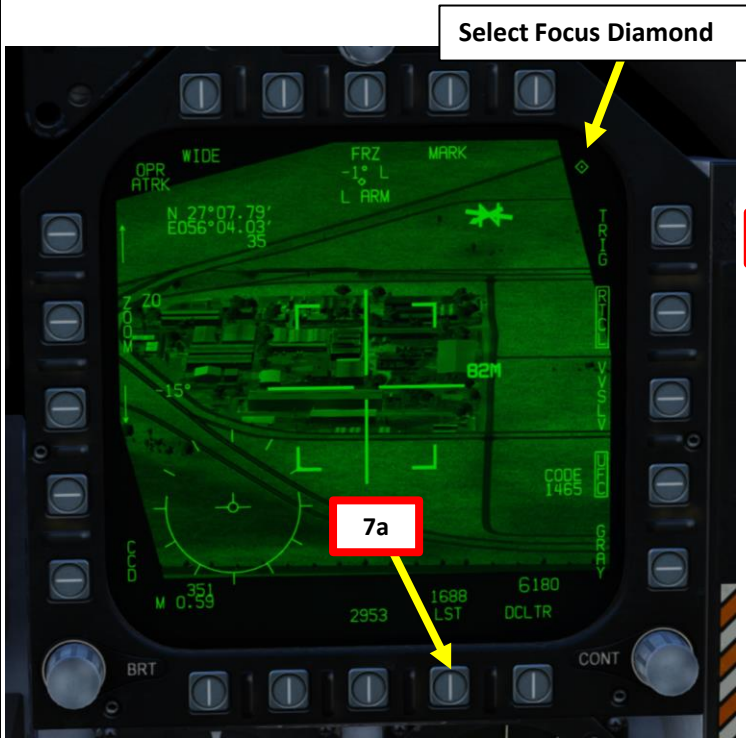


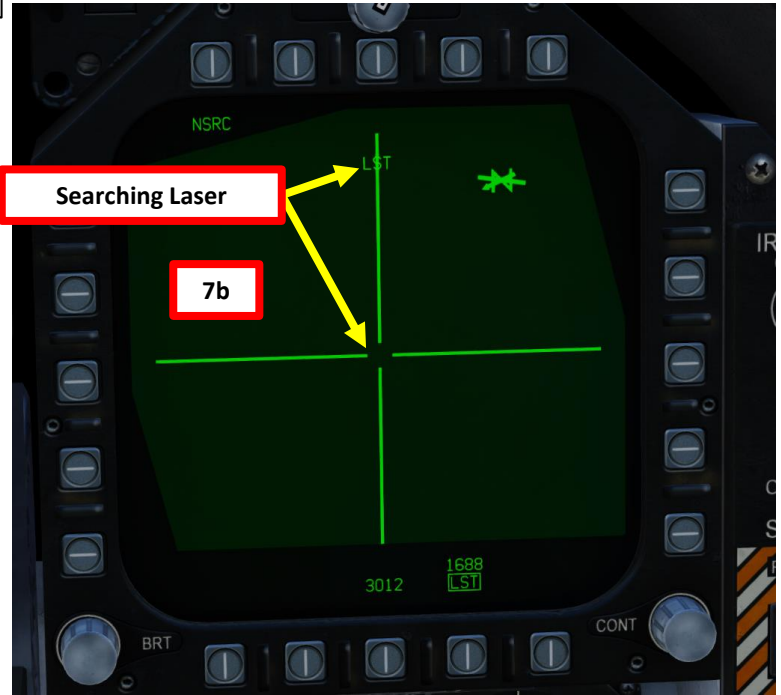
3 - AN/AAQ-28(V) LITENING II TGP
3.6 – LASER SPOT TRACKER (LST) MODE

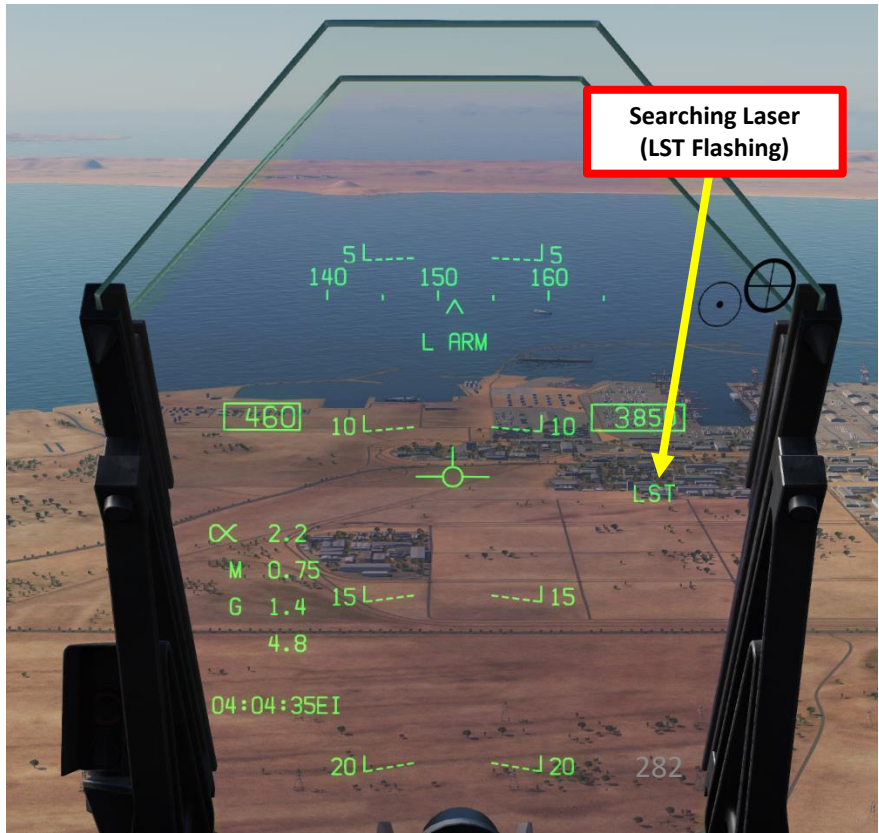
6. Set the targeting pod in Snowplow mode, then slew the targeting pod using the Sensor Control Switch (Sets Focus Diamond) and TDC controls within the vicinity of the JTAC location. If the targeting pod is looking too far from the laser, it will not be able to find the laser.
7. Press the OSB next to “LST” (Laser Spot Track) on the FLIR Format. Alternatively, you can use the Cage/Uncage Button. Once LST is selected, the indication will be boxed.
8. While the targeting pod is searching for a laser, the FLIR image feed is blank, "LST" flashes on the top of the FLIR format and on the HUD.







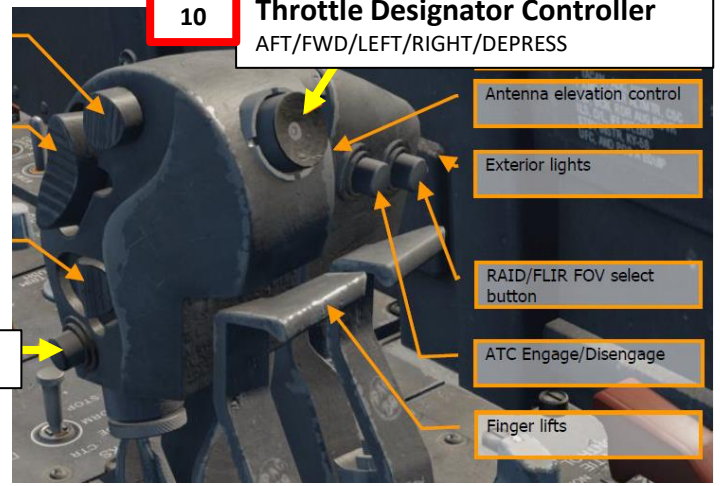




3 - AN/AAQ-28(V) LITENING II TGP
3.6 – LASER SPOT TRACKER (LST) MODE

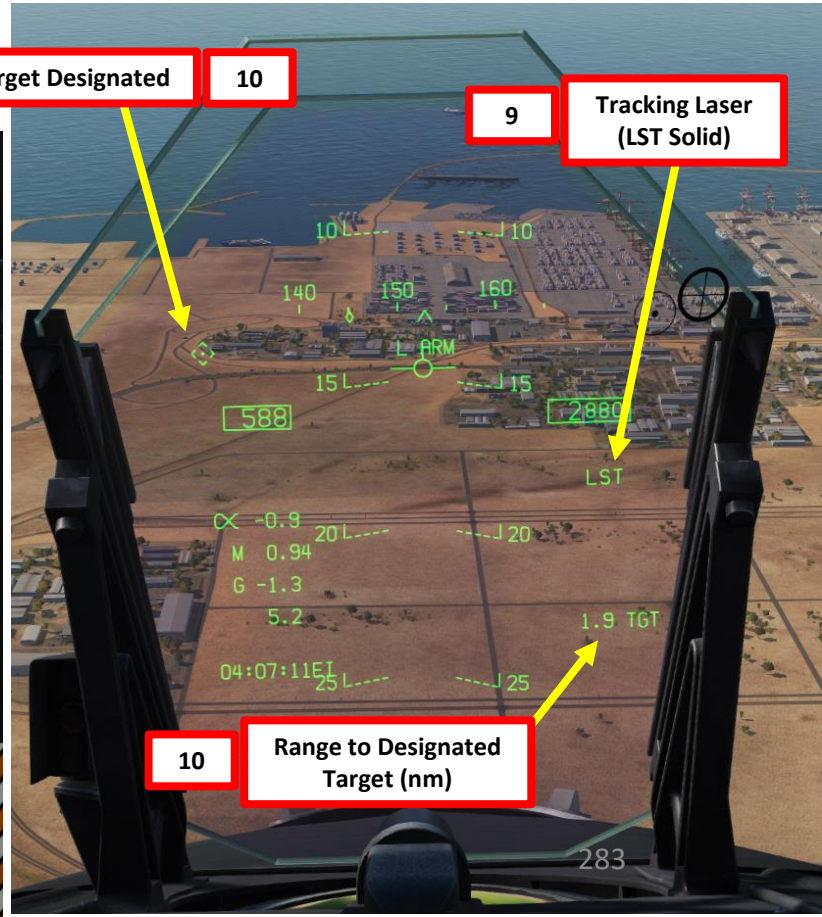
9. When targeting pod has found a friendly laser, the FLIR format will show the video feed centered on that laser and the "LST" indication will be solid. It will actively track the JTAC laser.
10. Use the TDC (Throttle Designator Controller) Depress button to designate the laser as the target point. This will slave selected air-to-ground weapons to where the laser is firing.
11. You may now launch laser-guided weapons as per their release procedure.
12. When desired, press the OSB next to LST to stop tracking the laser. Alternatively, you can use the Cage/Uncage button as well.
13. Pressing the Undesignate/Nosewheel Steering button will undesignate the target.







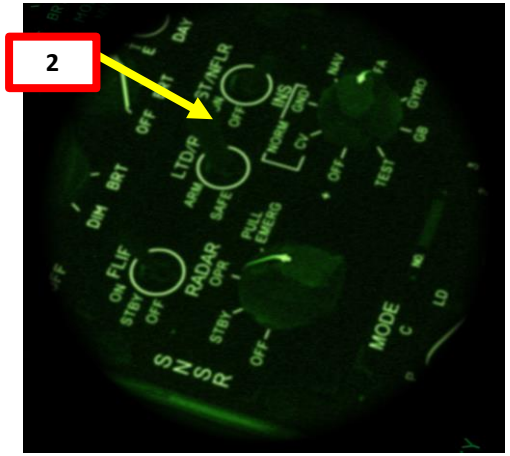


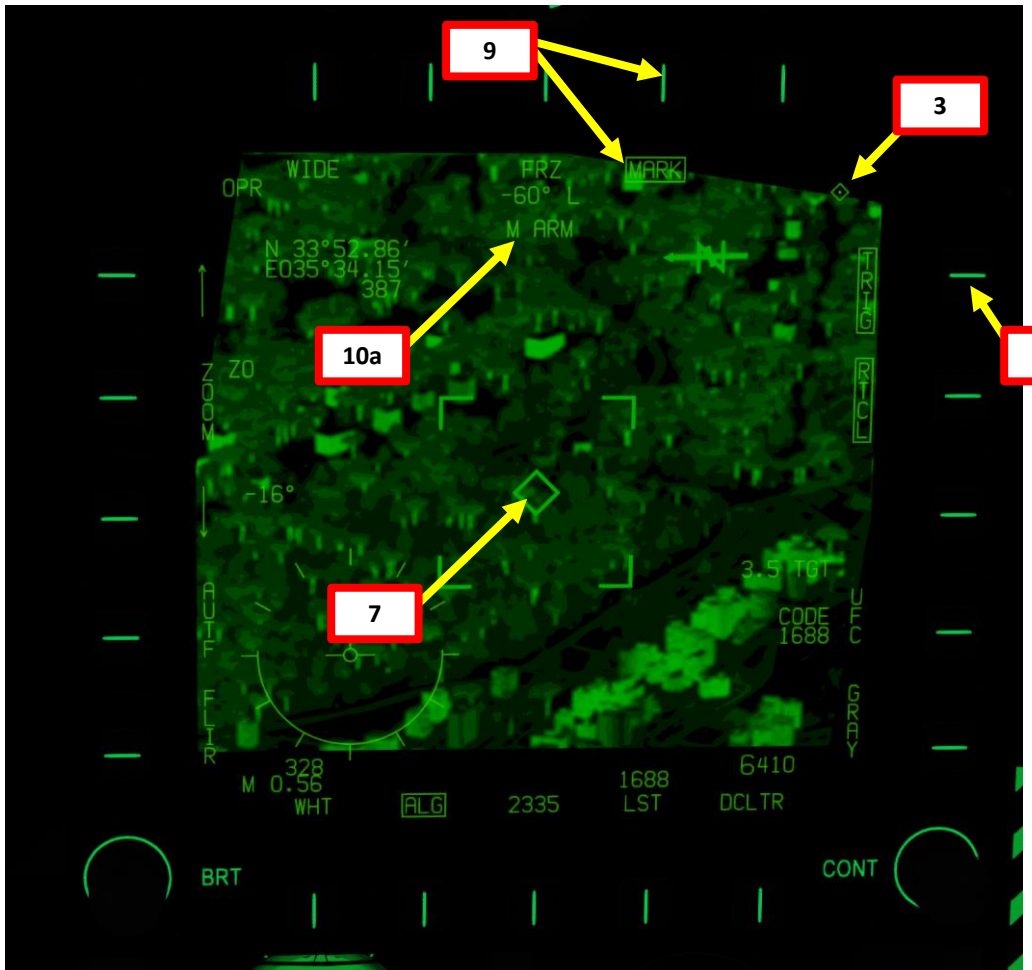


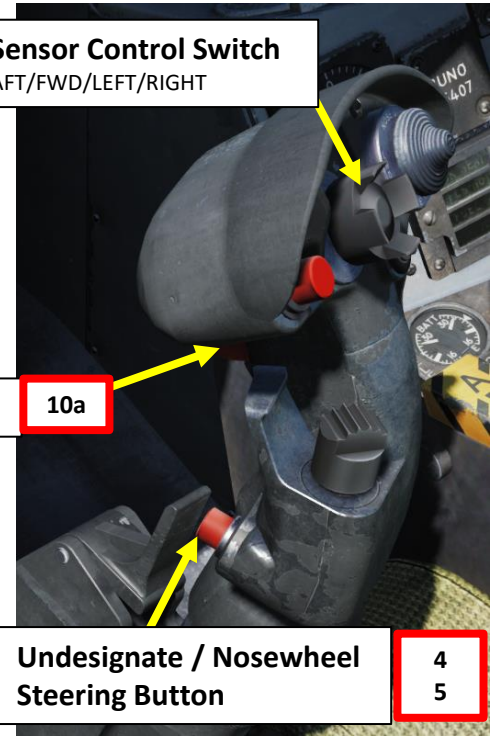
3 - AN/AAQ-28(V) LITENING II TGP
3.7 – LASER MARKING

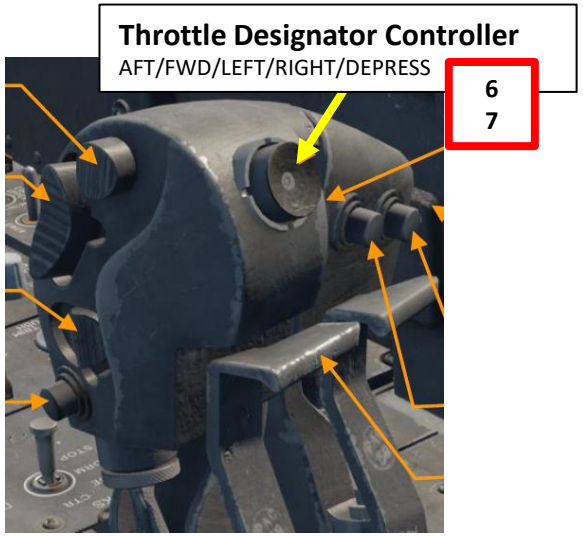
The targeting pod can also use a laser marker (the laser marker cannot be tracked by air-to-ground weapons), which is an infrared laser that can only be seen with night vision goggles (RSHIFT+H to toggle NVGs). This is used mainly to provide a visual reference to other aircraft on where a target is.

1. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
2. Set LTD/R (Laser Target Designator/Ranger) switch to ARM. This will arm the laser. Confirm that L ARM indication is displayed on the FLIR page.
3. Press the Sensor Control Switch in the direction of the selected DDI (Right for the Right DDI as an example). The Select Focus Diamond indicates what display is selected.
4. Press the Undesignate button twice to select VVSLV mode.
5. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
6. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target
7. Use the TDC DEPRESS control (“ENTER”) to designate target
8. Press the OSB next to “TRIG”. The indication will become boxed once selected, which means that a gun trigger press will fire the laser.
9. Press the OSB next to “MARK” to set the laser in “M Arm” (Marker Arm) mode. When selected, “Mark” indication will be boxed.
10. Press and hold the gun trigger to fire laser. Once laser is firing, the laser mode will switch from M ARM to MARK.



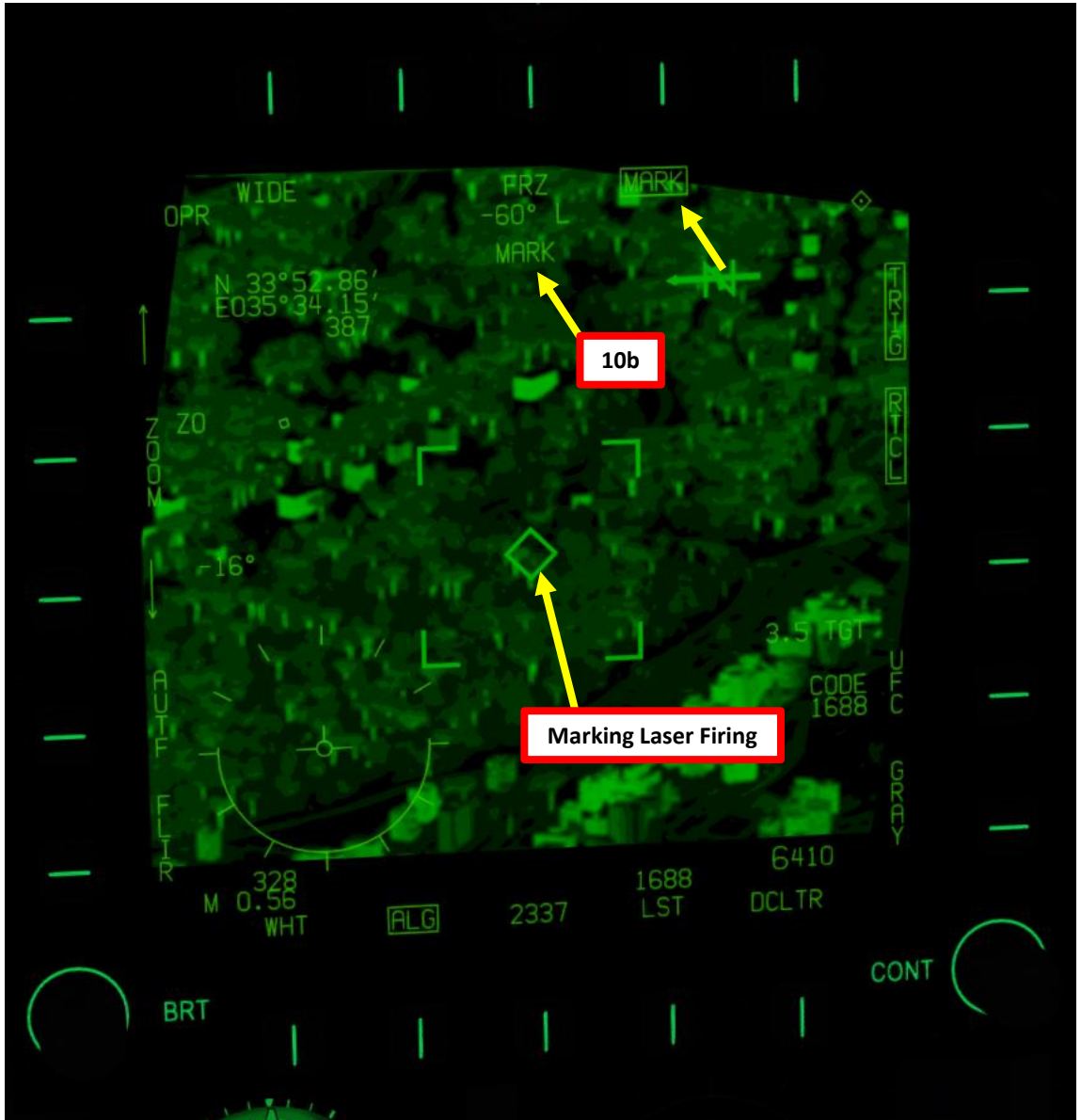


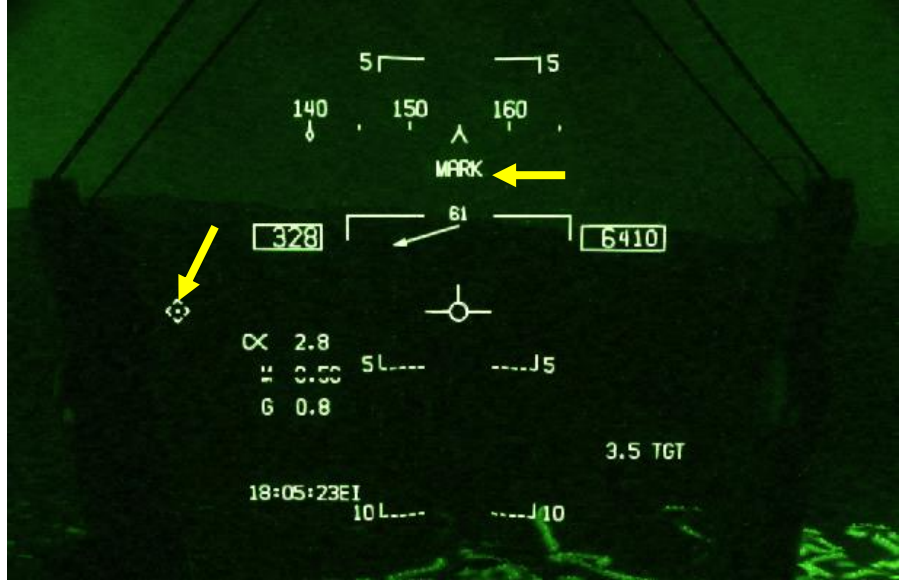


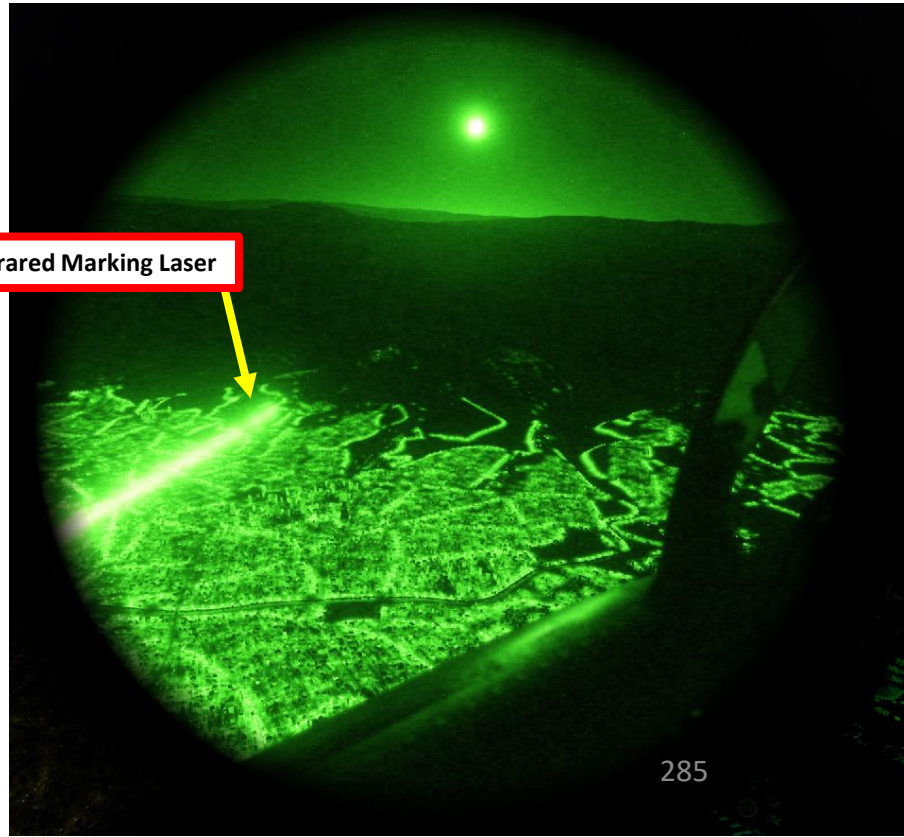


3 - AN/AAQ-28(V) LITENING II TGP
3.7 – LASER MARKING

11. An infrared laser will be visible with your night vision goggles.







3 - AN/AAQ-28(V) LITENING II TGP
3.8 – AIR-TO-AIR OPERATION
3.8.1 - Operation Modes

The targeting pod can also be used in air-to-air modes in conjunction with the radar. This is quite useful to perform visual identifications of air targets. To use Air-to-Air mode, the LITENING TGP requires the A/A Master Mode to be active. Here are the four main A-A operation modes of the pod:

- **Snowplow:** The FLIR is slewed freely and stabilized to the aircraft itself.
- **Velocity Vector Slaved:** The FLIR is slaved to the line of sight to the velocity vector. This is accessed via the VVSLV option on the A/A FLIR format when not in the Radar Slaved or Point Track modes.
- **Radar Slaved:** The FLIR is slaved to the extrapolated line of sight to the radar's L&S trackfile. This is accessed via the RRSLV option on the A/A FLIR format.
- **Point Track:** The FLIR itself is tracking a target. Point Track is accessed by "bumping" the Sensor Control Switch in the direction of the FLIR format with the TDC already assigned, and will attempt to acquire a recognized target within the reticle. Point Track is only entered when a successful track is acquired.

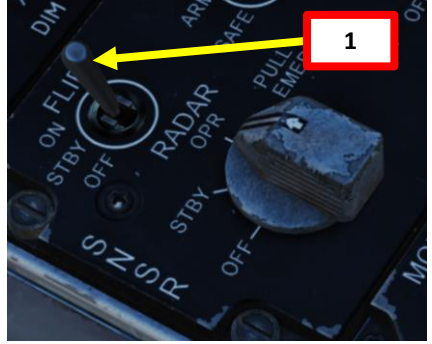




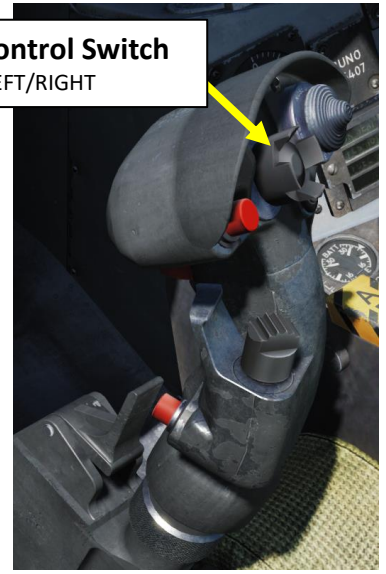




3 - AN/AAQ-28(V) LITENING II TGP
3.8 – AIR-TO-AIR OPERATION
3.8.2 - Point Track



3
9
11
Sensor Control Switch
AFT/FWD/LEFT/RIGHT

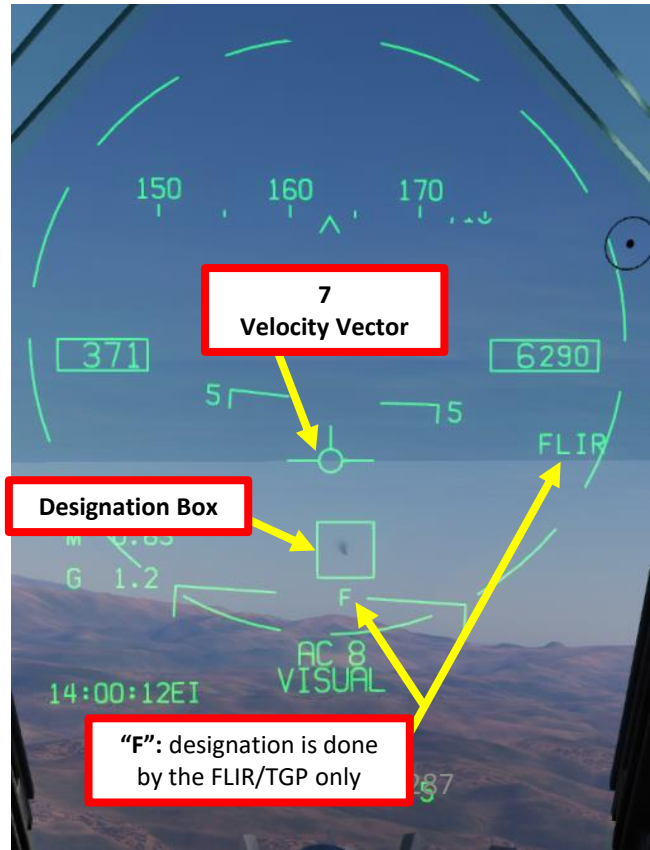


In order to **track a target with the targeting pod**:

1. Make sure the targeting pod is powered
2. Press the A/A Master Mode button. The RDR ATTK (radar) page will appear on the right DDI and the FLIR page will appear on the left DDI.
3. Select FLIR by pressing the Sensor Control Switch in the direction of the DDI with the FLIR page (left).
4. The Select Focus Diamond indicates what display is selected.
5. Select VVSLV by selecting the VVSLV pushbutton on the FLIR page. The FLIR will be slaved to the line of sight to the velocity vector.
6. Press OSB next to RTCL (boxed) to display the targeting pod's reticle
7. Fly the aircraft to put the velocity vector in the vicinity of the aircraft.
8. You can zoom and choose desired FLIR/CCD (TV) setting using the appropriate Option Select Buttons on the FLIR page.
9. Press/bump the Sensor Control Switch in the direction of the FLIR format page (left) to attempt to Point Track the target.
10. When Point Track is obtained, a designation box will appear on the HUD and the targeting pod will track the target.
11. If you want to "dump" the target, press the Sensor Control Switch in the direction of the DDI with the FLIR page (left).



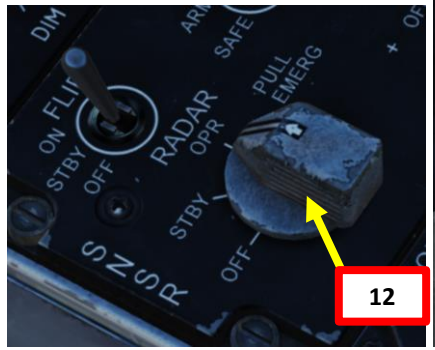




3 - AN/AAQ-28(V) LITENING II TGP
3.8 – AIR-TO-AIR OPERATION
3.8.2 - Point Track

You can also **slave the radar to the target designated by the FLIR pod**.

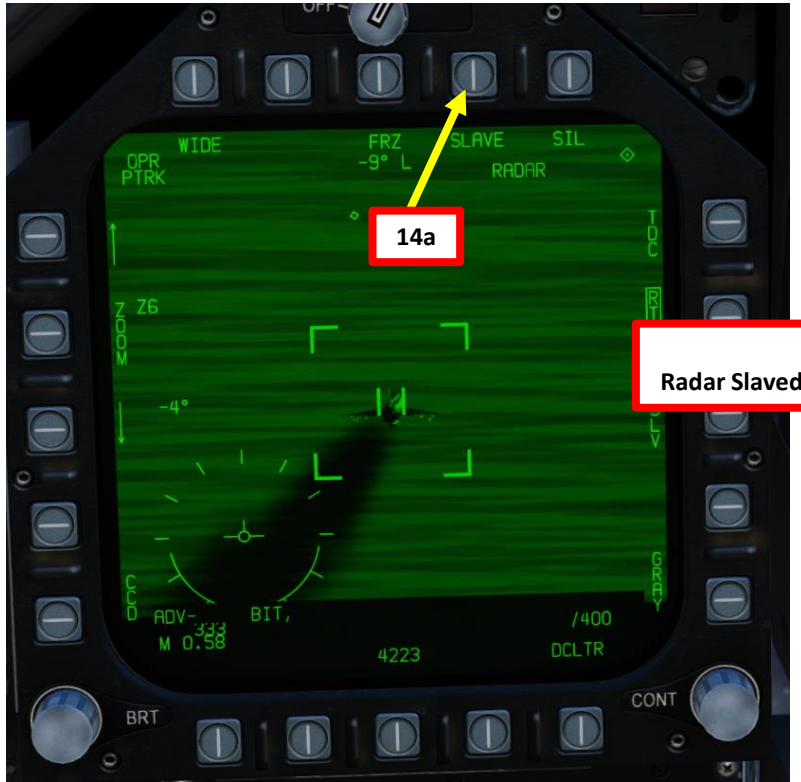
12. Make sure the radar is powered
13. Make sure Point Track is obtained
14. On FLIR page, press OSB next to SLAVE to slave the radar to the targeting pod's point track.
15. Both the radar and the TGP will now track the target.









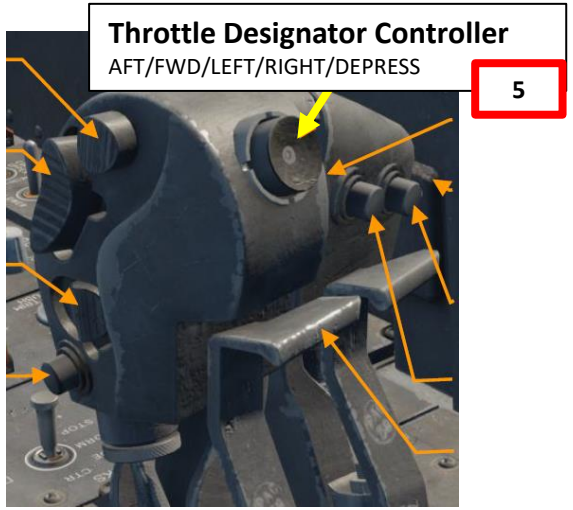


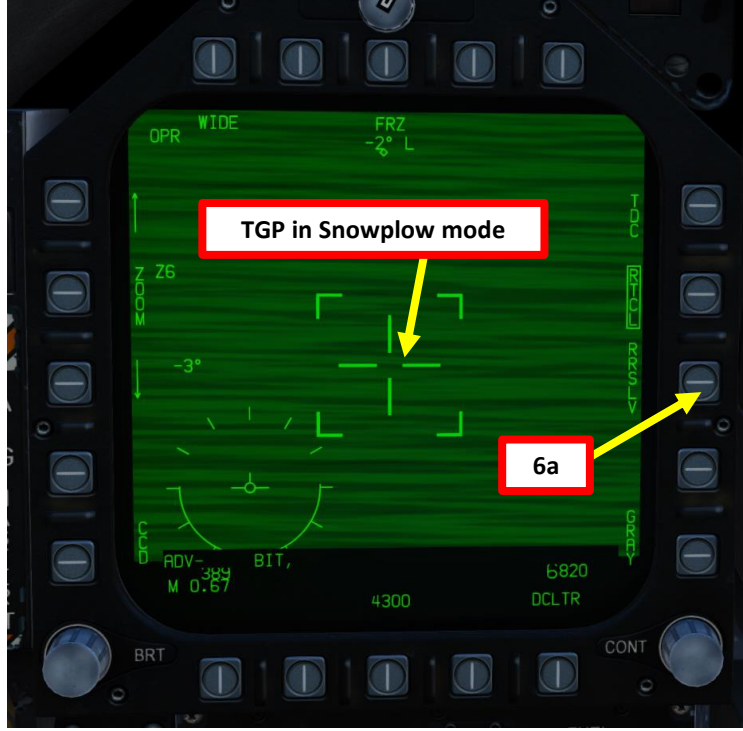


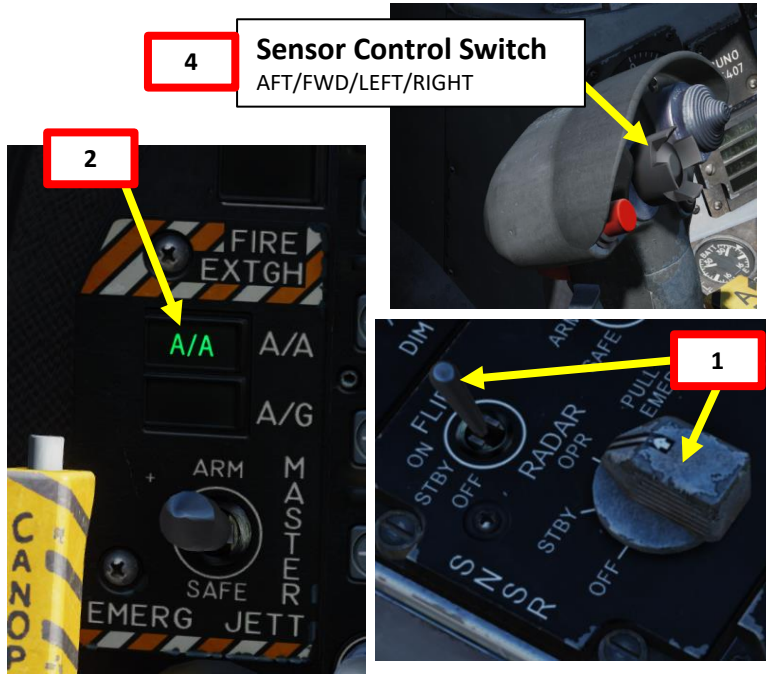
3 - AN/AAQ-28(V) LITENING II TGP
3.8 – AIR-TO-AIR OPERATION
3.8.3 - Air-to-Air Radar Slaving

While you can slave the radar to the targeting pod, you can also do this the other way around. Here is how to slave the targeting pod to a radar locked target in order to visually identify it.

1. Make sure the targeting pod and radar are powered
2. Press the A/A Master Mode button. The RDR ATTK (radar) page will appear on the right DDI and the FLIR page will appear on the left DDI.
3. Select RDR ATTK page by pressing the Sensor Control Switch in the direction of the DDI with the radar page (right).
4. The Select Focus Diamond indicates what display is selected.
5. Acquire a radar lock using the TDC Slew and TDC DEPRESS controls.
6. Press the OSB next to RRSLV (radar slave) to slave the slave the targeting pod to the radar lock (L&S trackfile).





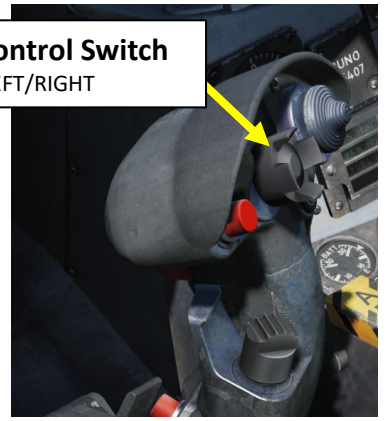


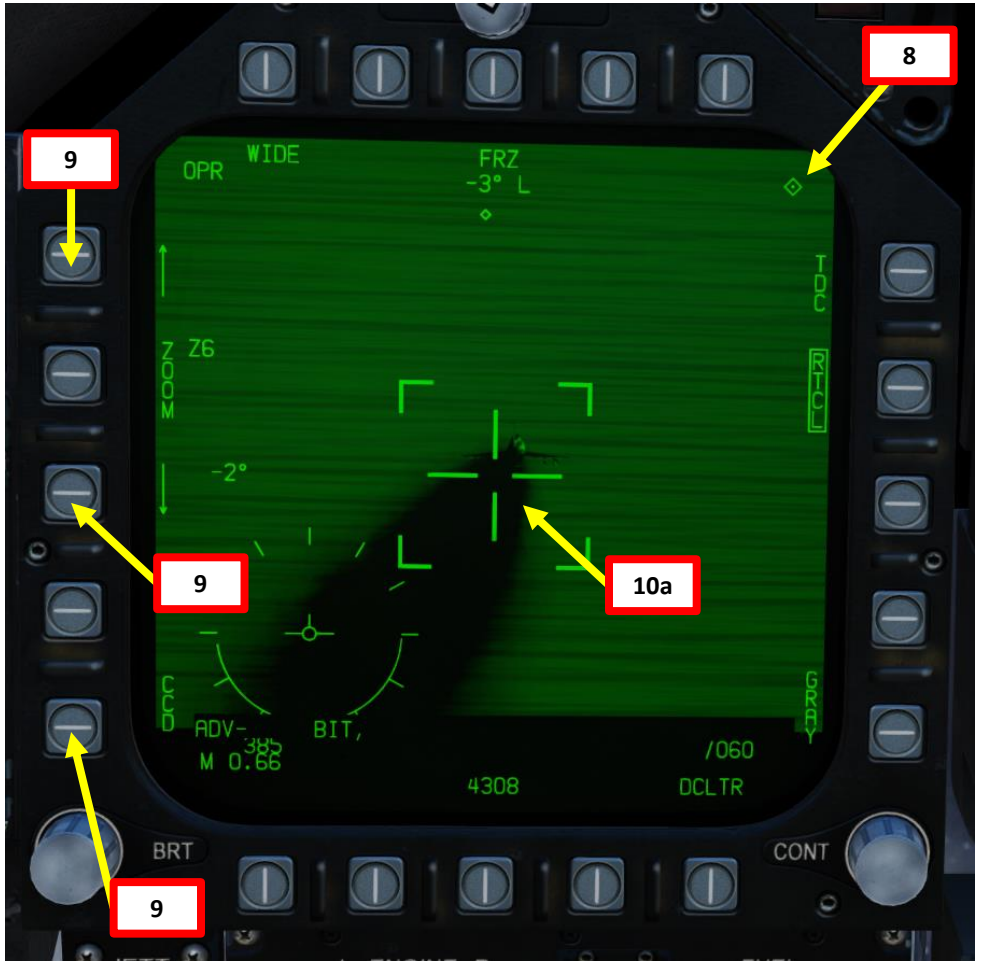




3 - AN/AAQ-28(V) LITENING II TGP
3.8 – AIR-TO-AIR OPERATION
3.8.3 - Air-to-Air Radar Slaving

7. Select FLIR by pressing the Sensor Control Switch in the direction of the DDI with the FLIR page (left).
8. The Select Focus Diamond indicates what display is selected.
9. You can zoom and choose desired FLIR/CCD (TV) setting using the appropriate Option Select Buttons on the FLIR page.
10. Press/bump the Sensor Control Switch in the direction of the FLIR format page (left) to attempt to Point Track the target.



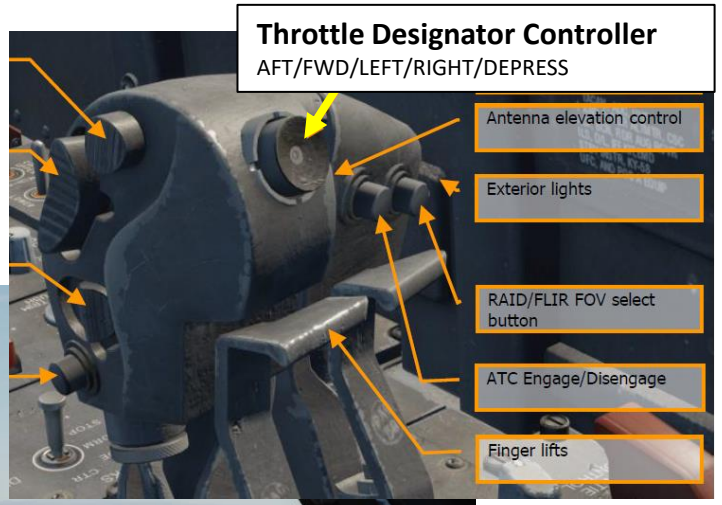




3 - AN/AAQ-28(V) LITENING II TGP
3.9 – TARGETING POD TIPS

To get a visual reference of where the targeting pod is looking, consult the SA (Situational Awareness) page. A small square represents the TGP reticle position in a top-down view. You can also use the TDC Depress button to designate the targeting pod reticle, which will appear as a diamond on the Heads-Up Display.





3 - AN/AAQ-28(V) LITENING II TGP
3.9 – TARGETING POD TIPS

When in bombing CCIP mode, the targeting pod will be slaved to the pipper of the CCIP bombing reticle.



4 - AN/ASQ-228 ATFLIR TGP
4.1 – INTRODUCTION

The AN/ASQ-228 ATFLIR (A-T-FLIR, or *Advanced Targeting Forward Looking Infrared*) targeting pod is a slewable electro-optical pod with laser designation, ranging, and searching capability. It is capable of both video and infrared imaging, as well as moving target tracking. The ATFLIR is effective in both the air-to-ground and air-to-air role. The ATFLIR can only be mounted on the left cheek hardpoint. Within DCS, most of the ATFLIR's controls and capabilities are very similar, but the symbology, zoom levels and field-of-view differ.

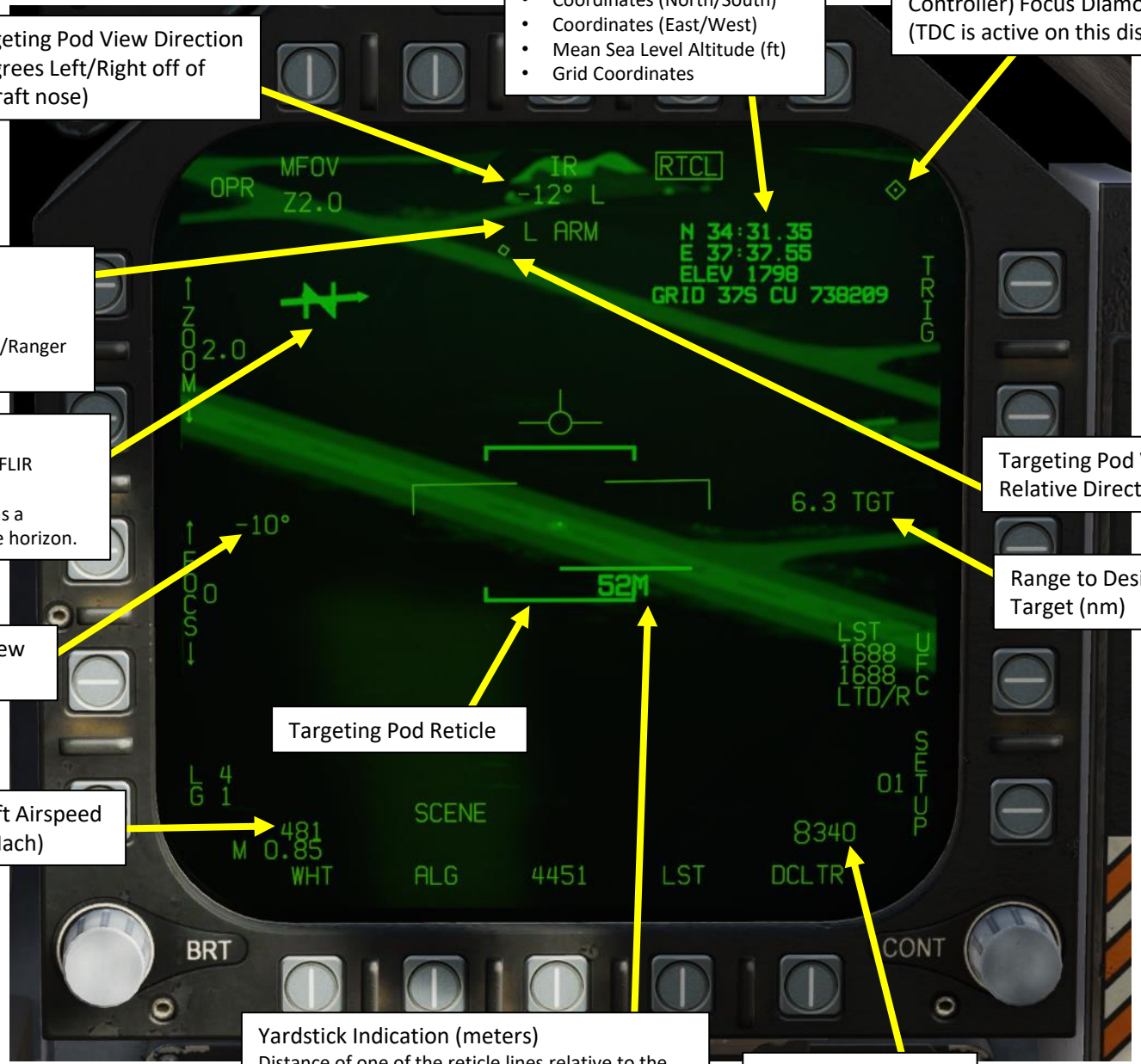


4 - AN/ASQ-228 ATFLIR TGP
4.2 – DISPLAYS

The targeting pod feed can be displayed on either DDI (Digital Display Indicator) or on the AMPCD (Advanced Multi-Purpose Color Display). To display targeting pod feed, select TAC page, then click on the OSB next « FLIR ». Take note that the FLIR page on the AMPCD is displayed in white and black, while the FLIR page on the DDIs are in shades of black and green.



From the TAC page, you can access the targeting pod feed by pressing the OSB next to “FLIR”.



Designation Point Data
- Coordinates (North/South)
- Coordinates (East/West)
- Mean Sea Level Altitude (ft)
- Grid Coordinates

TDC (Throttle Designator Controller) Focus Diamond (TDC is active on this display)

Targeting Pod View Direction (degrees Left/Right off of aircraft nose)

Laser Mode
- L ARM: Laser Armed
- M ARM: Laser Marker Armed
- LTD/R: Laser Target Designator/Ranger
- Blank: Safe/Off

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

Targeting Pod View Relative Direction

Targeting Pod View Elevation (deg)

Range to Designated Target (nm)

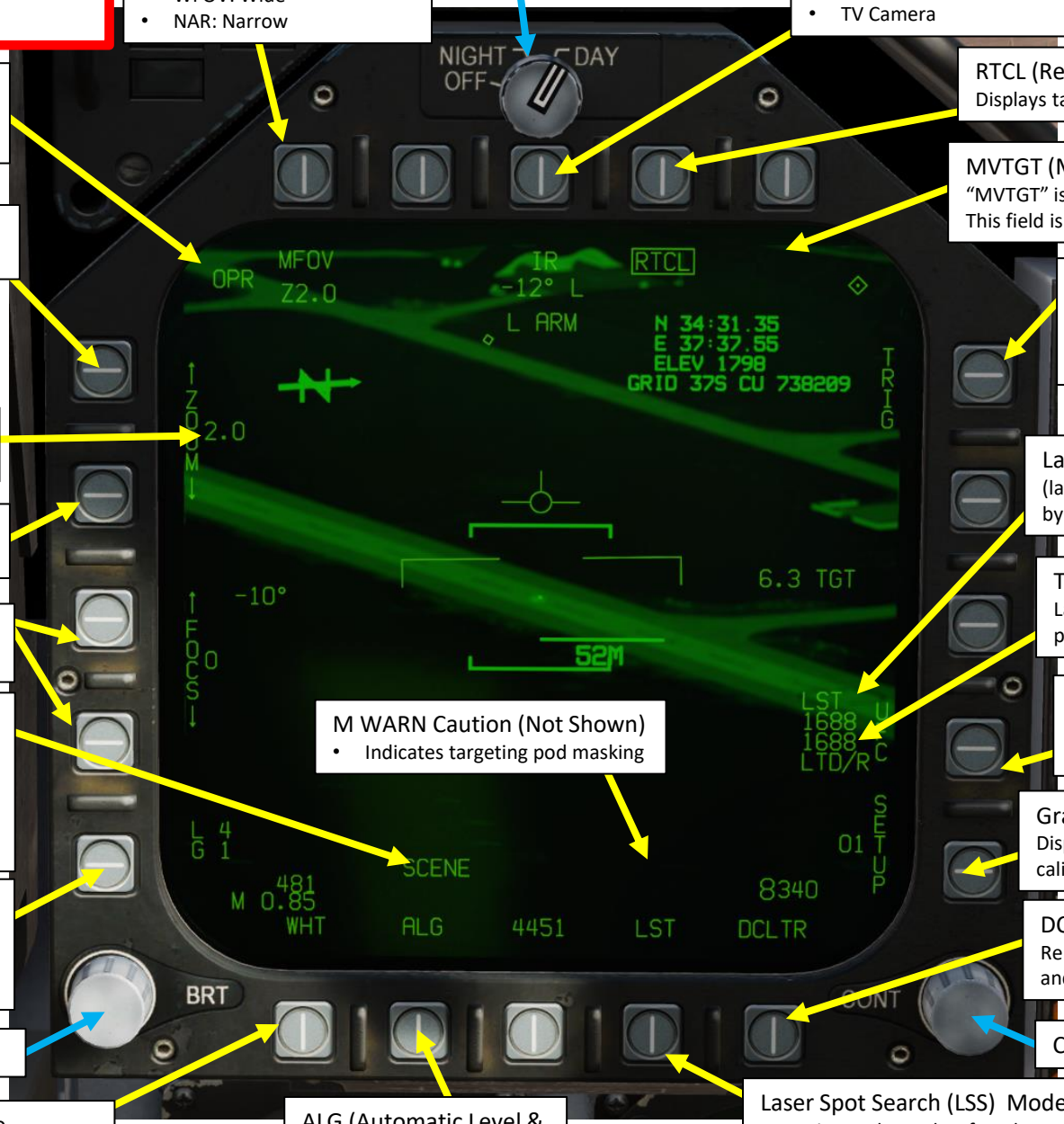
Targeting Pod Reticle

Aircraft Airspeed (kts/Mach)

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

Aircraft Altitude (ft)

4 - AN/ASQ-228 ATFLIR TGP
4.2 – DISPLAYS



Field of View (FOV) Setting
- MFOV: Medium
- WFOV: Wide
- NAR: Narrow

Day/Night Mode Control Knob

FLIR/TV Camera Mode Selector
- FLIR: Forward-Looking Infrared
- TV Camera

Targeting Pod Mode
- OPR: Operate
- STBY: Standby

RTCL (Reticle) Option
Displays targeting pod reticle

MVTGT (Moving Ground Target Indicator)
"MVTGT" is displayed when tracking a moving target. This field is blank when not tracking a moving target.

Increase Zoom Control
(Only functions with Wide and Medium FOV)

TRIG Option
When selected (boxed), pressing the second stage trigger will fire the laser. Also disables gun selection while enabled.

Zoom Control and Setting (1 through 2)
Only functions with Wide and Medium FOV

Laser Spot Tracker Code
(laser code searched/tracked by targeting pod)

Decrease Zoom Control
(Only functions with Wide and Medium FOV)

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

Targeting Pod Focus (FOCS) setting selectors

UFC (Up-Front Controller) Button
Allows you to change the laser code from the UFC.

Tracking Mode
- SCENE (Area Track)
- AUTO (Point Track)
- INR (Inertial, targeting pod is being slewed)
- INR SCENE / INR AUTO (targeting pod is being slewed while being in SCENE or AUTO tracking mode)

M WARN Caution (Not Shown)
- Indicates targeting pod masking

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

L: Manual Level Control Setting
G: Manual Gain Control Setting
Only visible if ALG (Automatic Level & Gain) Control option is unselected (unboxed)

DCLTR (Declutter) Button
Removes aircraft airspeed and altitude information.

Brightness Control

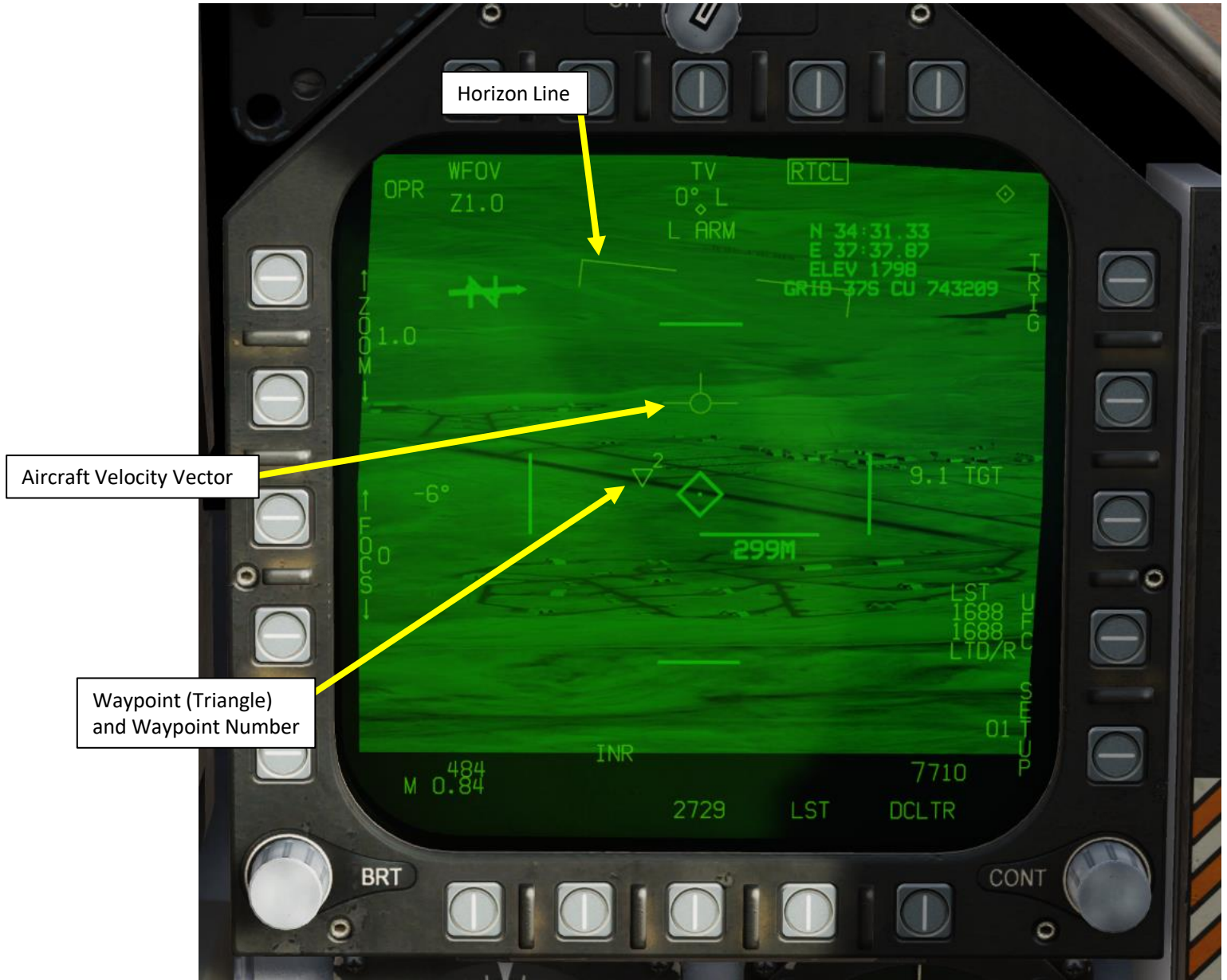
Contrast Control

FLIR WHT/BLK (White-Hot/Black-Hot) Option Button

ALG (Automatic Level & Gain) Control Option

Laser Spot Search (LSS) Mode Selector Button
Targeting pod searches for a laser code of either a JTAC or someone else's targeting pod laser (buddy lasing).

4 - AN/ASQ-228 ATFLIR TGP
4.2 – DISPLAYS



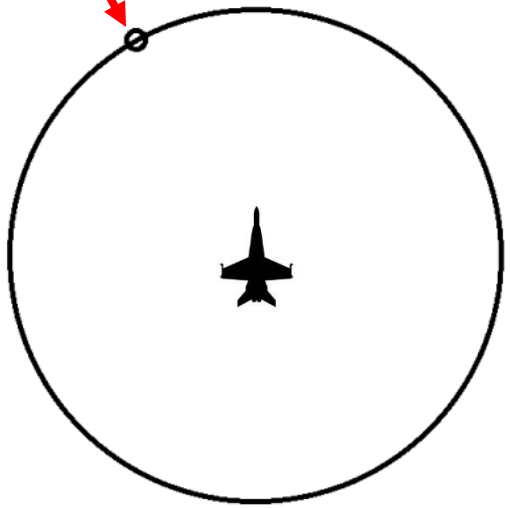
4 - AN/ASQ-228 ATFLIR TGP
4.2 – DISPLAYS

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



Situational Awareness Cue (Targeting Pod View Relative Direction)





4 - AN/ASQ-228 ATFLIR TGP
4.2 – DISPLAYS

From the FLIR page, you can access the SETUP menu by pressing the button next to SETUP.



Access SETUP Menu



Coordinates Option
Cycles between the display options for the coordinates datablock: ALL (latitude/longitude, elevation, and MGRS), L/L (latitude/longitude and elevation), GRID (elevation and MGRS) and OFF.

Eye Safe Laser Option
Boxing this option sets the LTD/R laser power to an eye-safe level suitable for training.
Not implemented.

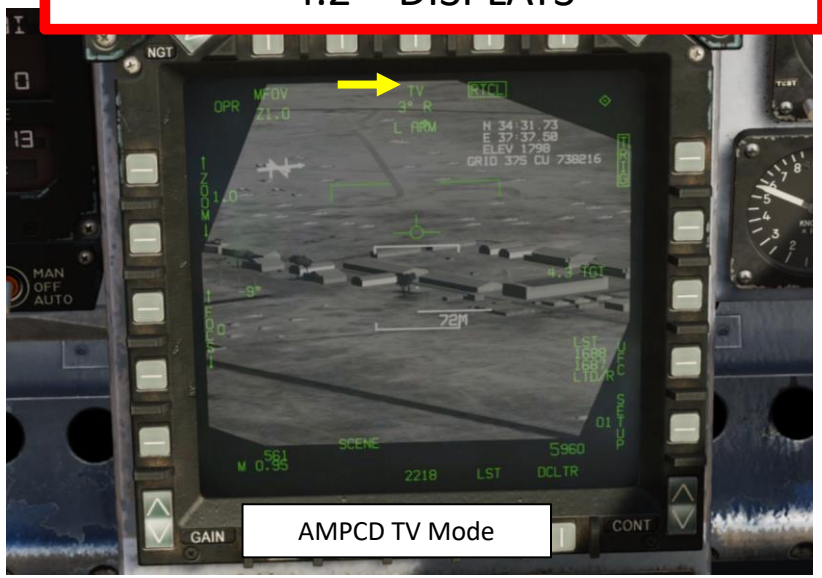
Transfer Alignment Mode
When boxed, the primary transfer alignment mode (transfers aircraft position and velocity) is used. When unboxed, the reversionary transfer alignment mode (transfers aircraft position only) is used.
Not implemented.

Re-Initialize Alignment Option
Restarts the transfer alignment process.
Not implemented.

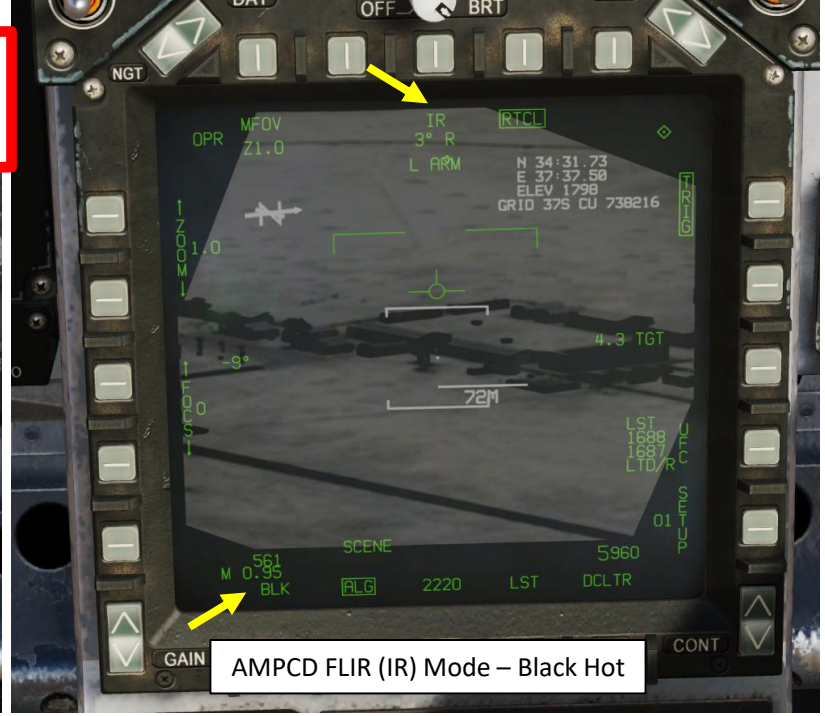
Calibrate Video Option

Grayscale
A static grayscale image. Can be used when manually setting level and gain.

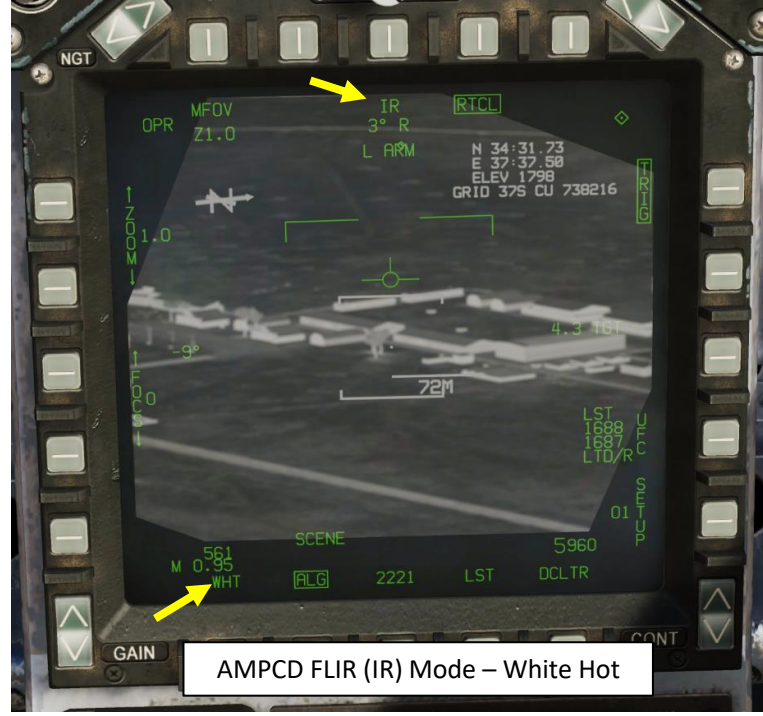
4 - AN/ASQ-228 ATFLIR TGP
4.2 – DISPLAYS



AMPCD TV Mode



AMPCD FLIR (IR) Mode – Black Hot



AMPCD FLIR (IR) Mode – White Hot



DDI TV Mode



DDI FLIR (IR) Mode – Black Hot



DDI FLIR (IR) Mode – White Hot

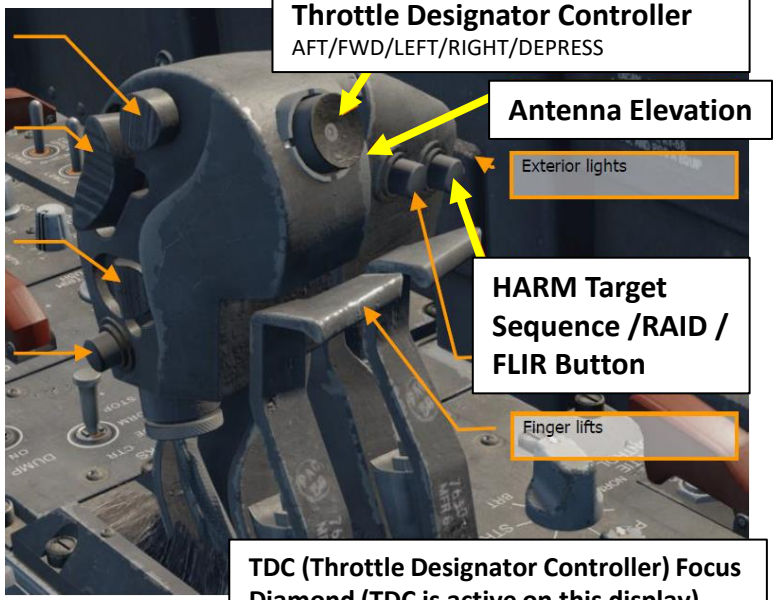
4 - AN/ASQ-228 ATFLIR TGP
4.3 – CONTROLS

Some useful HOTAS functionalities when using the targeting pod:

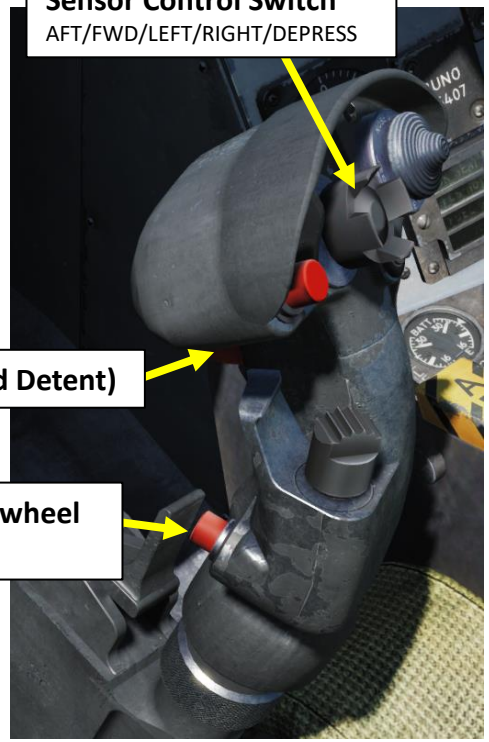
- **Sensor Control Switch Directions**: Selects which display is used to slew the targeting pod view with the TDC (Throttle Designator Controller). The Select Focus Diamond indicates what display is selected.
- **Sensor Control Switch Held Towards Selected Display**: Toggles between AUTO Track (tracks an object like a high-contrast vehicle) and SCENE Track (used for static targets).
- **Radar Elevation Control:** cycles both field-of-view and zoom level (can also be controlled directly from the DDI/AMPCD FLIR page)
- **RAID/FLIR Field-of-View Select Button Short Hold**: Toggles Wide/Narrow/Medium field-of-view
- **RAID/FLIR Field-of-View Select Button Long Hold**: Toggles TV and FLIR (IR, Infrared) modes
- **Throttle Designator Controller (TDC) Up/Down/Left/Right**: Slews targeting pod reticle
- **Throttle Designator Controller (TDC) Depressed**: Designates the point under the targeting pod crosshairs as the target when targeting pod is either in VVSLV or in Snowplow mode.
- **Nosewheel Steering Button**: Undesignates target, can toggle between VVSLV and Snowplow pointing modes
- **Gun Trigger (Second Stage)**: Fires laser if TRIG mode is boxed on the FLIR page.

A/G Master Mode Button
(required to use laser)





Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS



Gun Trigger (Second Detent)

Undesignate / Nosewheel Steering Button

TDC (Throttle Designator Controller) Focus Diamond (TDC is active on this display)



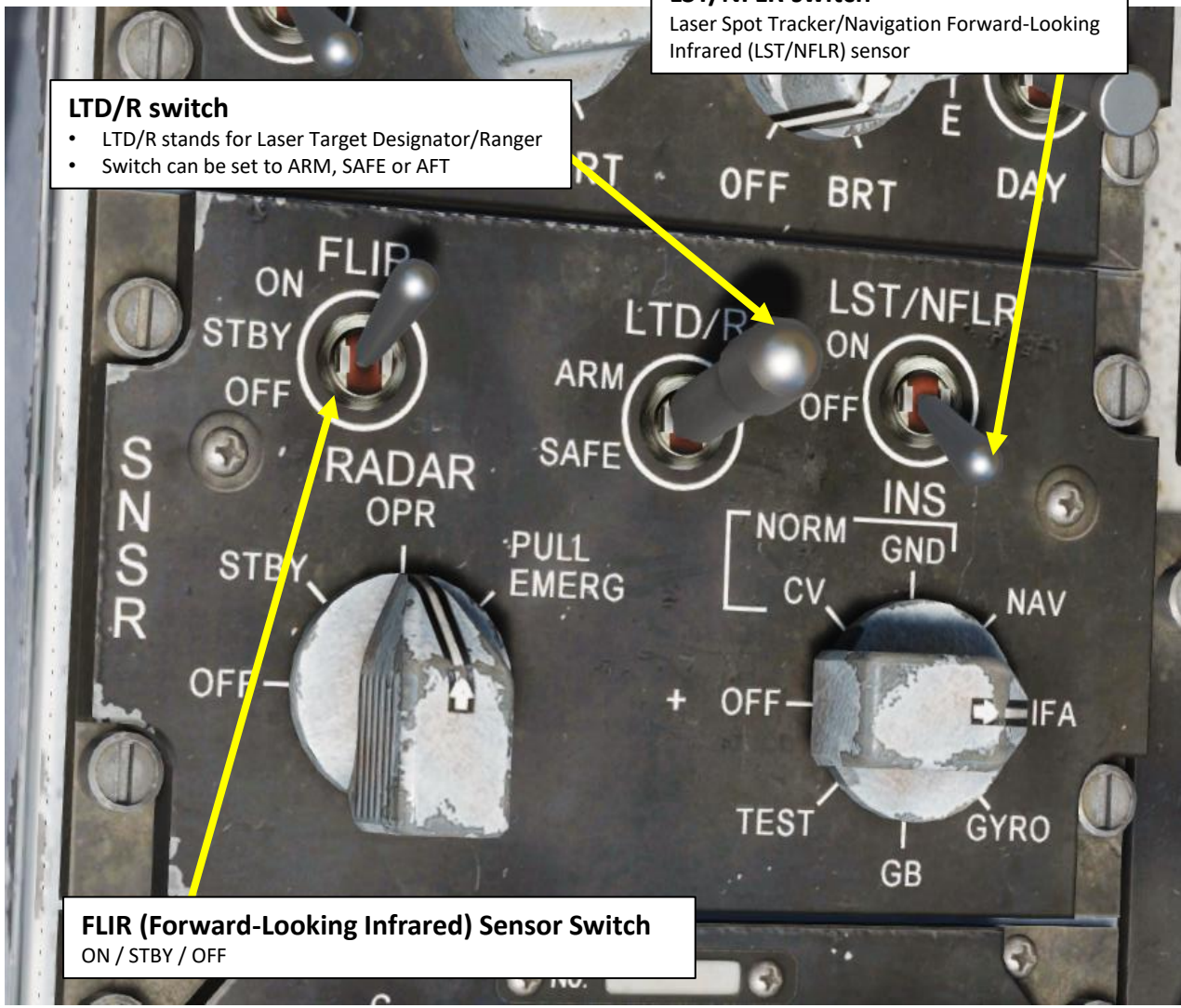
4 - AN/ASQ-228 ATFLIR TGP
4.3 – CONTROLS

Targeting Pod Page
OSB (Option Select Buttons) can be used to select various options or settings



LST/NFLR switch
Laser Spot Tracker/Navigation Forward-Looking Infrared (LST/NFLR) sensor

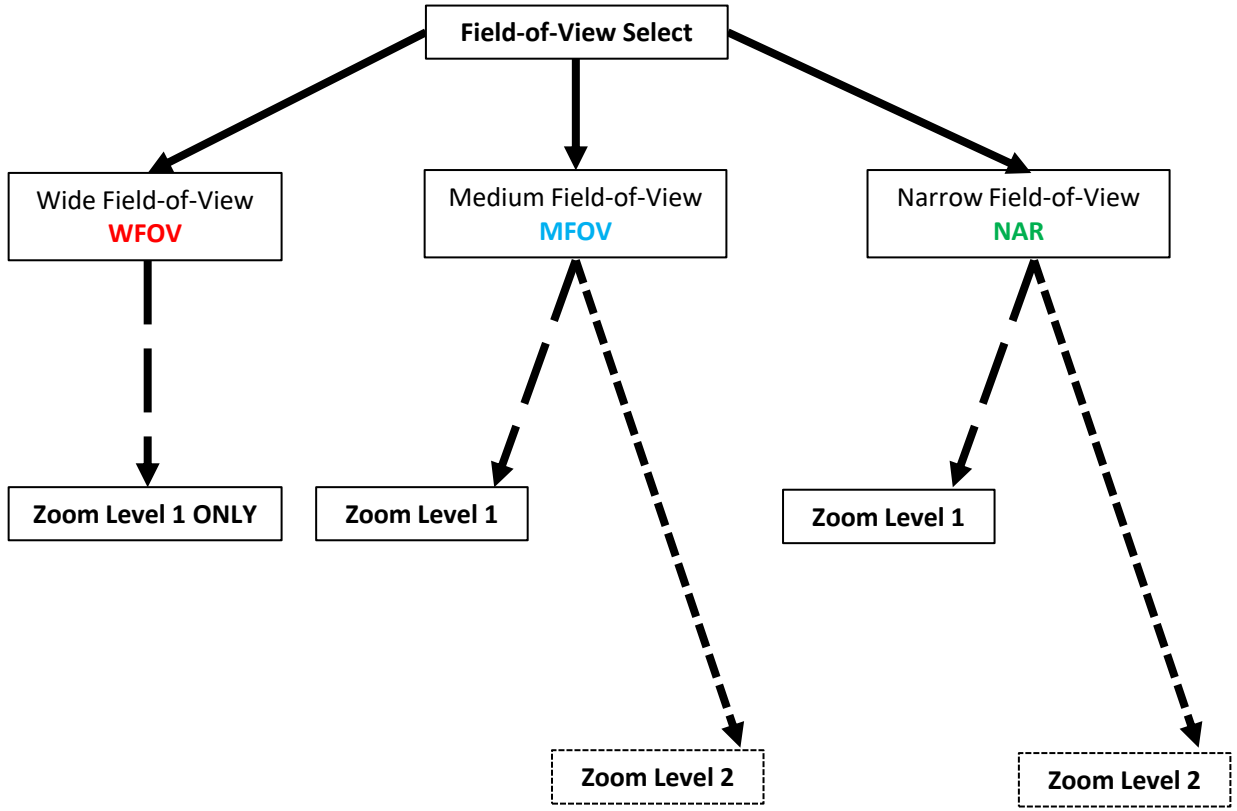
LTD/R switch
- LTD/R stands for Laser Target Designator/Ranger
- Switch can be set to ARM, SAFE or AFT



FLIR (Forward-Looking Infrared) Sensor Switch
ON / STBY / OFF

4 - AN/ASQ-228 ATFLIR TGP
4.3 – CONTROLS

Take note that Zoom levels available are different based on what FOV (Field-of-View) Setting is selected.



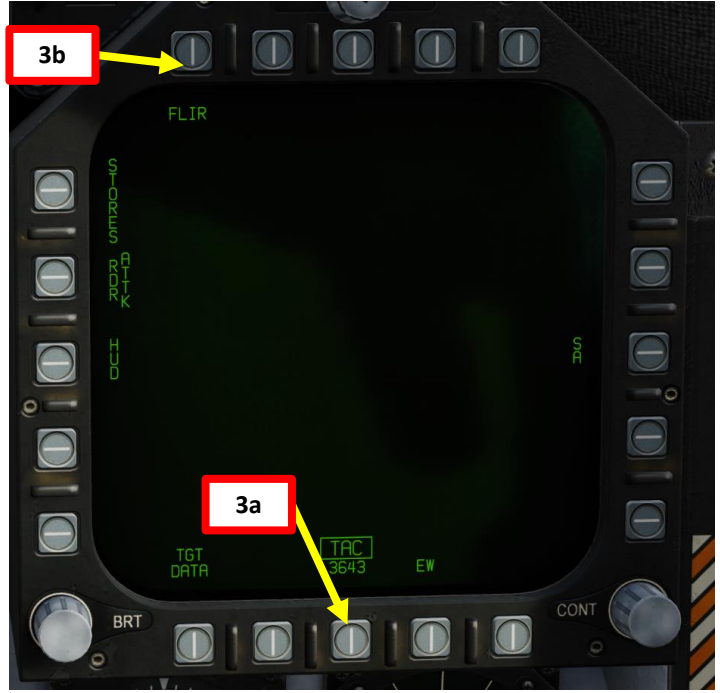
Field of View (FOV) Setting
- MFOV: Medium
- WFOV: Wide
- NAR: Narrow



Zoom Control and Setting (1 through 2)
Only functions with Wide and Medium FOV

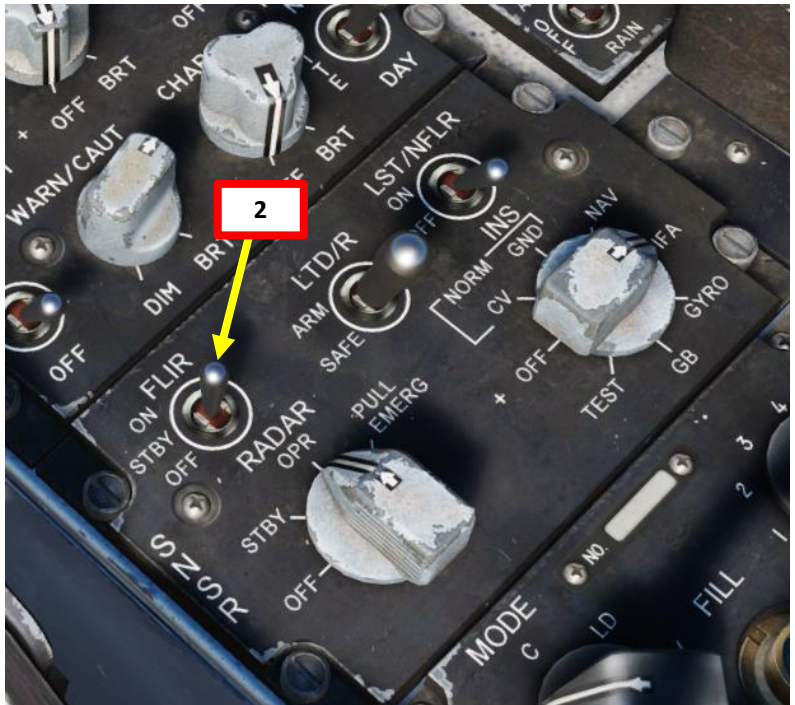
4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE

1. Press A/G Master Mode. This will allow you to arm the laser designator.
2. To power up the targeting pod, set FLIR Sensor Switch to STBY (Right Click).
3. From the TAC page on either DDI or the AMPCD, press the OSB (Option Select Button) next to “FLIR” (Forward-Looking Infrared) to select the Targeting Pod feed page.
4. Monitor the warm-up process. Targeting pod warm-up process will take about 2 minutes.
5. When targeting pod is ready to be used, the pod status will switch from ~~RDY~~ – NOT TIMED OUT to STBY (Standby).









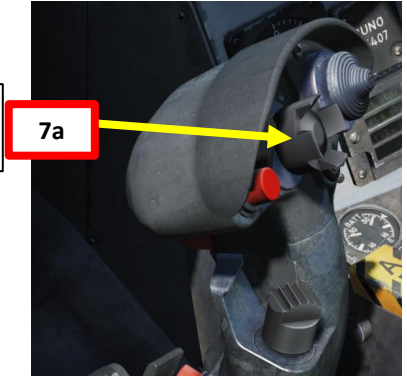


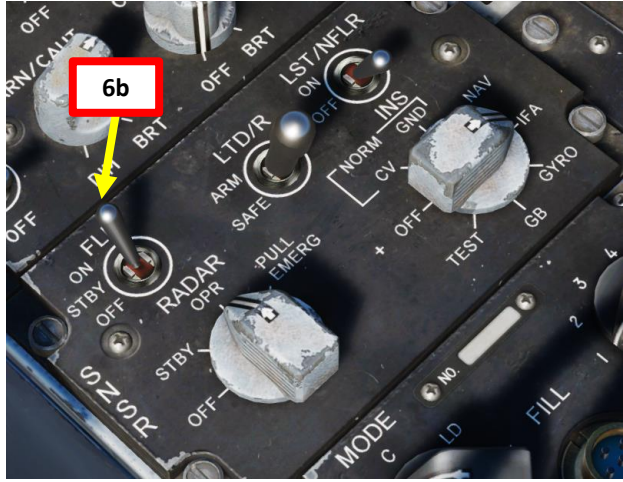
4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE

6. Set FLIR Sensor Switch to ON (Right Click). Confirm that Targeting Pod mode switches from STBY to OPR (Operate).
7. Press the Sensor Control Switch in the direction of the selected DDI (Right for the Right DDI as an example). The Select Focus Diamond indicates what display is selected.

Sensor Control Switch
AFT/FWD/LEFT/RIGHT

7a







TDC (Throttle Designator Controller) Focus Diamond (TDC is active on this display)

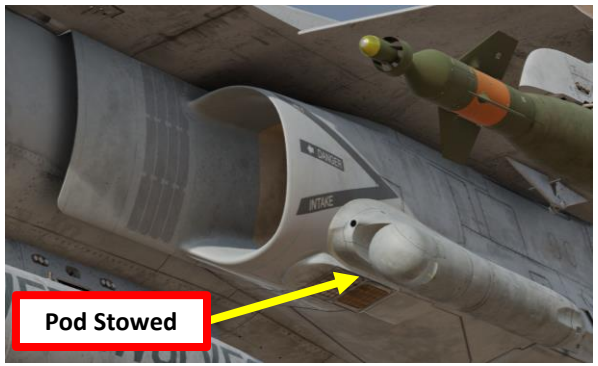
7b



4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE

8. Press the Undesignate button twice rapidly to select VVSLV (Velocity Vector Slaved) mode. This will un-stow the camera and slave the targeting pod to the velocity vector.
    - Alternatively, you can press the OSB next to VVSLV (boxed when selected).
9. Press the Undesignate button twice rapidly again to select Snowplow mode. When Snowplow mode is first entered, the FLIR is set to 0° left/right and -8° down.
    - Alternatively, you can press the OSB next to VVSLV to de-select VVSLV and use Snowplow mode (un-boxed when Snowplow is selected)
10. Adjust DDI (Digital Display Indicator) contrast and brightness as required
11. Set LTD/R (Laser Target Designator/Ranger) switch to ARM. This will arm the laser. Confirm that L ARM indication is displayed on the FLIR page.









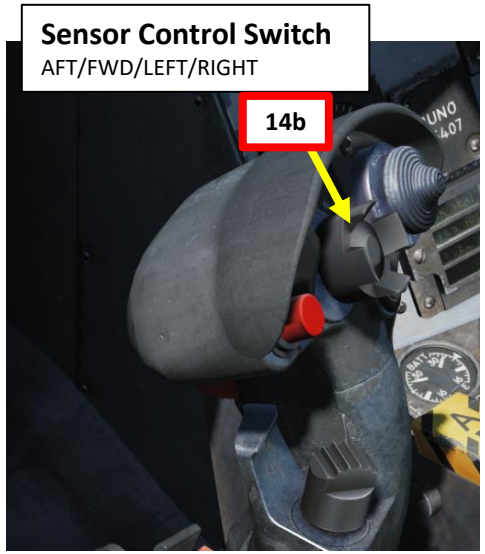


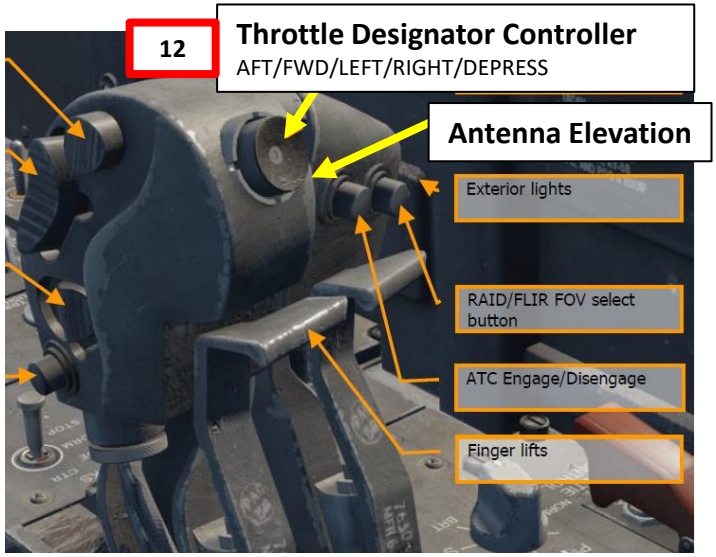


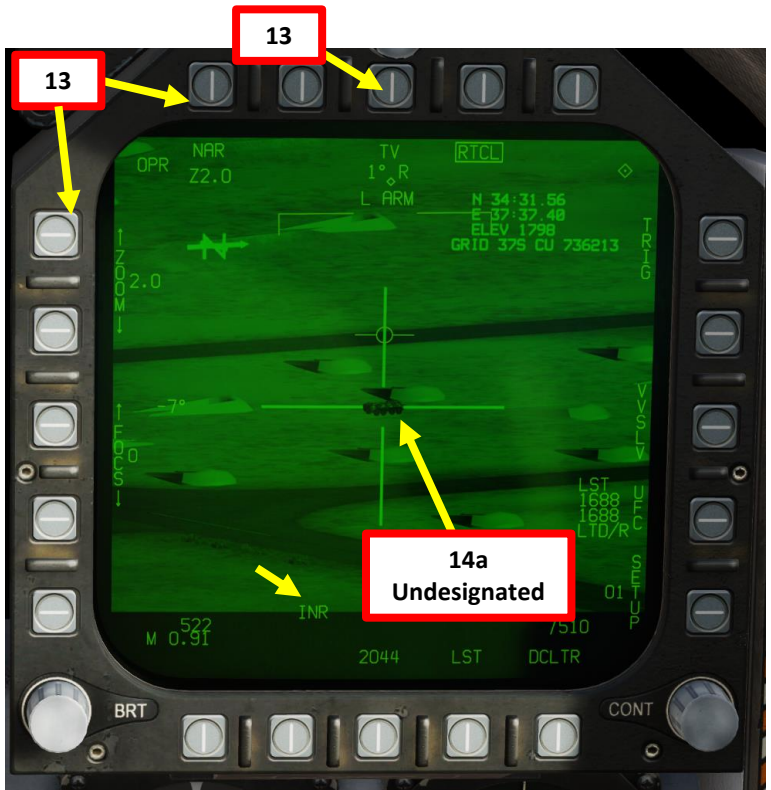


4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE

12. Using the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls, slew the targeting pod reticle over the desired target.
13. Use appropriate zoom level, field of view (NARROW/WIDE/MEDIUM) and camera mode (TV or FLIR) to identify the target.
14. Press the Sensor Control Switch Towards Selected Display (Right if our right DDI is selected) to toggle between Auto Track (similar to Point Track, tracks a moving object like a high-contrast vehicle) and SCENE Track (similar to Area Track, used for a static target).





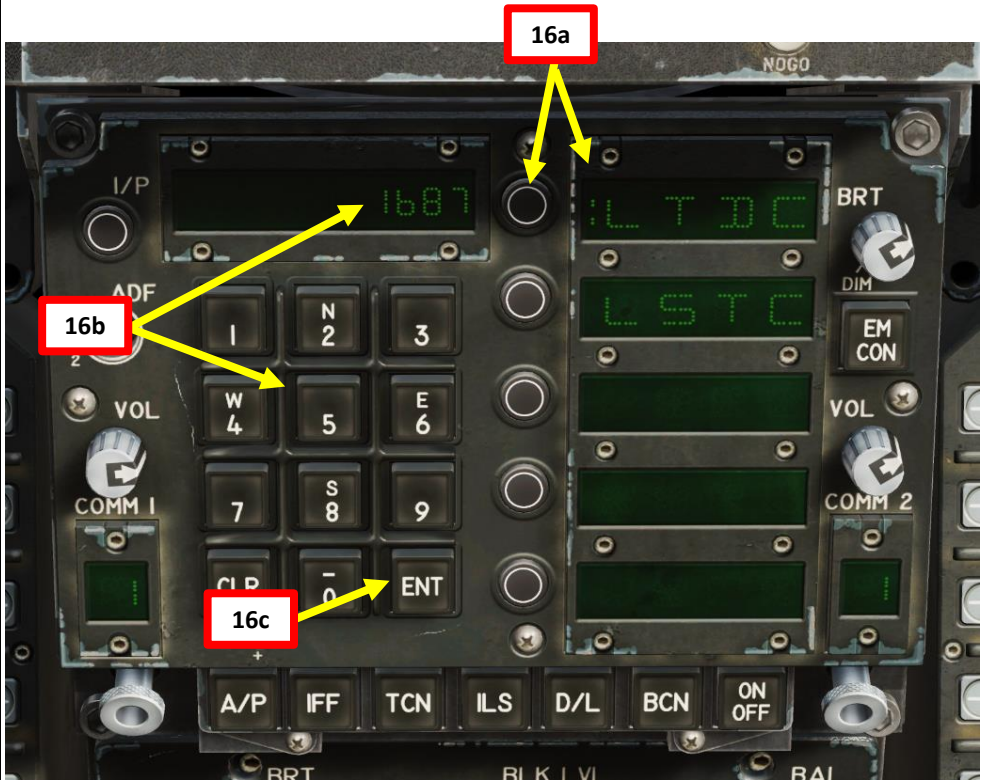


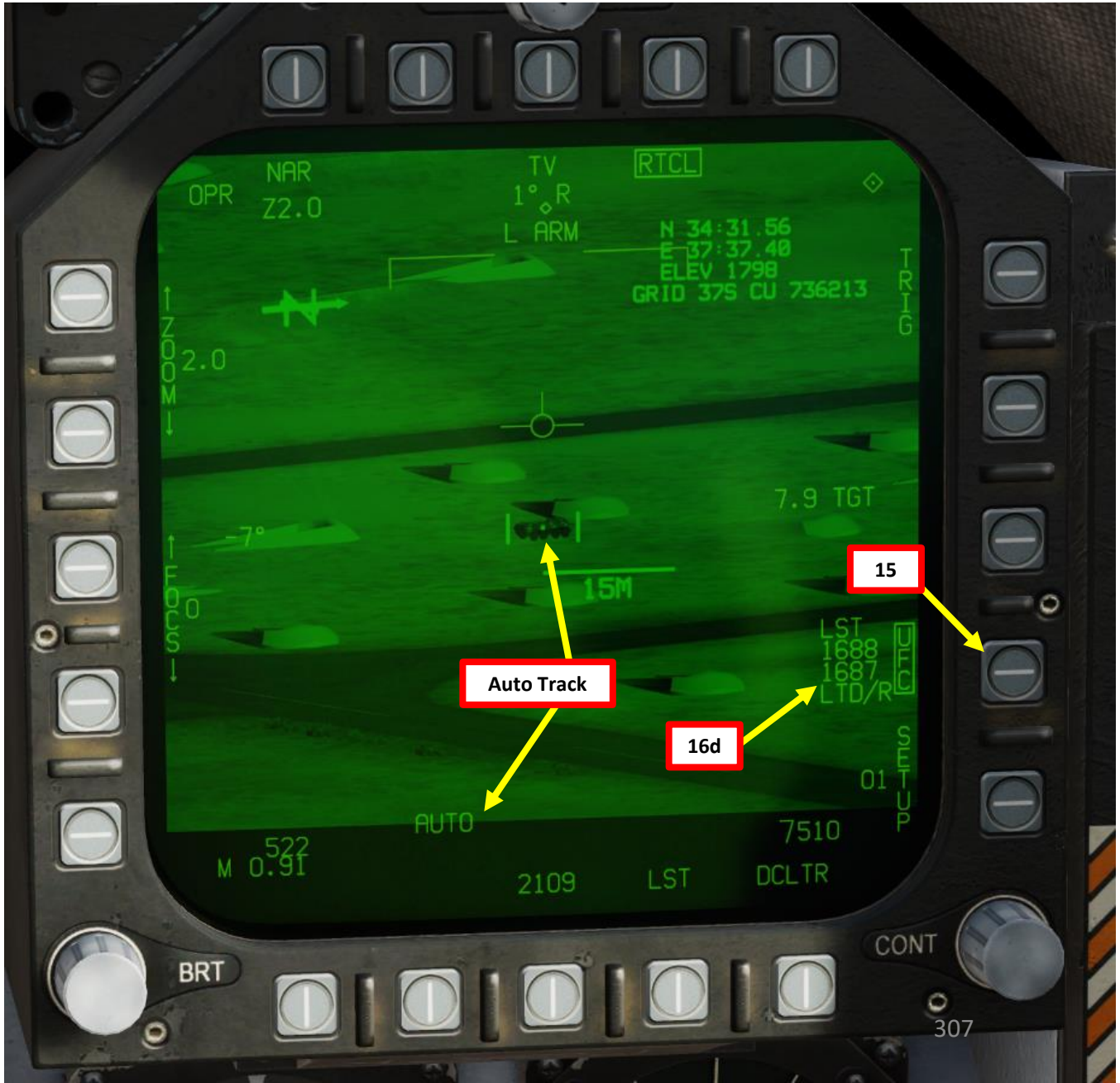




4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE

15. Press the OSB next to “UFC” to set the Targeting Pod laser code on the Up-Front Controller.
16. Press the button next to “LTDC” (Laser Target Designator Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose a laser code of 1687.

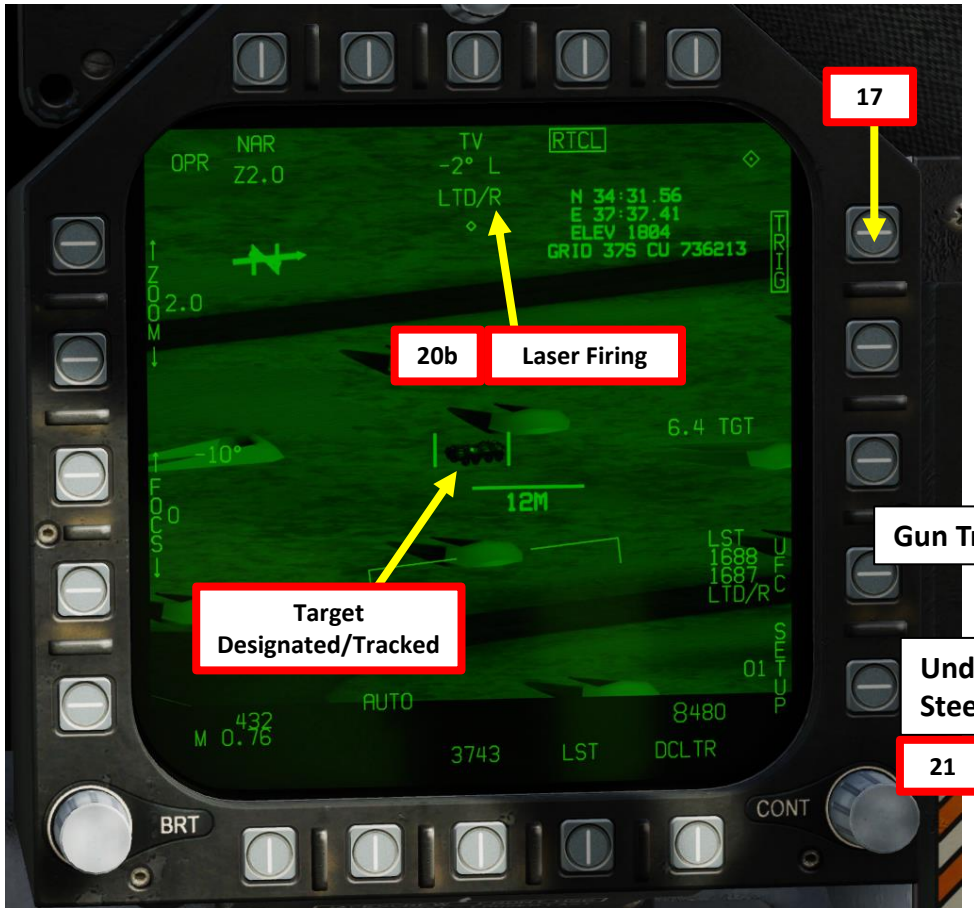


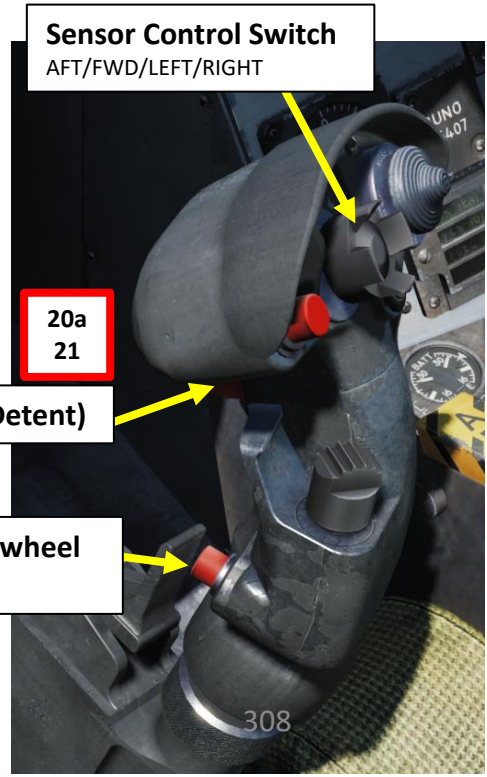


4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE

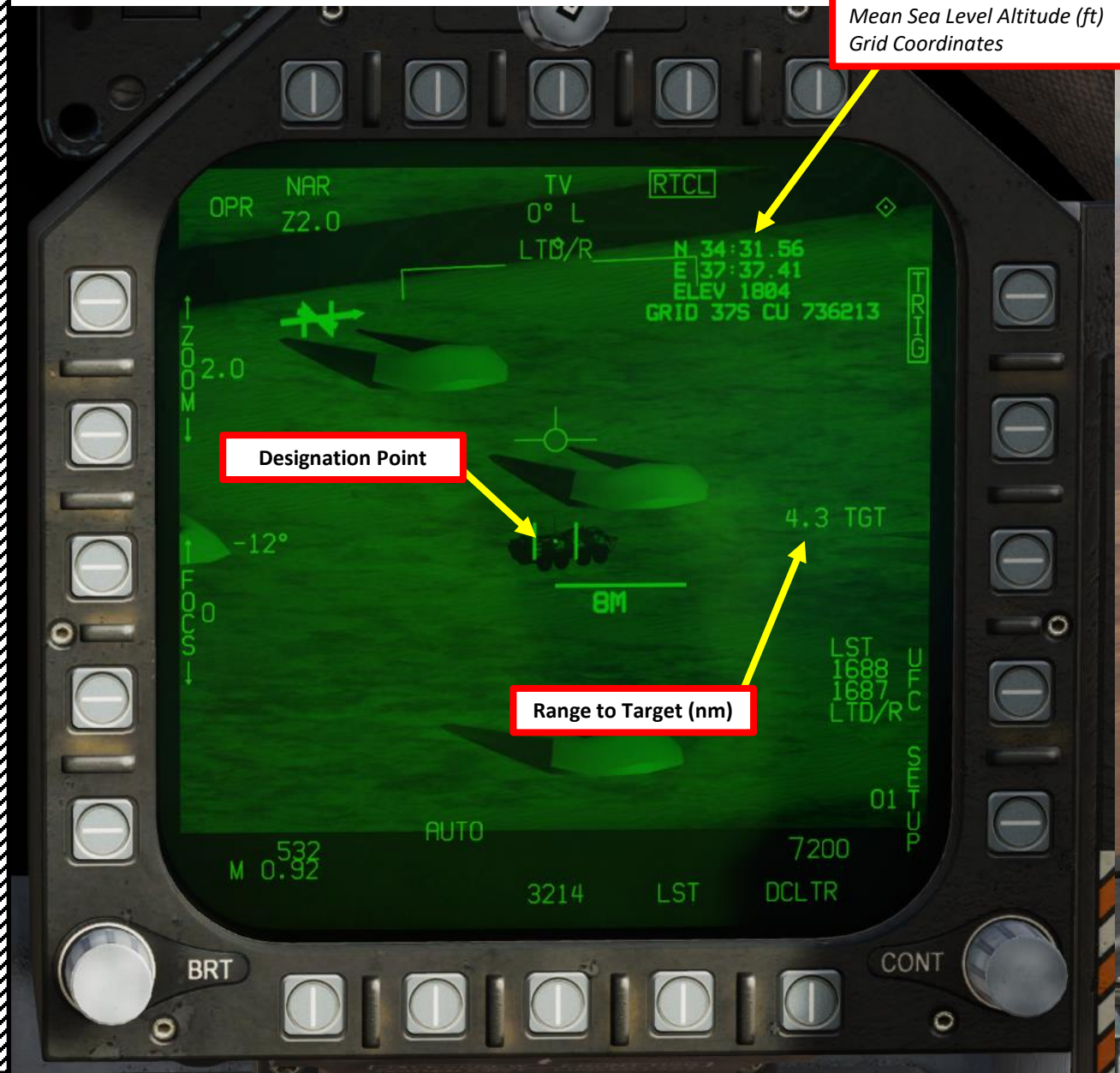
17. Press the OSB next to “TRIG” if you want to use the laser manually. The indication will become boxed once selected, which means that a gun trigger press will fire the laser. This step is required if you are “buddy lasing” (using your own laser for someone else to use).
    - If TRIG remains unboxed, the laser is in Automatic mode. The laser will automatically fire a few seconds before the laser-guided ordnance reaches the target.
18. When either Scene Track or Auto Track is performed, the target point is automatically designated. Air-to-ground weapons will be slaved to what the targeting pod is tracking and, incidentally, where the laser is firing.
19. You may now launch laser-guided weapons as per their release procedure.
20. If TRIG option is selected (boxed), press and hold the gun trigger to fire laser. Once laser is firing, the laser mode will switch from L ARM to LTD/R. If TRIG option is not selected (unboxed, AUTO lasing), the laser will automatically fire a few seconds before the ordnance reaches the target.
21. When desired, press the Gun Trigger a second time to stop firing the laser. You can use the Undesignate/Nosewheel Steering button to undesignate the target.







4 - AN/ASQ-228 ATFLIR TGP
4.4 – START-UP & LASING PROCEDURE



Designation Point
Coordinates (North/South)
Coordinates (East/West)
Mean Sea Level Altitude (ft)
Grid Coordinates

Designation Point

Range to Target (nm)



Targeting Pod Designation Point

Sensors are slaved to the Targeting Pod (FLIR, Forward-Looking Infrared)

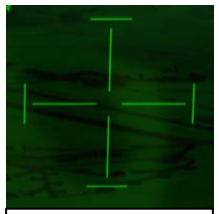
Range to Target (nm)

4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.1 - Overview

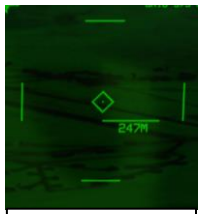
There are a few methods to point a target with the targeting pod.

- **Velocity Vector Slaved** mode has the FLIR slaved to the line of sight to the velocity vector.
- **Snowplow** mode is the default mode when no Target designation exists.
- **Stabilized Pointing Mode** is entered when a Target is designated from Snowplow or is cycled from Auto Track or Point Track
- **Waypoint Slaving** (TGP snaps to a selected navigation waypoint) is available using the Horizontal Situation Indicator page (see relevant section).
- **Scene Track** is used to keep track of a specific area (similar to Area Track in the LITENING II). This is best used for buildings of fixed targets. Scene Track can be set from any other pointing method.
- **Auto track** is used to keep track of a specific moving point (similar to Point Track in the LITENING II). This is best used for moving targets. Auto track can be set from any other pointing method.
- **INR (Inertial) / Stabilized Pointed** mode is active while the targeting pod is being slewed. It maintains pod orientation relative to the aircraft by using inertial rate data from the aircraft.

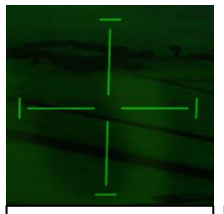
FLIR Reticles (with Wide, Medium and Narrow Field-of-View)



Undesignated WFOV



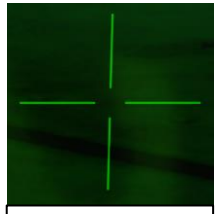
Designated WFOV



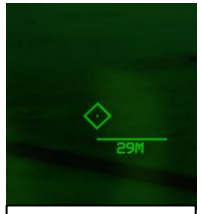
Undesignated MFOV



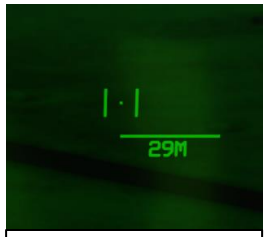
Designated MFOV



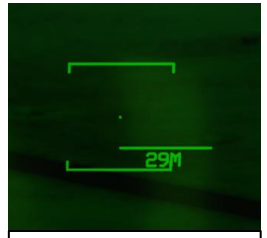
Undesignated NAR



Designated NAR



AUTO Track



SCENE Track



Slaved to Waypoint

1. *WYPT OSB (Option Select Button) selected on the HSI (Horizontal Situation Indicator)*
2. *Desired waypoint is selected*
3. *WPDSG (Waypoint Designate) OSB selected*

Targeting Pod is Powered Up

VVSLV OSB selected from FLIR page or Undesignate Button pressed twice within 1 sec

VVSLV (Velocity Vector Slaved)

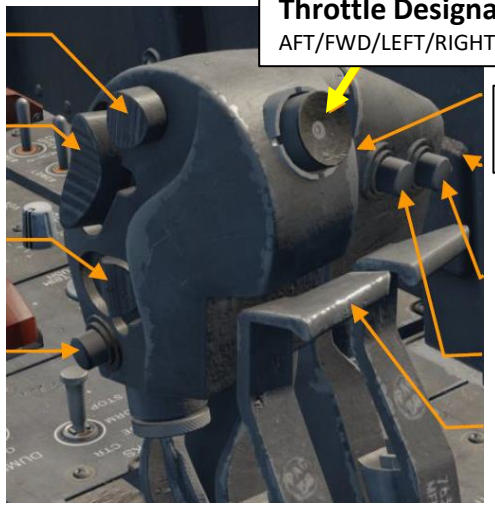
No Existing Target Designation or unselect VVSLV from FLIR page

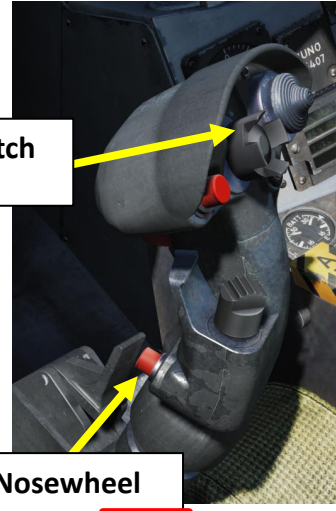
Snowplow Mode

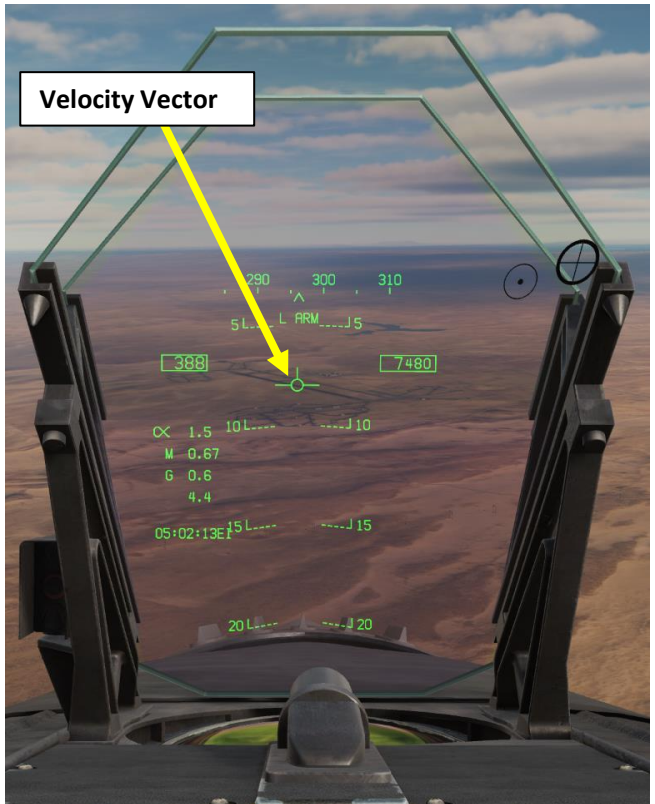
4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.2 - VVSLV (Velocity Vector Slaved)

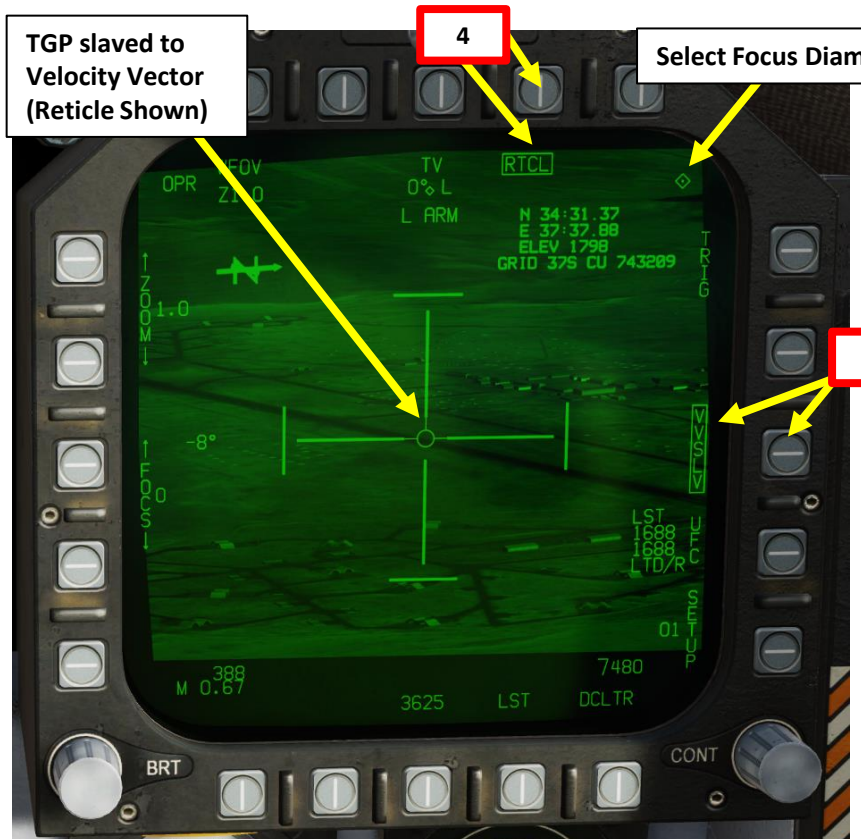
Velocity Vector Slaved mode has the FLIR slaved to the line of sight to the velocity vector.

- To select Velocity Vector Slaved mode:
  1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
  2. The Select Focus Diamond indicates what display is selected.
  3. Select VVSLV by either:
     a) Selecting the VVSLV pushbutton on the FLIR page, or;
     b) Pressing the Undesignate button twice within one second.
  4. Press OSB next to RTCL (boxed) to display the targeting pod's reticle
  5. To designate a target, fly the aircraft to set the velocity vector on the target, then use the TDC DEPRESS control ("ENTER"). A diamond will appear over the designated point on the FLIR page.





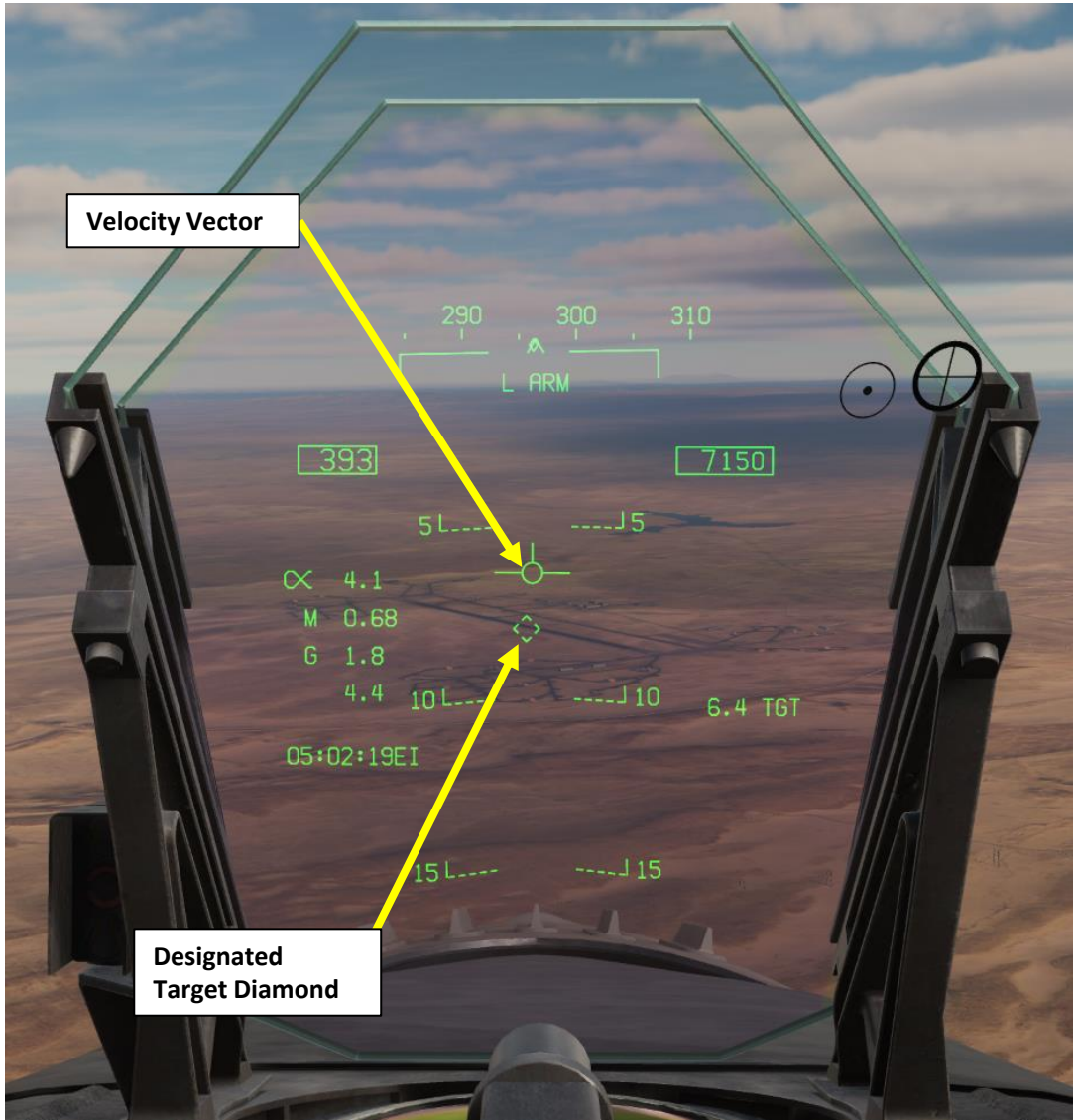






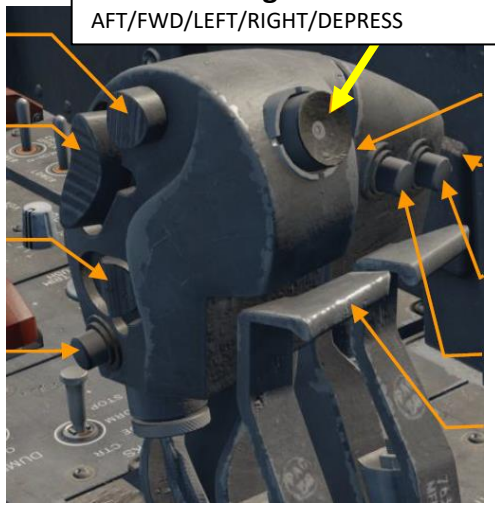
4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.2 - VVSLV (Velocity Vector Slaved)

When a target is designated, the targeting pod will track the designated point instead of the velocity vector. A designation diamond will then be visible on the Heads-Up Display.





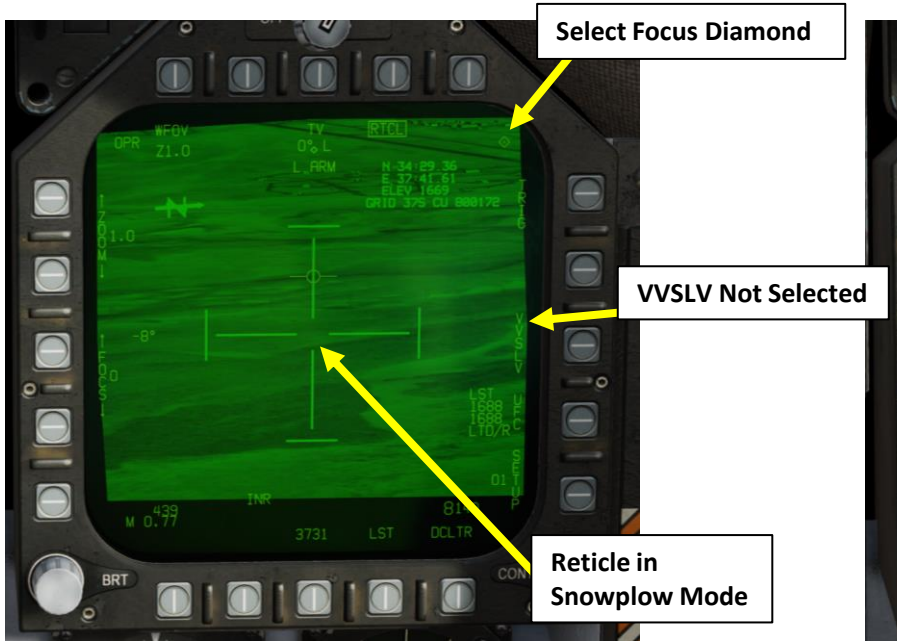
4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.3 - Snowplow



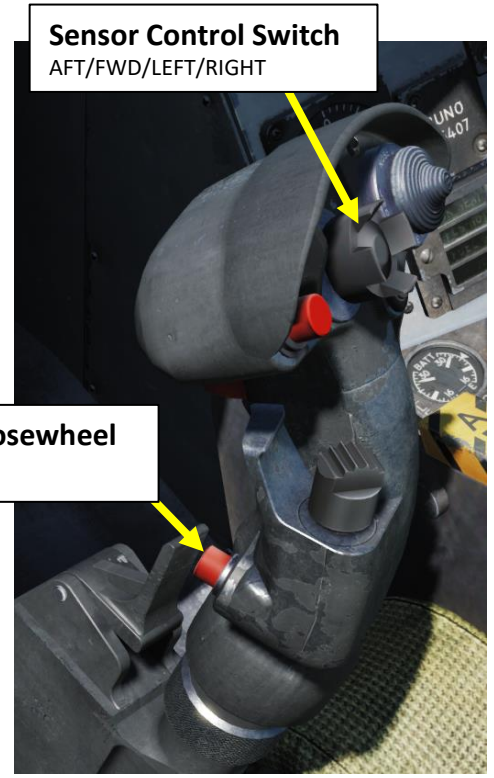
Snowplow mode is the default mode when no Target designation exists. However, when the targeting pod is first powered on, the VVSLV mode needs to be selected first, and only then can you switch to Snowplow. Snowplow mode is not stabilized to anything it is pointed at and slewing it changes the absolute position of the FLIR (Forward-Looking Infrared) relative to the pod.

- To slew the targeting pod:
  1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
  2. The Select Focus Diamond indicates what display is selected.
  3. Press the Undesignate button twice to select VVSLV mode.
  4. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
  5. When Snowplow is first entered, the FLIR is set to 0° left/right and -8° down.
  6. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target
  7. To **designate a target from Snowplow mode**, use the TDC DEPRESS control (“ENTER”). A diamond will appear over the designated point on the FLIR page and on the Heads-Up Display as well.

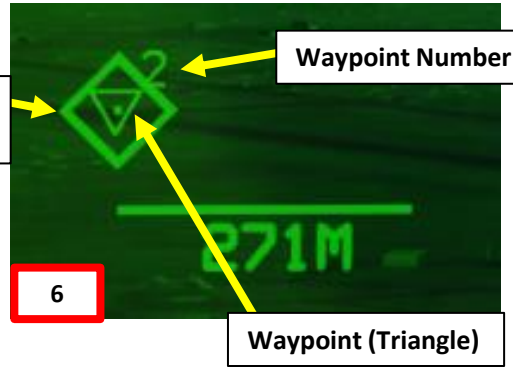
Stabilized Pointing Mode is entered when a Target is designated from Snowplow (including from a source other than the FLIR itself) or is cycled from Auto Track or Scene Track via the Sensor Control Switch. In this mode, the FLIR can be slewed freely and the designated target is constantly updated to its current location. When it is not being slewed, the FLIR stabilizes to whatever position on the ground it is pointed at.

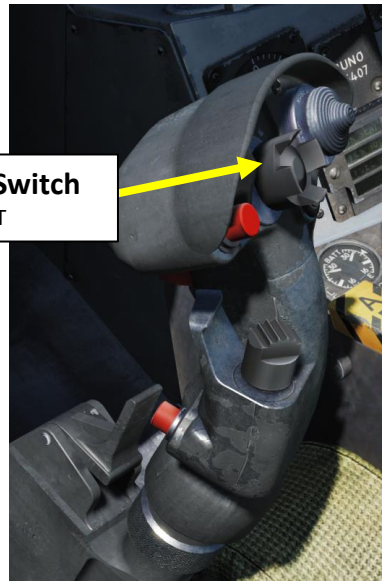






4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.4 - Waypoint Slaved

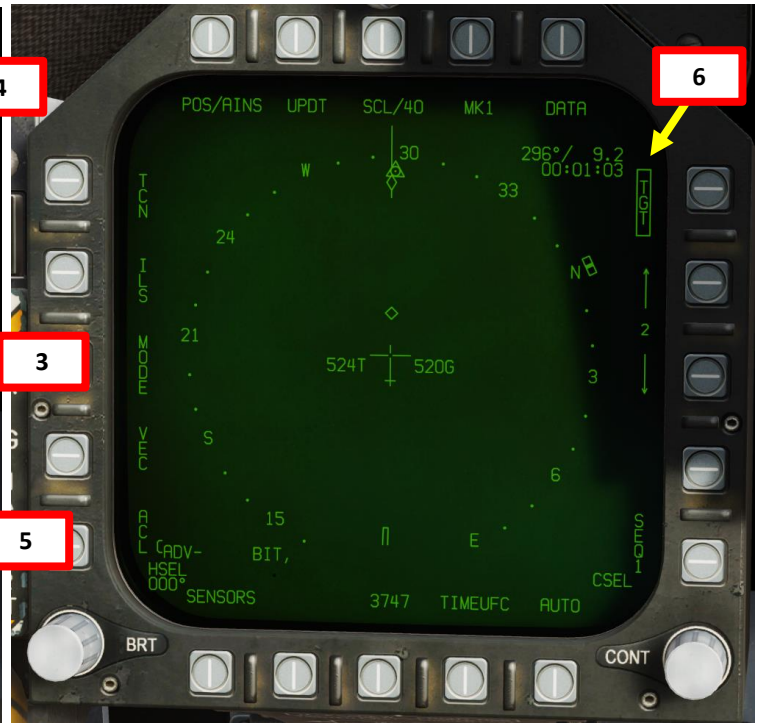


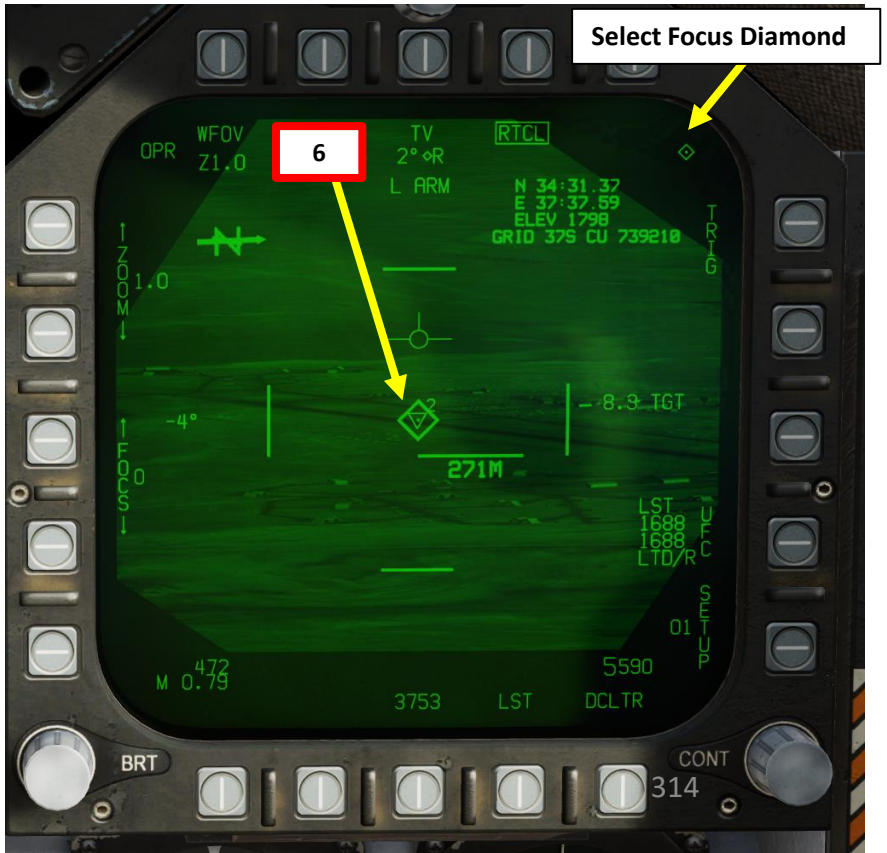


You can slave the targeting pod to an existing waypoint of your navigation database. Here's how:

1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
2. The Select Focus Diamond indicates what display is selected.
3. On HSI (Horizontal Situation Indicator) page, select desired waypoint using the OSBs (Option Select Button) next to UP or DOWN arrows.
4. Press OSB next to WYPT (boxed = selected)
5. Press on OSB next to WPSDG to designate waypoint as the target point (boxed = selected)
6. Targeting point will automatically slew to the selected waypoint.

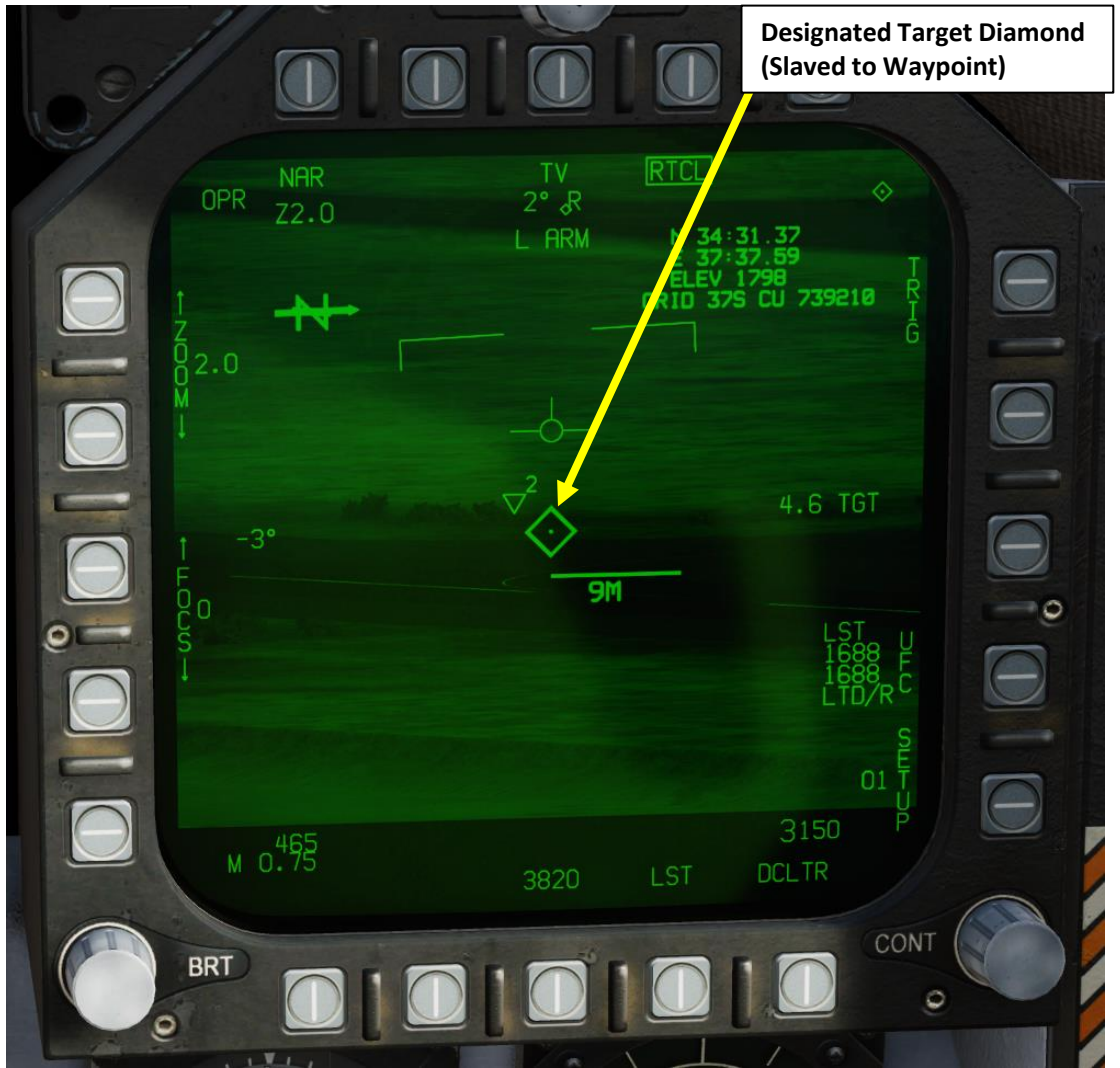


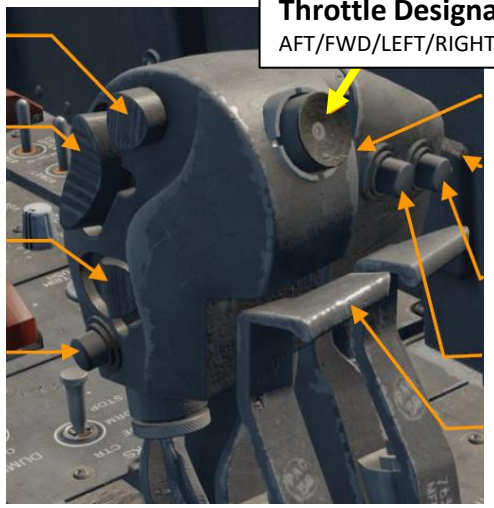


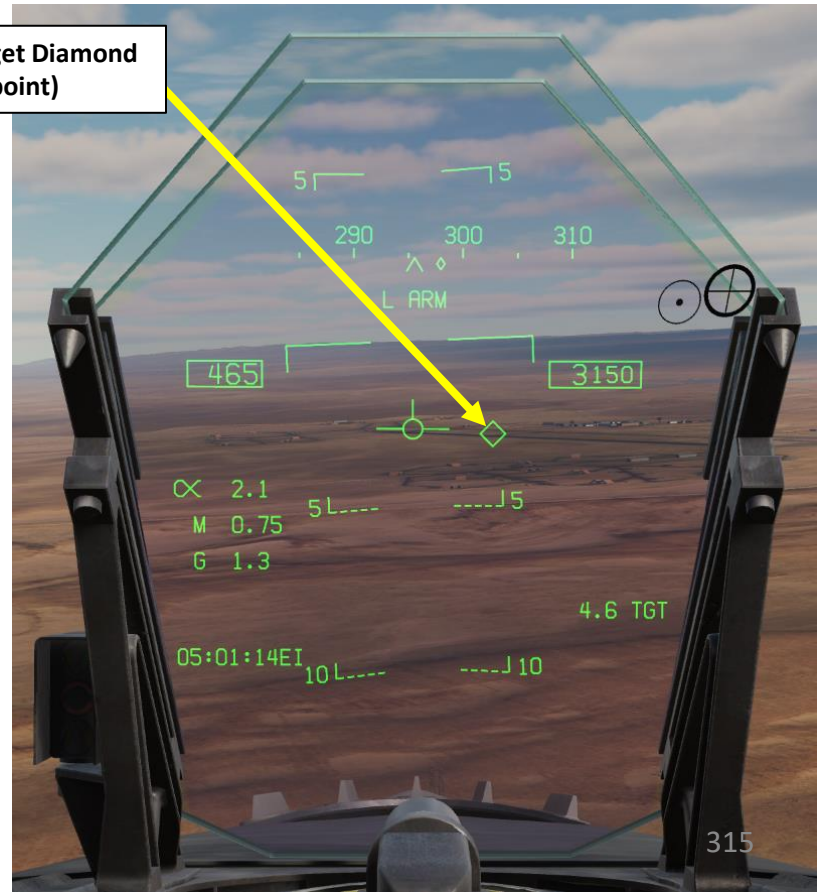


4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.4 - Waypoint Slaved

7. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target if adjustments are required.



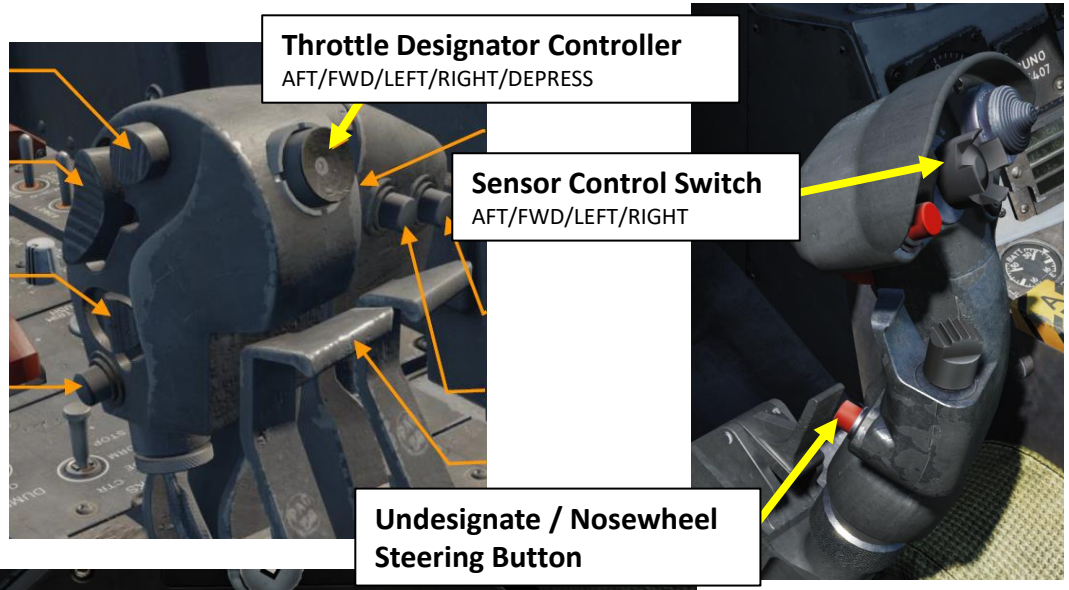




4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.5 – Scene Track & Auto Track

Scene Track (similar to Area Track) is entered by pressing the Sensor Control Switch in the direction of the FLIR format page. The FLIR is slaved to the static location of the Target. To select Scene Track:

1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
2. The Select Focus Diamond indicates what display is selected.
3. Press the Undesignate button twice to select VVSLV mode.
4. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
5. Press the Sensor Control Switch in the direction of the FLIR format page to toggle between Scene Track and Auto Track.
6. In Scene Track, the FLIR is slaved to the location of the "scene" (area). However, it the Scene Track reticle can still be slewed with TDC AFT/FWD/LEFT/RIGHT controls (INR SCENE when slewing).
7. Target is automatically designated by the targeting pod in Scene Track mode.
8. Pressing the Undesignate button once will revert back to Snowplow mode.



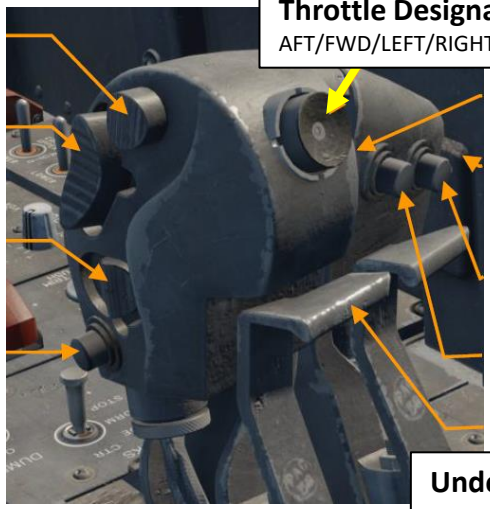




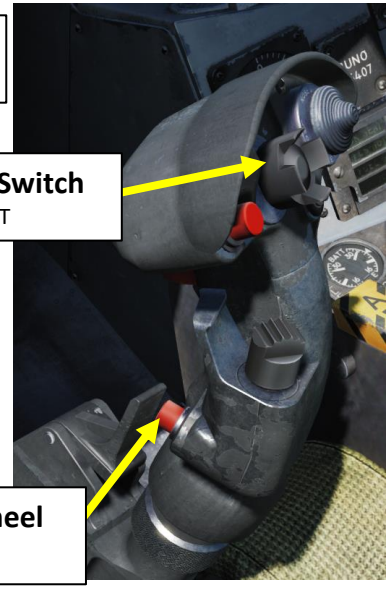
4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.5 – Scene Track & Auto Track

Auto Track (similar to Point Track) is entered by pressing the Sensor Control Switch in the direction of the FLIR format page. The FLIR tracks an object, including a moving one. To select Auto Track:

1. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
2. The Select Focus Diamond indicates what display is selected.
3. Press the Undesignate button twice to select VVSLV mode.
4. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
5. Press the Sensor Control Switch in the direction of the FLIR format page to toggle between Scene Track and Auto Track.
6. In Auto Track, the FLIR is slaved to the moving Target and cannot be slewed.
7. Target is automatically designated by the targeting pod in Auto Track mode.
8. Pressing the Undesignate button once will revert back to Snowplow mode.



Throttle Designator Controller
AFT/FWD/LEFT/RIGHT/DEPRESS



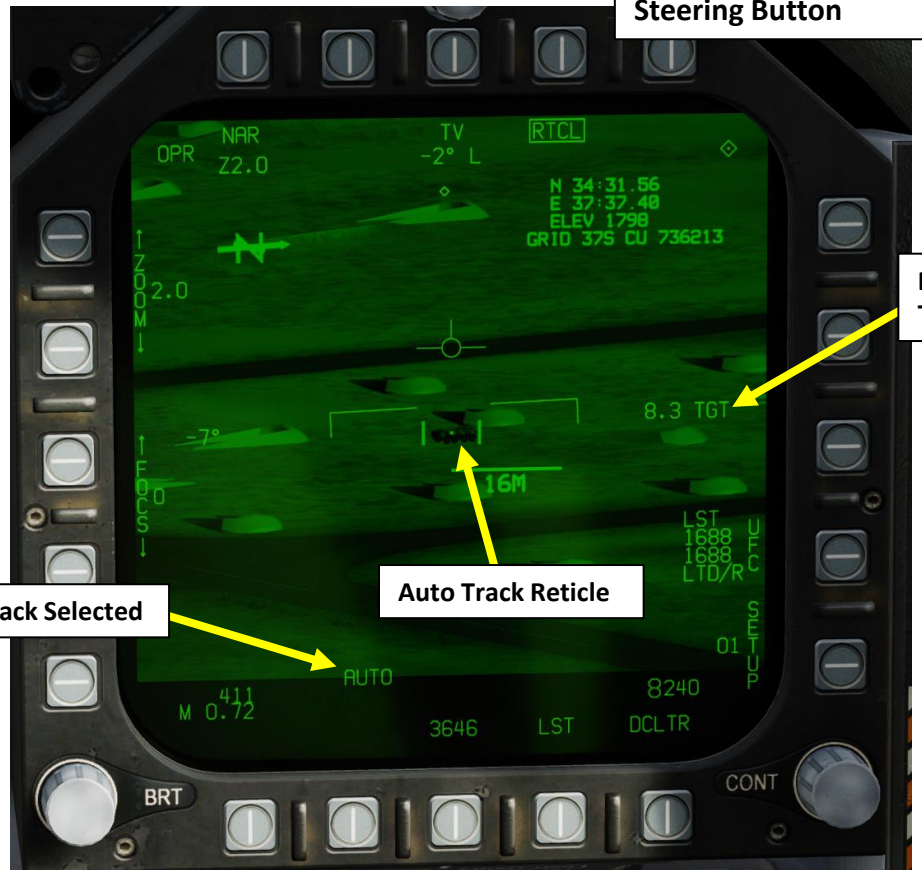
Sensor Control Switch
AFT/FWD/LEFT/RIGHT

Undesignate / Nosewheel Steering Button



Select Focus Diamond

Reticle in Snowplow Mode



Range to Designated Target (nm)

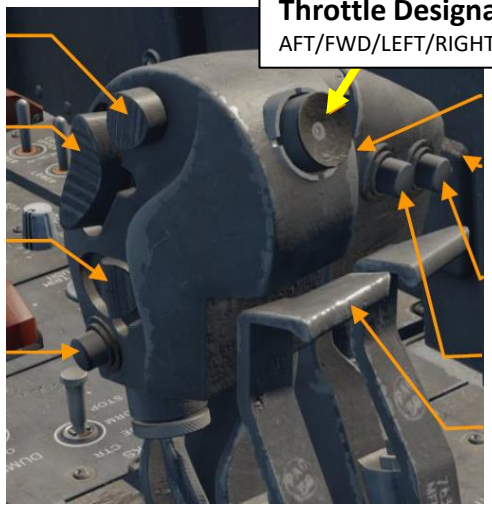
Auto Track Reticle

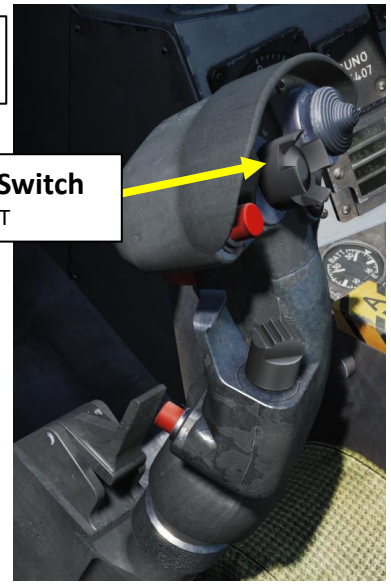
Auto Track Selected

4 - AN/ASQ-228 ATFLIR TGP
4.5 – POINTING METHODS
4.5.6 - Targeting Pod Offset

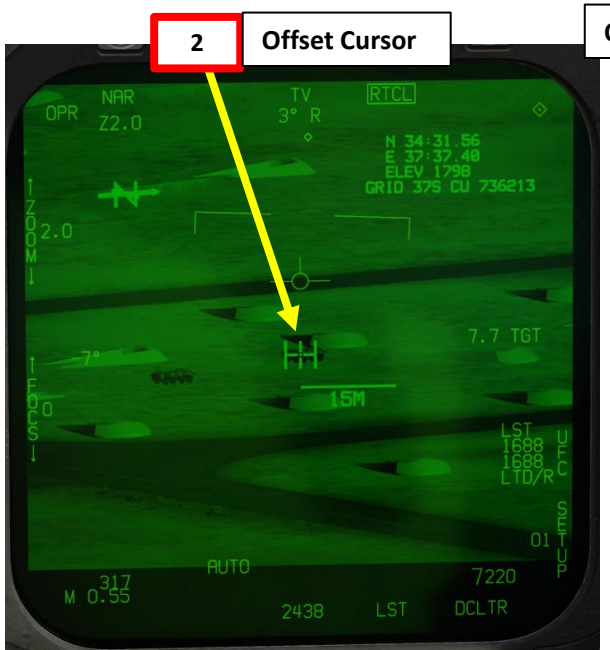
A useful offset function that comes with Auto Track is that you can "reset" the targeting pod to the Offset Cursor location. This allows you to not have to revert back to Snowplow mode and re-acquire the target, wasting precious time and situational awareness in the process.

1. In this example, we will start from a **Auto Track.** The targeting pod will be tracking a reference object.
2. Use the TDC DEPRESS control ("ENTER") to activate OFFSET function. A "+" cross (Offset Cursor) will appear at the center of the reticle.
3. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the Offset Cursor over the desired target.
4. Press the Sensor Control Switch in the direction of the FLIR format page to move the targeting pod to the location of the Offset Cursor.







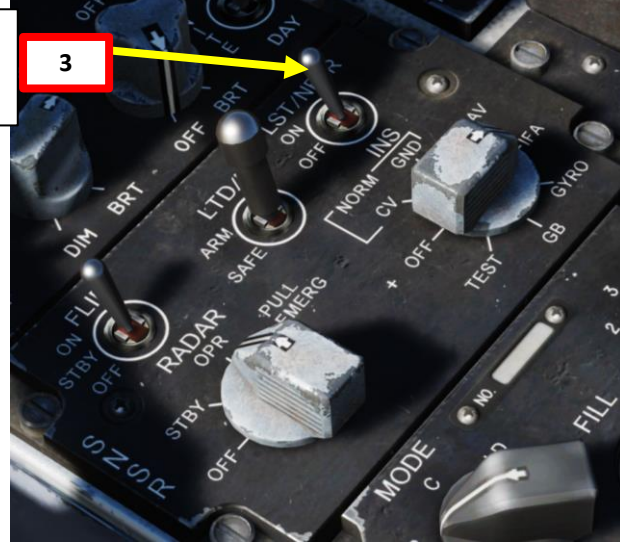






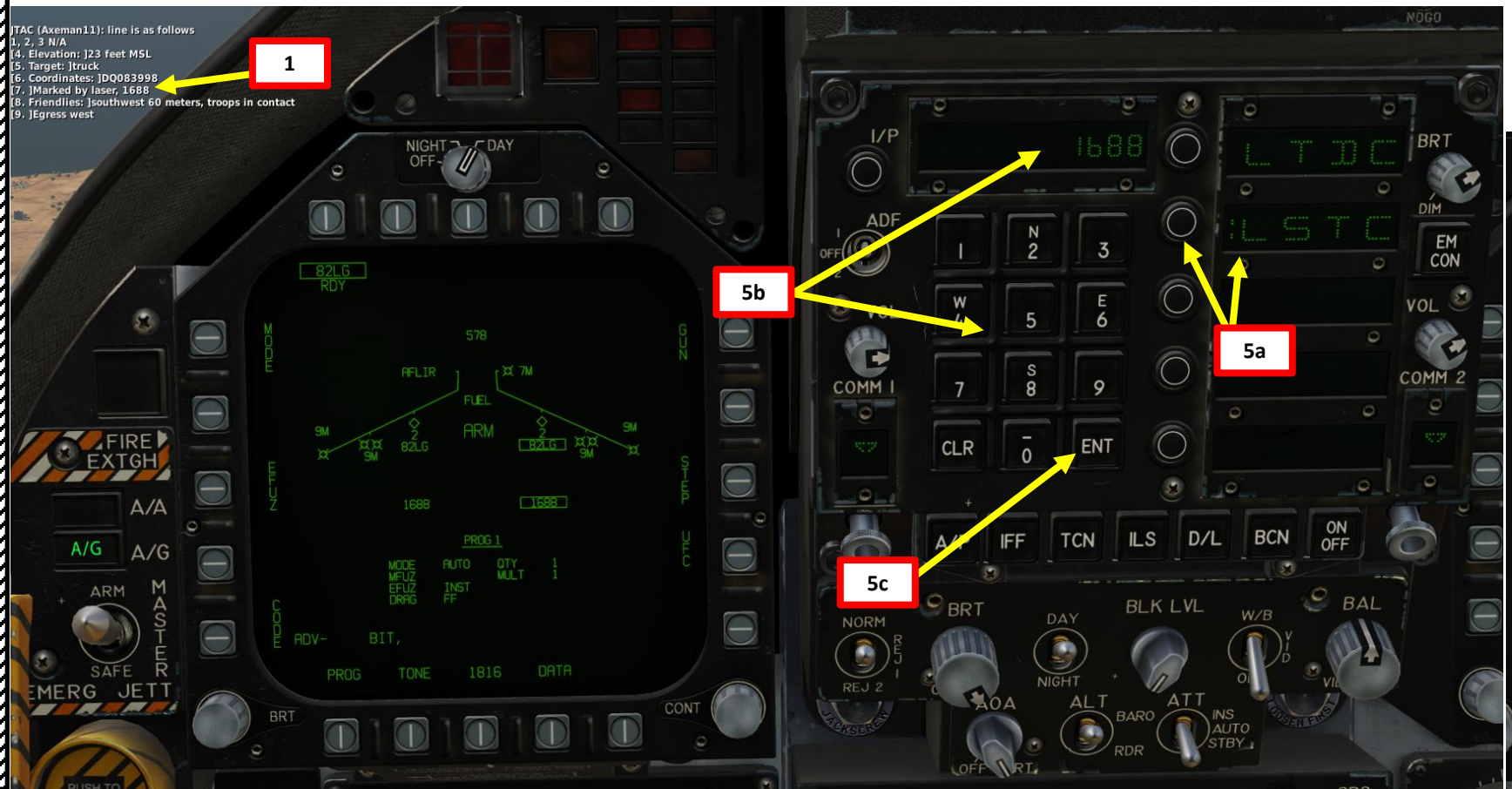
4 - AN/ASQ-228 ATFLIR TGP
4.6 – LASER SPOT TRACKER (LST) MODE

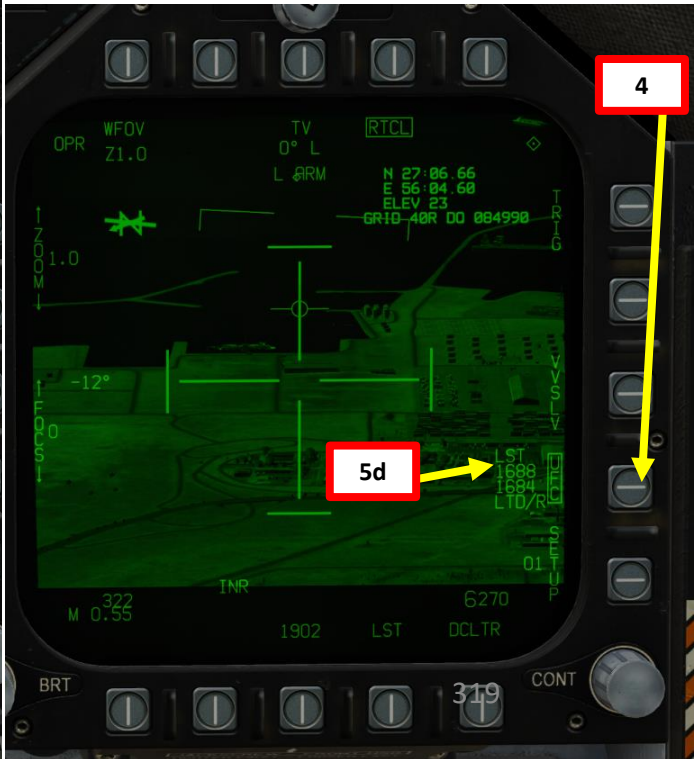
LST/NFLR switch
Laser Spot Tracker/Navigation Forward-Looking Infrared (LST/NFLR) sensor



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

1. Find out what the laser code used by the friendly is (in our case, the friendly JTAC uses code 1688). Make sure the friendly asset is lasing the target before attempting to track it.
2. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
3. Set the LST/NFLR (Laser Spot Tracker) switch to ON.
4. Press the OSB next to “UFC” to set the LSS (Laser Spot Search) code on the Up-Front Controller.
5. Press the button next to “LSTC” (Laser Spot Track Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose the default code used by the JTAC, which is 1688.

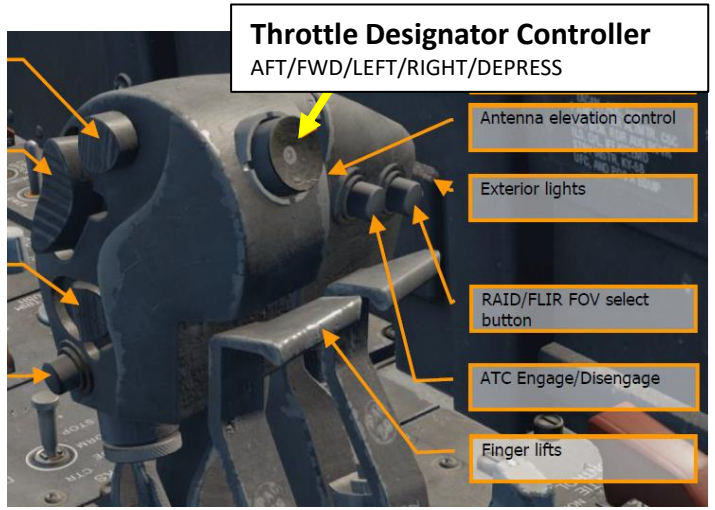


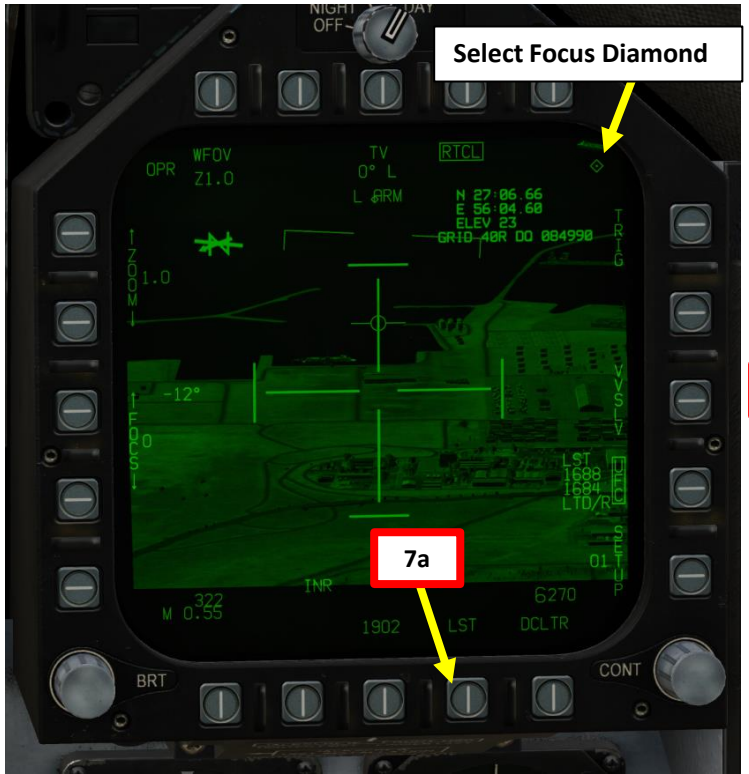


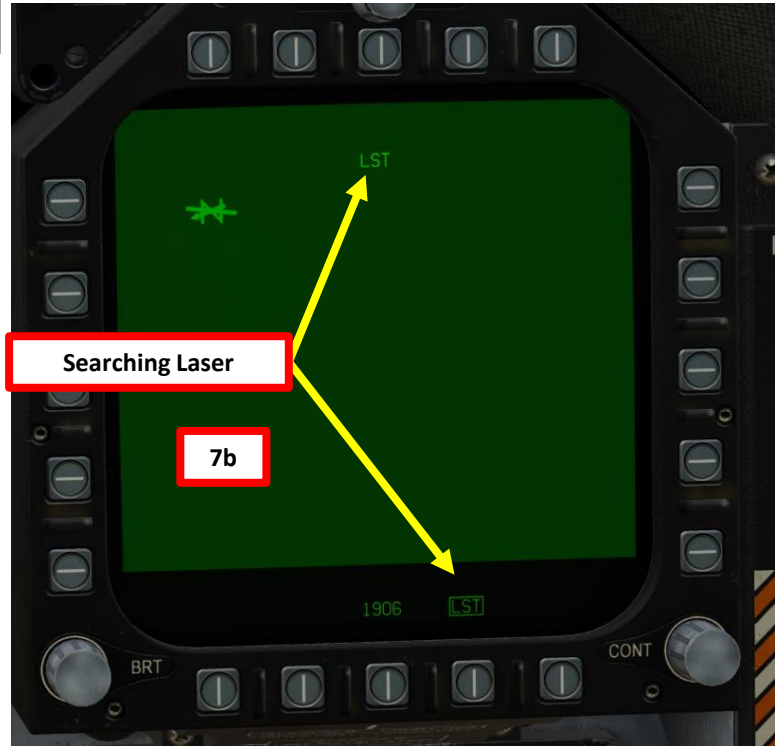
4 - AN/ASQ-228 ATFLIR TGP
4.6 – LASER SPOT TRACKER (LST) MODE

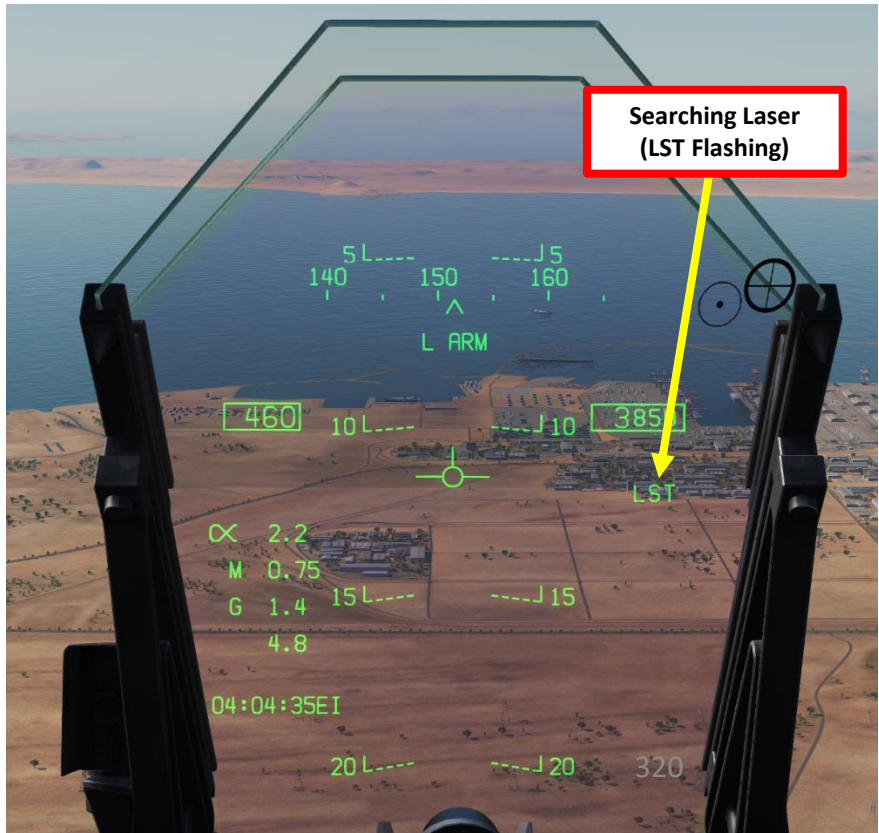
6. Set the targeting pod in Snowplow mode, then slew the targeting pod using the Sensor Control Switch (Sets Focus Diamond) and TDC controls within the vicinity of the JTAC location. If the targeting pod is looking too far from the laser, it will not be able to find the laser.
7. Press the OSB next to “LST” (Laser Spot Track) on the FLIR Format. Once LST is selected, the indication will be boxed.
8. While the targeting pod is searching for a laser, the FLIR image feed is blank, "LST" flashes on the top of the FLIR format and on the HUD.







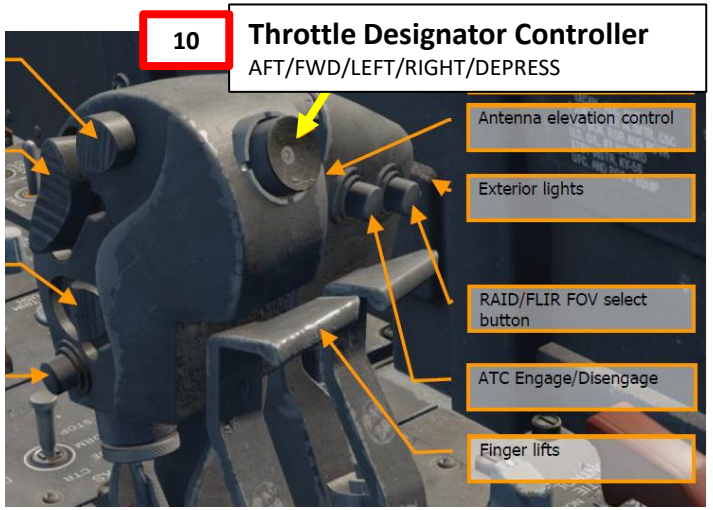




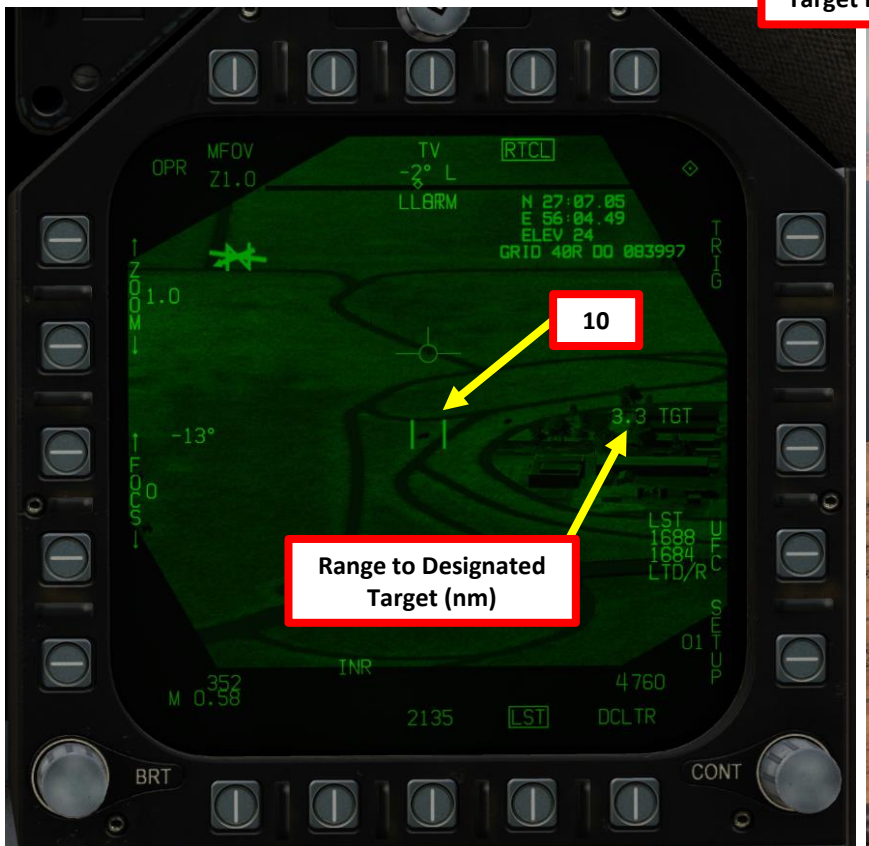
4 - AN/ASQ-228 ATFLIR TGP
4.6 – LASER SPOT TRACKER (LST) MODE

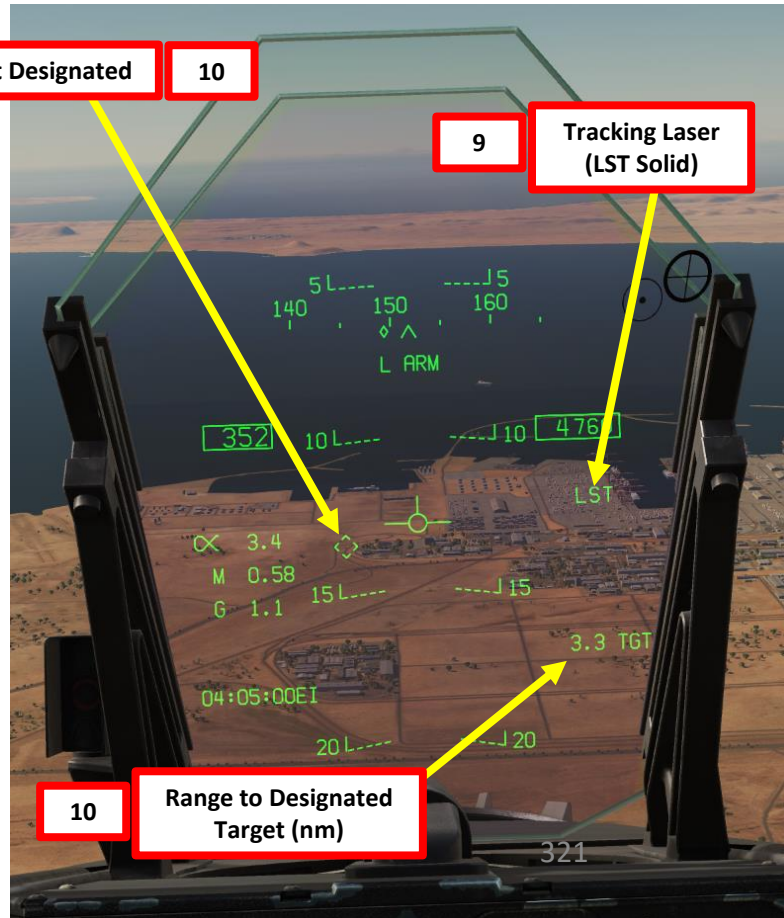
9. When targeting pod has found a friendly laser, the FLIR format will show the video feed centered on that laser and the "LST" indication will be solid. It will actively track the JTAC laser.
10. Use the TDC (Throttle Designator Controller) Depress button to designate the laser as the target point. This will slave selected air-to-ground weapons to where the laser is firing.
11. You may now launch laser-guided weapons as per their release procedure.
12. When desired, press the OSB next to LST to stop tracking the laser.
13. Pressing the Undesignate/Nosewheel Steering button will undesignate the target.









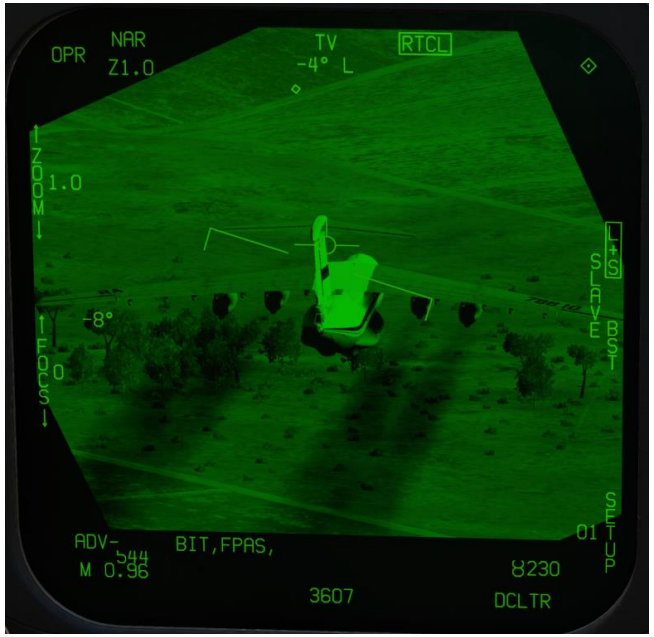


4 - AN/ASQ-228 ATFLIR TGP
4.7 – AIR-TO-AIR OPERATION
4.7.1 - Operation Modes

The targeting pod can also be used in air-to-air modes in conjunction with the radar. This is quite useful to perform visual identifications of air targets. To use Air-to-Air mode, the ATFLIR TGP requires the A/A Master Mode to be active. Here are the four main A-A operation modes of the pod:

- **Boresight (BST):** The FLIR line-of-sight is slaved to the boresight.
- **Inertial (INR) Pointed:** The FLIR is pointed at a fixed azimuth and elevation with respect to earth. Fallback mode entered when the az/el scan centering cross is used or when another mode is deselected.
- **L+S Slave (Radar Slaved):** The FLIR is slaved to the extrapolated line of sight to the radar's L&S trackfile. This is accessed via the L+S SLAVE option on the A/A FLIR format.
- **Auto Track:** The FLIR itself is tracking a target. Auto Track is accessed by "bumping" the Sensor Control Switch in the direction of the FLIR format with the TDC already assigned, and will attempt to acquire a recognized target within the reticle. Auto Track is only entered when a successful track is acquired.





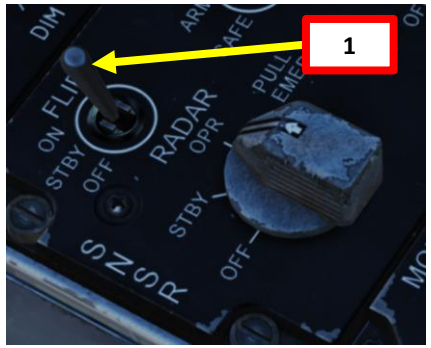




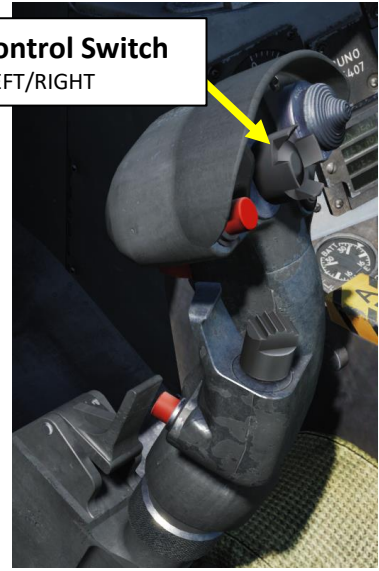
4 - AN/ASQ-228 ATFLIR TGP
4.7 – AIR-TO-AIR OPERATION
4.7.2 - Auto Track

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

1. Make sure the targeting pod is powered
2. Press the A/A Master Mode button. The RDR ATTK (radar) page will appear on the right DDI and the FLIR page will appear on the left DDI.
3. Select FLIR by pressing the Sensor Control Switch in the direction of the DDI with the FLIR page (left).
4. The Select Focus Diamond indicates what display is selected.
5. Select BST (Boresight) mode by selecting the BST pushbutton on the FLIR page. The FLIR will be slaved to the boresight line of sight.
6. Press OSB next to RTCL (boxed) to display the targeting pod's reticle

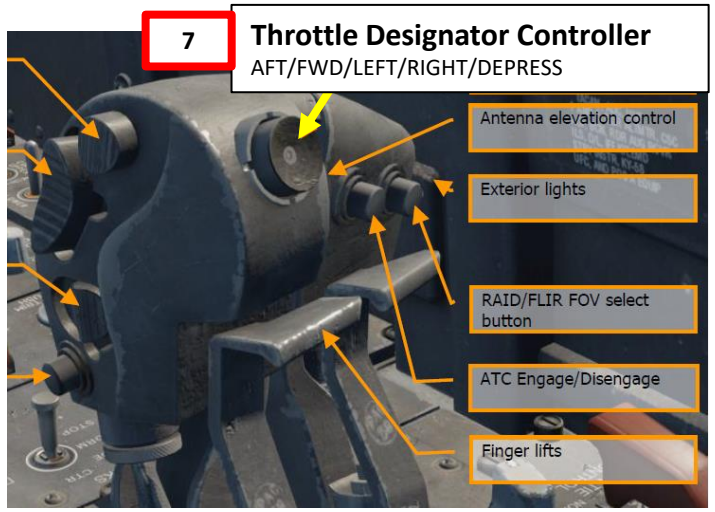


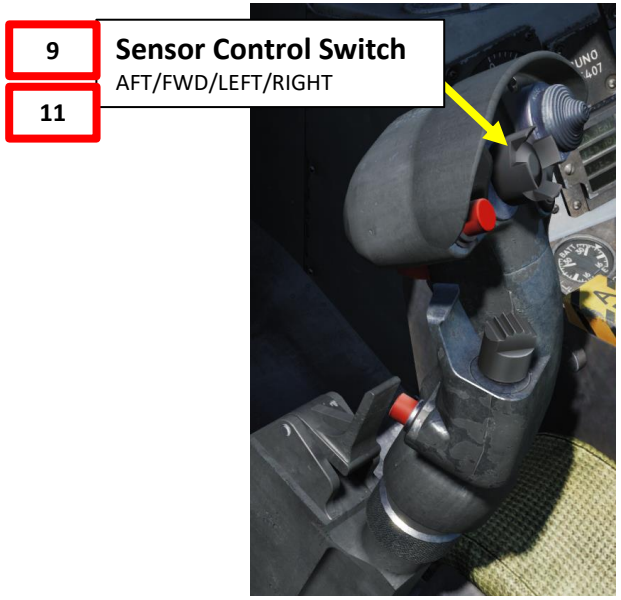


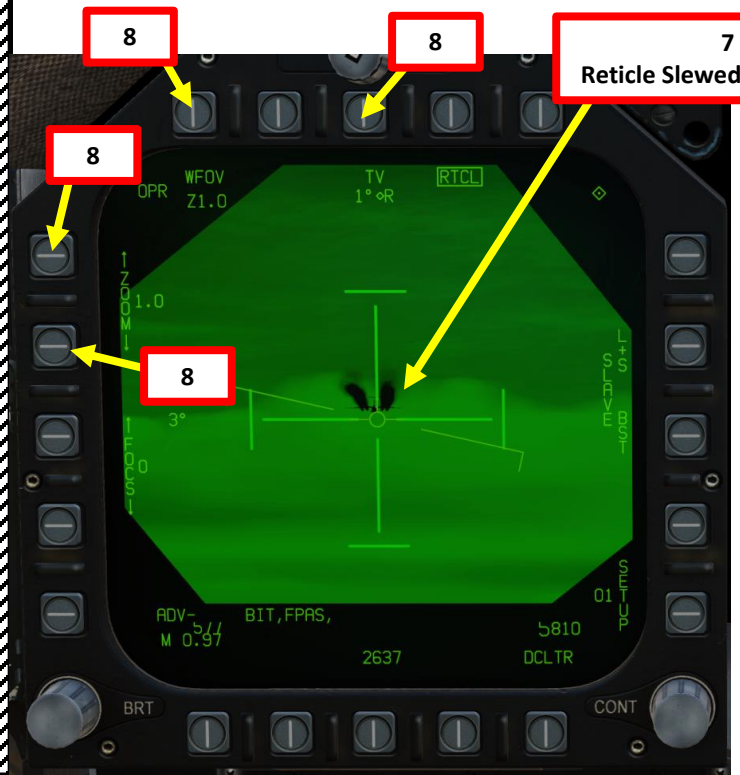


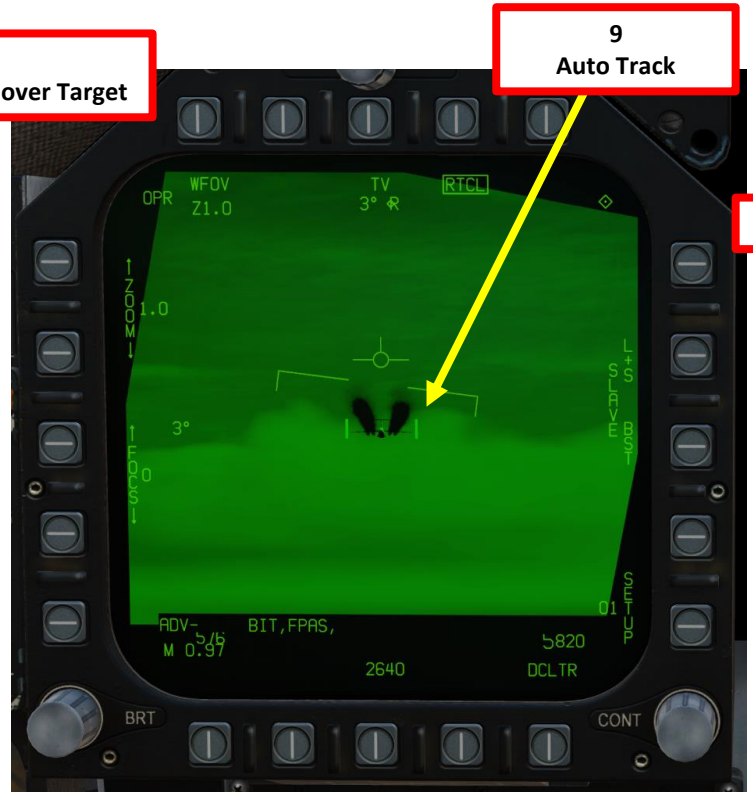
4 - AN/ASQ-228 ATFLIR TGP
4.7 – AIR-TO-AIR OPERATION
4.7.2 - Auto Track

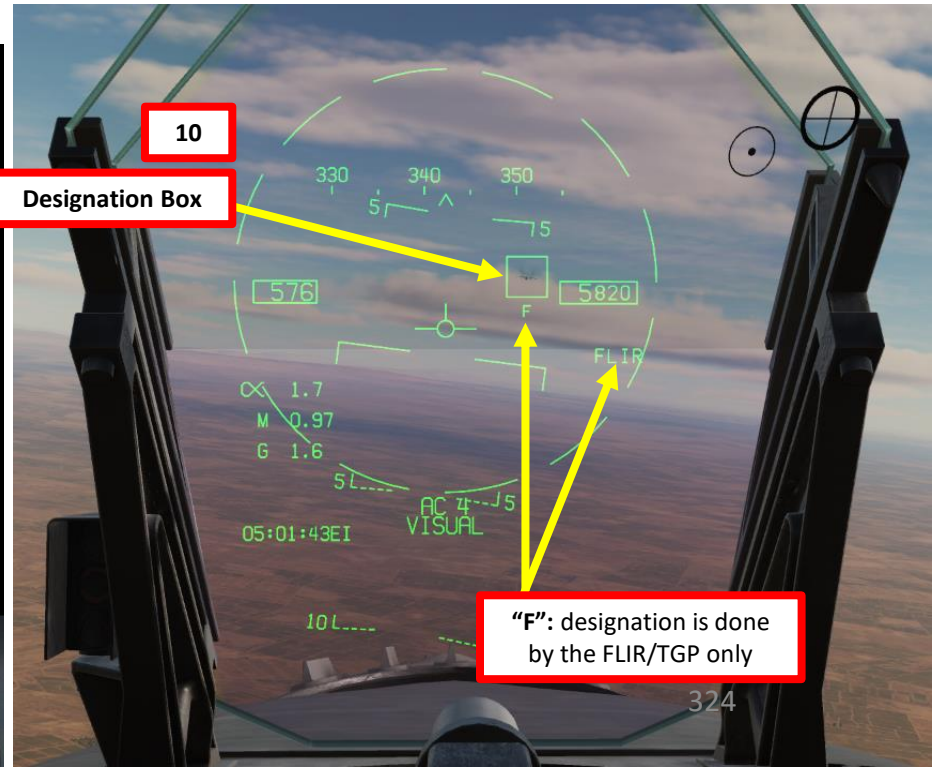
7. Use the TDC (Throttle Designator Controller) AFT/FWD/LEFT/AFT Controls to slew the targeting pod on the target. Slewing the targeting pod will automatically disengage Boresight mode.
8. You can zoom and choose desired FLIR/TV setting using the appropriate Option Select Buttons on the FLIR page.
9. Press/bump the Sensor Control Switch in the direction of the FLIR format page (left) to attempt to Auto Track the target.
10. When Auto Track is obtained, a designation box will appear on the HUD and the targeting pod will track the target.
11. If you want to "dump" the target, press the Sensor Control Switch in the direction of the DDI with the FLIR page (left).







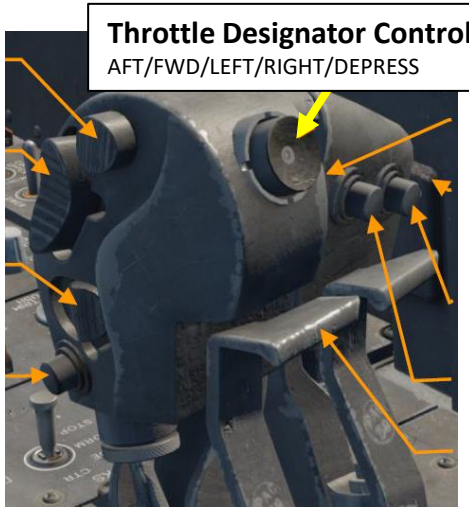


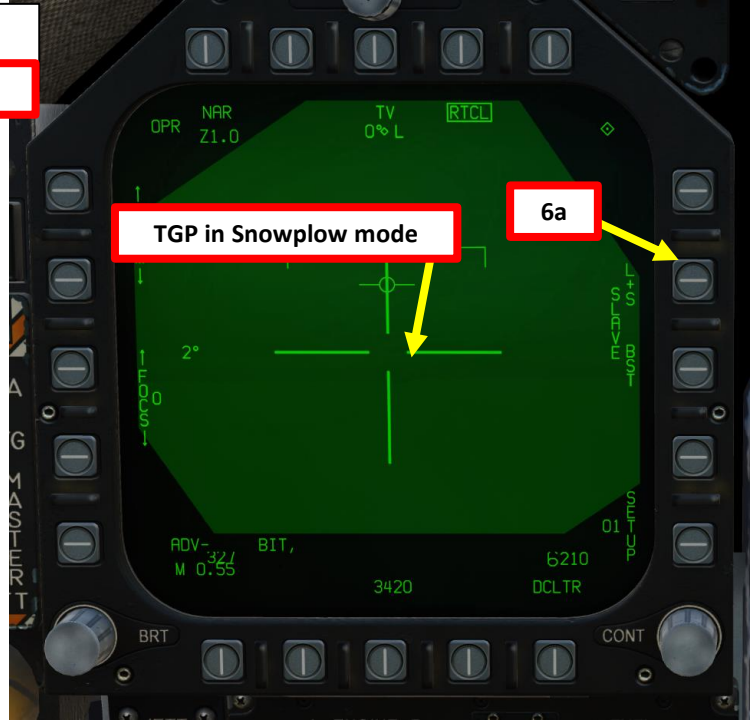


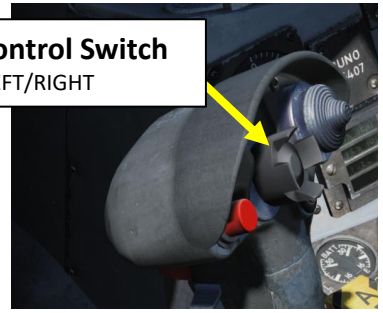
4 - AN/ASQ-228 ATFLIR TGP
4.7 – AIR-TO-AIR OPERATION
4.7.3 - Air-to-Air Radar Slaving (L+S Slave)

While you can slave the targeting pod to any radar locked target (Launch & Steering, Primary Target). Here is how to slave the targeting pod to a radar locked target in order to visually identify it.

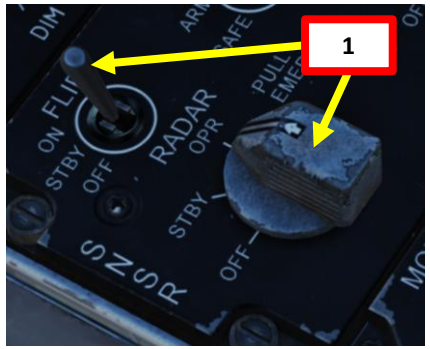
1. Make sure the targeting pod and radar are powered
2. Press the A/A Master Mode button. The RDR ATTK (radar) page will appear on the right DDI and the FLIR page will appear on the left DDI.
3. Select RDR ATTK page by pressing the Sensor Control Switch in the direction of the DDI with the radar page (right).
4. The Select Focus Diamond indicates what display is selected.
5. Acquire a radar lock using the TDC Slew and TDC DEPRESS controls.
6. Press the OSB next to L+S SLAVE (Launch & Steering Primary Target radar slave) to slave the slave the targeting pod to the radar lock (L&S trackfile).

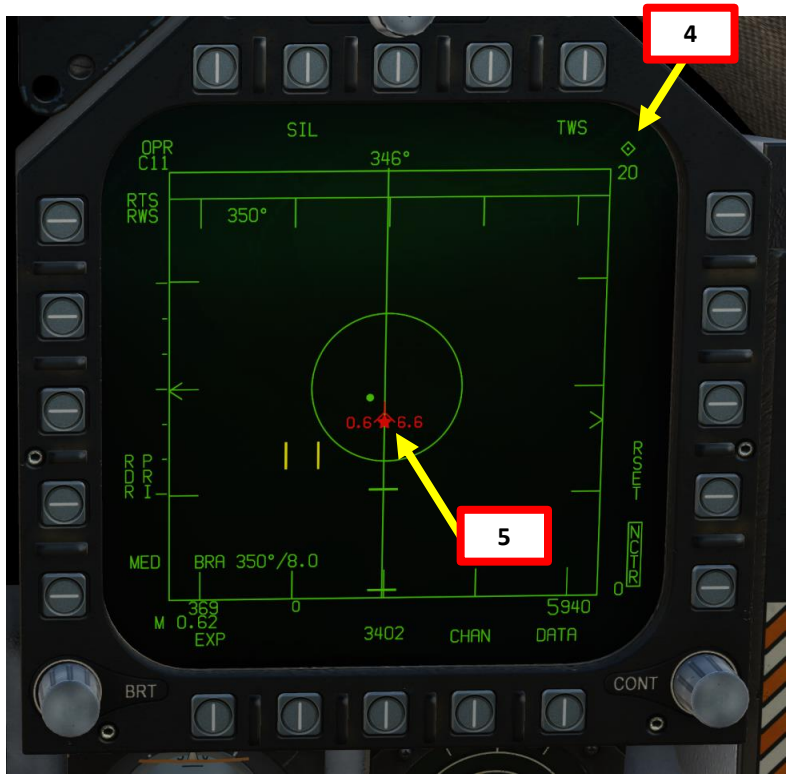


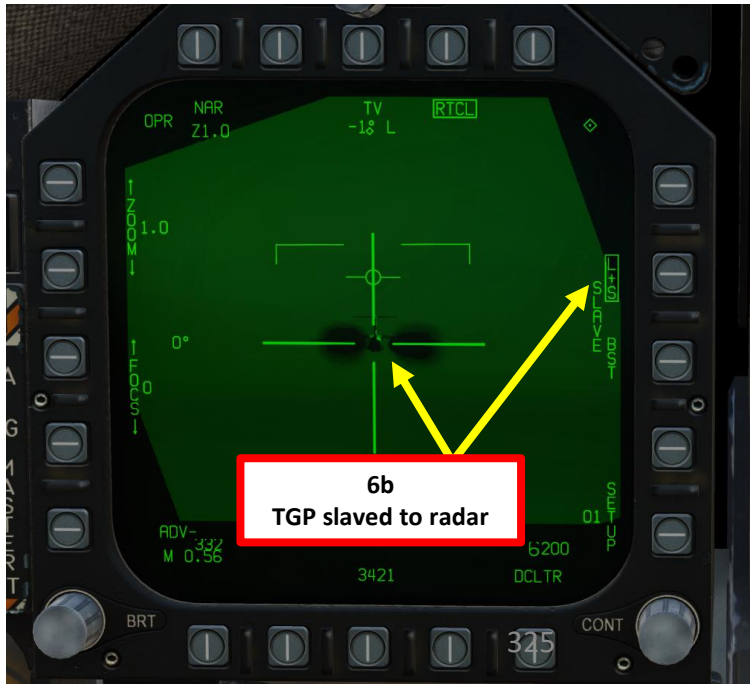






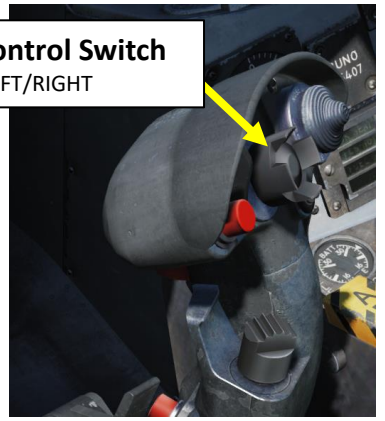


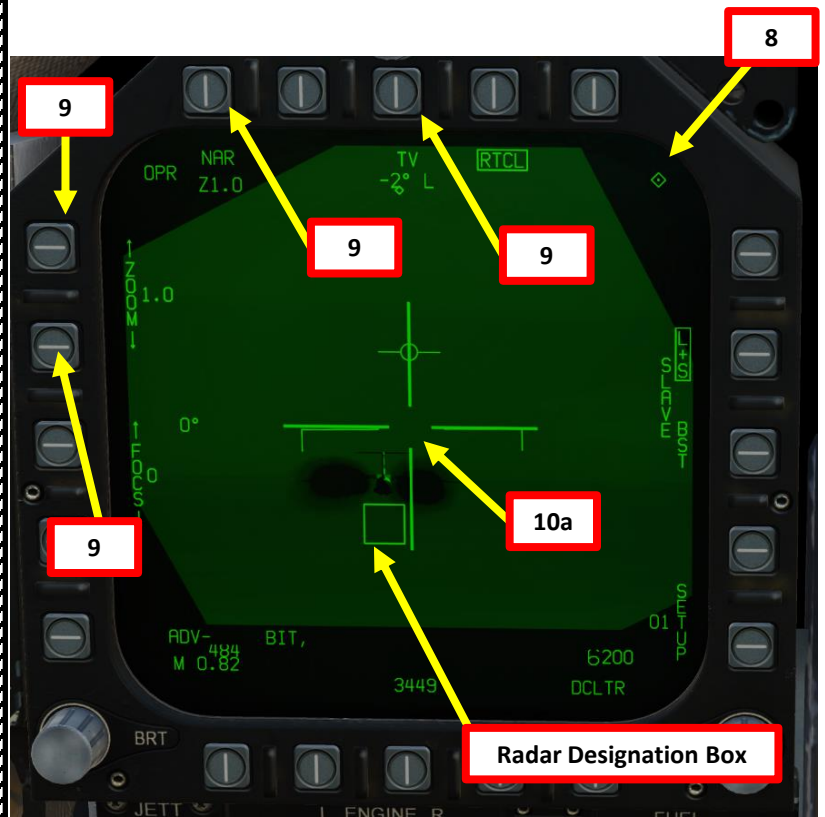




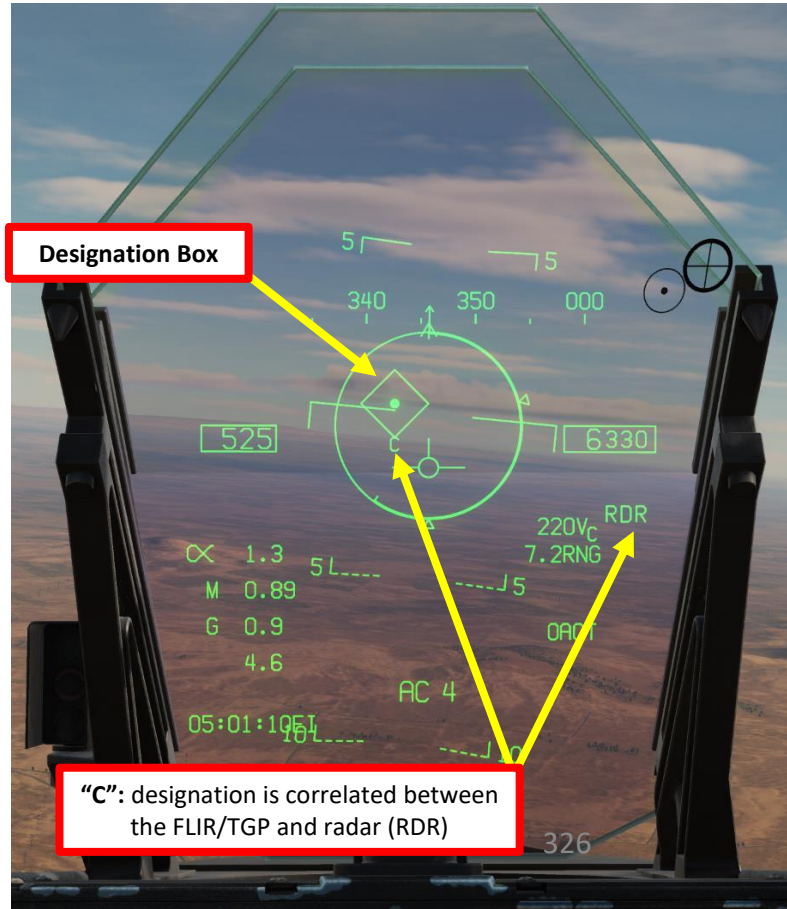
4 - AN/ASQ-228 ATFLIR TGP
4.7 – AIR-TO-AIR OPERATION
4.7.3 - Air-to-Air Radar Slaving (L+S Slave)

7. Select FLIR by pressing the Sensor Control Switch in the direction of the DDI with the FLIR page (left).
8. The Select Focus Diamond indicates what display is selected.
9. You can zoom and choose desired FLIR/TV setting using the appropriate Option Select Buttons on the FLIR page.
10. Press/bump the Sensor Control Switch in the direction of the FLIR format page (left) to attempt to Auto Track the target.









5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.1 – Introduction

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

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

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



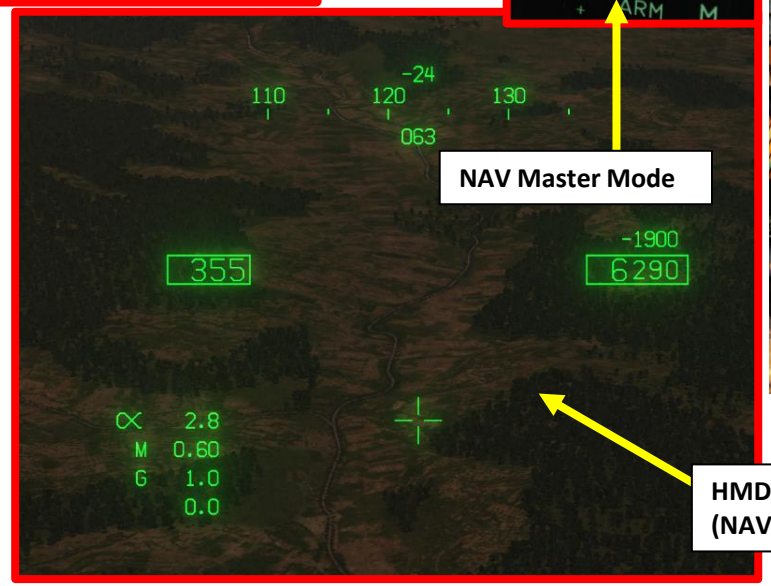


5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.2 – JHMCS Power-Up

To power up the JHMCS:

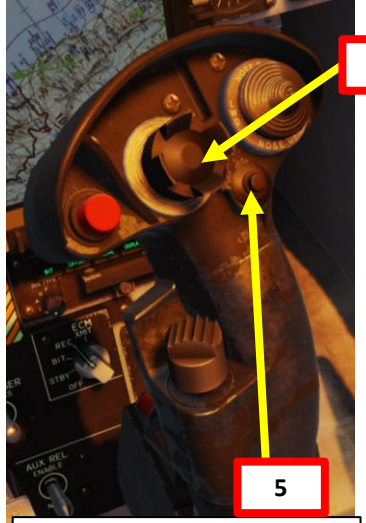
1. Set the HMD Brightness knob to BRT (Bright)
2. The default setting for the JHMCS is that the HMD overlay will only be visible when looking away from the Heads-Up Display.
3. Press Sensor Control Switch FWD to toggle the TDC (Throttle Designator Controller) priority between the HUD (Heads-Up Display) and the HMD (Helmet-Mounted Display). TDC priority is assigned to the helmet when the aiming reticle appears on the helmet. A center dot on the HUD's TVV means the priority is assigned to the HUD.
4. Select either A/A Master Mode for using the JHMCS with air-to-air missiles or A/G Master Mode to designate ground targets with the helmet.
5. To manually "blank" (occlude) the Helmet-Mounted Display, press the Recce Event Marker button on the stick ("R" binding). When enabled, all HMD symbology is hidden.





NAV Master Mode

HMD Overlay (NAV Master Mode)



3

Sensor Control Switch
AFT/FWD/LEFT/RIGHT

5

Event Marker "Recce" Button ("R" binding)



HMD (Helmet-Mounted Display) Brightness Control Switch

1

HMD Overlay (A/A Master Mode)



A/A Master Mode





HMD Overlay (A/G Master Mode)

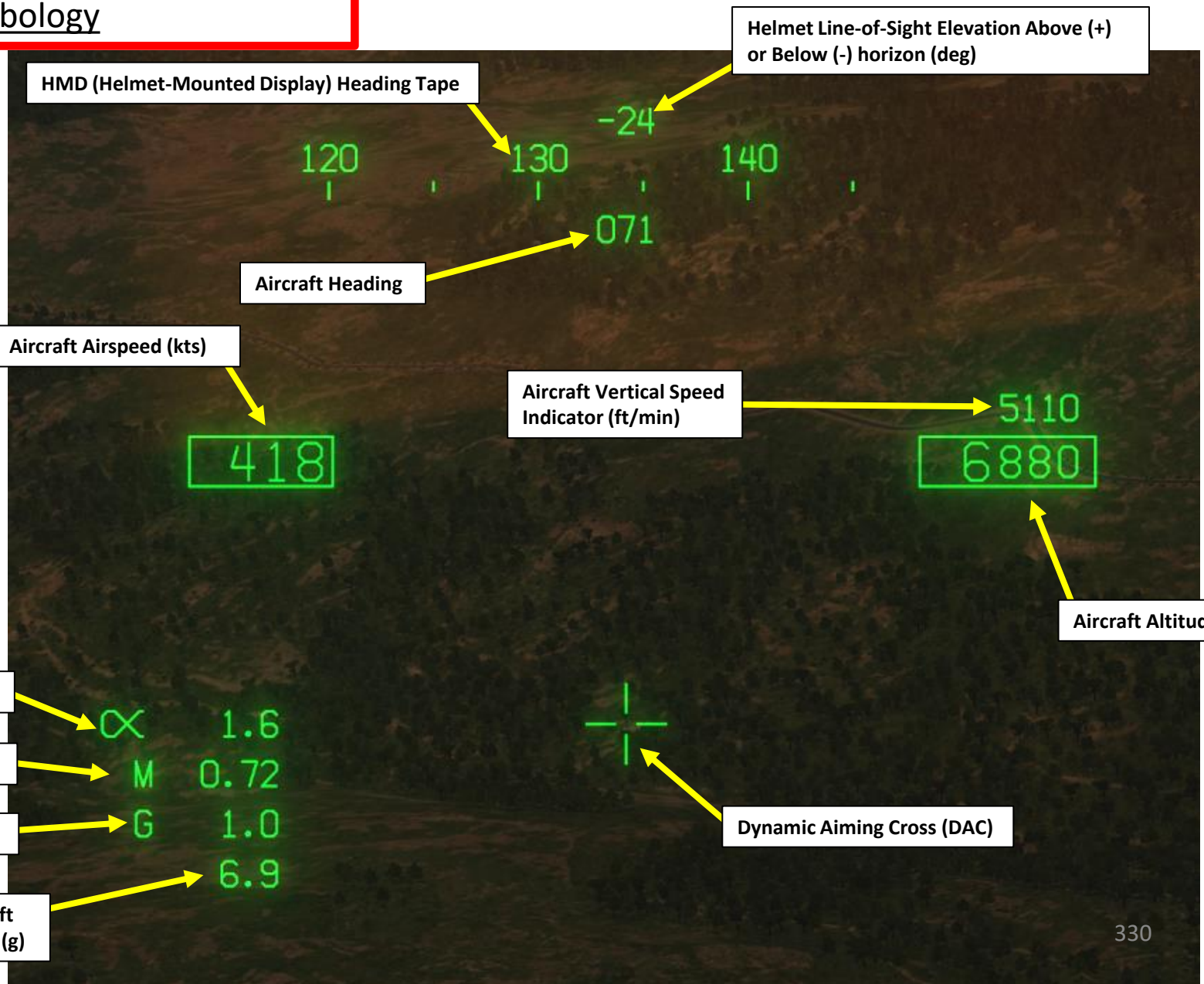
A/G Master Mode



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

A - Basic Symbology

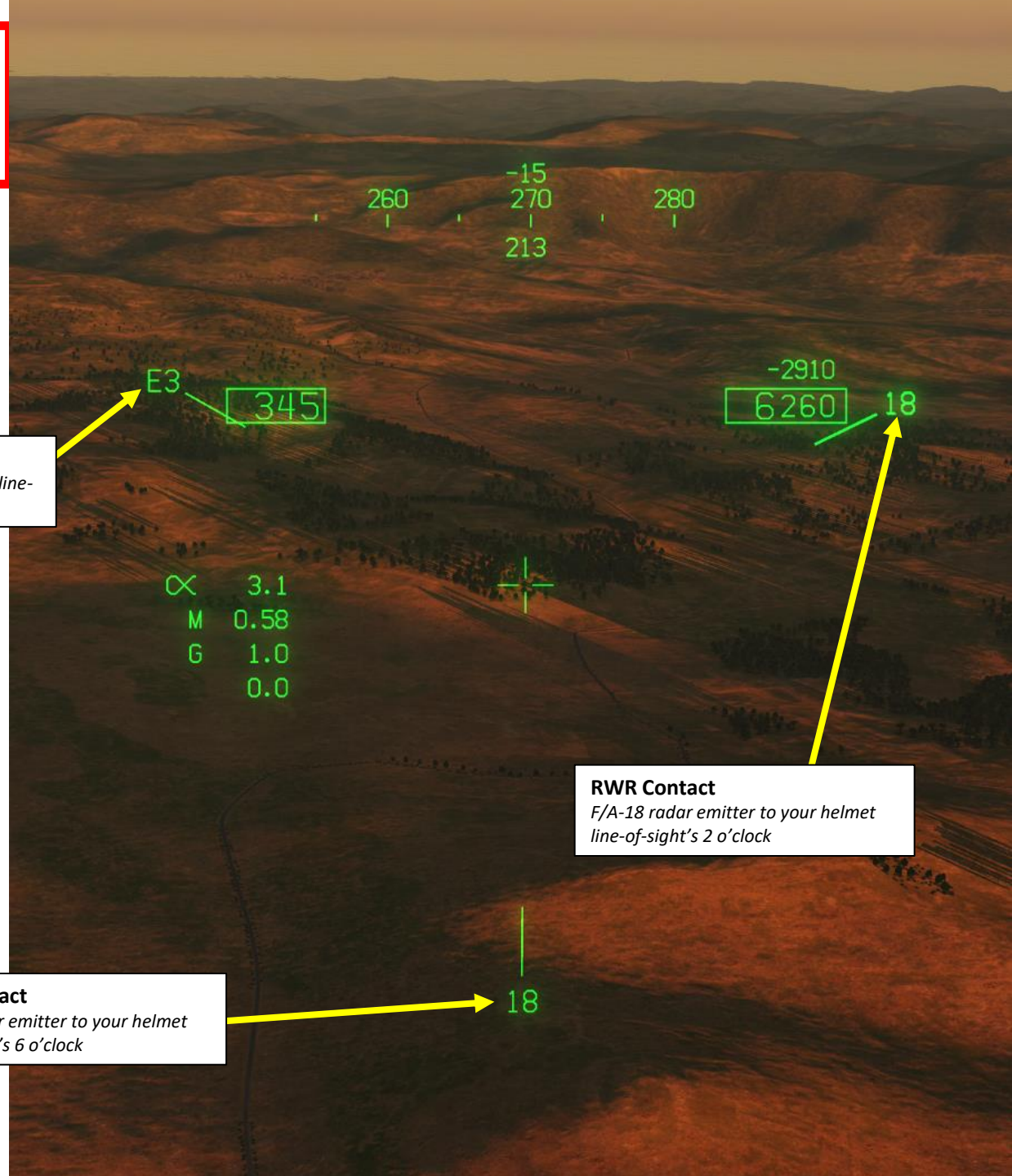
The Basic symbology refers mainly to aircraft flight parameters. This symbology Is similar to a Heads-Up Display repeater overlayed on your helmet.



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

B - Radar Warning Receiver (RWR) Symbology

Just like the HUD, the HMD (Helmet-Mounted Display) displays radar emitters detected by the RWR (Radar Warning Receiver). Keep in mind that the direction of the RWR contact indicated on the HMD is in relationship to your helmet's line of sight, NOT the aircraft itself. The RWR contacts indicated on the HUD (Heads-Up Display) are in relationship to the aircraft.



RWR Contact
E3 AWACS radar emitter to your helmet line-of-sight's 10 o'clock

RWR Contact
F/A-18 radar emitter to your helmet line-of-sight's 2 o'clock

RWR Contact
F/A-18 radar emitter to your helmet line-of-sight's 6 o'clock

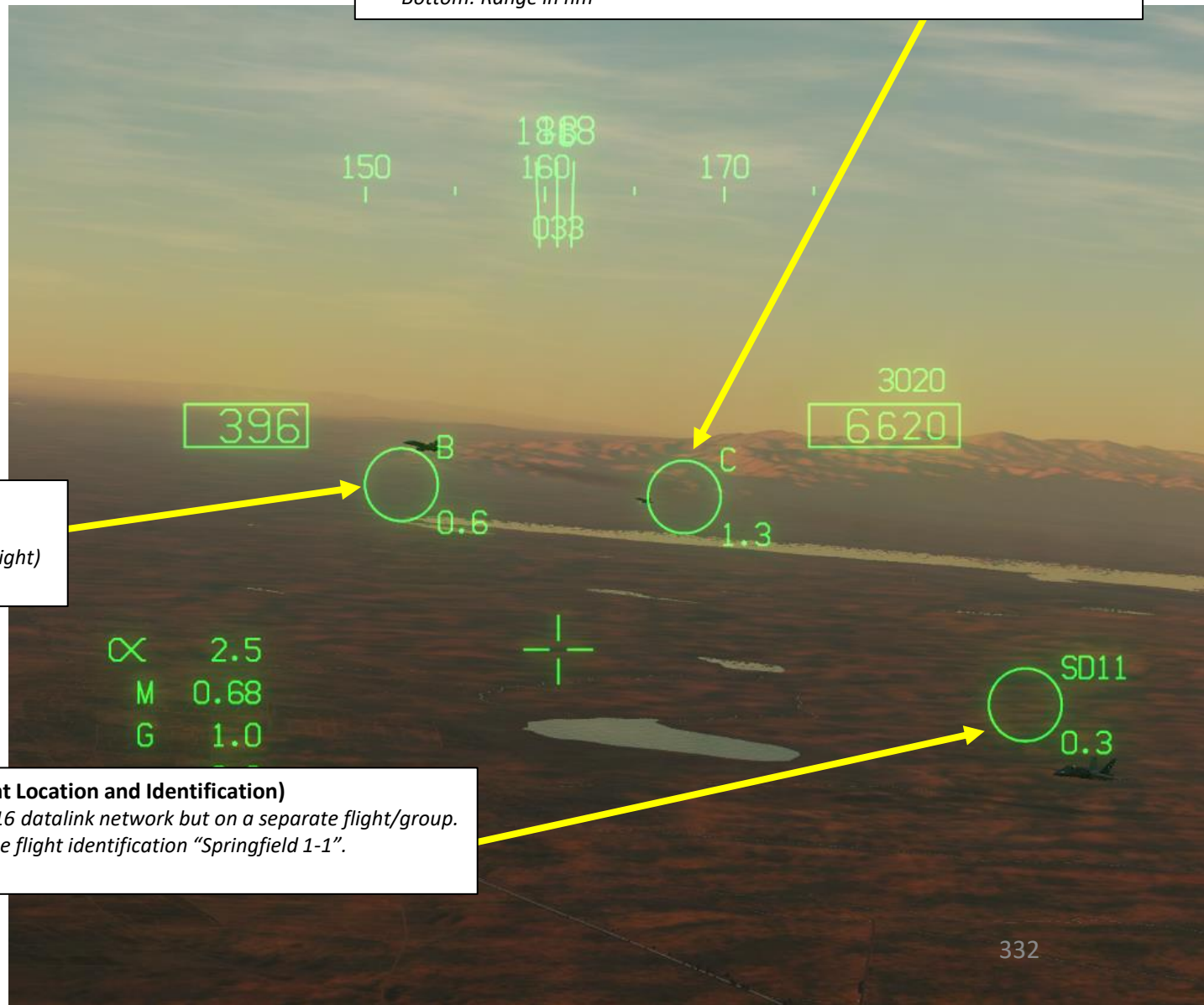
5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

C - Datalink Symbology

The HMD superimposes designators for **up to 7 datalink trackfiles** other than the air-to-air L&S (Launch & Steering Target) or DT2 (Secondary Designated Target) within a defined range. A trackfile designated as the L&S/DT2 will always display the box/diamond or X symbol.

Datalink contacts are shown on your Helmet-Mounted Display (HMD), with an ID (Identification) and a range in nautical miles.

Flight Member
Aircraft on the Link16 network and on the same flight/group as yourself.
- *Top: "C" stands for the flight member identifier "C" (third member of the flight)*
- *Bottom: Range in nm*



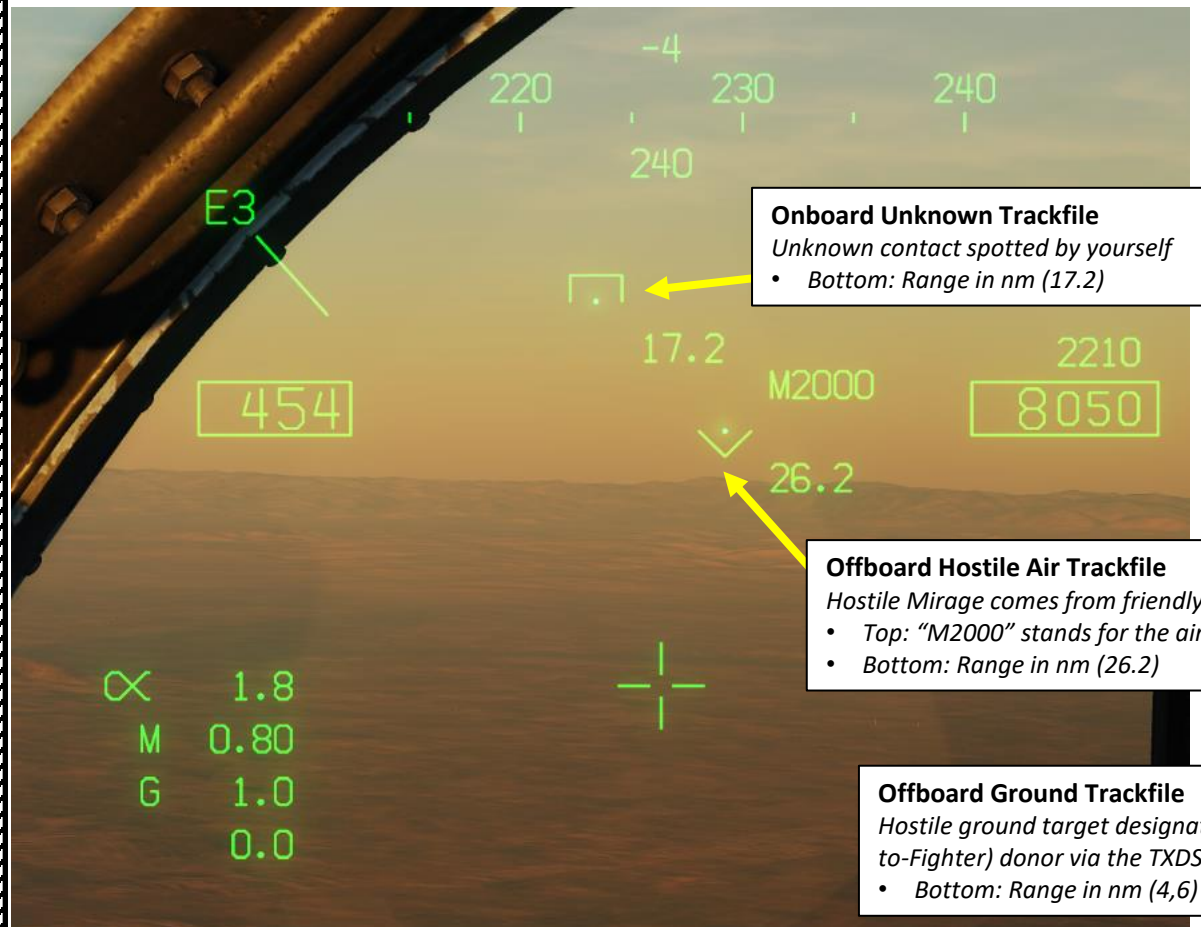
Flight Member
Aircraft on the Link16 network and on the same flight/group as yourself.
- *Top: "B" stands for the flight member identifier "B" (second member of the flight)*
- *Bottom: Range in nm*

Air PPLI (Precise Participant Location and Identification)
Friendly aircraft on the LINK16 datalink network but on a separate flight/group.
- *Top: "SD11" stands for the flight identification "Springfield 1-1".*
- *Bottom: Range in nm*

5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

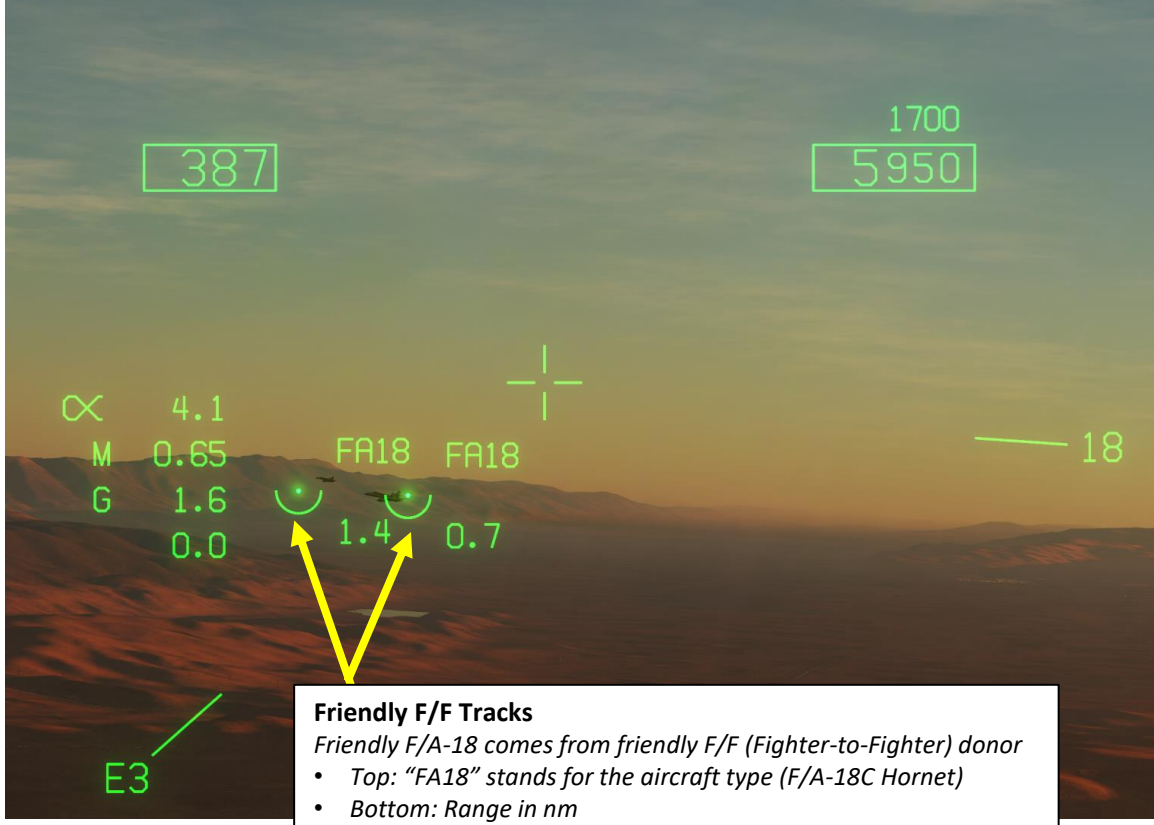
C - Datalink Symbology

Consult the "F/A-18C HORNET LINK 16 SA PAGE SYMBOLOGY & HAFU" table for more information about the meaning of each datalink symbol on the Helmet-Mounted Display.

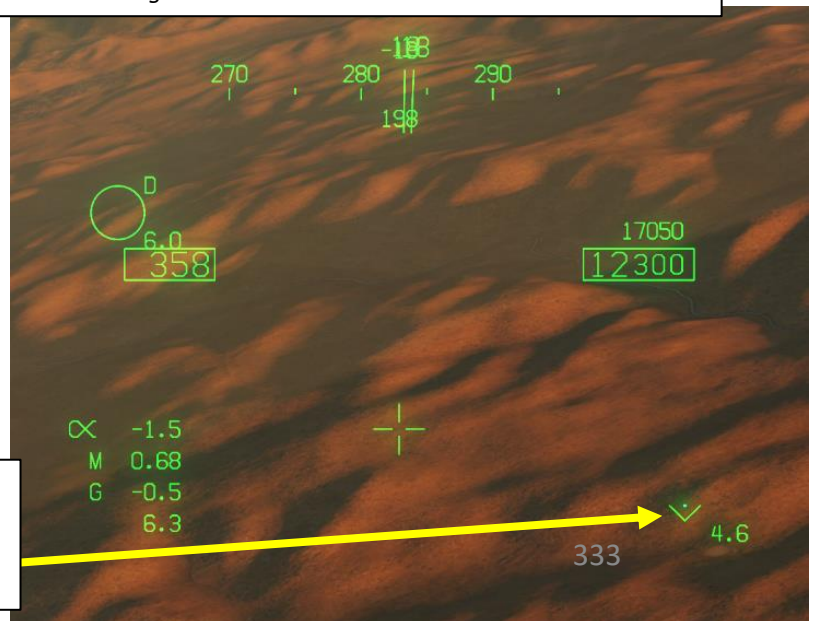


Onboard Unknown Trackfile
Unknown contact spotted by yourself
- *Bottom: Range in nm (17.2)*

Offboard Hostile Air Trackfile
Hostile Mirage comes from friendly F/F (Fighter-to-Fighter) donor
- *Top: "M2000" stands for the aircraft type (Mirage 2000)*
- *Bottom: Range in nm (26.2)*



Friendly F/F Tracks
Friendly F/A-18 comes from friendly F/F (Fighter-to-Fighter) donor
- *Top: "FA18" stands for the aircraft type (F/A-18C Hornet)*
- *Bottom: Range in nm*



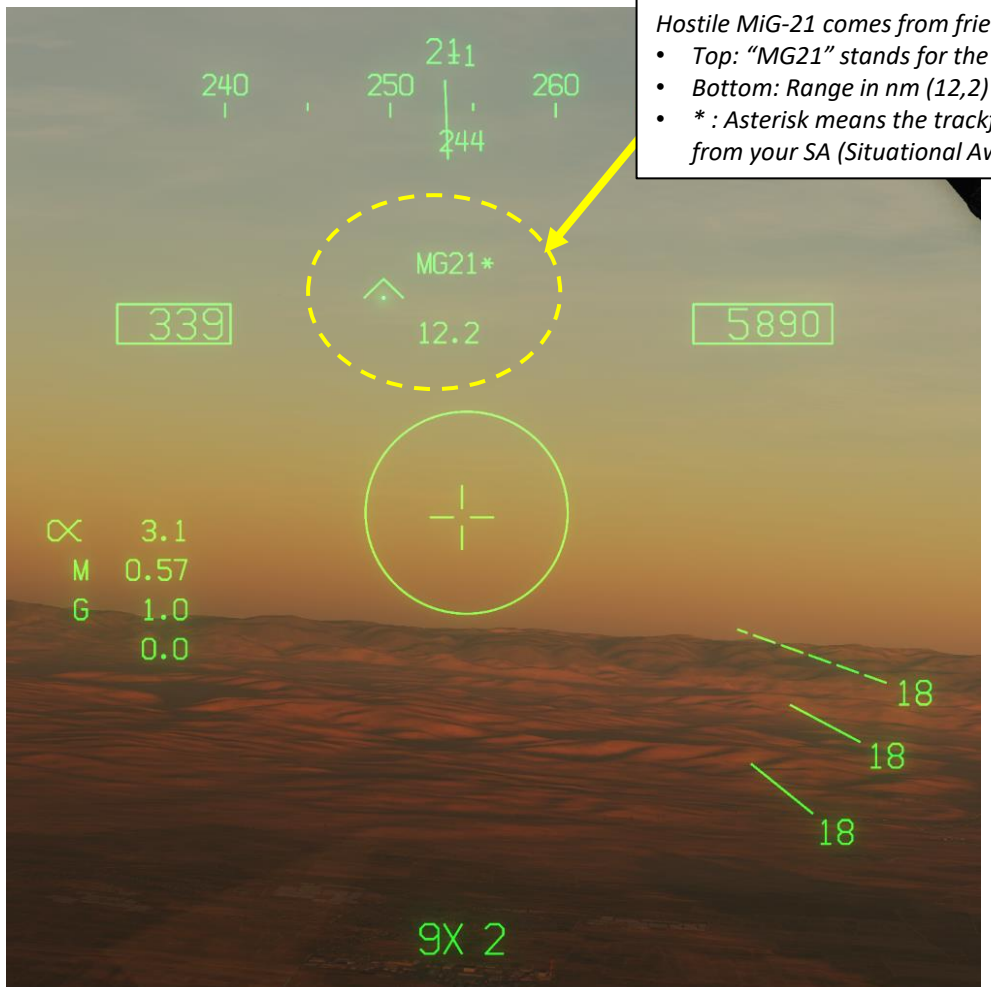
Offboard Ground Trackfile
Hostile ground target designated comes from friendly F/F (Fighter-to-Fighter) donor via the TXDSG (Transmit-Designate) function
- *Bottom: Range in nm (4,6)*

5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

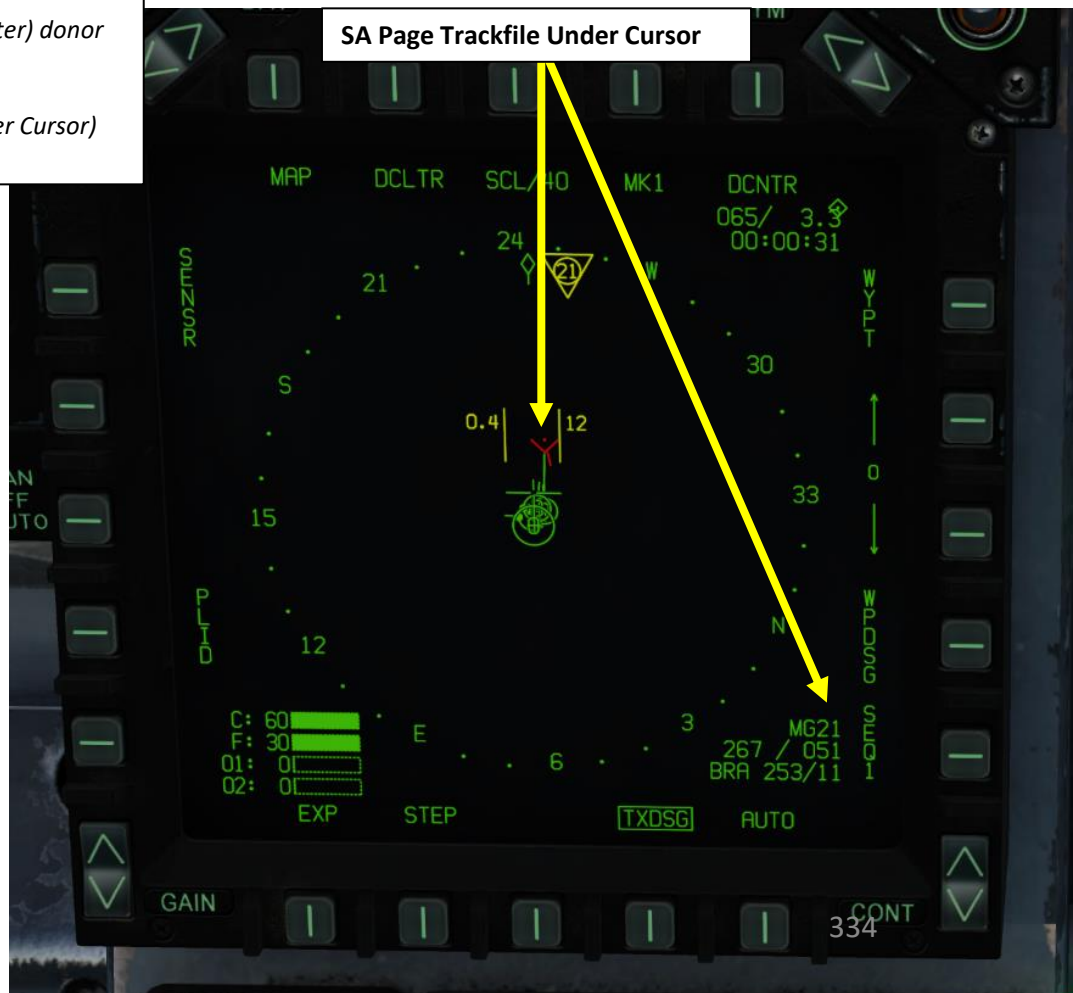
C - Datalink Symbology

An asterisk will denote if a trackfile is TUC'd (Target Under Cursor) by yourself on the SA (Situational Awareness) page.

Offboard Hostile Air Trackfile
Hostile MiG-21 comes from friendly F/F (Fighter-to-Fighter) donor
- *Top: "MG21" stands for the aircraft type (MiG-21)*
- *Bottom: Range in nm (12,2)*
- ** : Asterisk means the trackfile is TUC'd (Target Under Cursor) from your SA (Situational Awareness Page)*



SA Page Trackfile Under Cursor

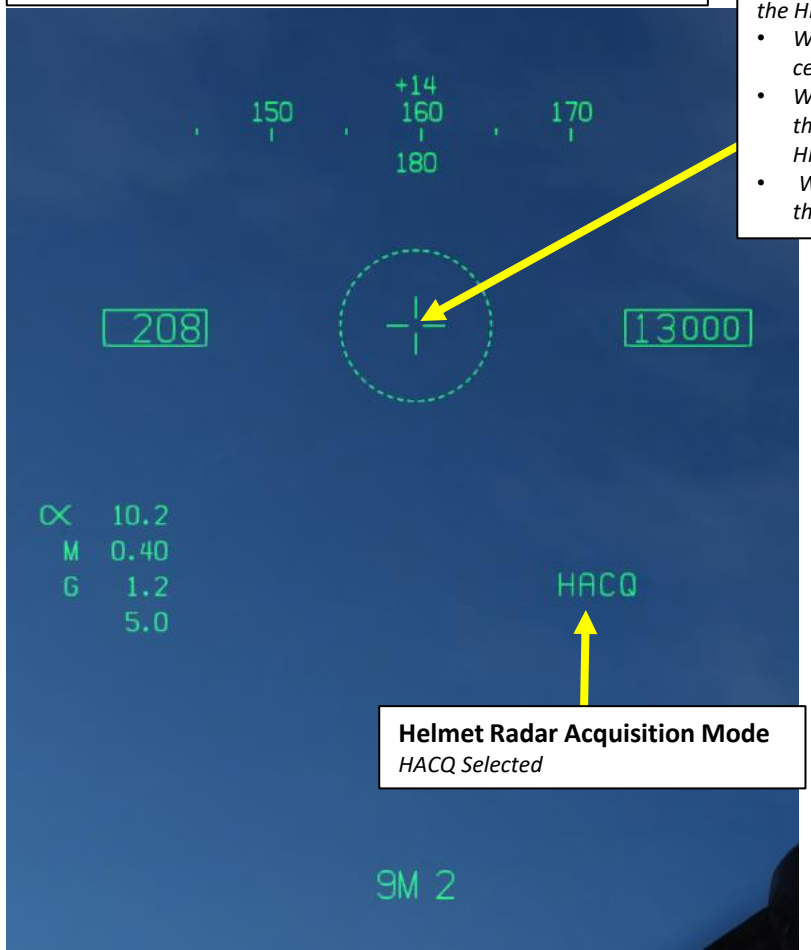


5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

D - Air-to-Air Symbology

When using the radar in air-to-air mode (A/A Master Mode button pressed), the following symbology is visible.

No STT (Single Target Track) Lock Acquired



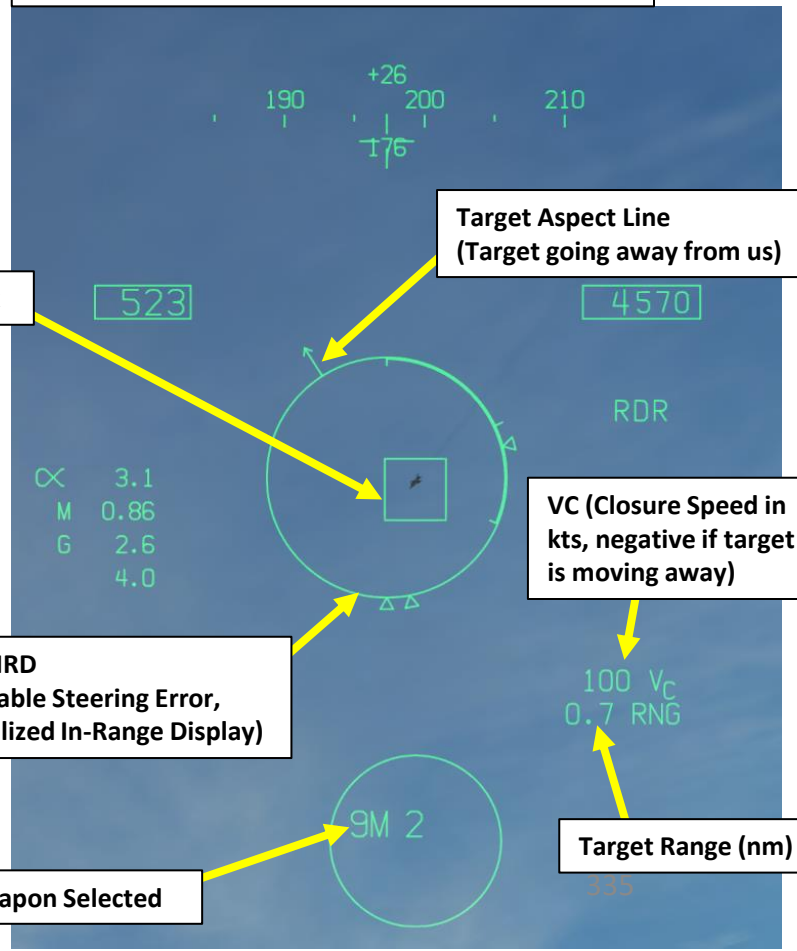
Helmet Reticle / DAC (Dynamic Aiming Cross)
When in Air-to-Air Master Mode, the DAC can be in one of three locations on the HMD (Helmet-Mounted Display), based on the HMD view angle.
- *When HMD line of sight is on or below the stabilized horizon, the DAC is centered with the HMD.*
- *When HMD line of sight is between 0 and 30 deg above stabilized horizon, the DAC is centered between the airspeed and altitude indicators on the HMD.*
- *When HMD line of sight is greater than 30 deg above stabilized horizon, the aiming cross is centered above the heading tape on the HMD.*

Helmet Radar Acquisition Mode
HACQ Selected

A/A (Air-to-Air) Master Mode Selected



STT (Single Target Track) Lock Acquired



TD (Target Designator) Box

Target Aspect Line
(Target going away from us)

VC (Closure Speed in kts, negative if target is moving away)

ASE/NIRD
(Allowable Steering Error, Normalized In-Range Display)

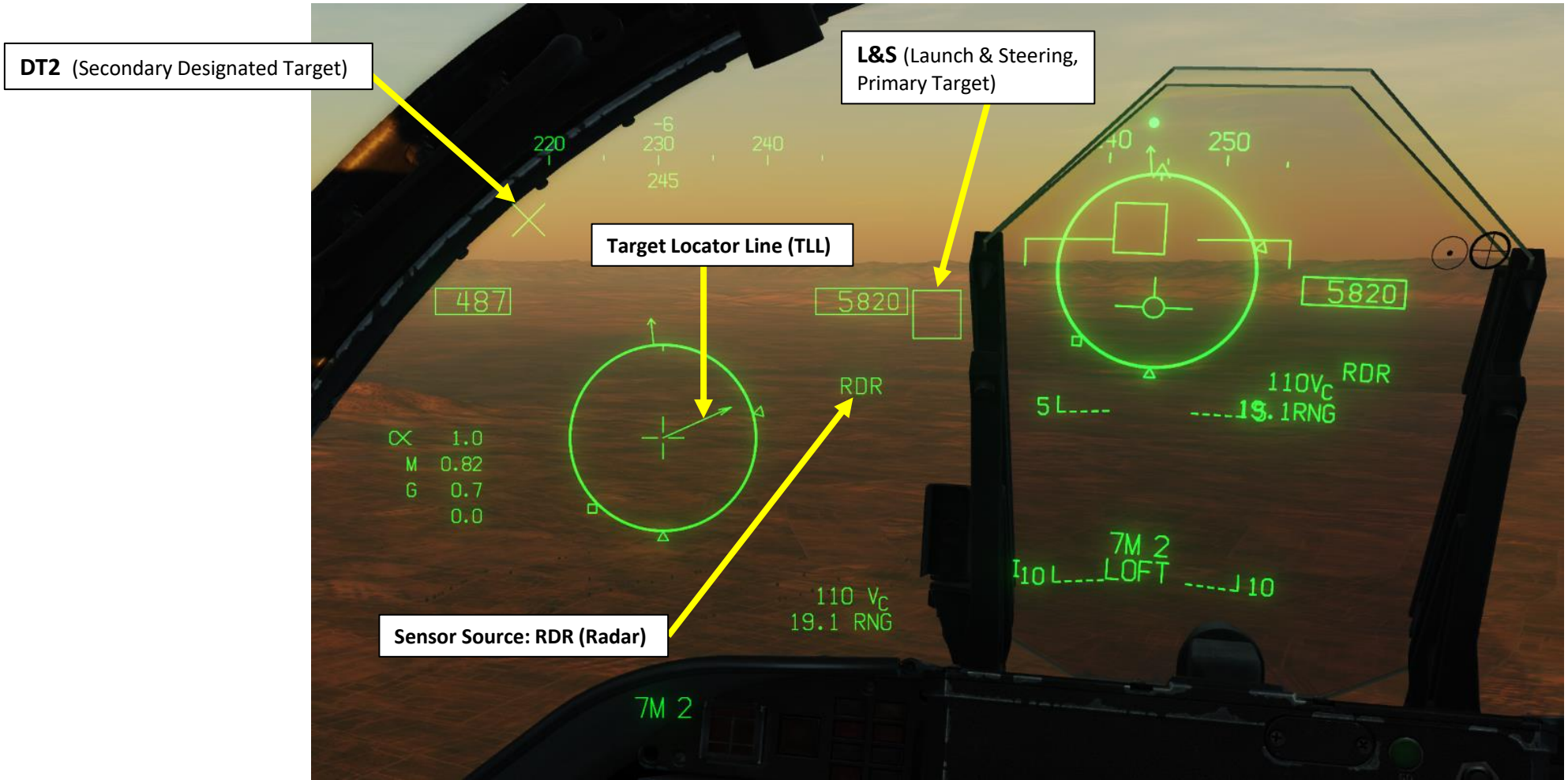
Target Range (nm)

Weapon Selected

5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

D - Air-to-Air Symbology

The L&S (Launch & Steering Target) or DT2 (Secondary Designated Target) are always displayed on the HMD within a defined range.

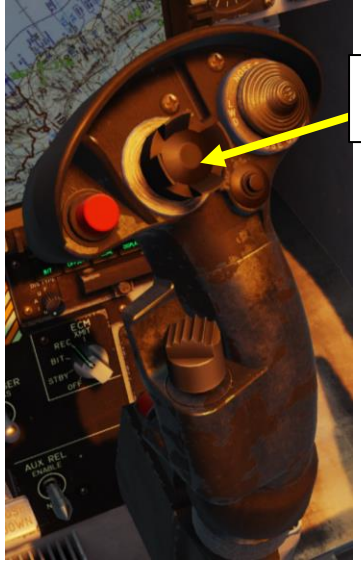


5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.1 – HMD Symbology

E - Air-to-Ground Symbology

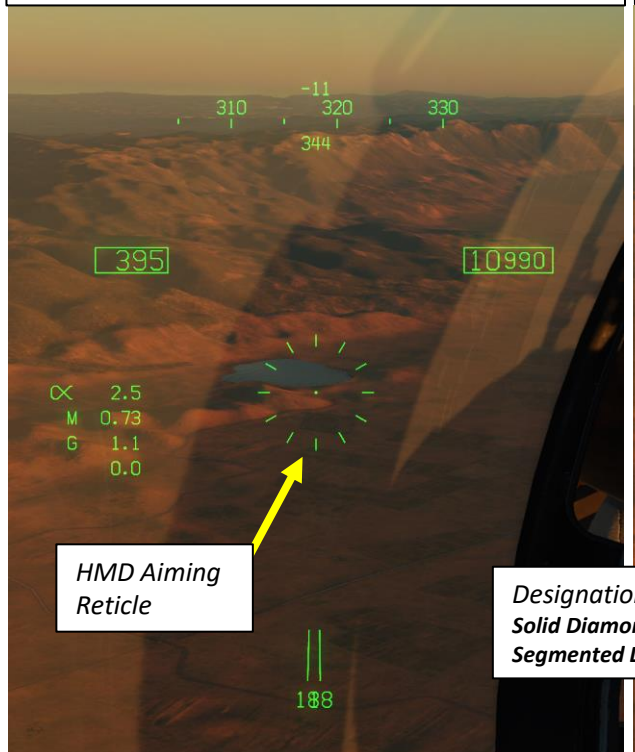
When using the air-to-ground Master mode (A/G Master Mode button pressed), the following symbology is visible. To enter Air-to-Ground JHMCS Mode:

1. Make sure JHMCS is powered
2. Press the A/G Master Mode Button
3. Press Sensor Control Switch FWD to toggle the TDC (Throttle Designator Controller) priority between the HUD (Heads-Up Display) and the HMD (Helmet-Mounted Display). TDC priority is assigned to the helmet when the aiming reticle appears on the helmet.
4. Designation can be performed with TDC controls (see sub-section 5.5.1 – Ground Target Designation).

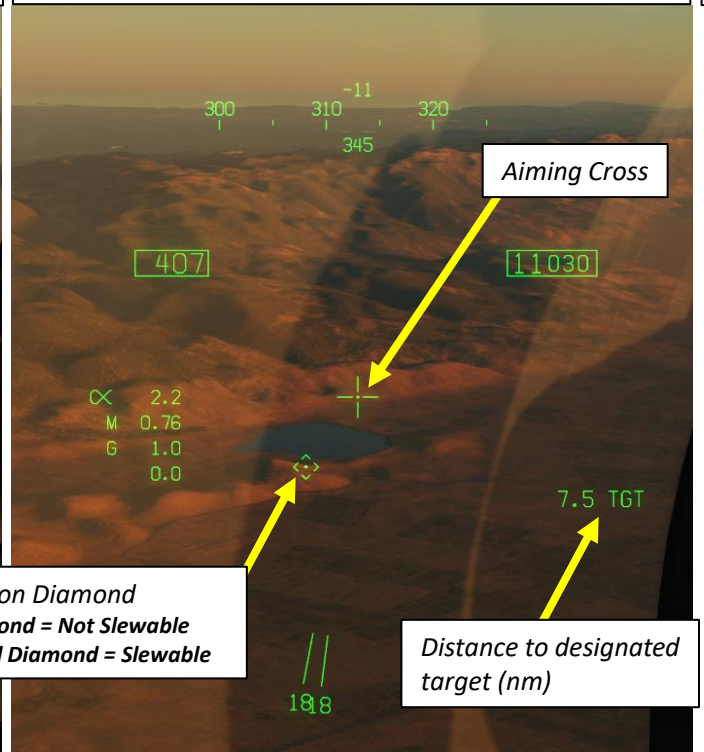




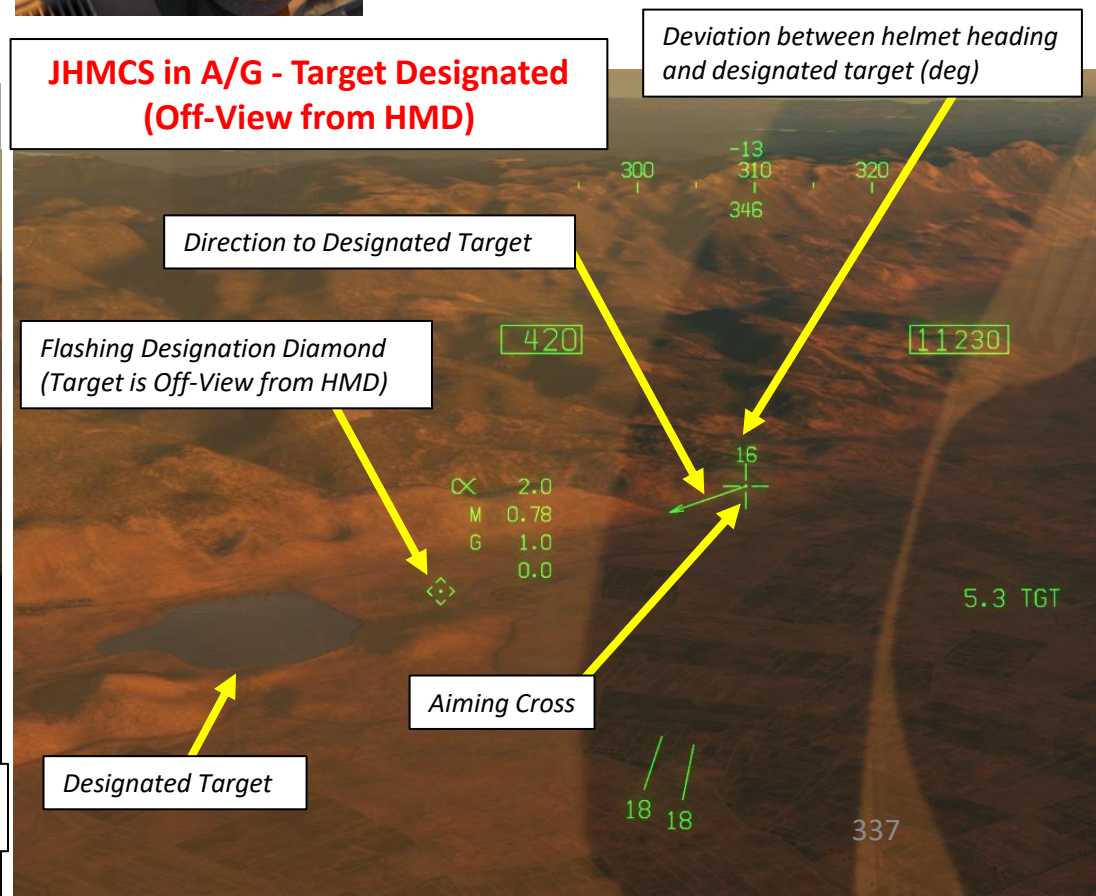
JHMCS in A/G - No Target Designated



JHMCS in A/G - Target Designated



JHMCS in A/G - Target Designated (Off-View from HMD)



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

A - HMD Format Page

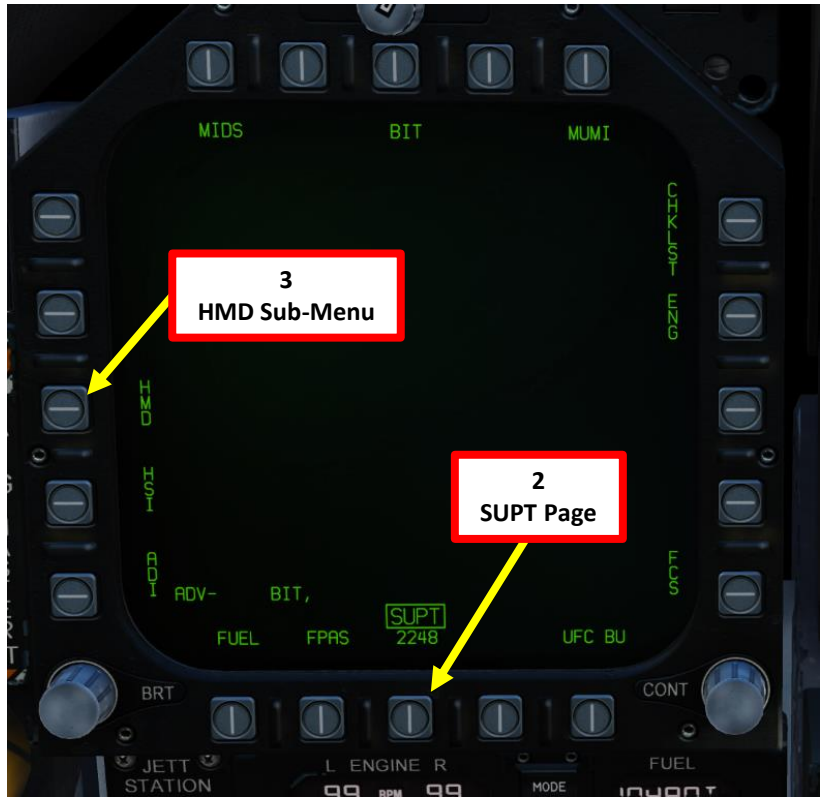
When the JHMCS is powered on (HMD Power knob set to BRT), you can access the SUPT (Support) page HMD Format sub-menu. This allows you to set up Helmet-Mounted Display options as desired.



1
HMD Power ON

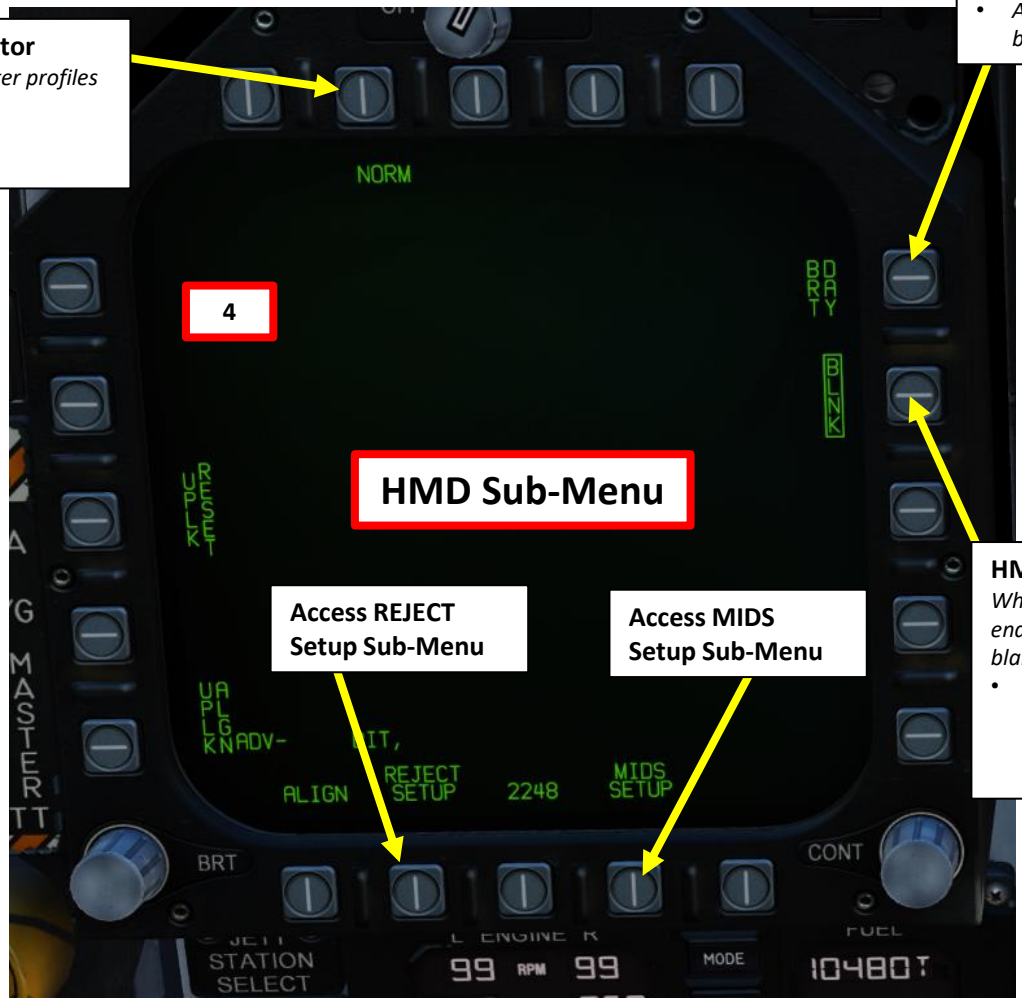
HMD Brightness (BRT) Selector
Toggles between HMD brightness options
- *DAY: Full Brightness*
- *NIGHT: Half Brightness*
- *AUTO: Automatic adjustment of brightness for best visibility*

HMD Reject Option Selector
Toggles between HMD declutter profiles
- *NORM: Normal Profile*
- *REJ1: Reject 1 Profile*
- *REJ2: Reject 2 Profile*



3
HMD Sub-Menu

2
SUPT Page



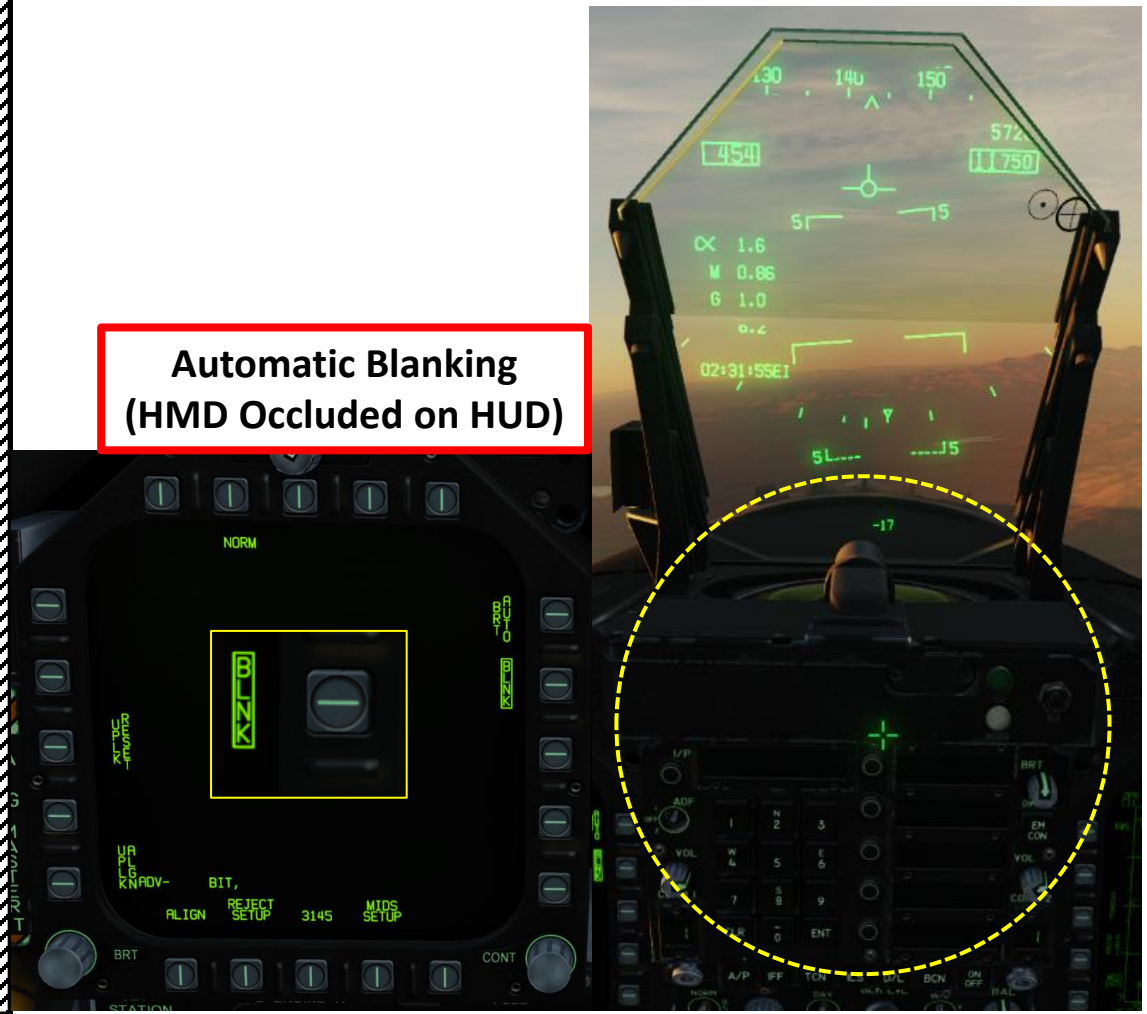
HMD Automatic Blanking Selector
When boxed, Automatic blanking is enabled. When unboxed, Automatic blanking is disabled.
- *"Blanking" means the HMD symbology is removed when the player is also looking through the Heads-Up Display in order to avoid duplicate indications.*

5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

B - HMD Manual vs Automatic Blanking

"Blanking" is the term used when the HMD symbology is occluded/removed when the player is also looking through the Heads-Up Display (HUD). Automatic blanking is useful to avoid duplicate indications. When BLNK is boxed, Automatic blanking is enabled. When BLNK is unboxed, Automatic blanking is disabled and HMD symbology will be visible when looking at the HUD.

Automatic Blanking (HMD Occluded on HUD)





Manual Blanking (HMD Not Occluded on HUD)

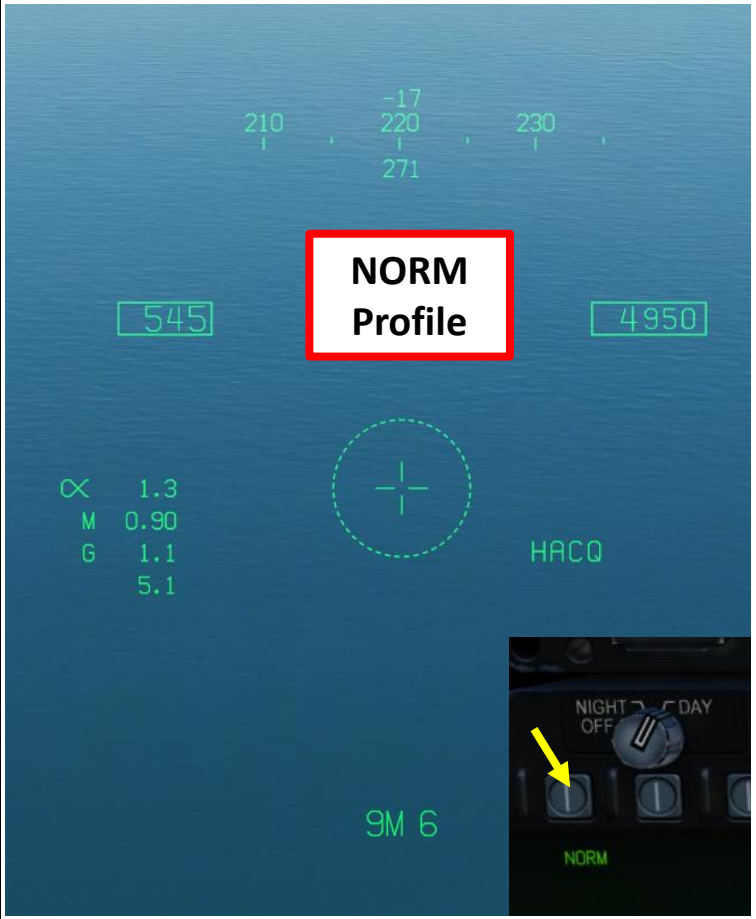


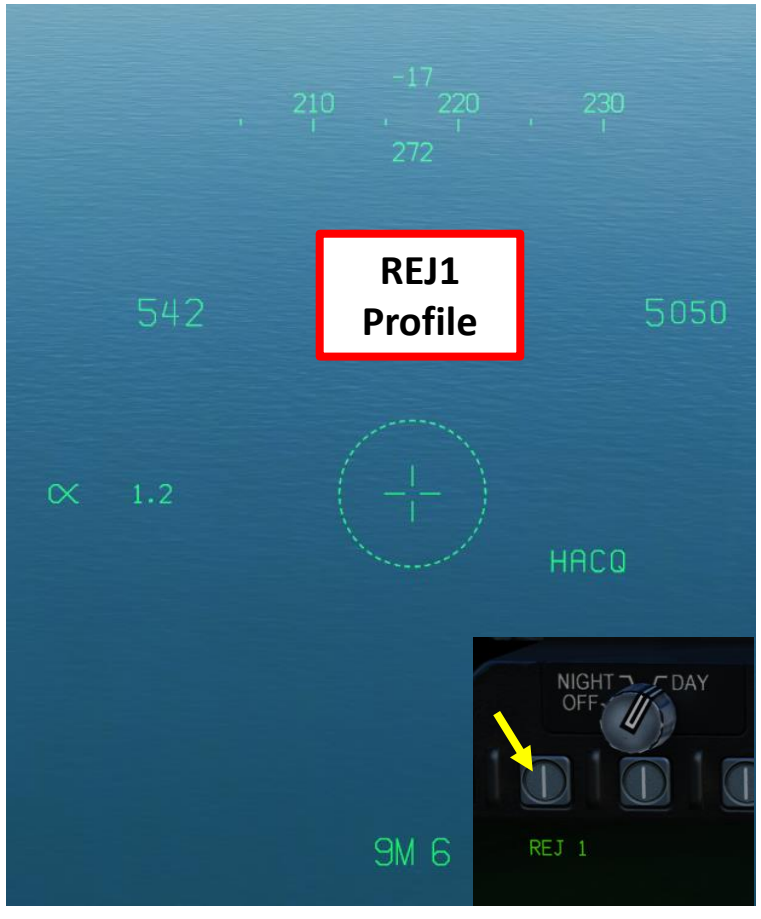
5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

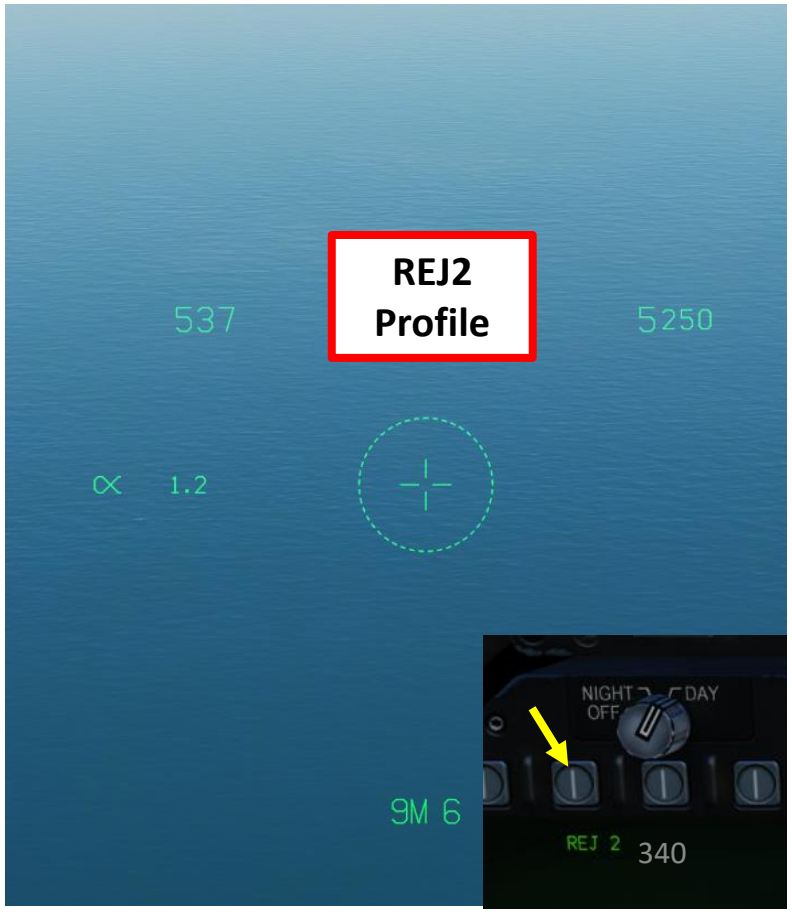
C - HMD Reject Modes

When pressing the **HMD Reject Option Selector**, you will toggle between HMD Declutter profiles (Reject Modes).

- **NORM**: normal amount of symbology is provided for all HUD displays
- **REJ1**: removes aircraft Mach number, aircraft G's, bank angle and pointer, airspeed box, altitude box, peak positive G, and required ground speed cue from the HUD
- **REJ2**: removes all REJ1 symbology plus the heading scale, current heading indication (caret/T), command heading marker, NAV/TACAN range, and the ET / CD timer,





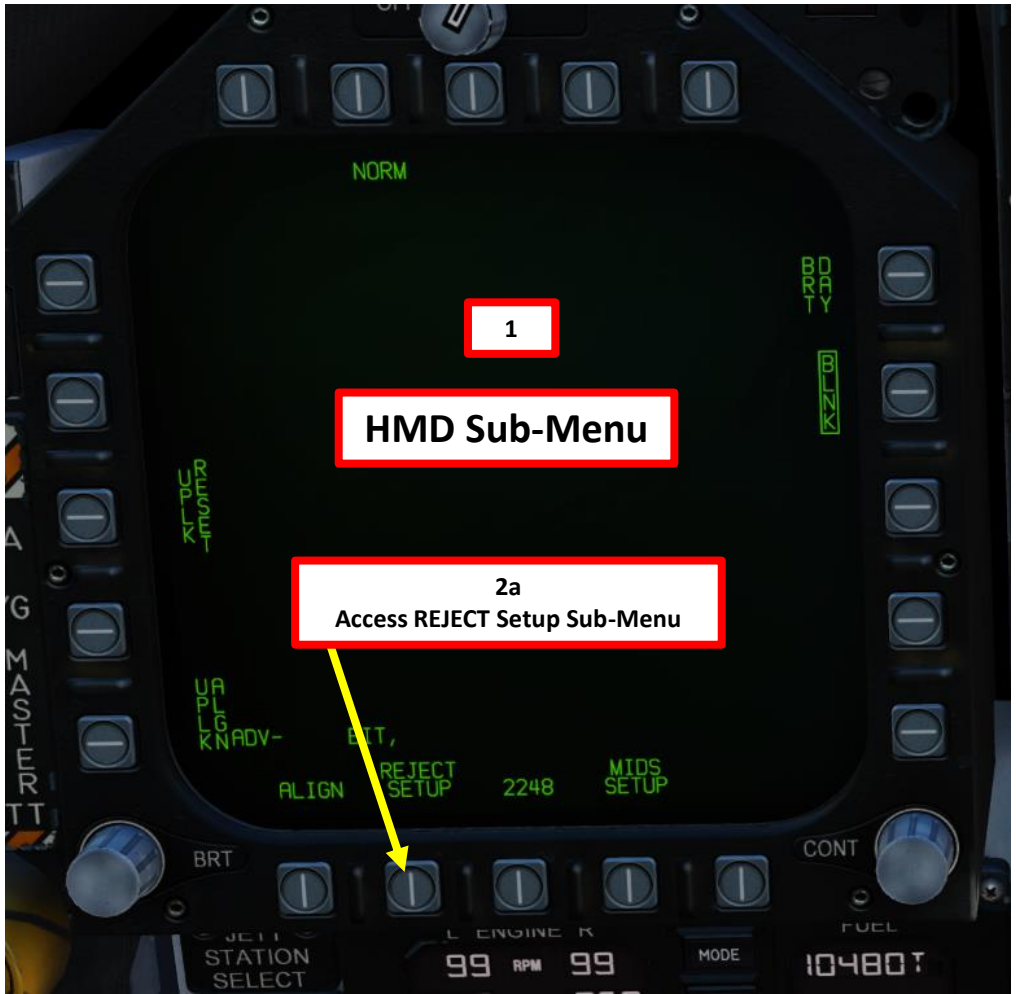


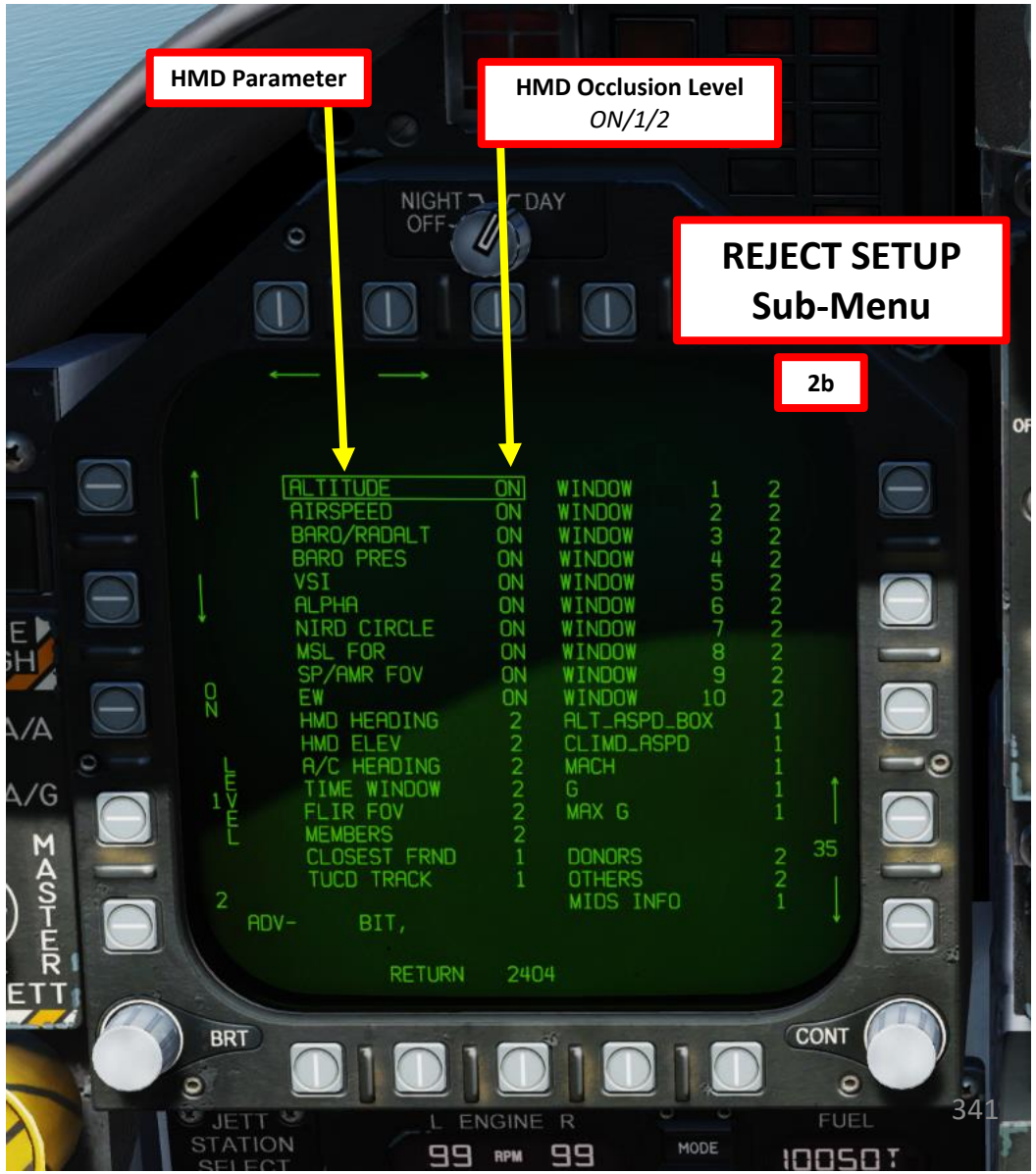
5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

D - HMD Reject Setup

In order to change manually what is shown or not shown on the HMD:

1. Access the HMD SUPT Sub-Menu
2. Access the REJECT Setup Sub-Menu.

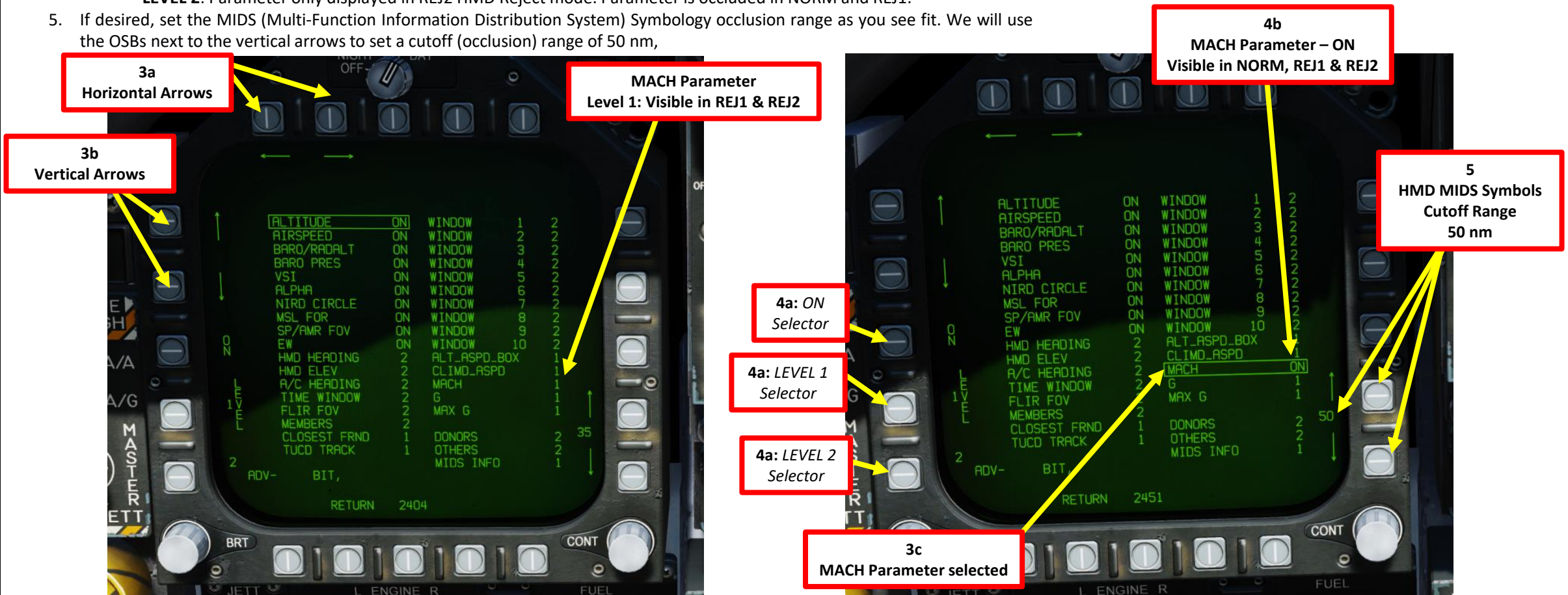




5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

D - HMD Reject Setup

3. Use the OSBs (Option Select Buttons) next to the vertical arrows and horizontal harrows to move the selection box on the parameter you want to modify. We will select the MACH parameter.
4. Once desired parameter is selected, press OSB next to desired occlusion/reject level setting.
    - **ON**: Parameter always displayed in NORM, REJ1 or REJ2 Reject modes.
    - **LEVEL 1**: Parameter only displayed in REJ1 and REJ2 HMD Reject modes. Parameter is occluded in NORM.
    - **LEVEL 2**: Parameter only displayed in REJ2 HMD Reject mode. Parameter is occluded in NORM and REJ1.
5. If desired, set the MIDS (Multi-Function Information Distribution System) Symbology occlusion range as you see fit. We will use the OSBs next to the vertical arrows to set a cutoff (occlusion) range of 50 nm,



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

D - HMD Reject Setup

Here is a list of all parameters you can reject or display on the Helmet-Mounted Display (HMD).

HMD Information/Symbol – Reject Sub-Level	
ALTITUDE: Aircraft altitude (ft)	WINDOW 1: No Function in DCS
AIRSPEED: Aircraft airspeed (kts)	WINDOW 2: No Function in DCS
BARO/RADALT: Barometric/Radar Altitude (ft)	WINDOW 3: No Function in DCS
BARO PRES: Barometric Pressure	WINDOW 4: No Function in DCS
VSI: Vertical Speed Indicator (ft/min)	WINDOW 5: No Function in DCS
ALPHA: Angle of Attack	WINDOW 6: No Function in DCS
NIRD CIRCLE: Normalized In-Range Display Circle	WINDOW 7: No Function in DCS
MSL FOR: Missile Selected	WINDOW 8: No Function in DCS
SP/AMR FOV: Sparrow/AMRAAM missile field-of-view	WINDOW 9: No Function in DCS
EW: Early Warning (Radar Warning Receiver) Symbols	WINDOW 10: No Function in DCS
HMD HEADING: Helmet-Mounted Display Heading	ALT ASPD BOX: Box on Altitude and Airspeed indications
HMD ELEV: Helmet-Mounted Display Elevation	CLIMB ASPD: Climb Airspeed (ft/min)
A/C HEADING: Aircraft Heading	MACH: Mach Number
TIME WINDOW: Time-On-Target Window	G: Current Acceleration (g)
FLIR FOV: Targeting Pod Field-of-View	MAX G: Maximum Recorded Acceleration (g)
MEMBERS: Flight Members	DONORS: Trackfiles contributing to the Fighter-to-Fighter (F/F) datalink net group
CLOSEST FRND: Closest Friendly Datalink Member	OTHERS: Trackfiles contributed to by an F/F or SURV datalink donor
TUC'D TRACK: TUC (Target Under Cursor) Track Symbol	MIDS INFO: Multi-Function Information Distribution System Info



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

E - HMD MIDS (Multi-Function Information Distribution System) Priority Setup

The HMD superimposes designators for up to 7 datalink trackfiles other than the A/A L&S or DT2 within a defined range. The 7 track limit is sorted by range from your aircraft (ownship). The priority of each category and the maximum distance from ownship displayed can be defined in the MIDS SETUP sub-menu on the HMD format, where the **bottom position is highest priority and the top is lowest**.

Each trackfile category gets a maximum number of allocations:

- MEMBERS may display up to 3 symbols.
- CLOSEST FRIENDLY and TUC'D TRACK may display up to 1 symbol each.
- DONORS may display up to 7 symbols.
- OTHERS may display up to 7 symbols if the group is placed at the bottom of the list. For every place the OTHERS group is moved upwards in the list, it loses the ability to display 1 symbol. If the OTHERS group is placed at the top of the list, it may only display up to 3 symbols. This prevents all 7 symbols from being occupied by the OTHERS group.

MIDS JHMCS PRIORITY TRACKFILE TYPES

- **Closest Friendly**: Closest trackfile to the L&S (in A/A or NAV master mode) or A/G designation (in A/G master mode) that is classified as friendly and has has an offboard datalink element. No closest friendly is displayed if there is no L&S (A/A and NAV) or A/G designation (A/G). Note that the closest friendly must still be within the maximum defined range from ownship to display.
- **Members**: PPLI (Precise Participant Location and Identification) ownship flight members.
- **TUC'd Track**: The trackfile under the cursor (TUC) on the SA format (regular cursor or STEP box). This indication cannot be affected by the AZ/EL (Azimuth/Elevation) or RDR ATTK (Radar Attack) format cursors. It also ignores the range from ownship limit set on the HMD format.
- **Donors**: Trackfiles contributing to the Fighter-to-Fighter (F/F) net group.
- **Others**: Trackfiles contributed to by an F/F (Fighter-to-Fighter) or SURV (Surveillance) donor.

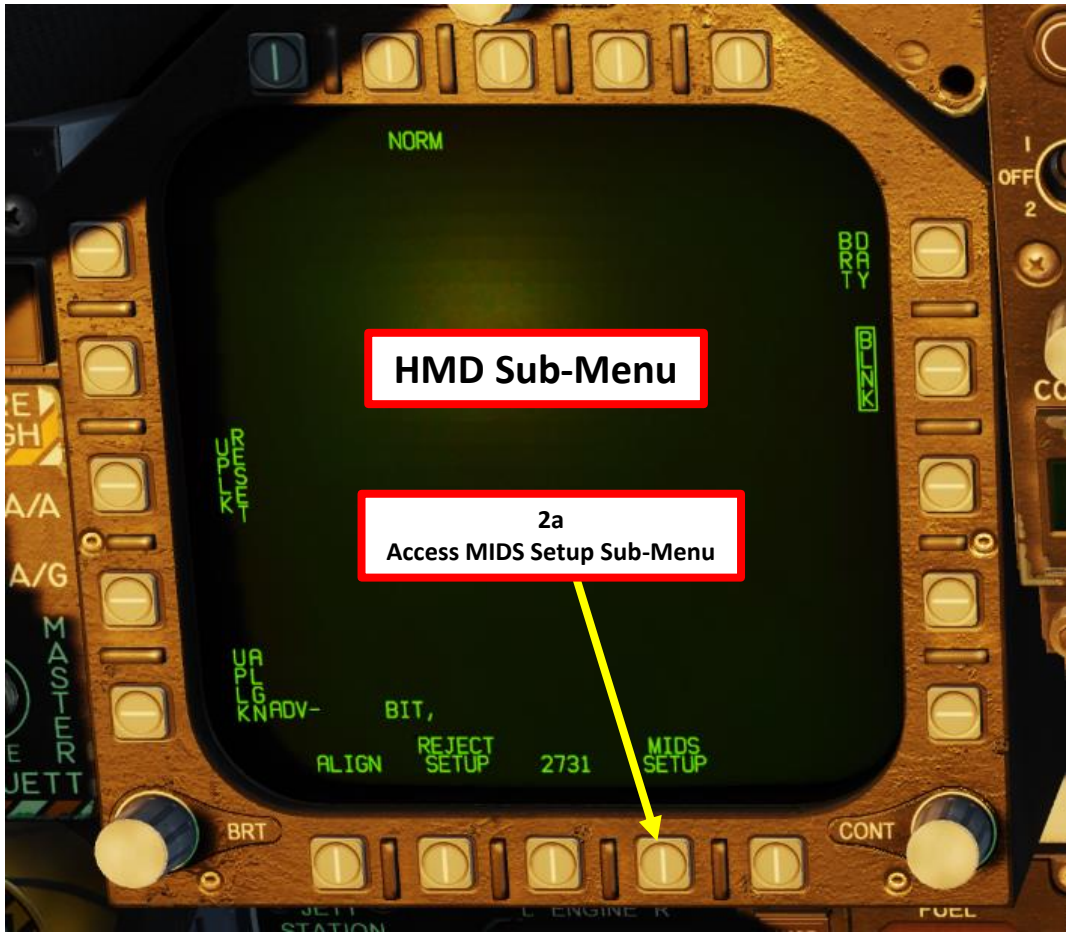


5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

E - HMD MIDS (Multi-Function Information Distribution System) Priority Setup

In order to change manually the priority order of the datalink trackfiles displayed on the Helmet-Mounted Display:

1. Access the HMD SUPT Sub-Menu
2. Access the MIDS Setup Sub-Menu.

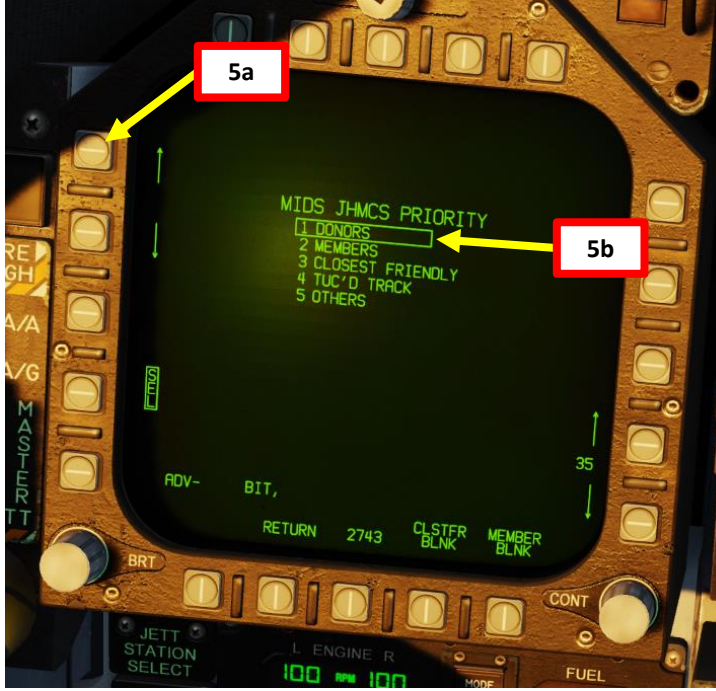


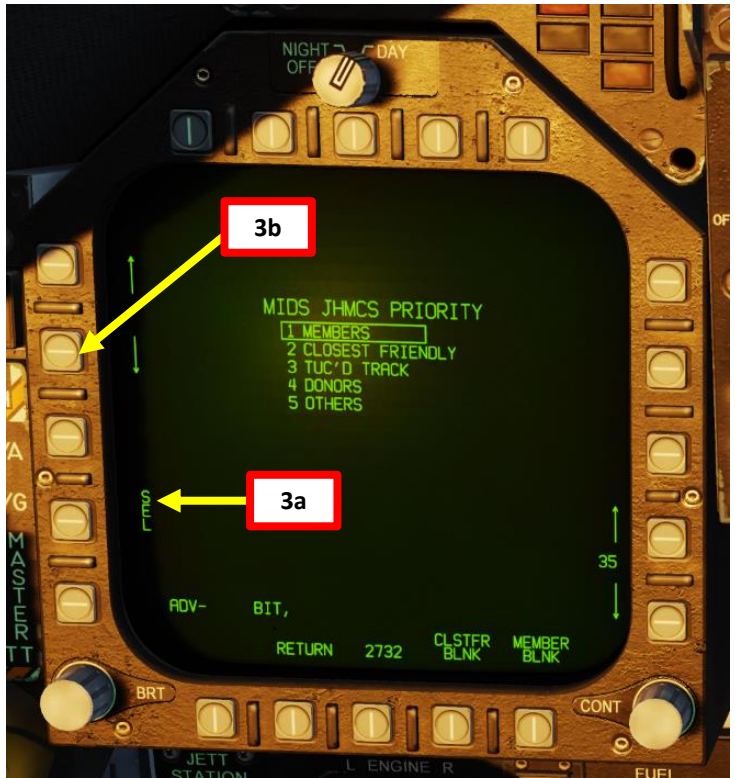


5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

E - HMD MIDS (Multi-Function Information Distribution System) Priority Setup

3. Verify that SEL (Select) function is un-boxed, then use the OSBs (Option Select Buttons) next to the vertical arrows to select the datalink trackfile type you want to change the priority of. We will select the DONORS parameter.
4. Once desired parameter is selected, press OSB next to SEL to select the parameter. SEL should become boxed.
5. Use the OSBs next to the vertical arrows to move the selected datalink trackfile type across the priority scale ("1" being the highest, "5" being the lowest). We will change DONORS priority from "4" to "1", which means that the DONORS datalink trackfiles will always be shown in priority when compared to other trackfile types if there are more than 7 datalink trackfiles.
6. Once selected parameter is at the priority you want, press OSB next to SEL to de-select the parameter. SEL should become un-boxed.





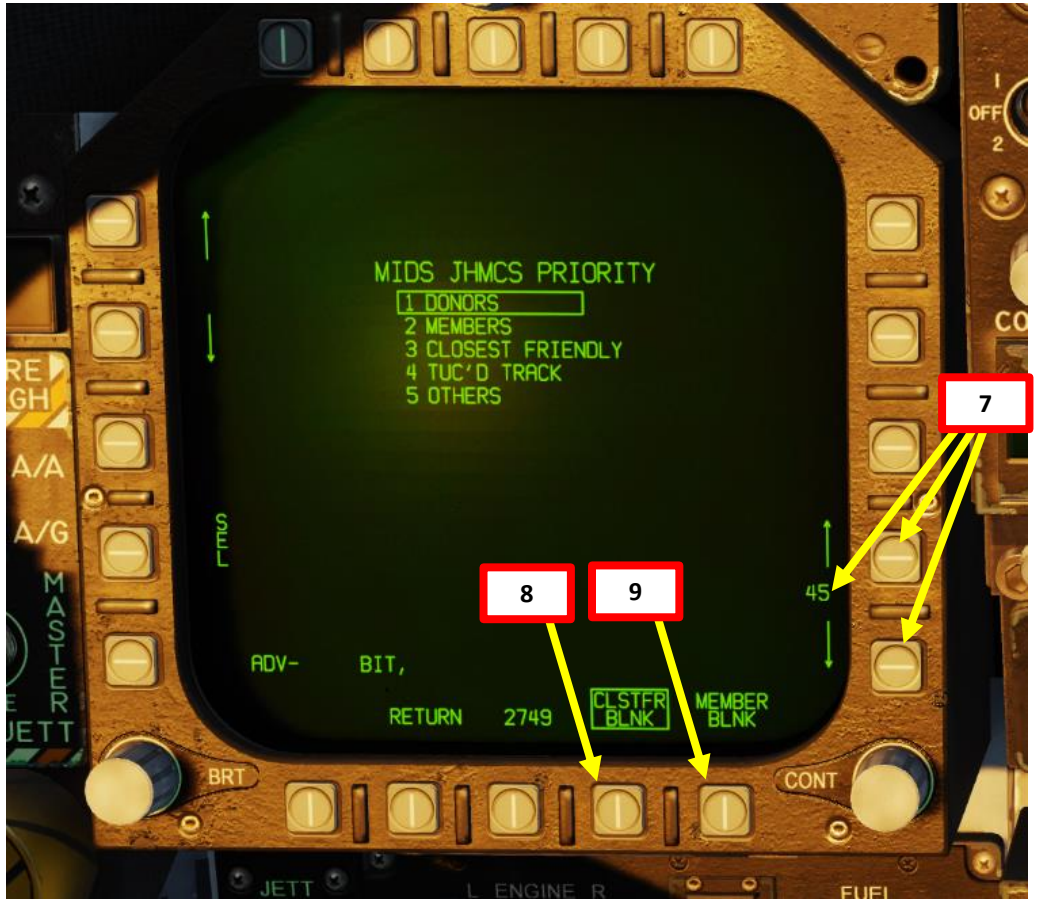




5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.3 – HMD (Helmet-Mounted Display) Symbology
5.3.2 – HMD Setup

E - HMD MIDS (Multi-Function Information Distribution System) Priority Setup

7. If desired, set the MIDS (Multi-Function Information Distribution System) Symbology occlusion range as you see fit. We will use the OSBs next to the vertical arrows to set a cutoff (occlusion) range of 45 nm,
8. The CLSTFR BLNK (Closest Friendly Trackfile Blank) function, when selected (boxed), allows you to occlude the closest friendly datalink trackfiles if desired.
9. The MEMBER BLNK (Flight Member Trackfile Blank) function, when selected (boxed), allows you to occlude the flight member datalink trackfiles if desired.



5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.4 – JHMCS Controls

- **HMD Brightness Control Knob**: When set to BRT, powers on the JHMCS system.
- **A/A & A/G Master Mode Buttons**: Controls symbology and functionality of the JHMCS based on whether you are in air-to-air or air-to-ground master mode.
- **Event Marker "Recce" Button**: Manually toggles HMD blanking (occlusion) of JHMCS symbology if pressed.
- **Sensor Control Switch**:
  - ***In A/A Master Mode***:
    - Switch FWD SHORT selects JHMCS LHACQ (Long Range Helmet Acquisition) Mode, which locks targets within 40 nm of the helmet reticle.
    - Switch FWD LONG selects JHMCS HACQ (Helmet Acquisition) Mode, which locks targets within 10 nm of the helmet reticle
  - ***In A/G Master Mode***: Switch FWD toggles Sensor controlled on HUD (Heads-Up Display) or HMD (Helmet-Mounted Display).
- **TDC (Throttle Designator Controller):**
  - LEFT/RIGHT/UP/DOWN: Slews designation diamond.
  - DEPRESS: Designates a target.
- **Undesignate / Nose Wheel Steer Button**: Undesignates any designated target.

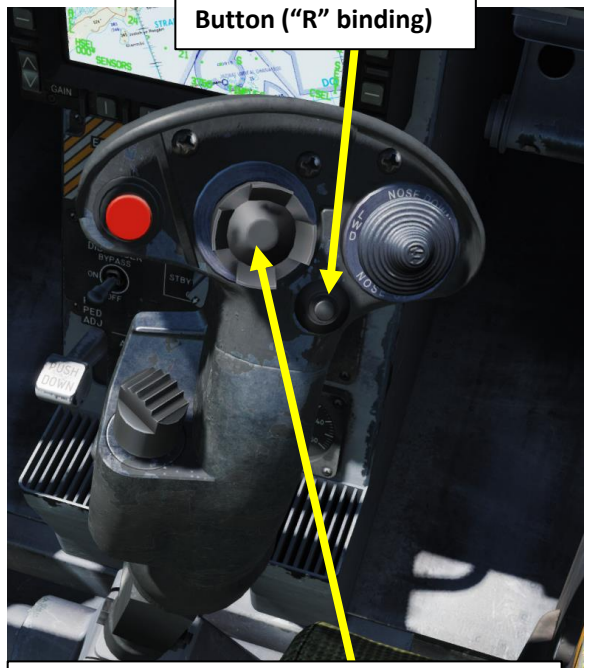


HMD (Helmet-Mounted Display) Brightness Control Switch



A/A (Air-to-Air) Master Mode Selected

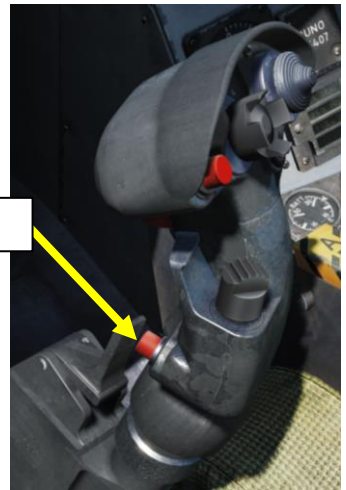
A/G (Air-to-Ground) Master Mode Selected



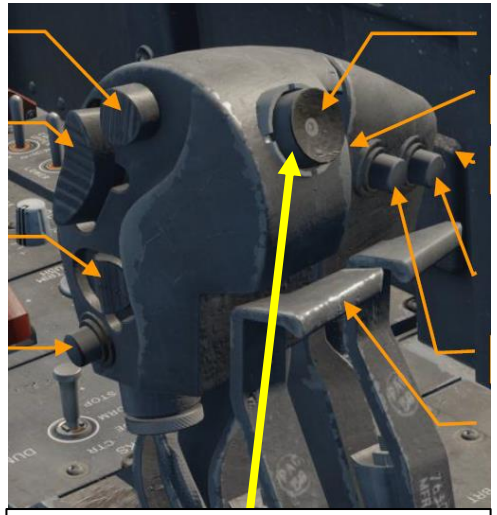
Event Marker "Recce" Button ("R" binding)

Sensor Control Switch (A/G Mode)
- FWD: Toggle Sensor controlled on HUD or HMD

Sensor Control Switch (A/A Mode)
- FWD (hold for more than 800 ms): Selects JHMCS LHACQ (Long Range Helmet Acquisition) Mode, which locks targets within 40 nm of the helmet reticle
- FWD (hold for less than 800 ms): Selects JHMCS HACQ (Helmet Acquisition) Mode, which locks targets within 10 nm of the helmet reticle



Undesignate / Nose Wheel Steer Button



TDC (Throttle Designator Controller)
(Left/Right/Up/Down/Depress)

5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.5 – JHMCS Functions
5.5.1 – Ground Target Designation

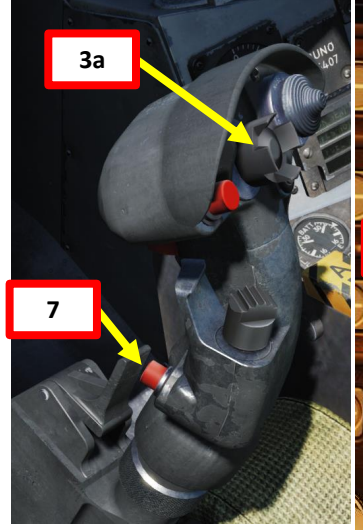
To designate a ground target using the JHMCS:

1. Power up the JHMCS by setting HMD Brightness knob to BRT (Bright)
2. Press the A/G Master Mode Button
3. Press Sensor Control Switch FWD to toggle the TDC (Throttle Designator Controller) priority between the HUD (Heads-Up Display) and the HMD (Helmet-Mounted Display). TDC priority is assigned to the helmet when the aiming reticle appears on the helmet. A center dot on the HUD's TVV means the priority is assigned to the HUD.
4. Move the helmet's Aiming Reticle on the target you want to designate.
5. Press the TDC Depress (« Enter ») to designate the target. A designation diamond will appear over the target, while the aiming cross will keep following your helmet.
6. You can slew/move the designation diamond using the TDC left/right/up/down controls.
7. To un-designate the target, press the Undesignate button on the stick.

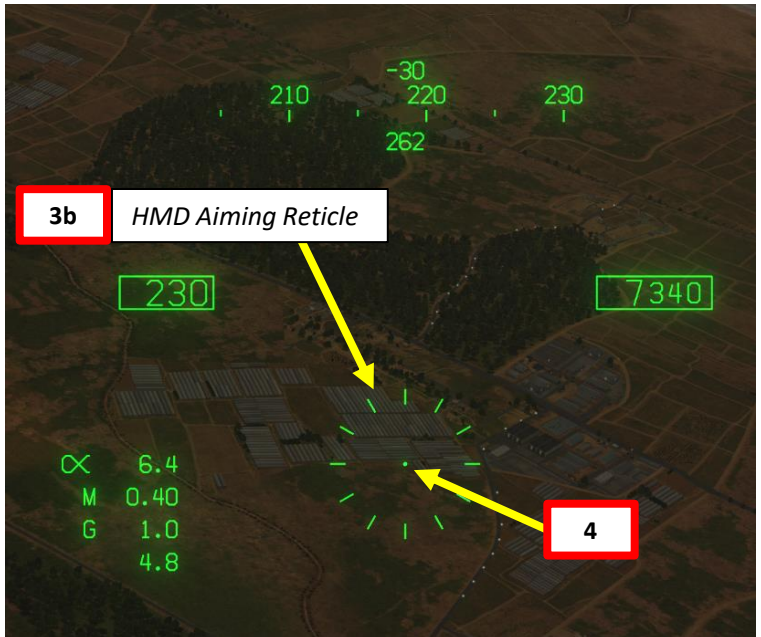


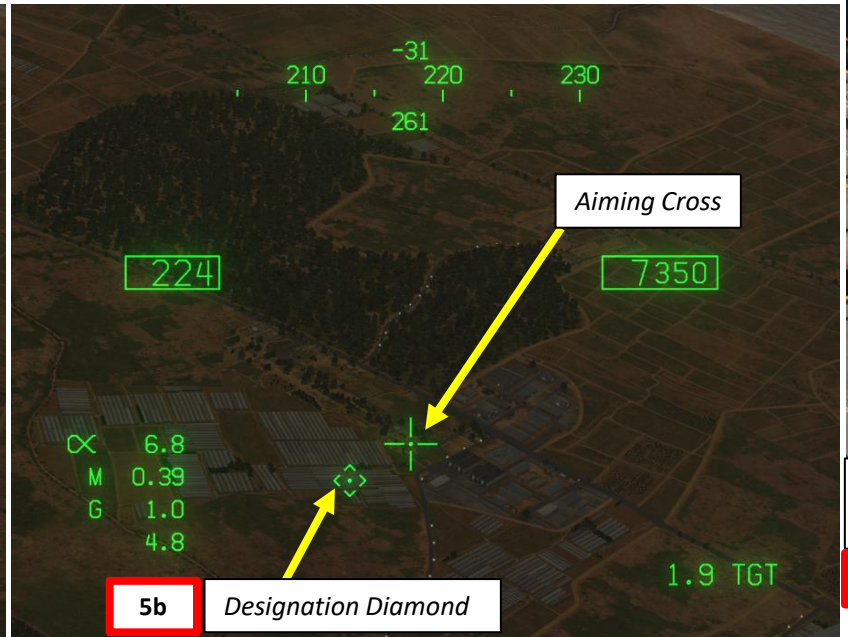


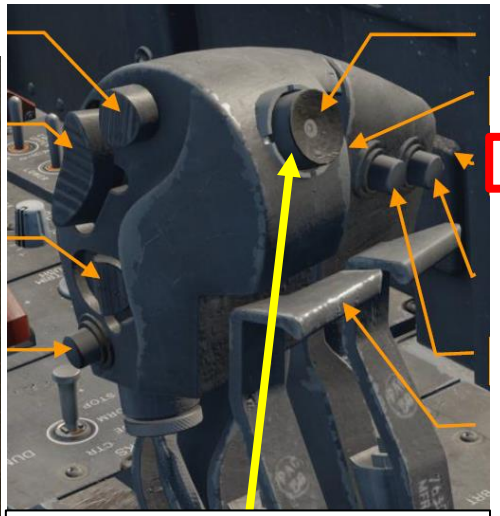
Center Dot on the TVV (Total Velocity Vector) means that the TDC (Throttle Designator Controller) is assigned to the HUD











TDC (Throttle Designator Controller)
(Left/Right/Up/Down/Depress)

5a 6



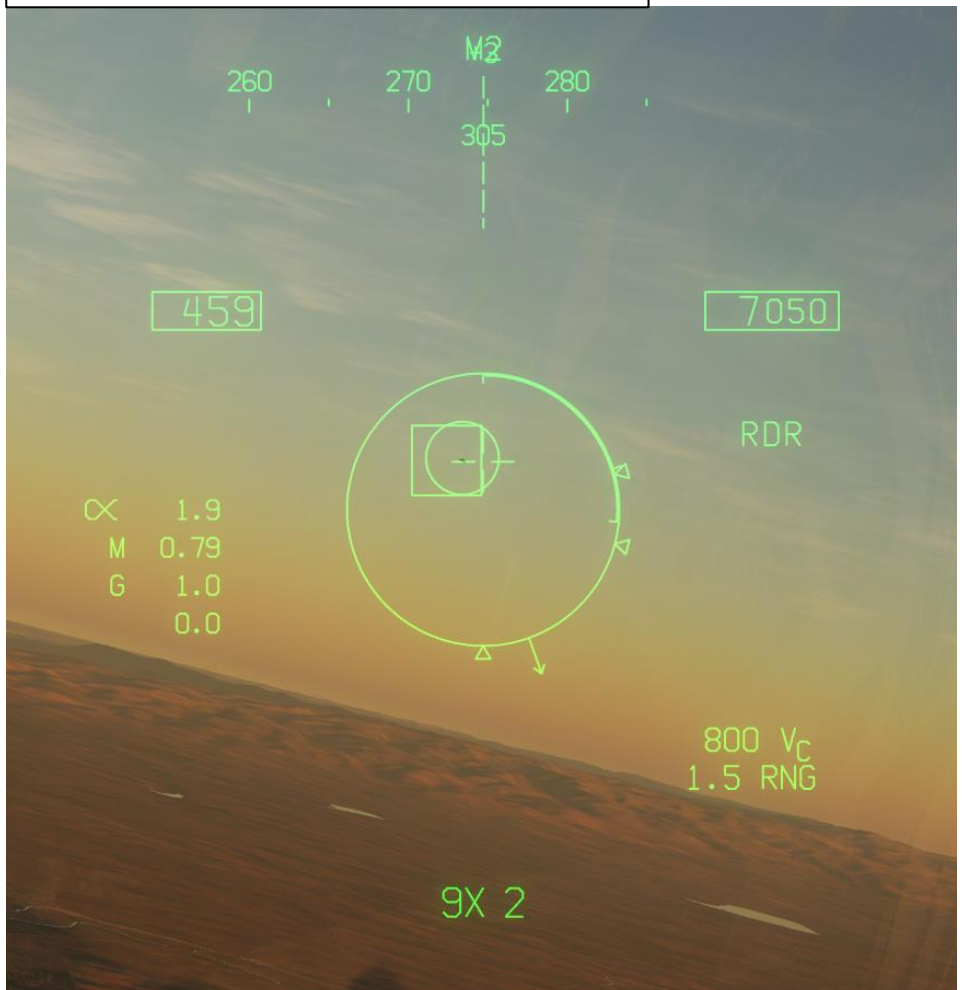
5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.5 – JHMCS Functions
5.5.2 – Air Target Radar Lock

While you can use the JHMCS to radar lock a target with the radar HACQ (Helmet Acquisition) and LHACQ (Long-Range Helmet Acquisition) modes (see tutorial PART 9 section 2.1.7.3 – JHMCS Lock), you can also use the helmet to launch AIM-9X Sidewinder with HOBS (High Off-Boresight) missile shots (see tutorial PART 10 section 3.3 – AIM-9X Sidewinder (JHMCS)). Consult relevant tutorial sections as required.

No STT (Single Target Track) Lock Acquired



STT (Single Target Track) Lock Acquired

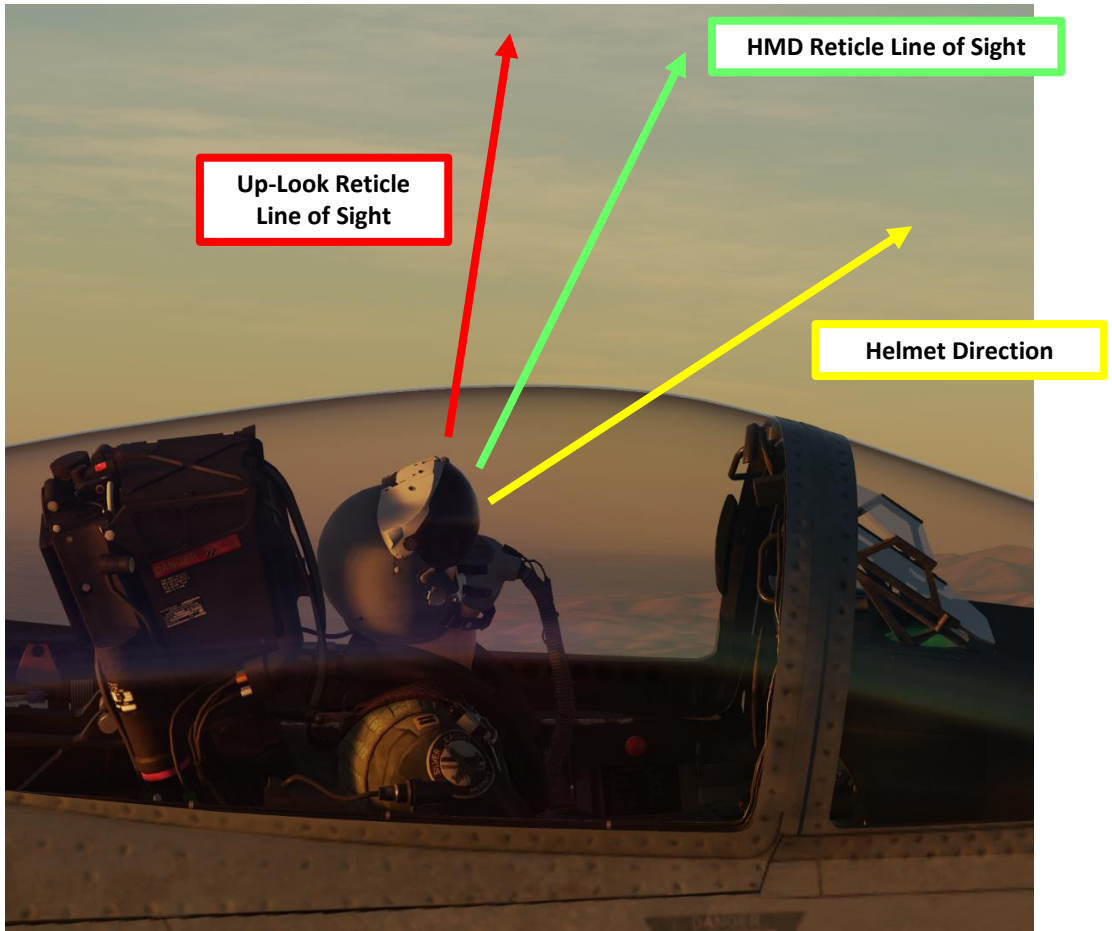


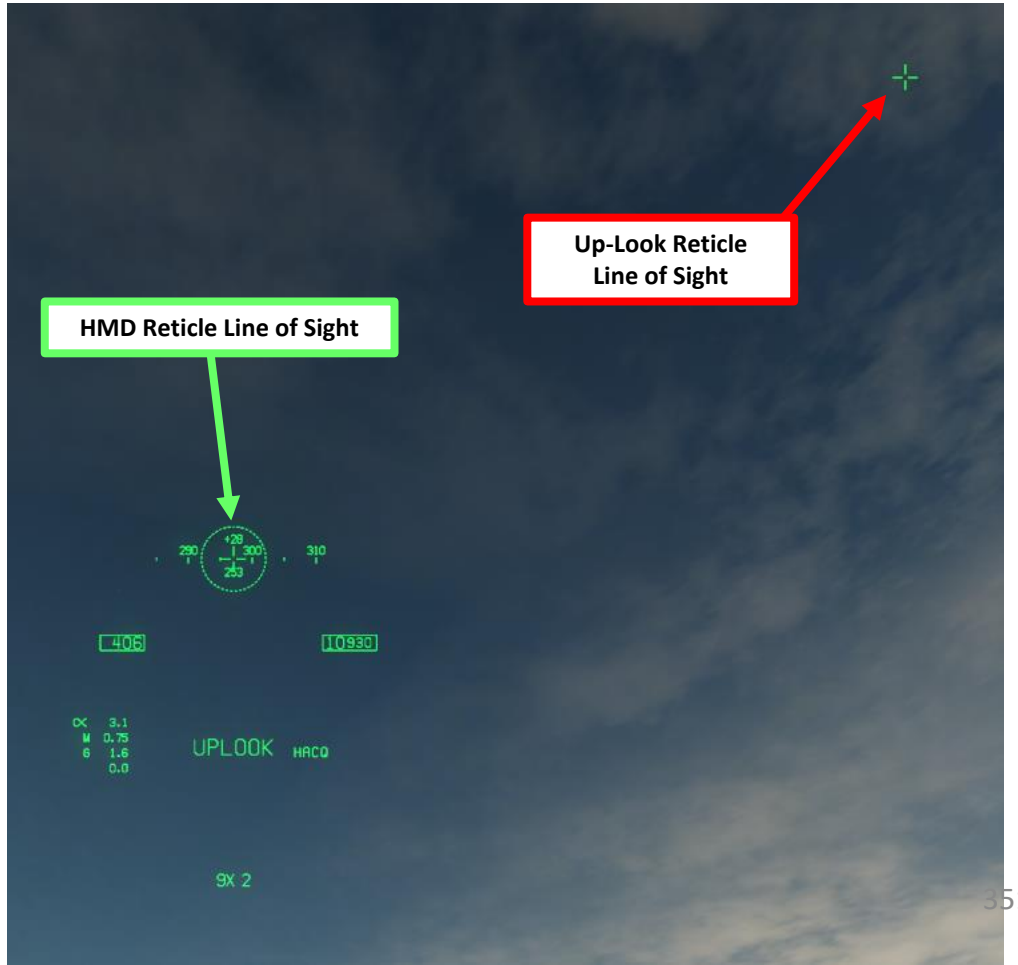
5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.5 – JHMCS Functions
5.5.3 – AIM-9X Up-Look Cueing

The JHMCS allows you to use "Up-Look cueing", which slaves the AIM-9X seeker to Up-Look reticles (they are visible if you zoom out). In DCS, Up-Look cueing is available as follows:

1. Set Master Mode to A/A
2. Select AIM-9X Sidewinder missile (Weapon Select Switch DOWN)
3. Set TDC (Throttle Designator Controller) priority to the Helmet Display by pressing Sensor Control Switch FWD
4. Press the Sensor Control Switch AFT to enter Up-Look Cueing.
5. Uncage AIM-9X (Cage/Uncage button on the throttle) and place Up-Look Reticle on target, which allows you to launch AIM-9X missiles beyond radar limits.

Note: this function is not fully implemented yet.



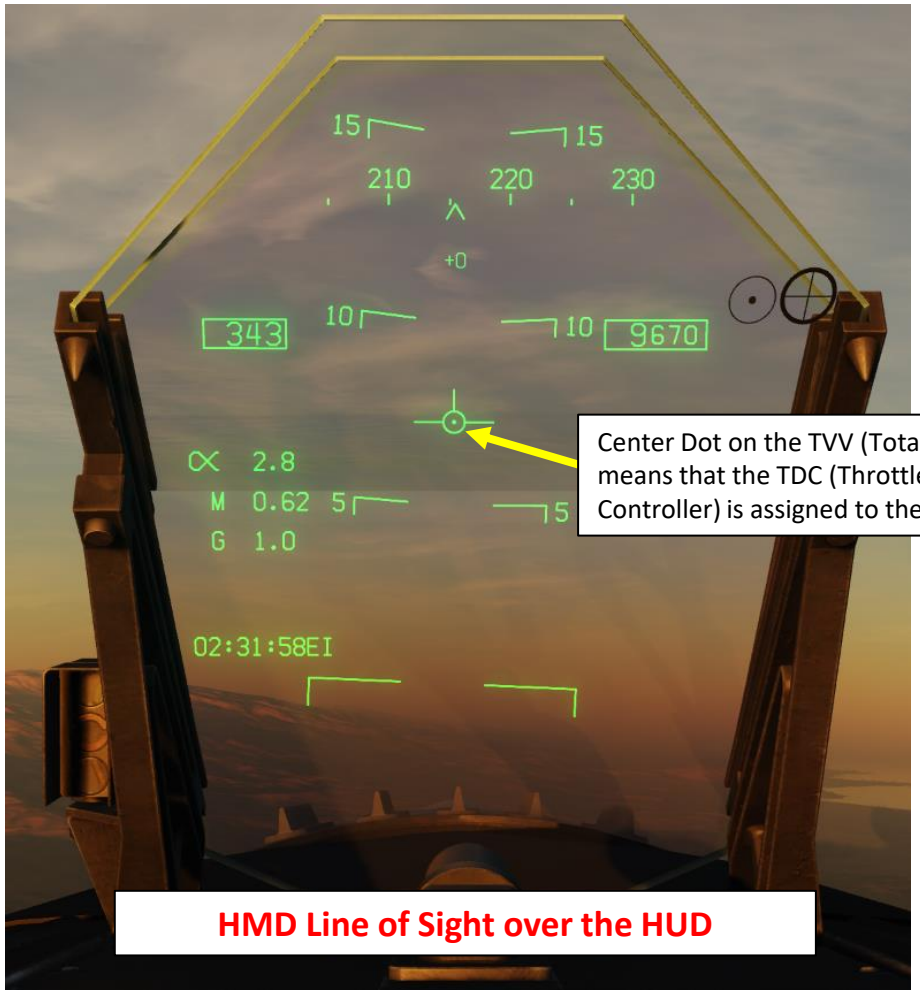


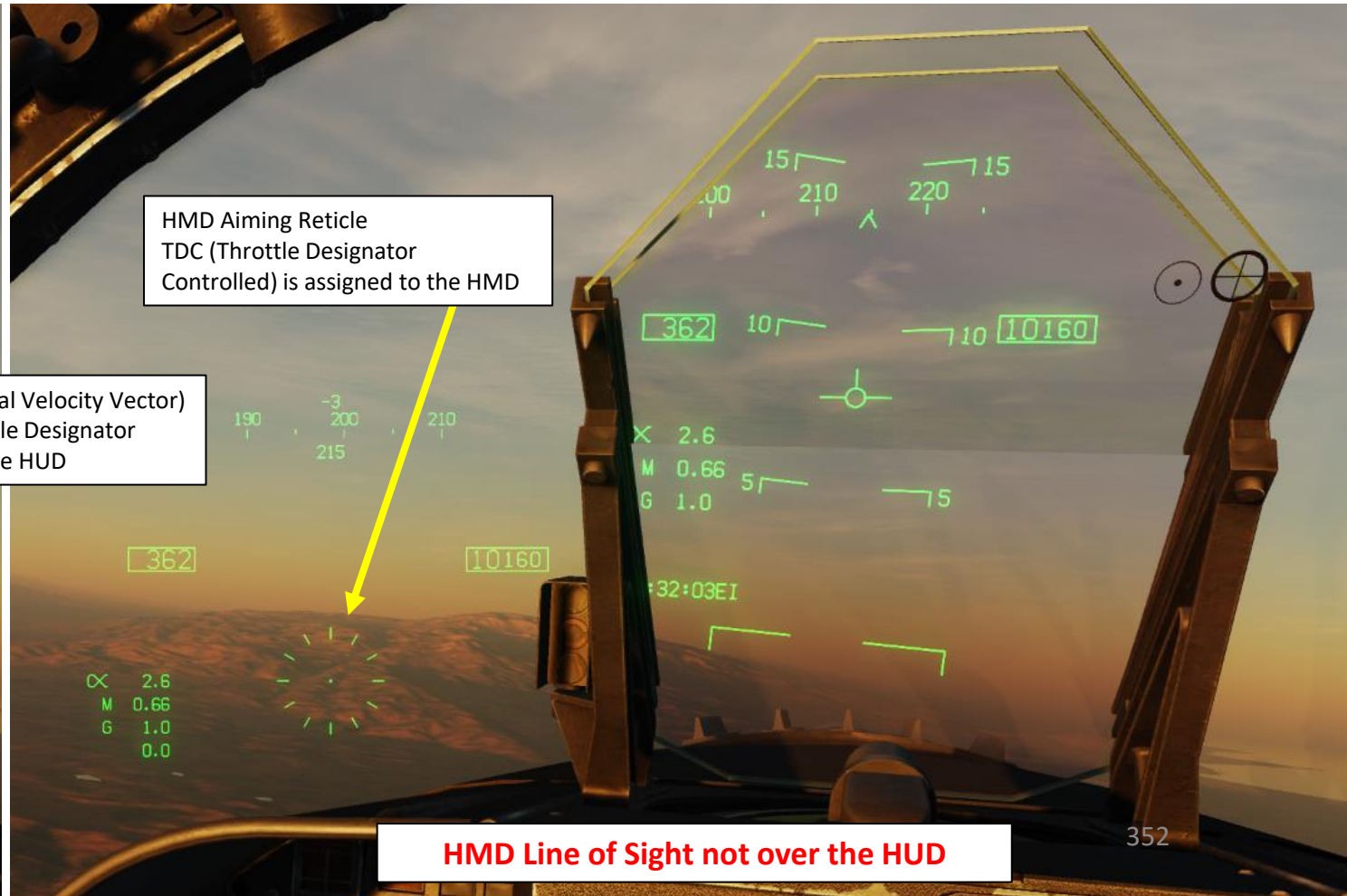
5 - JHMCS (JOINT HELMET-MOUNTED CUEING SYSTEM)
5.6 – HUD (Heads-Up Display) Designation Considerations

Pressing the Sensor Control Switch FWD will toggle the TDC (Throttle Designator Controller) priority between the HUD (Heads-Up Display) and the HMD (Helmet-Mounted Display). TDC priority is assigned to the helmet when the aiming reticle appears on the helmet. A center dot on the HUD's TVV means the priority is assigned to the HUD.

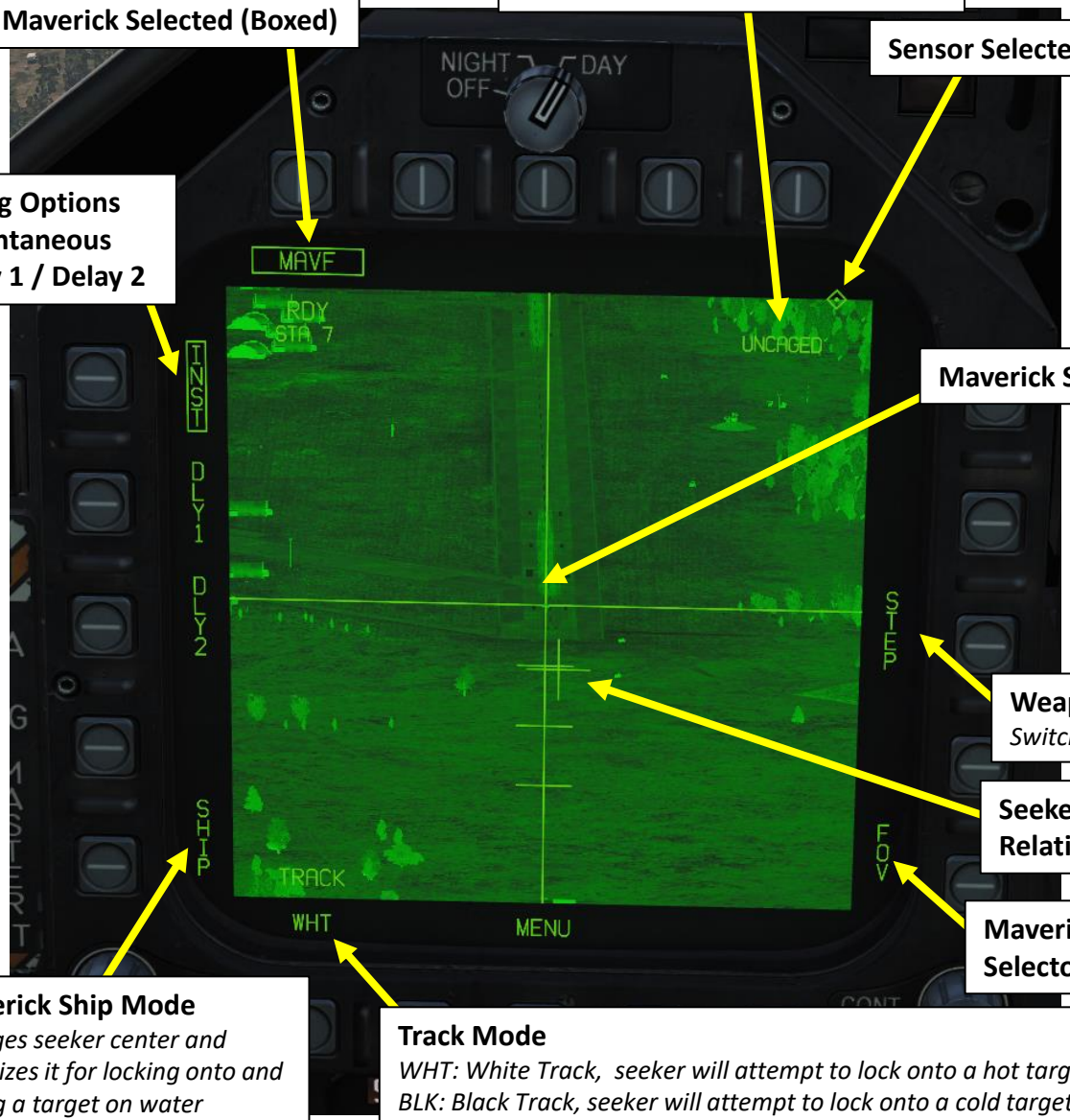
An important distinction to make is that if the Sensor Control Switch is pressed FWD and the JHMCS is powered, the TDC Priority system will automatically set the Helmet-Mounted Display as the sensor of interest… Unless the HMD line of sight is over the Heads-Up Display, which means the HUD will automatically become the sensor of interest.







6 - AGM-65F/G MAVERICK (IR-MAVF)
6.1 – DISPLAYS



Maverick Selected (Boxed)

Maverick Caged/Uncaged Status

Sensor Selected Diamond

Fuzing Options
Instantaneous
Delay 1 / Delay 2

Maverick Seeker Center

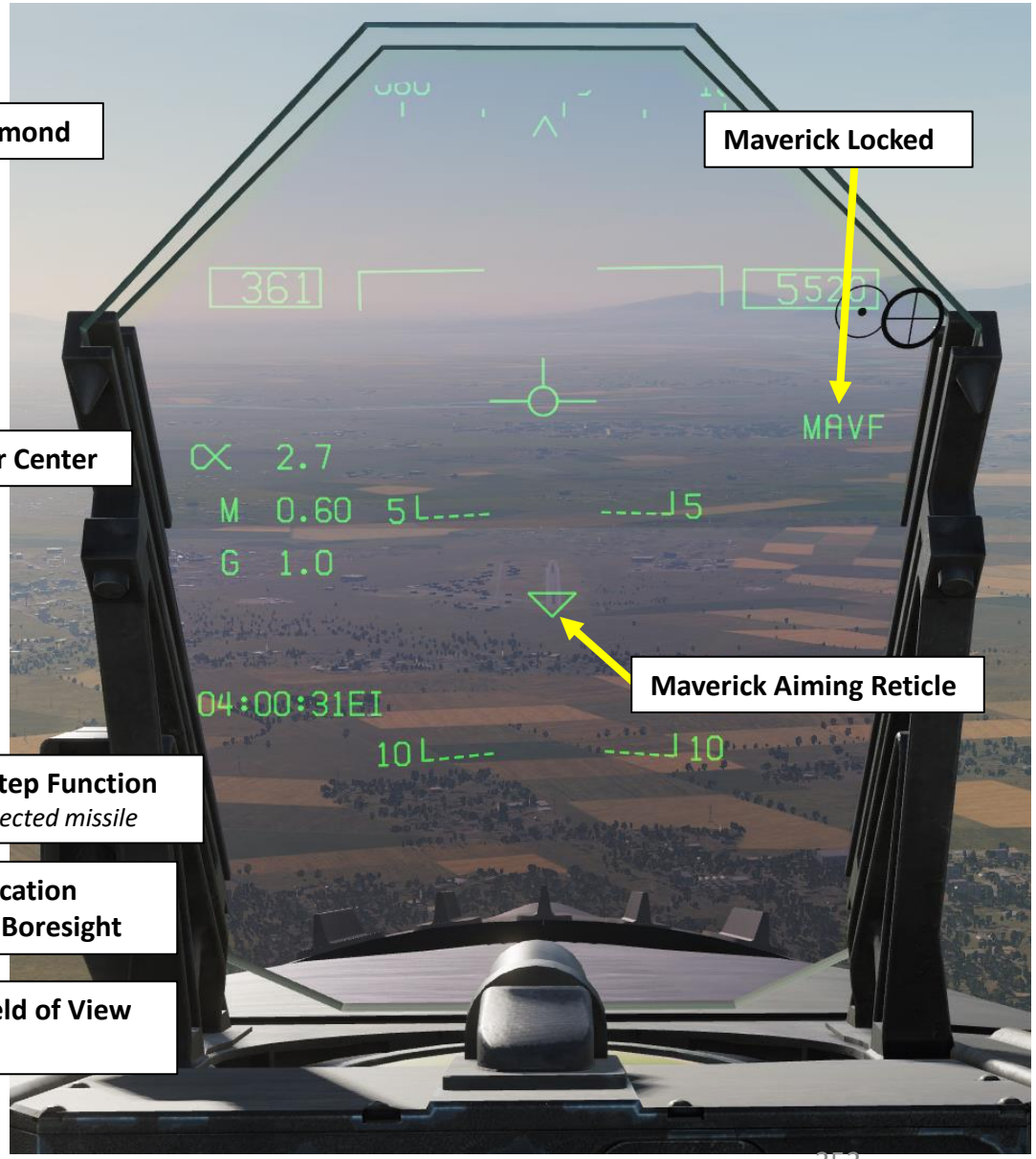
Weapon Step Function
Switches selected missile

Seeker Indication
Relative to Boresight

Maverick Field of View Selector

Maverick Ship Mode
Enlarges seeker center and optimizes it for locking onto and hitting a target on water

Track Mode
WHT: White Track, seeker will attempt to lock onto a hot target
BLK: Black Track, seeker will attempt to lock onto a cold target

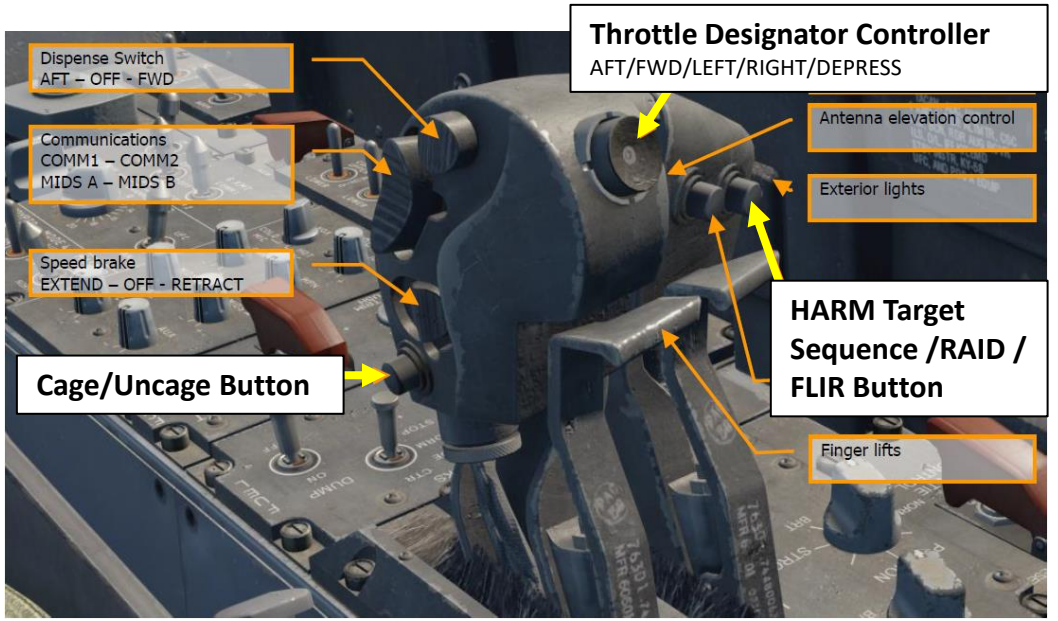


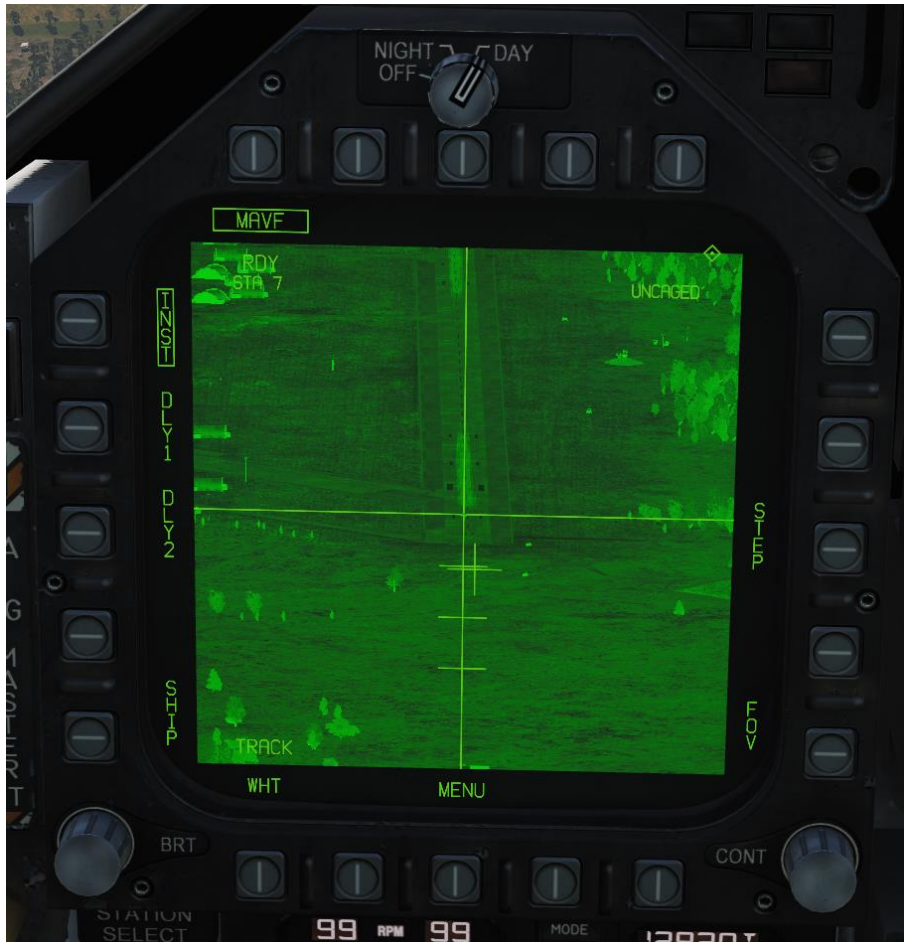
Maverick Locked

Maverick Aiming Reticle

6 - AGM-65F/G MAVERICK (IR-MAVF)
6.2 – CONTROLS

To operate the IR-Seeker Maverick, you need to first allow it to cooldown (will be shown in Weapons Section) by selecting it in the SMS (Stores Management System) page, setting Master Arm On and pressing the A/G Master Mode. Then, you can select the Maverick seeker head feed by going back to the TAC page and selecting IMAV DSPLY. Then, use the Sensor Control Switch to the Maverick Feed DDI, Uncage the Maverick, hold the TDC Depress button while slewing the Maverick to the target. When you release the TDC Depress button, the missile will attempt to lock its target.











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SECTION STRUCTURE

- **1 - Introduction**
  - 1.1 – Introduction to Weapons
  - 1.2 – Armament Matrix
  - 1.3 – My Weapons Control Setup
  - 1.4 – SMS (Stores Management System) Page
  - 1.5 – Bomb Delivery Modes
- **2 – Air-to-Ground Weapons**
  - 2.1 – Unguided Bombs
    - 2.1.1 – MK-82 (CCIP)
    - 2.1.2 – MK-82 (CCRP/AUTO)
  - 2.2 – MK-20 Rockeye Cluster Bombs (CCIP)
  - 2.3 – Rockets
  - 2.4 – M61A2 Gun (Air-to-Ground)
  - 2.5 – GPS-Guided Ordnance
    - 2.5.1 – GBU-38 JDAM (Pre-Planned)
    - 2.5.2 – GBU-38 JDAM (TOO + Targeting Pod)
    - 2.5.3 – AGM-154A JSOW (TOO + Waypoint Designate)
  - 2.6 – GBU-12 Paveway II (Laser-Guided)
  - 2.7 – AGM-65F/G Maverick (IR-MAVF)
    - 2.7.1 – AGM-65F Missile IR Seeker Only
    - 2.7.2 – AGM-65F Missile Slaving (Targeting Pod)
    - 2.7.3 – AGM-65F Missile Slaving (GMT Radar)
  - 2.8 – AGM-65E Maverick (Laser-Guided MAV)
  - 2.9 – AGM-88C HARM Anti-Radiation Missile
    - 2.9.1 – AGM-88C HARM (TOO)
    - 2.9.2 – AGM-88C HARM (SP)
    - 2.9.3 – AGM-88C HARM (PB)
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    - 2.10.1 – AGM-84D Harpoon (BOL)
    - 2.10.2 – AGM-84D Harpoon (R/BL)
    - 2.10.3 – AGM-84D Harpoon (SEA Radar)
- **2 – Air-to-Ground Weapons**
  - 2.11 – AGM-84E SLAM Cruise Missile
    - 2.11.1 – AGM-84E SLAM Introduction
    - 2.11.2 –Weapon Setup
    - 2.11.3 – Target Designation
      - 2.11.3.1 – TOO / Waypoint
      - 2.11.3.2 – TOO / Targeting Pod
      - 2.11.3.3 – TOO / Air-to-Ground Radar
      - 2.11.3.4 – Pre-Planned
    - 2.11.4 – Weapon Launch & Control
  - 2.12 – AGM-62 Walleye II TV-Guided Glide Bomb
    - 2.12.1 – AGM-62 Walleye II (No Datalink Pod)
    - 2.12.2 – AGM-62 Walleye II (With Datalink Pod)
- **3 – Air-to-Air Weapons**
  - 3.1 – M61A2 Gun
    - 3.1.1 – M61A2 Gun (Funnel / No Radar Tracking)
    - 3.1.2 – M61A2 Gun (Radar Tracking)
  - 3.2 – AIM-9M Sidewinder
    - 3.2.1 – AIM-9M (No Radar)
    - 3.2.2 – AIM-9M (Radar)
  - 3.3 – AIM-9X Sidewinder (JHMCS)
  - 3.4 – AIM-7M Sparrow (Radar)
  - 3.5 – AIM-120B AMRAAM (Radar)
- **4 – Selective Ordnance Jettison**
- **5 – Video Tutorials**

1.1 - INTRODUCTION

BOMBS			
WEAPON	TYPE	WEAPON	TYPE
MK-82	500 lbs low-drag unguided bomb ***Fuze Needed: MFUZ NOSE*** ***EFUZ INST***	CBU-99	500 lbs anti-tank cluster bomb ***Fuze Needed: MFUZ VT*** ***HT Function: Sets HOB (Height of Burst) - 1500***
MK-82SE (Snake Eye)	500 lbs unguided low-drag retarded bomb ***Fuze Needed: MFUZ NOSE*** ***EFUZ INST***	MK-20 Rockeye	Unguided cluster bomb ***Fuze Needed: MFUZ VT*** ***HT Function: Sets HOB (Height of Burst) - 1500***
MK-83	1000 lbs low-drag unguided bomb ***Fuze Needed: MFUZ NOSE*** ***EFUZ INST***	BDU-33	25 lbs unguided training bomb ***Fuze Needed: MFUZ NOSE*** ***EFUZ INST***
MK-84	2000 lbs low-drag unguided bomb ***Fuze Needed: MFUZ NOSE*** ***EFUZ INST***	AGM-154A/C JSOW	Global Positioning System (GPS)-guided Joint Standoff Weapon (JSOW) glide bombs ***Fuze Needed: EFUZ INST*** ***HT Function (AGM-154A): Sets HOB (Height of Burst)***
GBU-10/12/16 PAVEWAY II	2000/500/1000 lbs laser-guided bomb ***Fuze Needed: MFUZ OFF*** ***EFUZ INST or DLY1***	GBU-38 (J-82) JDAM	Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs
AGM-62 ER/DL Walleye II	2000 lbs TV-Guided bomb. ER/DL stands for “Extended Range/Datalink”.		

SMS Designations	
Type	**SMS Designation**
GBU-38	J-82
GBU-32	J-83
GBU-31	J-84
GBU-31(V)	J-109
AGM-154A	JSA
AGM-154C	JSC

1.1 - INTRODUCTION

GUN POD	
WEAPON	TYPE
M61A2 Vulcan	Six-barrel 20 mm Gatling-type rotary cannon (578 rounds)

AIR-TO-AIR MISSILES	
WEAPON	TYPE
AIM-9L/M/P Sidewinder	Infrared guided air-to-air missile
AIM-7F/M Sparrow	Semi-active radar-guided air-to-air missile
AIM-120 AMRAAM	Advanced Medium Range Air-to-Air Missile (AMRAAM), active radar homing air-to-air missile

ROCKETS	
WEAPON	TYPE
ZUNI MK-71	130 mm (5 inches) unguided rockets
2.75 in	2.75 inches rocket, used for general purpose

1.1 - INTRODUCTION

AIR-TO-GROUND MISSILES

WEAPON	TYPE
AGM-65F/G Maverick – IR Seeker (MAVF)	Air-to-Ground missile guided by imaging infrared system (MAVF) and used at night and during bad weather.
AGM-65E Maverick – Laser Guided (MAV)	Air-to-Ground missile guided by laser designator guidance system (MAV) optimized for fortified installations and heavier penetrating blast-fragmentation warhead
AGM-88C HARM	Air-to-Surface High-Speed Anti-Radiation Missile (HARM) missile. Anti-radiation guidance homes in on radiowave emissions from a radar, allowing it to attack surface-to-air missile (SAM) sites.
AGM-84D Harpoon	All-weather, over-the-horizon, Anti-Ship missile system.
AGM-84E SLAM	Stand off precision-guided, air-launched cruise missile. Standoff Land Attack Missile
AGM-84H/K SLAM-ER	Stand off precision-guided, air-launched cruise missile. Standoff Land Attack Missile-Expanded Response

1.2 - ARMAMENT MATRIX BY TWISTED-BISCUIT

ver. 1.0.2
11 July 2018

F/A-18C Hornet | Stations

9	8	7	6	5	4	3	2	1
AIM-9 ONLY	LAU-115 BRU-33 BRU-41A	LAU-115 BRU-33 BRU-41A	AIM-7 ONLY LAU-115 LAU-115C	BRU-33	AIM-7 ONLY LAU-115 LAU-115C	LAU-115 BRU-33 BRU-41A	LAU-115 BRU-33 BRU-41A	AIM-9 ONLY

Common Terms	
Cluster	A bomb which releases hundreds of smaller explosives at a given height or time.
Fuse	Determines the detonation condition of the warhead. Impact or electronic fuse on the head / tail.
Unguided	Once the ordnance is released, it receives no further direction from the pilot.
Fin-Retarding	Deploys a set of fins to slow the ordnance in order to allow the aircraft escape the explosion.
Free-Fall	Does not guide itself to a target.
Semi-Active Radar	Missile relies on the aircraft on-board radar to keep lock of the target.
IR	Infra-red tracking. When launched, the missile locks onto a heat signature and attempts to follow it.

F/A-18C Hornet | Armament Matrix

STATION	NAME	AKA	PURPOSE	TARGETS	FRAG DISTANCE	WEIGHT	LENGTH	RANGE	SPEED	SUB-MUNITIONS	EMPLOYMENT	SUB-MUNITIONS DISPENSER	FUSE	STORES SETTINGS	NOTE	NOTE
BOMBS																
BRU-33	Mk20 Rockeye	CBU-100	Air-to-Ground Multipurpose Cluster Munition	Armoured Vehicle Requiring Penetration	Unknown	220kg / 490lbs	2.34m	N/A	N/A	247 x Mk118 Bomblets	Unguided, Free-Fall	MK7	Mk331 Mod 1 Timed Fuse OR FMU-140 Radio Proximity Fuse	SMS Page > MFUZ > VT > HOB (Height of Burst) Toggle to desired height	Almost identical to CBU-99 except for the dispenser and fuze.	Aiming corrected as of DCS 2.5.2.19157 Update 6
BRU-33	CBU-99		Air-to-Ground Multipurpose Cluster Munition	Armoured Vehicle	Unknown	220kg / 490lbs	2.34m	N/A	N/A	247 x Mk118 Bomblets	Unguided, Free-Fall	SUU-75	FMU-140 Radio Proximity Fuse (Version Dependant)	SMS Page > MFUZ > VT > HOB (Height of Burst) Toggle to desired height	Almost identical to Mk20 Rockeye except for the dispenser and fuze.	Aiming corrected as of DCS 2.5.2.19157 Update 6
BRU-33	Mk-82		Low-Drag, General Purpose Iron Bomb	Unarmoured or Lightly Armoured Targets	80m Across, 30m Long (Approx.)	241kg / 500lbs	2.21m	N/A	N/A	N/A	Unguided, Free-Fall	N/A	Nose Only	SMS Page > MFUZ > Nose	Nose fuse only in current version.	
BRU-33	Mk-82 SnakeEye		Fin-Retarding, General Purpose Iron Bomb	Unarmoured or Lightly Armoured Targets	80m Across, 30m Long (2.400m2) Approx.	258kg / 568lbs	2.27m	N/A	N/A	N/A	Unguided, Fin-Retarded	N/A	Nose Only	SMS Page > DRAG > RET to toggle fin-retarder.	No longer releases with retarder automatically deployed as of DCS 2.5.2.19157 Update 6	
BRU-33	Mk-83		Low-Drag, General Purpose Iron Bomb	Unarmoured or Lightly Armoured Targets	200m Across Approx.	447kg / 1000lbs	3.01m	N/A	N/A	N/A	Unguided, Free-Fall	N/A	Nose Only	SMS Page > MFUZ > Nose	Nose fuse only in current version.	
BRU-33	Mk-84		Low-Drag, General Purpose Iron Bomb	Armoured Targets	360m Across Approx.	894kg / 2000lbs	3.84m	N/A	N/A	N/A	Unguided, Free-Fall	N/A	Nose Only	SMS Page > MFUZ > Nose	Nose fuse only in current version.	
BRU-41A	BDU-33		Training, "Dumb Bomb"	N/A	Dispenses at force of a Shotgun Blast	10kg / 24lbs		N/A	N/A	Phosphorus	Unguided, Free-Fall	N/A	Nose Only		Designed to simulate Mk82	
ROCKETS																
BRU-33 [LAU-10]	ZUNI MK71		Unguided Rocket	Anti-Tank / Anti-Personnel		56.3kg / 124lbs	2.93m	4 km	2520 km/h	N/A	Unguided, Solid-Fuel Rocket Motor Propelled	N/A	Nose			
BRU-33 [LAU-61]	MK151HE	Hydra 70	Unguided Rocket	Anti-Material / Anti-Personnel	10m (can be lethal to soft targets up to 50m)	6.2kg / 13.6lbs	1.06m	8.8 km	4388 km/h	N/A	Unguided, Solid-Fuel Rocket Motor Propelled	N/A	Nose			
BRU-33 [LAU-68]	M151HE	Hydra 70	Unguided Rocket	Anti-Material / Anti-Personnel	10m (can be lethal to soft targets up to 50m)	6.2kg / 13.6lbs	1.06m	8.8 km	4388 km/h	N/A	Unguided, MK66 Solid-Fuel Rocket Motor Propelled	N/A	Nose	SMS > MTR > MK66 to set rocket motor.		
BRU-33 [LAU-68]	MK5 HE	Hydra 70	Unguided Rocket	Anti-Tank / Anti-Personnel	10m (can be lethal to soft targets up to 50m)	6.2kg / 13.6lbs	1.06m	8.8 km	4388 km/h	N/A	Unguided, MK66 Solid-Fuel Rocket Motor Propelled	N/A	Nose	SMS > MTR > MK66 to set rocket motor.		
MISSILES																
Wing	AIM-9L	Sidewinder	IR Fire-and-Forget, Air-to-Air Missile	Anti-Aircraft, Anti-Helo	Unknown	85.5kg / 188.5 lbs	2.83m	11 km	2.5 mach	N/A	IR Guided, MK36 Solid-Fuel Rocket Motor	N/A	Laser Proximity Fuse		Less advanced seeker than AIM-9M	
Wing	AIM-9M	Sidewinder	IR Fire-and-Forget, Air-to-Air Missile	Anti-Aircraft, Anti-Helo	Unknown	85.5kg / 188.5 lbs	2.83m	18 km	2.5 mach	N/A	IR Guided, Reduced Smoke Solid-Fuel Rocket Motor	N/A	Laser Proximity Fuse		IR Coolant Required	
Wing	CAP-9M	Sidewinder	IR Fire-and-Forget, Air-to-Air Missile	Training	Unknown	85.5kg / 188.5 lbs	2.83m	11 km	2.5 mach	N/A	IR Guided, Reduced Smoke Solid-Fuel Rocket Motor	N/A	N/A			
LAU-115	AIM-7M	Sparrow	Radar-Guided, Medium Range, Air-to-Air Missile	Anti-Aircraft, Anti-Helo	Unknown	230kg / 507lbs	3.66m	45 km	3.0 mach	N/A	Semi-Active Radar Guided, Hercules MK58 Dual Thrust Solid Fuel Motor	N/A	Active Radar Proximity Fuse	Select AIM7 (automatically places you in A/G mode) > SMS > HELO (when tracking helo)	Blast Frag Warhead	
LAU-115	AIM-7F	Sparrow	Radar-Guided, Medium Range, Air-to-Air Missile	Anti-Aircraft, Anti-Helo	Unknown	230kg / 507lbs	3.66m	45 km	3.0 mach	N/A	Semi-Active Radar Guided, Hercules MK58 Dual Thrust Solid Fuel Motor	N/A	Active Radar Proximity Fuse		Continuous Rod Warhead	Continuous Rod Warhead is designed to explode in a radial fashion to shear a target in two.

1.3 - MY WEAPONS CONTROLS SETUP

Note: this is the setup as per aircraft. Feel free to customize your own control mapping for the Weapon Select functions.

Forward: AIM-7 Sparrow (no function for this Early Access version)
Press Down: AIM-9 Sidewinder
Aft: M61A2 20mm Gun
Right: AIM-120 AMRAAM
Left: No Function



Weapon Release

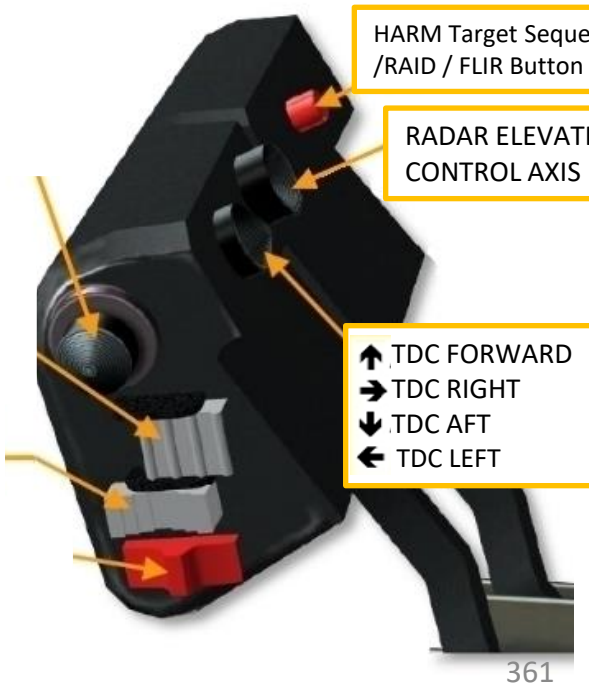
Gun Trigger: Second Detent

↑ Sensor Control Sw. FWD
→ Sensor Control Sw. RIGHT
↓ Sensor Control Sw. AFT
← Sensor Control Sw. LEFT
P Sensor Control Sw. DEPRESS

Undesignate / Nose Wheel Steer Button

↑ Select Sidewinder
→ Select Amraam
↓ Select Sparrow
← Select Gun

↑
→ TDC - DEPRESS
↓
← CAGE/UNCAGE BUTTON



HARM Target Sequence /RAID / FLIR Button

RADAR ELEVATION CONTROL AXIS

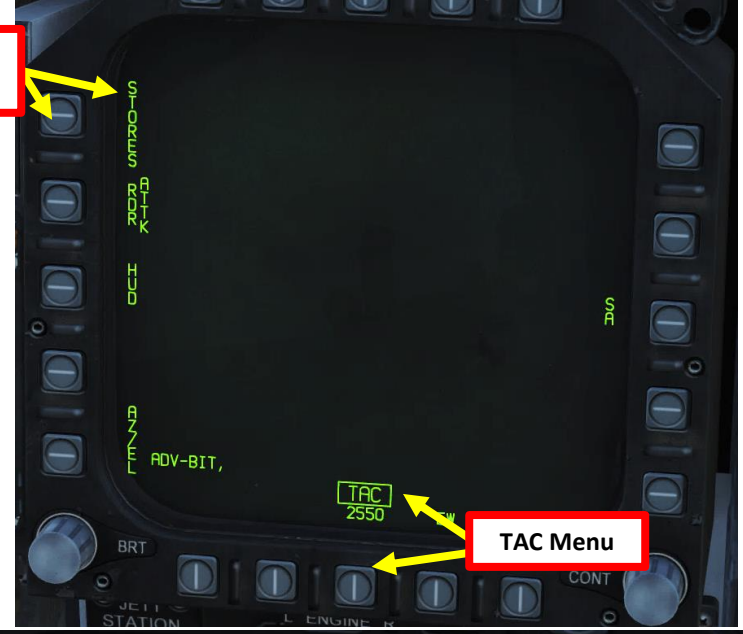
↑ TDC FORWARD
→ TDC RIGHT
↓ TDC AFT
← TDC LEFT

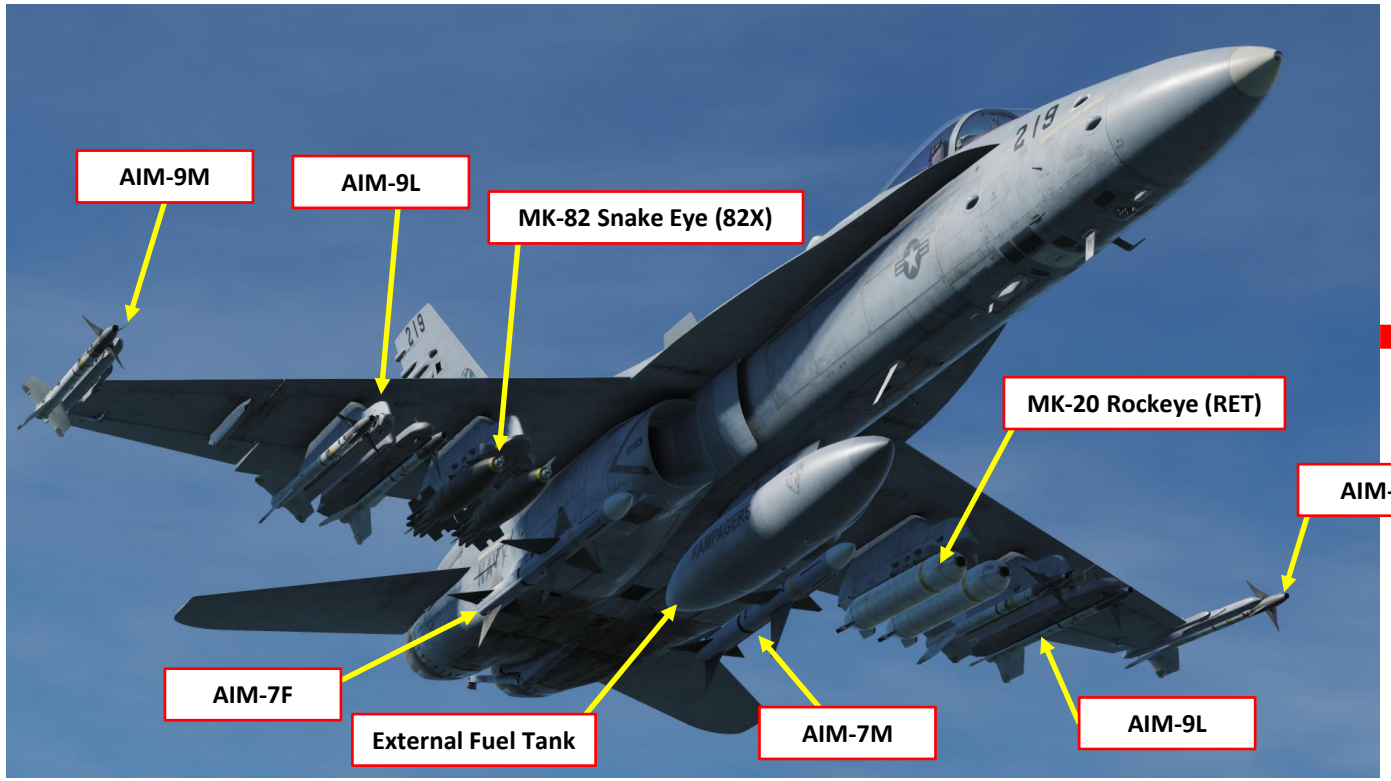
1.4 - SMS PAGE (STORES MANAGEMENT SYSTEM)

The SMS (Stores Management System) page can be accessed by clicking on the MENU OSB , then selecting the STORES sub-menu in the TAC (Tactical) menu.

This page acts like the A-10C's DSMS (Digital Stores Management Systems) page and allows you to select armament and program useful options like gun firing speed, bomb delivery mode or advanced air-to-air missile modes.

The wingform display provides the number, type, and status of all stores loaded on the aircraft's weapon stations. A weapons rack is indicated as a diamond symbol, and the number below indicates the number of weapons loaded on the rack or station. Various indications can be displayed below the number of weapons numeric to indicate weapon status such as RDY (ready, STBY (standby), SEL (selected), LKD (locked) and ULK (unlocked). The gun rounds remaining is indicated at the top of the wingform (578 being a full load and XXX when empty).







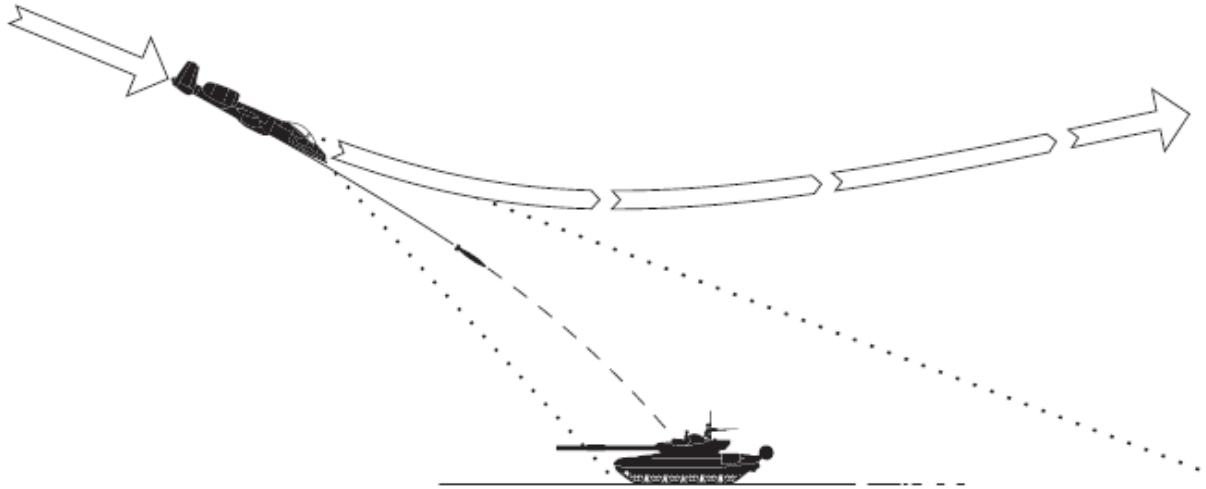
1.5 - BOMB DELIVERY MODES CCIP & CCRP (AUTO)

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

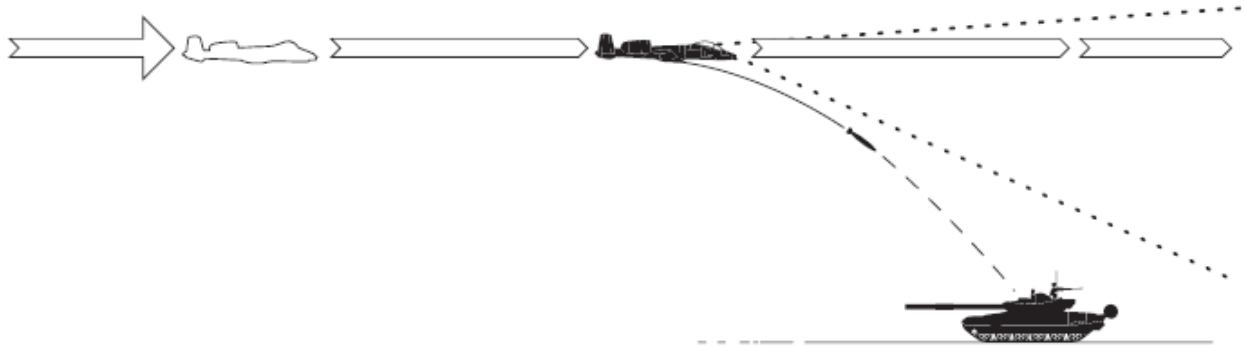
CCIP mode is the traditional dive bombing approach: you dive on target and the reticle will tell you where the bomb will impact.

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. CCRP mode is also referred to the AUTO mode.



CCIP: Continuously Computed Impact Point



CCRP: Continuously Computed Release Point

2.1.1 - UNGUIDED BOMB (MK-82) CCIP RELEASE MODE

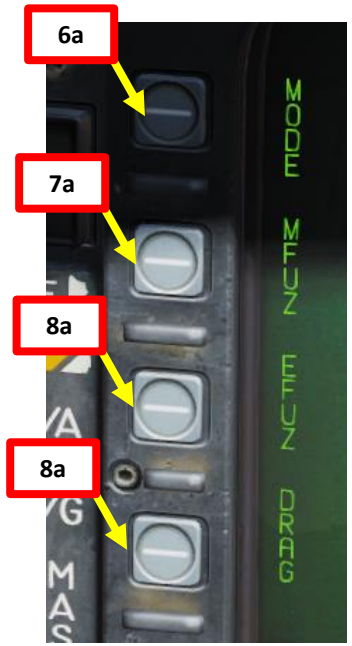
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Click on the desired bomb to select it (82B)
5. We will create a weapon delivery program by selecting a preset program. Toggle programs with the OSB next to PROG. We will use PROG 1.





2.1.1 - UNGUIDED BOMB (MK-82) CCIP RELEASE MODE

6. Click on OSB next to MODE, then click on OSB to select CCIP Mode
7. Click on OSB next to MFUZ (Mechanical Fuze), then press on OSB next to NOSE.
8. Click on OSB next to EFUZ (Electronic Fuze), then press on OSB next to DLY1 for a delay if desired, otherwise set to INST.
9. Click on OSB next to DRAG, then press on OSB next to either FF (Free-Falling low-drag bomb) or RET (retarded fuze) based on your bomb type.



- MFUZ (Mechanical Fuze)
  - OFF
  - NOSE (Nose Fuze Only)
  - TAIL (Tail Fuze Only)
  - NT (Nose and Tail)
- EFUZ (Electronic Fuze)
  - OFF
  - VT (Variable Time or Proximity)
  - INST (Instantaneous)
  - DLY1 (Delay 1)
  - DLY2 (Delay 2)
- DRAG
  - FF (Free Fall)
  - RET (Retarded)



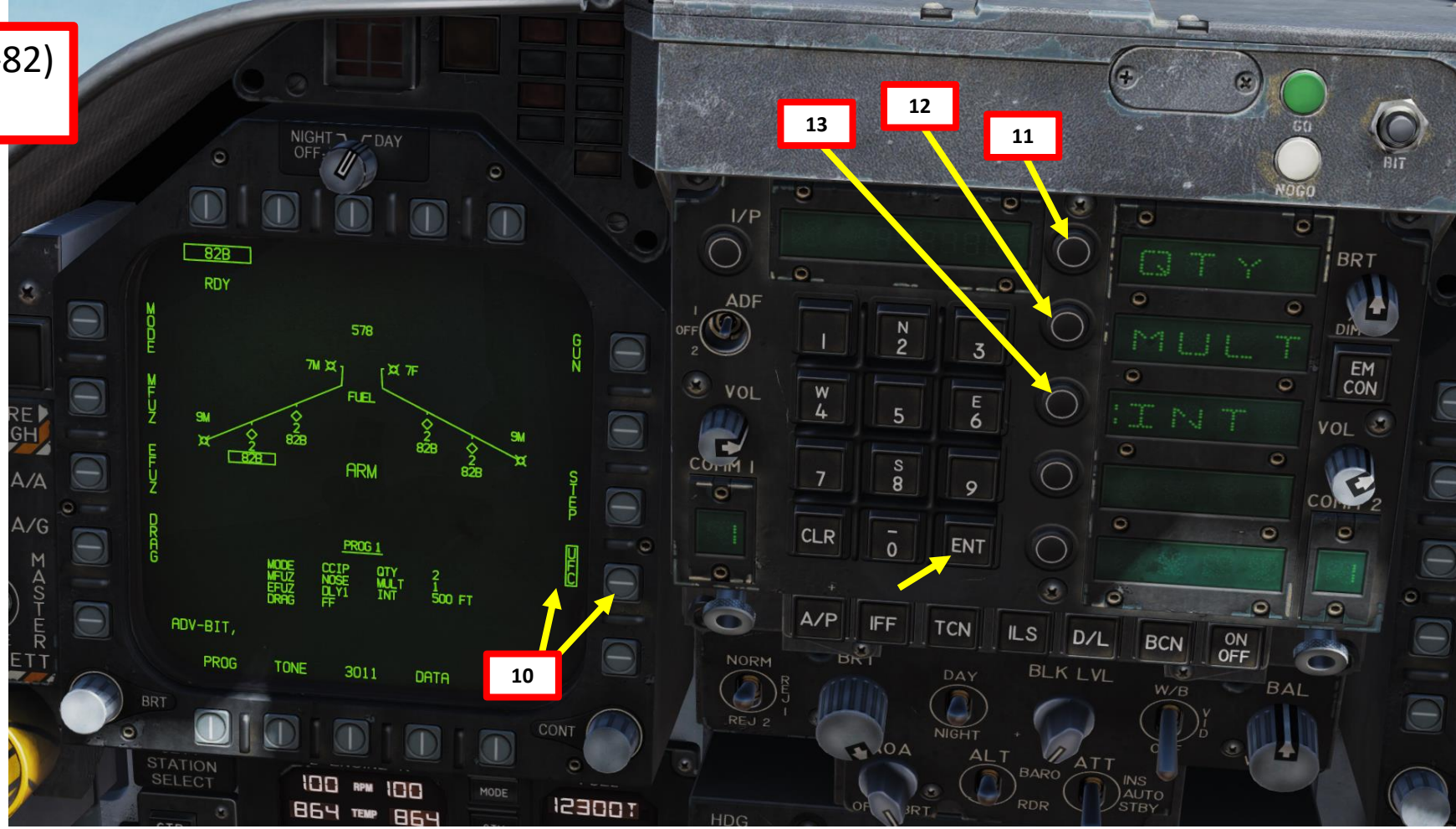






2.1.1 - UNGUIDED BOMB (MK-82) CCIP RELEASE MODE

10. Click on OSB next to « UFC » to activate the UFC keypad for the STORES page
11. Click on the OSB next to QTY (« : » means option is selected), type « 2 » on the UFC keypad, then press « ENT » (« : » means option is selected) to set 2 bombs per release.
12. Click on the OSB next to MULT (« : » means option is selected), type « 1 » on the UFC keypad, then press « ENT » to set 1 bomb to be released simultaneously from weapon stations
13. Click on the OSB next to INT (« : » means option is selected), type « 500 » on the UFC keypad, then press « ENT » to set a 500 ft bomb impact spacing.

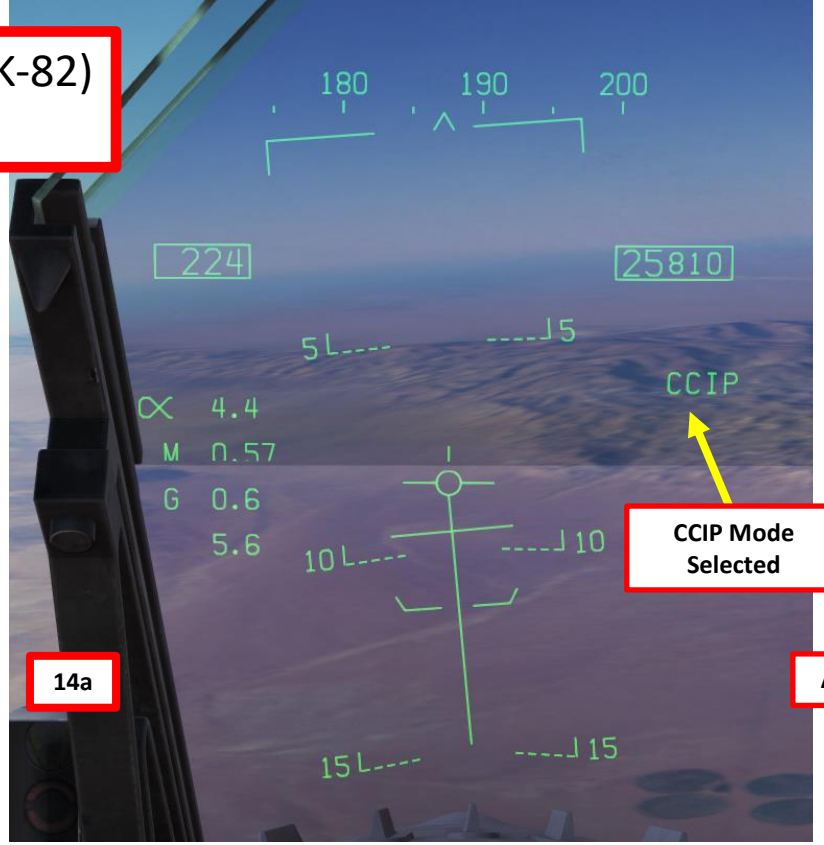




Quantity (QTY). Number of bombs to release, ranging from 1 to 30. When more than one bomb is selected, you must hold the Weapon Release Button down until all bombs in the salvo are released.
Multiples (MULT). Number of bombs to be released simultaneously from the weapon stations in each salvo
Interval (INT). The ground impact spacing in feet when in AUTO, FD, and CCIP modes, but milliseconds when on MAN mode.

2.1.1 - UNGUIDED BOMB (MK-82) CCIP RELEASE MODE

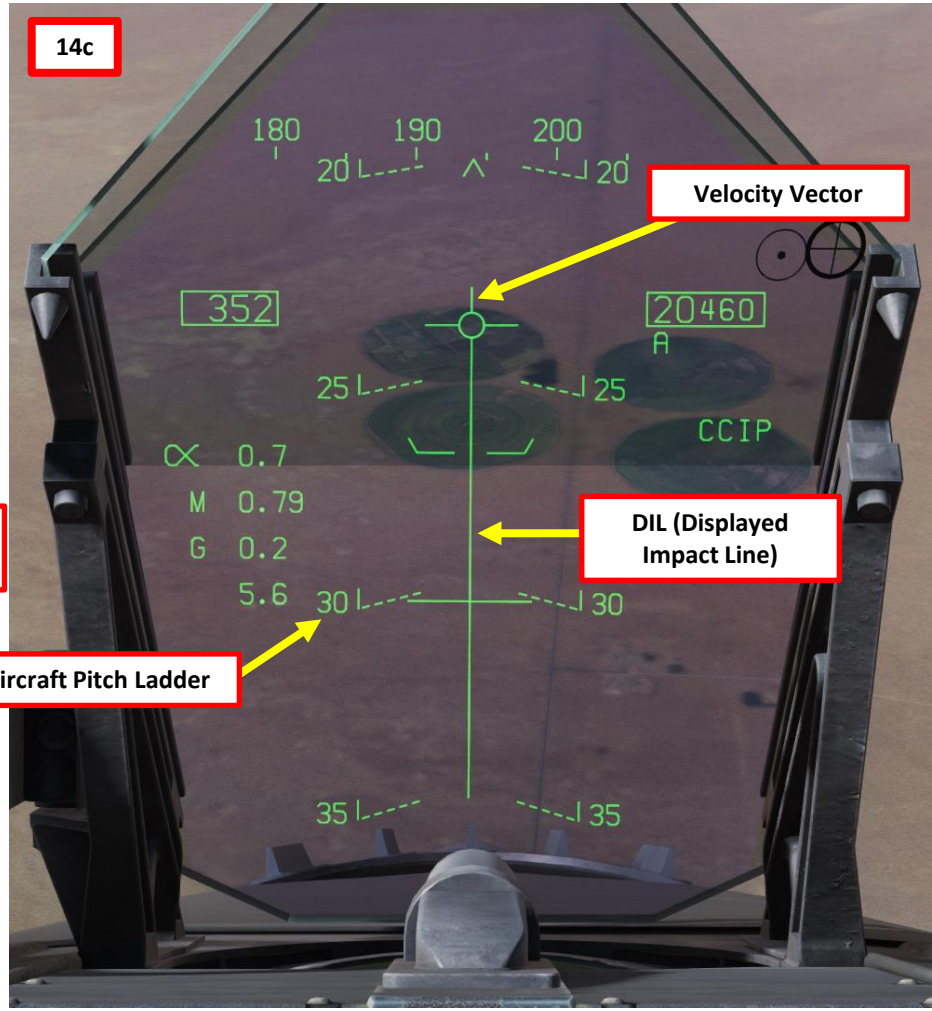
14. Start a 30-45 degree dive on your target
15. Align target vertically with DIL (Displayed Impact Line), also known as Bomb Fall Line.



14a



14b

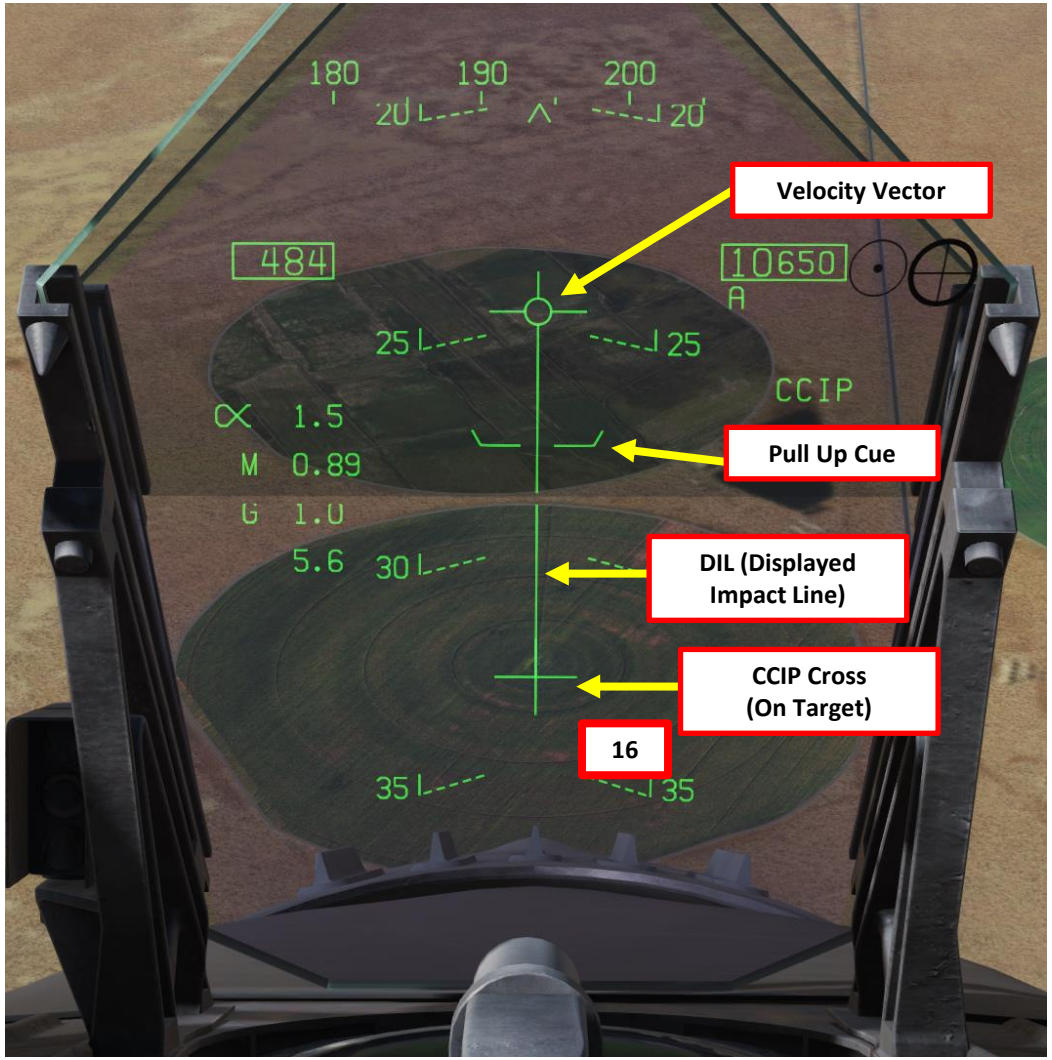


14c

2.1.1 - UNGUIDED BOMB (MK-82) CCIP RELEASE MODE

16. The CCIP cross will appear once a bombing solution is computed.
17. Steer aircraft to keep the DIL vertical and the CCIP cross on the target.
18. Press and hold the Weapon Release button (« RALT+SPACE ») once CCIP cross is on target. Hold button until all programmed bombs are released.
19. Pull up before velocity vector reaches the PULL UP cue.



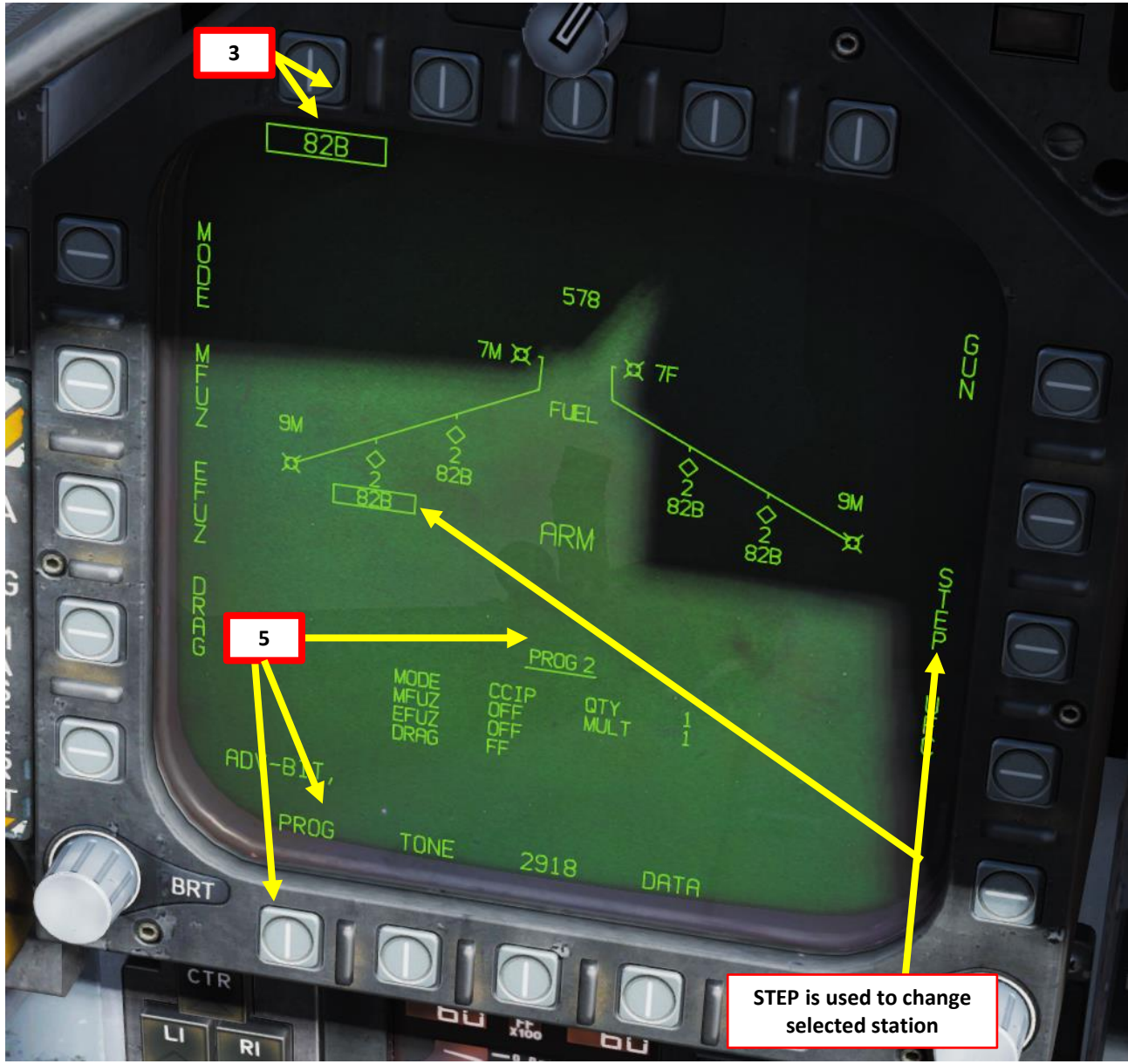




2.1.2 - UNGUIDED BOMB (MK-82) CCRP (AUTO) RELEASE MODE

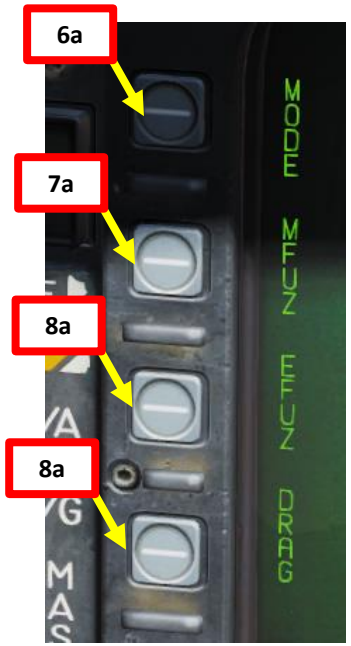
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Click on the desired bomb to select it (82B)
5. We will create a weapon delivery program by selecting a preset program. Toggle programs with the OSB next to PROG. We will use PROG 2.





2.1.2 - UNGUIDED BOMB (MK-82) CCRP (AUTO) RELEASE MODE

6. Click on OSB next to MODE, then click on OSB to select AUTO Mode
7. Click on OSB next to MFUZ (Mechanical Fuze), then press on OSB next to NOSE.
8. Click on OSB next to EFUZ (Electronic Fuze), then press on OSB next to DLY1 for a delay if desired, otherwise set to INST.
9. Click on OSB next to DRAG, then press on OSB next to either FF (Free-Falling low-drag bomb) or RET (retarded fuze) based on your bomb type.



- MFUZ (Mechanical Fuze)
  - OFF
  - NOSE (Nose Fuze Only)
  - TAIL (Tail Fuze Only)
  - NT (Nose and Tail)
- EFUZ (Electronic Fuze)
  - OFF
  - VT (Variable Time or Proximity)
  - INST (Instantaneous)
  - DLY1 (Delay 1)
  - DLY2 (Delay 2)
- DRAG
  - FF (Free Fall)
  - RET (Retarded)



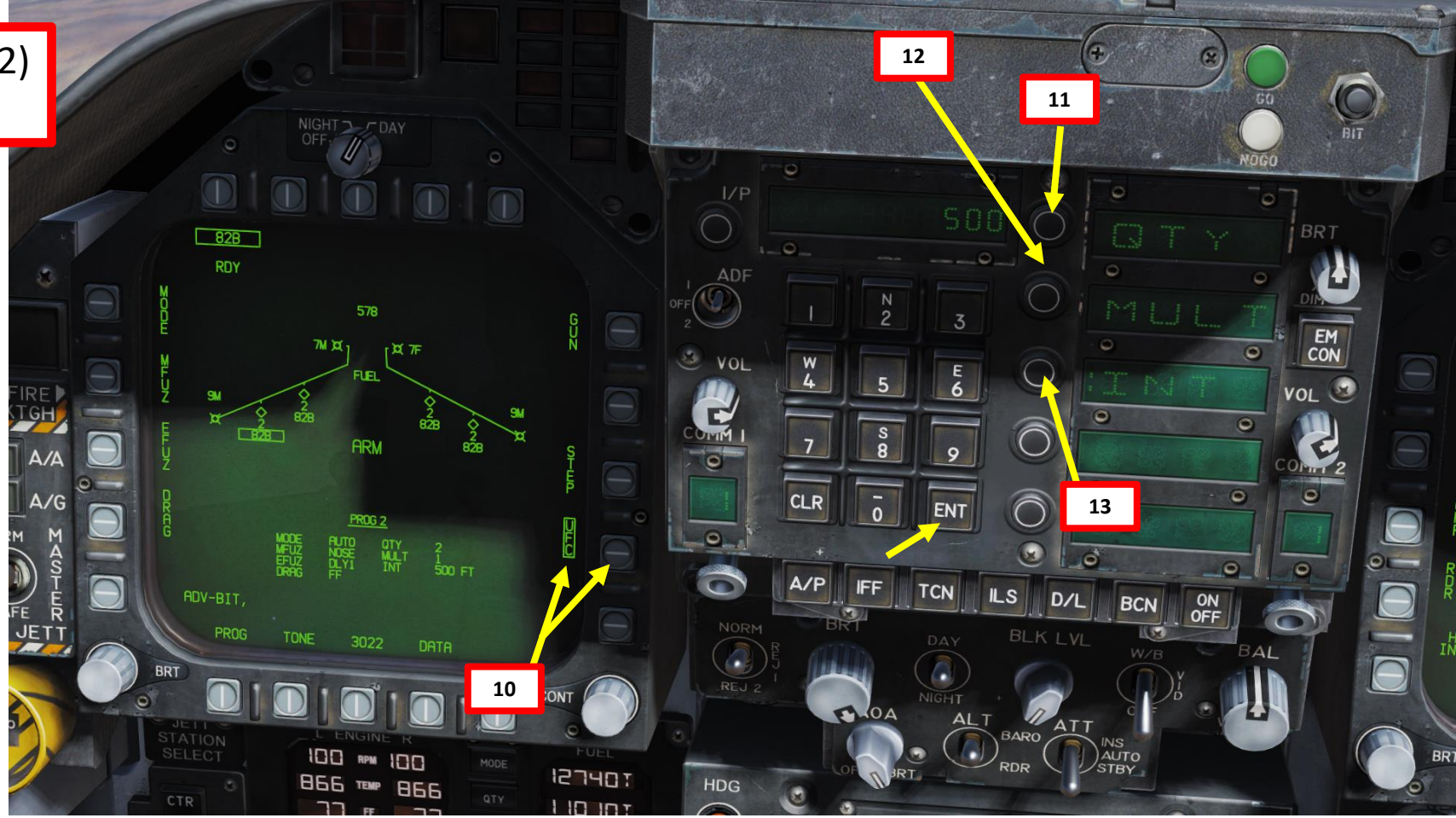






2.1.2 - UNGUIDED BOMB (MK-82) CCRP (AUTO) RELEASE MODE

10. Click on OSB next to « UFC » to activate the UFC keypad for the STORES page
11. Click on the OSB next to QTY (« : » means option is selected), type « 2 » on the UFC keypad, then press « ENT » (« : » means option is selected) to set 2 bombs per release.
12. Click on the OSB next to MULT (« : » means option is selected), type « 1 » on the UFC keypad, then press « ENT » to set 1 bomb to be released simultaneously from weapon stations
13. Click on the OSB next to INT (« : » means option is selected), type « 500 » on the UFC keypad, then press « ENT » to set a 500 ft bomb impact spacing.



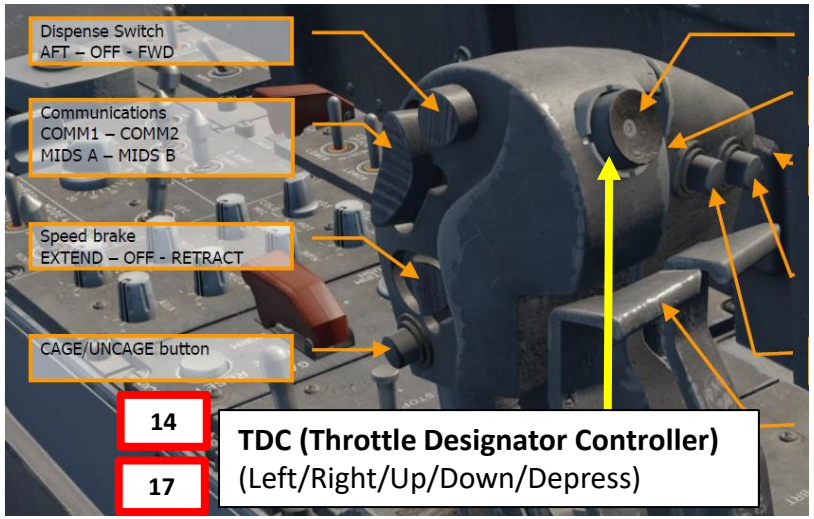


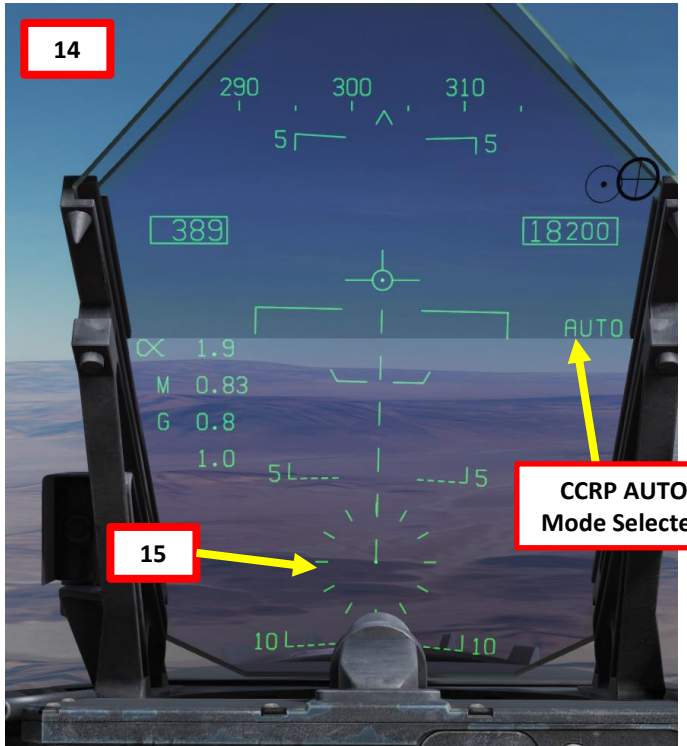
Quantity (QTY). Number of bombs to release, ranging from 1 to 30. When more than one bomb is selected, you must hold the Weapon Release Button down until all bombs in the salvo are released.
Multiples (MULT). Number of bombs to be released simultaneously from the weapon stations in each salvo
Interval (INT). The ground impact spacing in feet when in AUTO, FD, and CCIP modes, but milliseconds when on MAN mode.

2.1.2 - UNGUIDED BOMB (MK-82) CCRP (AUTO) RELEASE MODE

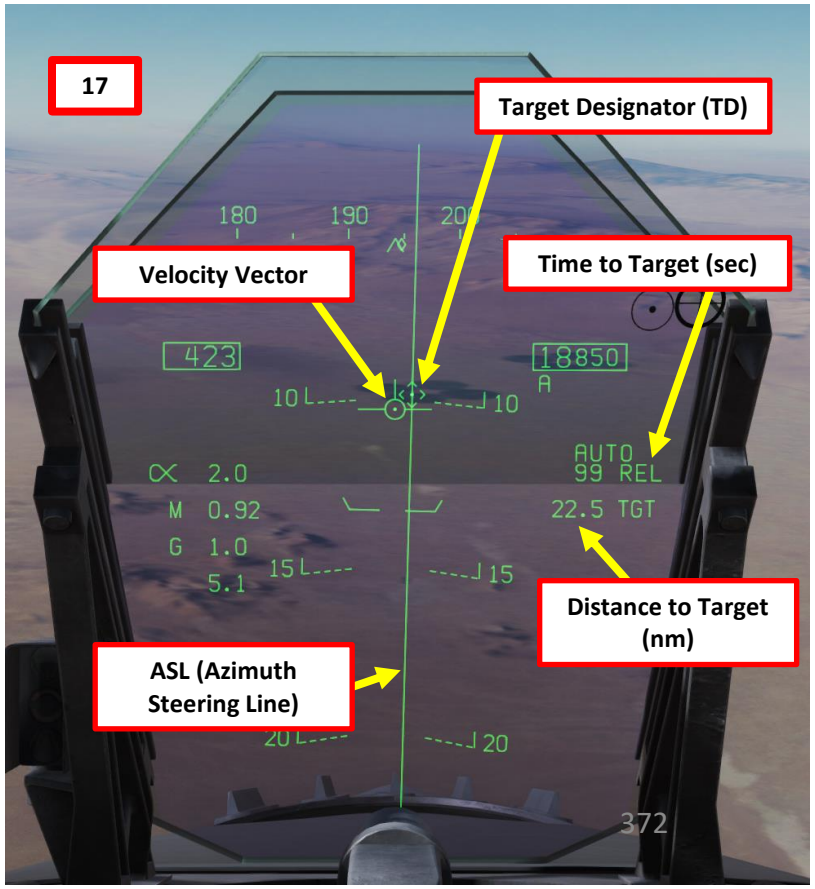
14. To slave your TDC (Throttle Designator Controller) to your HUD, press the Sensor Control Switch FWD.
15. You will see the « ball and chain » appear. In order to create a reference point for the CCRP, we will have to designate a specific point in space with the TDC.
16. Enter a 25 deg dive to the target and set your velocity vector on the target.
17. Once velocity vector is on the target, press the TDC Depress (« Enter ») to designate your CCRP reference point.







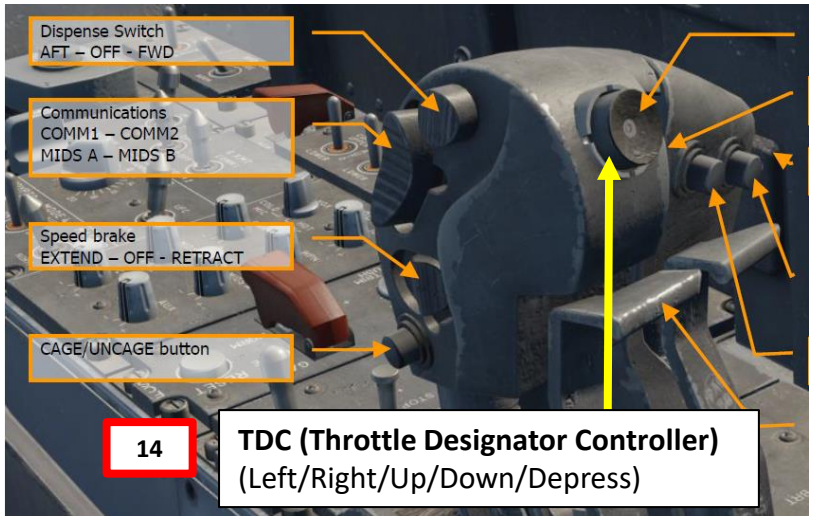


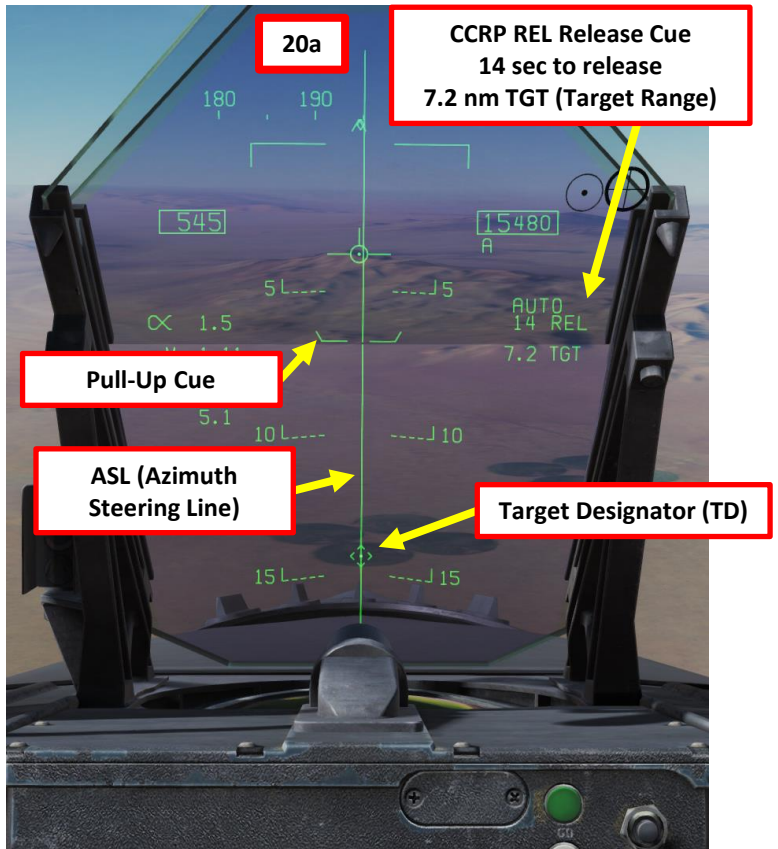


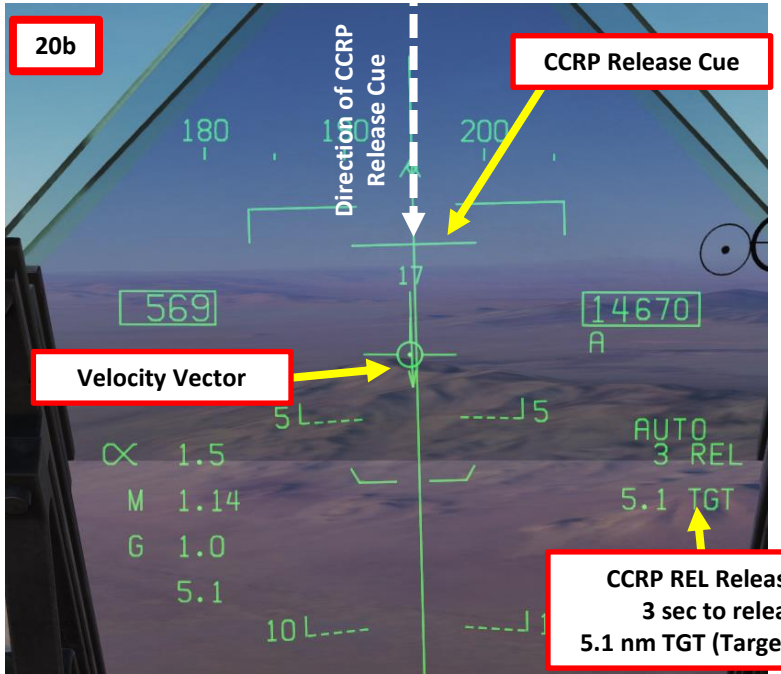
2.1.2 - UNGUIDED BOMB (MK-82) CCRP (AUTO) RELEASE MODE

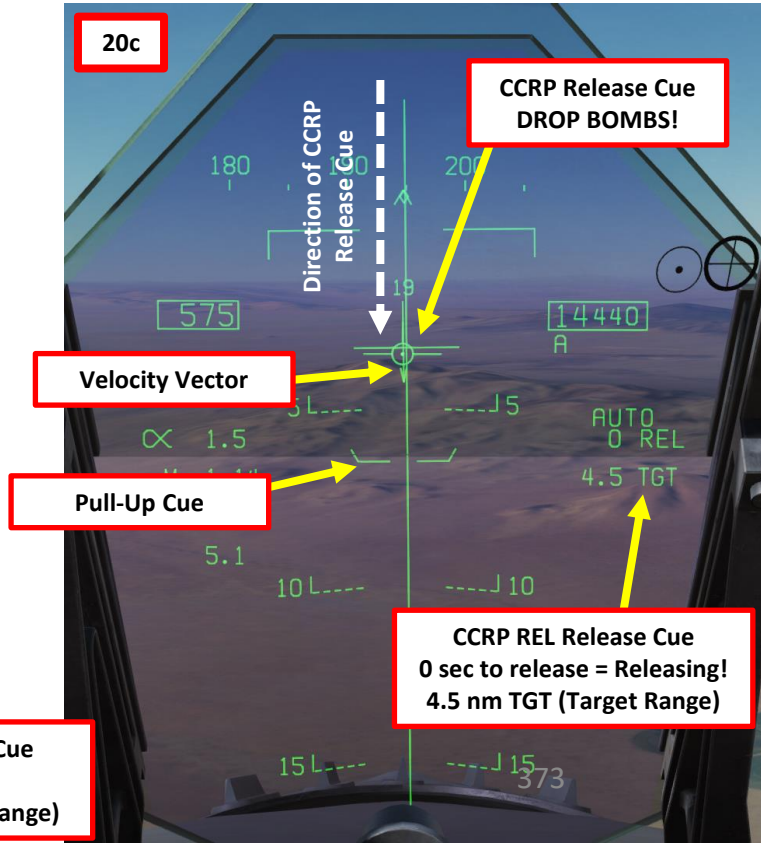
18. Slew your TD (Target Designator) with the TDC controls to adjust your CCRP reference point properly.
19. Fly level and keep your velocity vector aligned with the ASL (Azimuth Steering Line) and above the Pull-Up cue.
20. When release cue appears, hold the Weapon Release Button (« RALT+SPACE ») until all bombs in the pass have been released.
21. Pull up before velocity vector reaches the PULL UP cue.











2.1.2 - UNGUIDED BOMB (MK-82) CCRP (AUTO) RELEASE MODE

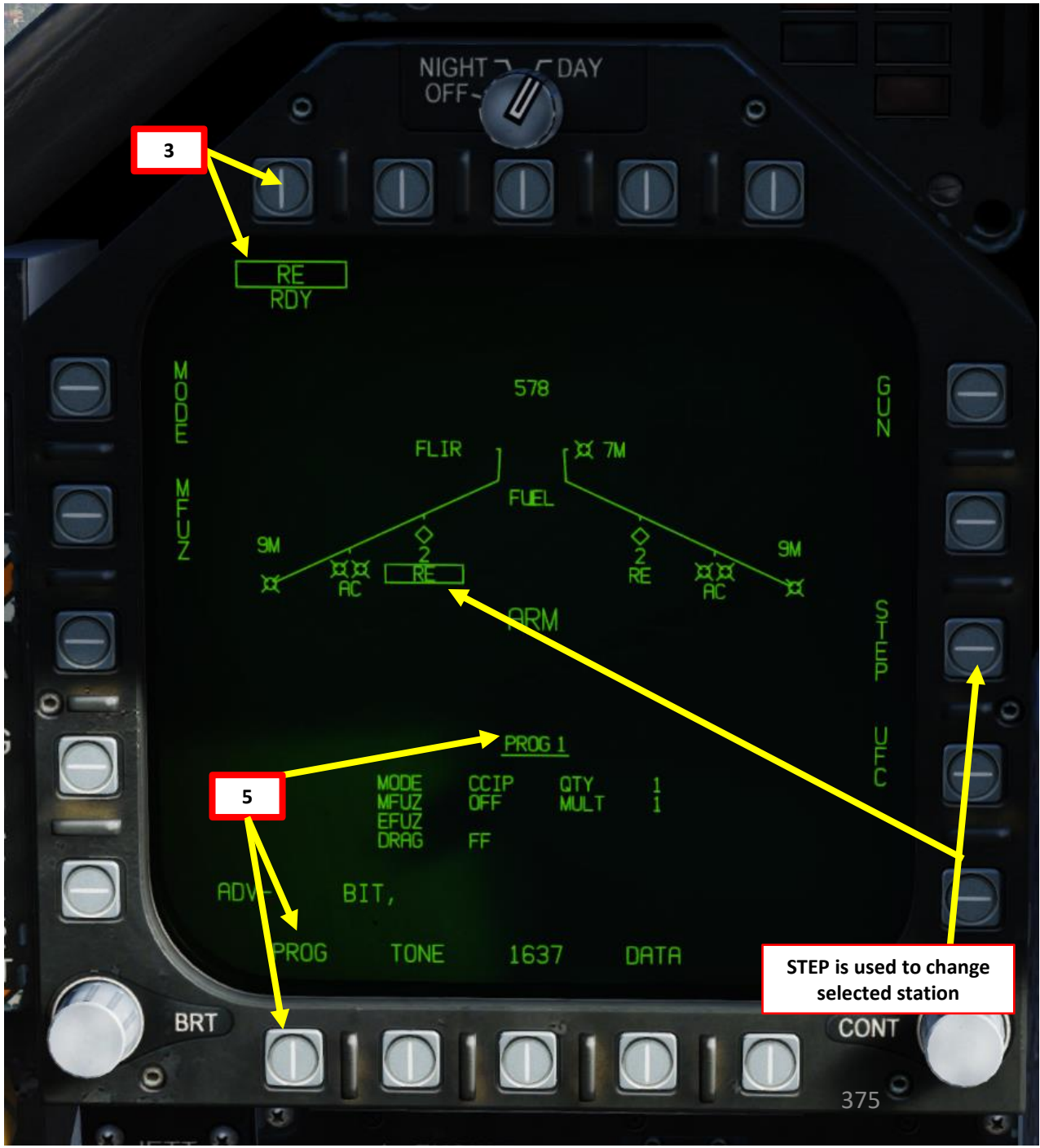




2.2 – MK-20 “Rockeye” Cluster Bombs CCIP Release Mode

1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Click on the desired MK-20 Rockeye station to select it (RE)
5. We will create a weapon delivery program by selecting a preset program. Toggle programs with the OSB next to PROG. We will use PROG 1.





2.2 – MK-20 “Rockeye” Cluster Bombs CCIP Release Mode

6. Click on OSB next to MODE, then click on OSB to select CCIP Mode
7. Click on OSB next to MFUZ (Mechanical Fuze), then press on OSB next to VT (Variable Time or Proximity). This will allow us to set the HOB (Height of Burst) setting.
8. The « HT » (Height of Burst) option will now become available.
9. Press on the OSB next to HT repeatedly to toggle between available Height of Burst settings. I recommend using 1500 ft.





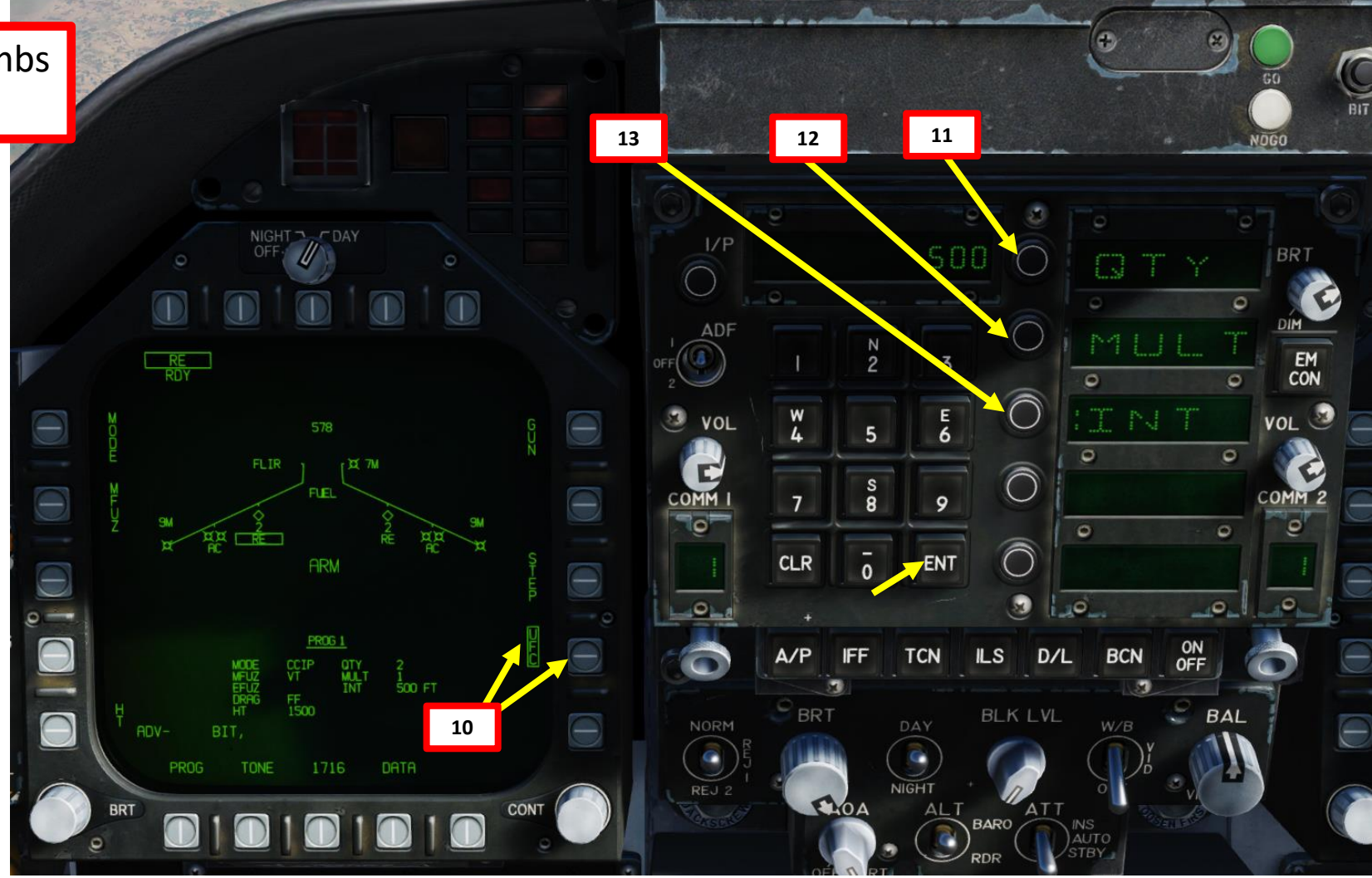






2.2 – MK-20 “Rockeye” Cluster Bombs CCIP Release Mode

10. Click on OSB next to « UFC » to activate the UFC keypad for the STORES page
11. Click on the OSB next to QTY (« : » means option is selected), type « 2 » on the UFC keypad, then press « ENT » (« : » means option is selected) to set 2 cluster bombs per release.
12. Click on the OSB next to MULT (« : » means option is selected), type « 1 » on the UFC keypad, then press « ENT » to set 1 cluster bomb to be released simultaneously from weapon stations
13. Click on the OSB next to INT (« : » means option is selected), type « 500 » on the UFC keypad, then press « ENT » to set a 500 ft bomb impact spacing.

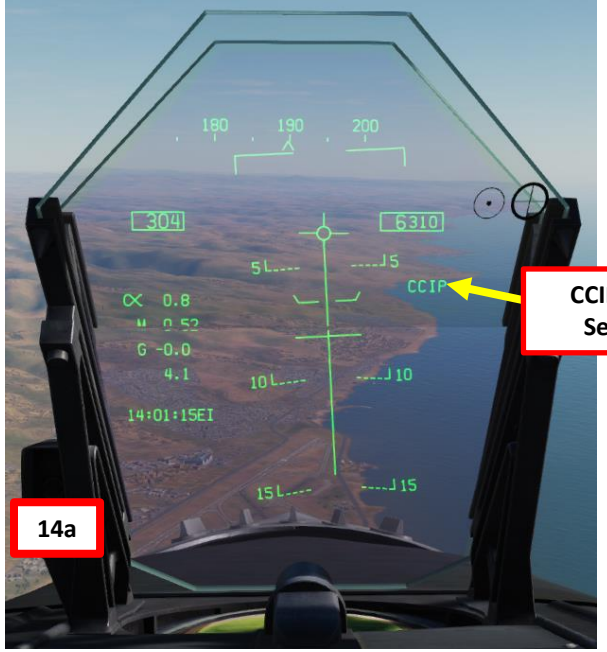




Quantity (QTY). Number of bombs to release, ranging from 1 to 30. When more than one bomb is selected, you must hold the Weapon Release Button down until all bombs in the salvo are released.
Multiples (MULT). Number of bombs to be released simultaneously from the weapon stations in each salvo
Interval (INT). The ground impact spacing in feet when in AUTO, FD, and CCIP modes, but milliseconds when on MAN mode.

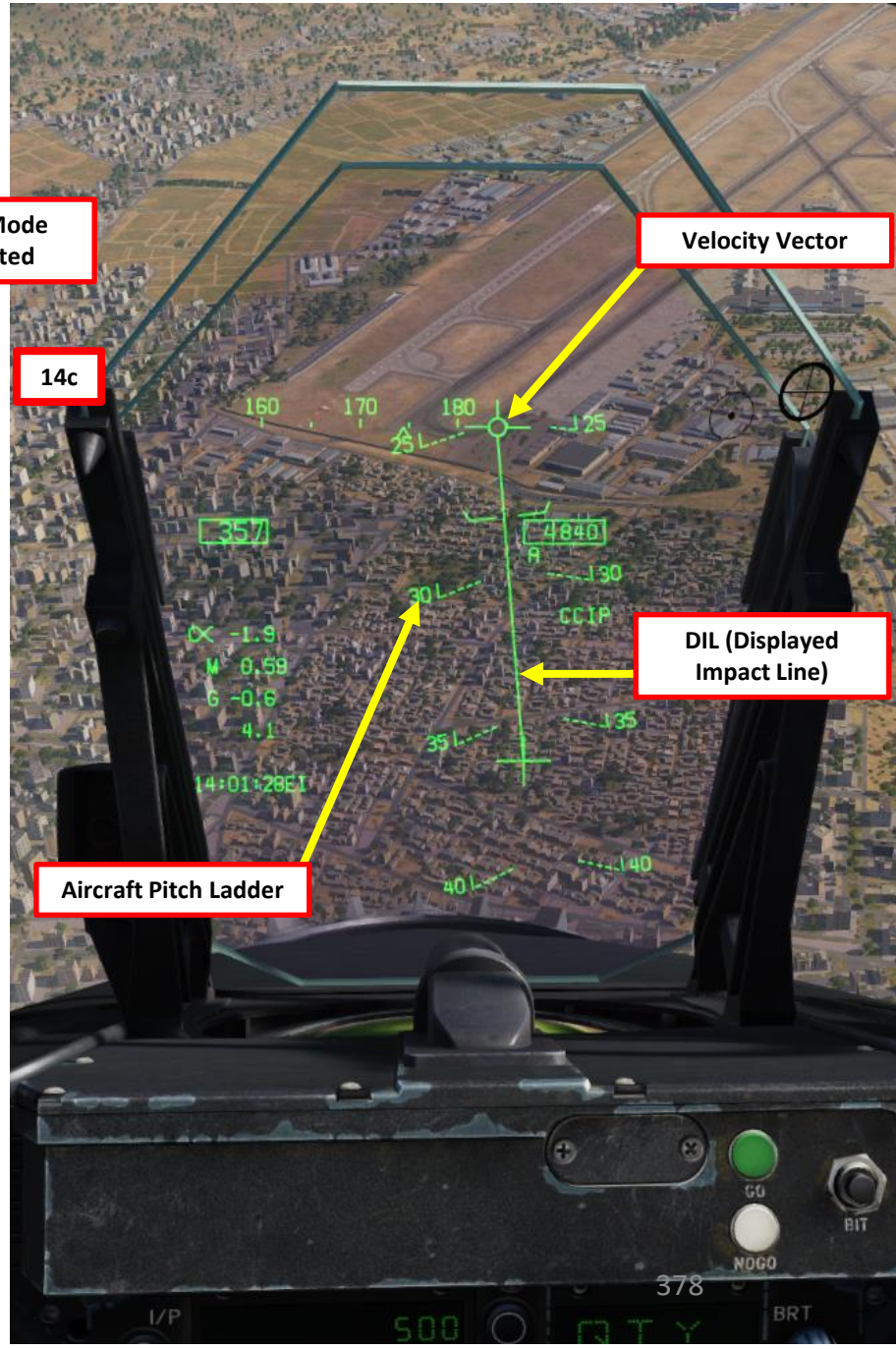
2.2 – MK-20 “Rockeye” Cluster Bombs CCIP Release Mode

14. Start a 30-45 degree dive on your target
15. Align target vertically with DIL (Displayed Impact Line), also known as Bomb Fall Line.



CCIP Mode Selected





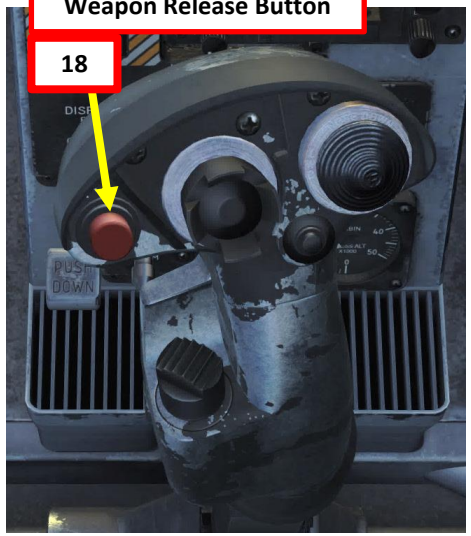
Velocity Vector

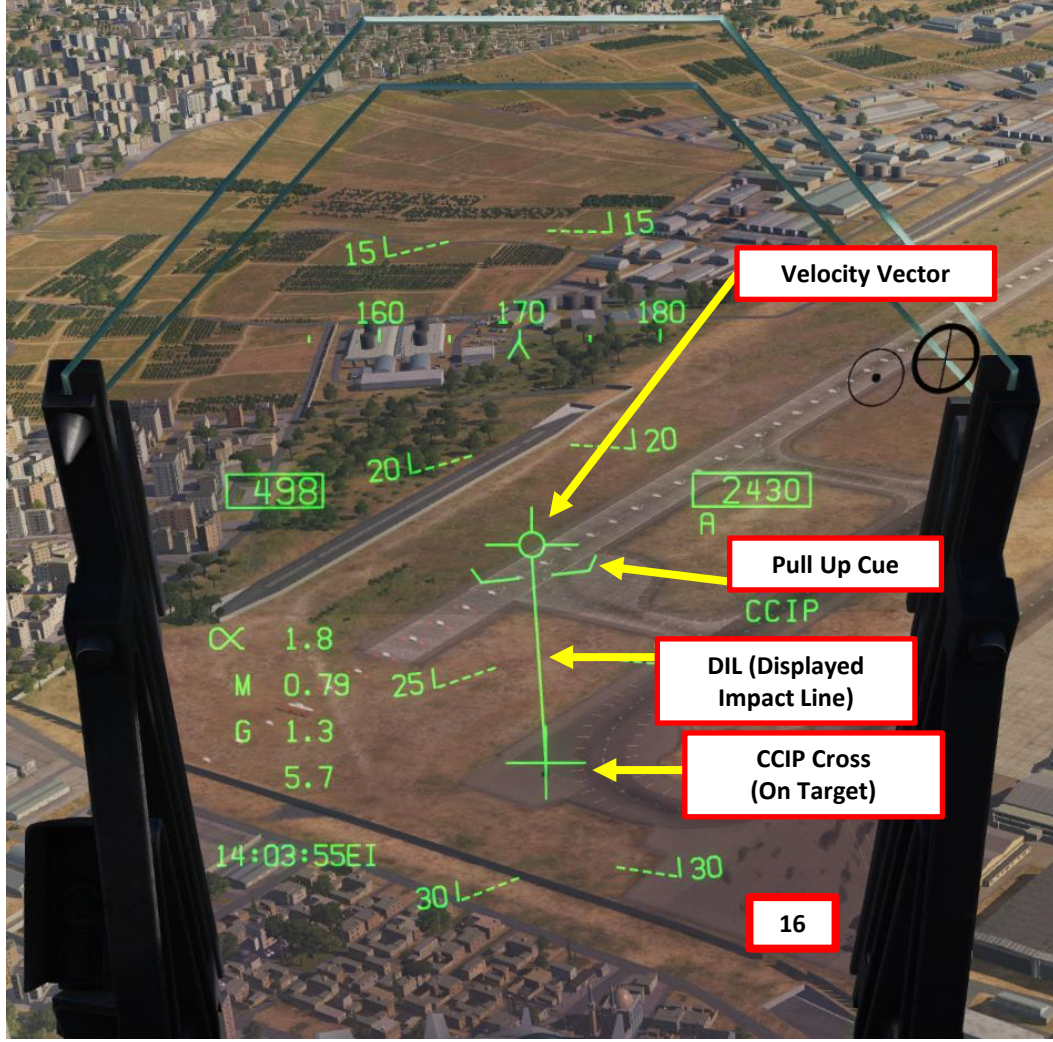
DIL (Displayed Impact Line)

Aircraft Pitch Ladder

2.2 – MK-20 “Rockeye” Cluster Bombs CCIP Release Mode

16. The CCIP cross will appear once a bombing solution is computed.
17. Steer aircraft to keep the DIL vertical and the CCIP cross on the target.
18. Press and hold the Weapon Release button (« RALT+SPACE ») once CCIP cross is on target. Hold button until all programmed cluster bombs are released.
19. Pull up before velocity vector reaches the PULL UP cue.







2.2 – MK-20 “Rockeye” Cluster Bombs CCIP Release Mode



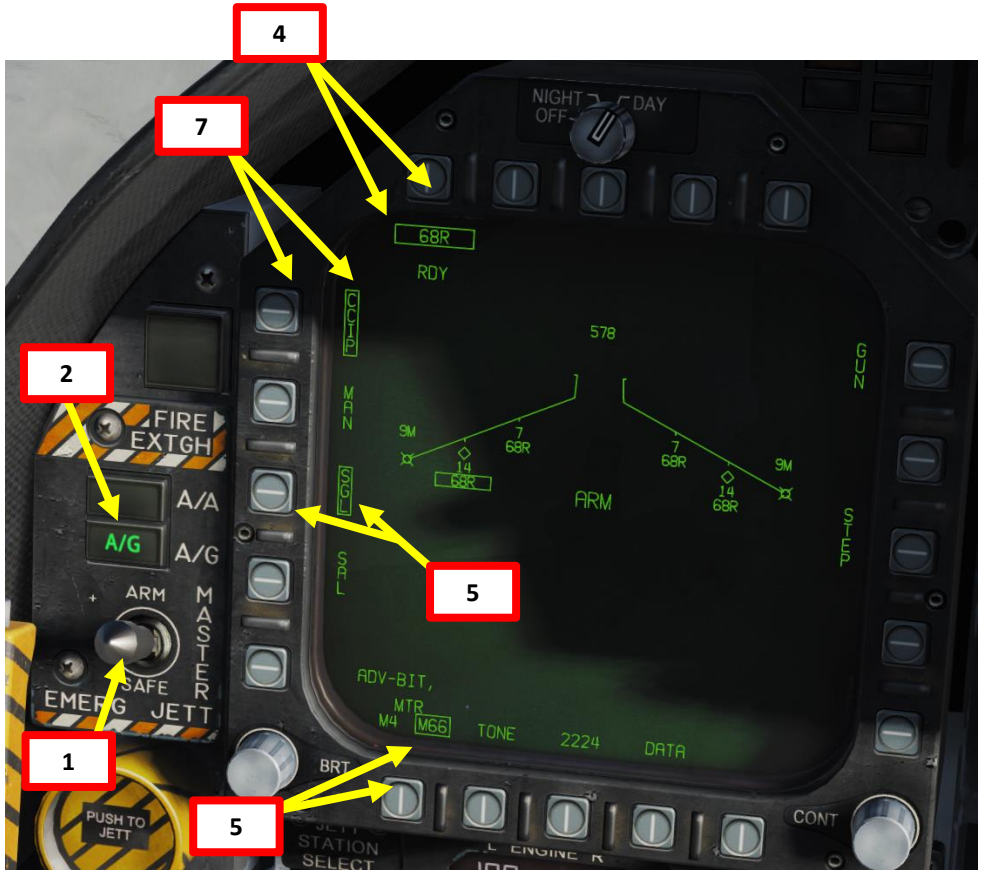


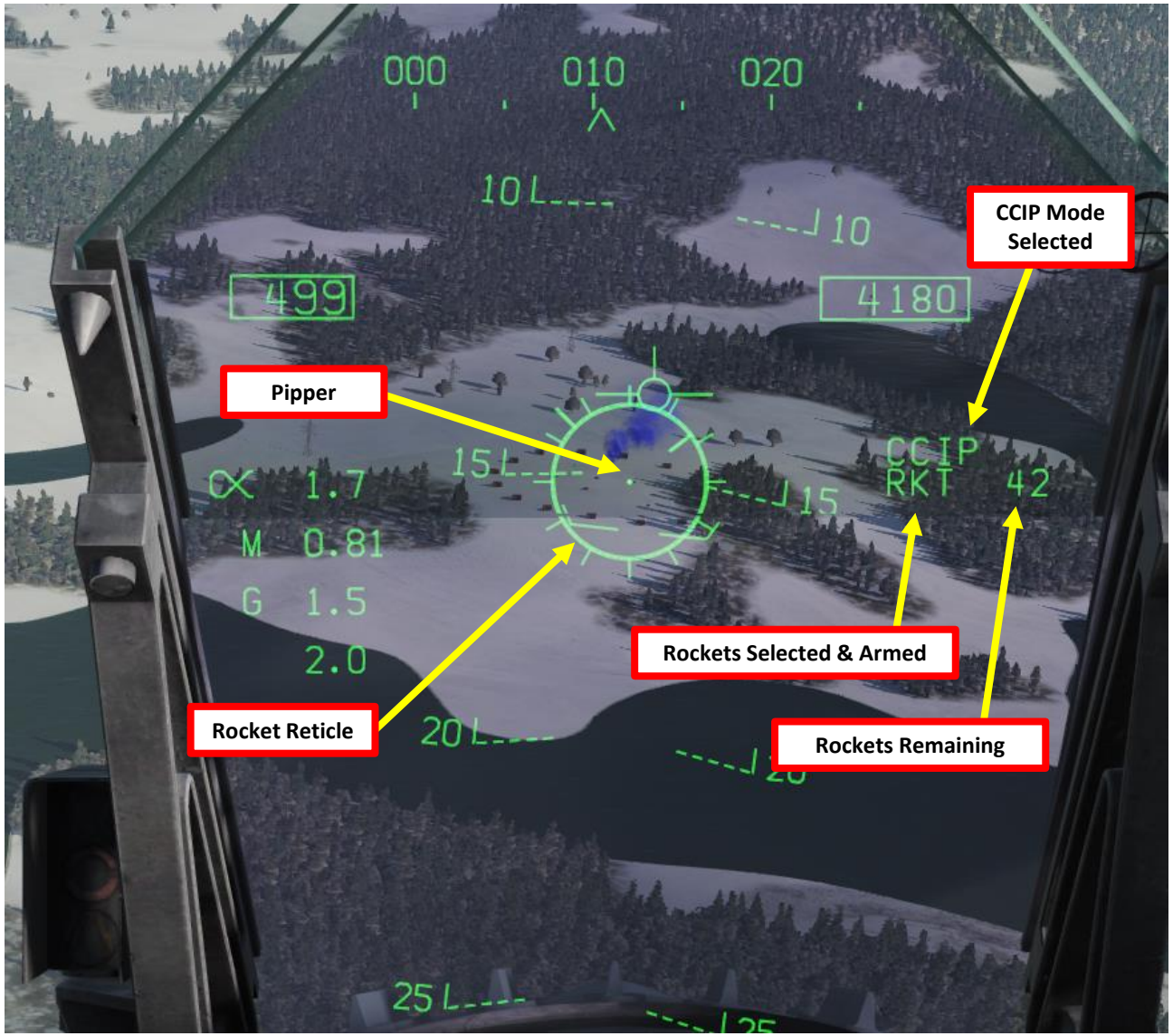




2.3 - ROCKETS

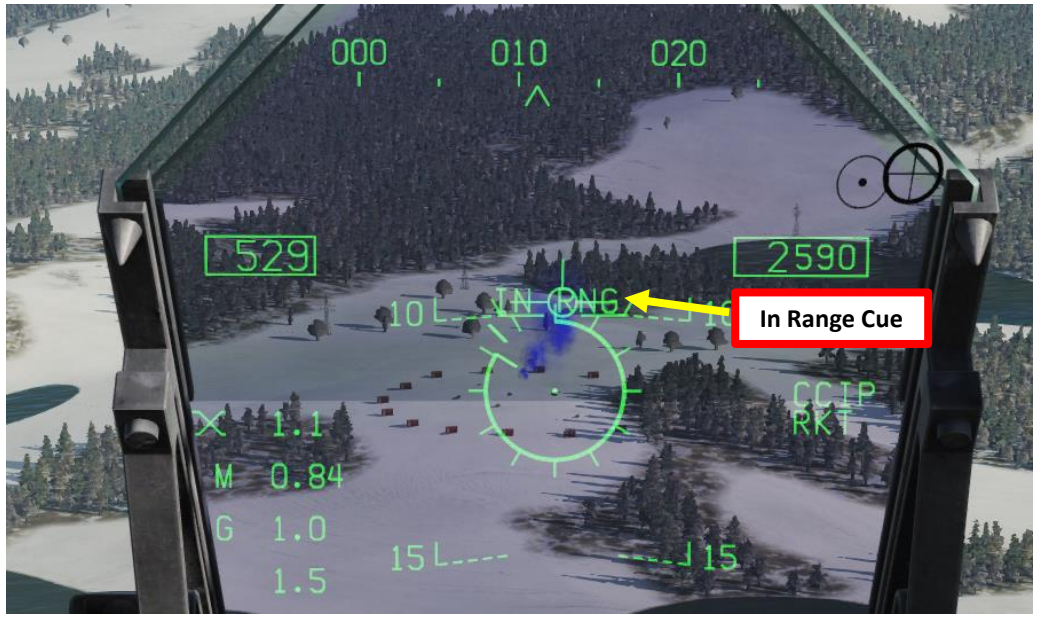
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Select desired rocket pods; « 68R » stands for LAU-68 rocket launcher pod. In our case, text should be boxed when selected.
5. Select desired Firing mode Option (SGL for Single, SAL for Salvo)
6. Set desired Rocket Motor (MTR) Type (M4 or M66)
7. Set Rocket Mode to CCIP (text should be boxed)





2.3 - ROCKETS

8. Set center of gun reticle on target and wait for the « IN RNG » (In Range) cue to appear.
9. Press the Weapon Release button (« RALT+ SPACE ») to fire rockets
10. Once you have done your run and the Breakaway X appears, break off the attack and wave off from target.





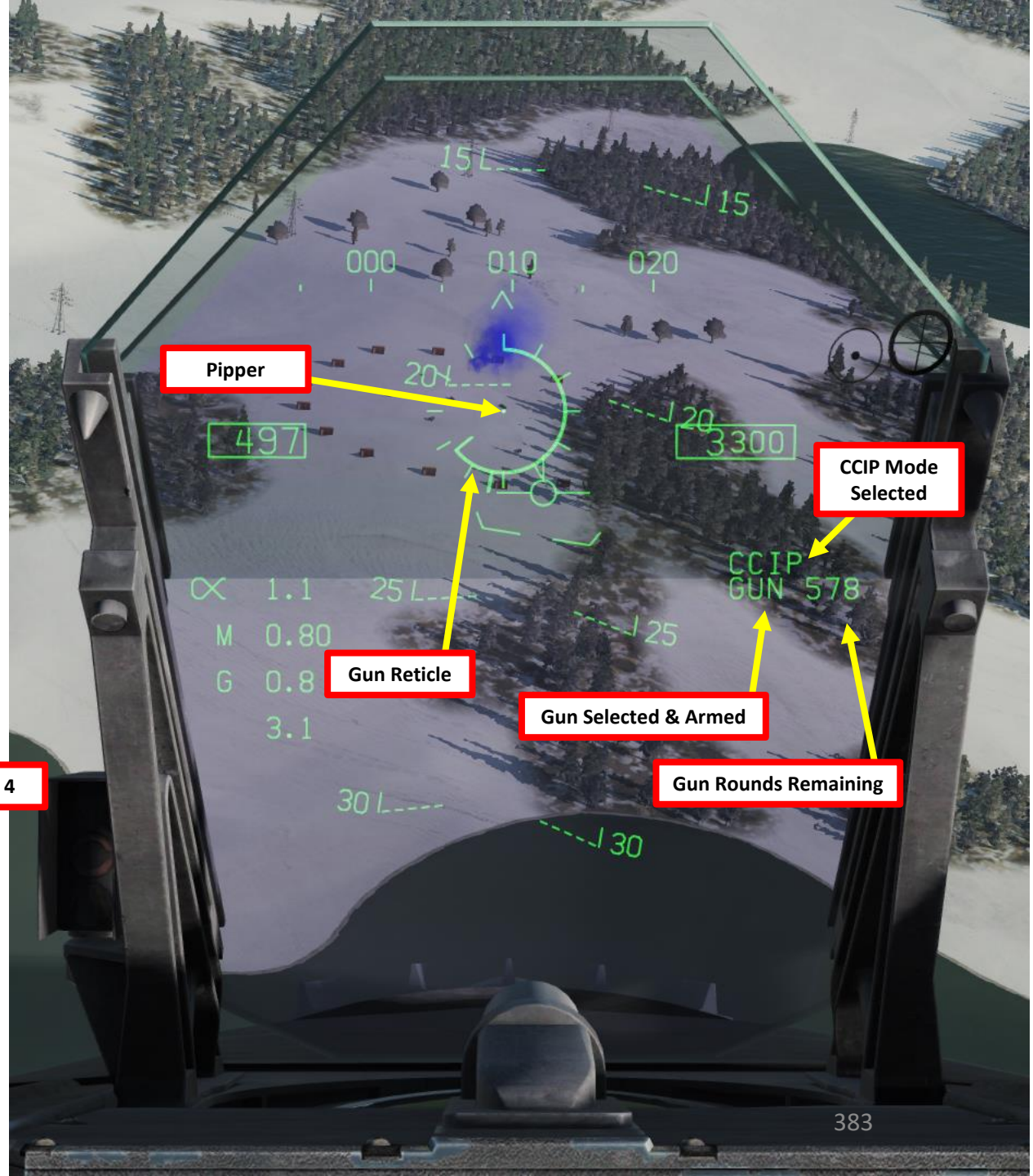




2.4 - M61A2 GUN (AIR-TO-GROUND)

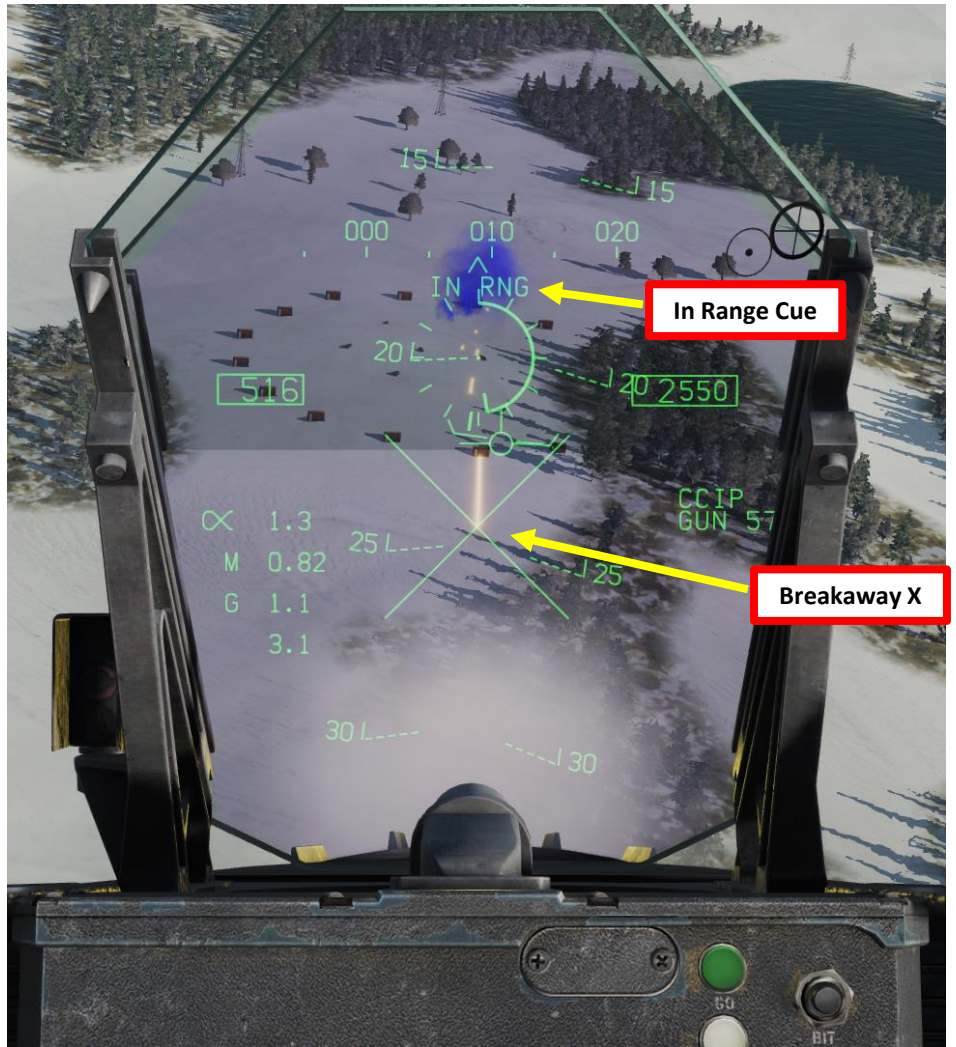
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Select GUN (text should be boxed)
5. Select Gun Rounds Options (MK-50 or PGU-28 rounds)
6. Set Gun Firing Rate Option (HI = 6000 rounds per minute, LO = 4000 rounds per minute)
7. Set Gun Mode to CCIP (text should be boxed)





2.4 - M61A2 GUN (AIR-TO-GROUND)

8. Set center of gun reticle on target and wait for the « IN RNG » (In Range) cue to appear.
9. Squeeze the gun trigger (« Spacebar »)
10. Once you have done your run and the Breakaway X appears, break off the attack and wave off from target.







2.5 – GPS-GUIDED ORDNANCE

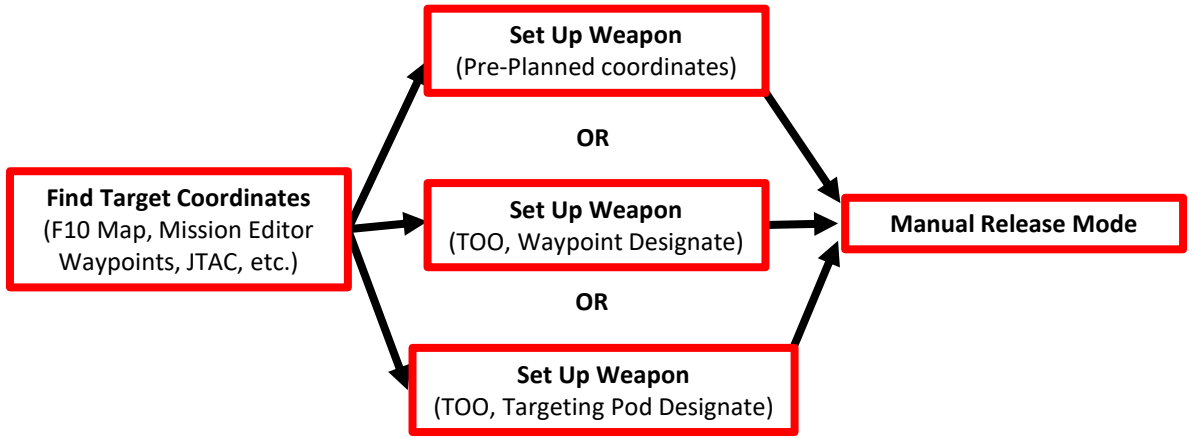


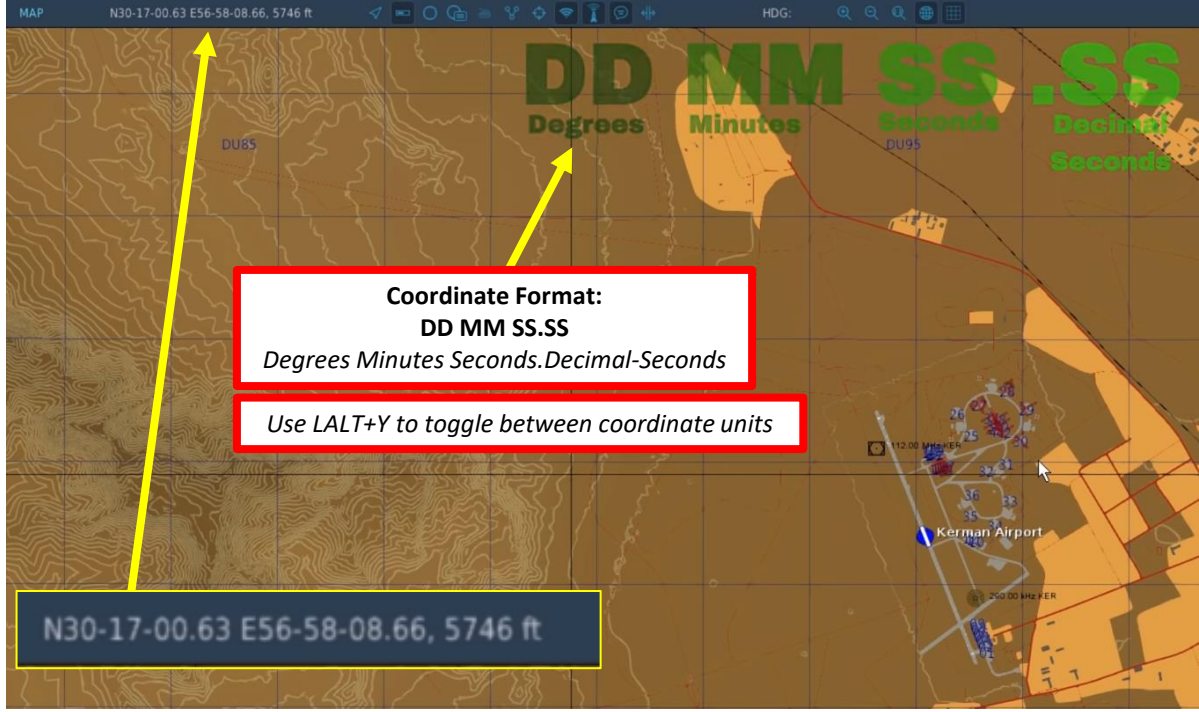
2.5.1 – GBU-38 JDAM INTRODUCTION

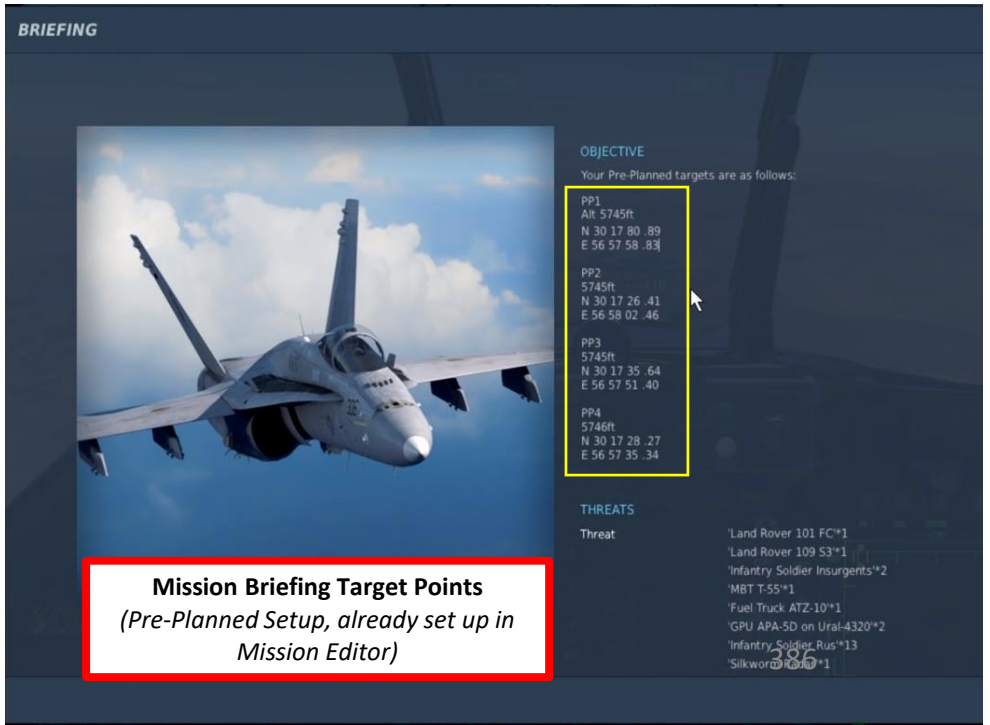
The F/A-18C is able to employ the Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs and the Joint Standoff Weapon (JSOW) glide bombs. JDAMs are modified general purpose bombs, equipped with a GPS and inertial navigation system (INS) for guidance as well as flight controls. The JSOW has the same guidance and is a bomb with wings to provide lift and maneuvering flight controls. As such, it has a significantly longer range than JDAMs. The JDAMs/JSOWs have (at optimal INS alignment) a margin of error of approximately 16 ft (5m). Independent programming of each individual bomb allows for simultaneous multi-target attacks.

Basically, the way to employ JDAMs is to first get your target coordinates from either the mission briefing or using the F10 map, input them to the weapons in either Pre-Planned Mode (coordinates need to be entered manually) or in TOO Mode (Target of Opportunity, weapons use the existing A/G (Air-to-Ground) designation, which is the Hornet (or Harrier) equivalent of the SPI (Sensor Point of Interest) in the A-10C. You can make an A/G designation with WPDSG (Waypoint Designate) button or via the HUD, but it is also possible to designate with the targeting pod or A/G radar.

For the JDAM tutorial, we will use the Pre-Planned Mode while for the JSOW tutorial we will use TOO Mode. Once the setup is done and the weapon alignment has been performed, we will then be able to release them in Manual Mode.







2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Find Coordinates

1. Find coordinates of targets in Degrees Minutes Seconds:Decimal-Seconds. Do not forget target elevation.

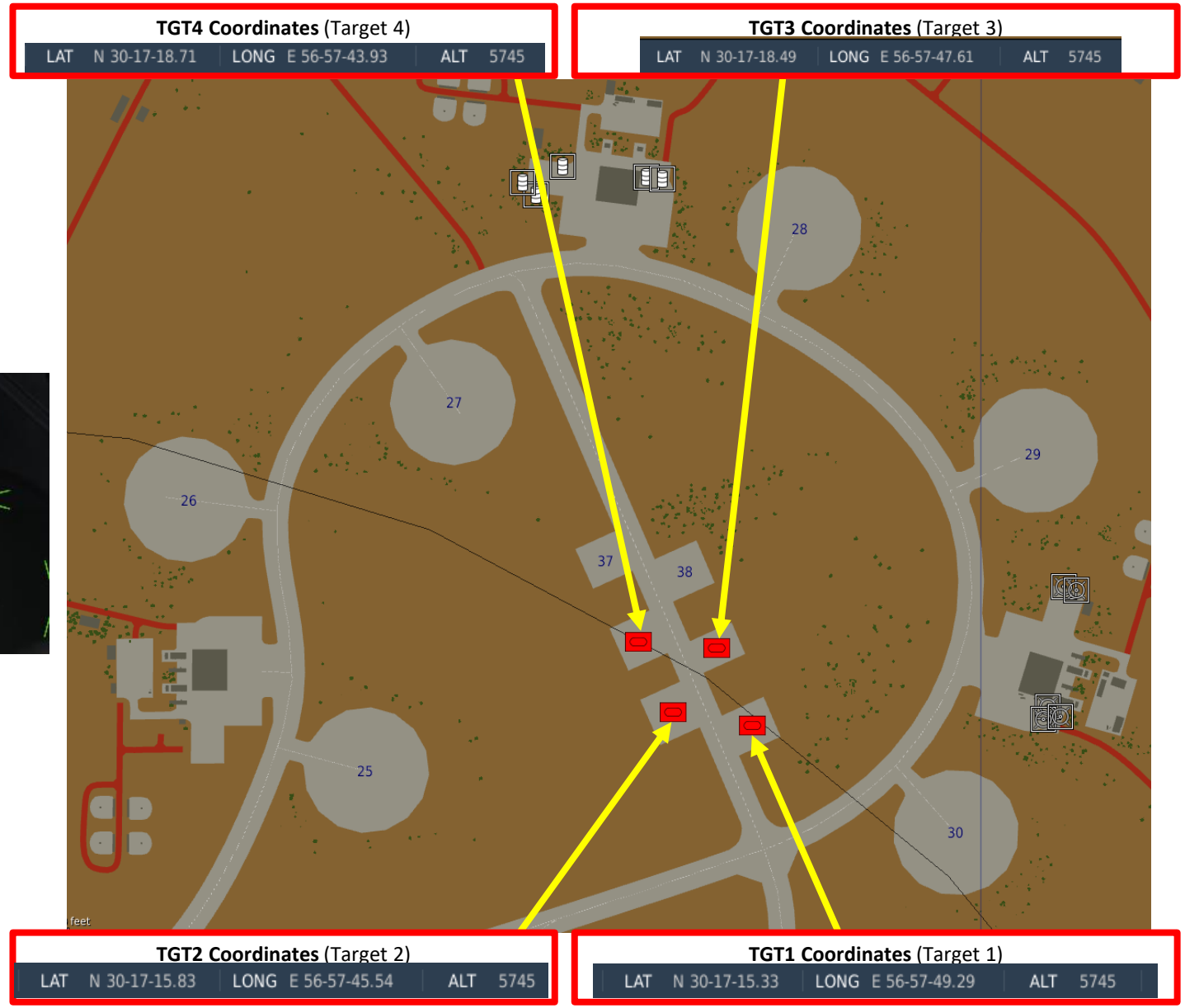
Note: Each JDAM station can have five individual Pre-Planned points per station (PP1 to PP5). This means 20 possible targets for four JDAMs. For simplicity's sake, we will use:

- PP1 for Station 2
- PP1 for Station 3
- PP1 for Station 8
- PP1 for Station 7.



Pre-Planned Points (Deg Min Sec.Decimal-Seconds)

Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA2 / PP1	30 17 15.33 N	56 57 49.29 E	5745
TGT2 STA3 / PP1	30 17 15.83 N	56 57 45.54 E	5745
TGT3 STA8 / PP1	30 17 18.49 N	56 57 47.61 E	5745
TGT4 STA7 / PP1	30 17 18.71 N	56 57 43.93 E	5745

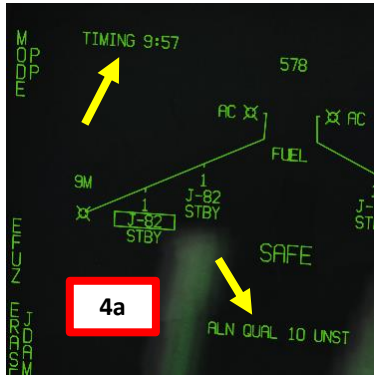


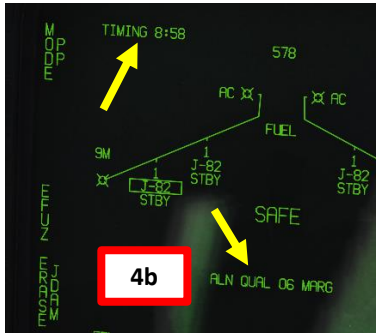
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

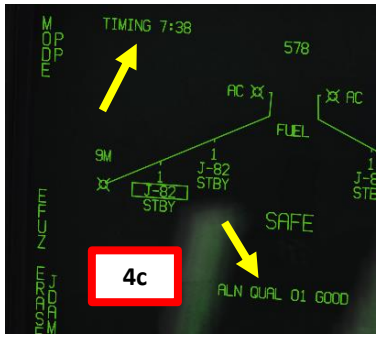
Set Up Weapons

2. While on the ground, go in SMS (Stores Management System) page
3. Click on the desired JDAM bomb to select it (J-82)
4. Once selected, JDAMs need about 3 minutes for alignment. It will go from 10 UNSTABLE, to 06 MARGINAL and finally 01 GOOD. When alignment is complete, the TIMING indicator will disappear from the JDAM page.













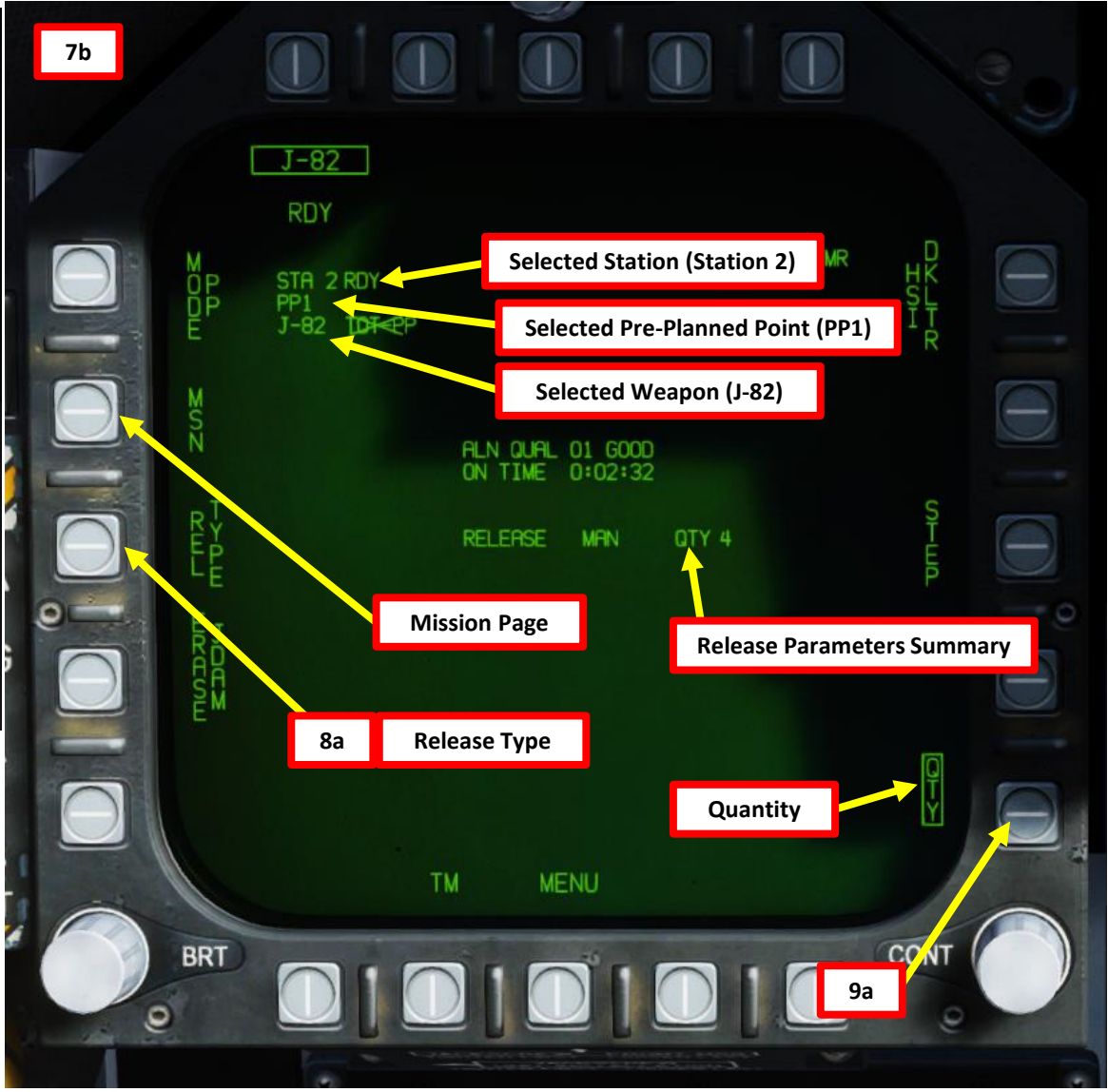
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

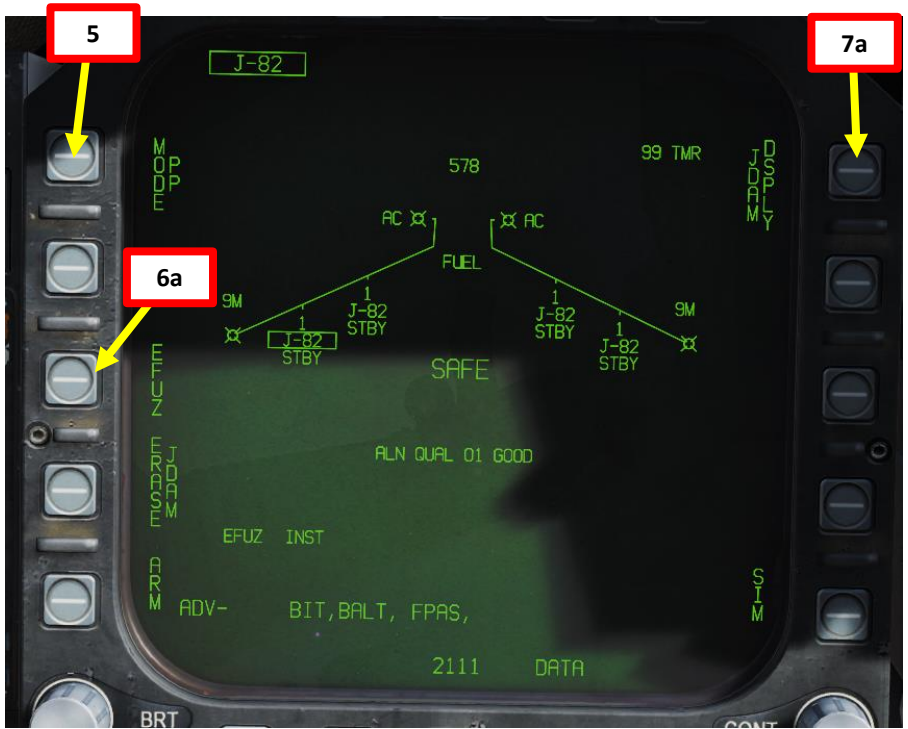
Set Up Weapons

5. Select PP (Pre-Planned) Release Mode
6. Select Electronic Fuze to INST (Instantaneous).
7. Go in the JDAM Display page by pressing the JDAM DSPLY OSB
8. Select Manual Release Type
9. Select desired JDAM quantity to be used for this mission.
    a) Press the OSB next to QTY
    b) Select desired stations to be used for the mission (I suggest you select all of them). Selected stations will become boxed.
    c) Press the OSB next to RTN (Return).









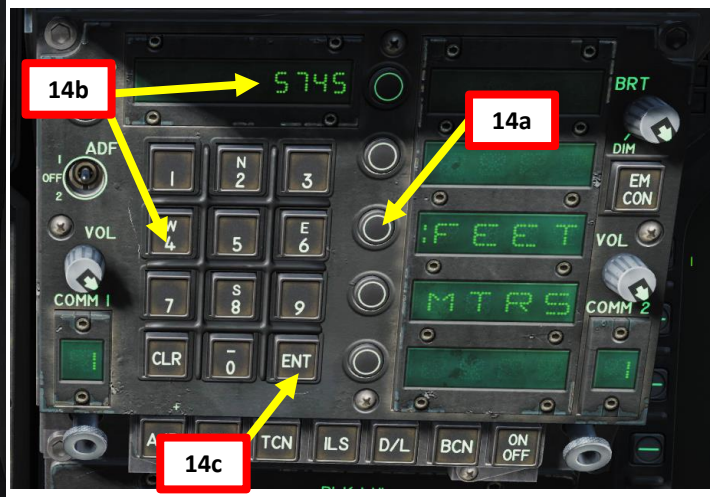


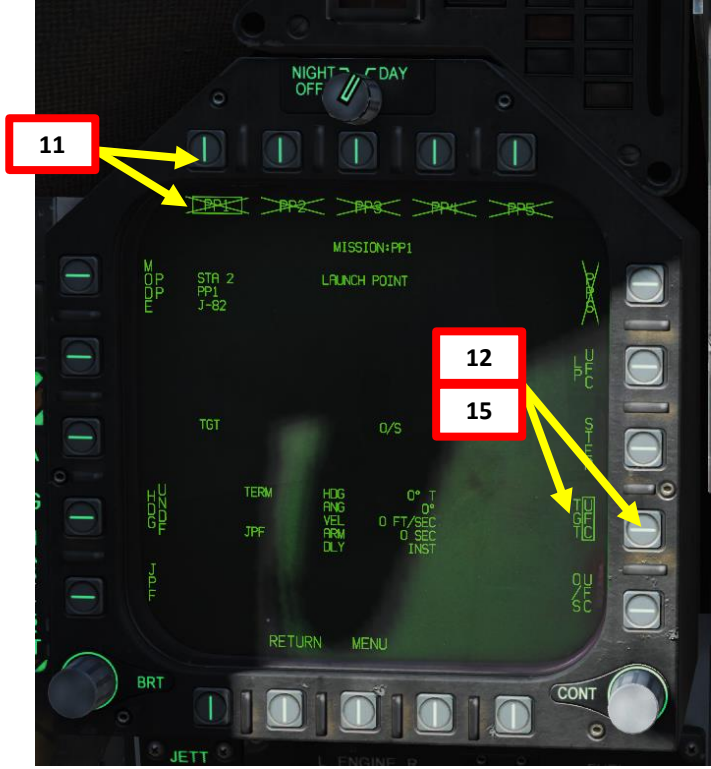
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Set Up Weapons

10. Enter MSN (Mission) page. Crossed-out PP Points mean no valid coordinates are entered yet.
11. Make sure PP1 is selected to input Target 1 coordinates
12. Select TGT UFC
13. On the UFC, select ELEV (Elevation)
14. Select FEET (« : » will appear when selected), then enter Target 1 altitude on the scratchpad (5745), then press the ENT (Enter) button.
15. Return to main UFC menu by pressing the TGT UFC button twice.









Pre-Planned Points (Deg Min Sec.Decimal-Seconds)

Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA2 / PP1	30 17 15.33 N	56 57 49.29 E	5745
TGT2 STA3 / PP1	30 17 15.83 N	56 57 45.54 E	5745
TGT3 STA8 / PP1	30 17 18.49 N	56 57 47.61 E	5745
TGT4 STA7 / PP1	30 17 18.71 N	56 57 43.93 E	5745

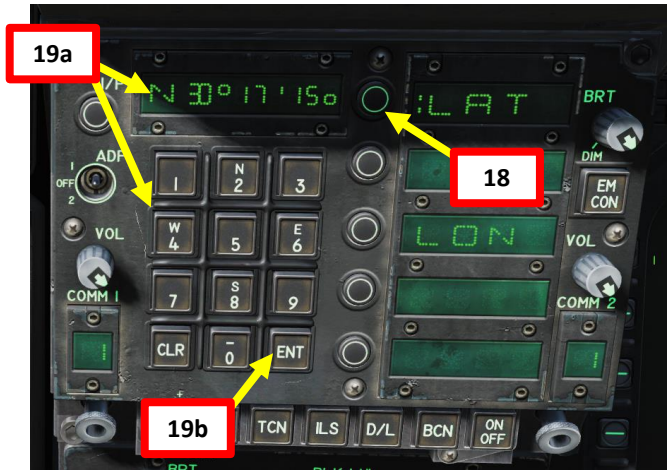
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

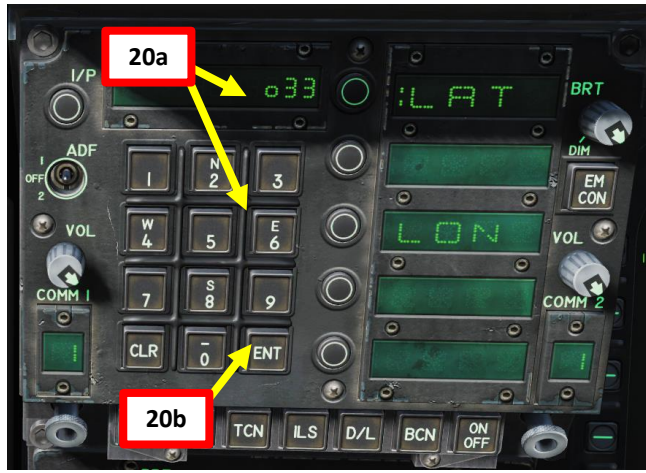
Set Up Weapons

16. On the UFC, select POSN (Position) « : » will appear once selected.
17. We will add the coordinates of Target 1 (PP1)
    30 °17'15.33'' North 56 °57'49.29'' East
18. On the UFC, select LAT (Latitude). « : » will appear once selected.
19. Press « 2 » (N) to select North coordinates, type « 301715 », then « ENT » to enter Degrees Minutes Seconds.
20. Wait for the UFC screen to reset, then type « 33 », then « ENT » to enter remaining Decimal-Seconds.
21. On the UFC, select LON (Longitude). « : » will appear once selected.
22. On the UFC, press « 6 » (E) to select East coordinates, type « 565749 », then « ENT » to enter Degrees Minutes Seconds.
23. Wait for the UFC screen to reset, then type « 29 », then « ENT » to enter remaining Decimal-Seconds.
24. Return to main UFC menu by pressing the TGT UFC button twice.













Pre-Planned Points (Deg Min Sec.Decimal-Seconds)

Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA2 / PP1	30 17 15.33 N	56 57 49.29 E	5745
TGT2 STA3 / PP1	30 17 15.83 N	56 57 45.54 E	5745
TGT3 STA8 / PP1	30 17 18.49 N	56 57 47.61 E	5745
TGT4 STA7 / PP1	30 17 18.71 N	56 57 43.93 E	5745

2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Set Up Weapons

- Take note that terminal parameters are not functional yet for the JDAM. Terminal parameters allow you to program the JDAM's attack heading (HDG), impact angle (ANG) and terminal velocity (VEL).
- Terminal parameters can be programmed by pressing the TGT UFC OSB, then selecting TERM on the UFC.



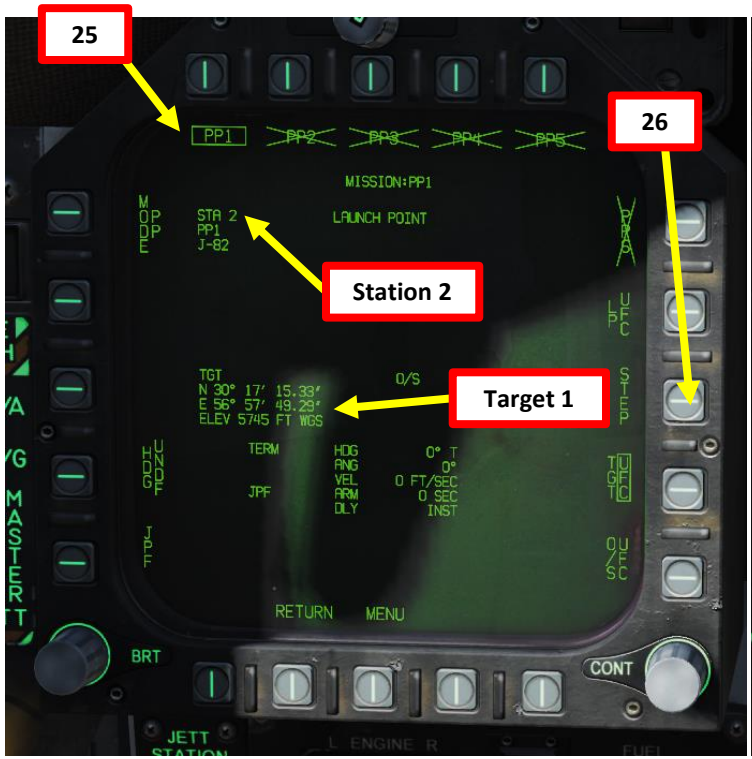


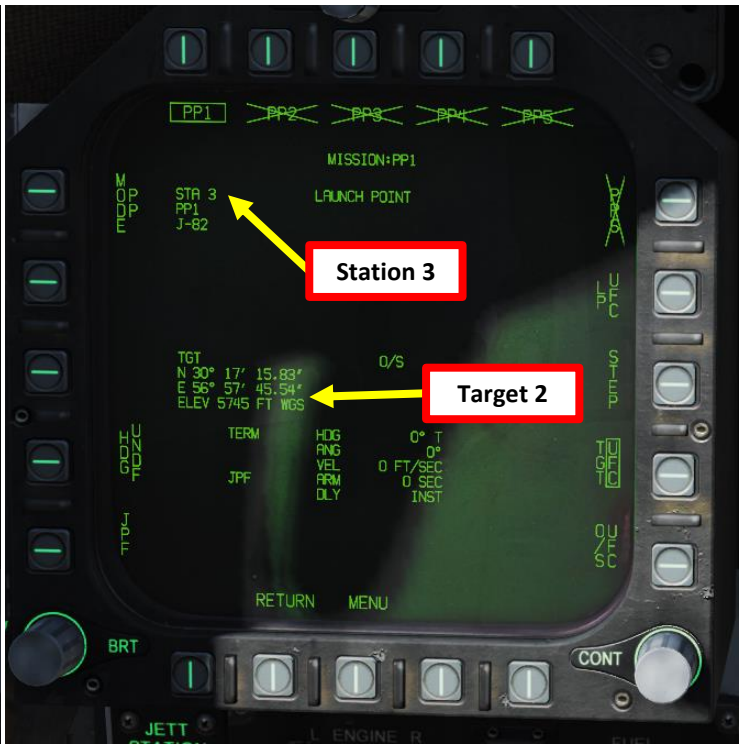


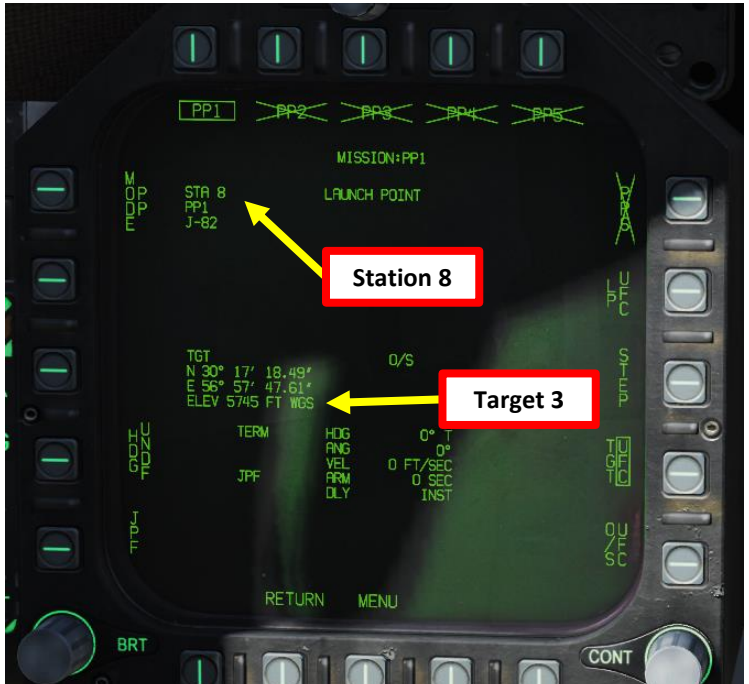
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Set Up Weapons

25. Once Longitude, Latitude and Elevation coordinates are entered for PP1, the PP1 icon will be boxed and no longer crossed out.
26. Press on STEP to select the next station (STATION 3).
27. Repeat process (Steps 11 through 24) for Station 3 PP1, Station 8 PP1, and Station 7 PP1.









Pre-Planned Points (Deg Min Sec.Decimal-Seconds)

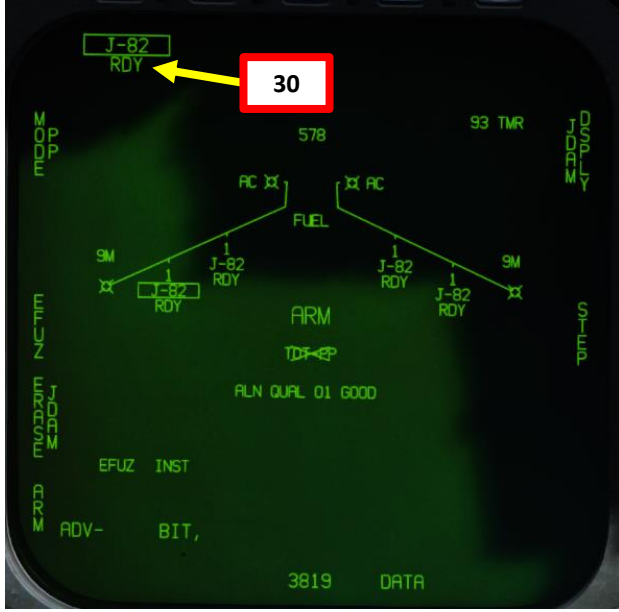
Target Point	Latitude	Longitude	Elevation (ft)
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TGT4 STA7 / PP1	30 17 18.71 N	56 57 43.93 E	5745

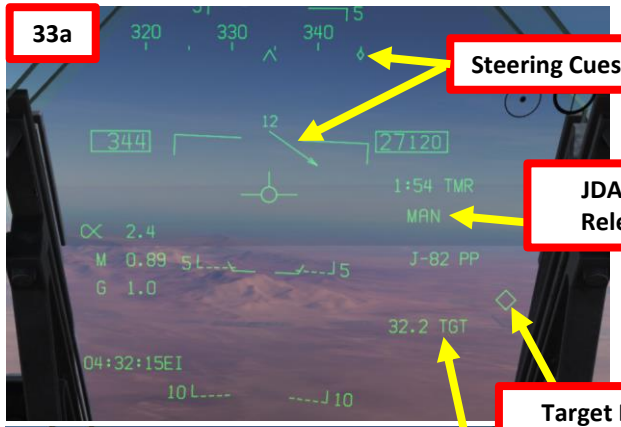
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Launch Weapons

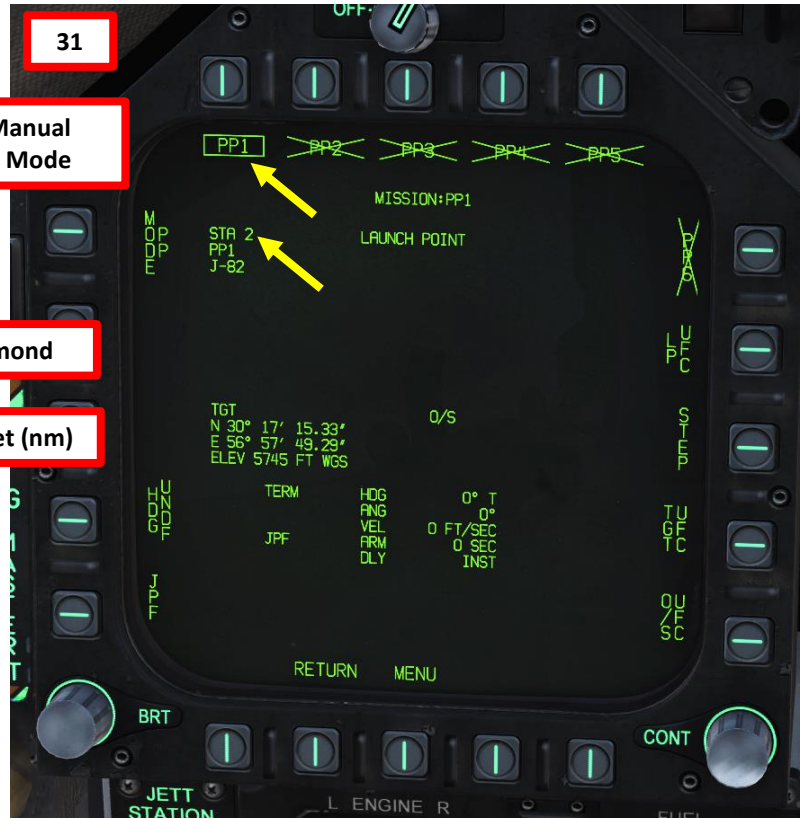
28. Master Arm switch – ARM (UP)
29. Master Mode – A/G
30. On the SMS (Stores Management System) page, verify that J-82 is selected
31. Set HSI on the right DDI and the JDAM Display page on the left DDI (from SMS page, press the JDAM DSPLY OSB, then select MSN (Mission) page)
32. Verify that Manual Release PP Release Mode is selected and that the desired station and PP is selected.
33. Steer aircraft to the target (indicated by a diamond on the HUD)







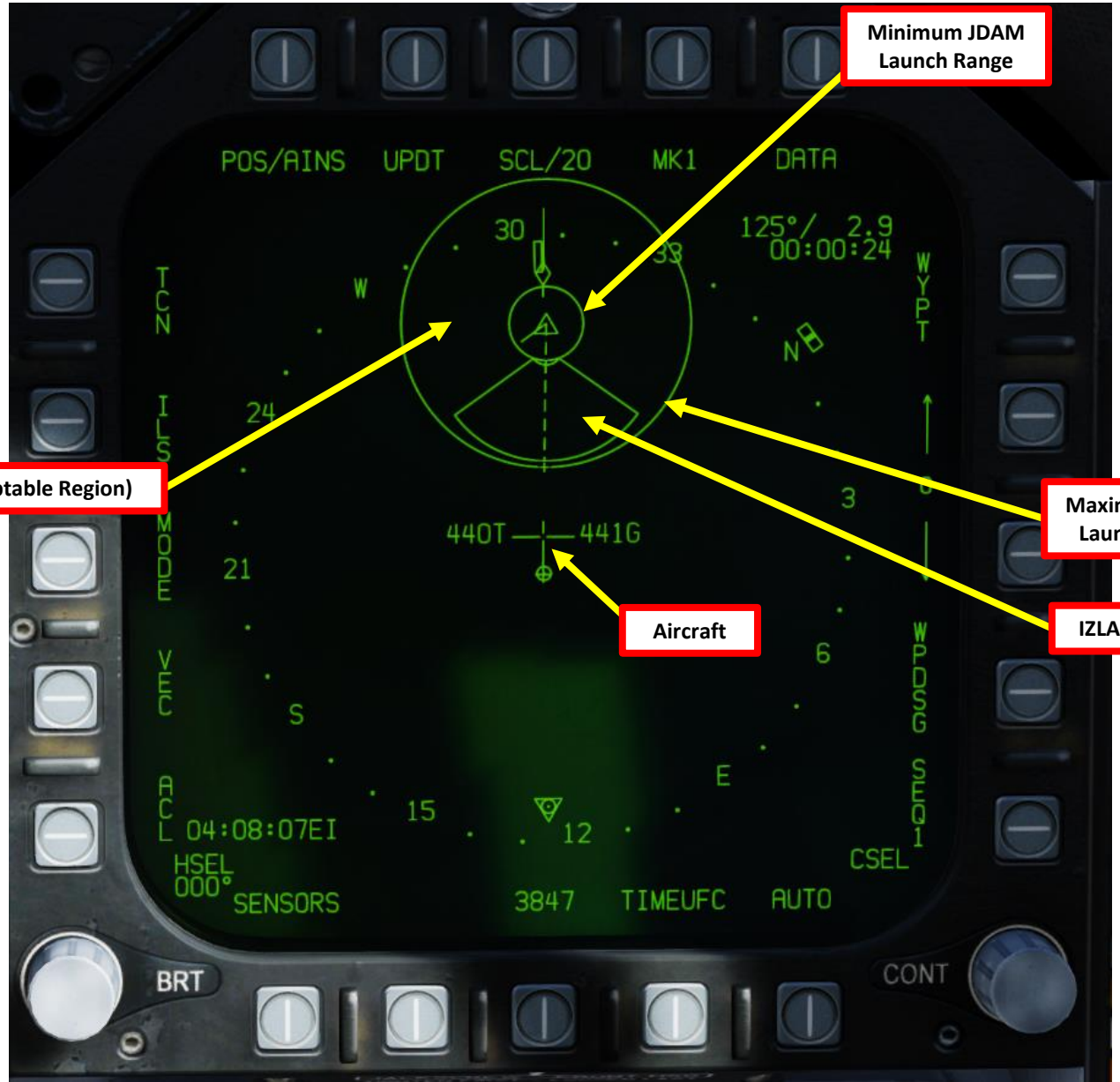






2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Launch Weapons



2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Launch Weapons

34. When you are within the acceptable release zone (between the minimum and maximum release limits identified on the HSI), the HUD will switch from displaying "TMR" (Time to reach launch acceptable region) to "IN RNG" (In Range).



TMR: Time to Launch Acceptable Region (sec)

J-82 PP
JDAM Selected, Pre-Planned Mode



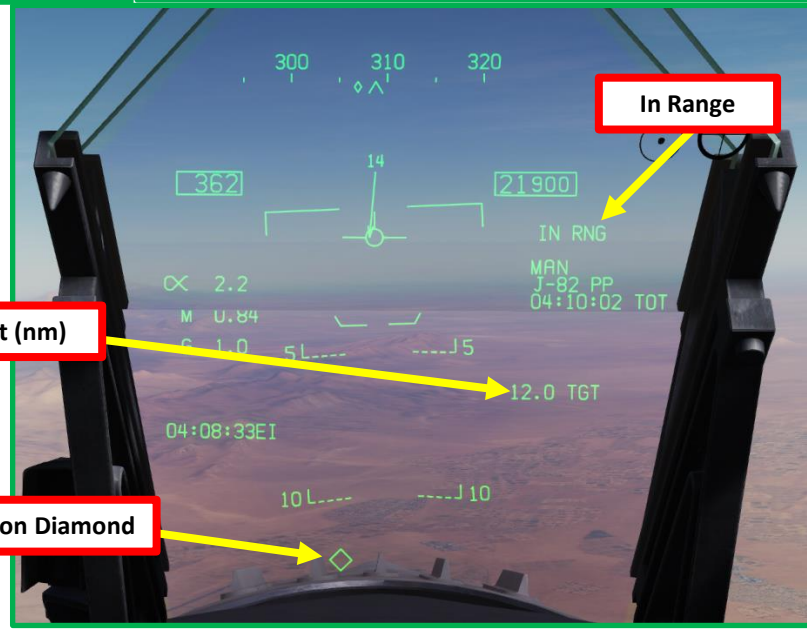
In Range





TMR: Time to Launch Acceptable Region (sec)





In Range

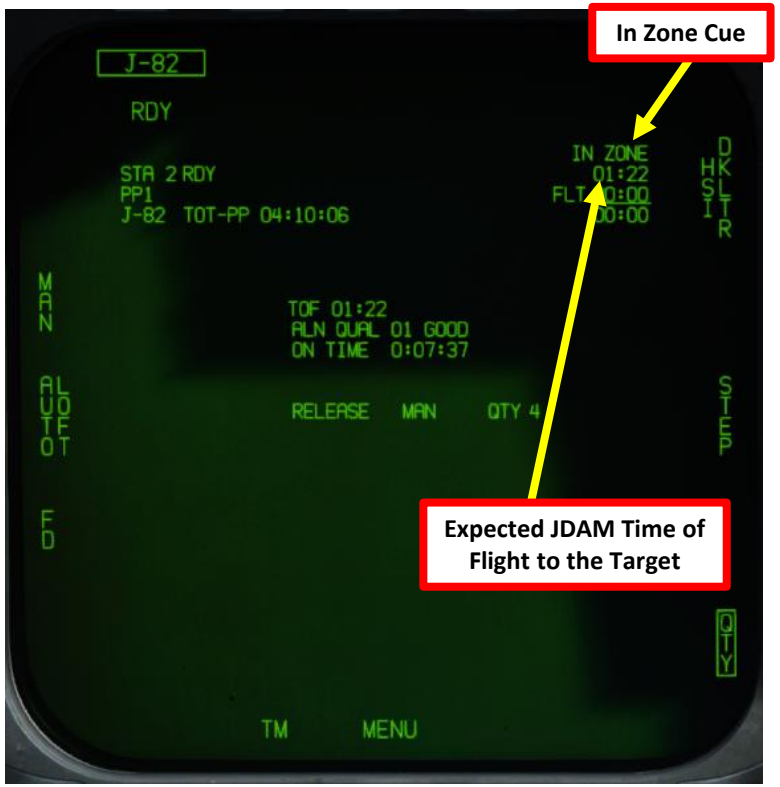
Range to Target (nm)

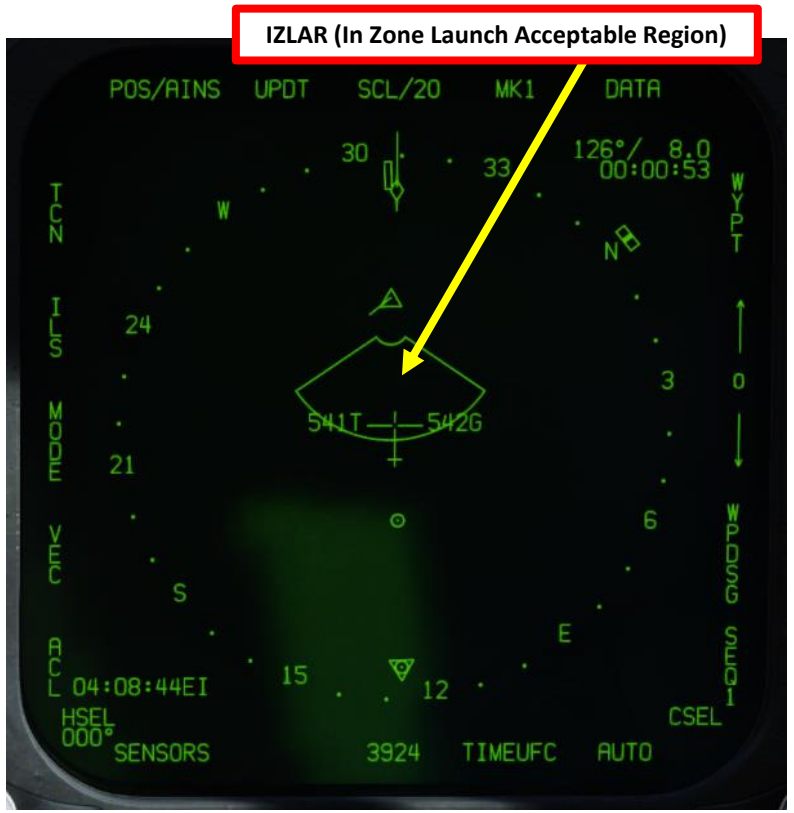
Target Designation Diamond

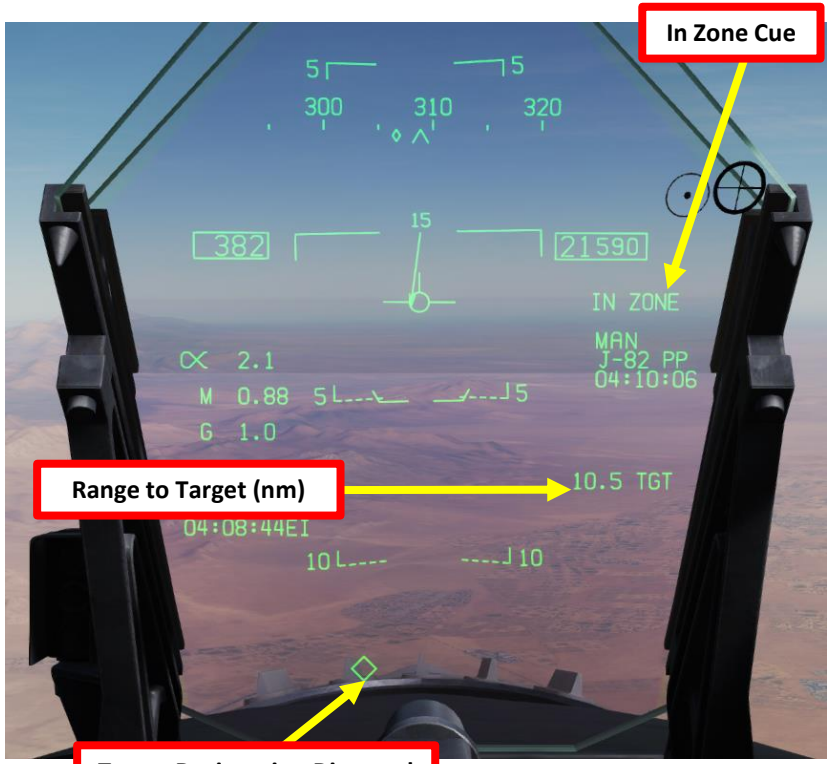
2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Launch Weapons

35. Once you are within the IZLAR (In Zone Launch Acceptable Region), the Minimum and Maximum Range circles will disappear and only the IZLAR will remain. IN ZONE cue will appear on the HUD and on the JDAM Display page. Expected JDAM flight time will also be displayed on the JDAM Display page.
36. You may now launch your JDAMs.







2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE

Launch Weapons

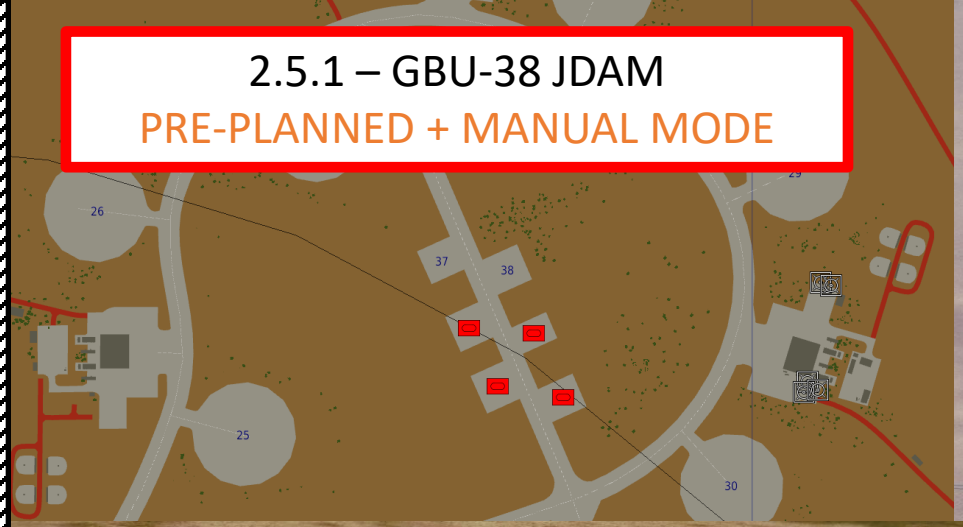
37. Hold the Weapon Release Button (« RALT+SPACE ») until all selected JDAMs are launched. All selected JDAMs will automatically guide themselves via GPS to the pre-planned designated points.







2.5.1 – GBU-38 JDAM
PRE-PLANNED + MANUAL MODE



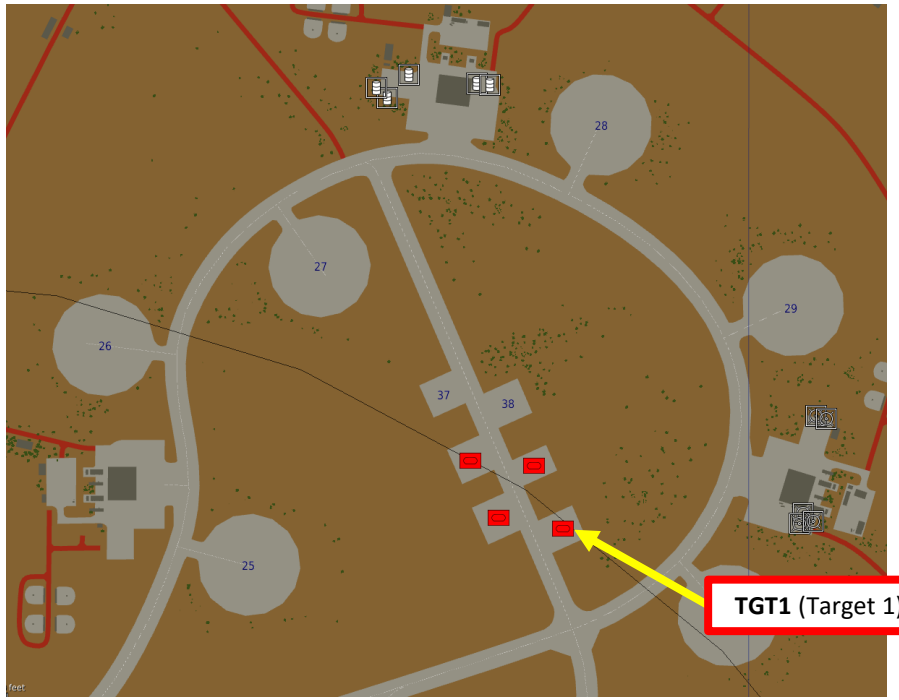




2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

A neat feature of the targeting pod is that you can designate targets with it even without a laser. The laser is used for laser-guided weapons, so the GPS-guided units only need valid coordinates. These coordinates can be obtained by designating a target with the targeting pod while the JDAM/JSOW is in TOO (Target of Opportunity) Mode. The coordinates are then memorized and automatically transferred to the selected JDAM/JSOW.



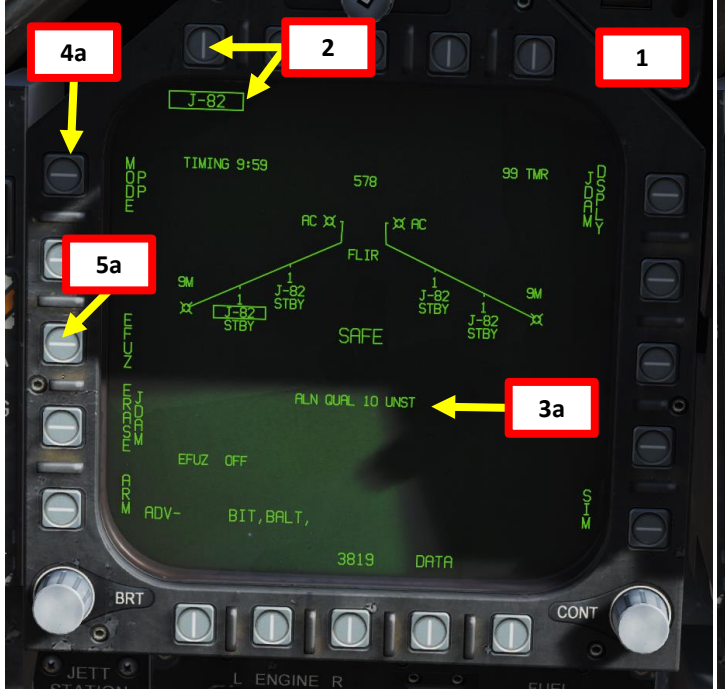


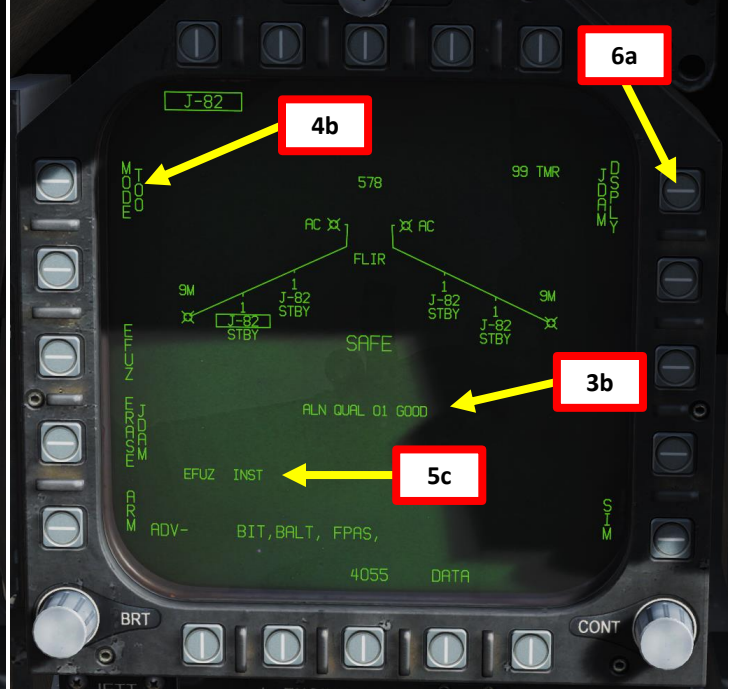
Find Target with Targeting Pod and Designate with TDC → **From Targeting Pod Designated Point, Obtain Coordinates** → **Set Up Weapon - TOO** (TOO, uses Designated Point from Targeting Pod) → **Manual Release Mode**

2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

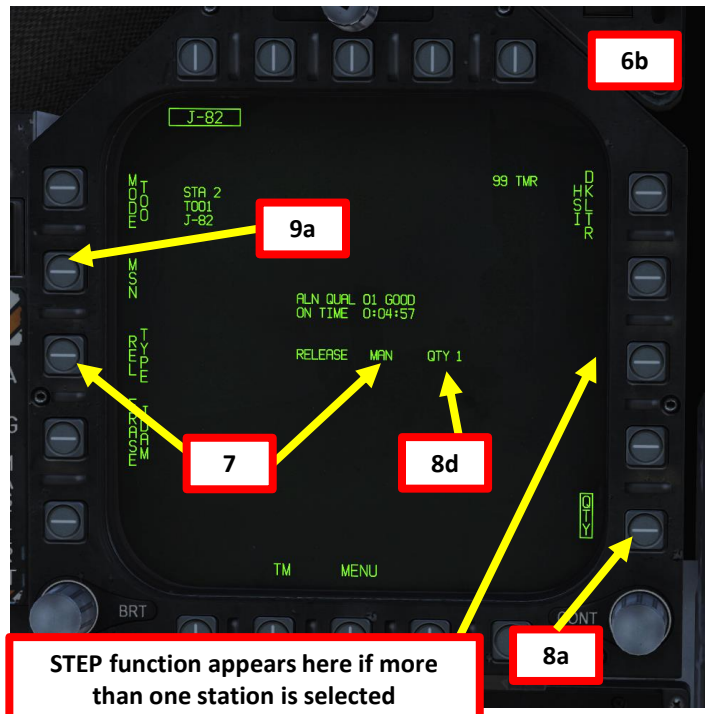
1. While on the ground, go in SMS (Stores Management System) page
2. Click on the desired JDAM or JSOW to select it (we will use the J-82 JDAM)
3. Once selected, JDAMs need about 3 minutes for alignment. It will go from 10 UNSTABLE, to 06 MARGINAL and finally 01 GOOD. When alignment is complete, the TIMING indicator will disappear from the JDAM page.
4. Select TOO (Target-of-Opportunity) Release Mode
5. Select Electronic Fuze to INST (Instantaneous).
6. Go in the JDAM Display page by pressing the JDAM DSPLY OSB
7. Select Manual Release Type
8. Select desired JDAM quantity to be used for this mission.
    a) Press the OSB next to QTY
    b) Select desired station(s) to be used for the mission (I suggest you select just one). Selected station(s) will become boxed.
    c) Press the OSB next to RTN (Return).
    d) If quantity is set to more than 1, the STEP function will be available to select desired weapon station.
    e) You may need to re-select TOO mode.
9. Enter MSN (Mission) page.
10. Select TOO1 to set Target 1 parameters. We will now have to designate Target 1 with the Targeting Pod to obtain the coordinates of this target.







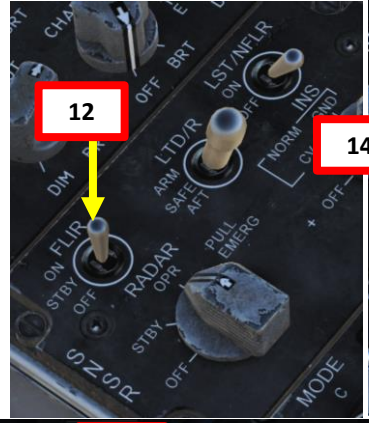


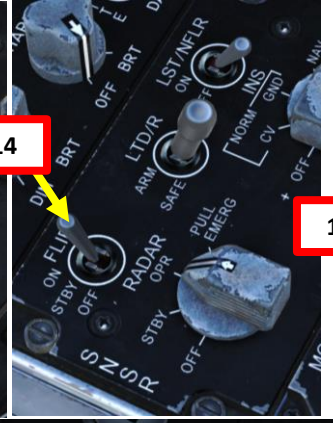




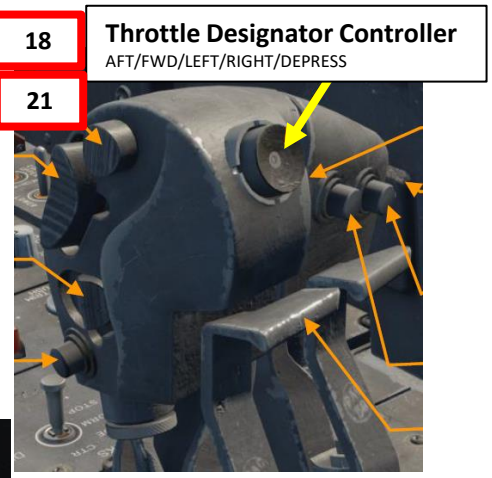
2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

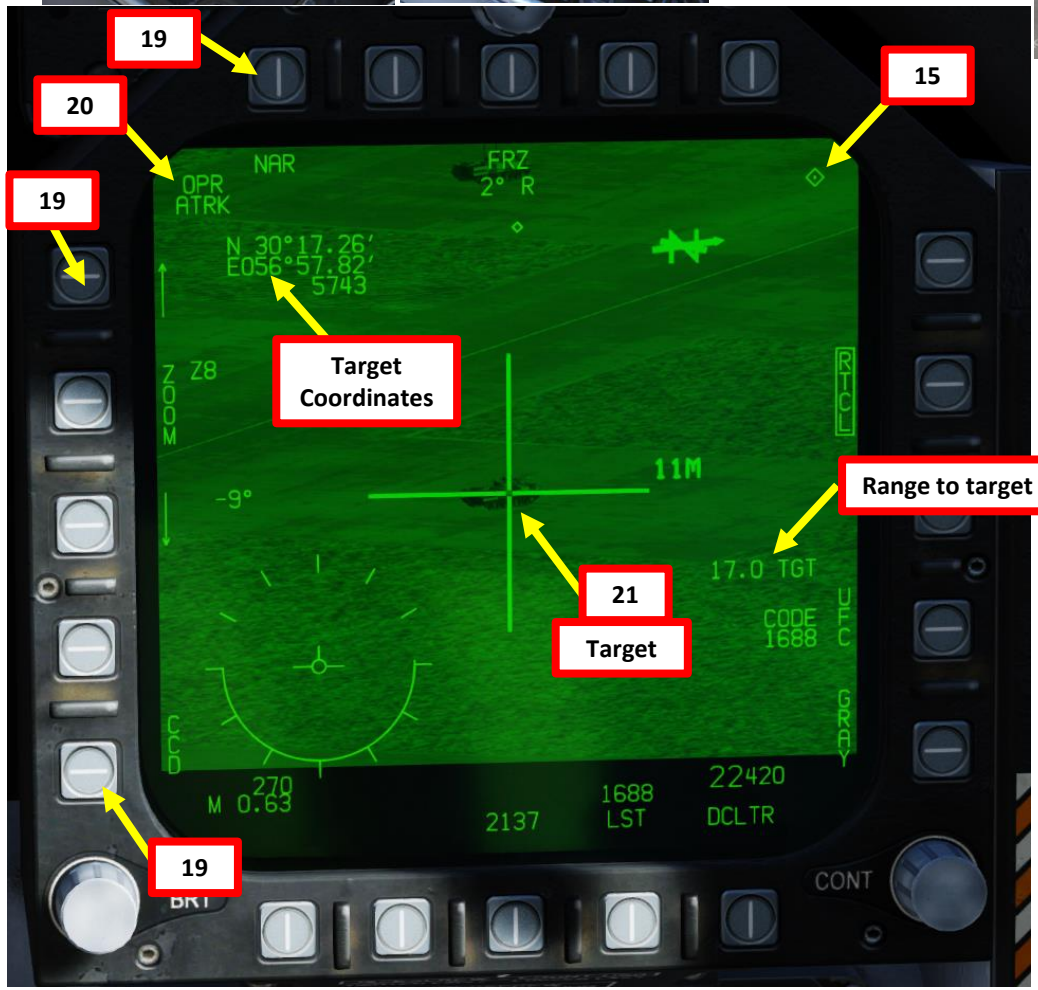
11. Set A/G Master Mode.
12. To power up the targeting pod, set FLIR Sensor Switch to STBY (Right Click).
13. From the TAC page on either DDI or the AMPCD, press the OSB (Option Select Button) next to “FLIR” (Forward-Looking Infrared) to select the Targeting Pod feed page. Monitor the warm-up process.
    - Targeting pod warm-up process will take about 2 minutes.
    - When targeting pod is ready to be used, the pod status will switch from ~~RDY~~ – NOT TIMED OUT to STBY (Standby).
14. Set FLIR Sensor Switch to ON (Right Click). Confirm that Targeting Pod mode switches from STBY to OPR (Operate).
15. Press the Sensor Control Switch in the direction of the selected DDI (Right for the Right DDI as an example). The Select Focus Diamond indicates what display is selected.
16. Press the Undesignate button twice rapidly to select VVSLV (Velocity Vector Slaved) mode. This will un-stow the camera and slave the targeting pod to the velocity vector.
17. Press the Undesignate button twice rapidly again to select Snowplow mode. When Snowplow mode is first entered, the FLIR is set to 0° left/right and -8° down.
18. Using the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls, slew the targeting pod reticle over the desired target.
19. Use appropriate zoom level, field of view (NARROW/WIDE) and camera mode (CCD/TV or FLIR) to identify the target.
20. Press the Sensor Control Switch Towards Selected Display (Right if our right DDI is selected) to toggle between Point Track (PTRK, tracks a moving object like a high-contrast vehicle) and Area Track (ATRK, used for a static target).
21. Use the TDC (Throttle Designator Controller) Depress button to designate the target point. This will slave selected air-to-ground weapons to the target point and display range to target and its coordinates.

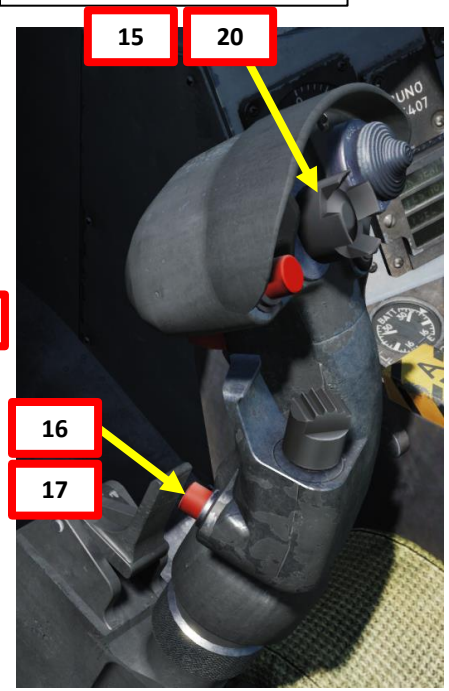






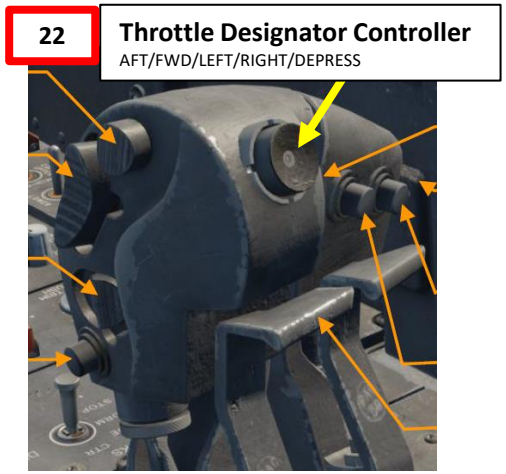






2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

22. Once the target has been designated with the TDC DEPRESS control, the target coordinates will automatically since the JDAM is in TOO mode.
23. Confirm on JDAM MSN (Mission) page that coordinates have updated properly once the TDC Depress button has been pressed.







2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

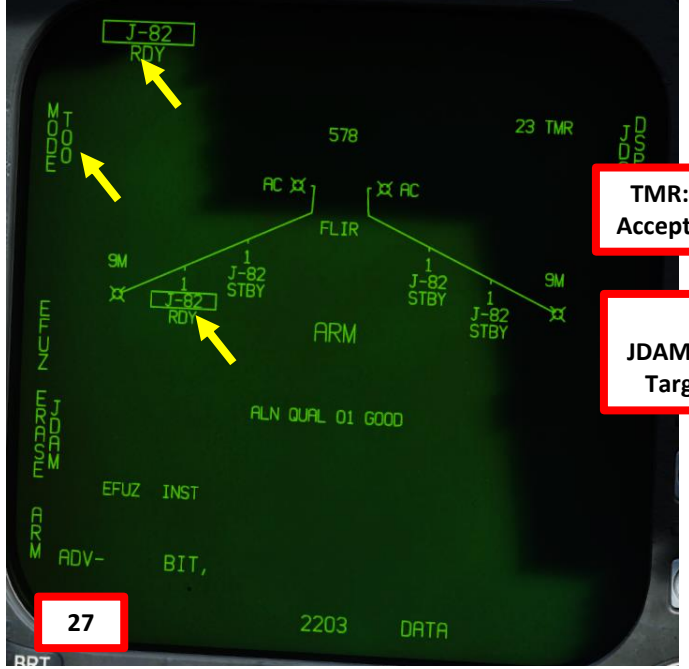
Note: Keep in mind that TOO mode only allows you to save coordinates for **one JDAM or JSOW at a time**. You **cannot** transfer coordinates from TOO to PP mode, which makes the use of TOO a bit cumbersome if you want to strike multiple targets at once.

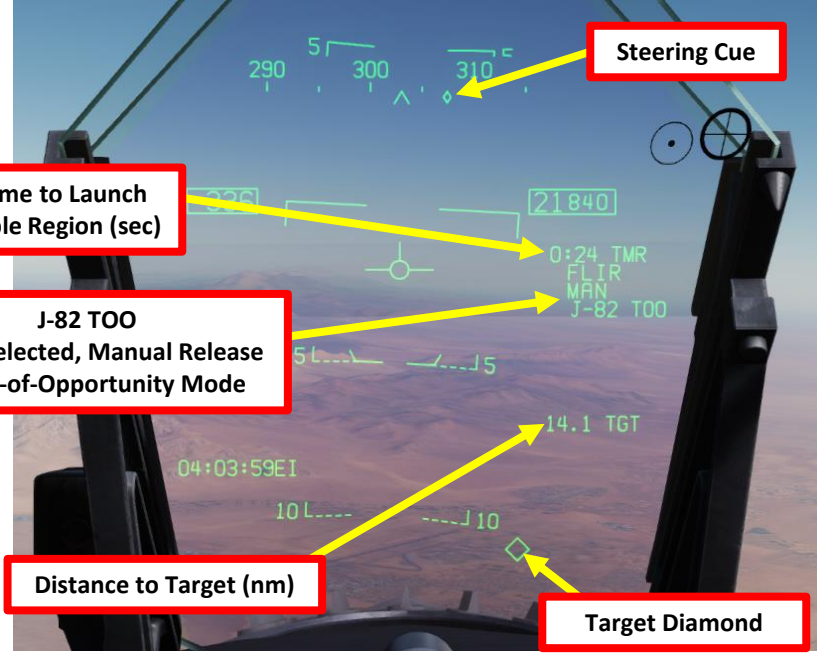
If you wanted to attack several targets at once, you would need to either set all your coordinates in advance in PP mode (in real life missions of this type are already pre-planned)… or you would need to designate a target with the targeting pod in TOO, release the JDAM, then acquire another target with the targeting pod in TOO, then launch another JDAM, and so on and so forth.



2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

24. Once your JDAM selected has its target coordinates and are in TOO mode, we can now start the attack run.
25. Master Arm switch – ARM (UP)
26. Verify that Master Mode is in A/G (Air-to-Ground)
27. On the SMS (Stores Management System) page, verify that J-82 is selected and RDY (Ready)
28. Set HSI on the lower AMPCD (I suggest you remove the moving map), the targeting pod feed on the right DDI, and the JDAM Display page on the left DDI (from SMS page, press the JDAM DSPLY OSB
29. Verify that Manual Release TOO Release Mode is selected and that the desired station and TOO is selected.
30. Steer aircraft to the target (indicated by a diamond on the HUD)

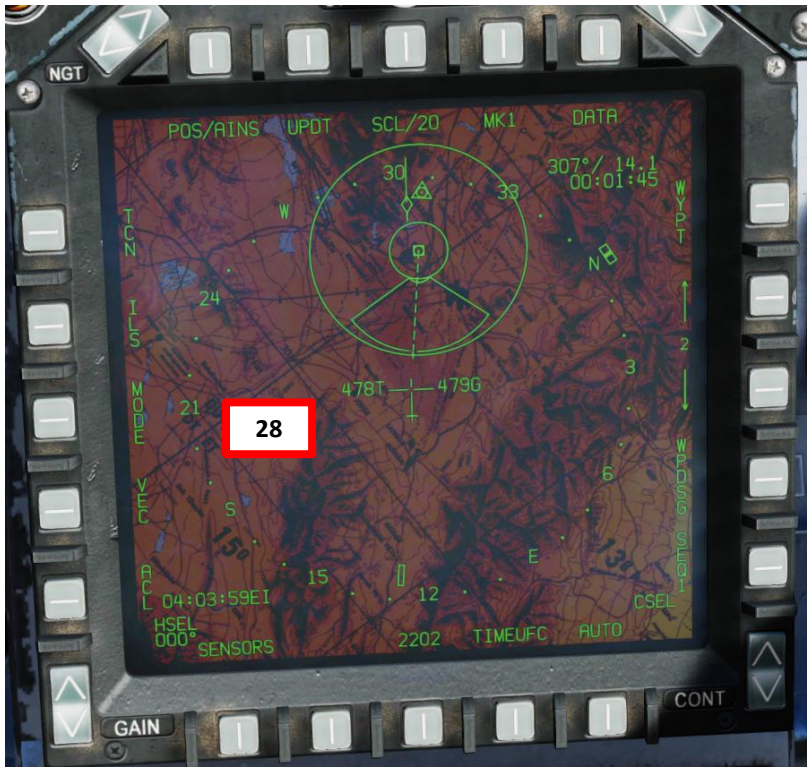




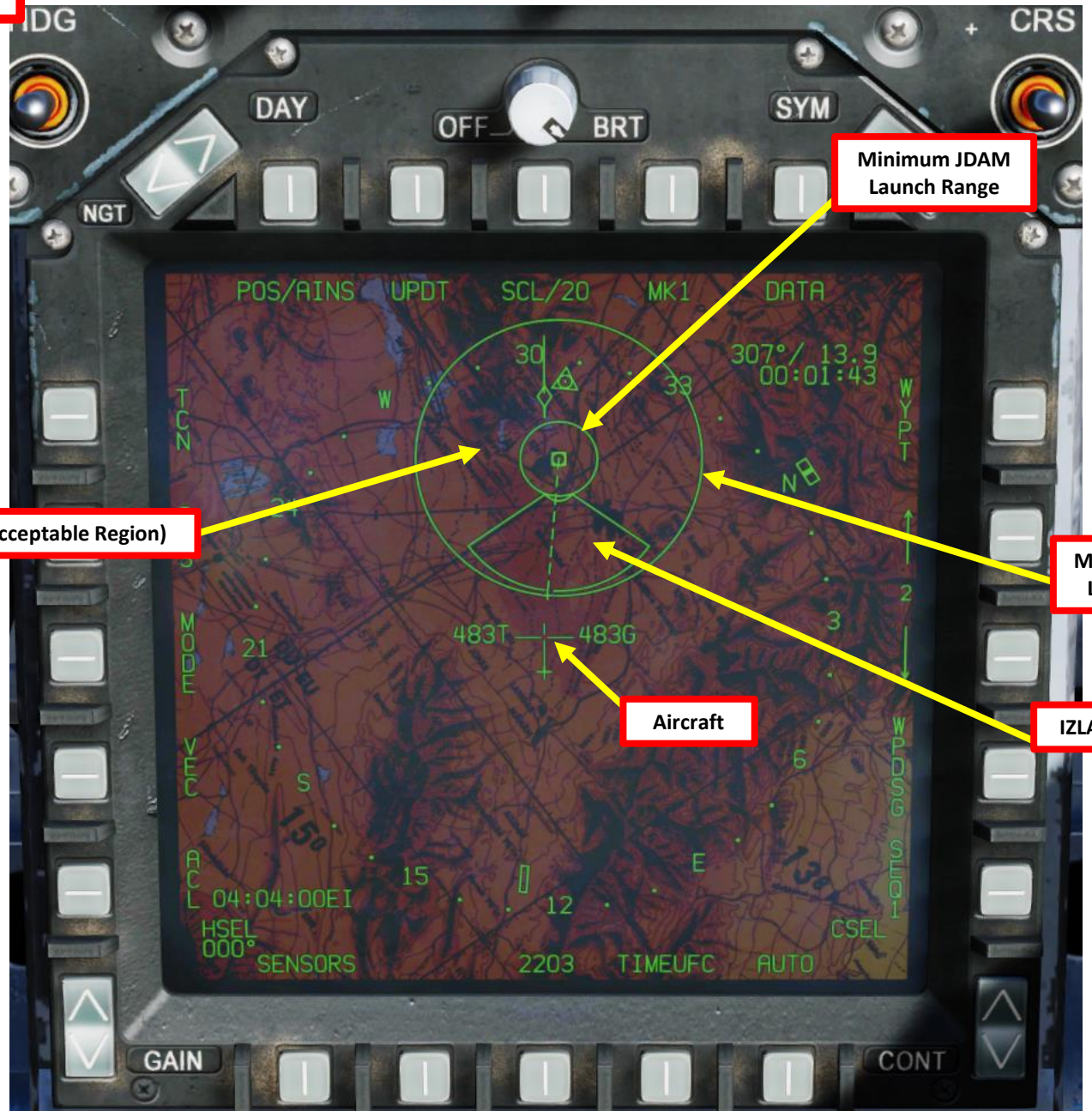








2.5.2 – GBU-38 JDAM
TARGETING POD + TOO



2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

31. When you are within the acceptable release zone (between the minimum and maximum release limits identified on the HSI), the HUD will switch from displaying “TMR” (Time to reach launch acceptable region) to “IN RNG” (In Range).







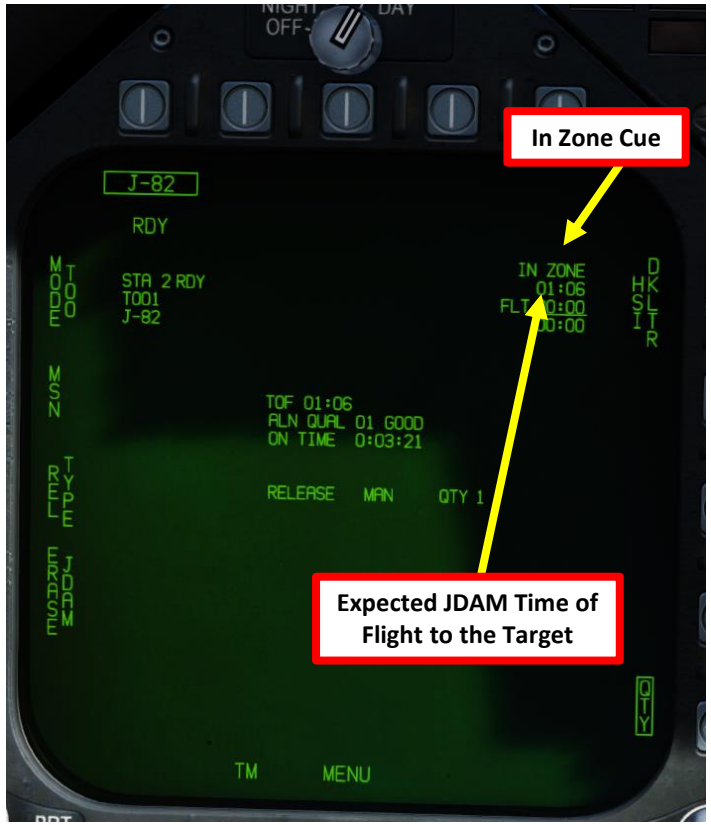


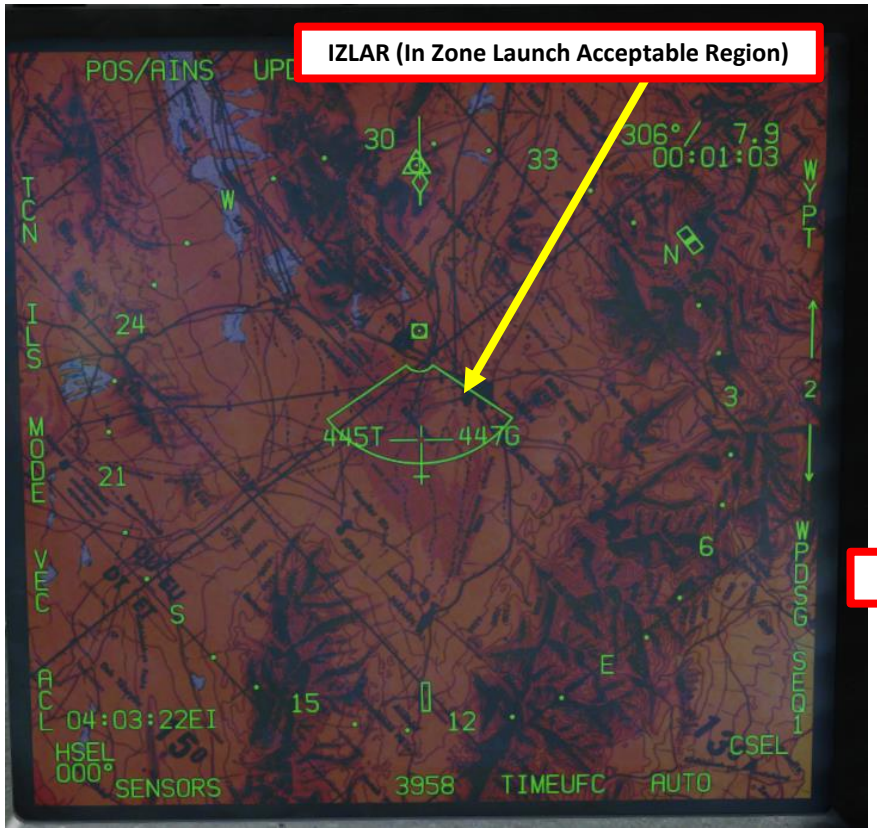


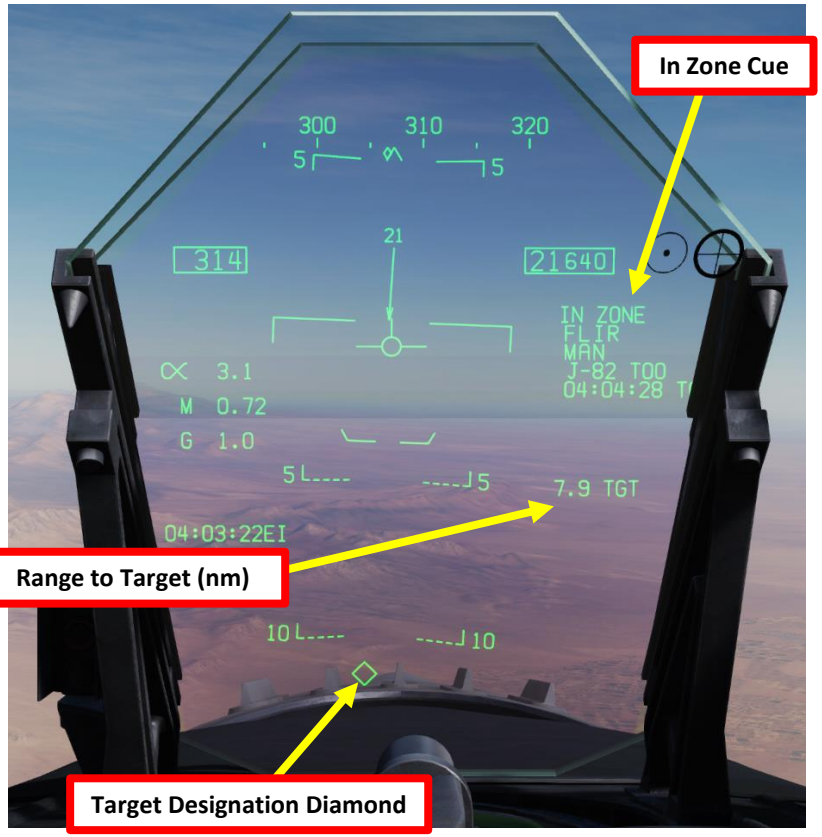


2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

32. Once you are within the IZLAR (In Zone Launch Acceptable Region), the Minimum and Maximum Range circles will disappear and only the IZLAR will remain. IN ZONE cue will appear on the HUD and on the JDAM Display page. Expected JDAM flight time will also be displayed on the JDAM Display page.
33. You may now launch your JDAM.





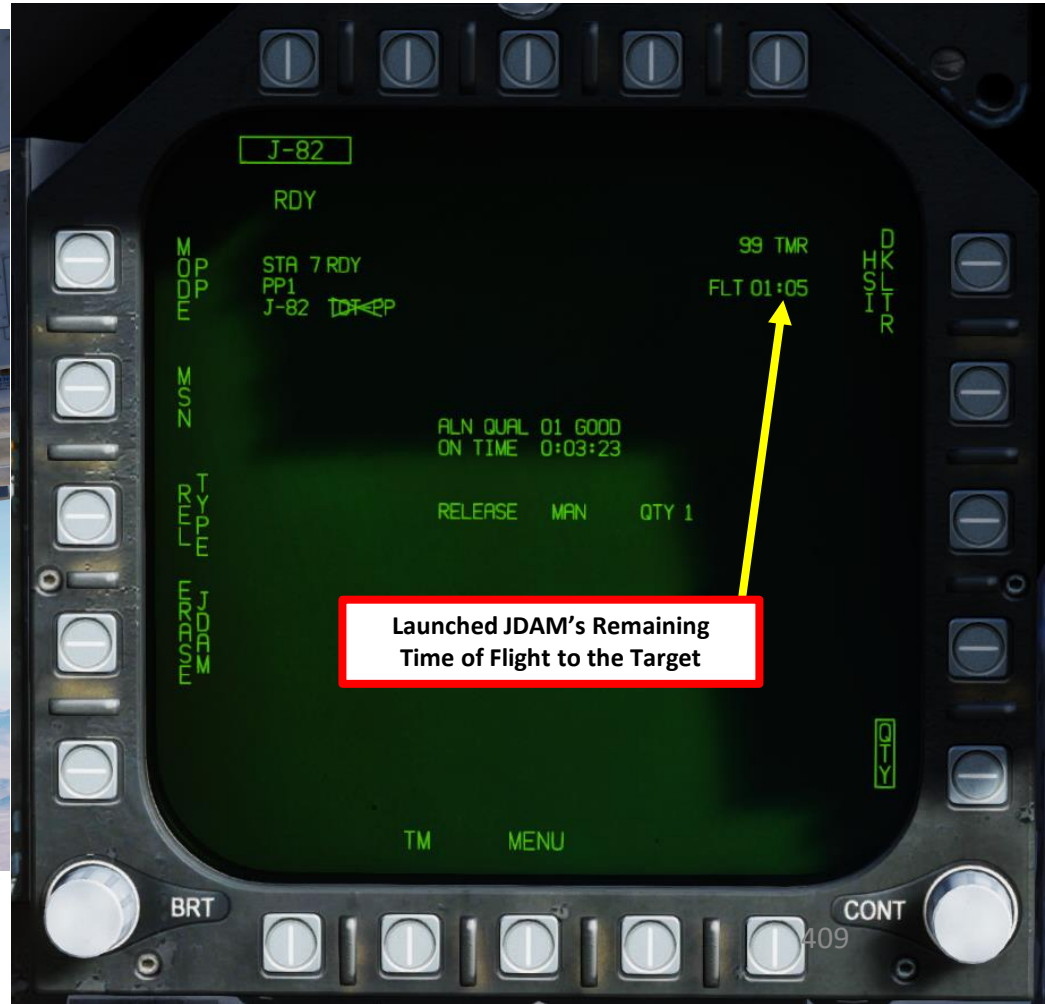


2.5.2 – GBU-38 JDAM
TARGETING POD + TOO

34. Hold the Weapon Release Button (« RALT+SPACE ») to release your JDAM. Selected JDAM will automatically guide itself via GPS to the designated target.







2.5.2 – GBU-38 JDAM
TARGETING POD + TOO





2.5.3 – AGM-154A JSOW INTRODUCTION



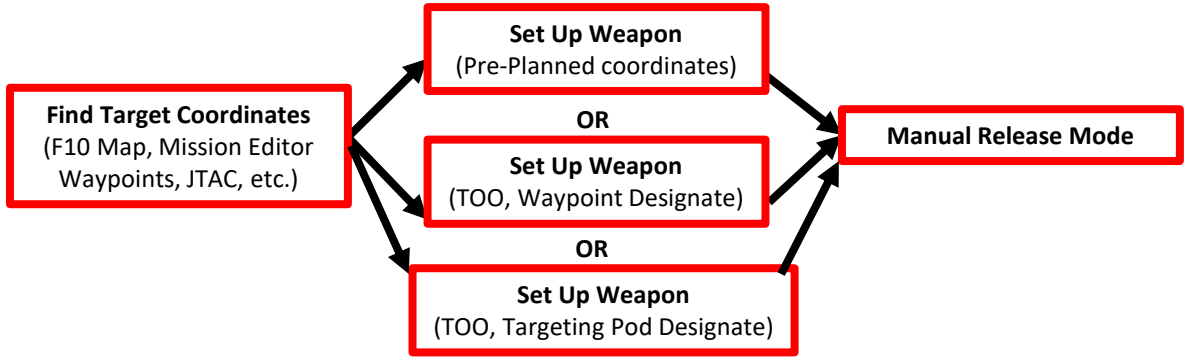
The F/A-18C is able to employ the Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs and the Joint Standoff Weapon (JSOW) glide bombs. JDAMs are modified general purpose bombs, equipped with a GPS and inertial navigation system (INS) for guidance as well as flight controls. The JSOW has the same guidance and is a bomb with wings to provide lift and maneuvering flight controls. As such, it has a significantly longer range than JDAMs. The JDAMs/JSOWs have (at optimal INS alignment) a margin of error of approximately 16ft (5m). Independent programming of each individual bomb allows for simultaneous multi-target attacks.

Basically, the way to employ JSOWs is to first get your target coordinates from either the mission briefing or using the F10 map, input them to the weapons in either Pre-Planned Mode (coordinates need to be entered manually) or in TOO Mode (Target of Opportunity, weapons use the existing A/G (Air-to-Ground) designation, which is the Hornet (or Harrier) equivalent of the SPI (Sensor Point of Interest) in the A-10C. You can make an A/G designation with WPDSG (Waypoint Designate) button or via the HUD, but it is also possible to designate with the targeting pod or A/G radar.

For the JSOW tutorial, we will use TOO Mode, while for the JDAM tutorial we will use the Pre-Planned Mode. Once the setup is done and the weapon alignment has been performed, we will then be able to release them in Manual Mode.

The warhead of the **AGM-154A** consists of 145 BLU-97/B Combined Effects Bomb (CEB) submunitions. These bomblets have a shaped charge for armor defeating capability, a fragmenting case for material destruction, and a zirconium ring for incendiary effects.

The **AGM-154C**, on the other hand, uses an Imaging Infrared (IIR) terminal seeker with autonomous guidance. The AGM-154C carries the BROACH warhead, which is designed to attack hardened targets.







JSOW A-1 with the BLU-111 warhead



JSOW C with the BROACH warhead



JSOW C-1 with the BROACH warhead and data link

2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

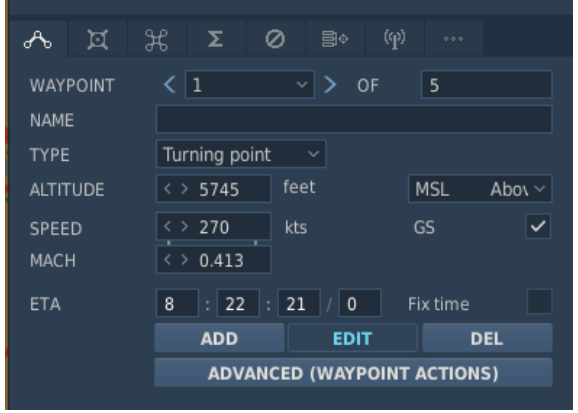
Verify Waypoint Coordinates

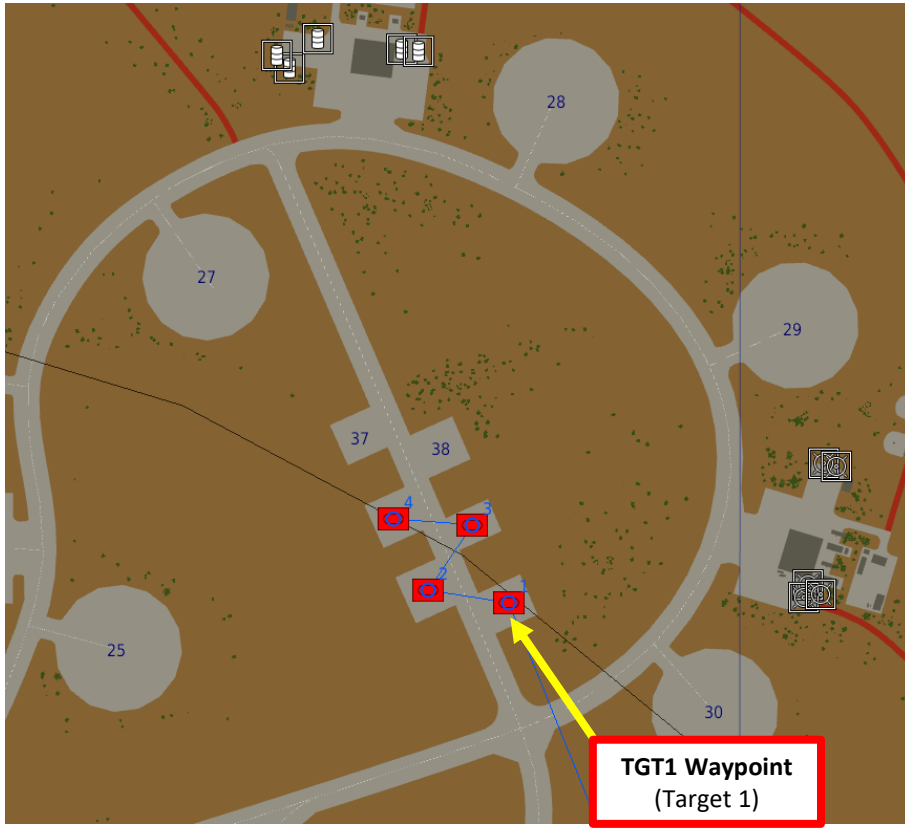
1. Normally, JSOW strikes using TOO (Target of Opportunity) use waypoint already defined in the mission editor. However, you should always cross-check with the F10 map if the coordinates make sense in terms of **Longitude**, **Latitude** and **Elevation** and modify them if required.
    a) Open the SUPT HSI page, then press open the "DATA" sub-menu.
    b) Cycle through existing waypoints and verify their coordinates and elevation.
    c) You can convert each waypoint to PRECISE coordinates by clicking on the OSB next to PRECISE. It will add two digits to existing coordinates.









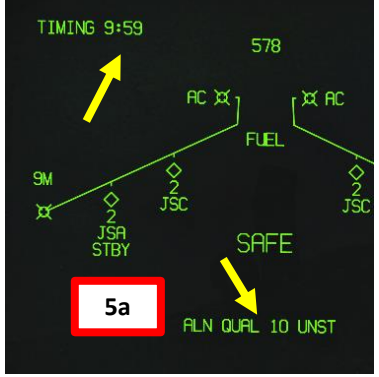


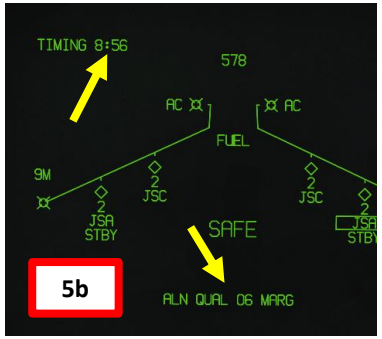
2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

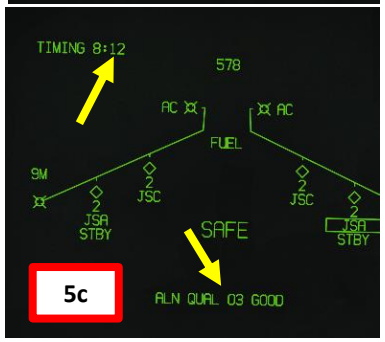
Set Up Weapons

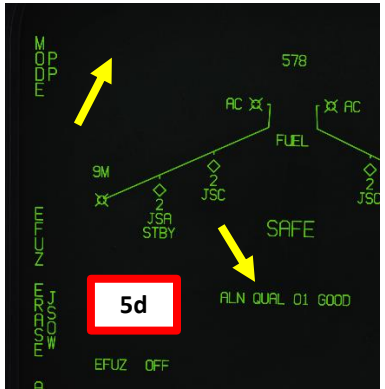
2. Set A/G Master Mode.
3. While on the ground, go in SMS (Stores Management System) page
4. Click on the desired JSOW to select it (JSA for AGM-154A and JSC for AGM-154C)
5. Once selected, JSOWs need about 3 minutes for alignment. It will go from 10 UNSTABLE, to 06 MARGINAL and finally 01 GOOD. When alignment is complete, the TIMING indicator will disappear from the JSOW page.

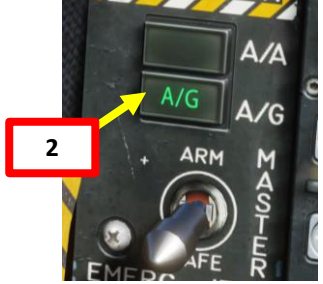










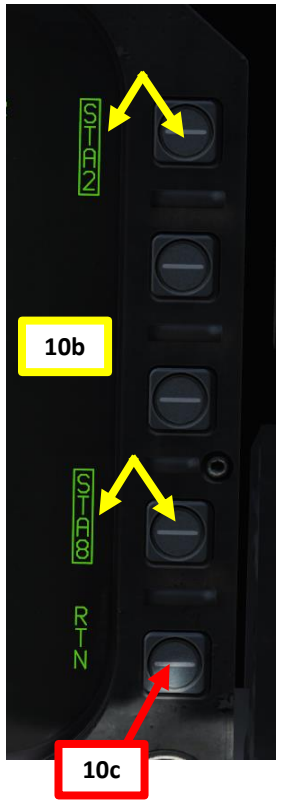


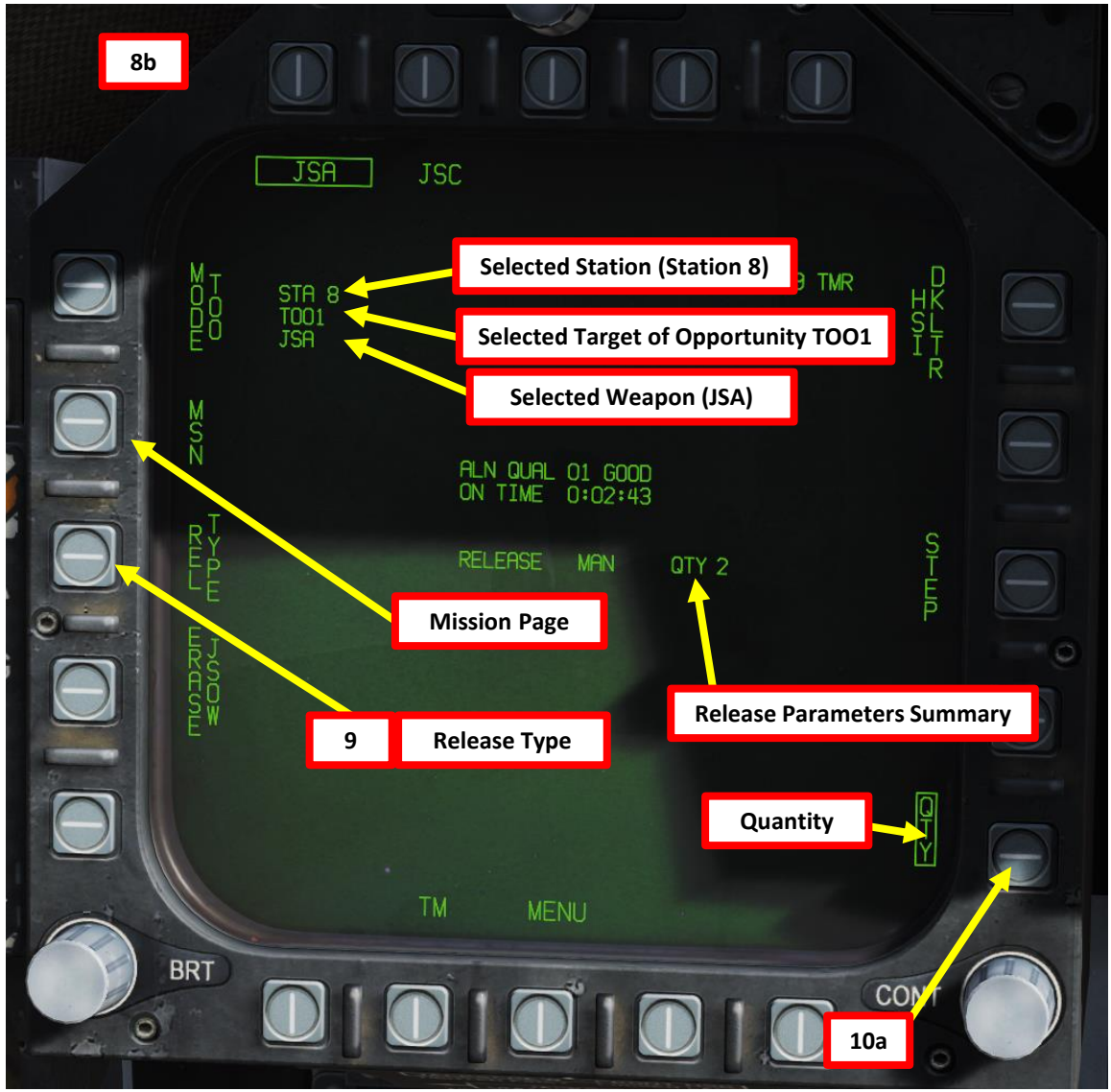


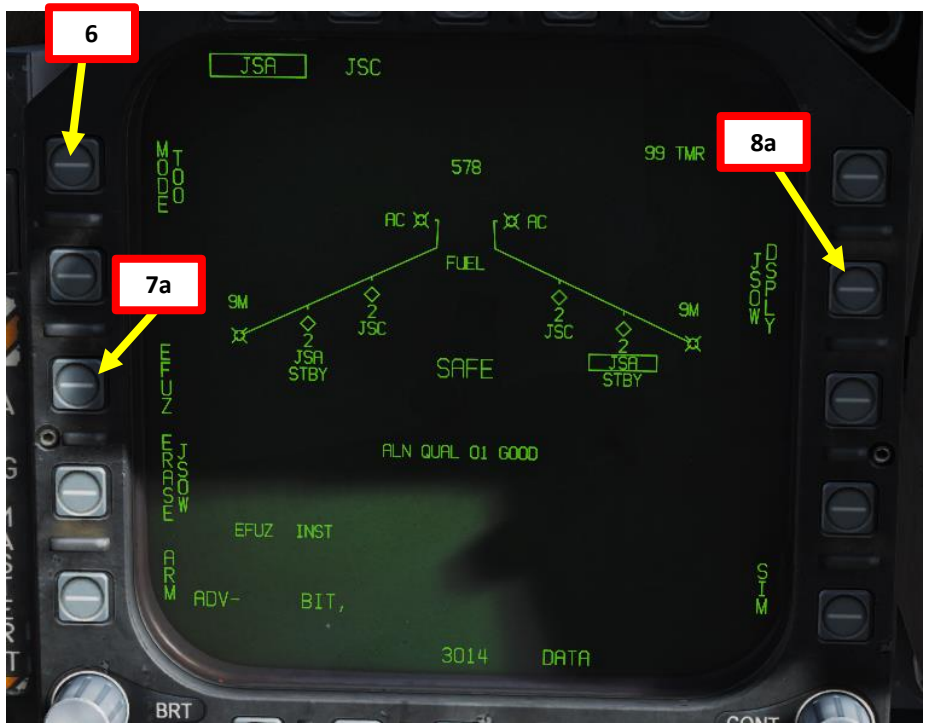
2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

Set Up Weapons

6. Select TOO (Target of Opportunity) Release Mode
7. Select Electronic Fuze to INST (Instantaneous).
8. Go in the JSOW Display page by pressing the JSOW DSPLY OSB
9. Select Manual Release Type
10. Select desired JSOW quantity to be used for this mission. In our case, we want to drop two JSOWs on Target 1.
    a) Press the OSB next to QTY
    b) Select desired stations to be used for the mission. Selected stations will become boxed.
    c) Press the OSB next to RTN (Return).







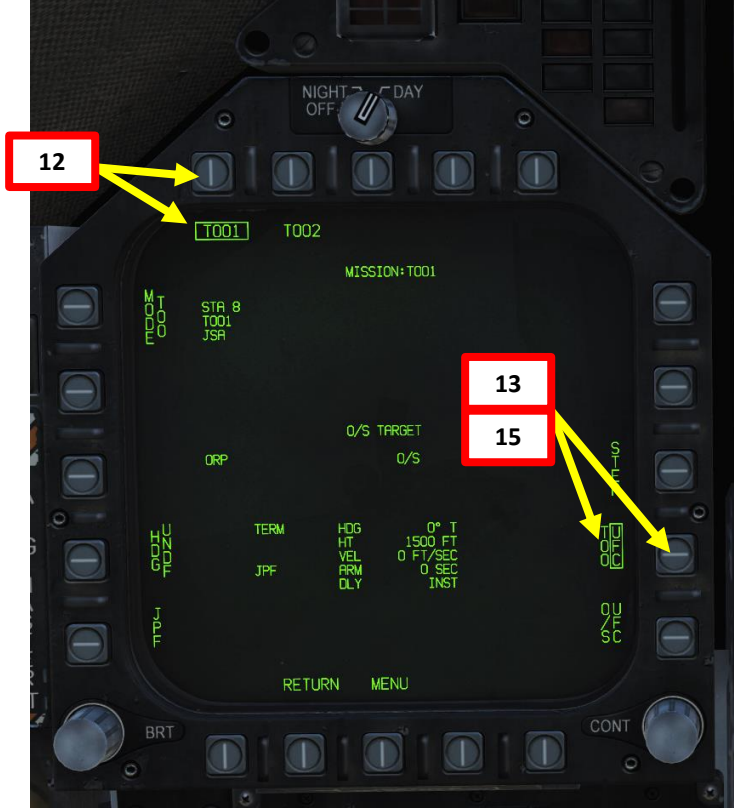


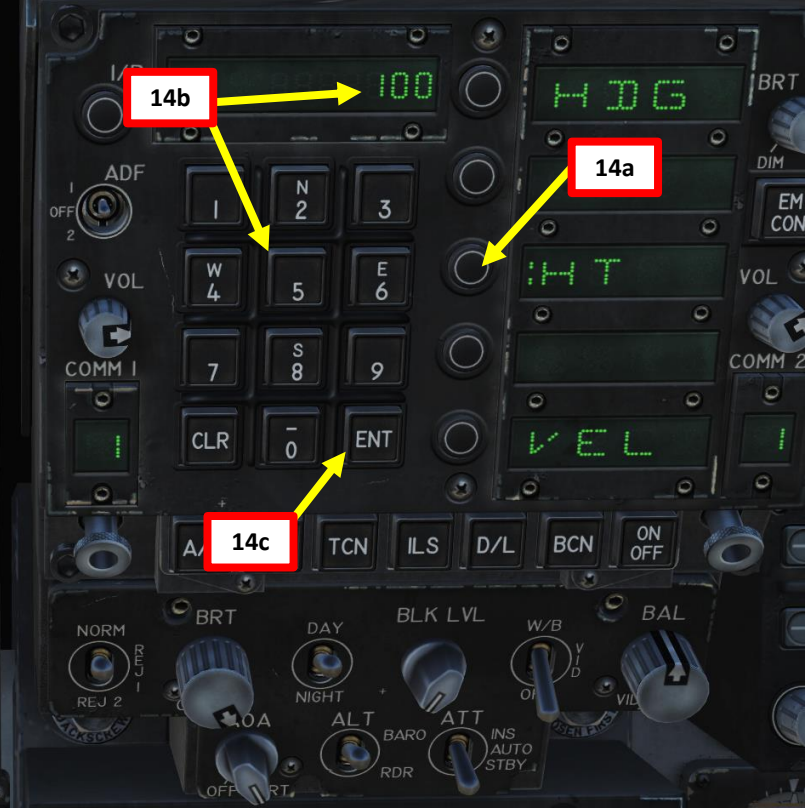
2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

Set Up Weapons

11. Enter MSN (Mission) page.
12. Select TOO1 to set Target 1 parameters
13. Select TOO UFC
14. On the UFC, Select HT (Height). « : » will appear when selected. Then, enter the Height above target in feet at which the JSOW cluster bomb will detonate. As an example, enter 100 on the scratchpad, then press the ENT (Enter) button. The greater the HT, the bigger radius the blast will have. **Note**: This step is only required for AGM-154A (cluster bombs). For the AGM154C, there is no HT setting.
15. Return to main UFC menu by pressing the TOO UFC button twice.











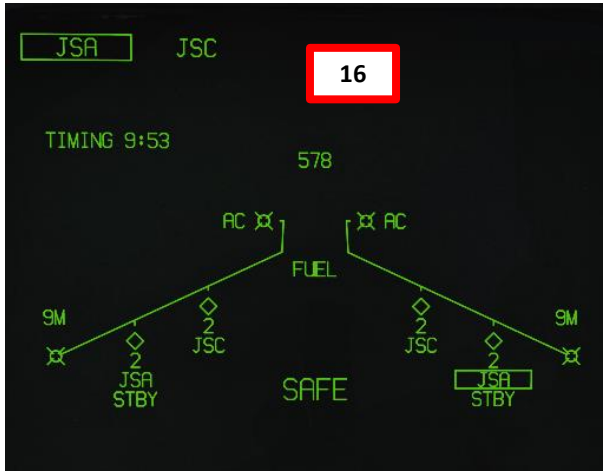
Waypoint Used for TOO	
Target Point	Waypoint Used
TGT1	Waypoint WP1

Note:
To access the burst height (HT) in pre-planned mode on MSN, you will need to press TGT UFC then press TERM (Terminal Attack Stage) , and select HT; one extra step vs TOO mode.

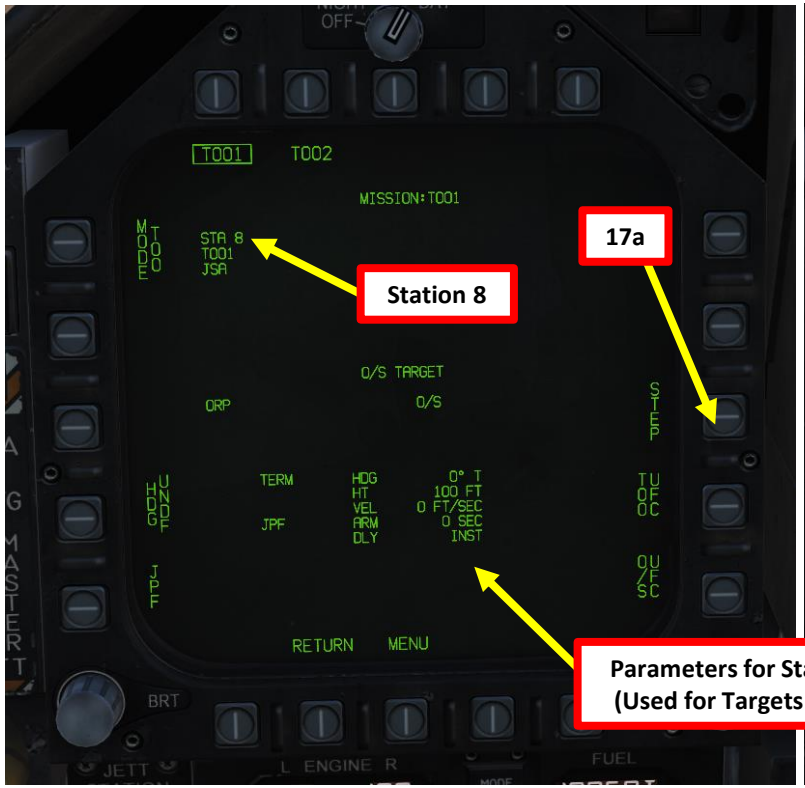
2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

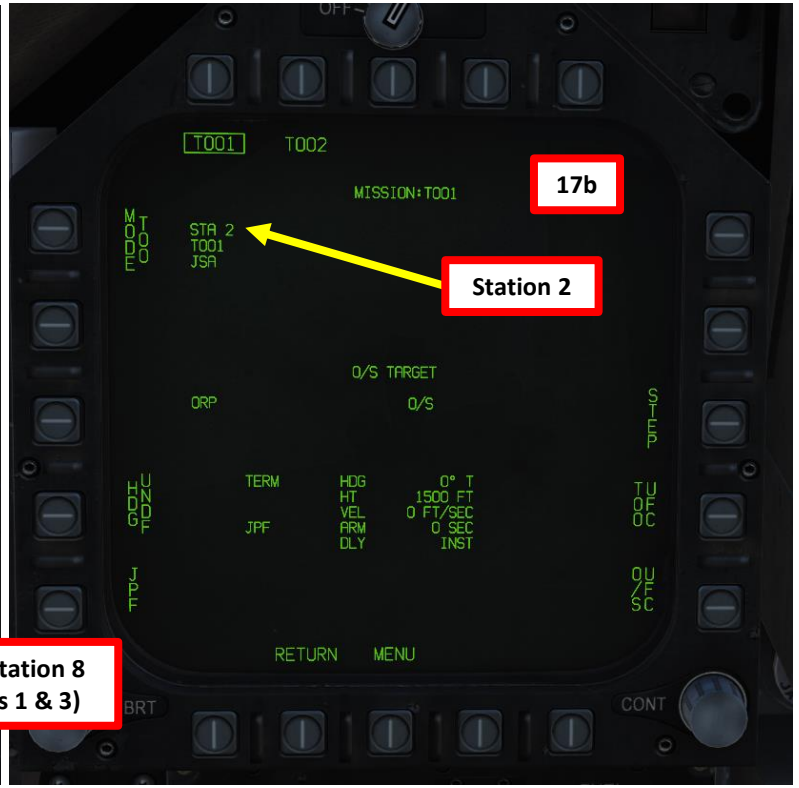
Set Up Weapons

16. Our current configuration is 2 stations with 2 JSOW-As each. Therefore, the second JSOW on the rack has the same release parameters and we only need to set up release parameters for Station 2, where the other two JSOW-As are installed.
17. Press on STEP to select the next station (STATION 2).
18. Repeat process (Steps 12 through 15) for Station 2 TOO1.











2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

Launch Weapons

19. Master Arm switch – ARM (UP)
20. Verify Master Mode is set to A/G
21. On the SMS (Stores Management System) page, verify that JSA is selected
22. Set HSI on the right DDI and the JSOW Display page on the left DDI (from SMS page, press the JSOW DSPLY OSB, then select MSN (Mission) page)
23. Verify that Manual Release TOO Release Mode is selected and that the desired station and TOO is selected.
24. On the HSI, select Waypoint 1 using the OSBs next to the arrows.
25. Once the Waypoint 1 is selected, press the OSB next to WPSDG (Waypoint Designate) to designate Waypoint 1 as your TGT1 (Target Point 1). On the HSI, « WYPT » will switch to « TGT ».





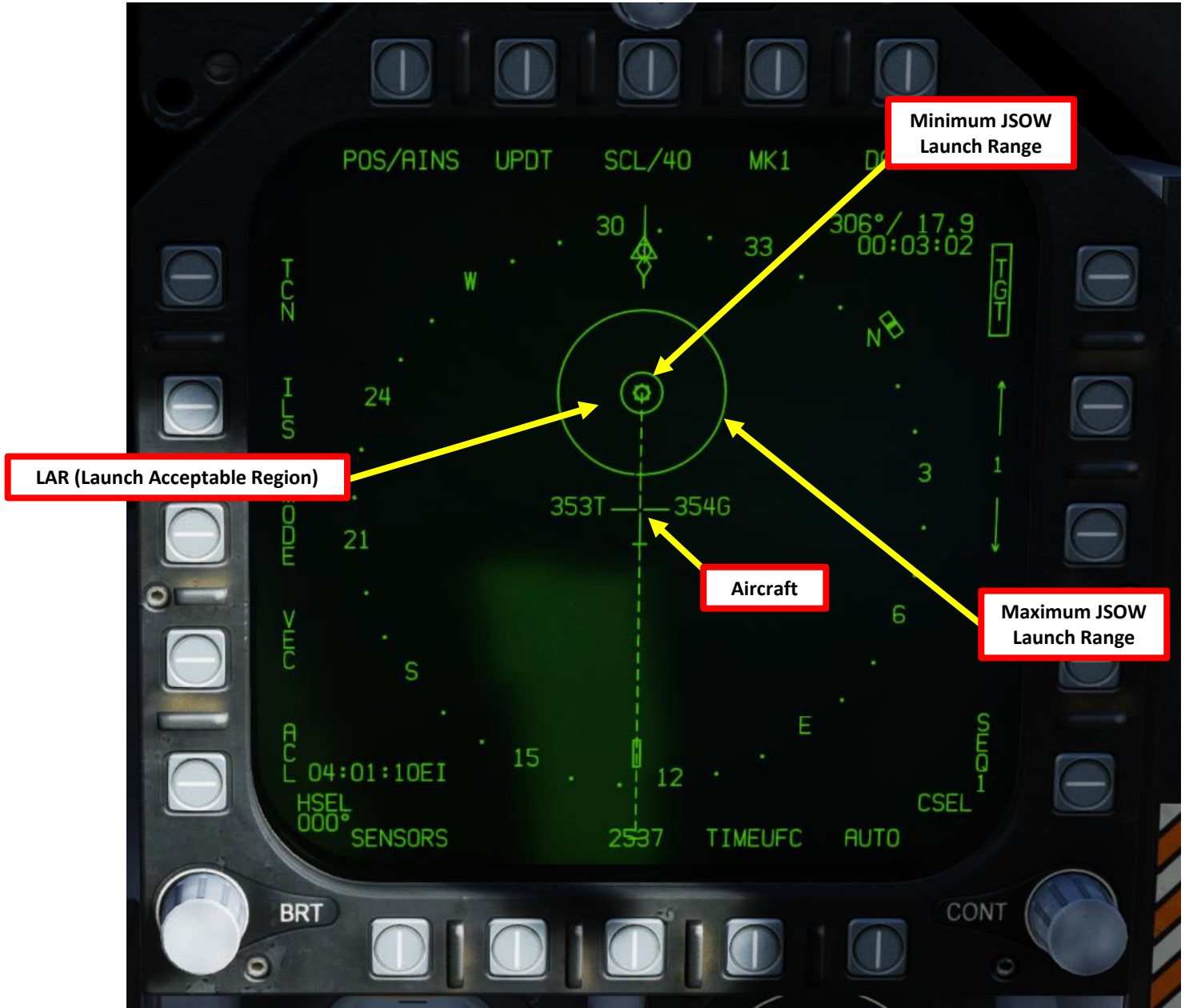






2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

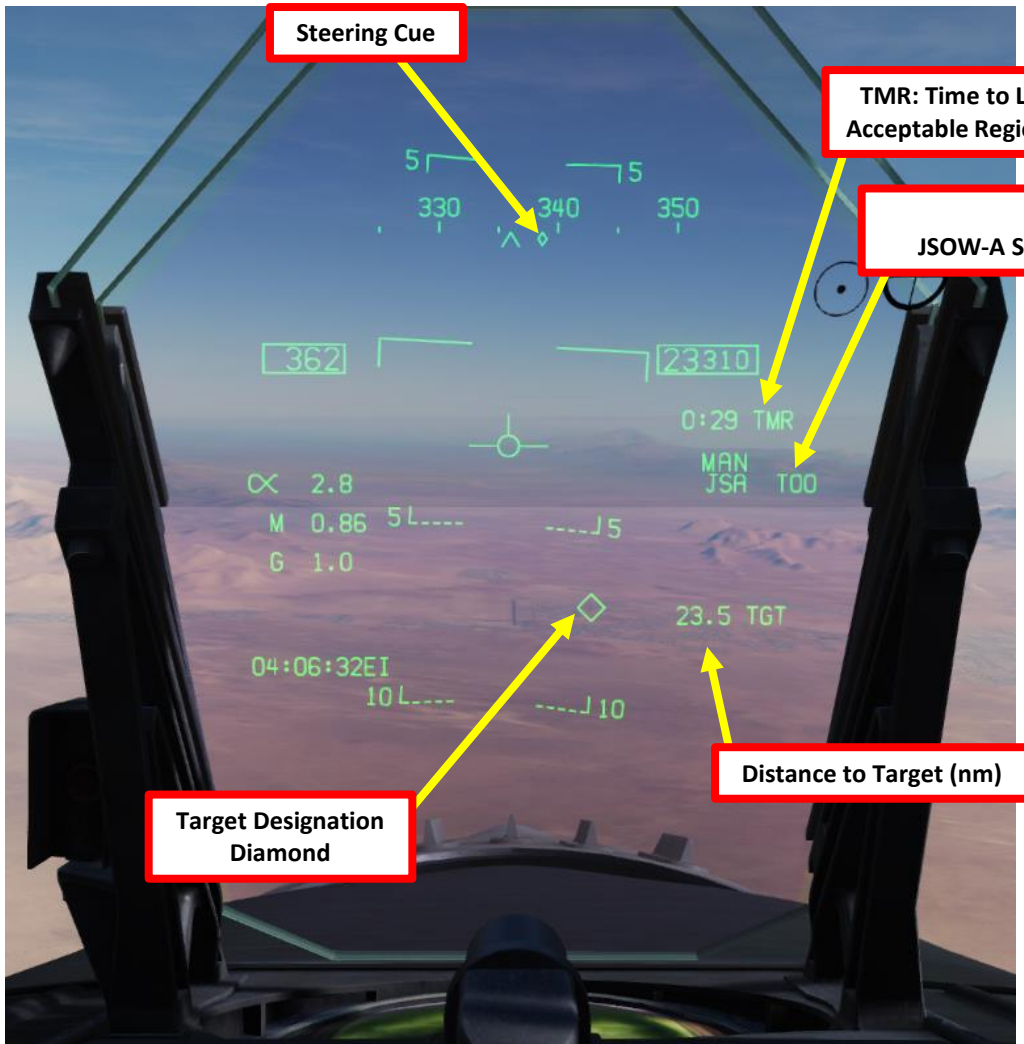
Launch Weapons



2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

Launch Weapons

26. Steer aircraft to the target (indicated by a diamond on the HUD)







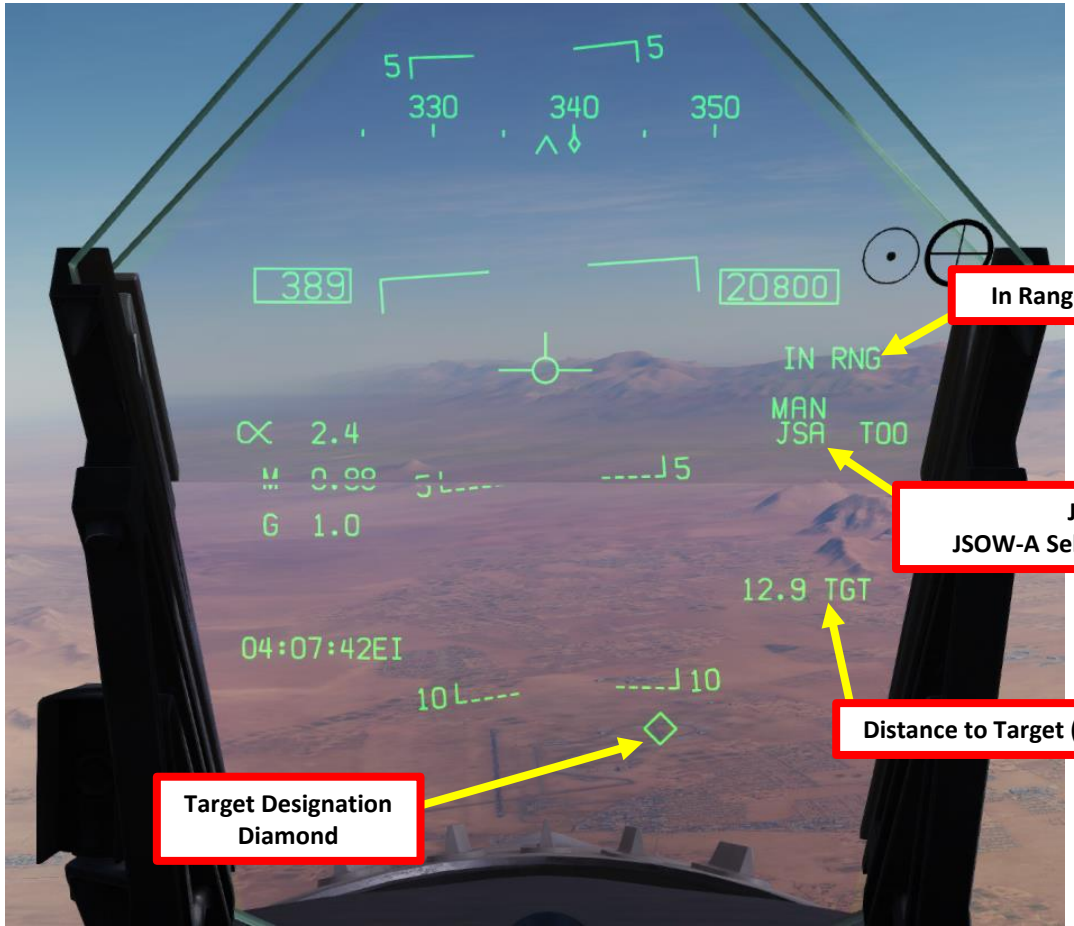
2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

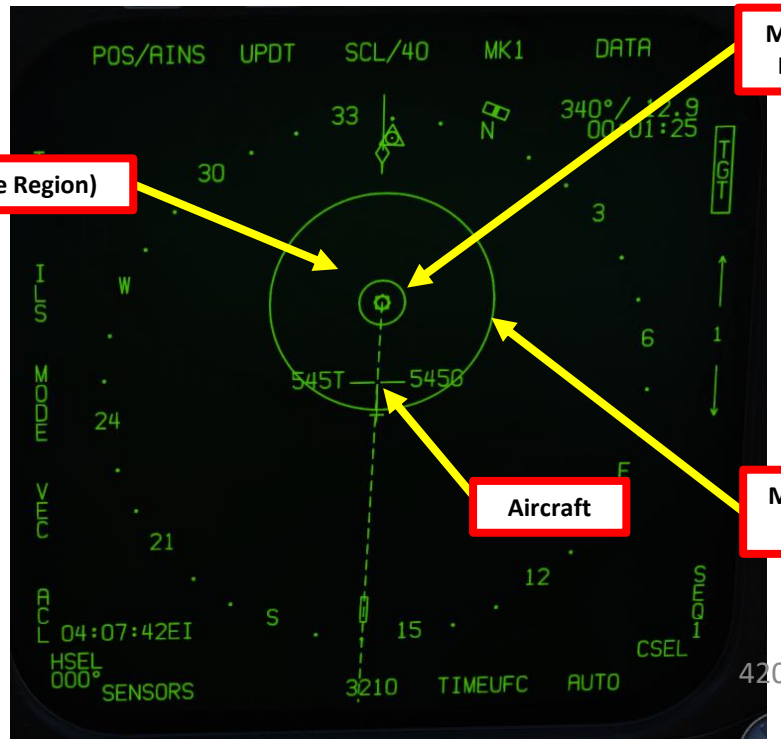
Launch Weapons

27. When you are within the acceptable release zone (between the minimum and maximum release limits identified on the HSI), the HUD will switch from displaying “TMR” (Time to reach acceptable release zone) to “IN RNG” (In Range). You may now release your weapons.
28. Hold the Weapon Release Button (« RALT+SPACE ») to drop your first JSOW.









2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO

Launch Weapons

29. Once the JSOW is released, the system will step to the next available JSOW. However, keep in mind that your next JSOW will still be slaved to Waypoint 1. You need to designate Waypoint 2 as your Target Point.
30. On the HSI, select Waypoint 2 using the OSBs next to the arrows.
31. Once the Waypoint 2 is selected, press the OSB next to WPSDG (Waypoint Designate) to designate Waypoint 2 as your TGT2 (Target Point 2). On the HSI, « WYPT » will switch to « TGT ».
32. Verify that TOO and station match as per our plan, then release weapon when ready.
33. Repeat for remaining bombs.







2.5.3 – AGM-154A JSOW
WAYPOINT DESIGNATE + TOO









2.6 – GBU-12 Paveway II (Laser-Guided Mode)

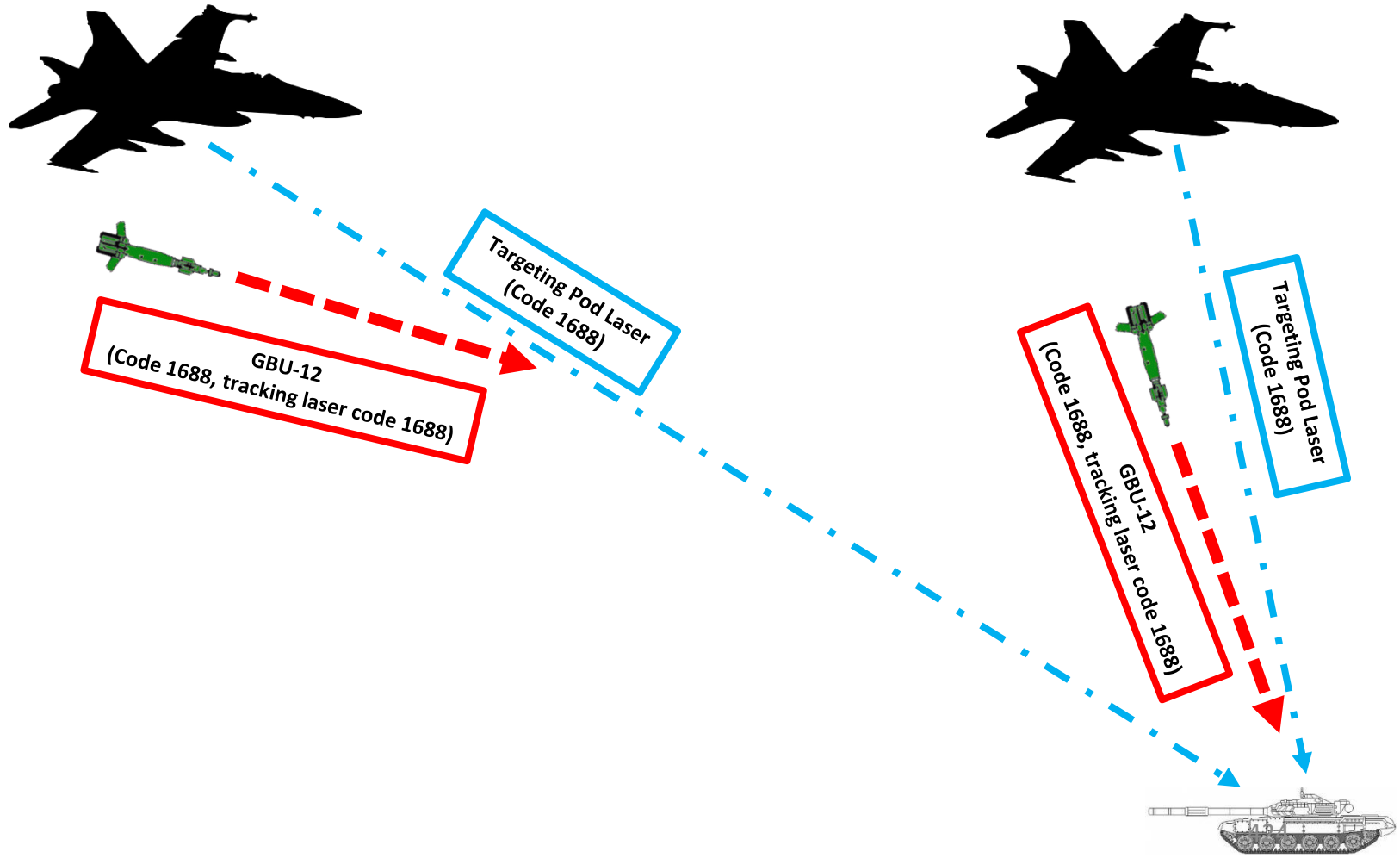


2.6 – GBU-12 Paveway II (Laser-Guided Mode)

The GBU-12 Paveway II is the laser-guided version of the Mk-82 unguided, general purpose bomb. The GBU-12 guides using the same principles as the GBU-10, the only difference being the bomb the LGB is based on. The seeker head on each laser guided bomb is set to track only a specific laser pulse rate frequency (PRF) code. These codes can be manually set through the UFC (Up-Front Controller) panel while selecting the SMS page for the bomb code and the FLIR page for the Targeting Pod laser code.

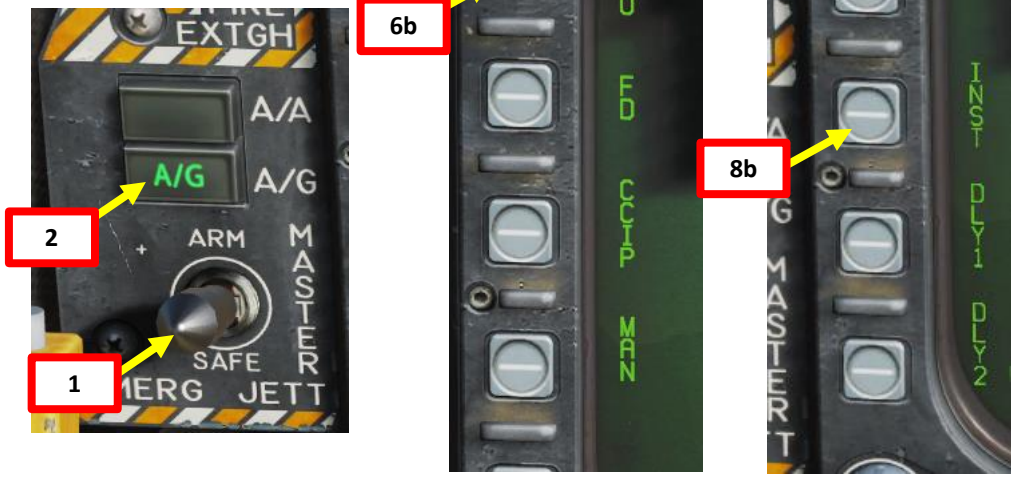


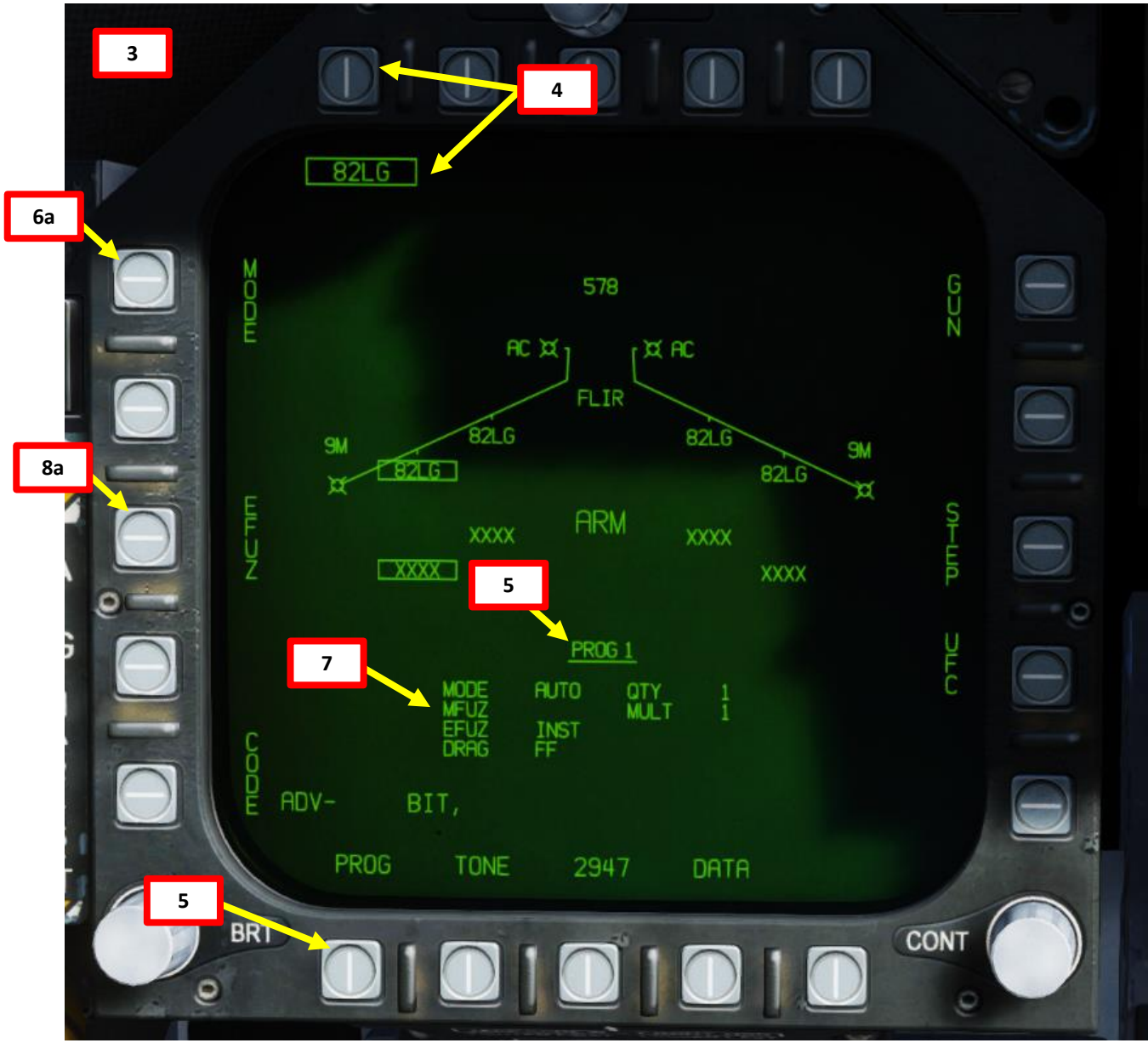




2.6 – GBU-12 Paveway II (Laser-Guided Mode)

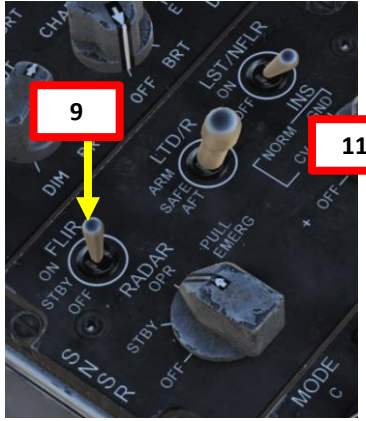
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Click on the desired bomb to select it (82LG, Laser-Guided)
5. We will create a weapon delivery program by selecting a preset program and modifying it. Toggle programs with the OSB next to PROG. We will use PROG 1 for simplicity.
6. The Release Mode can be set to either CCIP or CCRP (AUTO). In our case, we will choose CCRP (AUTO).
7. Leave MFUZ (Mechanical Fuze) to OFF.
8. Click on OSB next to EFUZ (Electronic Fuze), then press on OSB next to DLY1 for a delay if desired, otherwise set to INST (Instantaneous).

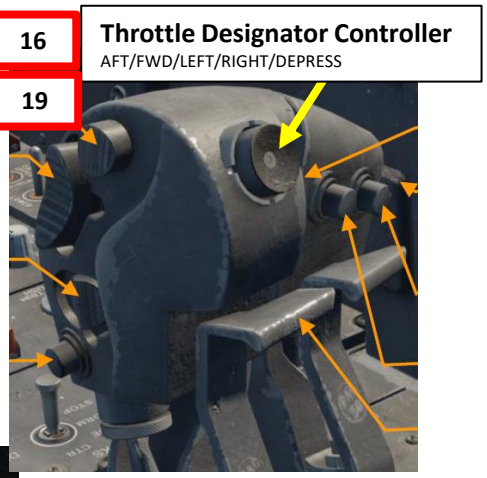


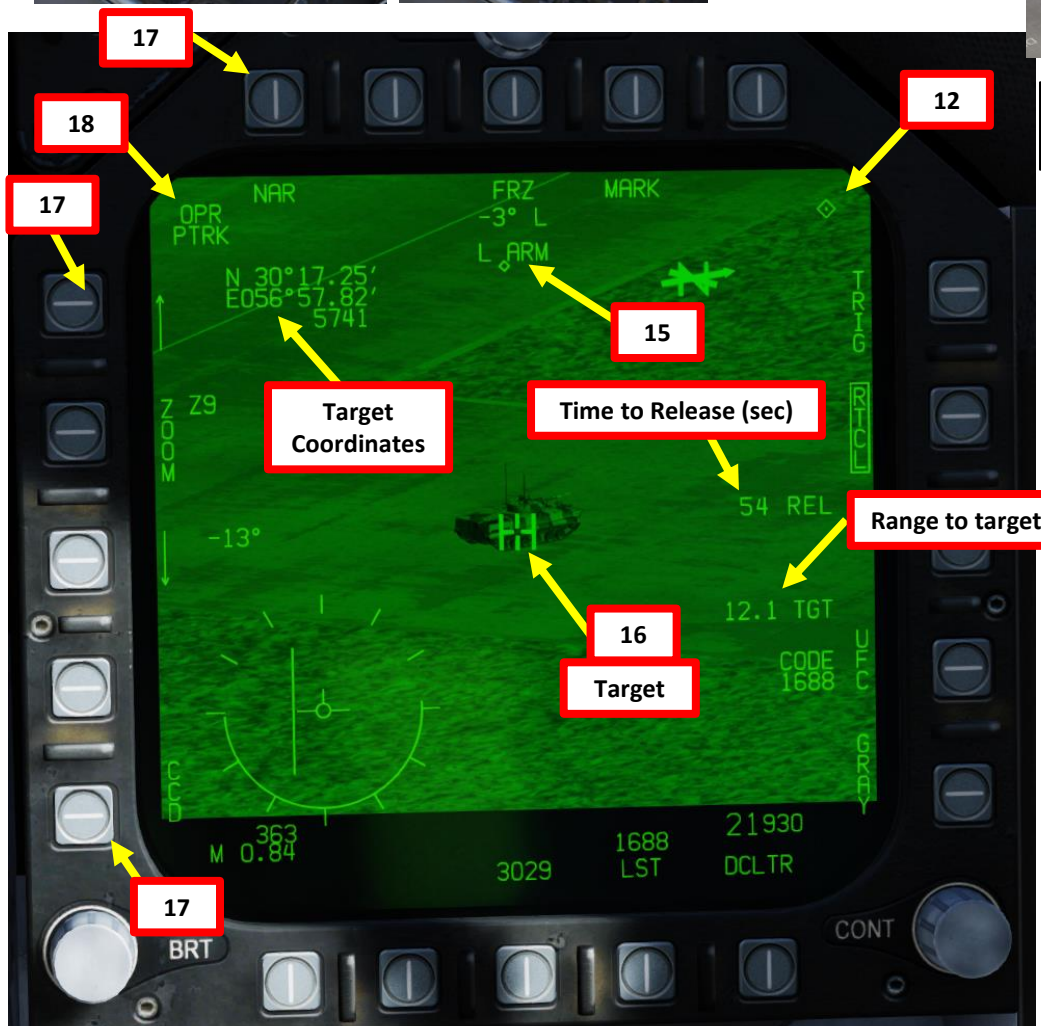


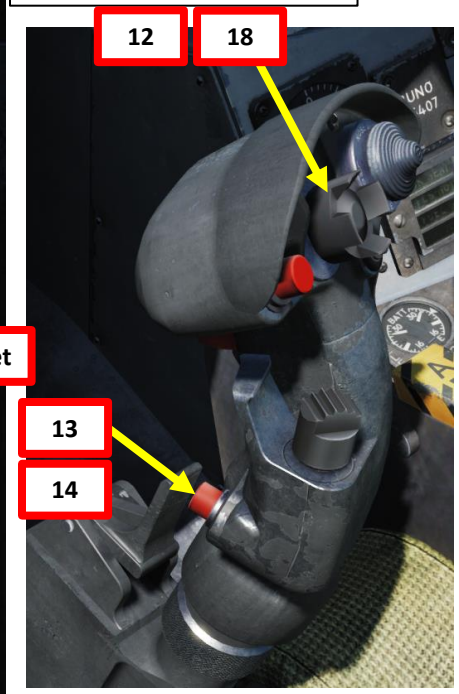
2.6 – GBU-12 Paveway II (Laser-Guided Mode)

9. To power up the targeting pod, set FLIR Sensor Switch to STBY (Right Click).
10. From the TAC page on either DDI or the AMPCD, press the OSB (Option Select Button) next to "FLIR" (Forward-Looking Infrared) to select the Targeting Pod feed page. Monitor the warm-up process.
    - Targeting pod warm-up process will take about 2 minutes.
    - When targeting pod is ready to be used, the pod status will switch from ~~RDY~~ – NOT TIMED OUT to STBY (Standby).
11. Set FLIR Sensor Switch to ON (Right Click). Confirm that Targeting Pod mode switches from STBY to OPR (Operate).
12. Press the Sensor Control Switch in the direction of the selected DDI (Right for the Right DDI as an example). The Select Focus Diamond indicates what display is selected.
13. Press the Undesignate button twice rapidly to select VVSLV (Velocity Vector Slaved) mode. This will un-stow the camera and slave the targeting pod to the velocity vector.
14. Press the Undesignate button twice rapidly again to select Snowplow mode. When Snowplow mode is first entered, the FLIR is set to 0° left/right and -8° down.
15. Set LTD/R (Laser Target Designator/Ranger) switch to ARM. This will arm the laser. Confirm that L ARM indication is displayed on the FLIR page. Verify A/G Master Mode is set since it will allow you to arm the laser designator.
16. Using the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls, slew the targeting pod reticle over the desired target.
17. Use appropriate zoom level, field of view (NARROW/WIDE) and camera mode (CCD/TV or FLIR) to identify the target.
18. Press the Sensor Control Switch Towards Selected Display (Right if our right DDI is selected) to toggle between Point Track (PTRK, tracks a moving object like a high-contrast vehicle) and Area Track (ATRK, used for a static target).
19. Use the TDC (Throttle Designator Controller) Depress button to designate the laser as the target point. This will slave selected air-to-ground weapons to where the laser is firing and display range to target and its coordinates.









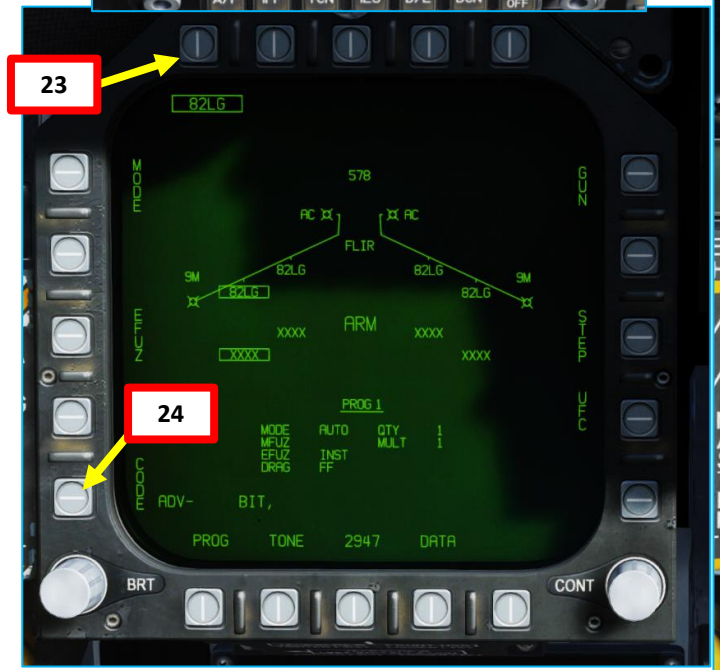
2.6 – GBU-12 Paveway II (Laser-Guided Mode)

20. Press the OSB next to “UFC” to set the Targeting Pod laser code on the Up-Front Controller.
21. Press the button next to “LTDC” (Laser Target Designator Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose the default laser code 1688.
22. Now that the targeting pod has its laser code, we need to tell the GBU which laser code to track.
23. In SMS (Stores Management System) page, select GBUs (82LG, boxed when selected).
24. Press the OSB next to “CODE”.
25. Press the button next to “CODE” (Guided Bomb Laser Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose targeting pod’s laser code 1688 (which we already set in **step 21**).
26. The 82LG indication will then display “RDY” since it now has all the information it needs to launch, track a laser with a specific code, then home on the target.
27. Press the OSB next to “TRIG” if you want to use the laser manually. The indication will become boxed once selected, which means that a gun trigger press will fire the laser. This step is required if you are “buddy lasing” (using your own laser for someone else to use). In our case, we will let the TRIG option off/unboxed.
    - If TRIG remains unboxed, the laser is in Automatic mode. The laser will automatically fire a few seconds before the laser-guided ordnance reaches the target.









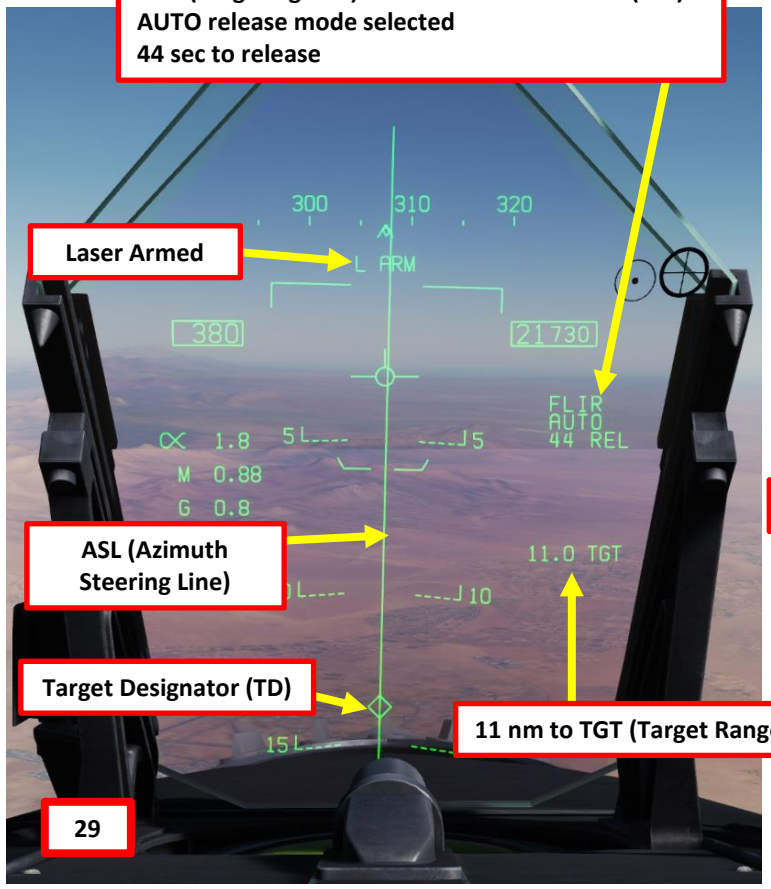


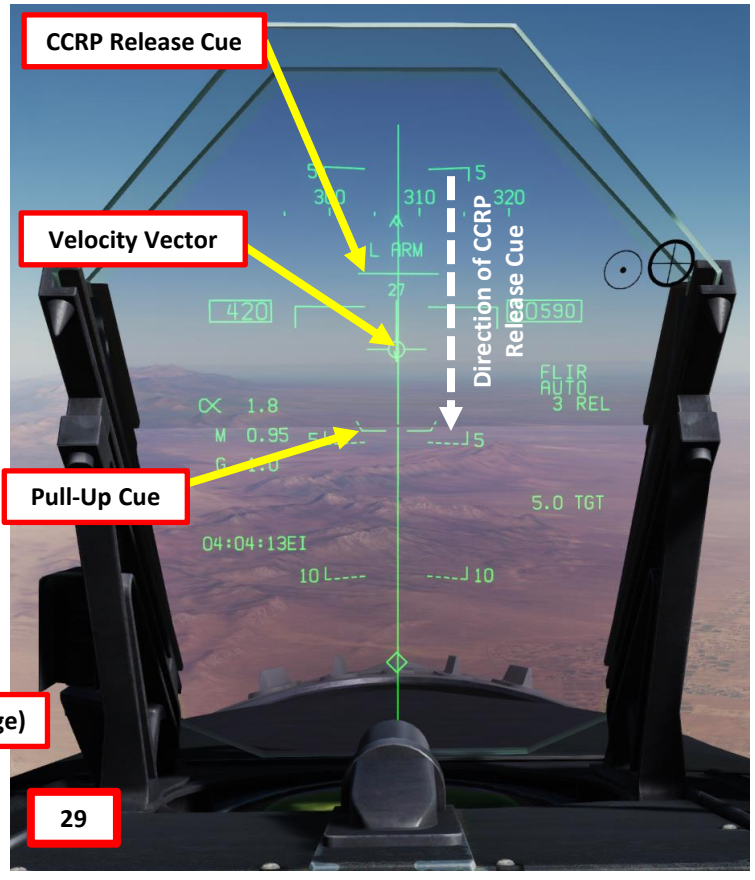
2.6 – GBU-12 Paveway II (Laser-Guided Mode)

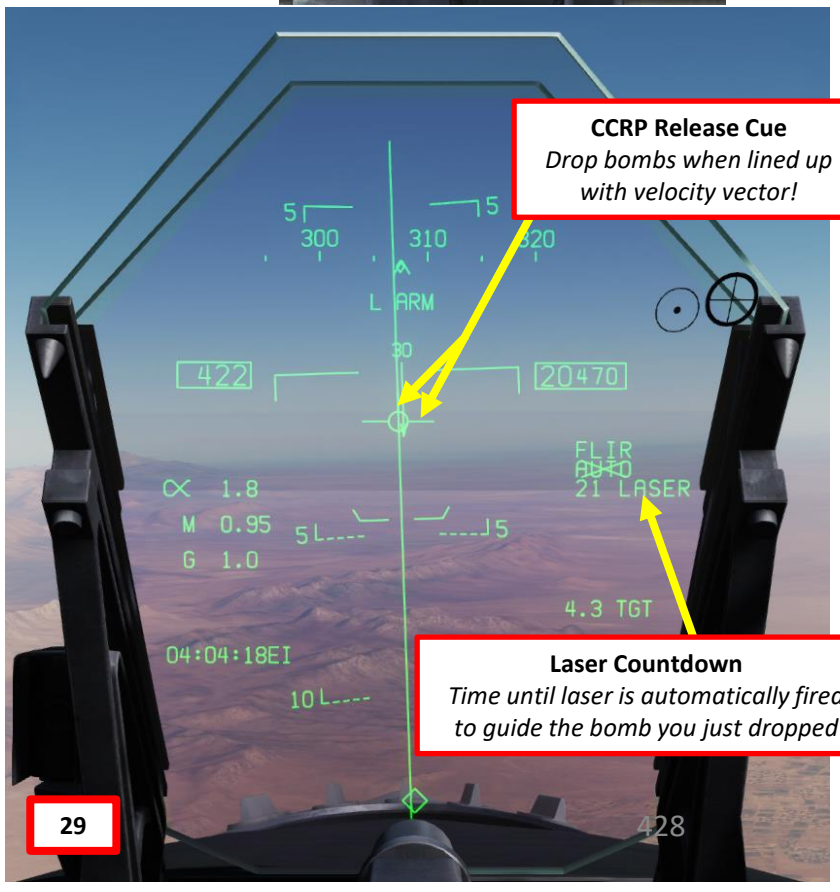
28. Fly level and keep your velocity vector aligned with the ASL (Azimuth Steering Line) and above the Pull-Up cue.
29. When release cue appears, hold the Weapon Release Button (« RALT+SPACE ») until bomb has been released.
30. If you want to drop other GBUs, you will have to re-enter a laser code for each bomb every time.





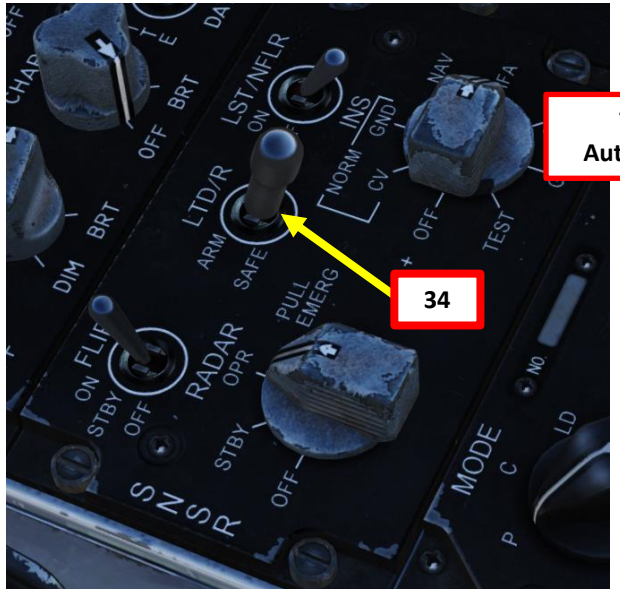


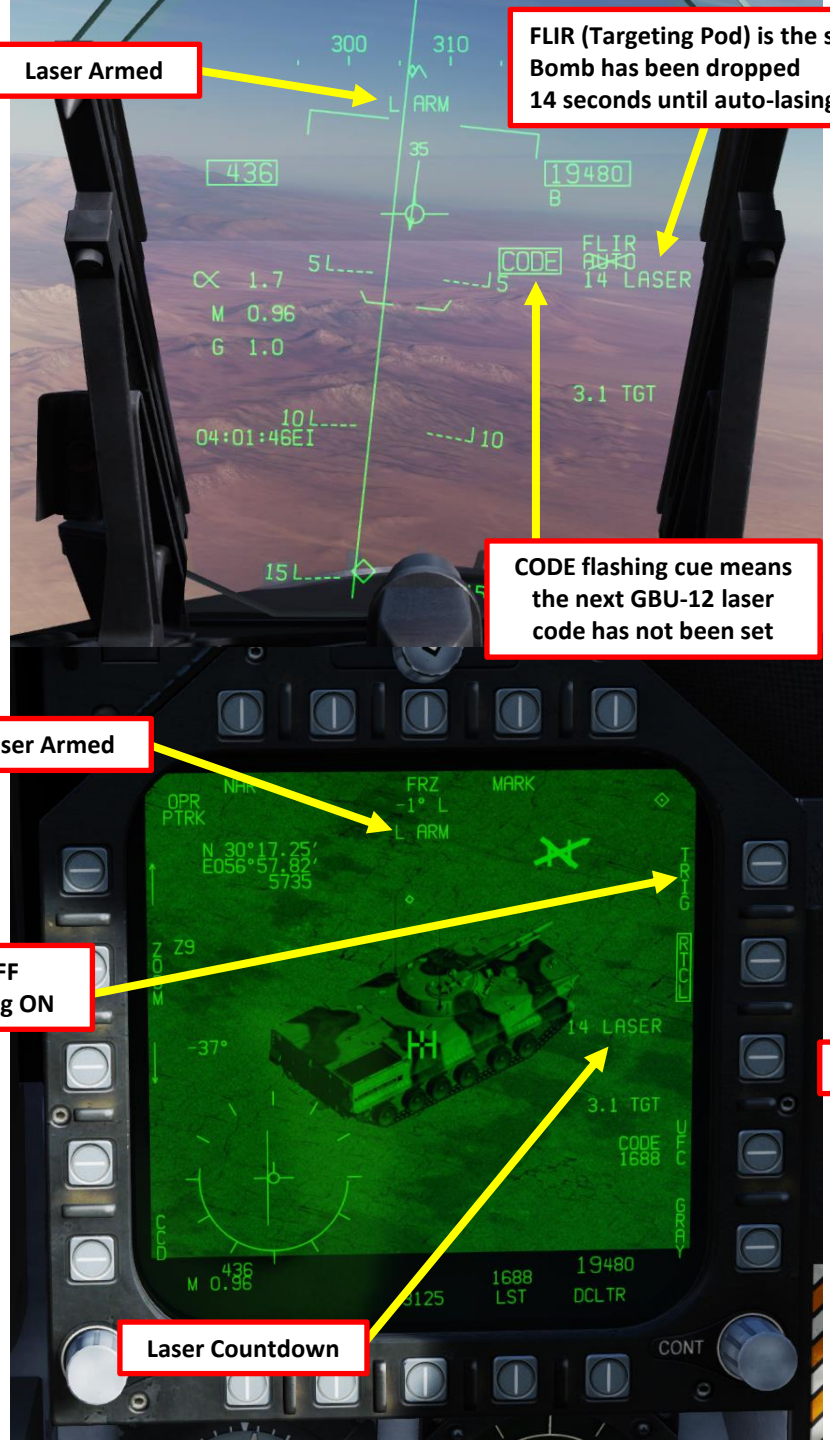




2.6 – GBU-12 Paveway II (Laser-Guided Mode)

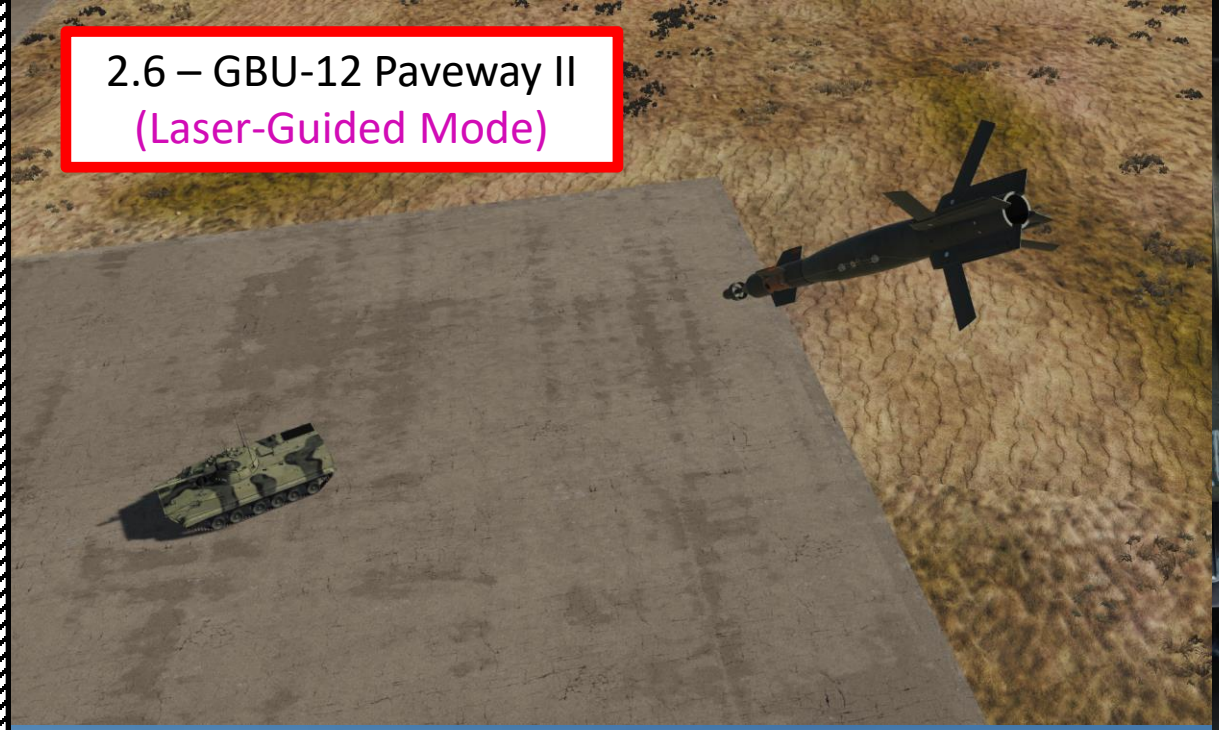
31. When bombs are falling and auto-lasing is selected (TRIG option unboxed/off), the laser will automatically fire when the GBU is close enough to the target.
32. Once laser is firing, the laser mode will switch from L ARM to LTD/R. The TTI (Time-to-Impact) will become visible.
33. The bomb will track the laser for as long as it is fired until it reaches the target.
34. Once the target is destroyed, the LTD/R (Laser Target Designator/Ranger) will automatically go back to SAFE. You will need to set it back to ARM if you want to lase more targets.
35. If you want to undesignated the target, use the Undesignate/Nosewheel Steering button on the stick.







2.6 – GBU-12 Paveway II (Laser-Guided Mode)



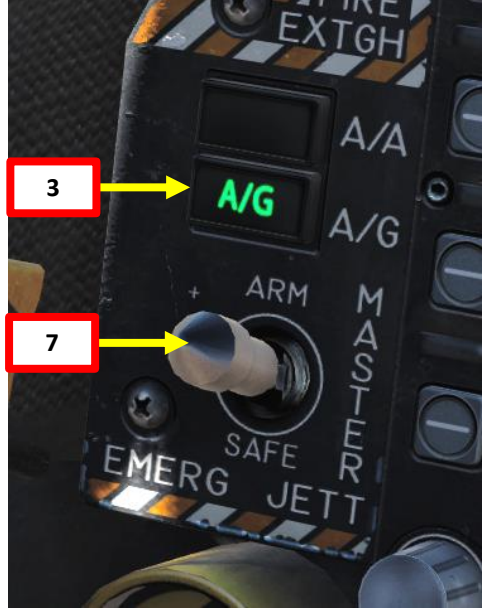


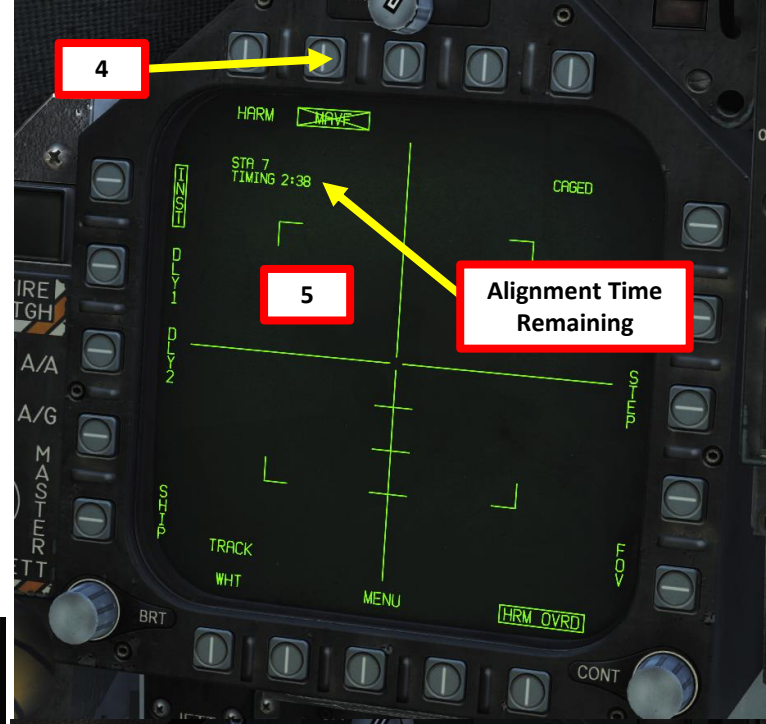


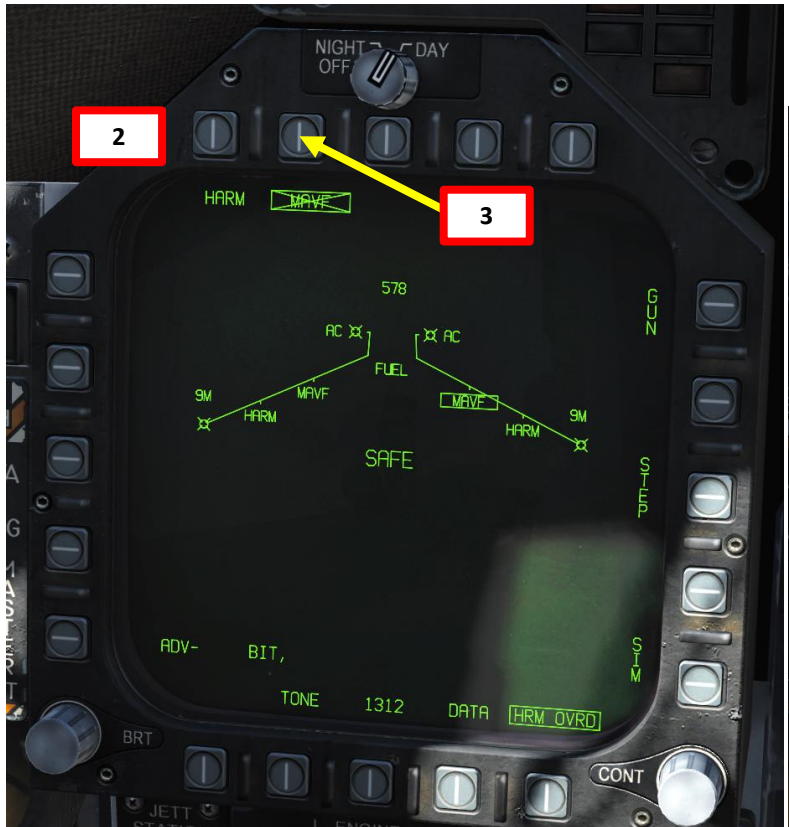


2.7.1 – AGM-65F/G MAVERICK (IR-MAVF, IR Missile Seeker Only)

1. The AGM-65F requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled. Upon first selection of it on the STORES format, cooling will be initiated. A timer counting down to operating status can be seen on the IMAV DSPLY format, which takes approximately 3 minutes. **Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.**
2. Go in SMS (Stores Management System) page
3. Master Mode – A/G
4. Select MAVF (text should be boxed)
5. Maverick cooldown process will start and take about 3 minutes. Monitor cooldown progress by pressing the OSB next to the crossed-out « MAVF », which will show you the Maverick seeker head feed.
6. Once Maverick cooldown is complete, the timer will disappear and the MAVF Feed will go live.
7. Master Arm switch – ARM (UP)









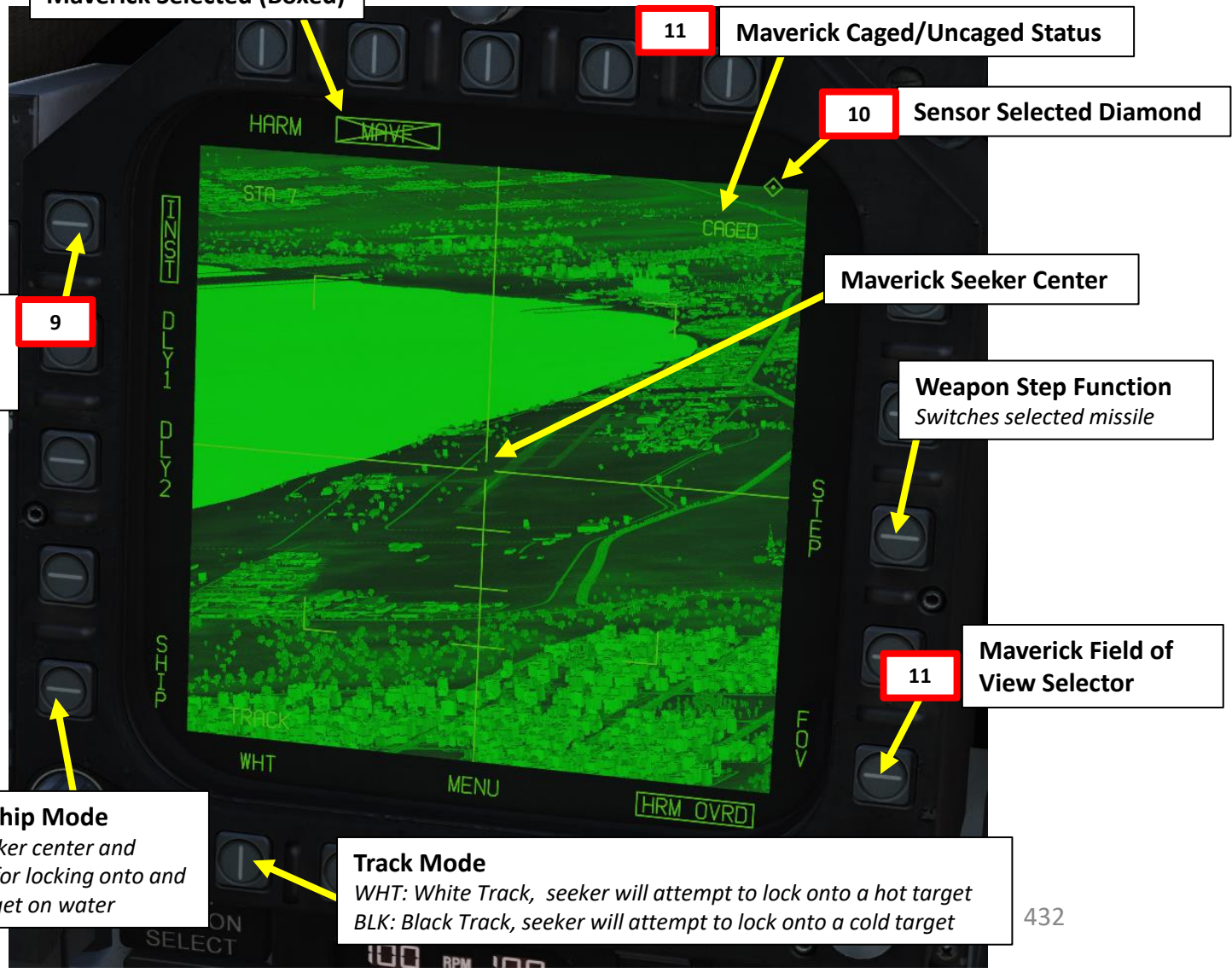
2.7.1 – AGM-65F/G MAVERICK
(IR-MAVF, IR Missile Seeker Only)

8. You can select the Maverick seeker head feed by going back to the TAC page and selecting IMAV DSPLY or by going in the STORES page and selecting MAVF twice as shown previously.
9. Set Fuzing to either INST (Instantaneous), DLY1 (Delayed Fuze) or DLY2.
10. Set Sensor Control Switch to the Maverick Feed DDI (Sensor Control Switch LEFT since we showed up the MAV feed on the left DDI). A diamond will appear to show the left DDI is selected.
11. Adjust FOV (Field of View) as required.
12. By default, the Maverick is Caged. When the seeker is caged, it will always point forward at its boresight.



Sensor Control Switch
AFT/FWD/LEFT/RIGHT





Maverick Selected (Boxed)

11 **Maverick Caged/Uncaged Status**

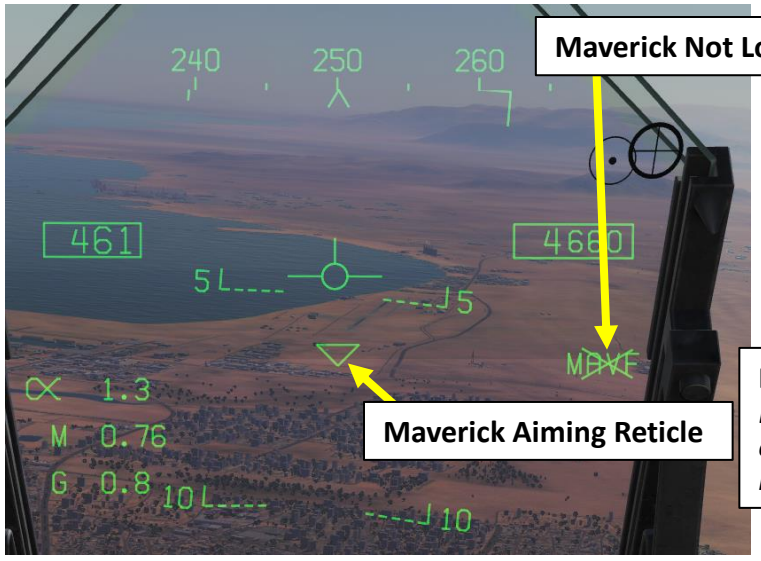
10 **Sensor Selected Diamond**

Maverick Seeker Center

Fuzing Options
Instantaneous
Delay 1 / Delay 2
9

Weapon Step Function
Switches selected missile

11 **Maverick Field of View Selector**



Maverick Not Locked

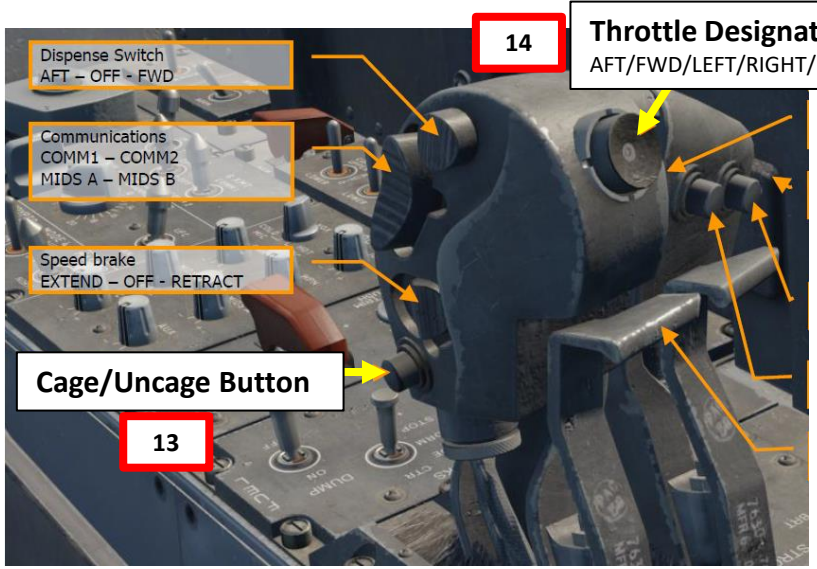
Maverick Aiming Reticle

Maverick Ship Mode
Enlarges seeker center and optimizes it for locking onto and hitting a target on water

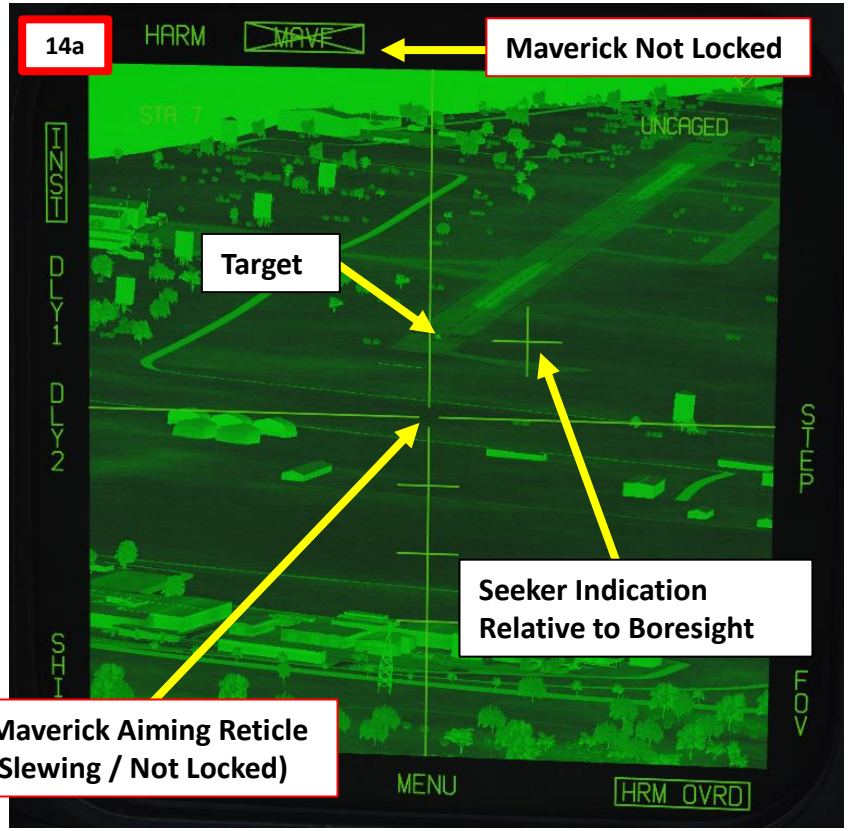
Track Mode
WHT: White Track, seeker will attempt to lock onto a hot target
BLK: Black Track, seeker will attempt to lock onto a cold target

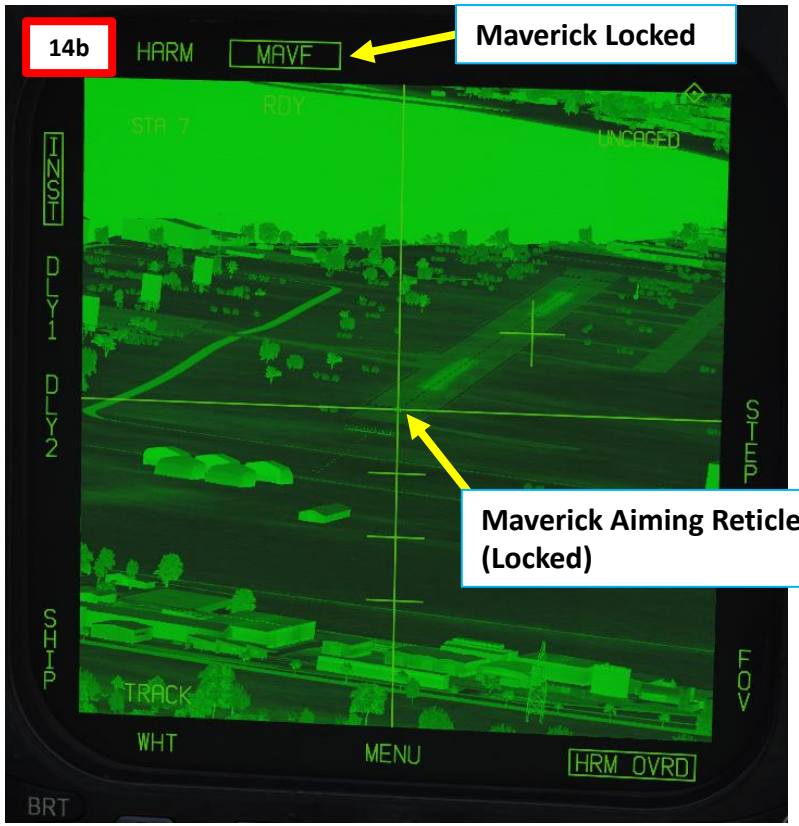
2.7.1 – AGM-65F/G MAVERICK
(IR-MAVF, IR Missile Seeker Only)

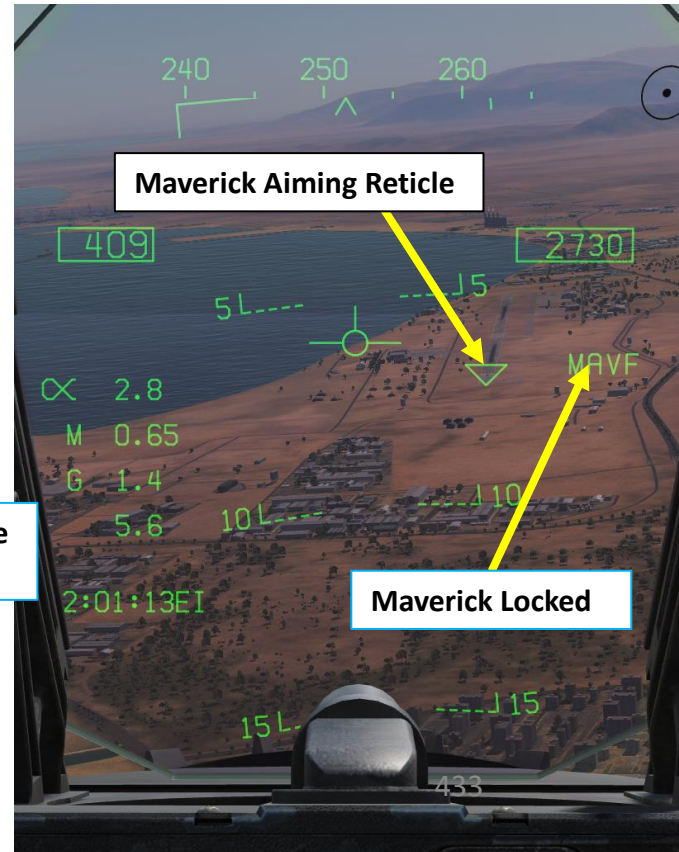
13. Press the Cage/Uncage Button to uncage the Maverick. When uncaged, the missile will attempt to lock onto a contrasting target within the seeker center.
14. Hold the TDC Depress button **while** slewing the Maverick to the target. When you release the TDC Depress button, the missile will attempt to lock its target. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles.
15. When lock is acquired by Maverick, the MAVF crossed-out indication will disappear. Hold the Weapon Release Button (« RALT+SPACE ») to fire missile.











2.7.1 – AGM-65F/G MAVERICK
(IR-MAVF, IR Missile Seeker Only)

Note: IR Mavericks have a Gimbal Limit warning. If the gimbal limits are reached, the missile's seeker will cage itself. You will have to uncage the missile again. If you attempt to uncage while the seeker is at gimbal limits, the warning will appear and the missile will cage itself again.



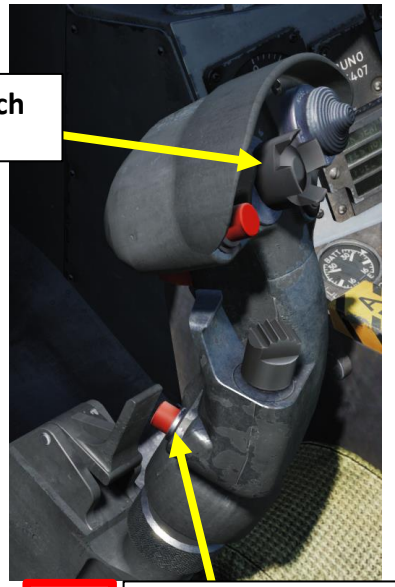




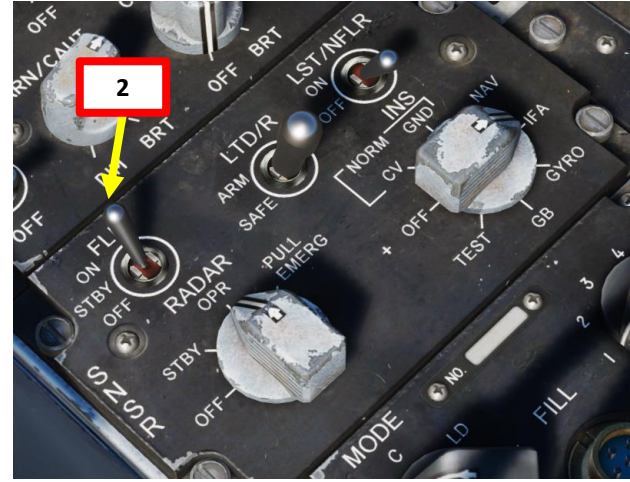
2.7.2 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Targeting Pod)

1. Press A/G Master Mode.
2. Set FLIR Sensor Switch to ON (Right Click). Confirm that Targeting Pod mode switches from STBY to OPR (Operate).
3. Select FLIR page.
4. Press the Sensor Control Switch in the direction of the selected FLIR DDI page (RIGHT).
5. The Select Focus Diamond indicates what display is selected.
6. Press the Undesignate button twice to select VVSLV mode.
7. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
8. When Snowplow is first entered, the FLIR is set to 0° left/right and -8° down.
9. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target
10. To **designate a target from Snowplow mode**, use the TDC DEPRESS control ("ENTER"). A diamond will appear over the designated point on the FLIR page and on the Heads-Up Display as well.
11. (Optional) If desired, press the Sensor Control Switch in the direction of the FLIR format page to toggle between Area Track and Point Track.

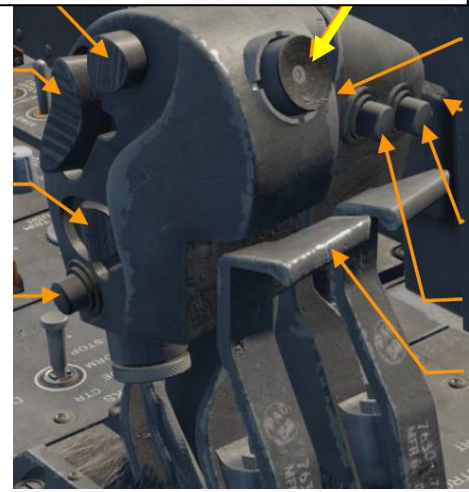
4 **11** **Sensor Control Switch**
AFT/FWD/LEFT/RIGHT

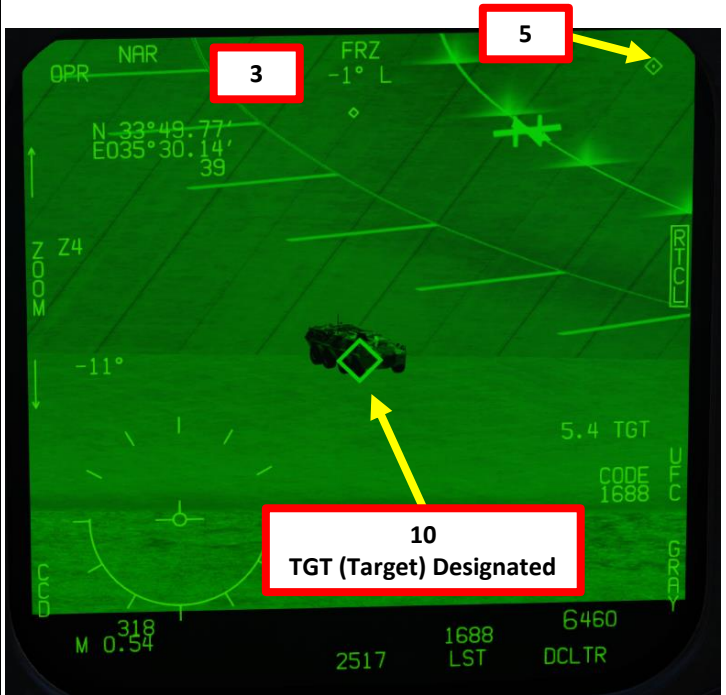


6 **7** **Undesignate / Nosewheel Steering Button**



9 **10** **Throttle Designator Controller**
AFT/FWD/LEFT/RIGHT/DEPRESS



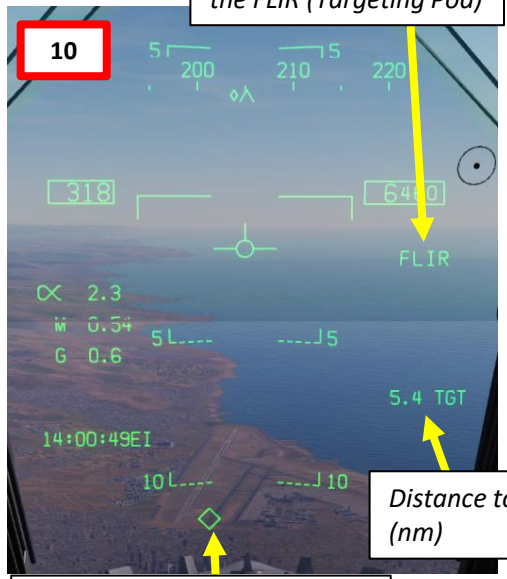


10
TGT (Target) Designated



11
Point Track

Sensors are slaved to the FLIR (Targeting Pod)



Distance to Target (nm)

Target Designation Diamond

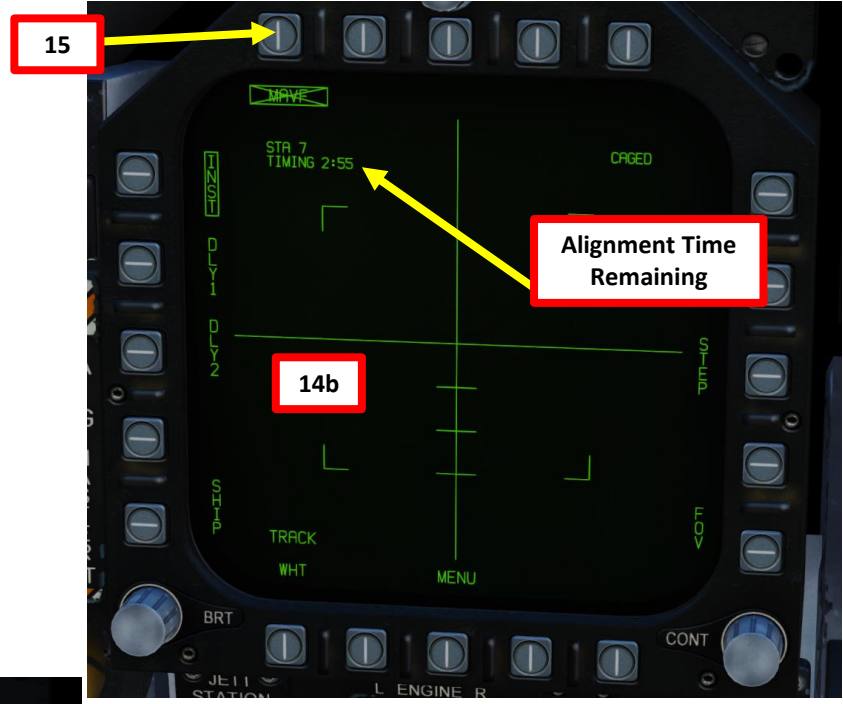
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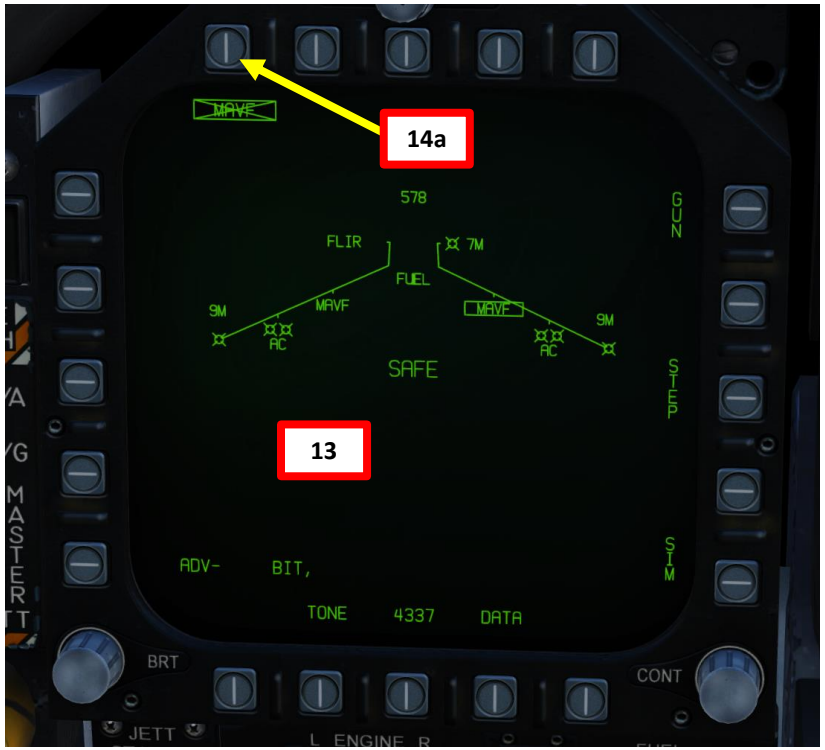


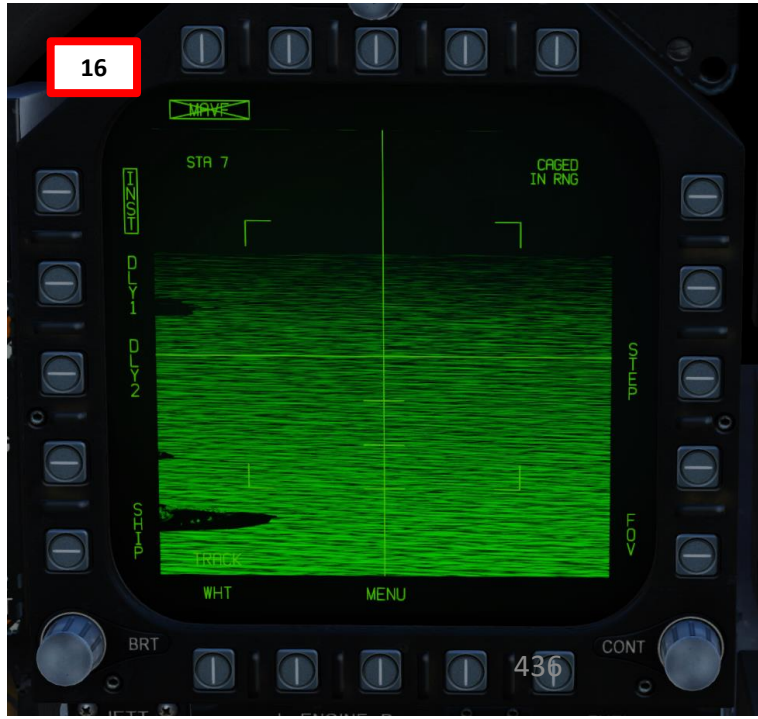
2.7.2 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Targeting Pod)

12. The AGM-65F requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled. Upon first selection of it on the STORES format, cooling will be initiated. A timer counting down to operating status can be seen on the IMAV DSPLY format, which takes approximately 3 minutes. **Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.**
13. Go in SMS (Stores Management System) page
14. Select MAVF (text should be boxed)
15. Maverick cooldown process will start and take about 3 minutes. Monitor cooldown progress by pressing the OSB next to the crossed-out « MAVF », which will show you the Maverick seeker head feed.
16. Once Maverick cooldown is complete, the timer will disappear and the MAVF Feed will go live.
17. Master Arm switch – ARM (UP)





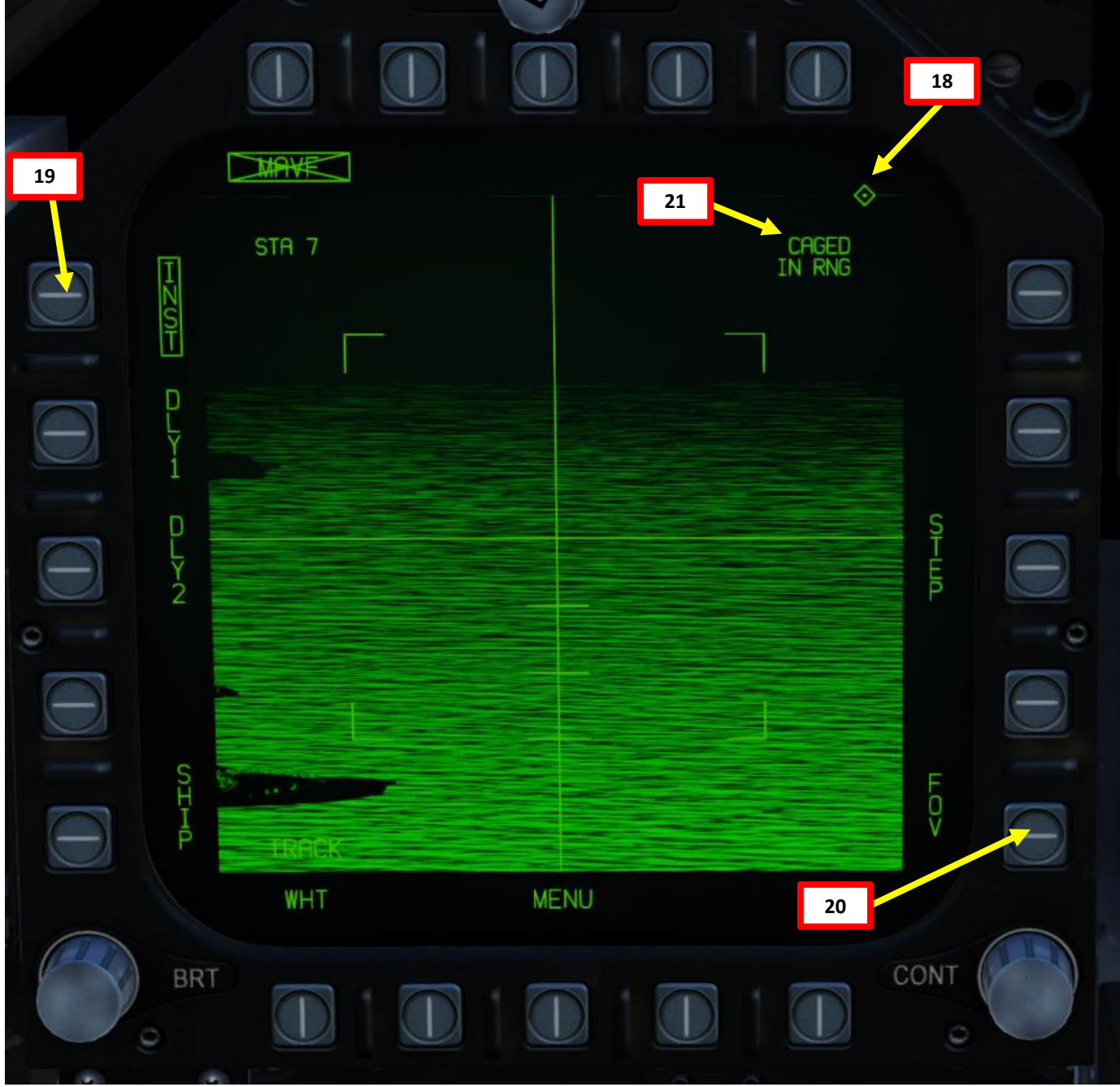




2.7.2 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Targeting Pod)

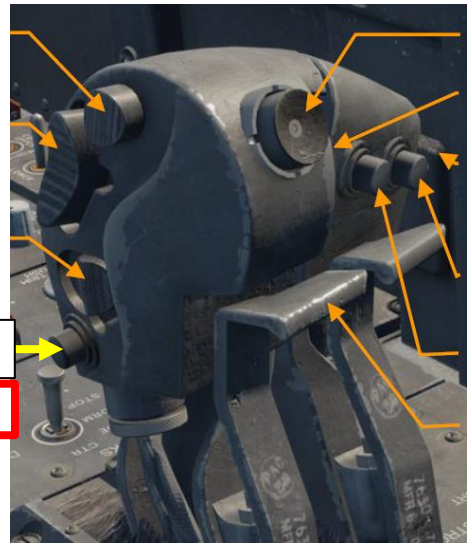
18. Set Sensor Control Switch to the Maverick Feed DDI (Sensor Control Switch LEFT since we showed up the MAV feed on the left DDI). A diamond will appear to show the left DDI is selected.
19. Set Fuzing to either INST (Instantaneous), DLY1 (Delayed Fuze) or DLY2.
20. Adjust FOV (Field of View) as required.
21. By default, the Maverick is Caged. When the seeker is caged, it will always point forward at its boresight.

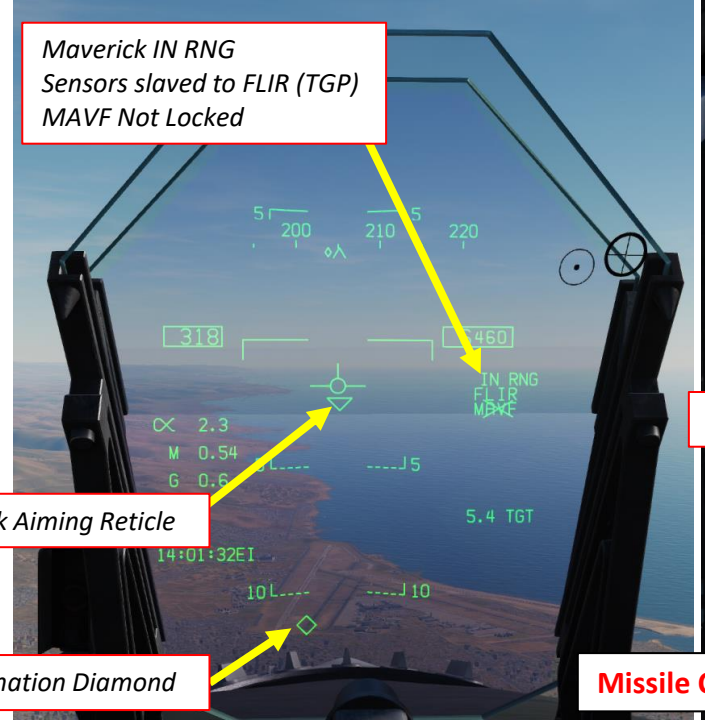


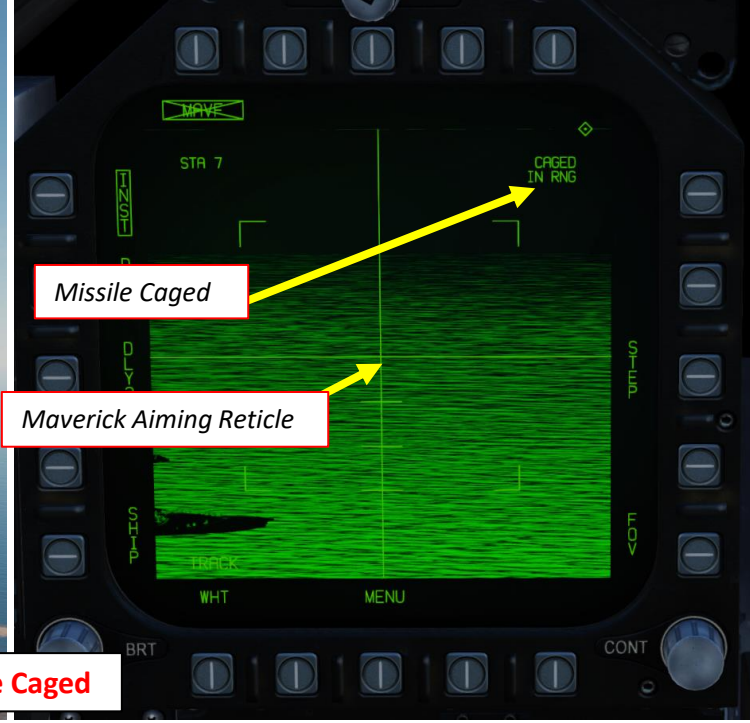


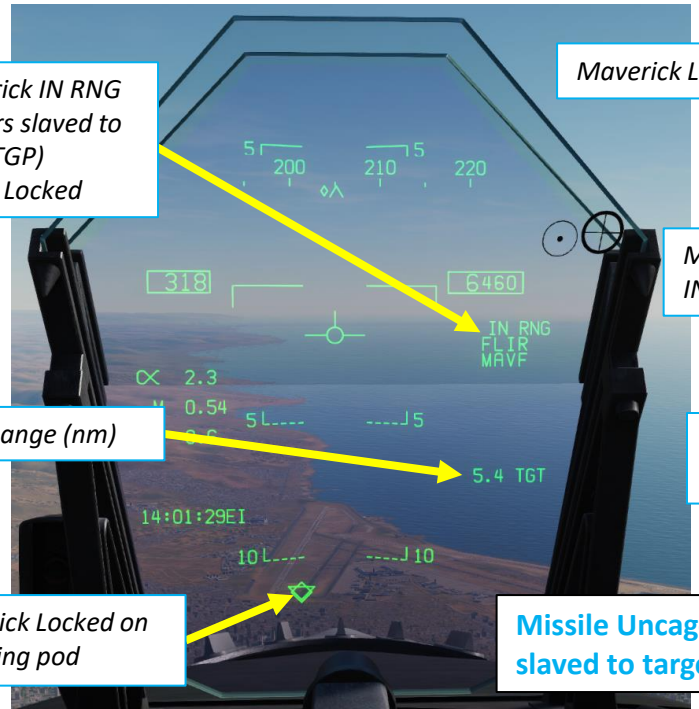
2.7.2 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Targeting Pod)

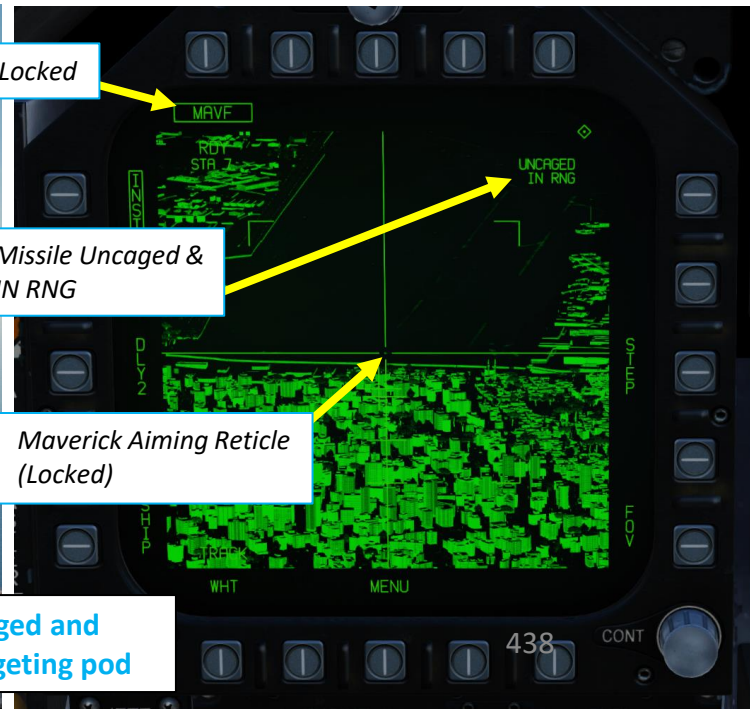
22. Press the Cage/Uncage Button to uncage the Maverick.
23. When the Maverick is uncaged and a A/G TGT (air-to-ground target) is designated by the targeting pod, the missile will attempt to lock onto a contrasting target **within the designated TGT area**. This procedure is much easier to do than trying to slew the missile itself.
24. The Maverick is within range (distance of 7.5 miles) to the target when IN RNG cue is visible on the HUD and MAVF feed page.
25. When lock is acquired by Maverick, the MAVF crossed-out indication will disappear.





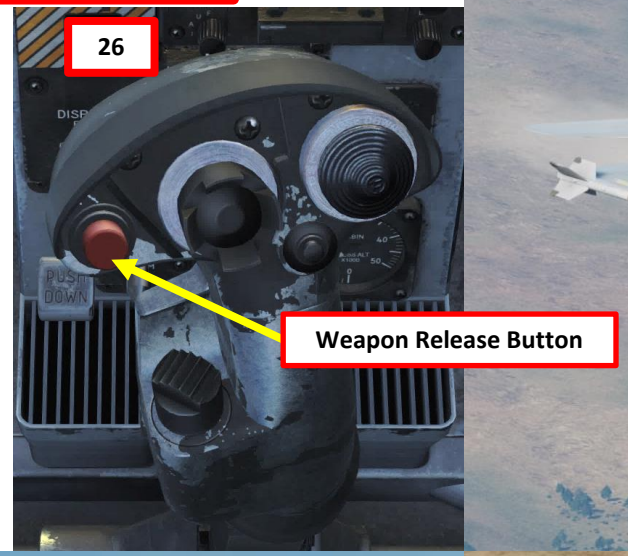






2.7.2 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Targeting Pod)

26. Hold the Weapon Release Button (« RALT+SPACE ») to fire missile.





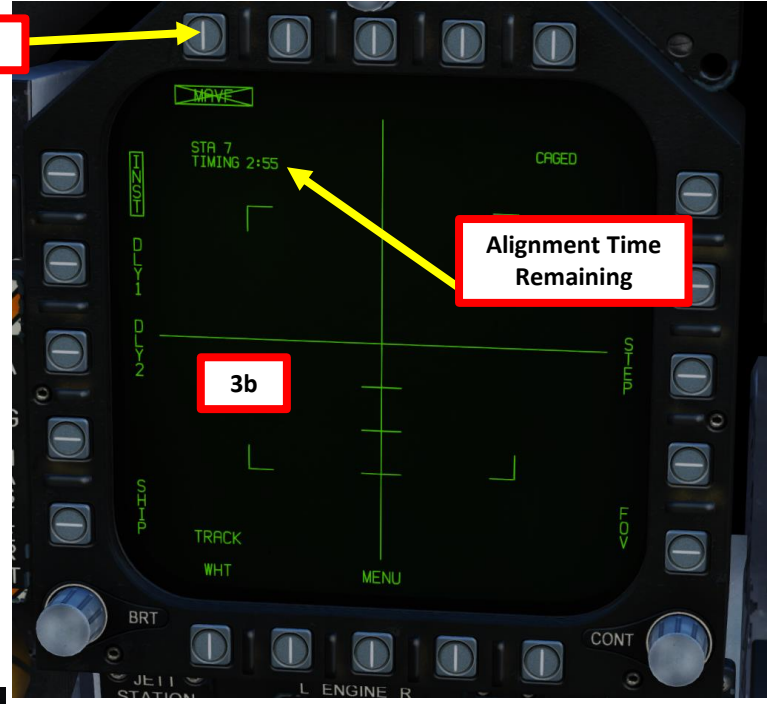


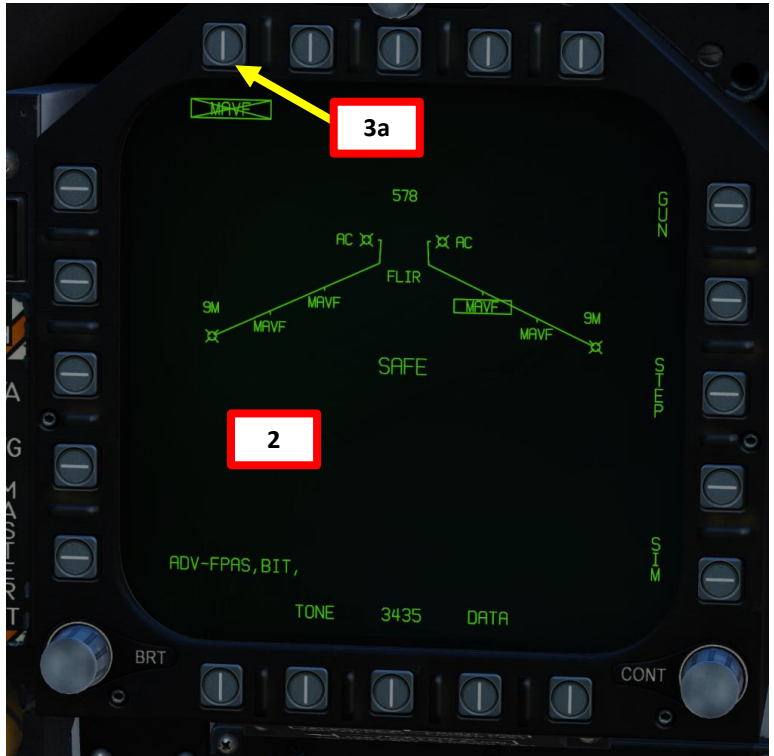


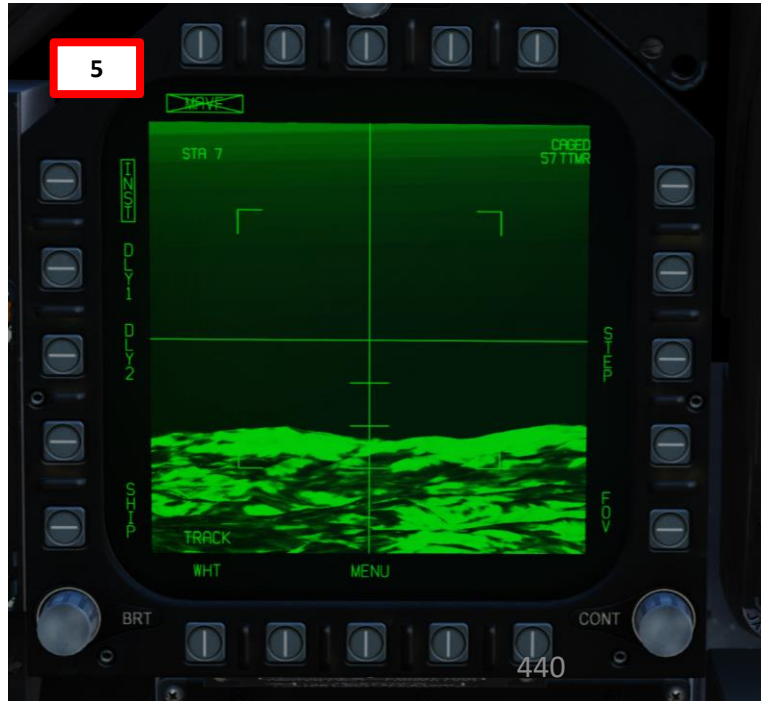
2.7.3 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Radar GMT Mode)

1. The AGM-65F requires its seeker to be cooled by releasing a fluid stored inside onto it for it to be able to see properly and cannot be operated until it is cooled. Upon first selection of it on the STORES format, cooling will be initiated. A timer counting down to operating status can be seen on the IMAV DSPLY format, which takes approximately 3 minutes. **Note: The cooldown should be started while you are in the air and the missile is selected since the Weight On Wheels (WoW) signal inhibits missile cooldown initiation.**
2. Go in SMS (Stores Management System) page
3. Select MAVF (text should be boxed)
4. Maverick cooldown process will start and take about 3 minutes. Monitor cooldown progress by pressing the OSB next to the crossed-out « MAVF », which will show you the Maverick seeker head feed.
5. Once Maverick cooldown is complete, the timer will disappear and the MAVF Feed will go live.
6. Master Arm switch – ARM (UP)









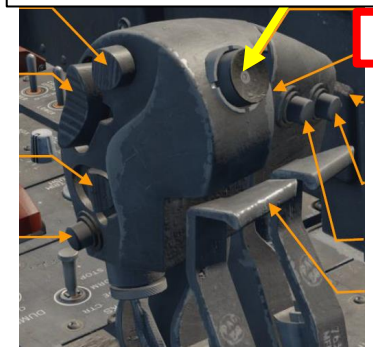
2.7.3 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Radar GMT Mode)

7. Make sure the Radar Power Switch is set to OPR (Operate).
8. Pressing the A/G Master Mode button will set the right DDI (Digital Display Indicator) to the radar A-G MAP page.
9. Toggle A-G MAP mode to A-G GMT mode by pressing the OSB next to MAP.
10. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
11. Slew the TDC cursor on the desired target (brick) you want to track using the TDC controls.
12. Press the Sensor Control Switch in the direction of the DDI (right) to command acquisition of the target. When Sensor Control Switch is released, target tracking is commanded. The radar mode will change to Ground Moving Target Track (GMTT) and additional target information will be displayed.
    - Note: GMTT is effective out to about 10 nautical miles.

10a
12a
Sensor Control Switch
AFT/FWD/LEFT/RIGHT



Throttle Designator Controller
AFT/FWD/LEFT/RIGHT/DEPRESS



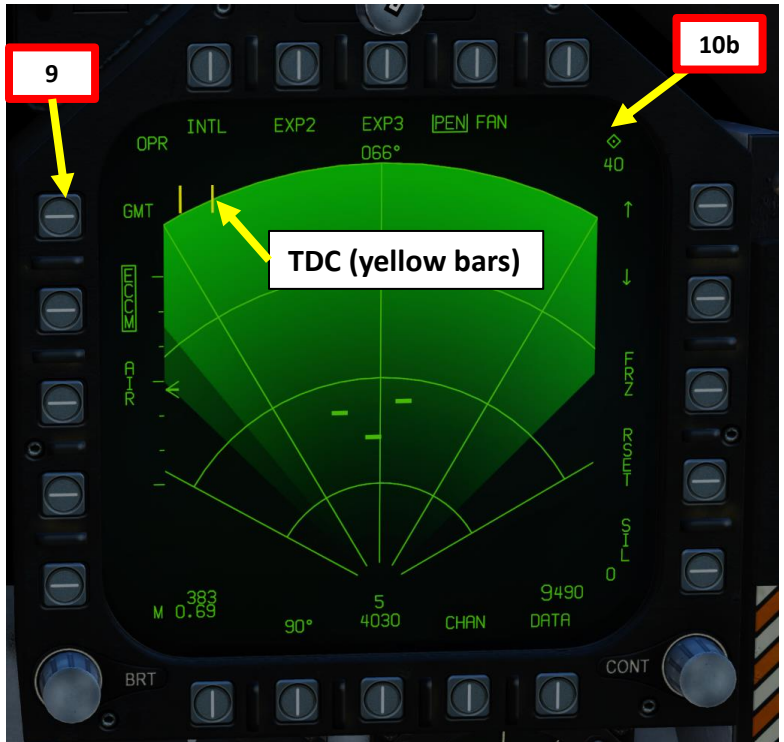
A/G (Air-to-Ground) Master Mode Selected



8

Radar Power Switch 7



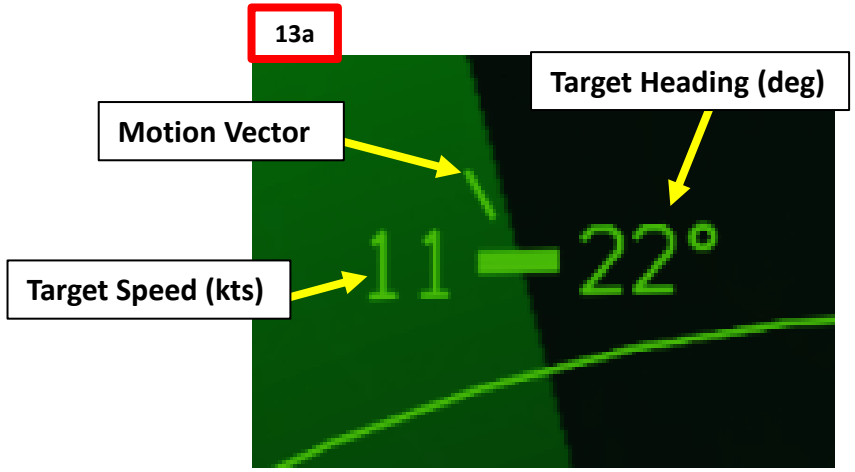


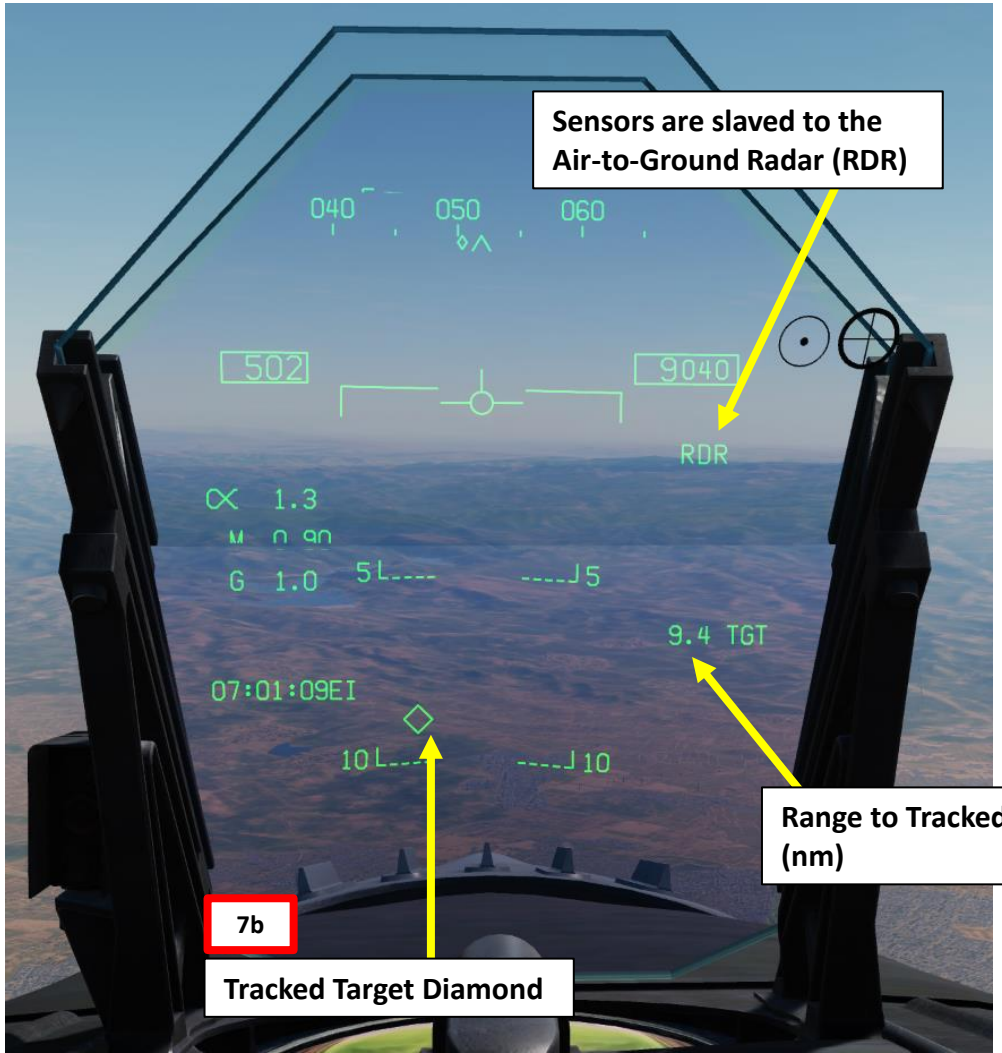


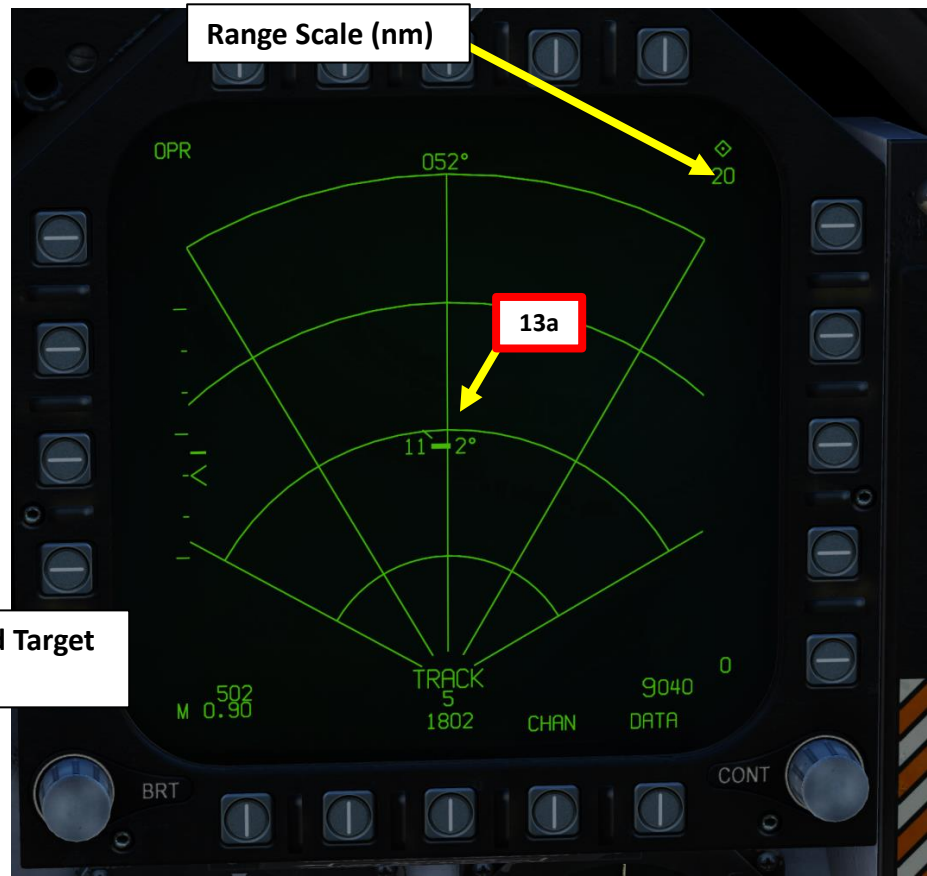


2.7.3 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Radar GMT Mode)

13. Once GMTT is engaged and target is tracked:
    a) On the Radar page, a brick with a motion vector, target speed and heading will be visible.
    b) On the HUD, a diamond will mark the tracked target.
    c) This point can be used/slaved to by other sensors (like the targeting pod) if desired.

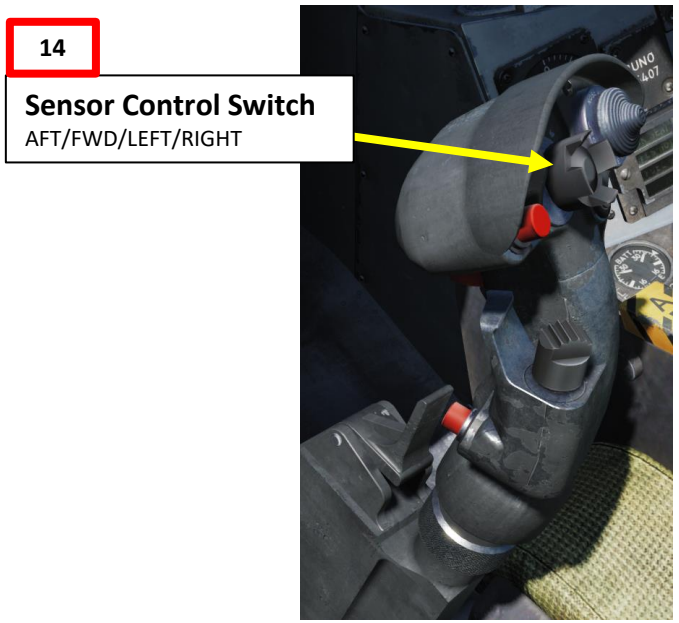


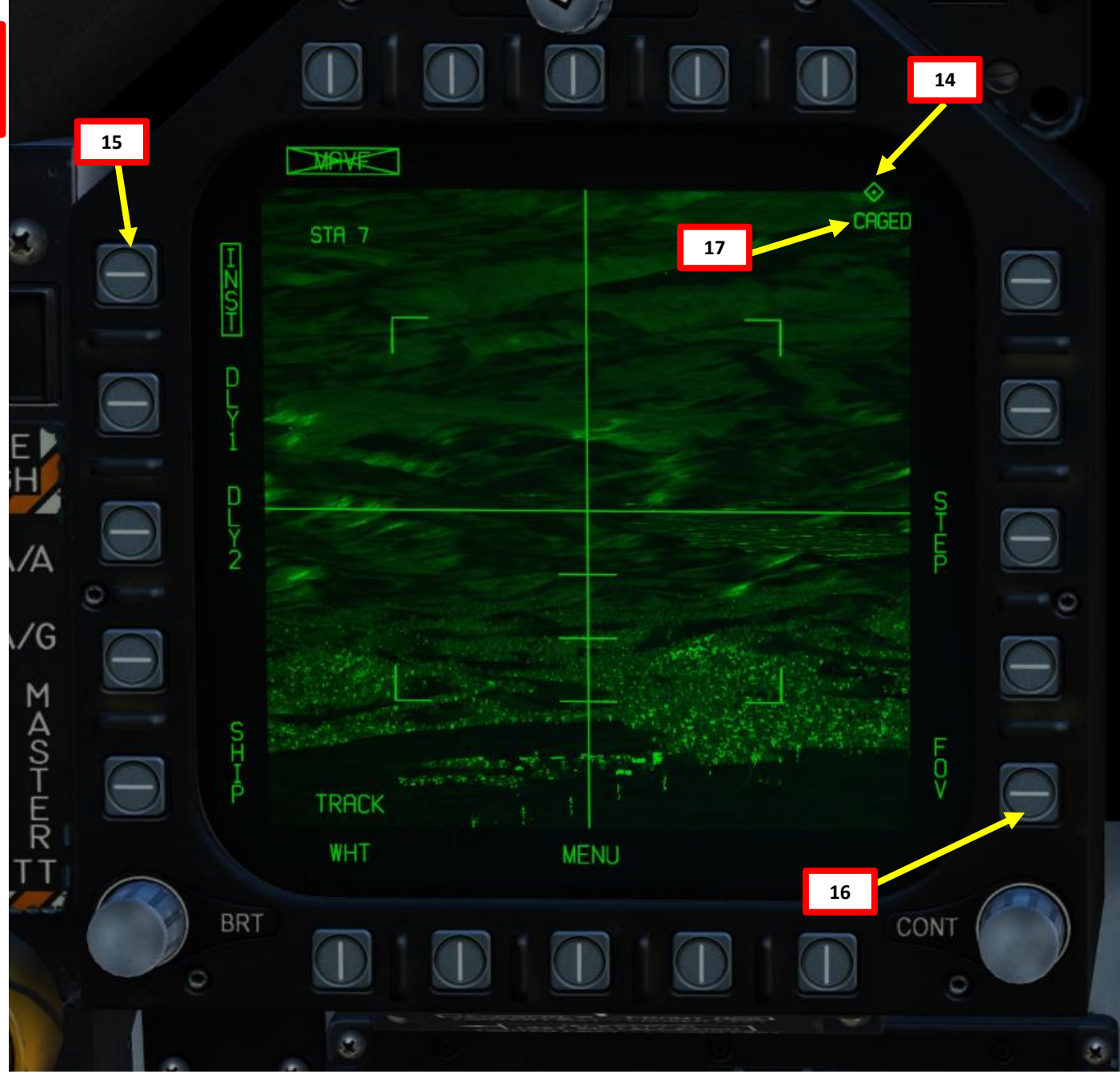




2.7.3 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Radar GMT Mode)

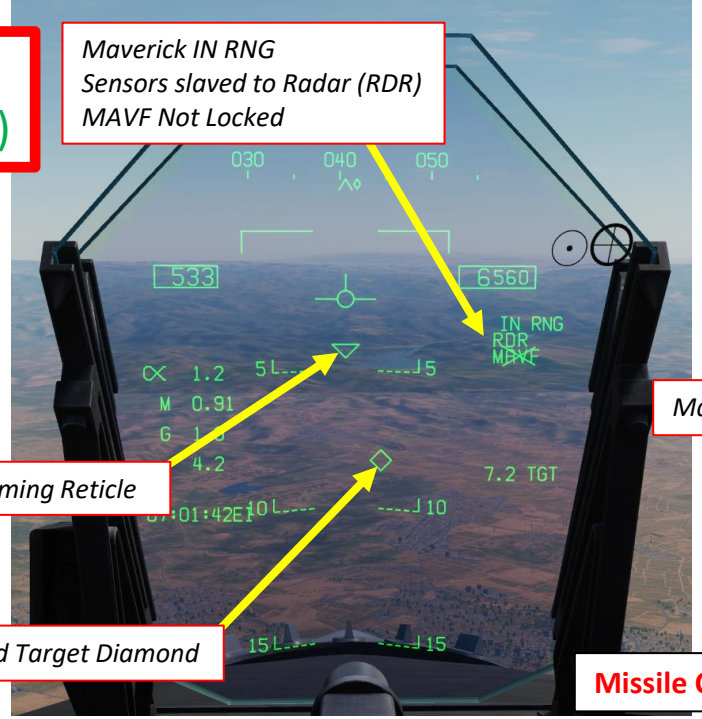
14. Set Sensor Control Switch to the Maverick Feed DDI (Sensor Control Switch LEFT since we showed up the MAV feed on the left DDI). A diamond will appear to show the left DDI is selected.
15. Set Fuzing to either INST (Instantaneous), DLY1 (Delayed Fuze) or DLY2.
16. Adjust FOV (Field of View) as required.
17. By default, the Maverick is Caged. When the seeker is caged, it will always point forward at its boresight.

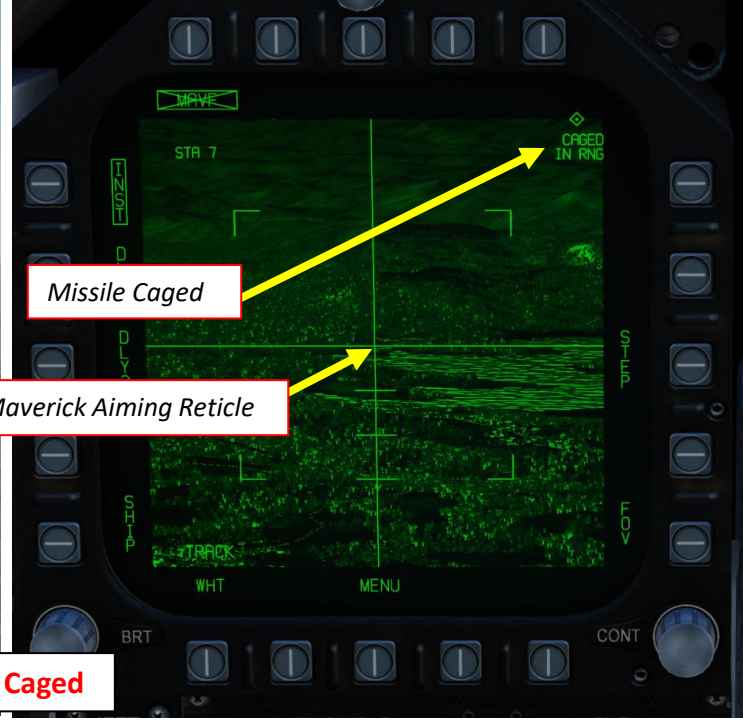




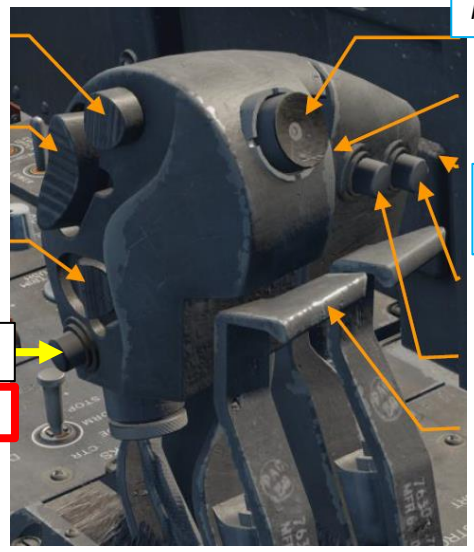
2.7.3 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Radar GMT Mode)

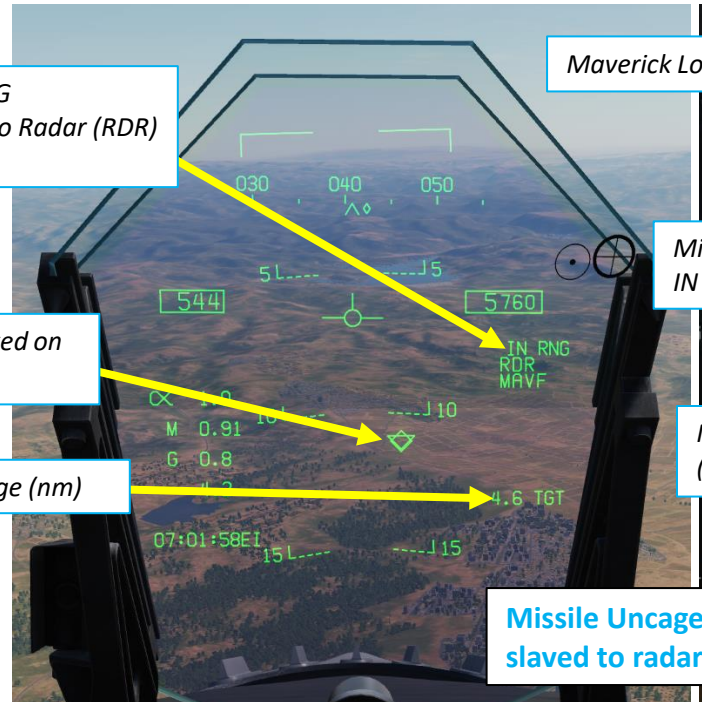
18. Press the Cage/Uncage Button to uncage the Maverick.
19. When the Maverick is uncaged and a A/G TGT (air-to-ground target) is designated/tracked by the radar's ground moving target mode, the missile will attempt to lock onto a contrasting target **within the designated TGT area**. This procedure is much easier to do than trying to slew the missile itself.
20. The Maverick is within range (distance of 7.5 miles) to the target when IN RNG cue is visible on the HUD and MAVF feed page.
21. When lock is acquired by Maverick, the MAVF crossed-out indication will disappear.

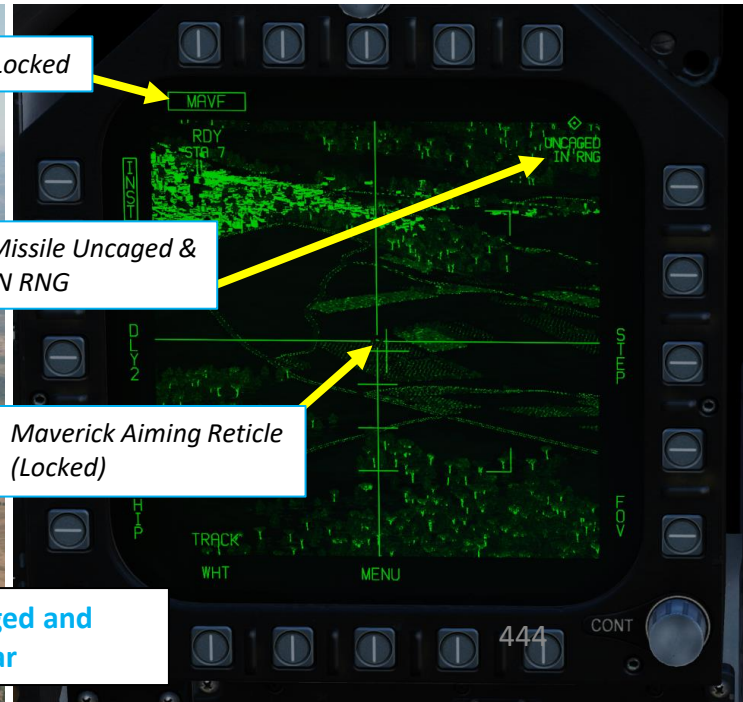




Missile Caged



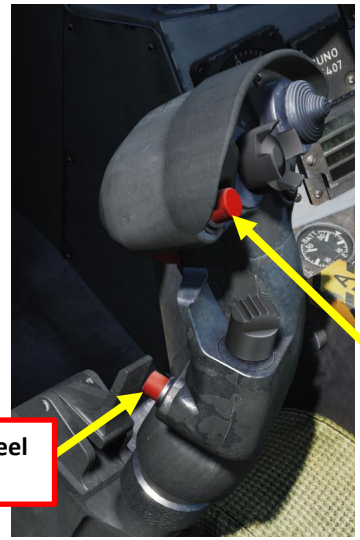




Missile Uncaged and slaved to radar

2.7.3 – AGM-65F/G MAVERICK
(IR-MAVF, Missile Slaving to Radar GMT Mode)

22. Hold the Weapon Release Button (« RALT+SPACE ») to fire missile.
23. Note: Pressing the « Undesignate » button on the stick to return the radar to GMT mode and exit tracking mode.



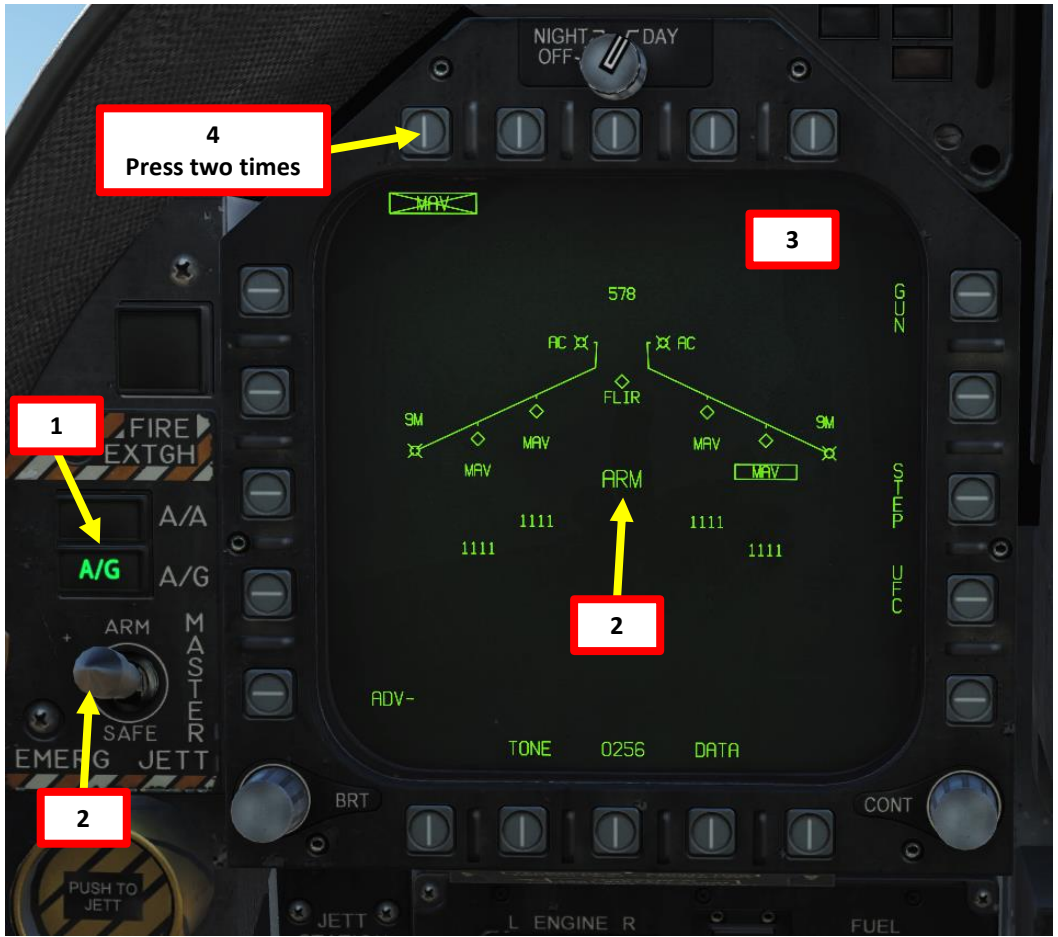


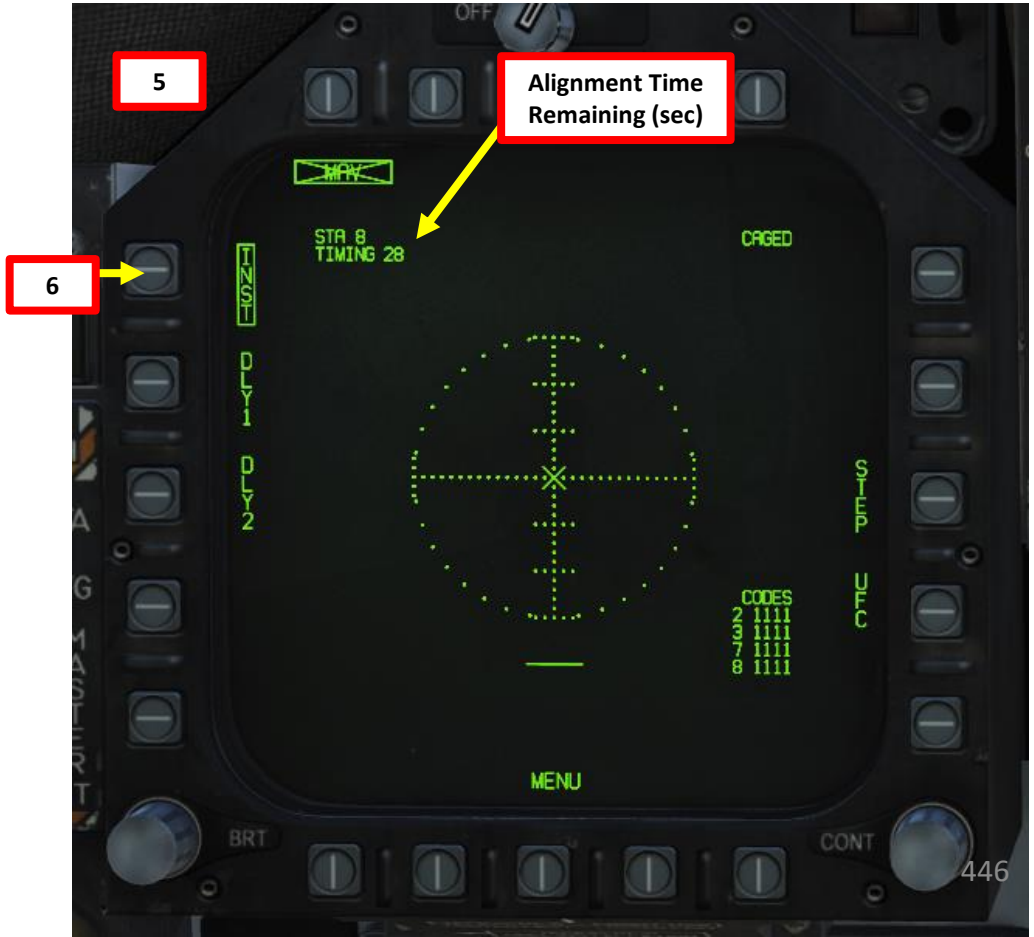




2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

1. Master Mode – A/G (switch can only be activated when wheels are off the ground)
2. Master Arm switch – ARM (UP)
3. Go in SMS (Stores Management System) page
4. Select MAV (text should be boxed) by pressing the OSB next to MAV. Press it a second time to enter the MAV DSPLY (Maverick Display) page.
5. Laser Maverick will start a self-test that takes about 30 seconds. You can monitor cooldown progress in the MAV DSPLY page by pressing the OSB next to the crossed-out « MAV » from the SMS (Stores Management System) page.
    - **Note:** Once Maverick cooldown is complete, the timer will disappear.
6. Select INST (Instantaneous) Fuzing.

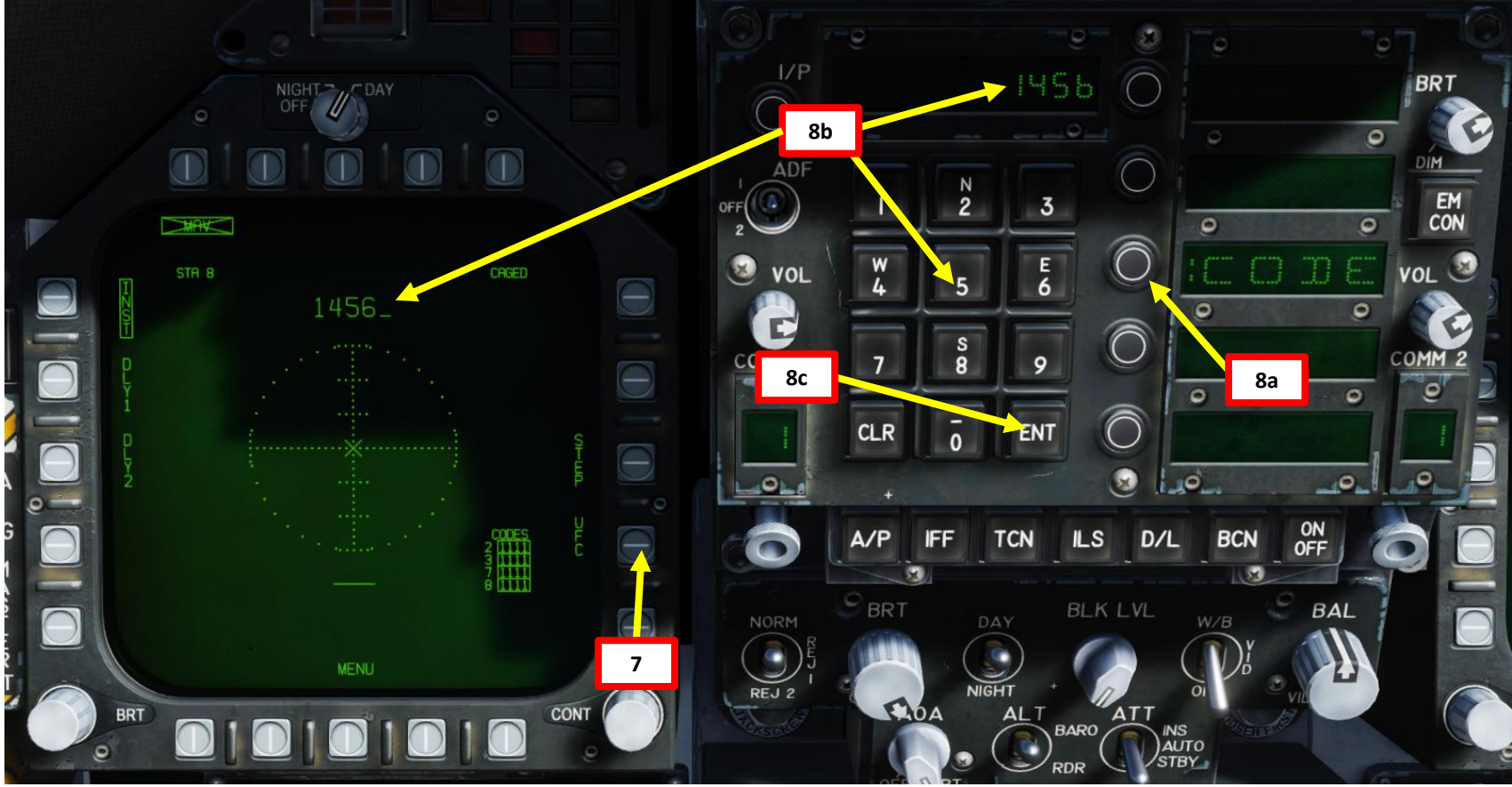


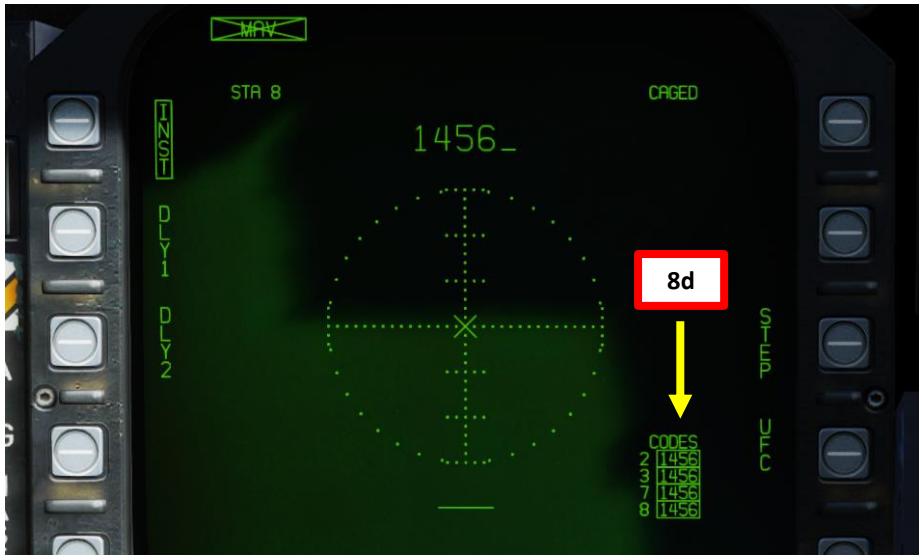


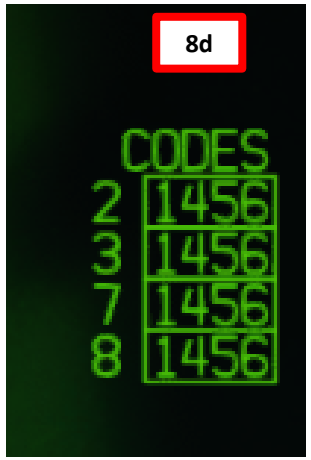
2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

7. In the MAV DSPLY page, press the OSB next to UFC (Up-Front Controller). This will select all Laser-Maverick stations (boxed when selected) and allow us to edit their laser codes all at once. If you want to edit a specific Maverick's laser code, press UFC again to switch between stations.
8. Press the button next to "CODE" (Laser-Guided Maverick Laser Code). A ":" will indicate it is selected. Then, enter the desired laser code on the keypad and press "ENT". In our case, we will choose a laser code 1456, which we will set up for our targeting pod as well in later steps.

Note: Keep in mind that if we were tracking someone else's laser, we would need to set the laser code to the one used by their own targeting pod.

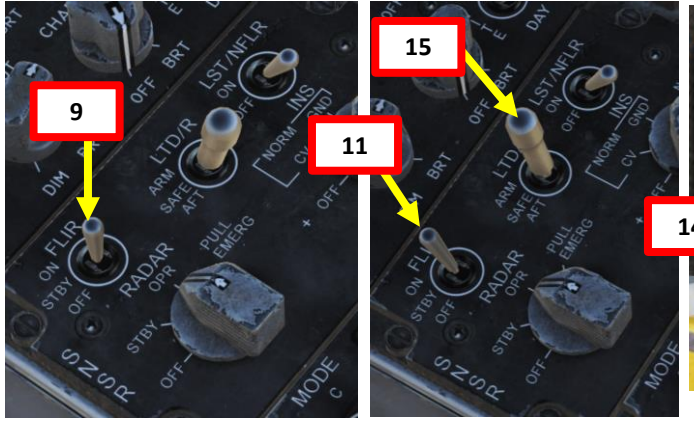


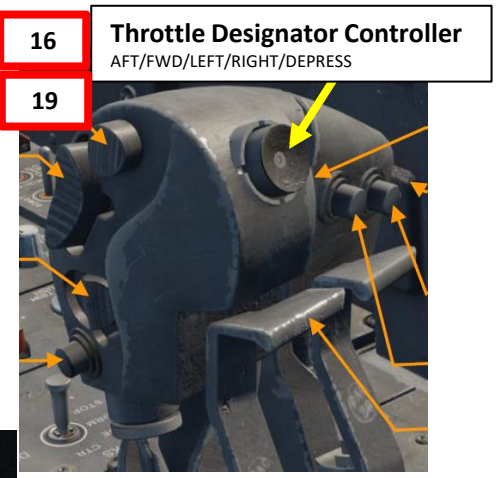


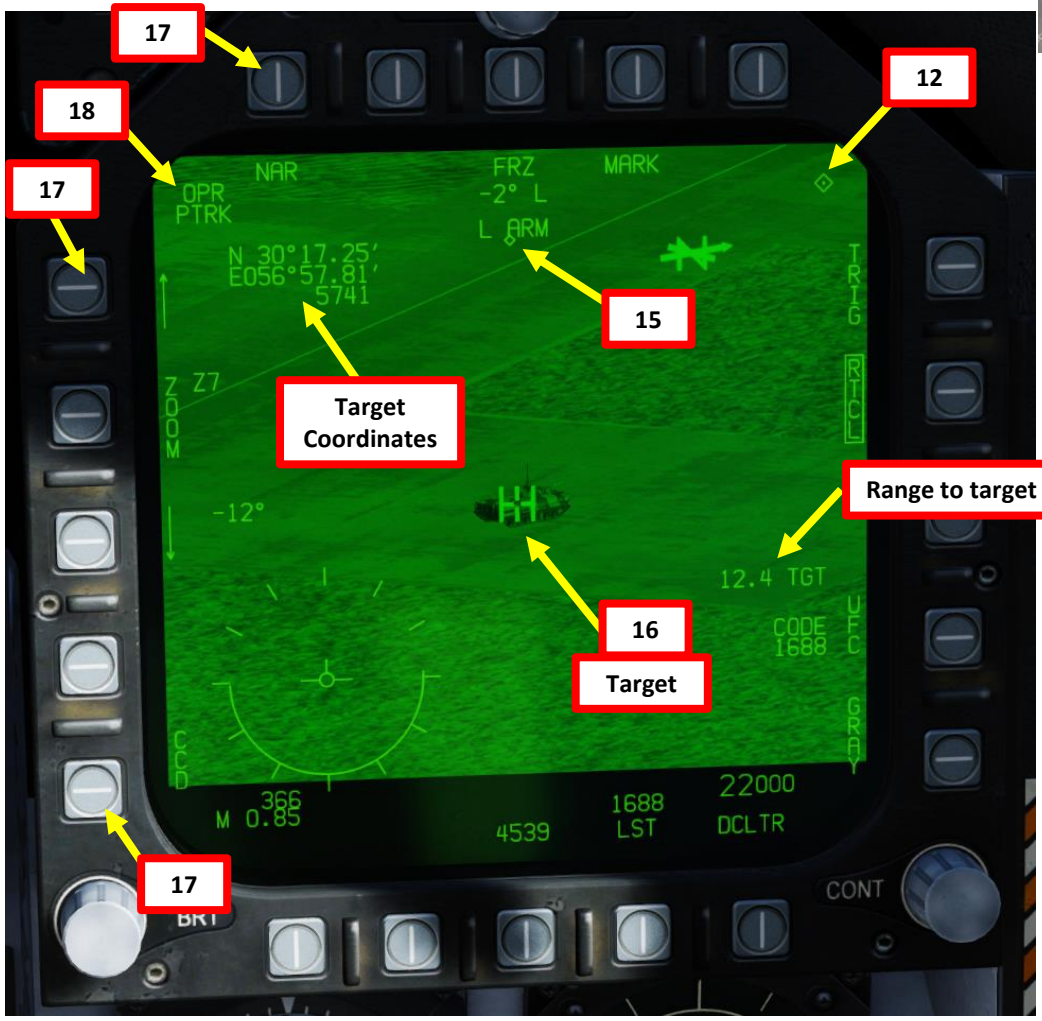


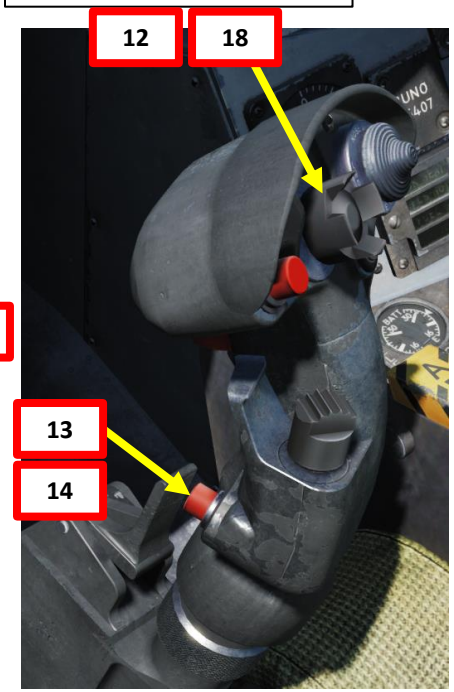
2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

9. To power up the targeting pod, set FLIR Sensor Switch to STBY (Right Click).
10. From the TAC page on either DDI or the AMPCD, press the OSB (Option Select Button) next to "FLIR" (Forward-Looking Infrared) to select the Targeting Pod feed page. Monitor the warm-up process.
    - Targeting pod warm-up process will take about 2 minutes.
    - When targeting pod is ready to be used, the pod status will switch from ~~RDY~~ – NOT TIMED OUT to STBY (Standby).
11. Set FLIR Sensor Switch to ON (Right Click). Confirm that Targeting Pod mode switches from STBY to OPR (Operate).
12. Press the Sensor Control Switch in the direction of the selected DDI (Right for the Right DDI as an example). The Select Focus Diamond indicates what display is selected.
13. Press the Undesignate button twice rapidly to select VVSLV (Velocity Vector Slaved) mode. This will un-stow the camera and slave the targeting pod to the velocity vector.
14. Press the Undesignate button twice rapidly again to select Snowplow mode. When Snowplow mode is first entered, the FLIR is set to 0° left/right and -8° down.
15. Set LTD/R (Laser Target Designator/Ranger) switch to ARM. This will arm the laser. Confirm that L ARM indication is displayed on the FLIR page. Verify A/G Master Mode is set since it will allow you to arm the laser designator.
16. Using the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls, slew the targeting pod reticle over the desired target.
17. Use appropriate zoom level, field of view (NARROW/WIDE) and camera mode (CCD/TV or FLIR) to identify the target.
18. Press the Sensor Control Switch Towards Selected Display (Right if our right DDI is selected) to toggle between Point Track (PTRK, tracks a moving object like a high-contrast vehicle) and Area Track (ATRK, used for a static target).
19. Use the TDC (Throttle Designator Controller) Depress button to designate the laser as the target point. This will slave selected air-to-ground weapons to where the laser is firing and display range to target and its coordinates.



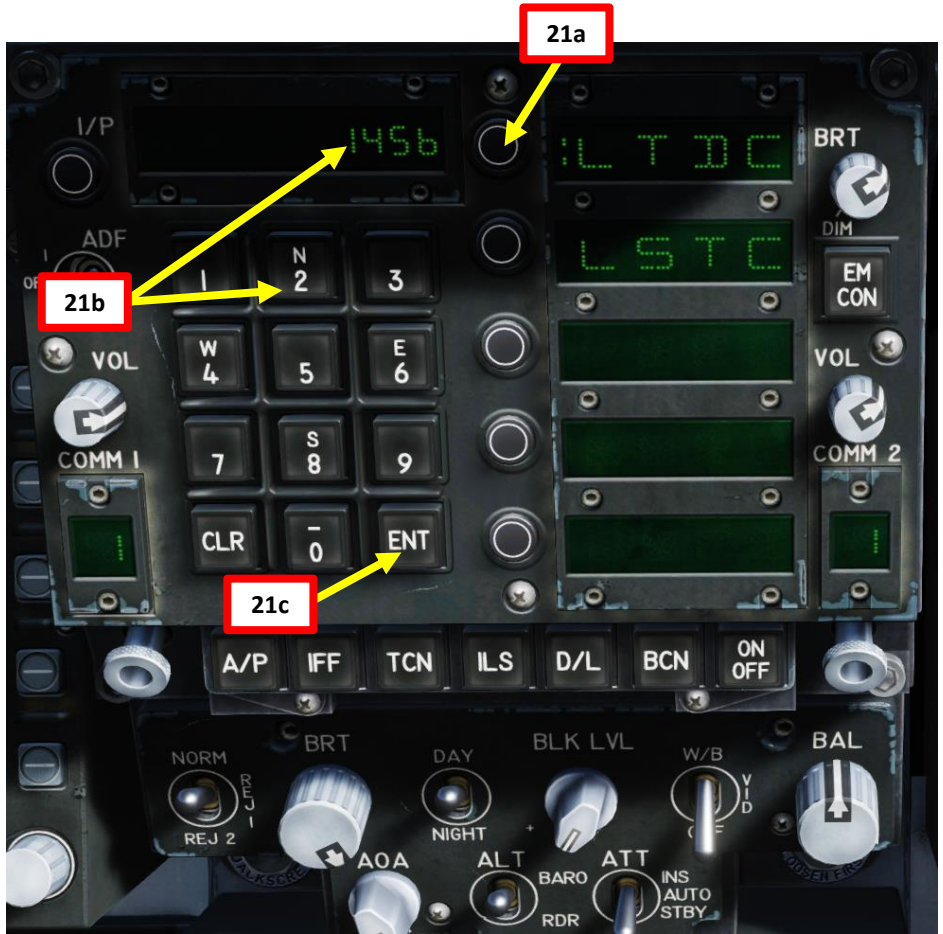


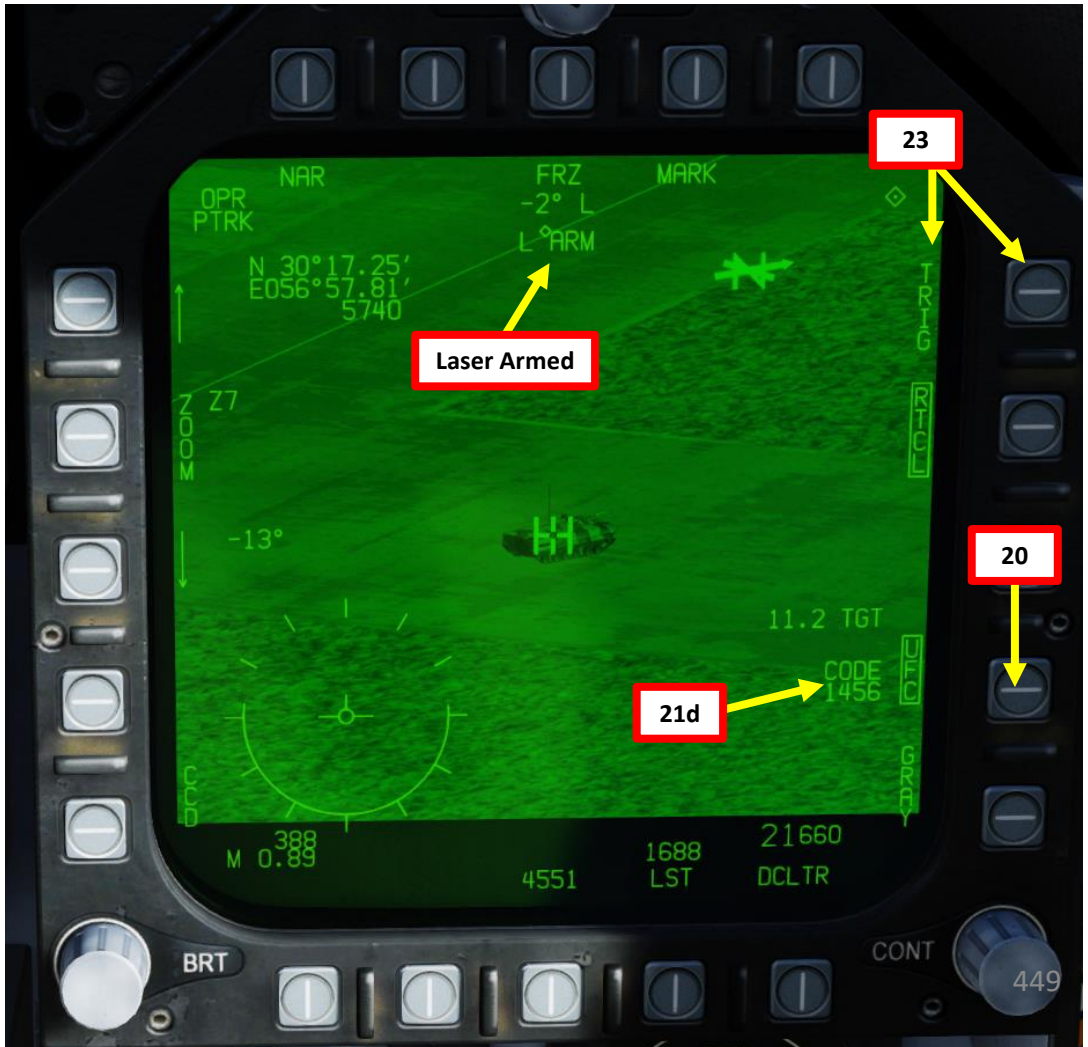




2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

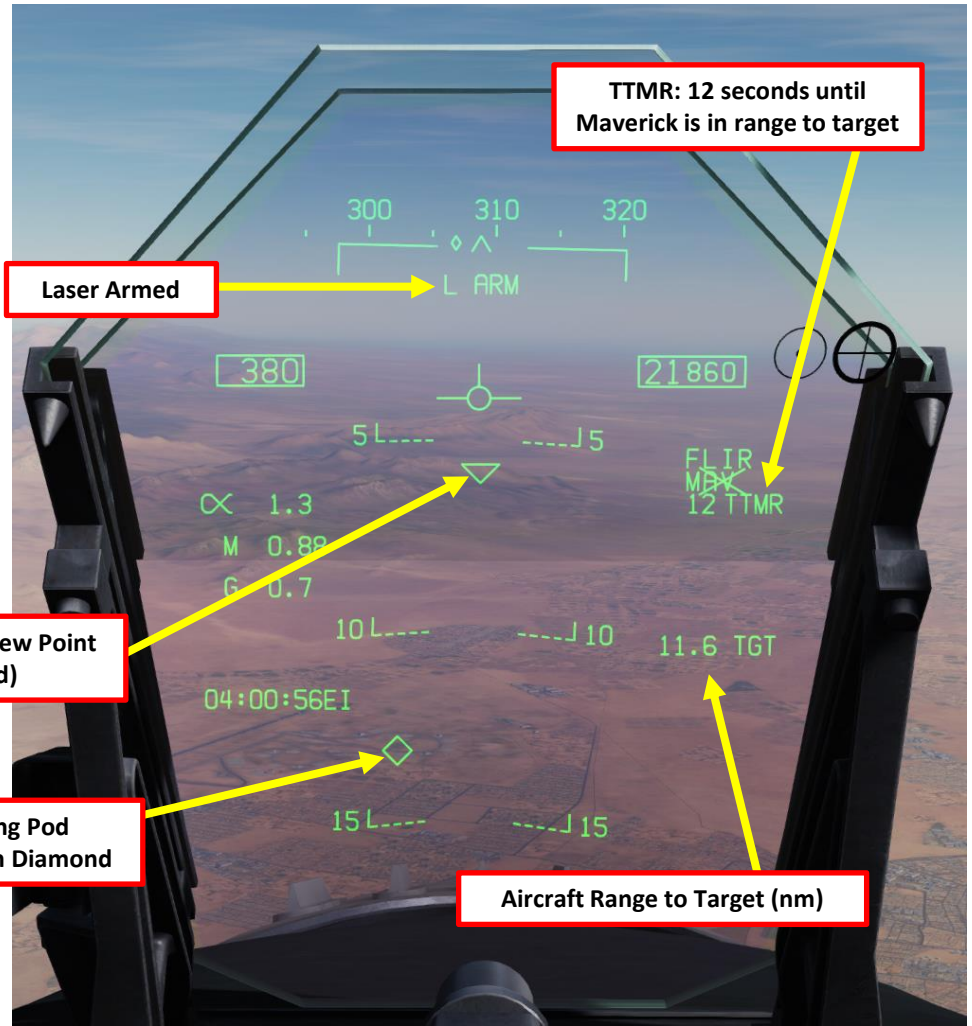
20. Press the OSB next to “UFC” to set the Targeting Pod laser code on the Up-Front Controller.
21. Press the button next to “LTDC” (Laser Target Designator Code). A “:” will indicate it is selected. Then, enter the desired laser code on the keypad and press “ENT”. We will choose laser code 1456, which we set previously in step **8** for the laser Mavericks themselves.
22. Now that the targeting pod has its laser code and it matches the laser code tracked by the Laser-Guided Maverick, we can now uncage the missile to make it track the laser.
23. On the FLIR page, make sure the OSB next to “TRIG” in unboxed (not selected). This means that the targeting pod will automatically lase (auto-lasing) once the AGM-65E Maverick is fired.

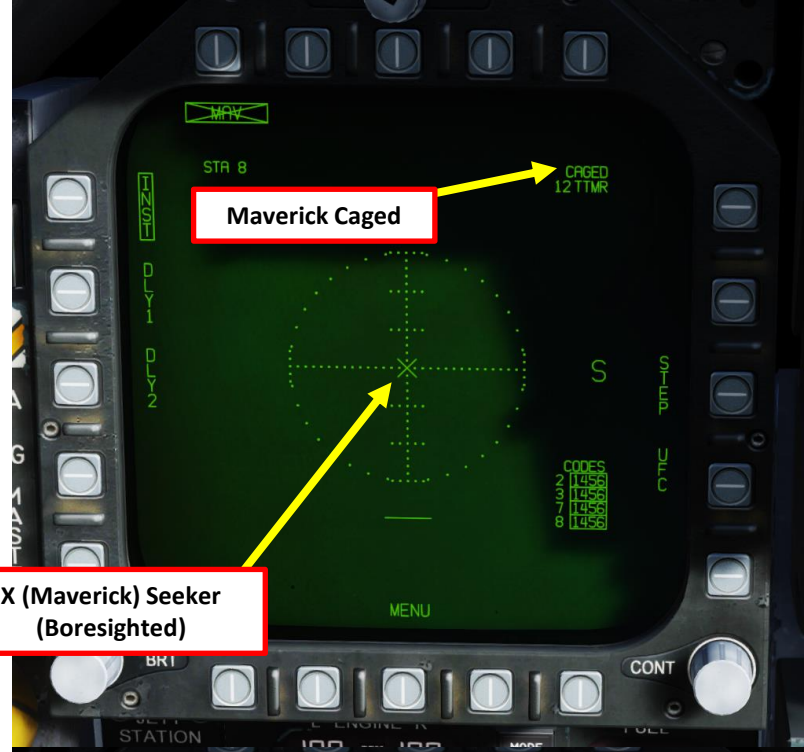


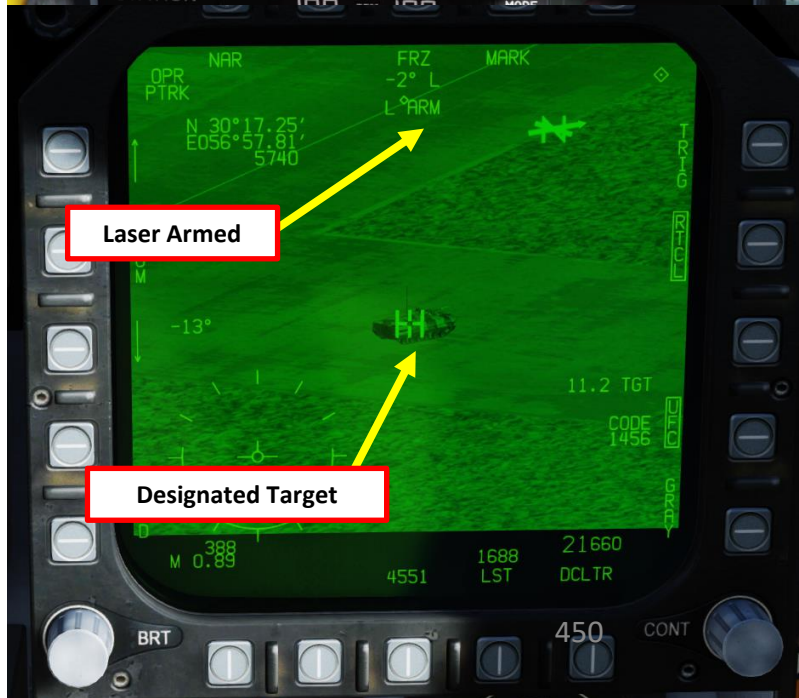


2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

24. While the sensor of interest is the targeting pod (Sensor Focus diamond is on the FLIR page), the Maverick remains caged and boresighted.
25. The crossed-out MAV indicates that the Maverick is not tracking any laser yet, which is normal since the targeting pod has not started firing its laser yet.
26. The TTMR indicates the time in seconds until the aircraft becomes within range to be able to fire the maverick.



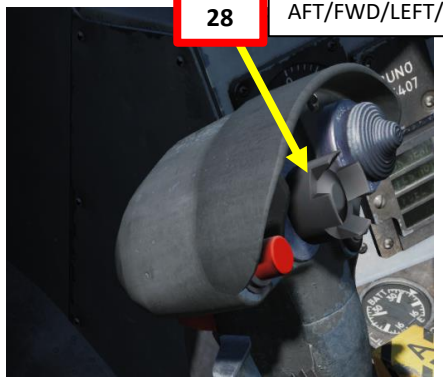


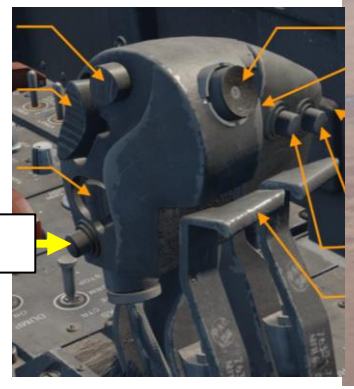


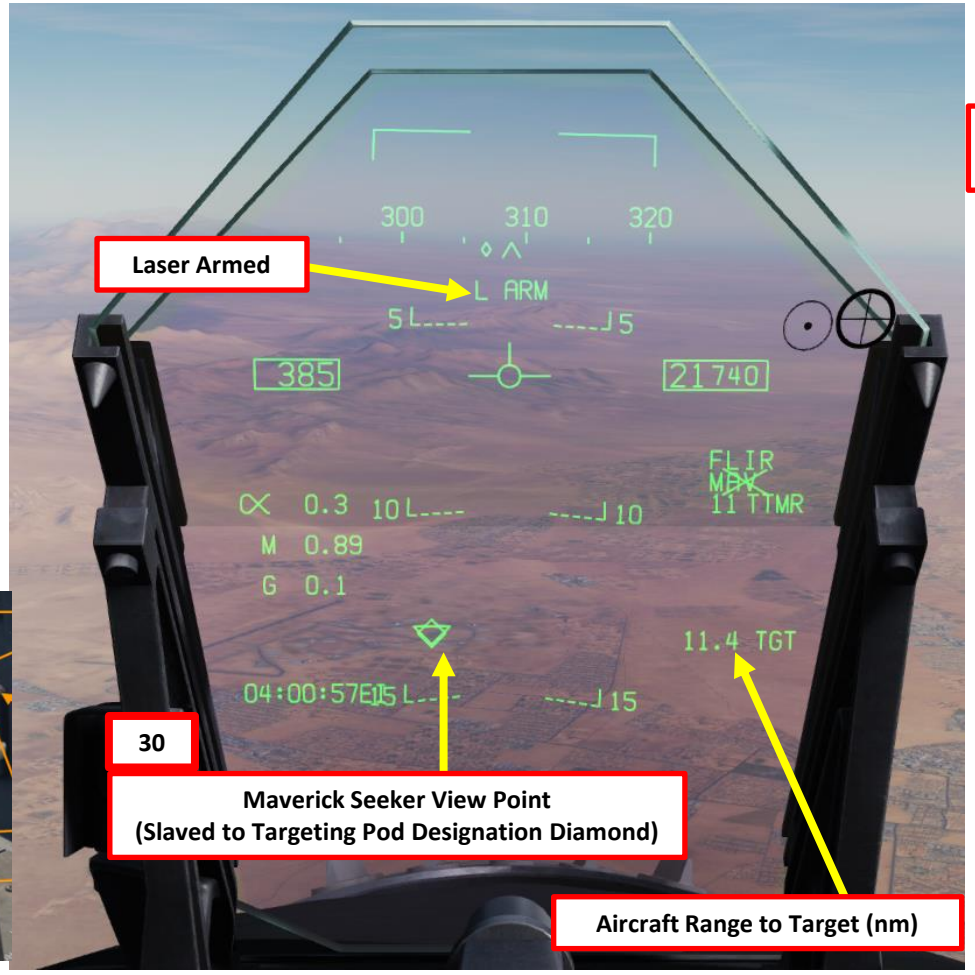
2.8 – AGM-65E MAVERICK
(Laser-Guided MAV)

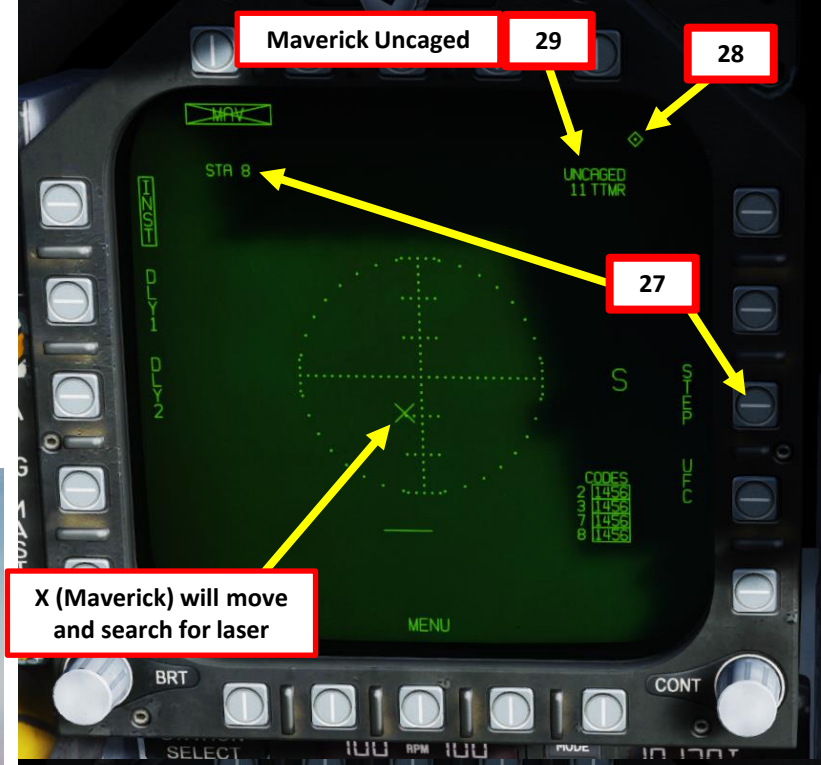
27. Select desired Maverick station using the OSB next to STEP. We will select Station 8.
28. Set Sensor Control Switch to the Maverick Display page's DDI (Sensor Control Switch LEFT since we showed up the MAV DSPLY feed on the left DDI). A focus diamond will appear to show the left DDI is selected.
29. Press the Cage/Uncage Button to uncage the Maverick.
30. When uncaged, the missile will scan ahead in a pattern to search for the nearest laser with the code we entered earlier (1456), then slave itself to the target designated by the targeting pod if available.

Note: If for some reason the missile is caged back, press the Cage/Uncage Button to uncage the Maverick once more.





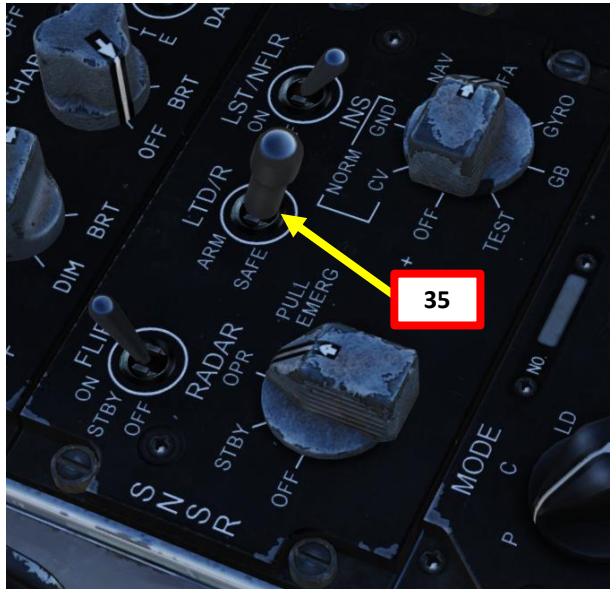




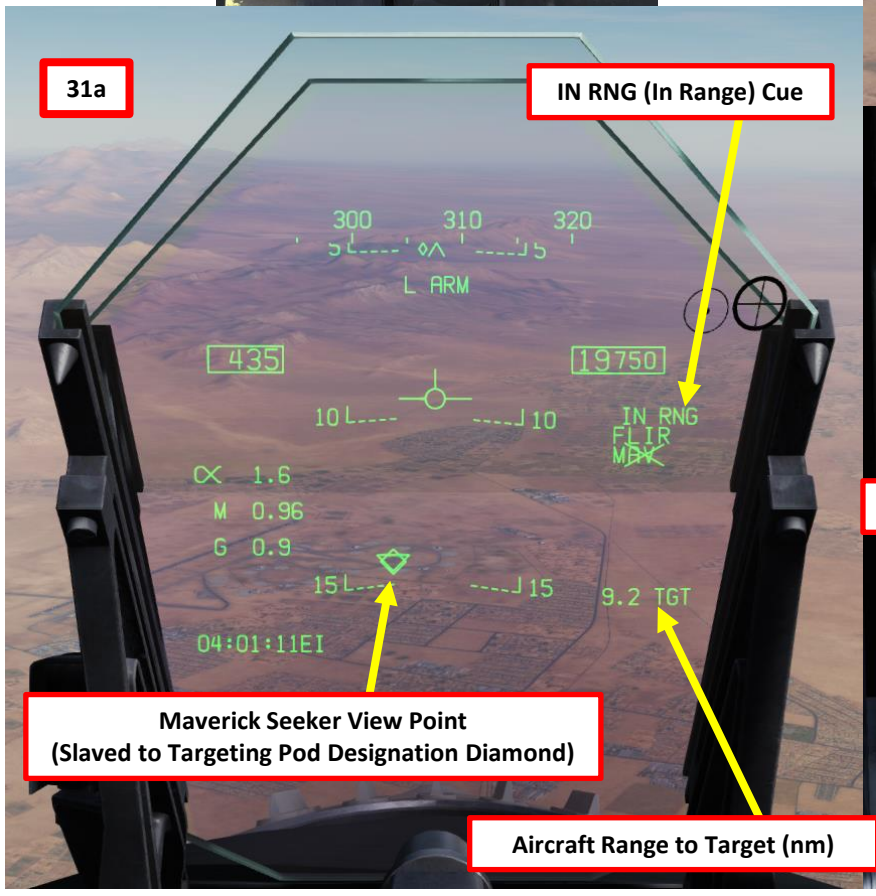


2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

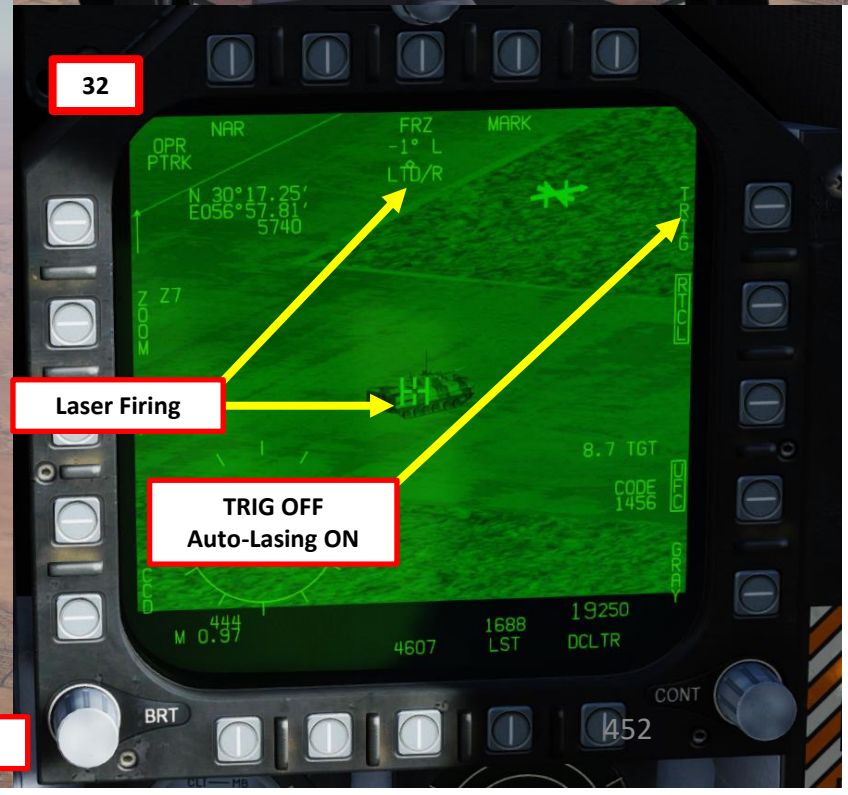
31. Once you are within firing range (IN RNG cue will become visible on the HUD), hold the Weapon Release Button (« RALT+SPACE ») to launch missile.
32. Once missile is fired, the targeting pod will automatically fire its laser on the designation point in order to guide the Maverick.
33. Once laser is firing, the laser mode will switch from L ARM to LTD/R.
34. The missile will follow the laser until impact.
35. Once the target is destroyed, the LTD/R (Laser Target Designator/Ranger) will automatically go back to SAFE. You will need to set it back to ARM if you want to lase more targets.
36. If you want to undesignated the target, use the Undesignate/Nosewheel Steering button on the stick.











2.8 – AGM-65E MAVERICK
(Laser-Guided MAV)



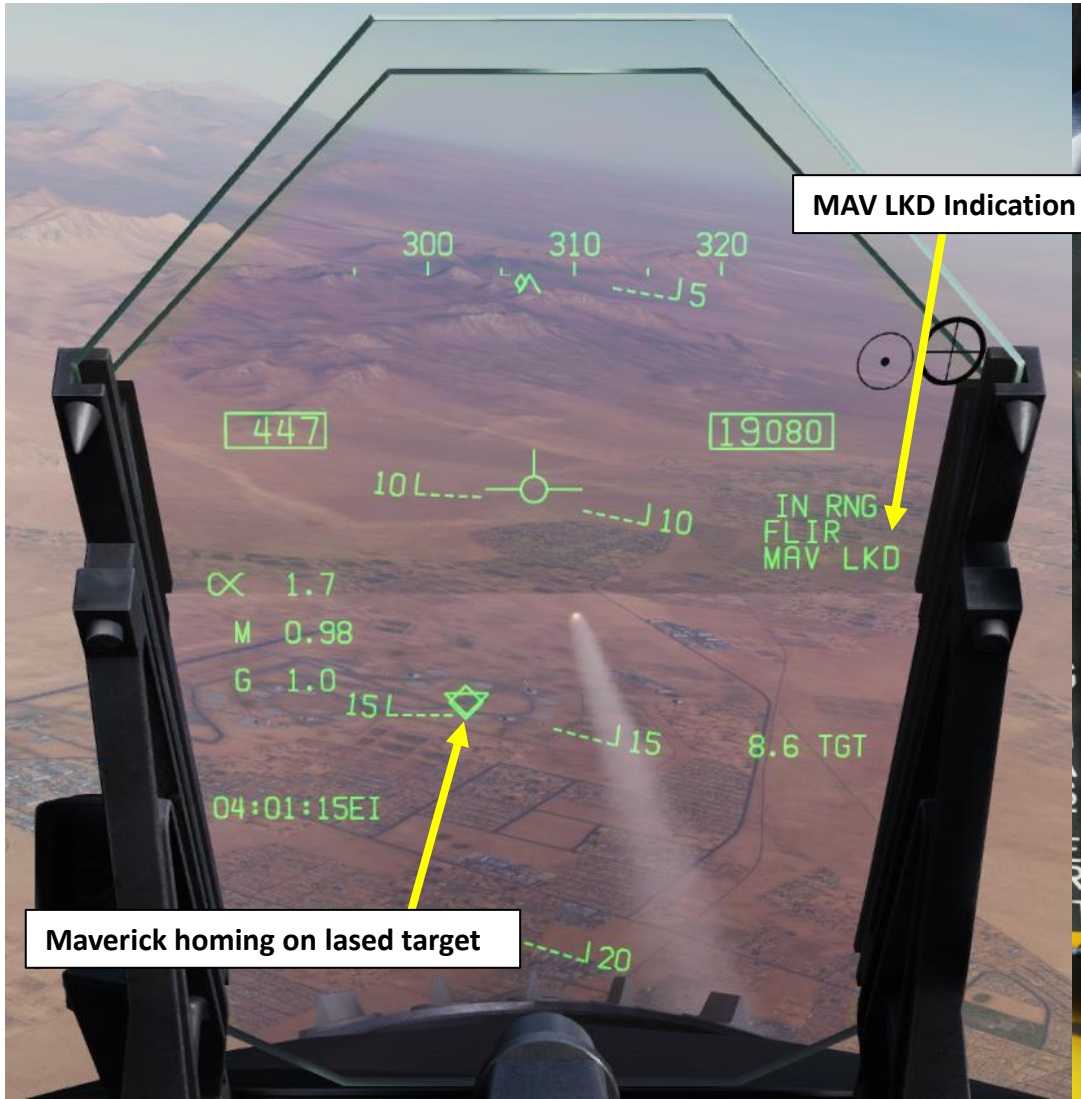


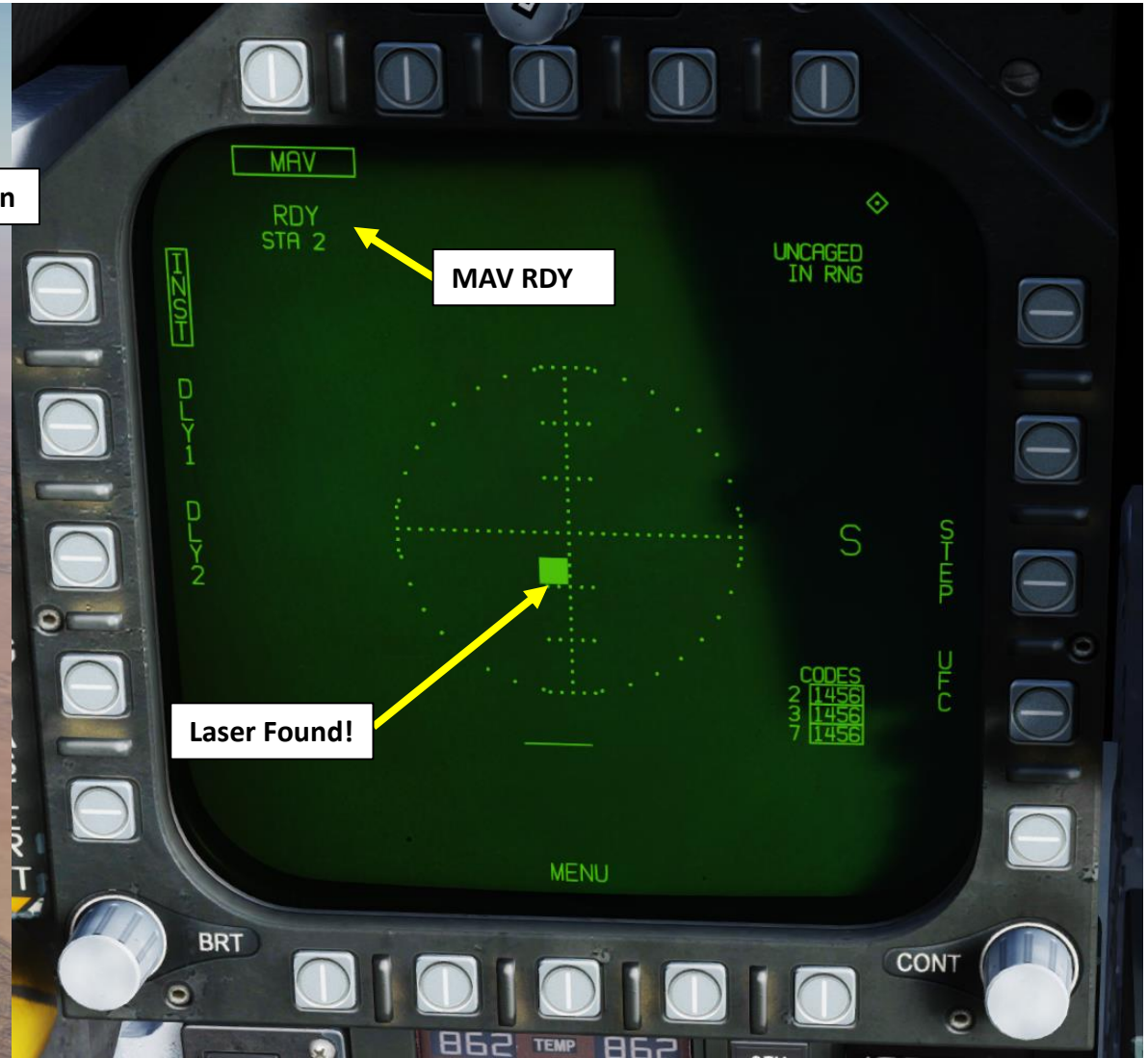


2.8 – AGM-65E MAVERICK (Laser-Guided MAV)

Note for lasers designated by others

- If you are tracking a target laser by another aircraft or a JTAC, uncaging the missile will search for any laser in the vicinity.
- If a laser is detected, the MAV crossed-out indication will disappear and be replaced by the RDY indication. The HUD will also display MAV LKD (Maverick Locked on Laser).





2.9 – AGM-88C HARM INTRODUCTION

Suppression of Enemy Air Defenses (SEAD, also known in the United States as "Wild Weasel" and (initially) "Iron Hand" operations, are military actions to suppress enemy surface-based air defenses, including not only surface-to-air missiles (SAMs) and anti-aircraft artillery (AAA) but also interrelated systems such as early-warning radar and command, control and communication (C3) functions, while also marking other targets to be destroyed by an air strike. Suppression can be accomplished both by physically destroying the systems or by disrupting and deceiving them through electronic warfare.

The **AGM-88 HARM** (High-speed Anti-radiation Missile) is a tactical, air-to-surface anti-radiation missile designed to home in on electronic transmissions coming from surface-to-air radar systems. The AGM-88 can detect, attack and destroy a radar antenna or transmitter with minimal aircrew input. The proportional guidance system that homes in on enemy radar emissions has a fixed antenna and seeker head in the missile's nose.

TLDR version? The HARM mainly homes on radar emitters. The best way to use the HARMs is to use the HARM Display page, the HUD and the EW (Early Warning) page with the RWR (Radar Warning Receiver) together to detect which radar emitters are actively tracking, which ones are locking you, what level of threat each emitter poses, and which one to target.

Here is an interesting DCS-centric SEAD Reference Guide by the 16th AGR Flight Training School:
https://drive.google.com/file/d/1jUbi9-2YJiKO3E2ZuHijFf231_cnsIw8/view

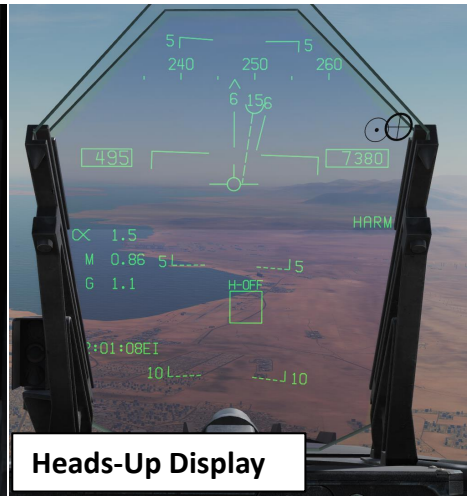


There are three main HARM modes: SP (Self-Protection), TOO (Target-of-Opportunity) and PB (Pre-Briefed).

- **SP** mode uses the radar warning receiver (RWR) to view and select emitters for the HARM to search for and then engage
- **TOO** uses the HARM seeker itself to view and engage emitters. Up to 15 emitters can be displayed.
- **PB** allows you to fire from maximum range to a preset waypoint without having to acquire a lock before firing.



HARM Display Page



Heads-Up Display



EW Page

SA6 SAM Site



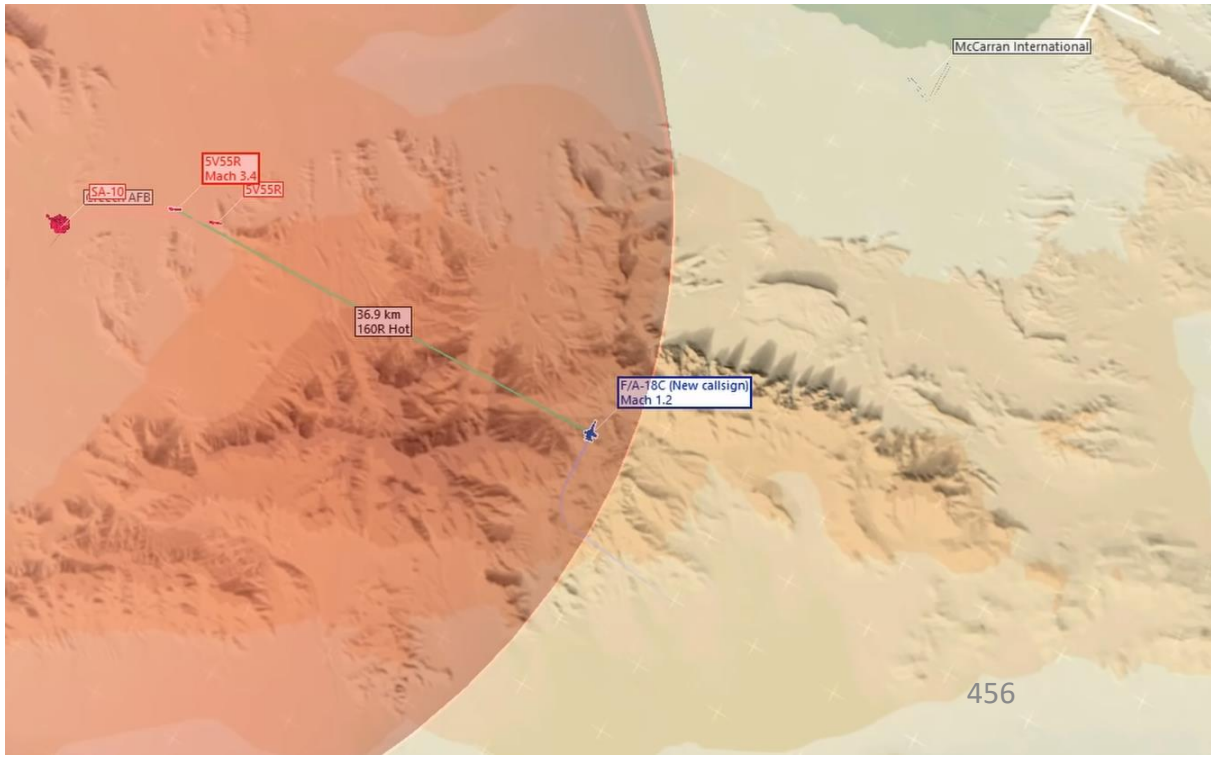
2.9 – AGM-88C HARM INTRODUCTION

Flying at high altitudes greatly enhances the HARM's range. However, the higher you are, the easier you are to find by enemy radars. Keep in mind that doing SEAD operations means that you will be locked by multiple radar stations and SAM sites can fire missiles on you or on your own HARM missiles. This means that your countermeasures programs must be ready at all times and you must often break away from the target once you have fired your weapon. A great way to do SEAD is to use terrain to mask your approach and fire your weapons at the last second before breaking off back your egress route.

HARM Range Table within DCS (Ref: RedKite Tutorial)

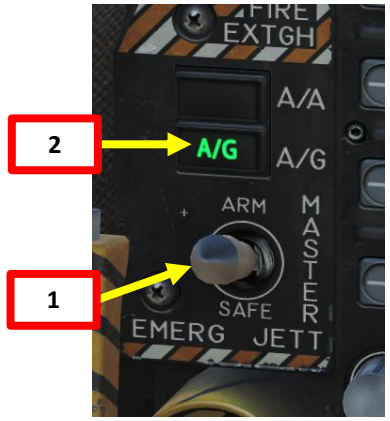
Range (nm)	Altitude (ft)	Airspeed (kts IAS)
70	40000	380
50	30000	400
35	20000	400
25	10000	400
15	5000	550





2.9.1 – AGM-88C HARM
(TOO, Target-of-Opportunity Mode)

1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Set the TAC EW (Early Warning) page on the right DDI and the SMS (Stores Management System) page on the left DDI.
4. In SMS (Stores Management System) page, click on the OSB next to HARM to select it
5. Select TOO (Target-of-Opportunity) Mode
6. Set Sensor Control Switch to the HARM page DDI (Sensor Control Switch LEFT since we showed up the HARM page on the left DDI). A diamond will appear to show the left DDI is selected.



6a **Sensor Control Switch**
AFT/FWD/LEFT/RIGHT



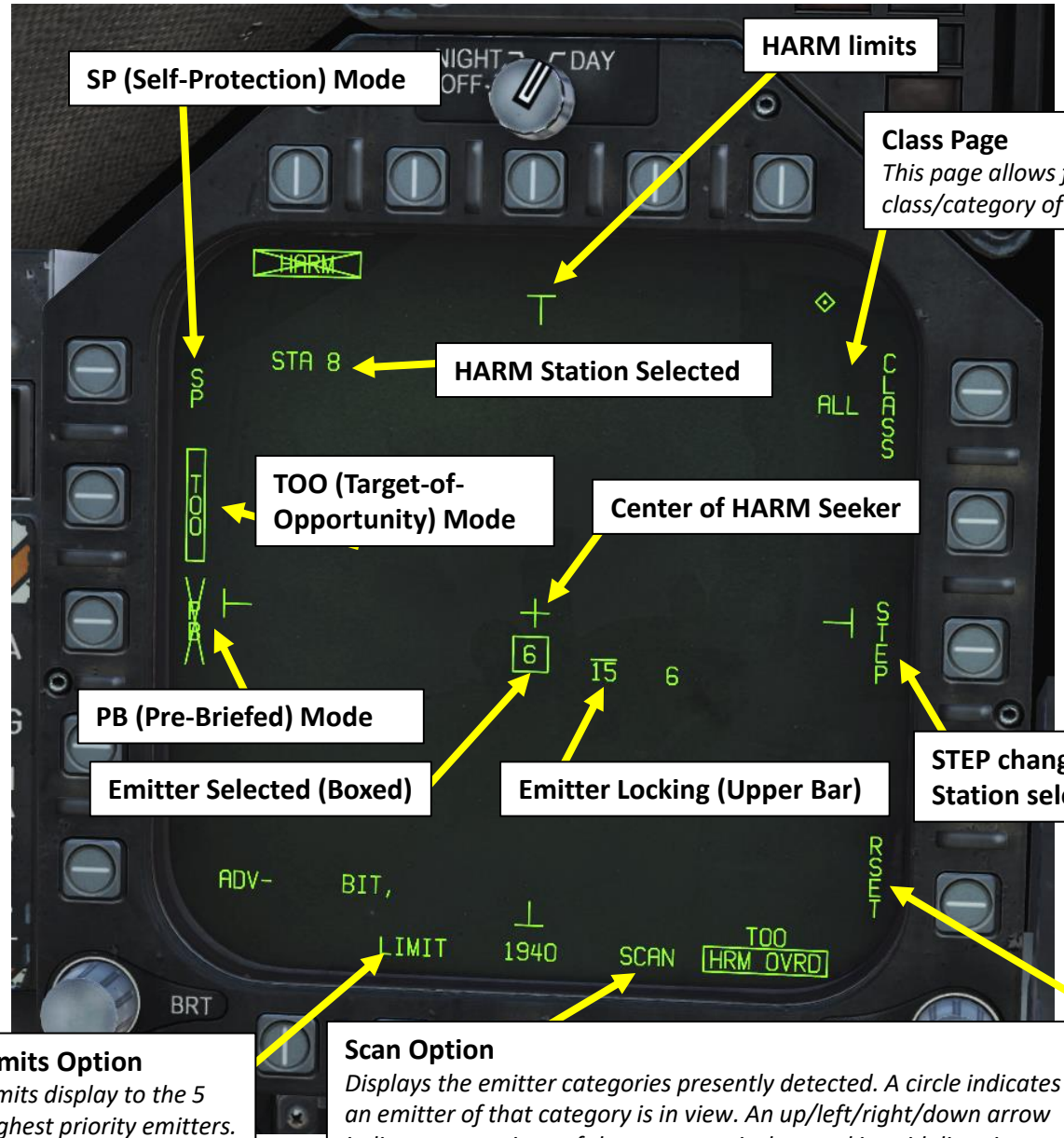


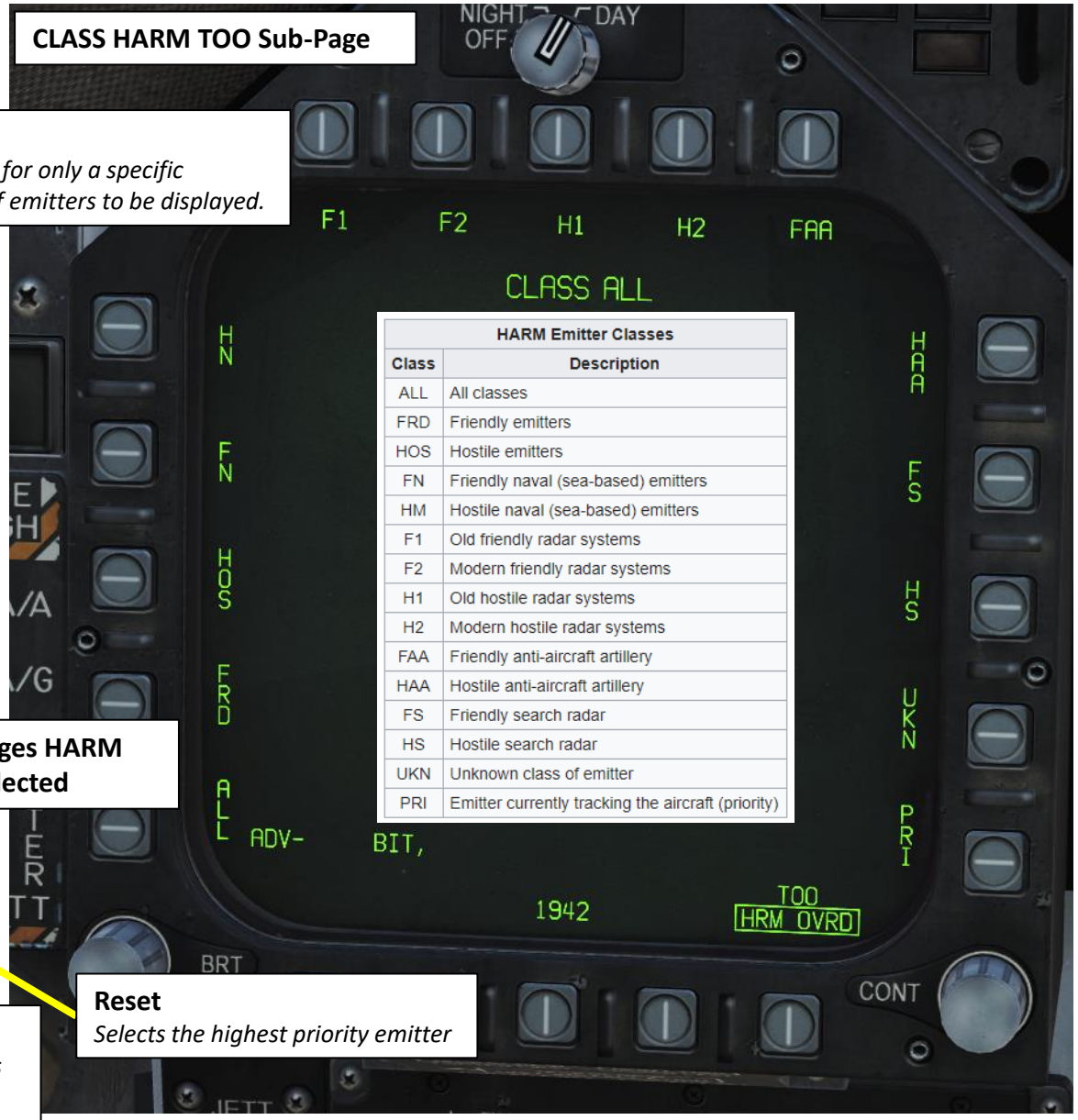




2.9.1 – AGM-88C HARM
(TOO, Target-of-Opportunity Mode)

HARM DISPLAY Notes
Friendly emitters have their code prefixed with an "F". The Upper Line on an emitter means the emitter is locking you. The Lower Line is used to denote a sea-based emitter.

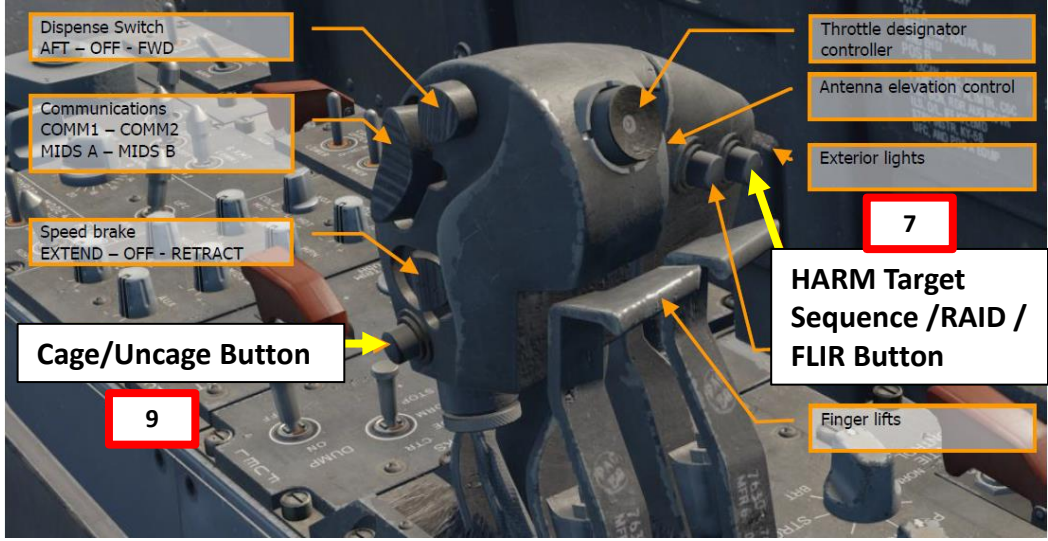


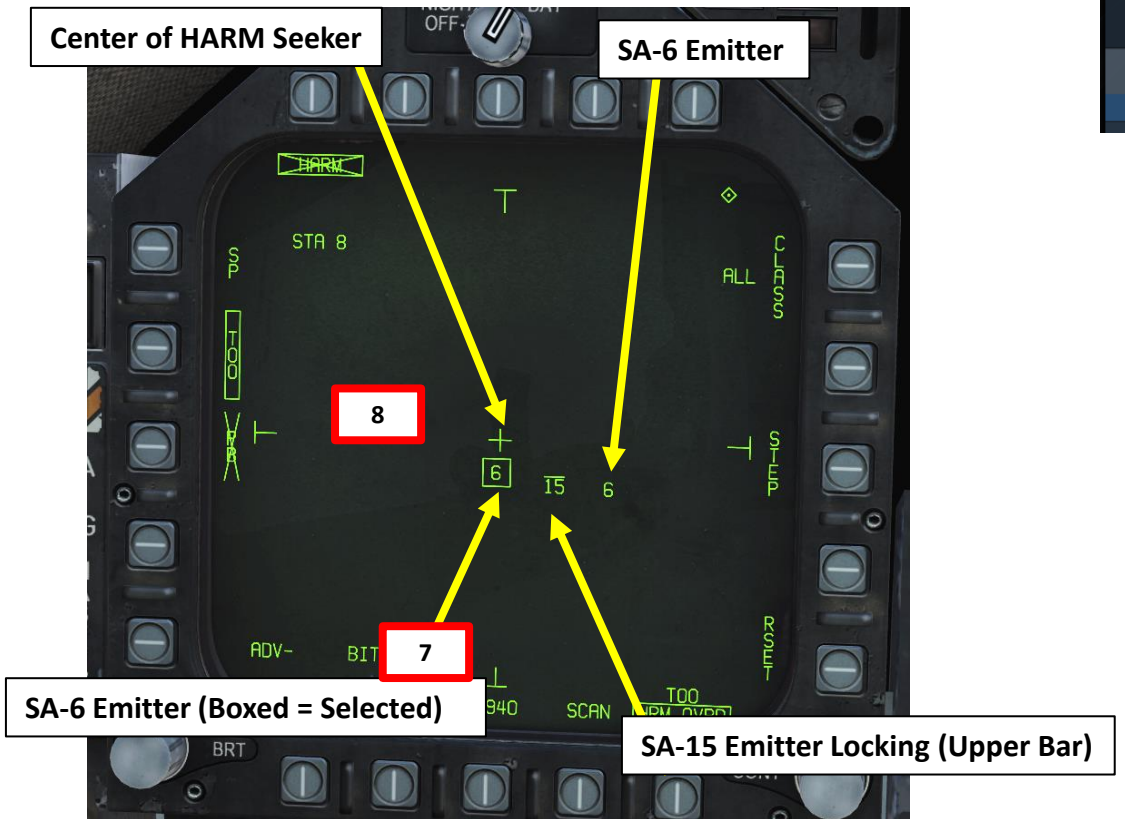


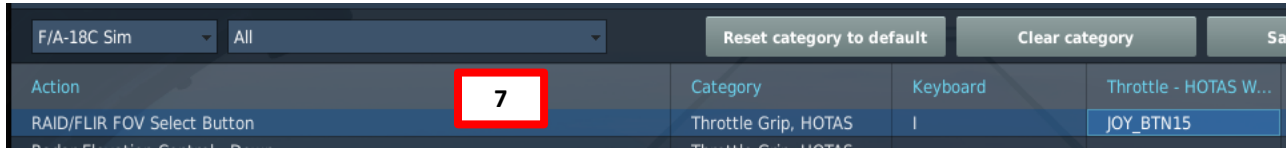
HARM Emitter Classes	
Class	**Description**
ALL	All classes
FRD	Friendly emitters
HOS	Hostile emitters
FN	Friendly naval (sea-based) emitters
HM	Hostile naval (sea-based) emitters
F1	Old friendly radar systems
F2	Modern friendly radar systems
H1	Old hostile radar systems
H2	Modern hostile radar systems
FAA	Friendly anti-aircraft artillery
HAA	Hostile anti-aircraft artillery
FS	Friendly search radar
HS	Hostile search radar
UKN	Unknown class of emitter
PRI	Emitter currently tracking the aircraft (priority)

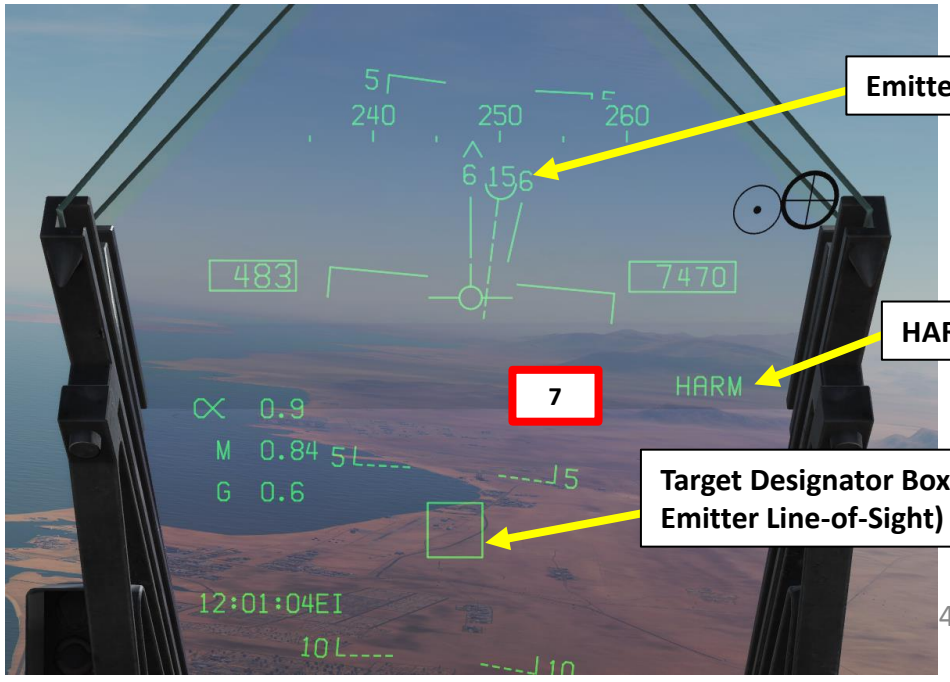
2.9.1 – AGM-88C HARM (TOO, Target-of-Opportunity Mode)

7. Select which emitter you want to track by pressing the HARM Target Sequence / RAID / FLIR Button ("I" binding). There is no range information available.
8. Fly to align the target icon with the center cross of the seeker head. **Note**: The HARM Display page is not a Top-Down view; it's a POV (Point-of-View) of the HARM seeker head with no ground stabilization. HARM DSPLY format provides a boresight view of the HARM seeker.
9. Press the Cage/Uncage Button to uncage the HARM and set it to HANDOFF (H-OFF) Mode. When uncaged, the missile will attempt to lock onto the selected target within the seeker center. The HARM has a range of up to 80 nm.
10. When lock is acquired by the HARM, the HARM crossed-out indication will disappear. Hold the Weapon Release Button (« RALT+SPACE ») to fire missile.





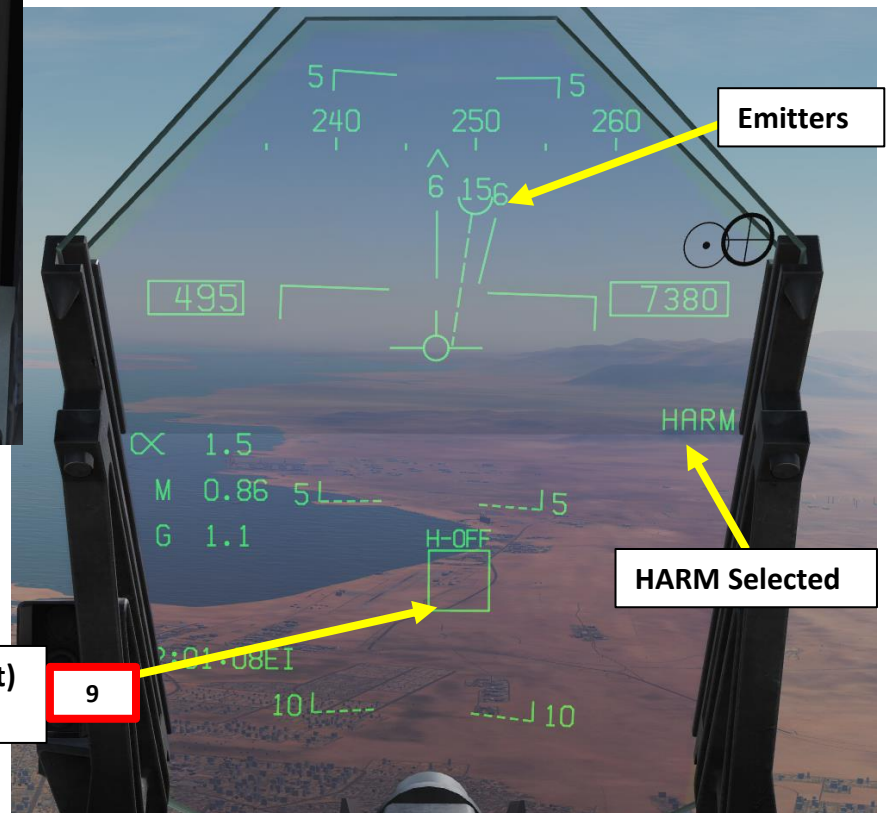




2.9.1 – AGM-88C HARM
(TOO, Target-of-Opportunity Mode)





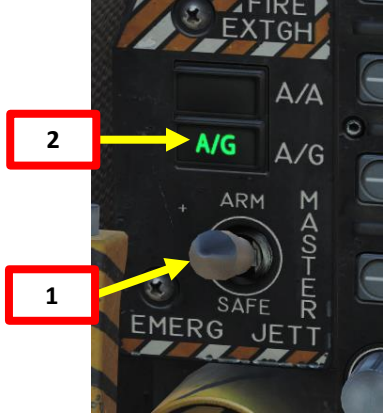


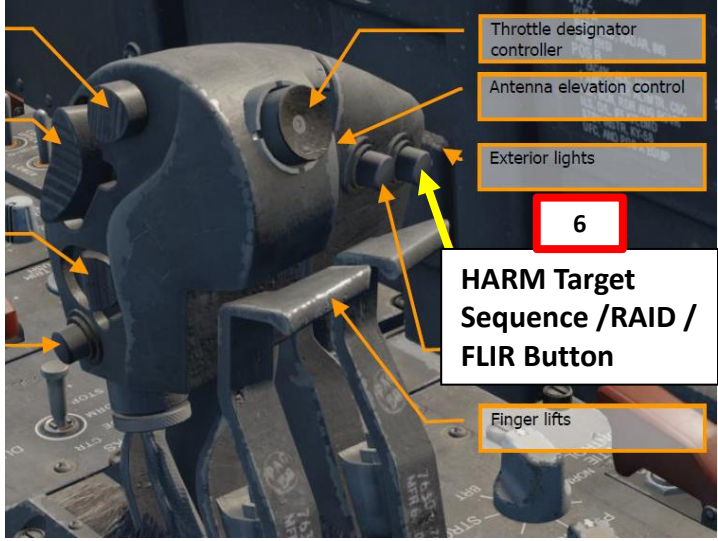


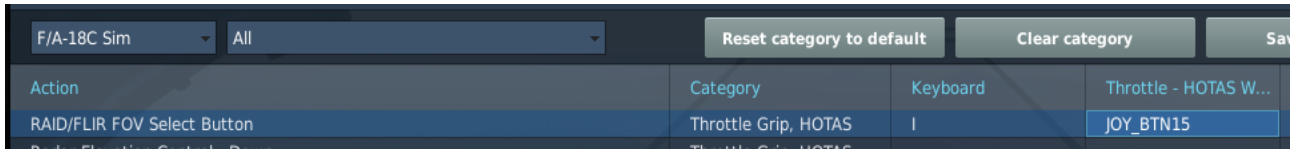
Target Designator Box (Selected Emitter Line-of-Sight) in HANDOFF (H-OFF) Mode

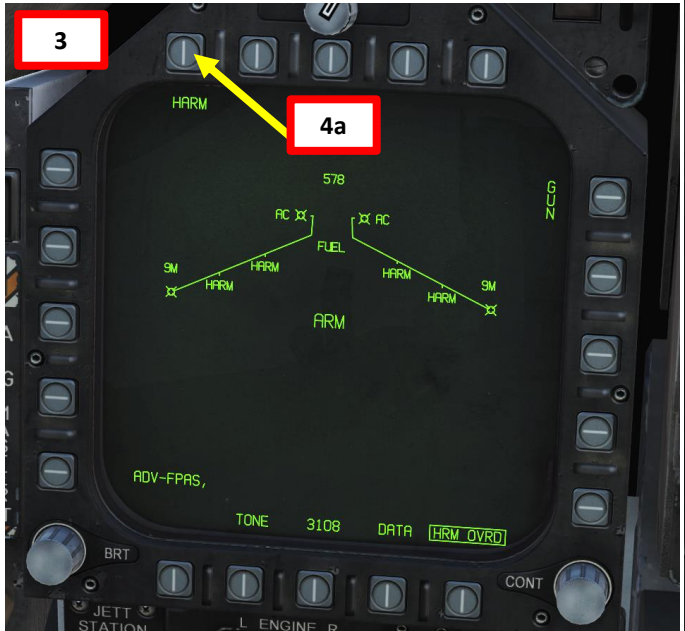
2.9.2 – AGM-88C HARM (SP, Self-Protection Mode)

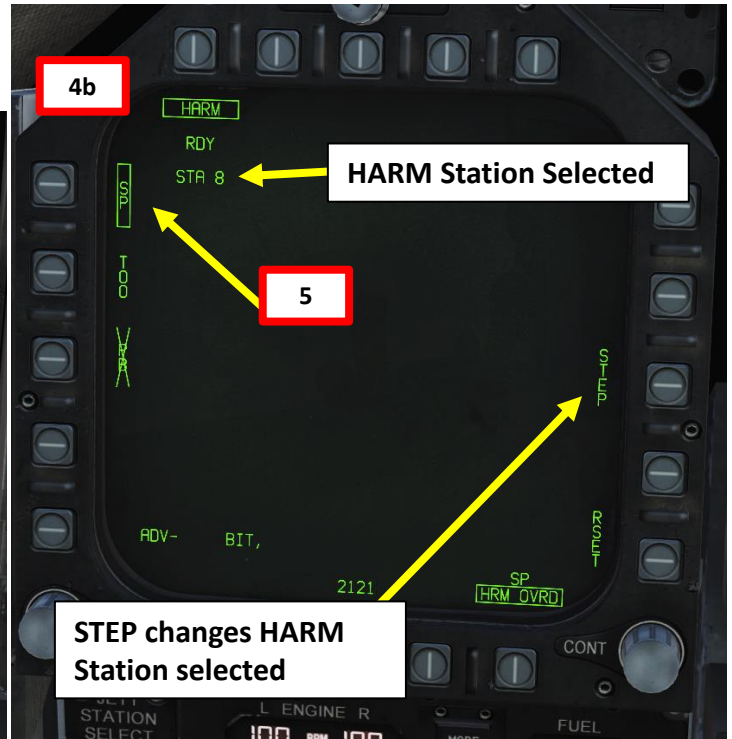
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Set the TAC EW (Early Warning) page on the right DDI and the SMS (Stores Management System) page on the left DDI.
4. In SMS (Stores Management System) page, click on the OSB next to HARM to select it
5. Select SP (Self-Protection) Mode
6. Consult the HUD, RWR or EW page ands select which emitter you want to track by pressing the HARM Target Sequence / RAID / FLIR Button ("I" binding). There is no range information available.

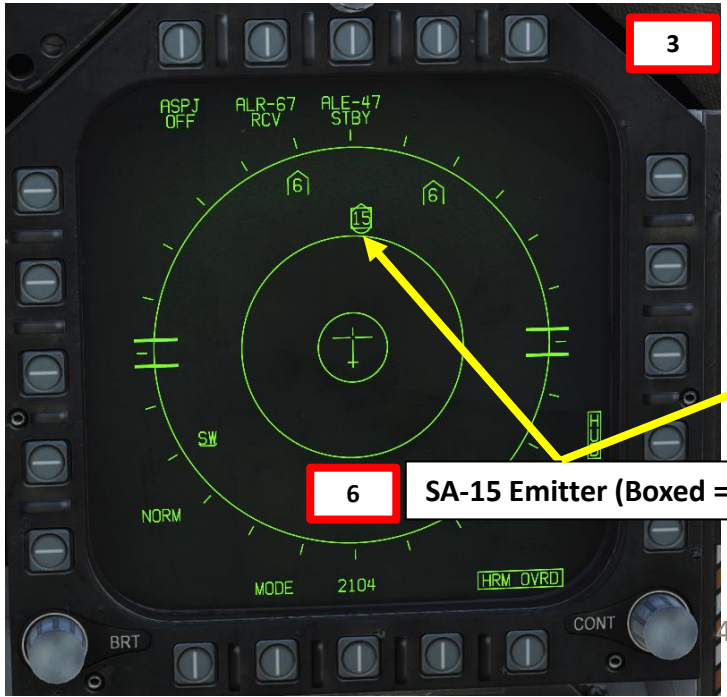












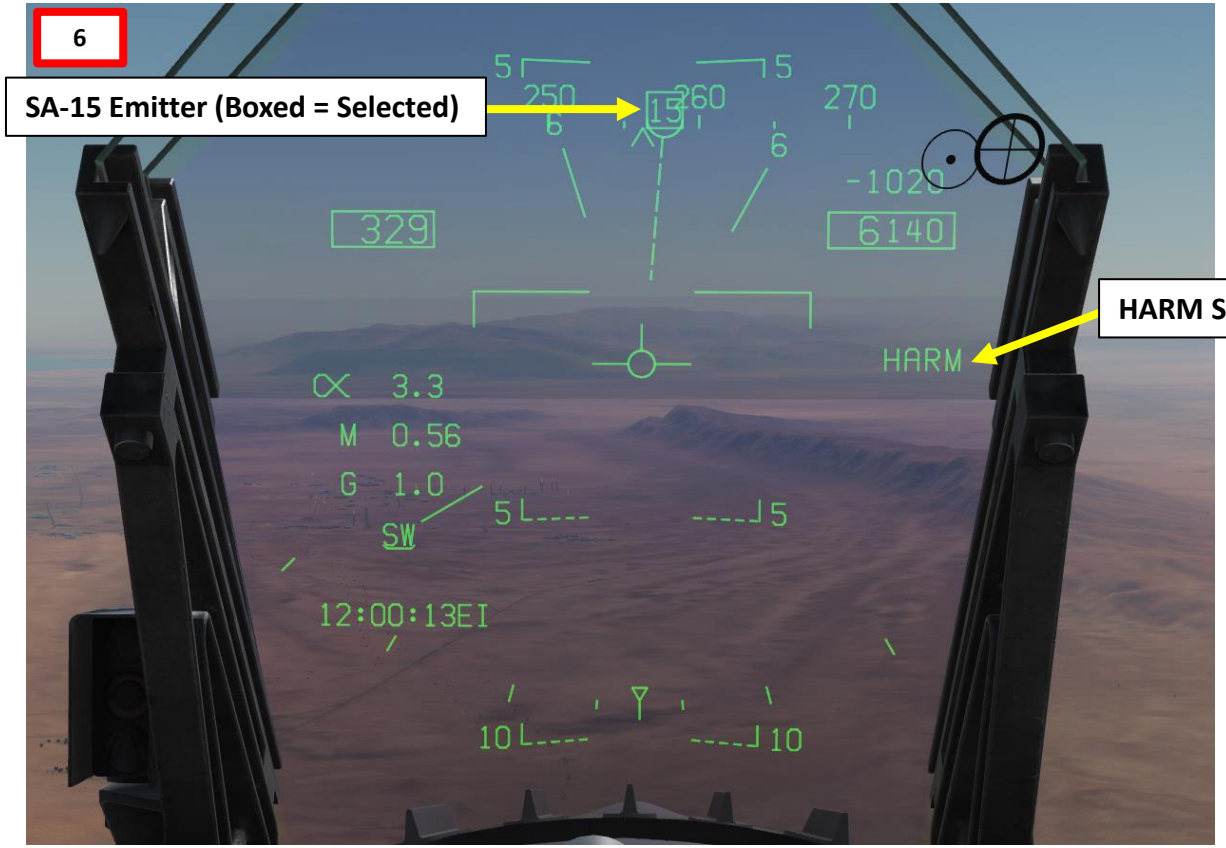


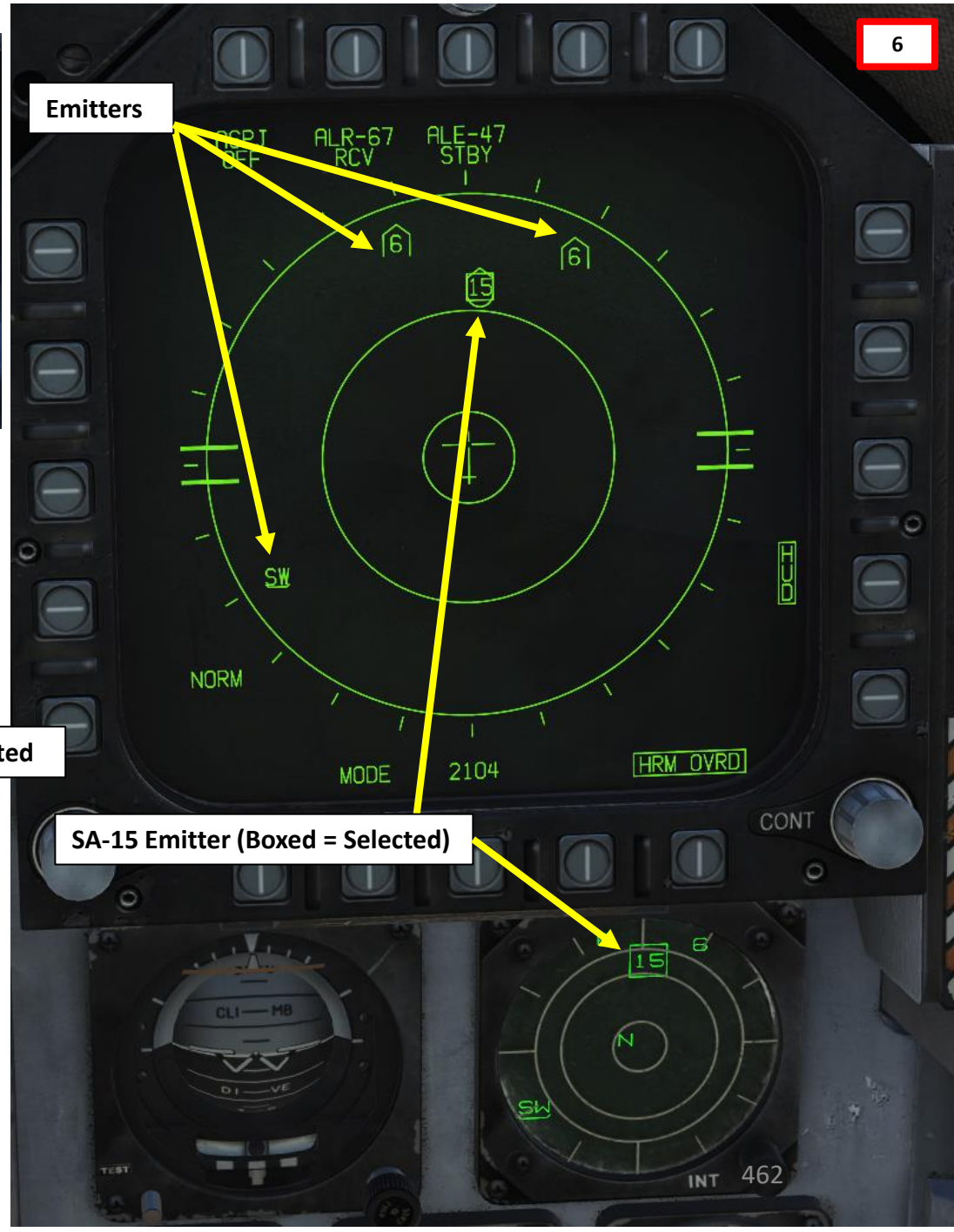
2.9.2 – AGM-88C HARM (SP, Self-Protection Mode)

7. Hold the Weapon Release Button (« RALT+SPACE ») to fire missile.

Note: SP Mode allows for 360° engagement; however, more kinetic energy is sacrificed to turn as the angle increases. Self-Protect is named as such because it is primarily designed for quick reaction to a threat. On these three RWR displays, whenever the HARM and SP mode is selected, a square is placed around the selected emitter; the highest priority emitter is selected automatically. Note that a maximum of 6 emitters are displayed on the HUD, but the HARM will always cycle all emitters. Once fired, the HARM will either have already acquired the selected emitter or, if it is outside the HARM seeker field of view, it will acquire it post-launch.







2.9.2 – AGM-88C HARM (SP, Self-Protection Mode)









2.9.2 – AGM-88C HARM (SP, Self-Protection Mode)

Pullback Sub-Mode

When the RWR (Radar Warning Receiver) detects a critical threat (either a tracking radar lock, active missile radar lock, or semi-active radar illumination), **the Self-Protect Pullback mode will automatically select and prepare a HARM for launch against the detected threat**. This is very useful if you are currently using another weapon type and do not have time to manually select your HARM.

Take note that this functionality is inhibited by default; Pullback mode must be enabled by unboxing the HRM OVRD option on the STORES format page. Pullback mode will activate regardless of master mode (A-A or A-G) if the HRM OVRD option is unboxed.

In this example, we will take a scenario where we are flying a CAS mission and we are currently looking for tanks with a Maverick missile already selected.

1. Master Arm switch – ARM (UP). Make sure HARM missile is powered.
2. In SMS (Stores Management System) page, click on the OSB next to HRM OVRD to « unbox » it and make Self-Protect Pullback mode active in the process.



HRM OVRD Boxed: Pullback Mode Inactive

2a



2b

HRM OVRD Unboxed: Pullback Mode Active



2.9.2 – AGM-88C HARM (SP, Self-Protection Mode)

Pullback Sub-Mode

3. Once **HRM OVRD is unboxed** and a **critical threat (tracking radar lock, active missile radar lock, or semi-active radar illumination) is detected by the RWR**, Pullback mode will activate automatically and the text "HARM" will appear on the HUD and Stores format.
4. If "HARM" is displayed with no X, pressing the Weapon Release button will immediately launch a HARM against the threat. You do not need to change master mode or select the HARM.

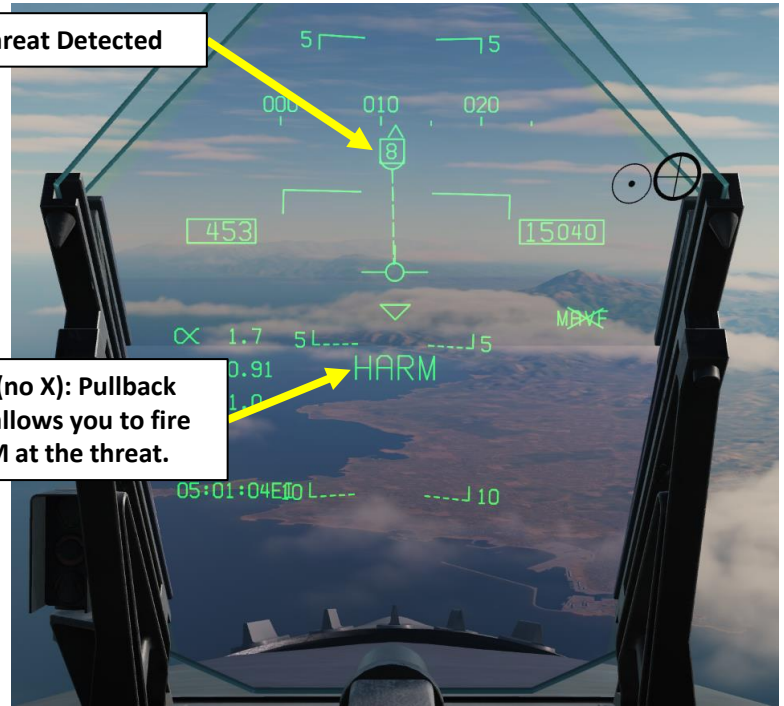
Notes

- Because the HARM has no ranging capability and is not slewed with another sensor in SP mode, there is no range to target provided.
- The HARM is best used at 30,000 feet AGL and above to maximize range.
- If the targeted radar turns off, the HARM will lose guidance and will likely not hit the target.











2.9.2 – AGM-88C HARM (SP, Self-Protection Mode)

Pullback Sub-Mode

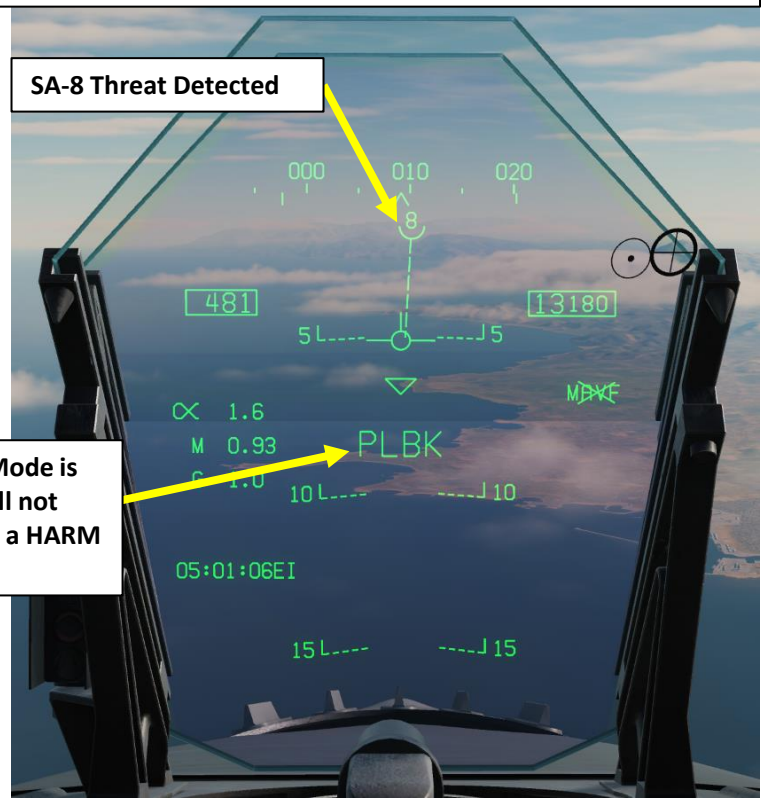
Notes:

- If Pullback Mode is inhibited (HRM OVRD is boxed) and a **critical threat (tracking radar lock, active missile radar lock, or semi-active radar illumination) is detected by the RWR,** the "PLBK" label is displayed. Pressing the Weapon Release button will not fire a HARM missile and result in a X-ed out "HARM" label to be displayed.
- The "HARM" label is X-ed out if the missile is not ready for launch (not powered on, MASTER ARM off, etc.).



Scenario: Pullback Mode is inhibited and a critical threat is detected.
Weapon Release button is not pressed.





Scenario: Pullback Mode is inhibited.
Weapon Release button is pressed: No HARM is launched.



2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

1 – Pre-Briefed Mode Introduction

The HARM pre-briefed mode provides an optimal HARM flight profile against emitters whose location is already known. This is the most precise method of using a HARM, especially against strongly defended areas.

HARM pre-briefed setup requires a target designation (waypoint designation or any other sensor designation) and a Target Code that identifies the signal characteristics of the emitter the HARM seeker will search for. These codes are listed in the **Target Codes Table**.

There are two release (pull-up) modes available:

- **A/C Pull-up**: the aircraft performs a pull-up maneuver while aligned with the ASL (Azimuth Steering Line). An A/C pull-up cue is displayed along the ASL at the calculated pull-up pitch angle. With the Weapon Release button held depressed, the pullup maneuver is performed by the aircraft and the HARM is automatically launched once the velocity vector intersects the pull-up cue.

- **HARM Pull-up**: a HARM pull-up cue (opposed chevrons) is displayed and referenced to the velocity vector. When displayed above the velocity vector, indicates the aircraft is outside of HARM pull-up range. Once they intersect the velocity vector, HARM may be launched with the Weapon Release button and the HARM will perform the pull-up maneuver.

Note: both release cues are always displayed regardless of selected release mode.
In range cues are provided in the HUD and PB format. TOF (Time-of-Flight) cues are provided in the PB format (prelaunch, postlaunch and differential TOF).

Pre-Briefed HARM - Target Codes Table

EWR 1L13 S	101	SAM Roland SR RO	205
EWR 55G6 S	102	SAM Hawk CWAR AN/MPQ-55 HK	206
SAM SA-10 S-300PS SR 5N66M CS	103	AAA Gepard A	207
SAM SA-10 S-300PS SR 64H6E BB	104	AAA Vulcan M163 A	208
SAM SA-11 Buk SR 9S18M1 SD	107	CV 1143.5 Admiral Kuznetsov SW	301
SAM SA-6 Kub STR 1S91 6	108	CV 1143.5 Admiral Kuznetsov (2017) SW	320
CP 9S80M1 Sborka DE	109	CG 1164 Moskva T2	303
SAM SA-10 S-300PS TR 30N6 10	110	FFL 1124.4 Grisha HP	306
SAM SA-11 Buk LN 9A310M1 11	115	FF 1135M Rezky TP	309
SAM SA-8 Osa 9A33 8	117	FSG 1241.1MP Molniya PS	312
SAM SA-13 Strela-10M3 9A35M3 13	118	CGN 1144.2 Piotr Velikiy HN	313
SAM SA-15 Tor 9A331 15	119	Ticonderoga class AE	315
SAM SA-19 Tunguska 2S6 19	120	FFG 11540 Neustrashimy TP	319
AAA ZSU-23-4 Shilka A	121	Oliver Hazzard Perry class 49	401
SAM SR P-19 S	122	CVN-70 Carl Vinson SS	402
SAM SA-3 S-125 TR SNR 3	123	CVN-71 Theodore Roosevelt SS	403
Rapier FSA Blindfire Tracker RP	124	CVN-72 Abraham Lincoln SS	404
Rapier FSA Launcher RT	125	CVN-73 George Washington SS	405
SAM SA-2 TR SNR-75 Fan Song 2	126	CVN-74 John C. Stennis SS	406
HQ7 Self-Propelled LN 7	127	LHA-1 Tarawa	407
HQ7 Self-Propelled STR HQ	128	Type 071 Amphibious Transport Dock PS	408
SAM Roland ADS RO	201	Type 052B Destroyer MR	409
SAM Patriot STR AN/MPQ-53 P	202	Type 052C Destroyer HN	410
SAM Hawk SR AN/MPQ-50 HK	203	Type 054A Frigate MR	411
SAM Hawk TR AN/MPQ-46 HK	204		

2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

2 – Weapon Preparation

1. Designate a point where the radar emitter is expected to be. This can be done with a Waypoint Designate (WPDSG) or any other method of designation (with a Targeting Pod for instance).
2. In our case, we will designate Waypoint 2 as the expected target location. Go to the HSI (Horizontal Situation Indicator) page, select Waypoint 2 with the selector arrows, then press OSB next to WPDSG.

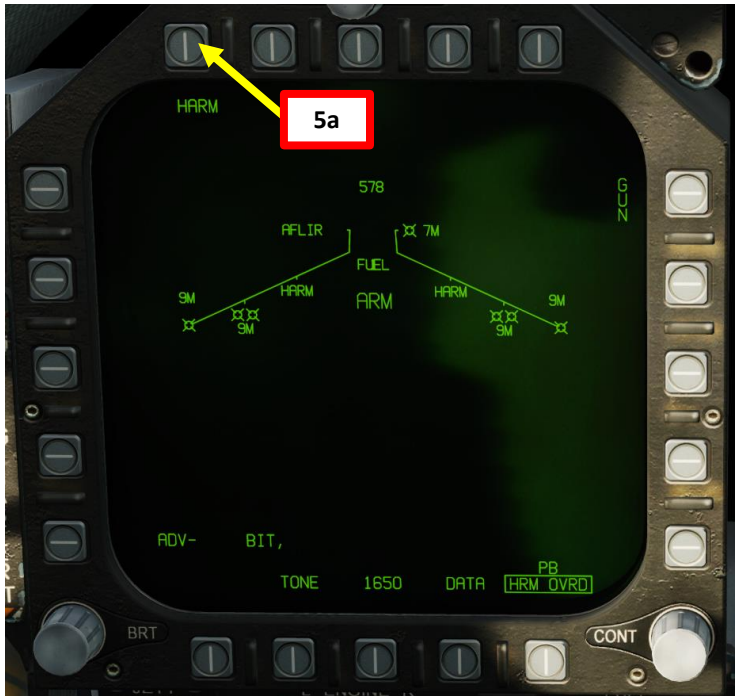


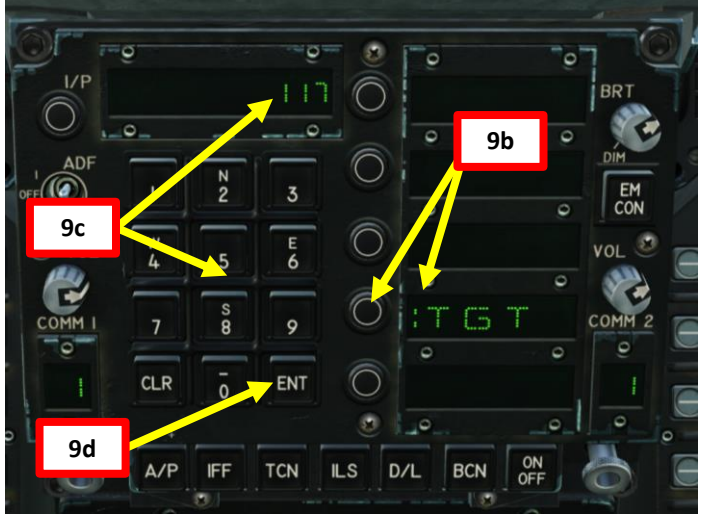


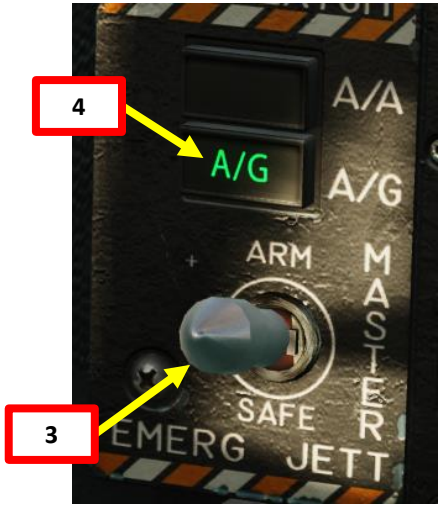
2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

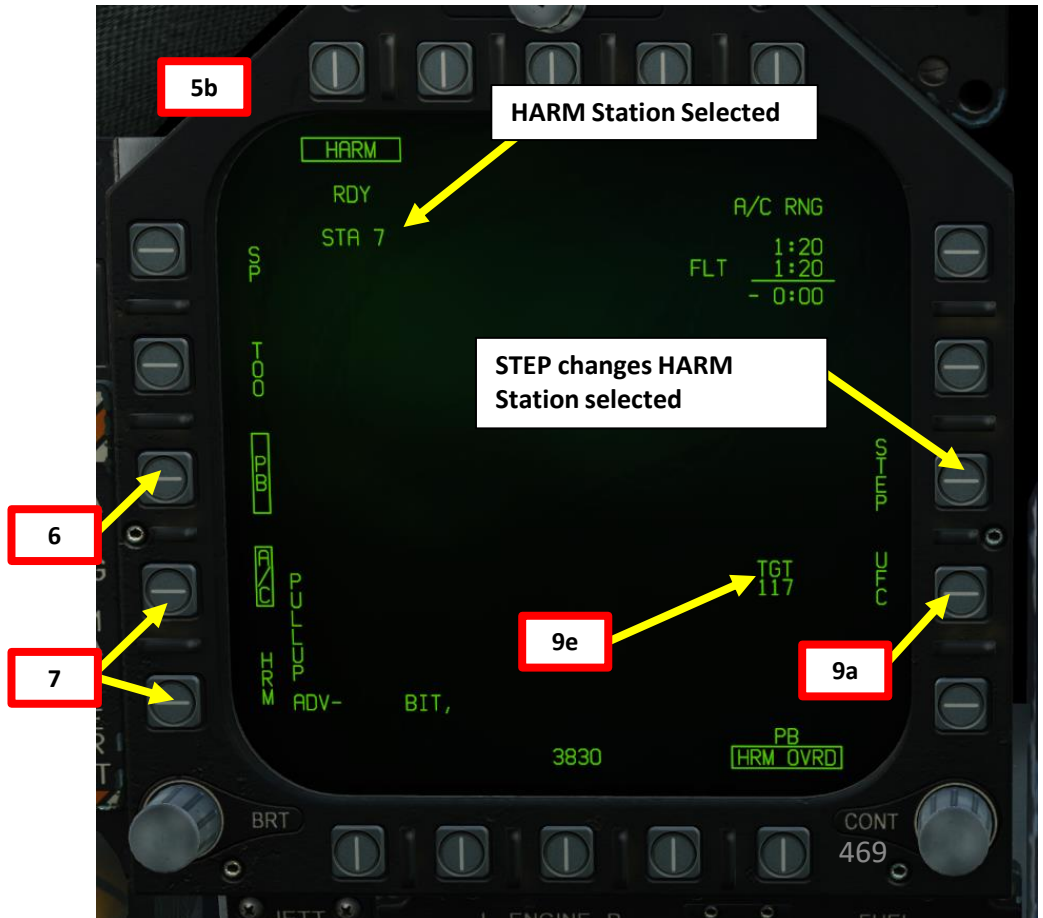
2 – Weapon Preparation

3. Master Arm switch – ARM (UP)
4. Master Mode – A/G
5. In SMS (Stores Management System) page, click on the OSB next to HARM to select it
6. Select PB (Pre-Briefed) Mode
7. Select desired Pull-Up mode
    - A/C (Aircraft Pull-Up): Aircraft pulls up and lofts the missile towards the selected target point.
    - HRM (HARM Pull-Up): Missile lofts towards the selected target point.
8. Determine Target Code with the Target Codes Table listed in the Introduction section. We expect to attack a SA-8, so the code will be « 117 ».
9. Enter the Target Code with the UFC. Press OSB next to « UFC » (Up-Front Controller), then press OSB next to TGT (displays « : » when selected), type « 117 » on the scratchpad, then press ENT button to enter the target code.





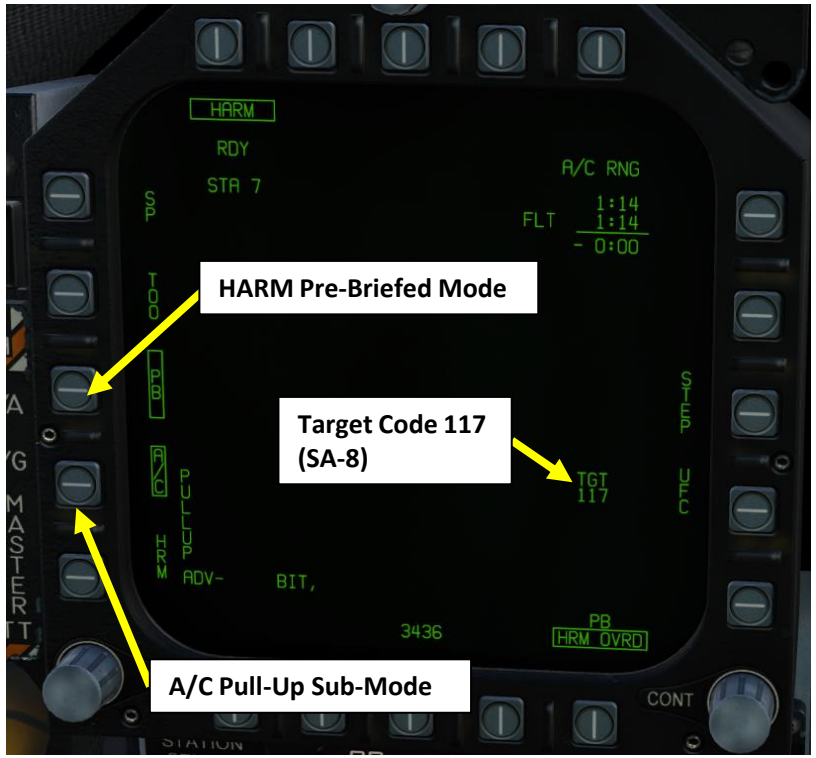




2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

3.A – Weapon Release: A/C Lofting Sub-Mode

Here is a brief overview of the A/C (Aircraft) Lofting attack profile.



HARM Pre-Briefed Mode

Target Code 117 (SA-8)

A/C Pull-Up Sub-Mode



Weapon Release Button

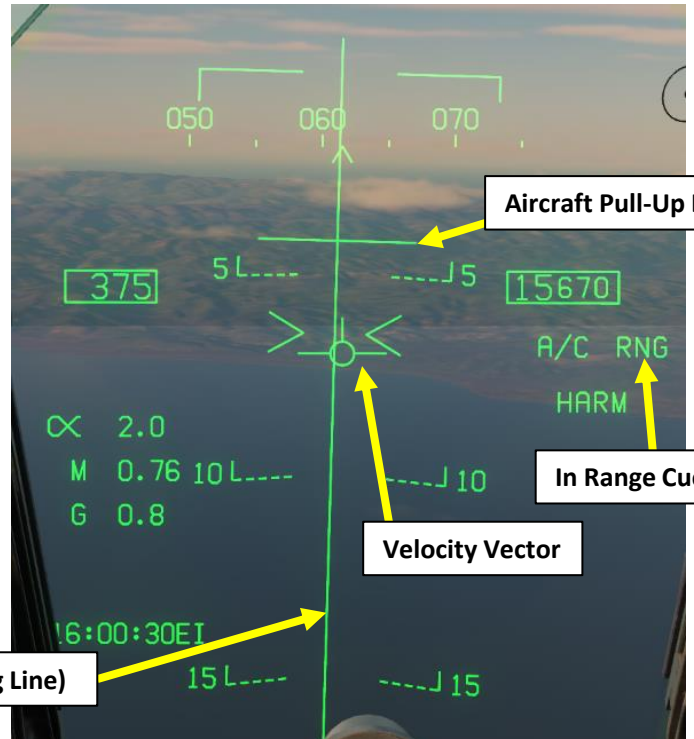
HARM Lofting

HARM Searching for Target (Code 117 = SA-8)

HARM Launches

Keep Velocity Vector aligned on ASL and Aircraft Pull-Up Line

Aircraft In Range: Pull Up
Weapon Release Button Pressed and HELD



Aircraft Pull-Up Line

In Range Cue

Velocity Vector

ASL (Azimuth Steering Line)

Designation Point

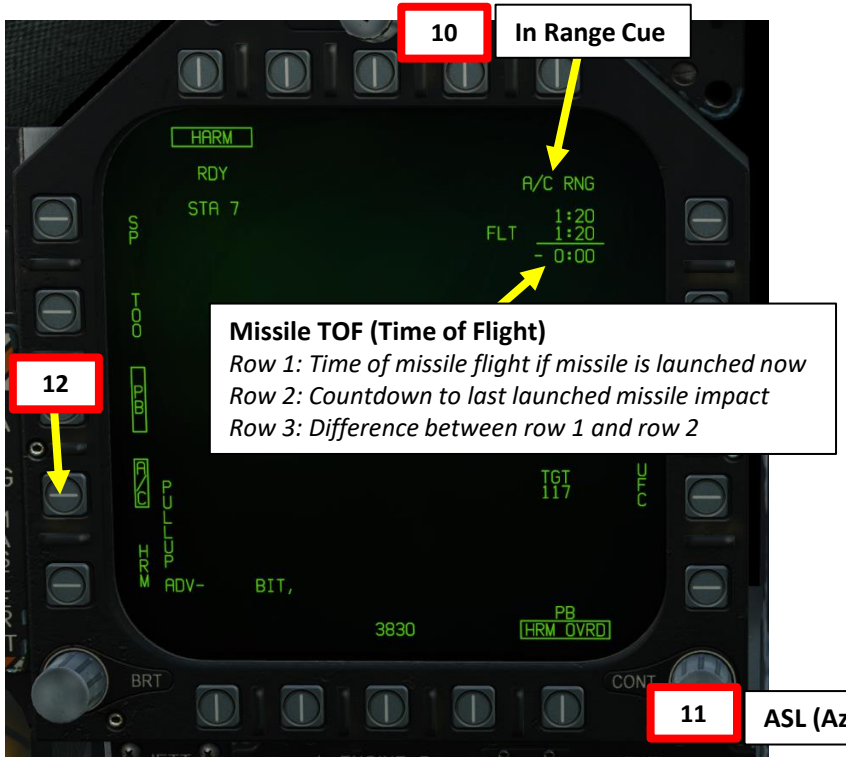
SA-8 SAM Site

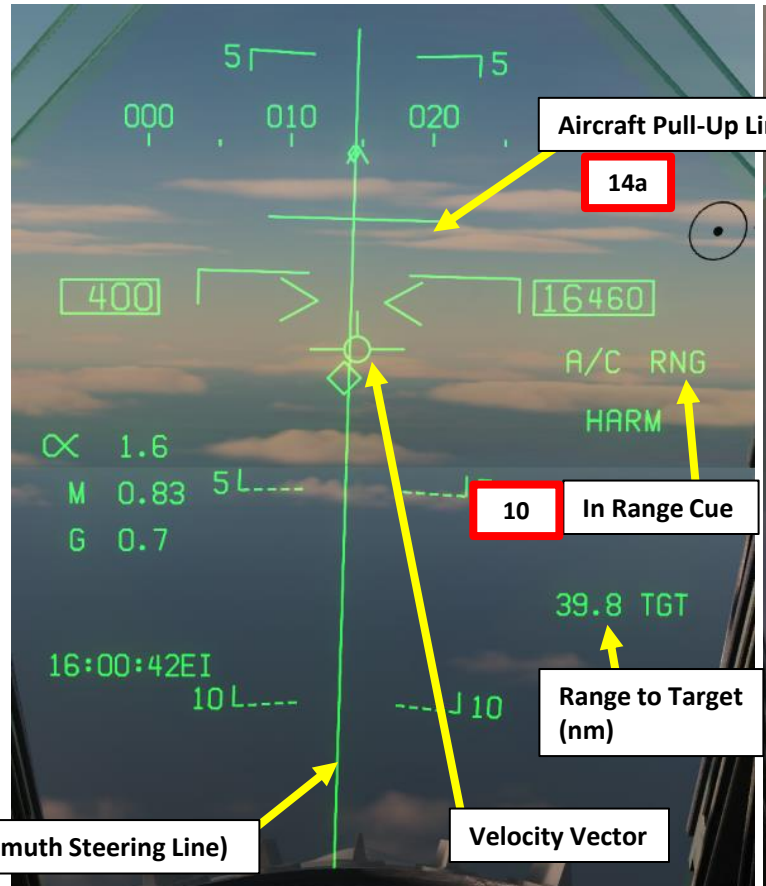
2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

3.A – Weapon Release: A/C Lofting Sub-Mode

10. When aircraft is within firing range to the designation point, « A/C RNG » cue will appear on the HARM page and the HUD.
11. Steer the aircraft to align the velocity vector with the ASL (Azimuth Steering Line).
12. Verify that A/C Pullup sub-mode is selected on the HARM page, then throttle up to full power to maximize aircraft airspeed (which will increase HARM range)
13. Press and hold the Weapon Release Button. Hold the button pressed until missile is launched.
14. Pull the stick back until the velocity vector is vertically aligned with the Aircraft Pull-Up Line.
15. HARM will automatically launch once velocity vector and Aircraft Pull-Up Line intersect.









2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

3.A – Weapon Release: A/C Lofting Sub-Mode

16. Once fired, HARM will search for the selected radar emitter near the designated point.
17. Release Weapon Release button and egress off the target.
18. Monitor EW (Early Warning) page to see if attack was succesful.



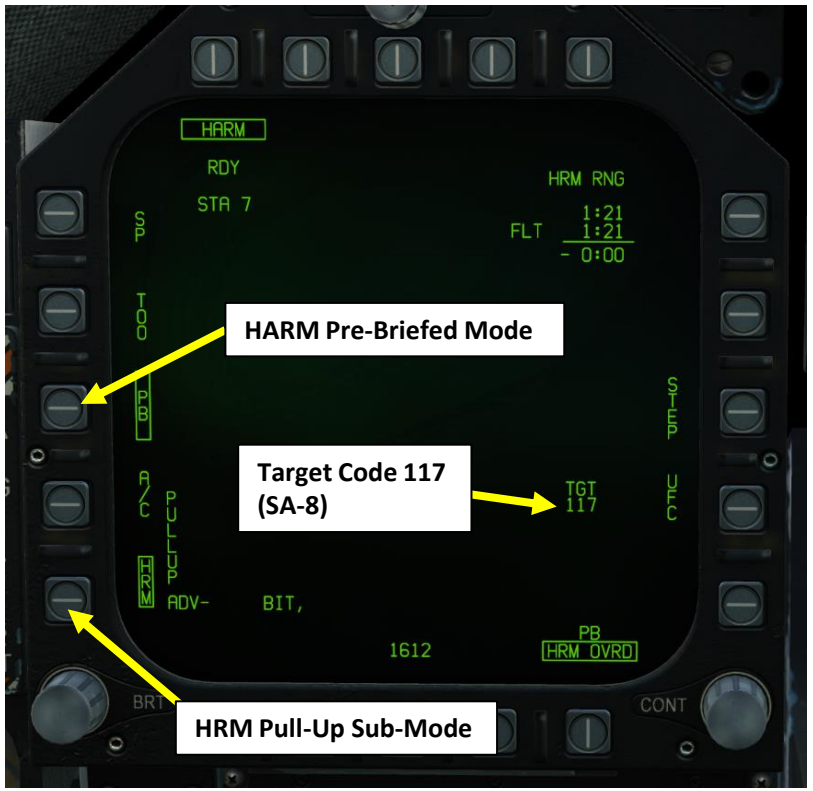




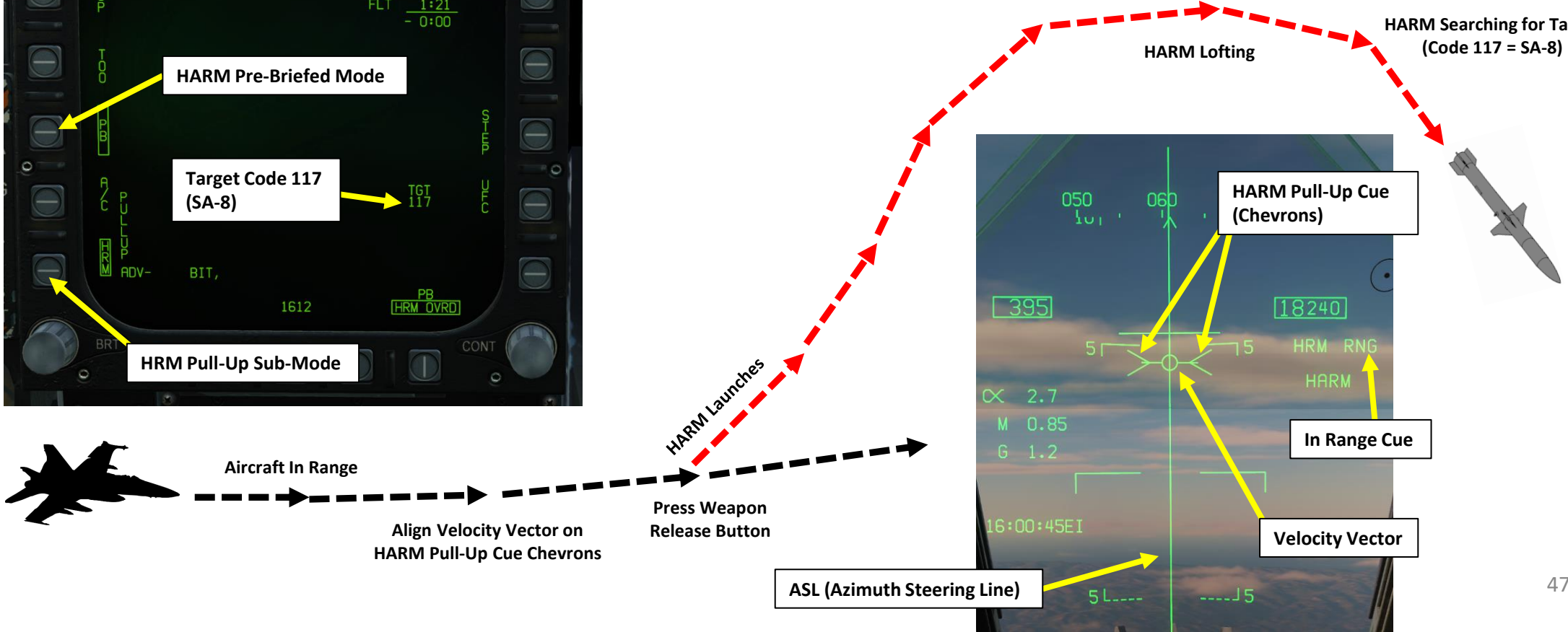
2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

3.B – Weapon Release: HRM Lofting Sub-Mode

Here is a brief overview of the HRM (HARM) Lofting attack profile.







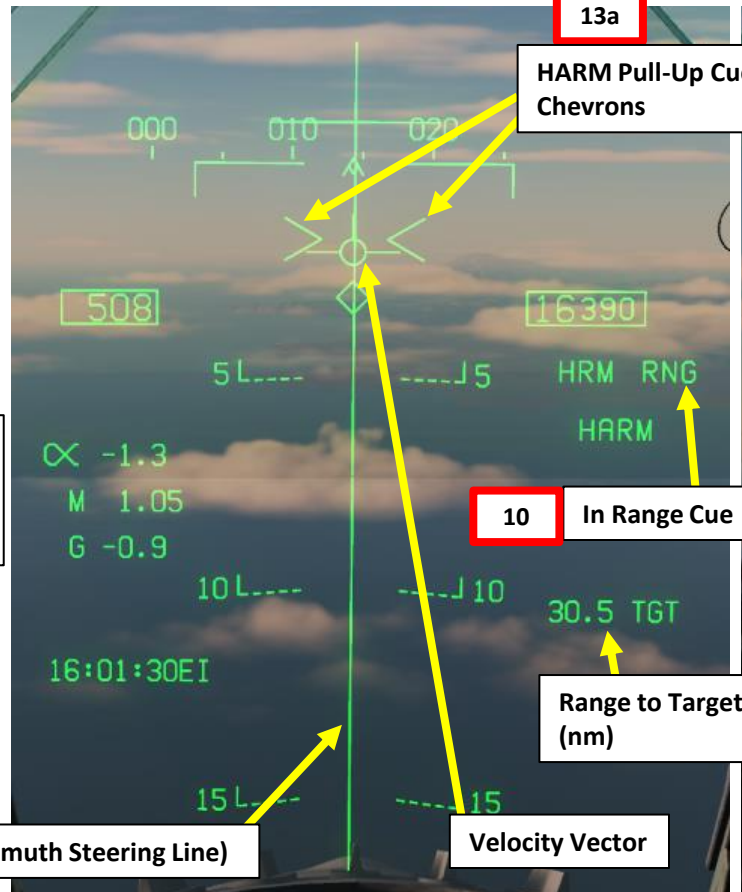
2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

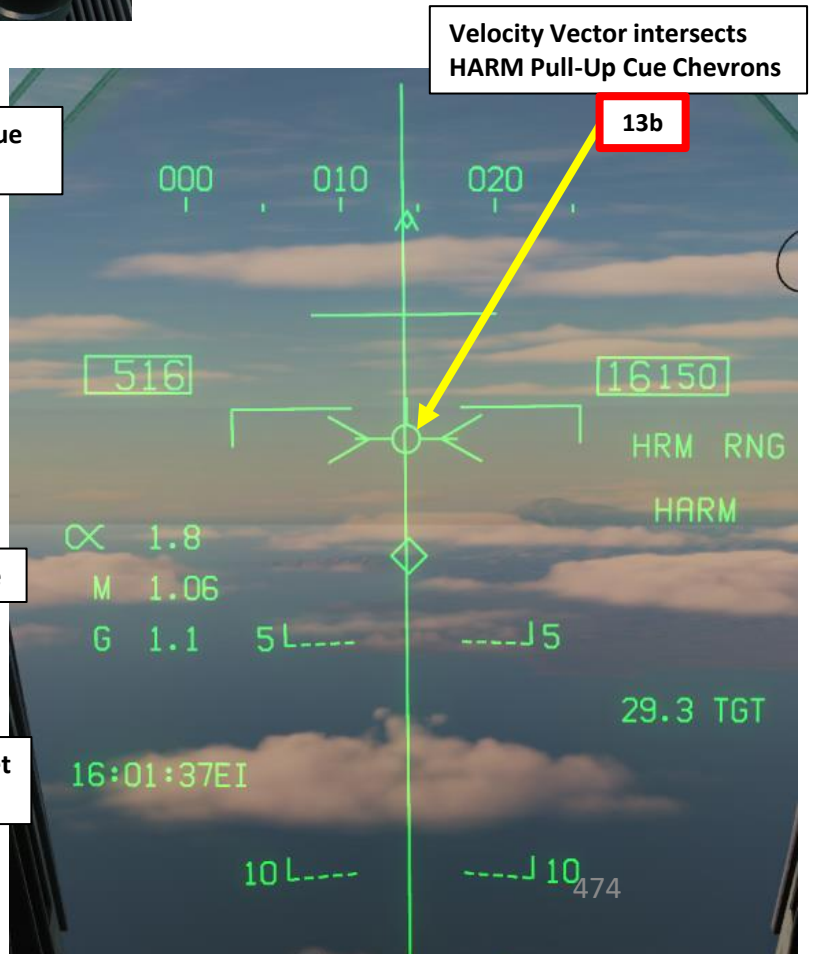
3.B – Weapon Release: HRM Lofting Sub-Mode

10. When aircraft is within firing range to the designation point, « HRM RNG » cue will appear on the HARM page and the HUD.
11. Steer the aircraft to align the velocity vector with the ASL (Azimuth Steering Line).
12. Verify that HRM Pullup sub-mode is selected on the HARM page, then throttle up to full power to maximize aircraft airspeed (which will increase HARM range)
13. Steer the aircraft to align the velocity vector with center of the HARM Pull-Up Cue Chevrons.
14. Press the Weapon Release Button to launch the missile.





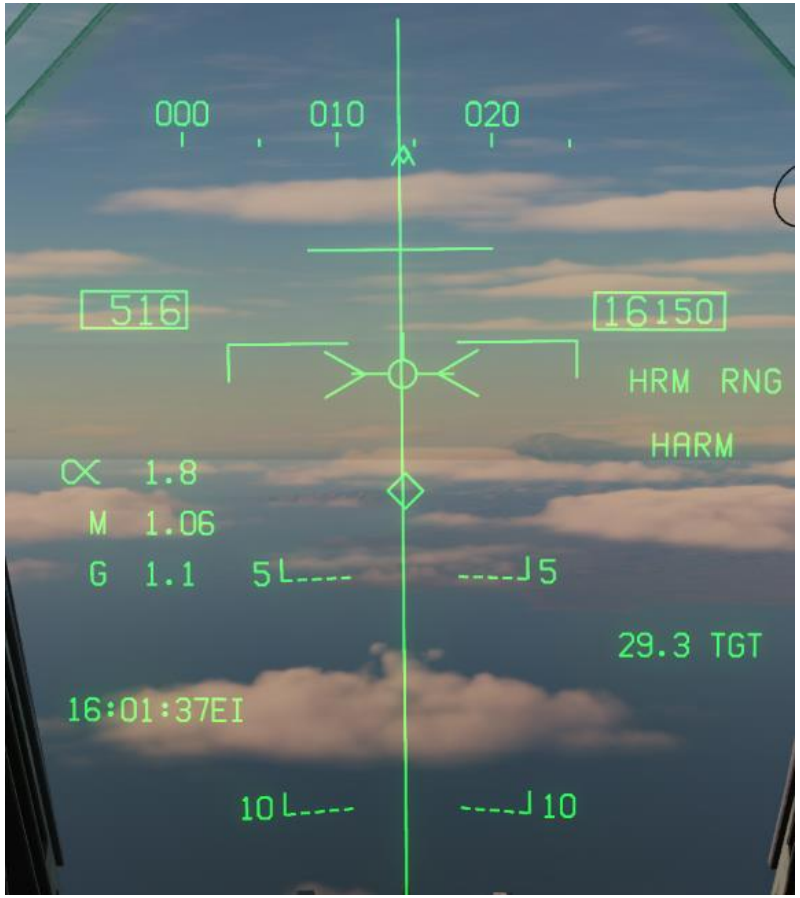




2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)

3.B – Weapon Release: HRM Lofting Sub-Mode

15. Once fired, HARM will loft and search for the selected radar emitter near the designated point.
16. Egress off the target.
17. Monitor EW (Early Warning) page to see if attack was succesful.







2.9.3 – AGM-88C HARM (PB, Pre-Briefed Mode)



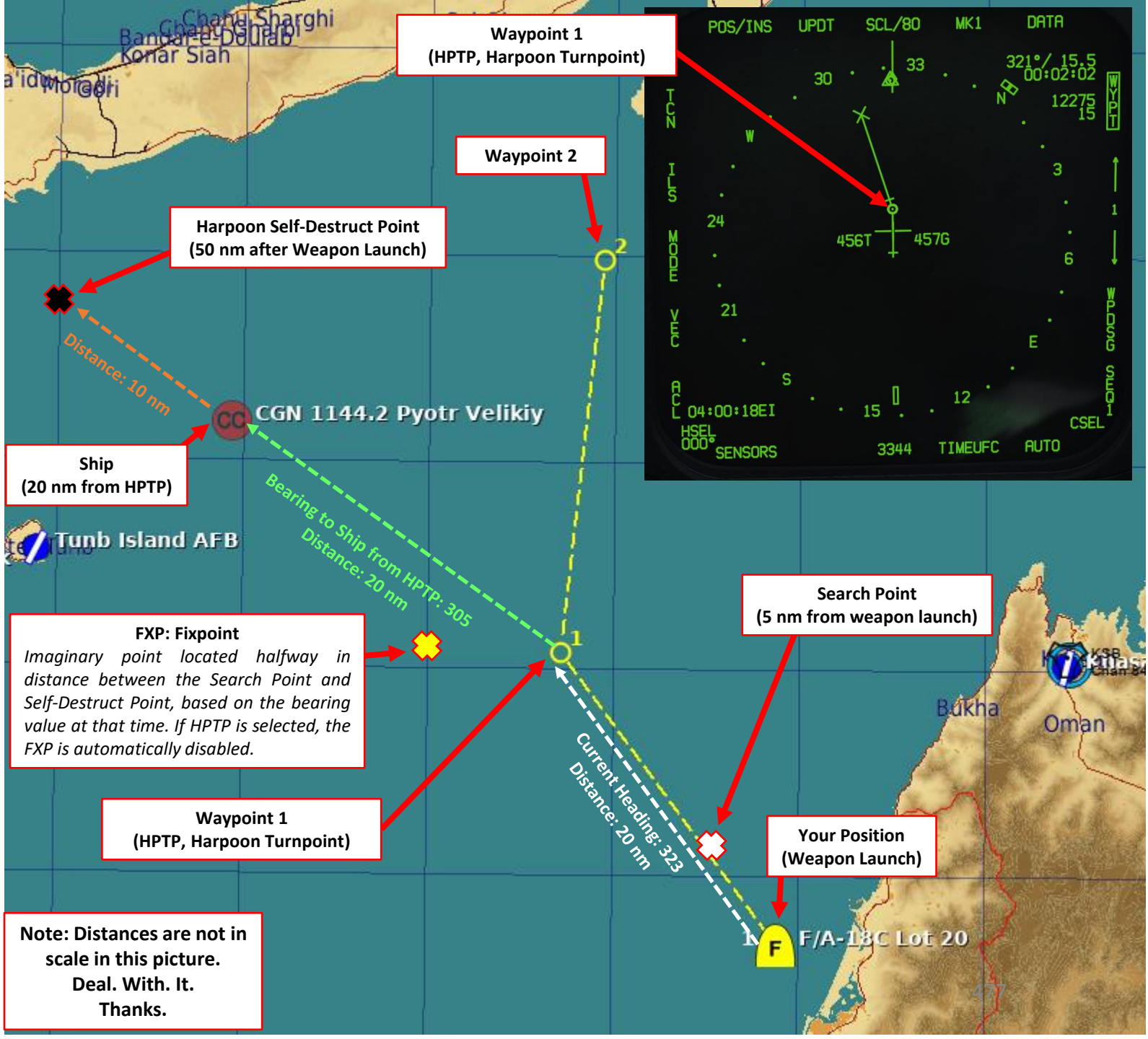


2.10.1 – AGM-84D Harpoon (BOL, Bearing-Only Launch Mode)

The Harpoon is a programmable anti-ship missile. In this tutorial, we will use the BOL (Bearing-Only Launch) mode, which requires us to enter the following parameters:

- **Search Point Distance**: distance from launch to when the Harpoon will begin searching for a target. Valid value is between 0–105 nm.
- **Self-Destruct Distance**: distance the Harpoon will travel after launch before self-destructing if it does not find a target.
- **Bearing to Target**: bearing (in degrees) the Harpoon will travel, if no Harpoon Turnpoint (HPTP) exists, at launch from the aircraft, or if a HPTP does exist, the bearing it will travel from the HPTP.
- **Fly-Out (FLT) Altitude** Option: toggle between HIGH, MED, and LOW. This is the altitude the missile will fly at during the ingress/searching phase of flight. LOW is 5,000 ft, MED is 15,000 ft, and HIGH is 35,000 ft.
- **Terminal (TERM) Altitude** Option: toggle between SKIM and POP. This is the altitude the missile will fly at in the terminal phase of flight to ultimately impact the target. SKIM performs a very low-level approach all the way to impact. POP performs a high-G "pop-up" maneuver to impact the target from above.

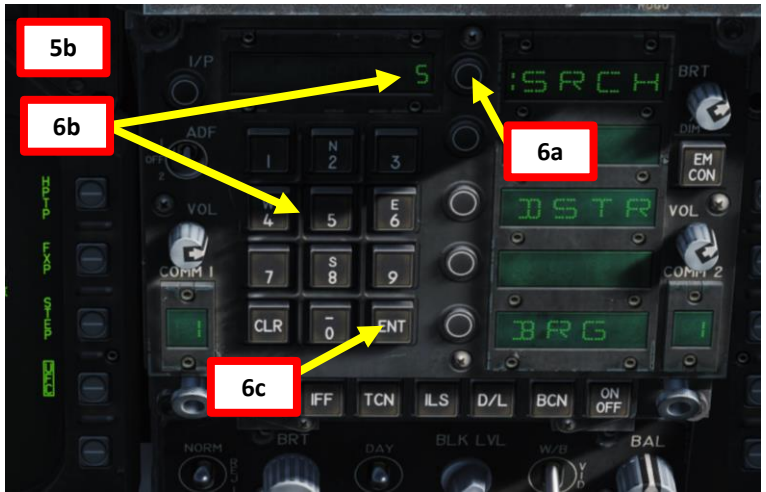


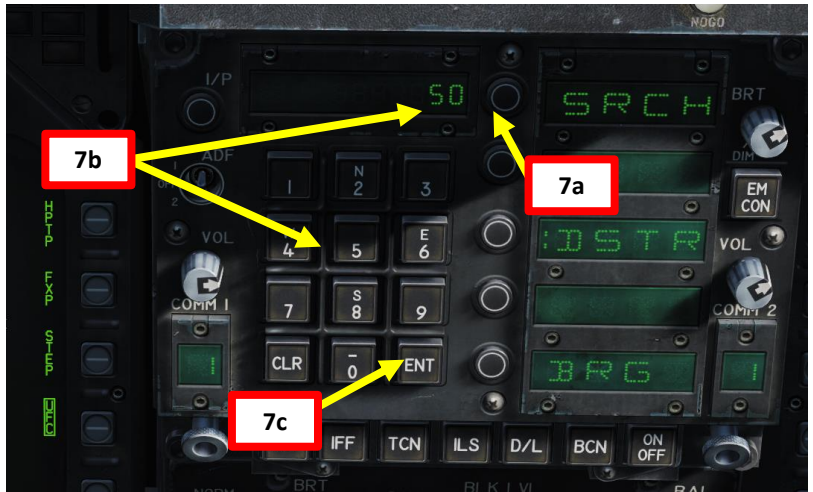


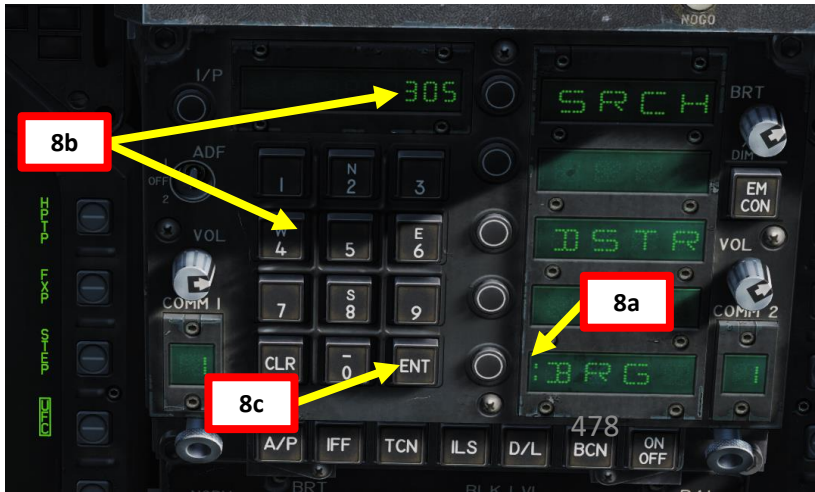
2.10.1 – AGM-84D Harpoon
(BOL, Bearing-Only Launch Mode)

1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. On the SMS (Stores) page, press OSB next to HPD (AGM-84D Harpoon)
4. Harpoon will start an inertial alignment that takes about 25 seconds. You can monitor gyro alignment process on the SMS (Stores Management System) page.
    - **Note:** Once Harpoon alignment is complete, the timer will disappear.
5. Press the OSB next to « UFC » (Up-Front Controller) to program Harpoon release parameters
6. On the UFC, press the button next to “SRCH” (Search Point). A “:” will indicate it is selected. Then, enter on the keypad the desired distance from launch to when the Harpoon will begin searching for a target. Press “ENT” afterwards. In our case, we will choose a Search Point distance of 5 nm.
7. On the UFC, press the button next to “DSTR” (Self-Destruct Distance). A “:” will indicate it is selected. Then, enter on the keypad the desired missile self-destruction distance, and press “ENT”. In our case, we will choose a self-destruction distance of 50 nm.
8. On the UFC, press the button next to “BRG” (Bearing). A “:” will indicate it is selected. Then, enter on the keypad the desired bearing (in degrees) the Harpoon will travel, and press “ENT”. In our case, we will choose a bearing of 305.





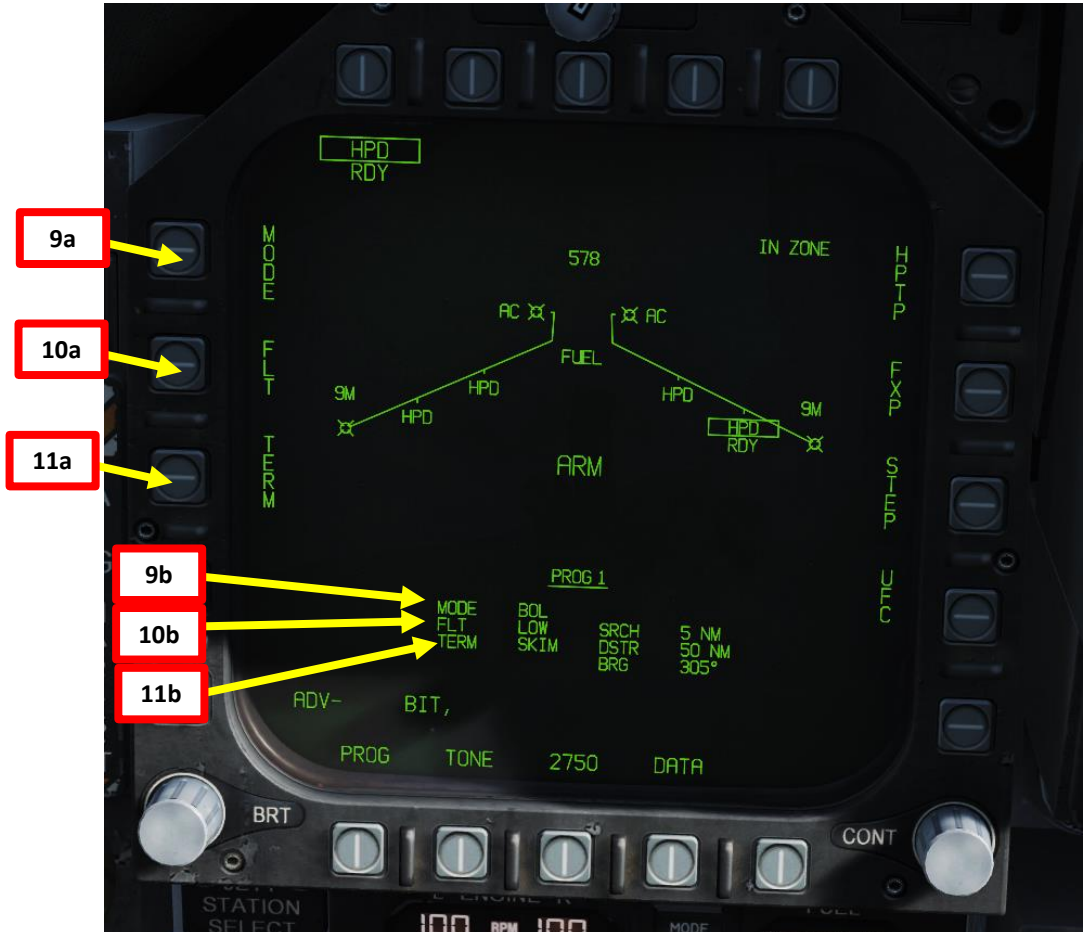




2.10.1 – AGM-84D Harpoon
(BOL, Bearing-Only Launch Mode)

9. Verify “BOL” release mode is selected (can be toggled to R/BL with the OSB next to “MODE” if a target is designated, which we will see in the R/BL tutorial).
10. Press OSB next to “FLT” (Fly-Out Altitude) to toggle between LOW, MED and HIGH. We will choose LOW.
11. Press OSB next to “TERM” (Terminal Altitude) to toggle between SKIM and POP attack profiles. SKIM performs a very low-level approach all the way to impact, while POP performs a high-G "pop-up" maneuver to impact the target from above. In our case, we will choose SKIM.
12. Set HSI (Horizontal Situation Indicator) on the other DDI from the SUPT menu. This will display the Harpoon profile without the use of a FXP (Fixpoint) or a HPTP (Harpoon Turnpoint). This basic profile will launch the missile and make it turn immediately to the bearing programmed earlier.

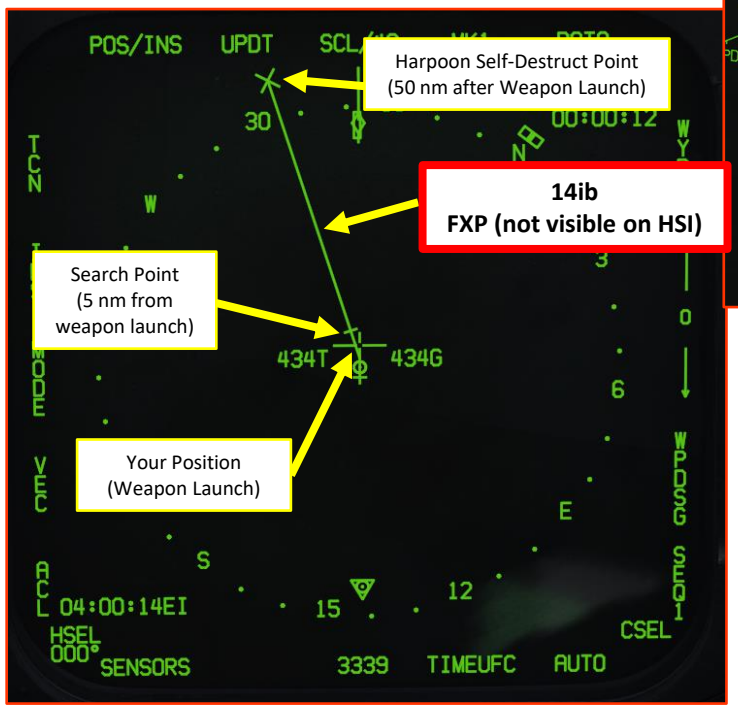
Note: Each Harpoon missile must be programmed individually since these programs are not shared between missiles.





2.10.1 – AGM-84D Harpoon
(BOL, Bearing-Only Launch Mode)

13. When launched in BOL mode, the Harpoon travels either directly in the direction of the set bearing from the aircraft, directly to a Harpoon Turnpoint (HPTP) and then to the set bearing, or directly to the Fixpoint (FXP).
14. Use Fixpoint or HPTP as required.
    i. If you want to use a **Fixpoint**, press the OSB next to FXP. This will create a Fixpoint, which is located halfway in distance between the search point and destruct point, based on the bearing value at that time. The course between the FXP and the aircraft then pivots around said FXP.
    ii. If you want to use a **Harpoon Turnpoint**, select a desired waypoint with the HSI, then press the OSB next to HPTP. This profile makes the missile travel directly to the Harpoon Turnpoint (HPTP) and then to the set bearing.











2.10.1 – AGM-84D Harpoon
(BOL, Bearing-Only Launch Mode)

15. Check the IN ZONE/IN RNG/TTMR/out of zone cue and confirm that “IN ZONE” is displayed. If you are not, steer the aircraft in the correct direction.
16. Make sure you are above the minimum launch altitude of 2500 ft and flying level. Launching the Harpoon during negative Gs can make the aircraft collide with the missile.
17. Press and hold the Weapon Release button (« RALT+SPACE ») to launch Harpoon.
18. Once launched, there can be a momentary radar altimeter warning; that is normal due to the free-falling missile being momentarily detected by the radar altimeter system.







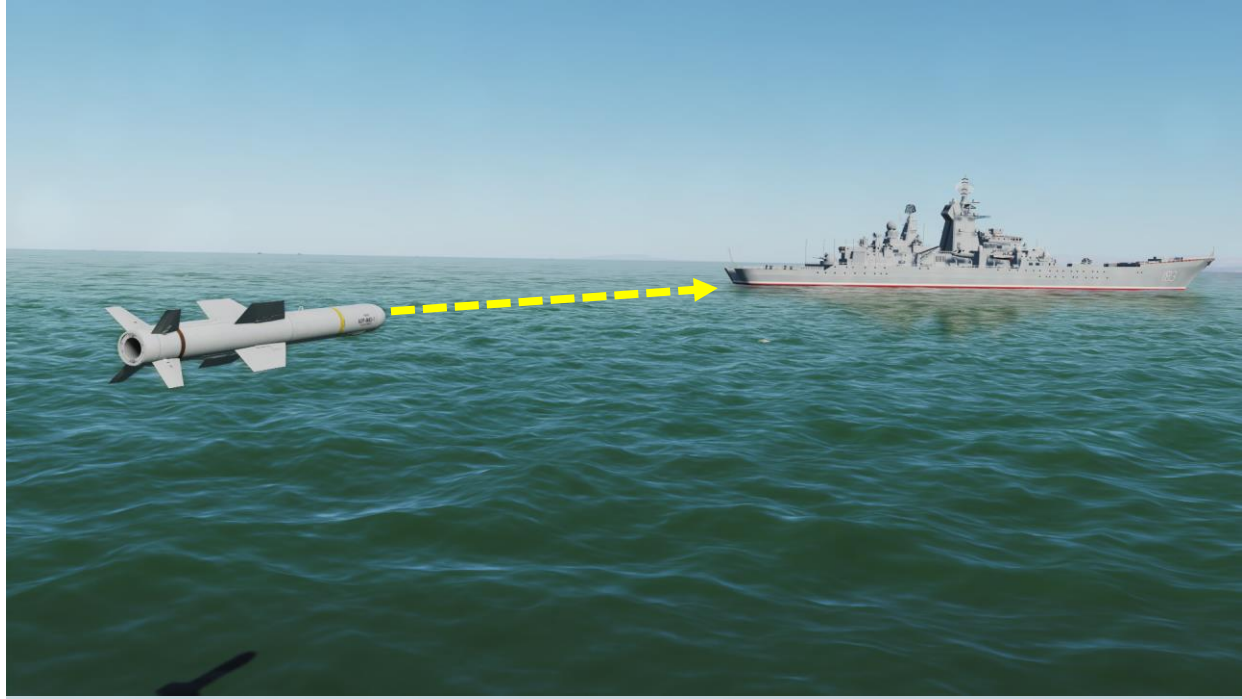


2.10.1 – AGM-84D Harpoon
(BOL, Bearing-Only Launch Mode)

19. The Harpoon, at an altitude corresponding to the FLT option (LOW, 5000 ft), travels either directly in the direction of the set bearing from the aircraft, directly to a Harpoon Turnpoint (HPTP) and then to the set bearing (305), or directly to the Fixpoint (FXP). At the defined search distance (5 nm after reaching the HPTP), the Harpoon will then initiate its search for a target. If it locates one, it will engage it based on the SKIM or POP terminal options (SKIM in our case). If it does not find a target before reaching the self-destruct point, it self-destructs (50 nm after launch).







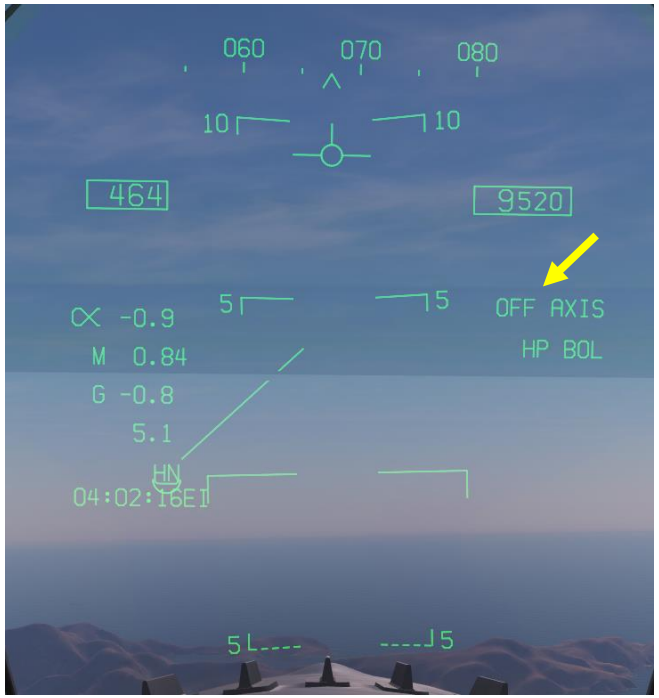


2.10.1 – AGM-84D Harpoon
(BOL, Bearing-Only Launch Mode)

Note 1: if the aircraft is not lined up properly to launch the Harpoon, the IN ZONE/IN RNG/TTMR/out of zone cue will let you know.

- IN ZONE: displayed in BOL when no out of zone condition exists.
- IN RNG: displayed in RB/L mode when the aircraft is in range and no out of zone condition exists.
- TTMR: predicted time in seconds (to a maximum of 99) until the aircraft will reach maximum range in RB/L.
- Out of zone: one of various cues displayed in either BOL or RB/L if the aircraft meets one of these out of zone conditions:
    - SRCH/DSTR: distance between BOL search point and destruct point is too small.
    - DSTR RNG: BOL destruct range is greater than maximum range.
    - INV TGT: R/BL TGT distance from aircraft is considered invalid (>172nm).
    - ALT: aircraft altitude less than absolute minimum (generally 2,500ft above the ground).
    - OFF AXIS: bearing to R/BL TGT, BOL search area, or HPTP is >90°.
    - HPTP ANG: total angle at the HPTP is too large.
    - A/C HPTP: aircraft is too close to the HPTP.
    - TGT/HPTP: HPTP is too close to the R/BL TGT or BOL search area.

Note 2: A dashed line on the HSI will indicate that you are off axis as well.





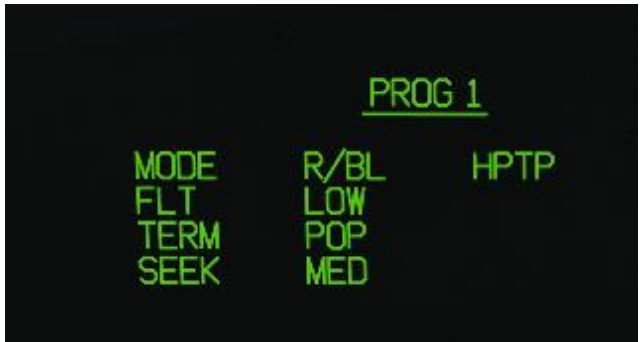


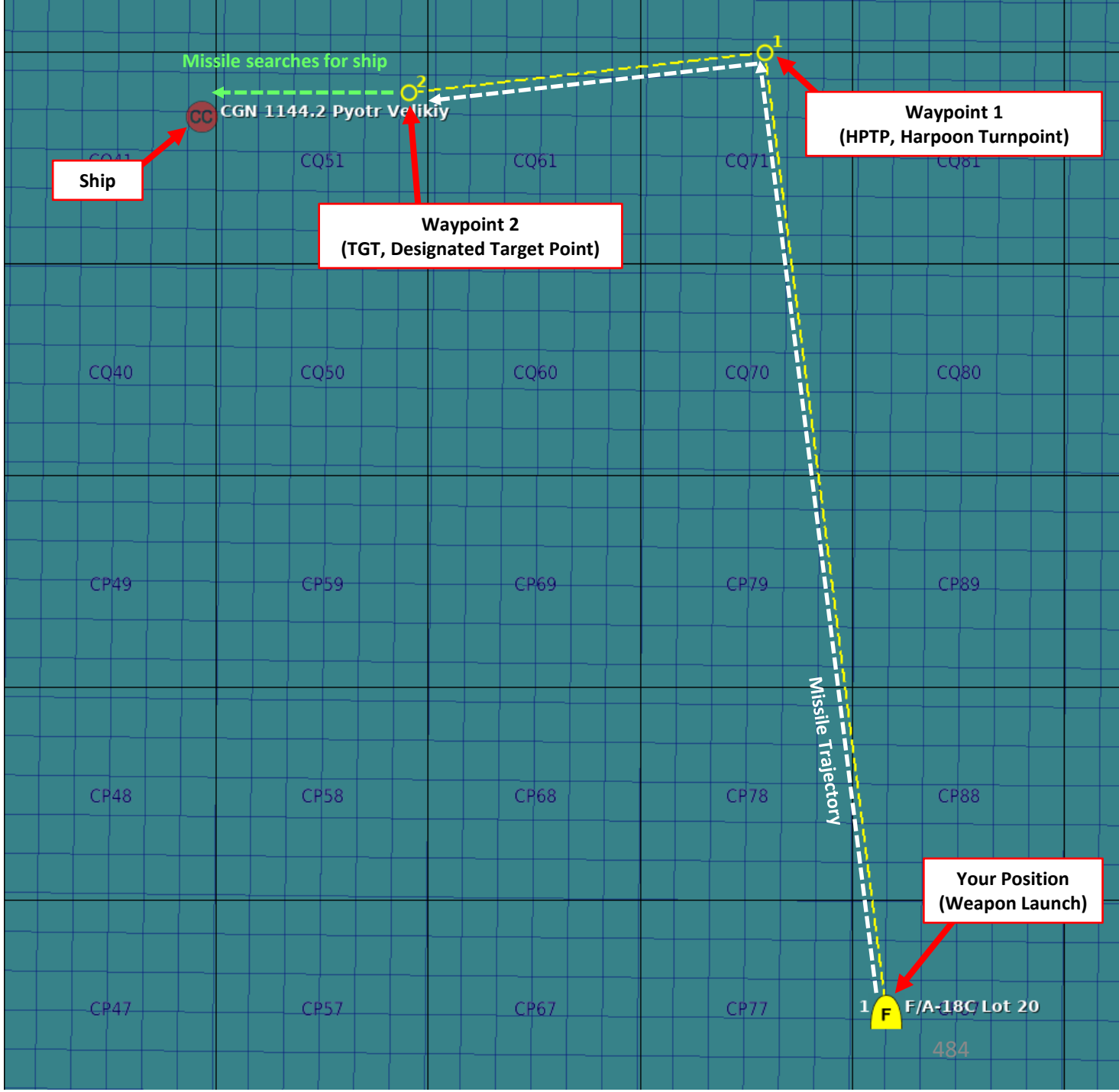
2.10.2 – AGM-84D Harpoon (R/BL, Range & Bearing Launch Mode)

The Harpoon is a programmable anti-ship missile. In this tutorial, we will use the R/BL (Range & Bearing Launch) mode. Range and Bearing Launch (R/BL) uses an Air-to-Ground Target (TGT) designation to provide both range and bearing information to the Harpoon. This mode does not command the Harpoon to detonate on the TGT, but rather to begin searching for a suitable target near the TGT designation and then engage it.

R/BL requires us to enter the following parameters:

- **Fly-Out (FLT) Altitude** Option: toggle between HIGH, MED, and LOW. This is the altitude the missile will fly at during the ingress/searching phase of flight. LOW is 5,000 ft, MED is 15,000 ft, and HIGH is 35,000 ft.
- **Terminal (TERM) Altitude** Option: toggle between SKIM and POP. This is the altitude the missile will fly at in the terminal phase of flight to ultimately impact the target. SKIM performs a very low-level approach all the way to impact. POP performs a high-G "pop-up" maneuver to impact the target from above.
- **Search Area (SEEK)** Option: toggle between SML (5.4 nm), MED (10.8 nm) and LRG (16.2 nm) search area distance. This is the distance before the TGT point the missile will begin searching.





2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

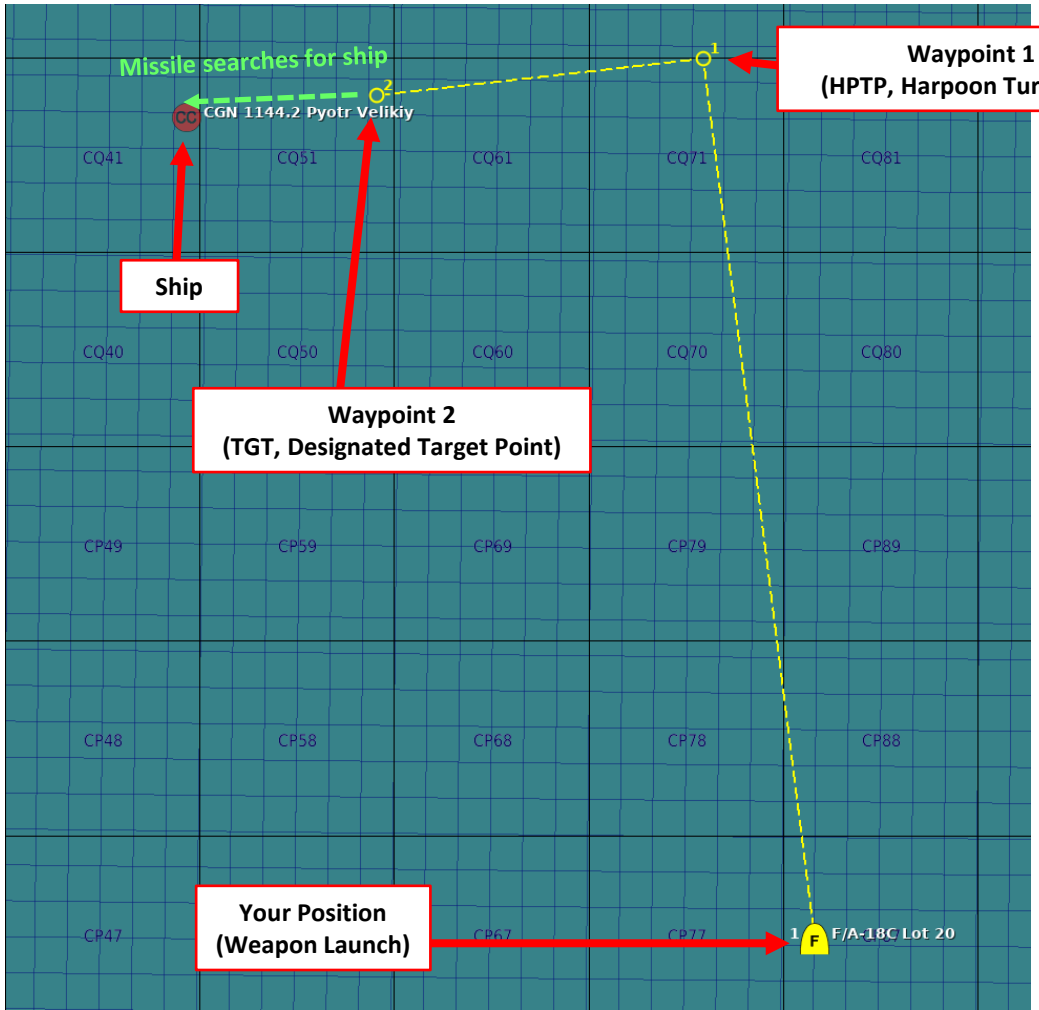
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. On the SMS (Stores) page, press OSB next to HPD (AGM-84D Harpoon)
4. Harpoon will start an inertial alignment that takes about 25 seconds. You can monitor gyro alignment process on the SMS (Stores Management System) page.
    - **Note:** Once Harpoon alignment is complete, the timer will disappear.



2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

5. If you want to use a **Harpoon Turnpoint**, select a desired waypoint with the HSI, then press the OSB next to HPTP.

   This profile makes the missile travel directly to the Harpoon Turnpoint (HPTP) and then to the Designated TGT point (we will see how to set it up in the next steps).





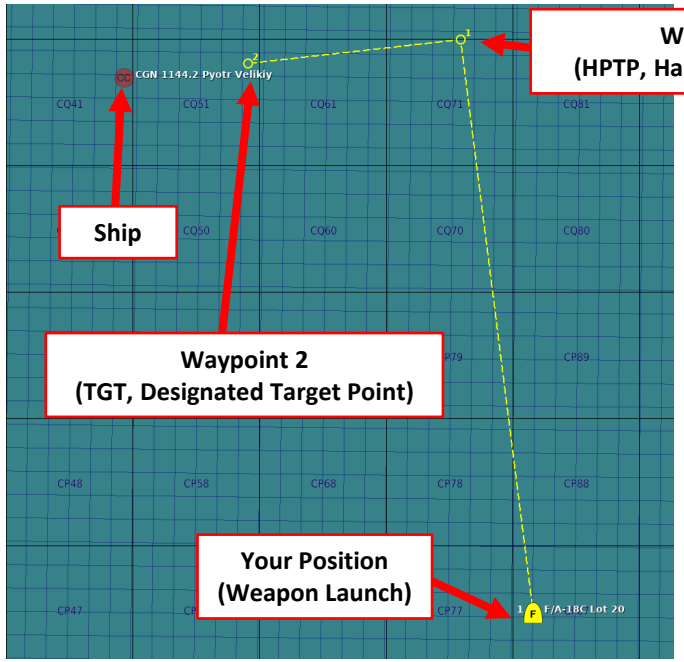




2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

6. You will only be able to select the R/BL mode is a target is designated. This can be done by either performing a Waypoint Designate (WPDSG) action via the HSI or by using the Targeting Pod and designating the ship's location with the TDC (Throttle Designation Control) Depress button.

   As an example, we will set Waypoint 2 as the TGT point by selecting Waypoint 2 with the OSB selectors, then pressing the OSB next to WPDSG (Waypoint Designate). Waypoint 2 will then become the designated target point.

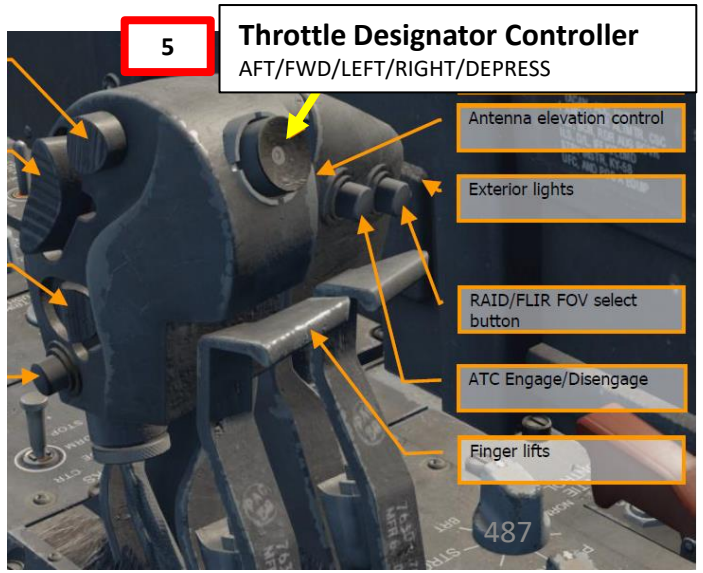




Targeting Pod (use at your own risk… some ship missiles have a longer range than your targeting pod's effective visibility)

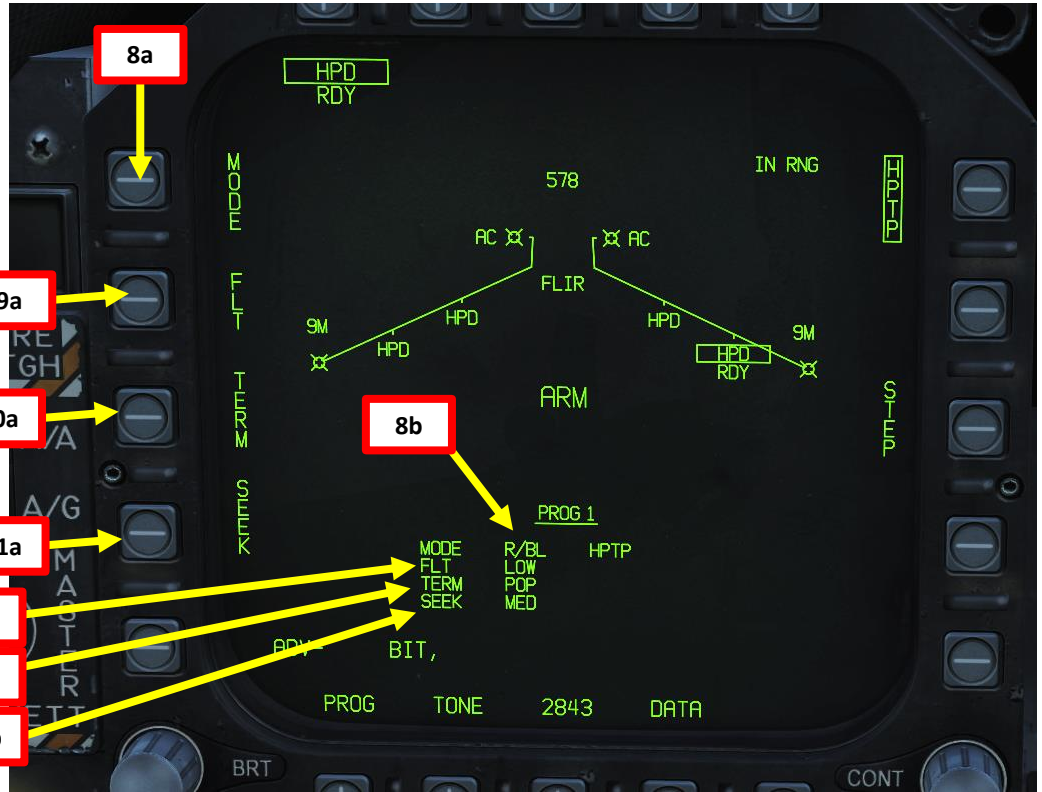






2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

7. Once the TGT (Air-to-Ground Target Point) has been designated, the R/BL Mode will become available for selection.
8. Select “R/BL” release mode by pressing the OSB next to “MODE” if a target is designated properly, the mode will switch from BOL to R/BL.
9. Press OSB next to “FLT” (Fly-Out Altitude) to toggle between LOW, MED and HIGH. We will choose LOW.
10. Press OSB next to “TERM” (Terminal Altitude) to toggle between SKIM and POP attack profiles. SKIM performs a very low-level approach all the way to impact, while POP performs a high-G "pop-up" maneuver to impact the target from above. In our case, we will choose POP.
11. Press OSB next to “SEEK” (Search Area) to between SML (5.4 nm), MED (10.8 nm) and LRG (16.2 nm) search area distance. In our case, we will choose MED.

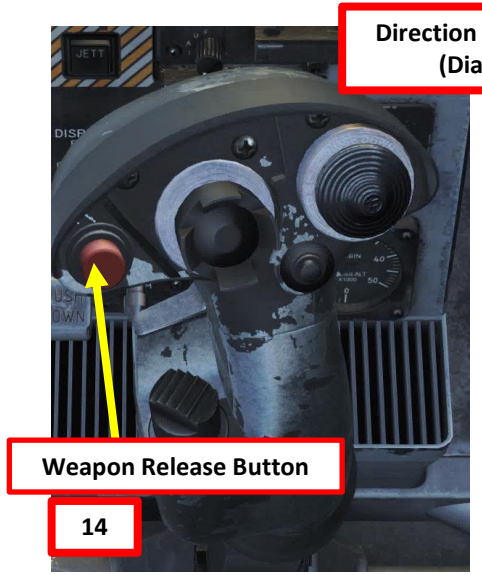






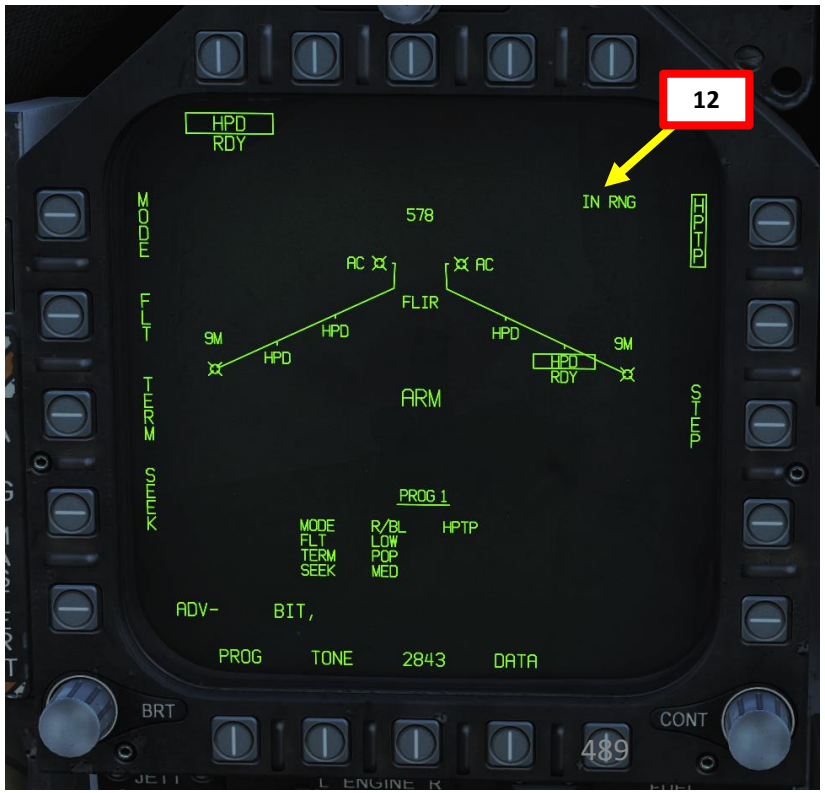
2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

12. Check the IN ZONE/IN RNG/TTMR/out of zone cue and confirm that “IN RNG” is displayed. If you are not, steer the aircraft in the correct direction and .
13. Make sure you are above the minimum launch altitude of 2500 ft and flying level. Launching the Harpoon during negative Gs can make the aircraft collide with the missile.
14. Press and hold the Weapon Release button (« RALT+SPACE ») to launch Harpoon.
15. Once launched, there can be a momentary radar altimeter warning; that is normal due to the free-falling missile being momentarily detected by the radar altimeter system.







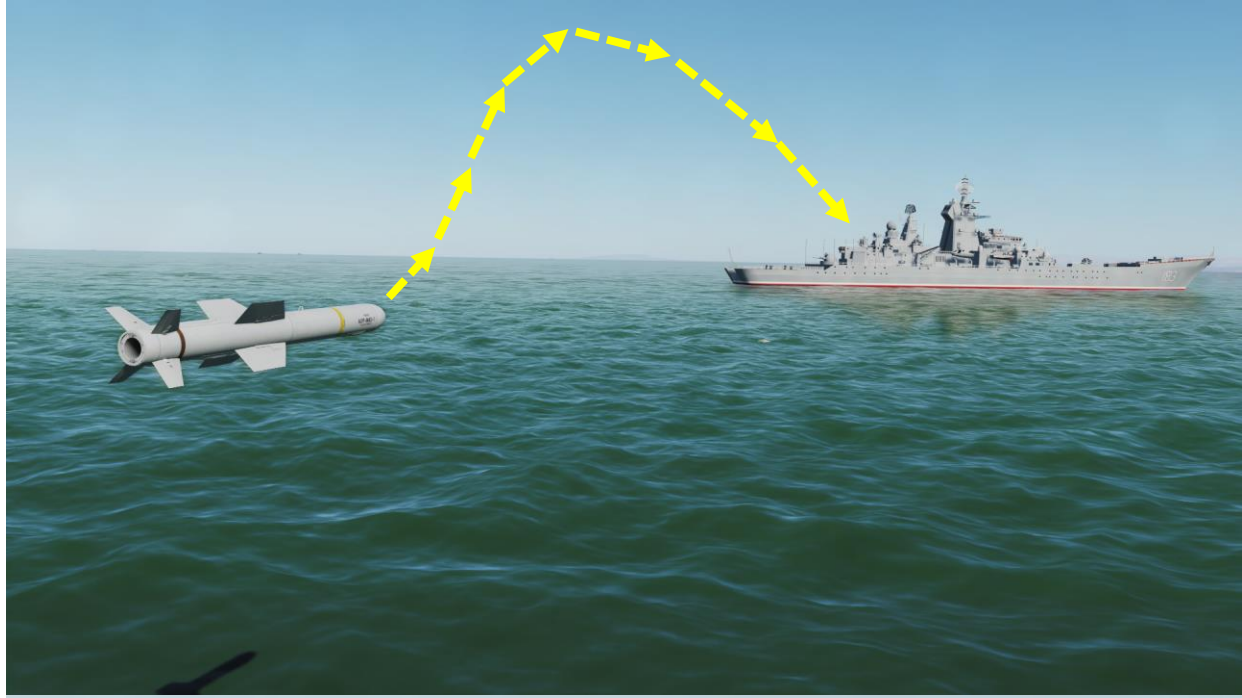


2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

16. The Harpoon, at an altitude corresponding to the FLT option (LOW, 5000 ft), travels either directly in the direction of the set bearing from the aircraft, directly to a Harpoon Turnpoint (HPTP) and then directly to the designated TGT point (Waypoint 2). The missile then begins searching a set programmed distance before the TGT. If it locates a target, it will engage it based on the SKIM or POP terminal modes.









2.10.2 – AGM-84D Harpoon
(R/BL, Range & Bearing Launch Mode)

Note 1: if the aircraft is not lined up properly to launch the Harpoon, the IN ZONE/IN RNG/TTMR/out of zone cue will let you know.

- IN ZONE: displayed in BOL when no out of zone condition exists.
- IN RNG: displayed in RB/L mode when the aircraft is in range and no out of zone condition exists.
- TTMR: predicted time in seconds (to a maximum of 99) until the aircraft will reach maximum range in RB/L.
- Out of zone: one of various cues displayed in either BOL or RB/L if the aircraft meets one of these out of zone conditions:
    - SRCH/DSTR: distance between BOL search point and destruct point is too small.
    - DSTR RNG: BOL destruct range is greater than maximum range.
    - INV TGT: R/BL TGT distance from aircraft is considered invalid (>172nm).
    - ALT: aircraft altitude less than absolute minimum (generally 2,500ft above the ground).
    - OFF AXIS: bearing to R/BL TGT, BOL search area, or HPTP is >90°.
    - HPTP ANG: total angle at the HPTP is too large.
    - A/C HPTP: aircraft is too close to the HPTP.
    - TGT/HPTP: HPTP is too close to the R/BL TGT or BOL search area.

Note 2: A dashed line on the HSI will indicate that you are off axis as well.

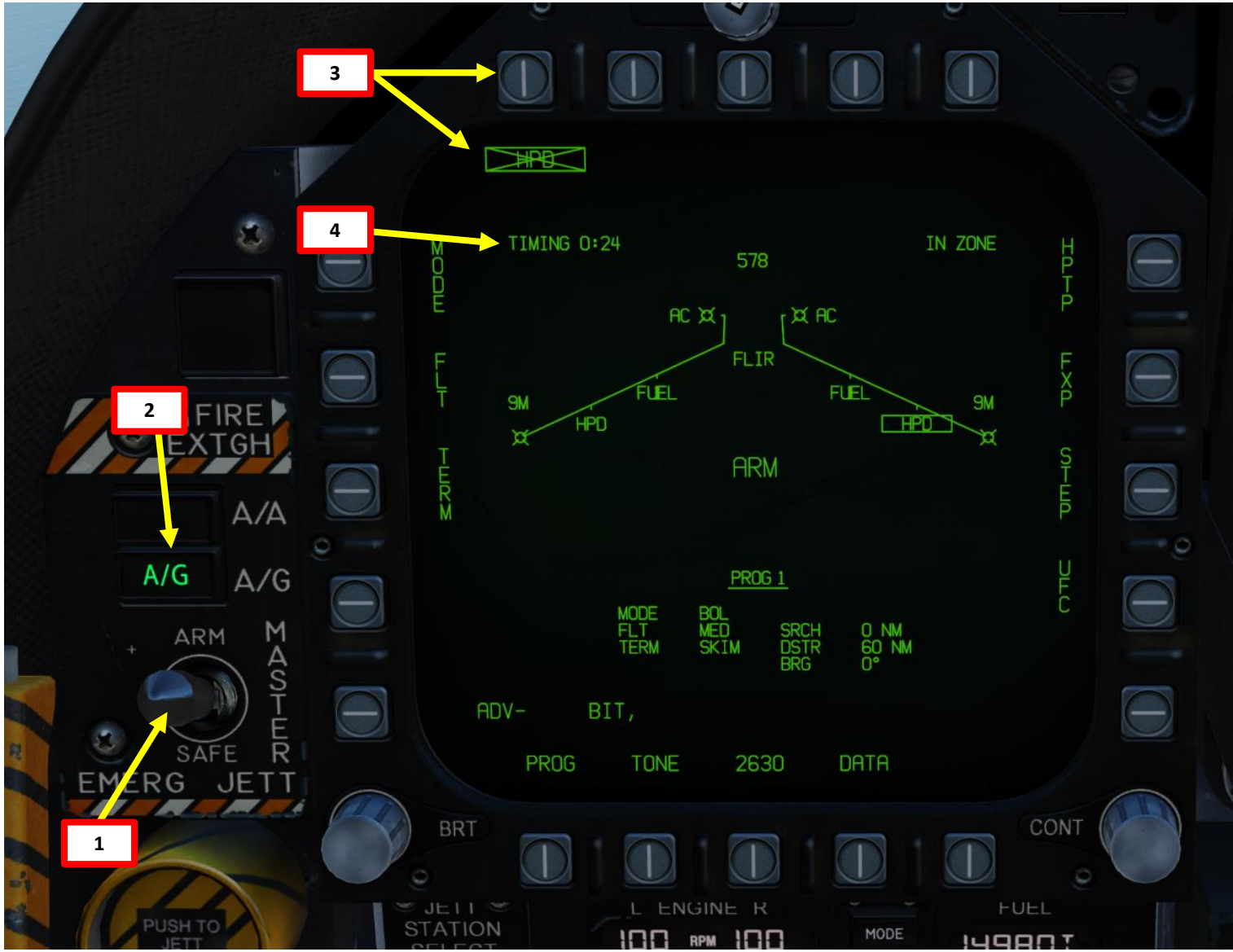






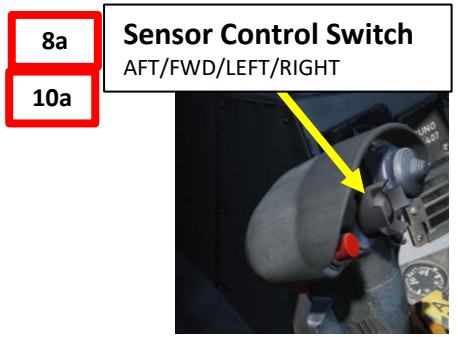
2.10.3 – AGM-84D Harpoon
(R/BL, SEA Radar Mode)

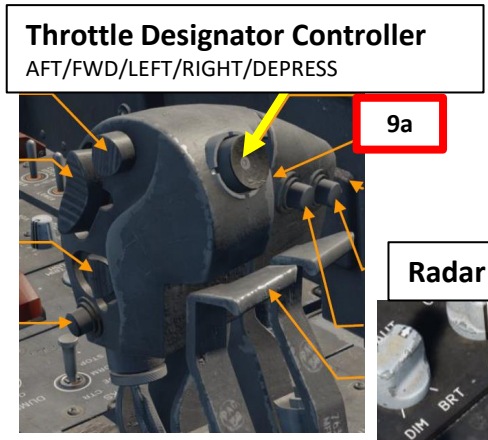
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. On the SMS (Stores) page, press OSB next to HPD (AGM-84D Harpoon)
4. Harpoon will start an inertial alignment that takes about 25 seconds. You can monitor gyro alignment process on the SMS (Stores Management System) page.
    - **Note:** Once Harpoon alignment is complete, the timer will disappear.

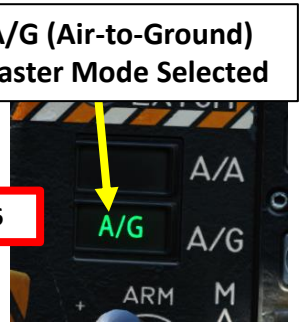


2.10.3 – AGM-84D Harpoon (R/BL, SEA Radar Mode)

5. Make sure the Radar Power Switch is set to OPR (Operate).
6. Verify that the A/G Master Mode button is pressed; it will set the right DDI (Digital Display Indicator) to the radar A-G MAP page.
7. Toggle A-G MAP mode to A-G SEA mode by pressing the OSB next to MAP.
8. Press the Sensor Control Switch in the direction of the radar screen (RIGHT) to slave the TDC (Throttle Designation Controller) to the current radar screen (diamond should be visible).
9. Slew the TDC cursor on the desired target (brick) you want to track using the TDC controls.
10. Press the Sensor Control Switch in the direction of the DDI (right) to command acquisition of the target. When Sensor Control Switch is released, target tracking is commanded. The radar mode will change to Tracking mode and additional target information will be displayed.



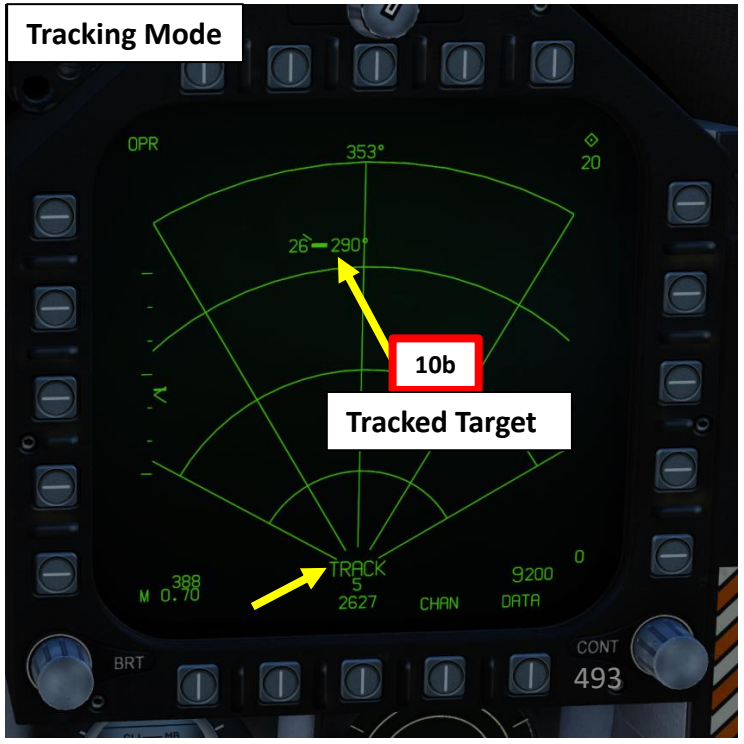






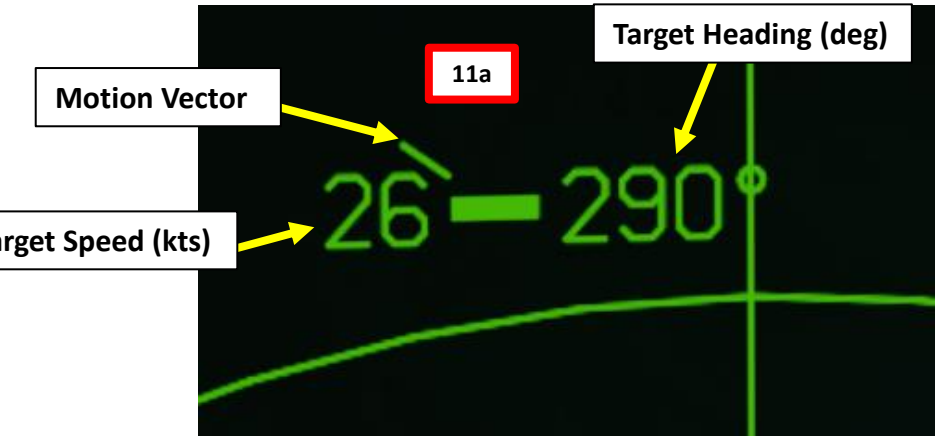


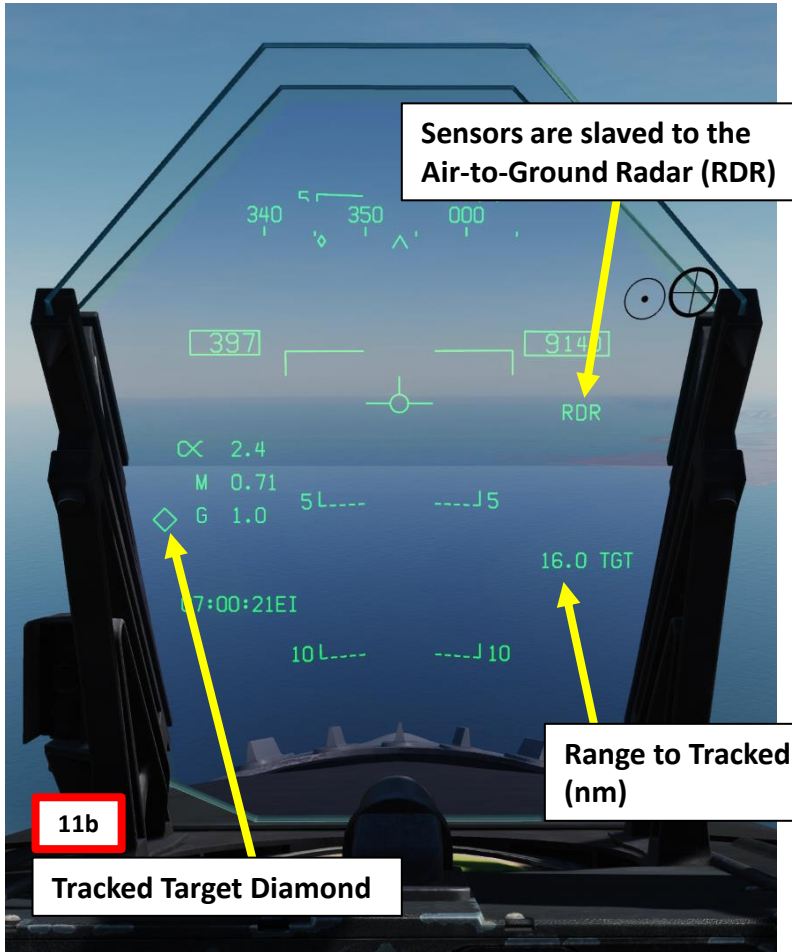




2.10.3 – AGM-84D Harpoon (R/BL, SEA Radar Mode)

11. Once target is tracked:
    a) On the Radar page, a brick with a motion vector, target speed and heading will be visible.
    b) On the HUD, a diamond will mark the tracked target.
    c) This point can be used/slaved to by other sensors (like the targeting pod) if desired.

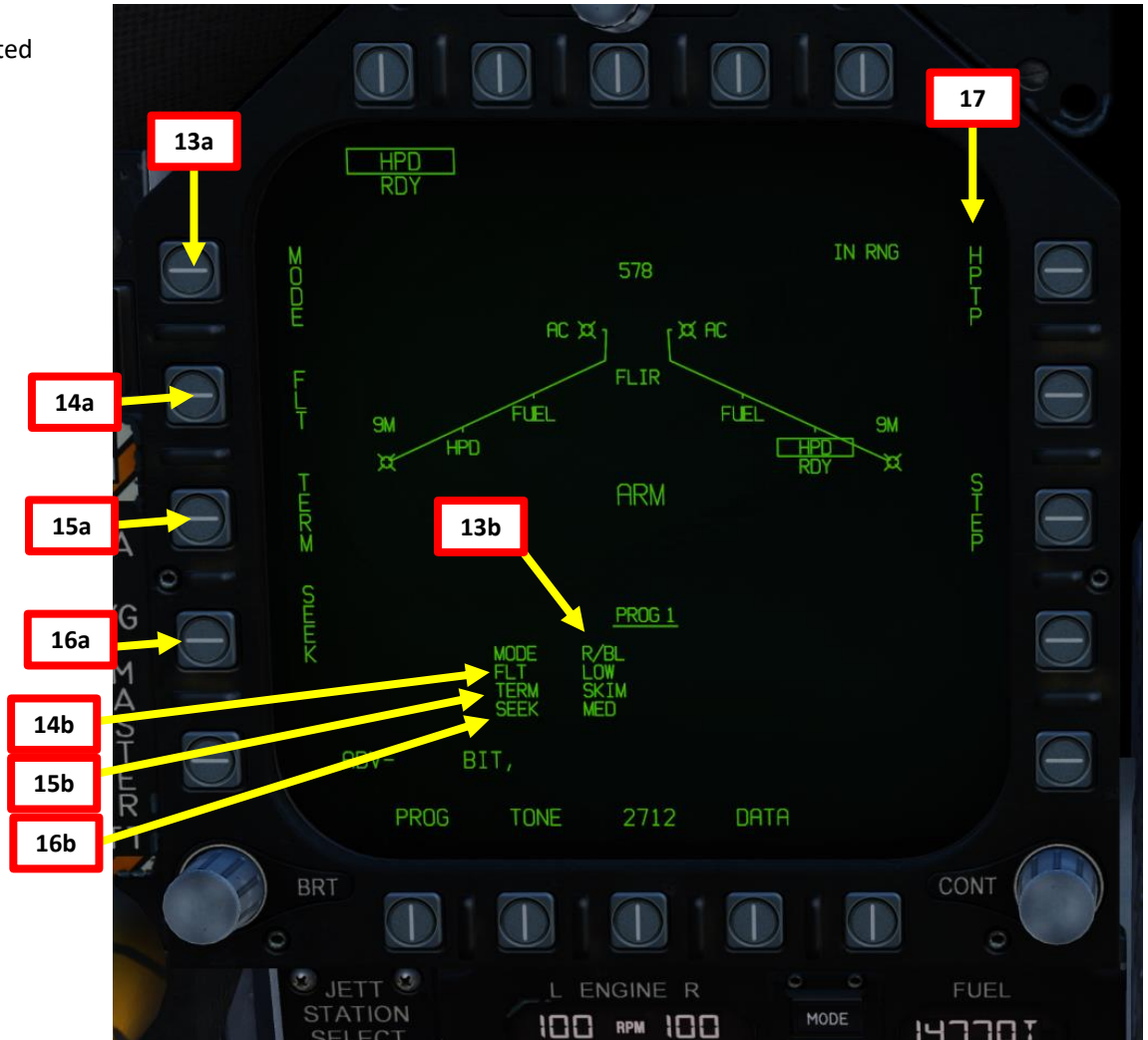






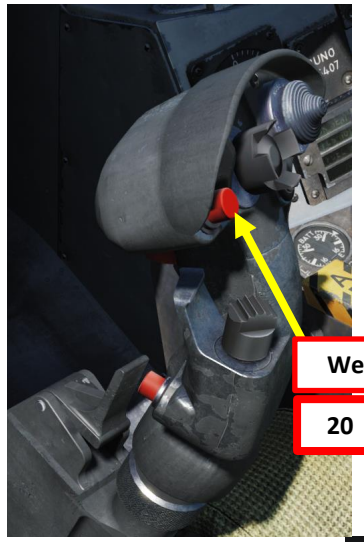
2.10.3 – AGM-84D Harpoon
(R/BL, SEA Radar Mode)

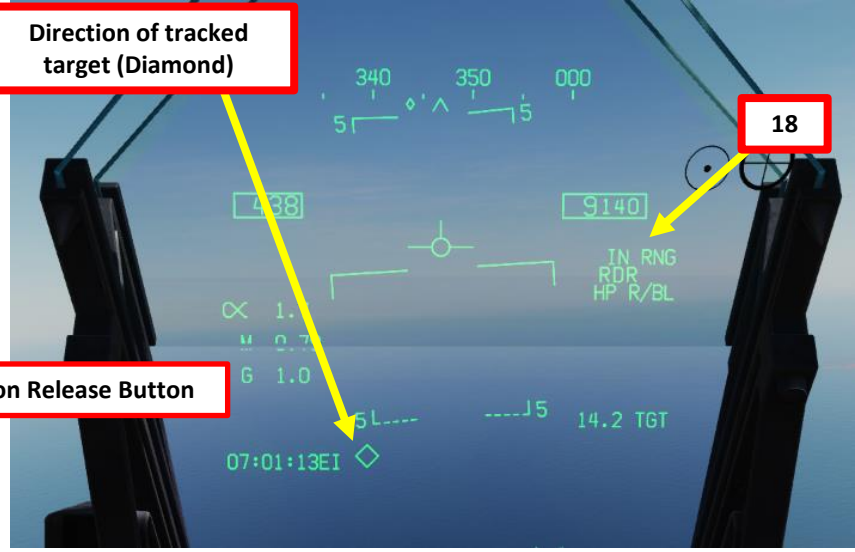
12. Once the target has been designated by the radar, the R/BL Mode will become available for selection.
13. Select “R/BL” release mode by pressing the OSB next to “MODE” if a target is designated properly, the mode will switch from BOL to R/BL.
14. Press OSB next to “FLT” (Fly-Out Altitude) to toggle between LOW, MED and HIGH. We will choose LOW.
15. Press OSB next to “TERM” (Terminal Altitude) to toggle between SKIM and POP attack profiles. SKIM performs a very low-level approach all the way to impact, while POP performs a high-G "pop-up" maneuver to impact the target from above. In our case, we will choose SKIM.
16. Press OSB next to “SEEK” (Search Area) to between SML (5.4 nm), MED (10.8 nm) and LRG (16.2 nm) search area distance. In our case, we will choose MED.
17. Check that HPTP (Harpoon Turnpoint) is not selected



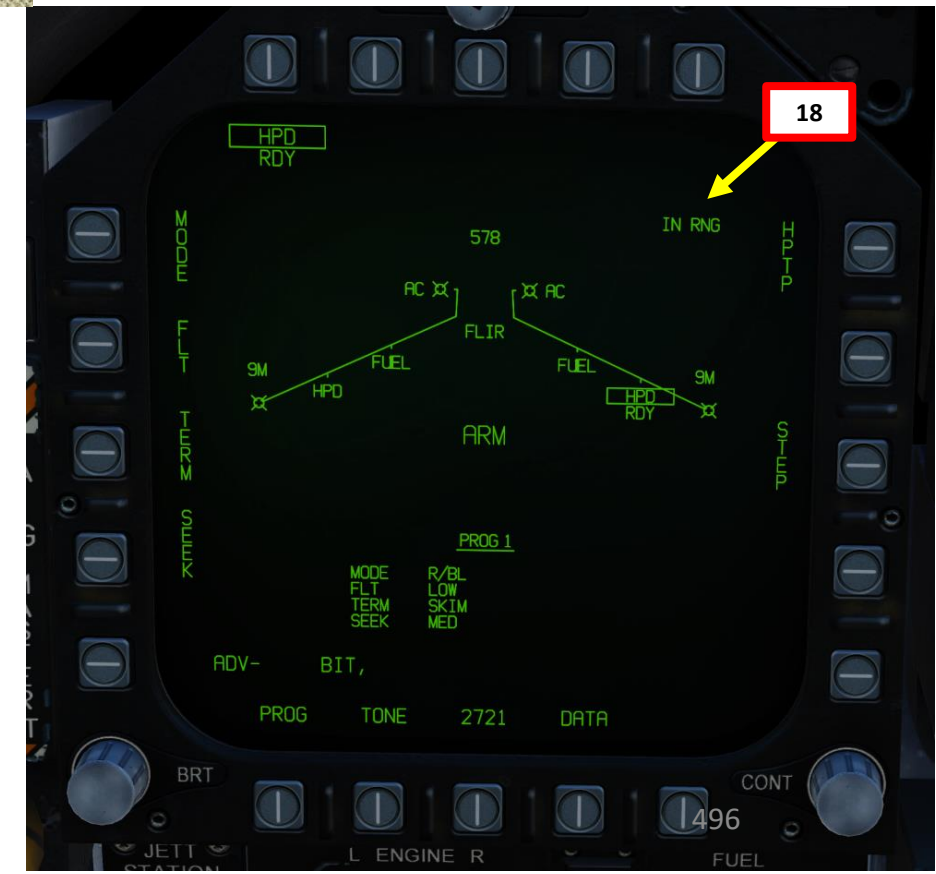
2.10.3 – AGM-84D Harpoon
(R/BL, SEA Radar Mode)

18. Check the IN ZONE/IN RNG/TTMR/out of zone cue and confirm that “IN RNG” is displayed. If you are not, steer the aircraft in the correct direction and .
19. Make sure you are above the minimum launch altitude of 2500 ft and flying level. Launching the Harpoon during negative Gs can make the aircraft collide with the missile.
20. Press and hold the Weapon Release button (« RALT+SPACE ») to launch Harpoon.
21. Once launched, there can be a momentary radar altimeter warning; that is normal due to the free-falling missile being momentarily detected by the radar altimeter system.



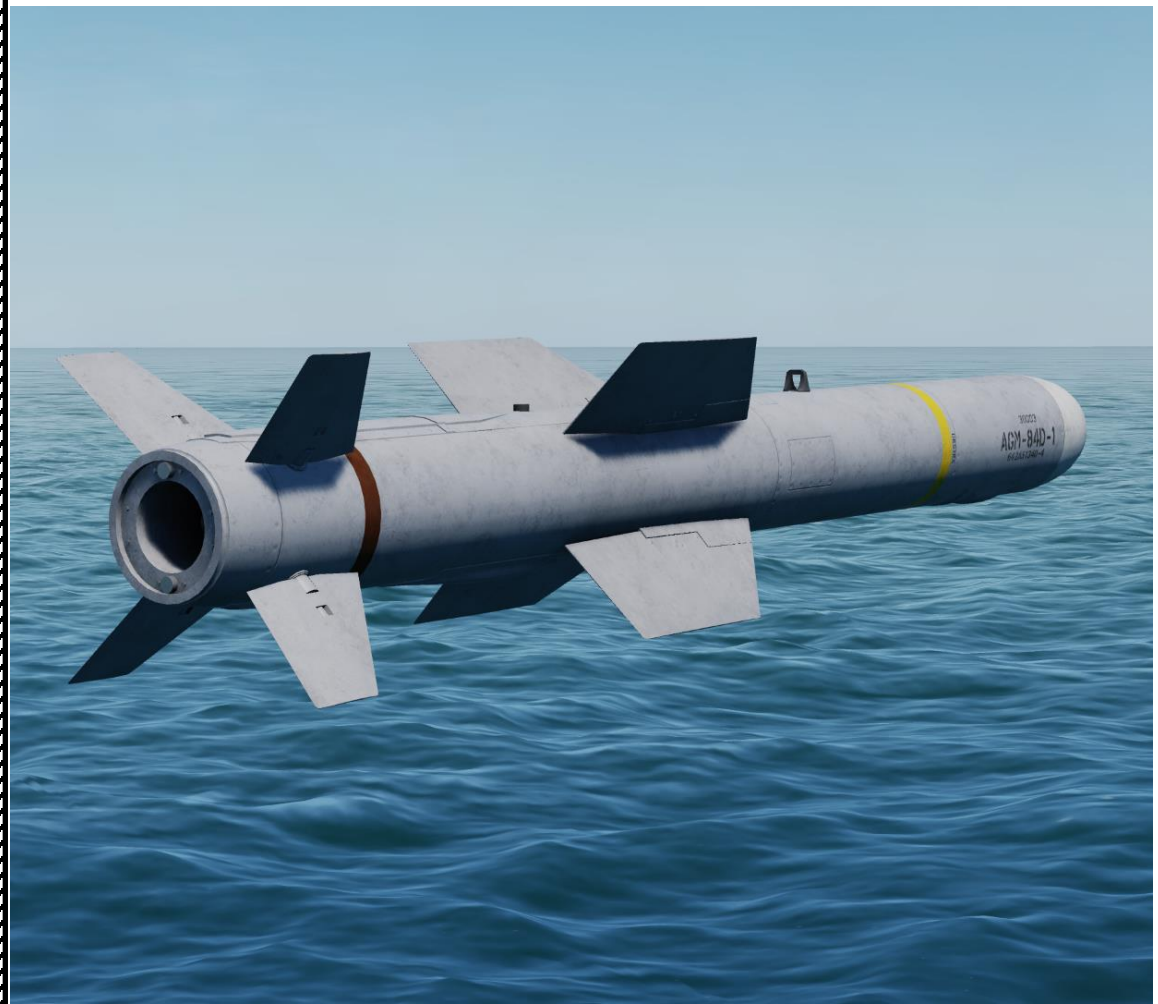






2.10.3 – AGM-84D Harpoon (R/BL, SEA Radar Mode)

22. The Harpoon, at an altitude corresponding to the FLT option (LOW, 5000 ft), travels directly in the direction of the set bearing from the aircraft to the designated TGT point by the air-to-sea radar. The missile then begins searching a set programmed distance before the TGT. If it locates a target, it will engage it based on the SKIM or POP terminal modes.
23. Pressing the « Undesignate » button on the stick will return the radar to SEA mode and exit tracking mode.





23 **Undesignate / Nosewheel Steering Button**



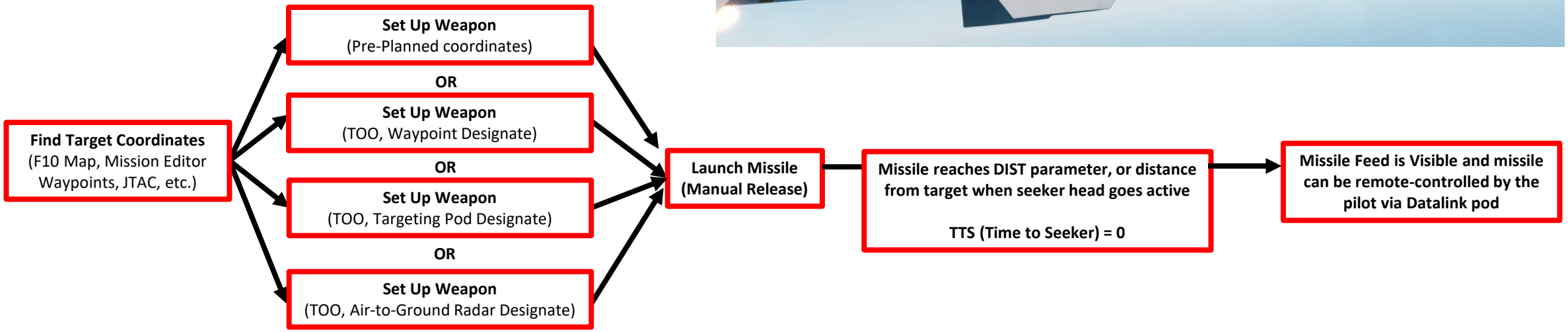
2.11 – AGM-84E SLAM
2.11.1 – Introduction

The AGM-84E SLAM (Standoff Land Attack Missile) is a sub-sonic over-the-horizon air-launched cruise missile. It was designed to provide all-weather, day and night, precision attack capabilities against stationary high-value targets. Except for new technologies in the guidance and seeker sections, which included a Global Positioning System (GPS) receiver, a Walleye optical guidance system, and a newly developed missile datalink, all of the missile hardware came directly from the Harpoon missile.

The SLAM offers two basic operating modes: Preplanned for land strike, and Target-of-Opportunity for maritime strike. Used in the latter mode, SLAM allows a selective attack on the most vulnerable part of the target vessel, particularly useful when hitting tankers.

Basically, the way to employ SLAMs is to first get your target coordinates from either the mission briefing or using the F10 map, input them to the weapons in either Pre-Planned Mode (coordinates need to be entered manually) or in TOO Mode (Target of Opportunity, weapons use the existing A/G (Air-to-Ground) designation, which is the Hornet (or Harrier) equivalent of the SPI (Sensor Point of Interest) in the A-10C.



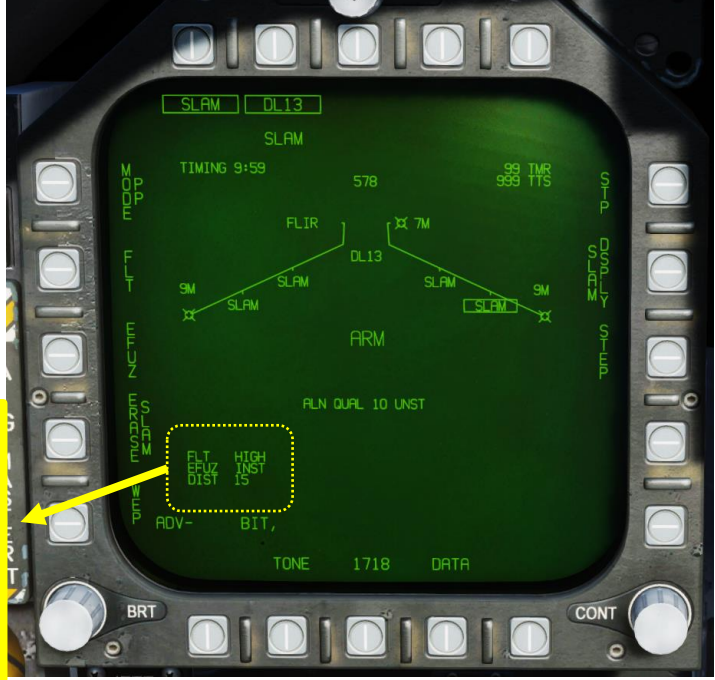


2.11 – AGM-84E SLAM
2.11.1 – Introduction

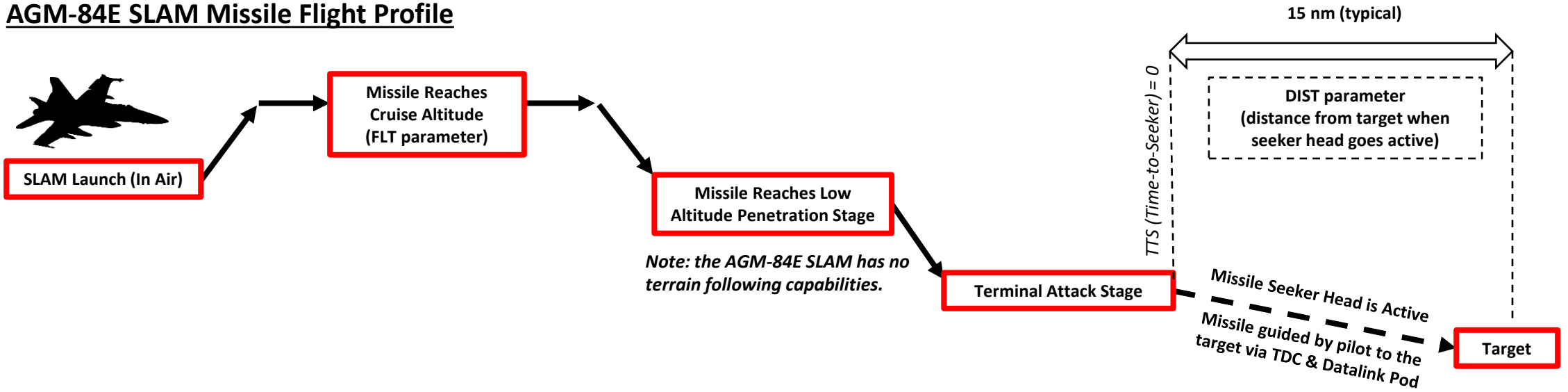
The profile of the SLAM cruise missile launched from the Hornet is:

1. The missile launches from the aircraft
2. The missile reaches Cruise Altitude (set through the FLT, Fly-Out Profile property)
3. The missile eventually enters a dive and goes into the Low Altitude Penetration Stage
4. When the missile is close enough to the target, it will steer directly to the target's area and enter Terminal Attack Stage
5. When missile reaches the distance parameter (DIST), the missile's seeker head becomes active. The pilot can then manually steer the missile using the TDC (Throttle Designation Control). Communication with the missile is done through the datalink pod.



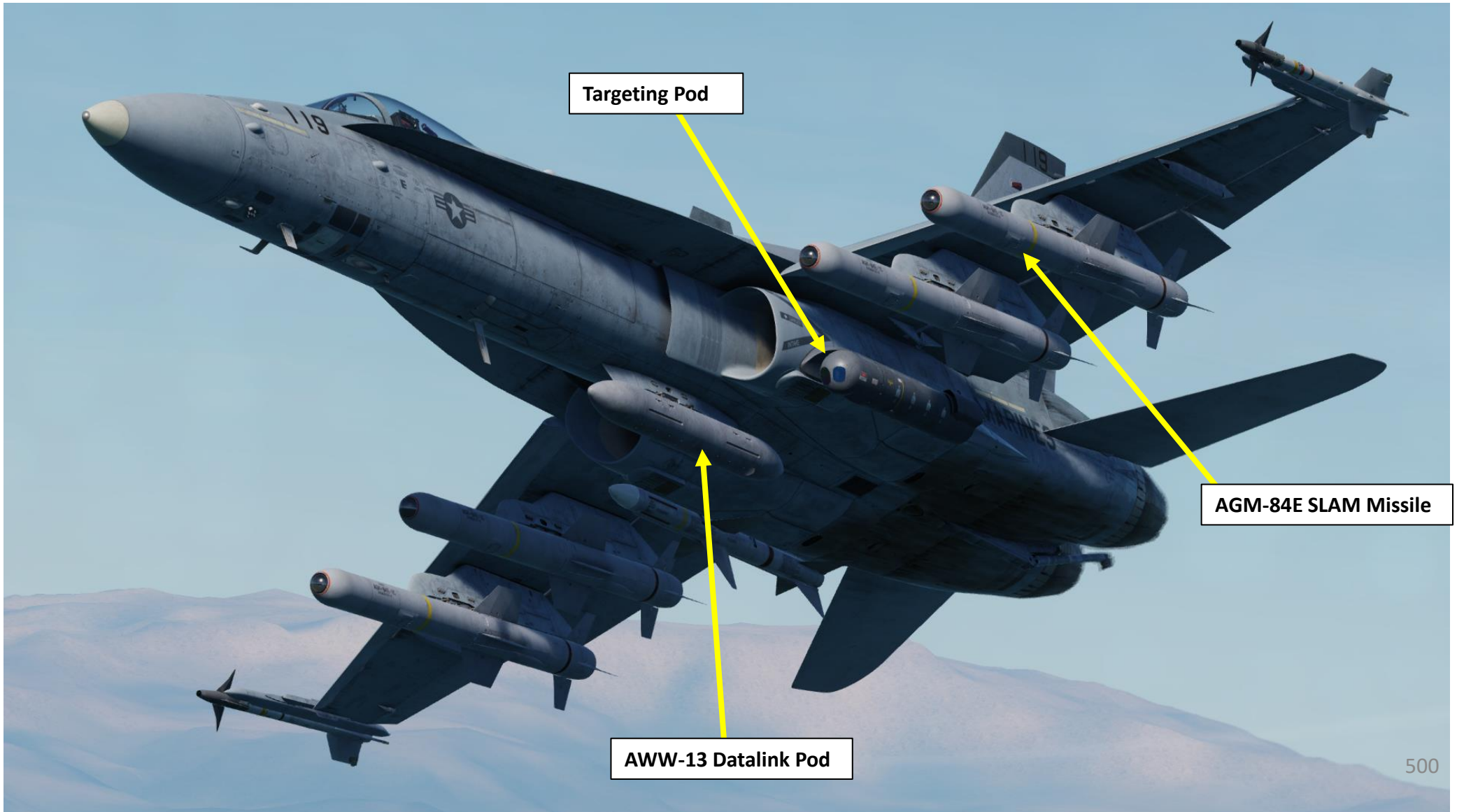


AGM-84E SLAM Missile Flight Profile



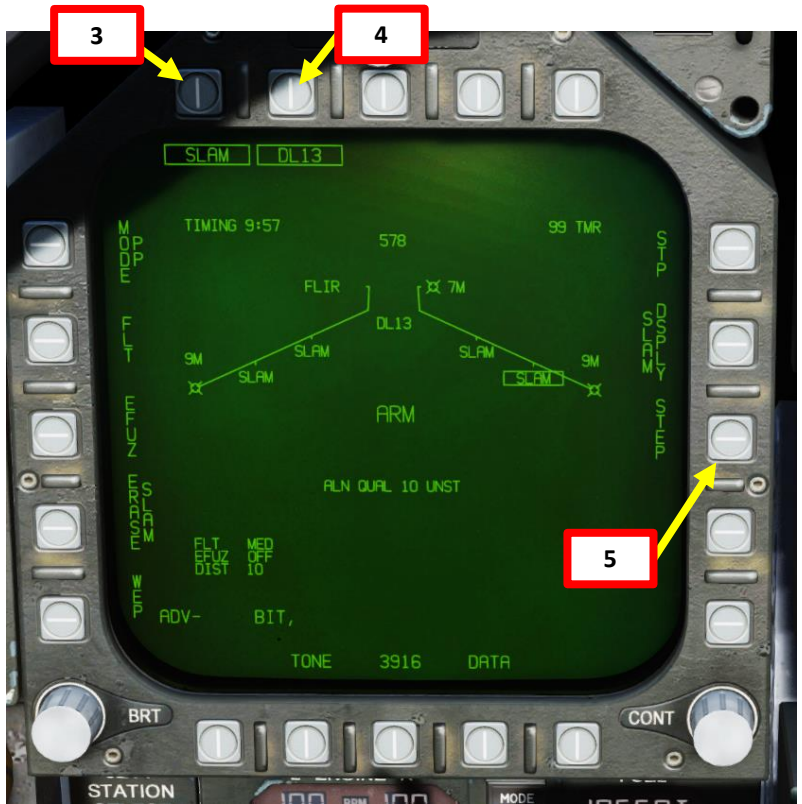
2.11 – AGM-84E SLAM
2.11.1 – Introduction

In order to control the missile, an AWW-13 Datalink Pod needs to be equipped to maintain communication between the aircraft (the pilot commands issues through the TDC (Throttle Designation Control)) and the missile.



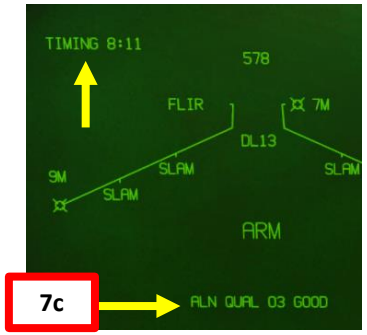
2.11 – AGM-84E SLAM
2.11.2 – Weapon Setup

1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. On the SMS (Stores) page, press OSB next to SLAM to power up the AGM-84E missile.
4. On the SMS (Stores) page, click on the OSB next to DL13 to turn on the Datalink Pod.
5. Use STEP function to select desired SLAM missile station.
6. Once selected, the SLAM needs about 3 minutes for alignment.
7. Alignment It will go from 10 UNSTABLE, to 06 MARGINAL and finally 01 GOOD. When alignment is complete, the TIMING indicator will disappear from the SMS page.

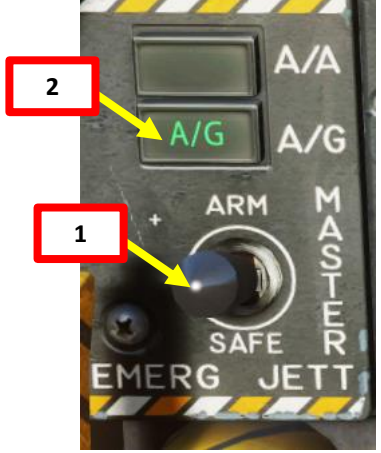








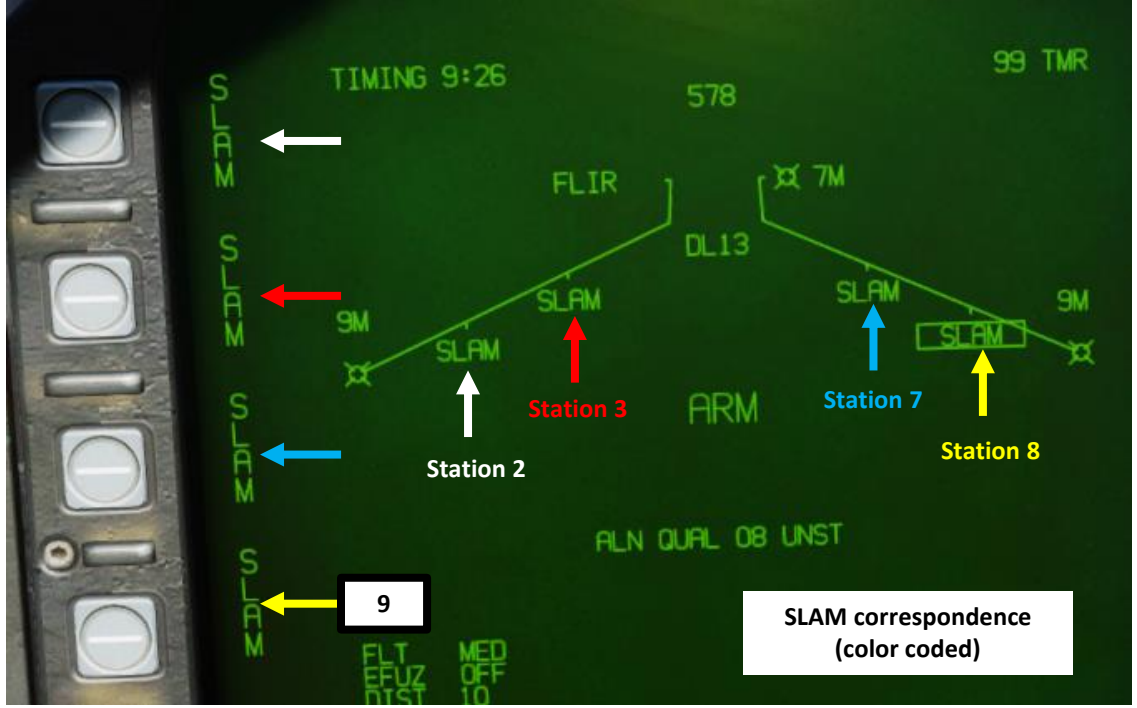




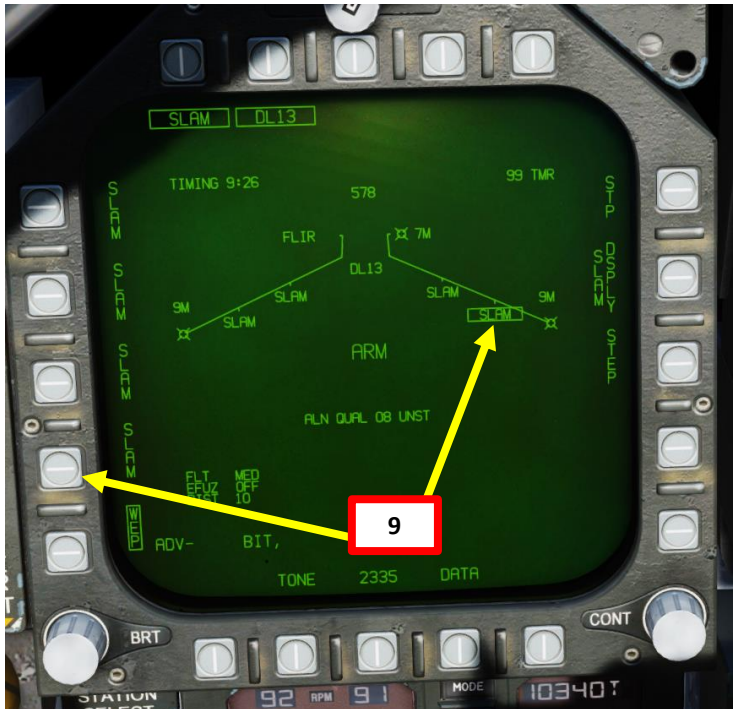


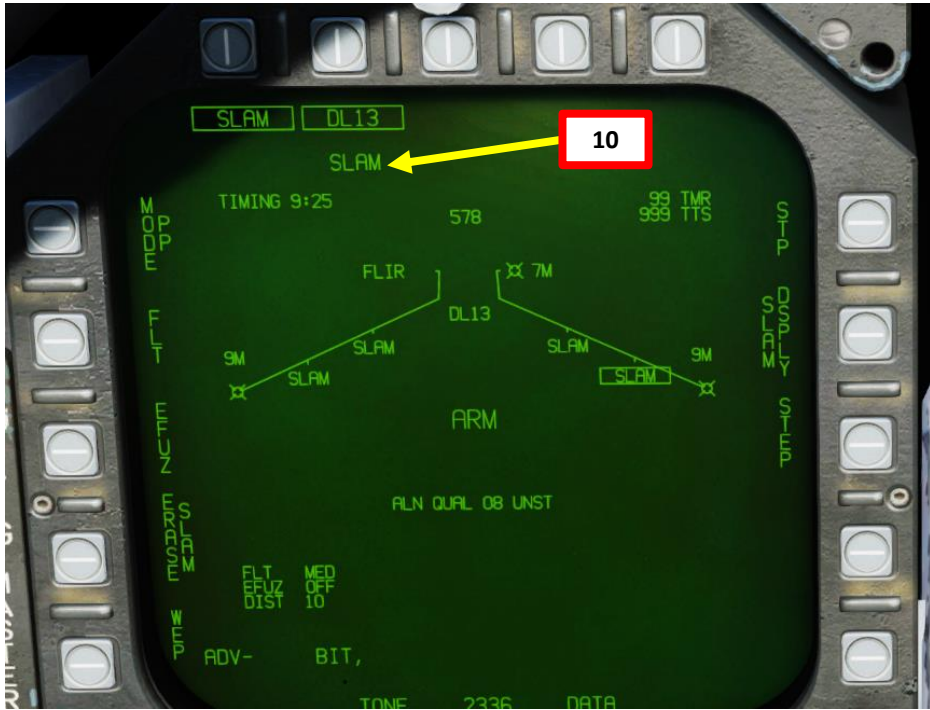
2.11 – AGM-84E SLAM
2.11.2 – Weapon Setup

8. Press OSB (Option Select Button) next to WEP. This will allow you to choose what SLAM missile is communicating with the Datalink pod.
9. Select corresponding SLAM station using the OSBs on the left side. In our case, the lower SLAM (yellow) OSB needs to be slaved to Station 8 (boxed).
10. Once communication between SLAM station and datalink pod has been established, a SLAM indication will be displayed under the boxed DL13 indication.



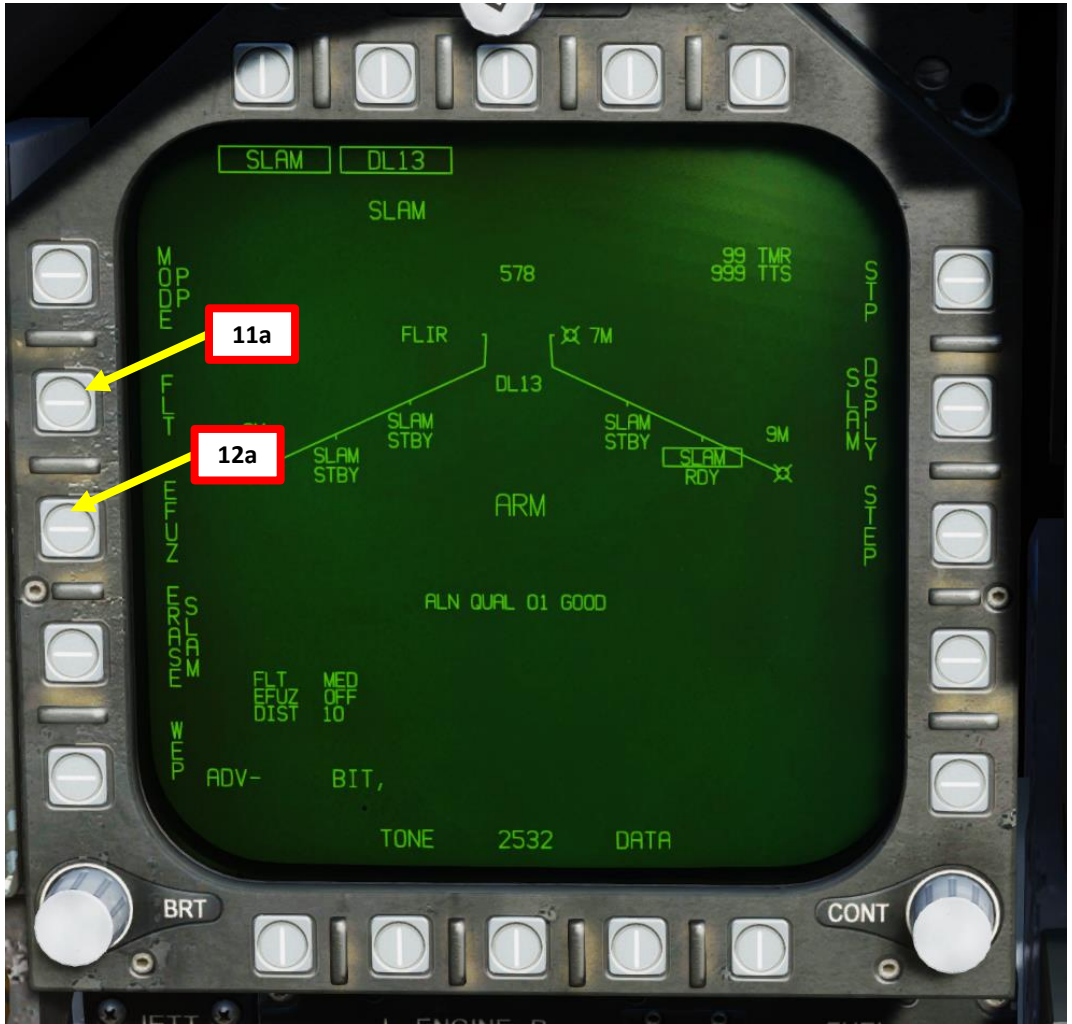


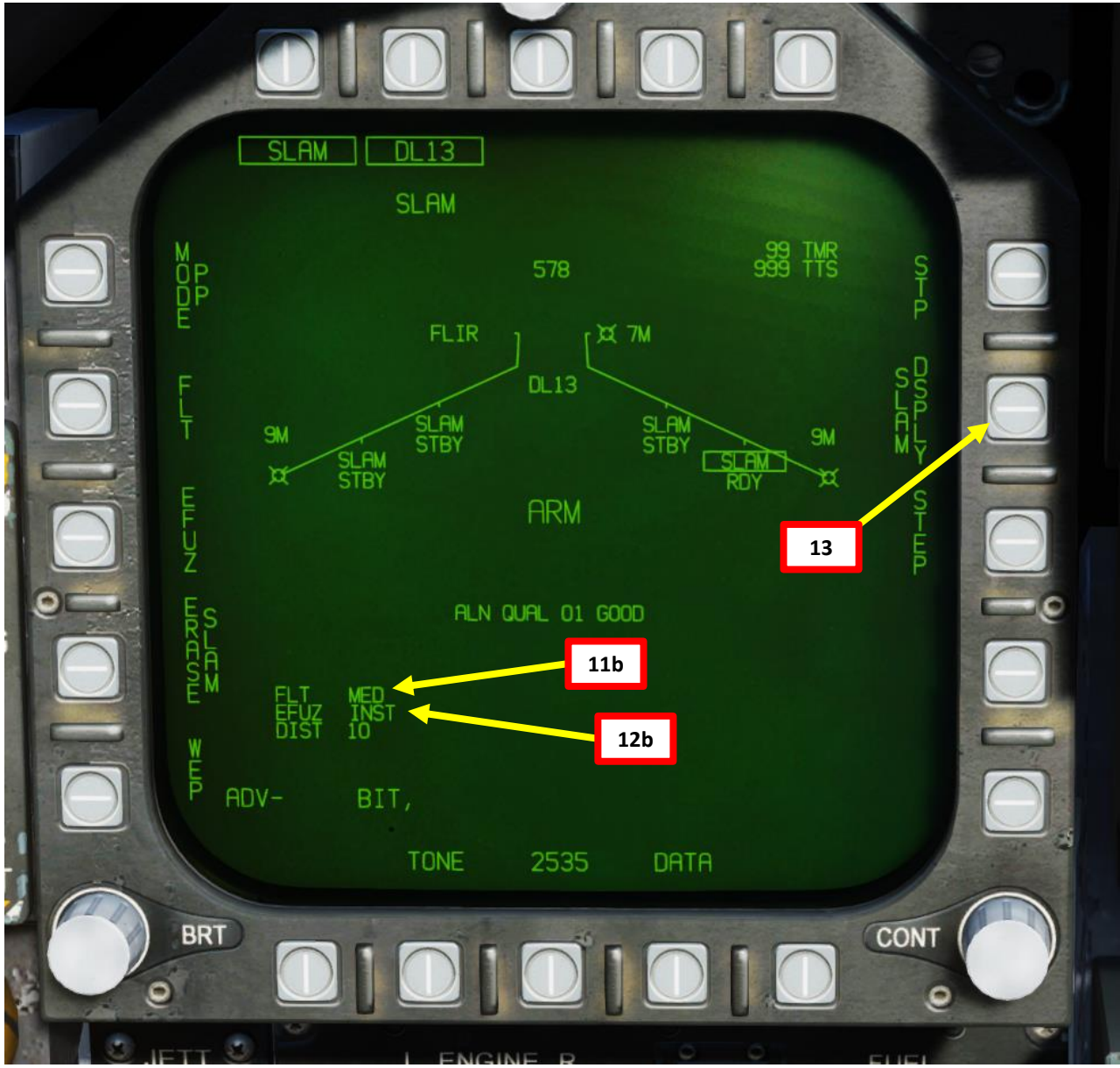




2.11 – AGM-84E SLAM
2.11.2 – Weapon Setup

11. Press OSB next to FLT (Fly-Out Altitude) parameter to toggle between HIGH (35,000 ft), MED (15,000 ft) and LOW (5,000 ft). We will set it to MED.
12. Press OSB next to EFUZ (Electronic Fuze) to toggle parameter to INST (Instantaneous).
13. Press OSB next to SLAM DSPLY to enter the SLAM DISPLAY page.



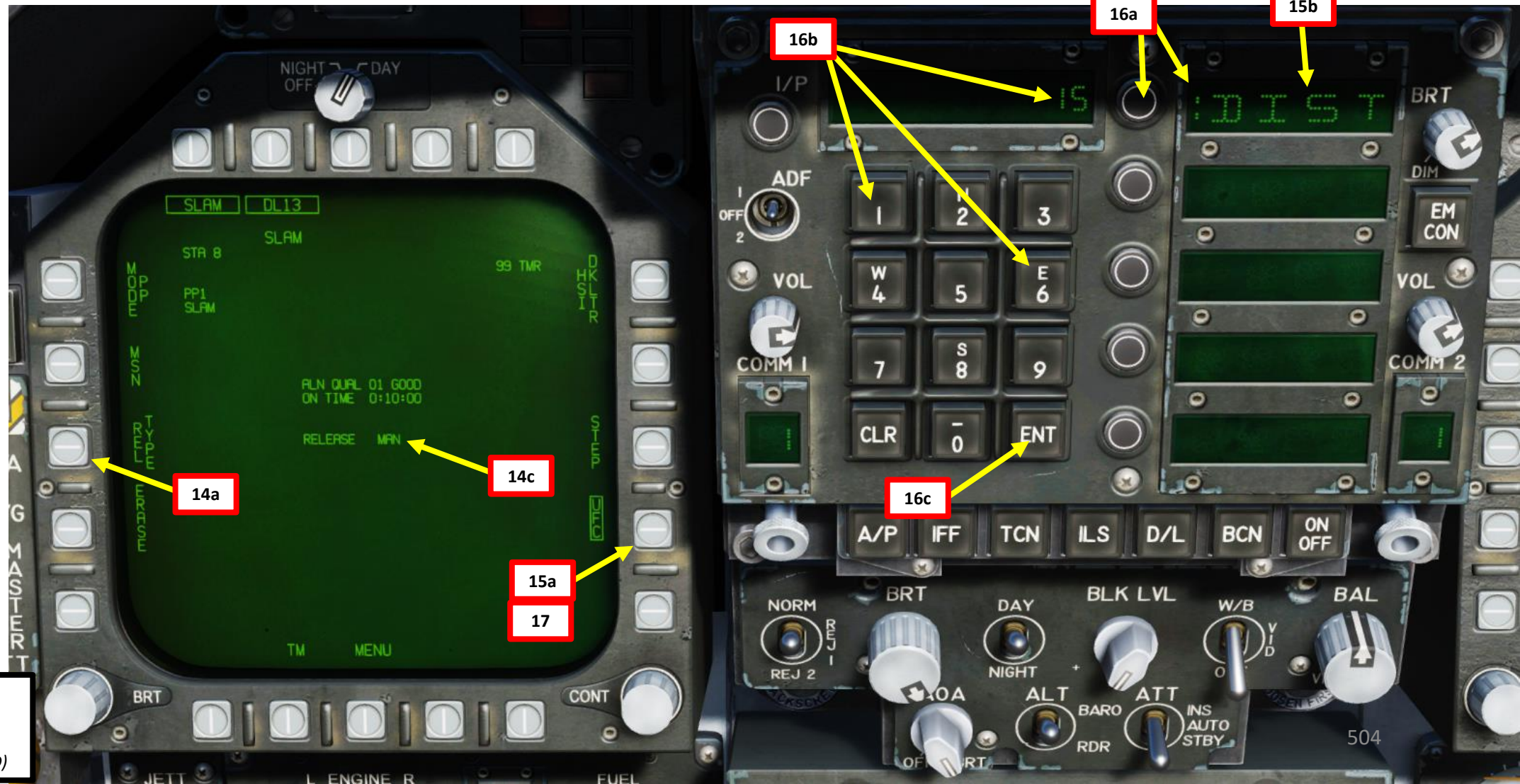


2.11 – AGM-84E SLAM
2.11.2 – Weapon Setup

14. Once you are in the SLAM DISPLAY page, press OSB next to REL TYPE (Release Type), then press OSB next to MAN to select a Manual Release.
15. Press OSB next to UFC (Up-Front Control). Once UFC is boxed, the DIST parameter (distance from target when seeker head goes active) can be modified from the UFC panel.
16. Press OSB next to DIST to select this field. ":" indicates the field is selected. Then, enter "15" on the UFC keypad, then press "ENT" button to set a DIST parameter of 15 nm.
17. Press OSB next to UFC to unselect (unbox) the function.



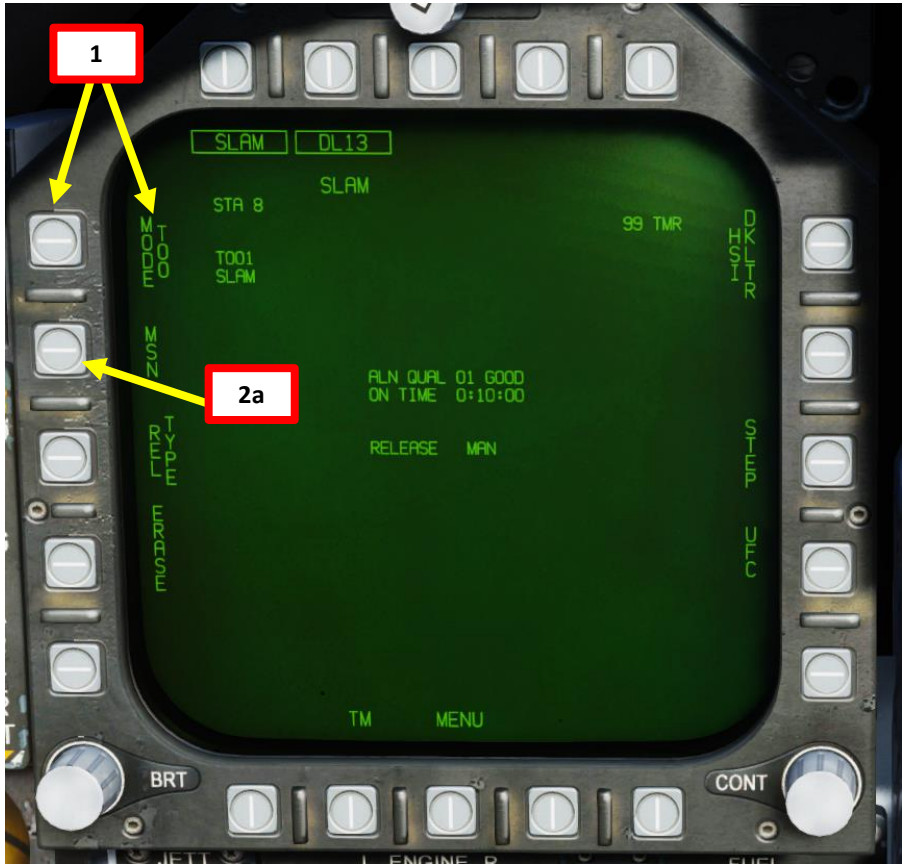
Release Types
- *Manual*
- *Auto Loft*
- *Flight Director (FD)*

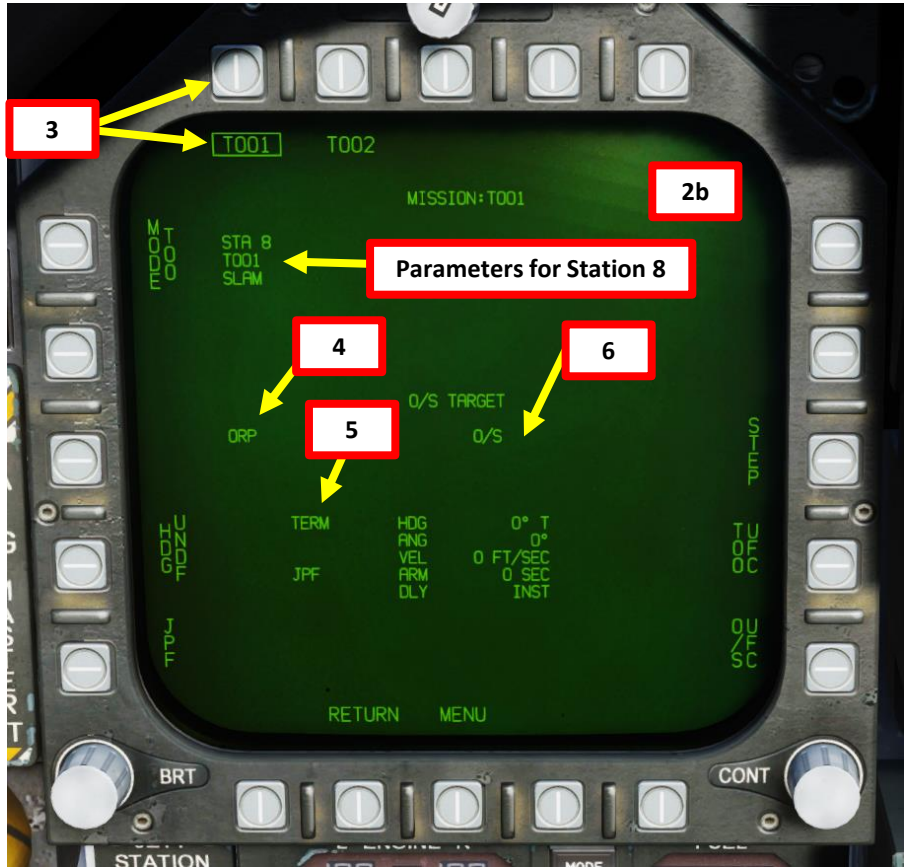


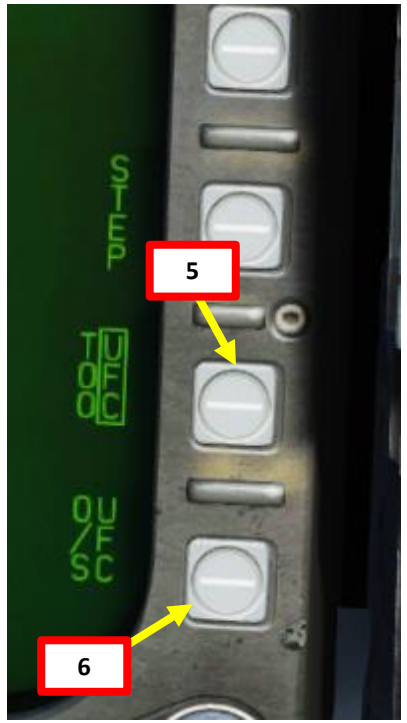
2.11 – AGM-84E SLAM
2.11.3.1 – Target Designation – TOO / Waypoint

1. Press OSB next to MODE to toggle between TOO (Target-of-Opportunity) and PP (Pre-Planned) target designation modes. In this case, we will choose TOO.
2. Press OSB next to MSN to enter the Mission Parameters page.
3. We can define up to two Targets of Opportunity per missile station: TOO1 and TOO2. We will designate the target on TOO1. Press OSB next to TOO1 to select it.
4. The ORP (Offset Release Point) is the designated target point (A/G TGT). For now, the field is empty since no target is defined yet.
5. (Optional) If you want to set TERM (Terminal Attack) parameters such as heading (HDG), attack angle (ANG) and velocity (VEL), press OSB next to TOO UFC. You will be able to enter them via the UFC. However, since we will control the missile remotely during the terminal attack stage, these parameters are not required and we will leave them blank,
6. (Optional) We do not need O/S (Offset) parameters to the ORP since we will control the missile remotely during the terminal attack stage. Therefore, we will not need to use O/S UFC function.



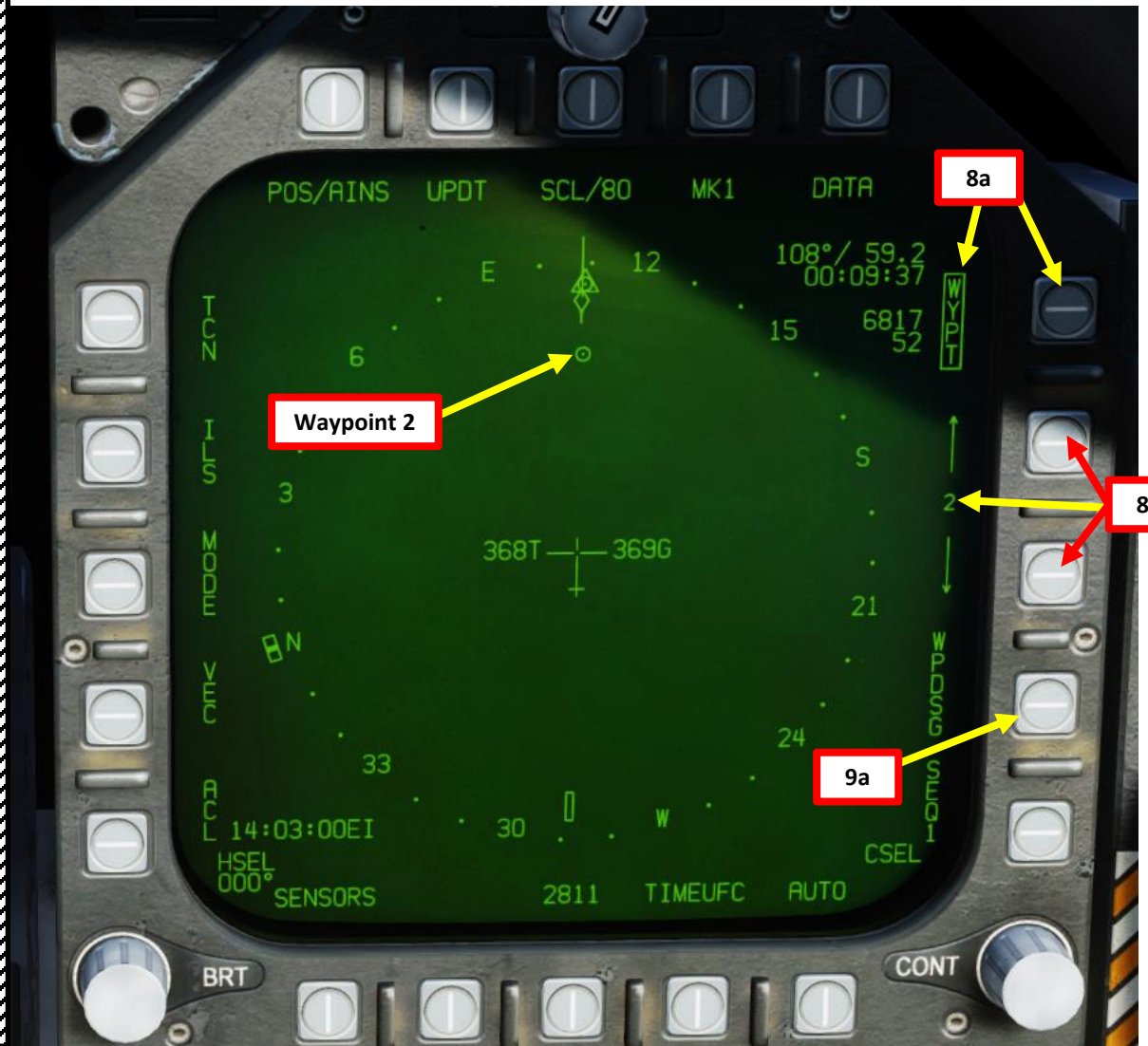


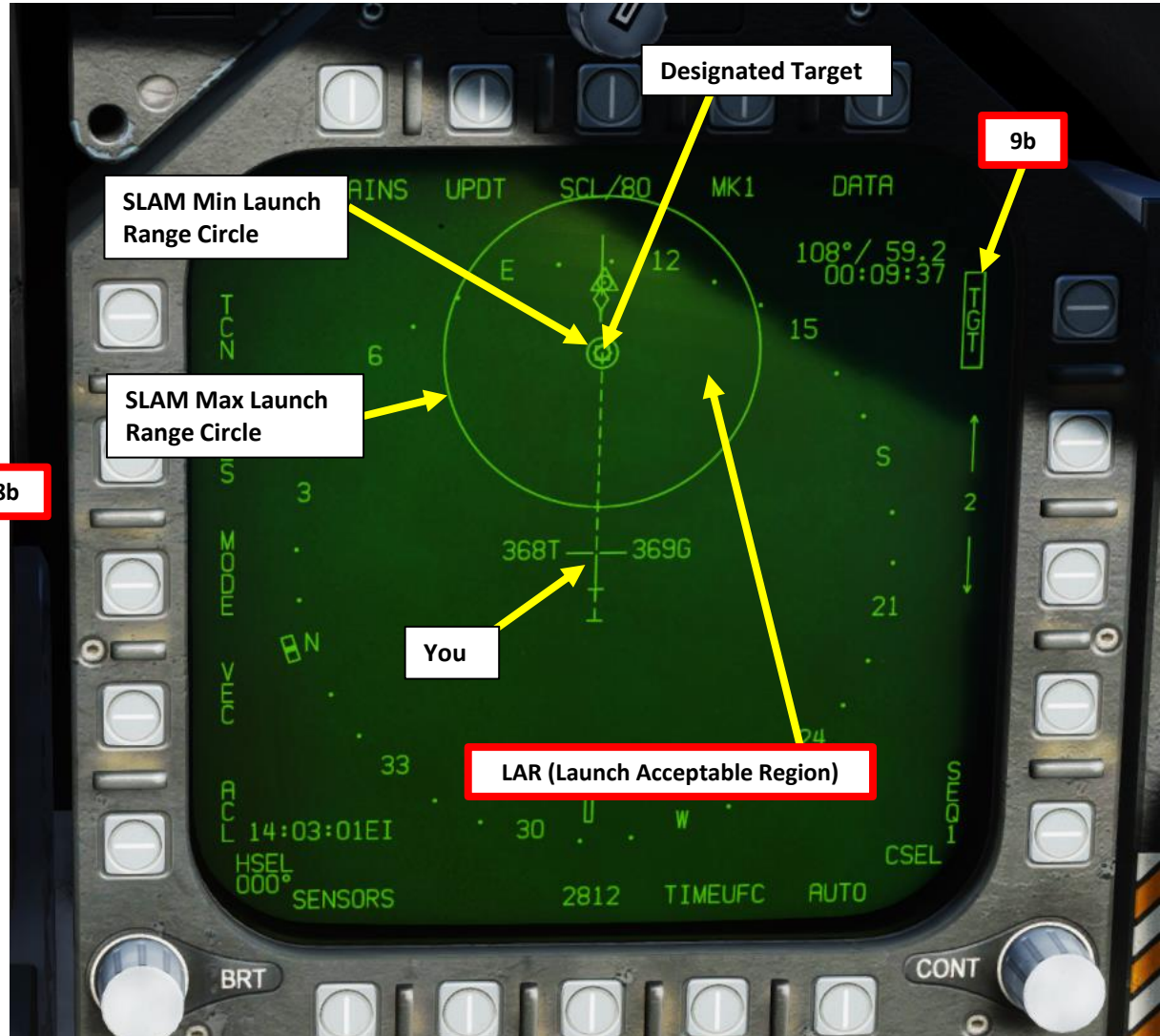




2.11 – AGM-84E SLAM
2.11.3.1 – Target Designation – TOO / Waypoint

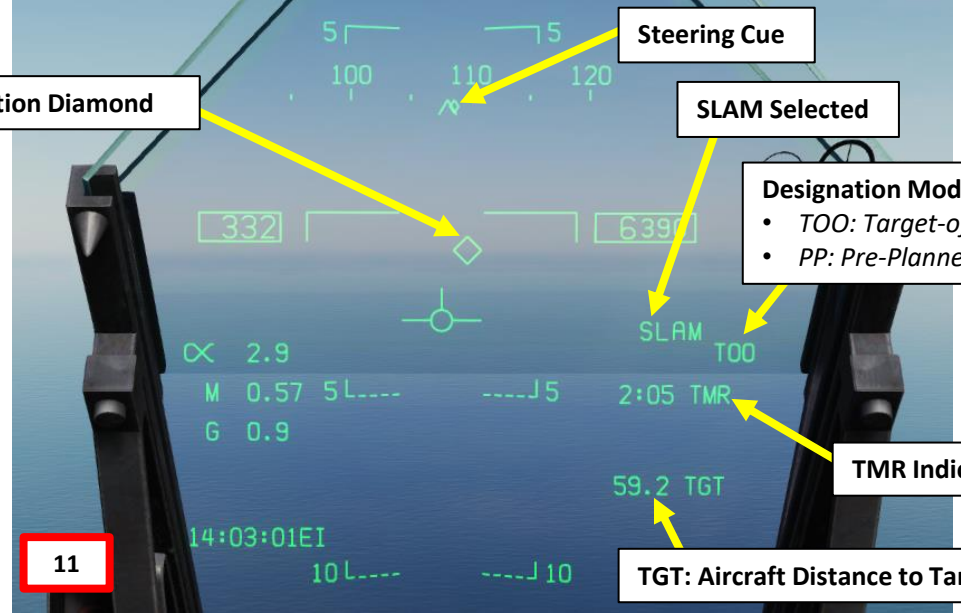
7. In this example, Waypoint 2 is set directly on our target. It is good practice to cross-check the waypoint elevation with the F10 map.
8. On the HSI (Horizontal Situation Indicator), press OSB to select WYPT (boxed when selected). After, select Waypoint 2 using the OSBs next to the arrows.
9. Once the Waypoint 2 is selected, press the OSB next to WPSDG (Waypoint Designate) to designate Waypoint 2 as your TGT1 (Target Point 1). On the HSI, « WYPT » will switch to « TGT ». Minimum and Maximum Launch Range circles will appear on the HSI.

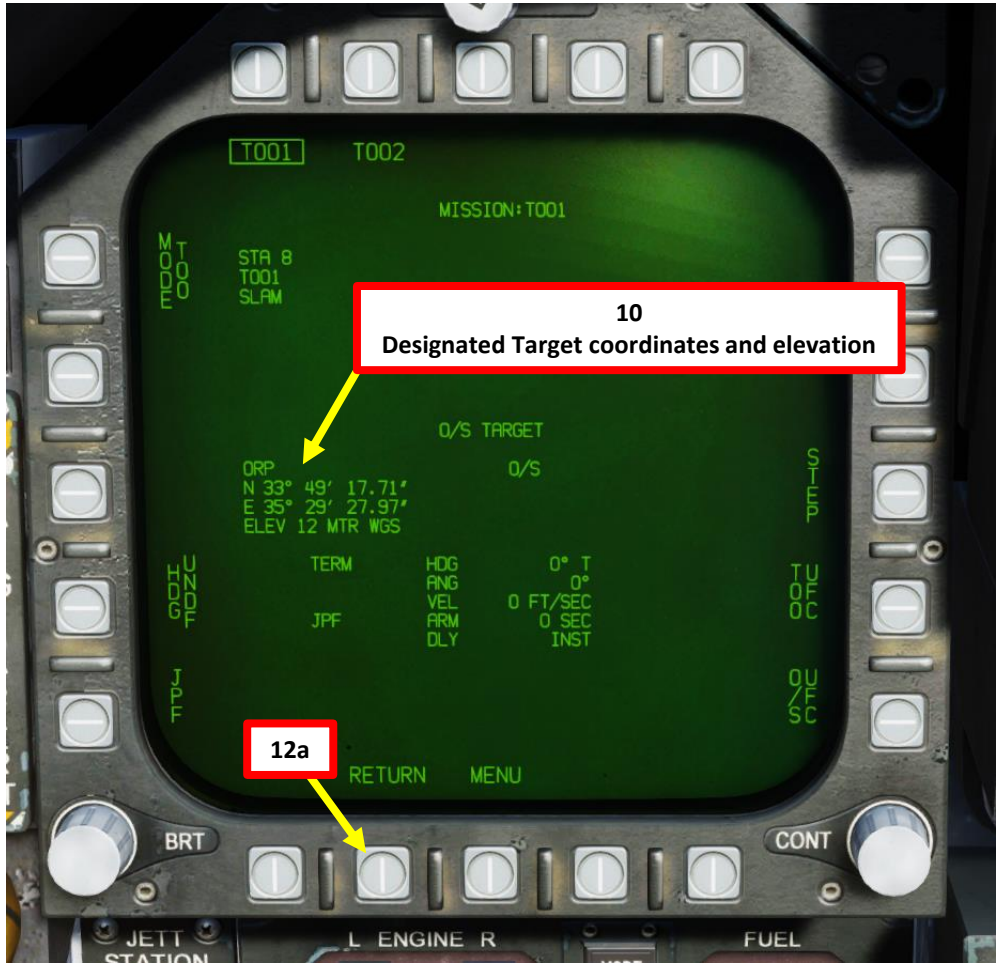




2.11 – AGM-84E SLAM
2.11.3.1 – Target Designation – TOO / Waypoint

10. The coordinates and elevation of the designated waypoint (TGT1) will then directly transfer to the ORP (Offset Release Point) in the MSN page.
11. The target designation diamond, steering cues, range to target, SLAM indication, TMR indication (time required to be within range of a valid SLAM launch) and TOO indication will appear on the HUD.
12. Press the OSB next to RETURN to return back to the SMS (Stores) page. We are now almost ready to begin our strike and launch the missile.
13. Please proceed to section 2.11.4 – Weapon Launch & Control.



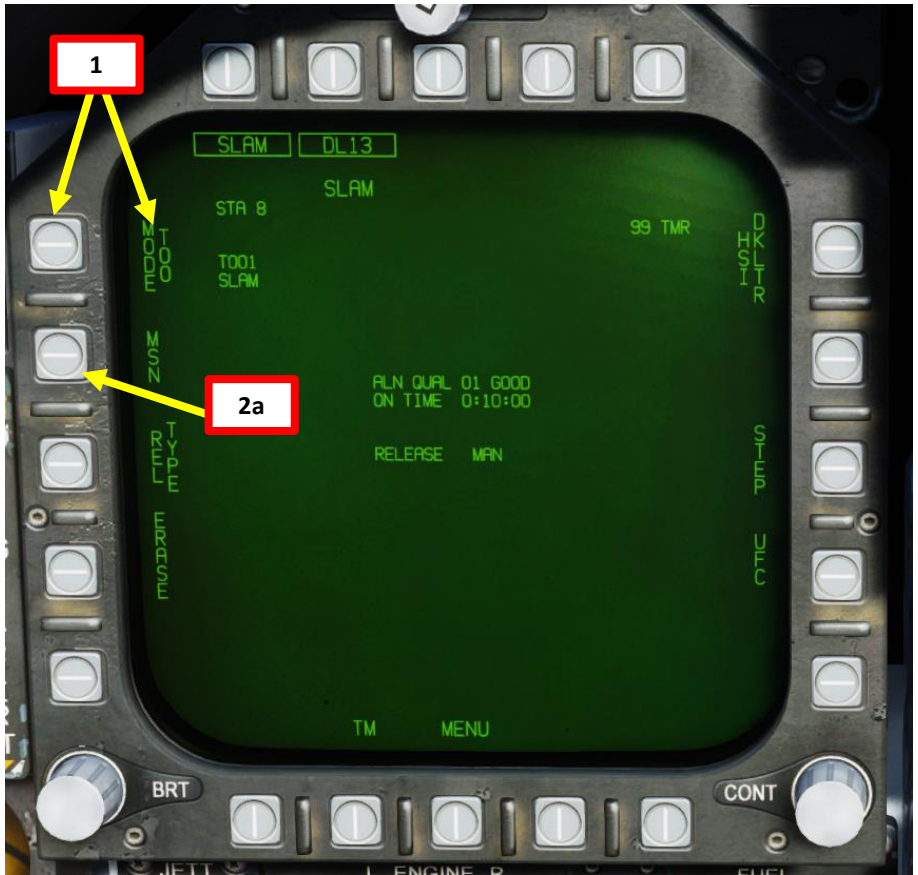


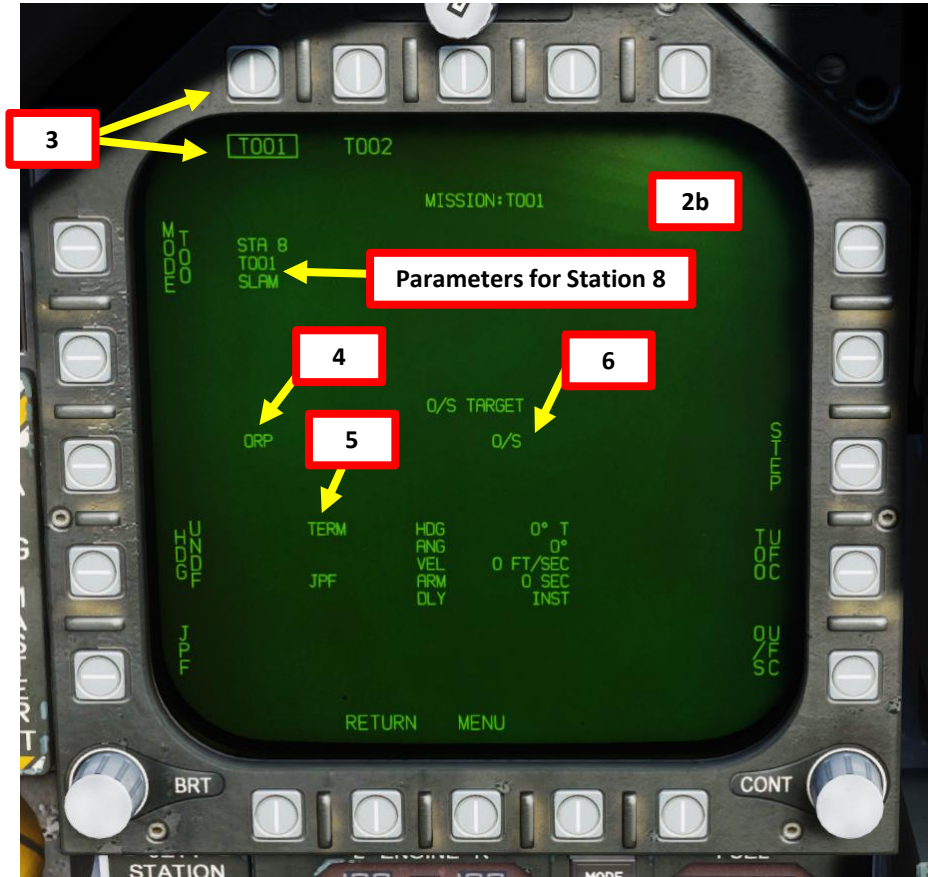


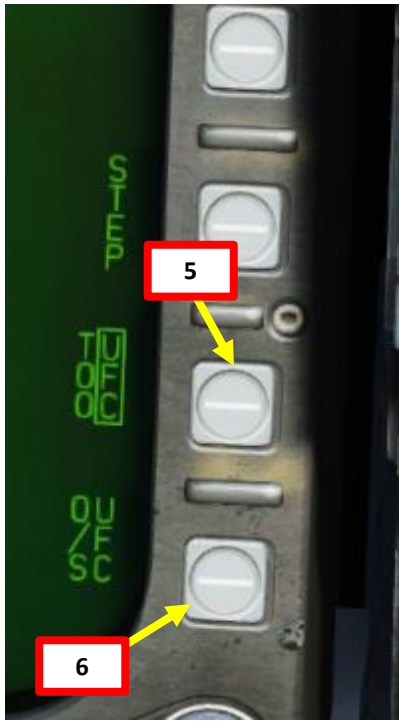
2.11 – AGM-84E SLAM
2.11.3.2 – Target Designation – TOO / Targeting Pod

1. Press OSB next to MODE to toggle between TOO (Target-of-Opportunity) and PP (Pre-Planned) target designation modes. In this case, we will choose TOO.
2. Press OSB next to MSN to enter the Mission Parameters page.
3. We can define up to two Targets of Opportunity per missile station: TOO1 and TOO2. We will designate the target on TOO1. Press OSB next to TOO1 to select it.
4. The ORP (Offset Release Point) is the designated target point (A/G TGT). For now, the field is empty since no target is defined yet.
5. (Optional) If you want to set TERM (Terminal Attack) parameters such as heading (HDG), attack angle (ANG) and velocity (VEL), press OSB next to TOO UFC. You will be able to enter them via the UFC. However, since we will control the missile remotely during the terminal attack stage, these parameters are not required and we will leave them blank,
6. (Optional) We do not need O/S (Offset) parameters to the ORP since we will control the missile remotely during the terminal attack stage. Therefore, we will not need to use O/S UFC function.



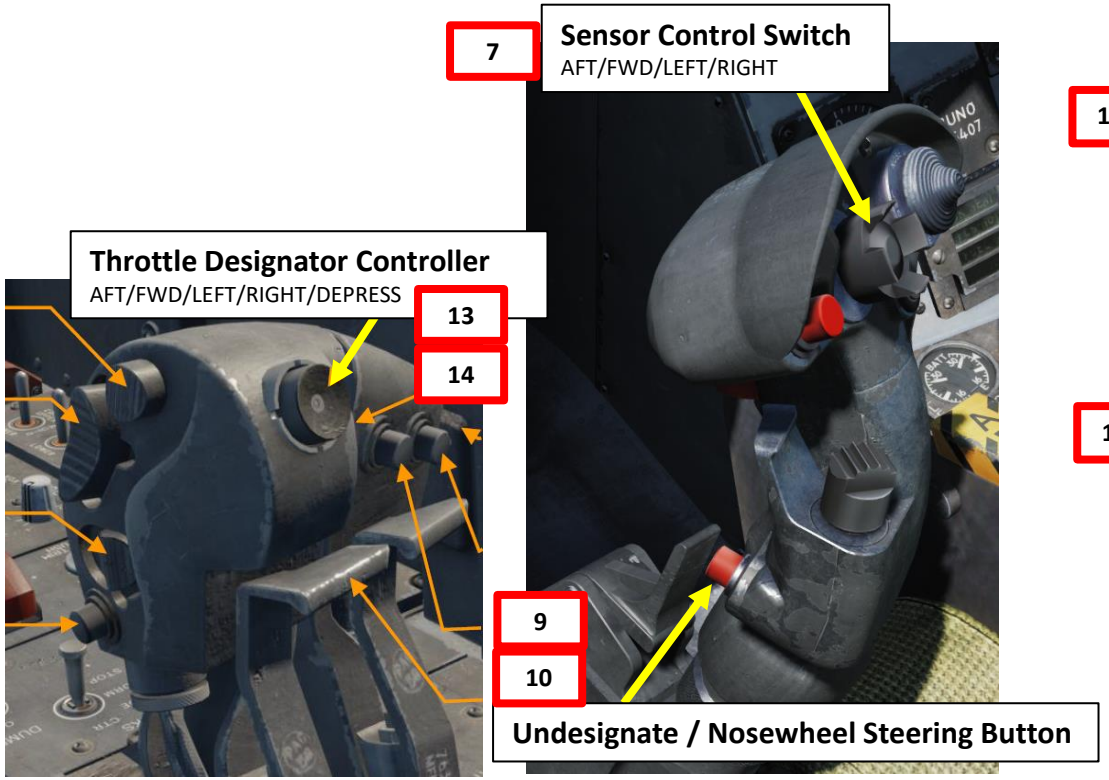






2.11 – AGM-84E SLAM
2.11.3.2 – Target Designation – TOO / Targeting Pod

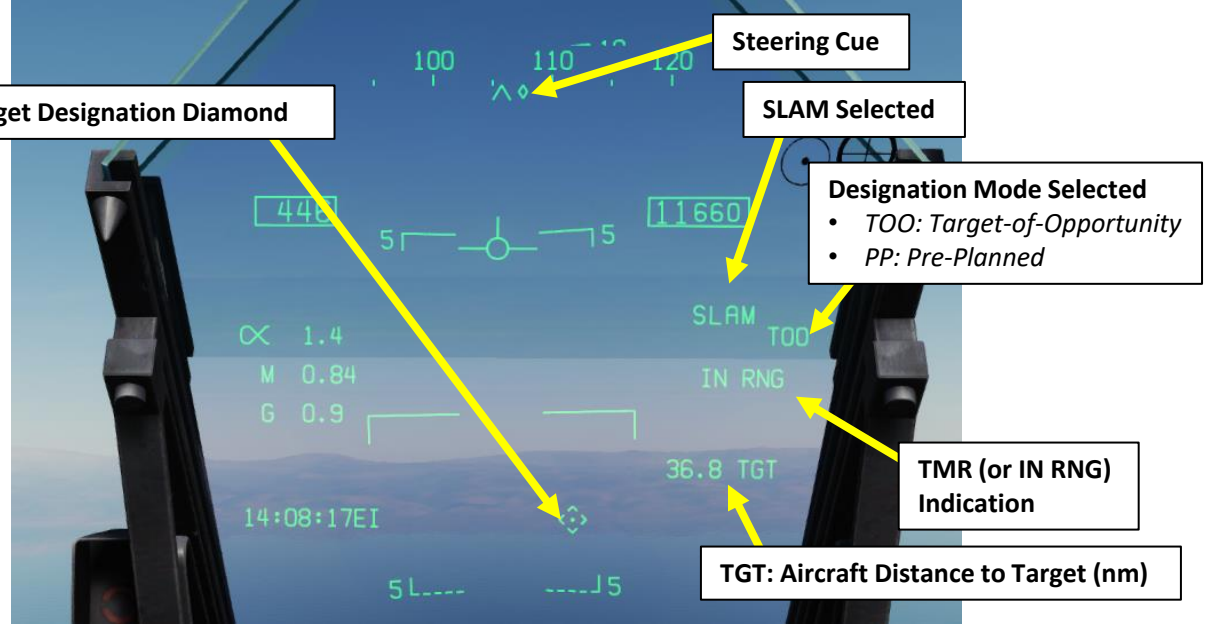
7. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI to slave TDC to the targeting pod.
8. The Select Focus Diamond indicates what display is selected.
9. Press the Undesignate button twice to select VVSLV mode.
10. Press the Undesignate button twice to select unselect VVSLV and switch to Snowplow mode.
11. When Snowplow is first entered, the FLIR is set to 0° left/right and -8° down.
12. Set Zoom level, TV/FLIR mode and Field-of-View as required.
13. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target.
14. To designate a target from Snowplow mode, use the TDC DEPRESS control ("ENTER"). A diamond will appear over the designated point on the FLIR page and on the Heads-Up Display as well.

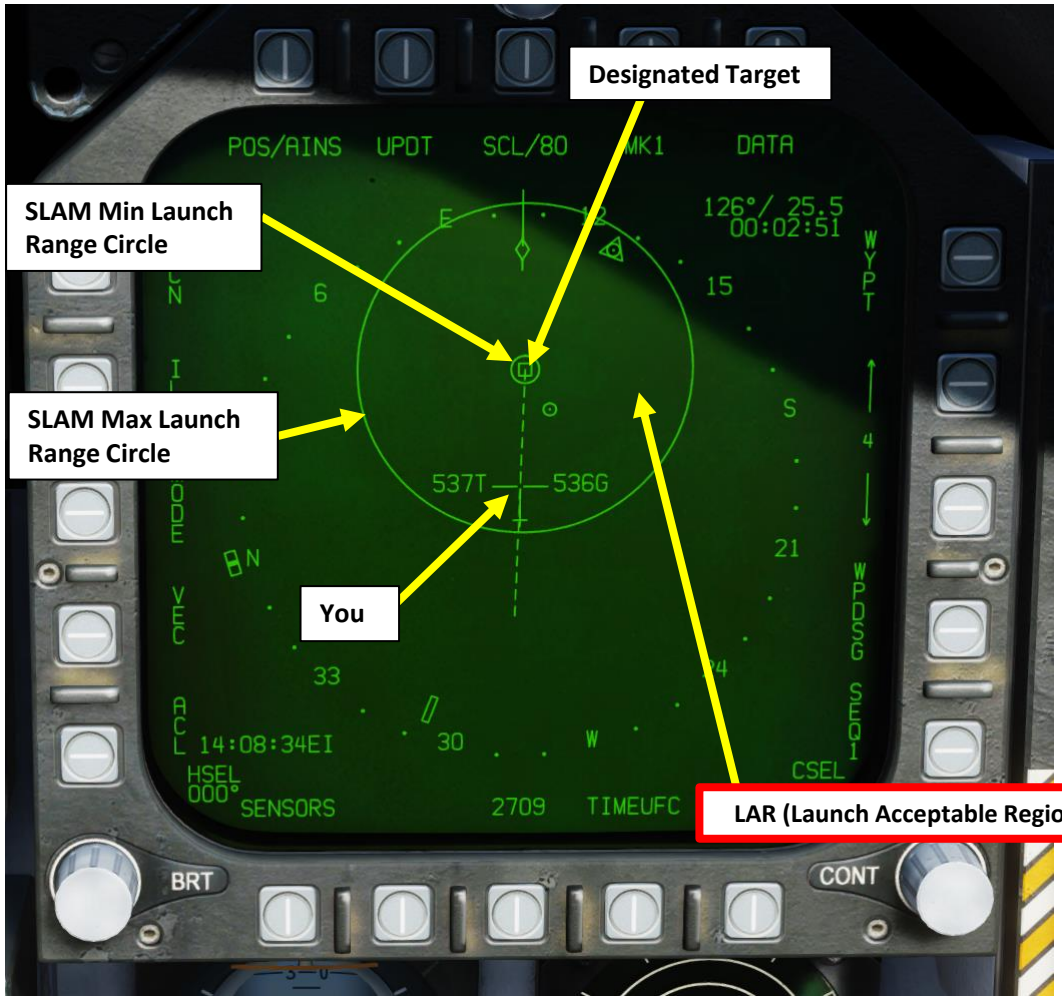




2.11 – AGM-84E SLAM
2.11.3.2 – Target Designation – TOO / Targeting Pod

15. The target designation diamond, steering cues, range to target, SLAM indication, TMR indication (time required to be within range of a valid SLAM launch) and TOO indication will appear on the HUD.
    - Note: Since the targeting pod's effective range is much shorter than the maximum range of a SLAM missile, it is possible that the TMR indication is already set to IN RNG (In Range) once you designate the target.
16. Minimum and Maximum Launch Range circles will appear on the HSI.

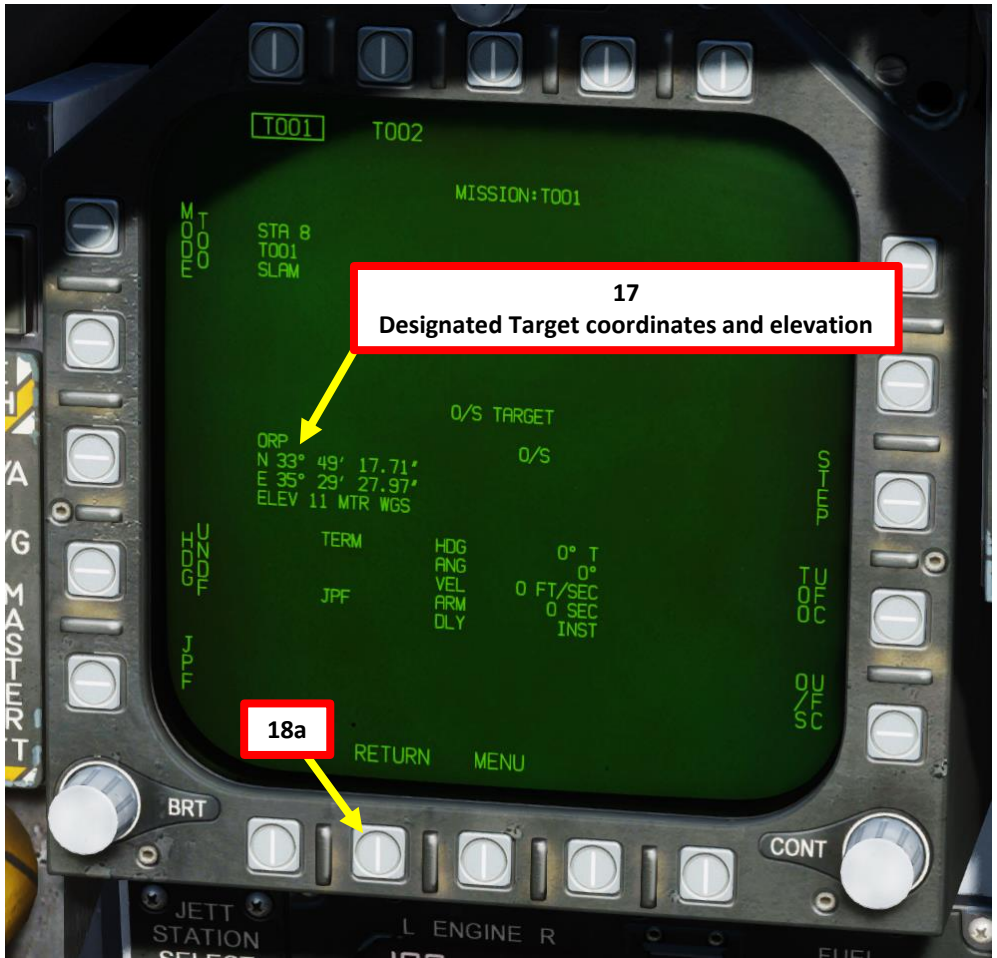






2.11 – AGM-84E SLAM
2.11.3.2 – Target Designation – TOO / Targeting Pod

17. The coordinates and elevation of the designated target point will then directly transfer to the ORP (Offset Release Point) in the MSN page.
18. Press the OSB next to RETURN to return back to the SMS (Stores) page. We are now almost ready to begin our strike and launch the missile.
19. Please proceed to section 2.11.4 – Weapon Launch & Control.

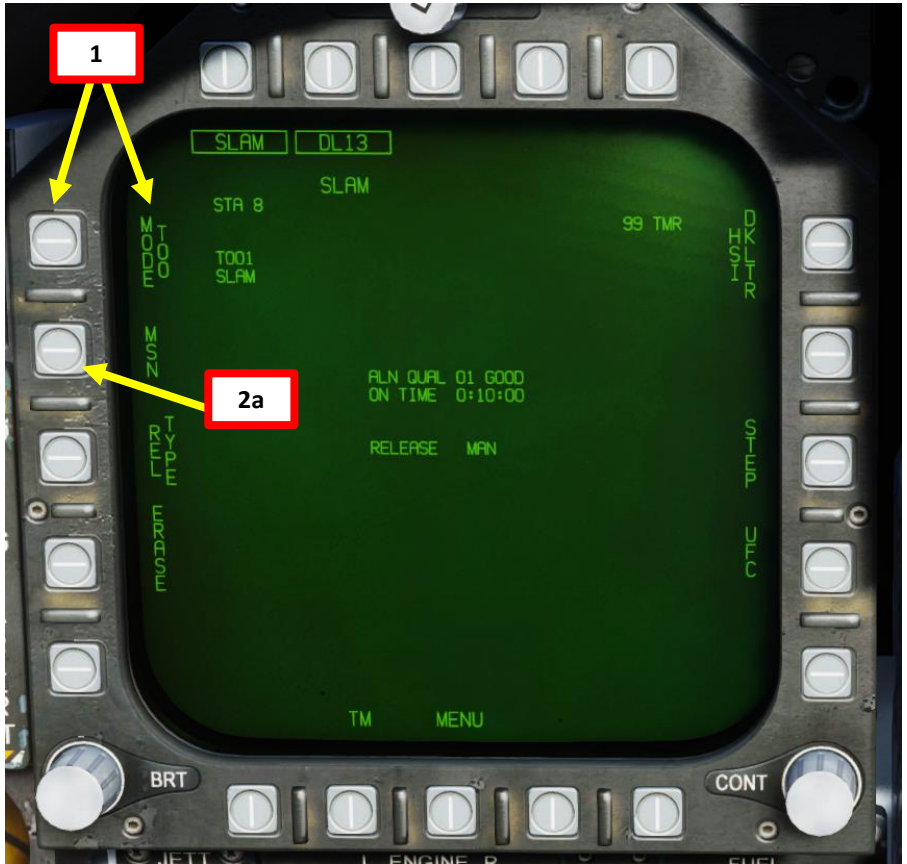


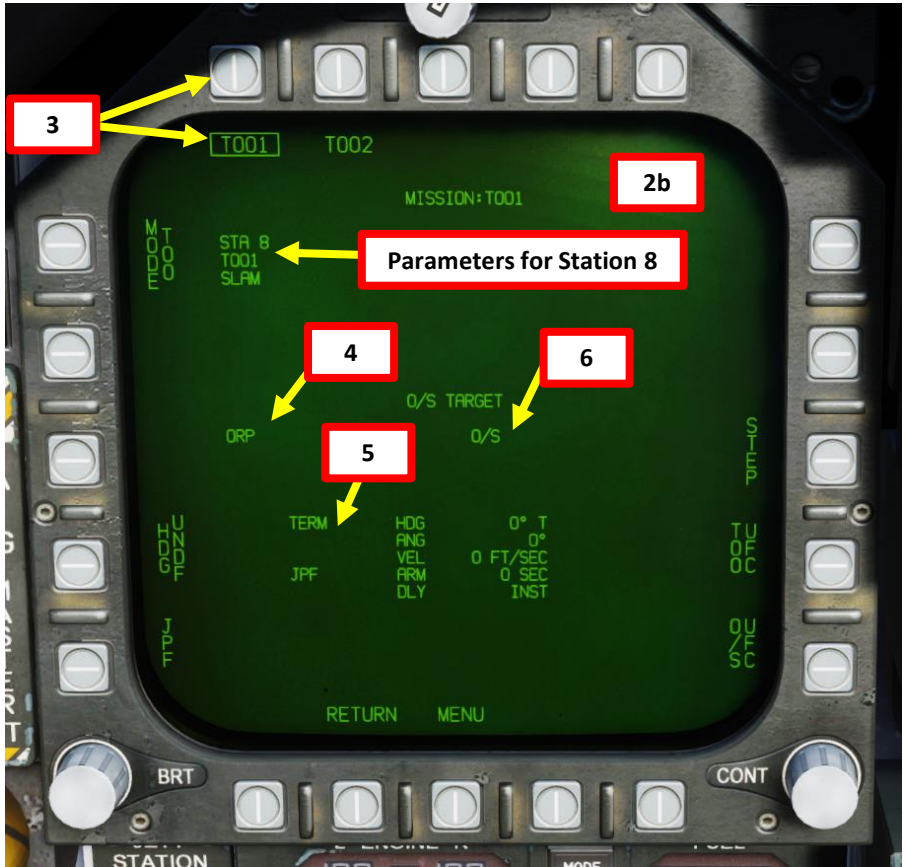


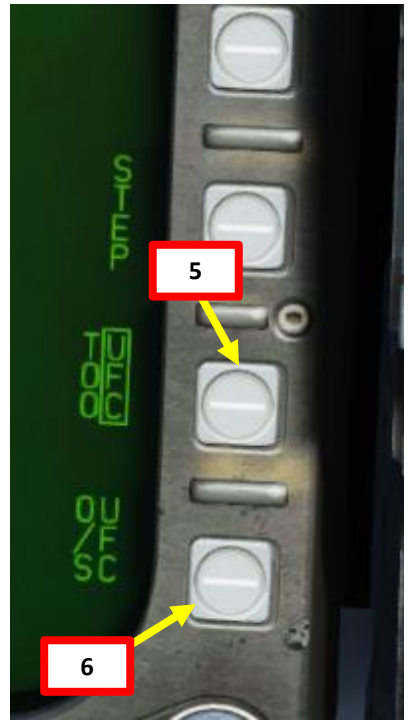
2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

1. Press OSB next to MODE to toggle between TOO (Target-of-Opportunity) and PP (Pre-Planned) target designation modes. In this case, we will choose TOO.
2. Press OSB next to MSN to enter the Mission Parameters page.
3. We can define up to two Targets of Opportunity per missile station: TOO1 and TOO2. We will designate the target on TOO1. Press OSB next to TOO1 to select it.
4. The ORP (Offset Release Point) is the designated target point (A/G TGT). For now, the field is empty since no target is defined yet.
5. (Optional) If you want to set TERM (Terminal Attack) parameters such as heading (HDG), attack angle (ANG) and velocity (VEL), press OSB next to TOO UFC. You will be able to enter them via the UFC. However, since we will control the missile remotely during the terminal attack stage, these parameters are not required and we will leave them blank,
6. (Optional) We do not need O/S (Offset) parameters to the ORP since we will control the missile remotely during the terminal attack stage. Therefore, we will not need to use O/S UFC function.



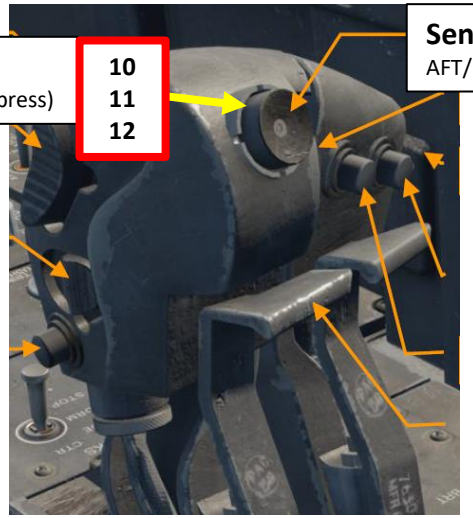




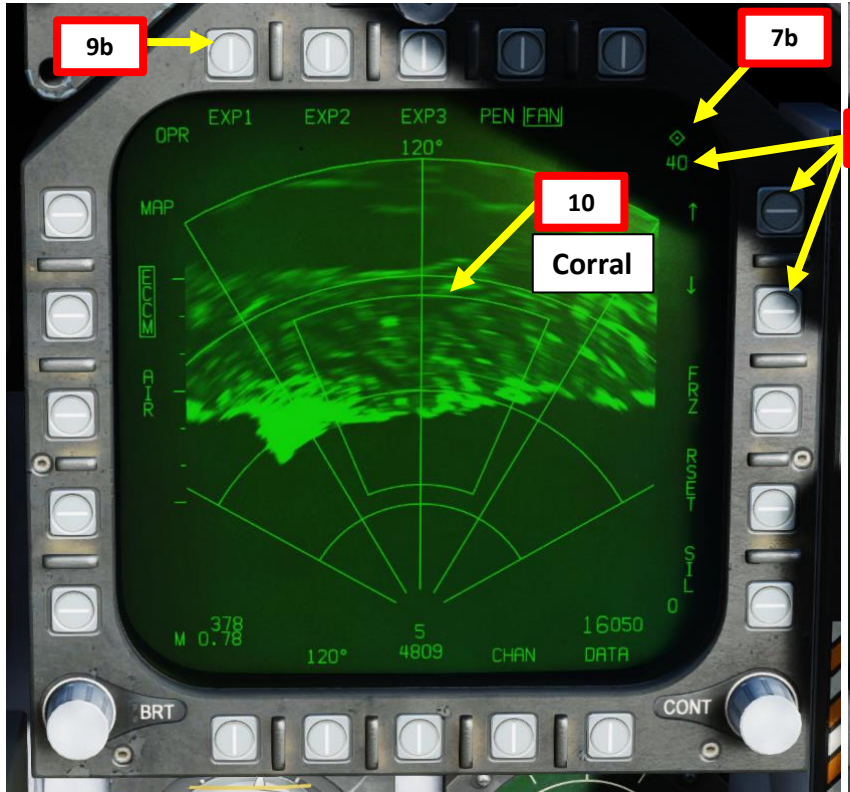


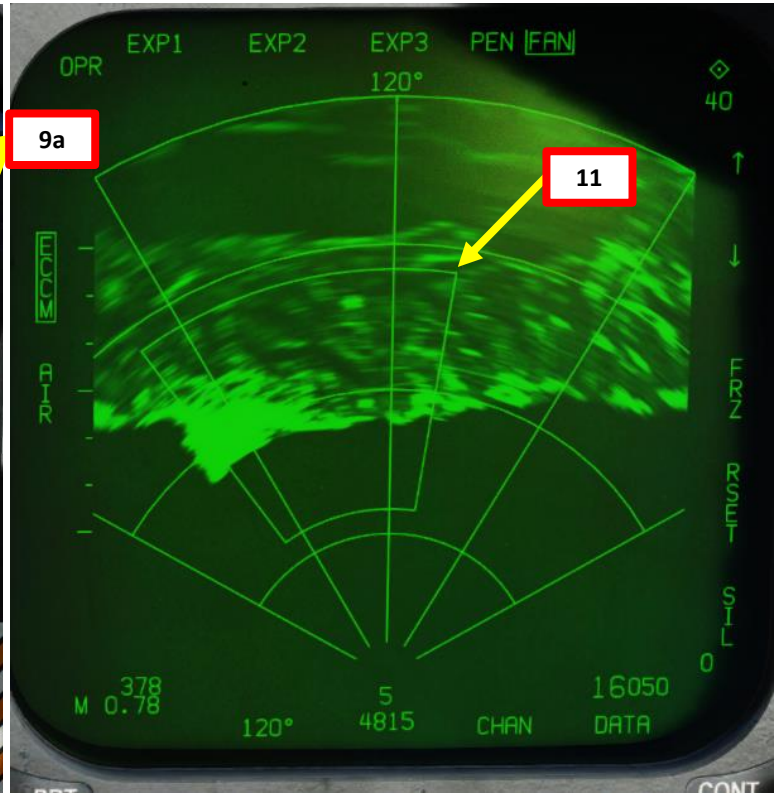
2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

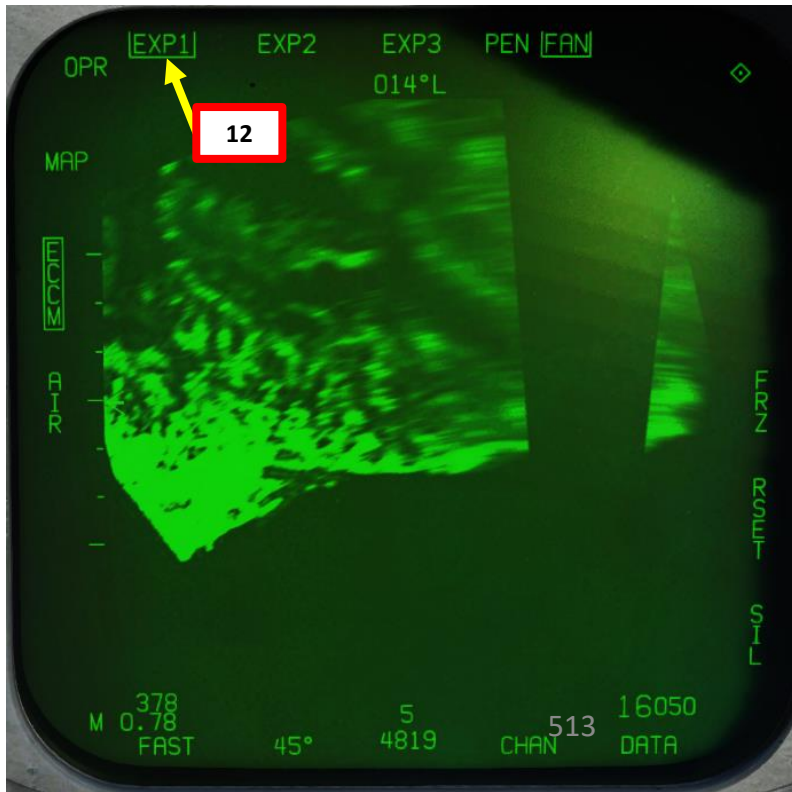
7. Select RDR ATTK page (since A/G Master Mode is selected, the air-to-ground radar page should be visible already) and press the Sensor Control Switch in the direction of the selected DDI (RIGHT) to slave TDC (Throttle Designation Controller) to the air-to-ground radar. Focus diamond should be visible.
8. We could designate the target directly from the MAP (Ground Mapping) mode, but we will use Expanded Modes (EXP) to progressively get a better view before designating the target. You could switch directly from MAP to EXP3, but going from MAP → EXP1 → EXP2 → EXP3 will make your life much easier.
9. Adjust radar range as desired, then press on the OSB (Option Select Button) next to EXP1.
10. Press and hold TDC DEPRESS control (« ENTER »).
11. While TDC DEPRESS is held, slew the trapezoidal corral over the desired region you want to set as a sector map (zoom) using the TDC controls.
12. Release the TDC DEPRESS control to enter EXP1 mode.
13. The air-to-ground radar will automatically adjust its range to give you a better view of the region you just expanded.





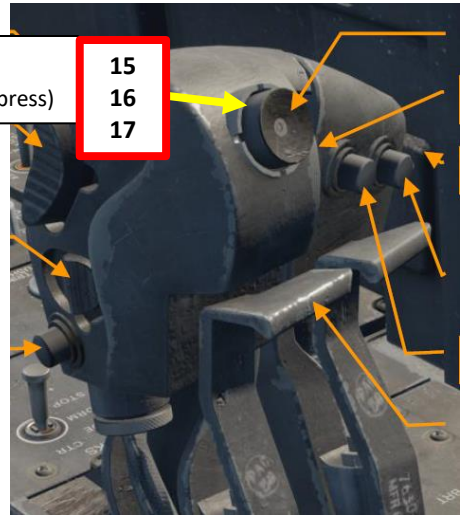


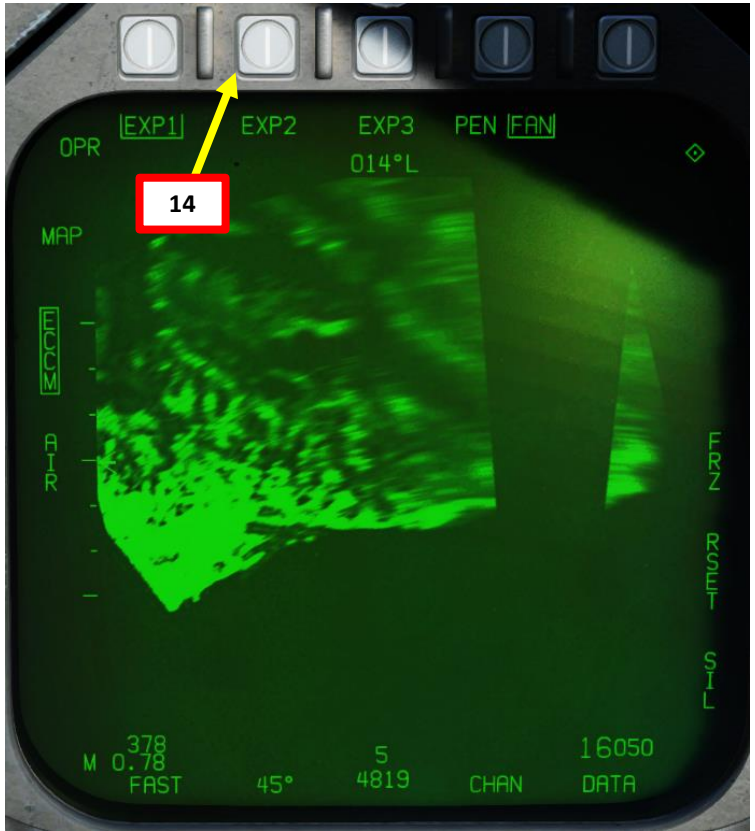


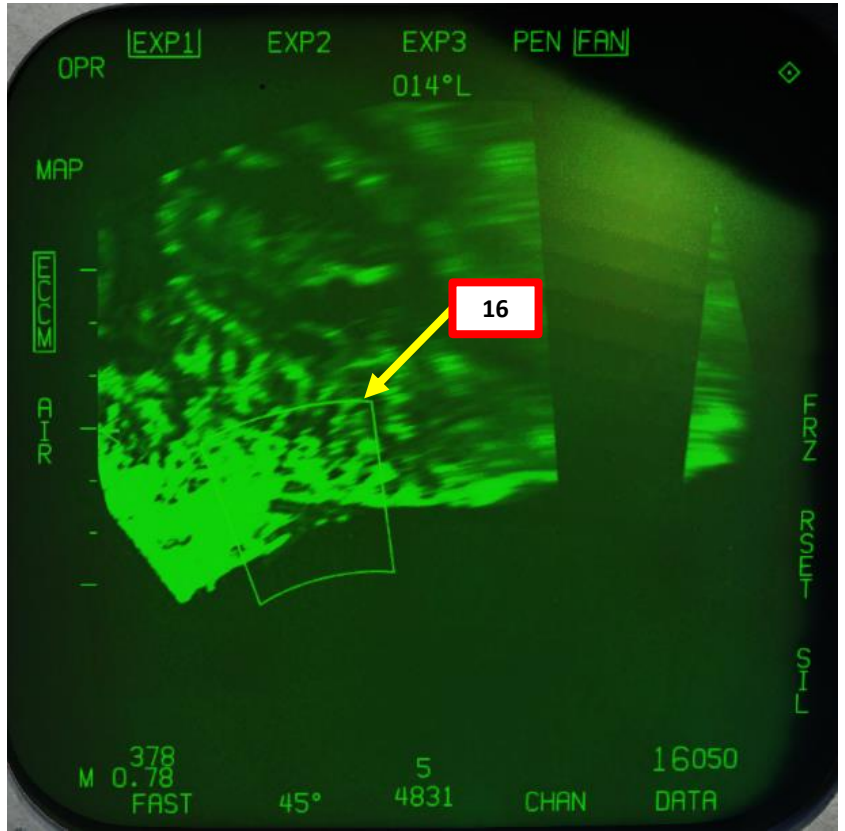


2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

14. Press on the OSB (Option Select Button) next to EXP2.
15. Press and hold TDC DEPRESS control (« ENTER »).
16. While TDC DEPRESS is held, slew the trapezoidal corral over the desired region you want to set as a patch map (zoom) using the TDC controls.
17. Release the TDC DEPRESS control to enter EXP2 mode.



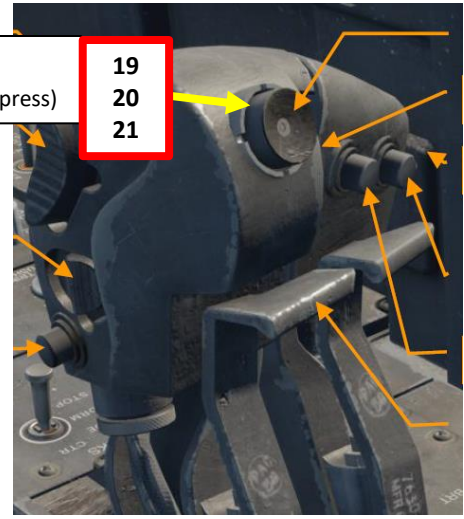




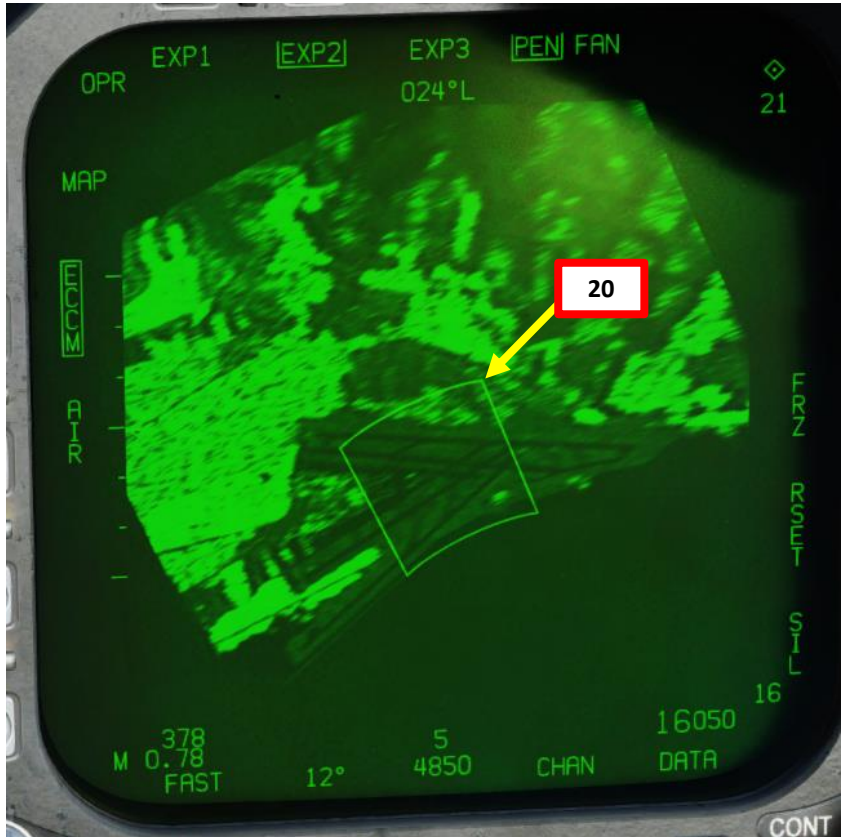


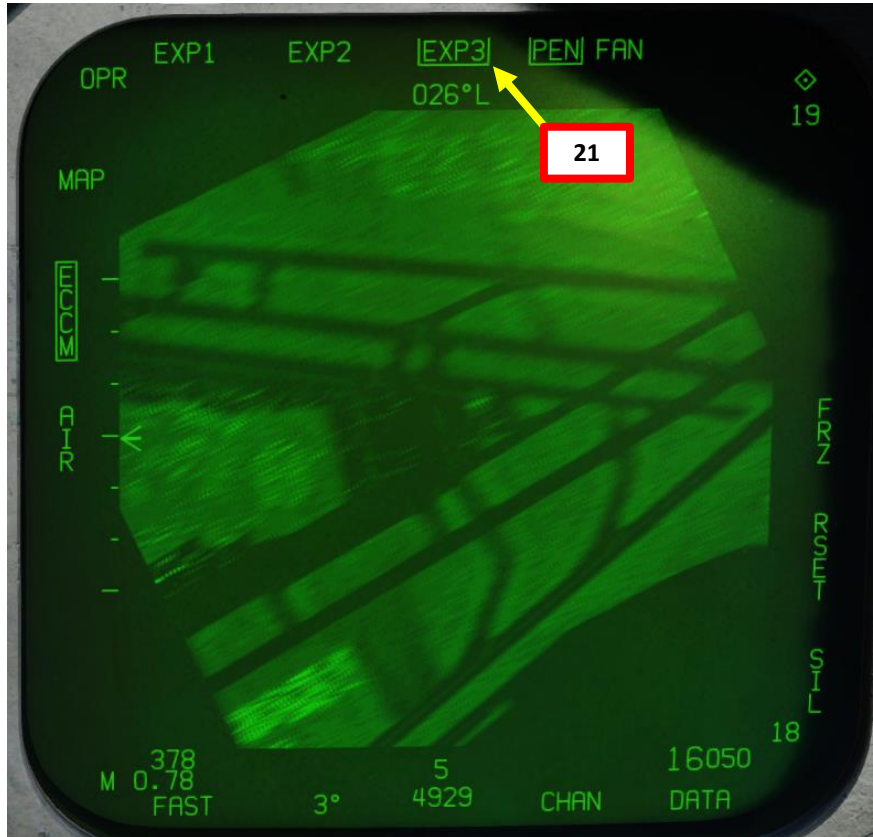
2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

18. Press on the OSB (Option Select Button) next to EXP3.
19. Press and hold TDC DEPRESS control (« ENTER »).
20. While TDC DEPRESS is held, slew the trapezoidal corral over the desired region you want to set as a Synthetic-Aperture Radar (SAR) map (zoom) using the TDC controls.
21. Release the TDC DEPRESS control to enter EXP3 mode.





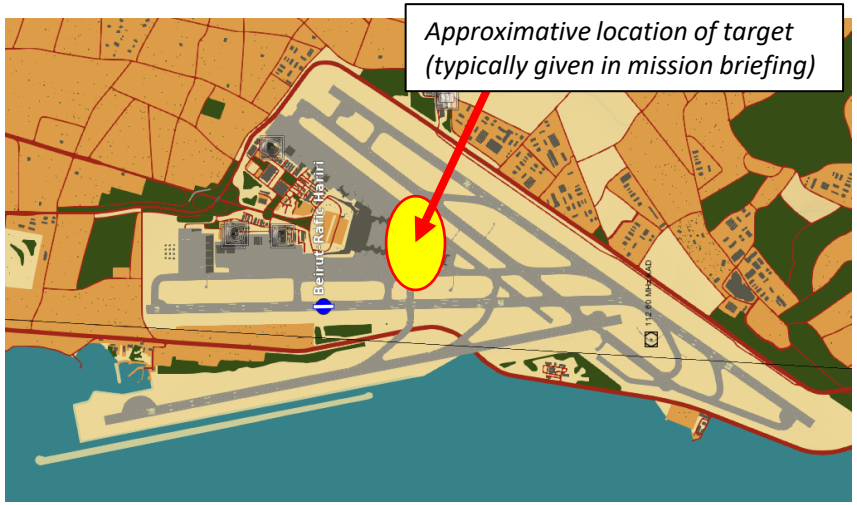


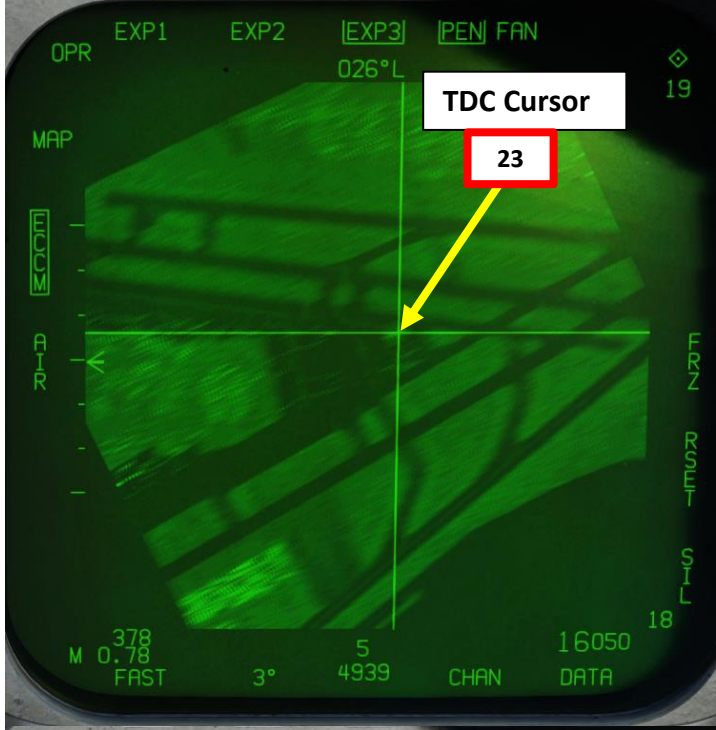


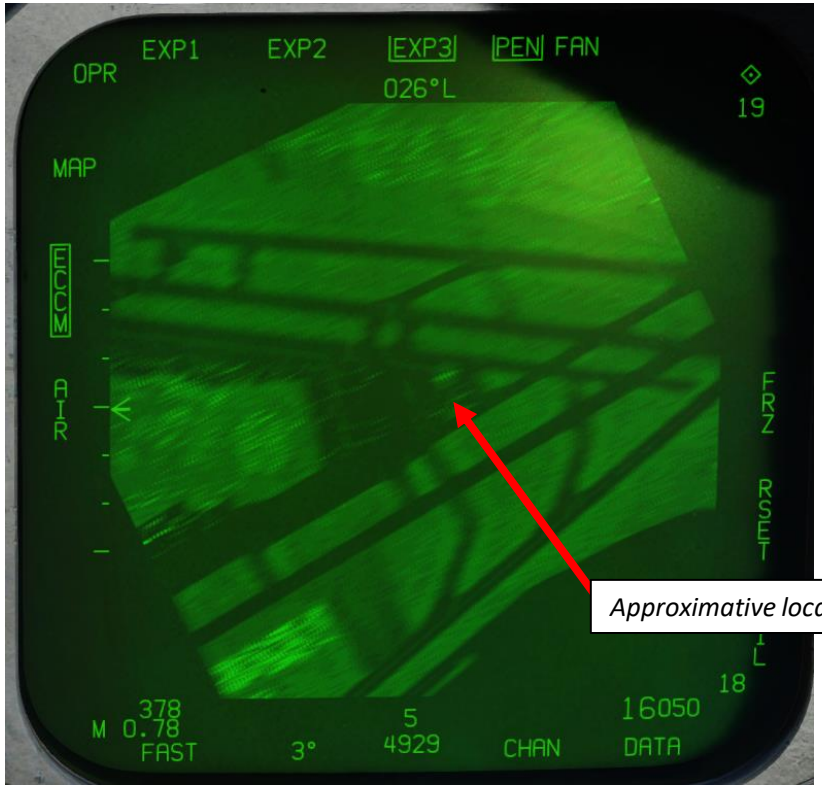
2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

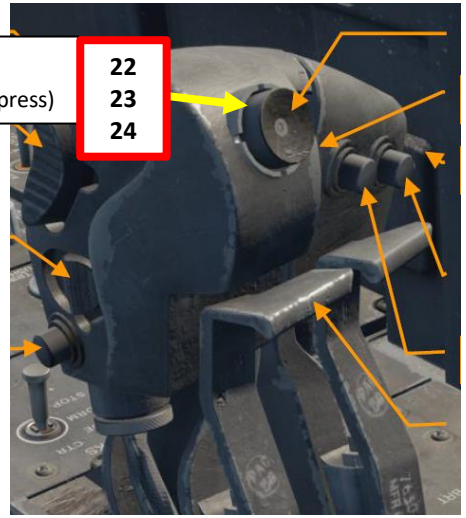
22. Press and hold TDC DEPRESS control (« ENTER »).
23. While TDC DEPRESS is held, slew the TDC cursor on the desired spot you want to designate using the TDC controls.
24. Release the TDC DEPRESS control to designate target. A designation cross will be visible on the RDR ATTK display.

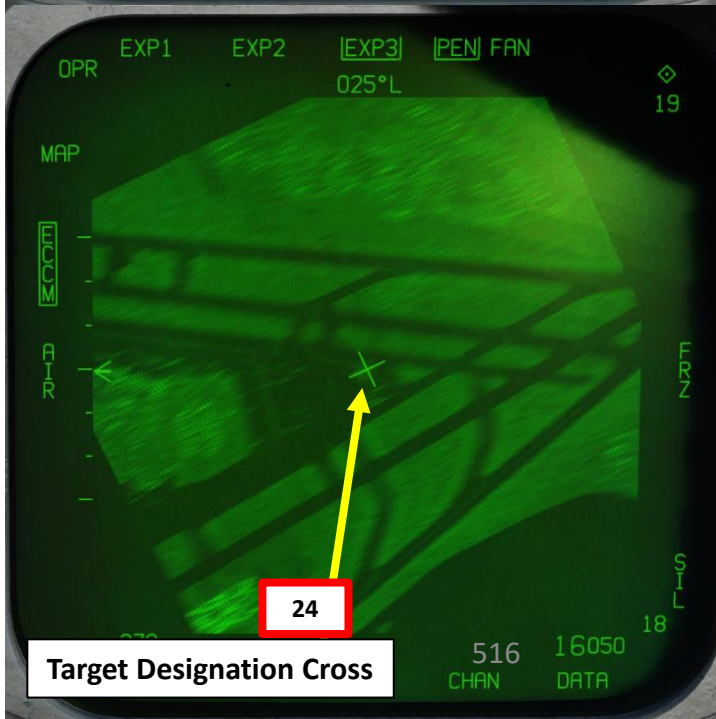
- *Take note that target designation with the air-to-ground radar is not very precise. If visibility allows it, a good idea would be to select the FLIR (Targeting Pod) page, which will automatically be slewed over the air-to-ground radar designated point. From there, you can perform some adjustments (see section 2.11.3.2 to designate a target with the targeting pod).*





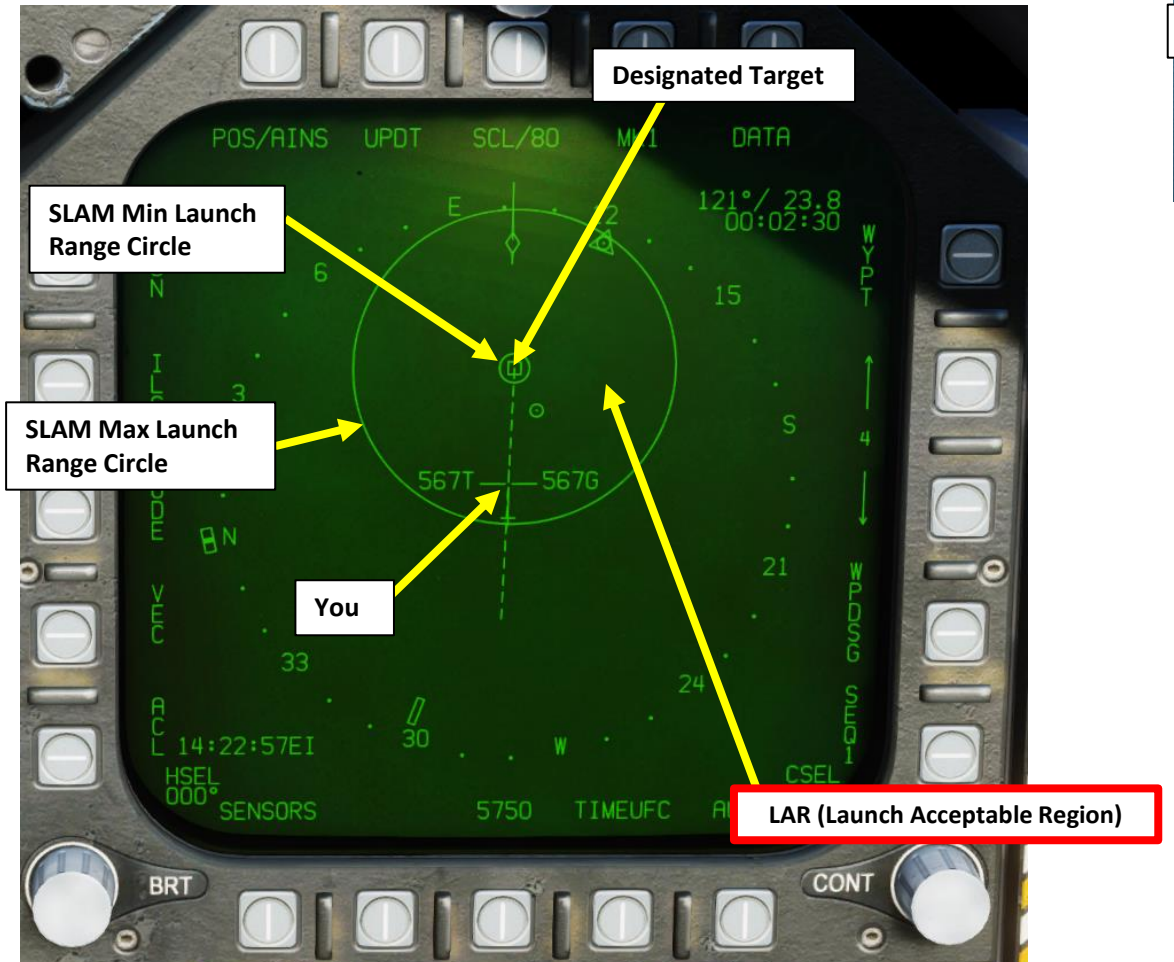


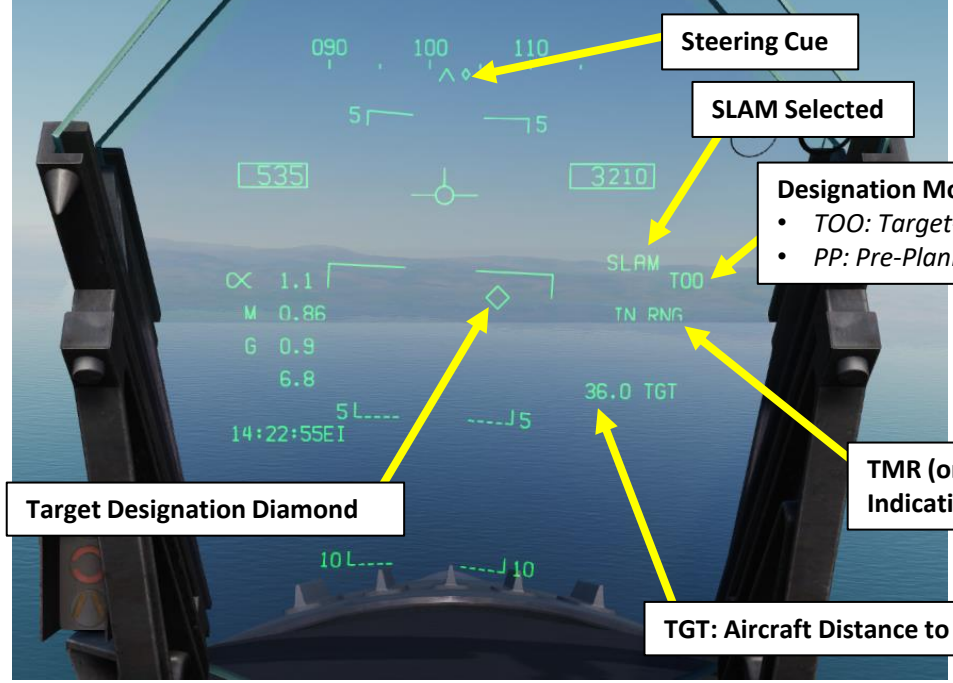


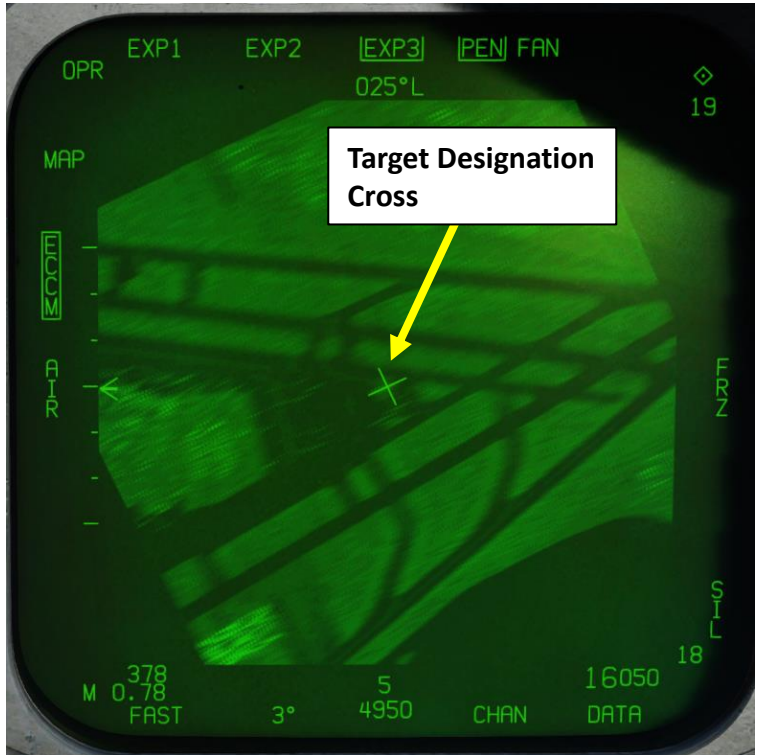


2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

25. The target designation diamond, steering cues, range to target, SLAM indication, TMR indication (time required to be within range of a valid SLAM launch) and TOO indication will appear on the HUD.
    - Note: Since the air-to-ground expanded modes' effective range is much shorter (30-40 nm) than the maximum range of a SLAM missile, it is possible that the TMR indication is already set to IN RNG (In Range) once you designate the target.
26. Minimum and Maximum Launch Range circles will appear on the HSI (Horizontal Situation Indicator) page.

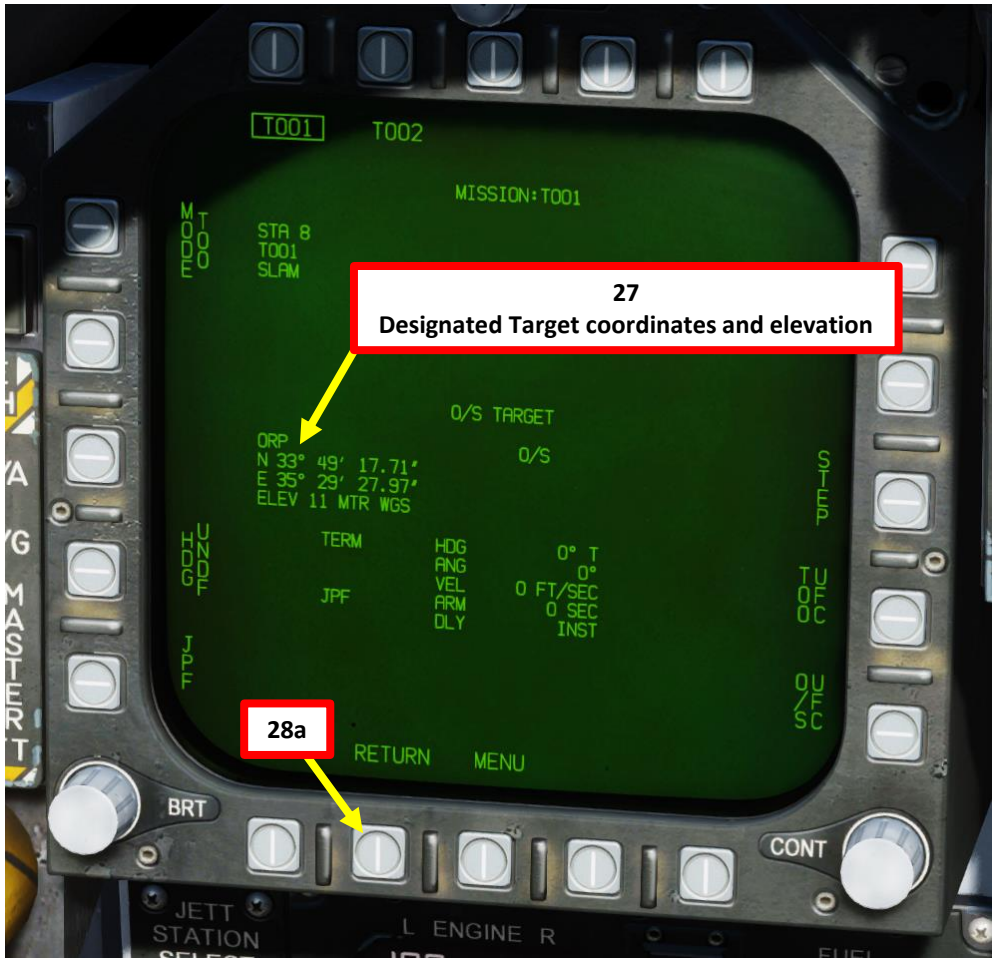






2.11 – AGM-84E SLAM
2.11.3.3 – Target Designation – TOO / Air-to-Ground Radar

27. The coordinates and elevation of the designated target point will then directly transfer to the ORP (Offset Release Point) in the MSN page.
28. Press the OSB next to RETURN to return back to the SMS (Stores) page. We are now almost ready to begin our strike and launch the missile.
29. Please proceed to section 2.11.4 – Weapon Launch & Control.

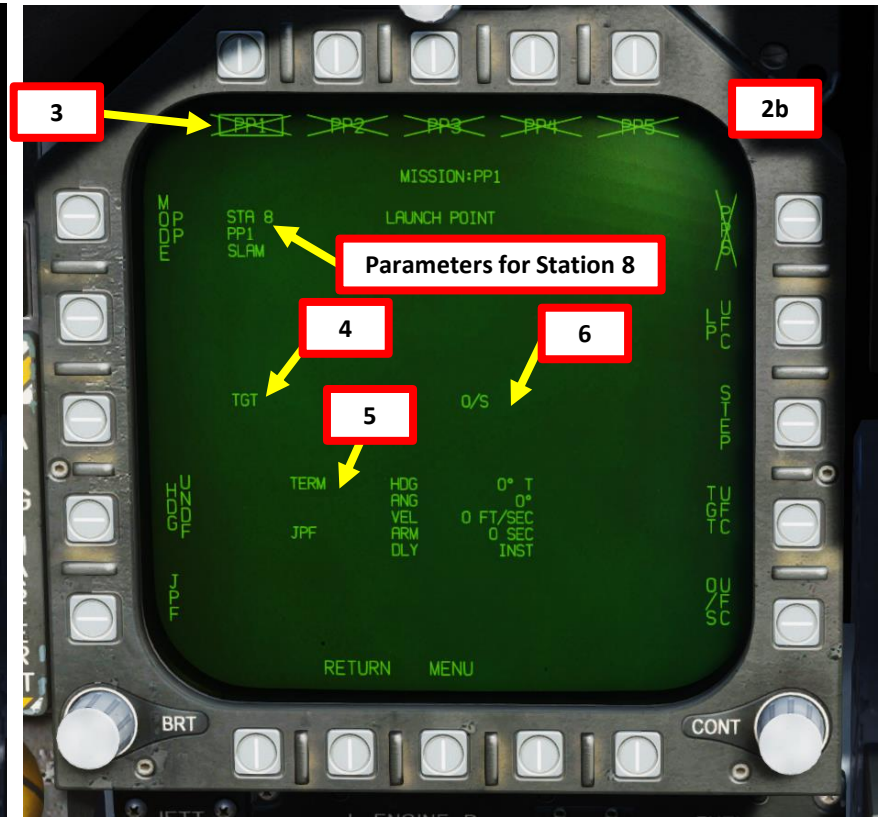




2.11 – AGM-84E SLAM
2.11.3.4 – Target Designation – Pre-Planned (PP)

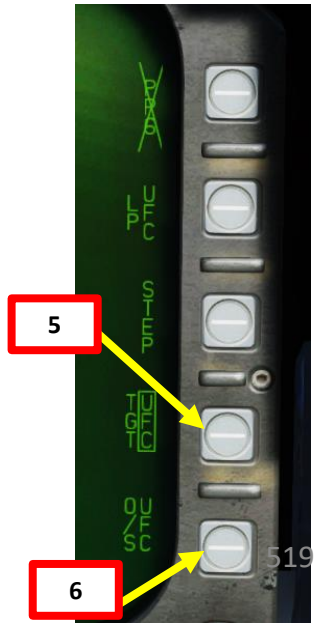
1. Press OSB next to MODE to toggle between TOO (Target-of-Opportunity) and PP (Pre-Planned) target designation modes. In this case, we will choose PP.
2. Press OSB next to MSN to enter the Mission Parameters page.
3. We can define up to five Pre-Planned targets per missile station: PP1 through PP5. We will designate the target on PP1. Press OSB next to another PP# to select it if you desire.
4. The TGT is the pre-planned target point (A/G TGT). For now, the field is empty since no target is defined yet.
5. (Optional) If you want to set TERM (Terminal Attack) parameters such as heading (HDG), attack angle (ANG) and velocity (VEL), press OSB next to TGTUFC, then press OSB next to TERM on the UFC. You will be able to enter terminal parameters via the UFC. However, since we will control the missile remotely during the terminal attack stage, these parameters are not required and we will leave them blank,
6. (Optional) We do not need O/S (Offset) parameters to the TGT since we will control the missile remotely during the terminal attack stage. Therefore, we will not need to use O/S UFC function.









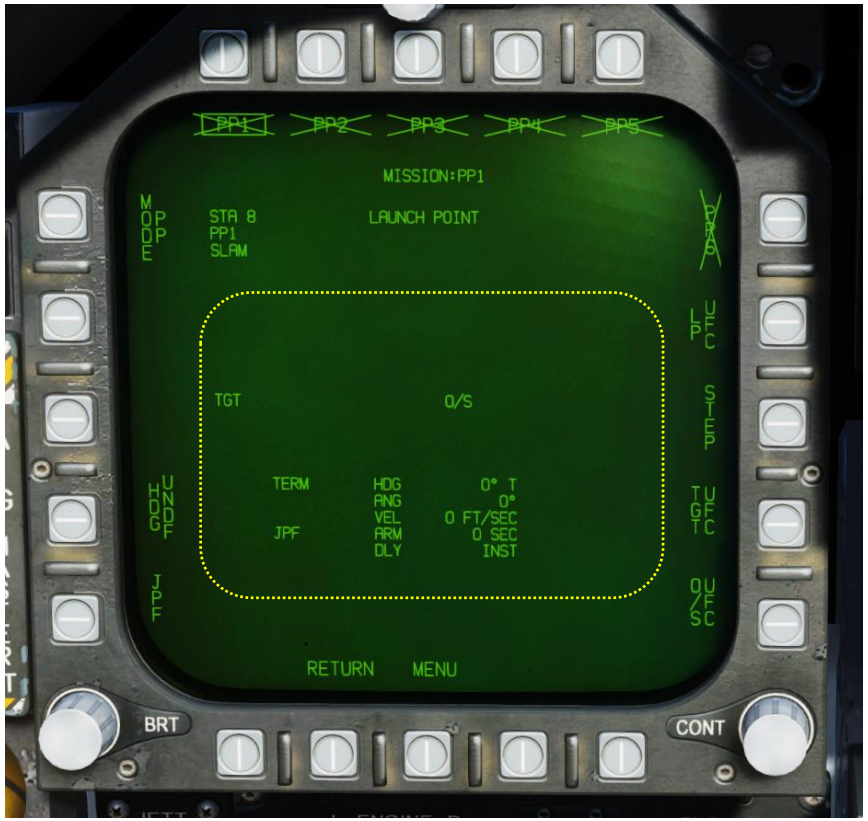


2.11 – AGM-84E SLAM
2.11.3.4 – Target Designation – Pre-Planned (PP)

7. We can get target coordinates and elevation from the mission briefing or from the F10 map. We will need this information in the Deg Min Sec.Decimal-Seconds format, which can be toggled by using « LALT+Y » while being in the F10 map..

Pre-Planned Point (Deg Min Sec.Decimal-Seconds)

Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA8 / PP1	33 49 17.83 N	35 29 37.64 E	39

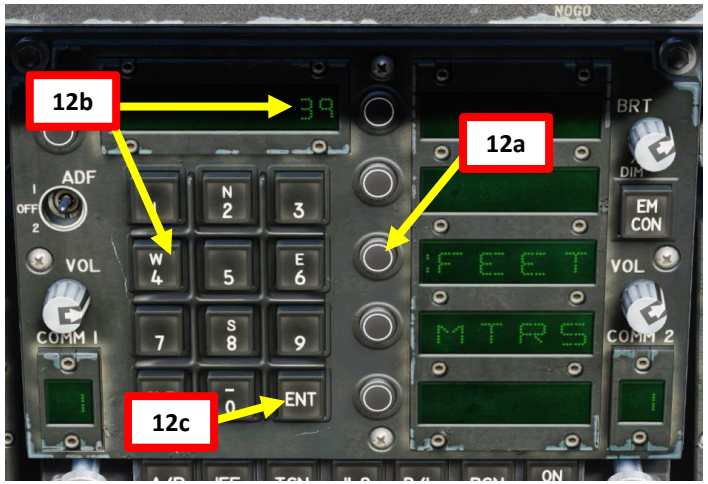




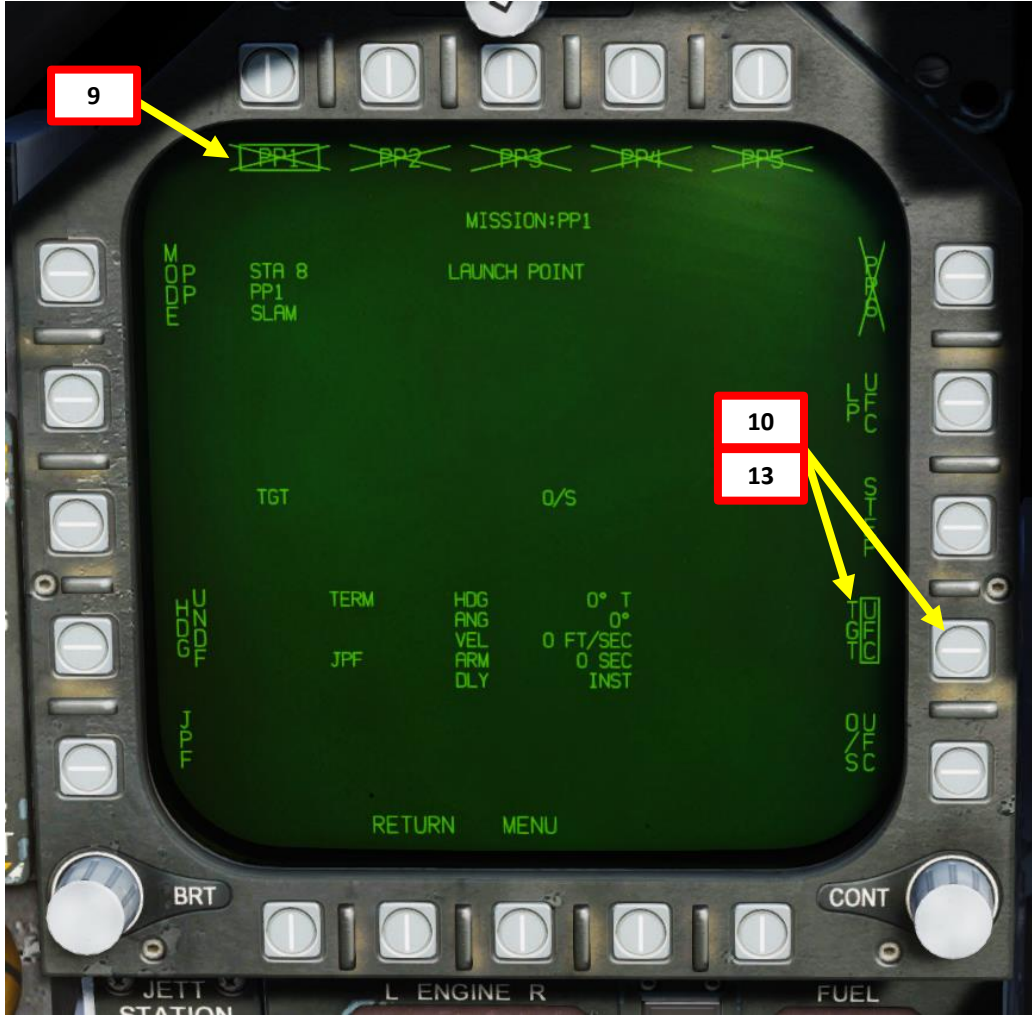
2.11 – AGM-84E SLAM
2.11.3.4 – Target Designation – Pre-Planned (PP)

8. Crossed-out PP Points mean no valid coordinates are entered yet.
9. Make sure PP1 is selected to input Target 1 coordinates
10. Select TGT UFC
11. On the UFC, select ELEV (Elevation)
12. Select FT (« : » will appear when selected), then enter Target 1 altitude on the scratchpad (39), then press the ENT (Enter) button.
13. Return to main UFC menu by pressing the TGT UFC button twice.









Pre-Planned Point (Deg Min Sec.Decimal-Seconds)

Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA8 / PP1	33 49 17.83 N	35 29 37.64 E	39

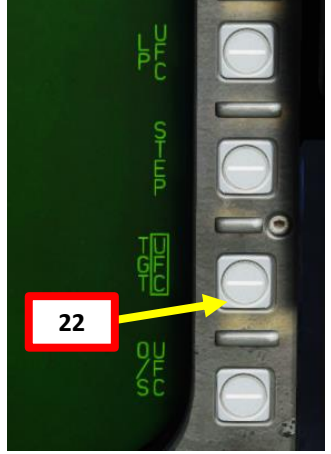
2.11 – AGM-84E SLAM
2.11.3.4 – Target Designation – Pre-Planned (PP)

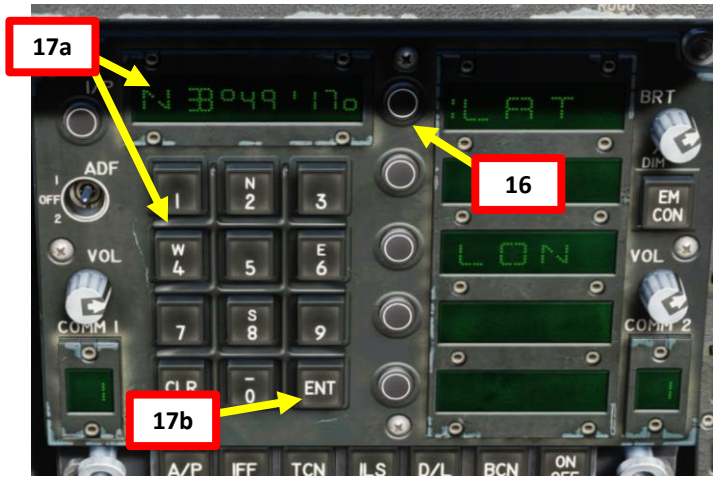
14. On the UFC, select POSN (Position) « : » will appear once selected.
15. We will add the coordinates of Target 1 (PP1)
    33 °49’17.83’’ North 35 °29’37.64’’ East
16. On the UFC, select LAT (Latitude). « : » will appear once selected.
17. Press « 2 » (N) to select North coordinates, type « 334917 », then « ENT » to enter Degrees Minutes Seconds.
18. Wait for the UFC screen to reset, then type « 83 », then « ENT » to enter remaining Decimal-Seconds.
19. On the UFC, select LON (Longitude). « : » will appear once selected.
20. On the UFC, press « 6 » (E) to select East coordinates, type « 352937 », then « ENT » to enter Degrees Minutes Seconds.
21. Wait for the UFC screen to reset, then type « 64 », then « ENT » to enter remaining Decimal-Seconds.
22. Return to main UFC menu by pressing the TGT UFC button twice.

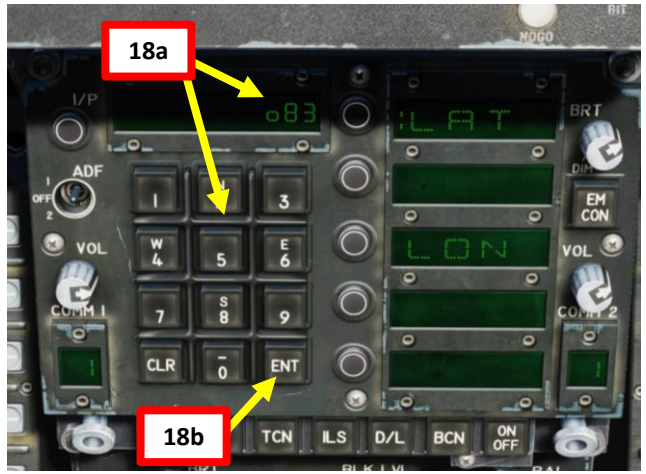
Pre-Planned Point (Deg Min Sec.Decimal-Seconds)

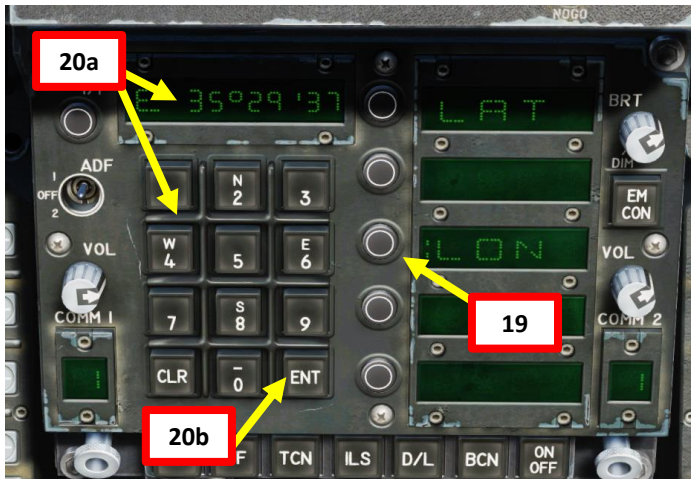
Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA8 / PP1	33 49 17.83 N	35 29 37.64 E	39

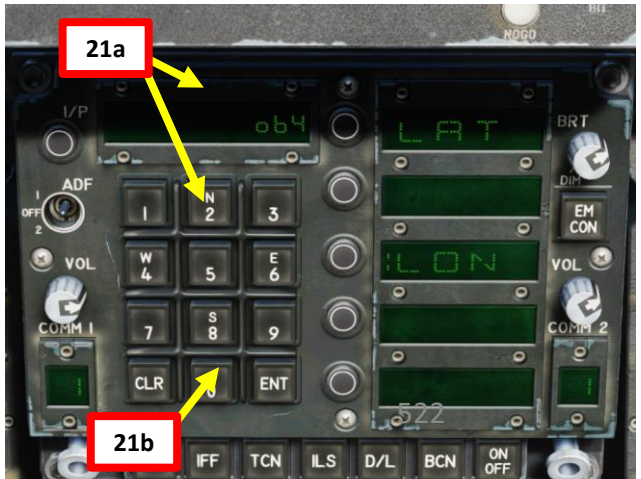










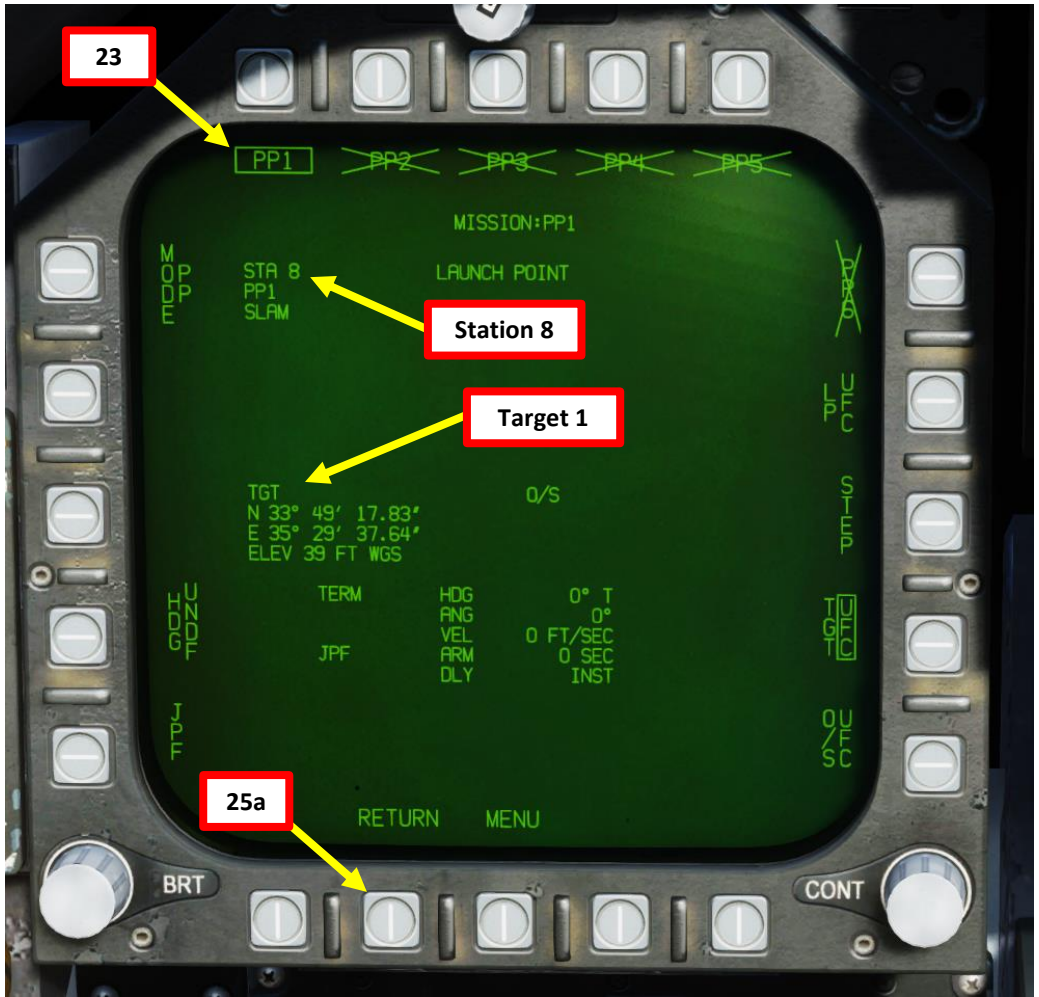


2.11 – AGM-84E SLAM
2.11.3.4 – Target Designation – Pre-Planned (PP)

23. Once Longitude, Latitude and Elevation coordinates are entered for PP1, the PP1 icon will be boxed and no longer crossed out.
24. The coordinates and elevation of the designated target point will then directly transfer to the TGT in the MSN page.
25. Press the OSB next to RETURN to return back to the SMS (Stores) page. We are now almost ready to begin our strike and launch the missile.

Pre-Planned Point (Deg Min Sec.Decimal-Seconds)

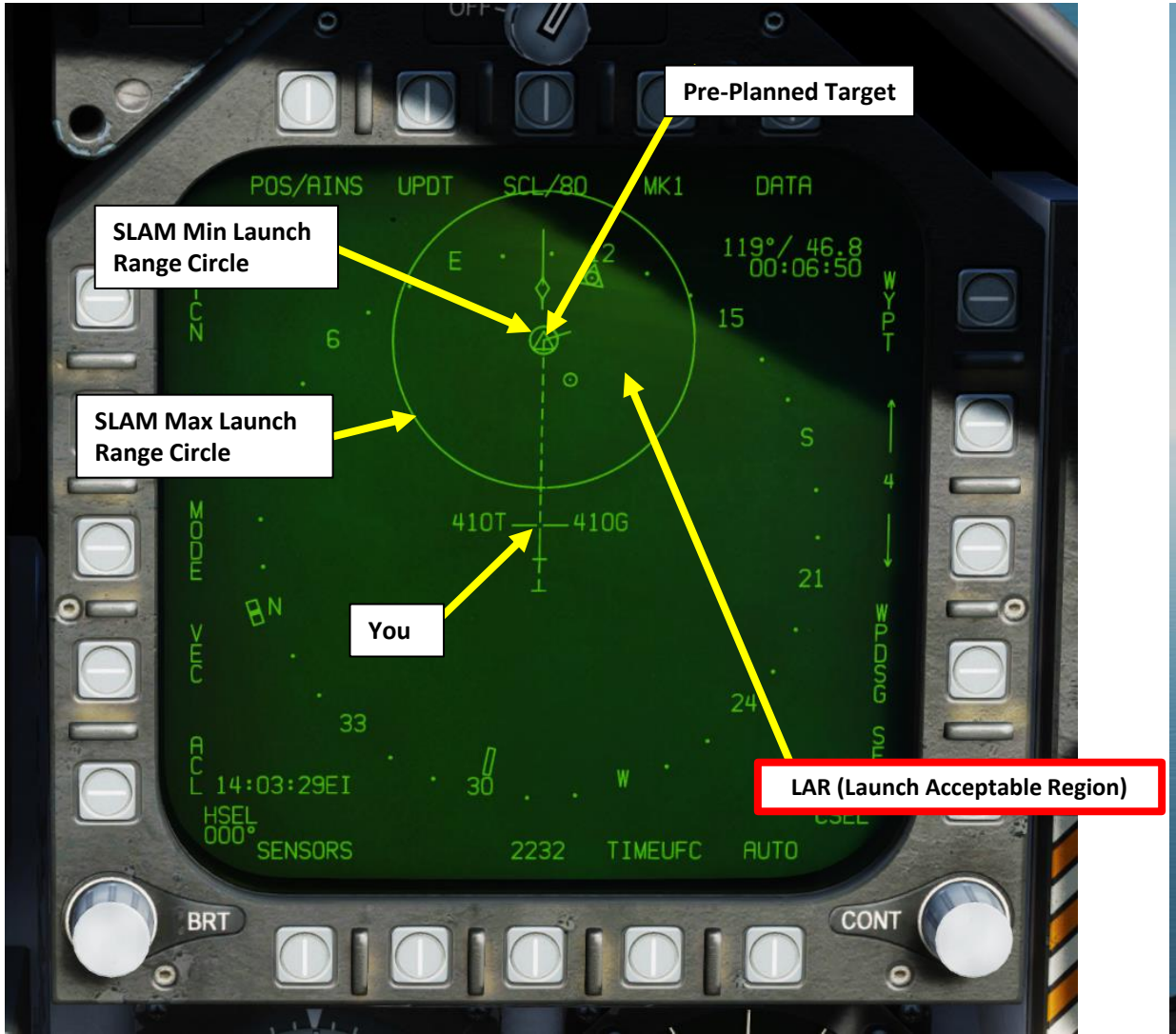
Target Point	Latitude	Longitude	Elevation (ft)
TGT1 STA8 / PP1	33 49 17.83 N	35 29 37.64 E	39

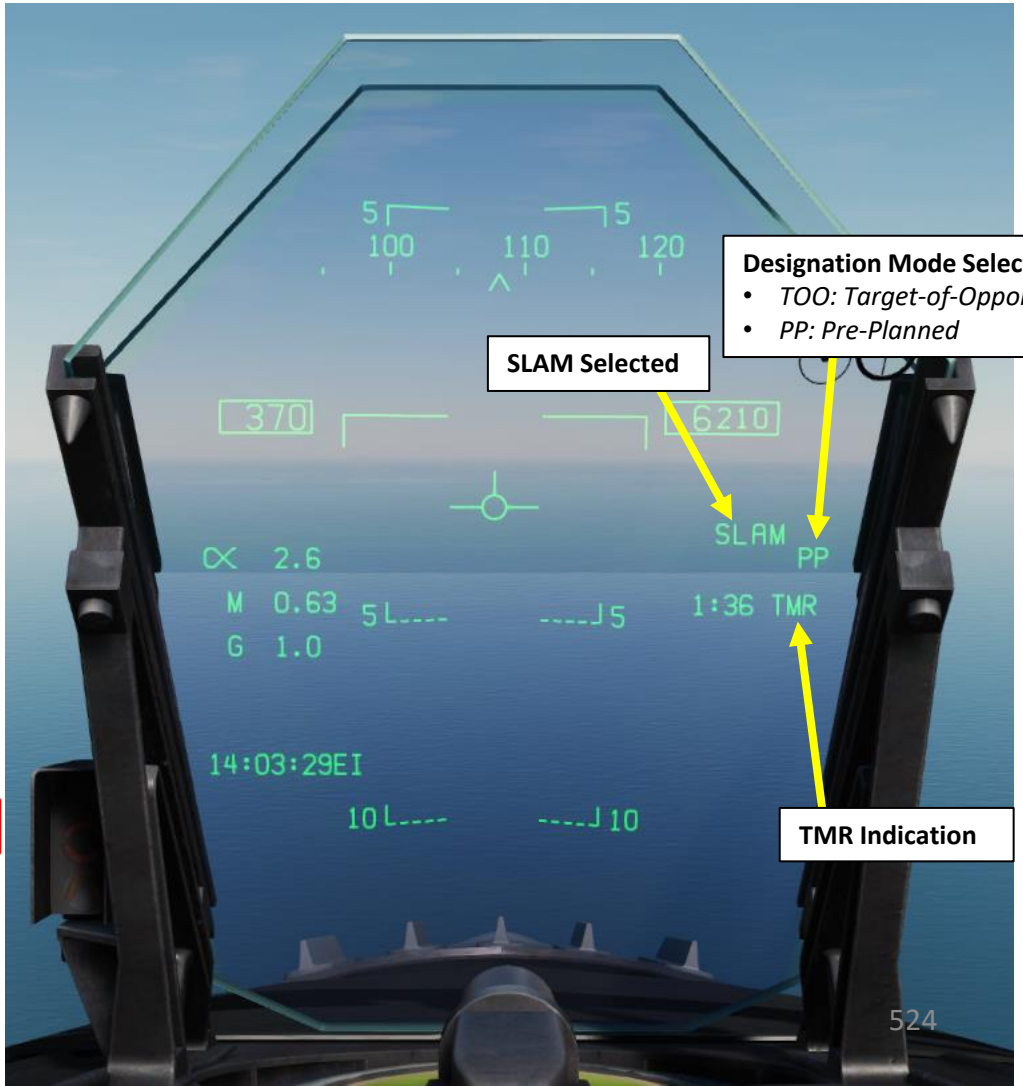




2.11 – AGM-84E SLAM
2.11.3.4 – Target Designation – Pre-Planned (PP)

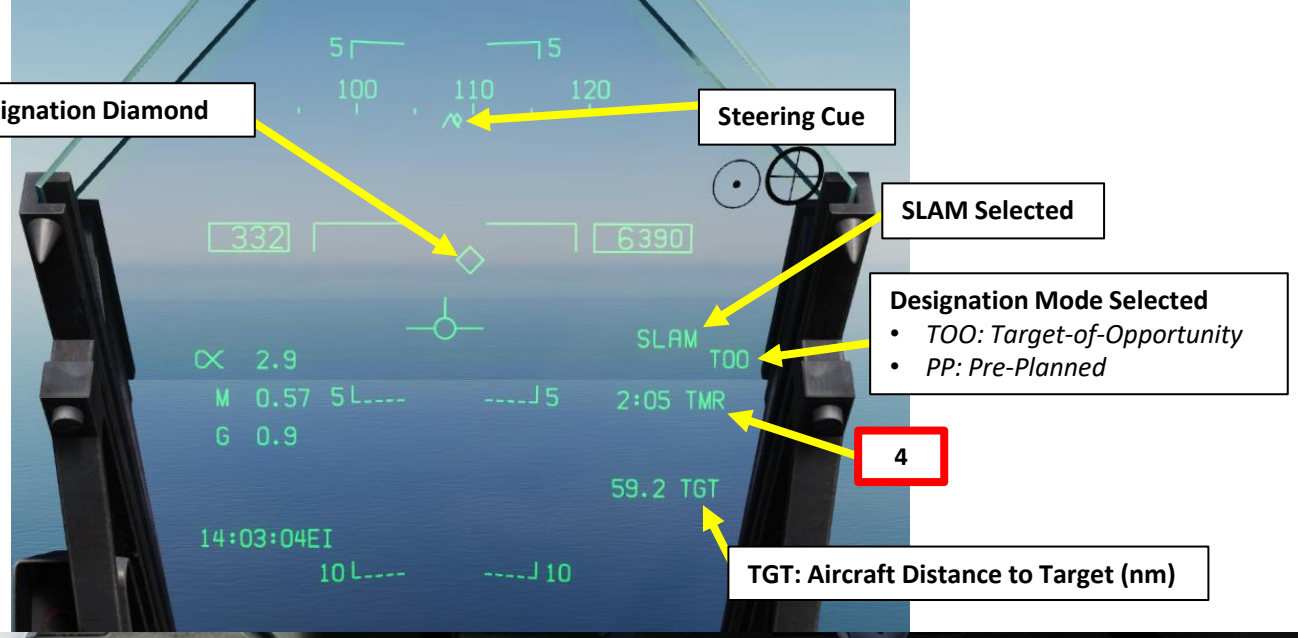
26. The SLAM indication, TMR indication (time required to be within range of a valid SLAM launch) and PP indication will appear on the HUD.
27. Minimum and Maximum Launch Range circles will appear on the HSI (Horizontal Situation Indicator) page.
28. Please proceed to section 2.11.4 – Weapon Launch & Control.



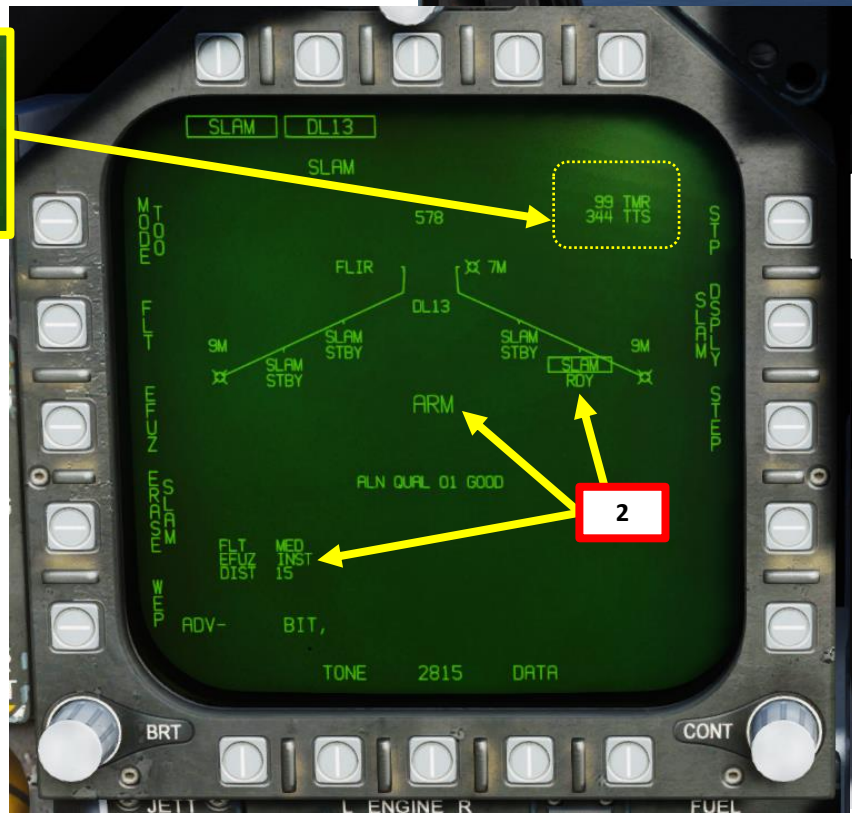


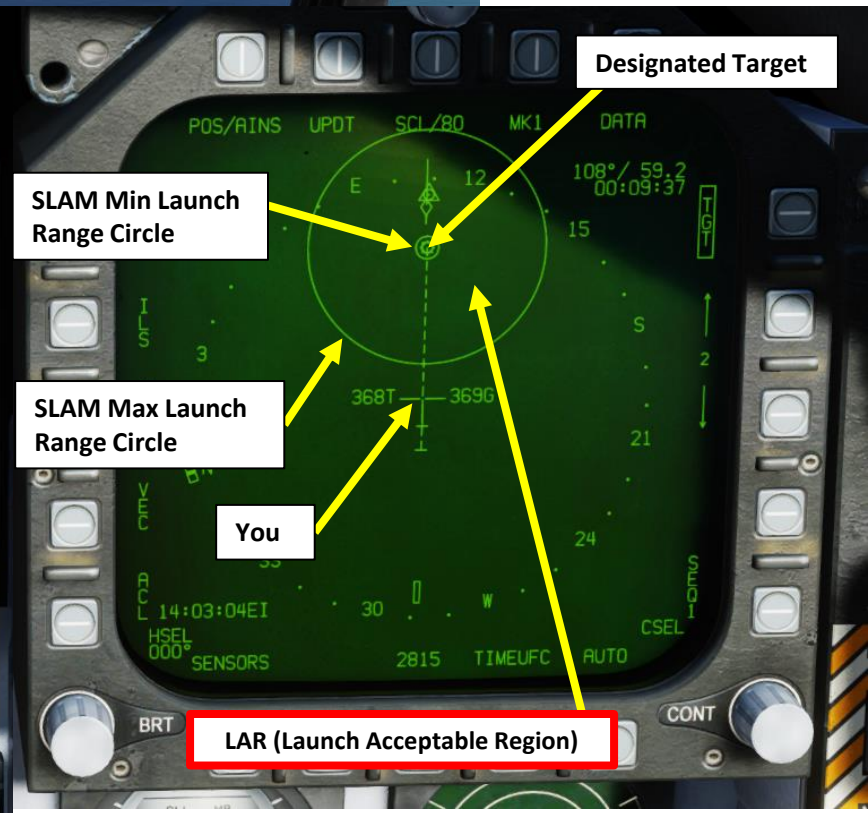
2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control

1. Make sure the SMS (Stores) page and HSI (Horizontal Situation Indicator) pages are both visible. I recommend setting SMS on the left DDI and HSI on the right DDI.
2. Verify the selected SLAM missile's status is RDY (ready), Master Arm is ON and the correct release profile is set.
3. TTS indicates the Time-to-Seeker (time until the SLAM seeker head becomes active and can be controlled by the pilot via the TDC and the datalink pod), in seconds.
4. TMR indicates the time required to be within range of a valid SLAM launch (max range circle), in seconds.
5. Fly the aircraft towards the target designated (diamond on the HUD or designation circle on HSI).



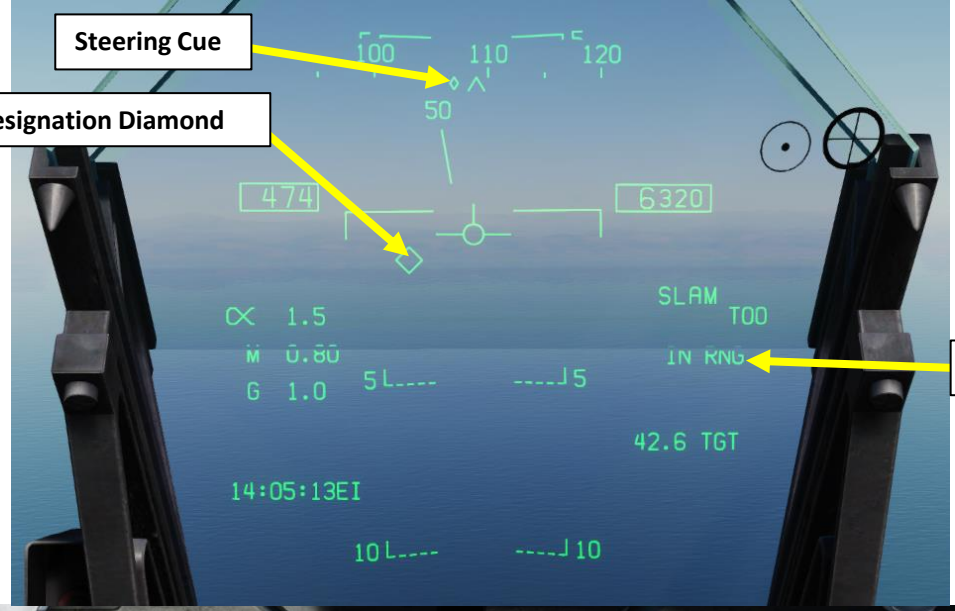




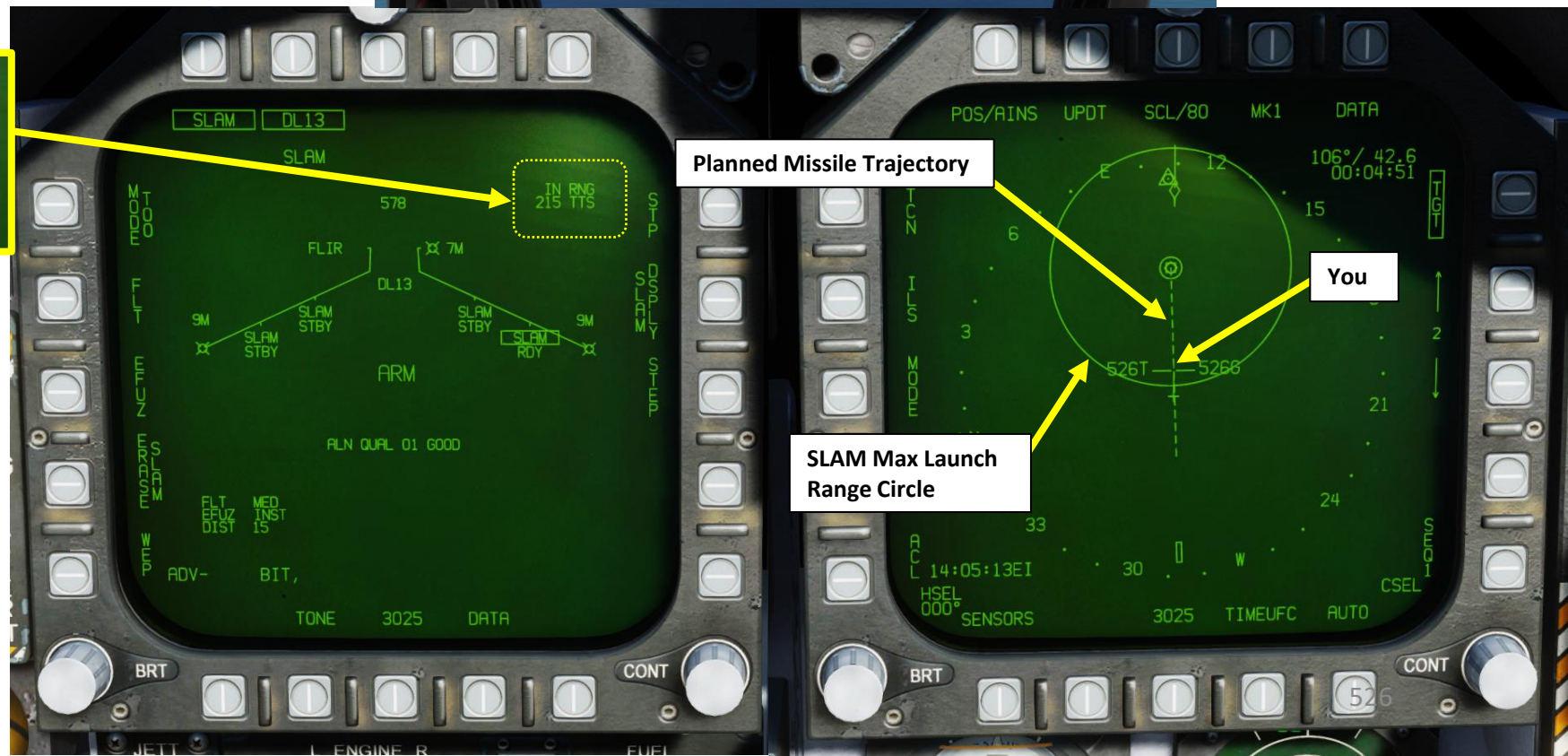


2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control

6. Once the IN RNG (In Range) cue is visible on the Heads-Up Display and SMS (Stores) page, you may launch the missile. However, we will do a few verifications prior to missile launch.







2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control

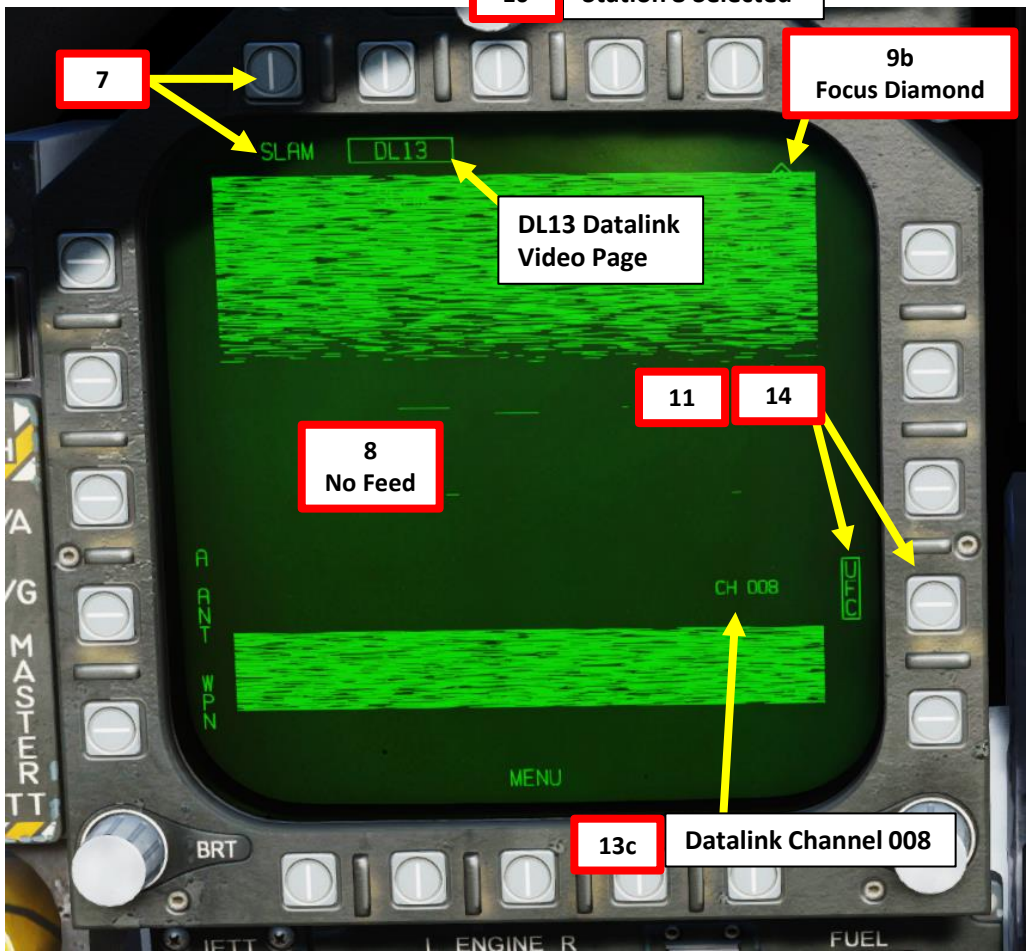
7. On the SMS (Stores) page, press OSB next to SLAM to unbox it.
8. With « DL13 » only being boxed, the screen will switch to Datalink SLAM seeker head video. Take note that no feed is yet available since the « TTS » (Time-To-Seeker » has not yet reached 0, which means that we have not yet reached the DIST parameter (Distance from target until seeker head activation) set previously.
9. Set Sensor Control Switch to the SLAM DL13 Feed DDI (Sensor Control Switch LEFT since we showed up the DL13 feed on the left DDI). A diamond will appear to show the left DDI is selected.
10. The SLAM missile installed on Station 8 is currently selected. We need to verify that the Datalink pod channel corresponds to this specific station. We need to make sure that the Datalink pod is set to Channel 008, which is the channel required for Station 8. (As an example, you would need a Datalink Pod channel of 002 for Station 2).
11. Press on the OSB next to UFC (Up-Front Control).
12. Press on the UFC button next to CHNL. « : » indicates Channel can be edited.
13. Enter « 8 » on the UFC scratchpad, then press ENT button to set Datalink pod to Channel 8 (Station 8). Your SLAM and Datalink Channel should now match.
14. Press on the OSB next to UFC again to deselect UFC menu.

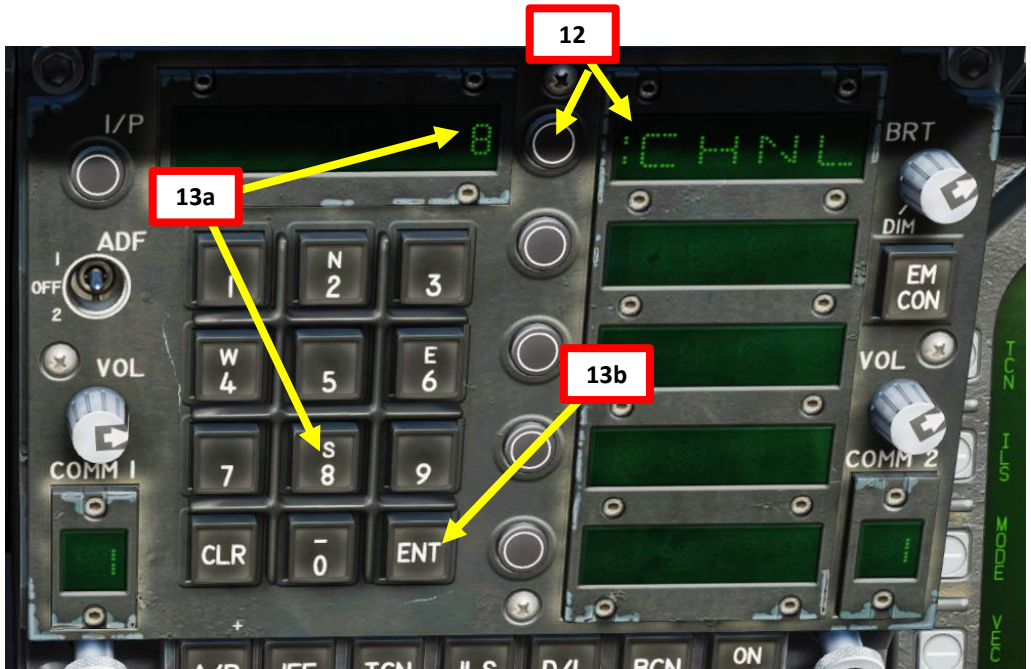


9a **Sensor Control Switch**
AFT/FWD/LEFT/RIGHT



10 **Station 8 Selected**

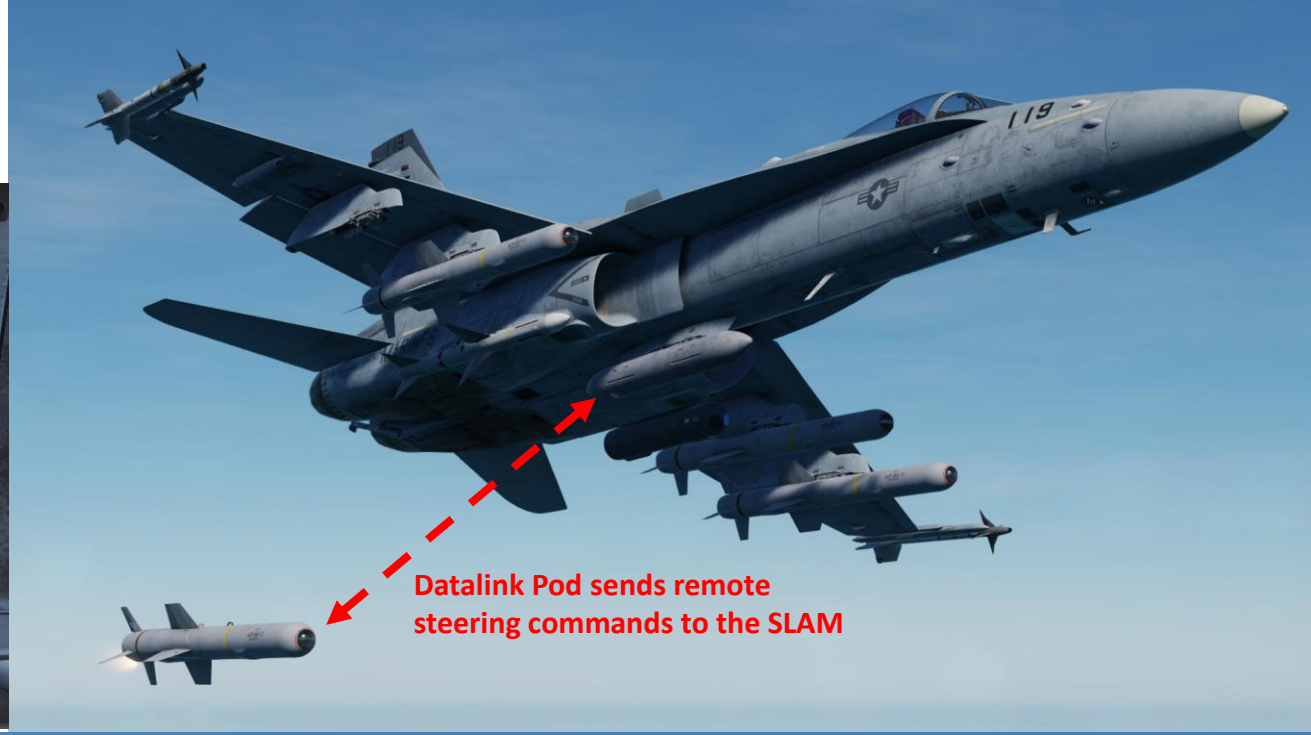




2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control

15. Press and hold the Weapon Release button (« RALT+SPACE ») to launch SLAM missile.
16. Once SLAM is launched, the missile will fly to the cruise altitude (FLT parameter).
17. The missile will eventually enter a dive and go into the Low Altitude Penetration Stage
18. When the missile is close enough to the target, it will steer directly to the target's area and enter Terminal Attack Stage.

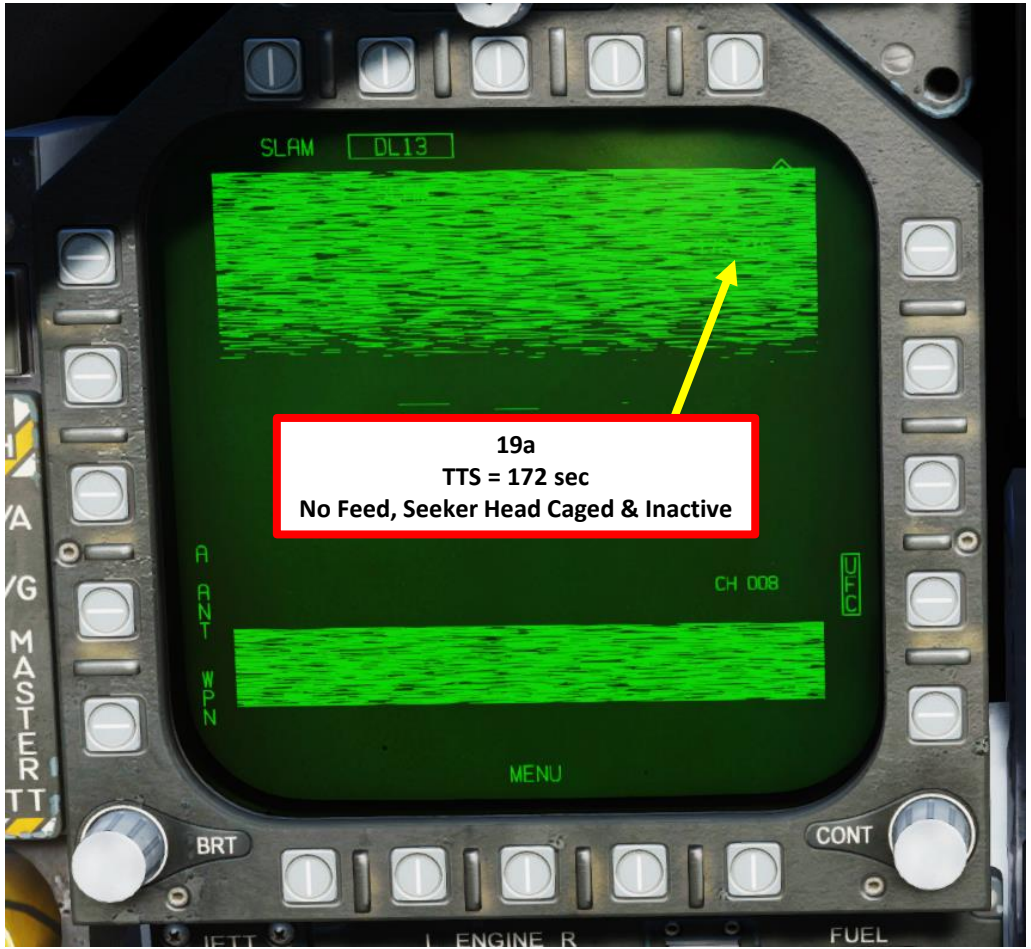


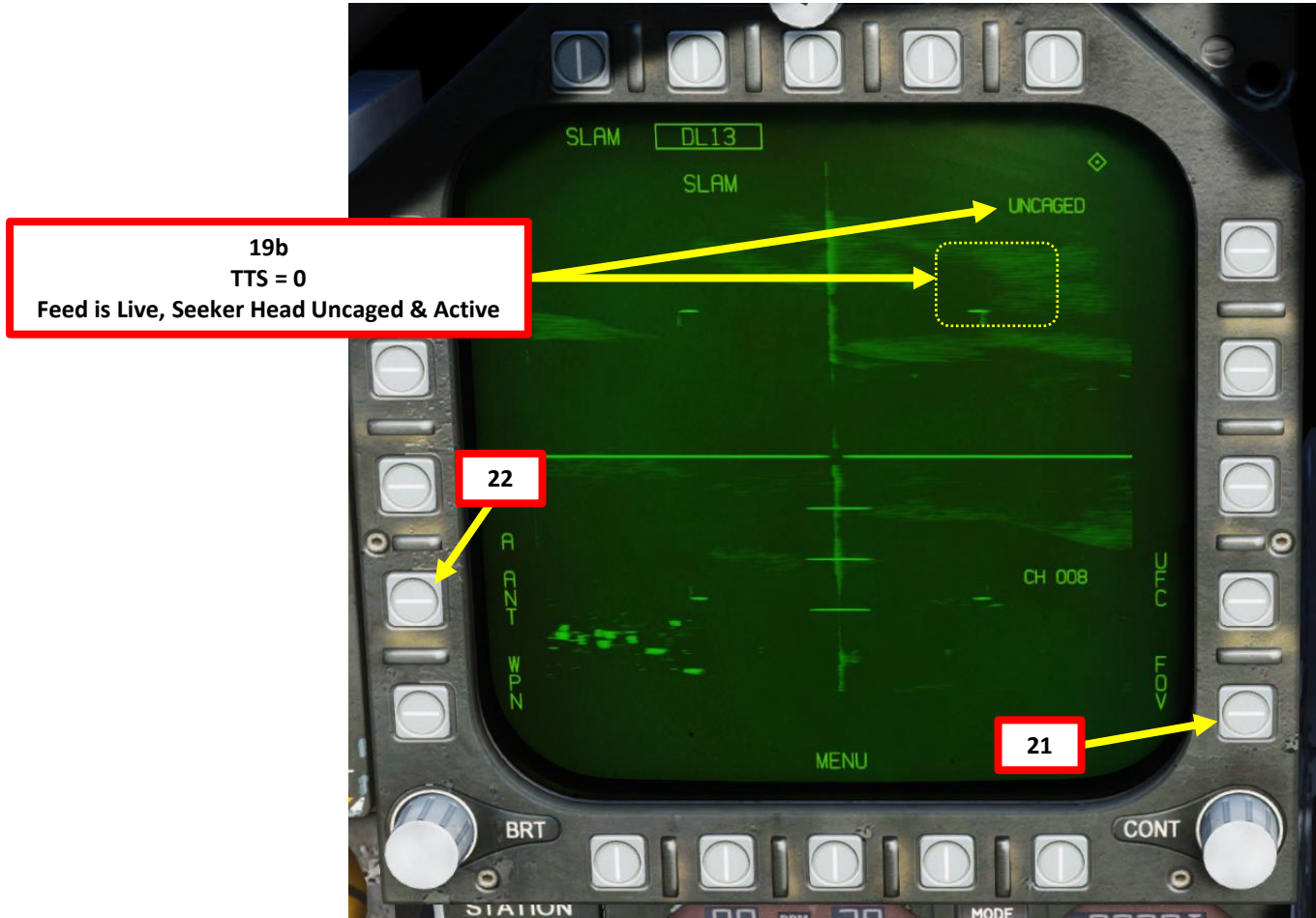




2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control

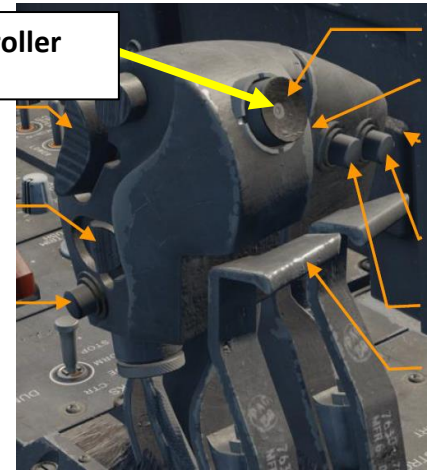
19. When missile TTS (Time-to-Seeker) reaches zero, this means that the missile has reached the DIST range parameter (distance from target), which is 15 nm. Datalink feed will then display a clear picture and the seeker head becomes « Uncaged ».
20. At this stage, you may not want to steer the missile needlessly yet until the missile goes into the Terminal Attack Stage (starts diving on the target designated previously).
21. Toggle field-of-view (FOV) as desired using the OSB next to FOV.
22. As a general rule, it is recommended to not fly in the same direction of the missile. If you are flying away from the missile (as in: you did a 180-deg turn to fly in opposite direction to the missile's trajectory), turn on the A ANT (Aft Antenna) option (boxed = on). This will turn the datalink antenna aft (facing the missile) and maintain communication between the missile and the aircraft to allow remote control. Since we are not flying away from the target in this example, we will leave the A ANT option OFF.

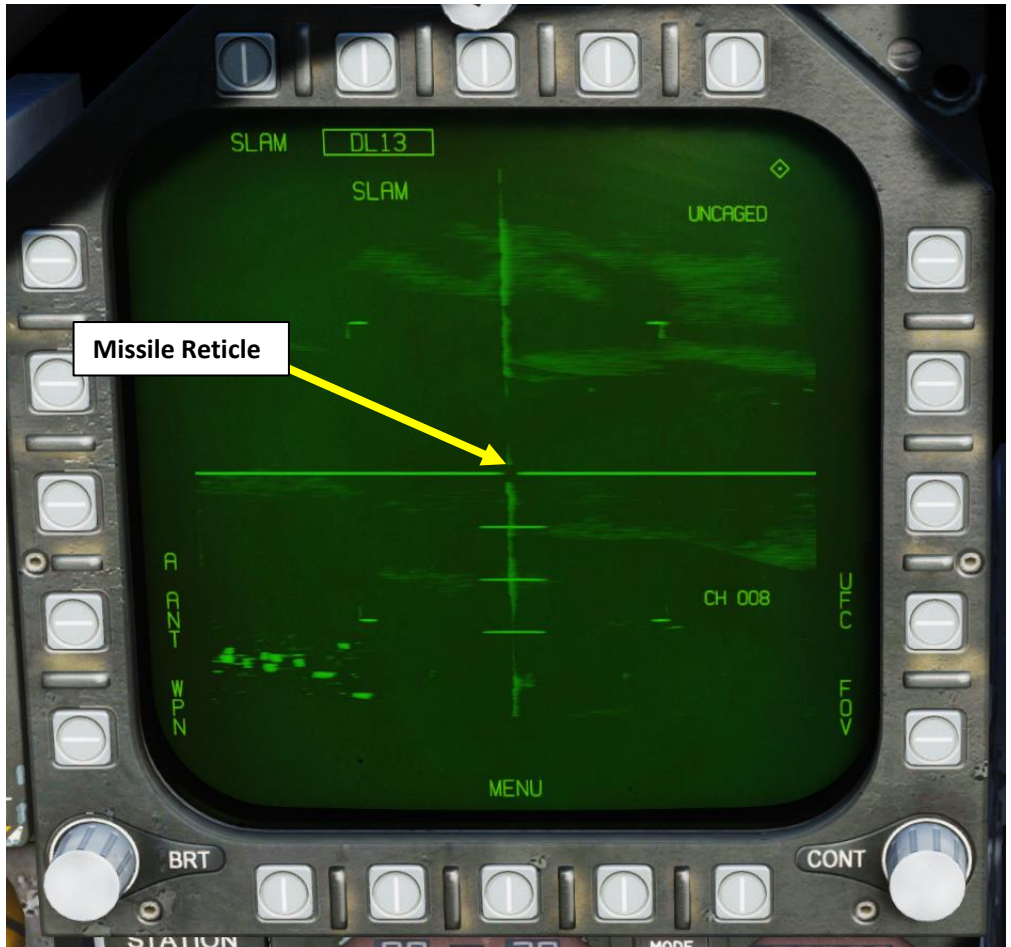




2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control

23. Once SLAM starts its Terminal Attack (dives on the target), you will have to control the missile remotely to adjust its trajectory to strike the target.
24. To modify the SLAM's trajectory, hold the TDC Depress button **while** slewing the TDC with the TDC AFT/FWD/LEFT/RIGHT controls.
25. Slew the missile crosshair on the target using the TDC (Throttle Designator Controller).
26. Once the missile crosshair is lined up on the target, release the TDC Depress button. The missile will then keep flying until it impacts the center of the reticle.
27. You will lose TV feed once the missile impacts the target.







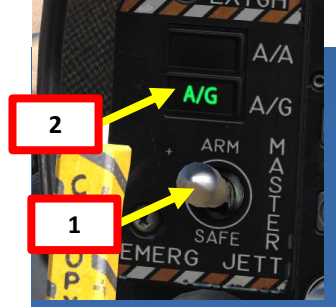
2.11 – AGM-84E SLAM
2.11.4 – Weapon Launch & Control



2.12.1 – AGM-62 Walleye II (No Datalink Pod)

Note: This procedure shows you how to use the Walleye without the datalink pod. The missile will operate like an AGM-65 Infrared Maverick in a "fire & forget" manner.

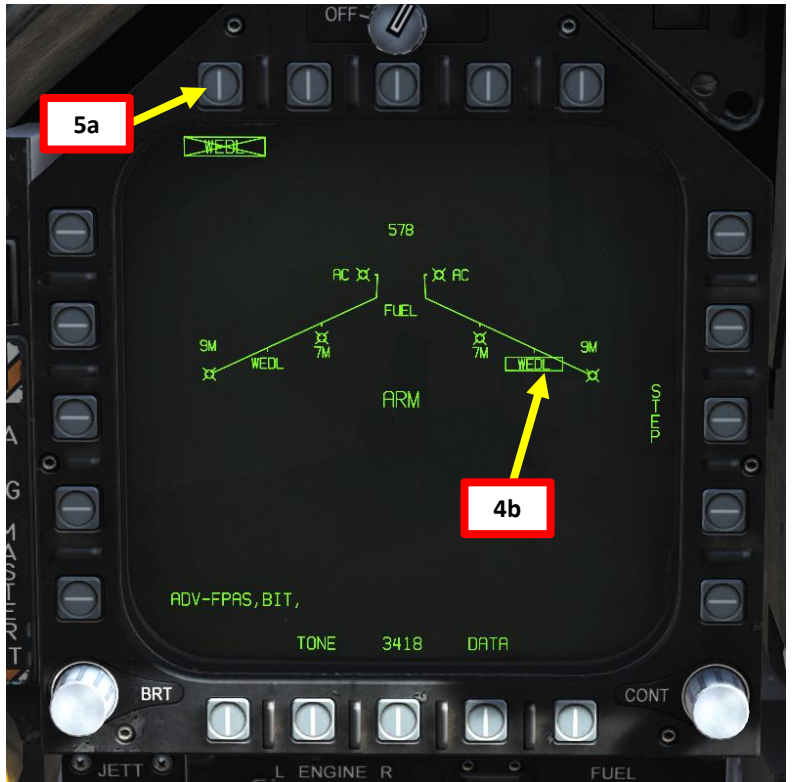
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Click on the OSB next to WEDL to select it. The crossed-out WEDL indication means weapon employment is inhibited.
5. Click on the OSB next to WEDL a second time to display the Walleye TV feed. DDIs will display a green-scaled screen, while the AMPCD will display a grey-scaled screen.

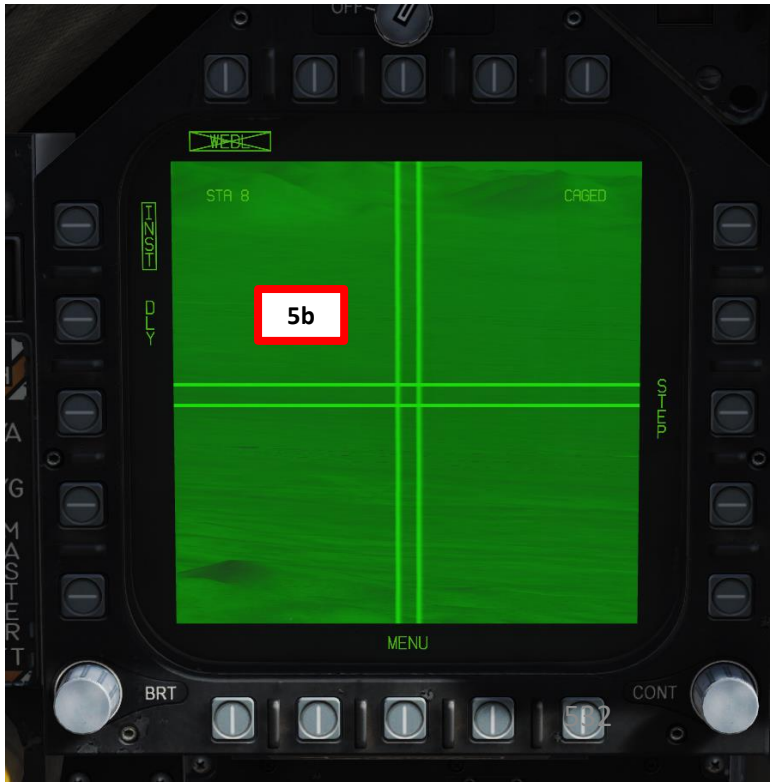


Note: Walleyes can only be mounted on Stations 2 and 8 (BOMBS category).







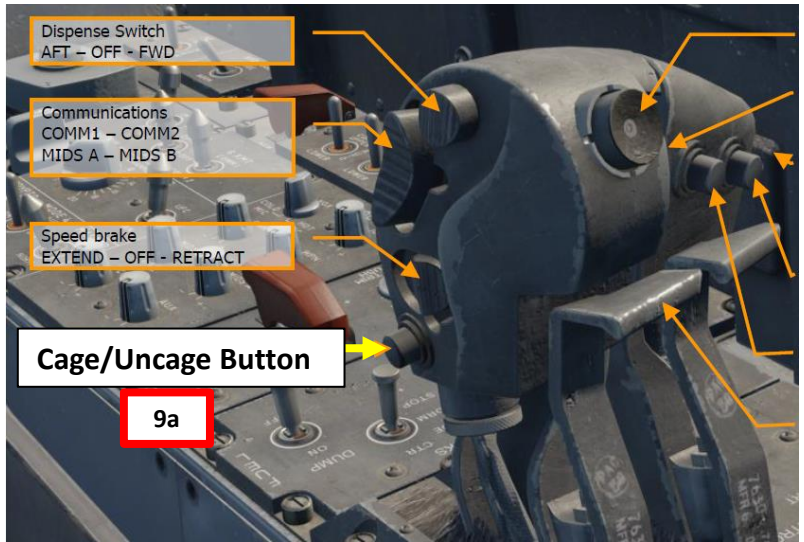


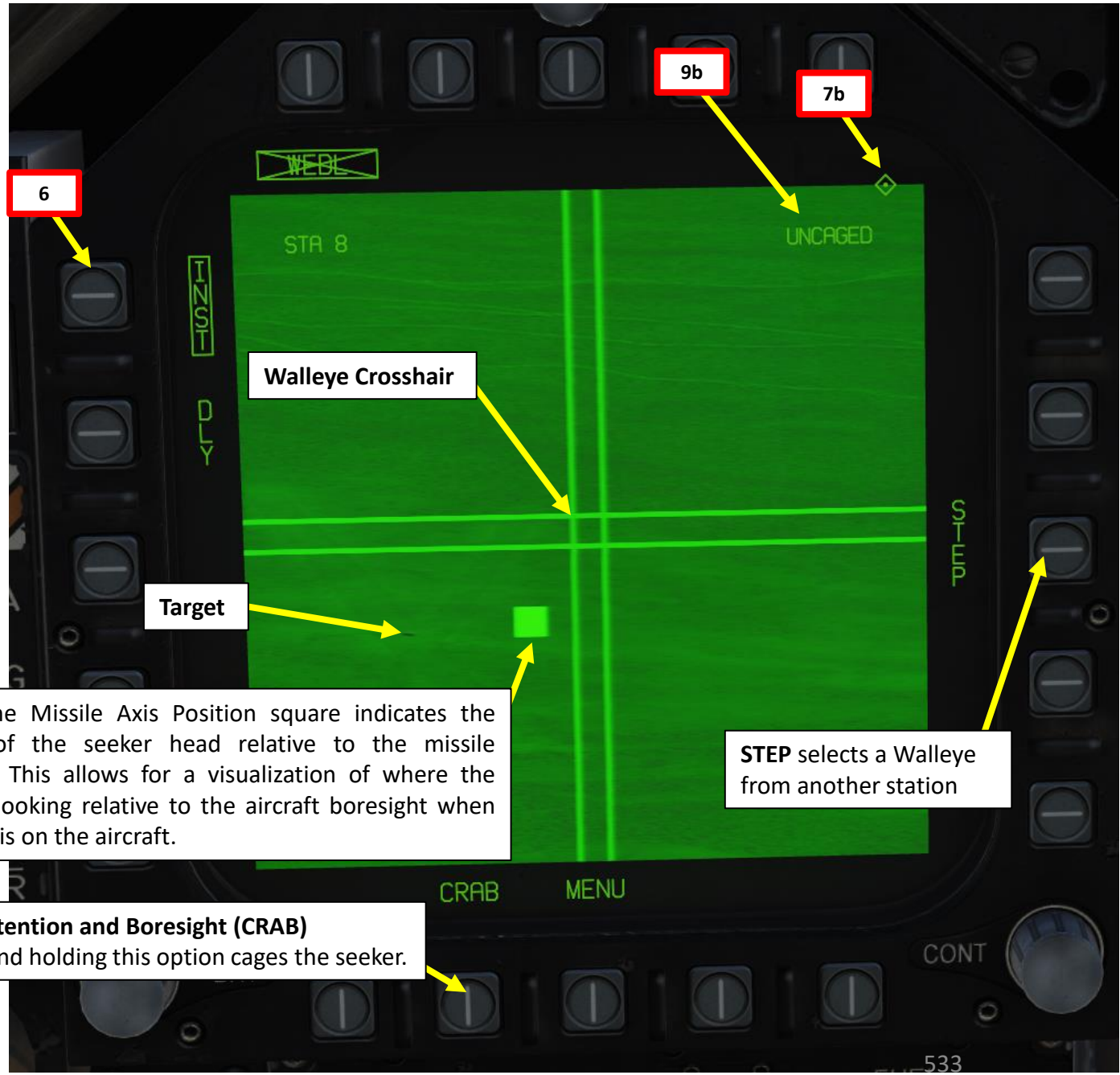
2.12.1 – AGM-62 Walleye II (No Datalink Pod)

6. Set Fuzing to either INST (Instantaneous), or DLY (Delayed Fuze).
7. Set Sensor Control Switch to the Walleye Feed DDI (Sensor Control Switch LEFT since we showed up the WEDL feed on the left DDI). A diamond will appear to show the left DDI is selected.
8. By default, the Walleye is Caged. When the seeker is caged, it will always point forward at its boresight.
9. Press the Cage/Uncage Button to uncage the Walleye. When uncaged, the bomb will attempt to lock onto a contrasting target within the seeker center.

Sensor Control Switch
AFT/FWD/LEFT/RIGHT







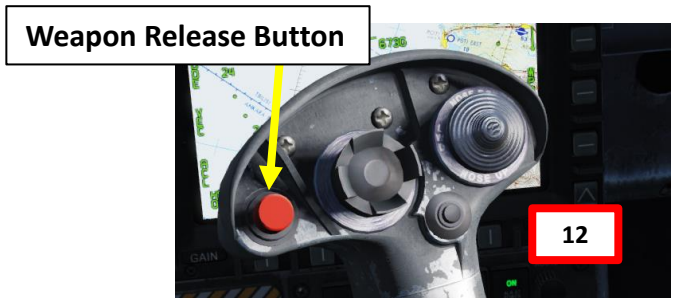
MAP - The Missile Axis Position square indicates the position of the seeker head relative to the missile boresight. This allows for a visualization of where the seeker is looking relative to the aircraft boresight when the bomb is on the aircraft.

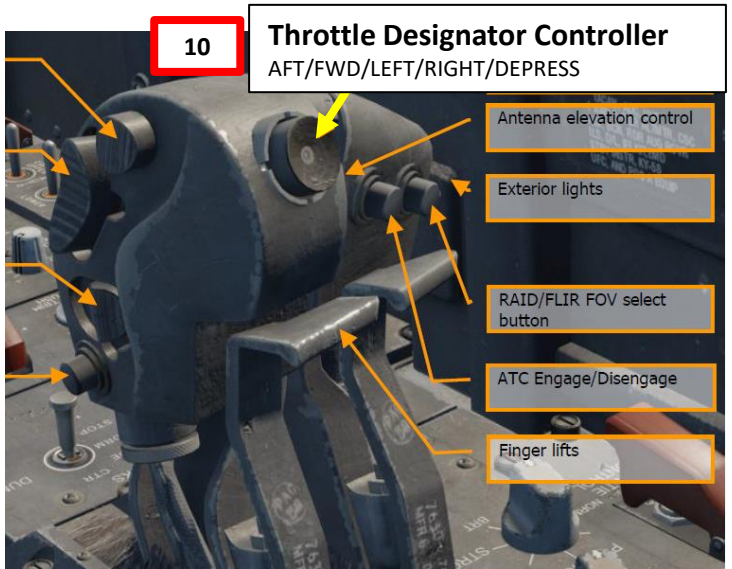
STEP selects a Walleye from another station

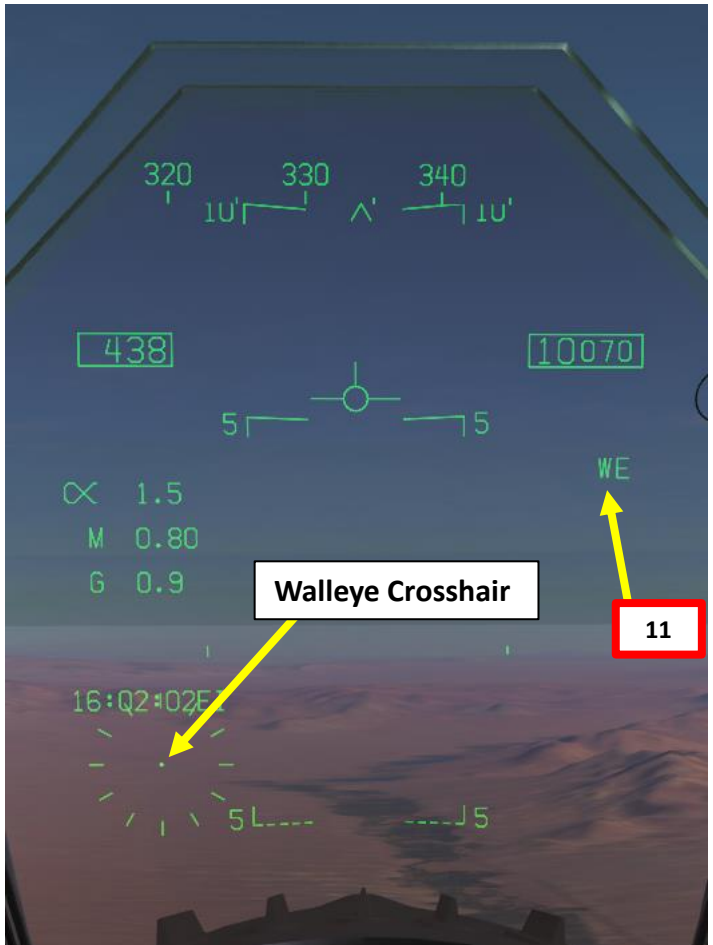
Caging Retention and Boresight (CRAB)
Pressing and holding this option cages the seeker.

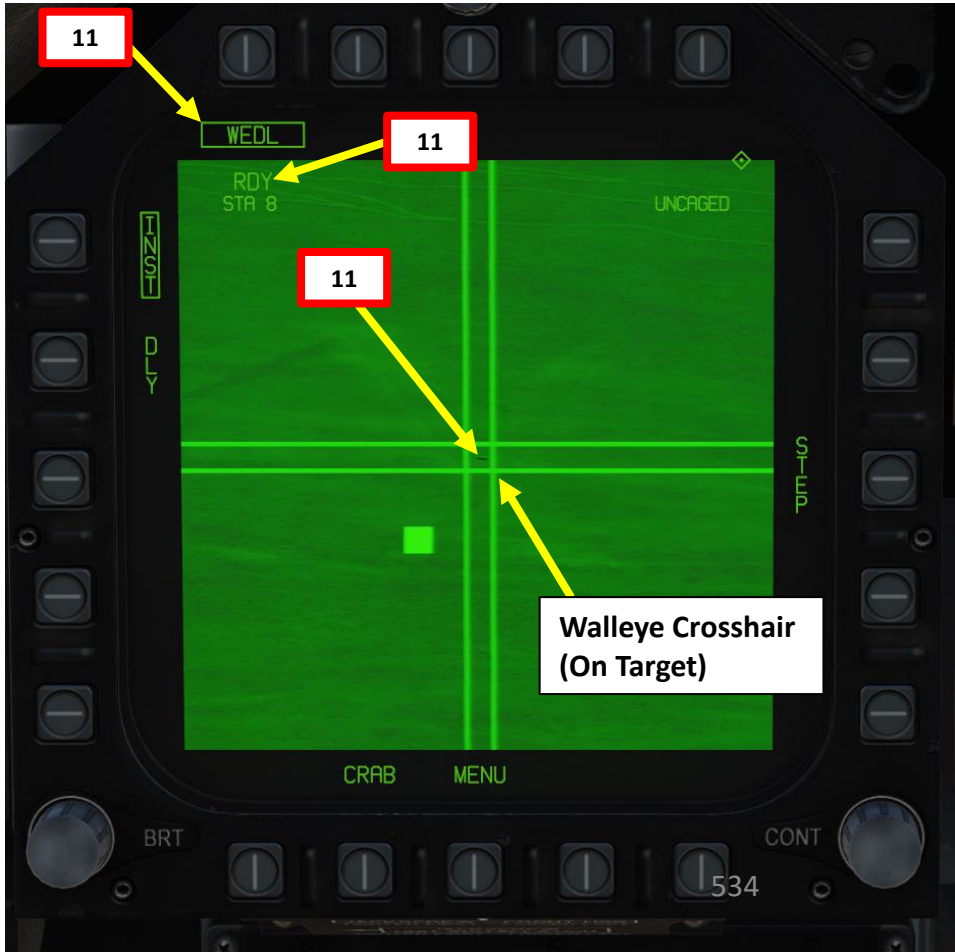
2.12.1 – AGM-62 Walleye II (No Datalink Pod)

10. Hold the TDC Depress button **<u>while</u>** slewing the Walleye to the target. When you release the TDC Depress button, the bomb will attempt to lock its target. The Walleye can be used from a range of 20 nm, but is most likely going to acquire a good lock from a distance of less than 10 miles.
11. When lock is acquired by Walleye:
    - WE crossed-out indication will disappear from the HUD
    - WEDL crossed-out indication will disappear from the Walleye Feed.
    - RDY will be displayed next to the selected station.
12. Hold the Weapon Release Button (« RALT+SPACE ») to launch Walleye.









2.12.1 – AGM-62 Walleye II (No Datalink Pod)



This propeller acts as a generator, which powers the Walleye control surfaces and datalink.





2.12.2 – AGM-62 Walleye II (With Datalink Pod)

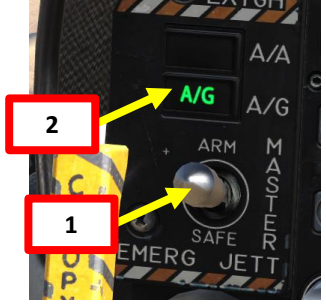
This procedure shows you how to use the Walleye with the AWW-13 Datalink pod. Once launched, the Walleye can be remote-controlled manually by the pilot.



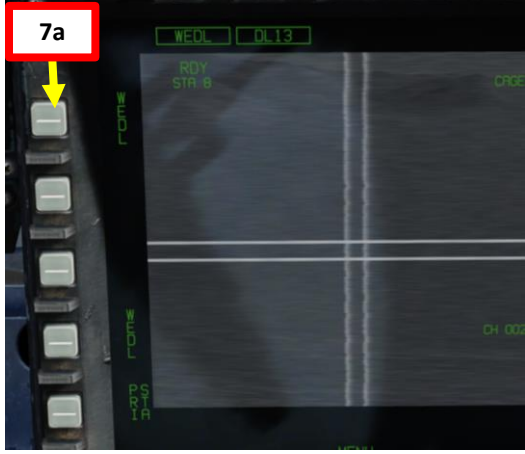
Note: Walleyes can only be mounted on Stations 2 and 8 (BOMBS category).

2.12.2 – AGM-62 Walleye II (With Datalink Pod)

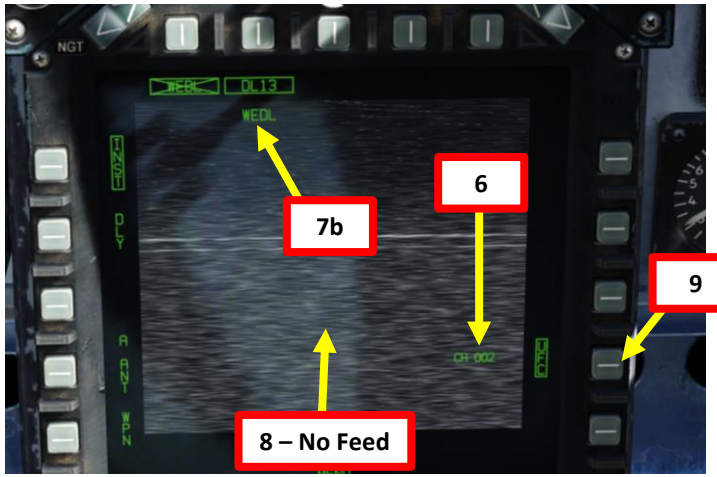
1. Master Arm switch – ARM (UP)
2. Master Mode – A/G
3. Go in SMS (Stores Management System) page
4. Click on the OSB next to WEDL to select it. The crossed-out WEDL indication means weapon employment is inhibited.
5. Click on the OSB next to DL13 to turn on the Datalink Pod and display the Walleye TV feed. DDIs will display a green-scaled screen, while the AMPCD will display a grey-scaled screen.
6. Click on the OSB next to WPN (weapon). This informs the data link pod that it is to be paired with a data link capable weapon. Available data link weapons will now be listed as options for pushbuttons 1 to 4. Walleye (WEDL) will appear on pushbutton 5.
7. Click on the OSB next to WEDL to pair the Walleye and data link pod. If successful, WEDL will appear below DL13.
8. Station 8 is currently selected, while Datalink pod is set to Channel 002 (Station 2). This mismatch can be seen by the lack of seeker feed. We need to match the station and channel.
9. Press on the OSB next to UFC (Up-Front Control).
10. Press on the UFC button next to CHNL. « : » indicates Channel can be edited.
11. Enter « 8 » on the UFC scratchpad, then press ENT button to set Datalink pod to Channel 8 (Station 8). Your Walleye and Datalink Channel should now match.
12. Press on the OSB next to UFC again to deselect UFC menu.





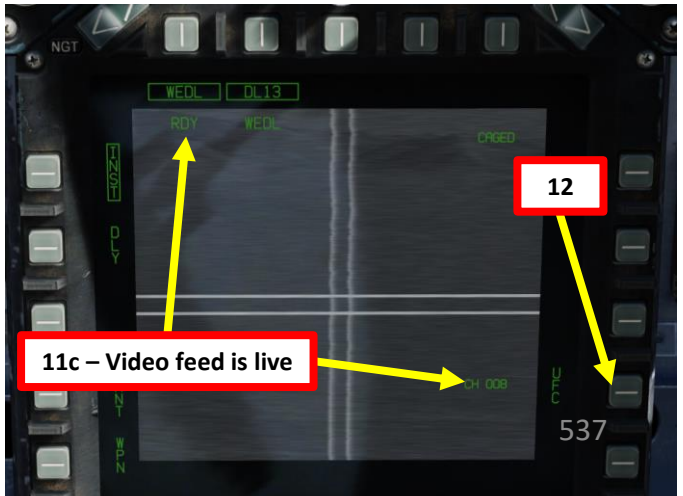








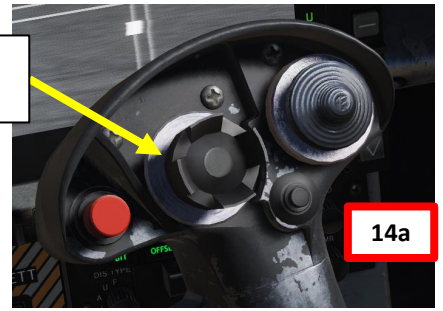


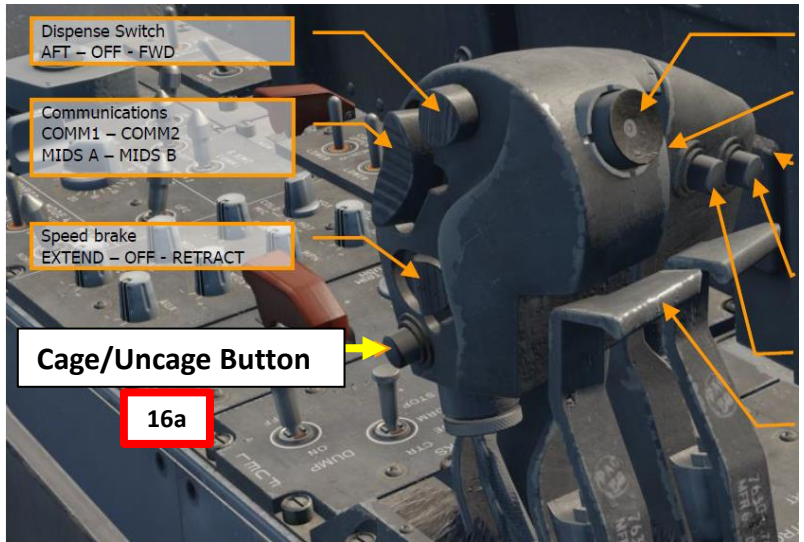


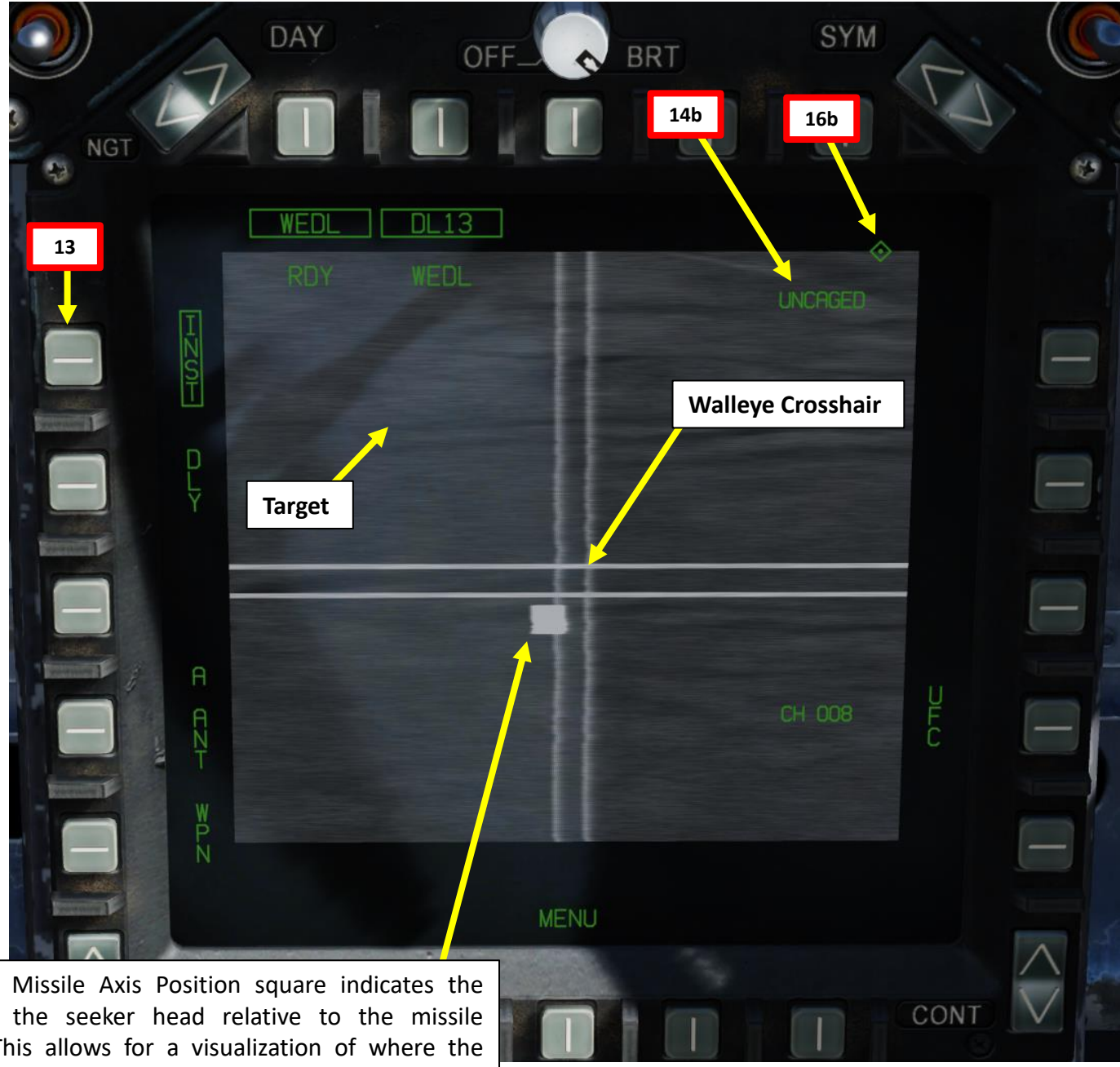
2.12.2 – AGM-62 Walleye II (With Datalink Pod)

13. Set Fuzing to either INST (Instantaneous), or DLY (Delayed Fuze).
14. Set Sensor Control Switch to the Walleye Feed DDI (Sensor Control Switch AFT since we showed up the WEDL feed on the lower AMPCD). A diamond will appear to show the central AMPCD is selected.
15. By default, the Walleye is Caged. When the seeker is caged, it will always point forward at its boresight.
16. Press the Cage/Uncage Button to uncage the Walleye. When uncaged, the bomb will attempt to lock onto a contrasting target within the seeker center.

Sensor Control Switch
AFT/FWD/LEFT/RIGHT



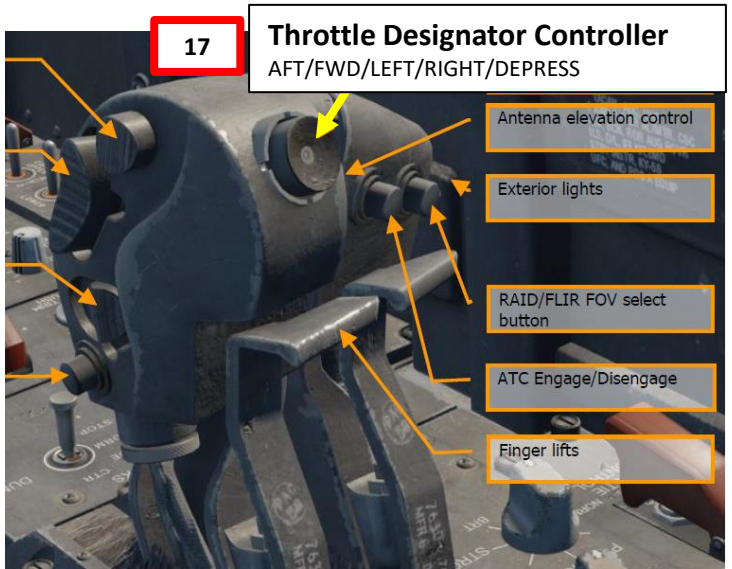




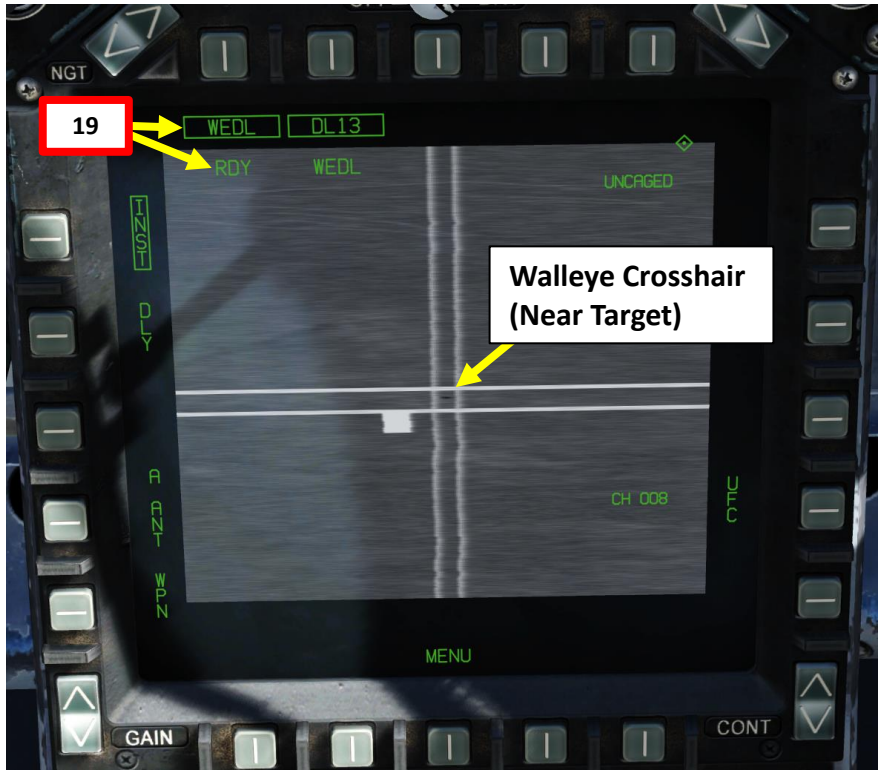
MAP - The Missile Axis Position square indicates the position of the seeker head relative to the missile boresight. This allows for a visualization of where the seeker is looking relative to the aircraft boresight when the bomb is on the aircraft.

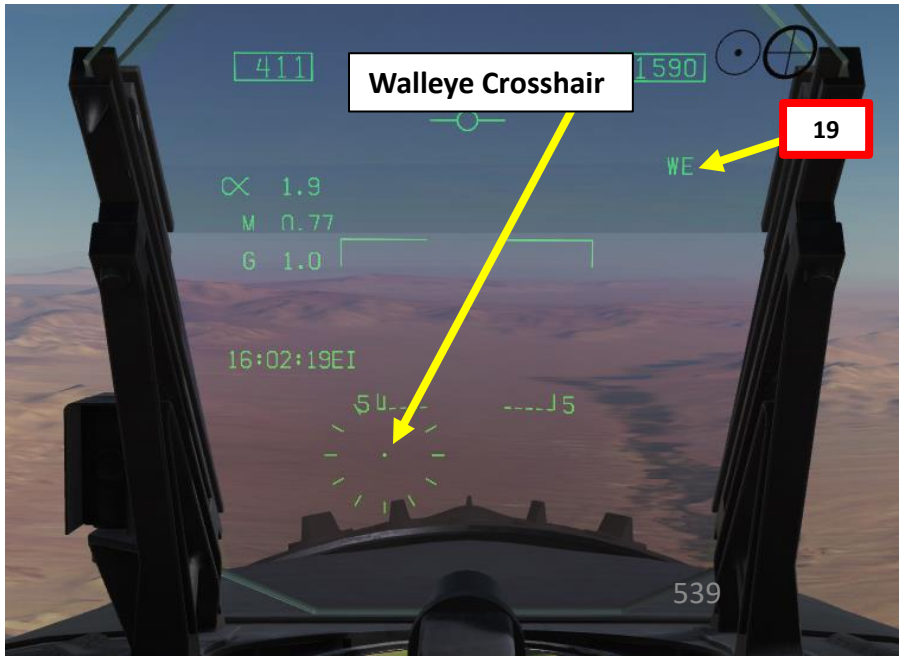
2.12.2 – AGM-62 Walleye II (With Datalink Pod)

17. Hold the TDC Depress button **while** slewing the Walleye to the target. When you release the TDC Depress button, the bomb will attempt to lock its target. The Walleye can be used from a range of 20 nm, but is most likely going to acquire a good lock from a distance of less than 10 miles. I would advise you to maintain sufficient airspeed and an altitude of at least 20000 ft; when remote-controlled, the Walleye can easily run out of altitude before reaching its target.
18. Note: the Walleye does not need a lock to be launched when using the Datalink pod, however it is recommended to have a lock prior to launching in order to make your life easier and minimize corrections.
19. When lock is acquired by Walleye, verify that:
    - WE crossed-out indication disappeared from the HUD
    - WEDL crossed-out indication disappeared from the Walleye Feed.
    - RDY is displayed next to the selected station.
20. Hold the Weapon Release Button (« RALT+SPACE ») to launch Walleye.





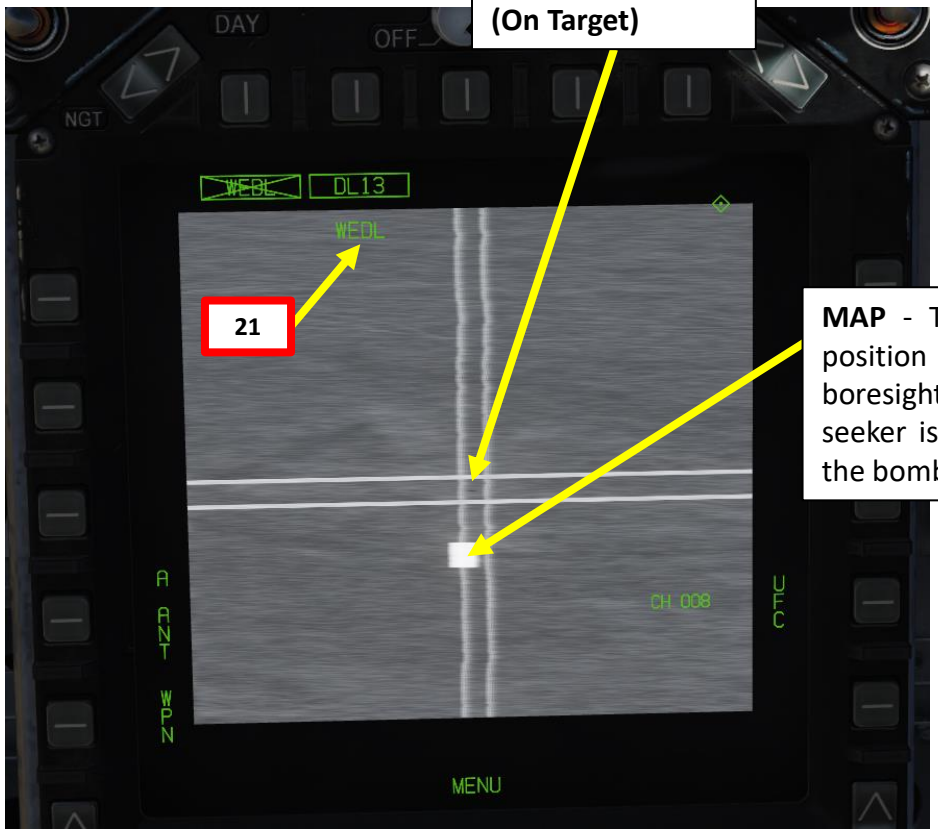




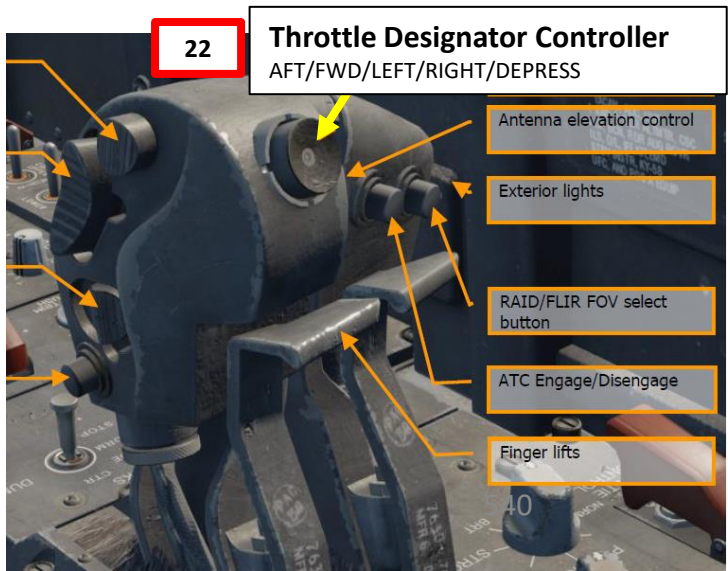
2.12.2 – AGM-62 Walleye II (With Datalink Pod)

21. Once Walleye is launched, the Datalink pod allows you to control the missile remotely. « WEDL » indication under DL13 indicates that the Walleye is launched and the feed is directly from the Walleye TV.
22. To modify the Walleye's trajectory, hold the TDC Depress button **while** slewing the TDC with the TDC AFT/FWD/LEFT/RIGHT controls.
23. Try to keep the missile crosshair and MAP lined up on the target.





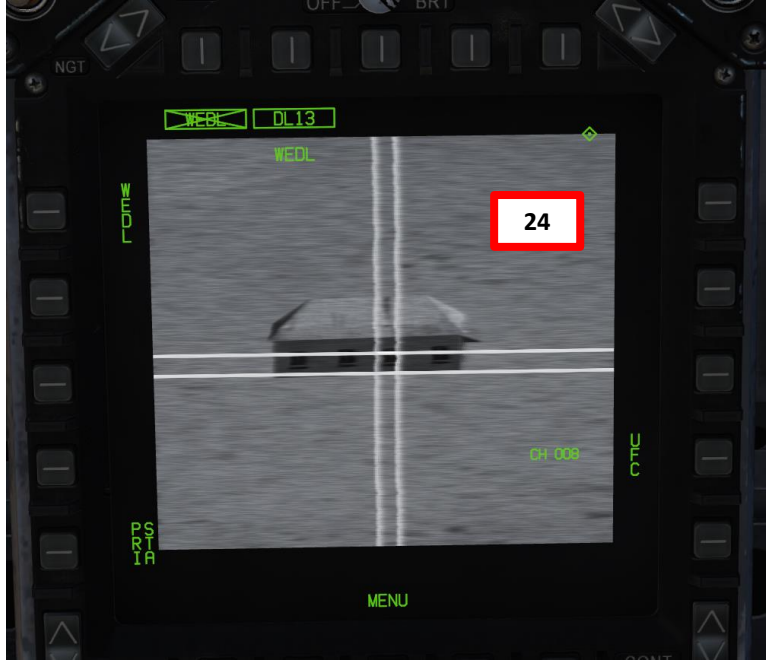
MAP - The Missile Axis Position square indicates the position of the seeker head relative to the missile boresight. This allows for a visualization of where the seeker is looking relative to the aircraft boresight when the bomb is on the aircraft.

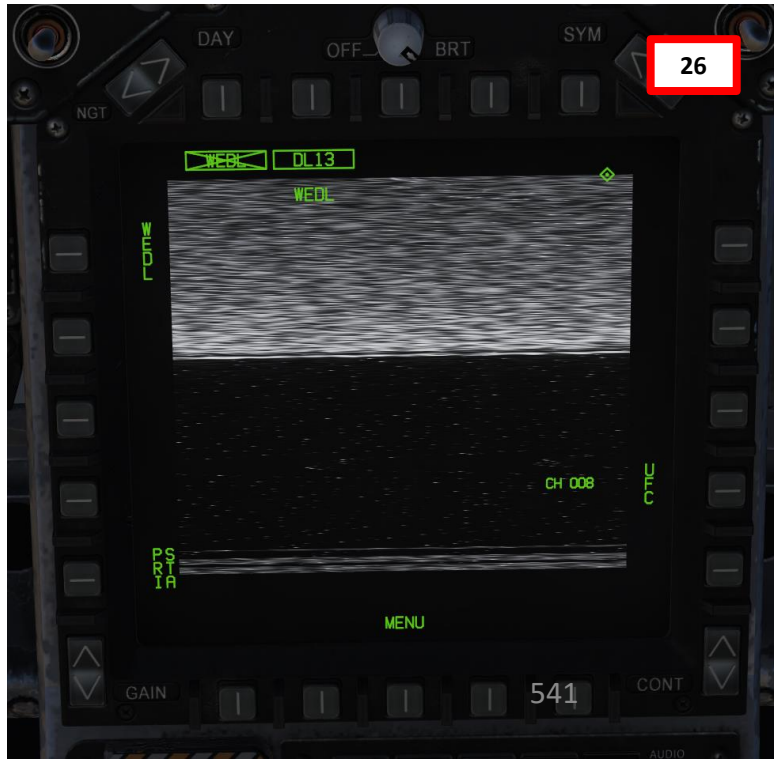


2.12.2 – AGM-62 Walleye II (With Datalink Pod)

24. When the MAP and Walleye crosshair are overlapped, MAP square disappears. This means the missile is heading where the seeker is looking.
25. Avoid overcontrolling the bomb since the bomb is heavy, draggy and loses energy very rapidly. You may run out of altitude before the bomb hits the target.
26. You will lose TV feed once the bomb impacts the target.



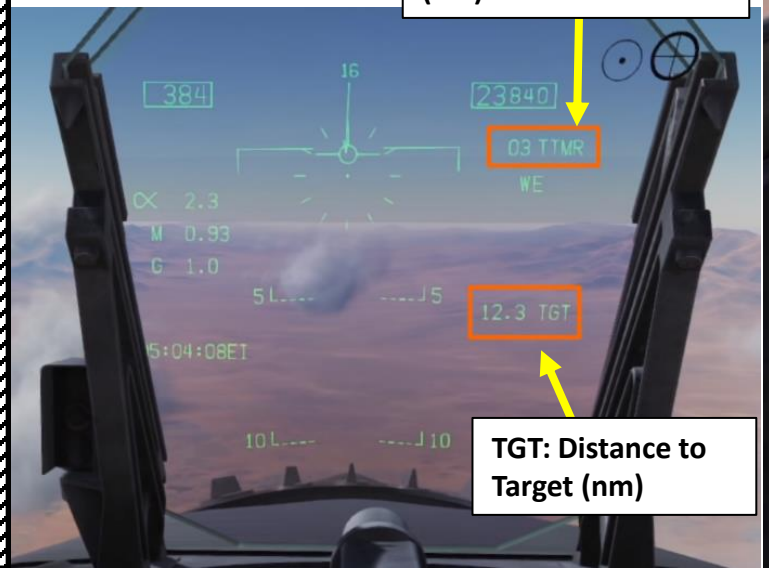


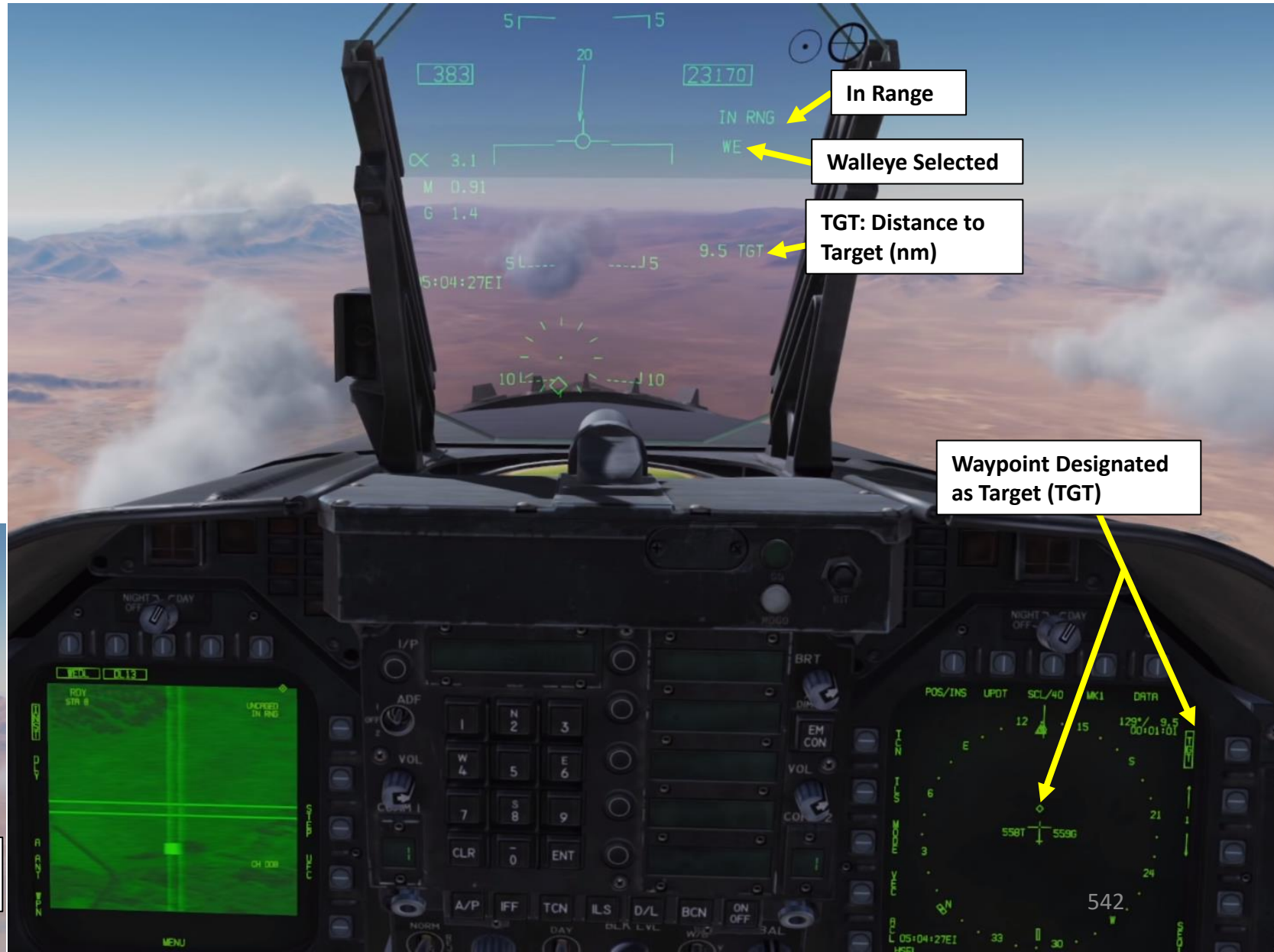


2.12.2 – AGM-62 Walleye II (With Datalink Pod)

Redkite gives valuable tips in his video on Walleyes: https://youtu.be/NsySaTNvprE

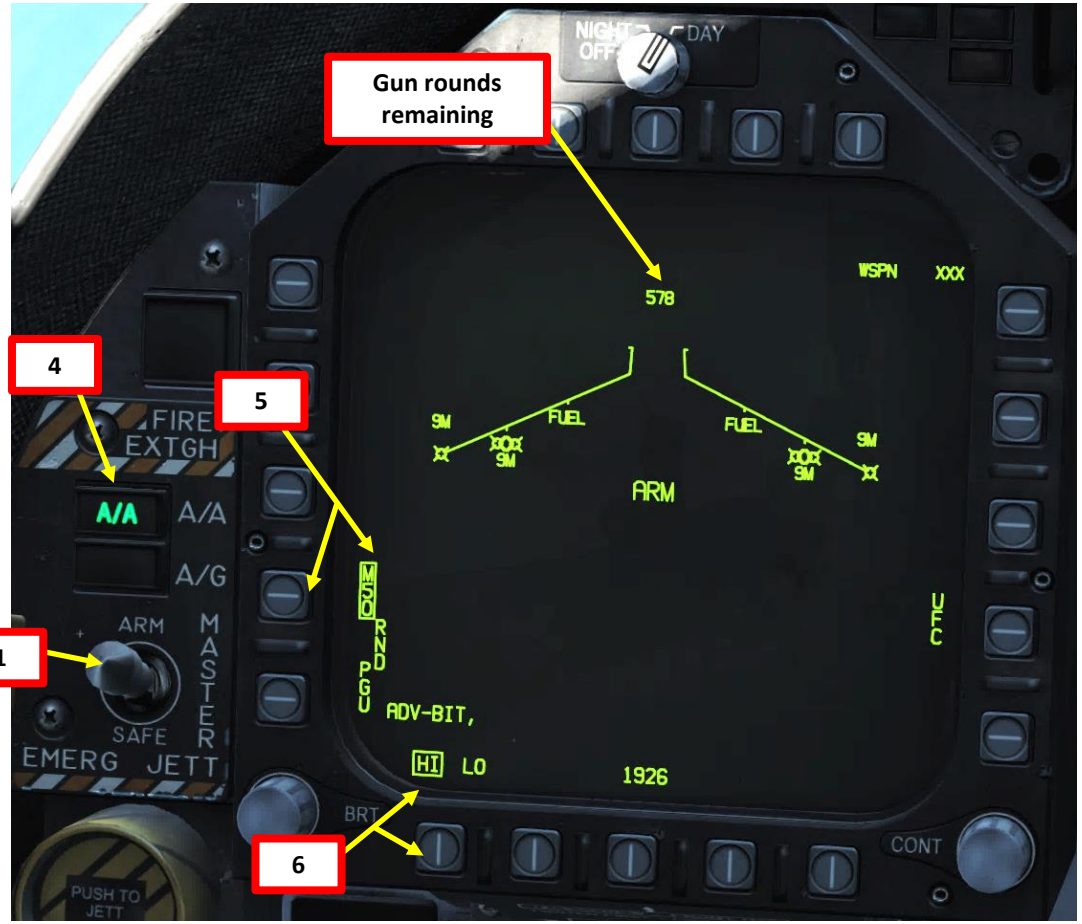
I would advise you to set a waypoint near the target area and designate it in order to have a better idea of the range to target and the time to launch.

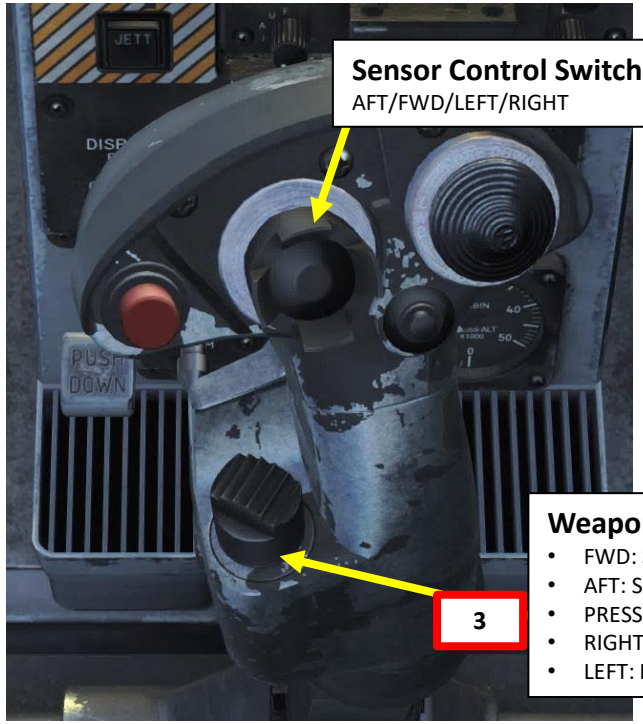


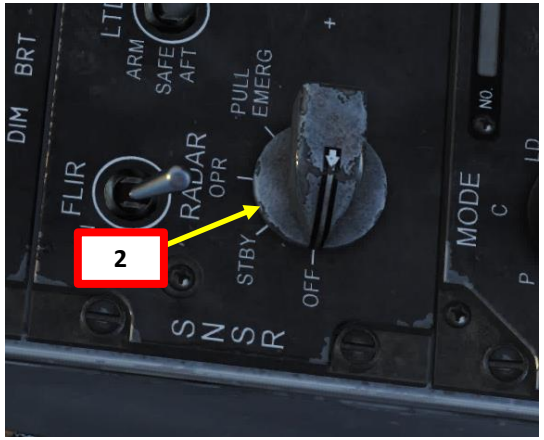


3.1.1 - M61A2 GUN (AIR-TO-AIR) (FUNNEL / NO RADAR TRACKING)

1. Master Arm switch – ARM (UP)
2. Radar switch – OFF
3. Weapon Select Switch – A/A GUN, or « LSHIFT+X »
4. Master Mode switch will be automatically set to A/A
5. Go in SMS (Stores Management System) page and select Gun Rounds Options (MK-50 or PGU-28 rounds)
6. Set Gun Firing Rate Option (HI = 6000 rounds per minute, LO = 4000 rounds per minute)





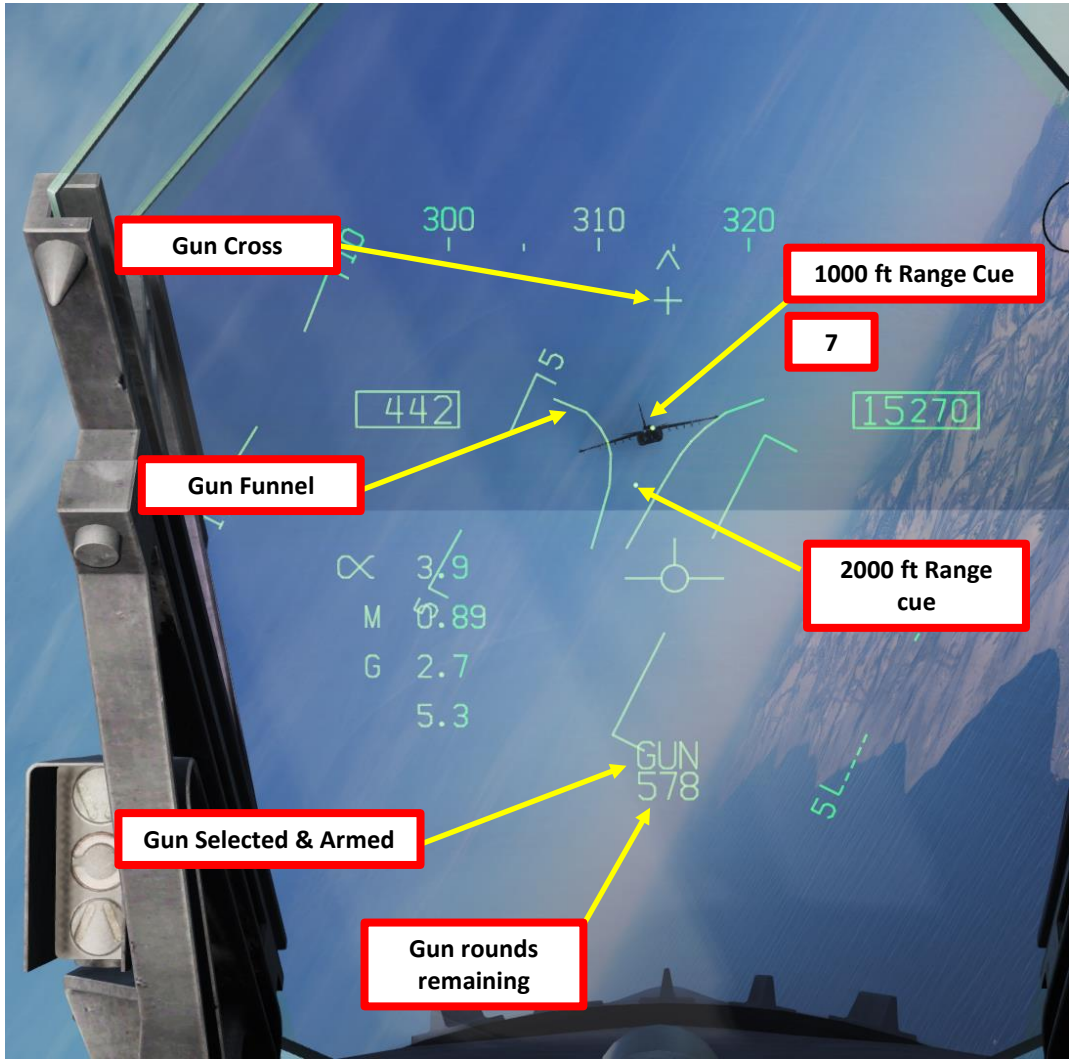


3.1.1 - M61A2 GUN (AIR-TO-AIR)
(FUNNEL / NO RADAR TRACKING)

7. Fly to place either the 1000 ft Range Cue dot or the 2000 ft Range Cue dot over the target. Once the 1000 ft (or 2000 ft) Range Cue dot is on the aircraft and its wingspan fits inside the Gun Funnel, you are now in range.
8. Squeeze the gun trigger (« Spacebar »)

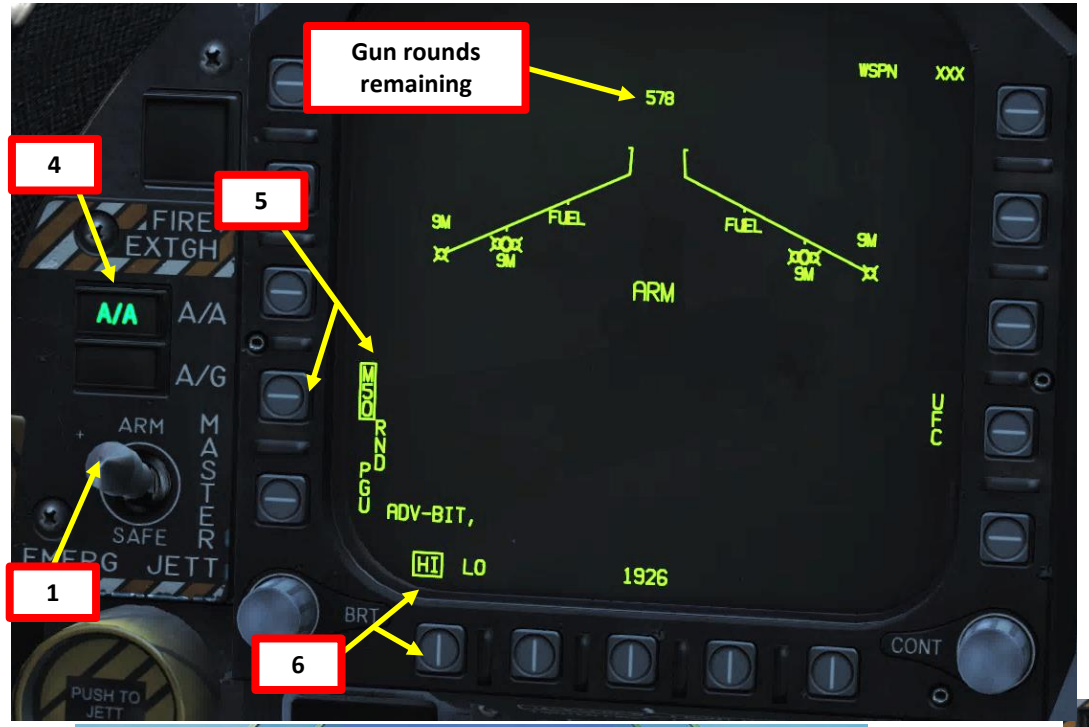


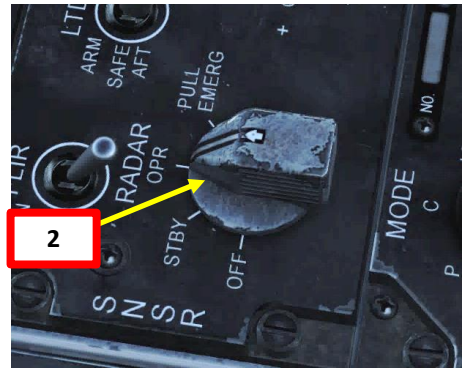


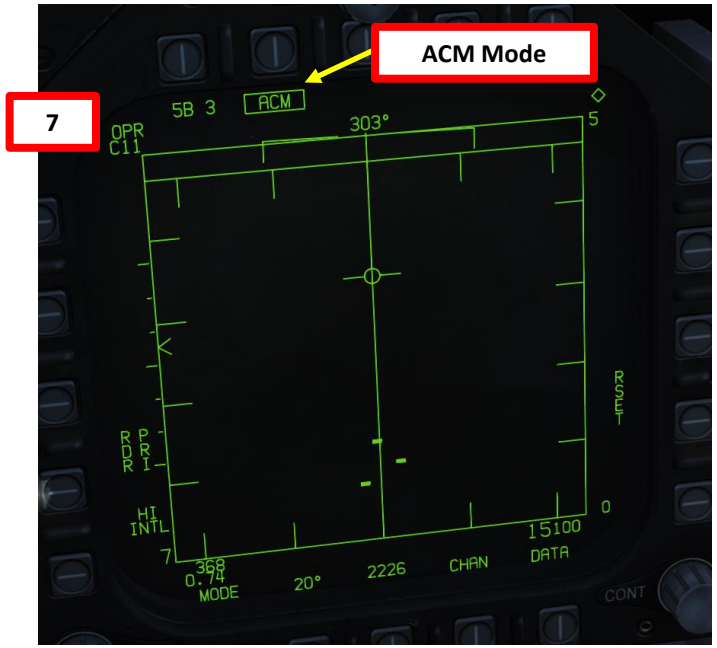


3.1.2 - M61A2 GUN (AIR-TO-AIR) (RADAR TRACKING)

1. Radar Switch - OPERATE
2. Master Arm switch – ARM (UP)
3. Weapon Select Switch – A/A GUN (AFT), or « LSHIFT+X »
4. Master Mode switch will be automatically set to A/A
5. Go in SMS (Stores Management System) page and select Gun Rounds Options (MK-50 or PGU-28 rounds)
6. Set Gun Firing Rate Option (HI = 6000 rounds per minute, LO = 4000 rounds per minute)
7. When A/A GUN is selected and radar is operating, the radar automatically switches to the ACM (Air Combat Maneuvering) GACQ (Gun Auto Acquisition) mode



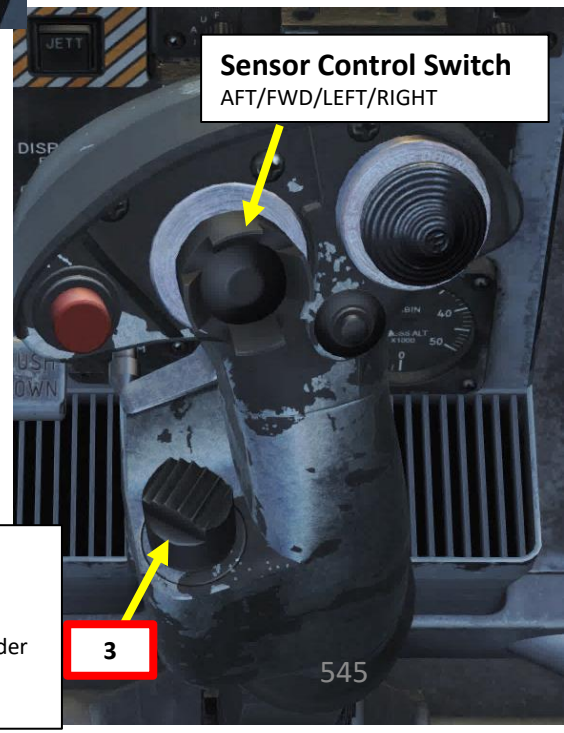






Weapon Select Switch

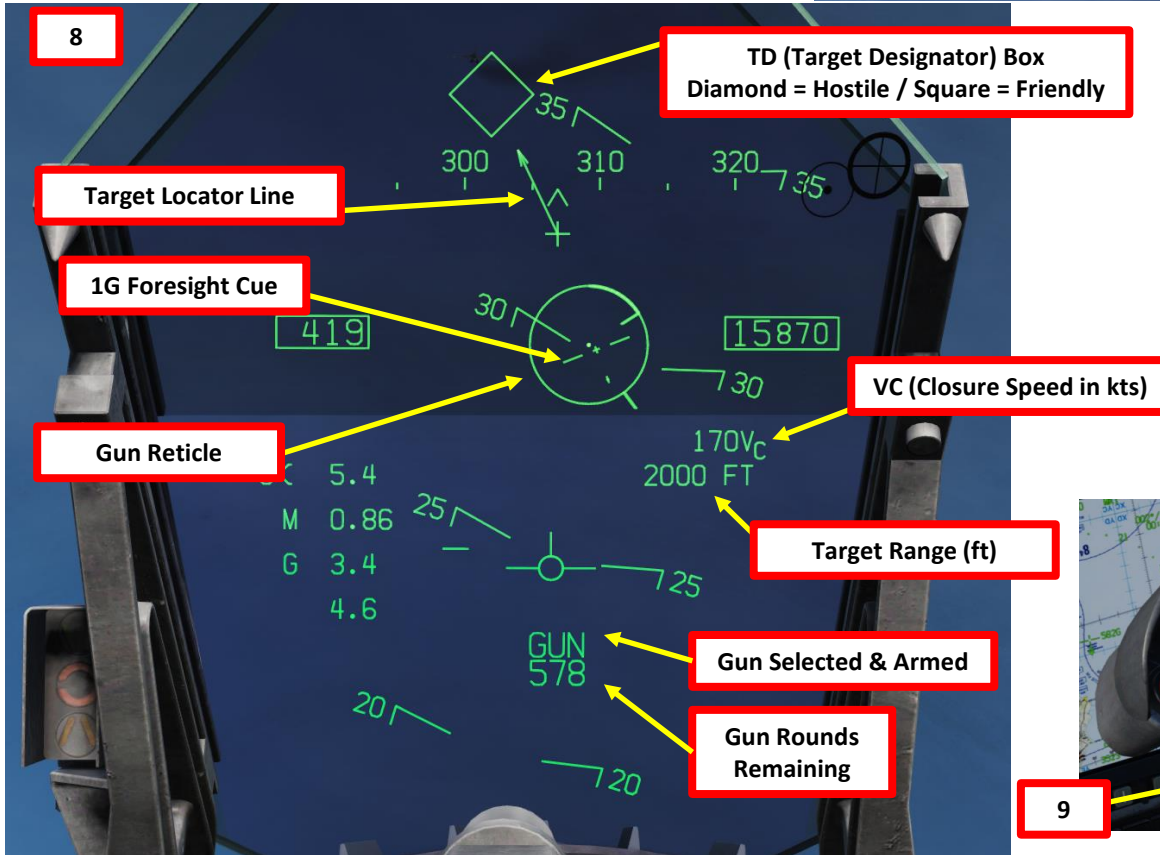
- FWD: Select Sparrow
- AFT: Select Gun
- PRESS DOWN: Select Sidewinder
- RIGHT: Select Amraam
- LEFT: No Function



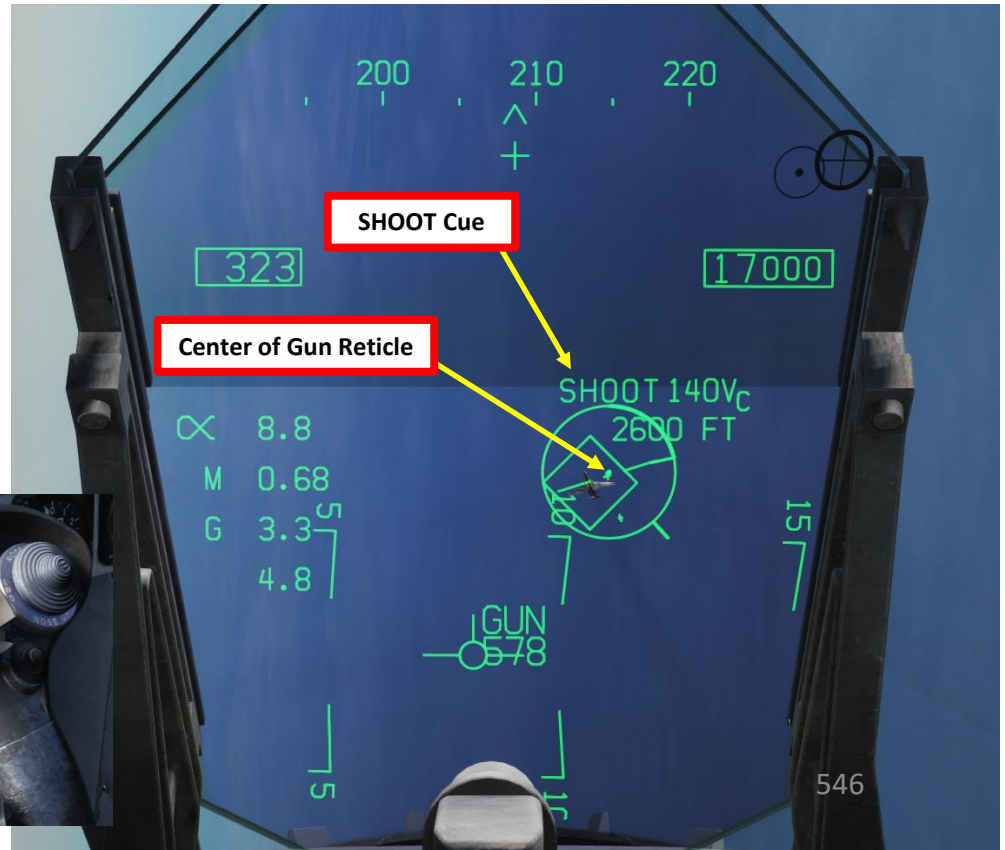
3.1.2 - M61A2 GUN (AIR-TO-AIR) (RADAR TRACKING)

8. Fly to place target in dashed circle on the HUD to lock it on radar when at 5 nm or closer. When target is flying through this scan zone, it is automatically locked on to in STT (Single Target Track) mode
9. Fly to place the dot in the center of the gun reticle over the target and squeeze the gun trigger (« Spacebar ») when you see the SHOOT cue on the HUD.



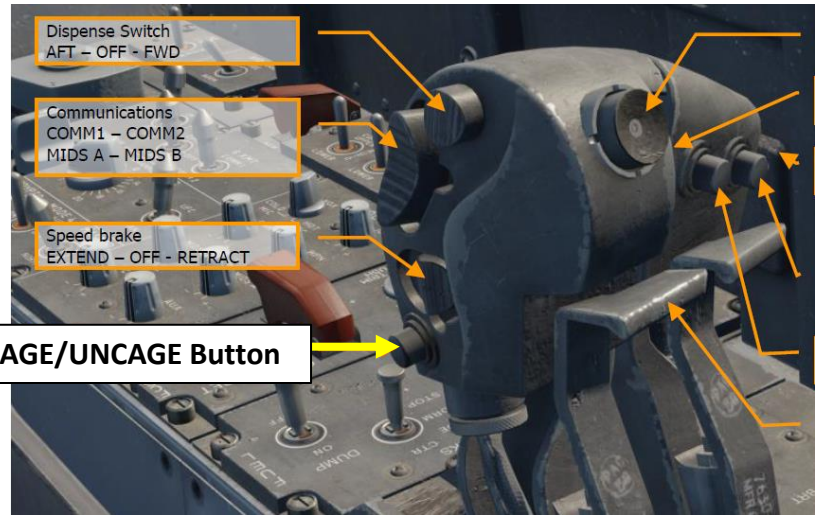


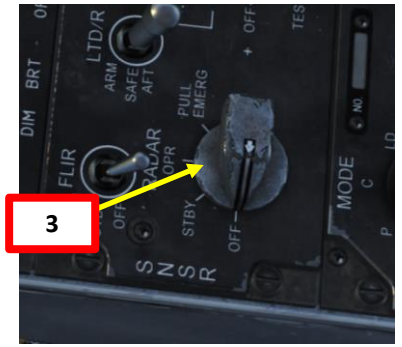


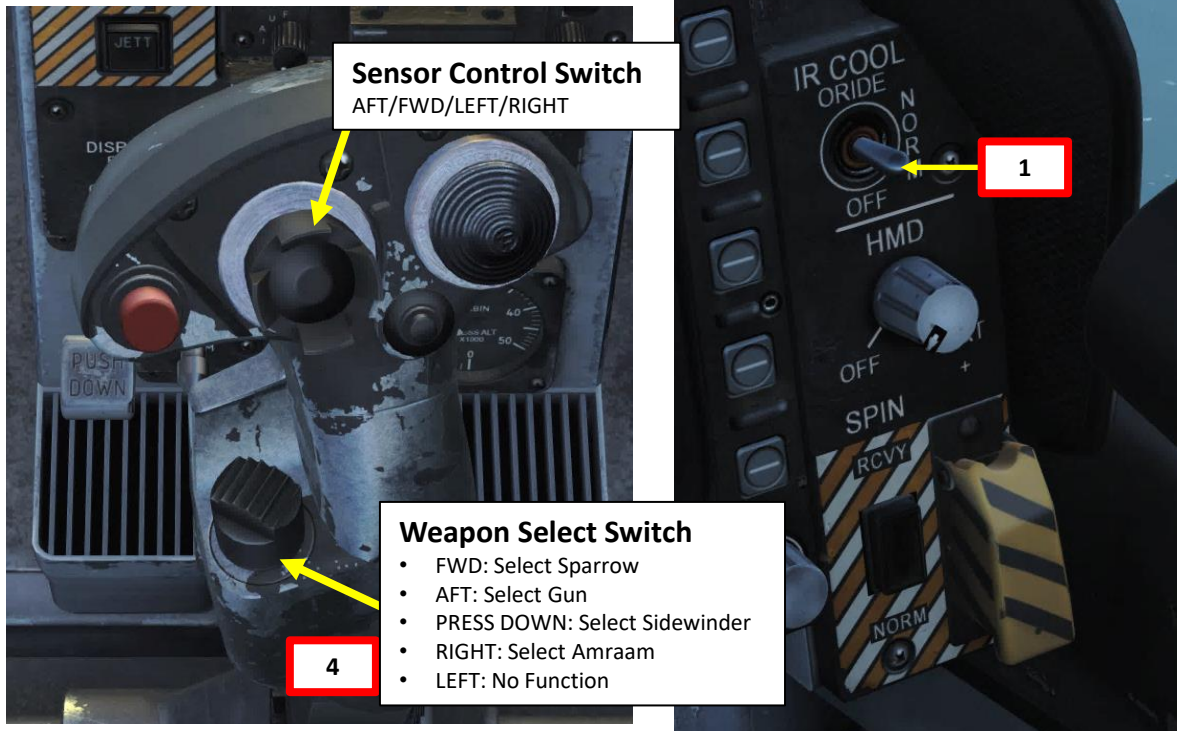


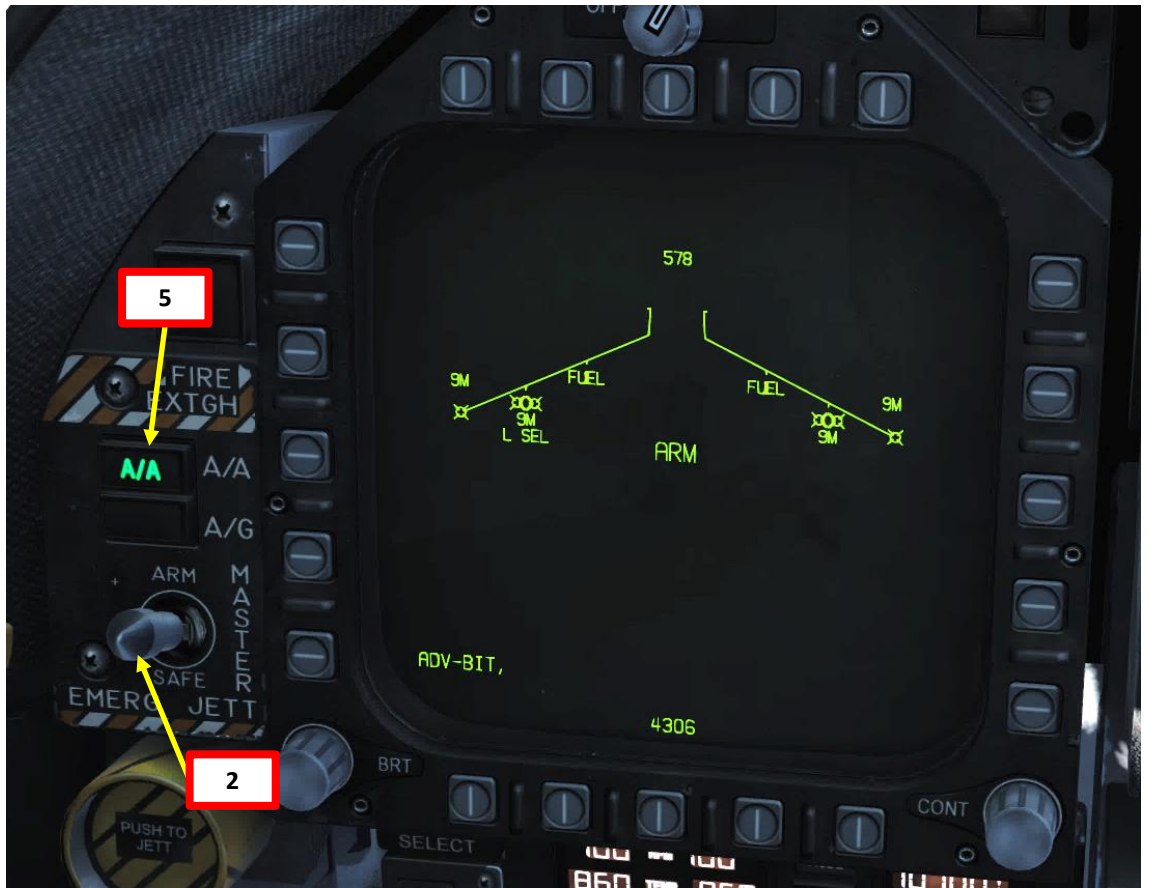
3.2.1 - AIM-9M SIDEWINDER AIR-TO-AIR IR MISSILE (NO RADAR)

1. Set IR COOL switch to NORM. Infrared seeker in the AIM-9 nose must be cooled down to increase sensitivity and reduce background noise. There is enough coolant for 3 hours.
2. Master Arm switch – ARM (UP)
3. Radar switch – OFF
4. Weapon Select Switch – SIDEWINDER, or « LSHIFT+S »
5. Master Mode switch will be automatically set to A/A
6. Press and hold the Cage/Uncage switch to uncage the Sidewinder (« C » by default). Once uncaged, the Sidewinder should be actively looking for a lock on the closest heat signature. As you uncage the Sidewinder, you should hear a low growl tone when the missile seeker is searching.





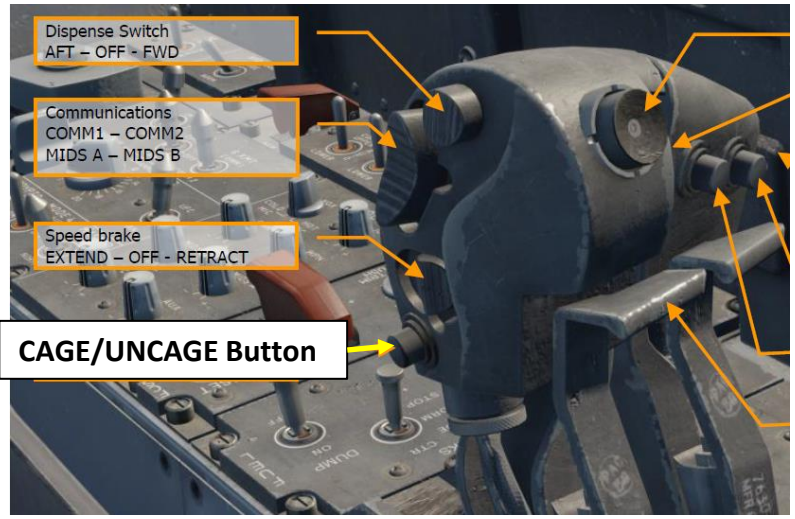




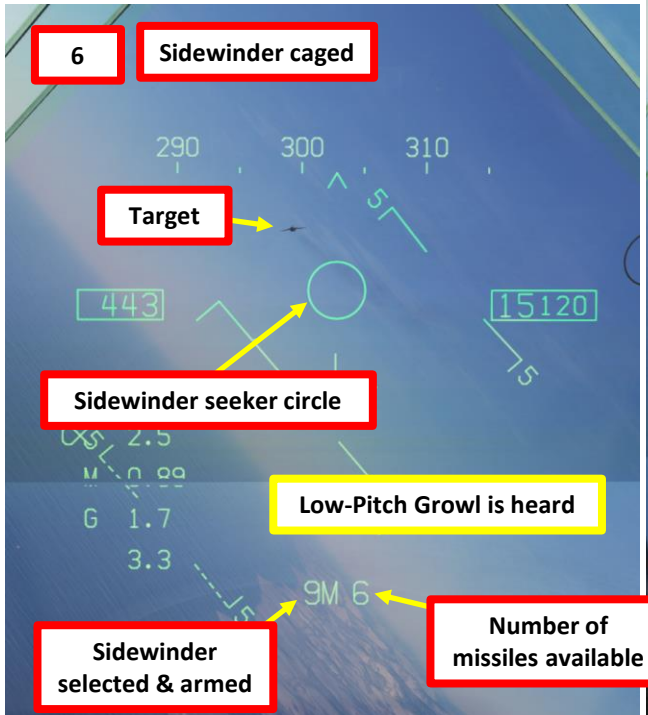
3.2.1 - AIM-9M SIDEWINDER AIR-TO-AIR IR MISSILE (NO RADAR)

7. Fly to place the target inside the Sidewinder seeker circle until a high-pitched audio sound confirms that the missile's seeker has acquired a solid lock.
8. Squeeze the gun trigger (« Spacebar ») to launch missile.







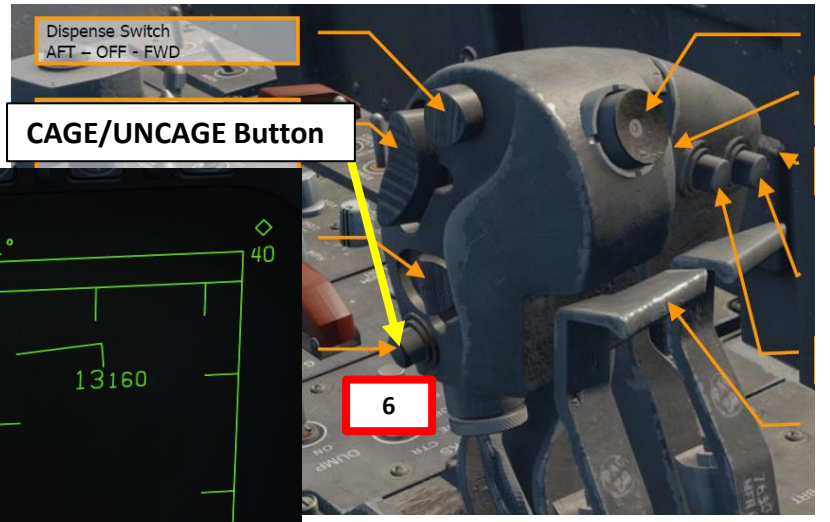


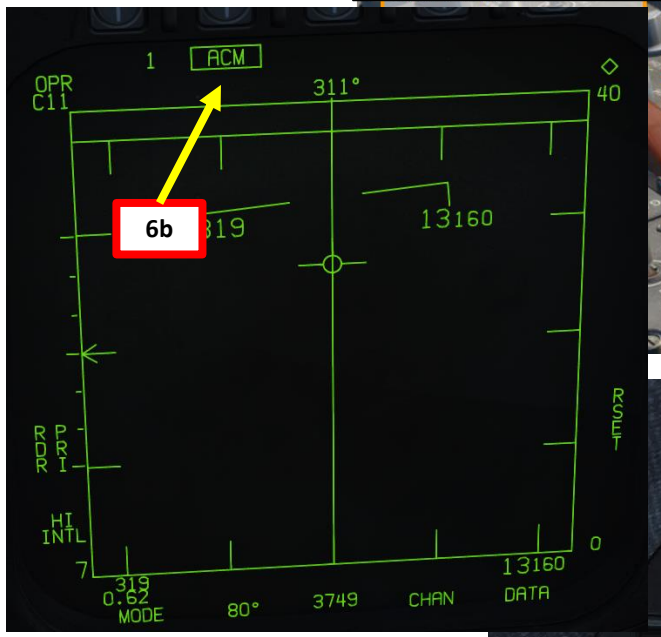




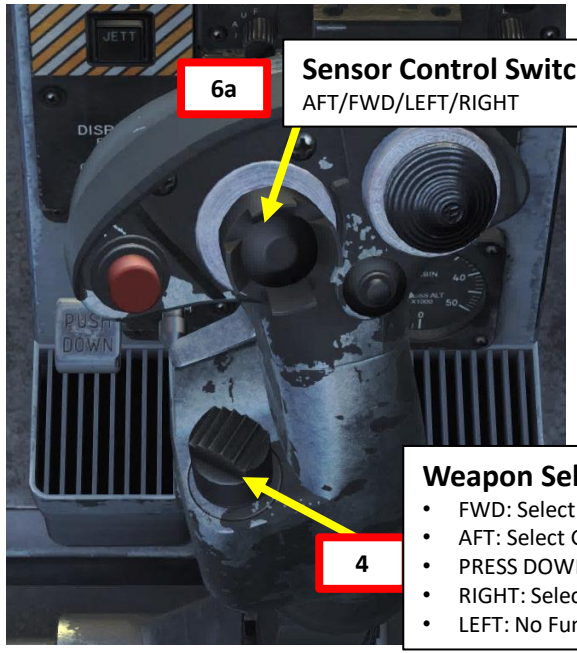
3.2.2 - AIM-9M SIDEWINDER AIR-TO-AIR IR MISSILE (RADAR)

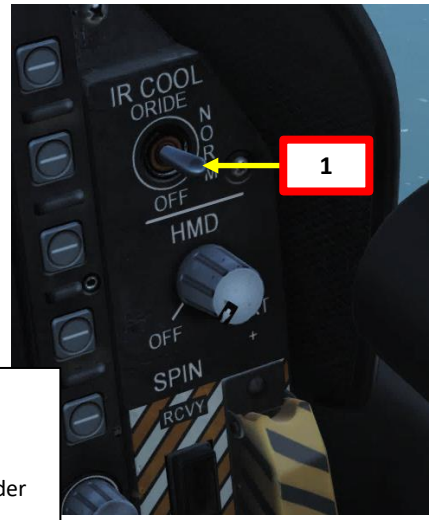
1. Set IR COOL switch to NORM. Infrared seeker in the AIM-9 nose must be cooled down to increase sensitivity and reduce background noise. There is enough coolant for 3 hours.
2. Master Arm switch – ARM (UP)
3. Radar Switch - OPERATE
4. Weapon Select Switch – SIDEWINDER (DOWN), or « LSHIFT+S »
5. Master Mode switch will be automatically set to A/A
6. When SIDEWINDER is selected and radar is operating, press the Sensor Control Switch FWD to select ACM (Air Combat Maneuvering) radar mode



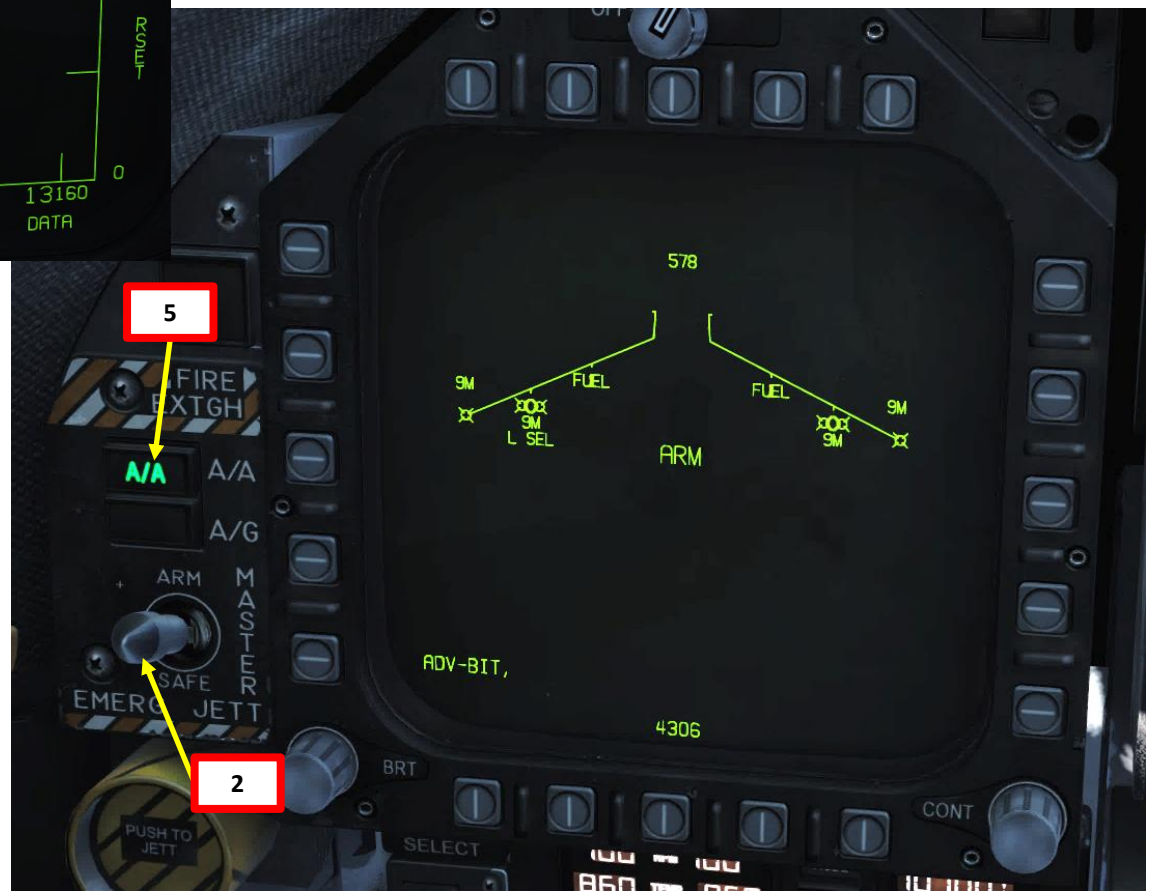








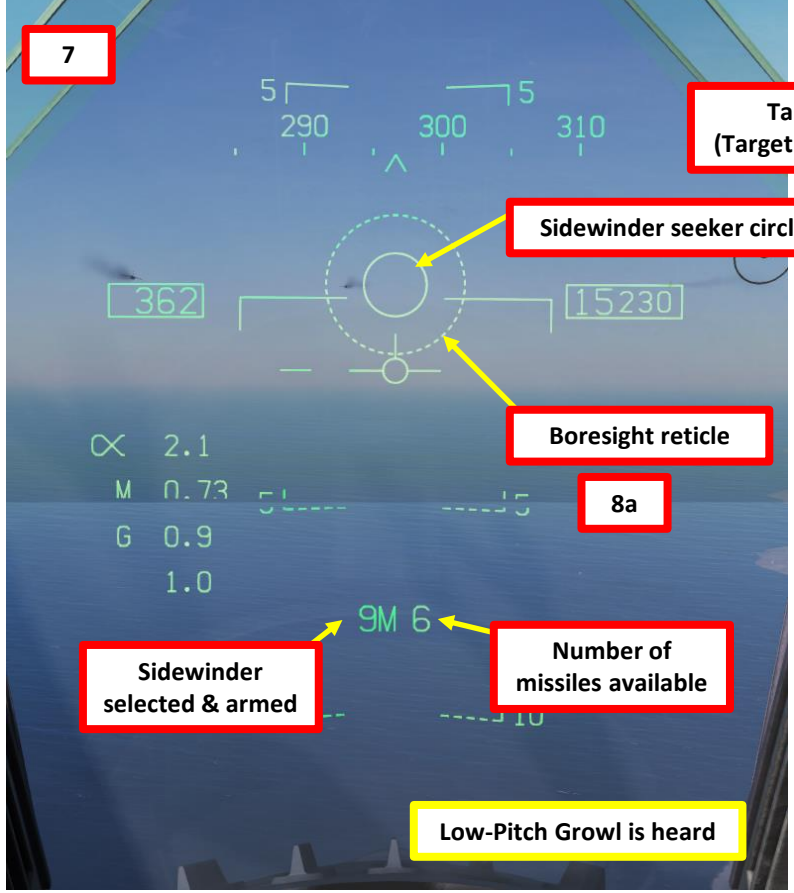
Weapon Select Switch
- FWD: Select Sparrow
- AFT: Select Gun
- PRESS DOWN: Select Sidewinder
- RIGHT: Select Amraam
- LEFT: No Function

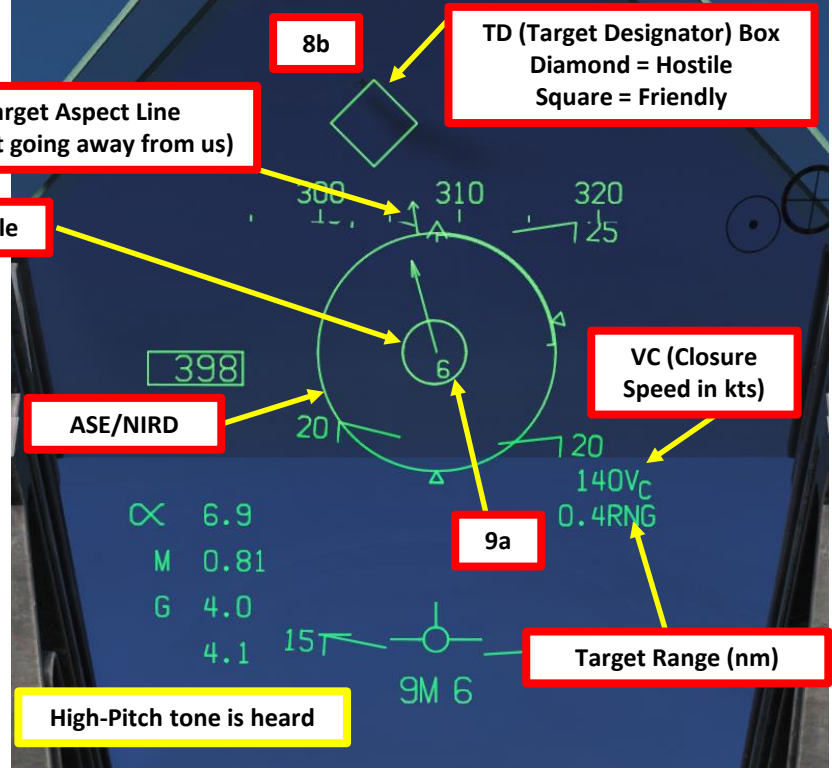


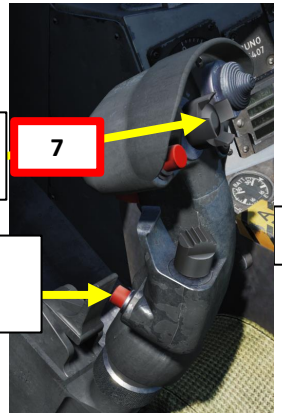
3.2.2 - AIM-9M SIDEWINDER AIR-TO-AIR IR MISSILE (RADAR)

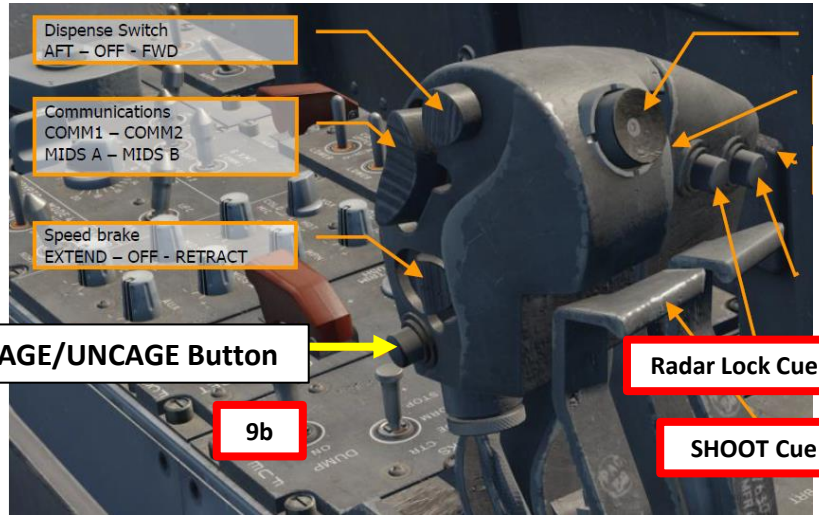
7. Select ACM sub-mode using the Sensor Select switch again. We will select BST sub-mode.
   a) BST (Boresight), Sensor Select FWD
   b) VACQ (Vertical Acquisition), Sensor Select AFT
   c) WACQ (Wide Acquisition), Sensor Select LEFT
8. Fly to place target in dashed circle on the HUD to lock it on radar when at 5 nm or closer. When target is flying through this scan zone, it is automatically locked on to in STT (Single Target Track) mode
9. Press and hold the Cage/Uncage switch (« C » by default) to uncage the Sidewinder.
10. Fly to place the Steering Dot inside the ASE/NIRD (Allowable Steering Error / Normalized In-Range Display) Circle and squeeze the gun trigger (« Spacebar ») when you see the SHOOT cue over the TD (Target Designation) box on the HUD to launch missile.

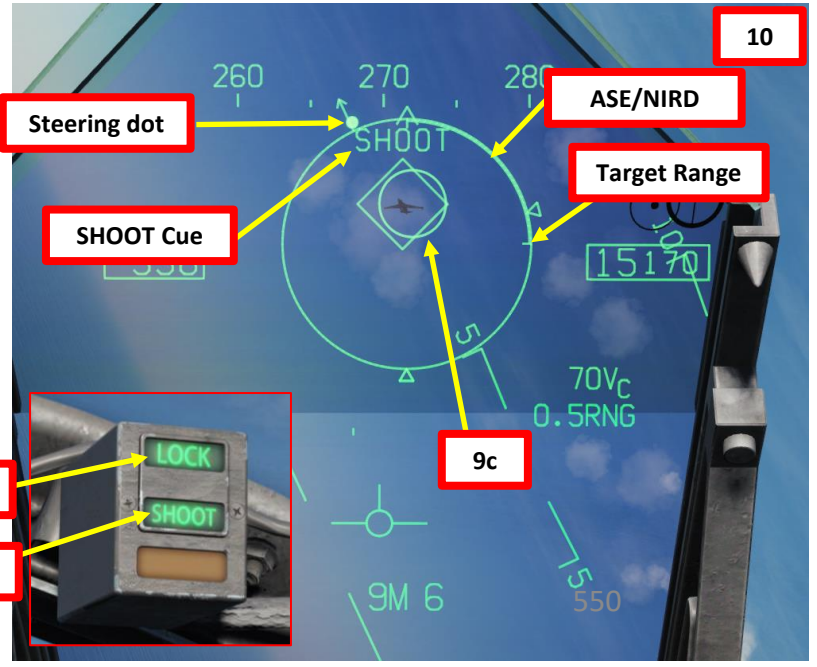
Note: You can unlock a target by pressing the Undesignate Button (« S »)











3.2.2 - AIM-9M SIDEWINDER AIR-TO-AIR IR MISSILE (RADAR)

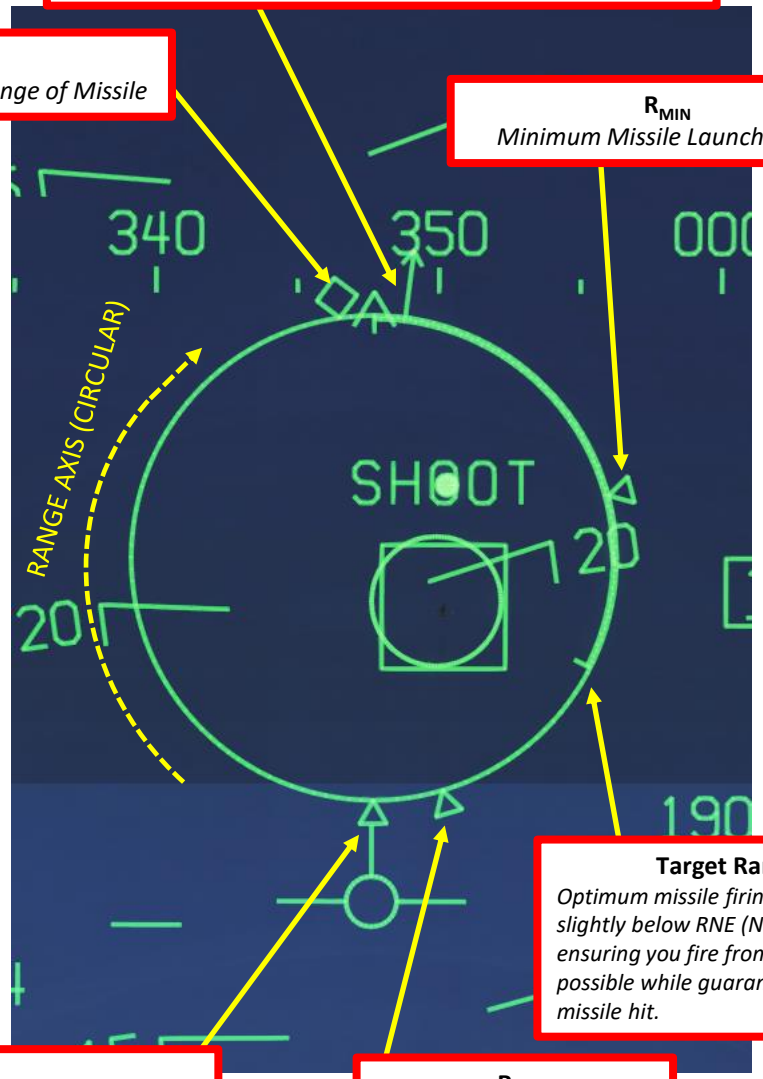




Target Aspect
Pointing Up = Target moving away from you (cold)
Pointing Down = Target moving towards you (hot)

R_{AERO}
Maximum Aerodynamic Range of Missile

R_{MIN}
Minimum Missile Launch Range



Target Range
Optimum missile firing range is slightly below RNE (No Escape), ensuring you fire from as far as possible while guaranteeing a missile hit.

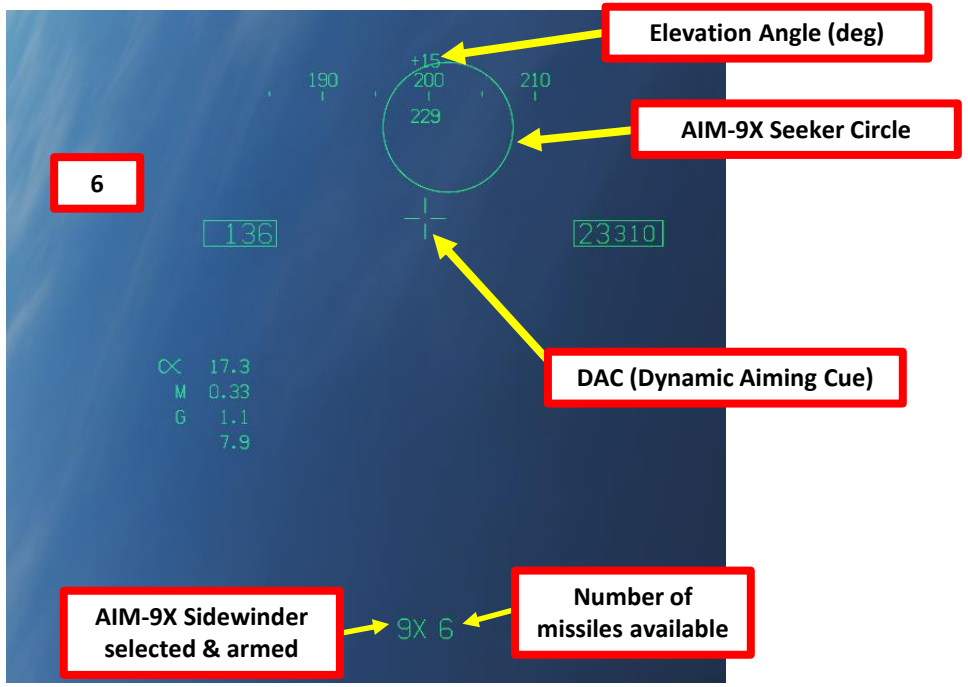
R_{MAX}
Maximum Launch Range of Missile

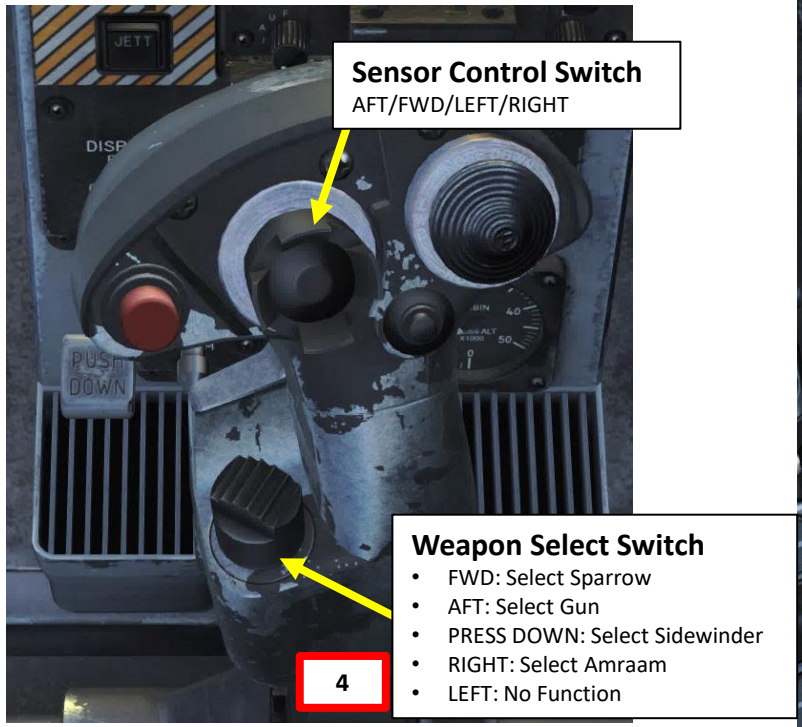
R_{NE}
Missile No Escape Range

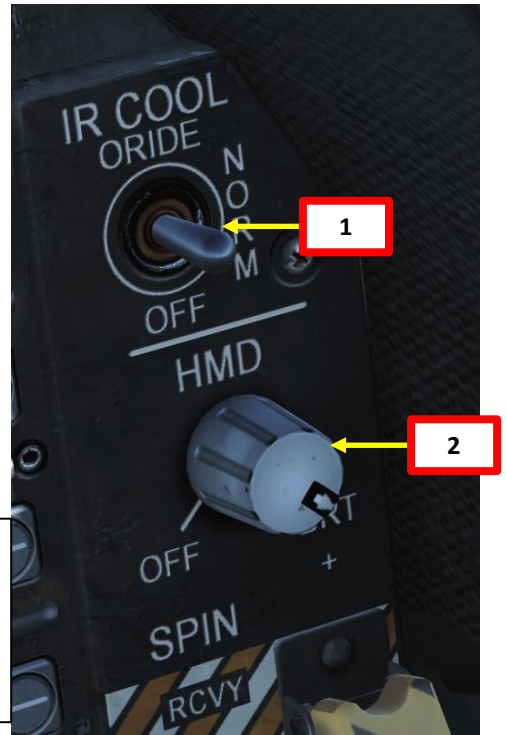
3.3 - AIM-9X SIDEWINDER AIR-TO-AIR IR MISSILE (JHMCS)

The HMD (Helmet-Mounted Display) and JHMCS (Joint Helmet-Mounted Cueing System) allow the pilot to project the Heads-Up Display in his field of vision at all times. It also allows the slaving of sensors and weapons to the helmet's line of sight. In the Hornet, the JHMCS is very useful for using missiles like the AIM-9X, an upgraded version of the AIM-9 with TVC (Thrust Vectoring Control) allowing 80 deg off-boresight shots.

1. Set IR COOL switch to NORM. Infrared seeker in the AIM-9 nose must be cooled down to increase sensitivity and reduce background noise. There is enough coolant for 3 hours.
2. Set HMD switch to BRT (Fully Right) to power up the JHMCS (Joint Helmet Cueing System)
3. Master Arm switch – ARM (UP)
4. Weapon Select Switch – SIDEWINDER, or « LSHIFT+S »
5. Master Mode switch will be automatically set to A/A
6. Move your head/helmet and try to place the DAC (Dynamic Aiming Cue) and AIM-9X Seeker Circle on the nearest target.





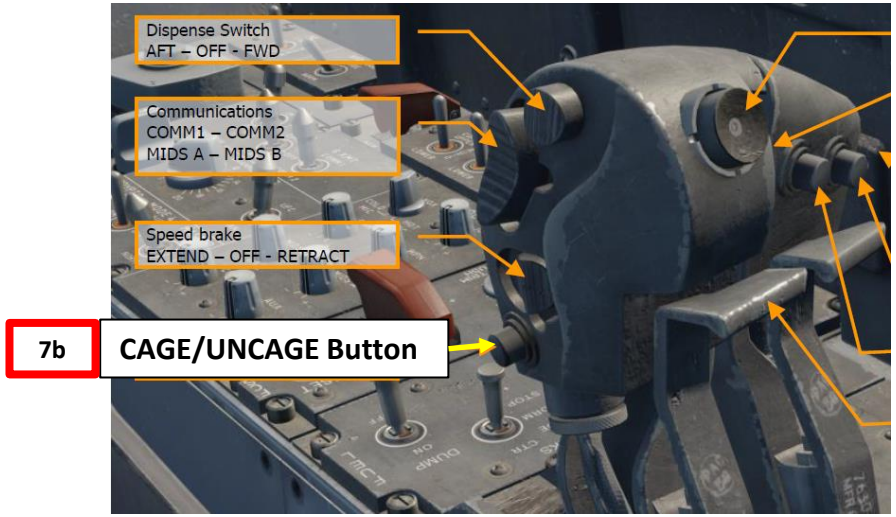


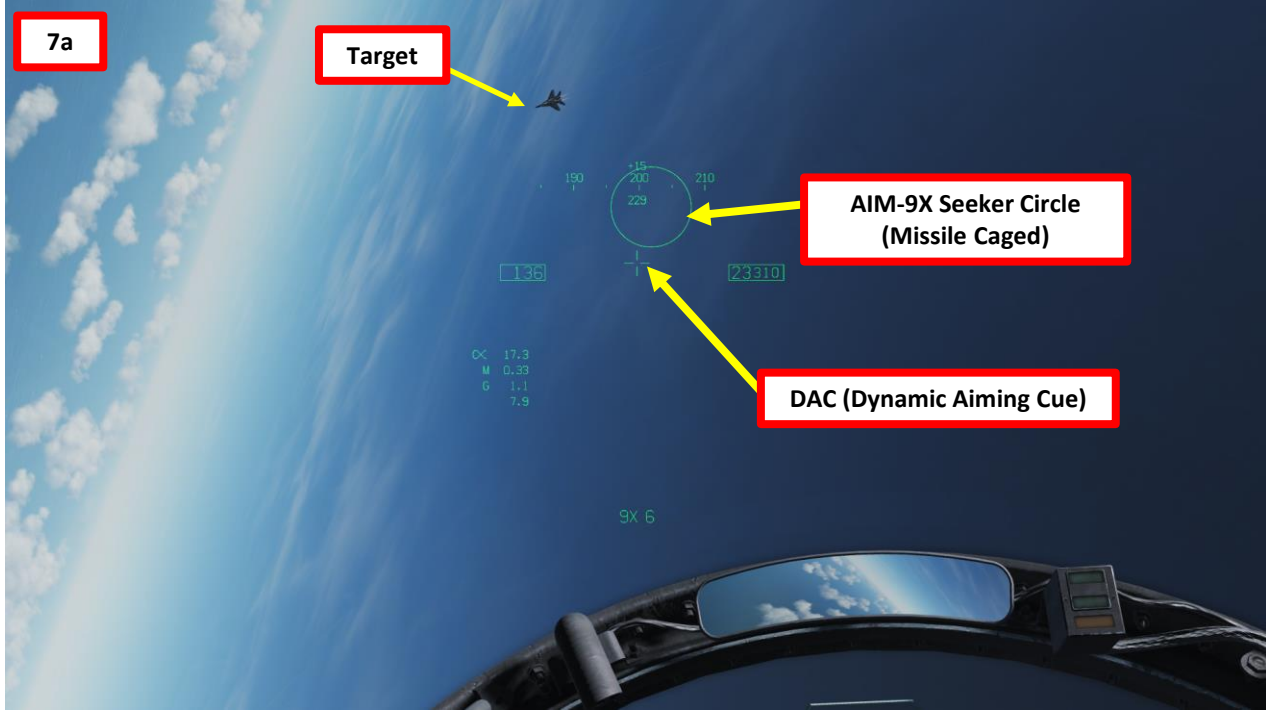


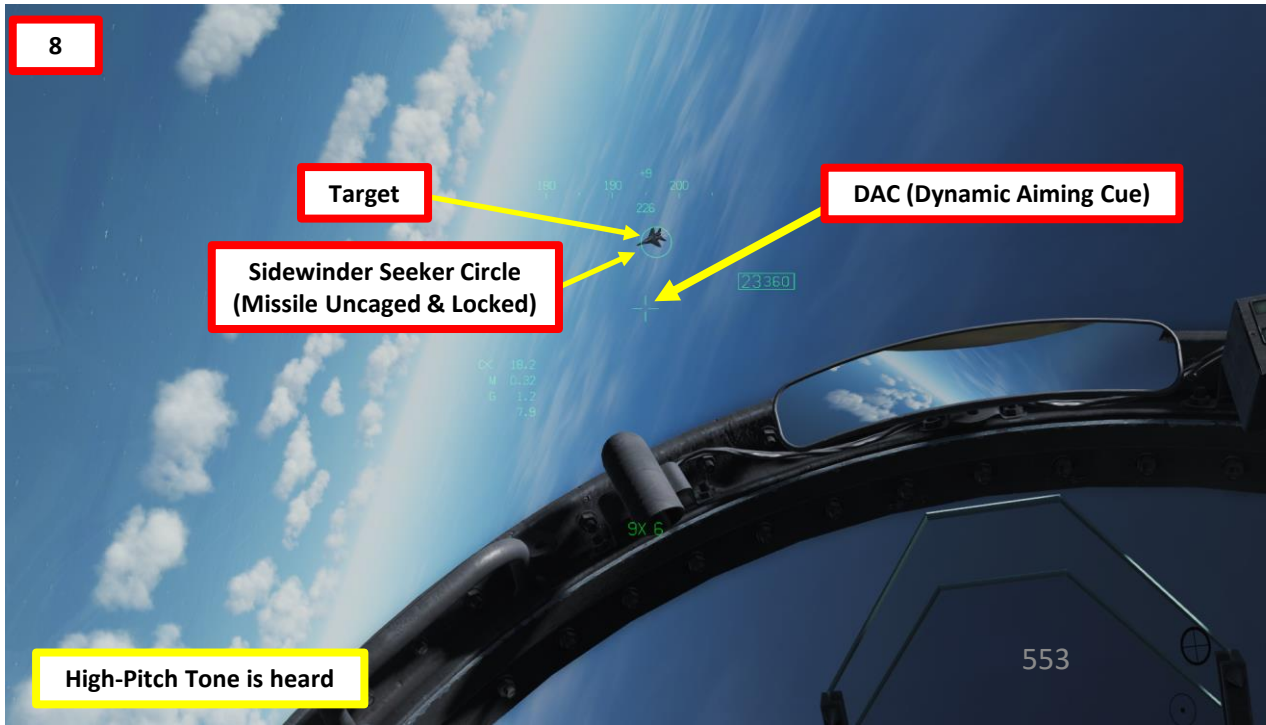
3.3 - AIM-9X SIDEWINDER AIR-TO-AIR IR MISSILE (JHMCS)

7. When DAC (Dynamic Aiming Cue) and Sidewinder Seeker Circle are placed on a target, press and hold the Cage/Uncage switch to uncage the Sidewinder (« C » by default). Once uncaged, the Sidewinder should be actively looking for a lock on the closest heat signature.
8. Once the Sidewinder is uncaged and has locked a heat signature, the Seeker Circle will become smaller and a high-pitched audio sound confirms that the missile's seeker has acquired a solid lock.
9. Squeeze the gun trigger (« Spacebar ») to launch missile.









3.3 - AIM-9X SIDEWINDER AIR-TO-AIR IR MISSILE (JHMCS)









3.3 - AIM-9X SIDEWINDER AIR-TO-AIR IR MISSILE (JHMCS)

AIM-9X Sounds:

- Static: Seeker is searching.
- Double Beep: Seeker has been moved past 27.5° off boresight while searching.
- Repeating Beep: Seeker sees infrared contrast, but not enough to reliably track (i.e. the seeker is too far from the source).
- Steady Tone: Seeker sees an infrared contrasting target.
- Steady High Pitch Tone: Seeker is uncaged.
- Steady Higher Pitch Tone: Seeker is uncaged and is more than 27.5° off boresight.

Wags' AIM-9X Tutorial: https://youtu.be/vLPkVOR5JY4

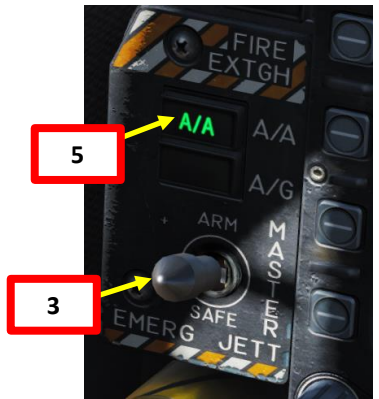
AIM-9X Tones: https://youtu.be/QV4GStRN5UU

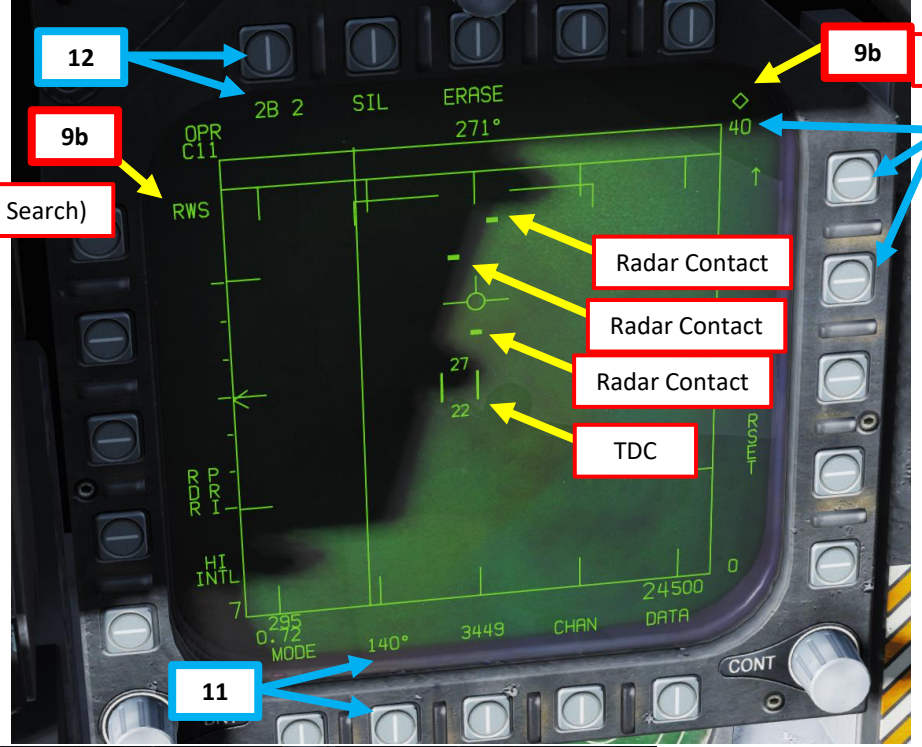




3.4 - AIM-7M SPARROW AIR-TO-AIR SARH MISSILE (RADAR)

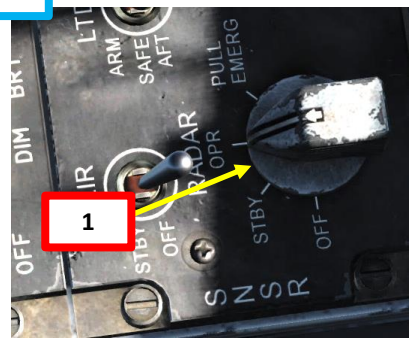
1. Radar Switch – OPERATE
2. Set RDR ATTK page on the right DDI and the SMS page on the left DDI (Digital Display Indicator) by pressing the MENU OSB, then selecting TAC or SUPT page, then choosing which menu to display on which DDI.
3. Master Arm switch – ARM (UP)
4. Weapon Select Switch – SPARROW, or « LSHIFT+W »
5. Master Mode switch will be automatically set to A/A
6. On SMS (Stores Management System) page, set your desired target size (SMALL/MEDIUM/LARGE).
7. Press OSB next to MODE to select missile mode. NORM is a normal launch, LOFT is to make the missile fly a higher trajectory to face less dense air and thus increase energy during hitting the target, and HELO is specifically use for helicopters. In our case, we will use NORM.
8. If you have different types of Sparrows loaded, select desired Sparrow type on the SMS page.
9. When SPARROW is selected, radar is operating, press the Sensor Select Switch RIGHT to select BVR/RWS (Beyond Visual Range/Range While Search) radar mode and slave the TDC (Throttle Designation Controller) to the radar screen.
10. Set desired radar range scale (40 nm in our case)
11. Set desired radar azimuth range (140 deg in our case)
12. Set desired radar bar mode (4 or 2 bars are generally used)





9b TDC is active on Right DDI

10







Sensor Control Switch
AFT/FWD/LEFT/RIGHT

9a

Weapon Select Switch

- FWD: Select Sparrow
- AFT: Select Gun
- PRESS DOWN: Select Sidewinder
- RIGHT: Select Amraam
- LEFT: No Function

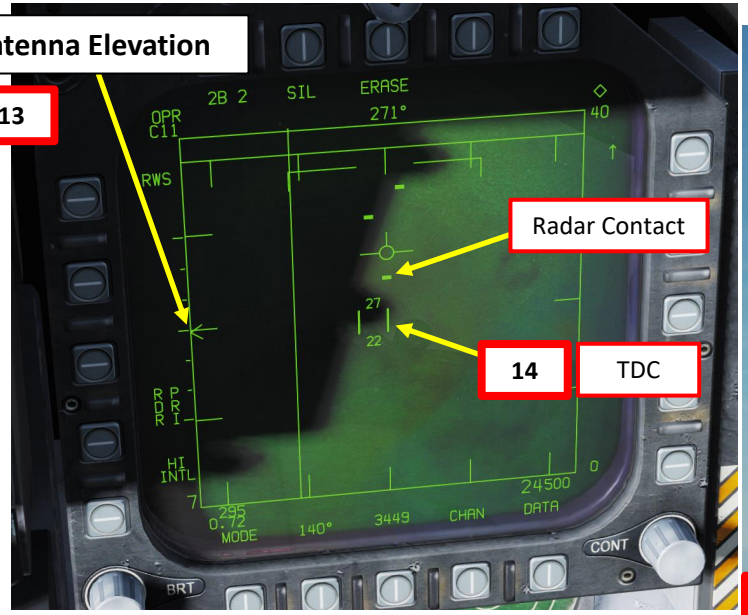
4

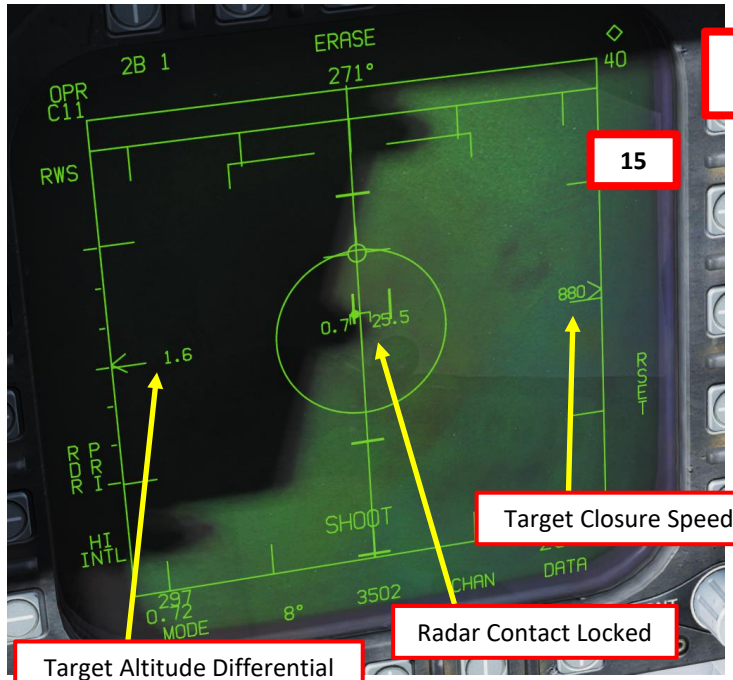
Undesignate / Nosewheel Steering Button

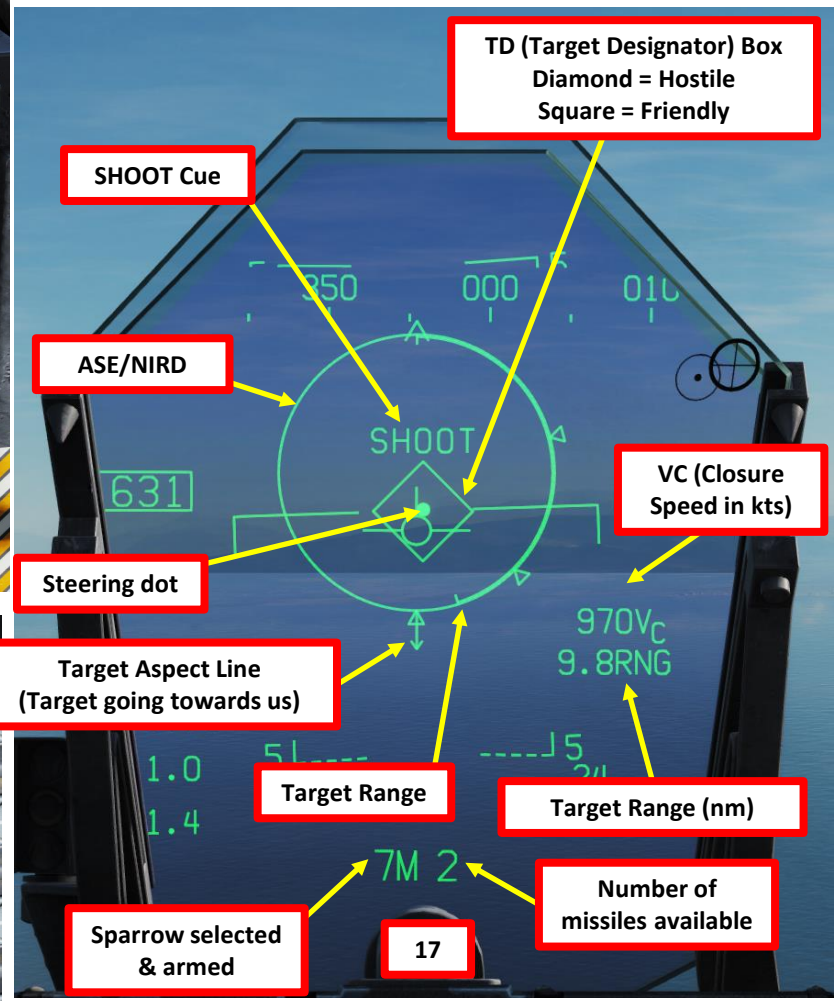
3.4 - AIM-7M SPARROW AIR-TO-AIR SARH MISSILE (RADAR)

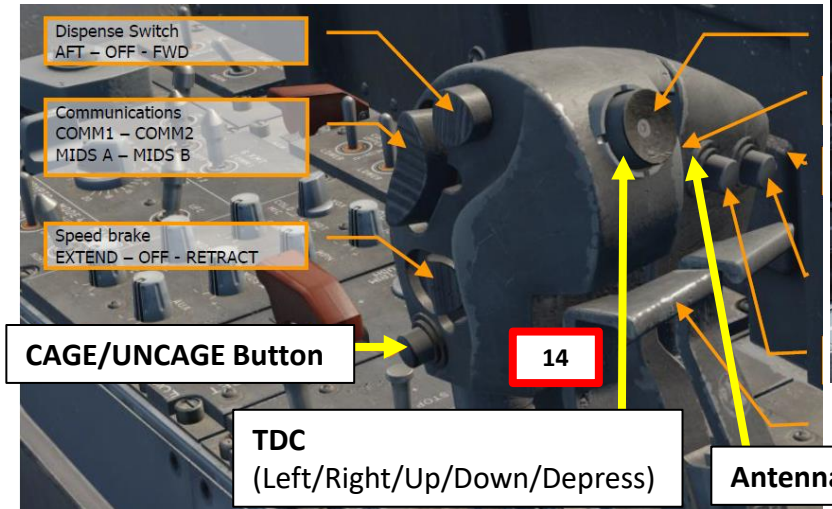
13. Control your antenna elevation to make sure the radar scans the desired area.
14. Move the TDC over the target using the TDC controls.
15. Lock target by using the TDC DEPRESS control (« ENTER »).
16. Fly to place target in ASE circle on the HUD to lock it on radar. When target is flying through this scan zone, it is automatically locked on to in STT (Single Target Track) mode
17. Fly to place the Steering Dot inside the ASE/NIRD (Allowable Steering Error / Normalized In-Range Display) Circle and squeeze the gun trigger (« Spacebar ») when you see the SHOOT cue over the TD (Target Designation) box on the HUD to launch missile.

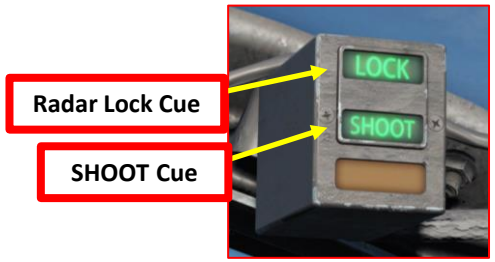
- Note 1: You can unlock a target by pressing the Undesignate Button
- Note 2: You can also use ACM (Air Combat Maneuvering) radar modes to lock a target, as shown in the AIM-9 Sidewinder tutorial.





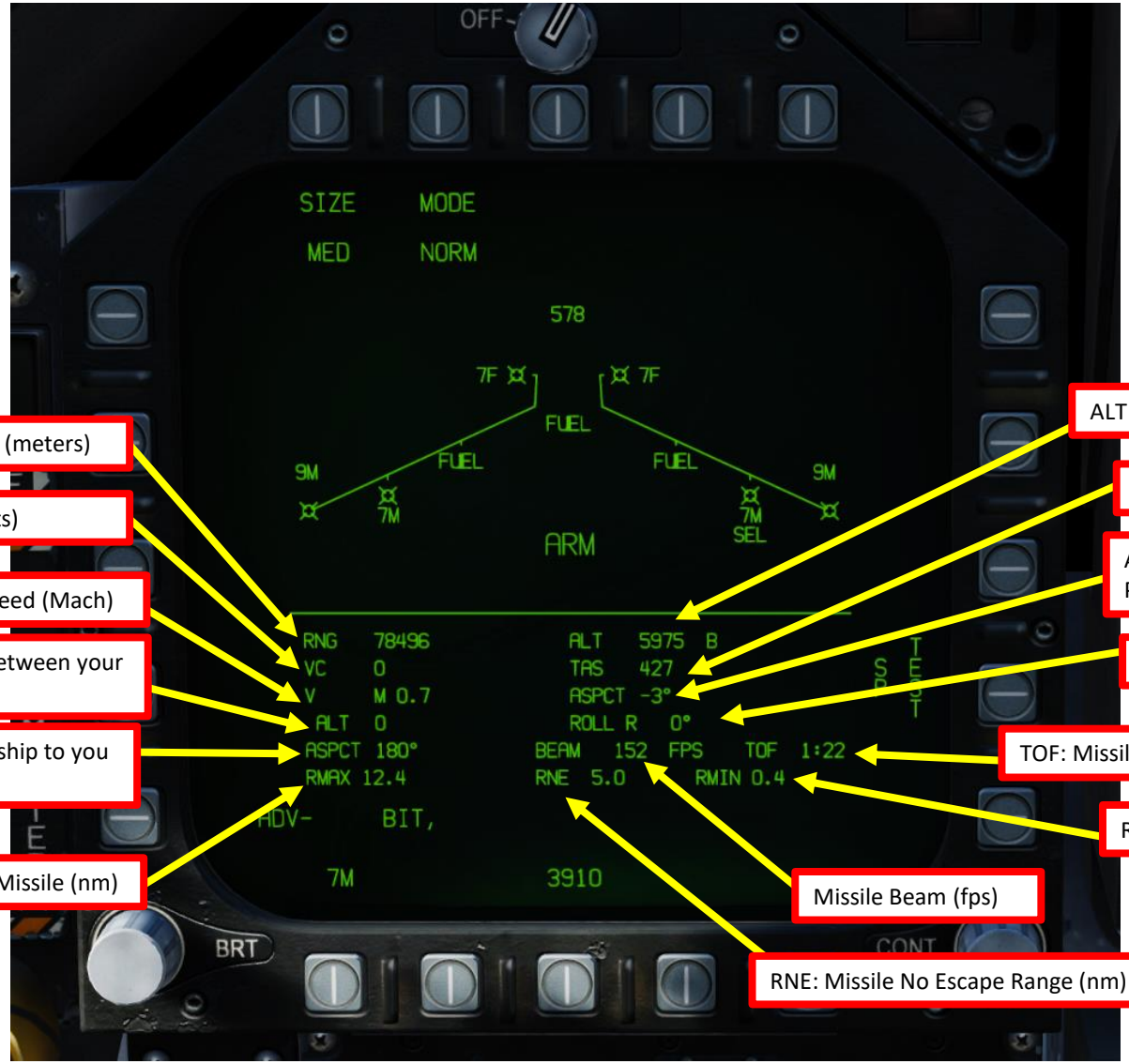






3.4 - AIM-7M SPARROW AIR-TO-AIR SARH MISSILE (RADAR)

When a radar lock is acquired, air-to-air mode is selected and a Sparrow is selected, the SMS (Stores) page displays useful information.



RNG: Range to target (meters)

VC: Closure Speed (kts)

V: Target Speed (Mach)

ALT (Left): Altitude difference between your aircraft and target

ASPCT (left): Aspect of target inrelation ship to you (180 = going towards you)

RMAX: Maximum Launch Range of Missile (nm)

ALT (Right): Barometric Altitude of Target

TAS: True Airspeed of your aircraft (kts)

ASPCT (Right): Angle between your velocity vector and the target. Positive values = above target, negative values = below target.

ROLL R/L: Your aircraft's Roll Angle (deg)

TOF: Missile Expected Time-of-Flight to Target

RMIN: Minimum Launch Range of Missile (nm)

Missile Beam (fps)

RNE: Missile No Escape Range (nm)

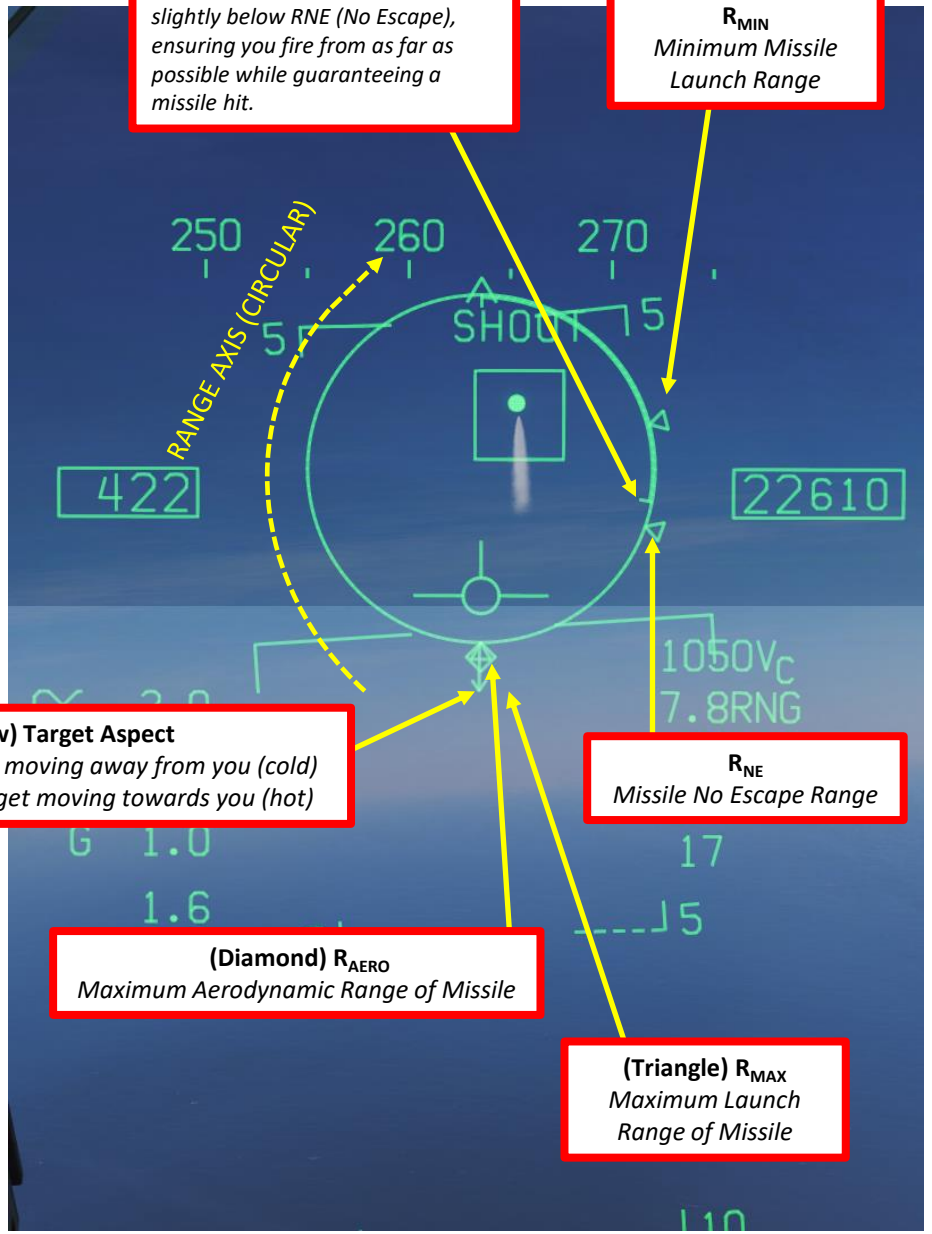
3.4 - AIM-7M SPARROW AIR-TO-AIR SARH MISSILE (RADAR)





TTG: Missile Time to Target (sec)





Target Range
Optimum missile firing range is slightly below RNE (No Escape), ensuring you fire from as far as possible while guaranteeing a missile hit.

R_{MIN}
Minimum Missile Launch Range

(Arrow) Target Aspect
Pointing Up = Target moving away from you (cold)
Pointing Down = Target moving towards you (hot)

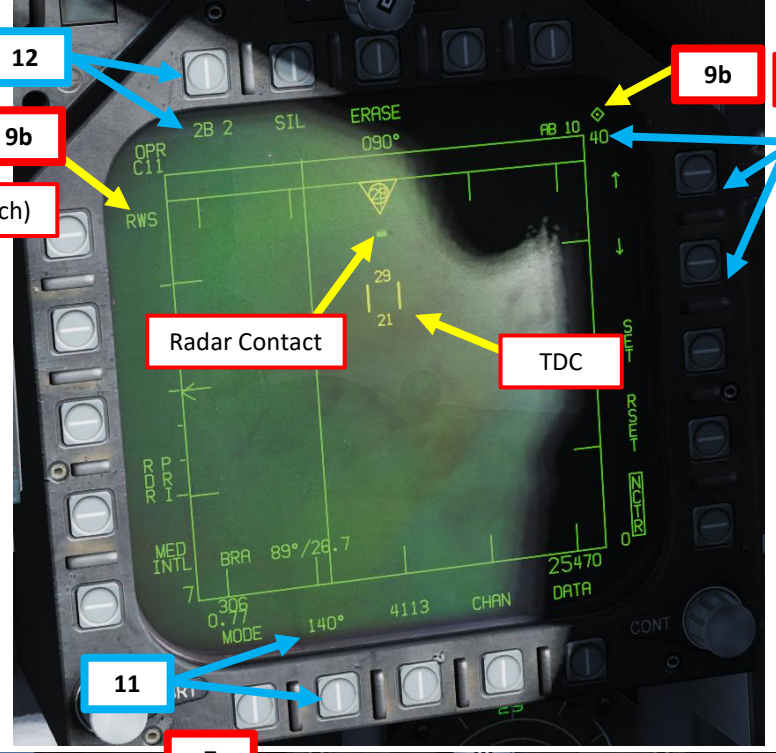
R_{NE}
Missile No Escape Range

(Diamond) R_{AERO}
Maximum Aerodynamic Range of Missile

(Triangle) R_{MAX}
Maximum Launch Range of Missile

3.5 - AIM-120B AMRAAM
AIR-TO-AIR ACTIVE RADAR HOMING MISSILE

1. Radar Switch – OPERATE
2. Set RDR ATTK page on the right DDI and the SMS page on the left DDI (Digital Display Indicator) by pressing the MENU OSB, then selecting TAC or SUPT page, then choosing which menu to display on which DDI.
3. Master Arm switch – ARM (UP)
4. Weapon Select Switch – Right/AMRAAM, or « LSHIFT+D »
5. Master Mode switch will be automatically set to A/A
6. On SMS (Stores Management System) page, set your expected target size (SMALL/MEDIUM/LARGE).
7. Set expected target RCS (Radar Cross-Section) on the SMS page (SMALL/MEDIUM/LARGE).
8. If you have different types of AMRAAMS loaded, select desired AMRAAM station by pressing the Weapon Select Switch – Right/AMRAAM, or « LSHIFT+D ». A « SEL » symbol will be near the selected station. AIM-120Cs are shown as « AC » while AIM-120Bs are shown as « AB ».
9. When AMRAAM is selected, radar is operating, press the Sensor Select Switch RIGHT to select BVR/RWS (Beyond Visual Range/Range While Search) radar mode and slave the TDC (Throttle Designation Controller) to the radar screen.
10. Set desired radar range scale (40 nm in our case)
11. Set desired radar azimuth range (140 deg in our case)
12. Set desired radar bar mode (4 or 2 bars are generally used)







Sensor Control Switch
AFT/FWD/LEFT/RIGHT

9a

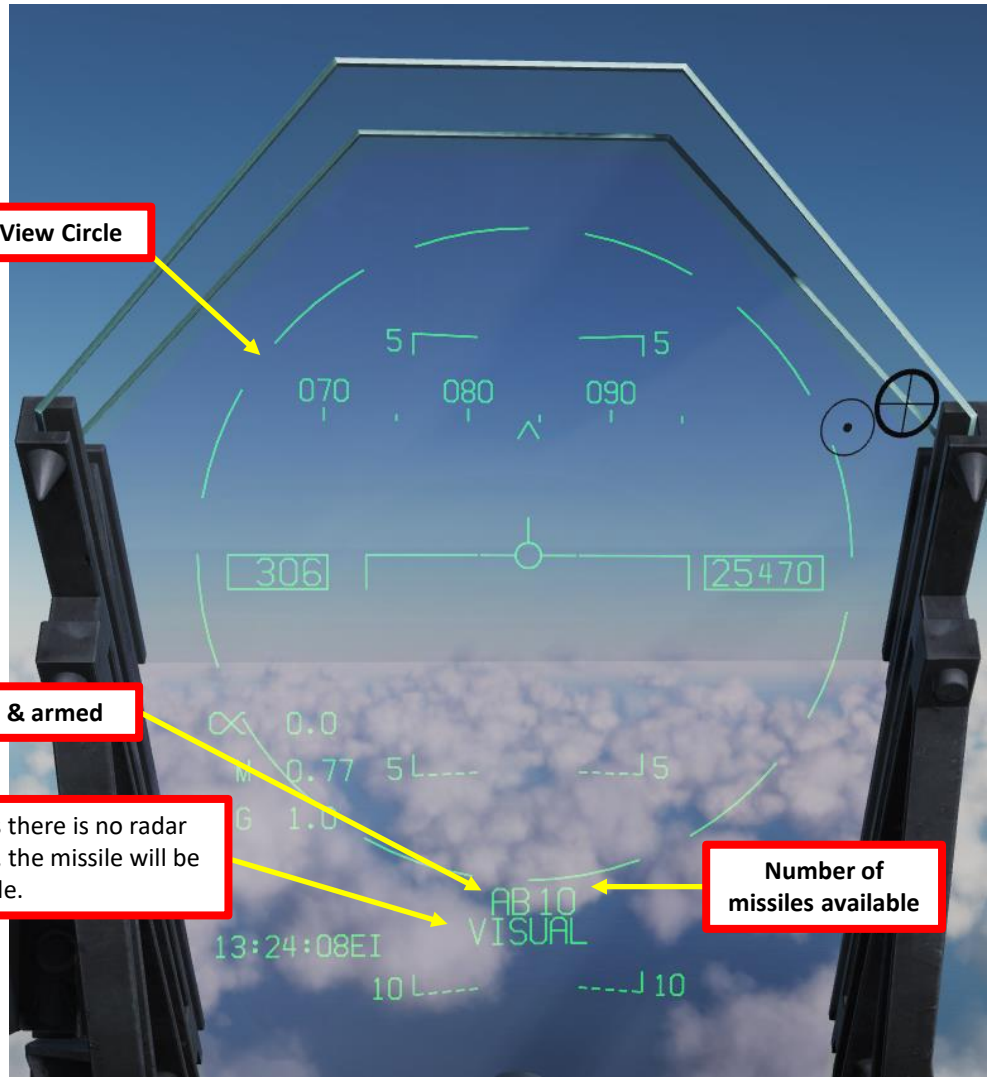
Weapon Select Switch
- FWD: Select Sparrow
- AFT: Select Gun
- PRESS DOWN: Select Sidewinder
- RIGHT: Select Amraam
- LEFT: No Function

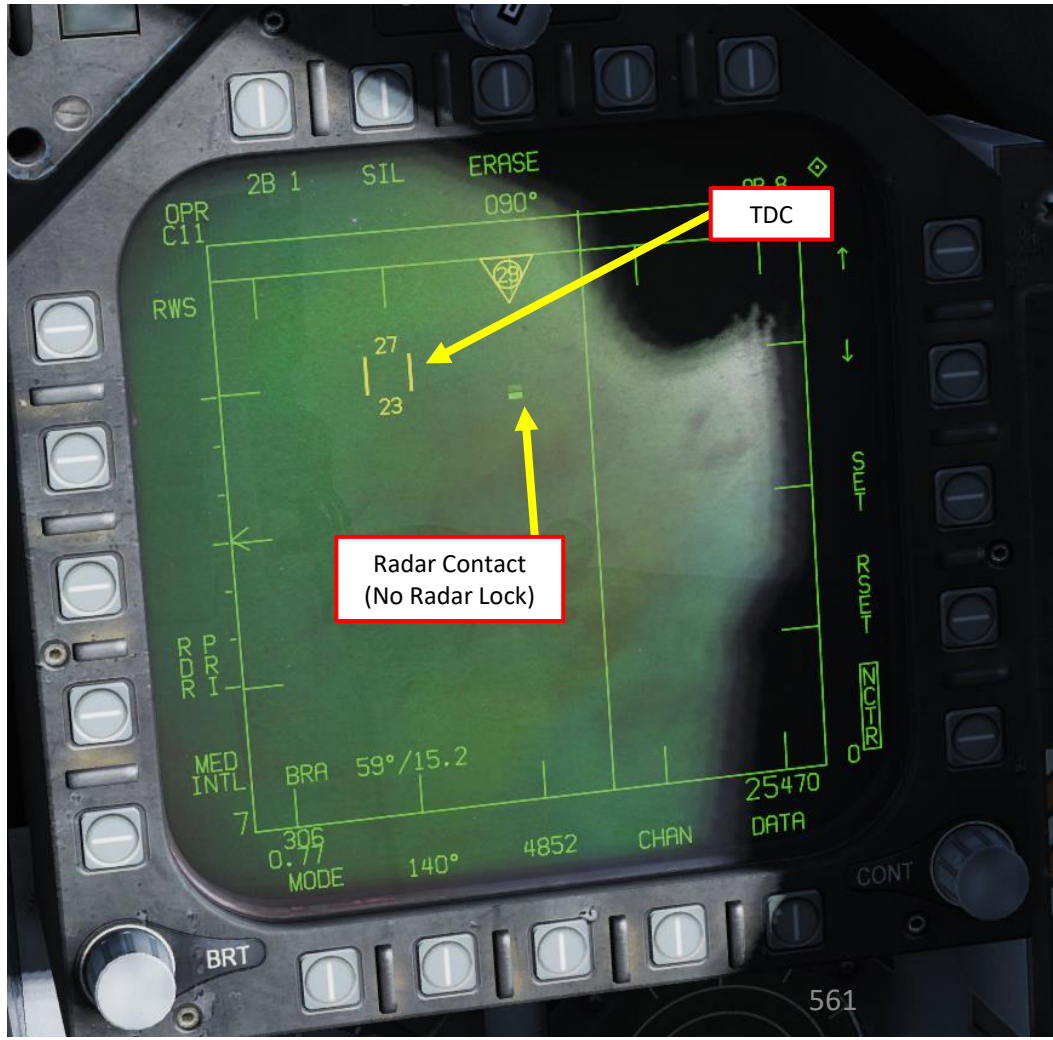
4

Undesignate / Nosewheel Steering Button

3.5 - AIM-120B AMRAAM
AIR-TO-AIR ACTIVE RADAR HOMING MISSILE

Note: When AMRAAM is selected and there is no radar lock yet, a large dashed circle will appear on the HUD. This circle is the seeker field of view if launched with no radar lock, which is termed a ***Mad Dog Launch***. A Mad Dog Launch will lock on to intercept the first target the missile seeker detects within the dashed circle area out to 10 miles.

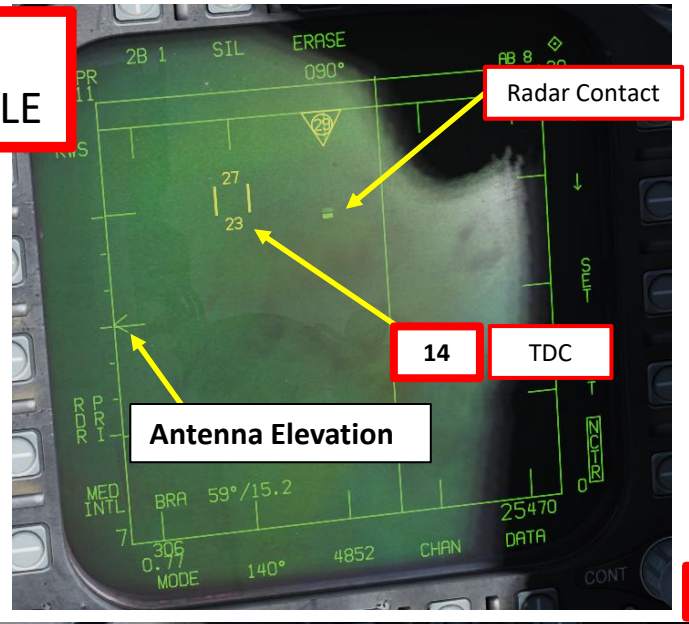


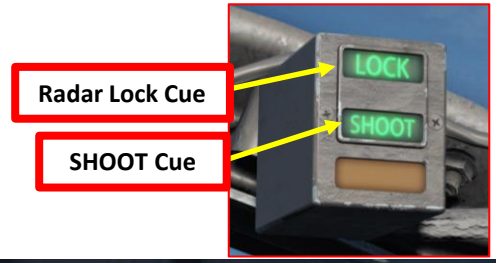


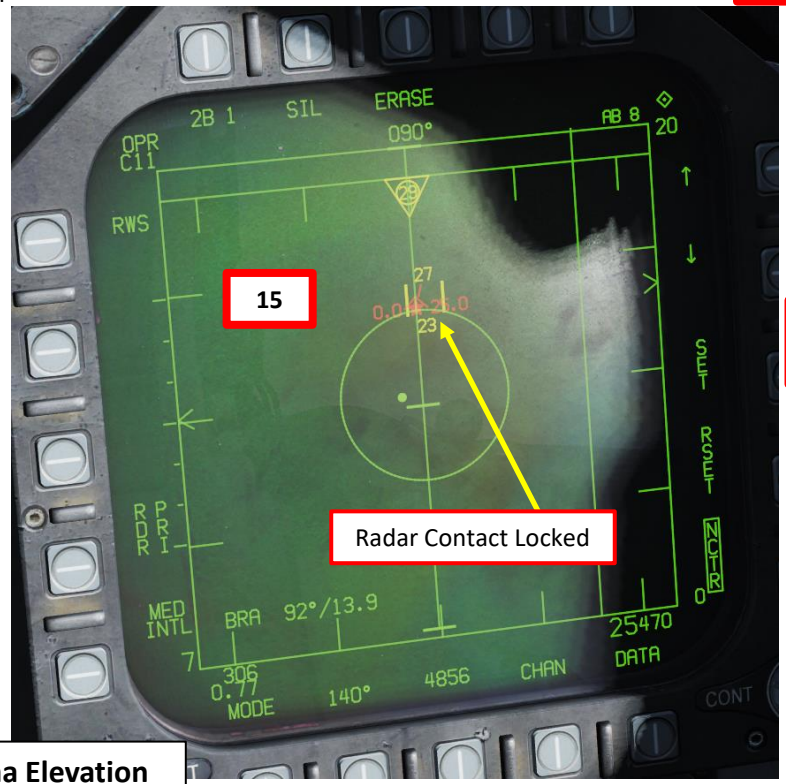
3.5 - AIM-120B AMRAAM
AIR-TO-AIR ACTIVE RADAR HOMING MISSILE

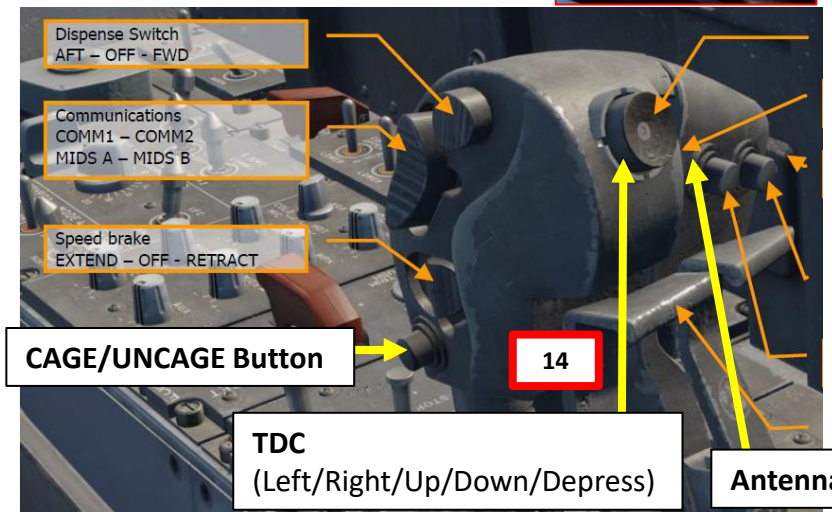
13. Control your antenna elevation to make sure the radar scans the desired area.
14. Move the TDC over the target using the TDC controls.
15. Lock target by using the TDC DEPRESS control (« ENTER »).
16. Fly to place target in ASE circle on the HUD to lock it on radar. When target is flying through this scan zone, it is automatically locked on to in STT (Single Target Track) mode
17. Fly to place the Steering Dot inside the ASE/NIRD (Allowable Steering Error / Normalized In-Range Display) Circle and squeeze the gun trigger (« Spacebar ») when you see the SHOOT cue over the TD (Target Designation) box on the HUD to launch missile.

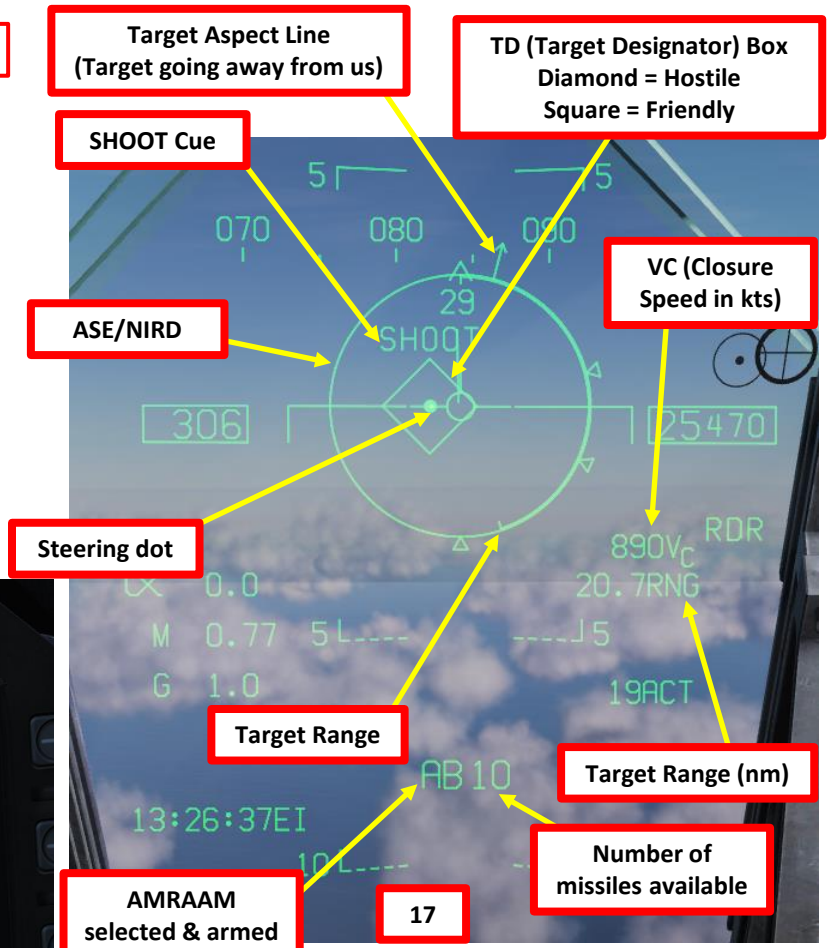
- Note 1: You can unlock a target by pressing the Undesignate Button
- Note 2: You can also use ACM (Air Combat Maneuvering) radar modes to lock a target, as shown in the AIM-9 Sidewinder tutorial.







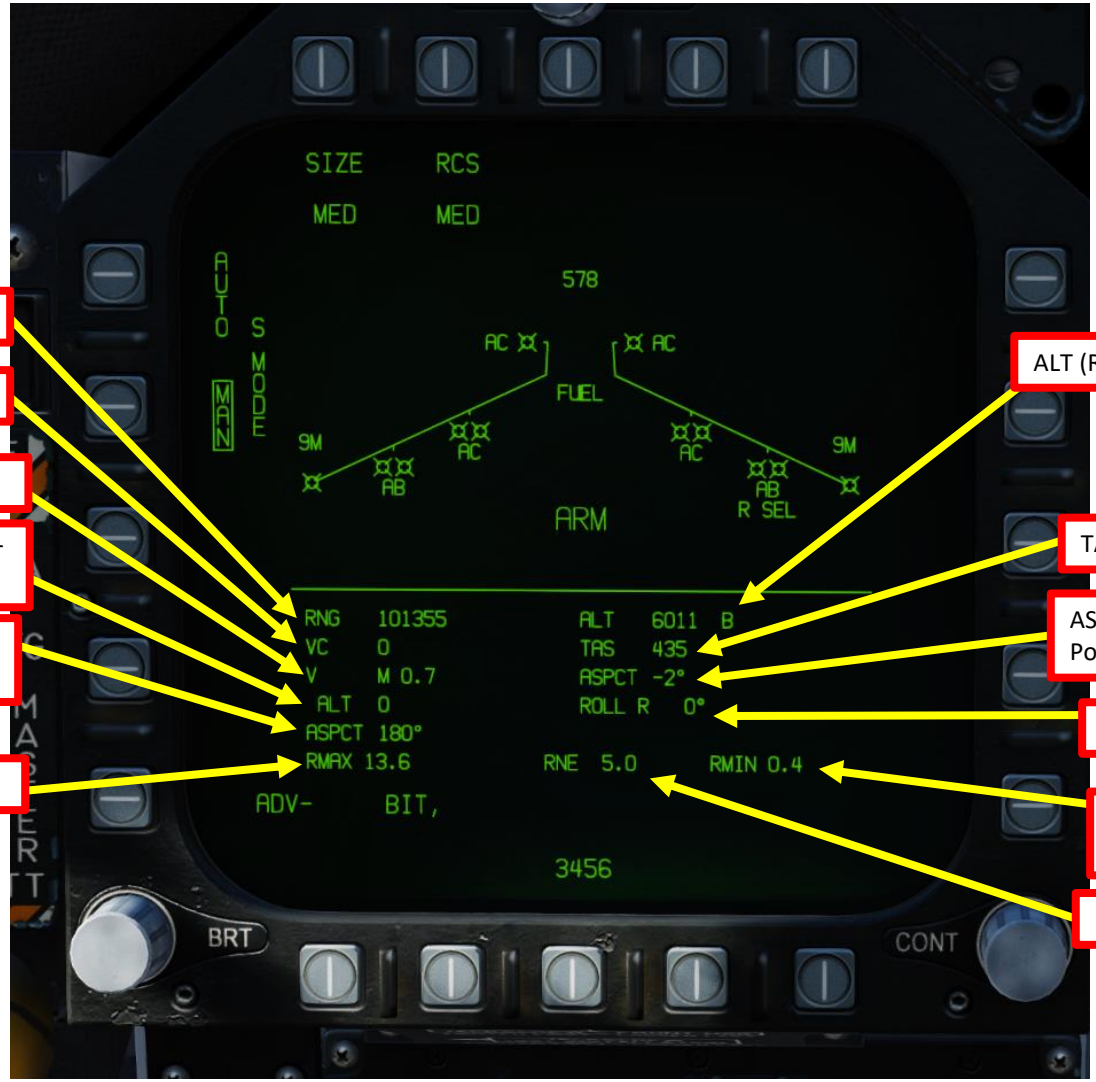






3.5 - AIM-120B AMRAAM
AIR-TO-AIR ACTIVE RADAR HOMING MISSILE

When a radar lock is acquired, air-to-air mode is selected and an AMRAAM is selected, the SMS (Stores) page displays useful information.



RNG: Range to target (meters)

VC: Closure Speed (kts)

V: Target Speed (Mach)

ALT (Left): Altitude difference between your aircraft and target

ASPCT (left): Aspect of target inrelation ship to you (180 = going towards you)

RMAX: Maximum Launch Range of Missile (nm)

ALT (Right): Barometric Altitude of Target

TAS: True Airspeed of your aircraft (kts)

ASPCT (Right): Angle between your velocity vector and the target. Positive values = above target, negative values = below target.

ROLL R/L: Your aircraft's Roll Angle (deg)

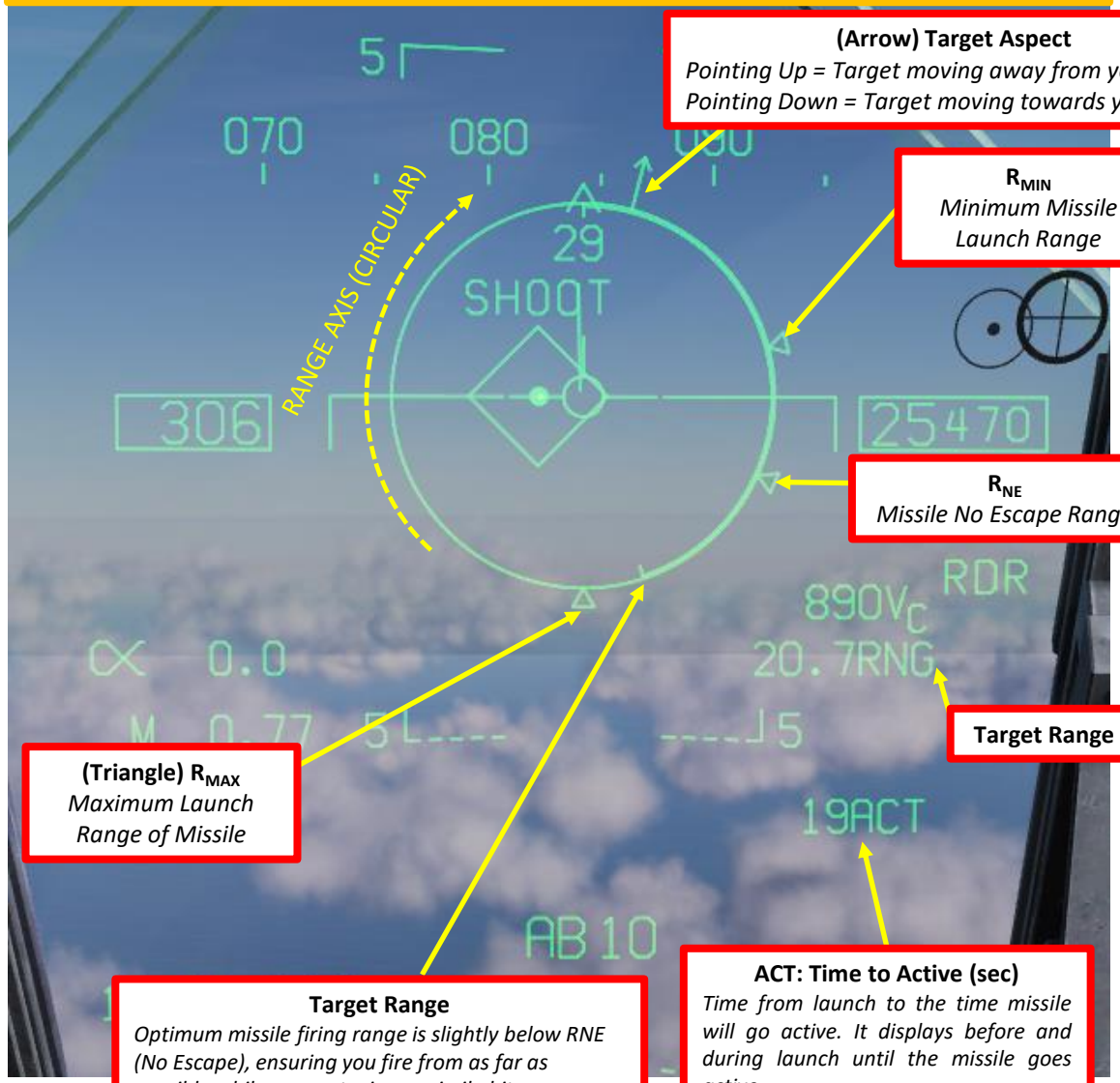
RMIN: Minimum Launch Range of Missile (nm)

RNE: Missile No Escape Range (nm)

3.5 - AIM-120B AMRAAM
AIR-TO-AIR ACTIVE RADAR HOMING MISSILE



Missile has not been fired yet



(Arrow) Target Aspect
Pointing Up = Target moving away from you (cold)
Pointing Down = Target moving towards you (hot)

R_{MIN}
Minimum Missile Launch Range

R_{NE}
Missile No Escape Range

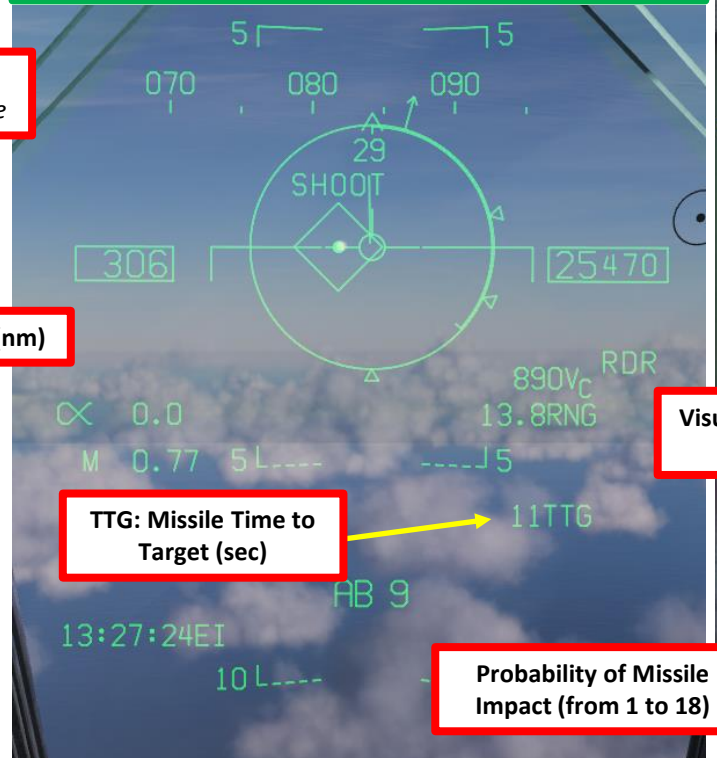
Target Range (nm)

(Triangle) R_{MAX}
Maximum Launch Range of Missile

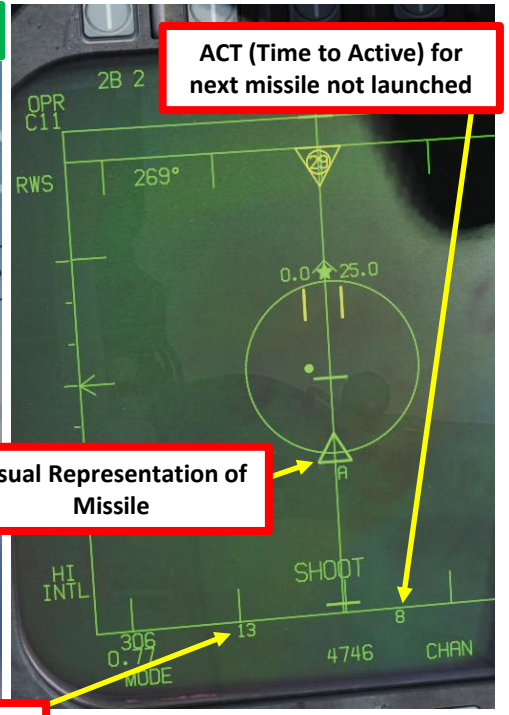
Target Range
Optimum missile firing range is slightly below RNE (No Escape), ensuring you fire from as far as possible while guaranteeing a missile hit.

ACT: Time to Active (sec)
Time from launch to the time missile will go active. It displays before and during launch until the missile goes active

Missile has been fired, Range of seeker is less than 10 nm



TTG: Missile Time to Target (sec)



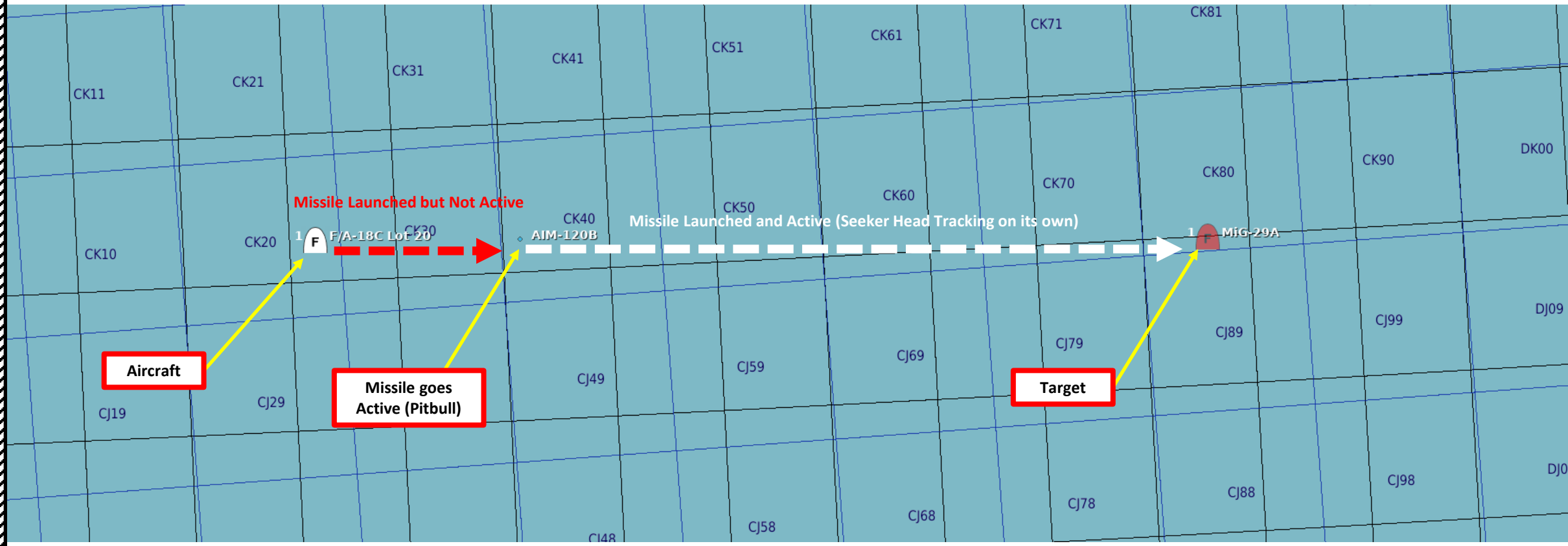
ACT (Time to Active) for next missile not launched

Visual Representation of Missile

Probability of Missile Impact (from 1 to 18)

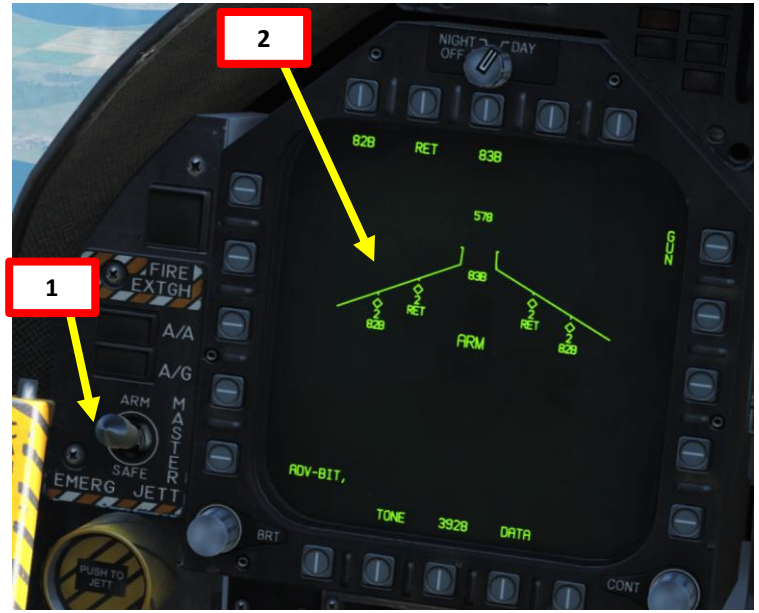
3.5 - AIM-120B AMRAAM
AIR-TO-AIR ACTIVE RADAR HOMING MISSILE

Note: When you first fire an AMRAAM missile, the missile is initially guided by your own radar. However, an « active radar homing missile » also has his own radar inside the seeker head. The moment the missile goes « active » (meaning it will start self-homing/tracking targets on his own instead of using your aircraft's radar) is called « Pitbull ». When the missile goes « Pitbull », the missile truly becomes fire-and-forget. NATO brevity word "Pitbull" would be called out on the radio to inform other pilots, just as "Fox Three" would be called out upon launch.



4 - SELECTIVE ORDNANCE JETTISON

1. Set Master Arm Switch – ON
2. Consult SMS (Stores Management System) page's wingform to see what is loaded on what pylon
3. Select store you want to jettison (Left Inner, Right Inner, Left Outer, Right Outer, Center) using the LI, RI, LO, RO, CTR pushbuttons
4. Rotate the Selective Jettison knob to desired release mode (we will use RACK/LCHR).
    - L FUS MSL and R FUS MSL are used to jettison AIM-7 or AIM-120 missiles attached to the fuselage
    - RACK/LCHR drops the weapon and its launcher rack
    - STORES drops the weapon but not its attachment rack
5. Press and hold the red JETT (Jettison) button to jettison ordnance.
6. Return Selective Jettison knob back to SAFE







5 – VIDEO TUTORIALS

2 – Air-to-Ground Weapons

2.1.1 – Unguided Bomb (MK-82 – CCIP)
https://youtu.be/JrMDXwaSHzE
2.1.2 – Unguided Bomb (MK-82 – CCRP/AUTO)
https://youtu.be/JrMDXwaSHzE
2.3 – Rockets
https://youtu.be/R1BTgGYij5o
2.4 – M61A2 Gun (Air-to-Ground)
https://youtu.be/R1BTgGYij5o
2.5.1 – GBU-38 JDAM (Pre-Planned)
https://youtu.be/UZ4uoT0sPK4
2.5.2 – GBU-38 JDAM (TOO + Targeting Pod)
https://youtu.be/HWdnLlyeEBs
2.5.3 – AGM-154A JSOW (TOO)
https://youtu.be/YAhISGnrjtk
2.6 – GBU-12 Paveway II (Laser-Guided)
https://youtu.be/urGAhuxmaEk
2.7.1 – AGM-65F/G Maverick (IR-MAVF)
https://youtu.be/cqIHsxfXsVM
2.8 – AGM-65E MAVERICK (Laser-Guided MAV)
https://youtu.be/uW7EO1VlGdw
2.9.1 – AGM-88C HARM (TOO)
https://youtu.be/2yS4eKuVjVw
2.9.2 – AGM-88C HARM (SP)
https://youtu.be/bf6EH9gRxlw
2.10.1 – AGM-84D Harpoon (BOL)
https://youtu.be/xoJLCxEzexk
2.10.2 – AGM-84D Harpoon (RB/L)
https://youtu.be/oDBPUkm2NYY
2.12 – AGM-62 Walleye II
https://youtu.be/NsySaTNvprE

3 – Air-to-Air Weapons

3.1.1 – M61A2 Gun (Funnel / No Radar Tracking)
https://youtu.be/jPe4k_Zo0MM
3.1.2 – M61A2 Gun (Radar Tracking)
https://youtu.be/jPe4k_Zo0MM
3.2.1 – AIM-9M (No Radar)
https://youtu.be/em9Kr31nPJE
3.2.2 – AIM-9M (Radar)
https://youtu.be/em9Kr31nPJE
3.3 – AIM-9X (JHMCS)
https://youtu.be/ceUtluGFFLM
3.4 – AIM-7M (Radar)
https://youtu.be/3SKP0uFdI2M
3.5 – AIM-120B (Radar)
https://youtu.be/MJOQfylt6nE

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 **RWR** (Radar Warning Receiver) is for: to help you know what is firing at you so you can take the adequate action to counter it.

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

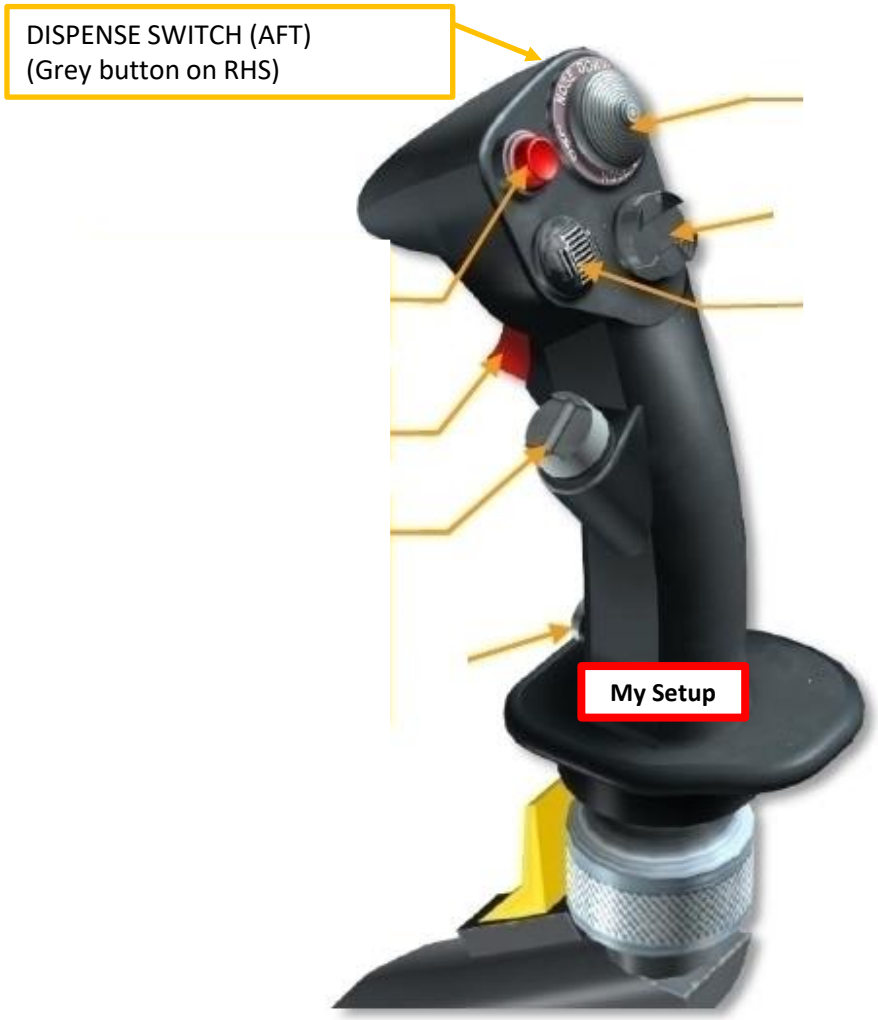
Chaff is a form of "passive" jamming. Passive (reflected) jamming is when a deceptive object or device reflects radar waves. Chaff is simply a bundle of small pieces of metal foil with reflective coating, which creates clusters of radar signatures that prevent a radar to get a solid lock on the aircraft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

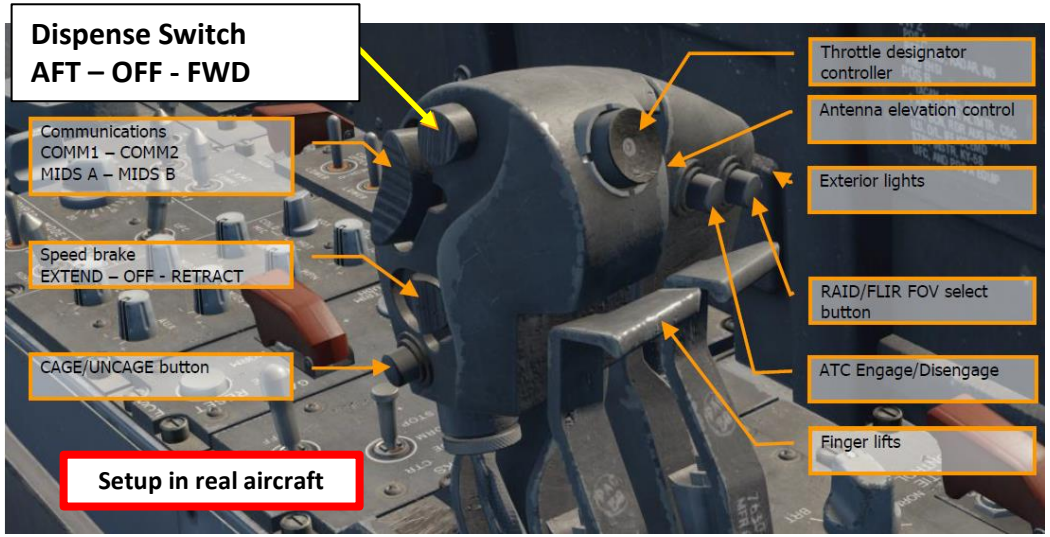
The **AN/ALQ-165 Airborne Self Protection Jammer (ASPJ)** is the onboard Electronic Countermeasure (**ECM**) system. It is a form of "continuous" jamming, also called "active" or "transmitted" jamming. This device transmits its own synchronized radar waves back at your enemy's radar receiver to simulate erroneous radar wave returns. Simply put, active jamming will try to drown a radar in white noise.

In order to use these three forms of countermeasures, you can use "countermeasure programs", routines that will deploy a number of flares/chaff for a number of cycles at a given interval.



COUNTERMEASURES CONTROL SETUP





AN/ALR-67 RWR (RADAR WARNING RECEIVER)

The RWR (Radar Warning Receiver) will tell if you are being searched or locked by radar. Just press the RWR ON button below the AMPCD and set up your EW (Early Warning) page on either DDI and you will have a top-down view of your aircraft.

The **annunciator threat lights** will tell you which type of threat is locking you. CW is for continuous wave emissions, AI is for Air Intercept, SAM is for surface-to-air-missiles, and AAA is for anti-aircraft artillery radar. DISP is for when the ALE-47 countermeasure dispenser system has a program ready for the detected threat and is waiting for start consent. In addition, a DISPENSE cue will be displayed on the HUD.

The **EW (Early Warning)** page and **Azimuth Display** will locate the radar emitters' heading but not their range. Instead, their spacing from the center of the RWR circle refers to the lethality of the threat. The inner band (critical) is generally missiles in flight. The middle band (lethal) is for radars actively tracking you. The outer band is classified as non-lethal since these are radars searching for you, not actively tracking you.

If an indication is illuminated, it means the radar emitter has a solid lock on you. Tones also indicate what's happening (new contact, radar lock warning, missile launch, etc.) The faster the tone frequency, the greater the danger.



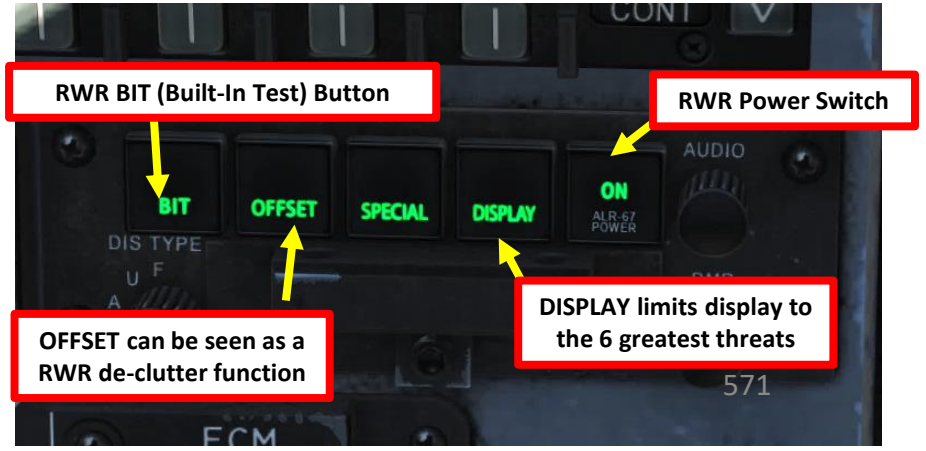
Annunciator Threat Lights



RWR EW Page



RWR Azimuth Display

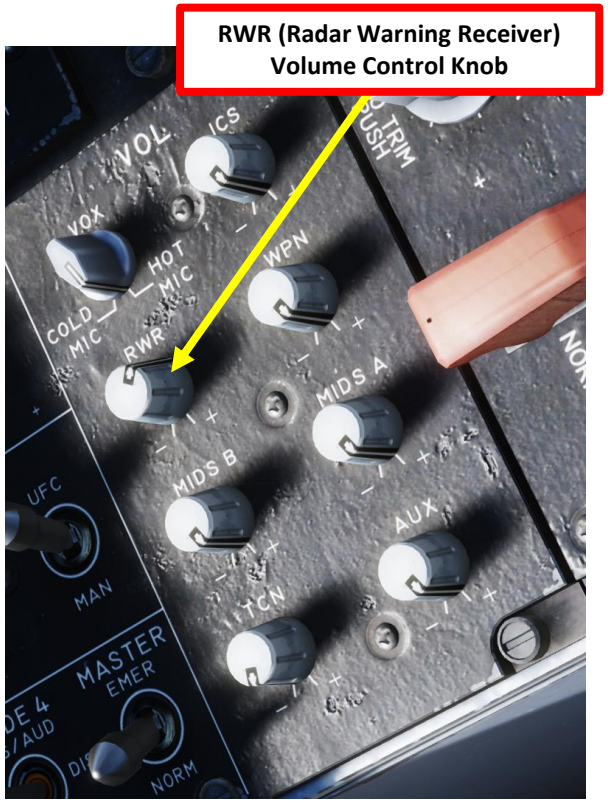


AN/ALR-67 RWR (RADAR WARNING RECEIVER)

If too many contacts start overlapping each other, you can use the “OFFSET” function, which will spread out enemy contacts. This can be quite useful when using HARMs in order to select a specific radar emitter. Keep in mind that when the OFFSET function is used, you will no longer have any directional information on the emitters, so you will need to set the OFFSET mode to OFF.



Note: The (very loud) volume of the RWR tones can be controlled on the Audio Panel.







AN/ALR-67 RWR (RADAR WARNING RECEIVER)

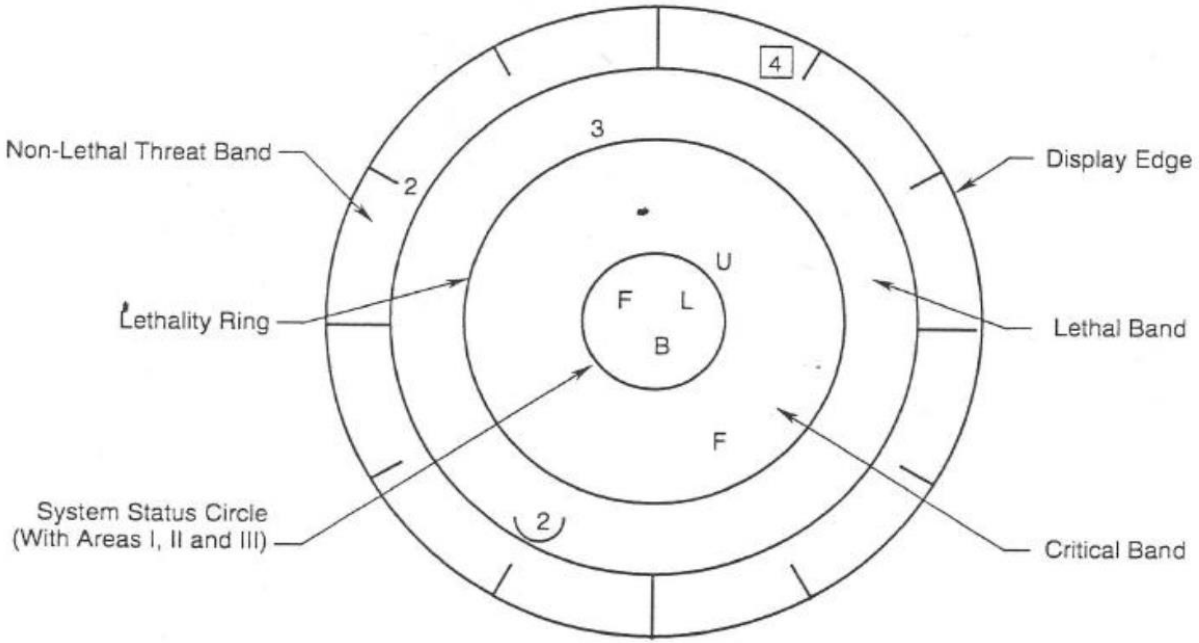
Source: Eagle Dynamics Early Access Manual (as of 10/06/2018). Remember that the RWR is currently a work-in-progress and its logic may be subject to change. This guide will be updated accordingly if such changes are made.

Accompanying the RWR are various audio feedback tones:

- **Single Beep**: A new ground- or sea-based emitter has been detected.
- **Double Beep**: A new airborne emitter has been detected.
- **Repeating Beep**: An emitter is tracking.
- **Faster Repeating Beep**: An emitter is guiding a missile or is a missile.







Area	Character	Meaning
I	N	NORMAL
	I	AI (Airborne Intercept)
	A	AAA (Anti-Air Artillery)
	U	UNKNOWN
	F	FRIENDLY
II	(BLANK)	FULL DISPLAY
	L	LIMITED DISPLAY
III	(BLANK)	NO FAILURE
	B	BIT (Built-In Test) FAILURE
	T	THERMAL OVERLOAD
	O	OFFSET DISPLAY

The status circle is in the center of the azimuth indicator and displays ALR-67(V) system status. The status circle is divided into three areas of display:

Upper left quadrant of circle (area I)
Upper right quadrant of circle (area II)
Bottom half of circle (area III)

- Area I displays the priority setting of the EW Mode as set on the EW page (N, I, A, U or F).
- Area II is either blank when ALR-67(V) system is operating in the full display mode, or displays the character L when operating in the display limit mode.
- Area III displays current ALR-67(V) Built-In Test (BIT) status. Area III is blank when there are no ALR-67(V) system failures. The character B is displayed when a failure is detected. The character T is displayed when a thermal overload has been detected in Countermeasures Computer or RADAR Receiver.

AN/ALR-67 RWR (RADAR WARNING RECEIVER)

Note: "U" symbol stands for "Unknown", which is sometimes attributed to ships.



RWR	Name
3	S125 TR SNR
6	Kub STR 9S91
8	Osa 9A33
10	RLS 5H63C
10	S300PS TR 30N6
11	BUK LL
11	Buk LN 9A310M1
11	F-111
12	RLS 9C32 1
12	S300V 9A82
12	S300V 9A83
13	C-130
13	Strela-9A35M3
14	F-14
15	F-15
15	Tor 9A331
16	F-16
17	C-17
18	FA-18
22	Tu-22M3
23	MIG-23
24	Su-24
25	MiG-25P
29	MIG-29
29	Su-27
29	Su-33
30	Su-30
31	MiG-31
34	Su-34
39	Su-39
40	Spruance
48	Vinson
49	Perry
50	A-50
52	B-52
76	IL-76
78	IL-78
95	Tu-95
A	Gepard
A	Vulcan M163
A	ZSU 23 4 Shilka
AE	Ticonderoga
AN	AN-26B
AN	AN-30M

RWR	Name
AV	AV-8B
B1	B-1
BB	S300PS SR 64H6E
BD	RLO 9C15MT
BJ	Tu-160
CD	Bobruisk
CD	Bora
CS	S300PS SR 5N66M
DE	Dog Ear
DT	Osa
E2	E-2C
E3	E-3
E6	EA-6B
F2	F-2
F4	F-4E
F5	F-5E
GR	Roland rdr
HA	Hawk SR ANMPQ 50
HK	Hawk TR ANMPQ 46
HN	Grozny
HN	Orel
HN	Skory
HP	Albatros
HS	RLO 9C19M2
KC	KC-10
KC	KC-135
M2	Mirage
PP	Veter
PS	Molniya
PT	Patriot STR ANMPQ 53
RO	Roland ADS
S	EWR 1L13
S	EWR 55G6
S	S125 SR P 19
S3	S-3
S6	Tunguska 2S6
SC	Ametyst
SD	Buk SR 9S18M1
SW	Kuznecow
T2	Moscow
TP	Neustrash
TP	Rezky
TS	Azov
Tu	Tu-142



List made by .408-X~RAY

AN/ALR-67 RWR
HUD & JHMCS Display

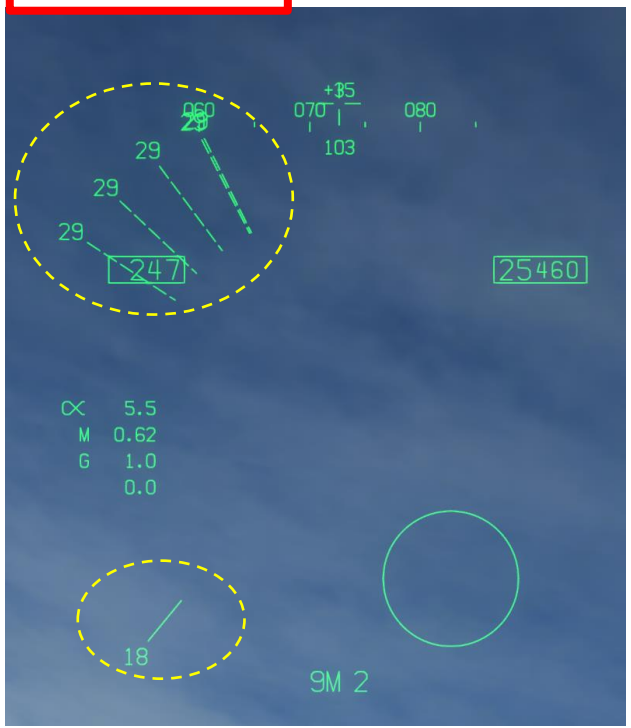
The RWR (Radar Warning Receiver) can also be displayed on the Heads-Up Display.

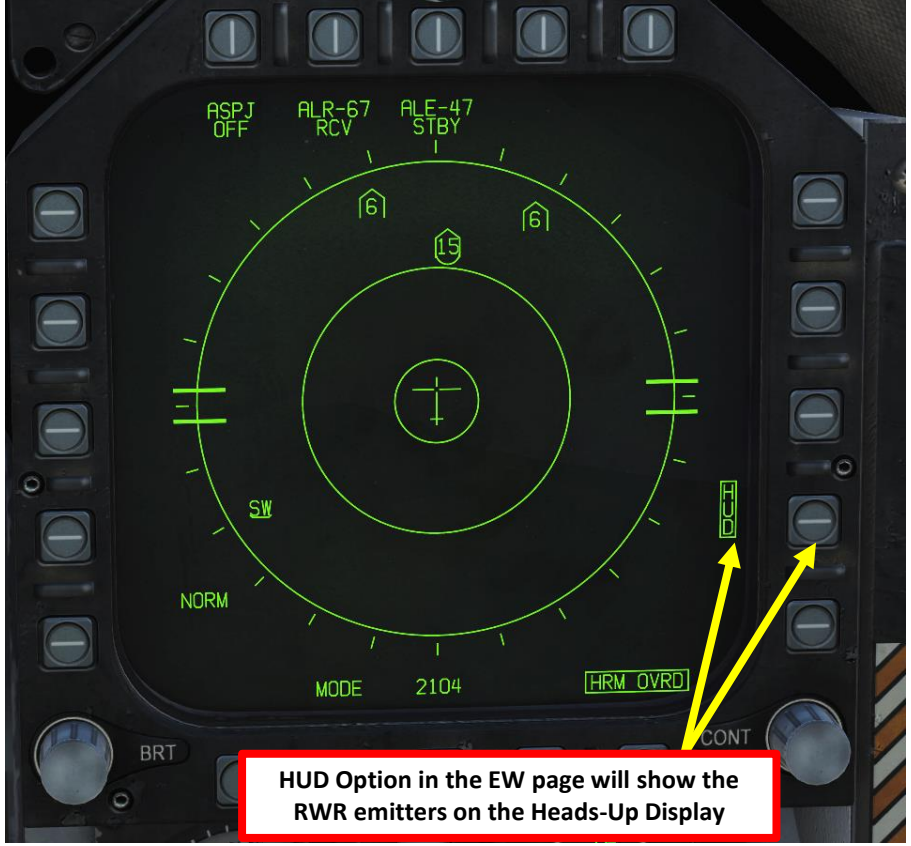
RWR symbols are also visible on the JHMCS (Joint Helmet-Mounted Cueing System).

HUD RWR Symbols



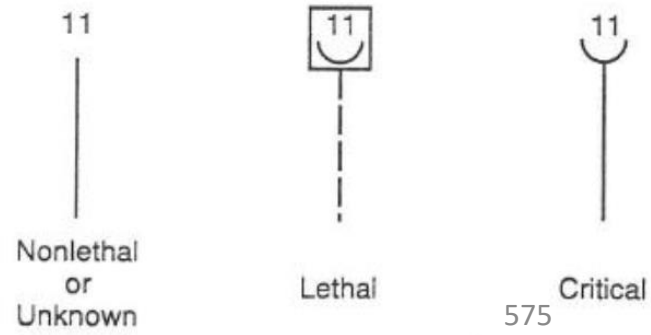
JHMCS RWR Symbols





HUD Option in the EW page will show the RWR emitters on the Heads-Up Display

- Non-critical/lethal steams are solid and short
- Critical threat stems are solid and long
- Lethal threat stems are dashed and long



AN/ALR-67 RWR ANNUNCIATOR THREAT LIGHTS

Annunciator Threat Lights

	DISP: Countermeasure dispense program is active
AI: Airborne Intercept (AI) Radar locked to aircraft	**SAM**: Surface-to-Air Missile tracking radar locked to aircraft. Light is solid when radar is tracking and flashing when guiding a missile.
CW: Aircraft illuminated by Continuous Wave (CW) radar	**AAA**: Anti-Aircraft Artillery (AAA) fire control radar is locked to aircraft. Steady light for all radar directed AAA except ZSU-23-4, in which the light will flash at 3 Hz.



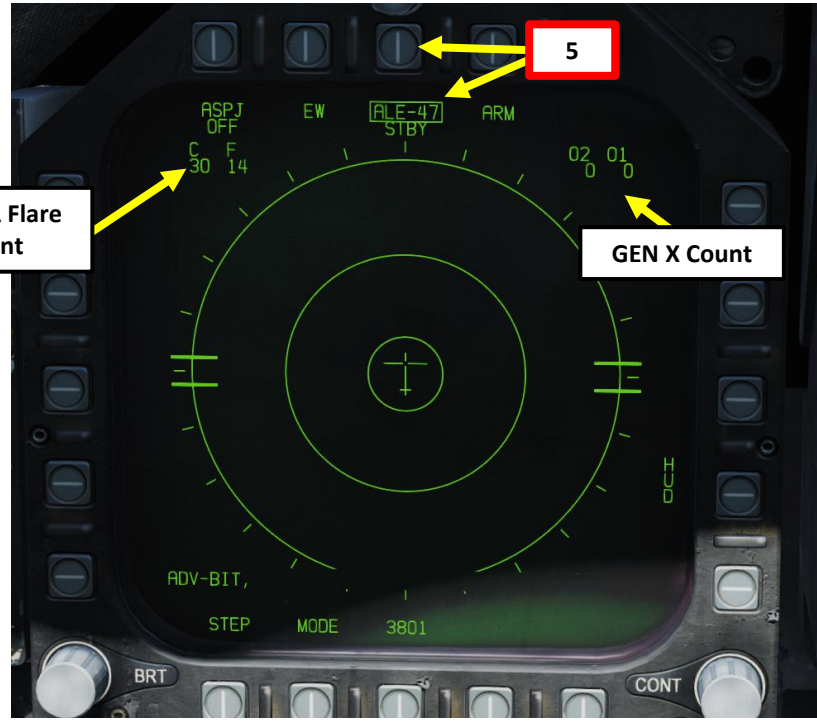


COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 ACMDS (AIRBORNE COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

1. Set Master Arm Switch – ON
2. In the TAC menu, select the EW (Early Warning) page
3. Set DISPENSER switch – ON (MIDDLE)
4. Once aircraft is in the air, ALE-47 status will perform a series of built-in tests by going to SF TEST (Self-Test), then PBIT GO, then to STBY.
5. Once ALE-47 status is set to STBY, click on the OSB above ALE-47 to select the countermeasure dispenser. ALE-47 will be boxed in green.
6. Click the OSB next to MODE to select desired dispenser mode (MAN1 (Manual), S/A (Semi-Automatic), AUTO, STBY). We will choose MAN1.













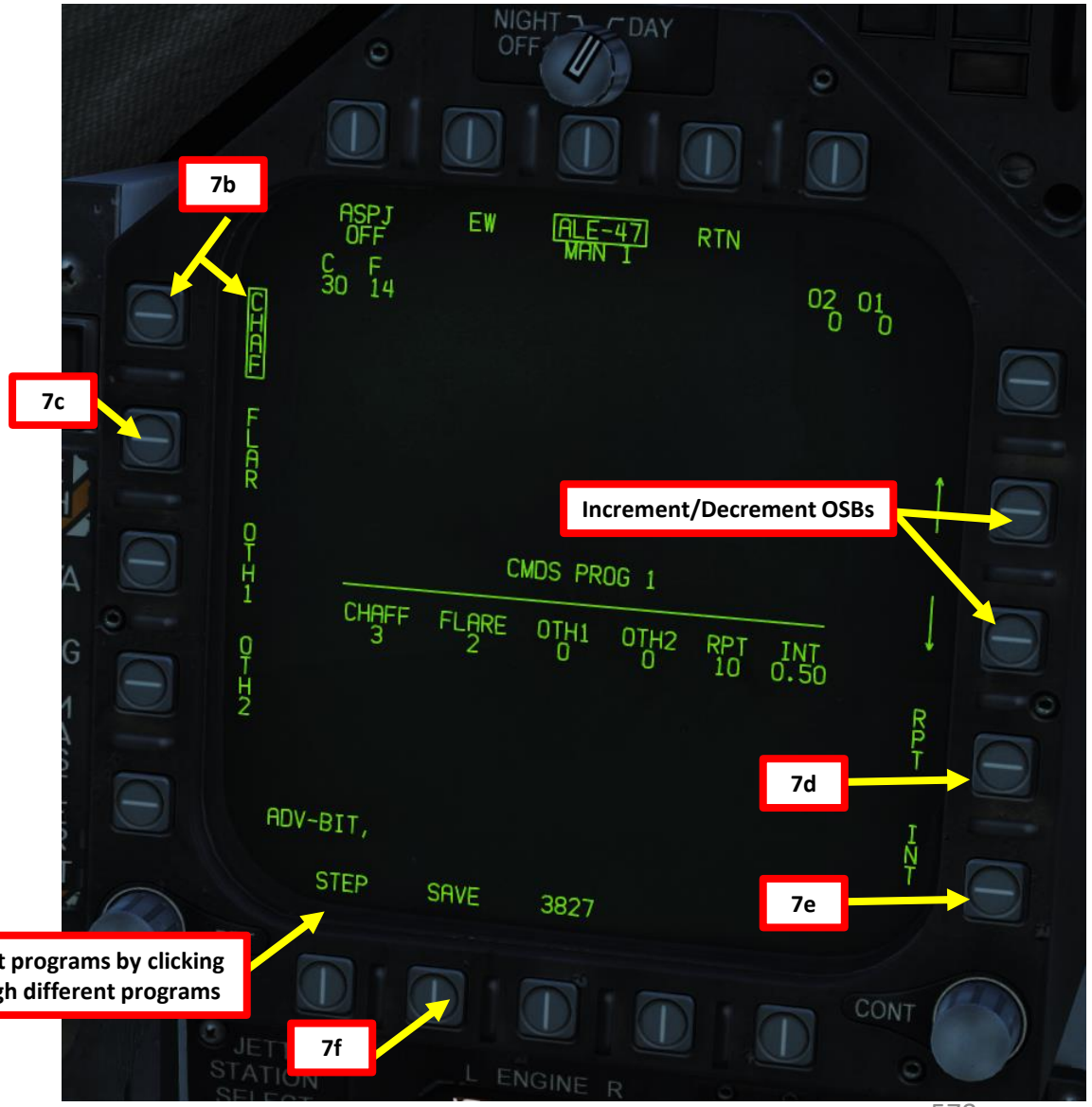


COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 ACMDS (AIRBORNE COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE PROGRAM & USAGE TUTORIAL

7. To create a countermeasure program:
   a) Press the OSB next to ARM
   b) Configure Chaff by pressing the OSB next to CHAF, then use the Increment/Decrement OSBs to set the desired number
   c) Configure Flares by pressing the OSB next to FLAR, then use the Increment/Decrement OSBs to set the desired number
   d) Configure the number of repetitions by pressing the OSB next to RPT, then use the Increment/Decrement OSBs to set the desired number
   e) Configure the interval time (sec) by pressing the OSB next to INT, then use the Increment/Decrement OSBs to set the desired number
   f) Press the OSB next to SAVE to save countermeasure program 1





COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 ACMDS (AIRBORNE COUNTERMEASURES DISPENSER SYSTEM)

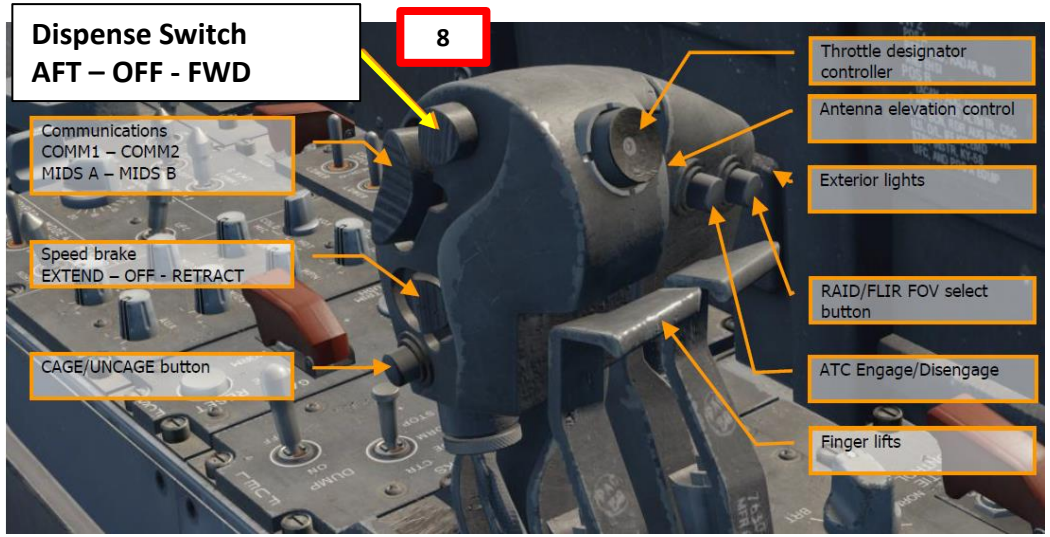
COUNTERMEASURE PROGRAM & USAGE TUTORIAL

8. To dispense countermeasures using Program 1, press the Dispense Switch – AFT button (key binding: D).

Note: the Dispense Switch – FWD button will use Program 5 by default. You can modify which program is used by either AFT or FWD Dispense by clicking on the STEP OSB.







DISP light: Countermeasure dispense program (Semi-Active or Automatic) is active



Countermeasure Modes

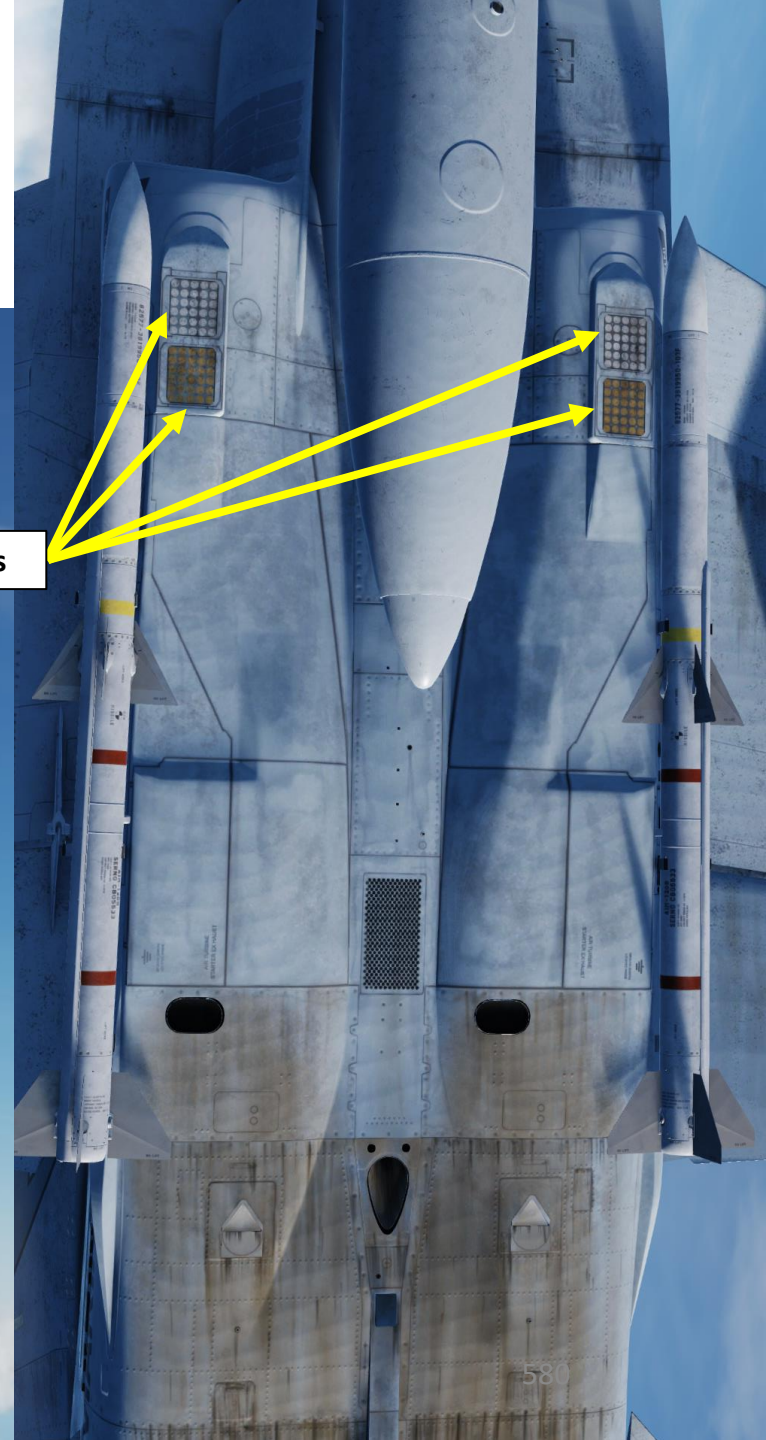
- **MAN**: manual program that can be stored and edited. You choose what the program is.
- **AUTO**: the ALE-47 chooses for you when to deploy countermeasures and what to use. Very wasteful mode, but reduces pilot workload.
- **S/A**: Semi-Automatic. ALE-47 will choose the best countermeasure program for you in response to the current threats, but you will have control on when the countermeasures are dispensed.
- **STBY**: Standby Mode



COUNTERMEASURES - CHAFF & FLARES
AN/ALE-47 ACMDS (AIRBORNE COUNTERMEASURES DISPENSER SYSTEM)

COUNTERMEASURE DISPENSERS





AN/ALQ-165 ASPJ (AIRBORNE SELF PROTECTION JAMMER)

The ALQ-165 Airborne Self Protection Jammer (ASPJ) is the onboard Electronic Countermeasure (ECM) system. The ALQ-165 detects and deceives threat pulse fire control and guidance RADARs and has four operating modes: standby, receive, transmit, and built in test. This ECM system detects, processes, and transmits a simulated target echo for deception when a RADAR signal is received. The simulated echoes are recognized by the enemy RADAR as true target returns. Tracking RADAR then tracks a false target and breaks lock from the true target. Threat RADAR indications are indicated as both indicators lights and the RADAR Warning Receiver.

ECM (Electronic Countermeasures) Mode Active



ECM (Electronic Countermeasures) Mode Selector

- **OFF**: turns OFF ECM pod
- **STBY**: Standby mode
- **BIT**: ECM jammer pod Built-In Test
- **REC**: Receive Mode collects information on radars scanning your aircraft but does not transmit jamming signal
- **XMIT**: ECM jammer actively transmits when radar lock is attempted on your aircraft



GO: Successful BIT (Built-In Test) of ALQ-165 (ASPJ, Airborne Self Protection Jammer). Remains illuminated until BIT mode is deselected.
NO GO: Unsuccessful BIT (Built-In Test) of ALQ-165 (ASPJ, Airborne Self Protection Jammer). Remains illuminated until BIT mode is deselected. ALQ-126 jammer is inoperable.
STBY: ALQ-165 (ASPJ) is set to STBY (Standby) on the ECM (Electronic Countermeasure) panel.
REC: Indicates aircraft is being illuminated by a threat's radar.
XMIT: Lit when ECM Jammer is transmitting.
ASPJ OH: ALQ-165 (ASPJ, Airborne Self Protection Jammer) is Overheating



Annunciator Threat Lights

RCDR ON: Flight Recorder is ON	**DISP**: Countermeasure dispense program is active
AI: Airborne Intercept (AI) Radar locked to aircraft	**SAM**: Surface-to-Air Missile tracking radar locked to aircraft. Light is solid when radar is tracking and flashing when guiding a missile.
CW: Aircraft illuminated by Continuous Wave (CW) radar	**AAA**: Anti-Aircraft Artillery (AAA) fire control radar is locked to aircraft. Steady light for all radar directed AAA except ZSU-23-4, in which the light will flash at 3 Hz.

AN/ALQ-165 ASPJ (AIRBORNE SELF PROTECTION JAMMER)

REC (RECEIVE) Mode

When the ECM Mode is set to REC (Receive), the jammer is in "passive" mode, meaning that it will detect incoming signals but not actively transmit any jamming signal. This is similar to standby mode but collects information on radar signals scanning your aircraft.





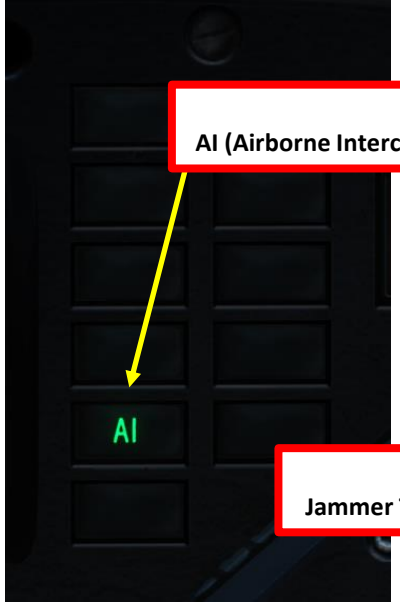


AN/ALQ-165 ASPJ (AIRBORNE SELF PROTECTION JAMMER)

X-MIT (Transmit) Mode

When the ECM Mode is set to X-MIT (Transmit), the jammer is in "active" mode, It will automatically transmit a jamming signal when a radar lock is attempted on you.

Take note that when ASPJ is jamming, your radar is turned off automatically (due to interference created by the jammer). The jammer attempts drowning the enemy radar emitter and covers a 360 deg area.

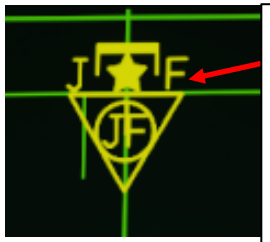








AN/ALQ-165 ASPJ (AIRBORNE SELF PROTECTION JAMMER)



An AOT is represented by a regular HAFU symbol without an aspect pointer. The center symbol is a letter A. A letter "**J**" to the left indicates that jamming is detected. An **"F"** to the right indicates the FLIR line of sight is correlated to that AOT. When the L&S trackfile is an angle only trackfile and the Radar is in STT, a "**RDR AOT"** cue is displayed at the center of the Attack format. On the HUD the target designator box and, if applicable, the Allowable Steering Error (ASE) and steering dot are still displayed. However, there are no Normalized In-Range Display (NIRD) cues. AOTs are Radar-only trackfiles as they inherently cannot be correlated to Datalink trackfiles without range from ownship. As such, AOTs are not transmitted as Datalink contributors.

"Burning" Through a Jammer

In DCS, when you are being actively jammed, most attempts to radar-lock the jamming contact result in having invalid ranges (displayed as "99.9 RNG"). On the RDR ATTK or AZ/EL radar pages, radar hits determined to have an invalid range are declared as AOTs (Angle-Only Trackfiles). AOTs are displayed in the AOT zone, or "dugout" area.

Jamming is effective at long distance. However, as your aircraft gets closer to the jamming source, your aircraft's radar power eventually becomes sufficient to "burn through" the jamming and provide accurate target location, including range.





DATALINK & IFF INTRODUCTION

One of the biggest challenges of integrated modern warfare is the identification of contacts. As various information donors like friendly fighters, ground radar stations, AWACS (Airborne Warning and Control System, like an E-3 Sentry or an E-2 Hawkeye), and ships interrogate unknown contacts with IFF (Identify-Friend-or-Foe) systems, this information needs to be relayed to everyone within a given Network. This is where Datalink comes in; with Link 16 Datalink, military aircraft as well as ships and ground forces may exchange their tactical picture in near-real time. Link 16 also supports the exchange of text messages, imagery data and provides two channels of digital voice (2.4 kbit/s and/or 16 kbit/s in any combination).

Multifunctional Information Distribution System (MIDS) is the NATO name for the communication component of Link-16. MID is an advanced command, control, communications, computing and intelligence (C4I) system incorporating high-capacity, jam-resistant, digital communication links for exchange of near real-time tactical information, including both data and voice, among air, ground, and sea elements. MIDS is intended to support key theater functions such as surveillance, identification, air control, weapons engagement coordination and direction for all Services.

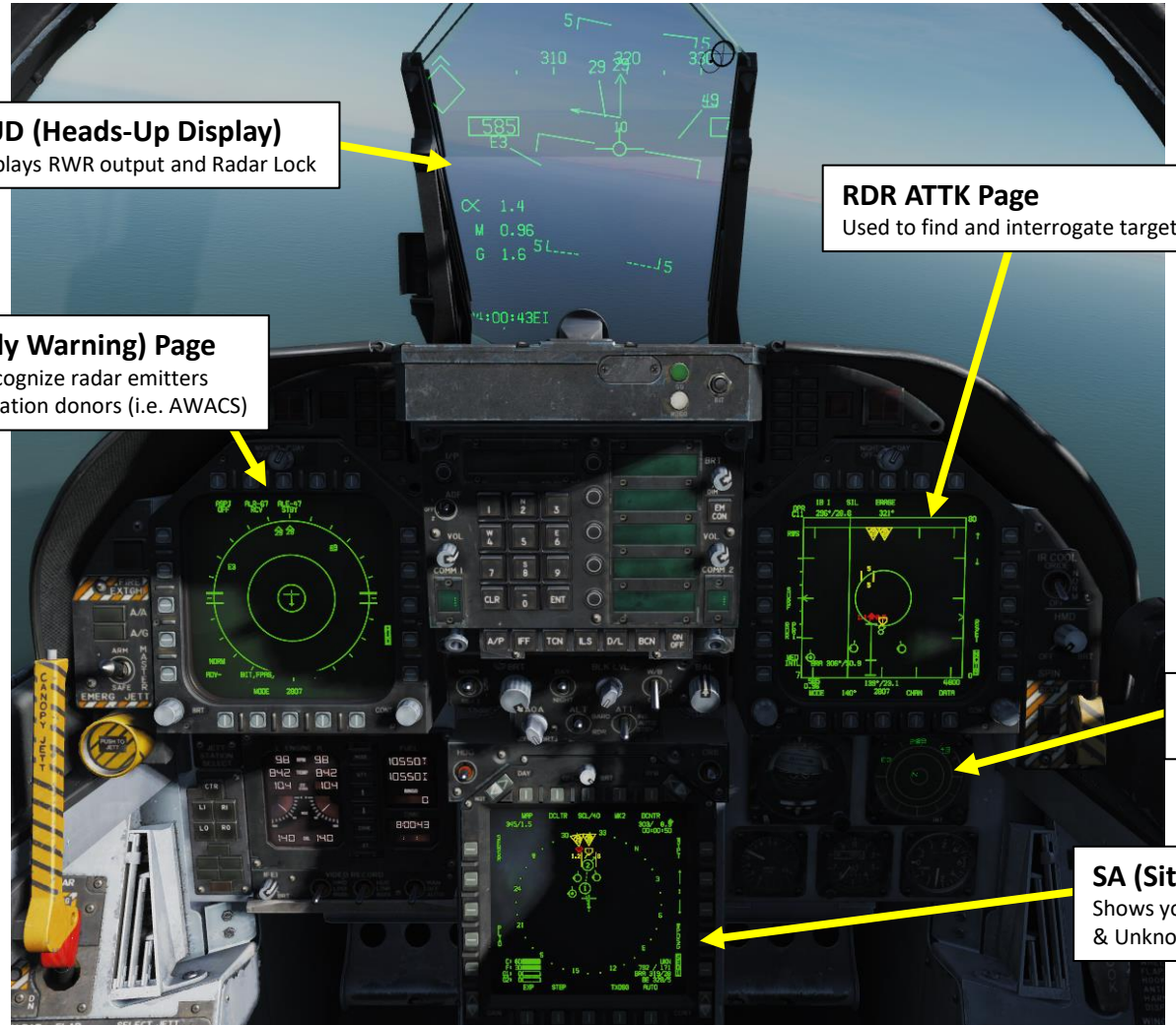


TYPICAL IFF SETUP

A typical setup that favors good situational awareness and ease of access to information is as follows:

- EW (Early Warning) Page on either DDI
- RDR ATTK (Radar Attack) Page on either DDI
- SA (Situational Awareness) Page on either DDI or on the AMPCD
- RWR (Radar Warning Receiver) output repeated on HUD

Operation of the IFF System is done with the TDC (Throttle Designator Controller) and the Sensor Control Switch.



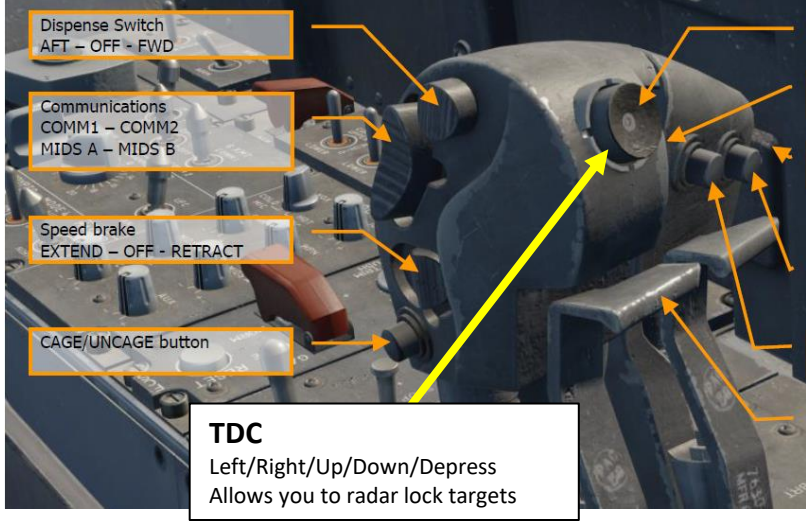
HUD (Heads-Up Display)
Displays RWR output and Radar Lock

RDR ATTK Page
Used to find and interrogate targets

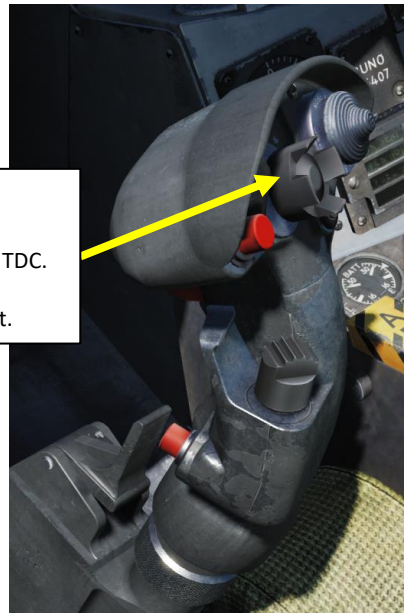
EW (Early Warning) Page
Used to recognize radar emitters and information donors (i.e. AWACS)

RWR (Radar Warning Receiver)
Used to recognize radar emitters

SA (Situational Awareness) Page
Shows you HAFU (Hostile, Ambiguous, Friendly, & Unknown) symbology



TDC
Left/Right/Up/Down/Depress
Allows you to radar lock targets

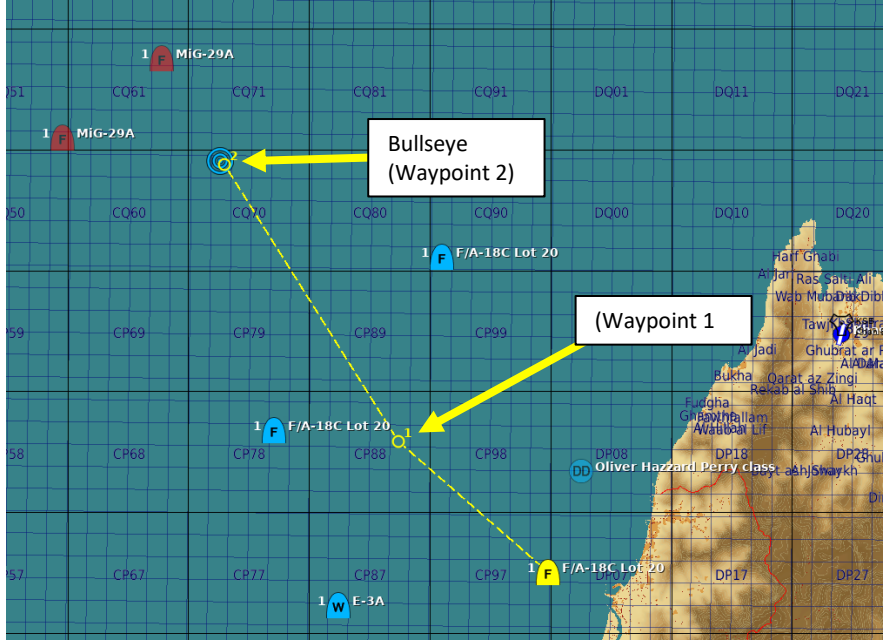


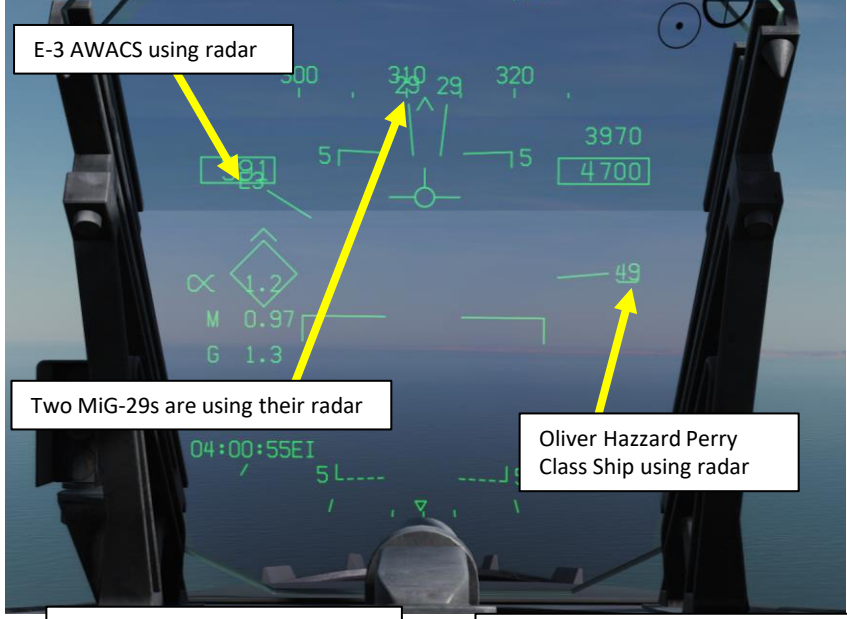
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS
Allows you to select which display to use when using the TDC.

Sensor Control Switch DEPRESS will interrogate the target.

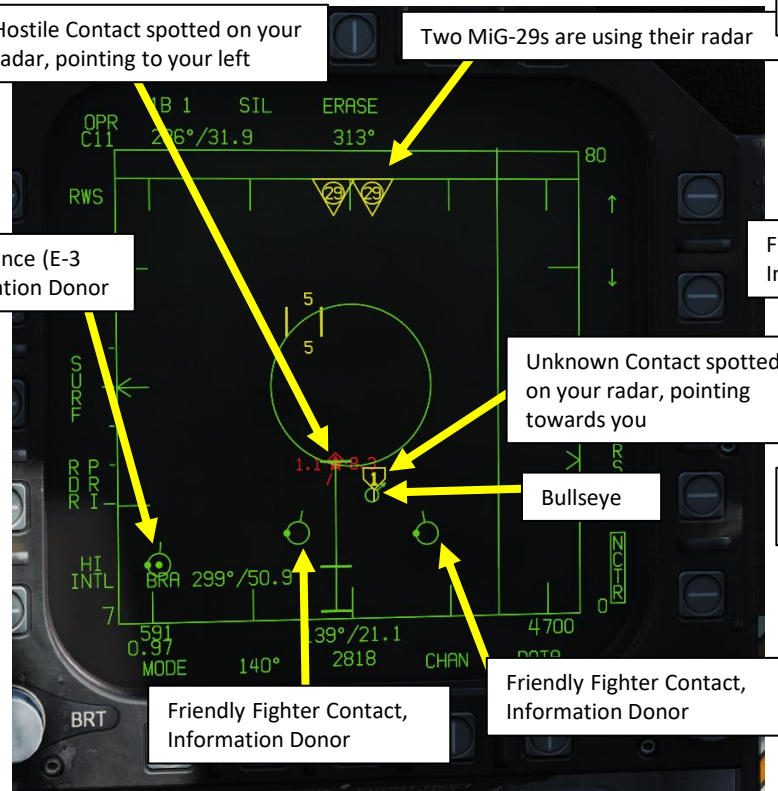
SENSORS INTEGRATED VIEW

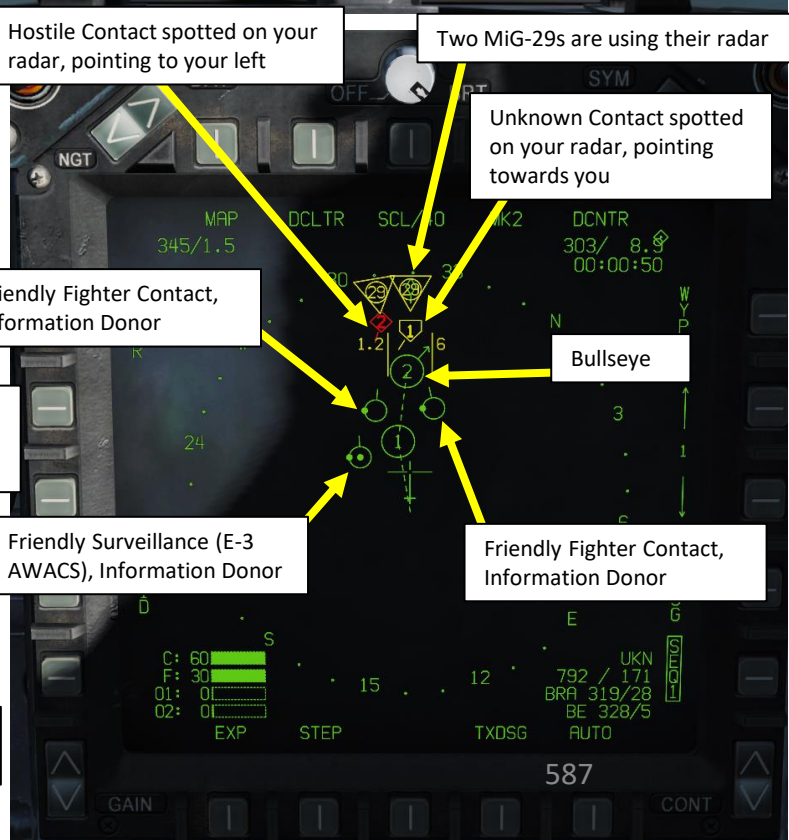
The F/A-18's sensors are integrated wonderfully. Here is an example of all the information you can find by consulting the HUD, EW page, SA page and RDR ATTK page.









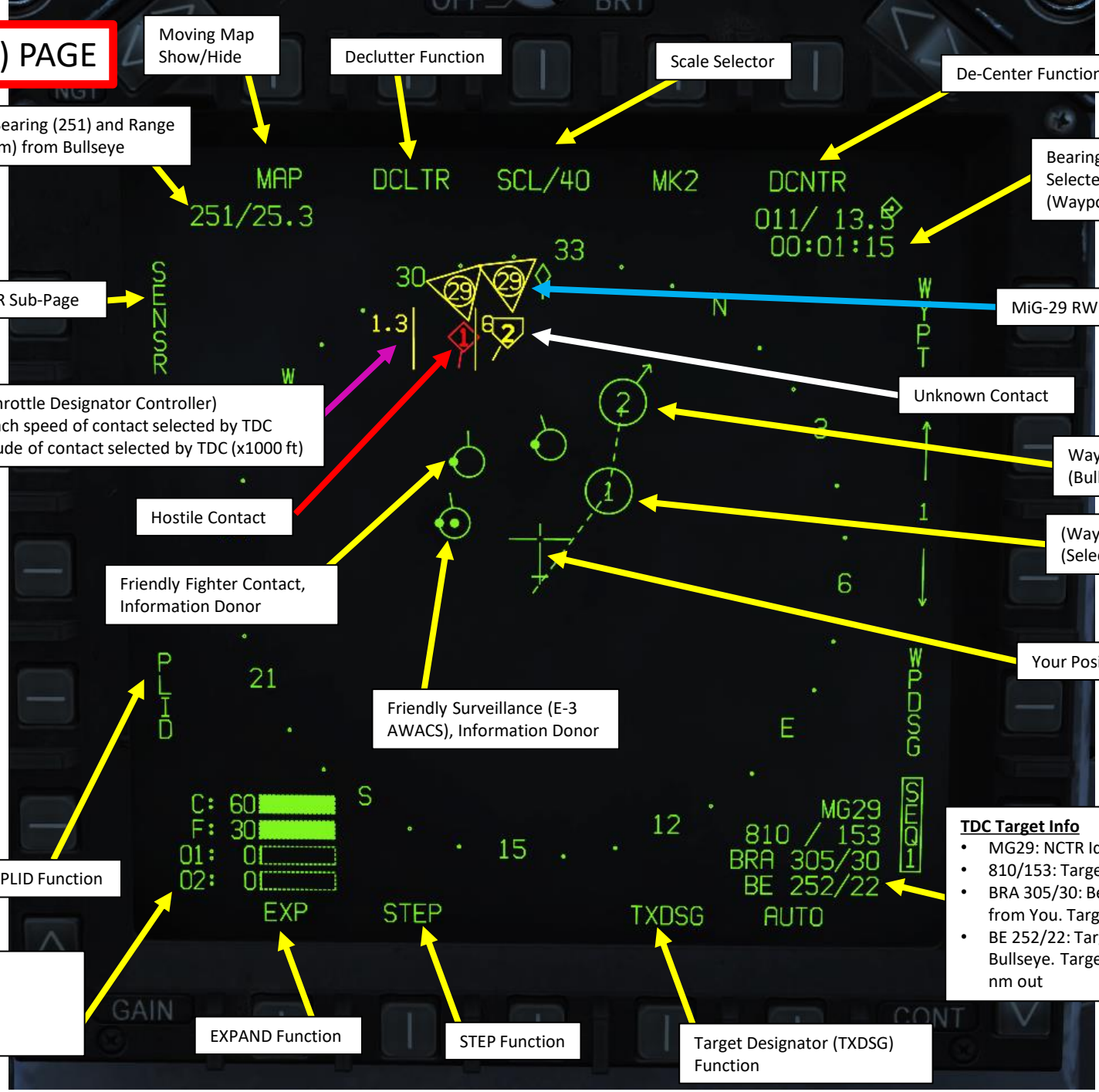


SA (SITUATIONAL AWARENESS) PAGE

The Situational Awareness (SA) format provides a top-down view of the area around the airplane. It displays trackfiles from all sources for the best possible situational awareness of airborne threats and allies. All trackfiles on the SA format are displayed as Hostile, Ambiguous, Friendly, or Unknown (HAFU) symbols.

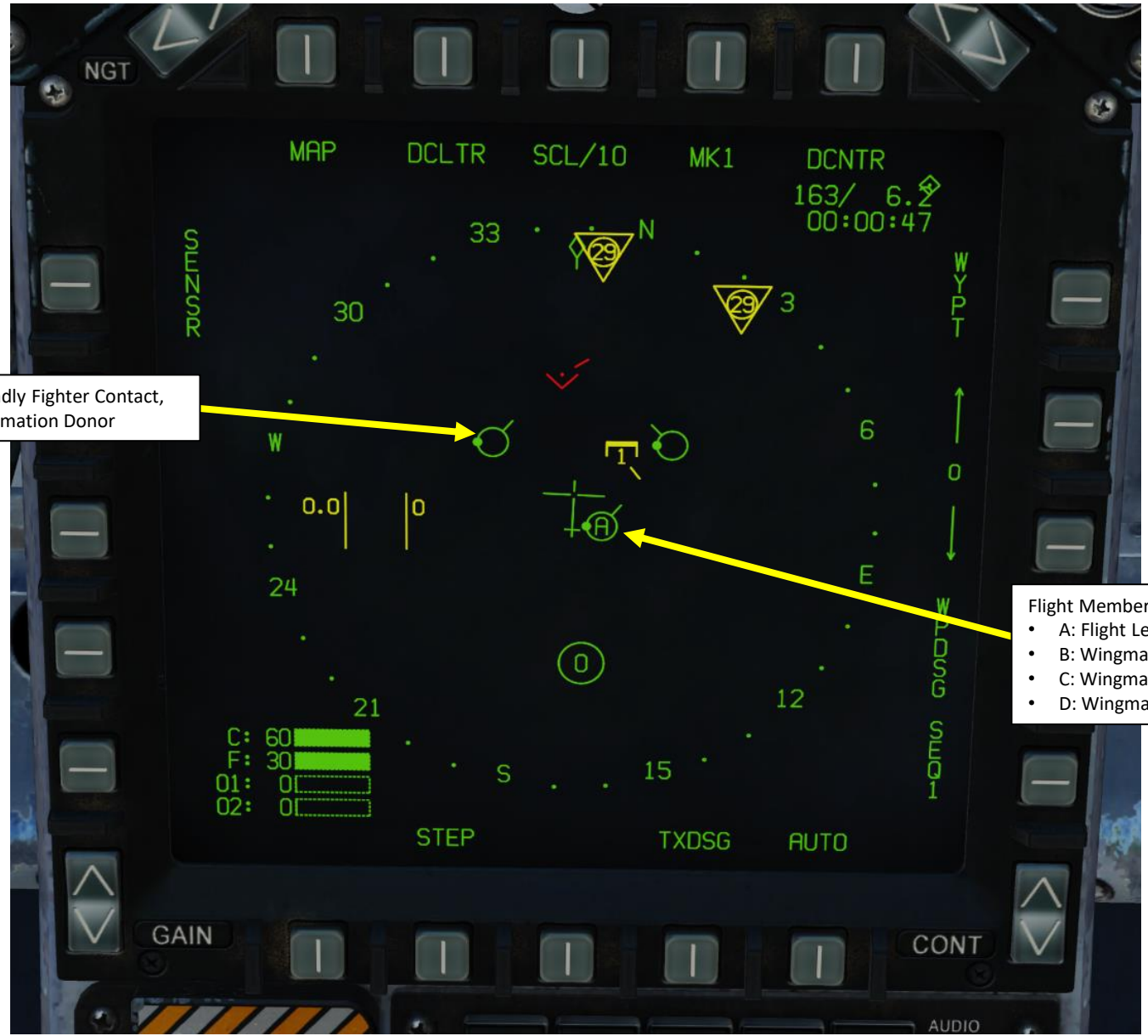
The SA format additionally allows for offboard trackfile sources to be selectively filtered for all formats displaying tracks and provides the ability to manually classify the HAFU identification of trackfiles.

The page also shows some symbology and provides access to some functions identical to those found on the HSI format; this excludes non-waypoint steering options and cues, the north up display option, and the aircraft heading line.



SA (SITUATIONAL AWARENESS) PAGE

Flight member symbols are distinct from Friendly contacts with the A, B, C or D letter.



SA (SITUATIONAL AWARENESS) PAGE

Threat zone rings are useful in order to have an idea about the effective range of air defenses.



SAM (Surface-to-Air Missile) Site Symbol (SA-11)

SAM (Surface-to-Air Missile) Site Threat Zone

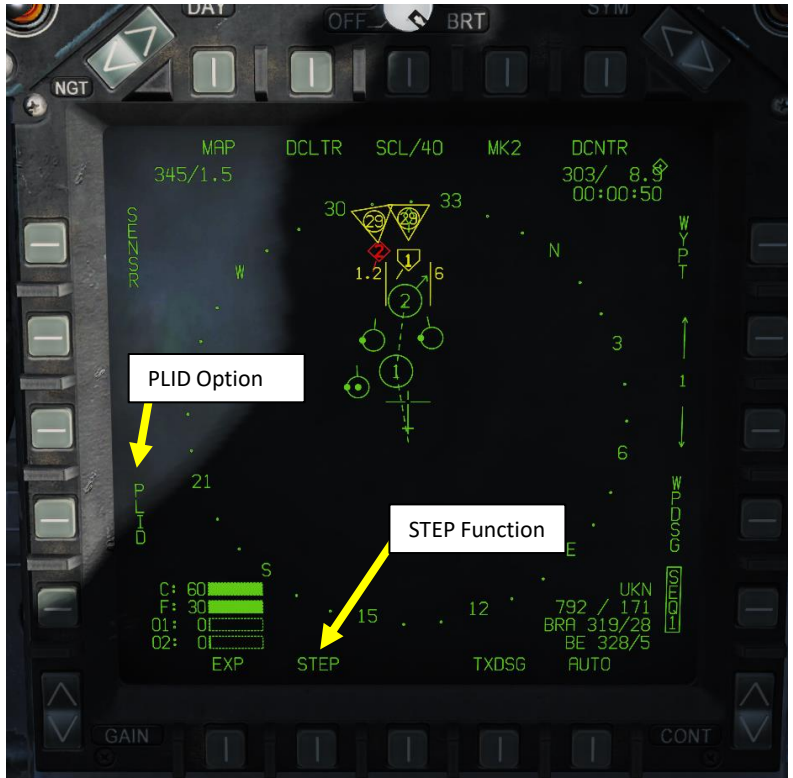
- This ring is set by the DTC (Data Transfer Cartridge) via the Mission Editor. This is an indicator of the SAM radar range and this region should be avoided if possible.
- If SAM site is destroyed, the Threat Ring will remain displayed. It does not update dynamically with the SAM site itself, it is merely a visual marker set prior to the mission according to currently available intelligence on deployment of enemy forces.

SA (SITUATIONAL AWARENESS) PAGE FUNCTIONS

Declutter Function
REJ1: Removes compass rose, ground track diamond, and SAM range rings.
REJ2: Removes REJ1 items and the waypoint/TGT data block.
MREJ1: Hides all SAM indications.
MREJ2: Not yet implemented.



- **MAP**: Toggles Moving Map
- **DCLTR**: De-Clutters SA page
- **DCNTR**: De-Centers SA page
- **STEP**: "STEP" function replaces the TDC cursor with a rectangular box, always centered around a trackfile. Around the trackfile selected is its Mach number to the left and altitude in thousands of feet. The option "steps" the STEP box through all trackfiles based on rank. If the TDC cursor is over a trackfile, the STEP box will first step to that track; otherwise, it will step to the L&S trackfile or, if none exists, the highest ranked track. Moving the TDC will bring back the cursor, which will appear at the last location of the STEP box.
- **PLID**: Pilot Identification option displays whenever the TDC cursor is over a trackfile or the STEP box exists. This allows for manual hostile, friendly, or unknown status designation of a trackfile which is not from a PPLI (Precise Participant Location and Identification) donor.

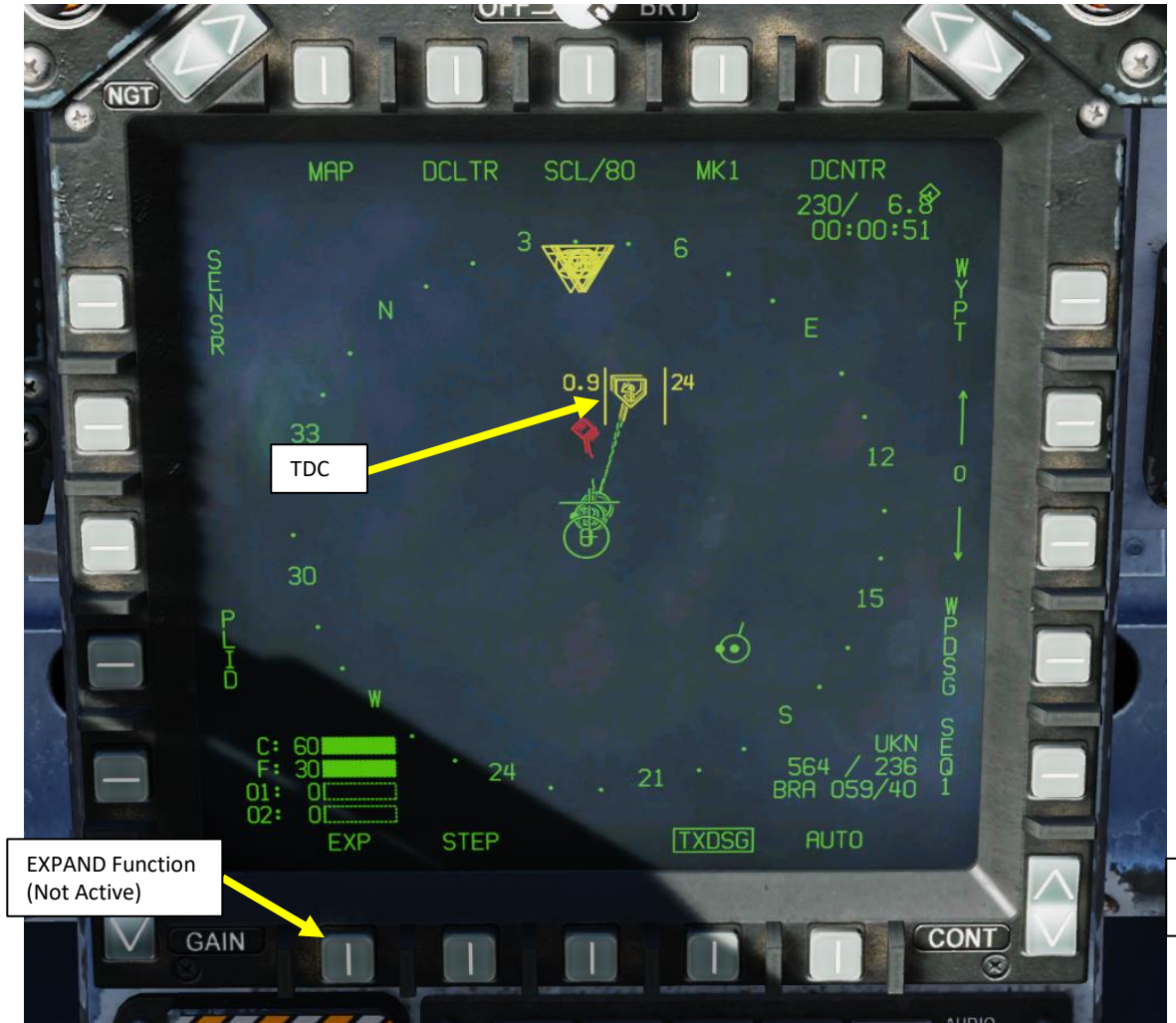


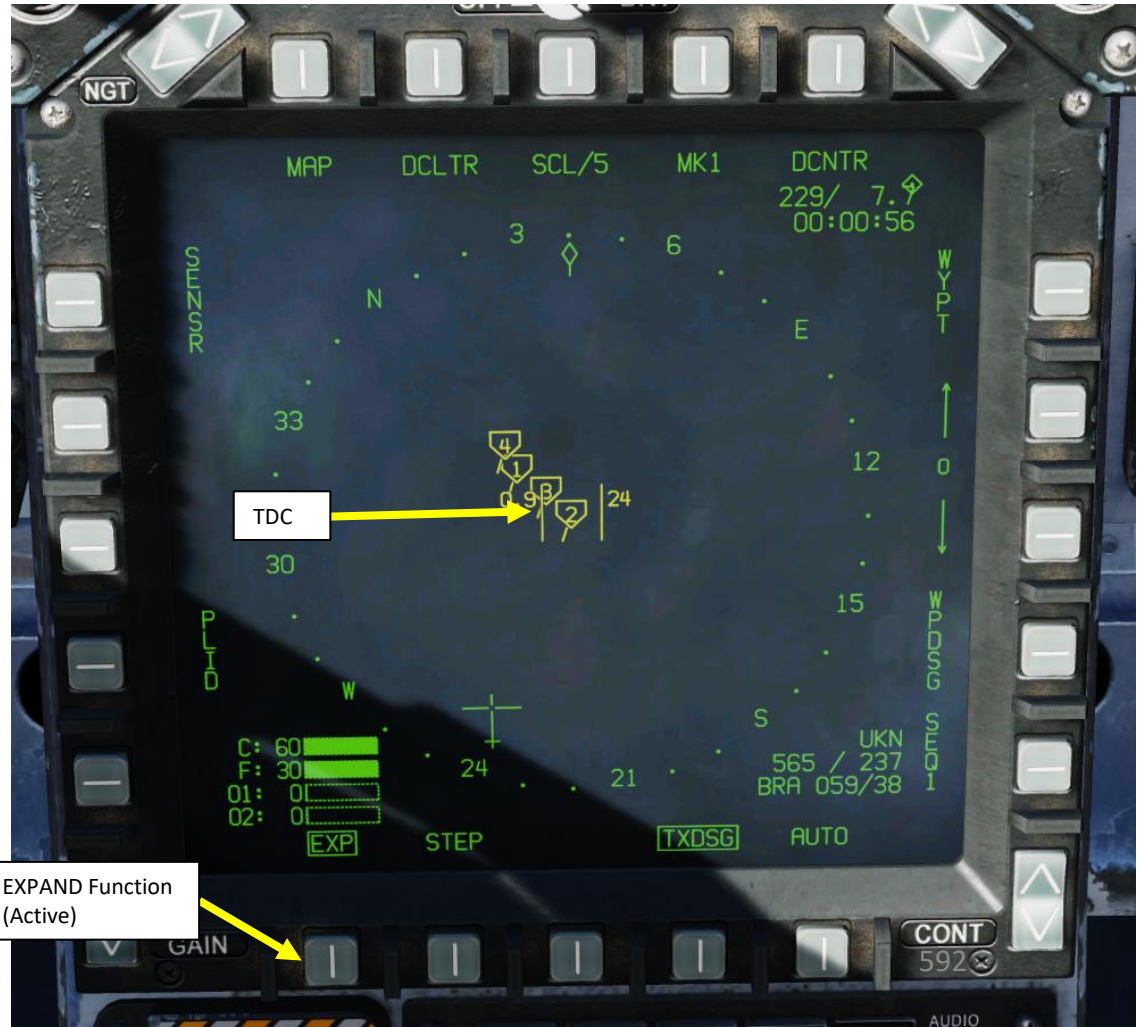




SA (SITUATIONAL AWARENESS) PAGE FUNCTIONS

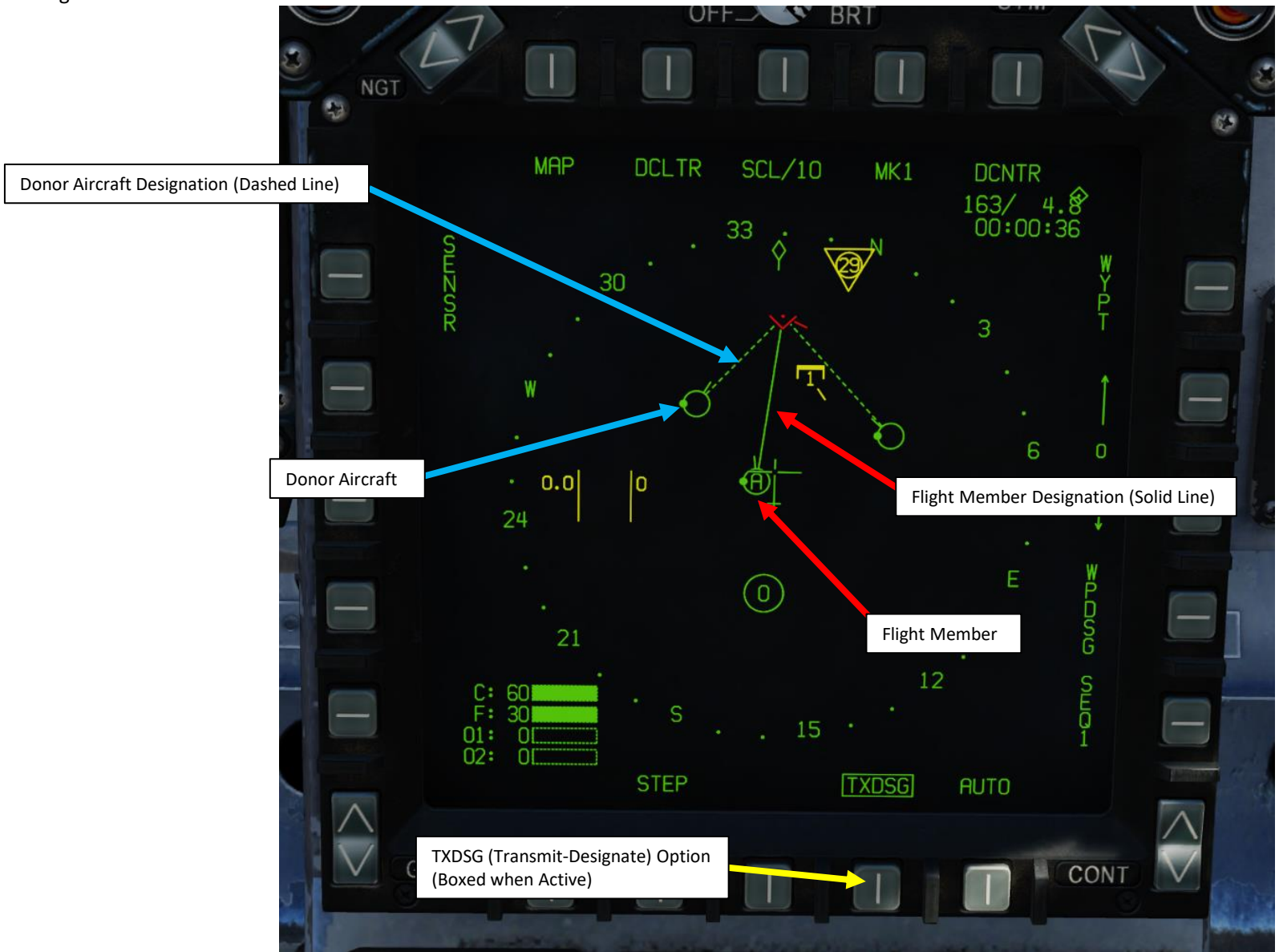
- **EXP**: Expand Mode (EXP) expands the SA format about a trackfile with a 5 nm range scale. The ownship aircraft indicator is repositioned relative to it. The current aircraft heading remains the source of orientation for the SA format. If the cursor or STEP box is not over a trackfile, EXP will expand on the L&S track. If either of the former happen, it will expand on the cursored-over/STEP box trackfile. If the cursor or STEP box is not over a track and no L&S exists, the EXP option is removed. EXP is boxed as long as EXP mode is active; pressing it again leaves EXP mode.





SA (SITUATIONAL AWARENESS) PAGE FUNCTIONS

- **TXDSG**: Transmit-designate option, when boxed, will display lines will between flight members/friendly donor aircraft and their air-to-air or air-to-ground L&S designations on the same Link-16 datalink network.

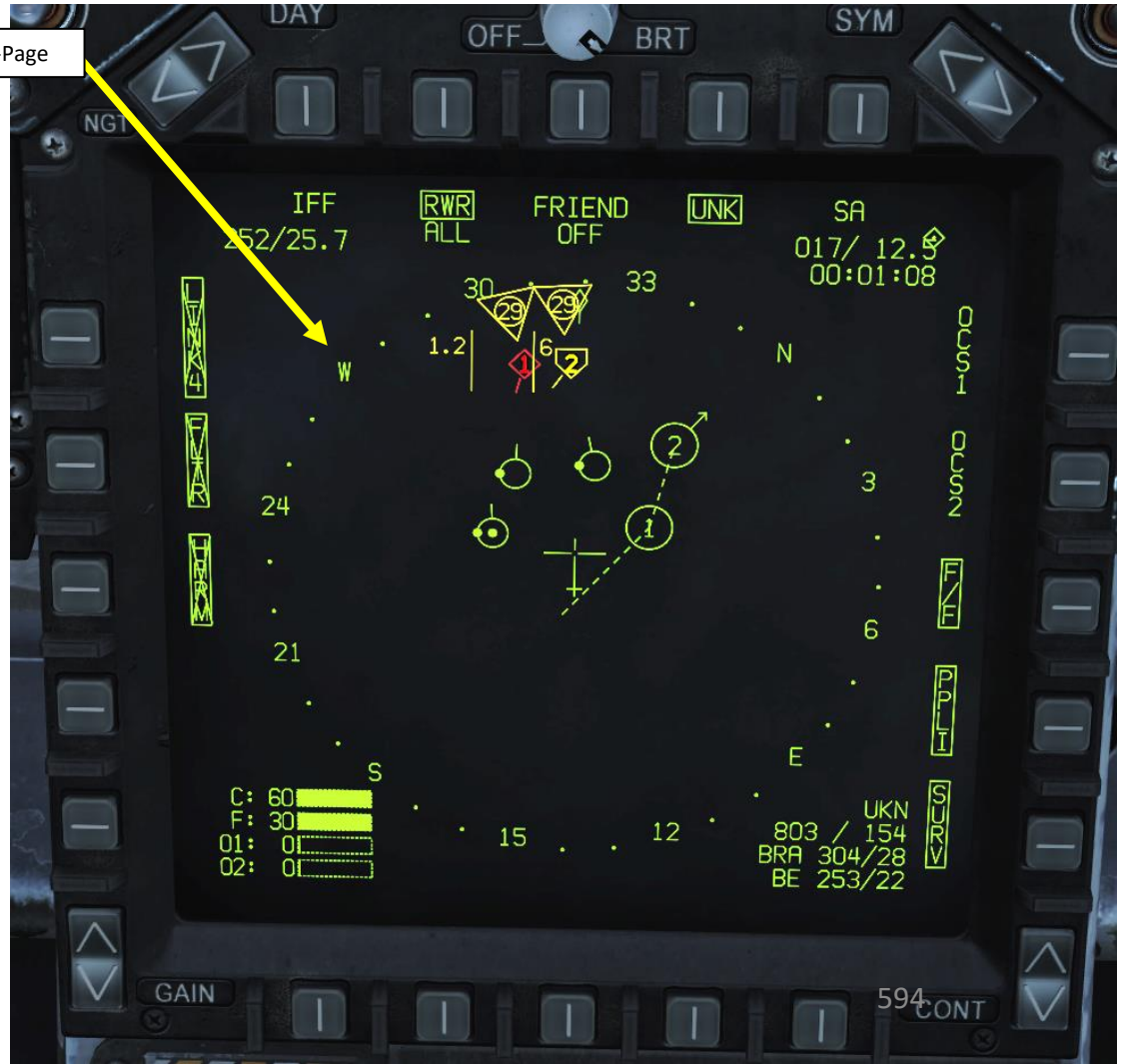


SA (SITUATIONAL AWARENESS) PAGE SENSORS SUB-PAGE

The SENSR (Sensor) SA Sub-Page controls what sensors contribute to the displays throughout the aircraft. Selecting SA returns to the main format.



SENSOR Sub-Page



- **LINK4**: Toggles trackfile information being displayed from LINK-4 Datalink
- **FLTR**: Not Yet Implemented
- **HARM**: Not Yet Implemented
- **IFF**: Not Yet Implemented
- **RWR**: Toggles display of the four most priority air-to-air RWR bearings, shown in yellow as a triangle with the emitter identifier. This affects the SA format itself and also the RDR ATTK with MSI enabled. This always displays hostiles and unknowns, but will also display friendly bearings based on the FRIEND setting. Unboxed will show no RWR bearings, "ALL" will show all, "CRIT LETH" will show only critical and lethal bearings, and "CRIT" will only show critical bearings.
- **FRIEND**: Toggles display of friendly air-to-air RWR bearings for the SA and RDR ATTK format. "OFF" shows none. "NO ID" shows friendly RWR bearings but without the emitter type in the triangle. "RWR ID" shows friendly RWR bearings with both the triangle and emitter type. Note that only the priority four emitters are displayed, so friendly emitters will not always be displayed even with the option enabled.
- **UNK**: Toggles display of unknown HAFU trackfiles.
- **OCS1/OCS2**: Not Yet Implemented
- **F/F**: Toggles trackfile information being displayed from fighter-fighter (F/F) donors.
- **PPLI**: Toggles trackfile information being displayed from Precise Participant Location and Identification (PPLI) donors.
- **SURV**: Toggles trackfile information being displayed from surveillance (SURV) donors.

HAFU SYMBOLOGY

Hostile, Ambiguous, Friendly or Unknown (HAFU) is a symbology system used by the F/A-18 to represent trackfiles; specifically, to show its status as a friendly or hostile. It is usually what trackfiles are displayed as across the software.

Here are four HAFU symbols:



- **Triangle:** Hostile (red when colored)
- **Thick Staple:** Ambiguous (yellow when colored)
- **Half-Circle:** Friendly (green when colored)
- **Thin Staple:** Unknown (yellow when colored)

A hostile HAFU will be assigned whenever:
A negative IFF response is returned, and

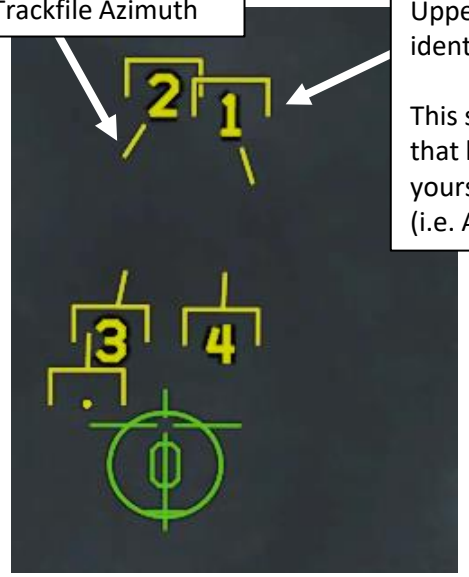
- An NCTR print returns with an aircraft type that is on the hostile coalition; or
- A SURV (surveillance, like an AWACS) source over datalink also marks it hostile; or
- A F/F (fighter-to-fighter, like another F/A-18) source over datalink also marks it hostile.

An ambiguous HAFU will be assigned when the aircraft and a donor have conflicting identifications (friendly and hostile).

A friendly HAFU will be assigned whenever an IFF interrogation returns as friendly or the track itself is contributed to by the Precise Participant Location and Identification (PPLI) system.

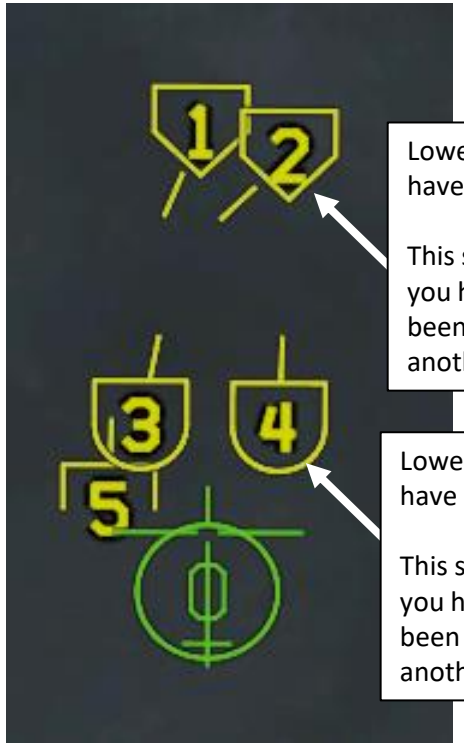
An unknown HAFU will be assigned by default until it is updated by meeting one of the requirements above.

A number is assigned on the HAFU symbol to show the level of criticality (1 being the most critical).



Upper Part: This is what you have identified.

This symbol shows an Unknown Target that has not been interrogated by either yourself or any other information donor (i.e. AWACS).



Lower Part: This is what information donors have identified.

This symbol shows an Unknown Target that you have not interrogated yet, but that has been interrogated and confirmed hostile by another information donor (i.e. AWACS).

Lower Part: This is what information donors have identified.

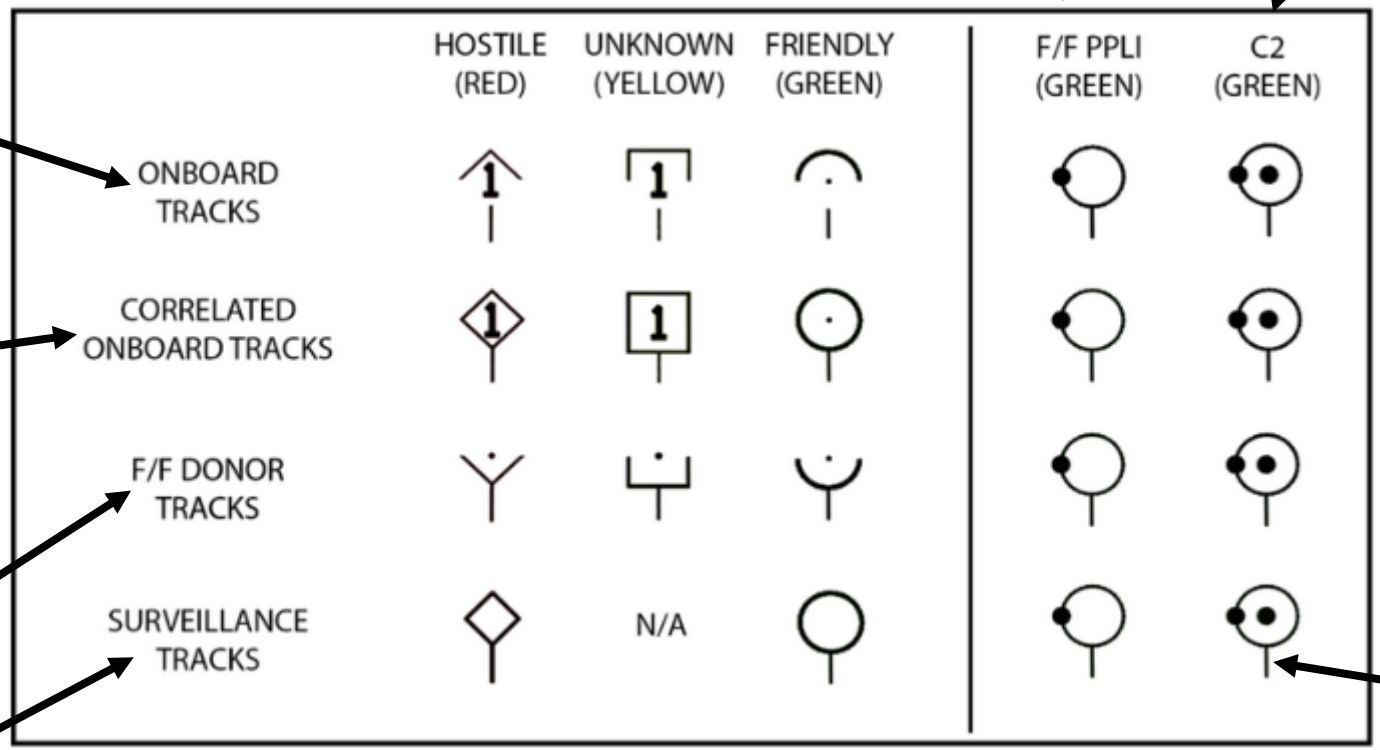
This symbol shows an Unknown Target that you have not interrogated yet, but that has been interrogated and confirmed friendly by another information donor (i.e. AWACS).

HAFU SYMBOLOGY

F/A-18C HORNET LINK 16 SA PAGE SYMBOLOGY & HAFU

The Precise Participant Location and Identification (PPLI) system broadcasts to other aircraft on datalink positional information about the PPLI donor itself. The dot on the side means it is a friendly fighter-to-fighter information donor.

A C2 HAFU represents a Command and Control Aircraft (AWACS, E3A Sentry, E2C Hawkeye, etc.), which is a friendly information donor.



You have acquired this track (**onboard trackfile**), but no other information donor has given you information about it.

You have acquired this track and another information donor has given you information (offboard trackfile) about it as well. This means this information is correlated/coherent between an onboard (you) and an offboard information source.

This information comes from a friendly fighter donor (F/F: Fighter-to-Fighter) on the same datalink network, however you have not acquired this track yourself. This is an **offboard trackfile**.

This information comes from a surveillance donor (like an AWACS or a ship) on the same datalink network. This is an **offboard trackfile**.

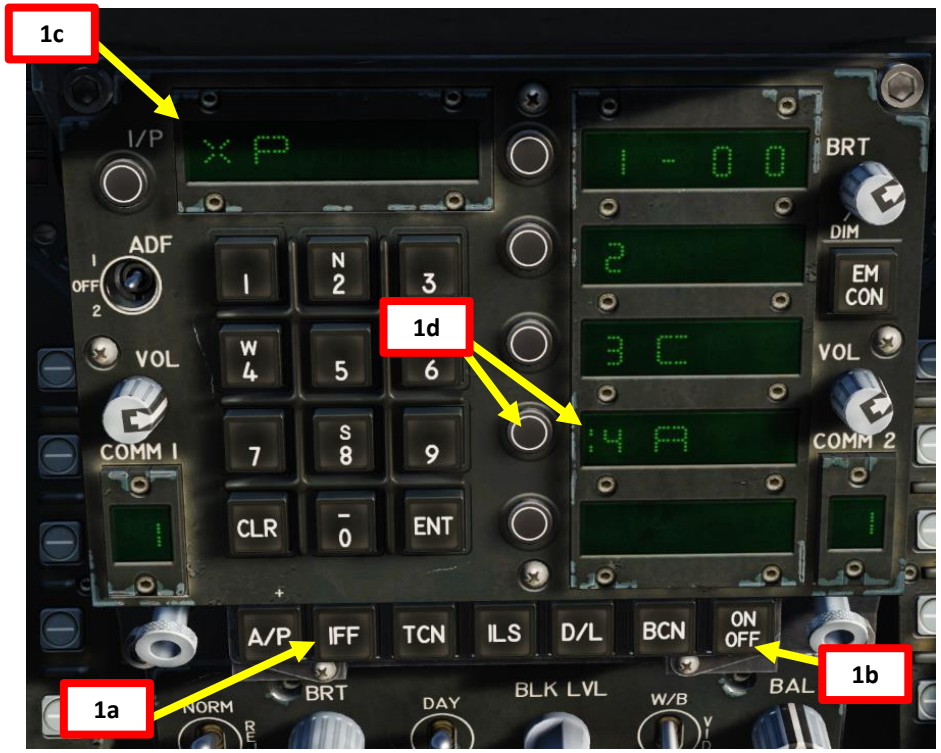
This vector line represents the direction of the trackfile/contact.

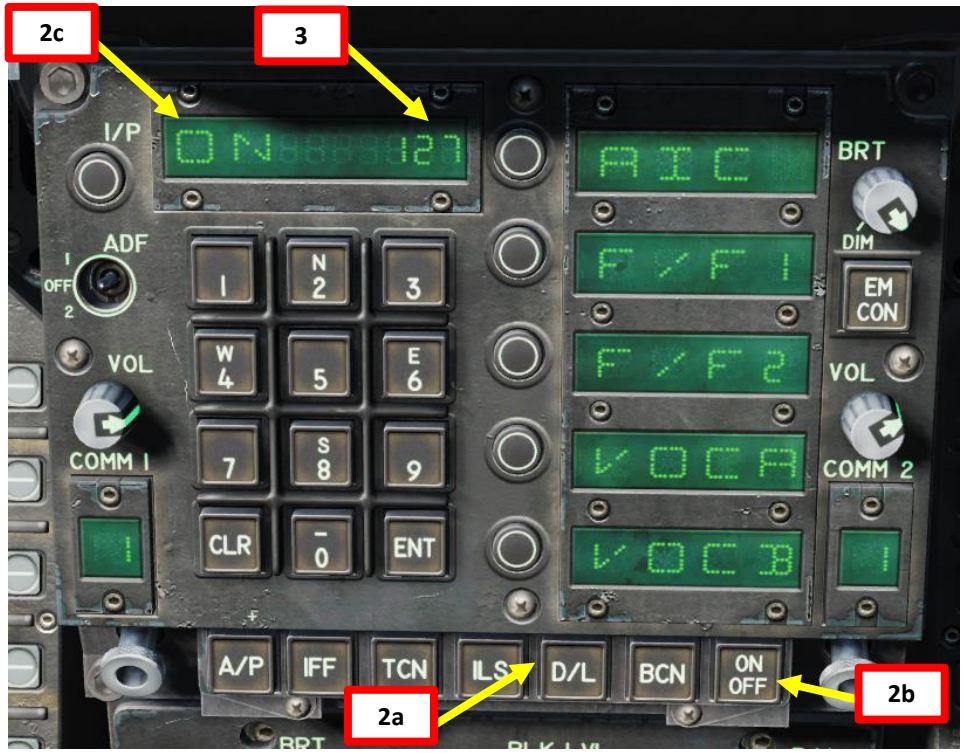
MANUAL IFF TUTORIAL – NCTR

The IFF (Identify-Friend-or-Foe) and Datalink systems need to be ON when wanting to identify radar contacts. Remember:

- **NCTR**: Non-Cooperative Target Recognition is done from the RDR ATTK (Radar Attack) page. Mode 4 Transponder operation is done when interrogating a contact.

1. Power Up IFF (Identify-Friend-or-Foe) system by pressing the IFF Button, then holding the ON button on the UFC for a few seconds. When « XP » is displayed, the IFF has been powered up correctly. Verify that Mode 4 is selected (« : » should be visible next to « 4 »). If it is not, press on the OSB (Option Select Button) next to it.
2. Power Up Datalink system by pressing the D/L Button, then holding the ON button on the UFC for a few seconds. When « ON » is displayed, the Datalink has been powered up correctly.
3. On UFC, set desired Datalink Frequency by entering it on the scratchpad, then pressing « ENT ». 127 is used by default, you can keep it.





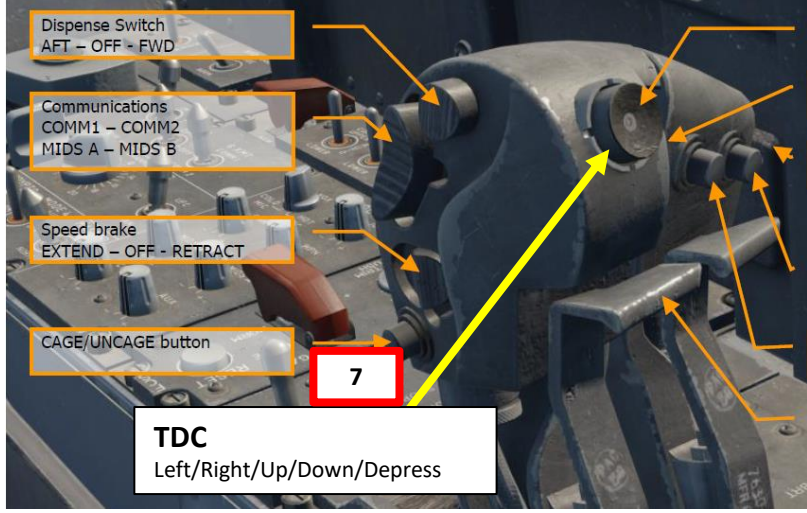
MANUAL IFF TUTORIAL – NCTR

4. Make sure your Radar Power switch is set to OPR.
5. Set Sensor Control Switch to the RDR ATTK DDI (Sensor Control Switch Right since we showed up the RDR ATTK on the right DDI). A diamond will appear to show the right DDI is selected.
6. Press the OSB next to NCTR (Non-Cooperative Target Recognition) activate (boxed)
7. Move the TDC over the target using the TDC controls.
8. Interrogate target by using the Sensor Control Switch DEPRESS control. You can radar lock your target by pressing TDC DEPRESS.

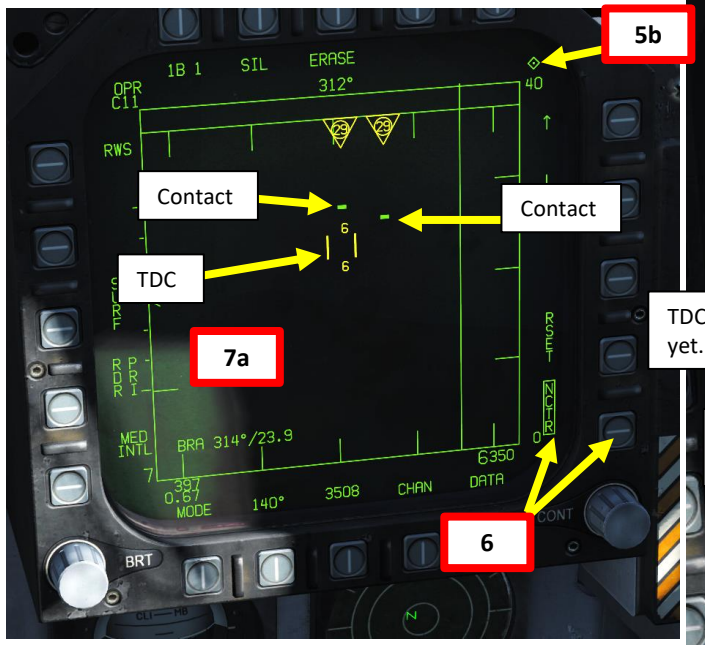


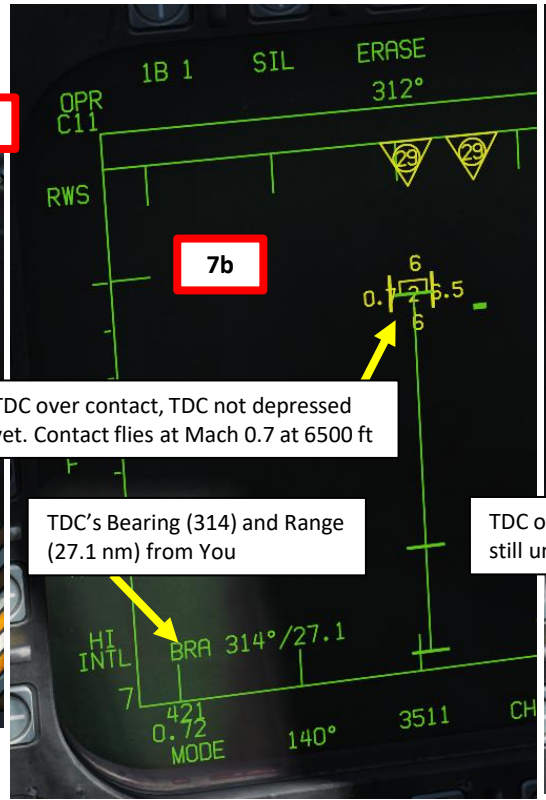
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS





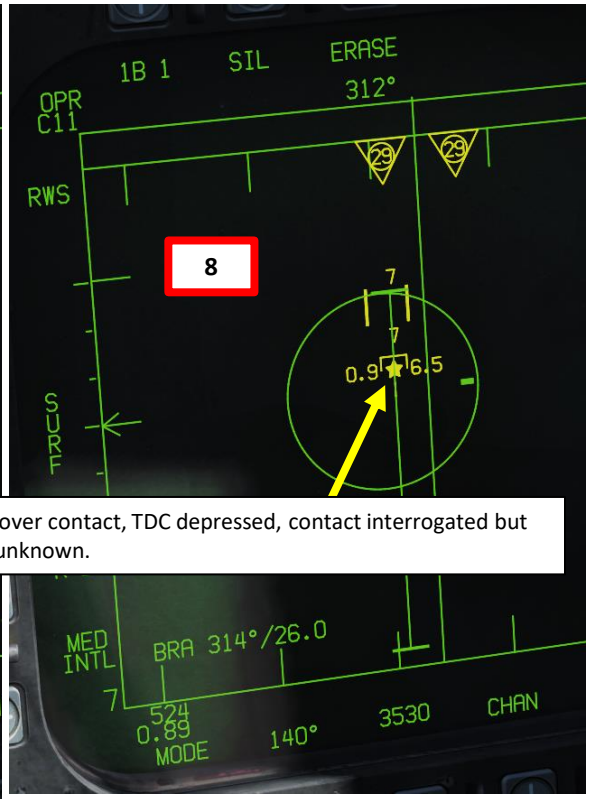
TDC
Left/Right/Up/Down/Depress





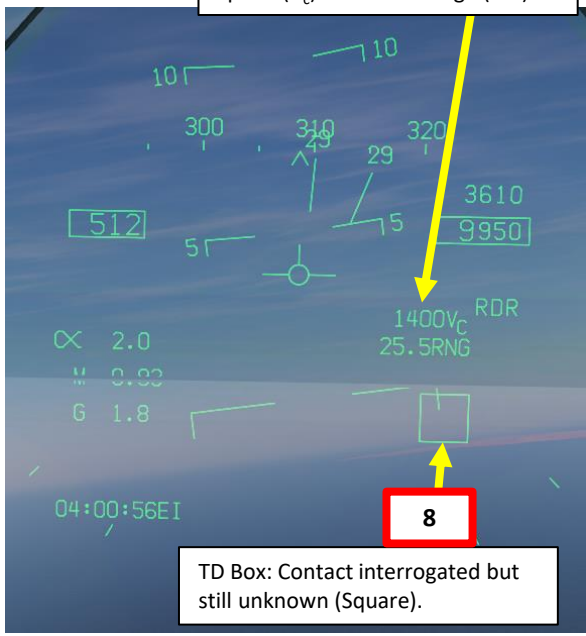
TDC over contact, TDC not depressed yet. Contact flies at Mach 0.7 at 6500 ft

TDC's Bearing (314) and Range (27.1 nm) from You



TDC over contact, TDC depressed, contact interrogated but still unknown.

If you radar lock a target after having interrogated it, you will get additional information like closure speed (V_c) in kts and range (nm).



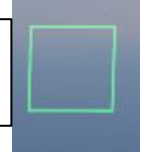
TD Box: Contact interrogated but still unknown (Square).

MANUAL IFF TUTORIAL – NCTR

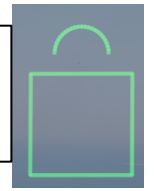
9. In NCTR Mode, targets that are farther than 25 nm may remain UNKNOWN or AMBIGUOUS. To get a proper identification, make sure you are within 25 nm.
10. After a few seconds, the trackfile should turn to either HOSTILE, FRIENDLY or AMBIGUOUS HAFU symbols. See HAFU legend.
11. You can set your Sensor Control Switch to the SA Page (Sensor Control Switch Down since we showed up the SA Page on the Lower AMPCD). A diamond will appear to show the AMPCD is selected. Then, you can move the TDC over a contact and gain additional information from it.



Square: Radar Locked Target, Identified as Friendly or Unknown by yourself alone



Square with Half Circle: Radar Locked Target, Identified as Friendly by yourself and another Link-16 Datalink Donor

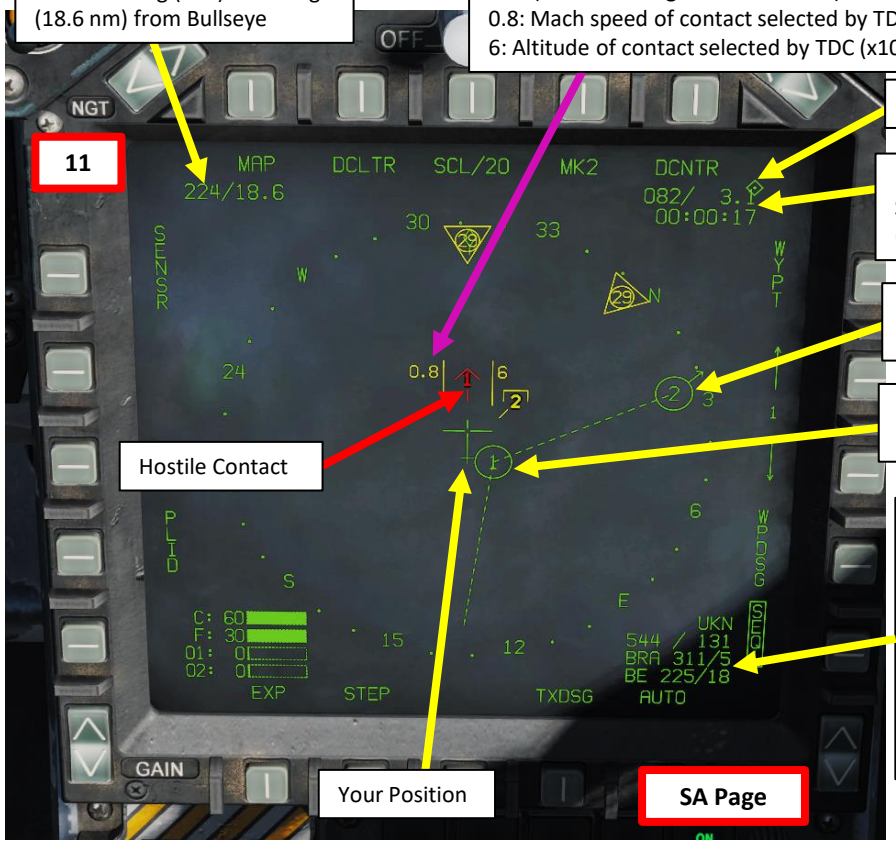


Diamond: Radar Locked Target, Identified as Hostile by yourself alone



Diamond with Caret: Radar Locked Target, Identified as Hostile by yourself and another Link-16 Datalink Donor





TDC's Bearing (224) and Range (18.6 nm) from Bullseye

TDC (Throttle Designator Controller)
0.8: Mach speed of contact selected by TDC
6: Altitude of contact selected by TDC (x1000 ft)

AMPCD Sensor Selected

Bearing & Range to Selected Waypoint (Waypoint 1)

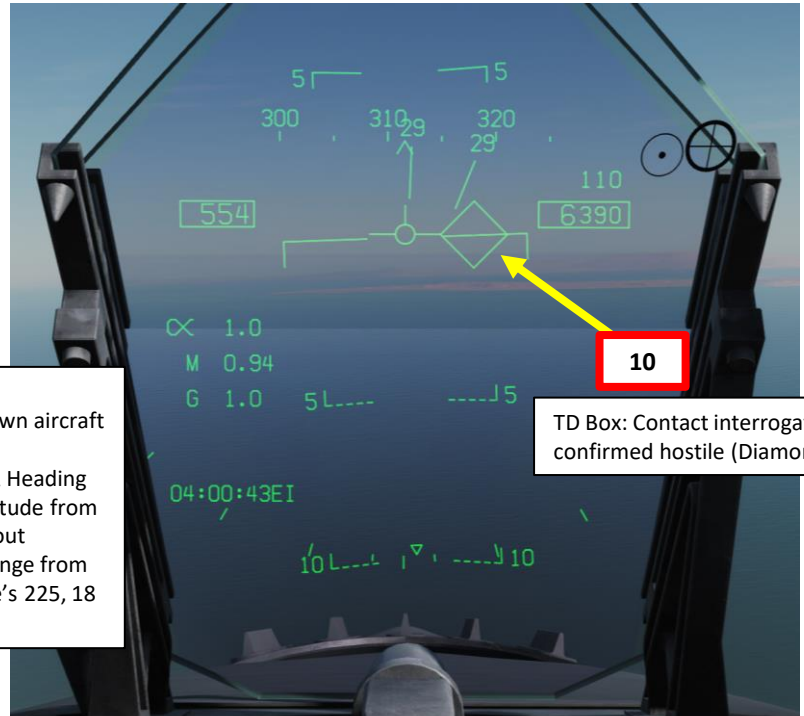
Waypoint 2 (Bullseye – A/A)

(Waypoint 1 (Selected)

Hostile Contact

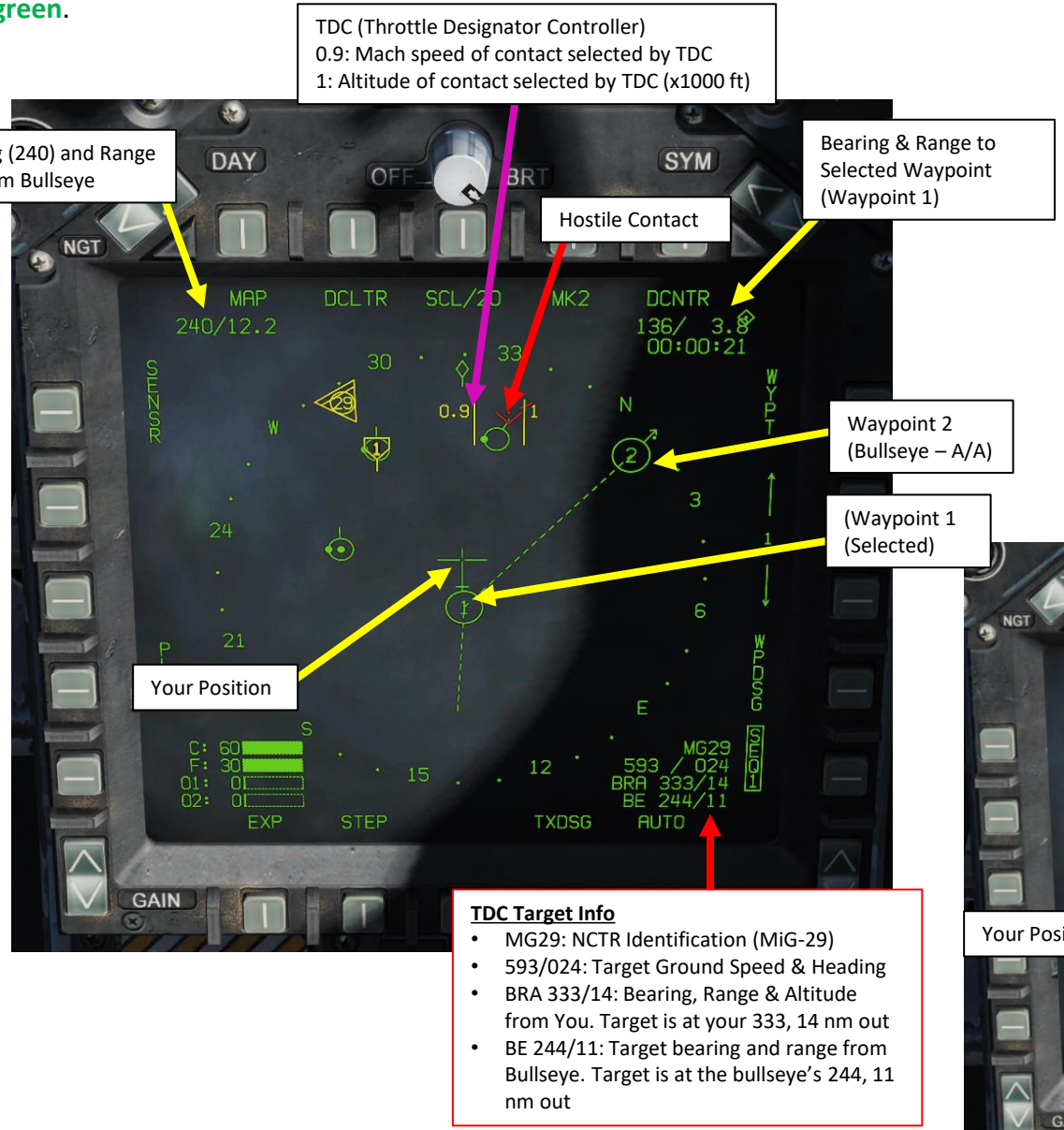
TDC Target Info

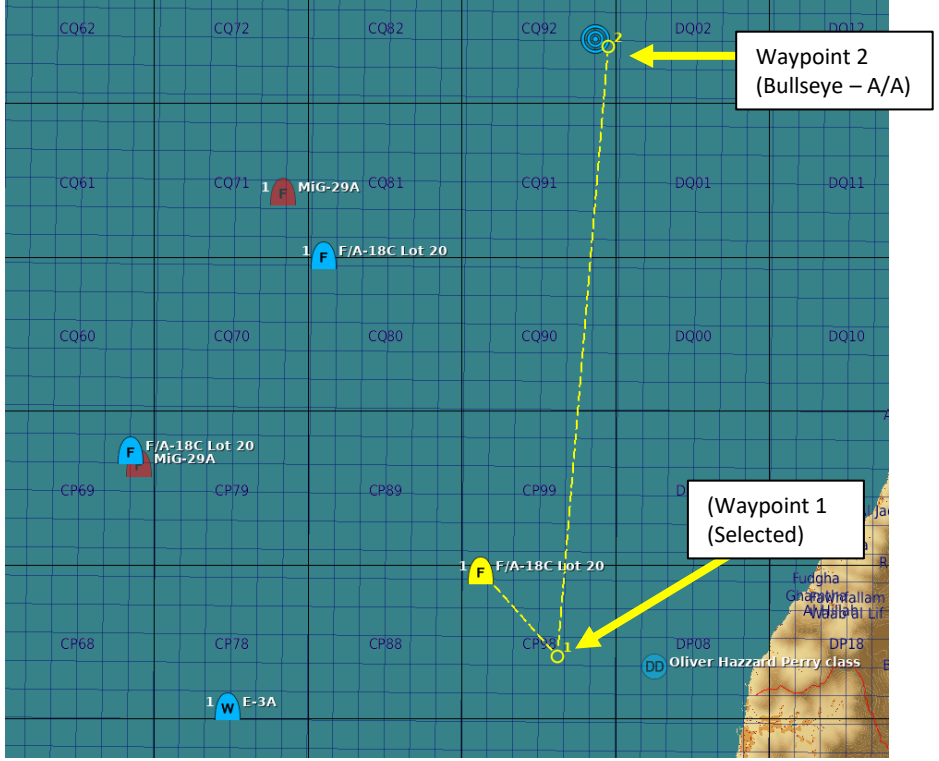
- UKN: NCTR Identification (Unknown aircraft type)
- 544/131: Target Ground Speed & Heading
- BRA 311/5: Bearing, Range & Altitude from You. Target is at your 311, 5 nm out
- BE 225/18: Target bearing and range from Bullseye. Target is at the bullseye's 225, 18 nm out

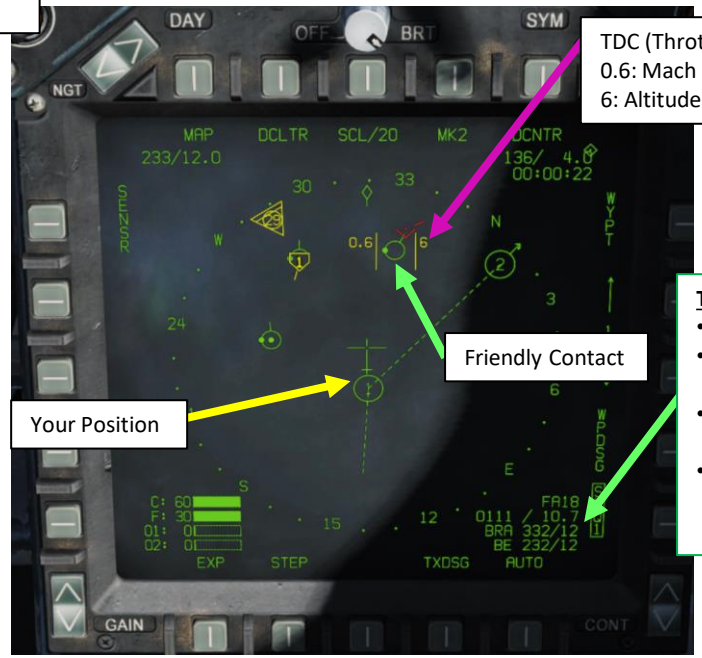


MANUAL IFF TUTORIAL – EXAMPLES

Note: When hovering the TDC on a friendly target, the TDC Target Info differs slightly. See notes in **red** and **green**.

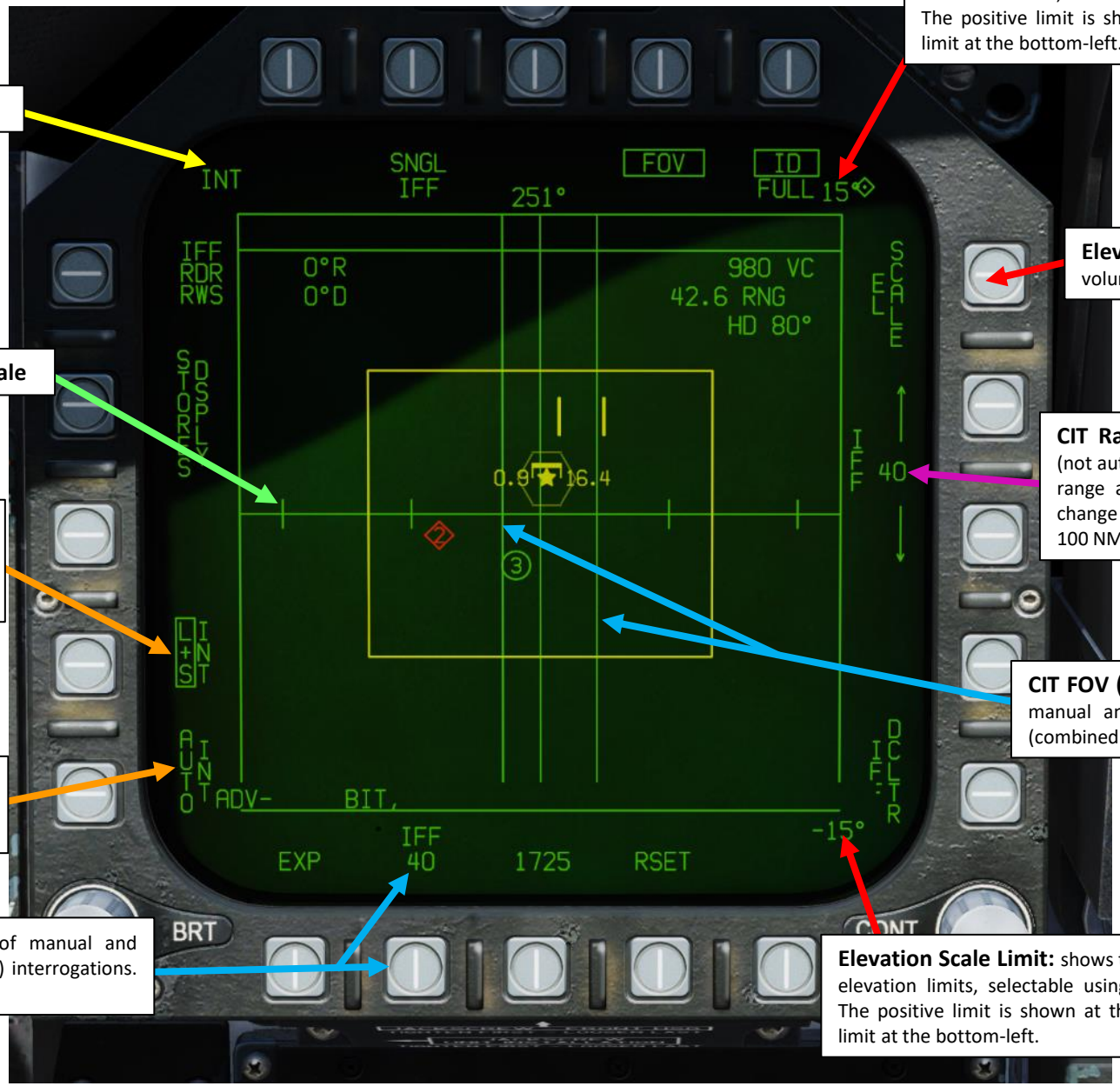






IFF FROM AZ/EL PAGE

You can perform a manual IFF interrogation from the AZ/EL page. The procedure is very similar to the one used with the RDR ATTK page.



Sensor Status: INT (Interrogation) Mode

Azimuth Scale

L&S Interrogation: when boxed, automatically performs continuous pointed CIT interrogations on the L&S (Launch & Steering) Primary Target (whenever a L&S is designated).

Auto Interrogation: when boxed, automatically performs scan interrogations at the selected azimuth centered about boresight every 10 seconds.

CIT Azimuth: changes the horizontal extent of manual and automatic CIT (combined interrogator/transponder) interrogations. Cycles between 20°, 40°, 80°, and 140°.

Elevation Scale Limit: shows the positive and negative elevation limits, selectable using EL SCALE pushbutton. The positive limit is shown at the top-left; the negative limit at the bottom-left.

Elevation Scale Toggle: Cycles between scan volumes: ±70°×±15°, ±70°×±30°, or ±70°×±70°.

CIT Range: shows the maximum range for manual (not automatic) CIT interrogations; returns beyond this range are not displayed. The up and down arrows change the range. Options are 5, 10, 20, 40, 80, and 100 NM.

CIT FOV (Field-of-View): shows the azimuthal extent of manual and automatic interrogations made by the CIT (combined interrogator/transponder).

Elevation Scale Limit: shows the positive and negative elevation limits, selectable using EL SCALE pushbutton. The positive limit is shown at the top-left; the negative limit at the bottom-left.

IFF FROM AZ/EL PAGE

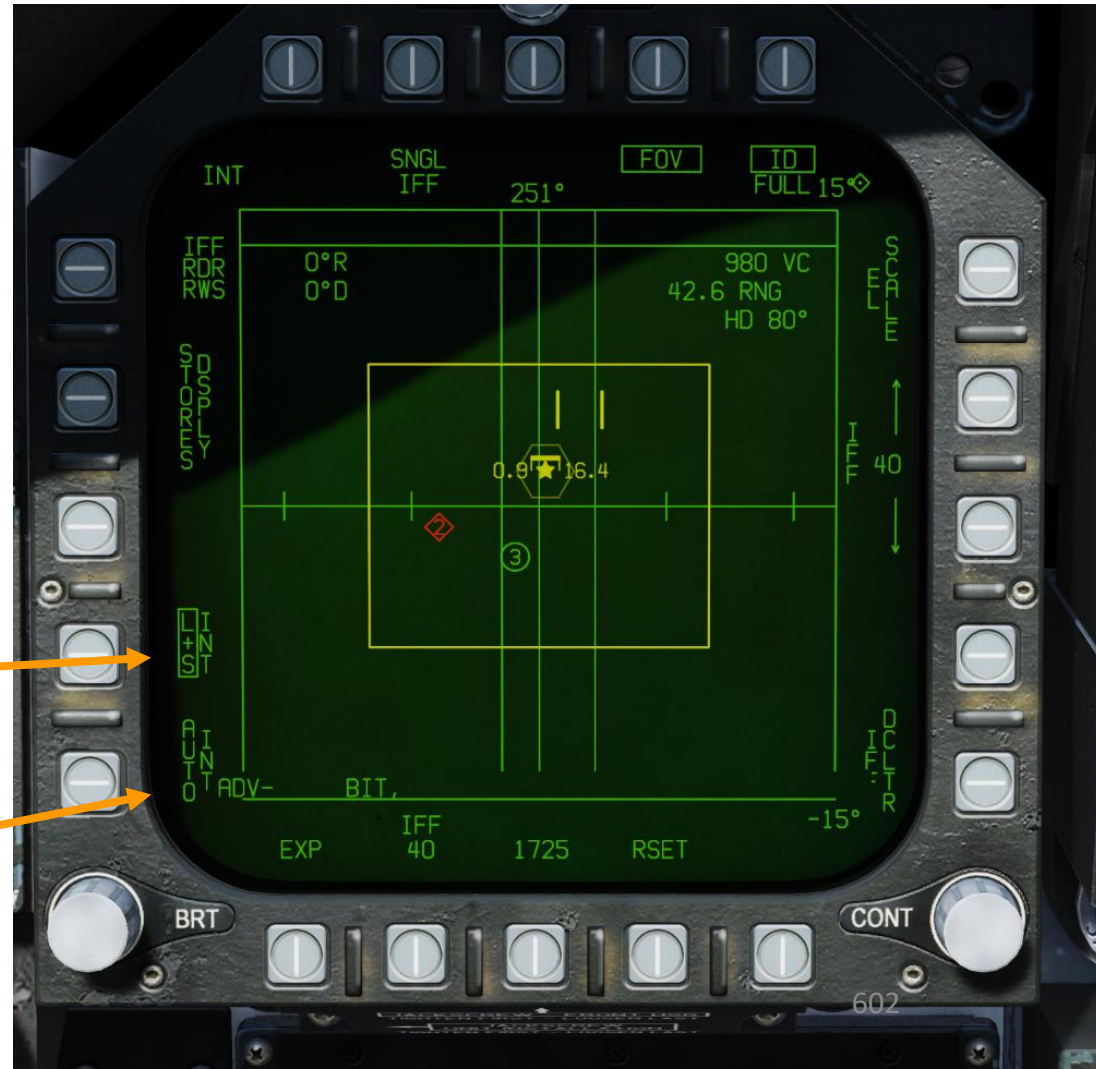
IFF interrogation modes differ based on the combination between “L+S INT” and “AUTO INT” options. See table below.

IFF Scanning Table

	"AUTO INT" unboxed	"AUTO INT" boxed
"L+S INT" unboxed	No automatiic interrogation performed	Automatic scan interrogation about boresight with selected azimuth every 10 seconds
"L+S INT" boxed	Pointed interrogation 22 degrees about L&S (Launch & Steering Primary Target) every 10 seconds	• When no L&S is designated: every 10 seconds, automatic scan interrogation about boresight with selected azimuth w • When L&S is designated: pointed interrogation 22 degrees about L&S when designated

L&S Interrogation: when boxed, automatically performs continuous pointed CIT interrogations on the L&S (Launch & Steering) Primary Target (whenever a L&S is designated).

Auto Interrogation: when boxed, automatically performs scan interrogations at the selected azimuth centered about boresight every 10 seconds.



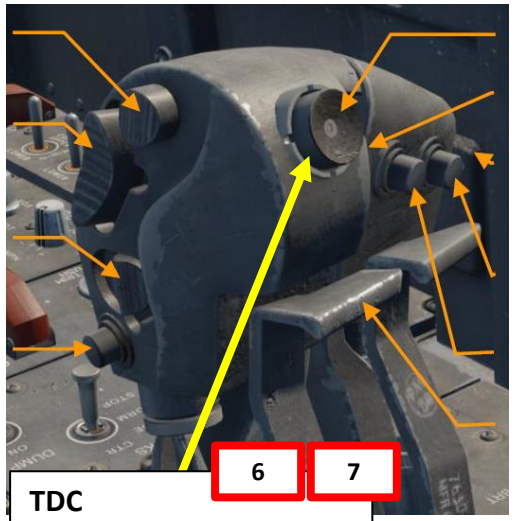
MANUAL IFF (AZ/EL)

Here is a brief example on how to perform an IFF interrogation manually from the AZ/EL page:

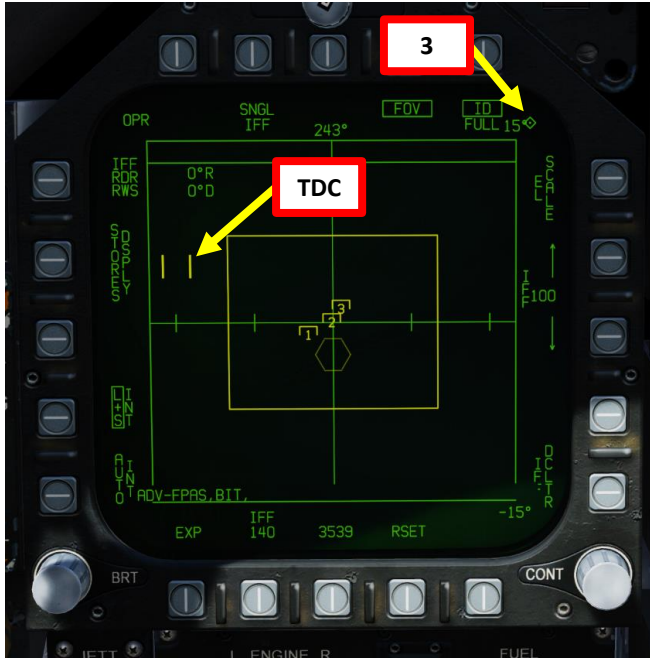
1. Power Up IFF (Identify-Friend-or-Foe) and Datalink systems as shown previously in the MANUAL IFF – NCTR example.
2. Make sure your Radar Power switch is set to OPR and Master Mode is set to A/A.
3. Set Sensor Control Switch to the AZ/EL DDI (Sensor Control Switch Left since we showed up the AZ/EL page on the left DDI). A diamond will appear to show the left DDI is selected.
4. Set AZ/EL Sub-page to IFF RDR.
5. Press the OSB next to L&S INT (Launch & Steering Interrogation) activate (boxed).
6. Move the TDC over the target using the TDC controls.
7. Interrogate target by pressing TDC DEPRESS.

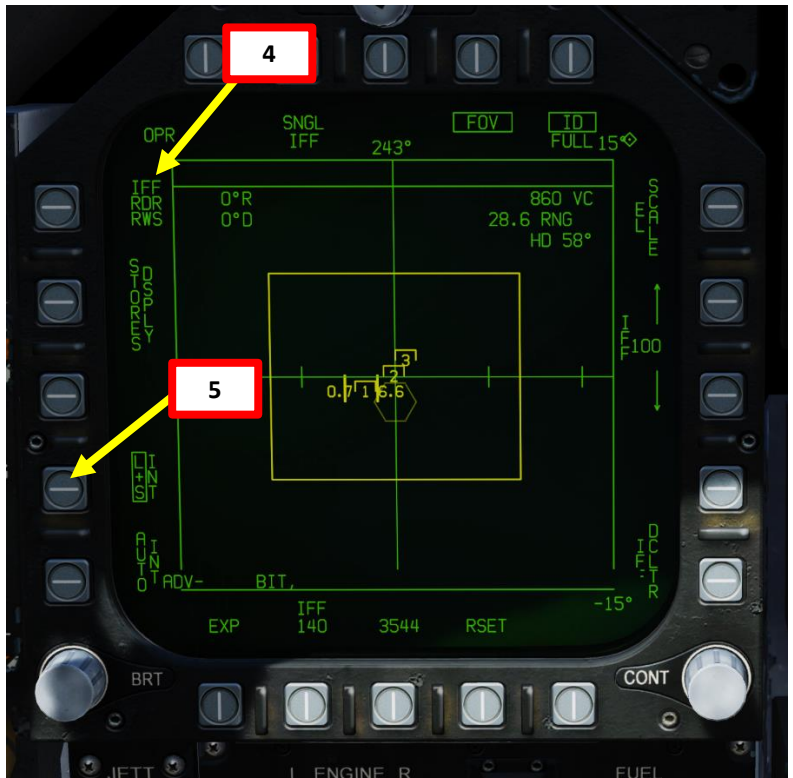


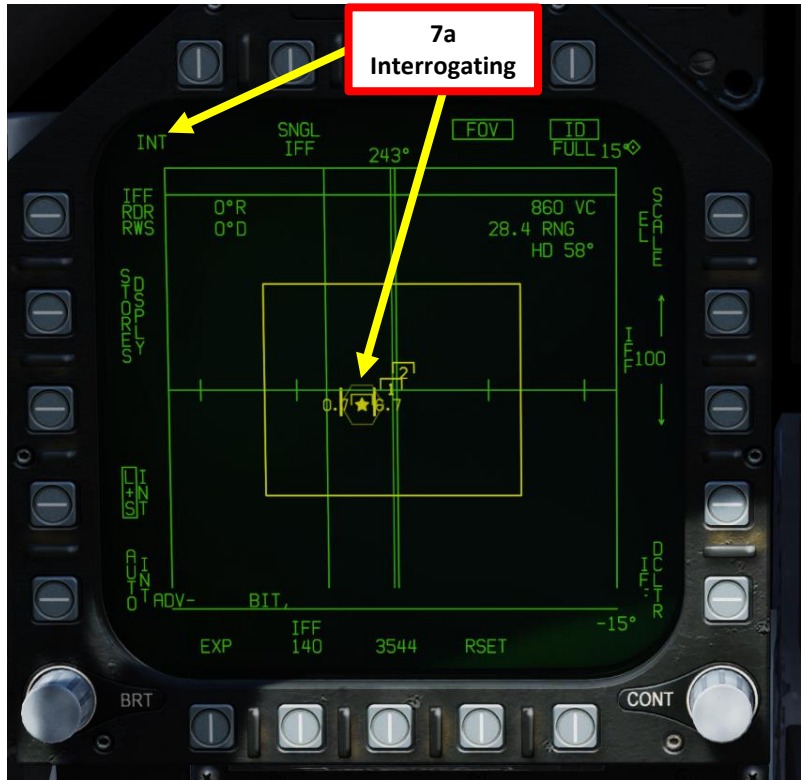
Sensor Control Switch
AFT/FWD/LEFT/RIGHT/DEPRESS

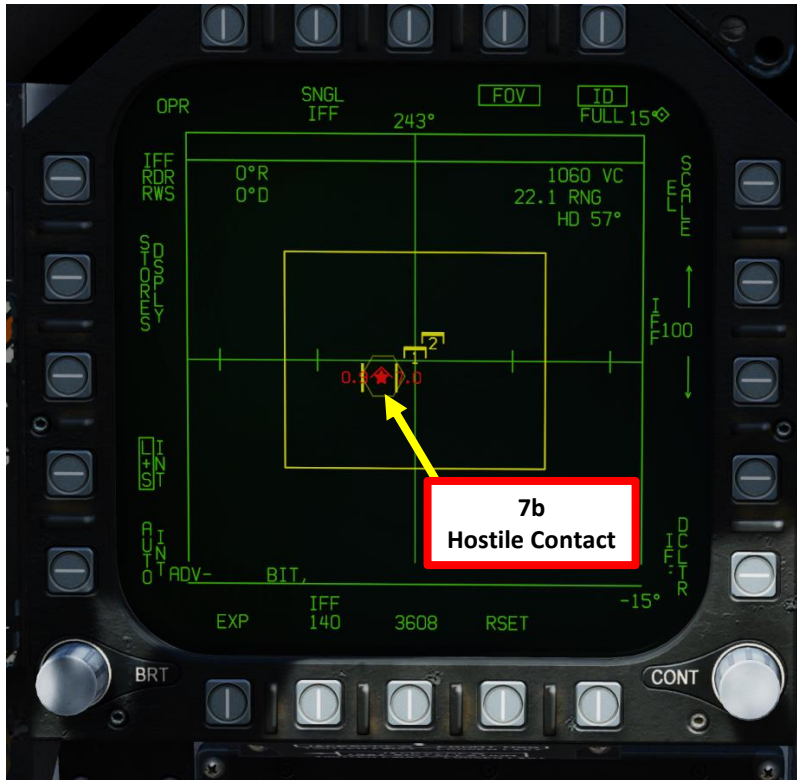


TDC
Left/Right/Up/Down/Depress







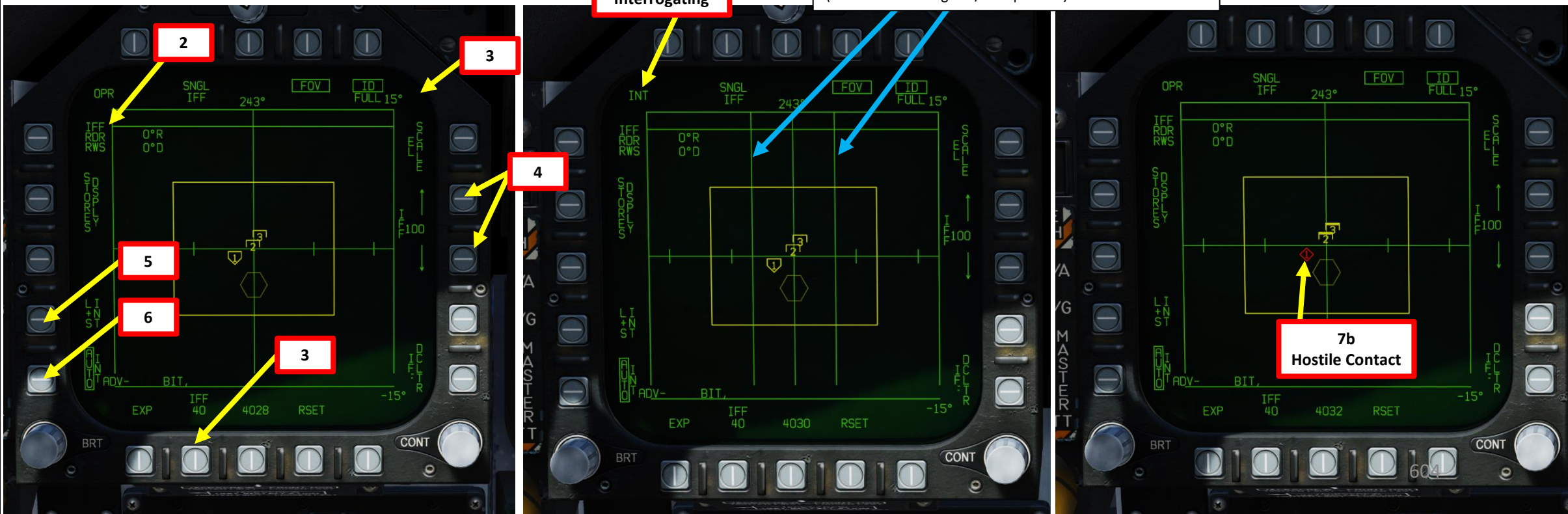


AUTO IFF TUTORIAL (AZ/EL)

You can also perform an automatic IFF interrogation, which reduces your workload significantly.

1. Power Up IFF (Identify-Friend-or-Foe) and Datalink systems as shown previously in the MANUAL IFF example.
2. Set AZ/EL Sub-page to IFF RDR.
3. Select desired IFF scanning azimuth (in deg).
4. Select desired IFF interrogation range (in nm).
5. Make sure the L+S INT (Launch & Steering Interrogation) option is unboxed (de-selected).
6. Select AUTO INT (Automatic Interrogation) option. When selected, it will be boxed.
7. The IFF system will automatically perform scan interrogations at the selected azimuth centered about boresight every 10 seconds.

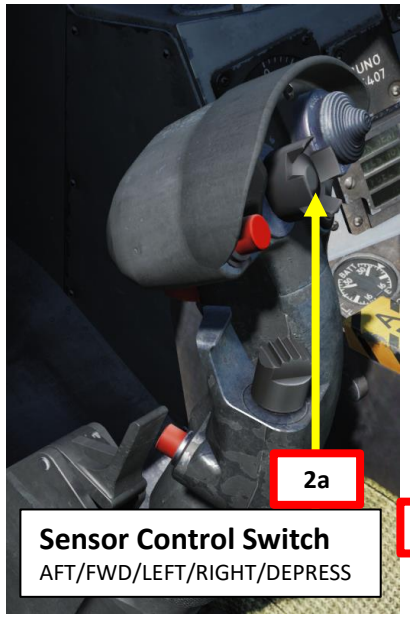
CIT FOV (Field-of-View): shows the azimuthal extent of manual and automatic interrogations made by the CIT (combined interrogator/transponder).



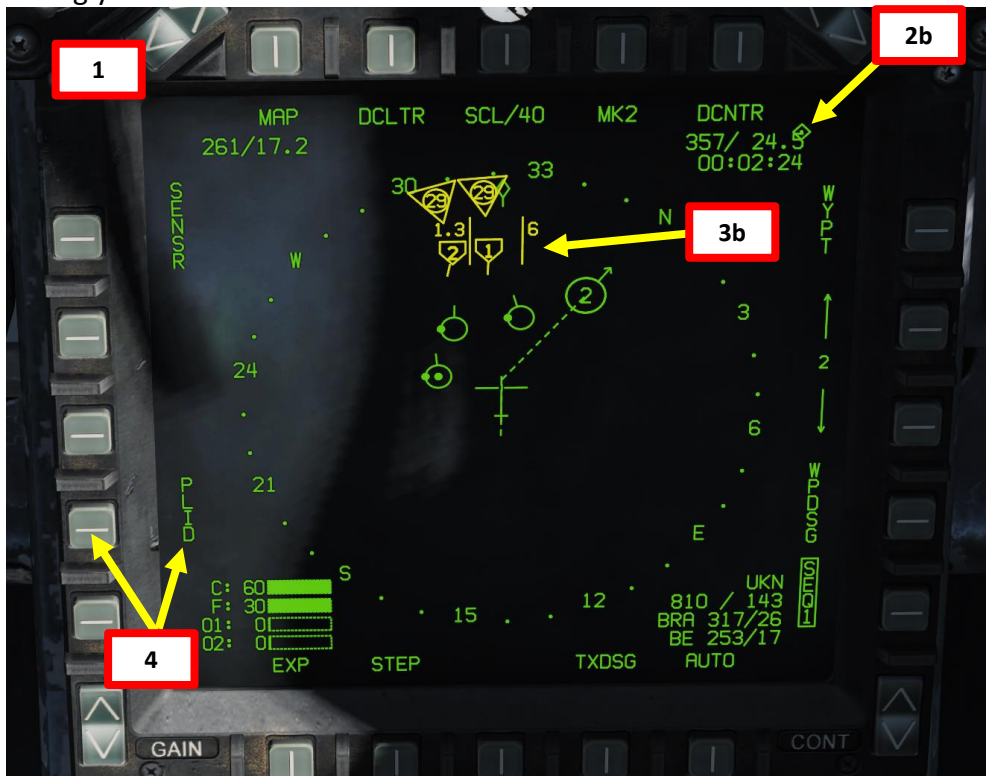
PLID (PILOT IDENTIFICATION)

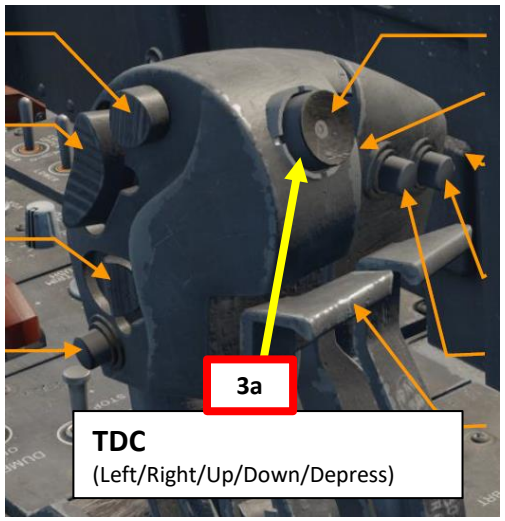
The Pilot Identification (PLID) is a nice function to the Situational Awareness (SA) page that you can use if you want to manually set the top half of a HAFU (your identification) for a non-PPLI (Precise Participant Location and Identification) donors contact on the SA page. The top half of the HAFU can be manually set to friendly, hostile, or unknown.

1. Open SA page
2. Set your Sensor Control Switch to the SA Page (Sensor Control Switch Down since we showed up the SA Page on the Lower AMPCD). A diamond will appear to show the AMPCD is selected.
3. Move the TDC over a contact and gain additional information from it.
4. Press the OSB next to PLID
5. Select which HAFU type you want to set (i.e. HOS for HOSTILE).
6. The HAFU symbol will change accordingly.











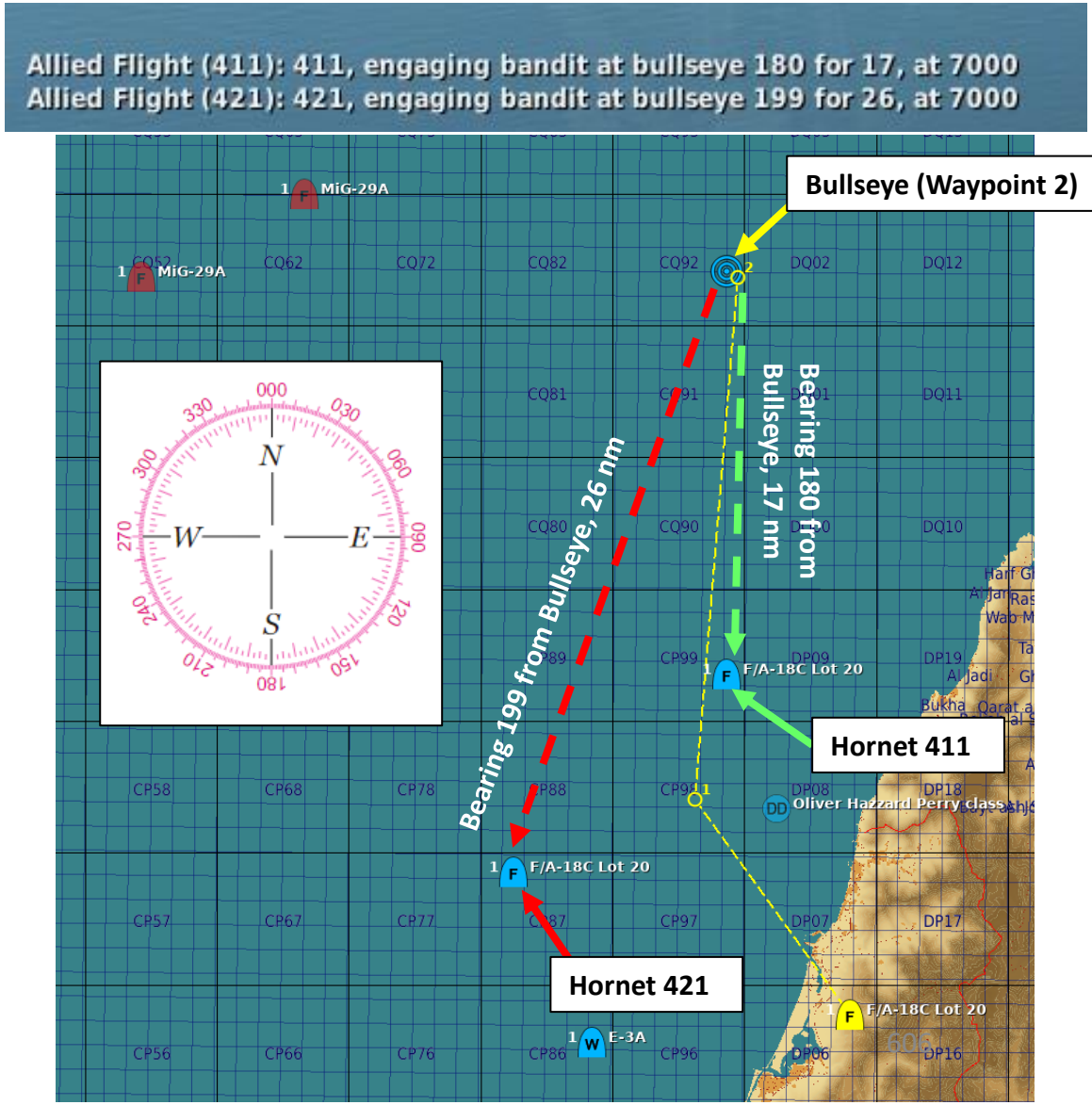
A/A WAYPOINTS & BULLSEYE

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

- Bearing from bullseye
- Range from bullseye
- Altitude

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

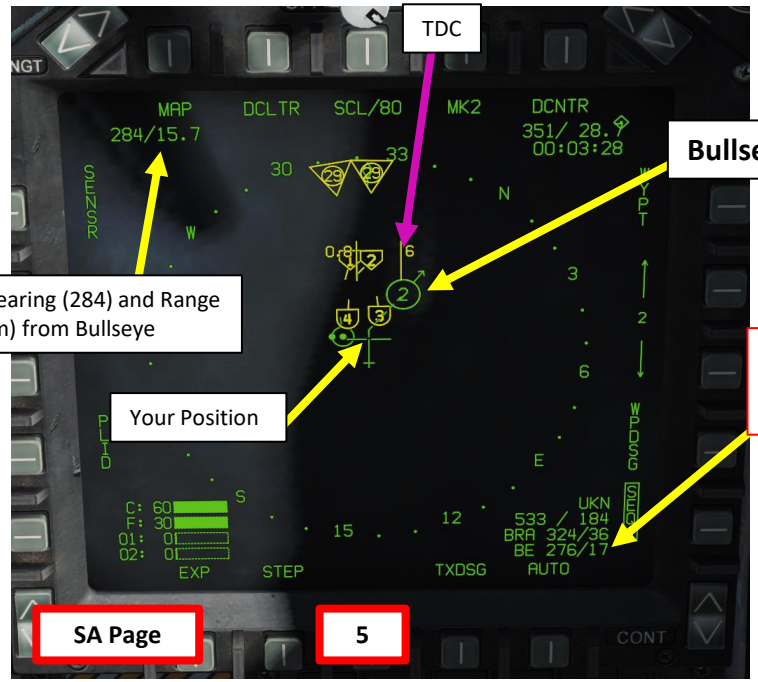




A/A WAYPOINTS & BULLSEYE

In order to gain trackfile information that uses Bullseye as a reference on your SA page, you need to select an existing waypoint and designate it as an "A/A" (Air-to-Air) Waypoint.

1. Open HSI page
2. Select DATA sub-menu
3. If we want to set Waypoint 2 as our Bullseye, select Waypoint 2 using the WYPT arrows.
4. Press the OSB next to "A/A WP" to set Waypoint 2 as an A/A Bullseye Waypoint.
5. You should now see the Bullseye (circle with an arrow pointing North) on your SA page and see a "BE" section in your TDC Target Info.

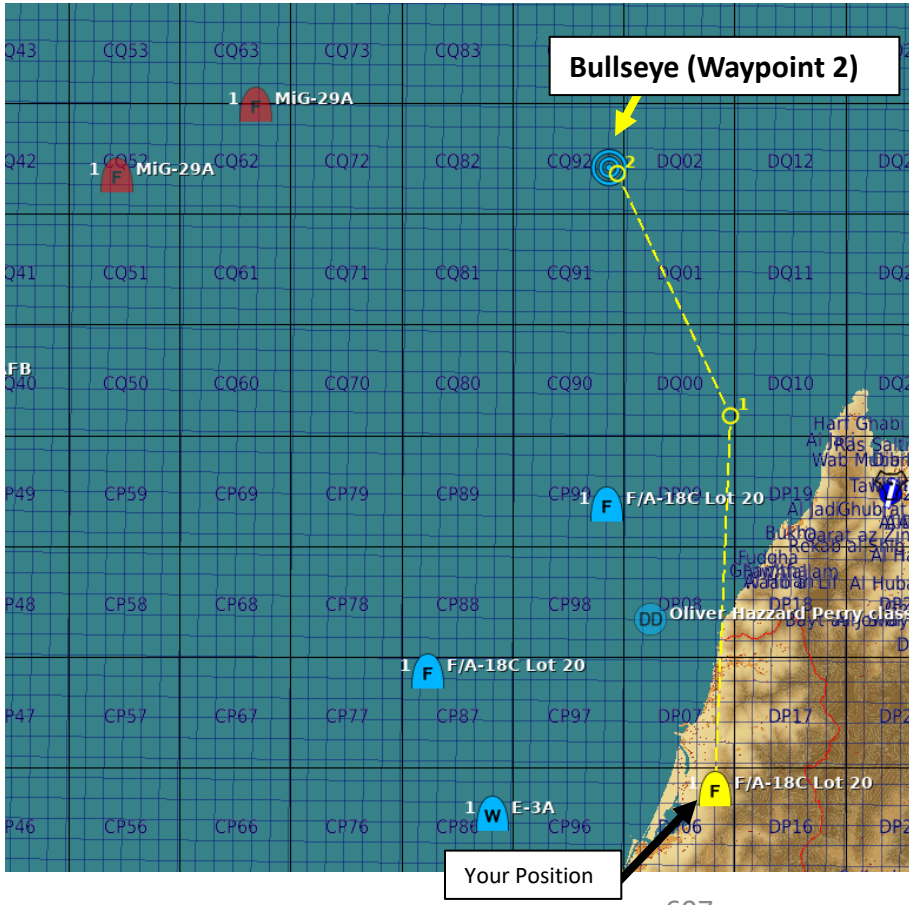


TDC Target Info

- BE 276/17: Target bearing and range from Bullseye. Target is at the bullseye's 276, 17 nm out





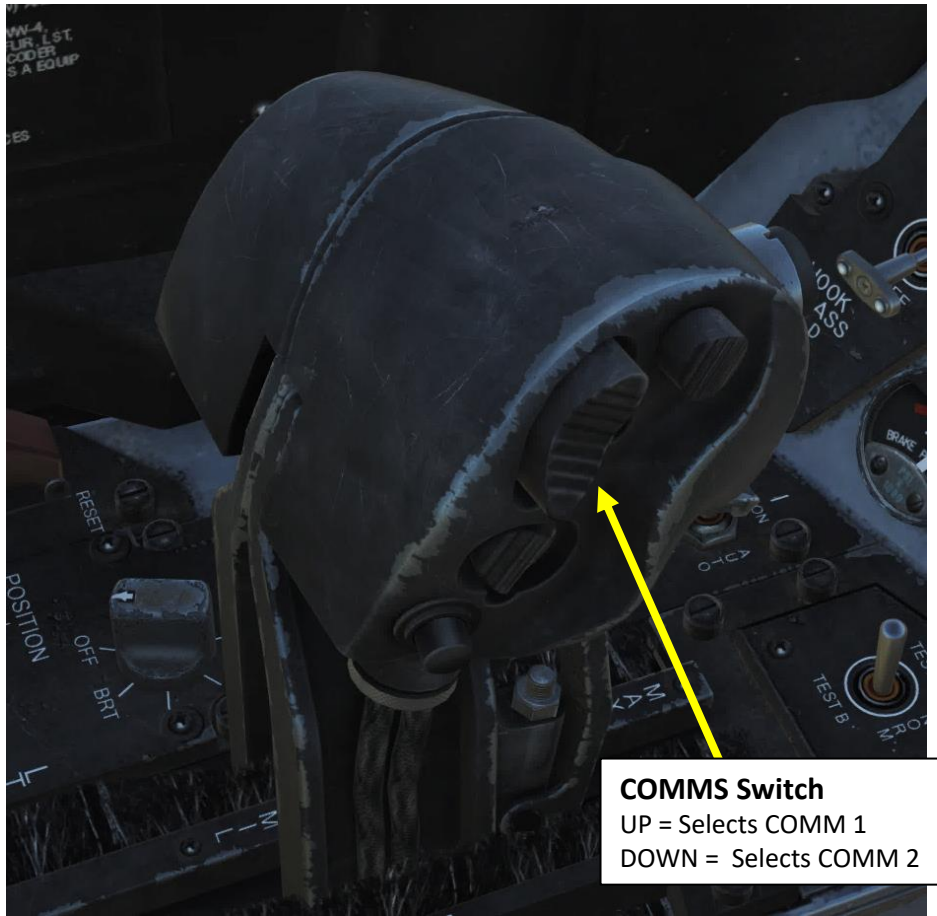


ARC-210 RADIO - INTRO

The ARC-210 radio provides transmission and reception of amplitude and frequency modulated (AM & FM) on frequencies ranging from 30 MHz to 399.975 MHz.

The Hornet has two radios installed: COMM1 and COMM2. They are independent and have 20 preset channels each. The preset frequencies are set in the mission editor.

You can control the radio through the Up-Front Control (UFC).





UFC: Up Front Control



ARC-210(RT-1556 and DCS)

Frequency Band (MHz)	Modulation	Guard Channel (MHz)
30 to 87.995	FM	
*108 to 135.995	AM	121.5
136 to 155.995	AM/FM	
156 to 173.995	FM	
225 to 399.975	AM/FM	243.0 (AM)

*Cannot transmit on 108 thru 117.995 MHz

ARC-210 RADIO - UFC

To turn on radios, rotate the VOL knobs of COMM1 and COMM 2.

To change preset frequency, rotate the COMM1 or COMM2 Channel selector knobs.

To set radio options, press the OSB (Option Select Buttons) to toggle parameters for each option.

To transmit to either COMM1 or COMM2, use the "COMM AFT: Select COMM2" and the "COMM FWD: Select COMM1" bindings.

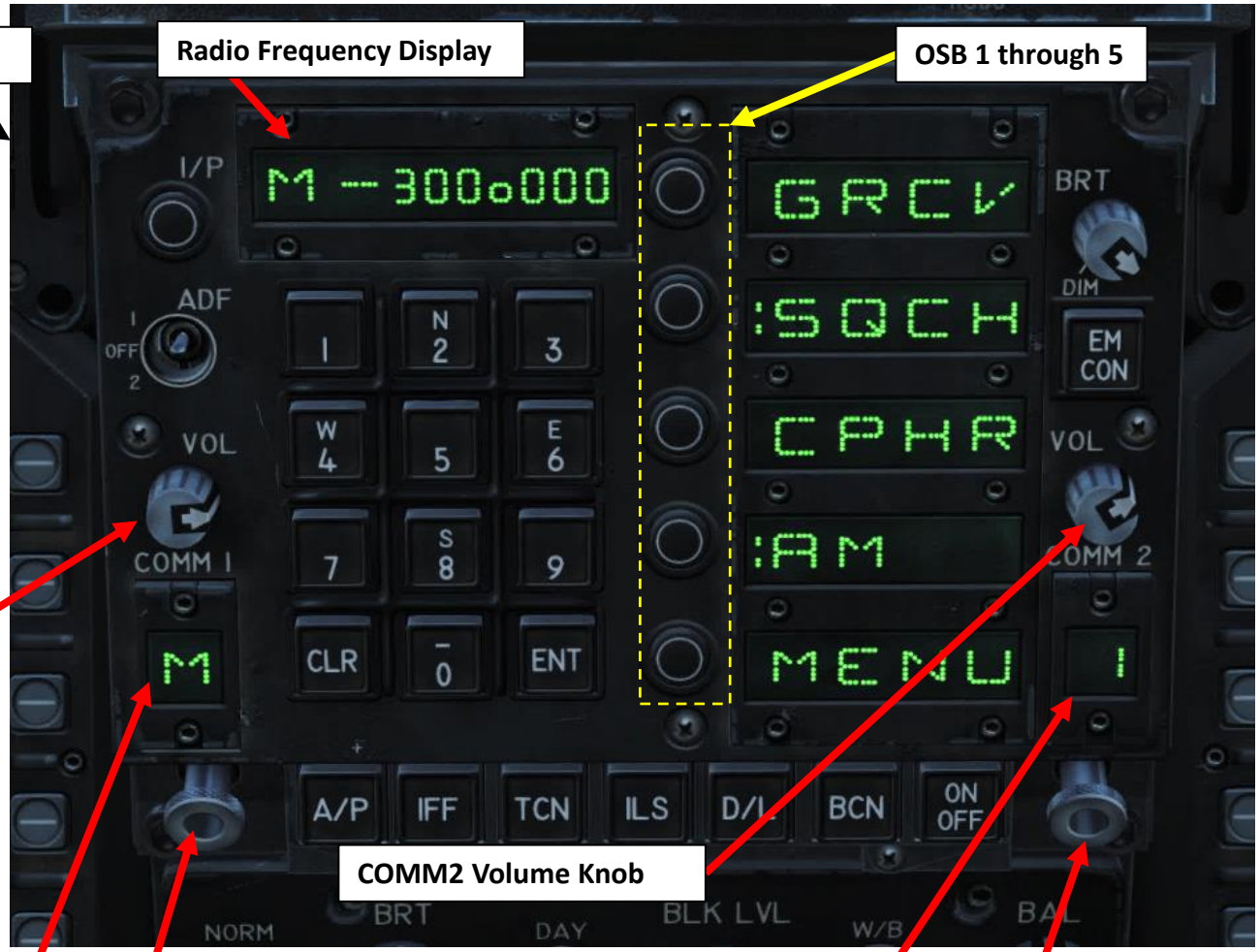
Option Select Button (OSB) 1
GRCV: Guard Receive

Option Select Button (OSB) 2
Toggles Squelch. ":" means Squelch is active.

Option Select Button (OSB) 3
Toggles cipher modes: PLN (plain), CIPH (cipher) and DLY (delay). Not simulated.

Option Select Button (OSB) 4
Selects AM or FM Frequency band. ":AM" means AM Frequency is selected, while ":FM" means FM Frequency is selected. This option is only visible when the frequency selected is within the FM/AM bands as shown on the previous page.

Option Select Button (OSB) 5
Menu Button



COMM1 Preset Channel Selected
- **M**: Manual
- **1 through 20**: Preset Channel
- **G**: Guard (243.000)
- **C**: Cue Channel for Single Channel Ground and Airborne Radio System (SINCGARS)
- **S**: Maritime (Sea)

COMM2 Preset Channel Selected
- **M**: Manual
- **1 through 20**: Preset Channel
- **G**: Guard (243.000)
- **C**: Cue Channel for Single Channel Ground and Airborne Radio System (SINCGARS)
- **S**: Maritime (Sea)

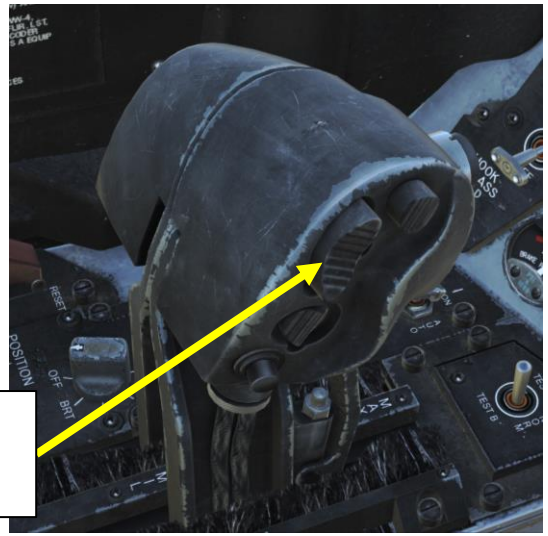
ARC-210 RADIO - UFC

To set a radio frequency manually on an existing preset frequency:

1. Left click on the COMM1 knob to pull it and select COMM1 Radio
2. Scroll mousewheel on COMM1 Radio Channel Selector to M (Manual) Mode
3. Press the OSB next to AM or FM to select the desired frequency band (if we choose FM, the ":FM" symbol will appear when selected)
4. Press CLR on the UFC to clear current frequency
5. Type "127500" on the UFC to set carrier radio frequency 127.5 MHz
6. Press ENT on the UFC to enter this frequency.
7. Press the COMM switch – COMM1 on your throttle to transmit.







7

COMMS Switch
UP = Selects COMM 1
DOWN = Selects COMM 2





FCS: Flight Control System

The primary flight controls are the ailerons, twin rudders, differential/collective leading edge flaps, differential/collective trailing edge flaps and differential/collective stabilators. position the control surfaces. Stick and rudder feel are provided by spring cartridges. Although there is no aerodynamic feedback to the stick and rudder pedals, the effect is simulated by flight control computer scheduling of control surface deflection versus pilot input as a function of flight conditions.

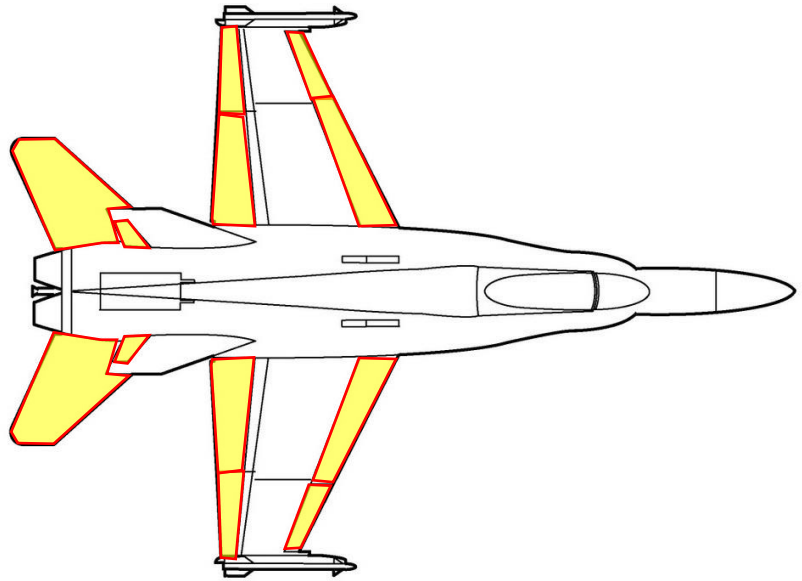
Normally, inputs to the hydraulic actuators are provided by the two flight control computers (FCC A and FCC B) through the full authority control augmentation system (CAS). A direct electrical link (DEL) automatically backs up the CAS. DEL is normally a digital system but has an analog mode for backup aileron and rudder control. If digital DEL fails, a mechanical link (MECH) automatically provides roll and pitch control through a direct mechanical input from the stick to the stabilator actuators. MECH bypasses both flight control computers and the stabilator actuator servo valves.



Pilot input on joystick

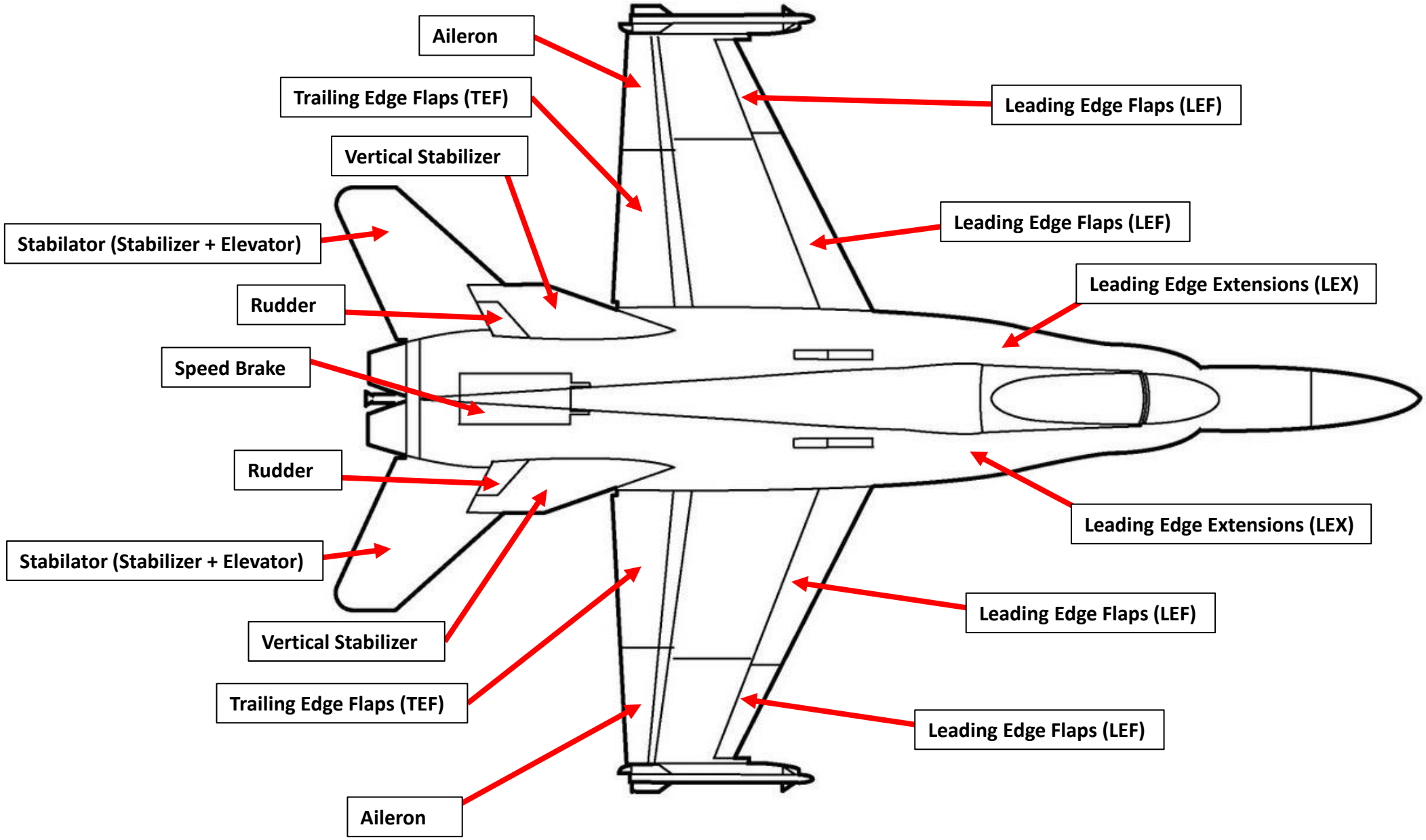
FLIGHT COMPUTER

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



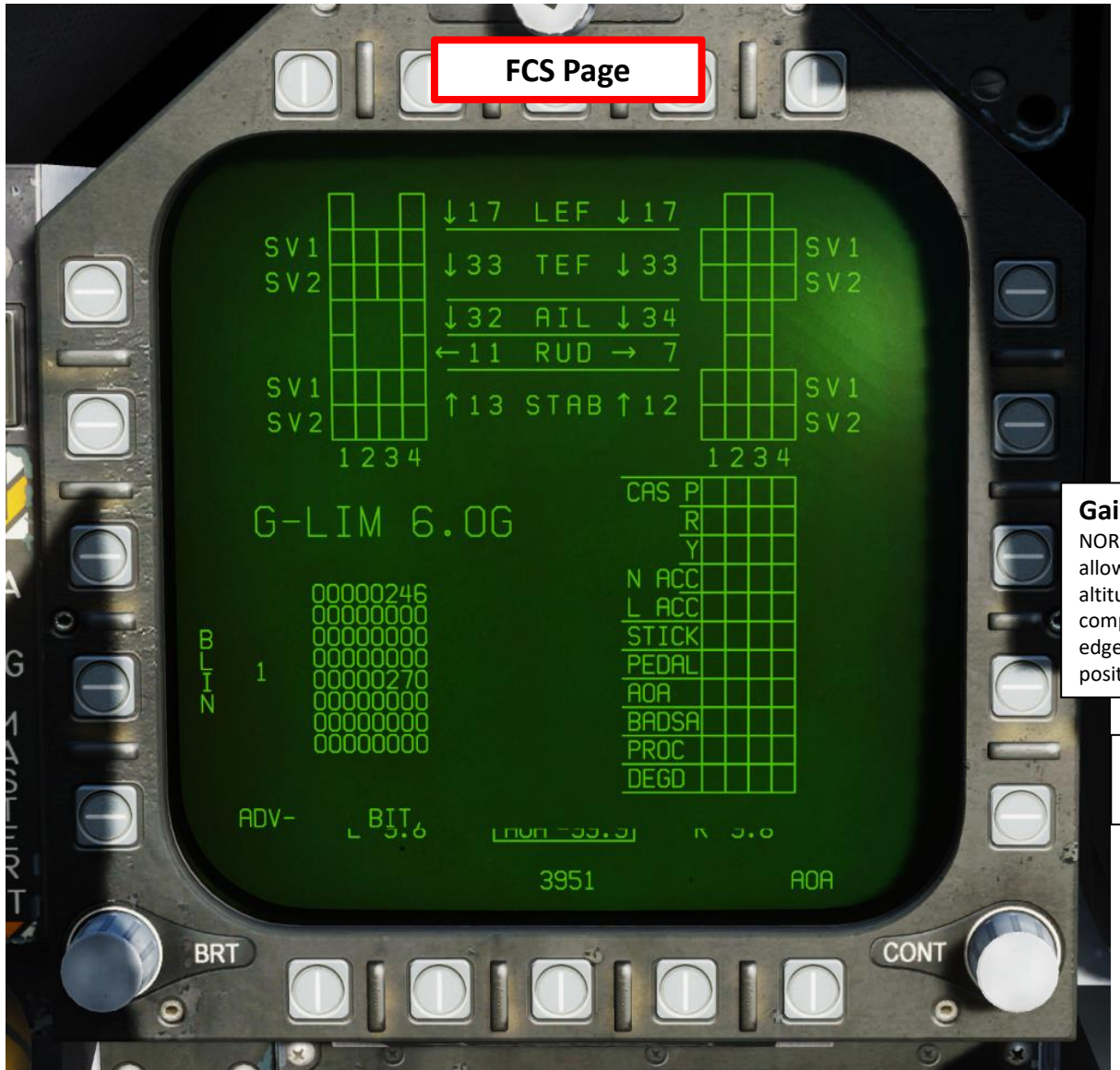
Electrical signal sent to actuators of control surfaces

FCS: Flight Control System



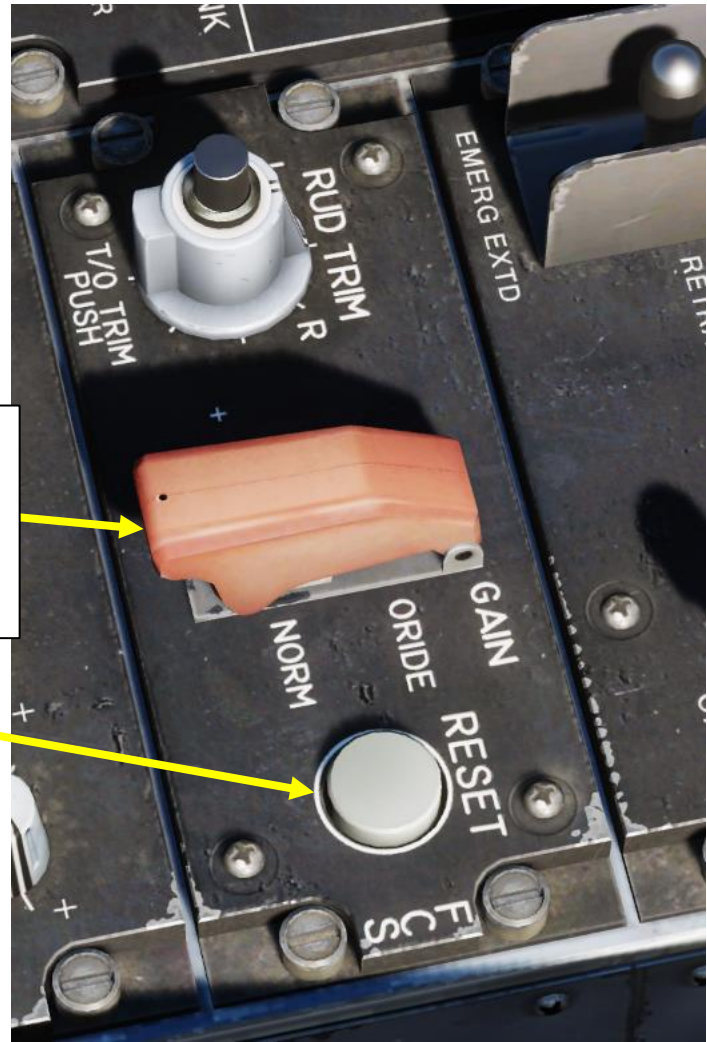
FCS: Flight Control System

Flight control deflections can be monitored on the DDI FCS (Flight Control System) page. This page monitors all four FCS channels and “X”s means a sub-system channel failure, or when the control surfaces droop after the aircraft has been on the ground for a while. In that case, the FCS RESET button resets these faults.



Gain Switch
NORM sets a normal flaps scheduling. OVERRIDE allows the pilot to select a fixed value for speed, altitude, and AOA inputs to the flight control computers and thus a fixed leading and trailing edge flap position dependent on FLAP switch position.

FCS (Flight Control System) Reset Switch



G LIMITER

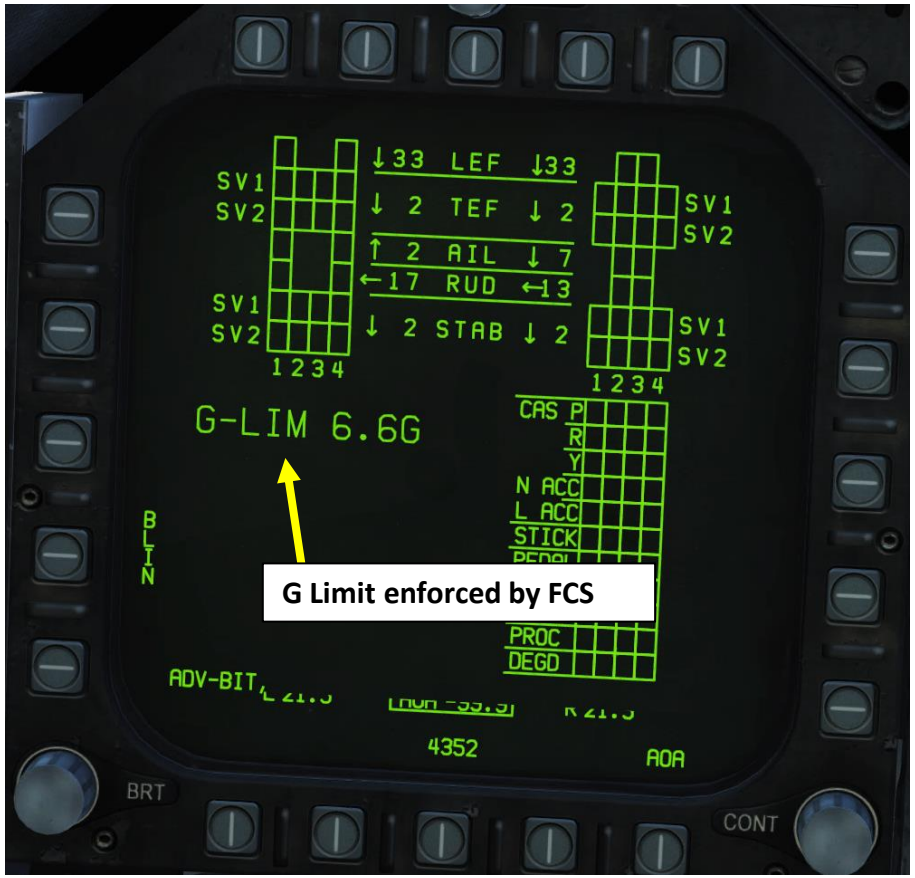
The F/A-18 has a “G Limiter”, which can override flight controls to prevent the exceedance of any load limit.

- The aircraft design load limit is +7.5 g at 32,357 lbs gross weight
- Below 44,000 lbs gross weight, the positive symmetrical command limit is calculated based on fuel state and stores loading.
- Above 44,000 lbs gross weight, the positive symmetrical command limit is fixed at +5.5 g.
- Negative symmetrical command limit is fixed at -3.0 g at all gross weights and stores loading

Note: the G Limiter can be overridden by momentarily pressing the paddle switch with the control stick near full aft. Command limit G is then increased by 33 %. A G-LIM OVRD caution is displayed and the MASTER CAUTION light and tone come on.



Paddle Switch
(Nosewheel steering disengage, Autopilot disengage & G-limiter override switch)



G Limit enforced by FCS

SRM (SPIN RECOVERY MODE)

The spin recovery system, when engaged, puts the flight controls in a spin recovery mode (SRM), which gives the pilot full aileron, rudder and stabilator authority without any control surface interconnects. The leading edge flaps are driven to 33 deg down and the trailing edge flaps are driven to 0 deg. The SRM will also give you a stick direction to recover from the spin.

If Spin Recovery Switch is in NORM, spin recovery mode is engaged when:

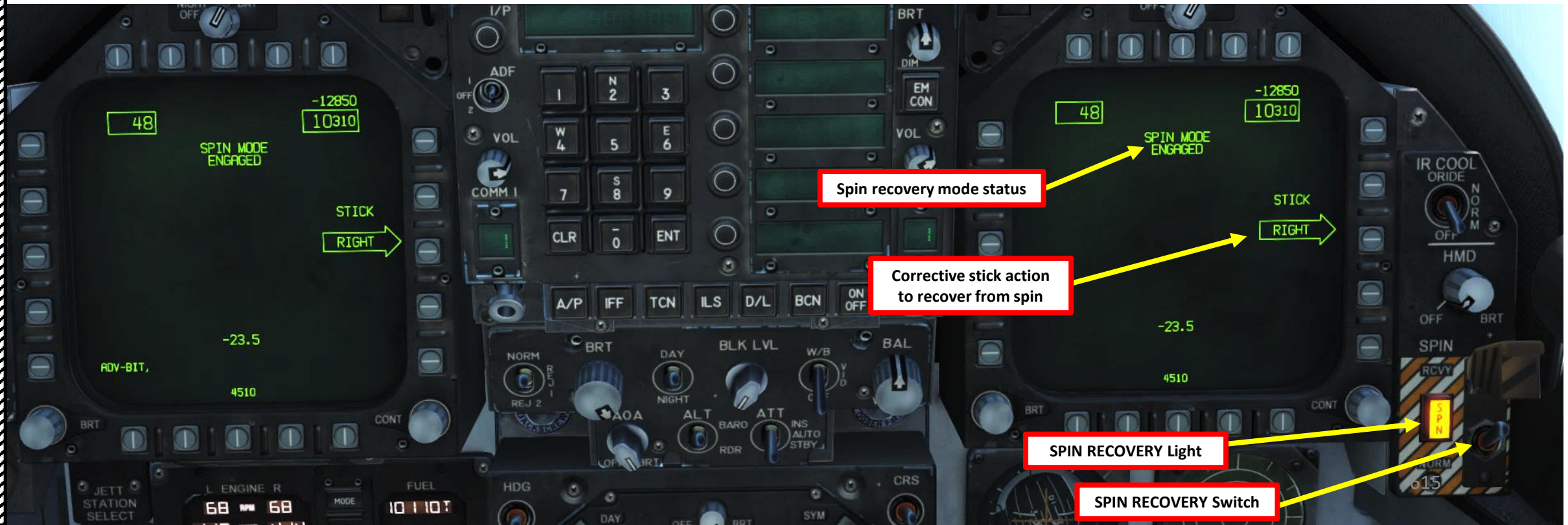
- Airspeed is at 120 +/- 15 kts
- Sustained, uncommanded yaw rate
- Stick is placed in the direction indicated on the DDI spin recovery display

Note: The flight controls revert to CAS (Control Augmentation System) any time the stick is placed in the wrong direction (i.e. prospin), the airspeed increases above 245 kts or the yaw rate decreases to less than 15 deg / sec.

If Spin Recovery Switch is in RCVY, spin recovery mode is engaged when:

- Airspeed is at 120 +/- 15 kts

Note: The flight controls revert to CAS when airspeed increases above 245 knots, but full authority prospin controls can be applied with the switch in RCVY and spin mode engaged.



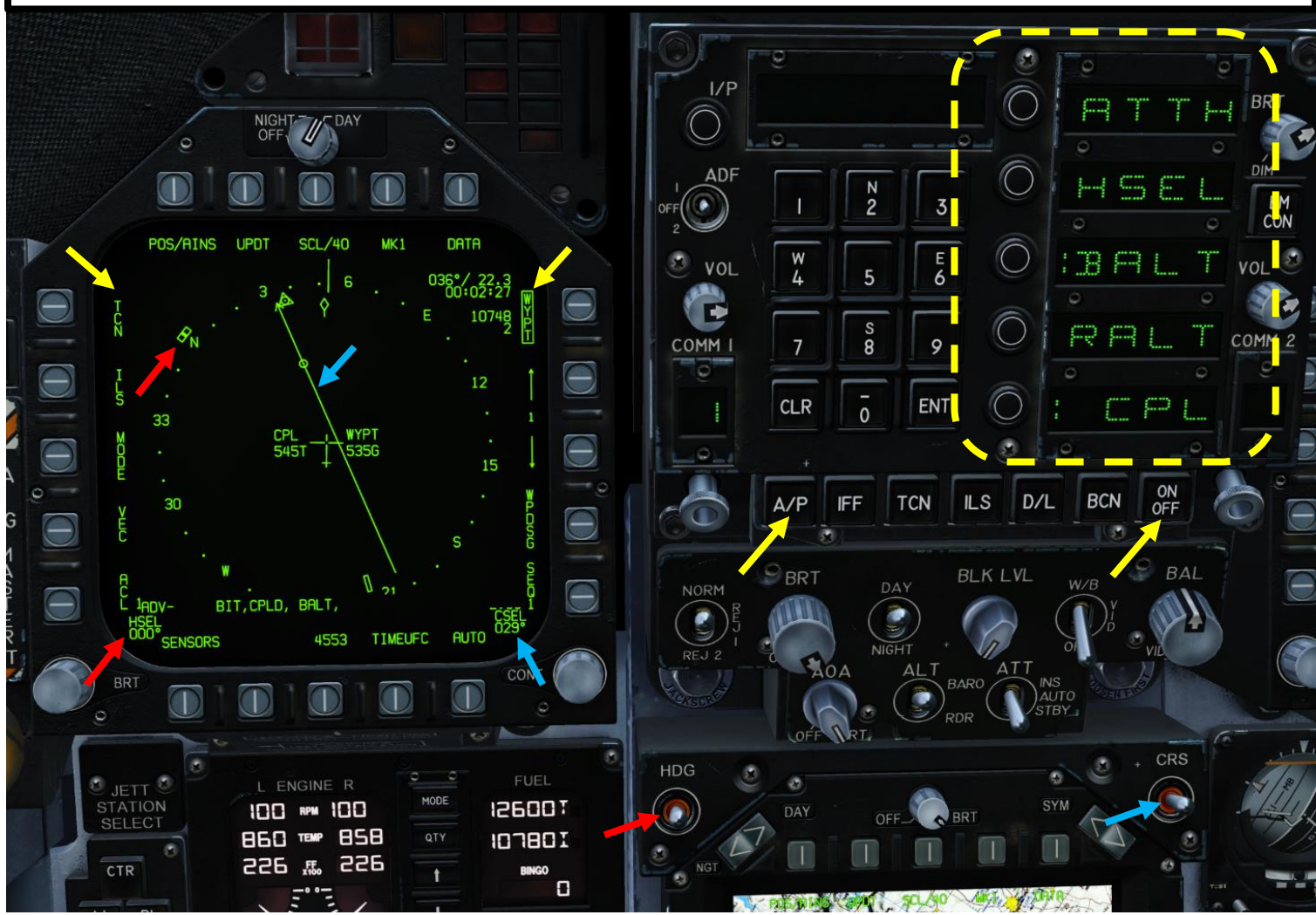
AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

The Hornet has a number of autopilot “relief modes” that assist the pilot in flying the aircraft. You can combine multiple autopilot modes together, in conjunction with the ATC (Automatic Throttle Controller). If you want to steer the aircraft to a particular heading while maintaining a certain speed and altitude, you could for instance engage the AFCS “BALT” mode to maintain altitude, then set the “HSEL” mode to steer your aircraft to the desired heading, then set the ATC to CRUISE mode to maintain your current airspeed. Powerful stuff!

AUTOPILOT AFCS MODES OVERVIEW

- **ATTH**: Attitude Hold. Aircraft will maintain the existing pitch and roll attitude in pitch and +/- 70 degrees in roll
- **BALT**: Barometric Altitude Hold. When engaged, aircraft will maintain current heading and barometric altitude between 0 and 70000 ft
- **HSEL**: Heading Select. Aircraft will turn to and fly the heading as set on the HSI (Horizontal Situation Indicator).
- **RALT**: Radar Altitude Hold. Aircraft will maintain current heading and radar altitude between 0 and 5000 ft
- **CPL**: Coupled Steering Mode. Aircraft will steer towards a selected waypoint, TACAN station or designated target (must require a weapon with an Azimuth Steering Line like a bomb released in AUTO/CCRP mode). A specific course can be set to approach the tracked waypoint/TACAN from.

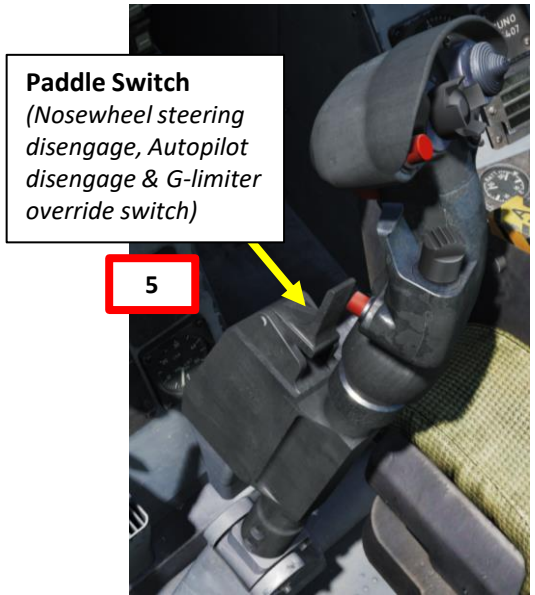
AFCS OVERVIEW



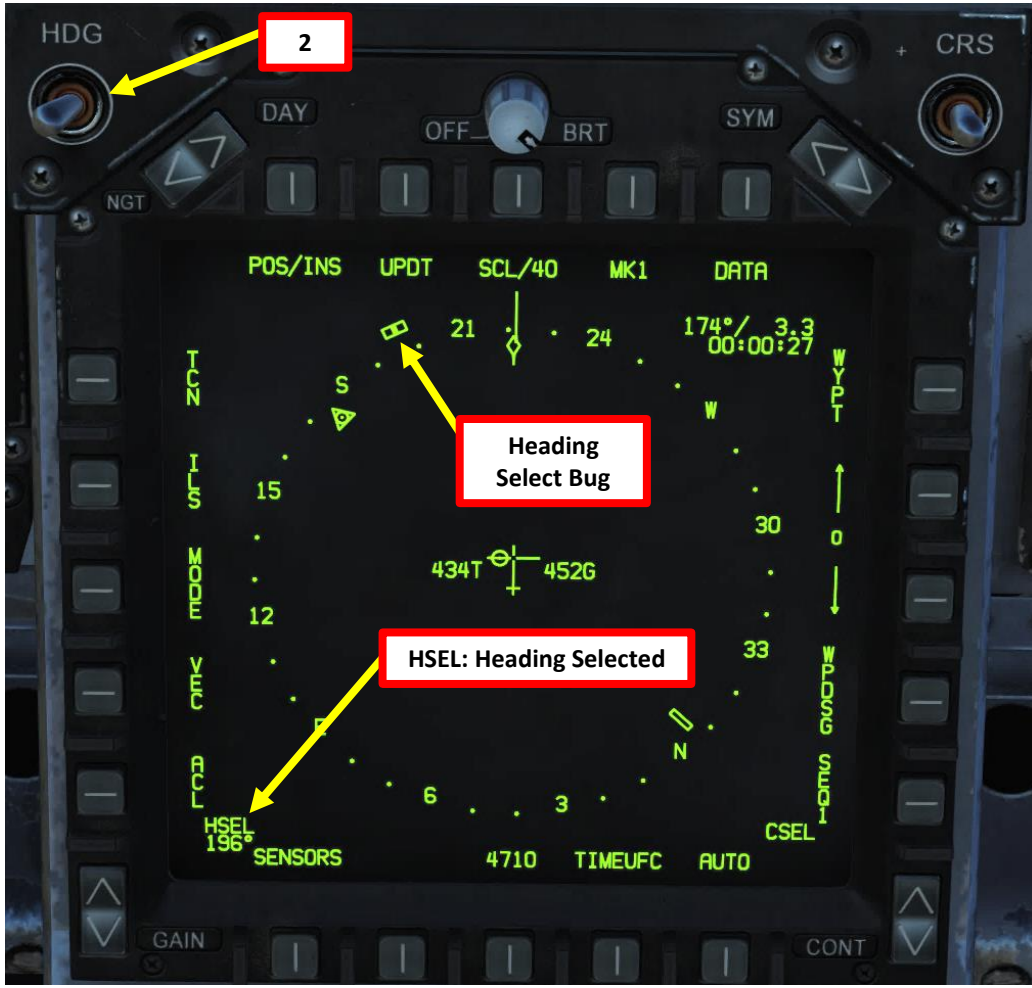
AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

ATTH/BALT/HSEL/RALT MODE PROCEDURE

1. Make sure your stick is centered, no force is applied on it and that you have an appropriate deadzone (see CONTROLS SETUP - WHAT YOU NEED MAPPED section). Stick movement automatically inhibits autopilot activation.
2. If you intend to use the HSEL (Heading Select) mode, set the desired heading with the HDG switch above the AMPCD screen. Otherwise, disregard this step.
3. Press the **A/P** button on the UFC (Up-Front Controller) to display autopilot modes
4. Press on the OSB (Option Select Button) next to the desired autopilot mode:
   - **ATTH**: Attitude Hold. Aircraft will maintain the existing pitch and roll attitude between +/- degrees in pitch and +/- 70-degrees in roll
   - **BALT**: Barometric Altitude Hold. When engaged, aircraft will maintain current heading and barometric altitude between 0 and 70000 ft
   - **HSEL**: Heading Select. Aircraft will turn to and fly the heading as set on the HSI (Horizontal Situation Indicator).
   - **RALT**: Radar Altitude Hold. Aircraft will maintain current heading and radar altitude between 0 and 5000 ft.
5. You can disengage autopilot by pressing the Paddle Switch on the control stick.







AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

COUPLED STEERING (CPL) MODE

INTRODUCTION

When in Coupled mode, the autopilot can fly to a waypoint or a TACAN station, can fly a specific course to a waypoint or TACAN station, and can automatically fly along a sequence of waypoints. Coupled mode only controls roll, not pitch. You can either control pitch yourself, or activate one of the pitch modes (BARO or RALT) together with CPL.

- **CPL WYPT**: Attitude Hold. Aircraft will maintain the existing pitch and roll attitude in pitch and +/- 70 degrees in roll
- **CPL TCN**: Barometric Altitude Hold. When engaged, aircraft will maintain current heading and barometric altitude between 0 and 70000 ft
- **CPL ASL**: Barometric Altitude Hold. When engaged, aircraft will maintain current heading and barometric altitude between 0 and 70000 ft

Note: When coupled mode is active, moving the stick will temporarily override it.







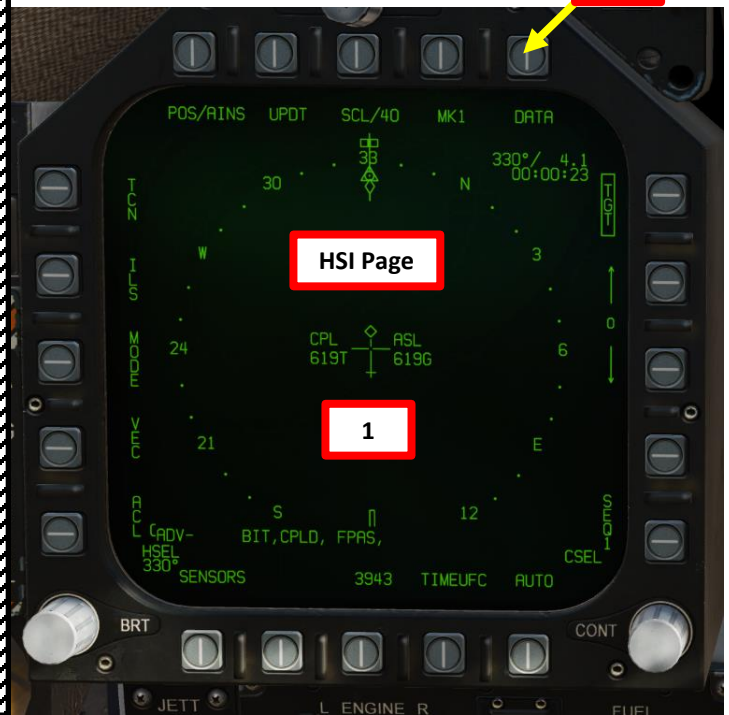
AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

COUPLED STEERING (CPL) MODE

INTRODUCTION

From the HSI (Horizontal Situation Indicator) page, you can access the DATA – A/C sub-menu to toggle the autopilot **BLIM (Bank Limiter)**. You can toggle between NAV (Navigation) Bank Limiter and TAC (Tactical) Bank Limiter modes.

- In NAV BLIM mode, autopilot commanded bank is limited to 30° when coupled.
- In TAC BLIM mode, autopilot commanded bank is limited to 60° when coupled.







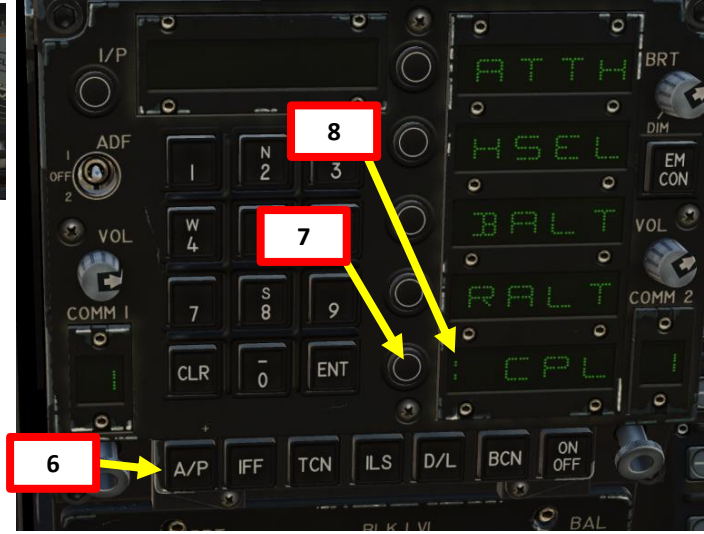
AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

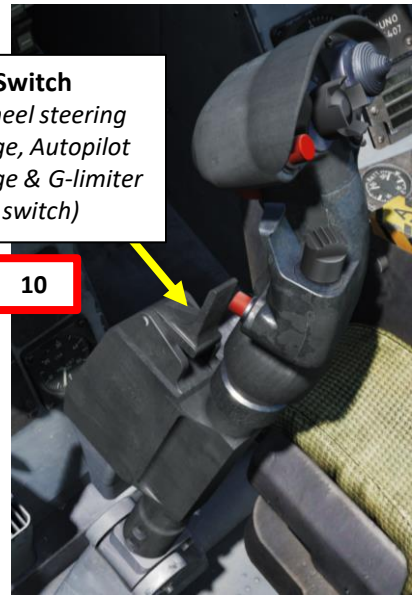
COUPLED STEERING (CPL) MODE

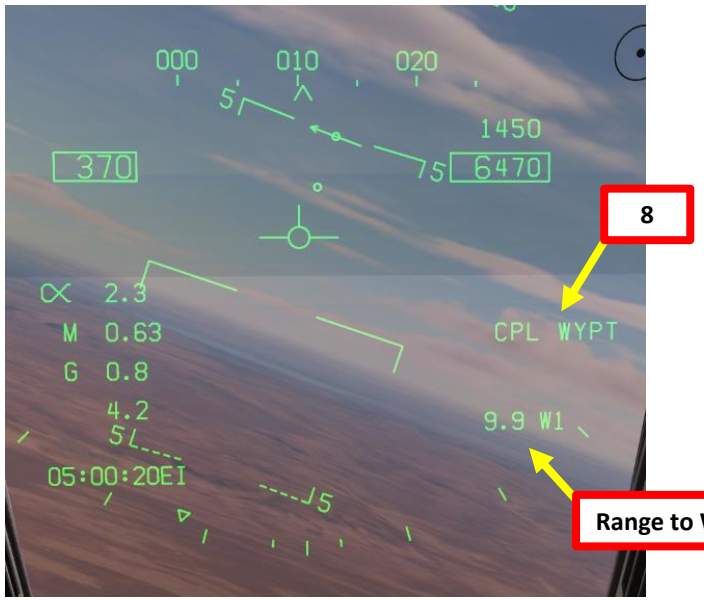
CPL WYPT (WAYPOINT) SUB-MODE EXAMPLE

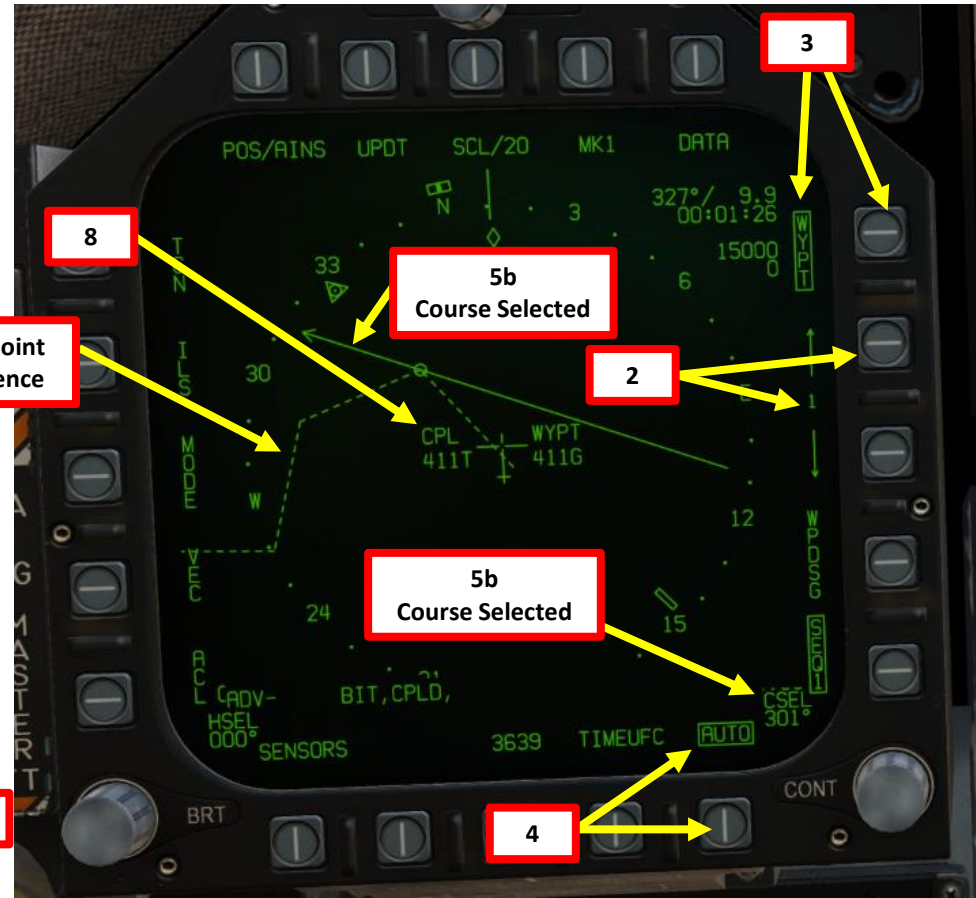
1. Make sure your stick is centered, no force is applied on it and that you have an appropriate deadzone (see CONTROLS SETUP - WHAT YOU NEED MAPPED section). Stick movement automatically inhibits autopilot activation.
2. Select a desired waypoint using the HSI format.
3. Activate the WYPT navigation mode by pressing OSB next to WYPT. WYPT is boxed when selected.
4. If desired, select AUTO to automatically follow the desired waypoint sequence (SEQ1 in our case).
5. If desired, click and hold (Left/Right mouse button) the CRS (Course Set) knob to set desired course (CSEL) to intercept the waypoint from.
6. Press the AP button on the UFC to show the autopilot options.
7. Press the OSB adjacent “CPL” to activate coupled autopilot mode.
8. A colon will appear (“:CPL”) to indicate that it is active. “CPL WYPT” will appear on both the HSI and HUD.
9. The autopilot will follow the selected waypoint (or waypoint sequence if AUTO is selected).
10. You can disengage autopilot by pressing the Paddle Switch on the control stick.









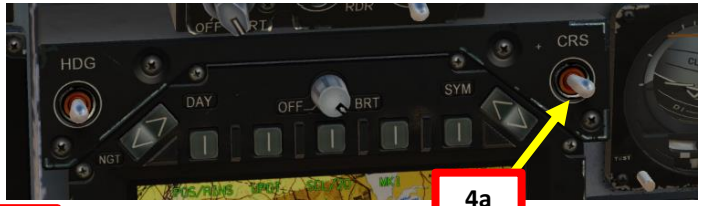


AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

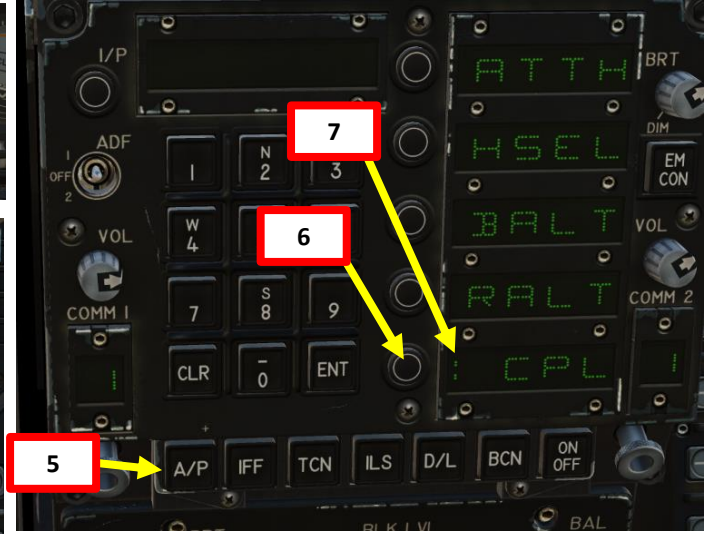
COUPLED STEERING (CPL) MODE

CPL TCN (TACAN) SUB-MODE EXAMPLE

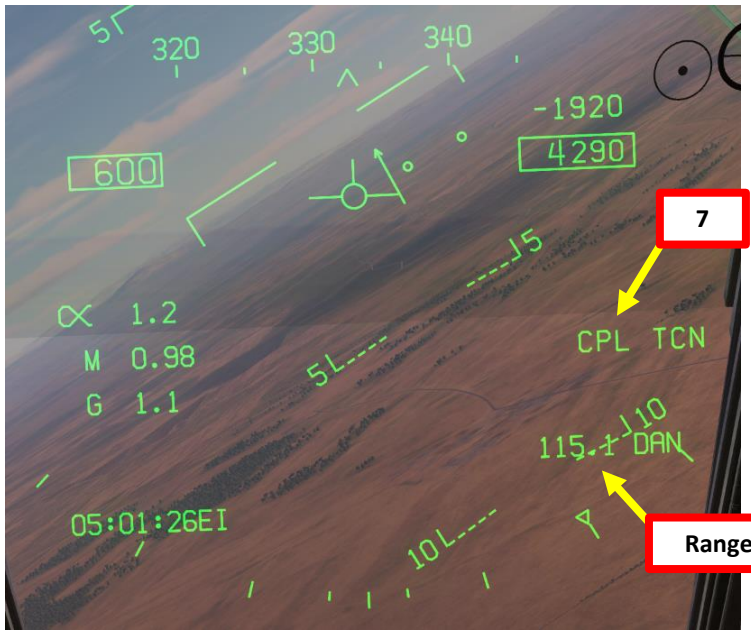
1. Make sure your stick is centered, no force is applied on it and that you have an appropriate deadzone (see CONTROLS SETUP - WHAT YOU NEED MAPPED section). Stick movement automatically inhibits autopilot activation.
2. Select the desired TACAN station using the UFC. Verify that the TACAN is on.
3. Activate the TCN navigation mode by pressing OSB next to TCN. TCN is boxed when selected.
4. If desired, click and hold (Left/Right mouse button) the CRS (Course Set) knob to set desired course (CSEL) to intercept the TACAN station from.
5. Press the AP button on the UFC to show the autopilot options.
6. Press the OSB adjacent “CPL” to activate coupled autopilot mode.
7. A colon will appear (“:CPL”) to indicate that it is active. “CPL TCN” will appear on both the HSI and HUD.
8. The autopilot will follow the selected TACAN station.
9. You can disengage autopilot by pressing the Paddle Switch on the control stick.

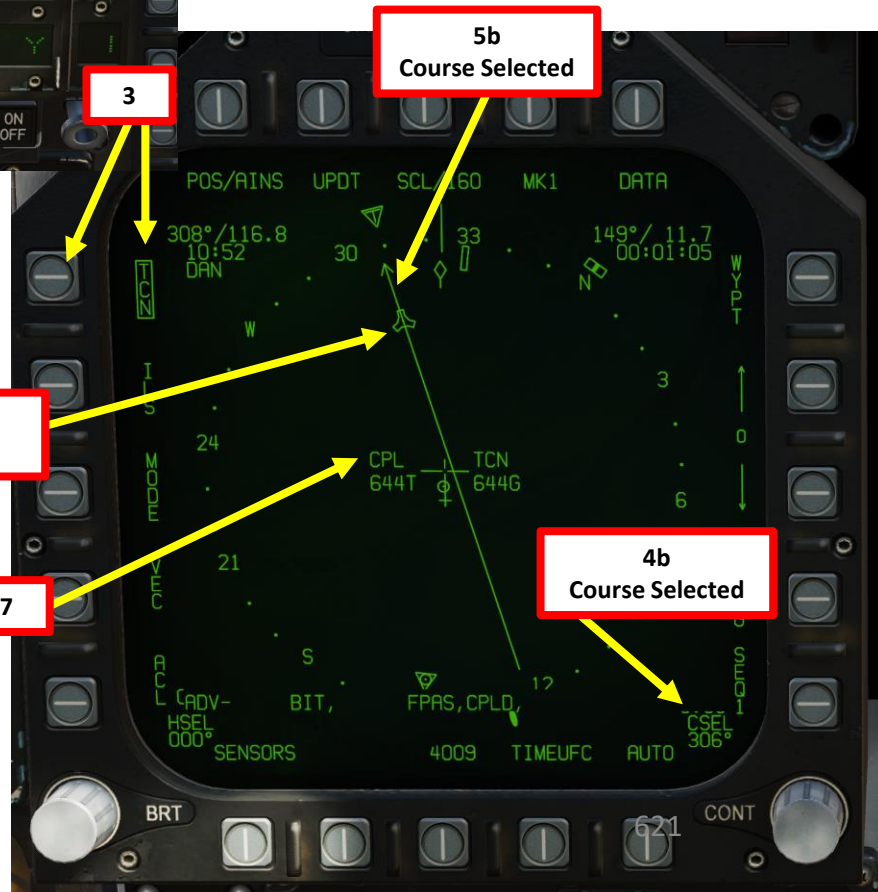










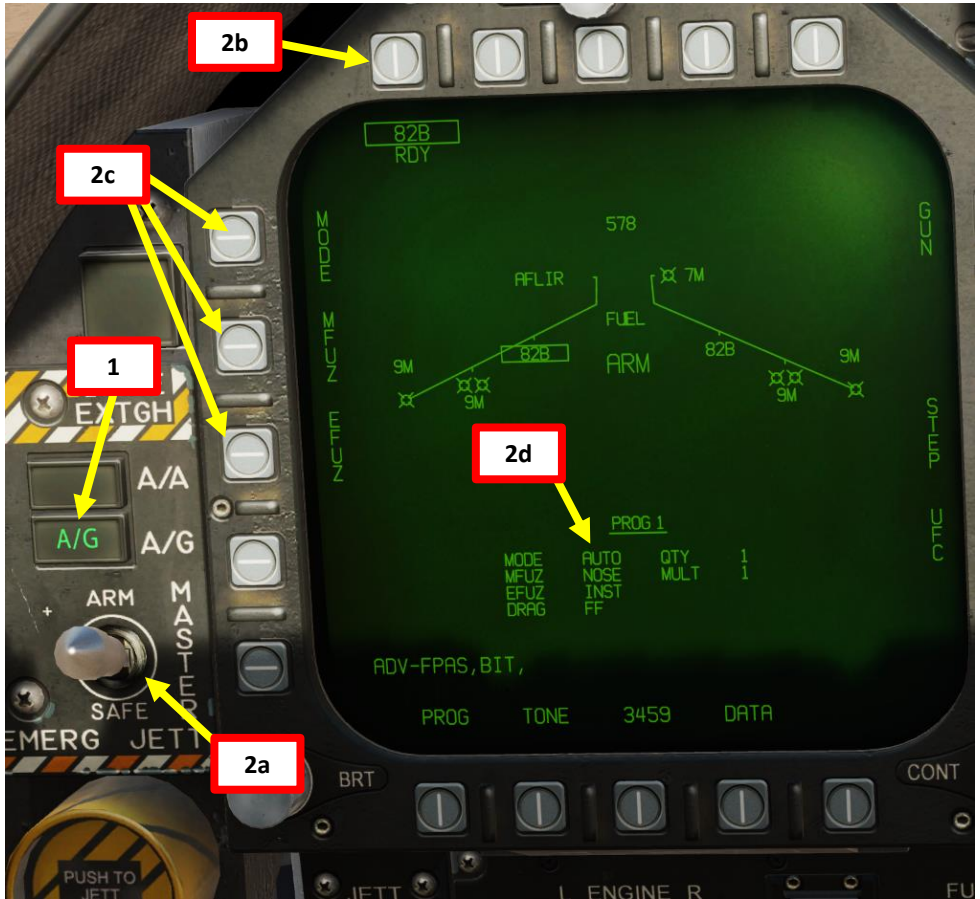


AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

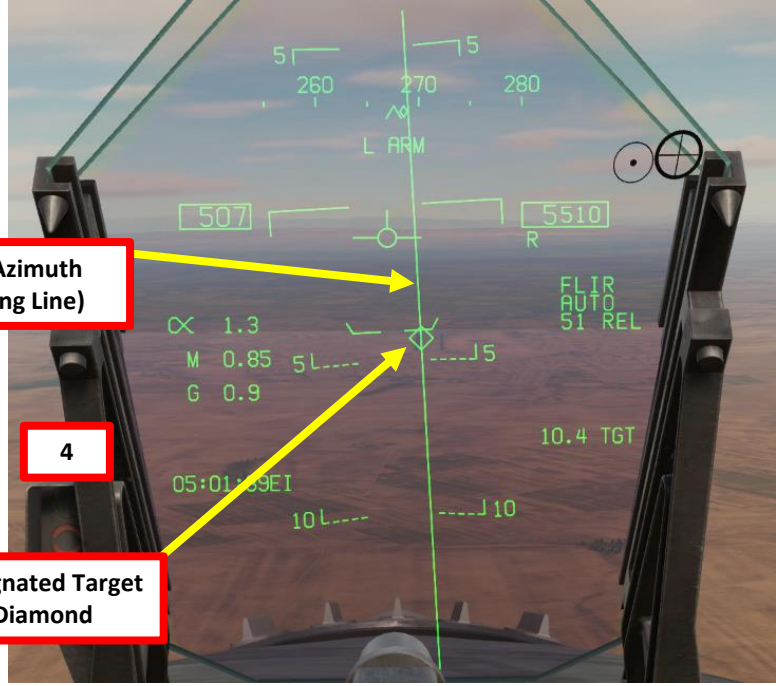
COUPLED STEERING (CPL) MODE

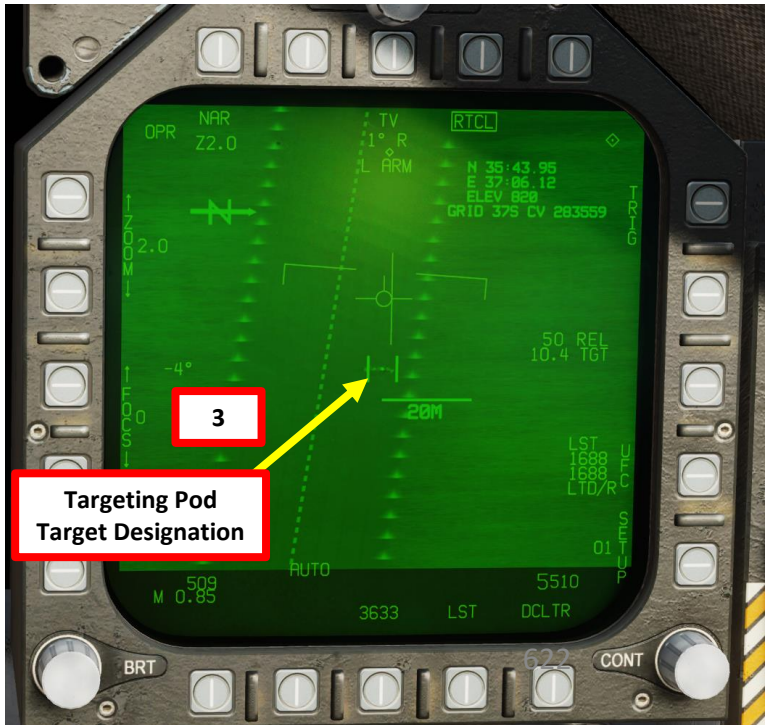
CPL ASL (AZIMUTH STEERING LINE) SUB-MODE EXAMPLE

1. Select A/G Master Mode
2. Select and arm a weapon that can be released with a CCRP/AUTO mode (like a MK-82 bomb, for instance)
3. Designate a target using available sensors (like a targeting pod designating a target with Auto/Point Track).
4. When target is designated, HSI page should display a boxed TGT (Target) and the HUD should display an ASL (Azimuth Steering Line) with a target designation diamond.









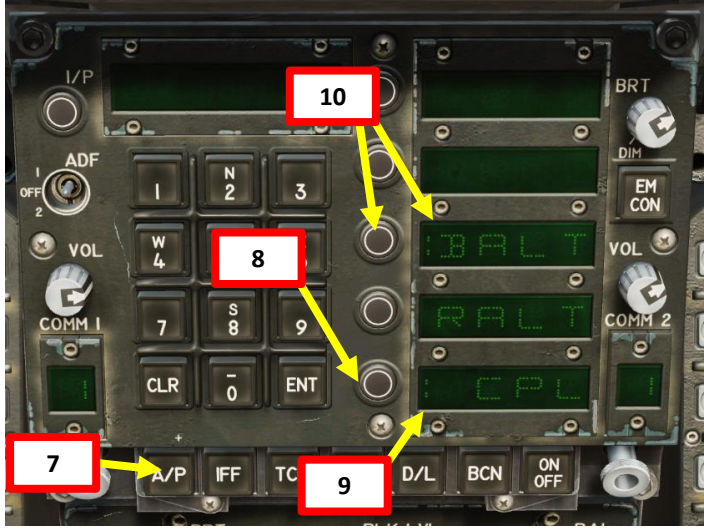
AFCS (AUTOMATIC FLIGHT CONTROL SYSTEM)

COUPLED STEERING (CPL) MODE

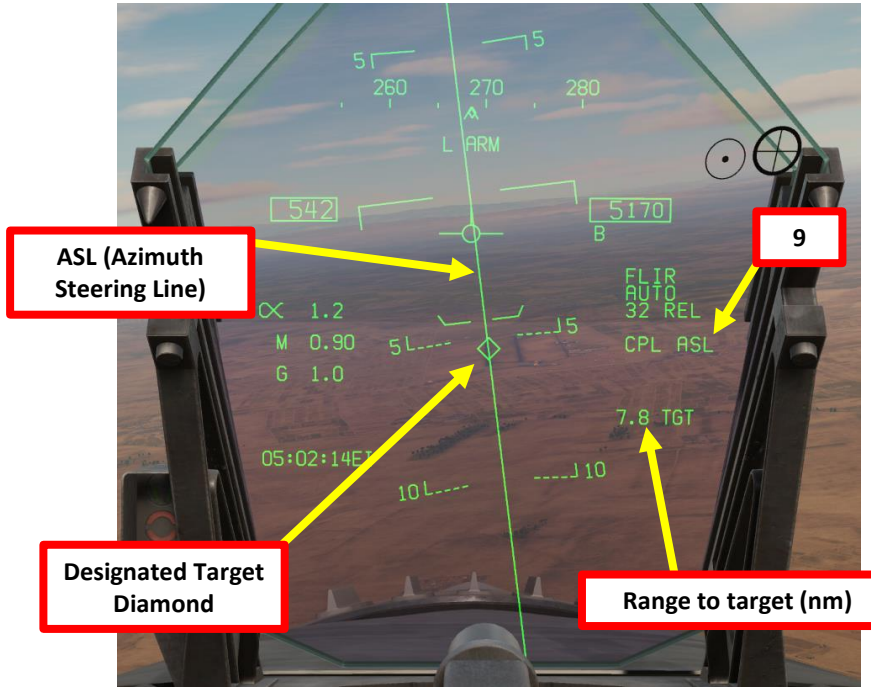
CPL ASL (AZIMUTH STEERING LINE) SUB-MODE EXAMPLE

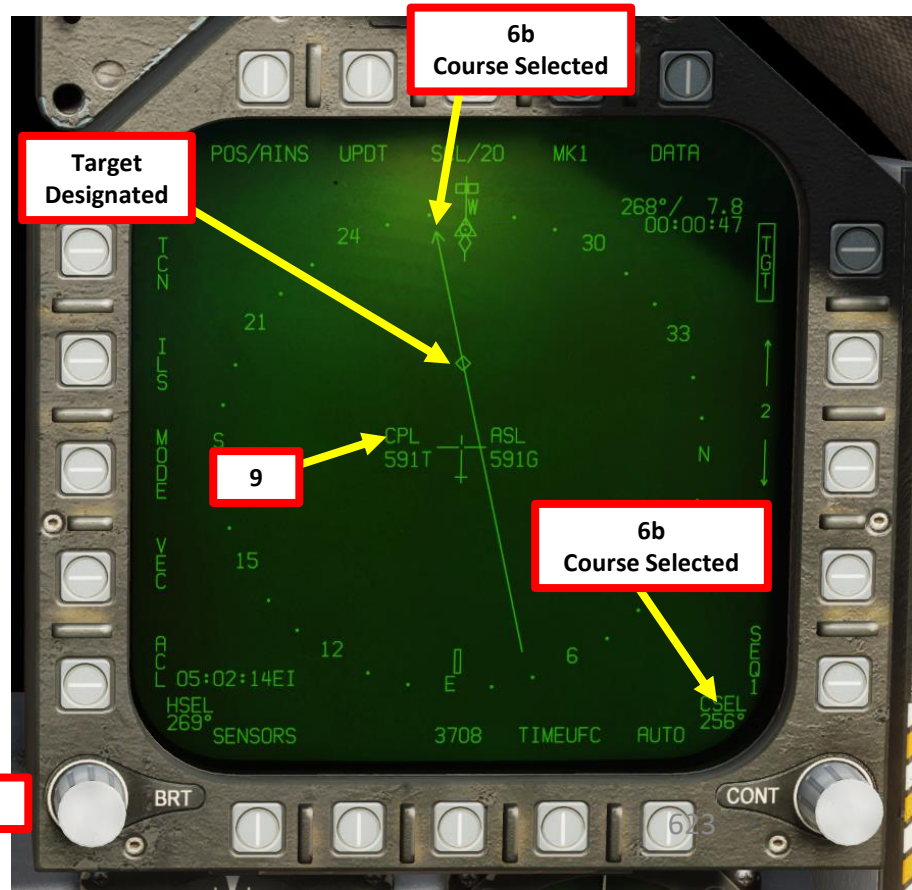
5. Make sure your stick is centered, no force is applied on it and that you have an appropriate deadzone (see CONTROLS SETUP - WHAT YOU NEED MAPPED section). Stick movement automatically inhibits autopilot activation.
6. If desired, click and hold (Left/Right mouse button) the CRS (Course Set) knob to set desired course (CSEL) to approach the target from.
7. Press the AP button on the UFC to show the autopilot options.
8. Press the OSB adjacent “CPL” to activate coupled autopilot mode.
9. A colon will appear (“:CPL”) to indicate that it is active. “CPL ASL” will appear on both the HSI and HUD.
10. If desired, select BALT (Barometric Altitude Hold) mode to maintain level flight while steering towards the target. A colon will appear (“:BALT”) to indicate that it is active.
11. The autopilot will steer towards the selected target.
12. You can disengage autopilot by pressing the Paddle Switch on the control stick.









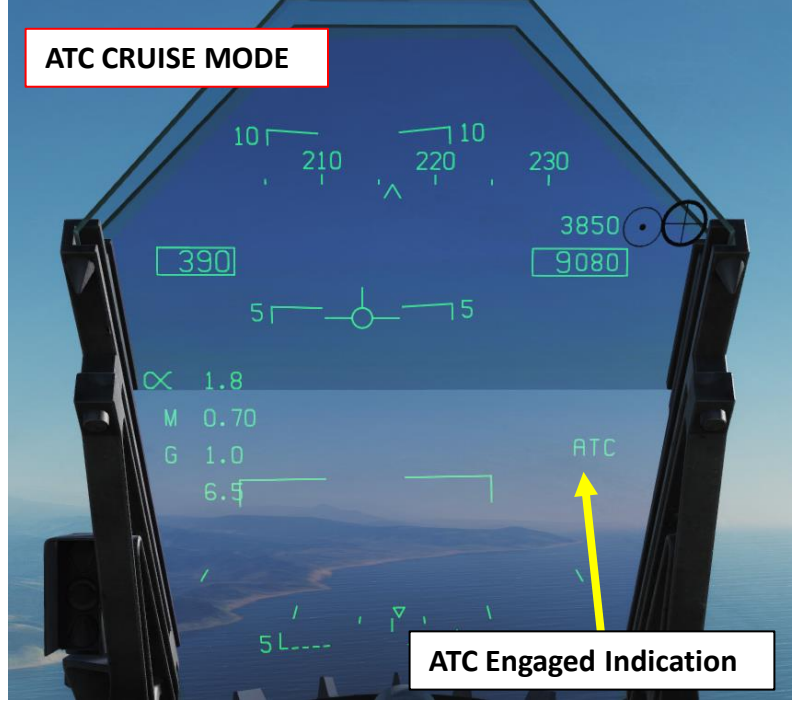


ATC (AUTOMATIC THROTTLE CONTROL)

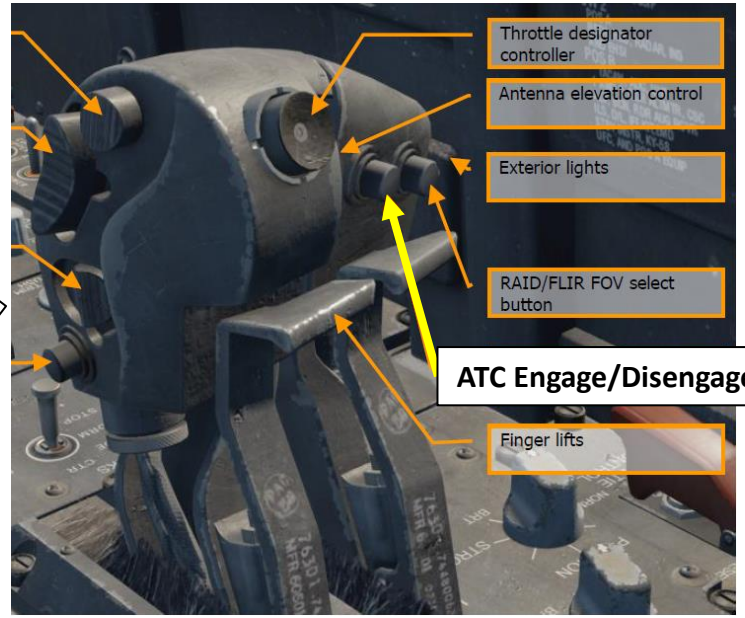
The ATC (Automatic Throttle Control) system is a two-mode auto-throttle system that automatically maintains angle of attack (approach mode) or airspeed (cruise mode) by modulating engine thrust in the range of FLIGHT IDLE through MILITARY power.

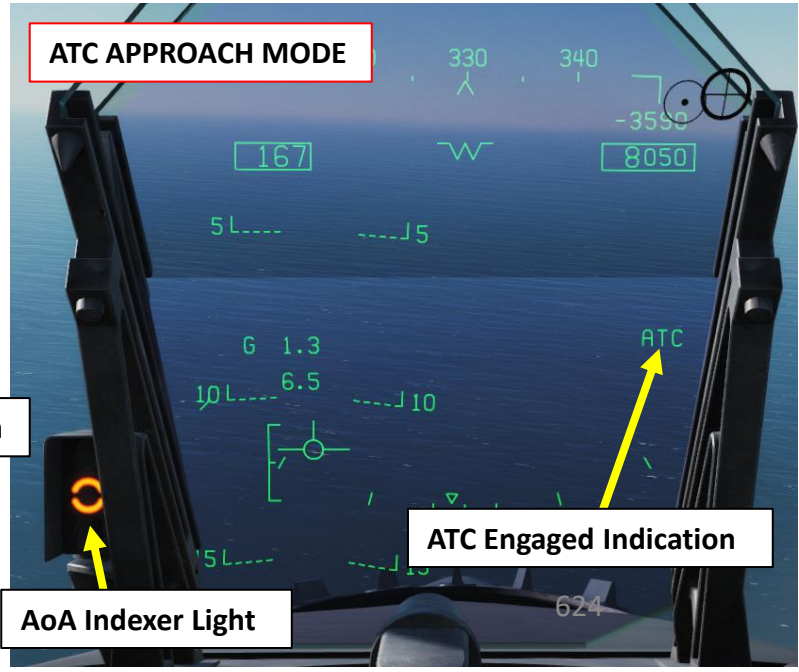
When either mode is engaged, the ECS (Environment Control System) air to the torque boosters is shut off, the throttles are initially backdriven, a stop is extended in the power lever control (PLC) to limit throttle travel from flight idle to MIL, and an ATC advisory is displayed on the HUD.

If either mode does not engage when selected, or automatically disengages after engagement, the ATC display flashes for 10 seconds and is then removed from the HUD. If a force of approximately 12 pounds (with friction off) is applied to either throttle the system automatically disengages. This force is sufficient to permit the hand to follow throttle movement without causing disengagement. Switching flap position also disengages the system.









ATC (AUTOMATIC THROTTLE CONTROL)

ATC APPROACH MODE:

HOW TO ENGAGE

Approach mode is engaged by pressing and releasing the **ATC button (T)** on the left throttle with the **FLAP switch in HALF or FULL** and **the trailing edge flaps extended at least 27 deg**.

WHAT IT DOES

When ATC is engaged in the approach mode, the flight control computer modulates engine thrust to maintain on-speed AoA (Angle of Attack). Computer uses inputs of AoA, normal load factor, stabilator position, pitch rate and angle of bank to generate command signals. These signals drive the throttle, which in turn commands engine fuel controls. Thrust will vary with pilot induced pitch changes and banking manoeuvers provide additional thrust to prevent the aircraft from falling out of the sky.

HOW TO DISENGAGE

Normal disengagement is accomplished by pressing the ATC button (T).

ATC Approach Mode Automatic Disengage Conditions

Flap AUTO up
AOA sensor failure
Two or more failures of either trailing edge flap
Trailing edge flap deflection less than 27°
ATC button fails
FCES channel 2 or 4 fails
WOW
FCS reversion to MECH or to DEL in any axis
Left and right throttle angles differ by more than 10° for more than 1 second
Bank angle exceeds 70°
Any internal system failure
Selection of GAIN ORIDE

ATC CRUISE MODE:

HOW TO ENGAGE

Cruise mode is engaged by pressing and releasing the **ATC button (T)** on the left throttle with the **FLAP switch in AUTO**.

WHAT IT DOES

When ATC is engaged in the cruise mode, existing airspeed is used by the flight control computer to module engine thrust to maintain this existing airspeed. Existing airspeed is the airspeed being sent from the ADC (Air Data Computer) to the flight control computers via the mission computers.

HOW TO DISENGAGE

Normal disengagement is accomplished by pressing the ATC button (T).

ATC Cruise Mode Automatic Disengage Conditions

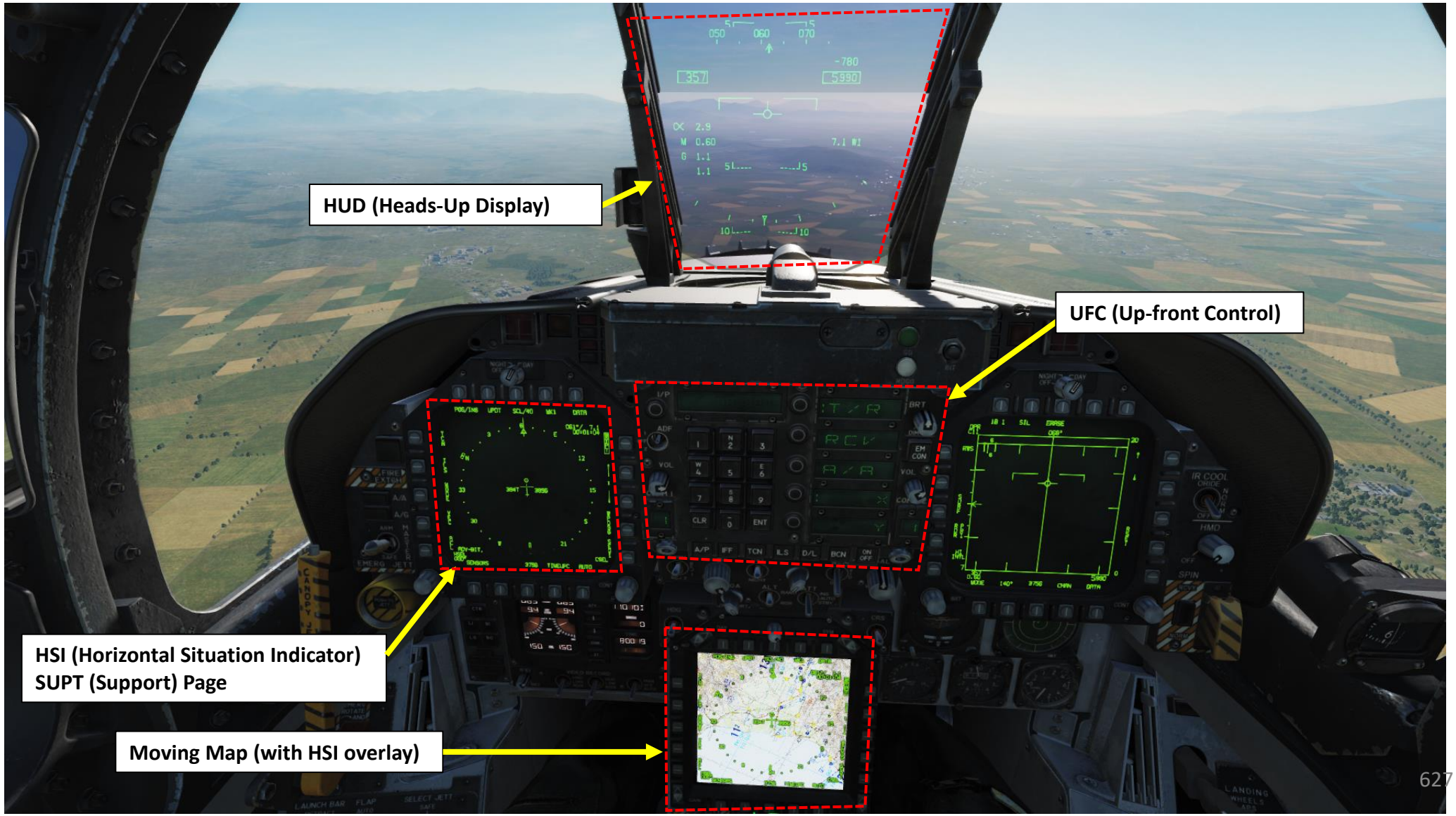
Flaps HALF or FULL
ATC button fails
FCES channel 2 or 4 fails
FCS reversion to MECH or to DEL in any axis
Left and right throttle angles differ by more than 10° for more than 1 second
ADC true airspeed failure
ADC degrade
Any internal system failure

NAVIGATION SECTION STRUCTURE

- 1 – Navigation Introduction
- 2 – Moving Map – DMS (Digital Map Set)
- 3 – HSI (Horizontal Situation Indicator)
  - 3.1 – HSI Main Page
  - 3.2 – HSI DATA Sub-Page
    - 3.2.1 – DATA A/C Tab
    - 3.2.2 – DATA WYPT Tab
    - 3.2.3 – DATA TCN Tab
    - 3.2.4 – DATA MDATA Tab
- 4 – Navigation Point Types
- 5 – Waypoints
  - 5.1 – Introduction
  - 5.2 – Waypoint Navigation
  - 5.3 – Manual vs Automatic Sequencing
  - 5.4 – How to Add/Remove Waypoints
  - 5.5 – How to Edit Waypoints
    - a – LAT/LONG coordinates
    - b – GRID coordinates
  - 5.6 – PRECISE Coordinates
- 6 – Markpoints
  - 6.1 – Markpoint Navigation
  - 6.2 – How to Add Markpoints
  - 6.3 – How to Use Markpoints
- 7 – ADF (Automatic Direction Finder) Navigation
- 8 – TACAN Navigation
- 9 – ICLS (Instrument Carrier Landing System) Tutorial / Case III Recovery

1 – NAVIGATION INTRODUCTION

Navigation in the F/A-18 is mostly done through the HSI (Horizontal Situation Indicator), which is a top-down view that displays your heading and navigation aids such as TACAN (Tactical Air Navigation) beacons and waypoints entered before flight in the mission editor.

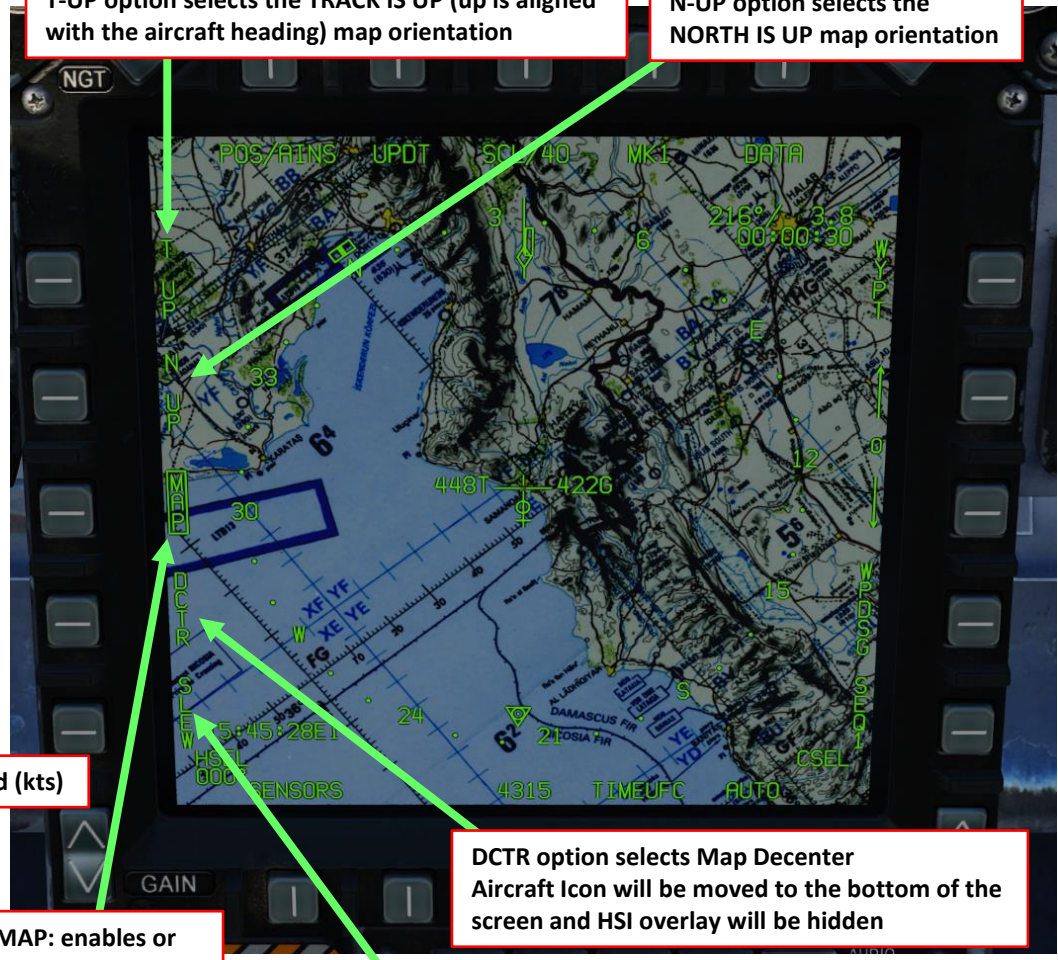


2 – MOVING MAP – DMS (DIGITAL MAP SET)

The Moving Map can only be seen on the AMPCD (Advanced Multi-Purpose Color Display). However, most of its functions will be covered in the “HSI“ section.



HSI Modes Sub-Menu



3.1 – HSI (HORIZONTAL SITUATION INDICATOR)

The HSI page is pretty much the most important tool at your disposal for navigation. Basically, it is a top-down view of your aircraft, flight plan and navigation aids. You can select it by pressing twice on the MENU OSB (Option Select Button).

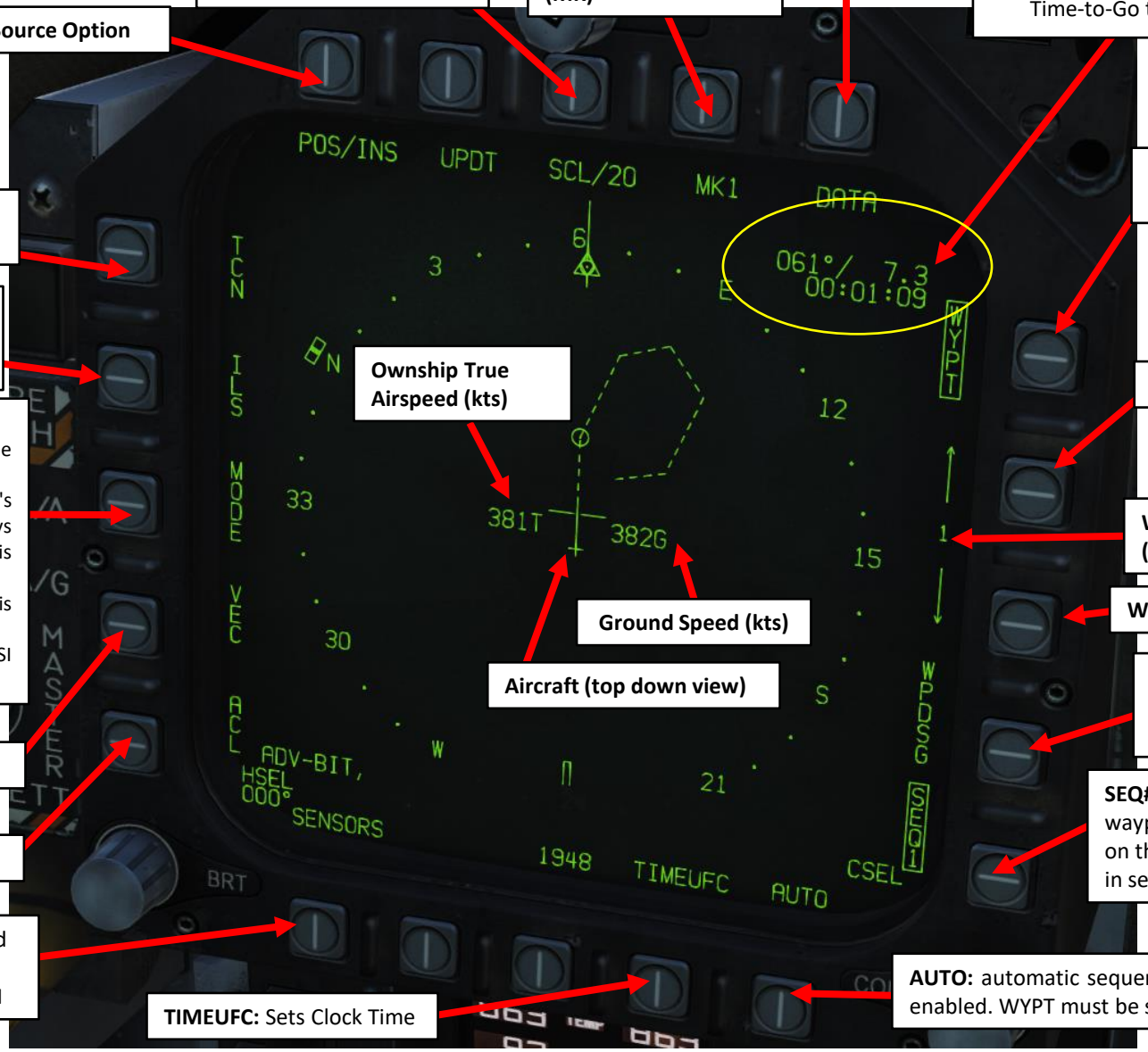








3.1 – HSI (HORIZONTAL SITUATION INDICATOR)



DATA selects the Data display mode (information about tracked aircraft/waypoint/TACAN)

HSI Scale (160/80/40/20/10/5)

Selects Mark Points (MK)

Waypoint Data
Bearing (degrees) Distance (Nm)
Time-to-Go to Waypoint (minutes:seconds)

Position Keeping Source Option

Waypoint Selected (Boxed)

TCN selects the TACAN tracking mode

ILS selects the Instrumented Landing System tracking mode

Ownship True Airspeed (kts)

Waypoint Increment

HSI Mode Menu

- MAP: toggles the chart overlay. This is only visible on the AMPCD.
- T UP: track up. The HSI will be oriented so that the aircraft's track (horizontal velocity across the ground) is always pointed up. However, technically the aircraft heading is always pointed directly up.
- N UP: north up. The HSI swill be oriented so that north is always up.
- DCTR: decenter. Places aircraft at the bottom of the HSI instead of the center and places the track up.

Waypoint Selected (Waypoint 1)

Waypoint Decrement

Ground Speed (kts)

Aircraft (top down view)

WPDSG: designates the current waypoint as a target waypoint (TGT)

VEC: Not Functional

SEQ#: when selected and boxed, all waypoints of the sequence are displayed on the HSI and dashed lines connect them in sequence

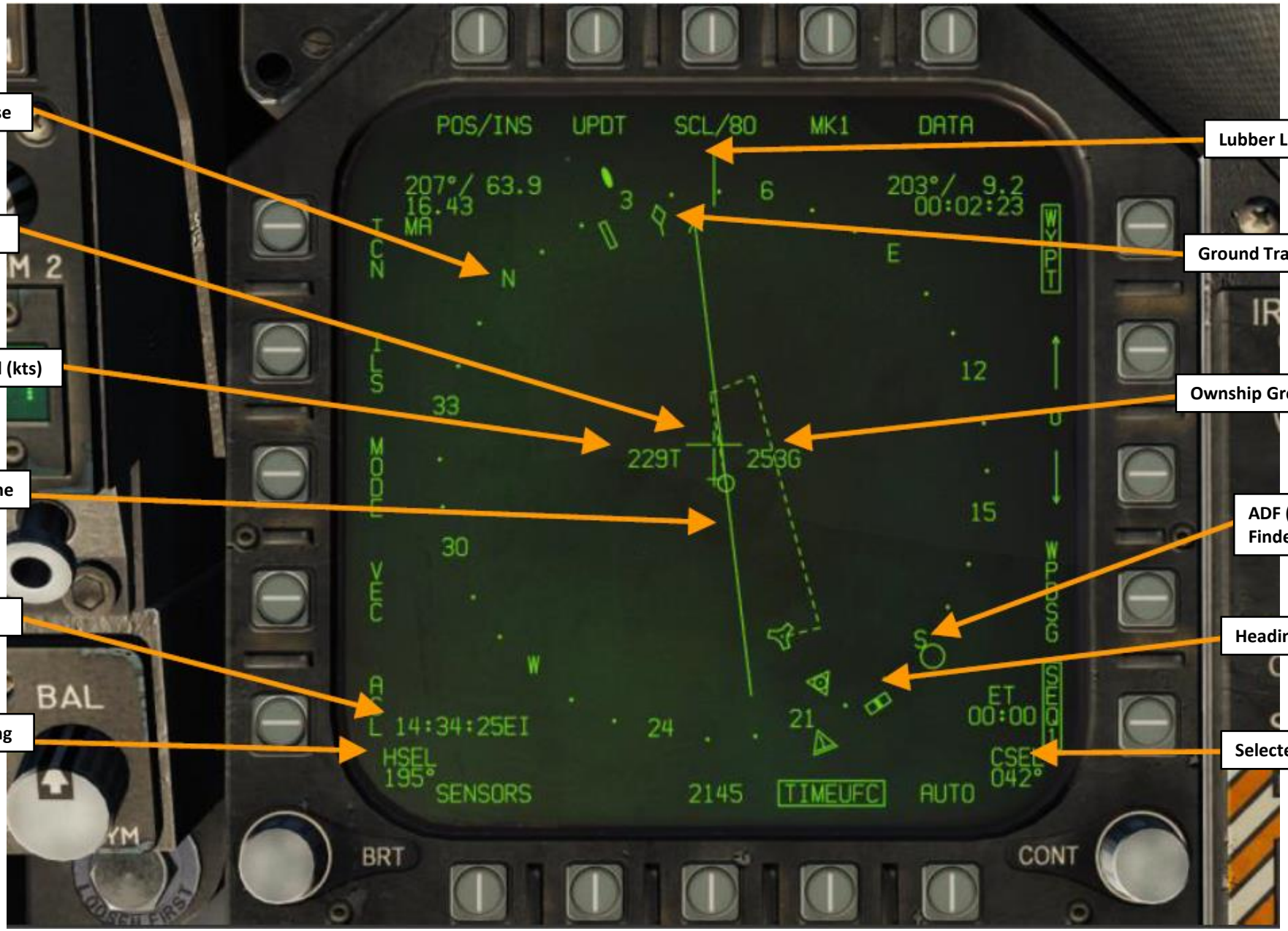
ACL: Not Functional

SENSORS: aerial targets detected by the RADAR in range and azimuth are displayed on the HSI

AUTO: automatic sequence steering to the next waypoint is enabled. WYPT must be selected as the navigation method

TIMEUFC: Sets Clock Time

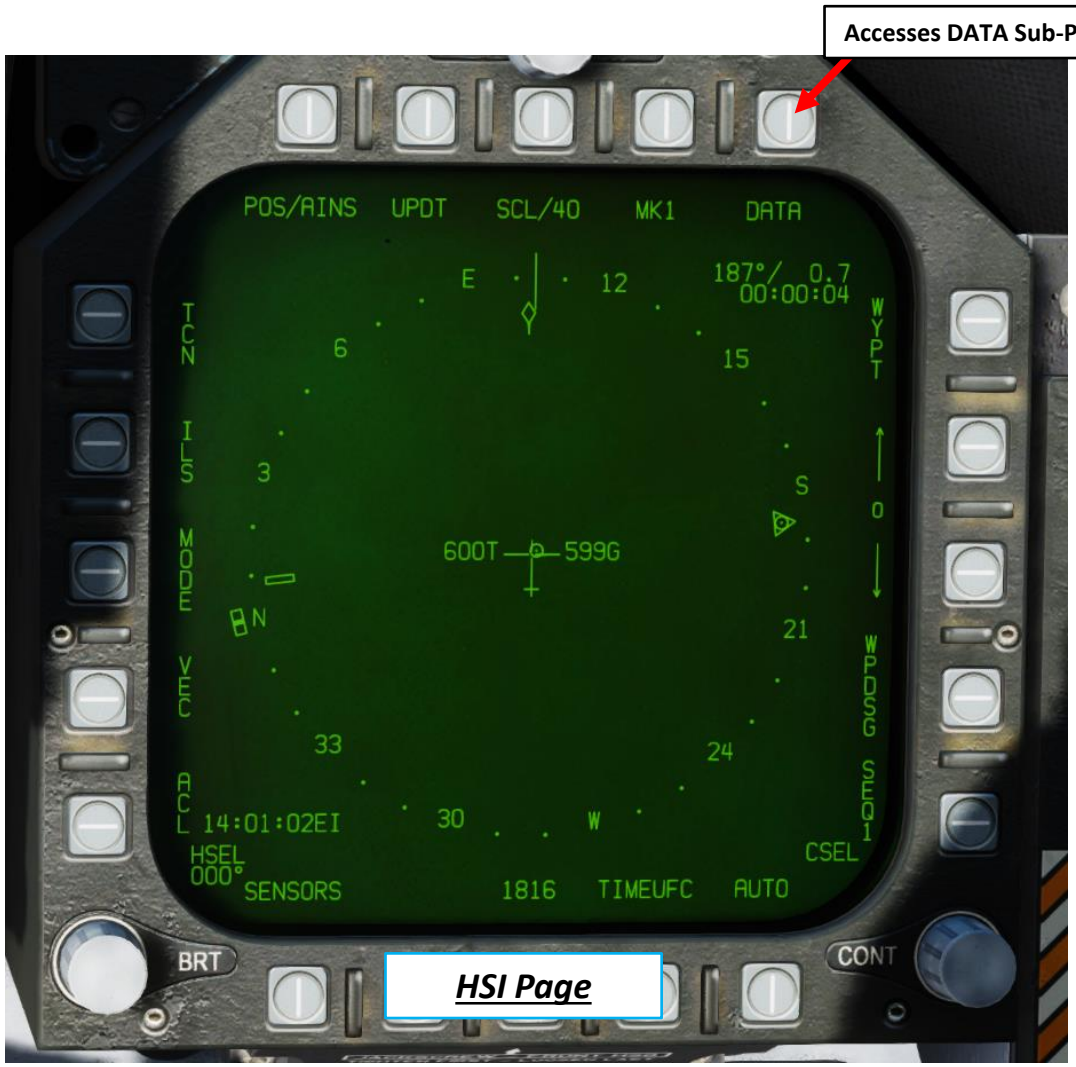
3.1 – HSI (HORIZONTAL SITUATION INDICATOR)



3.2 – HSI DATA Sub-Page
3.2.1 – DATA A/C Tab

The DATA sublevel of the HSI provides numerous navigation-related options. It is split into multiple tabs, selectable at the top. Selecting "HSI" will return to the main format.

- The A/C tab on the DATA sublevel displays information regarding the aircraft itself and the inertial navigation system.





3.2 – HSI DATA Sub-Page
3.2.1 – DATA A/C Tab



Aircraft Positional Information
- *Current aircraft latitude*
- *Current aircraft longitude*
- *Wind Speed (kts)*
- *Wind Direction*
- *Magnetic Variation at current aircraft location*

Selected Position Source

Returns to HSI Page

Not Simulated

Not Simulated

Not Simulated

Not Simulated

Not Simulated

Not Simulated

Magnetic / True North Selection
Selects between magnetic north and true north as the heading source for the aircraft

LATLN Coordinates Formatting Toggle
Changes latitude/longitude coordinate presentation throughout HIS format.
- *DCML: Degrees/decimal-minutes*
- *SEC: Degrees/minutes/seconds*

Warning Altitudes
Selects radar and barometric warning, or "soft" altitudes. Selecting either will allow for a value to be entered on the UFC. When either altitude is reached in a descent, "ALTITUDE, ALTITUDE" aural cue will be audible.

GPS (Global Positioning System) Information
- *Horizontal Error*
- *Vertical Error*
- *ZULU Time according to GPS*

TAWS (Terrain Awareness System) Toggle
Toggles TAWS verbal annunciations

3.2 – HSI DATA Sub-Page
3.2.2 – DATA WYPT Tab

The DATA sublevel of the HSI provides numerous navigation-related options. It is split into multiple tabs, selectable at the top. Selecting "HSI" will return to the main format.

- The WYPT tab allows for detailed information about waypoints to be viewed and edited.

UFC (Up-Front Control)
Brings up UFC options for the currently selected waypoint:

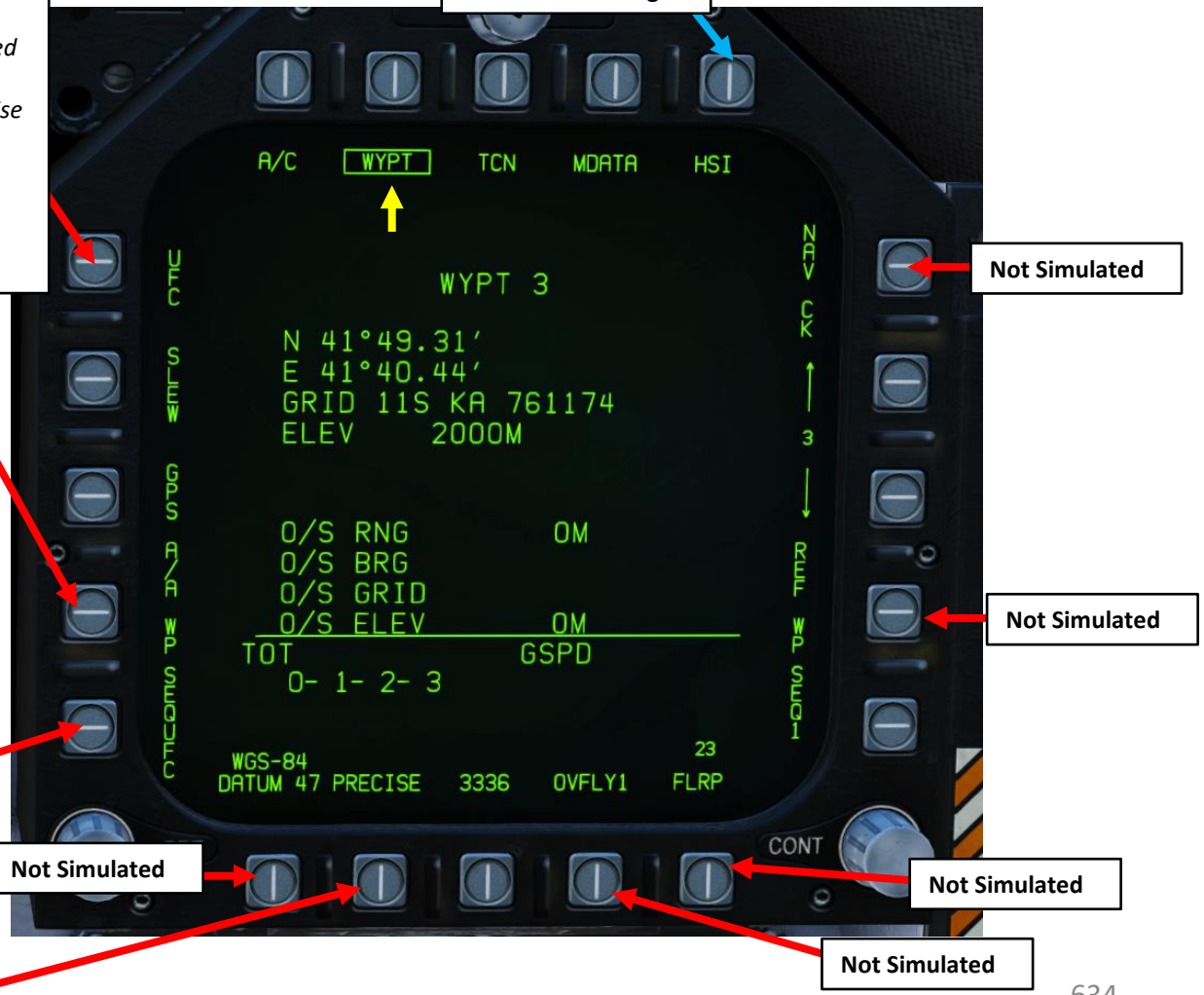
- *POSN: Enter desired waypoint location, first the latitude and then the longitude. This is entered in degrees/minutes/seconds or degrees/minutes, depending on the display setting in the A/C tab. Without precise coordinate mode, they are entered with all six digits at once. In the precise coordinate mode, the first four are entered, "ENTER" is pressed, and then the next four are entered.*
- *ELEV: Enter waypoint elevation. Option is given to enter in feet or meters.*
- *GRID: Selects MGRS coordinate grid reference.*
- *O/S: Offset, Not yet implemented.*

A/A Waypoint
Designates the currently selected waypoint as the air-to-air waypoint or "bullseye". This is for communicating target locations and is used in other formats.

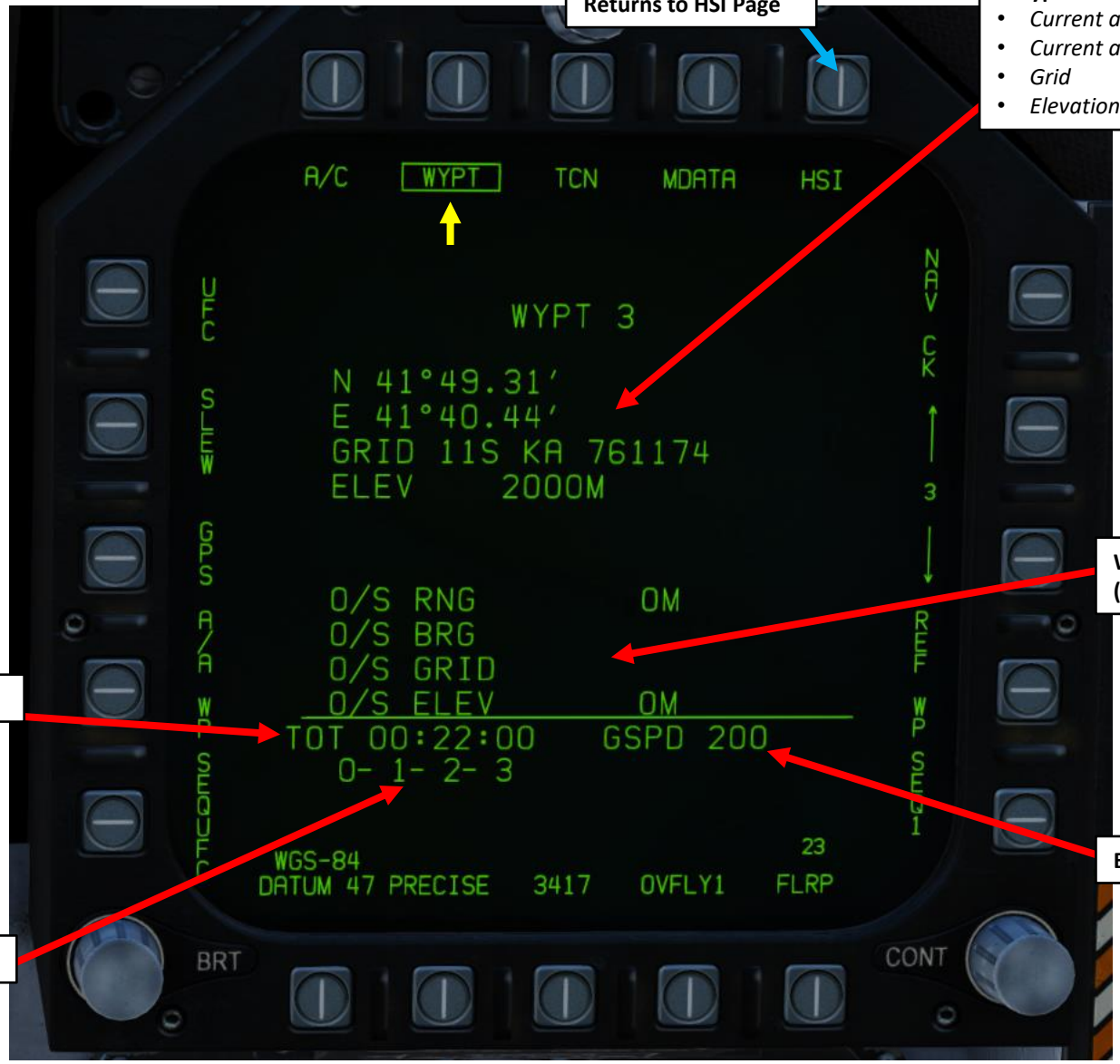
SEQUFC (Sequence Up-Front Control) Function
Brings up UFC options for the currently selected sequence.

- *GSPD: enter the desired ground speed in knots to be en route to the designated target waypoint (not to be confused with the waypoint designate/TGT function). This is used in conjunction with TOT. For waypoints in the sequence before it, the required ground speed will allow for the plane to be at this groundspeed en route to the target waypoint.*
- *TGT: Designate a waypoint number to be the target waypoint for the TOT function. It is important to note this operates entirely independently of the A/G Target.*
- *TOT: Designate a desired time on target in ZULU time in the format HH:MM:SS. The HSI will then display a required groundspeed to reach the target at that time.*
- *INS: Insert waypoints to the currently selected sequence. To add one in between two current ones, enter the preceding waypoint and then the in-between waypoint.*
- *DEL: Select a waypoint to delete from the sequence.*

PRECISE Coordinates
Toggles precise coordinate mode. When PRECISE is boxed, coordinates in the HSI format will show as 8 digits, other wise they will show as 6 digits.



3.2 – HSI DATA Sub-Page
3.2.2 – DATA WYPT Tab



Returns to HSI Page

Waypoint Position
- *Current aircraft latitude*
- *Current aircraft longitude*
- *Grid*
- *Elevation*

Waypoint Offset (Not Simulated)

Entered TOT (Time On Target)

Entered Ground Speed to Target (GSPD)

Waypoints In Sequence

3.2 – HSI DATA Sub-Page
3.2.3 – DATA TCN Tab

The DATA sublevel of the HSI provides numerous navigation-related options. It is split into multiple tabs, selectable at the top. Selecting "HSI" will return to the main format.

- The TCN tab allows for information to be viewed about TACAN stations in the aircraft database.



Returns to HSI Page

TACAN Frequency

UFC (Up-Front Control) Function
Allows for the coordinates/elevation/magnetic variation to be manually edited on the UFC

Not Simulated

Not Simulated

TACAN Database
Cycles TACANs in the database

TACAN Station Information
- *Latitude*
- *Longitude*
- *Elevation*
- *Magnetic Variation at TACAN*

3.2 – HSI DATA Sub-Page
3.2.4 – DATA MDATA Tab

Not Yet Implemented.



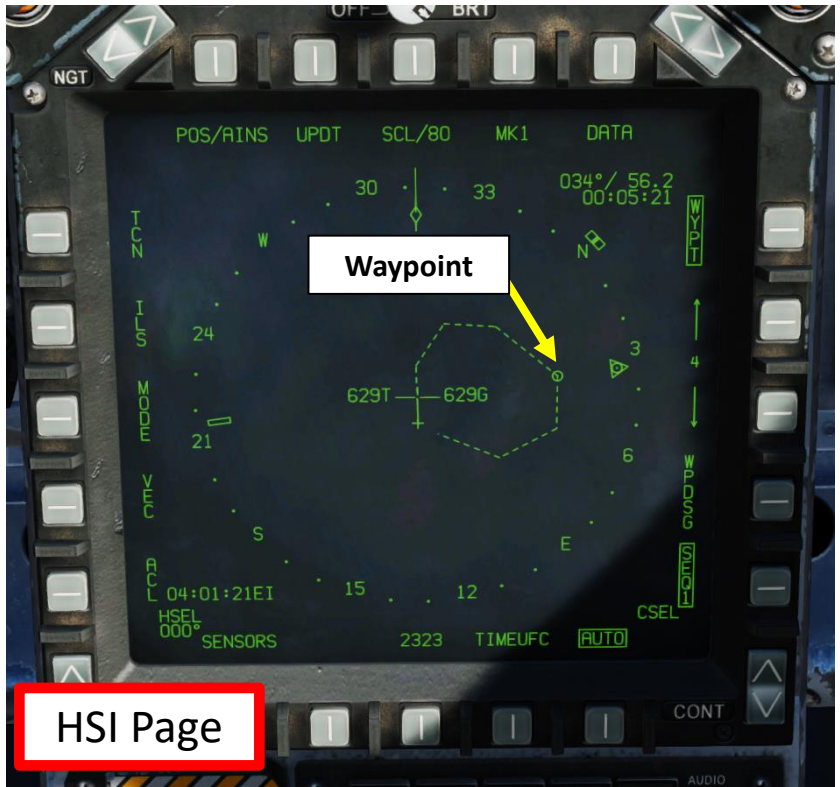
4 – NAVIGATION POINT TYPES

These are the available Navigation Point types used in the Hornet:

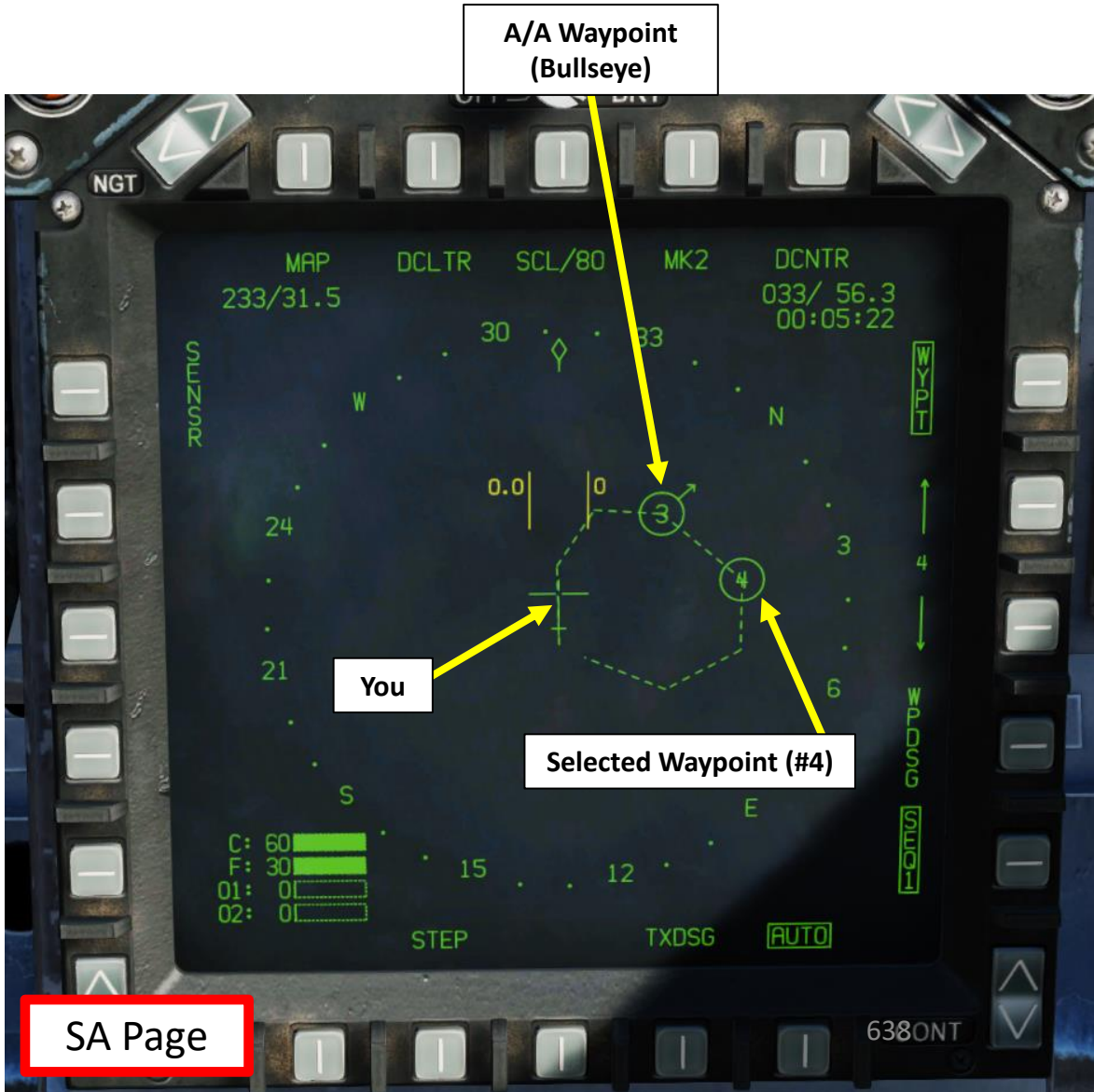
- **Steerpoints / Waypoints**
  - Steerpoints (or Waypoints) are pre-planned navigational points of reference for you to follow on route to your area of operation. You can create new ones, edit their coordinates and create flight plans with them. You can have up to 60 waypoints.

- **Markpoints**
  - Markpoints are used to "mark" a point of interest, whether flying over an interesting area or designating an enemy sighting. You can create up to 9 markpoints; they are numbered from MK1 to MK9.

- **A/A Waypoint / Anchor Point / Bullseye**
  - Also referred to as a “Bullseye” or “Anchor Point”, the A/A Waypoint serves as a common geographic reference for a mission amongst friendly forces.



HSI Page



SA Page

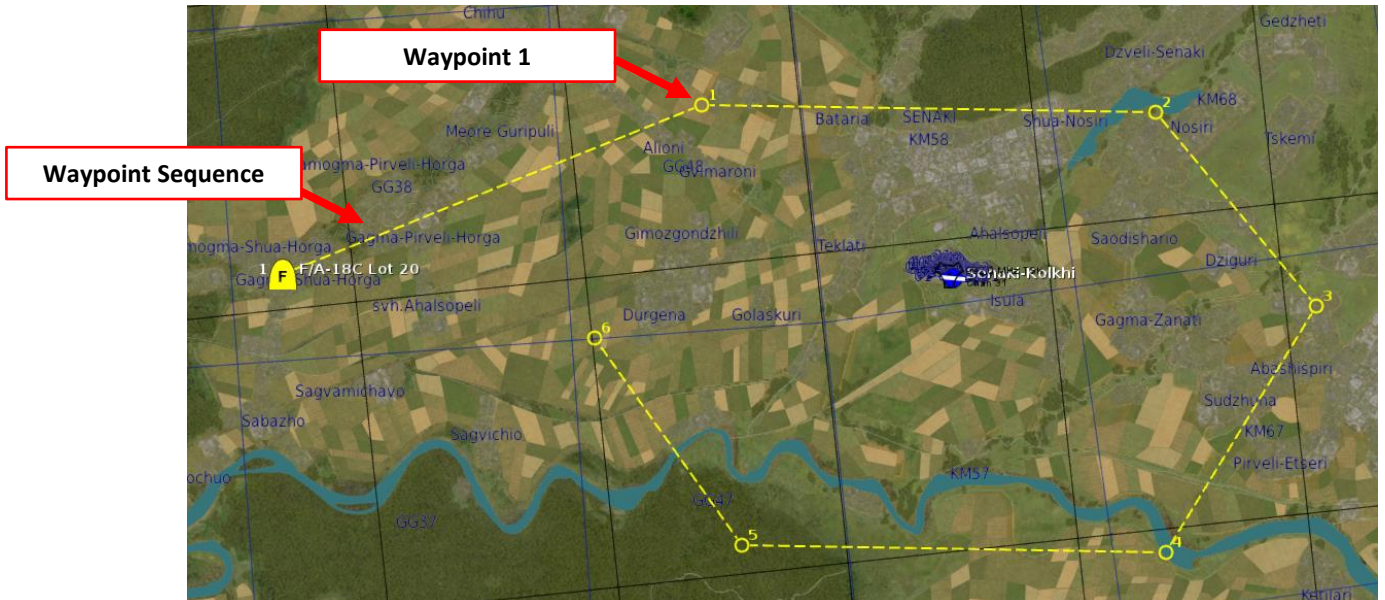
5 - WAYPOINTS
5.1 - WAYPOINT INTRODUCTION

Your waypoints are usually already set up with the mission editor. They are generally set up as a "sequence" and numbered 1, 2, 3… for a maximum of 60 waypoints. You can have up to three different sequences of waypoints.

You will have a number of options that you can select like WYPT, SEQ, AUTO, etc. You can select them by clicking on the Option Select Buttons next to them. A boxed option means it is selected.

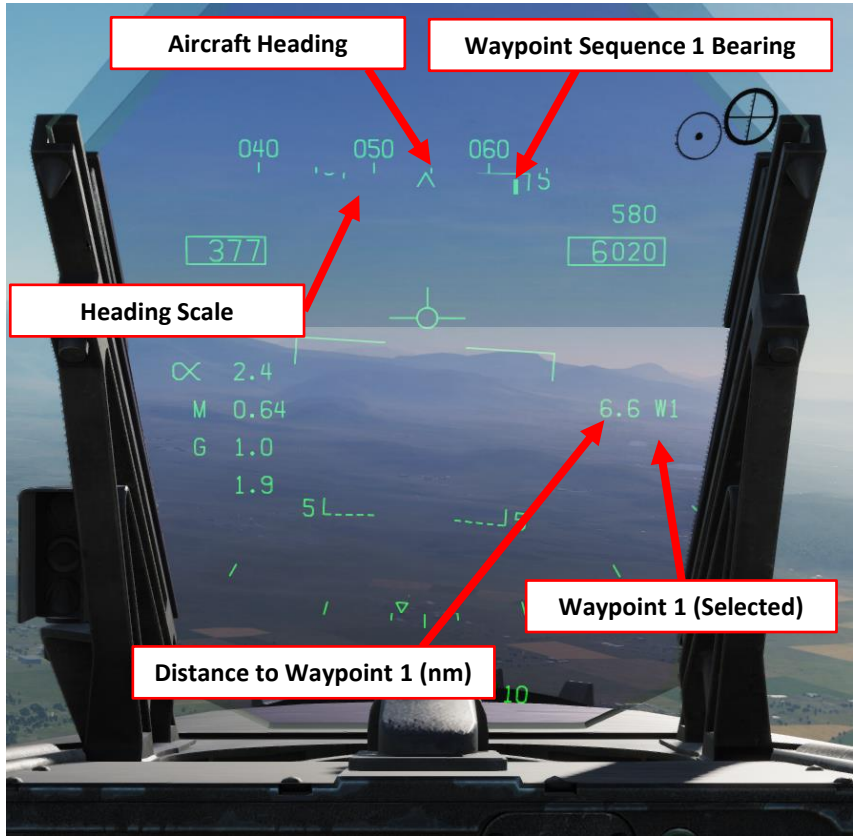


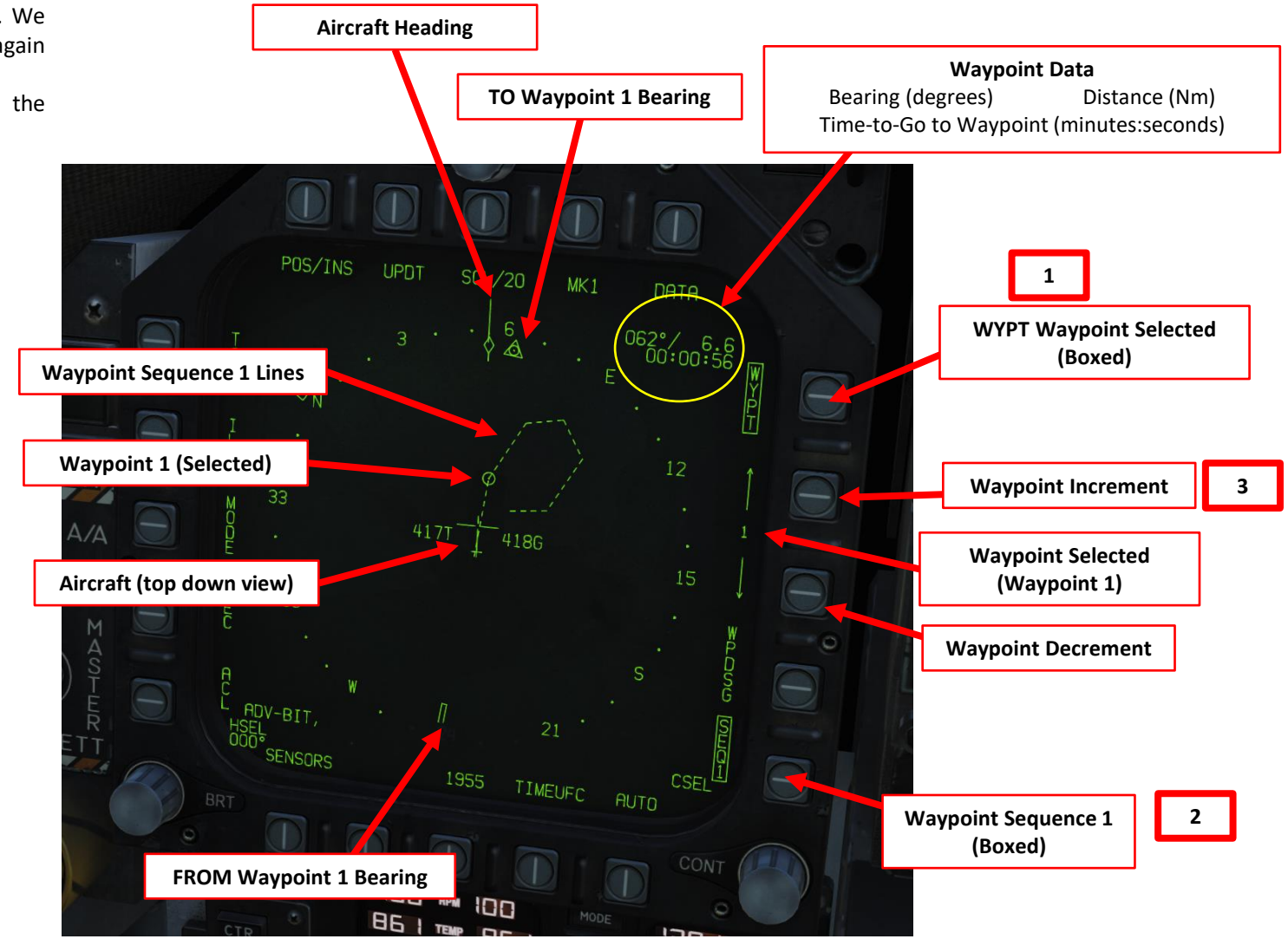




5 - WAYPOINTS
5.2 - WAYPOINT NAVIGATION

1. Press the OSB (Option Select Button) next to WYPT to set tracking mode to WAYPOINT.
2. Select desired waypoint sequence by pressing the OSB next to SEQ#. We will pick Sequence 1. To display the sequence lines, press on the OSB again to make the SEQ1 text boxed.
3. To select a waypoint, press the OSBs to increment or decrement the waypoint number.
4. Use the HSI and HUD to navigate towards waypoint



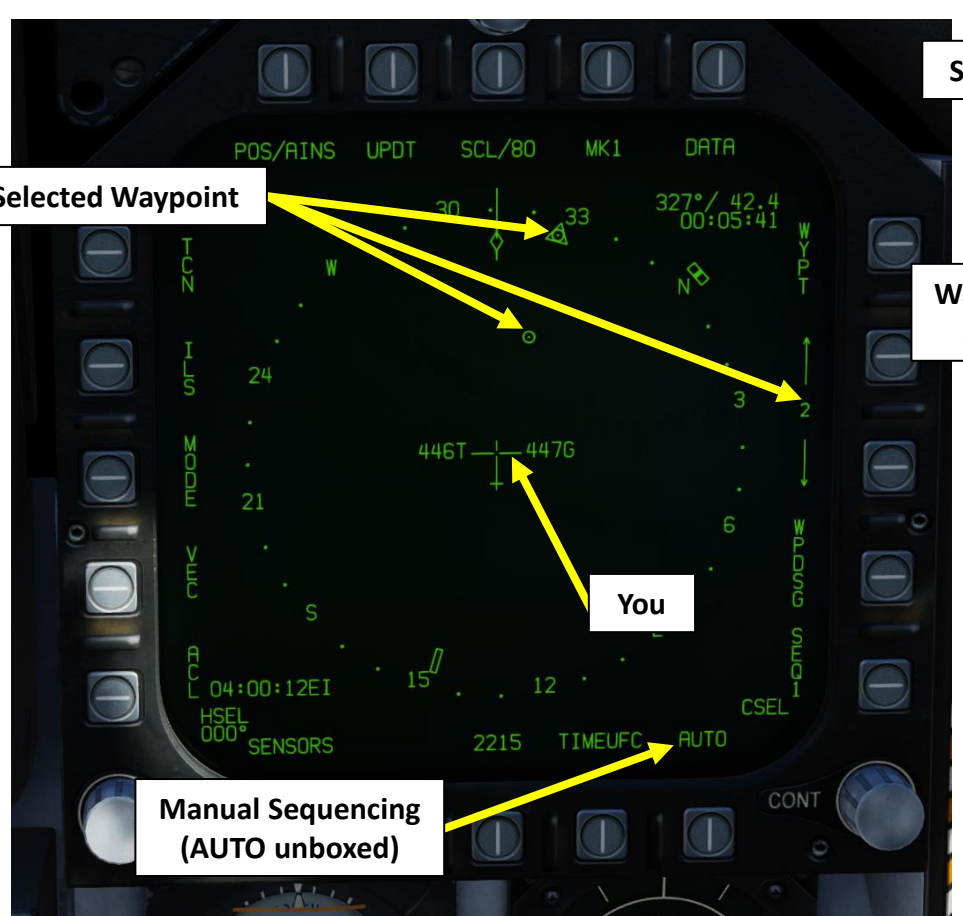


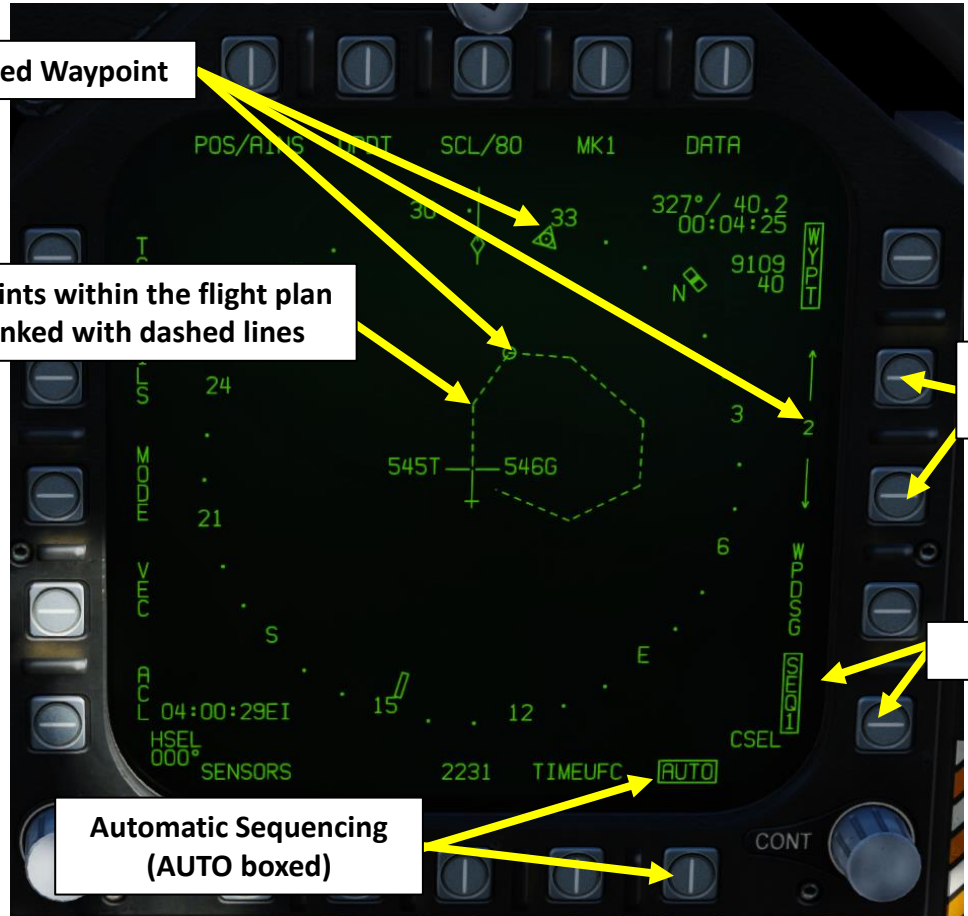
5 - WAYPOINTS
5.3 - MANUAL VS AUTO SEQUENCING

When following a flight plan and reaching the waypoint you have currently selected, "sequencing" modes determine whether you need to manually select the next waypoint with the Increment/Decrement OSBs (Manual Sequencing) or if the navigation computer will automatically select the next waypoint in your flight plan (AUTO Sequencing).

To select Automatic or Manual Waypoint Sequencing:

1. Go in HSI (Horizontal Situation Indicator) page
2. Select desired Waypoint Sequence (SEQ#1, SEQ#2 or SEQ#3 depending on your flight plan)
3. Press the OSB (Option Select Button) next to AUTO if you want automatic waypoint sequencing (boxed). Leave it OFF if you want manual waypoint sequencing (unboxed)





5 - WAYPOINTS
5.4 - HOW TO ADD/REMOVE WAYPOINTS

TO ADD WAYPOINTS:

1. In the HSI page, press the OSB next to DATA.
2. You will see the waypoint sequence. We want to insert a 7th waypoint after Waypoint 6, which we will call Waypoint 7.
3. Press the OSB next to SEQUFC (Sequence UFC)
4. On the UFC, press the OSB next to INS (Insert). « : » will appear once selected.
5. Press « 7 », then « ENT » to enter Waypoint 7.
6. Waypoint 7 will need coordinates, which we will add in the « HOW TO EDIT WAYPOINTS » tutorial.





TO REMOVE WAYPOINTS:

a) In the HSI page, press the OSB next to DATA.
b) You will see the waypoint sequence. Let's say we want to delete waypoint 2.
c) Press the OSB next to SEQUFC (Sequence UFC)
d) Press « CLR » to clear any displayed number on the UFC display
e) On the UFC, press the OSB next to DEL (Delete). « : » will appear once selected.
f) Press « 2 », then « ENT » to delete Waypoint 2
g) And that's it!

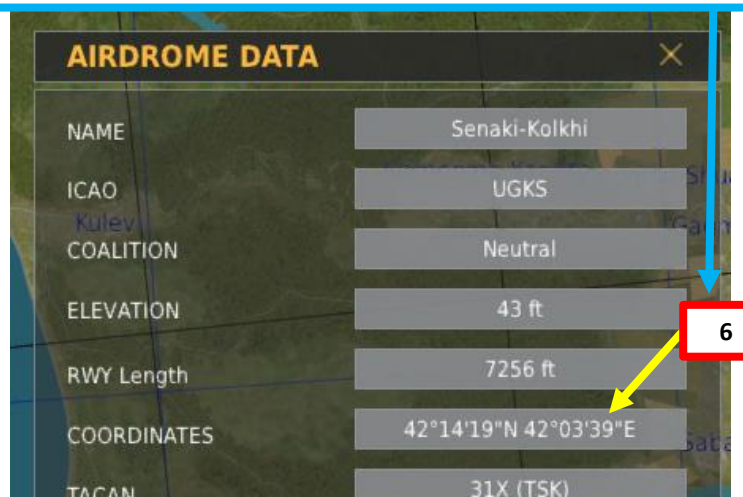


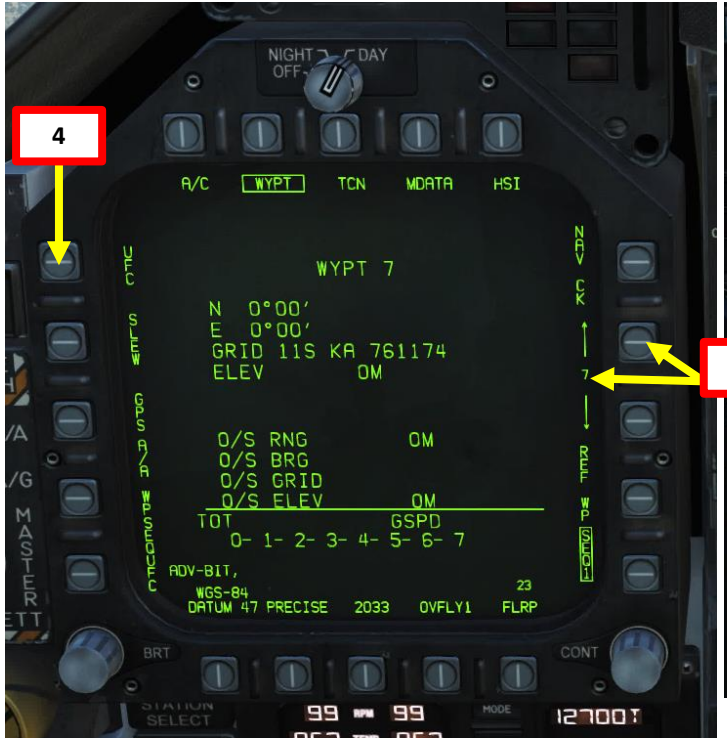


5 - WAYPOINTS
5.5 - HOW TO EDIT WAYPOINTS
a – LAT/LONG Coordinates

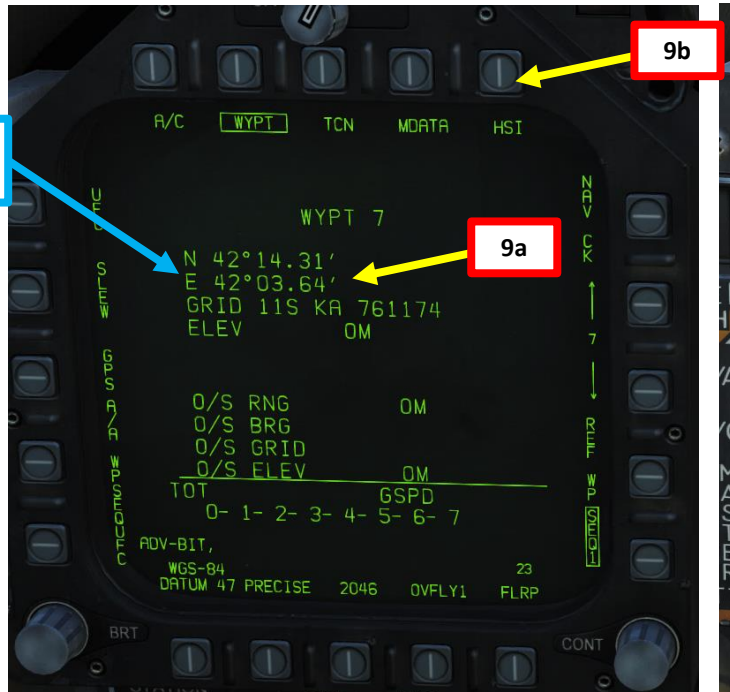
1. In the HSI page, press the OSB next to DATA.
2. You will see the waypoint sequence. We want to edit the coordinates of Waypoint 7 (which we created in the previous tutorial).
3. Press the Waypoint Increment/Decrement OSBs to select WYPT 7
4. Press the OSB next to UFC (Up-Front Controller)
5. On the UFC, press the OSB next to POSN (Position). « : » will appear once selected.
6. We will add the coordinates of the Senaki-Kolkhi Airdrome, which are in (deg, minutes, sec):
   42°14.31’ North 42°03.64’ East
7. On the UFC, press « 2 » (N) to select North coordinates, type « 421431 », then « ENT » to enter them.
8. On the UFC, press « 6 » (E) to select East coordinates, type « 420364 », then « ENT » to enter them.
9. And that’s it! You have edited Waypoint 7’s coordinates. If you click on the OSB next to HSI, you can see that Waypoint 7 is now visible in the sequence lines.

Coordinate format you input in the UFC is Degree, Minute, Decimal-Minutes.
INPUT 421431 = OUTPUT 42 deg 14.31 minutes





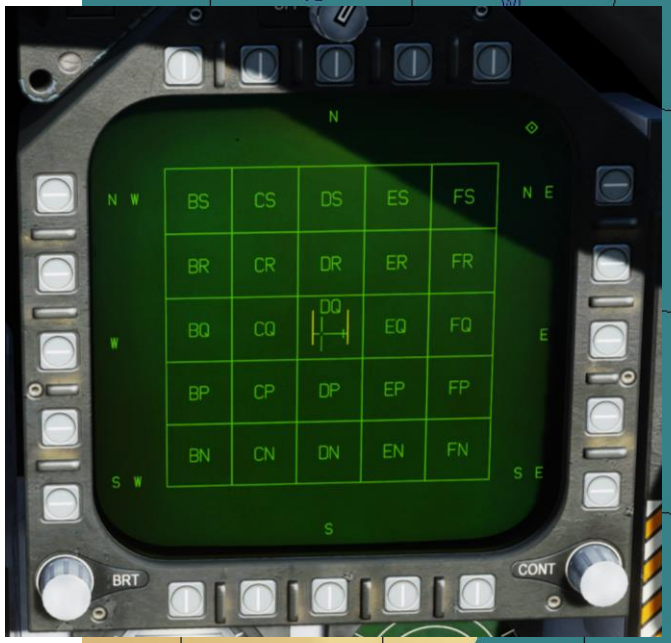






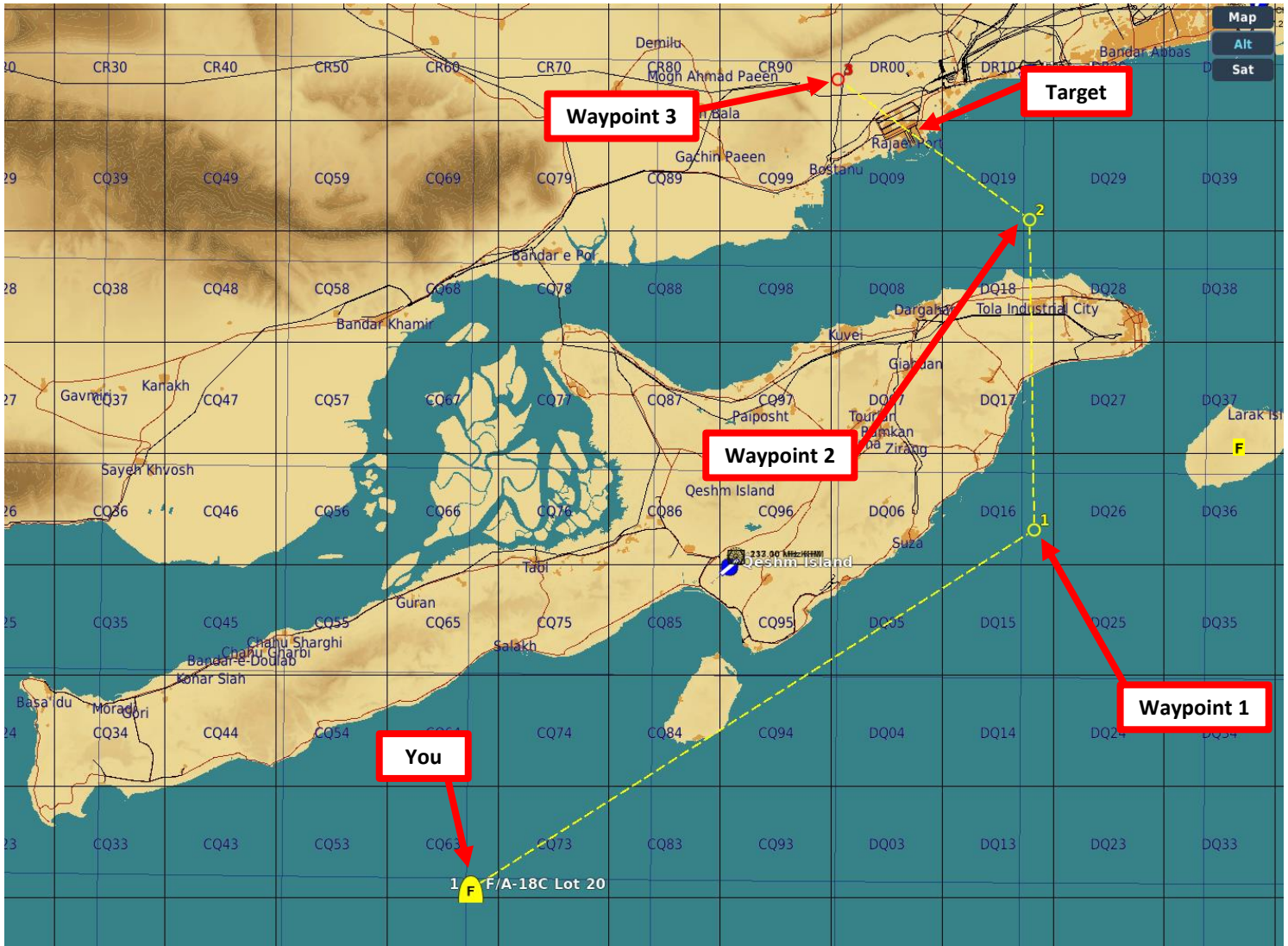
5 - WAYPOINTS
5.5 - HOW TO EDIT WAYPOINTS
b – GRID Coordinates

There are cases where coordinates for a target are given using a grid system. In this example, the target coordinates given to us by the JTAC, which are given in “UTM” (Universal Transverse Mercator) format. The GRID coordinates of the Hornet use MGRS (Military Grid Reference System), which is a simplified format than standard UTM.



5 - WAYPOINTS
5.5 - HOW TO EDIT WAYPOINTS
b – GRID Coordinates

We have currently 3 existing waypoints. We will edit the 3rd waypoint with the target coordinates sent from the JTAC in the MGRS format. The MGRS grid coordinates of the target are **DQ083998**.



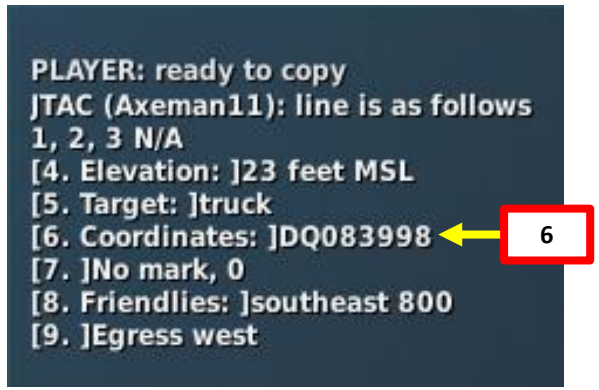
PLAYER: ready to copy
JTAC (Axeman11): line is as follows
1, 2, 3 N/A
[4. Elevation:]23 feet MSL
[5. Target:]truck
[6. Coordinates:]DQ083998
[7.]No mark, 0
[8. Friendlies:]southeast 800
[9.]Egress west

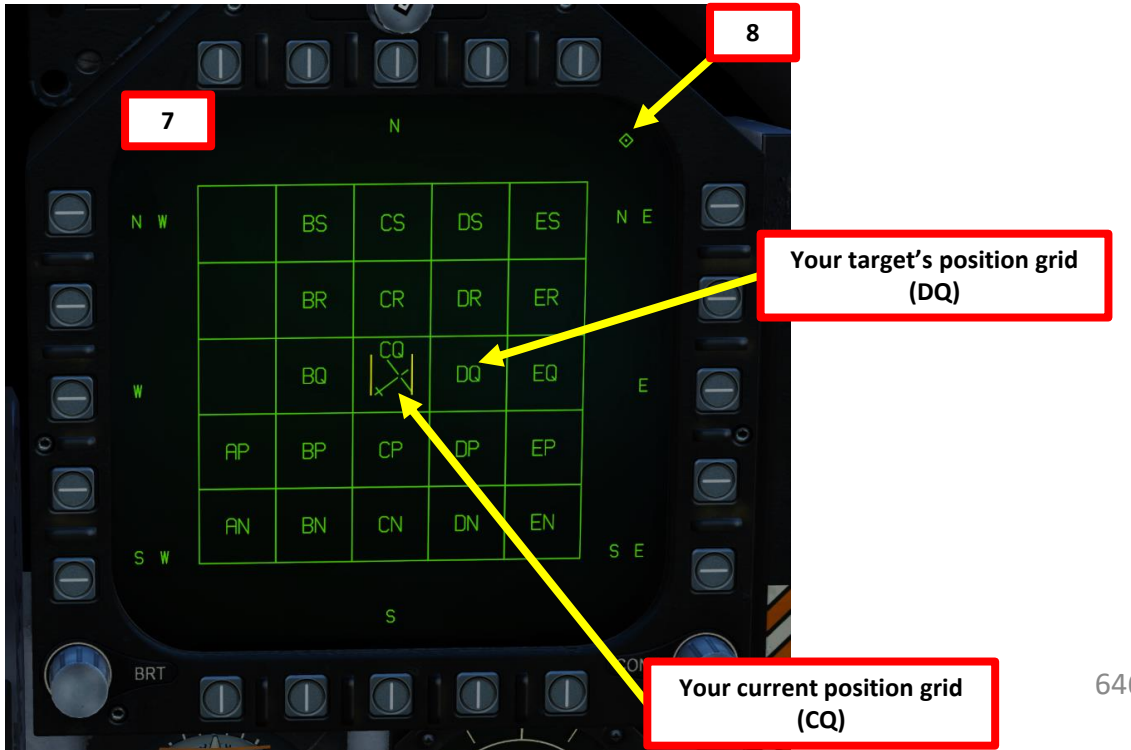
5 - WAYPOINTS
5.5 - HOW TO EDIT WAYPOINTS
b – GRID Coordinates

1. In the HSI page, press the OSB next to DATA.
2. You will see the waypoint sequence. We want to edit the coordinates of Waypoint 3.
3. Press the Waypoint Increment/Decrement OSBs to select WYPT 3
4. Press the OSB next to UFC (Up-Front Controller)
5. On the UFC, press the OSB next to GRID. « : » will appear once selected .
6. We will add the grid coordinates of the target as sent by the JTAC: **DQ083998**
   - Note: normal grid coordinates have 6 digits, while PRECISE grid coordinates have 10 digits.
7. The HSI display will be replaced by a grid menu. The letters represent grid squares of 100 x 100 km. Since the grid is DQ083998, we will select DQ.
8. Verify that TDC is assigned to the right DDI (the TDC Assignment Diamond is shown).



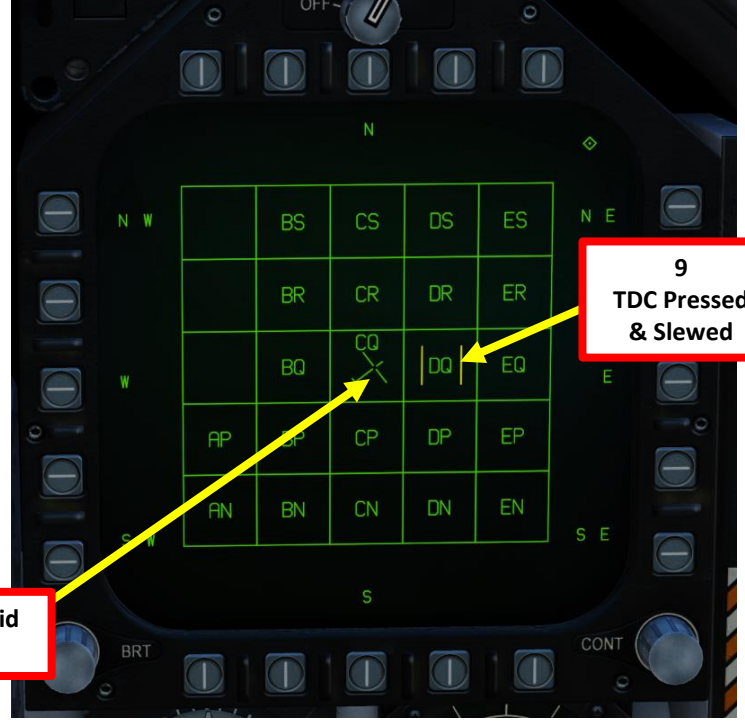


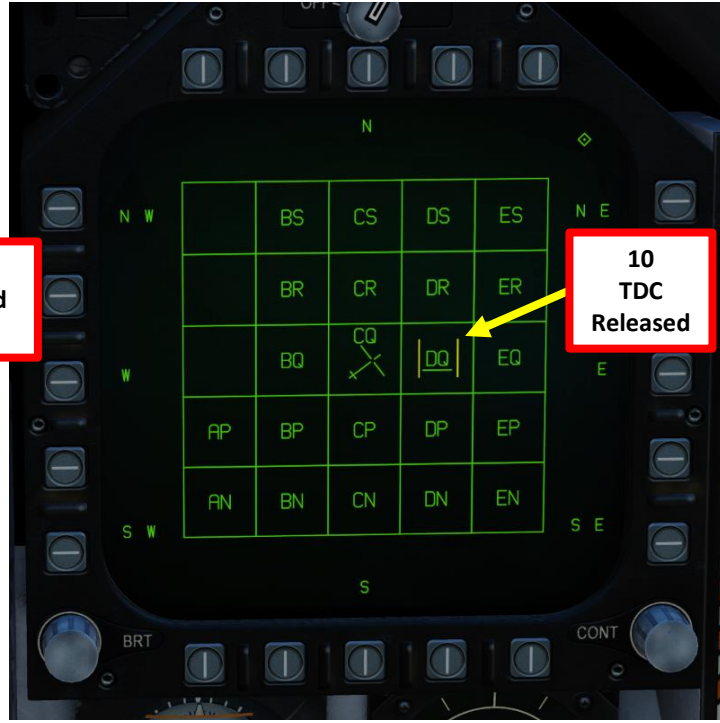




5 - WAYPOINTS
5.5 - HOW TO EDIT WAYPOINTS
b – GRID Coordinates

9. Press and hold the TDC (Throttle Designator Controller), then slew the TDC cursor over grid “DQ”.
10. Release TDC when cursor is over “DQ”. When “DQ” becomes underlined, it means the grid is selected.
11. On the UFC, press « 083998 » to enter the grid coordinates for DQ083998, then press « ENT ».
12. And that’s it! You have edited Waypoint 3’s coordinates. You would then have to edit elevation… but you already know how to do that, don’t you?





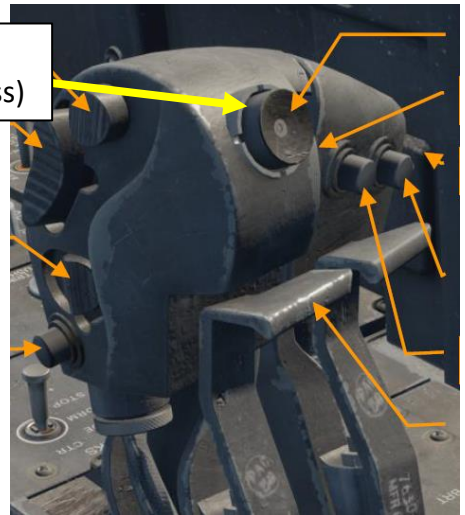
[6. Coordinates:]DQ083998





TDC
(Left/Right/Up/Down/Depress)

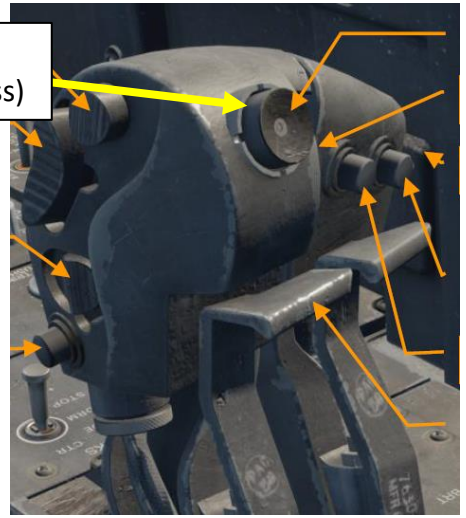
9 **10**

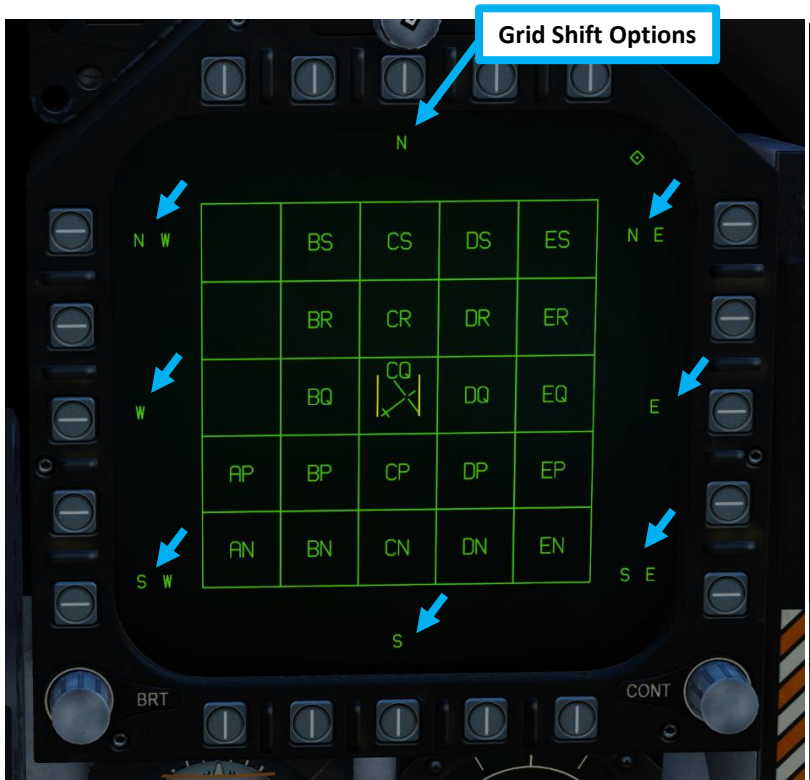


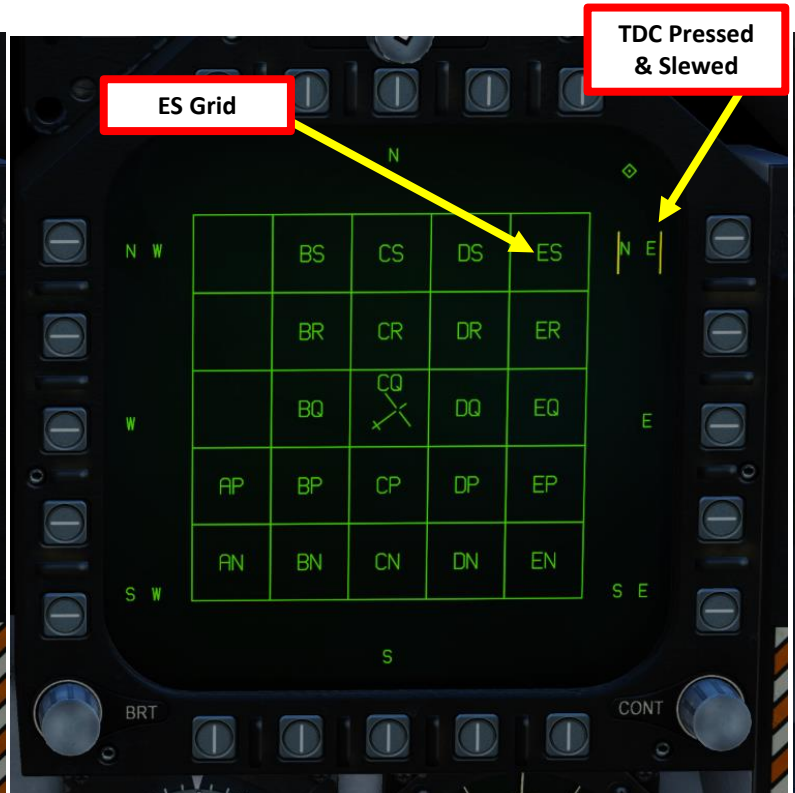
5 - WAYPOINTS
5.5 - HOW TO EDIT WAYPOINTS
b – GRID Coordinates

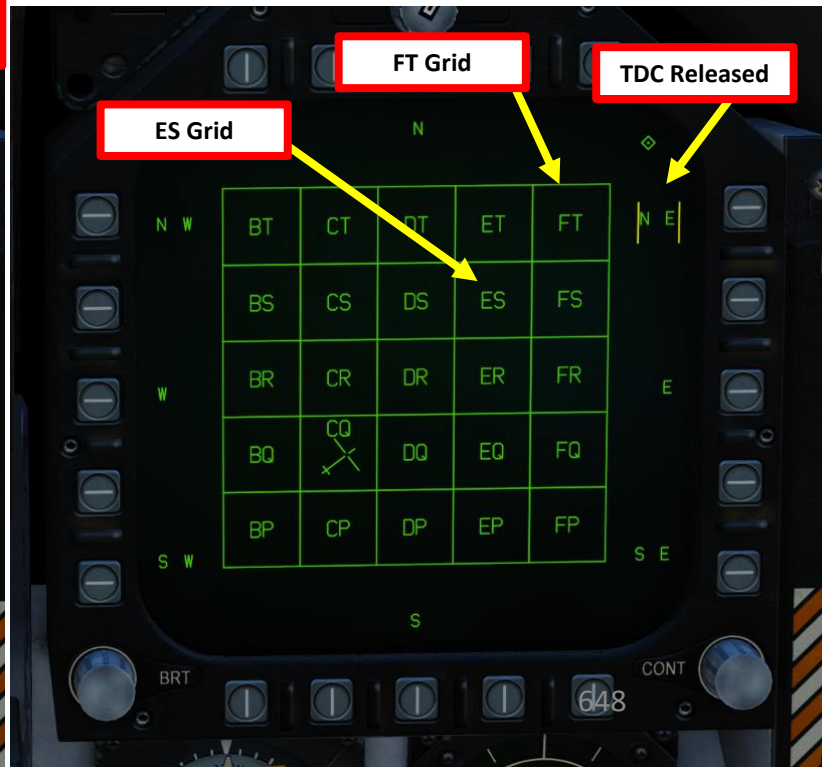
In case grid references are located further than the available squares, you can move the grid map around. In order to do so:

a) Let's say we want to select grid "FT", which is located to the North-East of grid "ES".
b) Press and hold the TDC (Throttle Designator Controller)
c) Slew the TDC cursor over "N E".
d) Release the TDC while cursor is over "N E".
e) The grid display will then shift 1 grid square North and 1 grid square to the East. You could use any of the other grid shift options (N, W, S, etc.)







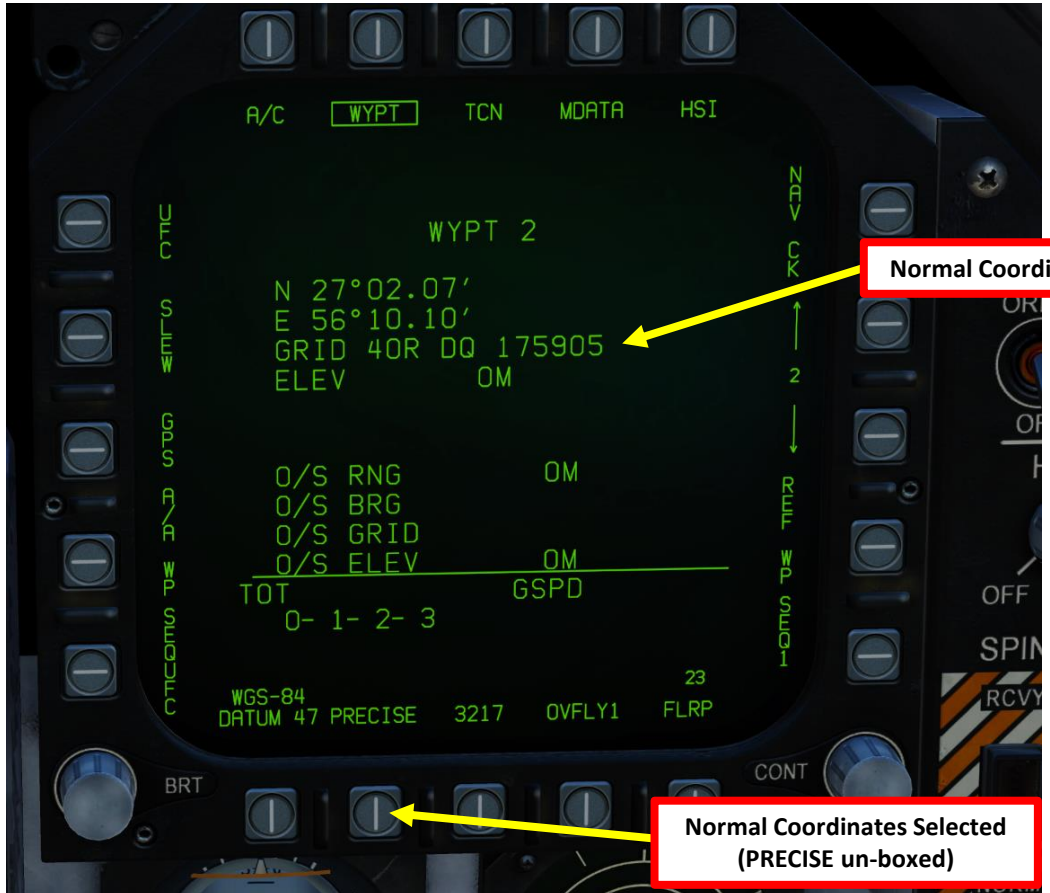


5 - WAYPOINTS
5.6 – PRECISE Coordinates

Coordinates can have various levels of precision. An increased coordinate precision is available when boxing (selecting) the PRECISE option, which is useful since it adds more digits and can guarantee a more accurate strike on precision-guided munitions (PGMs) like JDAMs or JSOWs that rely on GPS coordinates. PRECISE option can be selected in the HSI – DATA sub-menu.

Latitude and Longitude is entered as Degrees/Minutes/Thousandths of minutes (LATLN DCML), or Degrees/Minutes/Seconds (LATLN SEC).

- With PRECISE unboxed (not selected):
  - LAT / LONG is entered either as Degrees/Minutes/ Hundredths of minutes (LATLN DCML) or Degrees/Minutes/Seconds (LATLN SEC).
  - GRID coordinates have 6 digits.
- With PRECISE boxed (selected):
  - LAT / LONG is entered either as Degrees/Minutes/Ten Thousandths of minutes (LATLN DCML) or Degrees/Minutes/Seconds/Hundredths of seconds (LATLN SEC).
  - GRID coordinates have 10 digits.



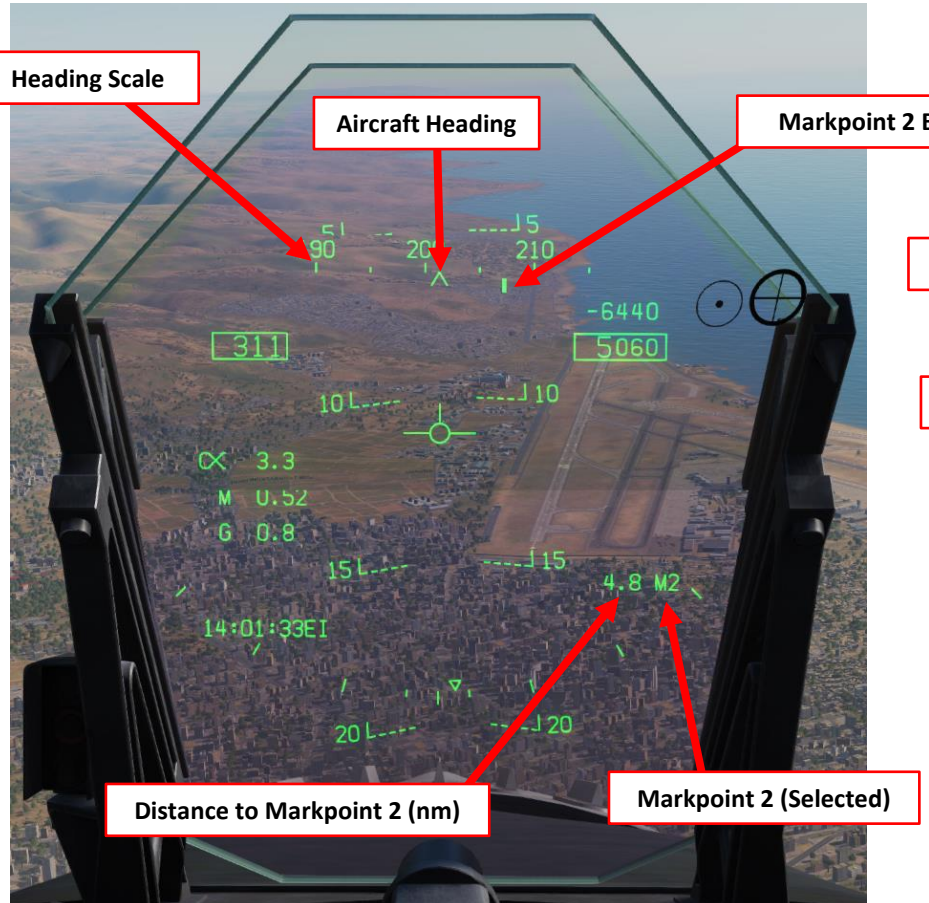


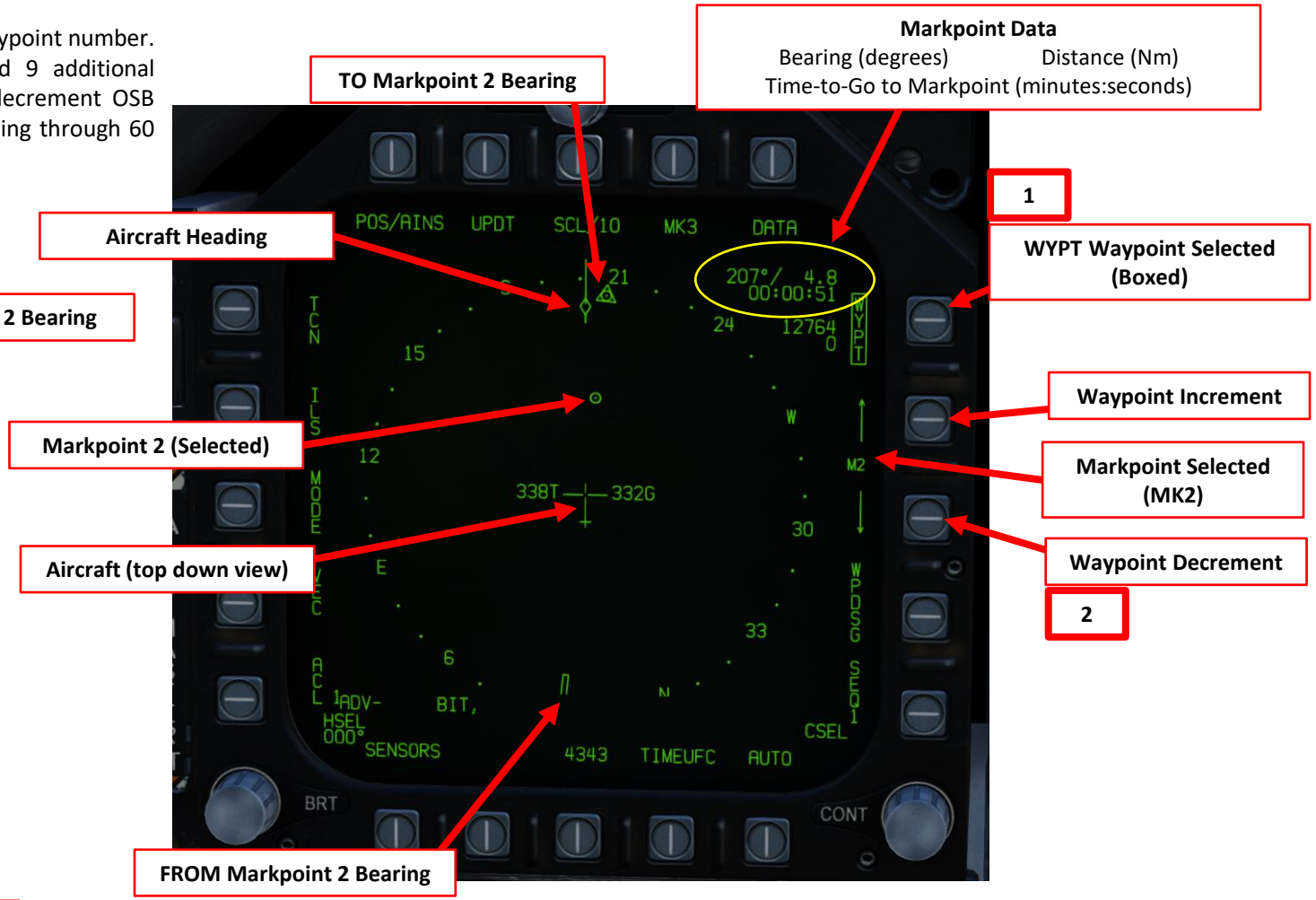
6 - MARKPOINTS
6.1 - MARKPOINT NAVIGATION

Markpoint Tutorial by Redkite:
https://youtu.be/zP8Xl XAA0

To navigate to an existing markpoint:

1. From the HSI page, Press the OSB (Option Select Button) next to WYPT to set tracking mode to WAYPOINT.
2. To select a markpoint, press the OSBs to increment or decrement the waypoint number. Since the Waypoint Database can contain up to 60 waypoints and 9 additional markpoints (stored AFTER waypoint 59). I would suggest using the decrement OSB instead of the increment OSB (quicker way to go to the MK#). since going through 60 waypoints can be a bit time-consuming.
3. Use the HSI and HUD to navigate towards waypoint





6 - MARKPOINTS
6.1 - MARKPOINT NAVIGATION

To consult markpoint data:

1. From the HSI page, press the OSB next to DATA to enter the DATA sub-page
2. Select desired markpoint using the increment/decrement OSBs





Waypoint Increment

Markpoint Selected (MK2)

Waypoint Decrement

2

6 - MARKPOINTS
6.2 - HOW TO ADD MARKPOINTS

There are two main methods of creating a markpoint in the Hornet:

- **Overfly Method**: you create a markpoint at the current location your aircraft is flying over
- **Target Designate Method**: you create a markpoint at the designated point/target by an existing sensor (i.e. targeting pod, air-to-ground radar, waypoint designate, etc.)

OVERFLY METHOD

1. Make sure that **no target is designated with any sensor** (targeting pod, air-to-ground radar, waypoint designate). Use the Undesignate Button if you wish to un-designate a target.
2. Fly over the location you want to mark
3. From either the HSI (Horizontal Situation Indicator) or the SA (Situational Awareness) page, press the OSB (Option Select Button) next to MK#.
4. The MK# will increment and the markpoint will be created at the coordinates you were at when pressing the MK# OSB.

- Note: Once MK#9 is created (the last of the 9 available markpoints), the next created MK# will overwrite MK#1, and so on and so forth.





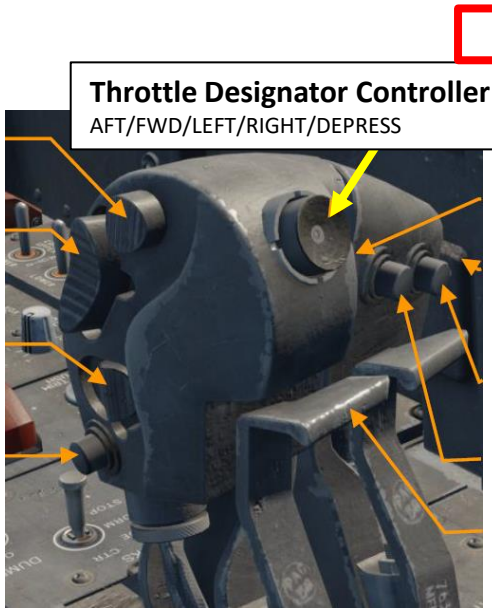


6 - MARKPOINTS
6.2 - HOW TO ADD MARKPOINTS

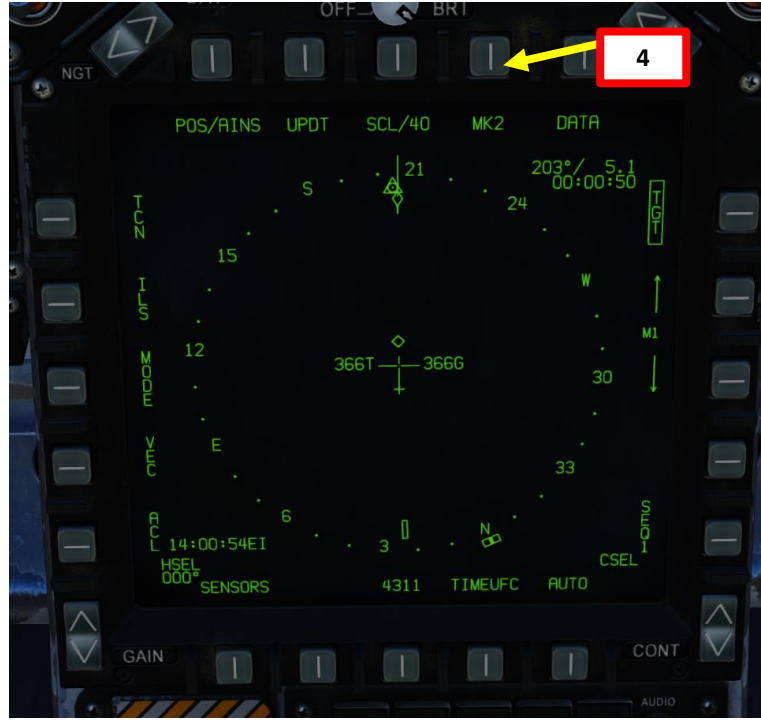
TARGET DESIGNATE METHOD (USING TARGETING POD)

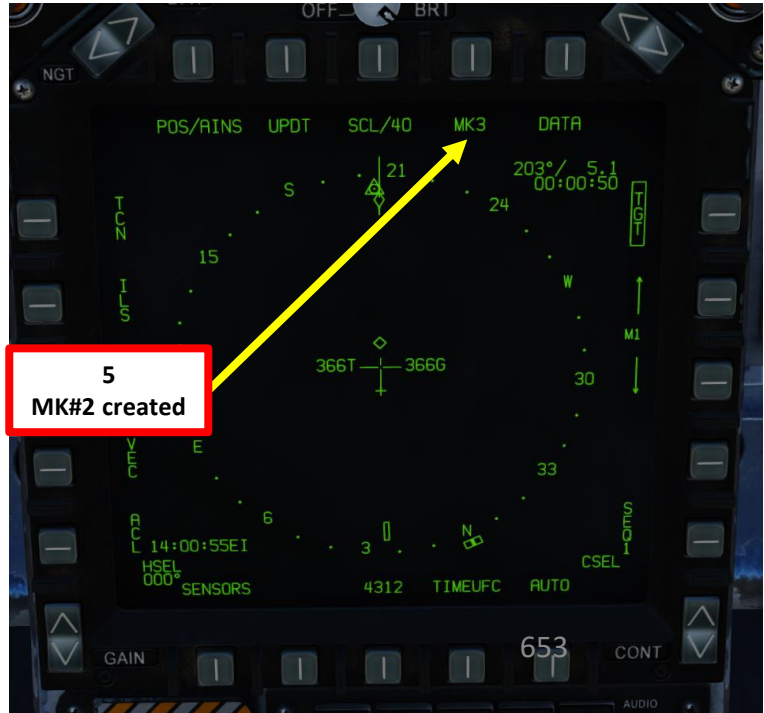
1. Slew the targeting pod to the desired markpoint location (see targeting pod section).
2. To designate a target, use the TDC DEPRESS control (“ENTER”).
3. A diamond will appear over the designated point on the FLIR page and on the Heads-Up Display as well.
4. From either the HSI (Horizontal Situation Indicator) or the SA (Situational Awareness) page, press the OSB (Option Select Button) next to MK#.
5. The MK# will increment and the markpoint will be **created at the designated target point selected when pressing the MK# OSB**.

- Note: Once MK#9 is created (the last of the 9 available markpoints), the next created MK# will overwrite MK#1, and so on and so forth.





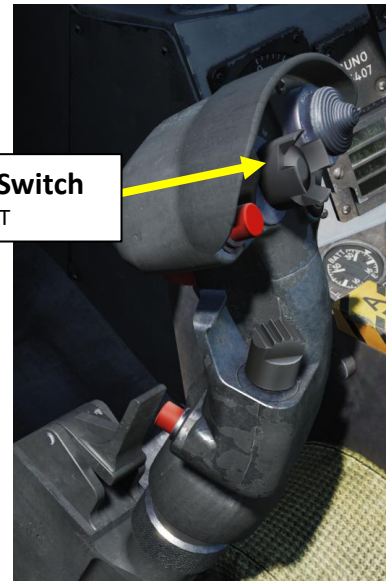


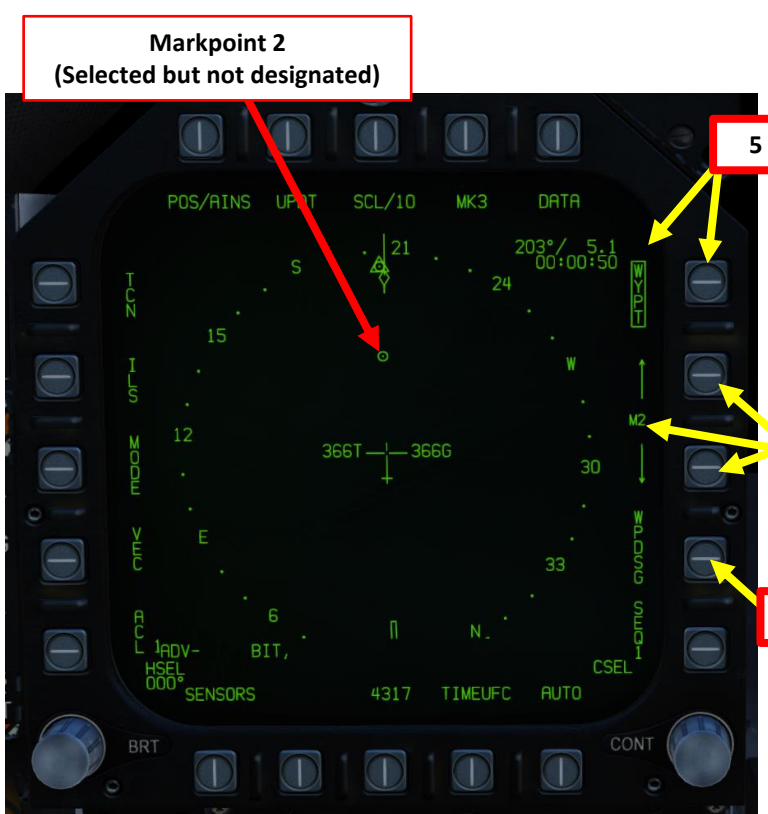


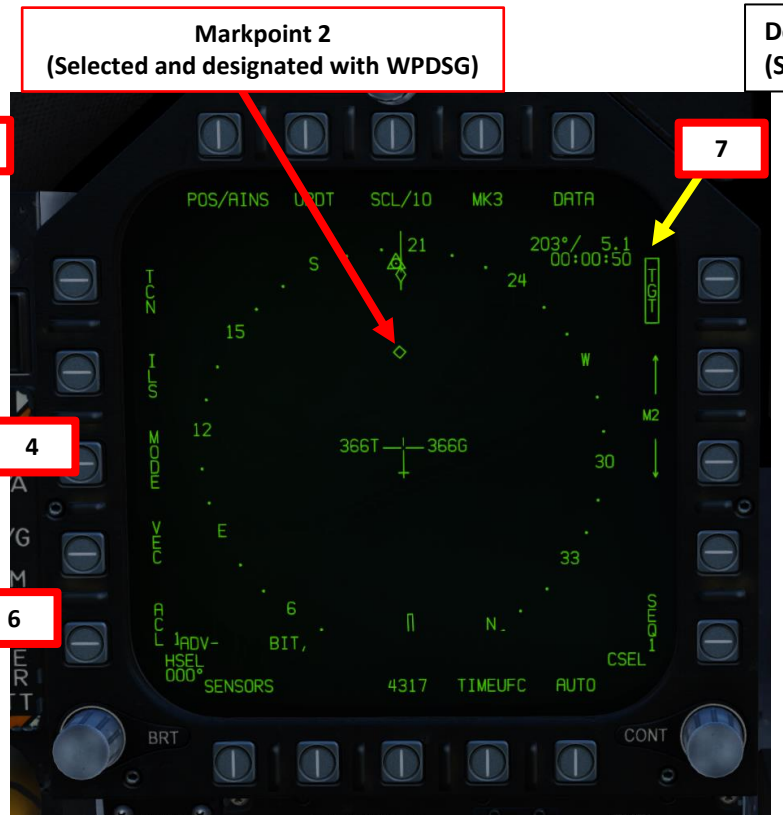
6 - MARKPOINTS
6.3 - HOW TO USE MARKPOINTS

Now that we have created markpoints, what do we do with them? Well, we can slave our sensors (i.e. targeting pod) to these markpoints and use them as reference to launch weapons at. We will use a similar approach to the "Waypoint Slave" function of the targeting pod.

1. We will assume Markpoint #2 (M2) has already been created beforehand with the Target Designate method mentioned earlier.
2. Select FLIR page and press the Sensor Control Switch in the direction of the selected DDI.
3. The Select Focus Diamond indicates what display is selected.
4. On HSI (Horizontal Situation Indicator) page, select desired markpoint using the OSBs (Option Select Button) next to UP or DOWN arrows.
5. Press OSB next to WYPT (boxed = selected)
6. Press on OSB next to WPSDG to designate waypoint/markpoint as the target point (boxed = selected)
7. Targeting pod will automatically slew to the selected waypoint/markpoint.



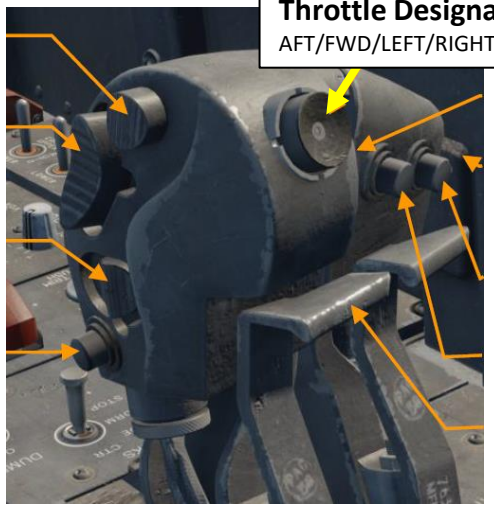




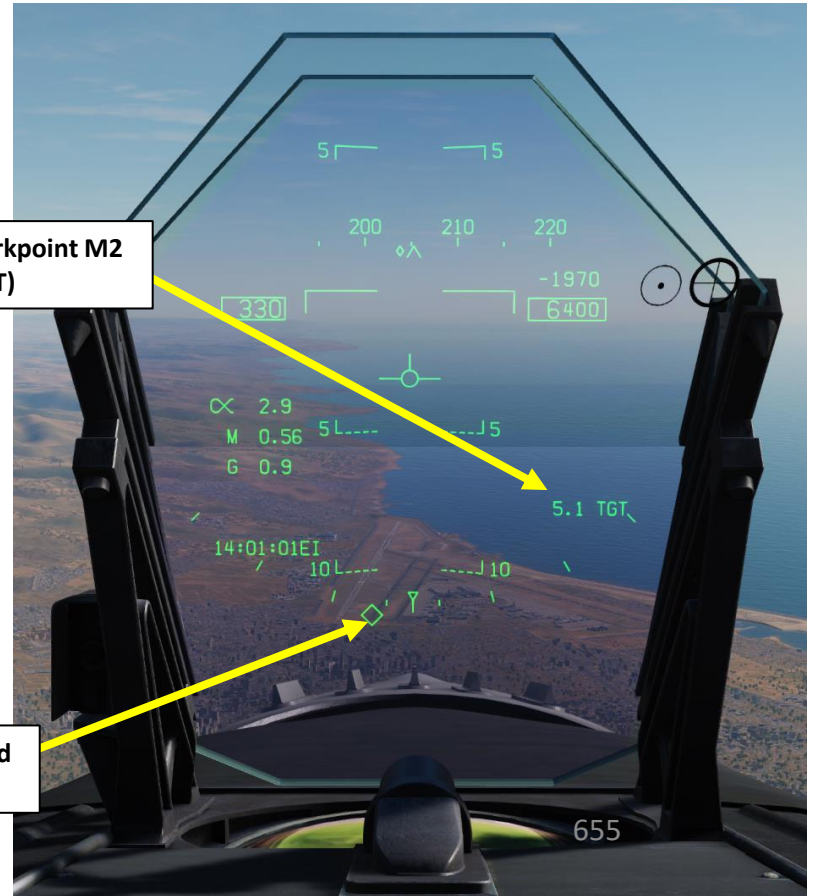


6 - MARKPOINTS
6.3 - HOW TO USE MARKPOINTS

8. Use the TDC (Throttle Designator Controller) Aft/Fwd/Left/Right controls to slew the targeting pod reticle over the desired target if adjustments are required.
9. You can then use a weapon of your choice like a Maverick and fire it on the designated point (markpoint in WPDSG).







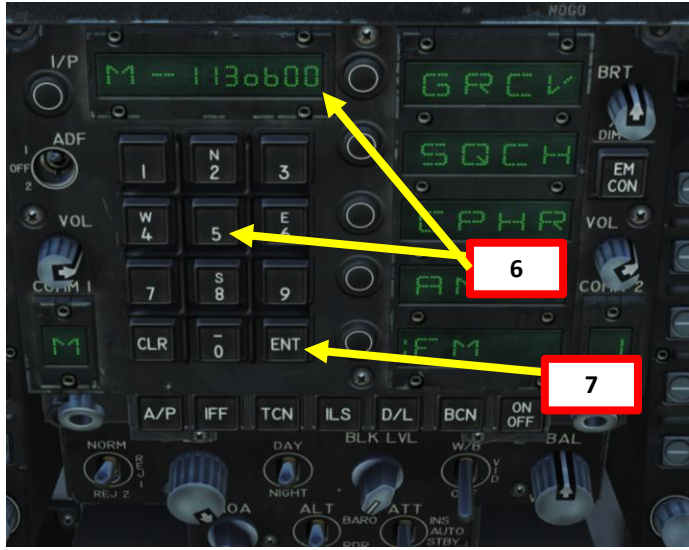
7 – ADF NAVIGATION

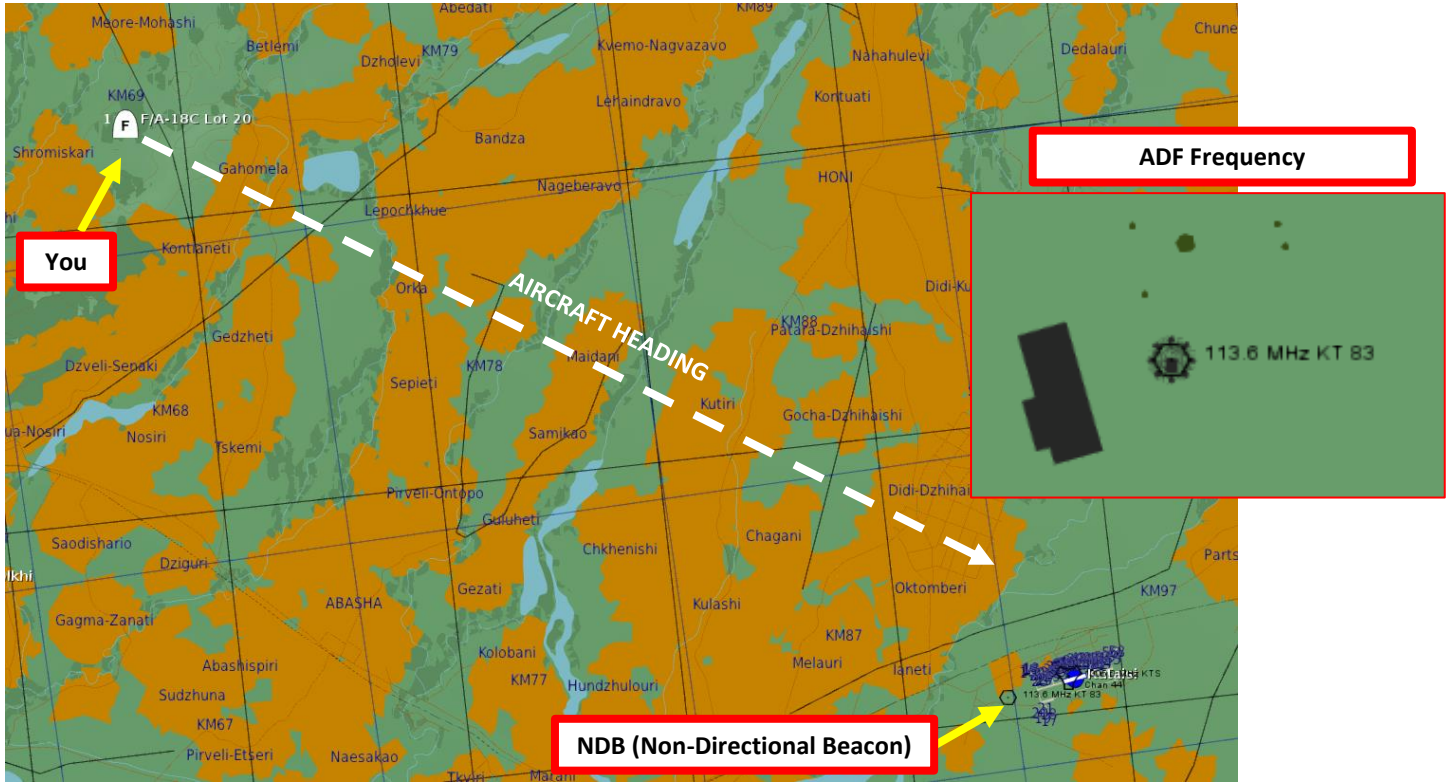
To track an ADF (Automatic Direction Finder):

We want to track NDB (Non-Directional Beacon) 113.6.

1. Set ADF switch to ADF1 (UP)
2. Left click on the COMM1 knob to pull it and select COMM1 Radio
3. Scroll mousewheel on COMM1 Radio Channel Selector to M (Manual) Mode
4. Press the OSB next to FM (":" will appear when selected)
5. Press CLR on the UFC to clear current frequency
6. Type "113600" on the UFC to set ADF frequency 113.6 MHz
7. Press ENT on the UFC to enter this frequency
8. You will now see a circle on the HSI compass rose. This is the heading towards the ADF beacon.





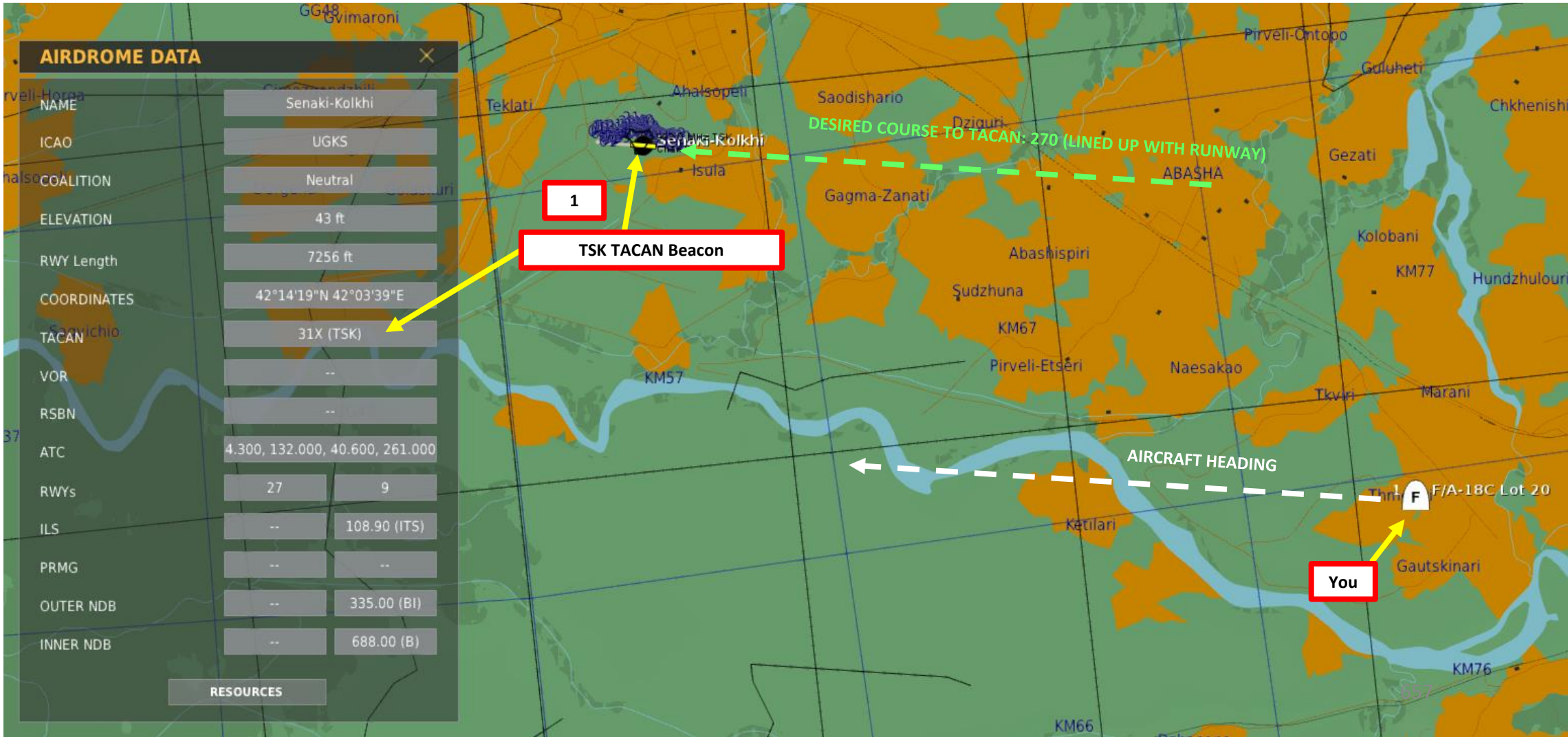




8 – TACAN NAVIGATION

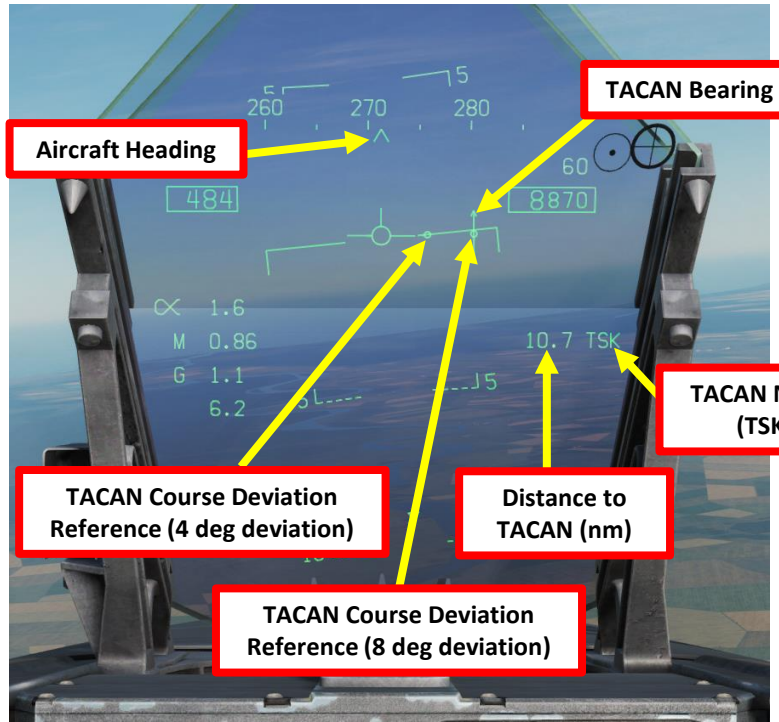
TACAN (Tactical Air Navigation) stations are navigation aids typically used by the military and provide you directional and distance guidance. They can be installed on airdromes, air refueling tankers or even aircraft carriers like the CVN-74 John Stennis (74-X frequency typically).

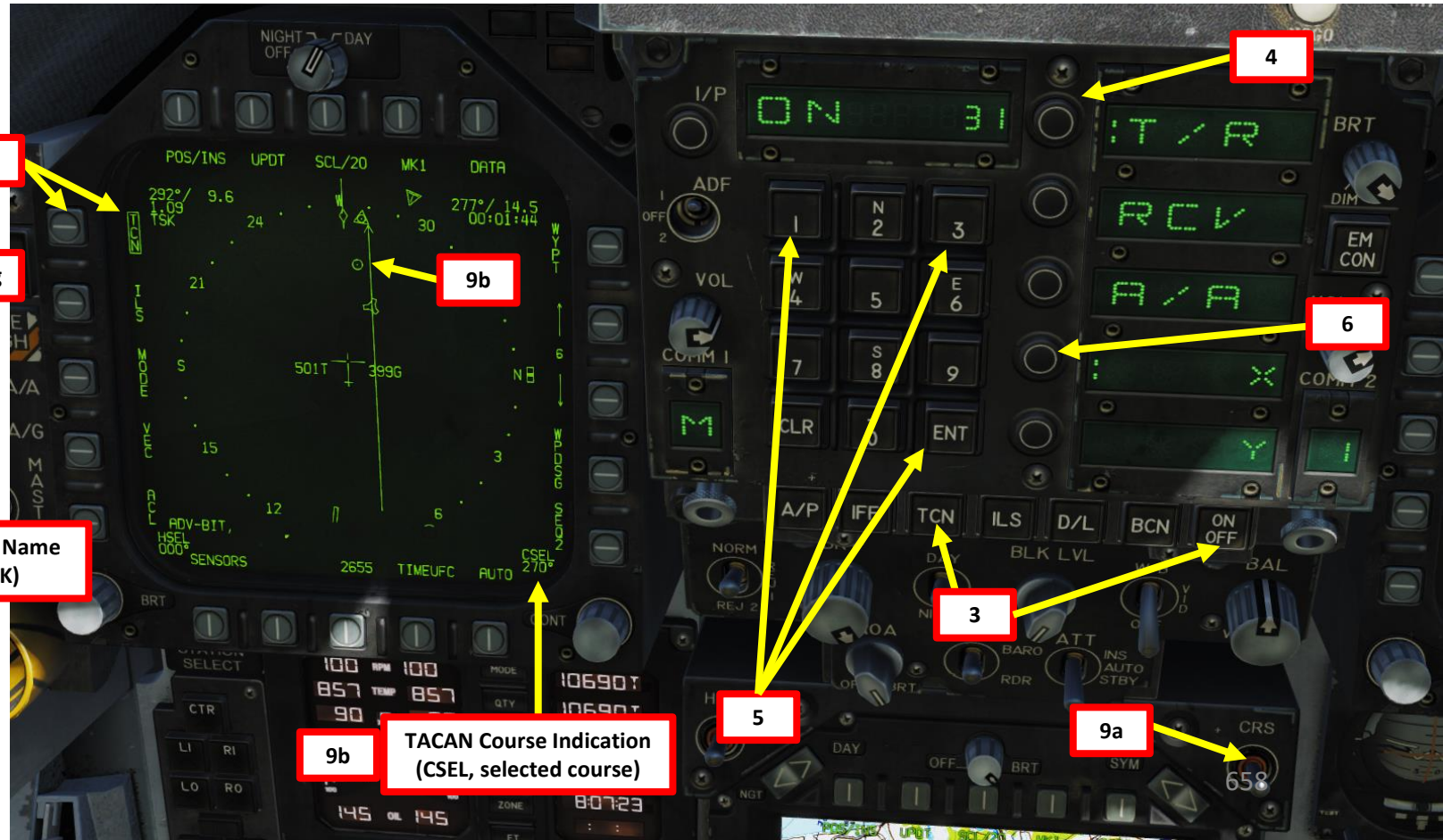
1. Determine the TACAN frequency you want to track by opening the map with F10 and by clicking on the airport you want to track. The frequency of the TACAN beacon for Senaki-Kolkhi is 31X (TSK).



8 – TACAN NAVIGATION

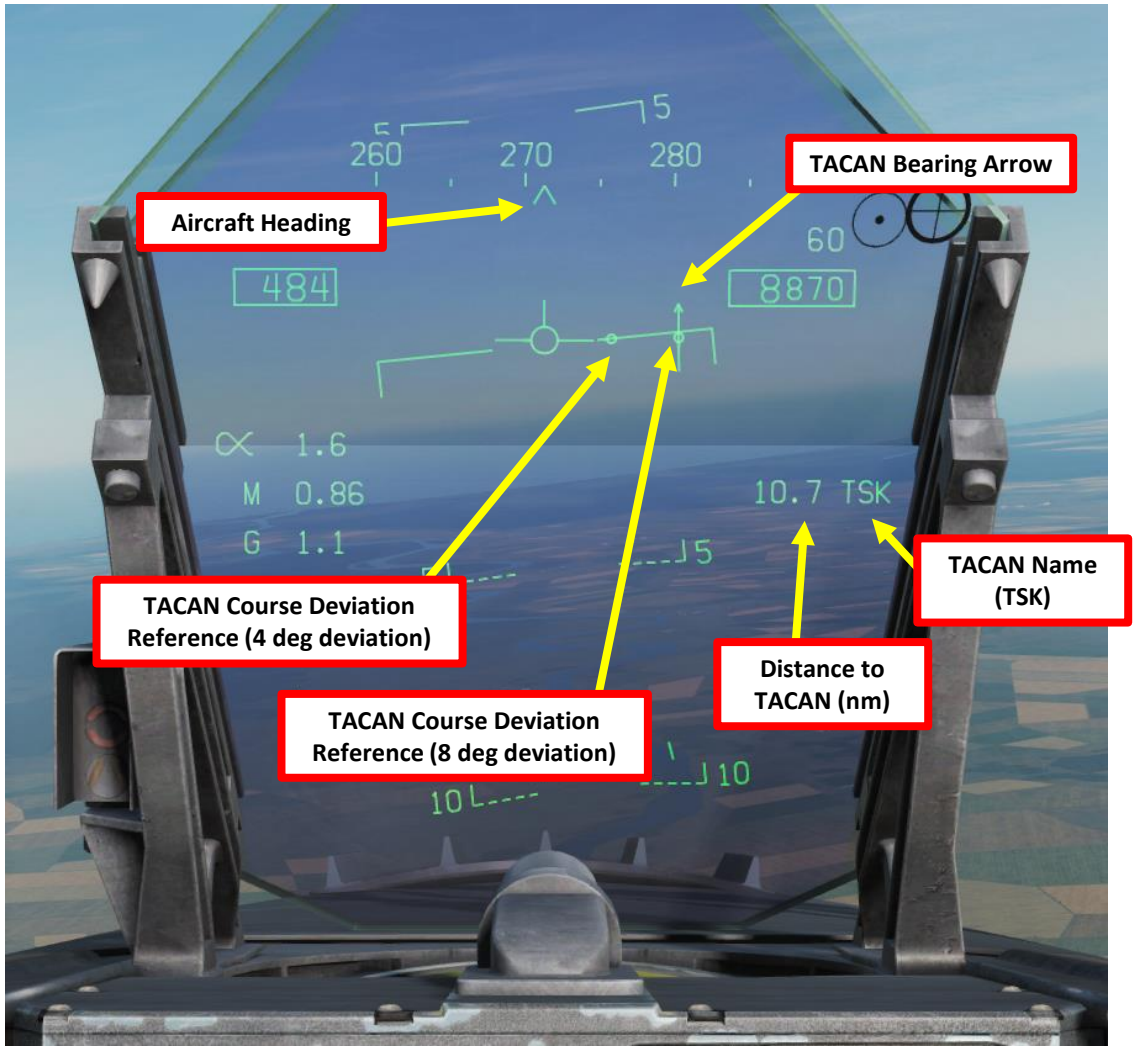
2. Select the HSI page on either DDI
3. On the UFC (Up-Front Control) Panel, press the TCN button and press the ON/OFF button if the ON indication is extinguished.
4. Press the T/R OSB button to set it to Transmit/Receive. The ":" symbol indicates that it is selected.
5. Press "31" on the scratchpad and press "ENT" to enter frequency.
6. Press the X or Y OSB to select the right letter of the TACAN frequency (31X in our case).
7. If you are tracking an aerial TACAN beacon (i.e. on a tanker), press the A/A OSB button to select air-to-air mode. The ":" symbol indicates that the mode is selected. Otherwise, make sure A/A is not selected (no ":" symbol).
8. Press the OSB next to TACAN to select tracking mode to TACAN. Once selected, TCN should be boxed.
9. Click and hold (Left/Right mouse button) the CRS (Course Set) knob to set desired course (CSEL) for TACAN approach. This is useful when approaching a carrier/airfield from a certain direction.
10. Once frequency is set and options are set, you can track the TACAN beacon via the HSI page and the HUD (Heads-Up Display).





8 – TACAN NAVIGATION

TSK TACAN Data
Bearing (degrees) Distance (Nm)
Time-to-Go to TACAN (minutes:seconds)
TACAN Name

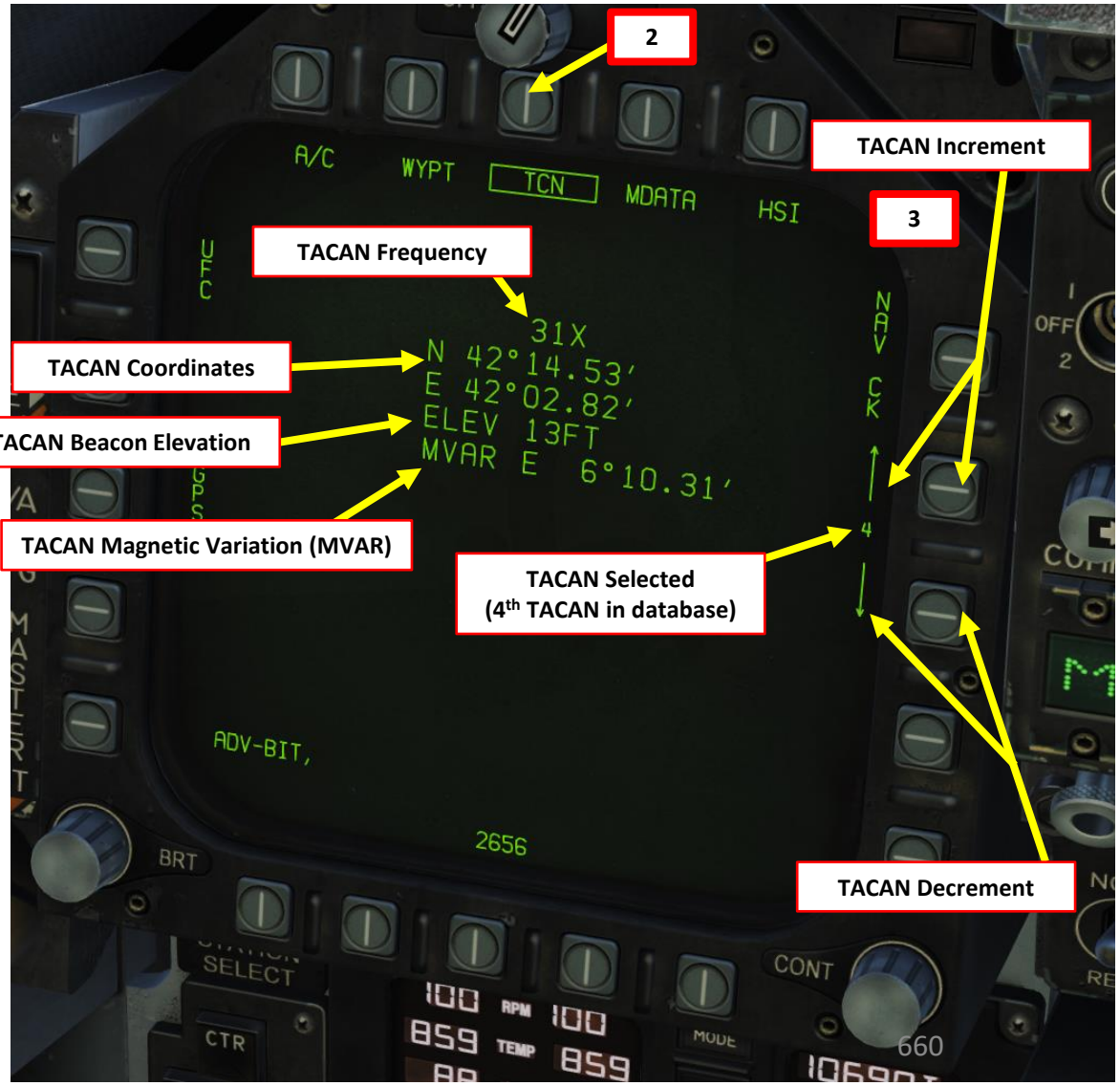




8 – TACAN NAVIGATION

Here's a nice trick for you. If you click the OSB next to DATA while in the main HSI page, then click the OSB next to TCN, you can find the whole TACAN database. You can cycle through every TACAN station using the Increment/Decrement OSBs.



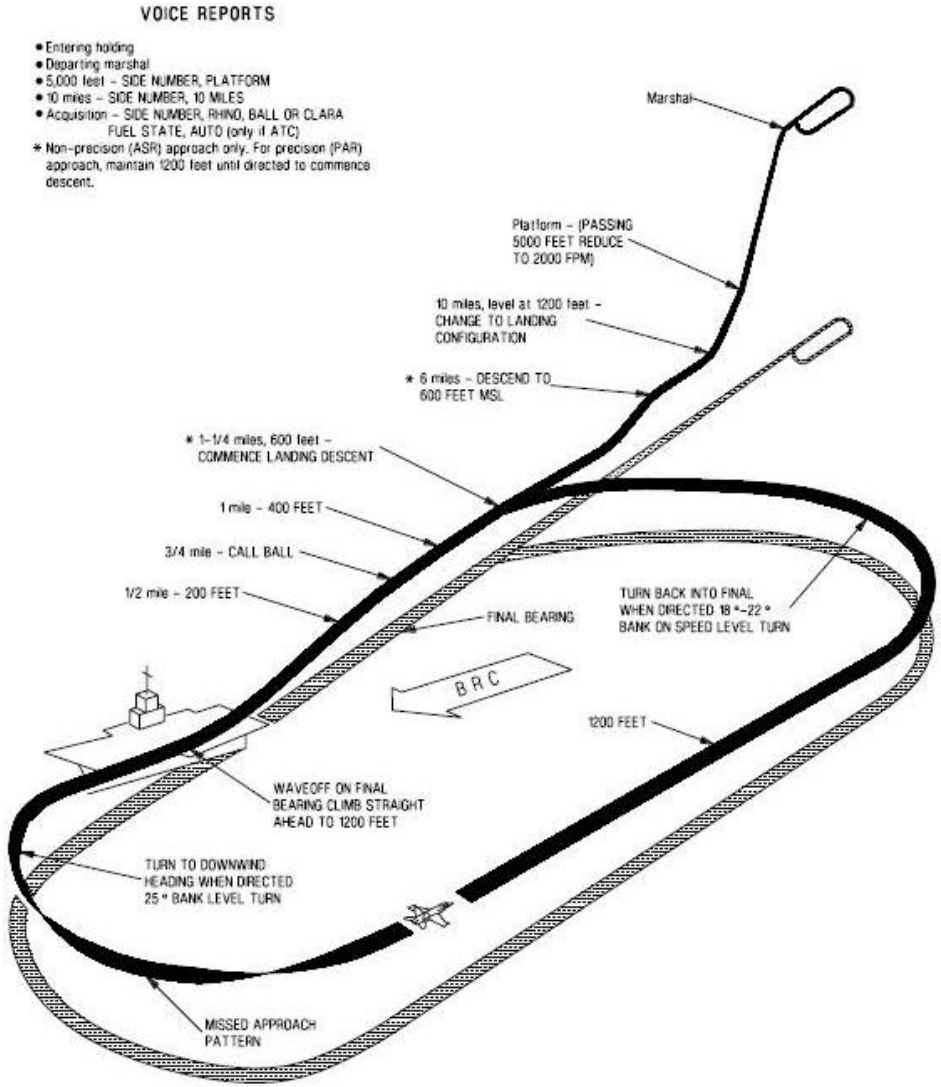


9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

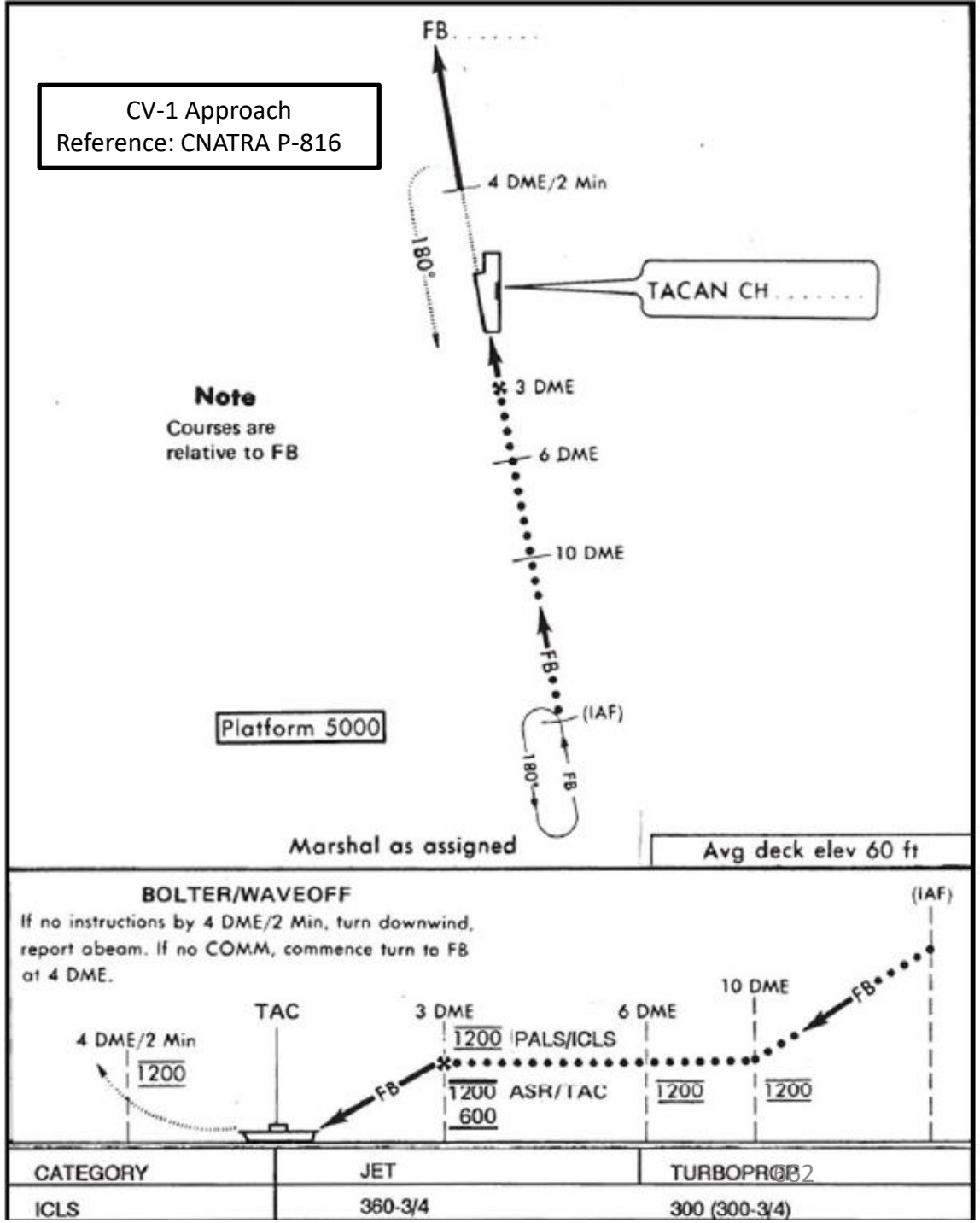


9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

Case III recovery is used for all night operations, as well as during the day when the weather is below Case II minimums (less than 1,000-3). In other words, a Case III recovery is used for bad weather with low visibility conditions. The ICLS (Instrumented Carrier Landing System) will act sort of like an ILS (Instrumented Landing System) but for a carrier (d'uh).



CV-1 Approach
Reference: CNATRA P-816



CATEGORY	JET	TURBOPROP
ICLS	360-3/4	300 (300-3/4)

9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

The landing looks complicated, but it's not that bad once you figure out what you need to do. Don't worry, we'll go through it together.

- You will generally start a Case III recovery in the Marshal Zone. It's an airspace 25 nautical miles from the carrier where aircraft wait for landing clearances. We will use the carrier's TACAN beacon to orient ourselves and approach the carrier from a certain direction in reference to the beacon, which is what we call a radial. The Marshal Radial is usually 15 to 30 degrees off the Final Bearing. In our case, the final bearing is 360 deg, so the Marshal Radial is 030.

- We will follow the Marshal Radial (030) and descend from 10,000 ft to 5,000 ft at 250 kts with a descent rate of 4000 ft/min

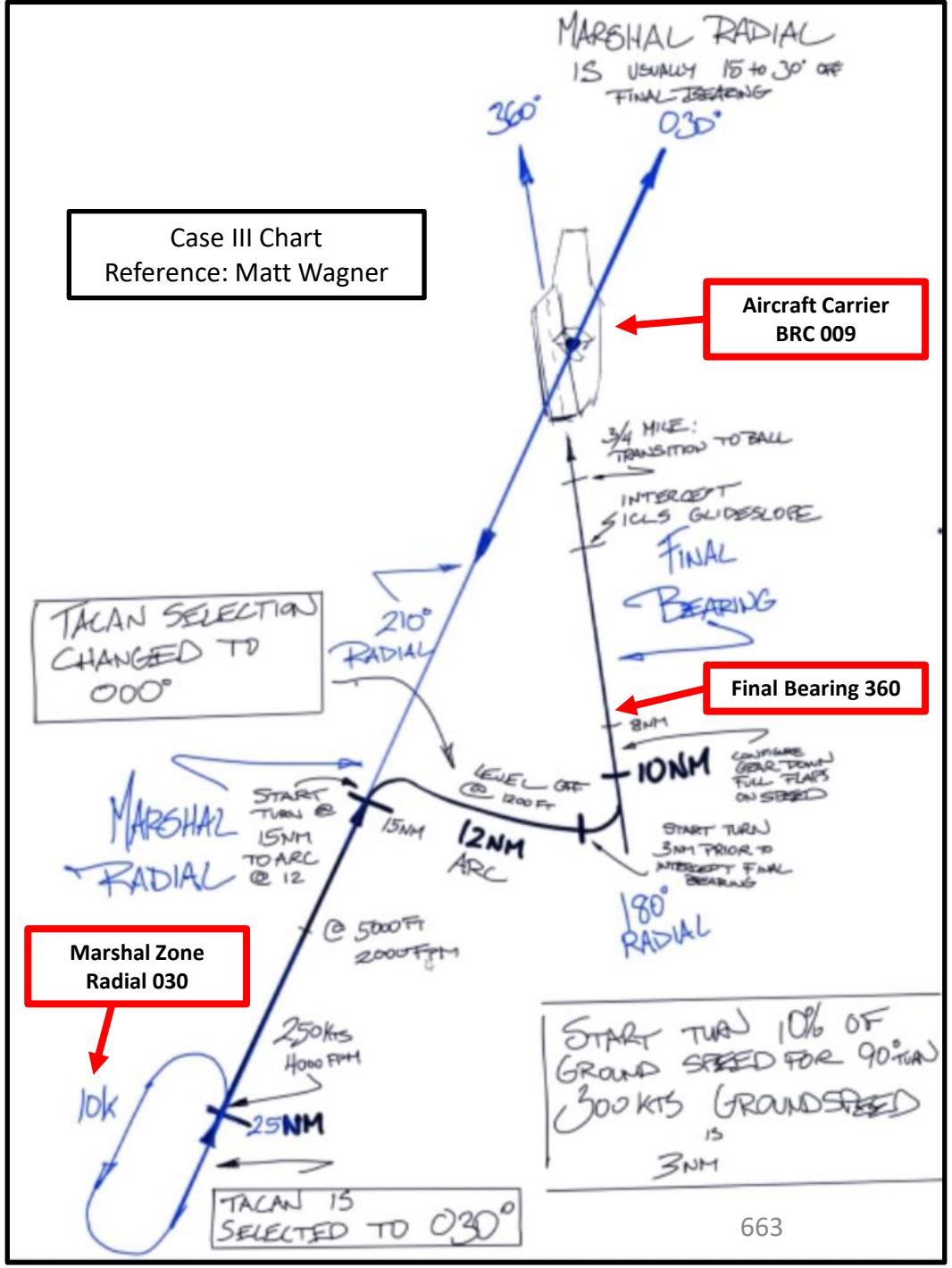
- Once we are 15 nm from the carrier on the Marshal Radial, we will turn 90 degrees right (030 + 90 degrees = 120 degrees) and maintain a 12 nm separation with the carrier.

- We will follow the "arc" until we reach the Final Bearing radial (360/000) approximately 10 nm from the carrier. We will then drop our gear down, set our flaps to full and set our angle of attack to ON SPEED AOA.

- Once we have turned to 360/000 and captured the carrier's localizer (indicates lateral deviation with runway centerline), we will then capture the glide slope (indicates vertical deviation with optimal path) using the ICLS (Instrumented Carrier Landing System).

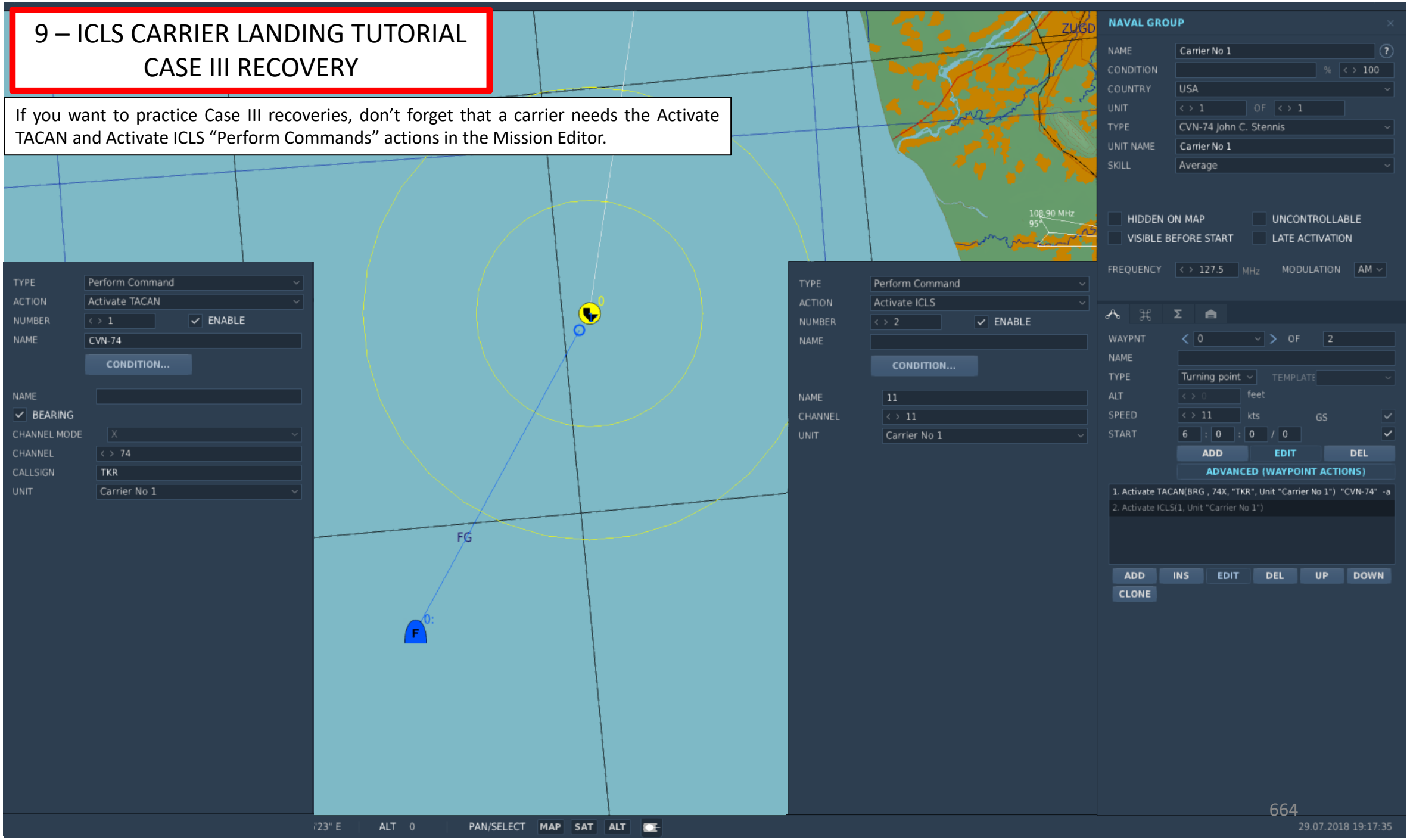
- Once we are 3/4 nm from the aircraft, we will track the meatball and use it as a reference to land.

- The TACAN is mostly used to help you track your radials and distance from the carrier during your approach. The ICLS, on the other hand, is used to give you a reference on where you should be during the final landing phase.



9 – ICLS CARRIER LANDING TUTORIAL CASE III RECOVERY

If you want to practice Case III recoveries, don't forget that a carrier needs the Activate TACAN and Activate ICLS "Perform Commands" actions in the Mission Editor.

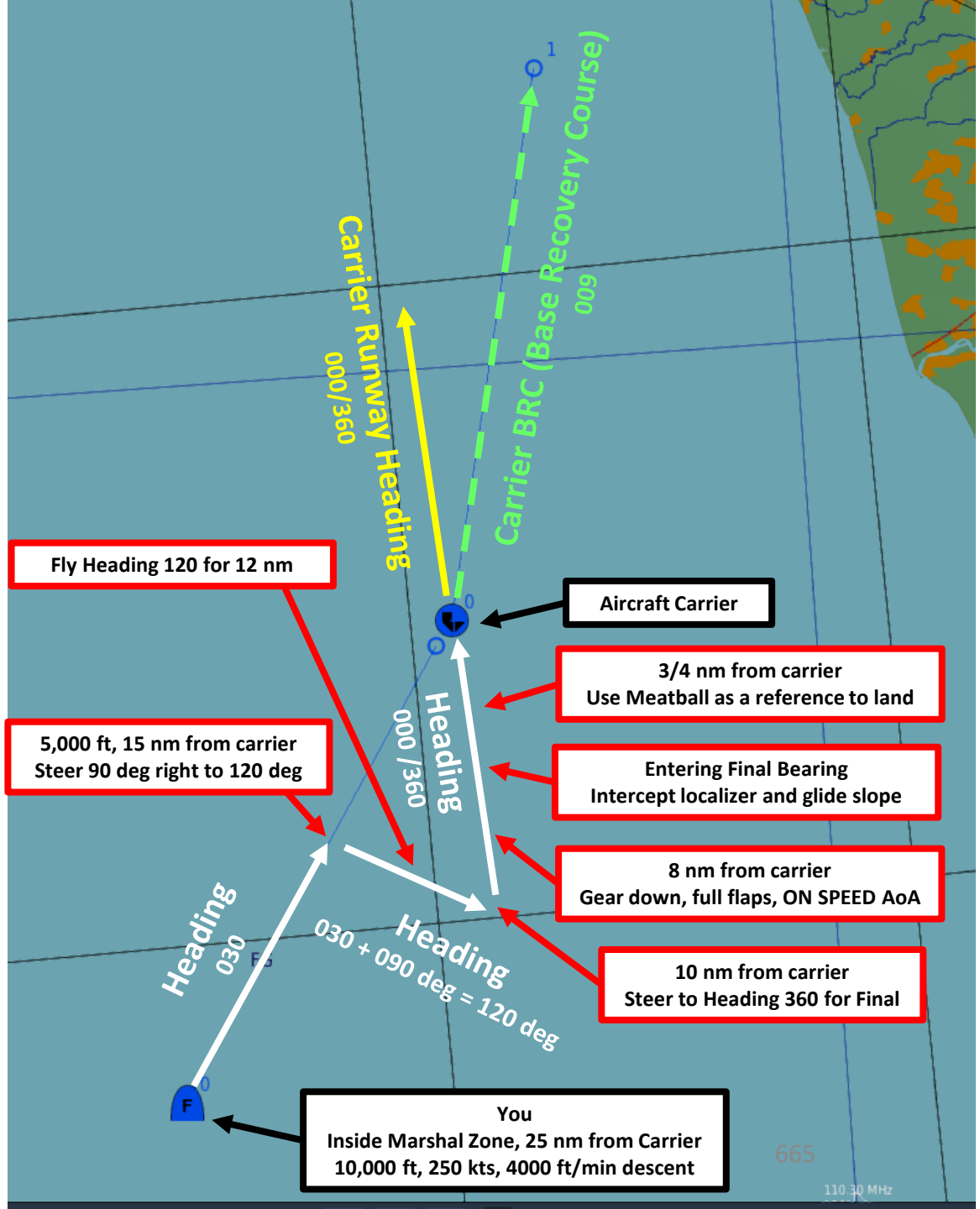


9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

Here is a brief overview of what we'll do.



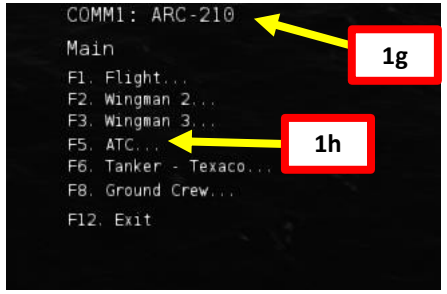


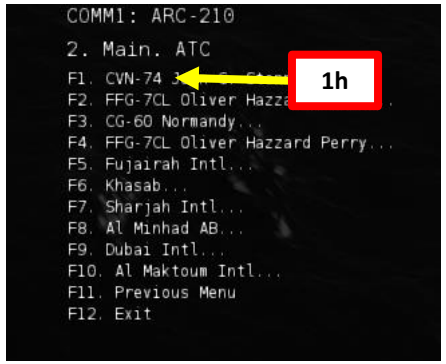


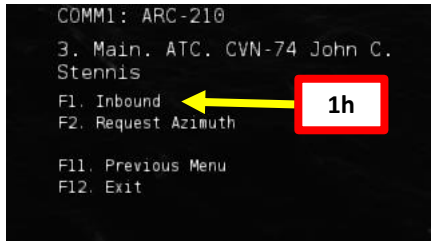
9 – ICLS CARRIER LANDING TUTORIAL CASE III RECOVERY

1. Contact Carrier to turn on the lights
   a. Left click on the COMM1 knob to pull it and select COMM1 Radio
   b. Scroll mousewheel on COMM1 Radio Channel Selector to M (Manual) Mode
   c. Press the OSB next to AM or FM to select the FM frequency (":FM" will appear when selected)
   d. Press CLR on the UFC to clear current frequency
   e. Type "127500" on the UFC to set carrier radio frequency 127.5 MHz
   f. Press ENT on the UFC to enter this frequency
   g. Press the COMM switch – COMM1 on your throttle to contact the carrier (RALT+\)
   h. Go in F5 – AT5 menu, then to the CVN-74 menu, then to the F1 – Inbound menu.
   i. And that's it, the carrier is now illuminated.











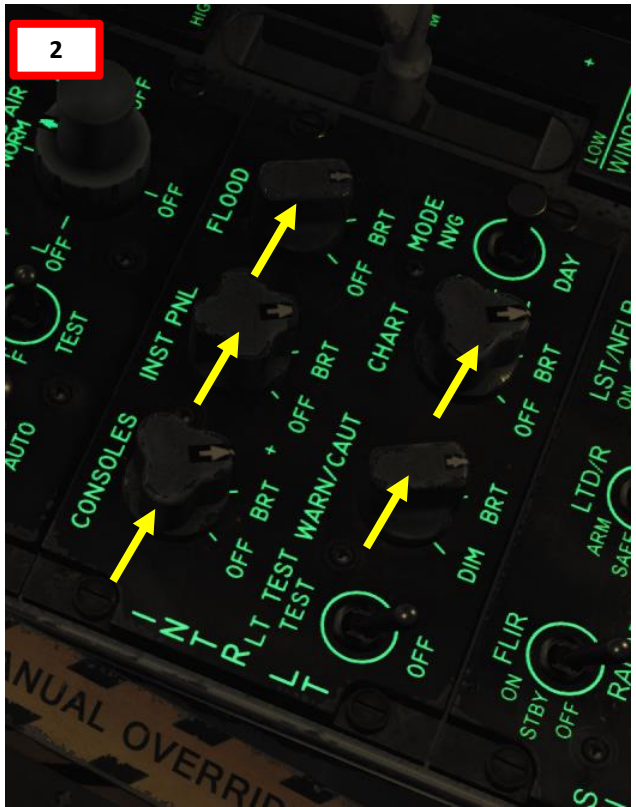


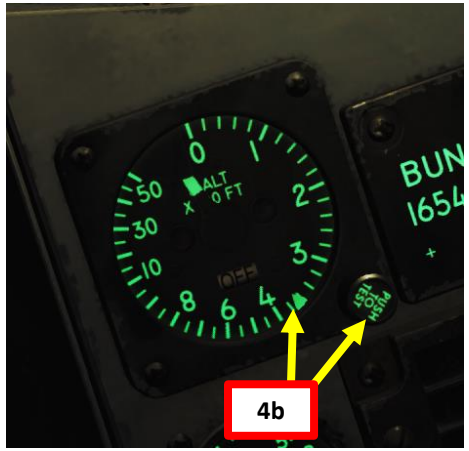


9 – ICLS CARRIER LANDING TUTORIAL CASE III RECOVERY

2. Adjust your interior cockpit lights as required
3. Set your HSI page on the left DDI, your FCS page on the right DDI, and the CHKLST page on the center AMPCD.
4. Set ALTITUDE Switch to RDR to use your radar altimeter as a reference for your HUD and set radar altimeter index to 370 ft or 320 (as you prefer). You use 370 ft to remind you that you need to make the ball call or 320 ft to make sure you have the proper altitude when 3/4 nm from the carrier.





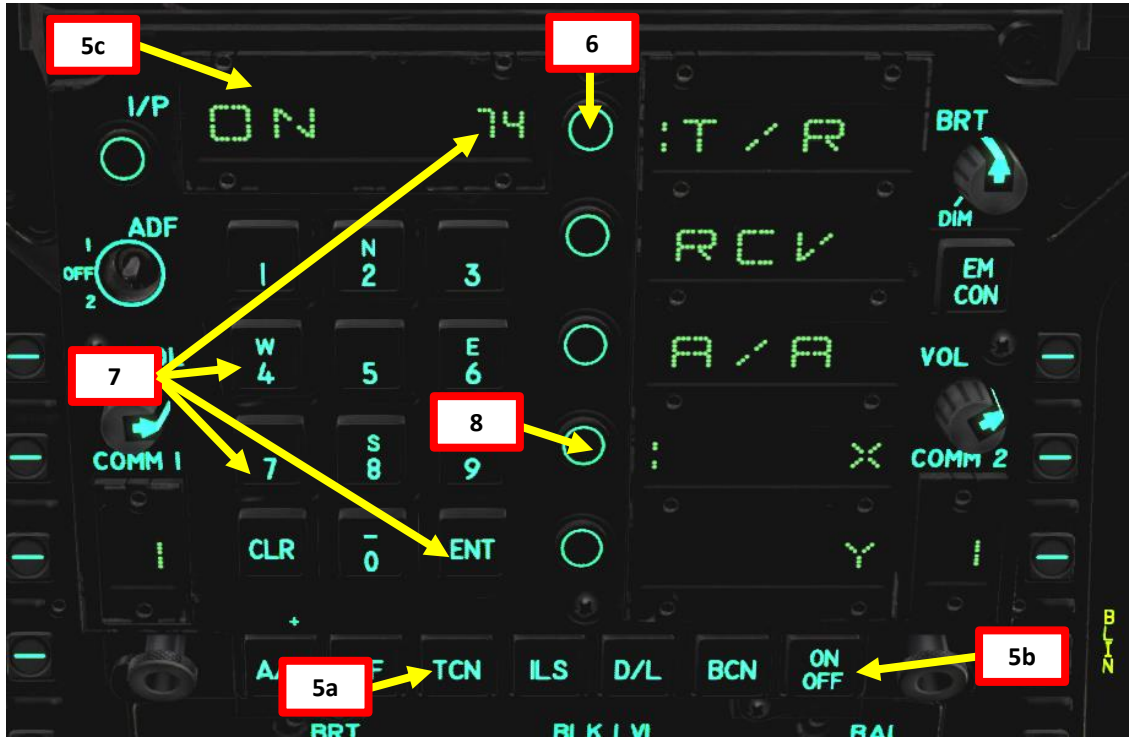




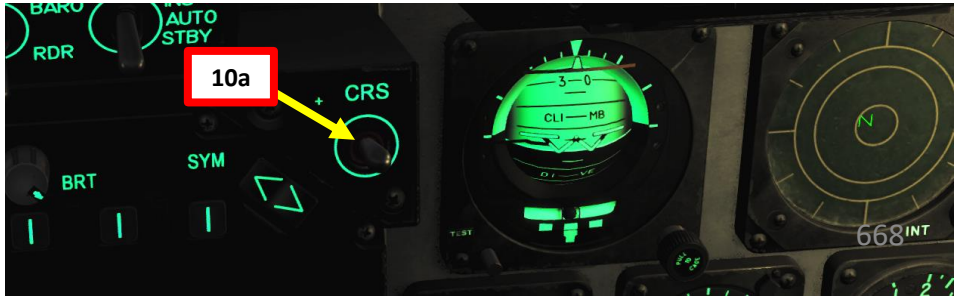
9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

Note: we will assume the carrier's **TACAN frequency is 74X** and our **ICLS channel is 11**.

5. On the UFC (Up-Front Control) Panel, press the TCN button and press the ON/OFF button if the ON indication is extinguished.
6. Press the T/R OSB button to set it to Transmit/Receive. The ":" symbol indicates that it is selected.
7. Press "74" on the scratchpad and press "ENT" to enter frequency.
8. Press the X or Y OSB to select the right letter of the TACAN frequency (74X in our case).
9. Press the OSB next to TACAN to select tracking mode to TACAN. Once selected, TCN should be boxed.
10. Click and hold (Left/Right mouse button) the CRS (Course Set) knob to set desired course (CSEL) for TACAN approach (030 for the Marshal Radial).







9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

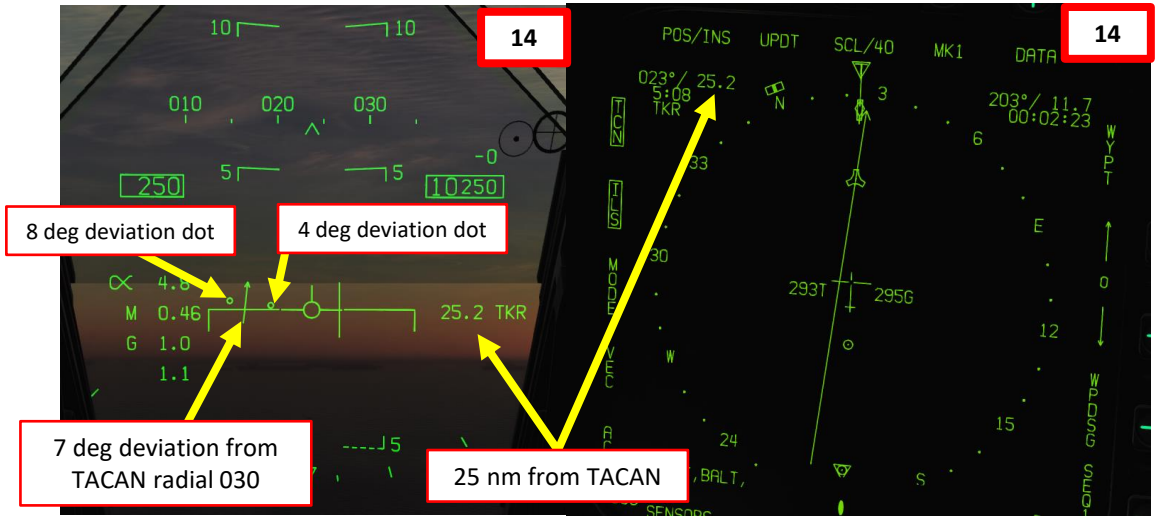
Note: we will assume the carrier's **TACAN frequency is 74X** and our **ICLS channel is 11**.

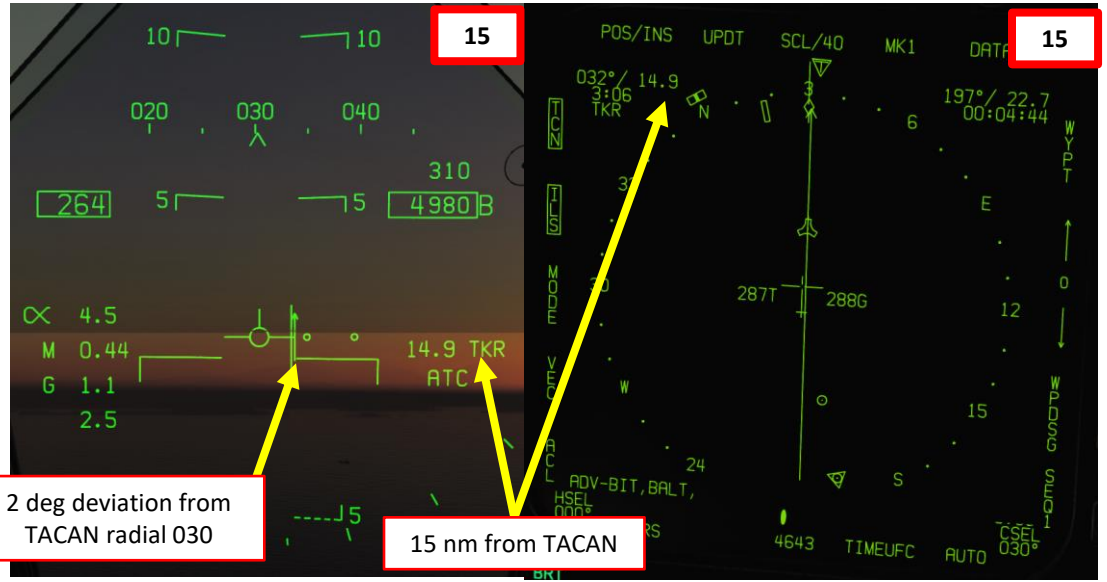
11. On the UFC (Up-Front Control) Panel, press the ILS button and press the ON/OFF button if the ON indication is extinguished.
12. Press "11" on the scratchpad and press "ENT" to enter ICLS frequency.
13. Press the OSB next to ILS to select tracking mode to ICLS. Once selected, ILS should be boxed.

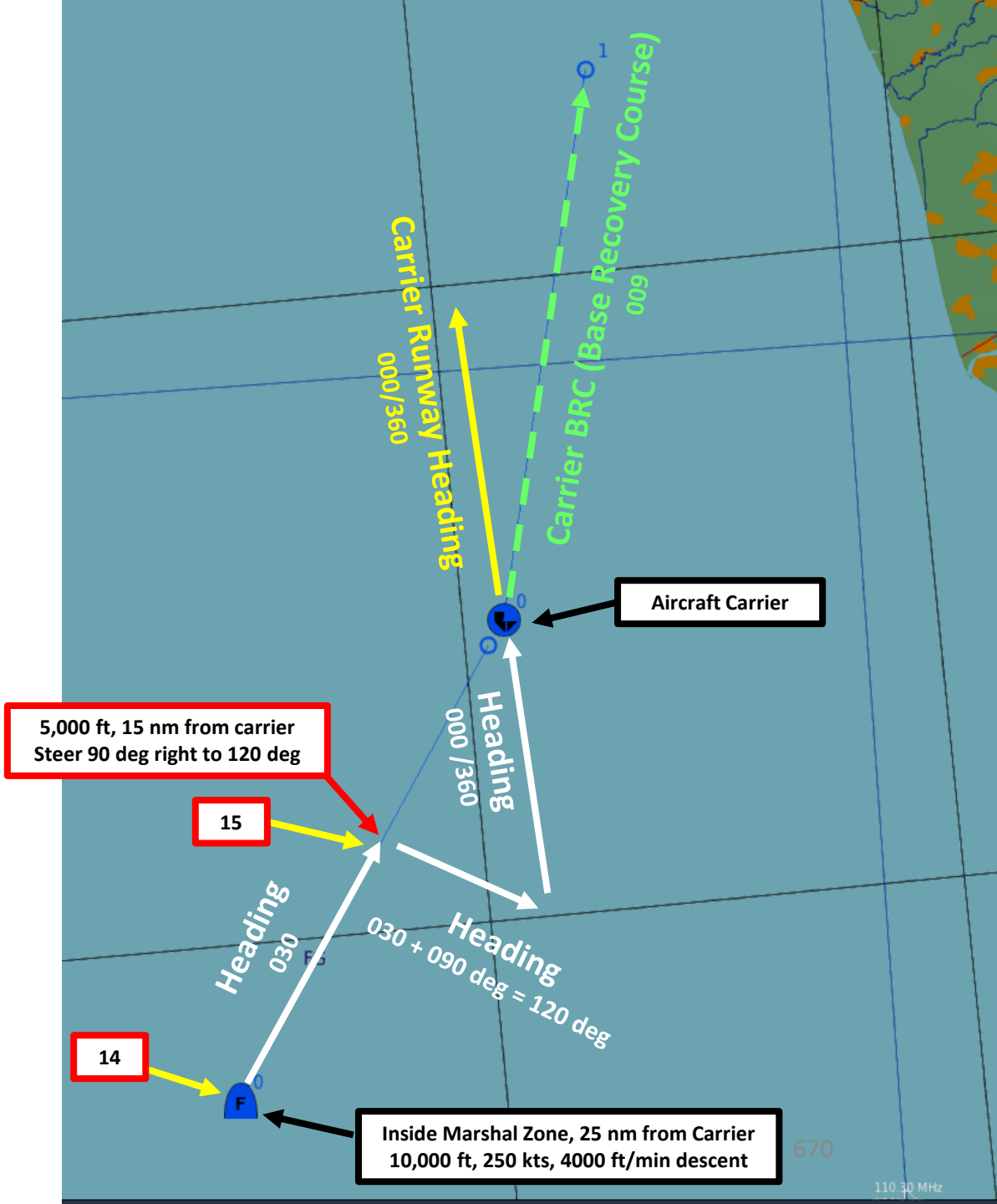


9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

14. When you are 25 nm from carrier, follow the Marshal Radial (030) and descend from 10,000 ft to 5,000 ft at 250 kts.
15. Maintain 5,000 ft until being 15 nm from carrier





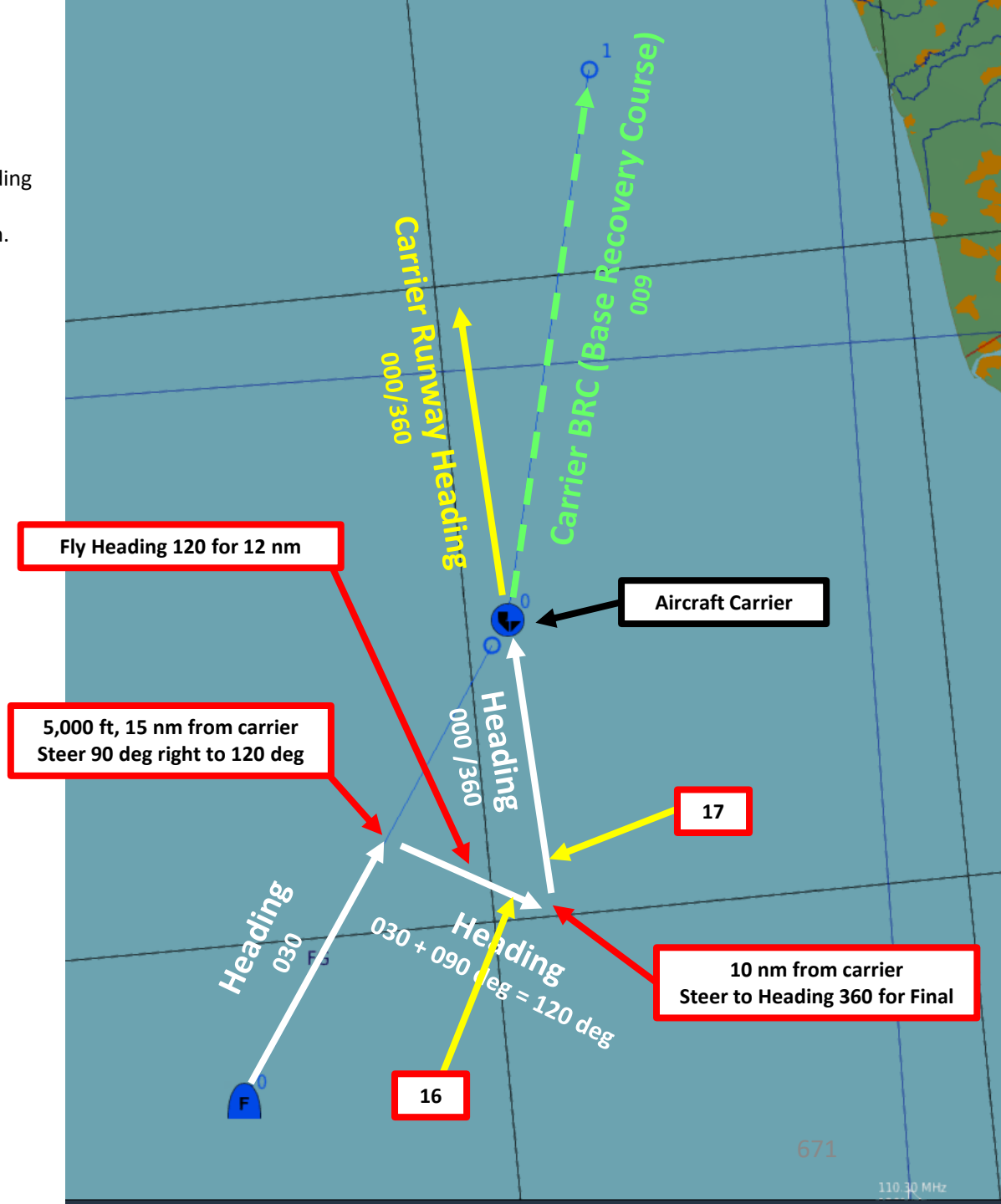


9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

16. Steer 90 deg right to a heading of 120 and set TACAN course to the Carrier Runway Heading (000/360).
17. When crossing the carrier's runway heading radial of 360, steer aircraft to 360 for Final Approach.

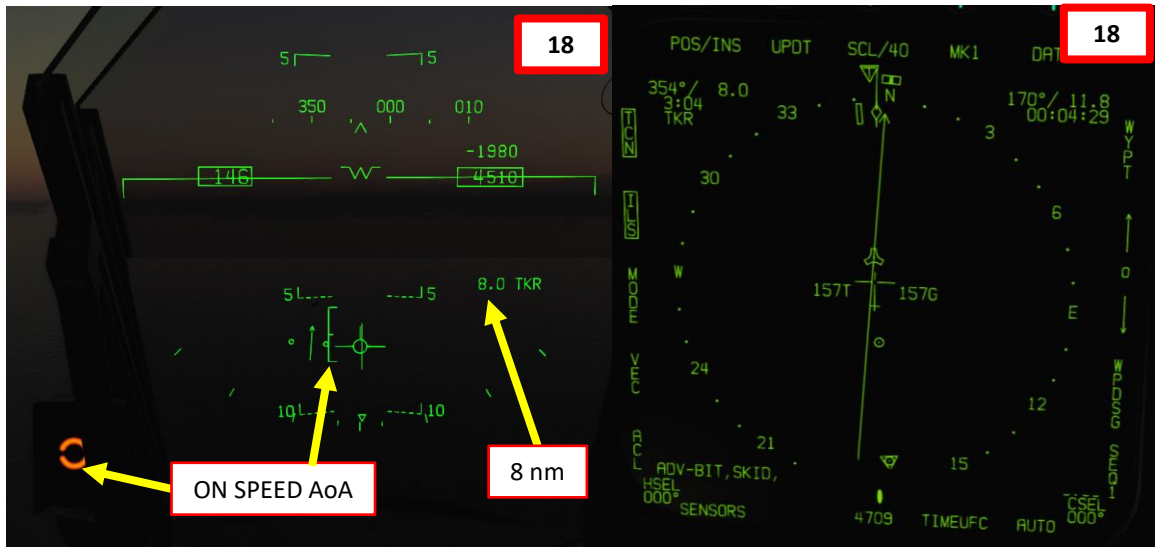


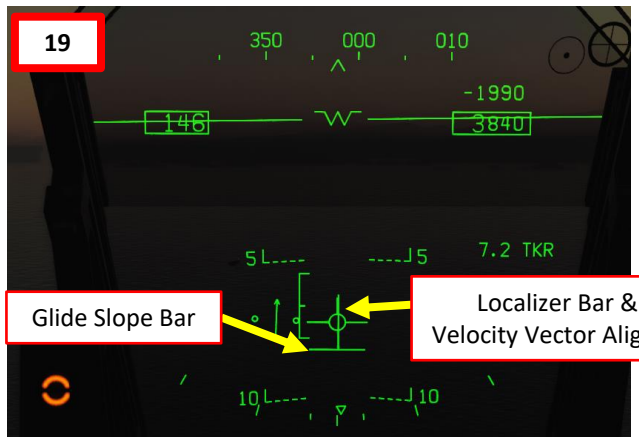




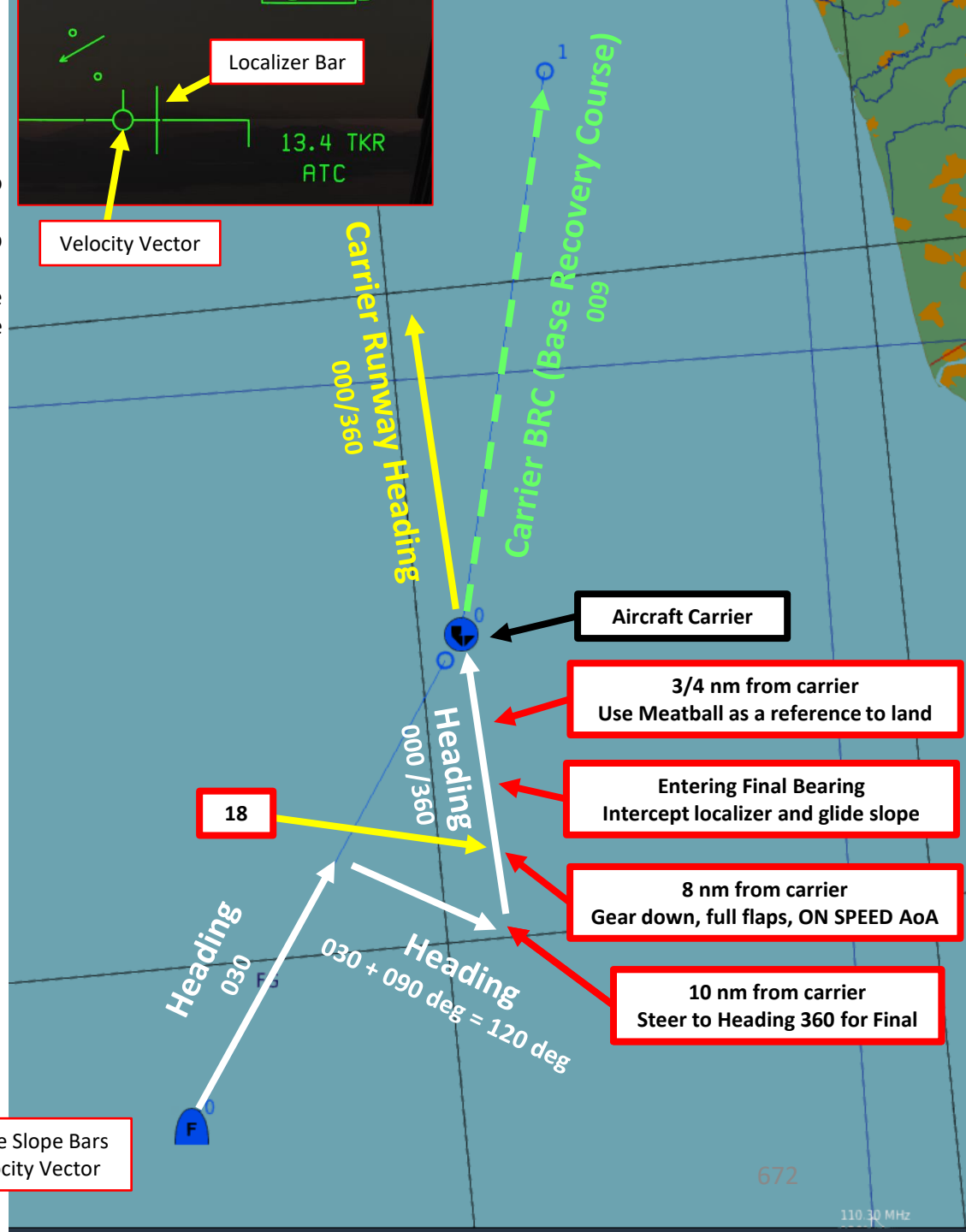
9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

18. When reaching 8 nm from carrier, set landing gear down, full flaps, On Speed AoA, Anti-Skid Switch to OFF, Hook Lever DOWN, Hook Bypass Switch to CARRIER.
19. When entering final bearing, intercept **localizer** line to guide yourself **laterally** on the runway. Line up Velocity Vector with the Localizer Line. « Chase » the line.
20. When Reaching approx. 7 nm from the carrier, the **glide slope** line will appear. Intercept the glide slope line to guide yourself **vertically** on the glide path. Line up Velocity Vector with the Glide Slope Line. « Chase » the line.







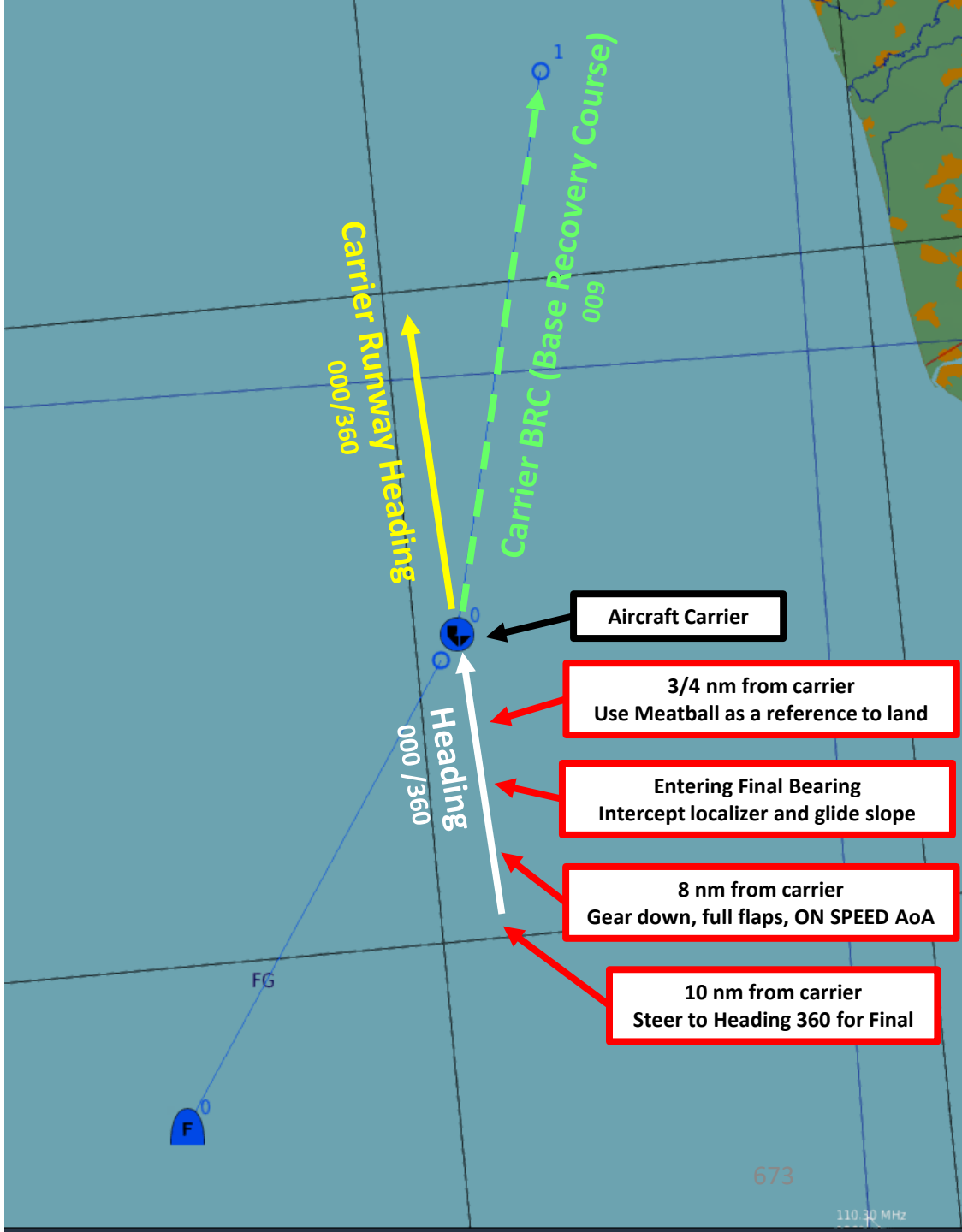


9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY

21. Keep your velocity vector lined up with the glide slope bar and the localizer bar. Perform gentle corrections until you reach 3/4 nm from the carrier.
22. Use Meatball as reference when at 3/4 nm and land.







9 – ICLS CARRIER LANDING TUTORIAL
CASE III RECOVERY



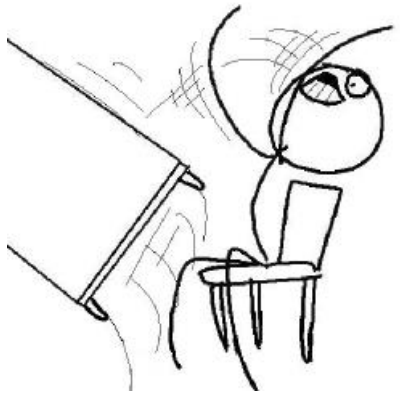
INTRODUCTION

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

Air-to-air refueling is one of the hardest, most hated, and most frustrating tasks in DCS. Ever. Of all time.

Why? Well, one of the main reasons for the difficulty behind refueling is the skill required to do formation flying. Flying in formation with another aircraft requires much more practice than you would initially think. Another reason is pure physics: there is this thing called “wake turbulence”. An aircraft flies through a fluid: air. Just like with any fluid, if you have something that displaces itself through it at a certain speed, the fluid will become disrupted (turbulence). Wingtip vortices and jetwash are both effects of this simple concept. Wake turbulence is the reason why airliners need to wait a minimum time between takeoffs: flying through disrupted air will destabilize the aircraft and it is unsafe, especially during critical phases of flight like takeoff and landing.

Unfortunately, wake turbulence is something a pilot **has** to deal with during air-to-air refueling. This is why the aircraft will fly just fine when approaching the tanker, but start wobbling around when flying in close proximity of the refueling basket/drogue and tanker engines.





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

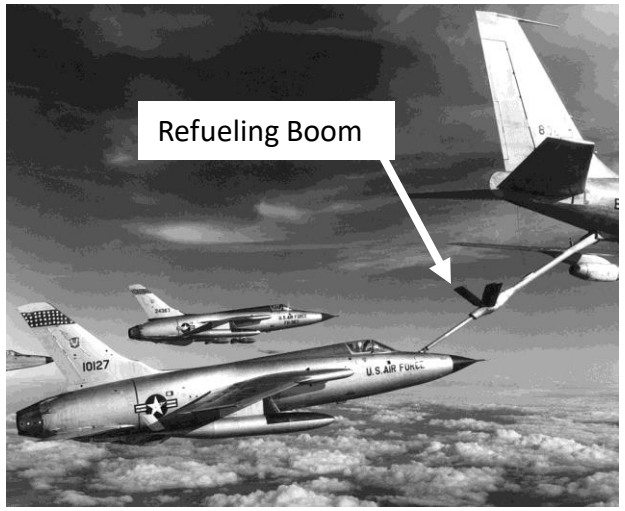
- The refueling aircraft available in DCS are:
  - The Ilyushin Il-78M "Midas", a russian **probe-and-drogue** tanker, which was developed from the Il-76
  - The Boeing KC-135 "Stratotanker", a US Air Force **flying boom** tanker, which was developed from the Boeing 367-80
  - The Lockheed S-3B "Viking", a US Navy **probe-and-drogue** tanker
  - The Lockheed KC-130 "Hercules", a USMC **probe-and-drogue** tanker, which was developed from the C-130.

The Hornet is equipped with a Probe-and-Drogue system, so air-to-air refueling will only be performed from either an Il-78M, a KC-130 or a S-3B tanker.









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



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

AIR-TO-AIR REFUELING DEMO

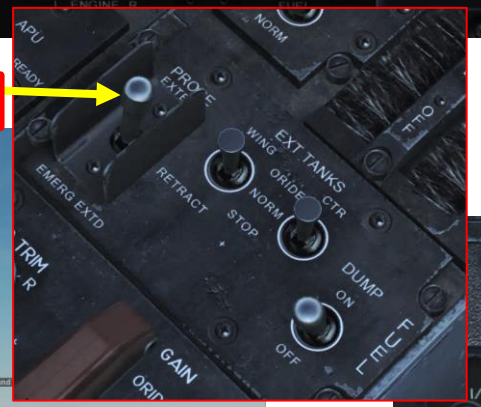
1. Consult mission briefing to know on which radio frequency you need to contact the tanker. In our case, we will use the frequency 251.000 AM on the COMM1 radio.
2. Find tanker using TACAN frequency as shown in the NAVIGATION - TACAN section.
3. Set your radio to 251 AM and turn radio VOL knobs ON, and press "/" to communicate with TEXACO (tanker callsign).
4. Select Tanker – Texaco (F6) communication menu, and then select "Intent to Refuel"
5. TEXACO should give you a pre-contact altitude (in our case 8,000 ft).
6. Set Master Arm Switch – OFF (DOWN)
7. Set Flaps to AUTO
8. Set PROBE switch to EXTEND (right click).

Note: Some tankers like the KC-130 are equipped with a TACAN beacon, which can give you a direction to find it easily. Just make sure you have the correct TACAN frequency set in the A/A (Air-to-Air) Mode. Set TACAN using the NAVIGATION TACAN tutorial.

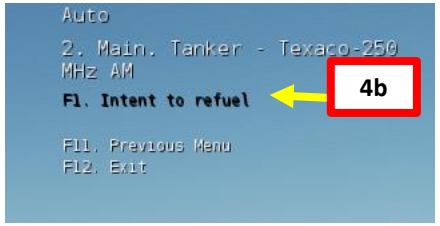


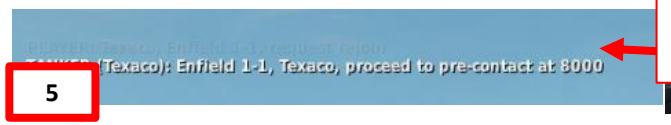














Pre-contact information: rendez-vous at 8,000 ft

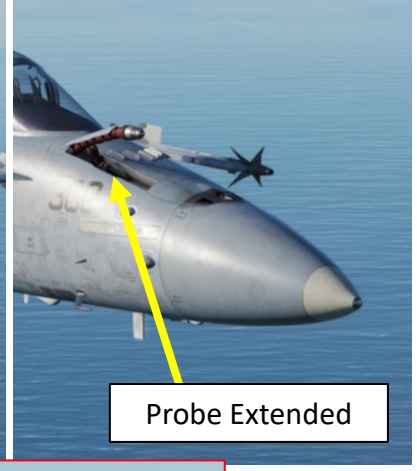


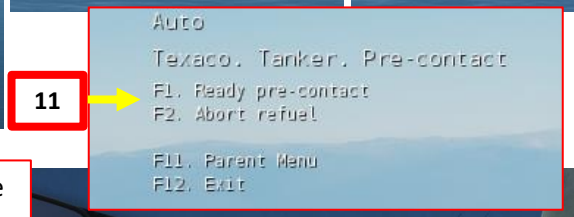
AIR-TO-AIR REFUELING DEMO

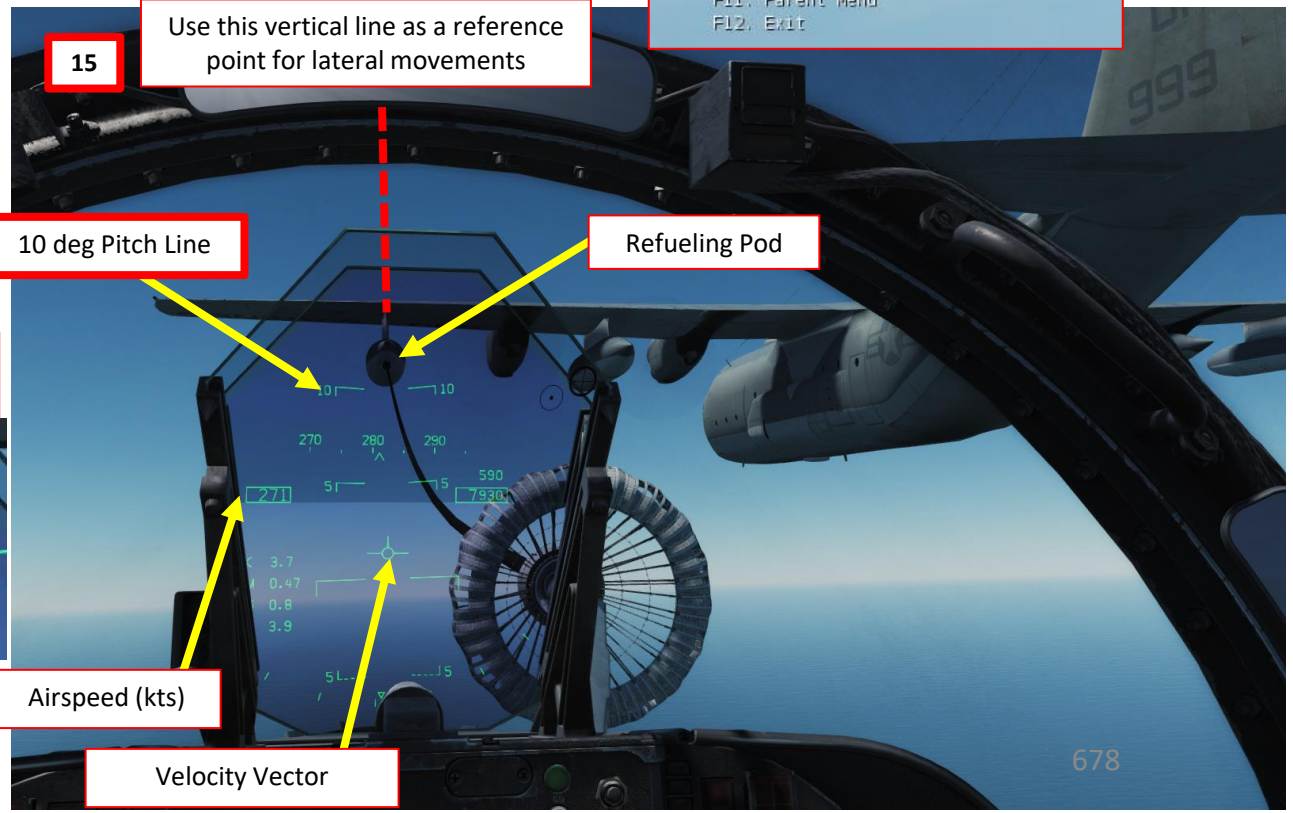
9. Make sure refueling probe has deployed correctly.
10. When you are less than 0.1 nm away from tanker, position yourself as shown on picture.
11. When in position, use your radio menu to select “Ready Pre-Contact” (F1).
12. The tanker’s pilot should answer you with “Cleared Contact” and should deploy his drogue basket and start to accelerate to cruising speed.
13. Fly formation with the tanker and approach the drogue basket very slowly (make sure you remain about 2-3 kts faster than the tanker) with very gentle inputs. Use stick for big corrections, but keep trimming constantly for small corrections.
14. Keep the aircraft **trimmed at ALL TIMES**. Approaching untrimmed is living hell. Be careful with the throttle since it has a long response time. Use airbrake if you need to slow down quickly while maintaining altitude.
15. Insert your probe into the drogue basket by using your reference points. The **10 deg Pitch Line should be lined up vertically with the left-most refueling pod**, and you should be **aligned with the engine pylon for lateral** movements
16. Additional drag should be generated by the drogue once you have contact with the drogue: your aircraft will slightly decelerate. Throttle up a little to keep the probe in. Once the probe is taking fuel, the tanker pilot should tell you “You’re taking fuel” and a green light should illuminate on the tanker’s refueling pod.
17. Keep formation with the tanker until your refueling is complete. Don’t aim for the probe, aim for the tanker’s refueling pod.
18. Detach your probe form the basket by throttling down and set PROBE switch to RETRACT.



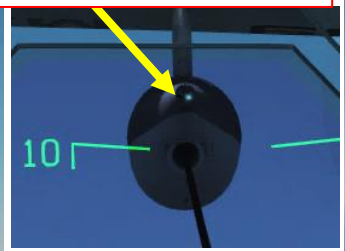












AIR-TO-AIR REFUELING DEMO

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
- Forget the airbrake on

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

- https://www.youtube.com/watch?v=T5dOLIqGQ-I
- https://www.youtube.com/watch?v=k8gDUUYy8Io

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.

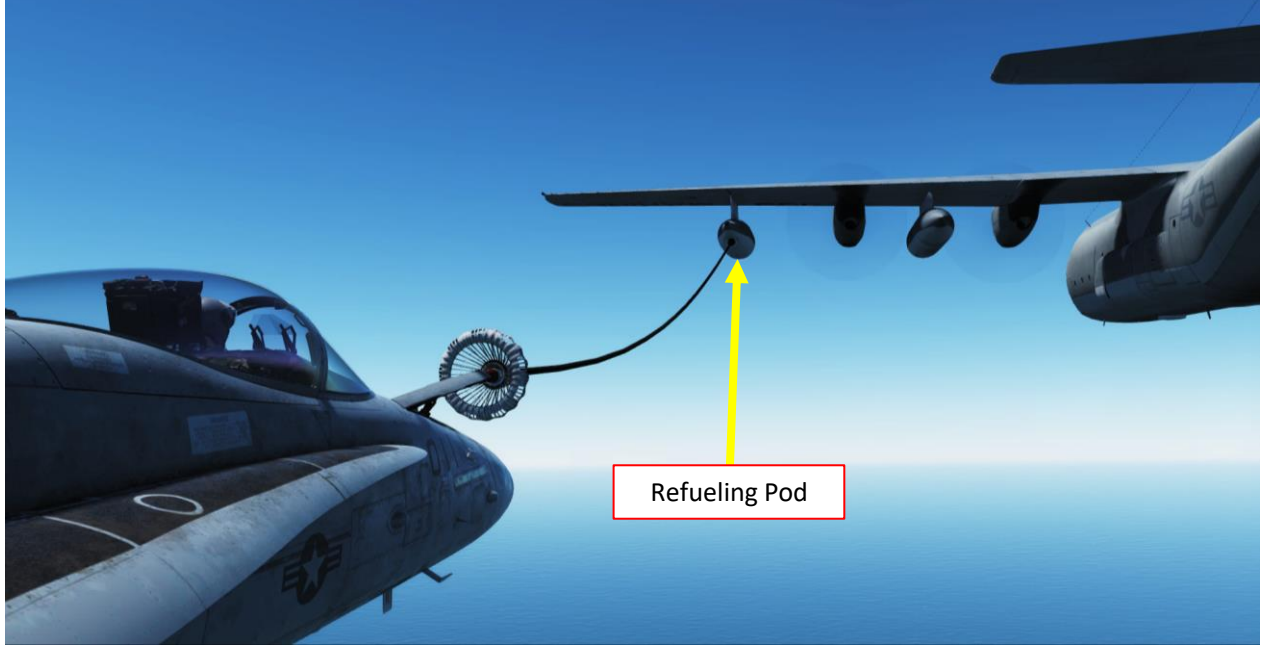


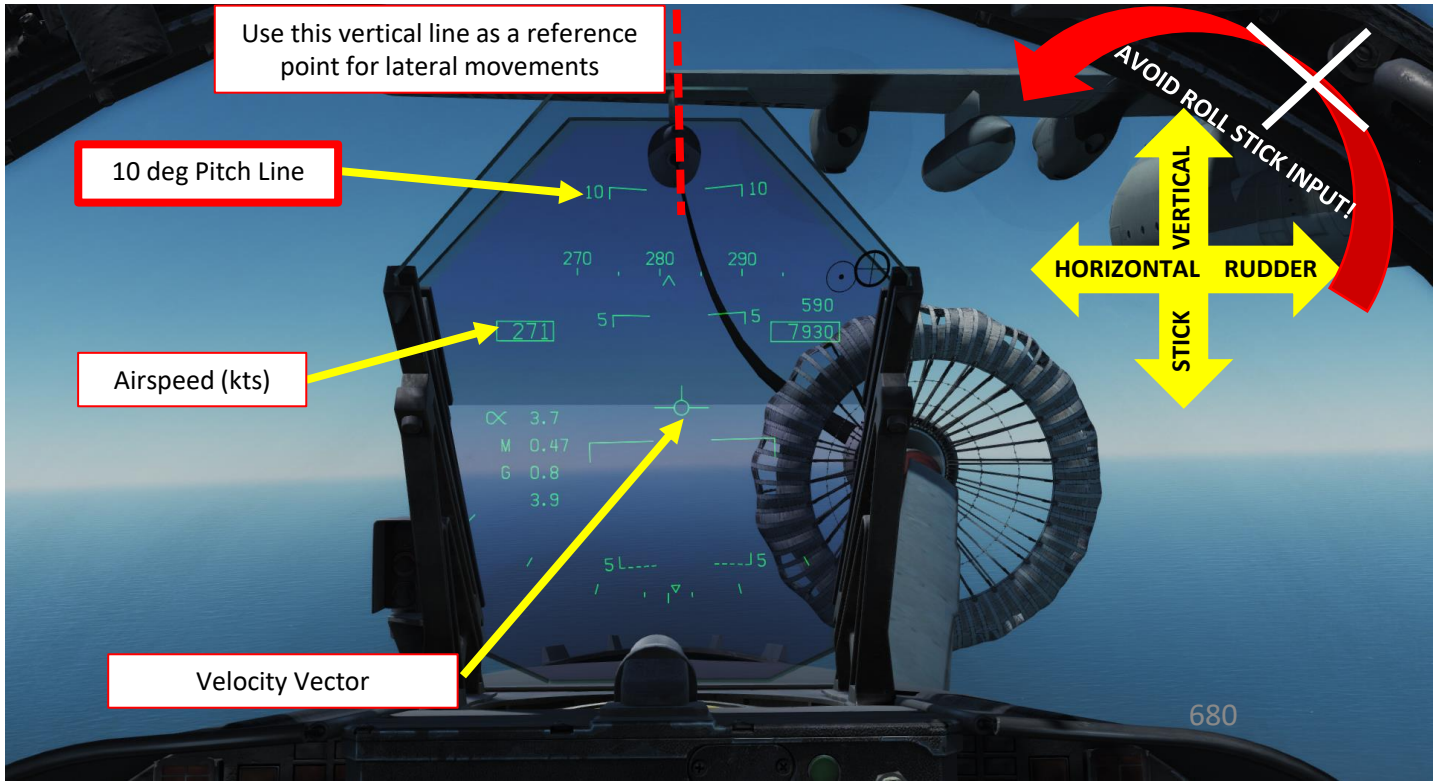




TIPS AND TRICKS

- 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 as per the reference points (10 deg pitch line lined up with refueling pod), **I gradually throttle up** and increase speed to **match the tanker's speed**. In this case, the tanker's speed is 270 kts. Make sure that you keep a constant speed.
- Avoid big throttle movements as the Hornet's engines respond very slowly.
- Once my speed matches the tanker's, I can gradually accelerate to a speed that is 2-3 kts faster (271 in our case), **approaching the basket very slowly**. At that part, the ONLY two things I am watching are my **AIRSPEED** and the **10 DEG PITCH LINE BEING LINED UP WITH THE TANKER'S ENGINE (NOT 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.





USEFUL RESOURCES

Eagle Dynamics (Official Developer) Work-In-Progress Early Access Guide
https://drive.google.com/file/d/1vJ94f1Z2RIz078bYUak-lPKJN8A0B1wB/view

Matt Wagner (Eagle Dynamics Producer) DCS F/A-18C Hornet Video Tutorials
https://www.youtube.com/user/wagmatt/videos

Hoggit Wiki
https://wiki.hoggitworld.com/view/F/A-18C

Redkite's Youtube Tutorials
https://www.youtube.com/watch?v=iKLrnJpc8I4&list=PLml_c09ciuctIreNtpLoPg1DByY5upg6v

Jabbers' Youtube Tutorials
https://youtu.be/lm-M3VUy-_I

A.E.W.'s Youtube Discussions on CASE I Recovery (Carrier Landing)
https://www.youtube.com/channel/UCNvV27UZkI8W-jvMA-iGqyQ/videos

Maverick's Air-to-Air Refueling Tutorial
https://youtu.be/T5dOLIqGQ-I

THANK YOU TO ALL MY PATRONS

Creating these guides is no easy task, and I would like to take the time to properly thank every single one of my Patreon supporters. The following people have donated a very generous amount to help me keep supporting existing guides and work on new projects as well:

- Merlin Kötz
- Scorch71
- Gerrit Buss
- ChazFlyz
- Ilko van der Velden
- Yves Blanchard
- Austin Green
- Charlie Z.


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F-5E 2.5.2
F-86F 2.5.2
F/A-18C 2.5.2 WIP
FC3 2.5.2
Fw 190 D-9 2.5.2
Hawk 2.5.2 Beta
Ka-50 2.5.2
L-39 2.5.2
M-2000C 2.5.1
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