DCS GUIDE
AV-8B N/A HARRIER II

BY CHUCK
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DISCLAIMER

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

The author of this document has never had access to restricted or classified documentation on the AV-8B Harrier. The author has never had access to OEM (Original Equipment Manufacturer) data related to the AV-8B Harrier, its armament systems nor its defensive systems. All the information within this document is taken from public documentation (i.e. AV-8B Early Access Manual by RAZBAM) 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 AV-8B module by RAZBAM.

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 AV-8B Harrier.

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

The **McDonnell Douglas AV-8B Harrier II (Night Attack)** is a single-engine ground-attack aircraft that constitutes the second generation of the Harrier Jump Jet family. Capable of vertical or short takeoff and landing (V/STOL), the aircraft was designed in the late 1970s as an Anglo-American development of the British Hawker Siddeley Harrier, the first operational V/STOL aircraft.

The first-generation Harriers entered service with the Royal Air Force (RAF) and United States Marine Corps (USMC) in the late 1960s and early 1970s, but were handicapped in range and payload. In short takeoff and landing configuration, the AV-8A (American designation for the Harrier) carried less than half the 4,000 lb (1,800 kg) payload of the smaller A-4 Skyhawk, over a more limited radius. To address this issue, Hawker Siddeley and McDonnell Douglas began joint development of a more capable version of the Harrier in 1973.

The AV-8B Harrier II retains the basic layout of the Hawker Siddeley Harrier, with horizontal stabilizers and shoulder-mounted wings featuring prominent anhedral (downward slope). The aircraft is powered by a single Rolls-Royce Pegasus turbofan engine, which has two intakes and four synchronized vectorable nozzles close to its turbine. Two of these nozzles are located near the forward, cold end of the engine and two are near the rear, hot end of the engine. This arrangement contrasts with most fixed-wing aircraft, which have engine nozzles only at the rear. The Harrier II also has smaller valve-controlled nozzles in the nose, tail, and wingtips to provide control at low airspeeds.

Typically operated from small aircraft carriers, large amphibious assault ships and simple forward operating bases, AV-8Bs have participated in numerous military operations, proving themselves versatile assets. The aircraft took part in combat during the Gulf War and the Iraq War beginning in 2003. The Harrier II has served in Operation Enduring Freedom in Afghanistan since 2001, and was used in Operation Odyssey Dawn in Libya in 2011. Italian and Spanish Harrier IIs have taken part in overseas conflicts in conjunction with NATO coalitions. During its service history, the AV-8B has had a high accident rate, related to the percentage of time spent in critical take-off and landing phases.

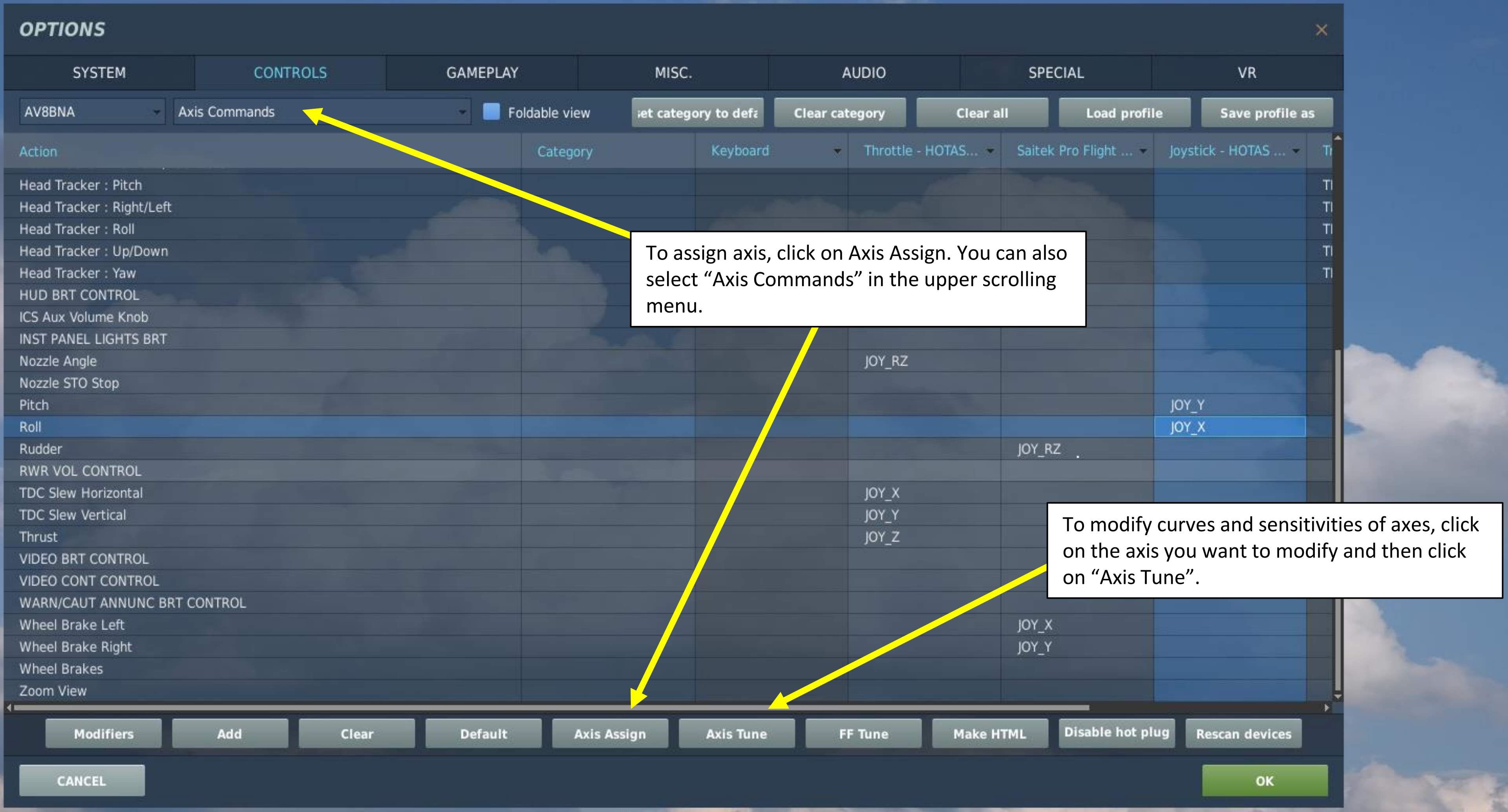
The high accident rate I was mentioning before will very likely be applicable to the simulation world as well. Doing a vertical landing is much harder than meets the eye. The Harrier will test your skills as a pilot like never before.

The cockpit feels modern with its MPCDs (Multi-Purpose Color Displays) and Heads-Up Display and the AV-8B has a number of very powerful tools and sensors at its disposal like a Targeting Pod, a Jamming Pod and a Dual Mode Tracker. The Harrier seems to have been designed to be a Jack of all Trades that could be used in more or less any type of mission. You can operate from the cramped deck of the Tarawa, to remote FOBs (Forward Operating Base) where all you have to land is a small helipad. The Harrier will force you to manage your weight and make mental calculations if you need to perform difficult landings like a Vertical Landing. Aerodynamically speaking, the AV-8B is challenging since it is one of the few aircraft that can land pretty much anywhere. You'll see: swivelling nozzles can be more difficult to use than you would think. I tried to explain the best practices in related sections, but I'm sure you'll have a blast trying to figure out the best ways to fly this bird.

This makes it a very interesting experience since there are a lot of stuff to do in it. You will not feel like you are flying a next-gen fighter jet, but you will have a flexible aircraft that can give you lots of options. Think of an hybrid between an A-10 on steroids with a helicopter. This is why it is one of my favourite modules in DCS.

A lot of love was poured into this aircraft by RAZBAM, and it shows. The Harrier being currently in early access, some features are still missing, but despite that the Harrier feels very much like a proper study-level simulation that will have you learning ungodly amounts of cool things about the (very much) insane minds of the British engineers who first came up with the idea of the Harrier.

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.



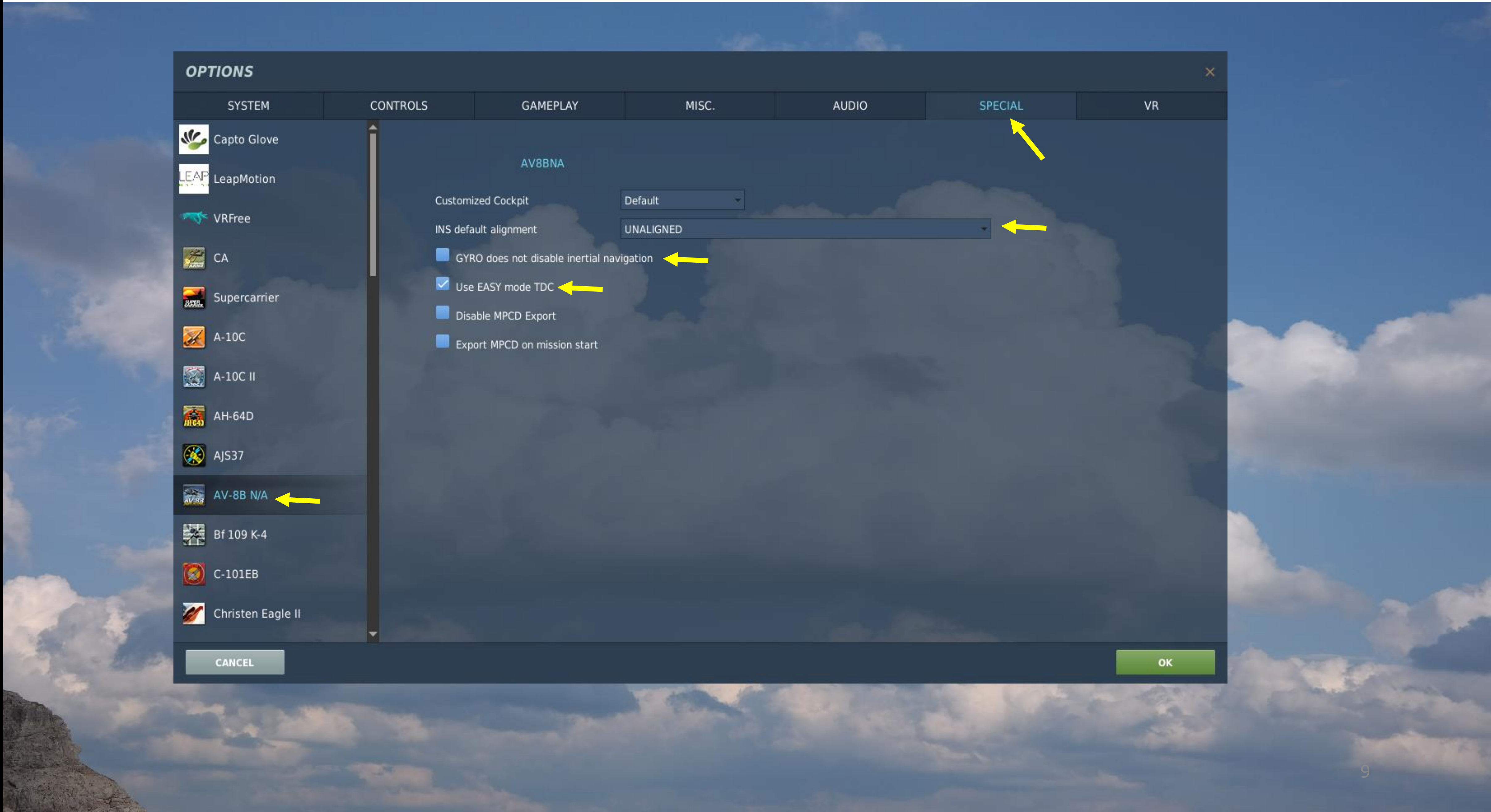
Bind the following axes:

- PITCH (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 15)
- ROLL (DEADZONE AT 0, 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
- NOZZLE – CONTROLS SWIVELLING NOZZLE ANGLE
- WHEEL BRAKE LEFT / RIGHT

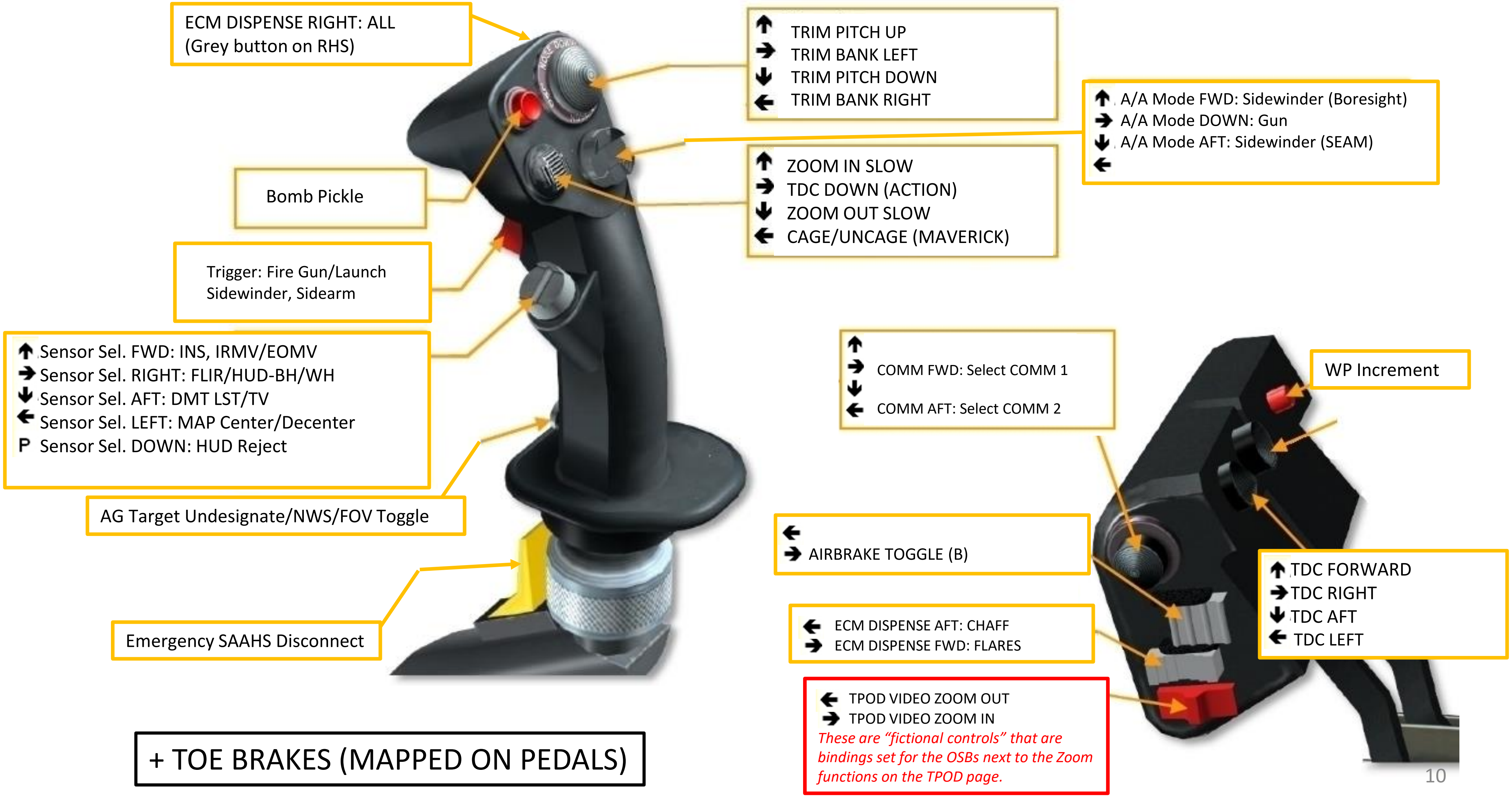
NOTES:

1. The Airbrake key must be mapped to “AIRBRAKE TOGGLE” (B by default) and will act as a toggle switch.
2. I would personally not map anything to the flaps since they will be set in AUTO mode most of the time.

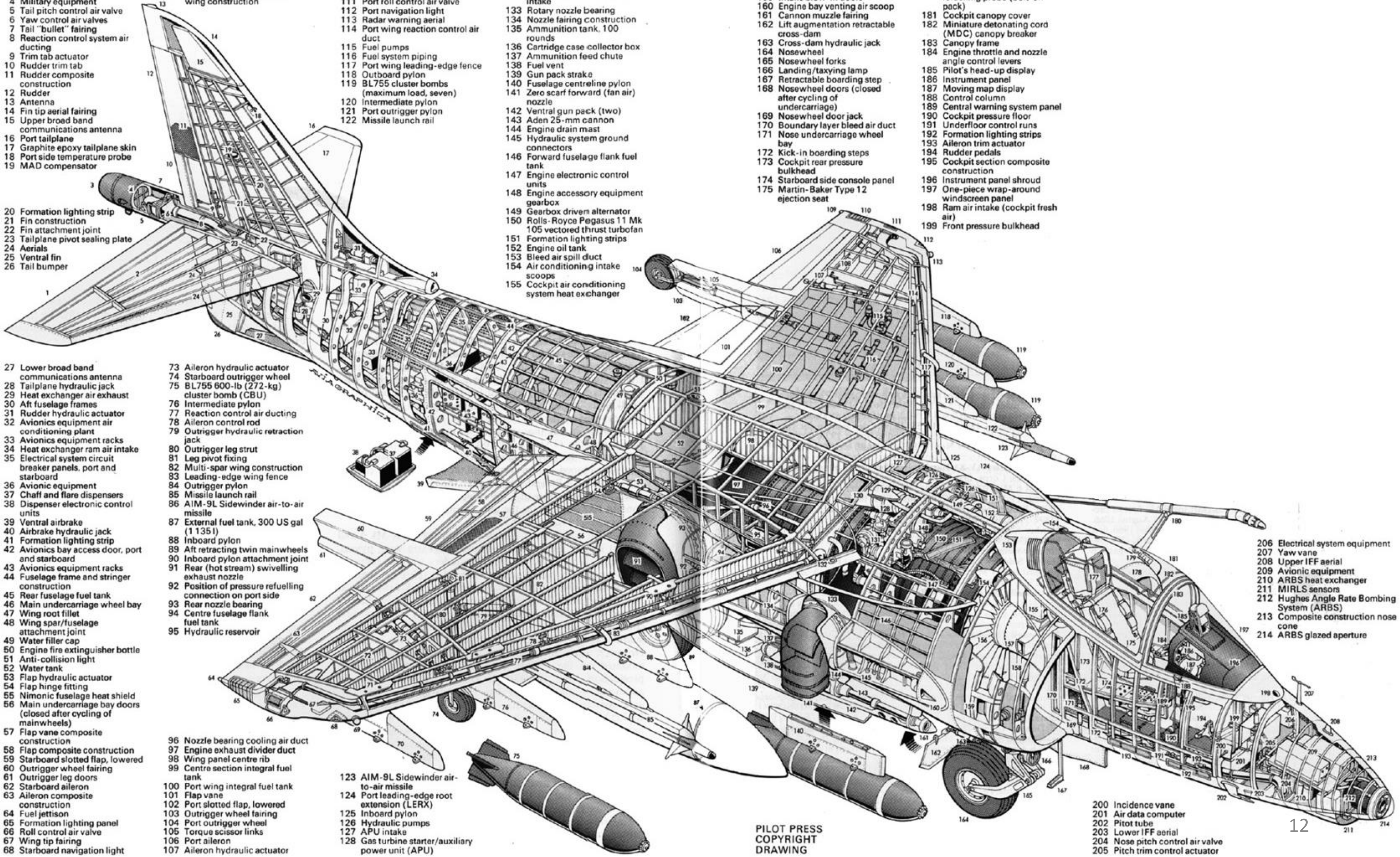
Here are my settings in the SPECIAL tab:



WHAT YOU NEED MAPPED



Harrier GR.7



1 Starboard all-moving tailplane
2 Tailplane composite construction
3 Tail radome
4 Military equipment
5 Tail pitch control air valve
6 Yaw control air valves
7 Tail "bullet" fairing
8 Reaction control system air ducting
9 Trim tab actuator
10 Rudder trim tab
11 Rudder composite construction
12 Rudder
13 Antenna
14 Fin tip aerial fairing
15 Upper broad band communications antenna
16 Port tailplane
17 Graphite epoxy tailplane skin
18 Port side temperature probe
19 MAD compensator
20 Formation lighting strip
21 Fin construction
22 Fin attachment joint
23 Tailplane pivot sealing plate
24 Aerials
25 Ventral fin
26 Tail bumper
27 Lower broad band communications antenna
28 Tailplane hydraulic jack
29 Heat exchanger air exhaust
30 Aft fuselage frames
31 Rudder hydraulic actuator
32 Avionics equipment air conditioning plant
33 Avionics equipment racks
34 Heat exchanger ram air intake
35 Electrical system circuit breaker panels, port and starboard
36 Avionic equipment
37 Chaff and flare dispensers
38 Dispenser electronic control units
39 Ventral airbrake
40 Airbrake hydraulic jack
41 Formation lighting strip
42 Avionics bay access door, port and starboard
43 Avionics equipment racks
44 Fuselage frame and stringer construction
45 Rear fuselage fuel tank
46 Main undercarriage wheel bay
47 Wing root fillet
48 Wing spar/fuselage attachment joint
49 Water filler cap
50 Engine fire extinguisher bottle
51 Anti-collision light
52 Water tank
53 Flap hydraulic actuator
54 Flap hinge fitting
55 Nimonic fuselage heat shield
56 Main undercarriage bay doors (closed after cycling of mainwheels)
57 Flap vane composite construction
58 Flap composite construction
59 Starboard slotted flap, lowered
60 Outrigger wheel fairing
61 Outrigger leg doors
62 Starboard aileron
63 Aileron composite construction
64 Fuel jettison
65 Formation lighting panel
66 Roll control air valve
67 Wing tip fairing
68 Starboard navigation light
69 Radar warning aerial
70 Outboard pylon
71 Pylon attachment joint
72 Graphite epoxy composite wing construction
73 Aileron hydraulic actuator
74 Starboard outrigger wheel
75 BL755 600-lb (272-kg) cluster bomb (CBU)
76 Intermediate pylon
77 Reaction control air ducting
78 Aileron control rod
79 Outrigger hydraulic retraction jack
80 Outrigger leg strut
81 Leg pivot fixing
82 Multi-spar wing construction
83 Leading-edge wing fence
84 Outrigger pylon
85 Missile launch rail
86 AIM-9L Sidewinder air-to-air missile
87 External fuel tank, 300 US gal (1 135 l)
88 Inboard pylon
89 Aft retracting twin mainwheels
90 Inboard pylon attachment joint
91 Rear (hot stream) swivelling exhaust nozzle
92 Position of pressure refuelling connection on port side
93 Rear nozzle bearing
94 Centre fuselage flank fuel tank
95 Hydraulic reservoir
96 Nozzle bearing cooling air duct
97 Engine exhaust divider duct
98 Wing panel centre rib
99 Centre section integral fuel tank
100 Port wing integral fuel tank
101 Flap vane
102 Port slotted flap, lowered
103 Outrigger wheel fairing
104 Port outrigger wheel
105 Torque scissor links
106 Port aileron
107 Aileron hydraulic actuator
108 Aileron/air valve interconnection
109 Fuel jettison
110 Formation lighting panel
111 Port roll control air valve
112 Port navigation light
113 Radar warning aerial
114 Port wing reaction control air duct
115 Fuel pumps
116 Fuel system piping
117 Port wing leading-edge fence
118 Outboard pylon
119 BL755 cluster bombs (maximum load, seven)
120 Intermediate pylon
121 Port outrigger pylon
122 Missile launch rail
123 AIM-9L Sidewinder air-to-air missile
124 Port leading-edge root extension (LERX)
125 Inboard pylon
126 Hydraulic pumps
127 APU intake
128 Gas turbine starter/auxiliary power unit (APU)
129 Alternator cooling air exhaust
130 APU exhaust
131 Engine fuel control unit
132 Engine bay venting ram air intake
133 Rotary nozzle bearing
134 Nozzle fairing construction
135 Ammunition tank, 100 rounds
136 Cartridge case collector box
137 Ammunition feed chute
138 Fuel vent
139 Gun pack strake
140 Fuselage centreline pylon
141 Zero scarf forward (fan air) nozzle
142 Ventral gun pack (two)
143 Aden 25-mm cannon
144 Engine drain mast
145 Hydraulic system ground connectors
146 Forward fuselage flank fuel tank
147 Engine electronic control units
148 Engine accessory equipment gearbox
149 Gearbox driven alternator
150 Rolls-Royce Pegasus 11 Mk 105 vectored thrust turbofan
151 Formation lighting strips
152 Engine oil tank
153 Bleed air spill duct
154 Air conditioning intake scoops
155 Cockpit air conditioning system heat exchanger
156 Engine compressor/fan face
157 Heat exchanger discharge to intake duct
158 Nose undercarriage hydraulic retraction jack
159 Intake blow-in doors
160 Engine bay venting air scoop
161 Cannon muzzle fairing
162 Lift augmentation retractable cross-dam
163 Cross-dam hydraulic jack
164 Nosewheel
165 Nosewheel forks
166 Landing/taxying lamp
167 Retractable boarding step
168 Nosewheel doors (closed after cycling of undercarriage)
169 Nosewheel door jack
170 Boundary layer bleed air duct
171 Nose undercarriage wheel bay
172 Kick-in boarding steps
173 Cockpit rear pressure bulkhead
174 Starboard side console panel
175 Martin-Baker Type 12 ejection seat
176 Safety harness
177 Ejection seat headrest
178 Port engine air intake
179 Probe hydraulic jack
180 Retractable in-flight refuelling probe (bolt-on pack)
181 Cockpit canopy cover
182 Miniature detonating cord (MDC) canopy breaker
183 Canopy frame
184 Engine throttle and nozzle angle control levers
185 Pilot's head-up display
186 Instrument panel
187 Moving map display
188 Control column
189 Central warning system panel
190 Cockpit pressure floor
191 Underfloor control runs
192 Formation lighting strips
193 Aileron trim actuator
194 Rudder pedals
195 Cockpit section composite construction
196 Instrument panel shroud
197 One-piece wrap-around windscreen panel
198 Ram air intake (cockpit fresh air)
199 Front pressure bulkhead
200 Incidence vane
201 Air data computer
202 Pitot tube
203 Lower IFF aerial
204 Nose pitch control air valve
205 Pitch trim control actuator
206 Electrical system equipment
207 Yaw vane
208 Upper IFF aerial
209 Avionic equipment
210 ARBS heat exchanger
211 MIRLS sensors
212 Hughes Angle Rate Bombing System (ARBS)
213 Composite construction nose cone
214 ARBS glazed aperture

PILOT PRESS
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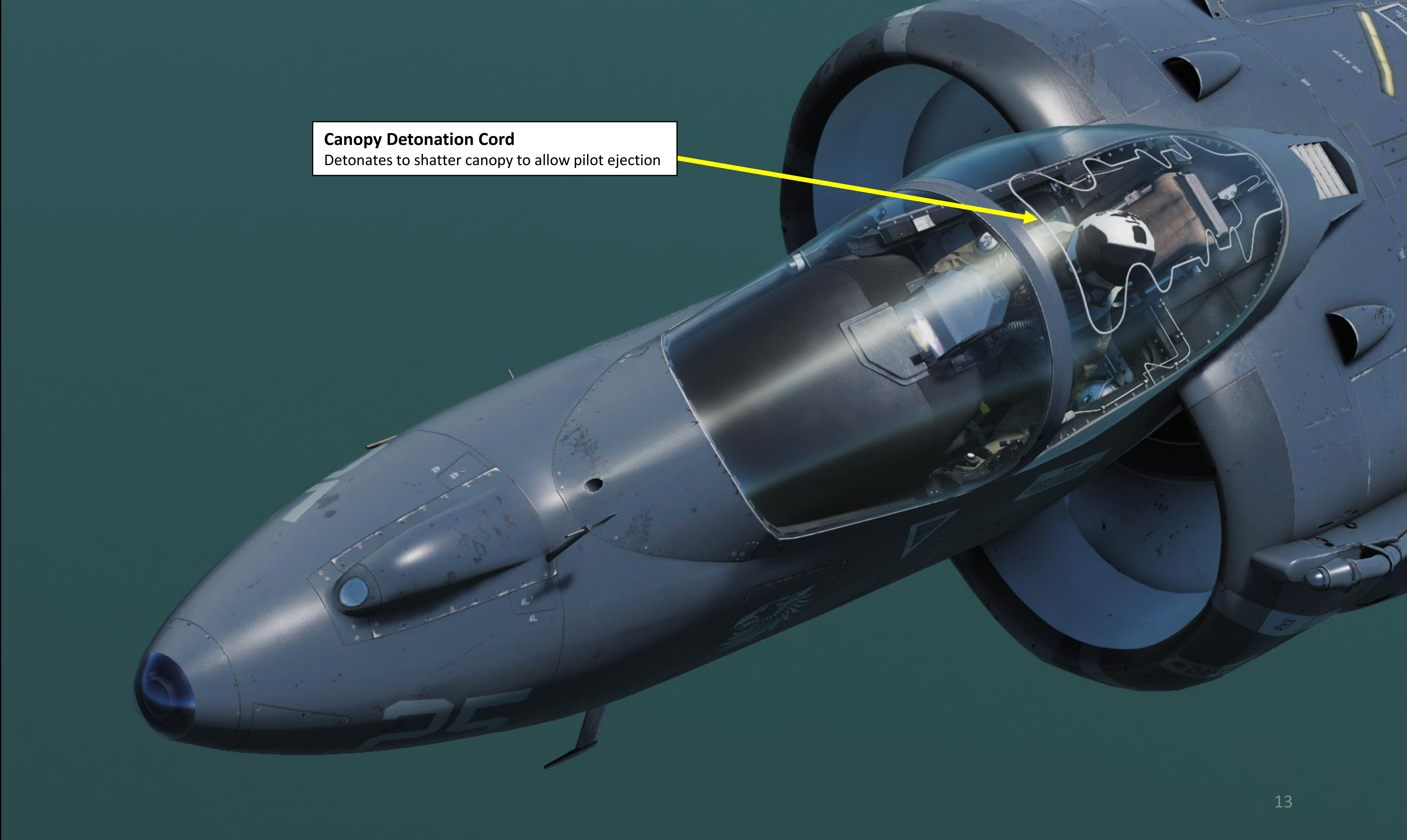
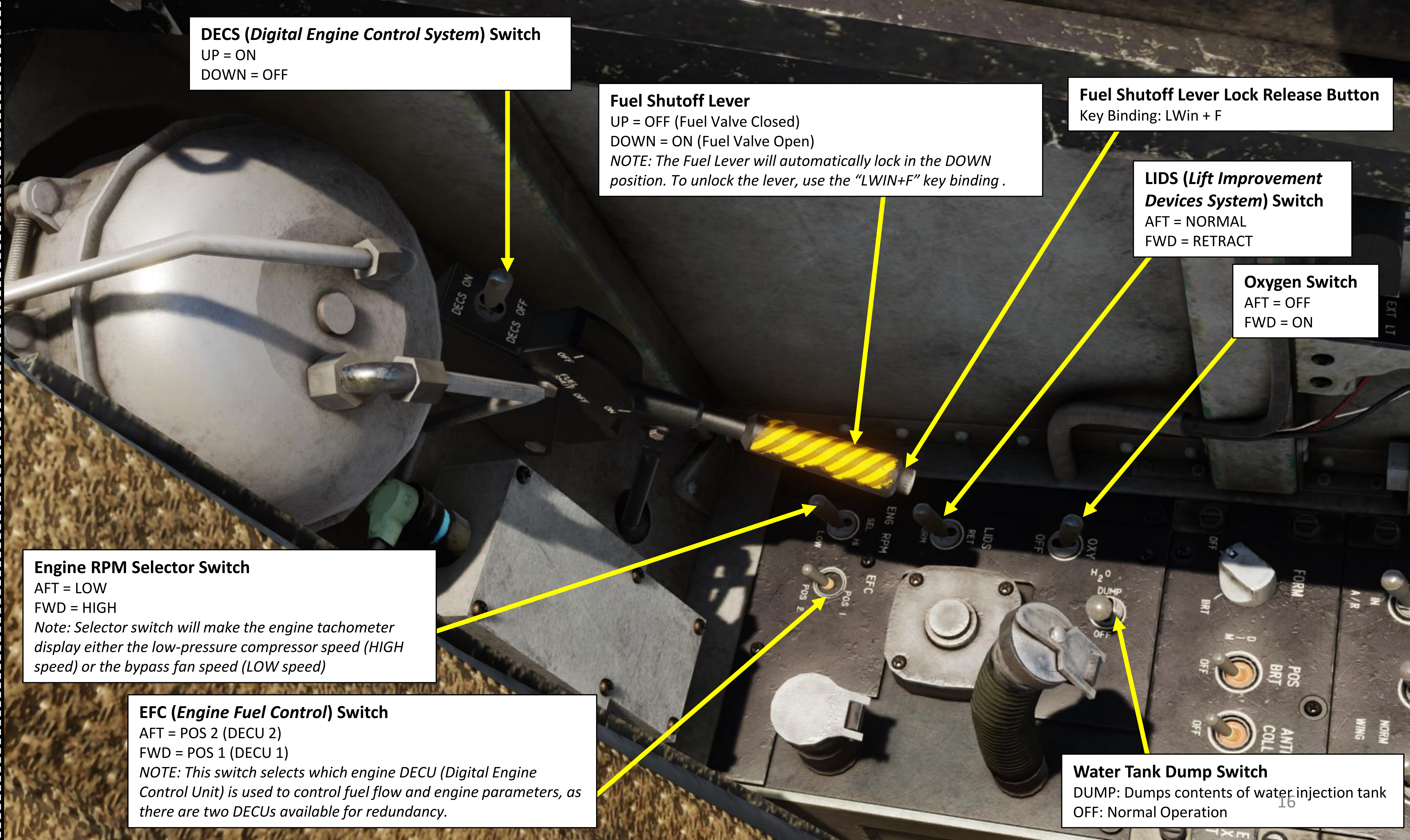
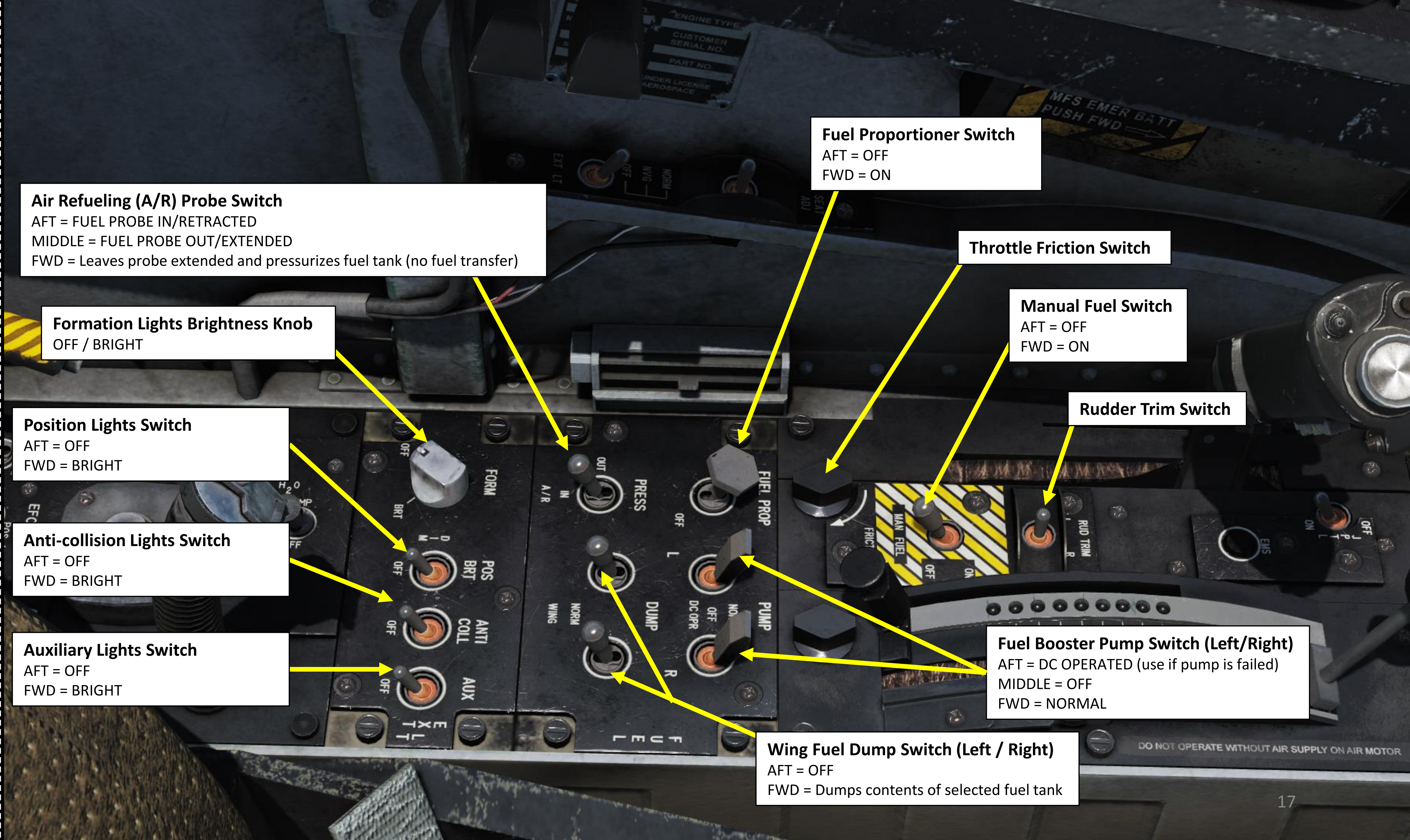
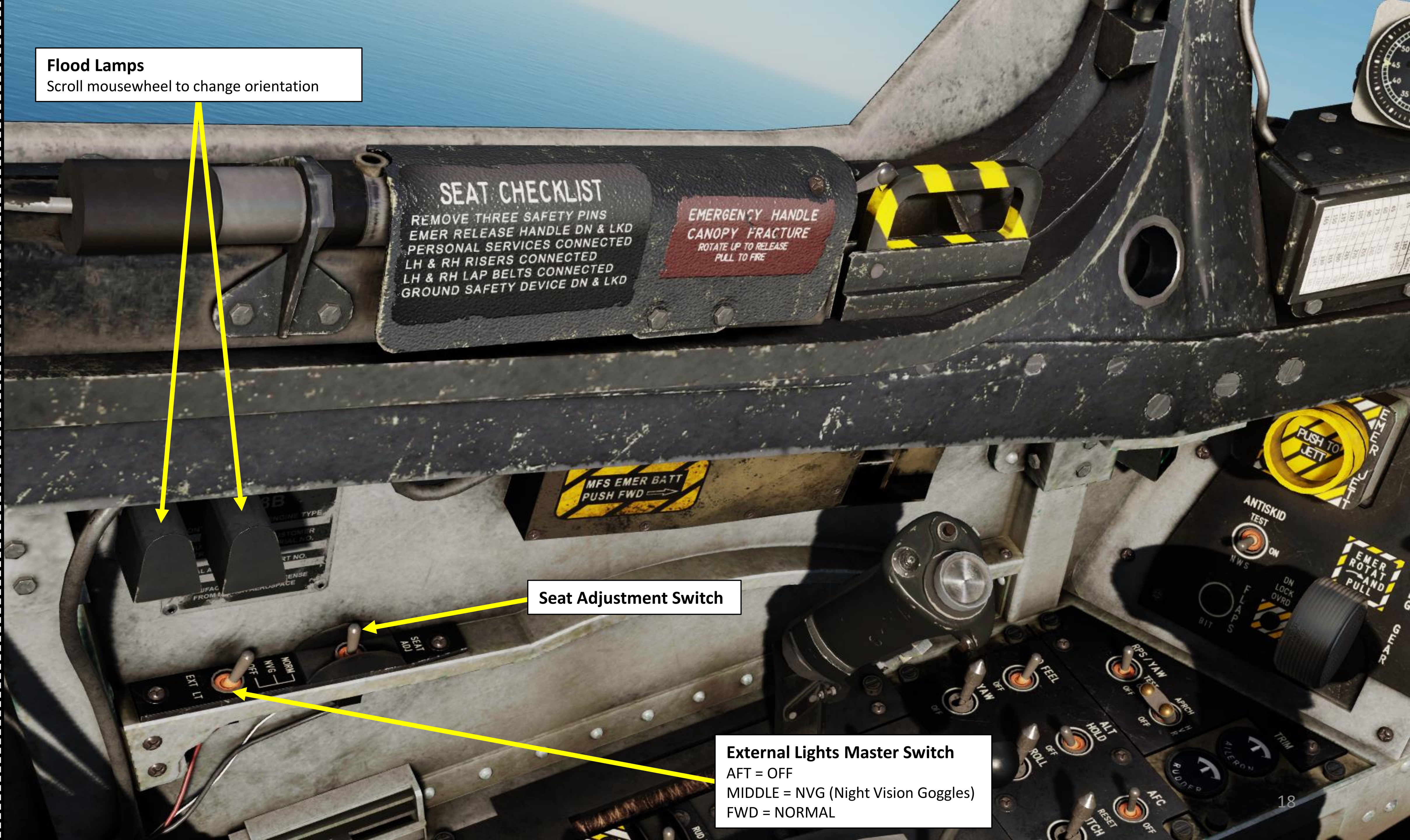
DRAWING


Canopy Detonation Cord
Detonates to shatter canopy to allow pilot ejection

Tip: Pilot body can be toggled ON/OFF with “RSHIFT+P”


DECS (*Digital Engine Control System*) Switch
UP = ON
DOWN = OFF
Fuel Shutoff Lever
UP = OFF (Fuel Valve Closed)
DOWN = ON (Fuel Valve Open)
NOTE: The Fuel Lever will automatically lock in the DOWN position. To unlock the lever, use the "LWIN+F" key binding .
Fuel Shutoff Lever Lock Release Button
Key Binding: LWin + F
LIDS (*Lift Improvement Devices System*) Switch
AFT = NORMAL
FWD = RETRACT
Oxygen Switch
AFT = OFF
FWD = ON
Engine RPM Selector Switch
AFT = LOW
FWD = HIGH
Note: Selector switch will make the engine tachometer display either the low-pressure compressor speed (HIGH speed) or the bypass fan speed (LOW speed)
EFC (*Engine Fuel Control*) Switch
AFT = POS 2 (DECU 2)
FWD = POS 1 (DECU 1)
NOTE: This switch selects which engine DECU (Digital Engine Control Unit) is used to control fuel flow and engine parameters, as there are two DECUs available for redundancy.
Water Tank Dump Switch
DUMP: Dumps contents of water injection tank
OFF: Normal Operation


Air Refueling (A/R) Probe Switch
AFT = FUEL PROBE IN/RETRACTED
MIDDLE = FUEL PROBE OUT/EXTENDED
FWD = Leaves probe extended and pressurizes fuel tank (no fuel transfer)
Formation Lights Brightness Knob
OFF / BRIGHT
Position Lights Switch
AFT = OFF
FWD = BRIGHT
Anti-collision Lights Switch
AFT = OFF
FWD = BRIGHT
Auxiliary Lights Switch
AFT = OFF
FWD = BRIGHT
Fuel Proportioner Switch
AFT = OFF
FWD = ON
Throttle Friction Switch
Manual Fuel Switch
AFT = OFF
FWD = ON
Rudder Trim Switch
Fuel Booster Pump Switch (Left/Right)
AFT = DC OPERATED (use if pump is failed)
MIDDLE = OFF
FWD = NORMAL
Wing Fuel Dump Switch (Left / Right)
AFT = OFF
FWD = Dumps contents of selected fuel tank
DO NOT OPERATE WITHOUT AIR SUPPLY ON AIR MOTOR

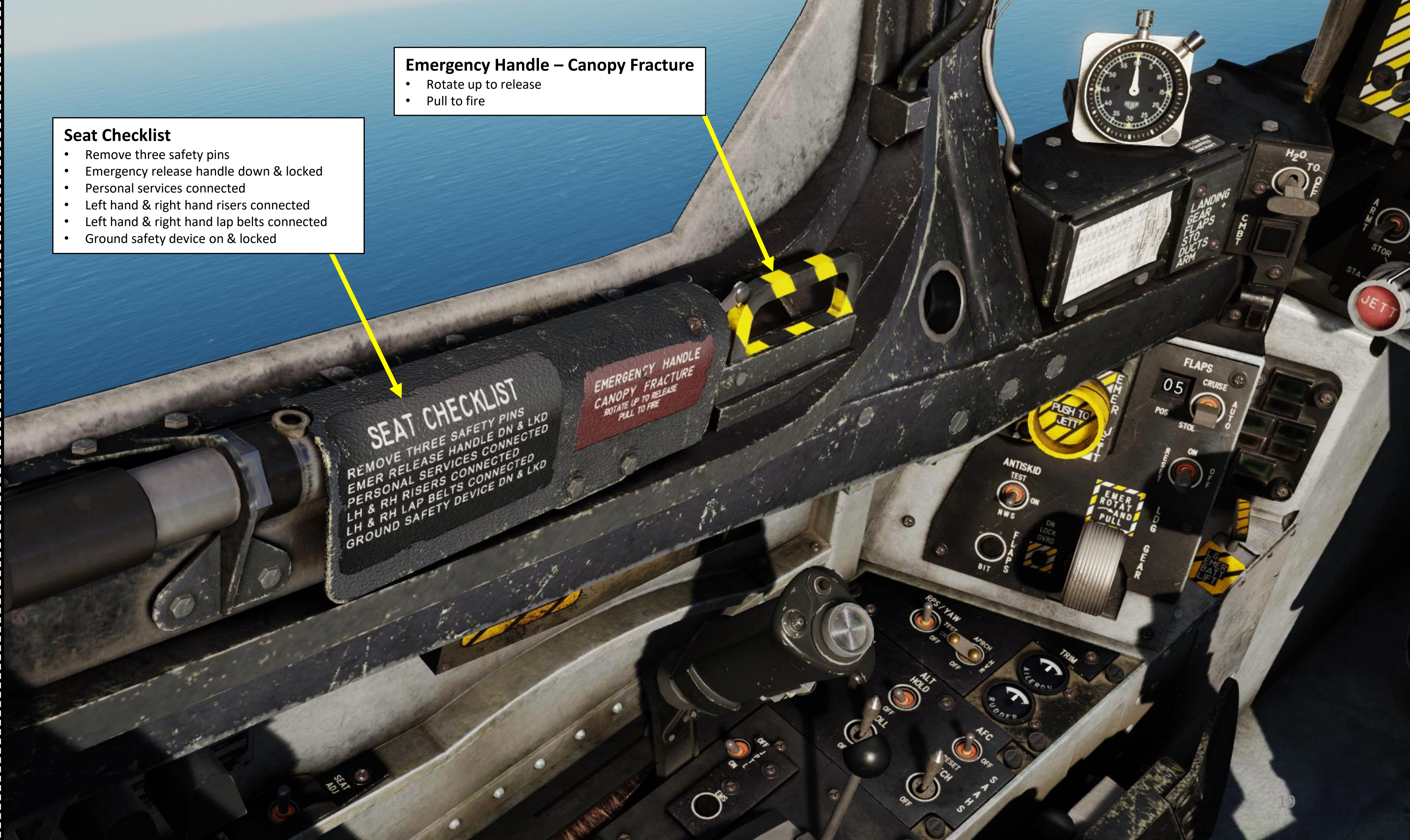

Flood Lamps
Scroll mousewheel to change orientation
SEAT CHECKLIST
REMOVE THREE SAFETY PINS
EMER RELEASE HANDLE DN & LKD
PERSONAL SERVICES CONNECTED
LH & RH RISERS CONNECTED
LH & RH LAP BELTS CONNECTED
GROUND SAFETY DEVICE DN & LKD
EMERGENCY HANDLE
CANOPY FRACTURE
ROTATE UP TO RELEASE
PULL TO FIRE
MFS EMER BATT
PUSH FWD
Seat Adjustment Switch
External Lights Master Switch
AFT = OFF
MIDDLE = NVG (Night Vision Goggles)
FWD = NORMAL

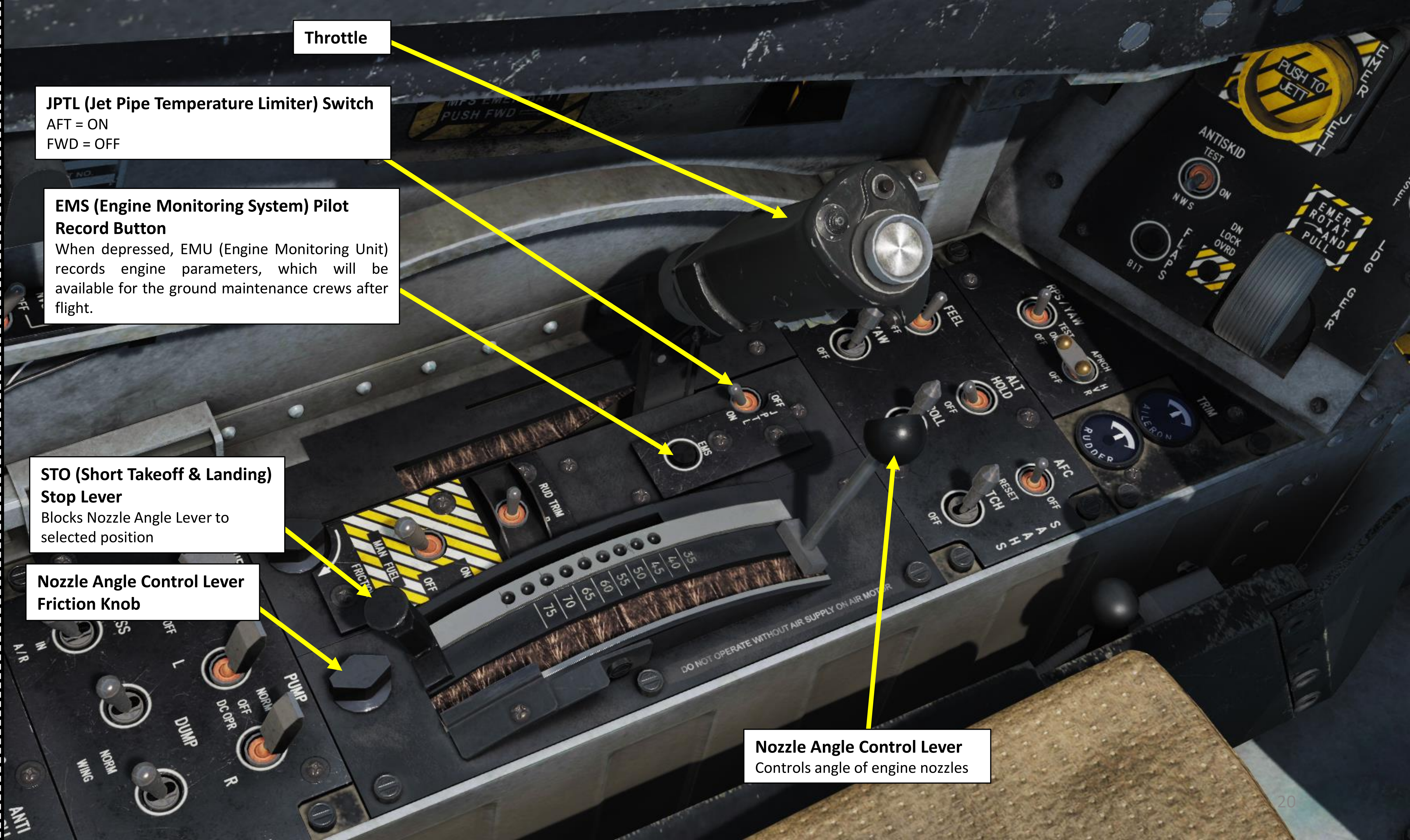
Emergency Handle – Canopy Fracture

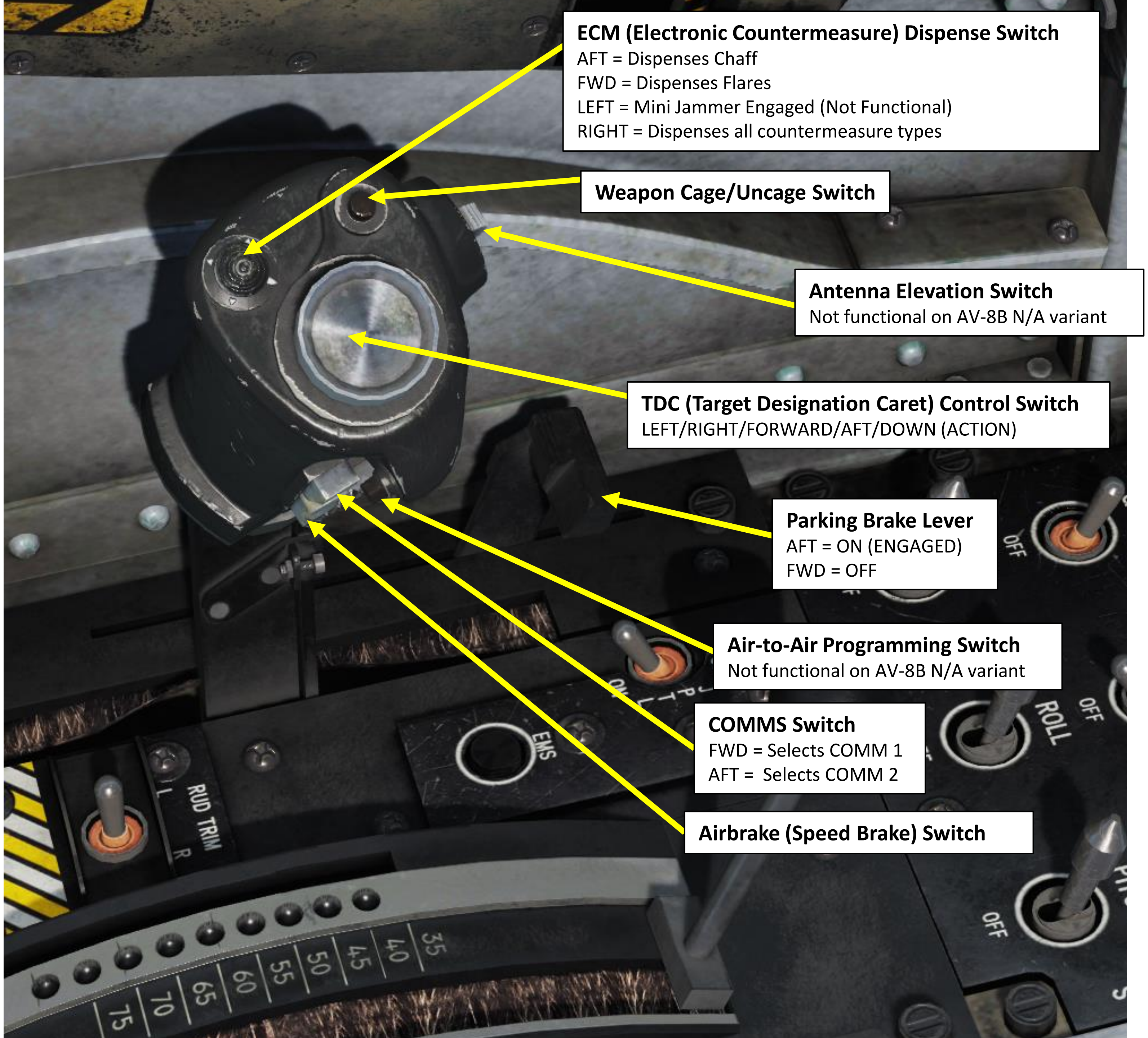
- Rotate up to release
- Pull to fire

Seat Checklist

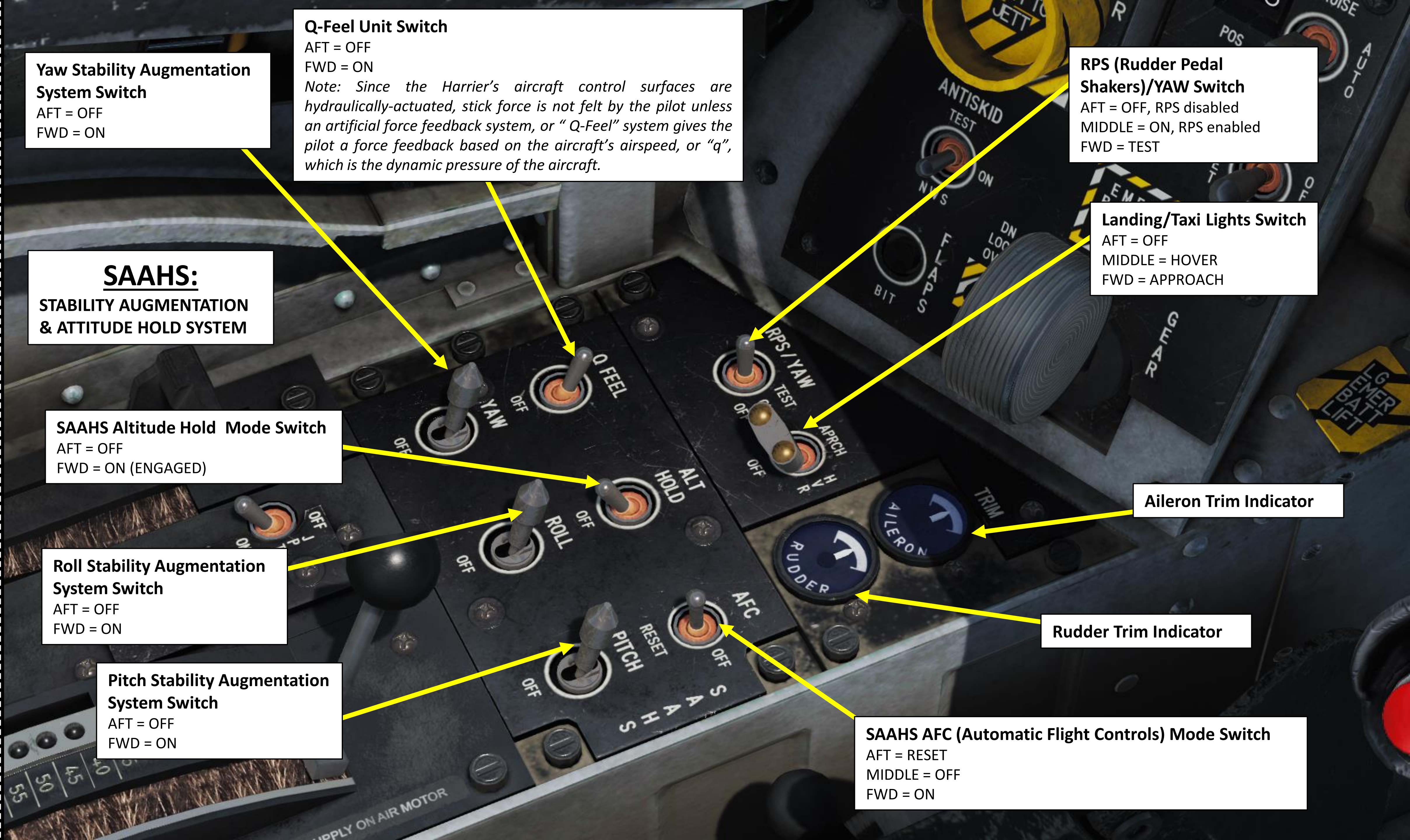
- Remove three safety pins
- Emergency release handle down & locked
- Personal services connected
- Left hand & right hand risers connected
- Left hand & right hand lap belts connected
- Ground safety device on & locked




Throttle
JPTL (Jet Pipe Temperature Limiter) Switch
AFT = ON
FWD = OFF
EMS (Engine Monitoring System) Pilot Record Button
When depressed, EMU (Engine Monitoring Unit) records engine parameters, which will be available for the ground maintenance crews after flight.
STO (Short Takeoff & Landing) Stop Lever
Blocks Nozzle Angle Lever to selected position
Nozzle Angle Control Lever Friction Knob
Nozzle Angle Control Lever
Controls angle of engine nozzles


ECM (Electronic Countermeasure) Dispense Switch
AFT = Dispenses Chaff
FWD = Dispenses Flares
LEFT = Mini Jammer Engaged (Not Functional)
RIGHT = Dispenses all countermeasure types
Weapon Cage/Uncage Switch
Antenna Elevation Switch
Not functional on AV-8B N/A variant
TDC (Target Designation Caret) Control Switch
LEFT/RIGHT/FORWARD/AFT/DOWN (ACTION)
Parking Brake Lever
AFT = ON (ENGAGED)
FWD = OFF
Air-to-Air Programming Switch
Not functional on AV-8B N/A variant
COMMS Switch
FWD = Selects COMM 1
AFT = Selects COMM 2
Airbrake (Speed Brake) Switch
RUD TRIM
ROLL
OFF
EMS


Throttle Cutoff Lever
Only clickable when throttle is at IDLE
RUD TRIM



SAAHS:
STABILITY AUGMENTATION & ATTITUDE HOLD SYSTEM

Yaw Stability Augmentation System Switch
AFT = OFF
FWD = ON

Q-Feel Unit Switch
AFT = OFF
FWD = ON
Note: Since the Harrier's aircraft control surfaces are hydraulically-actuated, stick force is not felt by the pilot unless an artificial force feedback system, or " Q-Feel" system gives the pilot a force feedback based on the aircraft's airspeed, or "q", which is the dynamic pressure of the aircraft.

RPS (Rudder Pedal Shakers)/YAW Switch
AFT = OFF, RPS disabled
MIDDLE = ON, RPS enabled
FWD = TEST

Landing/Taxi Lights Switch
AFT = OFF
MIDDLE = HOVER
FWD = APPROACH

SAAHS Altitude Hold Mode Switch
AFT = OFF
FWD = ON (ENGAGED)

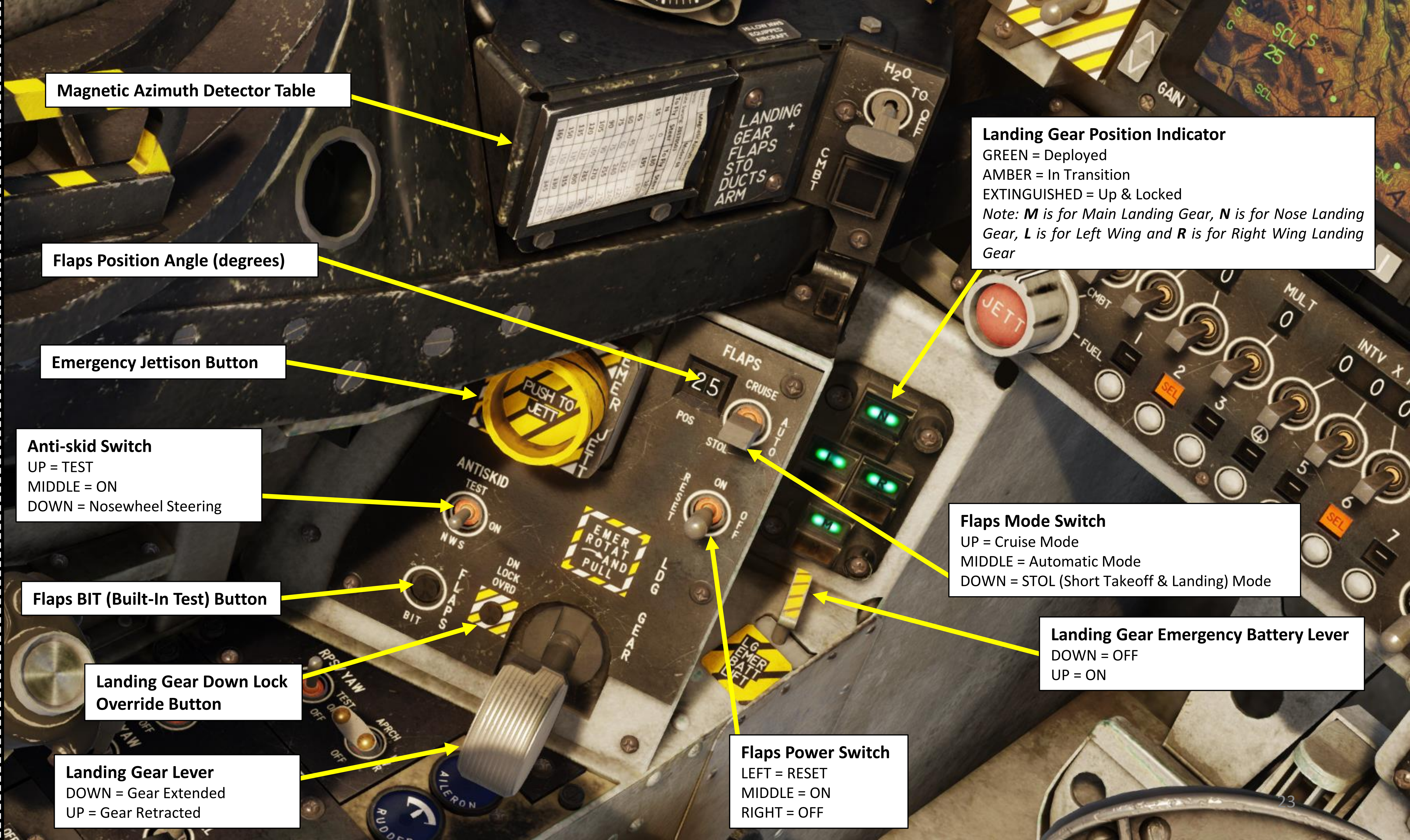
Aileron Trim Indicator

Roll Stability Augmentation System Switch
AFT = OFF
FWD = ON

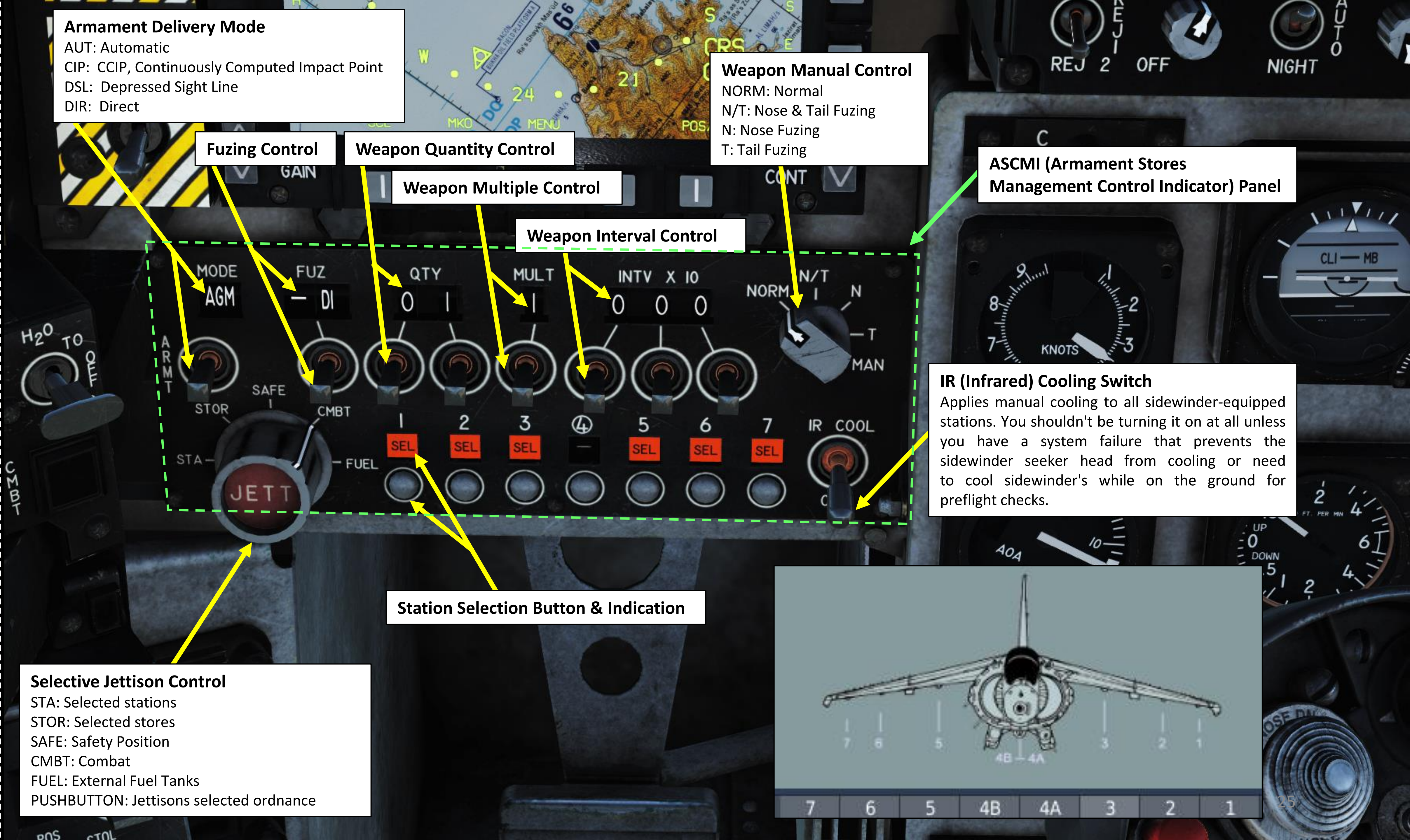
Rudder Trim Indicator

Pitch Stability Augmentation System Switch
AFT = OFF
FWD = ON

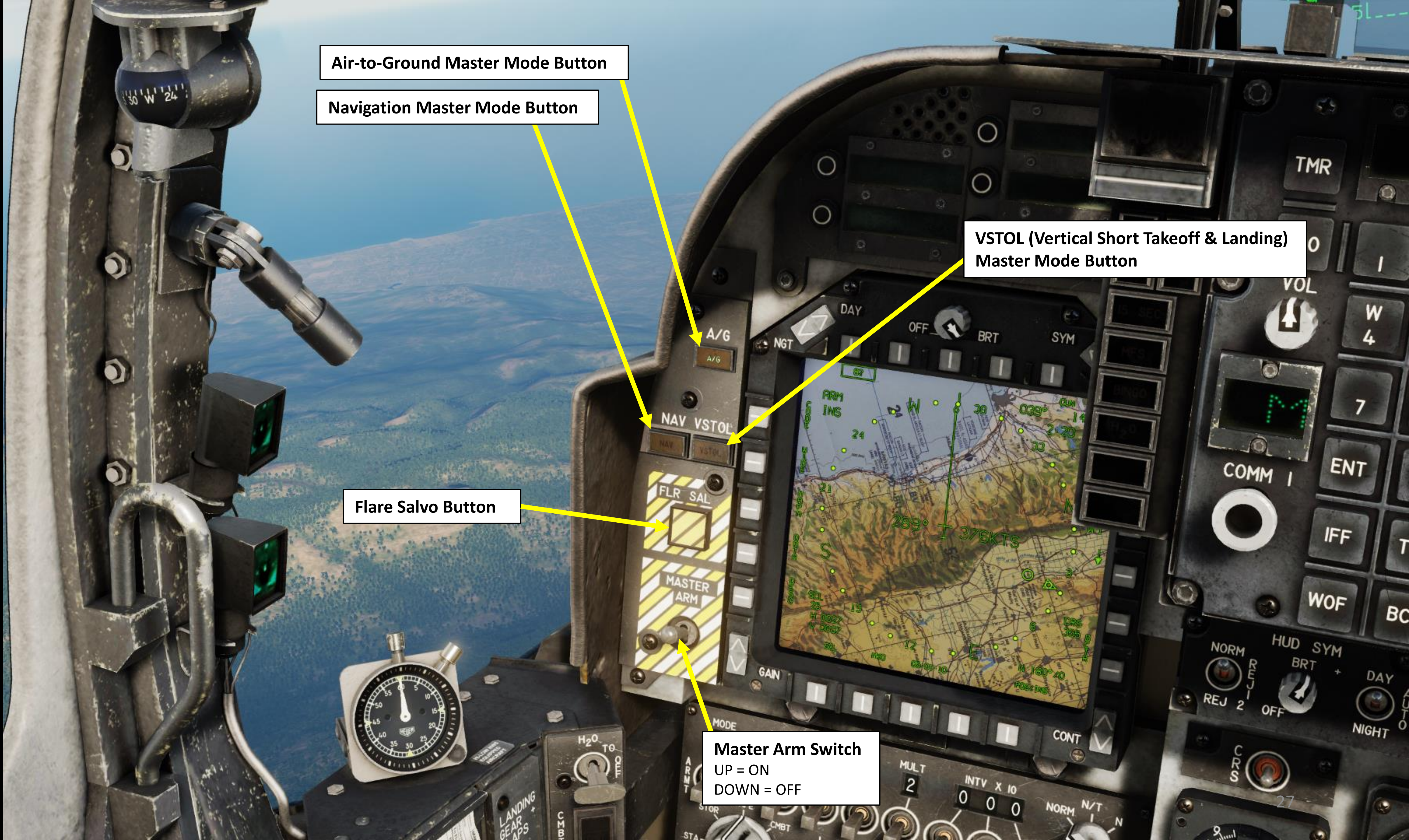
SAAHS AFC (Automatic Flight Controls) Mode Switch
AFT = RESET
MIDDLE = OFF
FWD = ON


Magnetic Azimuth Detector Table
Flaps Position Angle (degrees)
Emergency Jettison Button
Anti-skid Switch
UP = TEST
MIDDLE = ON
DOWN = Nosewheel Steering
Flaps BIT (Built-In Test) Button
Landing Gear Down Lock Override Button
Landing Gear Lever
DOWN = Gear Extended
UP = Gear Retracted
Landing Gear Position Indicator
GREEN = Deployed
AMBER = In Transition
EXTINGUISHED = Up & Locked
Note: M is for Main Landing Gear, N is for Nose Landing Gear, L is for Left Wing and R is for Right Wing Landing Gear
Flaps Mode Switch
UP = Cruise Mode
MIDDLE = Automatic Mode
DOWN = STOL (Short Takeoff & Landing) Mode
Landing Gear Emergency Battery Lever
DOWN = OFF
UP = ON
Flaps Power Switch
LEFT = RESET
MIDDLE = ON
RIGHT = OFF

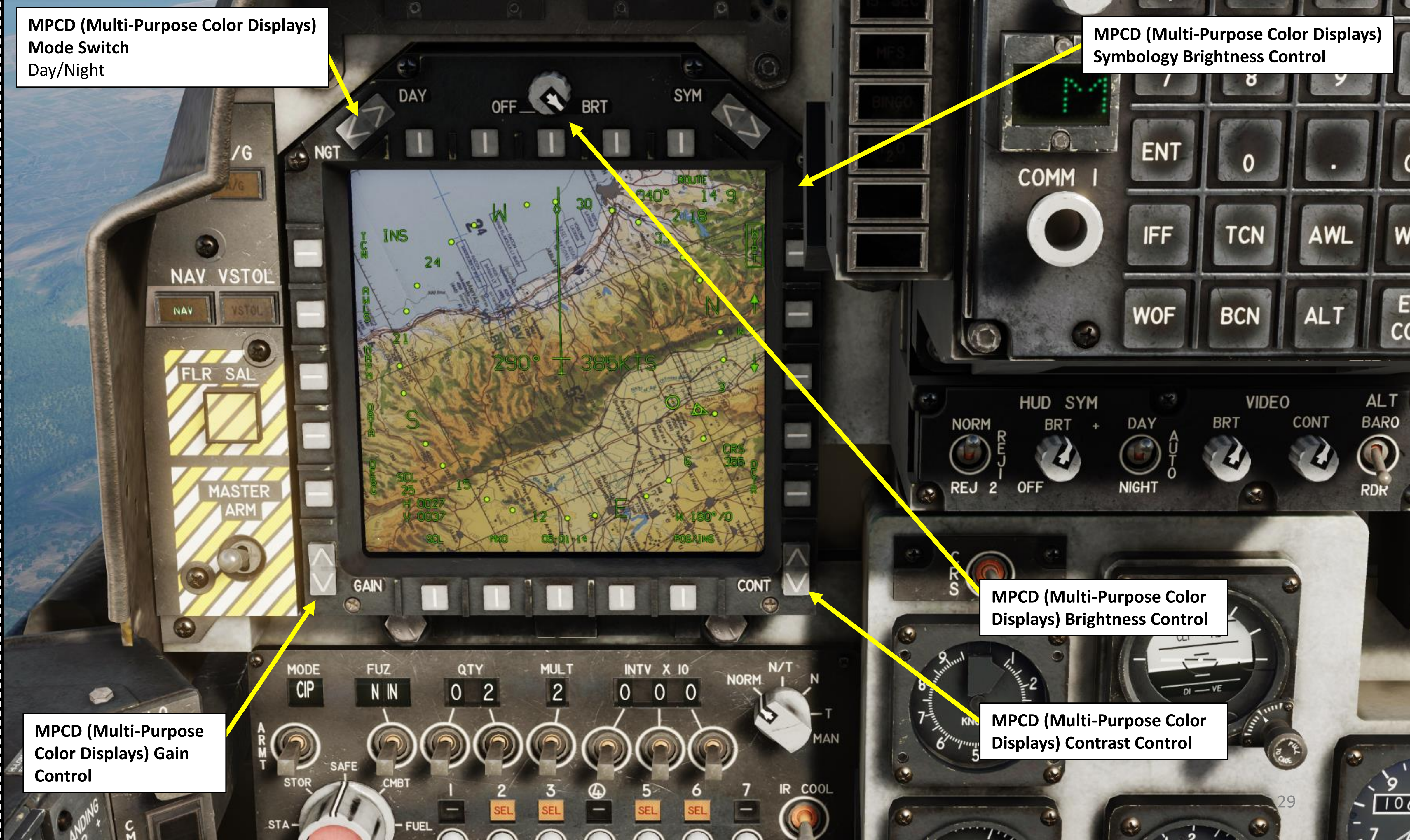
System:	Magnetic Azimuth Detector		
To Fly	**Steer**	**To Fly**	**Steer**
N	0	180	180
15	15	195	195
30	30	210	210
45	45	225	225
60	60	240	240
75	75	255	255
90	90	270	270
105	105	285	285
120	120	300	300
135	135	315	315
150	150	330	330
165	165	345	345

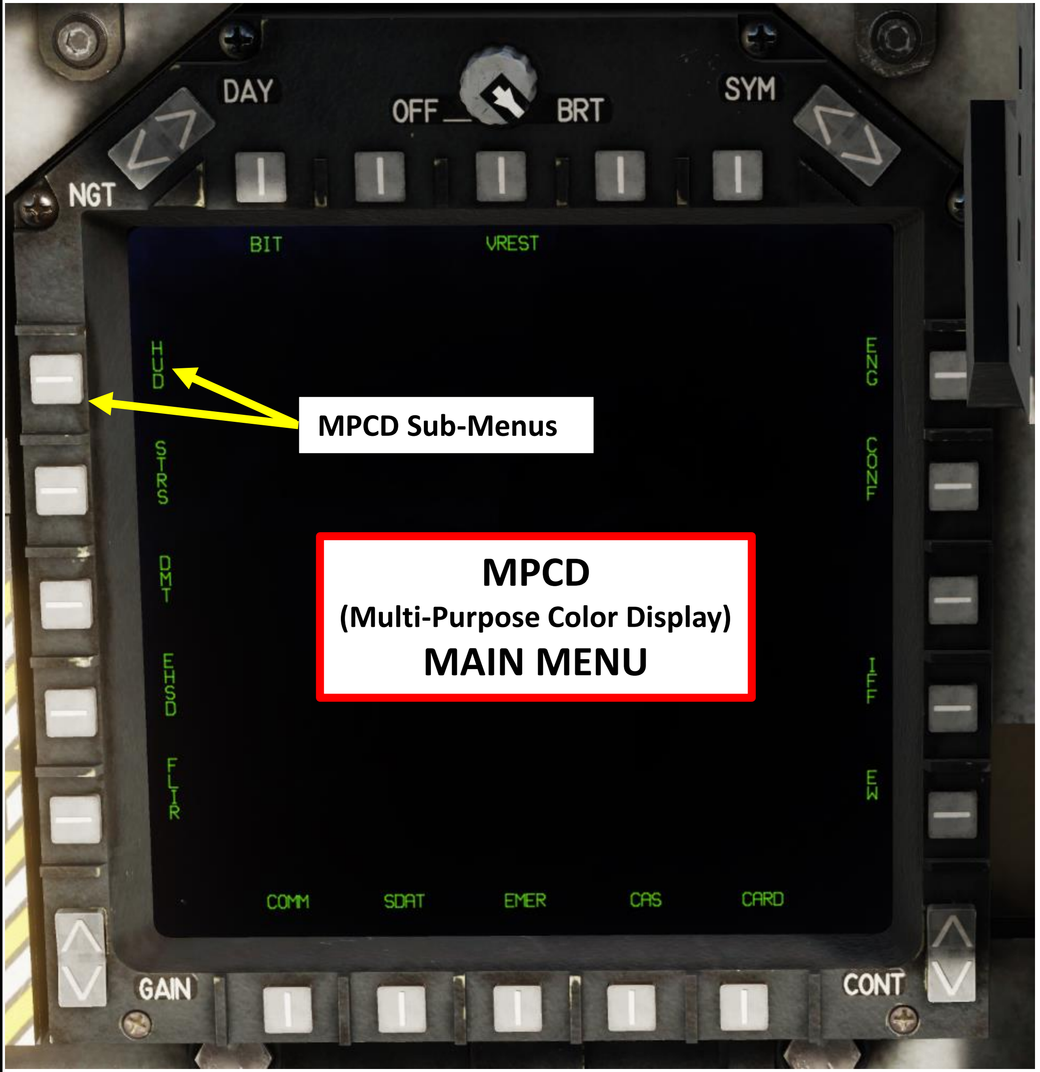

Armament Delivery Mode
AUT: Automatic
CIP: CCIP, Continuously Computed Impact Point
DSL: Depressed Sight Line
DIR: Direct
Fuzing Control
Weapon Quantity Control
Weapon Multiple Control
Weapon Interval Control
Weapon Manual Control
NORM: Normal
N/T: Nose & Tail Fuzing
N: Nose Fuzing
T: Tail Fuzing
ASCMI (Armament Stores Management Control Indicator) Panel
IR (Infrared) Cooling Switch
Applies manual cooling to all sidewinder-equipped stations. You shouldn't be turning it on at all unless you have a system failure that prevents the sidewinder seeker head from cooling or need to cool sidewinder's while on the ground for preflight checks.
Station Selection Button & Indication
Selective Jettison Control
STA: Selected stations
STOR: Selected stores
SAFE: Safety Position
CMBT: Combat
FUEL: External Fuel Tanks
PUSHBUTTON: Jettisons selected ordnance
7 6 5 4B 4A 3 2 1


Standby Magnetic Compass
Whiskey compass is used as a backup
Flood Lamps
Scroll mousewheel to change orientation
Canopy Handle
Key Binding: LCTRL+R


Air-to-Ground Master Mode Button
Navigation Master Mode Button
VSTOL (Vertical Short Takeoff & Landing) Master Mode Button
Flare Salvo Button
Master Arm Switch
UP = ON
DOWN = OFF

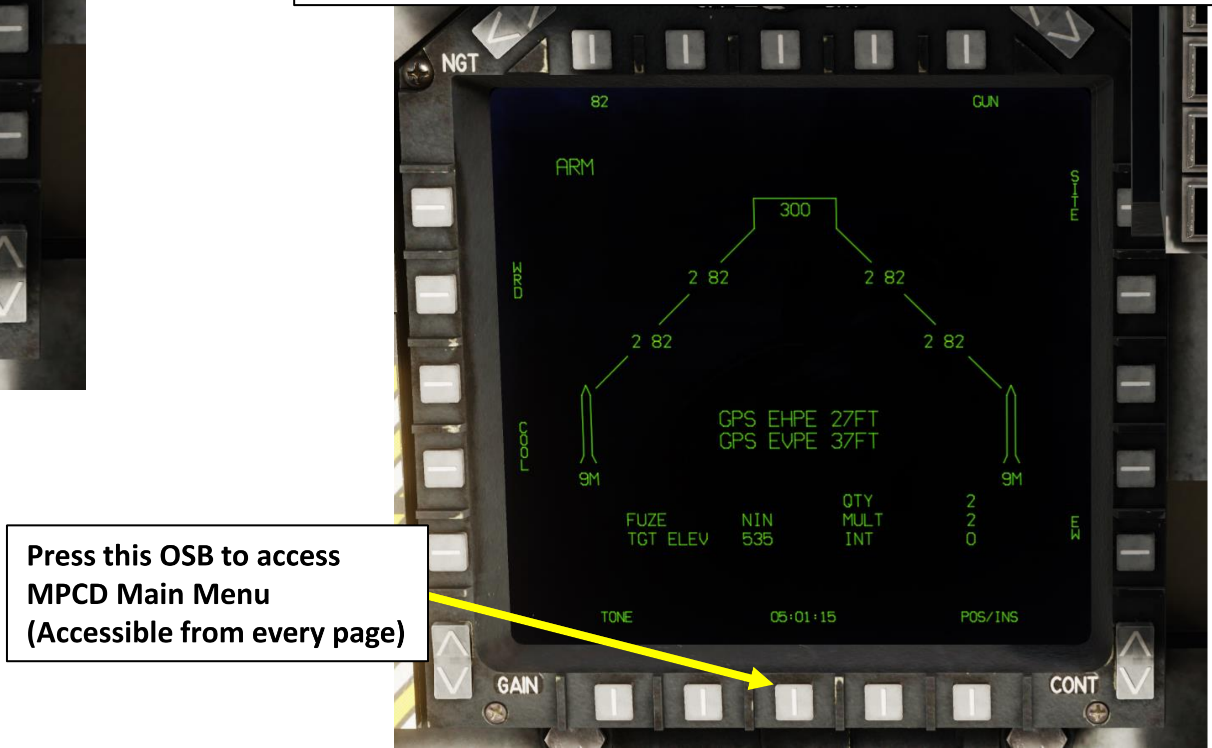

ODU (Option Display Unit) Option 1 Button & Indication
ODU (Option Display Unit) Option 2 Button & Indication
ODU (Option Display Unit) Option 3 Button & Indication
ODU (Option Display Unit) Option 4 Button & Indication
ODU (Option Display Unit) Option 5 Button & Indication

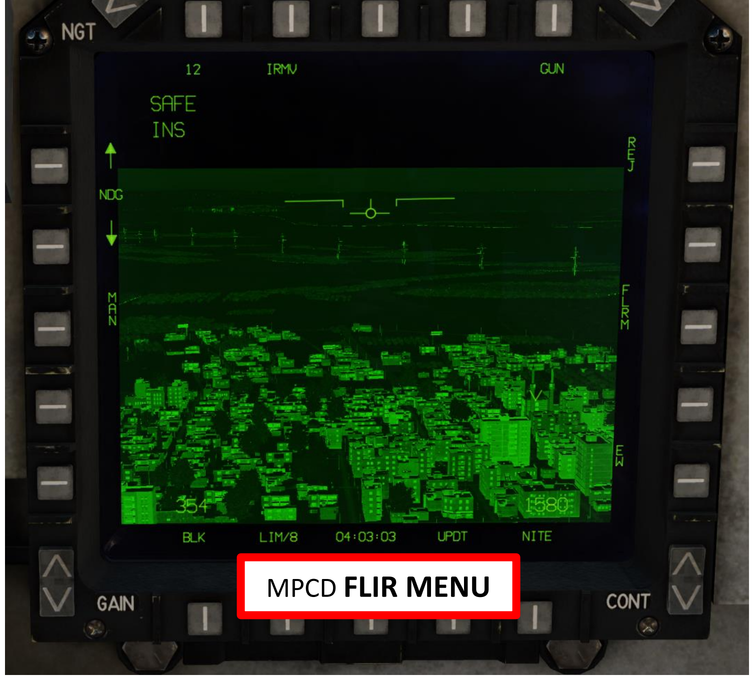

MPCD (Multi-Purpose Color Displays) Mode Switch
Day/Night
MPCD (Multi-Purpose Color Displays) Symbology Brightness Control
MPCD (Multi-Purpose Color Displays) Brightness Control
MPCD (Multi-Purpose Color Displays) Contrast Control
MPCD (Multi-Purpose Color Displays) Gain Control

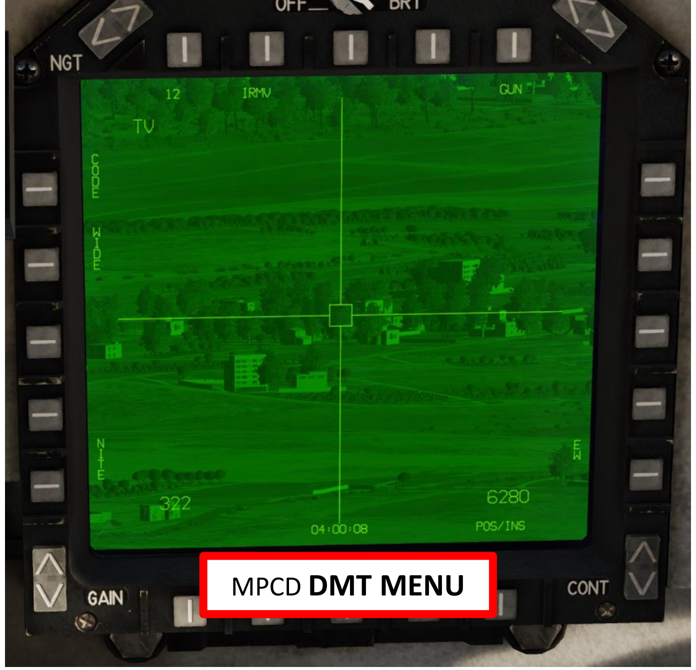


MPCD Sub-Menus

- FLIR: NAVFLIR (Navigation Forward-Looking Infrared) Display
- EHSD: Electronic Horizontal Situation Display
- DMT: Dual Mode Tracker display
- STRS: Stores Page
- HUD: Heads-Up Display repeater
- BIT: Built-In Test page
- VRST: VSTOL-REST (Vertical & Short Takeoff & Landing) calculator page
- ENG: Engine parameters page
- CONF: Software configuration page
- TPOD: Targeting Pod (LITENING II) page. Blank if no TPOD is loaded.
- IFF: Identify-Friend-or-Foe Data page.
- EW: Early Warning page, used for Electronic Countermeasures/Warfare. Displays RWR (Radar Warning Receiver)
- CARD: Pre-programmed kneeboard card display page.
- CAS: Close Air Support page.
- EMER: Emergency Checklist Cards page.
- SDAT: System Data page.
- COMM: Communication data page.




NGT
12
IRMV
GUN
SAFE
INS
NDG
MAN
REJ
FLRM
EW
354
1580
BLK
LIM/8
04:03:03
UPDT
NITE
GAIN
CONT
MPCD FLIR MENU


NGT
OFF
BRT
12
IRMV
GUN
TV
CODE
WIDE
NITE
322
6280
04:00:08
POS/INS
EW
GAIN
CONT
MPCD DMT MENU


NGT
OFF
BRT
12
IRMV
GUN
ARM
WRD
STIE
LOFT
300
TPOD
2 12
2 12
IRMV
IRMV
GPS EHPE 5FT
GPS EVPE 6FT
MODE AUTO QTY 1
FUZE SAFE MULT 1
TGT ELEV 985 INT 0
EW
TONE
04:00:09
POS/INS
GAIN
CONT
MPCD STRS MENU


DAY
OFF
BRT
SYM
NGT
JPT
ENG ID(3)-408
EMS
LIFE 29745
SORTIE JPT 591°C
MAX JPT 798°C
OT TIME 47 SEC
STAB POS 0.0
IGV 2
HOV 1
COMP RPM 93%
FAN RPM 96%
JPT 575°C
COR COMP 92%
COR FAN 95%
FUEL WT 7731
PHOV
ACCELERATION
RPM 35-60% 60-105%
TIME 2.9SEC 2.6SEC
EW
FRZ
04:00:10
ACCEL
GAIN
CONT
MPCD ENG MENU


DAY
OFF
BRT
SYM
NGT
ARMED
LTIP
FIRE
LASR
SWFV
TPOD 1688
N 35 02.224
37S BU 98251 79391
E036 47.297
ELV 1539F
CCD
1.0X
23M
AREA
TPOD DES
TPOD DES
T370
322 / 5.5
5763
000 / 0.0
AR
INR
04:00:32
PIP
SLAVE
GAIN
CONT
MPCD TPOD MENU

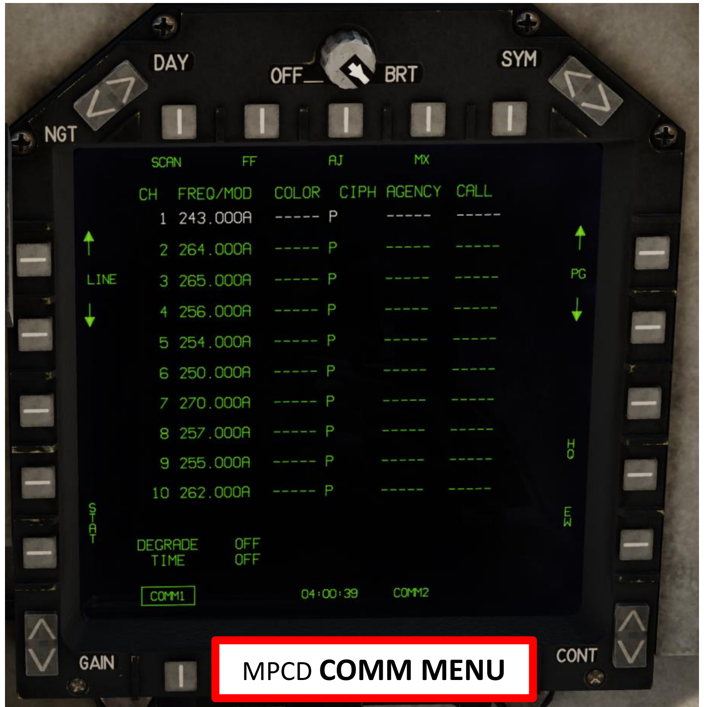

DAY
OFF
BRT
SYM
NGT
12
IRMV
GUN
EXP
AUTO
RWR
N
04:00:34
GAIN
CONT
MPCD EW MENU

MPCD HUD REPEATER MENU

MPCD CONF MENU

MPCD CAS MENU

MPCD EMER MENU



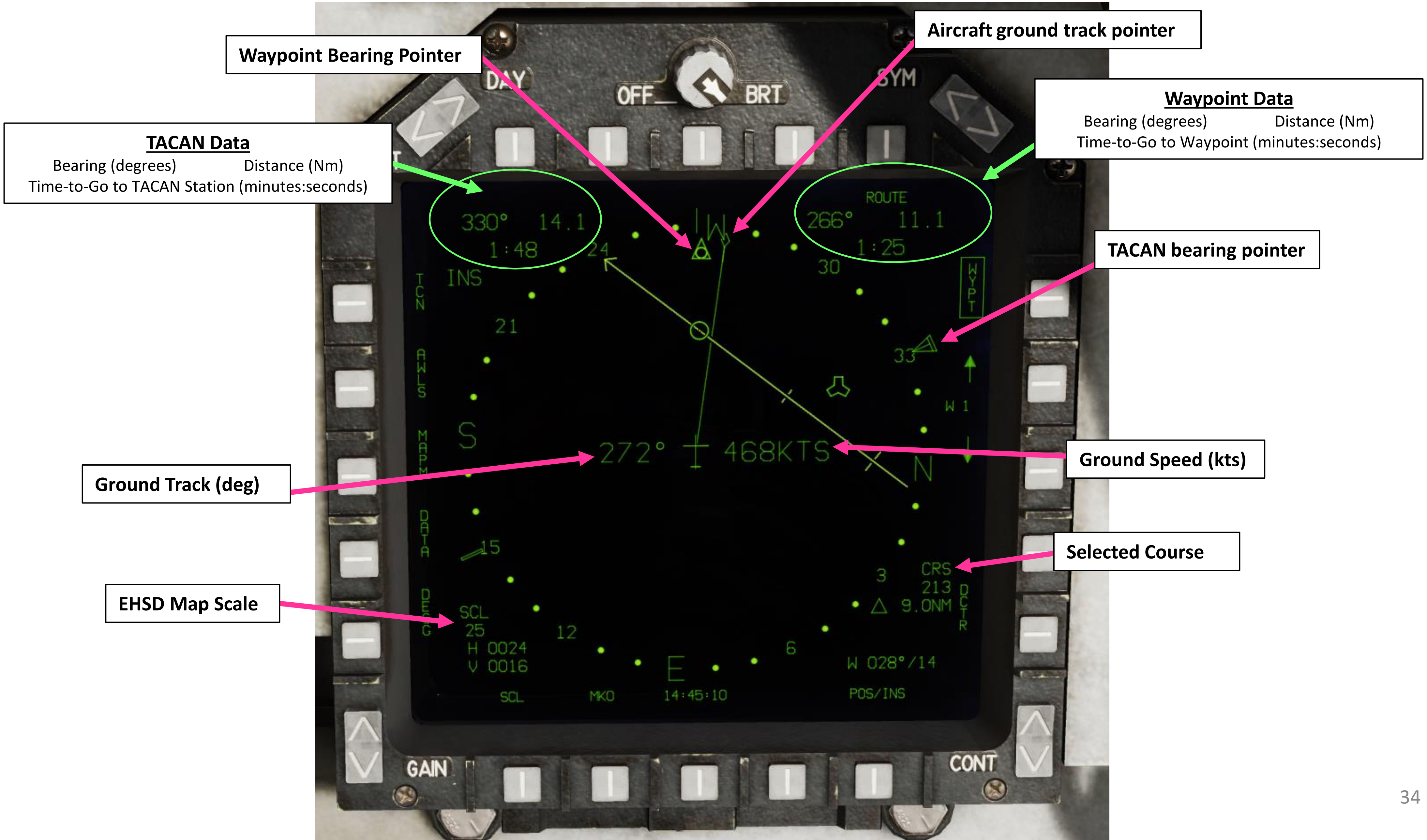
MPCD COMM MENU

MPCD BIT MENU


DAY
OFF
BRT
SYM
NGT
VL
VTO
STO
CRUS
TEMC
BNGO
WET DRY
NRAS 97 100
NOZ 55 55
GROL 839 910
DT50 1638 1738
ASPD *** ***
SDST *** ***
OATC 5
ALTM 29.92
FELV 0
GWT 27524
RUNW 07500/135DRY
GWIND 155/005
04:00:48
ABRT
GAIN
CONT
MPCD **VREST MENU**

MPCD

EHSD (Electronic Horizontal Situation Display) MENU



RIGHT Refuel Light

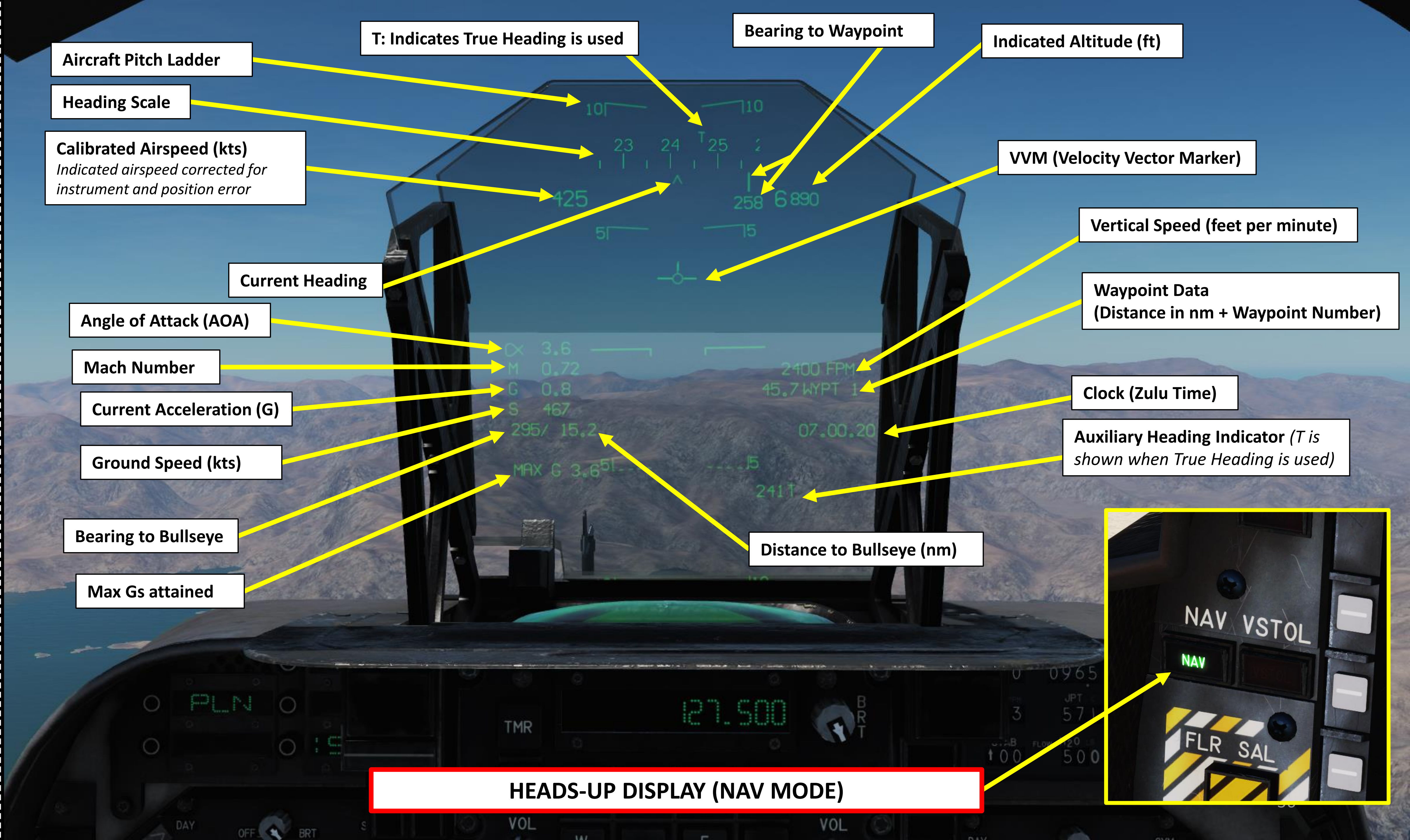
- Flashing: internal right wing tank or right external tank is full.
- Illuminated (steady): both right wing and right external tanks are full.

READY Refuel Light

- Illuminates when you are cleared for air-to-air refueling.
- Extinguishes during contact.

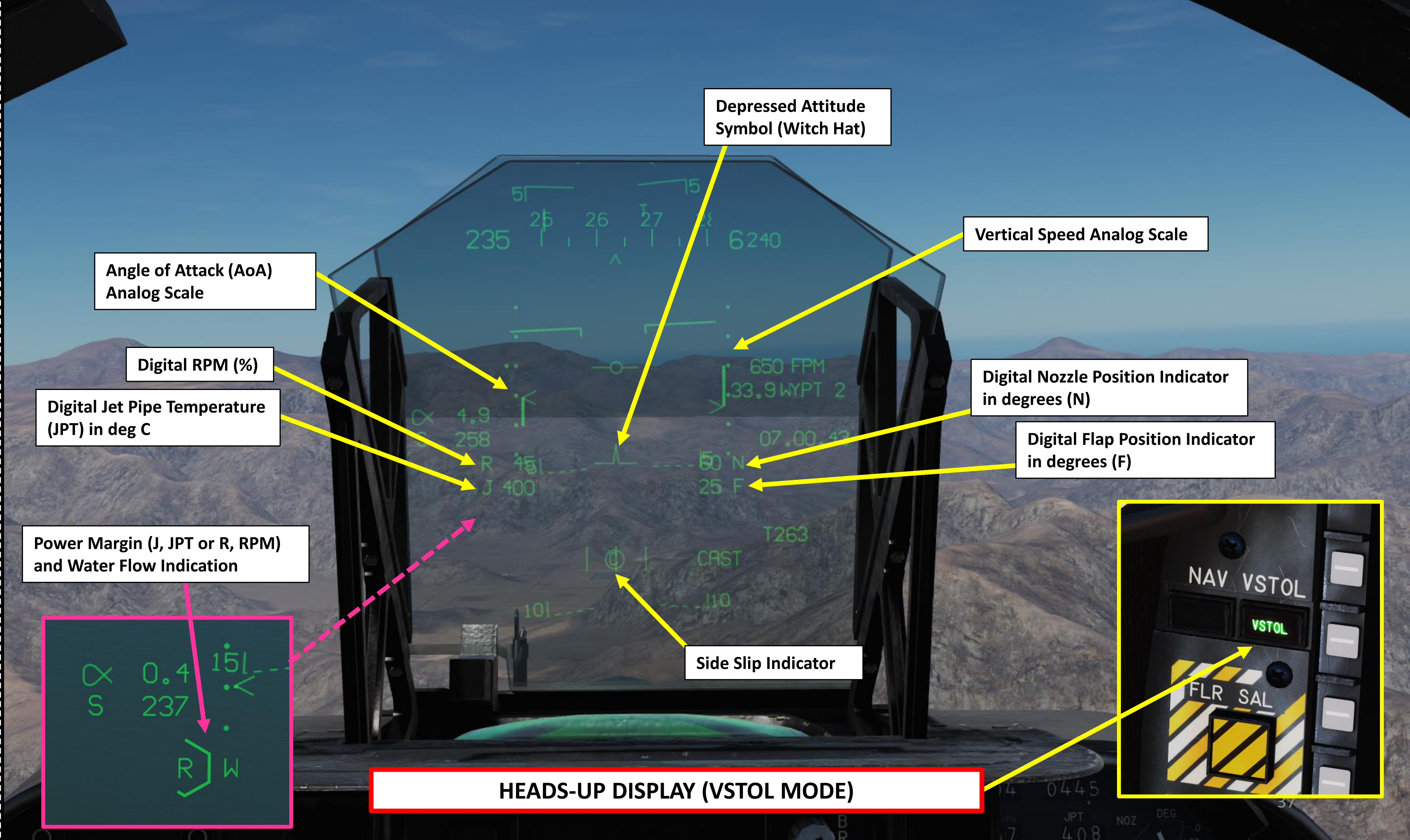
LEFT Refuel Light

- Flashing: internal left wing tank or left external tank is full.
- Illuminated (steady): both left wing and left external tanks are full.



HEADS-UP DISPLAY (NAV MODE)

HEADS-UP DISPLAY (VSTOL MODE)



Keypad

UFC (Upfront Control) Display
Shown: COMM 1 Frequency

Display Brightness Control

Function Mode Keys
TMR: Timer
TOO: Target-of-Opportunity

COMM1 & COMM2 Radio UFC
- Power/Volume Knob
- Radio Channel Display (M = Manual)
- Channel Selector (scroll mousewheel)

Function Mode Keys
ENT: Enter (validates & saves entered values)
IFF: Sets UFC for IFF system
TCN: Sets UFC for TACAN
AWL: Sets UFC for All Weather Landing System
WPN: Sets UFC for Weapons delivery programming
WOF: Waypoint Over Fly (INS position update)
BCN: Radar Beacon Identification System ON/OFF
ALT: Sets UFC to configure aircraft's altimeter
EM CON: Emission Control System ON/OFF

Specialty Input Keys
I/P: Identification-of-Position (used by IFF)
SVE: Save (not functional)

Master Caution
Push to Reset

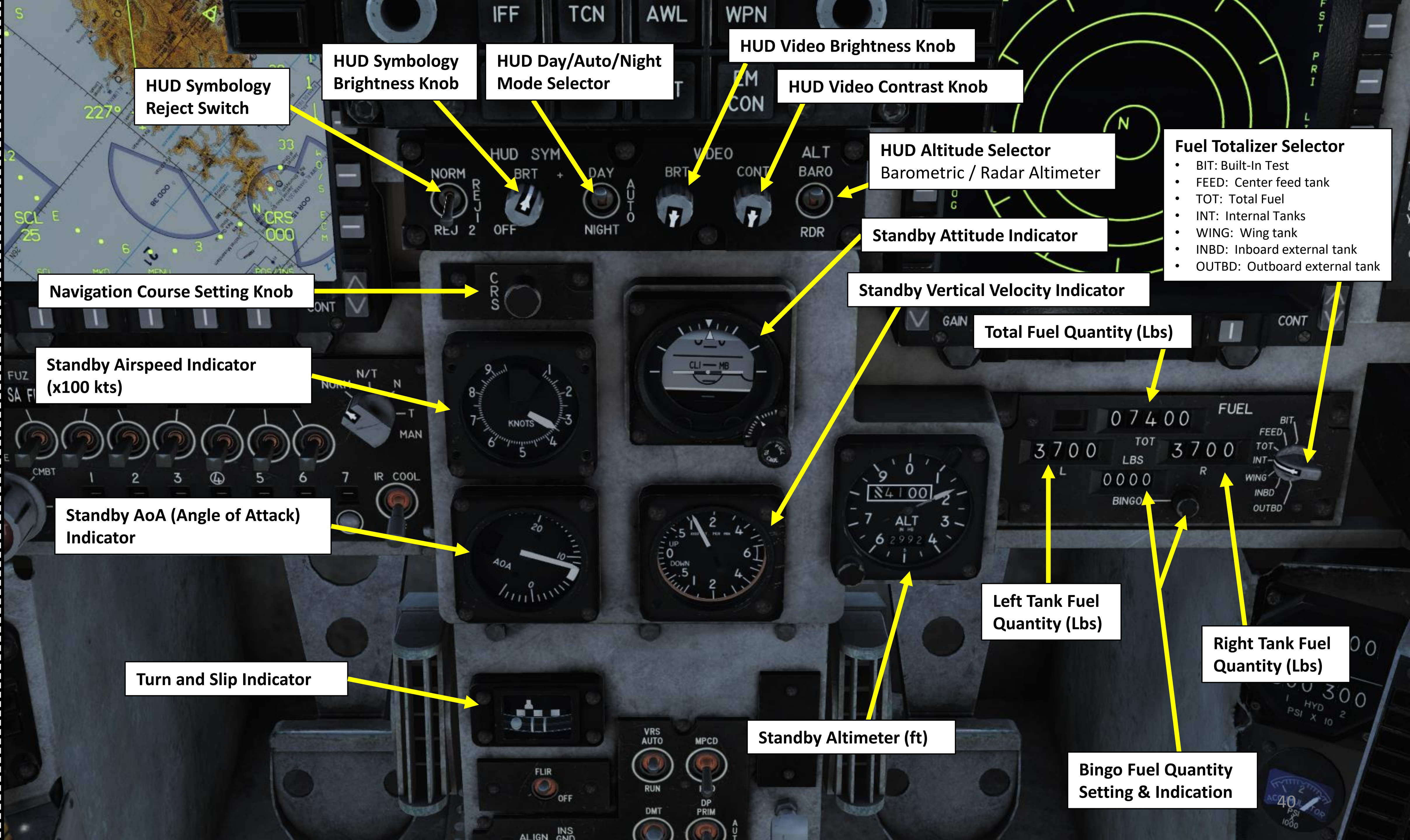
Master Warning
Push to Reset

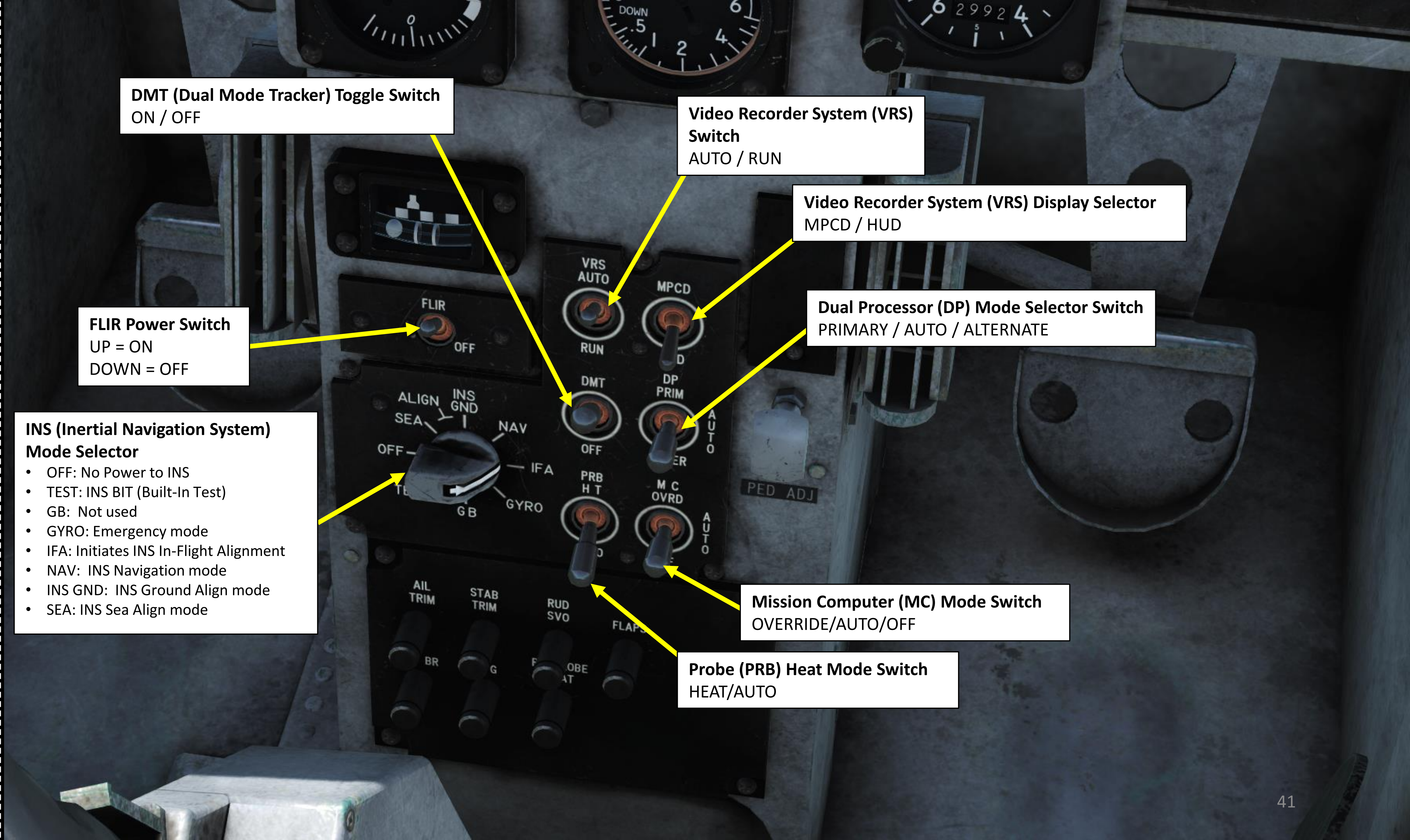
Warning Lights

- FIRE: engine fire detected
- LAW: Low Altitude Warning
- FLAPS: Flap system failure
- L TANK: Left fuel tank system overpressure or overtemperature
- R TANK: Right fuel tank system overpressure or overtemperature
- HYD: Both HYD1 and HYD2 hydraulic systems are failed
- GEAR: Landing Gear unsafe/fails to extend.
- OT: Overtemperature (Engine JPT limits exceeded)
- JPTL: Jet Pipe Temperature Limiter control inoperative
- EFC: Engine Fuel Control boxes DECU1 and DECU2 are both failed
- GEN: AC generator is offline

Caution Lights

- L FUEL: left fuel system level is low (steady when less than 750 lbs, flashing when less than 250 lbs)
- R FUEL: right fuel system level is low (steady when less than 750 lbs, flashing when less than 250 lbs)
- 15 SEC: JPT (Jet Pipe Temperature) above normal lift rating (flashes after 15 sec)
- MFS: Manual Fuel System ON
- BINGO: Fuel below bingo (return to base) setting
- H_2O: Less than 15 seconds of water injection remaining.


HUD Symbology Reject Switch
HUD Symbology Brightness Knob
HUD Day/Auto/Night Mode Selector
HUD Video Brightness Knob
HUD Video Contrast Knob
HUD Altitude Selector
Barometric / Radar Altimeter
Fuel Totalizer Selector
• BIT: Built-In Test
• FEED: Center feed tank
• TOT: Total Fuel
• INT: Internal Tanks
• WING: Wing tank
• INBD: Inboard external tank
• OUTBD: Outboard external tank
Standby Attitude Indicator
Navigation Course Setting Knob
Standby Vertical Velocity Indicator
Total Fuel Quantity (Lbs)
Standby Airspeed Indicator (x100 kts)
Standby AoA (Angle of Attack) Indicator
Left Tank Fuel Quantity (Lbs)
Right Tank Fuel Quantity (Lbs)
Turn and Slip Indicator
Standby Altimeter (ft)
Bingo Fuel Quantity Setting & Indication



DMT (Dual Mode Tracker) Toggle Switch
ON / OFF

Video Recorder System (VRS) Switch
AUTO / RUN

Video Recorder System (VRS) Display Selector
MPCD / HUD

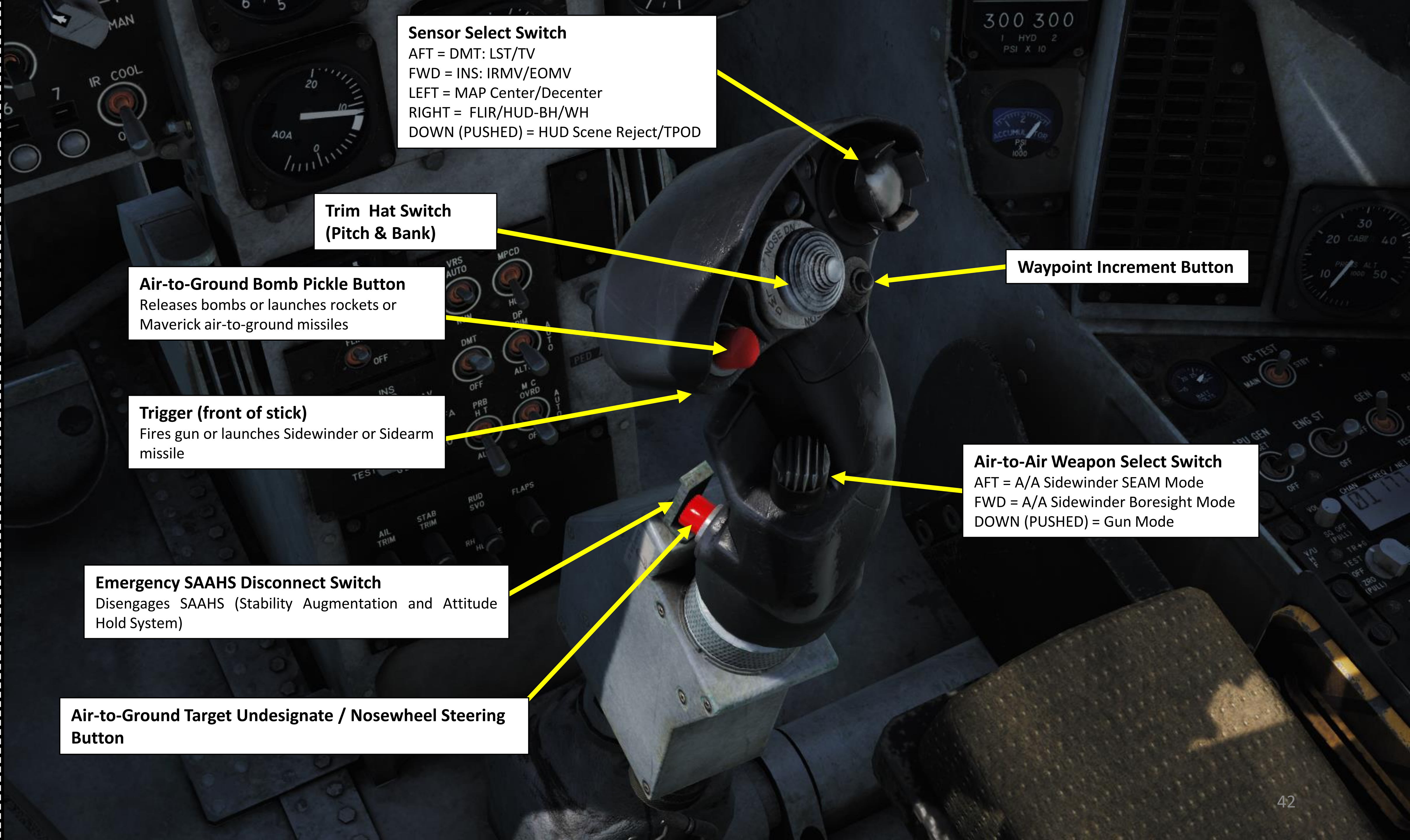
Dual Processor (DP) Mode Selector Switch
PRIMARY / AUTO / ALTERNATE

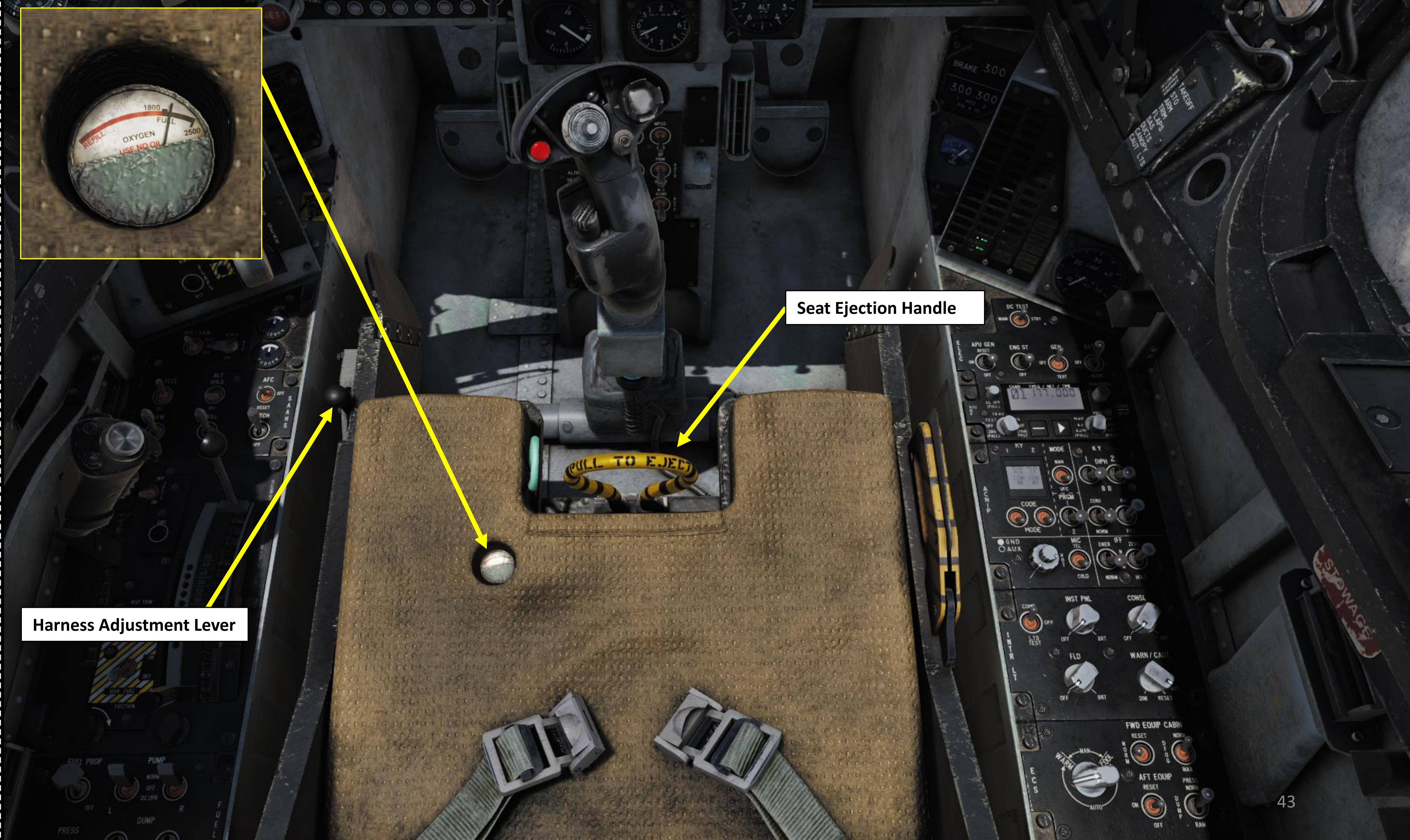
FLIR Power Switch
UP = ON
DOWN = OFF

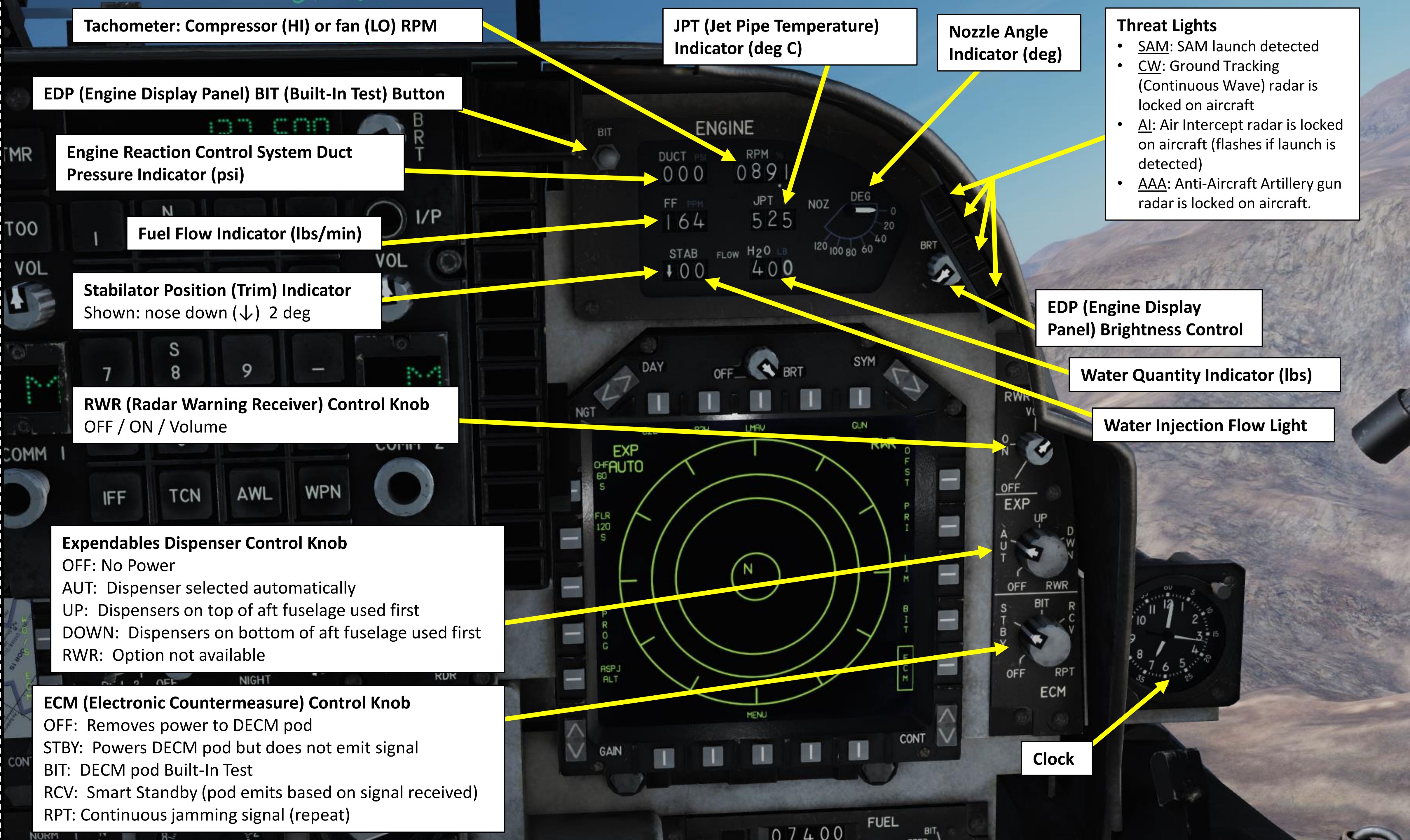
INS (Inertial Navigation System) Mode Selector
- OFF: No Power to INS
- TEST: INS BIT (Built-In Test)
- GB: Not used
- GYRO: Emergency mode
- IFA: Initiates INS In-Flight Alignment
- NAV: INS Navigation mode
- INS GND: INS Ground Align mode
- SEA: INS Sea Align mode

Mission Computer (MC) Mode Switch
OVERRIDE/AUTO/OFF

Probe (PRB) Heat Mode Switch
HEAT/AUTO


Sensor Select Switch
AFT = DMT: LST/TV
FWD = INS: IRMV/EOMV
LEFT = MAP Center/Decenter
RIGHT = FLIR/HUD-BH/WH
DOWN (PUSHED) = HUD Scene Reject/TPOD
Trim Hat Switch (Pitch & Bank)
Waypoint Increment Button
Air-to-Ground Bomb Pickle Button
Releases bombs or launches rockets or Maverick air-to-ground missiles
Trigger (front of stick)
Fires gun or launches Sidewinder or Sidearm missile
Air-to-Air Weapon Select Switch
AFT = A/A Sidewinder SEAM Mode
FWD = A/A Sidewinder Boresight Mode
DOWN (PUSHED) = Gun Mode
Emergency SAAHS Disconnect Switch
Disengages SAAHS (Stability Augmentation and Attitude Hold System)
Air-to-Ground Target Undesignate / Nosewheel Steering Button


Seat Ejection Handle
Harness Adjustment Lever
PULL TO EJECT
OXYGEN
USE NO OIL
REFILL
FULL
1800
2500



Tachometer: Compressor (HI) or fan (LO) RPM

EDP (Engine Display Panel) BIT (Built-In Test) Button

Engine Reaction Control System Duct Pressure Indicator (psi)

Fuel Flow Indicator (lbs/min)

Stabilator Position (Trim) Indicator
Shown: nose down (↓) 2 deg

RWR (Radar Warning Receiver) Control Knob
OFF / ON / Volume

Expendables Dispenser Control Knob
OFF: No Power
AUT: Dispenser selected automatically
UP: Dispensers on top of aft fuselage used first
DOWN: Dispensers on bottom of aft fuselage used first
RWR: Option not available

ECM (Electronic Countermeasure) Control Knob
OFF: Removes power to DECM pod
STBY: Powers DECM pod but does not emit signal
BIT: DECM pod Built-In Test
RCV: Smart Standby (pod emits based on signal received)
RPT: Continuous jamming signal (repeat)

JPT (Jet Pipe Temperature) Indicator (deg C)

Nozzle Angle Indicator (deg)

Threat Lights
- SAM: SAM launch detected
- CW: Ground Tracking (Continuous Wave) radar is locked on aircraft
- AI: Air Intercept radar is locked on aircraft (flashes if launch is detected)
- AAA: Anti-Aircraft Artillery gun radar is locked on aircraft.

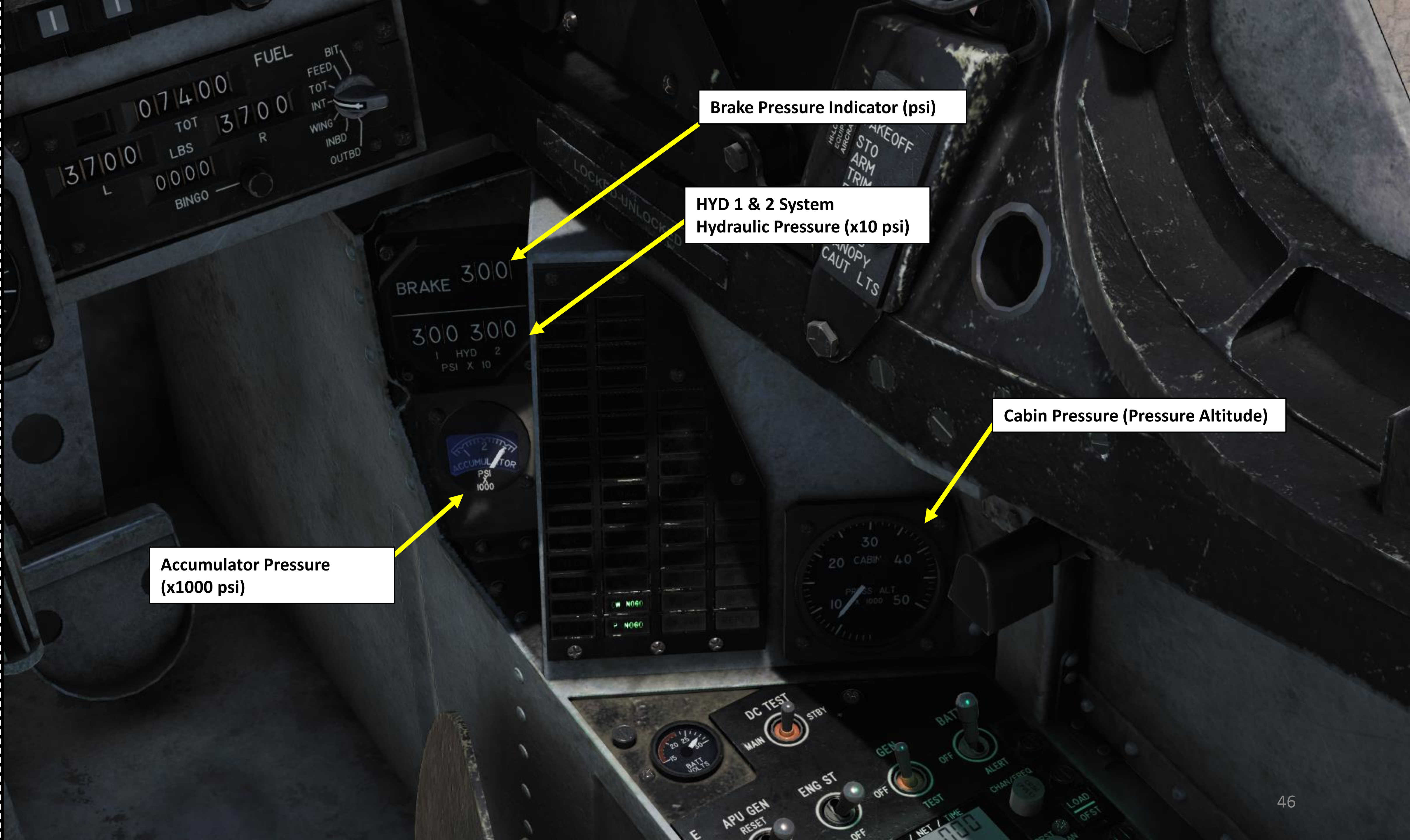
EDP (Engine Display Panel) Brightness Control

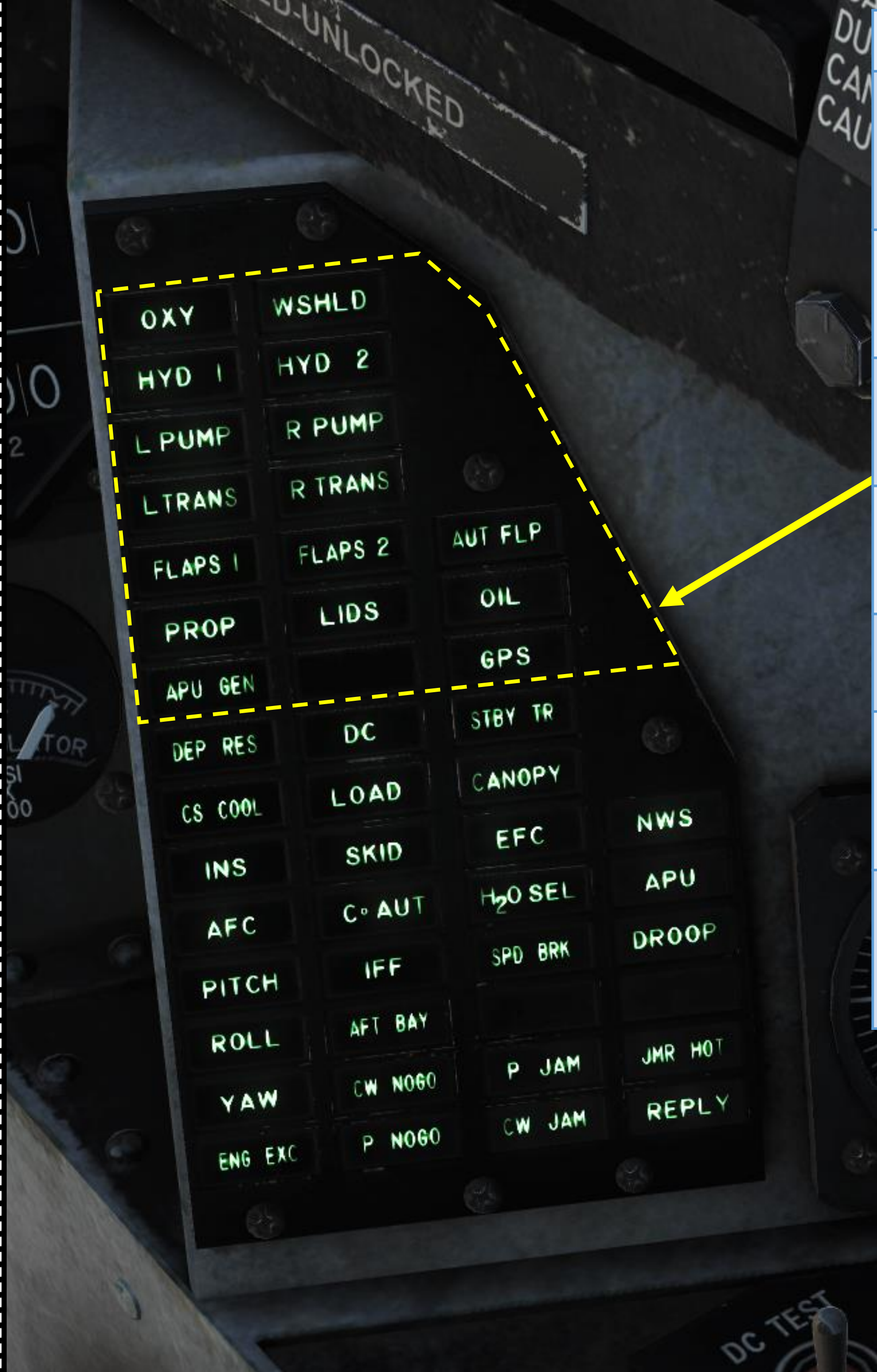
Water Quantity Indicator (lbs)

Water Injection Flow Light

Clock

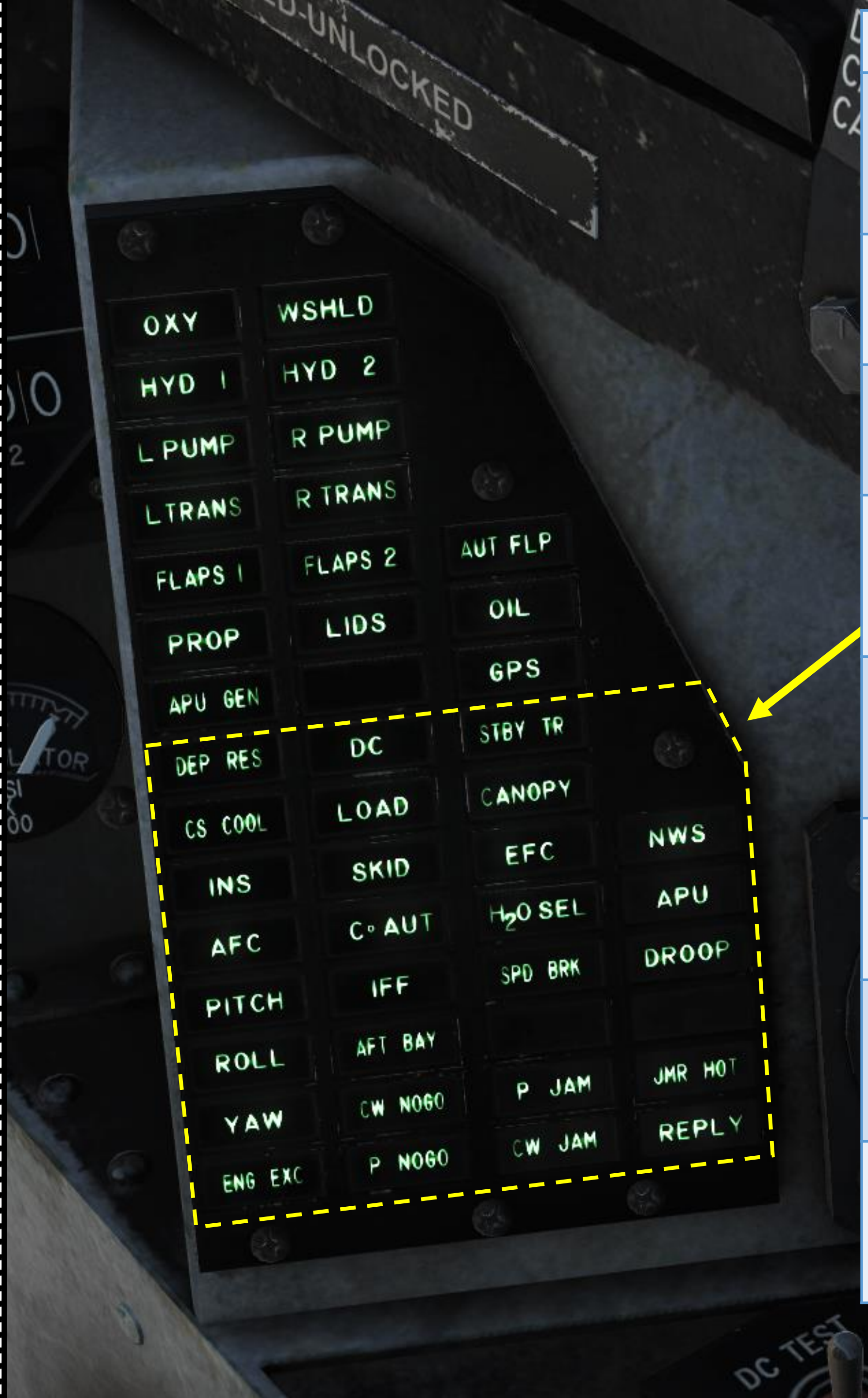

Flood Lamps
Scroll mousewheel to change orientation
Canopy Handle
Key Binding: LCTRL+C
Canopy Locking Lever
FWD: LOCKED
AFT: UNLOCKED


Brake Pressure Indicator (psi)
HYD 1 & 2 System Hydraulic Pressure (x10 psi)
Cabin Pressure (Pressure Altitude)
Accumulator Pressure (x1000 psi)



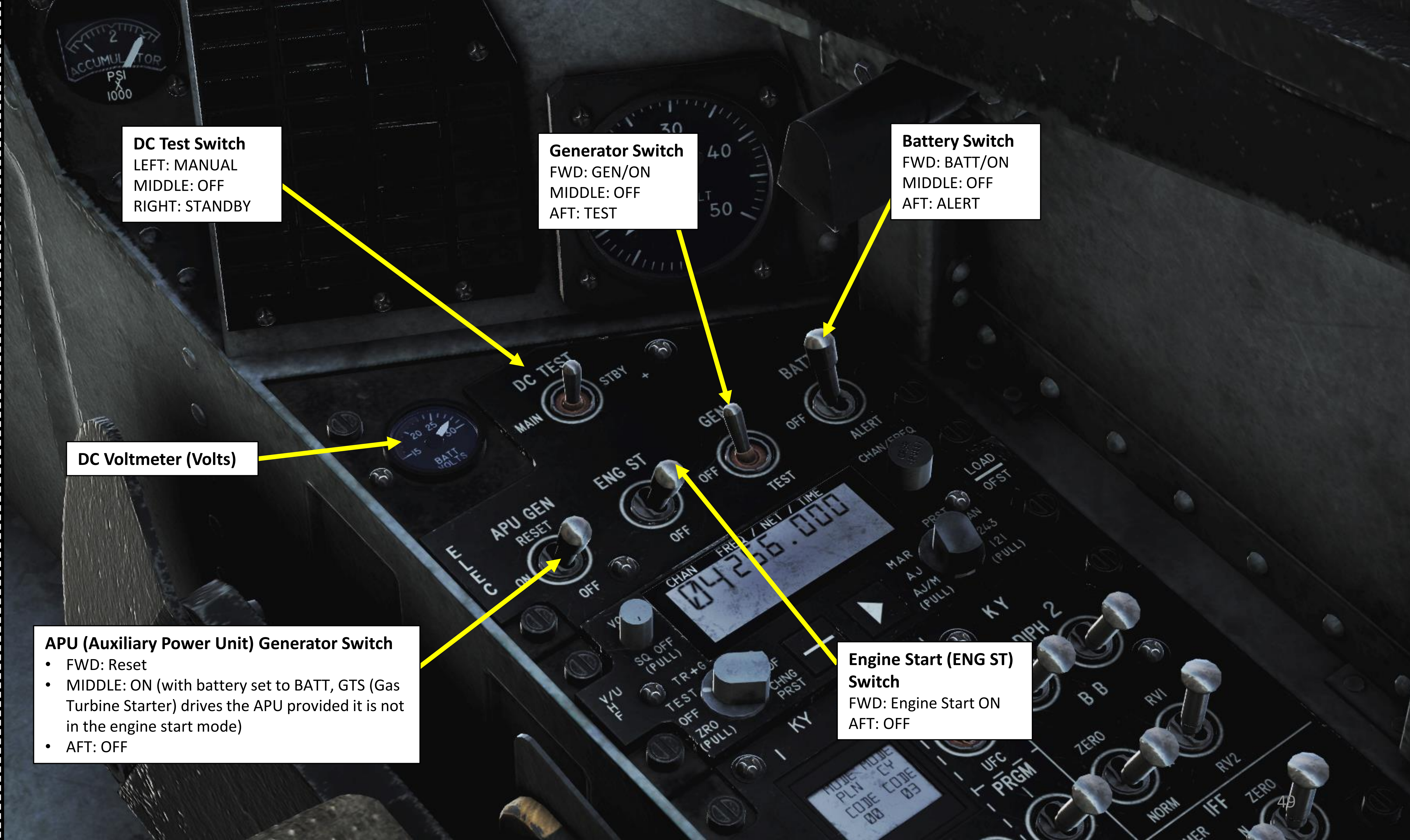
CAUTION / ADVISORY LIGHT PANEL

OXY OBOGS (On-Board Oxygen Generation System) malfunction	**WSHLD** Windshield hot		
HYD 1 Hydraulic System 1 pressure greater than 1400 psi	**HYD 2** Hydraulic System 2 pressure greater than 1400 psi		
L PUMP Left fuel boost pump pressure low	**R PUMP** Right fuel boost pump pressure low		
L TRANS Low air pressure to left feeder tank	**R TRANS** Low air pressure to right feeder tank		
FLAPS 1 Flaps 1 channel failed	**FLAPS 2** Flaps 2 channel failed	**AUT FLP** Auto flap mode or ADC failed	
PROP Fuel proportioner off or failed	**LIDS** LIDS (Lift Improvement Device System) not in correct position	**OIL** Oil pressure low	
APU GEN APU (Auxiliary Power Unit) selected and emergency generated failed		**GPS** GPS not valid	



CAUTION / ADVISORY LIGHT PANEL

DEP RES Departure Resistance reduced (aircraft more prone to depart from controlled flight)	**DC** Main transformer-rectifier failed	**STBY TR** Standby TRU (Transformer-Rectifier Unit) inoperative or offline	
CS COOL Cockpit avionics cooling fan failed	**LOAD** Fuel asymmetry over VL (Vertical Landing) limit	**CANOPY** Canopy not closed and locked	
INS Inertial Navigation System aligning or failed	**SKID** Anti-Skid system malfunction	**EFC** DECU 1 or 2 (Digital Engine Control Unit) failed	**NWS** Nosewheel steering malfunction
AFC AFC (Automatic Flight Controls) malfunction or deselected	**CIP AUT** Computed delivery mode not available	**H_2O SEL** Airspeed over 250 kts and water injection switch is not set to OFF	**APU** APU (Auxiliary Power Unit) operating
PITCH Pitch stabilization augmentation system off or failed	**IFF** IFF (Identify-Friend-or-Foe) system off, not zeroized or not responding.	**SPD BRK** Gear up and speed brake extended or gear down and speed brake not 25 deg	**DROOP** Ailerons dropped
ROLL Roll stabilization augmentation system off or failed	**AFT BAY** Aft avionics bay ECS (Environmental Control System) failed		
YAW Yaw stabilization augmentation system off or failed	**CW NO GO** CW (continuous wave) radar jammer failure.	**P JAM** Pulse-Doppler radar jammer pod active	**JMR HOT** Jammer pod overtemperature
ENG EXC Engine exceedance (overspeed, overtemperature or over-g) detected	**P NO GO** Pulse-Doppler radar jammer failure.	**CW JAM** CW (continuous wave) radar jammer pod active.	**REPLY** IFF responding to Mode 4 interrogation.



DC Test Switch
LEFT: MANUAL
MIDDLE: OFF
RIGHT: STANDBY

Generator Switch
FWD: GEN/ON
MIDDLE: OFF
AFT: TEST

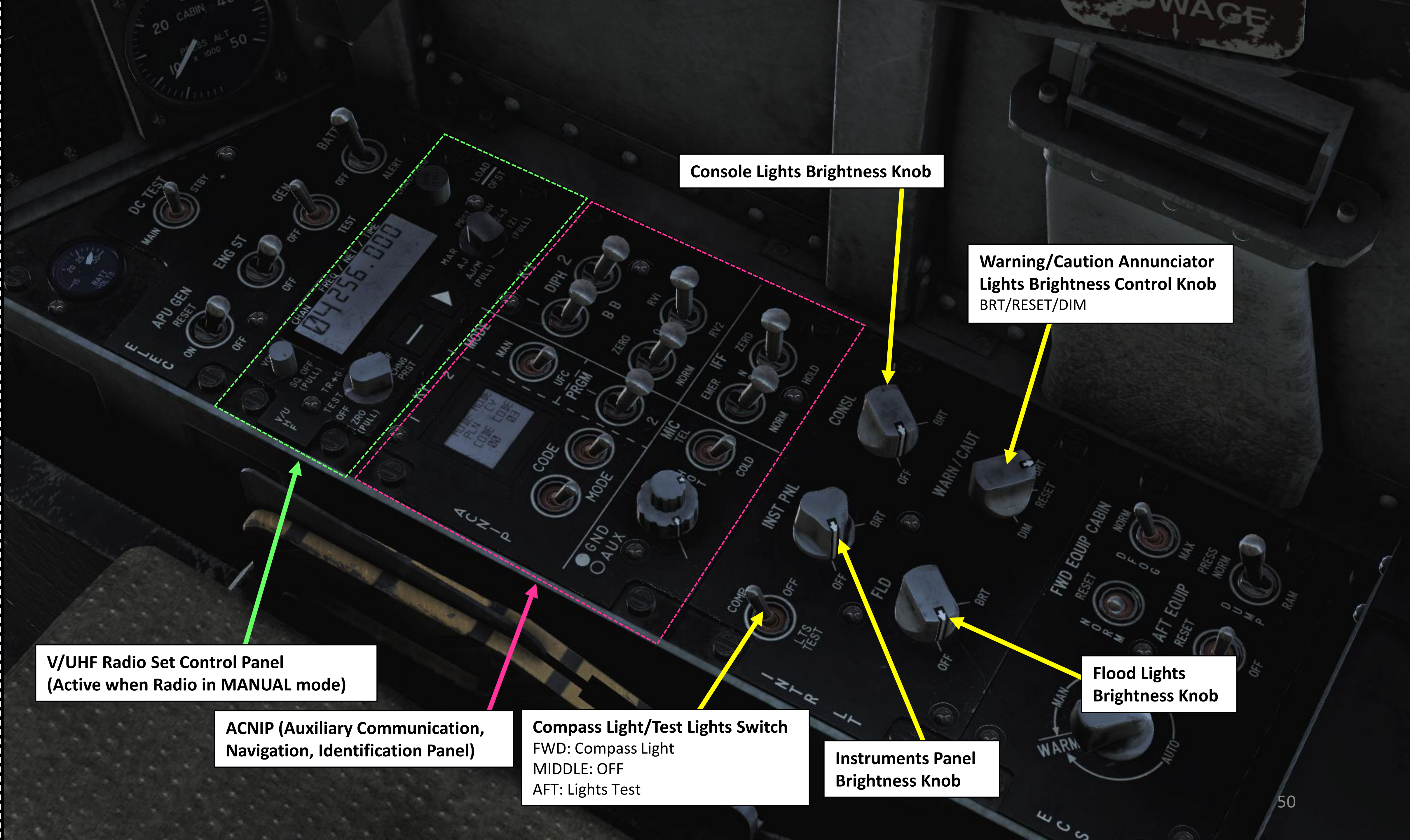
Battery Switch
FWD: BATT/ON
MIDDLE: OFF
AFT: ALERT

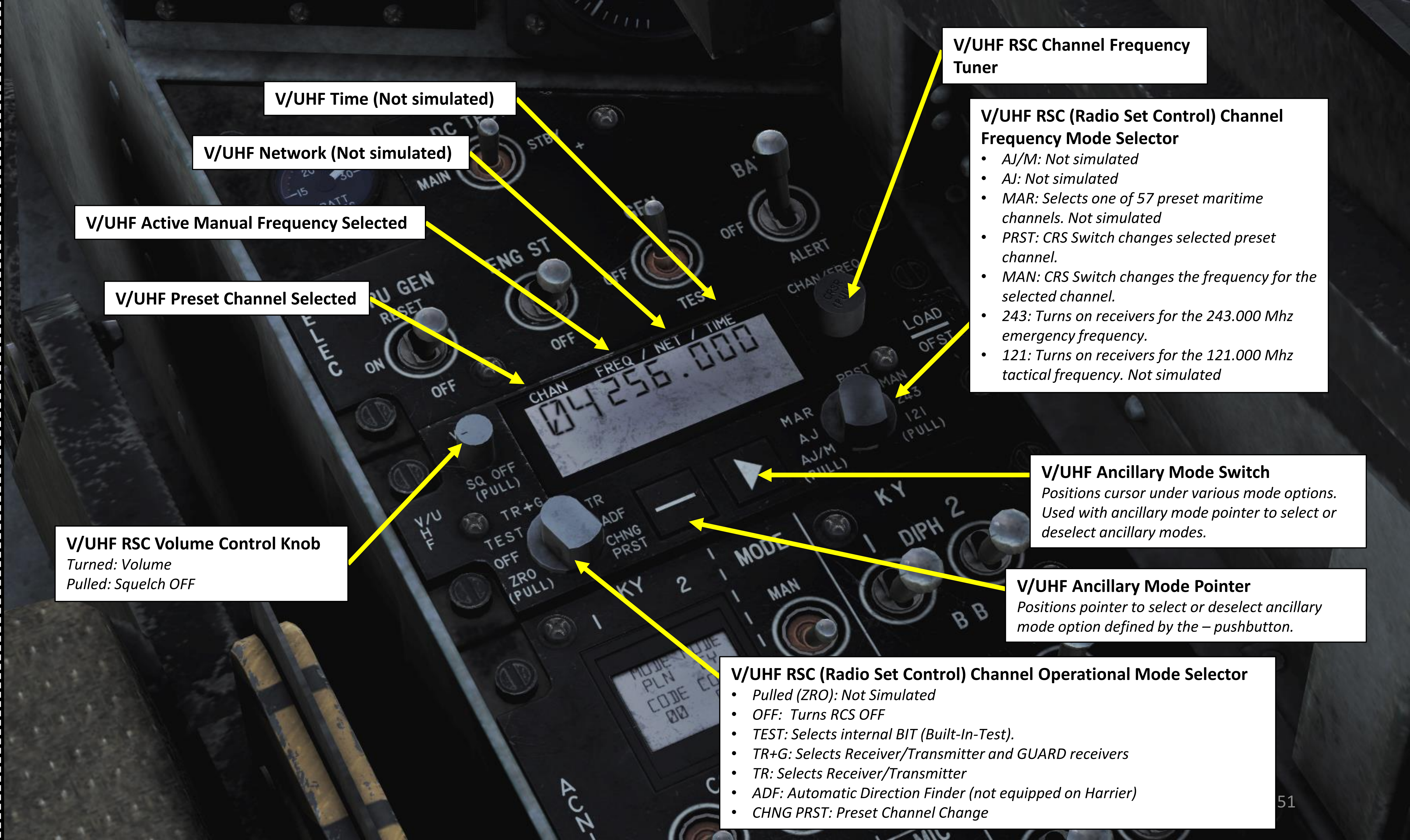
DC Voltmeter (Volts)

APU (Auxiliary Power Unit) Generator Switch

- FWD: Reset
- MIDDLE: ON (with battery set to BATT, GTS (Gas Turbine Starter) drives the APU provided it is not in the engine start mode)
- AFT: OFF

Engine Start (ENG ST) Switch
FWD: Engine Start ON
AFT: OFF


Console Lights Brightness Knob
Warning/Caution Annunciator Lights Brightness Control Knob
BRT/RESET/DIM
V/UHF Radio Set Control Panel (Active when Radio in MANUAL mode)
ACNIP (Auxiliary Communication, Navigation, Identification Panel)
Compass Light/Test Lights Switch
FWD: Compass Light
MIDDLE: OFF
AFT: Lights Test
Instruments Panel Brightness Knob
Flood Lights Brightness Knob



V/UHF Time (Not simulated)

V/UHF Network (Not simulated)

V/UHF Active Manual Frequency Selected

V/UHF Preset Channel Selected

V/UHF RSC Volume Control Knob
Turned: Volume
Pulled: Squelch OFF

V/UHF RSC Channel Frequency Tuner

V/UHF RSC (Radio Set Control) Channel Frequency Mode Selector

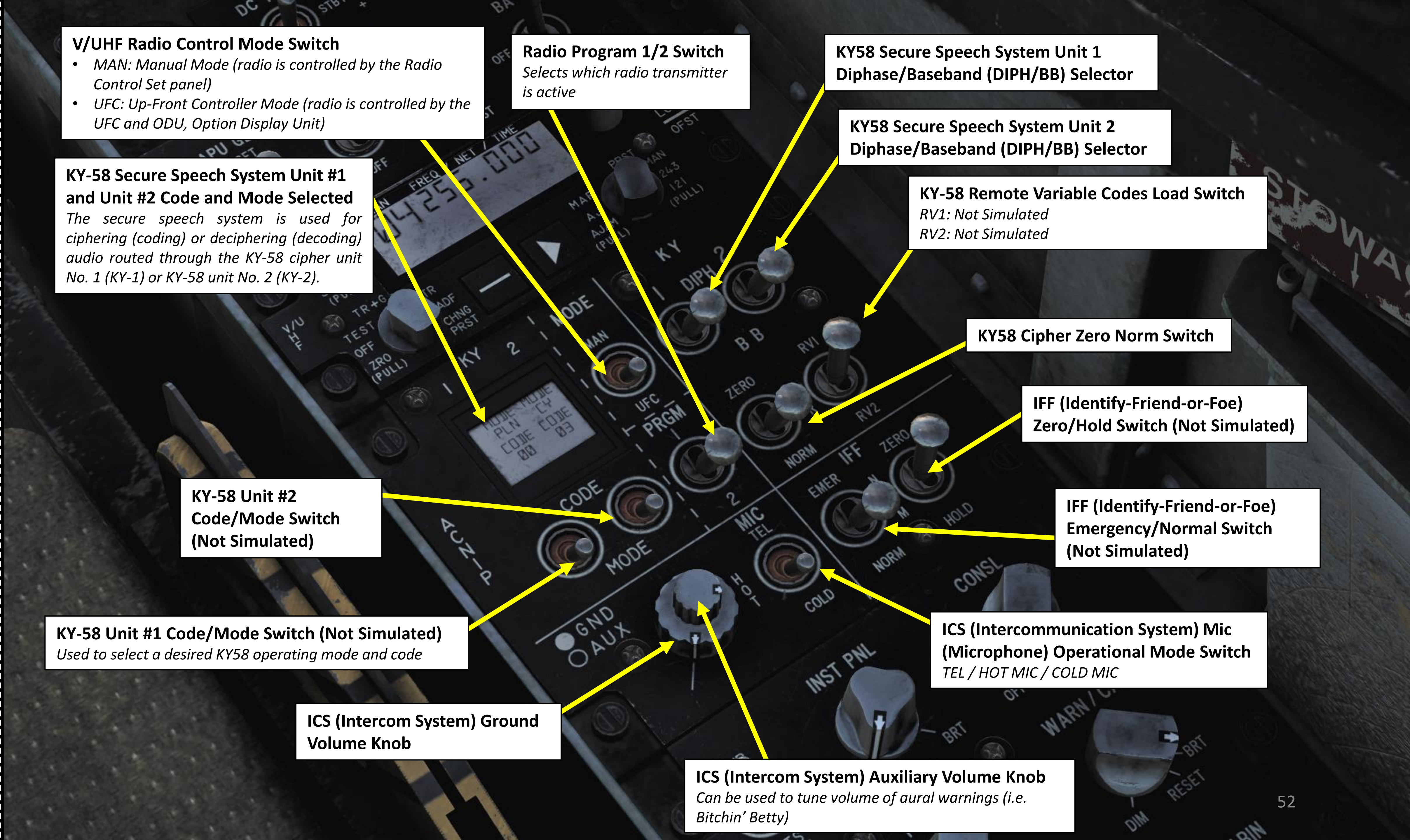
- *AJ/M: Not simulated*
- *AJ: Not simulated*
- *MAR: Selects one of 57 preset maritime channels. Not simulated*
- *PRST: CRS Switch changes selected preset channel.*
- *MAN: CRS Switch changes the frequency for the selected channel.*
- *243: Turns on receivers for the 243.000 Mhz emergency frequency.*
- *121: Turns on receivers for the 121.000 Mhz tactical frequency. Not simulated*

V/UHF Ancillary Mode Switch
Positions cursor under various mode options. Used with ancillary mode pointer to select or deselect ancillary modes.

V/UHF Ancillary Mode Pointer
Positions pointer to select or deselect ancillary mode option defined by the – pushbutton.

V/UHF RSC (Radio Set Control) Channel Operational Mode Selector

- *Pulled (ZRO): Not Simulated*
- *OFF: Turns RCS OFF*
- *TEST: Selects internal BIT (Built-In-Test).*
- *TR+G: Selects Receiver/Transmitter and GUARD receivers*
- *TR: Selects Receiver/Transmitter*
- *ADF: Automatic Direction Finder (not equipped on Harrier)*
- *CHNG PRST: Preset Channel Change*



V/UHF Radio Control Mode Switch
- *MAN: Manual Mode (radio is controlled by the Radio Control Set panel)*
- *UFC: Up-Front Controller Mode (radio is controlled by the UFC and ODU, Option Display Unit)*

Radio Program 1/2 Switch
Selects which radio transmitter is active

KY58 Secure Speech System Unit 1 Diphase/Baseband (DIPH/BB) Selector

KY58 Secure Speech System Unit 2 Diphase/Baseband (DIPH/BB) Selector

KY-58 Secure Speech System Unit #1 and Unit #2 Code and Mode Selected
The secure speech system is used for ciphering (coding) or deciphering (decoding) audio routed through the KY-58 cipher unit No. 1 (KY-1) or KY-58 unit No. 2 (KY-2).

KY-58 Remote Variable Codes Load Switch
RV1: Not Simulated
RV2: Not Simulated

KY58 Cipher Zero Norm Switch

IFF (Identify-Friend-or-Foe) Zero/Hold Switch (Not Simulated)

KY-58 Unit #2 Code/Mode Switch (Not Simulated)

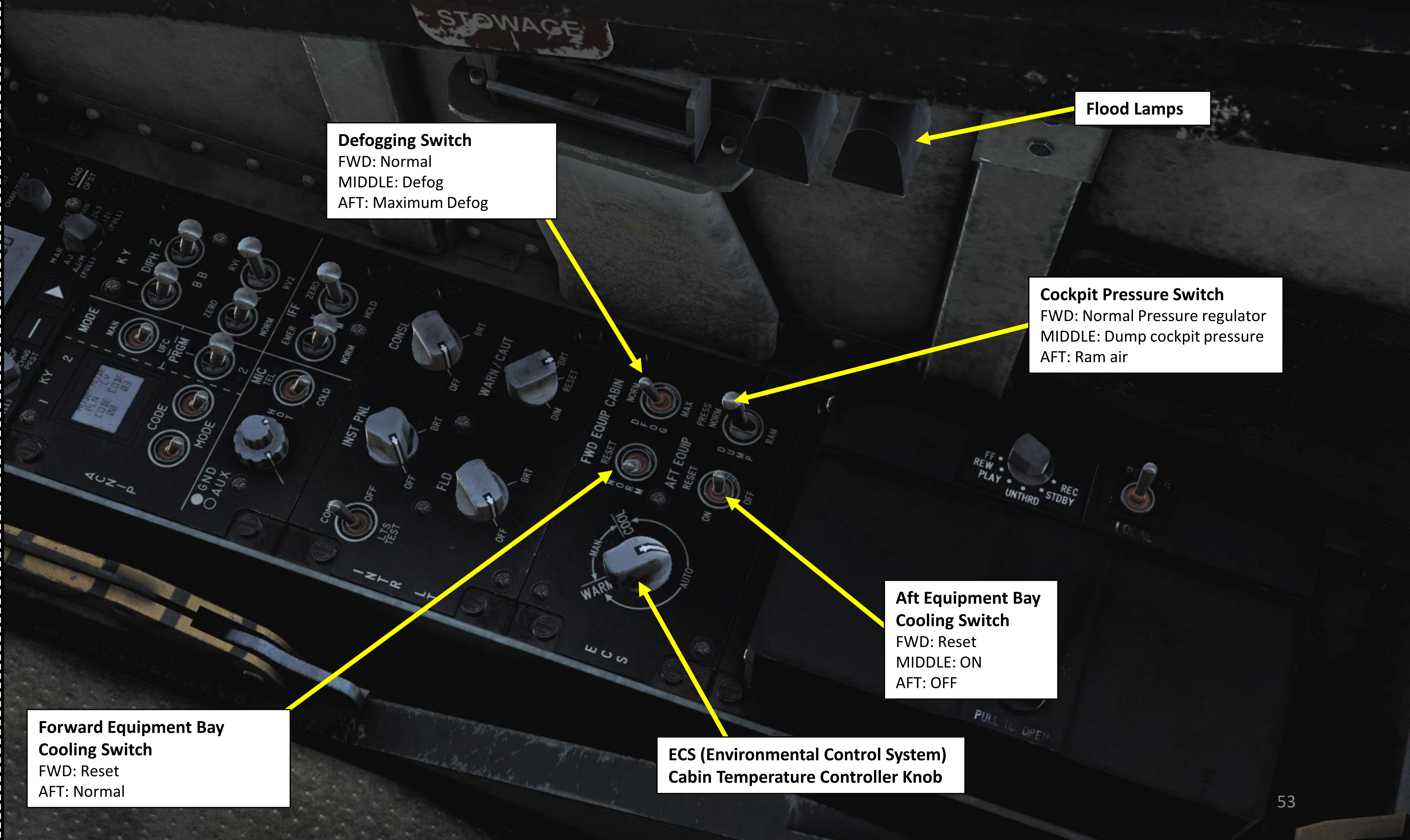
IFF (Identify-Friend-or-Foe) Emergency/Normal Switch (Not Simulated)

ICS (Intercommunication System) Mic (Microphone) Operational Mode Switch
TEL / HOT MIC / COLD MIC

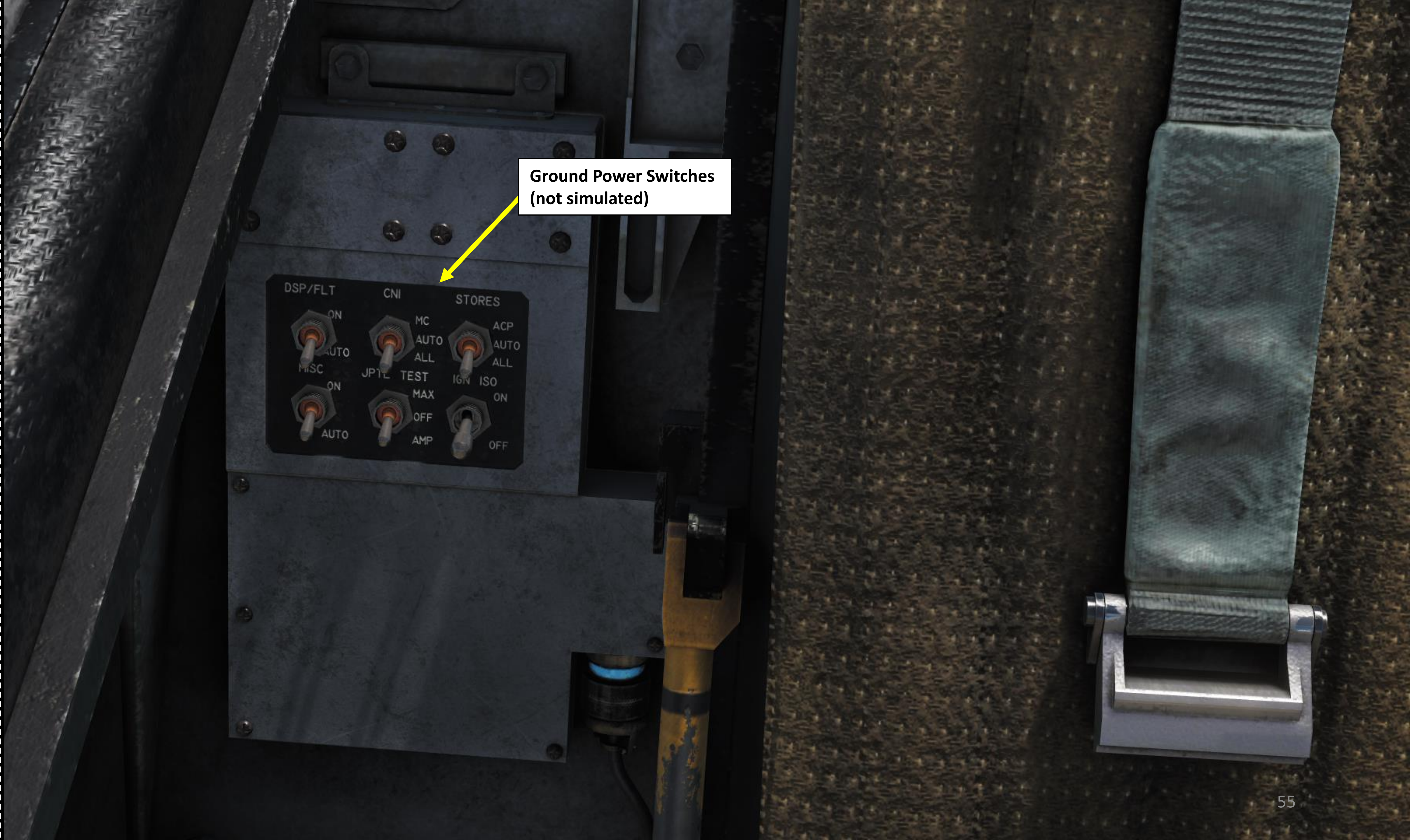
KY-58 Unit #1 Code/Mode Switch (Not Simulated)
Used to select a desired KY58 operating mode and code

ICS (Intercom System) Ground Volume Knob

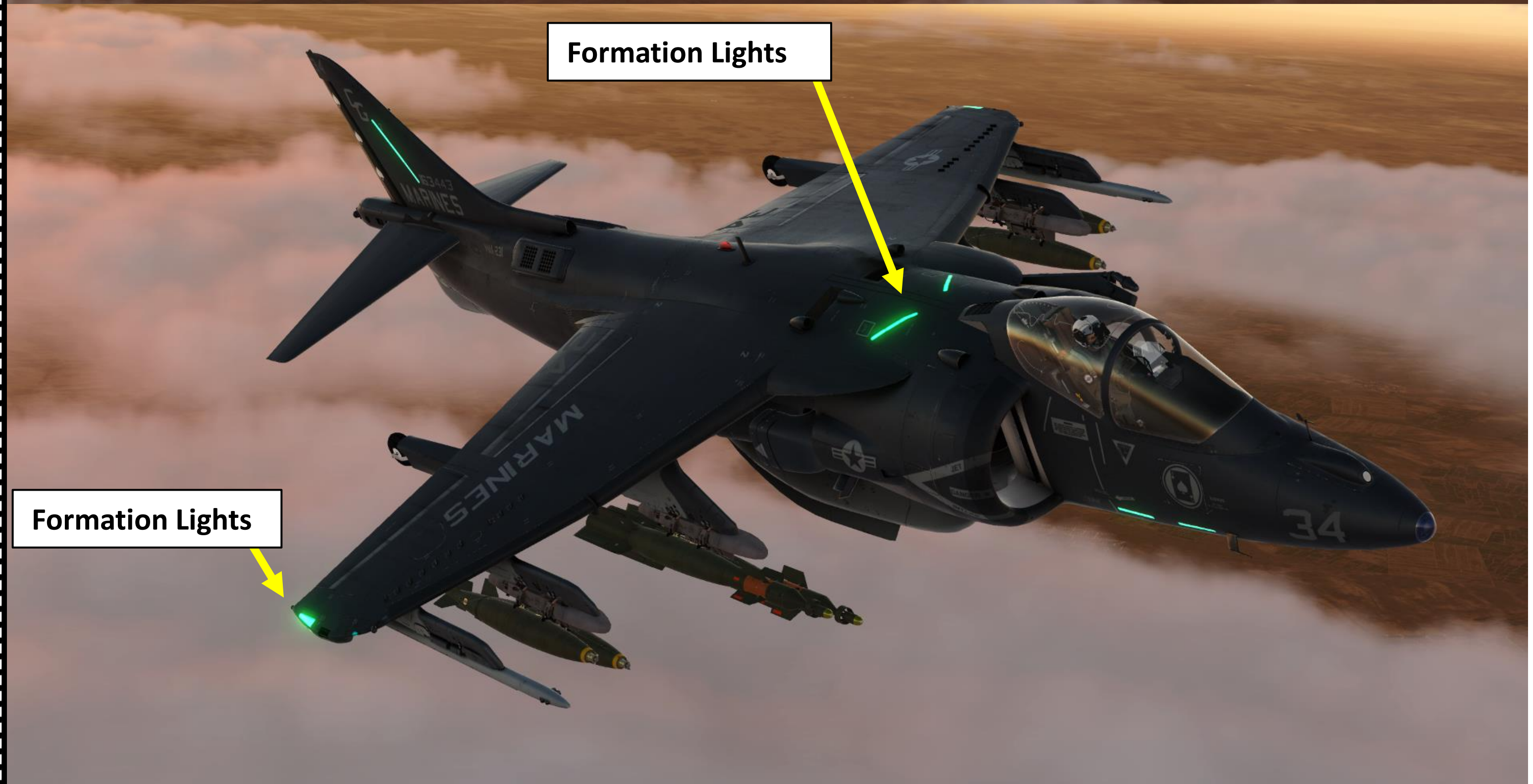
ICS (Intercom System) Auxiliary Volume Knob
Can be used to tune volume of aural warnings (i.e. Bitchin' Betty)

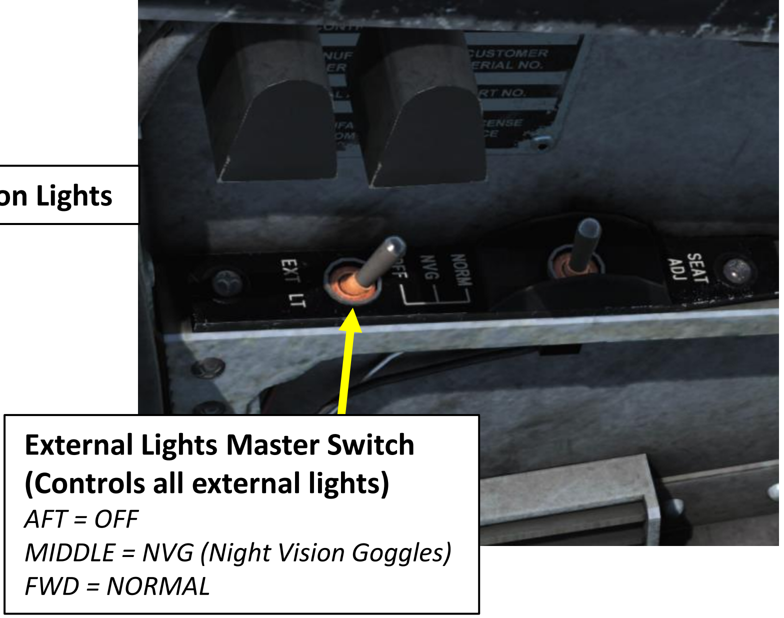

Defogging Switch
FWD: Normal
MIDDLE: Defog
AFT: Maximum Defog
Flood Lamps
Cockpit Pressure Switch
FWD: Normal Pressure regulator
MIDDLE: Dump cockpit pressure
AFT: Ram air
Aft Equipment Bay Cooling Switch
FWD: Reset
MIDDLE: ON
AFT: OFF
ECS (Environmental Control System) Cabin Temperature Controller Knob
Forward Equipment Bay Cooling Switch
FWD: Reset
AFT: Normal
STOWAGE


NVG (Night Vision Goggle) and Video Recorder Stowage
Seat Ground Safety Lever
RETRACTED (DOWN): Safety OFF
EXTENDED (UP): Safety ON

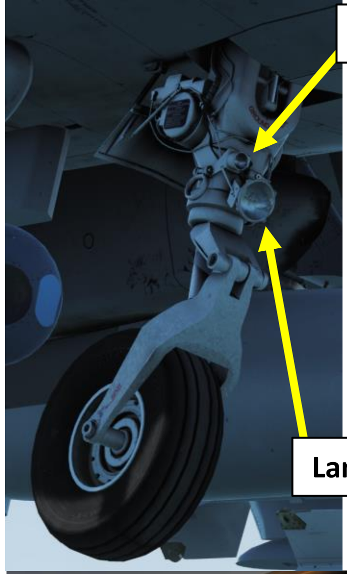

Ground Power Switches (not simulated)
DSP/FLT
ON
AUTO
MISC
ON
AUTO
CNI
MC
AUTO
ALL
JPTL
TEST
MAX
OFF
AMP
STORES
ACP
AUTO
ALL
IGN
ISO
ON
OFF

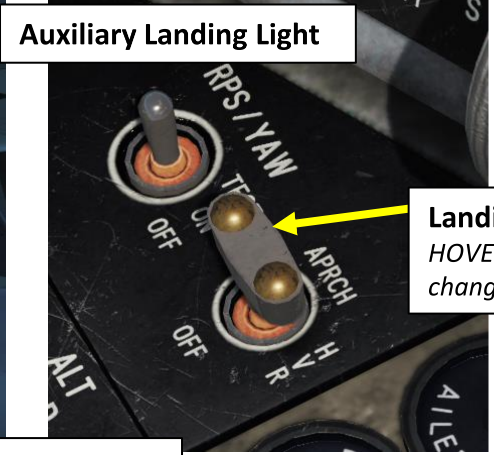

Formation Lights
Formation Lights
Formation Lights
Formation Lights
MARINES
163443
34

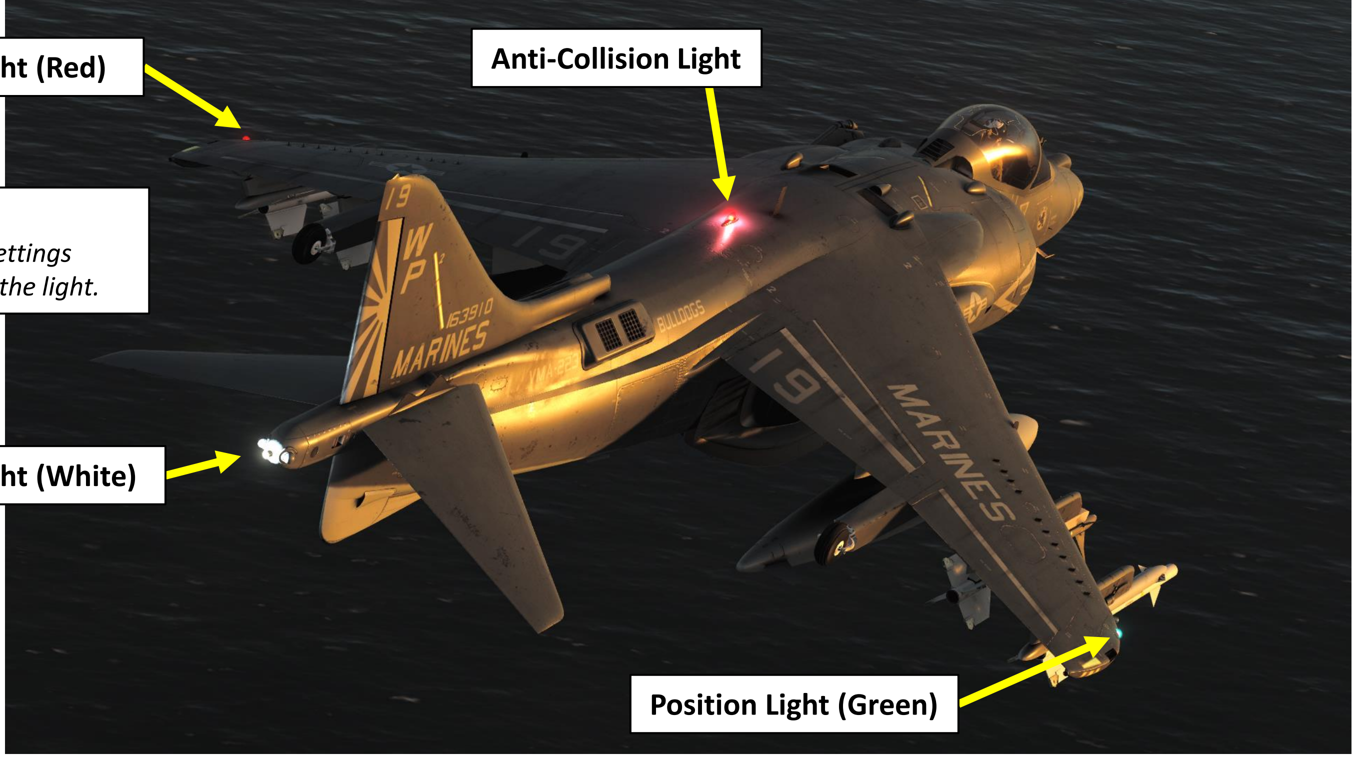

Formation Lights
Formation Lights
MARINES
34

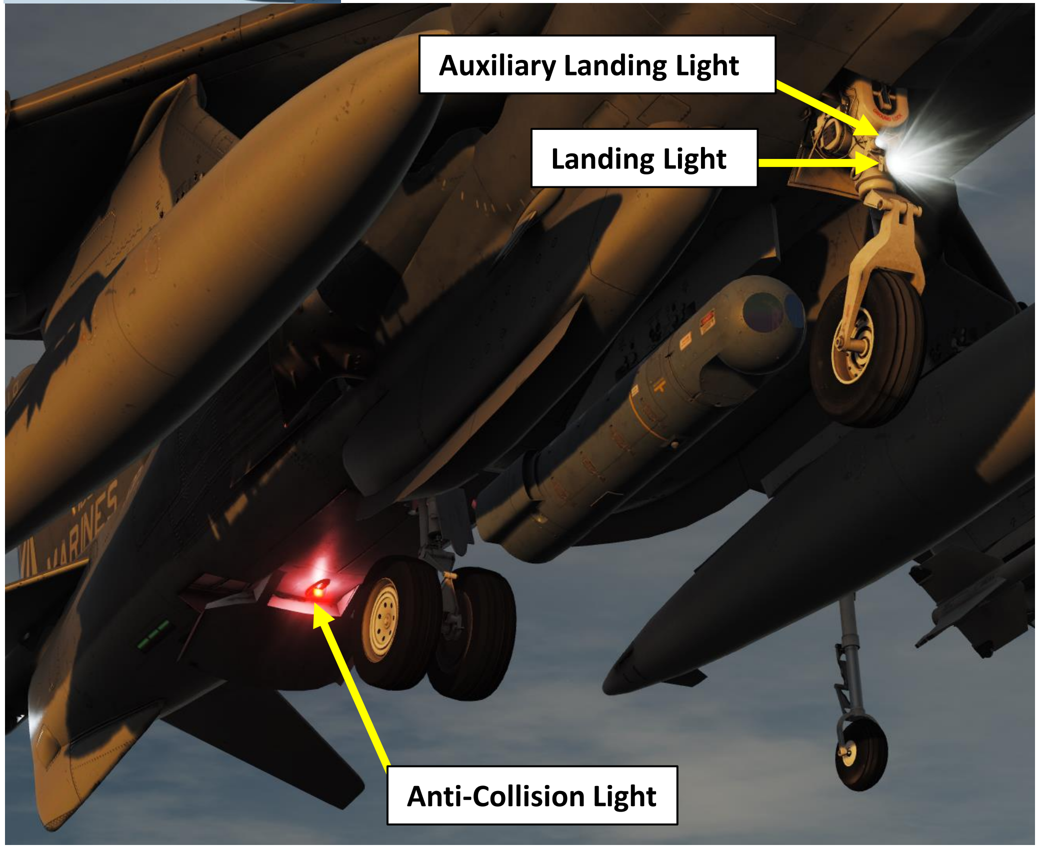

EXT LT
OFF
NVG
NORM
SEAT ADJ
External Lights Master Switch
(Controls all external lights)
AFT = OFF
MIDDLE = NVG (Night Vision Goggles)
FWD = NORMAL

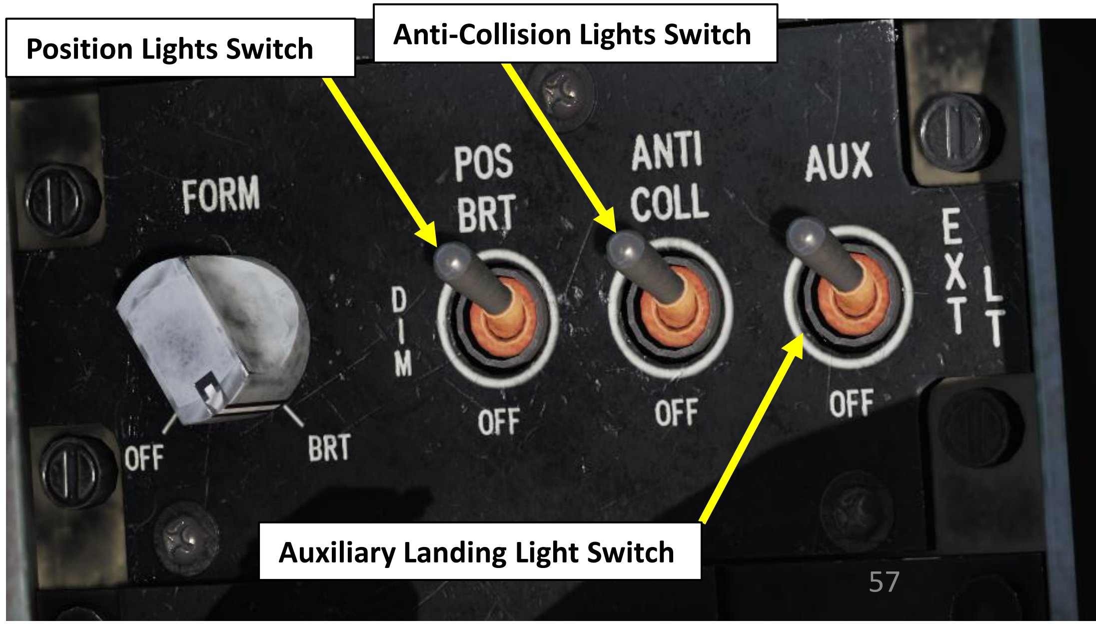

Formation Lights
Control Knob
A/R
FORM
OFF
BRT
POS BRT
DIM
OFF
ANTI COLL
OFF
AUX
OFF
EXT LT


Auxiliary Landing Light
Landing Light


RPS/YAW
OFF
APRCH
OFF
H
V
R
ALT
Landing Light Switch
HOVER and APPROACH settings change the brightness of the light.

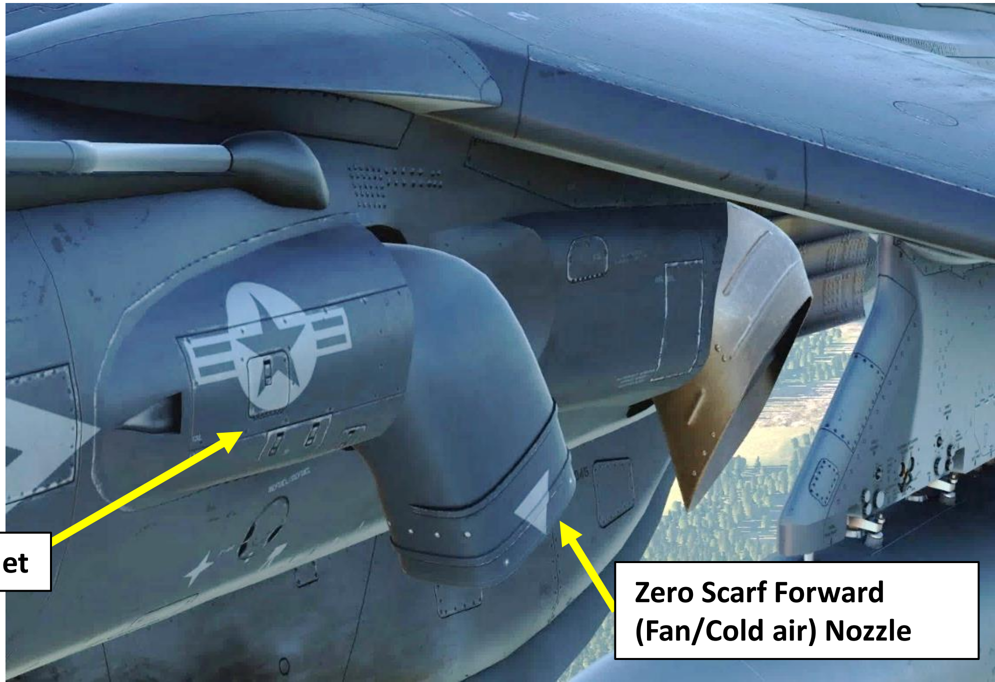

Position Light (Red)
Anti-Collision Light
Position Light (White)
Position Light (Green)
MARINES


Auxiliary Landing Light
Landing Light
Anti-Collision Light

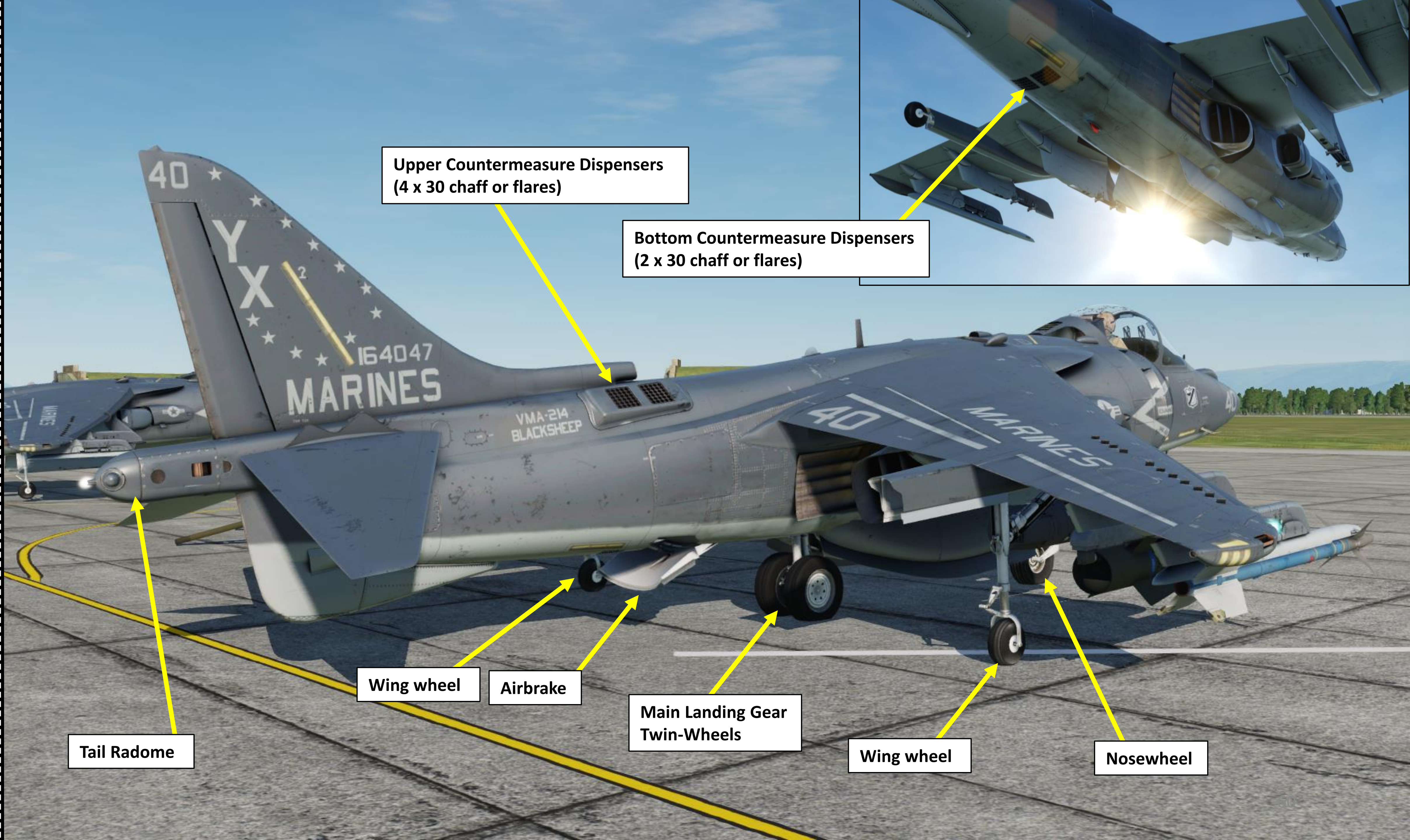

Position Lights Switch
Anti-Collision Lights Switch
FORM
OFF
BRT
POS
BRT
DIM
OFF
ANTI
COLL
OFF
AUX
OFF
EXT
LT
Auxiliary Landing Light Switch

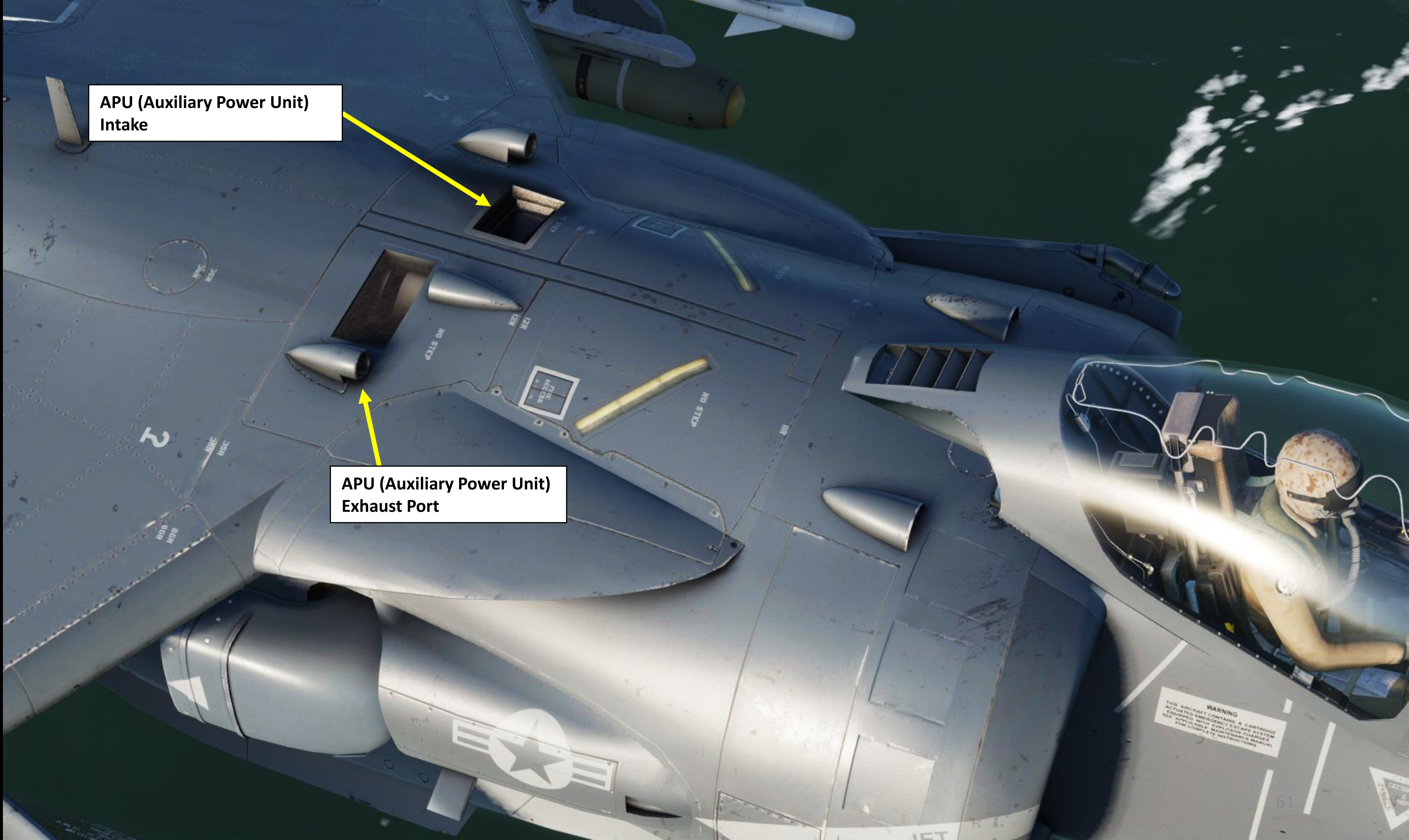

Air Refueling Probe
Air Refueling Probe Light


Rear Swivelling Hot Stream Engine Exhaust Nozzle

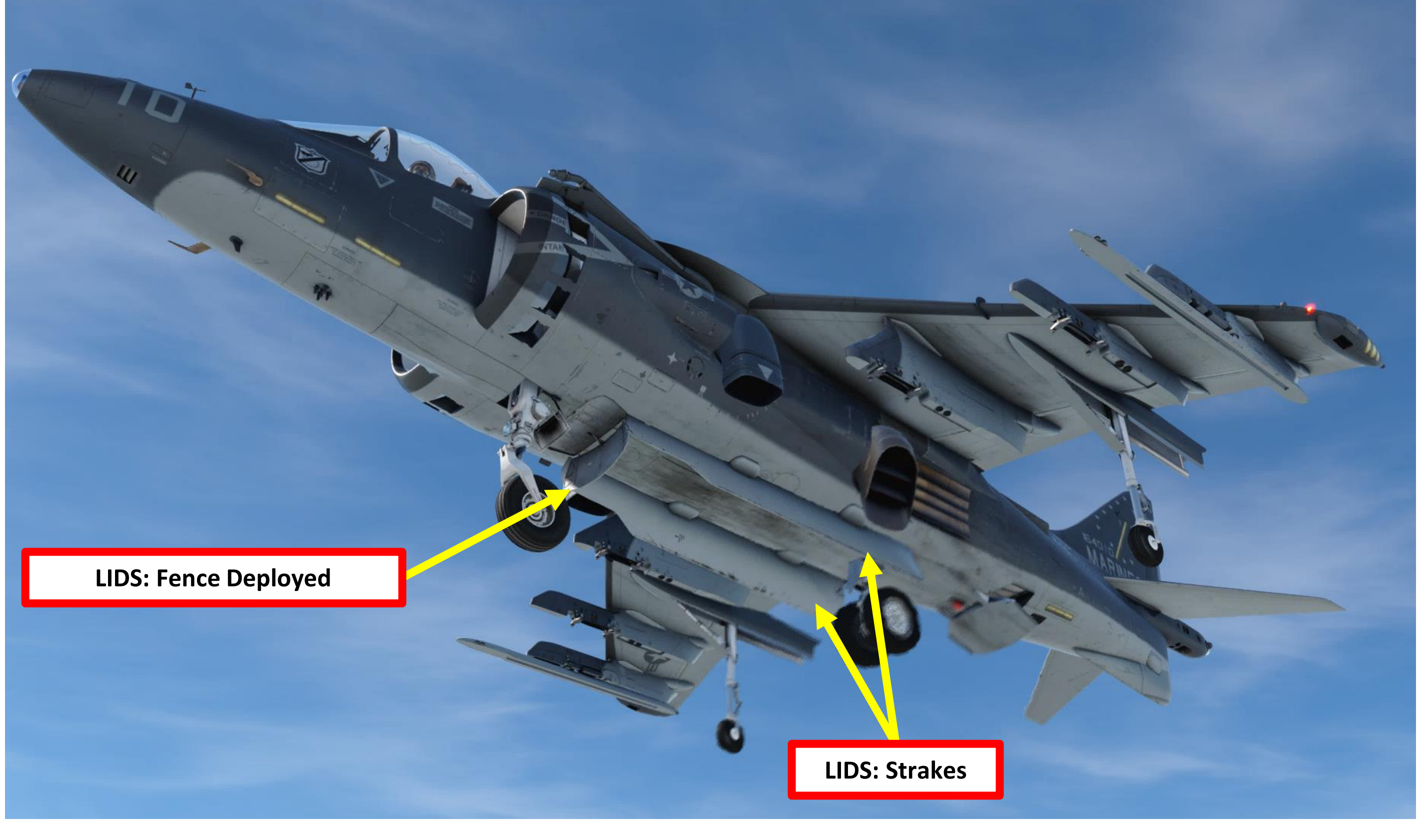

Engine Cold Air Outlet
Zero Scarf Forward (Fan/Cold air) Nozzle

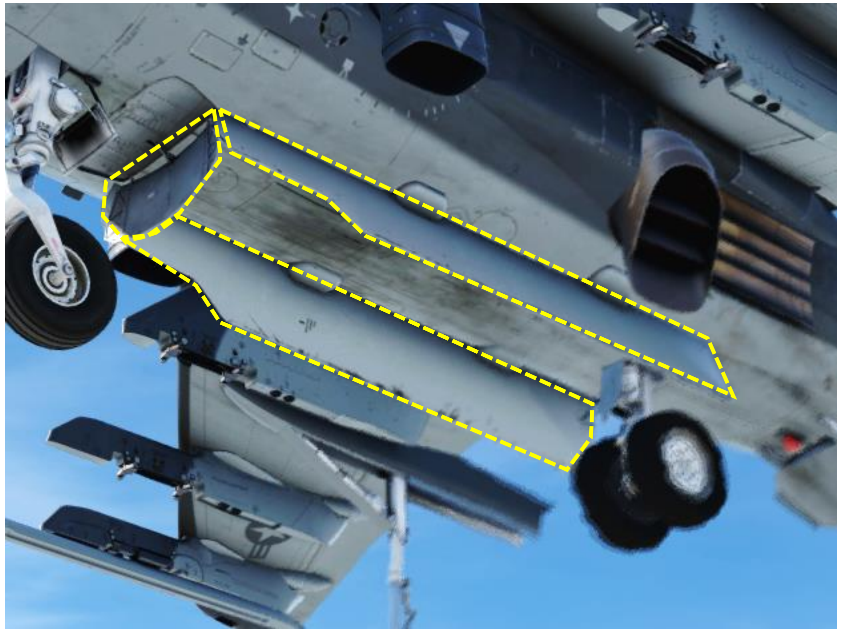

Engine Intake
Blow-In Doors


Upper Countermeasure Dispensers
(4 x 30 chaff or flares)
Bottom Countermeasure Dispensers
(2 x 30 chaff or flares)
Tail Radome
Wing wheel
Airbrake
Main Landing Gear
Twin-Wheels
Wing wheel
Nosewheel
40
YX
164047
MARINES
VMA-214
BLACKSHEEP


APU (Auxiliary Power Unit) Intake
APU (Auxiliary Power Unit) Exhaust Port


Yaw Vane
Used to get direction of wind relative to you. When hovering, you should make sure to keep it straight to hover into the wind direction.





LIDS: Lift Improvement Device System

The LIDS itself can be seen as the small wing-like structures or "Strakes" on the underside, underneath the nozzles. The LIDS switch controls the "fence" panel, which is located just behind the main landing gear to prevent the recirculating air cushion from escaping out the front.

When the harrier is in hover at low altitude, the recirculating air from the exhaust is harnessed to essentially form a cushion to provide additional lift during vertical landing.

LIDS are also designed to reduce the effect of hot gas ingestion (HGI) through recirculation of exhaust gases into the engine intake when operating vertically, since an increase in inlet temperature can cause a significant loss of thrust. Thise reduces HGI substantially.

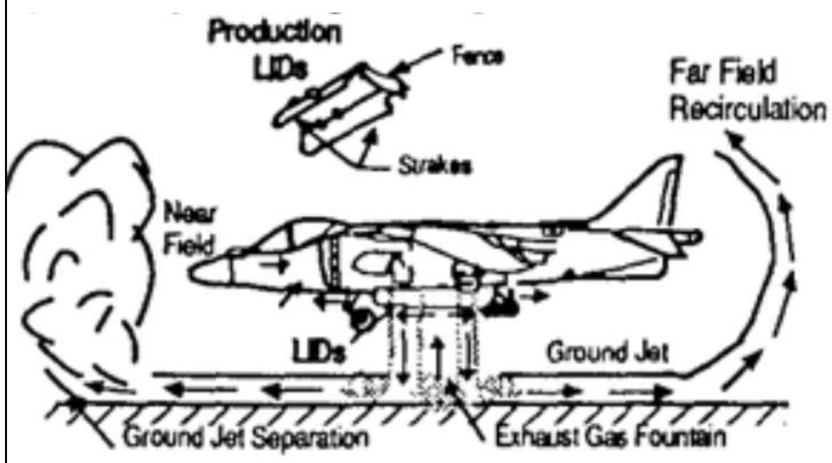
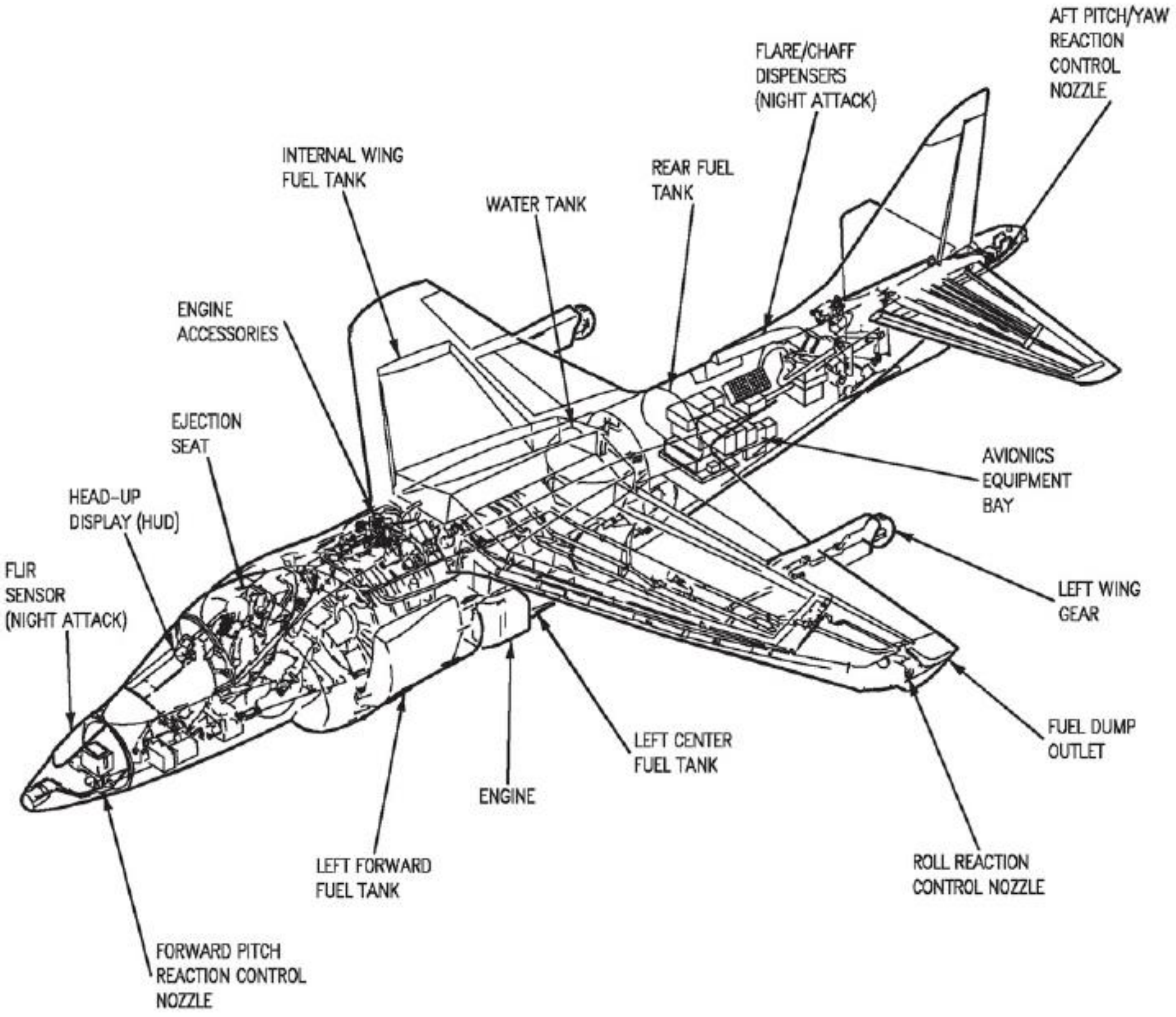
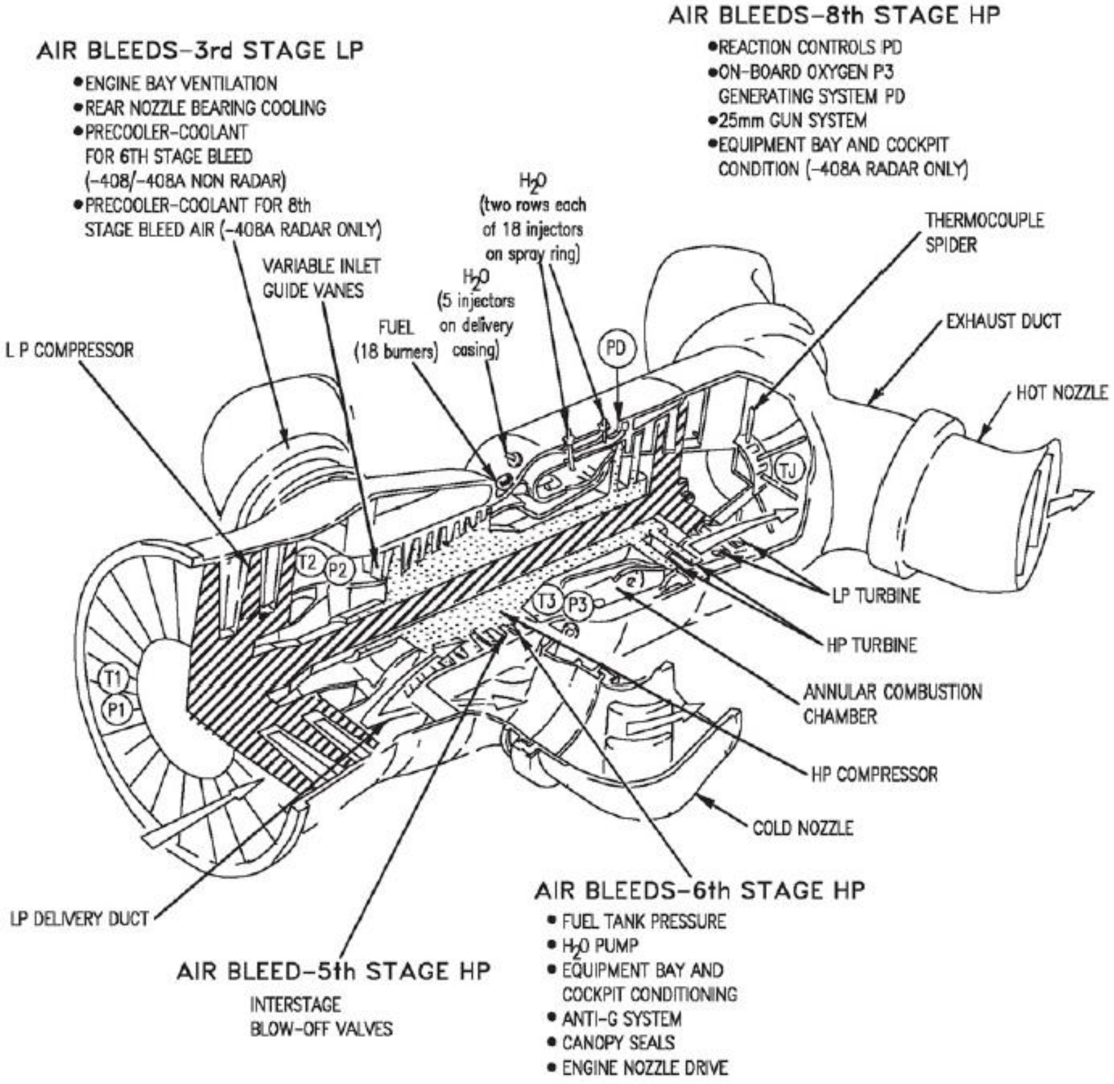


Figure 2. AV-8B HGI Phenomenon





NOTES

DELIVERY AIR PRESSURES

P1 intake
P2 LP Compressor
P3 HP Compressor
PD P3 duct differential when bleed demand made

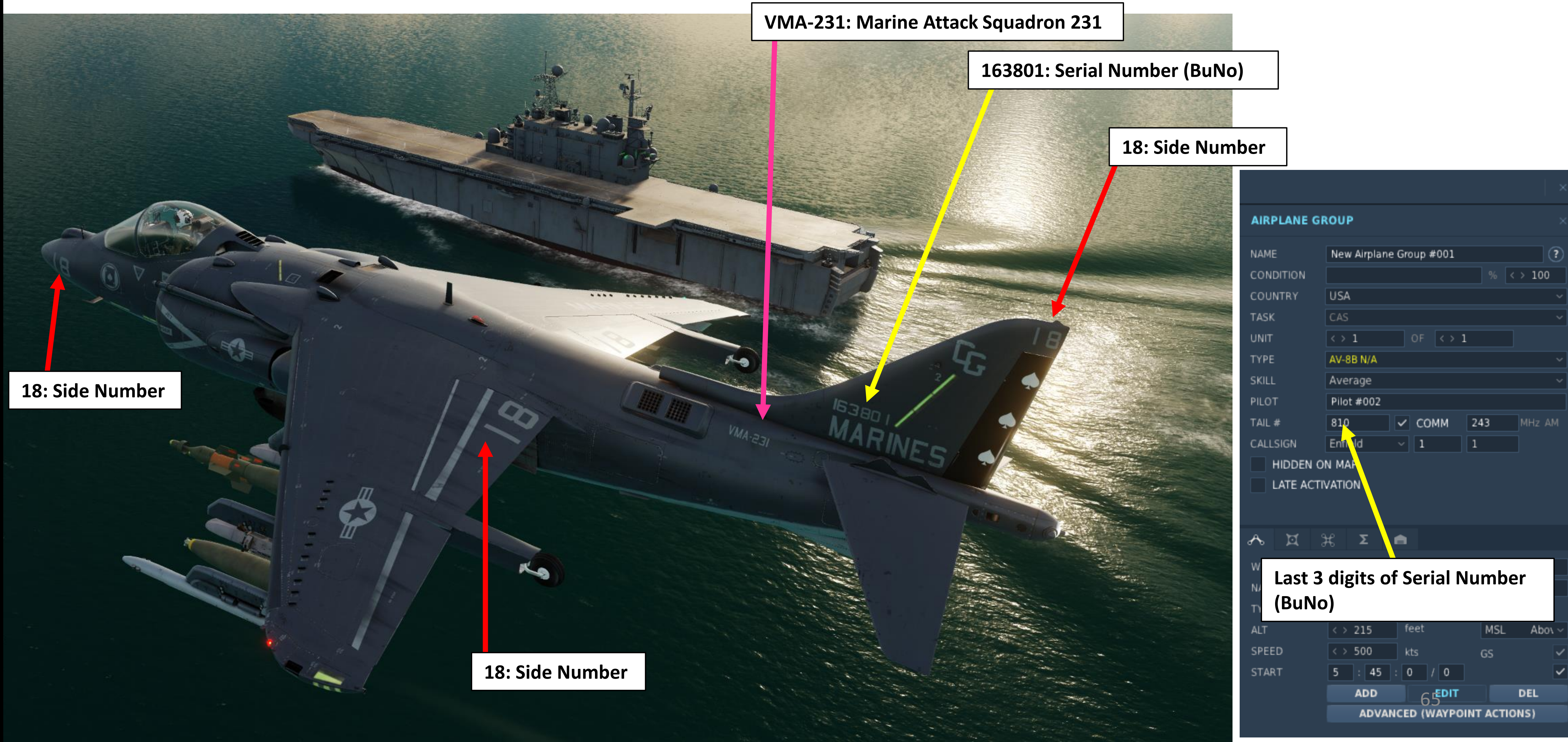
DELIVERY AIR TEMPERATURES

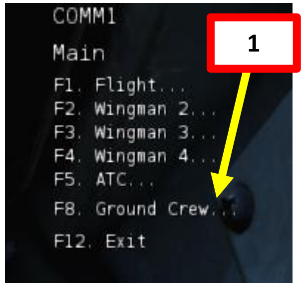
T1 intake
T2 LP Compressor
T3 HP Compressor
TJ Exhaust duct

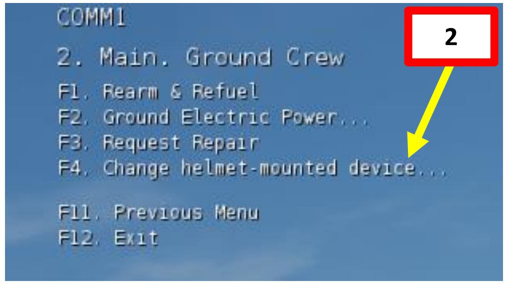
Aircraft Designation

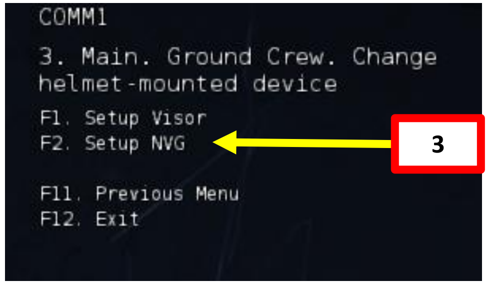
The Tail Number you enter in the Mission Editor are actually the last three digits of the aircraft's Bureau Number (BuNo), or the USN/USMC serial number. For tactical aircraft, the BuNo is unrelated to the aircraft's "Side Number" (the one you see painted on the nose and flaps). The "Side Number" you see on the aircraft is the first the first BuNo digits reversed so that there is no obvious correlation.

***As an example**: "**810**" entered in the Tail # field of the mission editor will give "**18**" on the aircraft's "Side Number".*

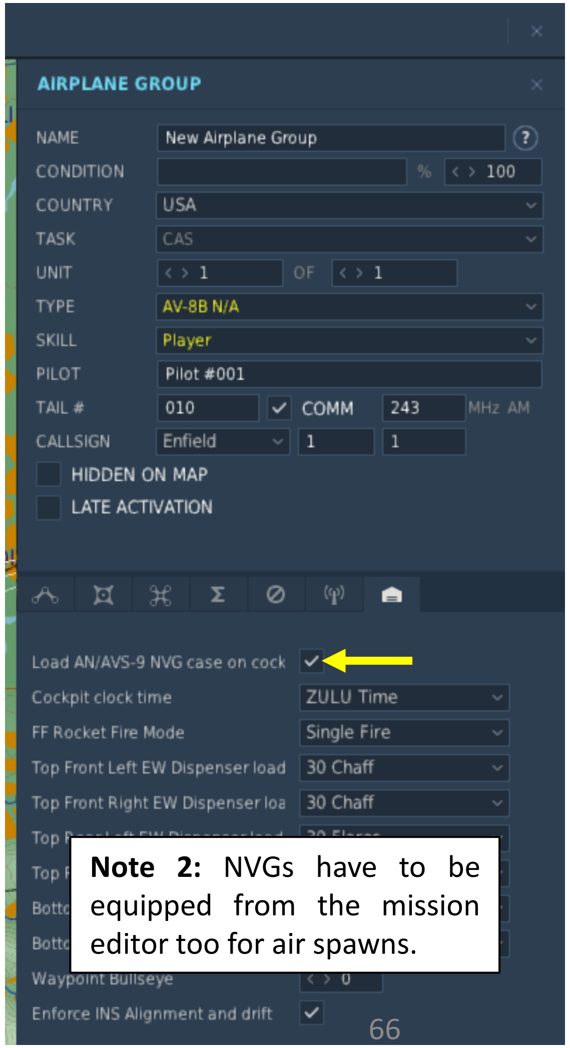








Note 1: You must contact the ground crew to equip either the Helmet Visor or Night Vision Goggles (NVGs). Using "\", then F8 (Ground Crew), then F4 (Change helmet-mounted device) then either F1 or F2 for your desired helmet type.

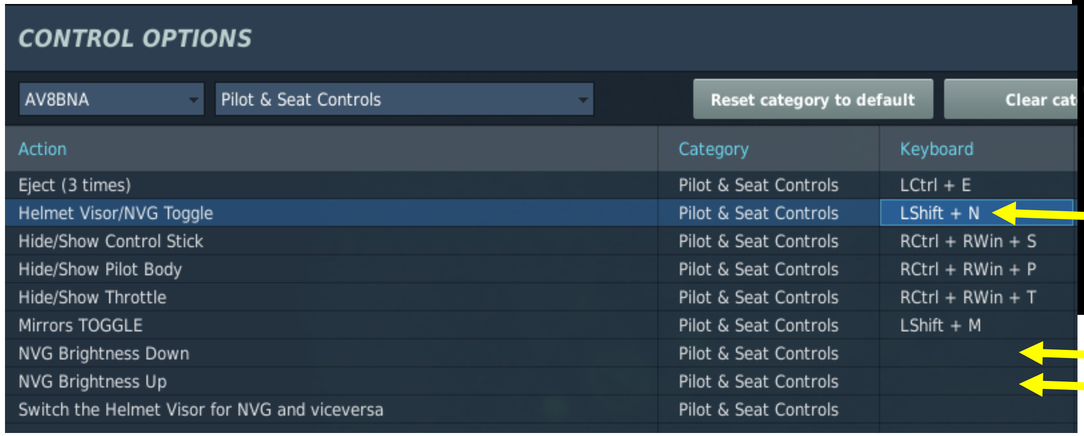


Note 2: NVGs have to be equipped from the mission editor too for air spawns.

Helmet-Mounted Visor

Night Vision Goggles

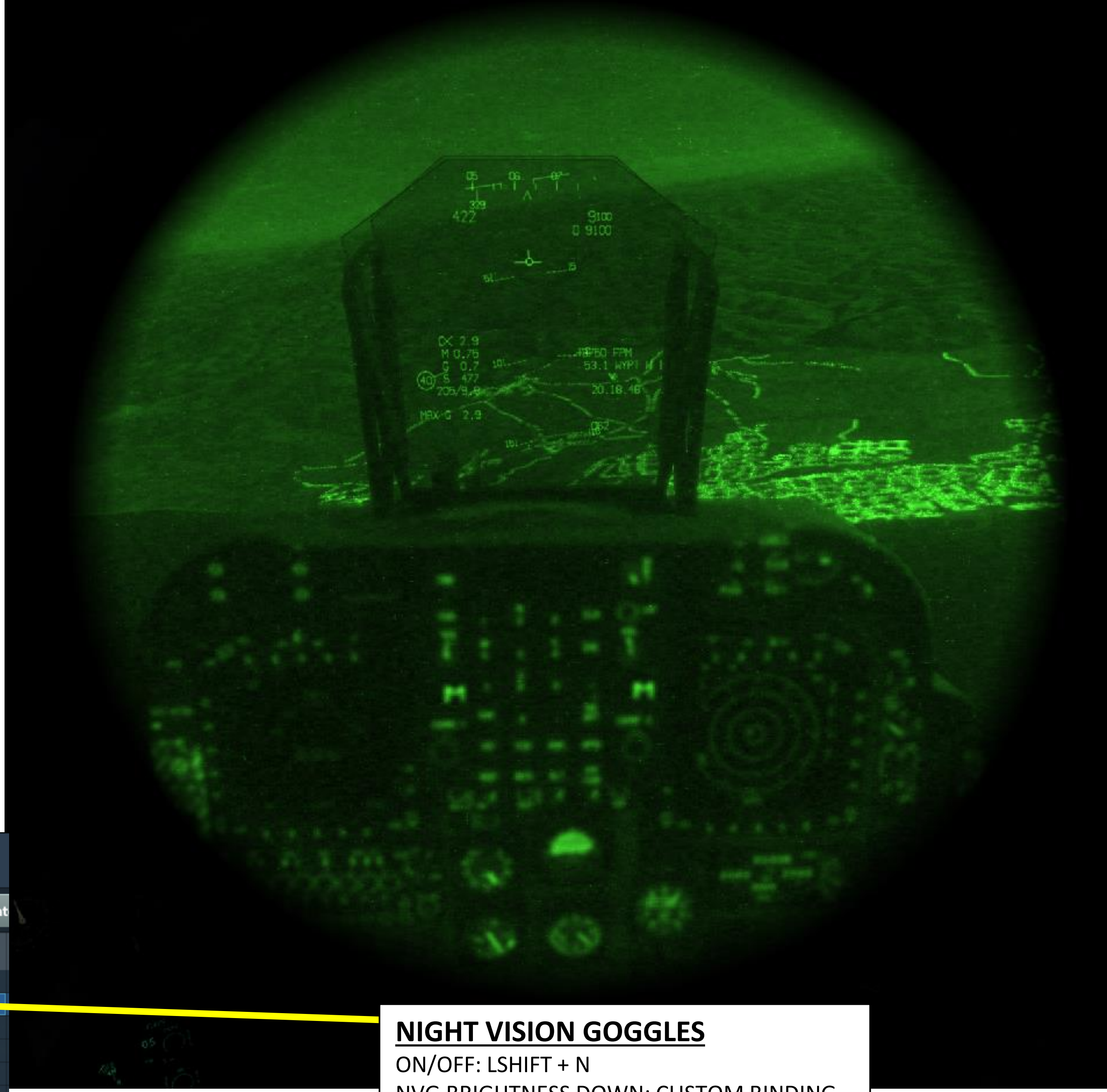
FLASHLIGHT CONTROL
ON/OFF: LALT + L



CONTROL OPTIONS

AV8BNA | Pilot & Seat Controls | Reset category to default | Clear cat

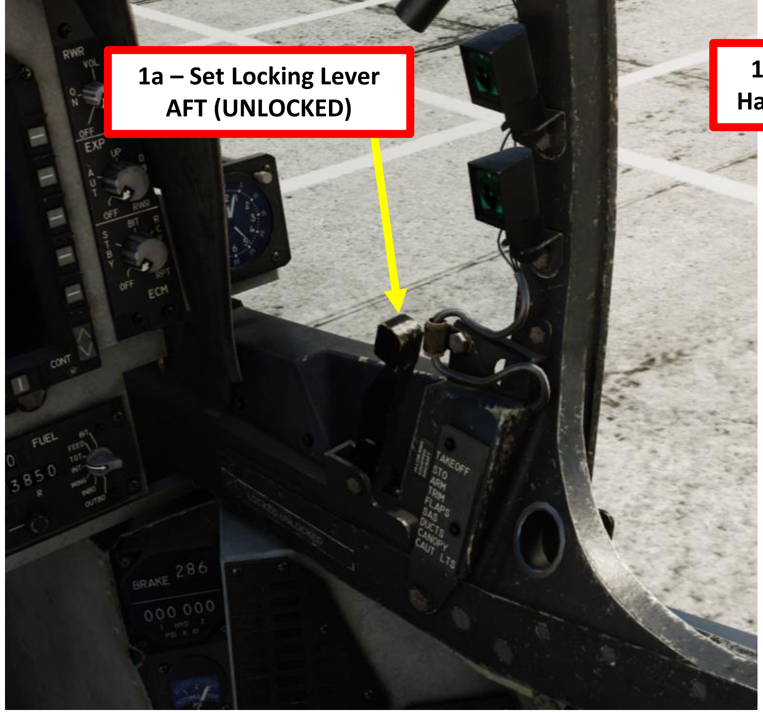
Action	Category	Keyboard
Eject (3 times)	Pilot & Seat Controls	LCtrl + E
Helmet Visor/NVG Toggle	Pilot & Seat Controls	LShift + N
Hide/Show Control Stick	Pilot & Seat Controls	RCtrl + RWin + S
Hide/Show Pilot Body	Pilot & Seat Controls	RCtrl + RWin + P
Hide/Show Throttle	Pilot & Seat Controls	RCtrl + RWin + T
Mirrors TOGGLE	Pilot & Seat Controls	LShift + M
NVG Brightness Down	Pilot & Seat Controls	
NVG Brightness Up	Pilot & Seat Controls	
Switch the Helmet Visor for NVG and viceversa	Pilot & Seat Controls	



NIGHT VISION GOGGLES
ON/OFF: LSHIFT + N
NVG BRIGHTNESS DOWN: CUSTOM BINDING
NVG BRIGHTNESS UP: CUSTOM BINDING

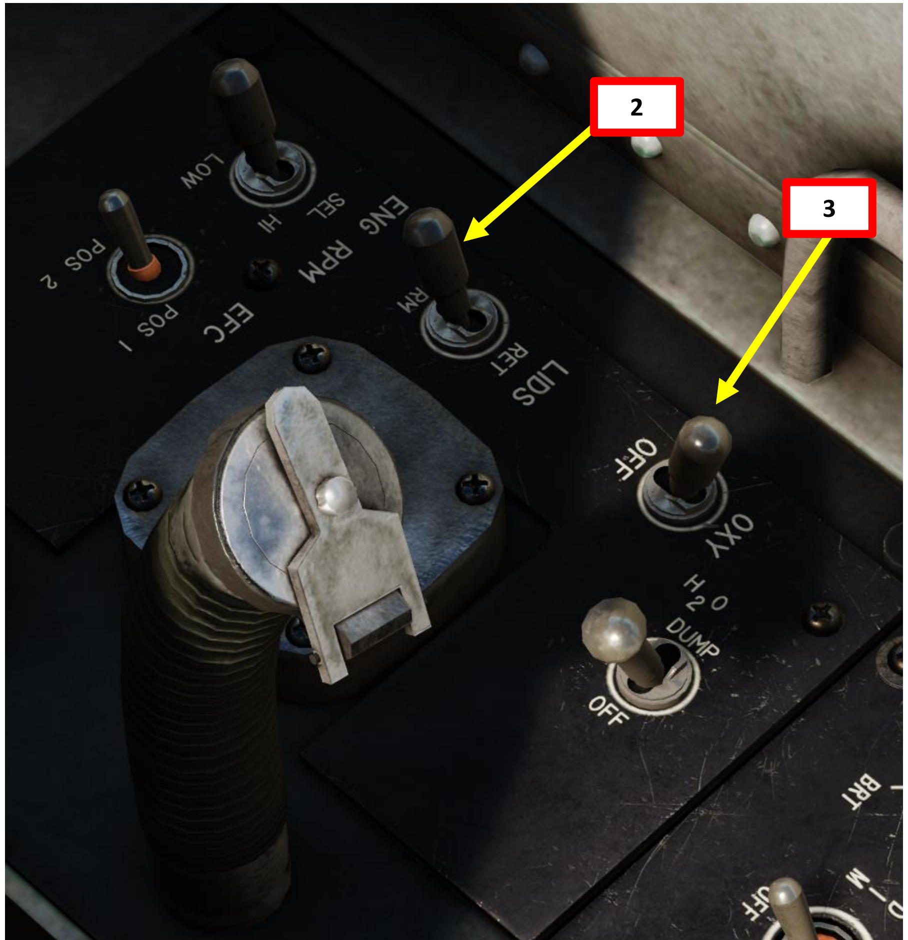
PRE-START-UP

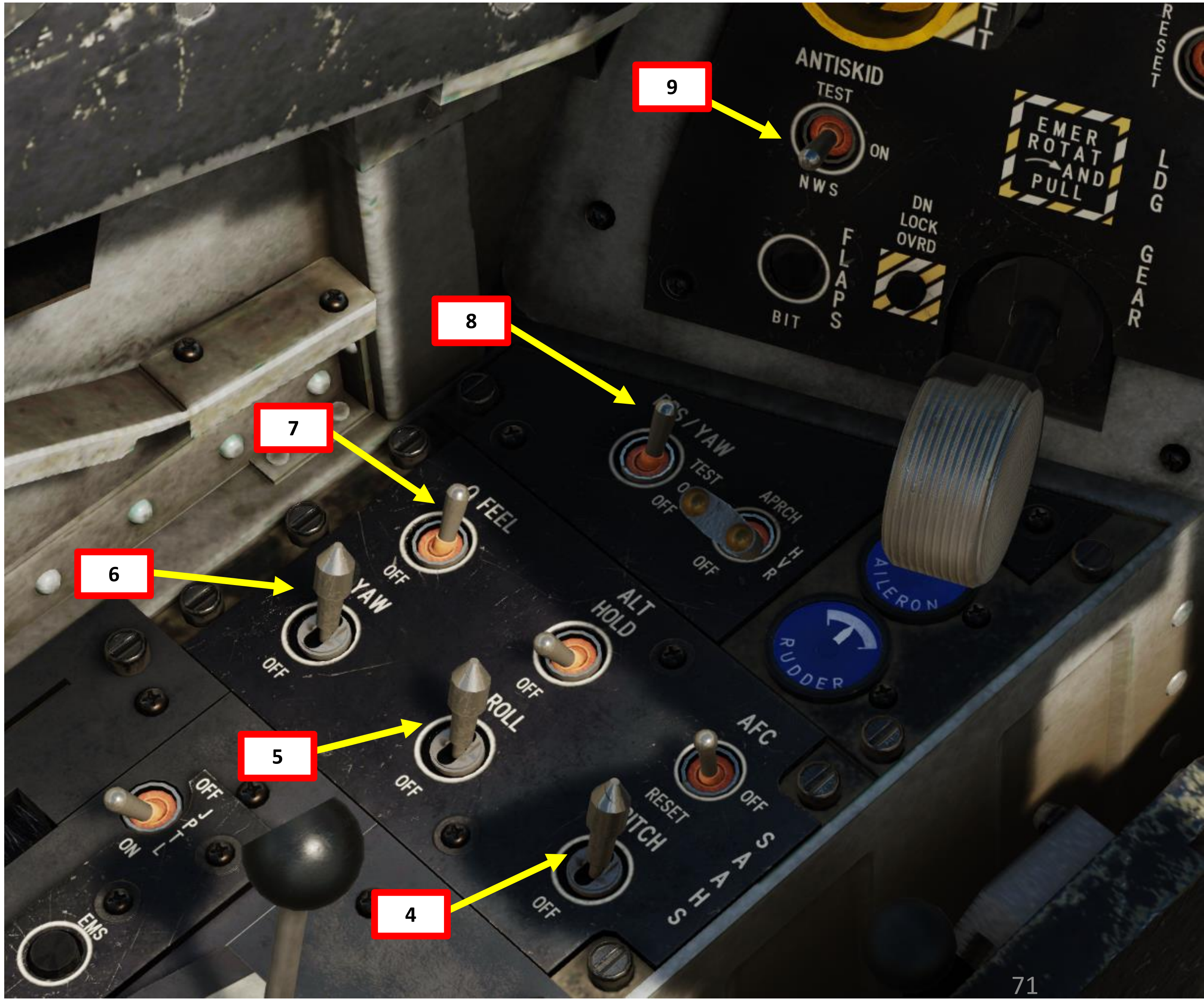
1. Close and Lock Canopy.



PRE-START-UP

2. LIDS (Lift Improvement Device System) Switch – NORM (AFT)
3. Oxygen Switch – ON (FWD)
4. SAS (Stability Augmentation System) Pitch Switch – ON (FWD)
5. SAS (Stability Augmentation System) Roll Switch – ON (FWD)
6. SAS (Stability Augmentation System) Yaw Switch – ON (FWD)
7. Q-Feel switch – ON (FWD)
8. Rudder Pedal Shaker (RPS/YAW) Switch – ON (MIDDLE)
9. Set Anti-Skid Switch – As Required
    - Set to ON (MIDDLE) for Ground Takeoffs
    - Set to NWS (DOWN) for Carrier/Ship Takeoffs





START-UP PROCEDURE

The Harrier is equipped with a GTS (Gas Turbine Starter), also referred to as APU (Auxiliary Power Unit). Many aircraft use the APU to provide pneumatic pressure for the engine starter, but the Harrier uses an electrical starter instead.

The GTS serves a dual purpose: to provide electrical power when the engine main generators are OFF and to provide a starting mechanism for the engine. The GTS/APU has two operation modes:

- **Mode 1:** APU Generator Mode
  This mode is used on ground to recharge the battery and supply electrical power to avionics systems. This is achieved when the APU GEN switch is turned on.
- **Mode 2:** Starter Mode
  This mode is used to spool the engine electrical starter and is automatically selected by the ENG ST switch.

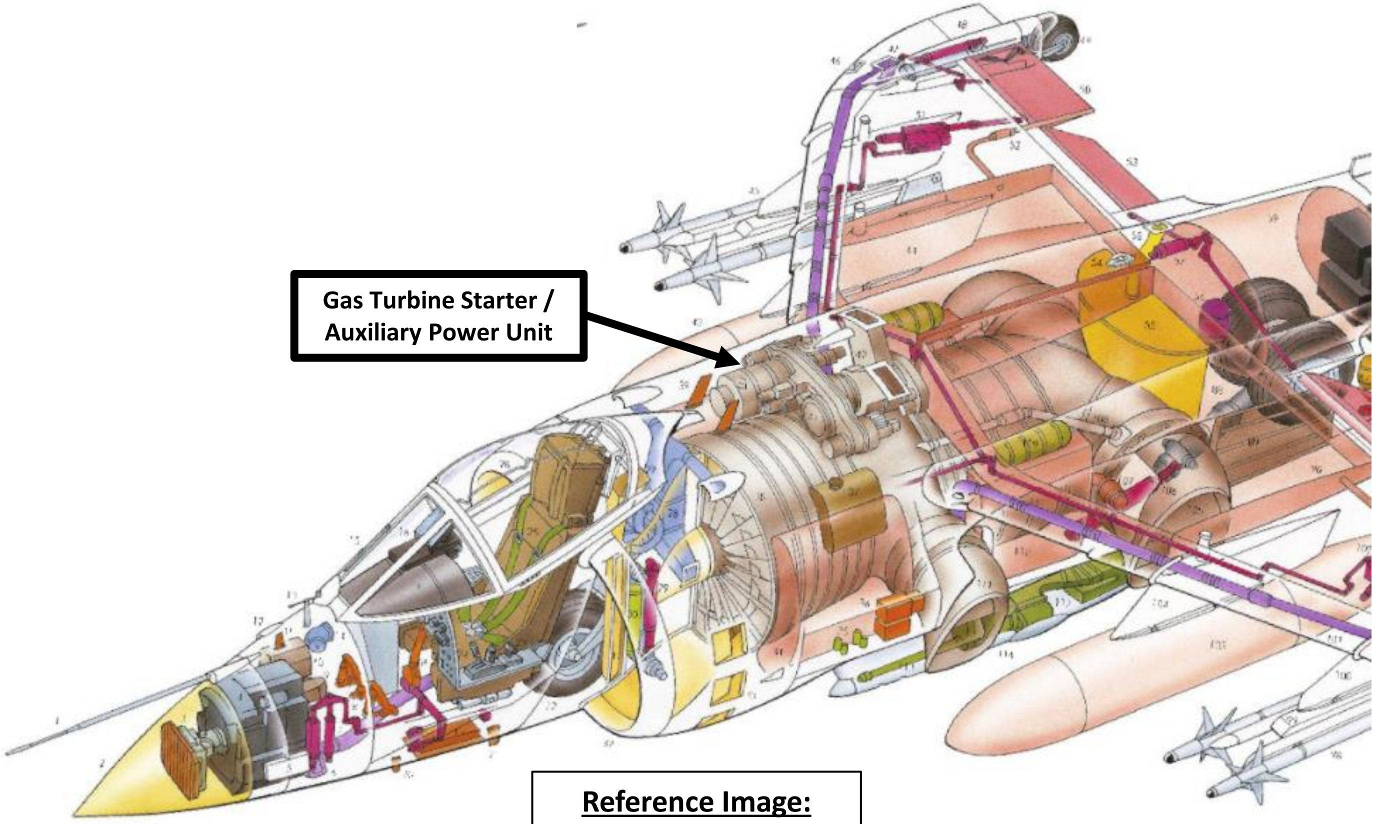
DIRECT ENGINE START: If the ENG ST (START) switch is held and the GTS/APU is not running, the GTS starts and accelerates to operating speed within 25 seconds. When the engine attains self-sustaining speed, the GTS automatically disengages and the engine start switch returns to OFF. If the GTS does not match operating speed within 25 seconds or the main engine is not self-sustaining within 40 seconds, the GTS automatically shuts down and the engine start switch returns to OFF.

TRANSLATION ENGINE START: If the ENG ST (START) is held and the GTS/APU is already running in APU GEN mode, the APU generator drops offline, the APU switch automatically returns to OFF (performing an APU shutdown), the 40-second GTS shutdown protection circuit is activated and the main engine is automatically engaged for start.

Take note that the GTS/APU cannot run both modes at the same time. Additionally, if the APU is running before takeoff and the main engine-driven generator is operating, the APU will automatically shutdown when the aircraft reaches 325 kts.

APU (Auxiliary Power Unit) Generator Switch
- FWD: Reset
- MIDDLE: ON (with battery set to BATT, GTS (Gas Turbine Starter) drives the APU provided it is not in the engine start mode)
- AFT: OFF

Engine Start (ENG ST) Switch
FWD: Engine Start ON
AFT: OFF

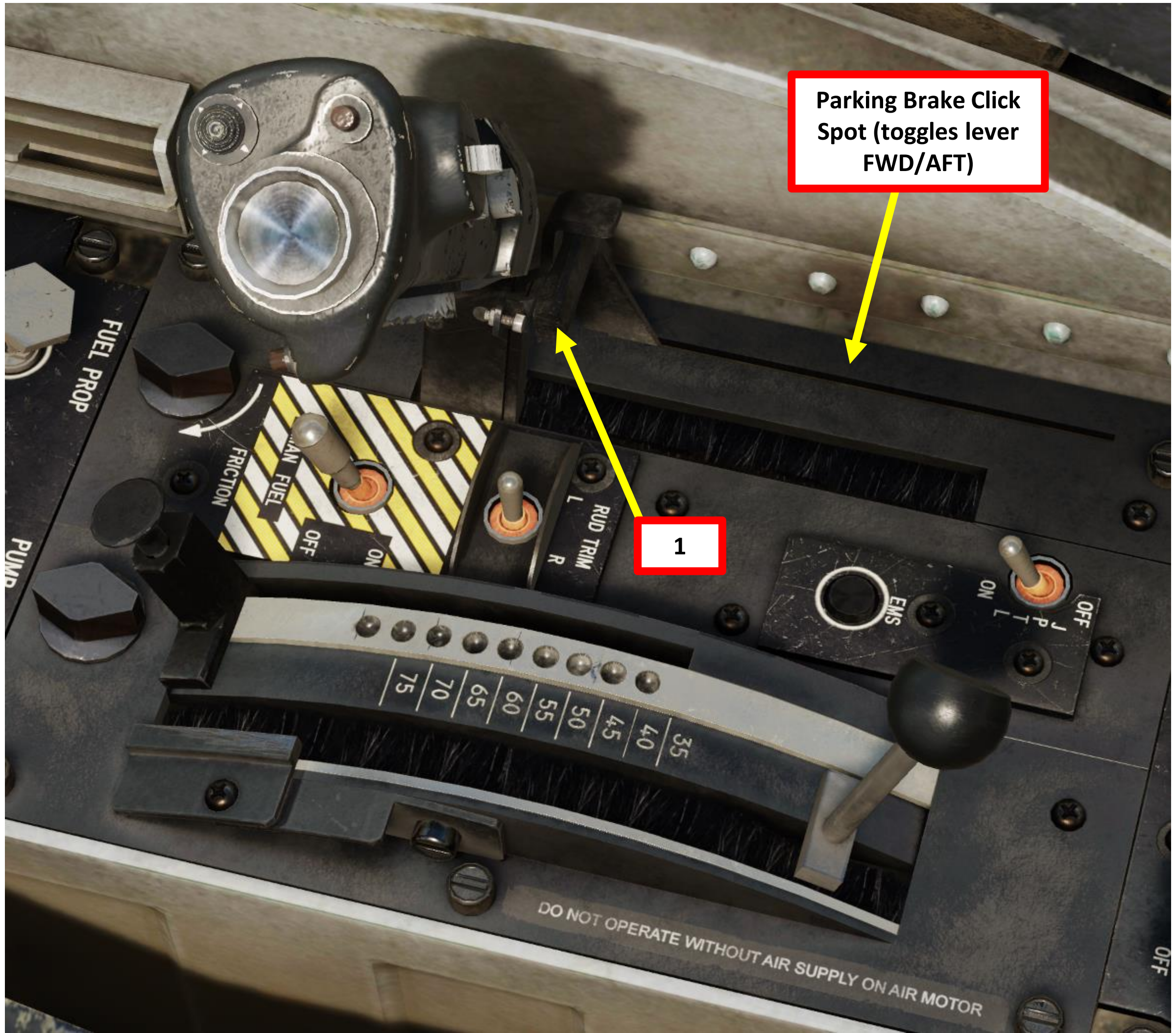


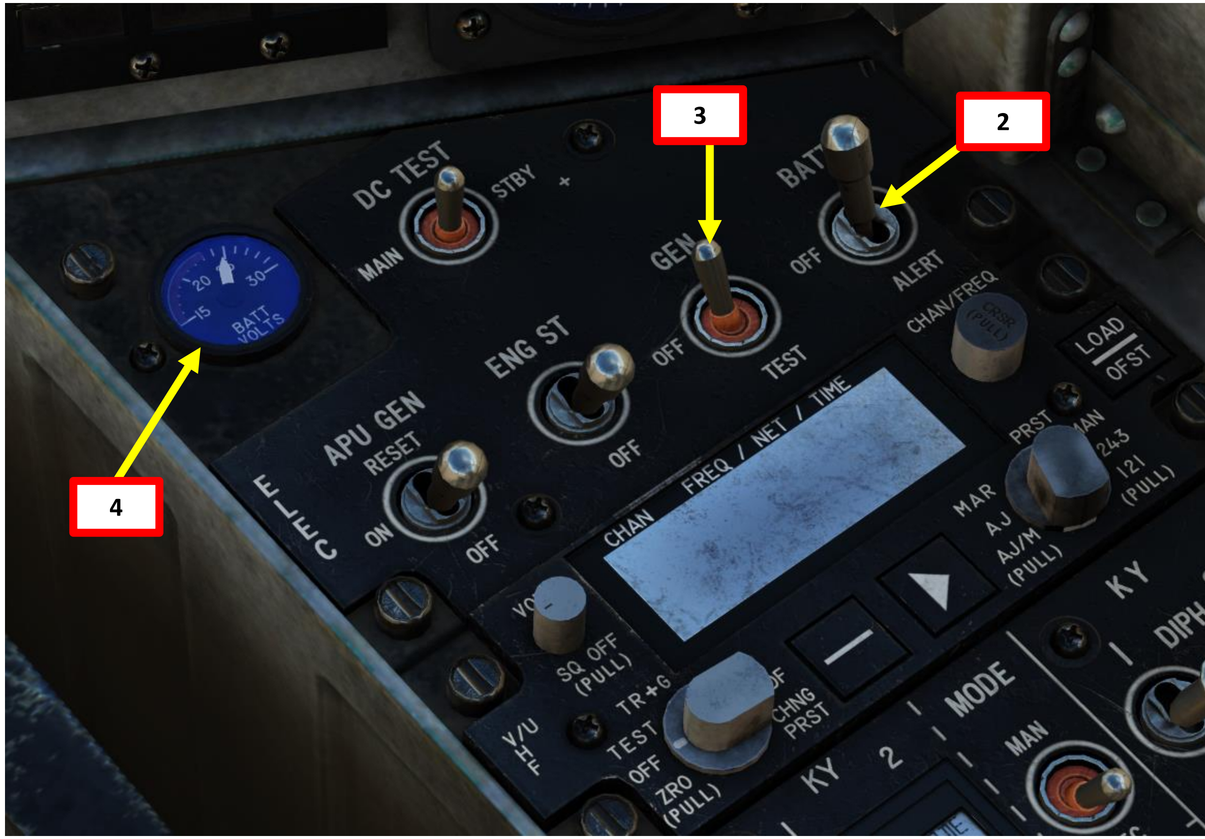
Gas Turbine Starter / Auxiliary Power Unit

Reference Image: Sea Harrier FRS.1

START-UP PROCEDURE

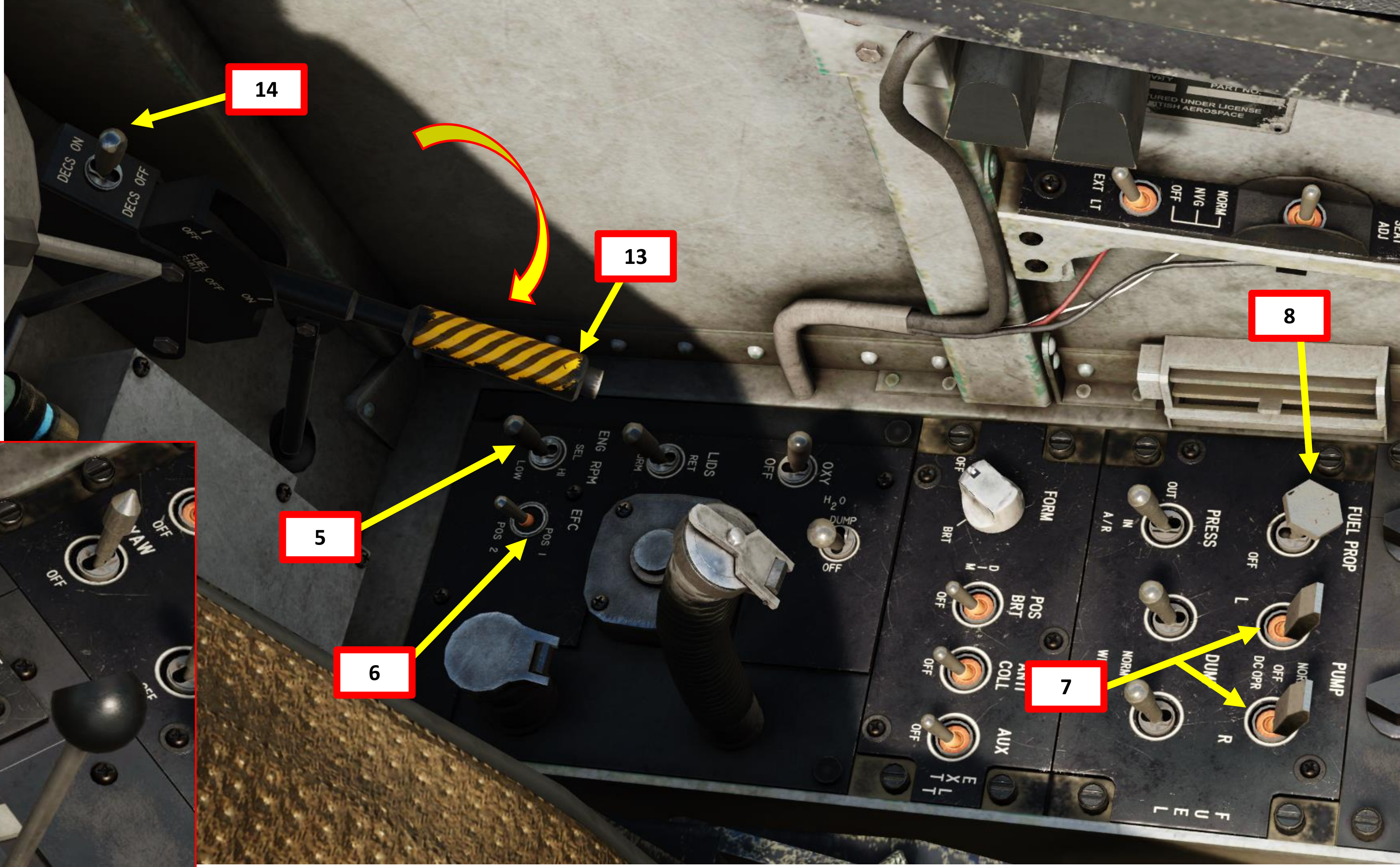
1. Parking Brake Lever – ON (AFT)
2. Battery Switch – BATT (FWD)
3. Main Generator Switch – GEN (FWD)
4. Check that Voltmeter is at least 24.5 V

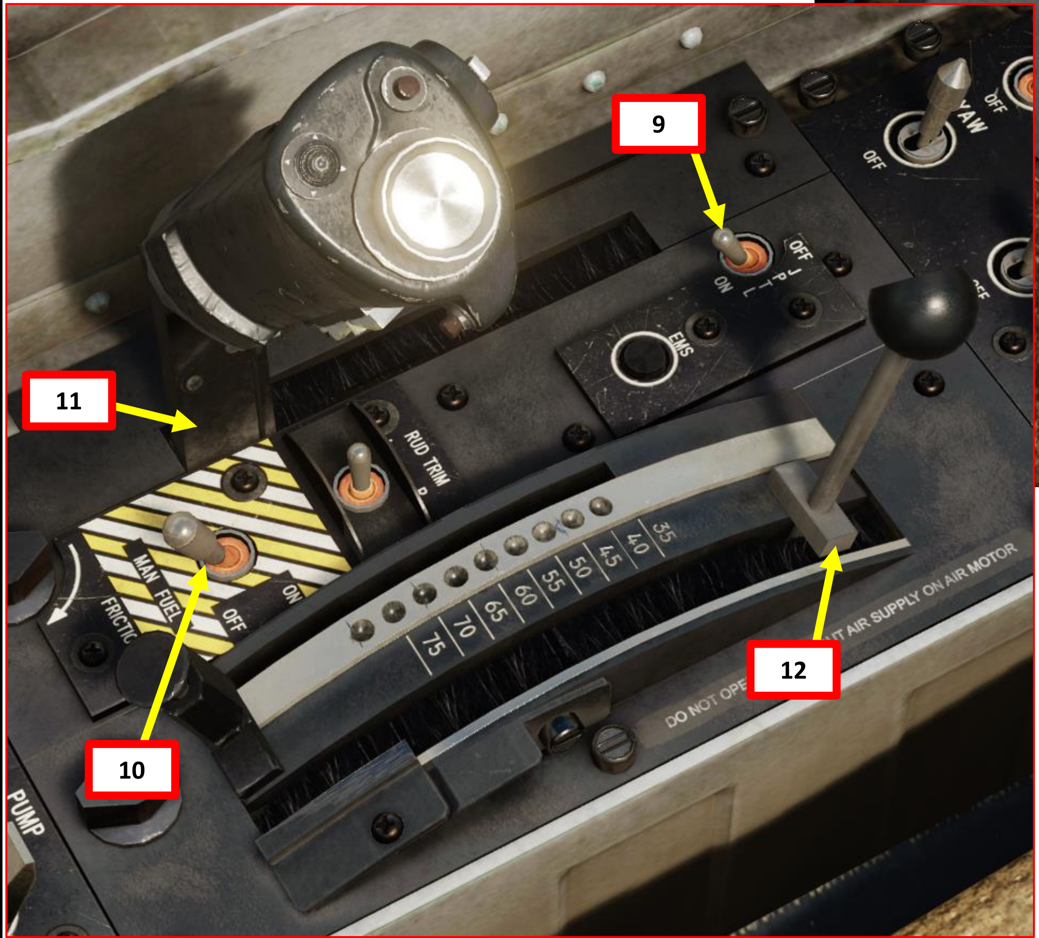




START-UP PROCEDURE

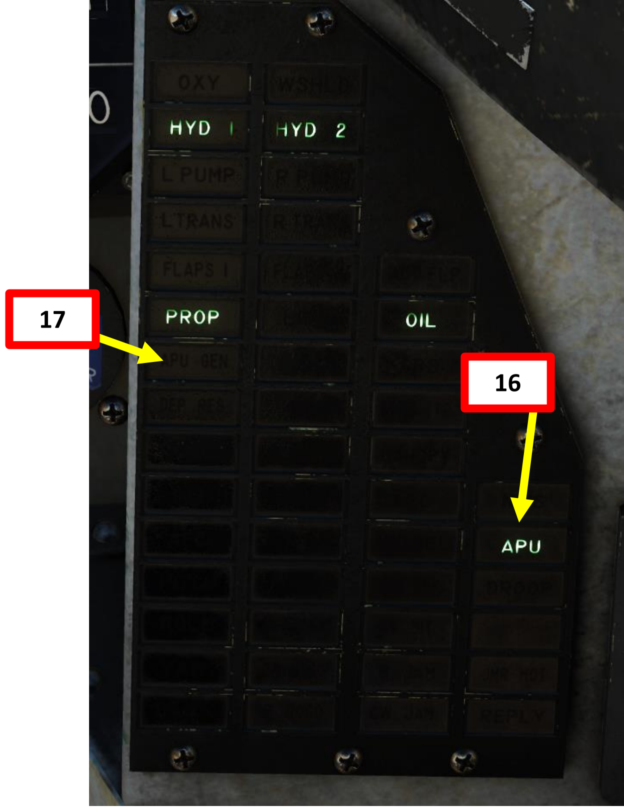
5. Engine RPM Switch – LOW
6. EFC (Engine Fuel Control) Switch – POS 2
7. Left/Right Boost Pump Switches – NORM (FWD)
8. Fuel Flow Proportioner Switch – ON (FWD)
9. JPTL (Jet Pipe Temperature Limiter) Switch – ON (AFT)
10. Manual Fuel Switch – OFF (AFT)
11. Throttle – OFF (fully AFT)
12. Set Nozzle position lever – Between AFT and 10 deg
13. Fuel Shutoff Handle – ON (DOWN)
14. DECS (Digital Engine Control System) switch – ON

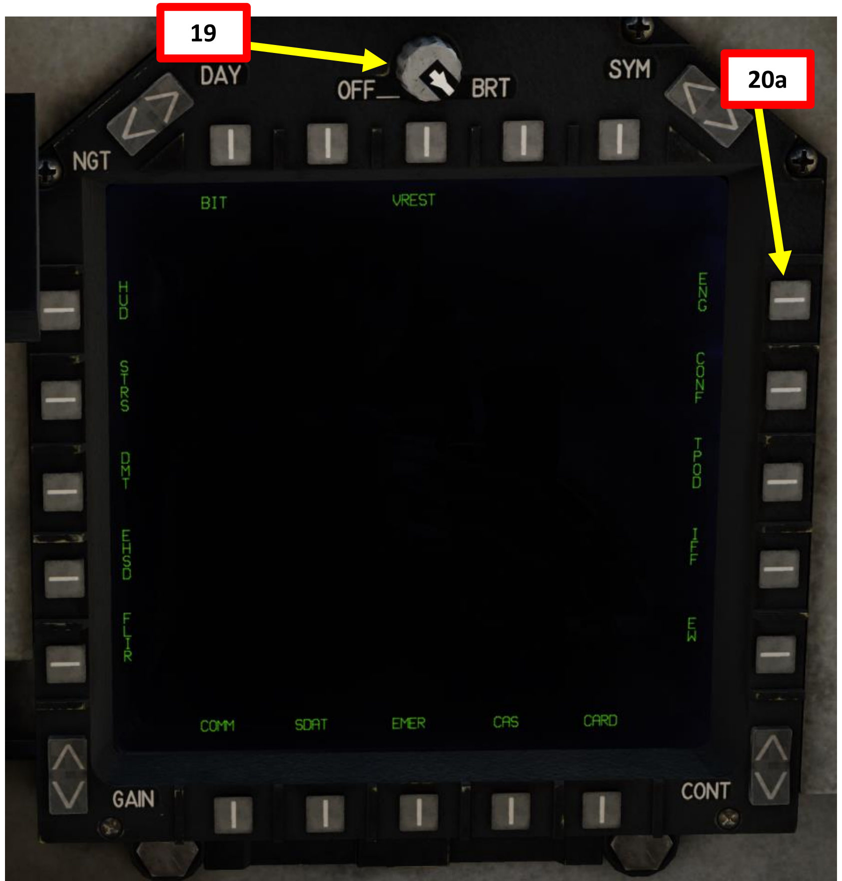




START-UP PROCEDURE

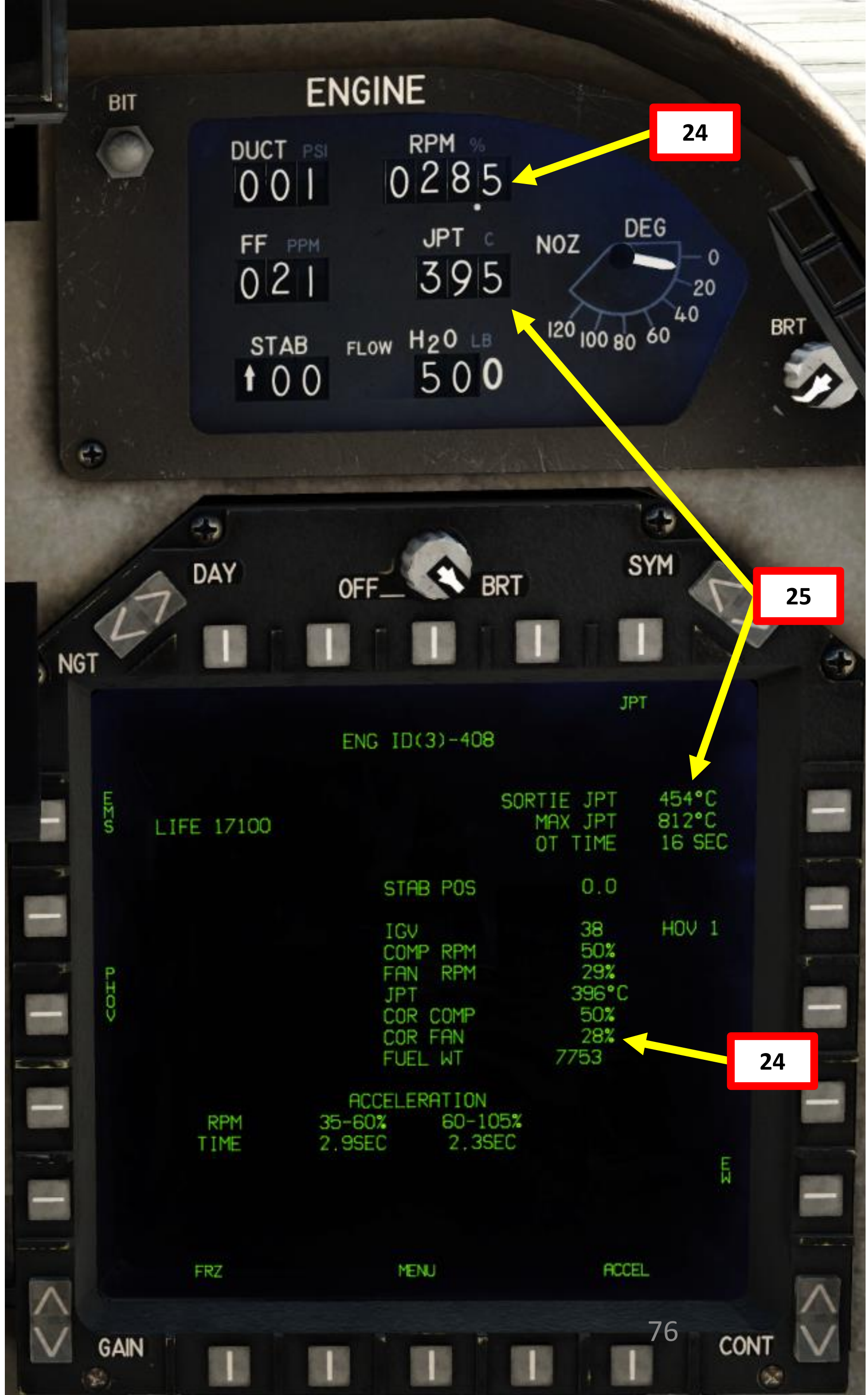
15. *Optional:* APU GENERATOR switch – ON
16. *Optional:* Confirm that APU advisory is ON
17. *Optional:* Confirm that APU GEN light is OUT
18. Press the Master Warning Reset switch to get rid of the aural warning messages
19. Set Left and Right MPCD brightness knobs
20. Click on « ENG » OSB (Option Select Button) to set right MPCD to the Engine Data page





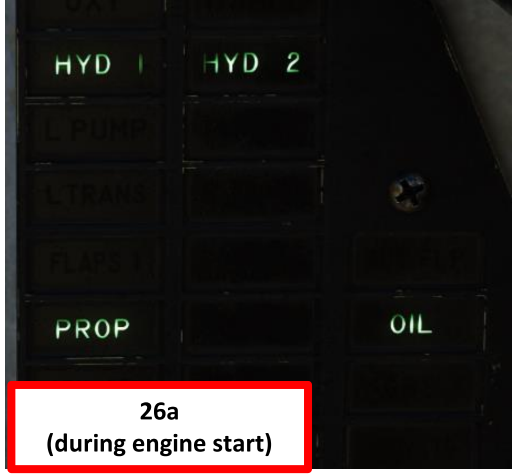
START-UP PROCEDURE

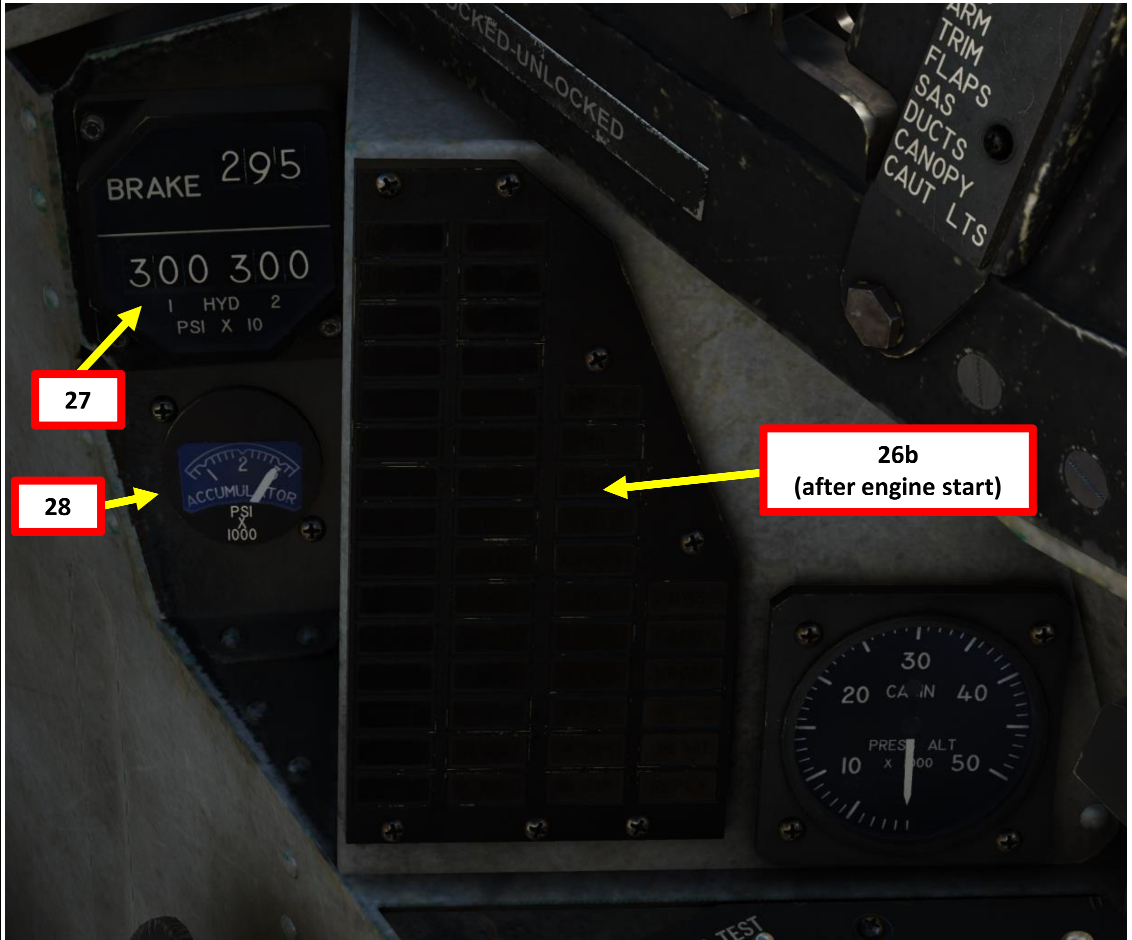
21. Set Engine Start Switch – ENG ST
    - On a direct engine start (GTS/APU is OFF), the GTS normally lights off in about 5 seconds automatically, after which the engine begins to rotate.
    - On a translation engine start (GTS/APU is already started), there is a 10 second deceleration of the APU (Auxiliary Power Unit) before the GTS (Gas Turbine Starter) engages to start the engine.
22. Once engine RPM starts rising, move throttle lever forward to GROUND IDLE position. The throttle will mechanically stop at GROUND IDLE since the parking brake lever acts as a safety stopper.
23. Check that Engine Start switch automatically resets at OFF prior to 15 % RPM. If it doesn't, set it to OFF manualy to prevent damage to the GTS.
24. Check that RPM stabilizes at IDLE RPM (between 28.4 and 29 % RPM)
25. Check that JPT (Jet Pipe Temperature) does not exceed 545 deg C.

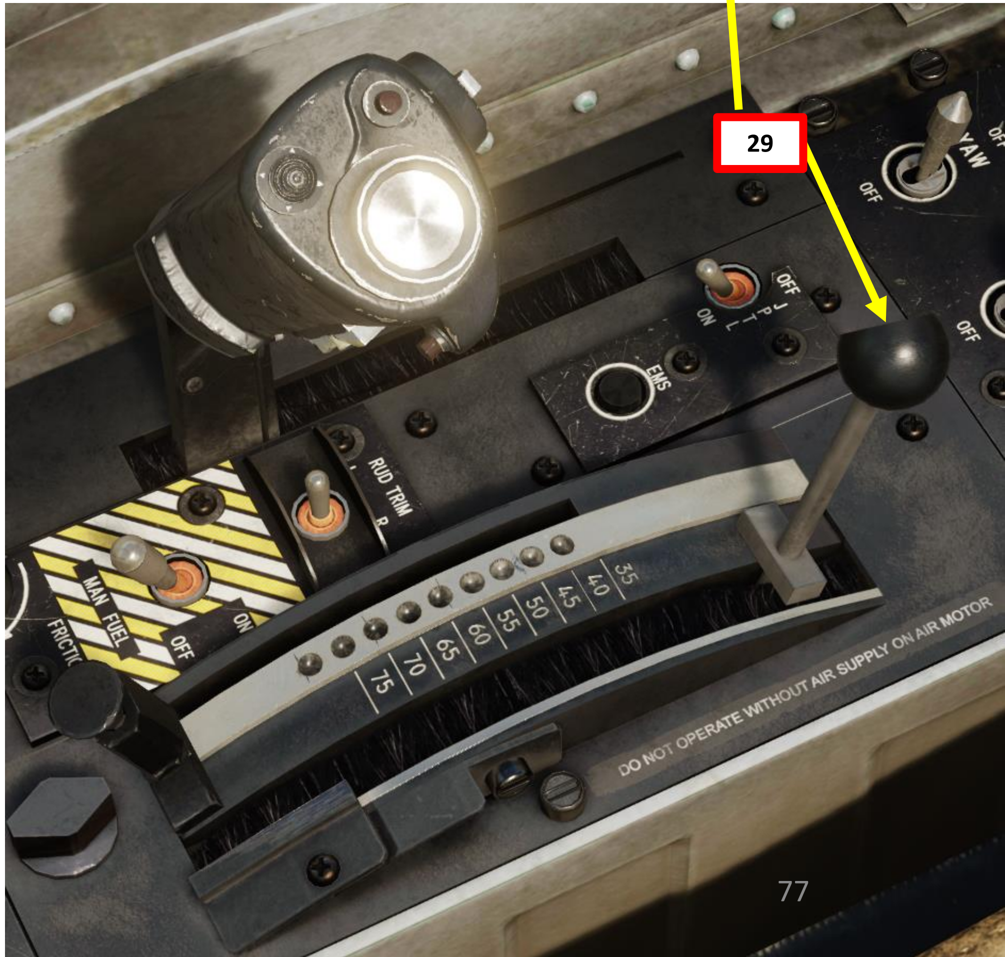


START-UP PROCEDURE

26. Check that oil pressure rises to nominal levels (OIL advisory extinguished)
27. Check that HYD 1 and HYD 2 Pressure stabilize at 3000 +/- 200 psi.
28. Check that brake accumulator Pressure stabilizes at 3000 +/- 200 psi.
29. Set Nozzle position lever to 10 deg. This will prevent excessive wear on the tail plane and flaps due to the heat and jet efflux acting on those control surfaces.







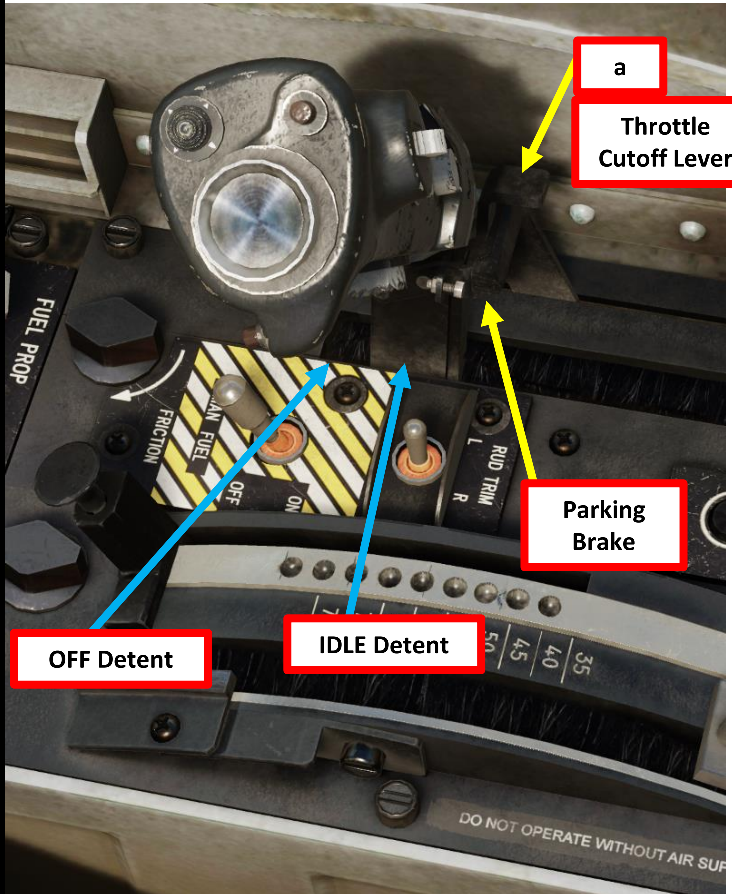
START-UP PROCEDURE

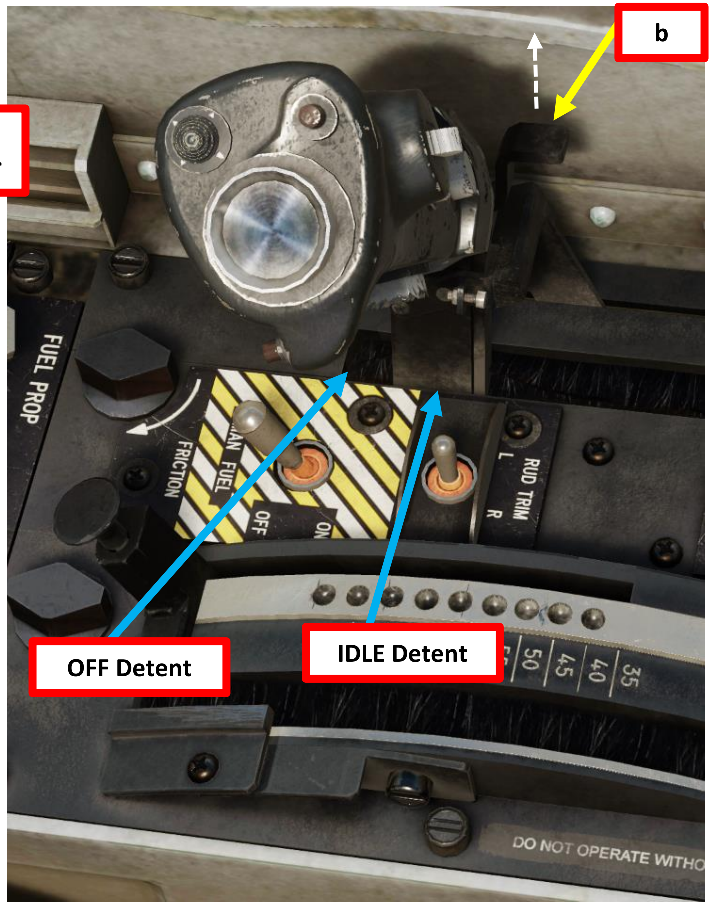
IMPORTANT NOTE ABOUT THROTTLE POSITION DURING ENGINE START:

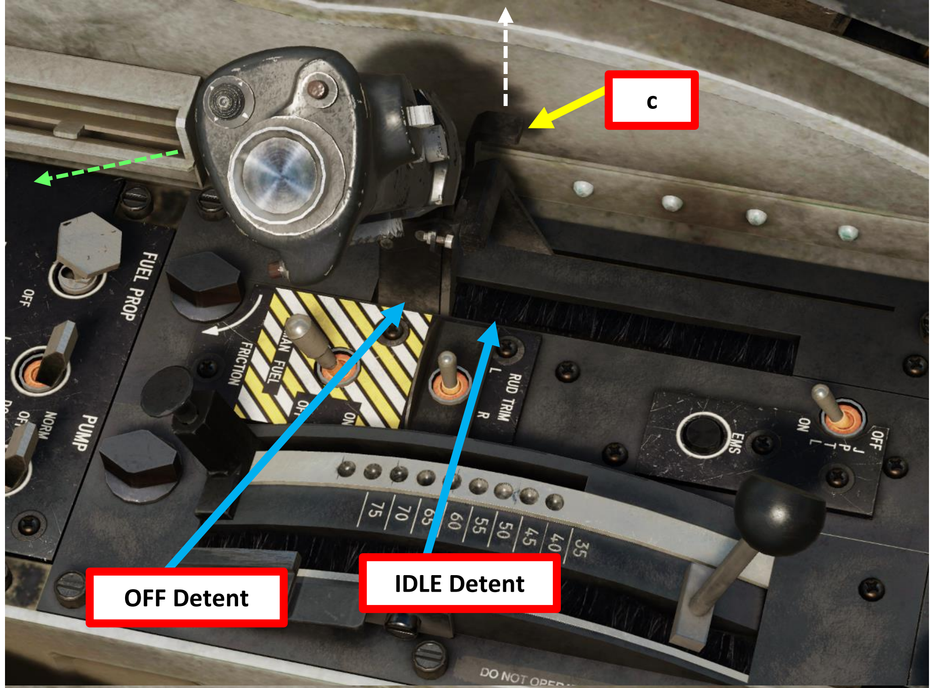
One mistake that new DCS Harrier players often do is that they inadvertently move the throttle out of the OFF position, then set the Engine Start Switch to ENG ST, then wonder why the engine isn't starting. When engine start is initiated, if the throttle is not to the OFF (fully AFT) detent, the engine controller will inhibit engine start.

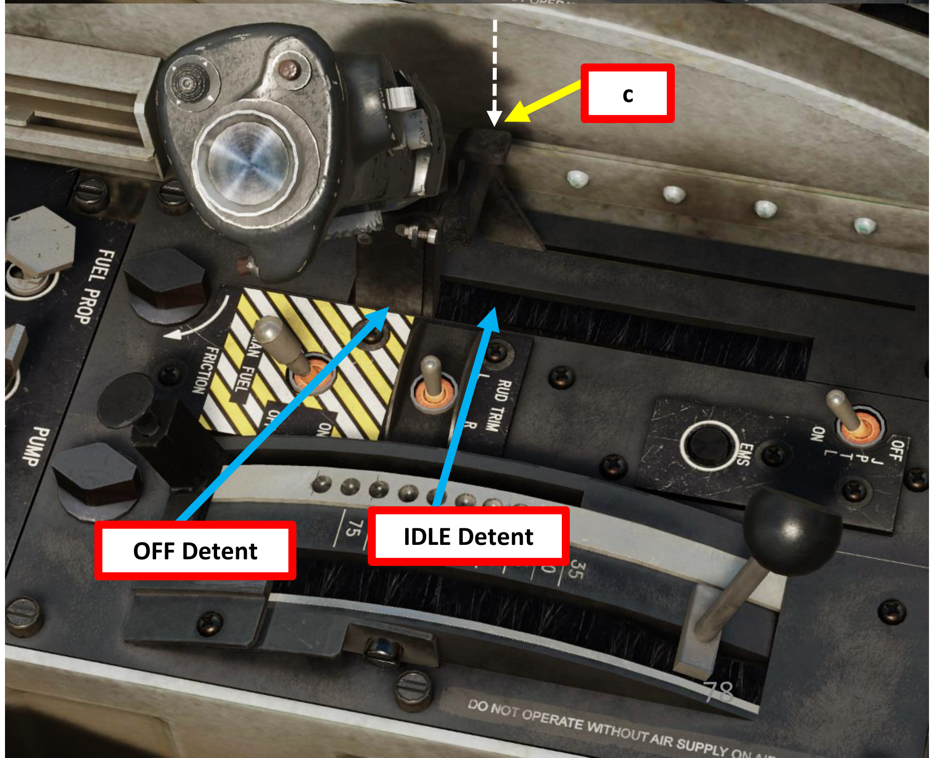
If the throttle is moved out of the OFF detent, there is a mechanical stopper that blocks the throttle from going back to OFF; this is a safety measure to prevent inadvertently shutting down the engine when throttling back.

In that case, you can click on the Throttle Cutoff Lever (near the Parking Brake Lever), which allows you to unlock the throttle fully back to the OFF position. Keep in mind that this Cutoff Lever is only clickable if the throttle is at the IDLE detent.



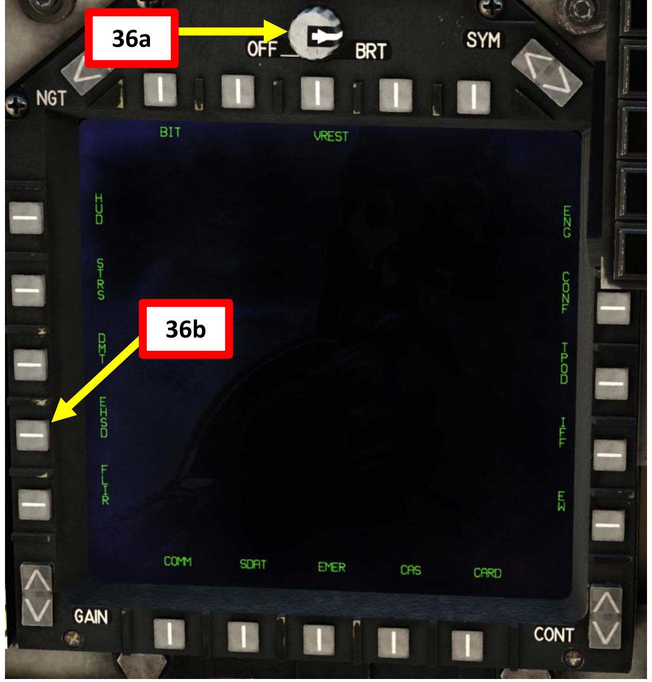


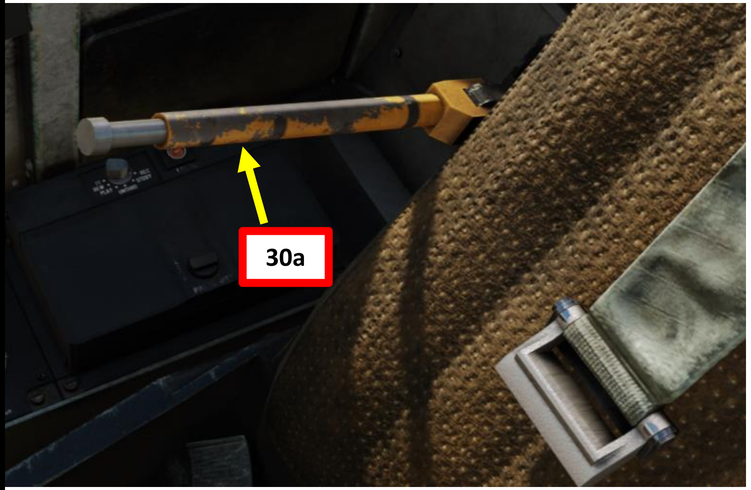


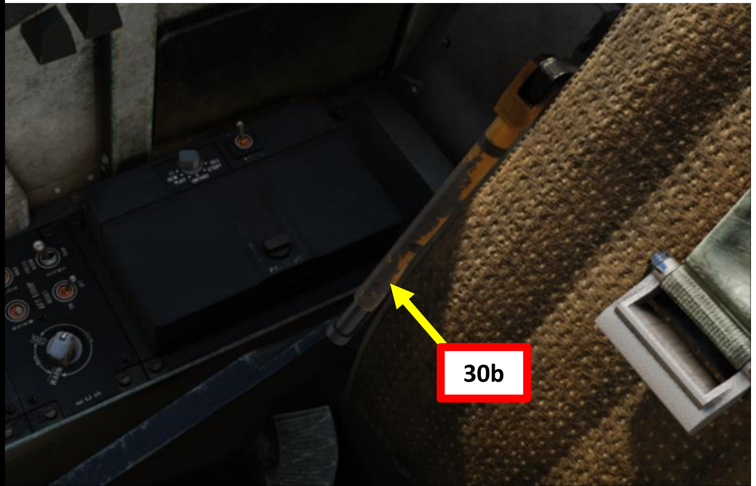


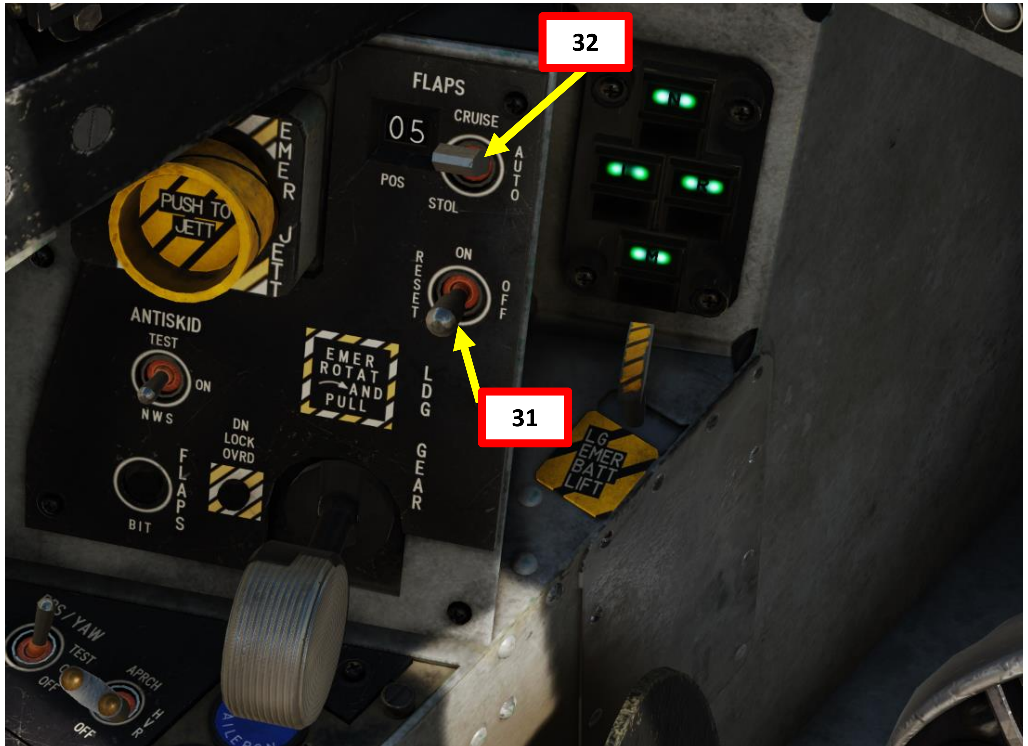
START-UP PROCEDURE

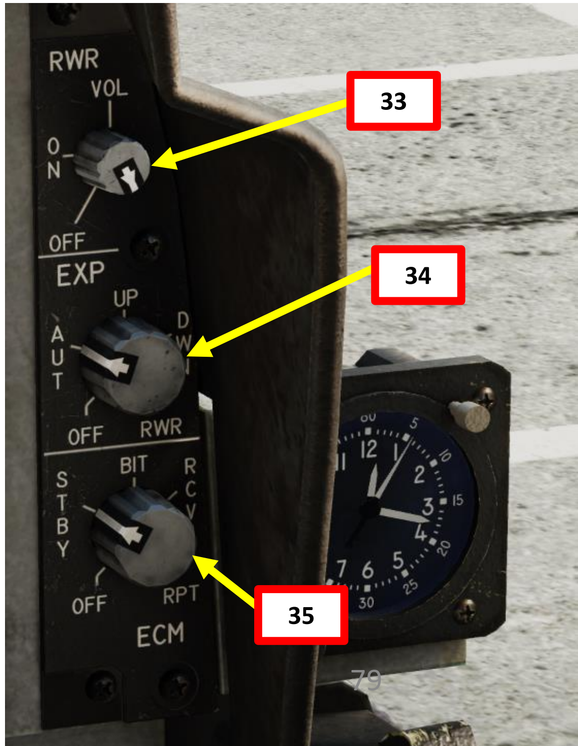
30. Set Seat Ground Safety Lever – DOWN
31. Set Flaps Power Switch – ON (MIDDLE)
32. Set Flaps Mode Switch – CRUISE (UP)
33. Set RWR (Radar Warning Receiver) Switch – ON
34. Set EXP (Expendables Decoy Dispenser) Switch – AUTOMATIC
35. Set DECM (Defensive Electronic Countermeasure) Switch - STBY
36. Set left MPCD Brightness knob and click on « EHSD » OSB (Option Select Button) to set left MPCD to the Electronic Horizontal Situation Display page











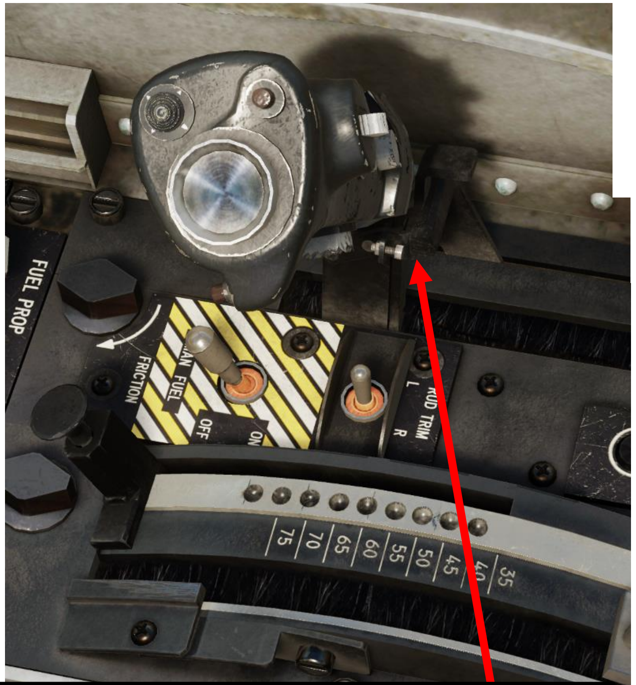
INS ALIGNMENT **OVERVIEW**

The ASN-139 INS (Inertial Navigation System) has four **alignment modes**:

- **SEA**: alignment performed aboard a carrier by plugging in a SINS (Sea INS) cable. Uses the carrier's own inertial navigation system to achieve INS precision.
- **GND**: Ground mode can only be performed with the aircraft on land.
- **IFA** (GPS): In-Flight Alignment uses the aircraft's built-in GPS (Global Positioning System). This alignment can be performed anywhere.
- **GYRO**: Degraded mode which provides a quick alignment process, but present position data is not available. This alignment can be performed anywhere.

Note: There are three INS **alignment sub-modes**:

- **SHDG**: (Stored heading alignment): Uses pre-existing heading for Ground & Sea modes, which accelerates alignment process.
- **Manual Sea Alignment**: performs a manual alignment without the carrier's SINS (Sea INS).
- **GPS airborne alignment**: available for IFA



Important: Always make sure your parking brake is engaged (lever AFT) during alignment!

Before starting INS alignment, always make sure the INS Mode switch is set to OFF.

INS ALIGNMENT PROCEDURE OVERVIEW

The main alignment sequence is the same for all modes and sub-modes, times for each sequence is in parenthesis:

a. Cage (3 seconds): The INS is aligned with the aircraft fuselage.
b. Warm-Up (time depends on ambient temperature): Gyros and accelerometers are heated to their operational temperature of 170°F (76.67°C) at a rate of 2.5°F per second.
c. Spin (13 seconds): Gyros are spun up to 22,500 rpm.
d. Level (9 seconds): INS platform is leveled with respect of local vertical.
e. Wide Angle Gyrocompass (WAG) (time depends on alignment mode/sub-mode): INS determines True North to within about 2°.

The approximate time for WAG depends on alignment time:

- GND: 66 seconds.
- SEA (SINS): 80 seconds.
- SEA (manual): 240 seconds
- IFA (Not moving): 80 seconds.

At this step the IMU is ready and a QAL number will be shown in the MPCD along with the word HDG.

f. Small Angle Alignment (SAA) (20 seconds): INS computes heading, tilts, and gyro mini-biases to the fine degree necessary. The beginning of SAA is indicated by the HDG legend displayed across from the QUAL digits on the MPCD.

INS Alignment Procedure

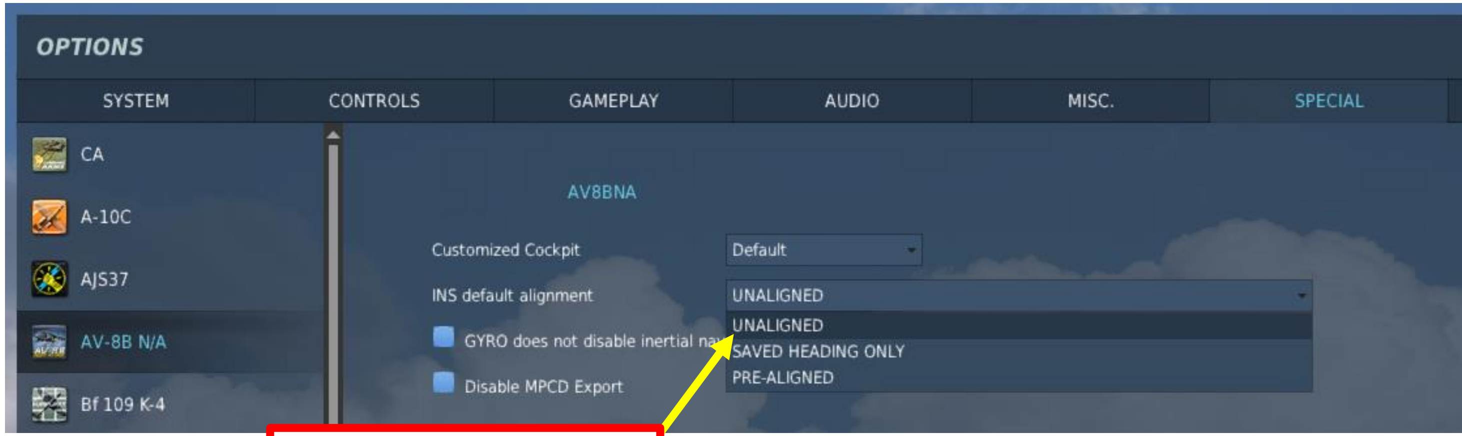
All modes

1. Make sure that the INS mode selector is in the OFF position.
2. Select EHSD o the MPCD (either left or right).
3. Select DATA on the MPCD.
4. Select AC (aircraft data) on the MPCD.
   a. Aircraft present position will be shown.
   b. UFC/ODU will enter Aircraft Position mode.
   c. The following ODU options are available:
      i. Option 1: POS (Lat/Lon position coordinates).
      ii. Option 2: MVAR (Local magnetic variation).
      iii. Option 3: WIND (Wind Direction and Speed).
      iv. Option 4: SHIP (Carrier heading and speed).
      v. Option 5: THDG (Aircraft true heading).
5. Enter AC initial present position (IPP) latitude and longitude.
6. Enter local magnetic variation (MVAR) if the value shown is 0.
7. Place the INS mode selector knob in the selected alignment mode: SEA< GND, IFA or GYRO. The alignment process will start immediately if the required data has been entered.
8. When the alignment is finished place the INS mode selector knob either in NAV (for degraded mode navigation) or IFA (for GPS coupled navigation).

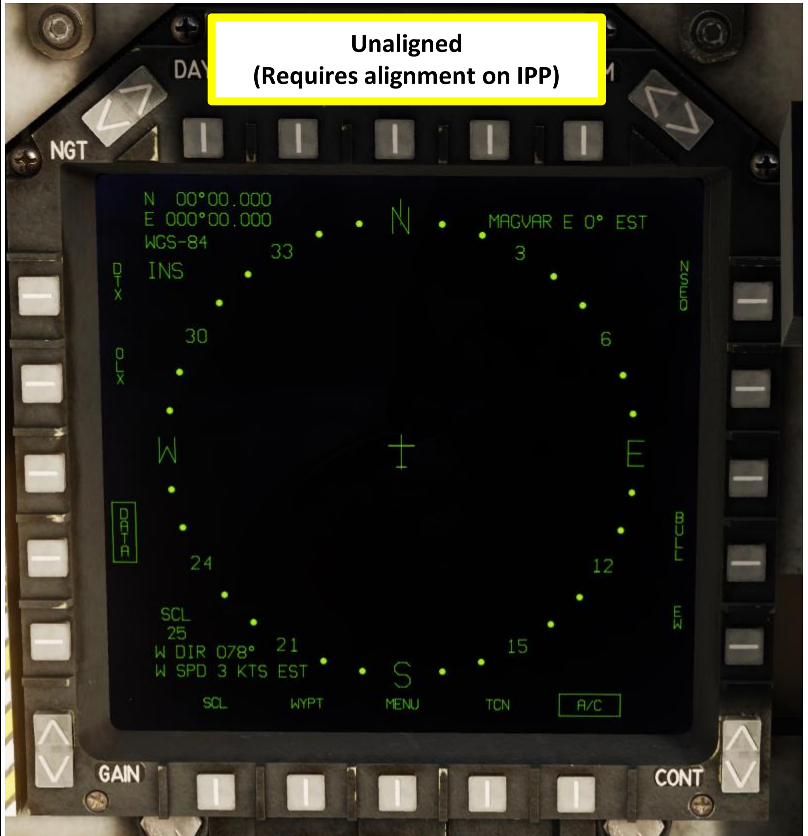
INS ALIGNMENT **OVERVIEW**

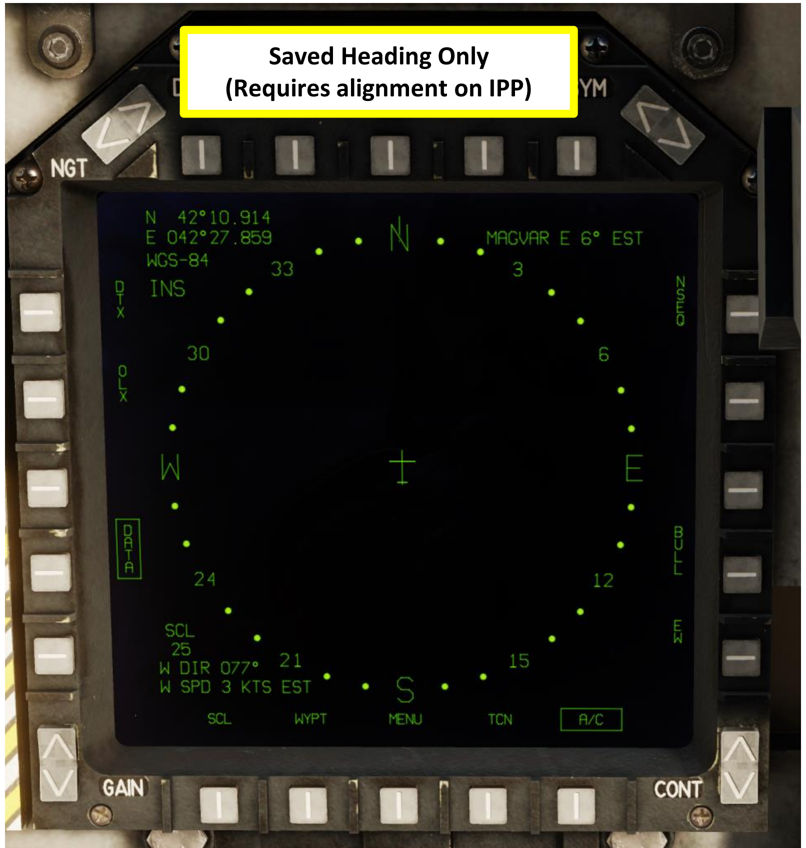
The difference between UNALIGNED, SAVED HEADING ONLY and PRE-ALIGNED is what data is already available in the INS when starting the alignment.

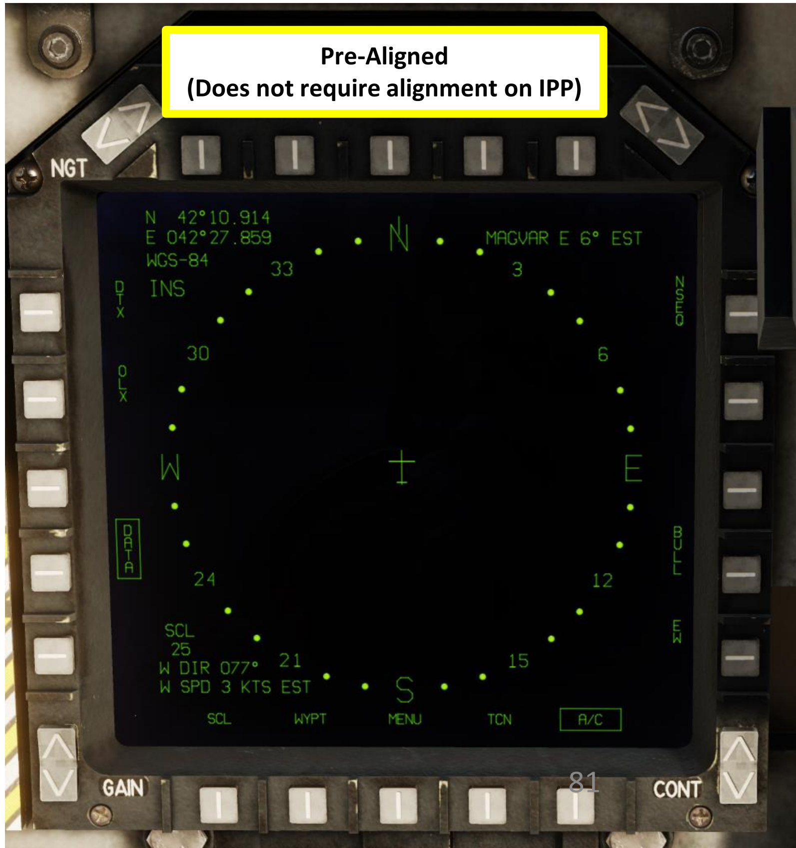
- **UNALIGNED**: You have to input IPP (Initial Present Position) data, magnetic variation and align the INS.
- **SAVED HEADING ONLY**: You still have to align the INS, but present position data is already in the system and you can bypass one of the steps. It has a faster alignment period.
- **PREALIGNED**: The INS is aligned from the get go.



Alignment options: unaligned, saved heading, or pre-aligned.

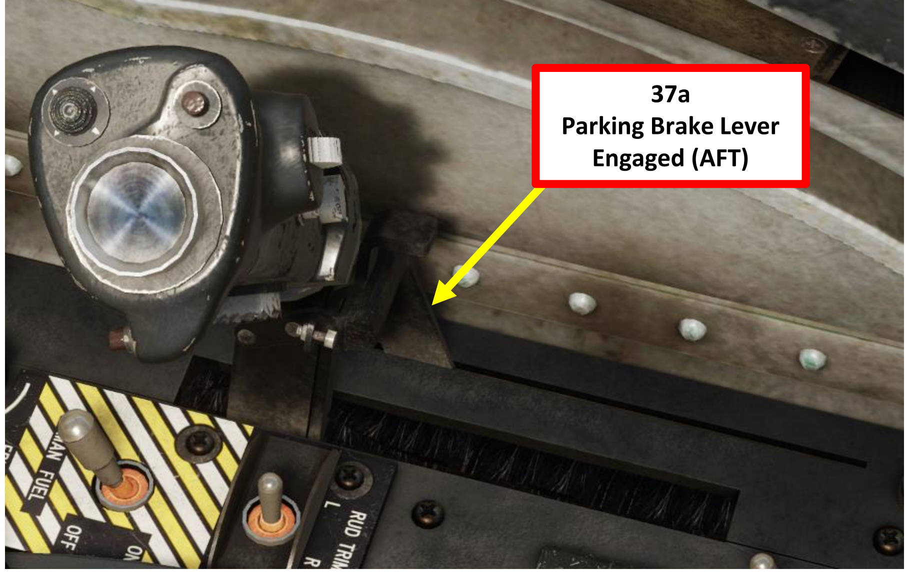


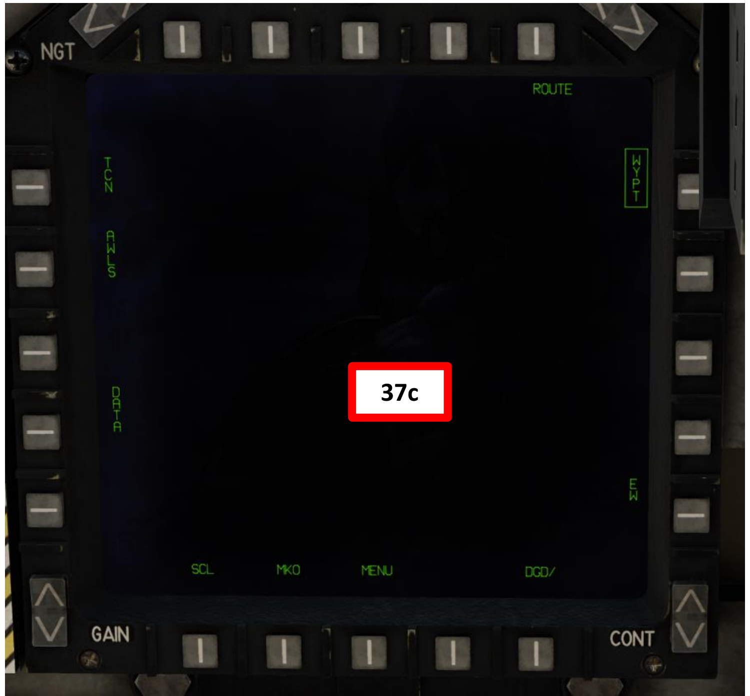


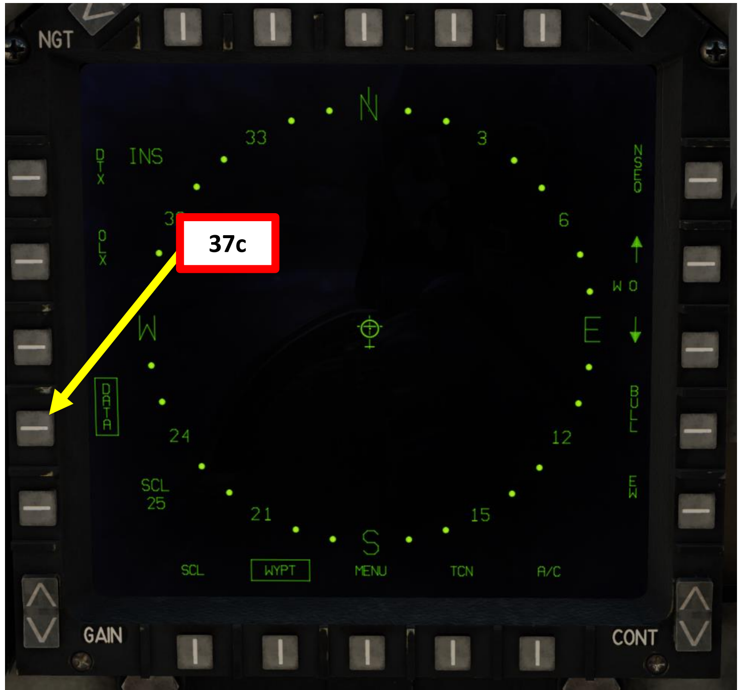


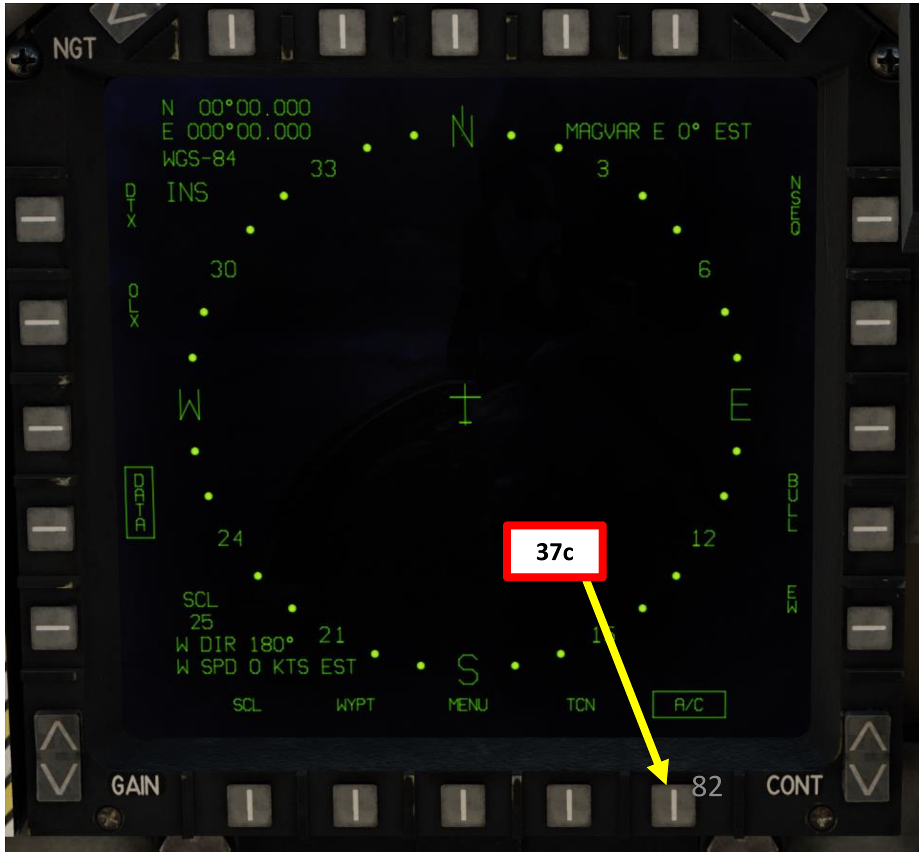
INS ALIGNMENT (GROUND)

37. Set IPP (Initial Present Position) if the aircraft is not pre-aligned, then start GND INS (Inertial Navigation System) alignment phase. Steps preceded by « * » are not required if the « PRE-ALIGNED » option is ticked in the Special Options tab.
    a) Make sure parking brake is engaged
    b) Set DISPLAY Brightness Knob to BRT
    c) * Select MENU->EHSD->DATA->A/C menu on the MPCD.



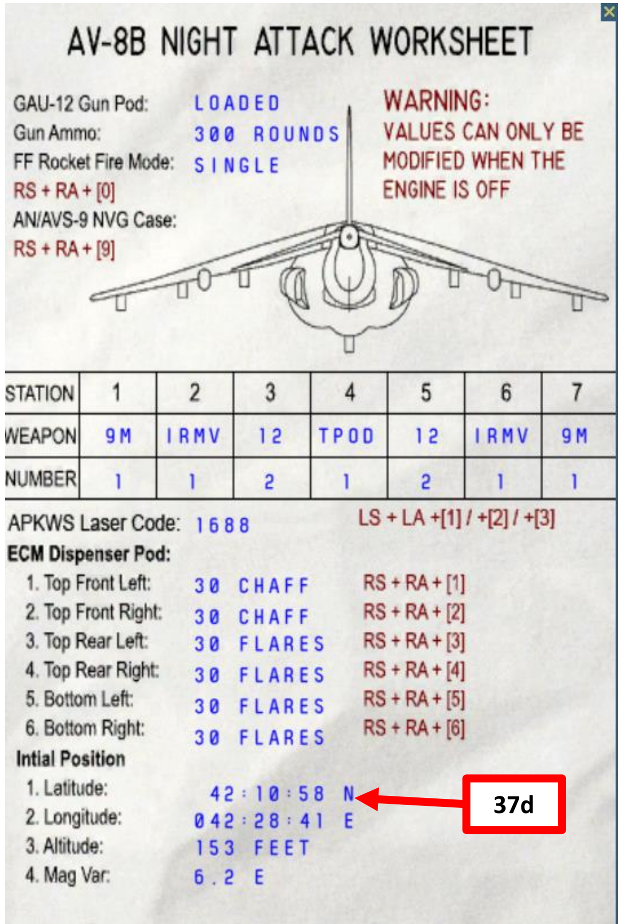






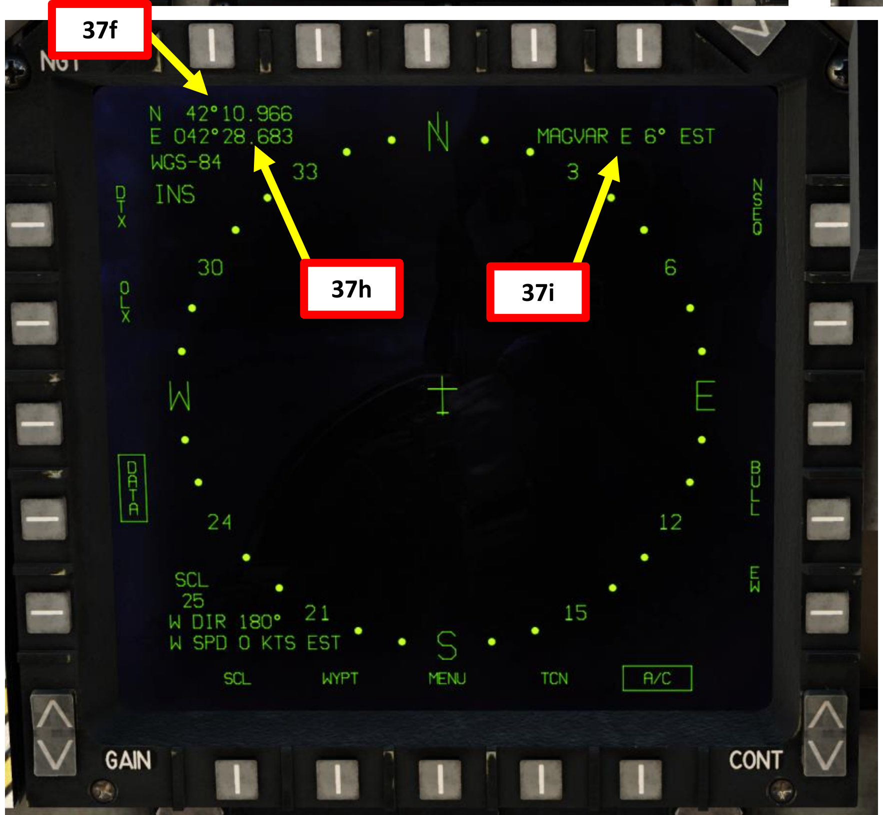
INS ALIGNMENT (**GROUND**)

37. Set IPP (Initial Present Position) if the aircraft is not pre-aligned, then start GND INS (Inertial Navigation System) alignment phase. Steps preceded by « * » are not required if the « PRE-ALIGNED » option is ticked in the Special Options tab.
    d) * Press « RSHIFT+K » to open up kneeboard and check your Initial Position. Write down your coordinates (i.e. **42°10'58'' North** **042°28'41'' East** in deg, min, sec) and magnetic variation (**6.2 deg East**). Keep in mind that the coordinate input to the Up-Front Controller is in deg, min, sec, while the displayed coordinate format on the EHSD is in deg, min decimals.



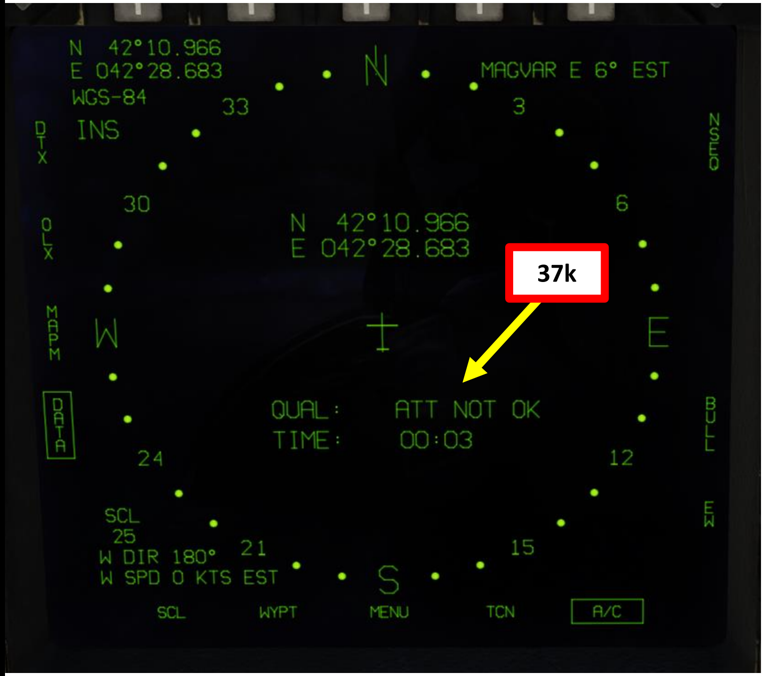
INS ALIGNMENT (**GROUND**)

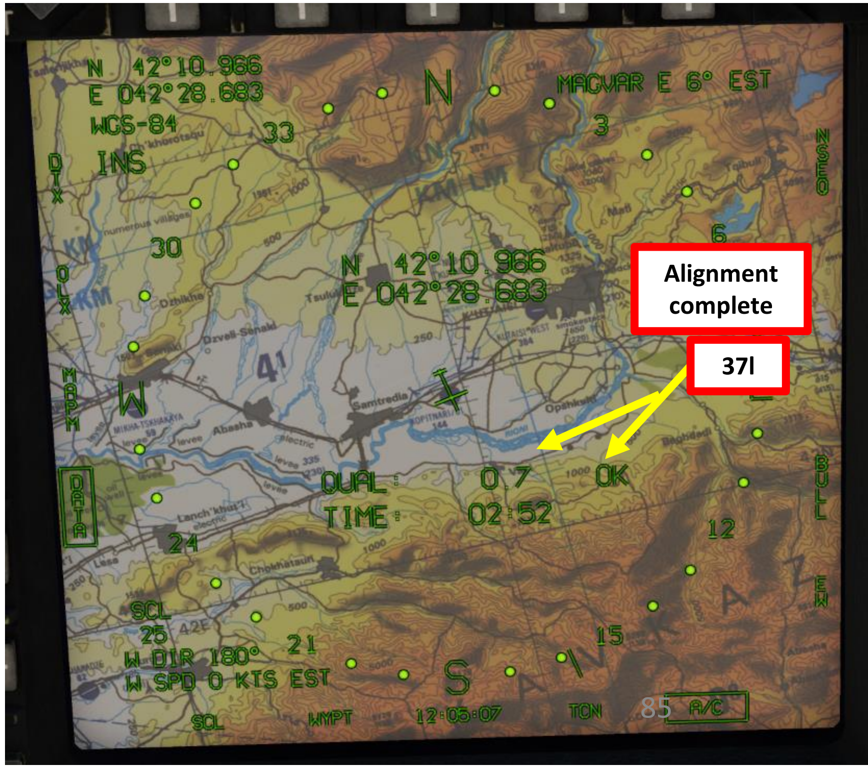
37. Set IPP (Initial Present Position) if the aircraft is not pre-aligned, then start GND INS (Inertial Navigation System) alignment phase. Steps preceded by « * » are not required if the « PRE-ALIGNED » option is ticked in the Special Options tab.
    d) * Press « RSHIFT+K » to open up kneeboard and check your Initial Position. Write down your coordinates (i.e. **42°10'58'' North** **042°28'41'' East** in deg, min, sec) and magnetic variation (**6.2 deg East**). Keep in mind that the coordinate input to the Up-Front Controller is in deg, min, sec, while the displayed coordinate format on the EHSD is in deg, min decimals.
    e) * Press the POS (Position) ODU (Option Display Unit) to select the coordinate Latitude (":"will appear next to it when selected).
    f) * On the UFC, press « 2 » (N) to select North coordinates, type « **421058** », then « ENT » to enter them.
    g) * Press on the POS ODU again to select the coordinate Longitude.
    h) * On the UFC, press « 6 » (E) to select East coordinates, type « **0422841** », then « ENT » to enter them. Don't forget to add the 0 at the beginning.
    i) * Enter the correct MVAR (Magnetic Variation) based on where you are. Press the ODU next to MVAR (":"will appear next to it when selected), press « 6 » (E) to select East coordinates, and then type « **6.2** », then « ENT » to enter the magnetic variation of 6.2 deg East.



INS ALIGNMENT (**GROUND**)

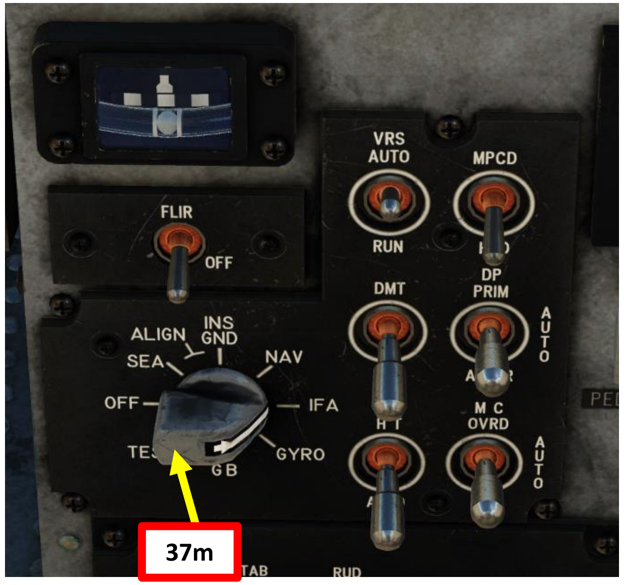
37. Set IPP (Initial Present Position) if the aircraft is not pre-aligned, then start GND INS (Inertial Navigation System) alignment phase. Steps preceded by « * » are not required if the « PRE-ALIGNED » option is ticked in the Special Options tab.
    - j) Set INS mode switch to ALIGN GND INS.
    - k) During the first 1 to 2 minutes of alignment, the indicator has ATT NOT OK displayed to the right of QUAL (Alignment Quality).
    - l) Once the message QUAL 0.7 OK appears, you can consider your alignment to be complete.

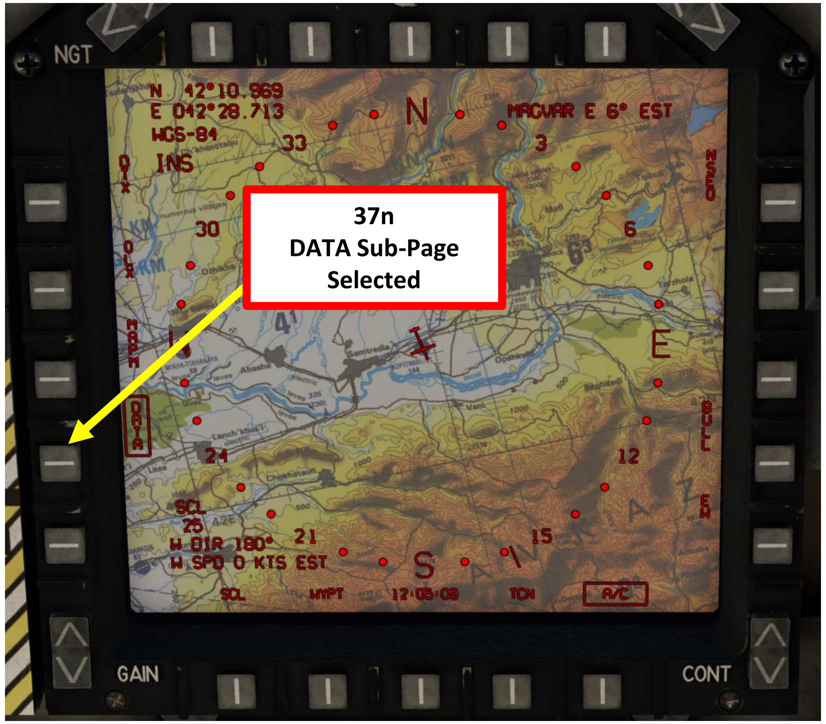


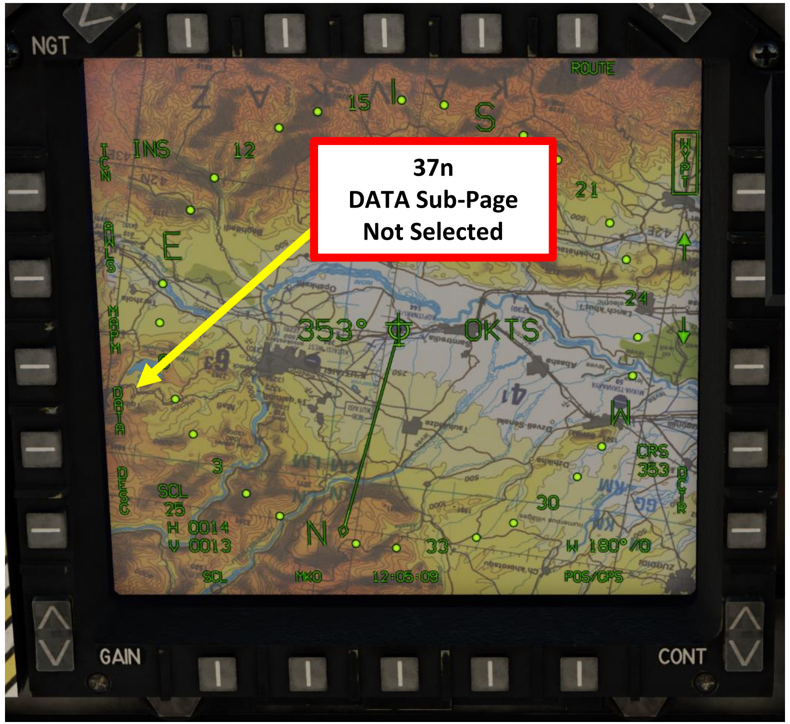


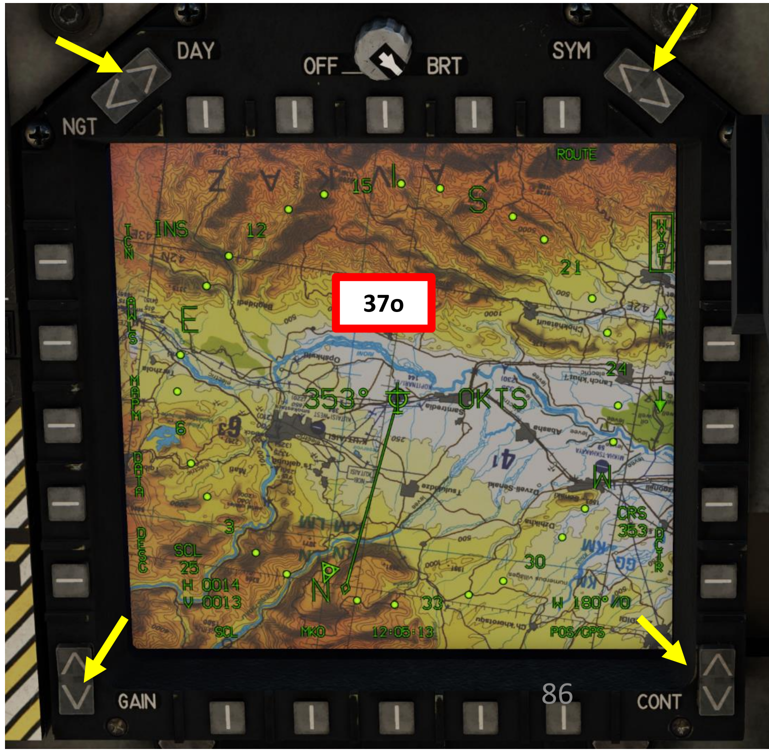
INS ALIGNMENT (**GROUND**)

37. Set IPP (Initial Present Position) if the aircraft is not pre-aligned, then start GND INS (Inertial Navigation System) alignment phase. Steps preceded by « * » are not required if the « PRE-ALIGNED » option is ticked in the Special Options tab.
    m) Set INS mode switch to IFA (In-Flight Alignment coupled with GPS).
    n) Press OSB next to DATA to un-select the DATA Menu (unboxed when un-selected).
    o) Adjust Moving Map brightness as required using the CONT (Contrast), SYM (Symbology Brightness), GAIN and Day/Night Mode switches.



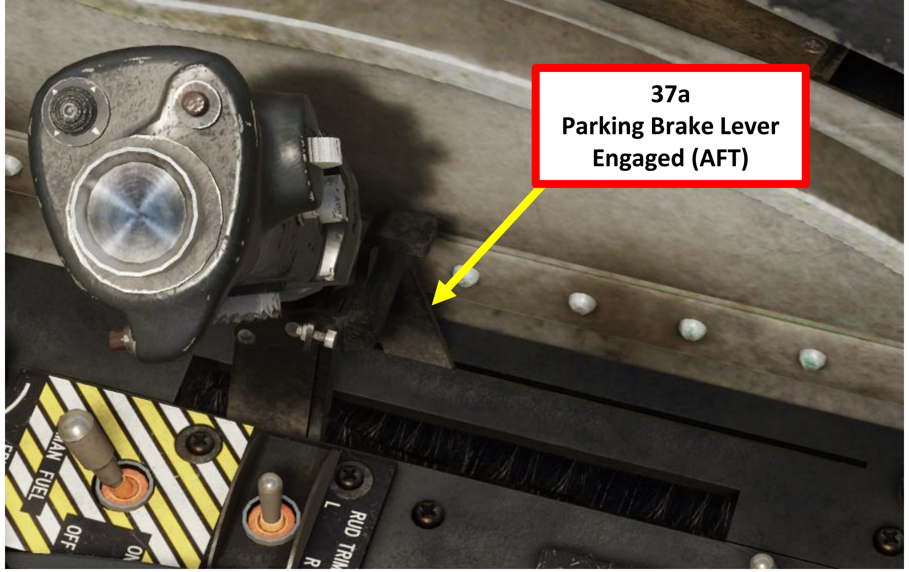


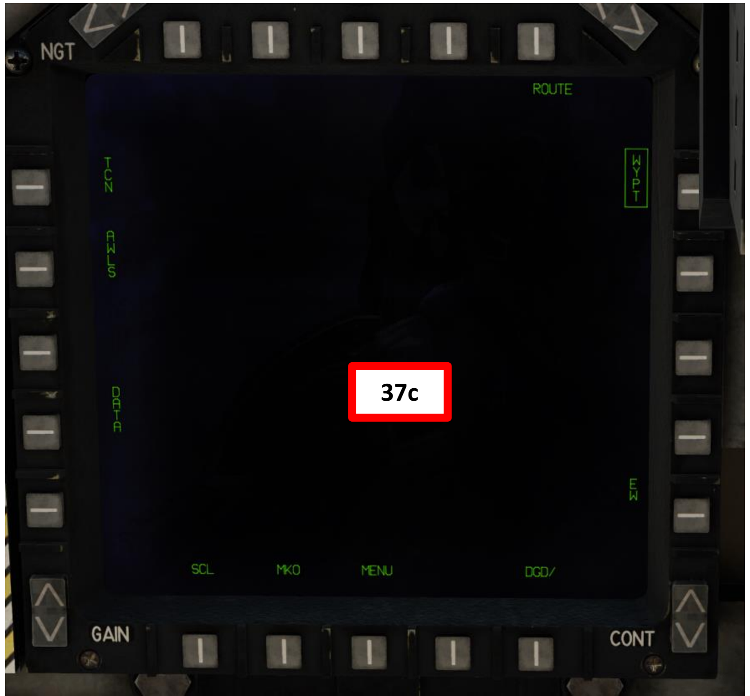


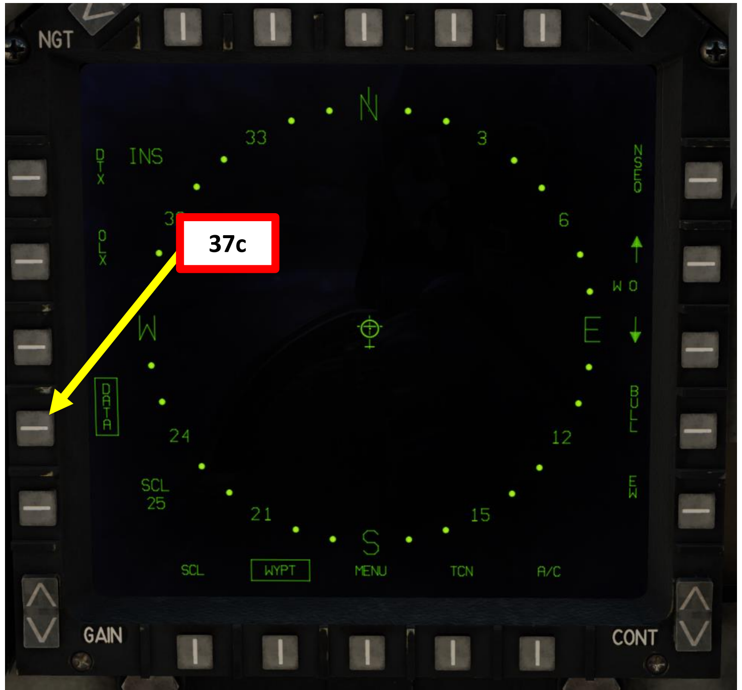


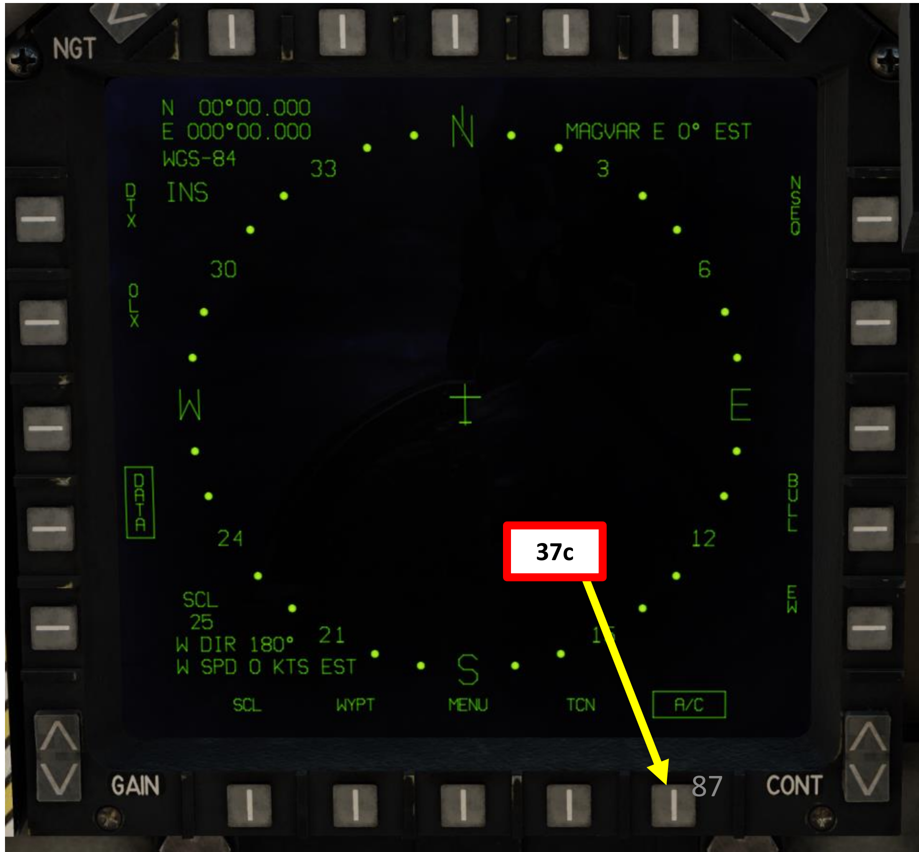
INS ALIGNMENT (SEA/SINS)

37. Start INS (Inertial Navigation System) alignment phase by connecting the SINS (Sea INS) data cable to the aircraft. Then, start SEA INS (Inertial Navigation System) alignment phase.
    a) Make sure parking brake is engaged
    b) Set DISPLAY Brightness Knob
    c) Select MENU->EHSD->DATA->AC menu on the MPCD.



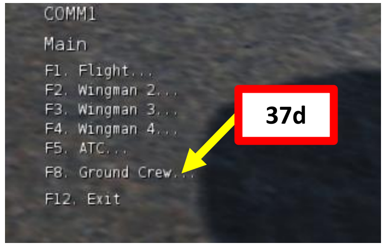


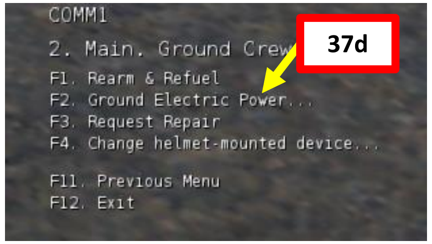


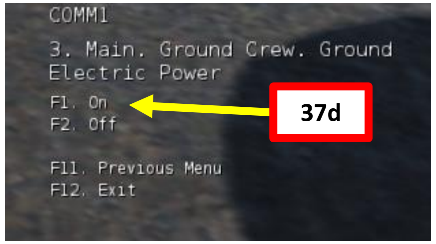


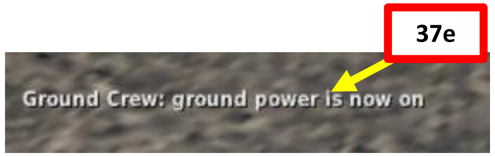
INS ALIGNMENT (SEA/SINS)

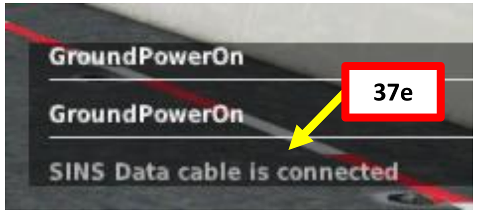
37. Start INS (Inertial Navigation System) alignment phase by connecting the SINS (Sea INS) data cable to the aircraft. Then, start SEA INS (Inertial Navigation System) alignment phase.
    d) Contact ground crew and request electrical power by pressing « \ », then pressing F8 (Ground Crew), F2 (Ground Electric Power), then F1 (ON).
    e) Electrical power will be applied and SINS (Sea INS) data cables will be connected from the carrier's INS system to the aircraft.





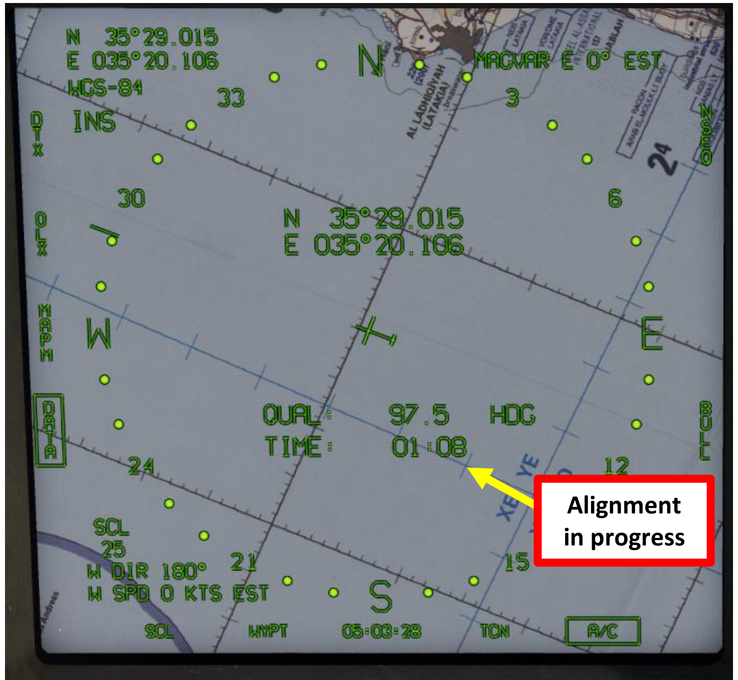






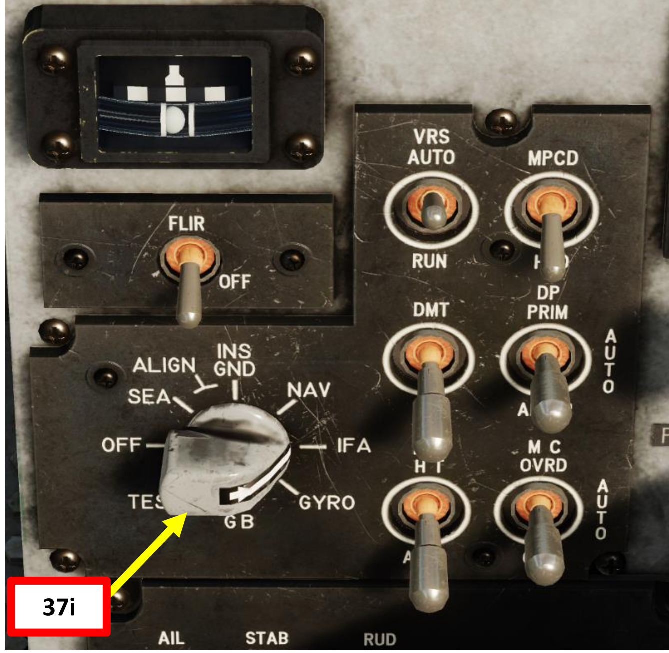
INS ALIGNMENT (**SEA/SINS**)

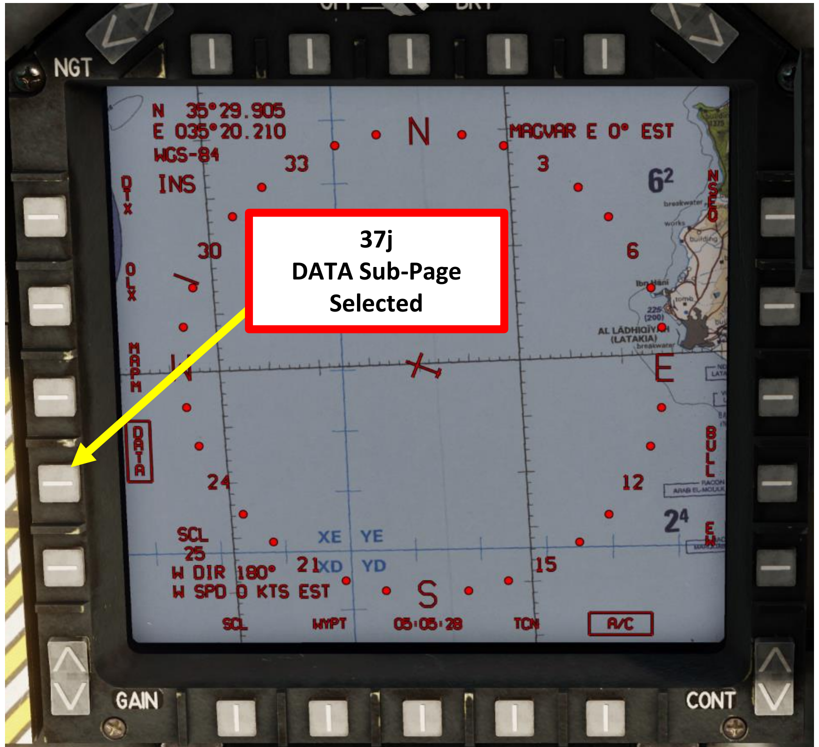
37. Start INS (Inertial Navigation System) alignment phase by connecting the SINS (Sea INS) data cable to the aircraft. Then, start SEA INS (Inertial Navigation System) alignment phase.
    - f) Set INS mode switch to ALIGN SEA INS (SINS).
    - g) During the first 1 to 2 minutes of alignment, the indicator has ATT NOT OK displayed to the right of QUAL (Alignment Quality).
    - h) Once the message QUAL 0.7 OK appears, you can consider your alignment to be complete.

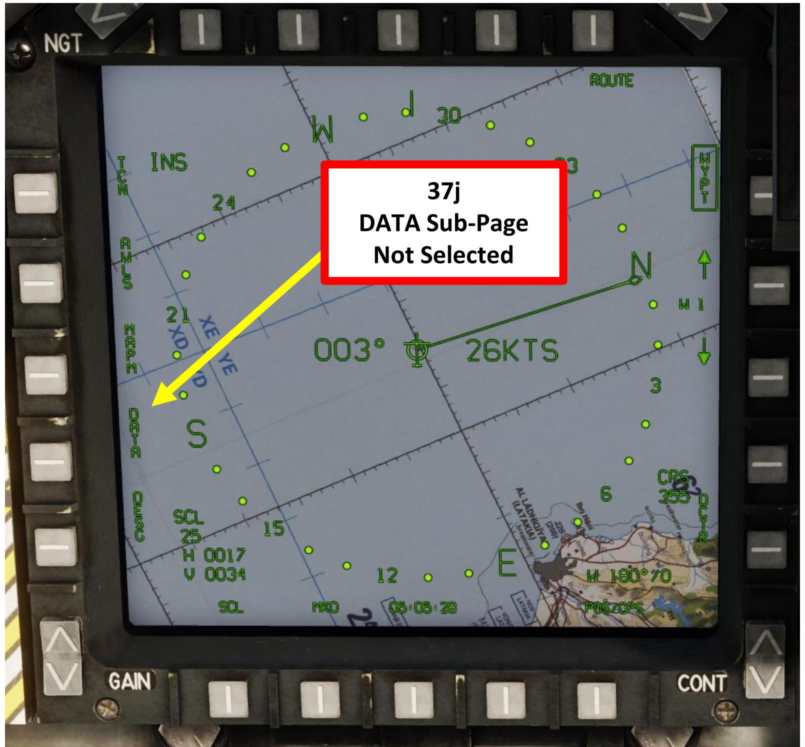


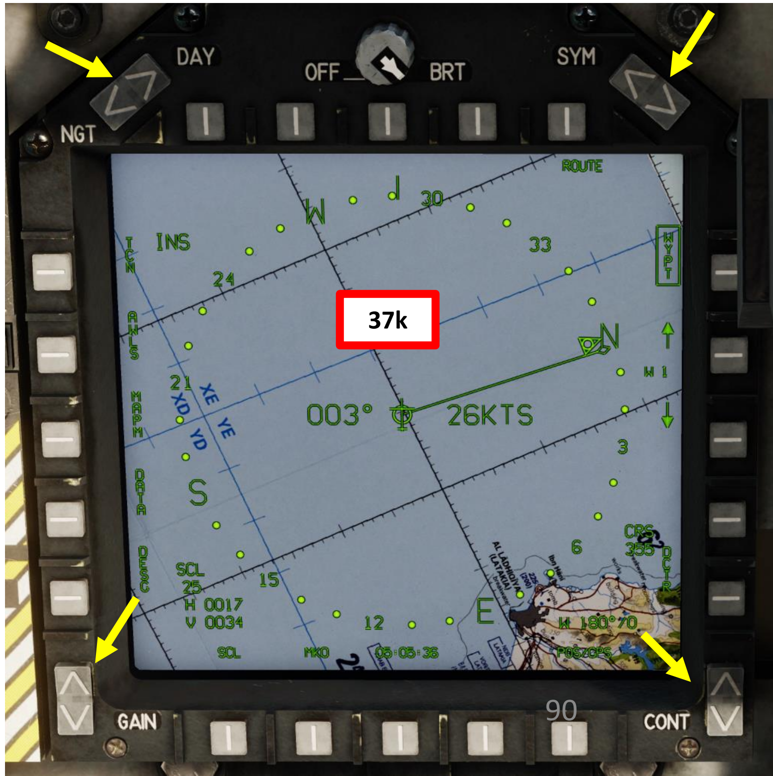
INS ALIGNMENT (SEA/SINS)

37. Start INS (Inertial Navigation System) alignment phase by connecting the SINS (Sea INS) data cable to the aircraft. Then, start SEA INS (Inertial Navigation System) alignment phase.
    i) Set INS mode switch to IFA (In-Flight Alignment coupled with GPS).
    j) Press OSB next to DATA to un-select the DATA Menu (unboxed when un-selected).
    k) Adjust Moving Map brightness as required using the CONT (Contrast), SYM (Symbology Brightness), GAIN and Day/Night Mode switches.
    l) Remove ground power / disconnect SINS cable.



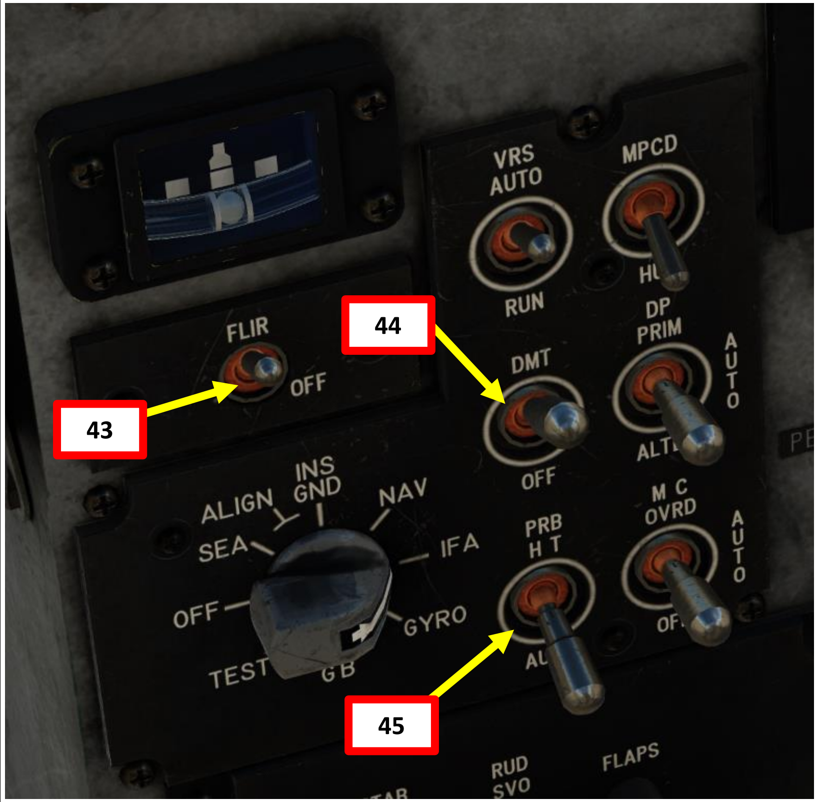


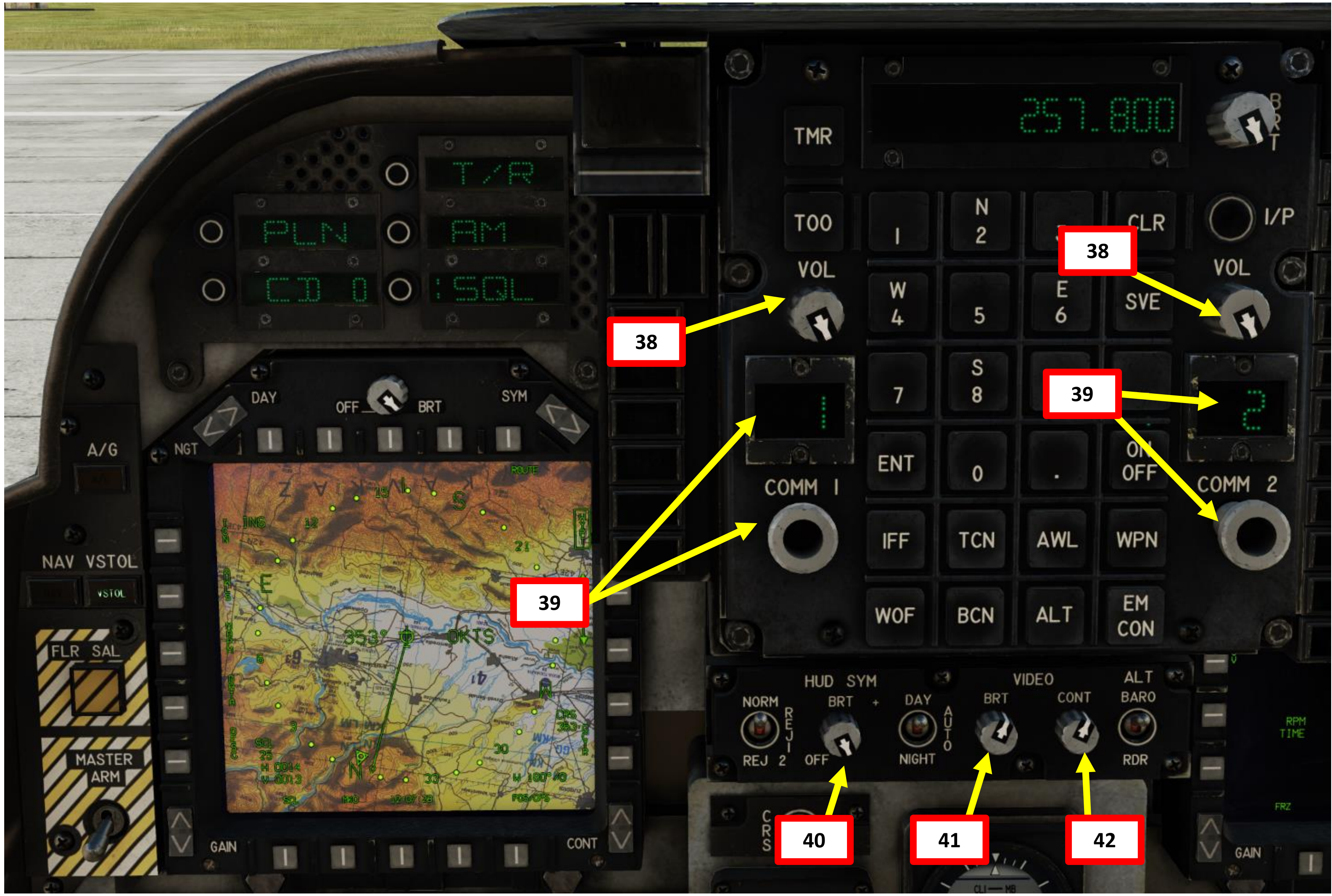




COMPLETE AIRCRAFT SET-UP

38. Set Radio 1 & 2 Volume Knobs
39. Set COMM1 and COMM2 Radios to desired frequencies
40. Set HUD SYMBOLOGY Brightness Knob
41. Set HUD VIDEO Brightness Knob
42. Set HUD VIDEO Contrast Knob
43. Set FLIR Switch – ON (UP)
44. Set DMT (Dual Mode Tracker) Switch – ON (UP)
45. Set PROBE HEAT switch – AUTO



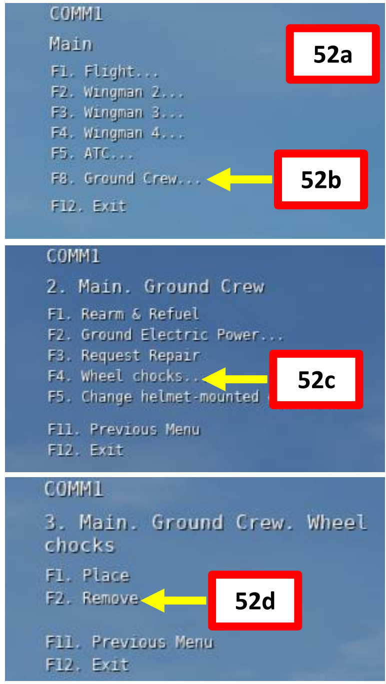


COMPLETE AIRCRAFT SET-UP

46. Press ALT button on UFC (Up-Front Control)
47. Turn on radar altimeter by pressing the « ON/OFF » button on the UFC.
48. Set ALT switch – RDR (Radar Altimeter)
49. Set GPWS (Ground Proximity Warning System) – As desired (« : » means active)
50. On the UFC, type « 4900 », then press « ENT » to enter a Low Altitude Warning of 4900 ft.
51. Make sure GPS is selected (":" means active). This will allow GPS altitude for ballistic computations.

COMPLETE AIRCRAFT SET-UP

52. Remove Wheel Chocks
    a) Press “\” (communication menu binding) to contact ground crew
    b) Press “F8” to select “Ground Crew”
    c) Press “F4” to select “Wheel Chocks”
    d) Press “F2” to “Remove Wheel Chocks”.



TAKEOFF TUTORIAL STRUCTURE

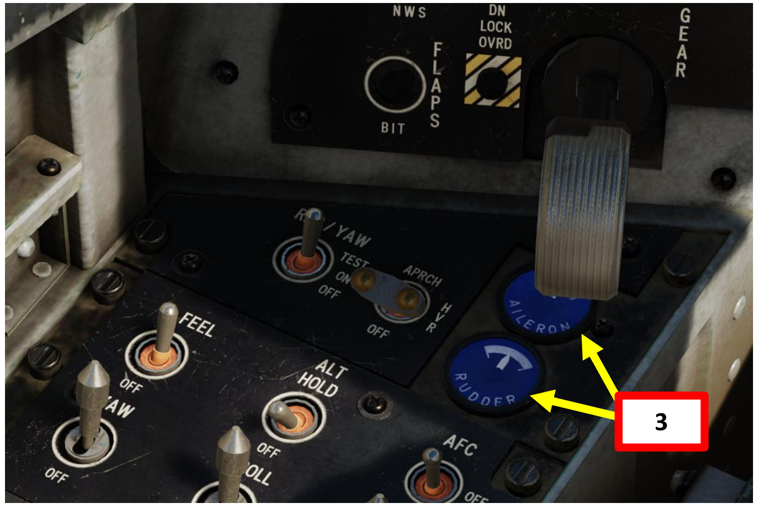
1. Taxi
2. Takeoff Principles
3. Takeoff Types
4. Conventional Takeoff (CTO)
5. Short Takeoff (STO)
6. Vertical Takeoff (VTO)
7. Rolling Vertical Takeoff (RVTO)
8. Ship Takeoff

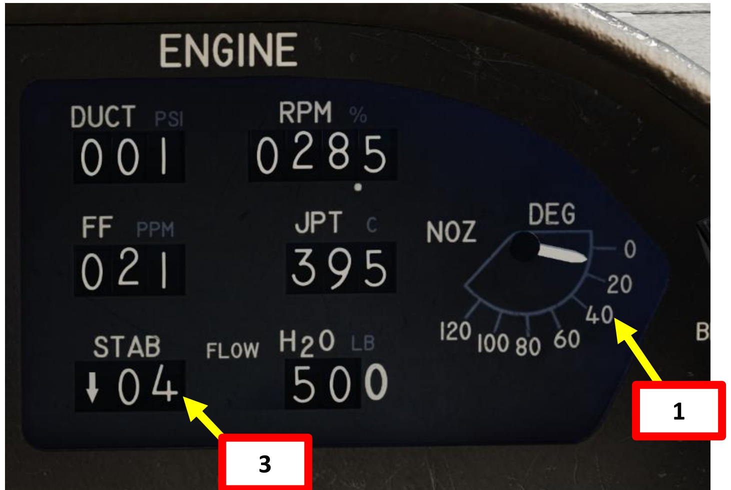
AV-8B HARRIER II

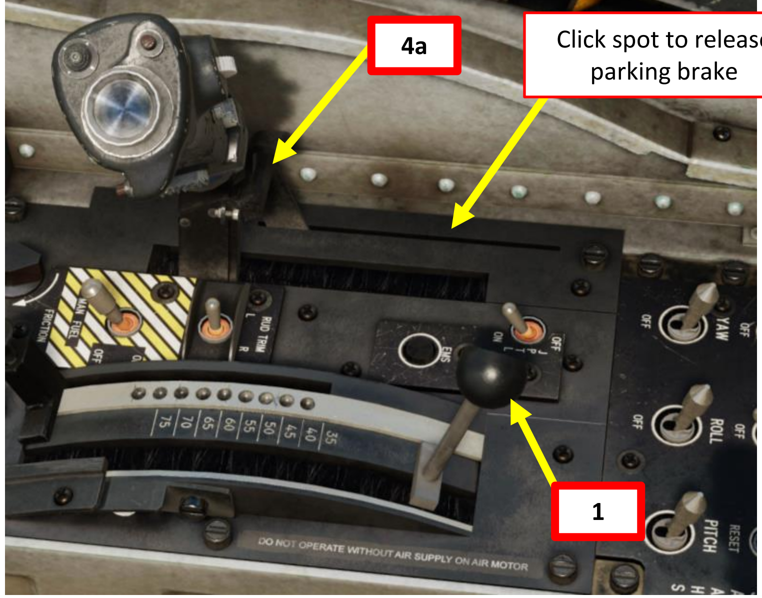
PART 5 – TAKEOFF

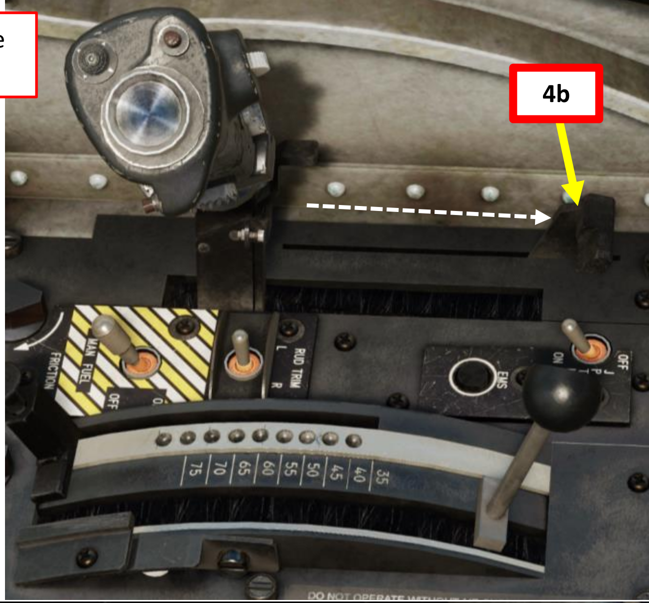
1 - TAXI

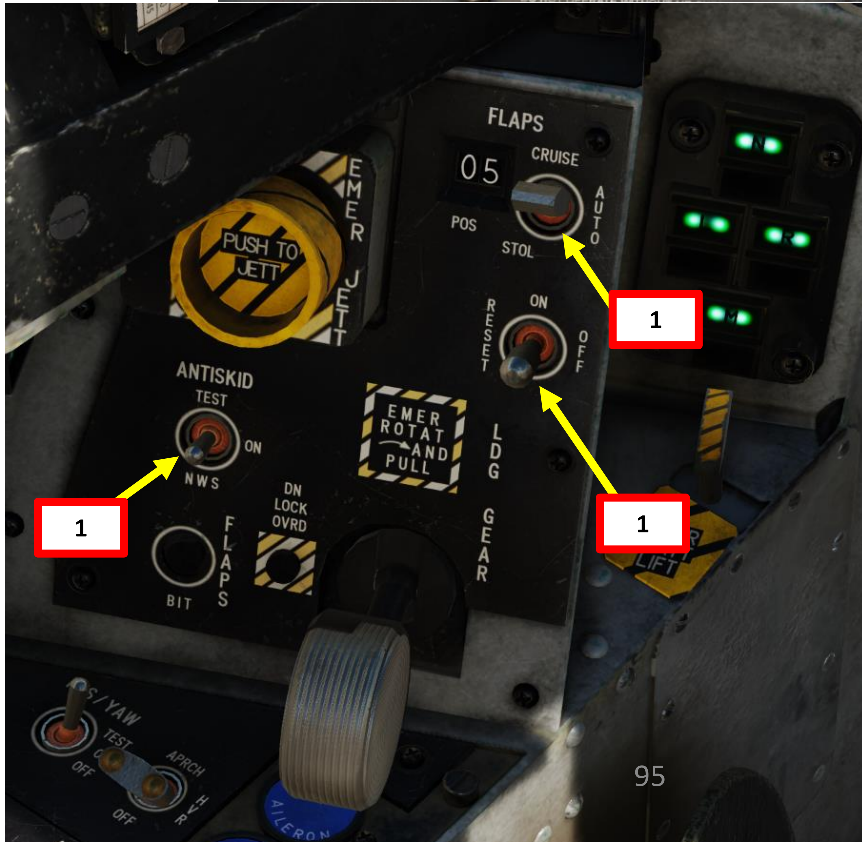
1. Ensure Anti-Skid Switch is set to the correct position (ON/Middle Position for Ground takeoff, NWS/DOWN position for Carrier/ship takeoff)), and . Ensure flaps are ON (MIDDLE position) and at CRUISE (UP position), and Nozzle angle is at 10 deg
2. Select VSTOL (Vertical Short Takeoff & Landing) Master Mode Switch
3. Set trim (Trim Hat on the stick) to 0 deg rudder, 0 deg aileron, and 4 deg stabilator nose down.
4. Release Parking Brake Lever (FWD)
5. Throttle up to taxi











1 - TAXI

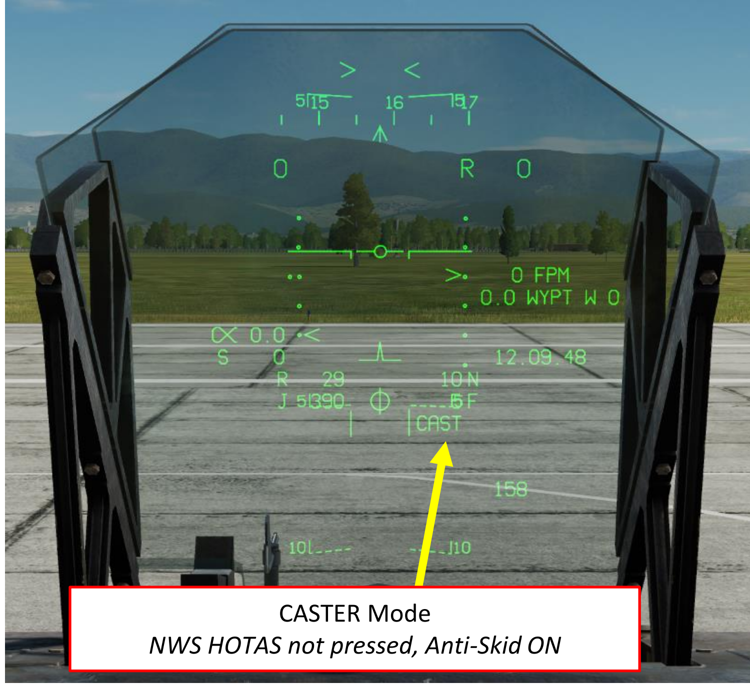
6. If you need to slow down, set Nozzle Control Lever between 45 and 60 degrees to better control taxi speed
7. Press and hold the « AG Target Undesignate/NWS/FOV Toggle) » HOTAS button (LWIN + N key binding by default) and use your rudder pedals to steer the aircraft.

Nosewheel Steering (NWS) Modes (NWS HOTAS Button):

- **CASTER**: Nose wheel is free to swivel, and rudder pedal movement is isolated from the NWS system.
- **LOW GAIN**: Rudder pedals are connected to the system, with a range of movement between +/- 14 deg
- **HIGH GAIN**: Rudder pedals are connected to the system, with a range of movement between +/- 45 deg. HI GAIN is undesirable above 20 kts ground speed due to poor directional control characteristics. This is used mainly on very tight spaces like on a carrier.

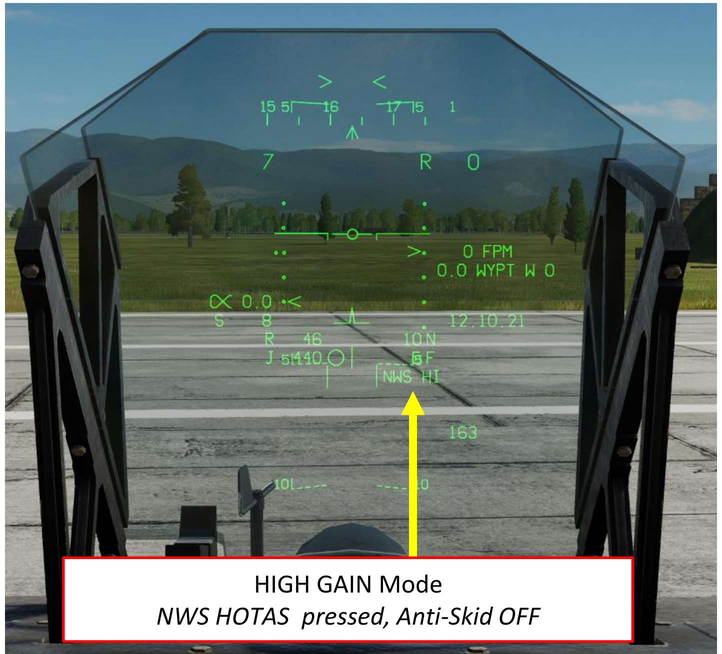
Anti-Skid Modes (ANTISKID Switch):

- **TEST**: Test Mode
- **ON**: Anti-Skid ON (*NWS CASTER Mode by default, NWS LO GAIN when NWS HOTAS button is pressed*). Setting used for ground operations.
- **NWS**: Anti-Skid OFF (*NWS LO GAIN Mode by default, NWS HI GAIN when NWS HOTAS button is pressed*). Setting used for carrier/ship operations.

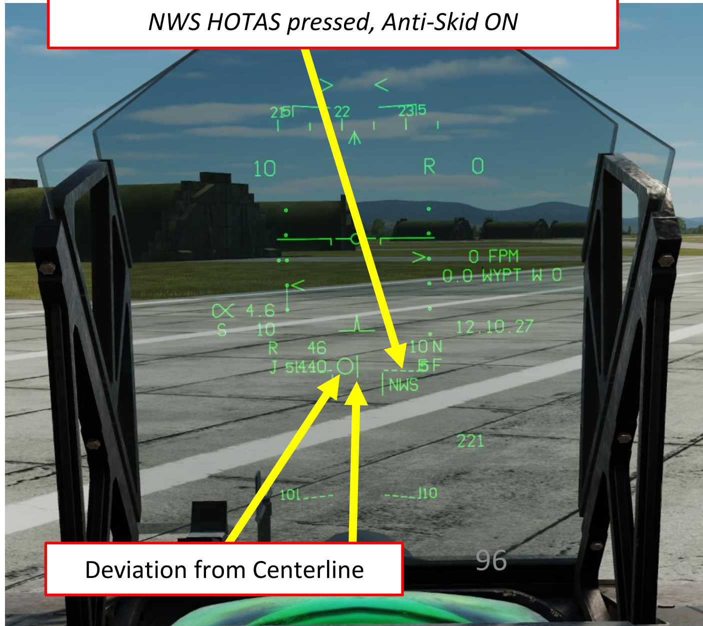


CASTER Mode
NWS HOTAS not pressed, Anti-Skid ON

NWS (LOW GAIN) Mode
NWS HOTAS not pressed, Anti-Skid OFF
OR
NWS HOTAS pressed, Anti-Skid ON



HIGH GAIN Mode
NWS HOTAS pressed, Anti-Skid OFF



Deviation from Centerline

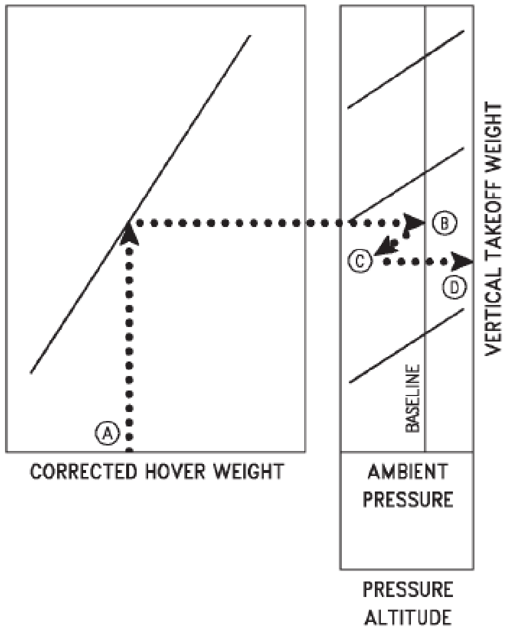
2 - TAKEOFF PRINCIPLES

Taking off and landing in the Harrier is one of the most interesting part of the aircraft: you can takeoff using a conventional method, but you can also takeoff vertically or perform a rolling takeoff depending on how much runway you have available or if you are operating on a FARP (Forward Arming & Refueling Point), an aircraft carrier or an amphibious assault ship like the LHA-1 USS Tarawa.

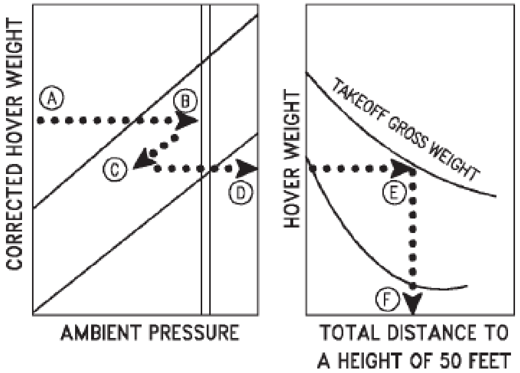
Taking off in real life requires performance charts to estimate various parameters like the Nozzle Rotation Airspeed (NRAS). There are documents with charts and graphs to calculate everything you need, but you do not have to use them for DCS.

Don't gasp in horror like that, we won't go as deep. I'll just give you some ballpark figures to get you up to speed without having to do much performance calculations.

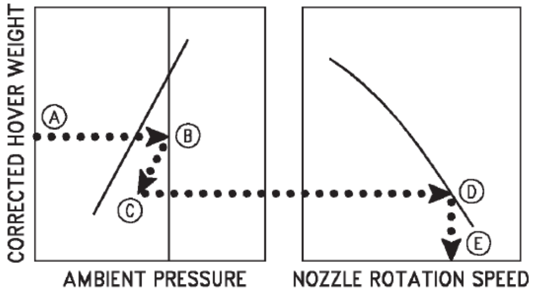
SAMPLE VERTICAL TAKEOFF CAPABILITY



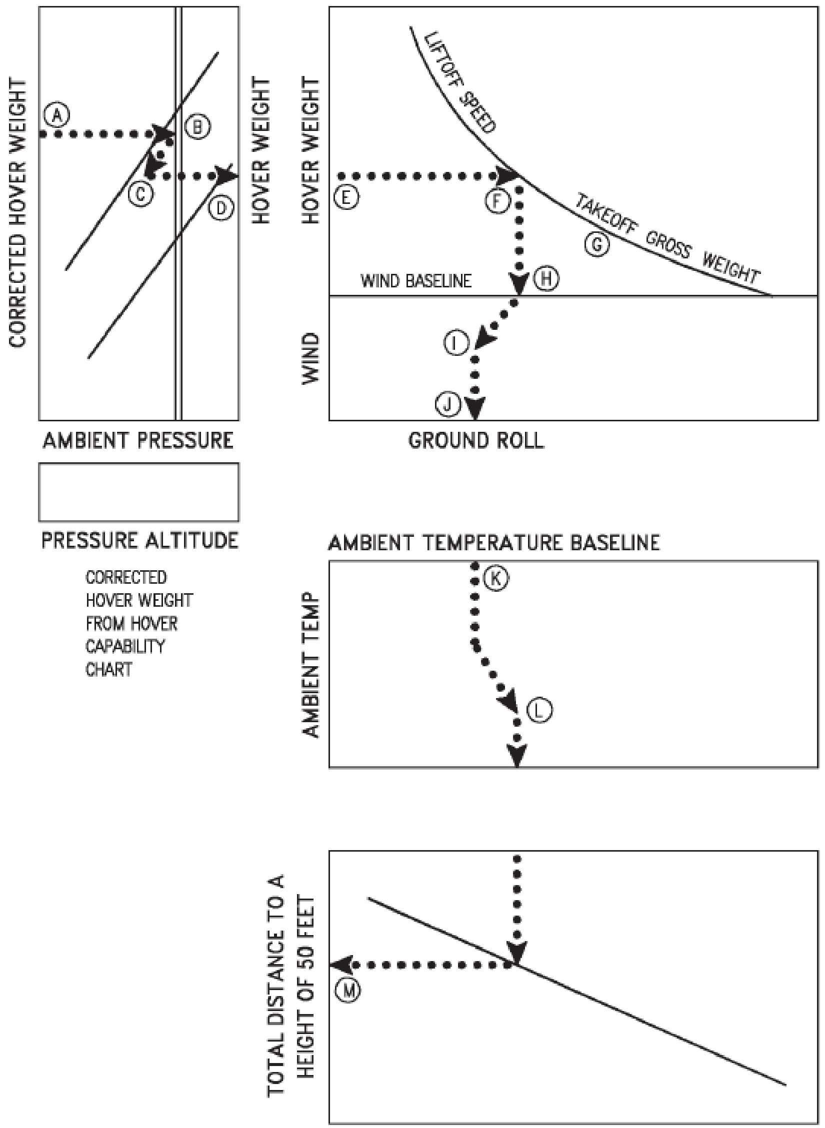
SAMPLE ROLLING VERTICAL TAKEOFF CAPABILITY



SAMPLE SHORT TAKEOFF ROTATION SPEED



SAMPLE CONVENTIONAL TAKEOFF DISTANCE



2 - TAKEOFF PRINCIPLES

Flyco on the Eagle Dynamics forums graciously produced a data sheet giving representative data for takeoff. This is accurate only for Standard Temperature and Pressure (ISA, or 29.92 in Hg/1013,25 hPa and 15 degrees C).

Performance

Best Climb Speed 300 kts > 0.78M

Penetration 280 kts

Diversion

Climb @ 300 kias to Cruise Ht shown Cruise @ MN shown Descend @ 230 kias

Fuel remaining at bottom of descent 800 lbs (200 lbs for Vert Ldg + 600 lbs reserve)

Fuel Remaining	1000 lbs	1500 lbs	2000 lbs	3000 lbs
Climb to Height	5,000 ft	30,000 ft	44,000 ft	44,000 ft
Cruise at	0.40 M	0.62 M	0.78 M	0.75 M
Total Range	17 nm	84 nm	178 nm	357 nm

AV-8B – DATA & LIMITATIONS

Aircraft Weights ZFW – 13,537 lbs Max Int Fuel & Water – 21,737 lbs

Max Wt – 31,086 lbs Max Ldg Wt – 26,000 lbs

Limiting Speeds Max - 585 kias, 1.0 M Gear - 250 kias Flaps - 300 kias 0.87 M

Engine Limits Max Continuous 102 % 645 °C

		15 secs	1½ mins	2½ mins	10 mins	15 mins
Wet	RPM	120 %	116%			
	JPT	800 °C	780 °C			
Dry	RPM	113.5 %		111 %	111 %	109 %
	JPT	780 °C		765 °C	750 °C	710 °C

Take-Off Data All at Standard Temperature & Pressure (STP)

Hover Power for Weight

Weight lbs	14000	16000	18000	20000	20,755
RPM	100.4 %	104.3 %	108.3 %	113.5 %	116.0 %
JPT	627 °C	667 °C	707 °C	758 °C	780 °

Short Take-Off

Weight	18,000	20,000	24,000	28,000	30,000	31,000
NRAS	77 kts	81 kts	88 kts	96 kts	98 kts	101 kts
Nozzle	60 °	60 °	60 °	60 °	55 °	50 °
Distance	550 ft	610 ft	750 ft	850 ft	970 ft	1100 ft

Conventional Take-Off

Weight	18,000	20,000	24,000	28,000	30,000	31,000
Lift-off Speed	135 kts	135 kts	139 kts	153 kts	160 kts	164 kts
Distance						

Landing Data At STP

Conventional Landing

Weight	18,000	20,000	24,000	28,000	30,000	31,000
Threshold Speed	142 kts	135	135	139	175 kts	183 kts
Distance	5200 ft				8500 ft	

3 - TAKEOFF TYPES

Conventional Takeoff (CTO):

The CTO can be used when configuration or environmental conditions preclude use of any other takeoff type (i.e. crosswinds or asymmetric loadings). The CTO is restricted to gross weights that will not cause the wheel/tire limitation speed of 180 KGS (Knots, Ground Speed) to be exceeded on the takeoff roll.

Short Takeoff (STO):

The STO can be used for the widest variety of aircraft configuration, weight and runway conditions provided that crosswinds remain within specified limits.

Vertical Takeoff (VTO):

Vertical Takeoff is perfect when you have less than 100 ft of available takeoff distance, like in a FARP (Forward Arming Refueling Point) or a FOB (Forward Operating Base). However, the limiting factor is the aircraft weight; you are more limited in the type/amount of payload the aircraft can carry. As much as possible, vertical takeoff should be performed into the wind. Lateral control during the first few feet of a VTO is critical; do not hesitate to make immediate, large and rapid control movements to counteract bank angles.

Rolling Vertical Takeoff (RVTO):

The RVTO requires approximately 100 feet of ground roll and should be made as nearly into the wind as possible.

Takeoff Crosswind Restrictions	
Conventional (CTO)	20 kts (Day or Night)
Short (STO) > 120 kts	15 kts (Day or Night)
Short (STO) <= 120 kts	10 kts (Day or Night)
Rolling Vertical (RVTO)	Day: 10 kts Night: 5 kts
Vertical (VTO)	10 kts (Day or Night)

4 - CONVENTIONAL TAKEOFF (CTO)

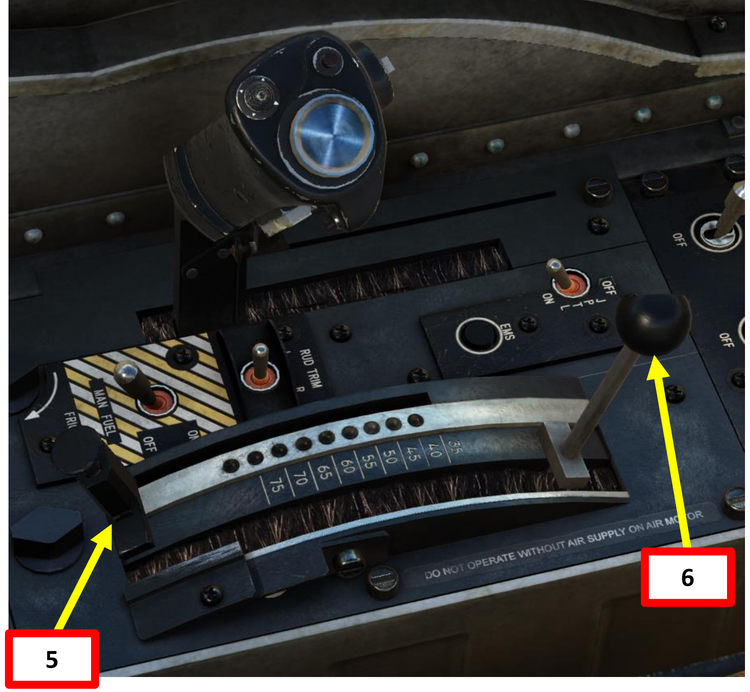
1. Press the V/STOL Master Mode button to colonize the ODU (Option Display Unit) with V/STOL (Vertical/Short Takeoff & Landing) options.
2. Select ODU button next to NRAS (“:” means selected), then enter “135” on the UFC scratchpad, then press “ENT”. Nozzle Rotation Airspeed (NRAS) is not used for conventional takeoff, but the NRAS setting will box the HUD airspeed indicator when the aircraft has reached the entered NRAS speed. In our case, 135 kts is our rotation speed on takeoff.
3. Select ODU button next to PC, or “Pitch Caret” (“:” means selected), then verify that “14 deg” is the value displayed on the UFC scratchpad, then press “ENT”. This means the Pitch Carets are placed 6 deg above the horizon, where we will seek to place the Depressed Attitude Indicator / Witch’s Hat for an accelerating transition into a positive rate of climb.
4. Since we will do a conventional takeoff on a pretty long runway, we will skip the use of the VREST page to calculate the Abort Speed (ASPD) and Stopping Distance (SDST). This will be further explored in the Short Takeoff tutorial.

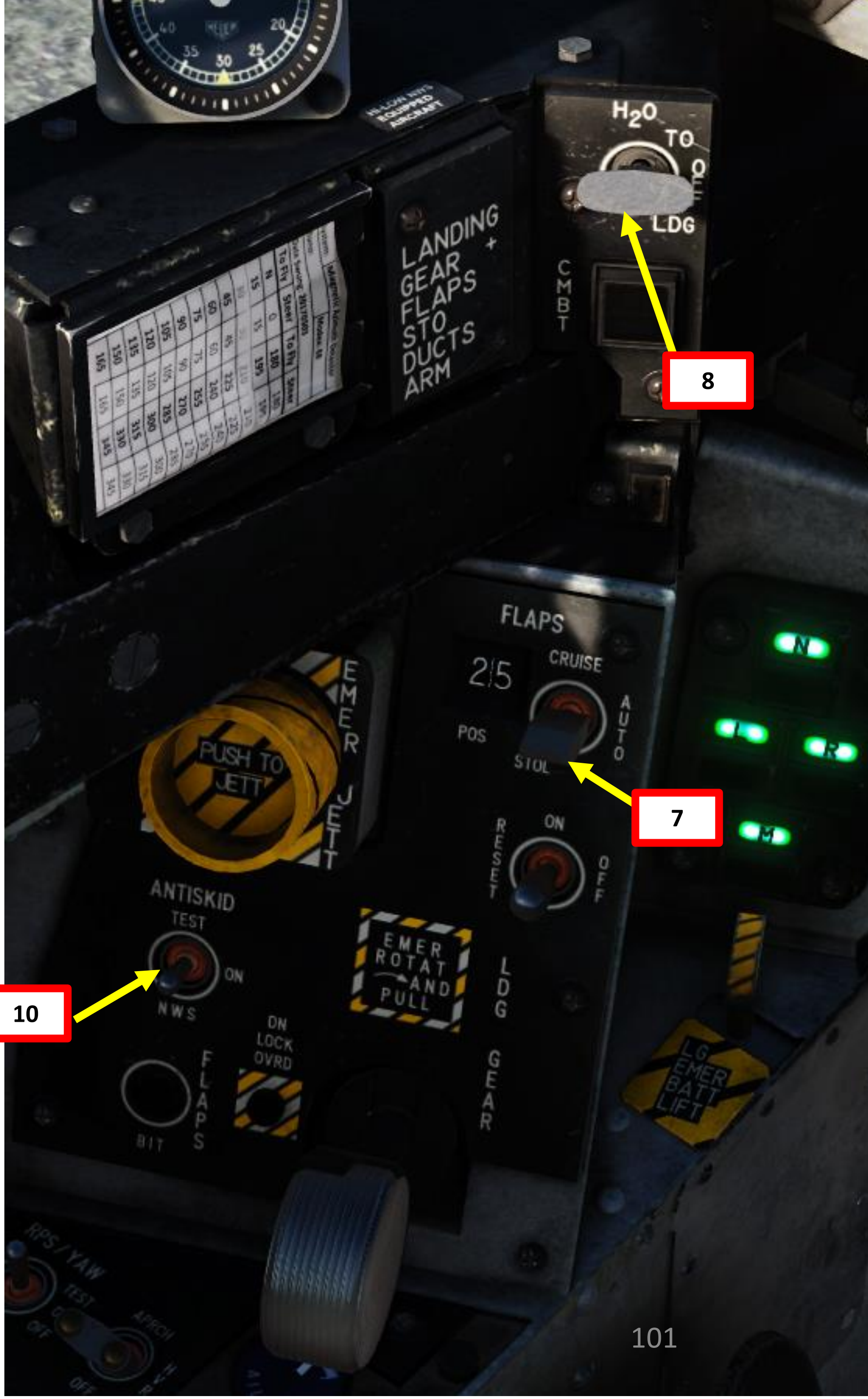
AV-8B HARRIER II

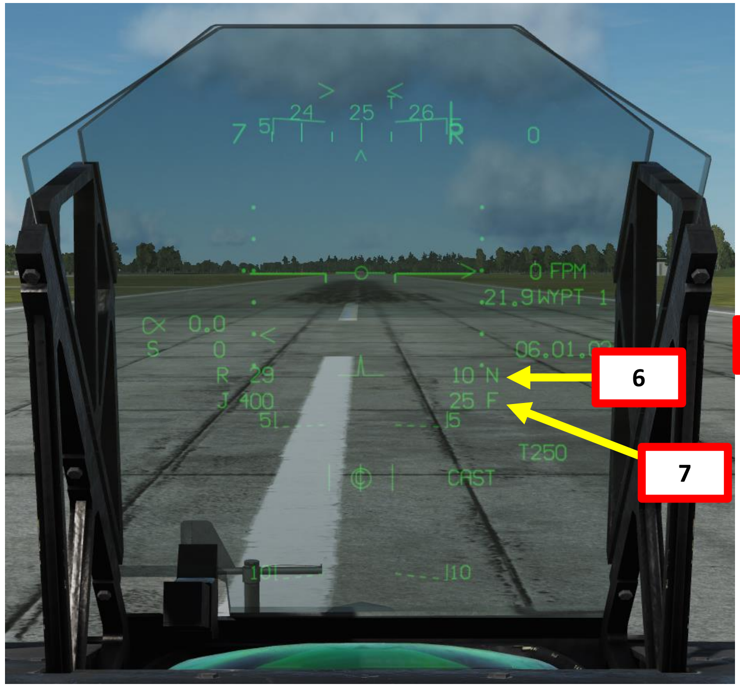
PART 5 – TAKEOFF

4 - CONVENTIONAL TAKEOFF (CTO)

5. Set STO STOP stopper fully AFT (CLEAR)
6. Set Nozzle Position Lever – 10 deg
7. Flaps Lever – AUTO
8. Set H2O Water Injection Switch – TAKEOFF (UP) (only if required in case of heavy payload)
9. Set Stabilator Trim to Takeoff Trim (2 deg nose down)
10. Check that Anti-Skid Switch is ON
11. Hold Brakes

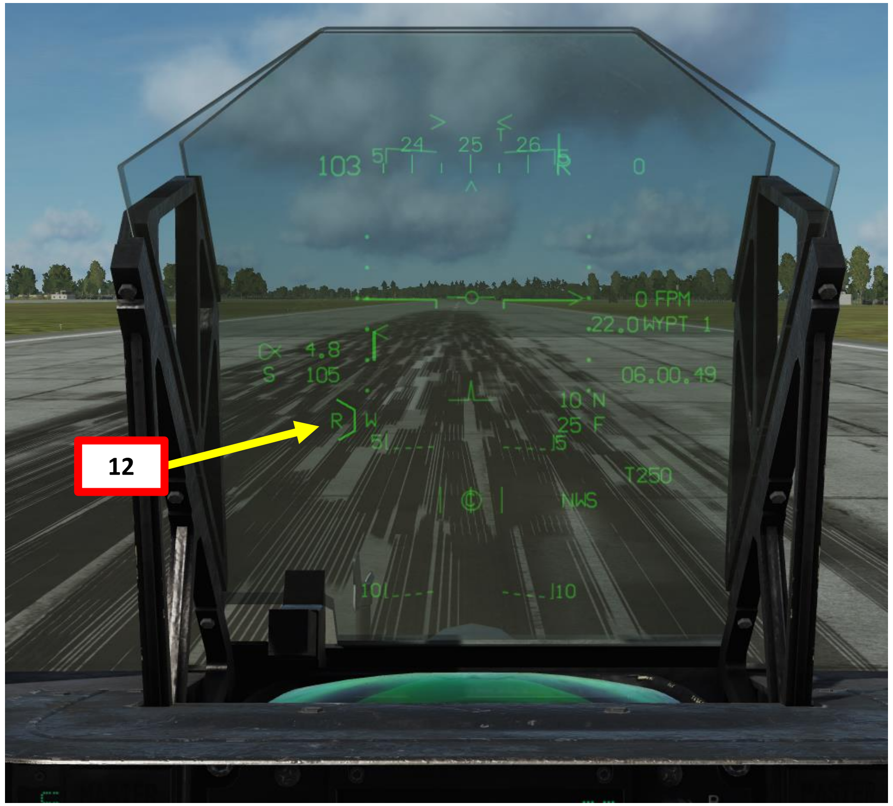


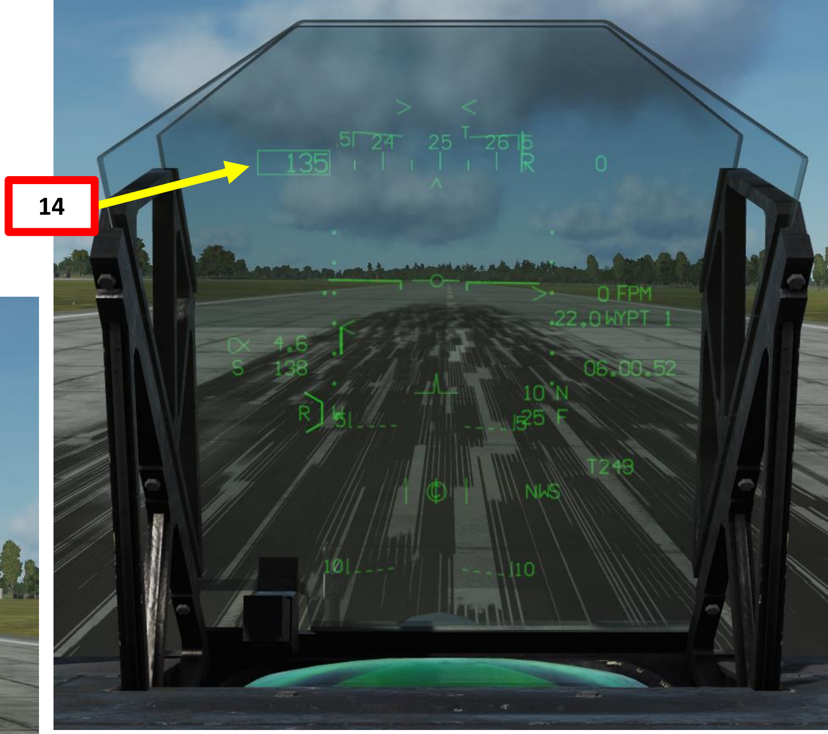


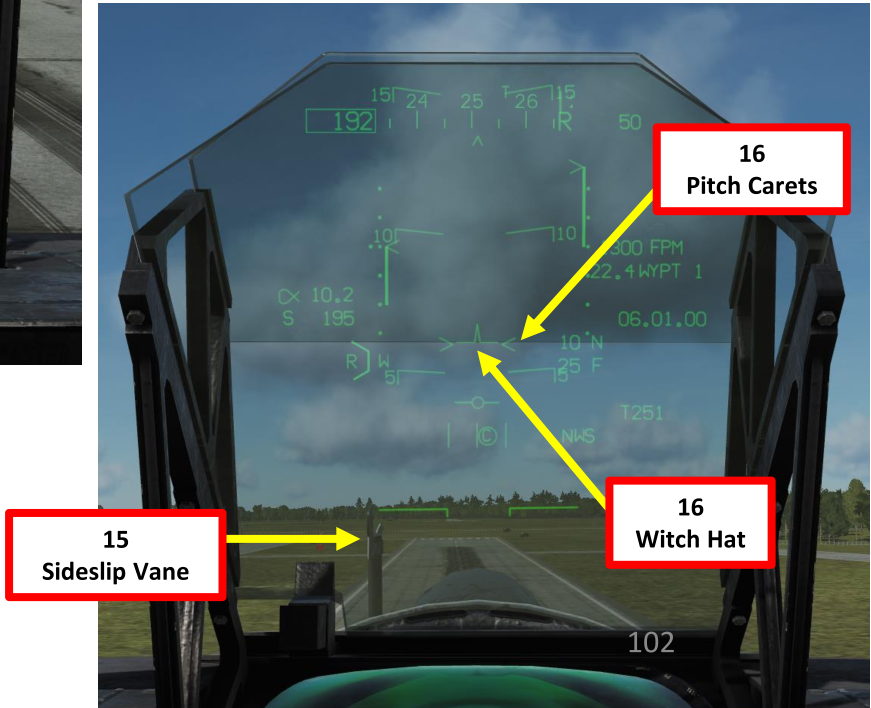


4 - CONVENTIONAL TAKEOFF (CTO)

12. Throttle up (make sure the limit icon does not go to FULL) and press the NWS HOTAS button to line up the aircraft with the center of the runway if need be
13. You will begin to have aerodynamic control of the rudder at 50-60 kts
14. Rotate very gently at around 135 kts
15. During liftoff, ensure wings remain level and center the sideslip vane to takeoff into the wind
16. Set aircraft attitude: line up Witch Hat with the Pitch Carets (currently set to a fixed value of 14 deg, or 6 deg elevation above horizon line).
17. After liftoff, set landing gear lever UP
18. Gradually set Nozzles to 0 deg
19. Set Water H2O Water Injection Switch – OFF (MIDDLE)

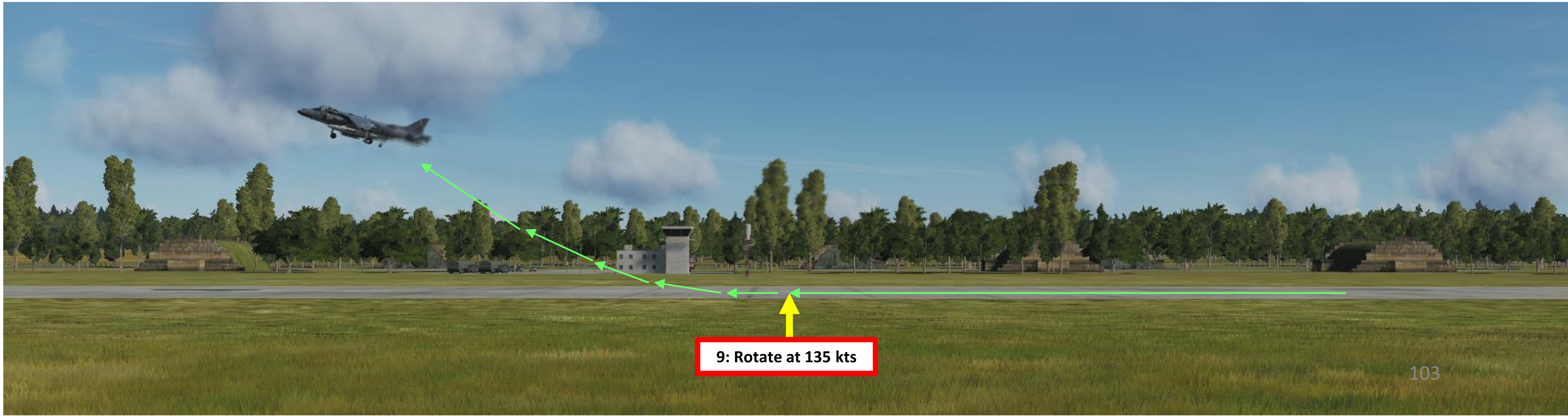






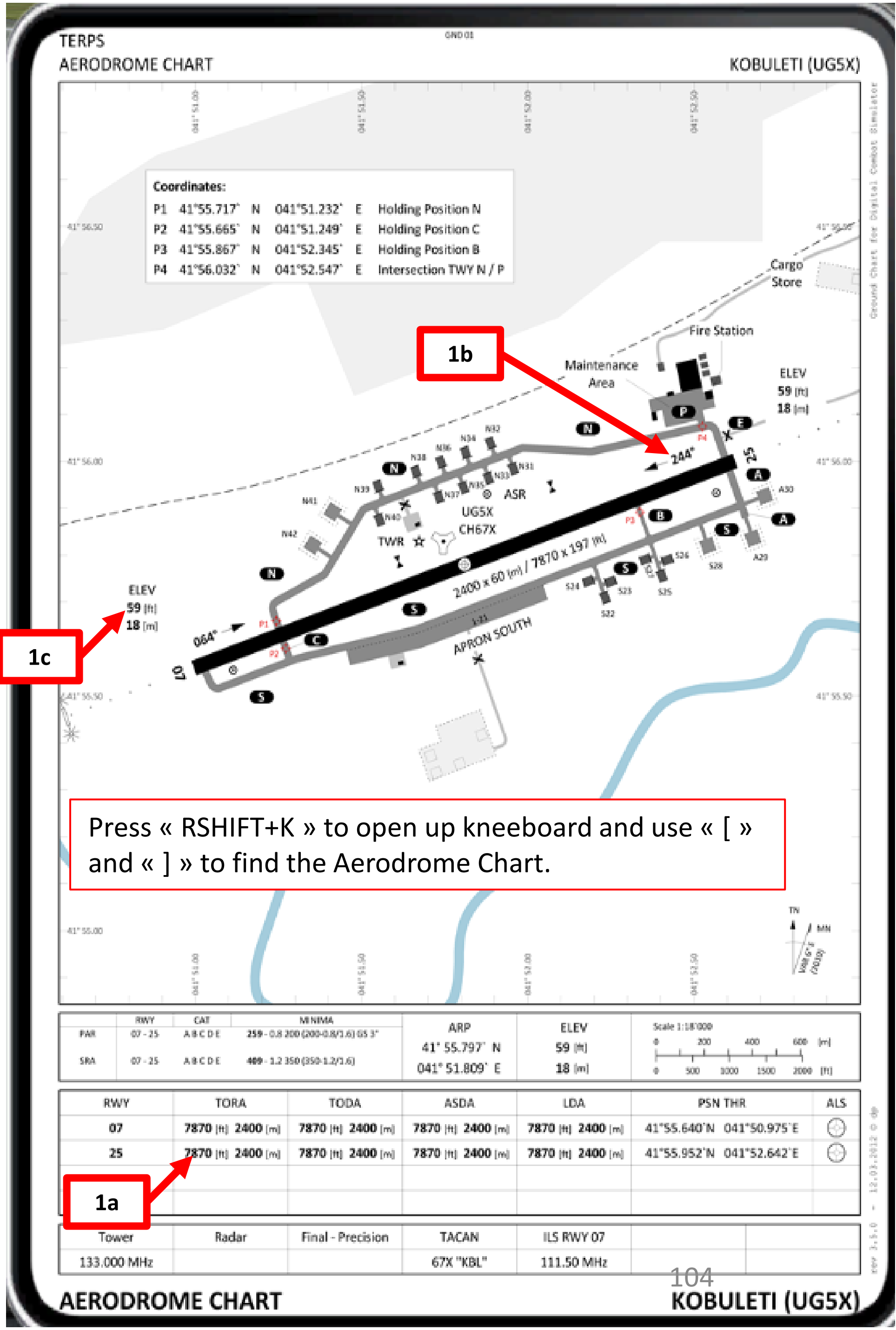
4 - CONVENTIONAL TAKEOFF (CTO)

CHECK THE ENGINES SECTION TO KNOW MORE ABOUT ENGINE OPERATION & LIMITS



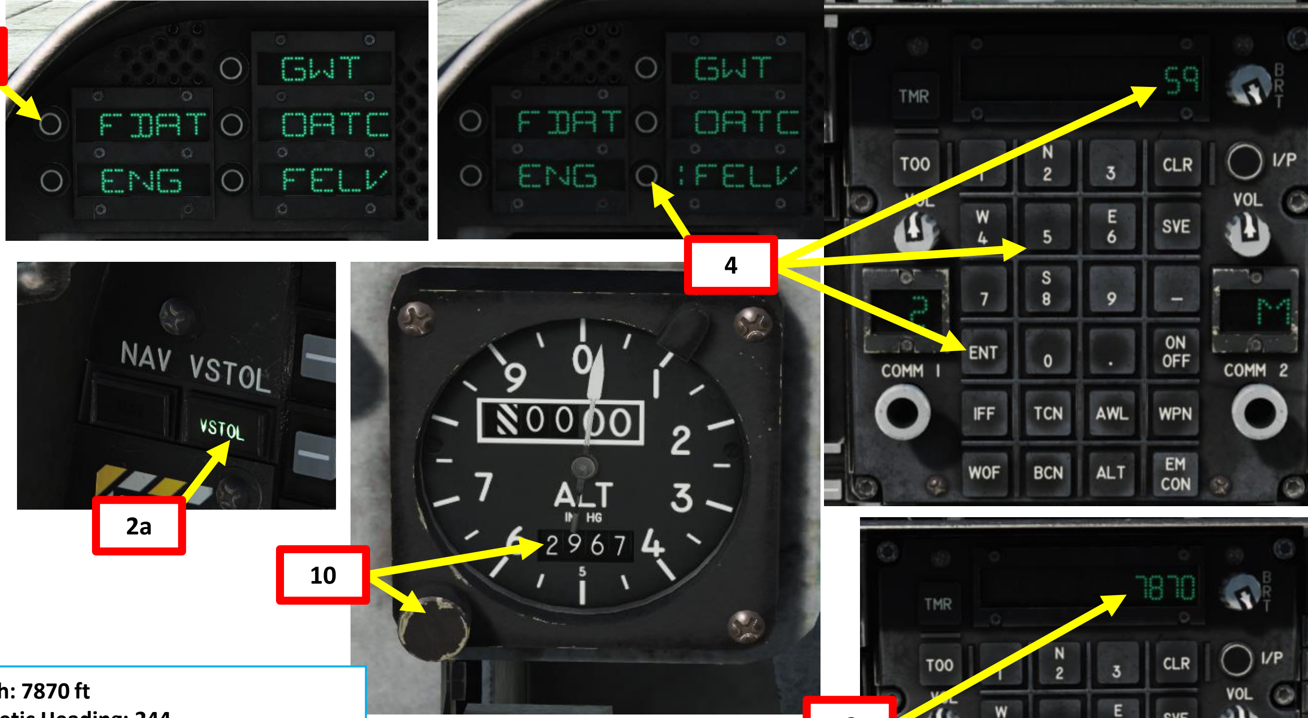
5 - SHORT TAKEOFF (STO)

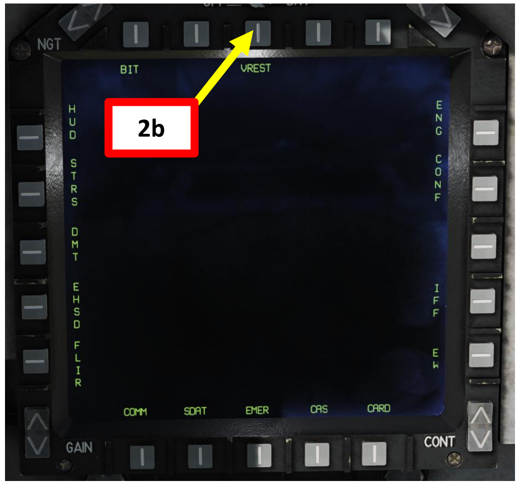
1. First, we need to gather the following information:
   - **a) Runway Length** (**7870 ft**, obtained by using "RSHIFT+K" to open kneeboard, and "[" and "]" to find the page for the desired airport (Kobuleti in our case)
   - **b) Runway Magnetic Heading** (**244** Magnetic for Runway 25)
   - **c) Field Elevation** (**59** ft)
   - **d) Barometric Pressure Setting** (**29.67** in Hg, obtained by contacting tower on the radio and requesting takeoff clearance)
   - **e) Wind** information (Magnetic Heading/Speed is **160 deg/ 009 kts**, given in the Mission Briefing page).

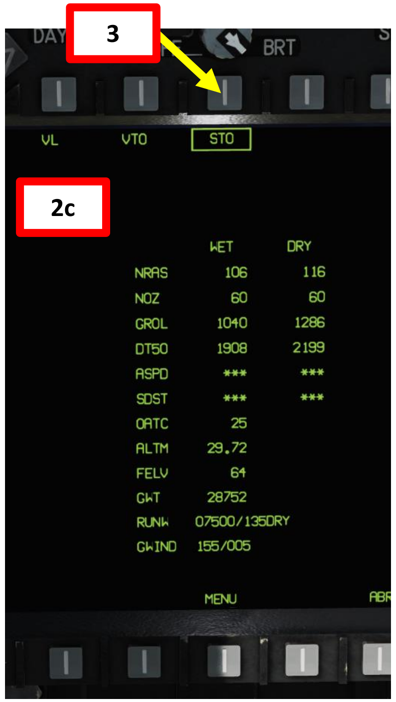


5 - SHORT TAKEOFF (STO)

2. Make sure the V/STOL Master Mode button is active and the VREST page is accessible from the MPCD main menu, then select VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page.
3. Press OSB next to “STO” to select “Short Takeoff” sub-page.
4. Select FELV (Field Elevation) ODU, enter 59 ft on the UFC, then press ENT.
5. Select FDAT (Field Data) ODU. “:” means it is selected.
6. Select RDIS (Runway Distance) ODU, enter 7870 on the UFC, then press ENT.
7. Select RHDG (Runway Heading) ODU, enter 244 on the UFC, then press ENT.
8. Select GWND (Ground Wind) ODU, enter 160/009 on the UFC, then press ENT.
9. Select RDRY (Runway Dry/Wet State) ODU: Dry = “:” or Wet = Empty.
10. Adjust Barometric Pressure Setting to 29.67 in Hg.



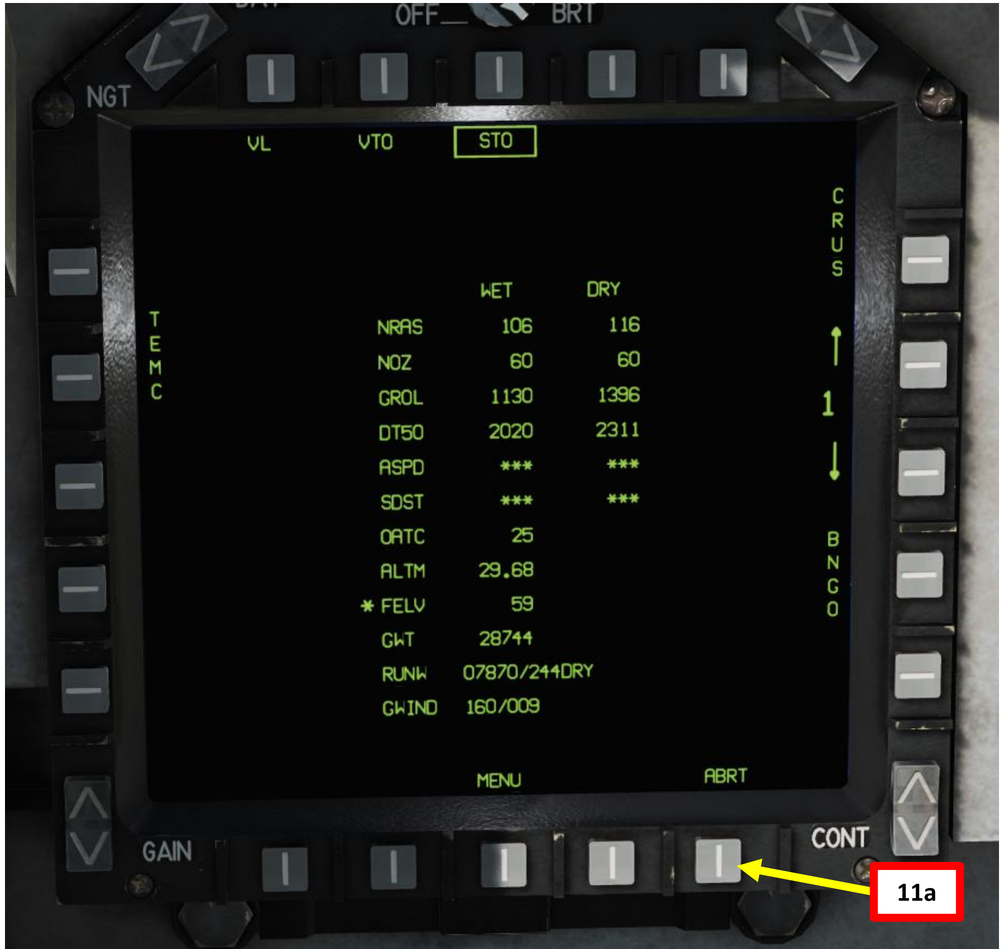


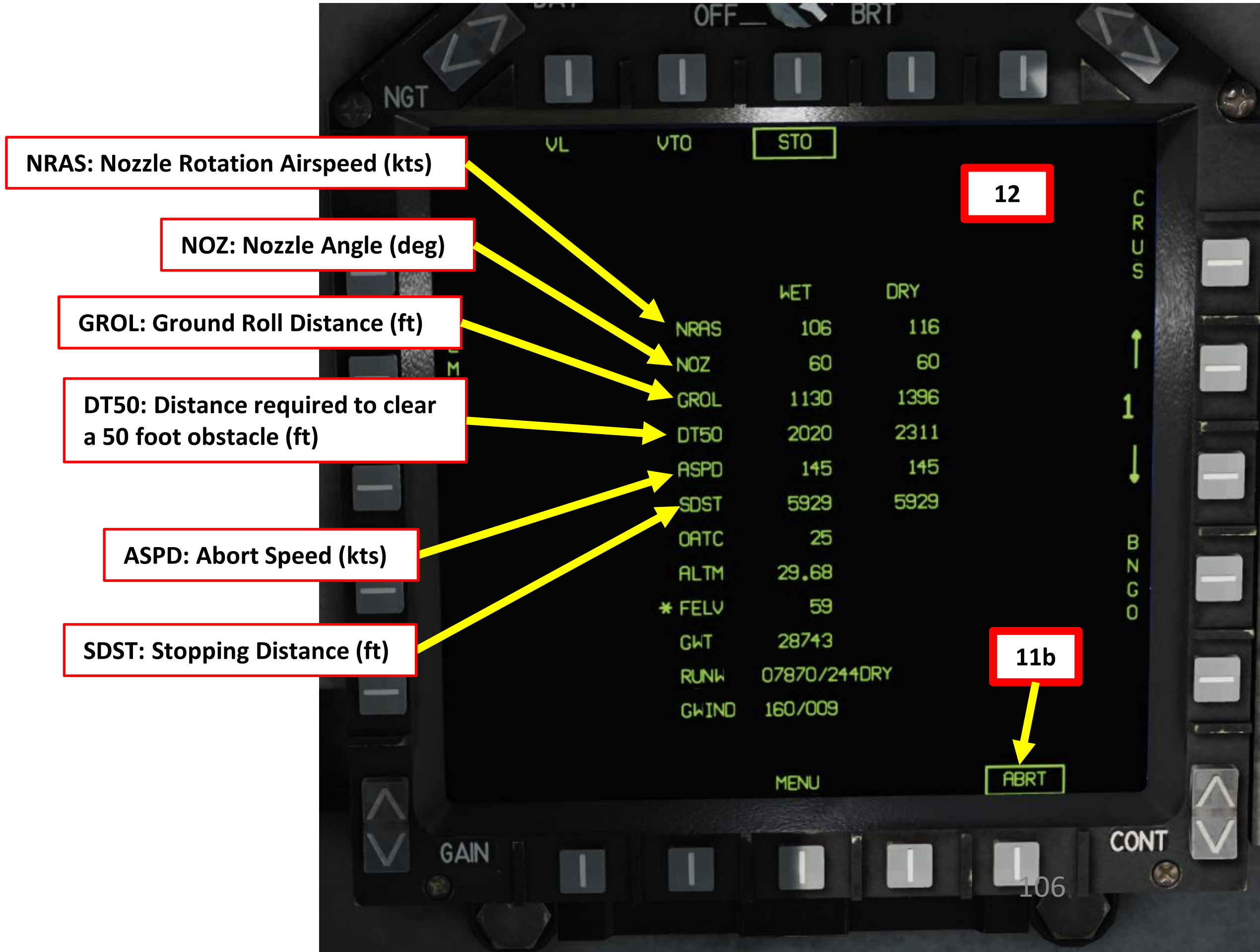


Runway Length: 7870 ft
Runway Magnetic Heading: 244
Field Elevation: 59 ft
Barometric Pressure Setting: 29.67 in Hg
Wind Magnetic Heading/Speed: 160 deg/ 009 kts

5 - SHORT TAKEOFF (STO)

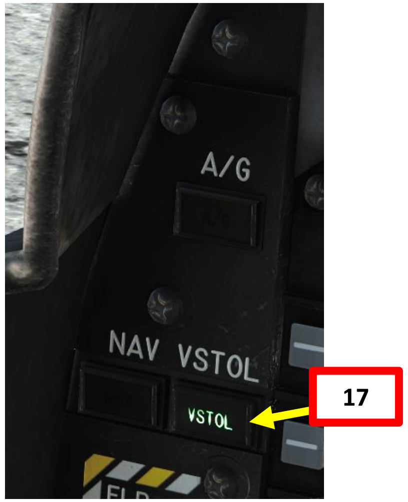
11. On the VREST STO page, press the OSB next to “ABRT” to calculate your Abort Criteria.
12. A number of takeoff parameters are then calculated for Wet Thrust (with Water Injection Cooling) and Dry Thrust (without Water Injection Cooling).
13. A NRAS (Nozzle Rotation Airspeed) is the speed at which we will rotate the nozzle. We will use 106 kts.
14. A NOZ (Nozzle Angle) setting is the nozzle angle we will use to transition from forward acceleration to a positive rate of climb.
15. Your ASPD (Abort Speed) is calculated for Wet Thrust (with Water Injection Cooling) and Dry Thrust (without Water Injection Cooling). Below this speed you can still abort your takeoff, but above this speed your are committed to takeoff.
16. Your SDST (Stopping Distance) is calculated as well in feet. This is not particularly useful for ground airports with no distance markings, but this value is useful for ship takeoffs on the LHA-1 Tarawa since you will have a much shorter distance available for takeoff and there are distance markings on the ship.

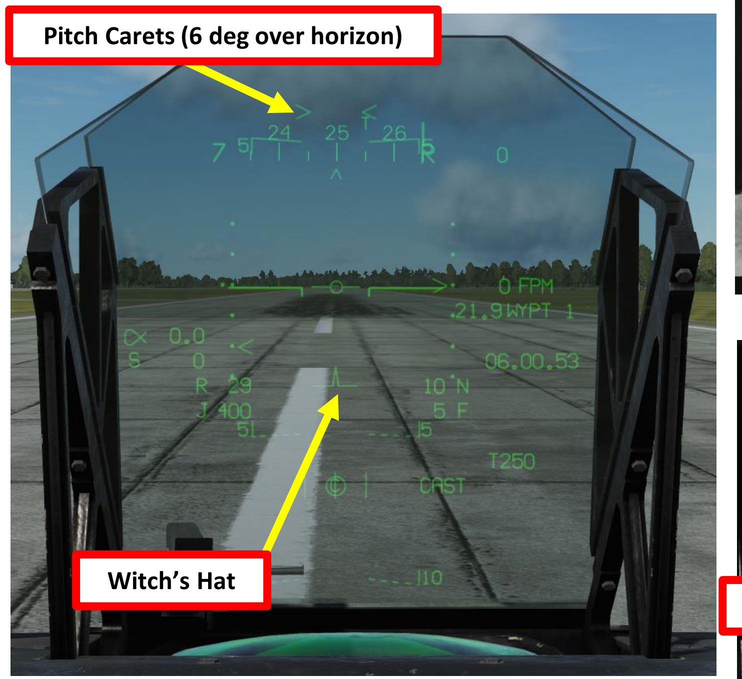




5 - SHORT TAKEOFF (STO)

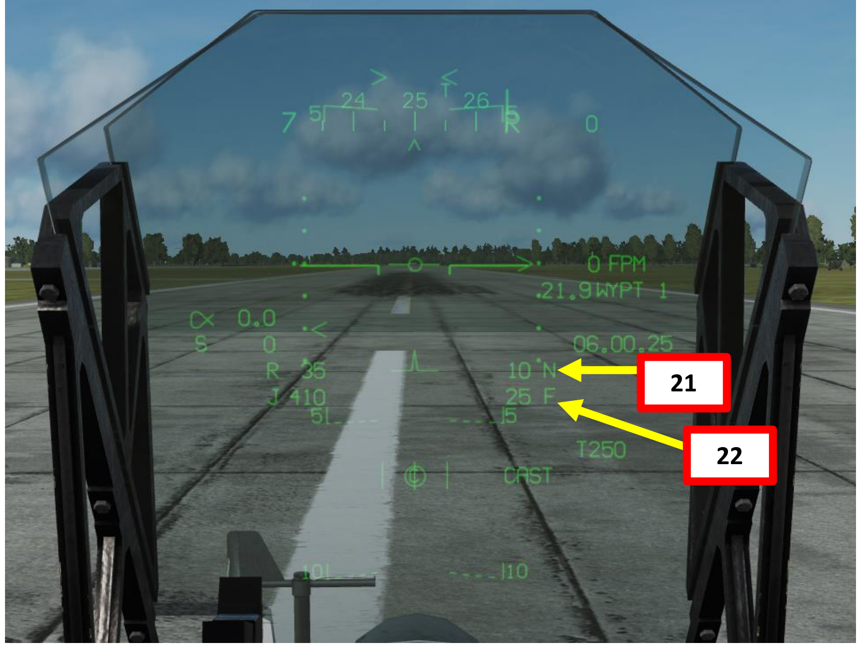
17. Press the V/STOL Master Mode button to colonize the ODU (Option Display Unit) with V/STOL (Vertical/Short Takeoff & Landing) options.
18. Select ODU button next to NRAS (":" means selected), then enter "106" on the UFC scratchpad, then press "ENT". Nozzle Rotation Airspeed (NRAS) setting will box the HUD airspeed indicator when the aircraft has reached the entered NRAS speed, at which we shall rotate the nozzle from 10 deg to the required NOZ nozzle angle calculated on VREST page (60 deg)
19. Select ODU button next to PC, or "Pitch Caret" (":" means selected), then verify that "14 deg" is the value displayed on the UFC scratchpad, then press "ENT". This means the Pitch Carets are placed 6 deg above the horizon, where we will seek to place the Depressed Attitude Indicator / Witch's Hat for an accelerating transition into a positive rate of climb.

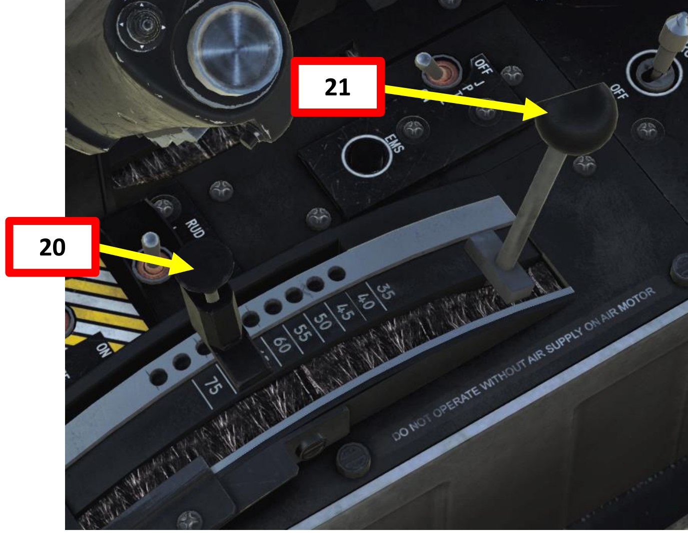


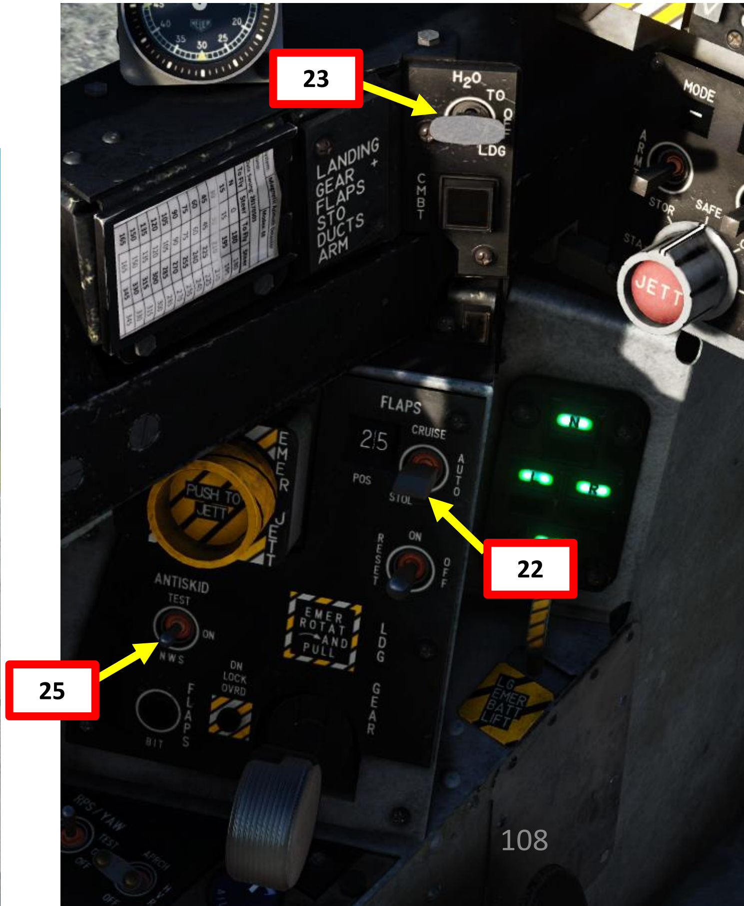


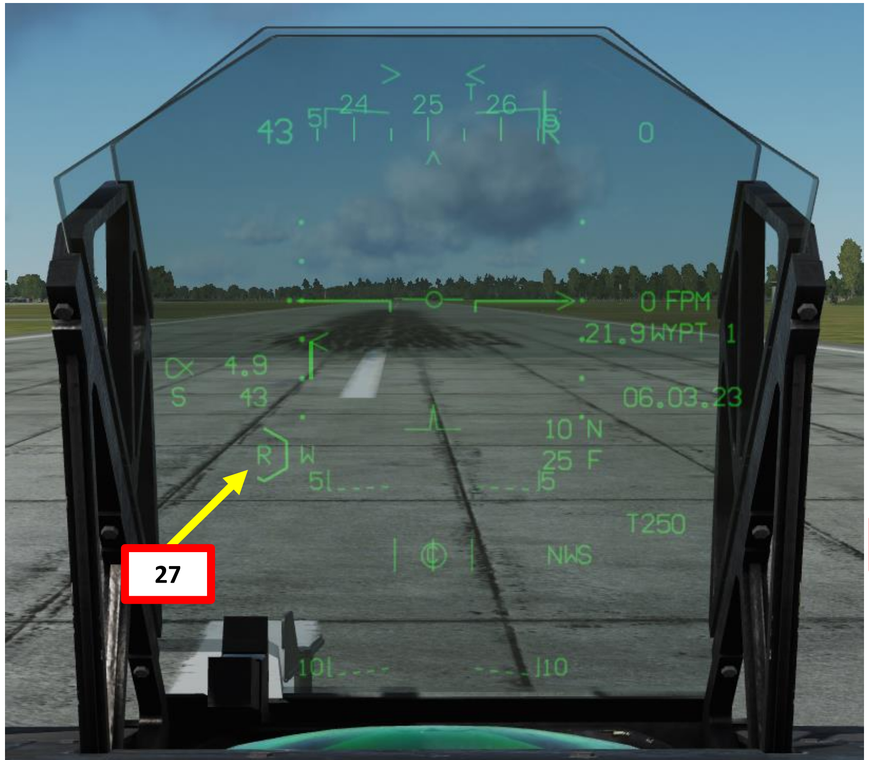
5 - SHORT TAKEOFF (STO)

20. Set STO STOP stopper at 60 deg
21. Set Nozzle Position Lever – 10 deg
22. Flaps Lever – AUTO (or STOL if desired)
23. Set H2O Water Injection Switch – TAKEOFF (UP) (only if required in case of heavy payload)
24. Set Stabilator Trim to Takeoff Trim (2 deg nose down)
25. Check that Anti-Skid Switch is ON
26. Hold Brakes
27. Throttle up (make sure the limit icon does not go to FULL) and press the NWS HOTAS button to line up the aircraft with the center of the runway if need be
28. You will begin to have aerodynamic control of the rudder at 50-60 kts



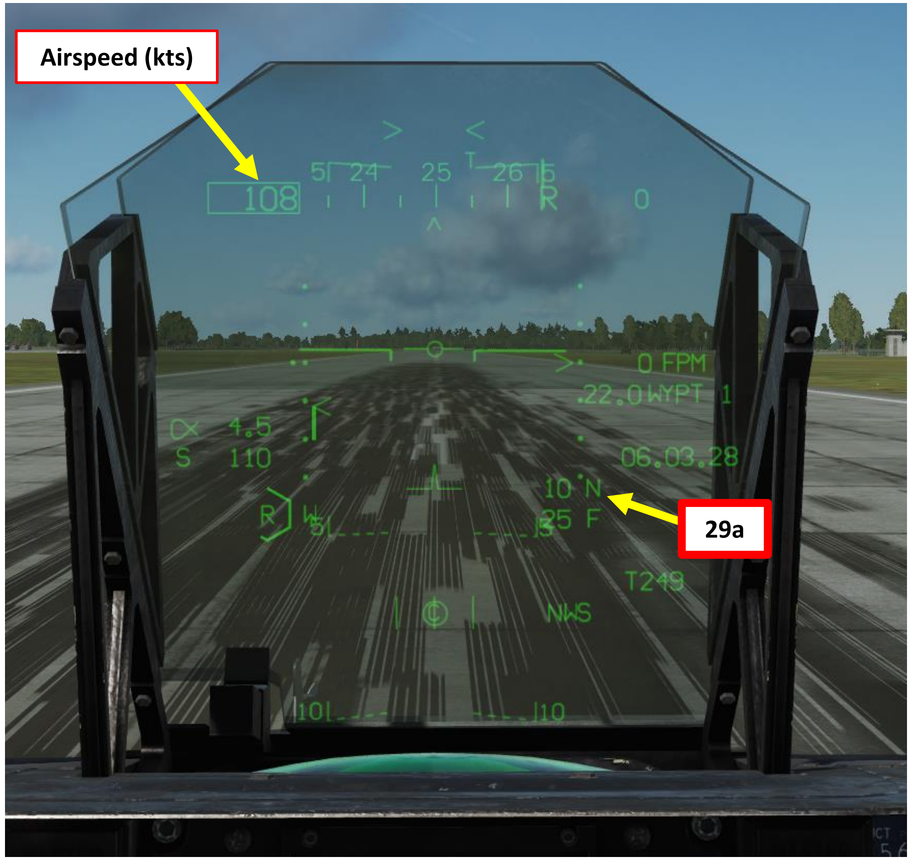


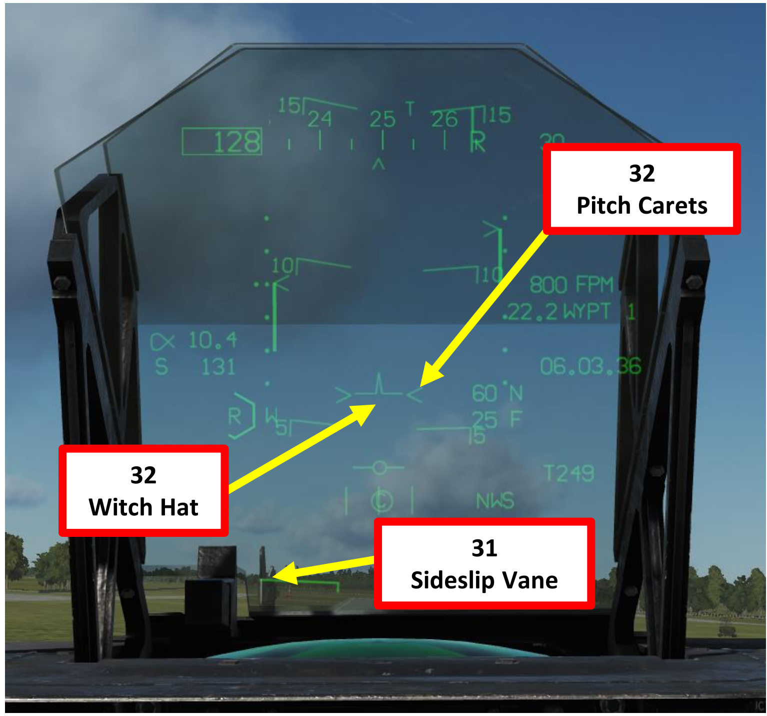




5 - SHORT TAKEOFF (STO)

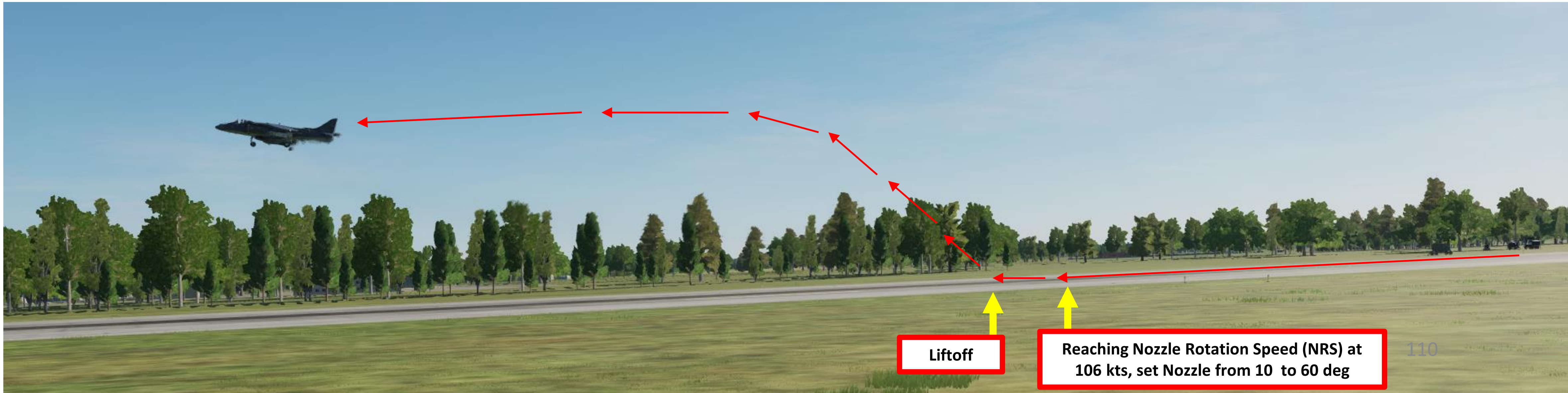
29. When reaching the Nozzle Rotation Speed (106 kts in our case), set Nozzle Position Lever AFT to the STO position set previously), which is 60 deg in our case. The STO STOP lever will act as a mechanical stopper to your Nozzle lever.
30. You should start ascending vertically
31. During liftoff, ensure wings remain level and center the sideslip vane to takeoff into the wind
32. Set aircraft attitude: line up Witch Hat with the Pitch Carets (currently set to a fixed value of 14 deg, or 6 deg elevation above horizon line).
33. After liftoff, set landing gear lever UP
34. Gradually set Nozzles to 0 deg (maintain nozzles at 25 deg while flaps are still in STOL at 25 deg)
35. Set Water H2O Water Injection Switch – OFF (MIDDLE)





5 - SHORT TAKEOFF (STO)

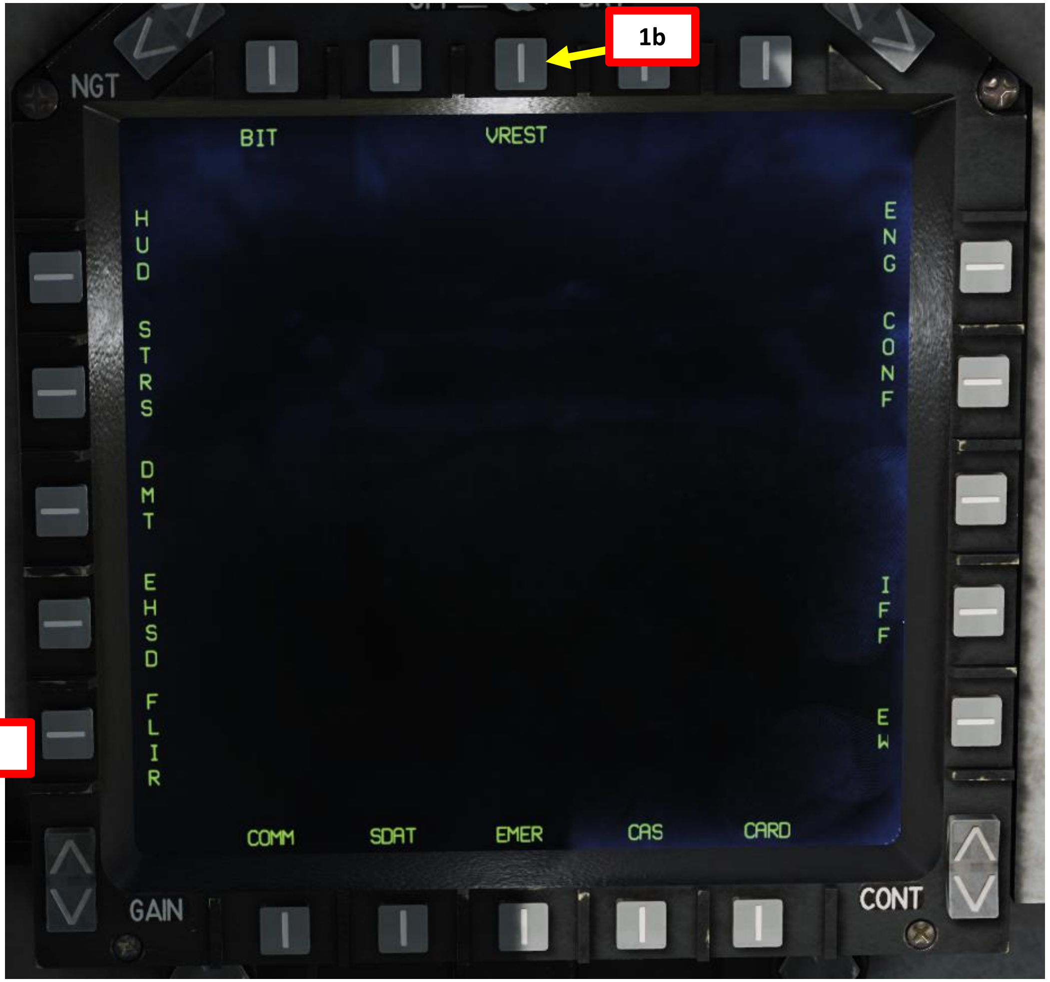
CHECK THE ENGINES SECTION TO KNOW MORE ABOUT ENGINE OPERATION & LIMITS

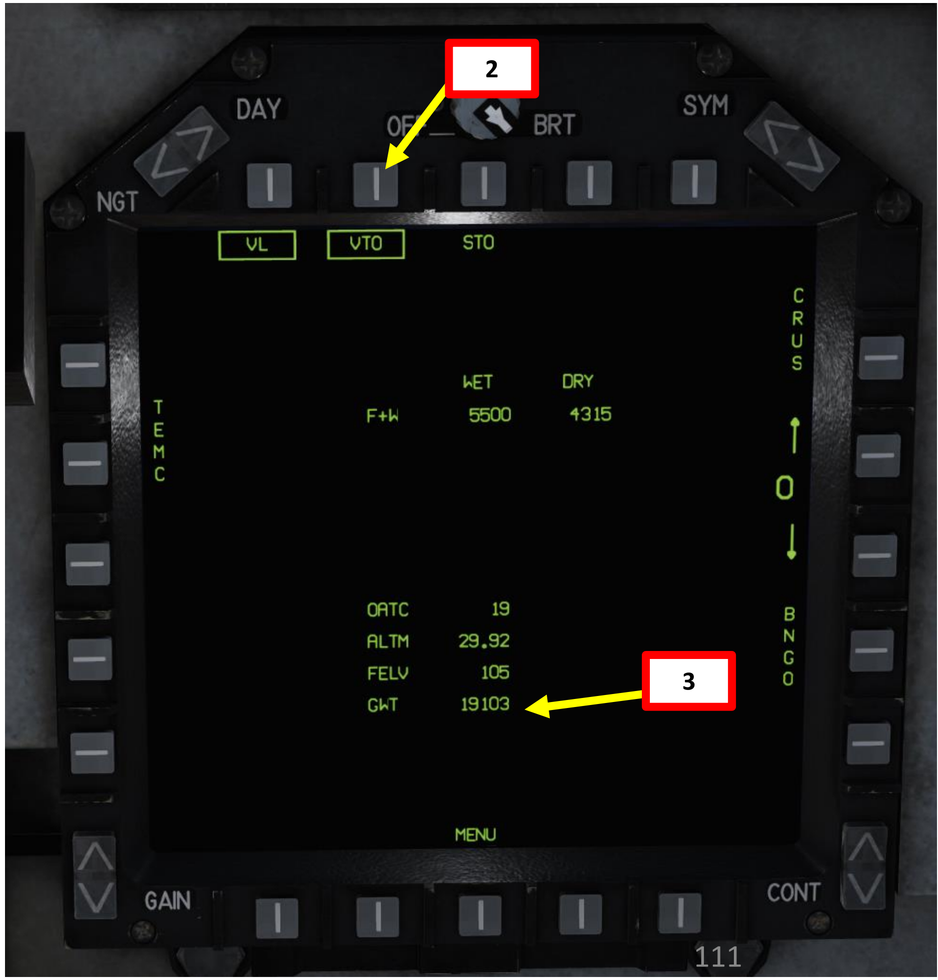


6 - VERTICAL TAKEOFF (VTO)

Note: Check beforehand that your aircraft weight is **below 20500 lbs** or you may never leave the ground. Vertical takeoffs are very restrictive in terms of what payload you can carry.

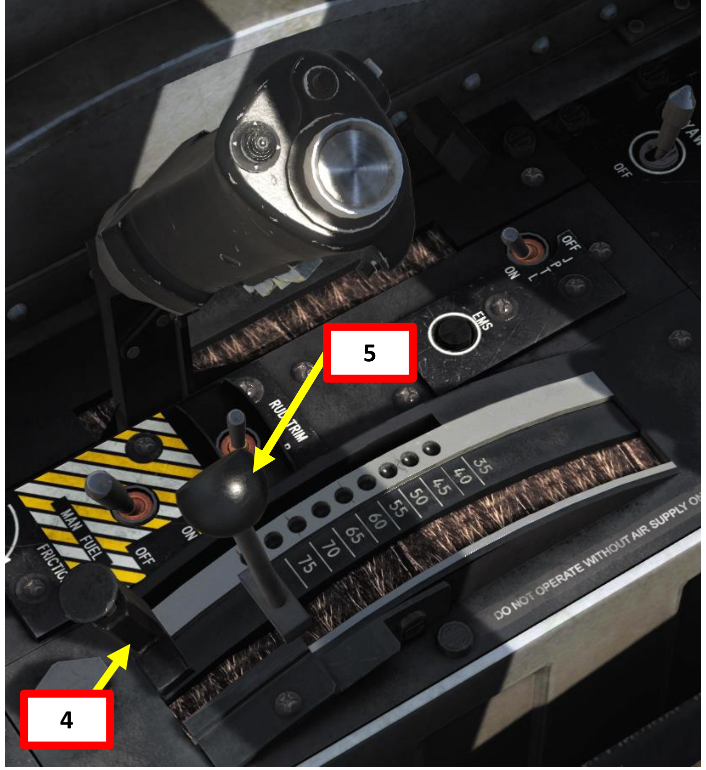
1. Make sure the V/STOL Master Mode button is active and the VREST page is accessible from the MPCD main menu, then select VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page.
2. Press OSB next to "VTO" to select "Vertical Takeoff" sub-page.
3. Make sure the GWT (Gross Weight) computed is below 20500 lbs.

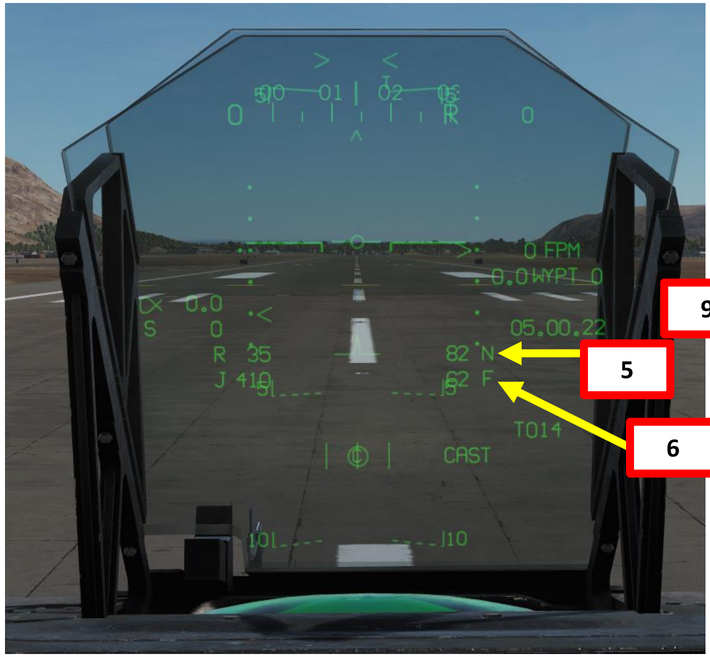




6 - VERTICAL TAKEOFF (VTO)

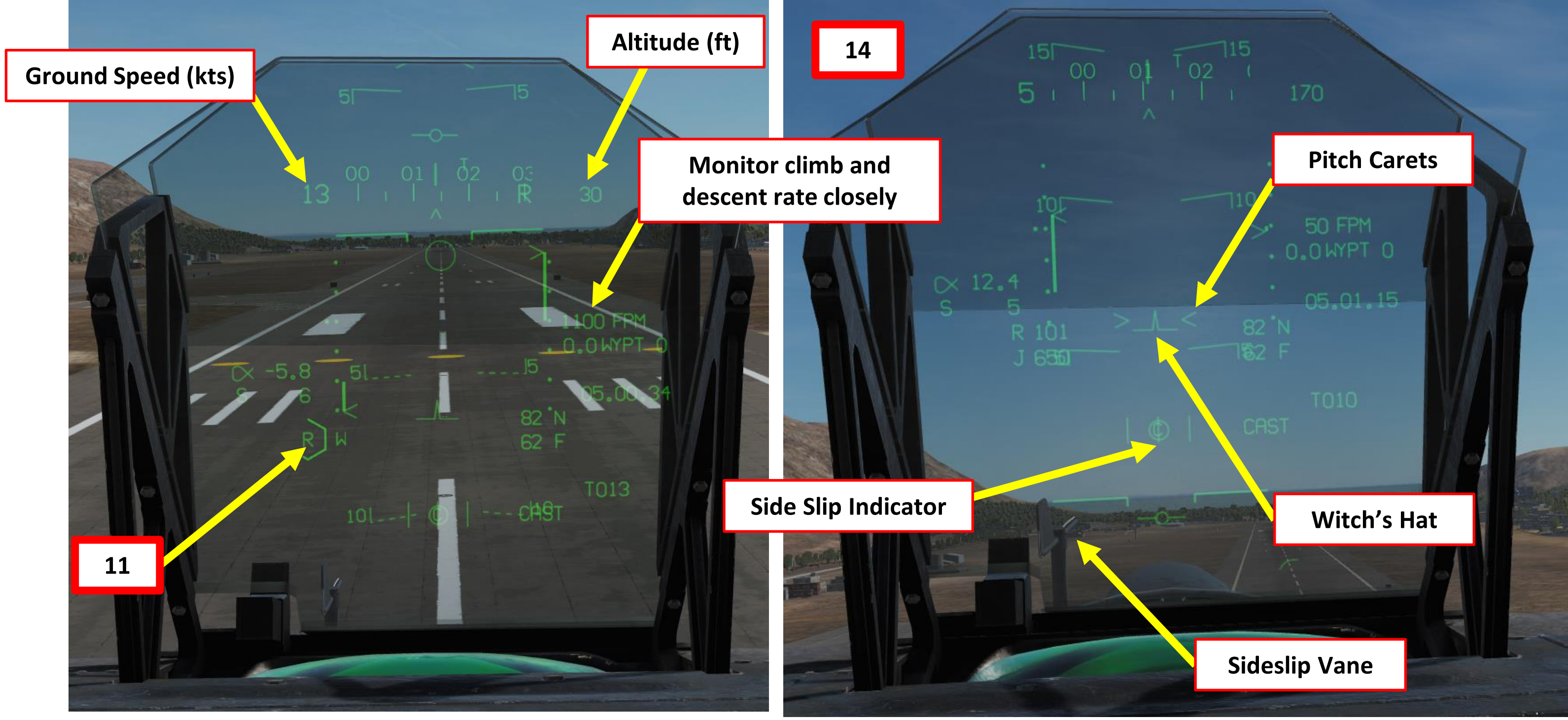
4. Set STO STOP stopper fully AFT (CLEAR)
5. Set Nozzle Position Lever – 82 deg
6. Flaps Lever – STOL (61 deg)
7. Set H2O Water Injection Switch – TAKEOFF (UP) (only if required in case of heavy payload)
8. Set Stabilator Trim to Takeoff Trim (2 deg nose down)
9. Check that Anti-Skid Switch is ON
10. Hold Brakes





6 - VERTICAL TAKEOFF (VTO)

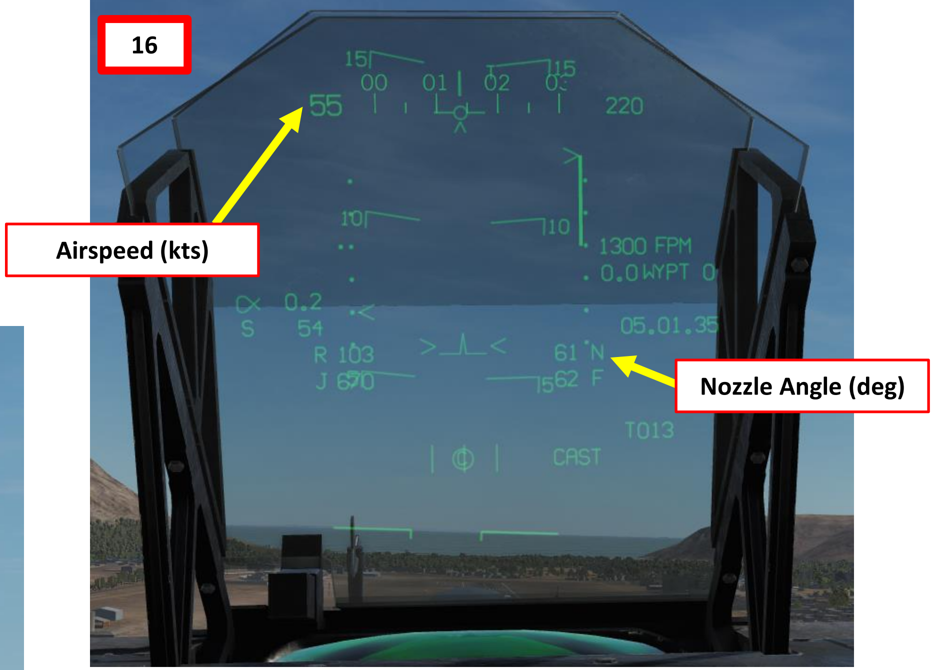
11. Throttle up gradually until liftoff in one smooth motion (make sure the limit icon does not go to FULL)
12. During liftoff, ensure wings remain level and center the sideslip vane to takeoff into the wind. Adjust attitude to prevent fore/aft drift. Refrain from pulling on the stick unless forward speed is developing, as hot RCS (Reaction Control System, which controls engine thrust to maintain a specific aircraft attitude) gas from the nose will raise temperatures and reduce engine performance.
13. When clear of ground effect (20-25 ft), gradually reduce power to establish hover.
14. When passing 50 ft and clear of obstacles, set your accelerating attitude by placing the Witch's Hat at the Pitch Carets (14 deg) and begin nozzling out towards 0 deg simultaneously.
15. You will center the sideslip vane and V/STOL sideslip ball in the HUD an using rudder pedals prior to reaching 30 kts, and remain wings level while gradually reducing nozzle angle even further.

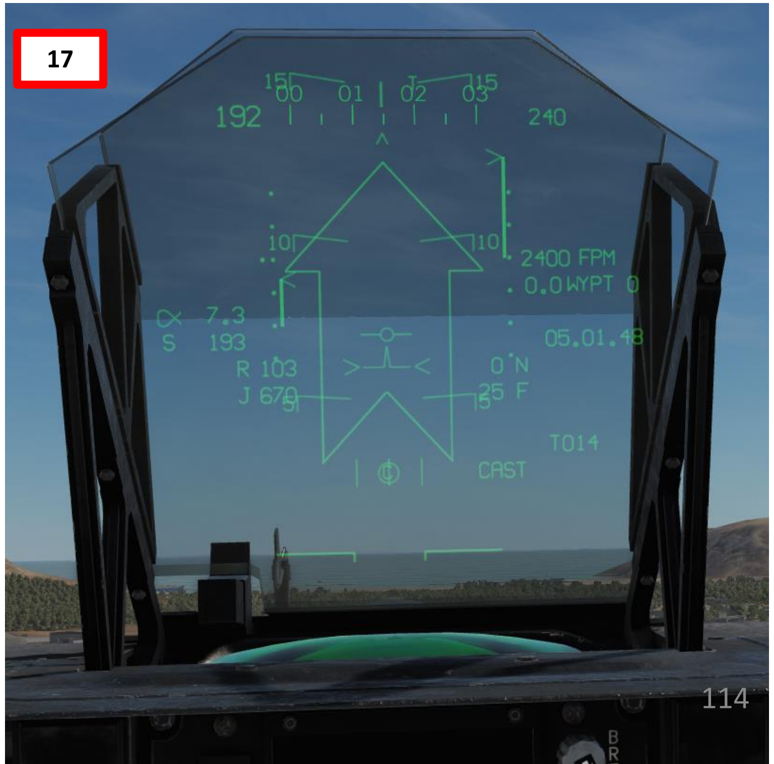


CHECK THE ENGINES SECTION TO KNOW MORE ABOUT ENGINE OPERATION & LIMITS

6 - VERTICAL TAKEOFF (VTO)

16. Once established in wingborne flight, reduce power and complete the nozzle out to fully AFT (0 deg). Maintain climbing flight and ensure velocity vector does not descend below horizon bars in the HUD.
17. After liftoff (wingborne flight, airspeed greater than 120 kts), set landing gear lever UP
18. Set Flaps switch to AUTO
19. Set Water H2O Water Injection Switch – OFF (MIDDLE)

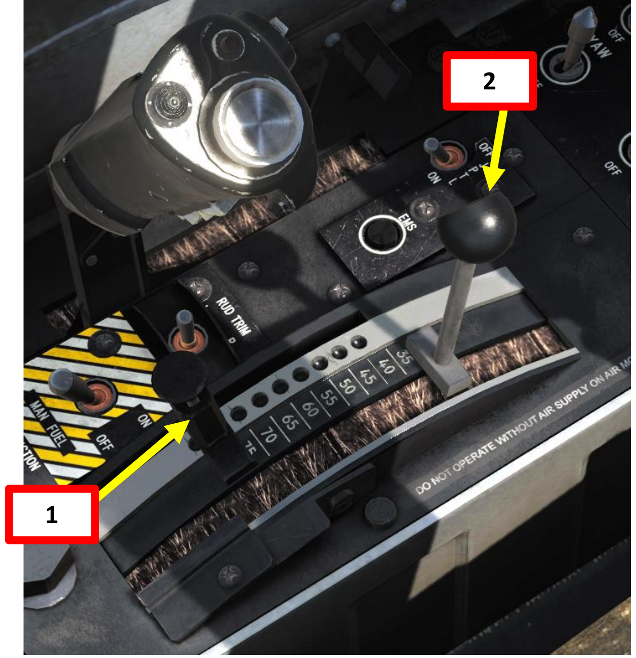


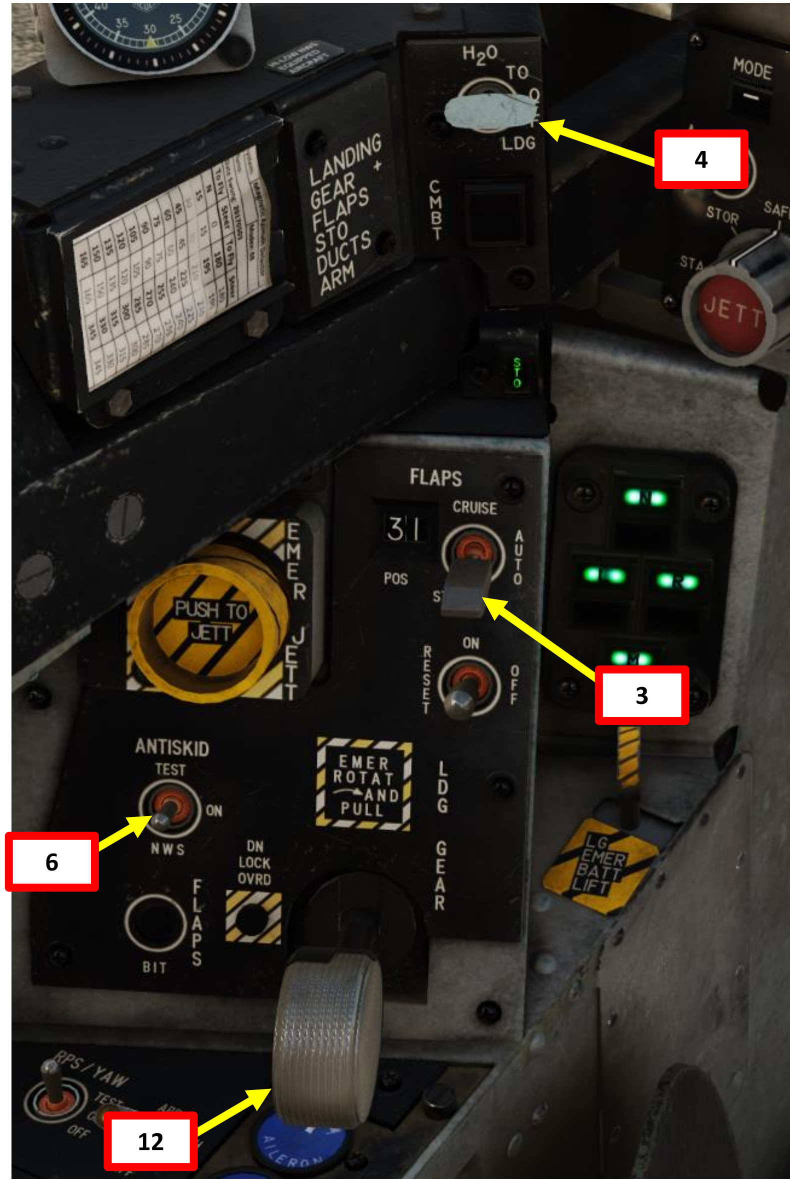


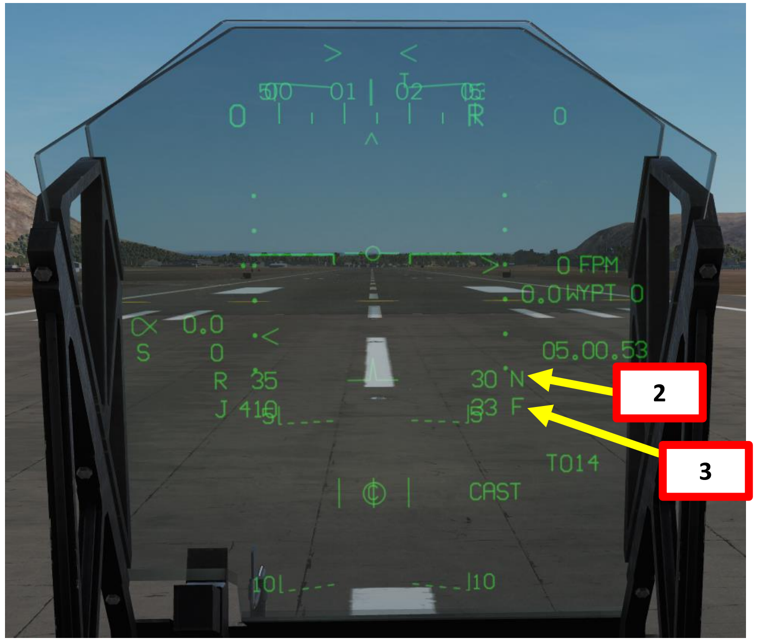
7 - ROLLING VERTICAL TAKEOFF (RVTO)

Note: You need at least 100 ft of runway to perform a RVTO. Similar weight restrictions to the Vertical Takeoff apply. Keep in mind that vertical takeoffs are restrictive in terms of what payload you can carry. Typically, RVTOs in the Harrier are **not** performed on carriers.

1. Set STO STOP stopper at 70 deg
2. Set Nozzle Position Lever – 30 deg
3. Flaps Lever – STOL (flaps will go in an intermediate position since nozzle angle is at 30 deg)
4. Set H2O Water Injection Switch – TAKEOFF (UP) (only if required in case of heavy payload)
5. Set Stabilator Trim to Takeoff Trim (2 deg nose down)
6. Check that Anti-Skid Switch is ON
7. Hold Brakes

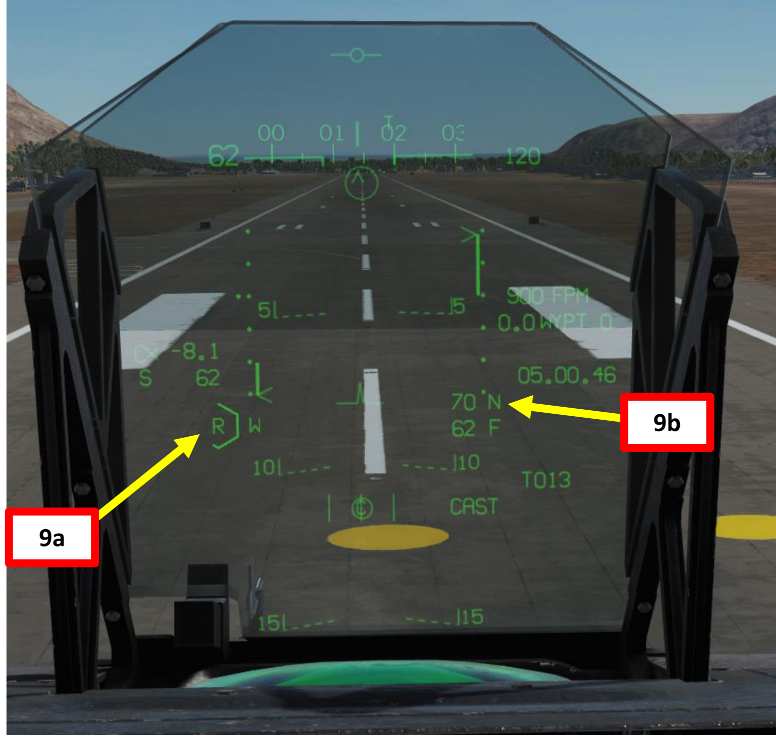


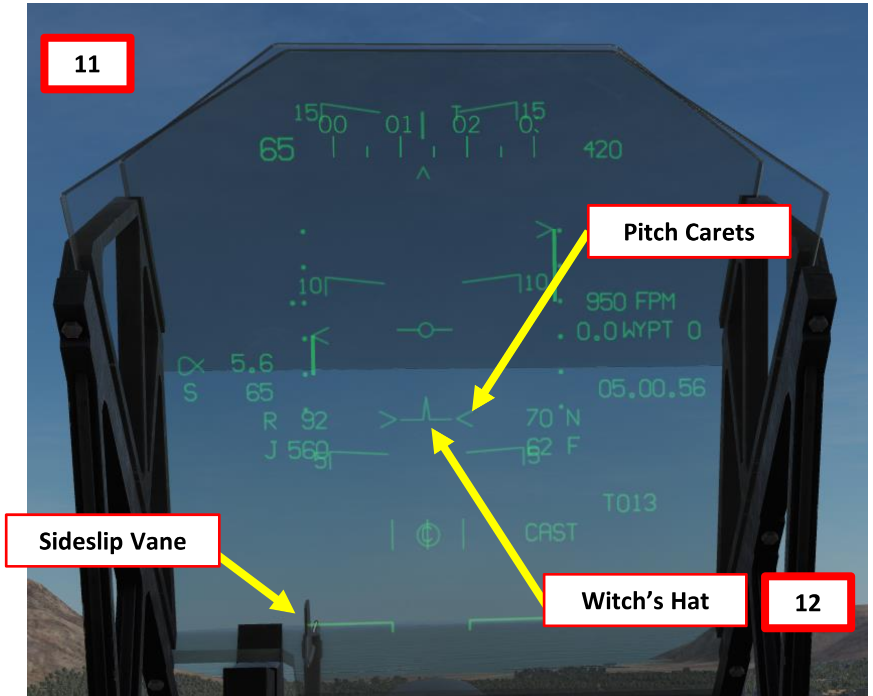


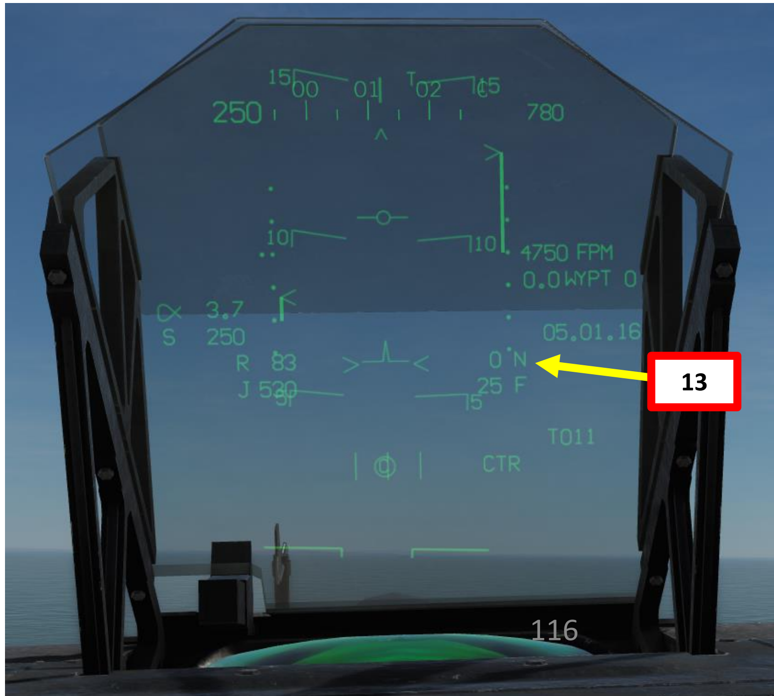


7 - ROLLING VERTICAL TAKEOFF (RVTO)

8. Throttle up, release brakes and press the NWS HOTAS button to line up the aircraft with the center of the runway if need be
9. As RPM increases to 110 % RPM, set Nozzle Position Lever AFT to the STO position set previously), which is 70 deg in our case. The STO STOP lever will act as a mechanical stopper to your Nozzle lever.
10. You should then start ascending vertically.
11. During liftoff, ensure wings remain level and center the sideslip vane to takeoff into the wind
12. Set aircraft attitude: line up Witch Hat with the Pitch Carets (currently set to a fixed value of 14 deg, or 6 deg elevation above horizon line).
13. Once established in wingborne flight, reduce power and complete the nozzle out to fully AFT (0 deg). Maintain climbing flight and ensure velocity vector does not descend below horizon bars in the HUD.
14. After liftoff (wingborne flight, airspeed greater than 120 kts), set landing gear lever UP
15. Set Flaps switch to AUTO
16. Set Water H2O Water Injection Switch – OFF (MIDDLE)

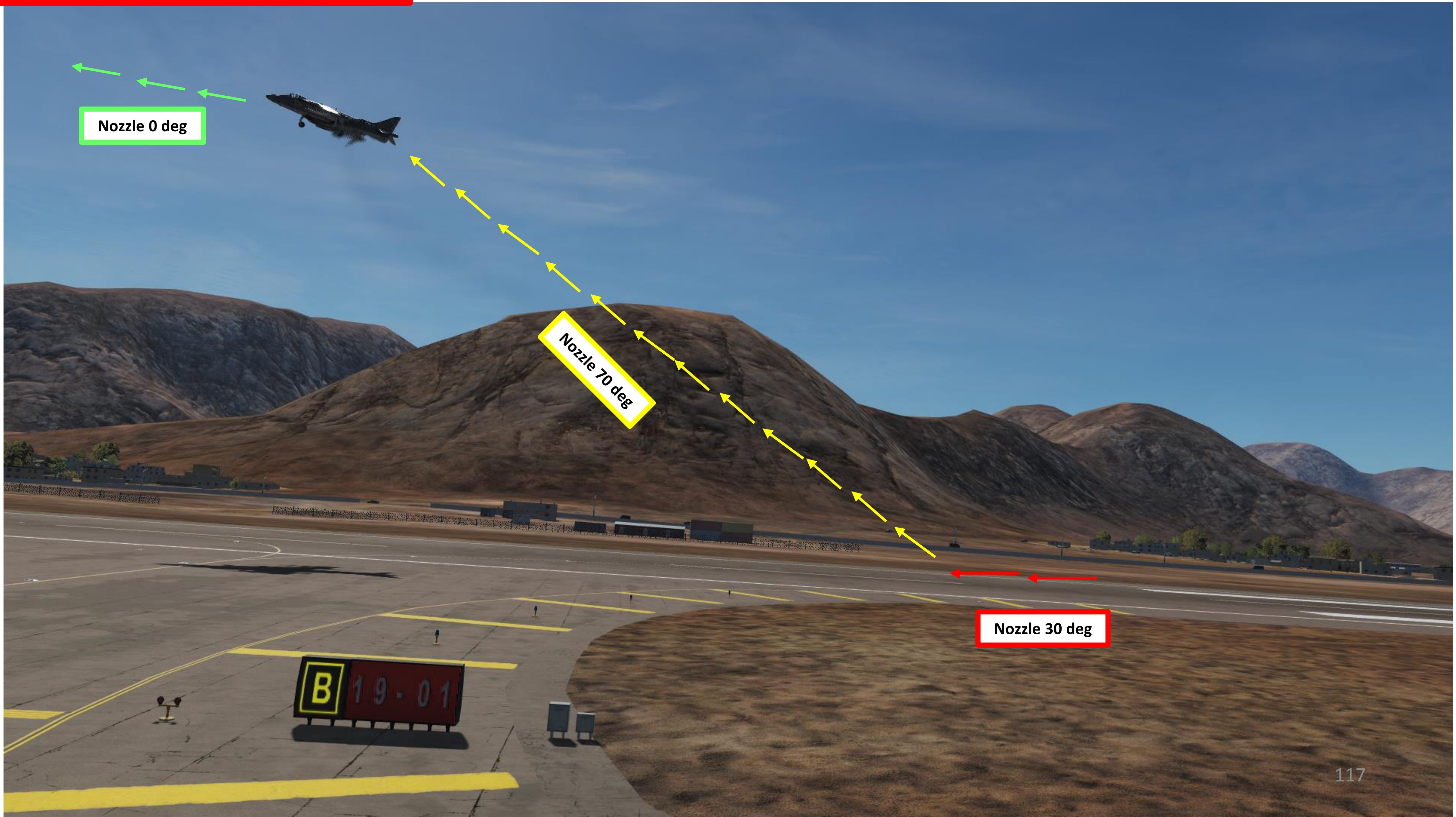






CHECK THE ENGINES SECTION TO KNOW MORE ABOUT ENGINE OPERATION & LIMITS

7 - ROLLING VERTICAL TAKEOFF (RVTO)



8 - SHIP TAKEOFF

Note: taking off on a ship like the amphibious assault ship LHA-1 Tarawa is slightly different from the Short Takeoff we have seen before. The main difference is that instead of rotating the nozzles at a set NRAS (Nozzle Rotation Airspeed) calculated by the VREST page, we will rotate the nozzles once we reach the Nozzle Rotation Line, then transition into wingborne flight.

8 - SHIP TAKEOFF

In real life, ship crews provide the pilot with a "Tote Board", which contains information about:

1. Takeoff Type (STO: Short Takeoff)
2. Calculated Takeoff Distance (ft)
3. Nose Trim for Takeoff (deg)
4. Nozzle Angle (set after crossing the Nozzle Rotation Line on the ship)
5. Takeoff Thrust Setting (WET uses Water Injection, DRY does not use Water Injection)
6. Maximum Allowable Takeoff Weight (lbs)

You will want to place your Harrier to have enough distance for takeoff by checking the Distance Markings on the ship's deck.

An Aviation Boatswain's Mate (Handling) uses a Tote Board to communicate with the pilot of a Harrier prior to launch from the flight deck (U.S. Navy photo by Mass Communication Specialist 3rd Class Michael Molina/Released)

TOTE BOARD

1.	STO
2.	460
3.	0 deg (neutral)
4.	60 deg
5.	DRY
6.	25250

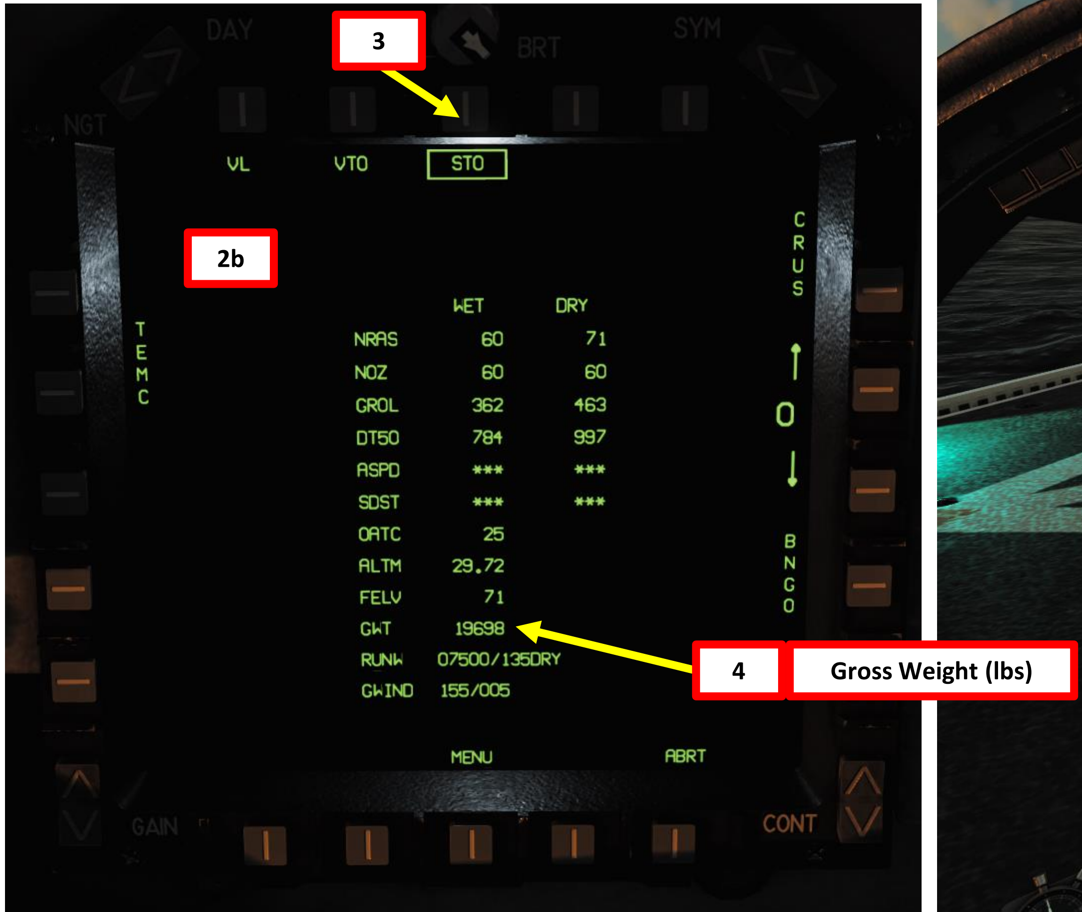
8 - SHIP TAKEOFF

Since no “Tote Board” is provided in DCS, we will use a plausible one taken from Baltic Dragon’s (Amazing) Training Missions.

1. Place the aircraft behind a Distance Marking that leaves you sufficient distance for takeoff (at the very least 460 ft).
2. Make sure the V/STOL Master Mode button is active and the VREST page is accessible from the MPCD main menu, then select VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page.
3. Press OSB next to “STO” to select “Short Takeoff” sub-page.
4. Verify that GWT (Gross Weight) of aircraft is below 25250 lbs.

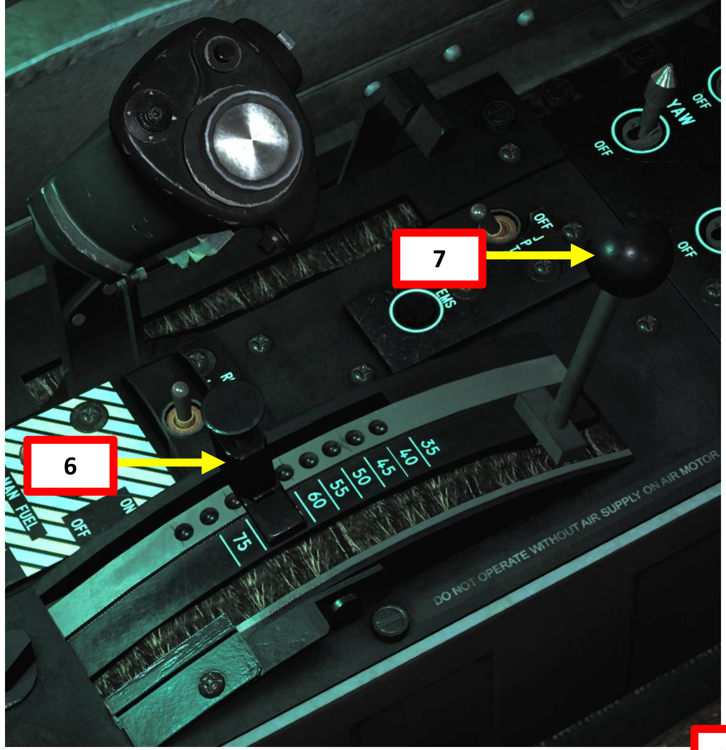
TOTE BOARD

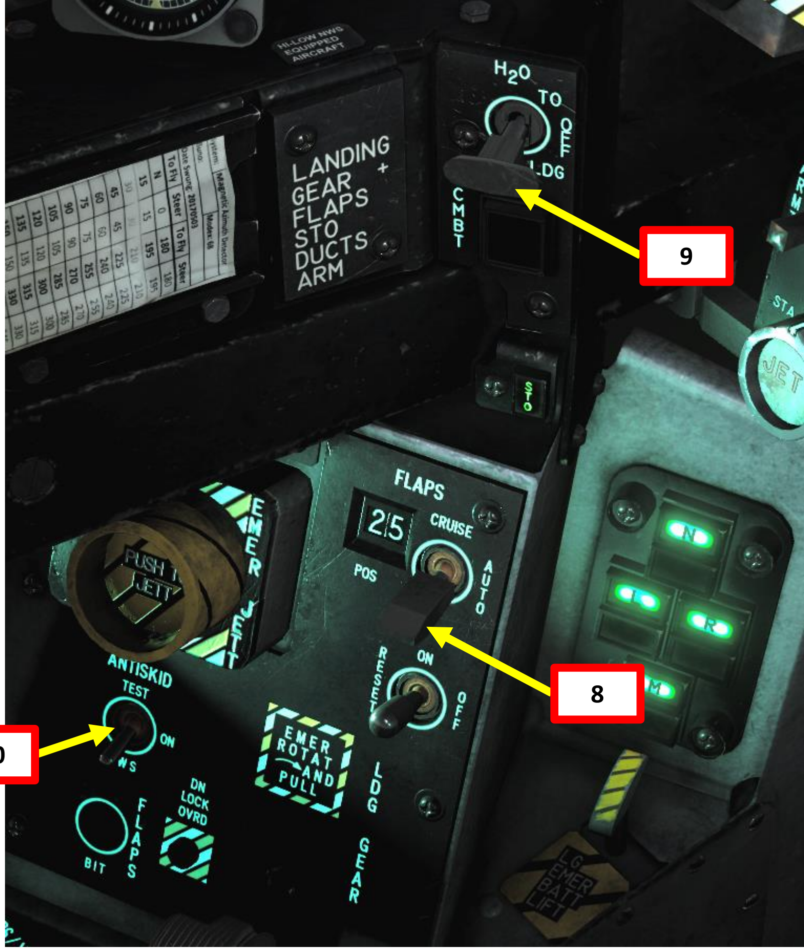
1.	STO
2.	460
3.	0 deg (neutral)
4.	60 deg
5.	DRY
6.	25250



8 - SHIP TAKEOFF

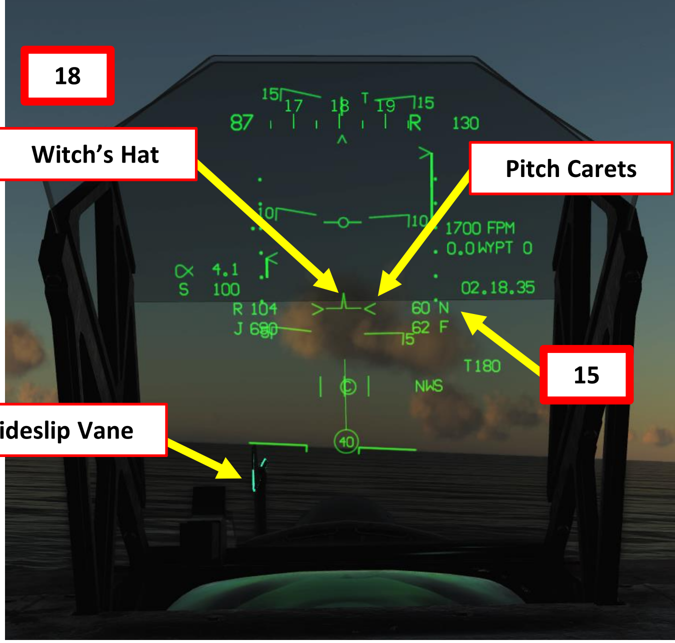
5. Since we will not use a NRAS (Nozzle Rotation Airspeed) as a reference to rotate our nozzles, we will not need to calculate our Abort Criteria.
6. Set STO STOP stopper at 60 deg
7. Set Nozzle Position Lever – 10 deg
8. Flaps Lever –STOL
9. Set H2O Water Injection Switch – As Required. We will leave Water Injection to OFF, but take note that you should set it to TAKEOFF (UP) in case of heavy payload.
10. Set Stabilator Trim to Takeoff Trim (0 deg, neutral)
11. Check that Anti-Skid Switch is OFF (NWS/DOWN, very important!)

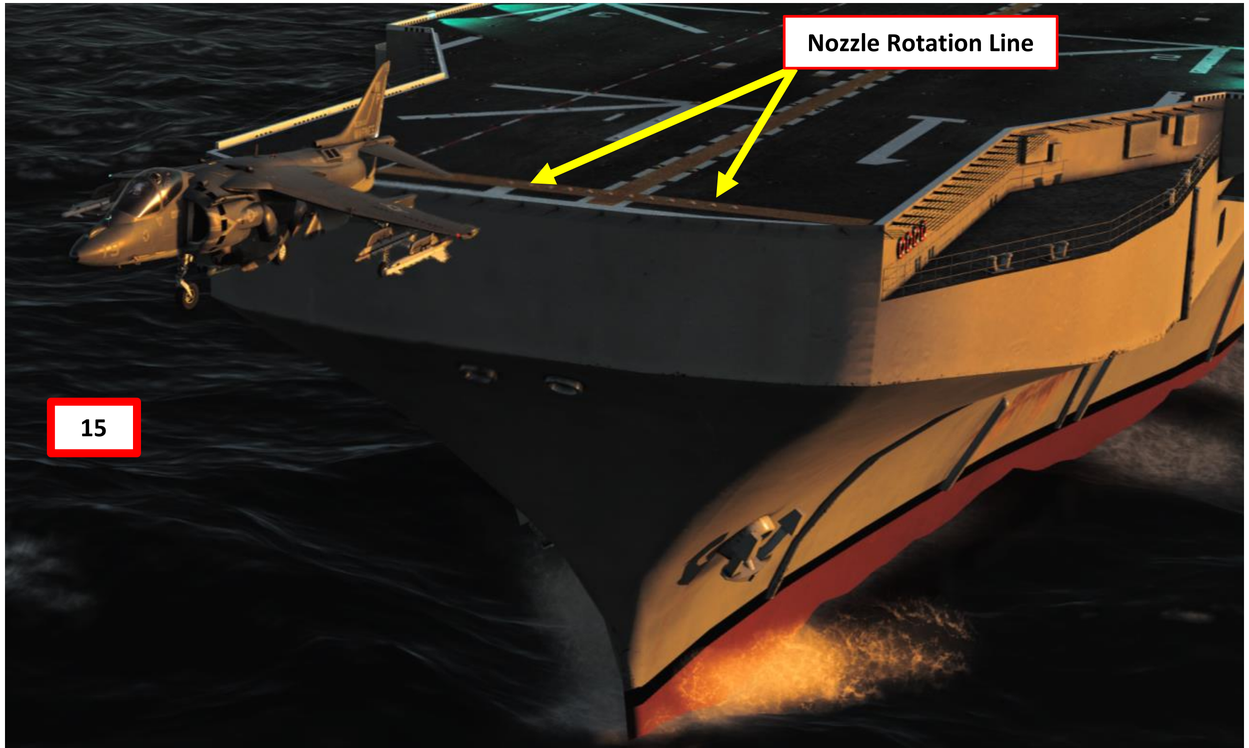


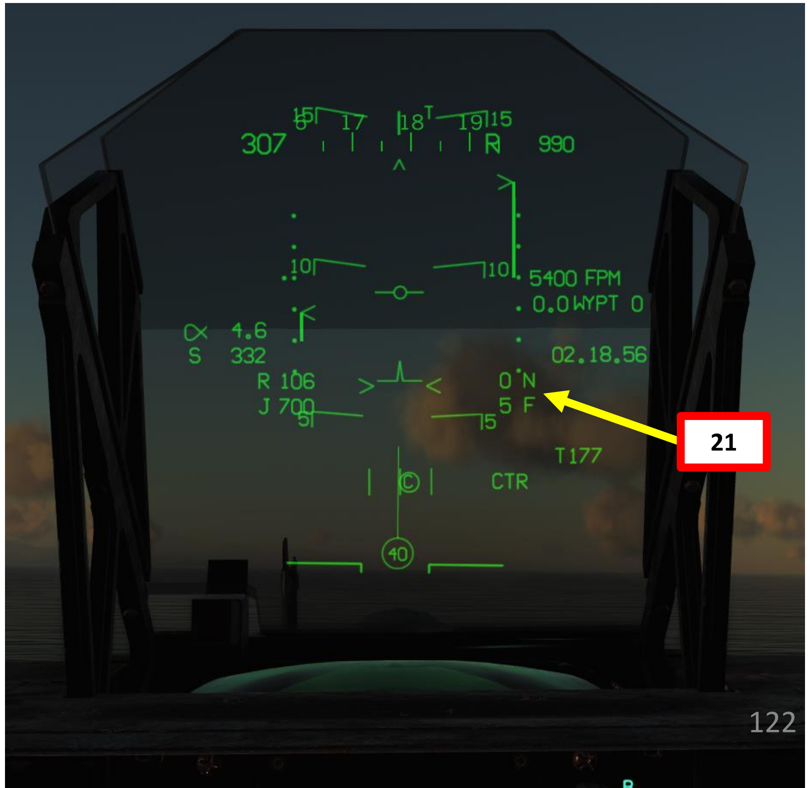


8 - SHIP TAKEOFF

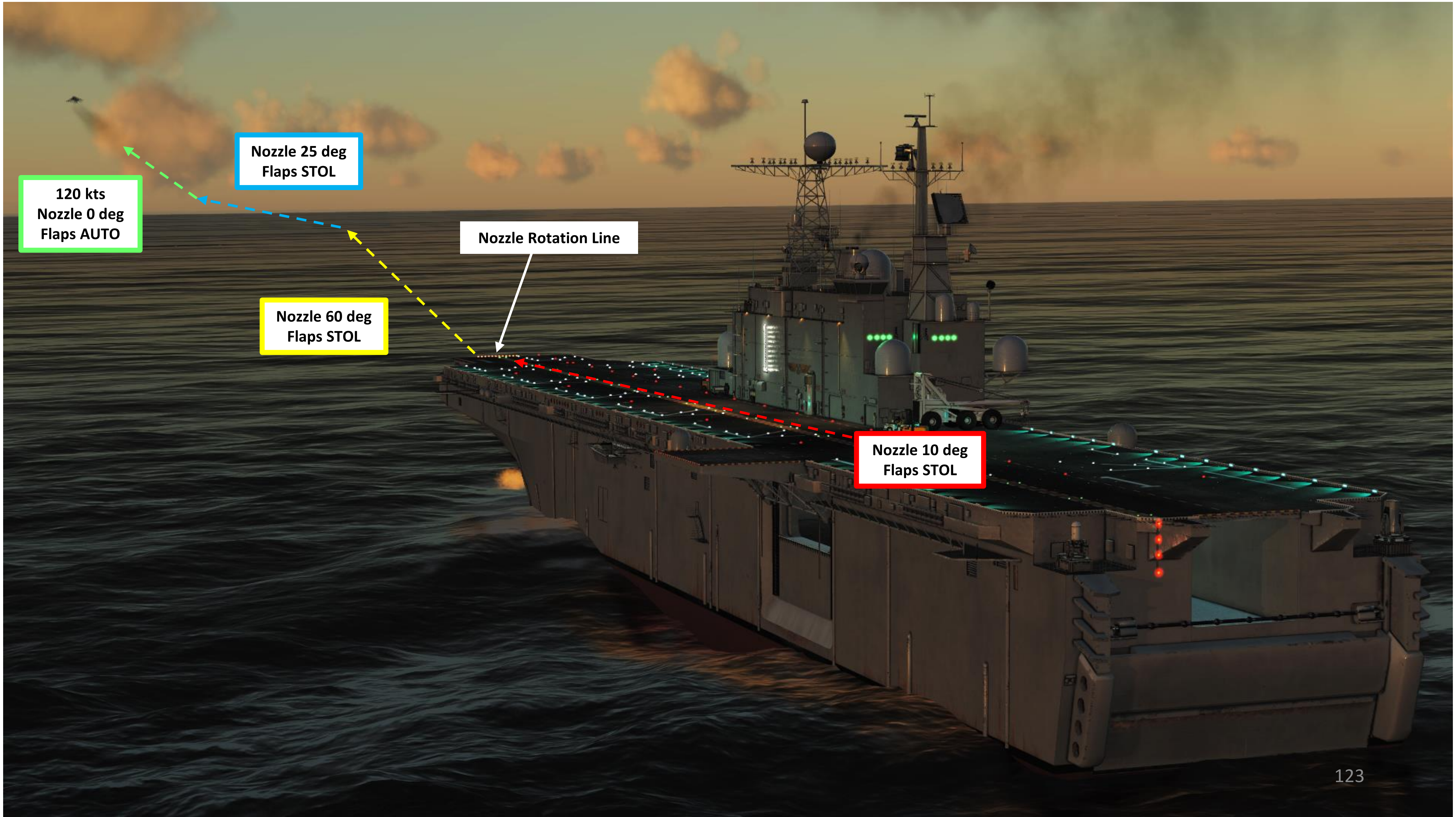
12. Hold Brakes
13. Throttle up (make sure the limit icon does not go to FULL)
14. You will begin to have aerodynamic control of the rudder at 50-60 kts
15. Once you cross the Nozzle Rotation Line on the ship’s deck, set Nozzle Position Lever AFT to the STO position set previously), which is 60 deg in our case. The STO STOP lever will act as a mechanical stopper to your Nozzle lever.
16. You should start ascending vertically
17. During liftoff, ensure wings remain level and center the sideslip vane to takeoff into the wind
18. Set aircraft attitude: line up Witch Hat with the Pitch Carets (currently set to a fixed value of 14 deg, or 6 deg elevation above horizon line).
19. After liftoff, set landing gear lever UP
20. Gradually set Nozzles to 25 deg
21. Above 120 kts, set Flaps to AUTO and set Nozzles to 0 deg
22. Set Water H2O Water Injection Switch – OFF (MIDDLE)







8 - SHIP TAKEOFF



LANDING TUTORIAL STRUCTURE

1. Weight Calculations
2. Stores & Fuel Jettison
3. Landing Types
4. Conventional Landing (CL)
5. Slow Landing – Variable Nozzle (VNSL)
6. Slow Landing – Fixed Nozzle (FNSL)
7. Rolling Vertical Landing (RVL)
8. Vertical Landing (VL)
9. Case I Recovery (Ship Landing)

1 - WEIGHT CALCULATIONS

Vertical landing on a ship needs some preparation. You cannot land vertically in any configuration: you need to make sure that you are light enough to be able to hover without smashing yourself against the ship's deck.

To land successfully on a ship, your **weight must not exceed 20500 lbs**. This is why you'll have to calculate your weight on landing. Redkite prepared some nice sheets to help you do it.

Example of Weight Calculation:

You approach the Tarawa loaded with the following weight:

- Airframe (14000 lbs) + Water Tank (500 lbs)
- Gunpod (1313 lbs)
- 2 x Sidearms (2 x 200 lbs)
- 2 x Mavericks AGM-65F (2 x 485 lbs)
- A targeting pod (445 lbs)
- 4100 lbs fuel
- A pilot + Equipment (300 lbs approx.)

Your total weight is 22028 lbs, which is roughly 1500 lbs over the limit.

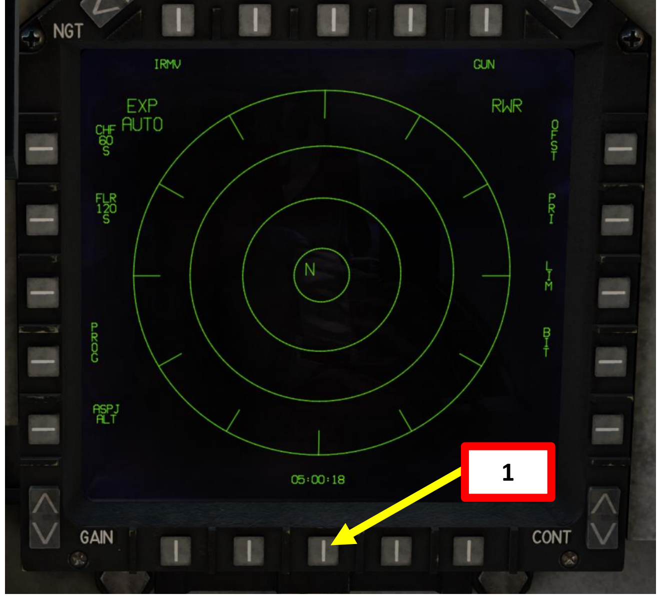
WEIGHT REFERENCE SHEET

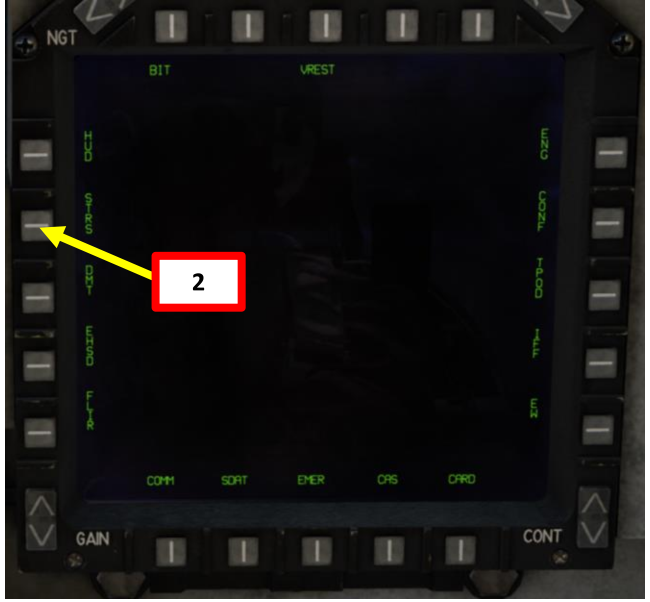
AIRFRAME: 14,000 lbs	**WATER TANK**: 500 lbs
BOMBS	**WEIGHT**
MK82/GBU-12/MK38	800 lbs
MK-84/GBU-10/MK31	2000 lbs
GBU-16	1243 lbs
MK-20 ROCKEYE	229 lbs
MK-83	985 lbs
SUU-26 x 8 LUU-2	286 lbs
MISSILES	**WEIGHT**
AGM-65F MAVERICK	485 lbs
AGM-65G MAVERICK	674 lbs
SIDEARM	200 lbs
AIM-9 SIDEWINDER	118 lbs
ROCKETS	**WEIGHT**
7 x FFAR	261 lbs
4 x ZUNI MK71	970 lbs
19 x FFAR	630 lbs
7 x 2.7 in	262 lbs
EQUIPMENT	**WEIGHT**
2 x EXTERNAL TANKS (EMPTY)	416 lbs
TGP (TARGETING POD)	445 lbs
GAU-12 GUNPOD	1313 lbs
DECM POD	317 lbs

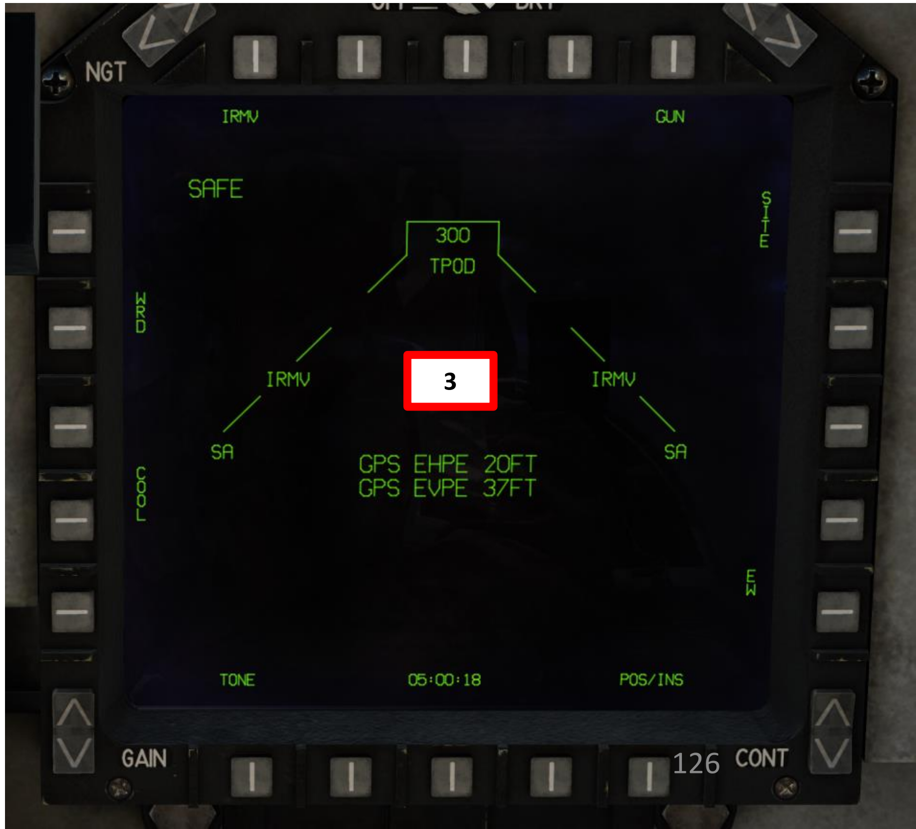
1 - WEIGHT CALCULATIONS

In order to see what you have loaded, you can consult the STORES page on your MPCD:

1. Click the OSB next to MENU
2. Click the OSB next to STRS (Stores)
3. You will have the STORES page open. As an example, you can see the Targeting Pod (TPOD), the Maverick (IRMV) and the Sidearm (SA) missiles on their respective pylons.



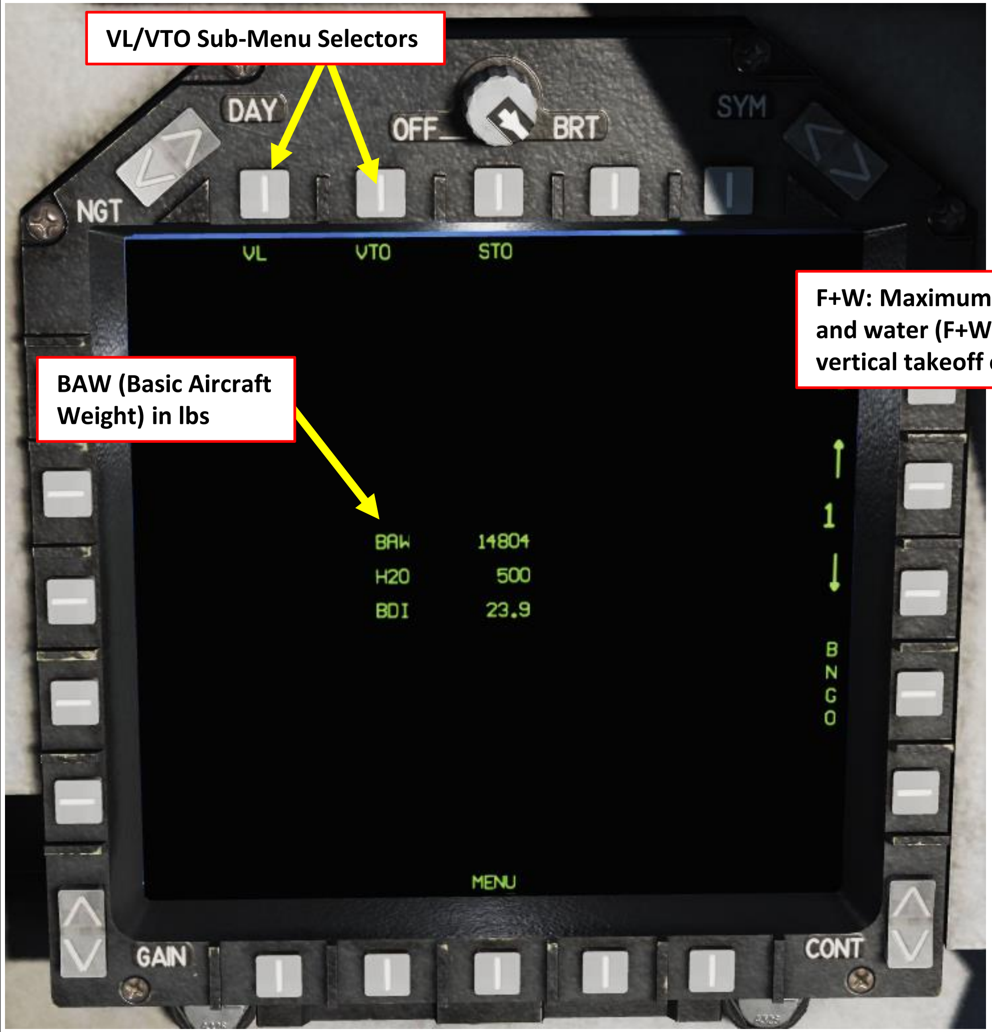


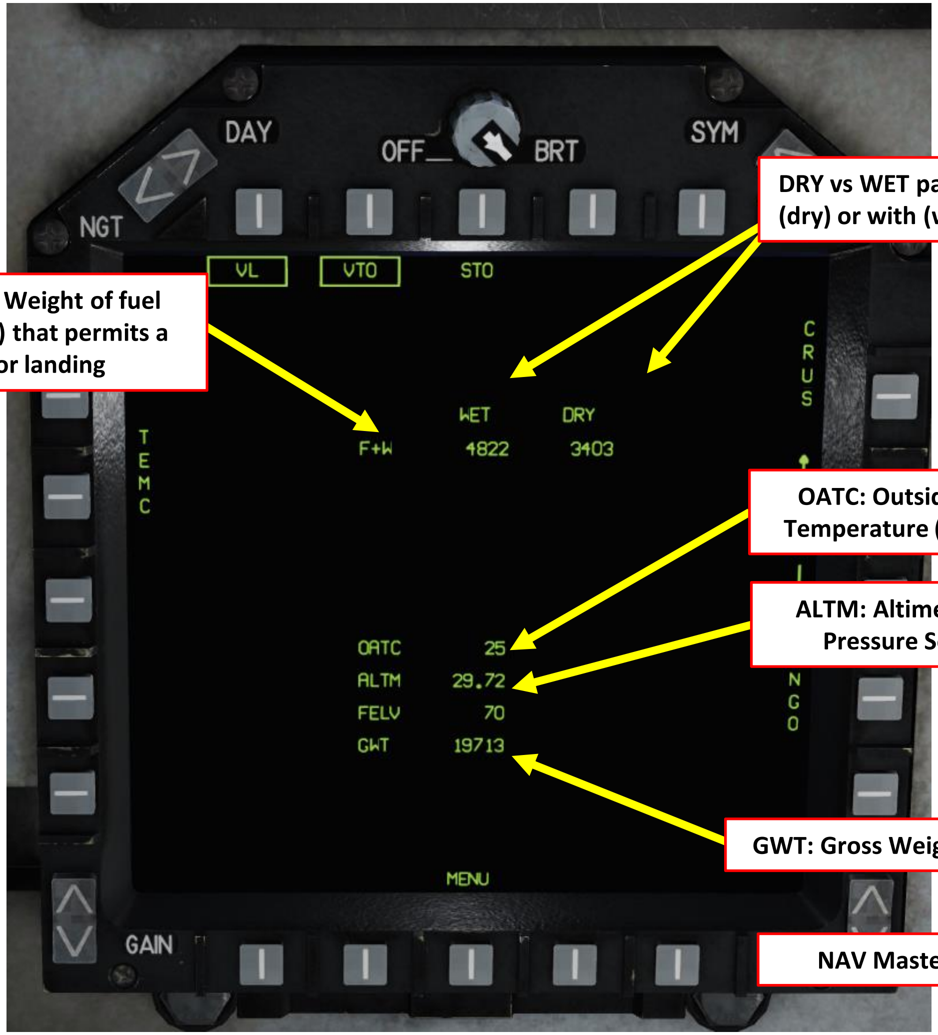


1 - WEIGHT CALCULATIONS

Note: Gross Weight is available from the VREST VL/VTO Sub-Menu (menu is only visible if the NAV Master Mode or A/G Master Mode is selected). It is the total weight of the aircraft including fuel, water, stores including hung stores, and rounds remaining including spent casings. The GWT is used to compute F+W. If displayed GWT is pilot entered, an asterisk (*) is displayed to the left of GWT.

In a nutshell, check that the GWT value is smaller than 20,500 lbs.





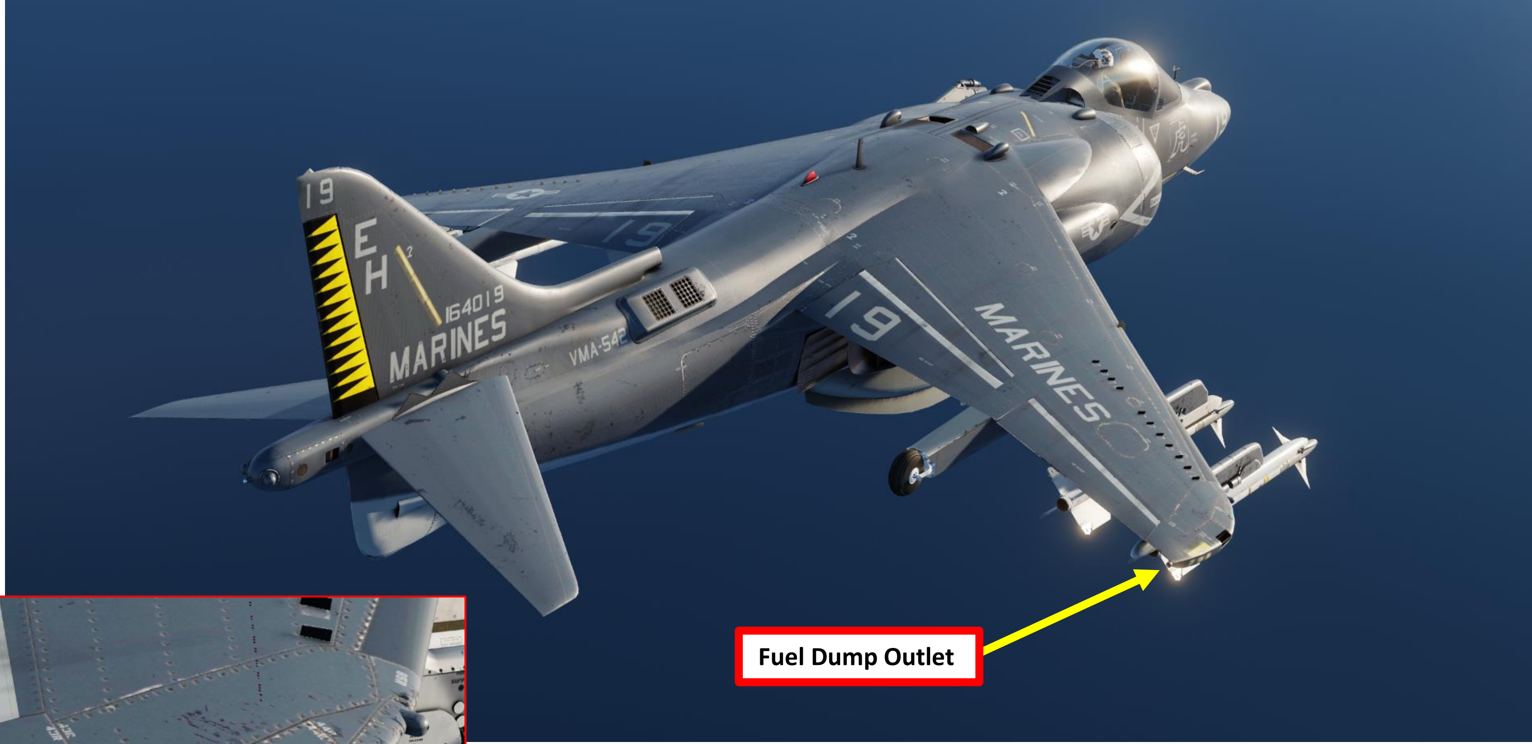
2 - FUEL DUMPING

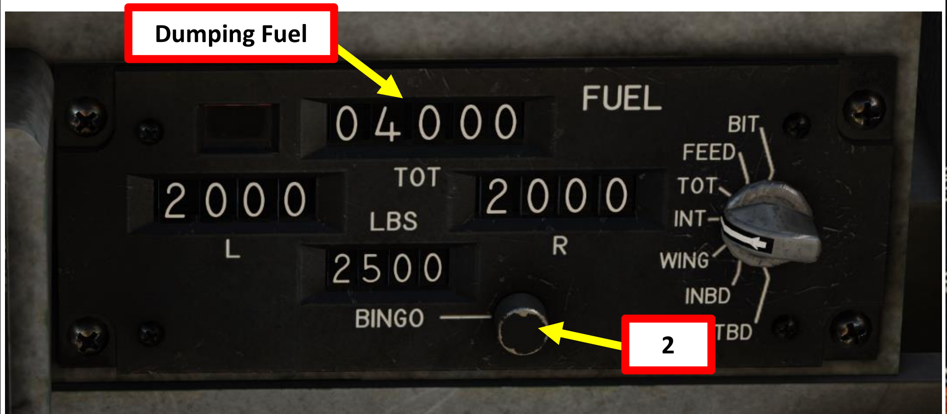
If we take an example where we are 1500 lbs overweight, we can either:

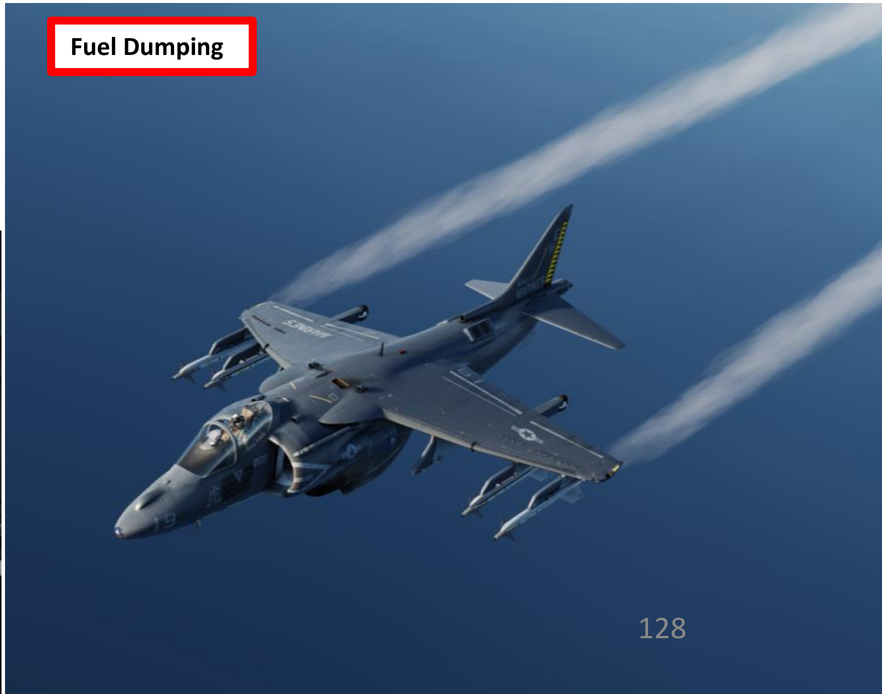
- Fly until we burn the excess fuel
- Dump the excess fuel
- Jettison our weapons

Jettisoning expensive missiles may not be the best idea for the taxpayer… so I'll show you how to dump fuel instead.

1. Calculate the Bingo Fuel you need to land: 4100 lbs – 1500 lbs = **2500** lbs
2. Set Bingo Fuel knob to 2500 lbs
3. Set the Left and Right Fuel Dump switches FWD (DUMP)
4. The fuel tanks will dump fuel until either BINGO FUEL target is reached or 2800 lbs remains (whichever comes first).
5. Once previous step is completed, Left and Right Fuel Dump Switches will automatically reset.







3 - LANDING TYPES

Conventional Landing (CL):

The CL requires substantially greater distance to stop than a SL or RVL. Landing distance available is a critical consideration when performing a CL. The brakes are designed primarily for V/STOL (Vertical/Short Takeoff & Landing) and are marginal for a CL without Power Nozzle Braking (PNB); therefore, always use PNB when performing a CL. CLs without using PNB is an emergency procedure only.

Slow Landing (SL):

The SL is used when aircraft gross weight is too high for a VL or RVL or to reduce engine stress. There are two basic types of Slow Landing: the Fixed Nozzle Slow Landing (FNSL) and the Variable Nozzle Slow Landing (VNSL).

- FNSL: The recommended slow landing technique is the Fixed Nozzle Slow Landing using STOL flaps. The use of AUTO flaps is recommended when crosswinds conditions are heavy or when dealing with high asymmetric store loadings.

- VNSL: It is used whenever the throttle needs to remain at a relatively constant setting throughout the approach, for example when the engine reliability is suspect

Rolling Vertical Landing (RVL):

The RVL should be used when the landing surface isn't long enough to support a SL, but the landing area cannot support a VL because it is subject to damage from heating or is a source of FOD (Foreign Object Damage).

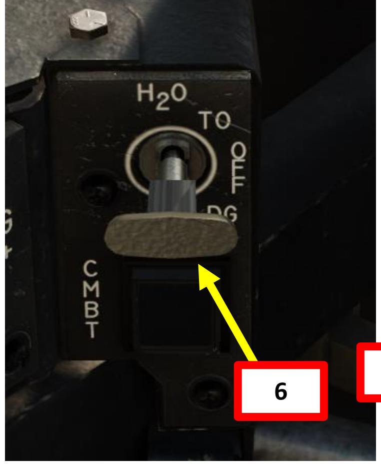
Vertical Landing (VL):

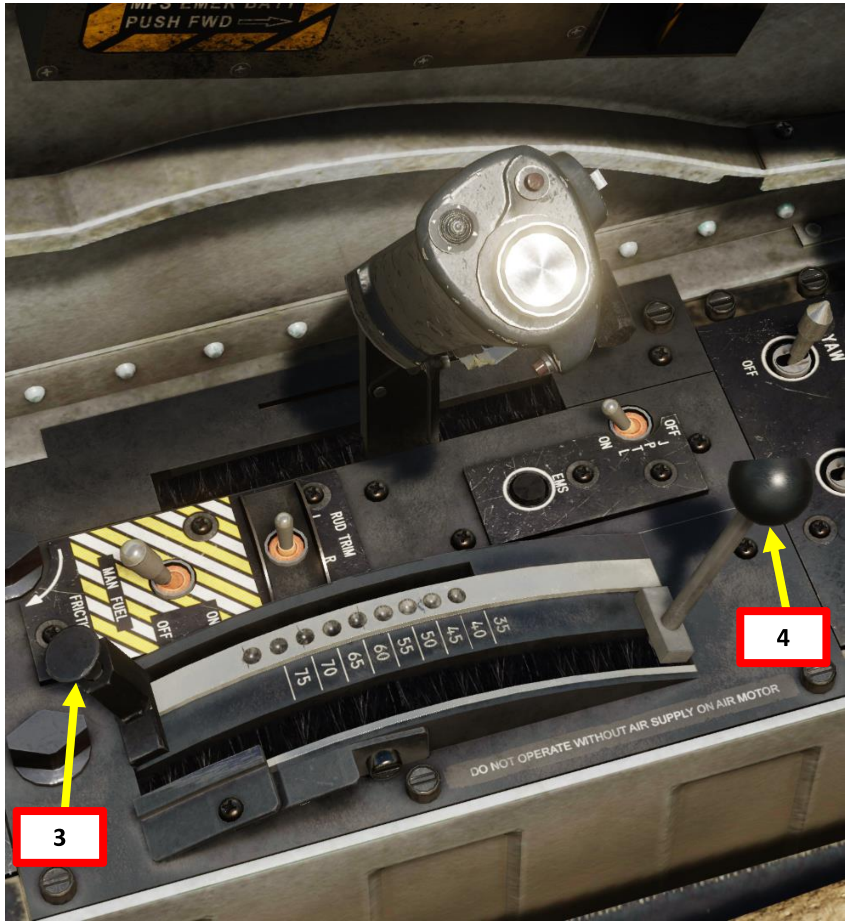
The VL is commenced from a 50 to 60 feet AGL hover. Landing should be made pointing into the wind to minimize exhaust reingestion.

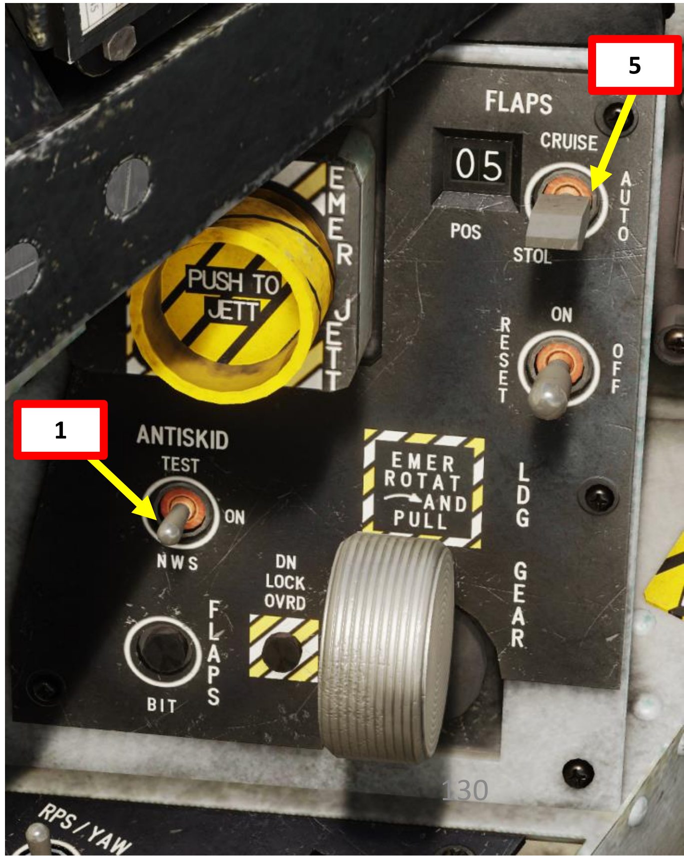
4 - CONVENTIONAL LANDING (CL)

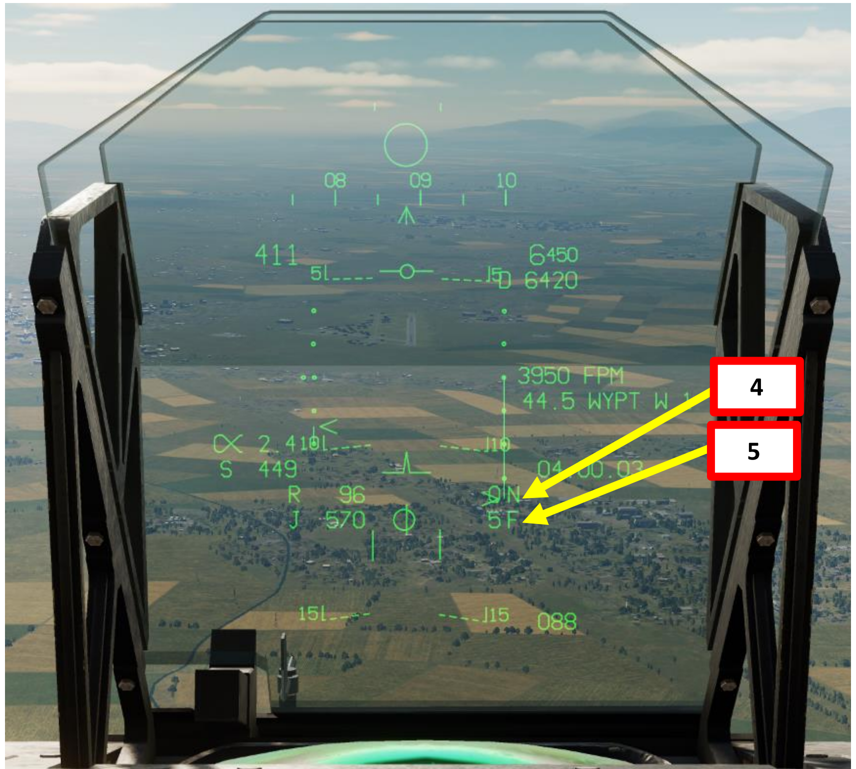
Approach Checklist

1. Set Anti-Skid Switch to ON (Middle Position)
2. Select VSTOL (Vertical Short Takeoff & Landing) Master Mode Switch
3. STO STOP lever – CLEAR
4. Set Nozzle Position lever – 0 deg
5. Set flaps to AUTO
6. Set Water Injection switch – OFF (MIDDLE)









4 - CONVENTIONAL LANDING (CL)

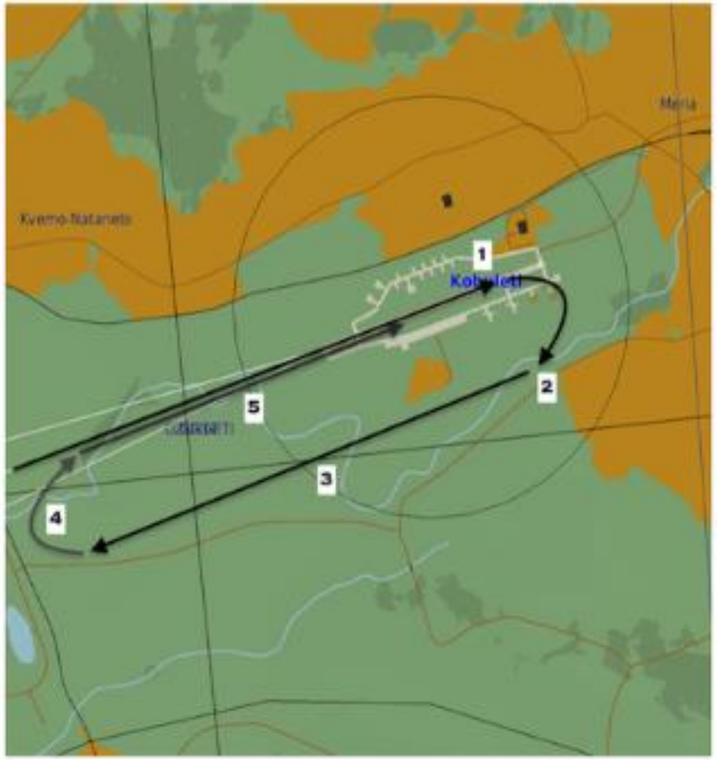
CONVENTIONAL LANDING

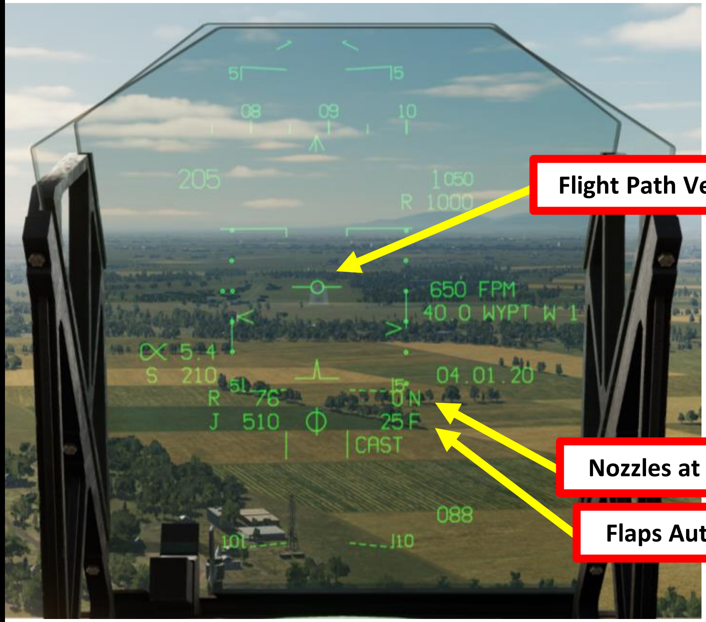
TRAINING MISSION 04

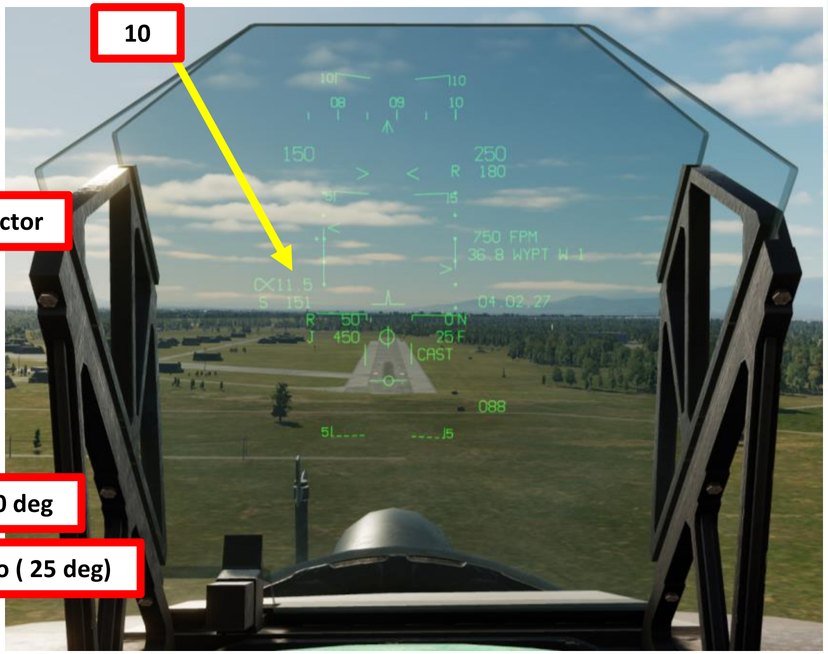
Landing Checklist (Overhead Break)

7. Fly at 800 ft AGL, 350 kts over the runway.
8. At the Break Point, perform a 4 G level turn, intercept 10 units of AoA (Angle of Attack), and exit turn at 250 kts
9. Descend to 600 ft AGL, set landing gear down, verify flaps are set to AUTO.
10. Keep about 10-12 units of AoA (use throttle to control the AoA) and descend to 200 ft AGL on Final
11. Set Flight Path Vector on end of runway. At 30 to 50 ft AGL: Set Witches Hat 2 degrees above the horizon and control rate of descent with throttle.
12. Touchdown when reaching runway threshold and cut throttle to slow down.
13. Engage Nosewheel Steering HOTAS button when rolling straight and pedals are neutralized

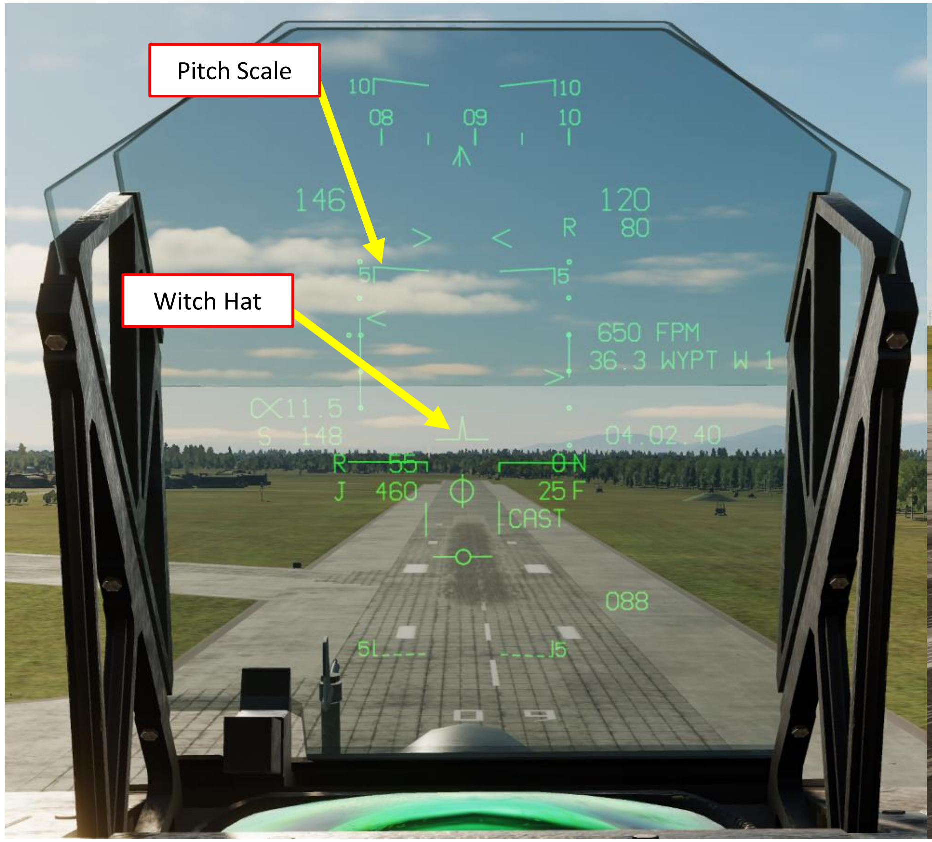
OVERHEAD BREAK



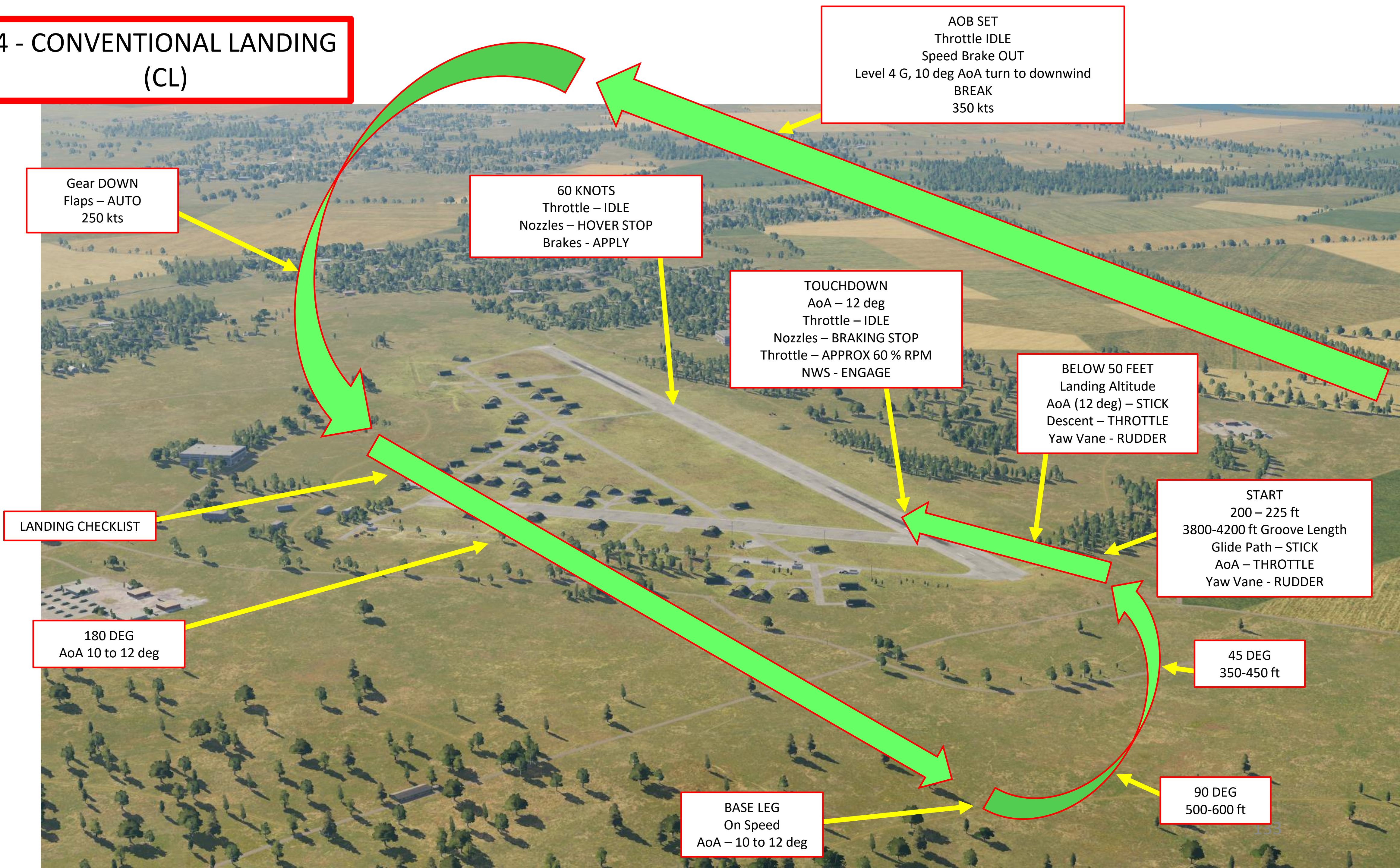




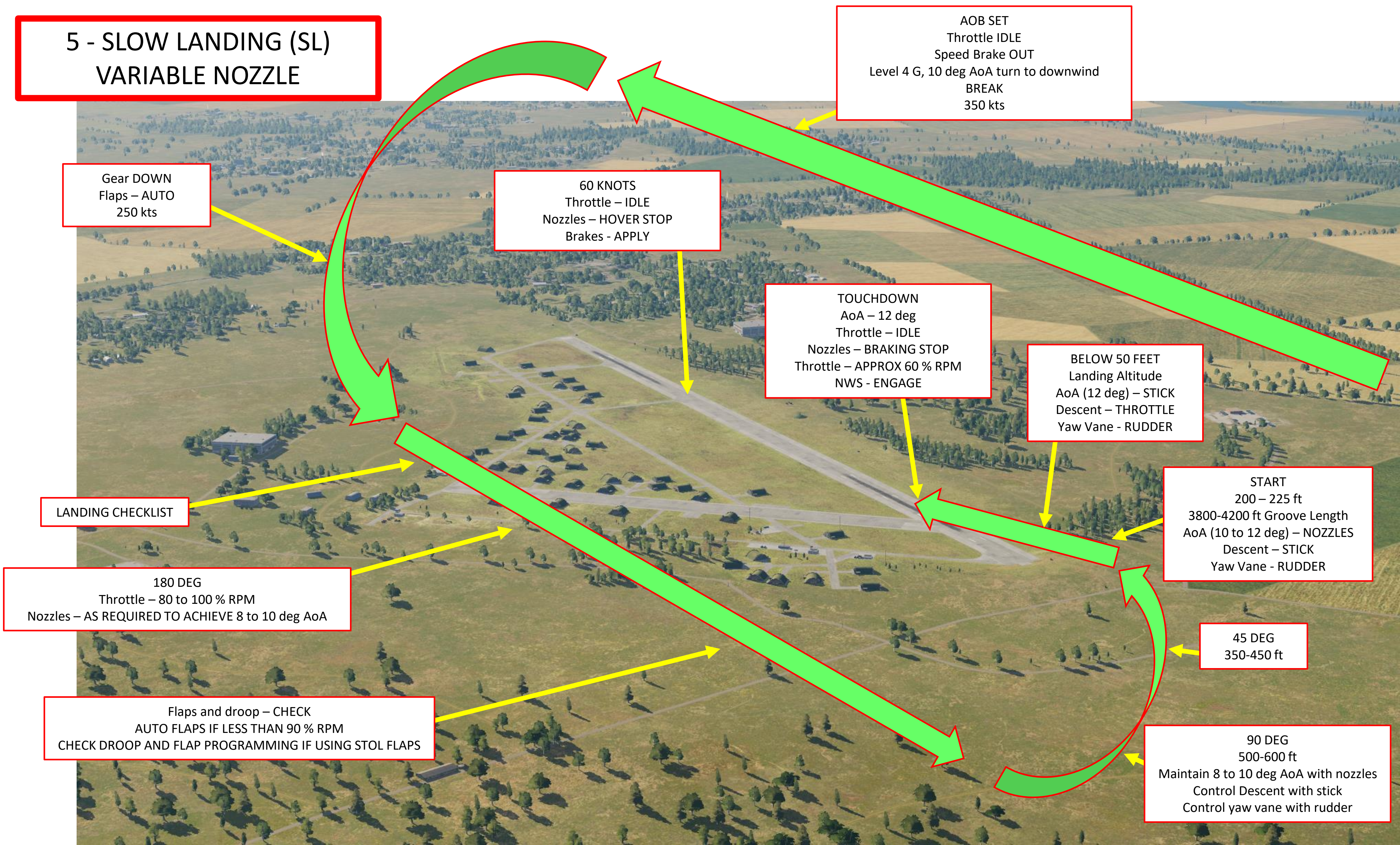
4 - CONVENTIONAL LANDING (CL)



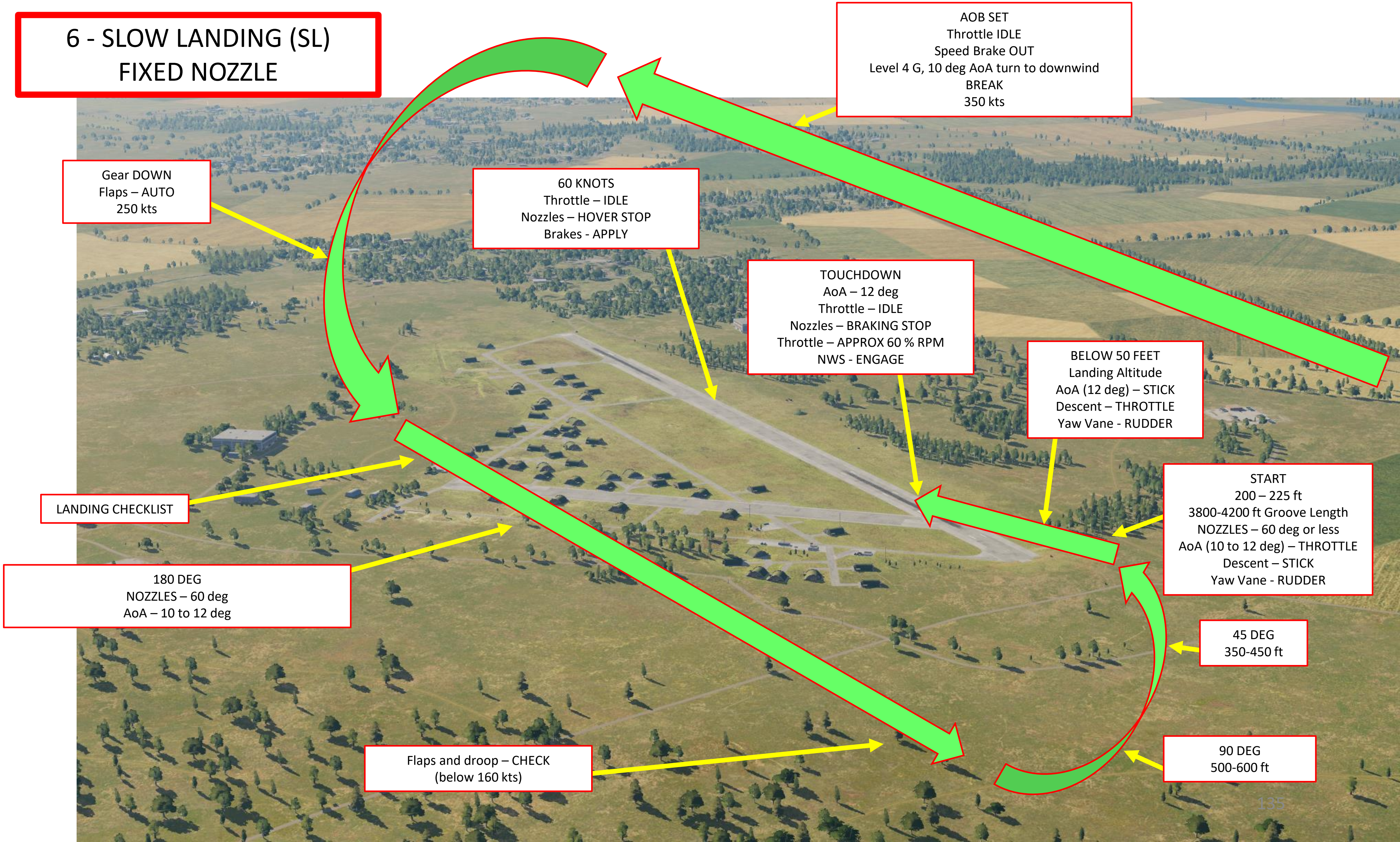
4 - CONVENTIONAL LANDING (CL)



5 - SLOW LANDING (SL) VARIABLE NOZZLE



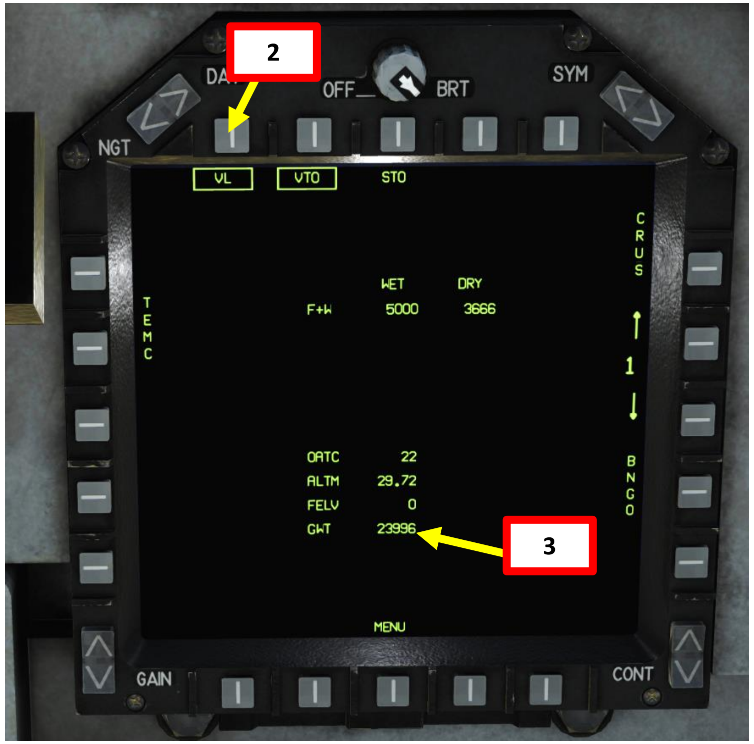
6 - SLOW LANDING (SL) FIXED NOZZLE



7 – ROLLING VERTICAL LANDING (RVL)

Note: If your aircraft exceeds the Vertical Landing Weight (VL) or 20,500 lbs by as much as 4000 lbs, you may conduct a Rolling Vertical Takeoff as fast as 70 kts at touchdown in order to augment your engine power with lift generated by the Harrier's wing. RVLs are not to be used on ships.

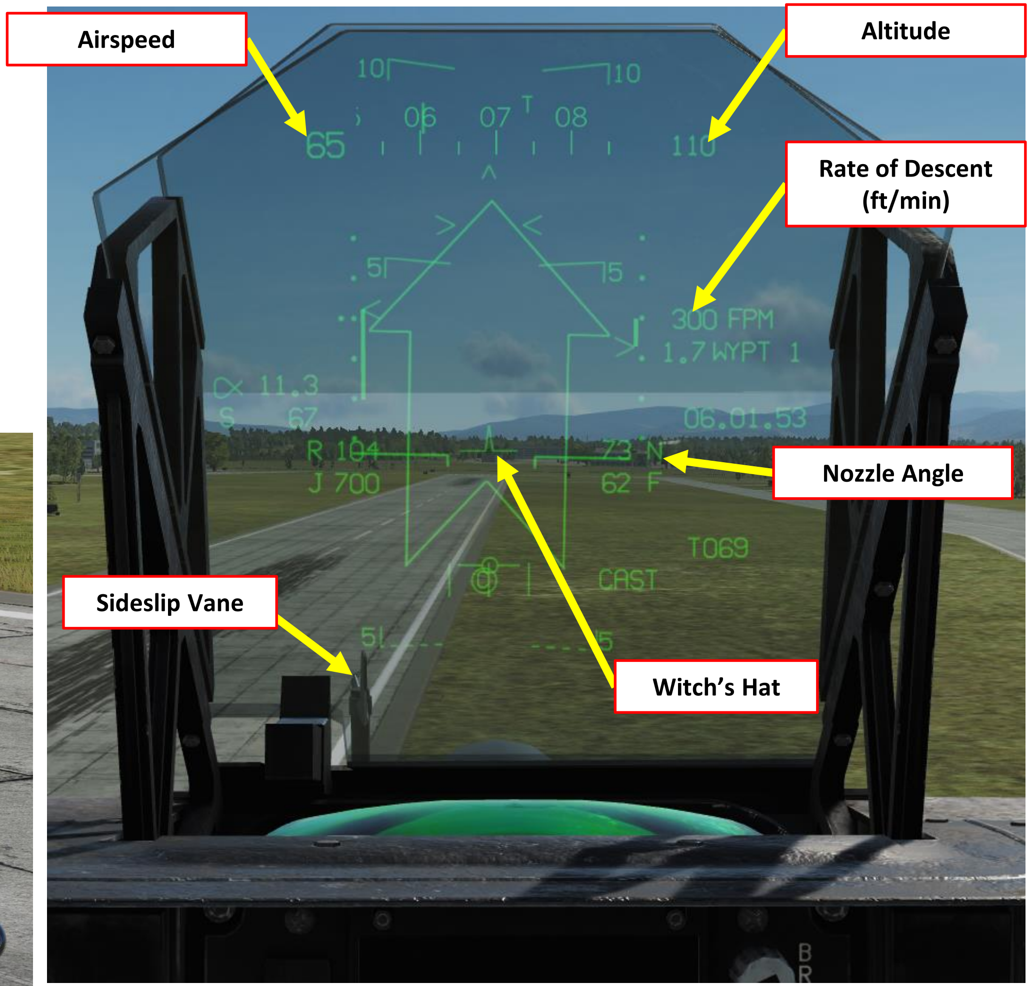
1. Make sure the V/STOL Master Mode button is active and the VREST page is accessible from the MPCD main menu, then select VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page.
2. Press OSB next to "STO" to select "Short Takeoff" sub-page.
3. Check GWT (Gross Weight) of aircraft and determine your touchdown speed based on it. In our case, our weight is almost 24000 lbs, so we will use a Touchdown Speed of 65 kts.
4. Set Altimeter Mode to Radar Altimeter
5. Set Anti-Skid Switch to ON (Middle Position)
6. Set Landing Gear DOWN
7. STO STOP lever – CLEAR
8. Set Nozzle Position lever – 60 deg
9. Set flaps to STOL
10. Set Water Injection switch – LANDING (DOWN)



TOUCHDOWN SPEED (KCAS)	MAXIMUM RVL WEIGHT
Below or at 45 knots	VL weight (max 20 500 lbs)
50 knots	VL + 2 300 lbs
55 knots	VL + 2 700 lbs
60 knots	VL + 3 100 lbs
65 knots	VL + 3 500 lbs
70 knots	VL + 4 000 lbs

7 – ROLLING VERTICAL LANDING (RVL)

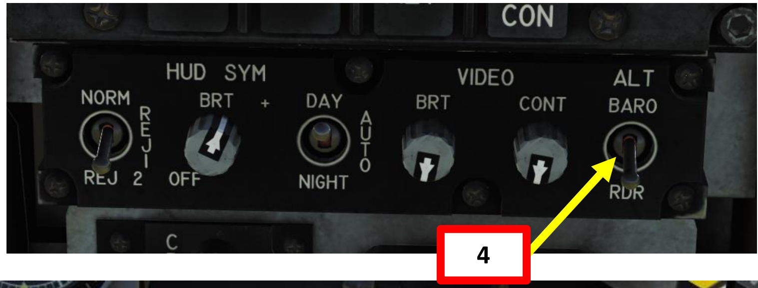
11. Approach the Key (reference point half a nautical mile from landing site) straight in at an altitude of 325 ft AGL. Make sure to adjust rudder to keep the Wind Sideslip Vane straight (land into the wind).
12. At the Key, adjust aircraft attitude to set the Witch Hat on the horizon, adjust nozzles to maintain touchdown speed (65 kts) and adjust power to maintain the desired glideslope of 5 deg. Your rate of descent should not exceed 300-400 ft/min.
13. When on the ground, set throttle to IDLE, use your brakes and set nozzles fully aft.

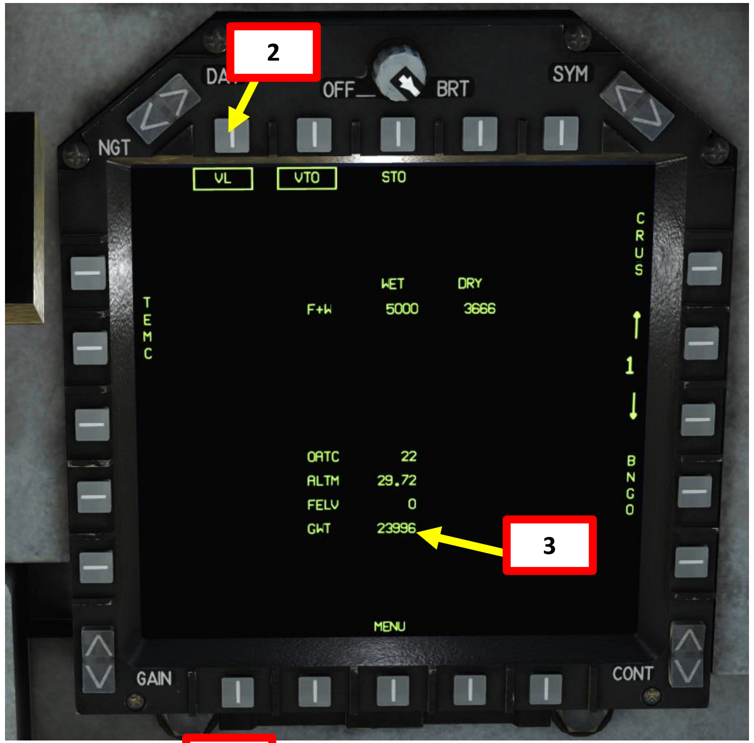


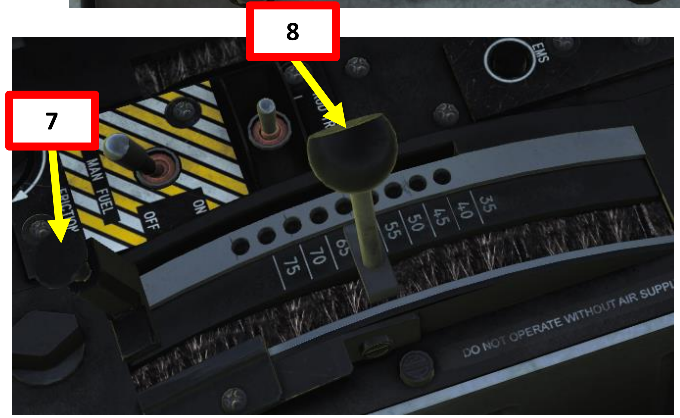
8 - VERTICAL LANDING (VL)

Note: For vertical landings, your aircraft must not exceed a weight of 20,500 lbs.

1. Make sure the V/STOL Master Mode button is active and the VREST page is accessible from the MPCD main menu, then select VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page.
2. Press OSB next to “VL” to select “Vertical Takeoff” sub-page.
3. Check GWT (Gross Weight) of aircraft and confirm that you do not exceed landing weight.
4. Set Altimeter Mode to Radar Altimeter
5. Set Anti-Skid Switch to ON (Middle Position)
6. Set Landing Gear DOWN
7. STO STOP lever – CLEAR
8. Set Nozzle Position lever – 60 deg
9. Set flaps to STOL
10. Set Water Injection switch – LANDING (DOWN)
11. STO STOP lever – CLEAR
12. For the approach, set Nozzle Position lever – 60 deg

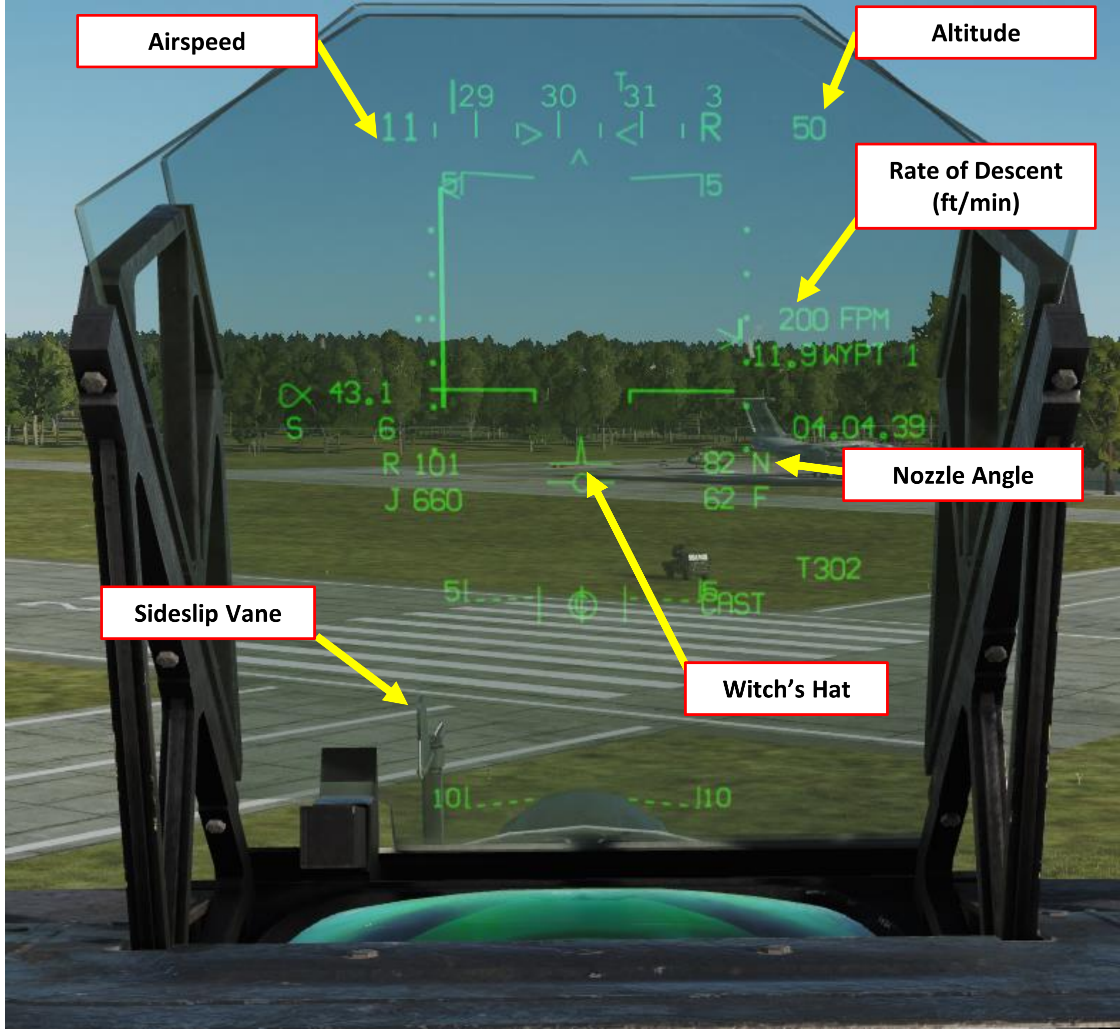




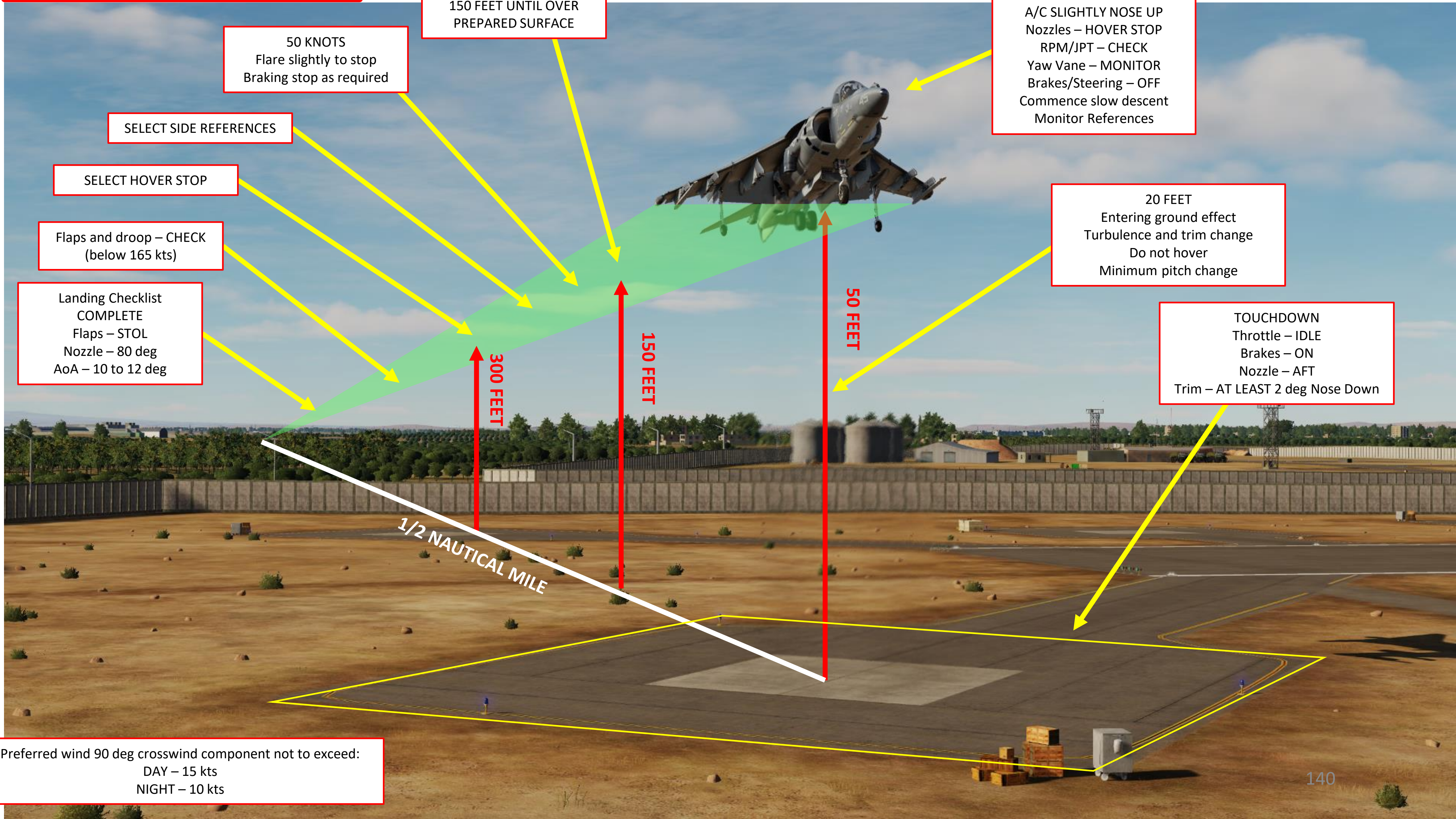


8 - VERTICAL LANDING (VL)

13. Approach the Key (reference point half a nautical mile from landing site) straight in at an altitude of 325 ft AGL. Make sure to adjust rudder to keep the Wind Sideslip Vane straight (land into the wind).
14. At the Key, set Nozzles to 82 deg.
15. Flare slightly to slow down to 50 kts and adjust aircraft attitude to set the Witch Hat on the horizon. Gradually slow down the aircraft to a hover.
16. Once set in a hover, gently reduce power to land. Your rate of descent should not exceed 300-400 ft/min.
17. At 20 ft, the aircraft will come into ground effect.
18. When on the ground, set throttle to IDLE, use your brakes and set nozzles fully aft.



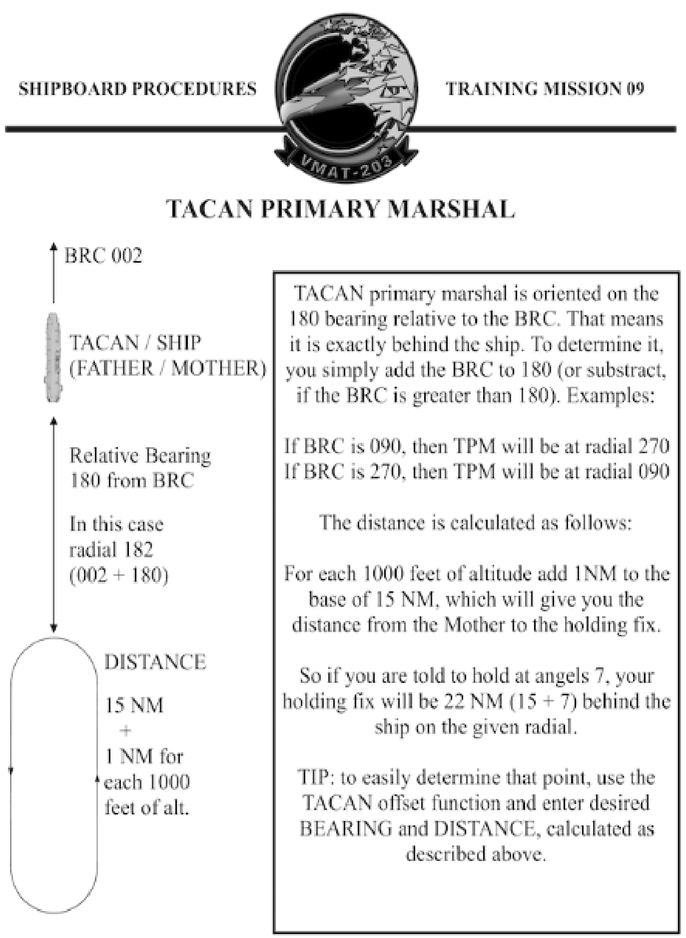
8 - VERTICAL LANDING (VL)

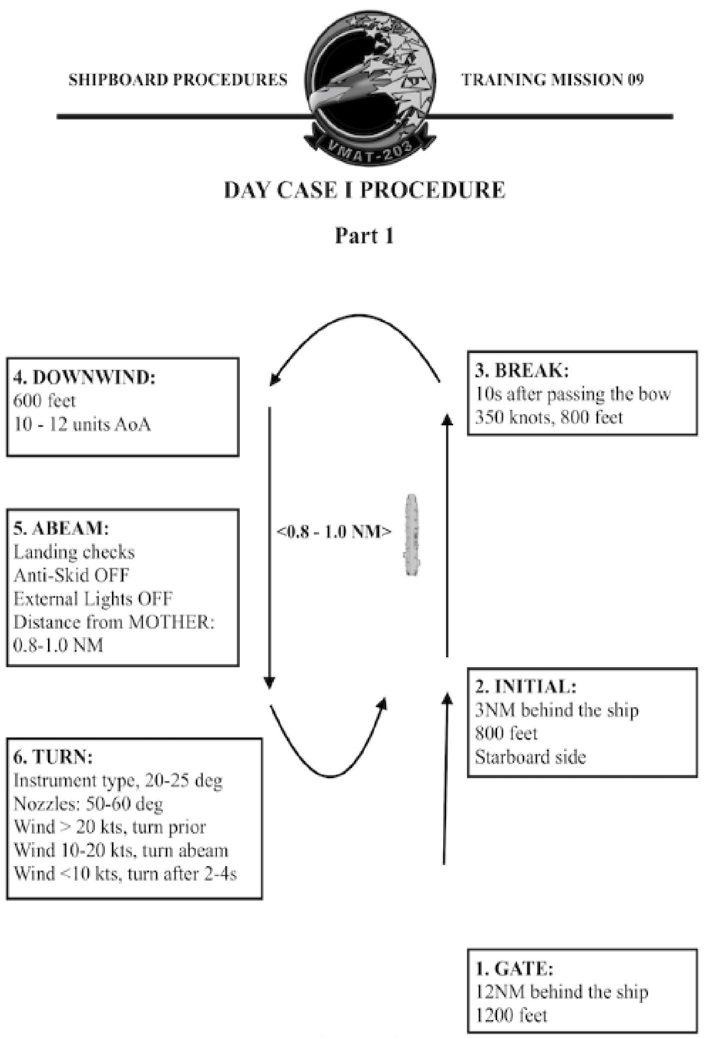


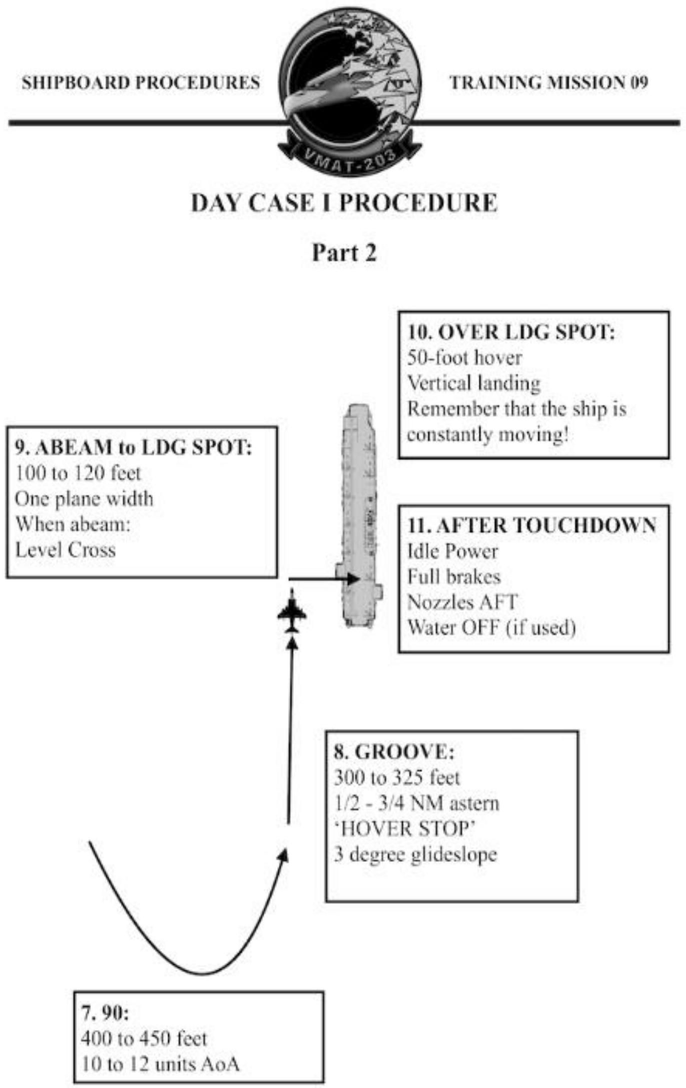
Preferred wind 90 deg crosswind component not to exceed:
DAY – 15 kts
NIGHT – 10 kts

9 - CASE I RECOVERY

Case I Recovery Procedure (taken from Baltic Dragon’s Training Case I Recovery Mission).







9 - CASE I RECOVERY

Note: For vertical landings, your aircraft must not exceed a weight of 20,500 lbs.

1. Make sure the V/STOL Master Mode button is active and the VREST page is accessible from the MPCD main menu, then select VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page.
2. Press OSB next to “VL” to select “Vertical Takeoff” sub-page.
3. Check GWT (Gross Weight) of aircraft and confirm that you do not exceed landing weight.

Before being in the Groove, you should:

4. Set Altimeter Mode to Radar Altimeter
5. Set Anti-Skid Switch to OFF (Down/NWS, very important!)
6. Set Landing Gear DOWN
7. STO STOP lever – CLEAR
8. Set Nozzle Position lever – 60 deg
9. Set flaps to STOL
10. Set Water Injection switch – LANDING (DOWN)
11. STO STOP lever – CLEAR
12. For the approach, set Nozzle Position lever – 60 deg

9 - CASE I RECOVERY

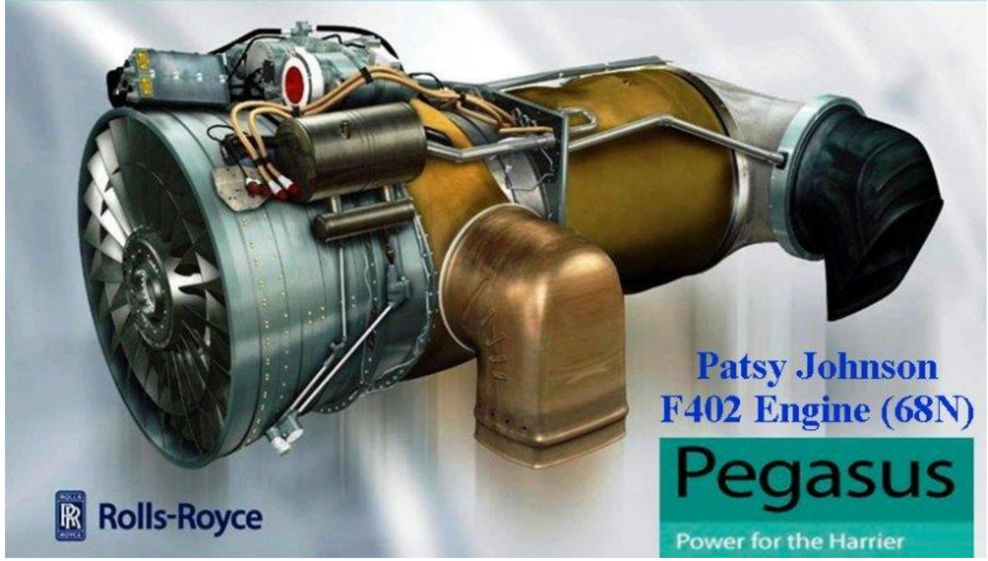
When entering the Groove:

13. Enter the Groove (Final) at approx. 300-325 ft
14. As you slow down at 130-140 kts, level off at 150 ft to avoid sinking and set Nozzle Position lever – 82 deg
15. Keep the aircraft between 1/2 and 3/4 nm astern of the ship. You should be flying in formation with the ship at that point.
16. Fly abeam of the landing spot at an altitude of 100-120 ft, then use rudder to move laterally while remaining level ("Level Cross").
17. Monitor constantly your variometer (sink rate in feet per minute), your Jet Pipe Temperature (J) and your engine RPM (R) in order to not exceed limitations.
18. Gently reduce power to land. Your rate of descent should not exceed 300-400 ft/min.
19. At 20 ft, the aircraft will come into ground effect.
20. When on the deck, set throttle to IDLE, use your brakes and set nozzles fully aft.

Aircraft always flies abeam the ship

9 - CASE I RECOVERY

PEGASUS ENGINE

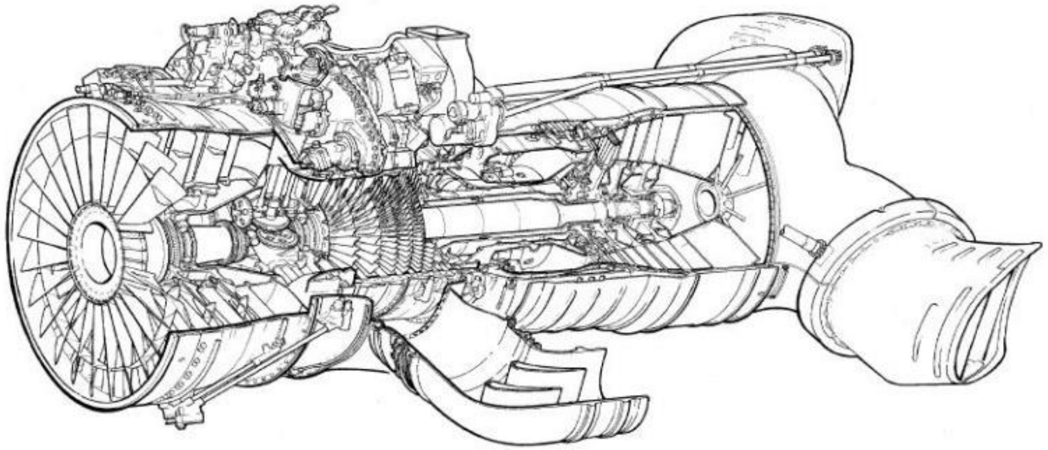


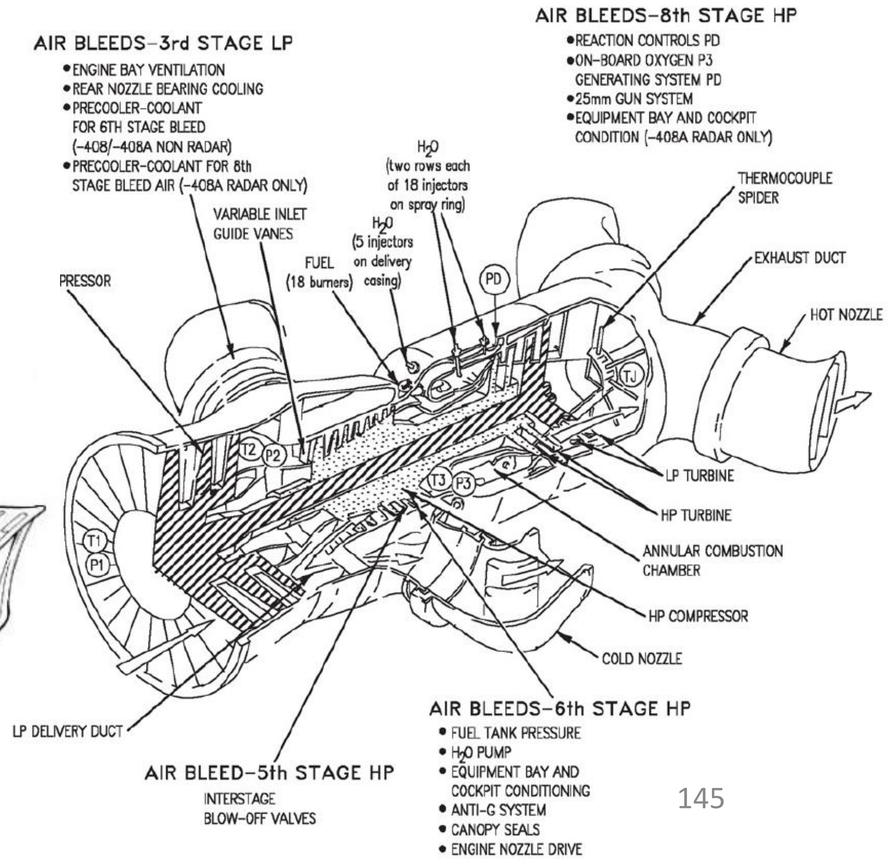
The AV-8B N/A also fields an updated version of the **Rolls-Royce Pegasus 11-61** (F402-RR-408) vectored-thrust turbofan engine.

In the 1950's, there was a perceived need for combat runways for takeoff and landing, and which could, if required, be dispersed for operation from unprepared and concealed sites. Naval interest focused on a similar objective to enable shipborne combat aircraft to operate from helicopter-size platforms and small ships, because of the high cost and expected vulnerability of large aircraft carriers. During the 1950s, numerous projects and research programs were initiated in the United States and Western Europe to study and validate alternative means of achieving the required short or vertical takeoff (VTO) and landing characteristics. One of the answers of the industry to this concern for short runway requirements resulted in the Pegasus.

Originally designed by Bristol Siddeley, the Pegasus was manufactured by Rolls-Royce plc and was not only able to power a jet aircraft forward, but also to direct thrust downwards via four swivelling nozzles. Lightly loaded aircraft equipped with this engine can manoeuvre like a helicopter. In particular, they can perform vertical takeoffs and landings. The Pegasus features three low pressure (LP) and eight high pressure (HP) compressor stages driven by two LP and two HP turbine stages respectively. The Pegasus 11-61 (MK.107, aka -408) is the latest and most power version of the Pegasus, providing 23,800 lbf (406 kN).

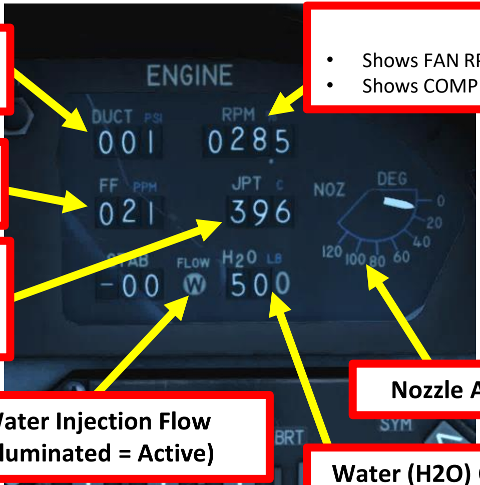
Unusually, the LP and HP spools rotate in opposite directions to greatly reduce the gyroscopic effects which would otherwise hamper low speed handling. LP and HP fan blading is made of titanium, and the LP fan blades operate in the partly supersonic region. Engine starting is done by a top-mounted packaged combined gas turbine starter/APU.

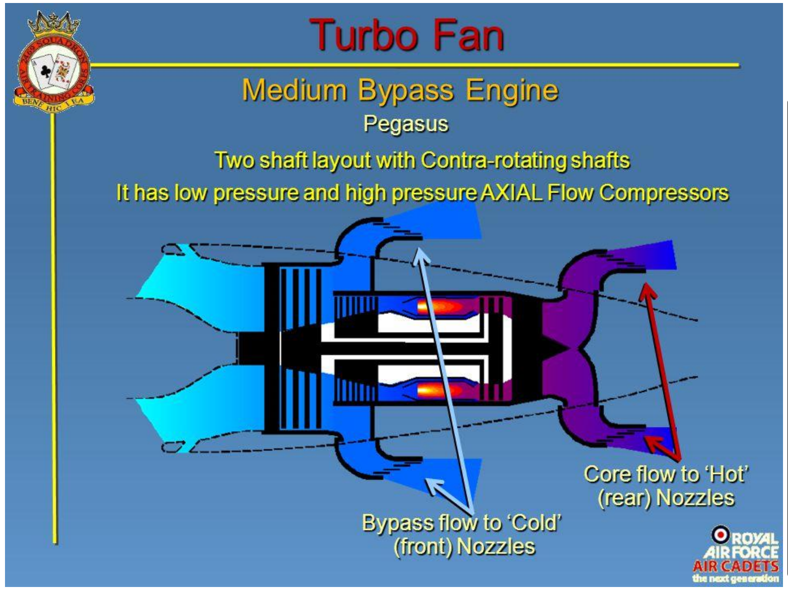




ENGINE PARAMETERS

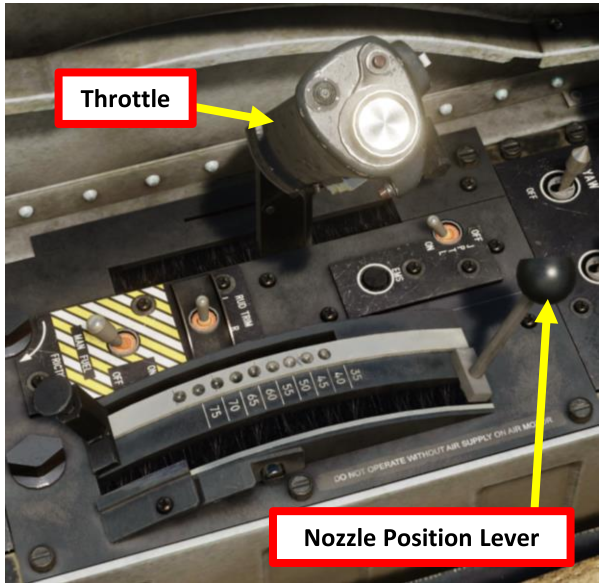
The Pegasus engine has multiple engine parameters. Engine RPM and Jet Pipe Temperature (JPT) can be monitored on the Heads-Up Display if the VSTOL Master Mode is ON.

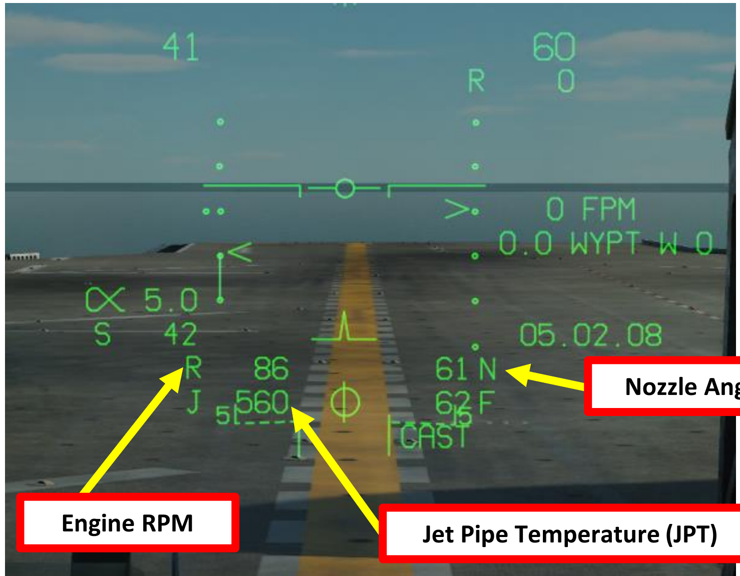




- **SORTIE JPT**: Engine Outlet Jet Pipe Temperature
- **Max JPT:** Maximum Jet Pipe Temperature allowable
- **OT TIME:** Time available while in overtemperature

- **IGV:** Inlet Guide Vane Position (deg). IGVs may be visualized as a valve controlling corrected air mass flow into the high pressure compressor.
- **COMP RPM:** Low Pressure Compressor Speed
- **FAN RPM:** Bypass Fan Speed
- **JPT:** Jet Pipe Temperature
- **COR COMP:** High Pressure Compressor Speed (Engine Core)
- **COR FAN:** High Pressure Fan Speed (Engine Core)
- **FUEL WT:** Fuel Weight (lbs)





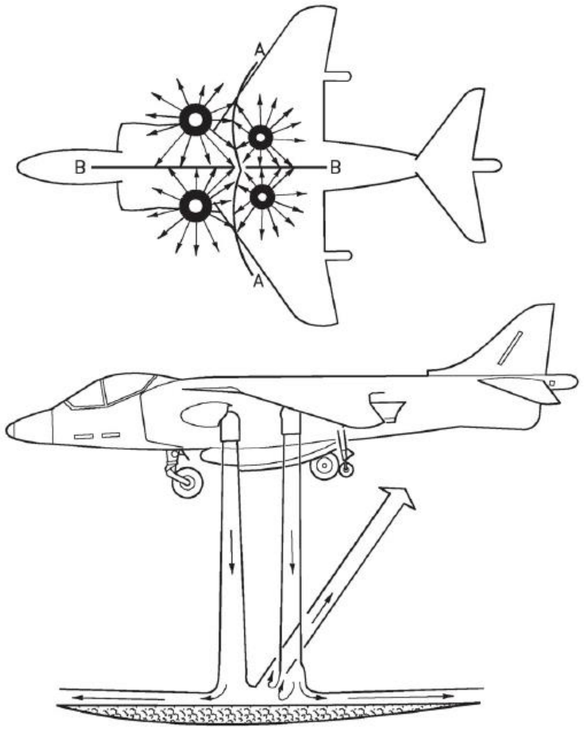
DRY VS WET THRUST

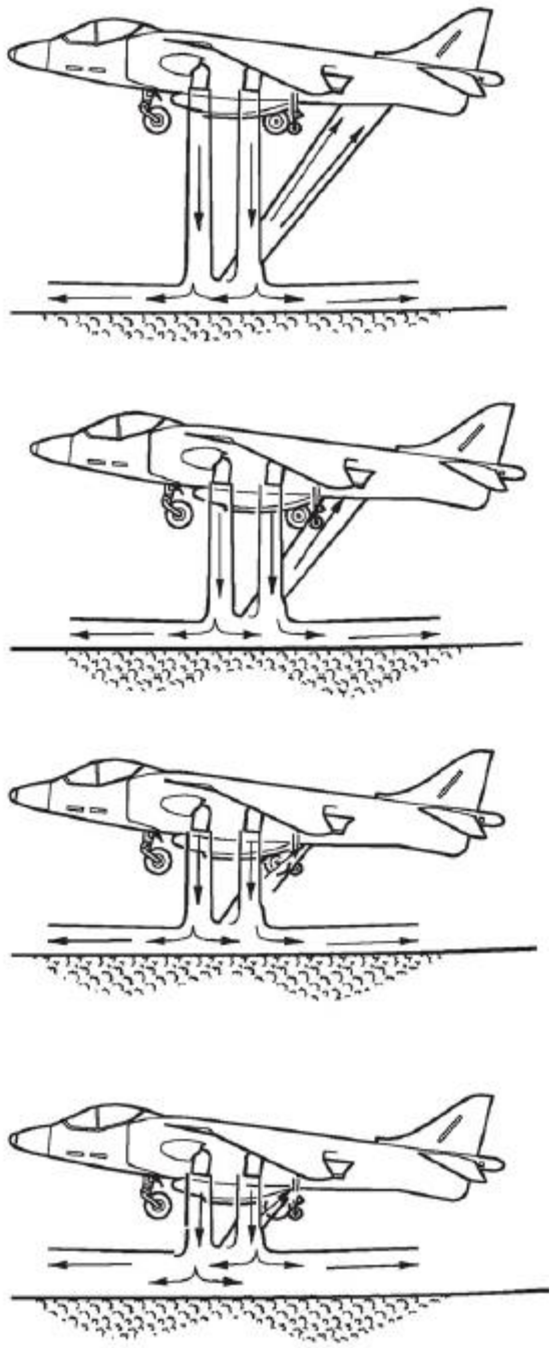
You will often hear “Dry Thrust” and “Wet Thrust” when reading about the Harrier. Is it related to water? Sort of. Is it related to flying over water? Umm… no.

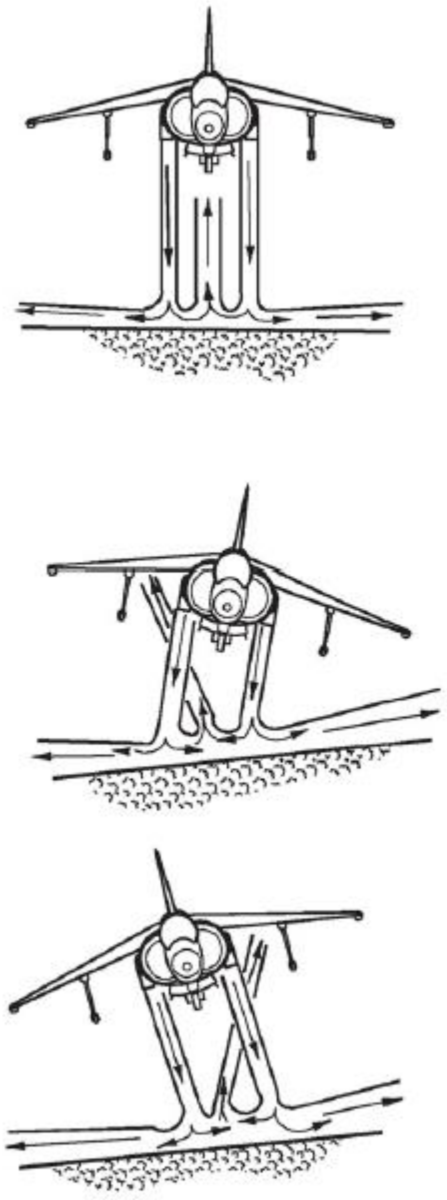
Dry thrust usually refers to « non-augmented” thrust. This means thrust produced without the use of afterburners or liquid injection. The maximum thrust produced by jet engines without afterburner is sometimes called MIL (Military) thrust.

Wet thrust, on the other hand, refers to « augmented » thrust. The thrust of a jet engine can be increased by using methods like water/methanol injection (mostly in older turbojet engines) or by using afterburners (reheaters).

Keep in mind that thrust in the Harrier can create a very unstable flight in certain conditions. Consult the pictures to the right and test out the behaviour of the harrier in vertical flight while hovering.







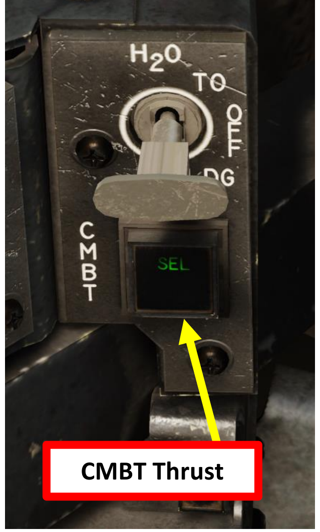
ENGINE RATINGS & LIMITS

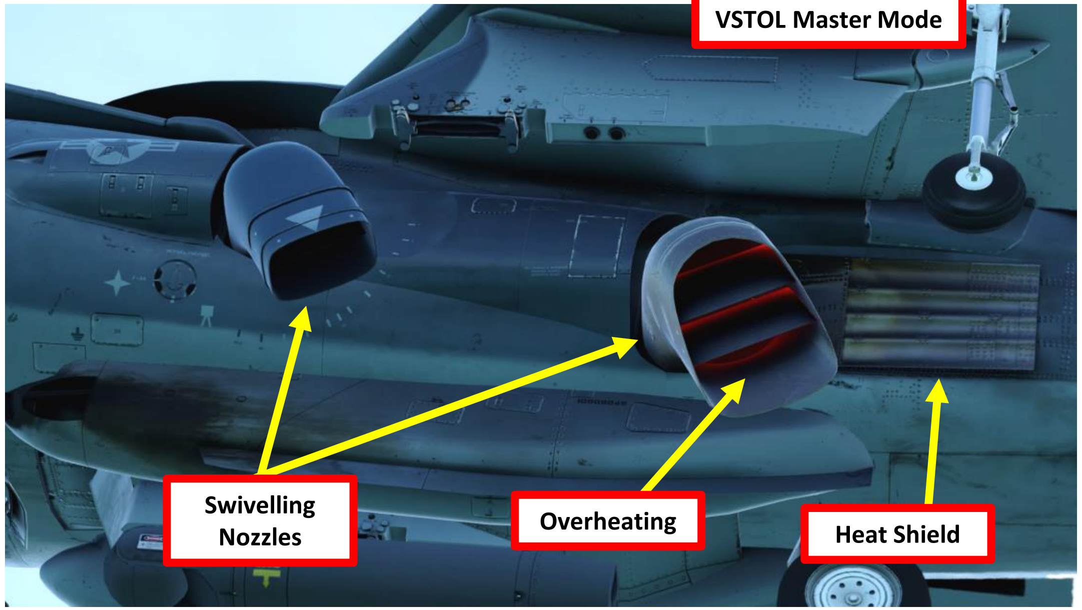
The Pegasus engine of the Harrier requires constant monitoring. The Pegasus is prone to overheating, especially in phases of flight like takeoff and hover.

RPM and JPT (Jet Pipe Temperature) are the primary parameters that you will have to keep an eye on.

If you use the "VSTOL" Master Mode, your engine parameters can be monitored directly on the HUD (Heads-Up Display) with their power margins.

The "**Combat Thrust**" rating can be selected by pressing the CMBT switch/light, which will give you additional thrust. A side-effect of this rating is that your JPT will increase to a point where you can't use this rating more than a few minutes (about 10 minutes).



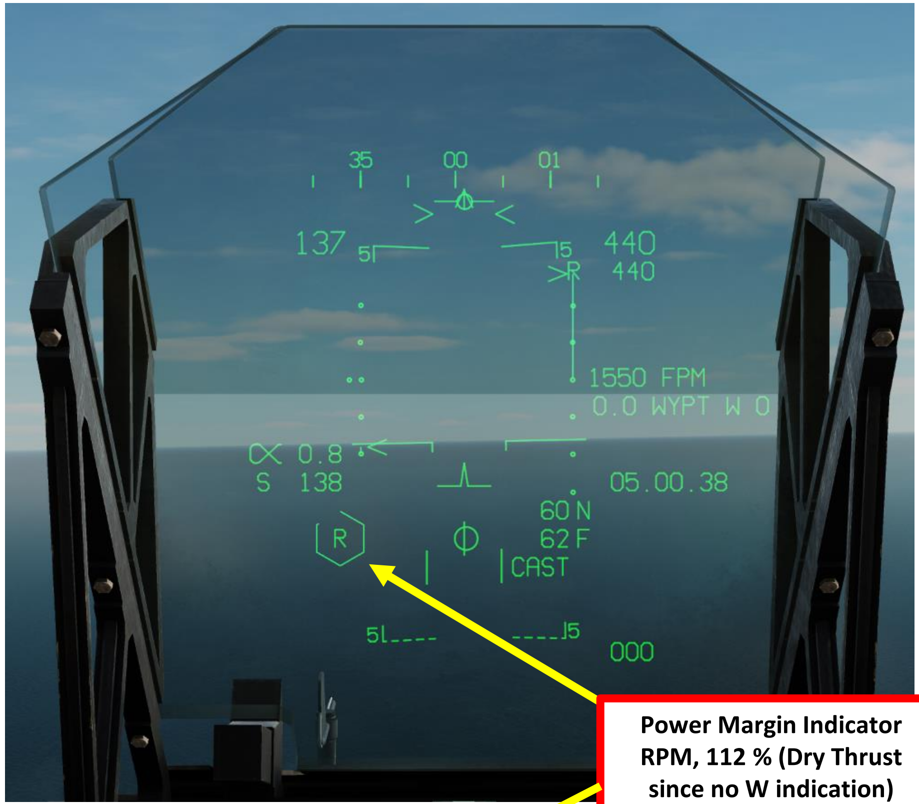


Engine Limits

<table>
<tr><th rowspan="2">RATING</th><th rowspan="2">Notes</th><th colspan="7">LIMITATIONS</th></tr>
<tr><th>MAXIMUM % RPM</th><th>MAXIMUM °C JPT</th><th colspan="5">COMBINED TIME LIMITS</th></tr>
<tr><td>SHORT LIFT WET</td><td>1</td><td>120.0</td><td>800</td><td rowspan="2">A</td><td rowspan="3">B</td><td rowspan="4">C</td><td rowspan="5">D</td><td rowspan="6">E</td></tr>
<tr><td>SHORT LIFT DRY</td><td></td><td>113.5</td><td>780</td></tr>
<tr><td>NORMAL LIFT WET</td><td>1, 2</td><td>116.0</td><td>780</td><td></td></tr>
<tr><td>NORMAL LIFT DRY</td><td>2</td><td>111.0</td><td>765</td><td></td><td></td></tr>
<tr><td>COMBAT</td><td></td><td>111.0</td><td>750</td><td></td><td></td><td></td></tr>
<tr><td>MAXIMUM THRUST</td><td></td><td>109.0</td><td>710</td><td></td><td></td><td></td><td></td></tr>
<tr><td>MAXIMUM CONTINUOUS</td><td>2</td><td>102.0</td><td>645</td><td colspan="5">UNLIMITED</td></tr>
<tr><td>IDLE</td><td>5</td><td>28.4 – 29.0</td><td>545</td><td colspan="5">UNLIMITED</td></tr>
<tr><td>STARTING</td><td>2, 4</td><td></td><td>475</td><td colspan="5">MOMENTARILY</td></tr>
<tr><td colspan="4">1. Do not use water injection below ambient temperatures of -5°C or at altitude above 10,000 feet.
2. Requires pilot action to maintain limit.
3. Each 2.5 or 10.0 minute period of operation at the lift or combat ratings respectively must be separated by a minimum of 1 minute at maximum thrust or below.
4. Slow or abortive starting attempts should be discontinued without waiting for JPT to reach 475°C.
5. The minimum allowable sub-idle RPM is 22%</td><td colspan="5">A. 15 Seconds
B. 1.5 Minutes
C. 2.5 Minutes
D. 10.0 Minutes
E. 15.0 Minutes</td></tr>
</table>

ENGINE RATINGS & LIMITS

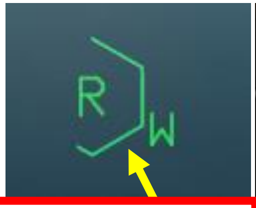
The Power Margin Indicator indicates the limiting engine parameter, either R (RPM) or J (Jet Pipe Temperature). The Hexagon gradually fills up as JPT/RPM increases. The last leg of the hexagon continues in a straight line and indicates an exceedance: avoid to remain in that engine setting for too long.



Power Margin Indicator RPM, 112 % (Dry Thrust since no W indication)

Power Margin Indicator

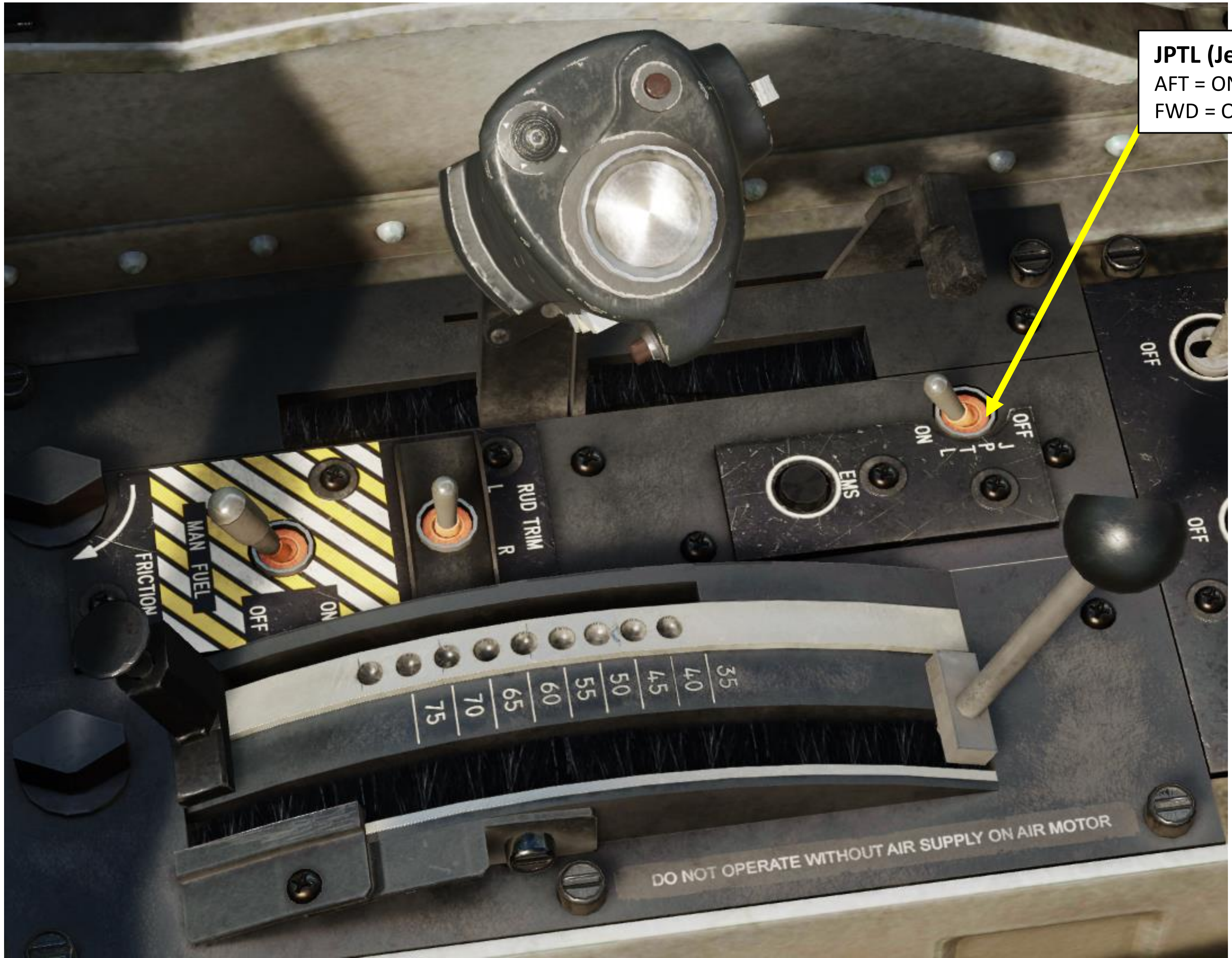
	RPM - %			JPT – °C	
	DRY	WET		DRY	WET
R	107.0	113.5	J	715	735
R	108.0	114.5	J	725	745
R	109.0	115.5	J	735	755
R	110.0	116.5	J	745	765
R	111.0	117.5	J	755	775
R	112.0	118.5	J	765	785
R	113.0	119.5	J	775	795
R	113.5	120.0	J	780	800



Power Margin Indicator RPM, 116.8 % (Wet Thrust there is a W indication)

JPTL (JPT LIMITER)

The engine controller has a JPT (Jet Pipe Temperature) Limiter, which is a control loop that automatically reduces fuel flow input to the engine when the engine is about to exceed acceptable JPT limits. This switch should be left to ON (AFT) during normal operation.



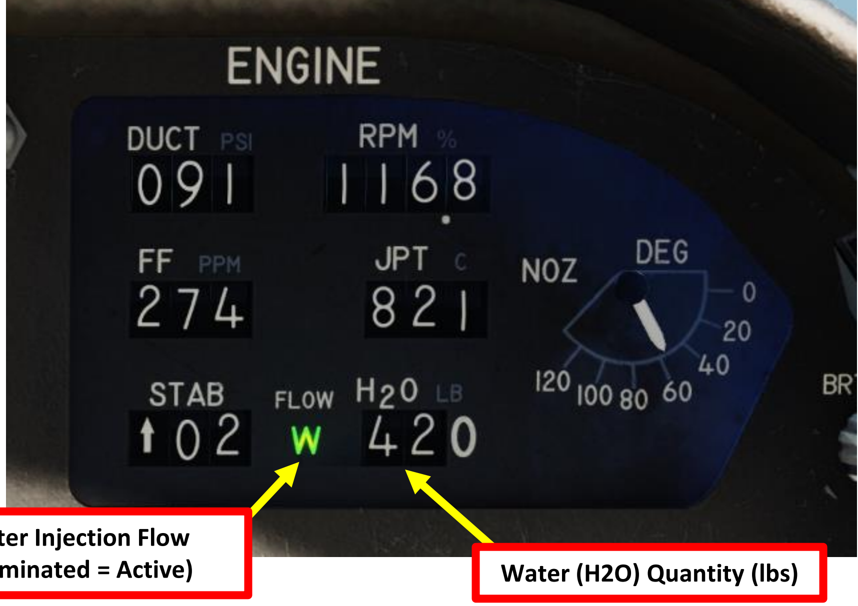
JPTL (Jet Pipe Temperature Limiter) Switch
AFT = ON
FWD = OFF

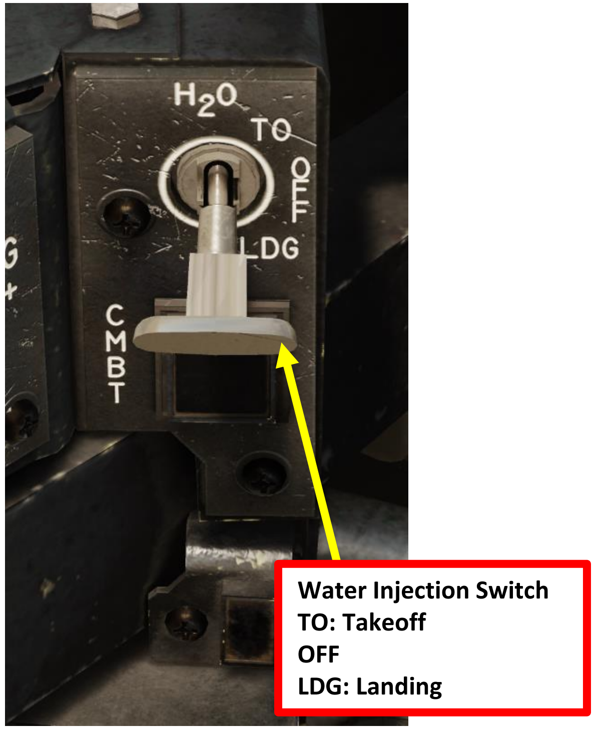
WATER INJECTION

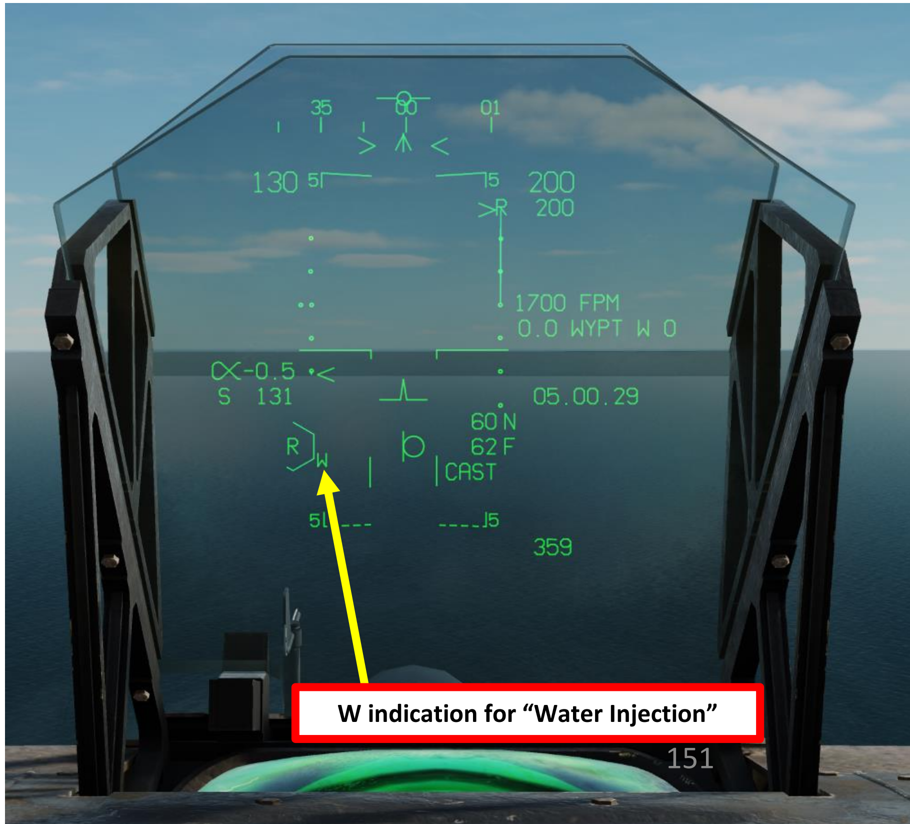
The Harrier uses a Water Injection system. This system injects water in order to cool the JPT (Jet Pipe Temperature) by about 20 deg C. The practical effect of water injection is that it allows the engine to reach higher power settings (i.e. engine RPM by 6 to 7 %) without exceeding JPT limits. Adding water increases the mass being accelerated out of the engine, increasing thrust, but it also serves to cool the turbines.

Keep in mind:

1. Operating the engine within these higher limits can seriously reduce engine life and can cause premature engine failure if overused
2. Water Injection will consume water from the water tank while it is used. When you run out of water, it's gone for good. If you are too heavy and need water injection to land and you have no more water in reserve, you should dump fuel to reduce your weight.
3. Water injection is really used during takeoff and landing. There is no practical use for it in other phases of flight.
4. Do not use water injection below ambient temperatures of 5 deg C, or at altitude above 10,000 ft.
5. Water injection will only be active if the Water Injection Switch is either to TO or LDG, and the engine is in a power setting that exceeds limitations listed on the Engine Limitations page.
6. Water flow is stopped by reducing the throttle below 103 to 105 % RPM or by setting the Water Injection Switch to OFF



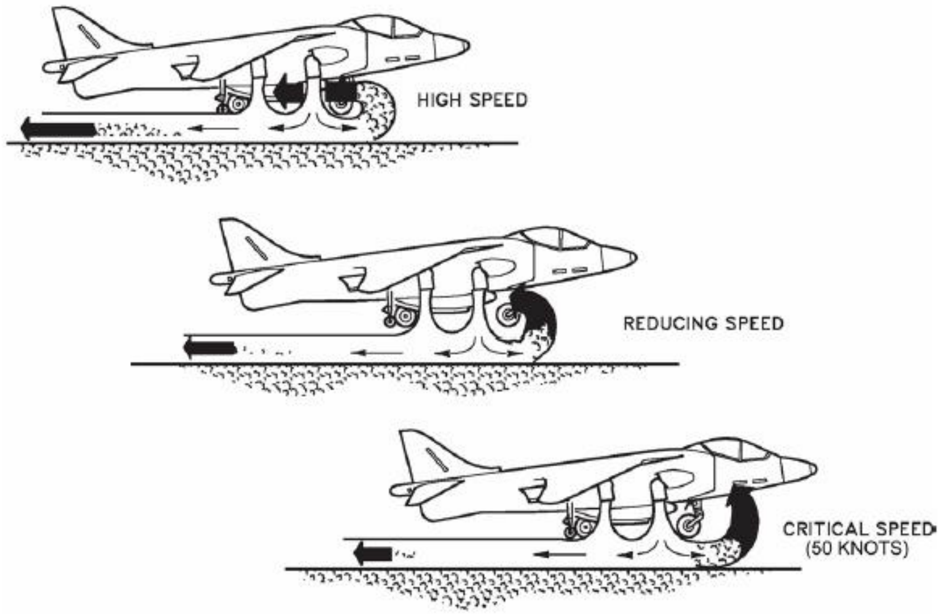


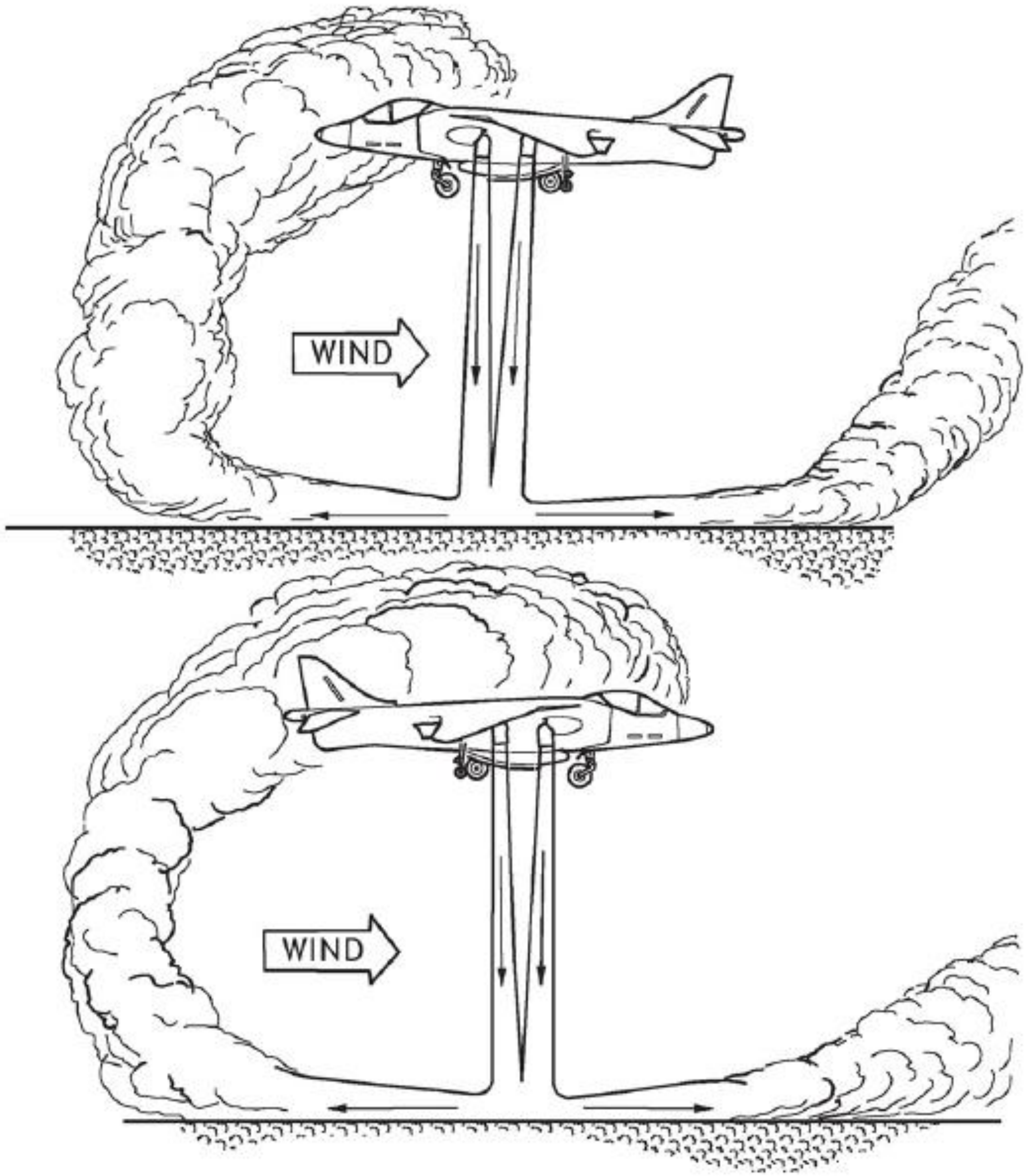


ENGINE OPERATION TIPS

The Harrier engine can be troublesome for the uninitiated. Here are some tips:

- Hot Gas Ingestion (HGI) is a serious hazard to consider when flying vertically. Avoid doing hover flights and descending too quickly: this can lead hot gas to enter the engine intake and seriously reduce your power, which can be very dangerous when landing or descending.
- Constantly monitor your engine parameters once in a while. The Pegasus CAN break and WILL break if you don't take good care of it.
- Always make mental calculations for your weight. Aircraft weight limitation exceedance is a critical factor when doing a short or vertical landing, and it is one of the main causes for botched vertical landings in DCS.



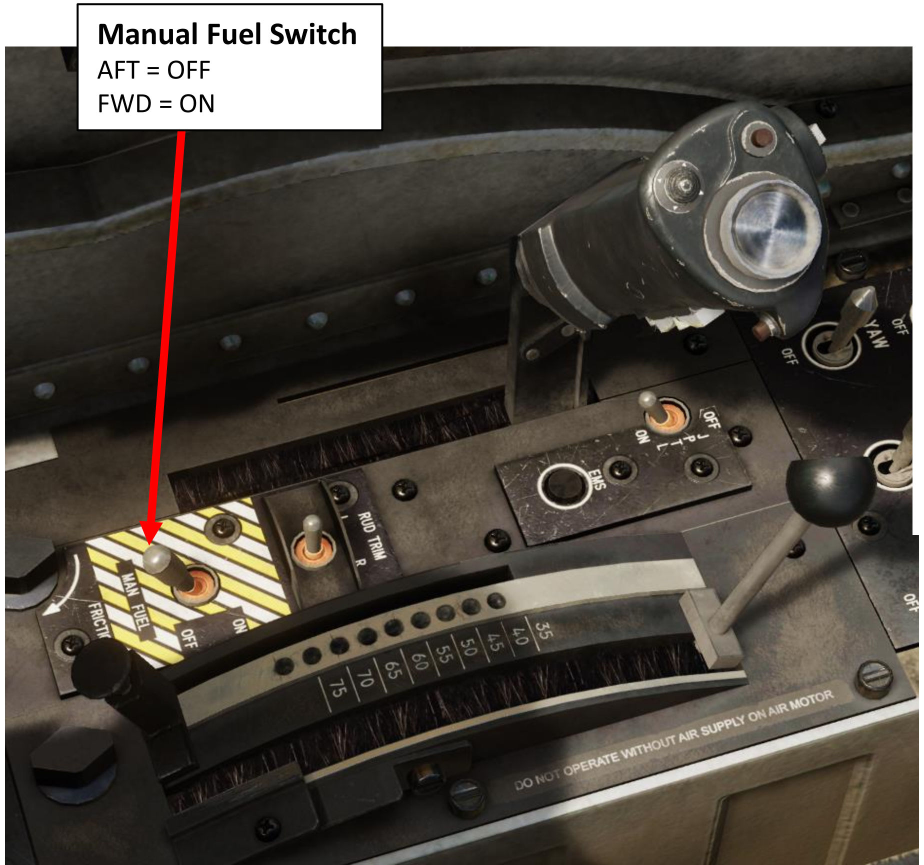


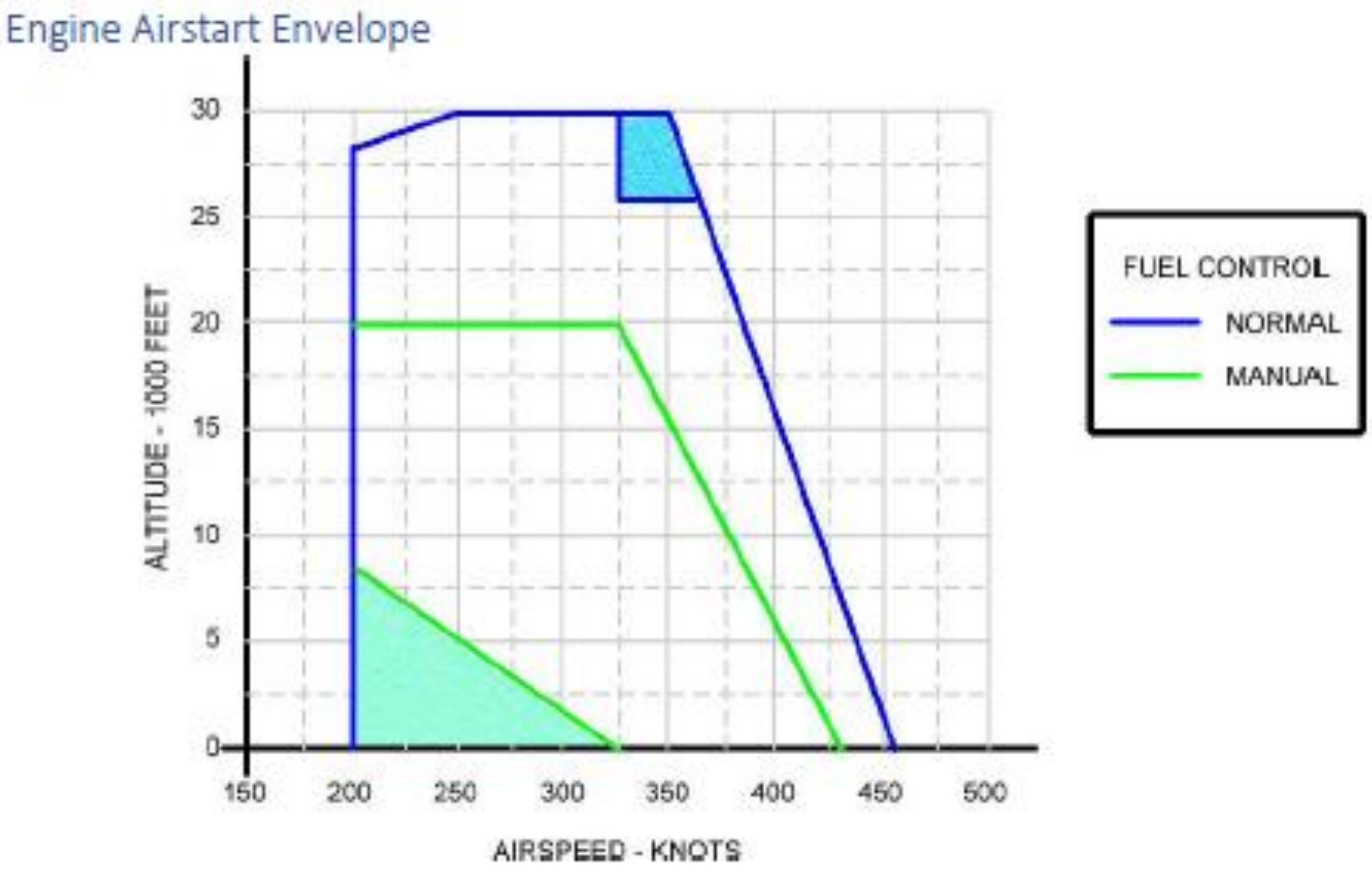
ENGINE RELIGHT

In case of an engine flameout, you can attempt to restart it by using the engine start procedure listed in the PART 4 – START-UP PROCEDURE section. The airstart envelope includes manual and normal fuel control.

Notes:

- Corrected fan speed is limited to 116.8 % below 10,000 ft MSL and 110.5 % above 30,000 ft.
- When manual fuel is selected, pilot action is required to maintain all engine limits since engine limiters will be overridden by the pilot.
- Maximum engine overspeed is 122 % for 15 seconds or 124 %





- Blue Region: Airstarts attempts in this region may require in excess of 15 seconds for light-off.
- Green Region: When the aircraft is in this region, there may not be enough time to relight the engine. Once relight has begun it may require over 30 seconds to reach IDLE rpm.

LIMITS

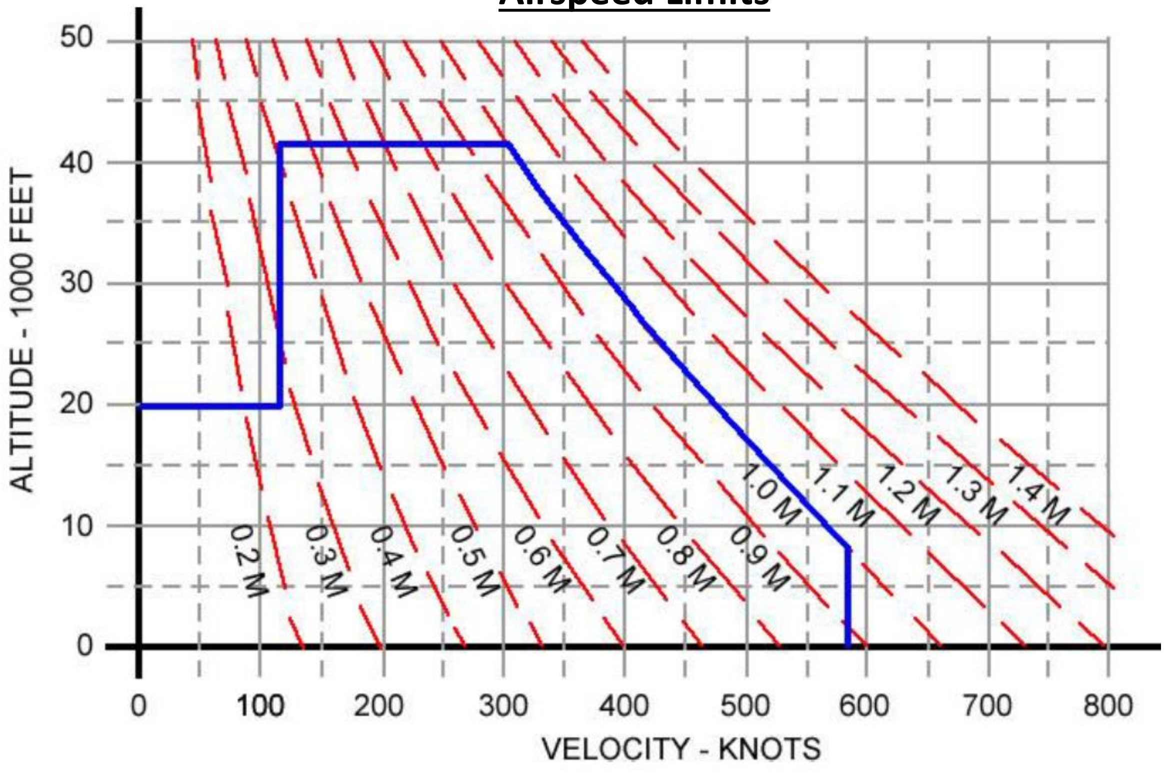
AIRSPEED LIMITATIONS

- Flaps – STOL: 300 kts
- Flaps – CRUISE: 0.87 Mach
- Landing Gear – OPERATION/LOCKED DOWN: 250 kts
- Landing Gear – EMERGENCY EXTENSION: 210 kts
- Q-feel disengaged: 500 kts
- One Hydraulics system inop: 500 kts
- Canopy open: 40 kts
- Wheel in contact with ground: 180 kts ground speed
- LIDS fence extended: 200 kts
- Air Refueling Probe extended: 300 kts

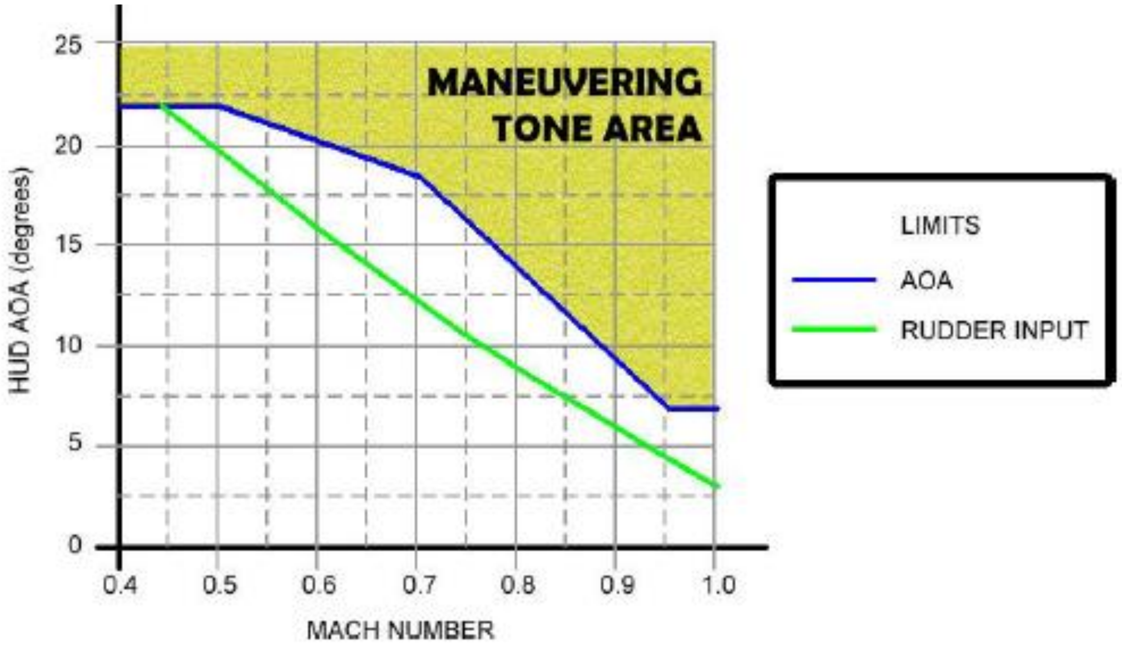
PROHIBITED MANOEUVERS

1. VTO with asymmetric load/stores greater than 45,000 inch-pounds.
2. STO with asymmetric load/stores greater than 85,000 inch-pounds.
3. CTO with asymmetric load/stores greater than 100,000 inch-pounds.
4. AUTO Flaps SL with asymmetric load/stores greater than 148,000 inch-pounds.
5. STOL Flaps SL with asymmetric load/stores greater than 85,000 inch-pounds.
6. VL with asymmetric load/stores greater than 80,000 inch-pounds.
7. Takeoff with less than 10^0 nozzles until wingborne.
8. Spin
9. Under 1g for more than 15 seconds.
10. Overriding aileron high speed stop.
11. Roll over 360^0.
12. In accelerating or decelerating transition:
    a. Over 15^0 AOA above 50 knots with landing gear down.
    b. Between 30 to 100 knots, slideslip requiring more than ½ lateral stick or with RPS on.
13. Rearward or sideward translation above 30 knots.
14. Thrust Vector Control (TVC) above 30,000 feet at AOA above onset of stall warning/maneuvering
15. Flight above onset of stall warning/maneuvering tone with more than 60,000 inch-pounds asymmetry.
16. Abrupt simultaneous stabilator, rudder or aileron inputs with more than 90,000 inch-pounds asymmetry.
17. Wingborne flight at any speed with more than 148,000 inch-pounds asymmetry.
18. Flight above 0.88 Mach with more than 90,000 inch-pounds asymmetry. (see note)
19. Departure above 250 knots.
20. Rudder deflection above 0.80 Mach.

Airspeed Limits



Angle of Attack Limits

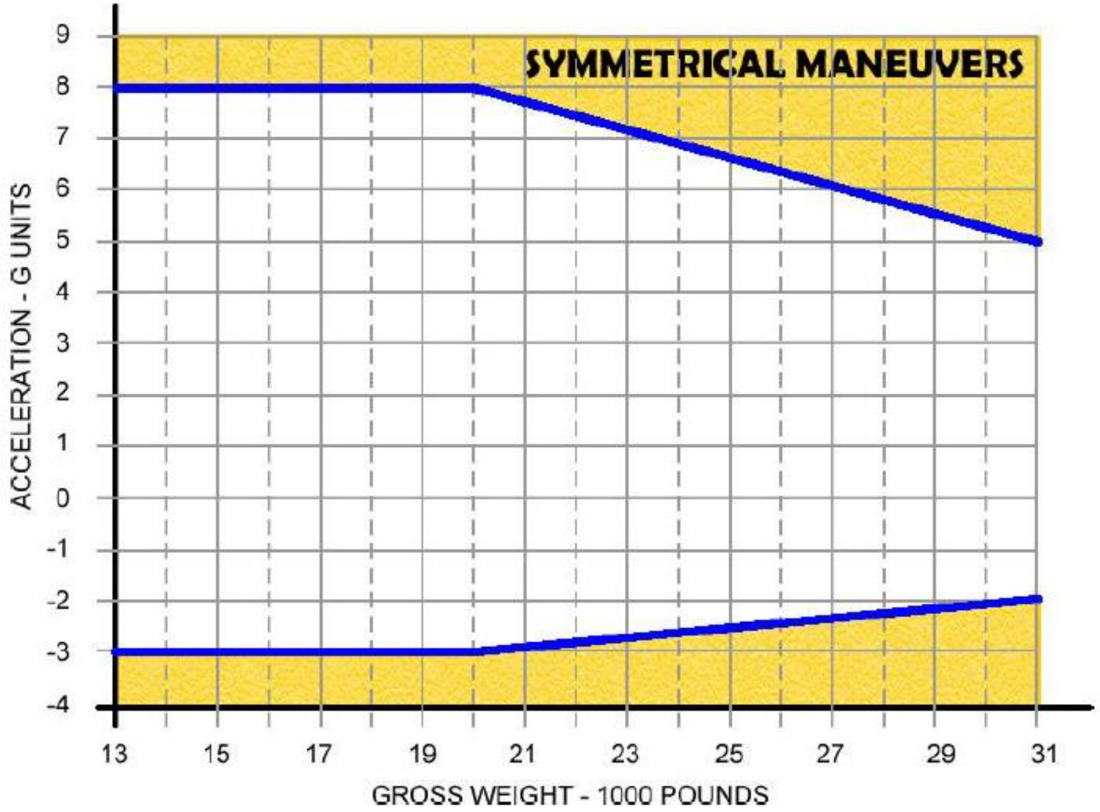


LIMITS

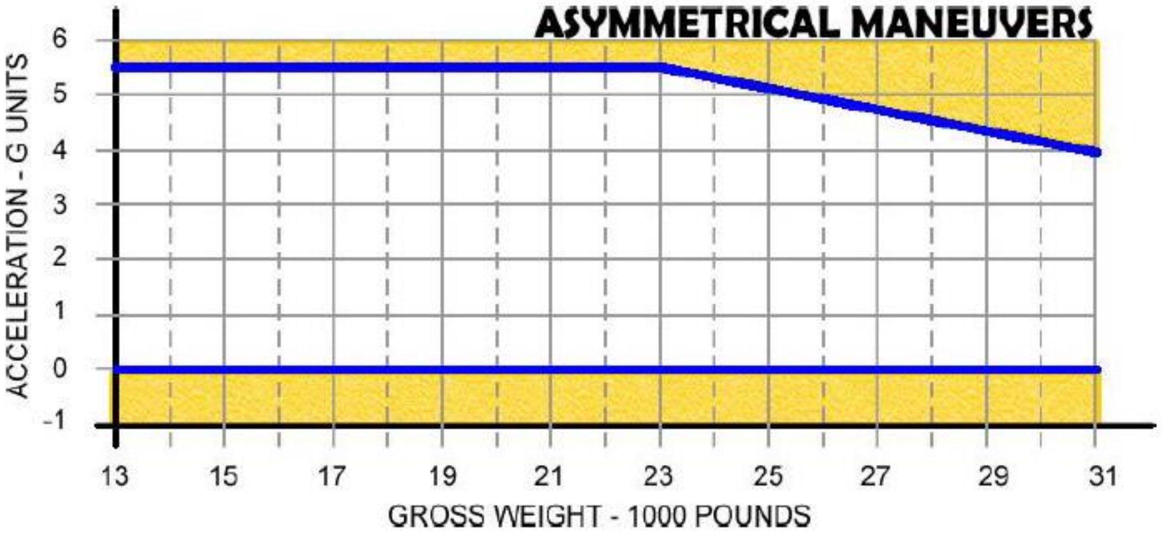
ACCELERATION LIMITATIONS NOTE

- Maximum permissible acceleration in the takeoff and landing configuration is 0.0 g to 2.0 g.

Acceleration Limits (G)
SYMMETRICAL MANOEUVERS



Acceleration Limits (G)
ASYMMETRICAL MANOEUVERS



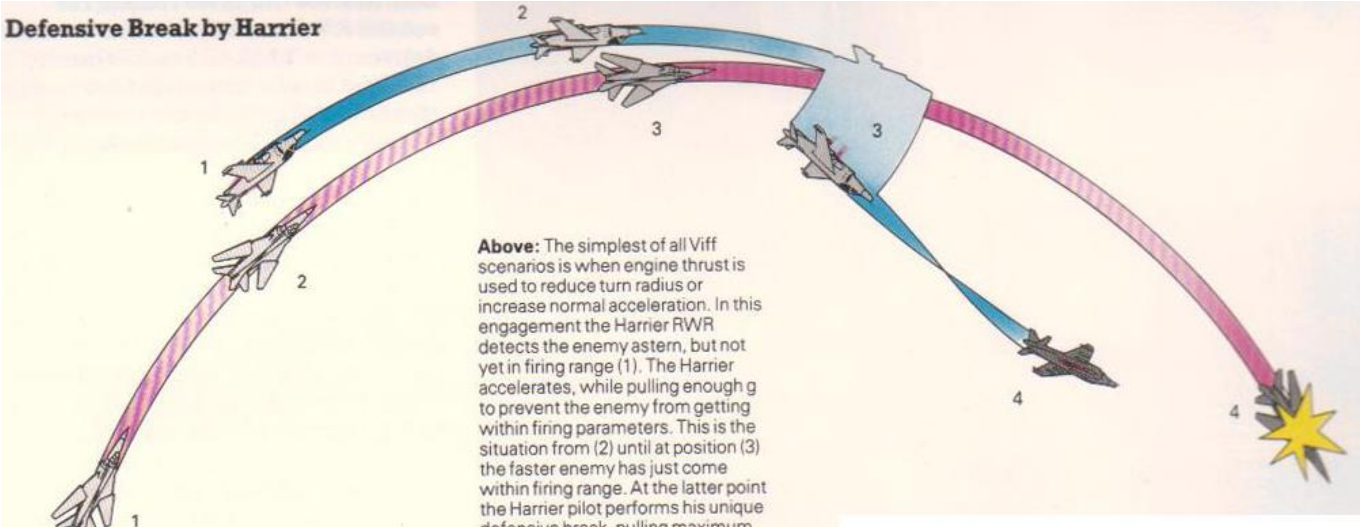
NOTE

Air-to-air load is two AIM-9 Sidewinders on pylons 1 and 7 and the GAU-12 gunpod.

THE VIFF CONCEPT

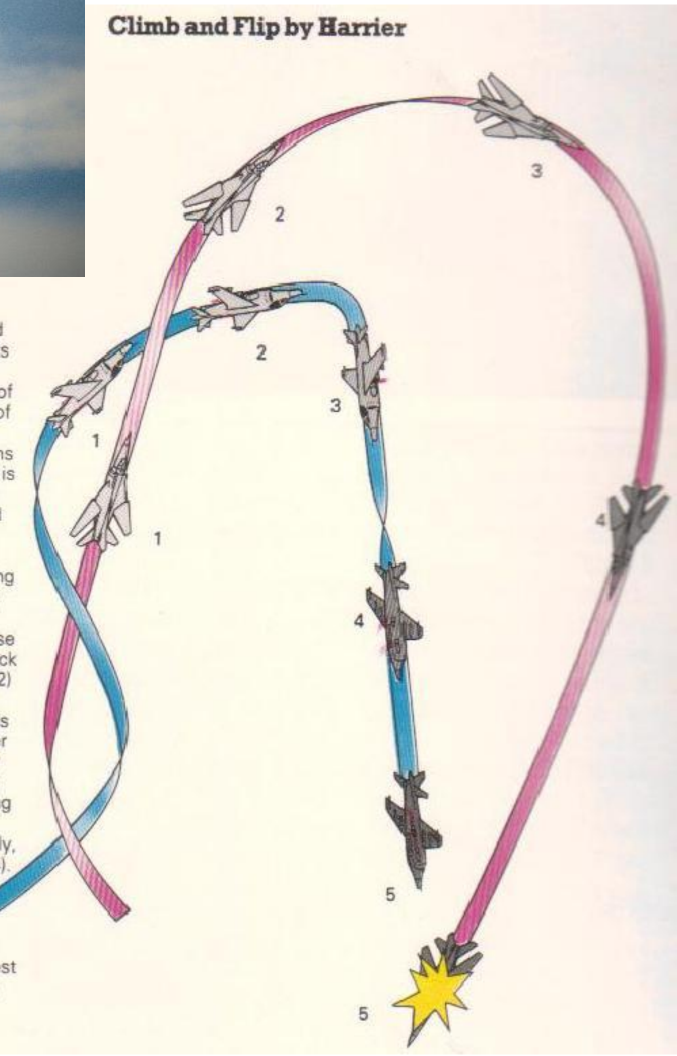
VIFF (Vectoring In Forward Flight) basically involves pilots rotating the nozzles forward from the usual in-flight horizontal position. In doing so, pilots can quickly deplete their airspeed and bleed energy, causing their surprised pursuer(s) to overshoot, suddenly finding their windscreen devoid of any prey they might have previously been chasing. After dropping altitude as a result of VIFFing, the Harrier can now be free to turn the tables on the predator, making the hunter the hunted. In a turning fight, this is an immense advantage for the Harrier's pilot. But as soon as the pilot VIFFs his opponent, he has to have had a plan for dealing with the bandit, or else he can be in for a world of hurt; that isn't a trick any combat pilot will fall for twice.

On paper, VIFFing sounds like a great idea. However, among VIFF's disadvantages is the fact that it can only really be used effectively in turning fights. If the pursuing aircraft is flying with a wingman, or as part of a larger attack flight, the odds would be stacked fairly high against the Harrier. Additionally, after VIFFing, any other enemy fighters that are not engaged in the melee between the Harrier and the first jet are placed in a prime position to take a shot at the jumpjet, which takes time to rebuild energy from the very-taxing VIFF maneuver (i.e. regain airspeed).



Right: In these three sets of artwork the Harrier appears as an RAF GR.3, but in fact the drawings are based on originals stemming from the US Marine Corps, who pioneered the use of Viffing as an extra advantage in combat.

Above: The simplest of all Viff scenarios is when engine thrust is used to reduce turn radius or increase normal acceleration. In this engagement the Harrier RWR detects the enemy astern, but not yet in firing range (1). The Harrier accelerates, while pulling enough g to prevent the enemy from getting within firing parameters. This is the situation from (2) until at position (3) the faster enemy has just come within firing range. At the latter point the Harrier pilot performs his unique defensive break, pulling maximum normal acceleration and adding Viff. There is no way the enemy can avoid overshooting, and he then becomes an easy close-range target (4). Variables are numerous, one being that at (3) the Harrier pilot could even set the nozzles to 98·5° for more violent deceleration; another is that at (4) the half-roll may not be necessary, especially if AAMs are used.



Right: In this so-called "climb and flip" the Harrier performs one of its numerous "impossible" manoeuvres, which are now part of the routine air-combat repertoire of all experienced US Marine Corps Harrier pilots. The sequence begins with the Harrier (whose trajectory is indicated by a blue line in all these illustrations) and its adversary (red line) climbing in a steep spiral and losing speed, the enemy close behind and eager to get within firing parameters before the Harrier can pull one of its tricks. From this position (1), with the enemy in close trail, the Harrier pilot using light stick forces pulls well past the vertical (2) and, as the speed bleeds away through the 200-knot level, he adds a small nozzle angle (3). The Harrier very quickly flips to a 90° nose-low attitude. The enemy has no option but to follow a semi-ballistic arching curve to end up going steeply downhill. Still travelling quite slowly, the Harrier goes into full reverse (4). There is no way the enemy can avoid going on down past what seems to be a Harrier stopped in mid-air. When the enemy gets to position (5) he presents the simplest possible target, for guns or AAMs.

GPWS: GROUND PROXIMITY WARNING SYSTEM

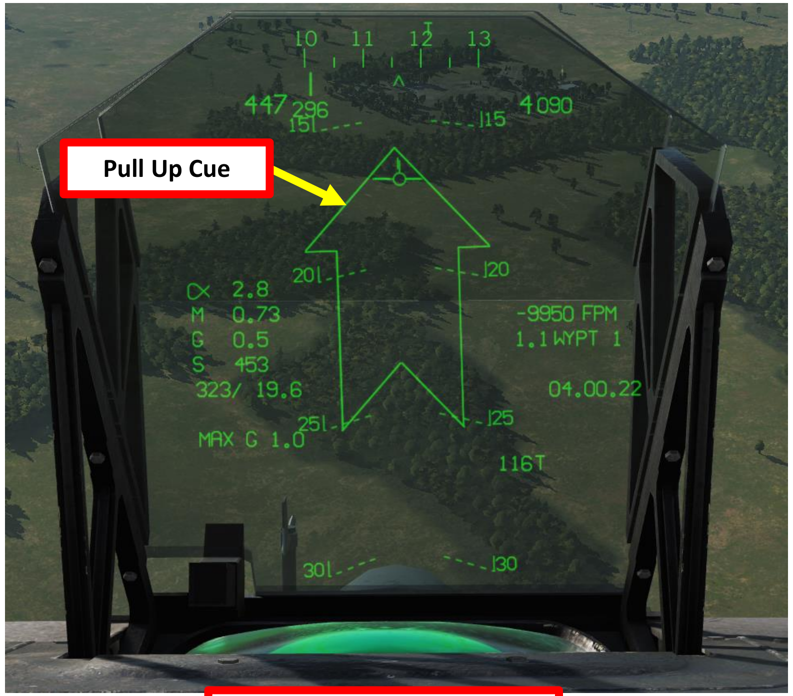
The GPWS (Ground Proximity Warning System) is a safety backup system that alerts (aural warnings) the aircrew of an impending controlled flight into terrain (CFIT) condition. The GPWS option window 4 on the ODU with **UFC ALT** option selected allows the pilot to disable/enable the system. A colon in the option window indicates selection. GPWS can be deactivated. Deactivation of GPWS starts a 20 minute timer which automatically activates GPWS when the 20 minutes has expired.

GPWS provides warnings of potentially unsafe maneuvering flight conditions, such as excessive bank angles, excessive sink rates, gear—up landings, floor altitude violations, limited protection against flight into rising terrain, diving flight depending on flight stages that include takeoff, cruise, or landing, and Altitude Loss During Recovery (ALDR). GPWS also provides for terrain compensation over downward sloping terrain.

You can also change the Low Altitude Warning Minimum Altitude. To set the LAW altitude just click on the ALT button and any option except PUC. The value in the scratchpad is the selected minimum altitude AGL.

GPWS: GROUND PROXIMITY WARNING SYSTEM

Voice Warning & Associated Warning/Caution Lights				
Voice Warning	**Priority Number**	**Caution Light**	**Warning Light**	**Implication**
ENGINE FIRE	1	-	FIRE	Same as warning light.
OVERTEMP	2	-	OT	Same as warning light.
HYDRAULICS	3	-	HYD	Same as warning light.
FUEL CONTROL	4	-	EFC	Same as warning light.
FLAP FAILURE	5	-	FLAPS	Same as warning light.
RIGHT FEED	5	-	R FEED	Same as warning light.
LANDING GEAR	6	-	GEAR	Same as flashing GEAR warning light.
ALTITUDE	7	-	LAW	Same as warning light.
LEFT TANK	8	-	LTANK	Same as warning light.
RIGHT TANK	8	-	RTANK	Same as warning light.
FIFTEEN SECONDS	9	15 SEC	-	Same as caution light.
BINGO	10	BINGO	-	Same as caution light.
LIMITER OFF	11	-	JPTL	Same as warning light.
OBSTACLE	12	-	-	Aircraft is at or below the set obstacle clearance elevation angle for AWLS.
WATER	13	H_2O	-	Same as caution light.
FUEL LOW LEFT	14	L FUEL	-	Same as flashing caution light.
FUEL LOW RIGHT	14	R FUEL	-	Same as flashing caution light.
GENERATOR	15	-	GEN	Same as warning light.
MANUAL FUEL	16	MFS	-	Same as caution light.
CAUTION	17	MASTER CAUTION	-	A caution light on the caution/advisory light panel has illuminated.
ACNIP GO	-		-	ACNIP BIT passed.
ACNIP FAIL	-		-	ACNIP BIT passed.



SECTION STRUCTURE

1 – SENSORS INTRODUCTION
1.1 – Sensors Overview

The Harrier comes equipped with the following sensors:

- **INS** (Inertial Navigation System): the built-in INS can be used for target designation with coordinate position (waypoint, mark points, mark offset points) and other parameters (inertial velocities, line of sight angles, etc.) to determine weapon release solution.
- **ARBS** (Hughes Angle Rate Bombing System): Built-in passive system designed to improve day and night bombing accuracy when operating in the close support role using unguided weapons
    - **DMT** (Dual Mode Tracker): Sub-system of the ARBS, the DMT tracks both TV (reflected light images) and laser-designated (LST) targets.
- **NAVFLIR** (Navigation Forward-Looking Infrared): Built-in FLIR system fixed on the aircraft's waterline, which is mainly used for navigation and target infrared spotting (Hot Spot Detector). It does not have any target designation capability.
- **AN/AAQ-28V LITENING G4 Targeting Pod (TPOD)**: 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 thermal imagery.
- **AMG-65F Maverick** Seeker Head feed: Maverick air-to-ground missiles have seeker heads that have video capability and that can be used as supplemental sensors.

Now… why would the Harrier need all these sensors? It seems a bit overkill, no? Well, not really. Each sensor is useful in specific cases with specific weaponry for specific missions. The Harrier being operated by the United States Marine Corps, mission versatility is one of the main reasons this aircraft was so relevant to the types of operations conducted by the USMC.

1 – SENSORS INTRODUCTION
1.1 – Sensors Overview

The sensors will make more sense to you once you start using them in the Weapons Tutorial section.

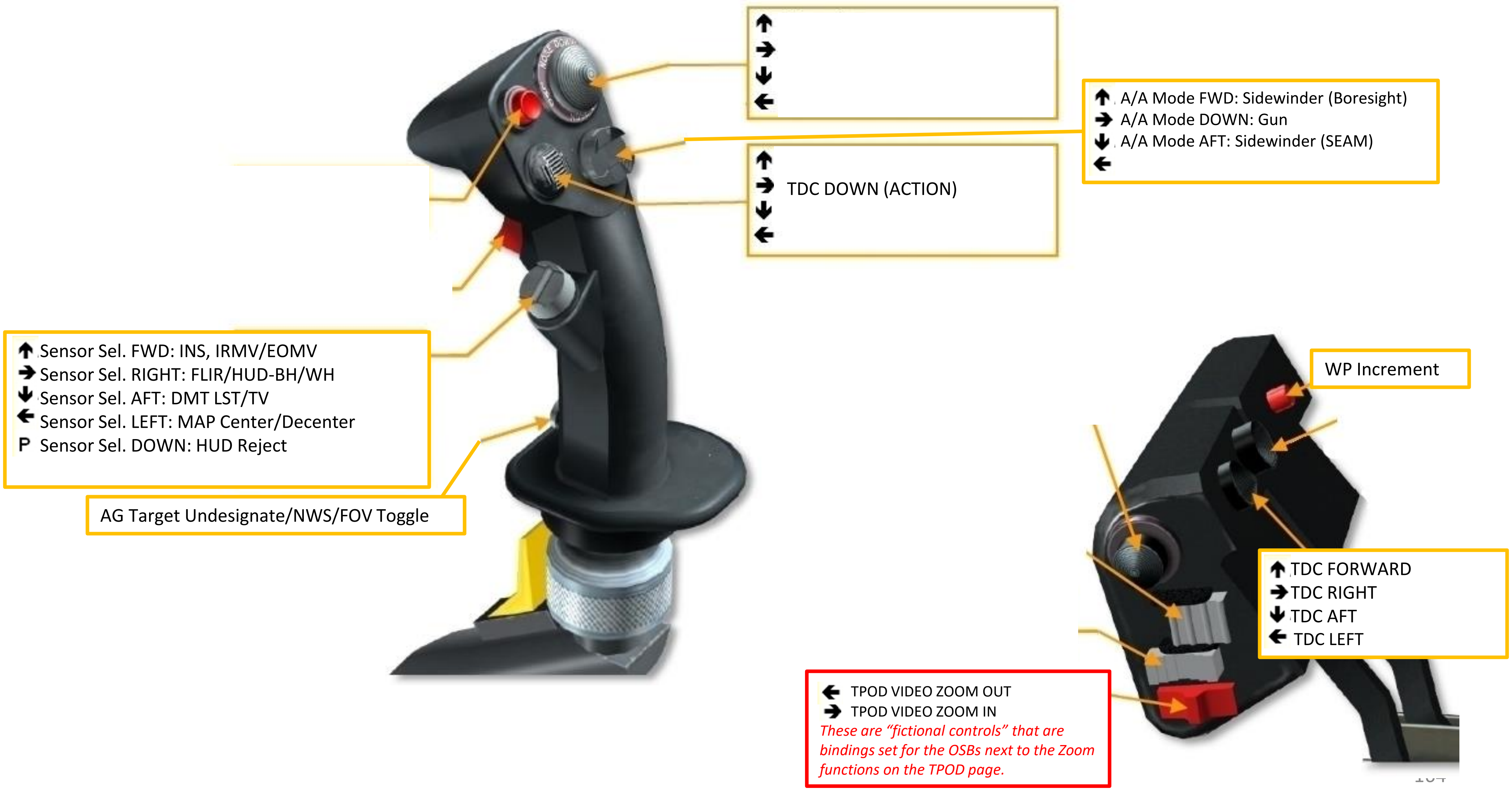
Sensor Select Switch
AFT = DMT: LST/TV
FWD = INS: IRMV/EOMV
LEFT = MAP Center/Decenter
RIGHT = FLIR/HUD-BH/WH
DOWN (PUSHED) = HUD Scene Reject/TPOD

TDC (Target Designation Caret) Control Switch
LEFT/RIGHT/FORWARD/AFT/DOWN (ACTION)

Screen

Controller

1 – SENSORS INTRODUCTION
1.2 – My Sensors Control Setup

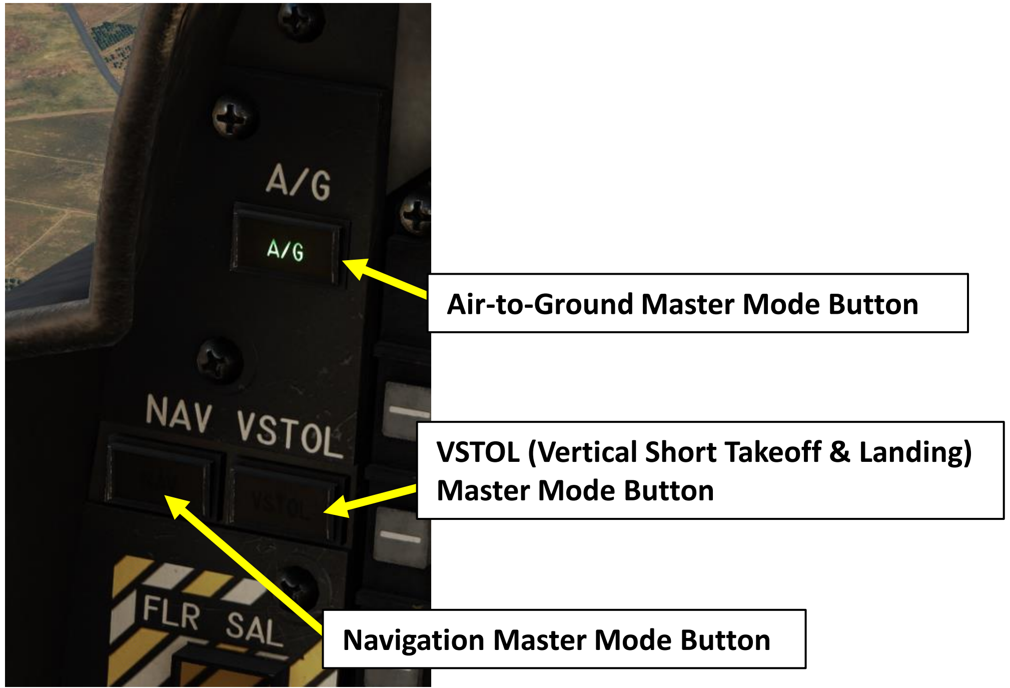


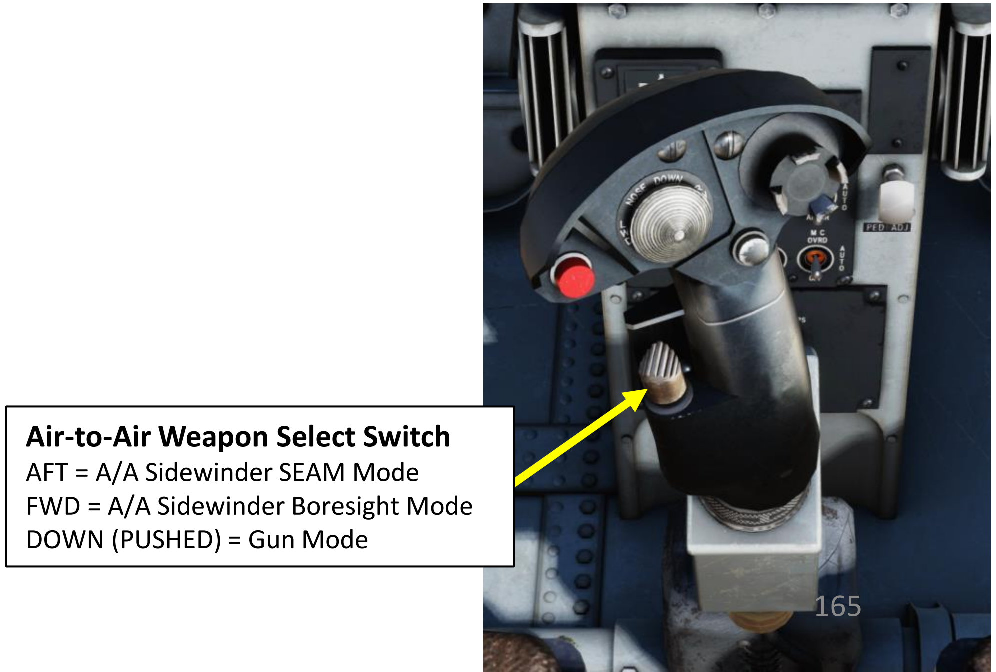
1 – SENSORS INTRODUCTION
1.3 – Master Modes

Controlled via three buttons left of the left display and the Air-to-Air Weapon Select switch, the Harrier's avionics system always operates in one of four master modes: Navigation (NAV), Air-to-Ground (A/G), Air-to-Air (A/A) or Vertical Short Takeoff & Landing (VSTOL). These master modes configure the avionics for one of these four purposes.

The master mode is changed via the four mentioned NAV, A/G and VSTOL buttons and the Air-to-Air Weapon Select Switch.

- **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. This mode is best suited to display navigation-related symbology.
- **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. This mode is best suited when employing weapons.
- **Air-to-Air (A/A):** A/A allows for the release of air-to-air weaponry such as the AIM-9 Sidewinder. It shows the appropriate symbology for the selected air-to-air weapon on the HUD. Air-to-Air Mode is selected by pressing the Air-to-Air Weapon Select Switch either AFT, FWD or DOWN (Pushed). When A/A is selected, A/G, NAV and VSTOL Master Mode buttons are all extinguished.
- **Vertical Short Takeoff & Landing (VSTOL):** VSTOL is used for takeoff and landing. This is a mode similar to NAV, but its symbology is specifically designed to help the pilot have all the information needed to takeoff or land properly.





1 – SENSORS INTRODUCTION
1.3 – 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. This mode is best suited to display navigation-related symbology.

1 – SENSORS INTRODUCTION
1.3 – 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. This mode is best suited when employing weapons.

1 – SENSORS INTRODUCTION
1.3 – Master Modes

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

A/A allows for the release of air-to-air weaponry such as the AIM-9 Sidewinder. It shows the appropriate symbology for the selected air-to-air weapon on the HUD.

Air-to-Air Mode is selected by pressing the Air-to-Air Weapon Select Switch either AFT, FWD or DOWN (Pushed). When A/A is selected, A/G, NAV and VSTOL Master Mode buttons are all extinguished.

Air-to-Air Weapon Select Switch
AFT = A/A Sidewinder SEAM Mode
FWD = A/A Sidewinder Boresight Mode
DOWN (PUSHED) = Gun Mode

1 – SENSORS INTRODUCTION
1.3 – Master Modes

VSTOL (Vertical Short Takeoff & Landing) Master Mode

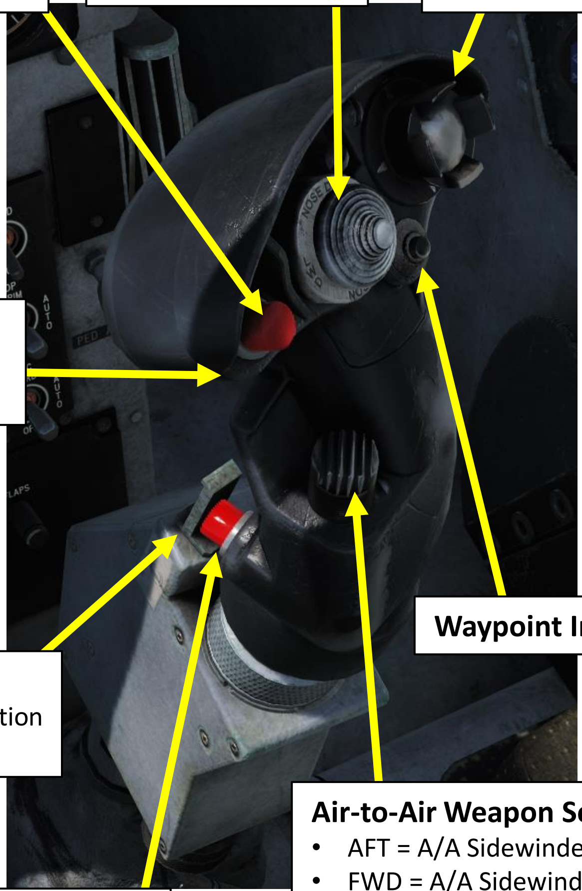
VSTOL is used for takeoff and landing. This is a mode similar to NAV, but its symbology is specifically designed to help the pilot have all the information needed to takeoff or land properly.

2 – HOTAS

HOTAS (Hands-On-Throttle-And-Stick) interface:

<u>Sensor Select Switch (SSS):</u>

- DOWN (Depressed):
  - Double-Tap within 0.8 s:
    - **Enters Targeting Pod (TPOD) sensor HOTAS mode (HTS)**. It also displays the TPOD video page on the right MPCD.
    - If TPOD HOTAS mode already selected, disables TPOD sensor HOTAS mode and returns Sensor Select Switch function to normal. Active sensor is set to the previously selected one.
- AFT:
  - Short (less than 0.8 s):
    - Cycles track mode between AR (Area Track), PT (Point Track) and MT (Moving Target) Modes
    - Releases LST (Laser Spot Track) mode and returns to previously selected track mode
    - Cancels LSS (Laser Spot Search) and returns to previous selected track mode.
  - Long (more than 0.8 s): Selects INR (Inertial) Track
- FWD:
  - Short (less than 0.8 s):
    - With TPOD HOTAS mode: Laser Range Update
    - Without TPOD HOTAS mode: Selects INS (MAP) Sensor or IRMV/EOMV (Maverick) Sensor
  - Long (more than 0.8 s): If AGM-65E Laser Maverick is the selected weapon, it removes the TPOD page and calls the LMAV page.
- LEFT:
  - Short (less than 0.8 s):
    - With TPOD HOTAS mode: Changes Field-of-View (FOV): Narrow (NR) or Wide (WD)
    - Without TPOD HOTAS mode: Map Center/Decenter
  - Long (more than 0.8 s): Activates LSS (Laser Spot Search)
- RIGHT:
  - Short (less than 0.8 s):
    - With TPOD HOTAS mode and FLIR video, toggles polarity (WH/BH)
    - With TPOD HOTAS mode and CCD (TV) video, no function.
    - Without TPOD HOTAS mode: Selects FLIR sensor and toggles polarity (WH/BH)
  - Long (more than 0.8 s): Toggles video between CCD and FLIR.



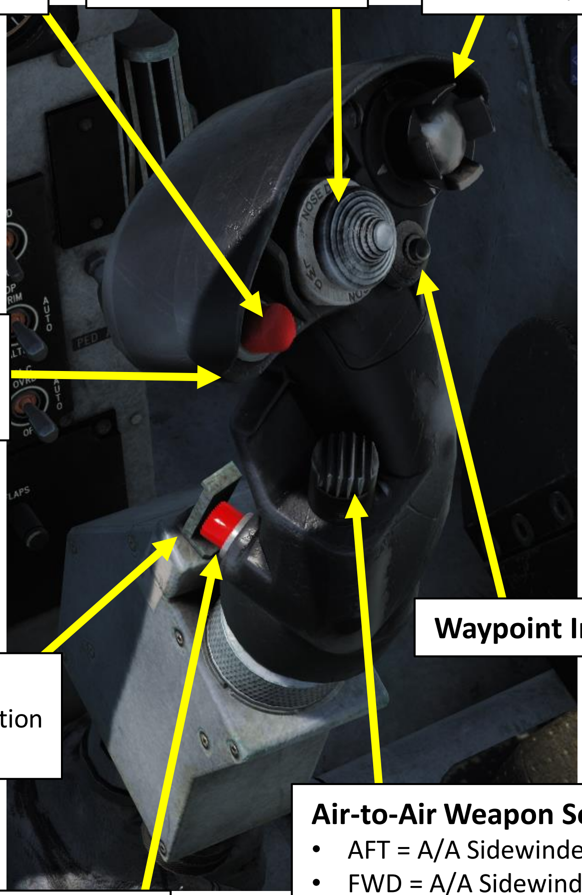
2 – HOTAS

HOTAS (Hands-On-Throttle-And-Stick) interface:

Air-to-Air Weapon Select Switch:
- DOWN (Depressed): selects gun mode.
- AFT: Selects AIM-9 Sidewinder SEAM Mode
- FWD: Selects AIM-9 Sidewinder Boresight Mode

Air-to-Ground Target Undesignate / Nosewheel Steering Button:
- Undesignates target or toggles targeting pod designation mode.
- If IRMV (IR-Maverick) is the sensor of interest, toggles IRMV field-of-view setting.

WP (Waypoint) Increment Button:
- Pressed SHORT: Increments Waypoint
- Pressed LONG: Selects Target Point T0



2 – HOTAS

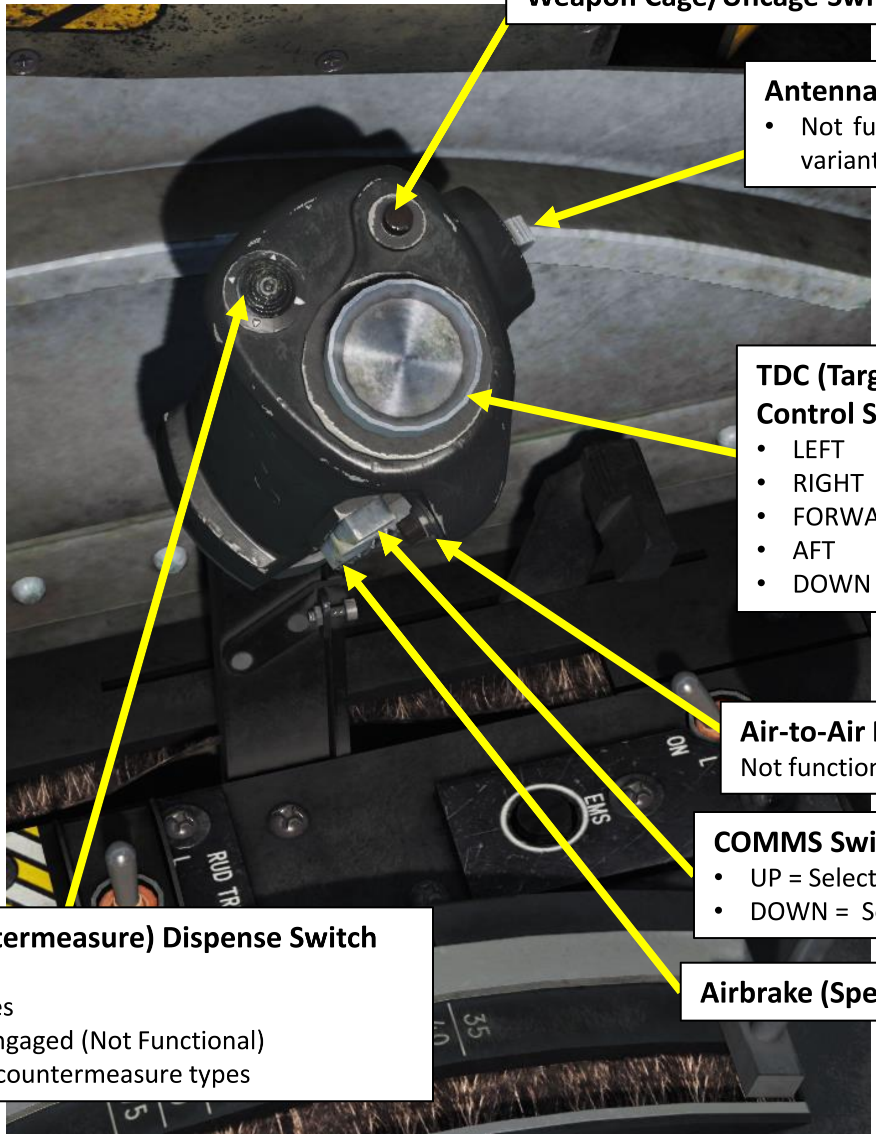
HOTAS (Hands-On-Throttle-And-Stick) interface:

TDC (Target Designation Caret) Control Switch:

- LEFT/RIGHT/FWD/AFT: slews selected sensor (targeting pod, DMT, moving map).
- DOWN (ACTION): Designates target. When pressed, allows targeting pod slewing.

Weapon Cage/Uncage Switch Switch:

- Use to cage or uncage Maverick missile. Other functions depend on selected weapon.



3 – ARBS & DMT
3.1 – ARBS Introduction

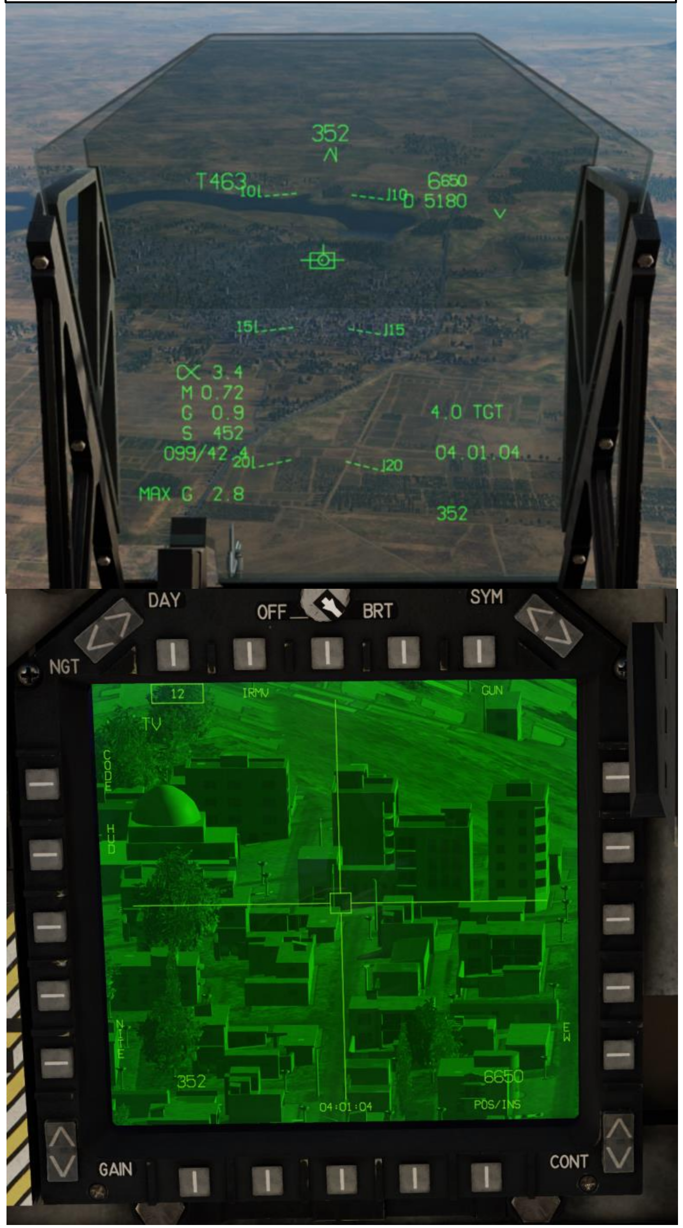
The ARBS's Dual Mode Tracker (DMT) has two main functions: TV and LST (Laser Spot Tracking).

The **TV function will allow you to set manually a target point** by pointing your nose at the target and then designating it. Then, the DMT is able to keep track of this position. This is useful when a targeting pod isn't available or you have spotted a target visually and need to quickly designate it before performing your attack run.

The **LST (Laser Spot Tracking) function will allow you to slave your DMT to a laser-designated point** by troops on the ground or friendly aircraft equipped with a laser designator (which can be done with the TGP). This is useful when a JTAC is lasing a target and you want to quickly acquire its position.

ARBS Glazed Aperture

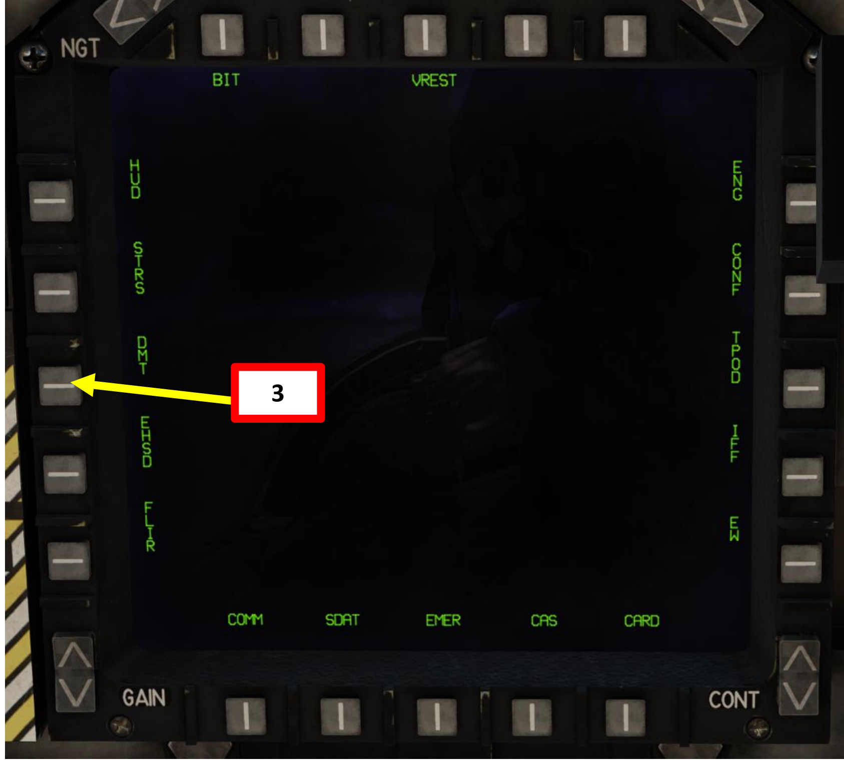
DMT: TV MODE

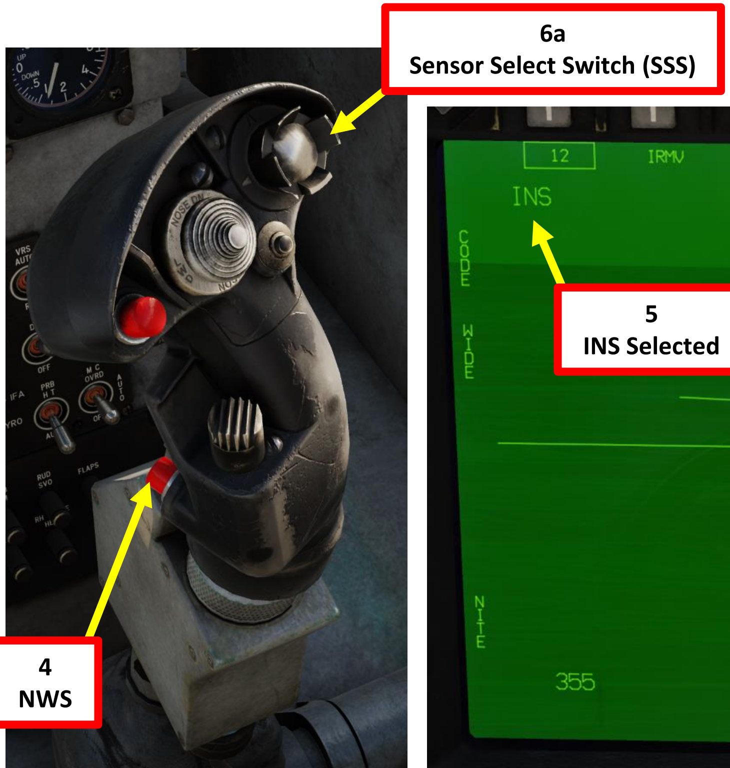


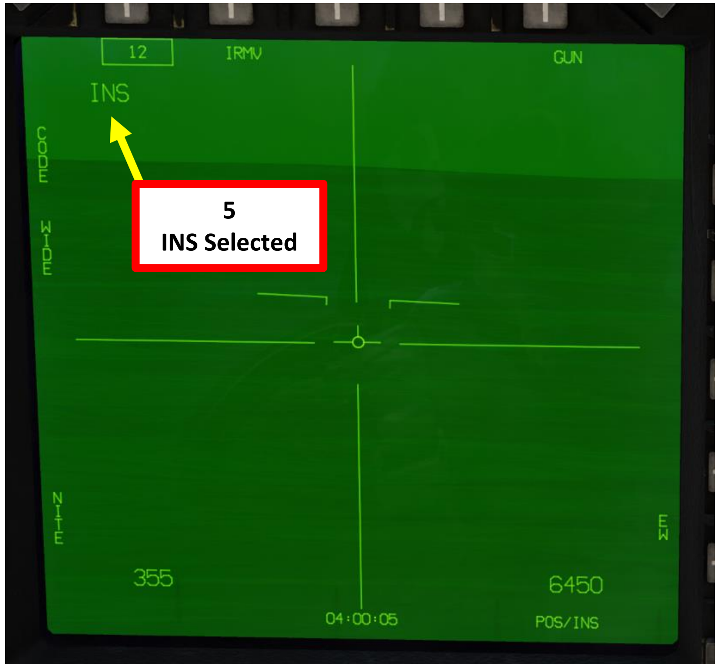
DMT: LASER MODE

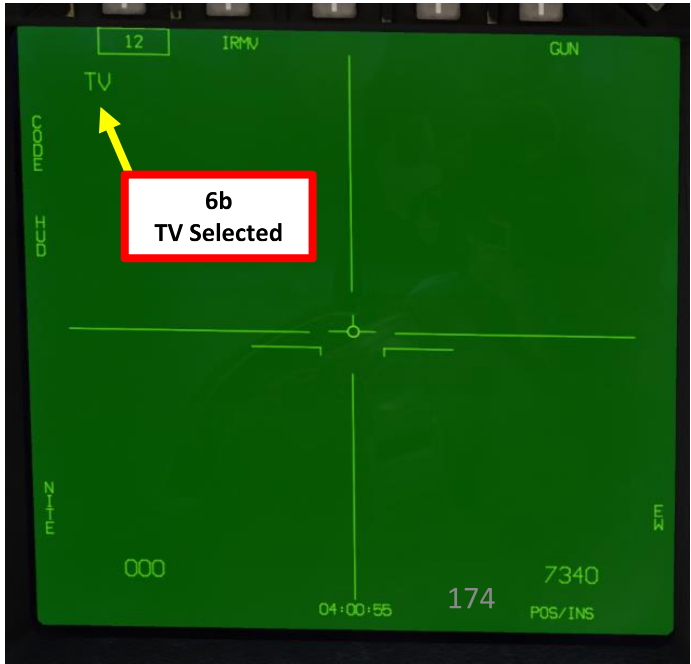
3 – ARBS & DMT
3.2 – DMT TV Mode

1. Set DMT (Dual Mode Tracker) Power Switch – ON (UP)
2. Select A/G (Air-to-Ground) Master Mode
3. From the main MPCD menu, select "DMT" page. DMT feed will appear on your MPCD display.
4. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
5. Check selected sensor on DMT page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor. In that case, double-tap the Sensor Select Switch in quick succession to select INS.
    c) TV indicates the DMT TV is the selected sensor. In that case, the DMT is already selected.
6. Press the Sensor Select Switch AFT to toggle between the LST (Laser Spot Track) and the TV DMT mode until "TV" is selected.







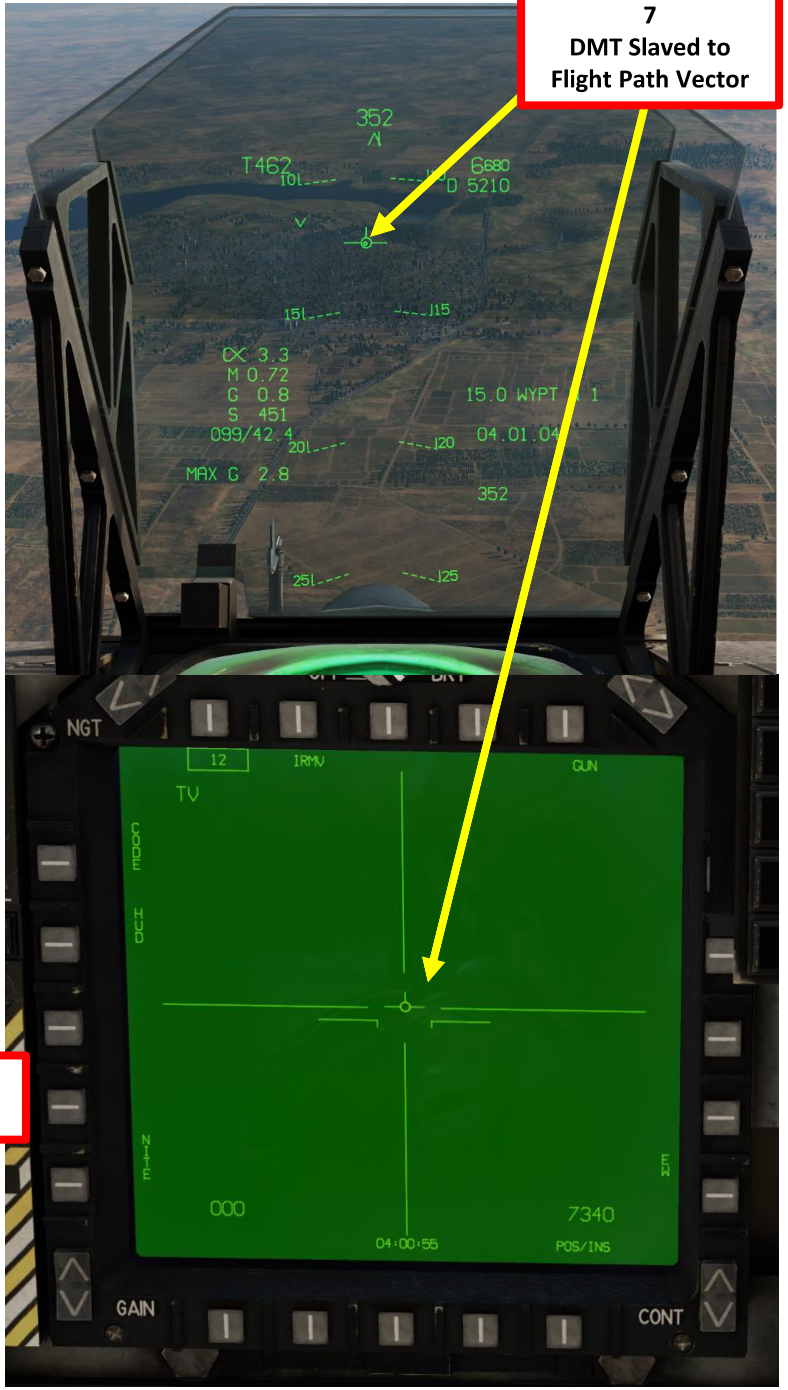


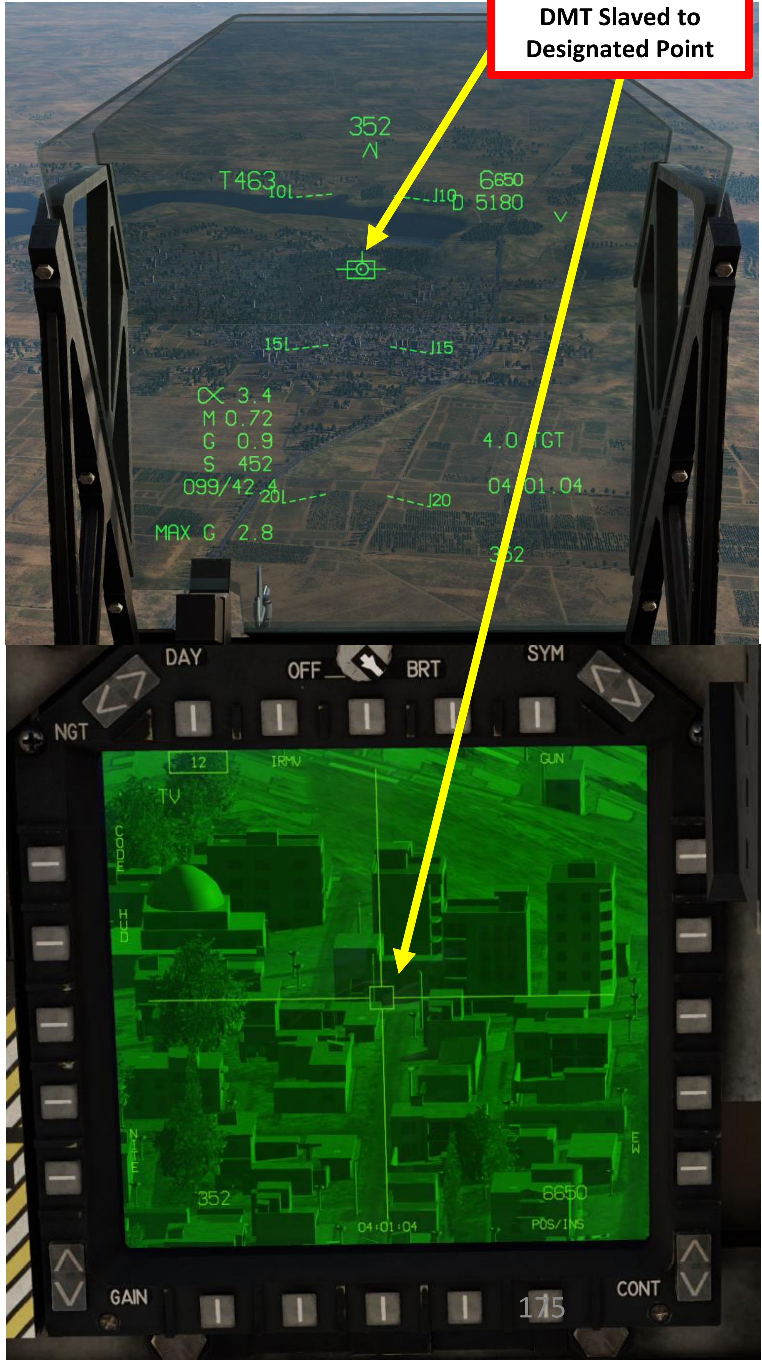
3 – ARBS & DMT
3.2 – DMT TV Mode

7. At first, TV Mode tracks your aircraft's flight path vector (where your aircraft's nose is pointing).
8. Place the flight path vector on the desired target, then press the « TDC DOWN Action Position » button to designate the target and slave the DMT to it.

7
DMT Slaved to
Flight Path Vector

8b
DMT Slaved to
Designated Point



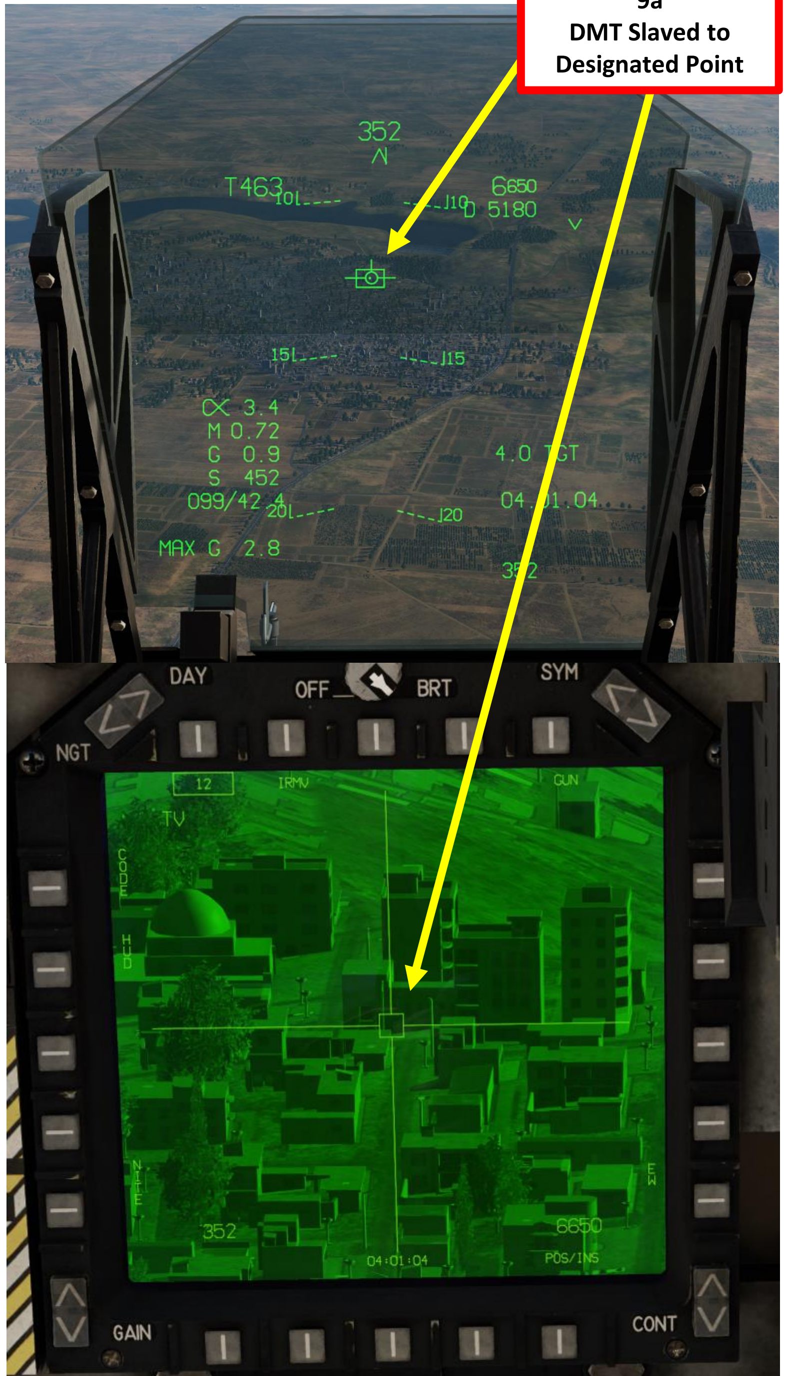


3 – ARBS & DMT
3.2 – DMT TV Mode

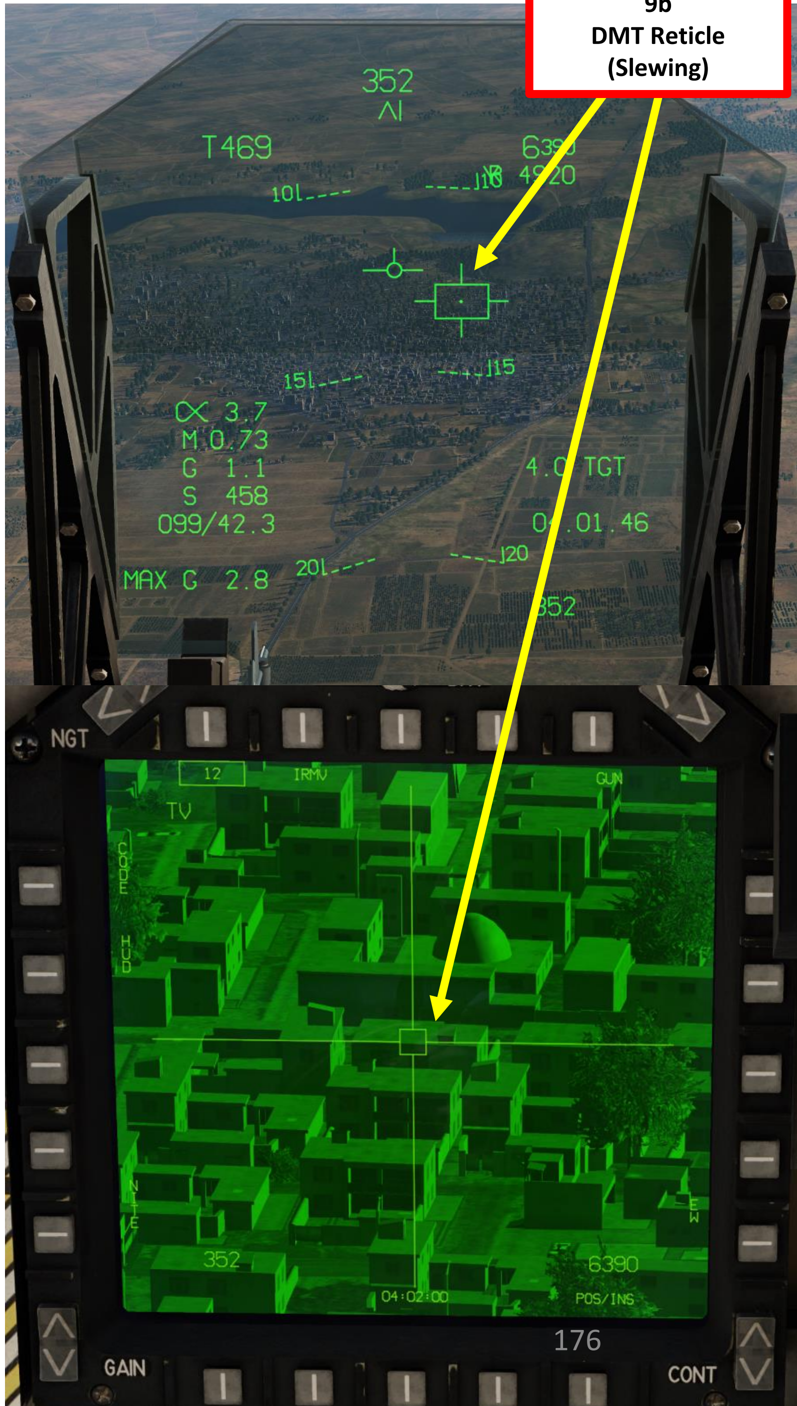
9. Once target is designated, you can slew the DMT with TDC Left/Right/Fwd/Aft controls.

9b
TDC (Target Designation Control)

9a
DMT Slaved to Designated Point

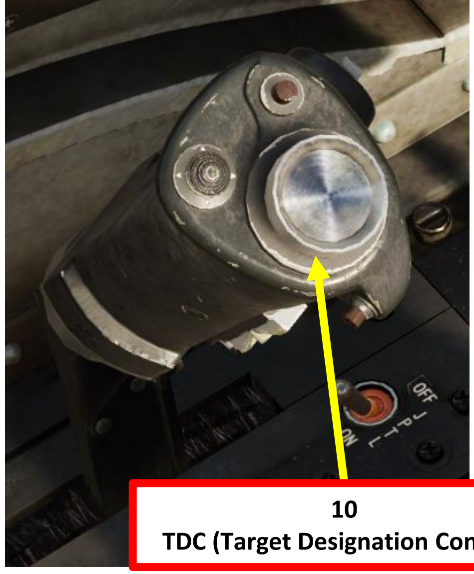


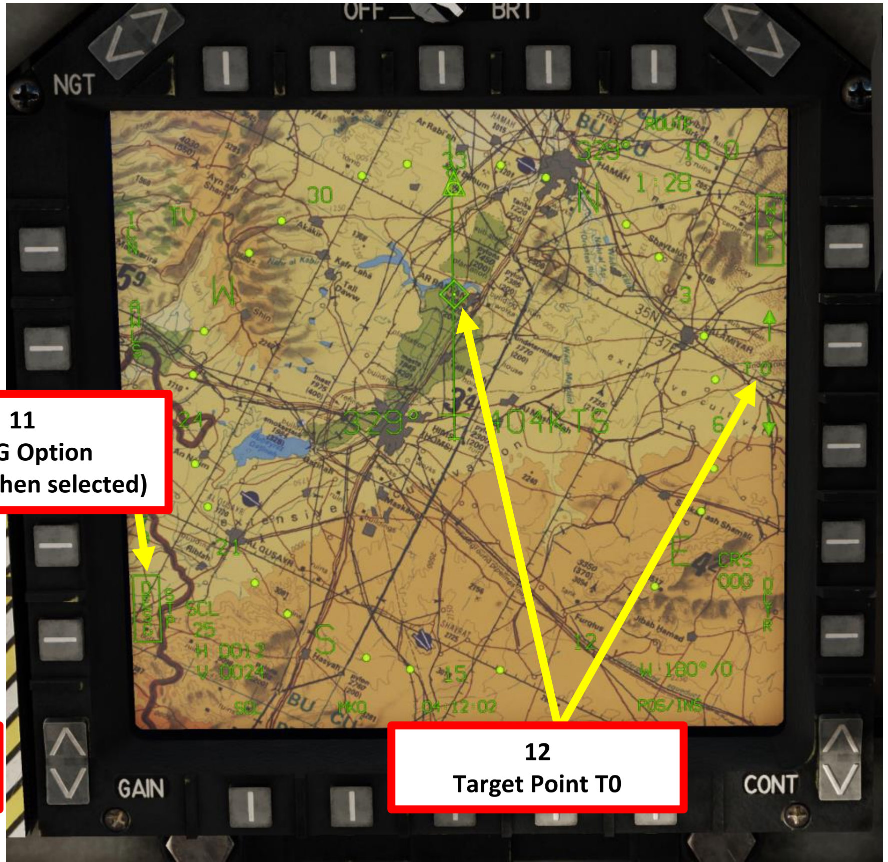
9b
DMT Reticle (Slewing)

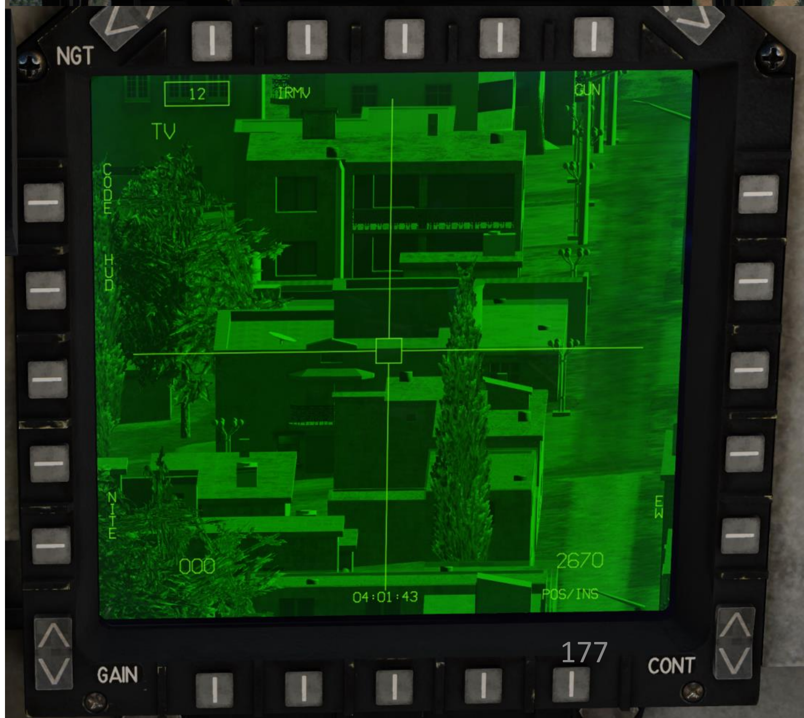


3 – ARBS & DMT
3.2 – DMT TV Mode

10. Once DMT is tracking the desired target, press « TDC DOWN Action Position » button to designate the target.
11. When « TDC DOWN Action » designates the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
12. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0. This will be explored later in the Weapons section.
13. To un-designate a target, press the « AG Target Undesignate/NWS/FOV Toggle » button.

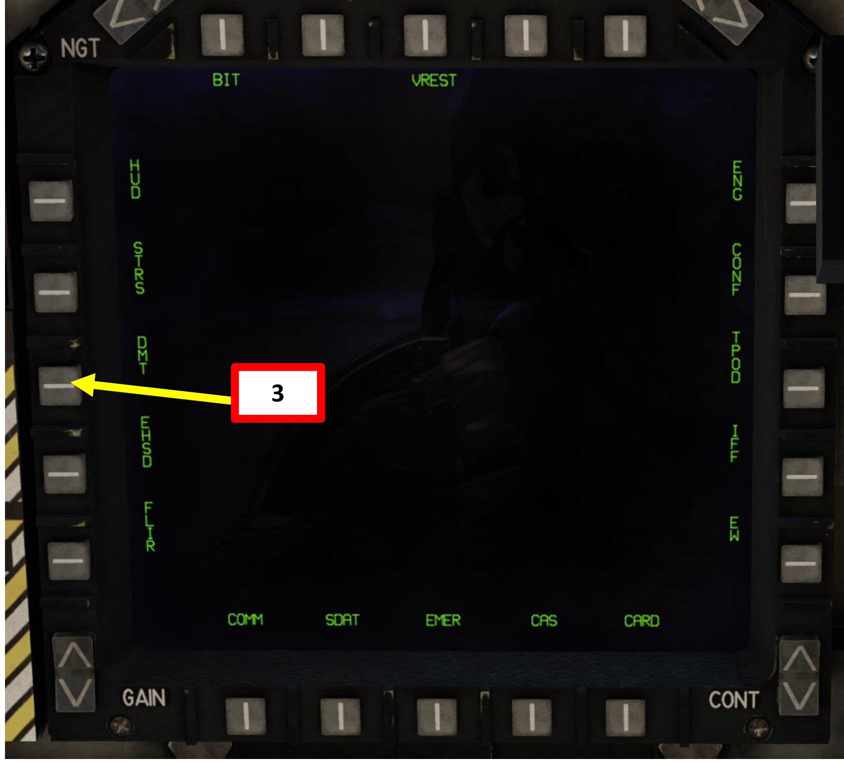


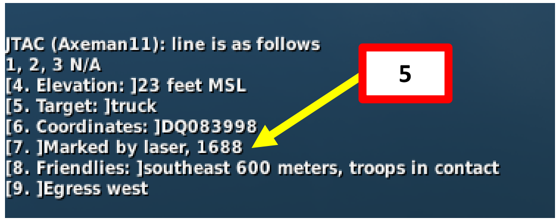


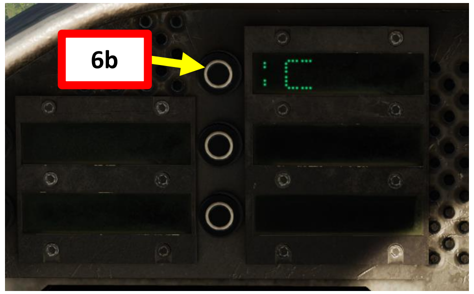


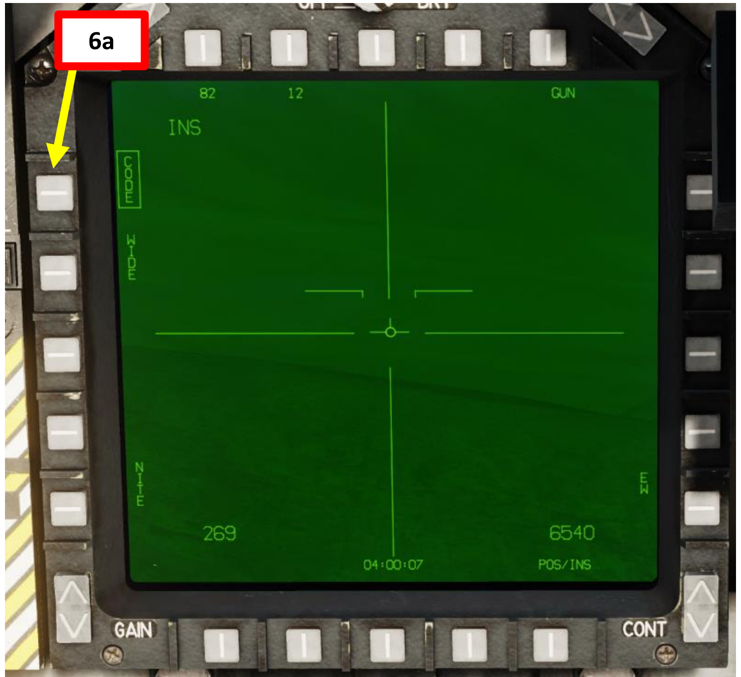
3 – ARBS & DMT
3.3 – DMT LST Mode

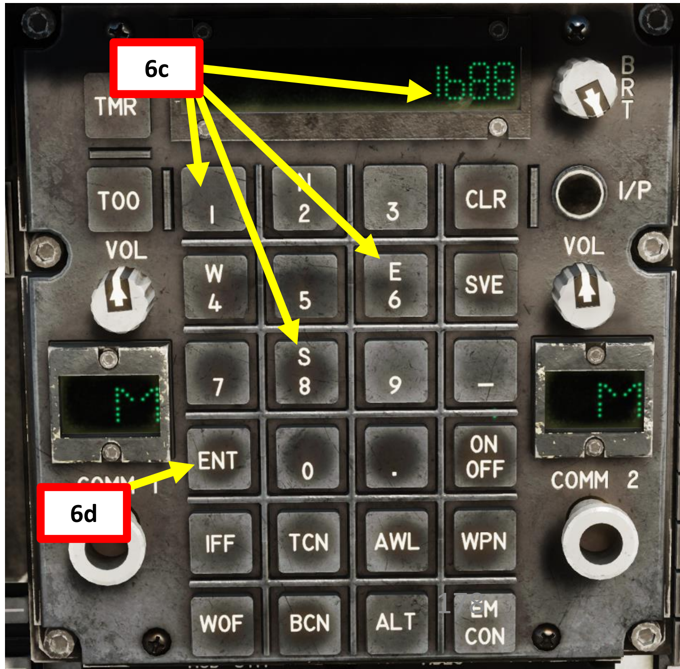
1. Set DMT (Dual Mode Tracker) Power Switch – ON (UP)
2. Select A/G (Air-to-Ground) Master Mode
3. From the main MPCD menu, select "DMT" page. DMT feed will appear on your MPCD display.
4. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
5. Once you have contacted the JTAC (Joint Terminal Attack Controller) and a friendly unit is lasing a target (LASER ON), fly towards the target and set your DMT Laser Tracking Point in the target area.
6. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT.





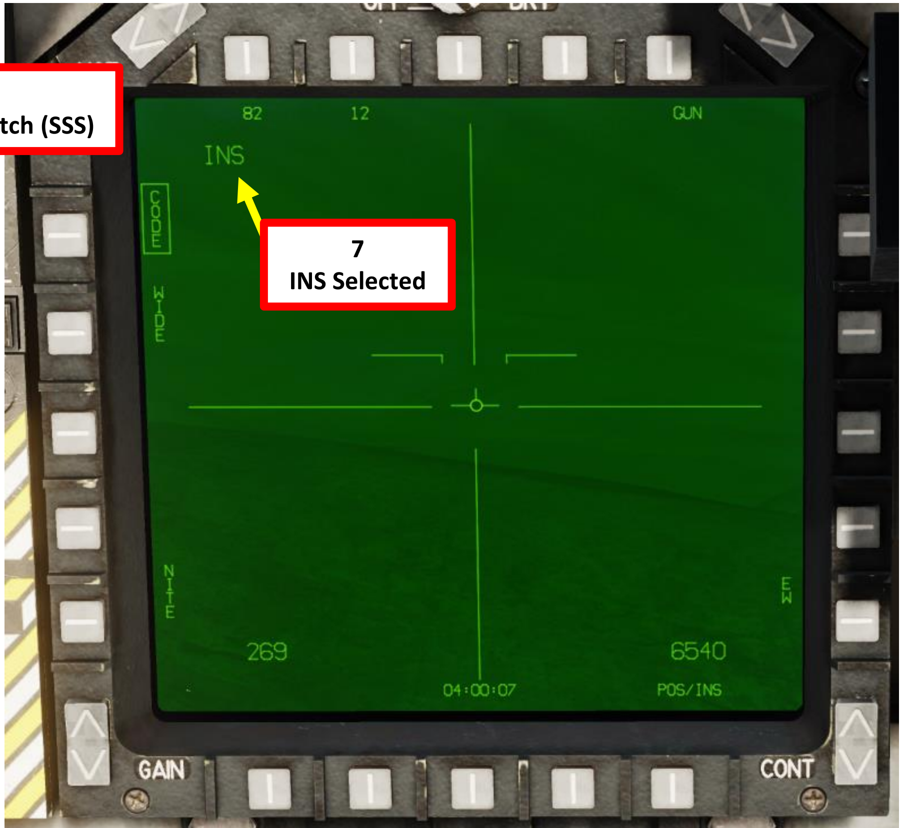


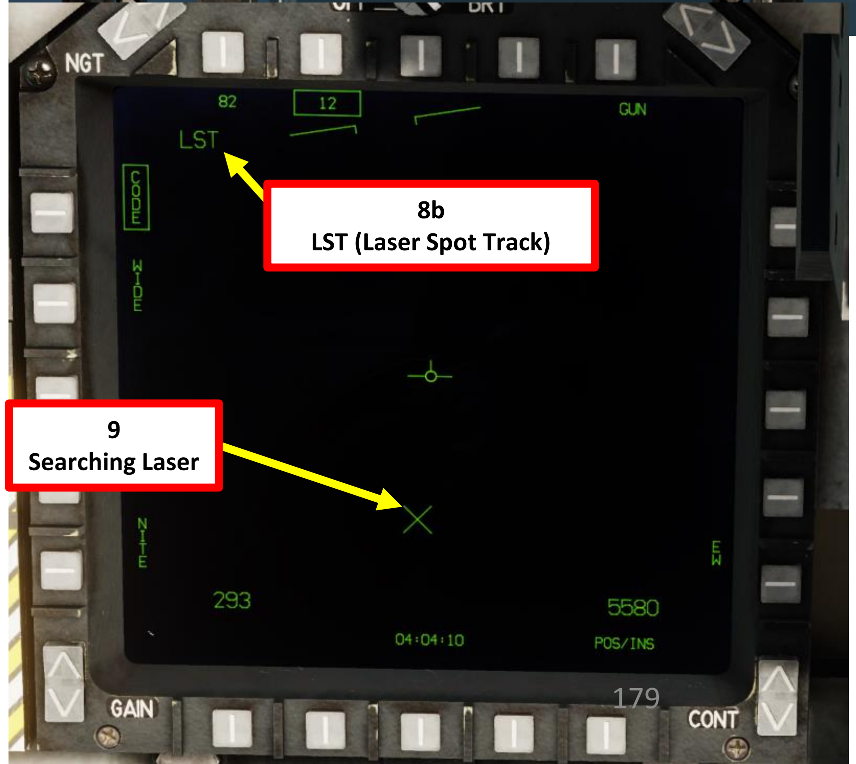




3 – ARBS & DMT
3.3 – DMT LST Mode

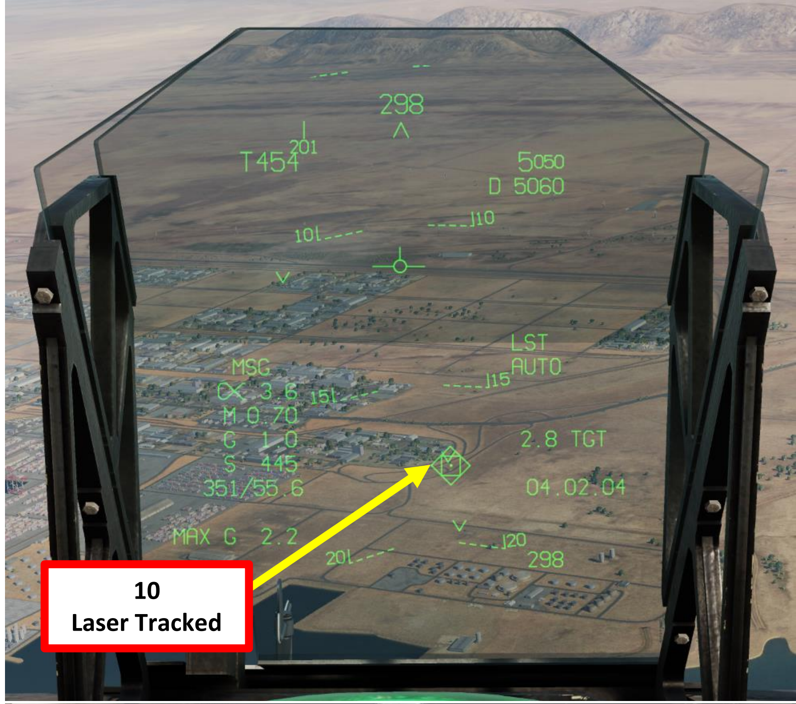
7. Check selected sensor on DMT page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor. In that case, double-tap the Sensor Select Switch in quick succession to select INS.
    c) TV indicates the DMT TV is the selected sensor. In that case, the DMT is already selected.
8. Press the Sensor Select Switch AFT to toggle between the LST (Laser Spot Track) and the TV DMT mode until "LST" is selected.
9. In Laser Spot Track Mode, a laser tracker symbol ("X" on DMT display, a square on the HUD) will scan the horizon until a laser is spotted.

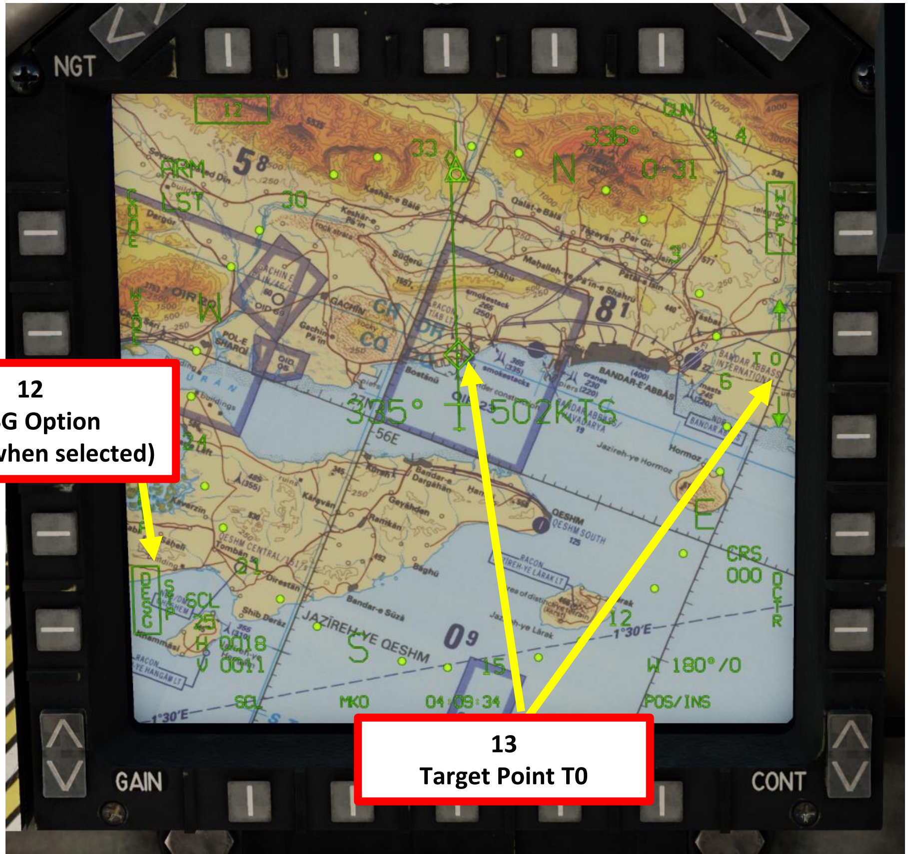


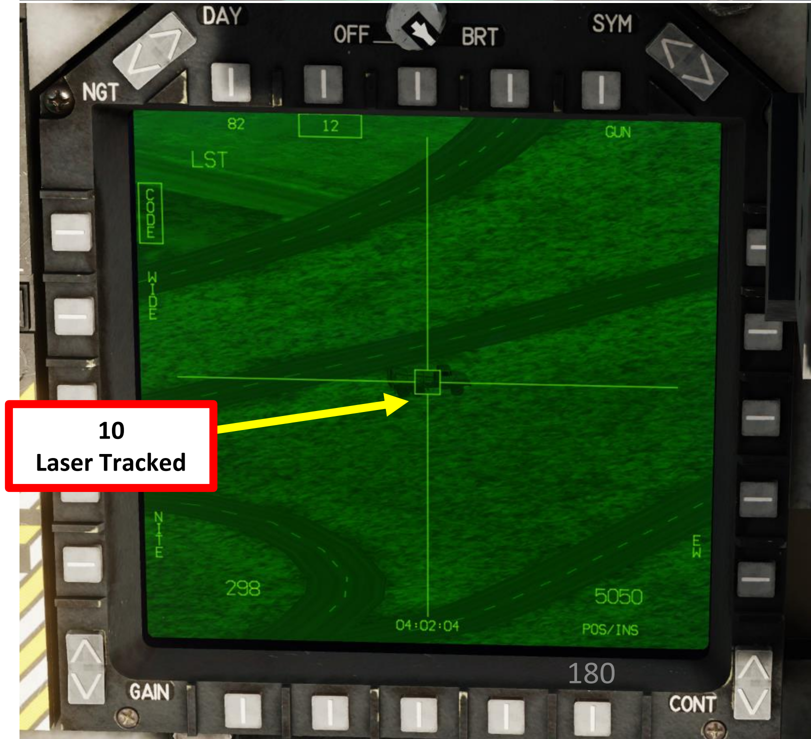


3 – ARBS & DMT
3.3 – DMT LST Mode

10. When laser is spotted, the DMT will track it.
11. Once DMT is tracking the desired lased target, press « TDC DOWN Action Position » button to designate the target on the laser designated point.
12. When « TDC DOWN Action » designates the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
13. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0. This will be explored later in the Weapons section.
14. To un-designate a target, press the « AG Target Undesignate/NWS/FOV Toggle » button.







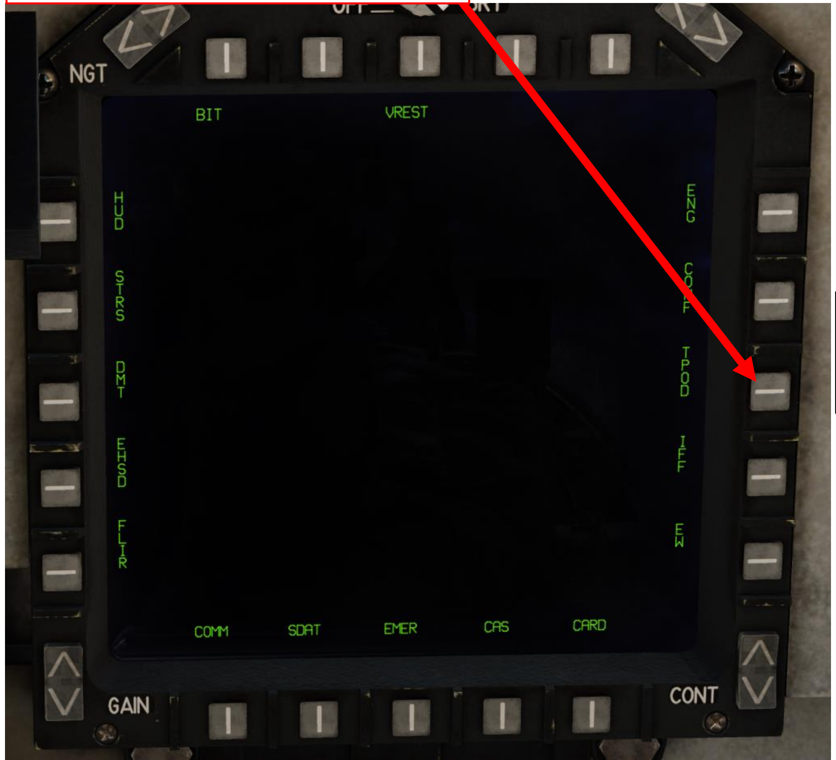
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.1 – Introduction

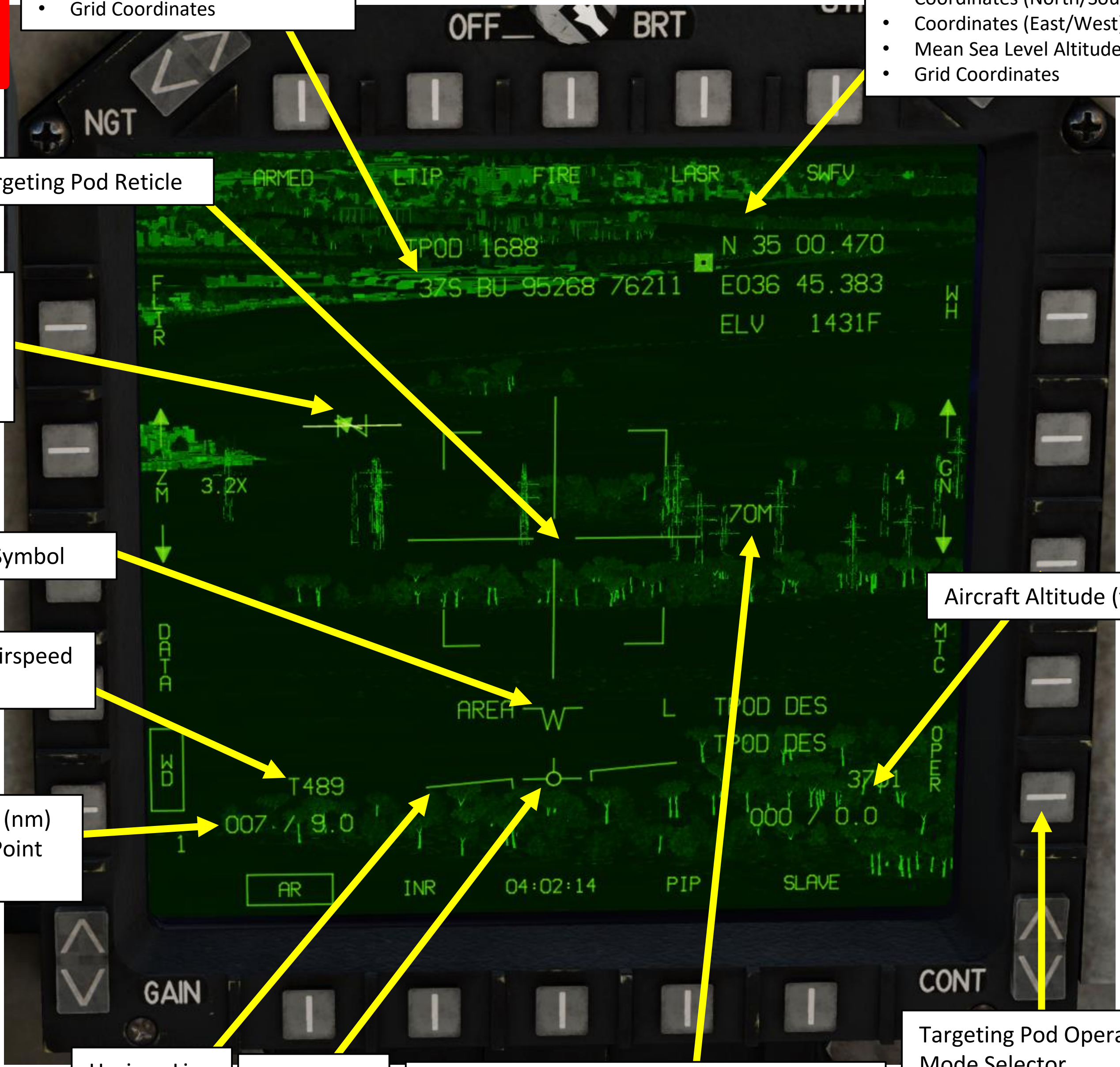
The AN/AAQ-28(V) LITENING G4 system is a self-contained, multi-sensor targeting and surveillance system. The LITENING enables aircrews to detect, acquire, auto-track and identify targets at long ranges for weapon delivery or non-traditional intelligence, surveillance and reconnaissance missions. LITENING's 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.

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays

The targeting pod feed can be displayed on either MPCD (Multi-Purpose Color Display). To display targeting pod feed, select main MPCD MENU, then click on the OSB next « TPOD ».

From the MAIN MPCD menu, you can access the targeting pod feed by pressing the OSB next to "TPOD".





Targeting Pod Reticle Data
- Grid Coordinates

Targeting Pod Reticle Data
- Coordinates (North/South)
- Coordinates (East/West)
- Mean Sea Level Altitude (ft)
- Grid Coordinates

Targeting Pod Reticle

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

Waterline Symbol

Aircraft True Airspeed (kts)

Bearing / Range (nm) to Designation Point (Reticle)

Aircraft Altitude (ft)

Horizon Line

Flight Path Marker

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.

Targeting Pod Operation Mode Selector
- OPER: Operating (ON)
- STBY: Standby (OFF)

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays

Laser Designator Fire Button
- FIRE Boxed: Laser is Firing
- Take note that Laser Firing is inhibited if either:
  - SWFV (Super-Wide Field-of-View) is enabled
  - Airspeed is less than 100 kts
  - Targeting Pod is not designating a target in either Area Track or Point Track
  - Master Arm is OFF
  - Master Mode is not set to A/G
  - Landing Gear is DOWN

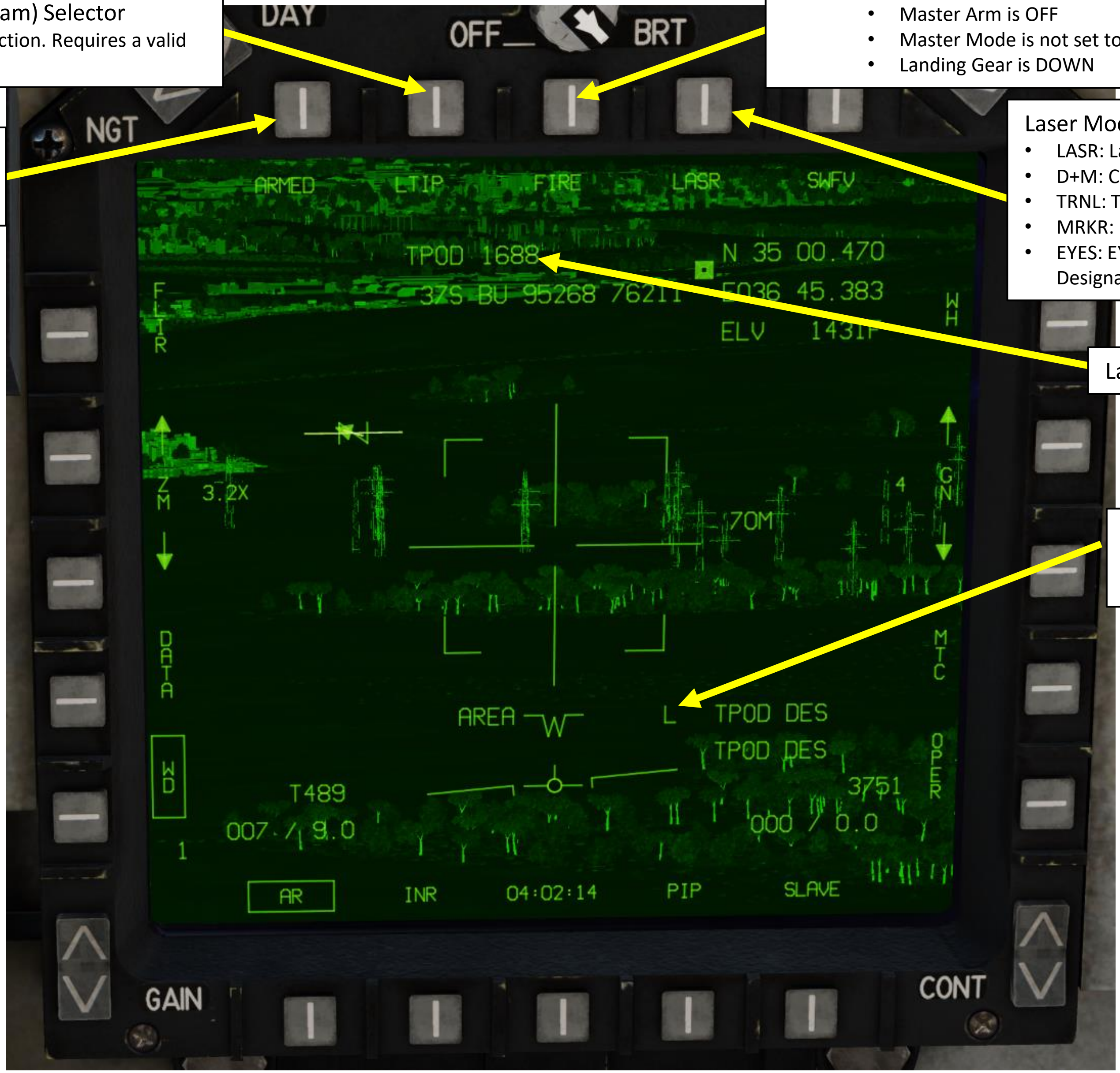
LTIP (Laser Target Imaging Program) Selector
- Similar to a Laser Rangefinder function. Requires a valid laser code.

Laser Arming Options
- ARMED
- SAFE

Laser Mode Selector
- LASR: Laser Designator Mode
- D+M: Combined Laser Designator + IR Marker Mode
- TRNL: Training Laser Mode
- MRKR: Laser IR (Infrared) Marker
- EYES: EYES laser system is a Low Intensity Laser Designator (protects eyes of troops on the ground)

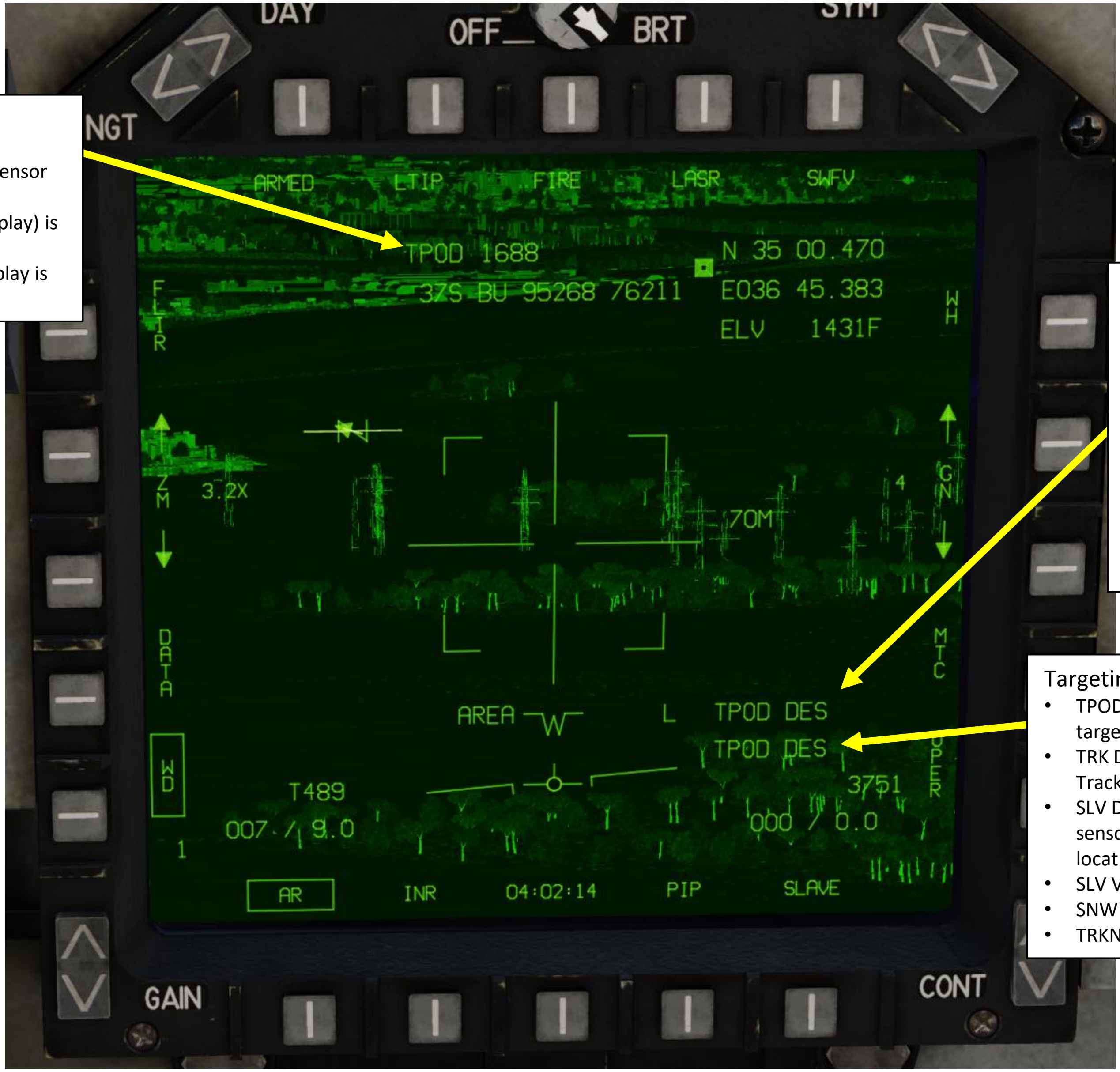
Laser Designation Code

Laser Options
- Steady: Laser Armed, but not firing
- Blinking: Laser Armed and Firing



4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays

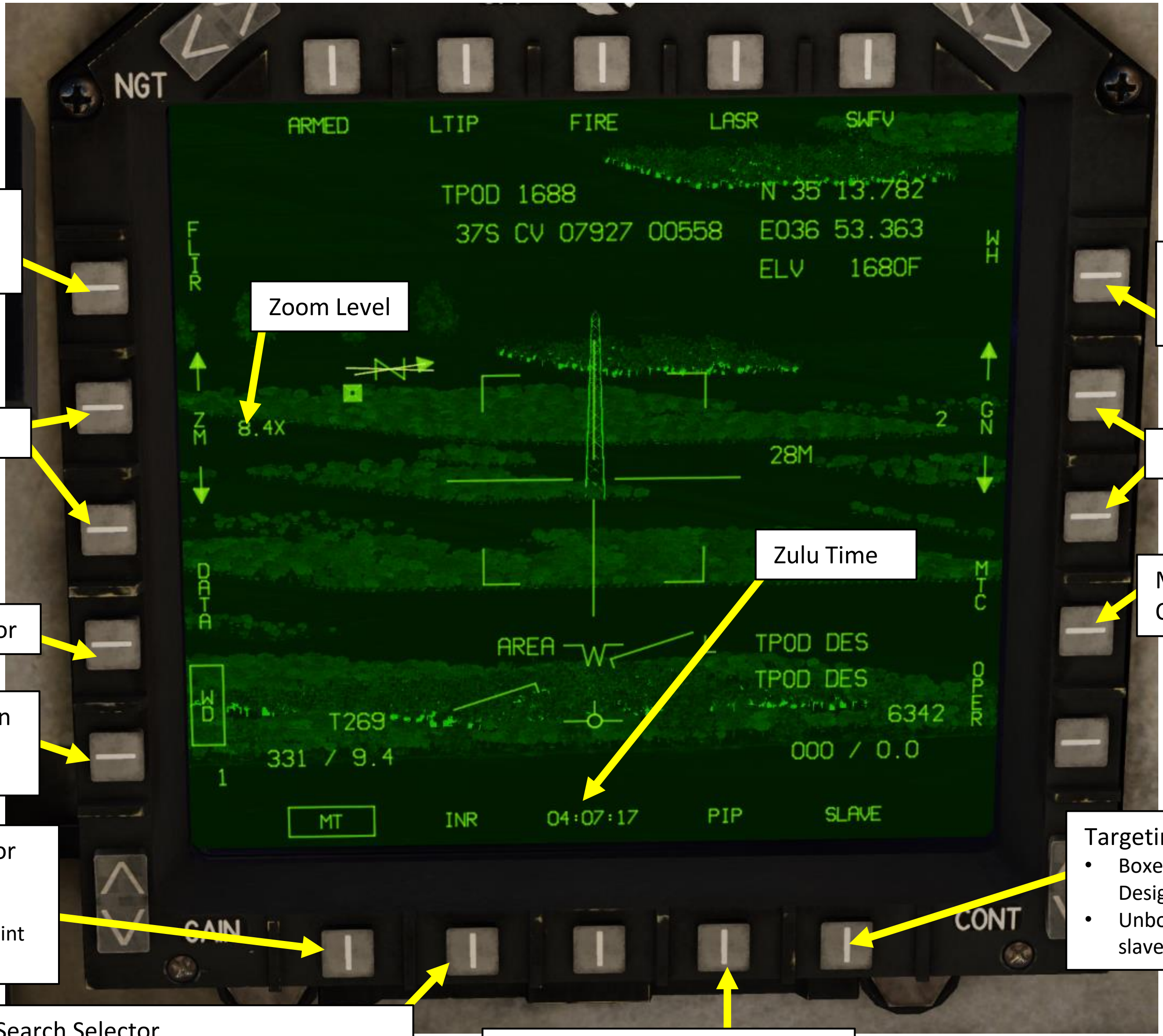
Designating Sensor (Sensor of Interest)
- TPOD: Targeting Pod is the sensor of interest
- TV: DMT (Dual Mode Tracker) TV Mode is the sensor of interest
- MAP: EHSD (Electronic Horizontal Situation Display) is the sensor of interest
- INS: Inertial Navigation System / Heads-Up Display is the sensor of interest



Target/System Designation Status
- TPOD DES: Targeting pod is the selected sensor for target designation
- HUD DES: INS or DMT is the selected sensor for target designation
- TV DES: DMT TV is the selected sensor for target designation
- MAP DES: EHSD Map (Waypoint) is the selected sensor for target designation
- NO DES: No target designated
- LSS: Laser Spot Search Mode
- LST: Laser Spot Tracking Mode

Targeting Pod Operational Mode
- TPOD DES: TDC Button has been pressed to designate the target, with the targeting pod as the selected sensor.
- TRK DES: Targeting pod is in either Area Track (AR), Point Track (PT) or Moving Target Track (MT)
- SLV DES: Target/System Designation exists from another sensor, and the targeting pod is slaved to the designated location.
- SLV VV: Targeting pod is slaved to the velocity vector.
- SNWPLW: Targeting pod is in Snowplow Mode
- TRKNODES: Targeting pod is being slewed

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays



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

Zoom Level

Zoom In/Out Control Buttons

Targeting Pod Data Menu Selector

Field-of-View Selector Button
- WD: Wide FOV
- NR: Narrow FOV

Targeting Pod Pointing Mode Selector
- AR: Area Track (static target)
- PT: Point Track (moving target)
- MT: Moving Target Track (similar to Point Track)

Inertial Tracking / Laser Spot Search Selector
- Short press - INR Boxed: Targeting pod keeps tracking inertial coordinates (useful when pod is masked)
- Long press – LSS Boxed: Laser Spot Search mode is scanning for a laser

Pip Option (Not Implemented)

Zulu Time

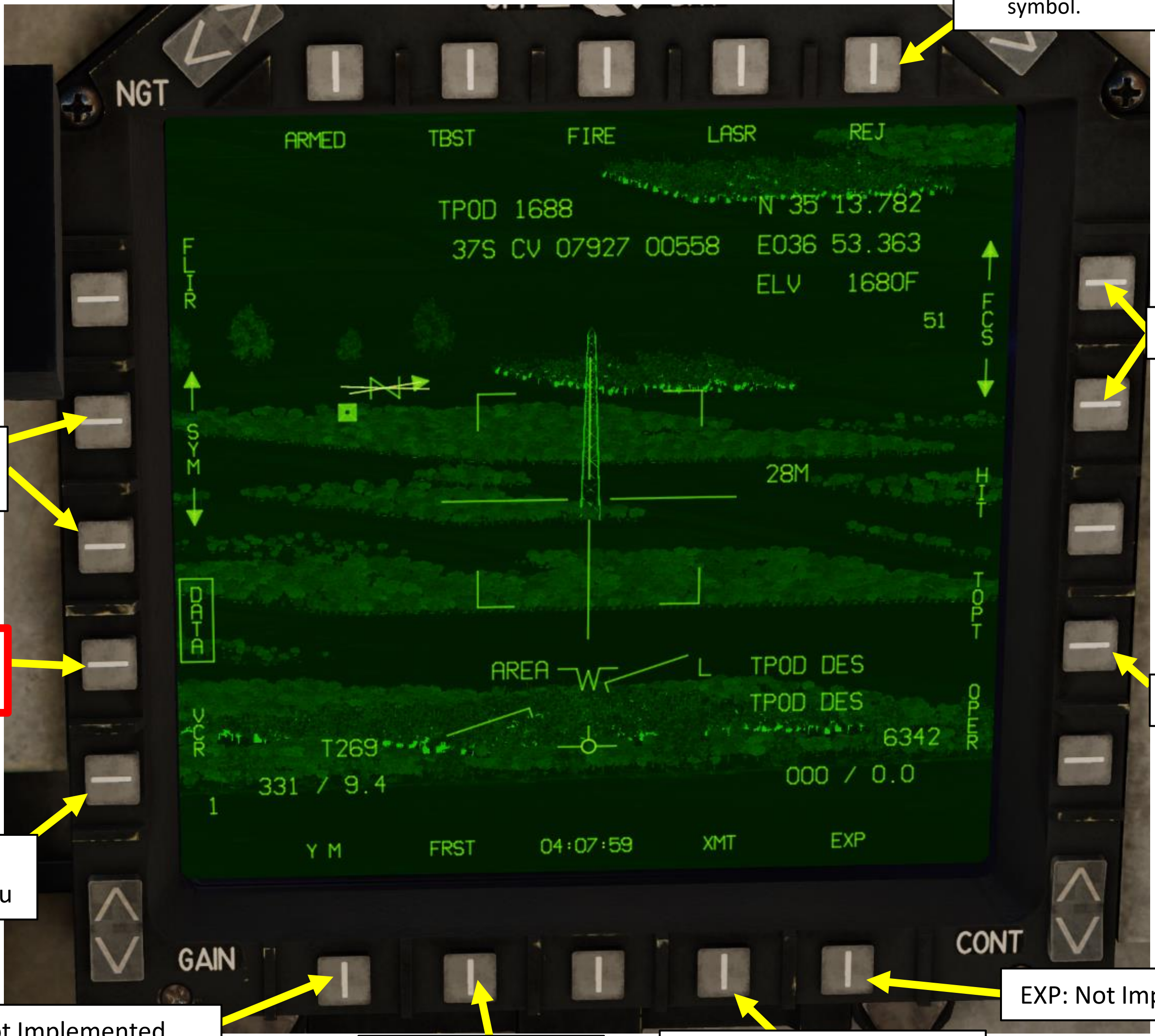
FLIR Polarity Selector Button
- WH: White Hot
- BH: Black Hot

FLIR Gain Control Buttons

MTC (Multiple Target Cueing) Option (Not Implemented)

Targeting Pod Slaving Mode
- Boxed: Slaved, Targeting Pod is slaved to Designating Sensor (Sensor of Interest)
- Unboxed: Not Slaved, Targeting Pod is not slaved to any sensor and tracks its own target.

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays



Reject Option
- Declutters TPOD page by removing horizon line, flight path marker and waterline symbol.

Focus Control Buttons

Symbology Brightness Control Buttons

Targeting Pod Data Menu Selector Boxed: Selected

TOPT: Not Implemented

VCR: Accesses Video Cassette Recording Menu

EXP: Not Implemented

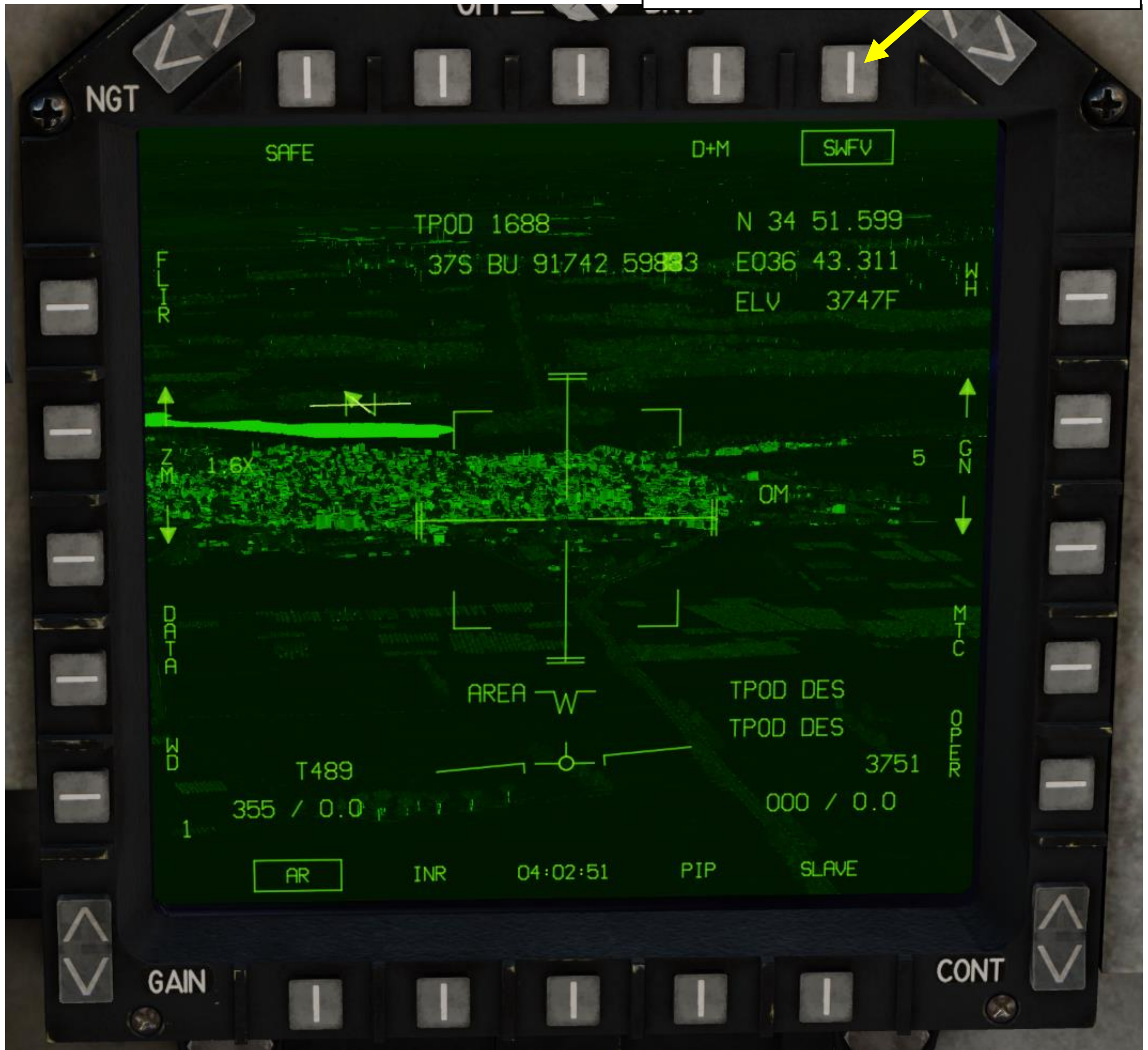
Y M: Not Implemented

FRST: Focus Reset

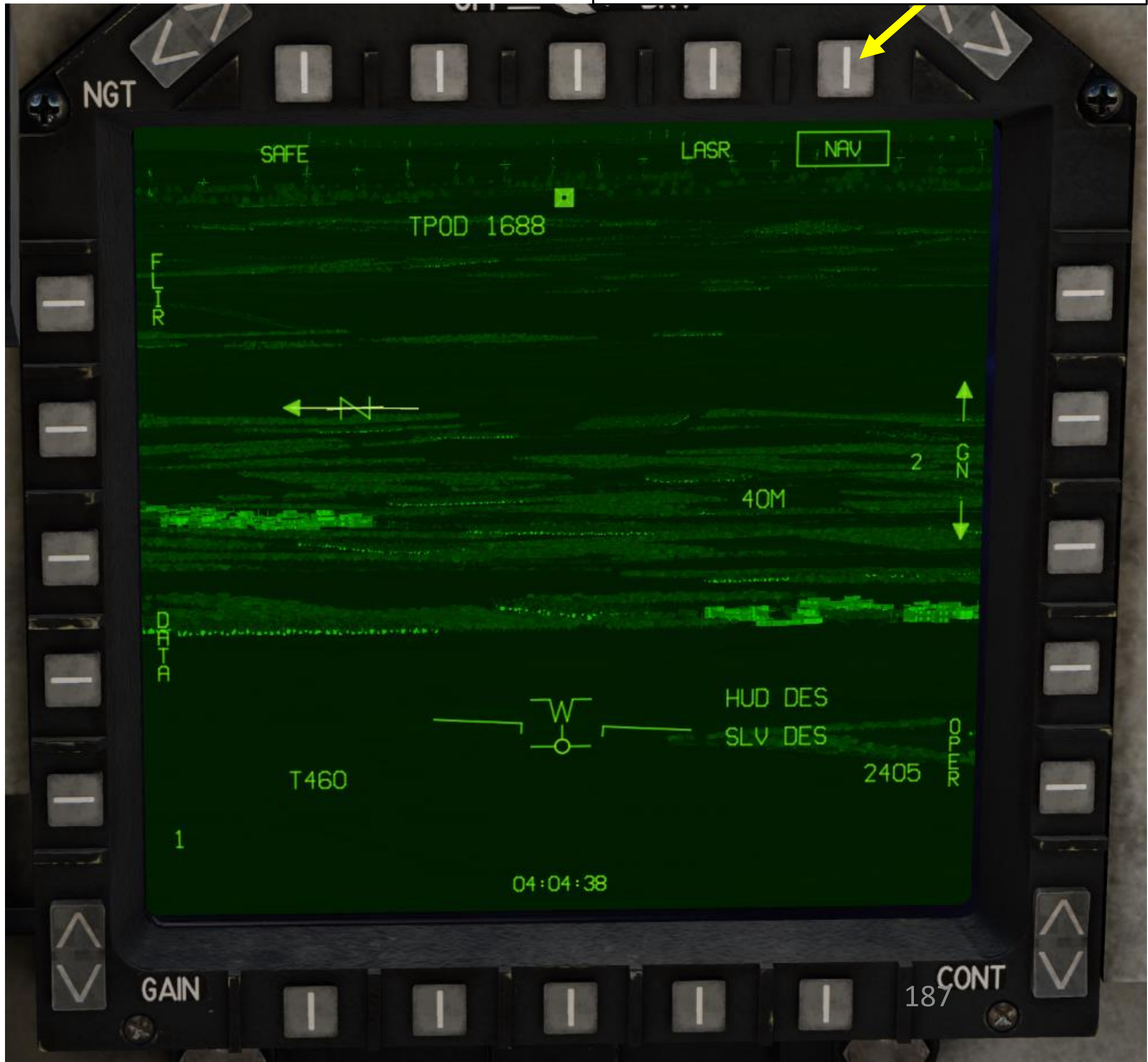
XMT: Not Implemented

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays

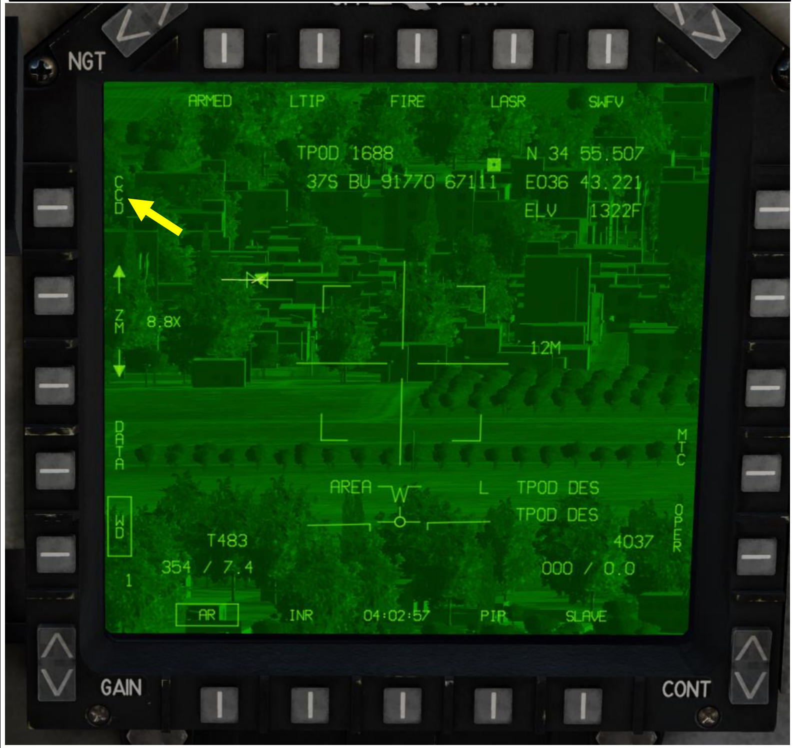
SWFV (Super-Wide Field-of-View) Option
- Short Press: selects SWFV.mode
- Long Press: selects NAV mode
- SWFV Boxed: ON



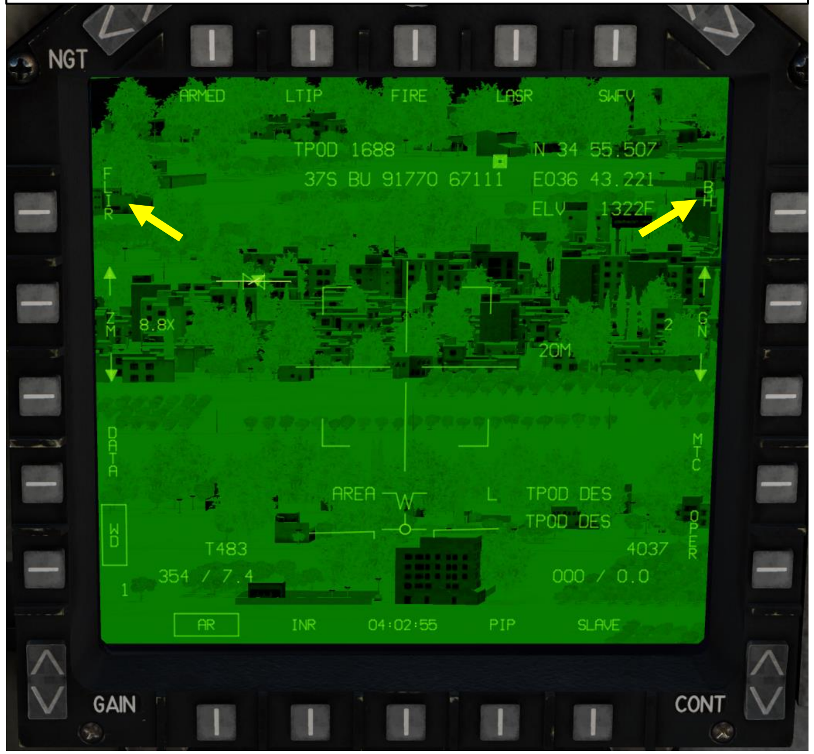
Targeting Pod NAV Mode Option: declutters targeting pod display and allows designation.
- Short Press: selects SWFV.mode
- Long Press: selects NAV mode
- NAV Boxed: ON



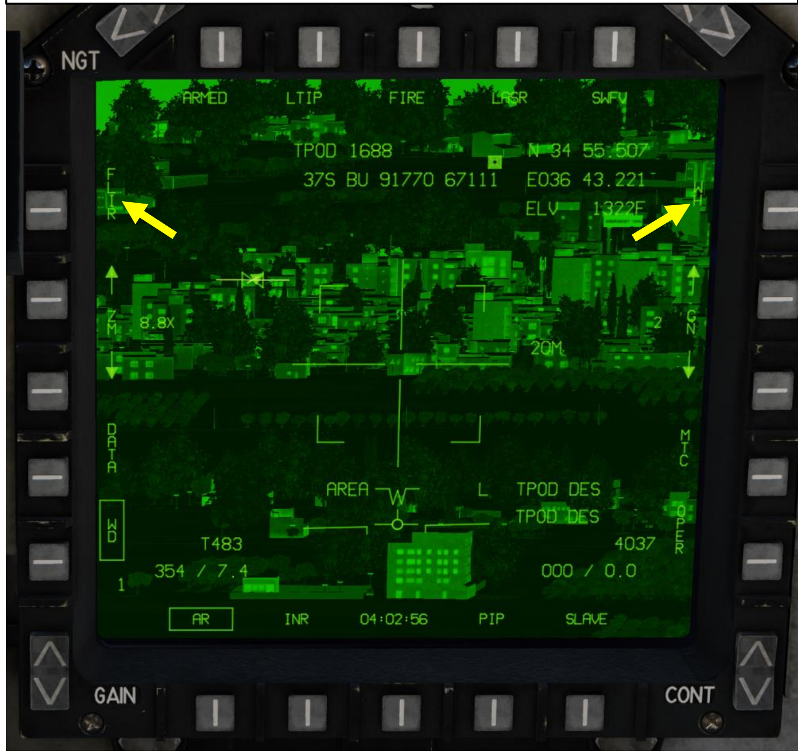
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays



MPCD CCD (TV) Mode



MPCD FLIR Mode – Black Hot (BH)

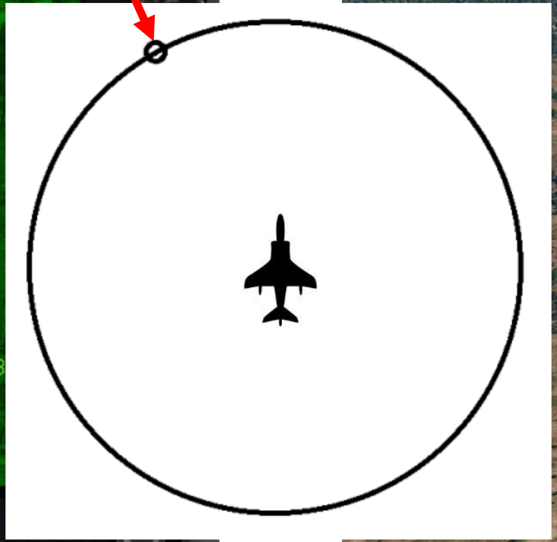


MPCD FLIR Mode – White Hot (WH)

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays

The Targeting Pod View Relative Direction symbol on the TPOD 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)

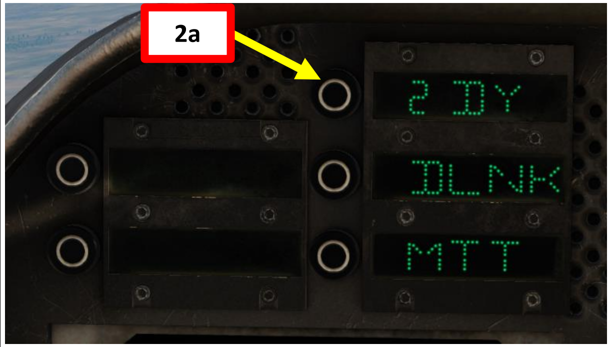


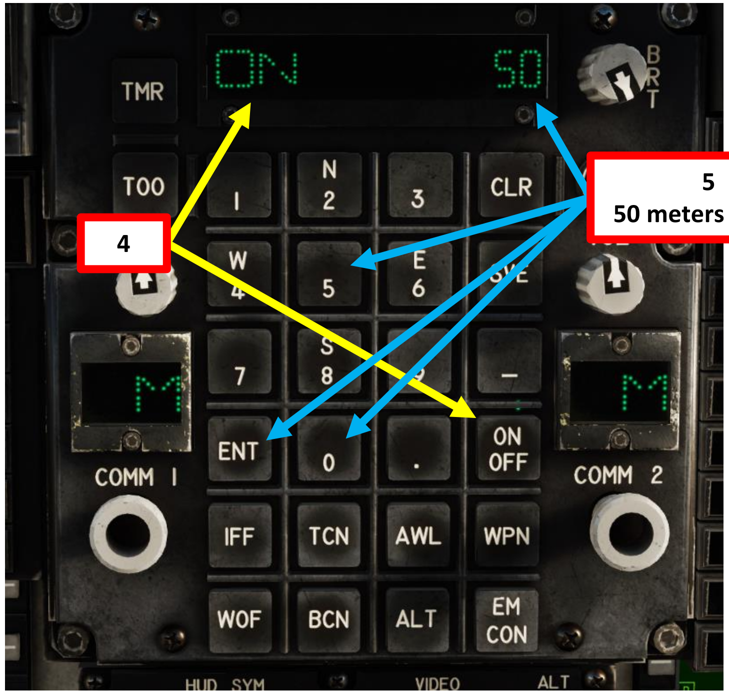
Targeting Pod is looking here

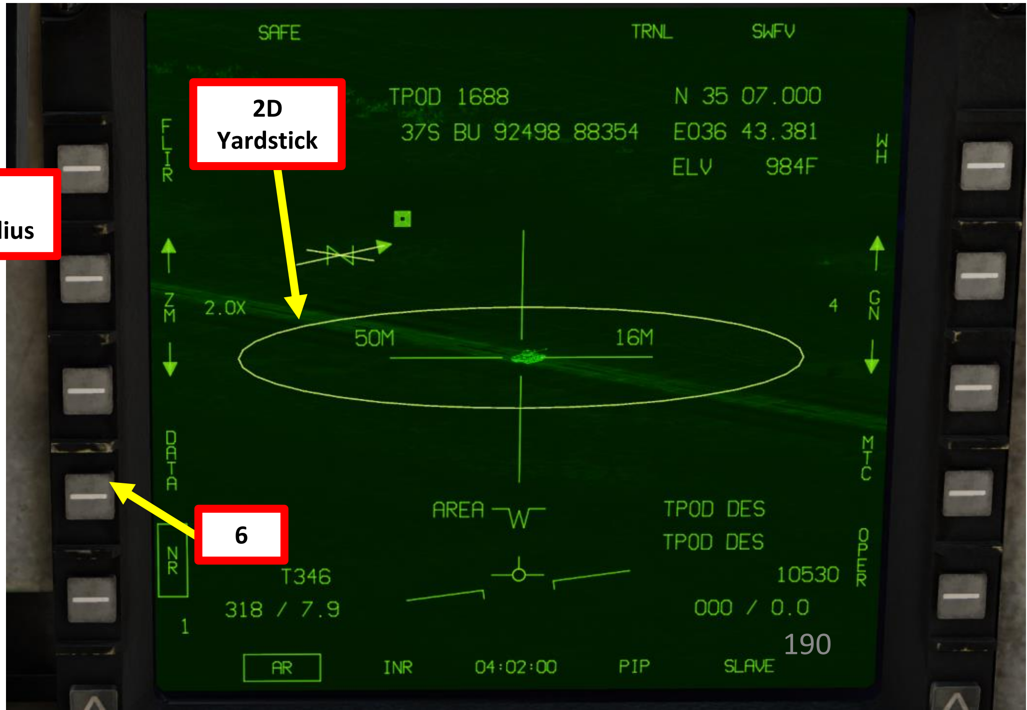
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.2 – Displays

In the TPOD page, when pressing the DATA OSB, you can select the 2DY ODU (Option Display Unit) to set a “2D Yardstick”, which is a 2D circular overlay with a customizable radius. This is helpful when you want to evaluate blast radius damage when friendlies are in the area.

1. On TPOD display, select DATA page (boxed when selected)
2. Press on “2 DY” ODU (Option Display Unit) button to enter the 2D Yardstick menu.
3. Select desired unit system by either selecting or not selecting ODU:
   - “: M” sets “meters” as units for the 2D Yardstick radius
   - “ M” sets “feet” as units for the 2D Yardstick radius
4. Press “ON/OFF” button on the UFC to set the 2D Yardstick to ON.
5. Enter 2D Yardstick radius on the UFC, then press “ENT” button.
6. De-select DATA page (unboxed when de-selected).







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4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.3 – Controls

Sensor Select Switch (SSS):

- DOWN (Depressed):
    - Double-Tap within 0.8 s:
        - **Enters Targeting Pod (TPOD) sensor HOTAS mode (HTS)**. It also displays the TPOD video page on the right MPCD.
        - If TPOD HOTAS mode already selected, disables TPOD sensor HOTAS mode and returns Sensor Select Switch function to normal. Active sensor is set to the previously selected one.
- AFT:
    - Short (less than 0.8 s):
        - Cycles track mode between AR (Area Track), PT (Point Track) and MT (Moving Target) Modes
        - Releases LST (Laser Spot Track) mode and returns to previously selected track mode
        - Cancels LSS (Laser Spot Search) and returns to previous selected track mode.
    - Long (more than 0.8 s): Selects INR (Inertial) Track
- FWD:
    - Short (less than 0.8 s):
        - With TPOD HOTAS mode: Laser Range Update
    - Long (more than 0.8 s): If AGM-65E Laser Maverick is the selected weapon, it removes the TPOD page and calls the LMAV page.
- LEFT:
    - Short (less than 0.8 s):
        - With TPOD HOTAS mode: Changes Field-of-View (FOV): Narrow (NR) or Wide (WD)
    - Long (more than 0.8 s): Activates LSS (Laser Spot Search)
- RIGHT:
    - Short (less than 0.8 s):
        - With TPOD HOTAS mode and FLIR video, toggles polarity (WH/BH)
        - With TPOD HOTAS mode and CCD (TV) video, no function.
    - Long (more than 0.8 s): Toggles video between CCD and FLIR.

Air-to-Ground Target Undesignate / Nosewheel Steering Button:

- Undesignates target or toggles targeting pod designation mode.

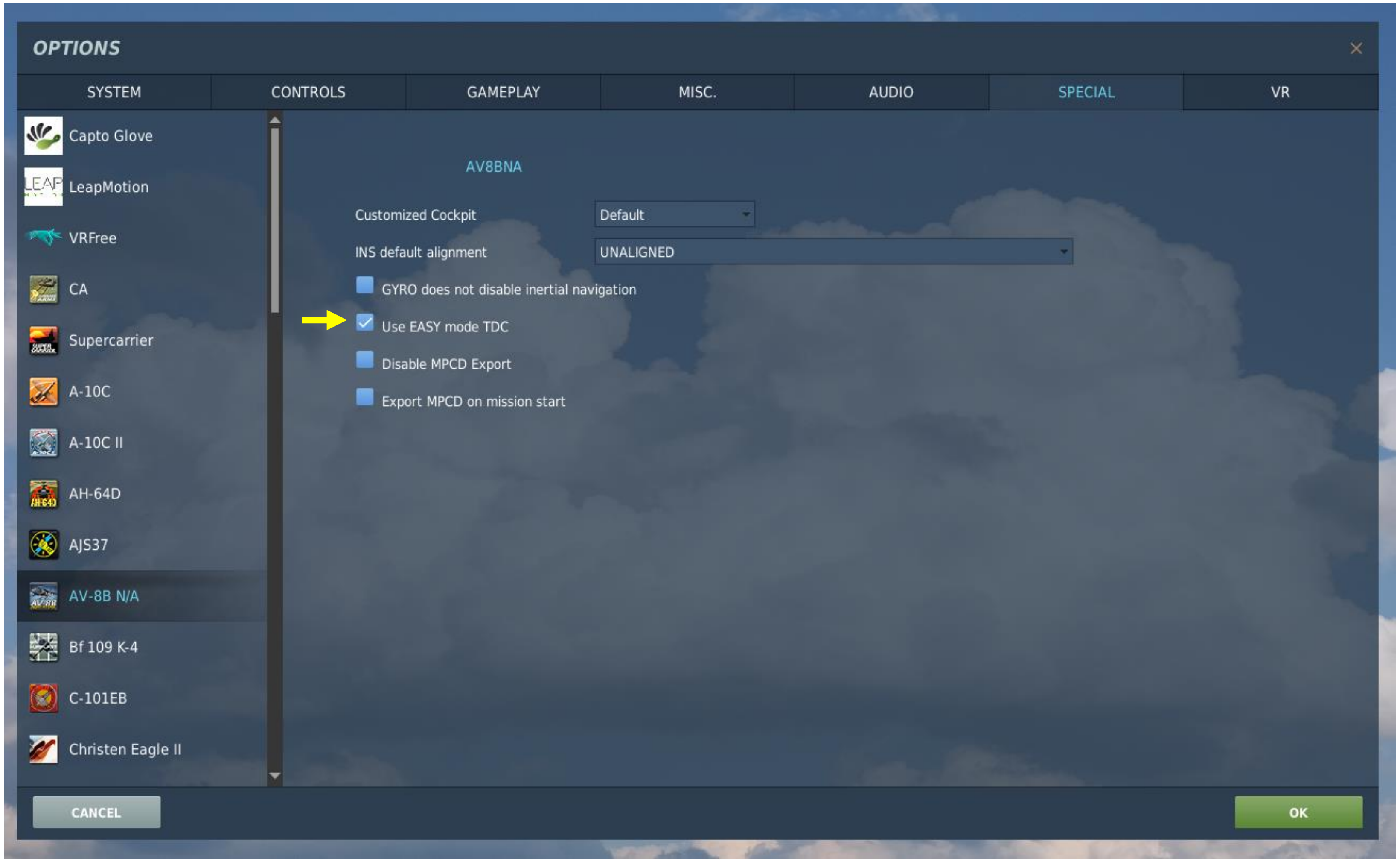
Sensor Select Switch (SSS)
- AFT
- FWD
- LEFT
- RIGHT
- DOWN (Depressed)

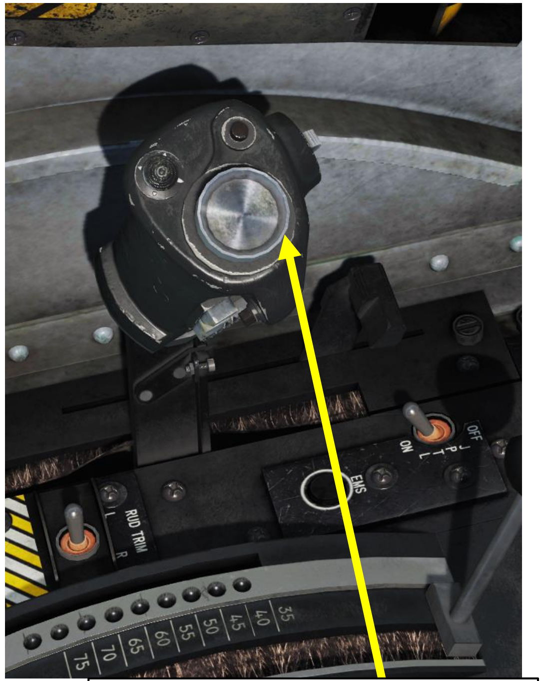
Air-to-Ground Target Undesignate / Nosewheel Steering Button

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.3 – Controls

TDC (Target Designation Caret) Control Switch:
- LEFT/RIGHT/FWD/AFT: slews selected sensor (targeting pod, DMT, moving map).
- DOWN (ACTION): Designates target. When pressed, allows targeting pod slewing.

Note: In the “Special Options” tab for the AV-8B N/A Harrier, make sure to have the “Use EASY mode TDC” enabled (checked). This option was previously known as the “Enable Action/No Action TDC” option.

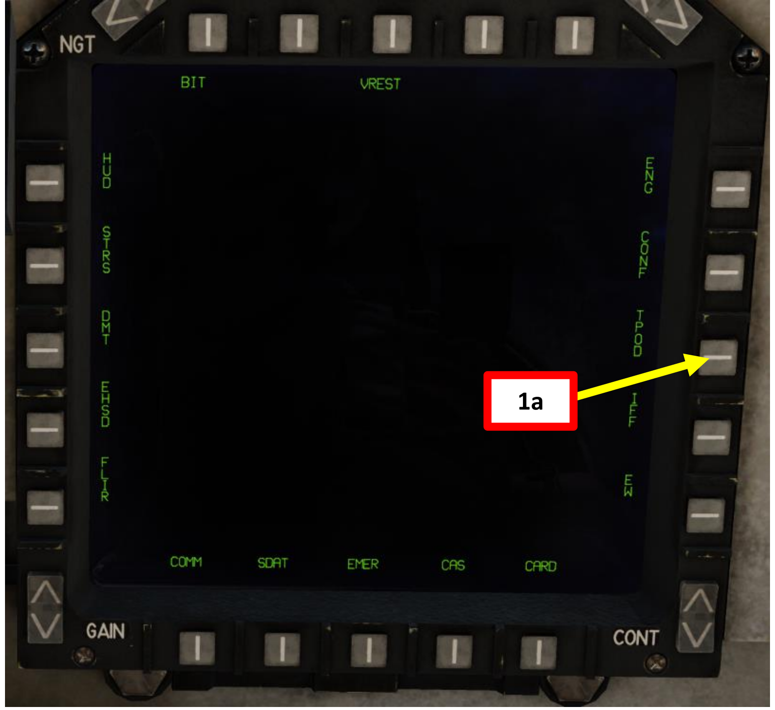


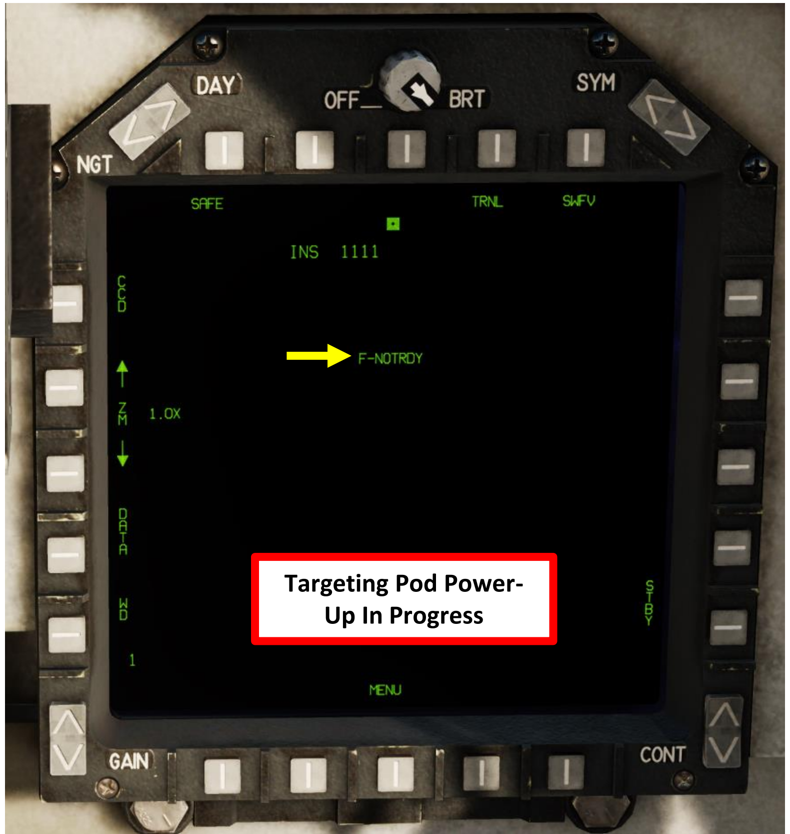


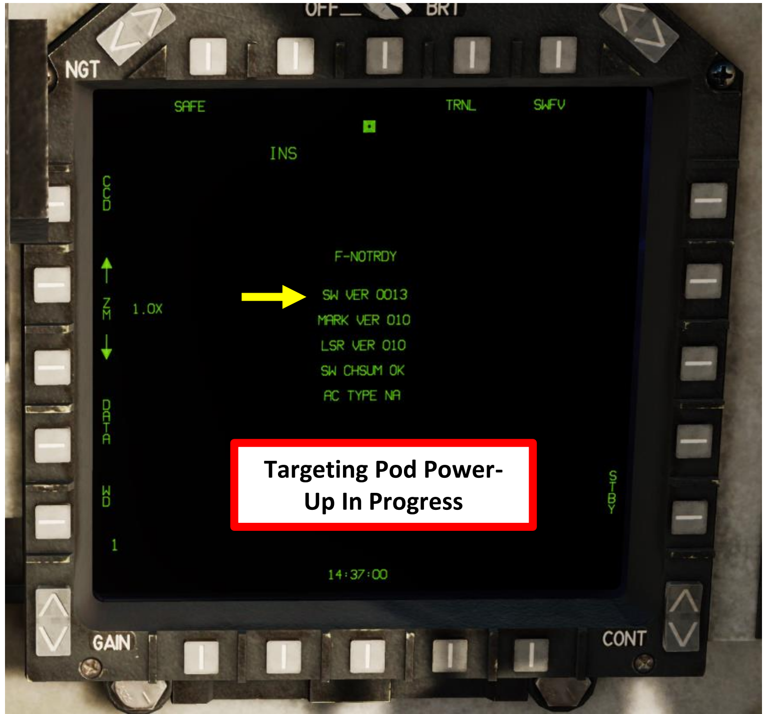
TDC (Target Designation Caret) Control Switch
- LEFT
- RIGHT
- FORWARD
- AFT
- DOWN (ACTION)

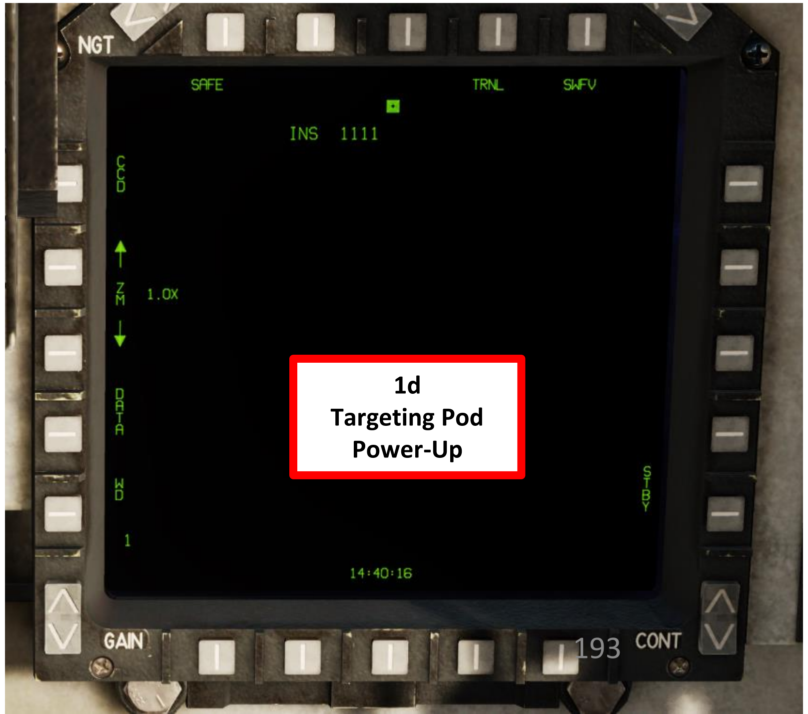
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

1. The Targeting Pod power-up sequence is described as follows:
   a) Press the OSB next to the "TPOD" page in the main MPCD MENU
   b) Once aircraft generators are on (engine running), the targeting pod will automatically begin its initialization sequence while in STBY (Standby) mode.
   c) After targeting pod initialization, the pod starts FLIR cooling, which takes approximately 6 to 8 minutes. Pod will display F-NOTRDY (FLIR Not Ready) indication when FLIR cooling is incomplete.
   d) Once FLIR cooling is complete, the F-NOTRDY indication disappears. The targeting pod may now be used.



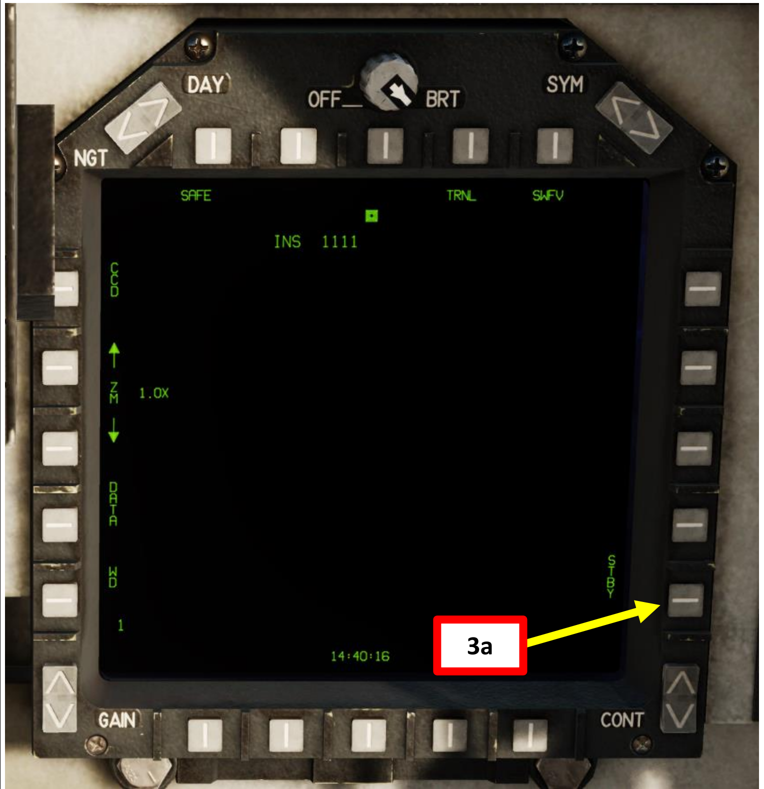


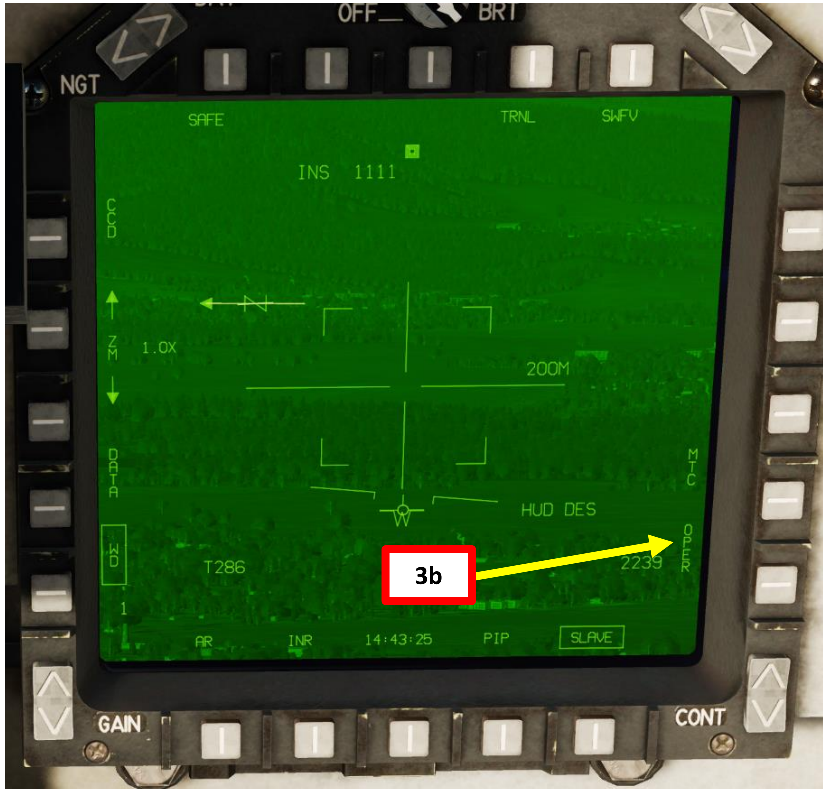




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

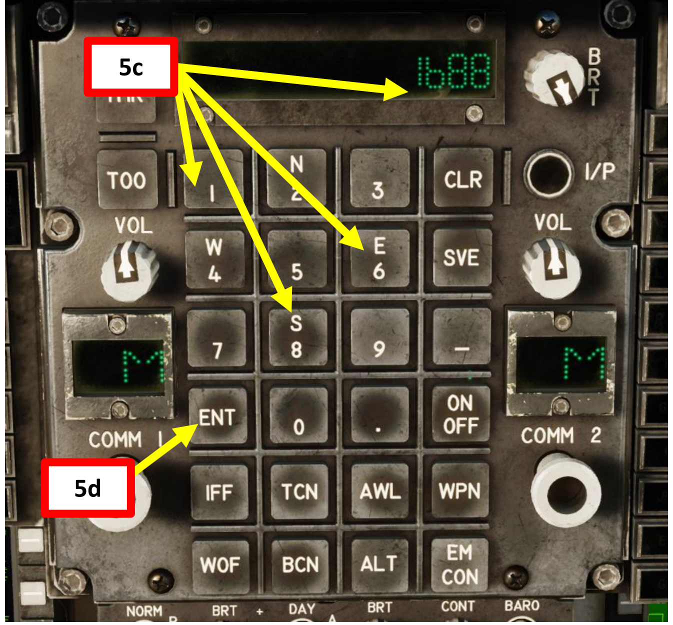
2. Select A/G (Air-to-Ground) Master Mode and set Master Arm Switch ON (UP)
3. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).

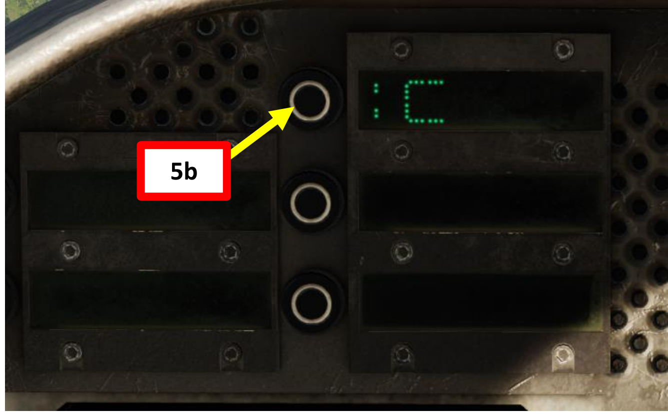


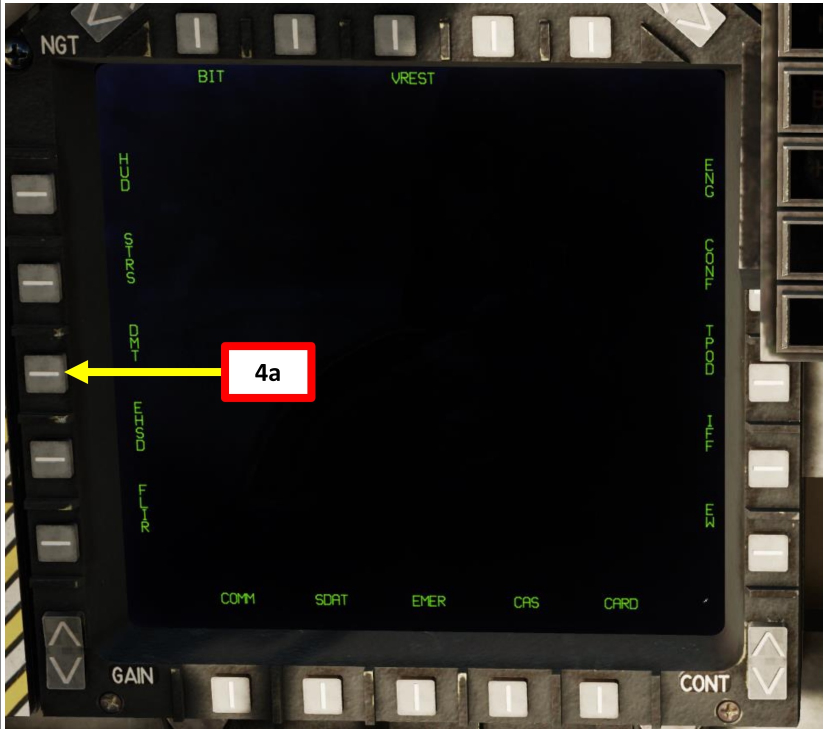


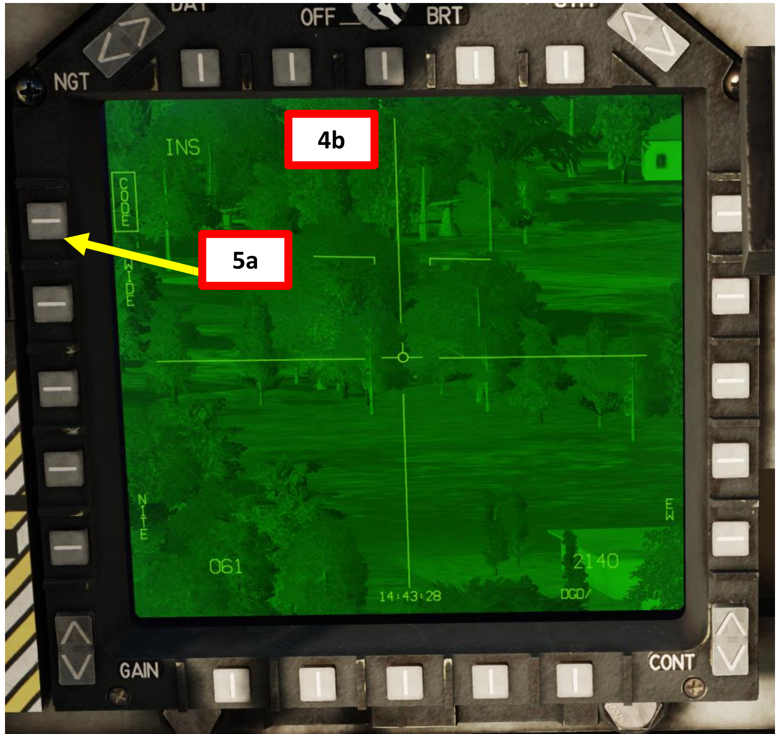
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

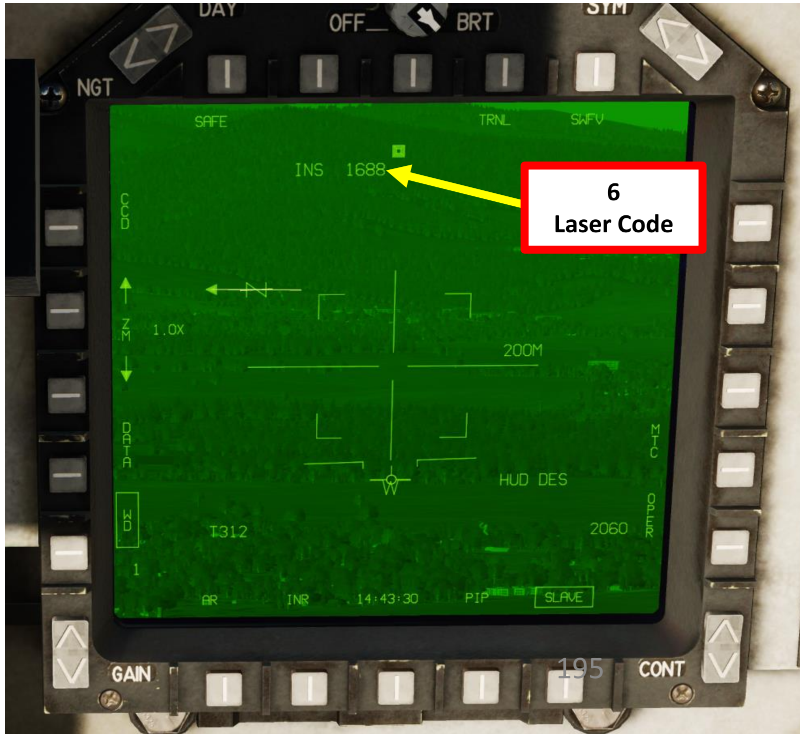
4. From the main MPCD menu, select "DMT" page. DMT feed will appear on your MPCD display. Take note that this can be performed from the "EHSD" page as well.
5. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT.
6. Laser Code will now be visible on the TPOD page.





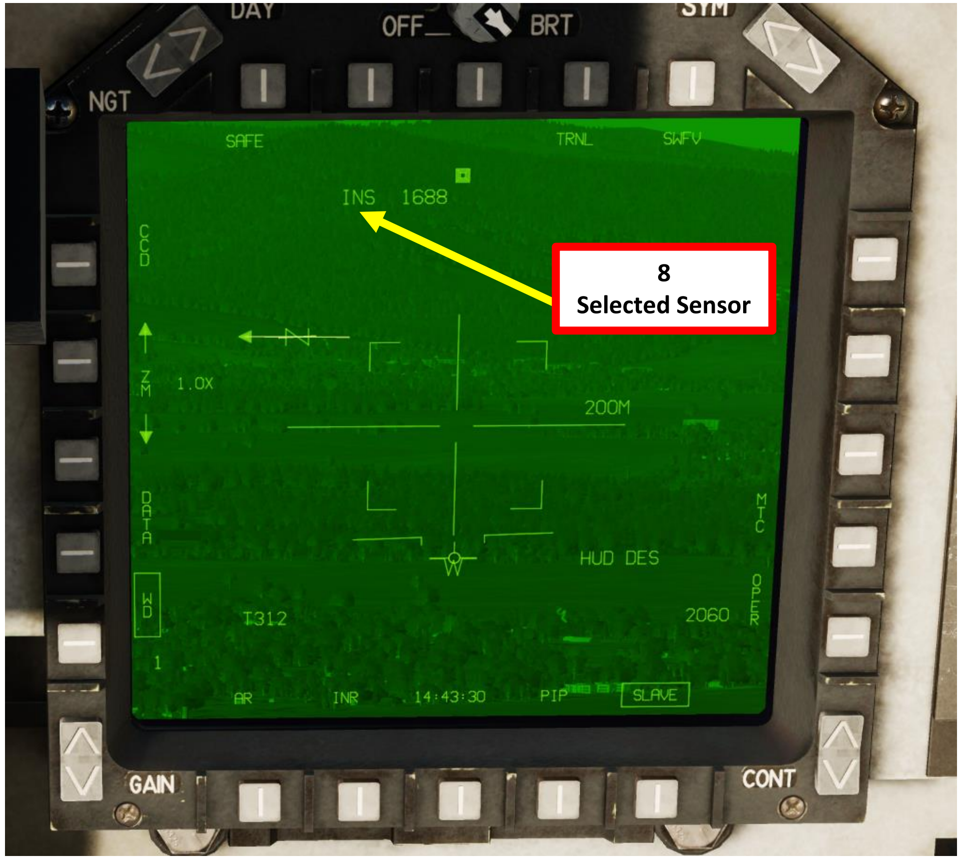


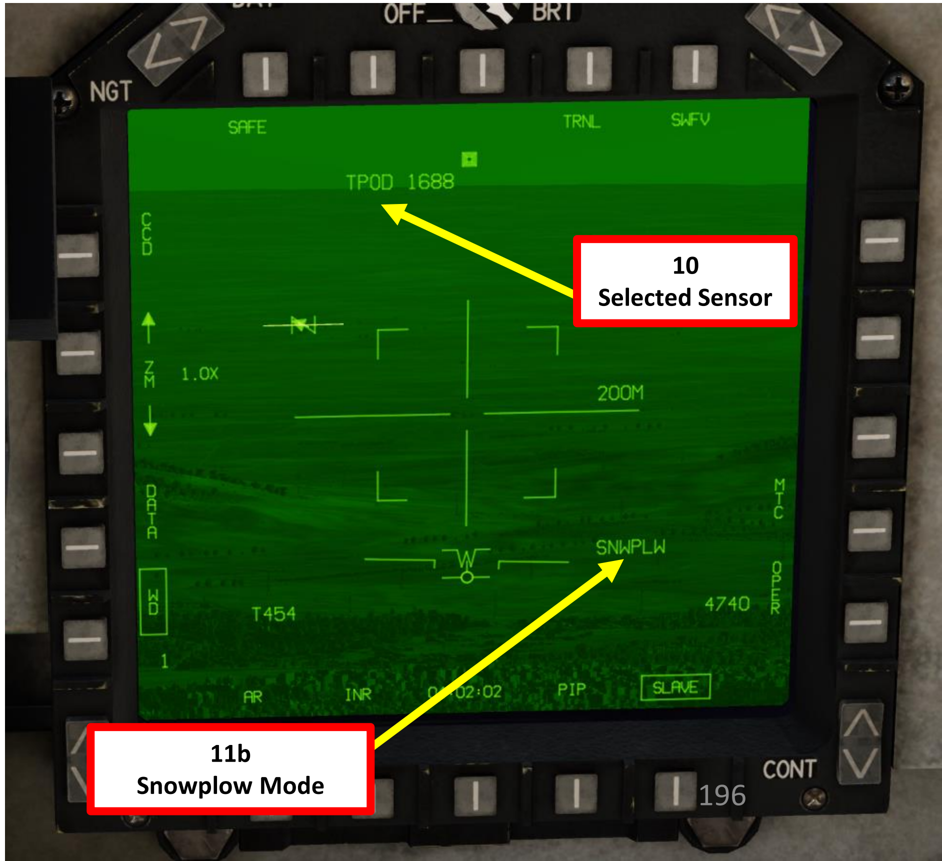




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

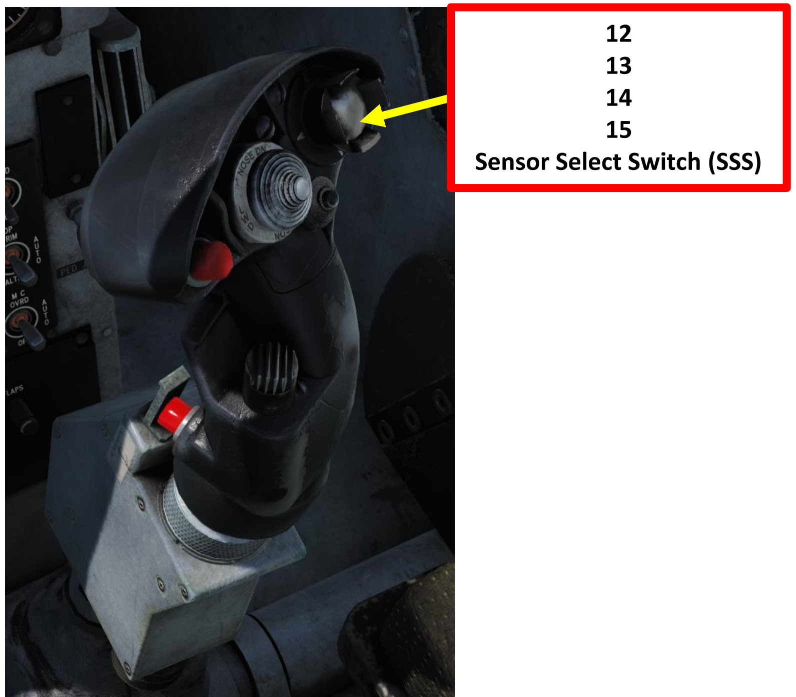
7. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
8. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
9. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
10. Confirm that Sensor of Interest switches to TPOD.
11. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.

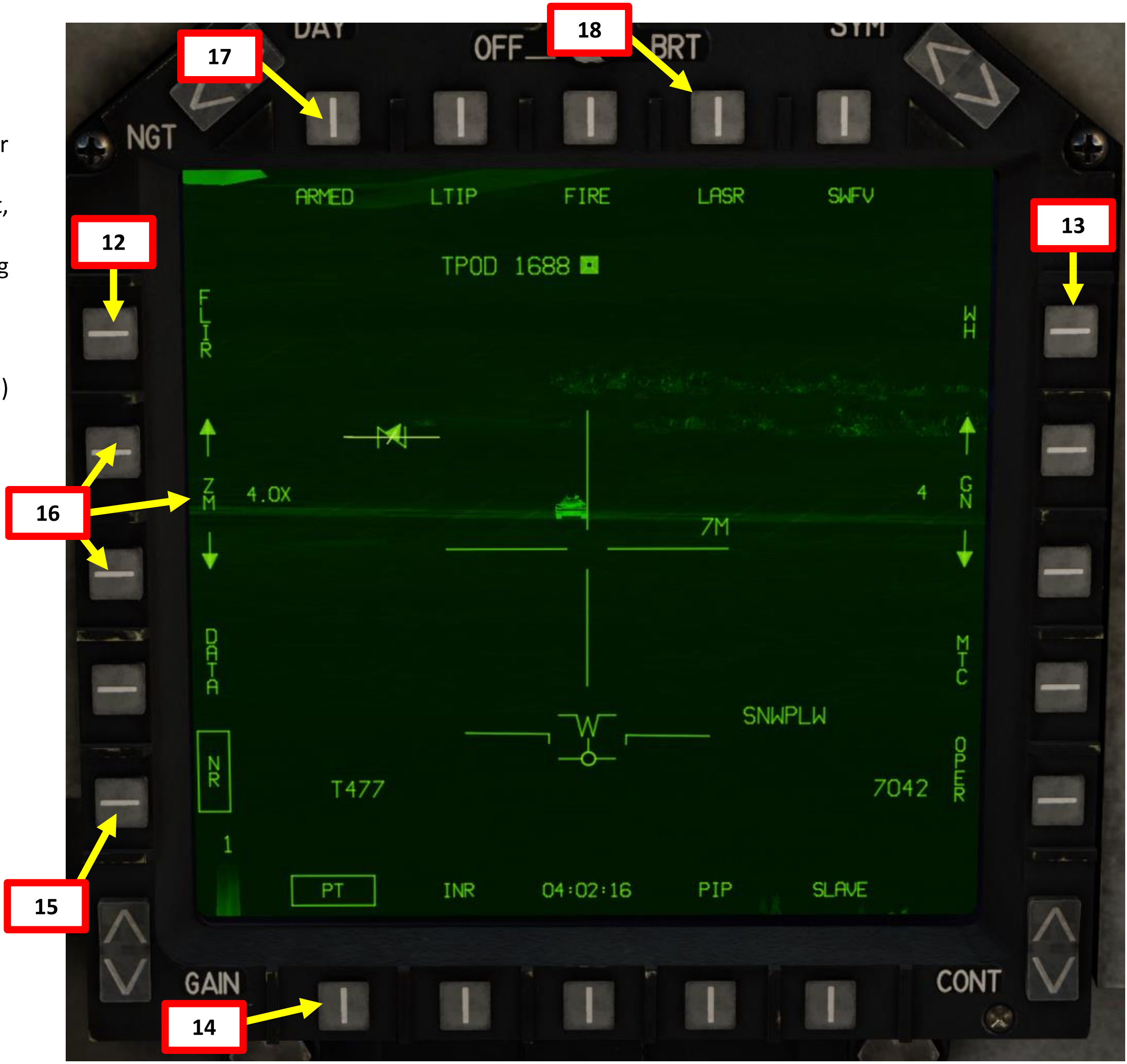




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

12. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
13. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
14. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
15. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
16. Select desired zoom level by using the ZM +/- OSBs.
17. Press Laser Arming OSB to select ARMED mode.
18. Press Laser Mode OSB to select LASR (Laser Designator) Mode.

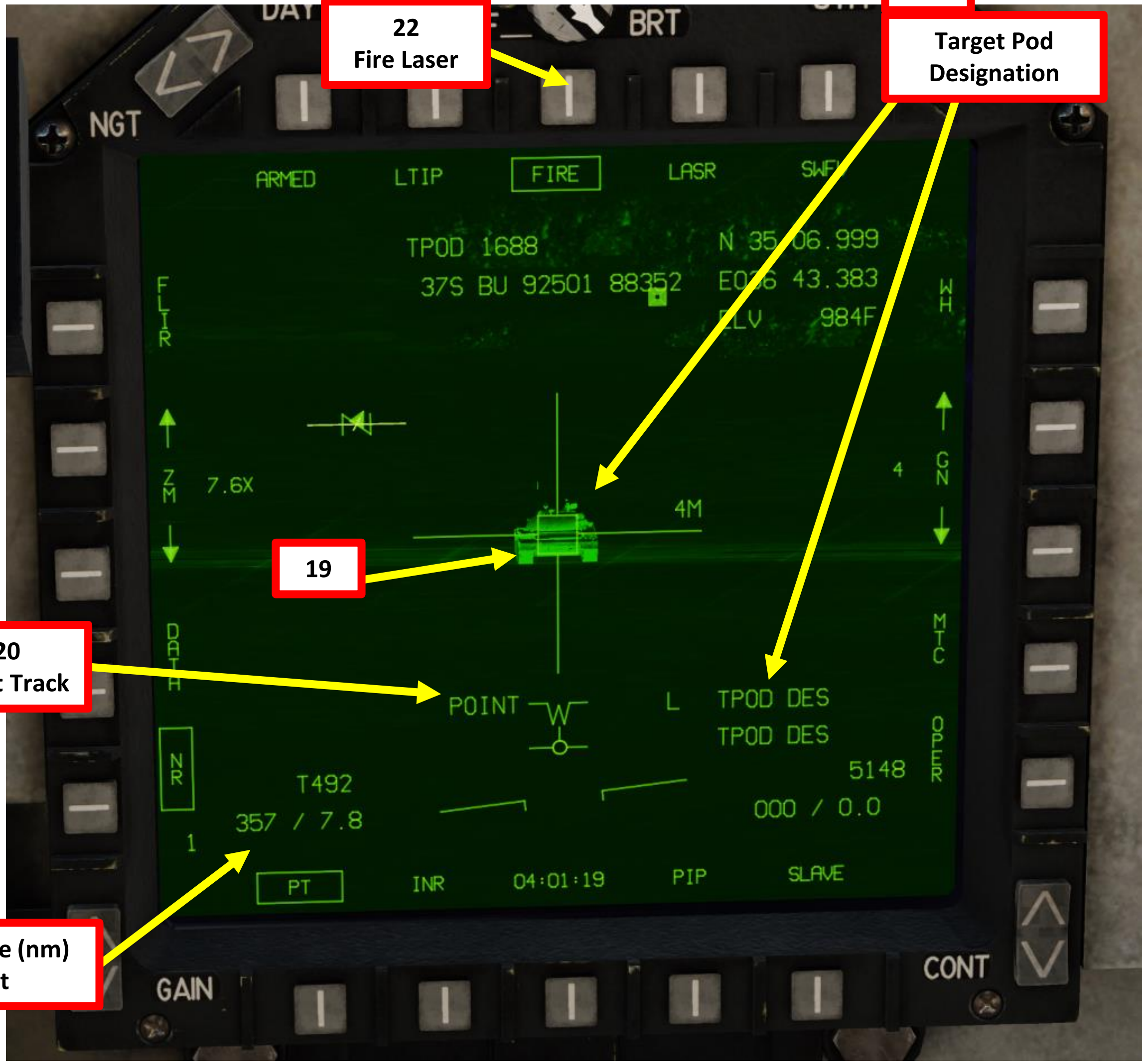




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

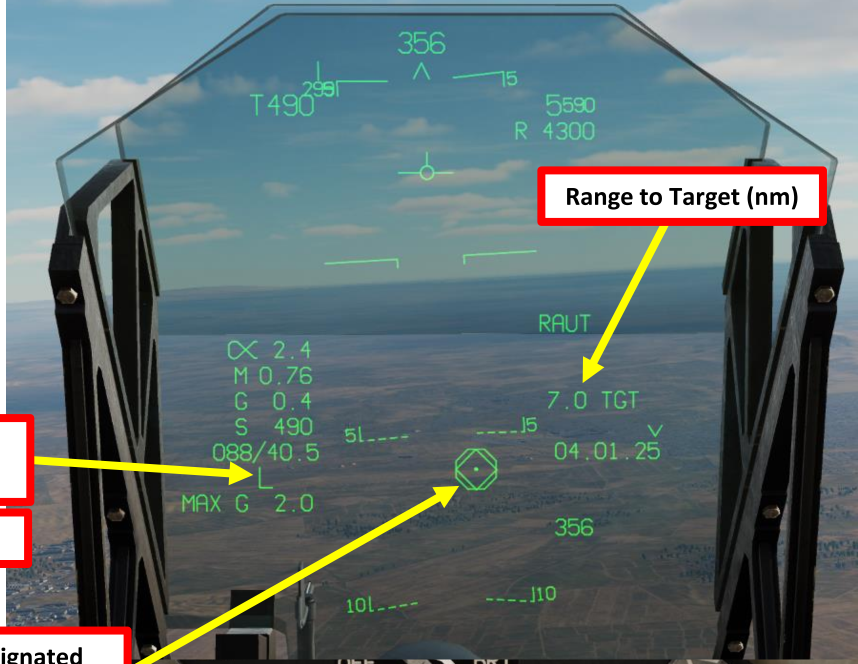
19. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
20. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
21. If you want to have a laser ranging update, make sure you have a valid laser code and press the OSB next to LTIP (Laser Target Imaging Profile) or press Sensor Select Switch FWD SHORT.
22. Press FIRE OSB to fire the laser. Laser-guided ordnance can now track this laser.

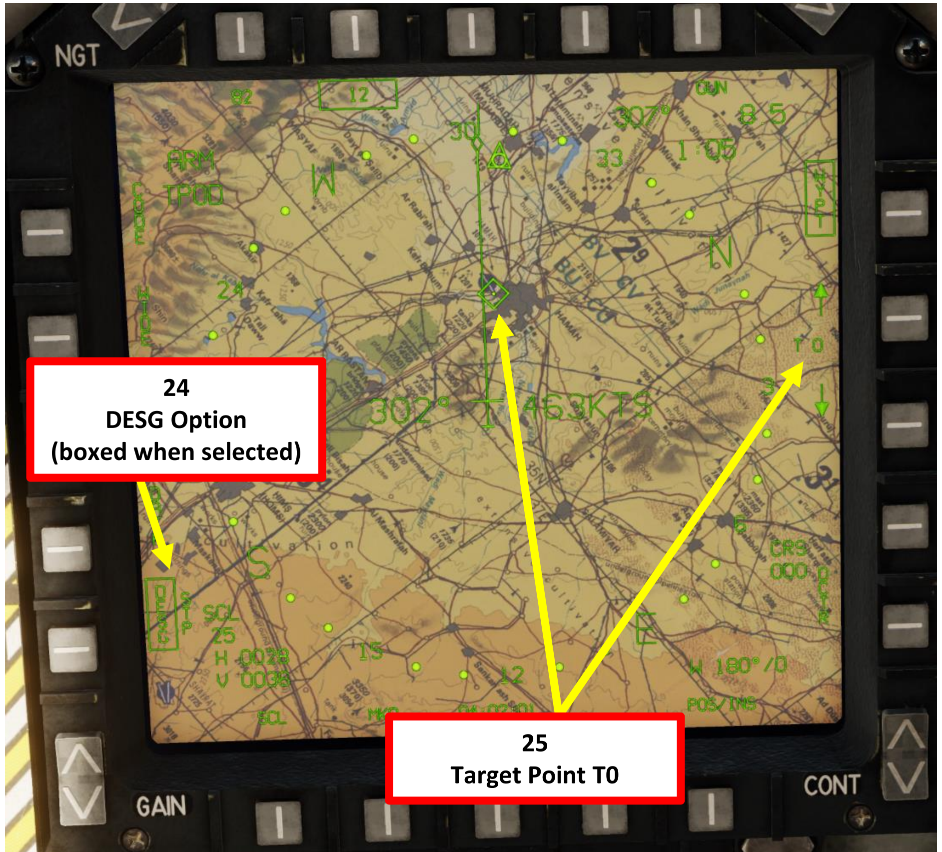
Take note that Laser Firing is inhibited if either:
- SWFV (Super-Wide Field-of-View) is enabled
- Airspeed is less than 100 kts
- Targeting Pod is not designating a target in either Area Track or Point Track
- Master Arm is OFF
- Master Mode is not set to A/G
- Landing Gear is DOWN

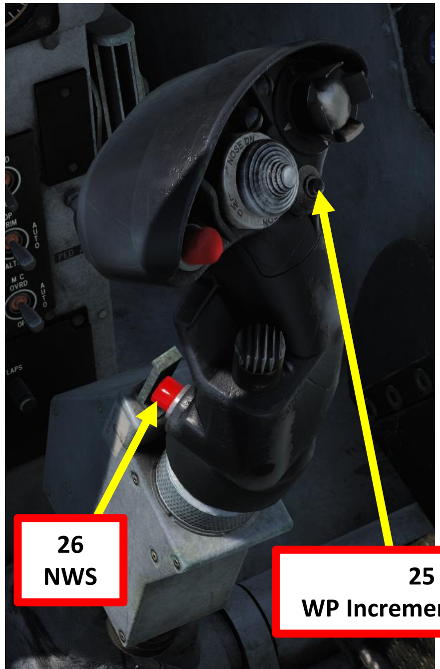


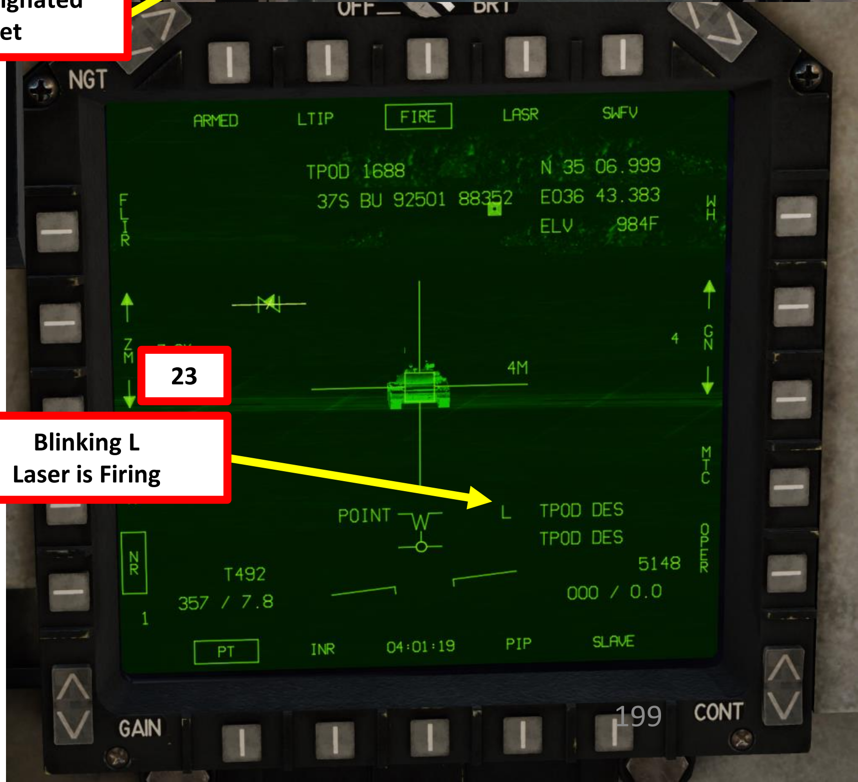
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.4 – Start-Up & Lasing Procedure

23. Once laser is firing, the « L » indication will blink on both the HUD and the TPOD page.
24. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
25. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0. This will be explored later in the Weapons section.
26. To un-designate a target, press the « AG Target Undesignate/NWS/FOV Toggle » button.





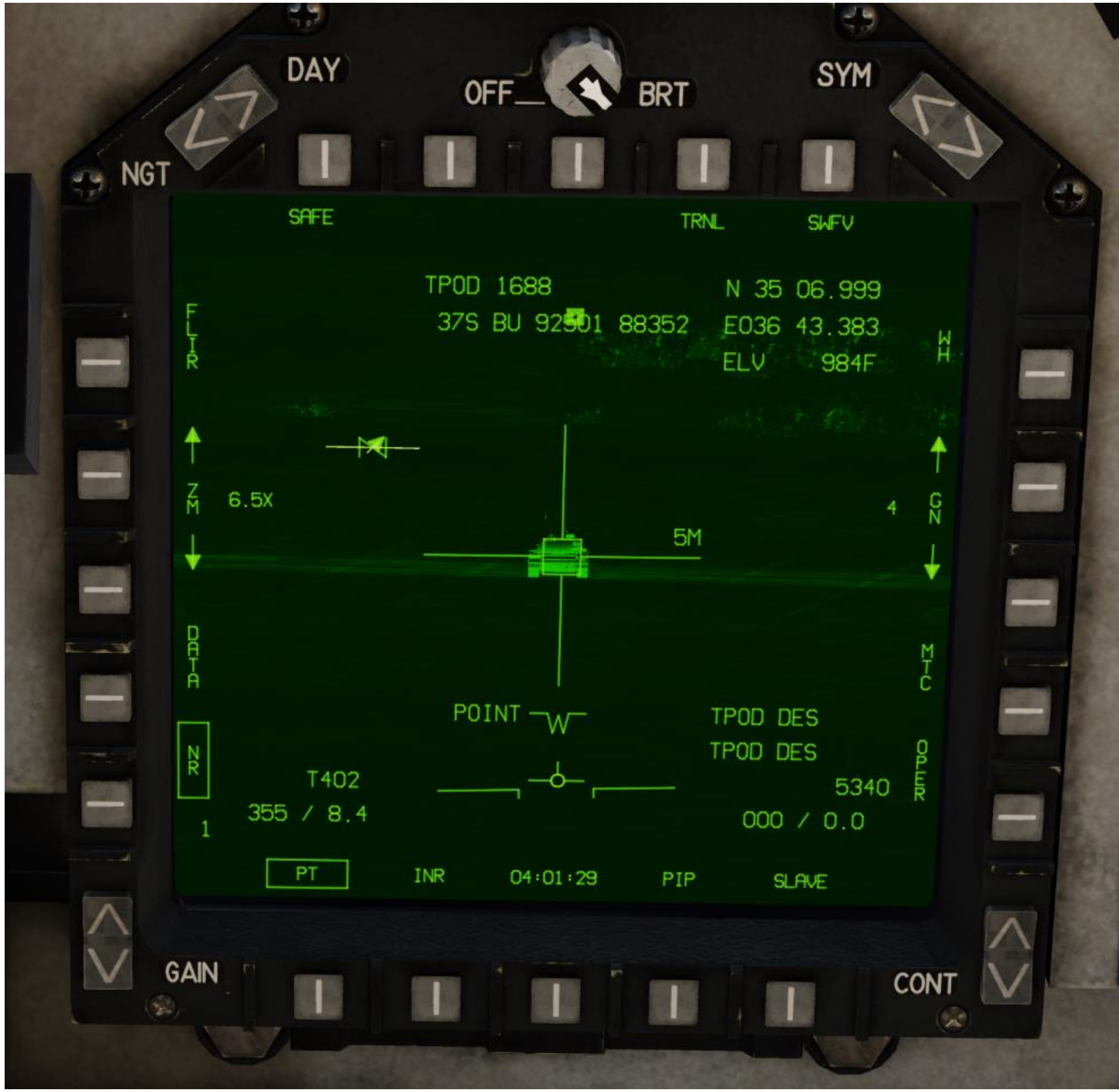




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.1 – Overview

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

- **SLV VV (Velocity Vector Slaved)** mode has the FLIR slaved to the line of sight to the velocity vector.
- **SNWPLW (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
- **MAP DES (Waypoint Slaving)** (TGP snaps to a selected navigation waypoint) is available using the EHSD page (see relevant section).
- **AR (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.
- **PT (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.
- **MT (Moving Target Track)** is used to keep track of a specific moving point. This is a similar mode to Point Track.



4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.1 – Overview

- **MAP DES**: EHSD (Map) is the selected sensor for System Designation (DESG Button)
- **TPOD DES**: TPOD is the selected sensor for System Designation.
- **HUD DES**: INS or DMT is the selected sensor for System Designation.
- **LSS**: TPOD is in Laser Spot Search mode.
- **LST**: TPOD is in Laser Spot Tracking mode.

- **TRK DES**: TPOD is in either AR, PT or MT modes with a designated target.
- **TPOD DES**: TDC Button has been pressed (Target Designation) with the TPOD as the selected sensor.
- **SLV DES**: System Designation exists. TPOD sensor is slaved to the designated location.

Here is an overview of the logic for the Target/System Designation with the Targeting Pod.

Targeting Pod is Powered Up

Sensor Select Switch DOWN x2
TPOD Sensor Selected

TPOD 1688
37S CV 17762 03126

Press NWS Button

NO DES
SLV VV
(TPOD Slaved to Velocity Vector)
NO DES
SLV VV

Press NWS Button

Snowplow Mode
SNWPLW

TDC Depressed (Action)

TDC Depressed (Action)

Press NWS Button

HUD DES
SLV DES
(TPOD slaved to INS or DMT)
HUD DES
SLV DES

Press NWS Button

TPOD DES
TPOD DES
(TPOD Designation)
- *Perform Area/Point/Moving Track as desired.*

TPOD DES
TPOD DES

1. *WYPT OSB (Option Select Button) selected on the EHSD (Electronic Horizontal Situation Display)*
2. *Desired waypoint is selected*
3. *DESG (Waypoint Designate) OSB selected on EHSD*

MAP DES
SLV DES
(TPOD Slaved to Waypoint)
MAP DES
SLV DES

TDC Depressed (Action)

Press NWS Button

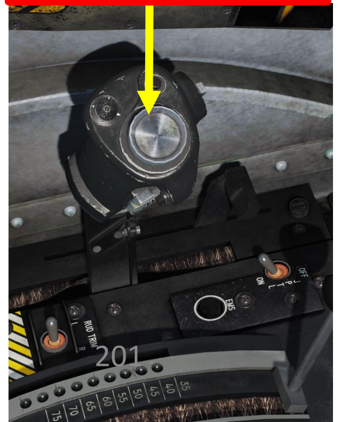
TPOD DES
TPOD DES
(TPOD Designation)
- *Perform Area/Point/Moving Track as desired.*

TPOD DES
TPOD DES

Sensor Select Switch (SSS)

NWS (Nosewheel Steering) Button

TDC (Target Designation Control)



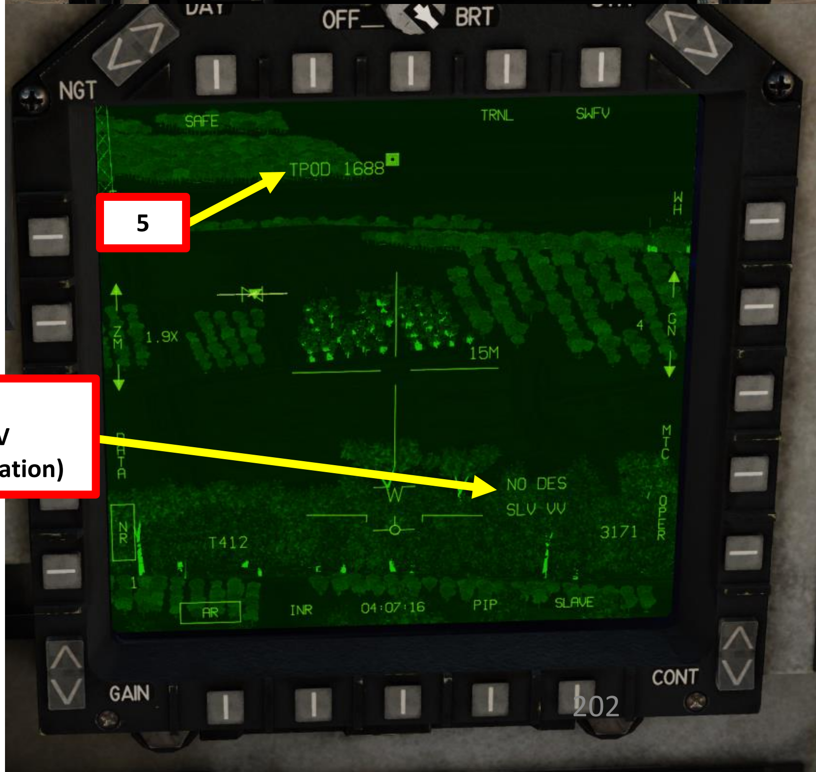
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.2 – SLV VV (Slave to Velocity Vector)

SLV VV (Slave to Velocity Vector) mode has the targeting pod slaved to the line of sight to the velocity vector.

- To select SLV VV mode:
    1. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
    2. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
    3. Check selected sensor on TPOD page
        a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
        b) TPOD indicates the targeting pod is the selected sensor.
        c) TV indicates the DMT TV is the selected sensor.
    4. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
    5. Confirm that Sensor of Interest switches to TPOD.
    6. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SLV VV Mode.
    7. To designate a target, fly the aircraft to set the velocity vector on the target, then use the TDC Depress (Action) control to designate the target.
        - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).

Velocity Vector (No Designation)

7



5

6
SLV VV
(No Designation)

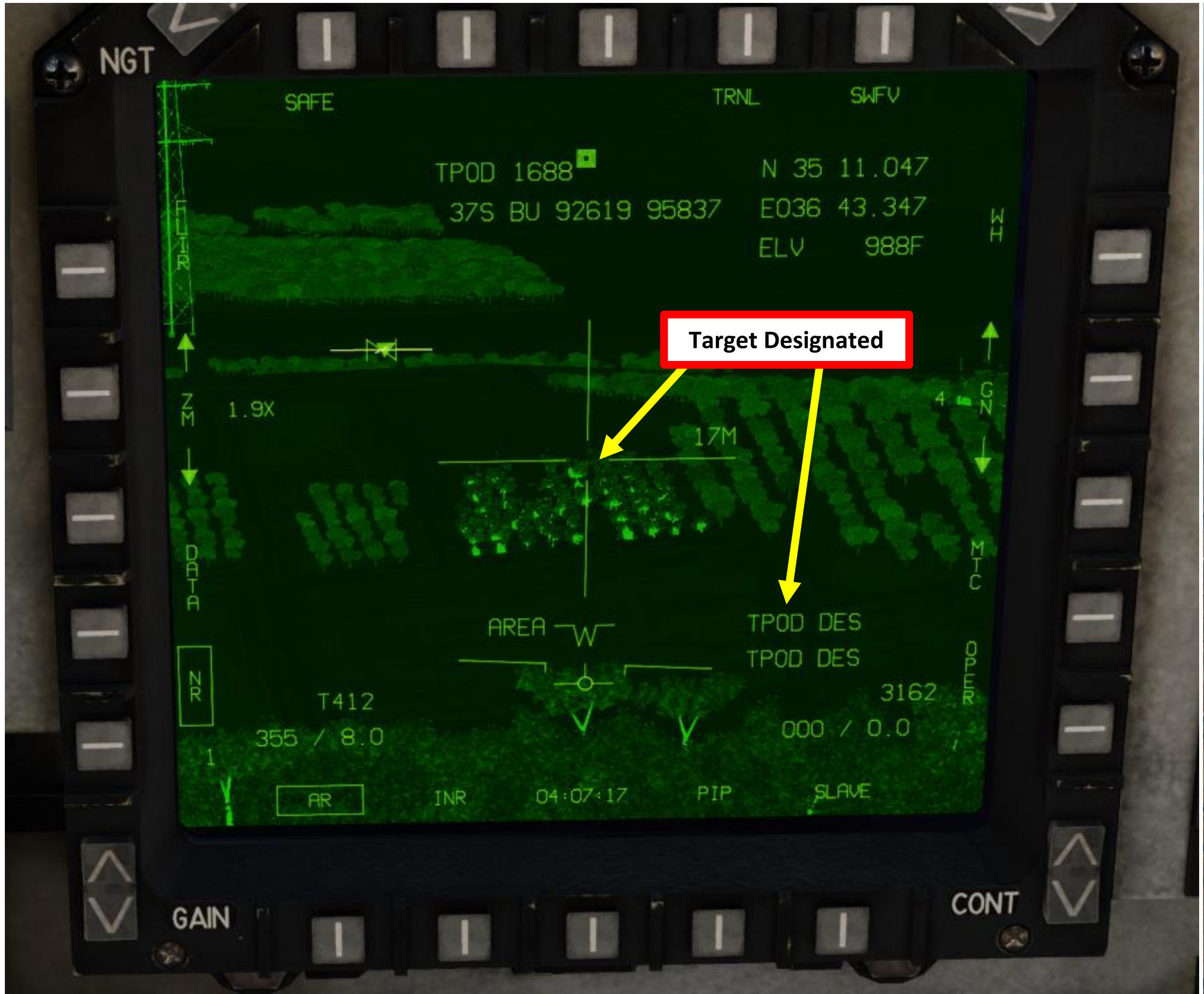
4
Sensor Select Switch (SSS)

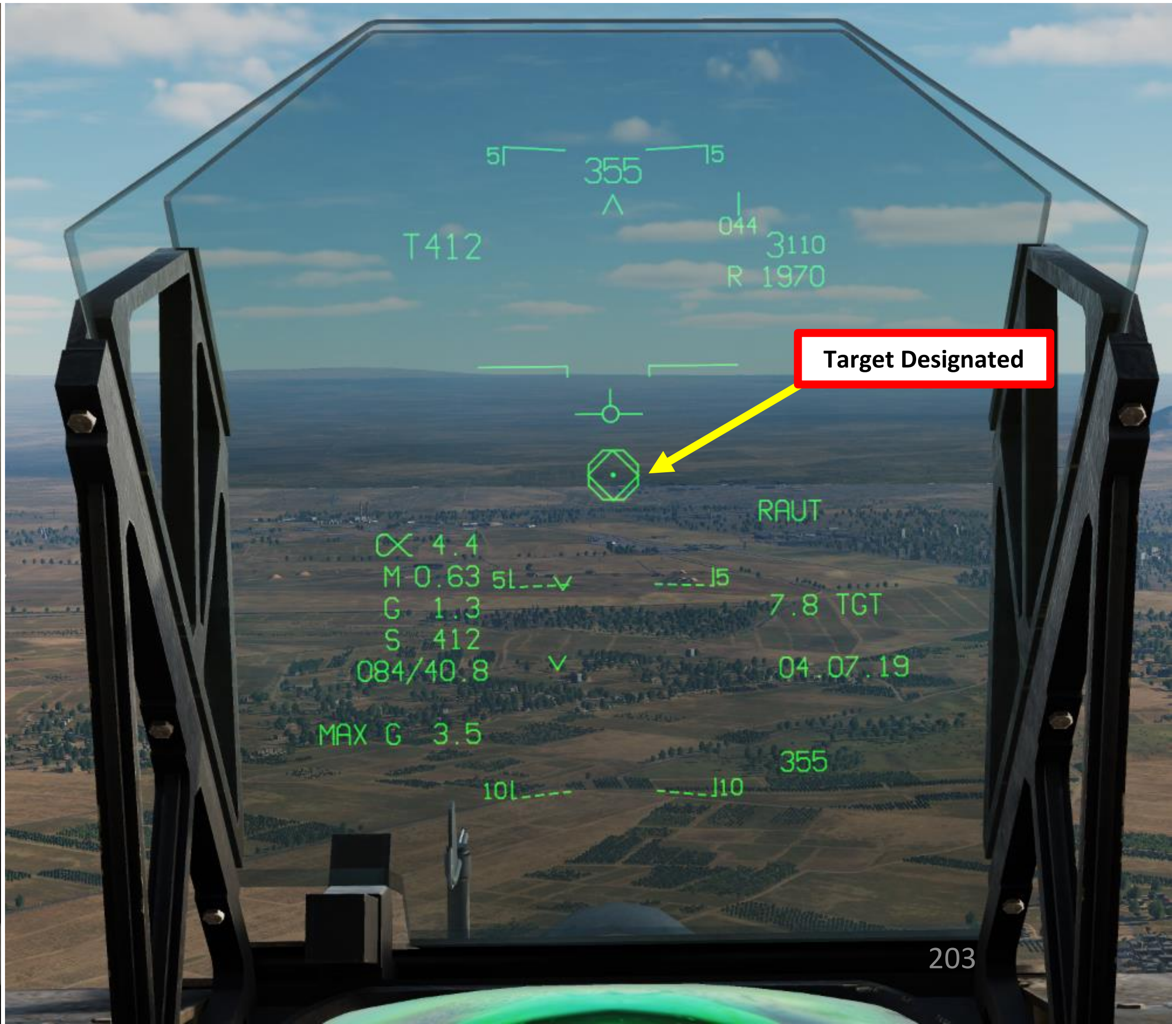
2
6
NWS (Nosewheel Steering) Button

7
TDC (Target Designation Control)

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.2 – SLV VV (Slave to Velocity Vector)

- To select SLV VV mode:
  8. 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.
  9. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle over the desired target if adjustments are required.

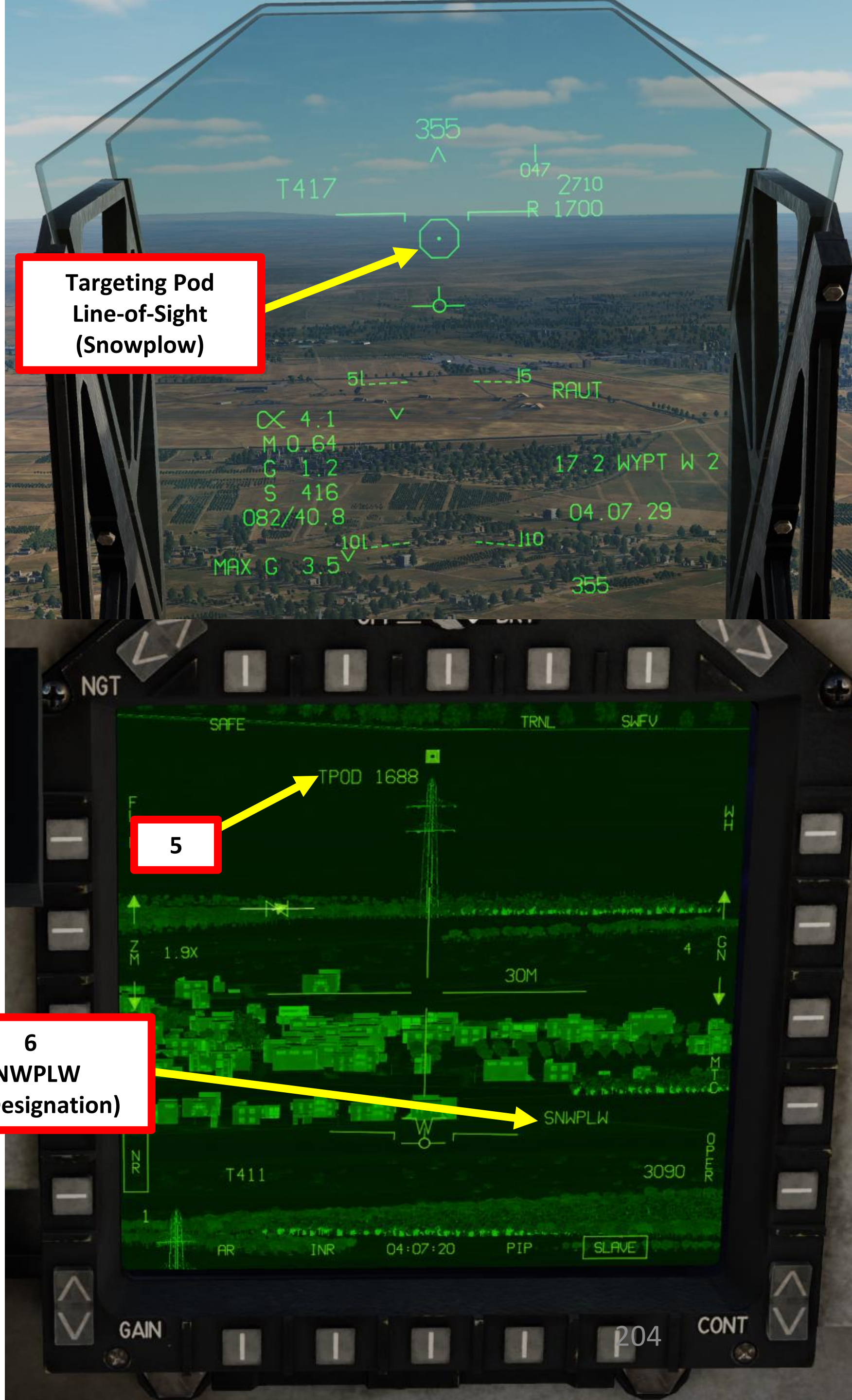




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.3 – SNWPLW (Snowplow)

SNWPLW (Snowplow) mode is not stabilized to anything it is pointed at; slewing it changes the absolute position of the reticle relative to the pod.

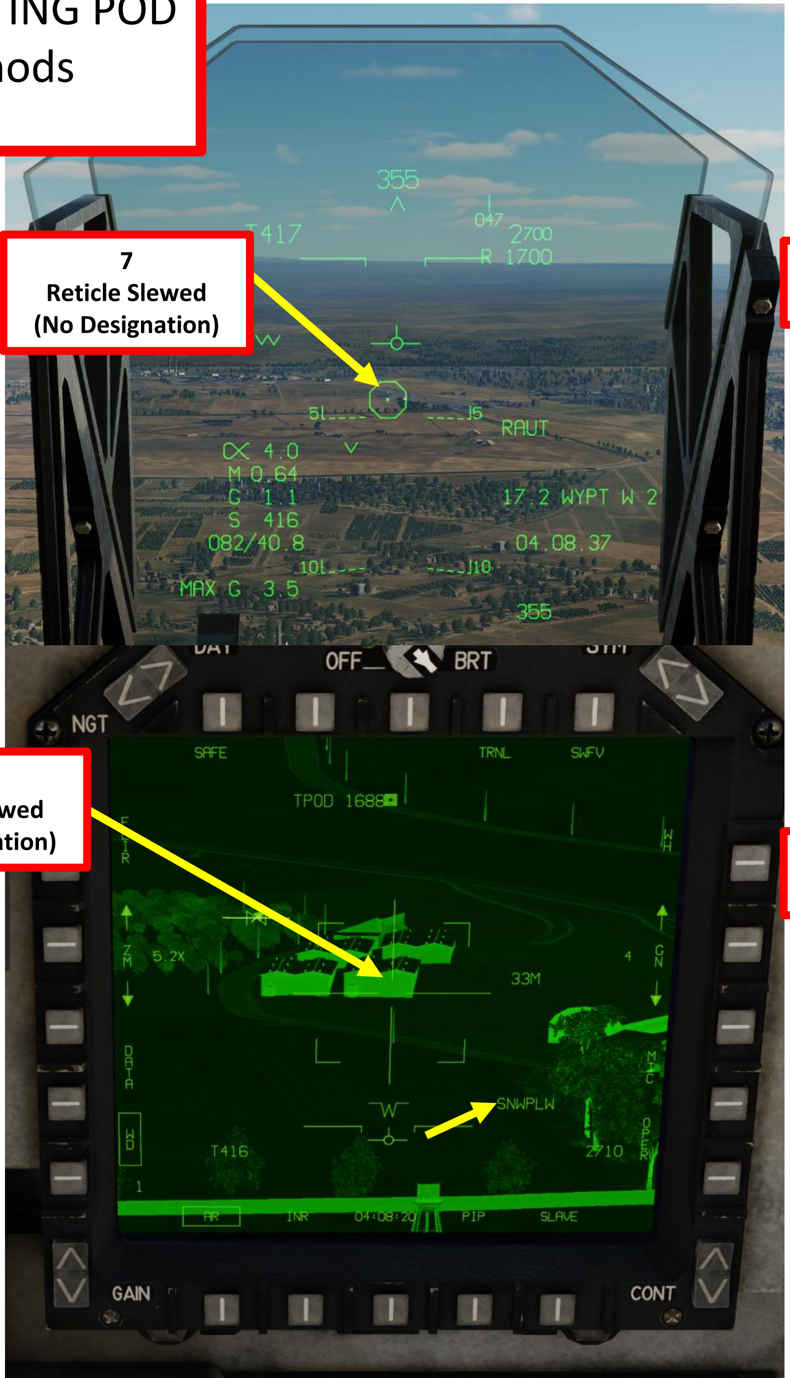
- To enter SNOWPLOW mode and slew the targeting pod:
  1. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
  2. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
  3. Check selected sensor on TPOD page
     a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
     b) TPOD indicates the targeting pod is the selected sensor.
     c) TV indicates the DMT TV is the selected sensor.
  4. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
  5. Confirm that Sensor of Interest switches to TPOD.
  6. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.



4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.3 – SNWPLW (Snowplow)

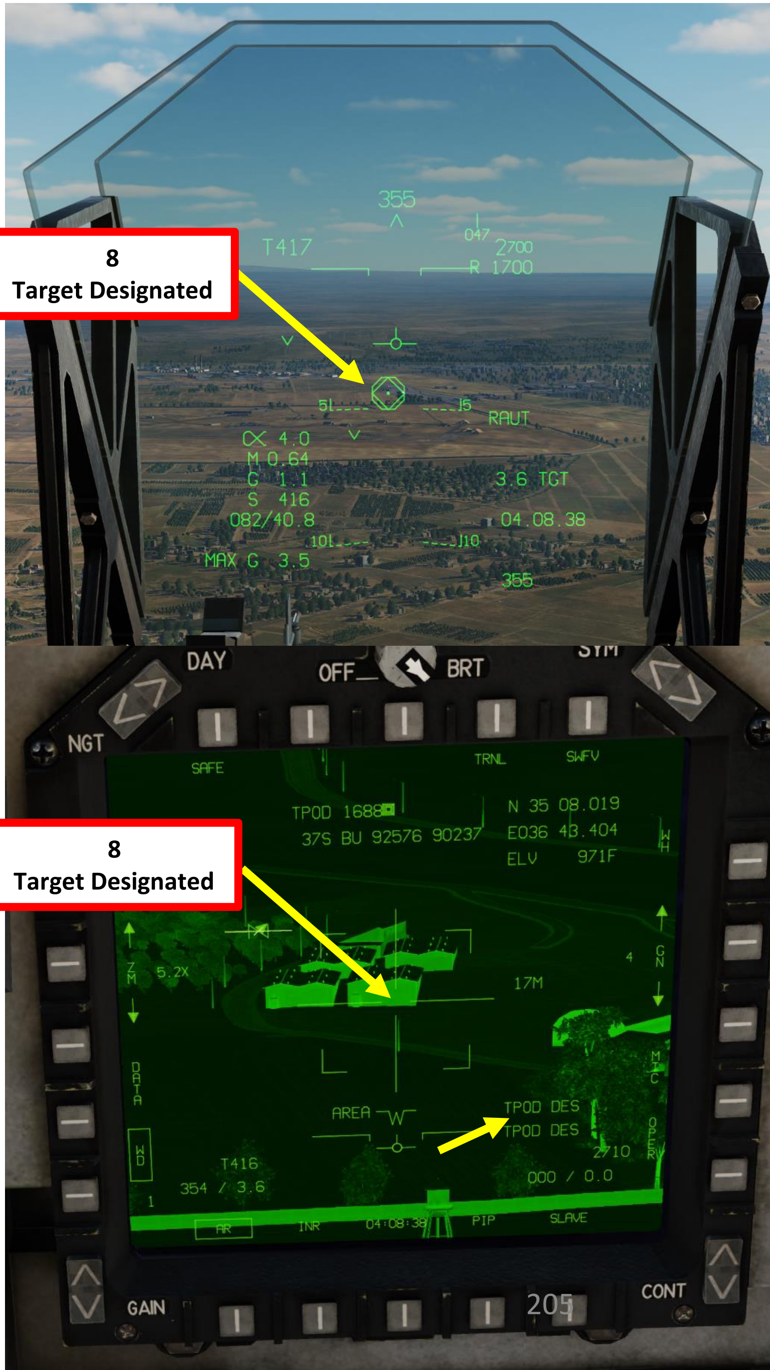
- To enter SNOWPLOW mode and slew the targeting pod:
  7. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
  8. Use TDC Depress (Action) control to designate the target.
     - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).

7
8
TDC (Target Designation Control)



7
Reticle Slewed
(No Designation)

7
Reticle Slewed
(No Designation)



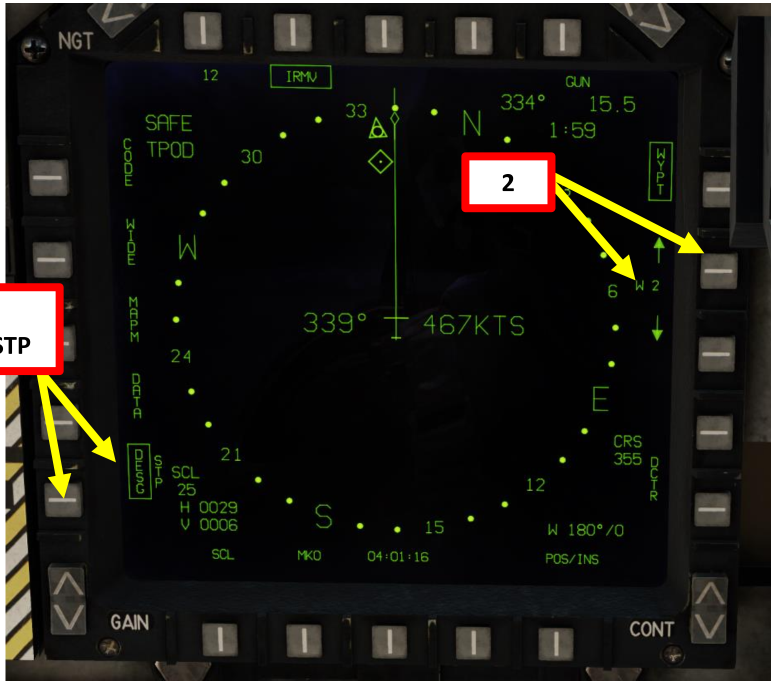
8
Target Designated

8
Target Designated

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.4 – MAP DES (Slave to Map/Waypoint)

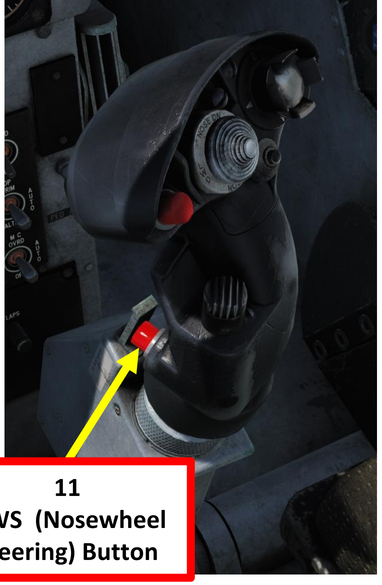
You can slave the targeting pod to an existing waypoint of your navigation database. Here's how:

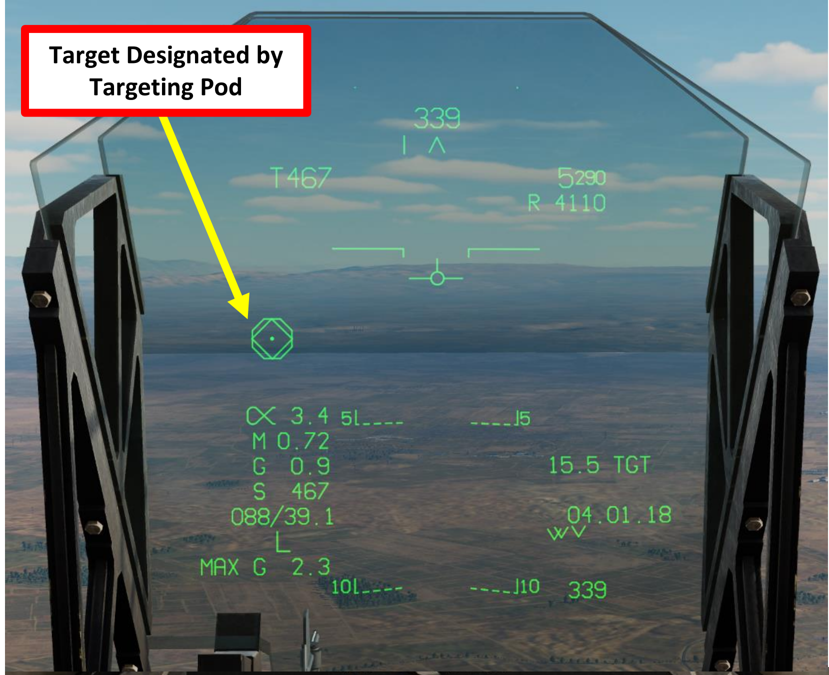
1. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
2. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
3. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
4. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
5. Confirm that Sensor of Interest switches to TPOD.
6. Select desired waypoint through the EHSD (Electronic Horizontal Situation Indicator) page.
7. Select « DESG » option to designate the waypoint/steerpoint.
8. SLAVE (boxed/selected) indication on the TPOD page indicates the targeting pod is slaved to the designated waypoint (MAP DES / SLV DES).

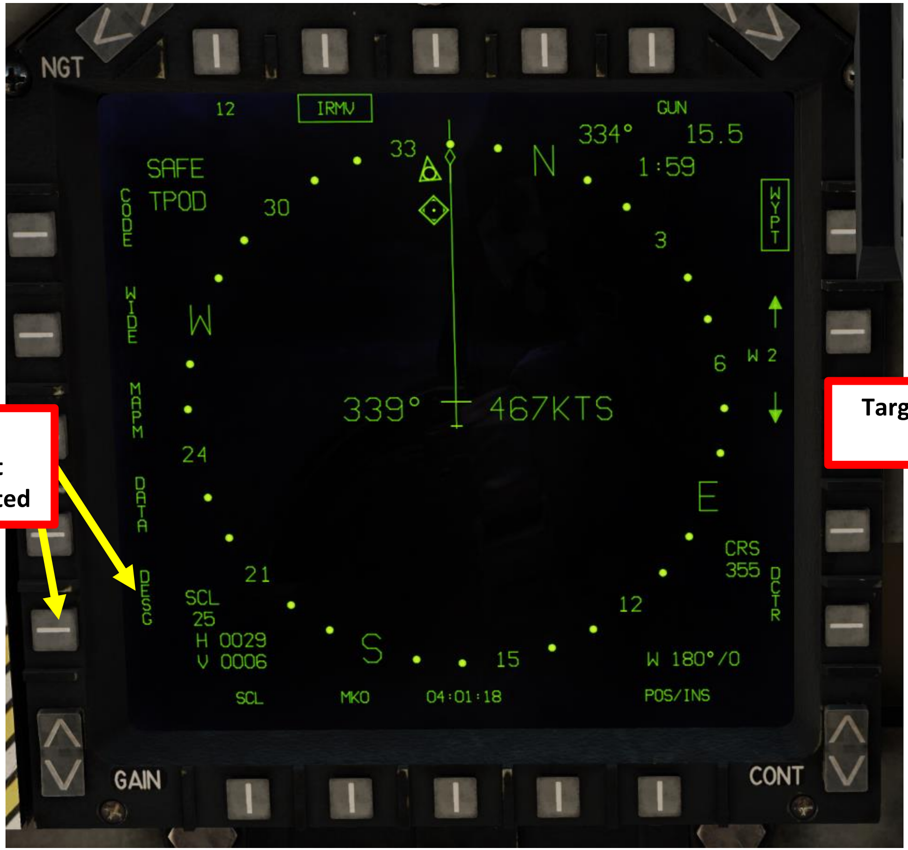


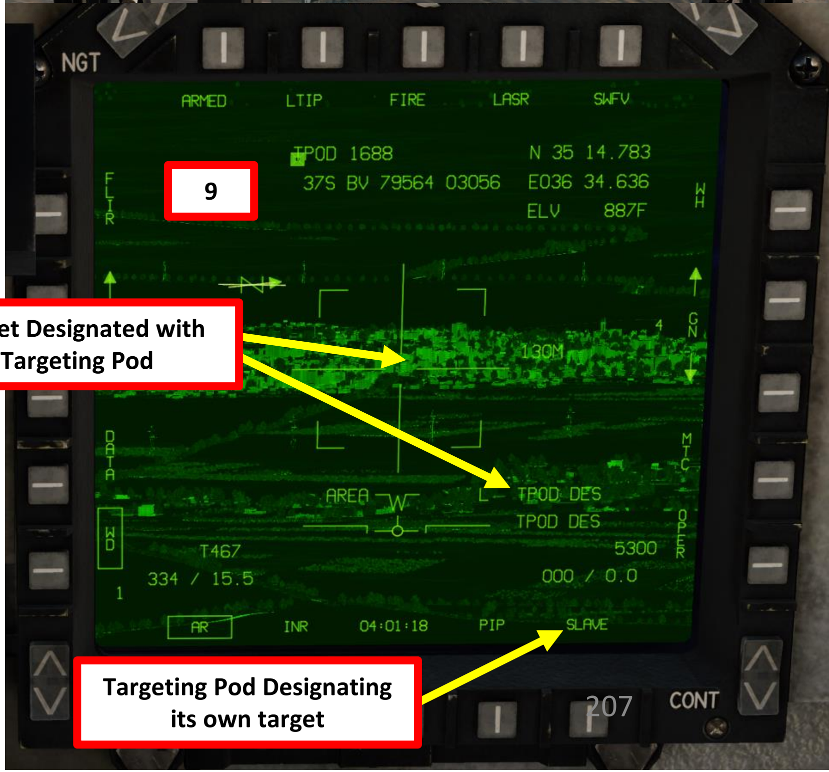
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.4 – MAP DES (Slave to Map/Waypoint)

9. Use TDC Depress (Action) control to designate the target with the targeting pod.
   - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
10. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle over the desired target if adjustments are required.
11. If you want to slave the targeting pod back to the designated waypoint, press the « AG Target Undesignate/NWS/FOV Toggle ». This will revert to MAP DES / SLV DES.
12. To un-designate a target slaved on a waypoint, press on the OSB next to “DESG” on the EHSD page to unbox it.

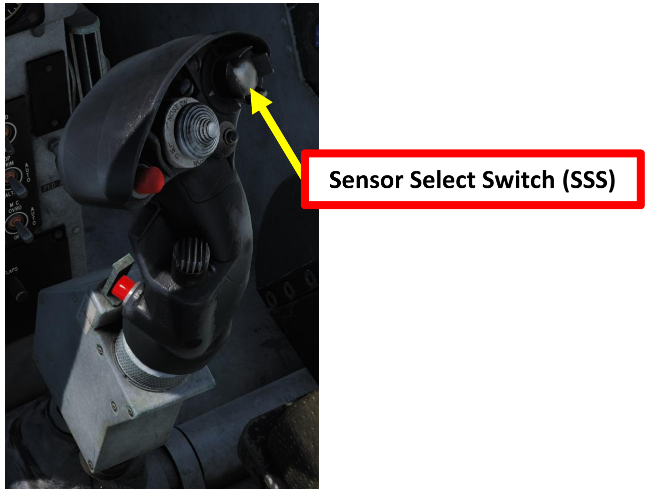








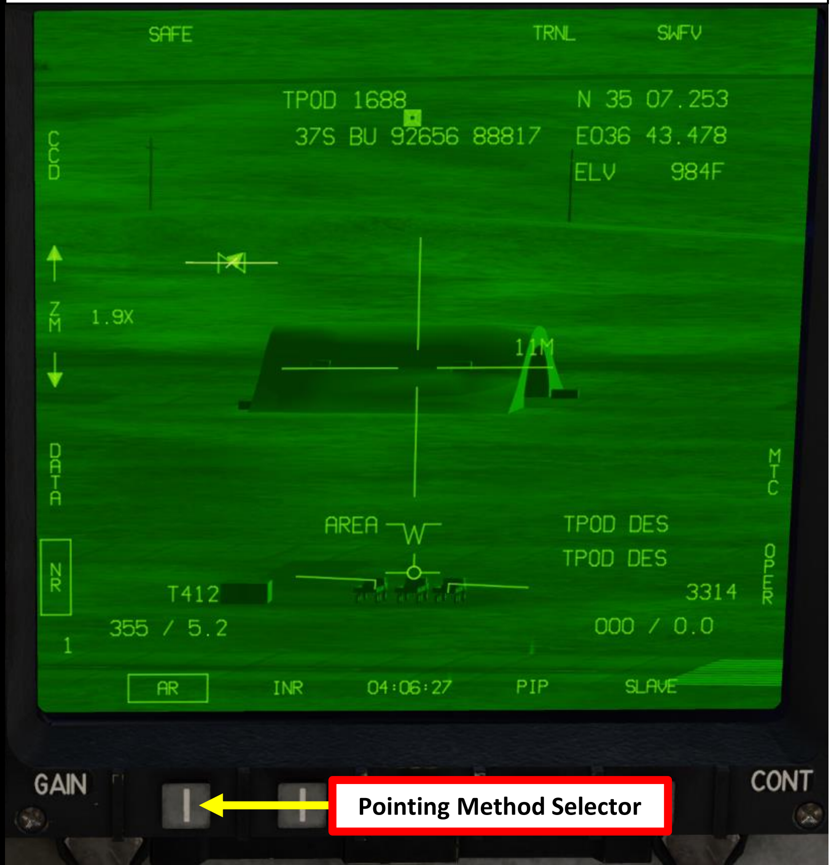
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.5 – Point, Area & Moving Target Track



In order to select pointing method, you have to designate a target first, then you can either use the Sensor Select Switch AFT SHORT or press the Pointing Method Selector OSB to toggle between tracking pointing modes:

- **AR (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.
- **PT (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.
- **MT (Moving Target Track)** is used to keep track of a specific moving point. This is a similar mode to Point Track.

Area Track (AR)

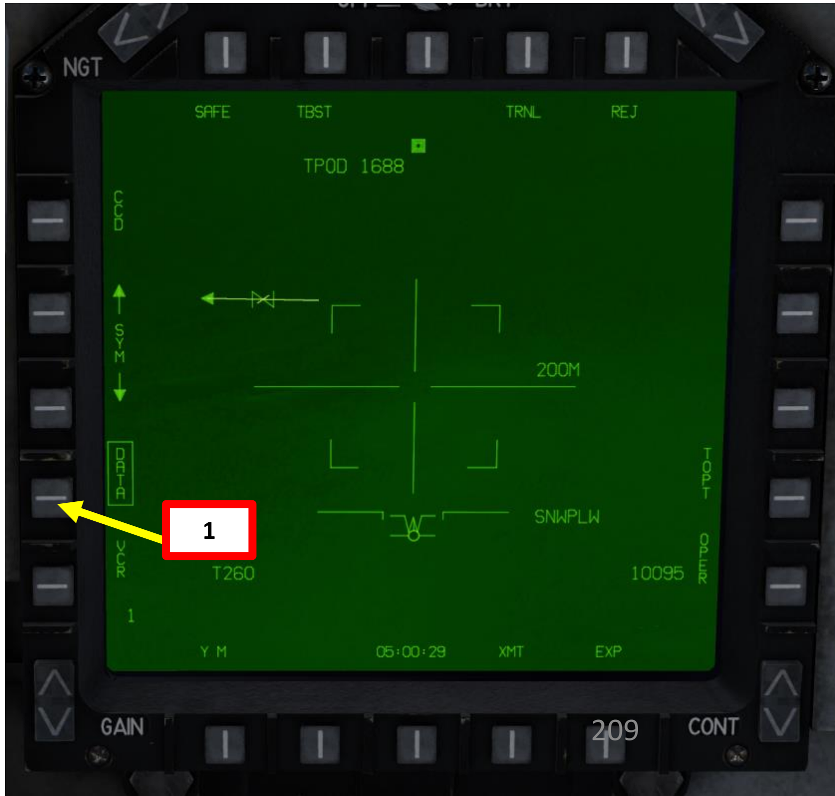


Point Track (PT)

Moving Target Track (MT)

4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.5 – Pointing & Designation Methods
4.5.6 – MTT (Multiple Target Track)

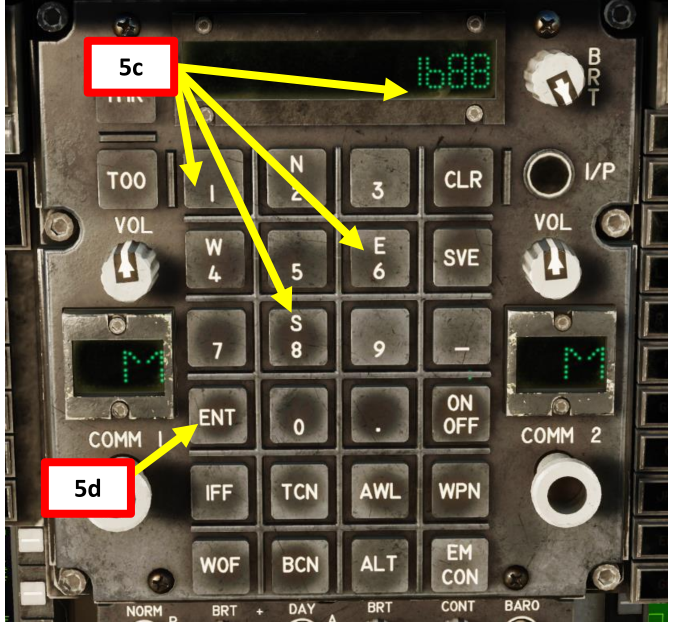
MTT (Multiple Target Track) allows you to track multiple targets at once. This mode is not yet implemented.

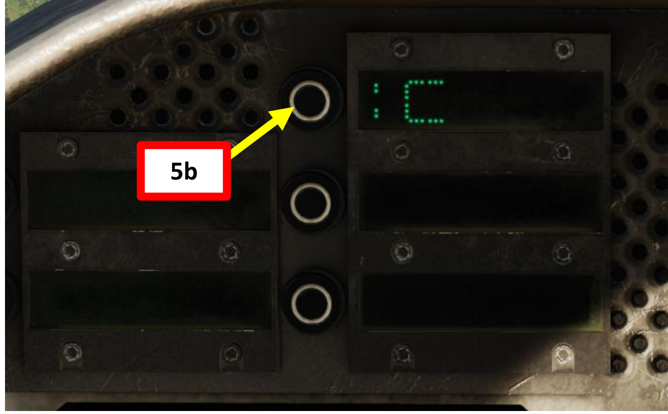


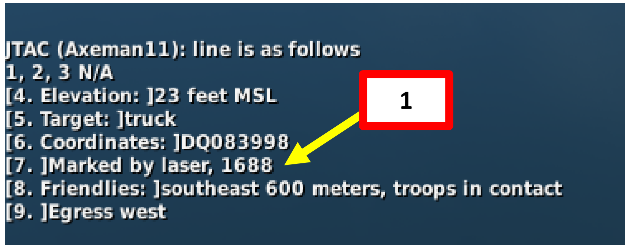
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.6 – Laser Spot Tracker (LST) Mode

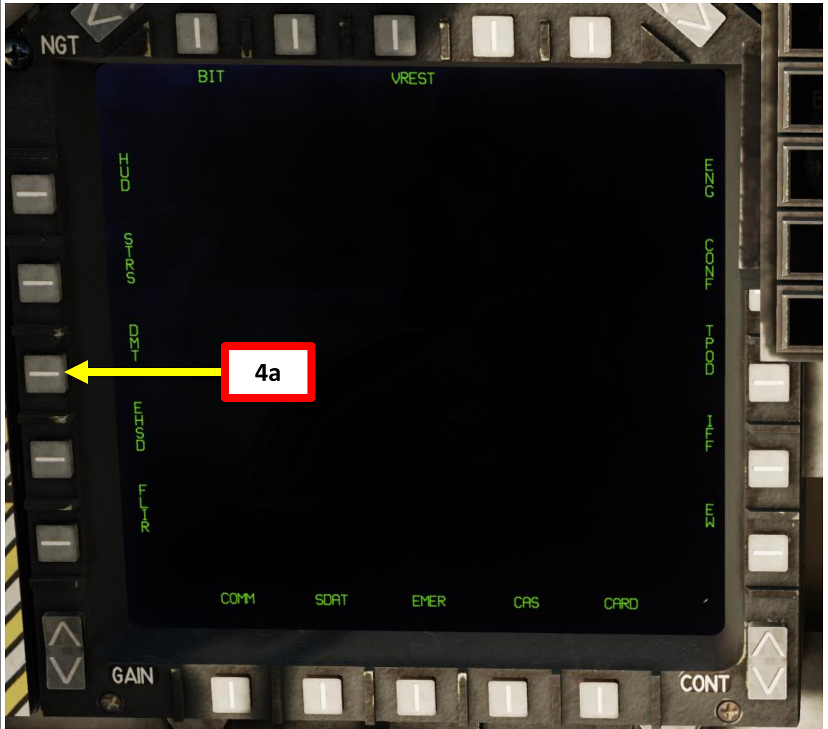
The targeting pod can also spot and track a laser from someone else (a friendly Harrier lasing his own target, or a JTAC, Joint Tactical Air Controller, calling an air strike). To track another laser:

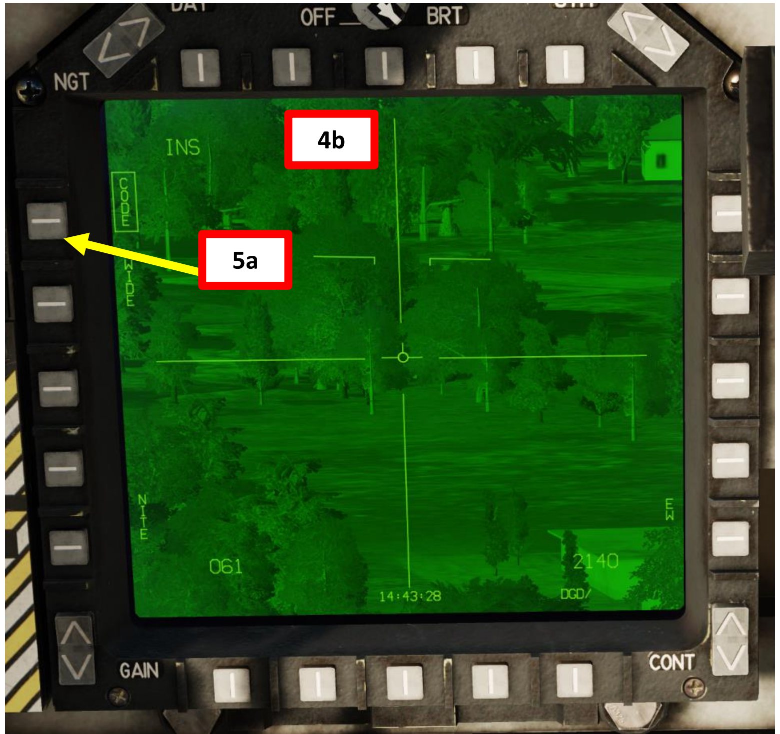
1. Find out what the laser code used by the friendly is (in our case, the friendly JTAC uses code 1688). Make sure the friendly asset is lasing the target before attempting to track it.
2. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
4. From the main MPCD menu, select "DMT" page. DMT feed will appear on your MPCD display. Take note that this can be performed from the "EHSD" page as well.
5. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT.
6. Laser Code will now be visible on the TPOD page.

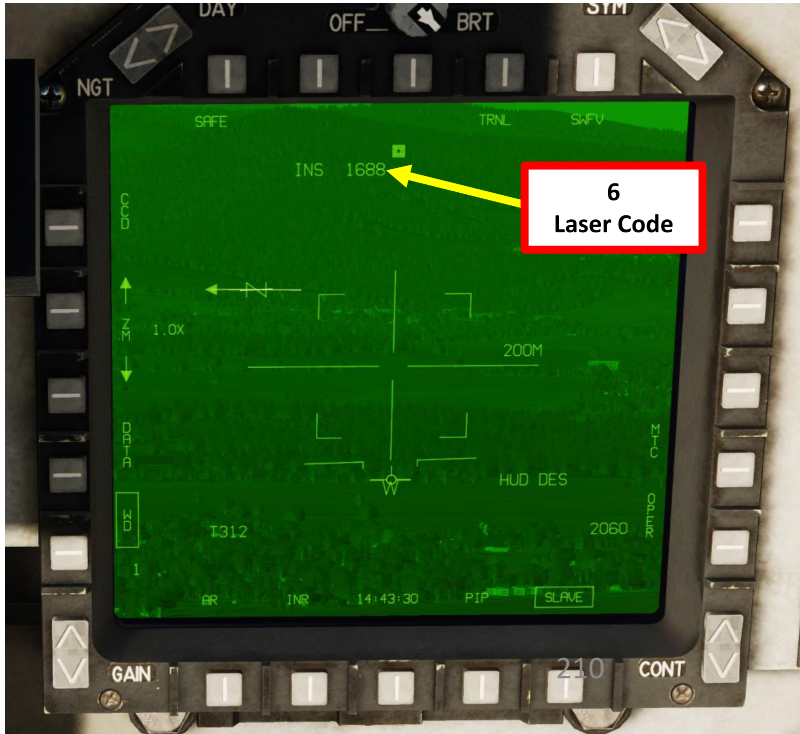






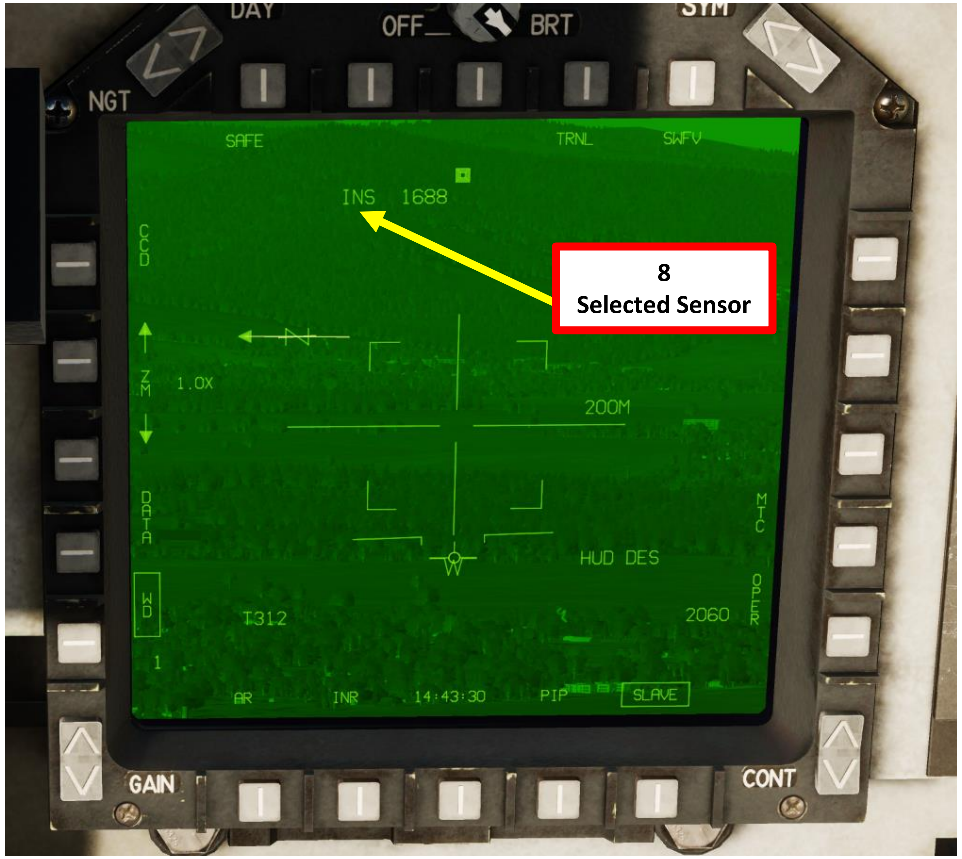


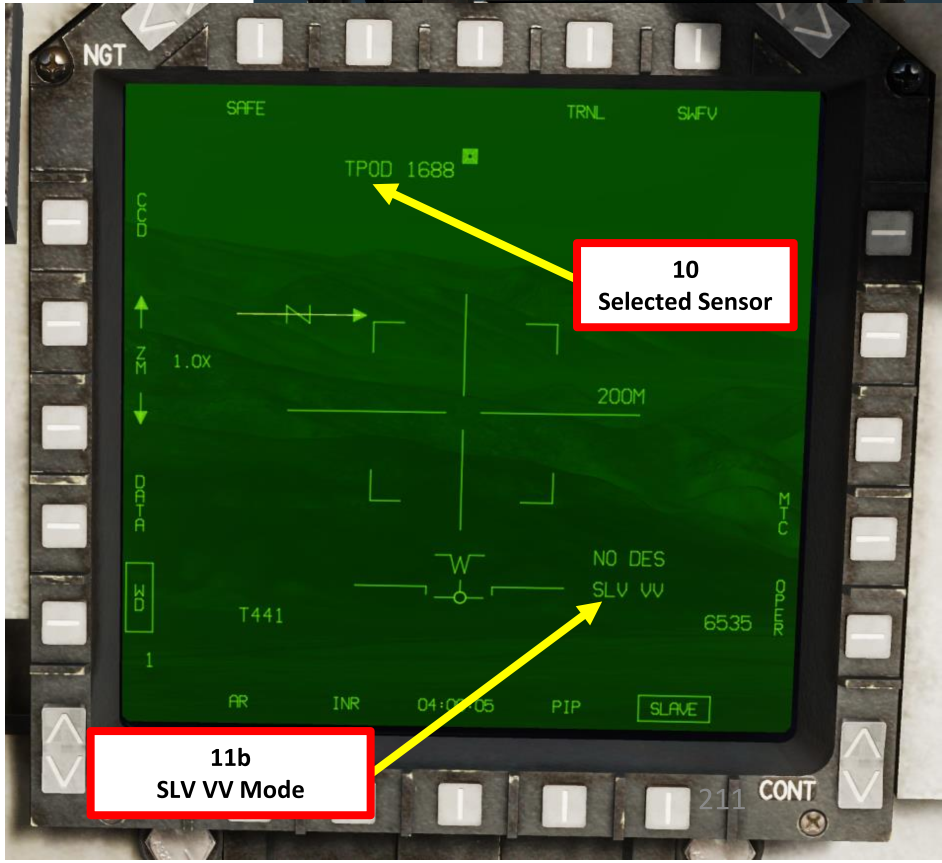




4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.6 – Laser Spot Tracker (LST) Mode

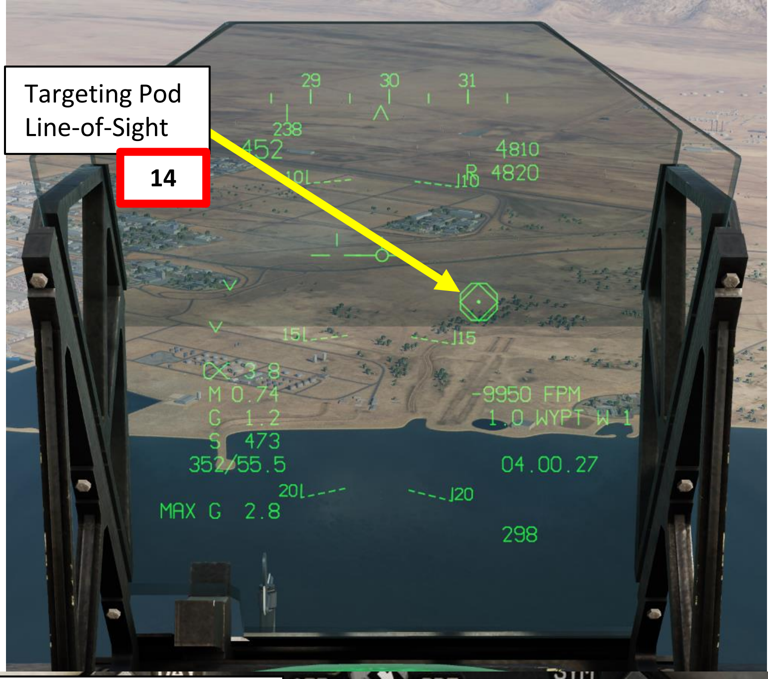
7. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
8. Check selected sensor on TPOD page
   a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
   b) TPOD indicates the targeting pod is the selected sensor.
   c) TV indicates the DMT TV is the selected sensor.
9. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
10. Confirm that Sensor of Interest switches to TPOD.
11. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SLV VV Mode.

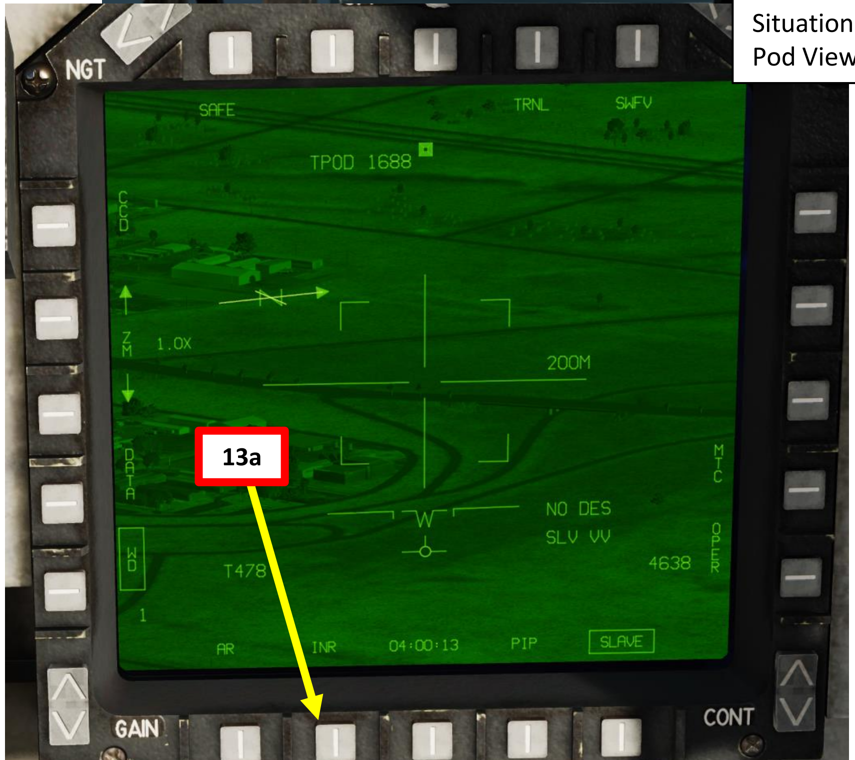


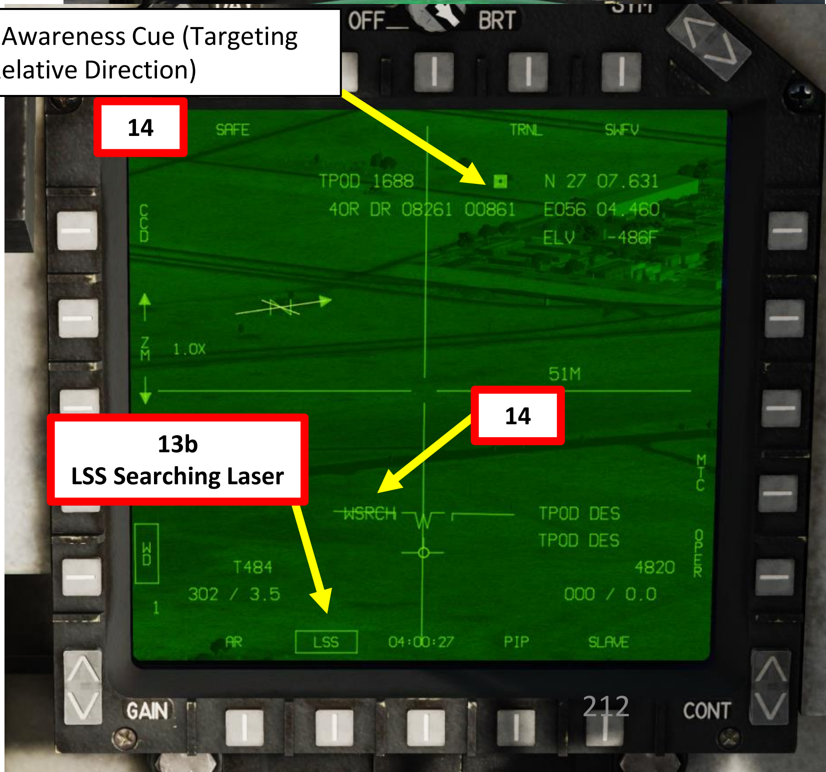


4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.6 – Laser Spot Tracker (LST) Mode

12. Fly the aircraft's flight path marker (velocity vector) near the target area. The targeting pod should be pointing in roughly the same direction as the lased target.
13. Press the OSB next to "INR" for more than 1 sec to enter "LSS" (Laser Spot Search) mode on the TPOD page. Once LSS is selected, the indication will be boxed.
14. While the targeting pod is searching for a laser, LSS and WSRCH (Wide Search) indications are visible. The targeting pod line-of-sight symbol on the HUD and Situational Awareness Cue on the TPOD page will move as the pod scans.

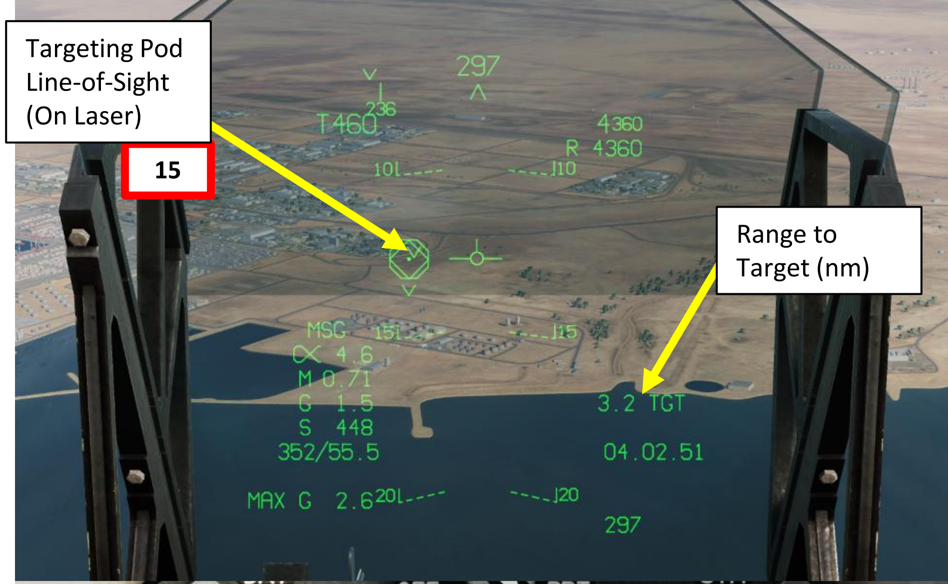


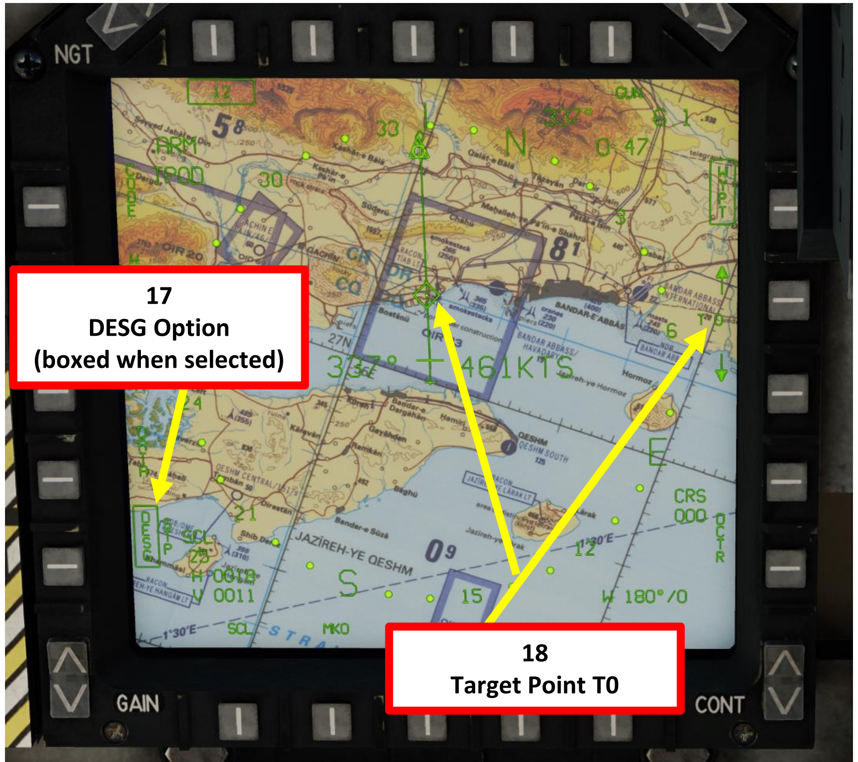


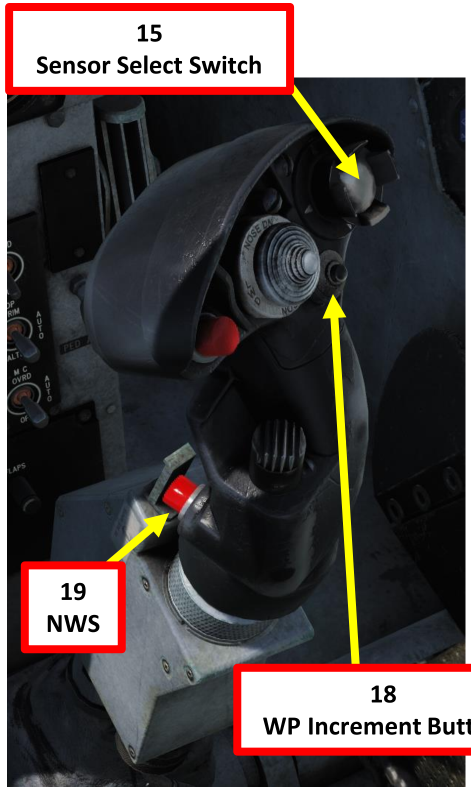


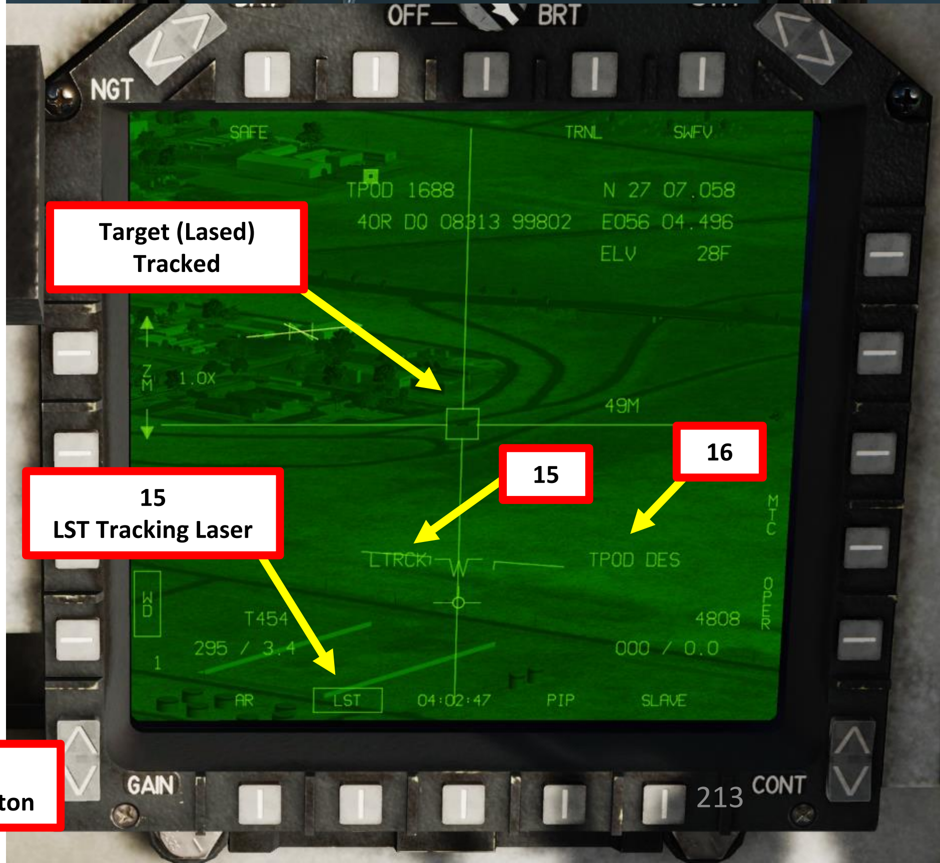
4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.6 – Laser Spot Tracker (LST) Mode

15. Once laser is spotted, targeting pod enters LST (Laser Spot Tracker) mode and tracks the laser designated target. L TRCK indication is visible on the TPOD page. If you want to exit LST mode, press Sensor Select Switch AFT SHORT.
16. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
17. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode. This will be explored later in the Weapons section.
18. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0.
19. To un-designate a target, press the « AG Target Undesignate/NWS/FOV Toggle » button.





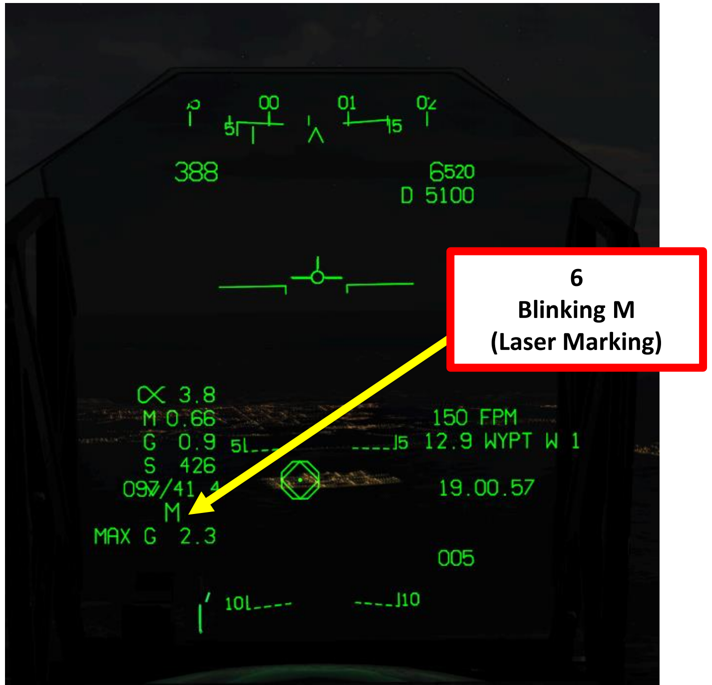


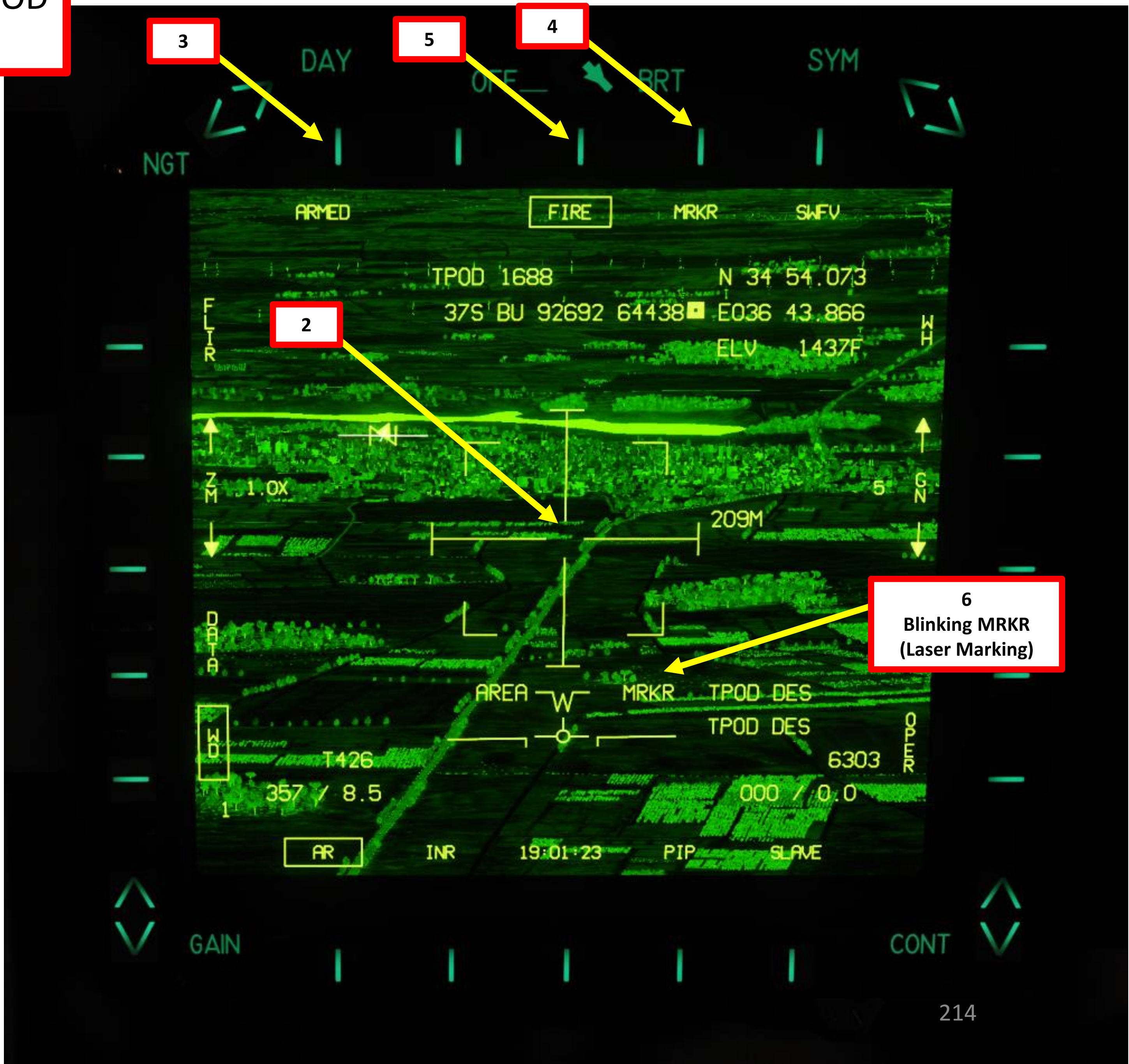


4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.7 – Laser Marker

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 (LSHIFT+N to toggle NVGs). This is used mainly to provide a visual reference to other aircraft on where a target is.

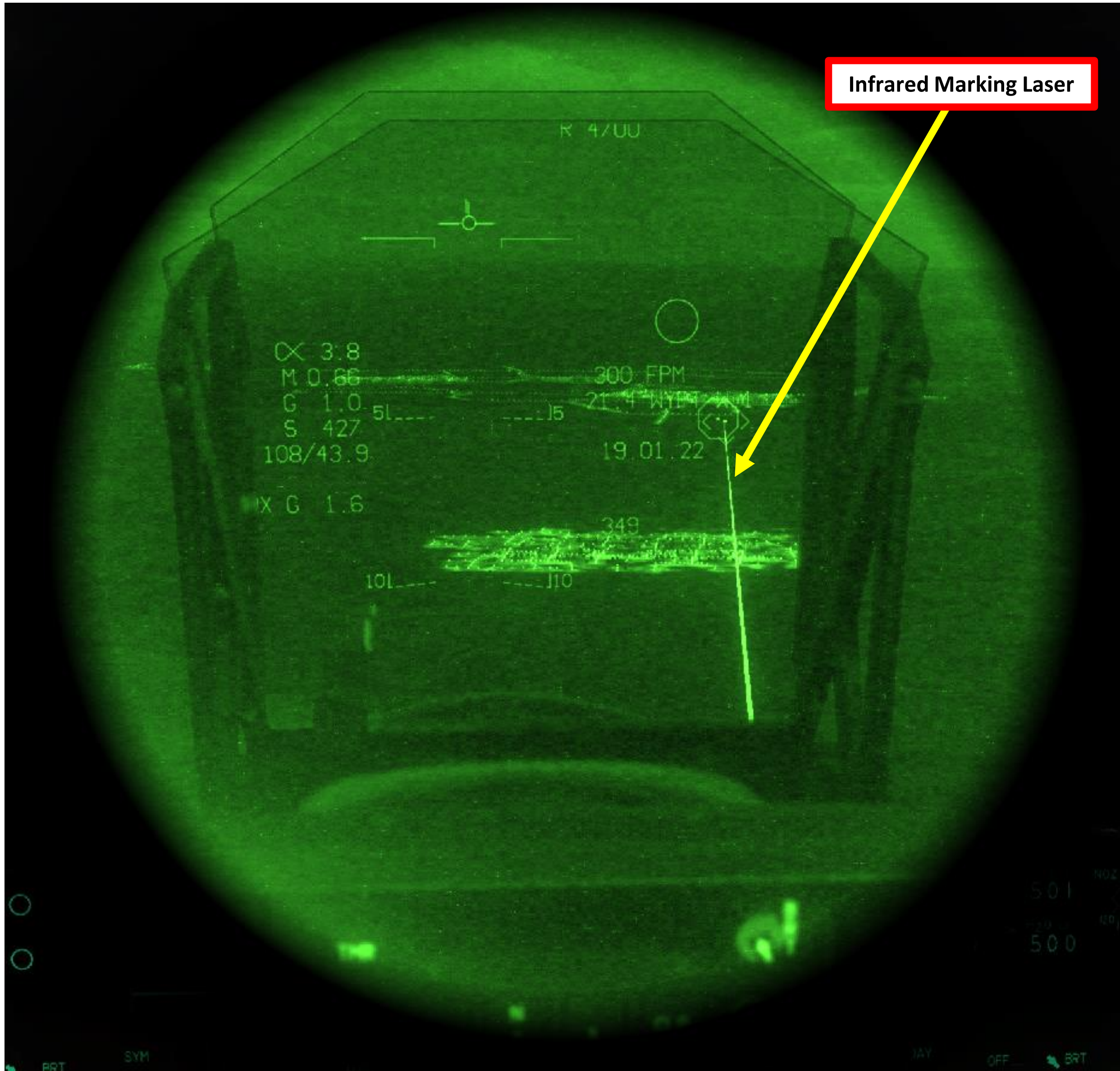
1. Power up the Targeting Pod and set A/G Master Mode as per the previous Power-Up Procedure.
2. Designate a target (enter TPOD HTS mode, slew TDC on target, then press TDC Depressed/Action) with the targeting pod.
3. Press Laser Arming OSB to select ARMED mode.
4. Press Laser Mode OSB to select MRKR (Laser Marker) Mode or D+M (Laser Designator + Marker) Mode.
5. Press FIRE OSB to fire the marking laser.
6. Once laser is firing, "MRKR" indication will blink on the TPOD page and "M" indication will blink on the HUD.





4 – AN/AAQ-28(V) LITENING G4 TARGETING POD
4.7 – Laser Marker

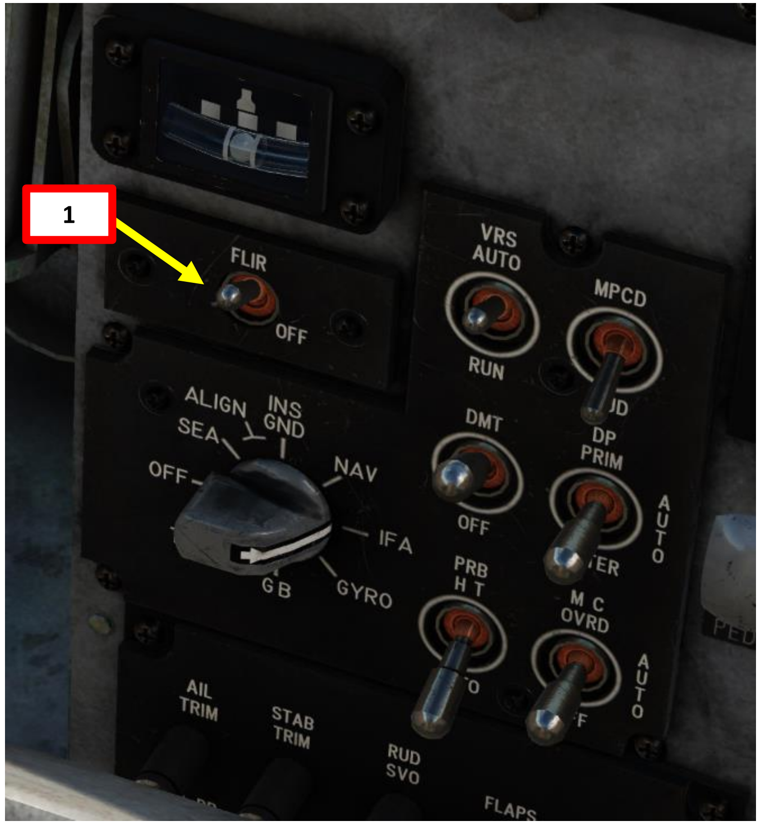
7. An infrared marking laser will be visible with your night vision goggles.
8. To stop firing laser, press on FIRE OSB again.
9. To un-designate target, press the « AG Target Undesignate/NWS/FOV Toggle » button.

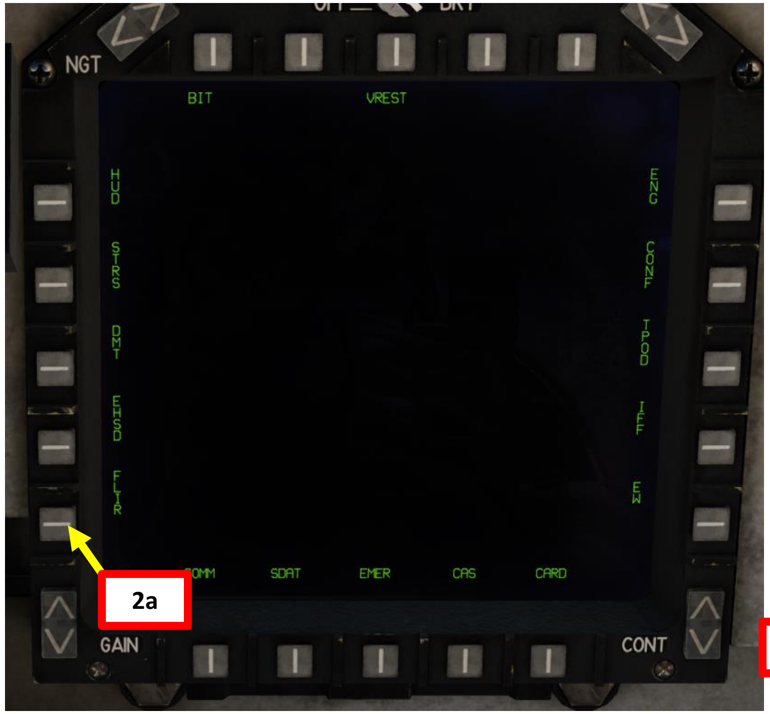


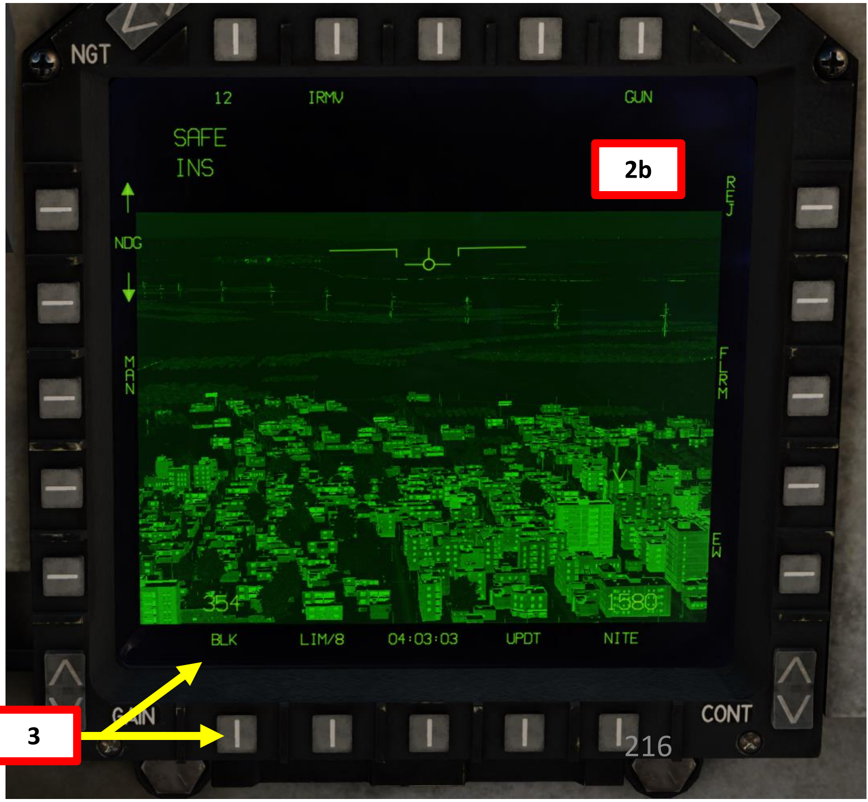
5 – NAVFLIR & Hot Spot Detector
5.1 - NAVFLIR

The NAVFLIR (Navigation Forward-Looking Infrared) Sensor is a GEC-Marconi FLIR camera system mounted in the nose) for night operations. While the ARBS/DMT TV is useful in day conditions with good visibility, night operations require a sensor that is better suited to use infrared imagery. Take note that NAVFLIR is mainly used as a reconnaissance sensor; it has no designation capability available for weapons.

1. NAVFLIR is powered by the FLIR switch (UP). The FLIR requires a cooldown time of approx. 5 minutes: NOT RDY legend on either MPCD will be shown as long as cooldown process is not complete.
2. You can consult the FLIR page on either MPCD by going in the main menu and pressing the OSB next to FLIR.
3. You can toggle BLACK/WHITE (BLK) modes using the BLK option.



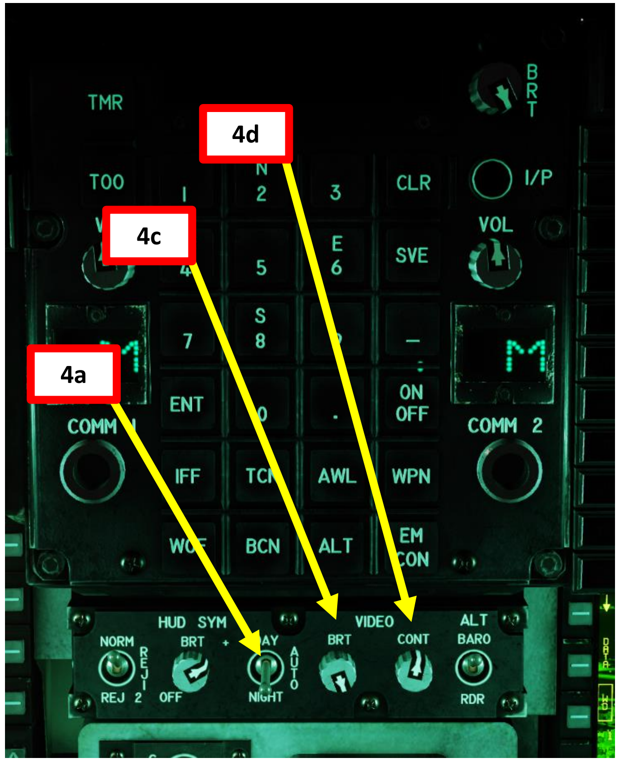




5 – NAVFLIR & Hot Spot Detector
5.1 - NAVFLIR

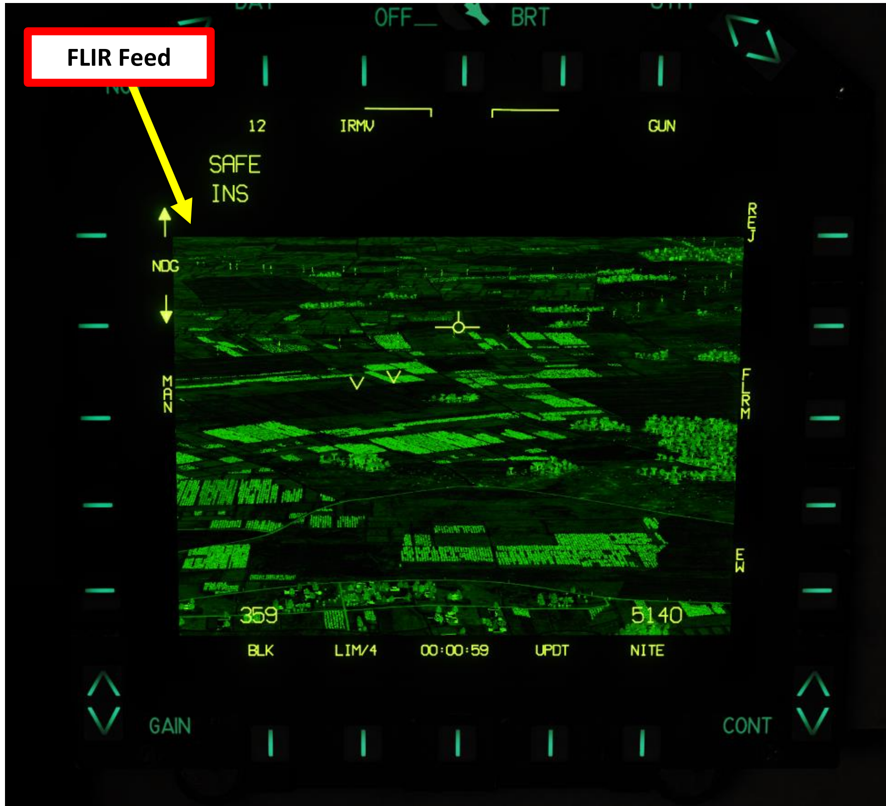
4. During night operations, you can overlay the FLIR feed on your Heads-Up Display directly.
   a) Set HUD Mode switch to NIGHT (down position)
   b) Press the « Sensor Select » switch DOWN (HUD Scene Reject) for more than 0.8 sec (LONG)
   c) Adjust Video Brightness – As Required
   d) Adjust Video Contrast – As Required
   e) FLIR overlay should now be visible on the Heads-Up Display.

Sensor Select Switch **4b**
AFT = DMT: LST/TV
FWD = INS: IRMV/EOMV
LEFT = MAP Center/Decenter
RIGHT = FLIR/HUD-BH/WH
DOWN (PUSHED) = HUD Scene Reject/TPOD



4e
FLIR Feed Overlay

FLIR Feed

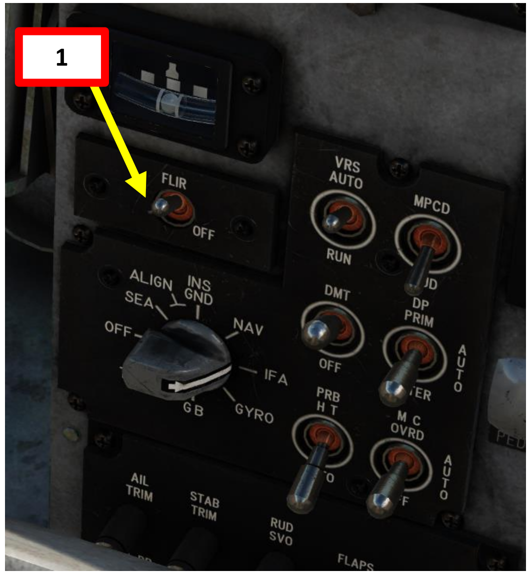


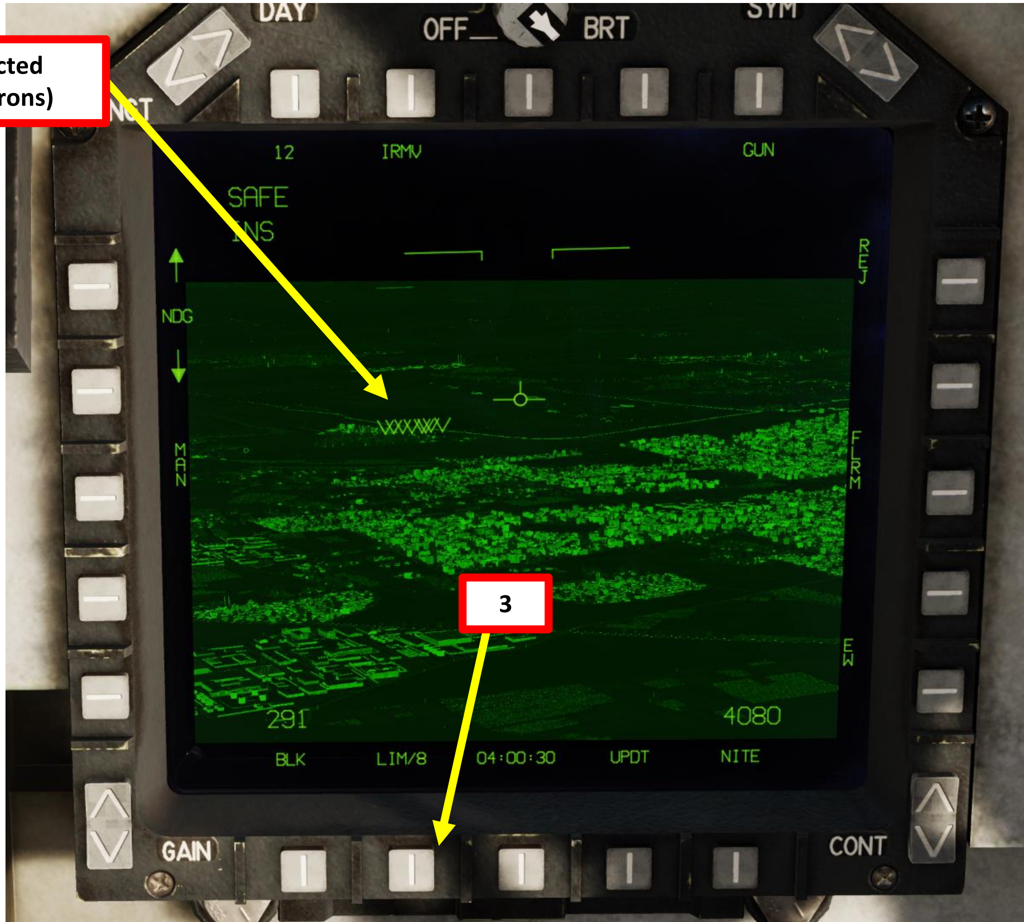
5 – NAVFLIR & Hot Spot Detector
5.1 - NAVFLIR

5 – NAVFLIR & Hot Spot Detector
5.2 – Hot Spot Detector

Another interesting function of the Harrier related to NAVFLIR is the Hot Spot Detector. It detects heat signatures (like vehicles) and shows them on the Heads-Up Display and FLIR page, represented by chevrons.

1. Make sure the FLIR Power Switch is ON (UP)
2. Hot Spot signatures are displayed on the FLIR page and on the HUD as chevrons.
3. You can customize the number of displayed Hot Spots with the LIM (Limit) setting on the FLIR page. Press OSB next to LIM to cycle between limits of 0, 4 and 8 hot spots.
4. Keep in mind that there are many « false positive » hot spots detected, which blink and disappear erratically. Use your own judgement to see if hot spots are valid heat signatures or ground clutter. The Hot Spot Detector is an imperfect system.

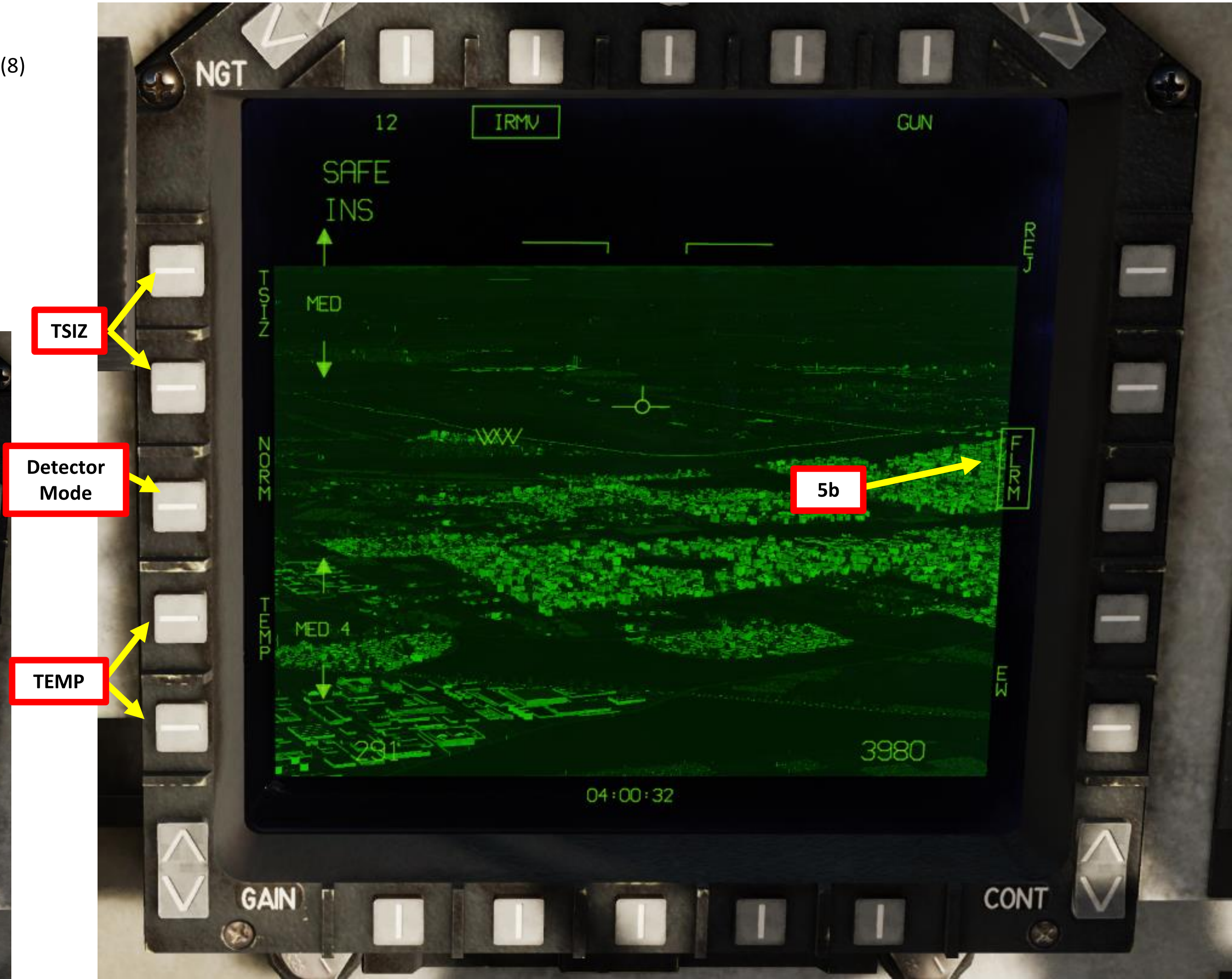




5 – NAVFLIR & Hot Spot Detector
5.2 – Hot Spot Detector

5. FLRM menu, when selected (boxed), customizes the Hot Spot detector settings:
    - TSIZ (Target Size): Large, Medium & Small
    - Hot Spot Detector Mode: Normal, Expanded, & Full
    - TEMP (Hot Spot Temperature): Low (1), Medium (4) or High (8)

- Note: These settings are not currently simulated in DCS.



6 – AGM-65F Maverick
6.1 – Display

There is no IRMV (Infrared-Maverick) display page directly accessible from the Main MPCD menu. To access the IRMV display:

1. Select Air-to-Ground Master Mode
2. From STRS (Stores) page, select IRMV
3. Press the Weapon Cage/Uncage Switch
4. The Maverick Feed page will appear on the left MPCD Display

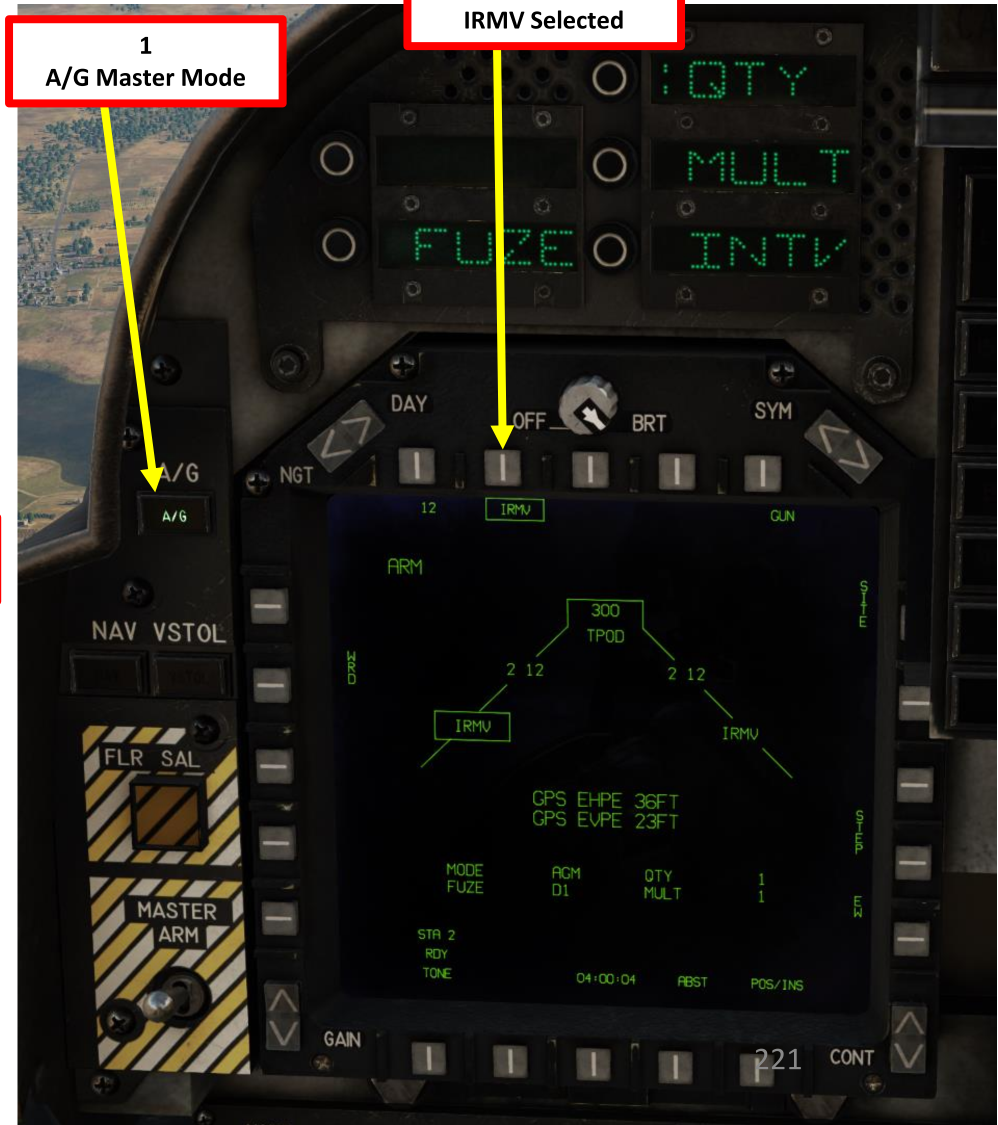
Sensor Select Switch (SSS)

4
Maverick Feed

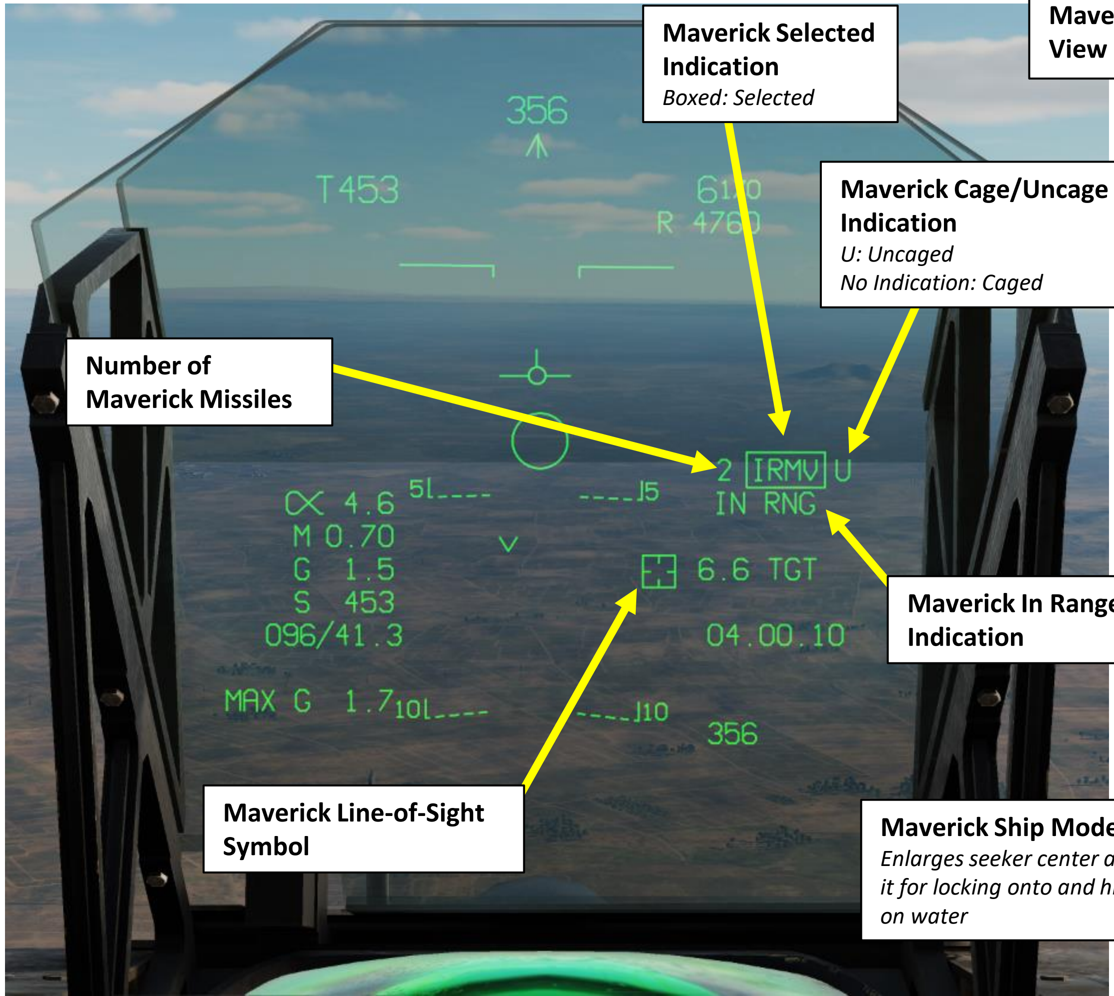
3
Weapon Cage/Uncage Switch

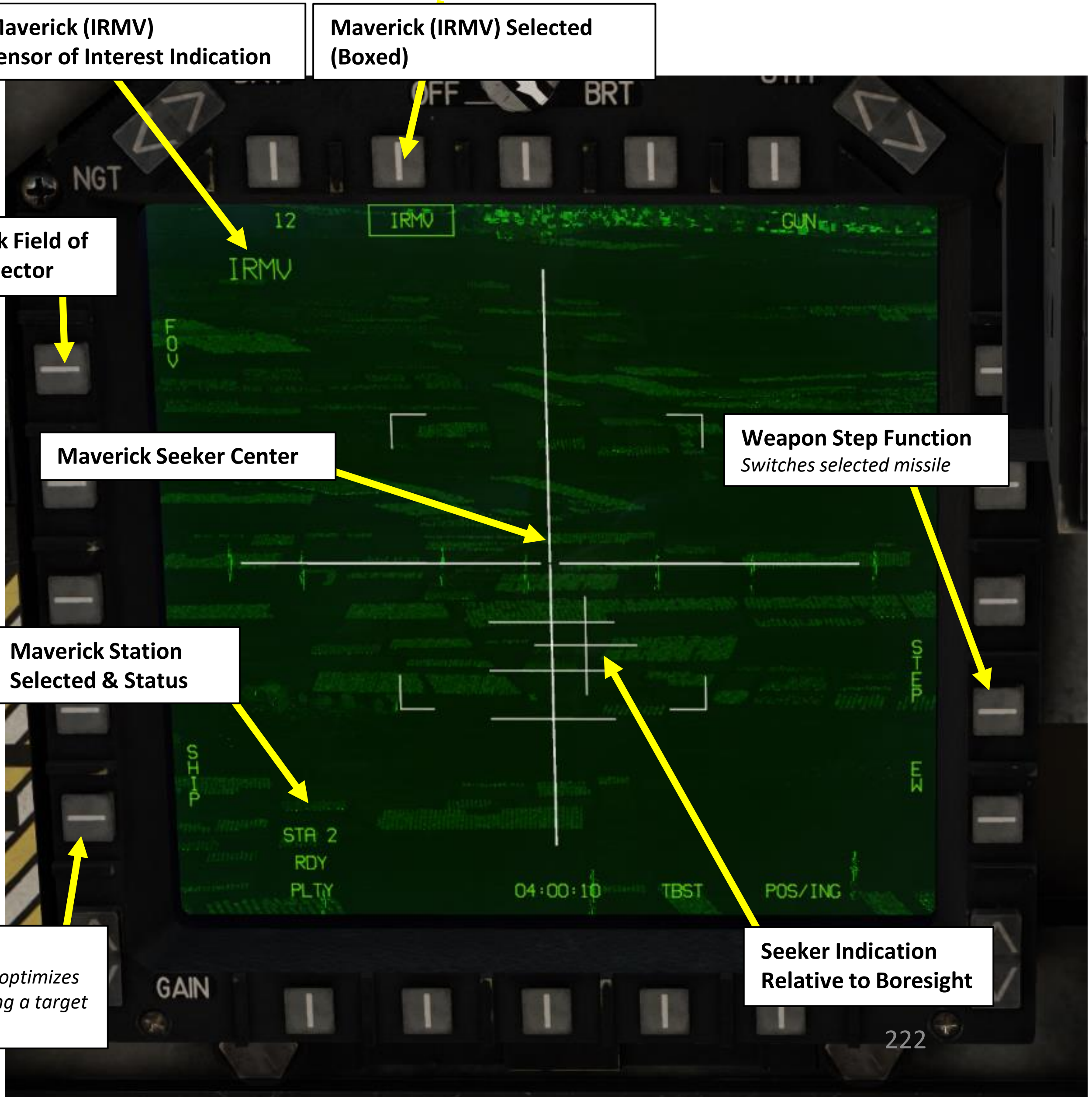
1
A/G Master Mode

2
IRMV Selected



6 – AGM-65F Maverick
6.1 – Display





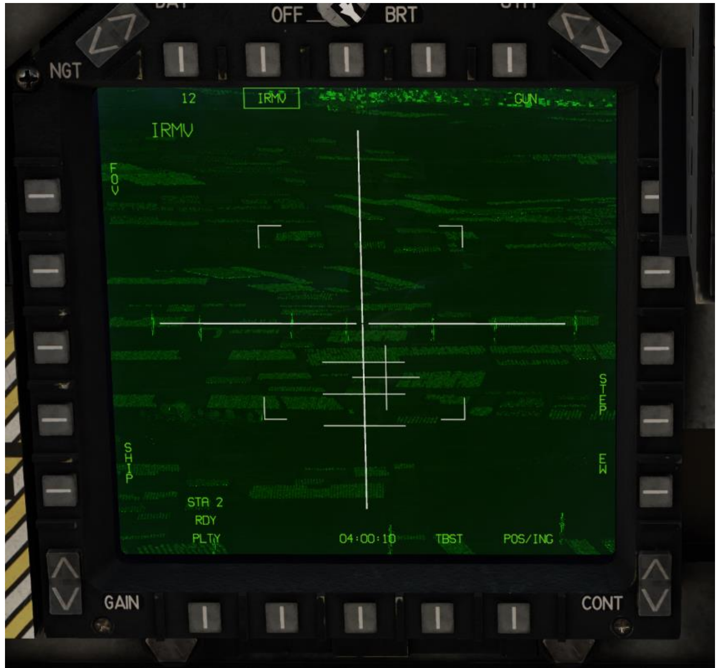
6 – AGM-65F Maverick
6.2 – Controls

To operate the IR-Seeker Maverick:

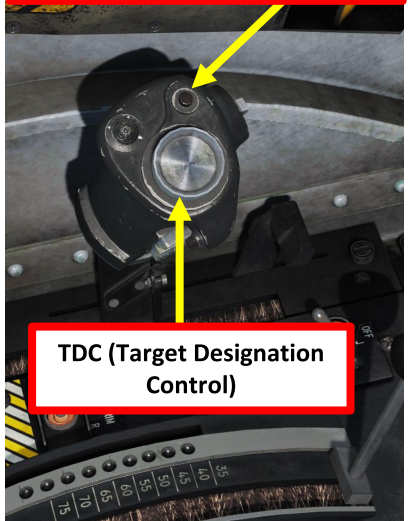
- You need to first allow it to cooldown (will be shown in Weapons Section) by selecting it in the STRS (Stores) page, setting Master Arm On and pressing the A/G Master Mode.
- Then, you can view the Maverick seeker head feed by using the Weapon Cage/Uncage Button.
- Use the Sensor Control Switch to set the Maverick (IRMV) as the Sensor of Interest.
    - If TPOD (Targeting Pod) is the selected sensor, double-press Sensor Select Switch DOWN to switch from TPOD to INS, then press Sensor Select Switch FWD to select IRMV.
    - If INS or TV (DMT) is the selected sensor, press Sensor Select Switch FWD to select IRMV.
- Use TDC Controls (Left/Right/Fwd/Aft) to slew the Maverick reticle over the desired target.
- Use TDC Depress (Action) control to attempt a missile lock the target (IR contrast).
- When IRMV is the sensor of interest:
    - If no lock is already acquired, pressing the « AG Target Undesignate/NWS/FOV Toggle » button toggles the missile FOV (Field-of-View).
    - If a lock is already acquired, pressing the « AG Target Undesignate/NWS/FOV Toggle » button unlocks target and boresights the missile on the flight path marker.

Sensor Select Switch (SSS)

NWS Button



Weapon Cage/Uncage Switch



TDC (Target Designation Control)

SECTION STRUCTURE

1 – INTRODUCTION
1.1 – Introduction to Weapons

BOMBS			
WEAPON	TYPE	WEAPON	TYPE
MK-82 LD	500 lbs unguided low-drag bomb	GBU-12	500 lbs laser guided bomb
MK-82SE (Snake Eye)	500 lbs unguided low-drag retarded bomb	GBU-16	1,000 lbs laser guided bomb
MK-82 AIR	500 lbs unguided low-drag ballute equipped bomb	BDU-33	25 lbs unguided training bomb
MK-20 Rockeye	Unguided cluster bomb	GBU-38 JDAM	Global Positioning System (GPS)-guided Joint Direct Attack Munition (JDAM) bombs
		GBU-54 LJDAM	A hybrid of a GBU-38 JDAM and a GBU-12 laser-guided bomb is the GBU-54/A LJDAM (Laser Joint Directed Attack Munition).

1 – INTRODUCTION
1.1 – Introduction to Weapons

MISSILES

WEAPON	TYPE
AIM-9M Sidewinder	Infrared guided air-to-air missile
AGM-65F Maverick (IRMV)	Air-to-Ground missile guided by infrared imaging system (IRMV) and used at night and during bad weather.
AGM-65E Maverick (LMAV)	Air-to-Ground missile guided by laser designator guidance system (LMAV) optimized for fortified installations and heavier penetrating blast-fragmentation warhead. As currently simulated, the AGM-65E can **only home on lasers from other designators** (i.e. a wingman equipped with a targeting pod or a JTAC squad on the ground). This means that **your LMAVs cannot track a laser designation from your own targeting pod**. The AGM-65E requires 30 seconds for the gyros to spool up before being able to uncage the missile and use it.
AGM-65E2 Maverick (LMV2)	Air-to-Ground missile guided by laser designator guidance system (LMV2) optimized for fortified installations and heavier penetrating blast-fragmentation warhead. As currently simulated, the AGM-65E2 can **home on lasers from other designators** (i.e. a wingman equipped with a targeting pod or a JTAC squad on the ground), but they **can also track a laser designation from your own targeting pod**. This version is used by the USMC. The AGM-65E requires 90 seconds for the gyros to spool up before being able to uncage the missile and use it.
AGM-65L Maverick (LMV2)	USAF version of the AGM-65E2.
AGM-122 Sidearm	Air-to-Surface Anti-Radiation Missile.

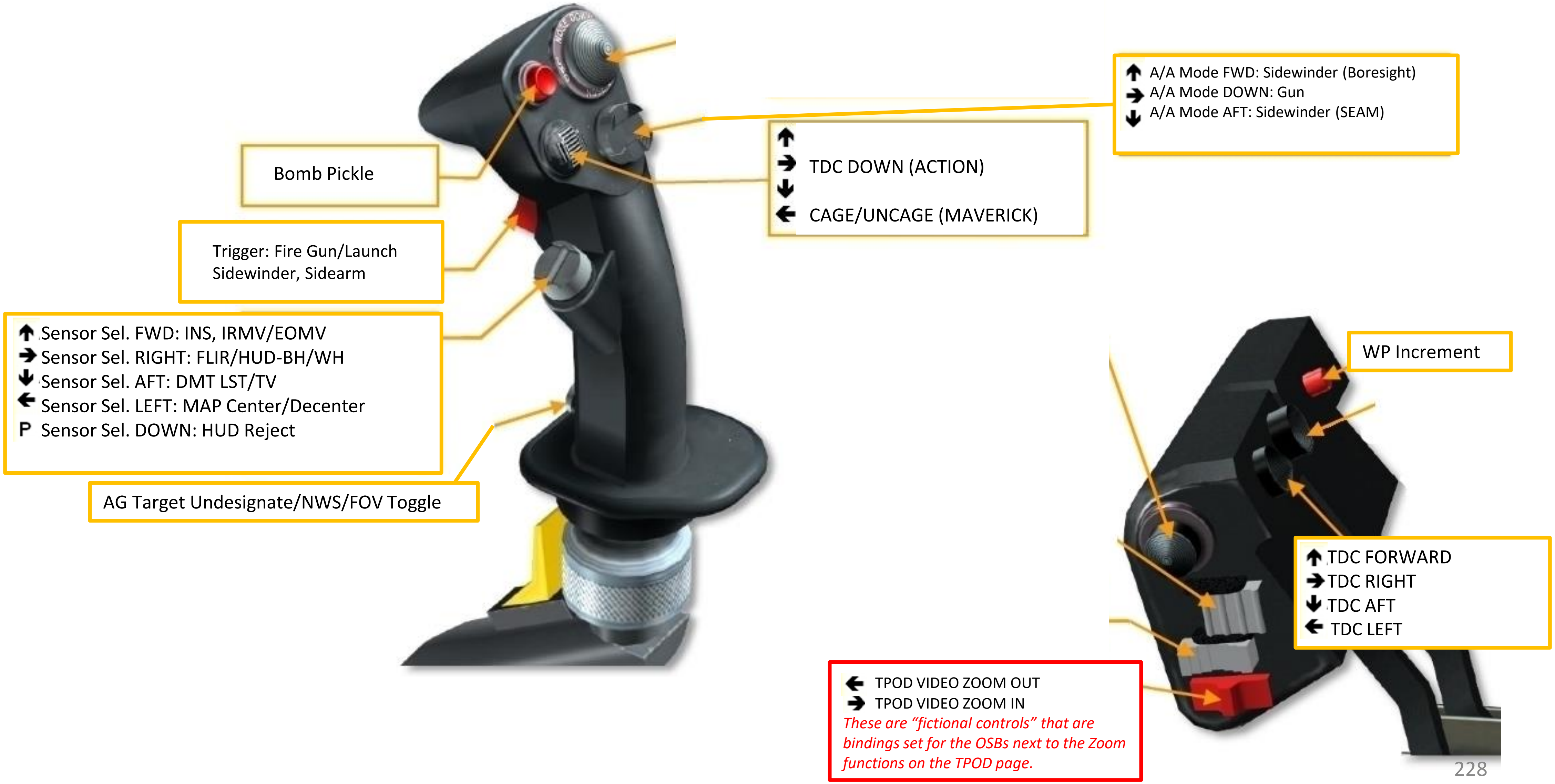
ROCKETS

WEAPON	TYPE
ZUNI MK-71	130 mm (5 inches) unguided rockets
FFAR	Folding-Fin Aerial Rocket, used as anti-bomber rockets
2.75 in	2.75 inches rocket, used for general purpose
APKWS	APKWS (Advanced Precision Kill Weapon System) combines a standard 2.75-inch high explosive rocket with a laser guidance kit and control fins.

GUN POD

WEAPON	TYPE
GAU-12	Five-barrel 25 mm Gatling-type rotary cannon (300 rounds)

1 – INTRODUCTION
1.2 - My Weapons Control Setup

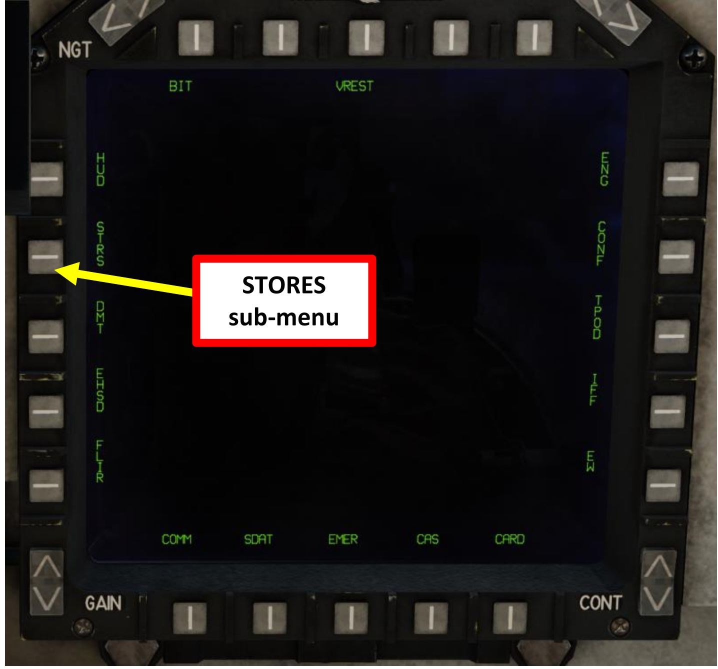


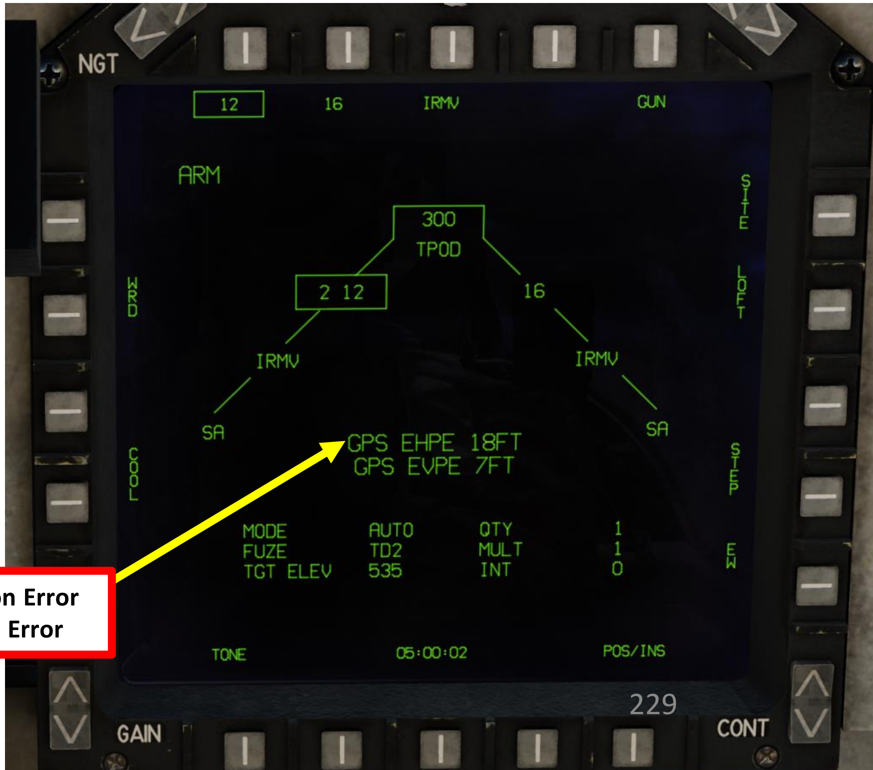
1 – INTRODUCTION
1.3 - SMS Page (Stores Management System)

The SMS (Stores Management System) page can be accessed by clicking on the MENU OSB , then selecting the STORES sub-menu.

This page acts like the A-10C's DSMS (Data & 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. The number next to the station indicates the number of weapons loaded on the rack or station. The gun rounds remaining is indicated at the top of the wingform (300 being a full load and XXX when empty). The Targeting Pod is indicated by TPOD. The GPS positional error is also listed, which affects GBU-38 JDAM precision.

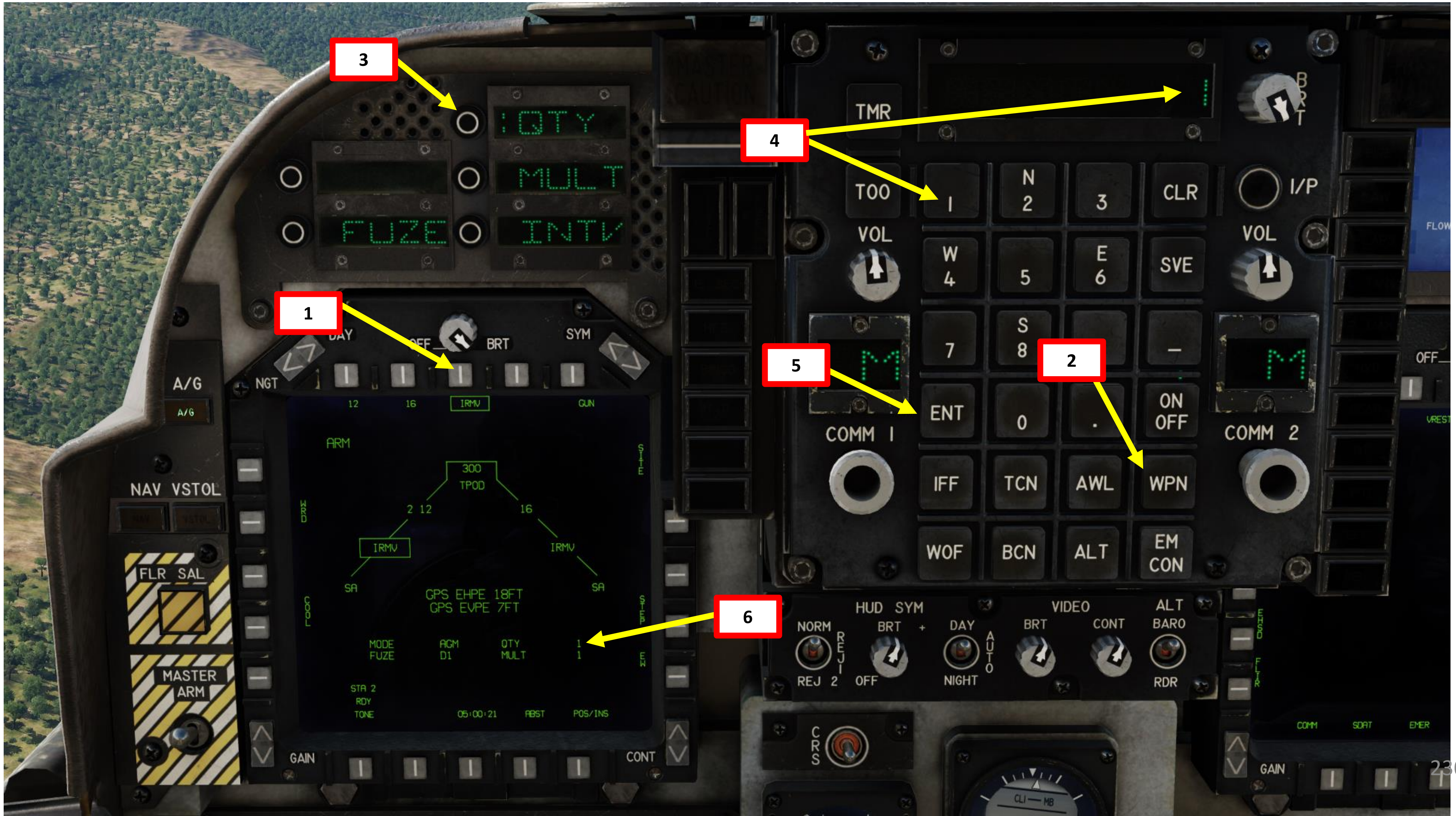




GPS EHPE: Estimated GPS Horizontal Position Error
GPS EVPE: Estimated GPS Vertical Position Error

1 – INTRODUCTION
1.4 - WPN UFC (Weapon Up-Front Control)

When a weapon is selected from the STORES page, you can press the « WPN » button the UFC (Up-Front Control) to display weapon parameters. Using the ODU Buttons (« : » means selected) and the UFC Scratchpad, you can set parameters like quantity, fuze, interval, etc. and enter them by pressing the « ENT » button.



1 – INTRODUCTION
1.5 - ASCMI (Armament Stores Management Control Indicator)

Alternatively, you can also use the ASCMI (Armament Stores Management Control Indicator) to set up weapon release parameters.

Armament Delivery Mode
AUT: Automatic
CIP: CCIP, Continuously Computed Impact Point
DSL: Depressed Sight Line
DIR: Direct

Fuzing Control

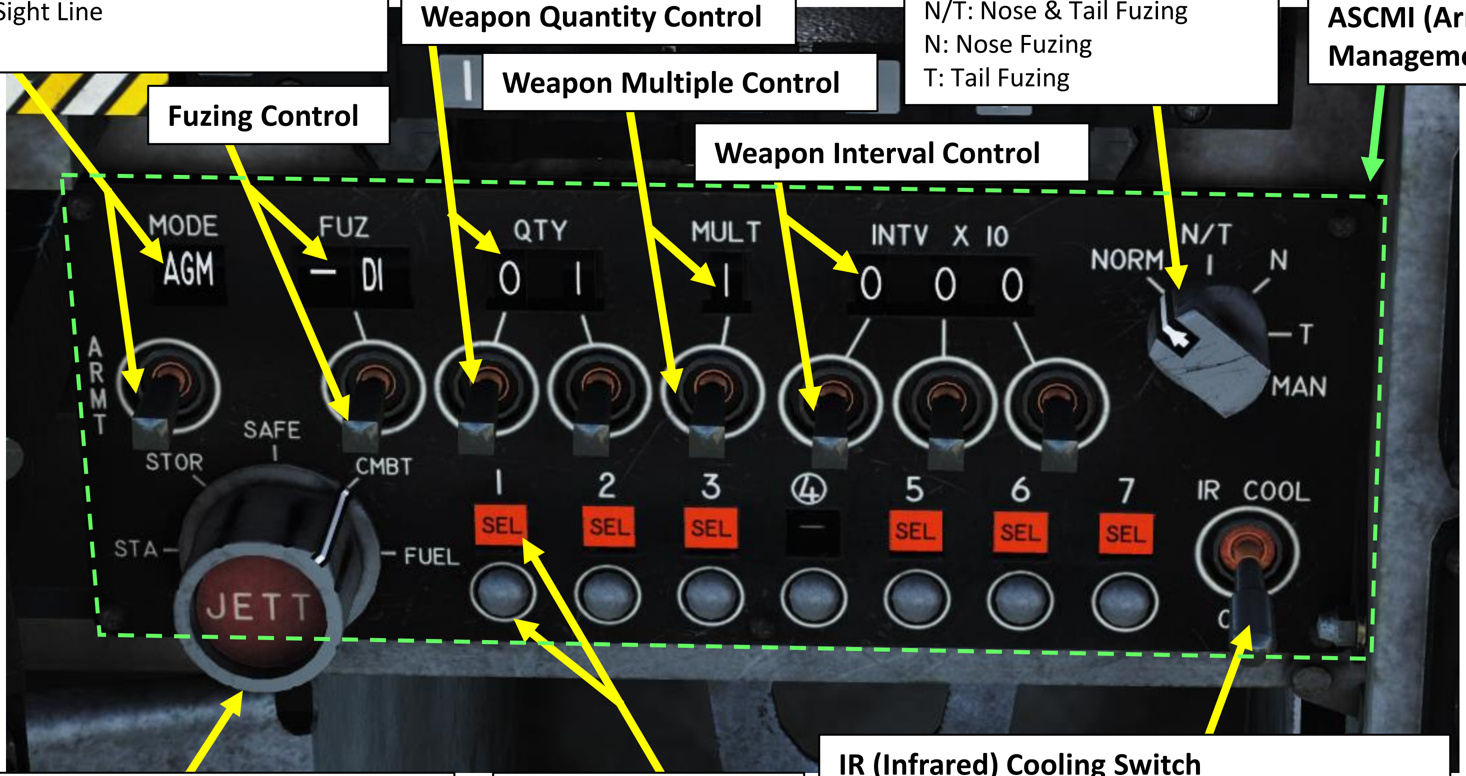
Weapon Quantity Control

Weapon Multiple Control

Weapon Interval Control

Weapon Manual Control
NORM: Normal
N/T: Nose & Tail Fuzing
N: Nose Fuzing
T: Tail Fuzing

ASCMI (Armament Stores Management Control Indicator) Panel



Selective Jettison Control
STA: Selected stations
STOR: Selected stores
SAFE: Safety Position
CMBT: Combat
FUEL: External Fuel Tanks
PUSHBUTTON: Jettisons selected ordnance

Station Selection Button & Indication

IR (Infrared) Cooling Switch
Applies manual cooling to all sidewinder-equipped stations. You shouldn't be turning it on at all unless you have a system failure that prevents the sidewinder seeker head from cooling or need to cool sidewinder's while on the ground for preflight checks.

ARMAMENT CONTROL PANEL

DELIVERY MODE: selects weapons delivery mode from the following list: **AUT** (Automatic), **CIP** (CCIP), **DSL** (Depressed sight line), **DIR** (direct), **AGM** (for Mavericks and Sidearms)

FUZING: see previous page.

QUANTITY: Selects the **total** quantity of weapons to be released during a delivery sequence. You cannot select quantity greater than the total number of weapons of the given type carried onboard.

MULTIPLE: Selects the number of stations that will simultaneously release their weapons during a delivery sequence. You cannot select a number greater than the number of stations carrying given type of weapon.

INTERVAL: Lets you select the release interval for multiple release sequence and represents the ground impact spacing in feet. In order to be able to set the interval, the **Q** must be greater than the **M** setting.

AVAILABLE OPTIONS

	QTY	MULT	INTV	FUZ	RANGE
BOMBS					
ROCKETS					
DISPENSERS					
AGM					
GUN					

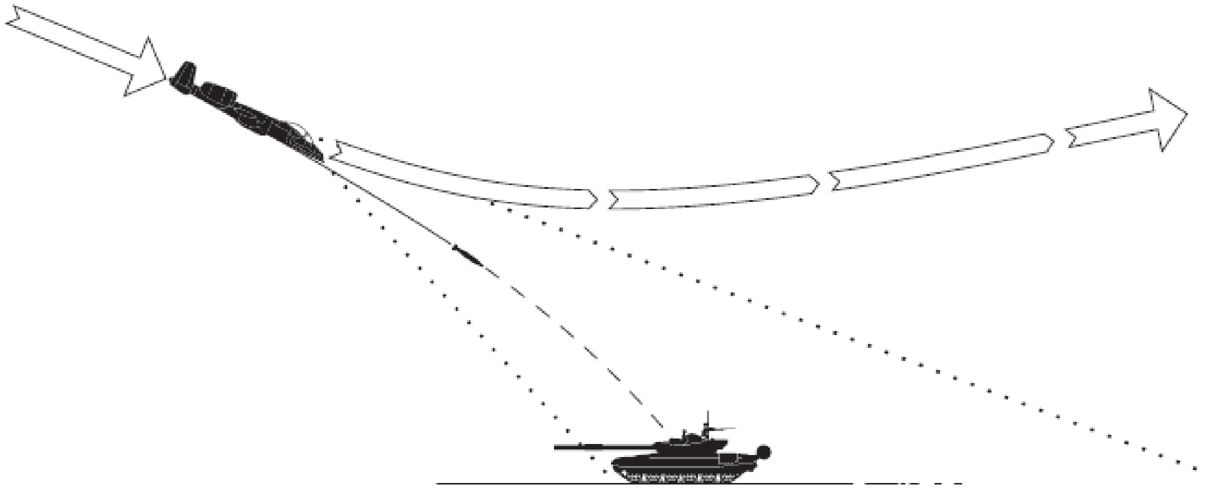
1 – INTRODUCTION
1.6 - Bomb Delivery Modes
CCIP & CCRP (AUTO)

There are 2 traditional ways to deliver a bomb with a computed mode: CCRP or CCIP modes.

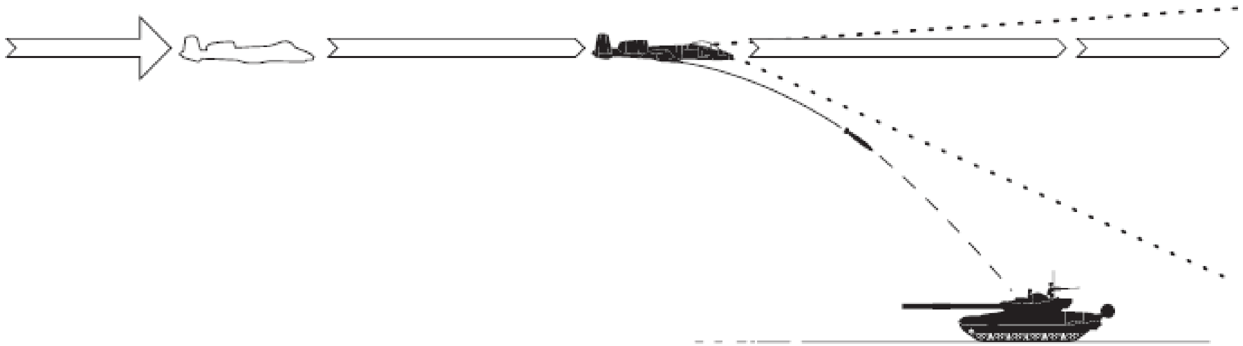
CCIP mode is the traditional dive bombing approach: you dive on target and the reticle will tell you where the bomb will impact.

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

1 – INTRODUCTION
1.6 - Bomb Delivery Modes
DSL, DIR & DSL1

There are three backup methods to deliver a bomb: DSL (Depressed Sight Line), DIR (Direct Delivery) or DSL (1) modes. These modes are similar to the dive bombing techniques used in the Vietnam War era; bombs are released according to specific delivery altitude and airspeed parameters.

DSL (Depressed Sight Line) mode is used when the Mission Computer, INS, HUD or avionics multiplex data bus fail. DSL Mode is only selectable from the Armament Control Panel. You need to meet specific, pre-determined release conditions such as altitude and dive angle.

DIR (Direct) mode displays a roll stabilized sight very similar to the DSL mode. DIR should be programmed prior to taxi. In order to do so, deselect all stations, set A/G Master Mode and then choose DIR on the Armament Control Panel. Bomb delivery technique is the same as for normal DSL mode.

DSL (1) mode is last of the backup modes, allowing to drop bombs if both Stores Management Computer and Armament Control Panel fail. It enables the pilot to use manual fuze arming. In this mode, you can only drop one bomb with each press of the Bomb Pickle button. Bomb delivery technique is the same as for normal DSL mode.

GENERAL PURPOSE BOMBS — VMAT-203 — TRAINING MISSION 15

DSL DELIVERY MODE PROCEDURE

The DSL mode provides weapon delivery capability when system failures prevent you from using any other modes. It provides pilot with a roll - stabilised reticle with manually adjusted depression angle.

1. Select the A/G Master Mode.
2. Select the desired weapon using the DDI, ODU or ACP.
3. Set up the Fuzing, Quantity, Multiple and Interval as required.
4. Choose DSL delivery mode on the ACP.
5. Press the SITE on Stores Page (P/B 12).
6. On the ODU make sure that SITE is colonised and enter required depression angle.
7. Align the Bomb Fall Line (BFL) with the target.
8. Make sure that your wings are level, enter a dive at required angle and speed. Hold the reticle 2-3 degrees above the target.
9. When reticle reaches the target at required altitude, press pickle button.
10. Pull hard across the horizon, verify the outcome of your attack.
11. Set Master Arm Switch to OFF.

The depression angle can be set between 0 and 240 mils.

When diving on the target, set your TVV 2-3 degrees above it holding a desired dive angle (if you put it on the target, you will not be able to walk the reticle to it).

Use sample settings listed on the next page to set up your bombing runs.

GENERAL PURPOSE BOMBS — VMAT-203 — TRAINING MISSION 15

DSL DELIVERY MODE SAMPLE TABLES (at 450 KTAS)

Mk82/ BDU-33

Starting altitude	Dive angle	Roll-in range	Release altitude	Sight angle
5000	10	4.7 Nm	2000	182
7000	20	3.2 Nm	2500	155
8000	30	2.3 Nm	3000	141
10000	45	1.7 Nm	4000	112

Mk82/ Low Drag

Starting altitude	Dive angle	Roll-in range	Release altitude	Sight angle
5000	10	4.7 Nm	2000	216
7000	20	3.2 Nm	2500	186
8000	30	2.3 Nm	3000	163
10000	45	1.7 Nm	4000	136

Mk82/ High Drag

Starting altitude	Dive angle	Roll-in range	Release altitude	Sight angle
2000	10	1.9 Nm	600	169
5000	20	2.3 Nm	1100	187
8000	30	2.2 Nm	2000	202

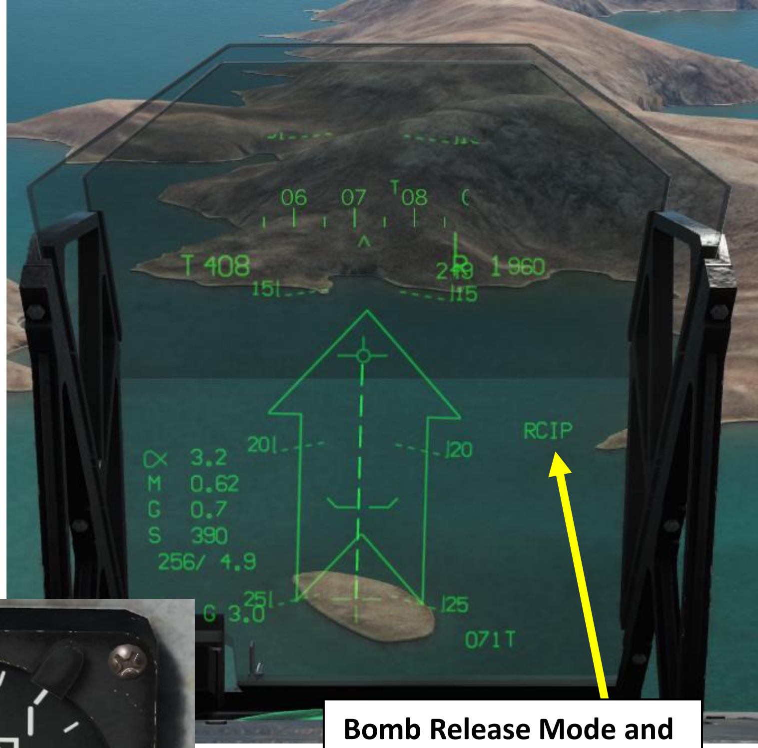
GBU-12/ Low Drag

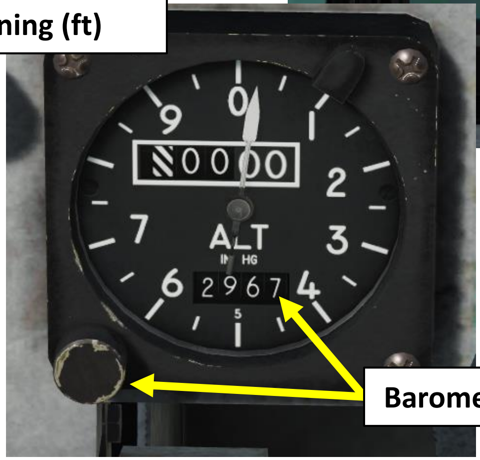
Starting altitude	Dive angle	Roll-in range	Release altitude	Sight angle
7000	10	6.5 Nm	2500	239
9000	20	4.0 Nm	3000	204
12000	30	3.4 Nm	4000	189
14000	45	2.3 Nm	5000	152

1 – INTRODUCTION
1.7 - Bomb Altitude Parameters

Having accurate data for altitude is crucial for precise weapons delivery. The Harrier can obtain this data from various sensors and systems with different levels of accuracy. **ARBS (Angle Rate Bombing System), Radar Altimeter, GPS and barometric altitude are the four main sources for altitude reference**.

1. To select your altitude source for bombing, press the “ALT” button on the UFC (Up-Front Control).
2. The **BOMB** ODU, when selected (“:”), uses the radar altimeter for ballistic computation by the mission computer. When selected, BOMB ODU will display on the scratchpad the last selected LAW (Low Altitude Warning), which you can modify. You need to make sure your radar altimeter is ON (ON/OFF switch)
3. The **GPS** ODU, when selected (“:”), uses the GPS for ballistic computation by the mission computer.
4. If neither the DMT (Dual Mode Tracker) of the ARBS, BOMB or GPS is selected, the **barometric** altitude source is used by default. However, you will need to make sure you have the correct barometric setting entered on the Standby Altimeter.





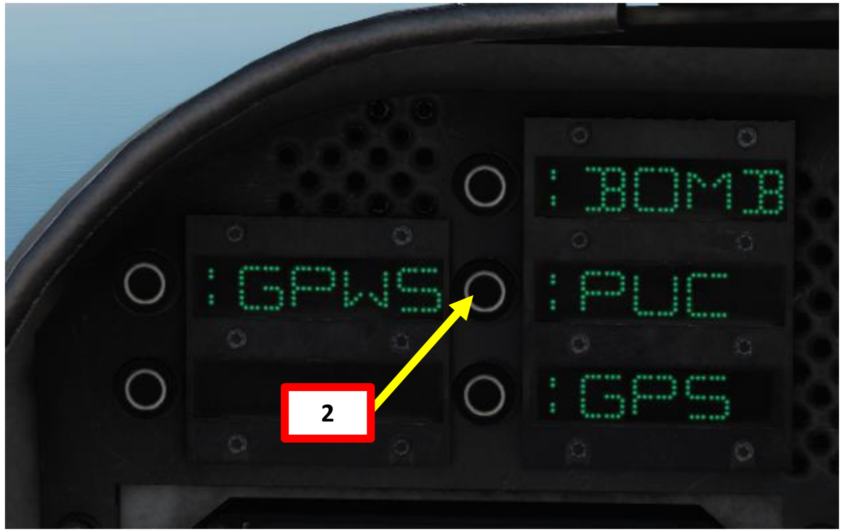
Depending on the system currently working, the following legend will appear on the HUD.

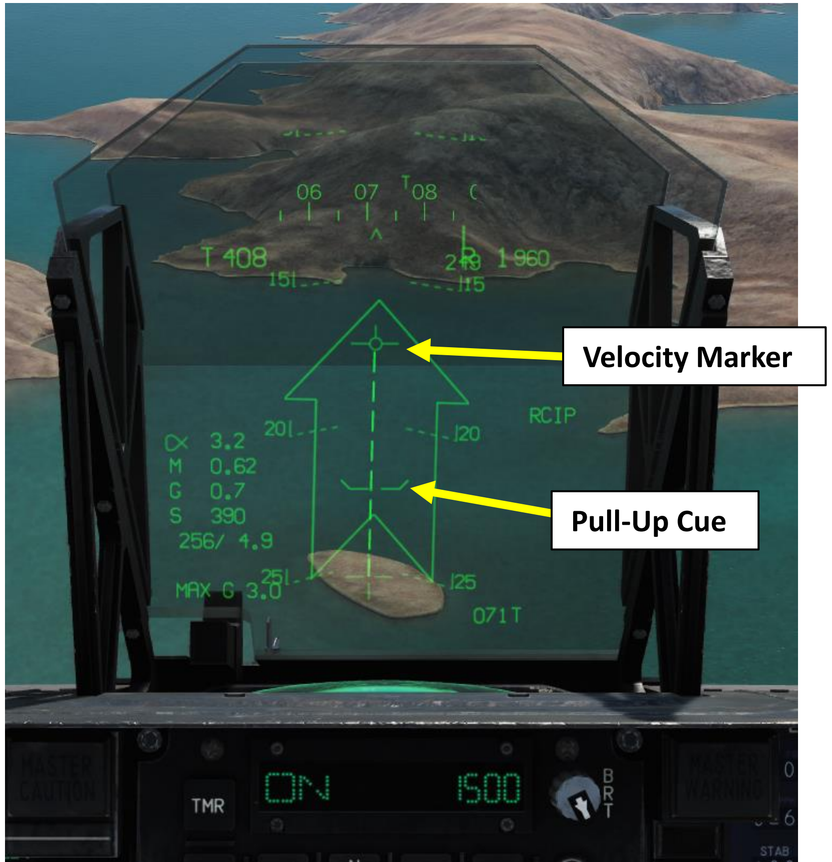
SYSTEM	AUTO	CCIP
ARBS	AUTO	CCIP
RADAR ALTITUDE	RAUT	RCIP
GPS	GAUT	GCIP
BAROMETRIC ALTITUDE	BAUT	BCIP

1 – INTRODUCTION
1.7 - Bomb Altitude Parameters

You can also program for a Pull-Up Cue altitude. When you are 9 seconds from reaching the selected pullup altitude, the PUC symbol appears below the Velocity Marker. It will climb towards the Velocity Marker as you get closer to the pullup altitude. The moment it reaches the VVM you are at the pullup altitude.

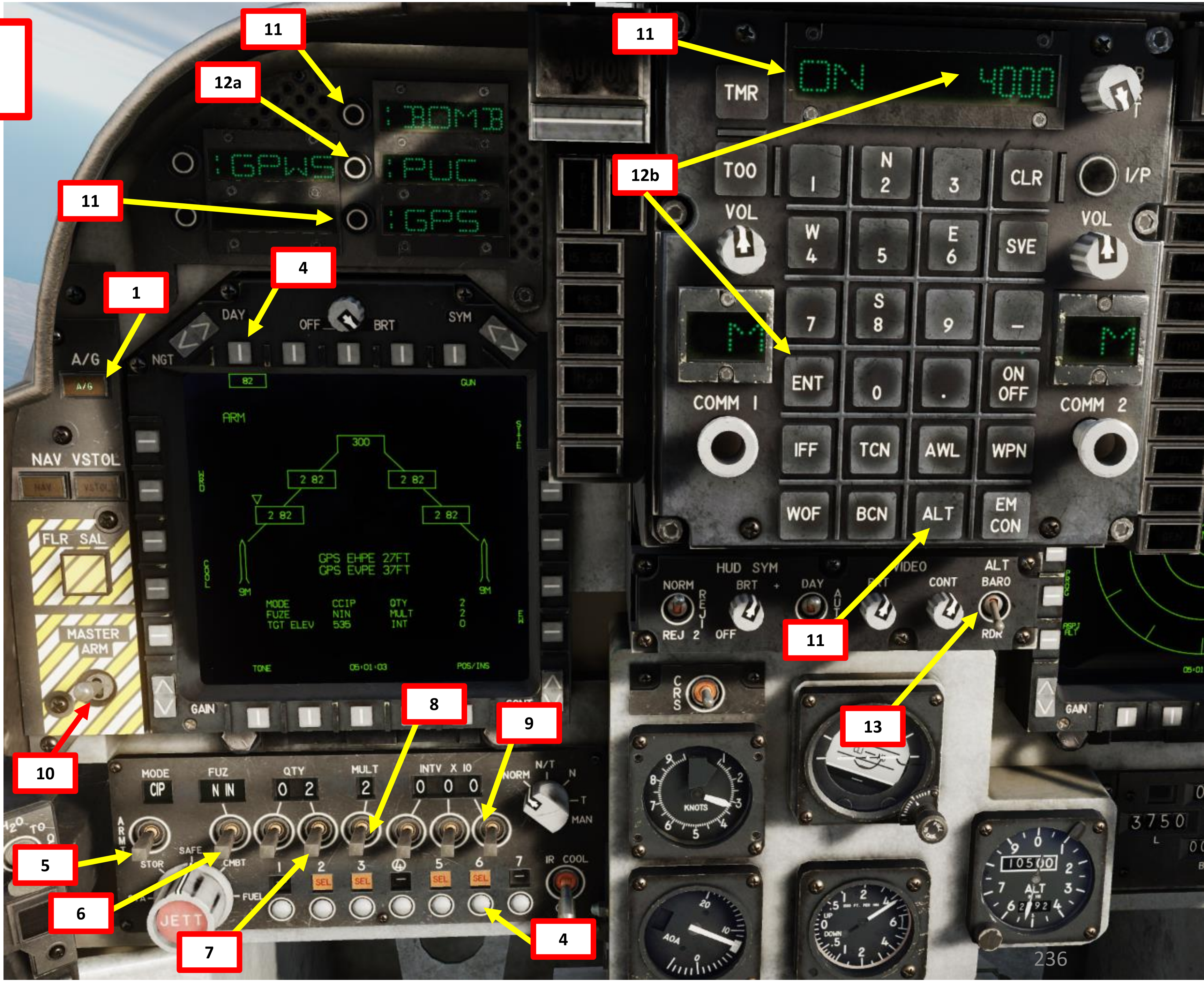
1. Press the “ALT” button on the UFC (Up-Front Control).
2. Select the PUC (Pull-Up Cue) ODU (“:” when selected)
3. Enter on the UFC scratchpad the desired Pull Up altitude in ft, then press ENT.





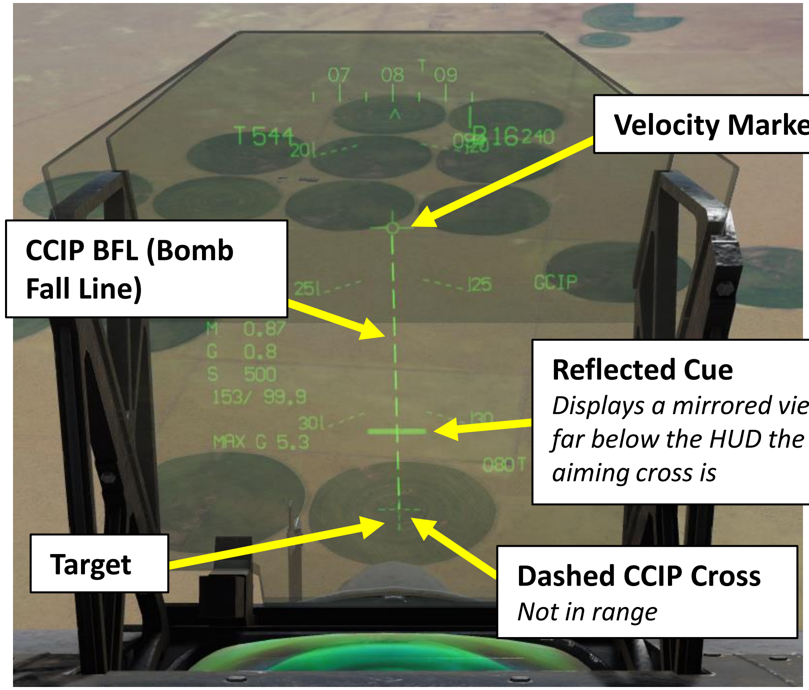
2.1 - UNGUIDED BOMBS
2.1.1 - MK82 (CCIP Release)

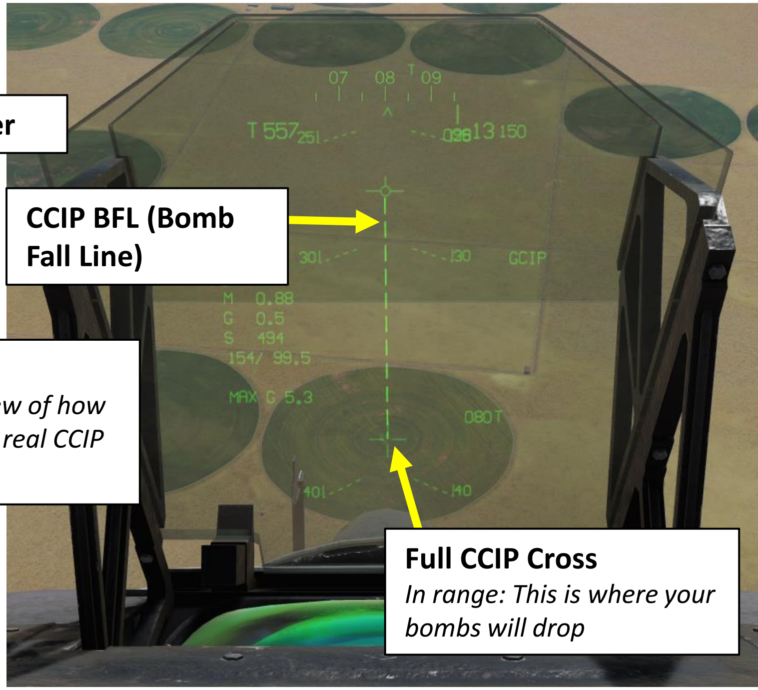
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired MK82 bombs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Select CIP (CCIP) Armament Mode
6. Set Fuzing to desired mode (N IN for this tutorial)
7. Set desired Bomb Quantity (total bombs to be dropped)
8. Set Multiple parameter to the number of pylons used (how many pylons are used to drop the total bomb quantity; we will use 2 in order to avoid asymmetrical loadouts).
9. Set desired Interval (distance between bombs dropped in ft). In order to be able to set an interval, Bomb Quantity needs to be greater than the Multiple parameters. Since this isn't the case, we will leave Interval at 0.
10. Set Master Arm Switch - ON (UP)
11. Press the ALT button on the UFC and verify that Radar Altimeter is ON, BOMB and GPS options are selected.
12. Select the PUC (Pull-Up Cue. « : » when selected), set desired altitude (4000 ft in our case), then press ENT on the UFC.
13. Set HUD Altitude Selector to RDR (Radar Altimeter)

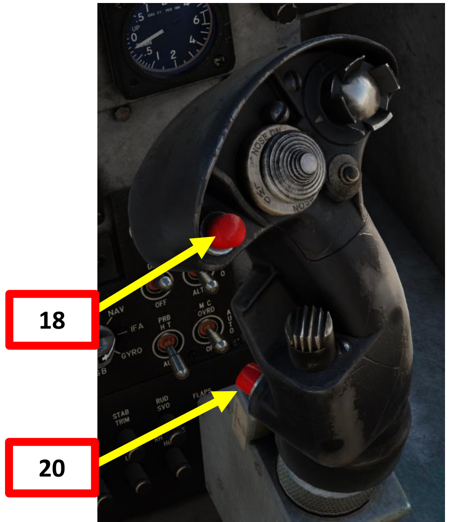


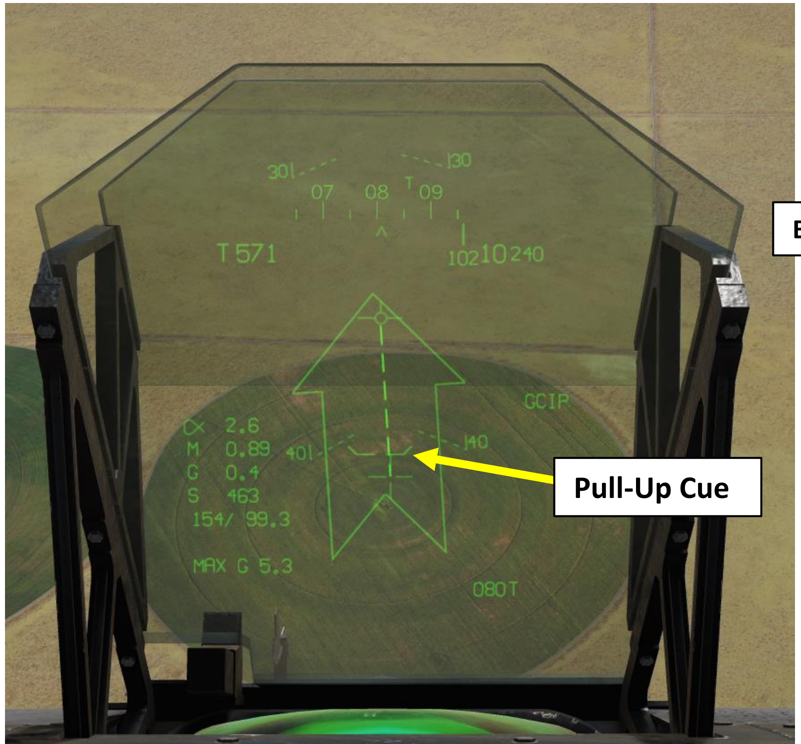
2.1 - UNGUIDED BOMBS
2.1.1 - MK82 (CCIP Release)

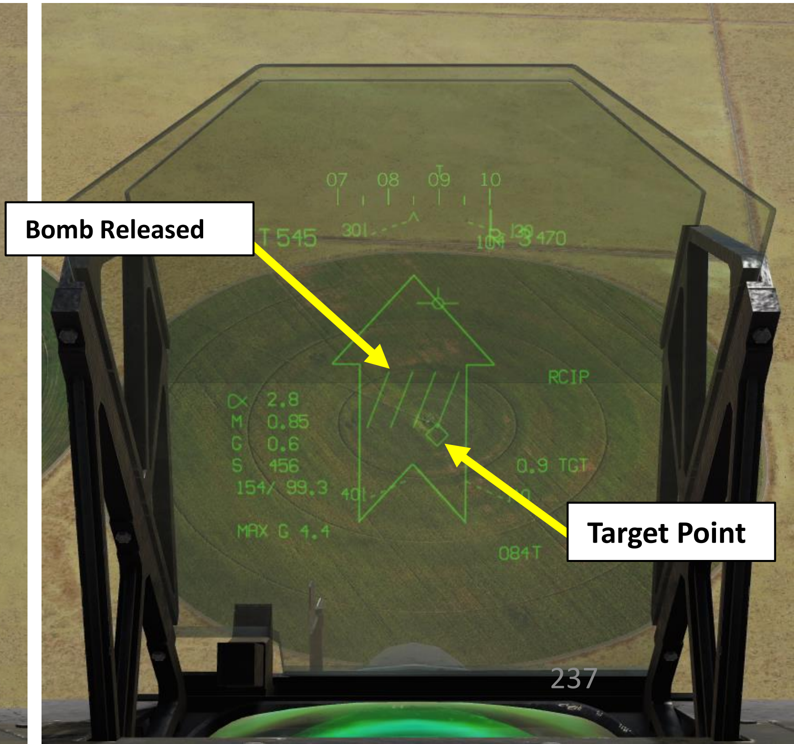
14. Perform a 45 degree dive on the target and fly to align the vertical CCIP line with the target.
15. At first, the CCIP cross will be dashed: this means your aircraft is not yet stabilized and ready to drop its bombs.
16. When CCIP cross becomes a solid cross, you can drop your bombs when the CCIP cross is aligned on your target.
17. When you are 9 seconds from reaching the selected Pull-Up altitude, the PUC (Pull-Up Cue) symbol appears below the Velocity Marker. It will climb towards the Velocity Marker as you get closer to the pullup altitude. The moment it reaches the Velocity Marker you are at the pullup altitude. The trick is to release before the PUC reaches the VVM and to make a 4G climb so you never go below the pullup altitude. Take note that the PUC symbol will be hidden most of the time, and will only appears when you are diving.
18. Press the Bomb Pickle button (RALT+SPACE) to drop your bombs
19. A Target Point (T0) will automatically be created once bombs are dropped.
20. To remove Target Point Desigation, press the « AG Target Undesignate/NWS/FOV Toggle » button.











2.1 - UNGUIDED BOMBS
2.1.1 - MK82 (CCIP Release)

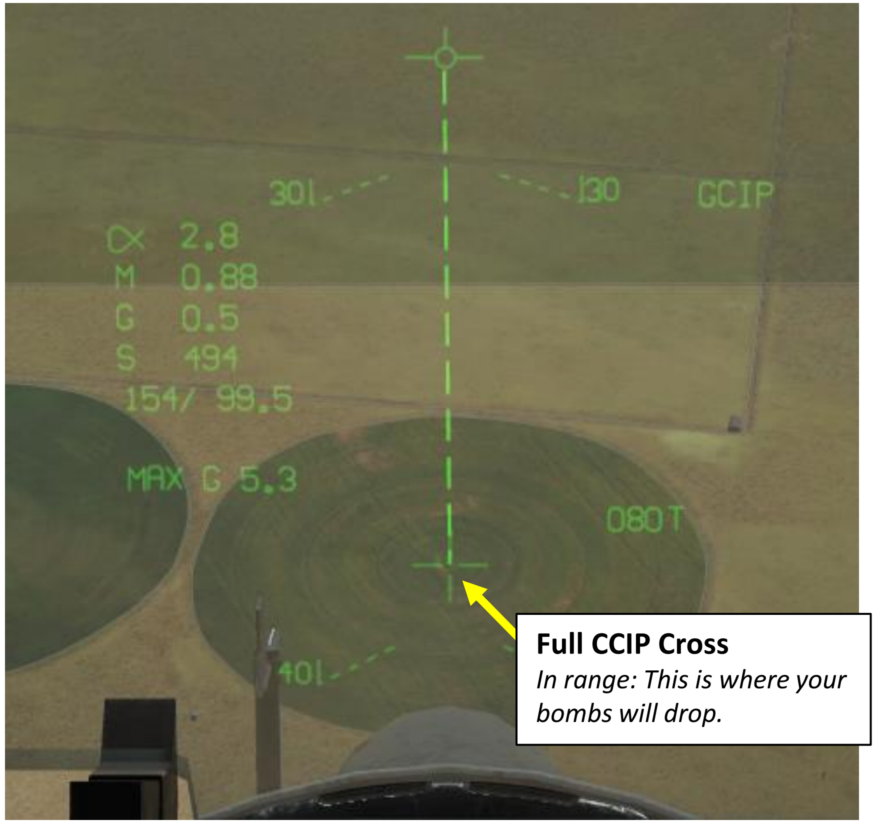
2.1 - UNGUIDED BOMBS
2.1.1 - MK82 (CCIP Release)

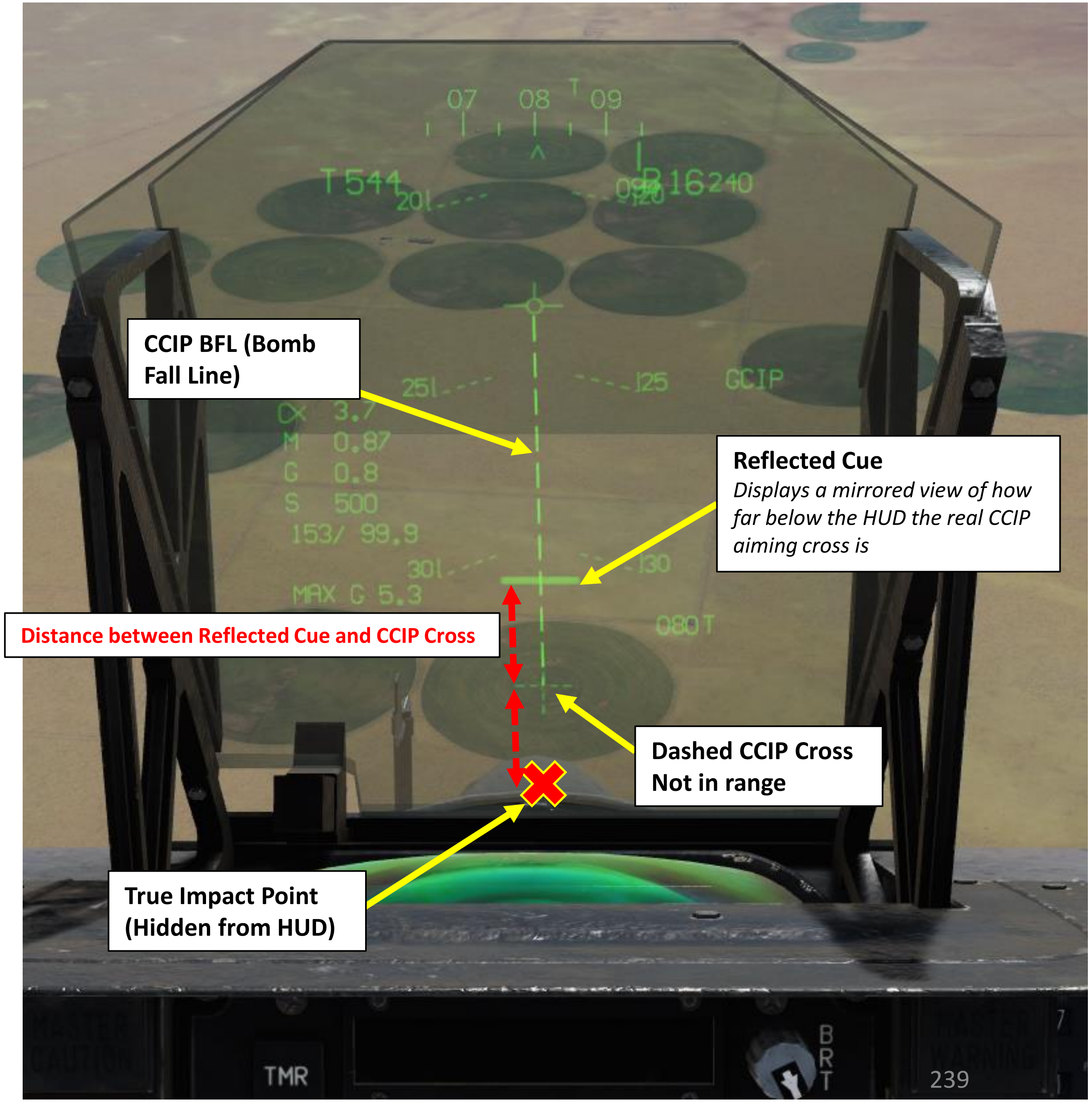
Note on CCIP Reflected Cue

Between the CCIP pipper and the velocity vector marker is the Reflected cue (or Delayed Cue).

When the Reflected cue is visible on the BFL (Bomb Fall Line), it indicates that the CCIP pipper on the HUD is not showing the true impact point if you were to drop the bomb at that moment.

Instead, the true impact location is a mirror of the distance from the Reflected Cue to the CCIP pipper. When Reflected Cue disappears, the CCIP pipper will then indicate the true impact point.





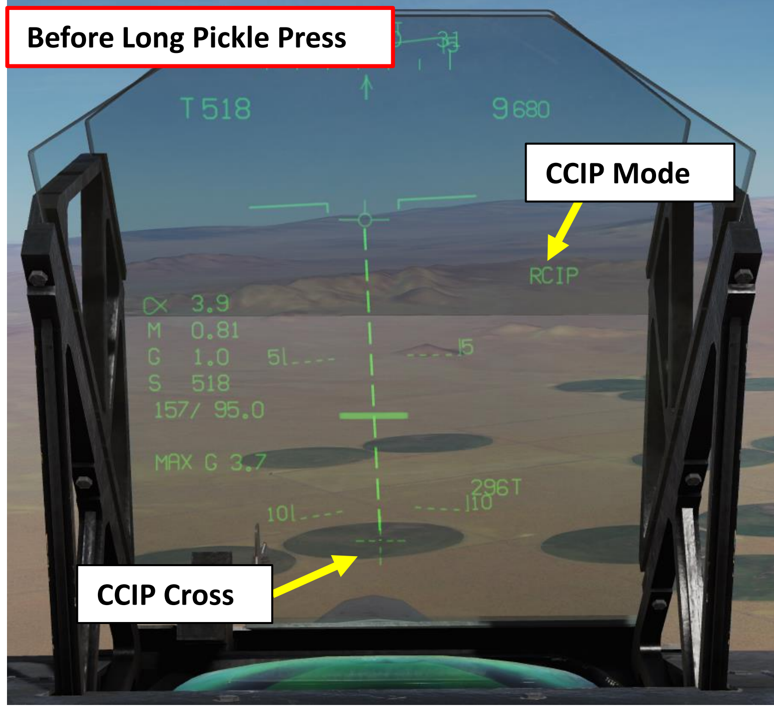
2.1 - UNGUIDED BOMBS
2.1.1 - MK82 (CCIP Release)

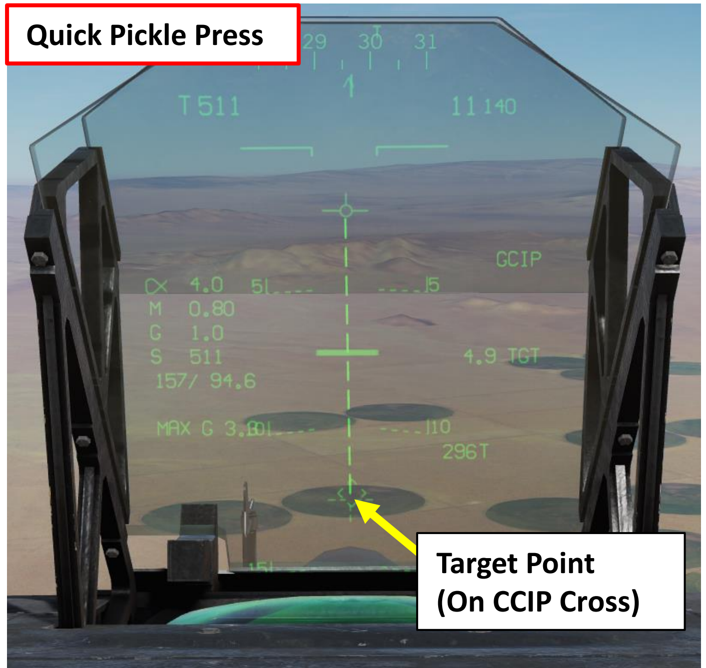
Notes on CCIP/Auto Mode Transition

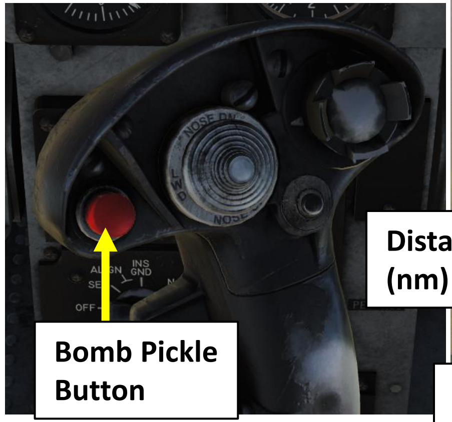
Note 1:
When CCIP Mode is selected and the CCIP Reflected Cue is visible (meaning that the CCIP cross is dashed and the actual aiming point is outside of the HUD), **pressing the Bomb Pickle Button quickly** will create a Target Point and slave the DMT (Dual Mode Tracker) to the location of the Aiming Reticle. You can then switch to CCRP AUTO mode if desired by **pressing the CAGE/UNCAGE button** on the throttle.

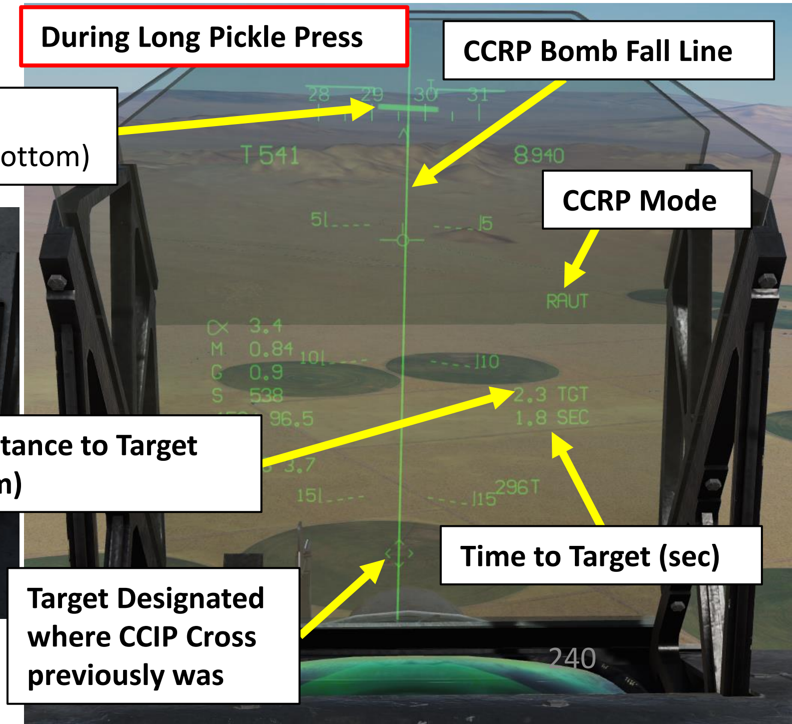
Note 2:
Pressing and Holding the Bomb Pickle Button will switch designate the target on the CCIP cross, and temporarily switch bomb release mode from CCIP to CCRP for as long as you keep the Bomb Pickle button pressed. This allows you to designate a target quickly while in a dive and then perform a level bombing run or a shallow dive bombing run. This is useful for cases where you find a target and realize a dive bombing run is too dangerous.

See Redkite's CCIP Upgrade video on the Harrier:
https://youtu.be/8tgrkiBmAng



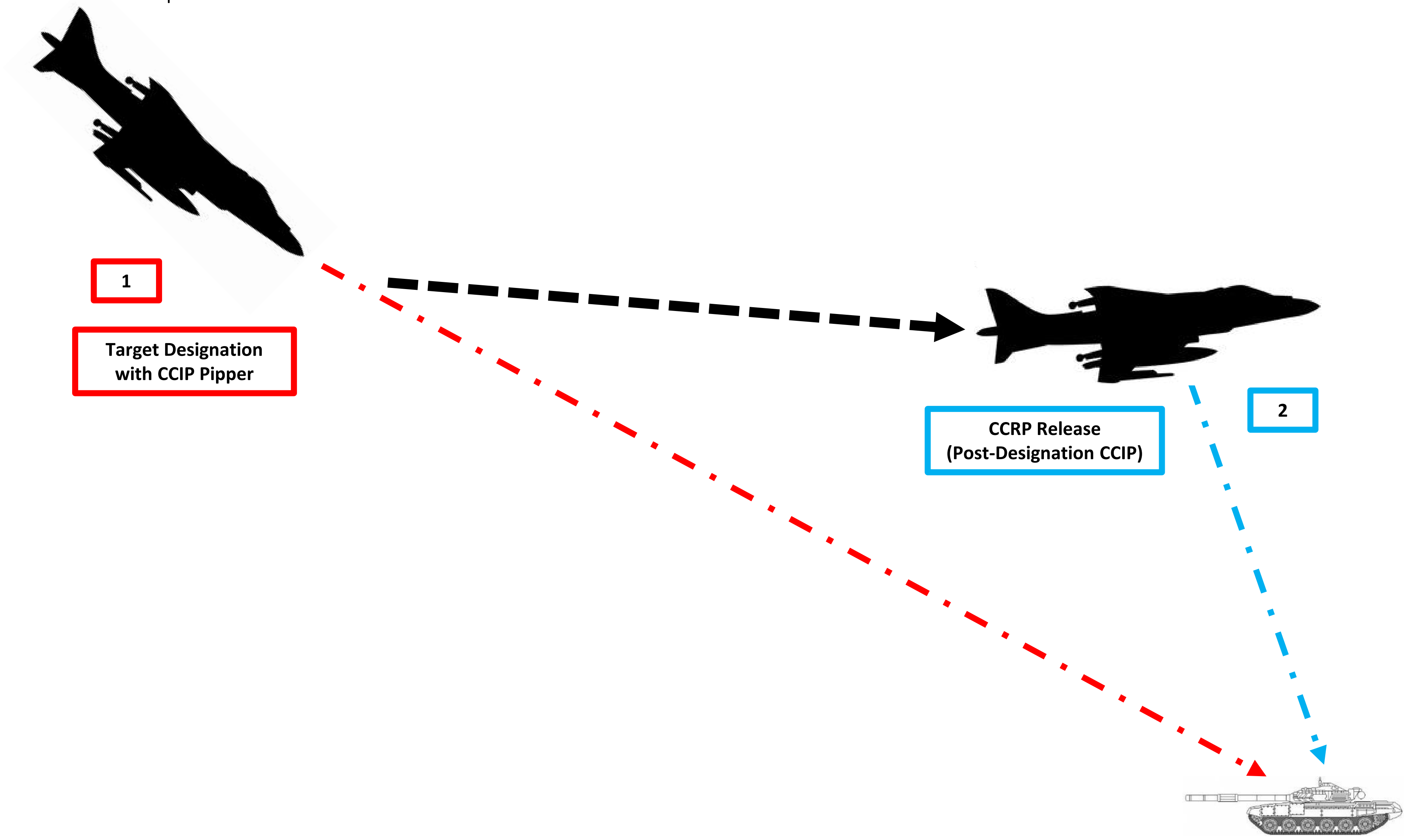






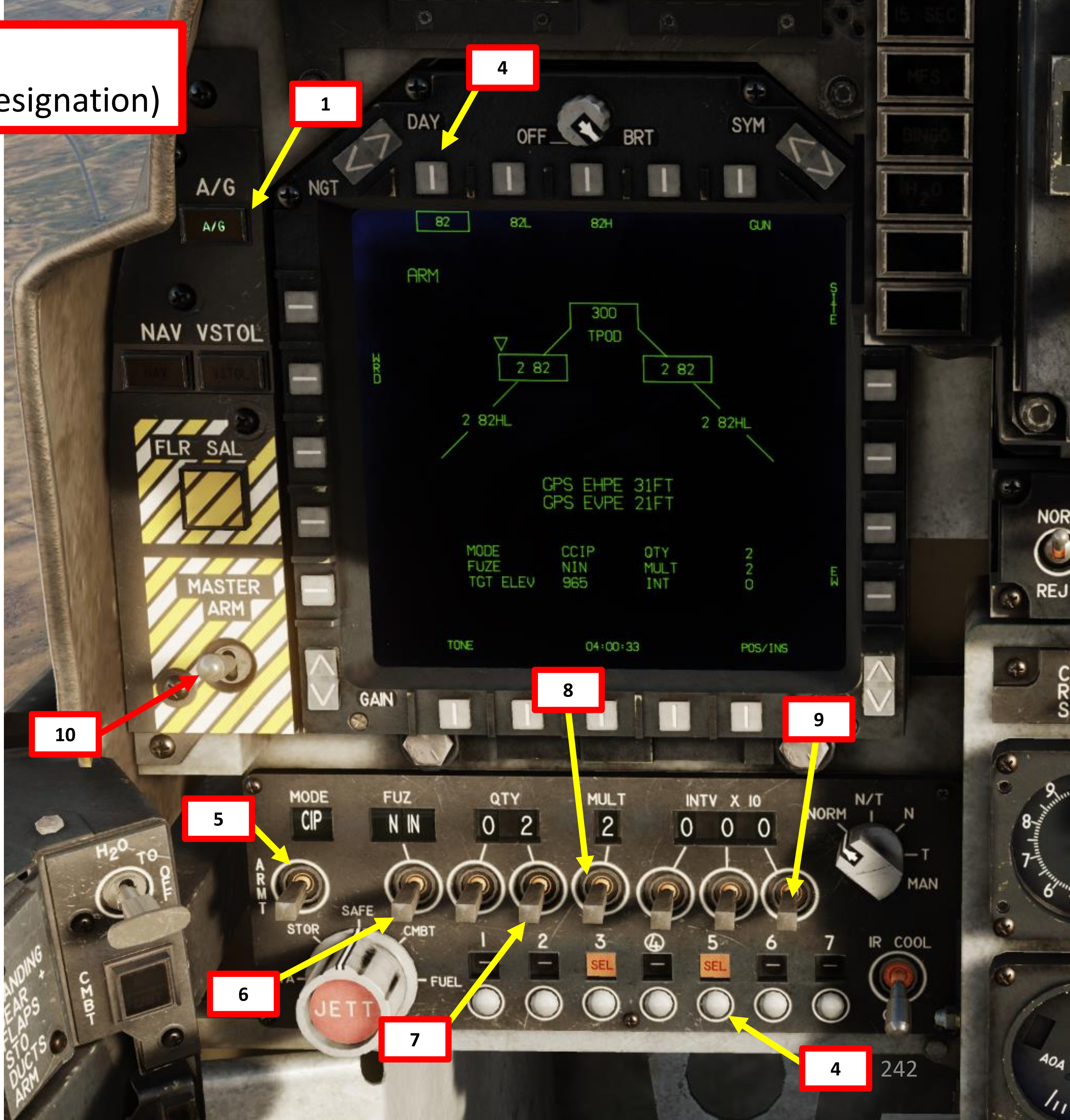
2.1 - UNGUIDED BOMBS
2.1.2 - MK82 (CCRP/Auto Release - Point Blank Designation)

An option for CCIP bombs delivery is available for situations where the target cannot be within the HUD field of view at release; this option is called “Point Blank Designation” (also known as Post-Designation CCIP). This can sometimes happen on attacks from a shallow dive angle or high altitude. The steps to enter CCIP mode are the same as described in the CCIP section. The difference is in when you depress and hold the Weapons Release button.



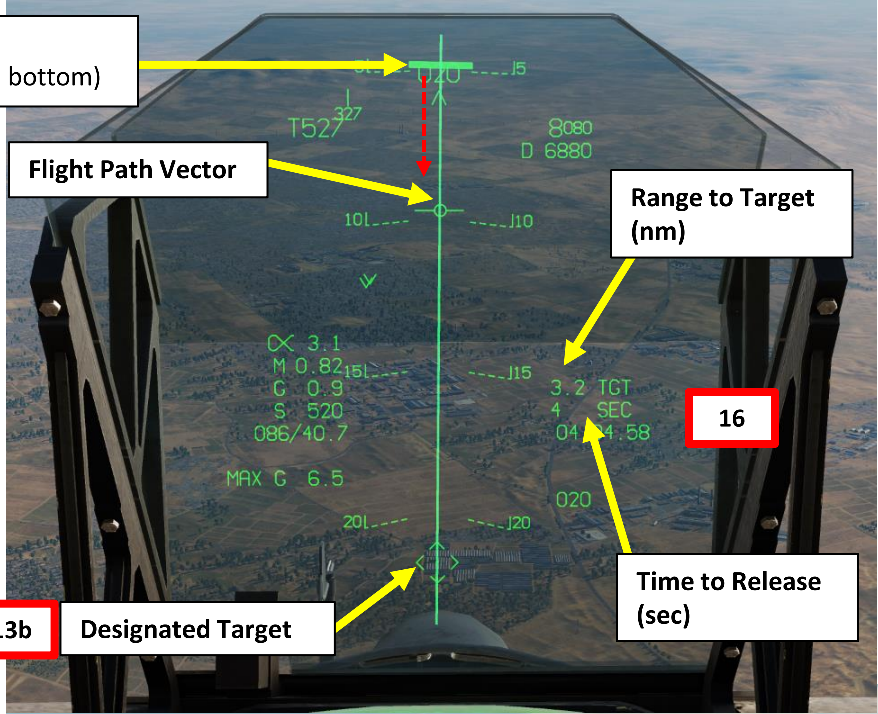
2.1 - UNGUIDED BOMBS
2.1.2 - MK82 (CCRP/Auto Release - Point Blank Designation)

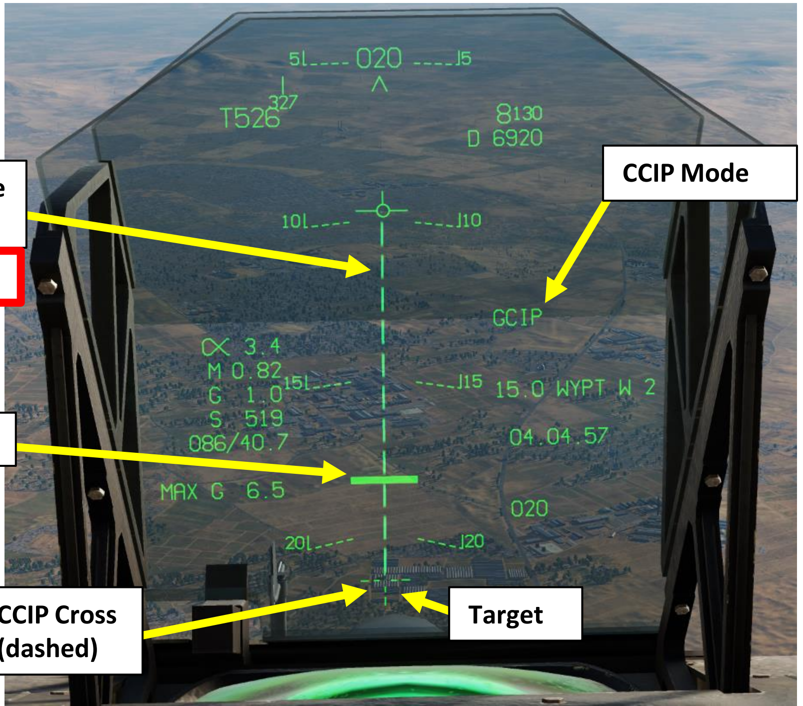
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired MK82 bombs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Select CIP (CCIP) Armament Mode
6. Set Fuzing to desired mode (N IN for this tutorial)
7. Set desired Bomb Quantity (total bombs to be dropped)
8. Set Multiple parameter to the number of pylons used (how many pylons are used to drop the total bomb quantity; we will use 2 in order to avoid asymmetrical loadouts).
9. Set desired Interval (distance between bombs dropped in ft). In order to be able to set an interval, Bomb Quantity needs to be greater than the Multiple parameters. Since this isn't the case, we will leave Interval at 0.
10. Set Master Arm Switch - ON (UP)

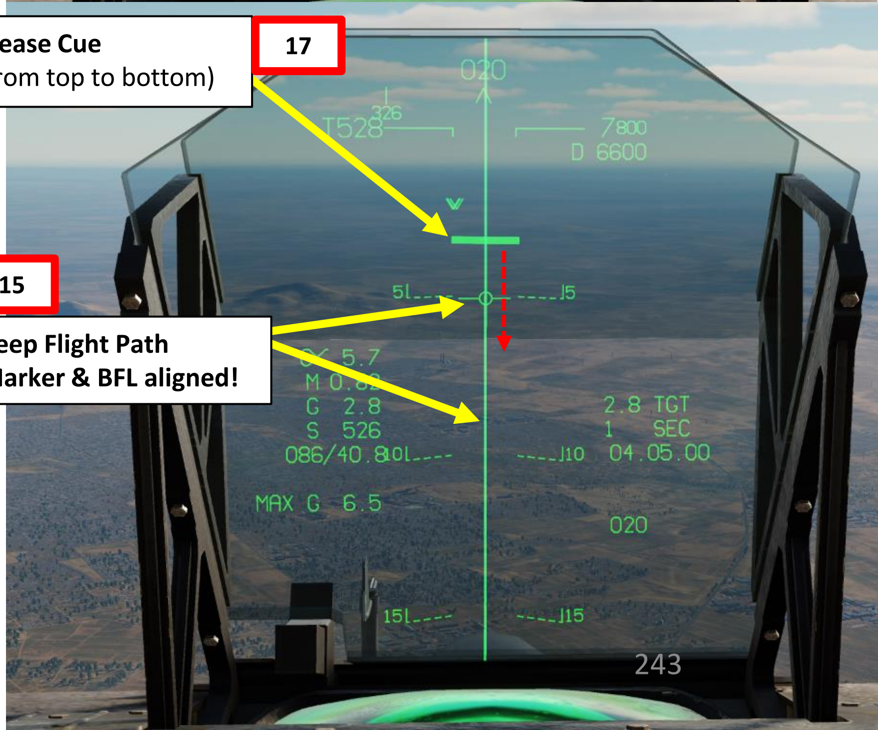


2.1 - UNGUIDED BOMBS
2.1.2 - MK82 (CCRP/Auto Release - Point Blank Designation)

11. Fly towards the target and fly to align the vertical CCIP line with the target. Try to have your nose at least 15 deg down.
12. Make sure you fly high enough so that:
    - The CCIP cross is dashed
    - The BFL (Bomb Fall Line) is dashed
    - A reflected cue is visible on the BFL. When the Reflected cue is visible on the BFL (Bomb Fall Line), it indicates that the CCIP pipper on the HUD is not showing the true impact point if you were to drop the bomb at that moment.
13. Place the dashed CCIP cross over the target, then press and hold the Bomb Pickle button (RALT+SPACE) to designate the target. Keep Bomb Pickle held until weapon release.
14. While keeping the Bomb Pickle button pressed, pull up to level out the aircraft. You will now perform a weapon release similar to CCRP/AUTO.
15. Fly level and manoeuver to align the vertical Bomb Fall Line with your flight path vector as much as possible.
16. The time to release and target range are indicated on the HUD.
17. As you fly over Release Point cue (will be indicated by a green horizontal line descending from top to bottom), your bombs will drop automatically provided that you are holding the Bomb Pickle button.

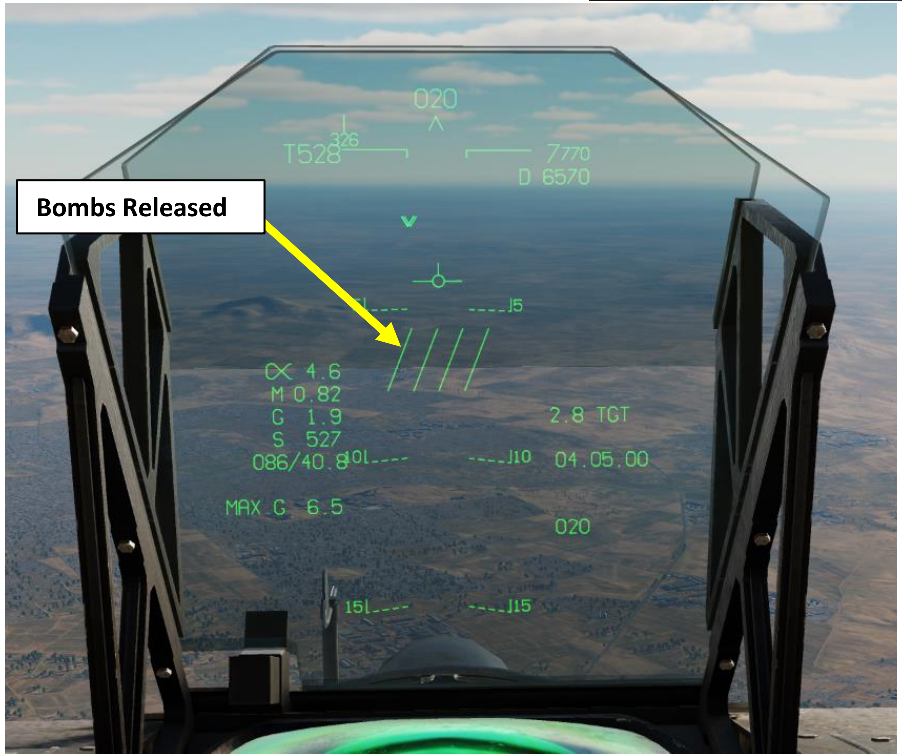






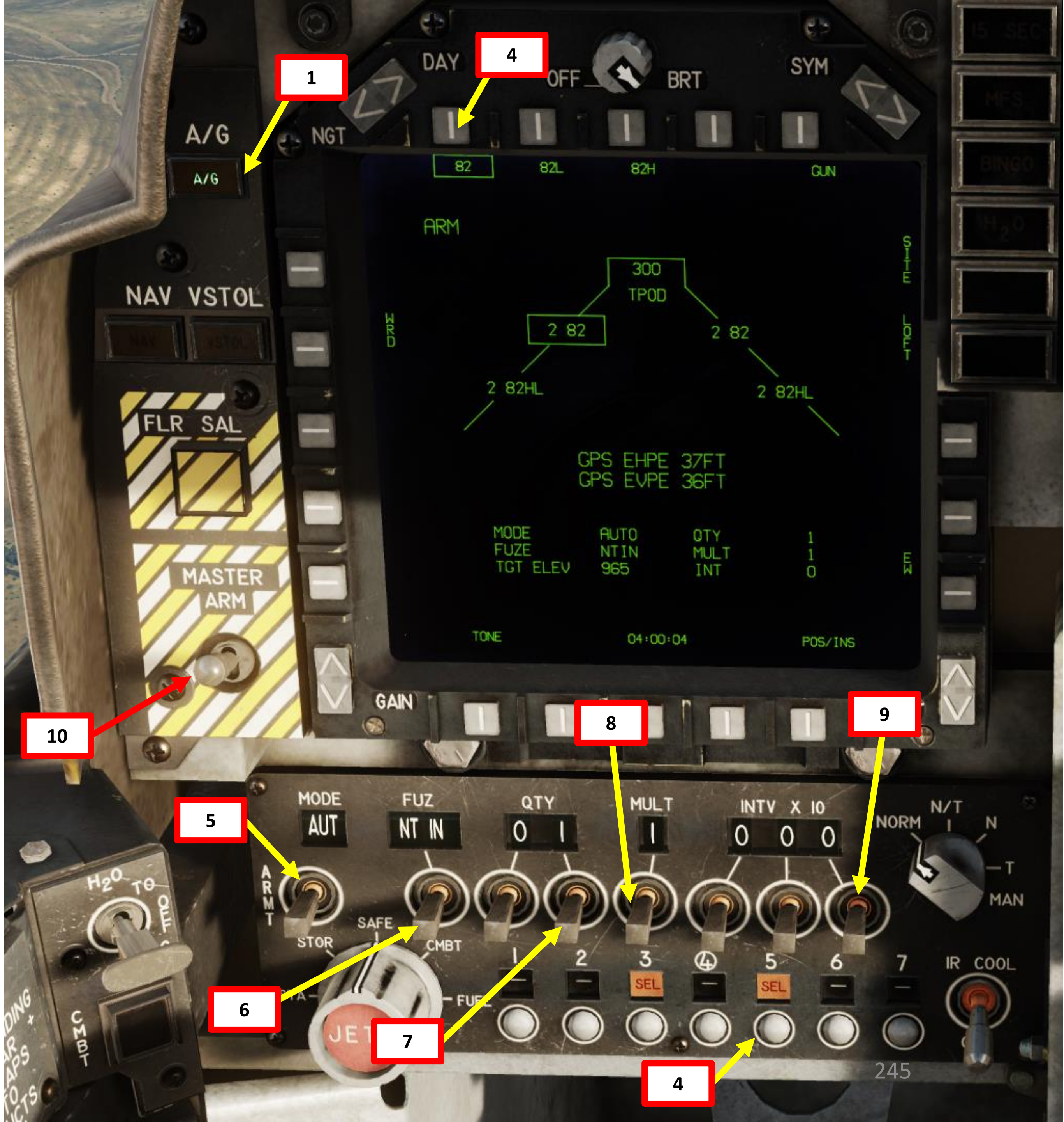
2.1 - UNGUIDED BOMBS
2.1.2 - MK82 (CCRP/Auto Release - Point Blank Designation)

18. A Target Point (T0) will automatically be created once bombs are dropped.
19. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.



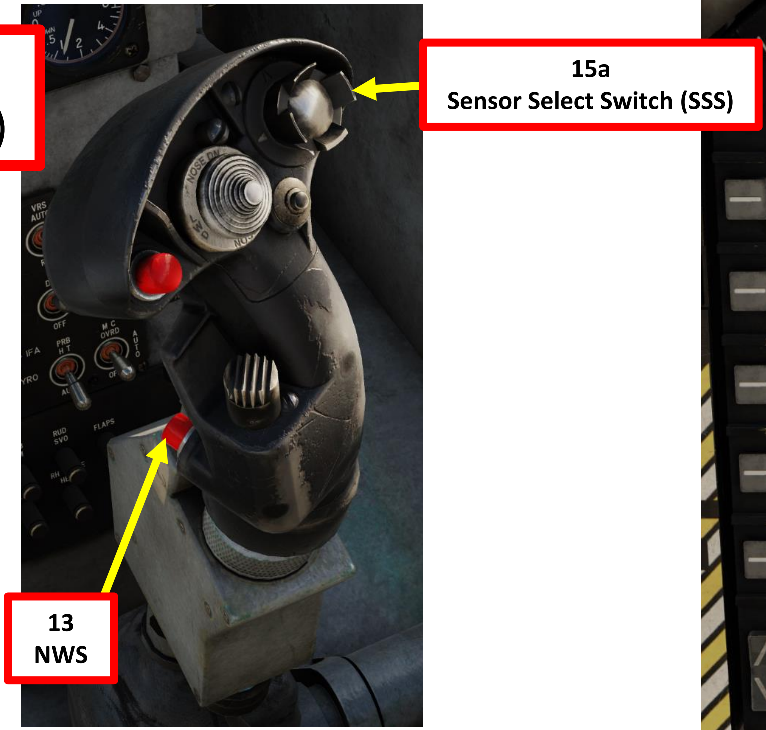
2.1 - UNGUIDED BOMBS
2.1.3 - MK82 (CCRP/Auto Release - DMT)

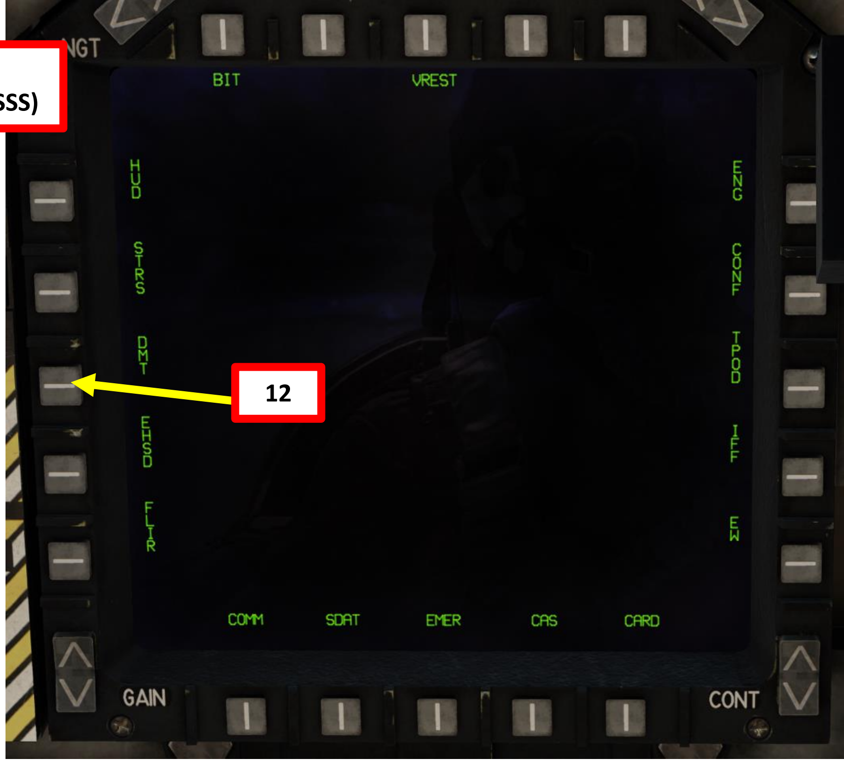
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired MK82 bombs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Select AUTO (CCRP) Armament Mode
6. Set Fuzing to desired mode (N IN for this tutorial)
7. Set desired Bomb Quantity (total bombs to be dropped)
8. Set Multiple parameter to the number of pylons used (how many pylons are used to drop the total bomb quantity.
9. Set desired Interval (distance between bombs dropped). In our case, we will choose 0.
10. Set Master Arm Switch - ON (UP)

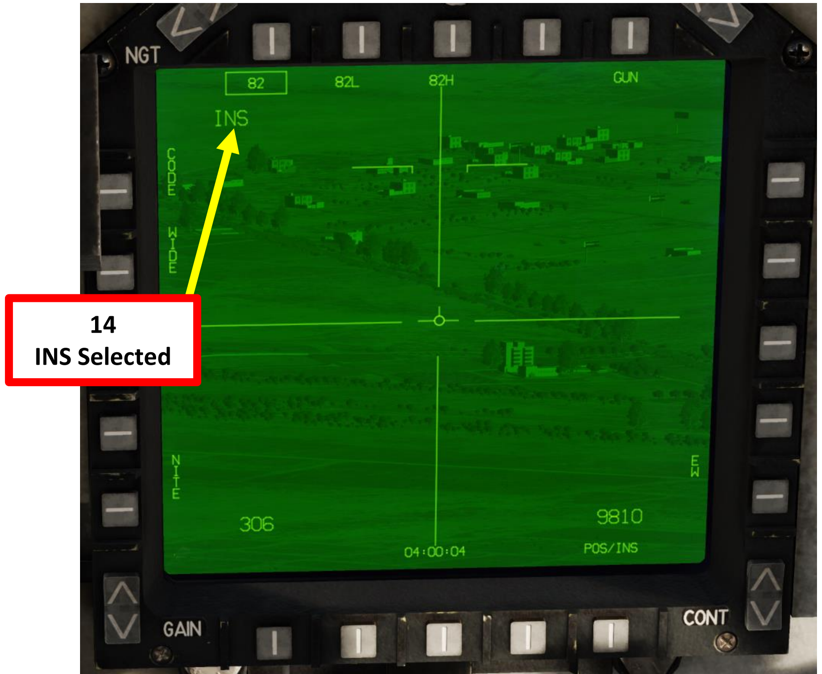


2.1 - UNGUIDED BOMBS
2.1.3 - MK82 (CCRP/Auto Release - DMT)

11. Set DMT (Dual Mode Tracker) Power Switch – ON (UP)
12. From the main MPCD menu, select “DMT” page. DMT feed will appear on your MPCD display.
13. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
14. Check selected sensor on DMT page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor. In that case, double-tap the Sensor Select Switch in quick succession to select INS.
    c) TV indicates the DMT TV is the selected sensor. In that case, the DMT is already selected.
15. Press the Sensor Select Switch AFT to toggle between the LST (Laser Spot Track) and the TV DMT mode until “TV” is selected.



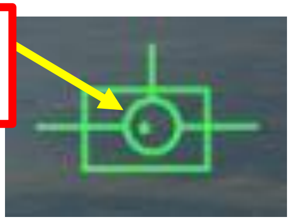




2.1 - UNGUIDED BOMBS
2.1.3 - MK82 (CCRP/Auto Release - DMT)

16. At first, TV Mode tracks your aircraft's flight path vector (where your aircraft's nose is pointing).
17. Place the flight path vector on the desired target's general area, then press the « TDC DOWN Action Position » button to designate the target and slave the DMT to it.
18. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0.

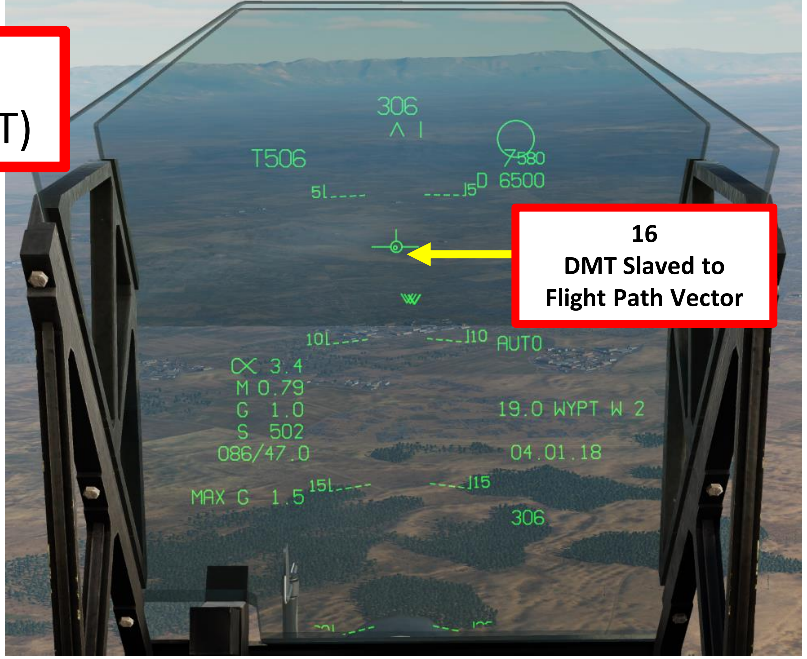
16
DMT Slaved to
Flight Path Vector



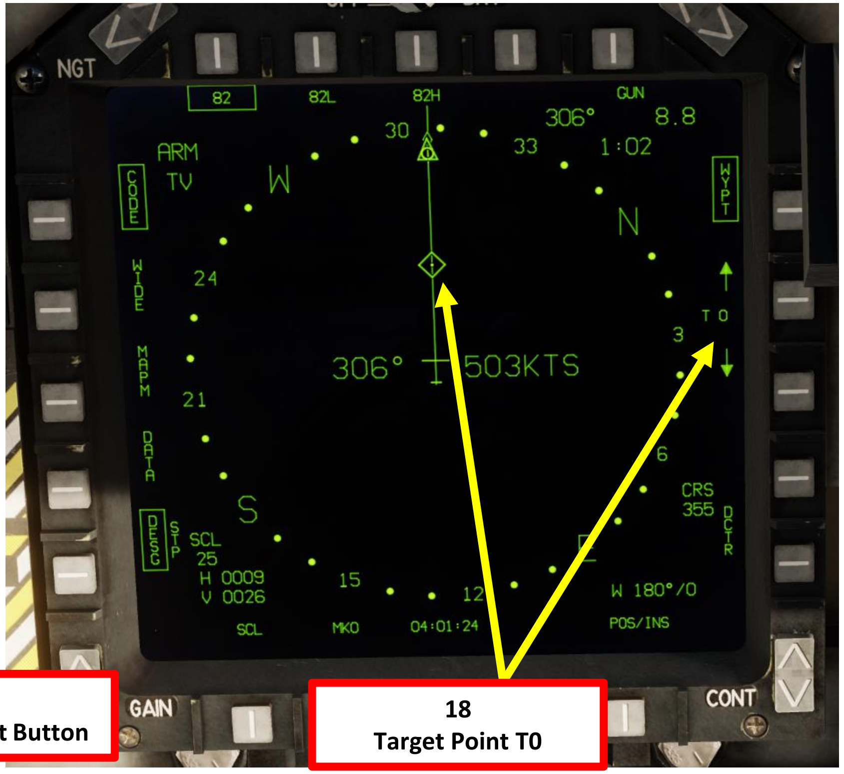
17b
DMT Slaved to
Designated Point

17a
TDC (Target Designation Control)

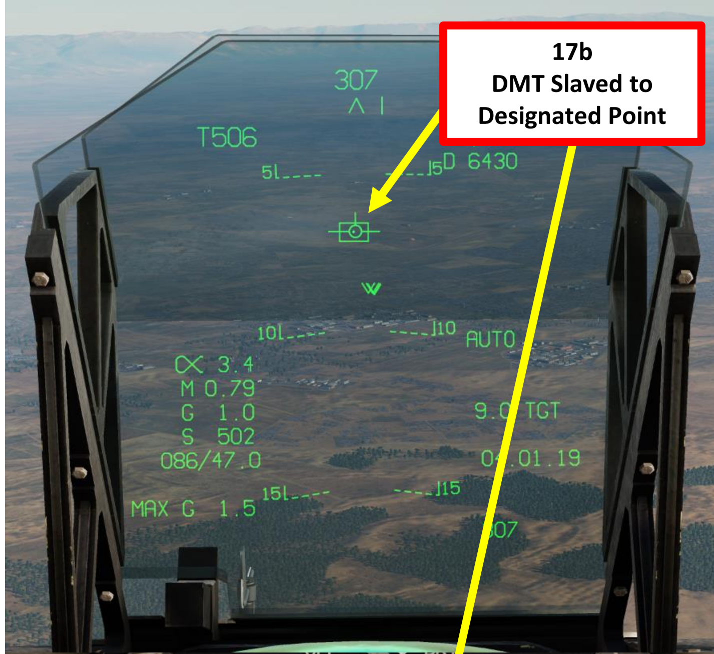
18
WP Increment Button



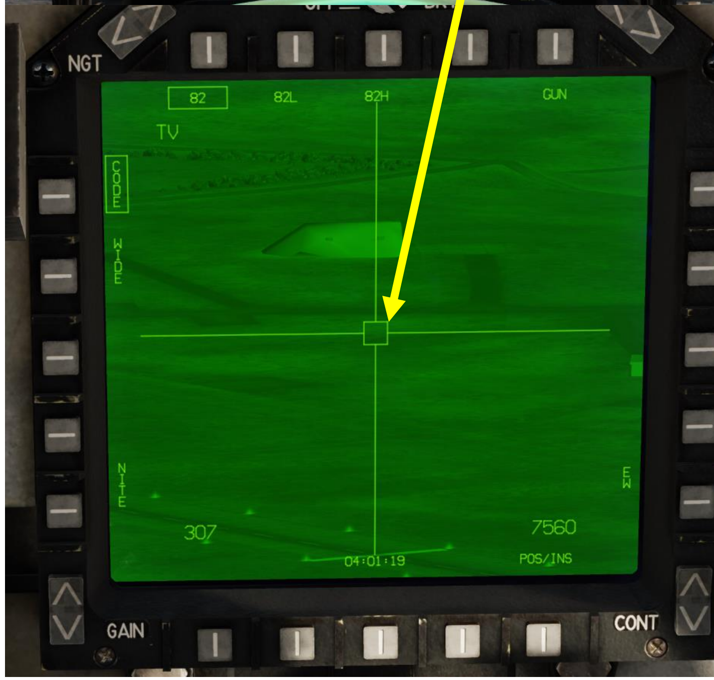
16
DMT Slaved to
Flight Path Vector



18
Target Point T0

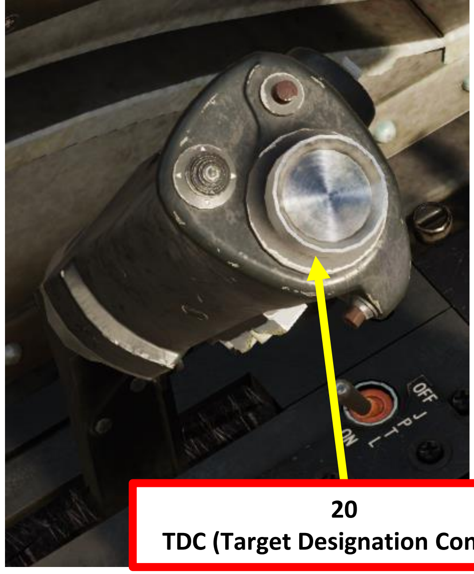


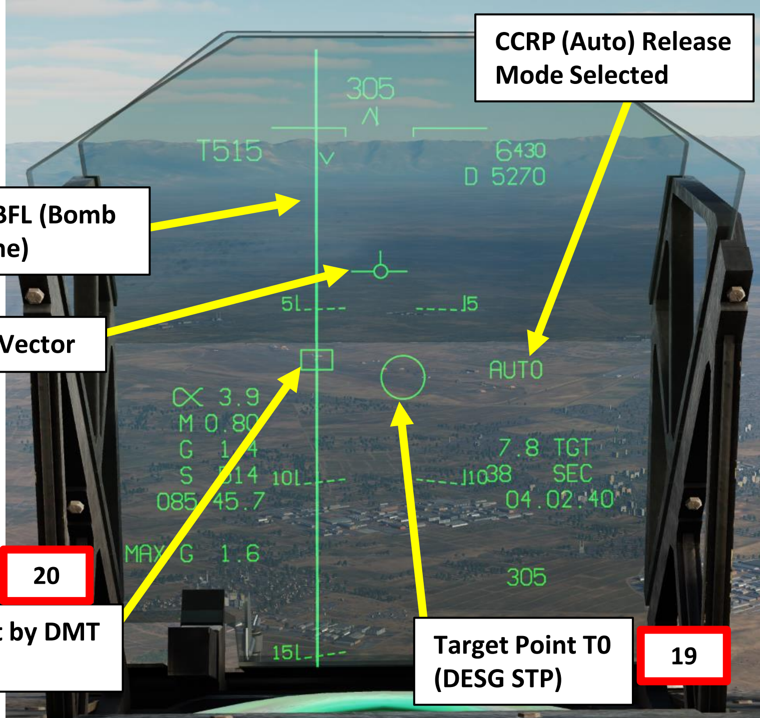
17b
DMT Slaved to
Designated Point

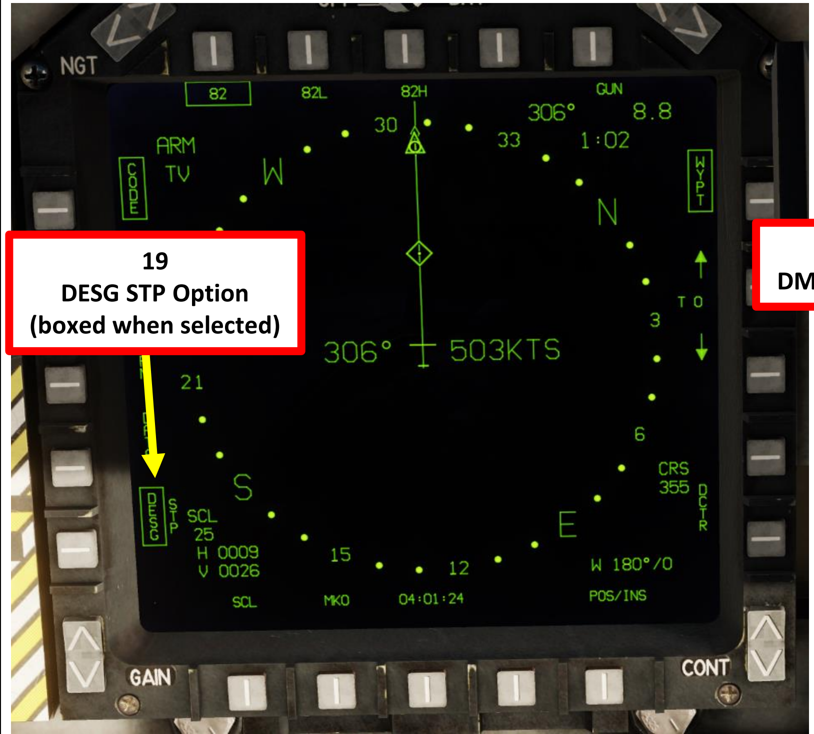


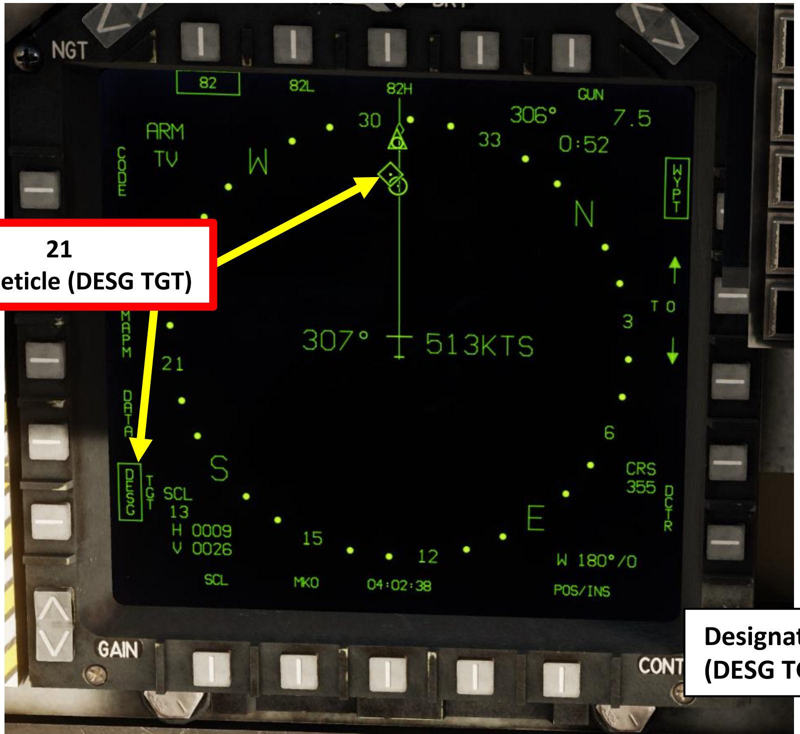
2.1 - UNGUIDED BOMBS
2.1.3 - MK82 (CCRP/Auto Release - DMT)

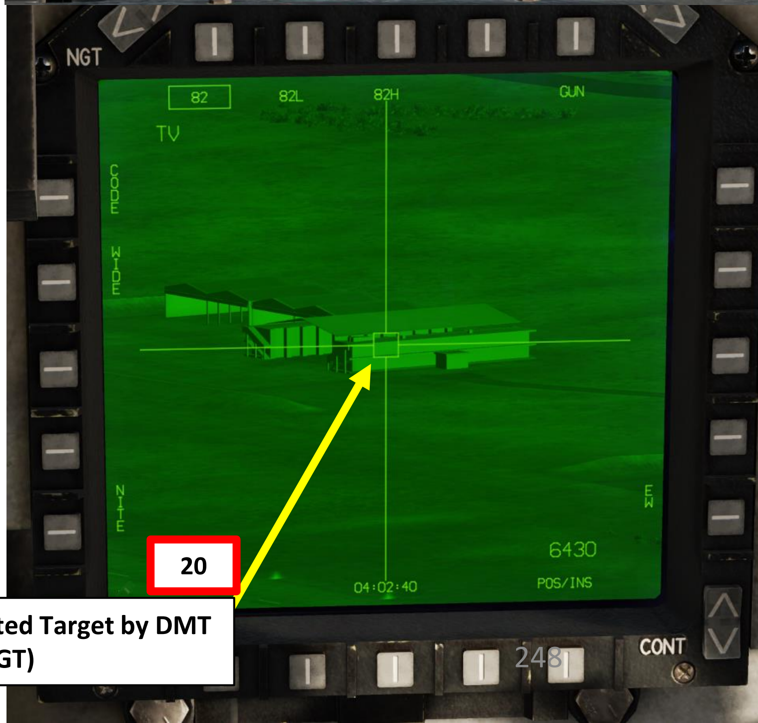
19. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
20. Once target is designated, you can slew the DMT with TDC Left/Right/Fwd/Aft controls for DMT reticle adjustments.
21. On the EHSD, the DESG mode will switch from DESG STP (Steerpoint) to DESG TGT (Target).
    - Note: DESG TGT is set on the DMT reticle, while DESG STP is set on the Target Point T0 initially designated when pressing « TDC DOWN Action Position » button.
    - <u>**CCRP tracks the DESG TGT in priority**</u>.
    - When in DESG TGT designation mode, pressing « TDC DOWN Action Position » button will reset the Target Point (T0) location to the DESG TGT. Designation Mode will then switch to DESG STP since both designation modes point at the same location.





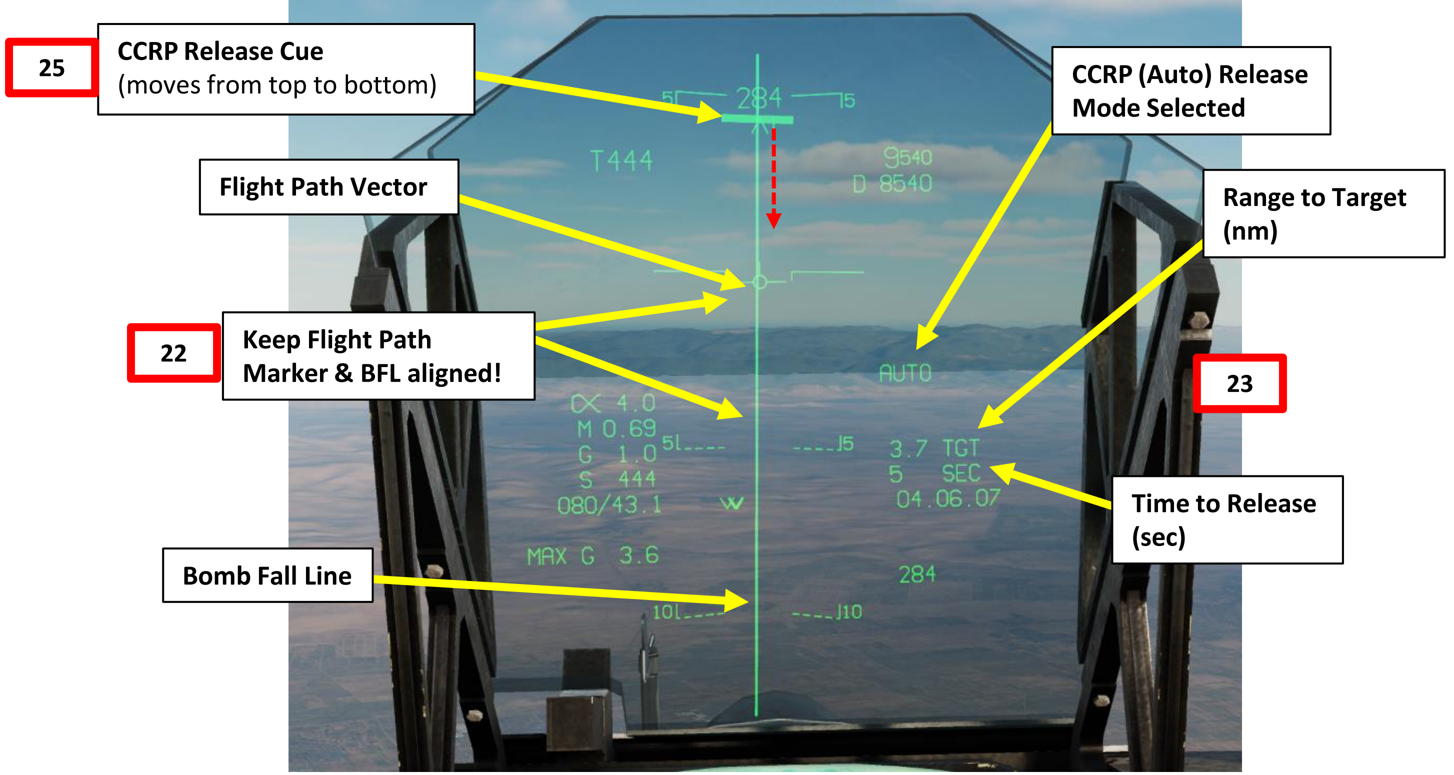


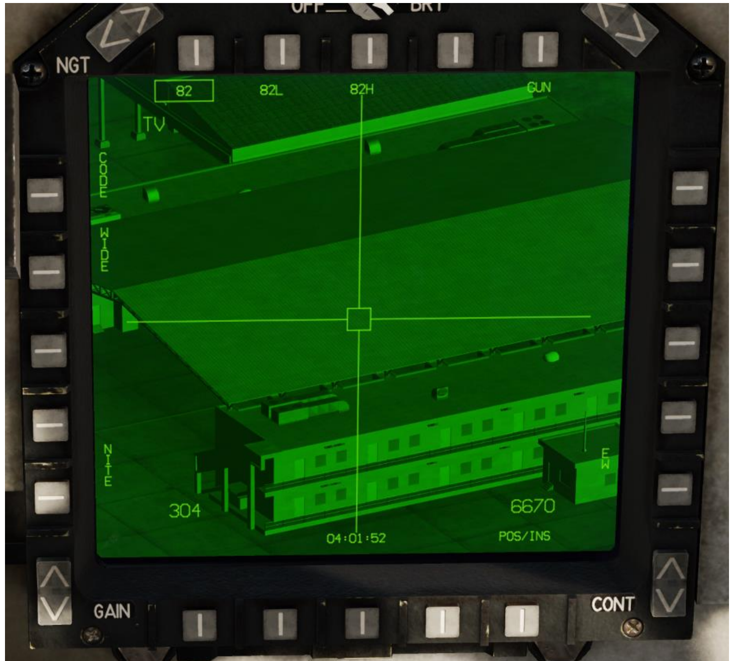




2.1 - UNGUIDED BOMBS
2.1.3 - MK82 (CCRP/Auto Release - DMT)

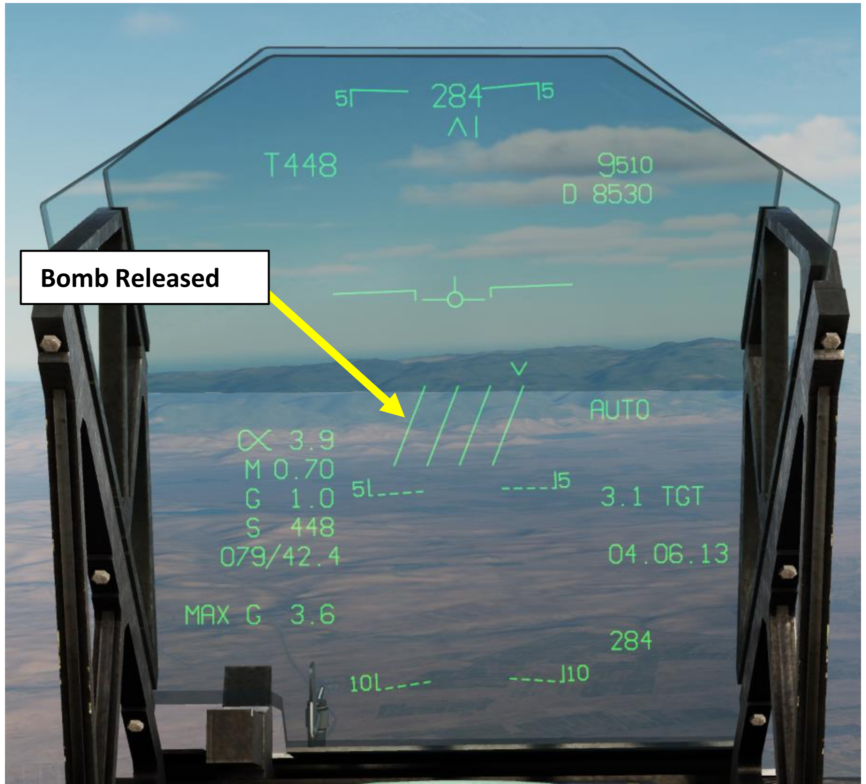
22. Fly level and manoeuver to align the vertical Bomb Fall Line with your flight path vector as much as possible.
23. The time to release and target range are indicated on the HUD.
24. When time is about 5 seconds before release, hold down the Bomb Pickle button (RALT+SPACE).
25. As you fly over Release Point cue (will be indicated by a green horizontal line descending from top to bottom), your bombs will drop automatically provided that you are holding the Bomb Pickle button.





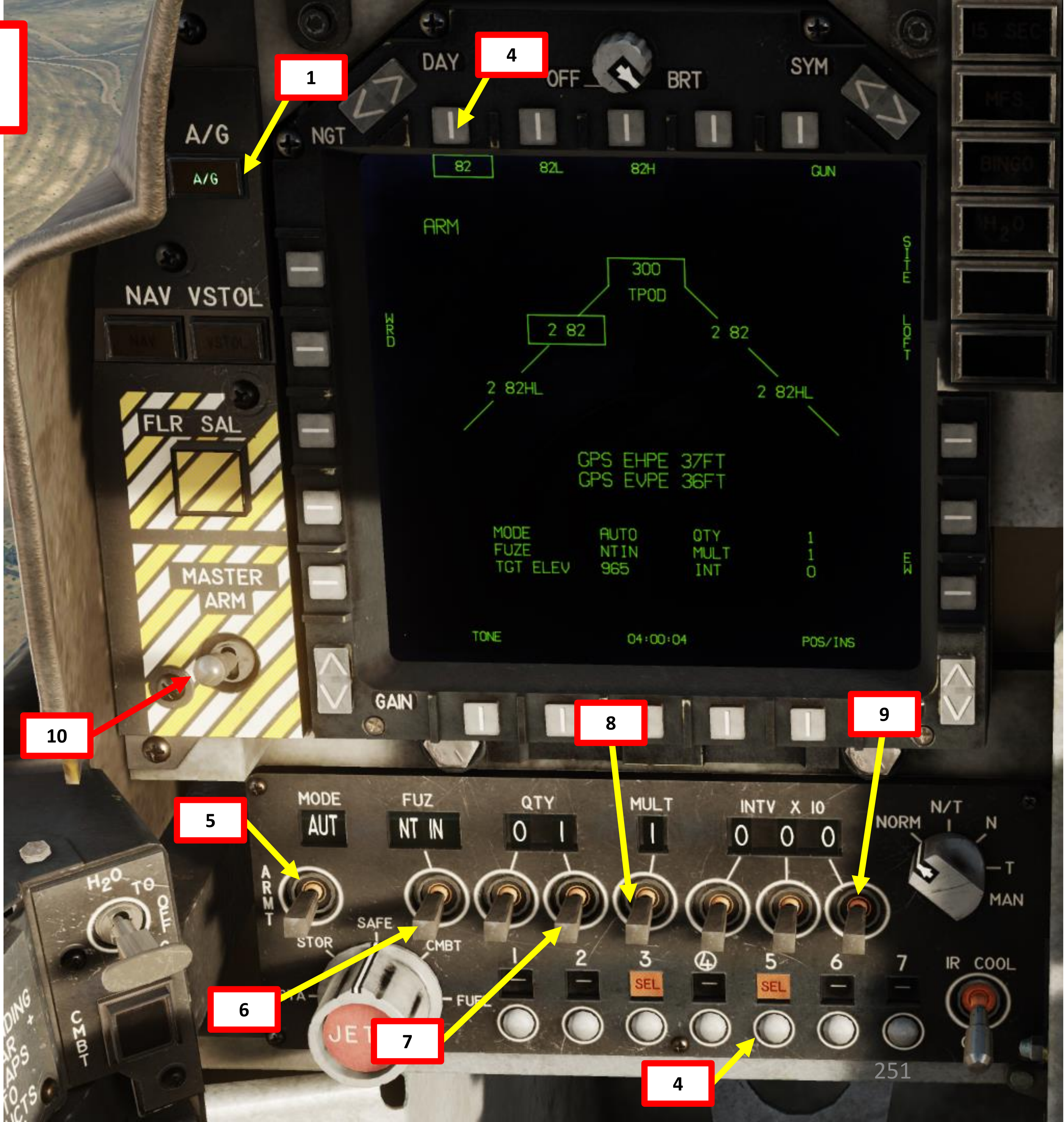
2.1 - UNGUIDED BOMBS
2.1.3 - MK82 (CCRP/Auto Release - DMT)

26. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.



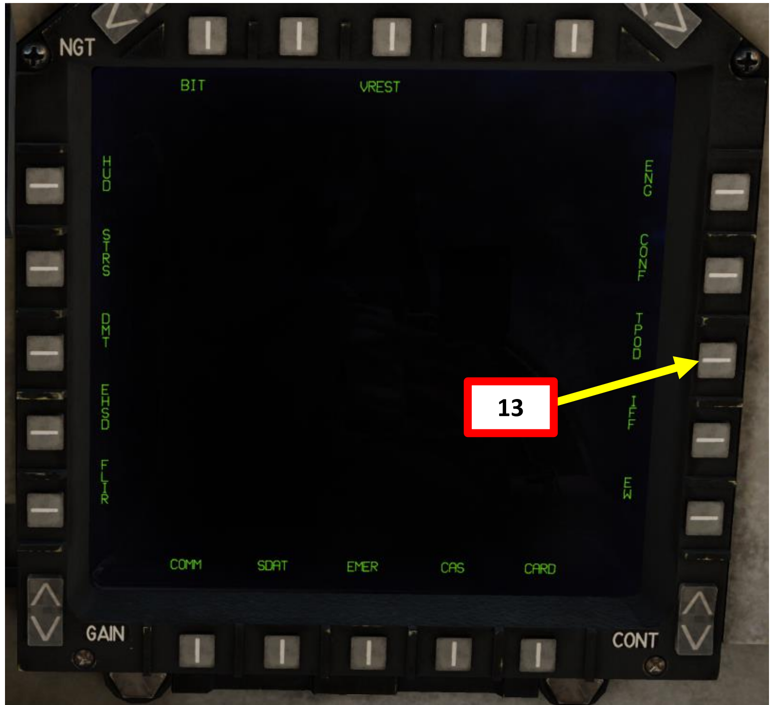
2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

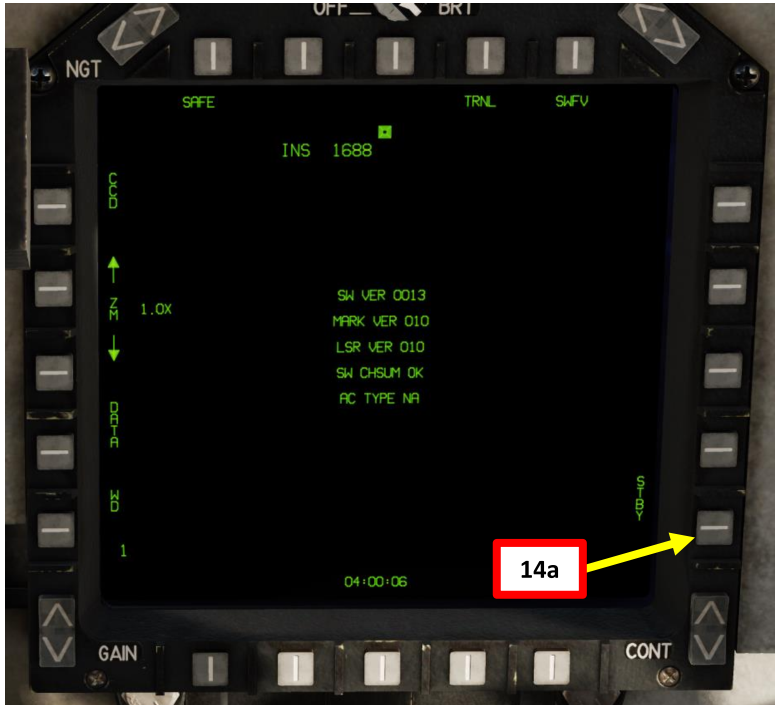
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired MK82 bombs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Select AUTO (CCRP) Armament Mode
6. Set Fuzing to desired mode (N IN for this tutorial)
7. Set desired Bomb Quantity (total bombs to be dropped)
8. Set Multiple parameter to the number of pylons used (how many pylons are used to drop the total bomb quantity.
9. Set desired Interval (distance between bombs dropped). In our case, we will choose 0.
10. Set Master Arm Switch - ON (UP)

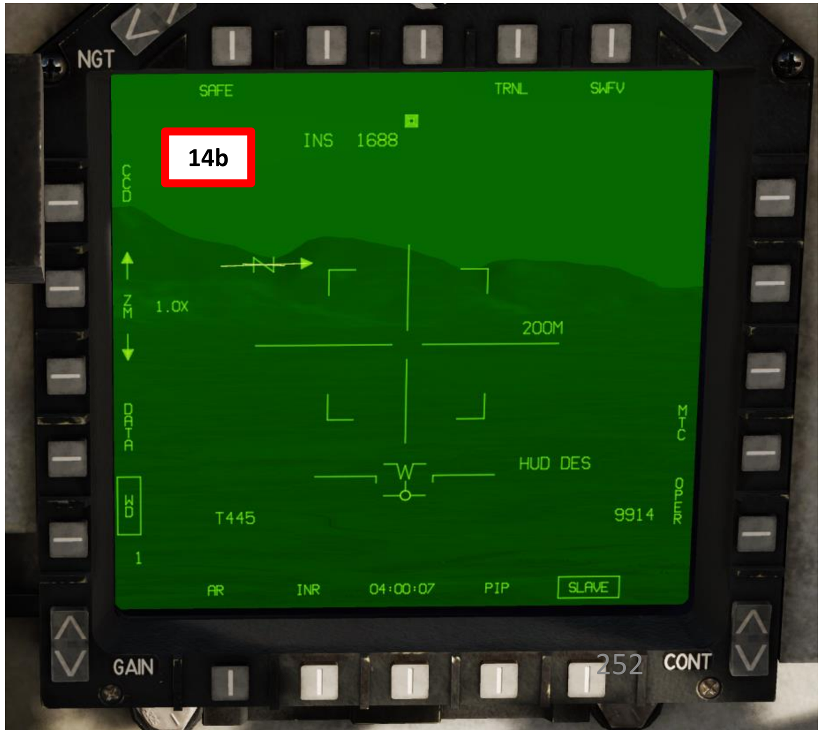


2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

11. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
12. Verify that A/G (Air-to-Ground) Master Mode is selected
13. Press the OSB next to the “TPOD” page in the main MPCD MENU
14. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).

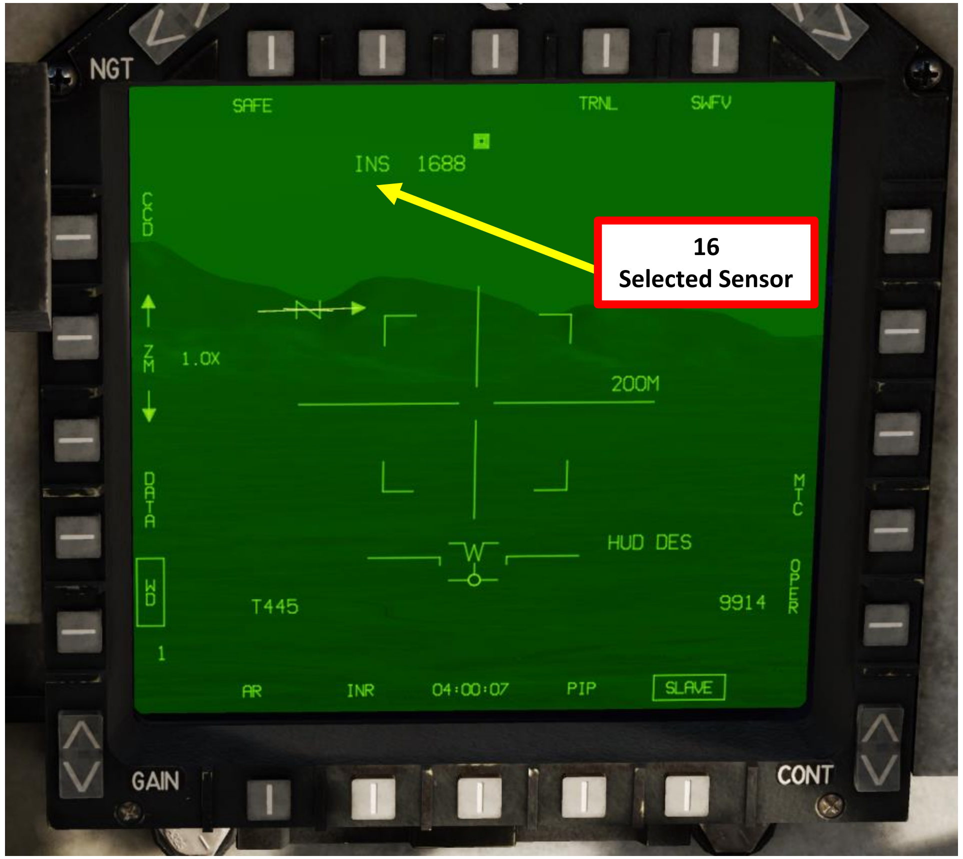


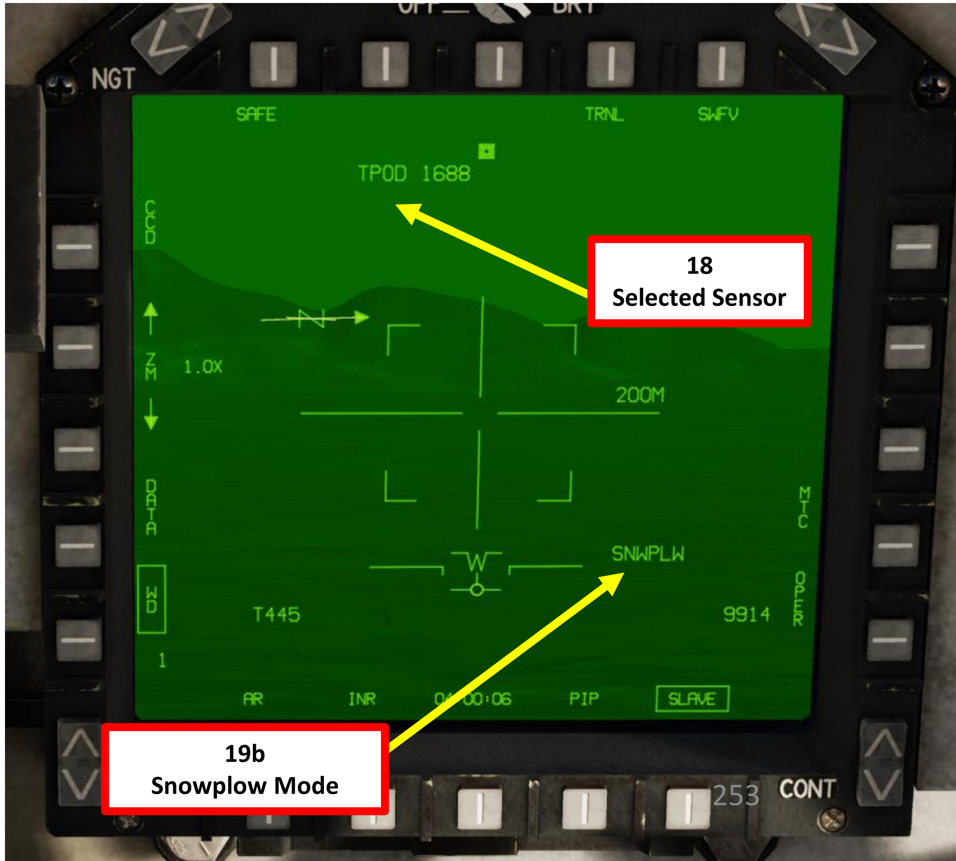




2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

15. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
16. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
17. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
18. Confirm that Sensor of Interest switches to TPOD.
19. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.

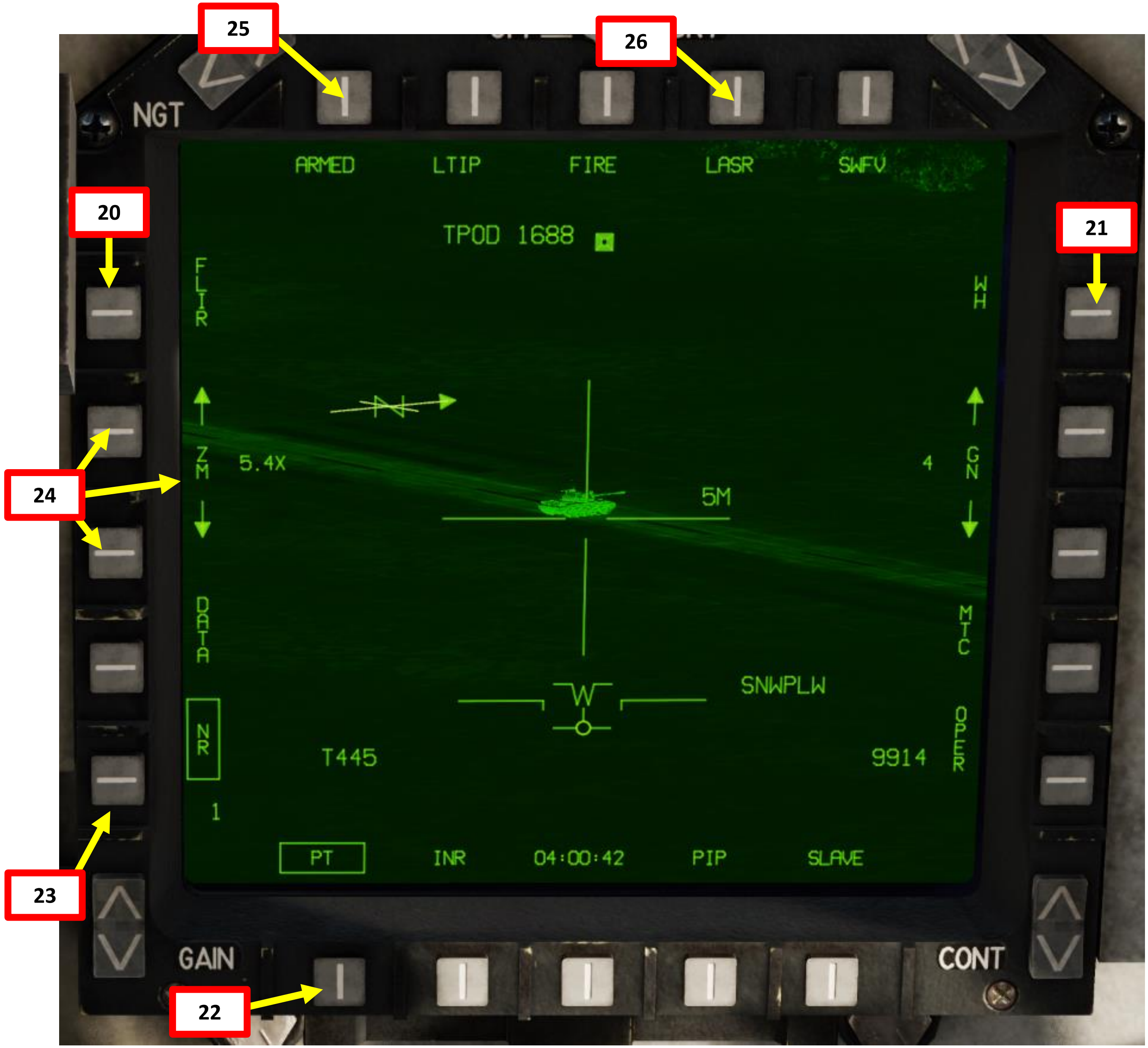




2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

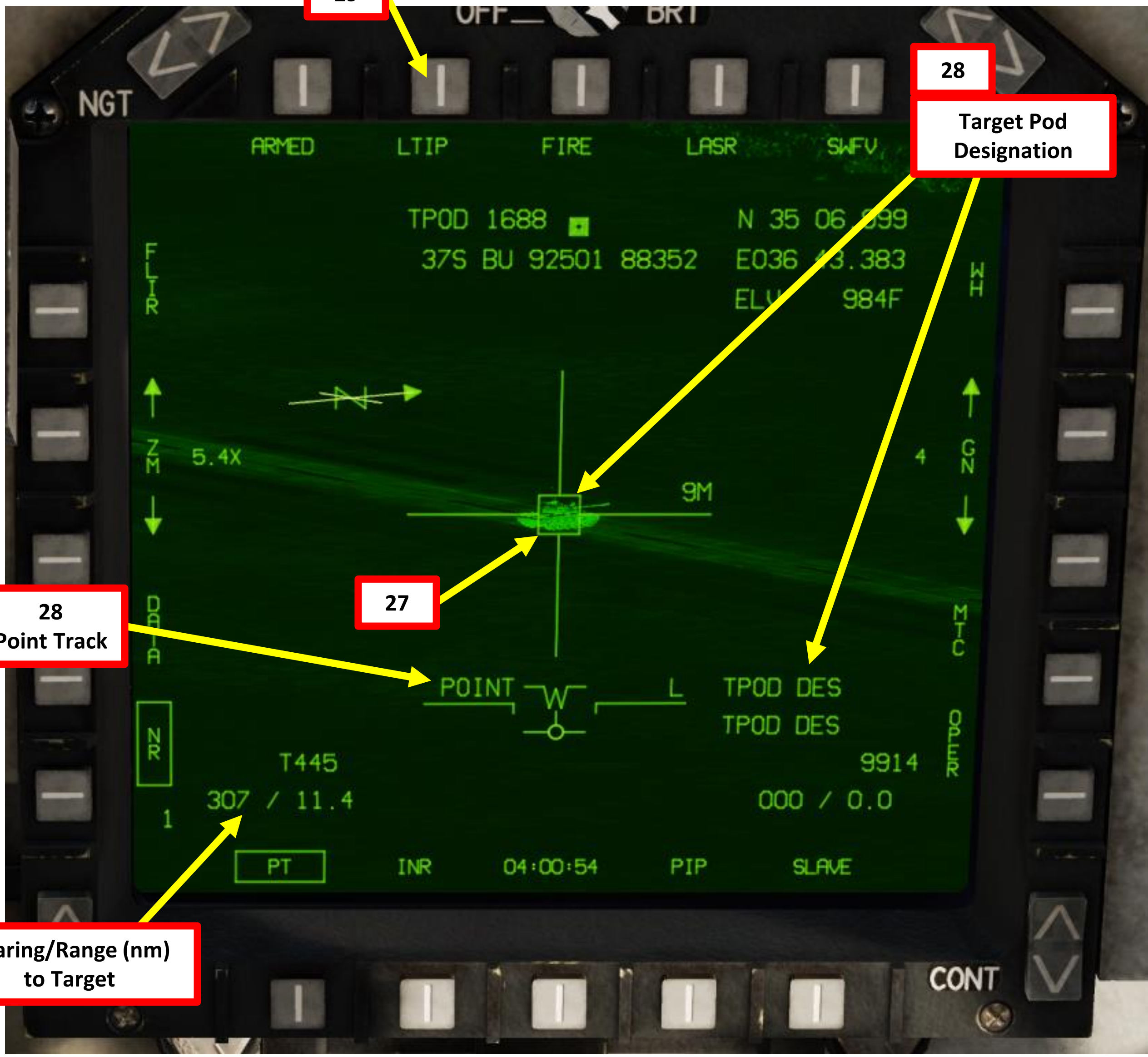
20. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
21. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
22. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
23. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
24. Select desired zoom level by using the ZM +/- OSBs.
25. Press Laser Arming OSB to select ARMED mode.
26. Press Laser Mode OSB to select LASR (Laser Designator) Mode.

20
21
22
23
Sensor Select Switch (SSS)



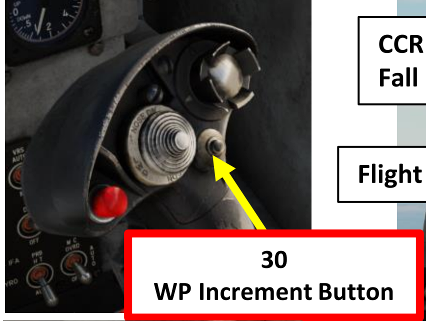
2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

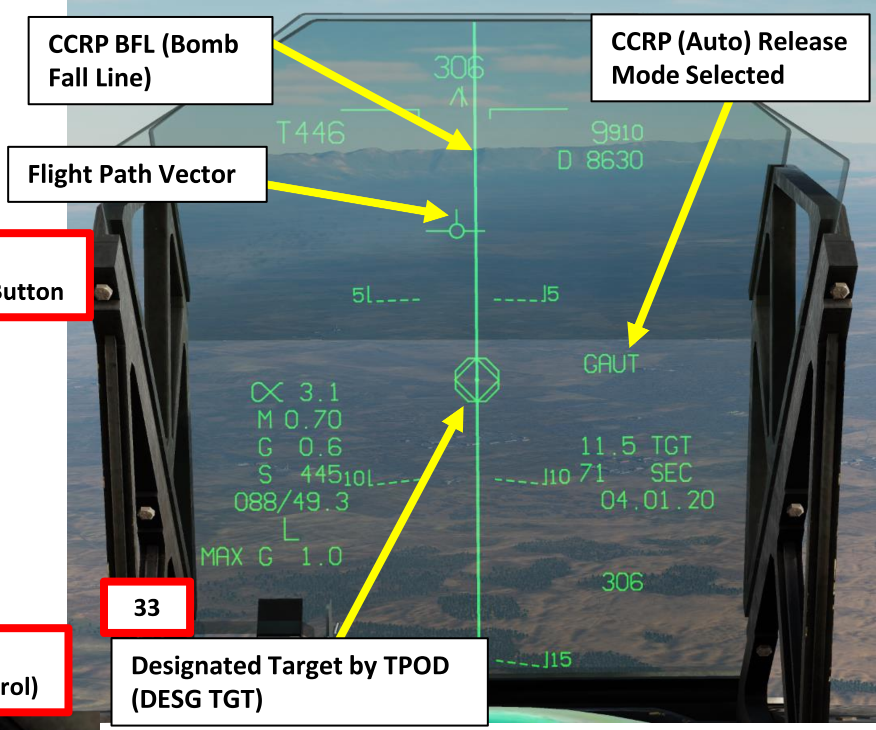
27. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
28. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
29. If you want to have a laser ranging update, make sure you have a valid laser code and press the OSB next to LTIP (Laser Target Imaging Profile) or press Sensor Select Switch FWD SHORT. This step is optional.

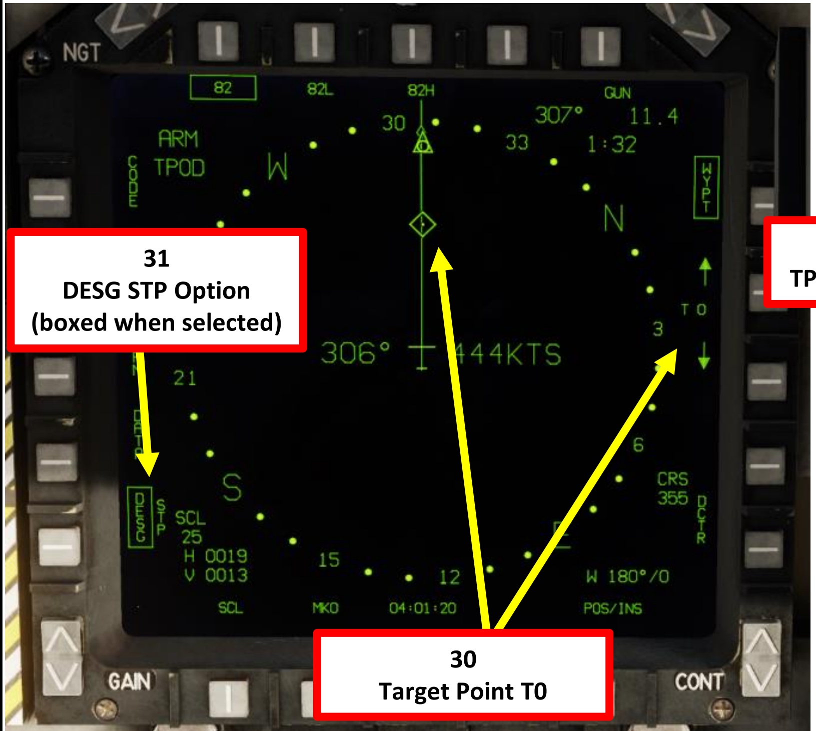


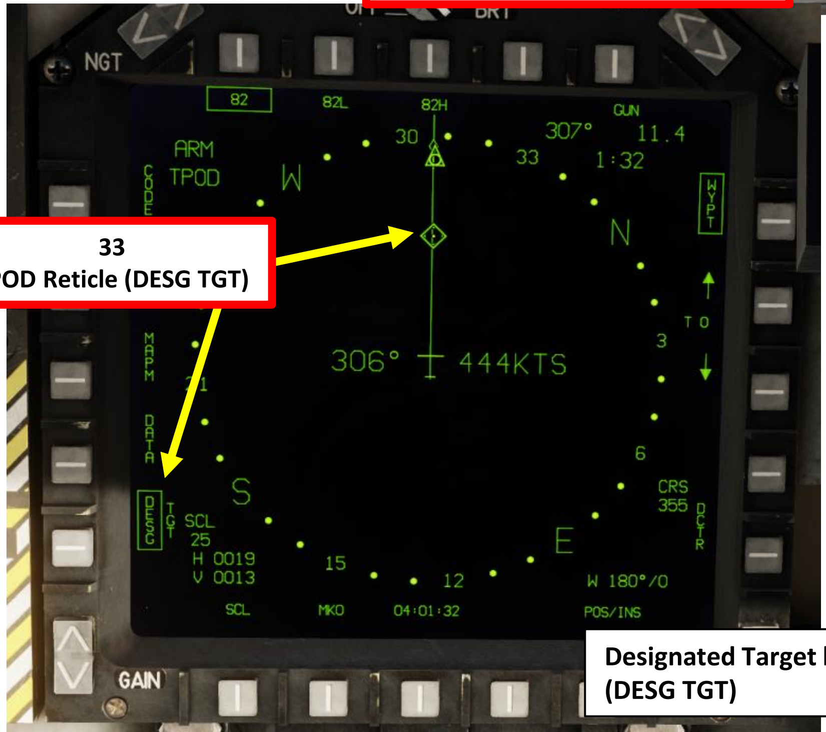
2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

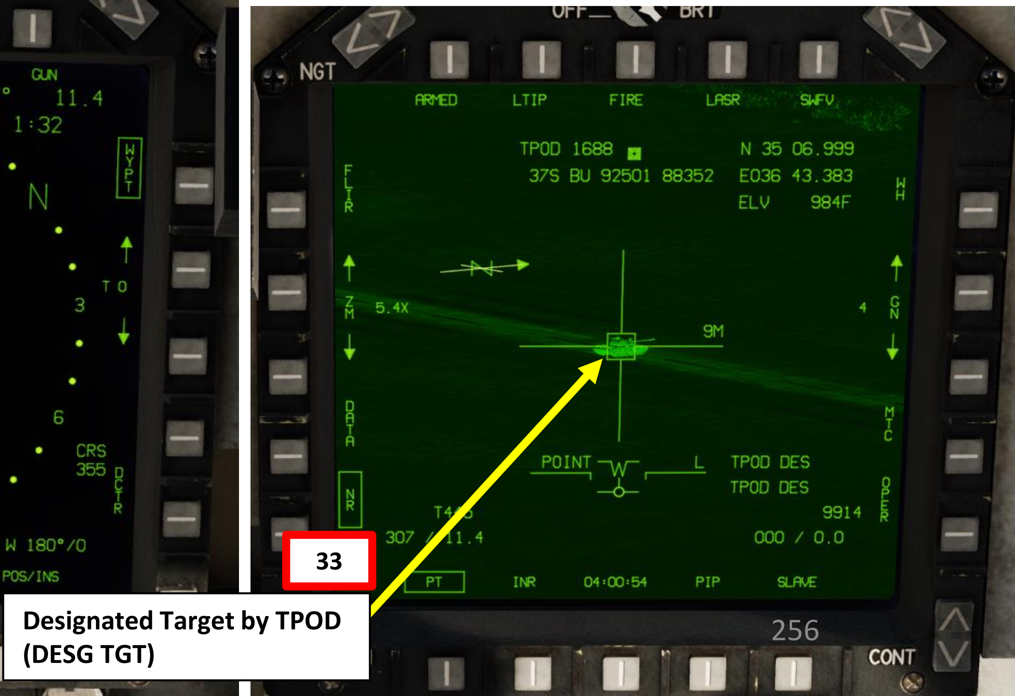
30. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0.
31. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
32. Once target is designated, you can re-slew the TPOD with TDC Left/Right/Fwd/Aft controls for targeting pod reticle adjustments.
33. On the EHSD, the DESG mode will switch from DESG STP (Steerpoint) to DESG TGT (Target).
    - Note: DESG TGT is set on the TPOD reticle, while DESG STP is set on the Target Point T0 initially designated when pressing « TDC DOWN Action Position » button.
    - **<u>CCRP tracks the DESG TGT in priority</u>**.
    - When in DESG TGT designation mode, pressing « TDC DOWN Action Position » button will reset the Target Point (T0) location to the DESG TGT. Designation Mode will then switch to DESG STP since both designation modes point at the same location.





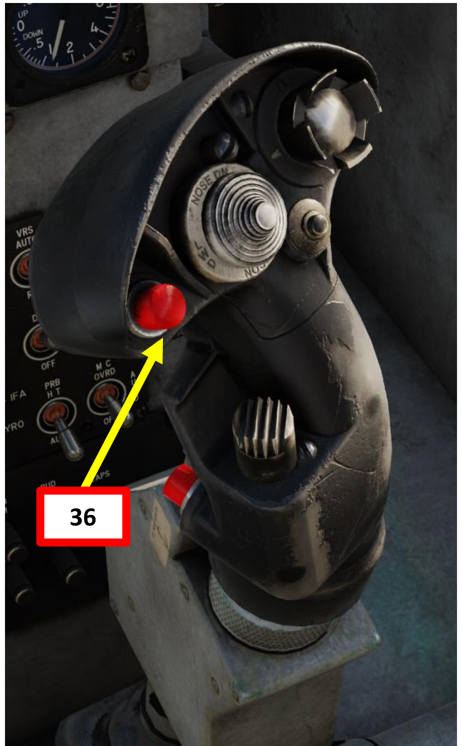


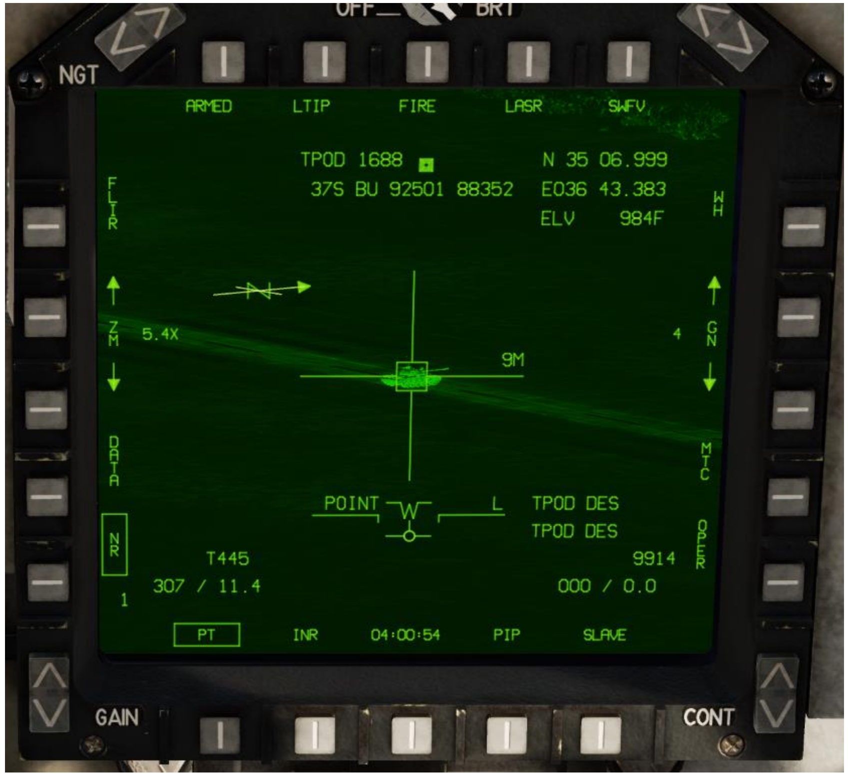


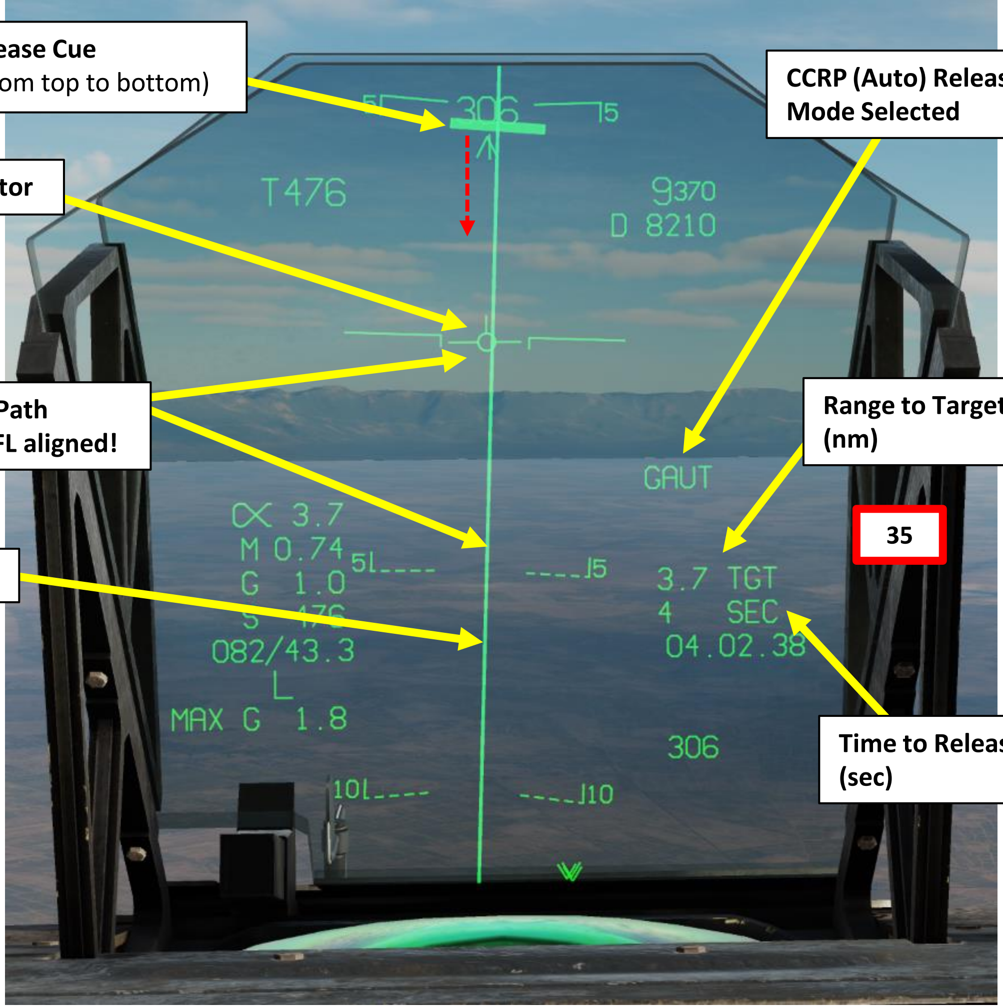


2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

34. Fly level and manoeuver to align the vertical Bomb Fall Line with your flight path vector as much as possible.
35. The time to release and target range are indicated on the HUD.
36. When time is about 5 seconds before release, hold down the Bomb Pickle button (RALT+SPACE).
37. As you fly over Release Point cue (will be indicated by a green horizontal line descending from top to bottom), your bombs will drop automatically provided that you are holding the Bomb Pickle button.

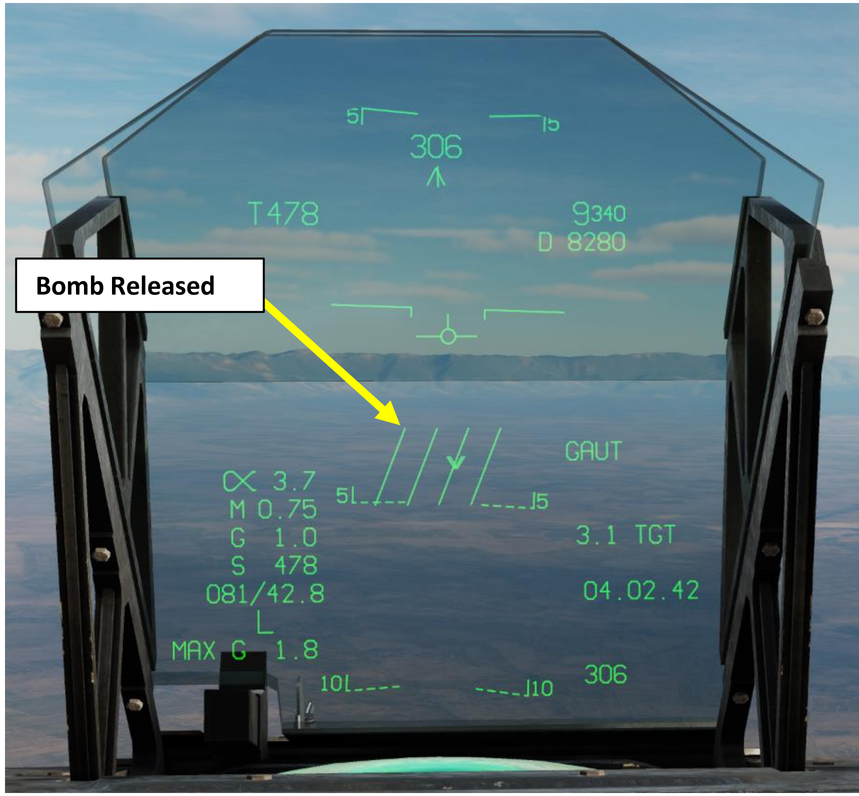






2.1 - UNGUIDED BOMBS
2.1.4 - MK82 (CCRP/Auto Release - Targeting Pod)

38. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.

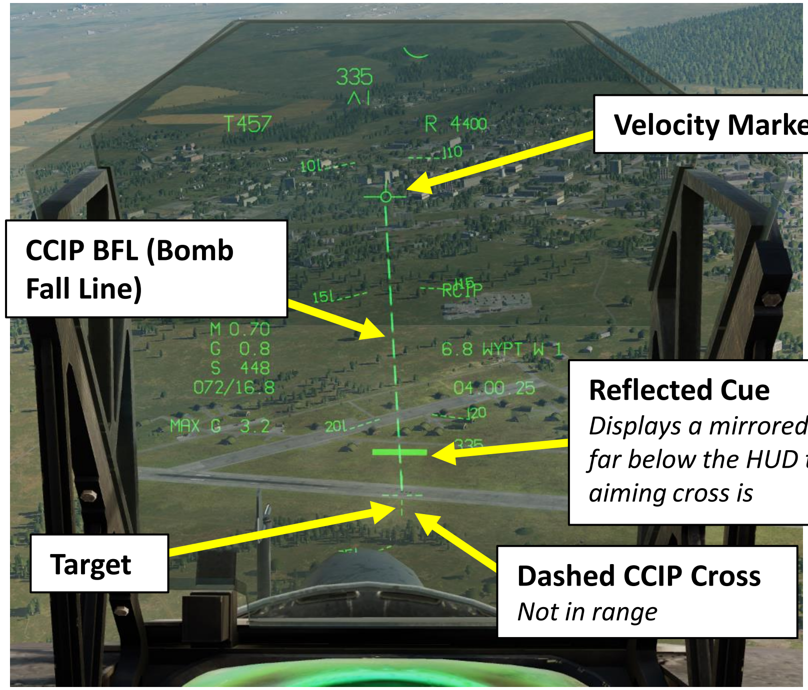


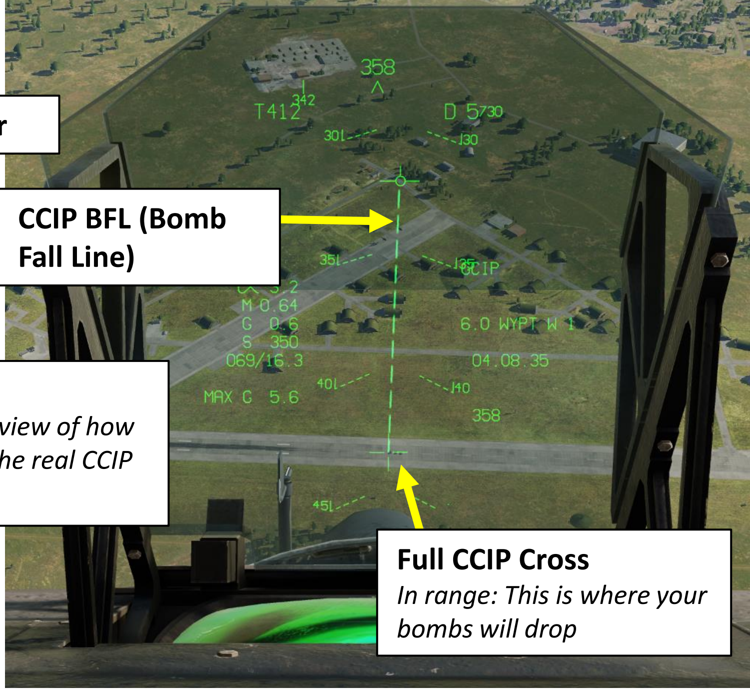
2.1 - UNGUIDED BOMBS
2.1.5 – MK20 Rockeyes (CCIP Release)

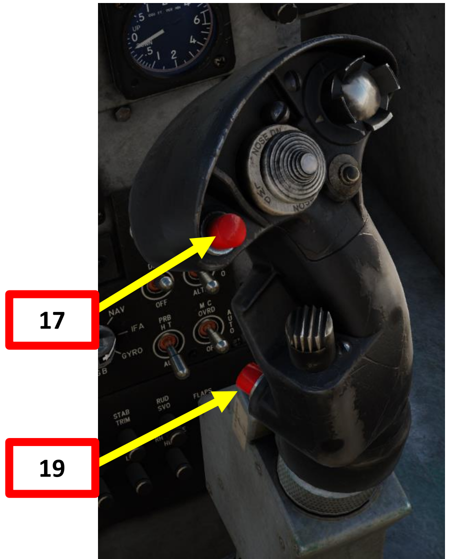
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired MK20 rockeye cluster bombs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Select CIP (CCIP) Armament Mode
6. Set Fuzing to desired mode (OP for this tutorial)
    - PR: Primary setting, 1.2 sec delay between weapon release and canister burst to release cluster munitions
    - OP: Option setting, 4 sec delay between weapon release and canister burst to release cluster munitions
7. Set desired Bomb Quantity (total bombs to be dropped)
8. Set Multiple parameter to the number of pylons used (how many pylons are used to drop the total bomb quantity; we will use 8).
9. Set desired Interval (distance between bombs dropped in ft). In order to be able to set an interval, Bomb Quantity needs to be greater than the Multiple parameters. We will set Interval at “4” (40 ft).
10. Set Master Arm Switch - ON (UP)
11. Press the ALT button on the UFC and verify that Radar Altimeter is ON, BOMB and GPS options are selected.
12. Select the PUC (Pull-Up Cue. « : » when selected), set desired altitude (2000 ft in our case), then press ENT on the UFC.
13. Set HUD Altitude Selector to RDR (Radar Altimeter)

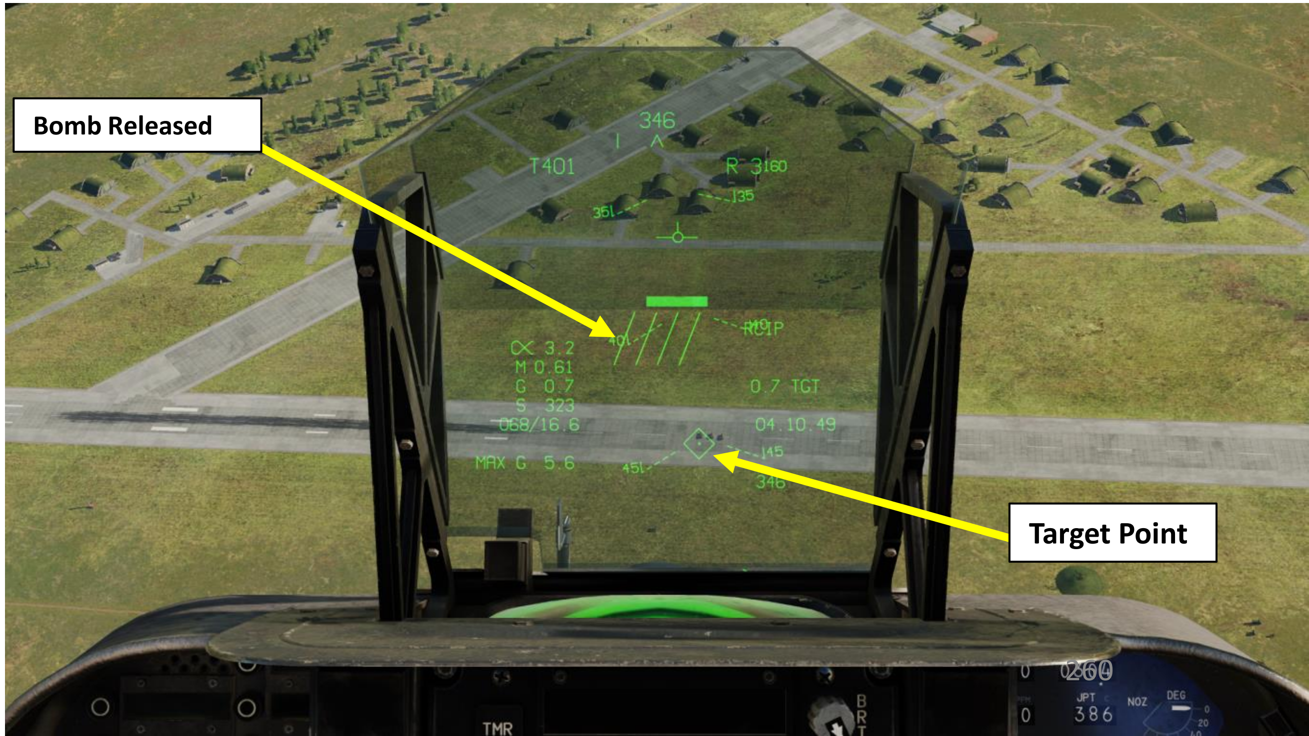
2.1 - UNGUIDED BOMBS
2.1.5 – MK20 Rockeyes (CCIP Release)

14. Perform a 45 degree dive on the target and fly to align the vertical CCIP line with the target.
15. At first, the CCIP cross will be dashed: this means your aircraft is not yet stabilized and ready to drop its bombs.
16. When CCIP cross becomes a solid cross, you can drop your bombs when the CCIP cross is aligned on your target.
17. Press the Bomb Pickle button (RALT+SPACE) to drop your bombs
18. A Target Point (T0) will automatically be created once bombs are dropped.
19. To remove Target Point Desigation, press the « AG Target Undesignate/NWS/FOV Toggle » button.









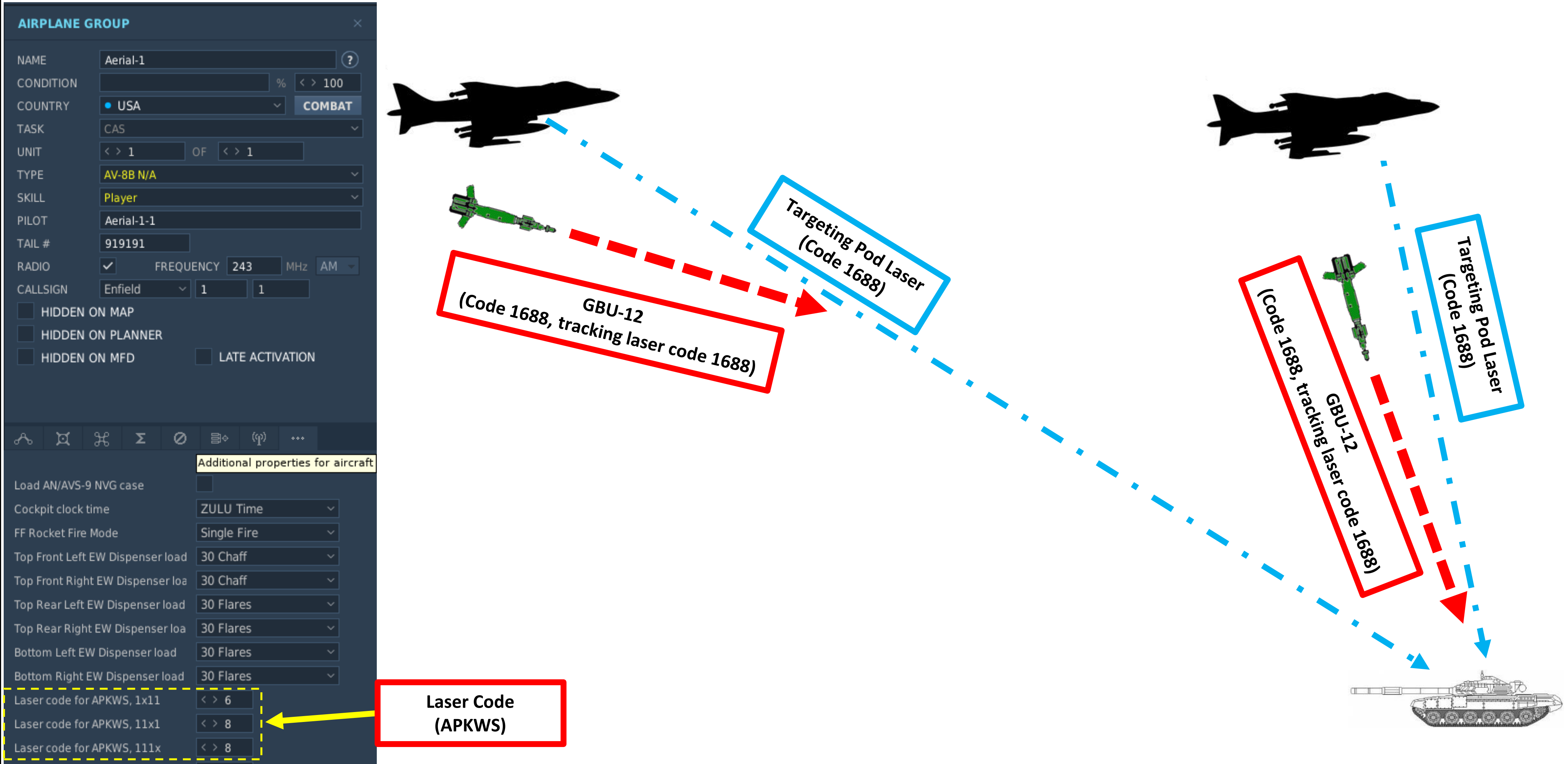
2.1 - UNGUIDED BOMBS
2.1.5 – MK20 Rockeyes (CCIP Release)

2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

The GBU-12 Paveway II is the laser-guided version of the Mk-82 unguided, general purpose bomb. The GBU-12 guides using the same principles as the GBU-10, the only difference being the bomb the LGB is based on. The seeker head on each laser guided bomb is set to track only a specific laser pulse rate frequency (PRF) code. These are manually set by the weapons load crew during ground operations (via Mission Editor) and may not be set from the cockpit during flight.

Currently in DCS, only the APKWS laser-guided rockets laser codes can be set by the ground crew.

- As of 2021-06-08, the GBU-12 laser code is simplified to automatically match the laser designation code of your targeting pod. This logic may change in the future.



2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

(Only applicable to APKWS as of 2021-06-08, but will be implemented later for GBU-12)

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

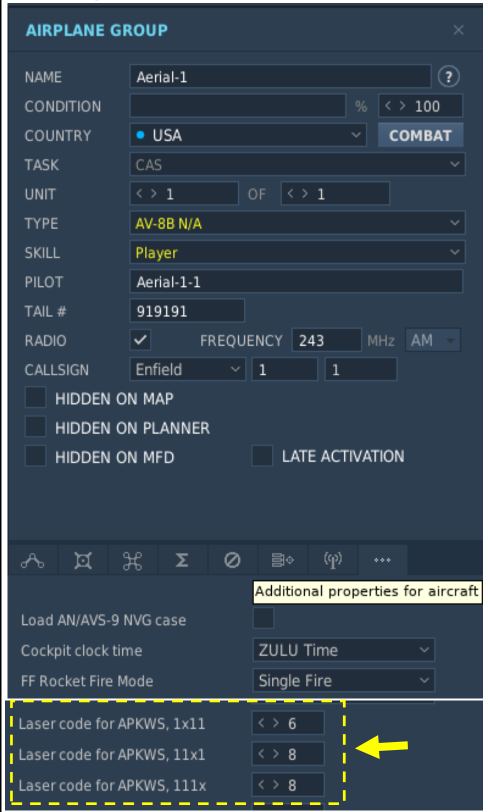
Laser-guided bomb laser codes will eventually be programmable on ground by using the following commands:

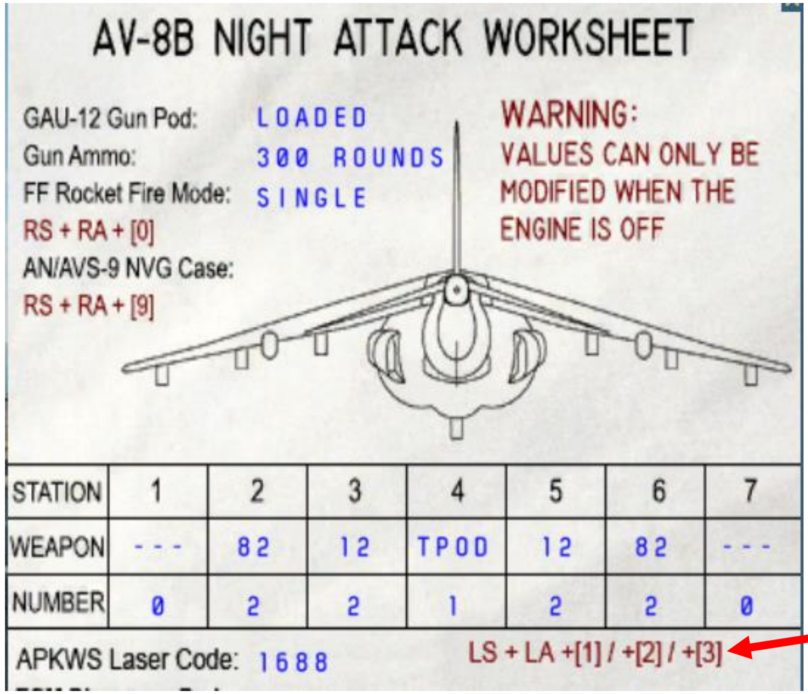
- **LSHIFT** + **LALT** + **1** : Changes Laser Code (Hundreds)
- **LSHIFT** + **LALT** + **2** : Changes Laser Code (Tens)
- **LSHIFT** + **LALT** + **3**: Changes Laser Code (Ones)

Take note that setting the bomb laser code should be done when the engine is shut down.

GBU-12 Laser Code 1688

Targeting Pod Laser Code needs to match GBU-12 Laser Code





AV-8B NIGHT ATTACK WORKSHEET

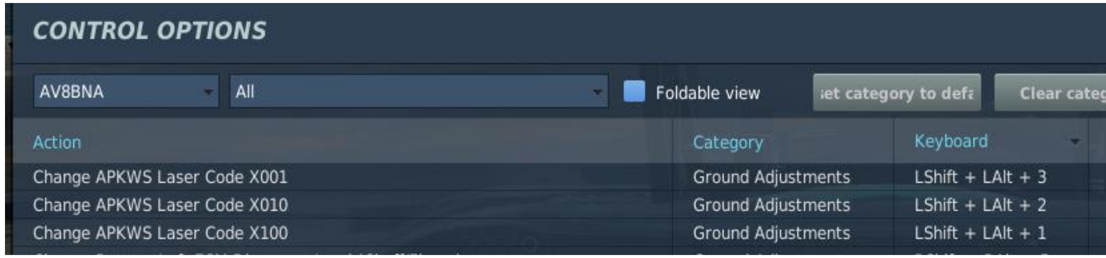
GAU-12 Gun Pod: LOADED
Gun Ammo: 300 ROUNDS
FF Rocket Fire Mode: SINGLE
RS + RA + [0]
AN/AVS-9 NVG Case:
RS + RA + [9]

WARNING:
VALUES CAN ONLY BE MODIFIED WHEN THE ENGINE IS OFF

STATION	1	2	3	4	5	6	7
WEAPON	- - -	82	12	TPOD	12	82	- - -
NUMBER	0	2	2	1	2	2	0

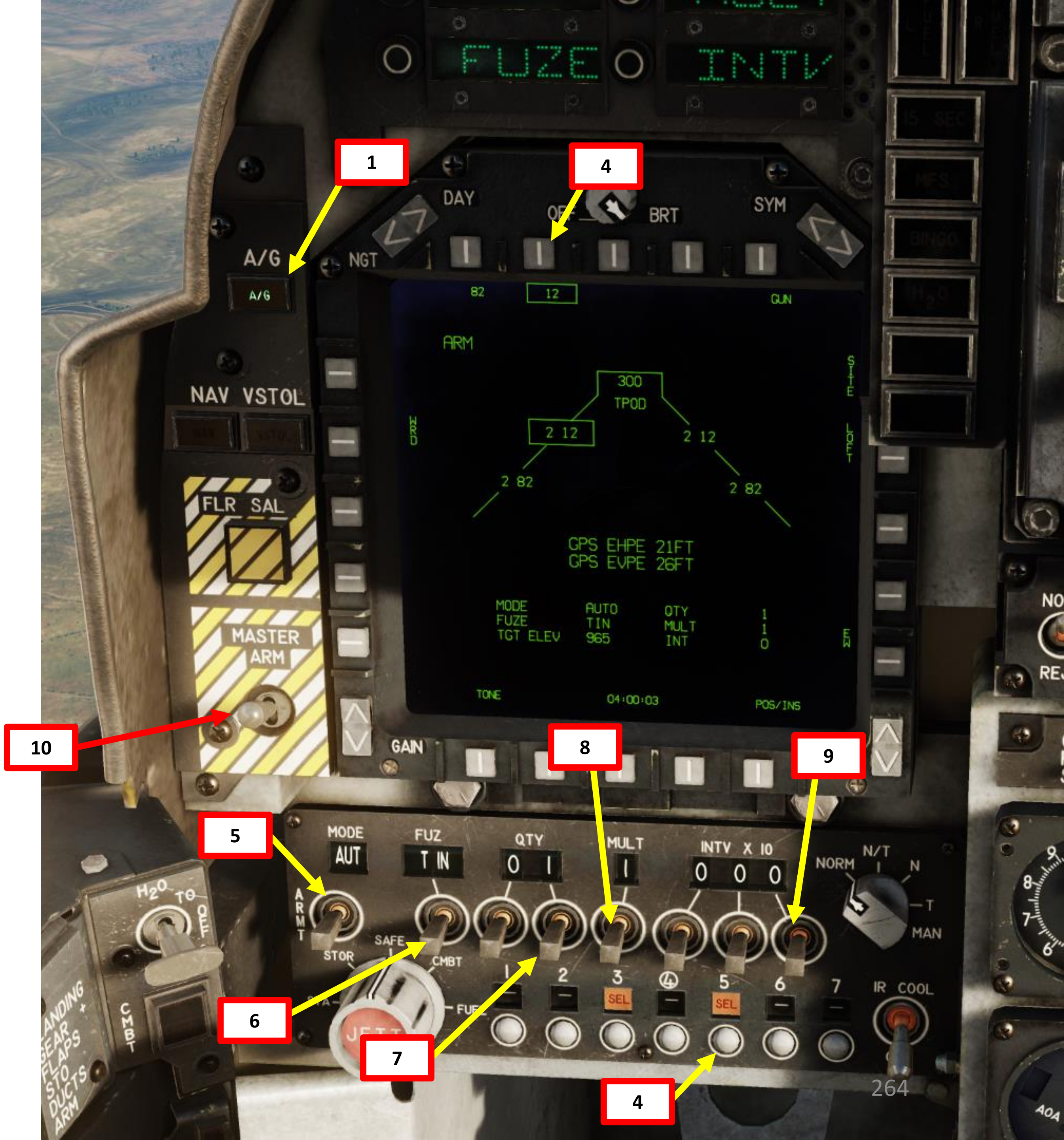
APKWS Laser Code: 1688 LS + LA +[1] / +[2] / +[3]

Laser Code (APKWS)



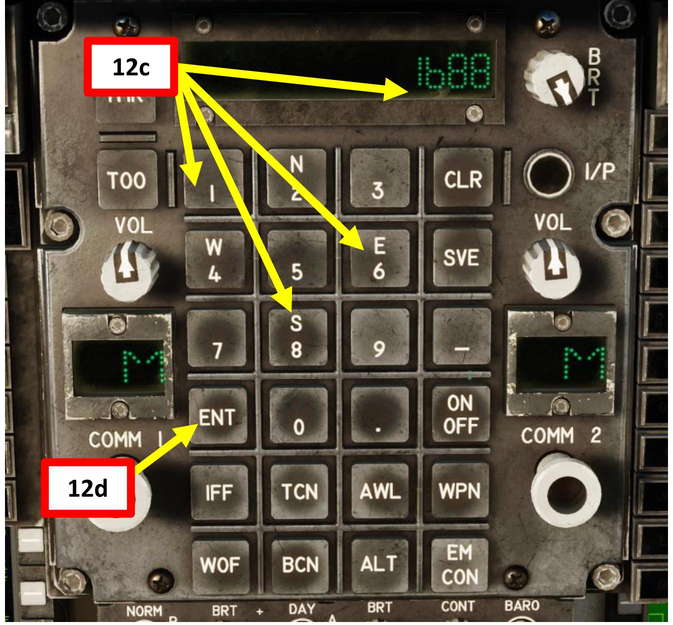
2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

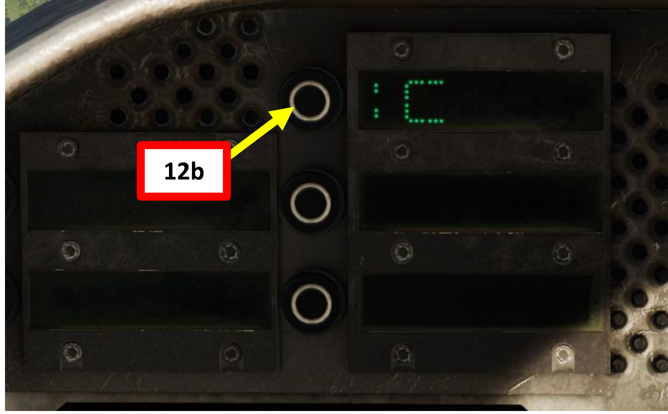
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired GBU12 bombs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Select AUTO (CCRP) Armament Mode
6. Set Fuzing to desired mode (T IN for this tutorial)
7. Set desired Bomb Quantity (total bombs to be dropped)
8. Set Multiple parameter to the number of pylons used (how many pylons are used to drop the total bomb quantity.
9. Set desired Interval (distance between bombs dropped). In our case, we will choose 0.
10. Set Master Arm Switch - ON (UP)

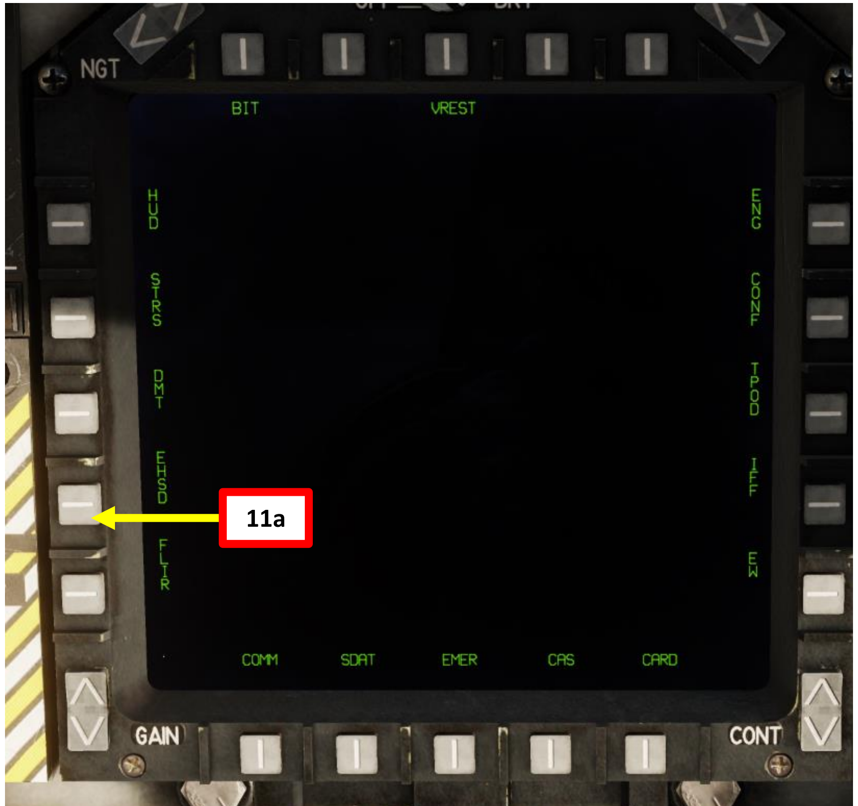


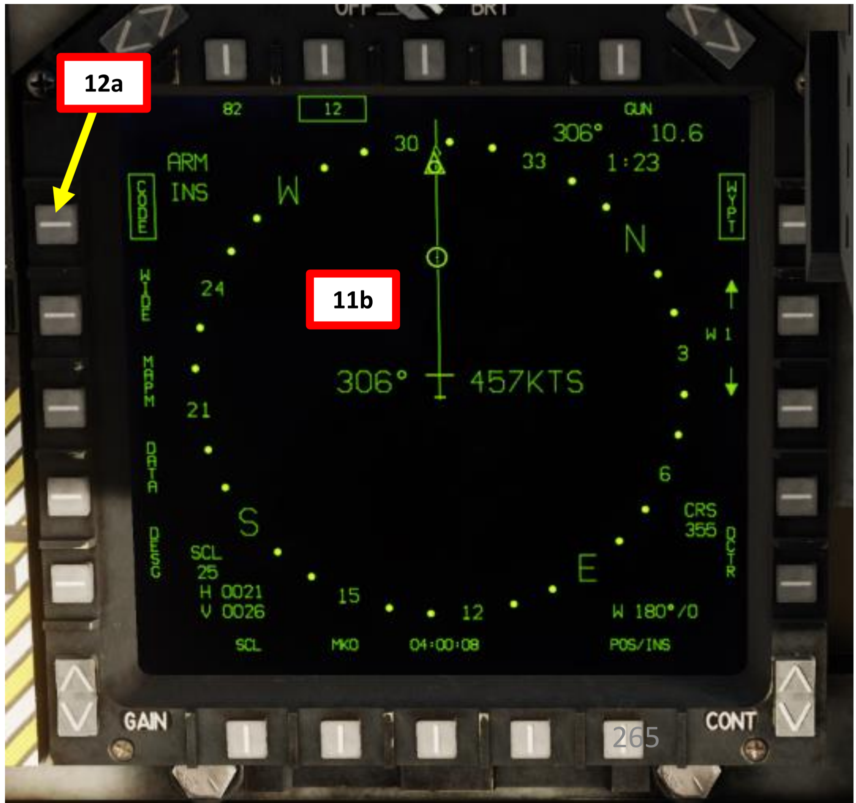
2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

11. From the main MPCD menu, select "EHSD" page. Take note that this can be achieved from the DMT page as well.
12. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT. This laser code is what the targeting pod will be lasing with while designating the target.



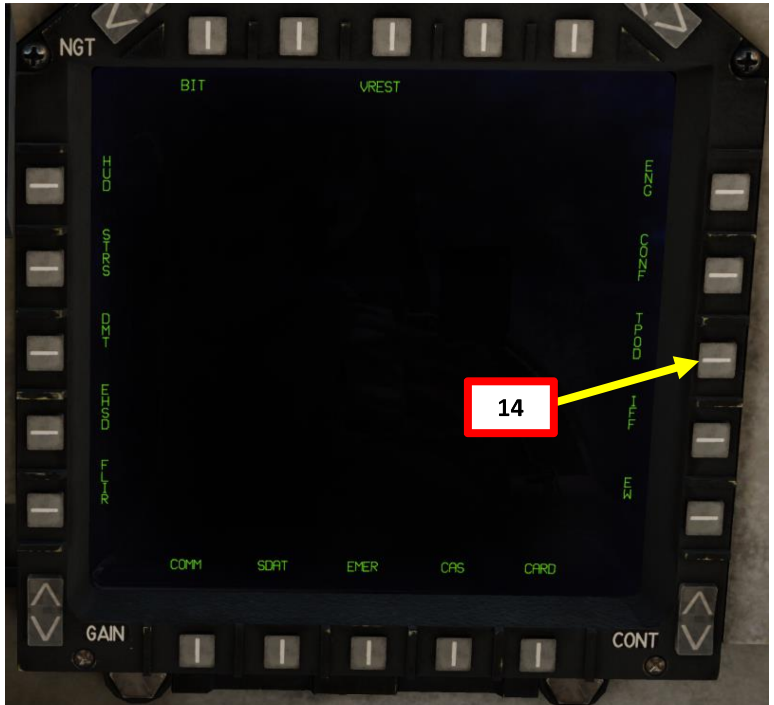


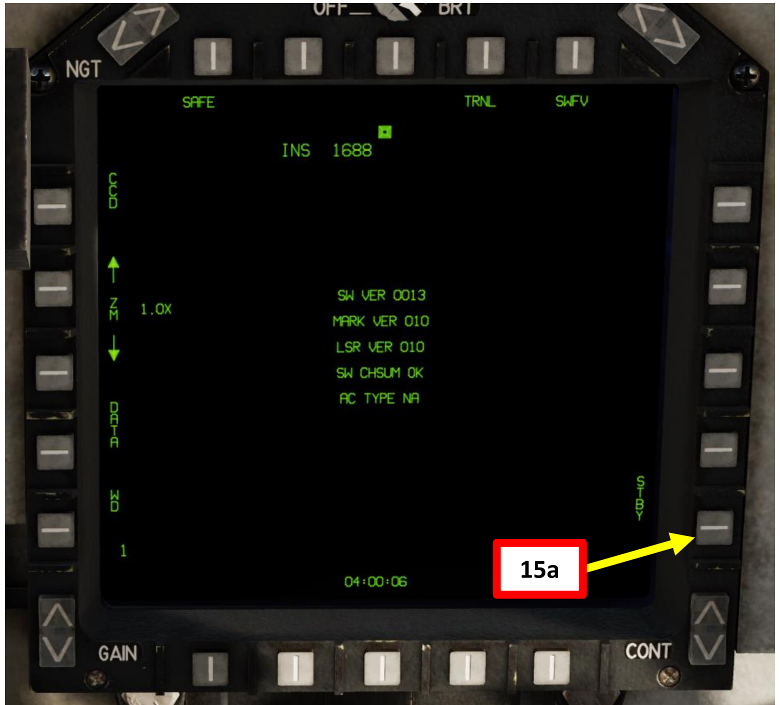


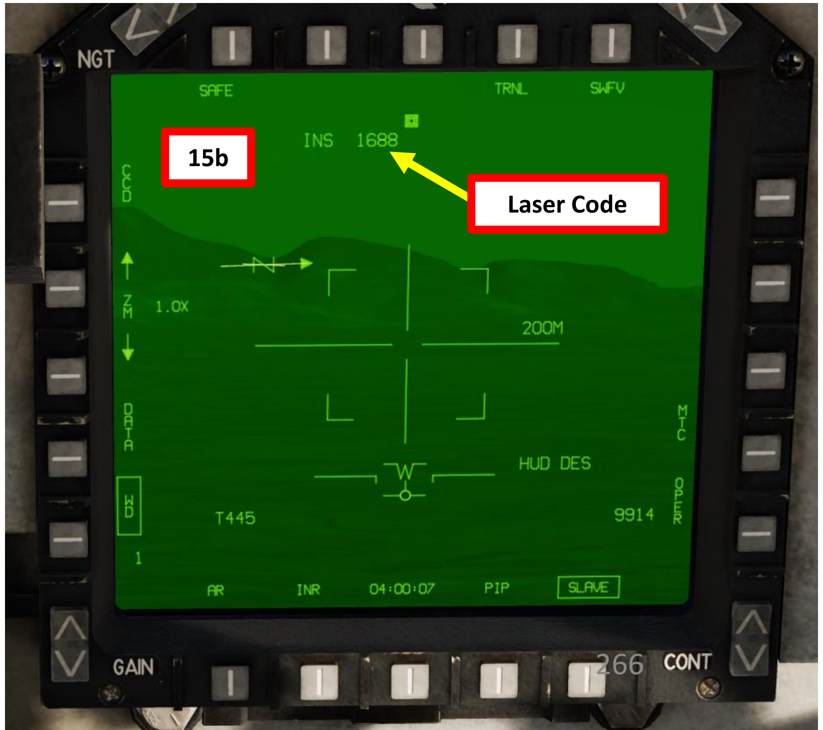


2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

13. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
14. Press the OSB next to the "TPOD" page in the main MPCD MENU
15. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).

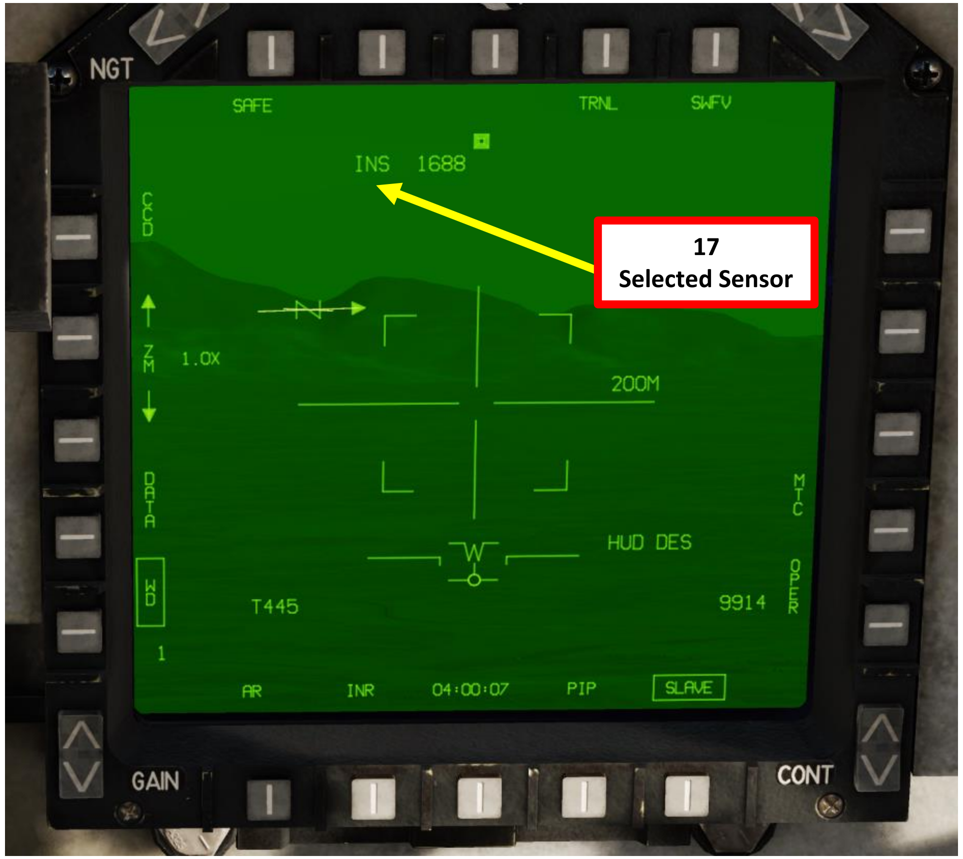


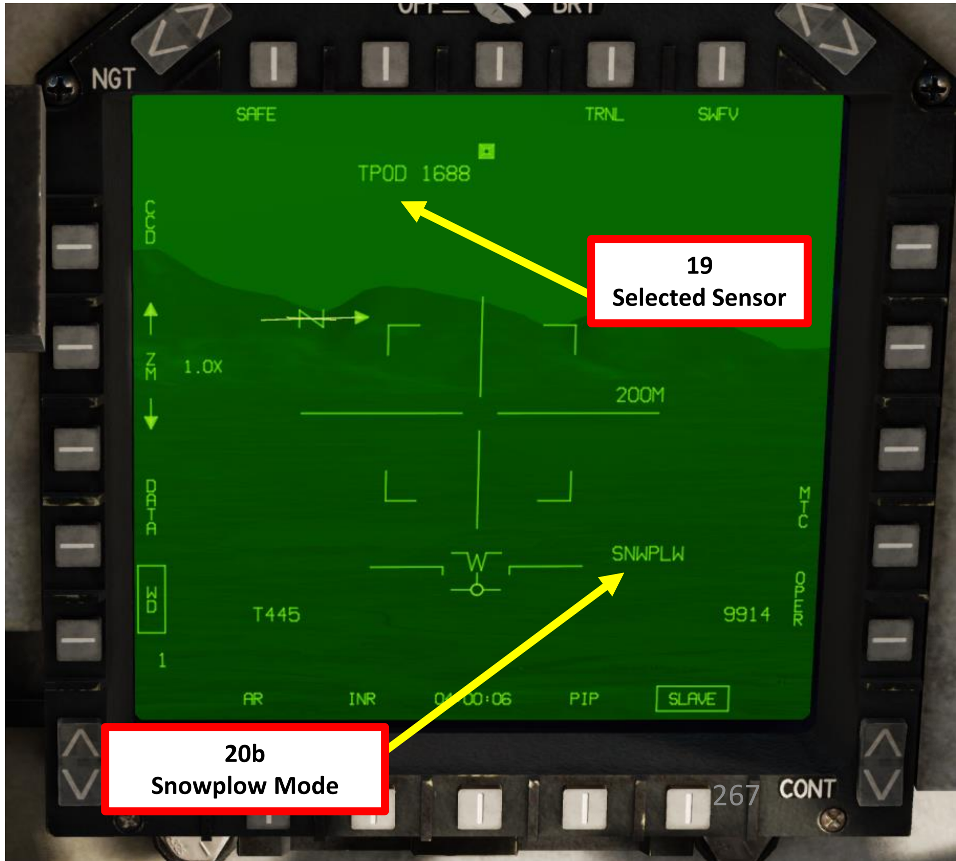




2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

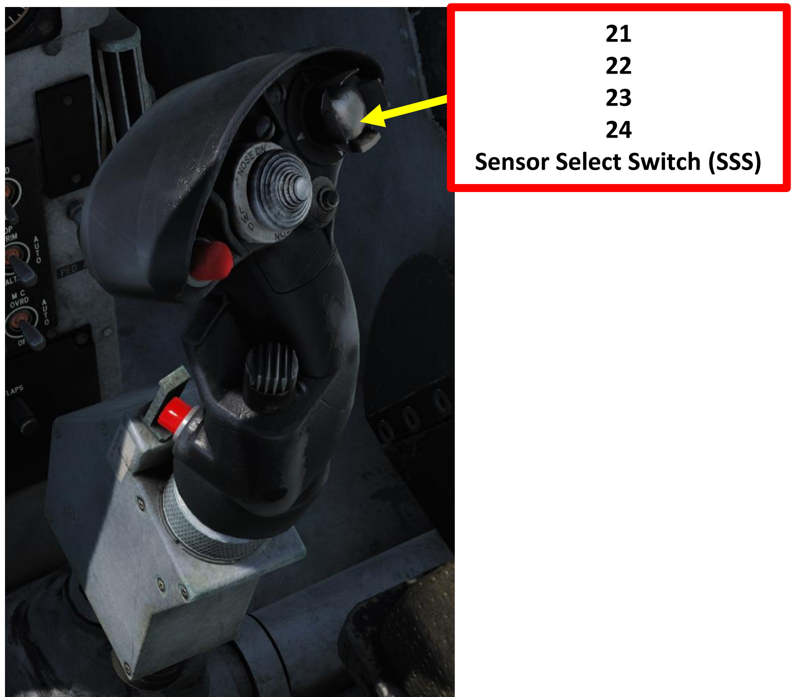
16. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
17. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
18. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
19. Confirm that Sensor of Interest switches to TPOD.
20. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.

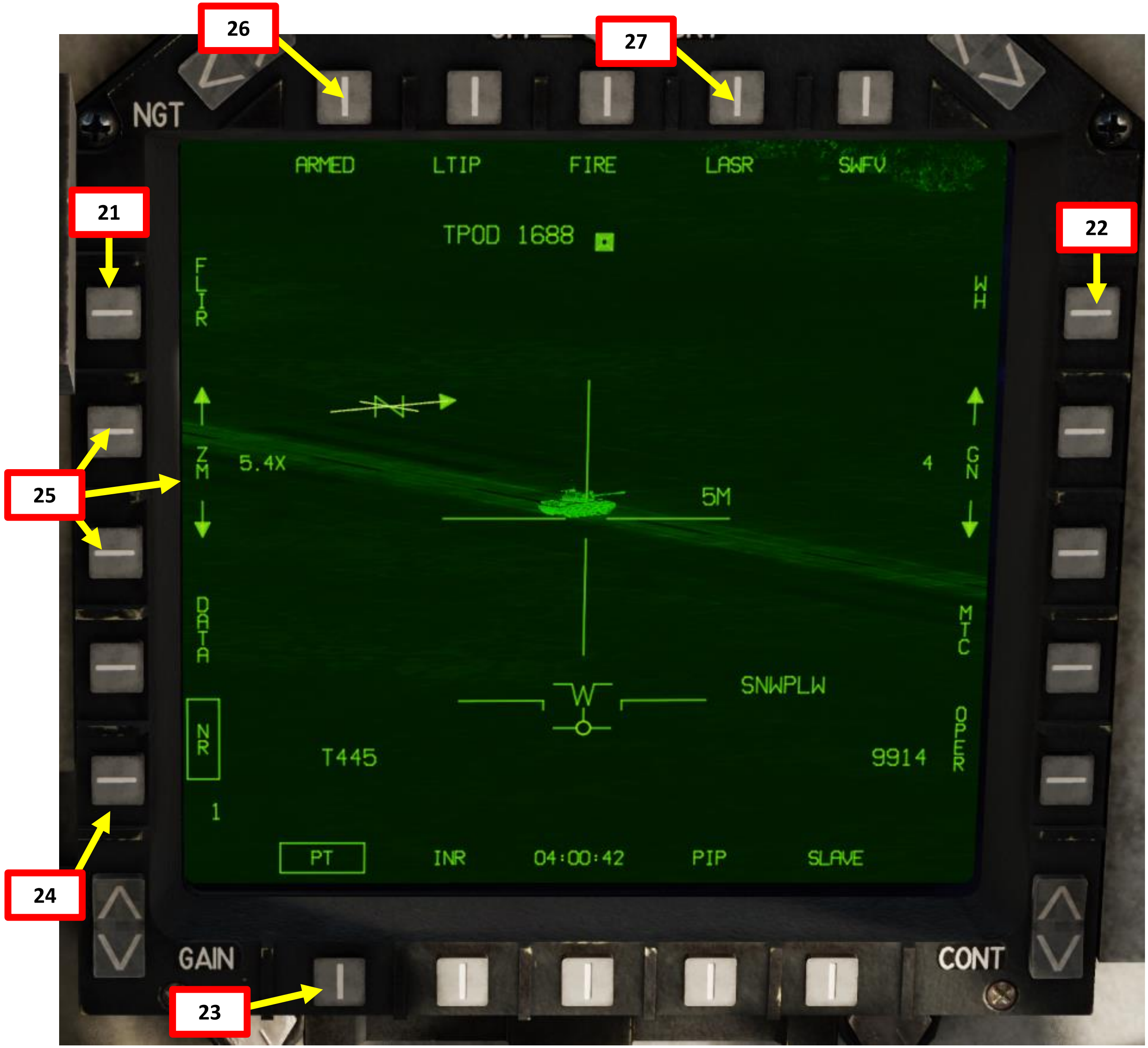




2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

21. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
22. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
23. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
24. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
25. Select desired zoom level by using the ZM +/- OSBs.
26. Press Laser Arming OSB to select ARMED mode.
27. Press Laser Mode OSB to select LASR (Laser Designator) Mode.



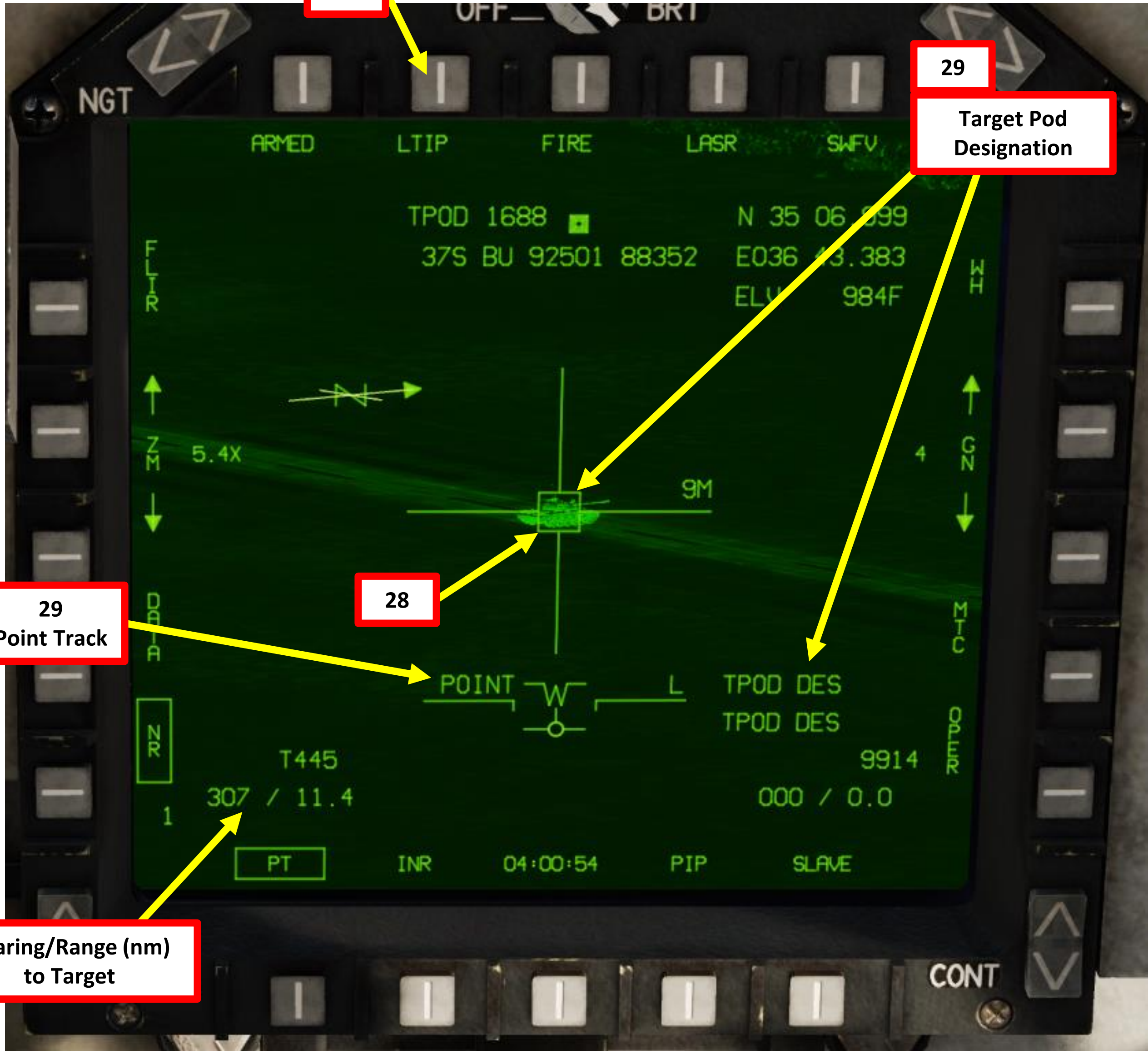


2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

28. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
29. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
30. If you want to have a laser ranging update, make sure you have a valid laser code and press the OSB next to LTIP (Laser Target Imaging Profile) or press Sensor Select Switch FWD SHORT. This step is optional.

30
Sensor Select Switch (SSS)

28
29
TDC (Target Designation Control)



30

29
Target Pod Designation

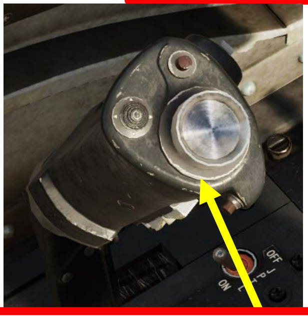
28

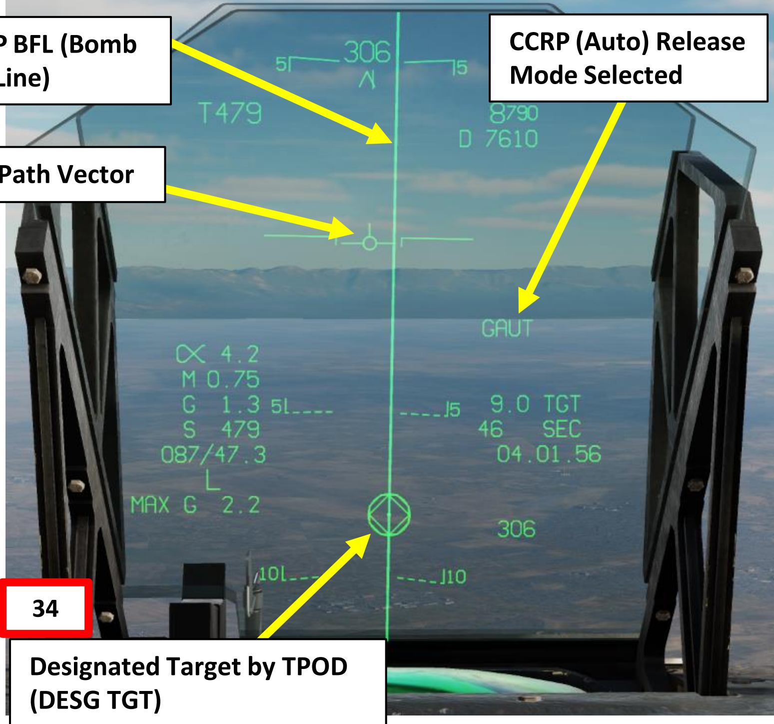
29
Point Track

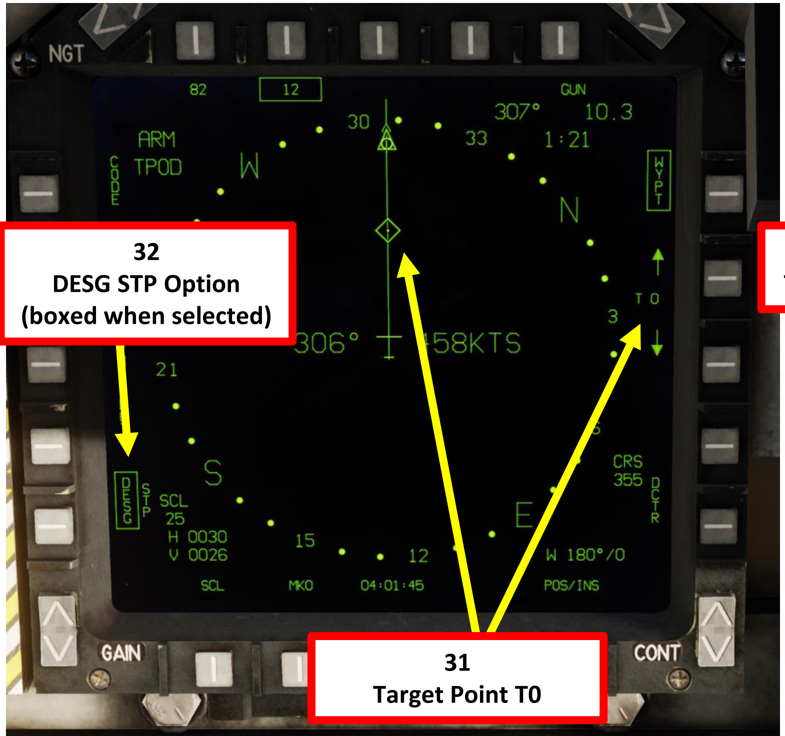
Bearing/Range (nm) to Target

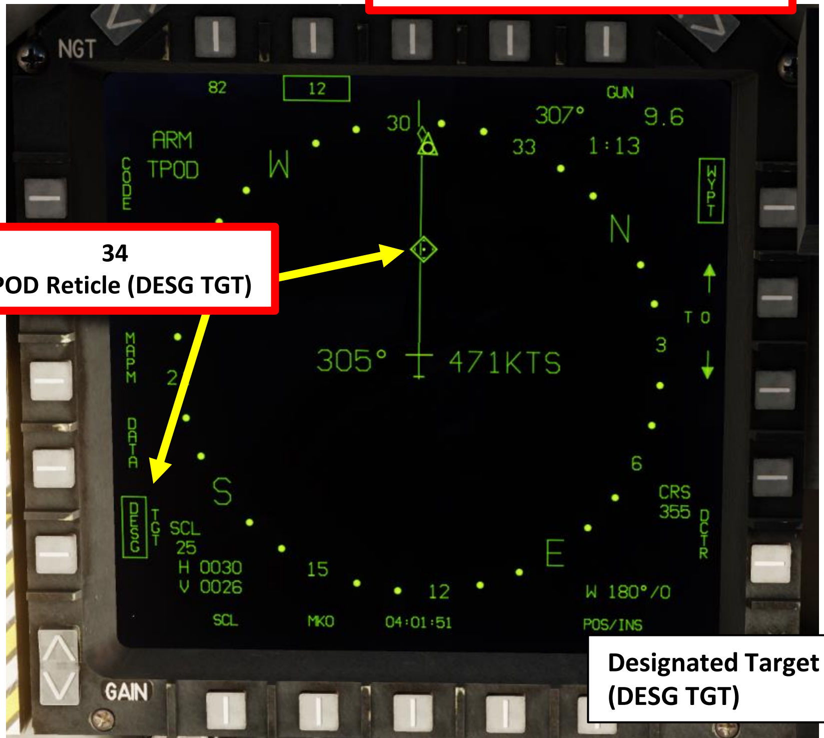
2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

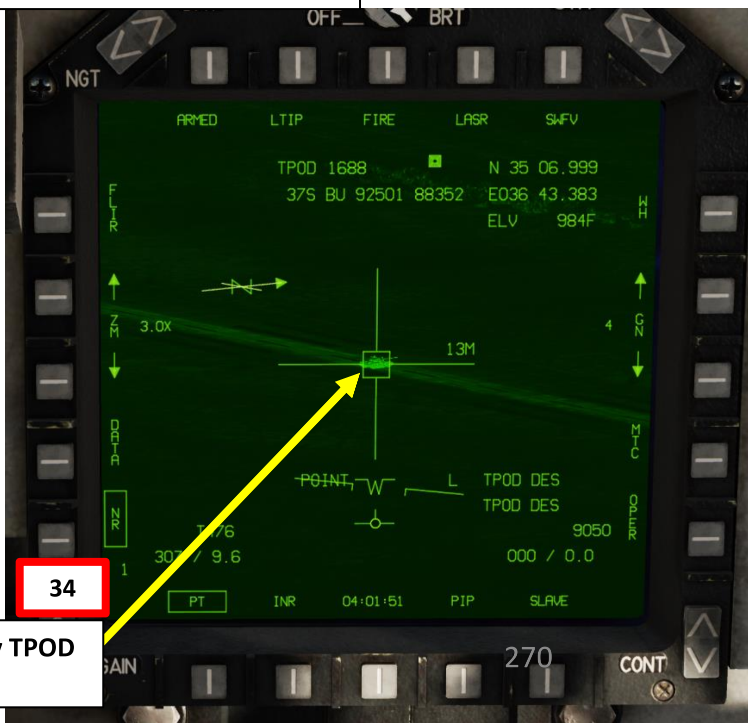
31. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0.
32. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
33. Once target is designated, you can re-slew the TPOD with TDC Left/Right/Fwd/Aft controls for targeting pod reticle adjustments.
34. On the EHSD, the DESG mode will switch from DESG STP (Steerpoint) to DESG TGT (Target).
    - Note: DESG TGT is set on the TPOD reticle, while DESG STP is set on the Target Point T0 initially designated when pressing « TDC DOWN Action Position » button.
    - **<u>CCRP tracks the DESG TGT in priority</u>**.
    - When in DESG TGT designation mode, pressing « TDC DOWN Action Position » button will reset the Target Point (T0) location to the DESG TGT. Designation Mode will then switch to DESG STP since both designation modes point at the same location.





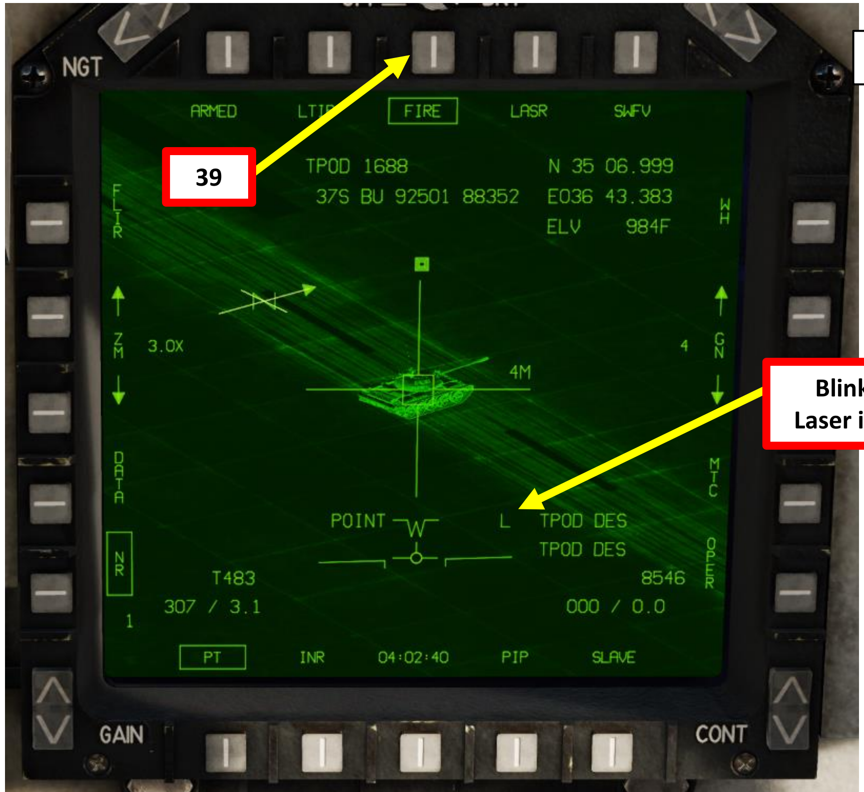


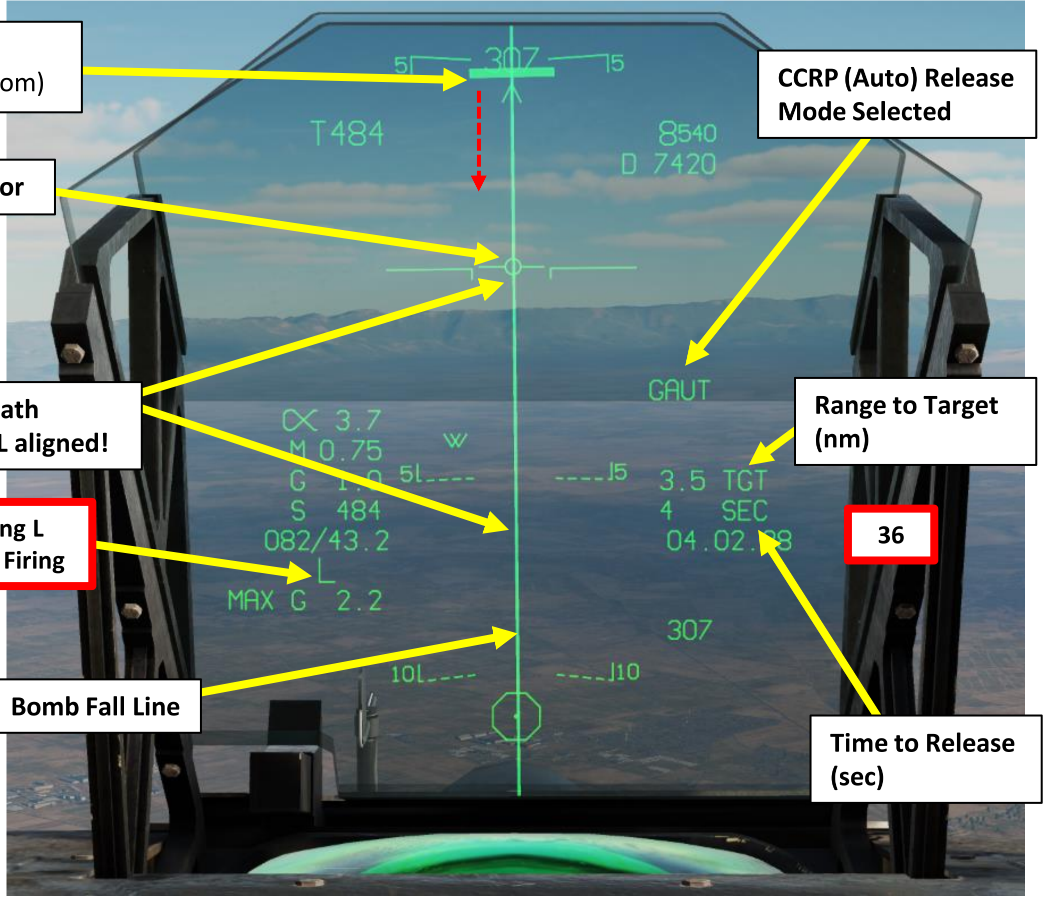




2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

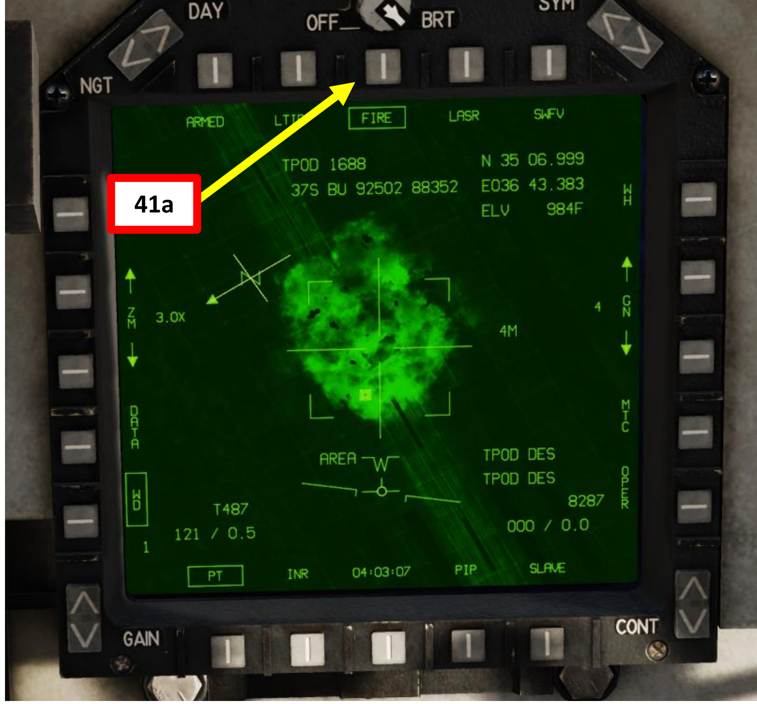
35. Fly level and manoeuver to align the vertical Bomb Fall Line with your flight path vector as much as possible.
36. The time to release and target range are indicated on the HUD.
37. When time is about 5 seconds before release, hold down the Bomb Pickle button (RALT+SPACE).
38. As you fly over Release Point cue (will be indicated by a green horizontal line descending from top to bottom), your bombs will drop automatically provided that you are holding the Bomb Pickle button.
39. Press FIRE OSB to fire the laser. Laser-guided bomb will then track this laser all the way to the target.
40. Once laser is firing, the « L » indication will blink on both the HUD and the TPOD page.

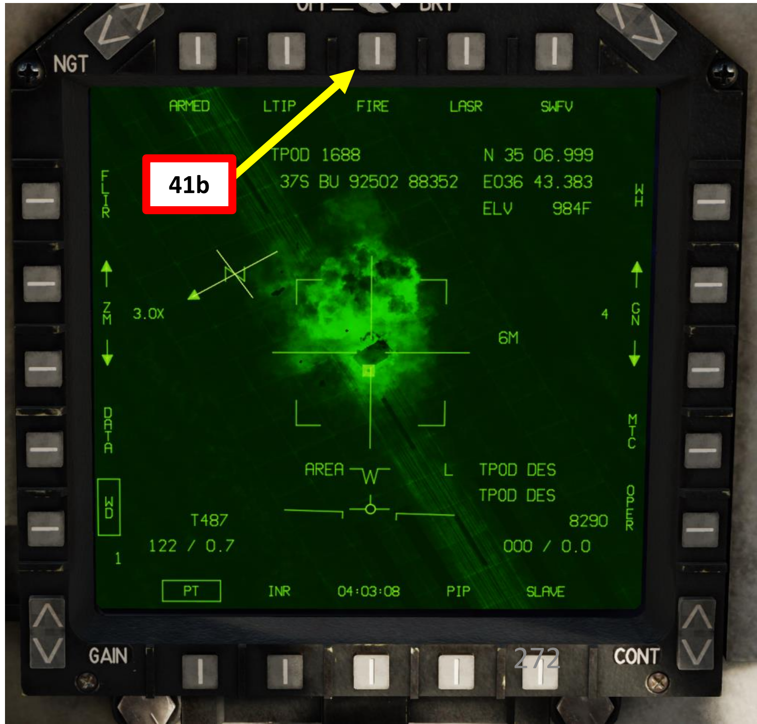


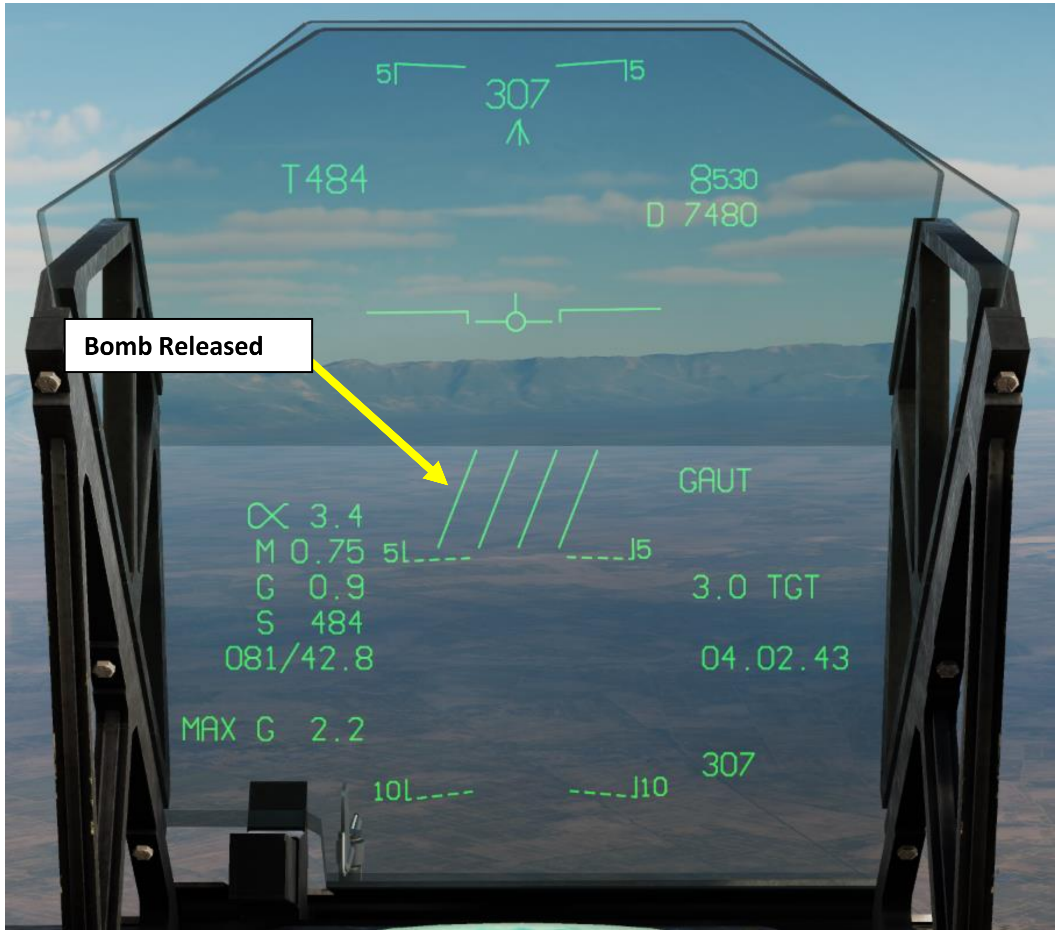


2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

41. After bomb impact, press the FIRE OSB to turn off the laser (unboxed when OFF).
42. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.







2.2 - Laser-Guided Bomb GBU-12 PAVEWAY II (Targeting Pod)

2.3 - ROCKETS (+ GAU12 GUN POD)

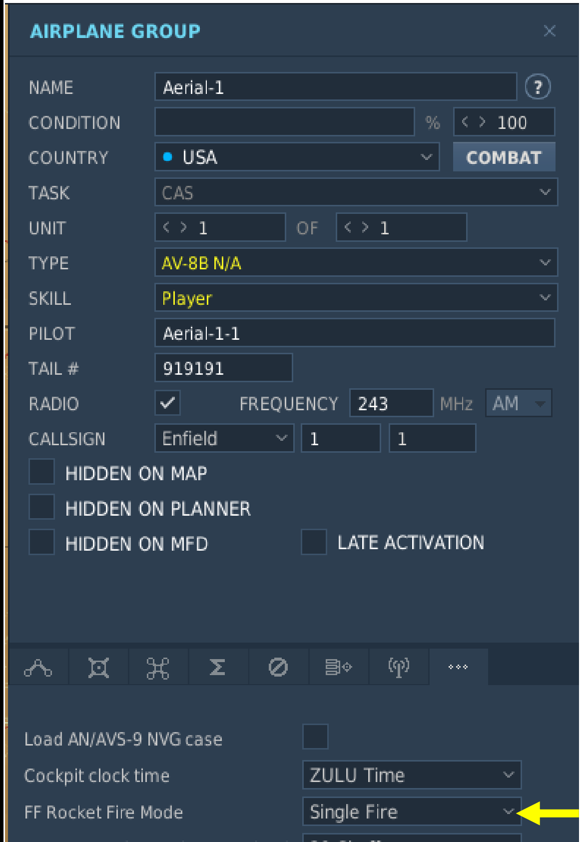
Rocket Firing Mode has to be set either in the mission editor or on the ground. You can open the WEAPON Kneeboard page by pressing "RSHIFT+K". This will show you the current Rocket Fire Mode.

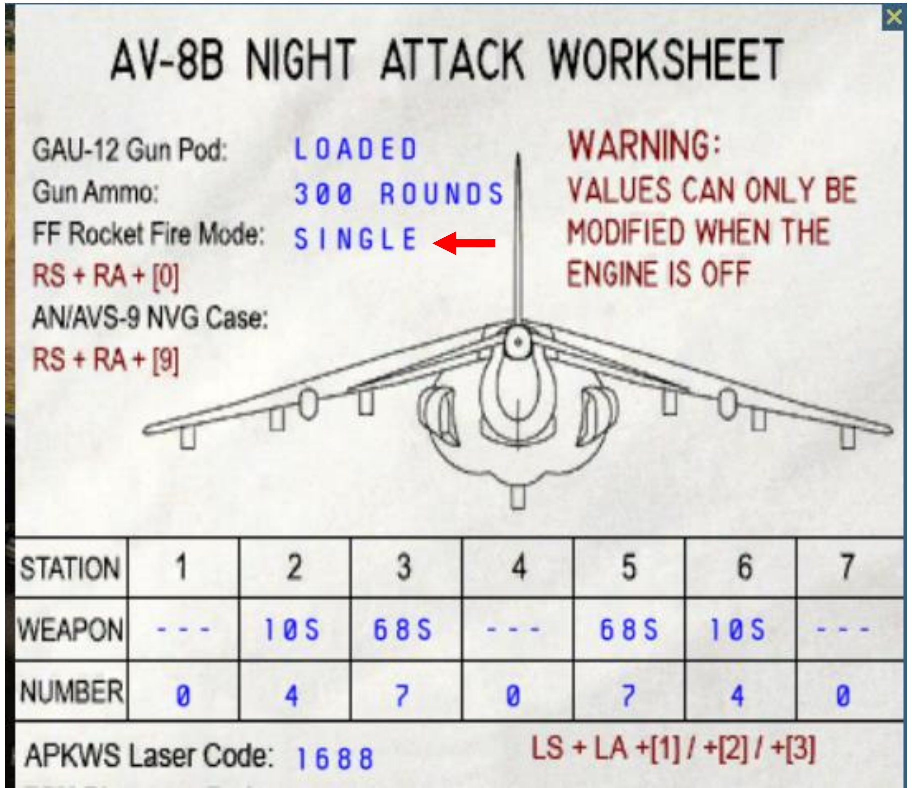
- **RSHIFT** + **RALT** + **0** : Changes Rockets Firing Mode (Single/Ripple)

Take note that setting the rocket firing mode should be done when the engine is shut down.

LAU-68 Pod
7 x 2.75 in HYDRA Rockets

LAU-10 Pod
4 x Mk71 ZUNI Rockets (127 mm)





AV-8B NIGHT ATTACK WORKSHEET

GAU-12 Gun Pod: LOADED
Gun Ammo: 300 ROUNDS
FF Rocket Fire Mode: SINGLE
RS + RA + [0]
AN/AVS-9 NVG Case:
RS + RA + [9]

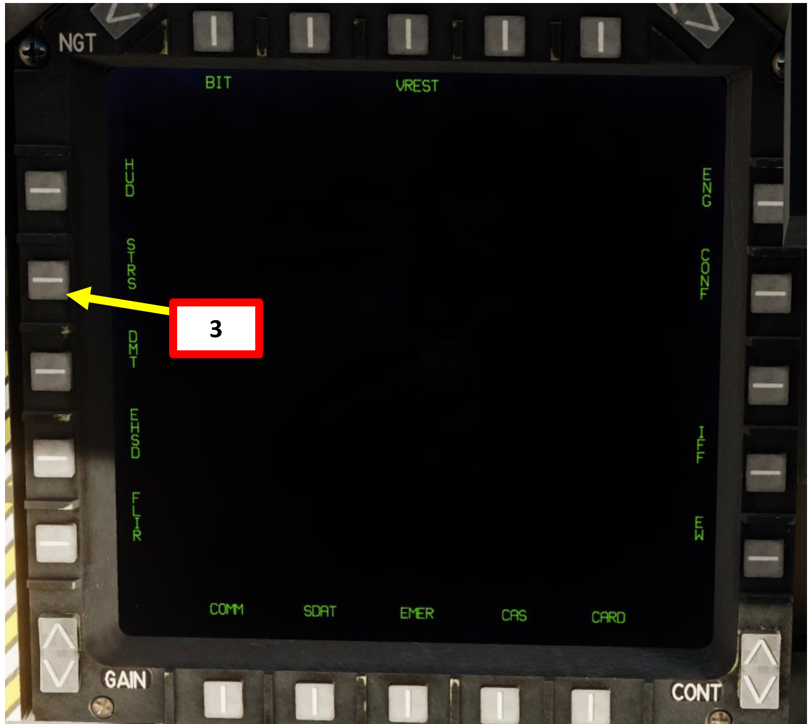
WARNING:
VALUES CAN ONLY BE MODIFIED WHEN THE ENGINE IS OFF

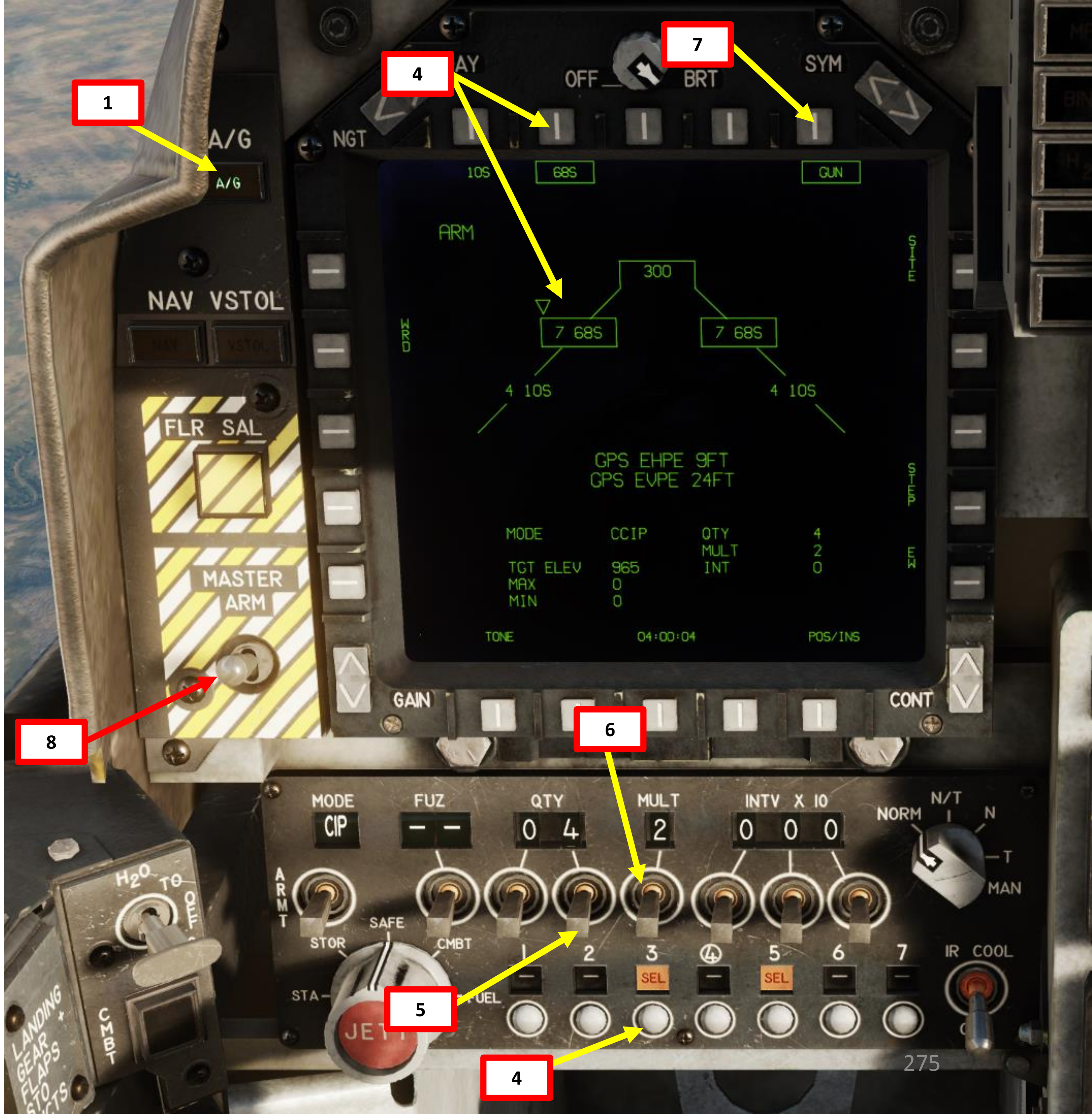
STATION	1	2	3	4	5	6	7
WEAPON	- - -	10S	68S	- - -	68S	10S	- - -
NUMBER	0	4	7	0	7	4	0

APKWS Laser Code: 1688 LS + LA +[1] / +[2] / +[3]

2.3 - ROCKETS (+ GAU12 GUN POD)

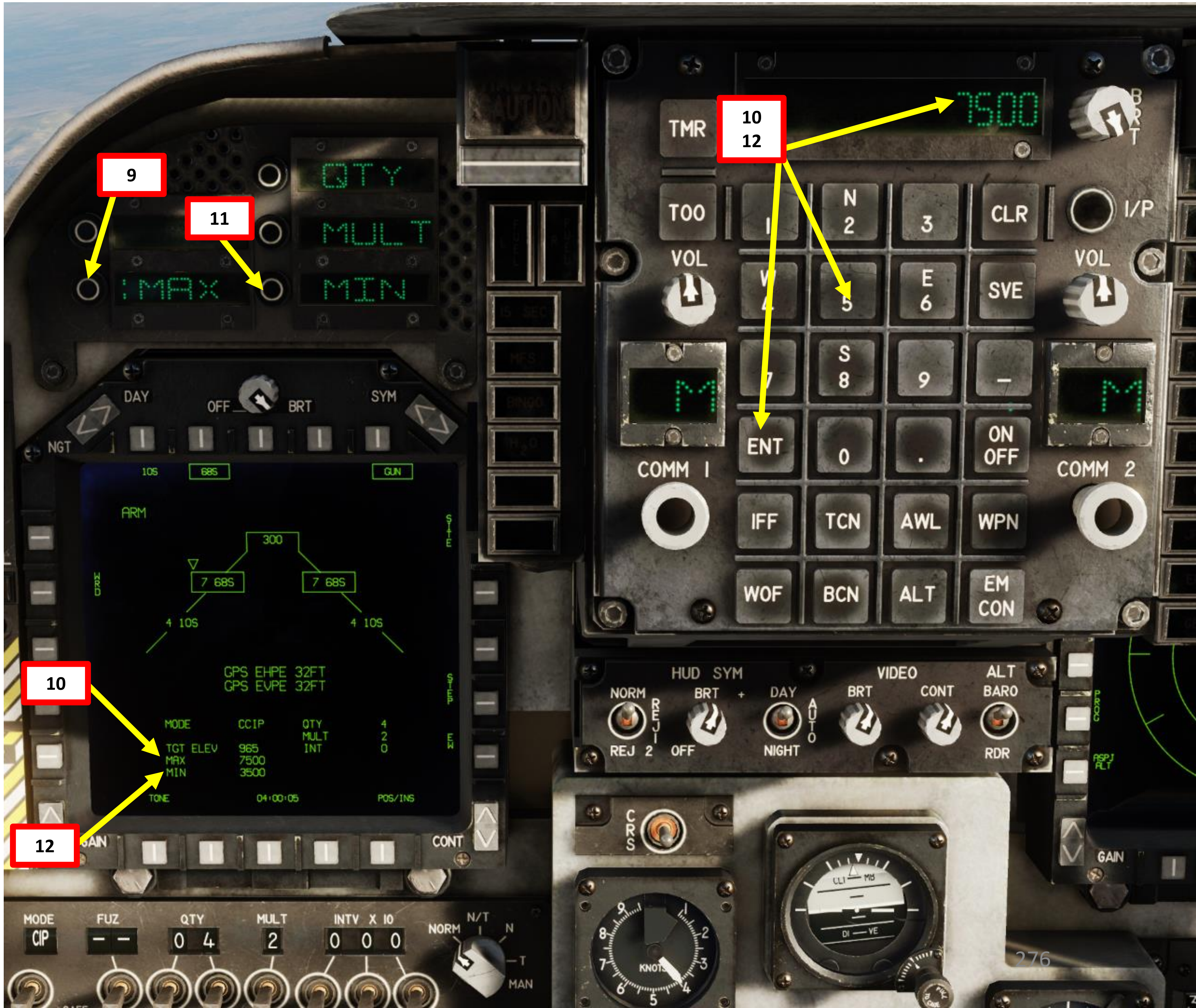
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired Ground Rockets by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Set desired Rocket Quantity (number of rockets fired per pod per trigger press)
6. Set Multiple parameter to the number of pylons used.
7. If desired, select Gun Pod with the upper OSB. You will be able to use it in addition to rockets. This step is optional.
8. Set Master Arm switch ON (UP)





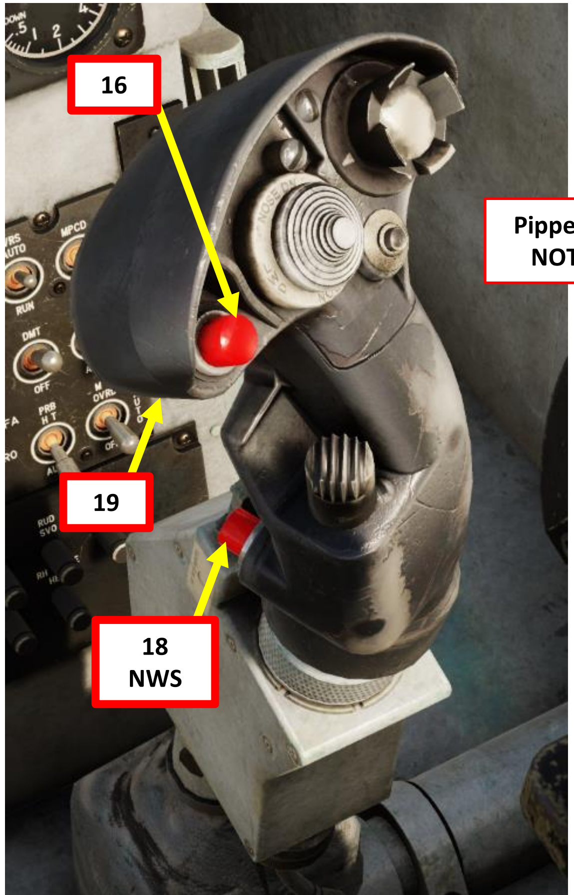
2.3 - ROCKETS (+ GAU12 GUN POD)

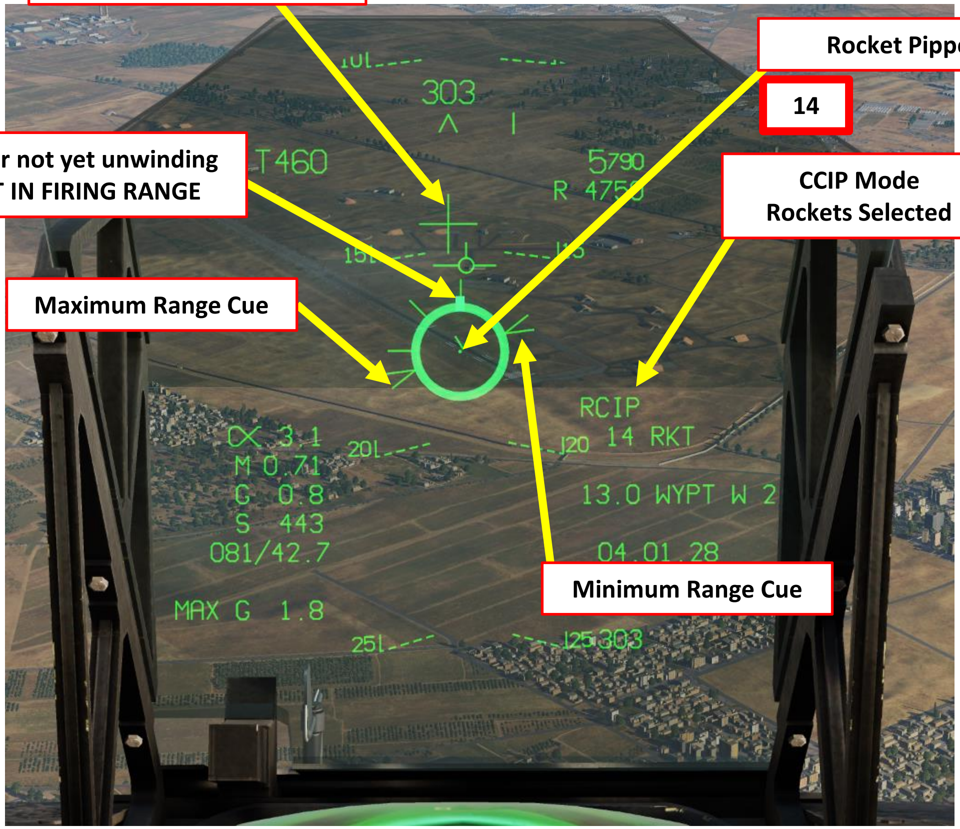
9. Press on MAX ODU (ODU (Option Display Unit, preceded by « : » when selected)
10. Enter desired Maximum Firing Range setting for the pipper on the keypad, then press ENT. A max range setting of 7500 ft is recommended.
11. Press on MIN ODU (ODU (Option Display Unit, preceded by « : » when selected)
12. Enter desired Minimum Firing Range setting for the pipper on the keypad, then press ENT. A min range setting of 3500 ft is recommended.

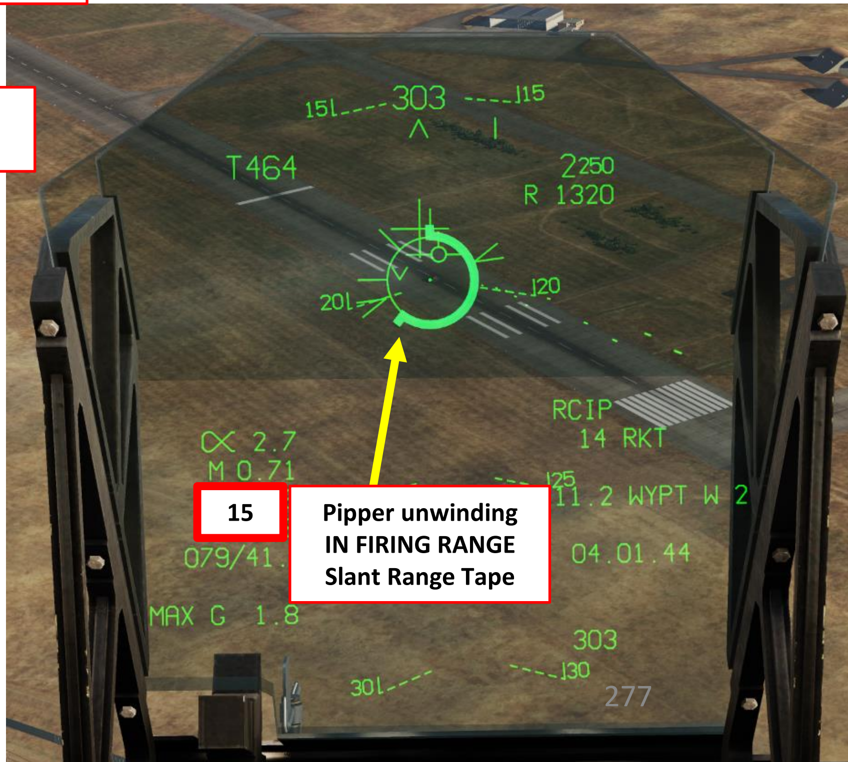


2.3 - ROCKETS (+ GAU12 GUN POD)

13. Start a 15 to 45-degree descent towards the target
14. Set pipper on target and wait for the pipper to unwind.
15. You will be within firing range once the pipper starts unwinding
16. When Pipper has unwinded between the Maximum Range and Minimum Range cues, press the Bomb Pickle button (RALT+SPACE) to fire rockets
17. Once rockets are launched, a target point is automatically created in case you need to attack the target again.
18. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.
19. To fire the gun, place target on the gun pipper cross, then press the Trigger (Fire Gun - SPACE).
    - Take note that at low altitudes, a minimum engine RPM has to be maintained (above 70 % RPM) in order to generate sufficient bleed air pressure to supply the pneumatic gun firing mechanism. At higher pressure altitudes (20000+ ft), a higher engine RPM setting is required (above 90 % RPM).



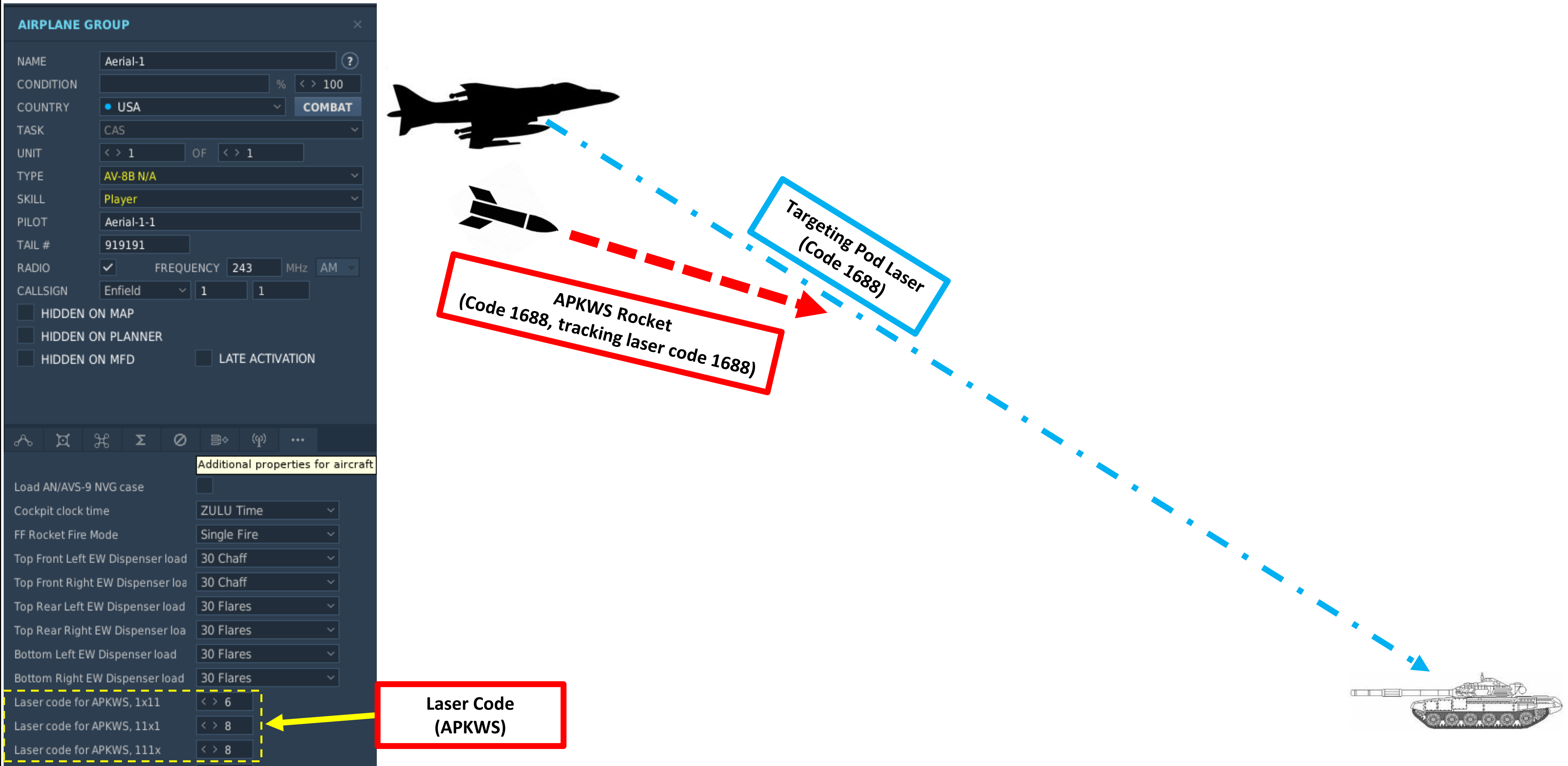




2.3 - ROCKETS (+ GAU12 GUN POD)

2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

Also displayed as the AGR-20A, the APKWS combines a standard 2.75-inch high explosive rocket with a laser guidance kit and control fins. There are two warhead options: the M-151 (High Explosive) and the M-282 (Penetrator Warhead). The seeker head on each laser guided rocket is set to track only a specific laser pulse rate frequency (PRF) code. These are manually set by the weapons load crew during ground operations (via Mission Editor) and may not be set from the cockpit during flight.



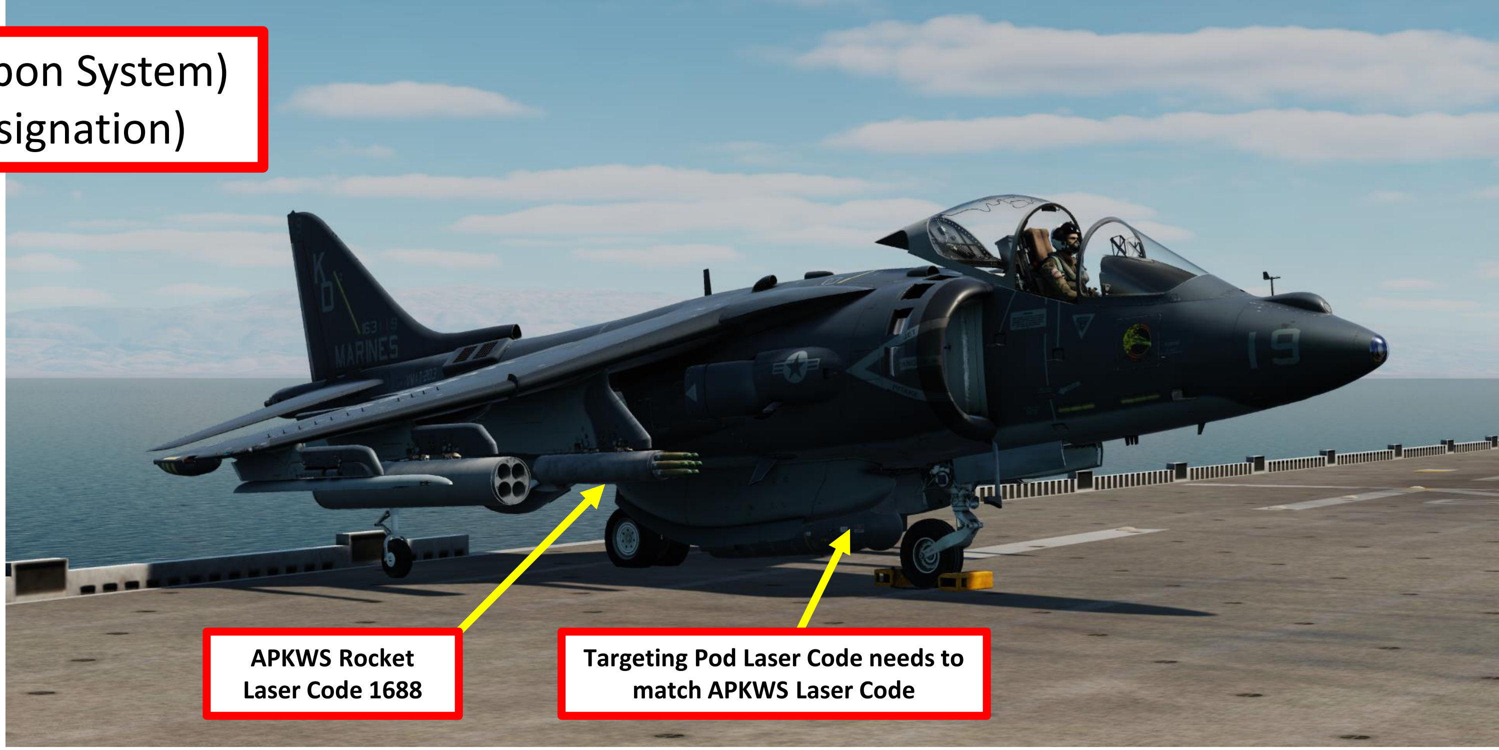
2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

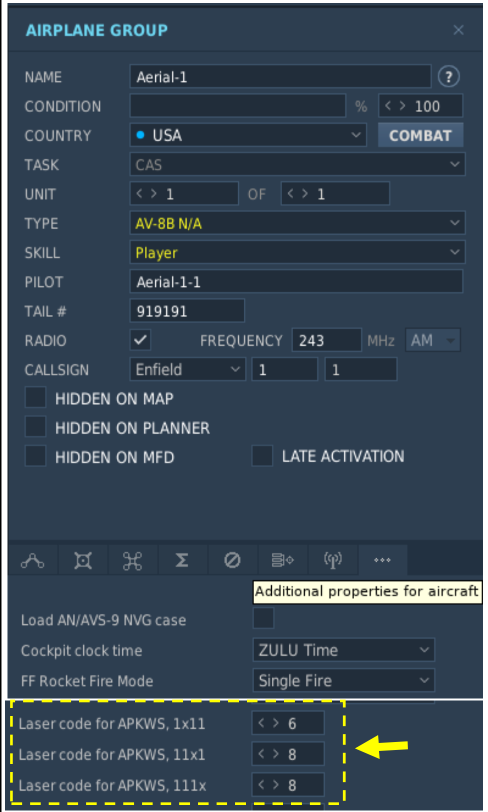
If you are flying in multiplayer and do not know your APKWS rocket laser code, you can open the WEAPON Kneeboard page by pressing "RSHIFT+K". This will show you the laser code set on your APKWS laser-guided rocket.

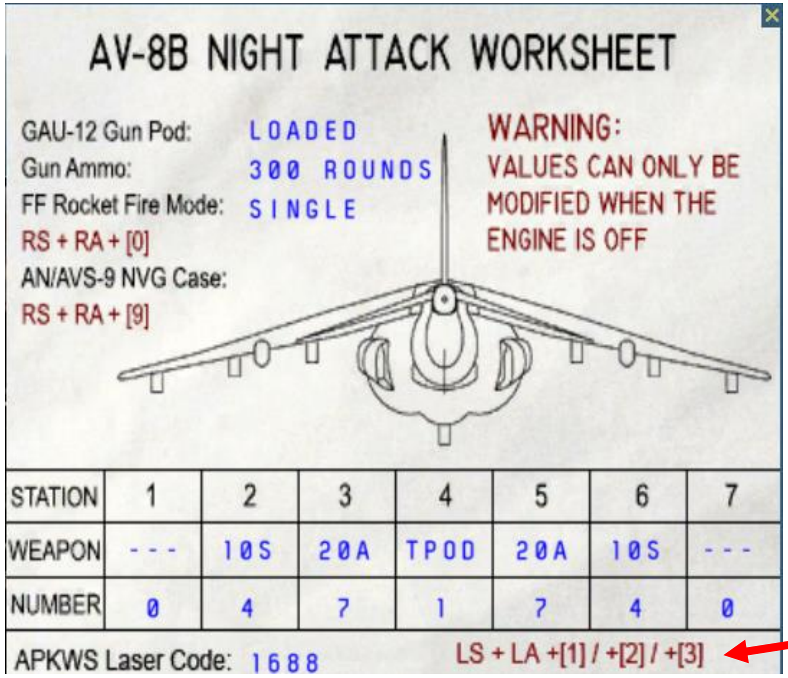
APKWS codes are programmable on ground by using the following commands:

- **LSHIFT** + **LALT** + **1** : Changes Laser Code (Hundreds)
- **LSHIFT** + **LALT** + **2** : Changes Laser Code (Tens)
- **LSHIFT** + **LALT** + **3**: Changes Laser Code (Ones)

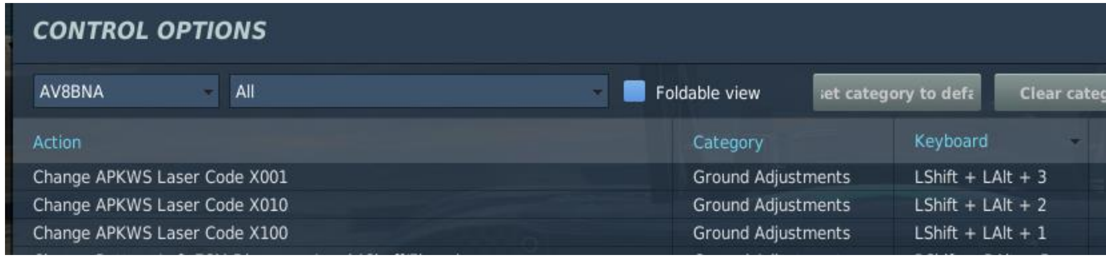
Take note that setting the rocket laser code should be done when the engine is shut down.





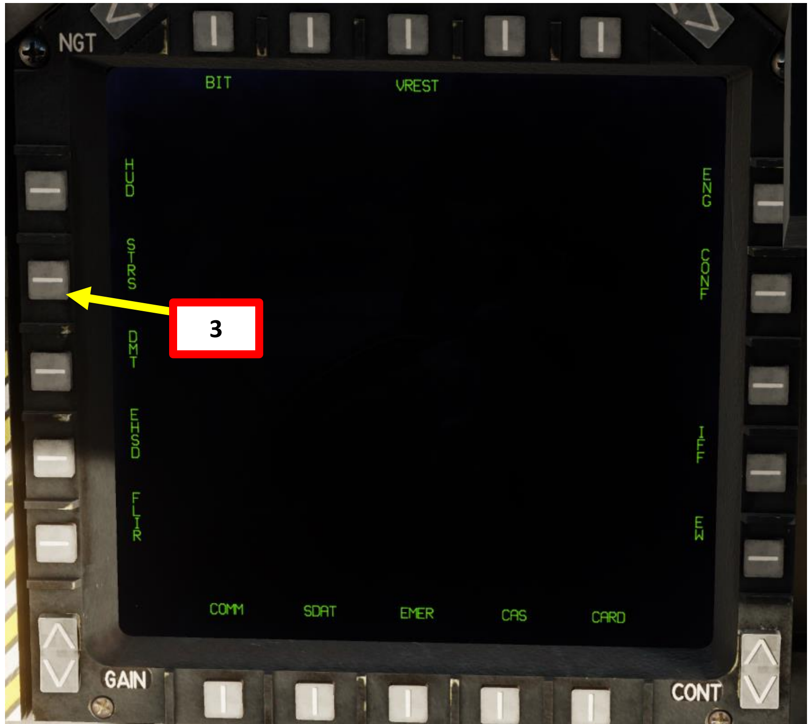


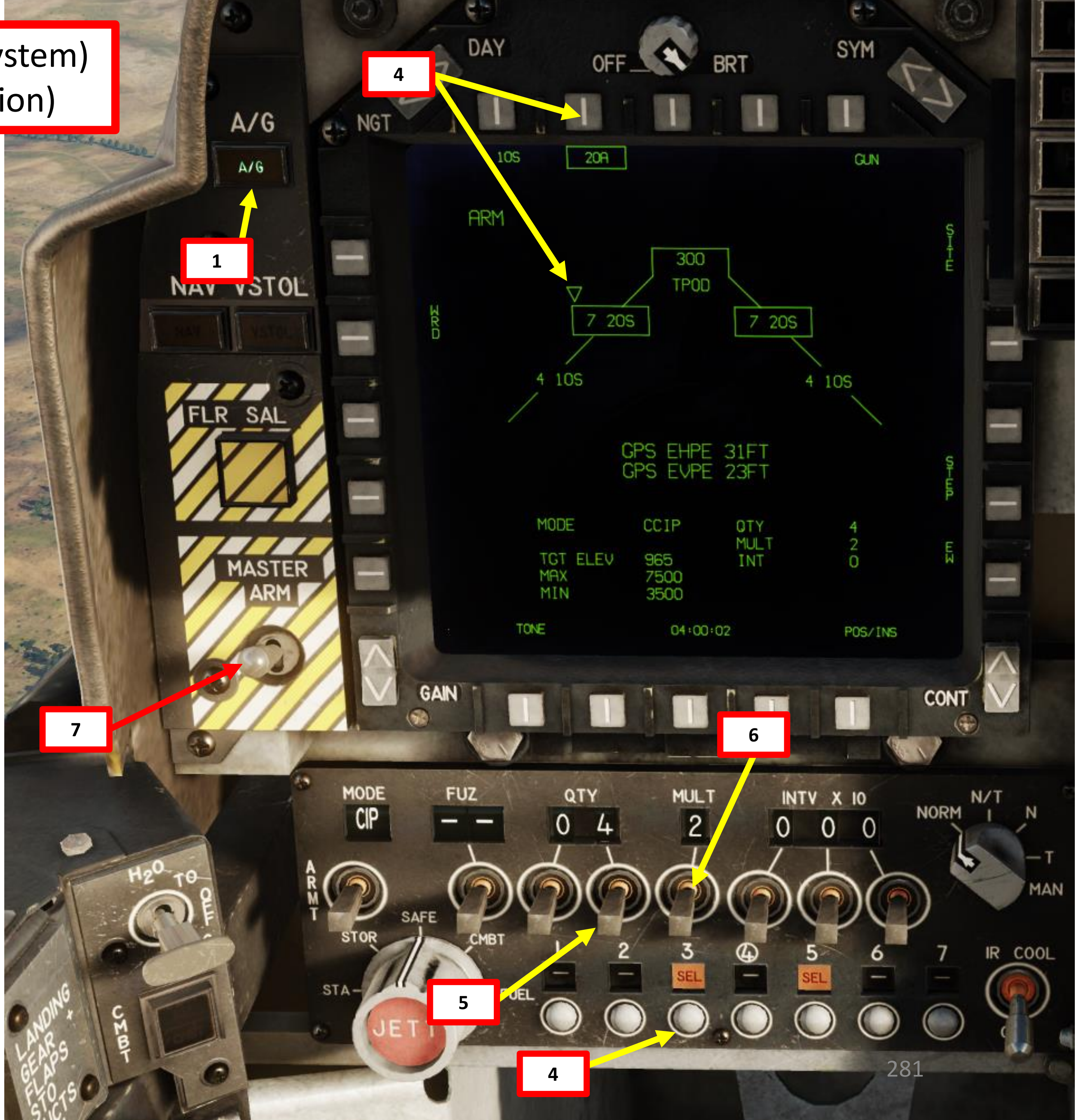
Laser Code (APKWS)



2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

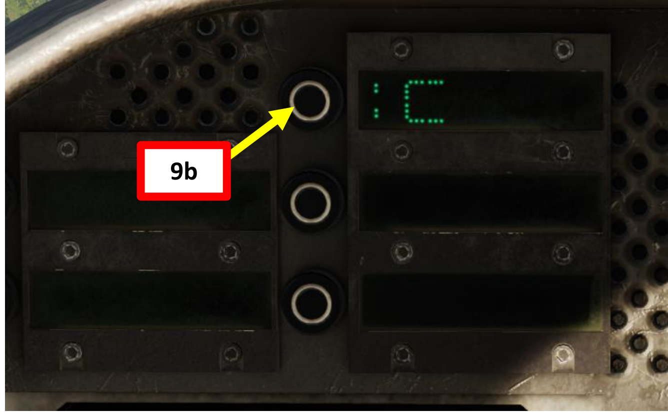
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select desired Ground Rockets by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. Set desired Rocket Quantity (number of rockets fired per pod per trigger press)
6. Set Multiple parameter to the number of pylons used.
7. Set Master Arm switch ON (UP)

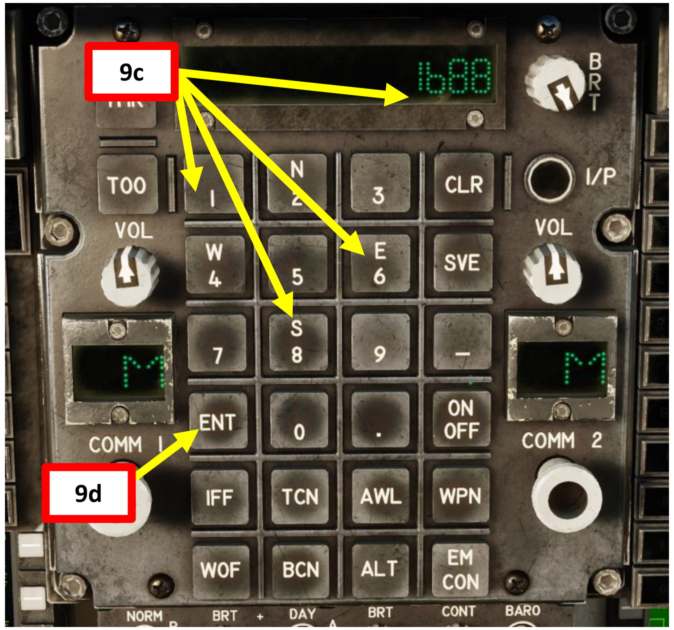


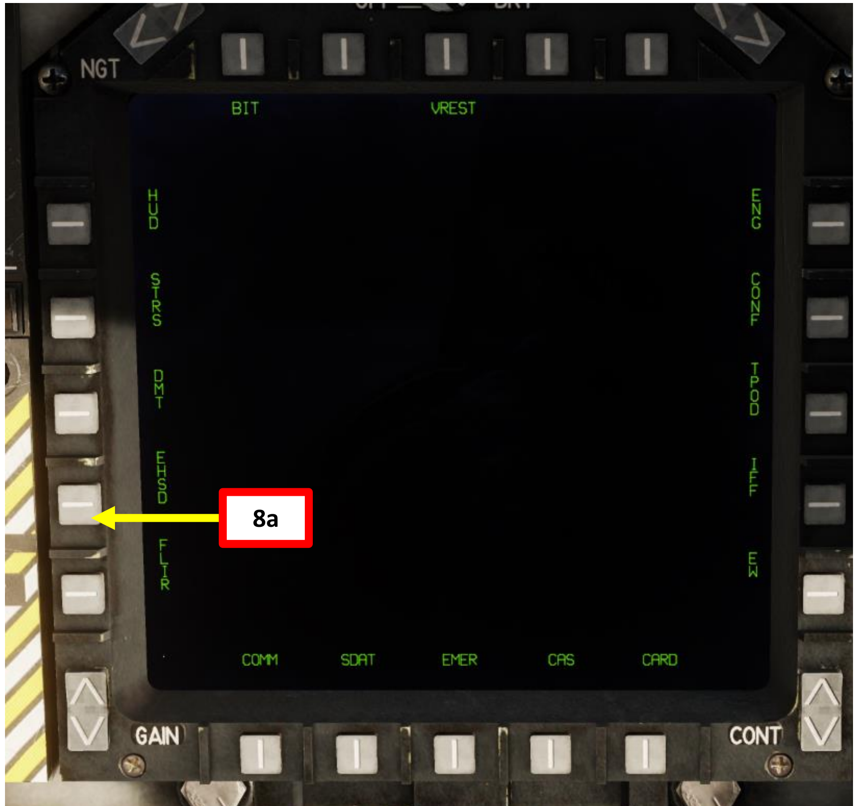


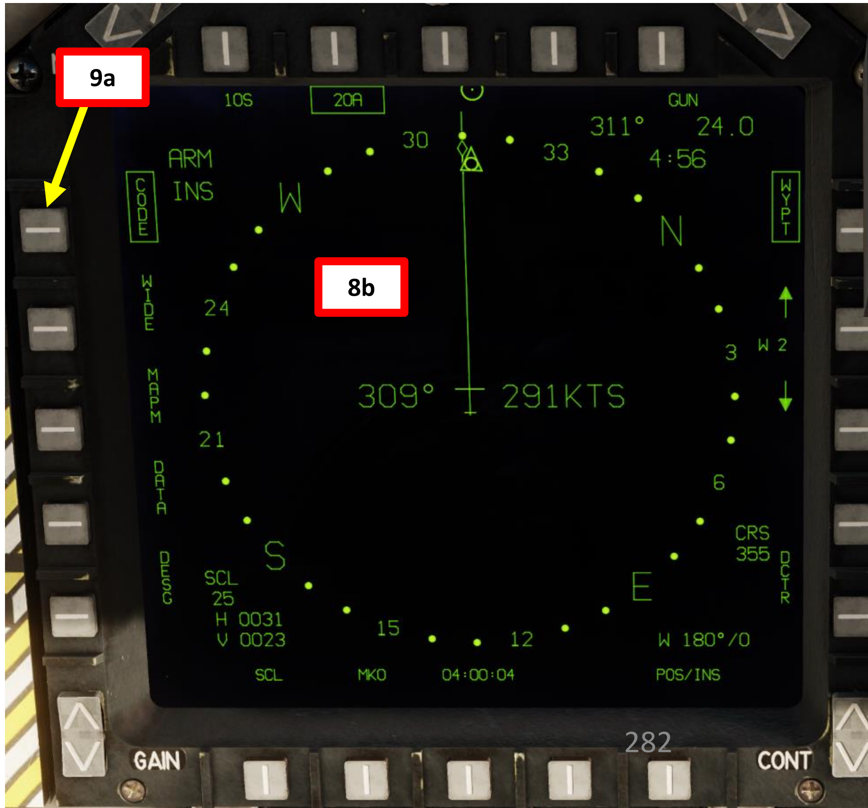
2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

8. From the main MPCD menu, select "EHSD" page. Take note that this can be achieved from the DMT page as well.
9. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT. This laser code is what the targeting pod will be lasing with while designating the target.



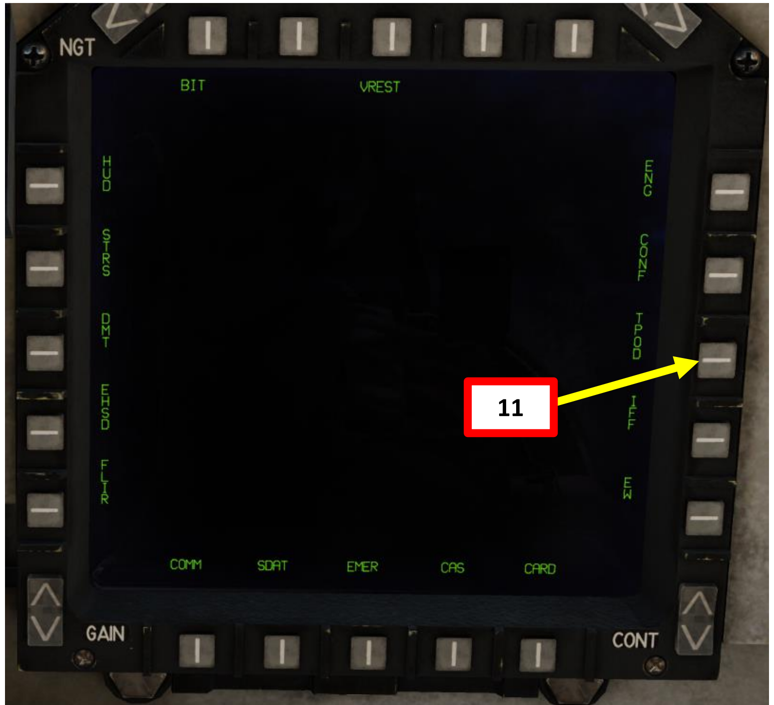


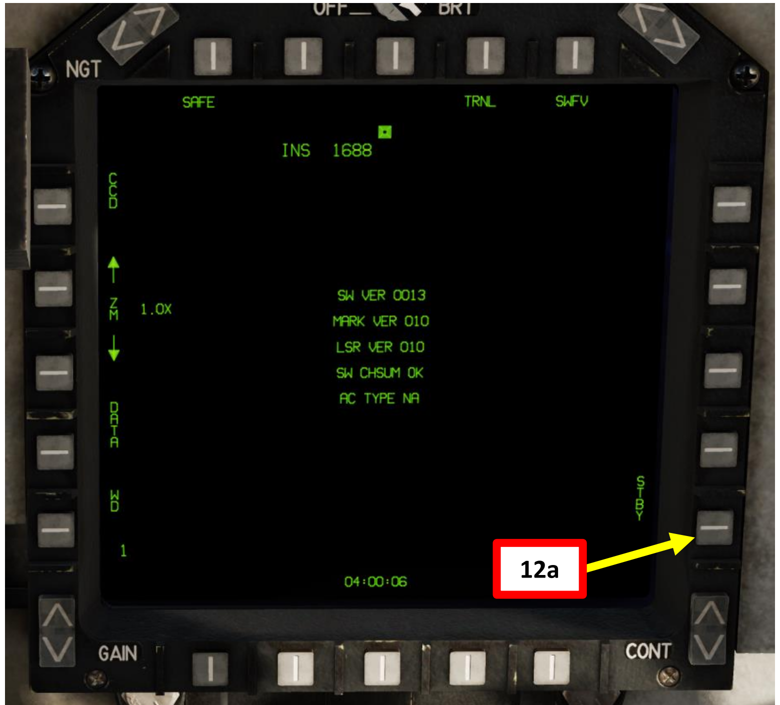


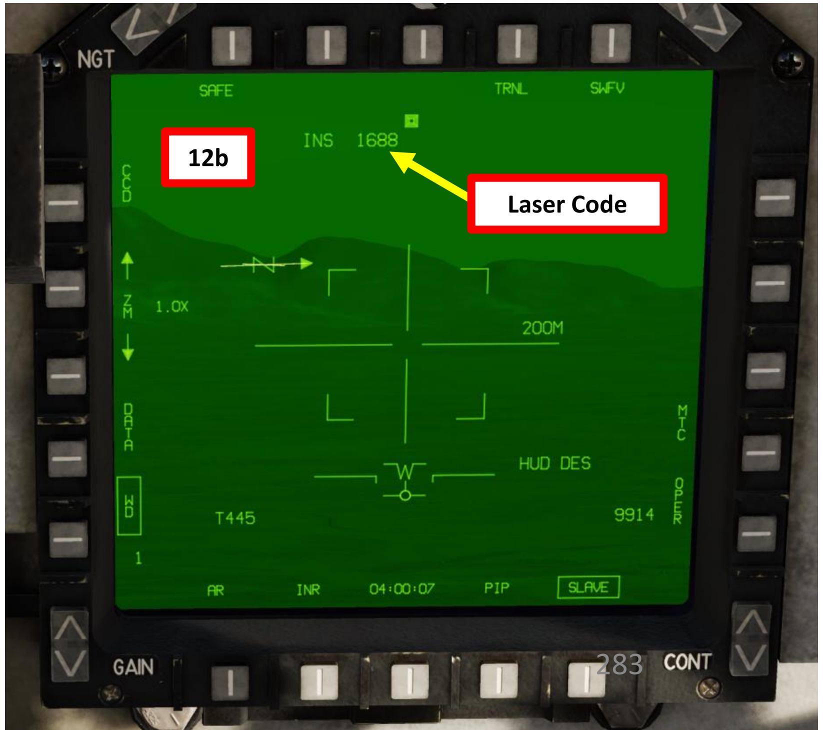


2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

10. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
11. Press the OSB next to the “TPOD” page in the main MPCD MENU
12. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).

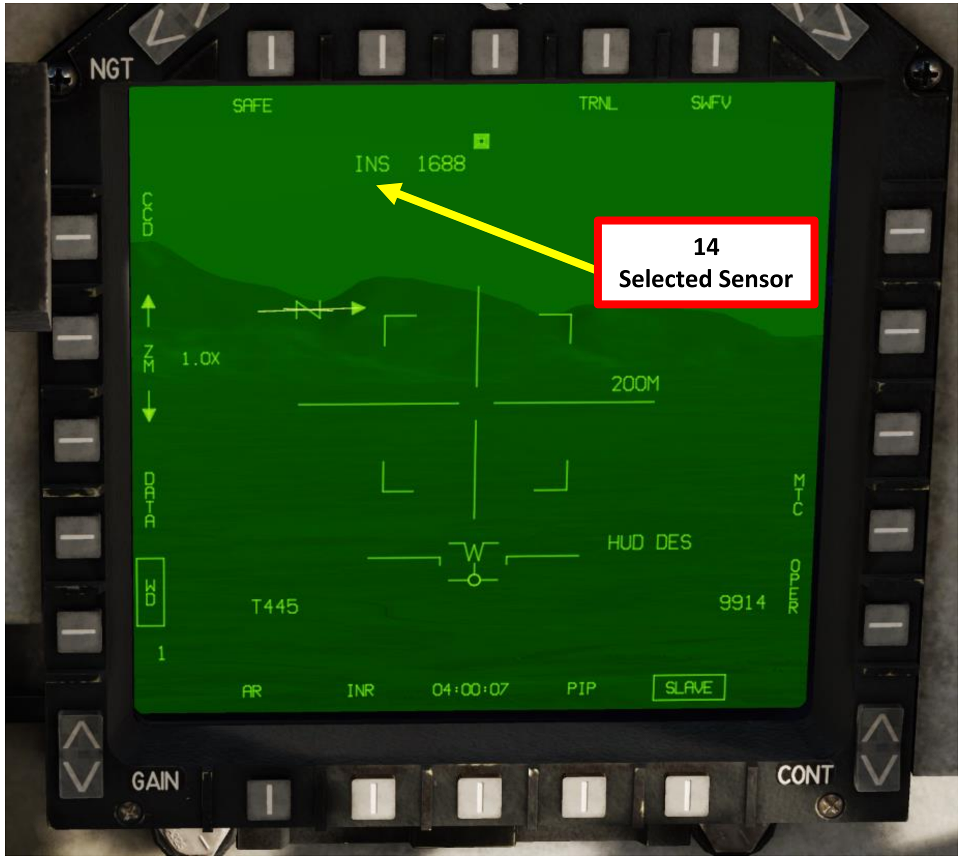


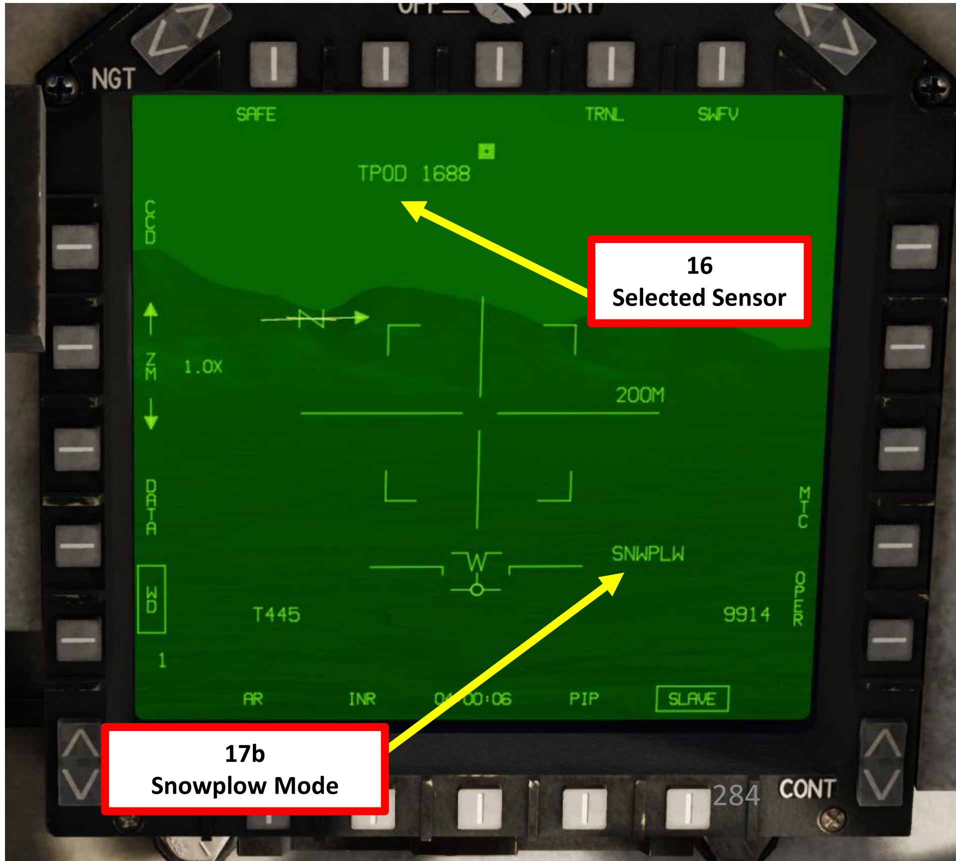




2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

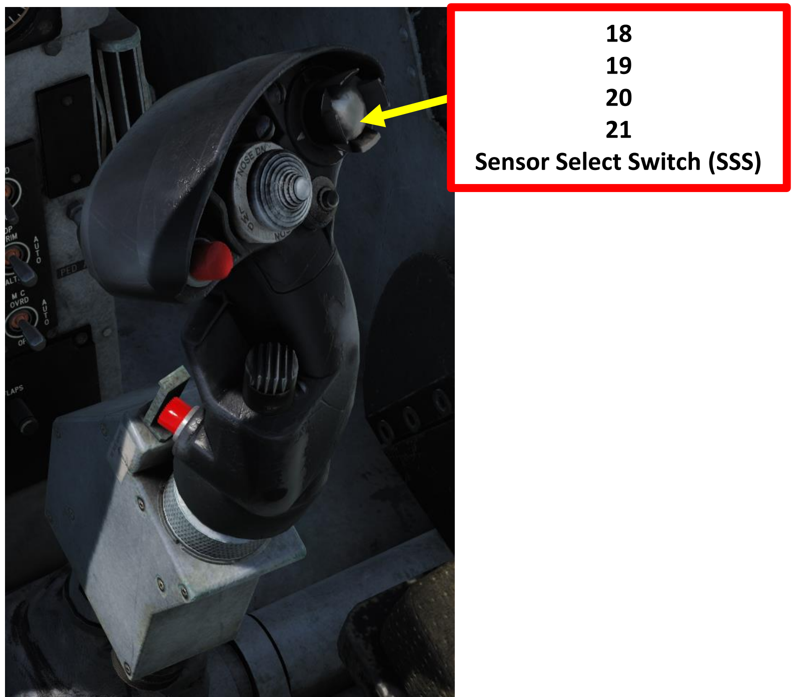
13. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
14. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
15. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
16. Confirm that Sensor of Interest switches to TPOD.
17. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.

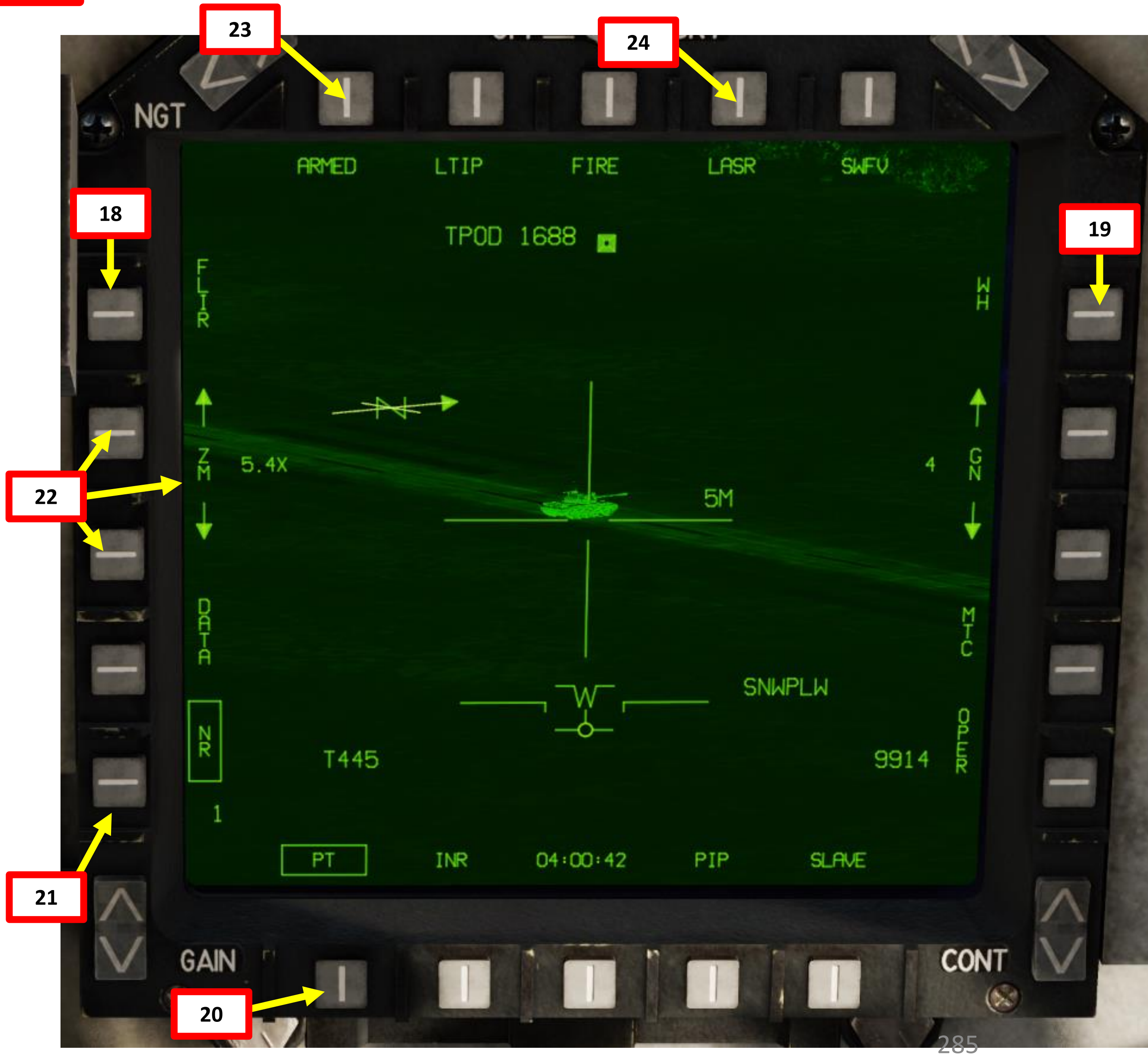




2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

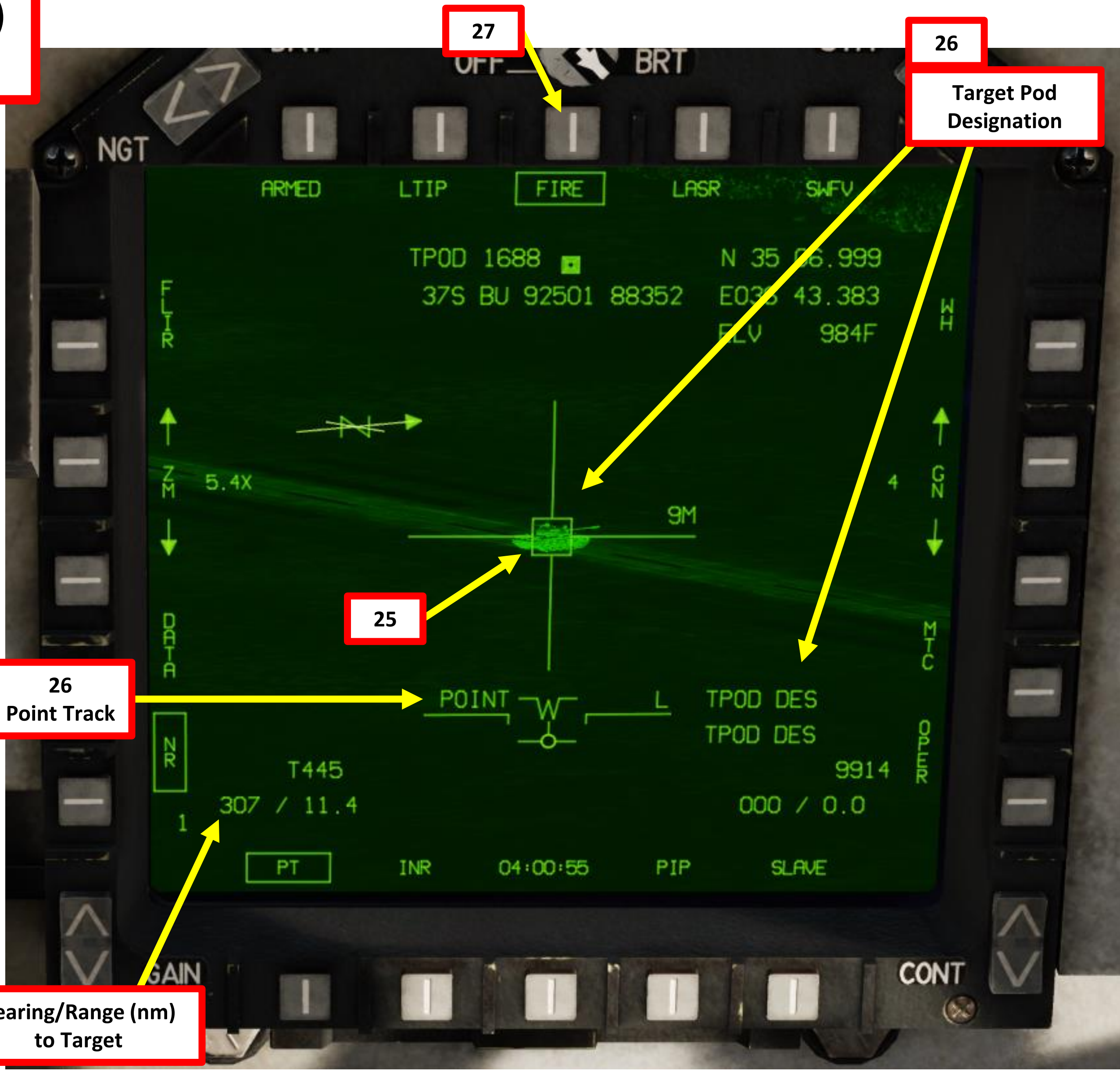
18. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
19. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
20. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
21. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
22. Select desired zoom level by using the ZM +/- OSBs.
23. Press Laser Arming OSB to select ARMED mode.
24. Press Laser Mode OSB to select LASR (Laser Designator) Mode.





2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

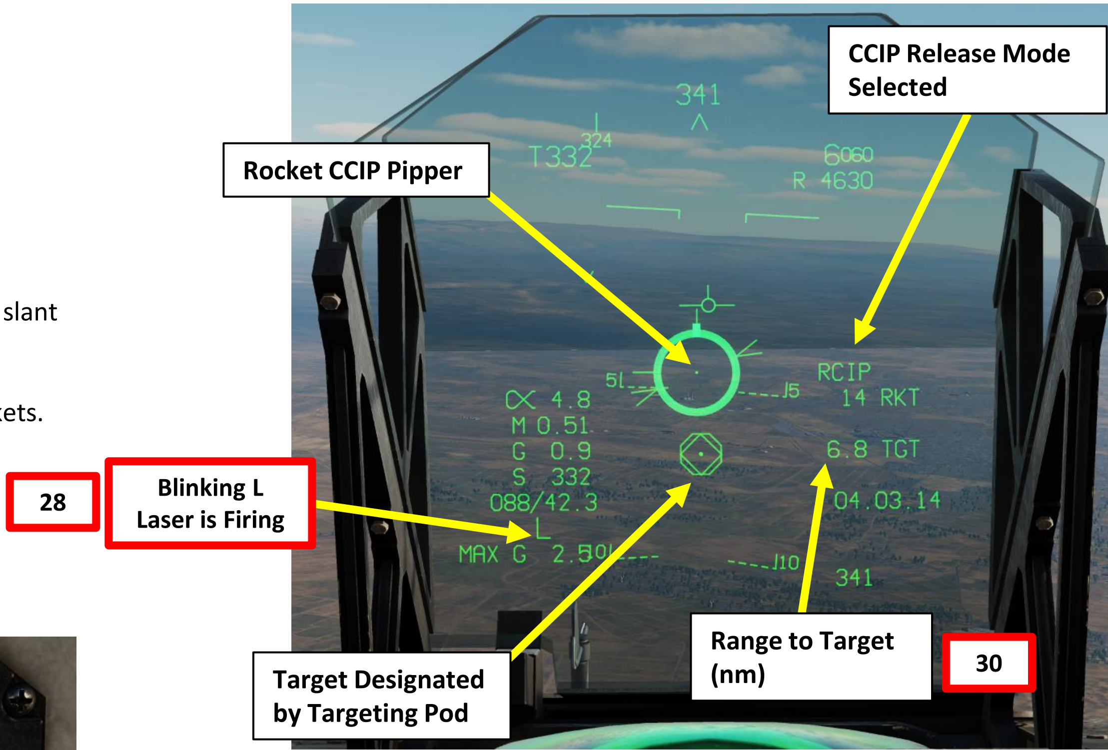
25. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
26. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
27. Press FIRE OSB to fire the laser. When fired, the rocket will track this laser all the way to the target.

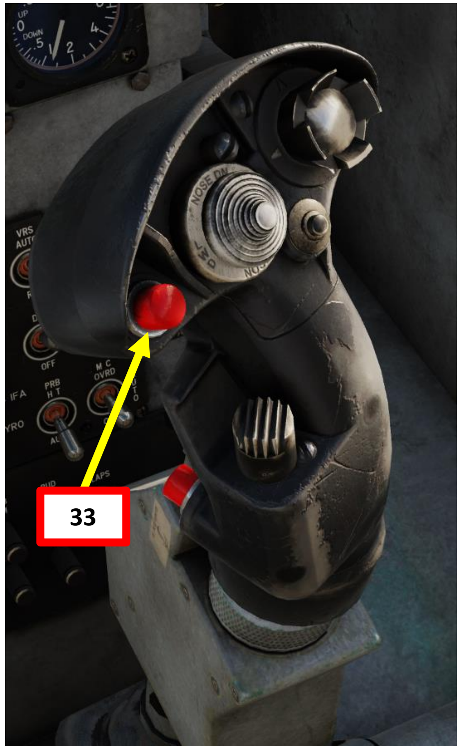


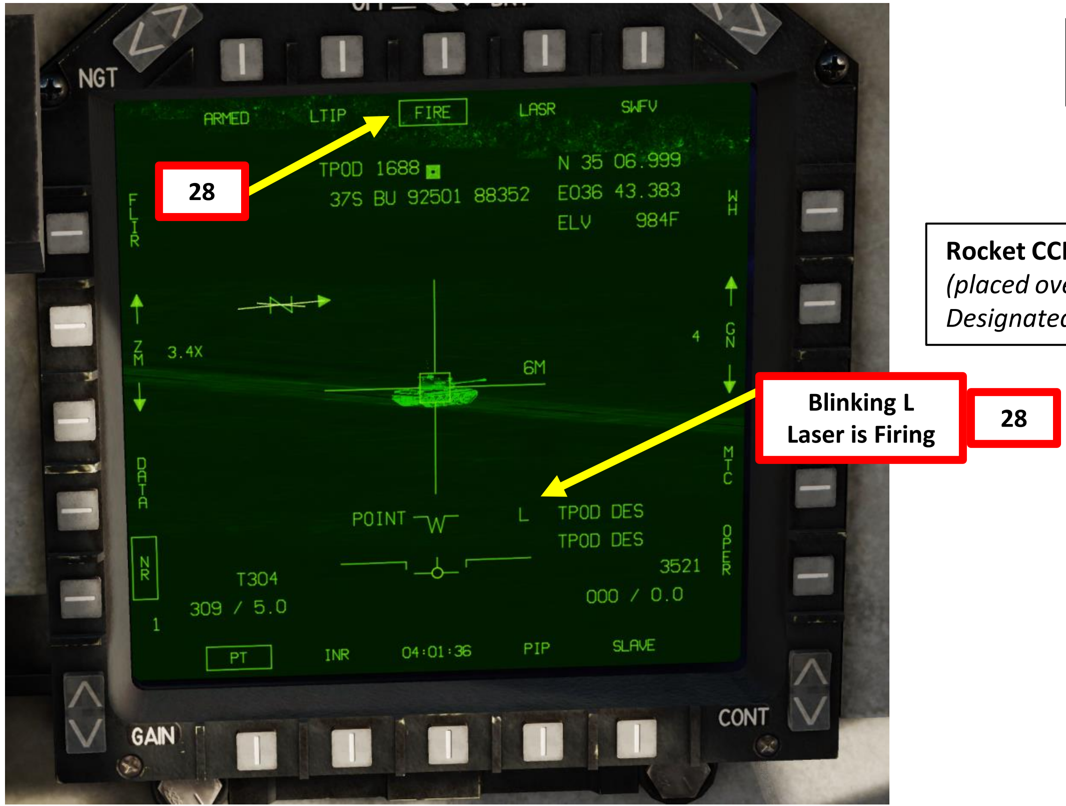
25
26
TDC (Target Designation Control)

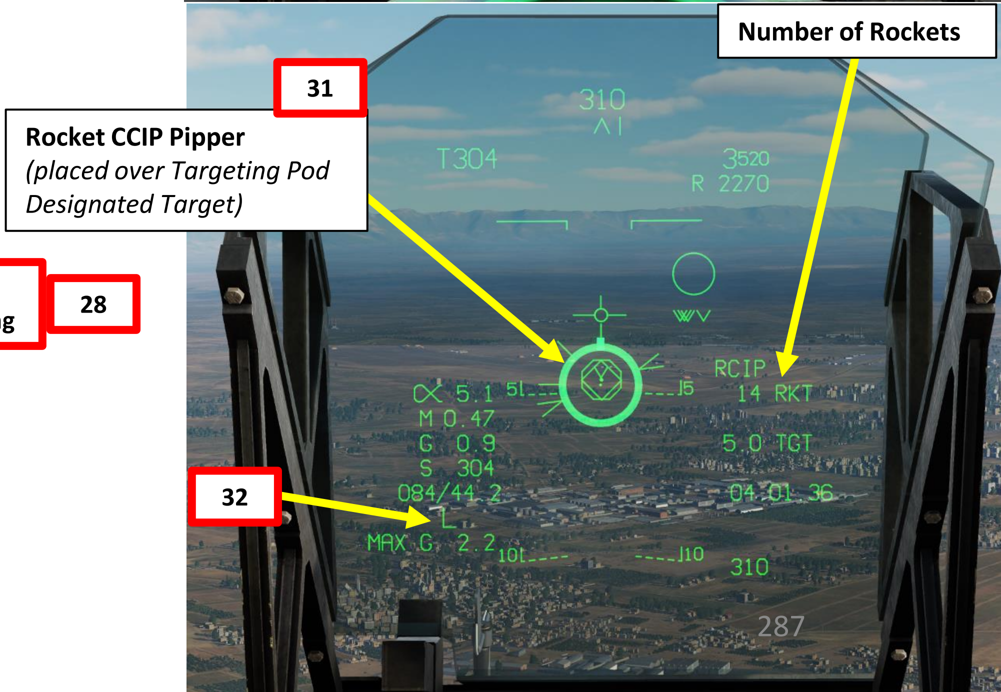
2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

28. Once laser is firing, the « L » indication will blink on both the HUD and the TPOD page.
29. Perform a shallow dive between 10 and 45 deg from at least 10000 ft.
30. Target range is indicated on the HUD.
31. A CCIP Rocket Reticle & Pipper will appear when you are not yet close enough to the target. When the slant range to target is less than 10 nm, place the center of the CCIP Reticle on the target.
32. Verify that Laser is firing (blinking "L" on the HUD).
33. At a slant range of around 5.5 to 5.0 nm, hold down the Bomb Pickle button (RALT+SPACE) to launch rockets.
34. Rockets will launch and track the laser until impact.



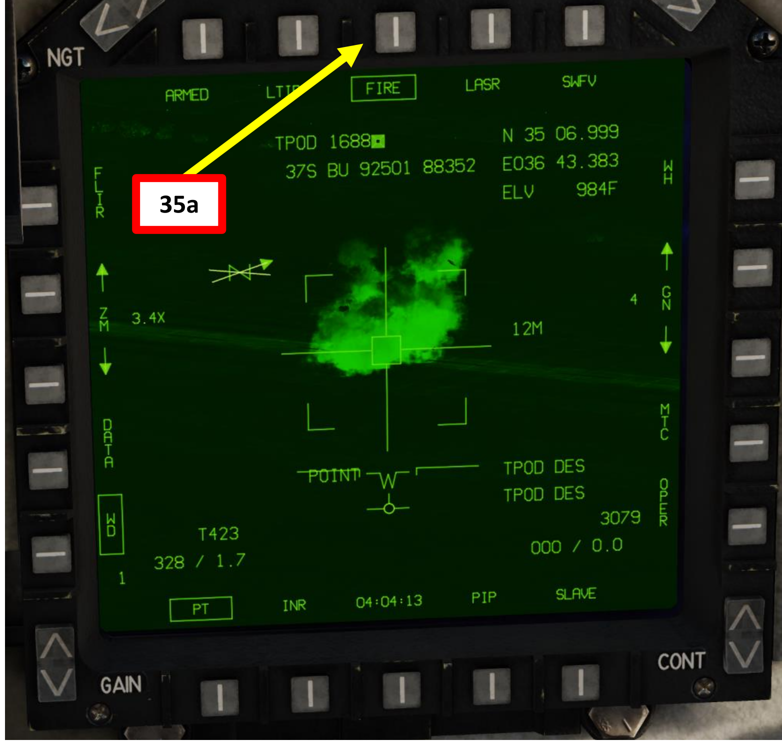


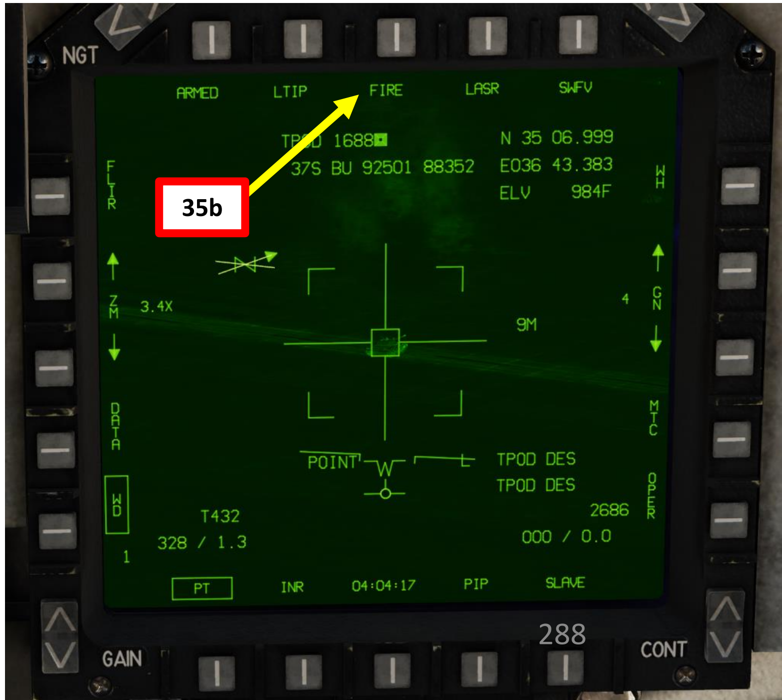




2.4 - APKWS (Advanced Precision Kill Weapon System) Laser-Guided Rockets (Targeting Pod Designation)

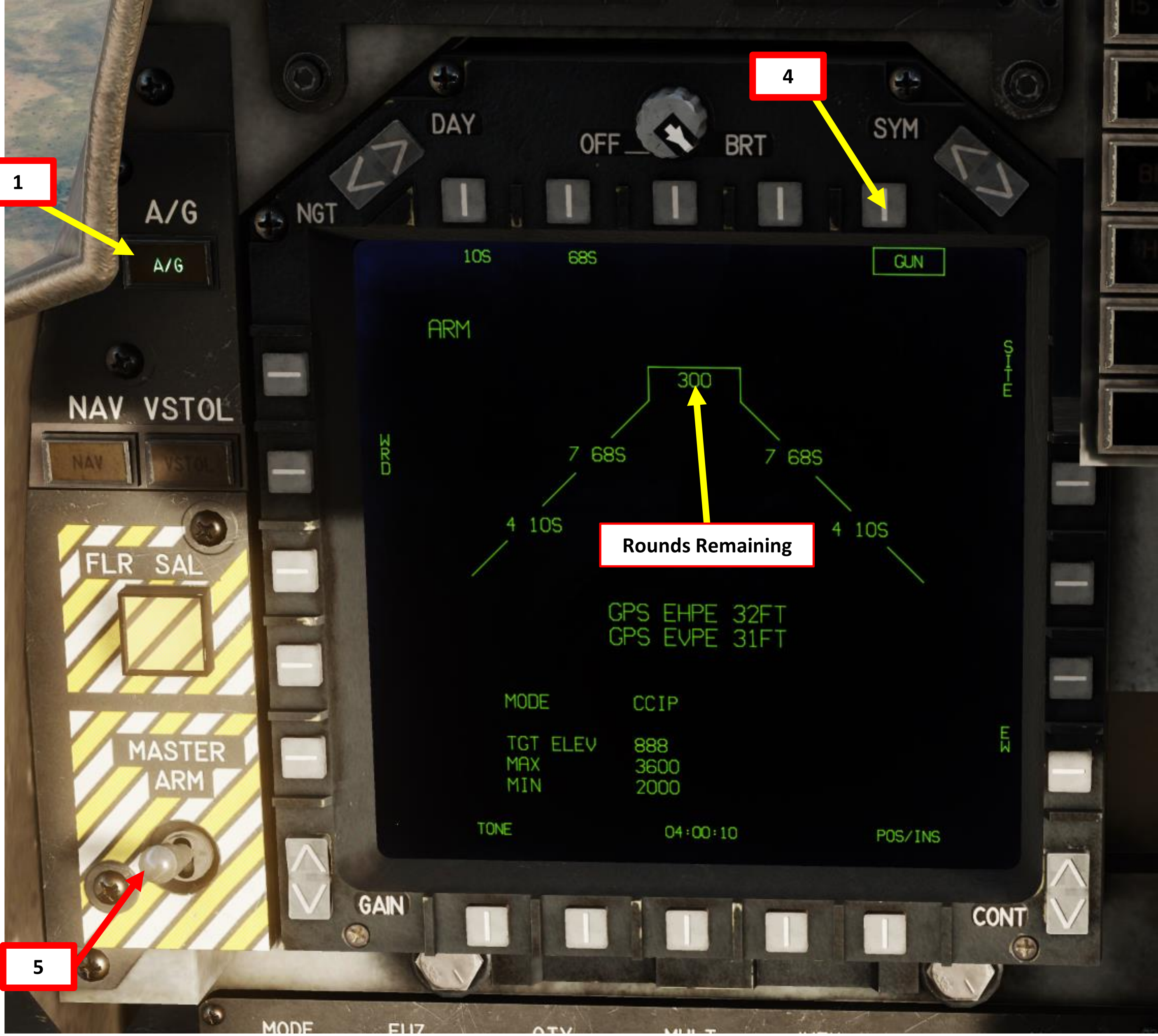
35. After rocket impact, press the FIRE OSB to turn off the laser (unboxed when OFF).
36. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.

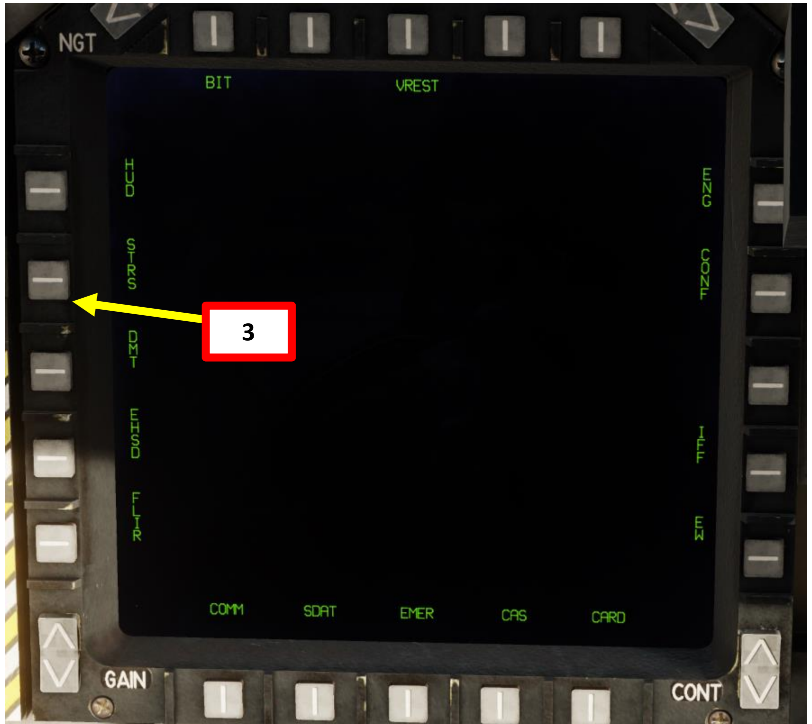




2.5 - GAU-12 Gun Pod (Air-to-Ground)

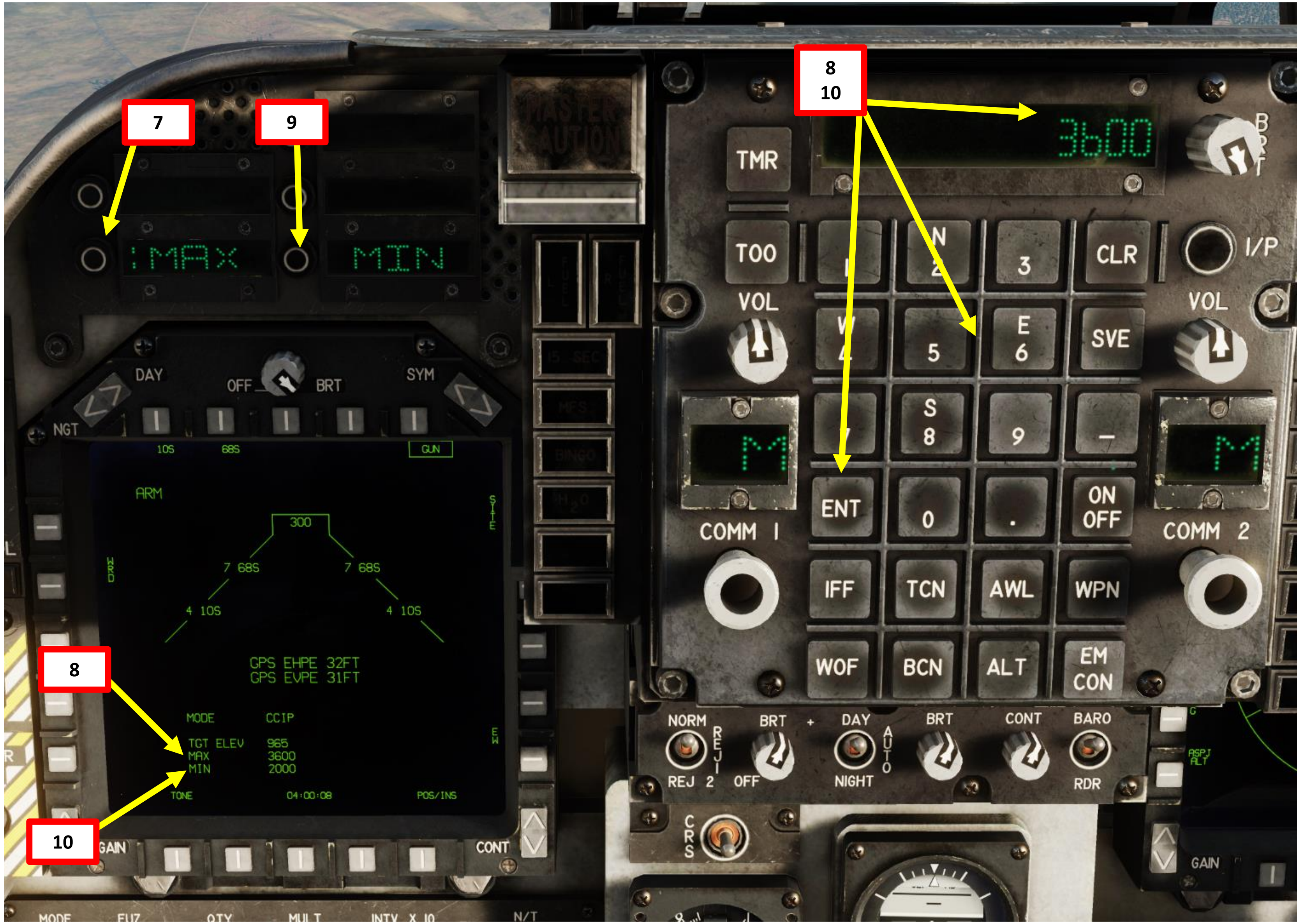
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select Gun Pod with the upper OSB.
5. Set Master Arm switch ON (UP)





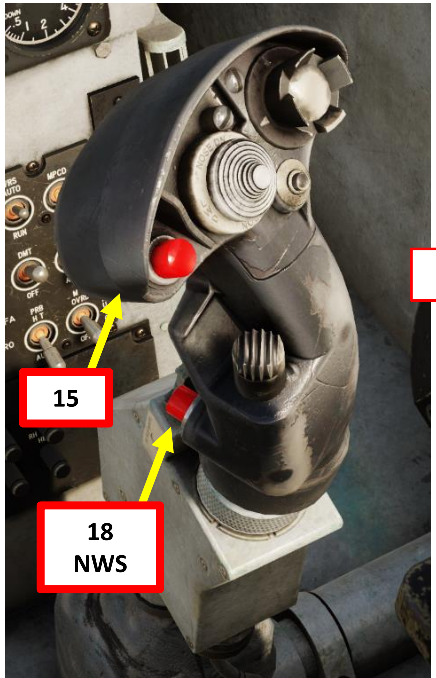
2.5 - GAU-12 Gun Pod (Air-to-Ground)

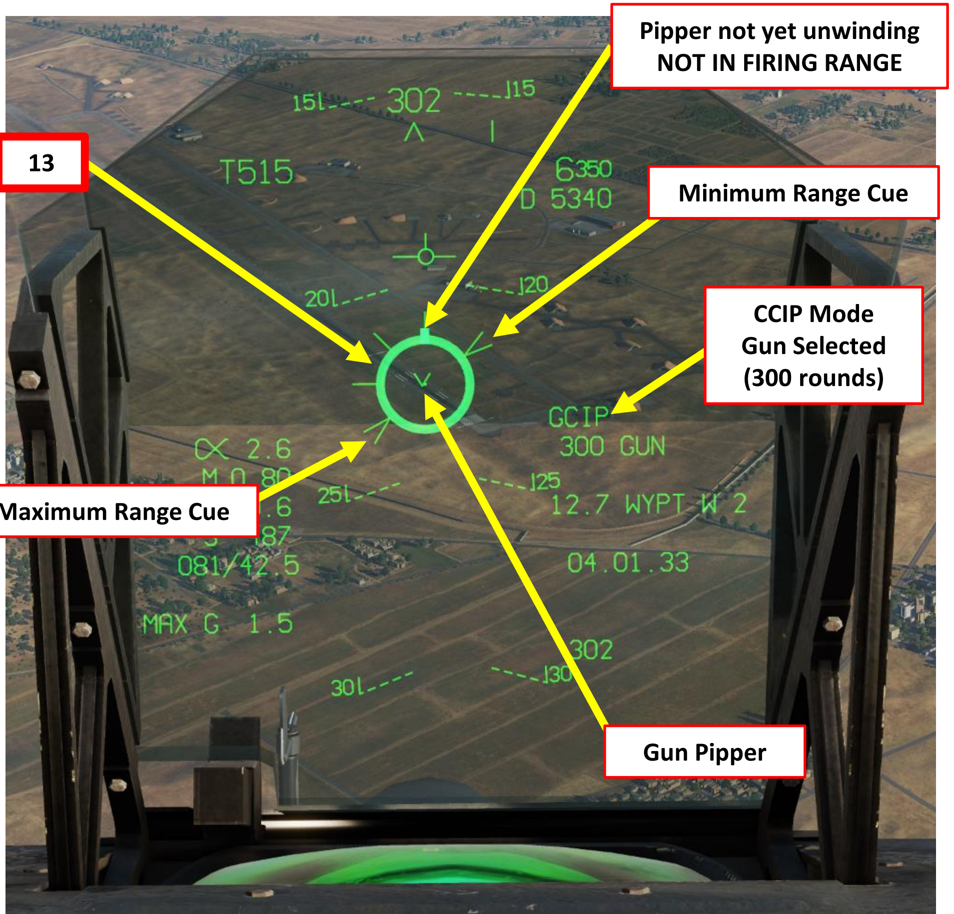
6. If desired, customize your pipper max/min range settings.
7. Press on MAX ODU (ODU (Option Display Unit, preceded by « : » when selected)
8. Enter desired Maximum Firing Range setting for the pipper on the keypad, then press ENT. A max range setting of 3600 ft is recommended.
9. Press on MIN ODU (ODU (Option Display Unit, preceded by « : » when selected)
10. Enter desired Minimum Firing Range setting for the pipper on the keypad, then press ENT. A min range setting of 2000 ft is recommended.

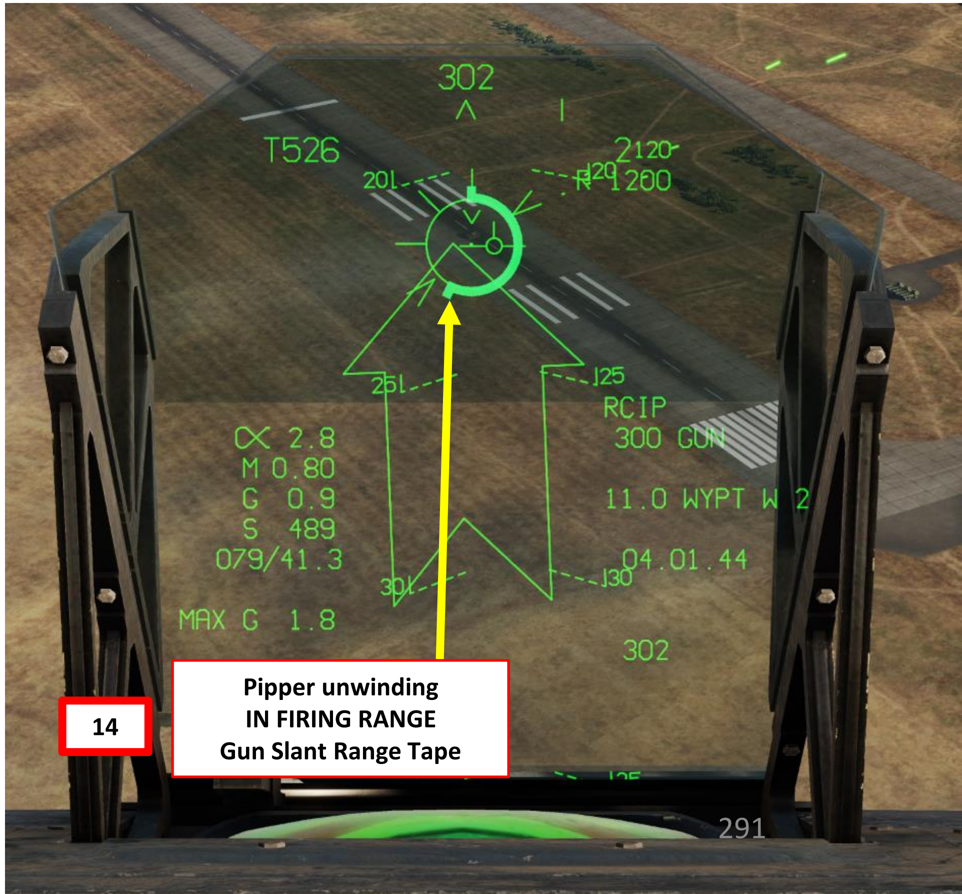


2.5 - GAU-12 Gun Pod (Air-to-Ground)

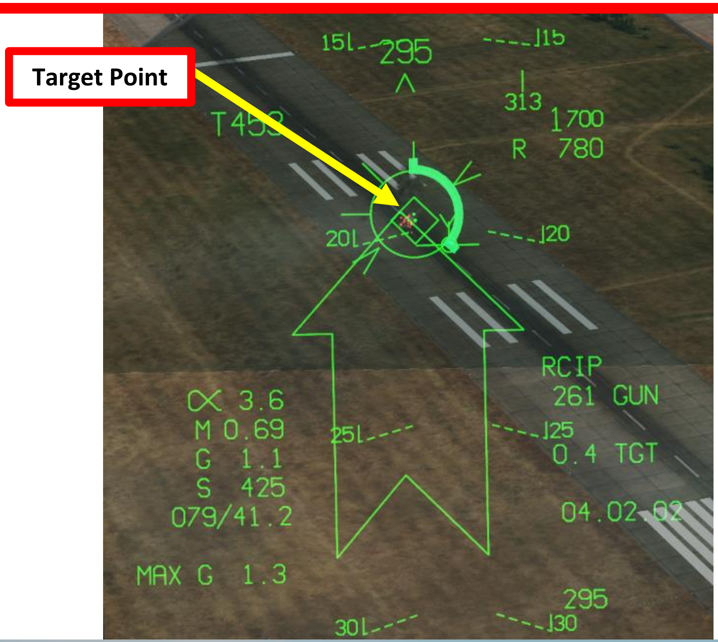
11. Start a 15 to 30-degree descent towards the target.
12. Adjust throttle to maintain engine RPM above 70 % RPM at low pressure altitudes or above 90 % RPM at high pressure altitudes (20000+ ft).
    - At low altitudes, a minimum engine RPM has to be maintained (above 70 % RPM) in order to generate sufficient bleed air pressure to supply the pneumatic gun firing mechanism. At higher pressure altitudes, a higher engine RPM setting is required (above 90 % RPM).
13. Set pipper on target and wait for the pipper to unwind.
14. You will be within firing range once pipper has unwinded between the Maximum Range and Minimum Range cues.
15. Press the Trigger (Fire Gun - SPACE) button to fire gun.
16. Keep in mind that the gun pod is located to the left and will induce a yaw moment when firing. You will have to compensate it with your rudder.
17. Once gun is fired on a ground target, a target point is automatically created in case you need to attack the target again.
18. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.





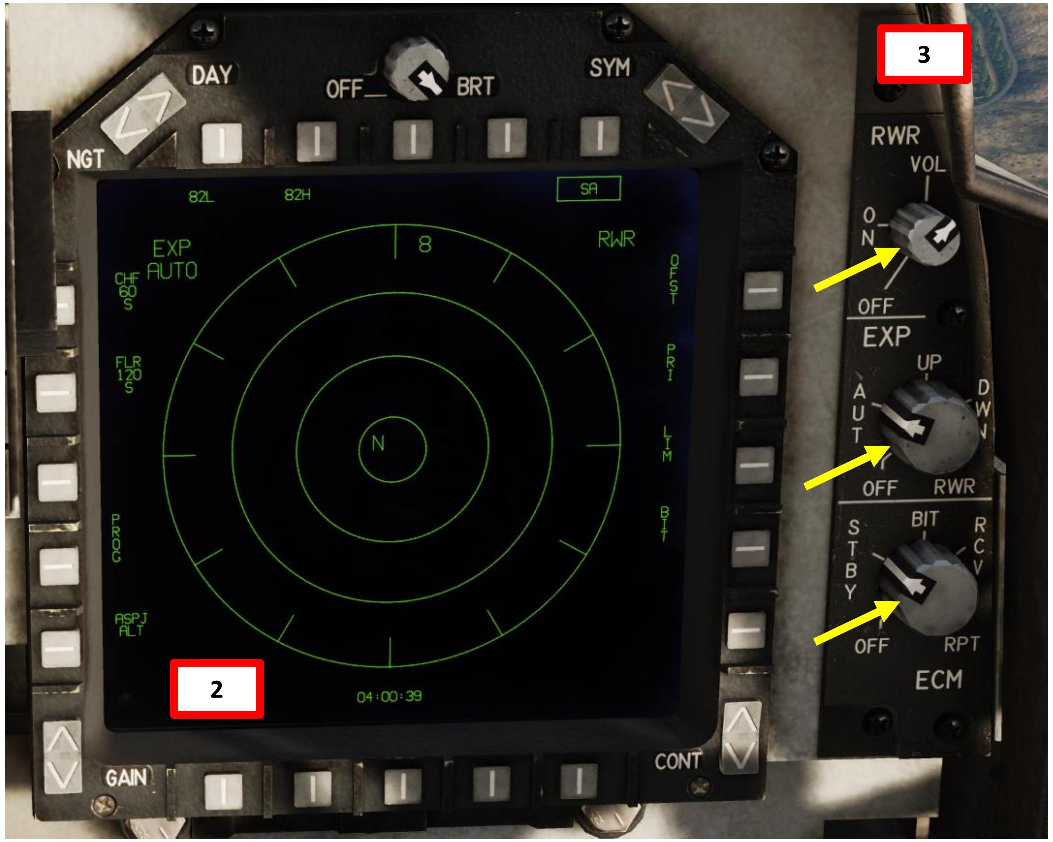


2.5 - GAU-12 Gun Pod (Air-to-Ground)



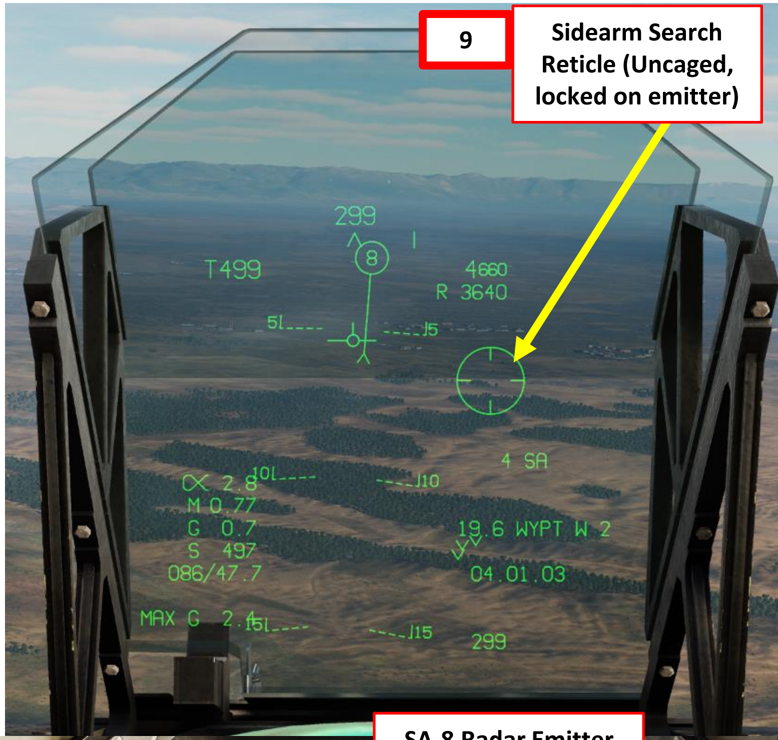
2.6 - AGM-122 SIDEARM AIR-TO-SURFACE ANTI-RADIATION MISSILE

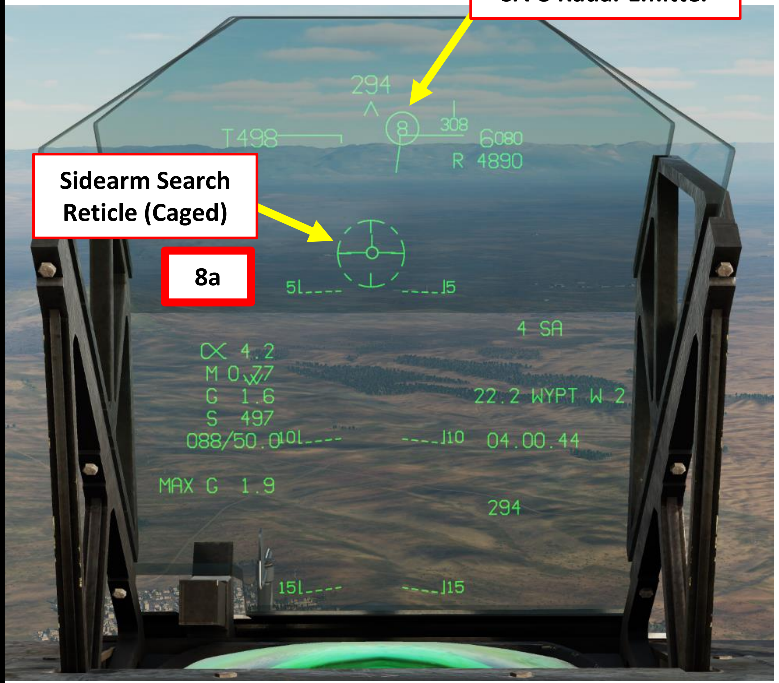
1. Set Master Mode to A/G (Air-to-Ground)
2. Set the EW (Electronic Warfare) page on one of your MPCDs, and the STRS (Stores) page on the other MPCD.
3. For SEAD (Suppression of Enemy Air Defenses) missions, I suggest that you make sure your RWR (Radar Warning Receiver) is set to ON, your EXP (Expendable) countermeasures are set to AUTO and your ECM (Electronic Countermeasures) switch is set in the appropriate position if a DECM pod is equipped.
4. Click on the SEL buttons to select your Sidearm missiles (SA).
5. Set Master Arm switch – ON (UP)

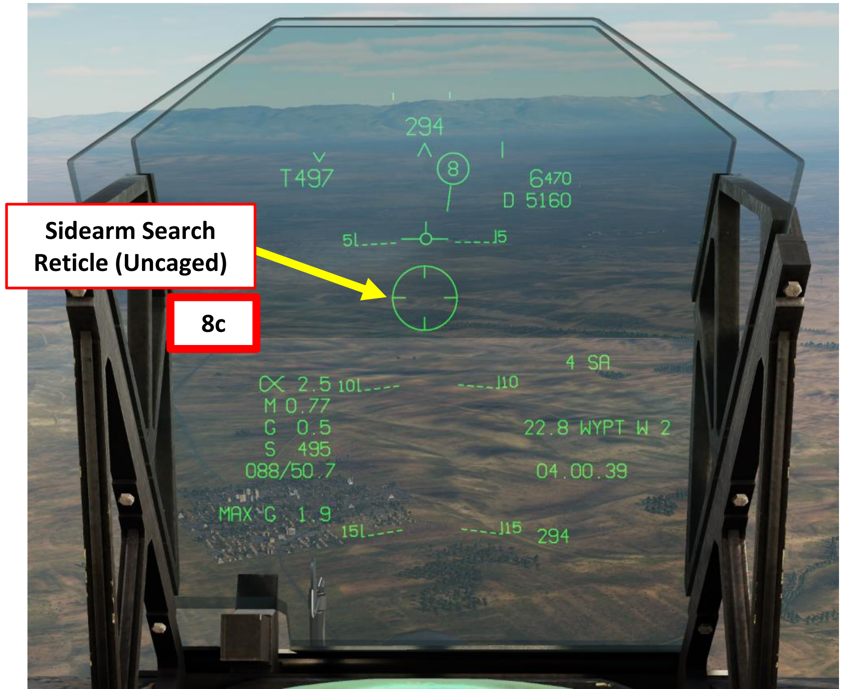


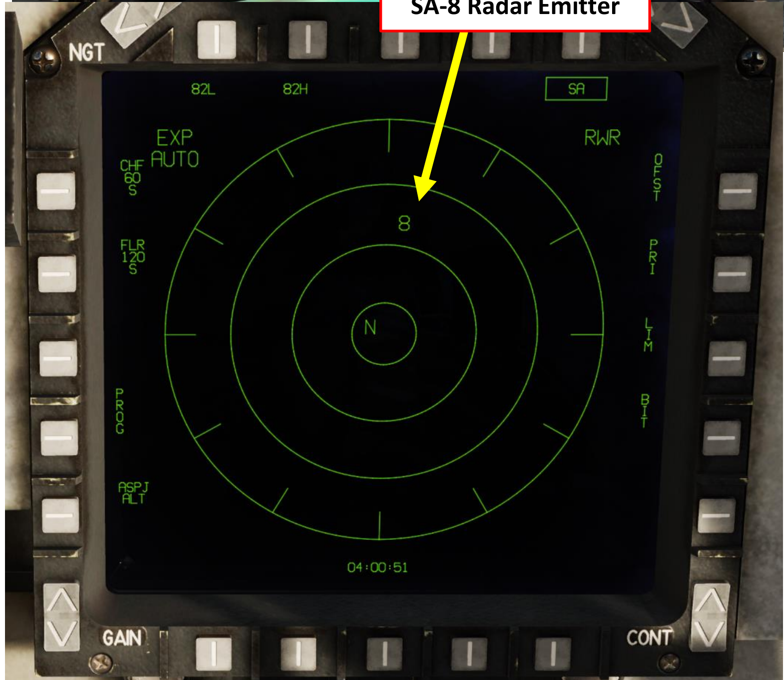
2.6 - AGM-122 SIDEARM AIR-TO-SURFACE ANTI-RADIATION MISSILE

6. Find radar emitters using the RWR on the EW page and on your HUD.
7. While Sidearm seeker is in search mode, it will emit a low-pitch growling tone.
8. Press the CAGE/UNCAGE button to uncage the Sidearm. When Sidearm is uncaged, the missile seeker is allowed to self track a target and its sensitivity is increased.
9. When the low-pitch growling tone switches to a high-pitch tone and your seeker reticle locks onto the general direction of source of radiation emission, your Sidearm has locked on the target. Keep in mind that you do not have any range indication from the emitter.
10. Press the Trigger (Fire Gun - SPACE) button to fire Sidearm missile
11. Once Sidearm is fired, break away from the emitter and deploy countermeasures as required.





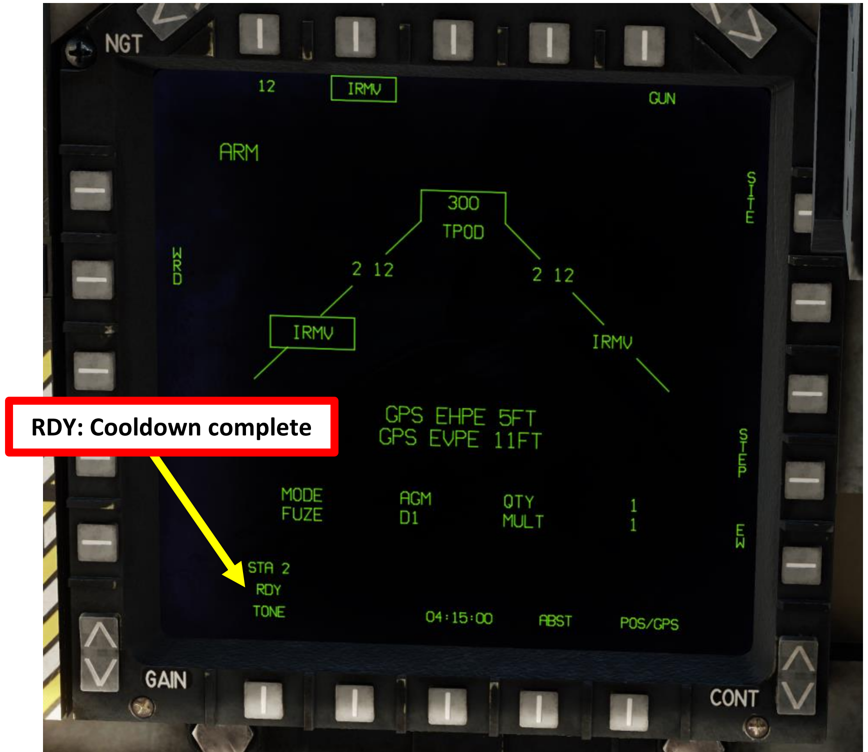




2.6 - AGM-122 SIDEARM
AIR-TO-SURFACE ANTI-RADIATION MISSILE

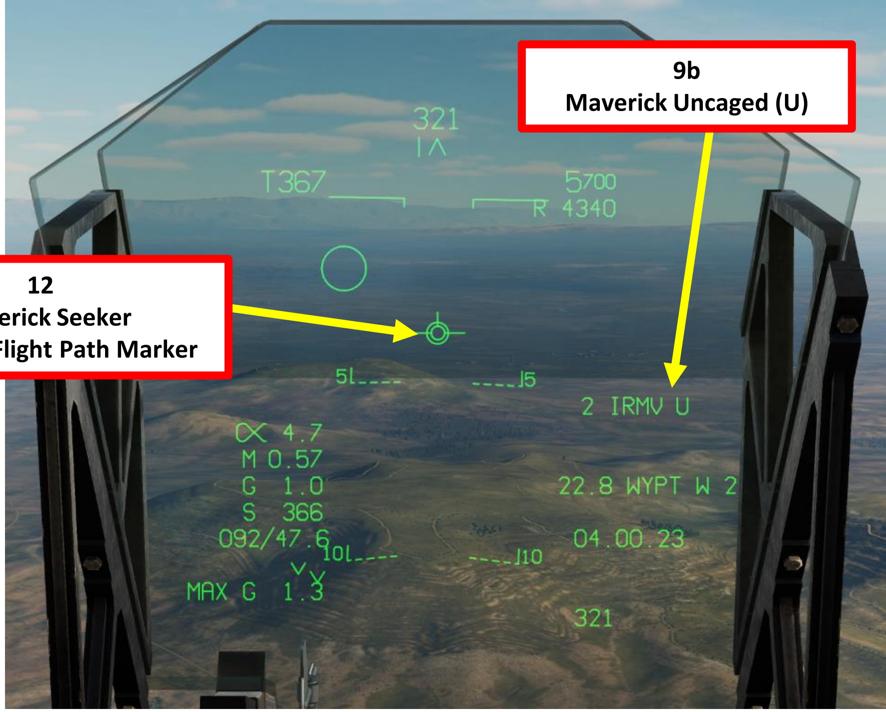
2.7 - AGM-65F MAVERICK (IRMV)
2.7.1 - IRMV Sensor Only

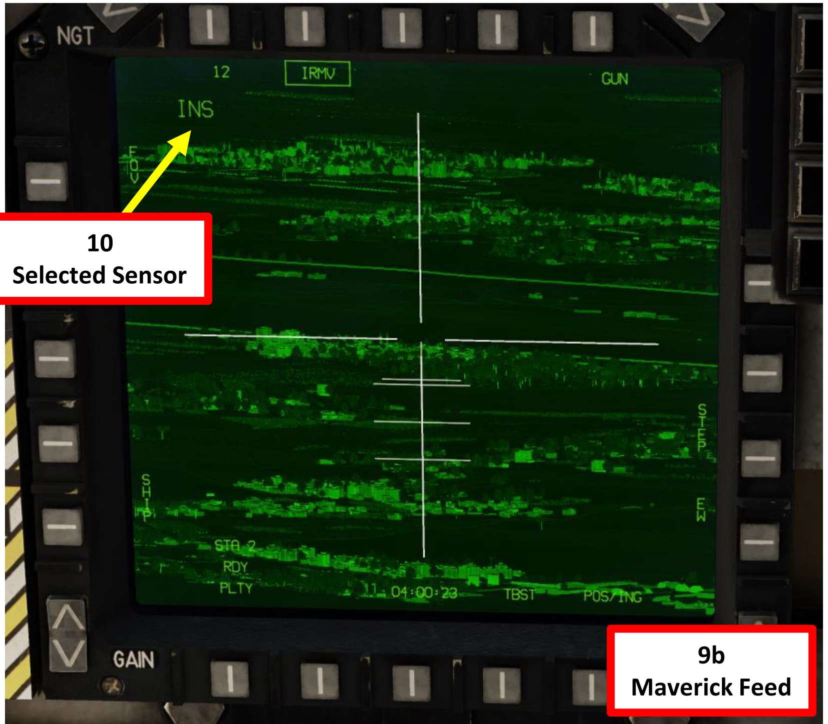
1. Set Master Mode to A/G (Air-to-Ground)
2. You should prepare your Maverick missiles as soon as possible. Cooldown and preparation take a while.
3. Go in MPCD main MENU
4. Select STRS (Stores) Page
5. Select IRMV (Infrared Maverick) missile by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
6. As soon as the Maverick missile is selected, it will begin its cooldown phase, which will last 3 minutes. STBY indicates the cooldown phase in in progress, while RDY indicates that the Maverick is warmed-up and ready for use.
7. Set FUZ (fusing) switch to either IN, D1 or D2.
8. Set Master Arm Switch - ON (UP)

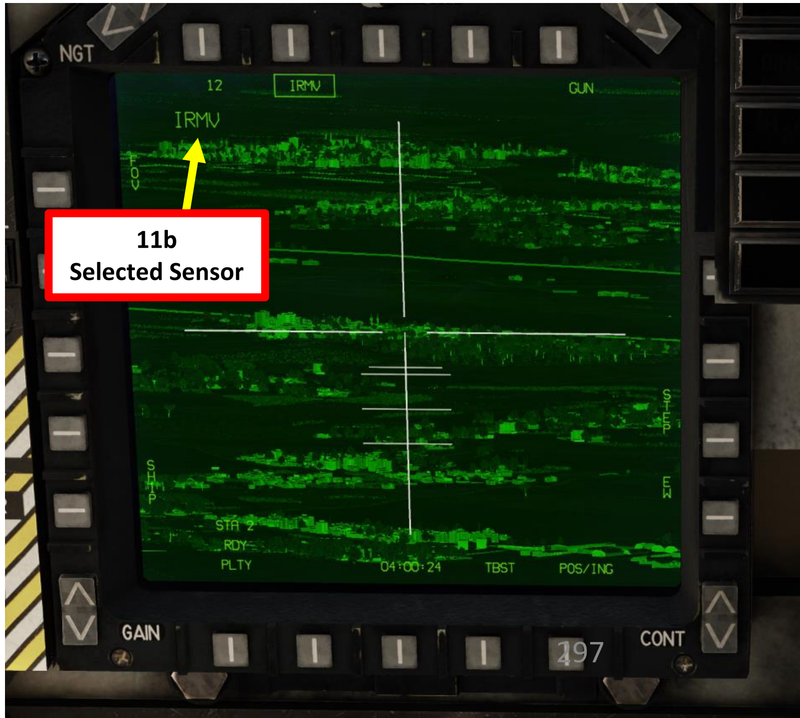


2.7 - AGM-65F MAVERICK (IRMV)
2.7.1 - IRMV Sensor Only

9. Press on the Weapon Cage/Uncage button to view the Maverick seeker head feed.
10. Check selected sensor on IRMV page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
11. Use the Sensor Control Switch to set the Maverick (IRMV) as the Sensor of Interest.
    - If TPOD (Targeting Pod) is the selected sensor, double-press Sensor Select Switch DOWN to switch from TPOD to INS, then press Sensor Select Switch FWD to select IRMV.
    - If INS or TV (DMT) is the selected sensor, press Sensor Select Switch FWD to select IRMV.
12. When Maverick is first uncaged without any target designation previously set by other sensors, its seeker head is boresighted on the HUD’s Flight Path Marker.

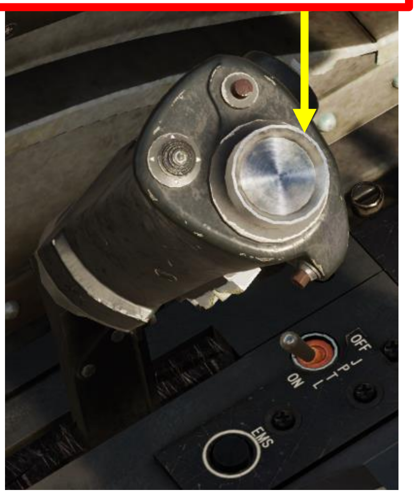



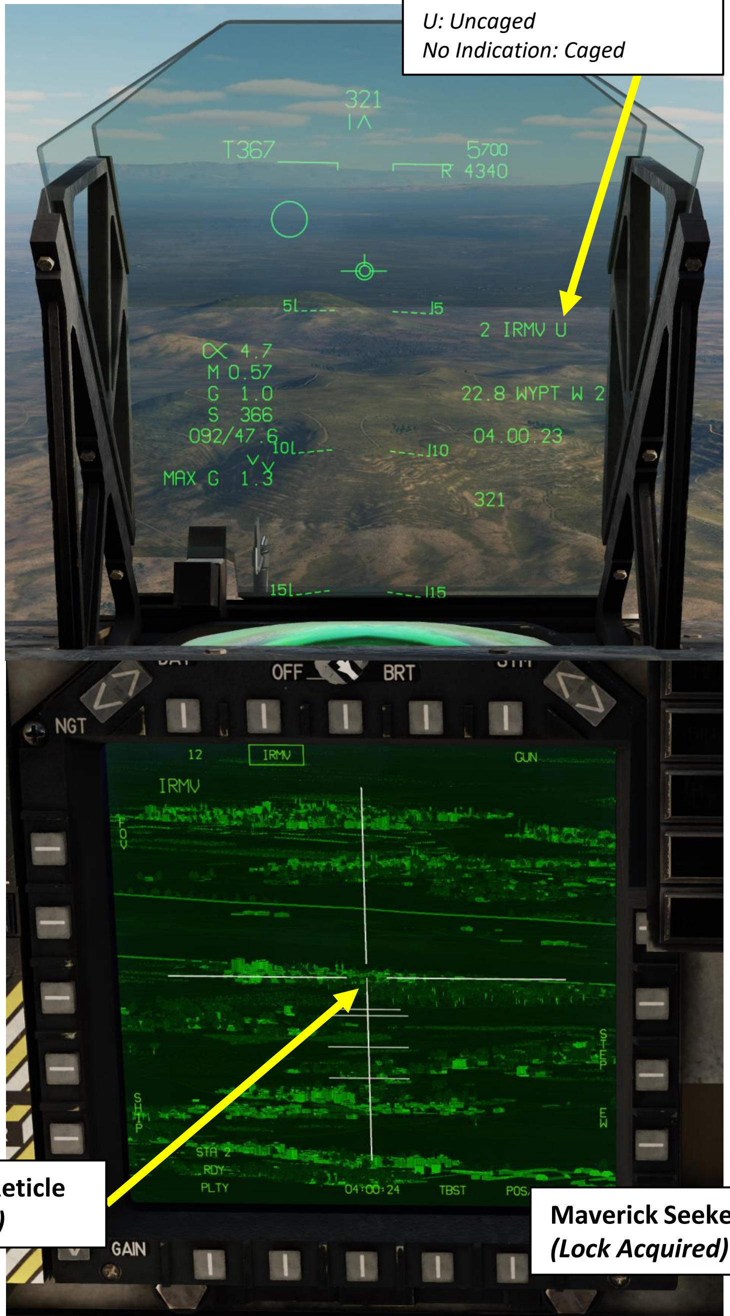


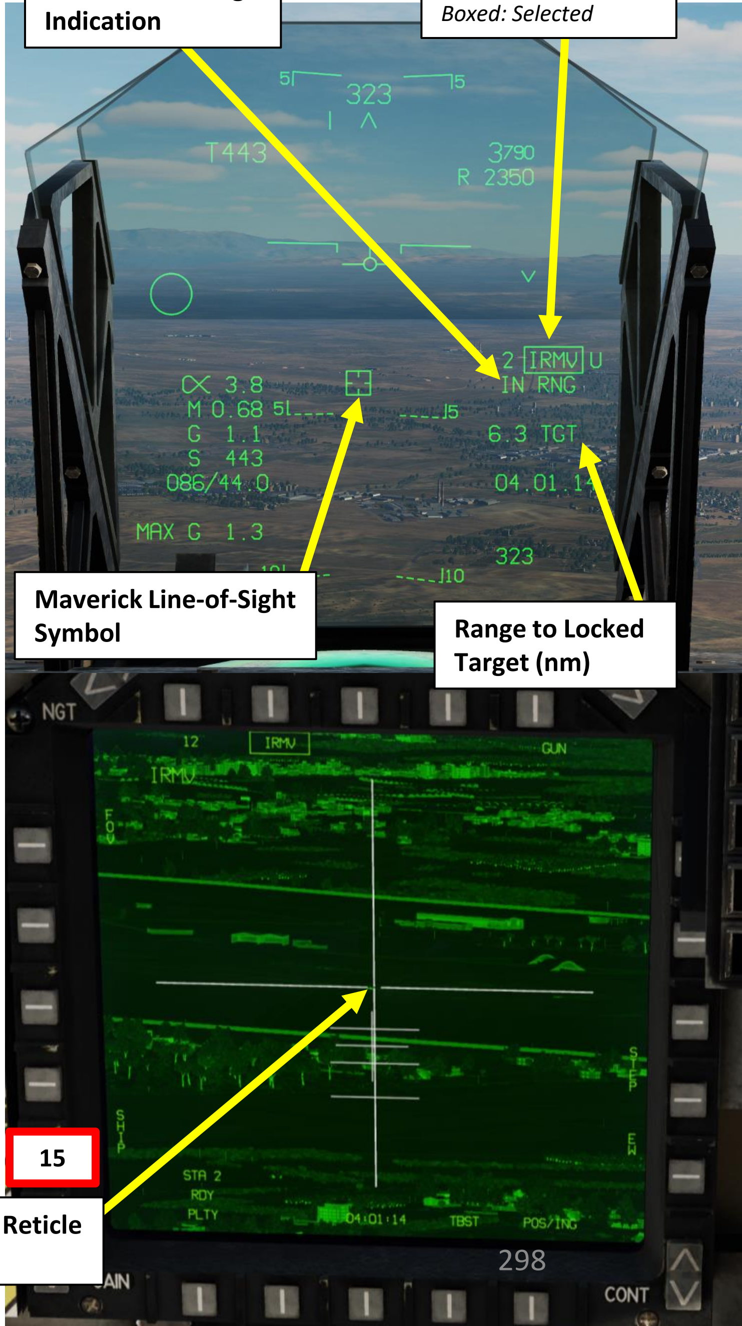


2.7 - AGM-65F MAVERICK (IRMV)
2.7.1 - IRMV Sensor Only

13. Toggle Maverick Field-of-View by pressing the « AG Target Undesignate/NWS/FOV Toggle ».
14. Use TDC Controls (Left/Right/Fwd/Aft) to slew the Maverick reticle over the desired target.
15. Periodically use TDC Depress (Action) control to attempt a missile lock the target (IR contrast).
16. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.
17. When lock is acquired and IN RNG (In Range) cue is visible, you may fire the missile.

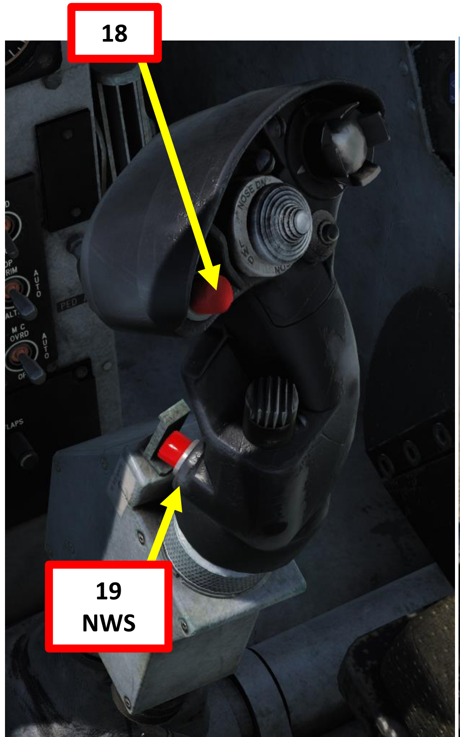






2.7 - AGM-65F MAVERICK (IRMV)
2.7.1 - IRMV Sensor Only

18. Press the Bomb Pickle button (RALT+SPACE) to fire missile.
19. If a missile lock is acquired and you want to unlock target, pressing the « AG Target Undesignate/NWS/FOV Toggle » button unlocks target and boresights the missile on the flight path marker.
20. To fire subsequent Mavericks, press the Weapon Cage/Uncage switch again, then Sensor Select Switch FWD to set the IRMV as the sensor of interest.



2.7 - AGM-65F MAVERICK (IRMV)
2.7.1 - IRMV Sensor Only

Note: IR Mavericks have a Gimbal Limit warning. If the gimbal limits are reached, a "GIMBAL LIMITS" warning will flash on the MPCD screen and then 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. Gimbal Limits may be reached when the missile is slaved to the DMT.

2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

In this tutorial, we will use the targeting pod's superior zooming capabilities to find a valid target, then slave the Maverick to the targeting pod's line of sight. This method is a bit more complicated than using the Maverick seeker alone, but it has all many advantages provided by the ground-stabilized targeting pod.

One aspect that is important to understand for this tutorial is the « flow » of actions used get a missile lock since we use multiple sensors.

Targeting Pod is Powered Up
Master Mode: A/G

Sensor Select Switch
DOWN x2
Sensor Control: TPOD

TDC Depressed (Action)

TPOD DES
TPOD DES
(TPOD Designation)
- *Perform Area/Point/Moving Track as desired.*

Sensor Select Switch
DOWN x2
Sensor Control: INS
(Coordinates memorized)

Select Maverick Missile in STORES page
+ Weapon Cage/Uncage Button
Maverick Feed Live
(Missile Slaved to INS coordinates)

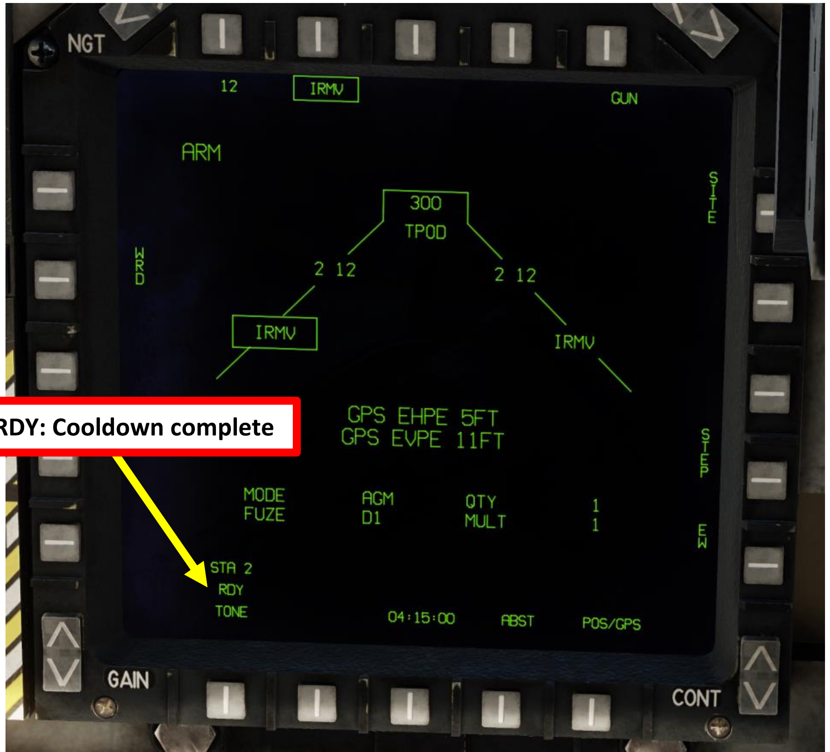
Sensor Select Switch
FWD
Sensor Control: IRMV

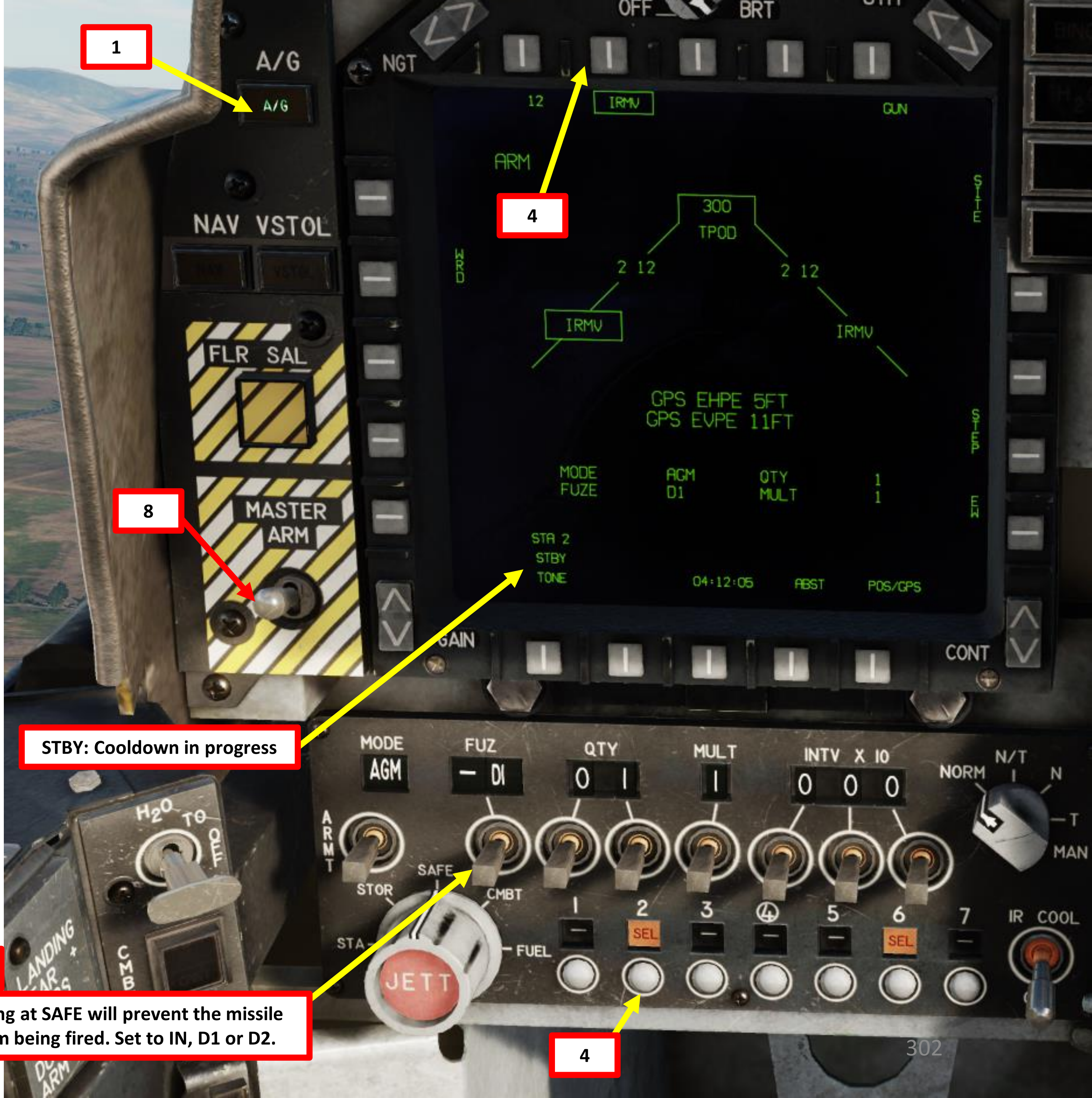
TDC Slew: Moves Maverick Reticle if required
TDC Depressed (Action): Missile Lock

Fire Missile

2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

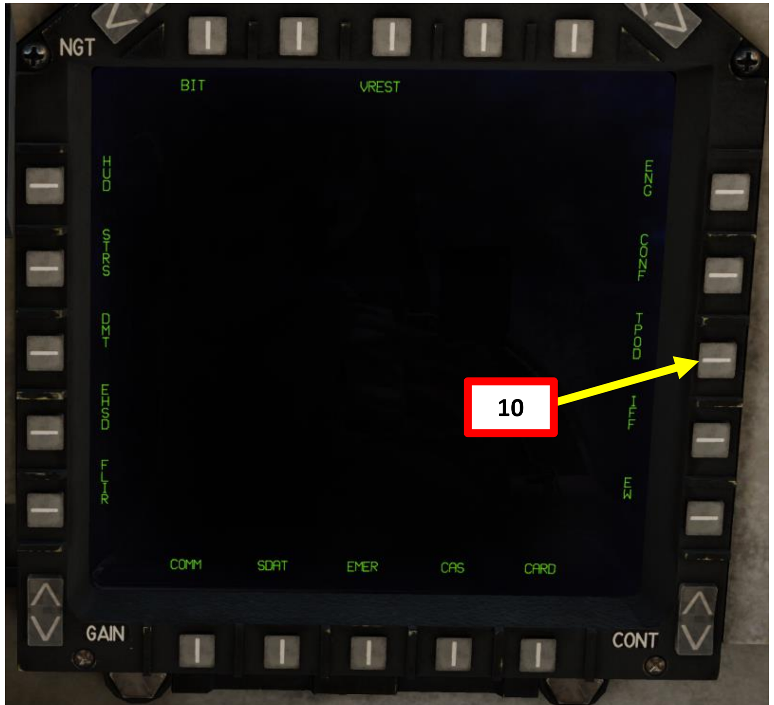
1. Set Master Mode to A/G (Air-to-Ground)
2. You should prepare your Maverick missiles as soon as possible. Cooldown and preparation take a while.
3. Go in MPCD main MENU
4. Select STRS (Stores) Page
5. Select IRMV (Infrared Maverick) missile by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
6. As soon as the Maverick missile is selected, it will begin its cooldown phase, which will last 3 minutes. STBY indicates the cooldown phase in in progress, while RDY indicates that the Maverick is warmed-up and ready for use.
7. Set FUZ (fusing) switch to either IN, D1 or D2.
8. Set Master Arm Switch - ON (UP)

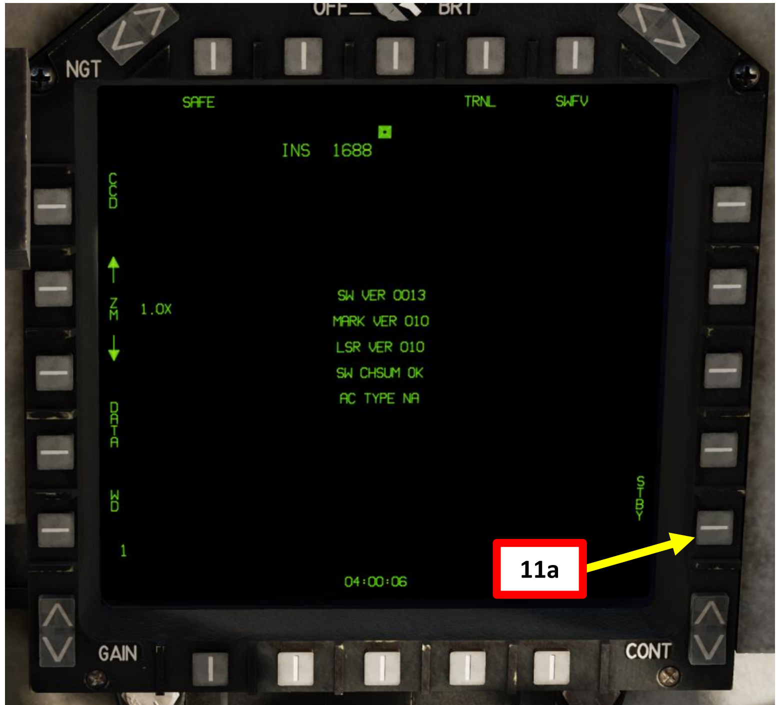


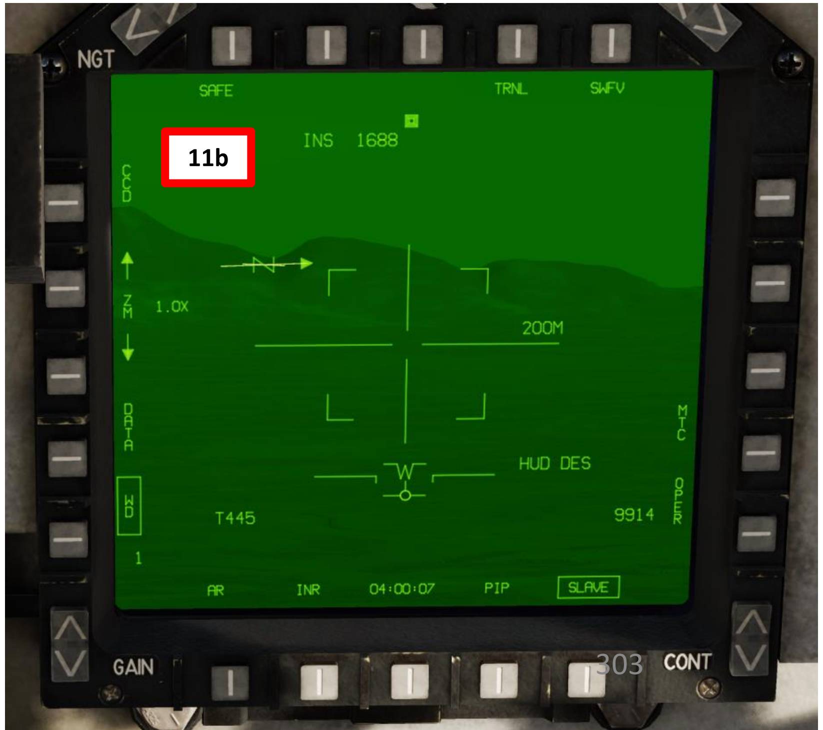


2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

9. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
10. Press the OSB next to the “TPOD” page in the main MPCD MENU
11. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).

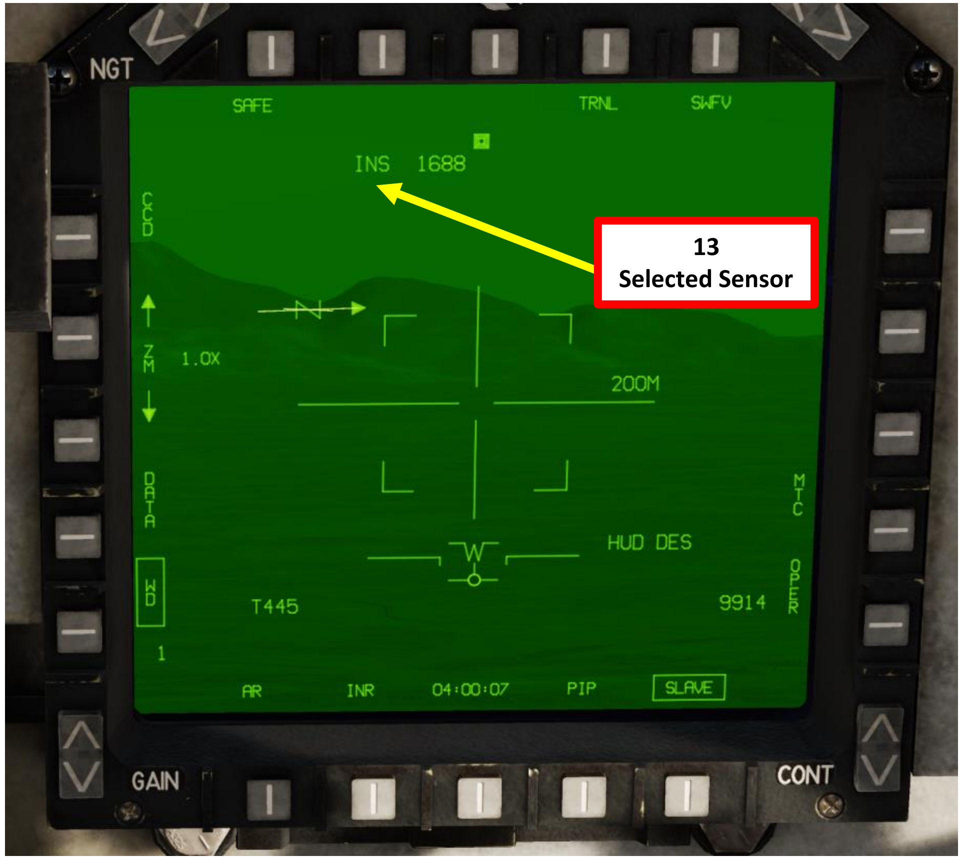


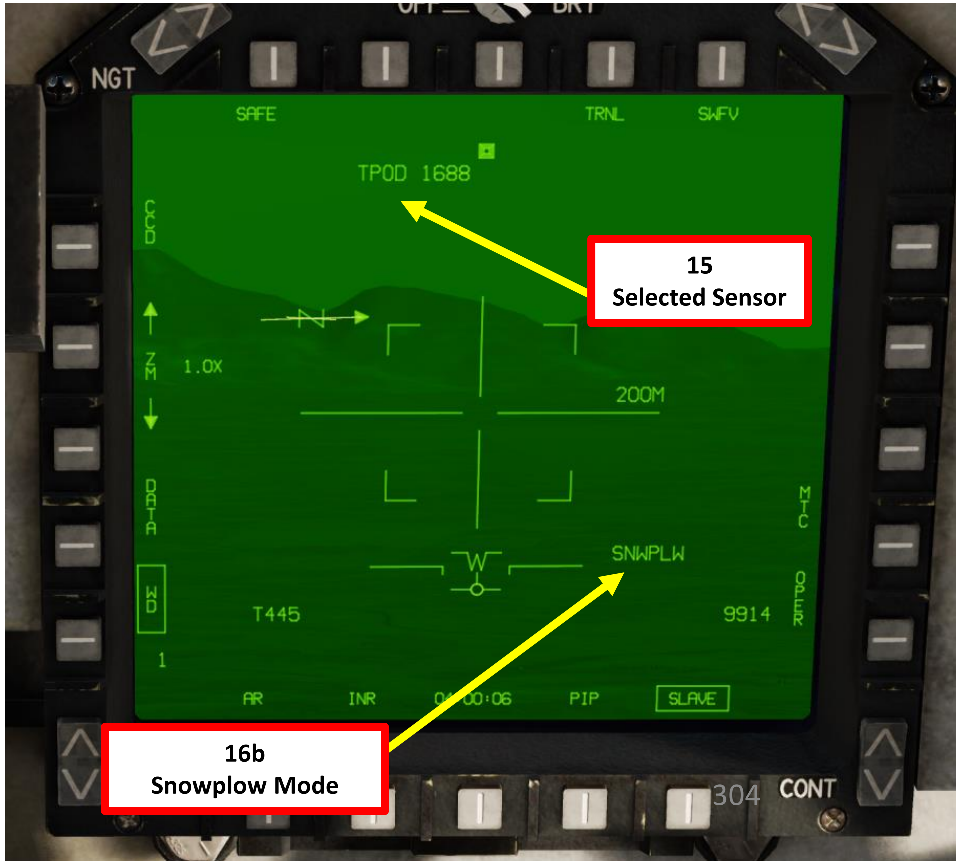




2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

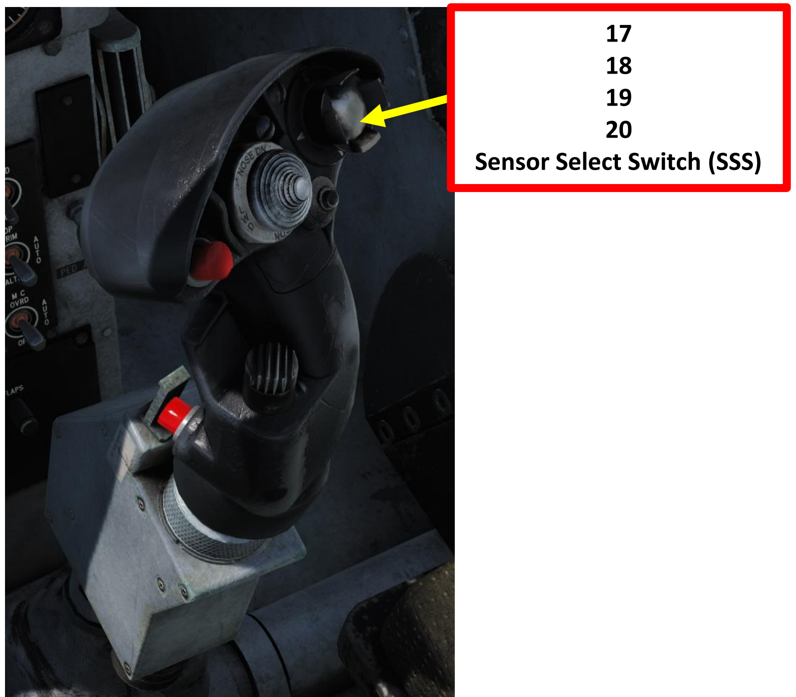
12. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
13. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
14. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
15. Confirm that Sensor of Interest switches to TPOD.
16. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.

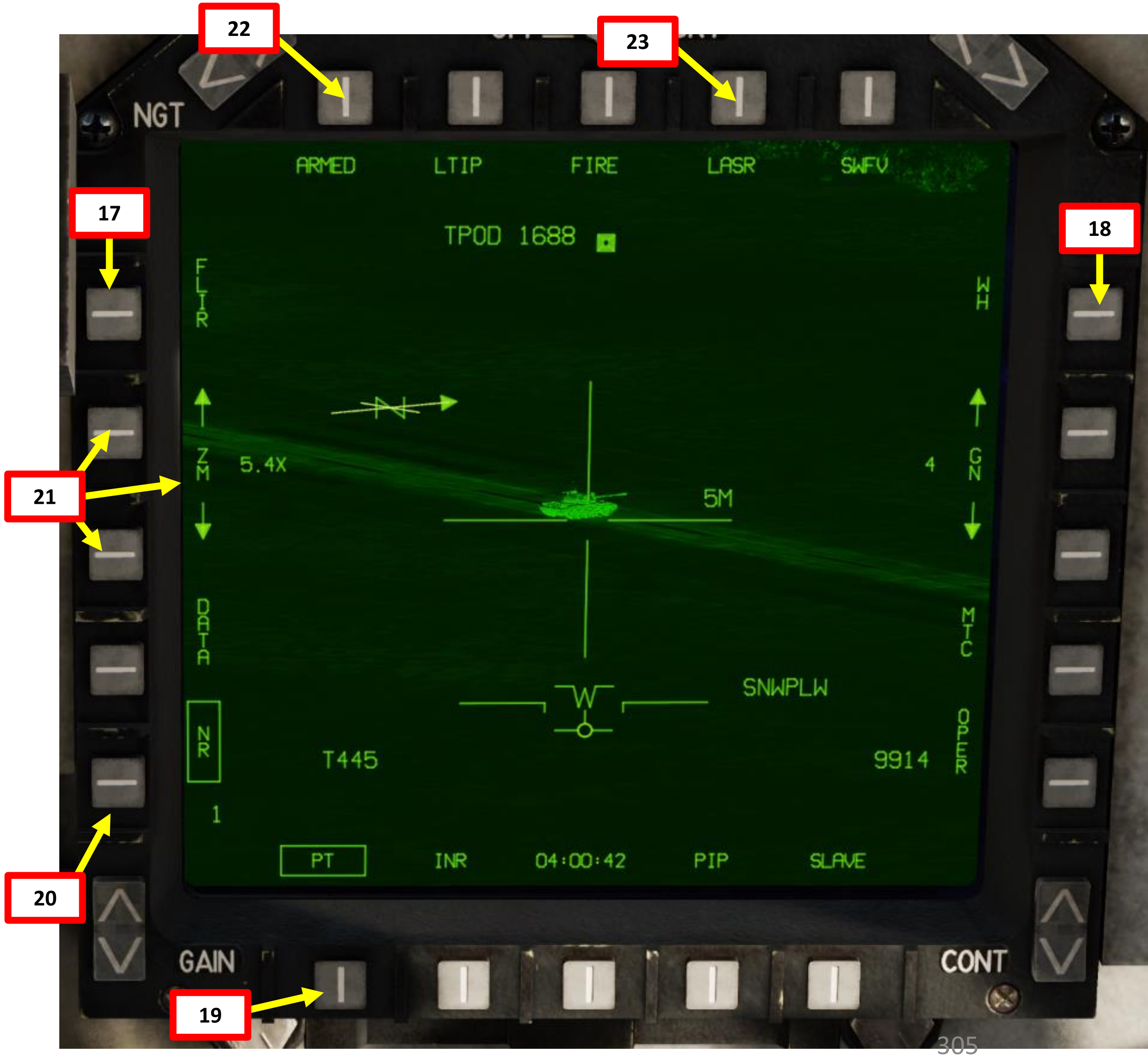




2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

17. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
18. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
19. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
20. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
21. Select desired zoom level by using the ZM +/- OSBs.
22. Press Laser Arming OSB to select ARMED mode.
23. Press Laser Mode OSB to select LASR (Laser Designator) Mode.



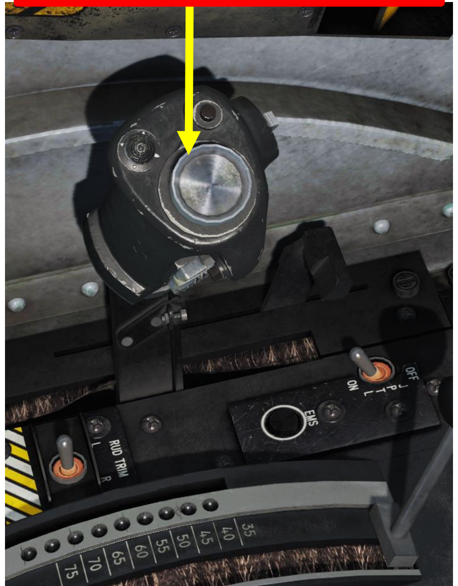


2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

24. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
25. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
26. If you want to have a laser ranging update, make sure you have a valid laser code and press the OSB next to LTIP (Laser Target Imaging Profile) or press Sensor Select Switch FWD SHORT. This step is optional.

26
Sensor Select Switch (SSS)

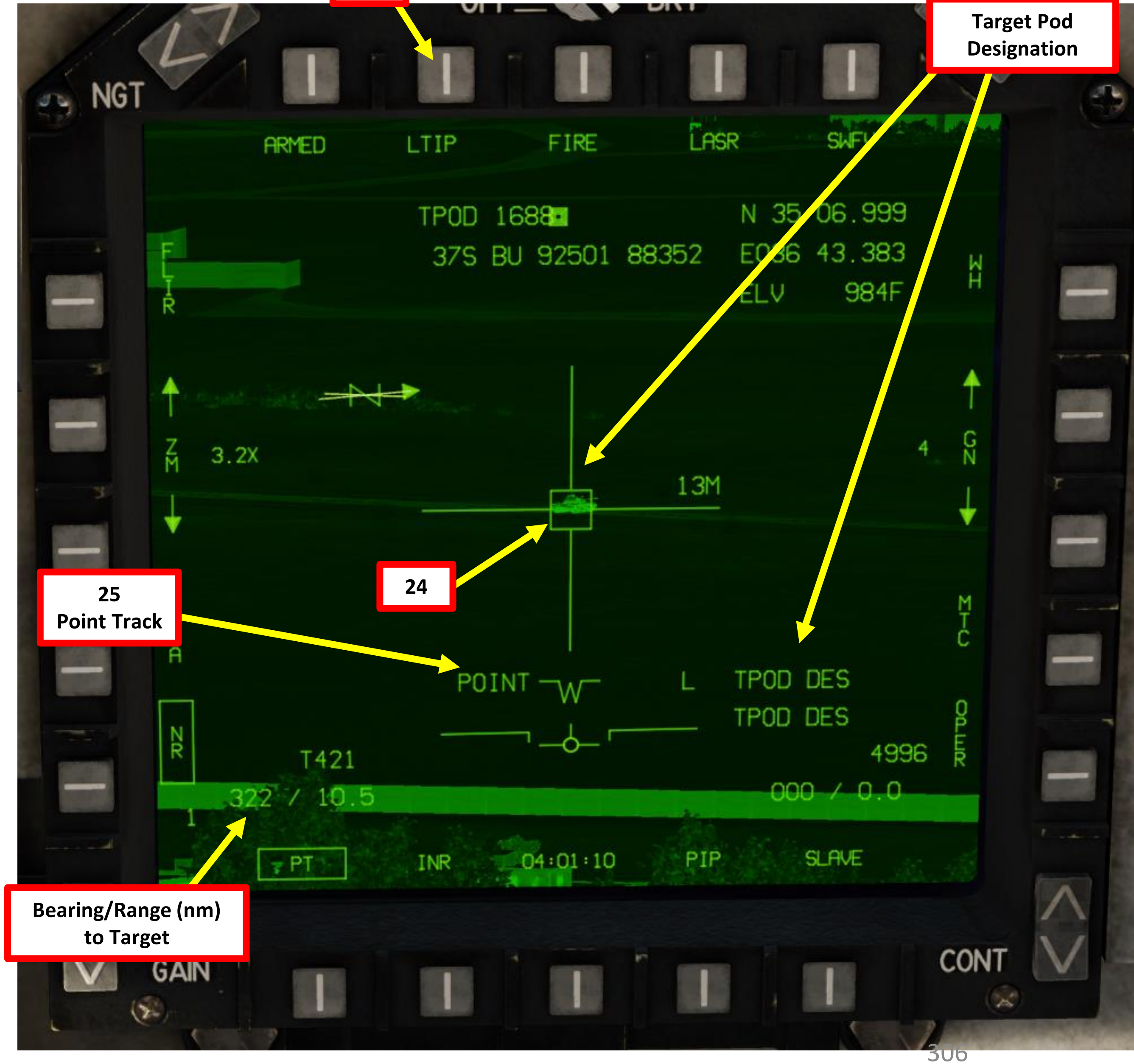
24
25
TDC (Target Designation Control)



26

25

Target Pod Designation



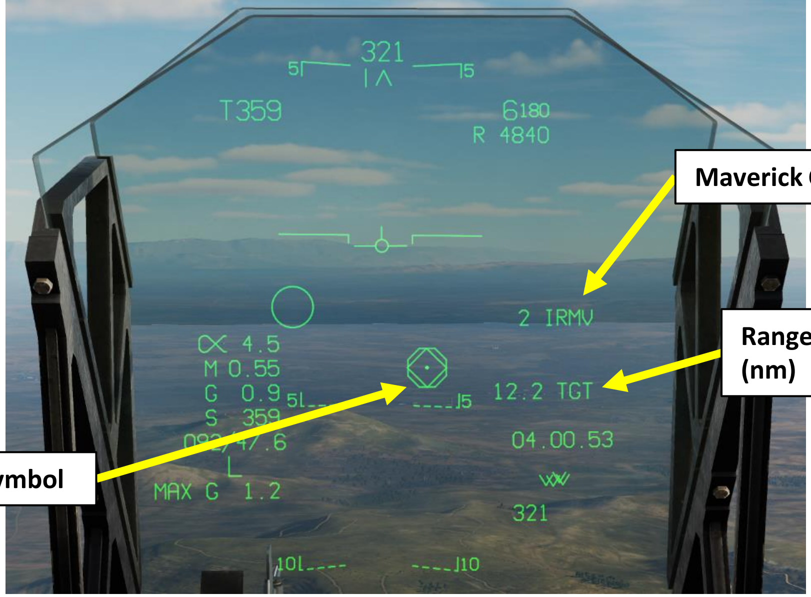
24

25
Point Track

Bearing/Range (nm) to Target

2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

27. Exit TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession. This will switch the sensor of interest from the TPOD to the INS (Inertial Navigation System), memorizing the target coordinates in the process.



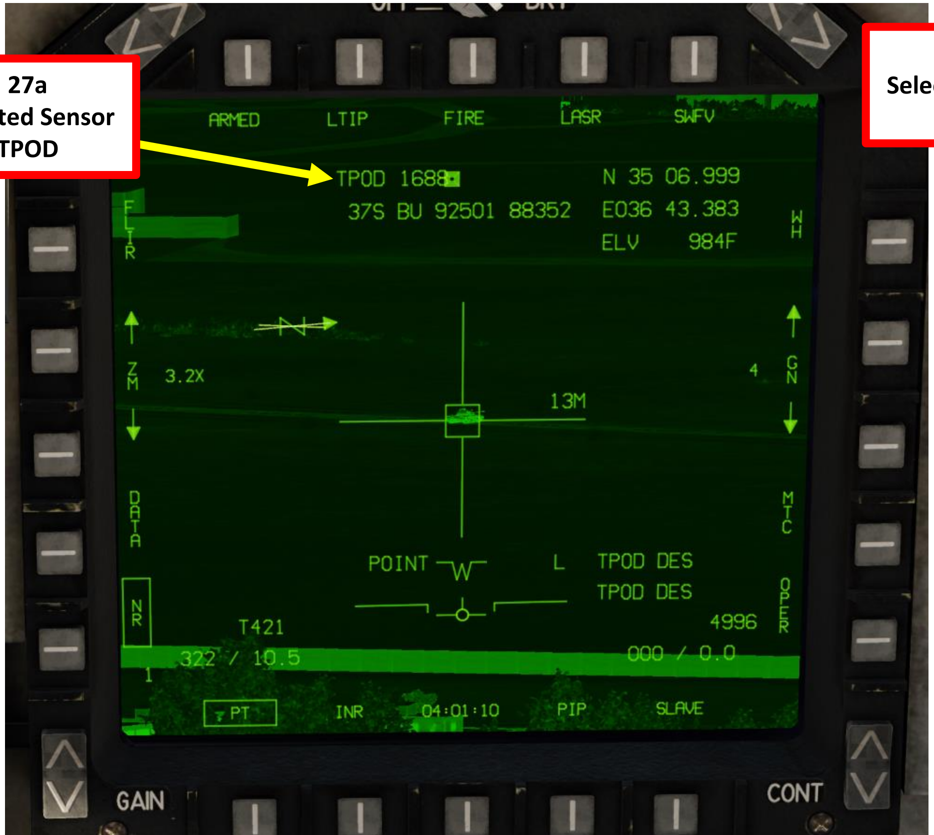
Maverick Caged

Range to Target (nm)

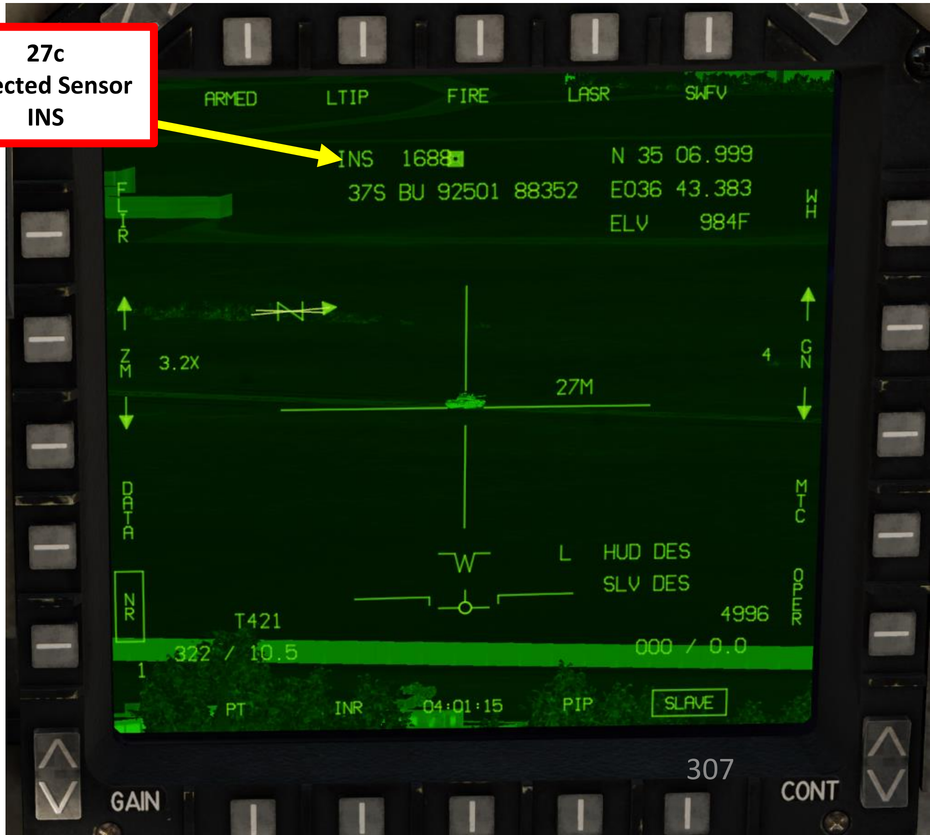
TPOD Line-of-Sight Symbol

27b
Sensor Select Switch (SSS)

27a
Selected Sensor
TPOD

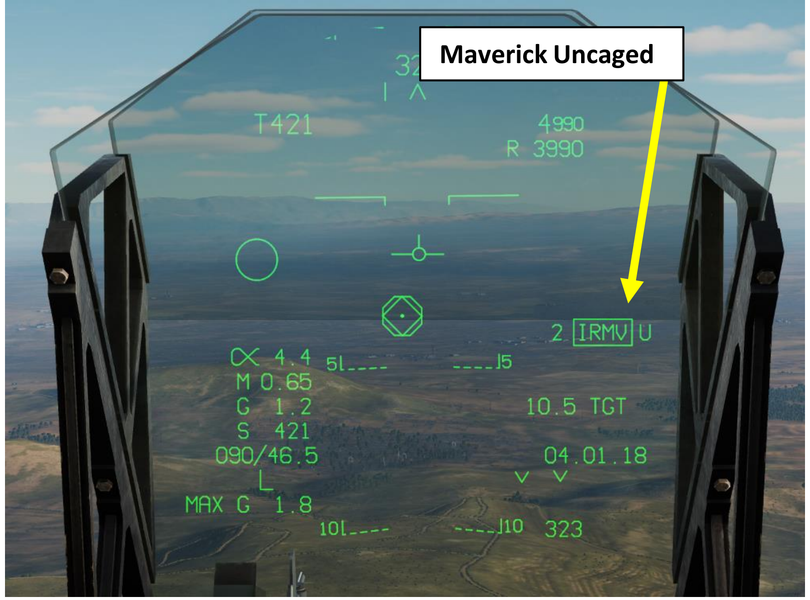


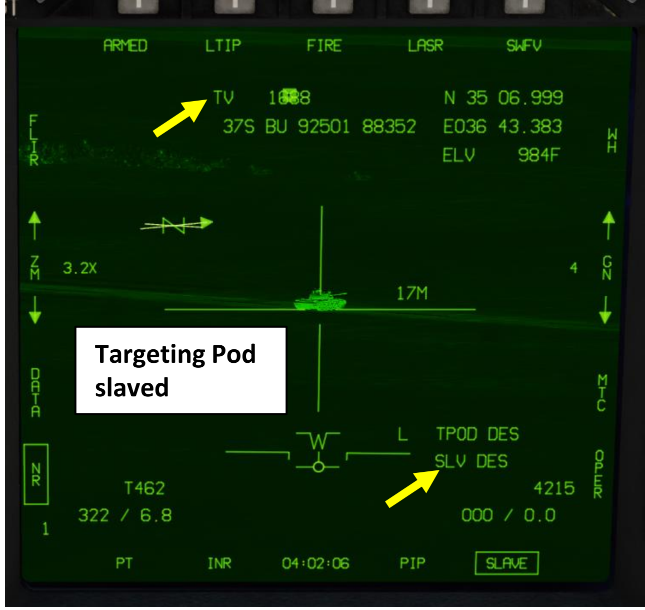
27c
Selected Sensor
INS

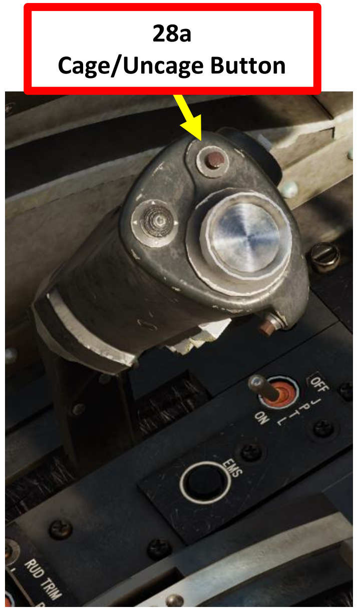


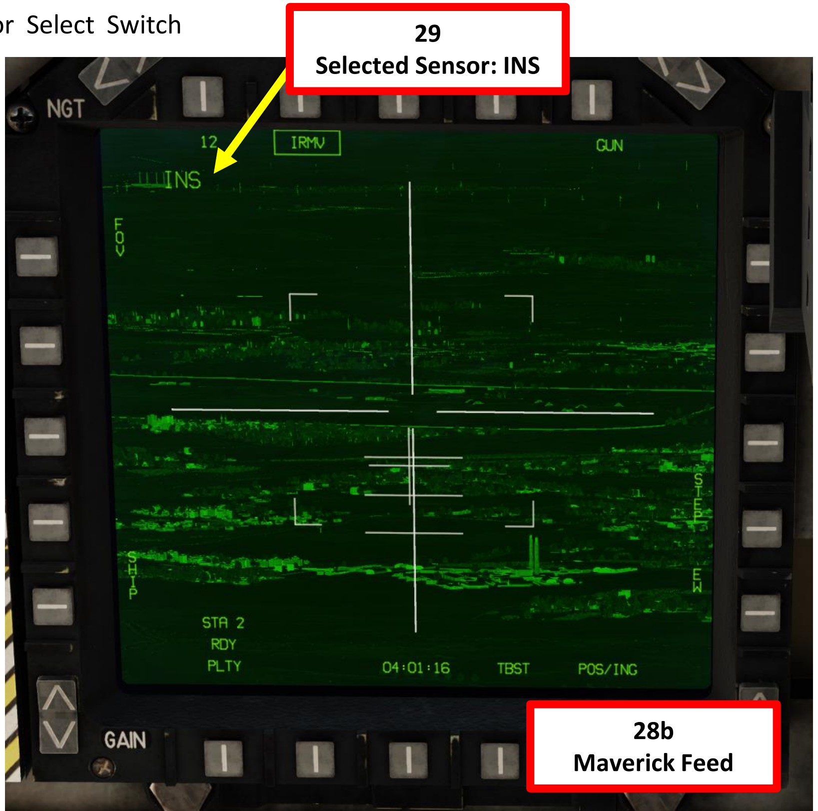
2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

28. Press on the Weapon Cage/Uncage button to view the Maverick seeker head feed, which will replace the TPOD feed.
29. Check selected sensor on IRMV page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
30. When Maverick is first uncaged and a target designation is stored (which is what we have done with the TPOD), the Maverick seeker head is slaved to the INS coordinates designated previously (however, no missile lock is performed). This will make Maverick aiming much easier.
31. Use the Sensor Control Switch to set the Maverick (IRMV) as the Sensor of Interest.
    - Since INS is the selected sensor, press Sensor Select Switch FWD to select IRMV.



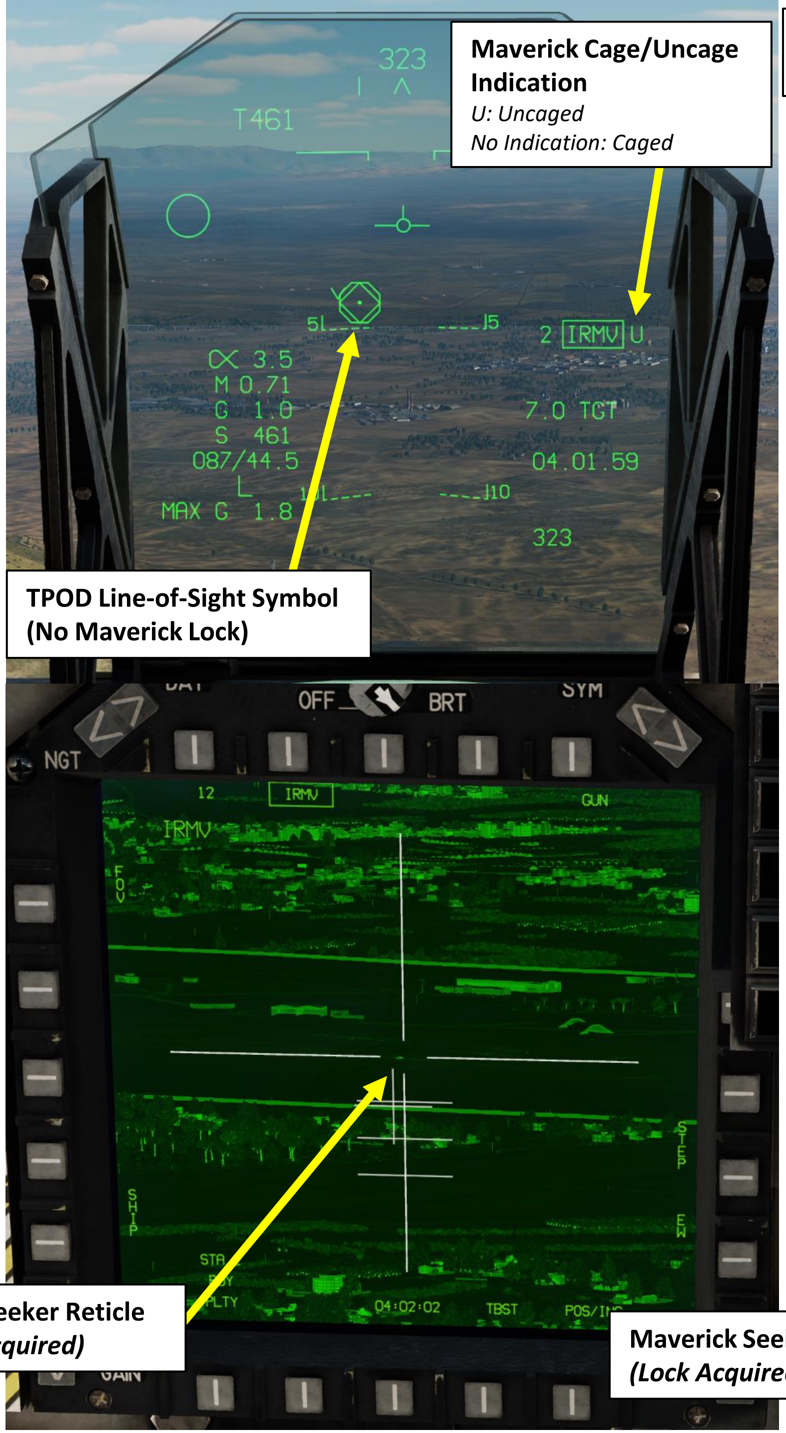


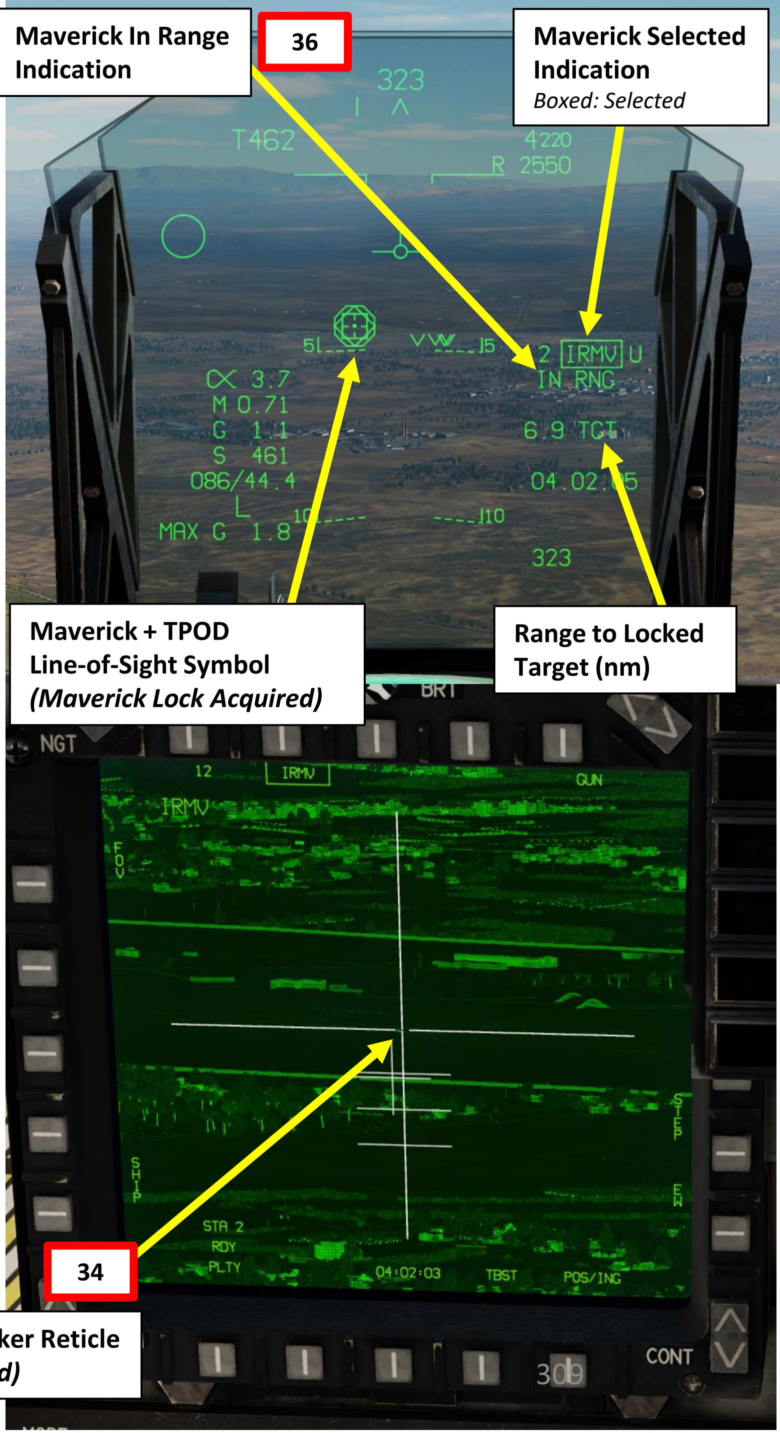




2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

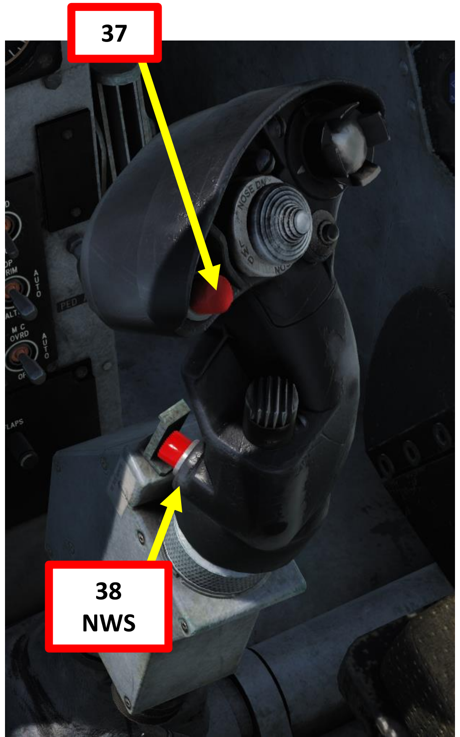
32. Toggle Maverick Field-of-View by pressing the « AG Target Undesignate/NWS/FOV Toggle ».
33. Use TDC Controls (Left/Right/Fwd/Aft) to slew the Maverick reticle over the desired target.
34. Periodically use TDC Depress (Action) control to attempt a missile lock the target (IR contrast).
35. The Maverick is most likely going to acquire a good lock from a distance of 7.5 miles or less.
36. When lock is acquired and IN RNG (In Range) cue is visible, you may fire the missile.

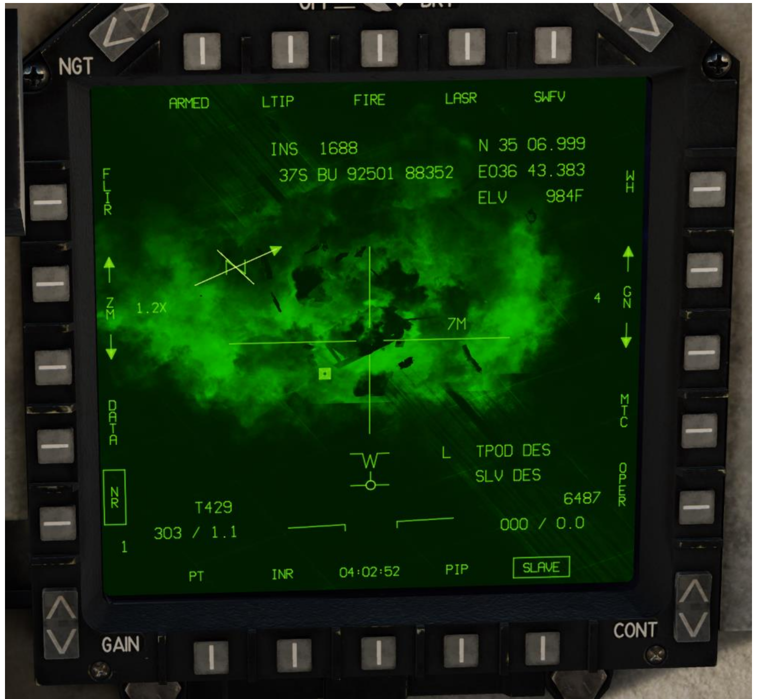




2.7 - AGM-65F MAVERICK (IRMV)
2.7.2 - Targeting Pod Slaving

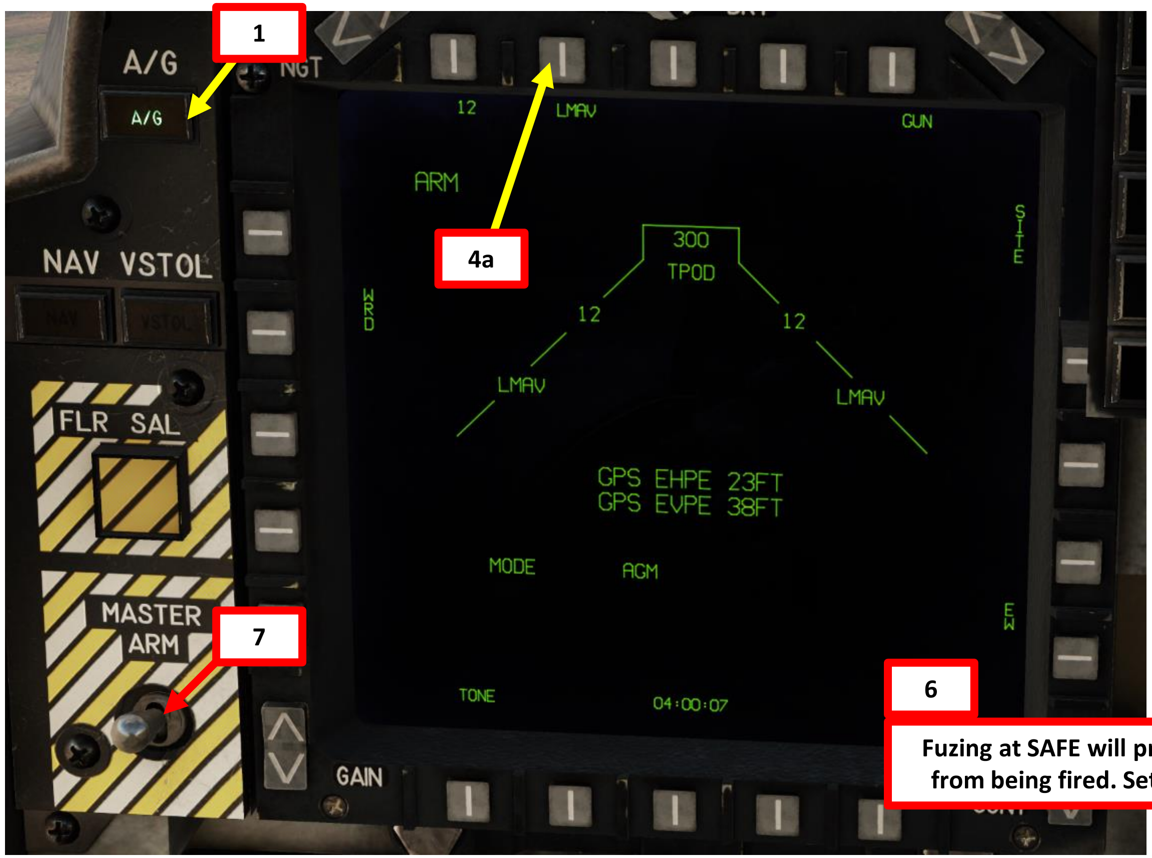
37. Press the Bomb Pickle button (RALT+SPACE) to fire missile.
38. If a missile lock is acquired and you want to unlock target, pressing the « AG Target Undesignate/NWS/FOV Toggle » button unlocks target and boresights the missile on the flight path marker.
39. Take note that the TPOD and Maverick feed of the AGM-65F cannot be displayed at the same time. If the TPOD is active, Maverick video will replace TPOD video when the missile is active. If the TPOD is selected after selecting a Maverick, the missile will be deselected.
40. To fire subsequent Mavericks, press the Weapon Cage/Uncage switch again, then Sensor Select Switch FWD to set the IRMV as the sensor of interest.



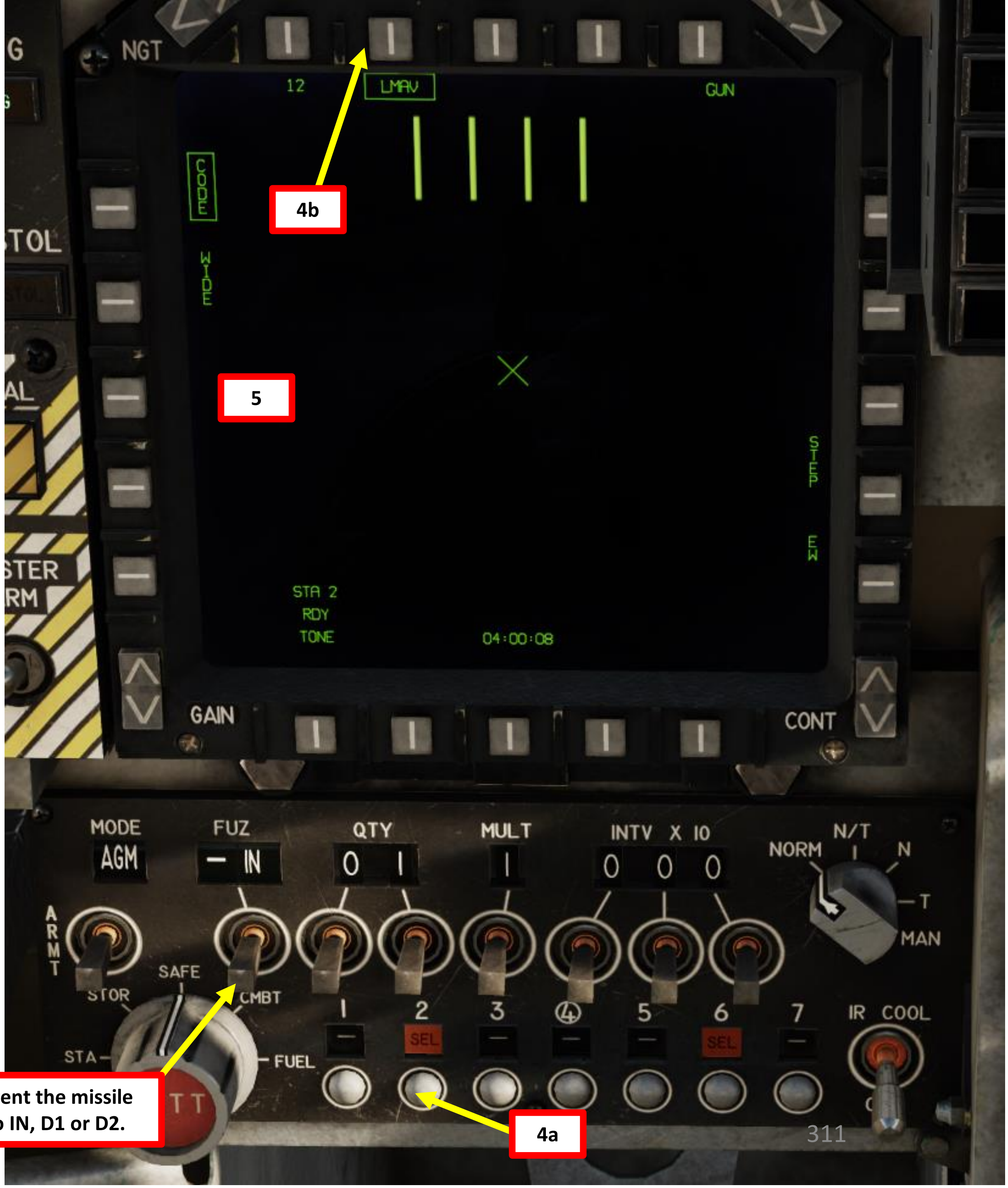


2.8.1 - AGM-65E MAVERICK (LMAV) JTAC Laser Designation

1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select LMAV (Laser-Guided Maverick) missile by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel). A 30-second delay is required to spool up the missile gyros. During that delay, the missile cannot be uncaged or fired.
5. As soon as the Maverick missile is selected, the CAGED maverick page will appear with its laser code.
6. Set FUZ (fusing) switch to IN
7. Set Master Arm Switch - ON (UP)

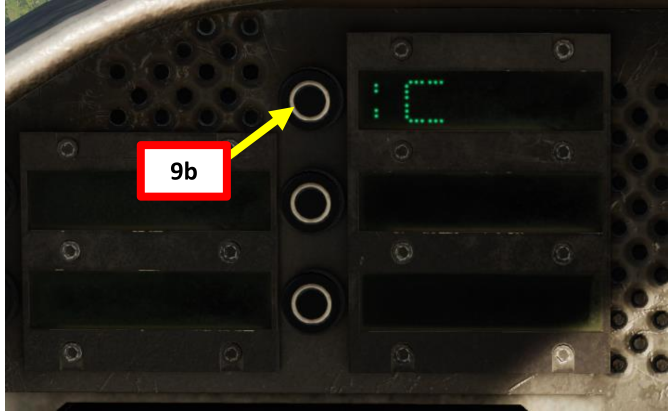


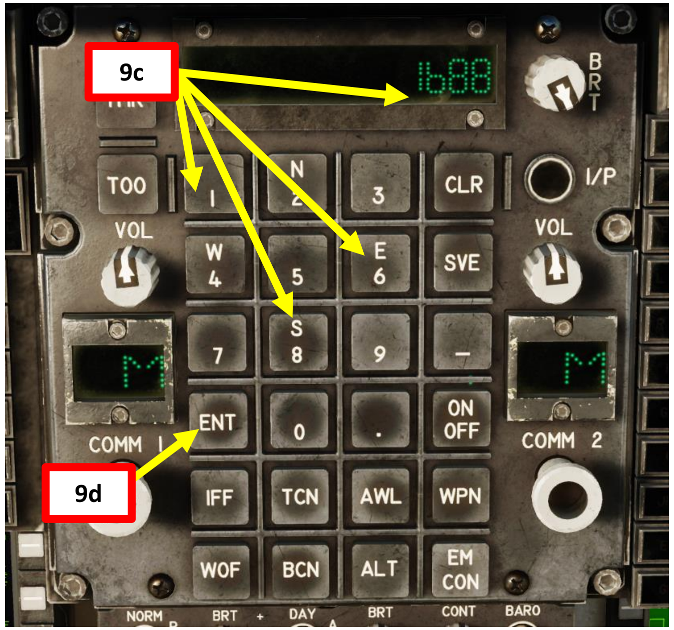
Fuzing at SAFE will prevent the missile from being fired. Set to IN, D1 or D2.

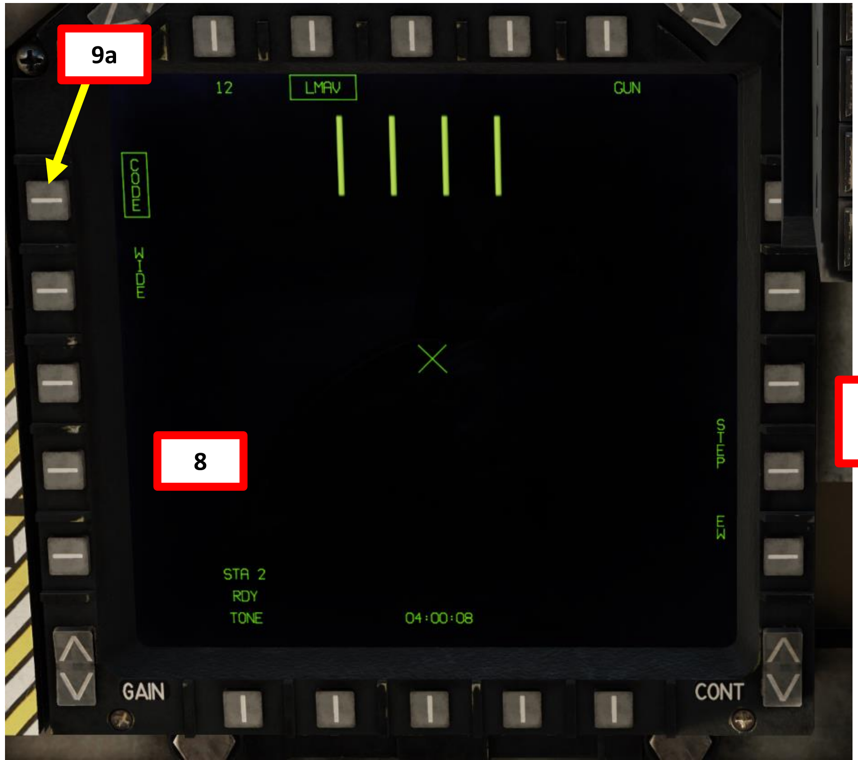


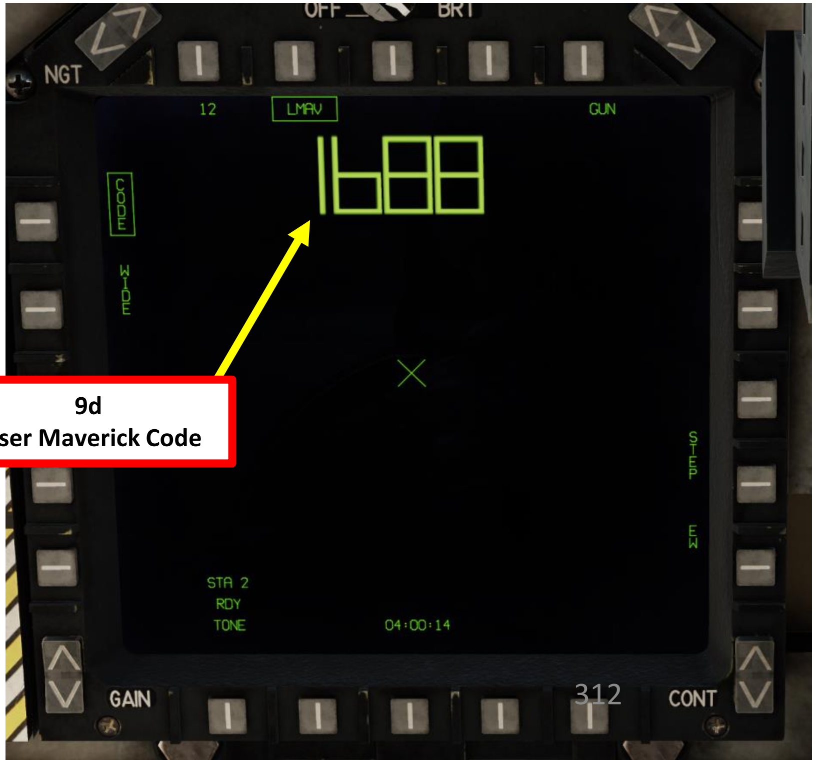
2.8.1 - AGM-65E MAVERICK (LMAV) JTAC Laser Designation

8. Go in the LMAV feed page. Take note that you can also achieve the same result from the “EHSD” page or DMT page as well.
9. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT. This laser code is what the targeting pod will be lasing with while designating the target.









2.8.1 - AGM-65E MAVERICK (LMAV) JTAC Laser Designation

10. Communicate with either a JTAC (Joint Terminal Attack Controller) on the ground or another wingman that has a targeting pod to lase a target) and request him to lase the target with the radio.

PLAYER: Axeman 1-1, this is Enfield 1-1, 1 x AV-8B N/A
DQ3094 at 16000
Armed with: AGM-65E, GBU-12
Play time is 0 + 15
Available for tasking. What do you have for us?

JTAC (Axeman11): Enfield 1-1, this is Axeman 1-1, type 2 in effect. Advise when ready for 9-line

PLAYER: ready to copy

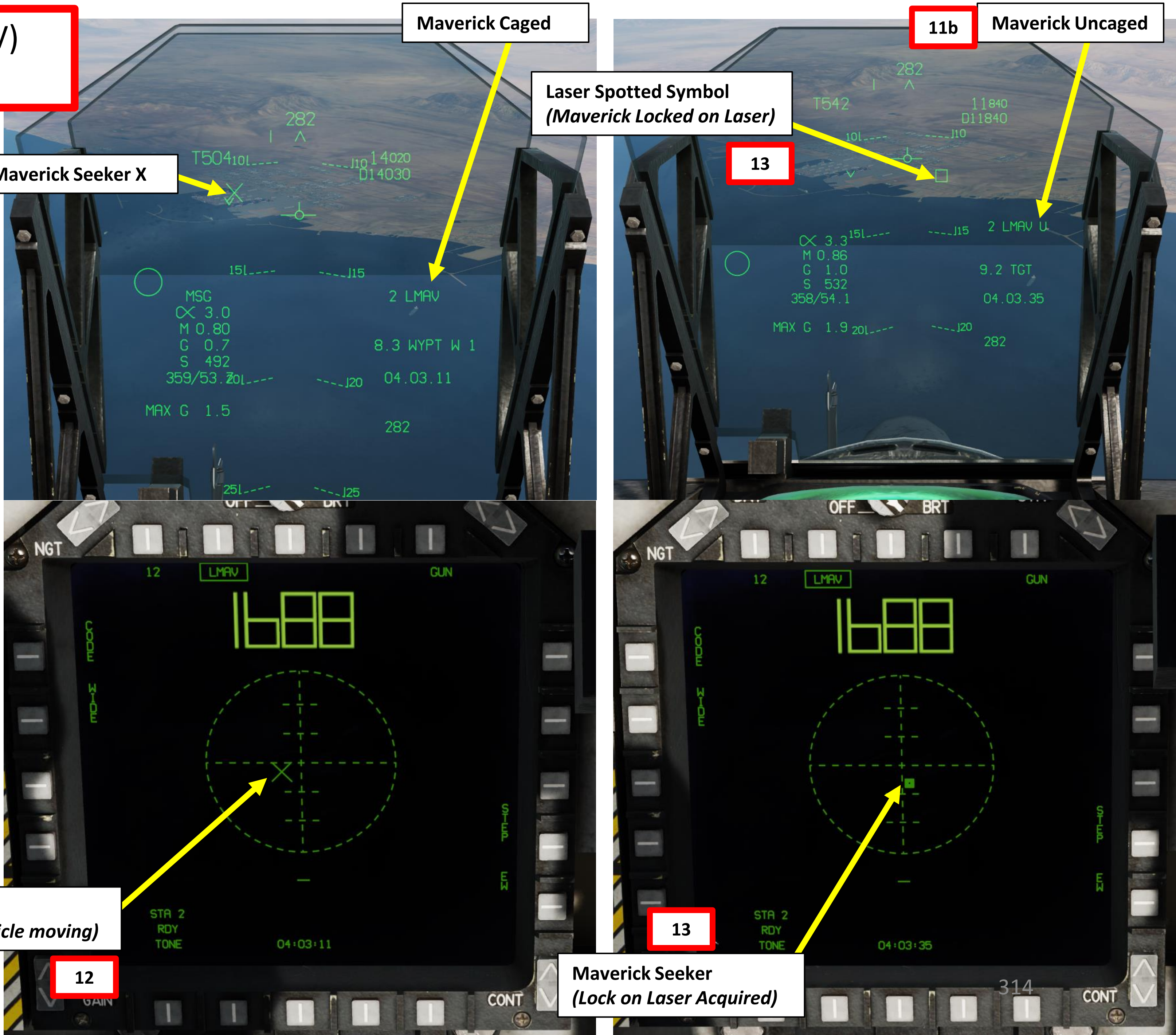
JTAC (Axeman11): line is as follows
1, 2, 3 N/A
[4. Elevation:]23 feet MSL
[5. Target:]truck
[6. Coordinates:]DQ083998
[7.]Marked by laser, 1688
[8. Friendlies:]southeast 210 meters, troops in contact
[9.]Egress west

JTAC (Axeman11): LASING

2.8.1 - AGM-65E MAVERICK (LMAV) JTAC Laser Designation

11. Fly towards the approximate area where the laser-designated target is expected to be, then press the CAGE/UNCAGE button to uncage the Maverick. The missile will start looking for the laser.
12. The seeker head will automatically scan for the laser.
13. Once the Maverick seeker has found the laser and you are in range to fire, the Maverick feed will be filled with a full square.

11a
Cage/Uncage Button

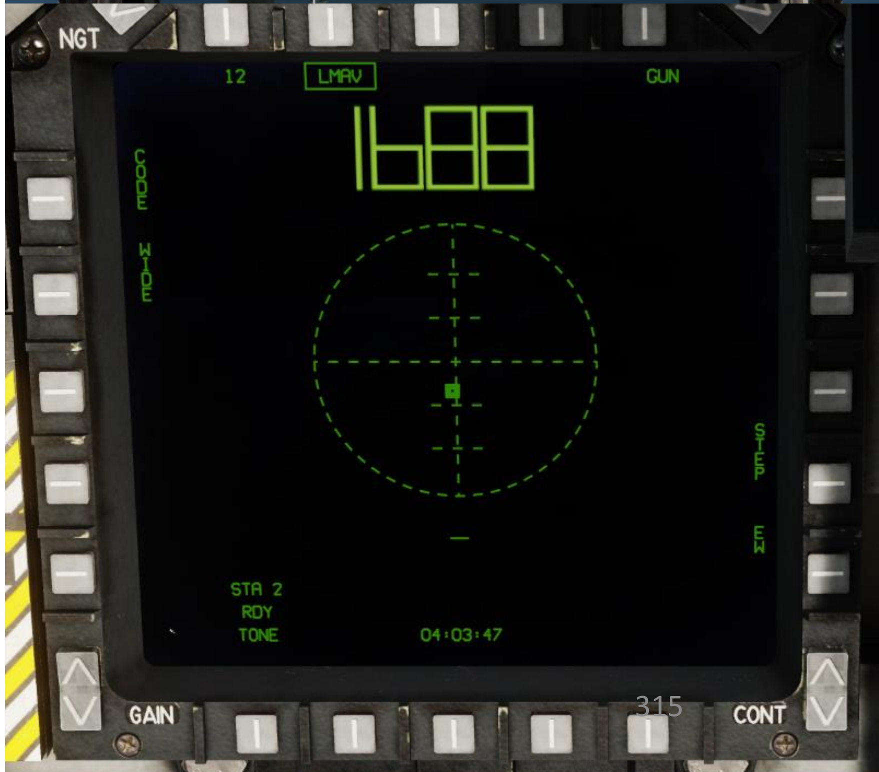


2.8.1 - AGM-65E MAVERICK (LMAV) JTAC Laser Designation

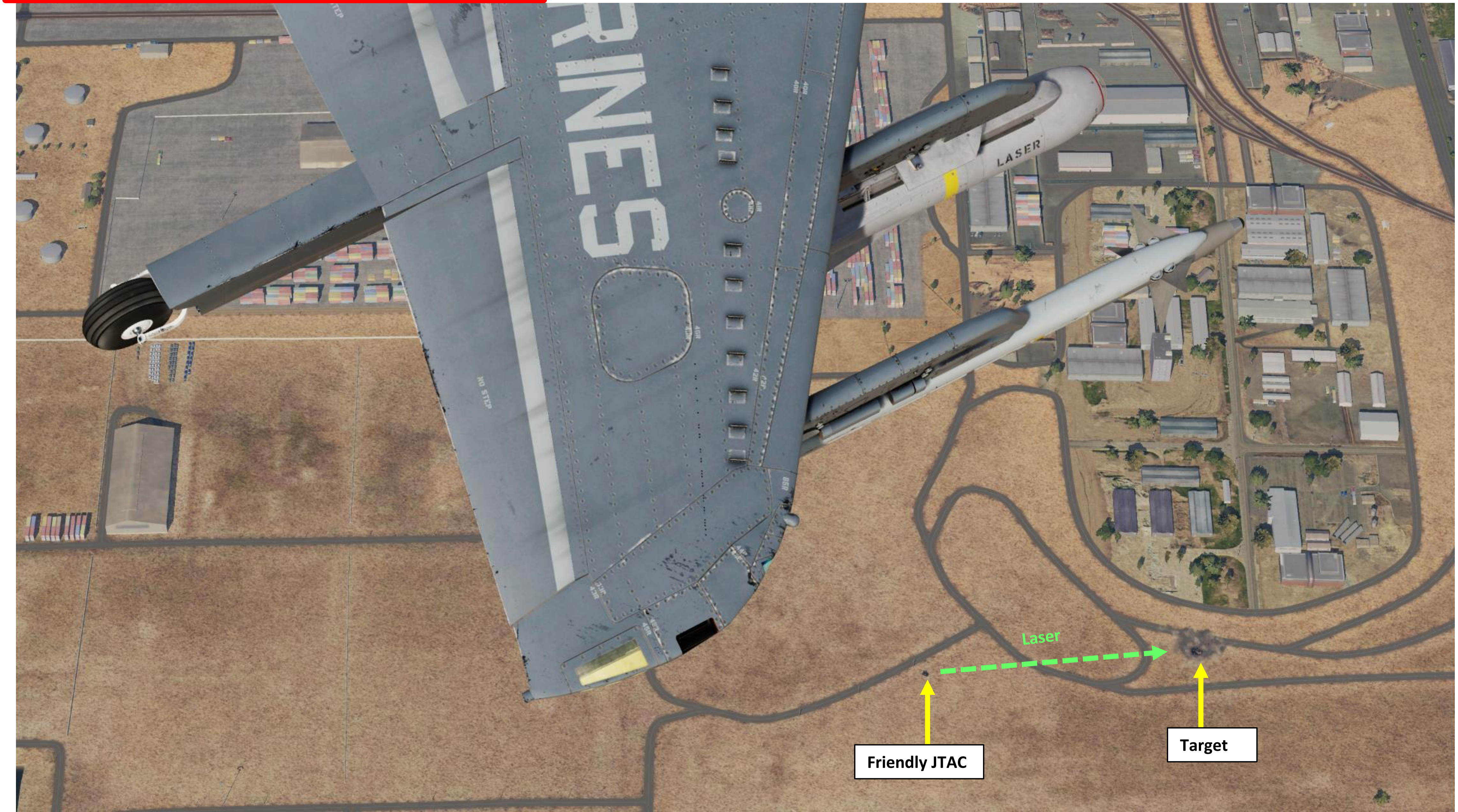
14. Press the Bomb Pickle button (RALT+SPACE) to fire the laser Maverick.
15. The missile will follow the designation laser all the way to the target.

14

Laser Spotted Symbol
(Maverick Locked on Laser)

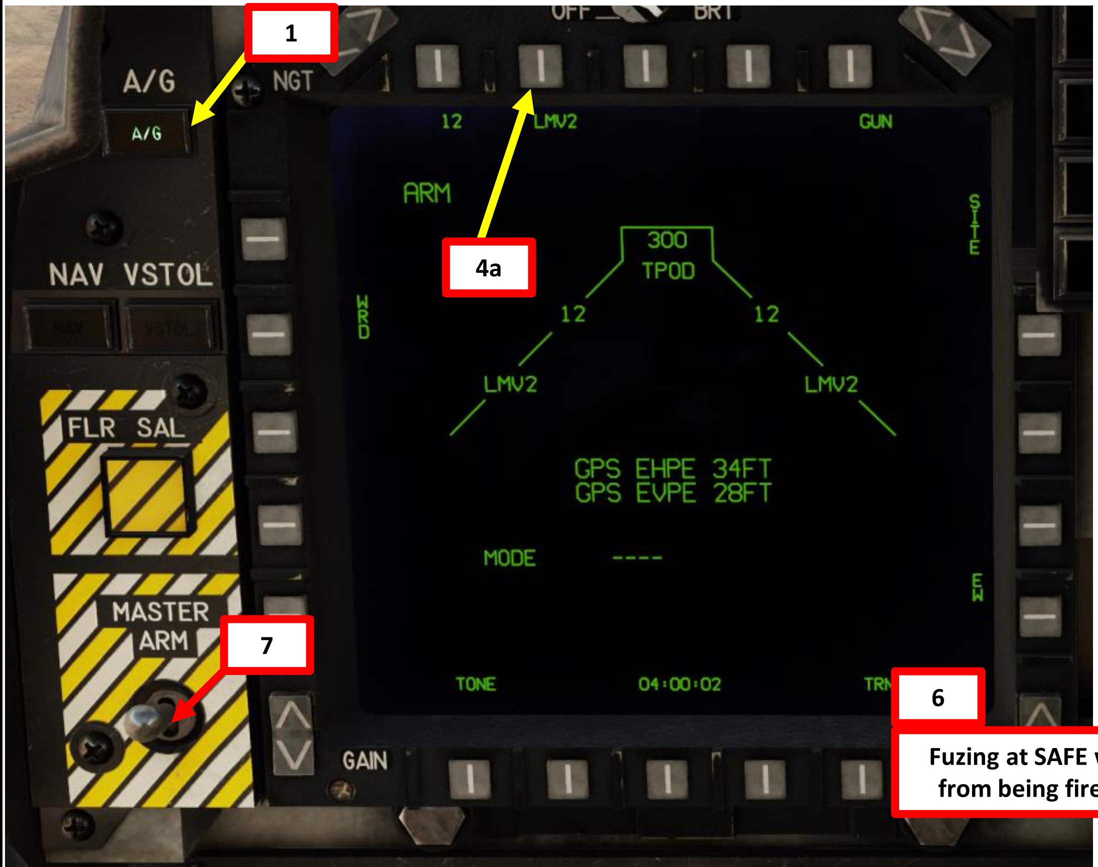


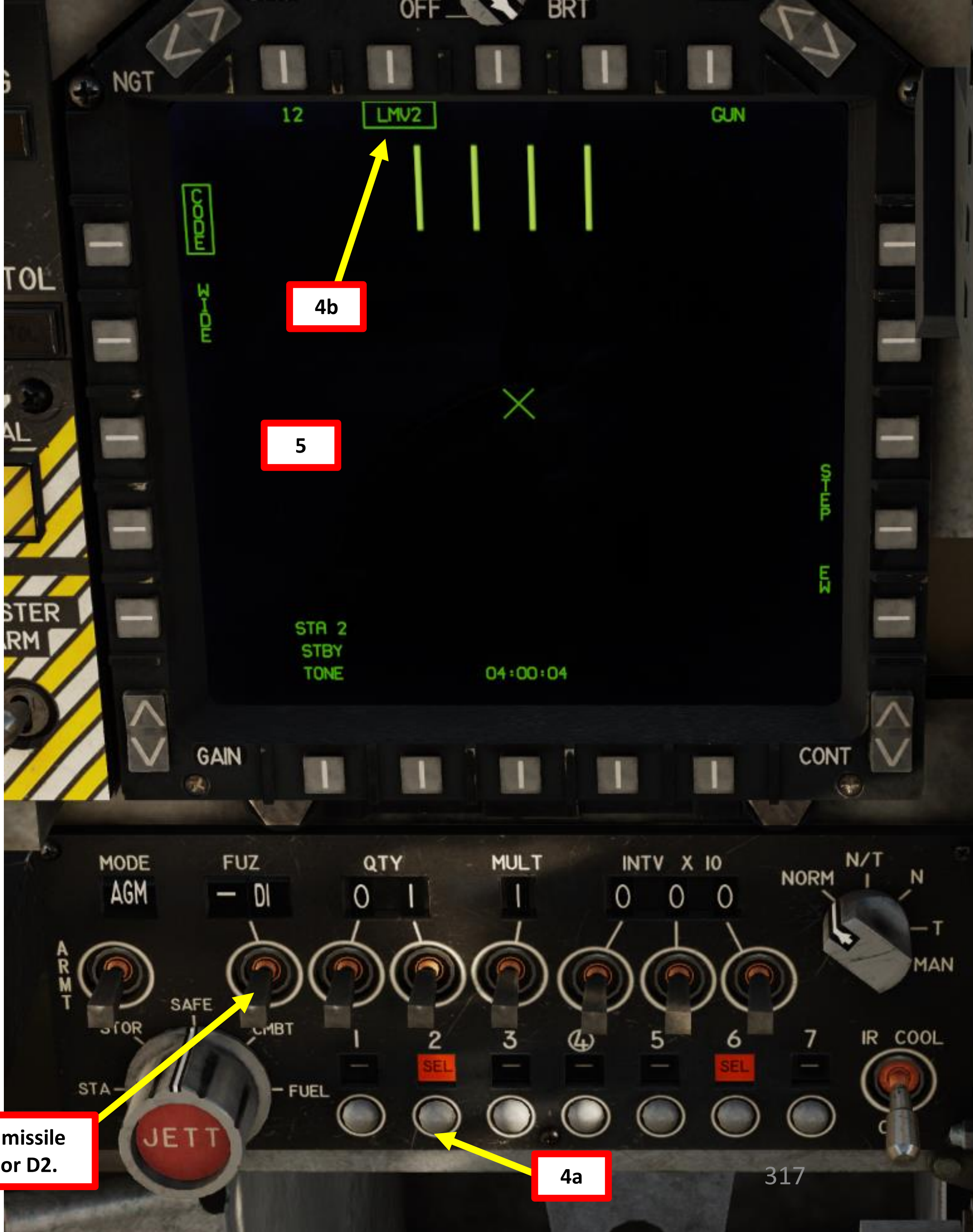
2.8.1 - AGM-65E MAVERICK (LMAV)
JTAC Laser Designation



2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

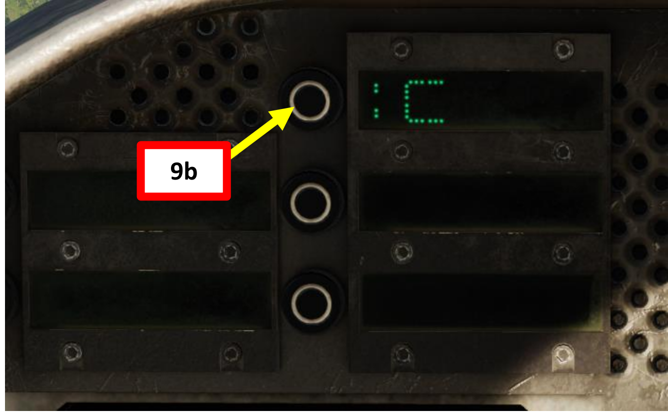
1. Set Master Mode to A/G (Air-to-Ground)
2. Go in MPCD main MENU
3. Select STRS (Stores) Page
4. Select LMV2 (Laser-Guided Maverick E2) missile by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel). A 90-second delay is required to spool up the missile gyros. During that delay, the missile cannot be uncaged or fired.
5. As soon as the Maverick missile is selected, the CAGED maverick page will appear with its laser code.
6. Set FUZ (fusing) switch to IN
7. Set Master Arm Switch - ON (UP)

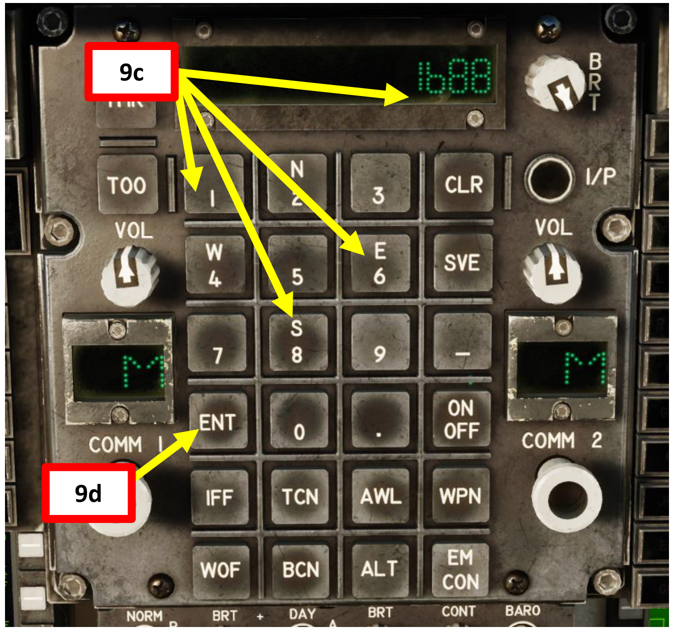


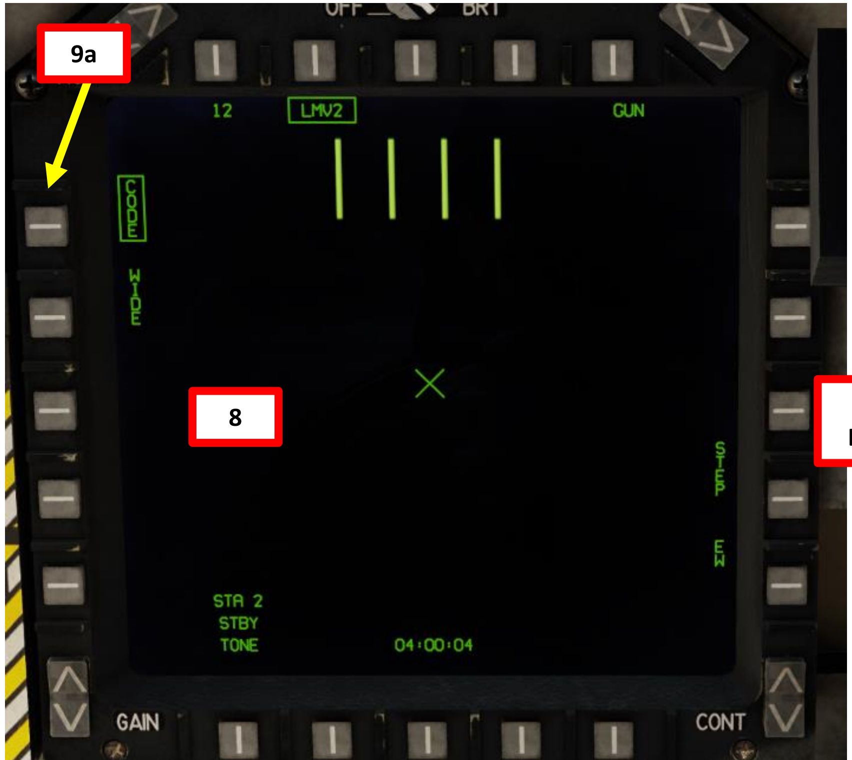


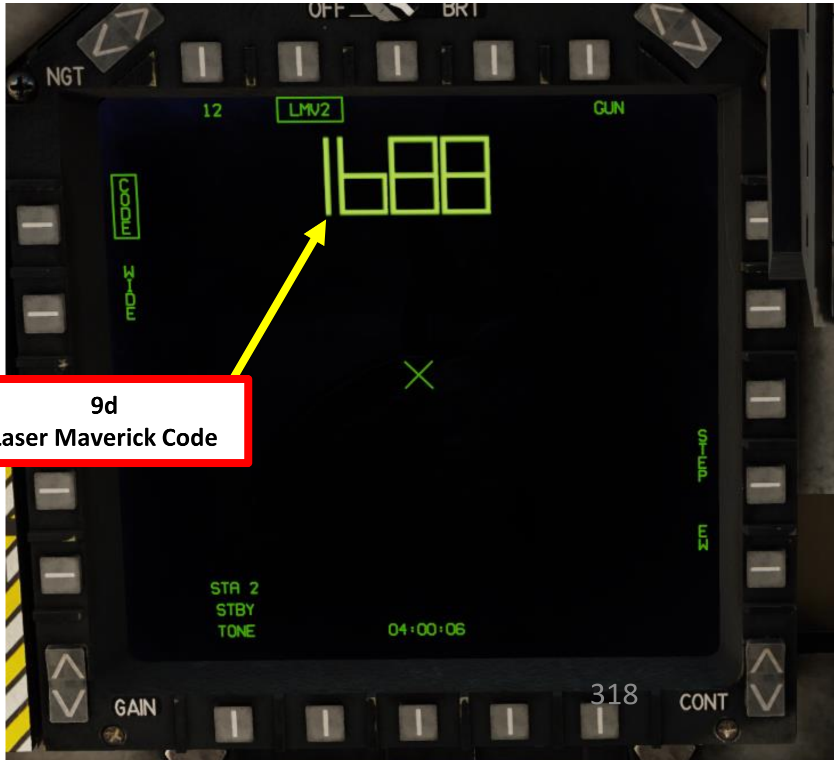
2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

8. Go in the LMAV feed page. Take note that you can also achieve the same result from the “EHSD” page or DMT page as well.
9. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT. This laser code is what the targeting pod will be lasing with while designating the target.



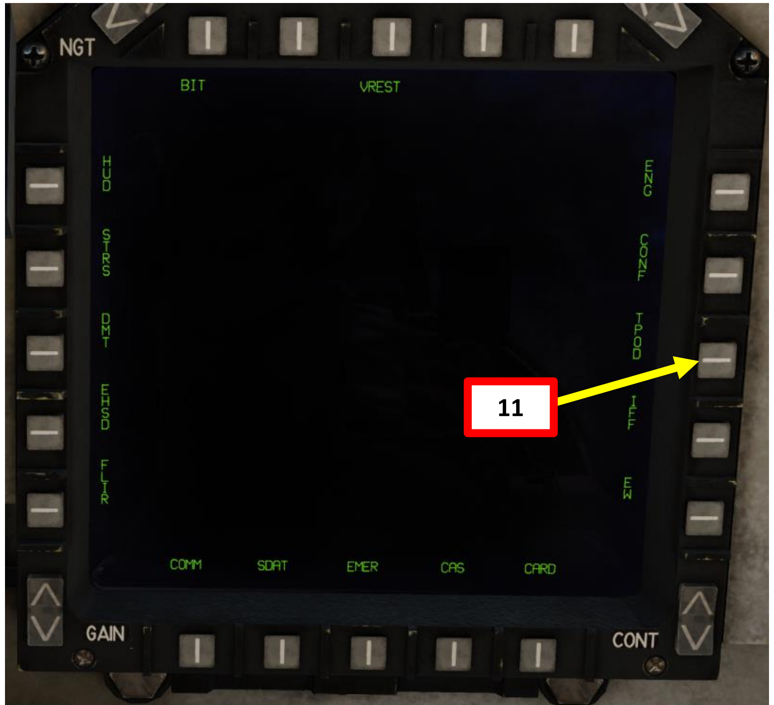


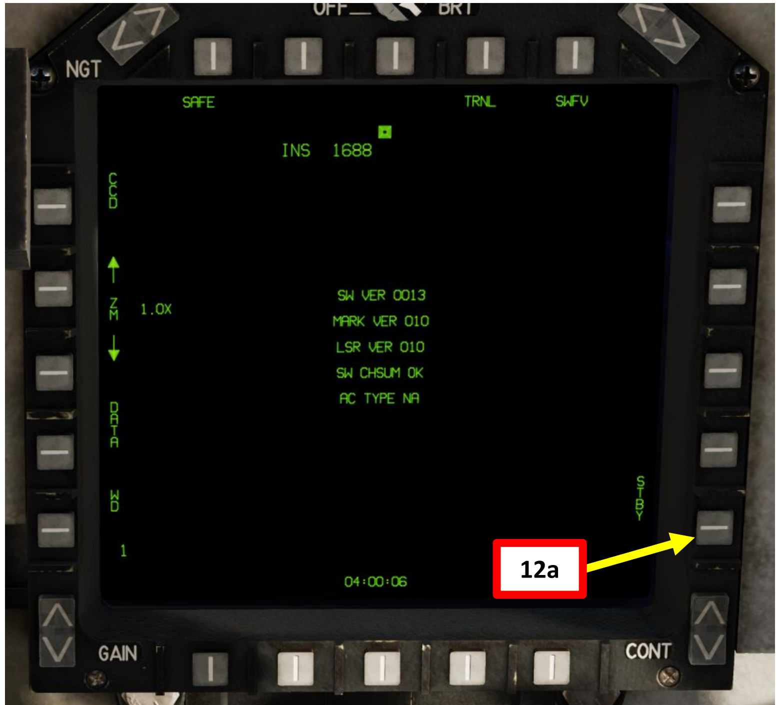


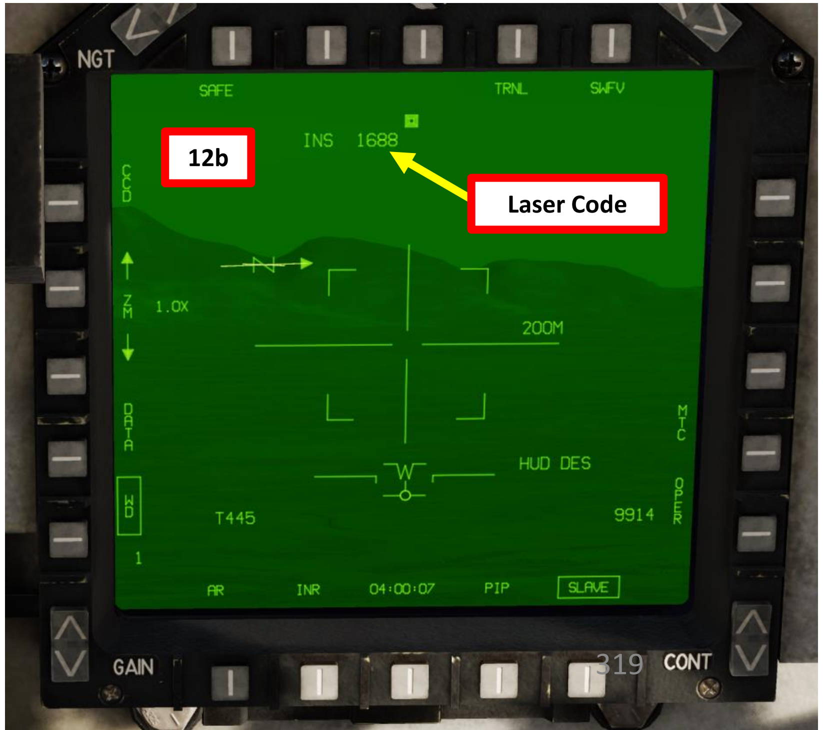


2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

10. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
11. Press the OSB next to the "TPOD" page in the main MPCD MENU
12. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).

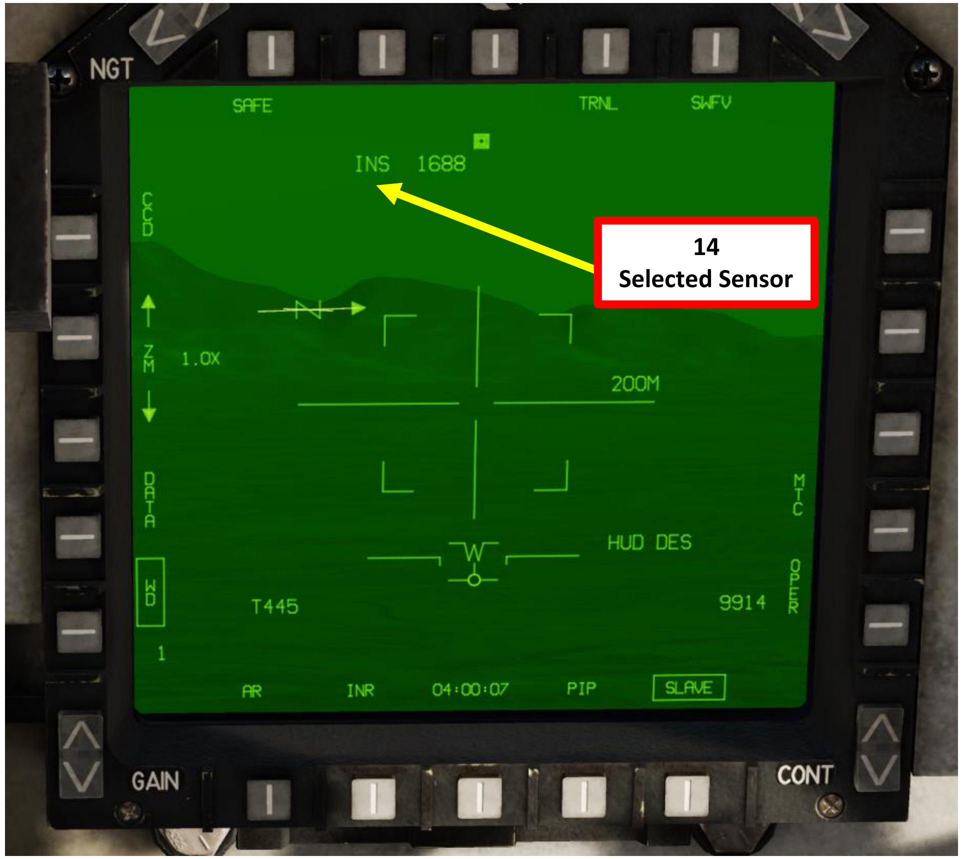


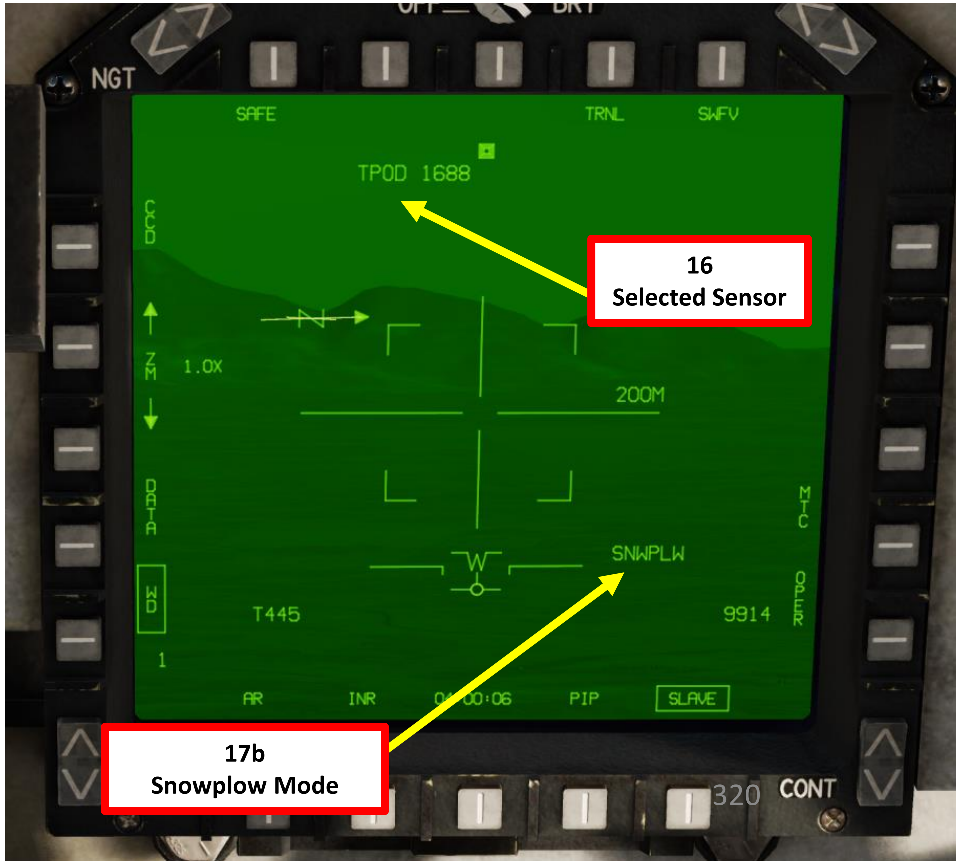




2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

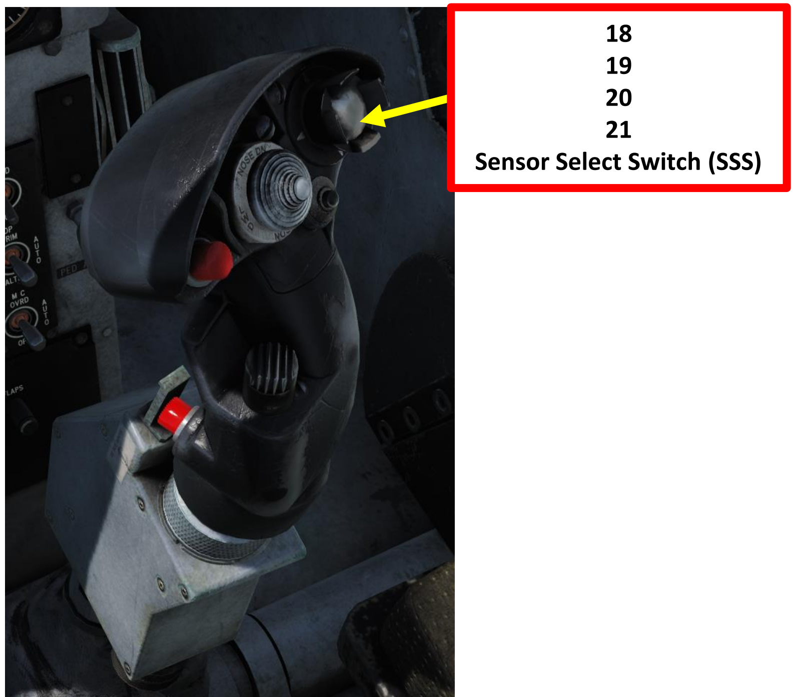
13. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
14. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
15. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
16. Confirm that Sensor of Interest switches to TPOD.
17. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.

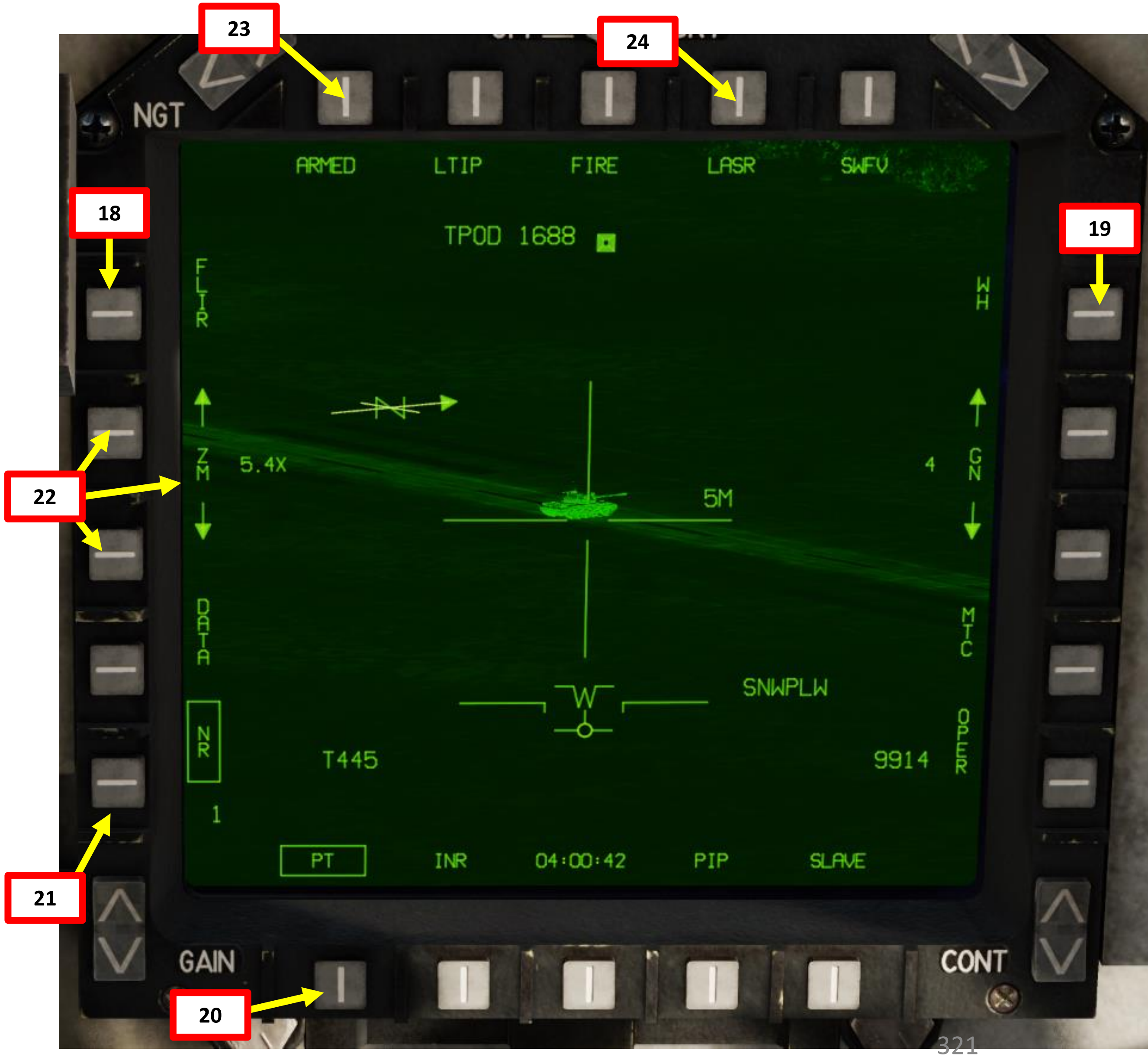




2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

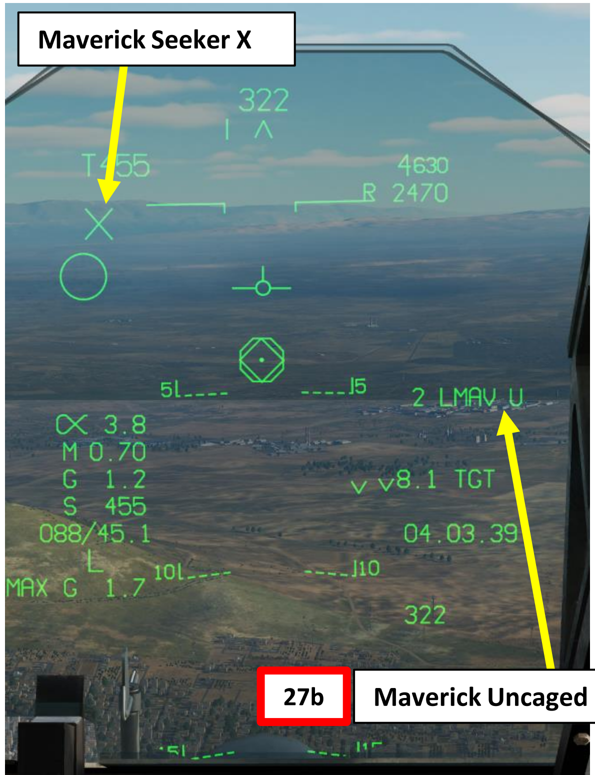
18. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
19. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
20. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
21. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
22. Select desired zoom level by using the ZM +/- OSBs.
23. Press Laser Arming OSB to select ARMED mode.
24. Press Laser Mode OSB to select LASR (Laser Designator) Mode.

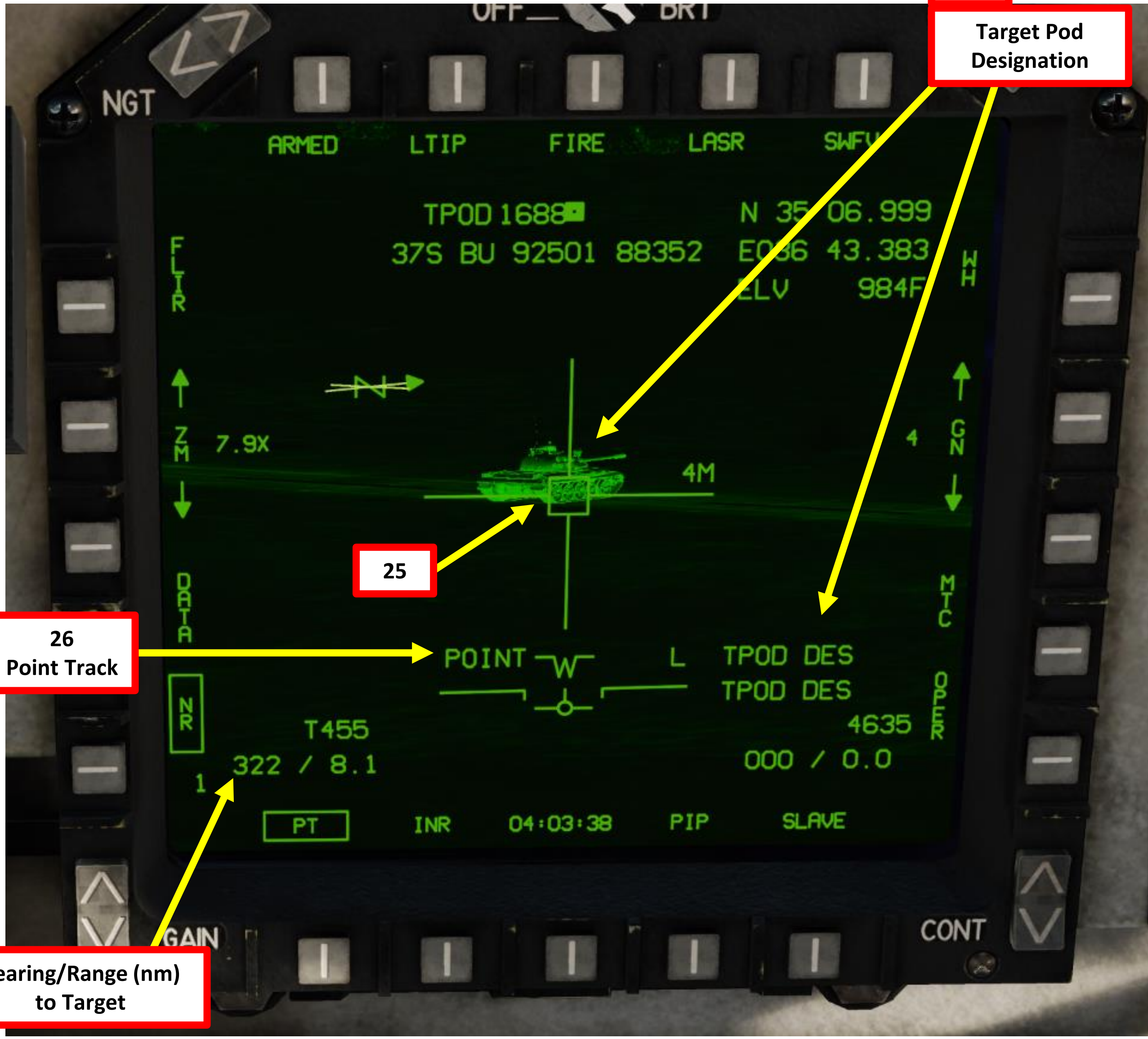




2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

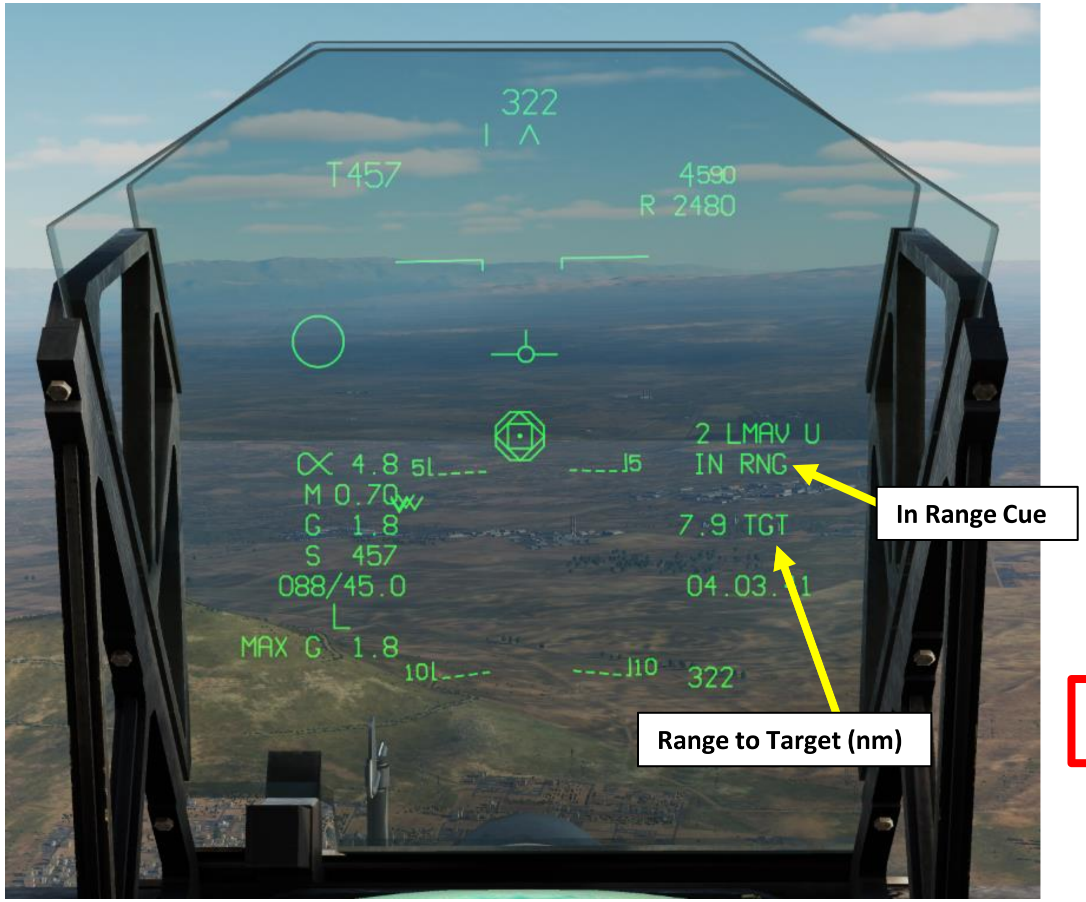
25. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
26. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
27. Press the CAGE/UNCAGE button to uncage the Maverick.
28. The seeker head will automatically scan for the laser.

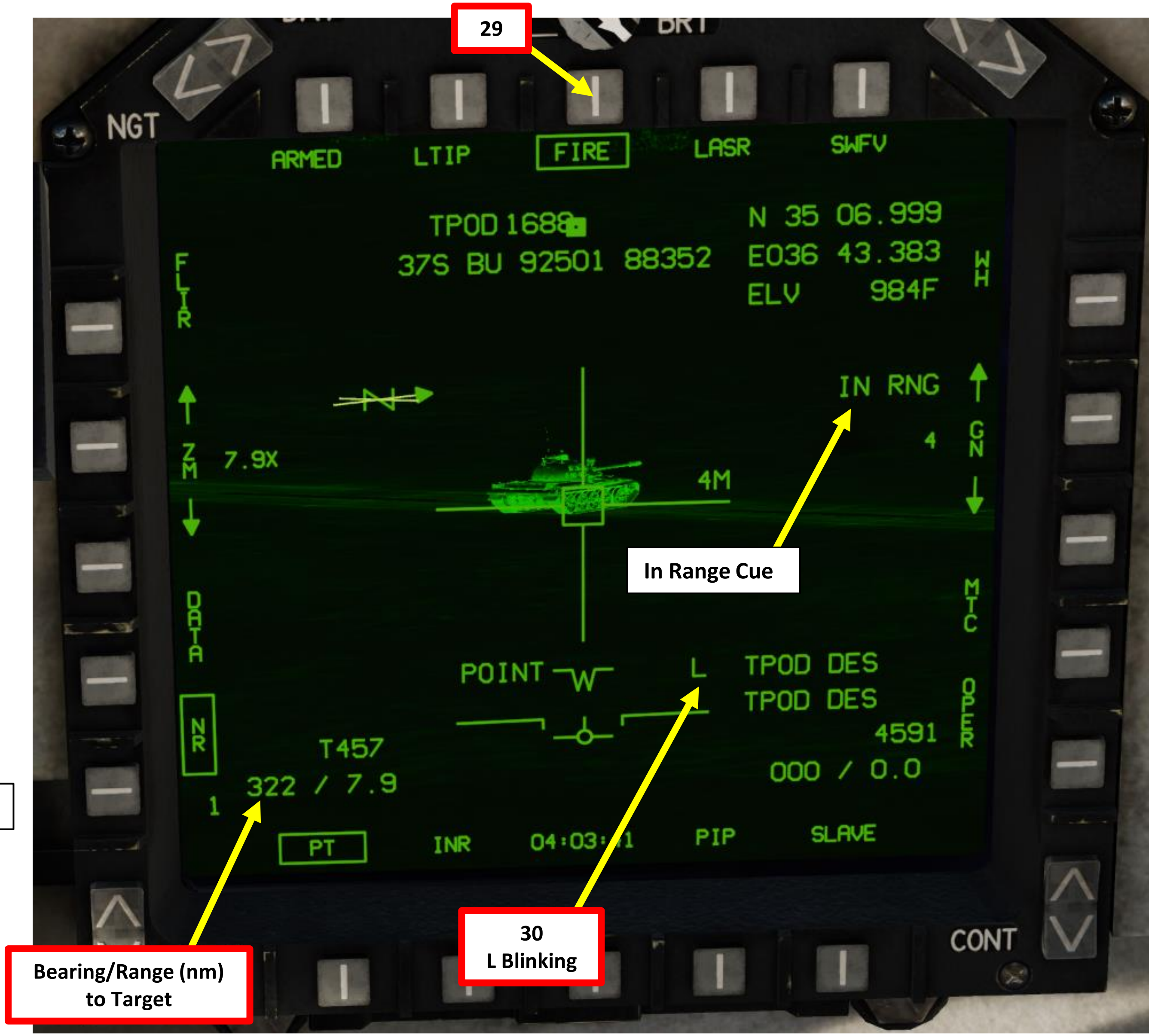




2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

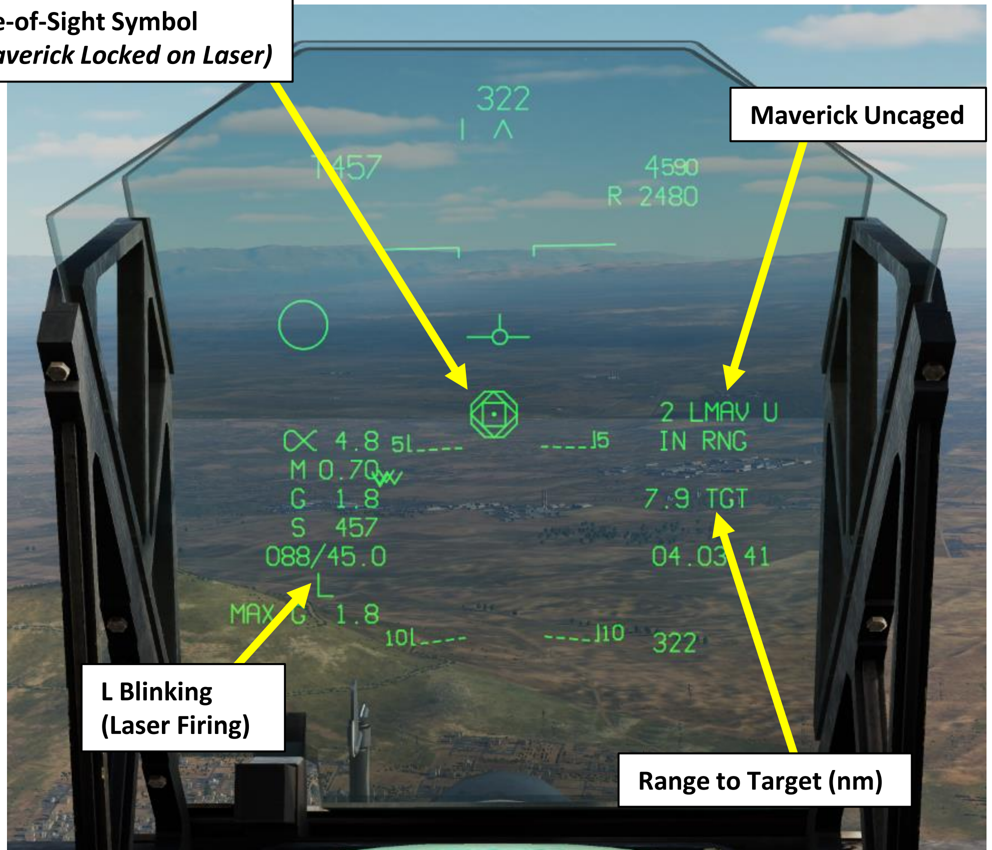
29. Press FIRE OSB to fire the laser. When fired, the Maverick will track this laser all the way to the target.
30. Once laser is firing, the « L » indication will blink on both the HUD and the TPOD page.
31. Target range is indicated on the HUD.

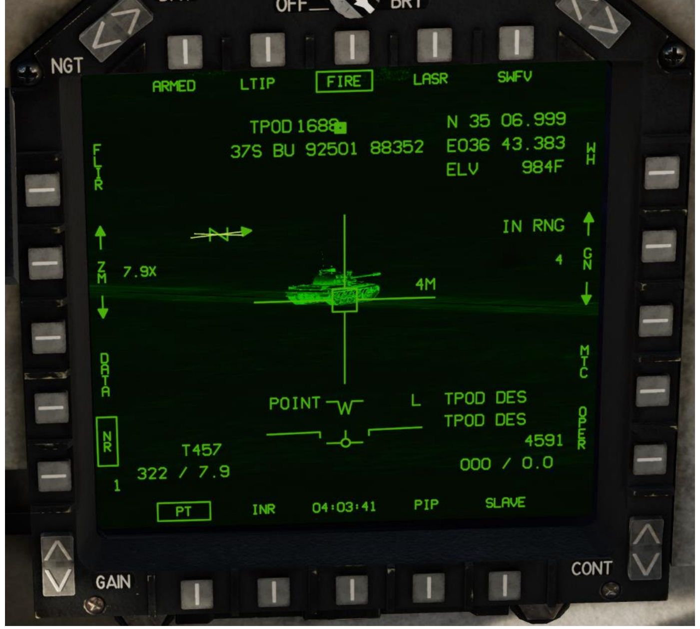




2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

32. Press the Sensor Select Switch FWD LONG to display the Maverick Feed.
33. The Maverick video will replace TPOD video for 14 seconds. The TPOD laser will continue painting the designated target. After 14 seconds, TPOD video replaces Maverick video.
34. Fly towards the approximate area where the laser-designated target is. Once the Maverick seeker has found the laser and you are in range to fire, the Maverick feed will be filled with a full square.





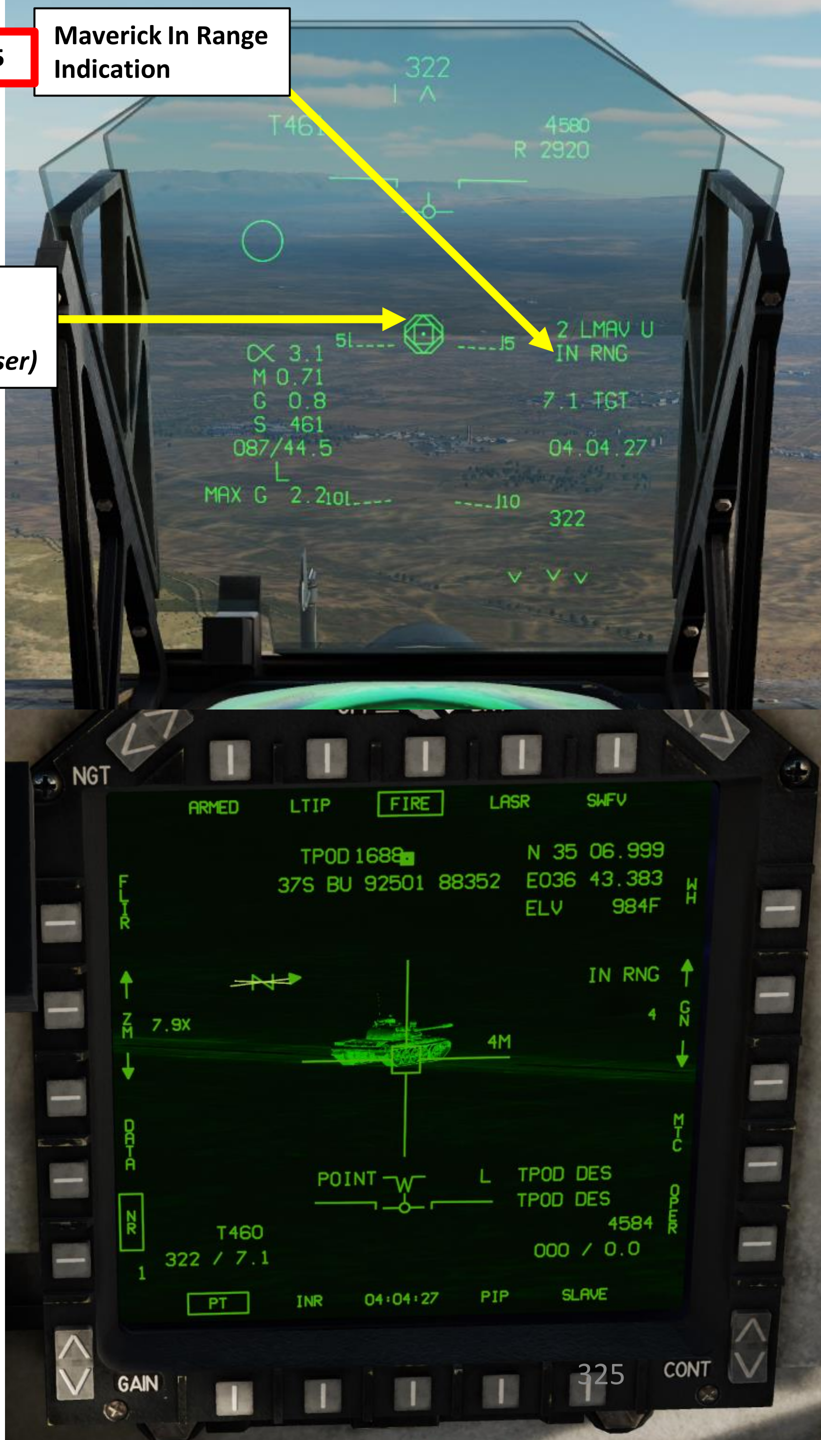
2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

35. "IN RNG" (In Range) indication appears on the HUD when you are close enough to target for missile launch.
36. Press the Bomb Pickle button (RALT+SPACE) to fire the laser Maverick. The missile will follow the designation laser all the way to the target.
37. Maintain laser on target until missile impact.


36

Maverick + TPOD Line-of-Sight Symbol *(Maverick Locked on Laser)*

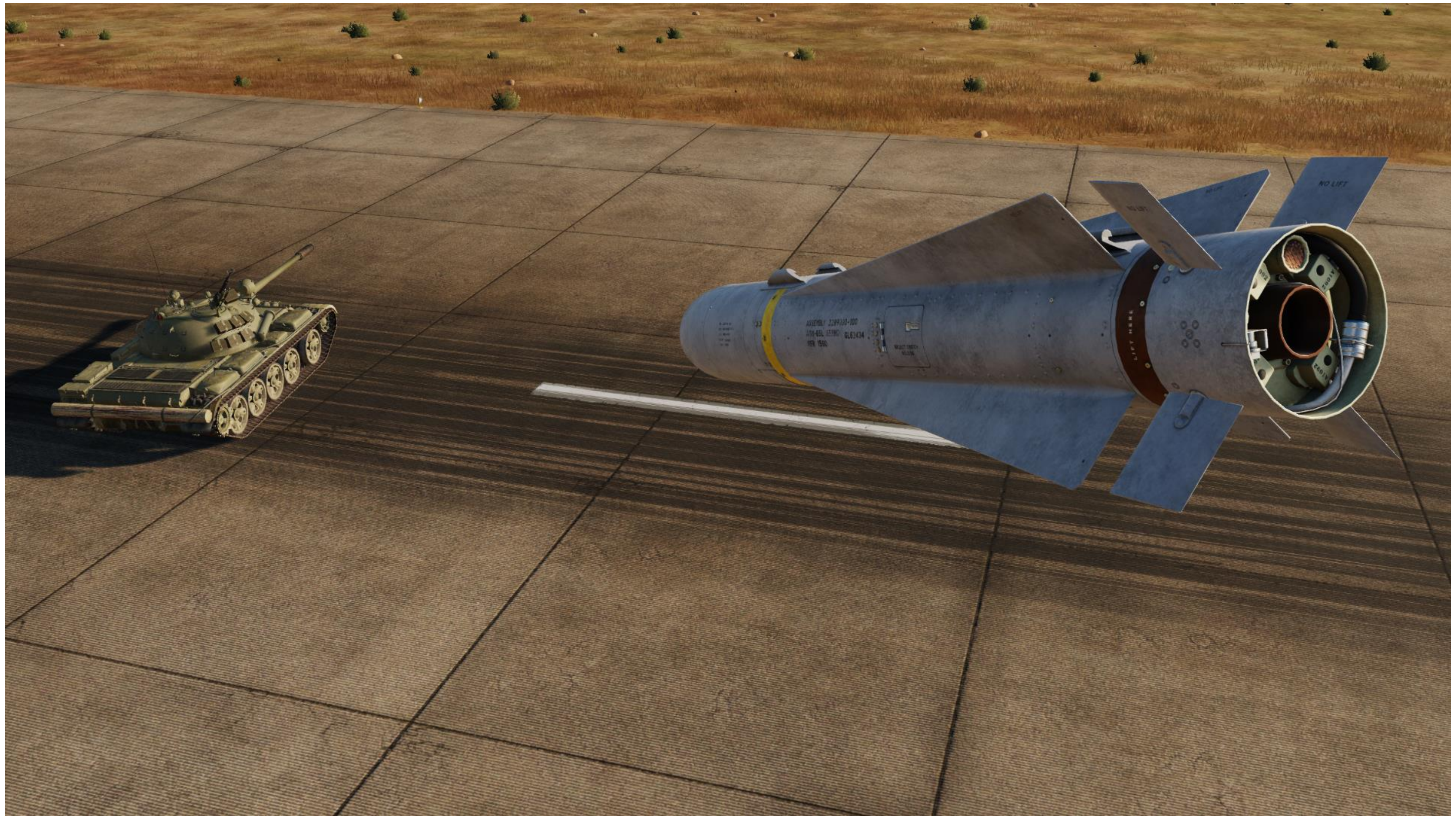
35 Maverick In Range Indication

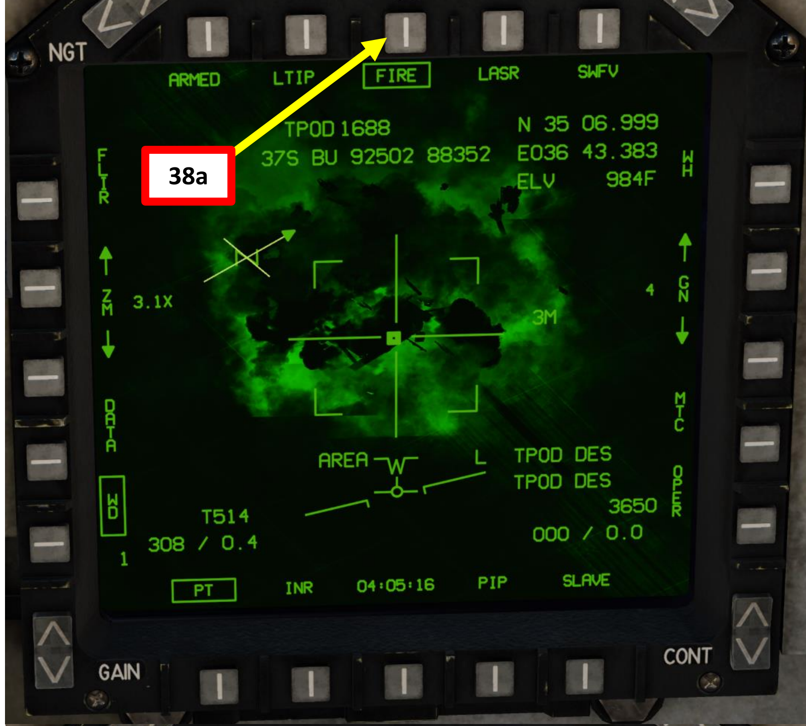


2.8.2 - AGM-65E2/L MAVERICK (LMV2) Targeting Pod + Laser Self-Designation

38. After missile impact, press the FIRE OSB to turn off the laser (unboxed when OFF).
39. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.

39
NWS





2.9 - GBU-38 JDAM
2.9.1 - INTRODUCTION

The JDAM (Joint Direct Attack Munition) is a guidance kit that converts unguided bombs into all-weather precision-guided munitions. JDAM equipped bombs are guided by an integrated inertial guidance system coupled to a GPS receiver, giving them a published range of up to 15 nm (28 km).

The JDAM used by the Harrier is employed slightly differently than on other aircraft like the Hornet. There are two primary methods of using the JDAM:

METHOD 1: Absolute Release (Pre-Planned)

Absolute Release is the primary mode of operation. It is used against preplanned targets that were loaded into the aircraft along with the mission flight plan. They are present in the flight plan as Targetpoints 1 to 9. It is the most accurate mode since the target position is precisely positioned in relation to the world. In real life, the Forward Air Controller (FAC) sends close air support mission data through the ATHS (Automatic Target Handoff System), which relays information to the AV-8B Harrier itself.

In other words, The **ATHS** provides a digital communication link between a Forward Air Controller and the AV-8B. The system is capable of communicating with US Army, USAF and USMC FACs and AOs. Received data is displayed in USMC format. In the DCS version, it is the only way to insert target information into the flight plan’s Targetpoints 1 to 9 (and a tenth Targetpoint TX). These Targetpoints are set via the F10 map or can be transmitted by a FAC or JTAC (Joint Terminal Attack Controller).

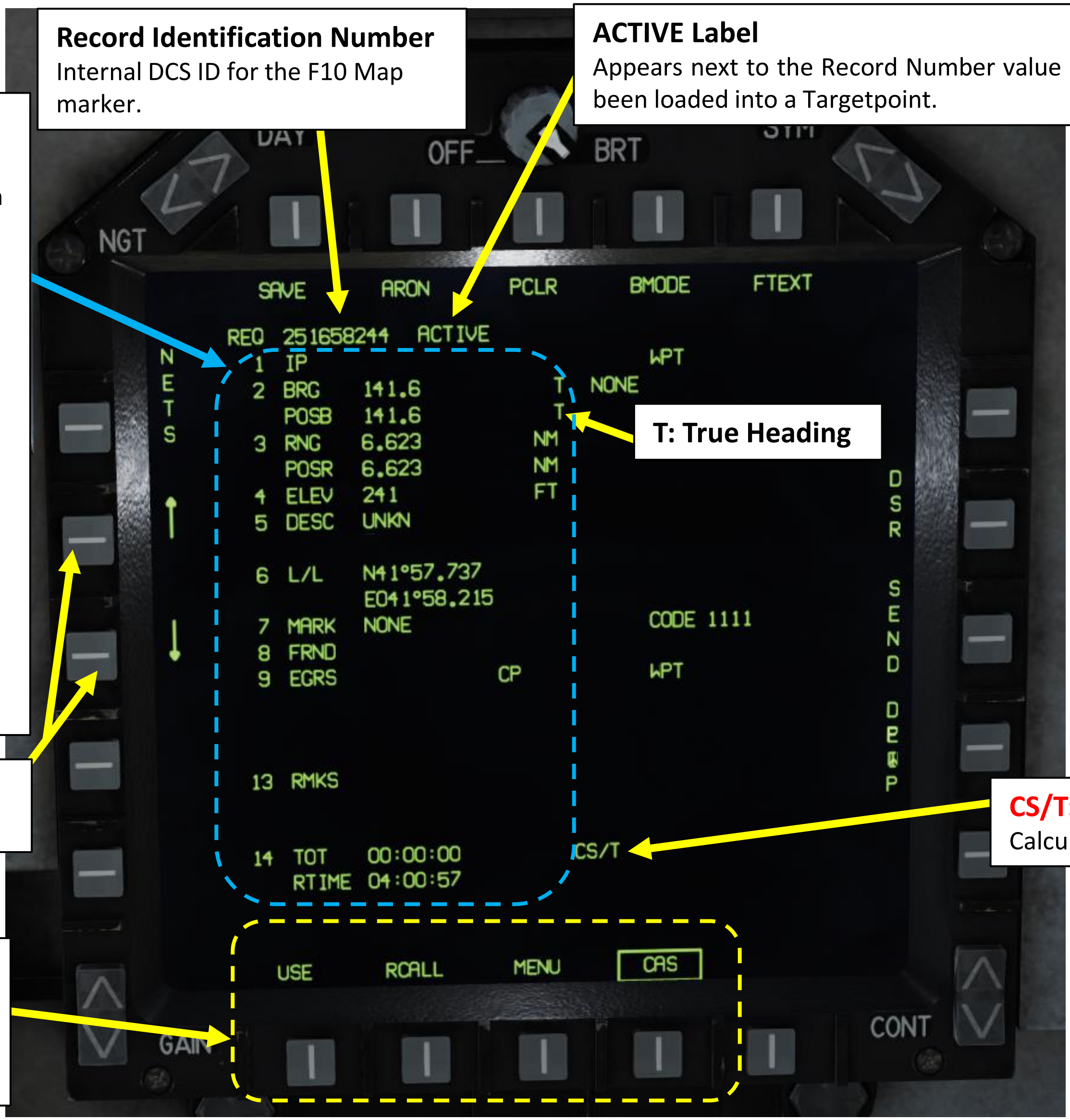
METHOD 2: Relative Release (TOO, Target-of-Opportunity)

Relative Release mode is used whenever the target is designated by using the aircraft’s onboard sensors (DMT, INS, **Targeting Pod**). It is the least accurate mode since the target position is determined in relation to the aircraft’s own position. It is highly recommended that you use a targeting pod for this since laser ranging is required for TOO mode.

2.9 - GBU-38 JDAM
2.9.1 - INTRODUCTION

Information in red is entered by the FAC using a special transmitter. Currently the device cannot be reliably simulated in DCS so they are not used.

The **Close Air Support (CAS) MPCD Display** is used to show all available targets entered by loading the F10 Map markers.



Record Identification Number
Internal DCS ID for the F10 Map marker.

ACTIVE Label
Appears next to the Record Number value if the record information has been loaded into a Targetpoint.

Record Data

1. **IP:** Initial Point Name
2. **BRG:** Bearing to target from the IP. If no IP exists, it is calculated from the aircraft.
   POSB: Bearing to target from aircraft current position.
3. **RNG:** Range to target (nm) from the IP. If no IIP, it is calculated from aircraft position.
   POSR: Range to target (nm) from aircraft current position.
4. **ELEV:** Target ground elevation (ft)
5. **DESC:** Target shorthand description
6. **L/L:** Target Latitude/Longitude Coordinates
7. **MARK:** Indicates if target is being marked
8. **FRND:** Friendly forces position (Direction & Range)
9. **EGRS:** Egress route from target
13. **RMKS:** Any notes, remarks or observations about the target.
14. **TOT:** Time-On-Target
    RTIME: Aircraft real time.

T: True Heading

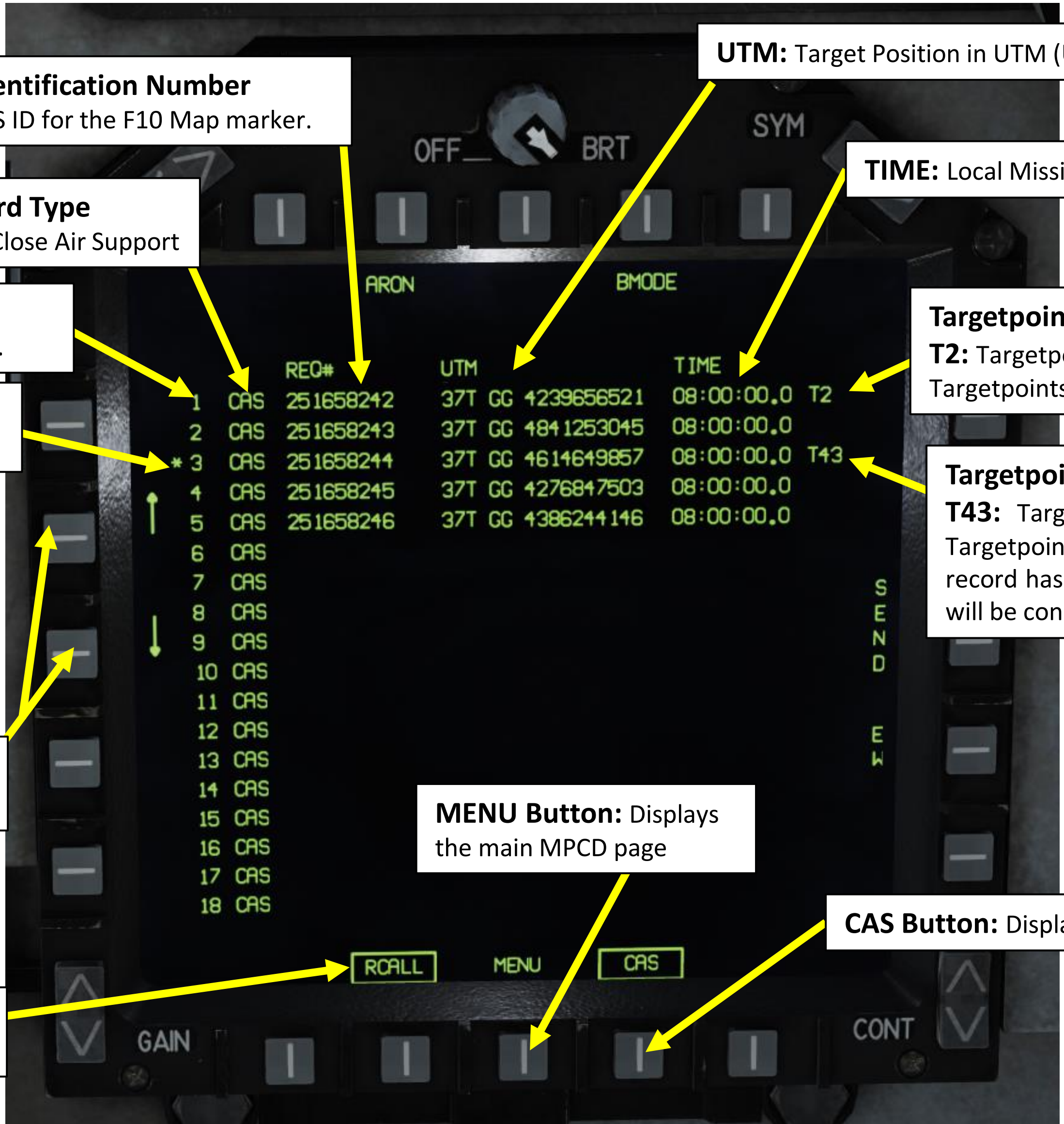
Up Arrow: Moves to previous record
Down Arrow: Moves to next record

CS/T: Command Speed/Time. Calculated based on TOT.

- **USE Button:** Sets the UFC for target data transfer to a Targetpoint.
- **RCALL Button:** Recalls/Displays the list of available targets
- **MENU Button:** Displays the main MPCD page
- **CAS Button:** Displays the CAS (Close Air Support) data page.

2.9 - GBU-38 JDAM
2.9.1 - INTRODUCTION

The **RCALL (Recall) Display** of the CAS page shows a list of all targets available for use with the INS Targetpoint. Only a maximum number of 18 records can be loaded. These records can be assigned to a maximum of 10 Target Points (T1-T9, and TX).



Record Identification Number
Internal DCS ID for the F10 Map marker.

UTM: Target Position in UTM (Universal Transverse Mercator) Coordinates

Record Type
CAS: Close Air Support

TIME: Local Mission Time when the F10 Map marker was created

Record Number
Record for F10 map markers from 1 to 18.

Targetpoint
T2: Targetpoint where the target record has been uploaded. Targetpoints go from T1 to T4.

Asterisk *: Indicates which one is the active record in the CAS page

Targetpoint
T43: Targetpoint where the target record has been uploaded. Targetpoints go from T1 to T9, with an extra Targetpoint TX. If a record has been uploaded to two or more targetpoints the indexes will be concatenated (i.e.: T43, indicating targetpoints 4 and 3).

Up Arrow: Moves to previous record
Down Arrow: Moves to next record

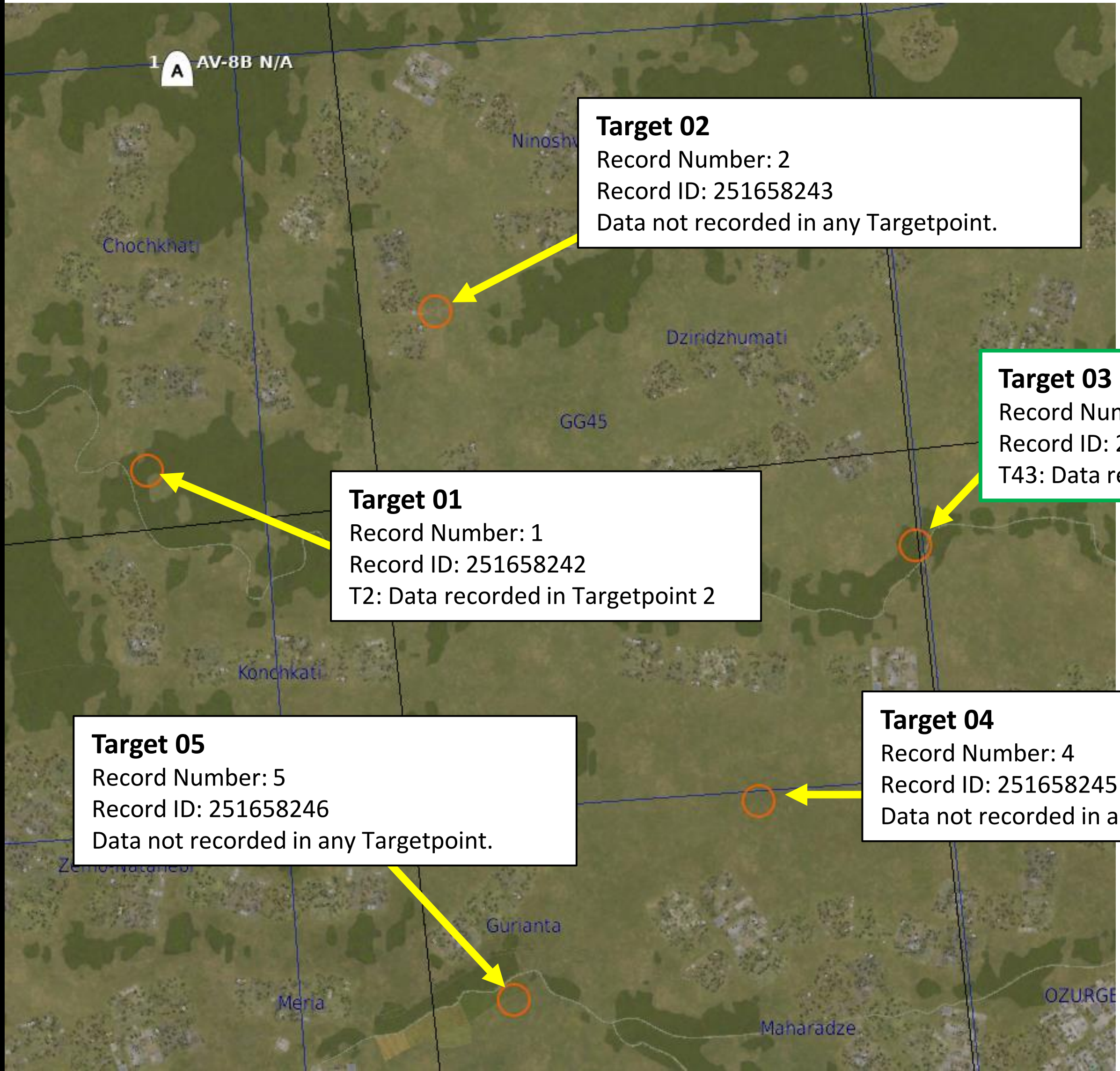
MENU Button: Displays the main MPCD page

CAS Button: Displays the CAS (Close Air Support) data page.

RCALL Indication (Boxed): RCALL (Recall) page is selected

2.9 - GBU-38 JDAM
2.9.1 - INTRODUCTION

Here is an example of how the CAS and RCALL pages are integrated together.



2.9 - GBU-38 JDAM
2.9.1 - INTRODUCTION

Here is an overview of JDAM employment methods for the Harrier within DCS:

PRE-PLANNED (ATHS) – F10 Map Markers

1. **Create F10 Map Marking Labels** →
2. **Transmit Records to ATHS** RSHIFT+RALT+8 →
3. **Assign Records to Targetpoints** via CAS & RCALL pages →
4. **Set Weapon Release Parameters** →
5. **Attack** Fly to LAR (Launch Acceptable Range) then Launch Weapon

PRE-PLANNED (ATHS) – JTAC Transmission

1. **Contact JTAC for Fire Mission Request** →
2. **Receive Records to ATHS** Automatic with JTAC 9-line →
3. **Assign Records to Targetpoint** via CAS & RCALL pages →
4. **Set Weapon Release Parameters** →
5. **Attack** Fly to LAR (Launch Acceptable Range) then Launch Weapon

TOO/TARGET-OF-OPPORTUNITY (TARGETING POD)

1. **Set Weapon Release Parameters** →
2. **Designate Target with Targeting Pod Laser Ranging** →
3. **Attack** Fly to LAR (Launch Acceptable Range) then Launch Weapon

2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

A - CREATE F10 MAP MARKING LABELS

In a case where there is no JTAC (Joint Terminal Attack Controller) available in your mission, this method allows you to self-create a request to the ATHS (Automatic Target Handoff System) with markers placed on the F10 map.

1. Press F10 to display the map, then select the MARK LABEL button.
2. Click where you want to create a target point, then type "#TP" followed by the Target number you want to create. "#TP01" would be "Target 1", "#TP02" would be "Target 2", etc.

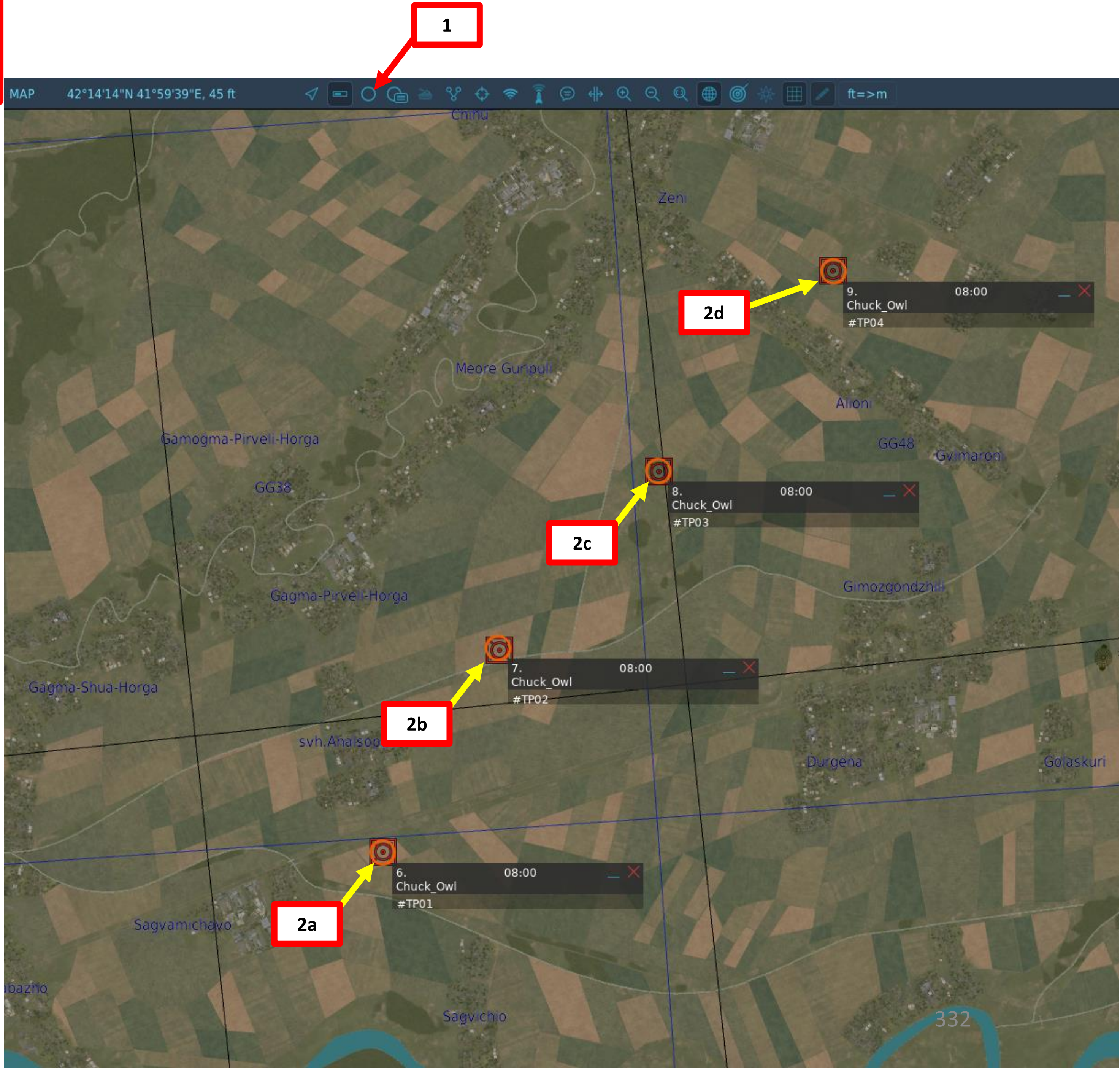
ATHS Records Database
RSHIFT+RALT+8
Populates records database

→

Assign Records to Targetpoints
T1
T2
T3
T4
T5
T6
T7
T8
T9
TX

↓

Select desired Targetpoint(s)
to be used as TGTS reference by JDAM

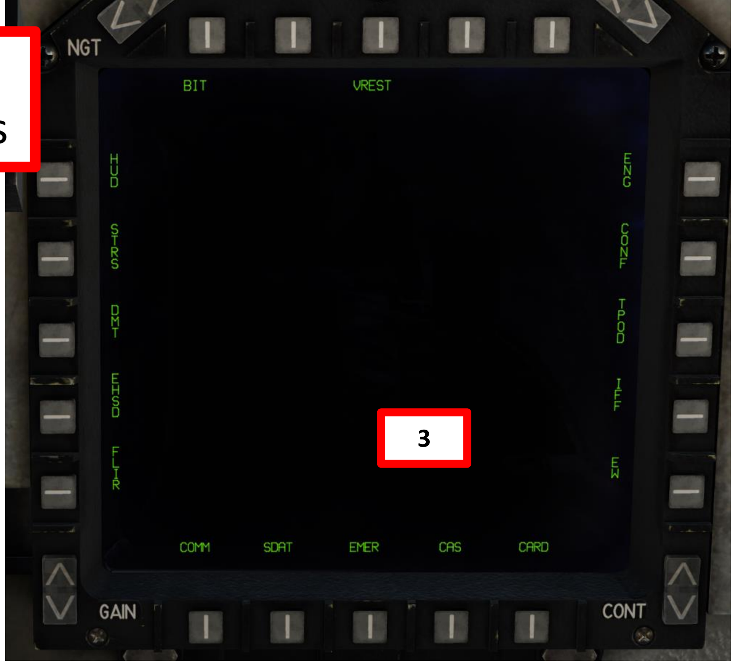


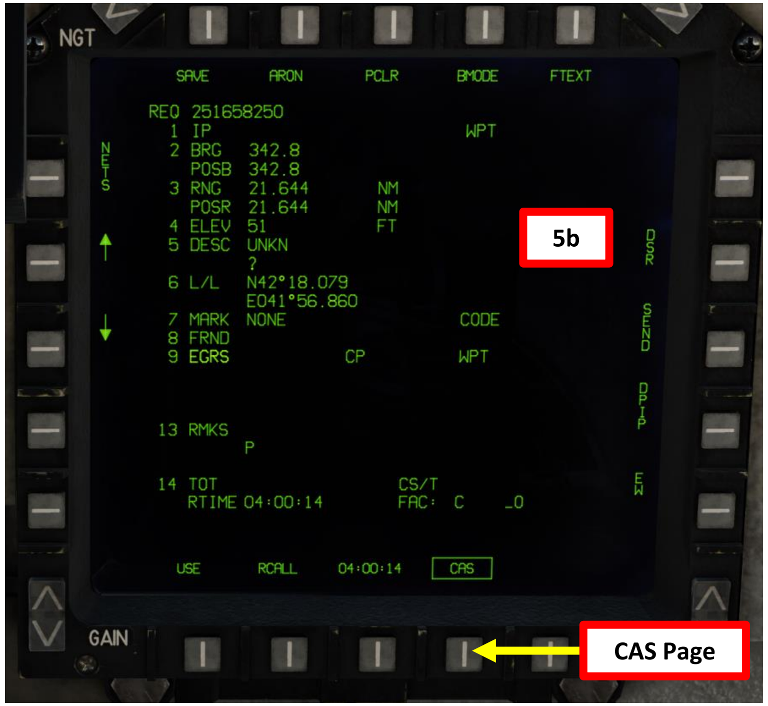
2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

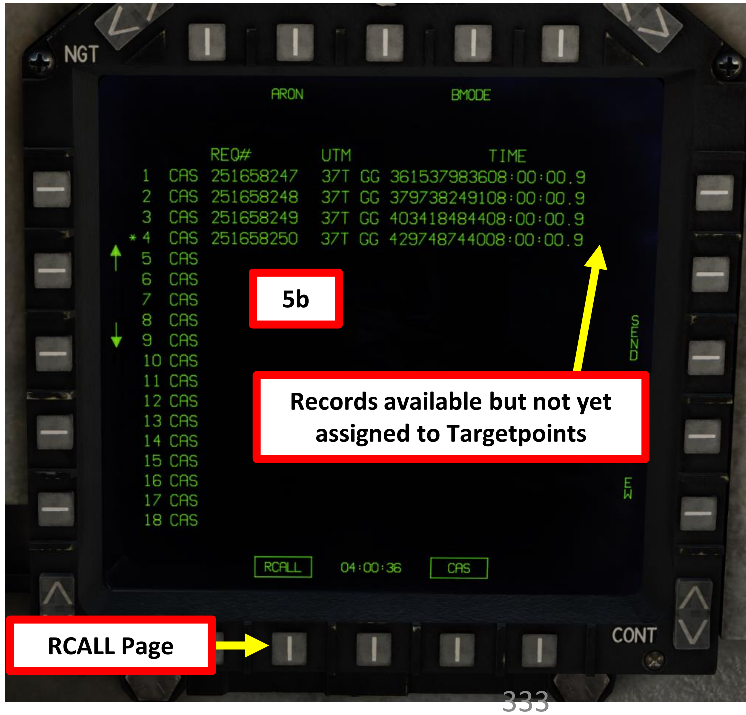
B - TRANSMIT RECORDS TO ATHS

3. Go in MPCD main MENU
4. Select CAS (Close Air Support) Page. At the moment, there should be no records available yet.
5. Transmit marking label data (records) to the ATHS (Automatic Target Handoff System) by pressing "**RSHIFT+RALT+8**". This will simulate a FAC (Forward Air Controller) sending you the records for fire missions.
6. If you perform the previous step while on the ground, records for T01 through T04 will automatically be assigned to Targetpoints 1 through 4. This information will be available through the Kneeboard (RSHIFT+K) on the TARGET LIST page.

However, if the previous step is performed while in the air, the TARGET LIST page will remain empty and records for T01 through T04 will have to be manually assigned to the desired Targetspoints. The next steps will show you how.

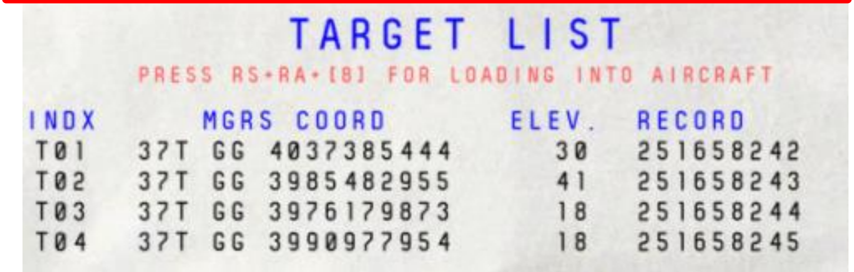






6

Unrelated Example of Target List in the Kneeboard



TARGET LIST

PRESS RS+RA+[8] FOR LOADING INTO AIRCRAFT

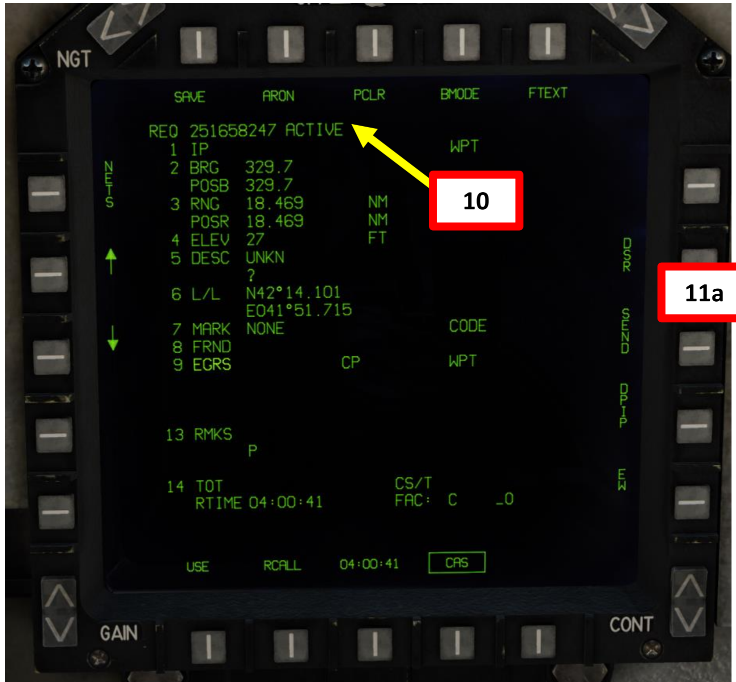
INDX	MGRS COORD	ELEV.	RECORD
T01	37T GG 4037385444	30	251658242
T02	37T GG 3985482955	41	251658243
T03	37T GG 3976179873	18	251658244
T04	37T GG 3990977954	18	251658245

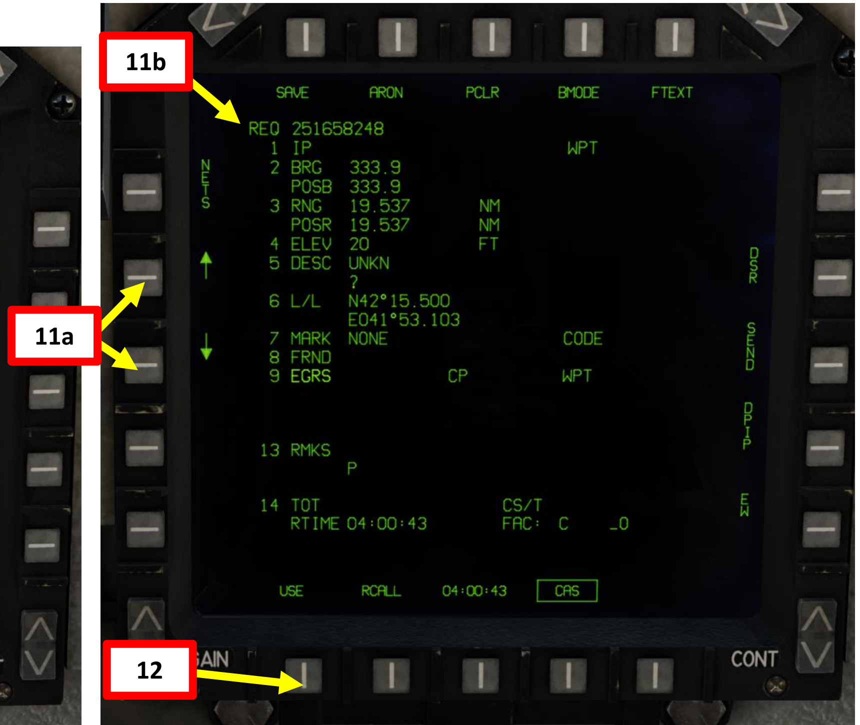
2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

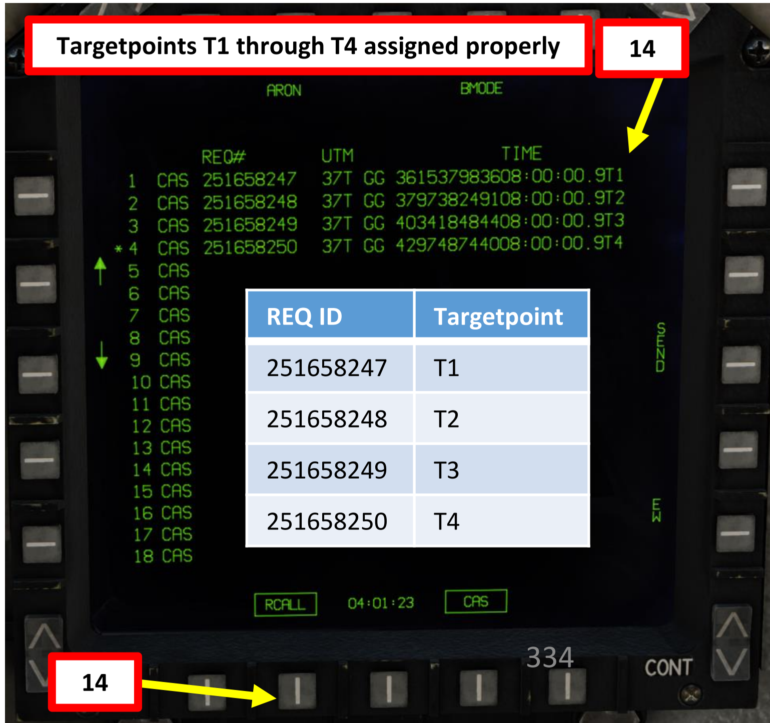
C - ASSIGN RECORDS TO TARGETPOINTS

Note: the following steps can be skipped if data was updated on the ground.

7. In CAS page, select the first record (use arrows on the side) that you want to assign to Targetpoint 1, which is REQ 251658247.
8. Press on the OSB (Option Select Button) next to USE. The UFC (Up-Front Control) will become available to assign your desired Targetpoint.
9. On the UFC, press “1”, then “ENT” to assign REQ 251658247 to Targetpoint 1.
10. REQ 251658247 will become ACTIVE and assigned to Targetpoint 1.
11. Select the next record (REQ 251658248).
12. Press on the OSB (Option Select Button) next to USE. On the UFC, press “2” to assign REQ 251658248 to Targetpoint 2.
13. Repeat previous steps for REQ 251658249/Targetpoint 3 and REQ 2516582450/Targetpoint 4.
14. Press on the OSB next to RCALL (Recall) and confirm all records are assigned to the correct Targetpoint.







REQ ID	Targetpoint
251658247	T1
251658248	T2
251658249	T3
251658250	T4

2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

C - ASSIGN RECORDS TO TARGETPOINTS

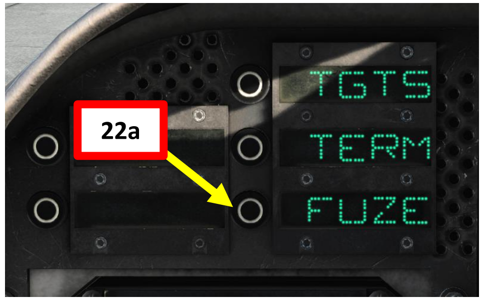
15. When the target points are created, the EHSD will automatically go to the EHSD DATA sub-page. Press on the OSB next to DATA to unbox (de-select) the menu.

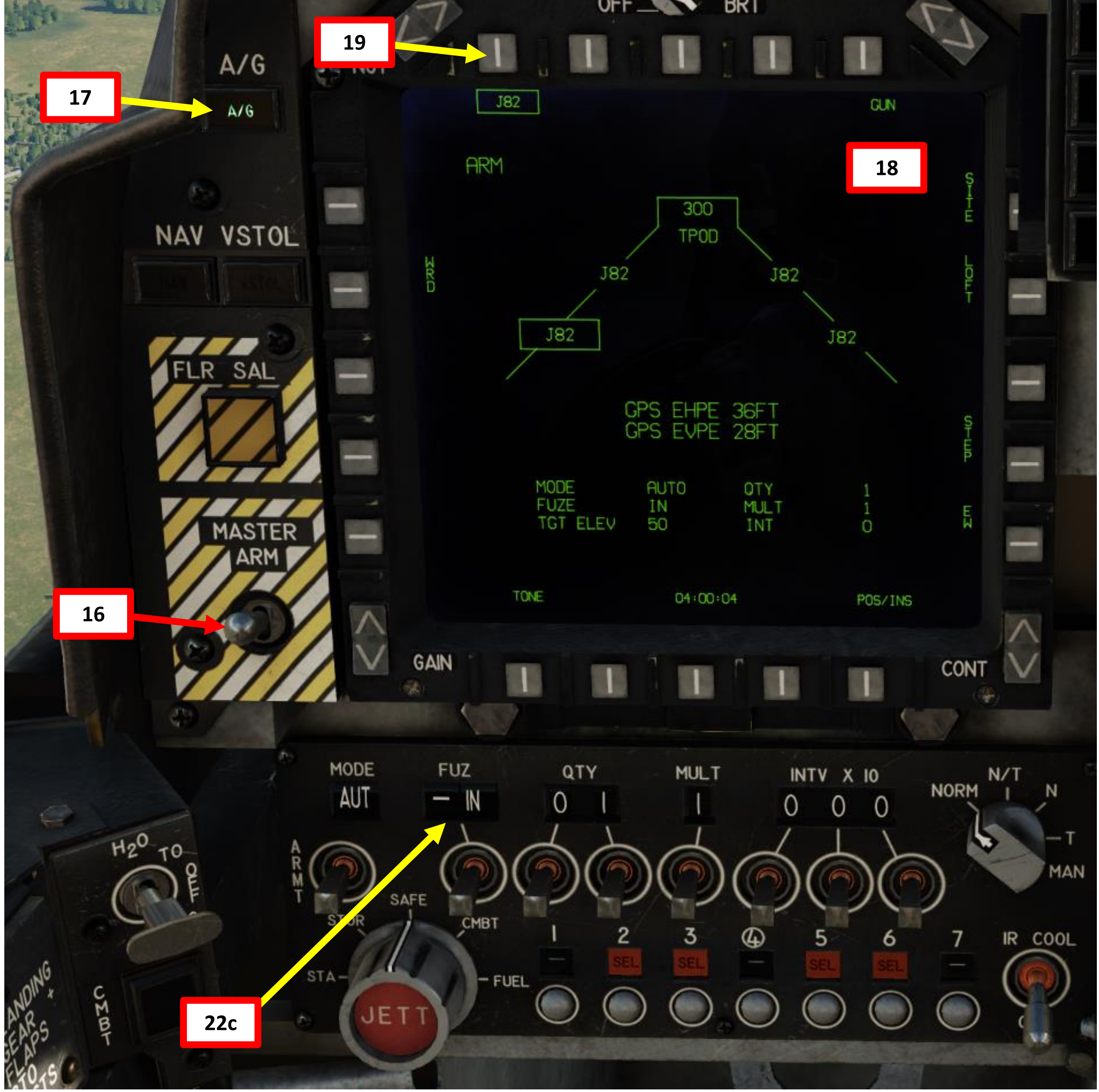
15a

2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

D - SET WEAPON RELEASE PARAMETERS

16. Set Master Arm Switch - ON (UP)
17. Set Master Mode to A/G (Air-to-Ground)
18. Go in MPCD main MENU and select STRS (Stores) Page
19. Select desired J82 (GBU-38) JDAMs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
20. When aircraft generator is powered (engine running), the JDAM will automatically begin an alignment process that may take a few minutes. This process is mostly automatic.
21. Once weapon is selected, press the « WPN » button on the UFC to display available JDAM parameter ODUs (Option Display Units).
22. Press on FUZE ODU to select the JDAM fuzing. In our case, we will choose INST (Instantaneous). « : » will indicate when selected.
23. Press on FUZE ODU again to return to JDAM parameters.

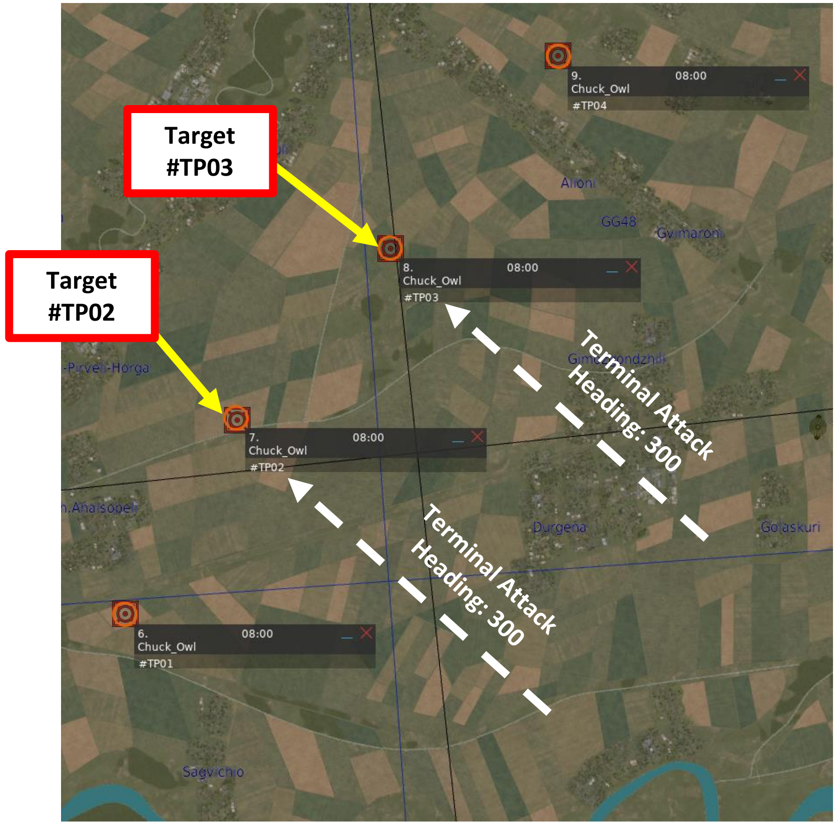


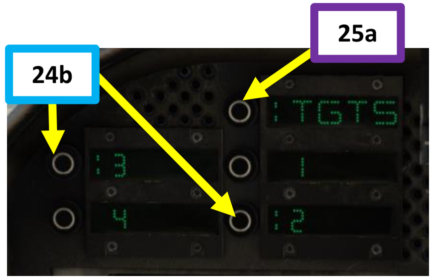


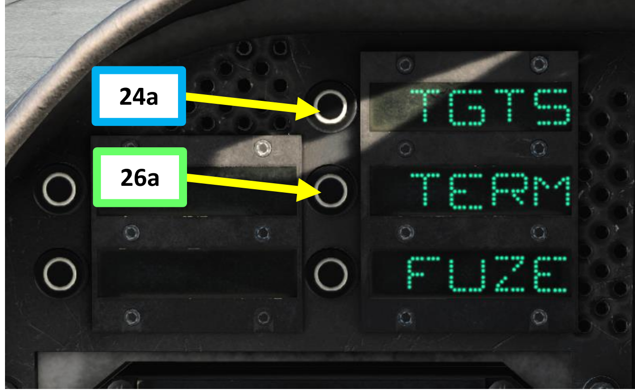
2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

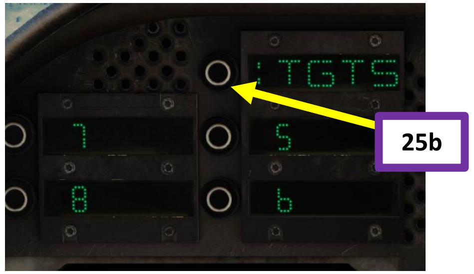
D - SET WEAPON RELEASE PARAMETERS

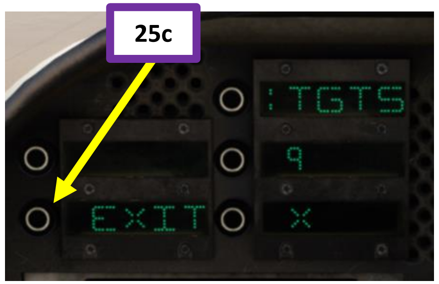
24. Press on TGTS ODU to select which targetpoints we will use for this attack. In our case, we will use Targetpoints 2 and 3 only. « : » will indicate when a targetpoint is selected.
25. Press on TGTS ODU again (then press EXIT) to return to return to JDAM parameters.
26. OPTIONAL: If desired, select what Terminal Attack Parameters you want to set like attack heading and impact angle.
    a) Press on TERM ODU
    b) Press on HDG ODU, enter JDAM approach heading to target (i.e. 300), then press "ENT" button on the UFC.
    c) Press on ANG ODU, enter JDAM impact angle (i.e. 045), then press "ENT" button on the UFC.
    d) Press on TERM ODU again to return to JDAM parameters.

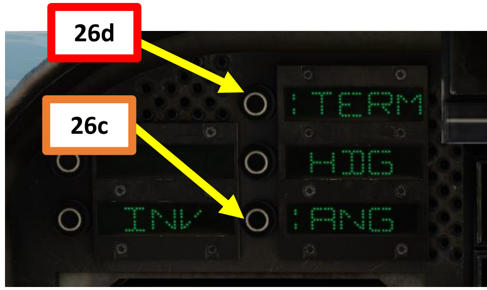








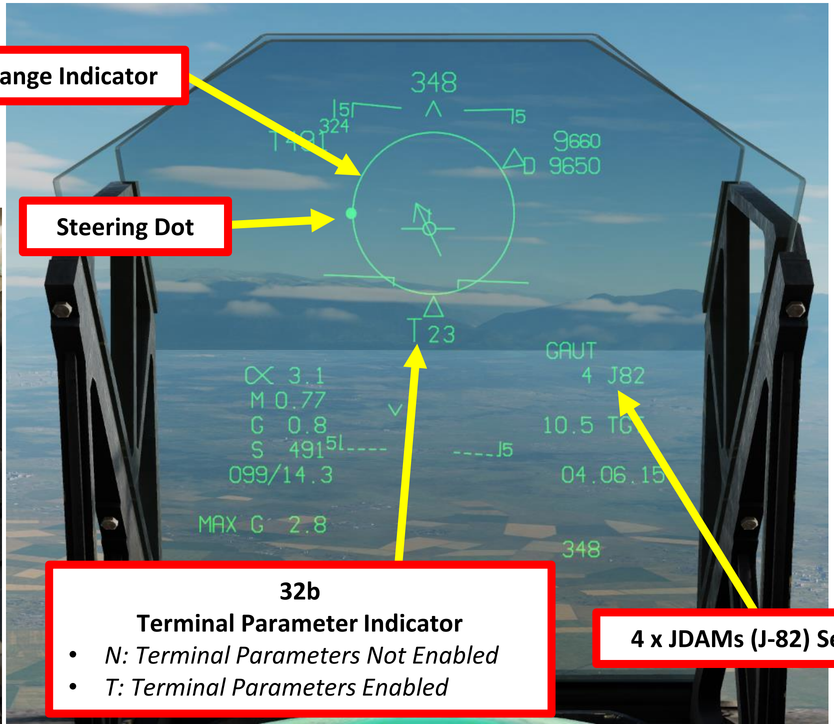


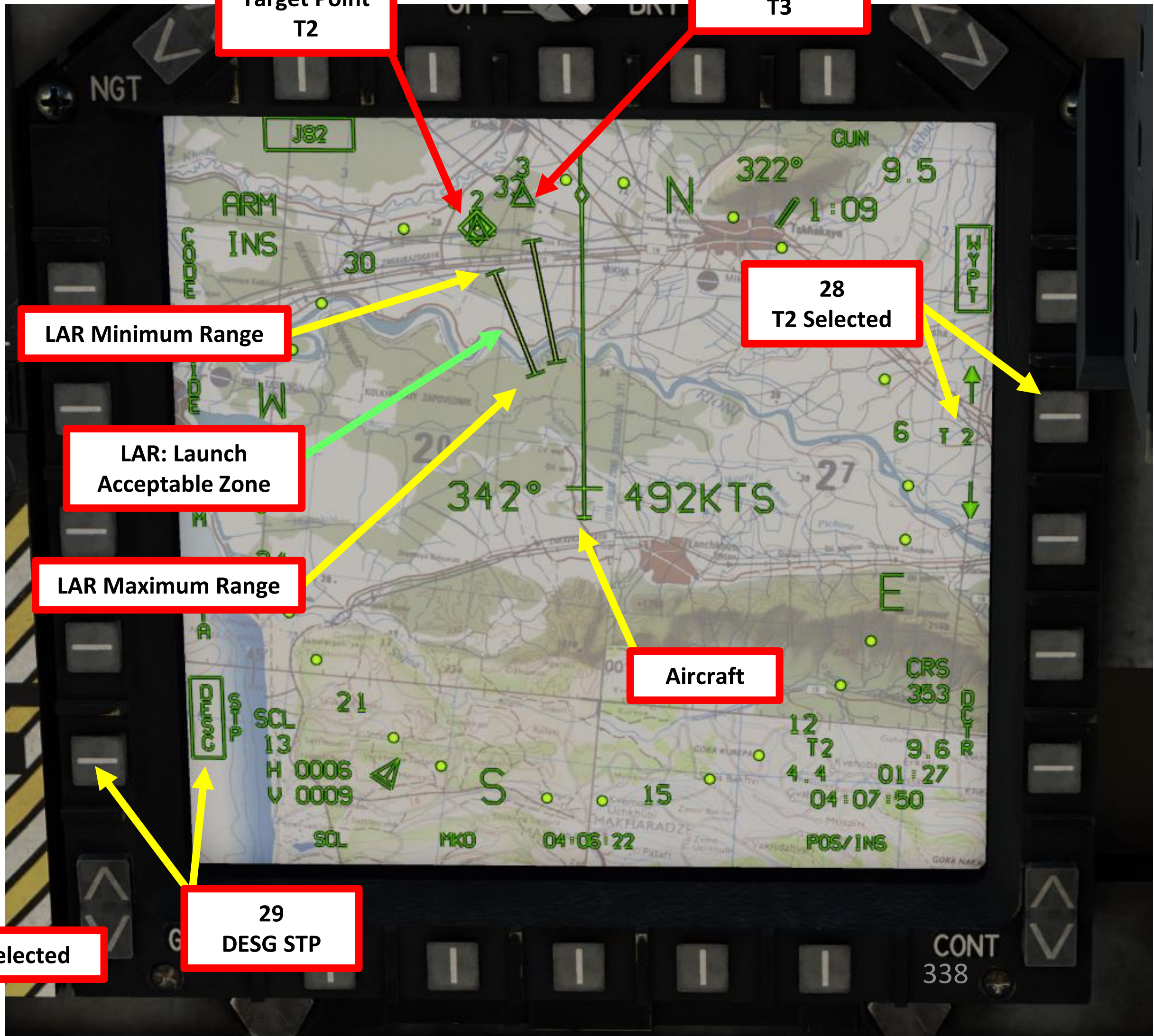


2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

D - SET WEAPON RELEASE PARAMETERS

27. Go in MPCD main MENU and select EHSD (Electronic Horizontal Situation Indicator) Page
28. Select either Target Point T2 or Target Point T3.
29. Press DESG (Designate) OSB. This will select the Target Point as the DESG STP (Designation Steerpoint). DESG should be boxed when selected.
    - Note: This step could also be done by designating the target with the targeting pod and selecting T0.
30. Upon selection of the JDAM and DESG, only the center dot, Terminal Parameters Indicator and the bomb count and stores code are visible.
31. The JDAM range circle, LAR (Launch Acceptable Range) minimum value and the target list become visible.
32. If you want to enable the TERM (Terminal) Parameters on the JDAM, you must press the “Cage/Uncage” HOTAS Button.
33. We can now perform the JDAM strike.

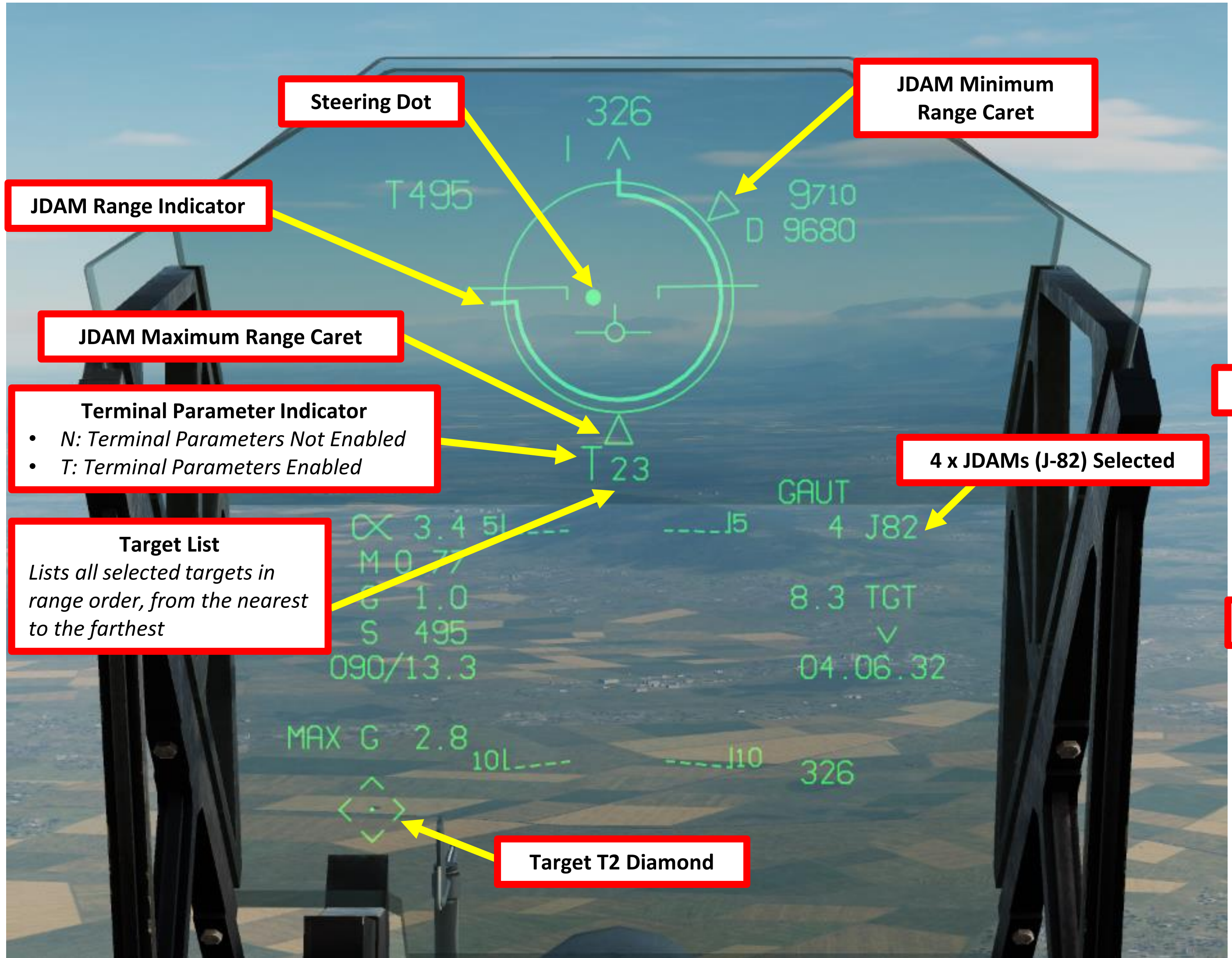


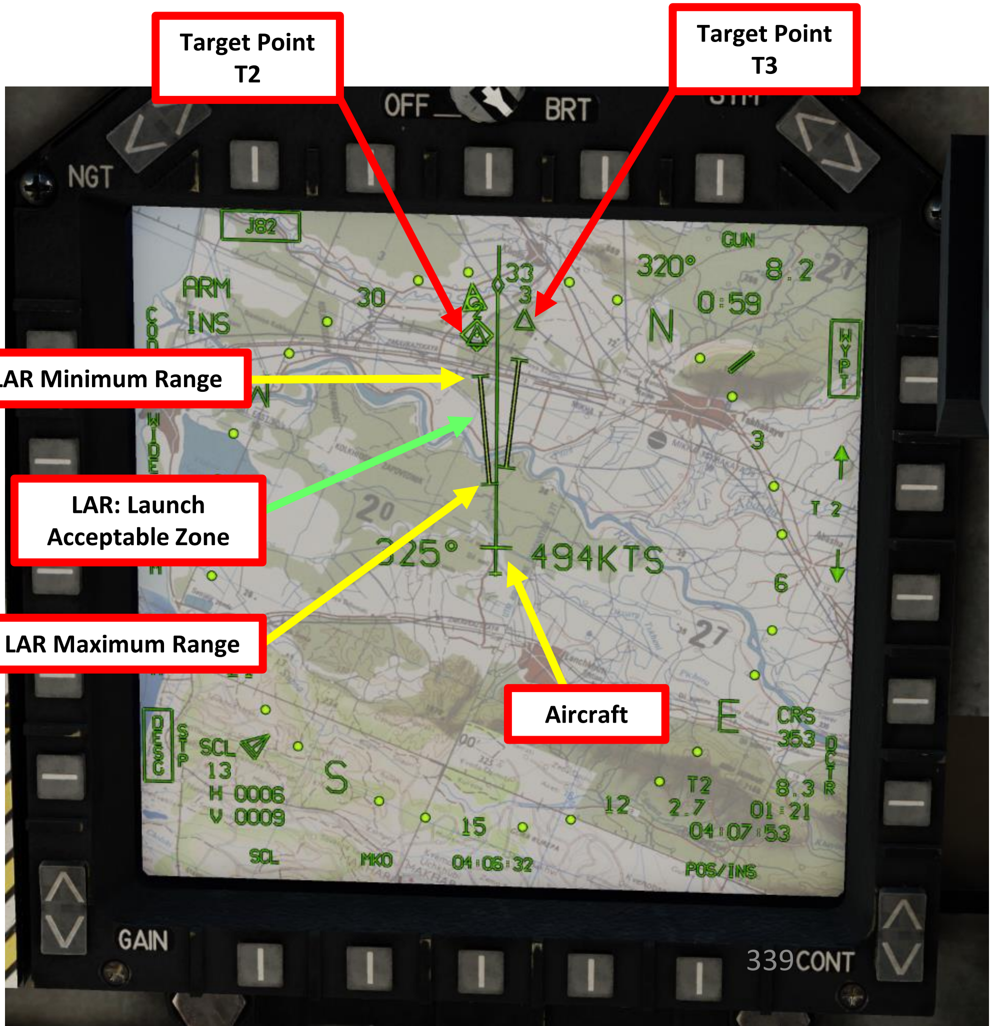


2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

E - ATTACK

34. Fly the aircraft level and line up the steering dot at the center of the JDAM Range Circle on the HUD.

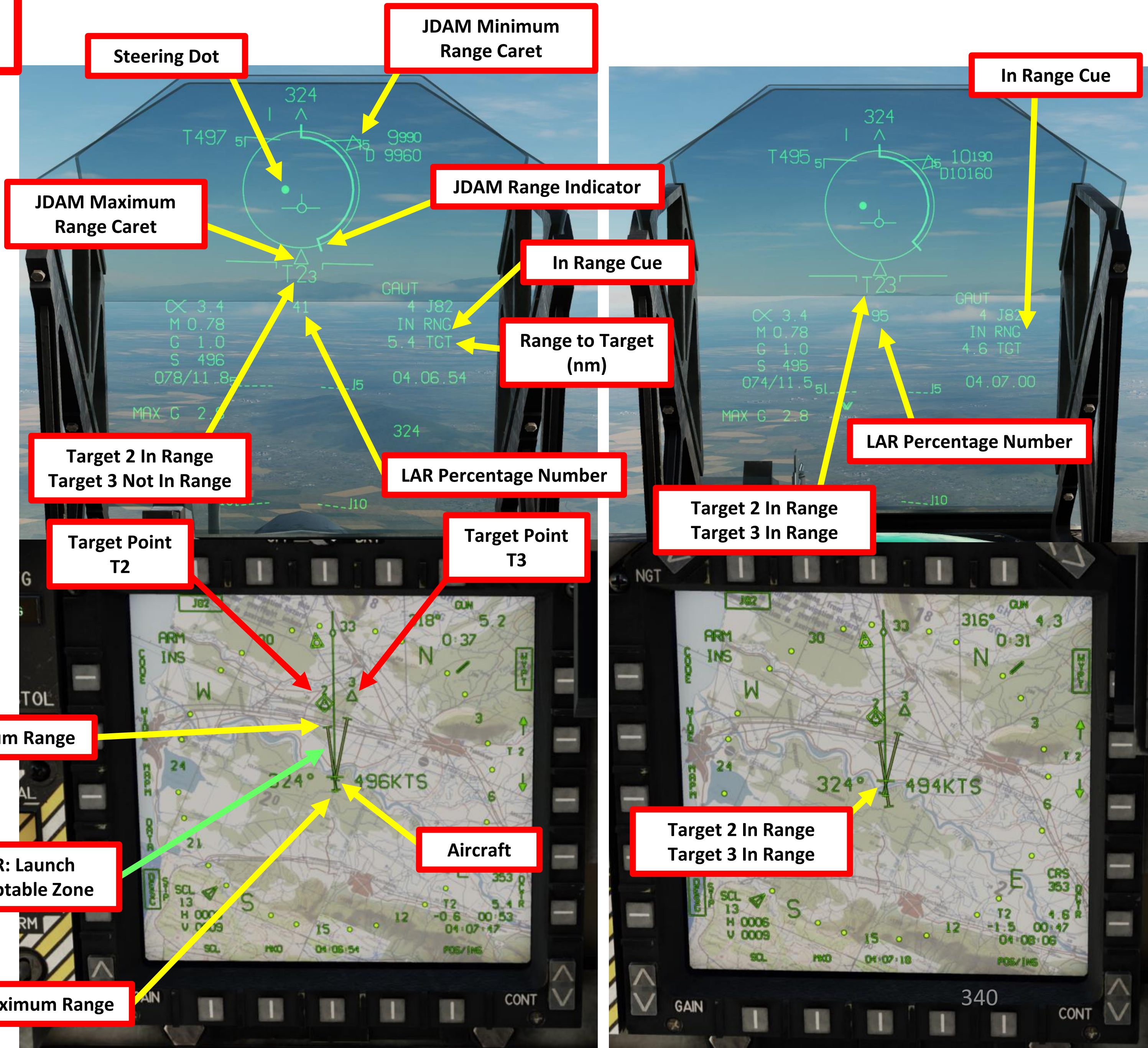




2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

E - ATTACK

35. The aircraft will be in release range as soon as it enters the LAR zone. The HUD will indicate this condition when:
    a) The target number font becomes larger.
    b) The Range to Target appears inside the Range Circle and its edge starts moving towards the Minimum LAR Marker.
    c) The LAR Percentage number (% to the center of the LAR the aircraft is at) appears in the bottom of the HUD and starts counting towards 100.
36. The bombs can be released as soon as the aircraft is inside the LAR zone. For better results it is advisable to wait until the aircraft is in the center of the LAR zone before release. Check the LAR Percentage indicator on the HUD and release as soon as the indicated value is near 100.

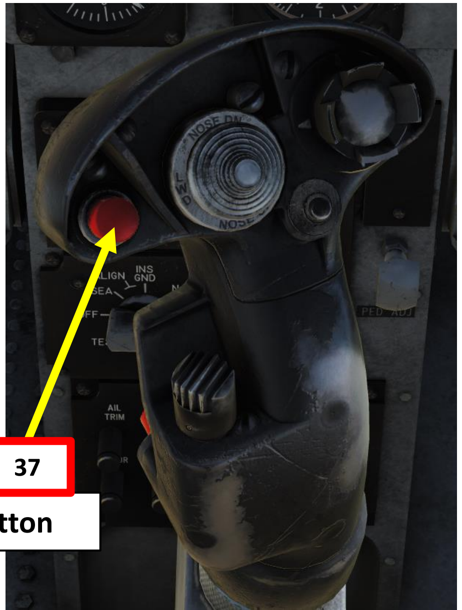


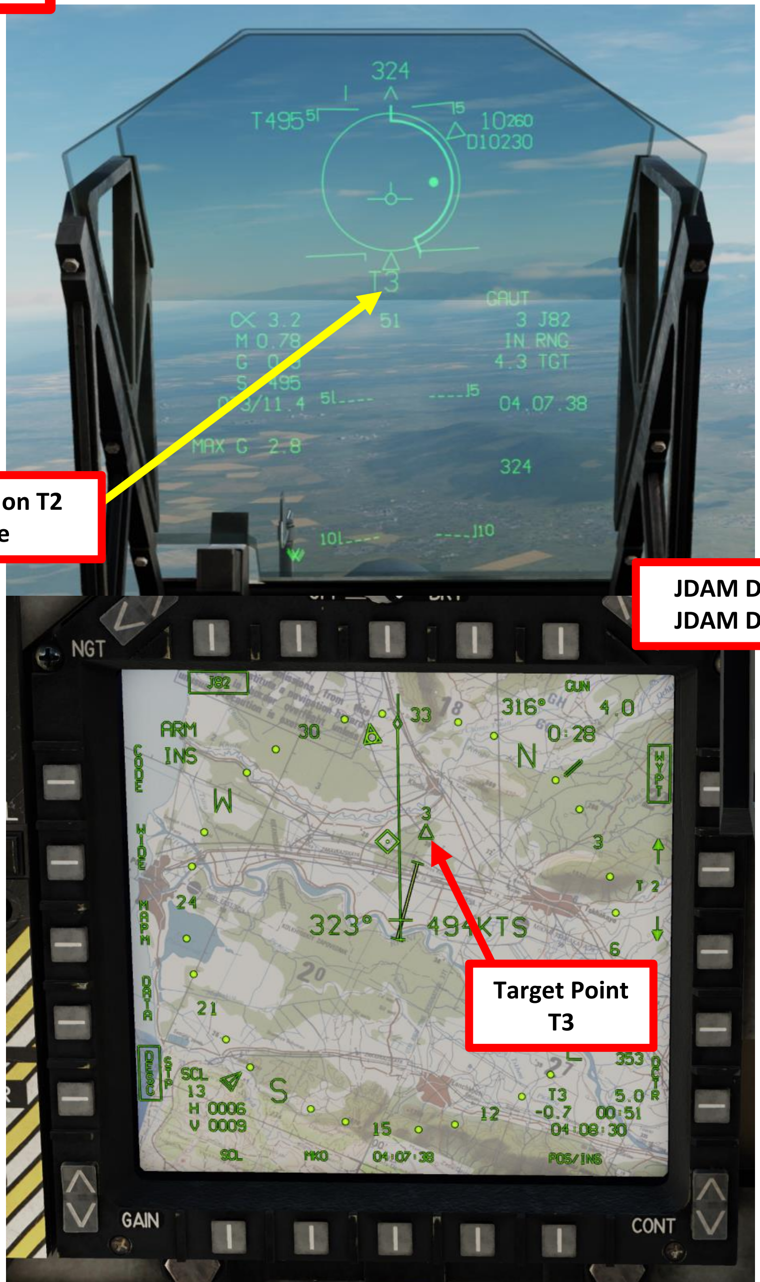
2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

E - ATTACK

37. Press and hold the Bomb Pickle button (RALT+SPACE) for approx. 1.5 seconds to launch the first JDAM. Repeat for remaining JDAM(s).

- Note 1: If multiple targets are selected, their respective JDAM bombs will be released at 1 second interval as long as the pickle is being pressed.
- Note 2: There is no automatic bomb release. The pilot must judge when it is time to release the bomb.



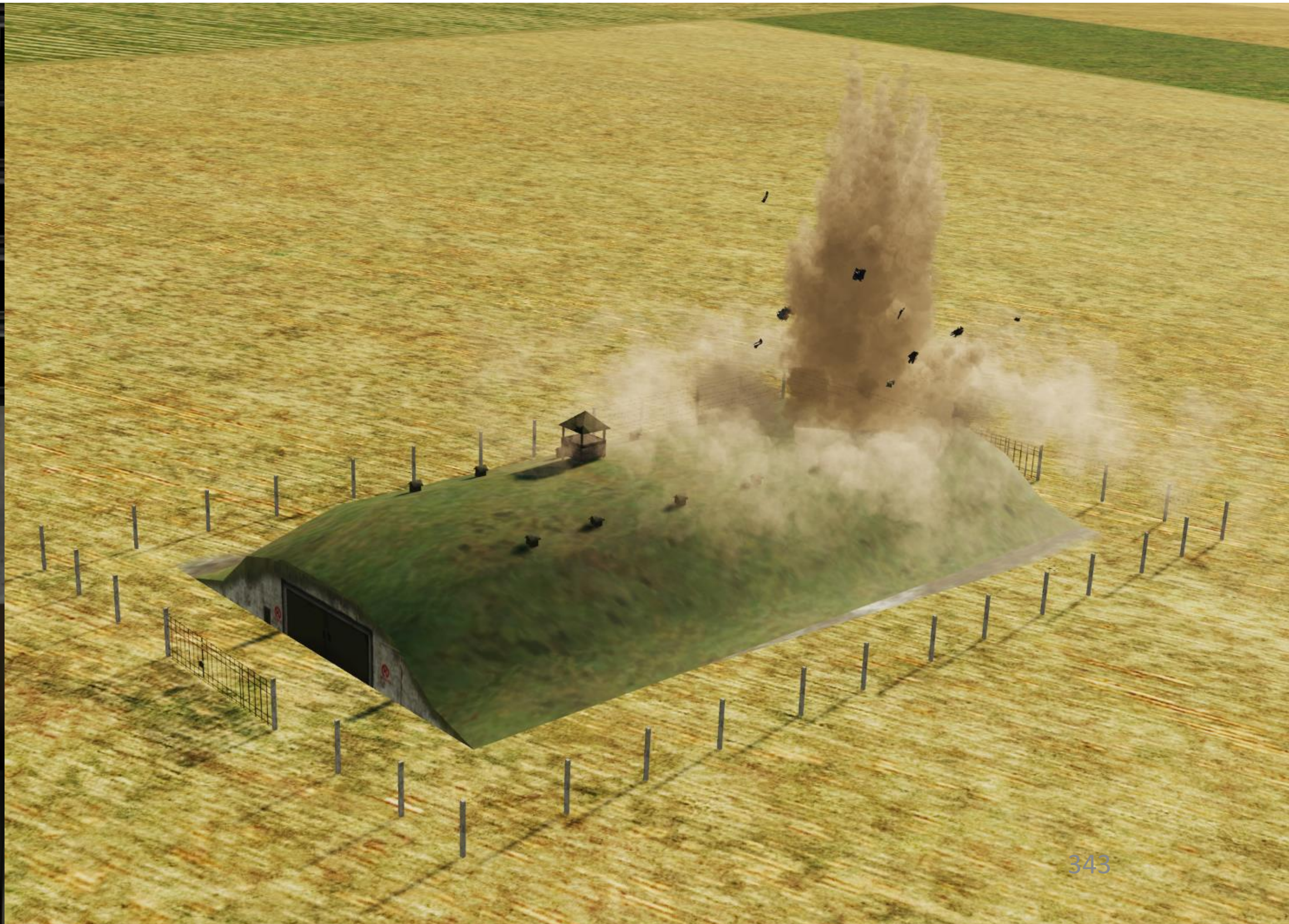


2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

2.9 - GBU-38 JDAM
2.9.2 - PRE-PLANNED (ATHS) - F10 Markers

E - ATTACK

38. After successful attack, press the DESG OSB again to un-designate. DESG should become un-boxed when de-selected.



2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

The JTAC (Joint Terminal Attack Controller) is the radio operator that finds targets for you and requests air strikes. He is the main line of communication between the grunts on the ground and yourself.

Performing a successful JDAM (Joint Directed Attack Munition) strike with the help of a JTAC is done in the following manner:

A. Find the JTAC radio frequency and request a fire mission.
B. The JTAC then sends a Mission Request to the Harrier's ATHS (Automatic Target Handoff System), which will store information under a 9-line format Record.
C. Assign a Target Point to the required Request/Record.
D. Select and arm the GBU-38 JDAM, then set up a weapon release parameters
E. Perform the attack and launch the JDAM, which will home on the target by itself.

2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

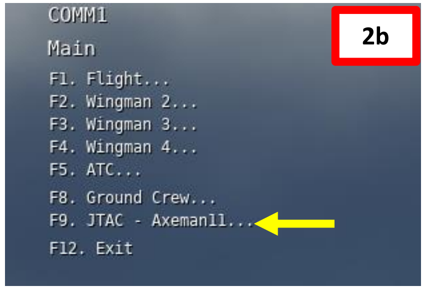
A - CONTACT JTAC

1. Set required JTAC frequency (UHF 245.00 MHz).
2. Press “COMMS Switch FWD” to communicate on UHF radio COMM1 and select JTAC – Axeman11 (F9) in radio menu.
3. Select “CHECK-IN 15 MIN” (F1)
4. You will contact the JTAC and give him your altitude and ordnance available, plus your time available on station.
5. JTAC will answer “Type 3 in effect” and ask you when you are ready to receive a 9-line.
6. Select “READY TO COPY” (F1) to receive 9-line.
7. The JTAC will give you the 9-line and ask you when you are ready for remarks.
8. Select “READY TO COPY REMARKS” (F1)
9. JTAC will give you remarks.
10. Select “9-LINE READBACK” to repeat the information you have given and confirm it with the JTAC.
11. JTAC will confirm your readback, send you a JTAC transmission and clear you to engage target.

1

COMMS Switch
- FWD = Selects COMM 1
- AFT = Selects COMM 2

2a



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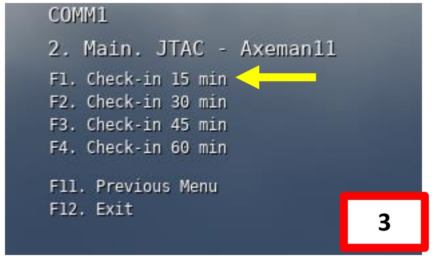

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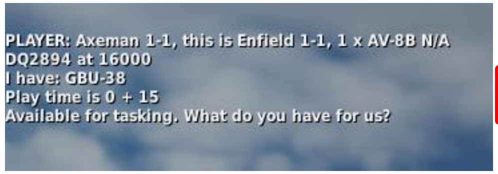

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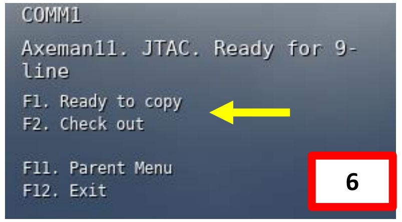

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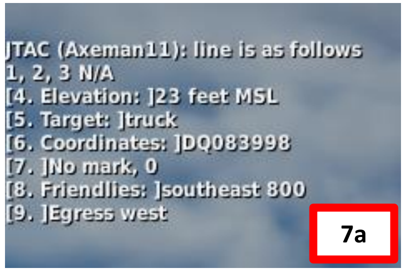

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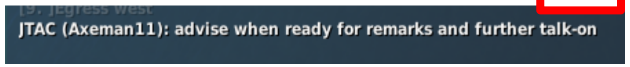

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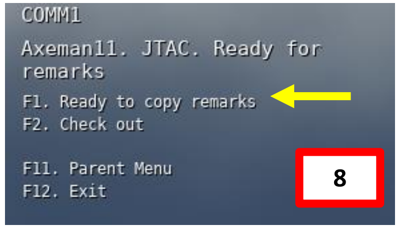

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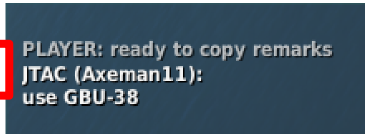
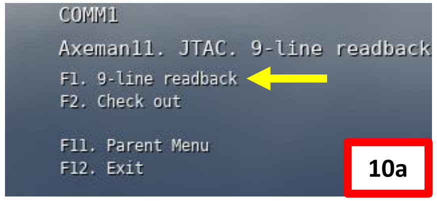




10a

10b

11

2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

A - CONTACT JTAC

What is a CAS (Close Air Support) 9-line and why is it important? The goal of a 9-line is to provide you as much information as concisely as possible.

9-line

Line 1: IP/BP – Initial Point/Battle Position (N/A in our case)
Line 2: Heading from the IP to the Target (N/A in our case)
Line 3: Distance from the IP/BP to target (N/A in our case)
Line 4: Target elevation – 23 feet above Mean Sea Level (MSL)
Line 5: Target description: Truck.
Line 6: Target location: Grid coordinates of target (UTM coordinates DQ083998)
Line 7: Target Mark Type: No Mark
Line 8: Location of Friendlies: JTAC located 800 meters Southeast of Target
Line 9: Egress semi-cardinal direction when departing from target: West

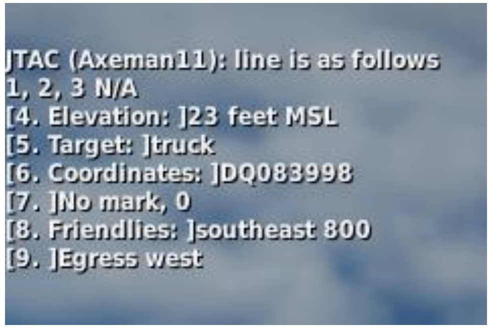
Remarks

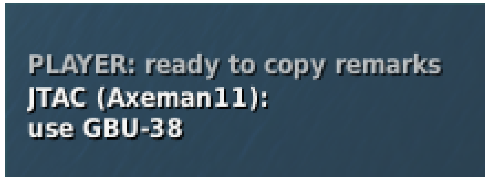
Remarks generally include information about troops in contact or danger close, SEAD support in effect, hazards, weather or other threats. In our case, the JTAC wants us to use GBU-38 JDAMs.

JTAC TASKING/REQUEST:

When the JTAC sends his 9-line, a new tasking transmission is sent to the CAS (Close Air Support) page.

- When a new message is received via the ATHS, the **MSG** indication is visible on the HUD.
- From the main MPCD Menu, click on the OSB next to **CAS** to access the Close Air Support Page page.
- If many missions/records are already stored, click on the arrows to cycle through the Request Database. The RCALL (Recall) page allows you to have an overview of all requests stored.





MSG (Message) Received

Request Selectors

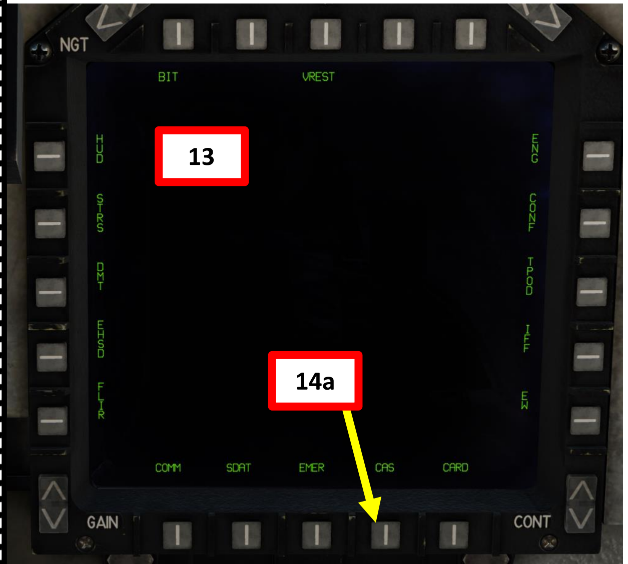
CAS Page

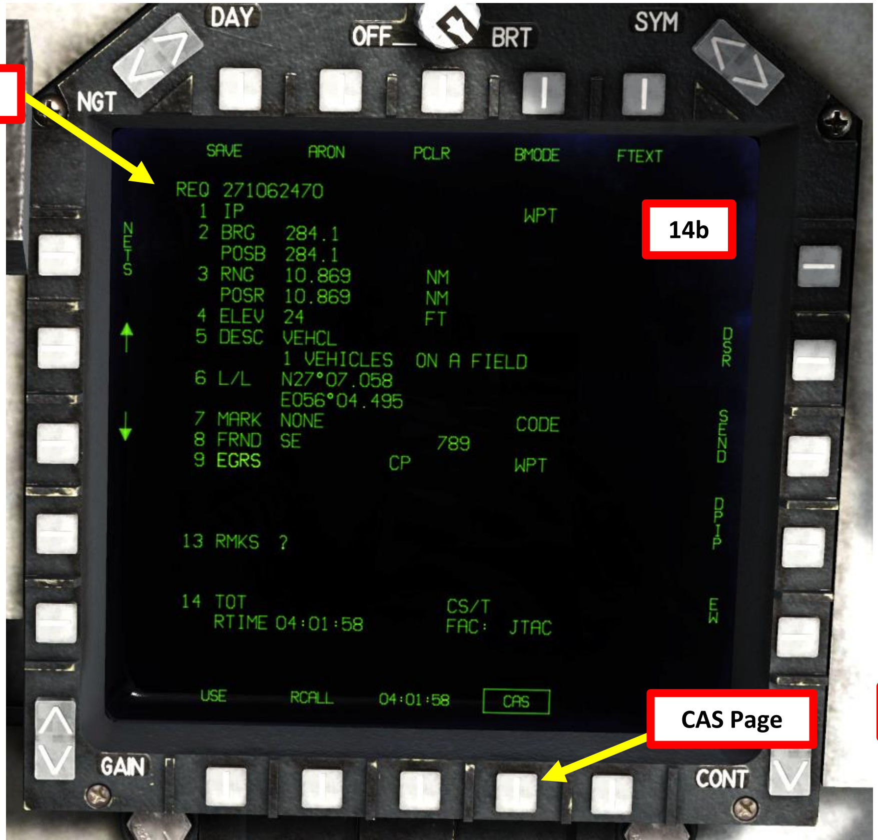
2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

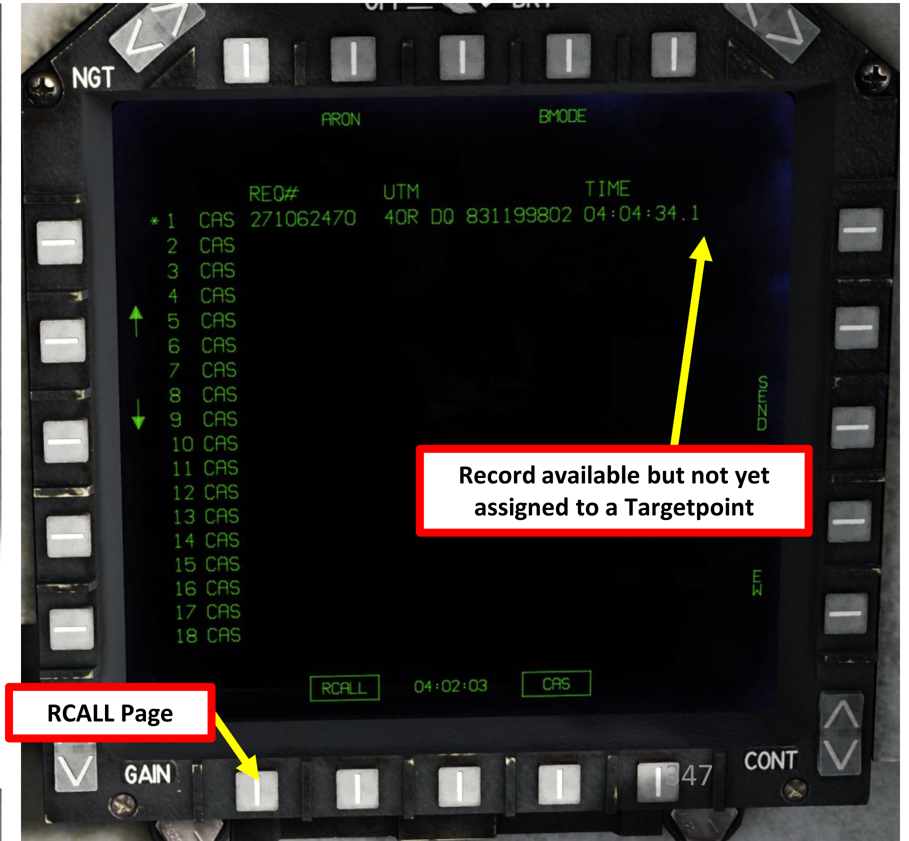
B - RECEIVE FIRE MISSION REQUEST

12. When JTAC has sent you his 9-line fire mission request, the MSG indication will appear on the HUD.
13. Go in MPCD main MENU
14. Select CAS (Close Air Support) Page. The latest record should be visible (REQ 271062470).
15. If you select the RCALL (Recall) sub-page, you will notice that the record we just received has not been assigned to a Target Point yet.

Received Request (not Active)



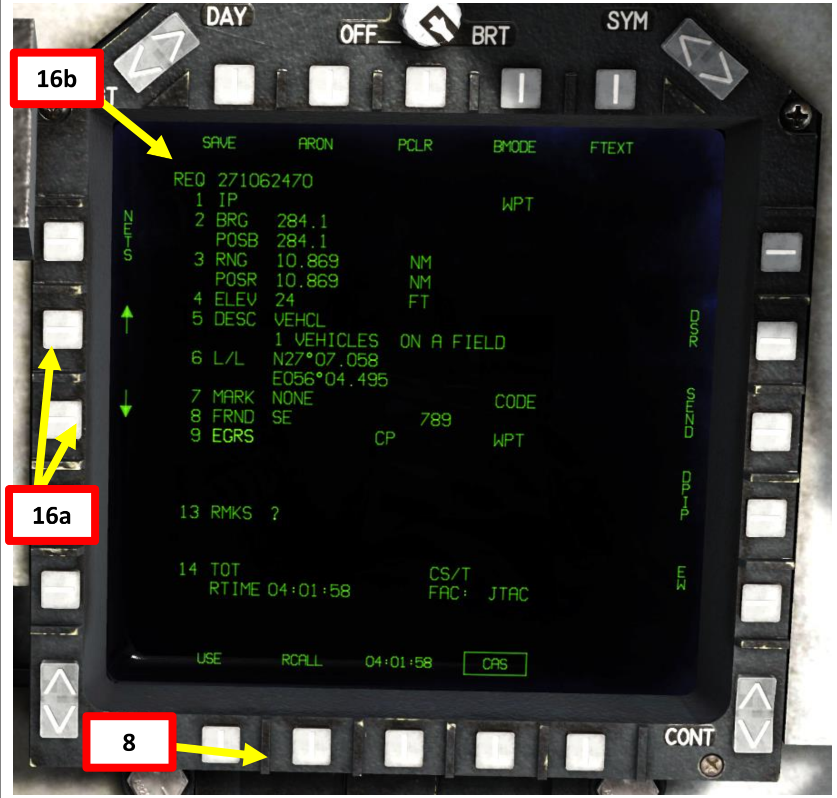


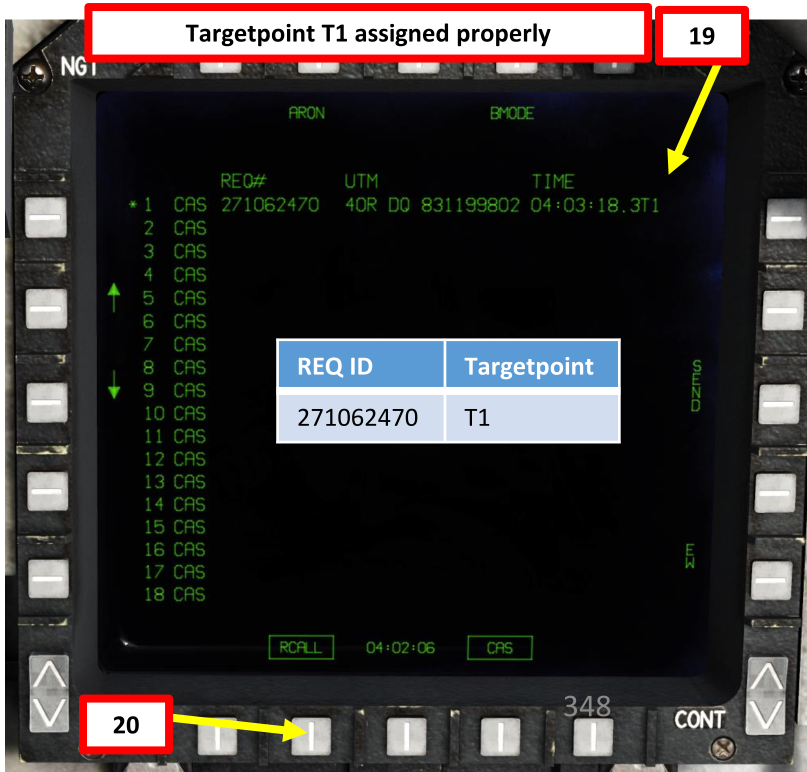


2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

C - ASSIGN RECORD TO TARGETPOINT

16. In CAS page, select the record received previously (use arrows on the side) to assign it to Targetpoint 1. Our desired record is REQ 271062470.
17. Press on the OSB (Option Select Button) next to USE. The UFC (Up-Front Control) will become available to assign your desired Targetpoint.
18. On the UFC, press "1", then "ENT" to assign REQ 271062470 to Targetpoint 1.
19. REQ 271062470 will become ACTIVE and assigned to Targetpoint 1.
20. Press on the OSB next to RCALL (Recall) and confirm all records are assigned to the correct Targetpoint.



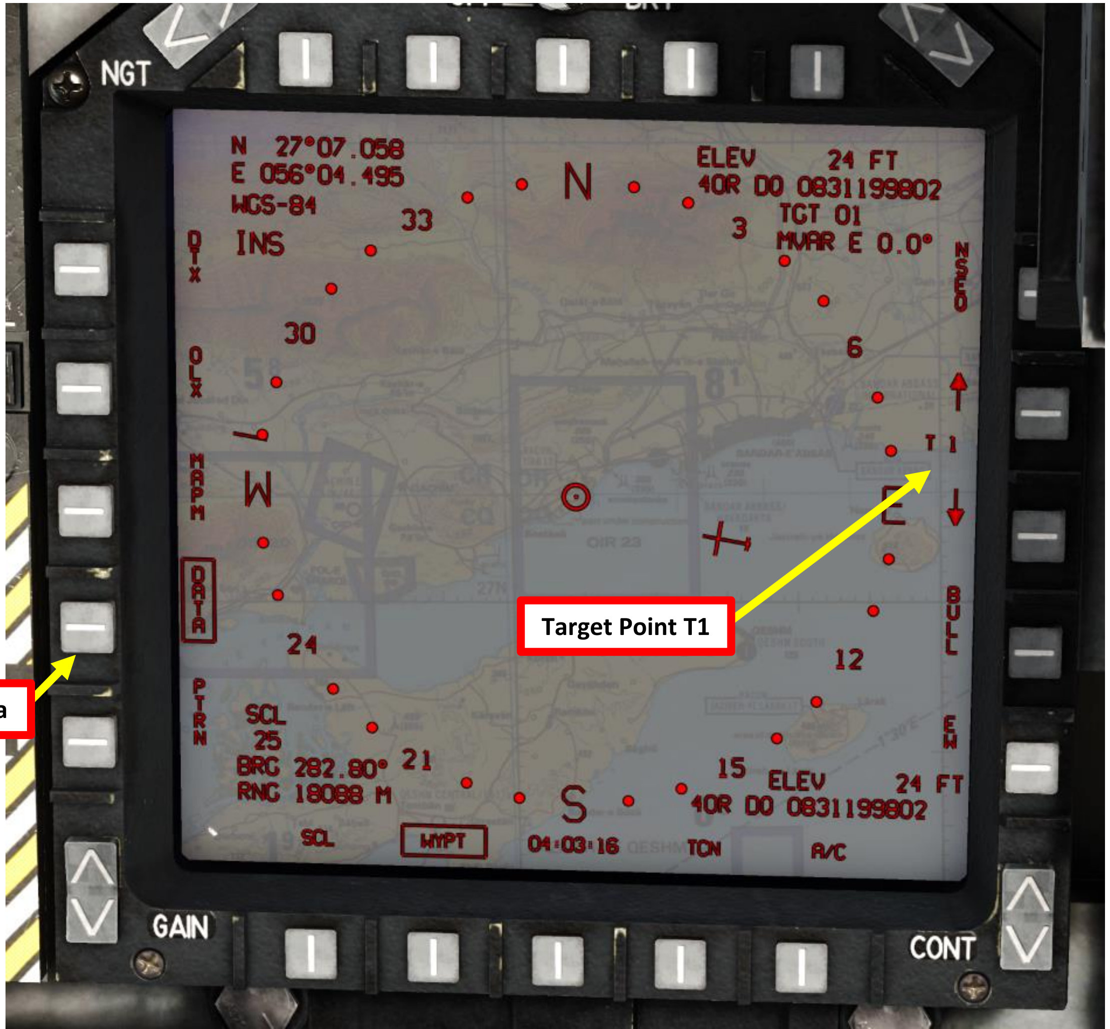


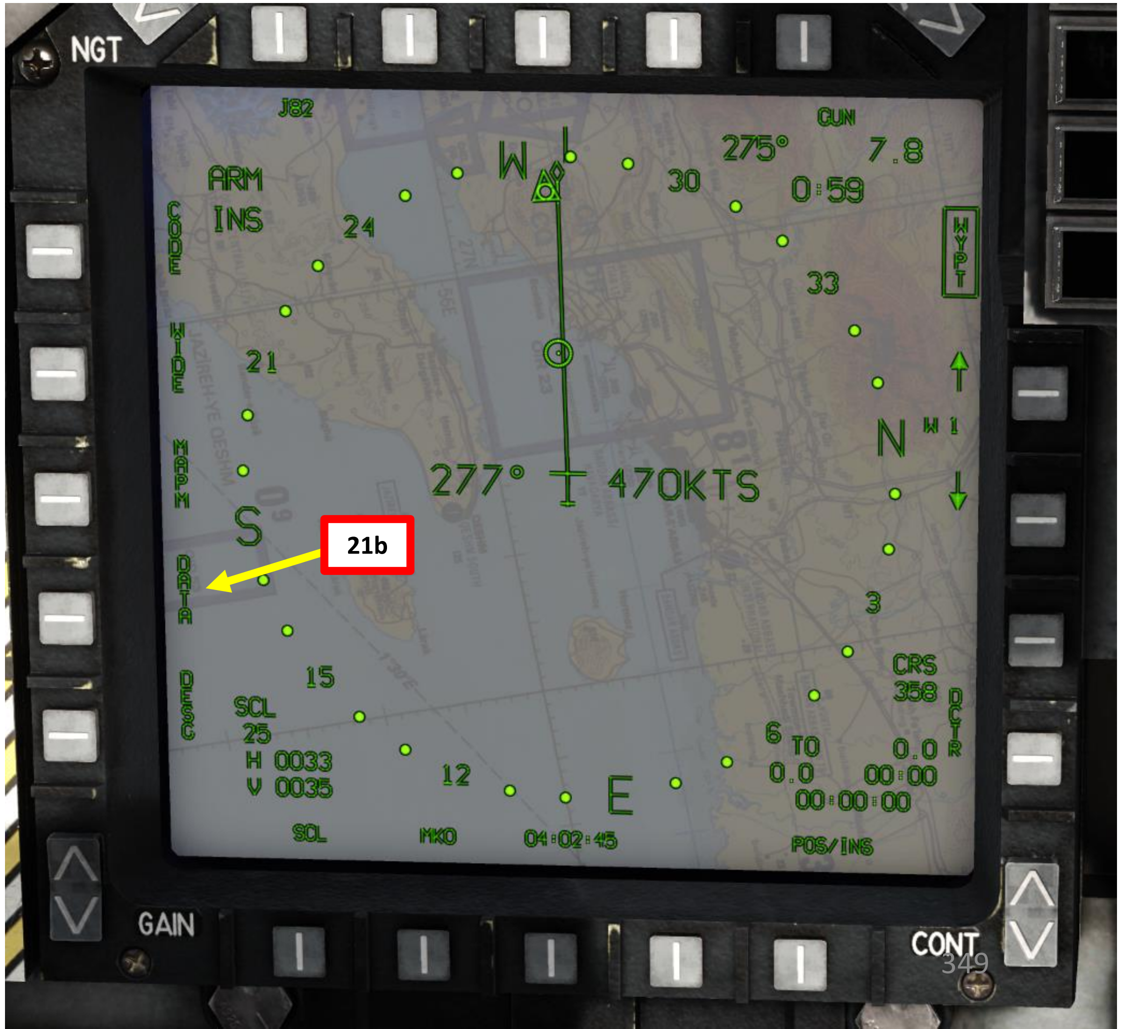
REQ ID	Targetpoint
271062470	T1

2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

C - ASSIGN RECORD TO TARGETPOINT

21. When the target points are created, the EHSD will automatically go to the EHSD DATA sub-page. Press on the OSB next to DATA to unbox (de-select) the menu.

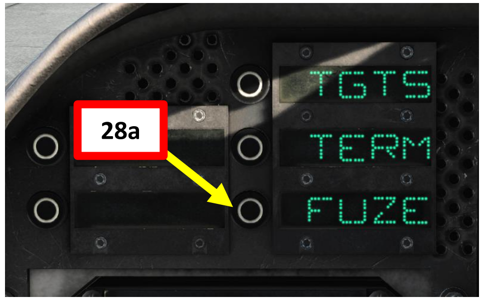


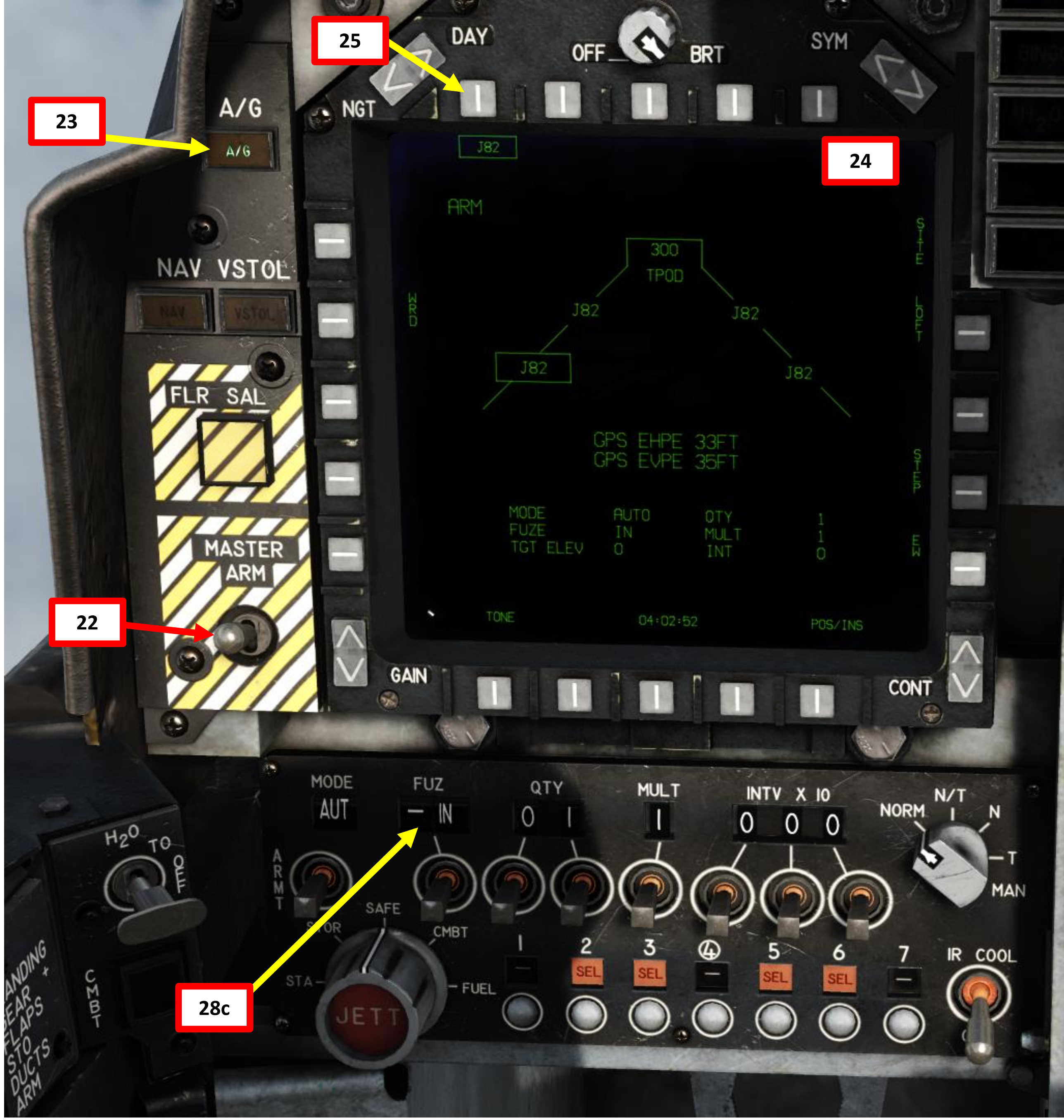


2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

D - SET WEAPON RELEASE PARAMETERS

22. Set Master Arm Switch - ON (UP)
23. Set Master Mode to A/G (Air-to-Ground)
24. Go in MPCD main MENU and select STRS (Stores) Page
25. Select desired J82 (GBU-38) JDAMs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
26. When aircraft generator is powered (engine running), the JDAM will automatically begin an alignment process that may take a few minutes. This process is mostly automatic.
27. Once weapon is selected, press the « WPN » button on the UFC to display available JDAM parameter ODUs (Option Display Units).
28. Press on FUZE ODU to select the JDAM fuzing. In our case, we will choose INST (Instantaneous). « : » will indicate when selected.
29. Press on FUZE ODU again to return to JDAM parameters.

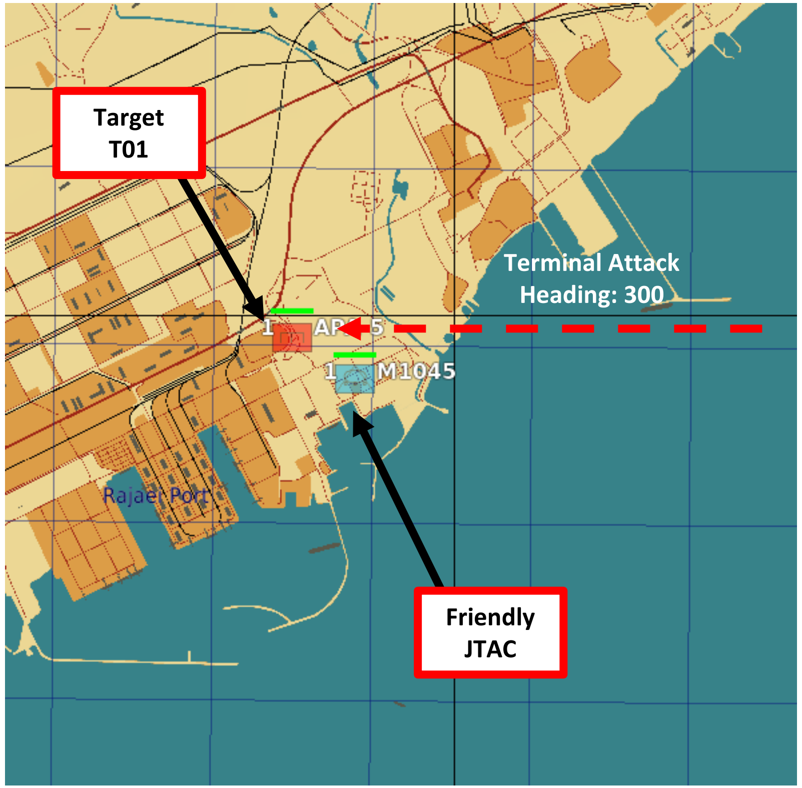


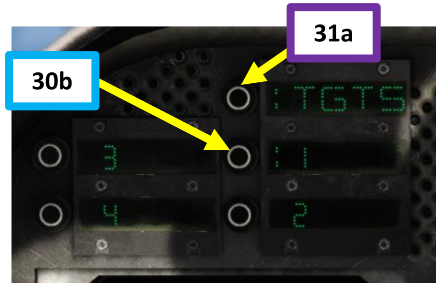


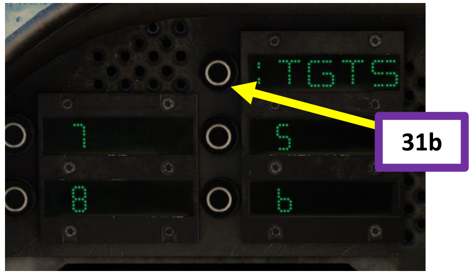
2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

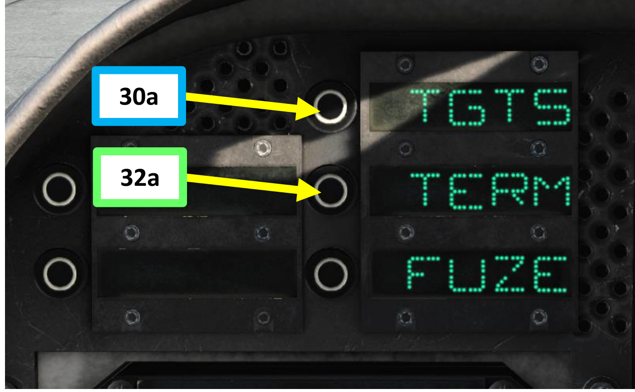
D - SET WEAPON RELEASE PARAMETERS

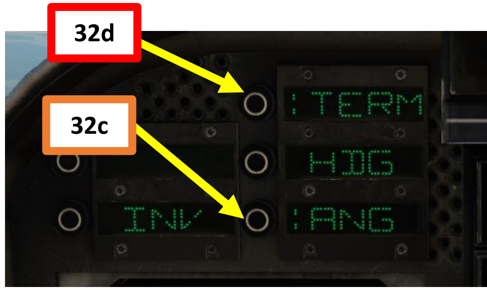
30. Press on TGTS ODU to select which targetpoint we will use for this attack. In our case, we will use Targetpoint 1 only, which is assigned to the JTAC request/record received earlier. « : » will indicate when a targetpoint is selected.
31. Press on TGTS ODU again (then press EXIT) to return to return to JDAM parameters.
32. OPTIONAL: If desired, select what Terminal Attack Parameters you want to set like attack heading and impact angle.
    a) Press on TERM ODU
    b) Press on HDG ODU, enter JDAM approach heading to target (i.e. 270), then press "ENT" button on the UFC.
    c) Press on ANG ODU, enter JDAM impact angle (i.e. 045), then press "ENT" button on the UFC.
    d) Press on TERM ODU again to return to JDAM parameters.







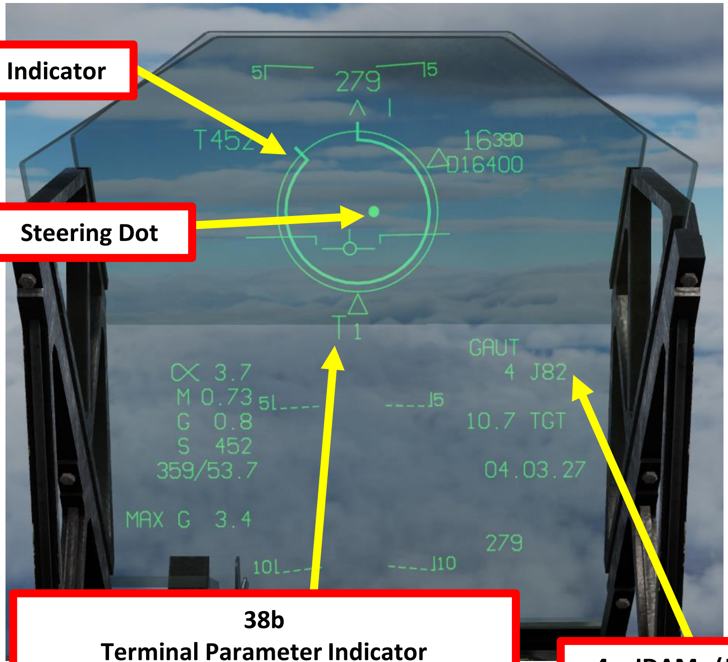


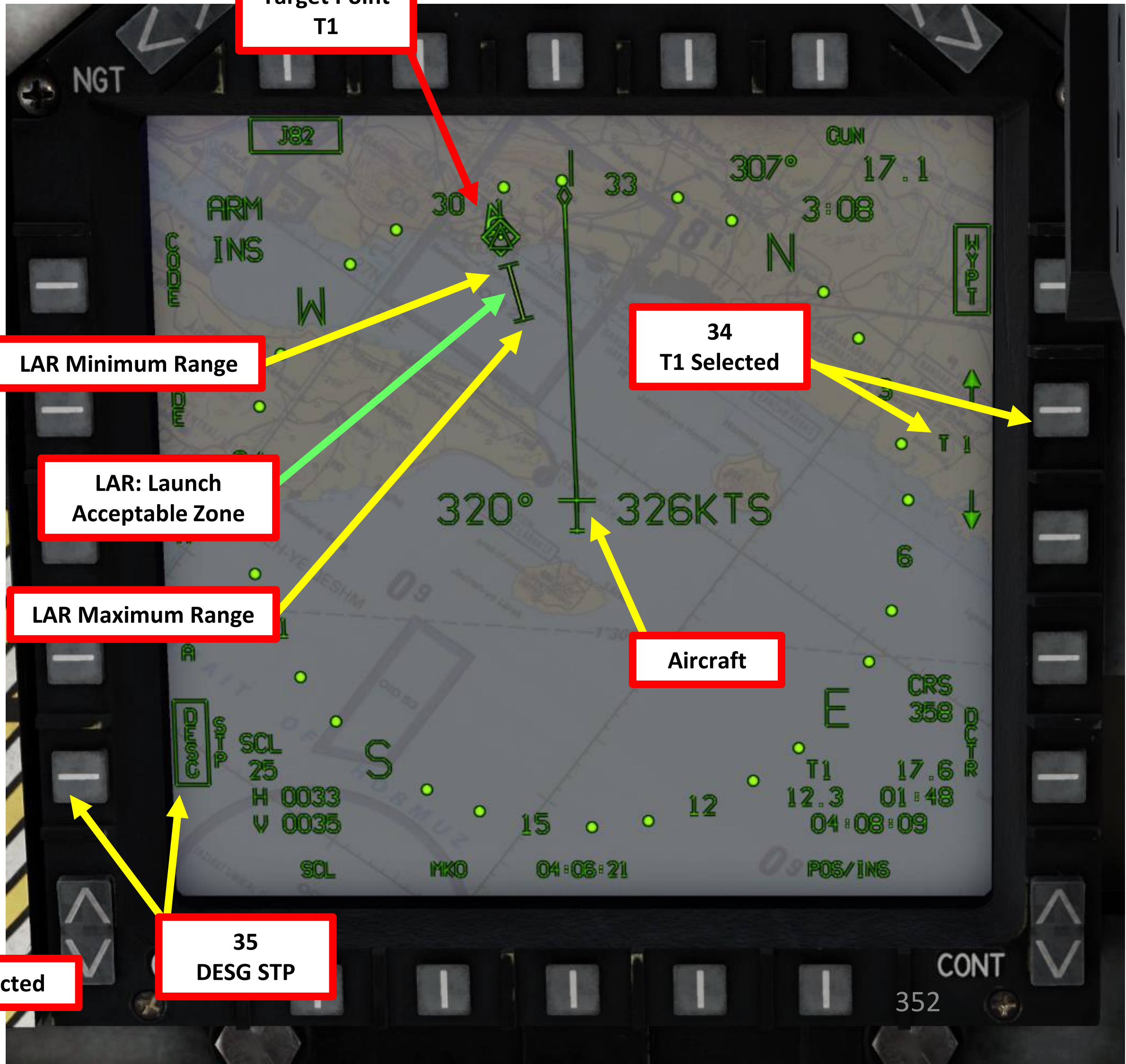


2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

D - SET WEAPON RELEASE PARAMETERS

33. Go in MPCD main MENU and select EHSD (Electronic Horizontal Situation Indicator) Page
34. Select Target Point T1.
35. Press DESG (Designate) OSB. This will select the Target Point as the DESG STP (Designation Steerpoint). DESG should be boxed when selected.
    - Note: This step could also be done by designating the target with the targeting pod and selecting T0.
36. Upon selection of the JDAM and DESG, only the center dot, Terminal Parameters Indicator and the bomb count and stores code are visible.
37. The JDAM range circle, LAR (Launch Acceptable Range) minimum value and the target list become visible.
38. If you want to enable the TERM (Terminal) Parameters on the JDAM, you must press the "Cage/Uncage" HOTAS Button.
39. We can now perform the JDAM strike.

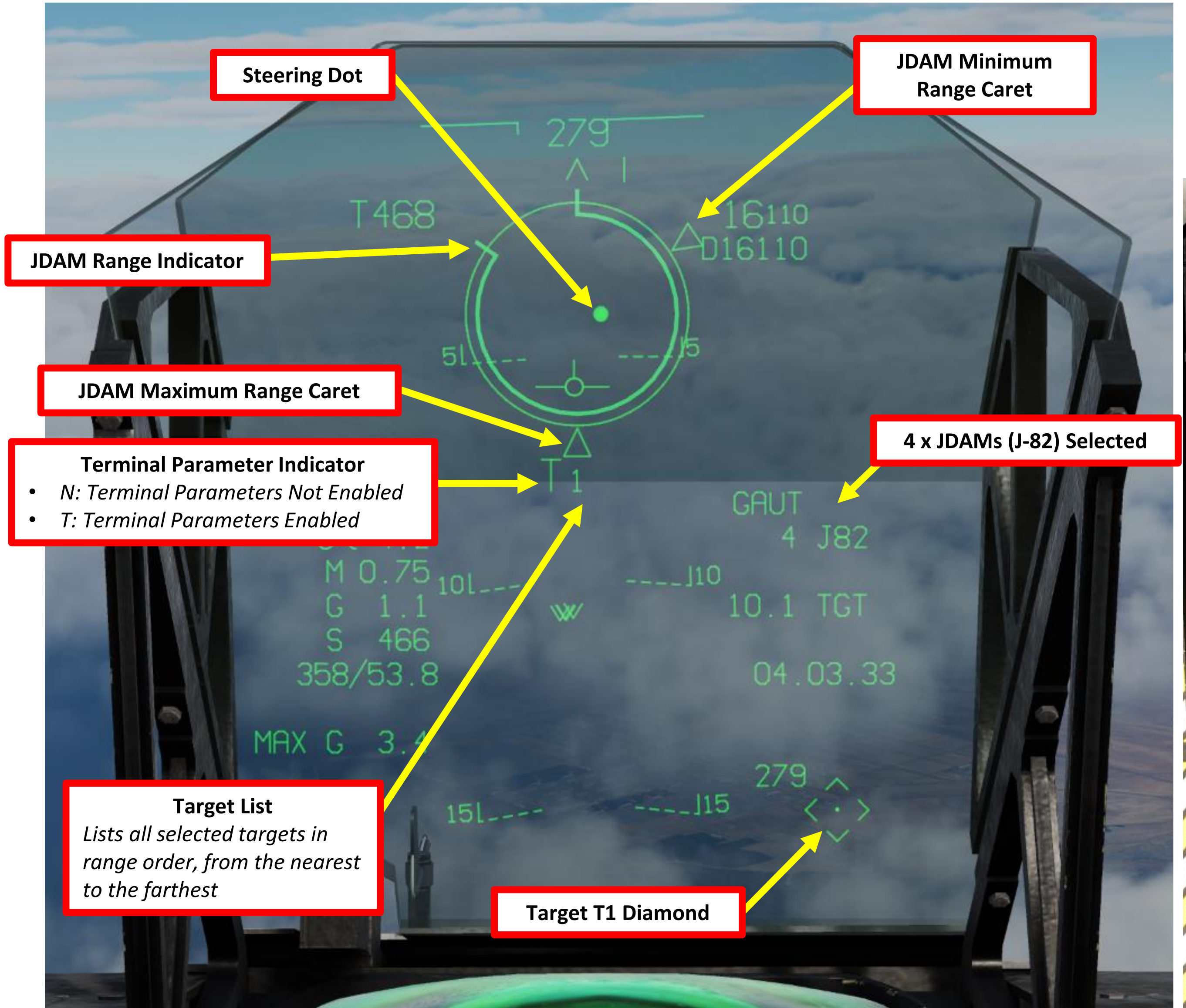


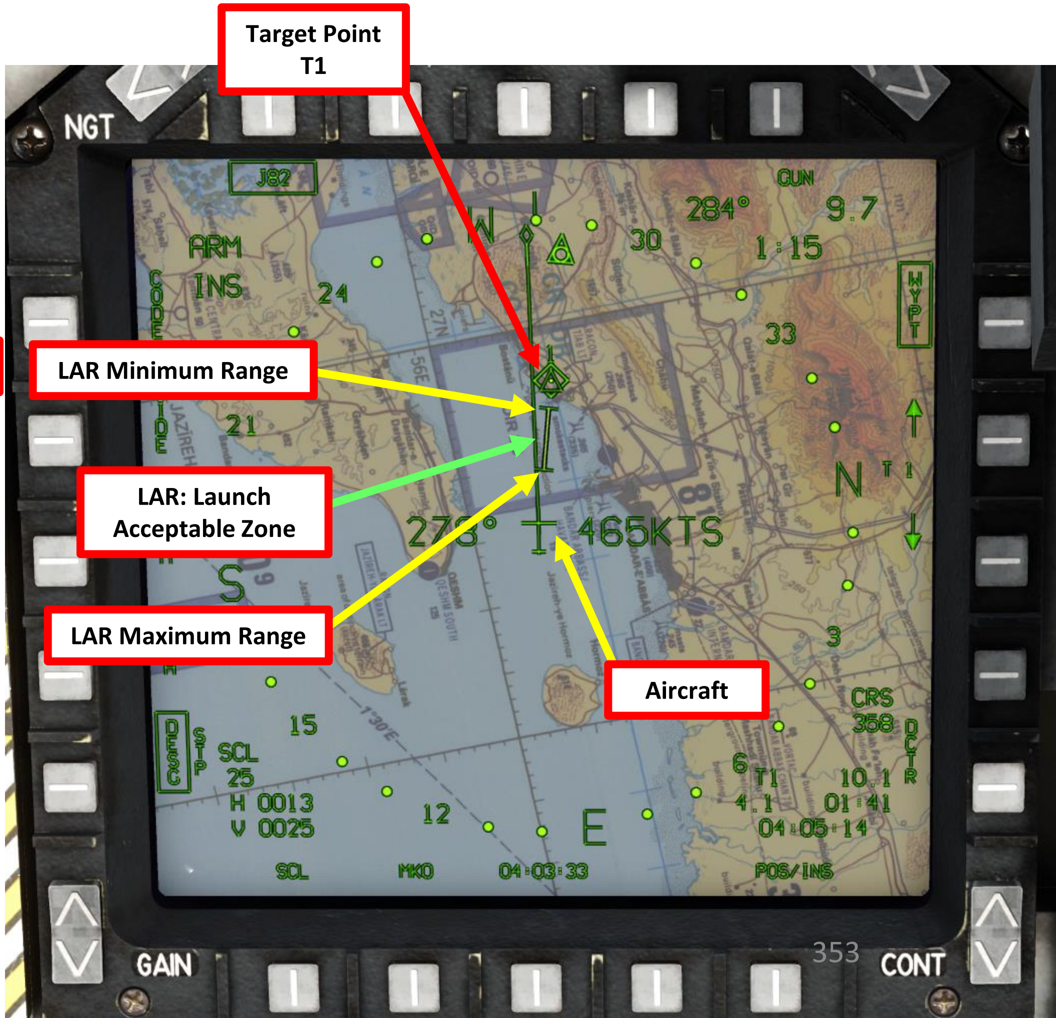


2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

E - ATTACK

40. Fly the aircraft level and line up the steering dot at the center of the JDAM Range Circle on the HUD.



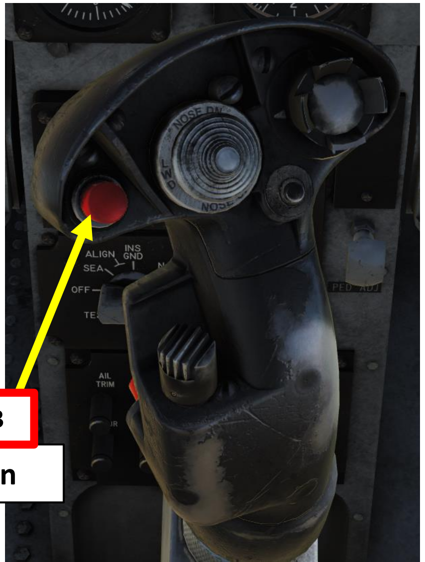


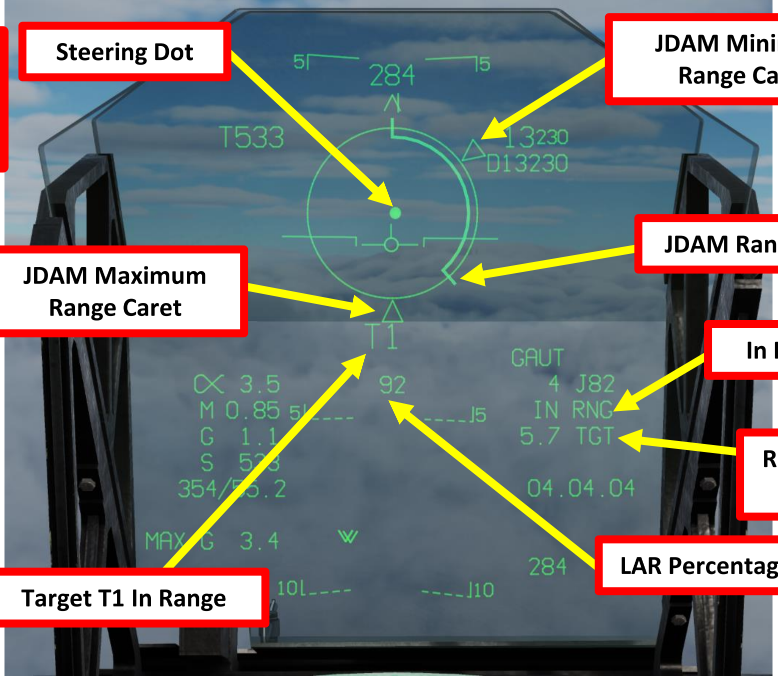
2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

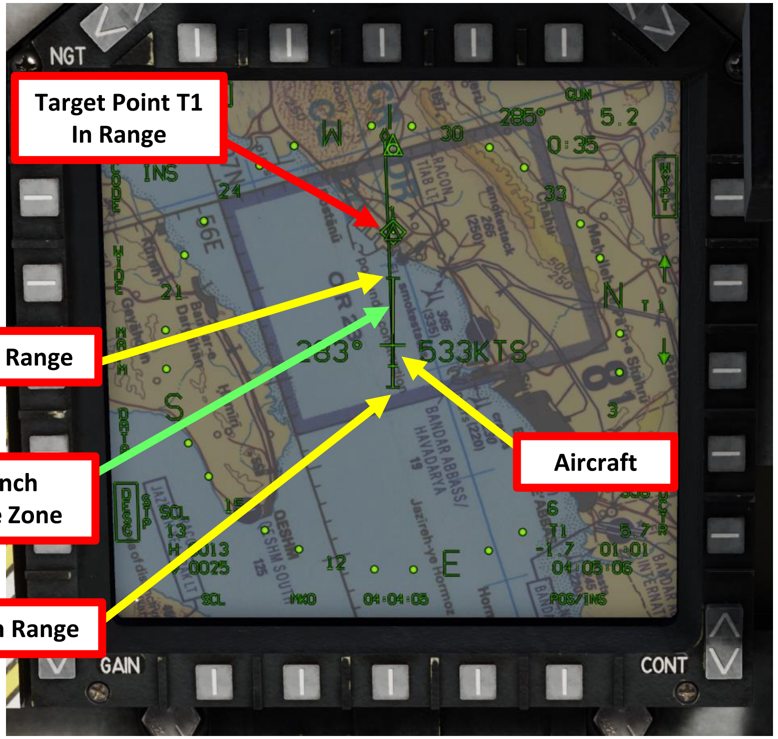
E - ATTACK

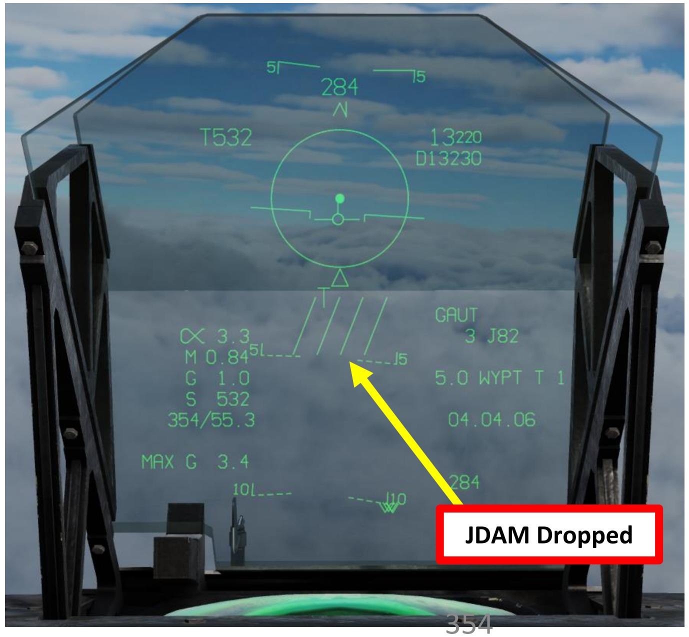
41. The aircraft will be in release range as soon as it enters the LAR zone. The HUD will indicate this condition when:
    a) The target number font becomes larger.
    b) The Range to Target appears inside the Range Circle and its edge starts moving towards the Minimum LAR Marker.
    c) The LAR Percentage number (% to the center of the LAR the aircraft is at) appears in the bottom of the HUD and starts counting towards 100.
42. The bombs can be released as soon as the aircraft is inside the LAR zone. For better results it is advisable to wait until the aircraft is in the center of the LAR zone before release. Check the LAR Percentage indicator on the HUD and release as soon as the indicated value is near 100.
43. Press and hold the Bomb Pickle button (RALT+SPACE) for approx. 1.5 seconds to launch the JDAM.

- Note : There is no automatic bomb release. The pilot must judge when it is time to release the bomb.







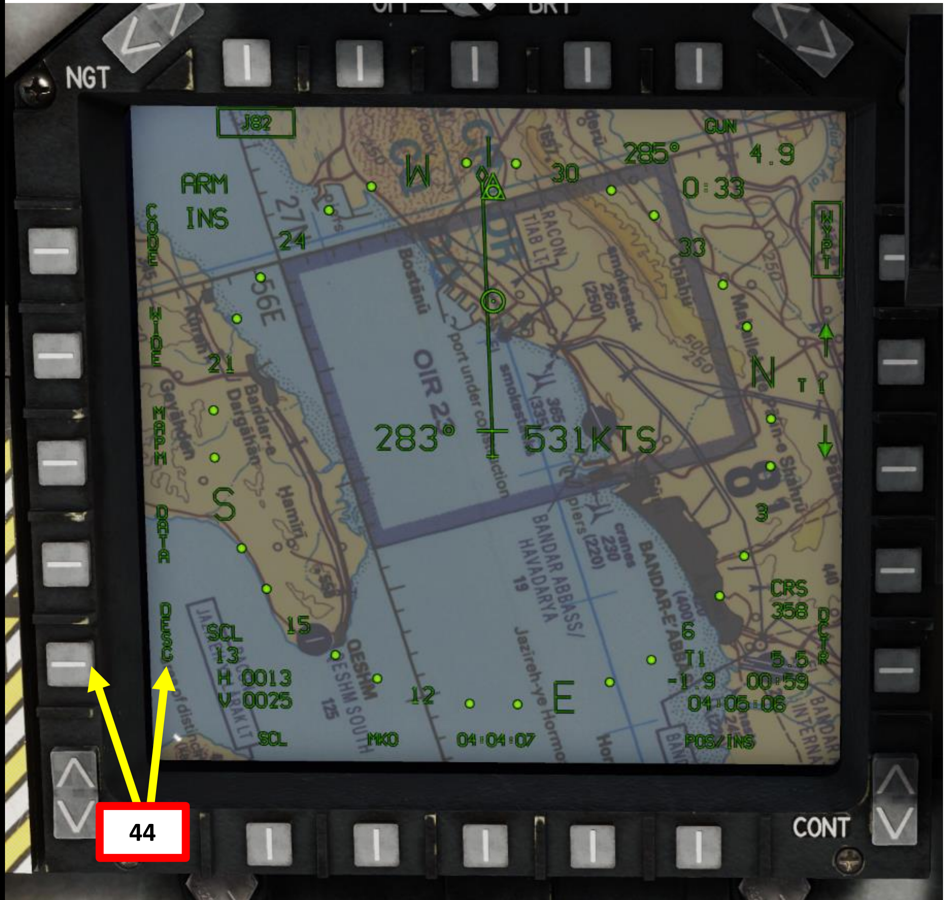


2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

E - ATTACK

44. After successful attack, press the DESG OSB again to un-designate. DESG should become un-boxed when de-selected.

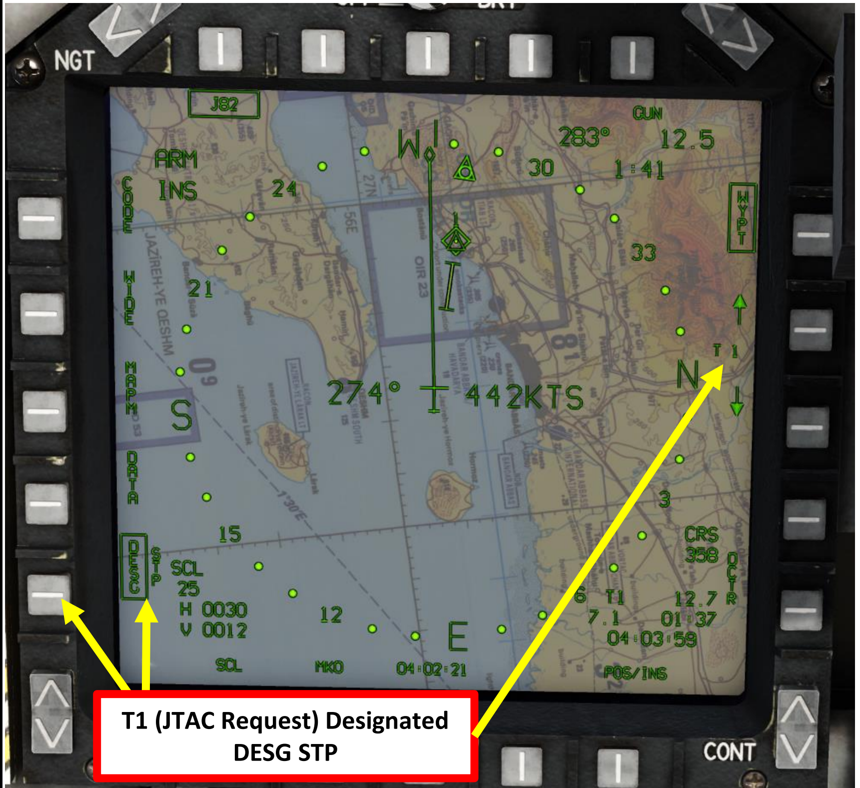


2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

NOTES

This tutorial is useful for conditions where visibility does not allow the use of a targeting pod. This can be tricky since JTAC coordinates may not necessarily be right on the target. However, if there are few clouds, you can use the targeting pod and slave it to the JTAC Target Point T1, then slew it to get more precise coordinates with the targeting pod. In short:

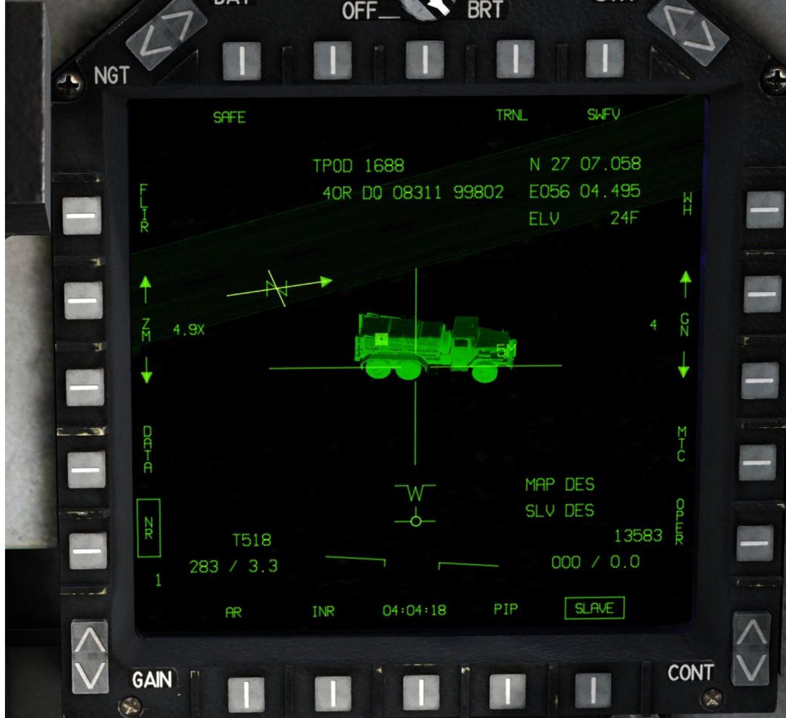
a) Have a Target Point T1 already selected and designated (DESG STP)
b) Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
c) With T1 already being designated on the EHSD, the targeting pod will be slaved to the T1 coordinates (mode MAP DES / SLV DES).
d) Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle for adjustments.
e) Press TDC Depress (Action) control to designate the target, Target/System Designation Status and Targeting Operational Mode both switch from MAP DES (slaved to T1) to TPOD DES (Targeting Pod Designate).

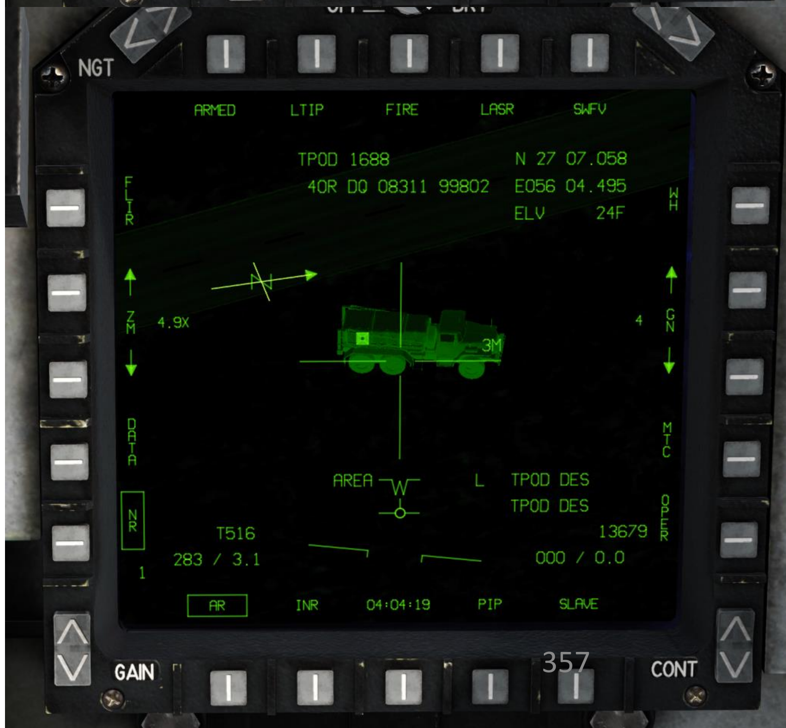


T1 (JTAC Request) Designated DESG STP

Sensor Select Switch (SSS)

TDC (Target Designation Control)

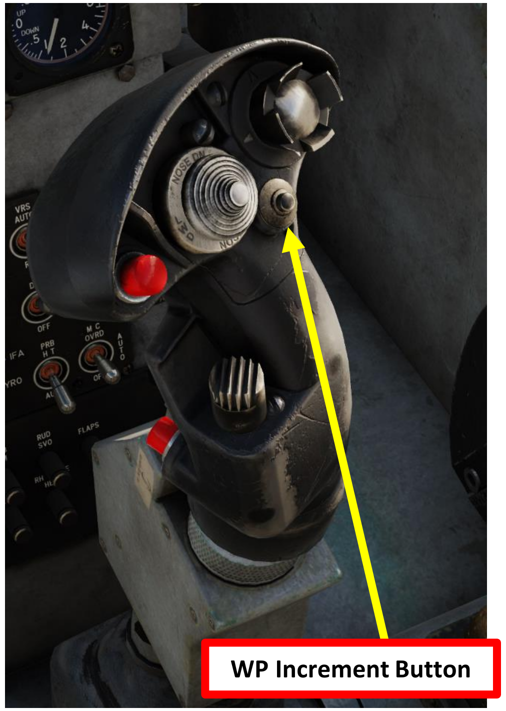


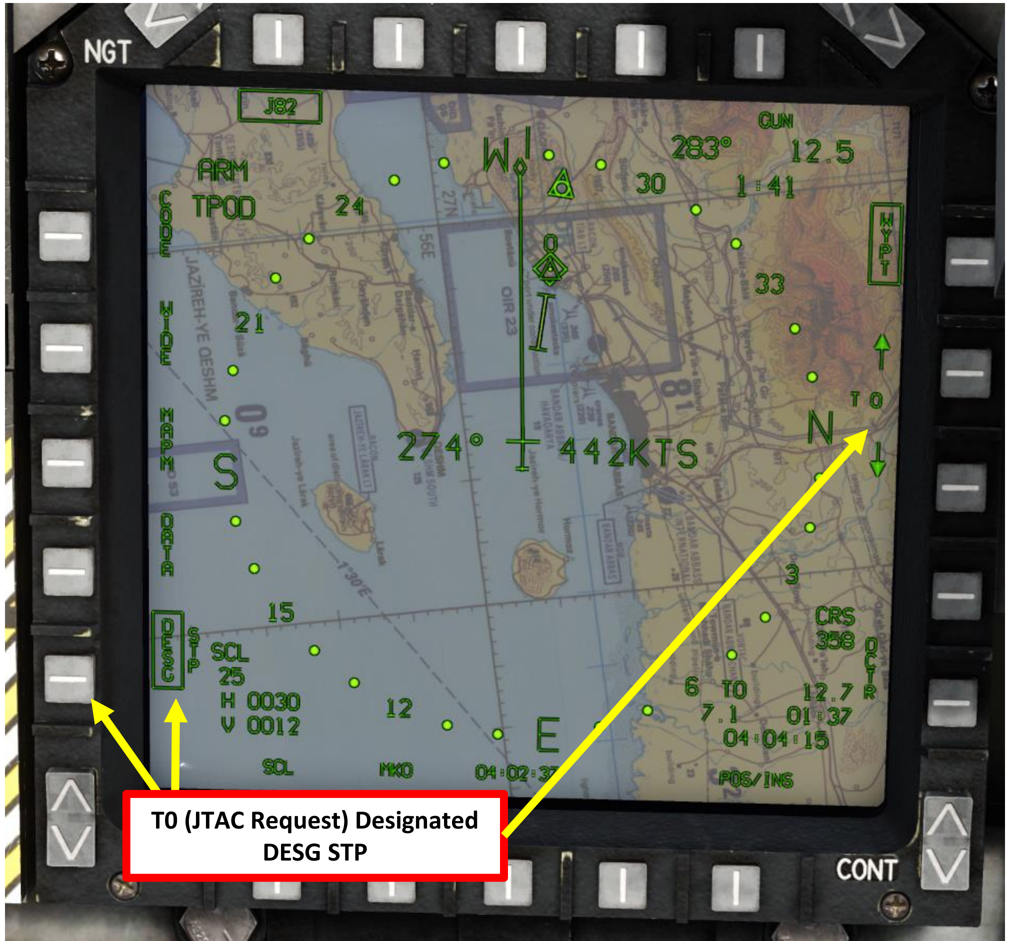


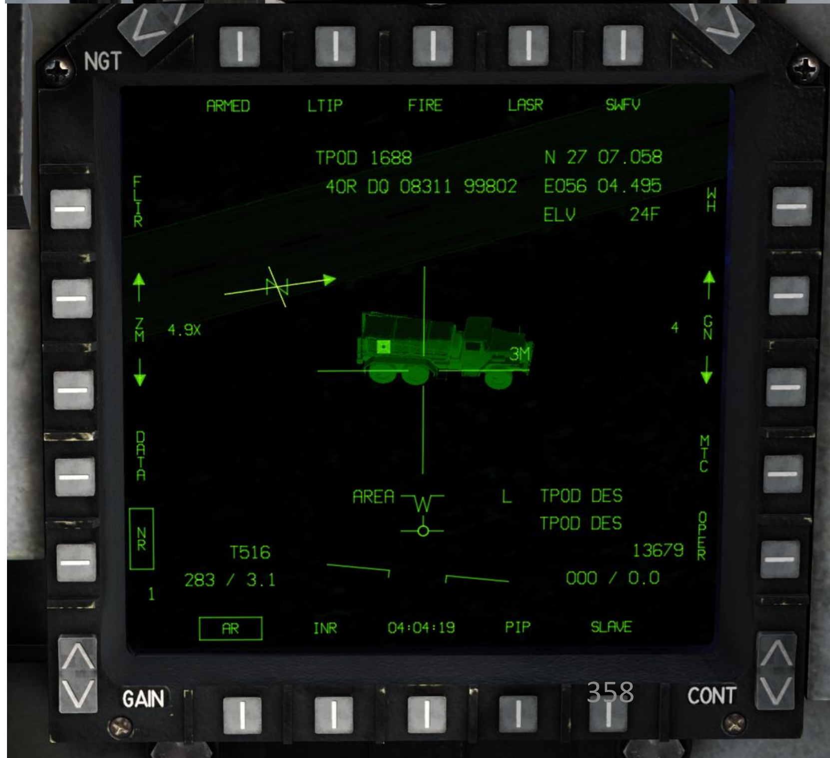
2.9 - GBU-38 JDAM
2.9.3 - PRE-PLANNED (ATHS) - WITH JTAC

NOTES

f) Press the WP Increment button LONG to select Target Point T0. This will allow you to release JDAMs in TOO mode as per the TOO JDAM procedure.



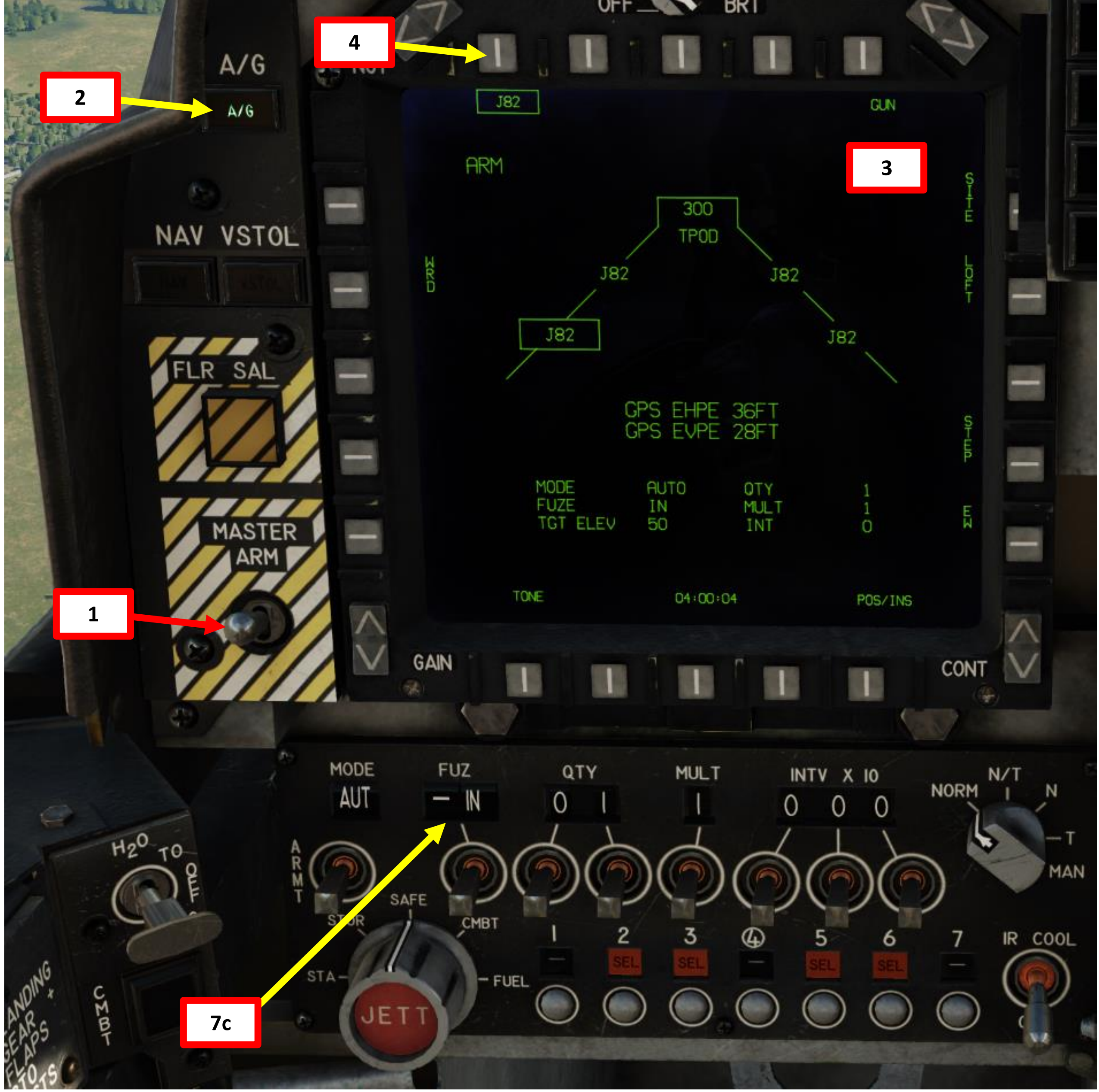


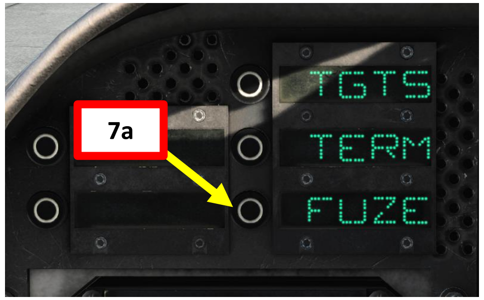


2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

A - SET WEAPON RELEASE PARAMETERS

1. Set Master Arm Switch - ON (UP)
2. Set Master Mode to A/G (Air-to-Ground)
3. Go in MPCD main MENU and select STRS (Stores) Page
4. Select desired J82 (GBU-38) JDAMs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. When aircraft generator is powered (engine running), the JDAM will automatically begin an alignment process that may take a few minutes. This process is mostly automatic.
6. Once weapon is selected, press the « WPN » button on the UFC to display available JDAM parameter ODUs (Option Display Units).
7. Press on FUZE ODU to select the JDAM fuzing. In our case, we will choose INST (Instantaneous). « : » will indicate when selected.
8. Press on FUZE ODU again to return to JDAM parameters.

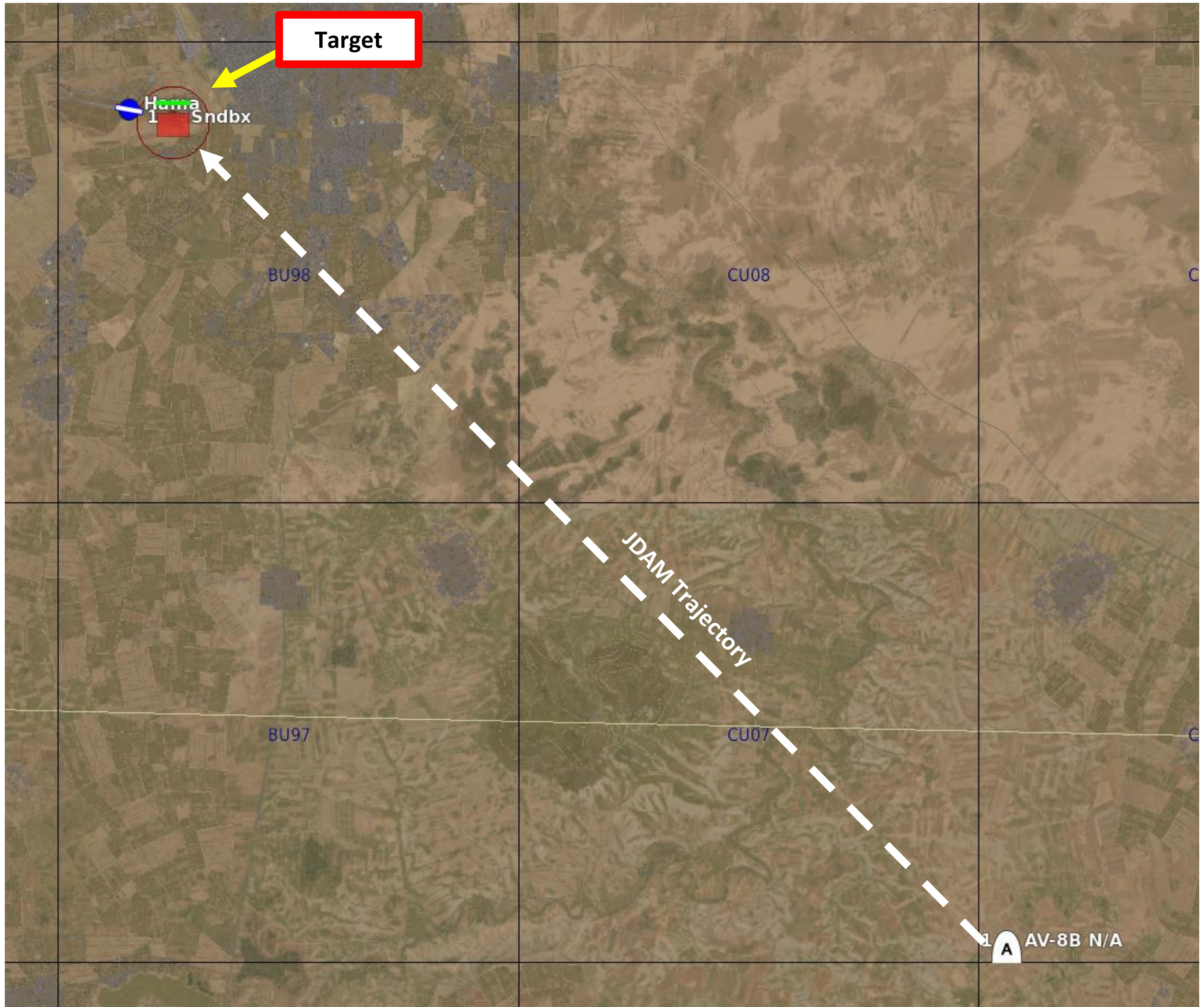




2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

A - SET WEAPON RELEASE PARAMETERS

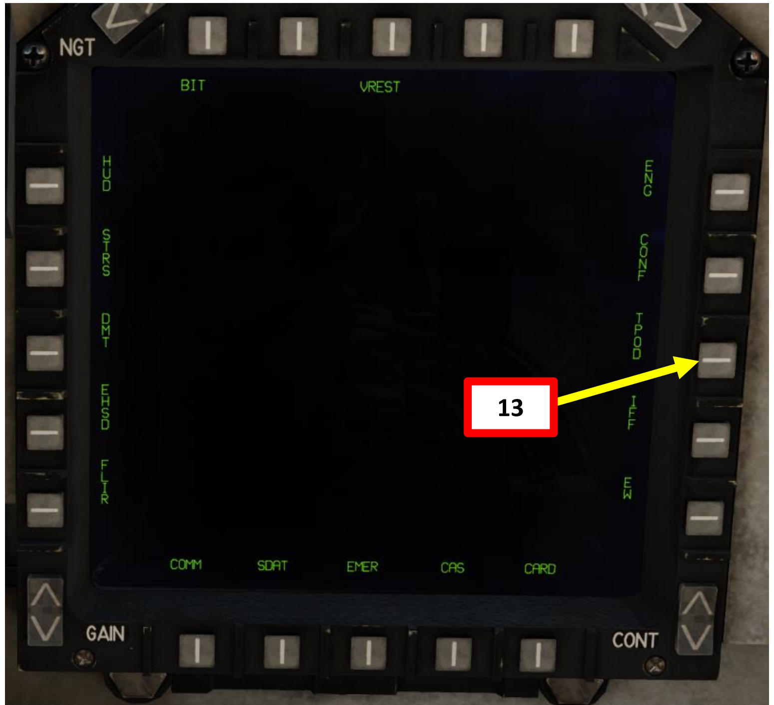
9. OPTIONAL: If desired, select what Terminal Attack Parameters you want to set like attack heading and impact angle.
10. In this tutorial case, we will not use Terminal Attack parameters and go for a straight-in attack.

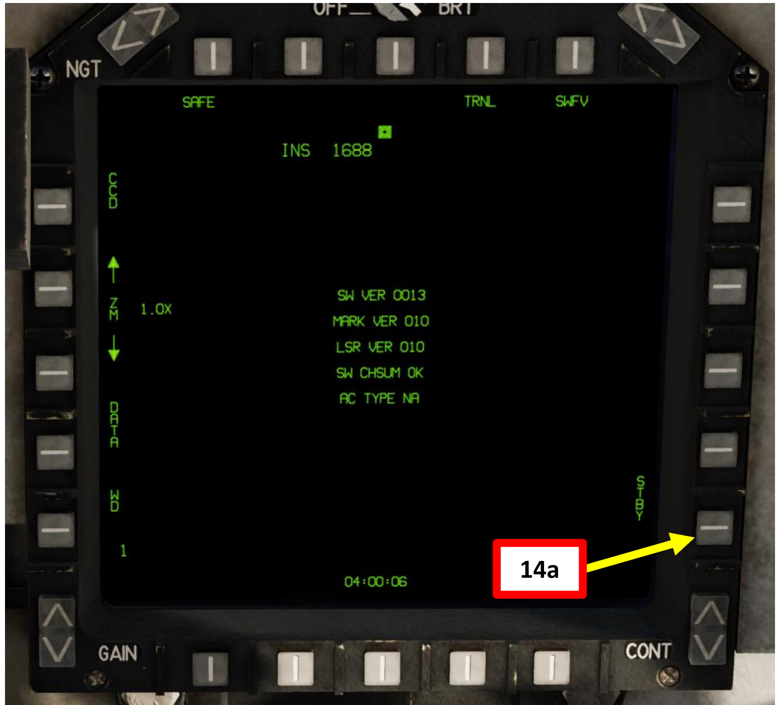


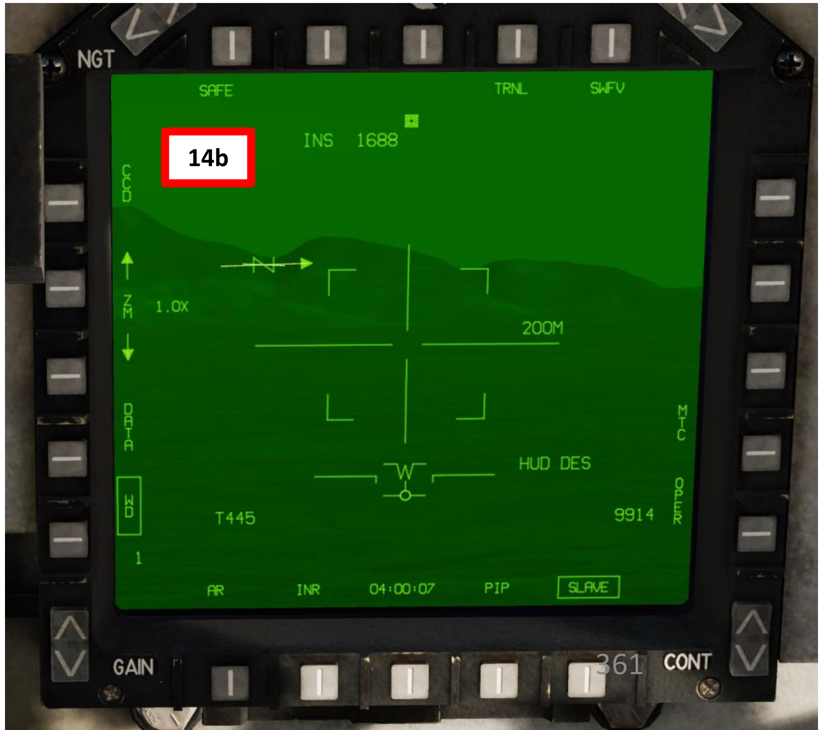
2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

B - DESIGNATE TARGET WITH TARGETING POD

11. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
12. Verify that A/G (Air-to-Ground) Master Mode is selected
13. Press the OSB next to the "TPOD" page in the main MPCD MENU
14. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).



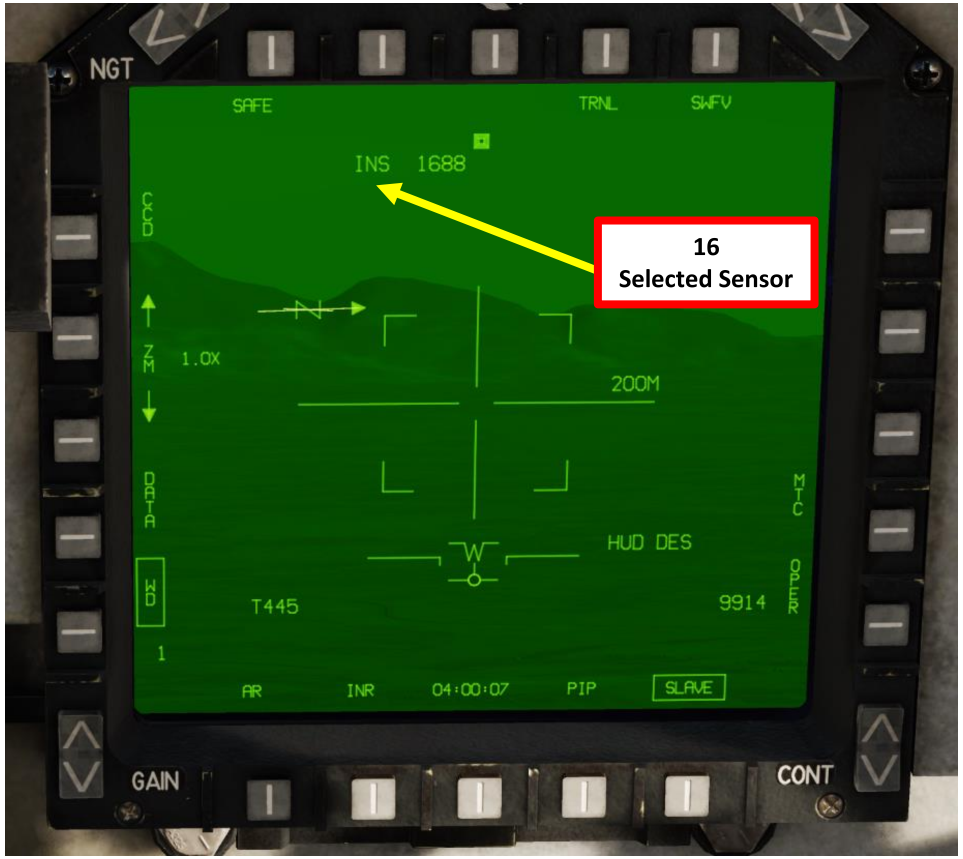


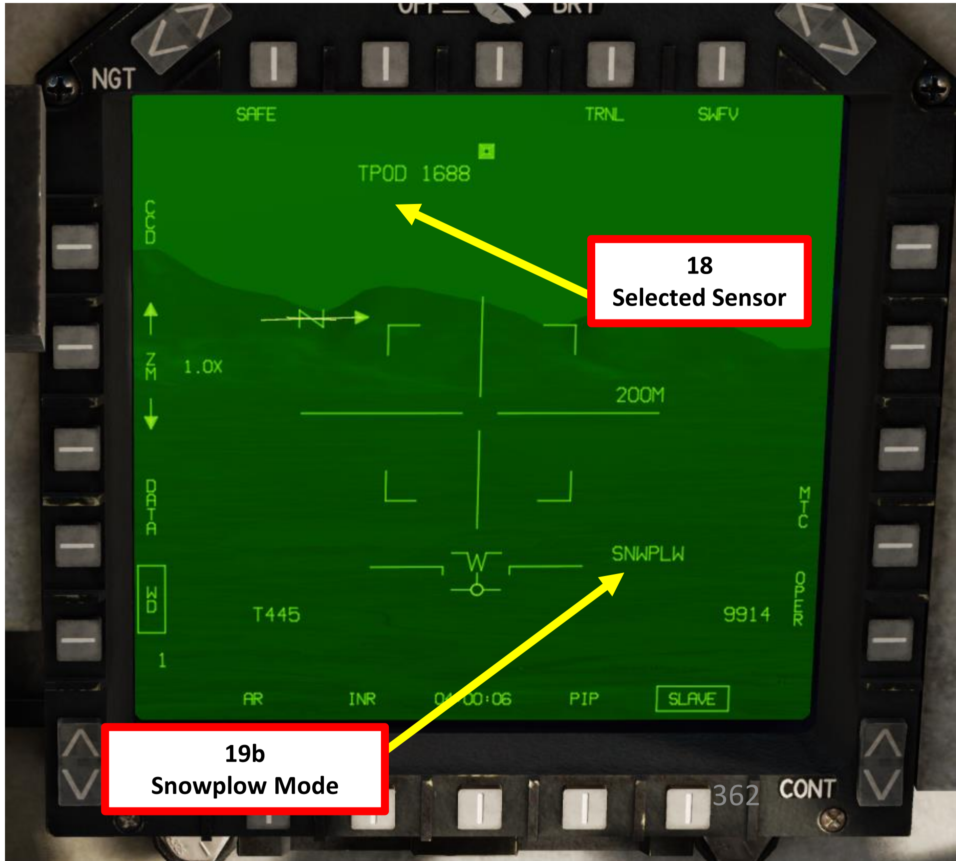


2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

B - DESIGNATE TARGET WITH TARGETING POD

15. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
16. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
17. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
18. Confirm that Sensor of Interest switches to TPOD.
19. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.



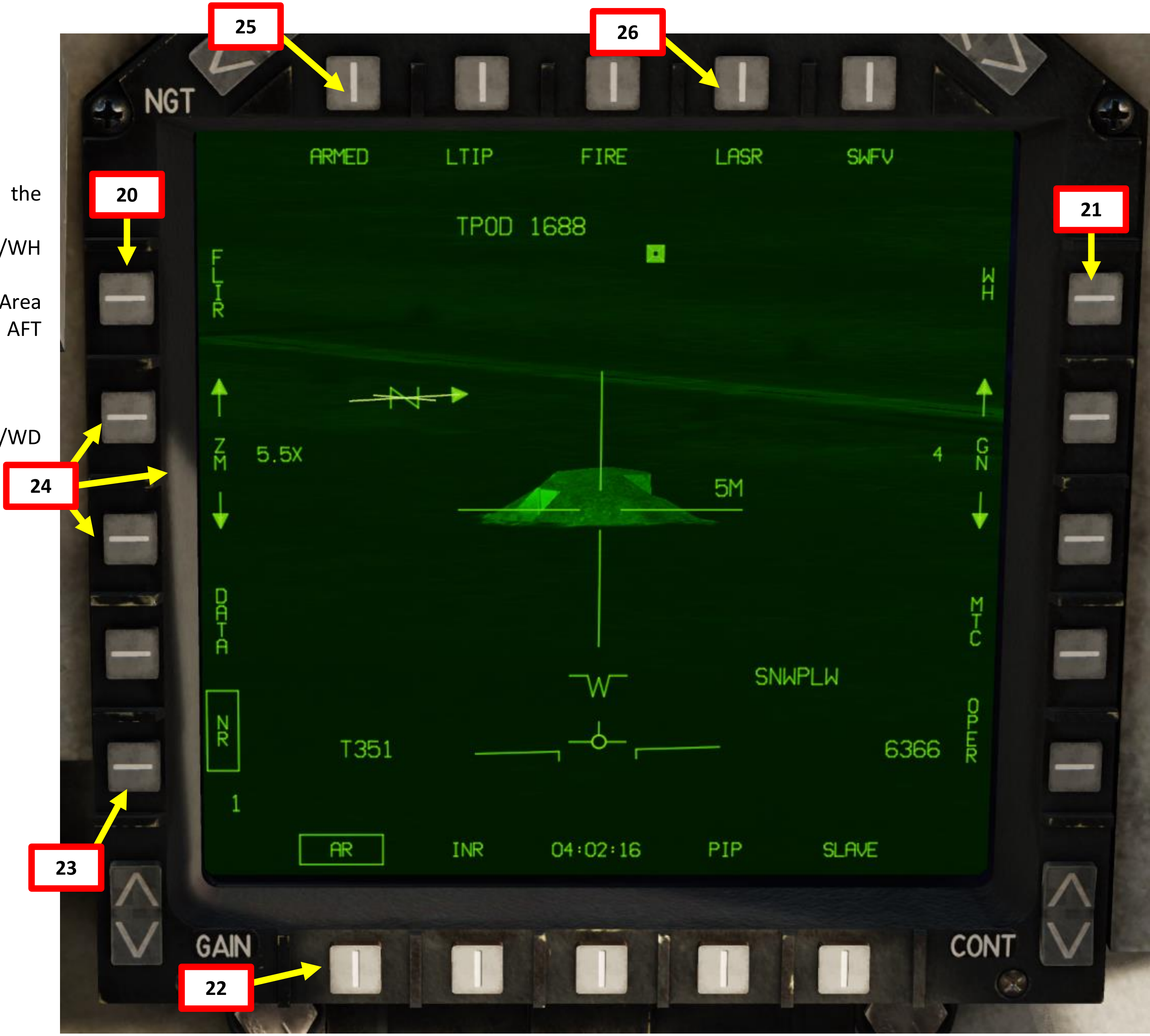


2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

B - DESIGNATE TARGET WITH TARGETING POD

20. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
21. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
22. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
23. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
24. Select desired zoom level by using the ZM +/- OSBs.
25. Press Laser Arming OSB to select ARMED mode.
26. Press Laser Mode OSB to select LASR (Laser Designator) Mode.

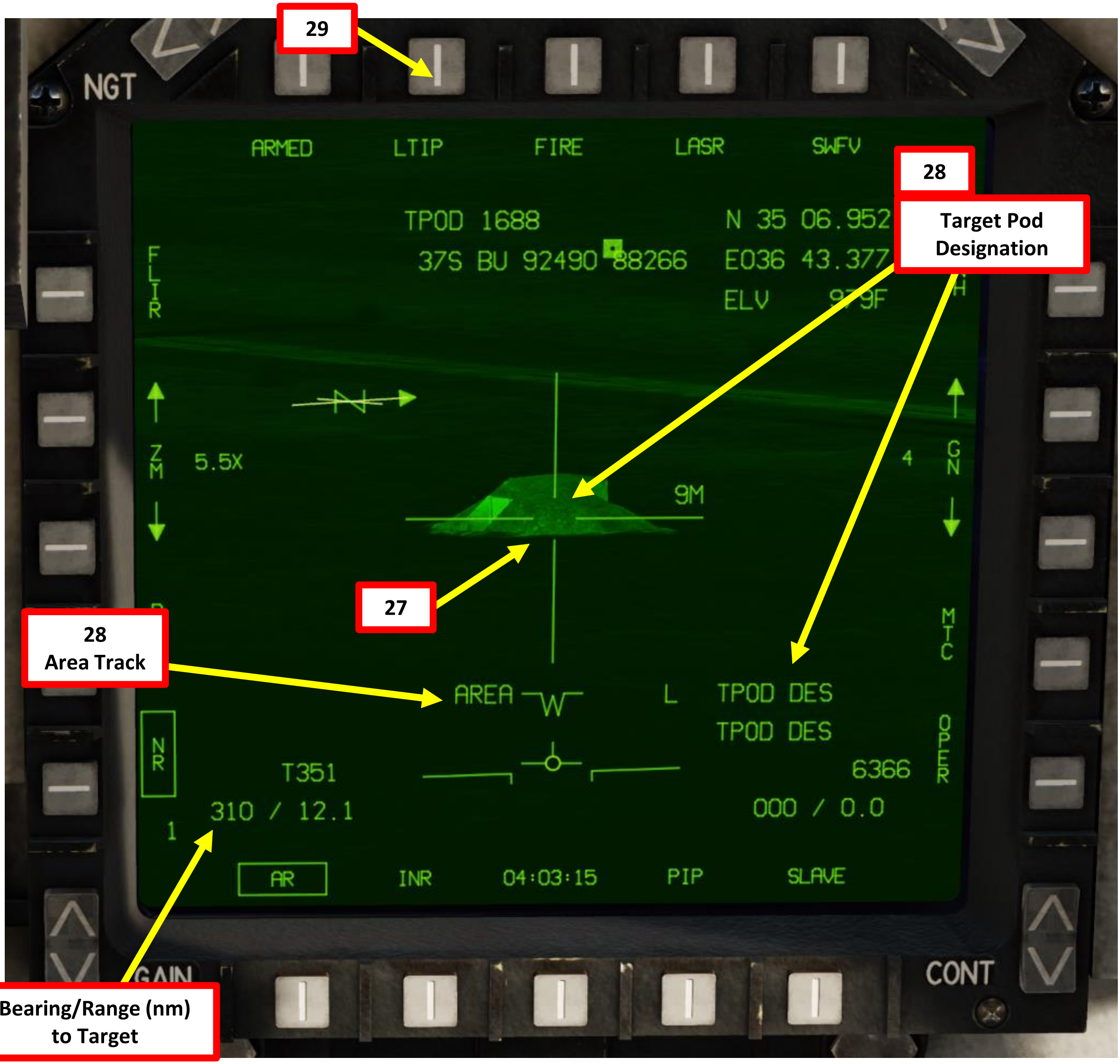
20
21
22
23
Sensor Select Switch (SSS)



2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

B - DESIGNATE TARGET WITH TARGETING POD

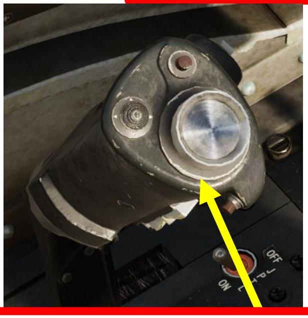
27. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
28. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.
29. If you want to have a laser ranging update, make sure you have a valid laser code and press the OSB next to LTIP (Laser Target Imaging Profile) or press Sensor Select Switch FWD SHORT. This step is optional.

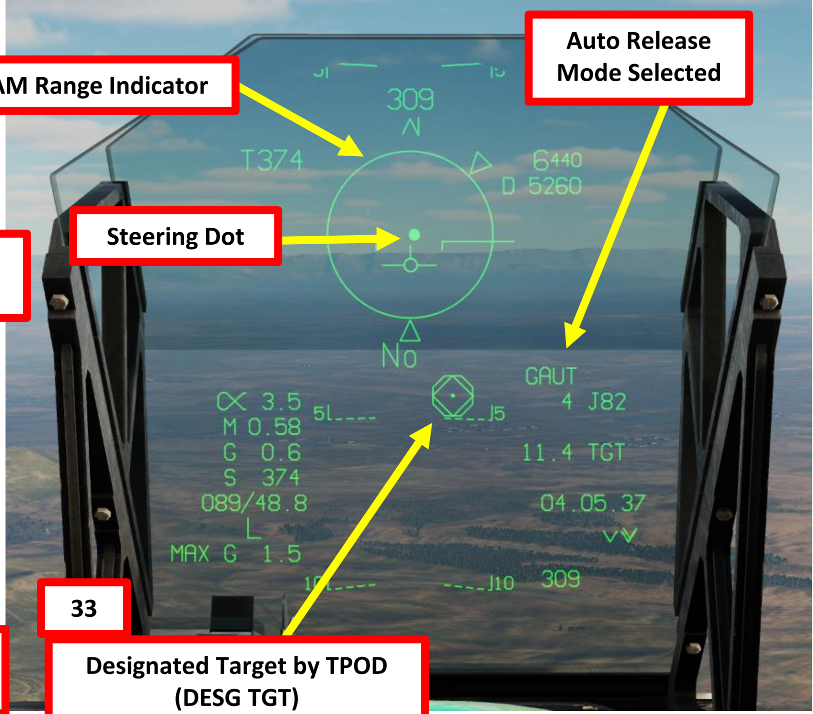


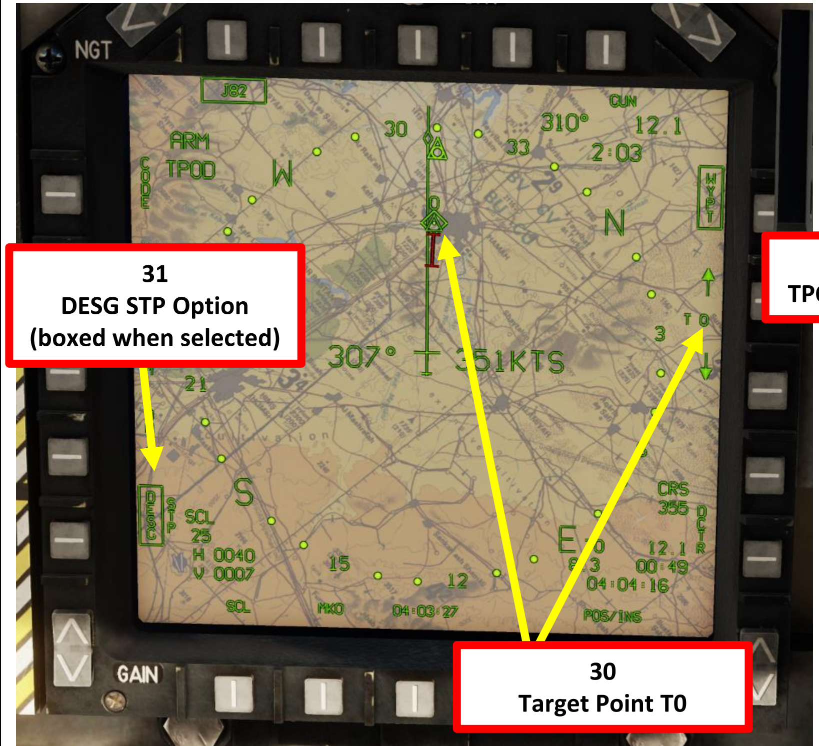
2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

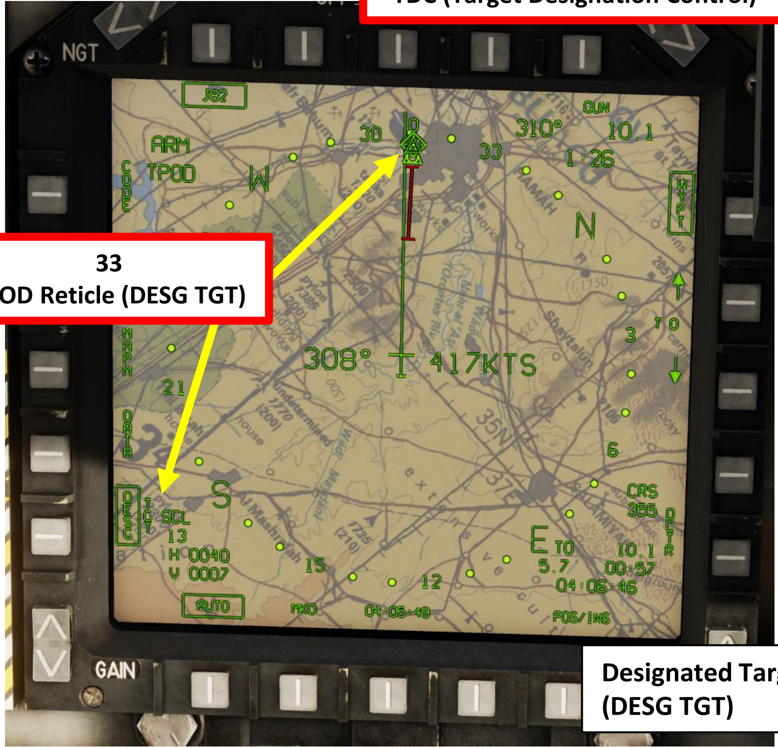
B - DESIGNATE TARGET WITH TARGETING POD

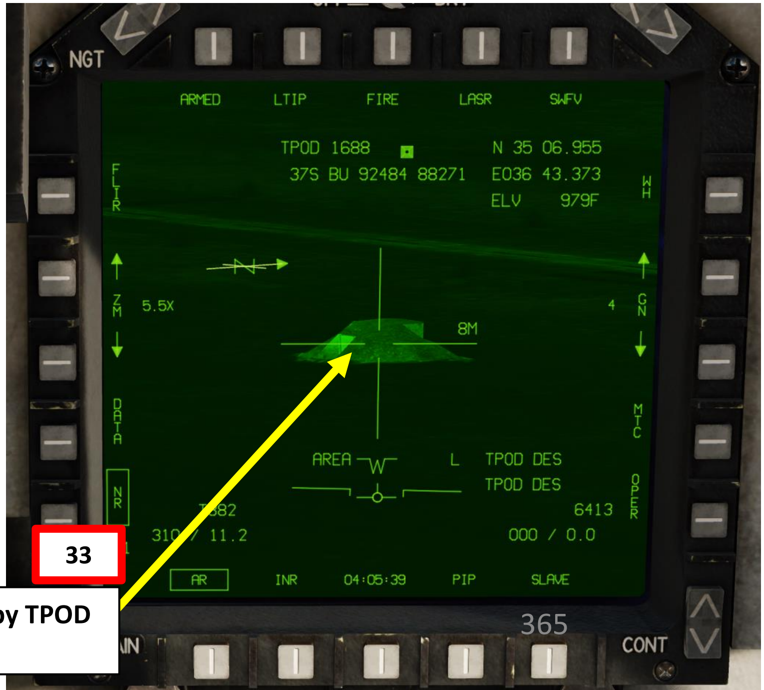
30. In order to release JDAMs in TOO mode, Target Point T0 needs to be selected via the EHSD. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0.
31. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
32. Once target is designated, you can re-slew the TPOD with TDC Left/Right/Fwd/Aft controls for targeting pod reticle adjustments.
33. On the EHSD, the DESG mode will switch from DESG STP (Steerpoint) to DESG TGT (Target).
    - Note: DESG TGT is set on the TPOD reticle, while DESG STP is set on the Target Point T0 initially designated when pressing « TDC DOWN Action Position » button.
    - **The JDAM tracks the DESG TGT in priority**.
    - When in DESG TGT designation mode, pressing « TDC DOWN Action Position » button will reset the Target Point (T0) location to the DESG TGT.







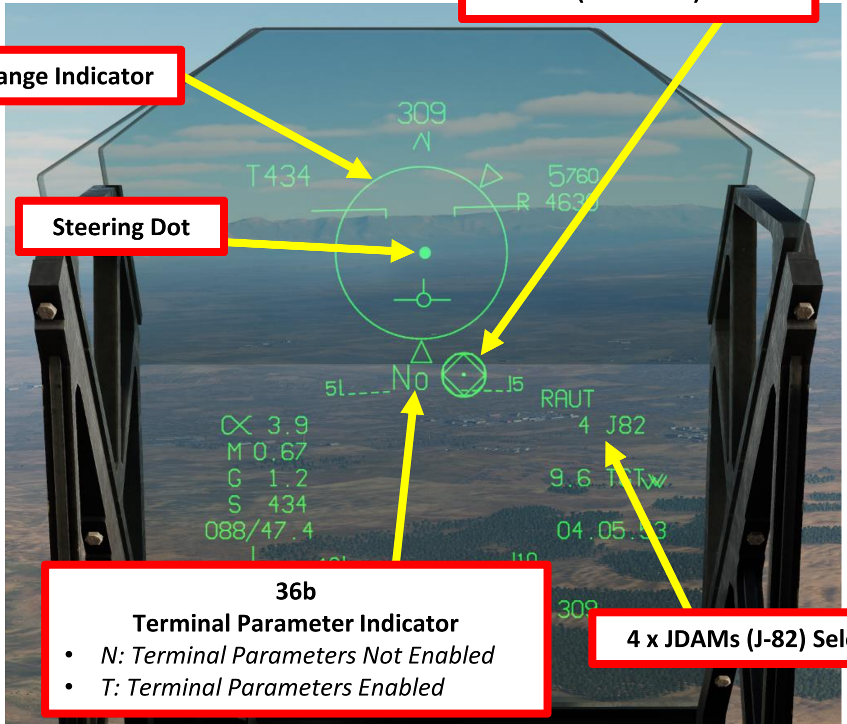


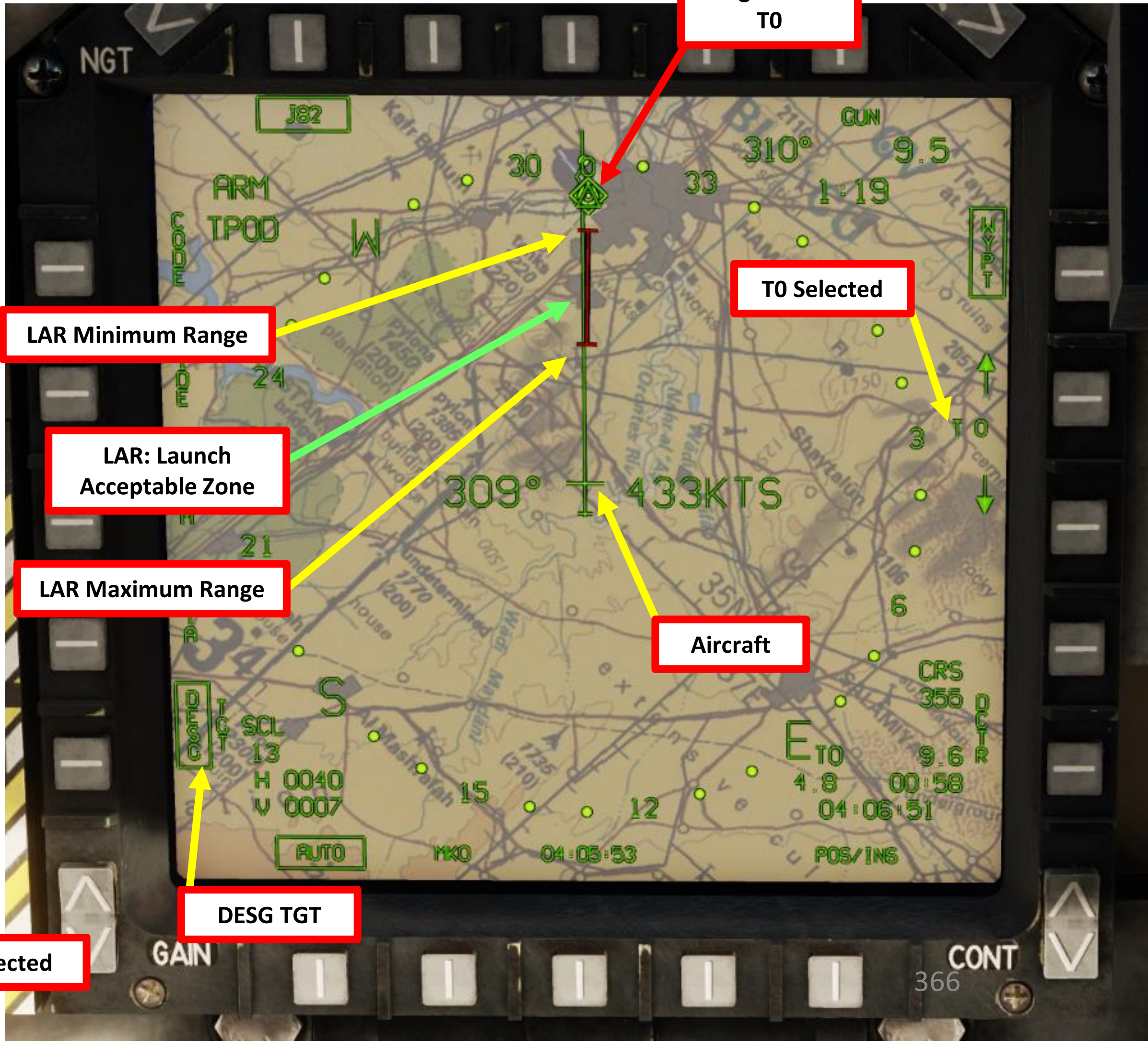


2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

B - DESIGNATE TARGET WITH TARGETING POD

34. Upon selection of the JDAM, T0 (with Waypoint Increment Button LONG) and DESG, only the center dot, Terminal Parameters Indicator and the bomb count and stores code are visible.
35. The JDAM range circle and LAR (Launch Acceptable Range) minimum value become visible.
36. If you want to enable the TERM (Terminal) Parameters on the JDAM, you must press the “Cage/Uncage” HOTAS Button. In our case, we will not use them and leave the Terminal Parameter Indicator to “N” (Not Enabled).
37. We can now perform the JDAM strike.

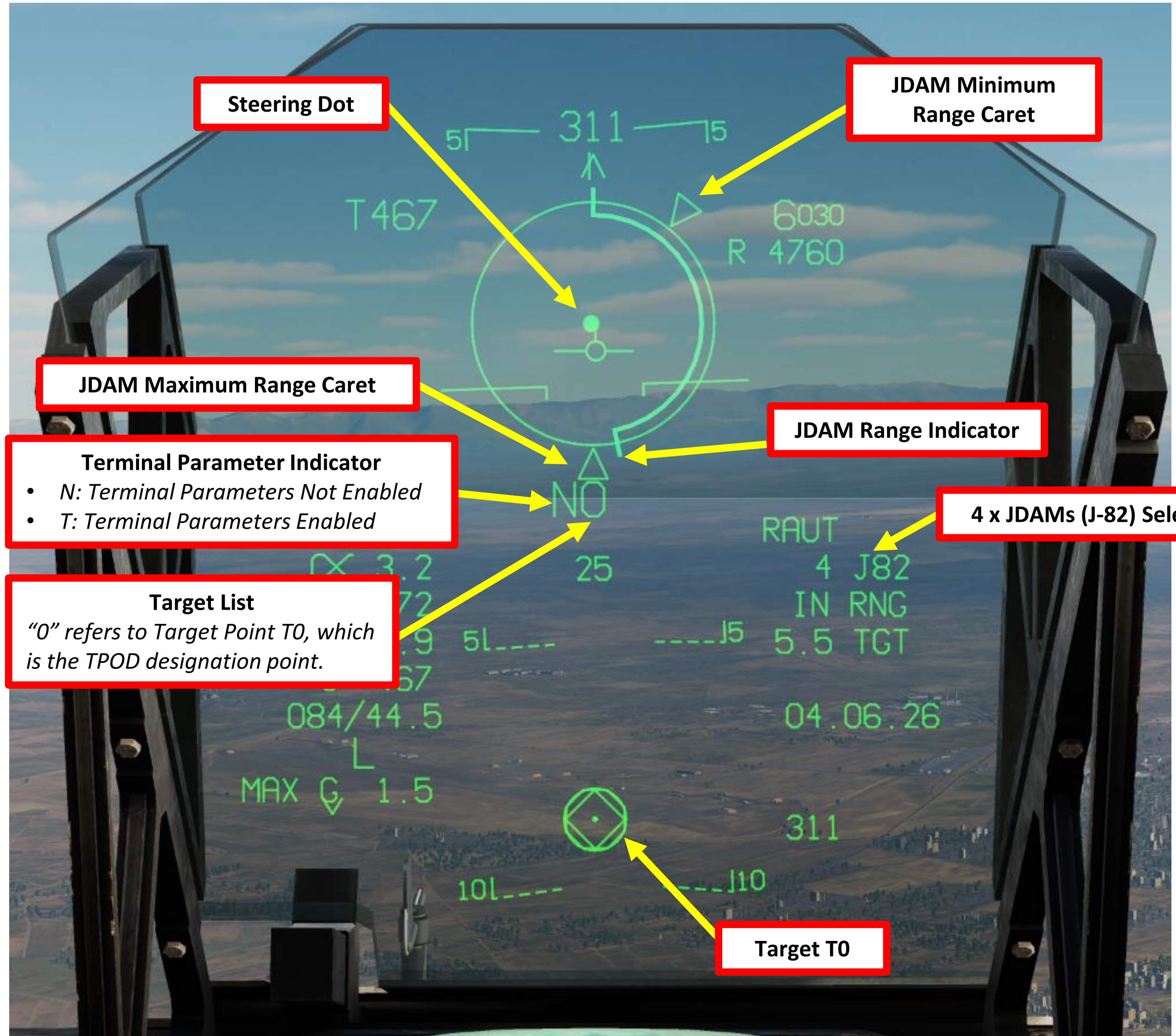


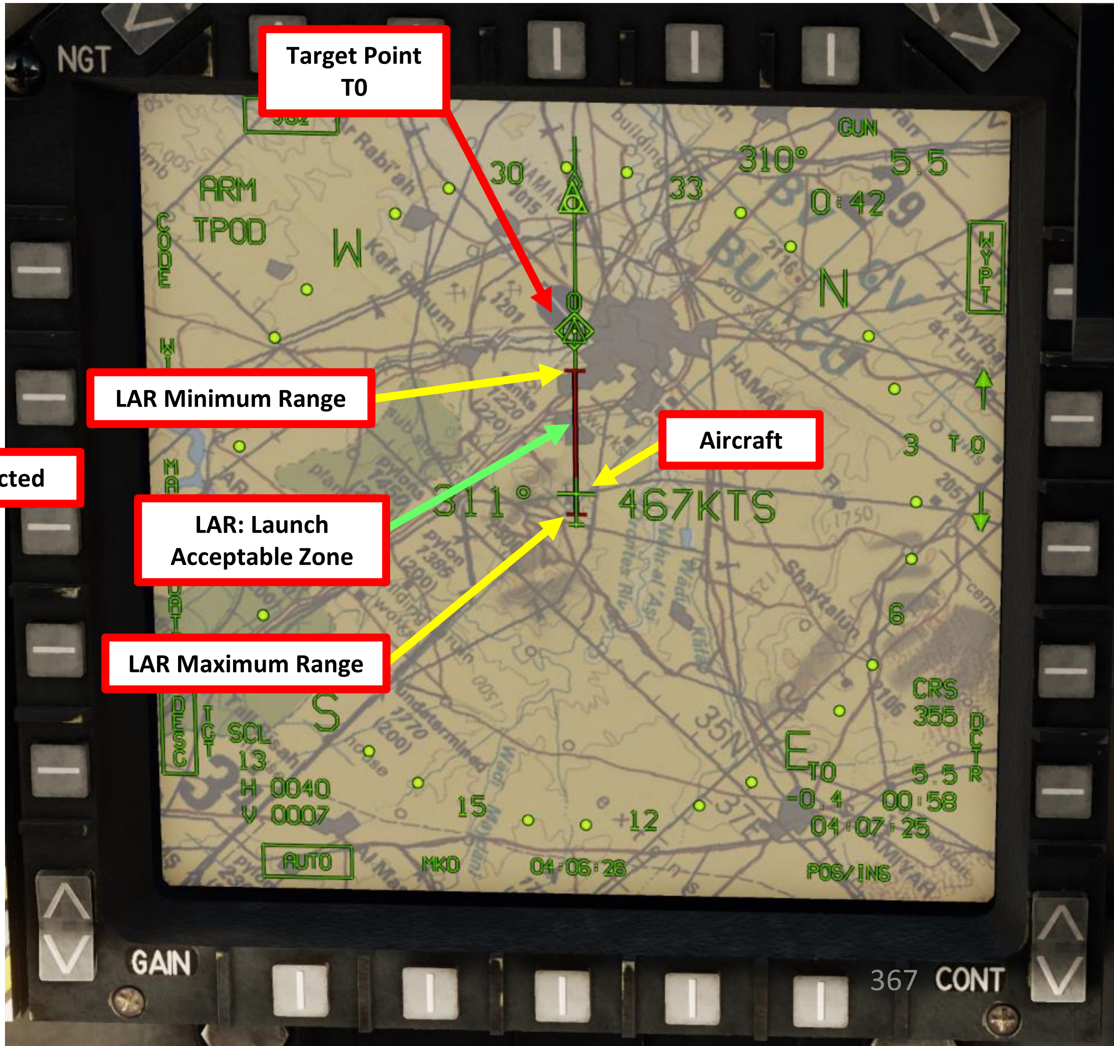


2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

C - ATTACK

38. Fly the aircraft level and line up the steering dot at the center of the JDAM Range Circle on the HUD.



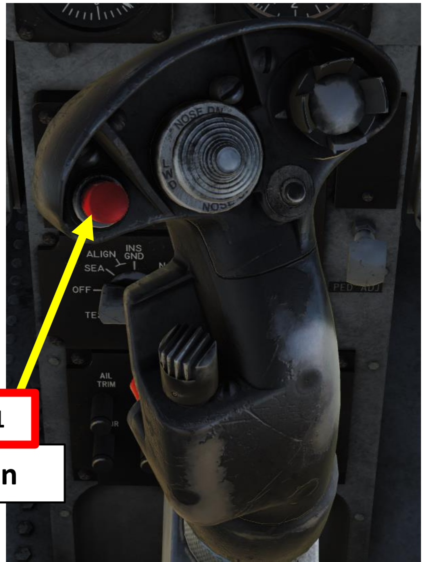


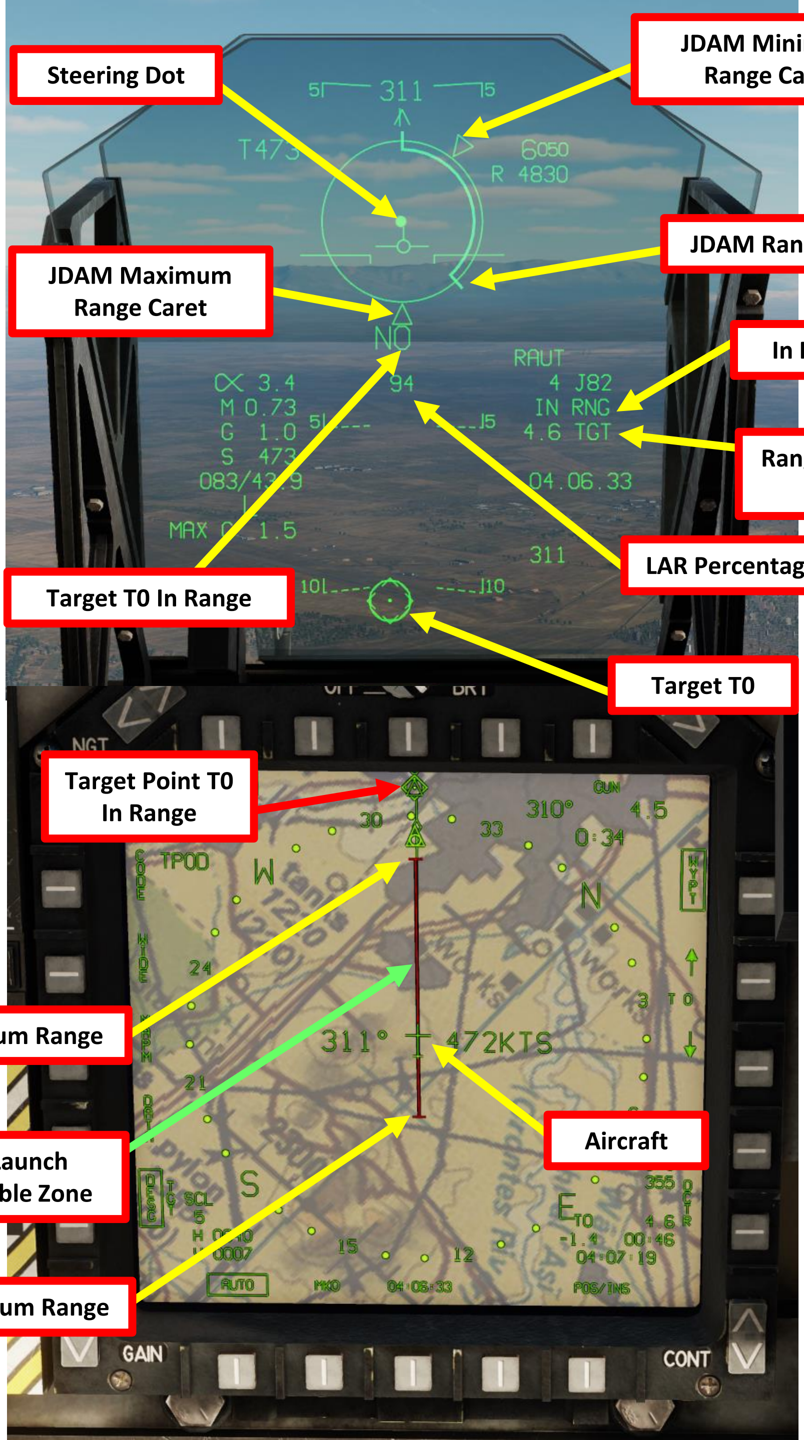
2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

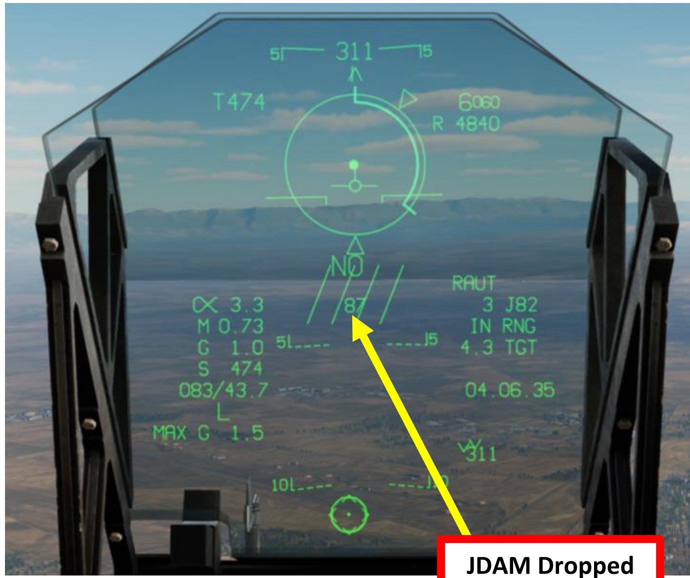
C - ATTACK

39. The aircraft will be in release range as soon as it enters the LAR zone. The HUD will indicate this condition when:
    a) The target number font becomes larger.
    b) The Range to Target appears inside the Range Circle and its edge starts moving towards the Minimum LAR Marker.
    c) The LAR Percentage number (% to the center of the LAR the aircraft is at) appears in the bottom of the HUD and starts counting towards 100.
40. The bombs can be released as soon as the aircraft is inside the LAR zone. For better results it is advisable to wait until the aircraft is in the center of the LAR zone before release. Check the LAR Percentage indicator on the HUD and release as soon as the indicated value is near 100.
41. Press and hold the Bomb Pickle button (RALT+SPACE) for approx. 1.5 seconds to launch the JDAM.

- Note : There is no automatic bomb release. The pilot must judge when it is time to release the bomb.





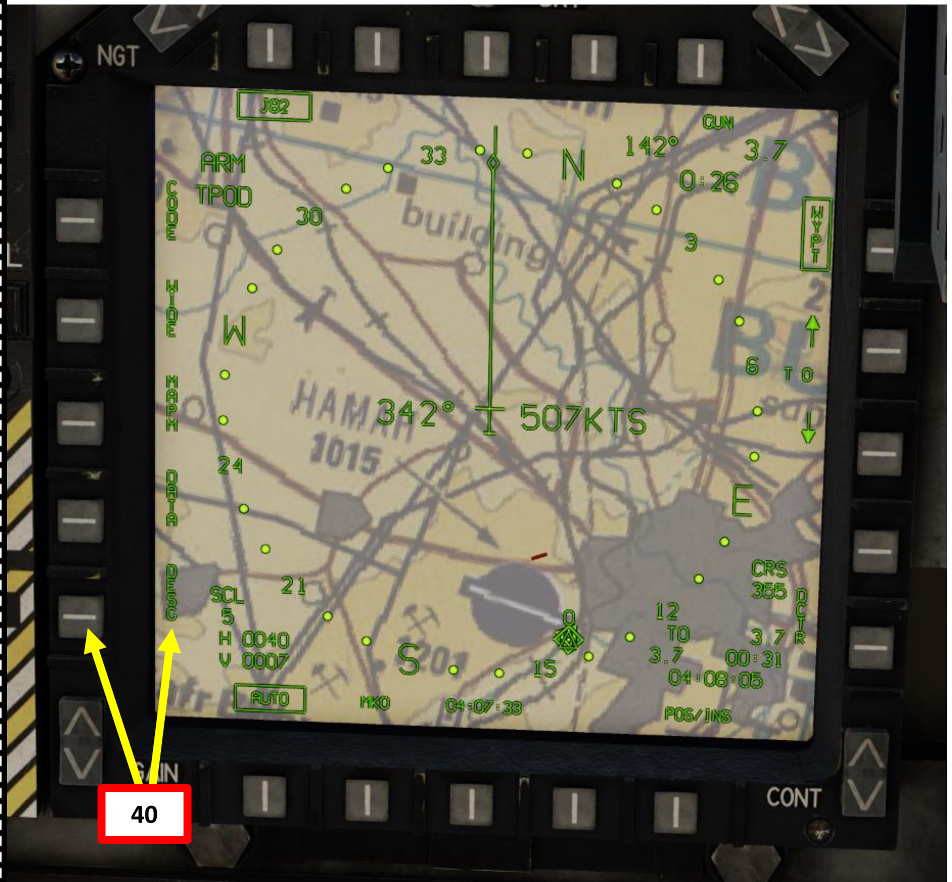


2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

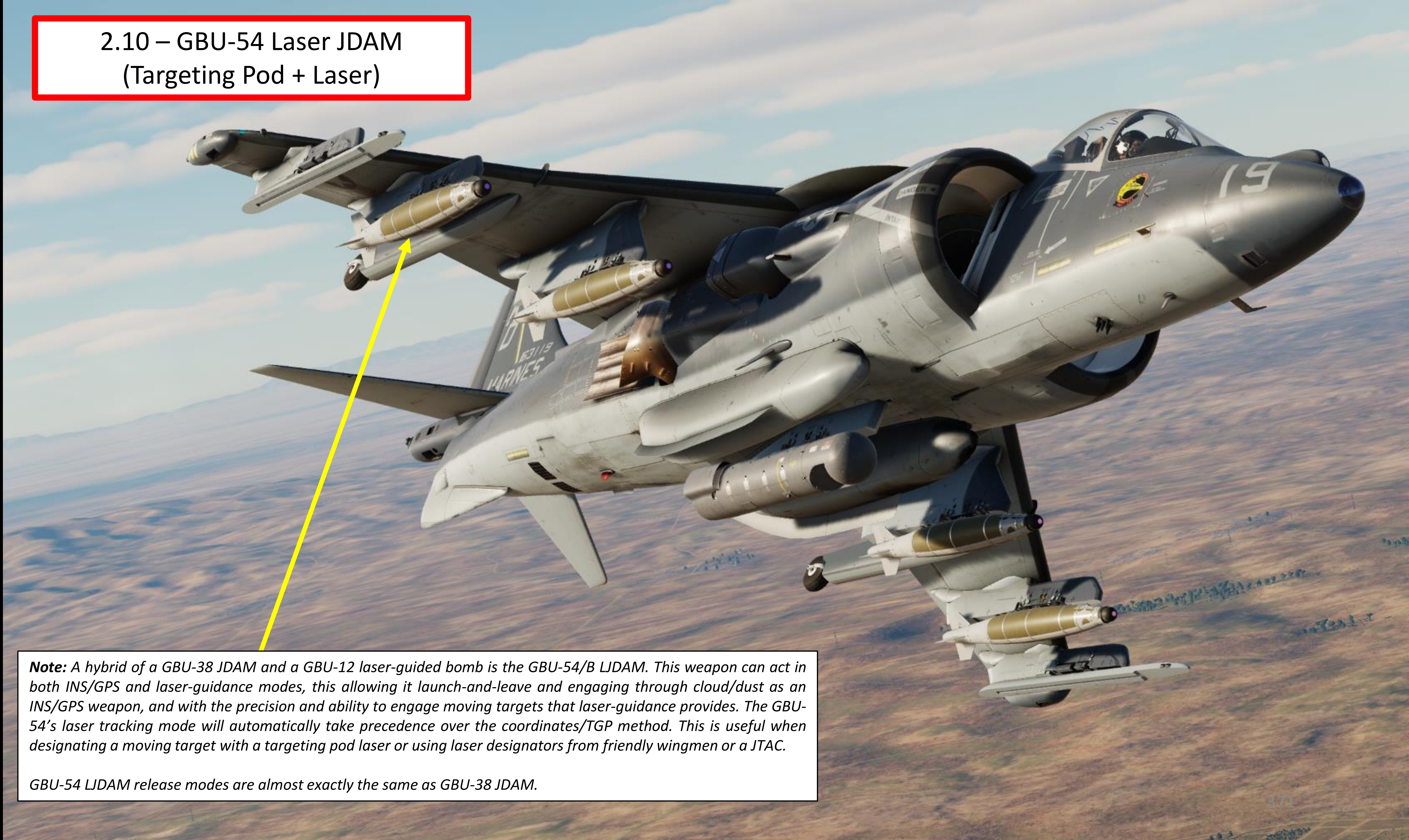
2.9 - GBU-38 JDAM
2.9.4 - TOO (TARGETING POD)

E - ATTACK

40. After successful attack, press the DESG OSB again to un-designate. DESG should become un-boxed when de-selected.



2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)



Note: *A hybrid of a GBU-38 JDAM and a GBU-12 laser-guided bomb is the GBU-54/B LJDAM. This weapon can act in both INS/GPS and laser-guidance modes, this allowing it launch-and-leave and engaging through cloud/dust as an INS/GPS weapon, and with the precision and ability to engage moving targets that laser-guidance provides. The GBU-54's laser tracking mode will automatically take precedence over the coordinates/TGP method. This is useful when designating a moving target with a targeting pod laser or using laser designators from friendly wingmen or a JTAC.*

GBU-54 LJDAM release modes are almost exactly the same as GBU-38 JDAM.

2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

Here is an overview of LJDAM employment methods for the Harrier within DCS. Take note that they are almost identical to JDAM employment methods, with the added benefit of being able to track a laser designator for moving targets.

PRE-PLANNED (ATHS) – F10 Map Markers

1. **Create F10 Map Marking Labels**
2. **Transmit Records to ATHS** – RSHIFT+RALT+8
3. **Assign Records to Targetpoints** – via CAS & RCALL pages
4. **Set Weapon Release Parameters**
5. **Attack** – Fly to LAR (Launch Acceptable Range) then Launch Weapon (can track laser designator from TPOD)

PRE-PLANNED (ATHS) – JTAC Transmission

1. **Contact JTAC for Fire Mission Request**
2. **Receive Records to ATHS** – Automatic with JTAC 9-line
3. **Assign Records to Targetpoint** – via CAS & RCALL pages
4. **Set Weapon Release Parameters**
5. **Attack** – Fly to LAR (Launch Acceptable Range) then Launch Weapon (can track laser designator from TPOD)

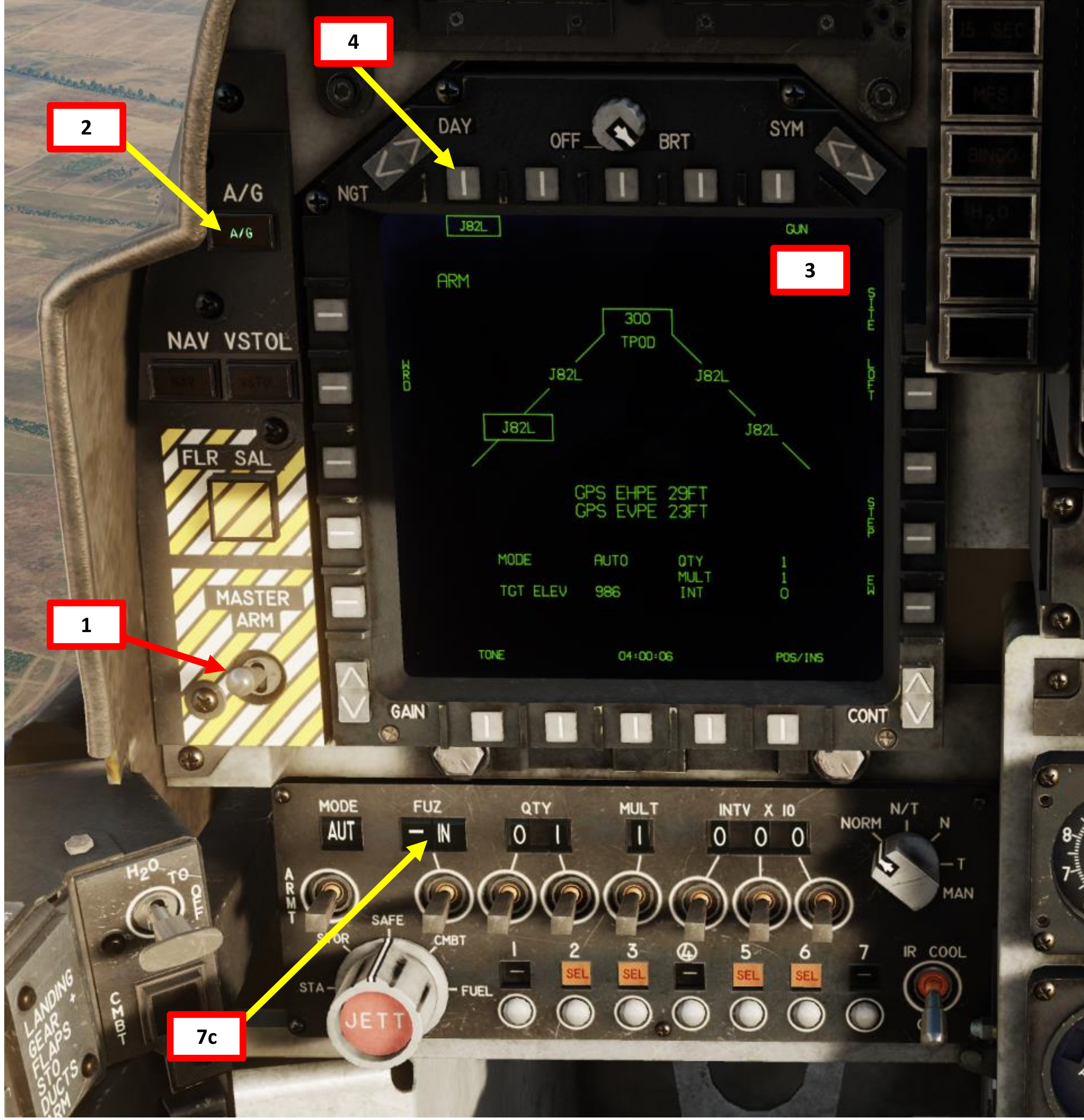
TOO/TARGET-OF-OPPORTUNITY (TARGETING POD)

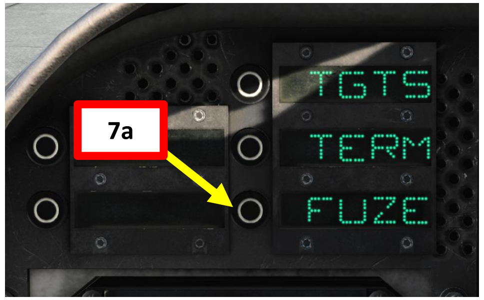
1. **Set Weapon Release Parameters**
2. **Designate Target with Targeting Pod + Laser**
3. **Attack** – Fly to LAR (Launch Acceptable Range) then Launch Weapon (can track laser designator from TPOD)

2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

A - SET WEAPON RELEASE PARAMETERS

1. Set Master Arm Switch - ON (UP)
2. Set Master Mode to A/G (Air-to-Ground)
3. Go in MPCD main MENU and select STRS (Stores) Page
4. Select desired J82L (GBU-54) Laser JDAMs by either selecting them with the upper OSB (Option Select Button) or by pressing the pylon SEL buttons on the ACP (Armament Control Panel).
5. When aircraft generator is powered (engine running), the LJDAM will automatically begin an alignment process that may take a few minutes. This process is mostly automatic.
6. Once weapon is selected, press the « WPN » button on the UFC to display available JDAM parameter ODUs (Option Display Units).
7. Press on FUZE ODU to select the JDAM fuzing. In our case, we will choose INST (Instantaneous). « : » will indicate when selected.
8. Press on FUZE ODU again to return to JDAM parameters.

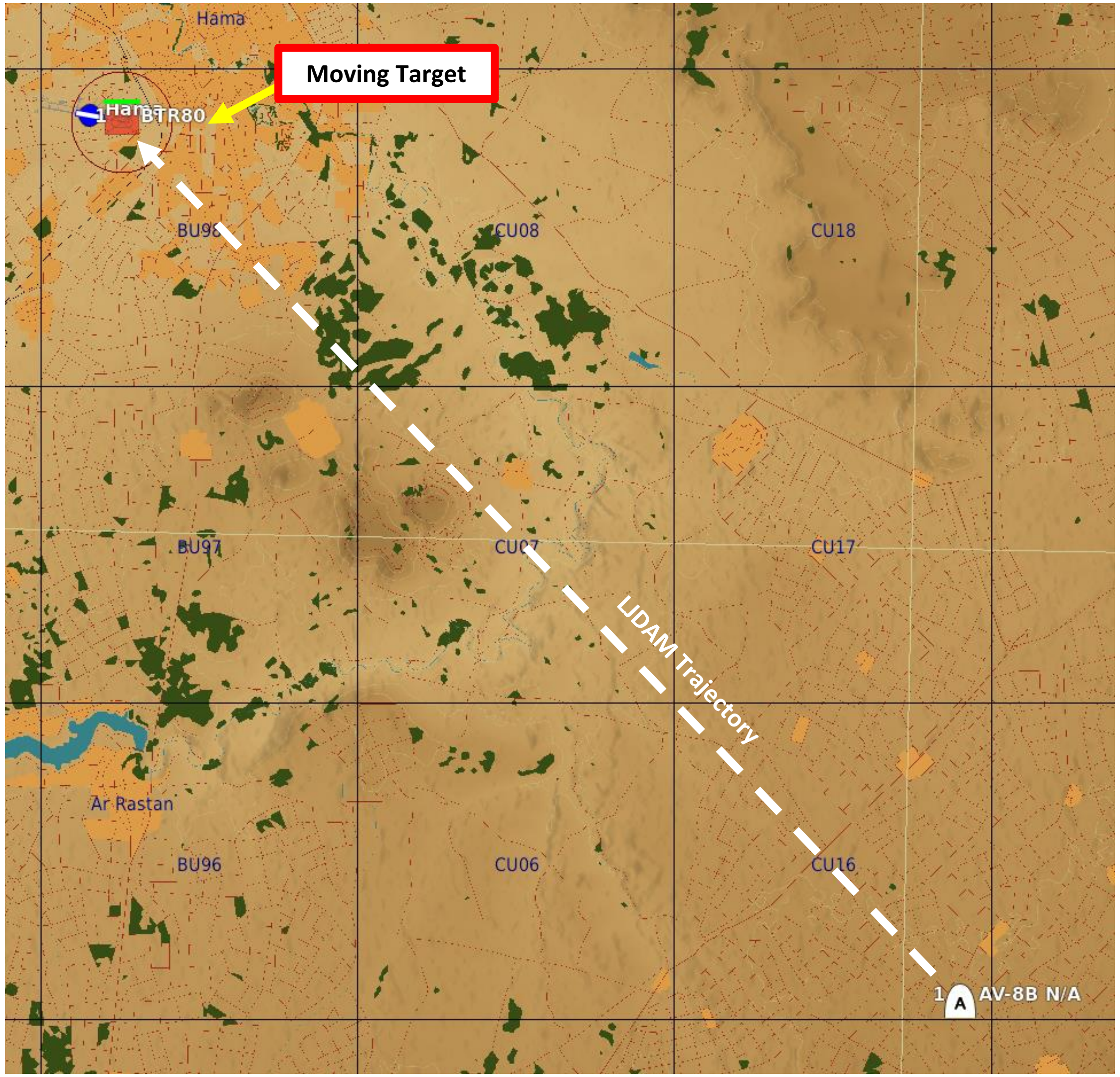




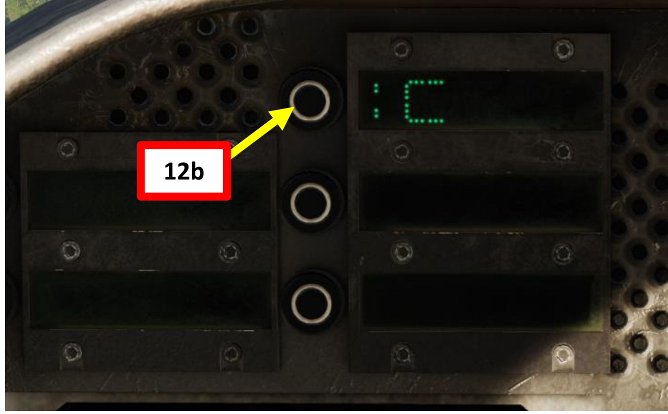
2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

A - SET WEAPON RELEASE PARAMETERS

9. OPTIONAL: If desired, select what Terminal Attack Parameters you want to set like attack heading and impact angle.
10. In this tutorial case, we will not use Terminal Attack parameters and go for a straight-in attack.

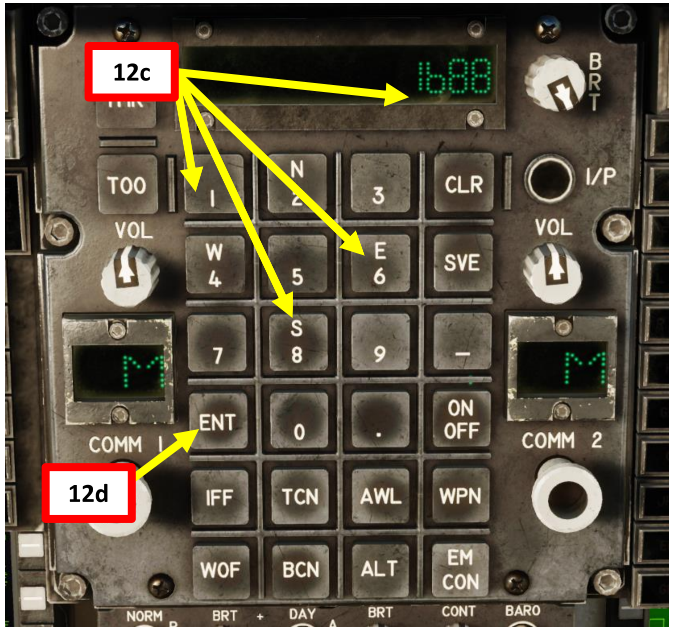


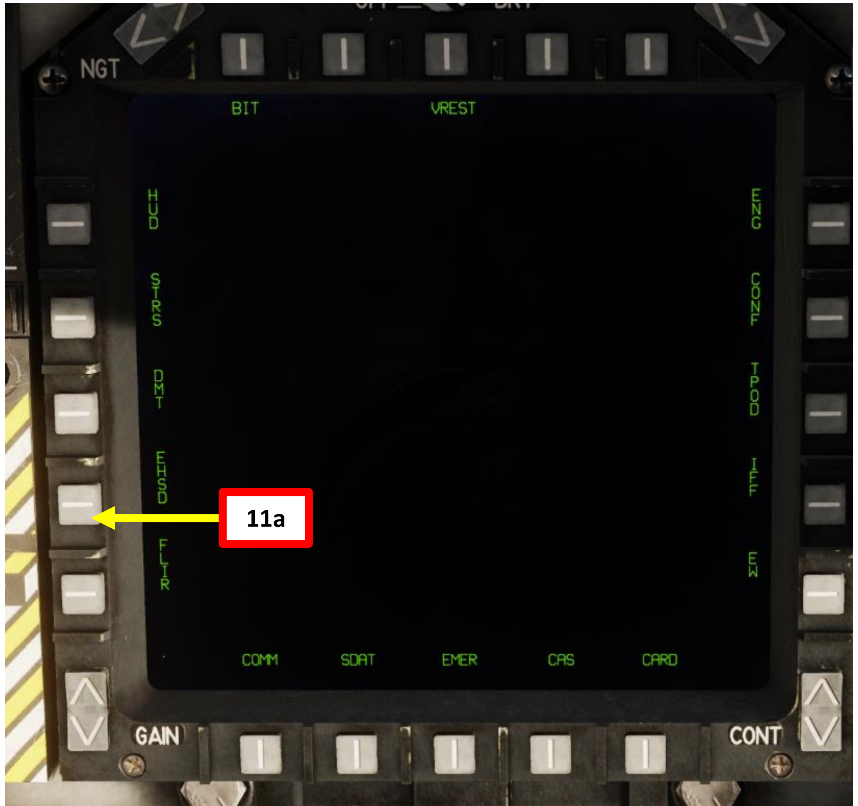
2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

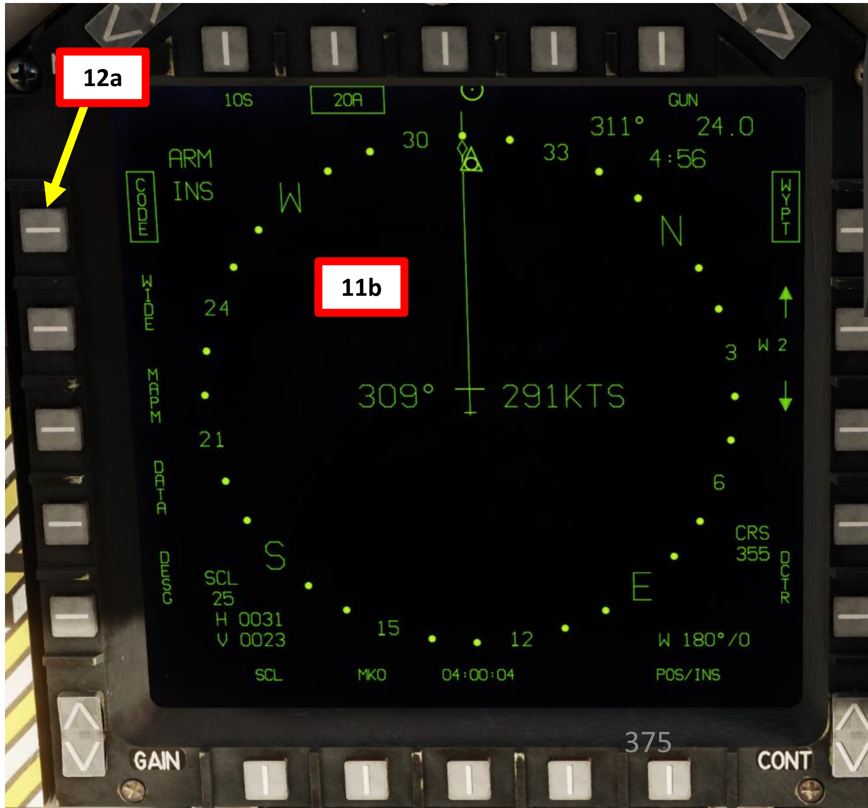


B - DESIGNATE TARGET WITH TARGETING POD

11. From the main MPCD menu, select "EHSD" page. Take note that this can be achieved from the DMT page as well.
12. Press the OSB (Option Select Button) next to CODE, select « C » ODU (Option Display Unit, preceded by « : » when selected), then set required laser code on the keypad (1688 by default), then press ENT. This laser code is what the targeting pod will be lasing with while designating the target.



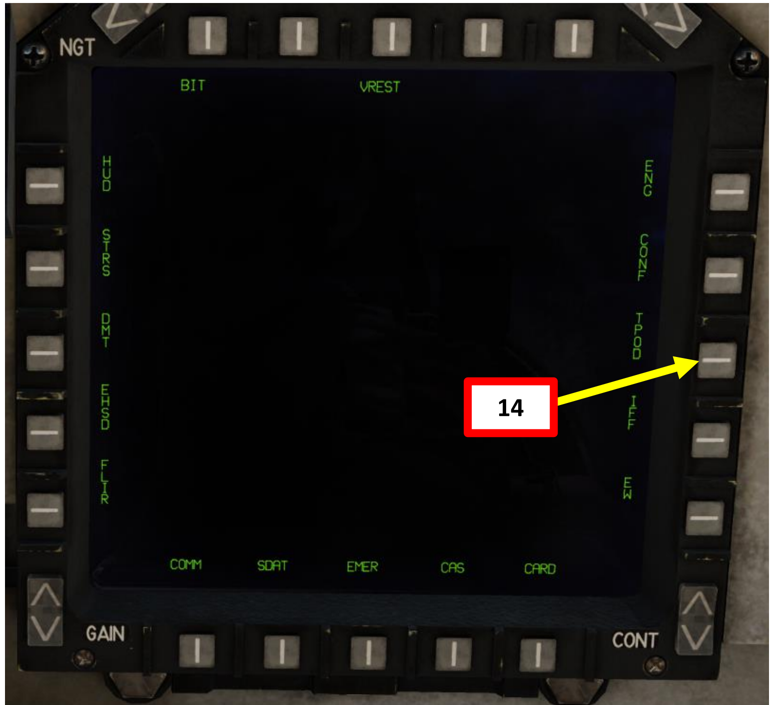


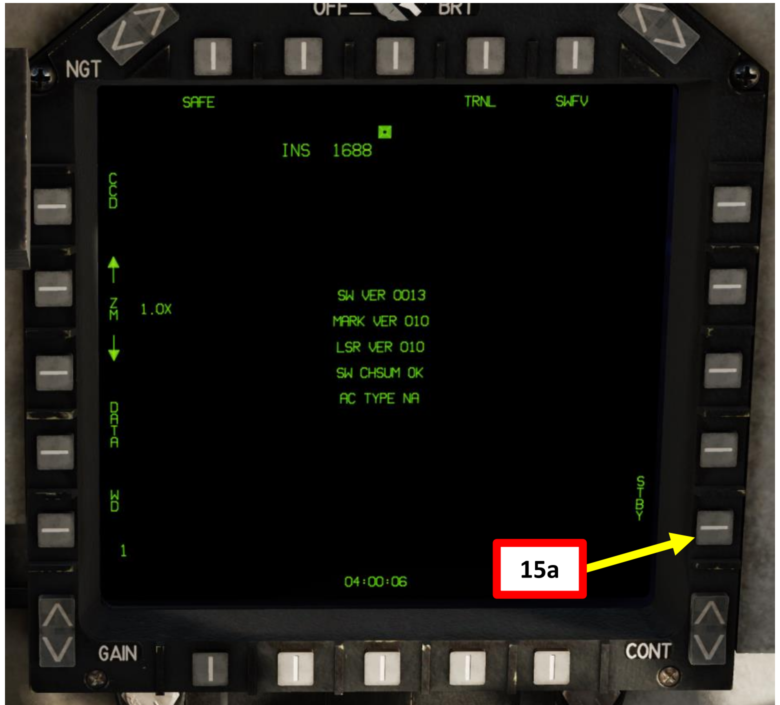


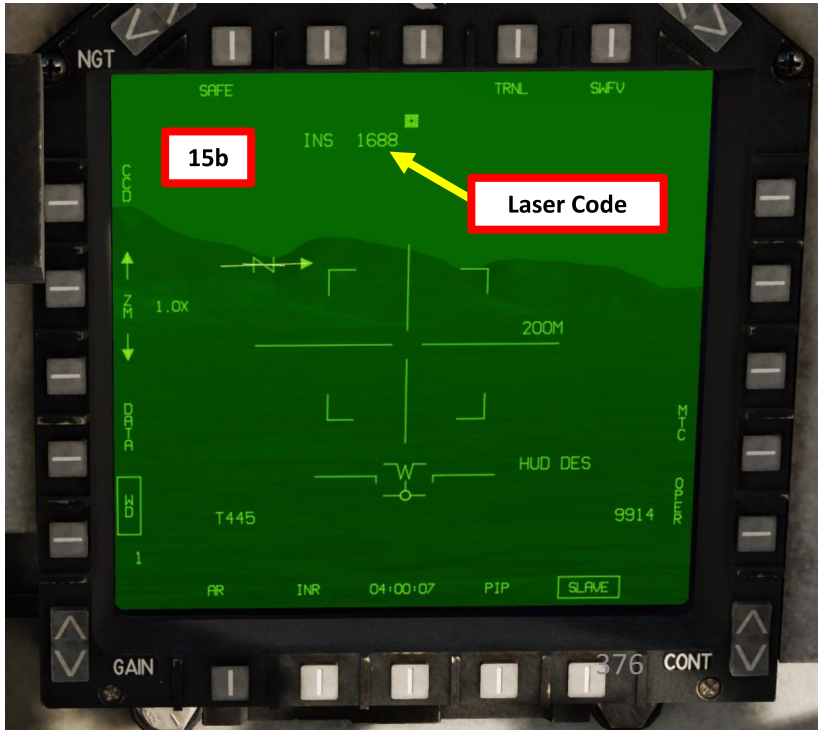
2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

B - DESIGNATE TARGET WITH TARGETING POD

13. Targeting Pod Power-Up is complete 6 to 8 minutes after generator power has kicked in.
14. Press the OSB next to the "TPOD" page in the main MPCD MENU
15. Press OSB next to STBY to set the targeting pod to OPR mode. The targeting pod camera sensor will un-stow. Confirm that Targeting Pod mode switches from STBY to OPR (Operate).



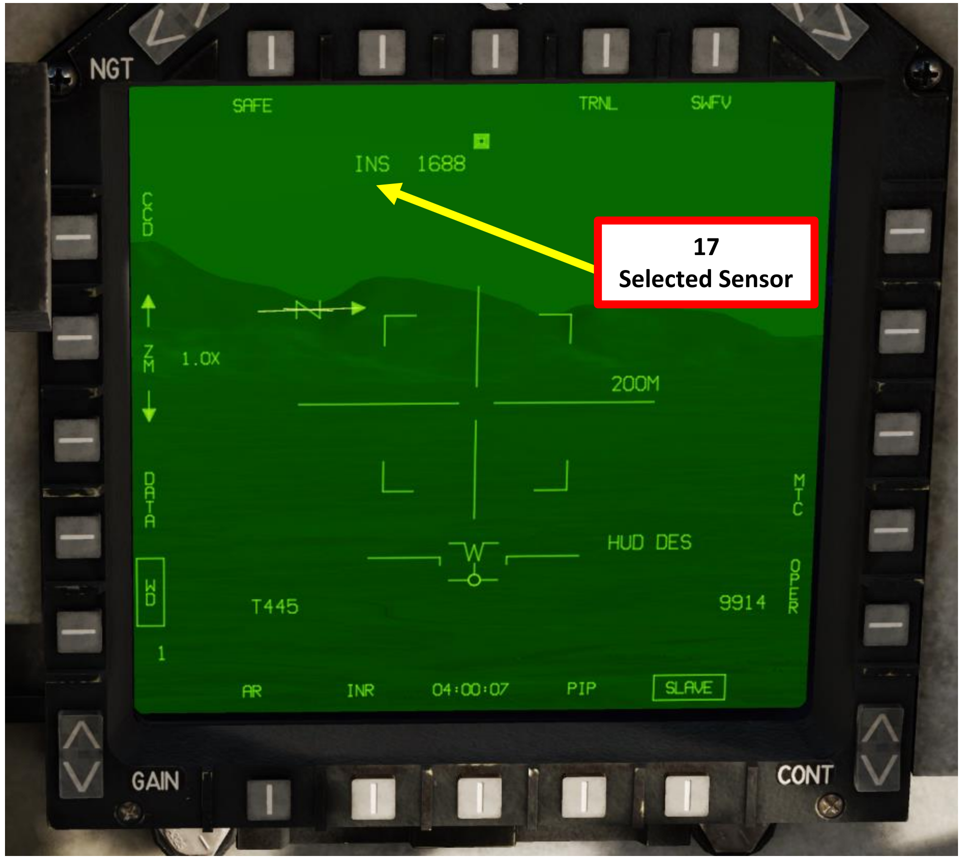


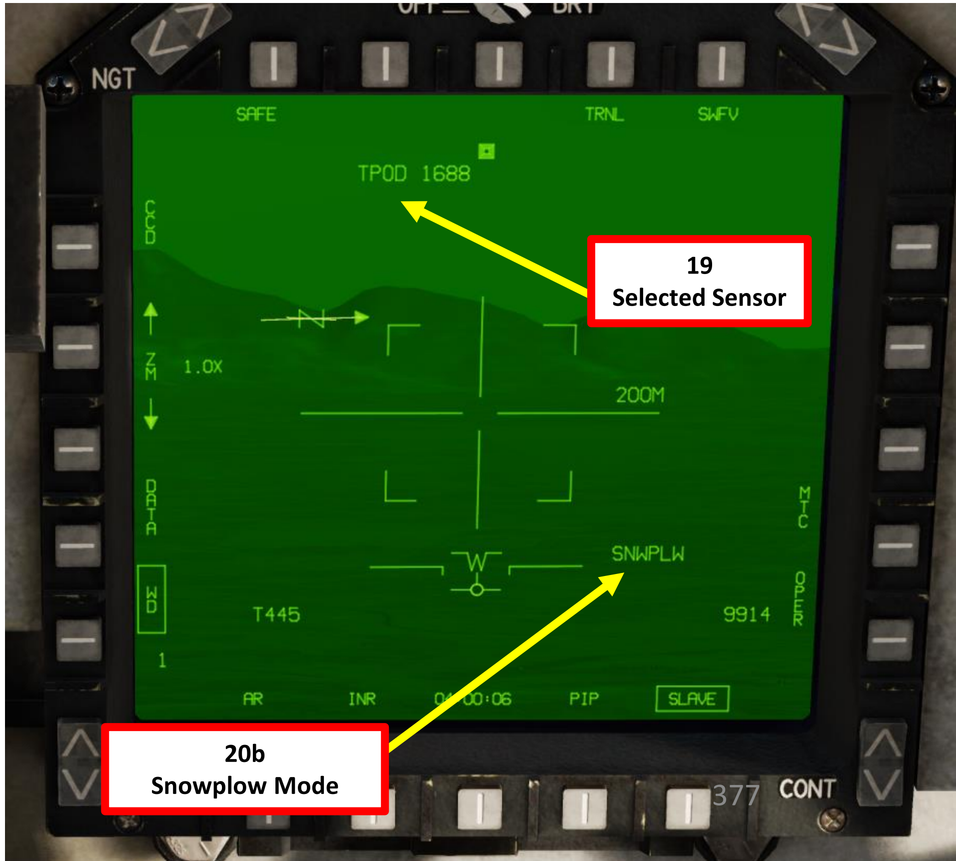


2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

B - DESIGNATE TARGET WITH TARGETING POD

16. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate any previously designated target.
17. Check selected sensor on TPOD page
    a) INS indicates the Inertial Navigation System (i.e. navigation waypoint) is the selected sensor.
    b) TPOD indicates the targeting pod is the selected sensor.
    c) TV indicates the DMT TV is the selected sensor.
18. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
19. Confirm that Sensor of Interest switches to TPOD.
20. Select desired targeting pod pointing mode by pressing the « AG Target Undesignate/NWS/FOV Toggle » button. In TPOD HTS mode, this button toggles between SNWPLW (Snowplow) and SLV VV (Slave to Velocity Vector). In our case, we will select SNWPLW Mode.



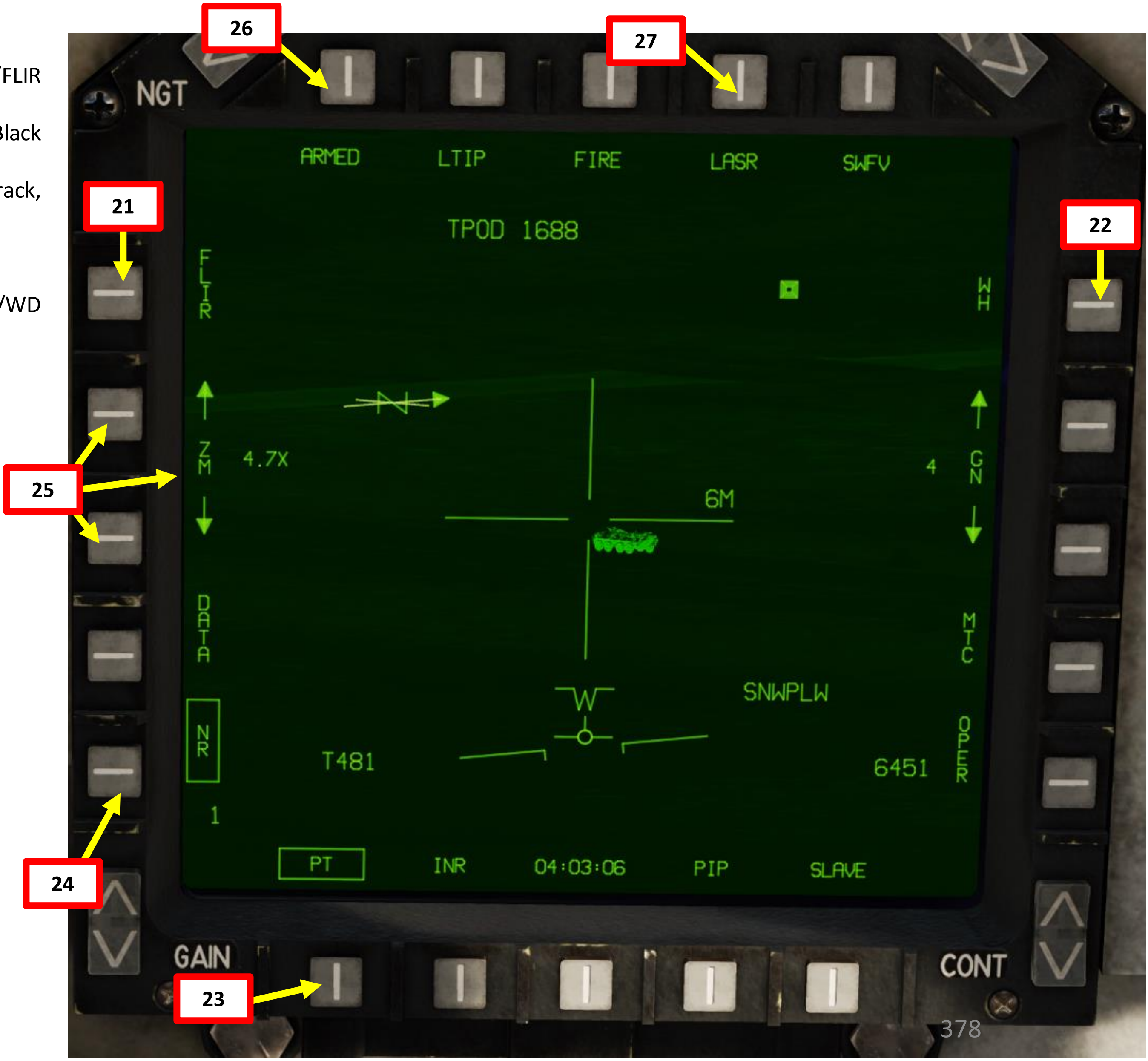


2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

B - DESIGNATE TARGET WITH TARGETING POD

21. Select desired camera polarity mode (CCD/TV or FLIR) by either using the CCD/FLIR OSB or pressing Sensor Select Switch RIGHT LONG.
22. If using FLIR camera, select desired thermal imaging by either using the BH/WH (Black Hot, White Hot) OSB or pressing Sensor Select Switch RIGHT SHORT.
23. Select desired tracking mode by either using the PT/AR/MT (Point Track, Area Track, Moving Target Track) OSB or by pressing Sensor Select Switch AFT SHORT.
    - PT and MT are best used against moving targets like vehicles
    - AR is best used against static targets like buildings.
24. Select desired camera FOV (Field-of-View) setting by either using the NR/WD (Narrow/Wide) OSB or pressing Sensor Select Switch LEFT SHORT.
25. Select desired zoom level by using the ZM +/- OSBs.
26. Press Laser Arming OSB to select ARMED mode.
27. Press Laser Mode OSB to select LASR (Laser Designator) Mode.

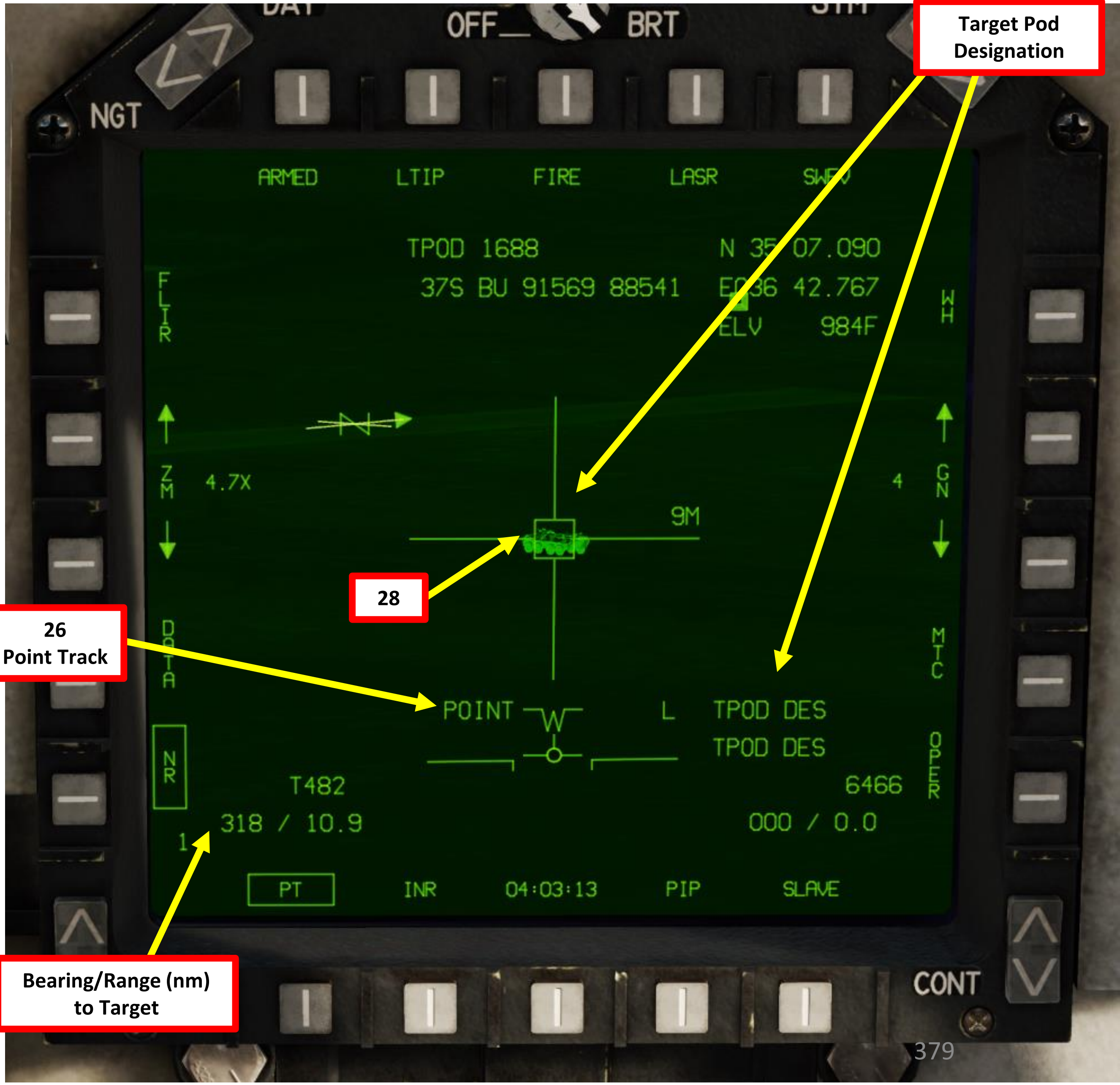
21
22
23
24
Sensor Select Switch (SSS)



2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

B - DESIGNATE TARGET WITH TARGETING POD

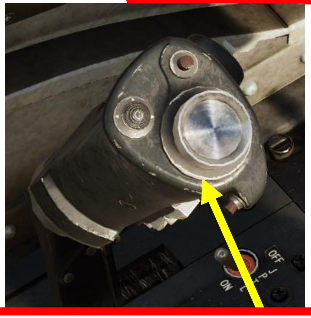
28. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
29. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
    - If PT or MT tracking is selected and no vehicle can be tracked, tracking mode will default to AR (Area Track) automatically.

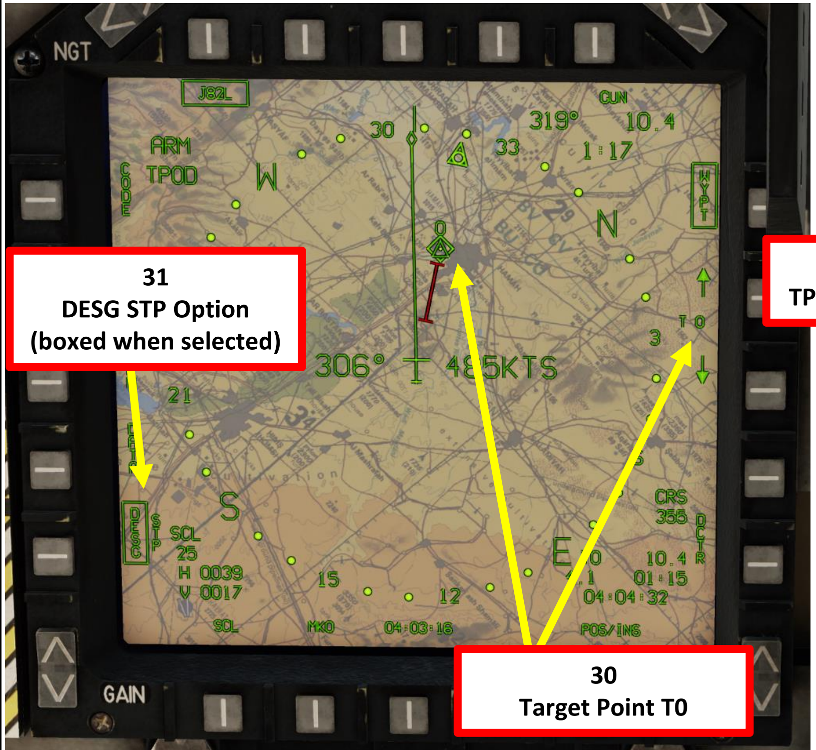


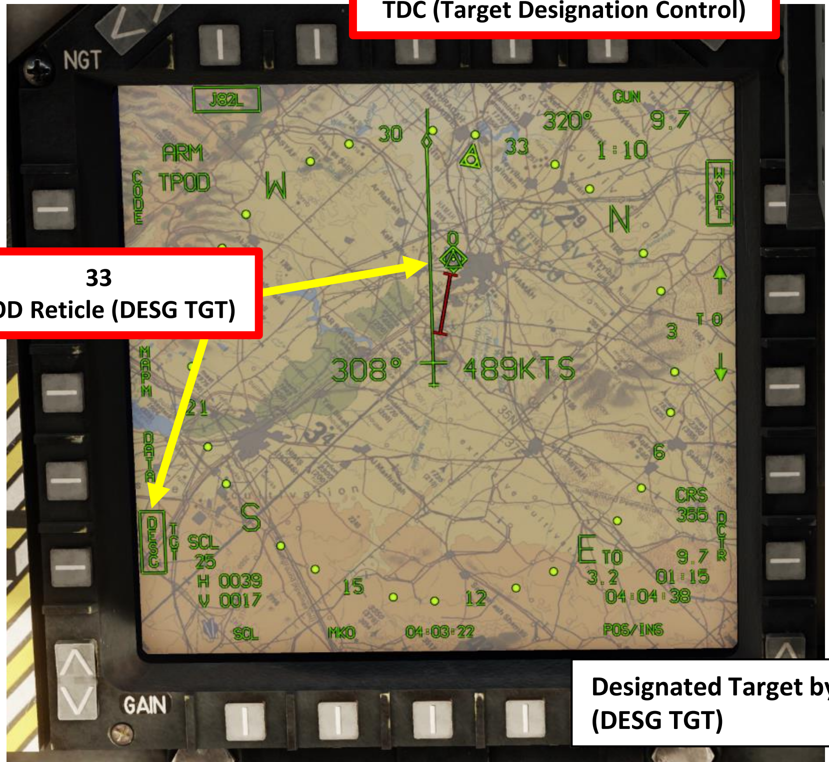
2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

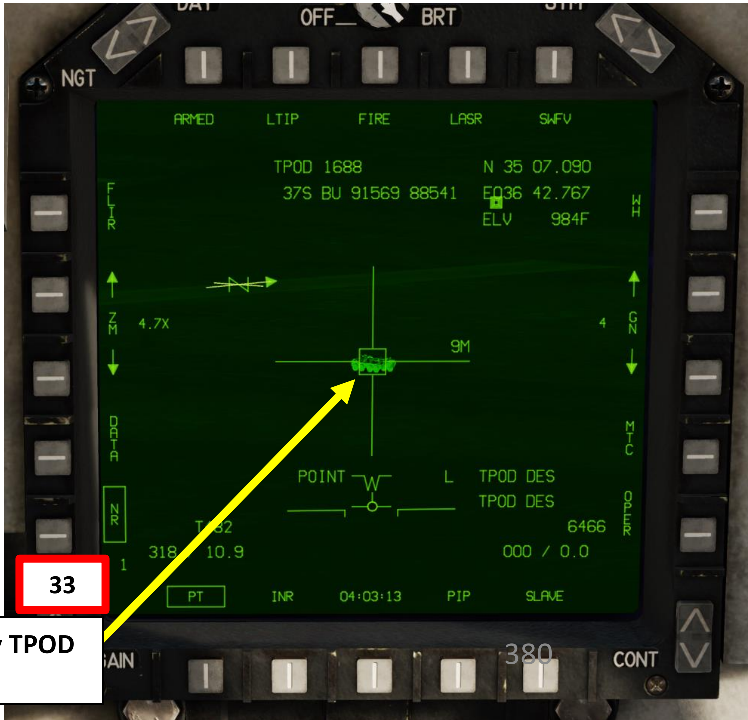
B - DESIGNATE TARGET WITH TARGETING POD

30. In order to release LJDAMs in TOO mode, Target Point T0 needs to be selected via the EHSD. Press the WP Increment button LONG (more than 0.8 sec) to transfer target coordinates to Target Point T0 and select T0.
31. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.
32. Once target is designated, re-slew the TPOD with TDC Left/Right/Fwd/Aft controls for targeting pod reticle adjustments. It will be necessary to re-acquire a point track.
33. On the EHSD, the DESG mode will switch from DESG STP (Steerpoint) to DESG TGT (Target).
    - Note: DESG TGT is set on the TPOD reticle, while DESG STP is set on the Target Point T0 initially designated when pressing « TDC DOWN Action Position » button.
    - **The JDAM tracks the DESG TGT in priority**.
    - When in DESG TGT designation mode, pressing « TDC DOWN Action Position » button will reset the Target Point (T0) location to the DESG TGT.





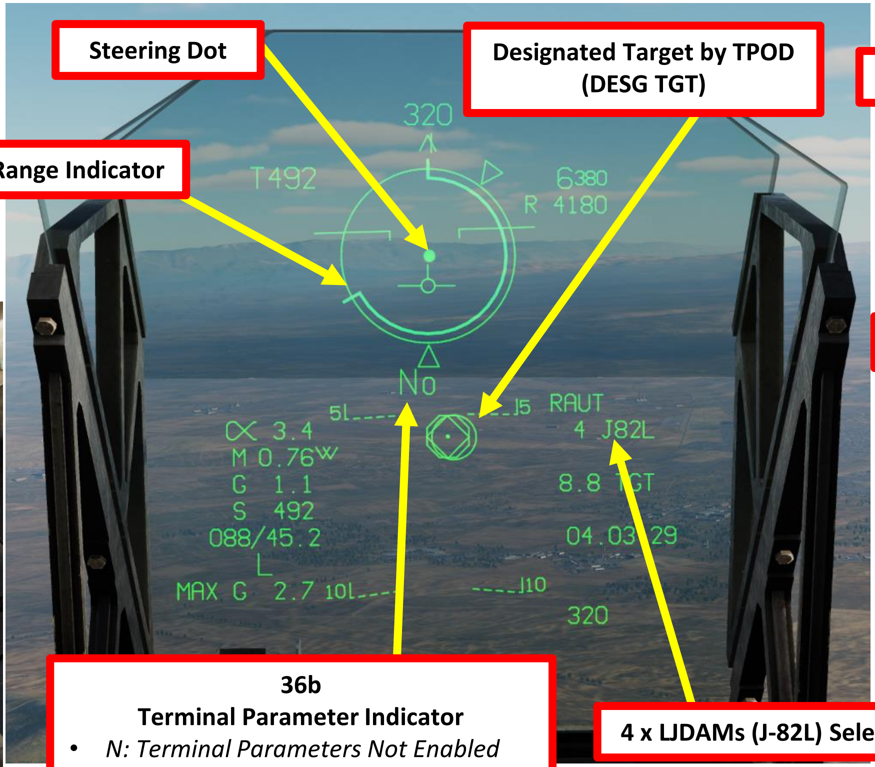


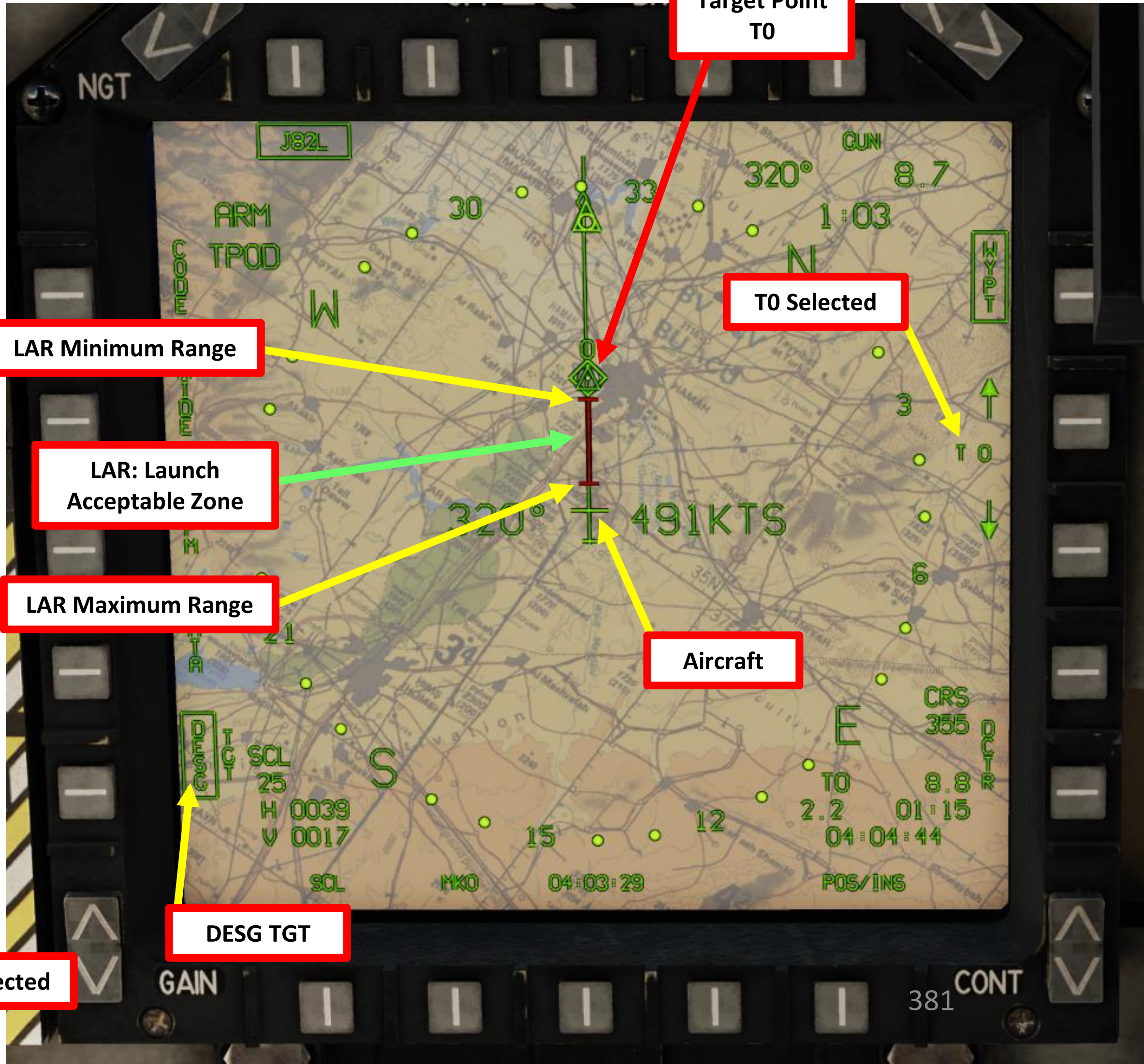


2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

B - DESIGNATE TARGET WITH TARGETING POD

34. Upon selection of the JDAM, T0 (with Waypoint Increment Button LONG) and DESG, only the center dot, Terminal Parameters Indicator and the bomb count and stores code are visible.
35. The JDAM range circle and LAR (Launch Acceptable Range) minimum value become visible.
36. If you want to enable the TERM (Terminal) Parameters on the JDAM, you must press the “Cage/Uncage” HOTAS Button. In our case, we will not use them and leave the Terminal Parameter Indicator to “N” (Not Enabled).
37. We can now perform the LJDAM strike.

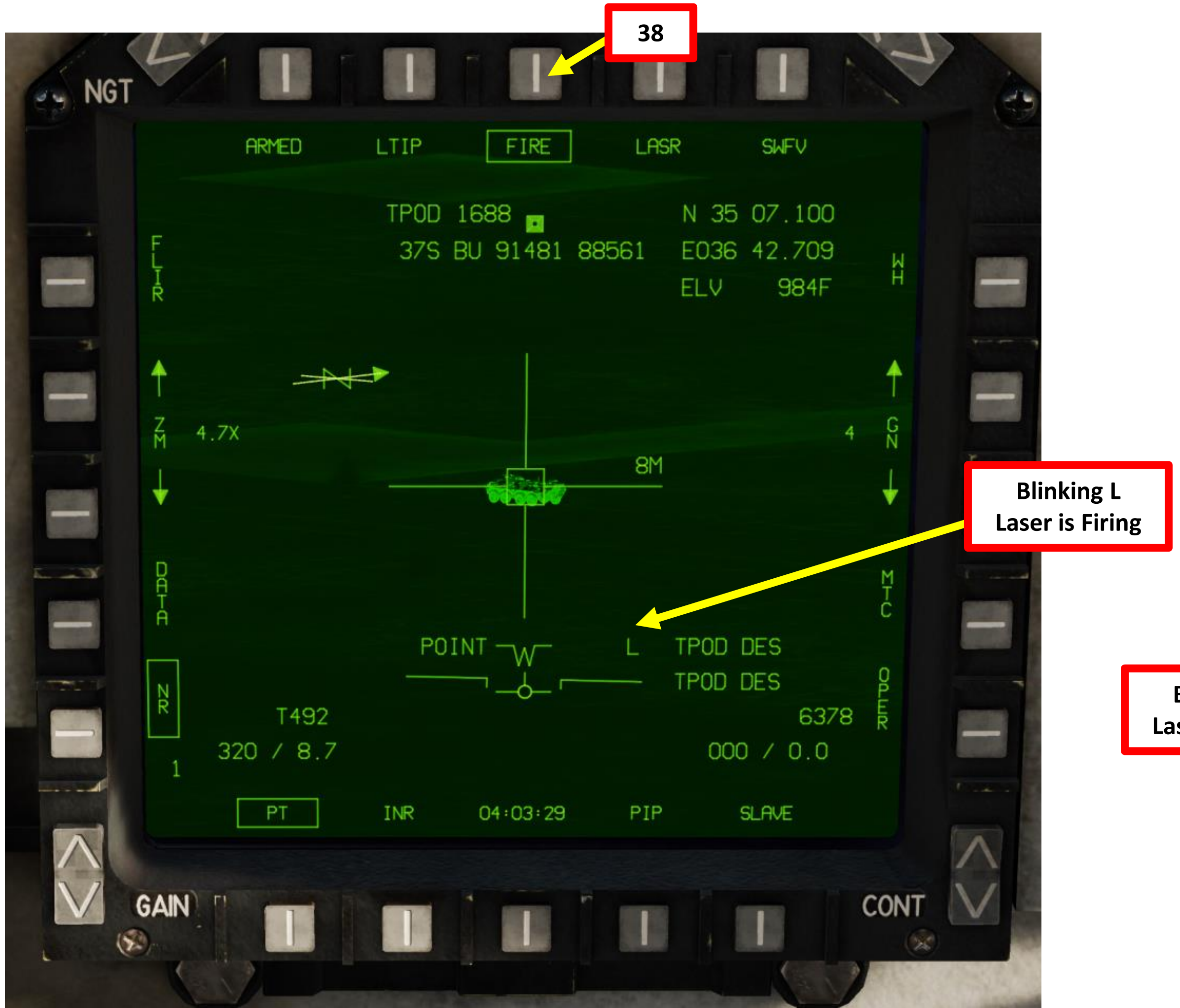




2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

C - LASE TARGET

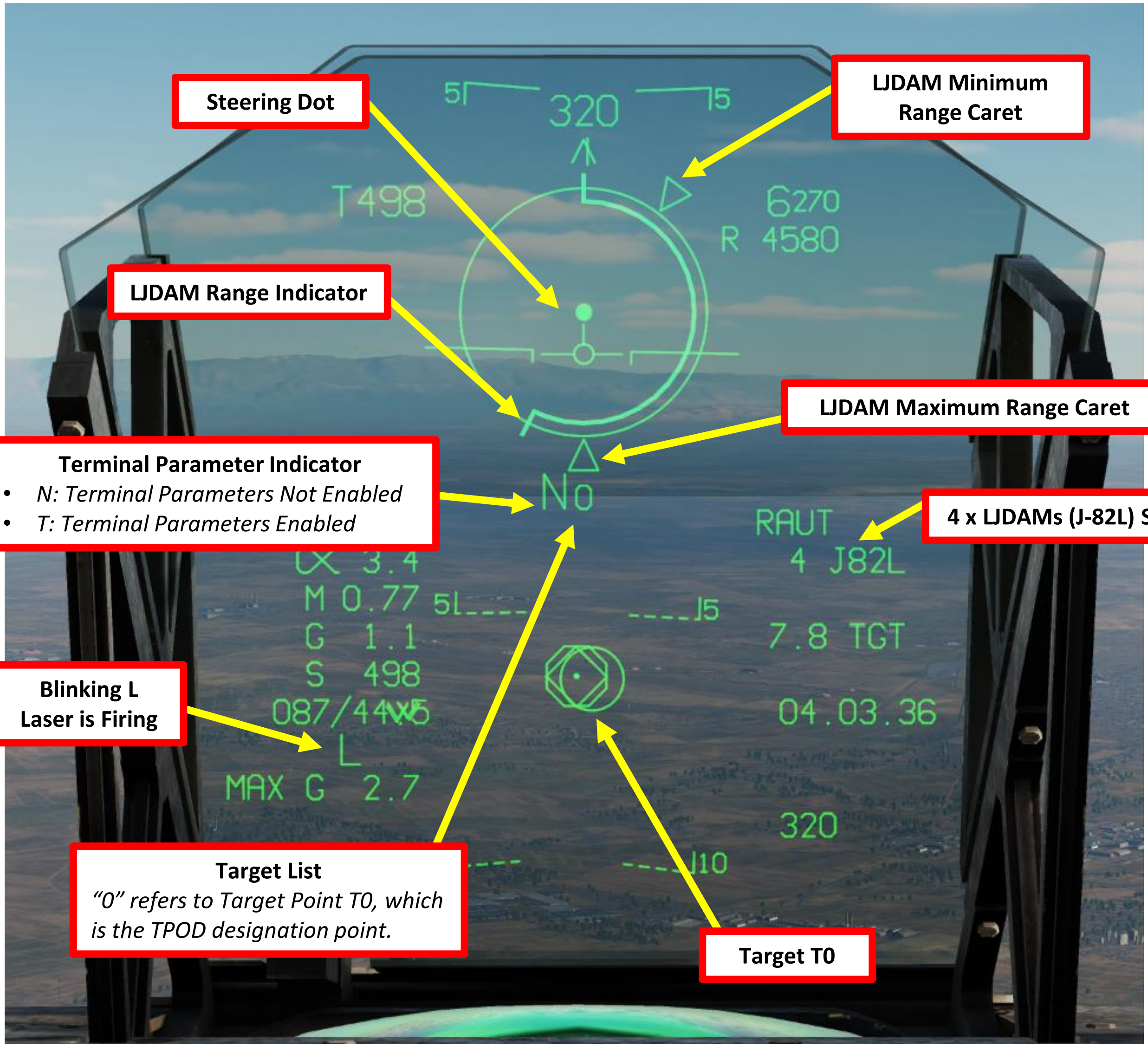
38. Press FIRE OSB to fire the laser. When fired, the GBU-54 will track this laser all the way to the target.
39. Once laser is firing, the « L » indication will blink on both the HUD and the TPOD page.

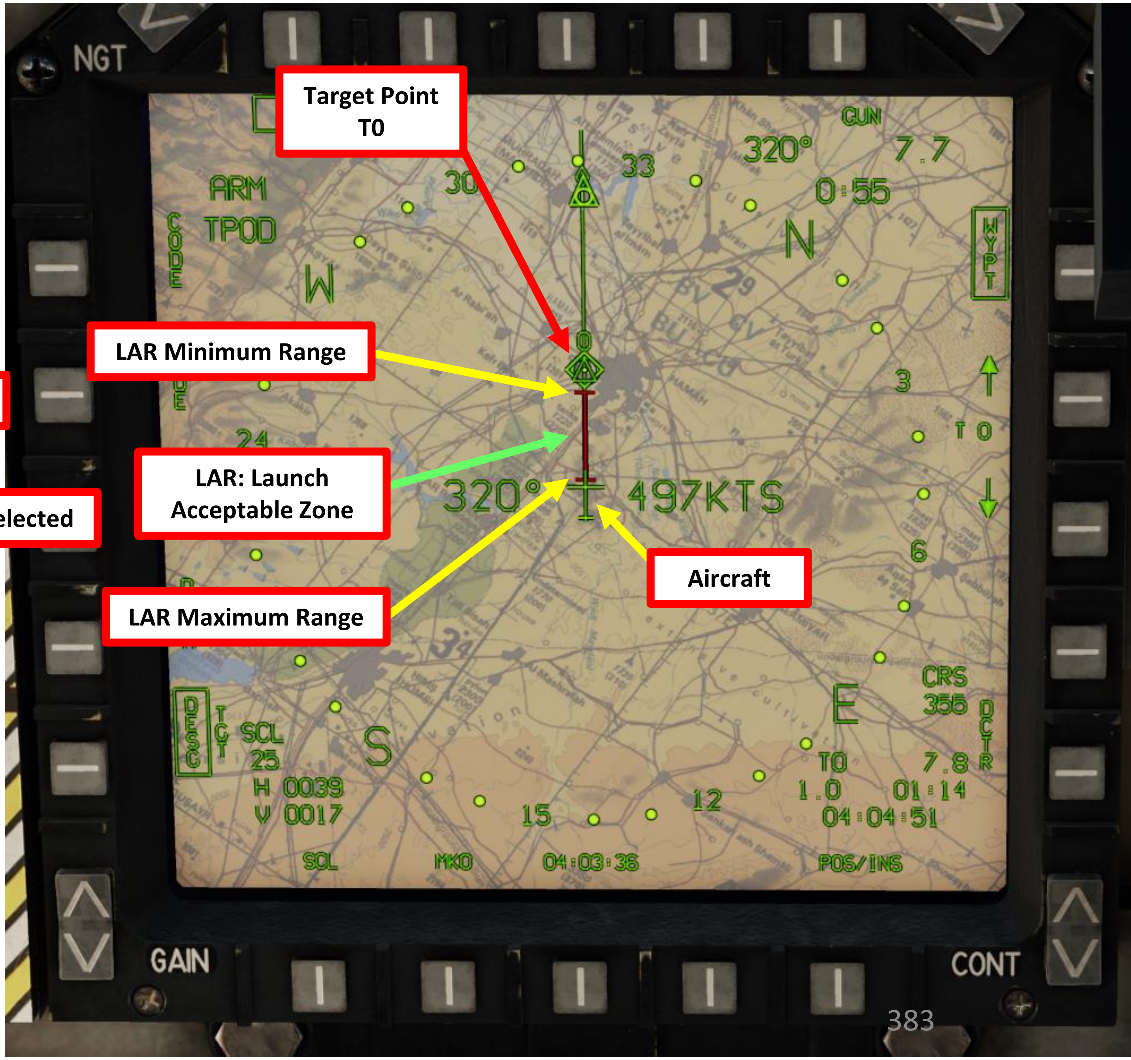


2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

D - ATTACK

40. Fly the aircraft level and line up the steering dot at the center of the LJDAM Range Circle on the HUD.



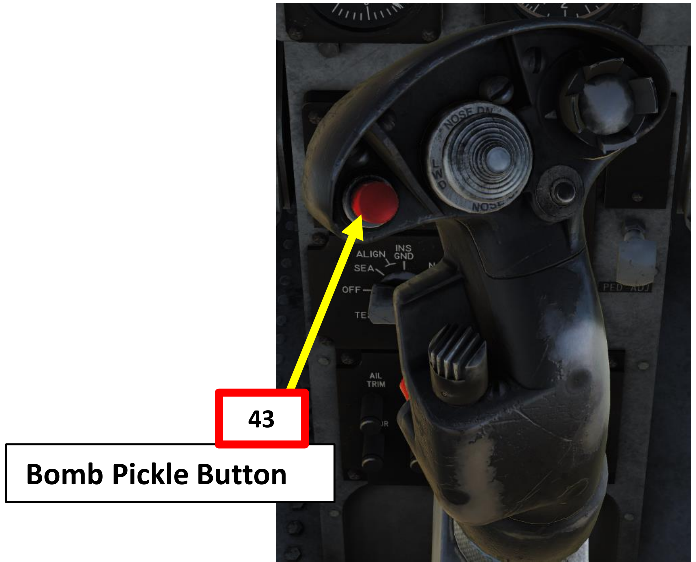


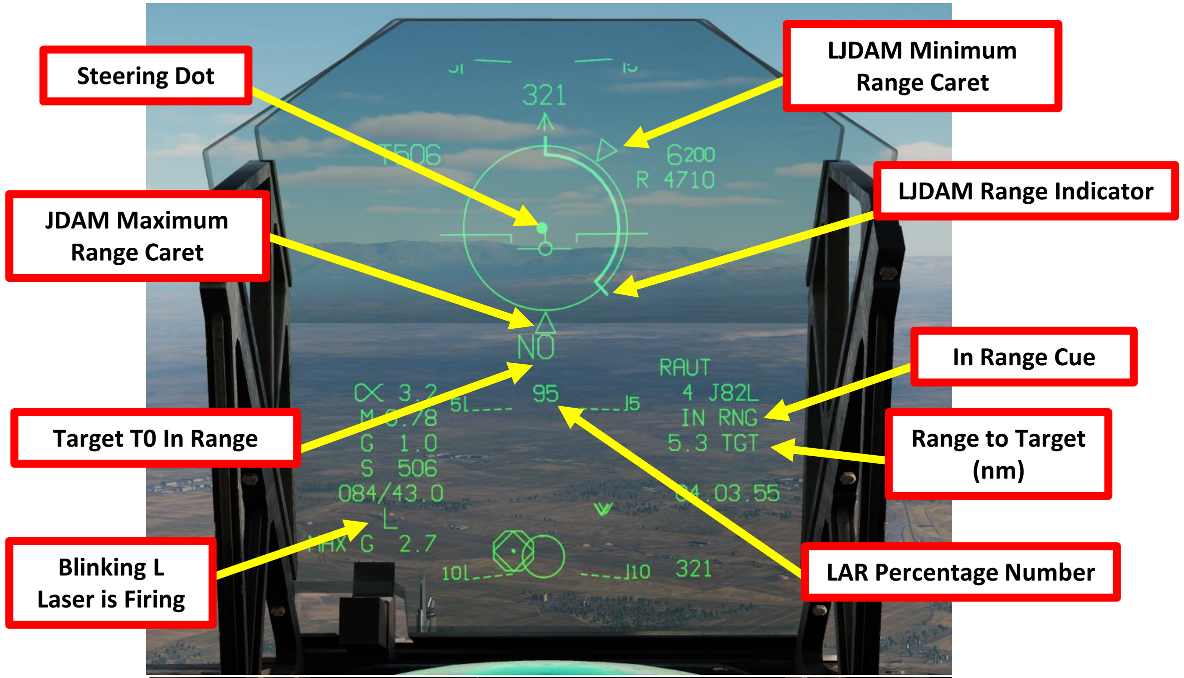
2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

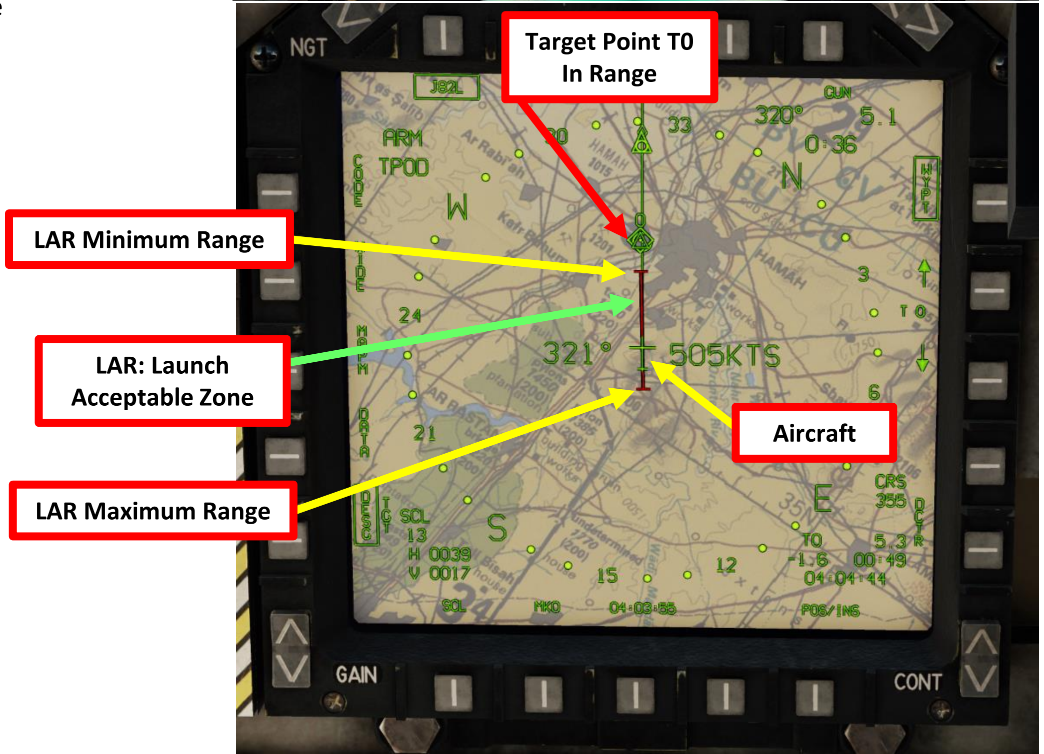
D - ATTACK

41. The aircraft will be in release range as soon as it enters the LAR zone. The HUD will indicate this condition when:
    a) The target number font becomes larger.
    b) The Range to Target appears inside the Range Circle and its edge starts moving towards the Minimum LAR Marker.
    c) The LAR Percentage number (% to the center of the LAR the aircraft is at) appears in the bottom of the HUD and starts counting towards 100.
42. The bombs can be released as soon as the aircraft is inside the LAR zone. For better results it is advisable to wait until the aircraft is in the center of the LAR zone before release. Check the LAR Percentage indicator on the HUD and release as soon as the indicated value is near 100.
43. Press and hold the Bomb Pickle button (RALT+SPACE) for approx. 1.5 seconds to launch the LJDAM. The LJDAM will then track the laser all the way to the target.

- Note : There is no automatic bomb release. The pilot must judge when it is time to release the bomb.





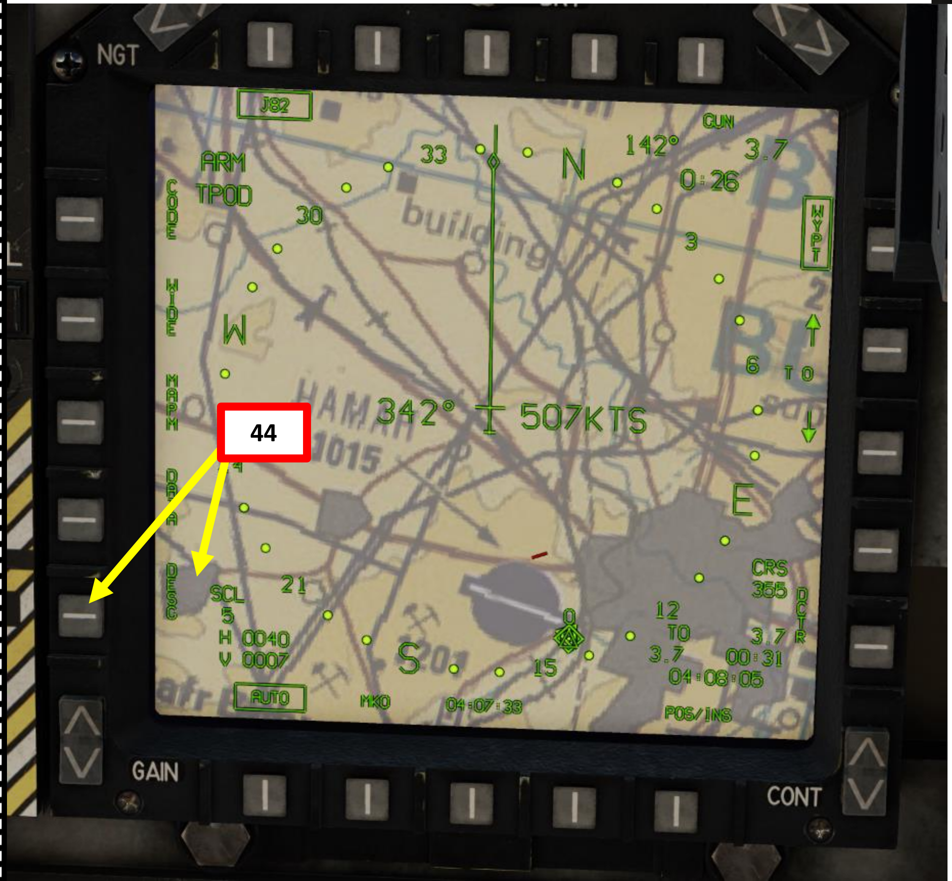


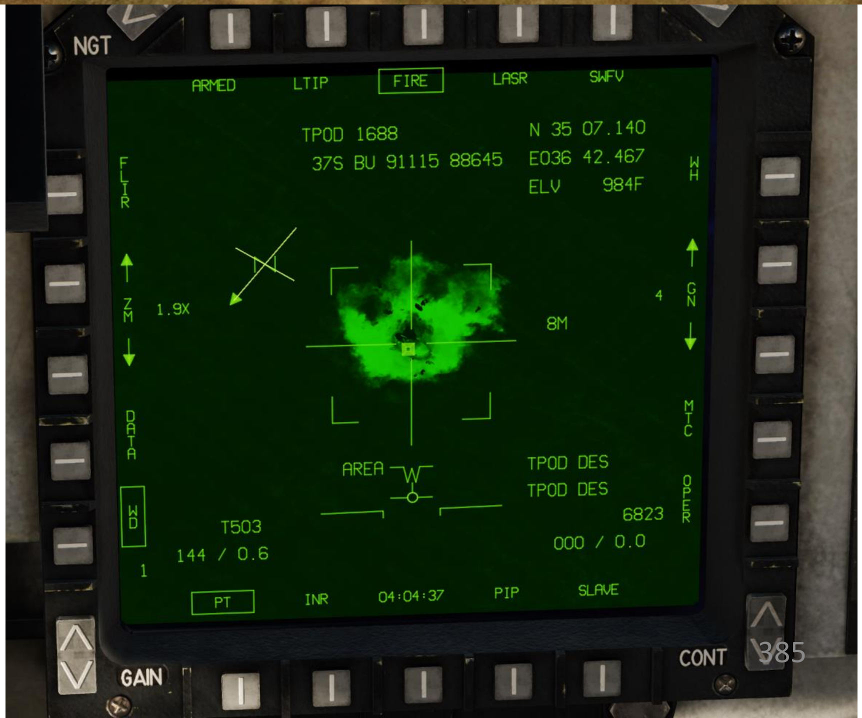
2.10 – GBU-54 Laser JDAM (Targeting Pod + Laser)

D - ATTACK

44. After successful attack, press the DESG OSB again to un-designate. DESG should become un-boxed when de-selected.
45. Press on the FIRE OSB to stop firing laser (unboxed when de-selected).
46. Press the « AG Target Undesignate/NWS/FOV Toggle » to un-designate target once target is destroyed.

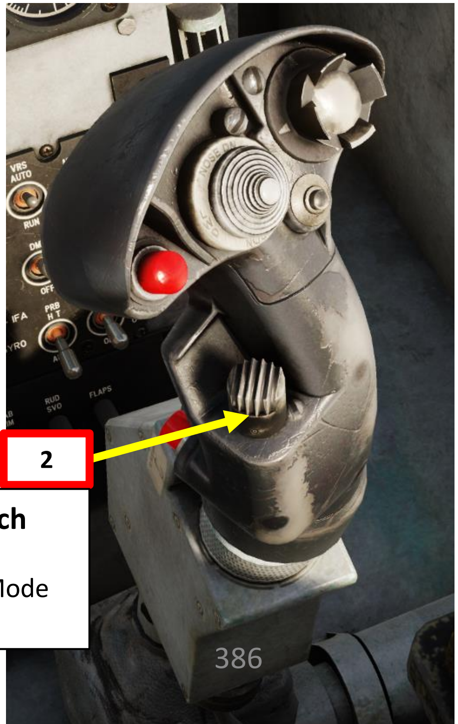
46
NWS





3.1 - GAU-12 Gun Pod (Air-to-Air)

1. Set Master Arm Switch – ON (UP)
2. Press the Air-to-Air Weapon Select Switch DOWN on your HOTAS to select the gun in A/A Mode. (“C” key binding by default)
3. Confirm that Air-to-Air Master Mode is selected (A/G, NAV and VSTOL Master Mode lights are extinguished)



Air-to-Air Weapon Select Switch
AFT = A/A Sidewinder SEAM Mode
FWD = A/A Sidewinder Boresight Mode
DOWN (PUSHED) = Gun Mode

3.1 - GAU-12 Gun Pod (Air-to-Air)

4. Adjust throttle to maintain engine RPM above 70 % RPM at low pressure altitudes or above 90 % RPM at high pressure altitudes (20000+ ft).
   - At low altitudes, a minimum engine RPM has to be maintained (above 70 % RPM) in order to generate sufficient bleed air pressure to supply the pneumatic gun firing mechanism. At higher pressure altitudes, a higher engine RPM setting is required (above 90 % RPM).
5. Press Weapon Cage/Uncage button to toggle between pippers.
   - **Long Range Gun Pipper**: smaller circle, optimized for a range of 2400 ft. Circle has a 12.5 mils diameter with wings 5.5 mils wide on each side.
   - **Short Range Gun Pipper**: larger circle, optimized for a range of 1200 ft. Circle has a 22.5 mils diameter with wings 12 mils wide on each side.

Rule of thumb for the pipper:

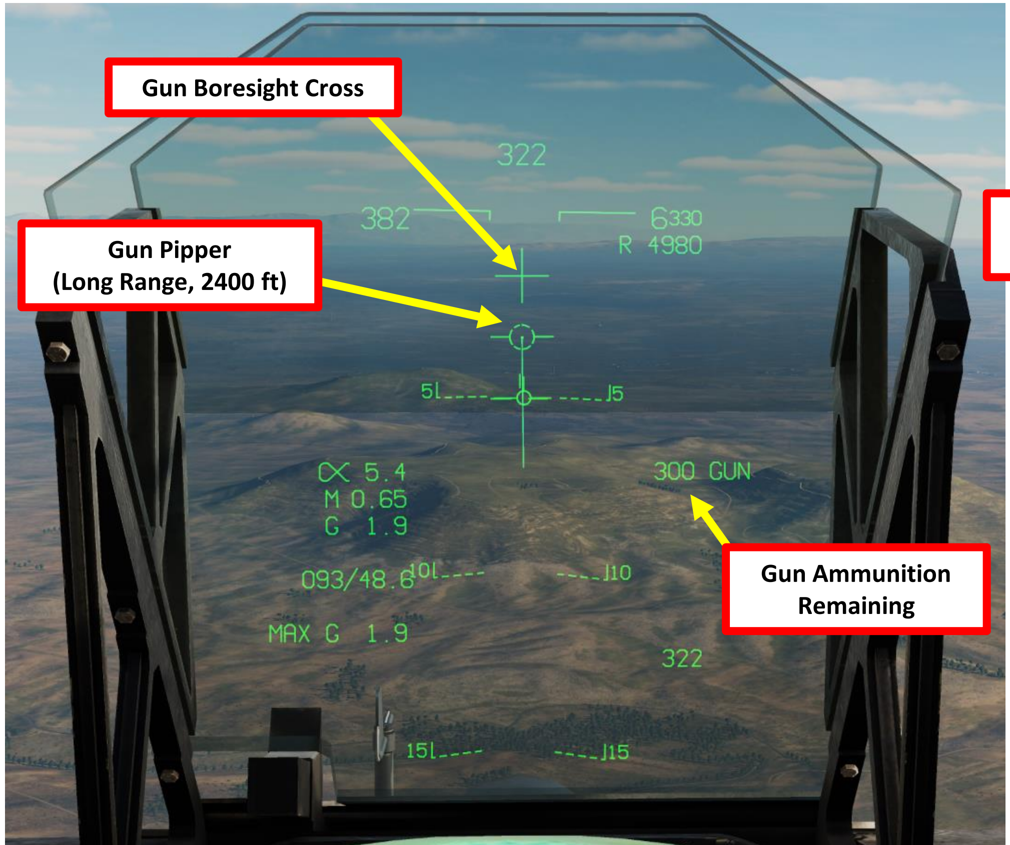
Say that 1 mil is what 1 unit at 1000 units looks like or in this case what 1 ft at 1000 ft looks like. Size of the object at that range is mil*(range/1000).

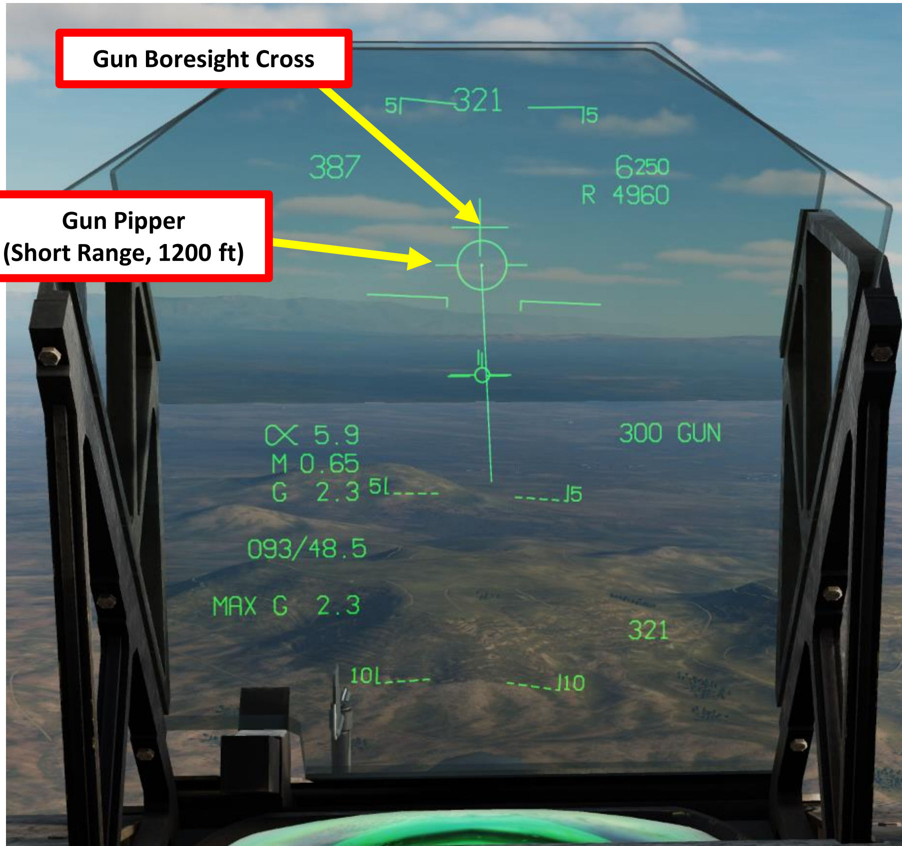
- The long range reticle at 2,400 ft looks like a 30 ft diameter circle with 13.2 ft wings on each side. 56.4 ft wide total.
- The short range reticle at 1200 ft looks like a 30.6 ft diameter circle with 12 ft wings on each side. 54.6 ft wide total.

For a lot of aircraft, the wingspan is as wide as the circle or a combination of one wing and the circle (o vs -o). A lot of the A2G aircraft you'd run into match the full reticle (-o-).

Which parts of the reticle to reference

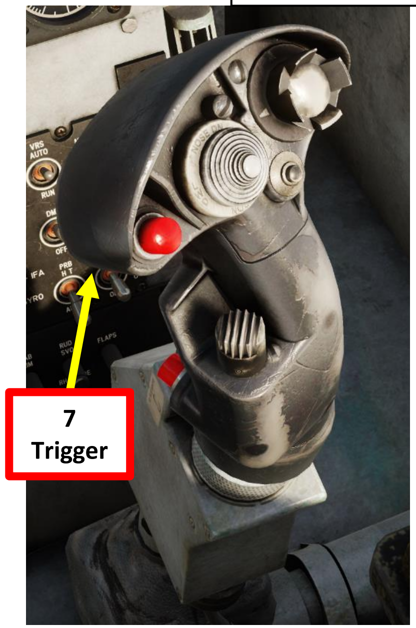
Aircraft	Wingspan (ft)	Reticle Match
F/A-18	45'	-o
Su-25T	47'	-o
A-10C	58'	-o-
Su-24 (swept forward)	58'	-o-
AV-8B	22'	o
Mig-21	23'	o
F5-E	26'	o
Mi-26 (height)	26'	o
C-101	35'	o

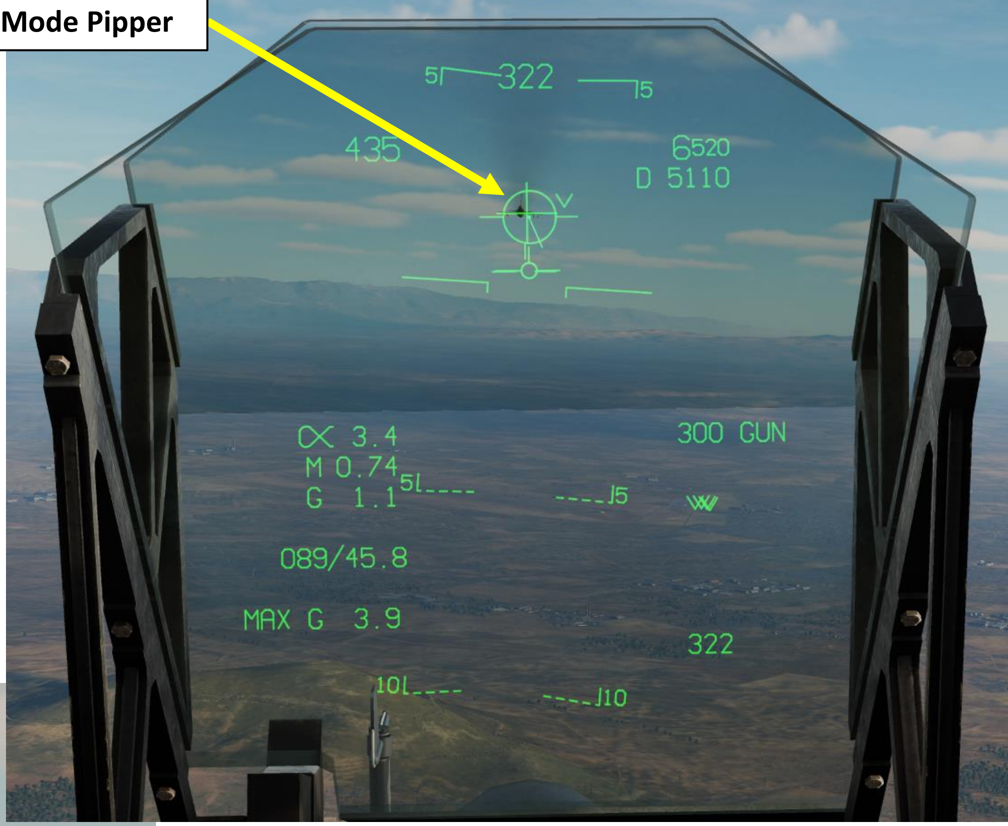




3.1 - GAU-12 Gun Pod (Air-to-Air)

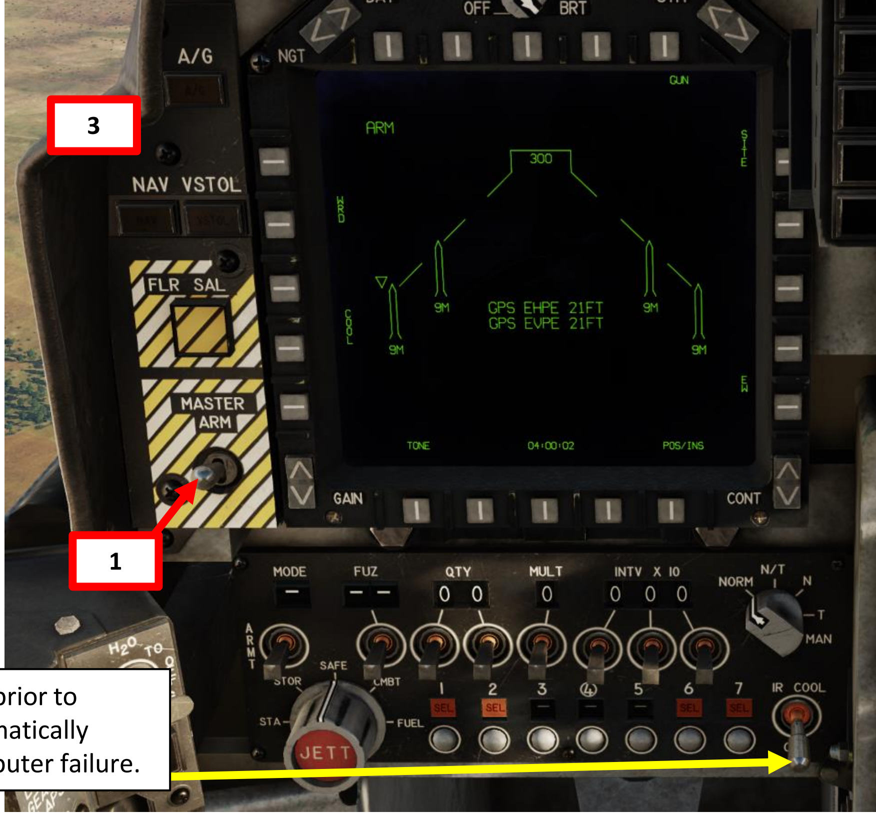
6. Set gun pipper on target.
7. When in range, press the Trigger (Fire Gun - SPACE) button to fire gun.
8. Keep in mind that the gun pod is located to the left and will induce a yaw moment when firing. You will have to compensate it with your rudder.



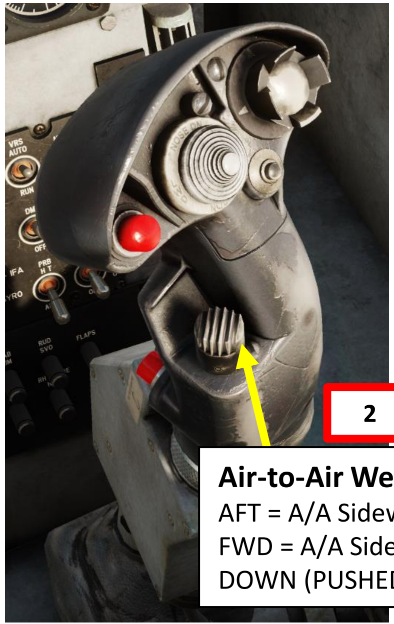


3.2 - AIM-9M SIDEWINDER AIR-TO-AIR MISSILE

1. Set Master Arm switch ON (UP)
2. Set either Air-to-Air Weapon Select switch to AFT (A/A Sidewinder SEAM Mode) or to FWD (A/A Sidewinder Boresight Mode) to power on IR missile seeker. Sidewinder will start a low-pitch growl when seeking.
    - SEAM mode (Sidewinder Expanded Acquisition Mode) will rotate its seeker head around to have a greater field of view.
    - Boresight mode will make the seeker head look straight in front of you with a reduced field of view.
3. Confirm that Air-to-Air Master Mode is selected (A/G, NAV and VSTOL Master Mode lights are extinguished)

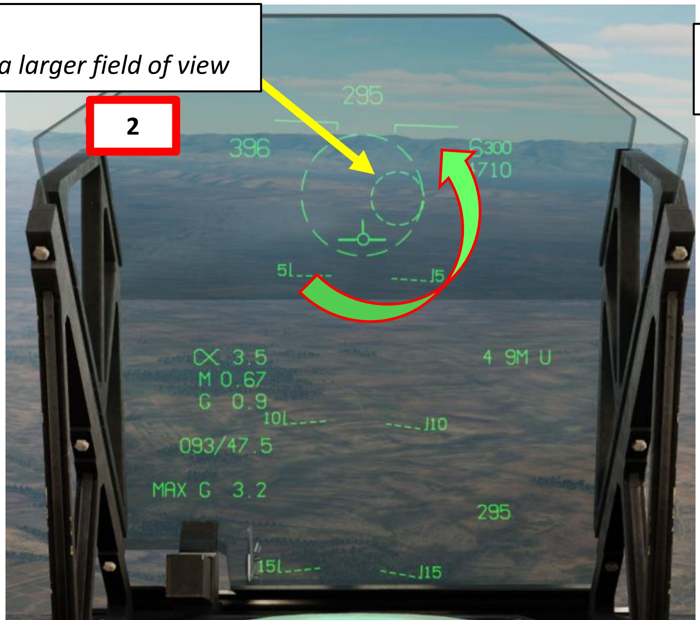


IR COOL is for manually cooling the Sidewinder seekers prior to selecting and arming them (which would normally automatically initiate cooling at this point) or in the case of some computer failure.

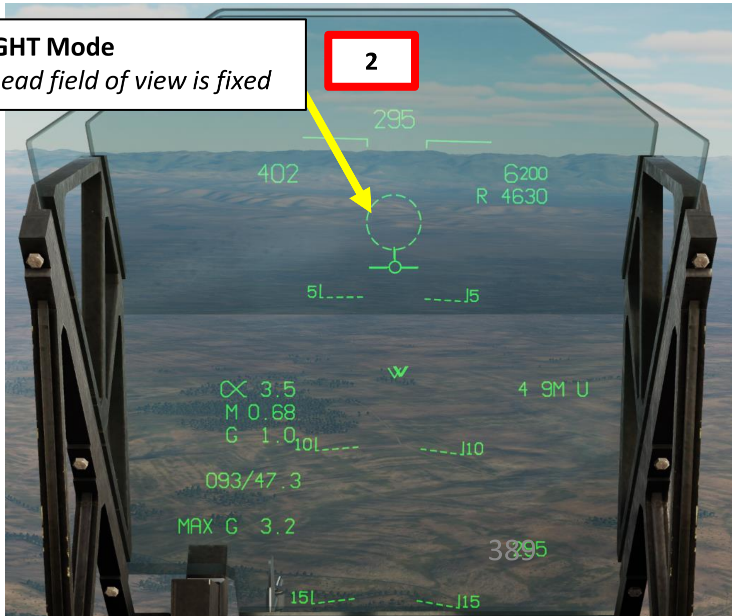


Air-to-Air Weapon Select Switch
AFT = A/A Sidewinder SEAM Mode
FWD = A/A Sidewinder Boresight Mode
DOWN (PUSHED) = Gun Mode

SEAM Mode
Seeker head rotates in a larger field of view

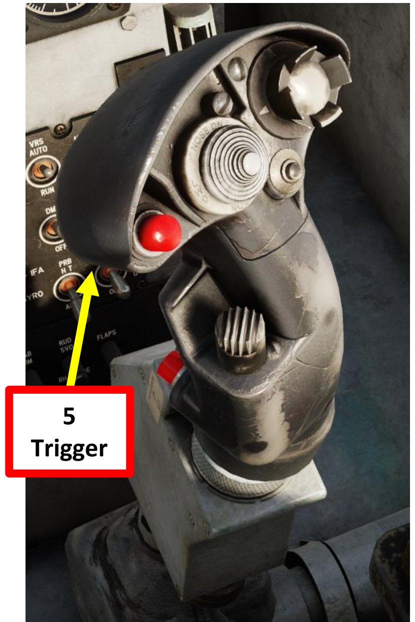


BORESIGHT Mode
Seeker head field of view is fixed



3.2 - AIM-9M SIDEWINDER AIR-TO-AIR MISSILE

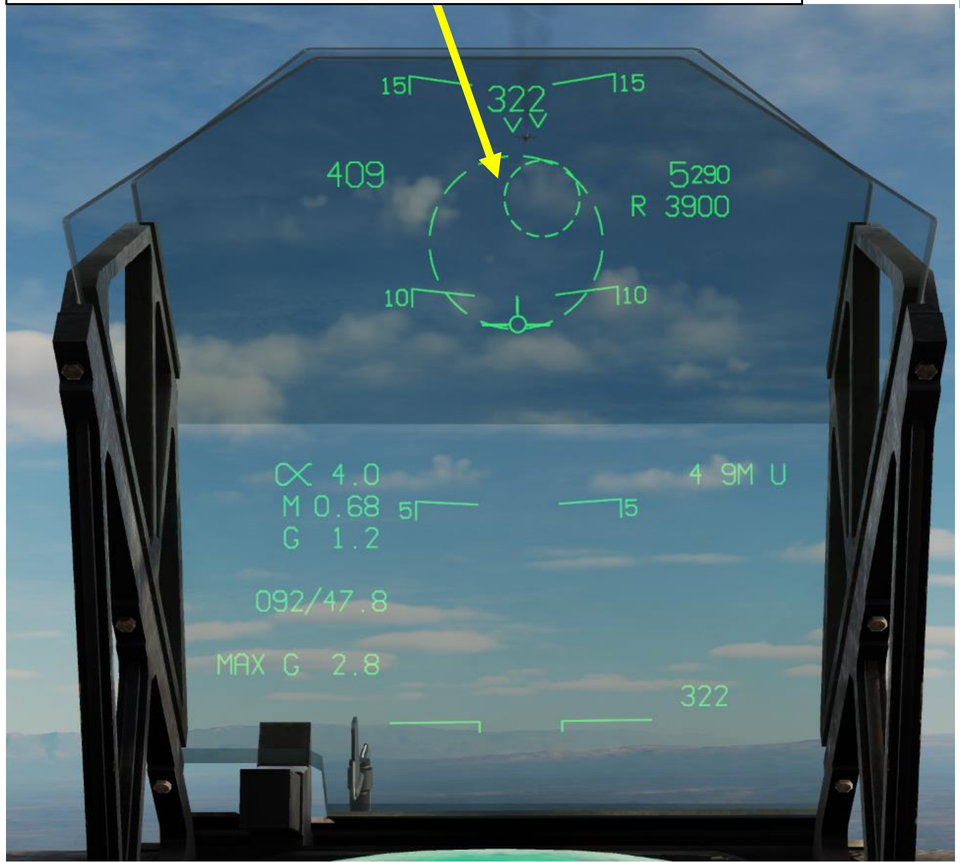
4. When within firing range, the seeker growling will become high-pitched and seeker circle will become full.
5. Press the Trigger (Fire Gun - SPACE) button to fire missile.



5
Trigger

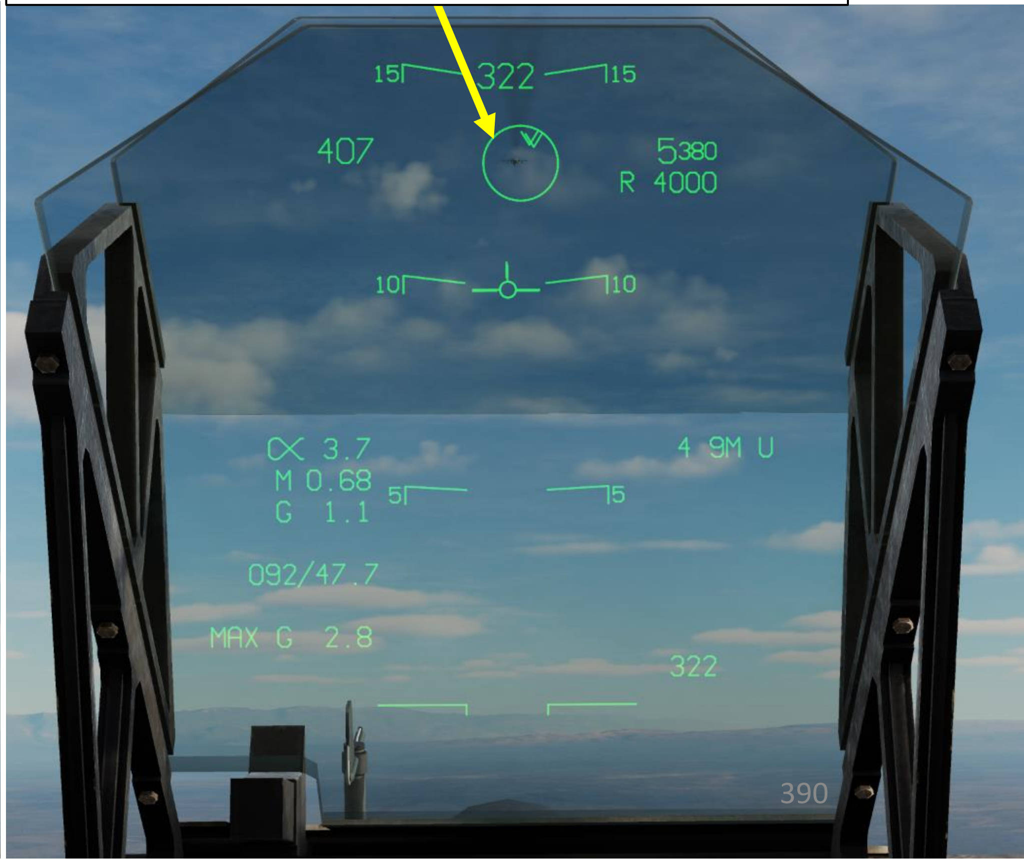
4a

Seeker has not detected heat signature: Low Pitch Growl

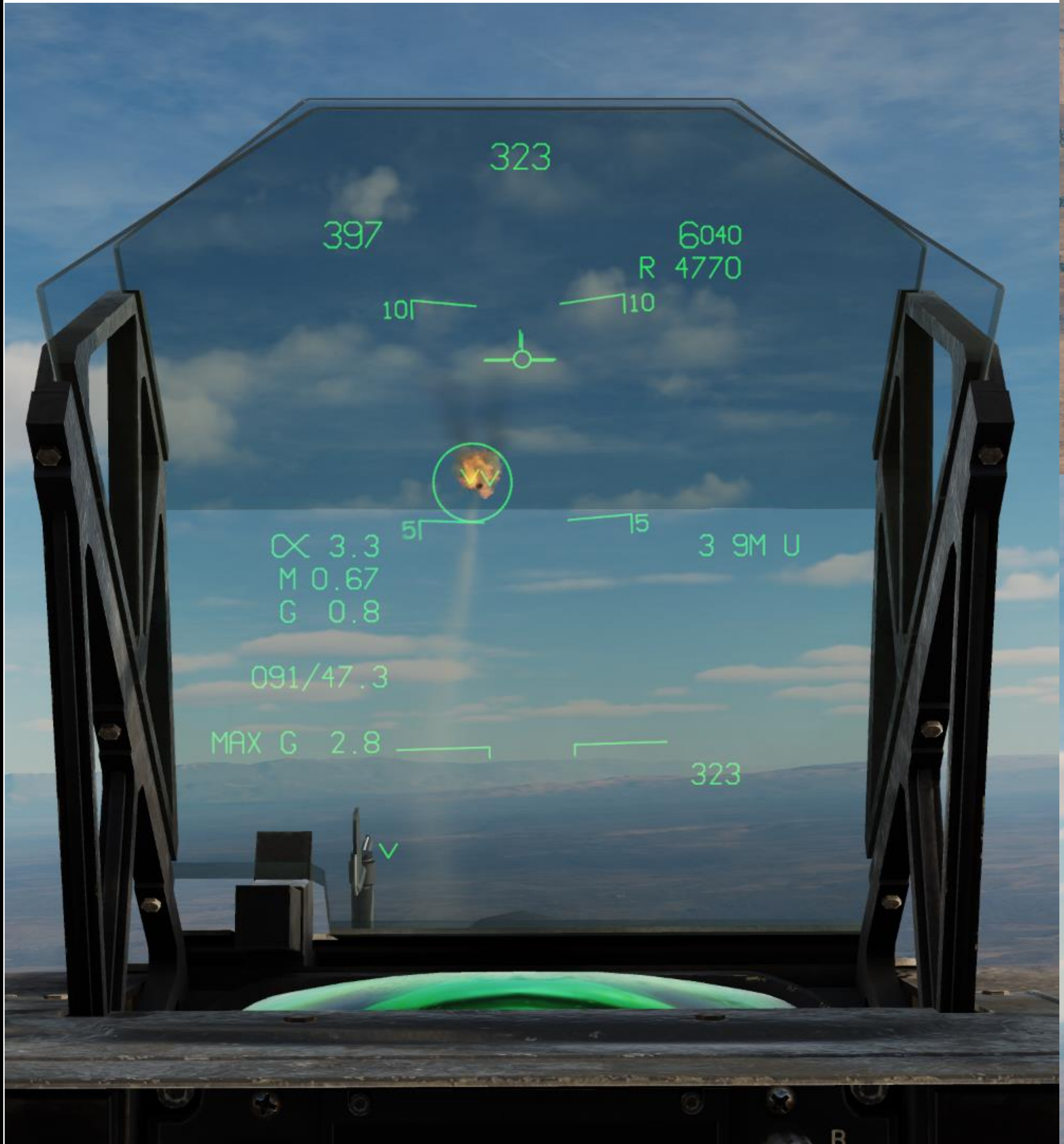


4b

Seeker homing on target’s heat signature: High Pitch Growl



3.2 - AIM-9M SIDEWINDER AIR-TO-AIR MISSILE



4 - MISCELLANEOUS
4.1 - Ordnance Jettison

In situations where you want to jettison your weapons, you can perform the following:

1. Set the Jettison Control white knob to STA (Selected Stations)
2. Press the « SEL » buttons at the stations you wish to jettison (try to avoid having an asymmetric configuration)
3. Alternatively, you can set the Selective Jettison Control Knob to specific preset positions like FUEL to select automatically external fuel tanks.
4. Press the JETT red button to jettison.

Selective Jettison Control
STA: Selected stations
STOR: Selected stores
SAFE: Safety Position
CMBT: Combat
FUEL: External Fuel Tanks
JETT PUSHBUTTON: Jettisons selected ordnance

1


MARINES

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.

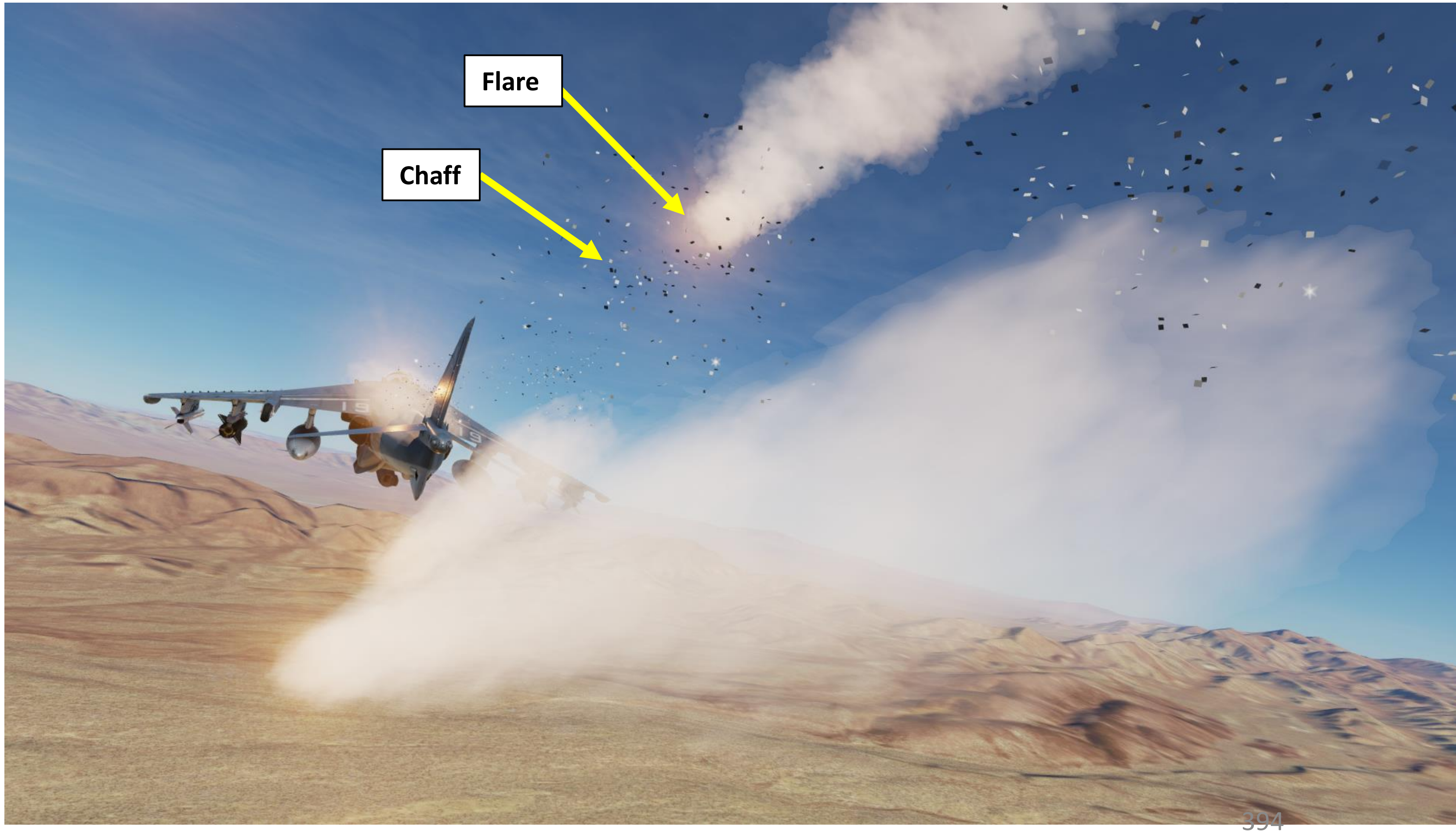
Missiles can generally track you using 2 things: radar signature (radar waves are sent on you and you reflect them, which is called a “radar signature”) and heat signature (like the exhaust of your engines). Countermeasures will only be effective against the kind of weapon it was meant to counter; a 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. Keep in mind that the Harrier **does not have a MLWS** (Missile Launch Warning System), so you cannot know when a missile has been fired at you and is actively tracking you.

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.

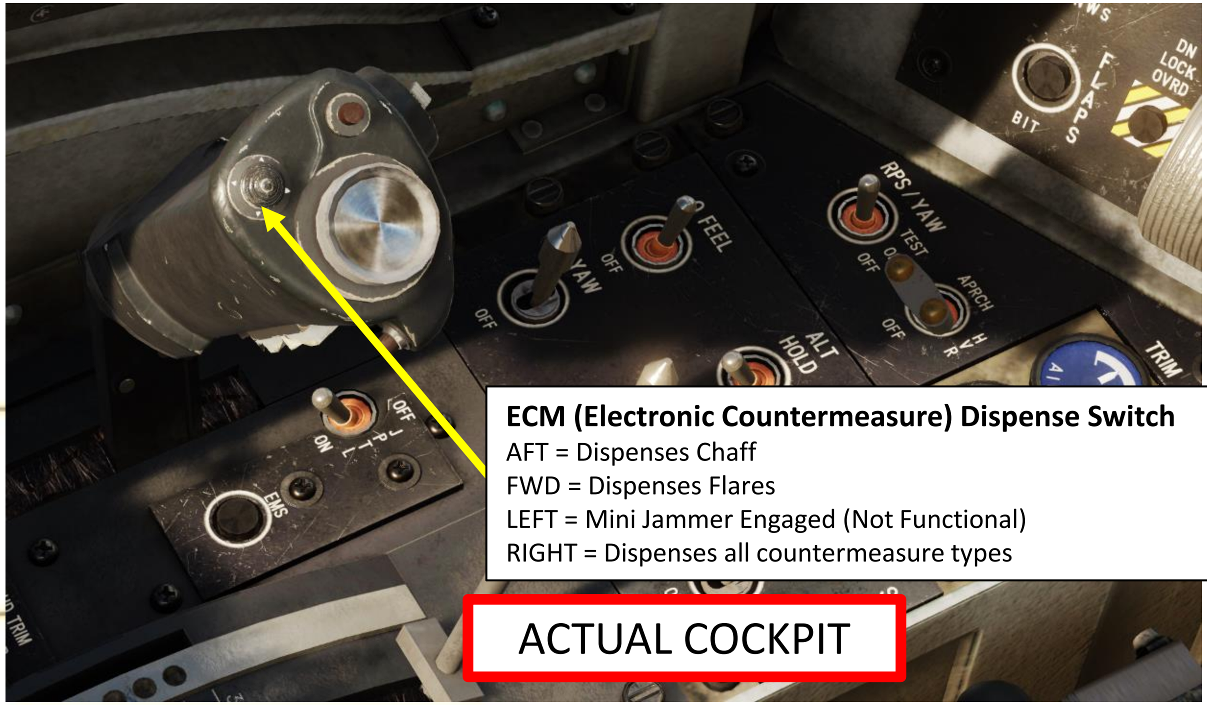
The **AN/ALQ-164 DECM jammer pod** is a form of “continuous” jamming, also called “active” or “transmitted” jamming. This device transmits its own synchronized radar waves back at your enemy’s radar receiver to simulate erroneous radar wave returns. Simply put, active jamming will try to drown a radar 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

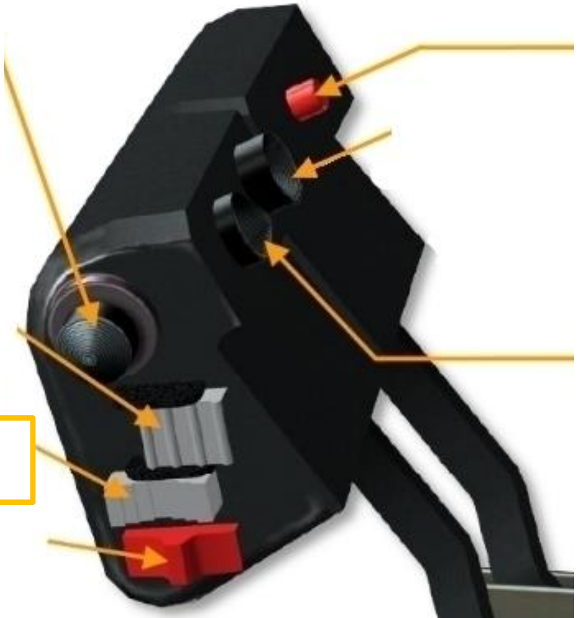
ECM DISPENSE RIGHT: ALL
(Grey button on RHS)



ECM (Electronic Countermeasure) Dispense Switch
AFT = Dispenses Chaff
FWD = Dispenses Flares
LEFT = Mini Jammer Engaged (Not Functional)
RIGHT = Dispenses all countermeasure types

ACTUAL COCKPIT

THRUSTMASTER WARTHOG



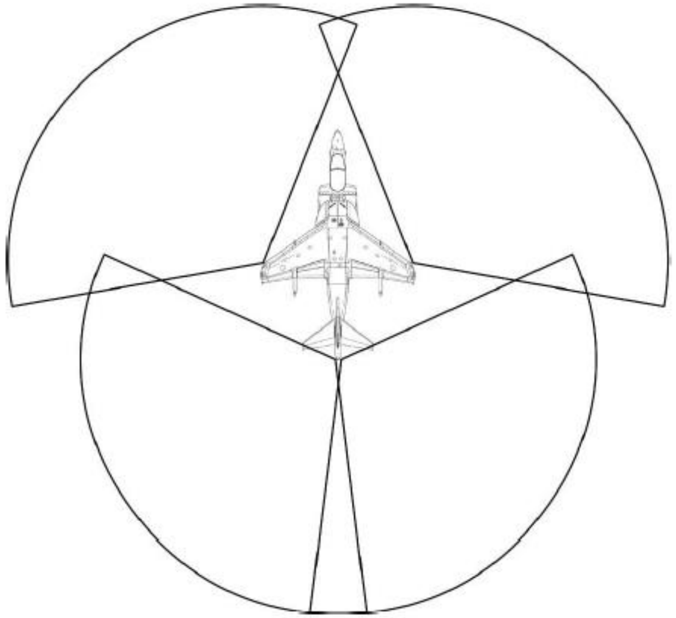
← ECM DISPENSE AFT: CHAFF
→ ECM DISPENSE FWD: FLARES

AN/ALR-67(v) **RWR** (RADAR WARNING RECEIVER)

Your RWR will tell you what is around you with a top-down view, both friendly and enemy contacts. The closer the symbol to the center of the circle, the stronger the radar signal strength.

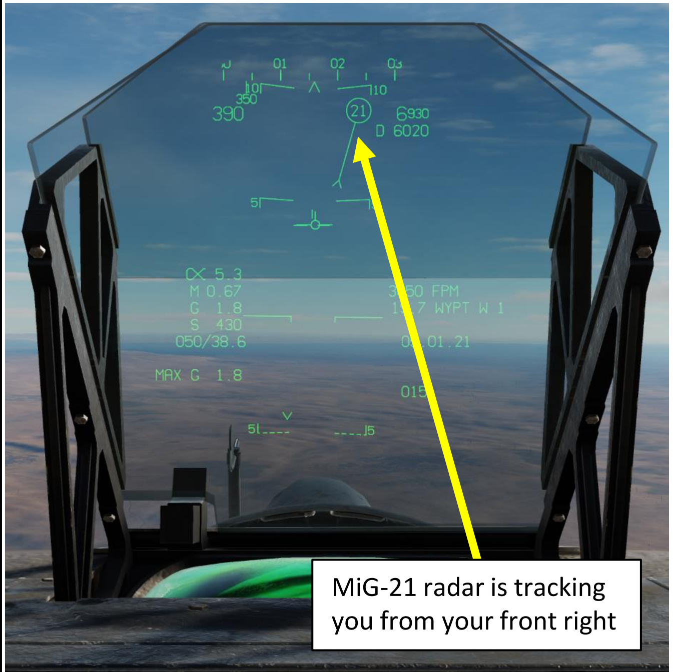
The RWR display consists of 4 concentric circles at predetermined intervals. The circles do not represent range but signal strength and priority. Each detected signal displayed consists of two parts: an alphanumeric code that identifies signal type, and a symbol that indicates emitter platform and priority. The RWR is also displayed on your Heads-Up Display in a top-down view (up is forward, down is aft)

To power up the RWR, just set the RWR selector to ON. You can access the RWR by going in the main MPCD menu and clicking "EW". This enters the EW (Early Warning) page, which is the main interface for all your electronic warfare or countermeasure programming needs.

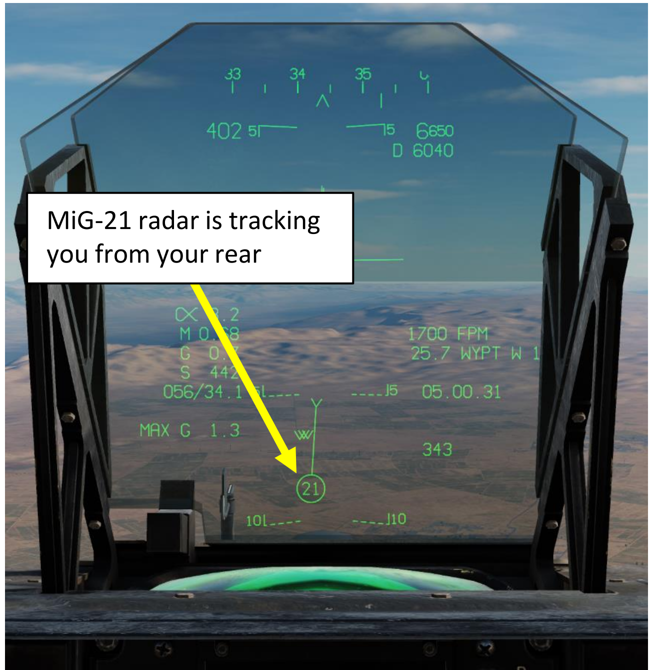


RWR Coverage

MiG-21 radar is locking/tracking you from your rear (symbol blinking)

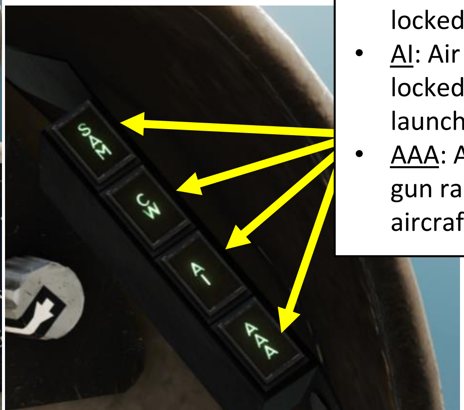


MiG-21 radar is tracking you from your front right



MiG-21 radar is tracking you from your rear

RWR (Radar Warning Receiver) Control Knob
OFF / ON / Volume



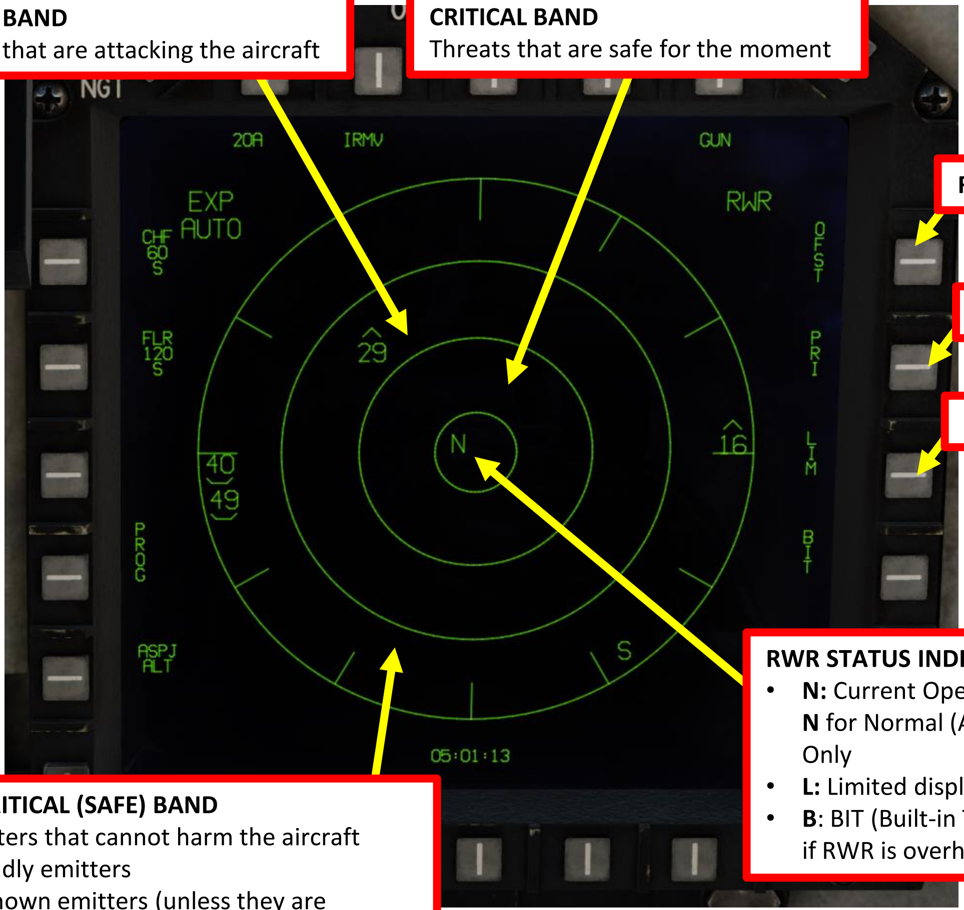
Threat Lights

- SAM: SAM launch detected
- CW: Ground Tracking (Continuous Wave) radar is locked on aircraft
- AI: Air Intercept radar is locked on aircraft (flashes if launch is detected)
- AAA: Anti-Aircraft Artillery gun radar is locked on aircraft.

AN/ALR-67(v) **RWR** (RADAR WARNING RECEIVER)

The "lollypops" indicate threat level for each signal:

- Short stem: Non-Lethal
- Dashed: Lethal
- Long Stem: Critical
- Long Stem with Arrow: Radar Lock
- Flashing long stem with arrow: Missile Launch



LETHAL BAND
Threats that are attacking the aircraft

CRITICAL BAND
Threats that are safe for the moment

RWR Offset Function

RWR Priority Function

RWR Limit Function

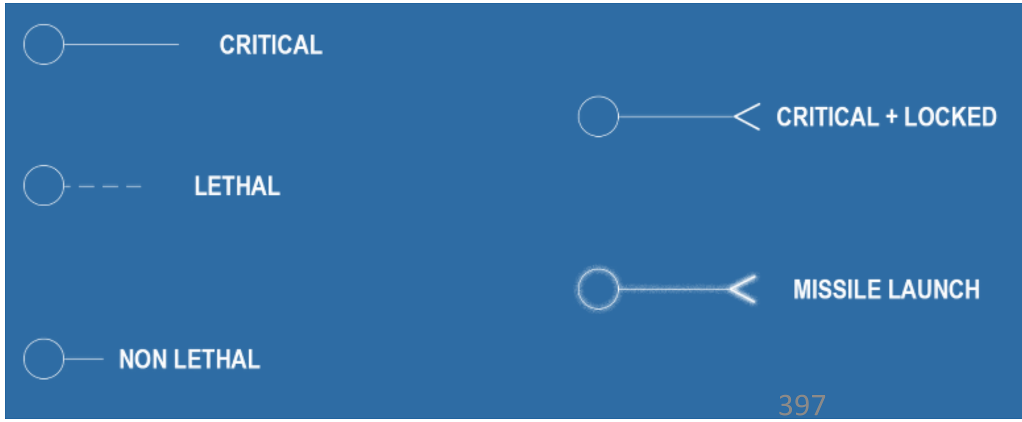
NON-CRITICAL (SAFE) BAND

- Emitters that cannot harm the aircraft
- Friendly emitters
- Unknown emitters (unless they are threatening)

RWR STATUS INDICATOR

- **N:** Current Operational Filter (filters are **N** for Normal (All), and **P** for Priority Only
- **L:** Limited display (6 contacts max)
- **B**: BIT (Built-in Test) Failure. T is shown if RWR is overheated.

"Lollypop"



AN/ALR-67(v) **RWR** (RADAR WARNING RECEIVER)

A steady symbol means that the radar is in search mode (in other words: not tracking you yet).

A flashing symbol indicates that the radar is locking/tracking you. You might be about to receive a missile right up the arse. This is where you prepare to pop chaff, flares, ECM and start your evasive manoeuvers.

Note: "U" symbol stands for "Unknown", which is sometimes attributed to ships.

Threat Symbology

Primary threat as dictated by the RWR

Threat is tracking your aircraft / Threat has locked your aircraft

Newest detected threat

Airborne threat

A symbol without a circle around it means that the radar is in search mode and is not tracking your airplane yet.

A symbol with steady circle around it means that the radar is tracking you, but the missile has not been shot at you yet.

A symbol with a flashing circle around it means that the radar is supporting a missile shot at you.

List made by .408-X~RAY

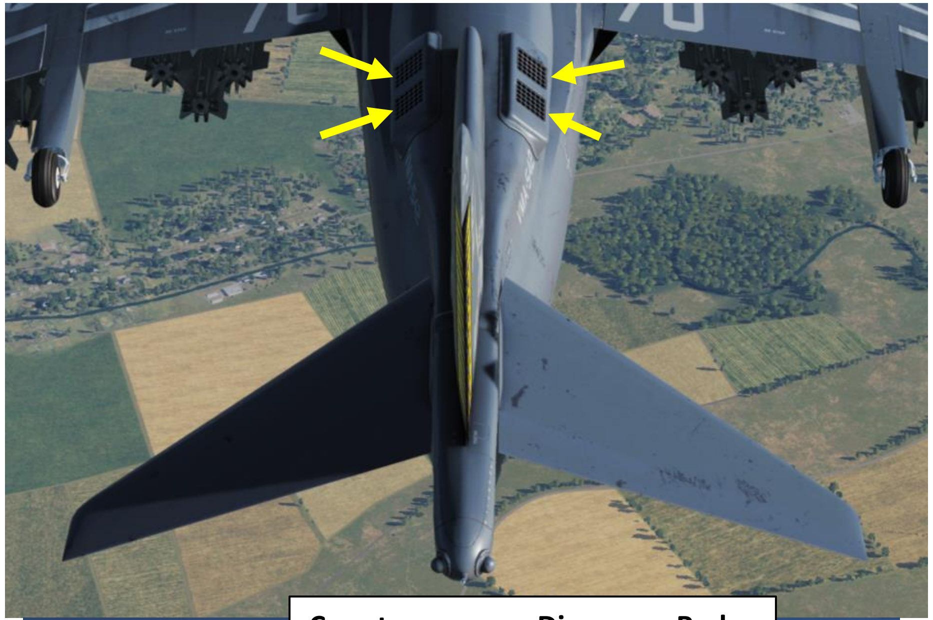
RWR	Name
3	S125 TR SNR
6	Kub STR 9S91
8	Osa 9A33
10	RLS 5H63C
10	S300PS TR 30N6
11	BUK LL
11	Buk LN 9A310M1
11	F-111
12	RLS 9C32 1
12	S300V 9A82
12	S300V 9A83
13	C-130
13	Strela-9A35M3
14	F-14
15	F-15
15	Tor 9A331
16	F-16
17	C-17
18	FA-18
22	Tu-22M3
23	MIG-23
24	Su-24
25	MiG-25P
29	MIG-29
29	Su-27
29	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

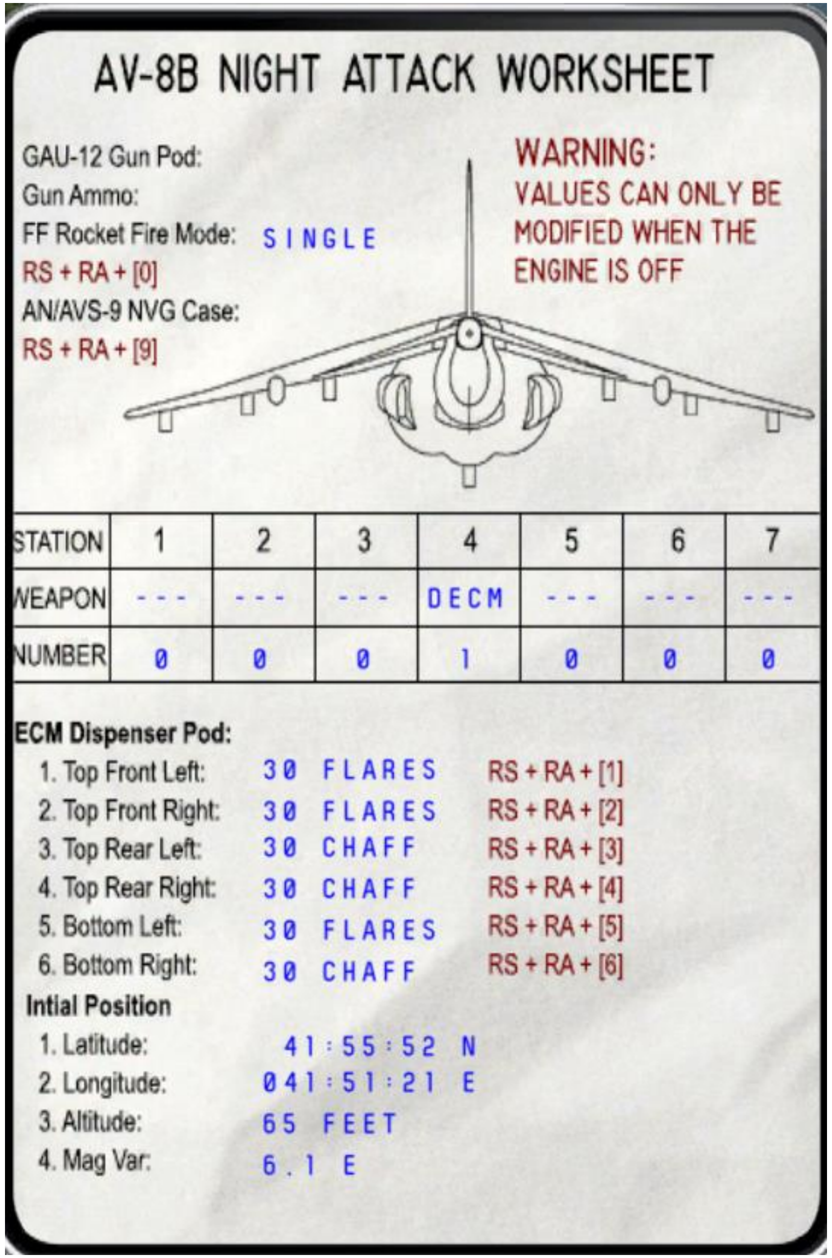
COUNTERMEASURES – CHAFF & FLARES (EXPENDABLES)
Dispenser Pods

An important note about chaff and flares is that individual dispenser pods can be set on the ground by the ground crew by opening the kneeboard (RSHIFT+K), then pressing the right keys to cycle between chaff and flare pods (i.e. RSHIFT+RALT+1 will cycle the Top Front Left dispenser between 30 flares and 30 chaff).

Keep in mind that the engine needs to be OFF when performing these changes.



Countermeasure Dispenser Pods



AV-8B NIGHT ATTACK WORKSHEET

GAU-12 Gun Pod:
Gun Ammo:
FF Rocket Fire Mode: SINGLE
RS + RA + [0]
AN/AVS-9 NVG Case:
RS + RA + [9]

WARNING:
VALUES CAN ONLY BE MODIFIED WHEN THE ENGINE IS OFF

STATION	1	2	3	4	5	6	7
WEAPON	- - -	- - -	- - -	DECM	- - -	- - -	- - -
NUMBER	0	0	0	1	0	0	0

ECM Dispenser Pod:

1. Top Front Left: 30 FLARES RS + RA + [1]
2. Top Front Right: 30 FLARES RS + RA + [2]
3. Top Rear Left: 30 CHAFF RS + RA + [3]
4. Top Rear Right: 30 CHAFF RS + RA + [4]
5. Bottom Left: 30 FLARES RS + RA + [5]
6. Bottom Right: 30 CHAFF RS + RA + [6]

Intial Position

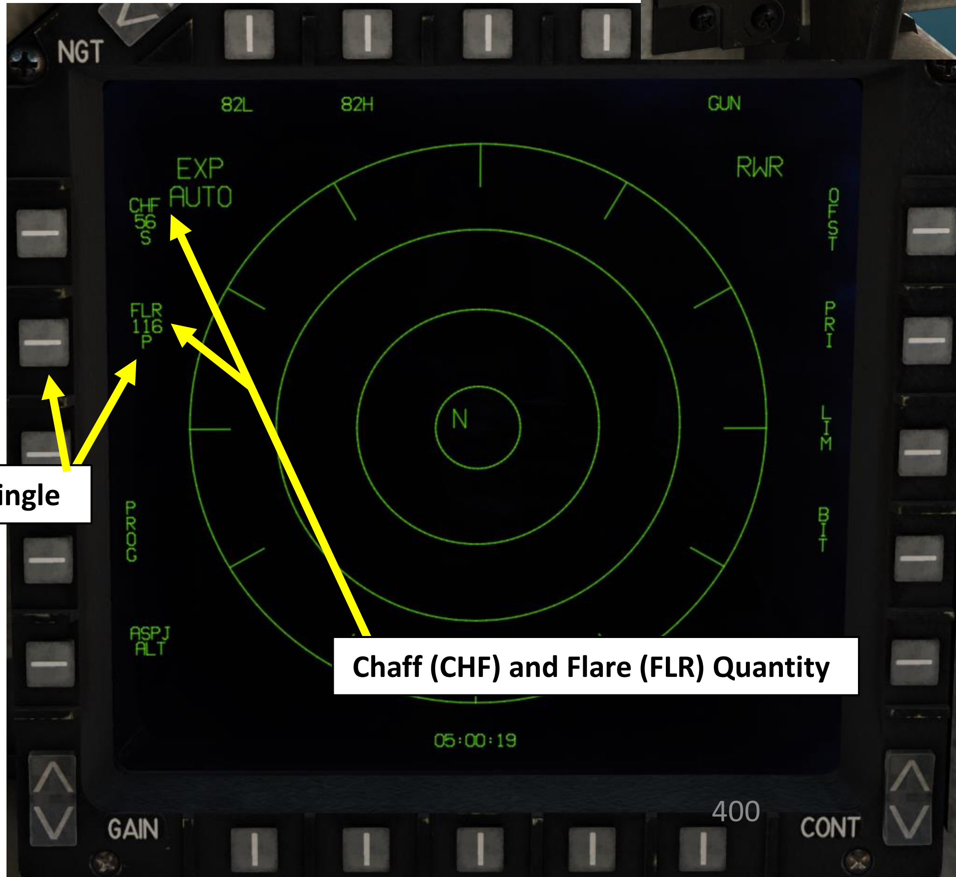
1. Latitude: 41:55:52 N
2. Longitude: 041:51:21 E
3. Altitude: 65 FEET
4. Mag Var: 6.1 E

COUNTERMEASURES – CHAFF & FLARES Release Procedure

1. Set Expendables Dispenser Control Knob to desired mode (preferably AUTO)
2. Set CHF and FLR release parameters to P (Program) or S (Single) by clicking the OSB next to their quantity in the EW (Electronic Warfare) page.
3. To dispense chaff or flares, use the ECM DISPENSE AFT/FWD/RIGHT switches (8, 7 and 0 key bindings)
4. Flare & Chaff counters are available on the EW RWR page.

ECM (Electronic Countermeasure) Dispense Switch
AFT = Dispenses Chaff
FWD = Dispenses Flares
LEFT = Mini Jammer Engaged (Not Functional)
RIGHT = Dispenses all countermeasure types

Expendables Dispenser Control Knob
OFF: No Power
AUT: Dispenser selected automatically
UP: Dispensers on top of aft fuselage used first
DOWN: Dispensers on bottom of aft fuselage used first
RWR: Option not available



P = Program, S = Single

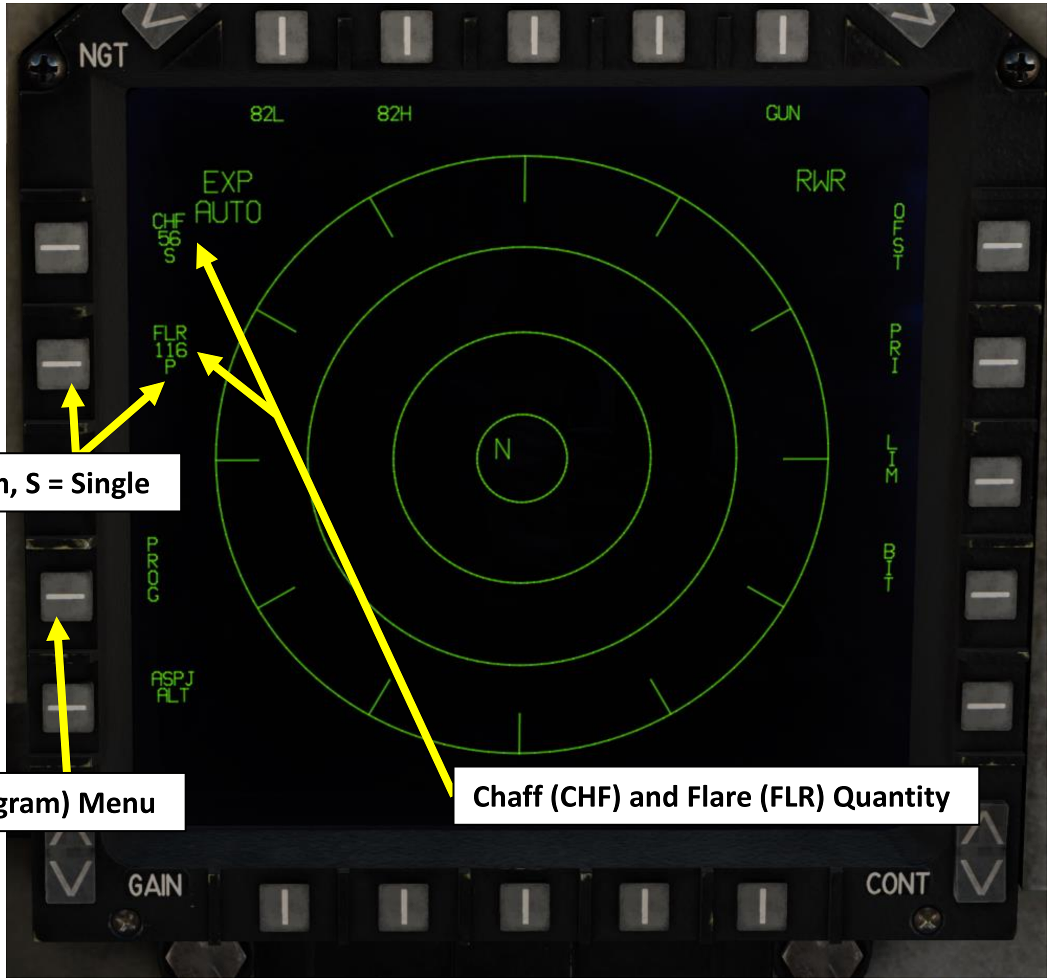
Chaff (CHF) and Flare (FLR) Quantity

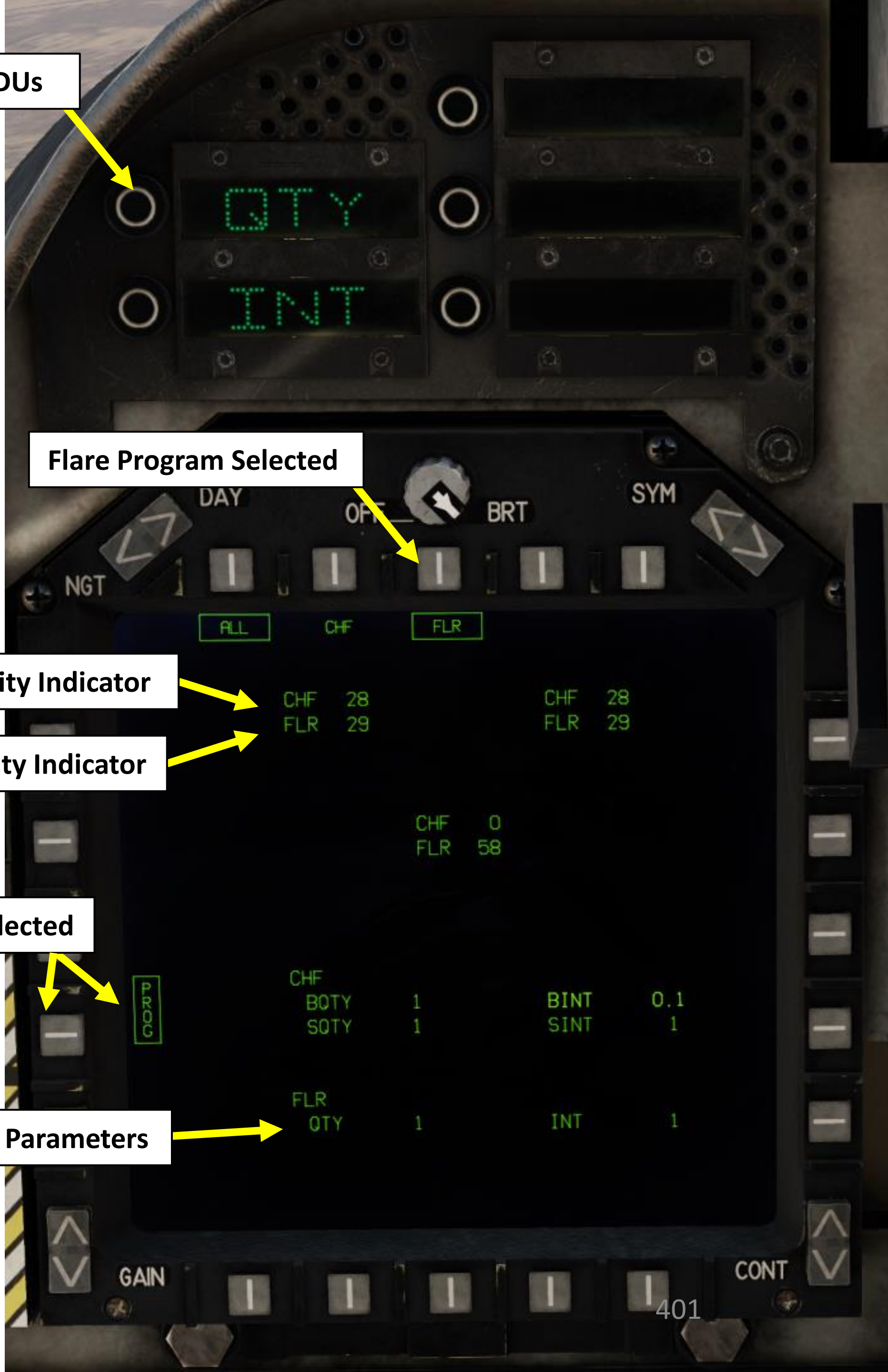
COUNTERMEASURES – CHAFF & FLARES
Countermeasure Programs

Countermeasure release programs can be modified via the EW page. Access the Countermeasures PROG (Program) page by going in the main MPCD menu, selecting the OSB next to "EW" and then selecting the OSB next to PROG. You can then select if you want to program Chaff (CHF) or Flares (FLR).

Two parameters are customizable for **Flares** (needs the "P" mode next to Quantity):

- **QTY**: Quantity determines how many flare in total will be release per press of the ECM switch FWD.
- **INT**: Interval determines time between each flare (seconds).



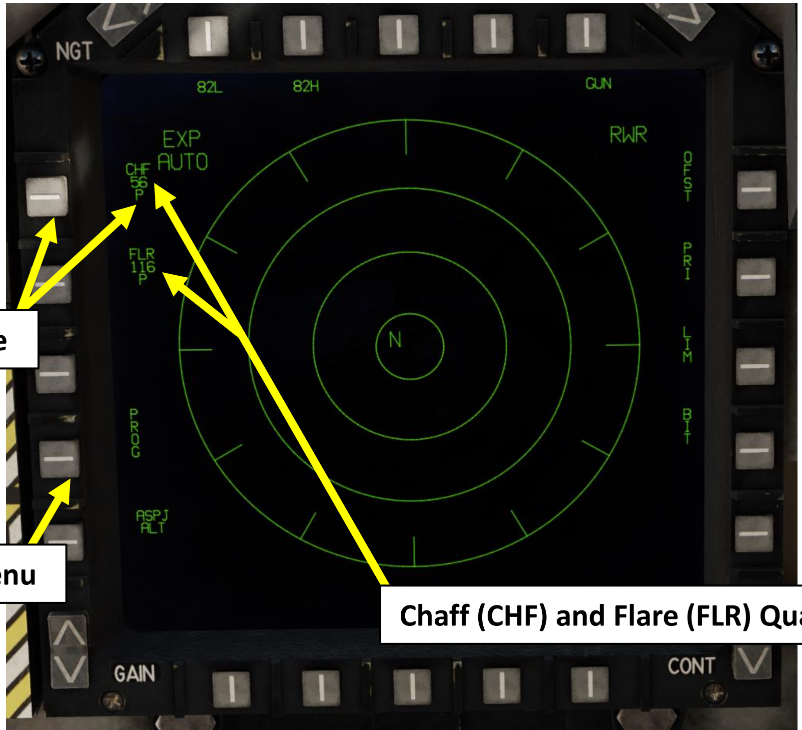


COUNTERMEASURES – CHAFF & FLARES
Countermeasure Programs

Four parameters are customizable for **Chaff** (needs the "P" mode next to Quantity):

- **BQTY**: Burst Quantity determines number of chaff released in each burst.
  - NUM parameter lets you set desired number of chaff
  - CONT parameter continues to release chaff until they are depleted
  - RND parameters randomly dispenses between 1 and 6 expendables in each burst
- **BINT**: Burst Interval determines time that will pass between release of each chaff in the given burst. Can be set between 0.1 and 1.5 sec.
- **SQTY**: Salvo Quantity. Each salvo is a full burst cycle, so the number of chaff released at the set interval for the burst option.
- **SINT**: Salvo Interval. Interval between the salvos. Can be set between 1 and 15 sec.

Example:
BQTY 3 / BINT 0.5 / SQTY 3 / SINT 5
Upon ECM switch press, 1 chaff will be released every 0.5 sec. 5 seconds later, three more chaff will be released with 0.5 sec interval. Another 5 seconds later, three more chaff will be released every 0.5 sec.



P = Program, S = Single

PROG (Program) Menu

Chaff (CHF) and Flare (FLR) Quantity

Chaff Parameter ODUs

Chaff Program Selected

Chaff Quantity Indicator

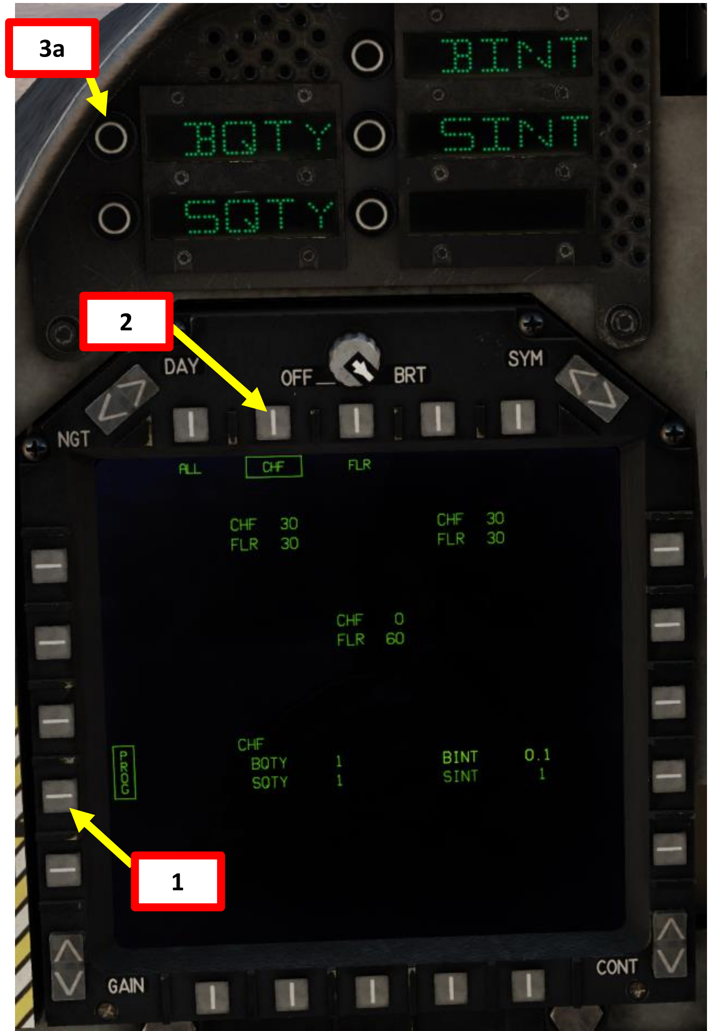
Flare Quantity Indicator

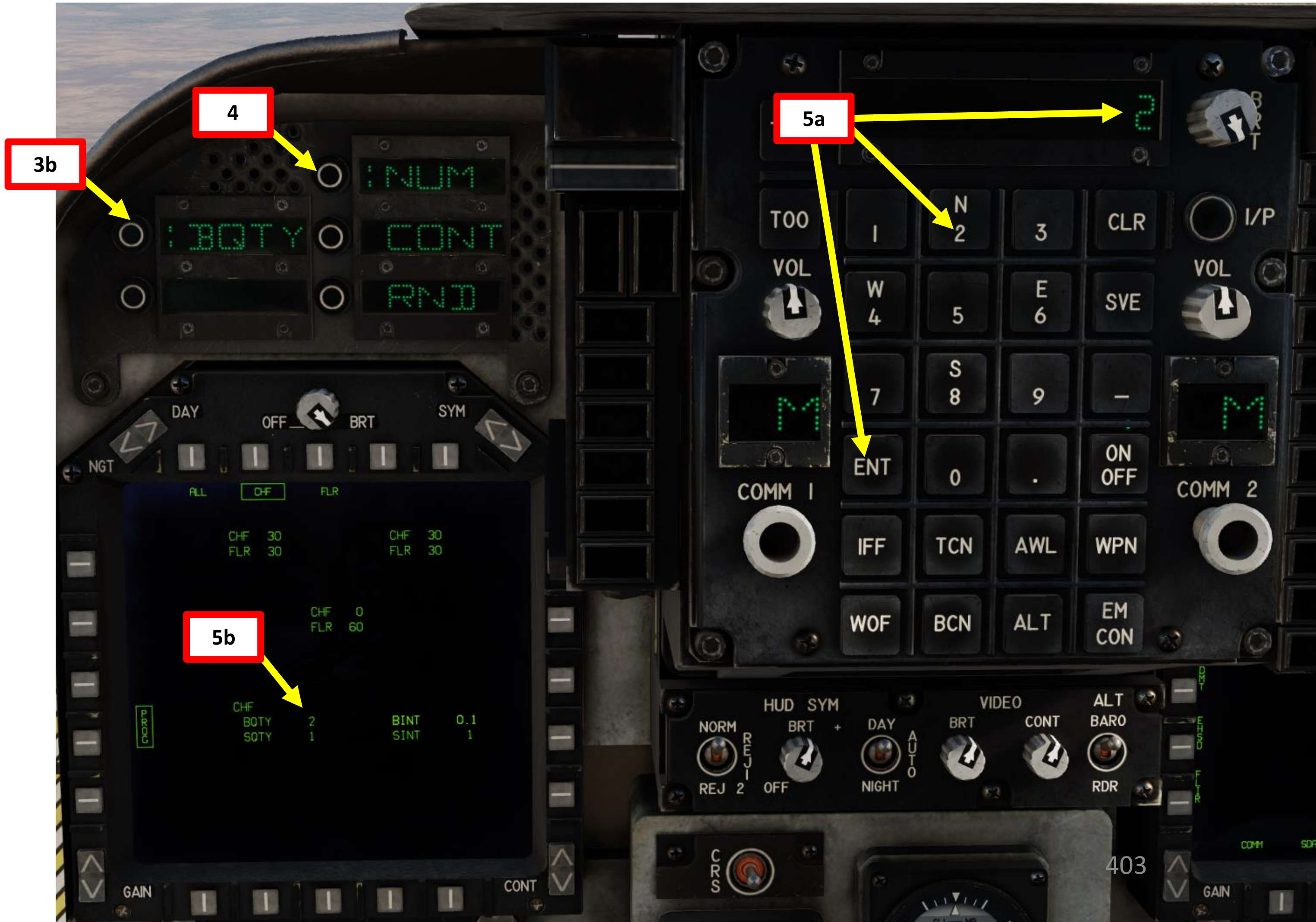
PROG page selected

Chaff Program Parameters

COUNTERMEASURES – CHAFF & FLARES
Countermeasure Programs

To modify a parameter of the program:
1. From the EW page, select PROG menu
2. Select either CHF (Chaff) or FLR (Flare) release program
3. Select parameter that you want to modify with ODU (Option Display Unit) buttons. In our case, we will choose Burst Quantity (BQTY).
4. Choose any sub-parameter if required (we will choose NUM for Number of Chaff).
5. Enter the new value on the UFC scratchpad, then press "ENT".



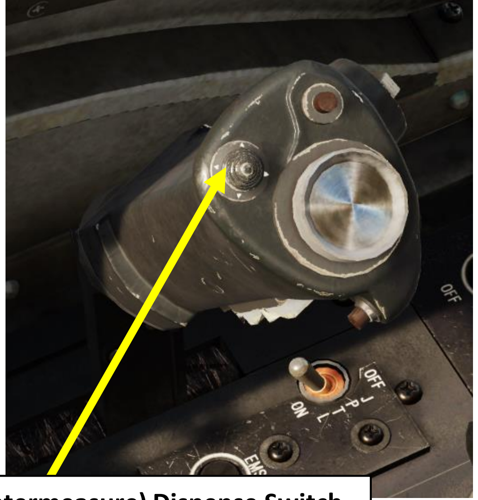


AN/ALQ-164 **DECM** JAMMER POD (DEFENSIVE ELECTRONIC COUNTERMEASURES)

The DECM Jammer pod needs to be equipped on the ground and is externally mounted on the aircraft. It uses the ALQ-126B Charger Blue to counter pulse threats and the ALQ-162 Compass Sail to counter CW (Continuous Wave threats) like SARH (Semi-Active Radar Homing) missiles like the AIM-7 Sparrow.

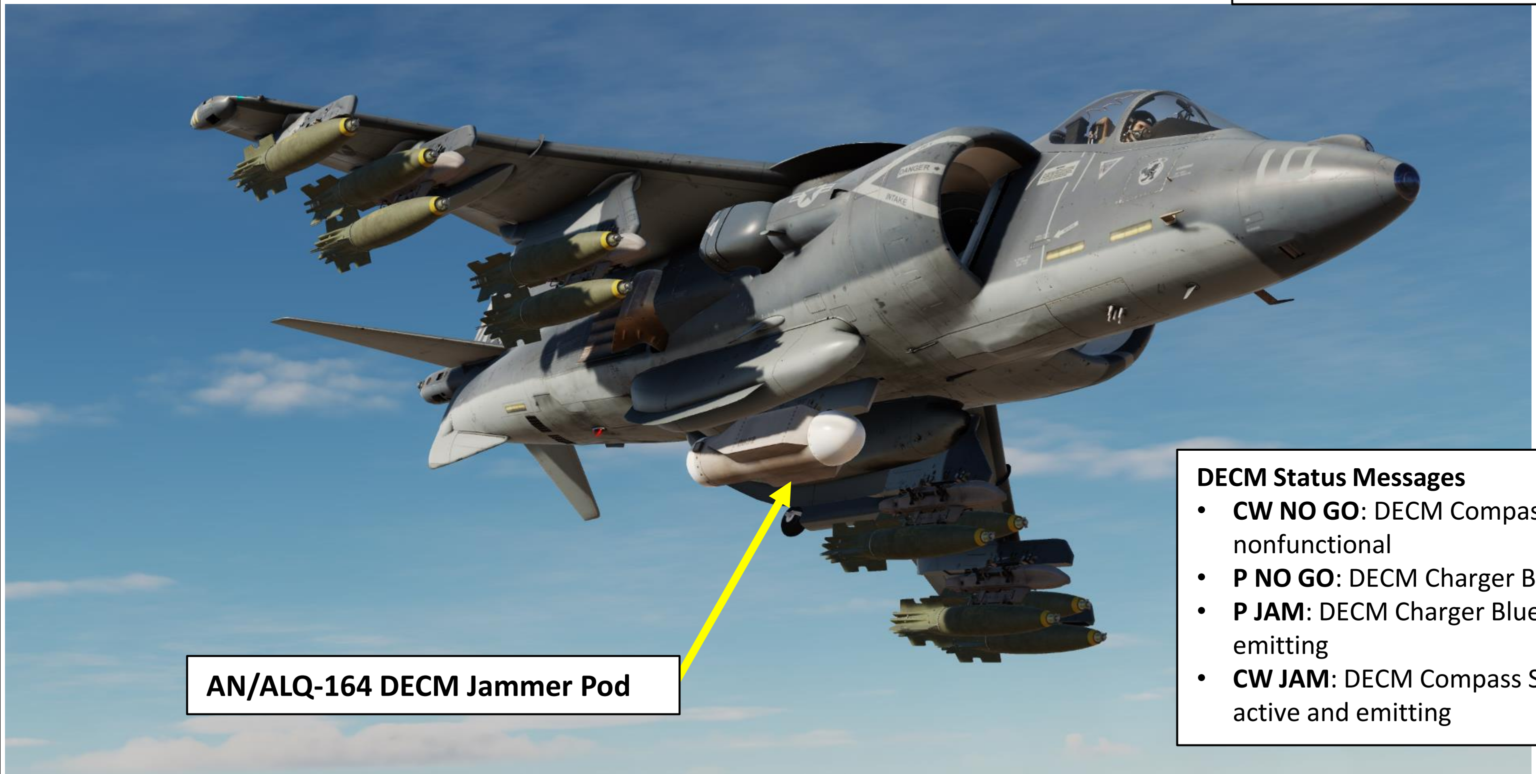
The **Charger Blue** provides deceptive jamming against pulse-doppler threats in the E-J bands (2-18 GHz frequency range), which includes most radars on fighter aircraft from the 1960's. However, the Charger Blue does not have any capability against CW threats, therefore it is paired with a **Compass Sail**, which jams radar waves in the H-J bands (6-20 GHz frequency range) in a 120-degree beam width.

To use DECM, set the ECM Control Knob in the desired position (STBY when not needed, RCV if you want to avoid detection, and RPT when being actively tracked by a radar).



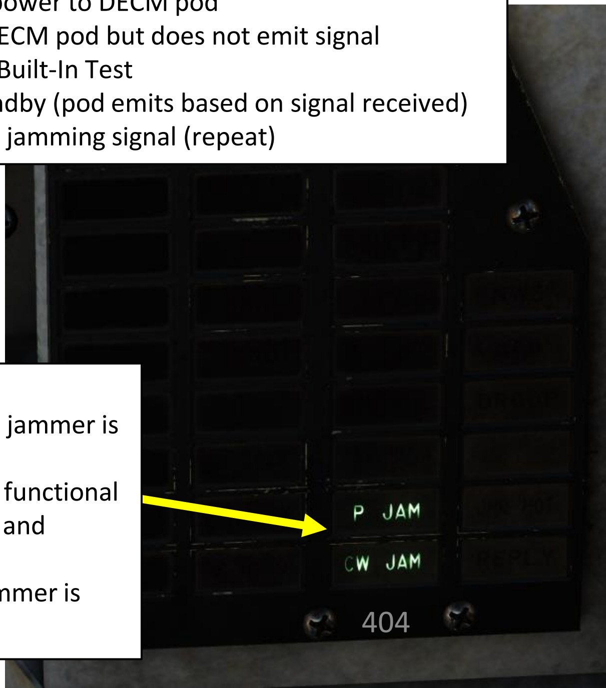
ECM (Electronic Countermeasure) Dispense Switch
AFT = Dispenses Chaff
FWD = Dispenses Flares
LEFT = Mini Jammer Engaged (Not Functional)
RIGHT = Dispenses all countermeasure types

ECM (Electronic Countermeasure) Control Knob
OFF: Removes power to DECM pod
STBY: Powers DECM pod but does not emit signal
BIT: DECM pod Built-In Test
RCV: Smart Standby (pod emits based on signal received)
RPT: Continuous jamming signal (repeat)



AN/ALQ-164 DECM Jammer Pod

DECM Status Messages
- **CW NO GO**: DECM Compass Sail Continuous Wave jammer is nonfunctional
- **P NO GO**: DECM Charger Blue pulse jammer is not functional
- **P JAM**: DECM Charger Blue pulse jammer is active and emitting
- **CW JAM**: DECM Compass Sail continuous wave jammer is active and emitting



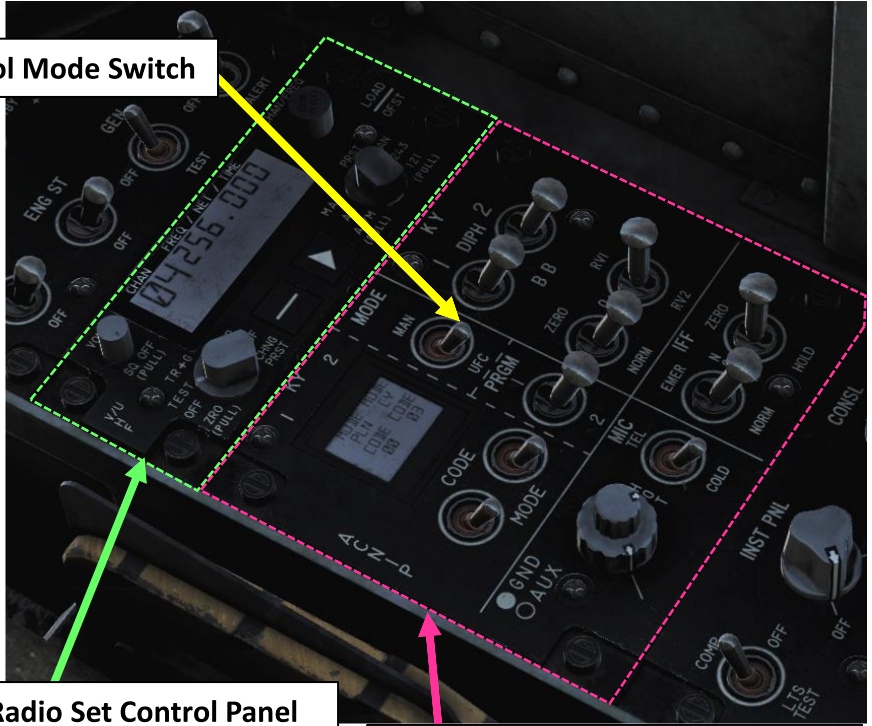
ARC-210 RADIO - INTRO

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 Harrier has two radios installed: COM1 and COM2. They are independent and have 26 preset channels each. The preset frequencies are set in the mission editor.

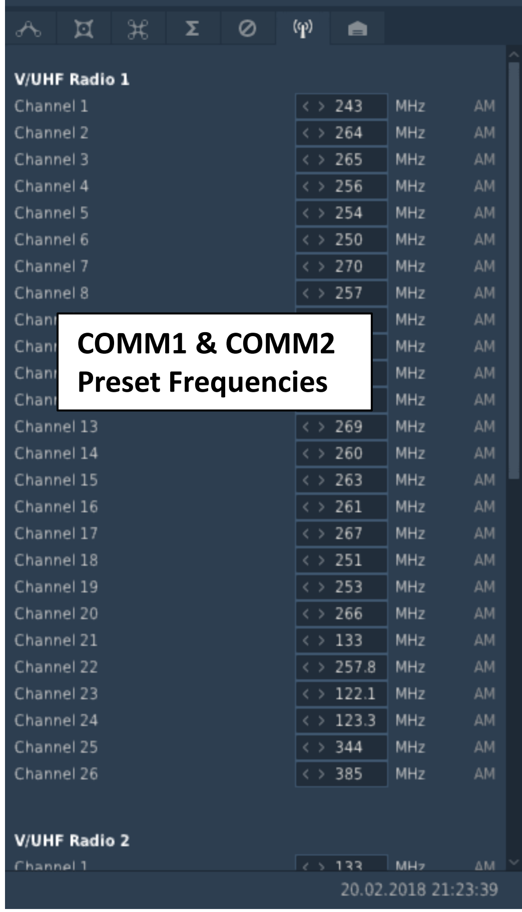
You can control the radio through two interfaces: the Up-Front Control (UFC) and through the ACNIP and V/UHF Radio Set Control (RSC). The radio has 2 operating modes: through UFC (Upfront Control) or MANUAL (through the ACNIP and RSC). You can toggle between UFC and MANUAL mode with the MODE switch on the ACNIP panel. Take note that the MANUAL mode is primarily used as an emergency mode for in-flight failures of the UFC.

V/UHF Radio Control Mode Switch



V/UHF Radio Set Control Panel

ACNIP (Auxiliary Communication, Navigation, Identification Panel)



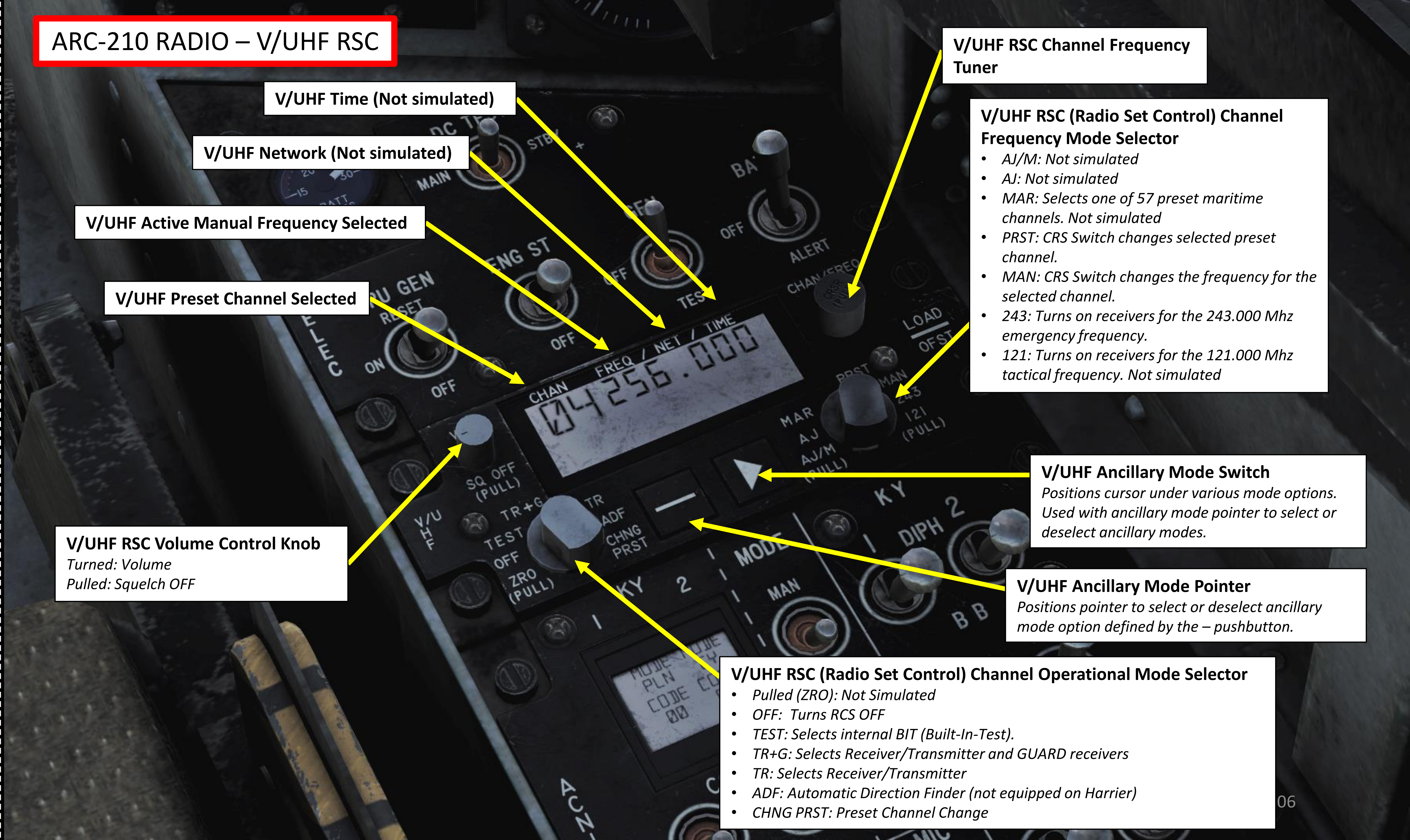
COMM1 & COMM2 Preset Frequencies

UFC: Up Front Control

COMM AFT: Select COMM 2	HOTAS	LCtrl + Num+	JOY_BTN3
COMM FWD: Select COMM 1	HOTAS	LCtrl + Num-	JOY_BTN5

COMMS Switch
FWD = Selects COMM 1
AFT = Selects COMM 2

ARC-210 RADIO – V/UHF RSC



V/UHF Time (Not simulated)

V/UHF Network (Not simulated)

V/UHF Active Manual Frequency Selected

V/UHF Preset Channel Selected

V/UHF RSC Volume Control Knob
Turned: Volume
Pulled: Squelch OFF

V/UHF RSC Channel Frequency Tuner

V/UHF RSC (Radio Set Control) Channel Frequency Mode Selector

- *AJ/M: Not simulated*
- *AJ: Not simulated*
- *MAR: Selects one of 57 preset maritime channels. Not simulated*
- *PRST: CRS Switch changes selected preset channel.*
- *MAN: CRS Switch changes the frequency for the selected channel.*
- *243: Turns on receivers for the 243.000 Mhz emergency frequency.*
- *121: Turns on receivers for the 121.000 Mhz tactical frequency. Not simulated*

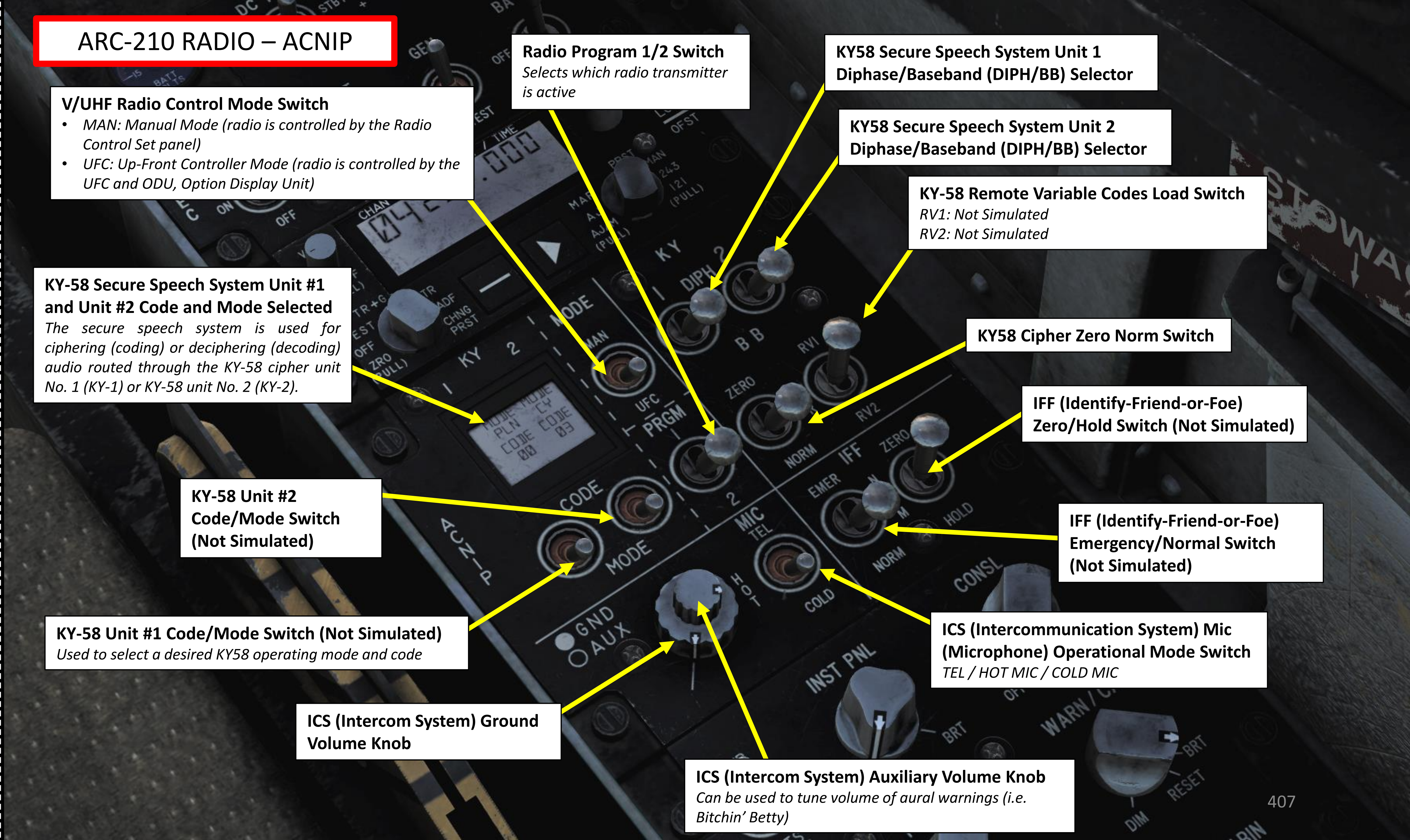
V/UHF Ancillary Mode Switch
Positions cursor under various mode options. Used with ancillary mode pointer to select or deselect ancillary modes.

V/UHF Ancillary Mode Pointer
Positions pointer to select or deselect ancillary mode option defined by the – pushbutton.

V/UHF RSC (Radio Set Control) Channel Operational Mode Selector

- *Pulled (ZRO): Not Simulated*
- *OFF: Turns RCS OFF*
- *TEST: Selects internal BIT (Built-In-Test).*
- *TR+G: Selects Receiver/Transmitter and GUARD receivers*
- *TR: Selects Receiver/Transmitter*
- *ADF: Automatic Direction Finder (not equipped on Harrier)*
- *CHNG PRST: Preset Channel Change*

ARC-210 RADIO – ACNIP



V/UHF Radio Control Mode Switch
- *MAN: Manual Mode (radio is controlled by the Radio Control Set panel)*
- *UFC: Up-Front Controller Mode (radio is controlled by the UFC and ODU, Option Display Unit)*

Radio Program 1/2 Switch
Selects which radio transmitter is active

KY58 Secure Speech System Unit 1 Diphase/Baseband (DIPH/BB) Selector

KY58 Secure Speech System Unit 2 Diphase/Baseband (DIPH/BB) Selector

KY-58 Remote Variable Codes Load Switch
RV1: Not Simulated
RV2: Not Simulated

KY-58 Secure Speech System Unit #1 and Unit #2 Code and Mode Selected
The secure speech system is used for ciphering (coding) or deciphering (decoding) audio routed through the KY-58 cipher unit No. 1 (KY-1) or KY-58 unit No. 2 (KY-2).

KY58 Cipher Zero Norm Switch

IFF (Identify-Friend-or-Foe) Zero/Hold Switch (Not Simulated)

KY-58 Unit #2 Code/Mode Switch (Not Simulated)

IFF (Identify-Friend-or-Foe) Emergency/Normal Switch (Not Simulated)

KY-58 Unit #1 Code/Mode Switch (Not Simulated)
Used to select a desired KY58 operating mode and code

ICS (Intercommunication System) Mic (Microphone) Operational Mode Switch
TEL / HOT MIC / COLD MIC

ICS (Intercom System) Ground Volume Knob

ICS (Intercom System) Auxiliary Volume Knob
Can be used to tune volume of aural warnings (i.e. Bitchin' Betty)

ARC-210 RADIO - UFC

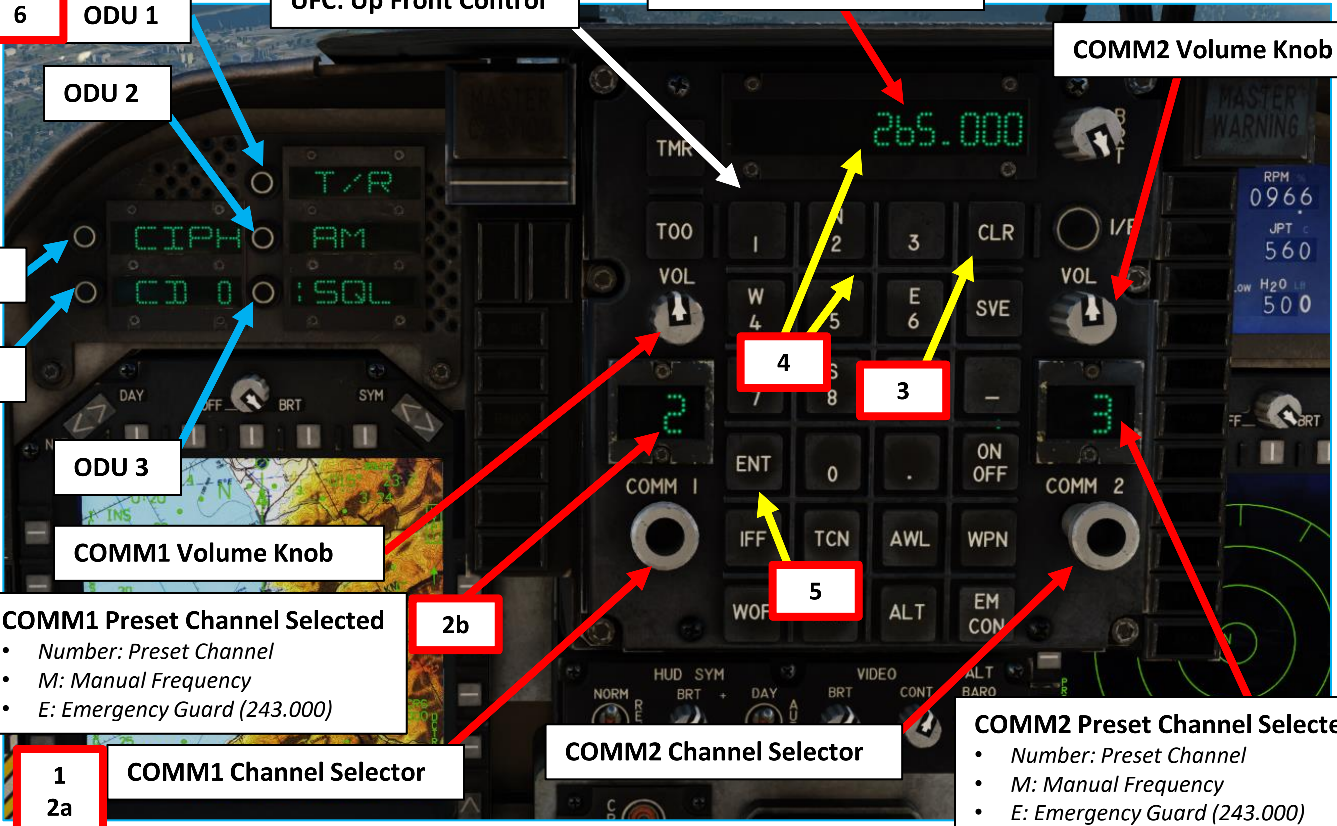
The UFC gives you access to the 26 preset channels of COMM 1 and COMM 2 radios.

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 a radio frequency manually on an existing preset frequency:

1. Left click on the desired COMM1 or COMM2 Channel Selector button to select it
2. Scroll mousewheel on desired COMM Channel Selector button to select desired Channel
3. Press the CLR (CLEAR) button on the UFC
4. Enter the desired frequency on the scratchpad (“265.000” is entered for frequency 265.000 MHz). Do not forget the decimal point.
5. Press the ENT (ENTER) to overwrite the frequency.
6. To set radio options, press the ODU buttons (Option Display Unit) to toggle parameters for each option.
7. To transmit to either COMM1 or COMM2, use the “COMM AFT: Select COMM2” and the “COMM FWD: Select COMM1” bindings.



Option Display Unit (ODU) 1
T/R: Transmit/Receive
TR+G: Transmit/Receive + Guard
G: Guard

Option Display Unit (ODU) 2
Only avail when freq. between 225.000 to 400.000. Toggles AM or FM modulation.

Option Display Unit (ODU) 3
Toggles Squelch. “:” means Squelch is active.

Option Display Unit (ODU) 4
Toggles cipher modes: PLN (plain), CIPH (cipher) and DLY (delay). Not simulated.

Option Display Unit (ODU) 5
Cipher code index to use when not in PLN (plain) mode. Not simulated since DCS does not have encrypted communications.

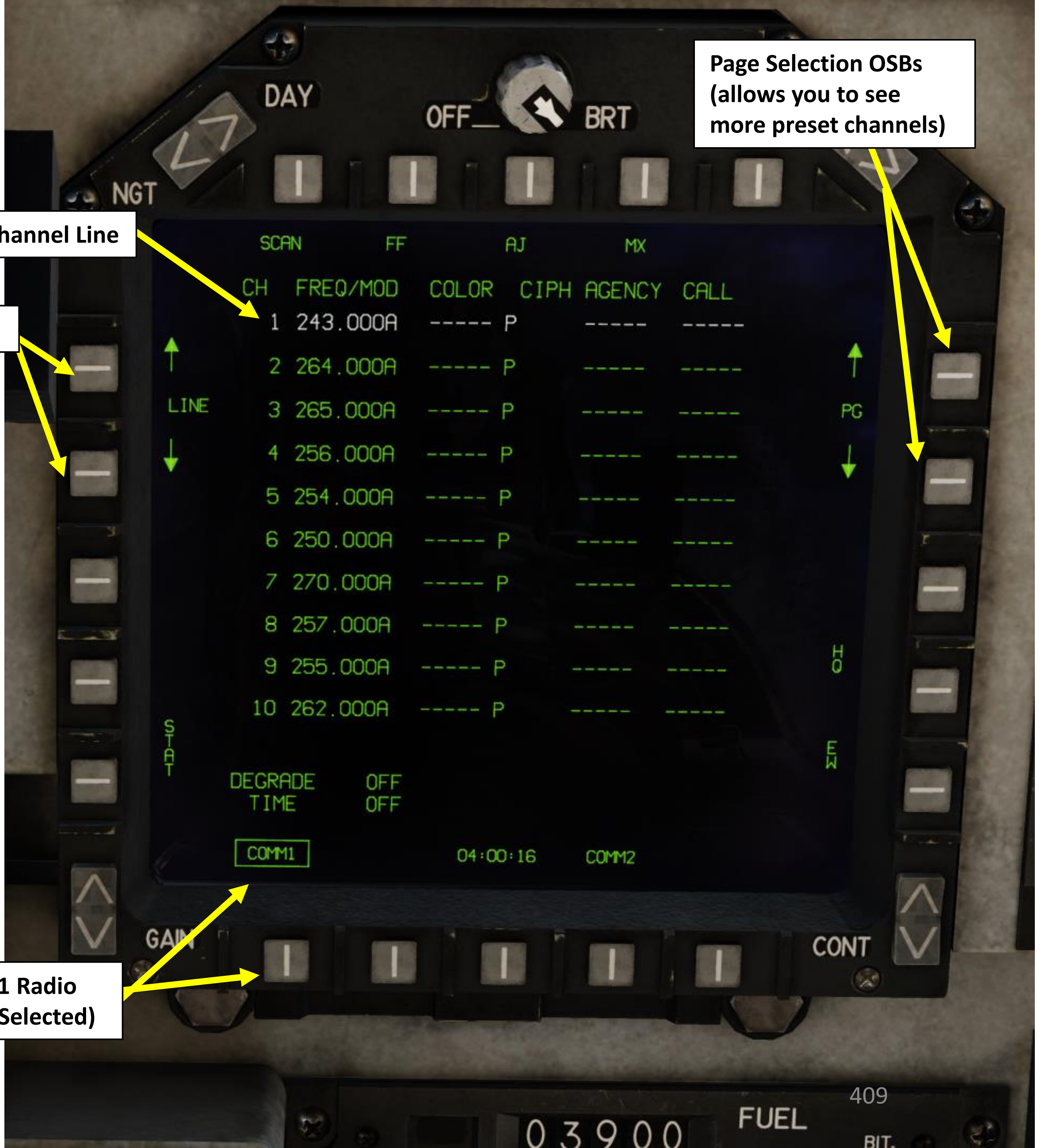
COMMS Switch
FWD = Selects COMM 1
AFT = Selects COMM 2

7

COMM AFT: Select COMM 2	HOTAS	LCtrl + Num+	JOY_BTN3
COMM FWD: Select COMM 1	HOTAS	LCtrl + Num-	JOY_BTN5

MPCD COMM PAGE

From the Main Menu, you can access the COMM page, which will list all your preset frequencies.



AFC: Automatic Flight Control

The autopilot of the Harrier is not very complicated to use.

1. Make sure you have all your Yaw, Pitch and Roll SAS swiches ON
2. Set aircraft in desired altitude/attitude and make sure that the following conditions are respected or the autopilot will automatically disengage
    - You are not in a steep climb/descent (+/- 2000 ft per minute)
    - Airspeed must be greater than 160 kts
    - Your bank angle must be lesser than +/- 20 deg
    - Your pitch angle must be between -15 deg to +20 deg
3. Engage desired AFC Mode using the AFC switch (and the ALT HOLD switch if required)
4. You can use your trim controls while the autopilot is engaged to fine-tune your aircraft attitude.
5. You can disengage the SAAHS using the Emergency SAAHS Disconnect Switch or by simply setting the ALT HOLD & AFC switches OFF (AFT).

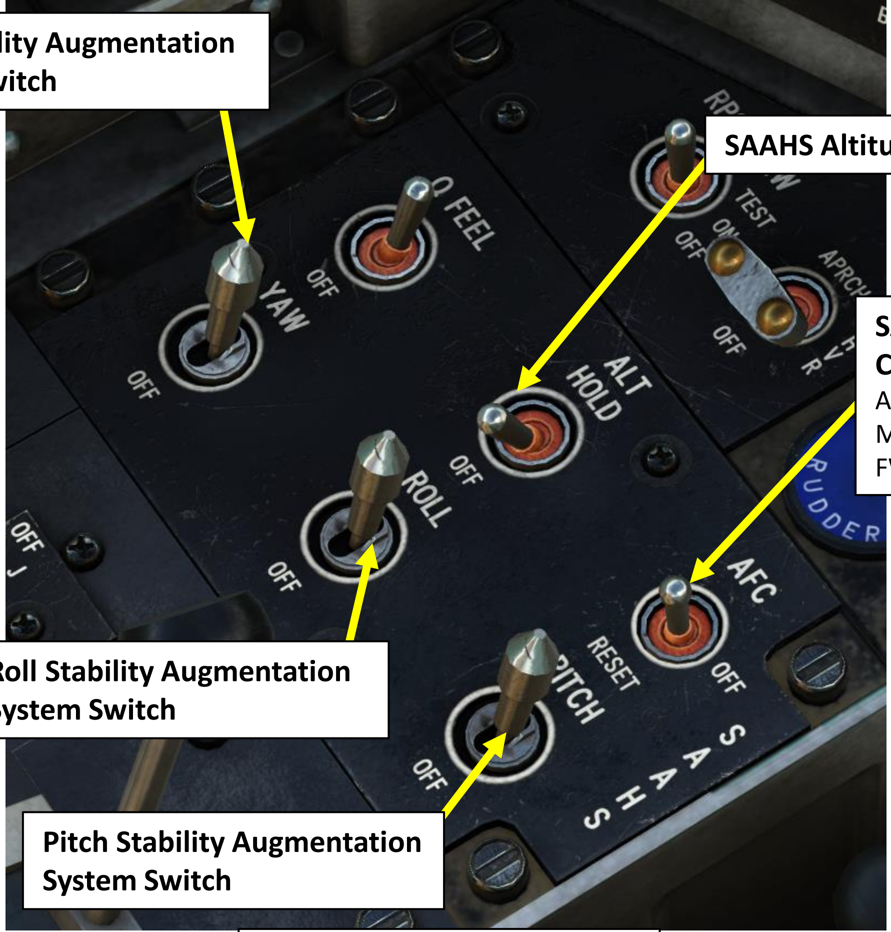
AFC Modes

AFC Switch Only - Engaged

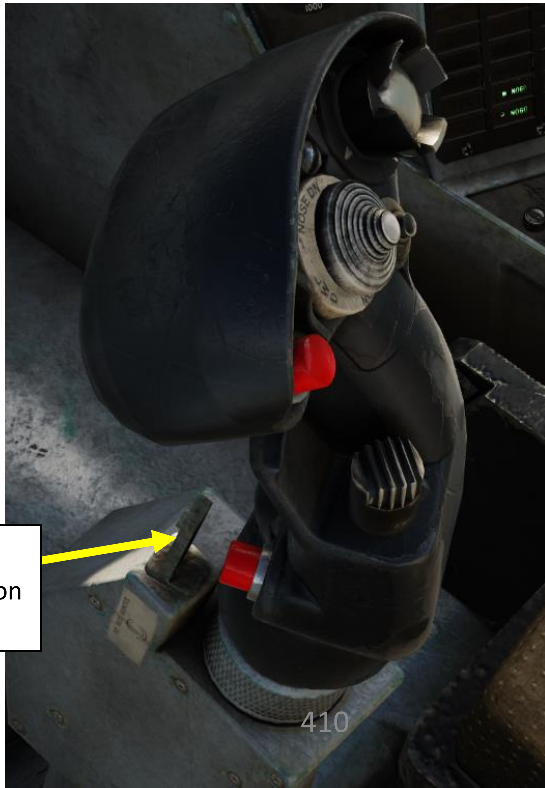
AFC mode provides pitch attitude hold, roll attitude hold, and heading hold. You can see this as an "Attitude Hold".

AFC Switch + ALT HOLD Switch - Engaged

ALT HOLD mode is pretty self-explanatory: the aircraft will provide an altitude hold. Keep in mind that you need to put yourself in level flight first, then engage the AFC switch, and finally set the ALT HOLD switch afterwards.



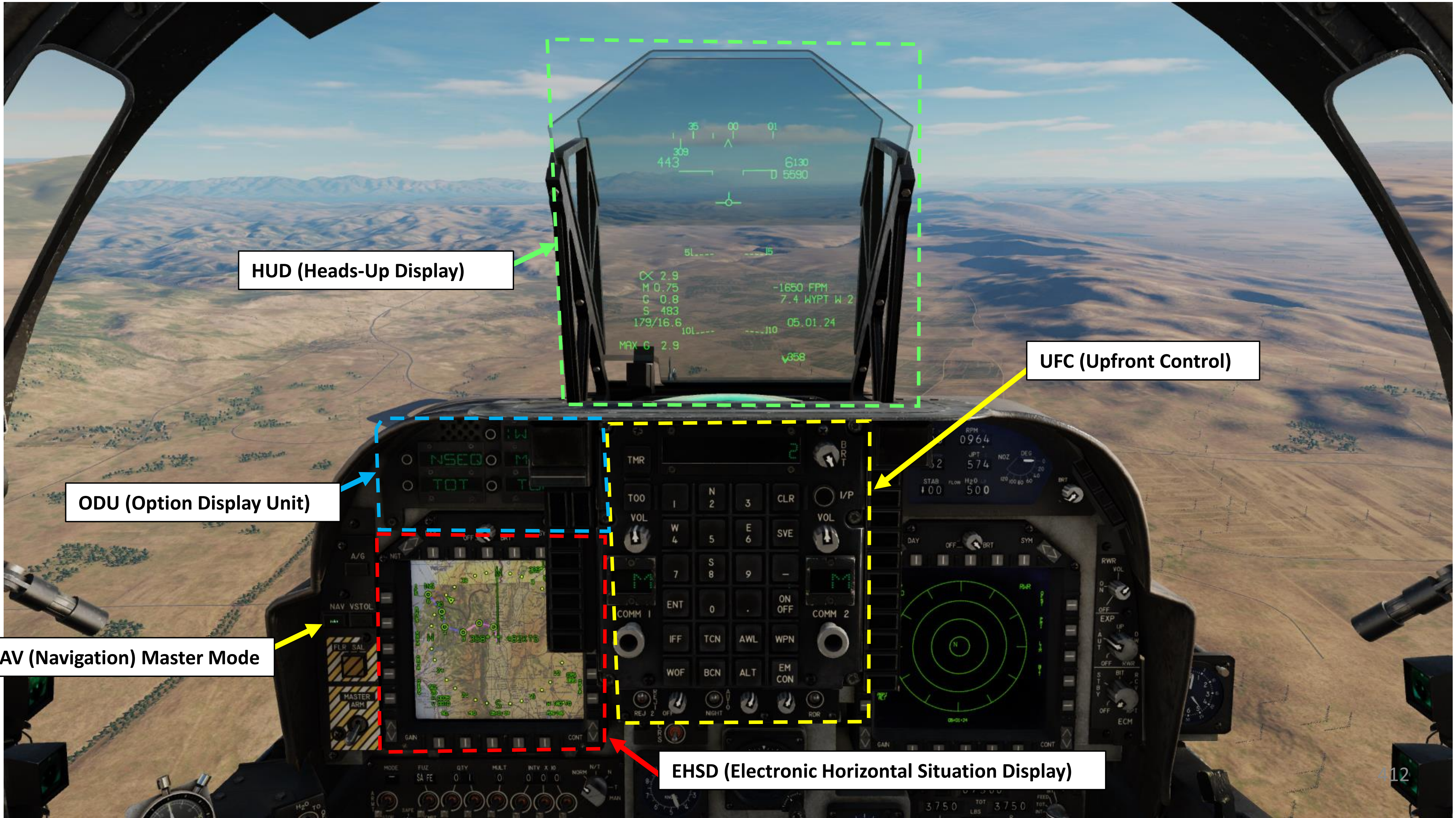
SAAHS:
STABILITY AUGMENTATION & ATTITUDE HOLD SYSTEM



SECTION STRUCTURE

1 - NAVIGATION INTRODUCTION

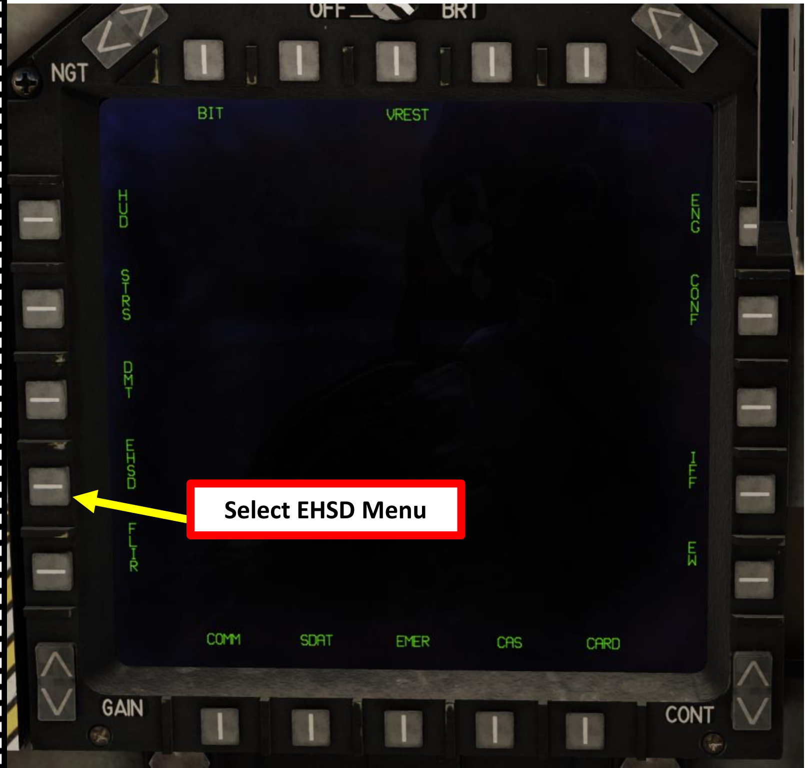
Navigation in the Harrier is mostly done through the EHSD (Electronic Horizontal Situation Display), which is a top-down view that displays your heading and navigation aids such as TACAN (Tactical Air Navigation) beacons and waypoints entered before flight in the mission editor.

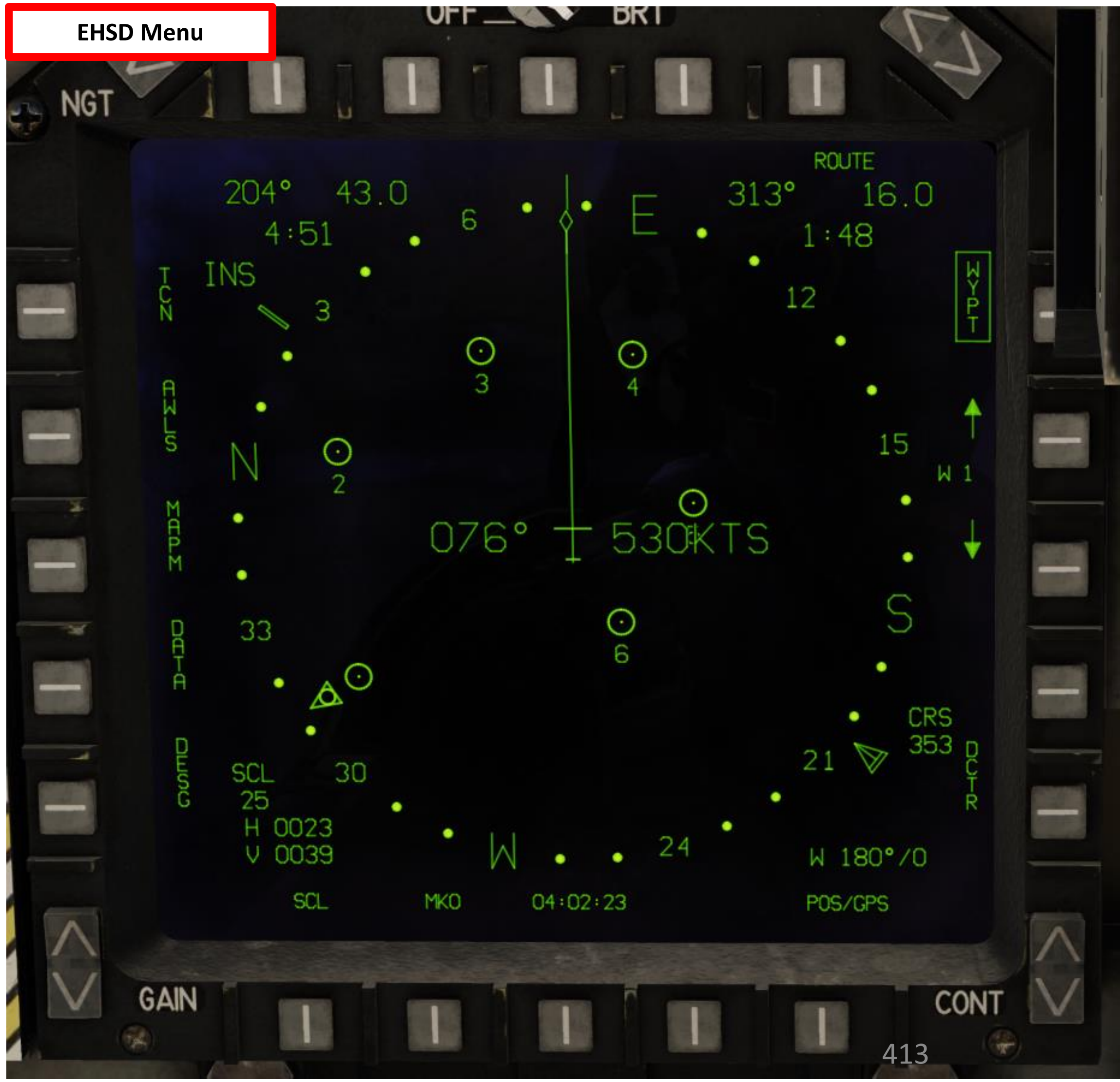


2 - EHSD & MAPM (MOVING MAP)

The EHSD (Electronic Horizontal Situation Display) 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 selecting the MAIN MPCD menu and selecting the EHSD OSB. The EHSD's various functions will be explored throughout the whole navigation section. To use the EHSD for navigation, make sure the NAV Master Mode is selected.

By default, the Moving Map overlay is visible on the EHSD. In this screenshot, the Moving Map is removed for illustrative purposes.

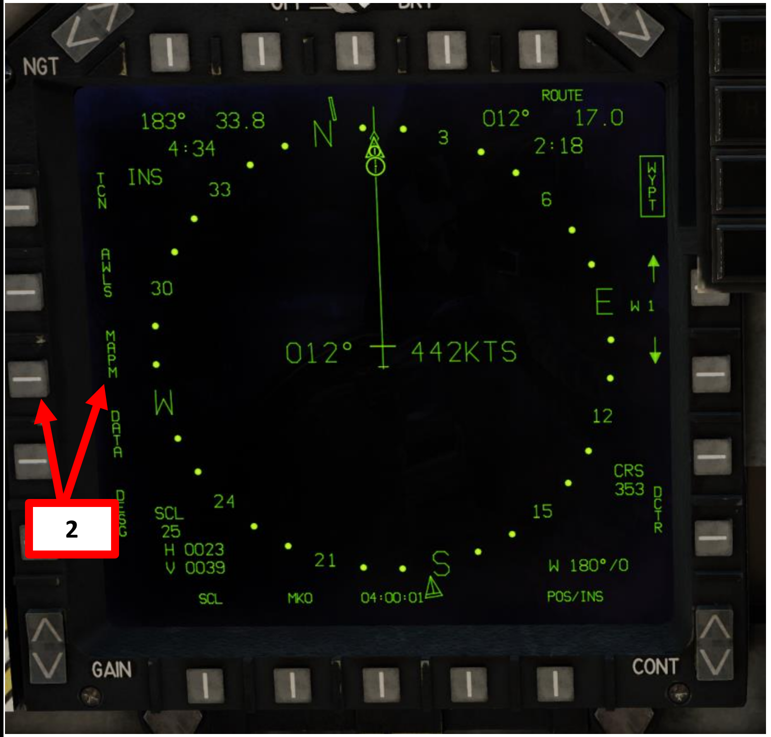


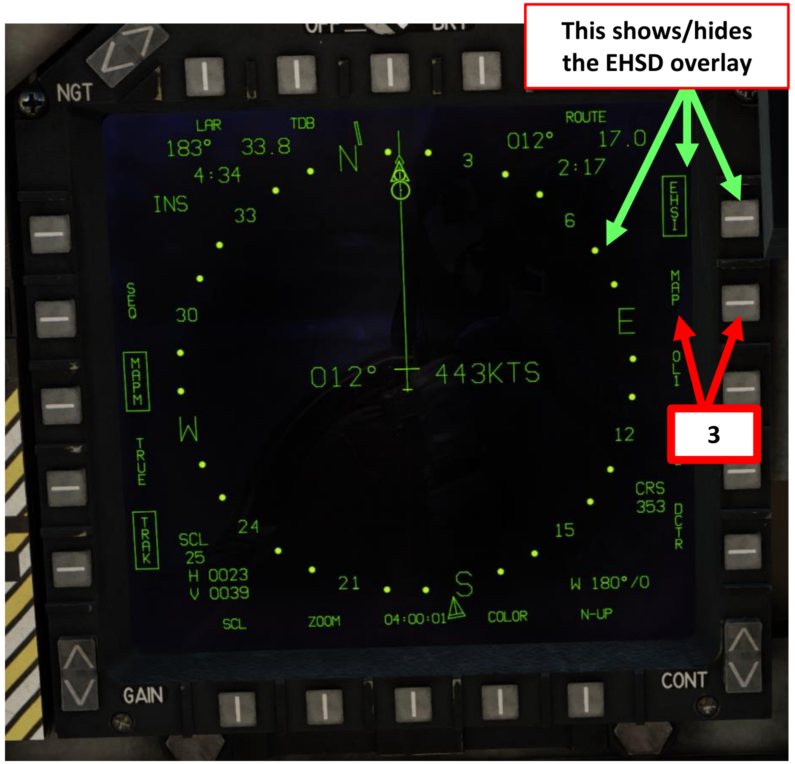


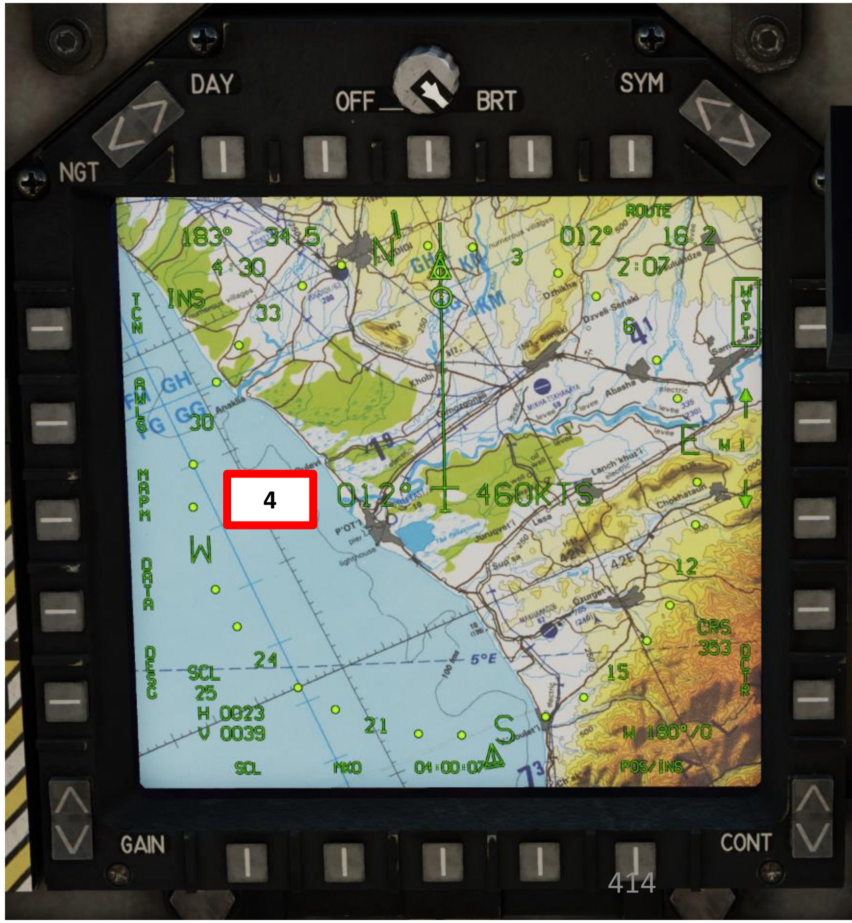
2 - EHSD & MAPM (MOVING MAP)

The Moving Map can be used to help you navigate. To turn it on:

1. Select the EHSD page on either MPCD
2. Press the OSB next to MAPM to select the Moving Map menu.
3. Press the OSB next to MAP to activate the Moving Map.
4. Take note that the MAP-specific menus that appeared in step 3) will automatically revert back to the EHSD-specific menus after a short delay as shown in step 2).







2 - EHSD & MAPM (MOVING MAP)

MOVING MAP (0 to 10 SECONDS AFTER MAP MENU SELECTED)

SEQ option will display waypoints and their numbers

EHSI option shows/hides the EHSD overlay

MAP option shows/hides moving map

TRUE option will display True Track instead of Magnetic Track

TRAK option will display Ground Track Line

SCL option will change map scaling (100, 25, 13, 5, AUTO)

ZOOM option magnifies map scaling by 2

N-UP option selects the NORTH IS UP or the TRACK IS UP (up is aligned with the aircraft heading) map orientation

Color Settings

2 - EHSD & MAPM (MOVING MAP)

MOVING MAP (MORE THAN 10 SECONDS AFTER MAP MENU SELECTED, AUTOMATICALLY REVERTED BACK TO EHSD MENU)

TCN selects the TACAN tracking mode

AWLS selects the All-Weather Landing System tracking mode

MAPM selects the MOVING MAP menu

DATA selects the Data display mode (information about tracked aircraft/waypoint/TACAN)

DESG is used for Steer to Point Designation

ROUTE option enables non-sequential (NSEQ) waypoint navigation

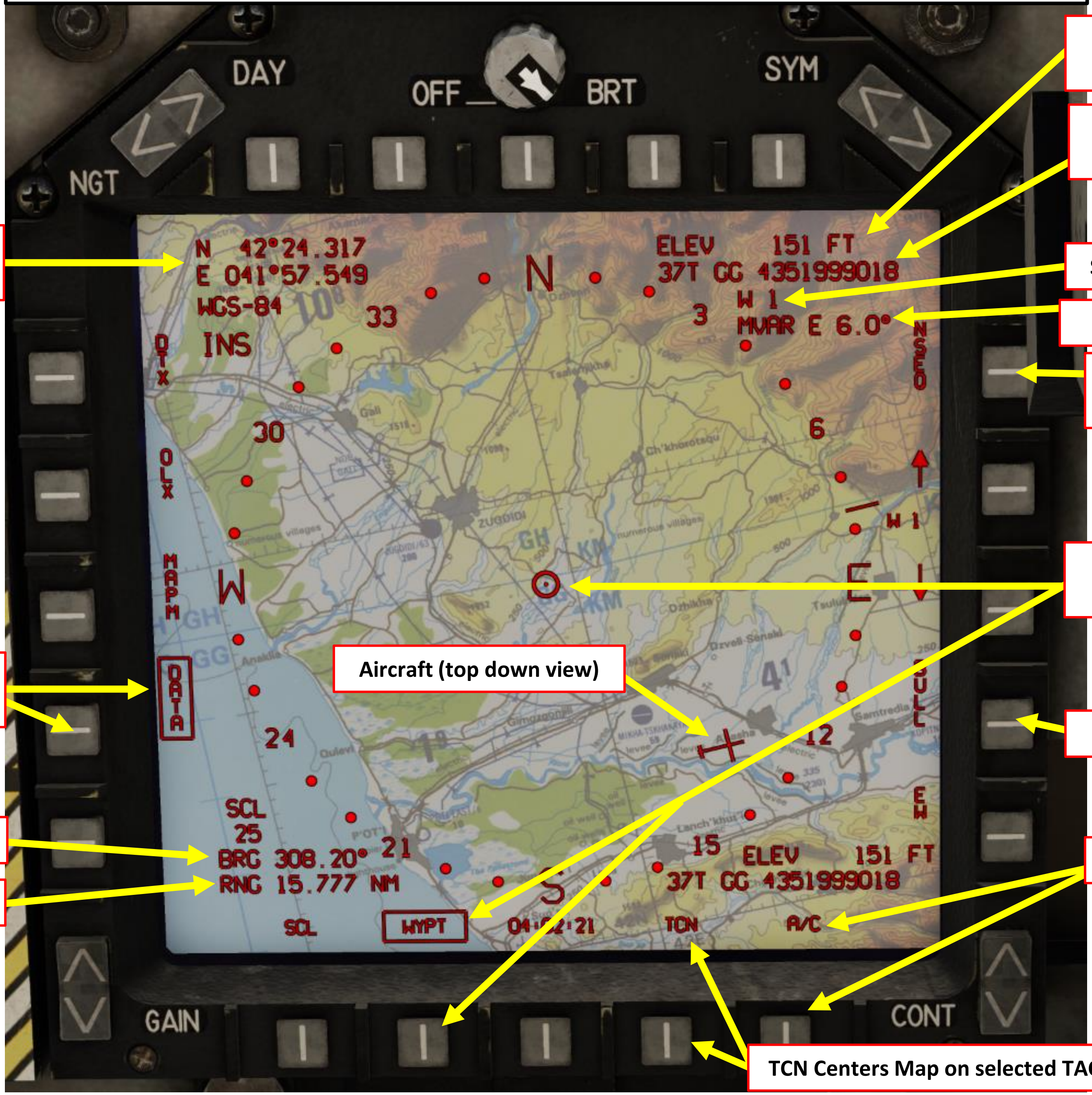
Ground Track

Ground Speed (kts)

Aircraft (top down view)

2 - EHSD & MAPM (MOVING MAP)

MOVING MAP (DATA MENU)



Ground elevation for tracked waypoint/TACAN/aircraft

UTM coordinates for tracked waypoint/TACAN/aircraft

GPS coordinates for tracked waypoint/TACAN/aircraft

Selected Waypoint (W1: Waypoint 1)

MVAR: Magnetic Variation

NSEQ: Non-Sequential Waypoint Settings

WYPT Centers Map on Selected Waypoint

DATA selects the Data display mode (information about tracked aircraft/waypoint/TACAN)

Aircraft (top down view)

BULL: Bullseye Settings

Bearing for tracked waypoint/TACAN/aircraft

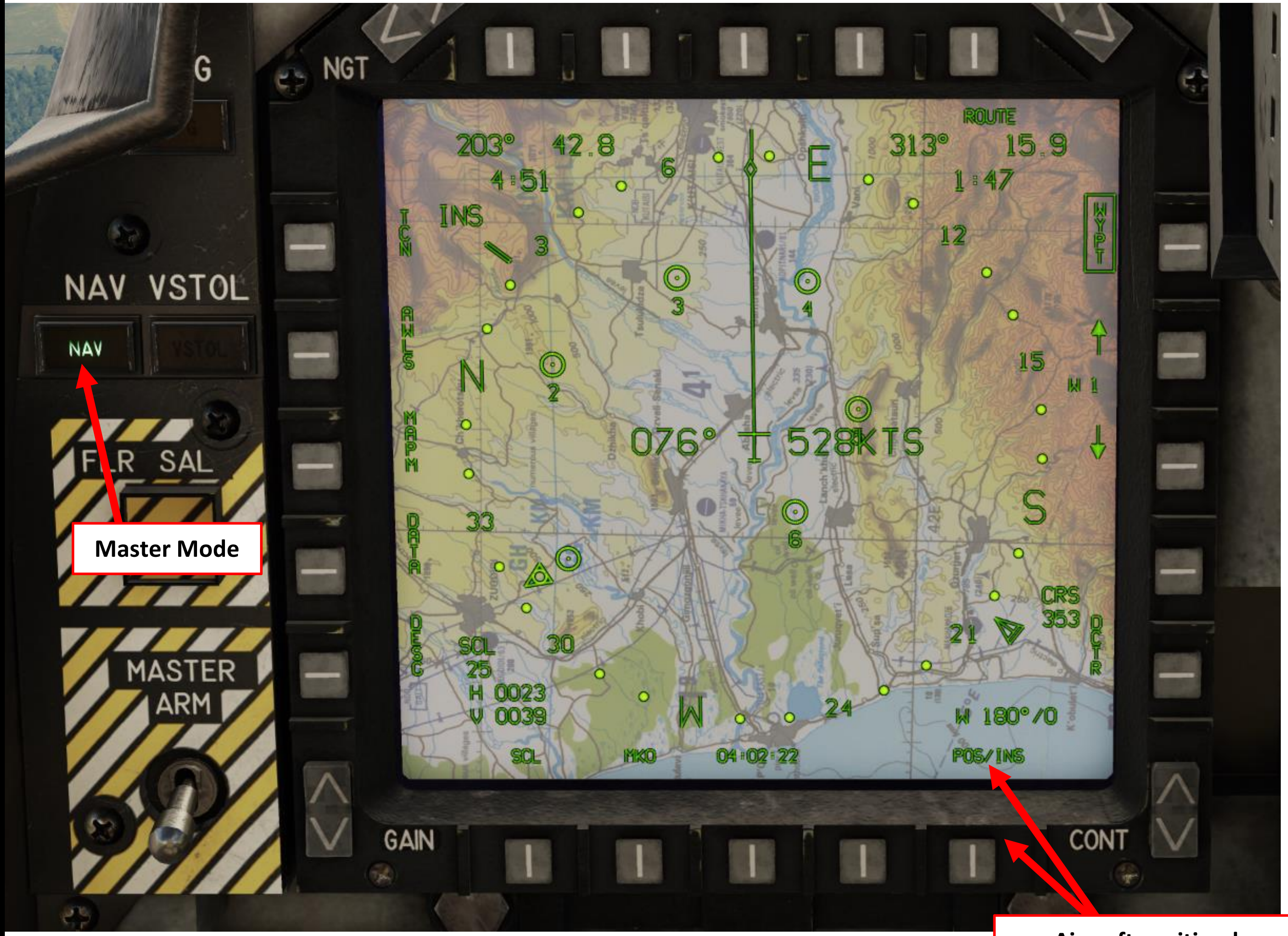
Range for tracked waypoint/TACAN/aircraft

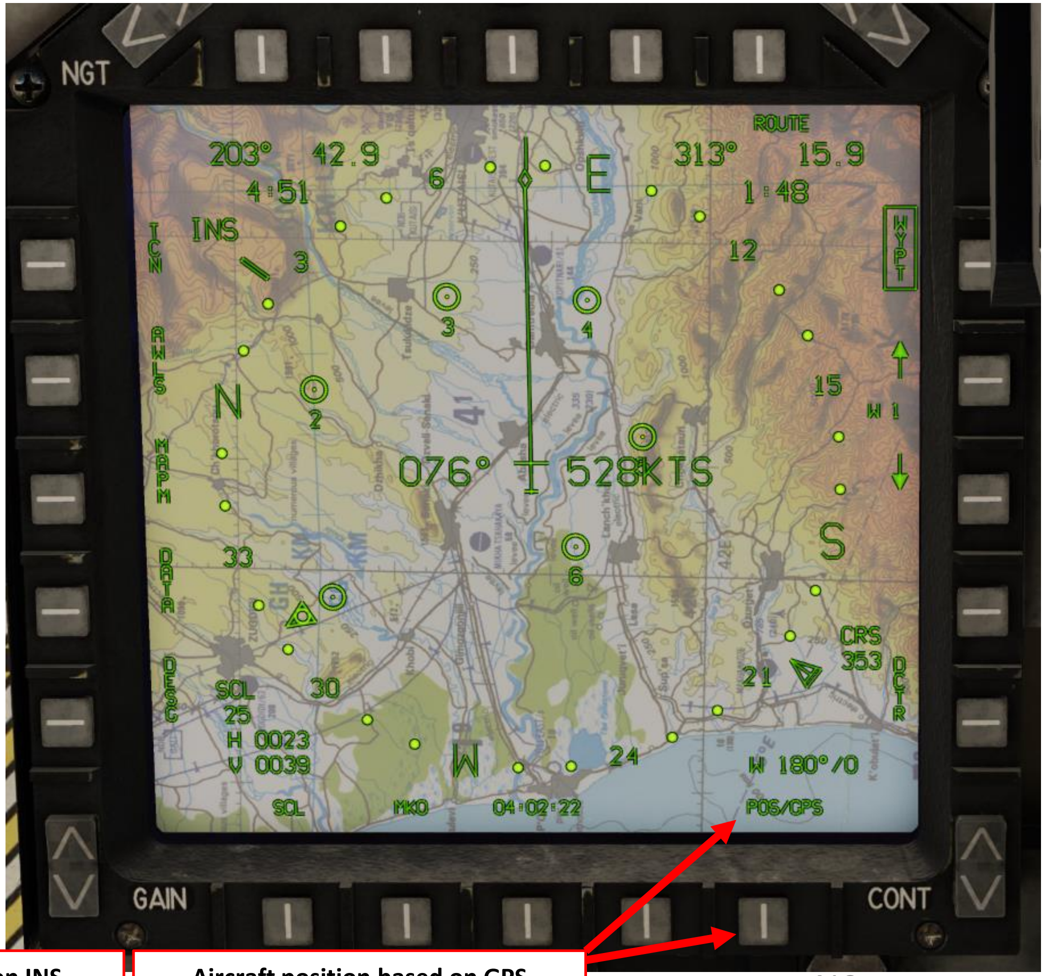
A/C Centers Map on aircraft

TCN Centers Map on selected TACAN

2 - EHSD & MAPM (MOVING MAP)

When Master Mode is set to NAV, you can choose if the aircraft position is based on the INS (Inertial Navigation System) or the GPS (Global Positioning System). Both the GPS and INS are coupled together, so in normal operation conditions it doesn't really matter. However, INS accumulates drift error and can eventually become inaccurate. GPS is more reliable, yet it relies on satellite data.





Aircraft position based on INS (Inertial Navigation System)

Aircraft position based on GPS (Global Positioning System)

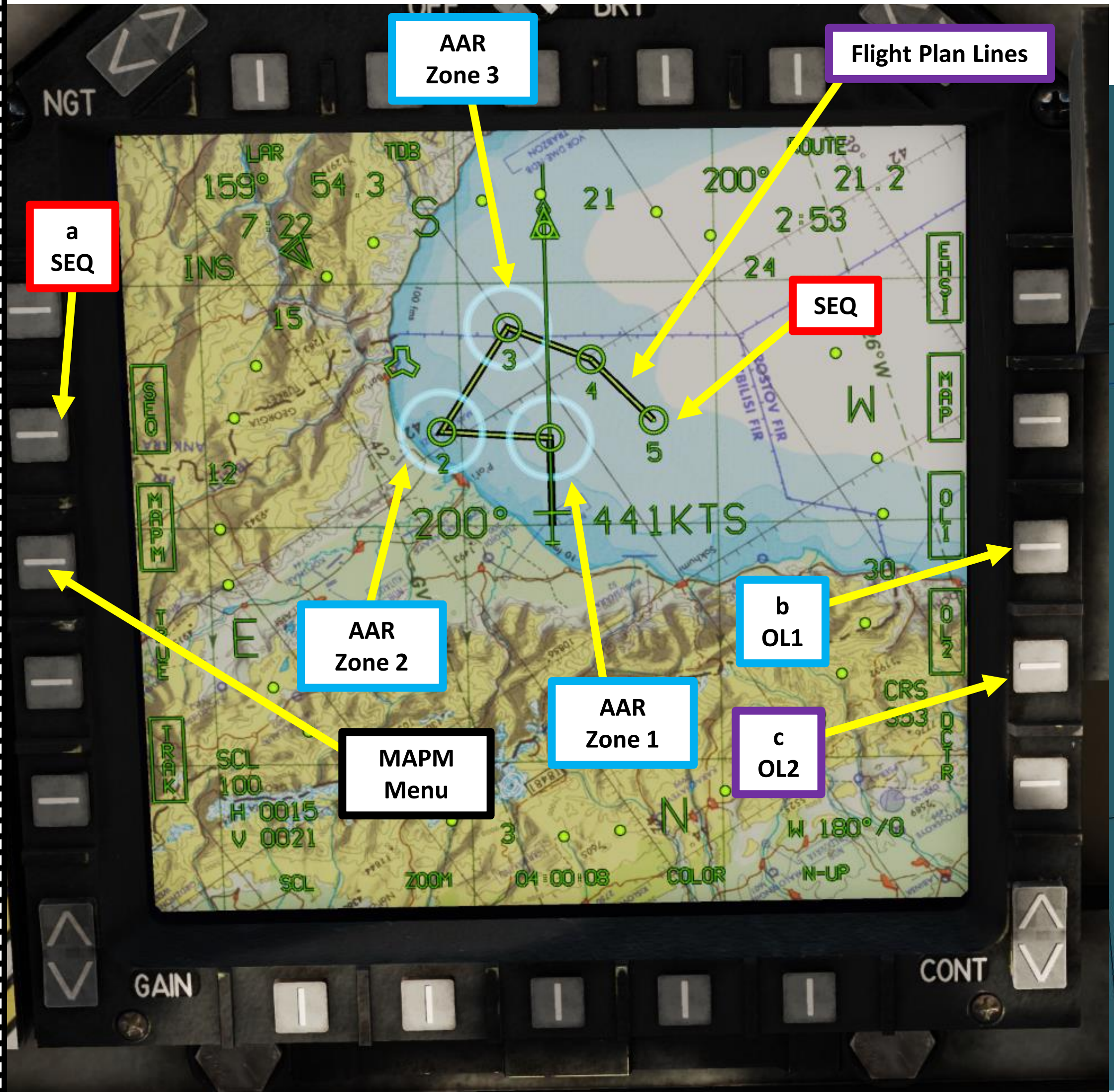
2 - EHSD & MAPM (MOVING MAP)

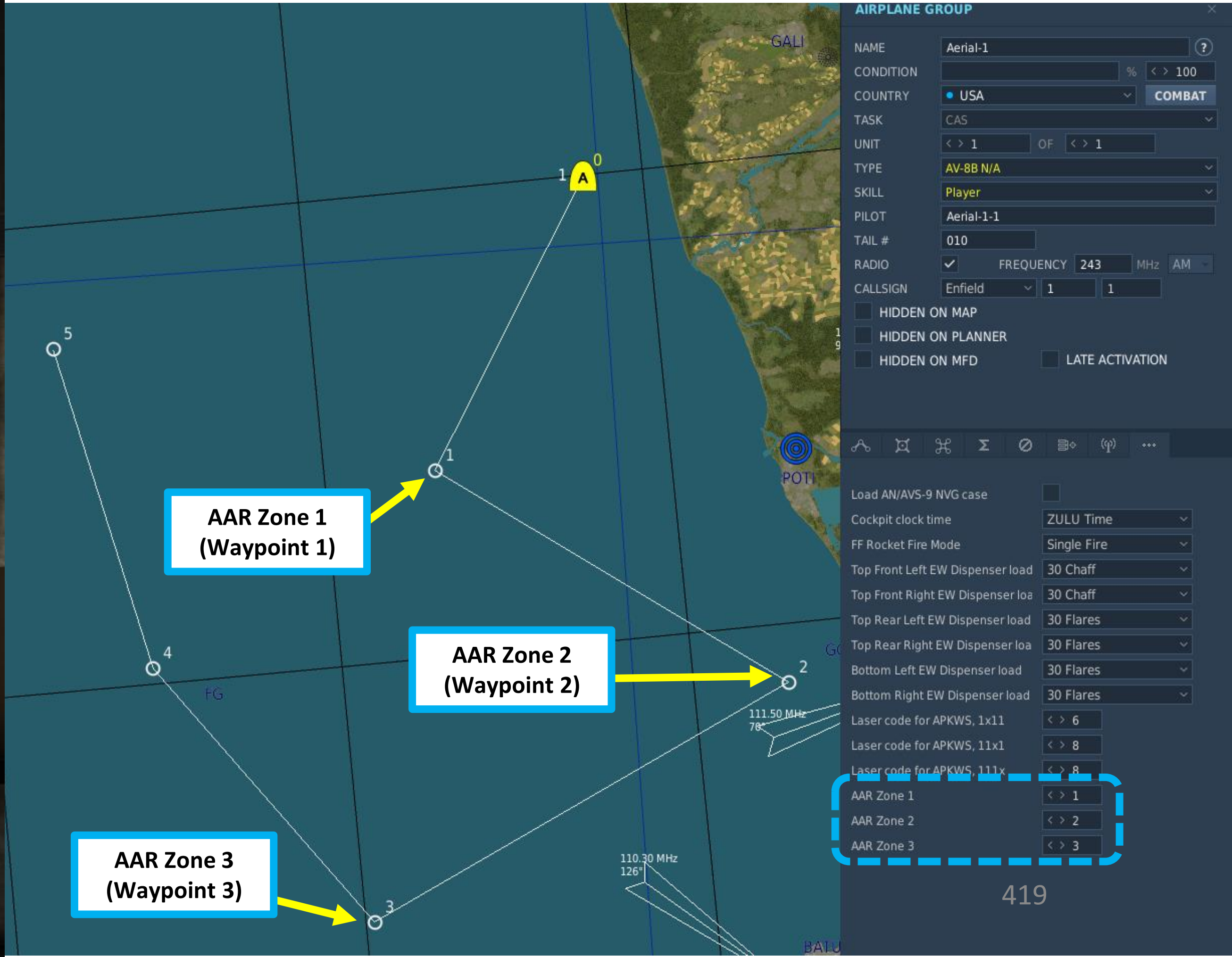
The Moving Map can display various overlays of symbology. This can clutter the screen. When going into the MAPM Menu:

a) SEQ: When selected (boxed), displays all numbered waypoint symbols in your flight plan (waypoint sequence).

b) OL1 (Overlay 1): When selected (boxed), displays AAR (Air-to-Air Refueling) Zones. These zones are defined in the Mission Editor, where a zone is associated to a waypoint of your flight plan. As an example, AAR Zone 1 is associated with Waypoint 1.

c) OL2 (Overlay 2): When selected (boxed), displays lines between waypoints of your flight plan.





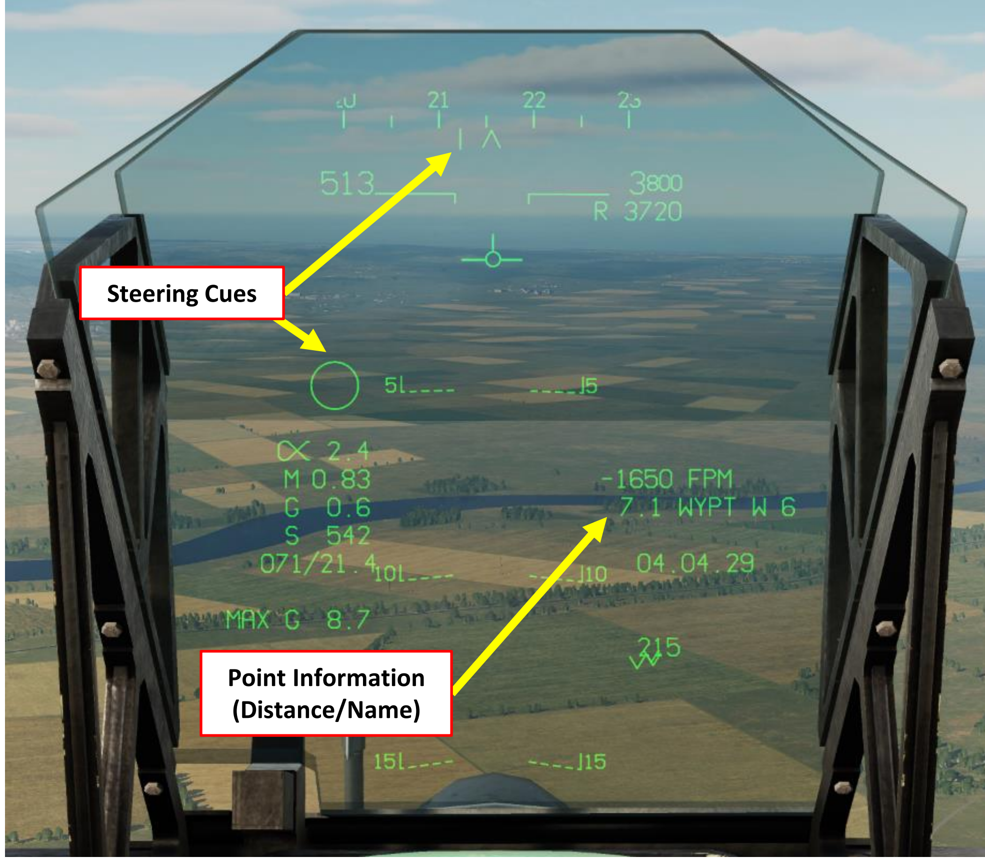
3 - STEERPOINT TYPES

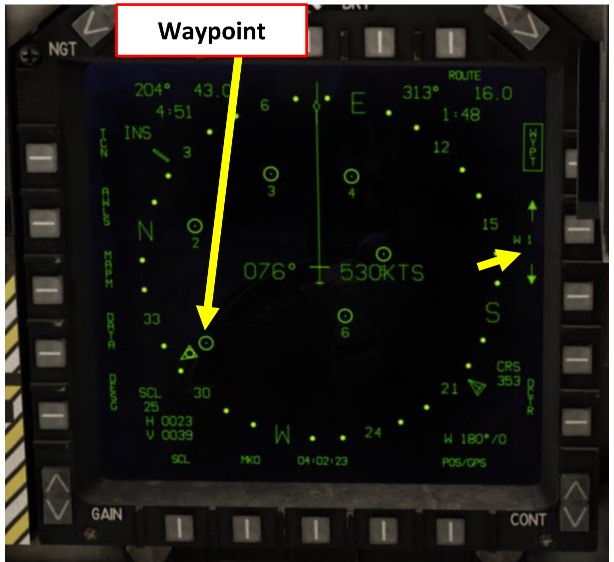
There are three main Steerpoint types use in the Harrier:

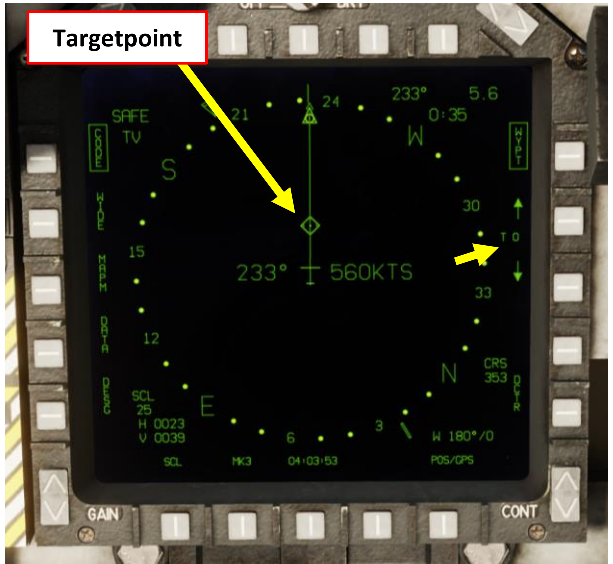
- **Waypoints**
  - Waypoints are pre-planned navigational points of reference for you to follow on route to your area of operation. You can create new ones, edit their coordinates and even create “Waypoint Offsets” if a target location is given to you with range and bearing information in relationship to an existing waypoint (i.e. Bullseye). Bullseye is a pre-determined point in space used as a reference point for flights to relay positions, used as a bearing and distance from Bullseye.

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

- **Targetpoints**
  - Targetpoints are navigation points on which weapons can be employed. “T0” corresponds to the System Designation and gets replaced/updated each time a new designation is made. “T1” to “T9” are targeting points that are used for multi-target drops with JDAMs. Take note Target Point T0 is updated and memorized every time you press the Air-to-Ground Bomb Pickle Button and release a bomb in CCIP. This functionality is quite useful if you need to perform subsequent passes on a single target.







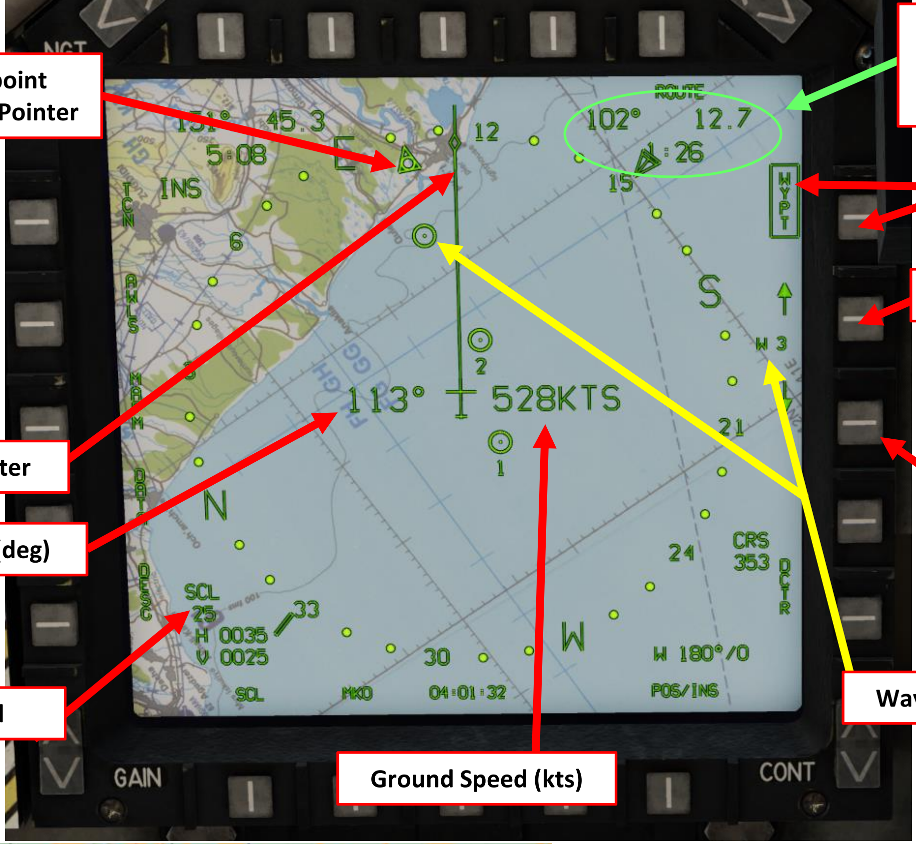
4 - WAYPOINTS

Take note that for each tutorial, the Master Mode must be set to NAV unless specified otherwise.

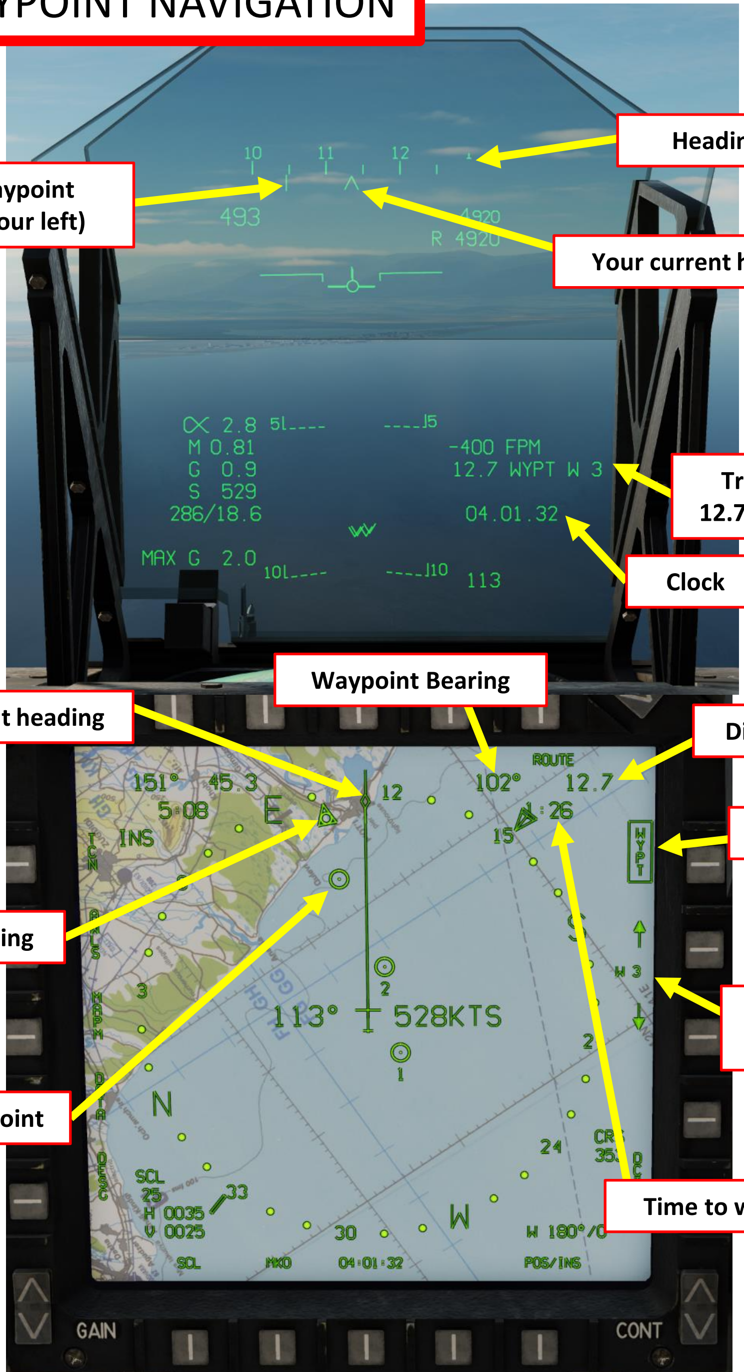
Master Mode NAV (Navigation)

4.1 - WAYPOINT NAVIGATION

1. Select the EHSD page on either MPCD
2. Press the OSB next to WYPT to set tracking mode to WAYPOINT.
3. To select a waypoint, press the OSB (Option Select Button) to increment or decrement the waypoint number.
4. Make sure the Master Mode is set to NAV to be able to track your waypoint directly from your HUD.
5. Check the previous MOVING MAP section to see how to display/remove the moving map

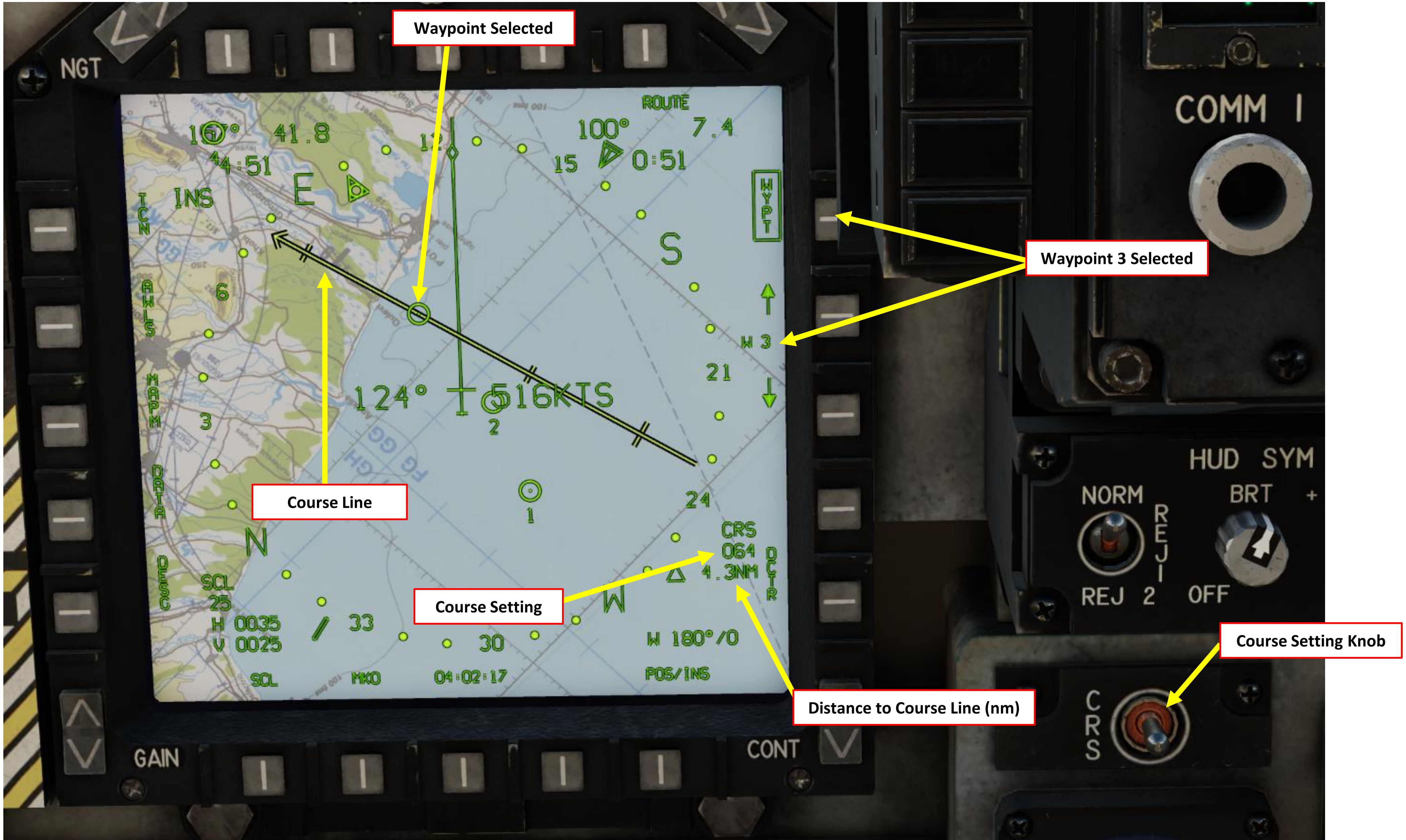


4.1 - WAYPOINT NAVIGATION



4.1 - WAYPOINT NAVIGATION

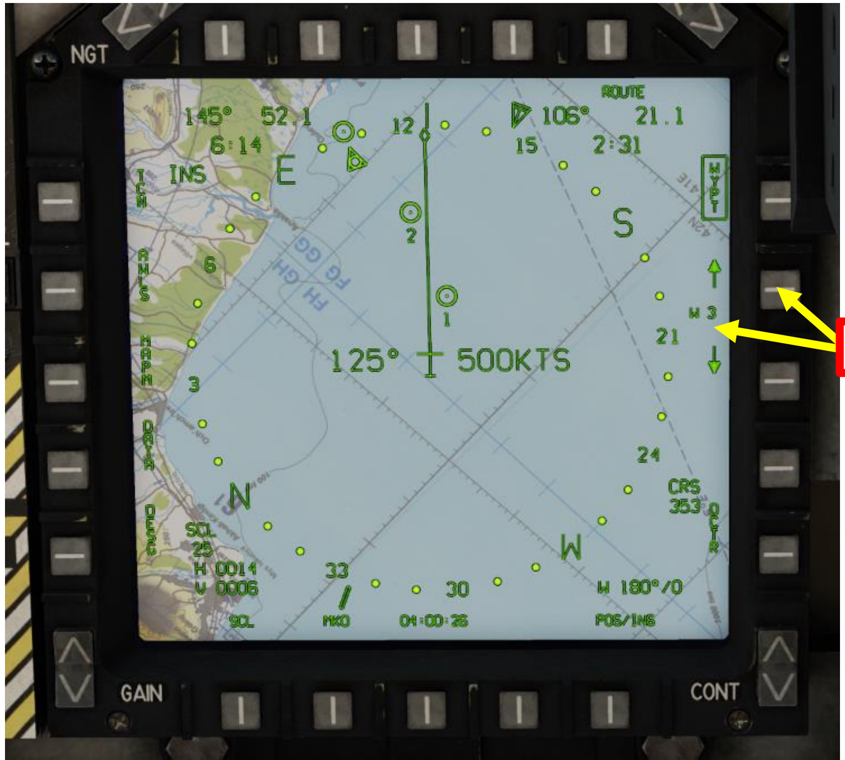
6. Note 1: you can also use the Course Setting Knob to set a course line to the selected waypoint.



4.1 - WAYPOINT NAVIGATION

7. Note 2: you can cycle to the next waypoint by either:
   a) Using the OSBs next to the arrows
   b) Pressing the “WP Increment”, or “WINC” switch (Waypoint Increment, or “RWin+W” binding) for less than 0.8 sec.
   c) Pressing and holding the “WP Increment” switch for more than 0.8 sec, which will display the QA (Quick Access) menu. From there, you can select whatever steerpoint you want. As an example, to select Waypoint 3, press and hold the WINC switch, select the ODU next to WYPT (“:”), then press “3” and “ENT” on the UFC scratchpad.

Quick Access (QA) Menu ODUs
Waypoint, Markpoint and Targetpoint selectable
7c



7a

7c
7c
7c

Waypoint Increment Button 7b 7c

4.2 - HOW TO ADD WAYPOINTS

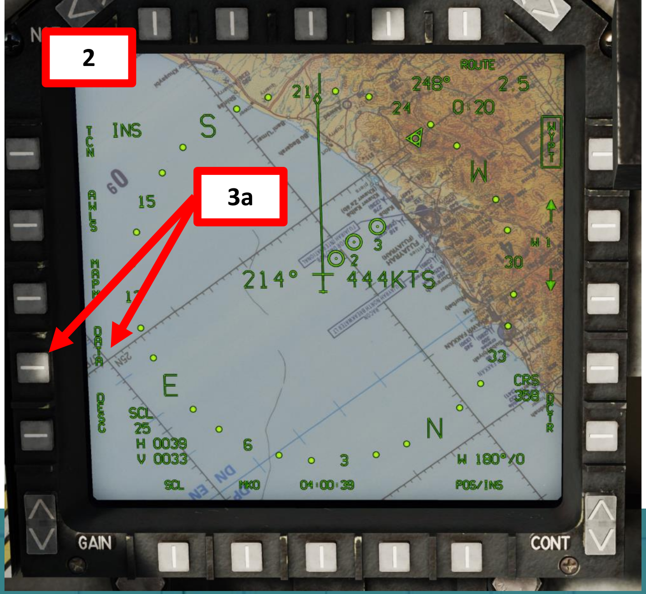
1. We want to create Waypoint 4 after Waypoint 3.
2. Select the EHSD page on either MPCD, and make sure NAV Master Mode is selected.
3. Click on the OSB next to "DATA" to select the EHSD data sub-menu (will become boxed when selected)
4. Make sure WYPT ODU (Option Display Unit) is selected (":" next to it)
5. On the UFC (Up-Front Controller) scratchpad, press "3", then "4", then "ENT" to enter Waypoint No. 4 after Waypoint No. 3.
   ***Note**: Alternatively, you can enter "77", which will add a waypoint after the last waypoint entered.*
6. "* 4" should appear on the UFC, meaning a new waypoint numbered "4" has been created.

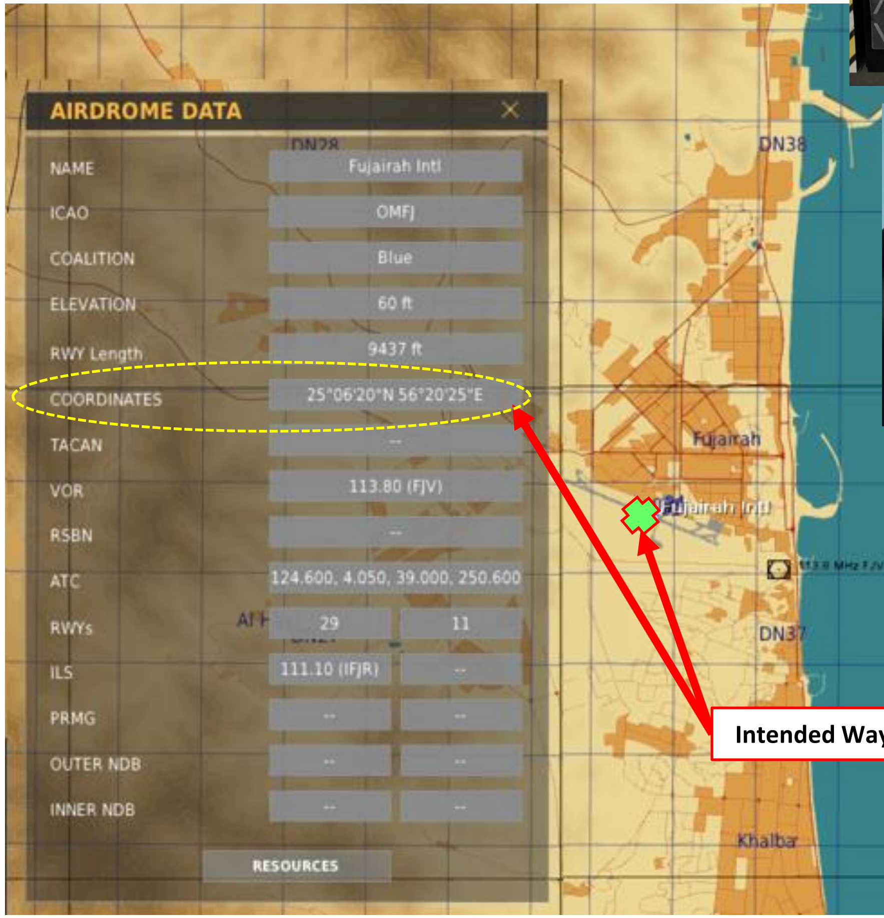
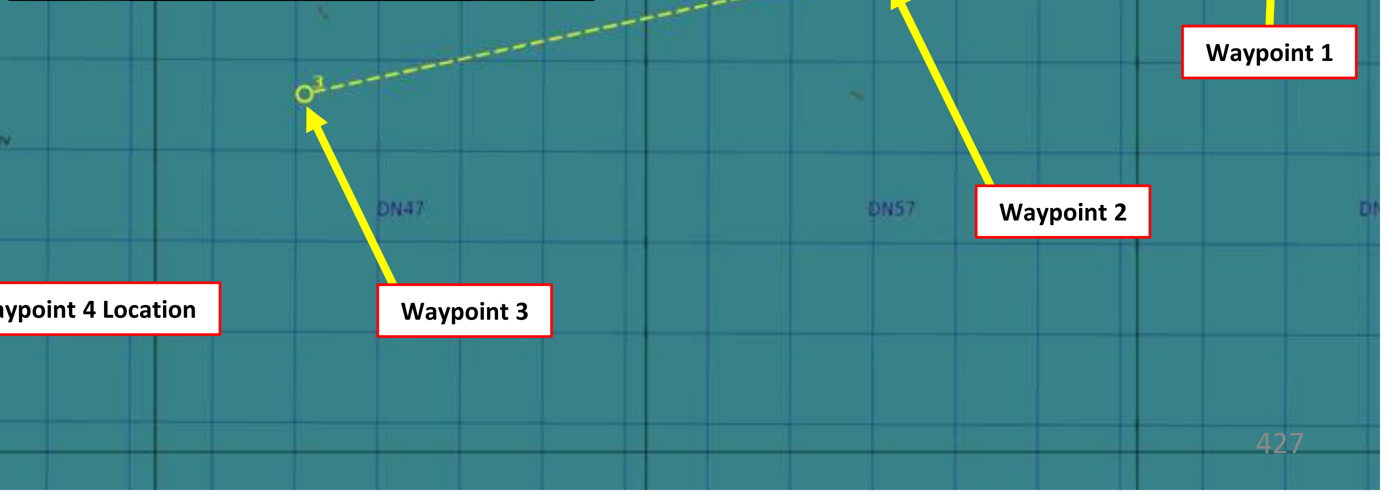
NOTE: Waypoint 4 has been created but has no coordinates yet. See sub-section 4.3 to see how coordinates are entered.

4.3 - HOW TO EDIT WAYPOINTS

This tutorial is a continuation of sub-section 4.2.

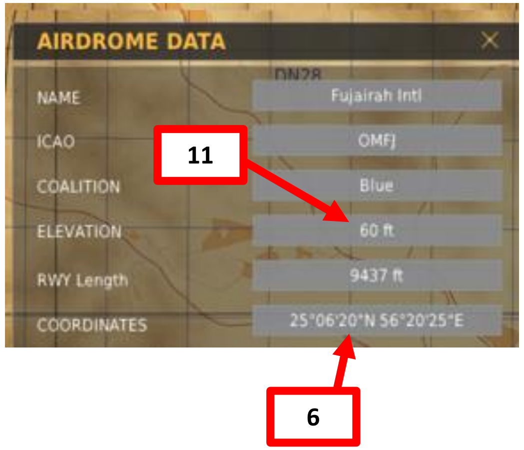
1. We will want to edit Waypoint 4, which has been created but does not have any coordinates associated with it yet.
2. Select the EHSD page on either MPCD, and make sure NAV Master Mode is selected.
3. Click on the OSB next to “DATA” to select the EHSD data sub-menu (will become boxed when selected)
4. Make sure WYPT ODU (Option Display Unit) is selected (“:” next to it)
5. On the UFC (Up-Front Controller), press “4”, then “ENT” to select Waypoint 4 to edit it.

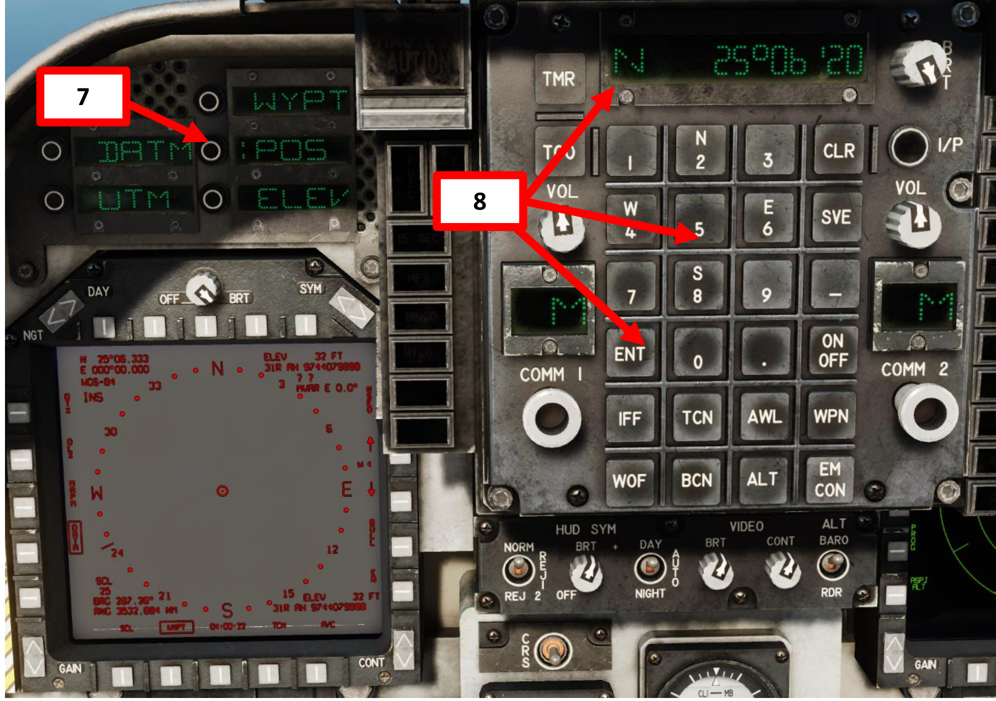


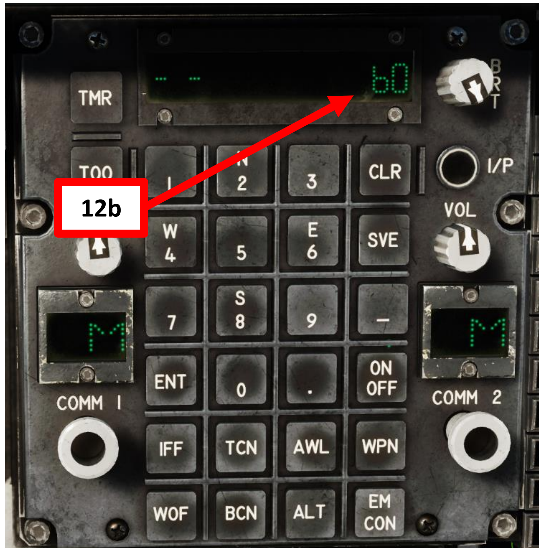



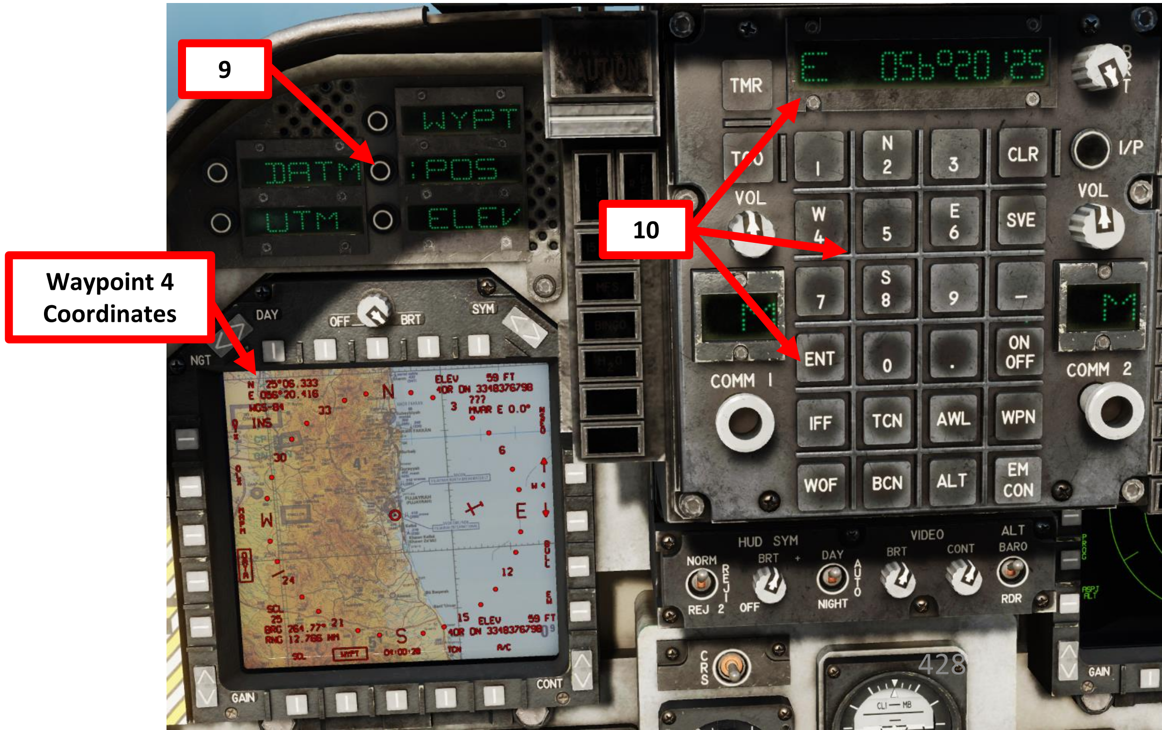

4.3 - HOW TO EDIT WAYPOINTS

6. We will add for Waypoint 4 the coordinates of the Fujairah International Airport, which are in (deg, minutes, sec):
   25°06'20'' North 56°20'25'' East
7. Press the POS (Position) ODU (Option Display Unit) to select the coordinate Latitude (":"will appear next to it when selected).
8. On the UFC, press « 2 » (N) to select North coordinates, type « **250620** », then « ENT » to enter them.
9. Press on the POS ODU again to select the coordinate Longitude.
10. On the UFC, press « 6 » (E) to select East coordinates, type « 0**562025** », then « ENT » to enter them. Don't forget to add the 0 at the beginning.
11. The waypoint elevation is automatically computed based on GPS navigation data.
12. If you want to consult the waypoint elevation, press on ODU next to ELEV.



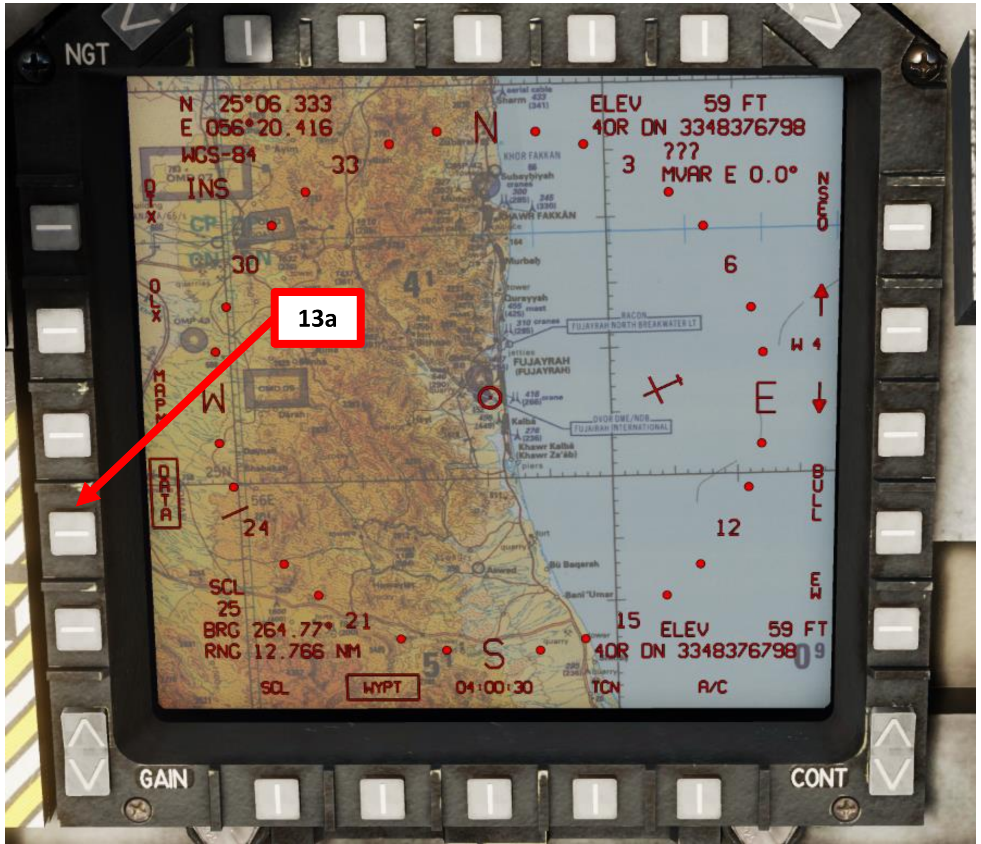


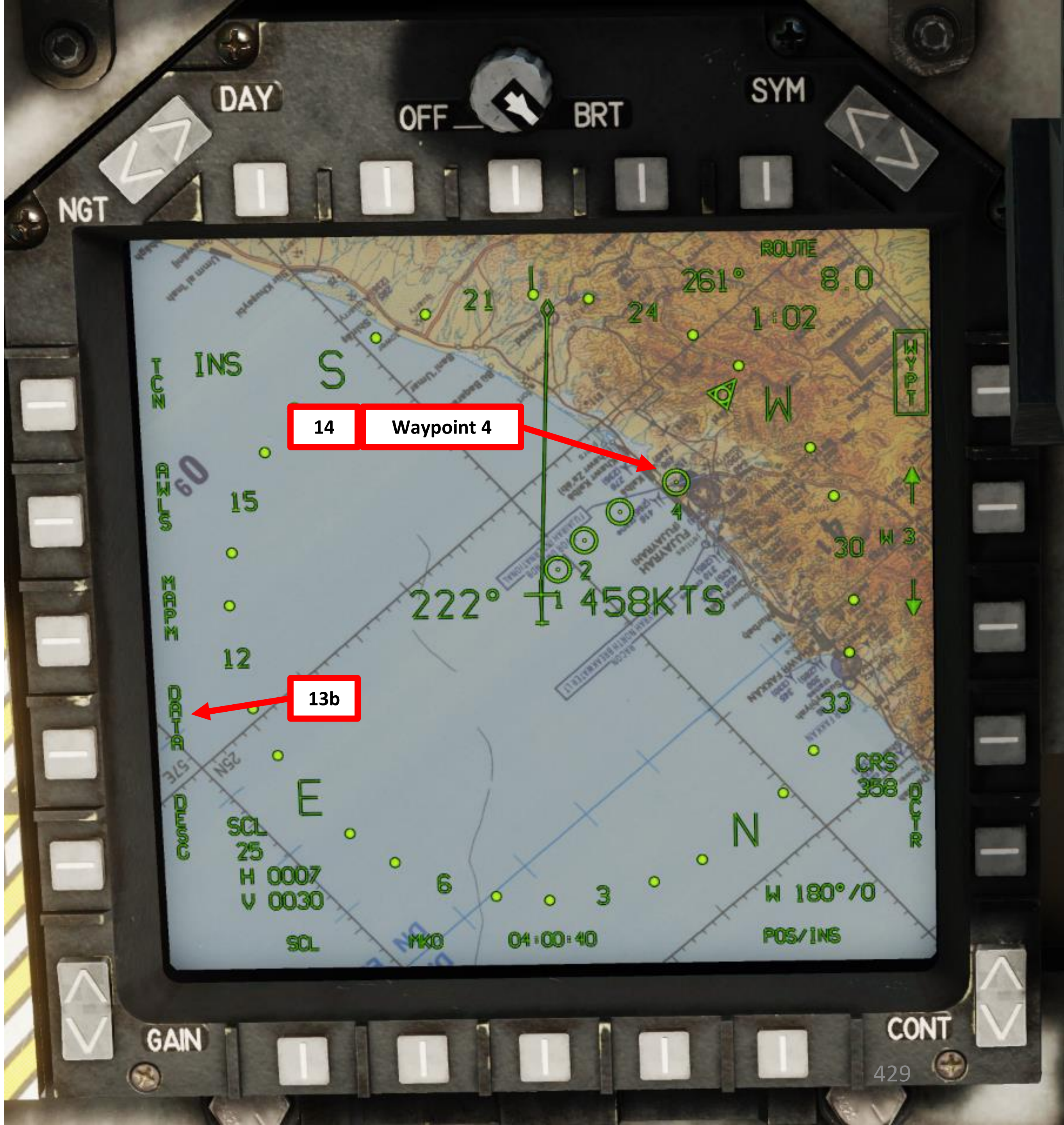




4.3 - HOW TO EDIT WAYPOINTS

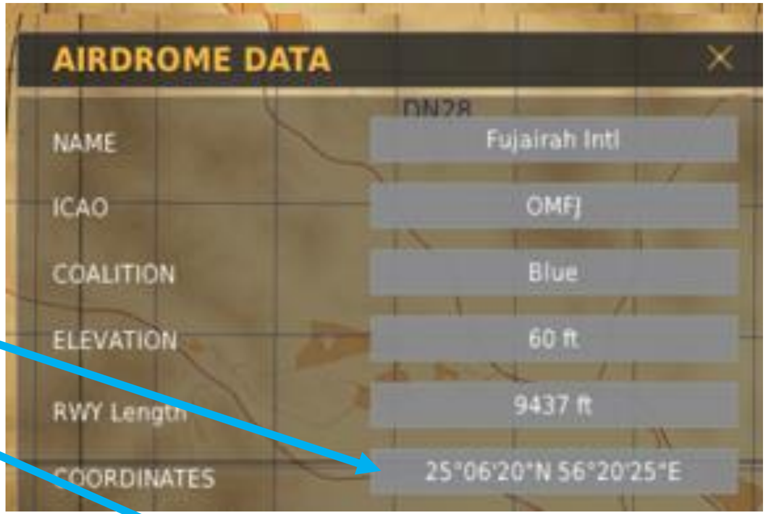
13. Press on the OSB next to DATA to un-select (unbox) it.
14. And that's it! You have edited Waypoint 4's coordinates. If you click on the OSB next to DATA to de-selected it (not boxed), you can see that Waypoint 4 is now visible in the sequence if the SEQ option is enabled.

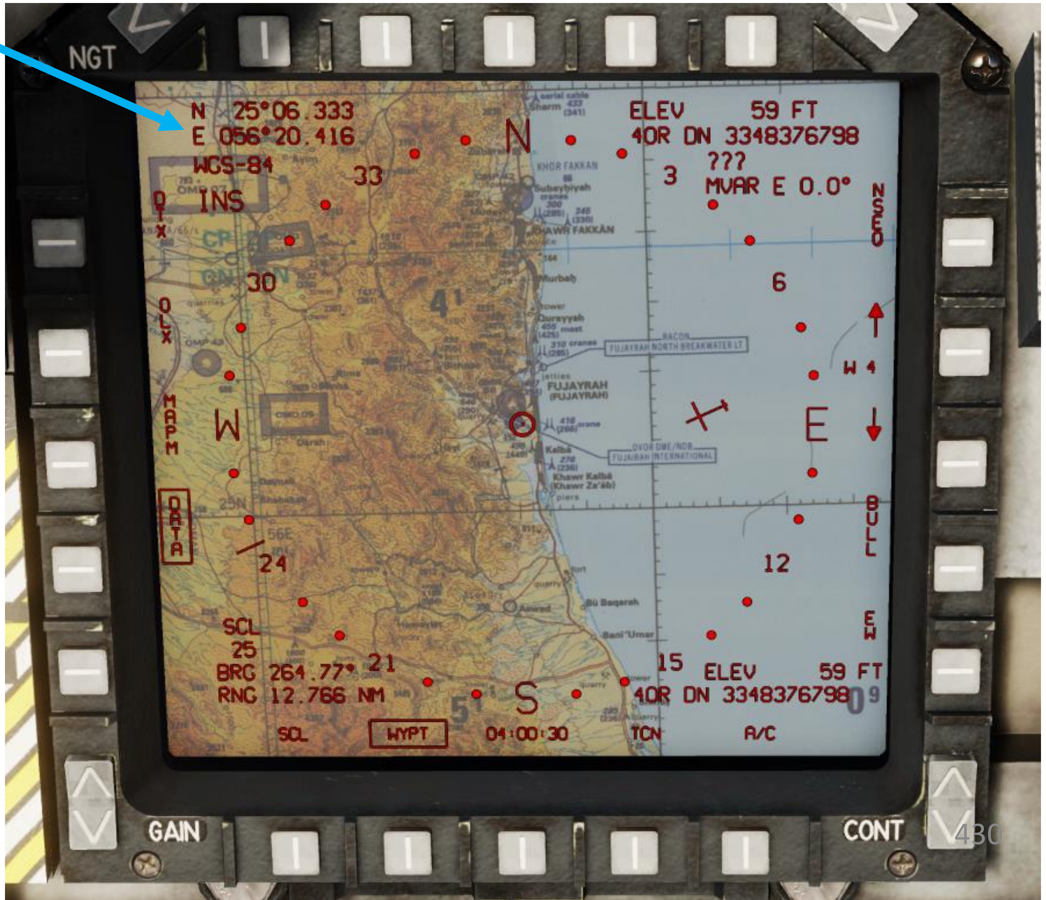




4.3 - HOW TO EDIT WAYPOINTS

Coordinate format you input in the UFC is Degree, Minute, Seconds.
Coordinate format displayed on the DATA page is Degree, Minute, Decimal.
INPUT 25 deg 06 minutes 20 seconds = OUTPUT 25 deg 06.333 minutes



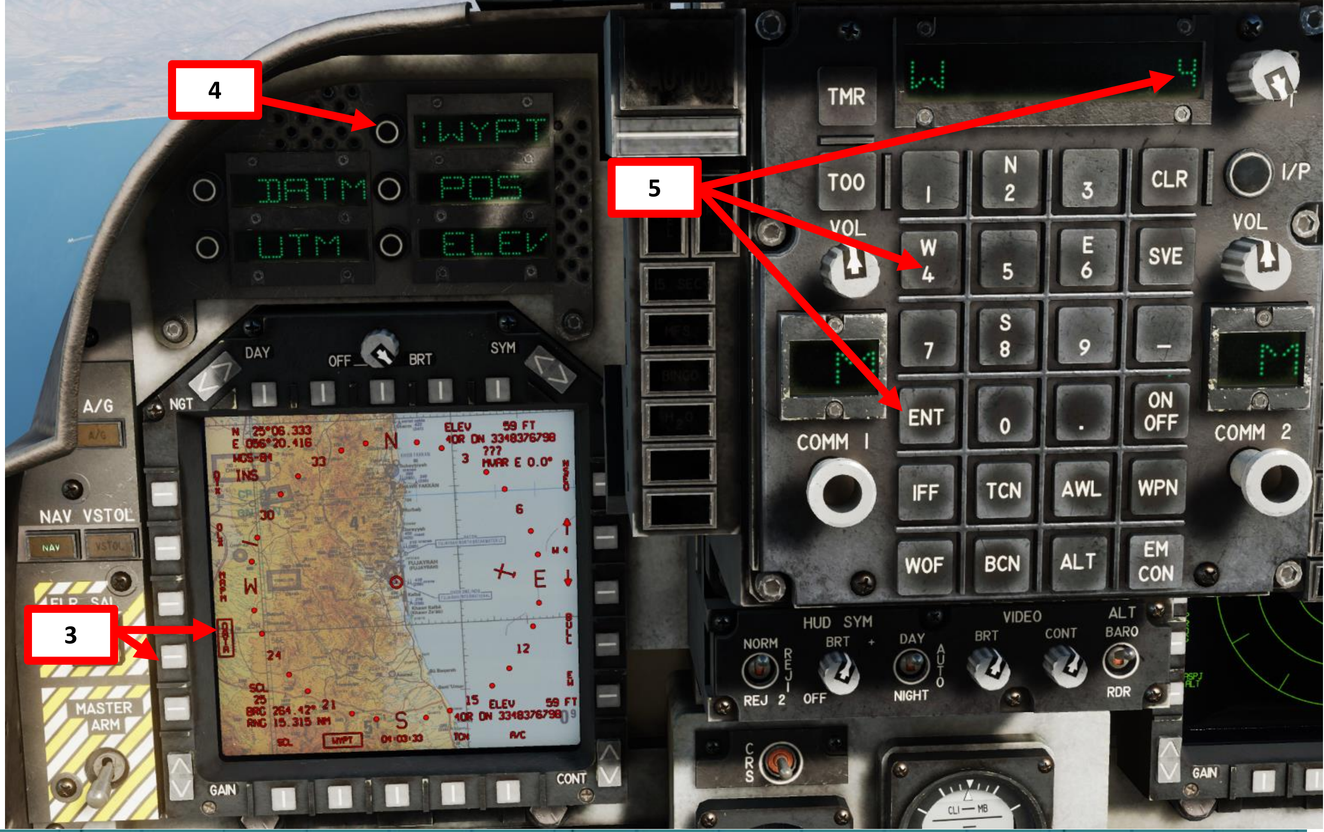


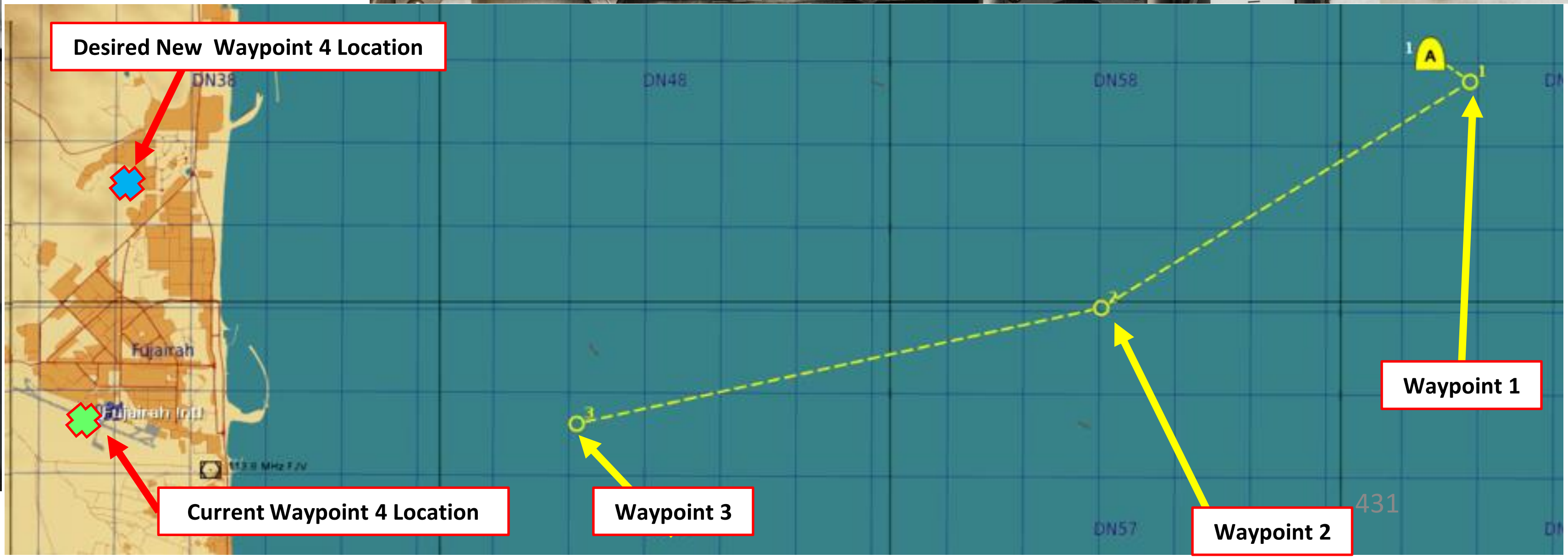
4.4 - HOW TO EDIT WAYPOINT WITH MOVING MAP & TDC

What if you already have a waypoint with coordinates and want to move it quickly to somewhere else? There’s a neat trick that allows you to do it quite simply with the TDC.

This tutorial is a continuation of sub-section 4.3.

1. Select the EHSD page on either MPCD, and make sure NAV Master Mode is selected.
2. Make sure the Moving Map is activated (see the MAPM: Moving Map Tutorial).
3. Click on the OSB next to “DATA” to select the EHSD data sub-menu (will become boxed when selected)
4. Press the WYPT ODU (Option Display Unit) is selected (“:” next to it)
5. On the UFC (Up-Front Controller), press “4”, then “ENT” to select Waypoint 4 to edit it.
6. Press the POS (Position) ODU (Option Display Unit)

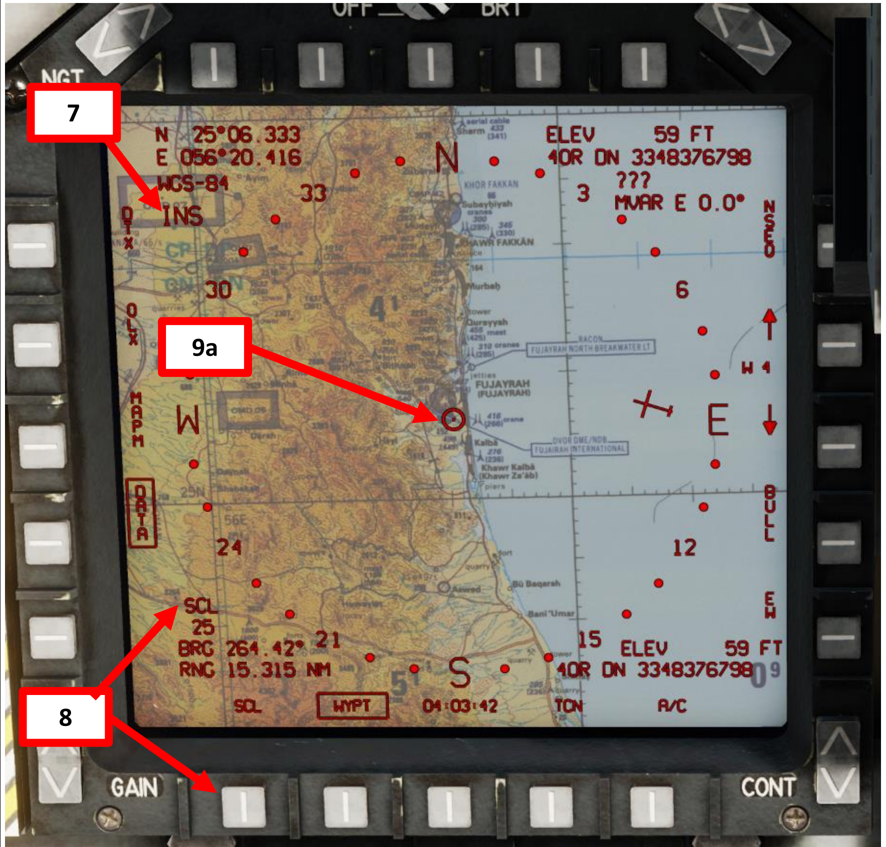


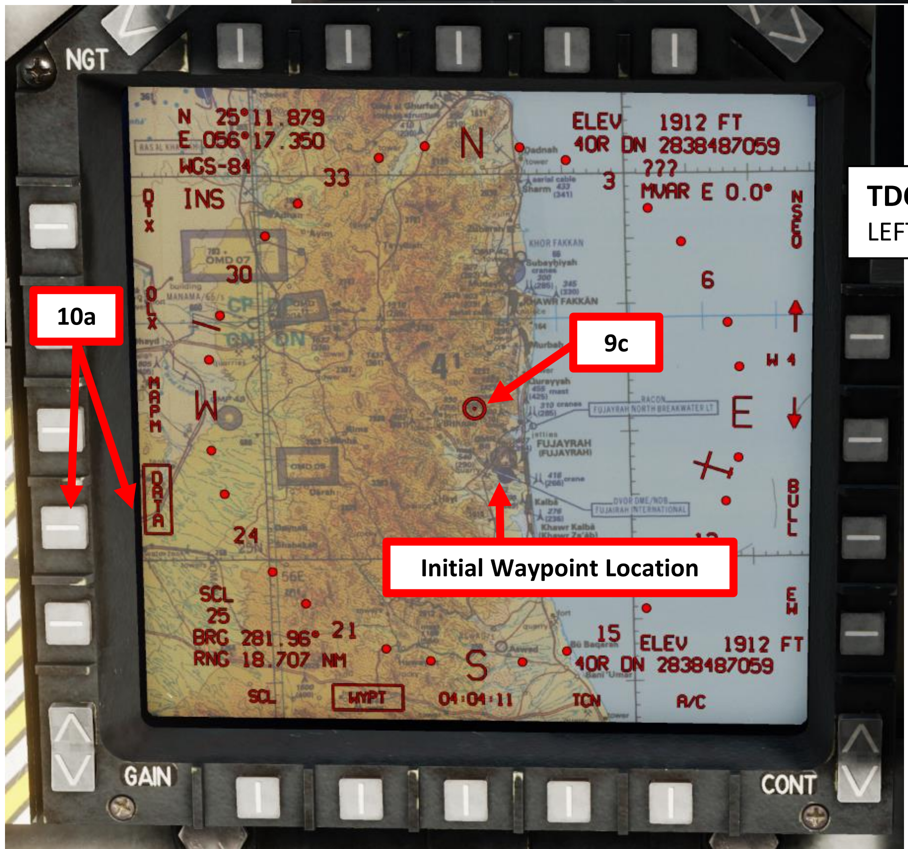


4.4 - HOW TO EDIT WAYPOINT WITH MOVING MAP & TDC

7. Press the Sensor Select Switch – FWD (INS) to slave the TDC (Target Designation Caret) to the Inertial Navigation System.
8. Press on the OSB next to SCL (scale) to choose desired scale. This can be useful to zoom out if you need to move the waypoint a long distance since the TDC is automatically scaled with the Moving Map scale.
9. Use the TDC controls to move the waypoint on the moving map
10. Once you are satisfied with its location, click on the OSB next to DATA to de-select the data sub-menu.

Sensor Select Switch
AFT = DMT: LST/TV
FWD = INS: IRMV/EOMV
LEFT = MAP Center/Decenter
RIGHT = FLIR/HUD-BH/WH
DOWN (PUSHED) = HUD Scene Reject/TPOD

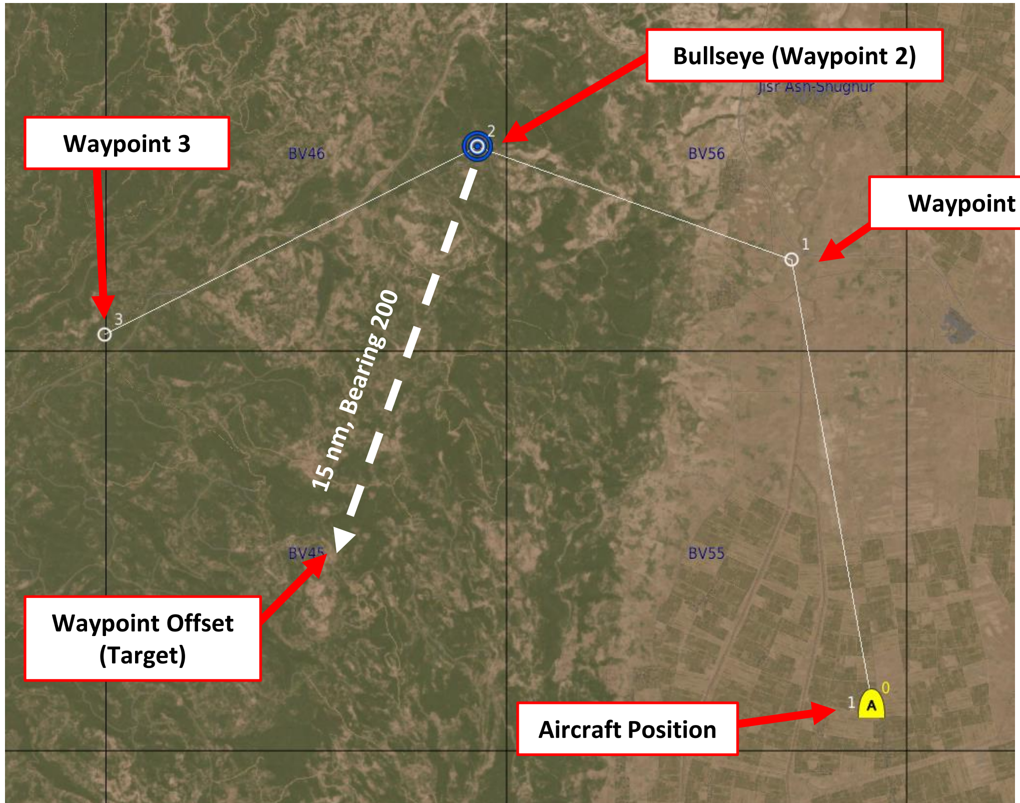




TDC (Target Designation Caret) Control Switch
LEFT/RIGHT/FORWARD/AFT/DOWN (ACTION)

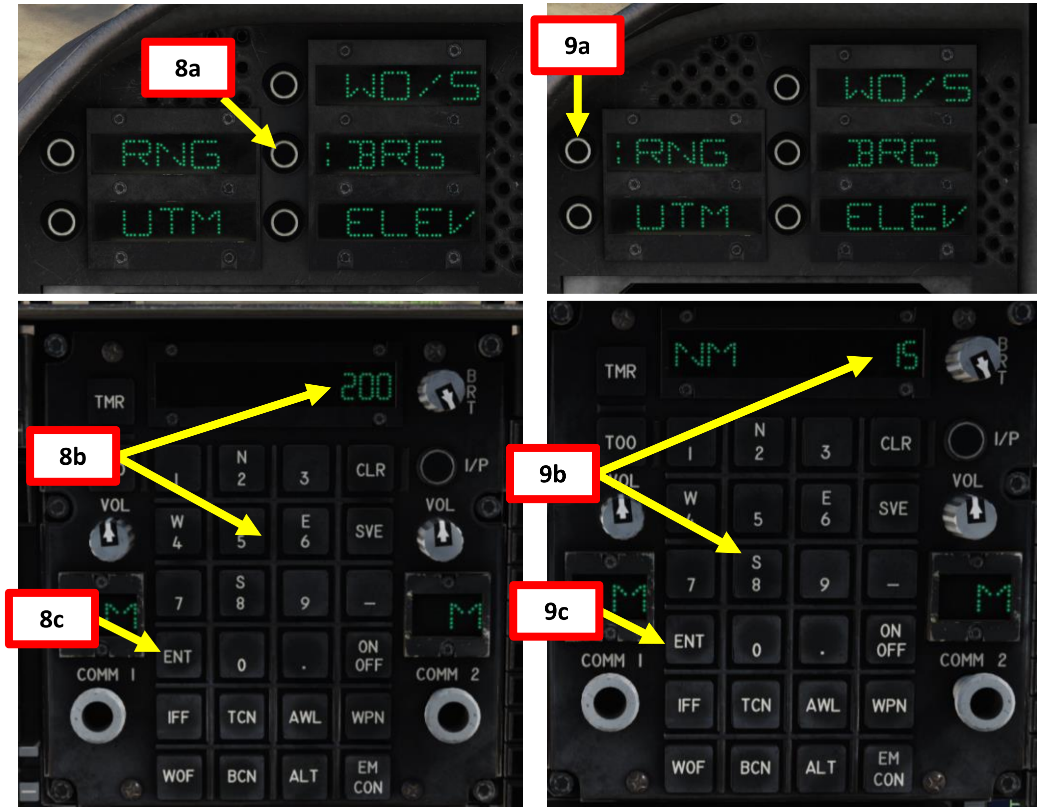
4.5 – WAYPOINT OFFSET

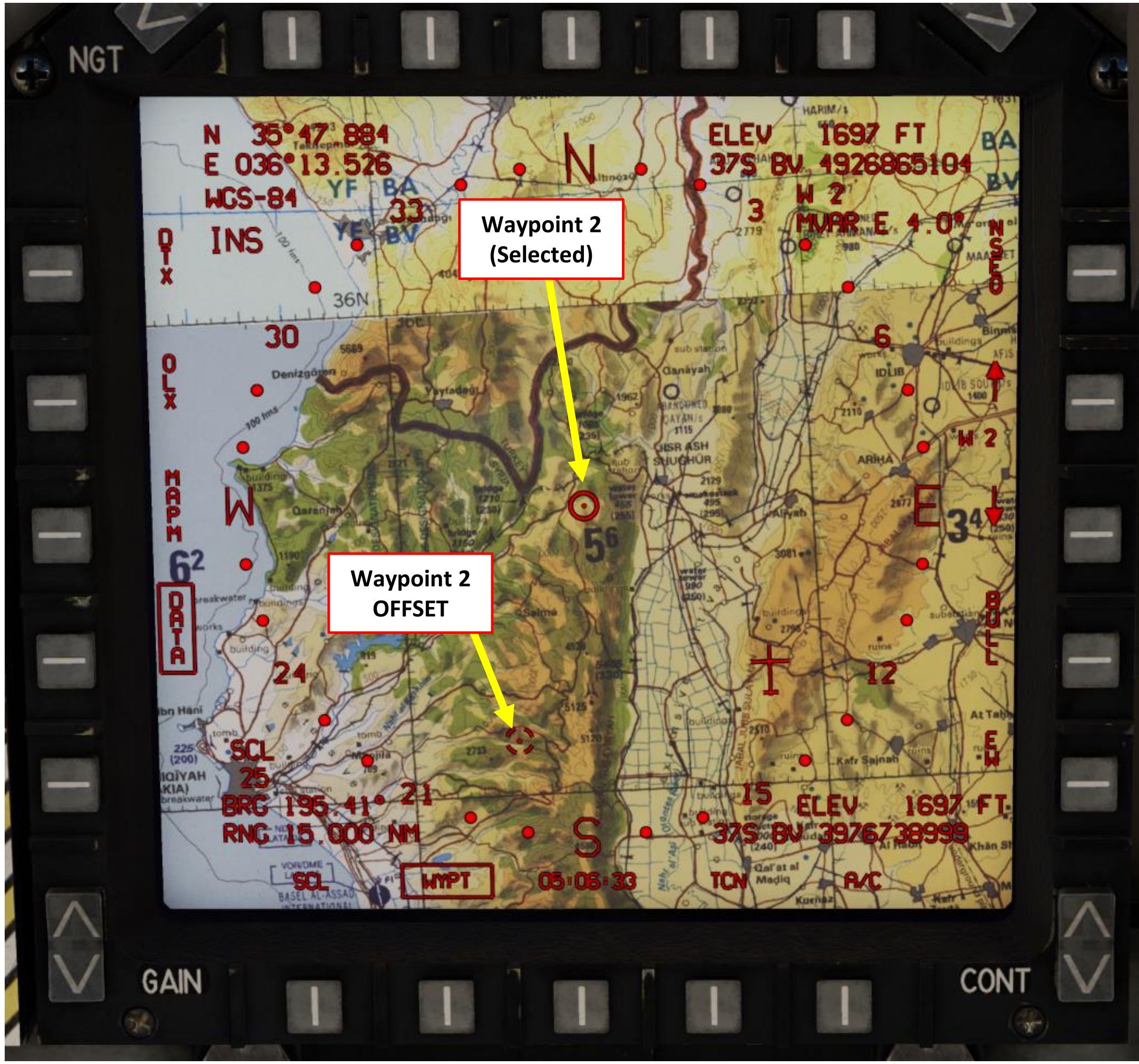
1. The most common use for a Waypoint Offset is a Bullseye Call. If the Bullseye is set on a Waypoint (in our case Waypoint 2) and we receive a Bullseye call for a target with a bearing and range from the Bullseye, we can create a "Waypoint Offset" and navigate to it just like any other waypoint.
2. As an example, a threat is at "Bullseye 200 for 15 miles". Since our Waypoint 2 is set to the Bullseye location, we can create a waypoint offset at a bearing of 200 and at a distance of 15 nm from WP2.
3. Make sure the Master Mode is set to NAV to be able to track your waypoint directly from your HUD.
4. Select the EHSD page on either MPCD
5. Select Waypoint 2 (set on Bullseye) with OSBs or the Waypoint Increment button.
6. Click on the OSB next to "DATA" to select the EHSD data sub-menu (will become boxed when selected)
7. Press the ODU (Option Display Unit) next to WYPT to toggle WYPT to WO/S.



4.5 – WAYPOINT OFFSET

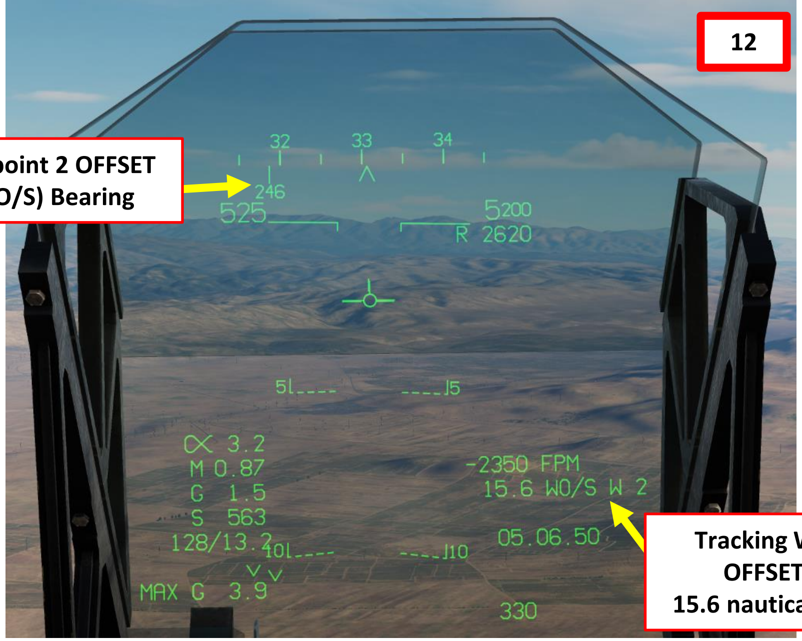
8. Enter the Waypoint Offset Bearing of 200 by selecting the "BRG" (Bearing) ODU (":" appears when selected), then entering "200" on the UFC, and pressing "ENT".
9. Enter the Waypoint Offset Range of 15 nm by selecting the "RNG" (Range) ODU (":" appears when selected), then entering "15" on the UFC, and pressing "ENT".

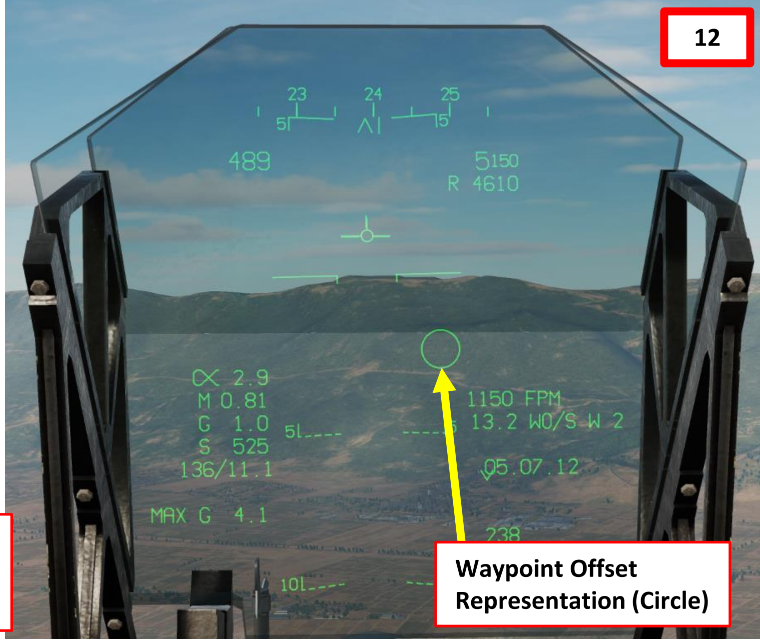


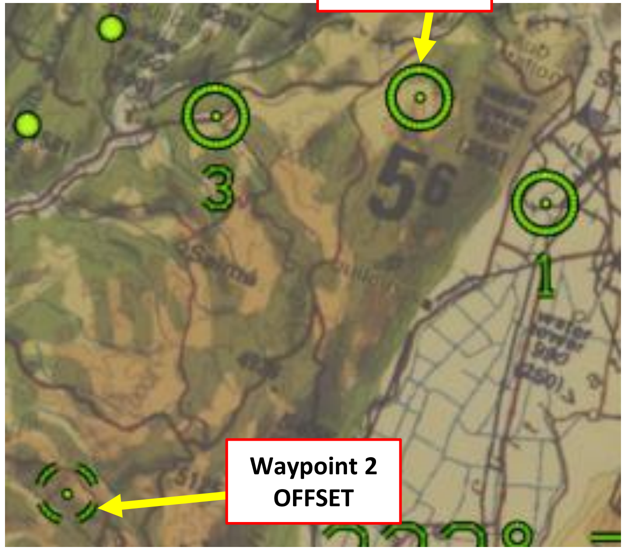


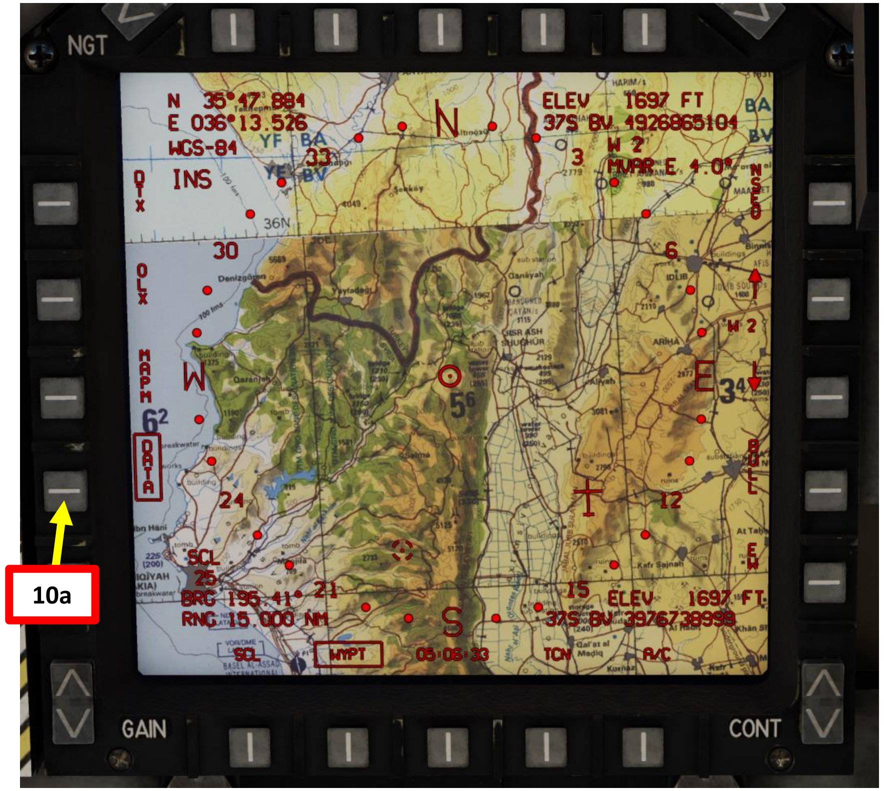
4.5 – WAYPOINT OFFSET

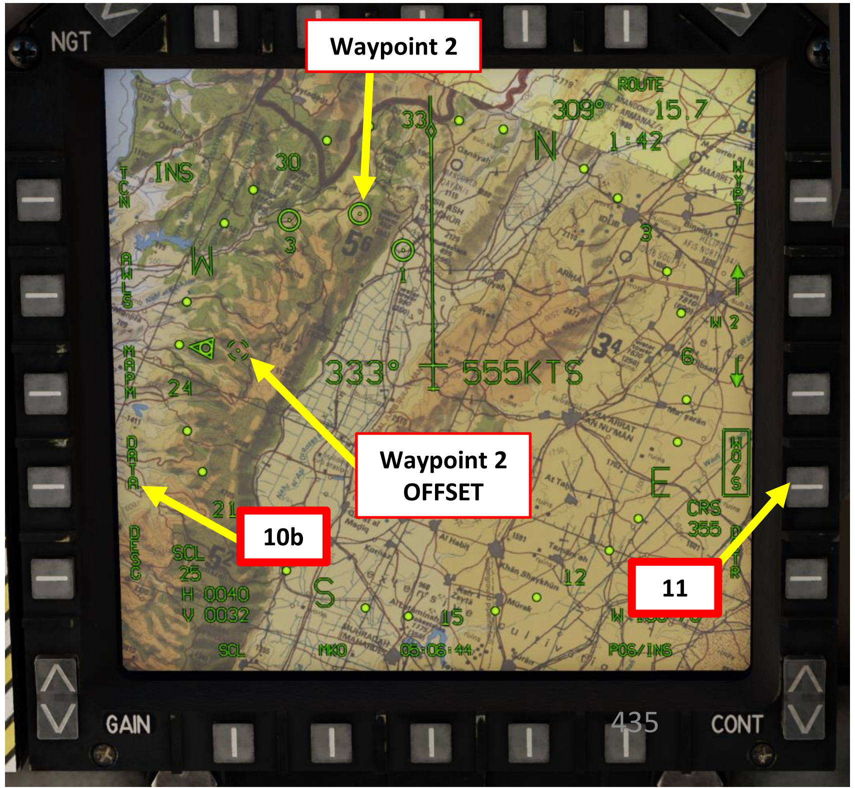
10. Exit the EHSD DATA sub-menu by pressing the OSB next to “DATA”.
11. Press the OSB next to “WO/S” (Waypoint Offset) to select the Waypoint 2 Offset (boxed when selected).
12. The Waypoint 2 Offset will appear on the EHSD and the HUD as well.
13. To track Waypoint 2 without the Waypoint Offset, press the “WO/S” OSB again to unselect it.











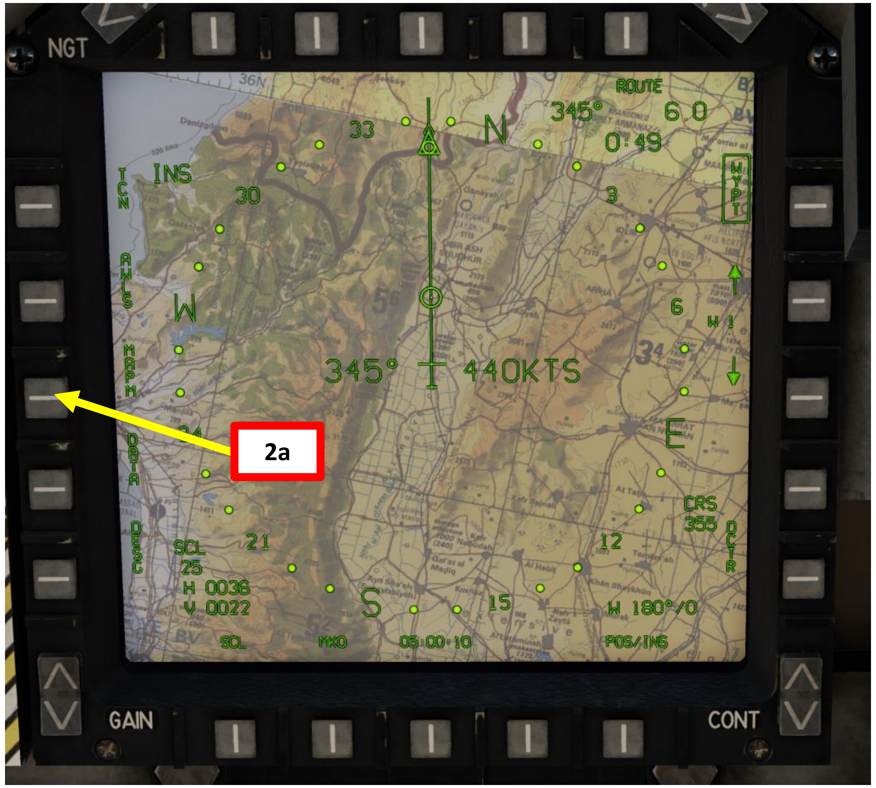
4.6 – WAYPOINT SEQUENCING

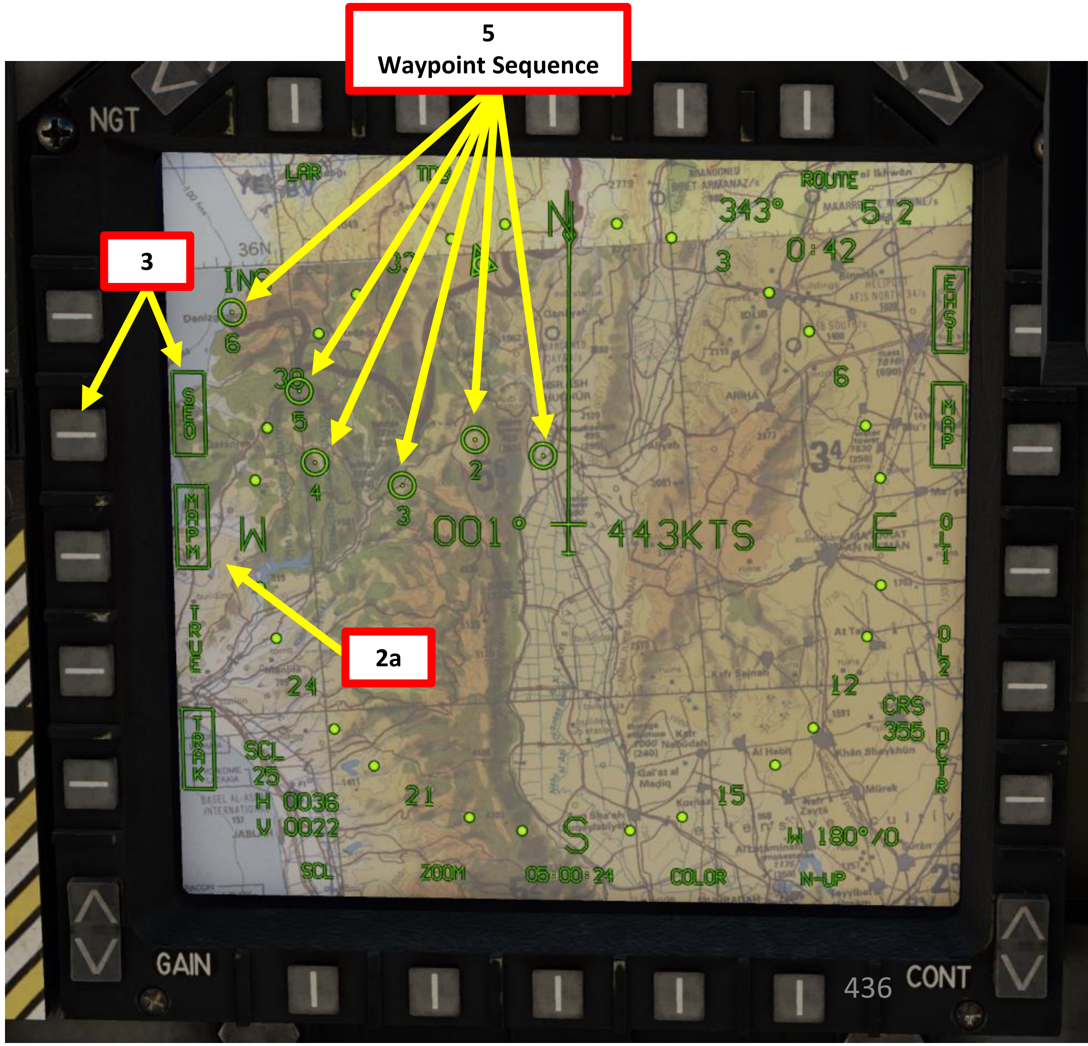
When following a flight plan and reaching the waypoint you have currently selected, "sequencing" waypoints allows you to follow a flight plan. We will explore two functions of the EHSD:

- SEQ, which displays all waypoints of a sequence (flight plan)
- NSEQ/ROUTE, which allows you to display a route created from a custom sequence (non-sequential) of waypoints.

A – How to display Waypoint Sequencing (SEQ):

1. Select the EHSD page on either MPCD, and make sure NAV Master Mode is selected.
2. Select MAPM Menu
3. Press on OSB next to SEQ. When selected, SEQ will be boxed.
4. Take note that the MAP-specific menus that appeared in step 3) will automatically revert back to the EHSD-specific menus after a short delay.
5. All waypoints within your flight plan will be displayed as numbered circles.





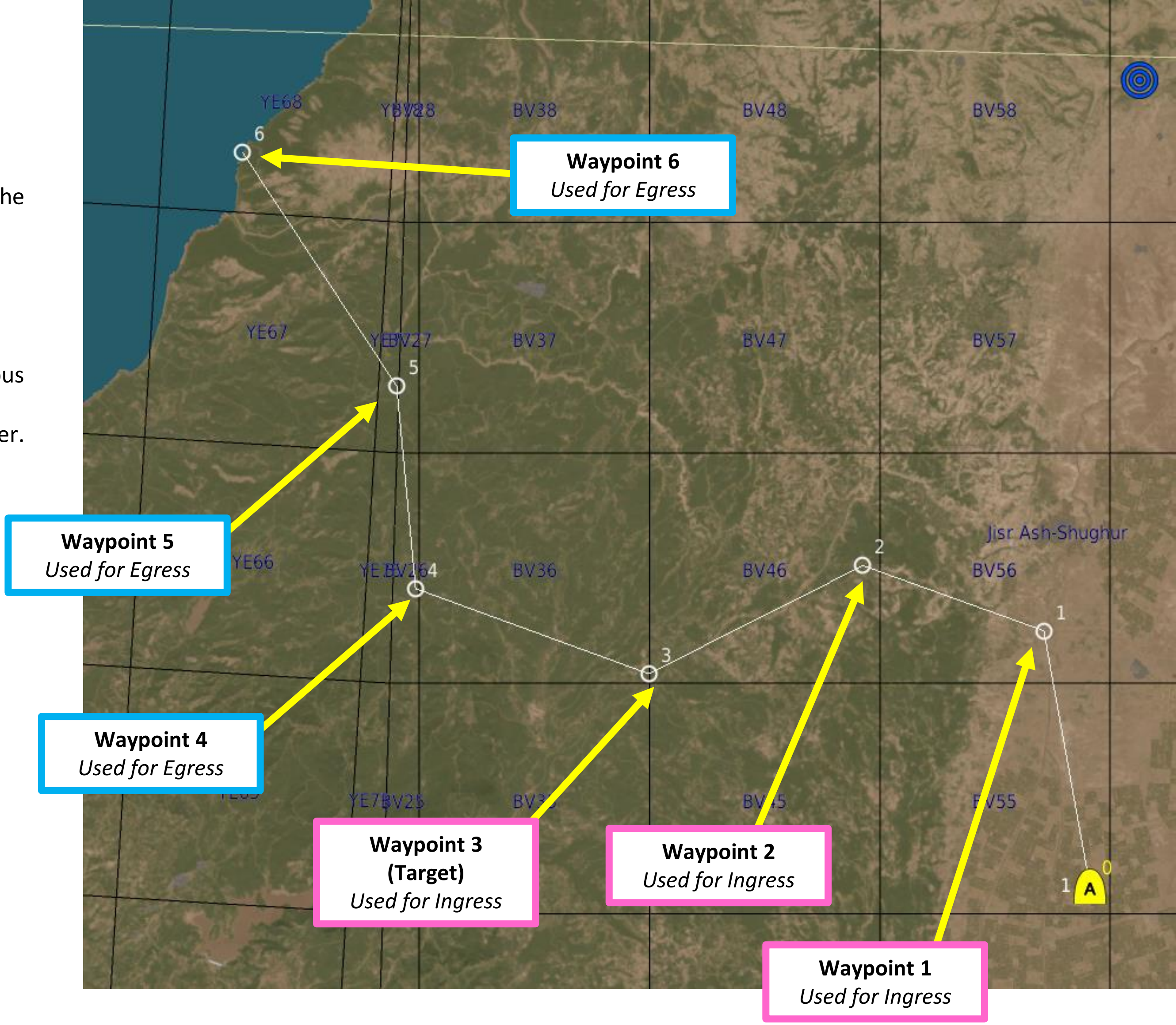
4.6 – WAYPOINT SEQUENCING

B – How to set and display a Non-Sequential Route (NSEQ):

In this tutorial, we want to set a NSEQ Route to attack a target set on Waypoint 3. The Route is split into two segments:

- The Ingress Route: this is the flight path you follow to attack a target.
- The Egress Route: this is the flight path you follow after you have attacked the target.

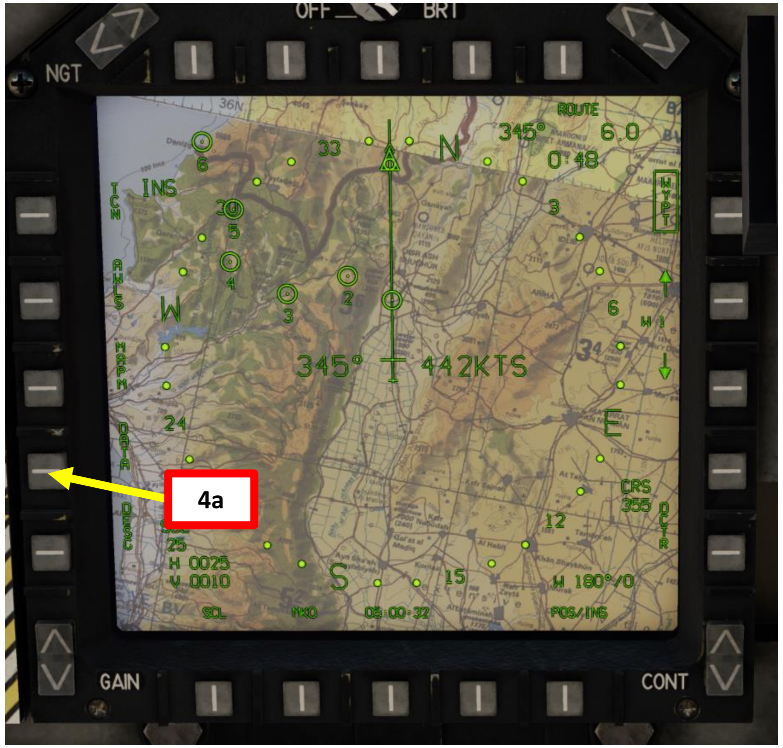
1. Select the EHSD page on either MPCD, and make sure NAV Master Mode is selected.
2. In this tutorial, we will assume the SEQ option is already selected/boxed (see previous tutorial) in order to display the waypoint symbols.
3. We have already the 6 waypoints we need programmed in the navigation computer. Now, we need to create the route.

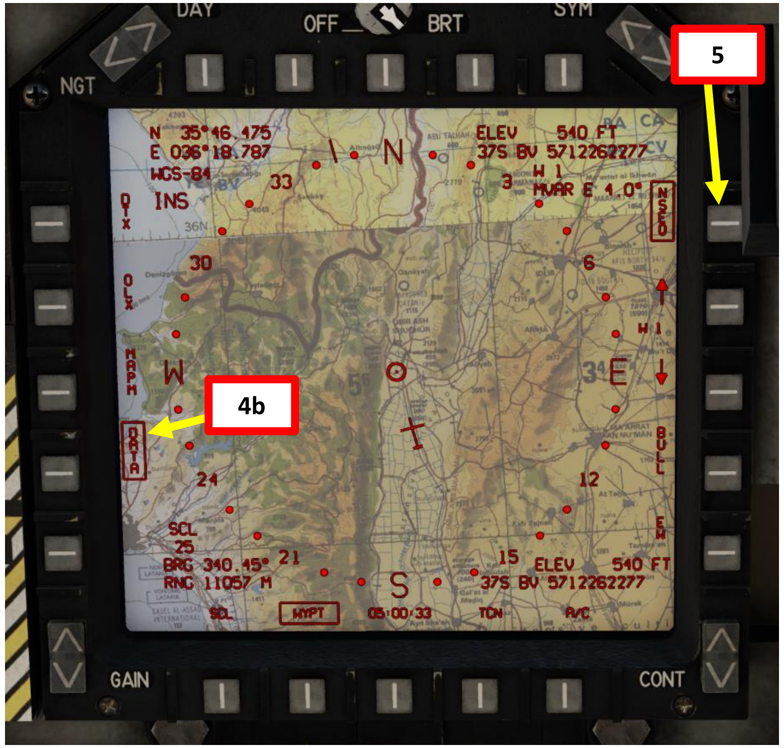


4.6 – WAYPOINT SEQUENCING

B – How to set and display a Non-Sequential Route (NSEQ):

4. Select EHSD DATA menu.
5. Select NSEQ Option (boxed when selected)
6. If a Route already exists, press the RSET ODU (Option Display Unit) button to reset it.
7. Press IGRS (Ingress) ODU to select the Ingress Route.
8. Press PROG (Program) ODU.
9. On UFC, enter your Ingress route in the following manner:
    a) Type “01” for Waypoint 1, then press “ENT” to enter it in the Ingress Route.
    b) Type “02” for Waypoint 2, then press “ENT” to enter it in the Ingress Route.
    c) Type “03” for Waypoint 3, then press “ENT” to enter it in the Ingress Route.
10. Press IGRS ODU to toggle EGRS (Egress) option; this will select the Egress Route.
11. On UFC, enter your Egress route in the following manner:
    a) Type “04” for Waypoint 4, then press “ENT” to enter it in the Egress Route.
    b) Type “05” for Waypoint 5, then press “ENT” to enter it in the Egress Route.
    c) Type “06” for Waypoint 6, then press “ENT” to enter it in the Egress Route.

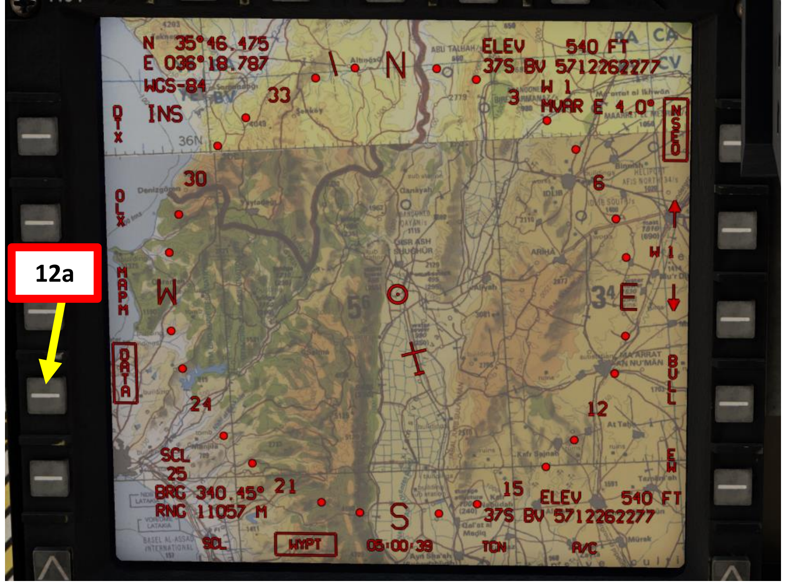


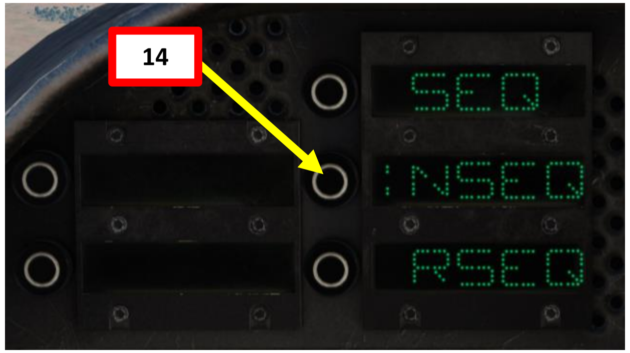


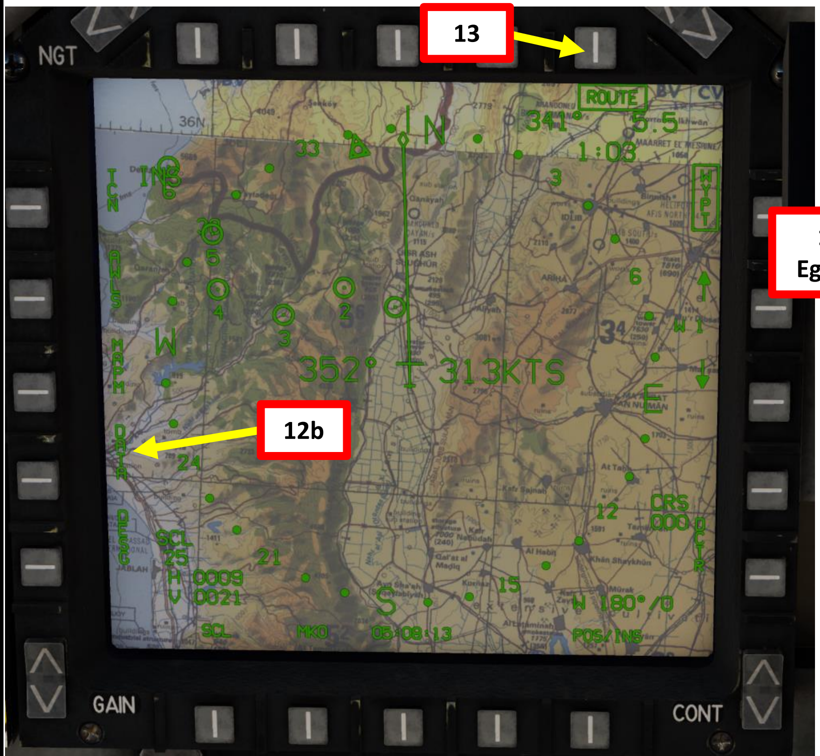
4.6 – WAYPOINT SEQUENCING

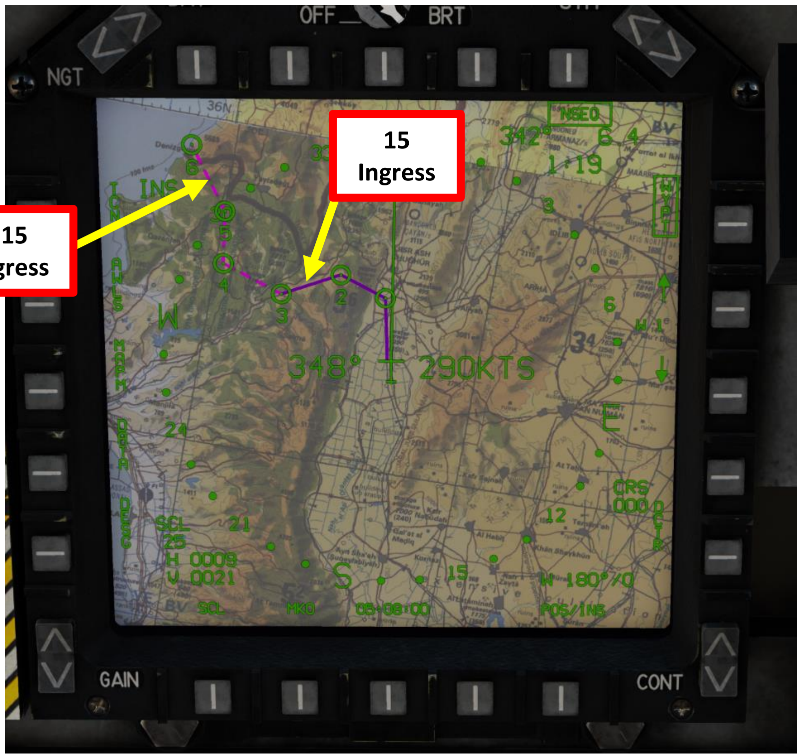
B – How to set and display a Non-Sequential Route (NSEQ):

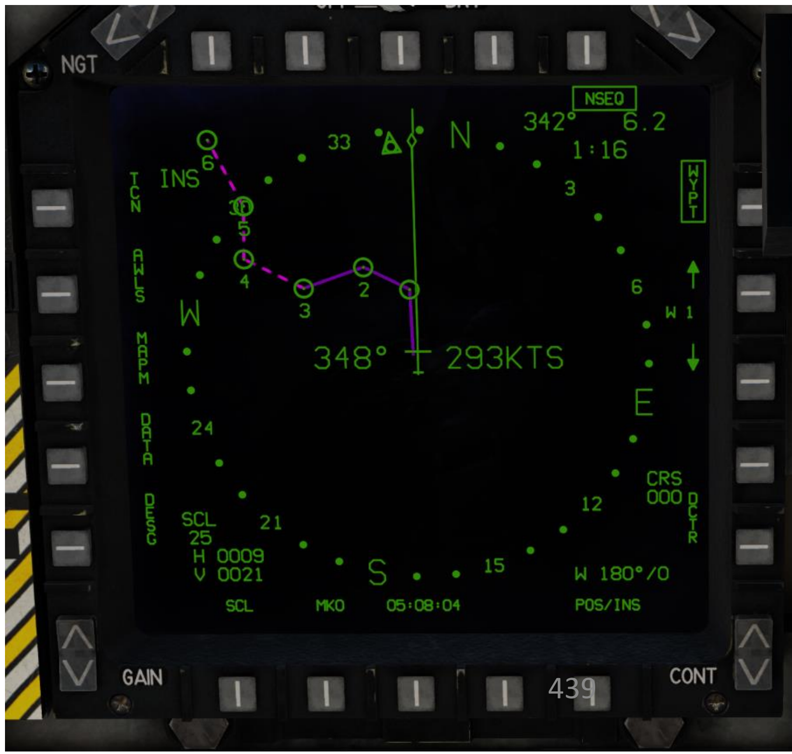
12. Exit the DATA sub-menu by pressing OSB next to DATA. When unboxed, DATA is un-selected.
13. Press on OSB next to ROUTE to select it (boxed when selected).
14. Press the NSEQ ODU to select the Non-Sequential Route we just programmed.
15. The route will be drawn on your EHSD/Moving Map.





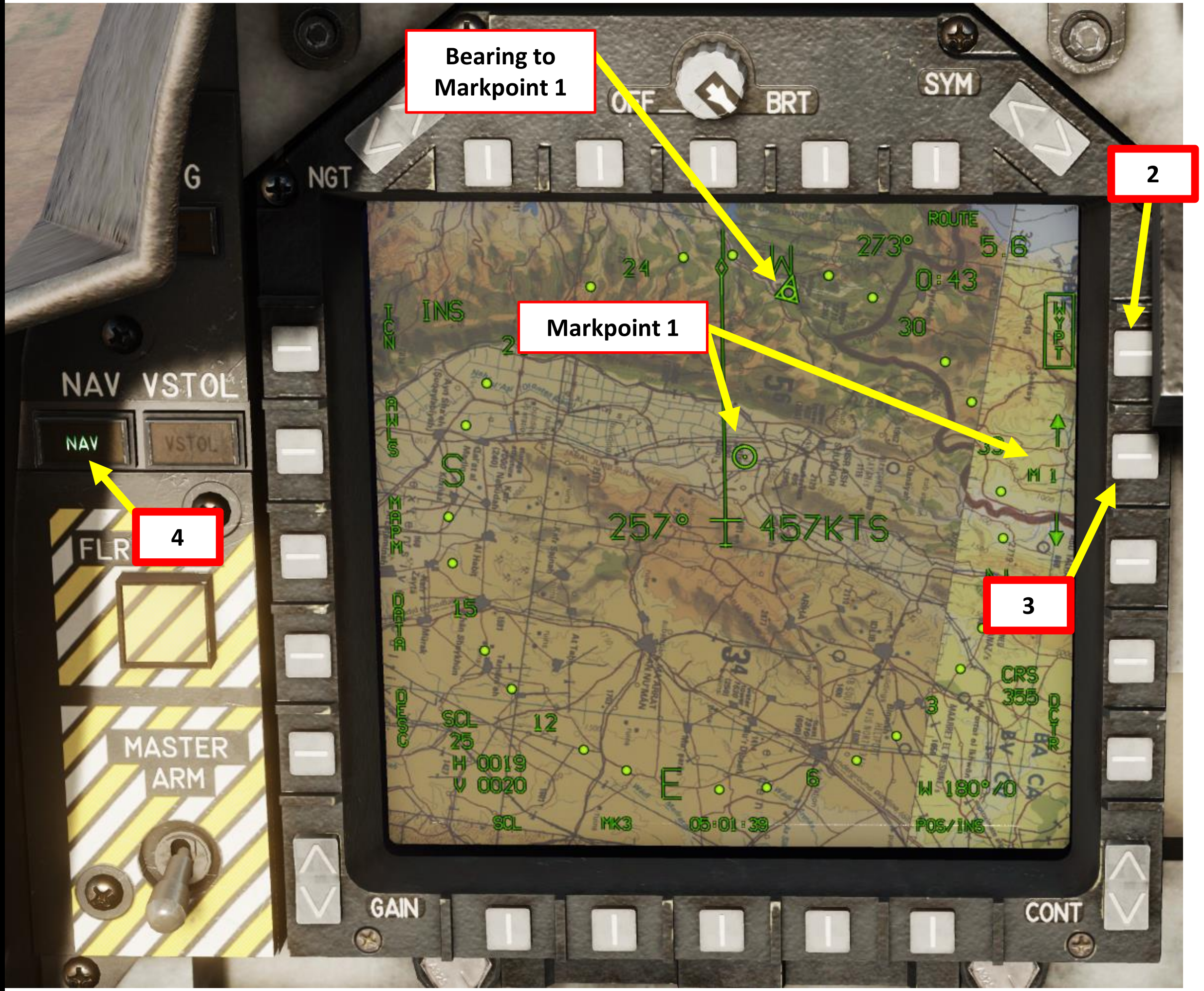


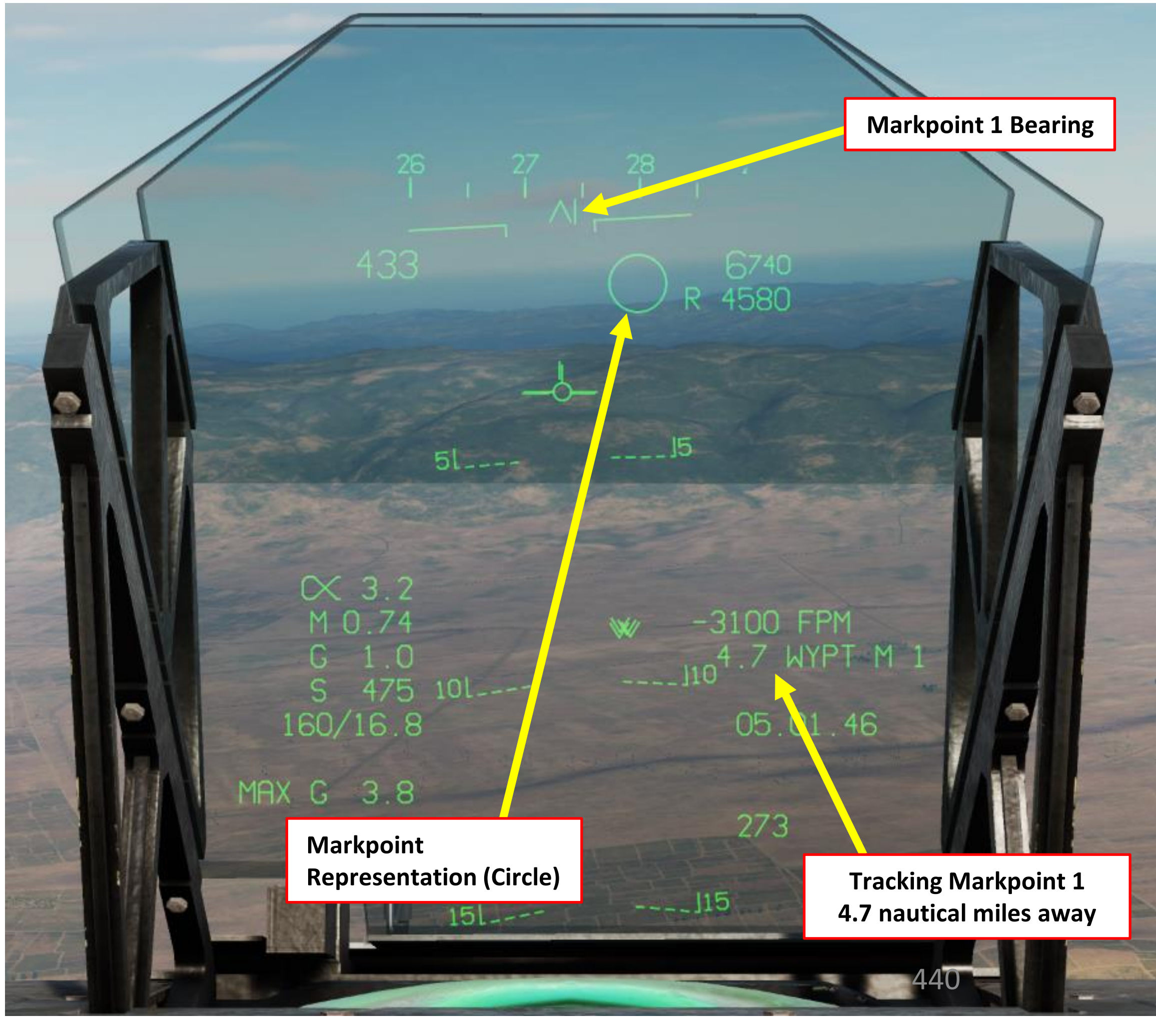




5.1 - MARKPOINT NAVIGATION

1. Select the EHSD page on either MPCD
2. Press the OSB next to WYPT to set tracking mode to WAYPOINT.
3. To select a markpoint, press the OSB (Option Select Button) to increment or decrement the waypoint number until you reach the desired Markpoint (M1, M2, etc). Alternatively, you can use the WP Increment button on the stick.
4. Make sure the Master Mode is set to NAV to be able to track your waypoint directly from your HUD.
5. Consult EHSD and HUD to find selected Markpoint

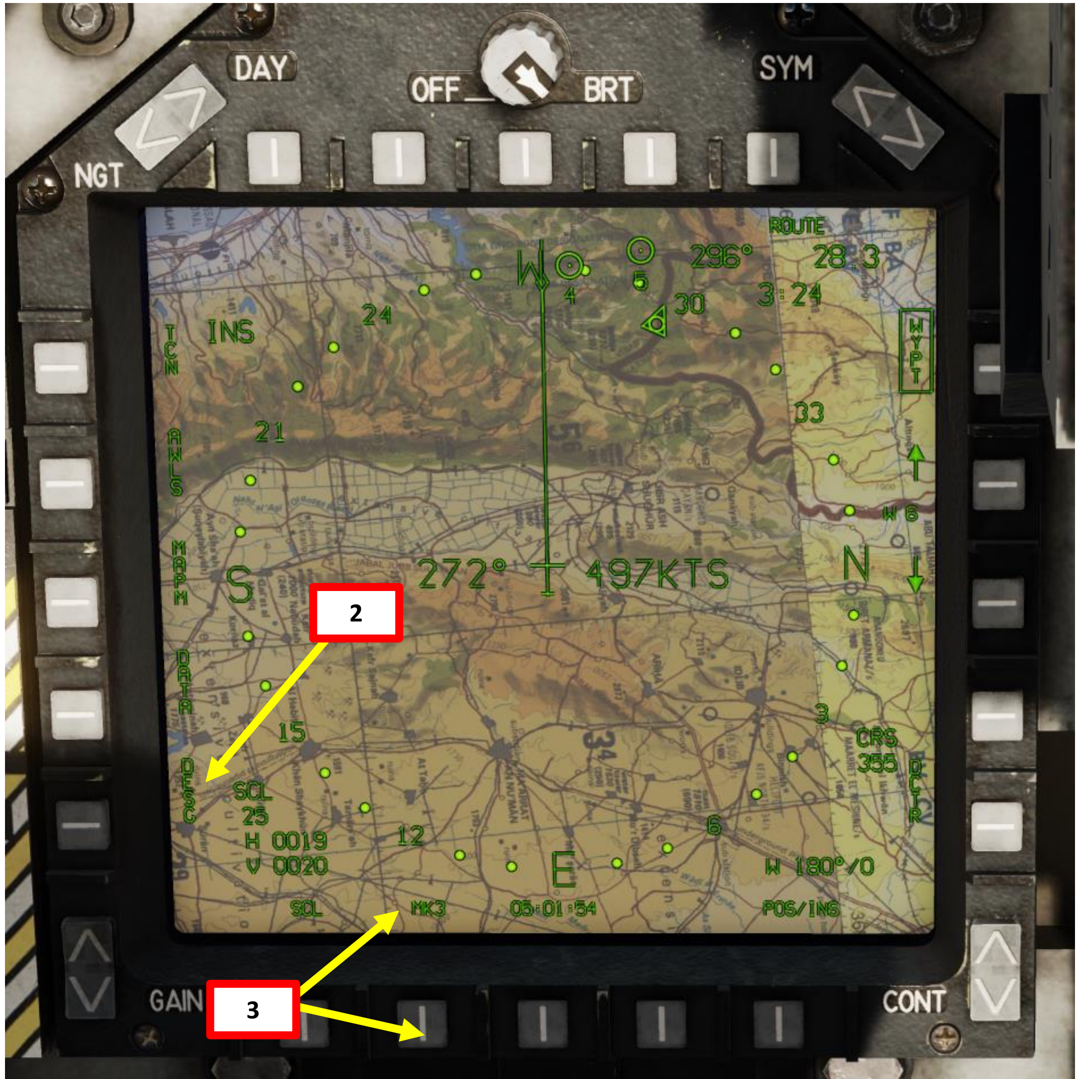




5.2 - HOW TO ADD MARKPOINTS

A - OVERFLY Method

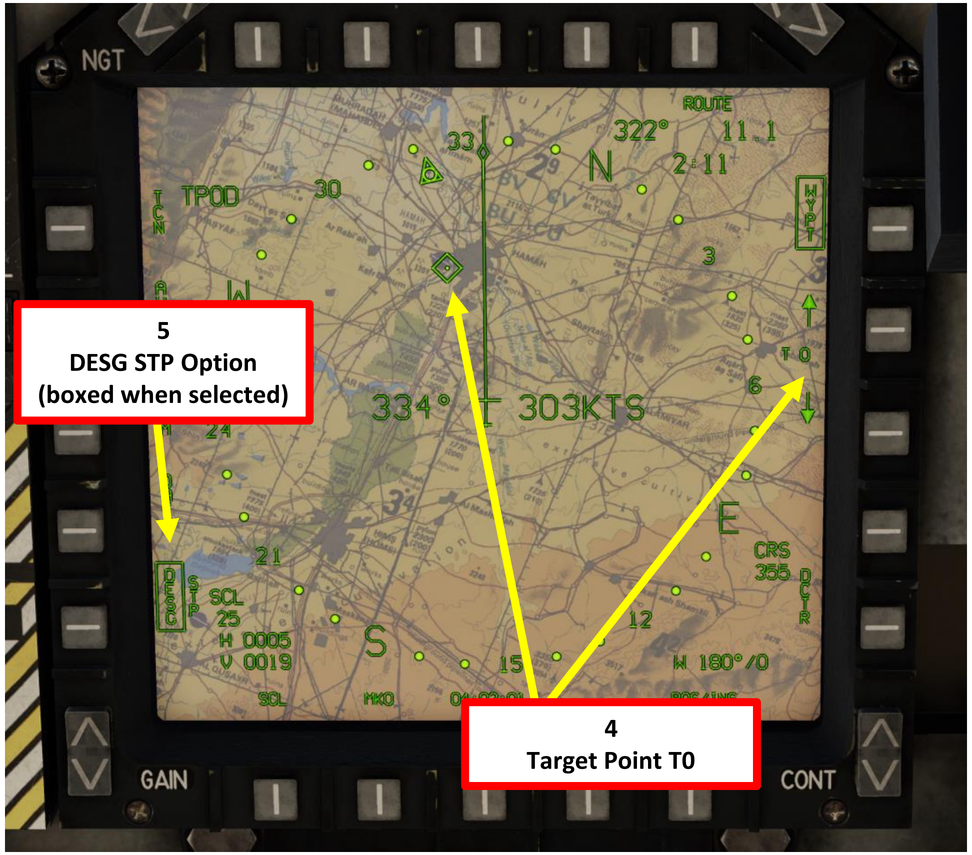
1. Select the EHSD page on either MPCD
2. To create a markpoint with the OVERFLY method, make sure you have no target designated (DESG unboxed).
3. Press the OSB next to “MK”.
4. A markpoint will be created at the aircraft’s location at the time the Markpoint OSB was pressed.

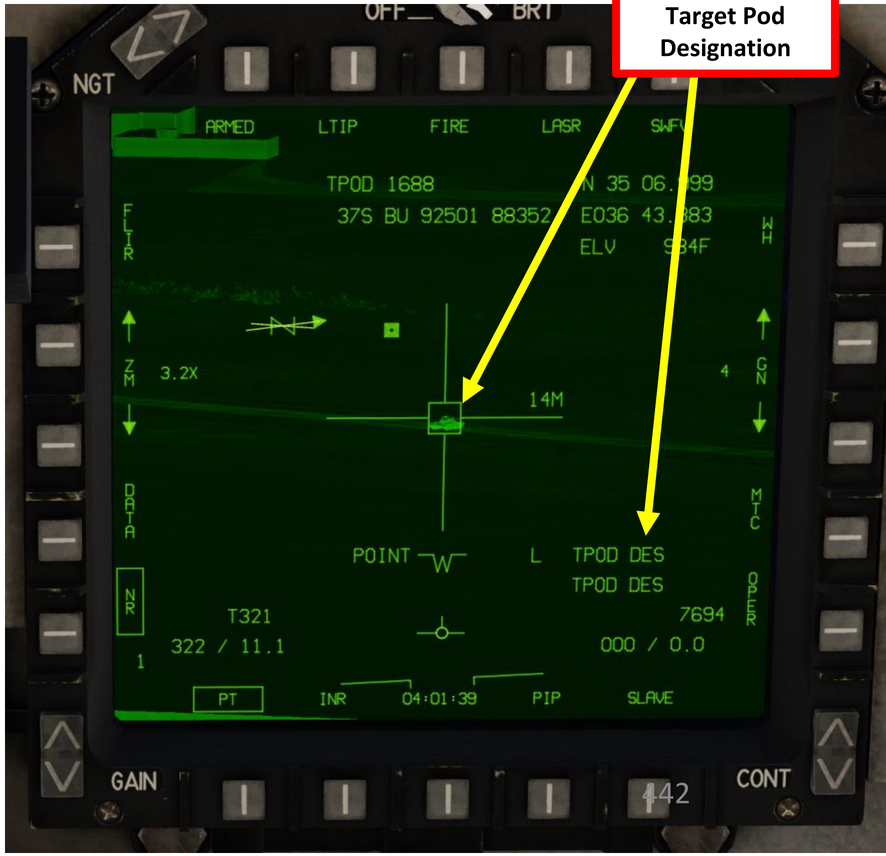


5.2 - HOW TO ADD MARKPOINTS

B - DESIGNATE Method (Example with Targeting Pod)

1. Enter TPOD HTS (Targeting Pod HOTAS) Mode by pressing the Sensor Select Switch DOWN twice in quick succession.
2. Use TDC Controls (Left/Right/Fwd/Aft) to slew the targeting pod reticle on the target.
3. Use TDC Depress (Action) control to designate the target.
    - Confirm that Target/System Designation Status and Targeting Operational Mode both switch to TPOD DES (Targeting Pod Designate).
4. Press the WP Increment button LONG to select Target Point T0.
5. When TDC Depress (Action) control has designated the target, the EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.



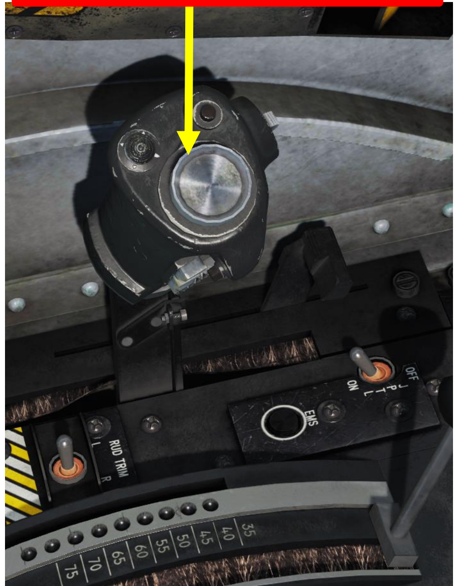


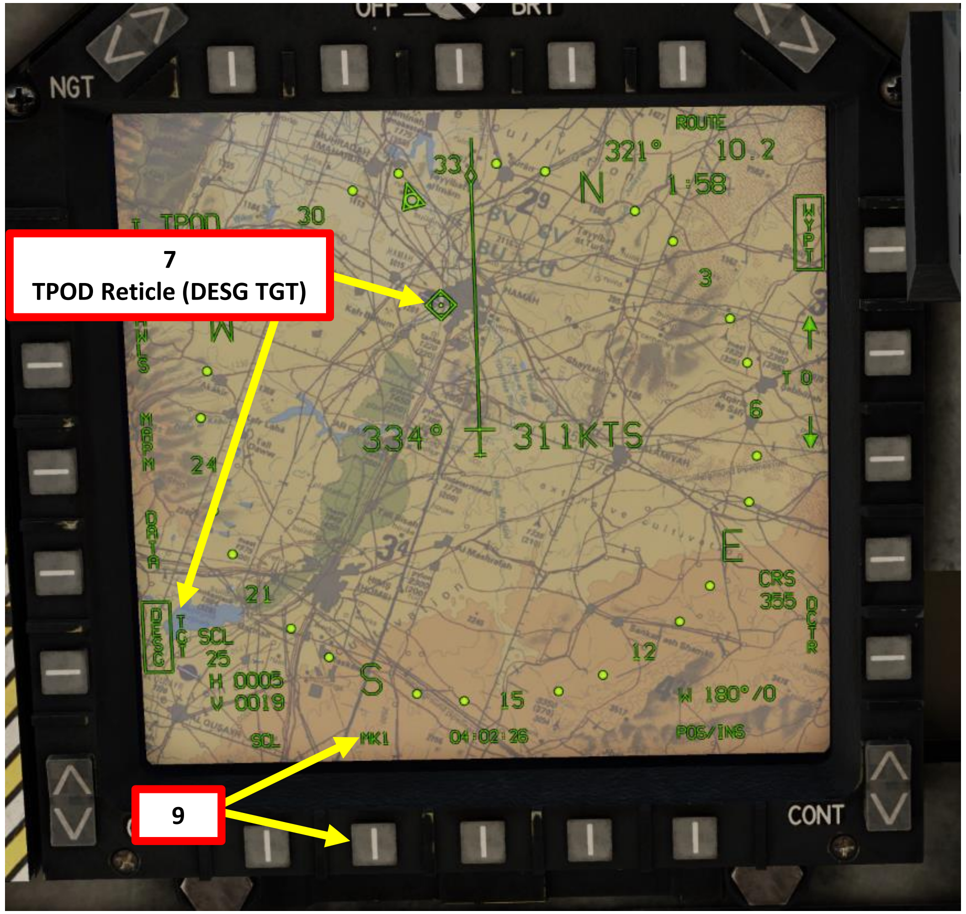
5.2 - HOW TO ADD MARKPOINTS

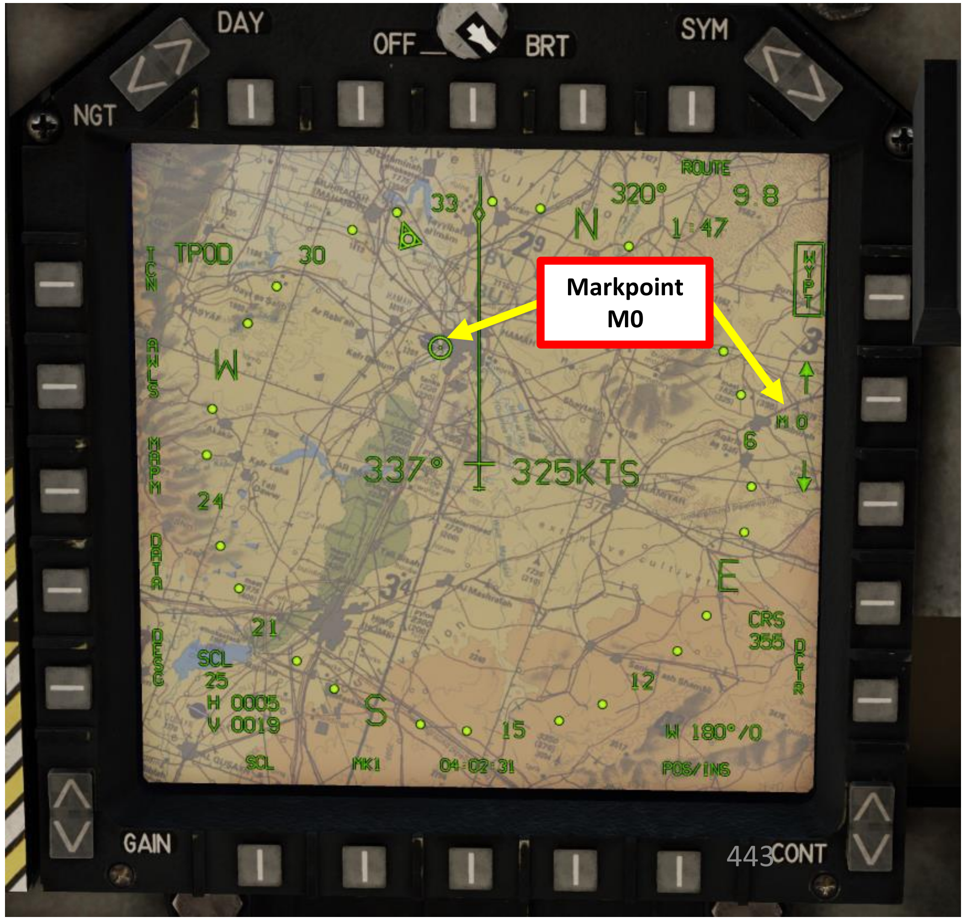
B - DESIGNATE Method (Example with Targeting Pod)

6. Once target is designated, you can re-slew the TPOD with TDC Left/Right/Fwd/Aft controls for targeting pod reticle adjustments.
7. On the EHSD, the DESG mode will switch from DESG STP (Steerpoint) to DESG TGT (Target).
   - Note: DESG TGT is set on the TPOD reticle, while DESG STP is set on the Target Point T0 initially designated when pressing « TDC DOWN Action Position » button.
8. To create a markpoint with the DESIGNATE method, make sure you have a target designated (see previous steps)
9. Press the OSB next to “MK”.
10. A markpoint will be created at the designated Target Point location at the time the Markpoint OSB was pressed.
11. And that’s it! You have now stored markpoint data on the designation point.

6
TDC (Target Designation Control)







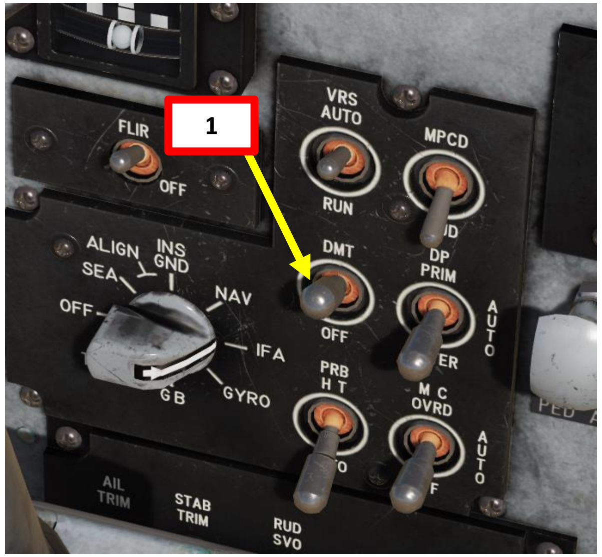
5.3 - USING MARKPOINTS

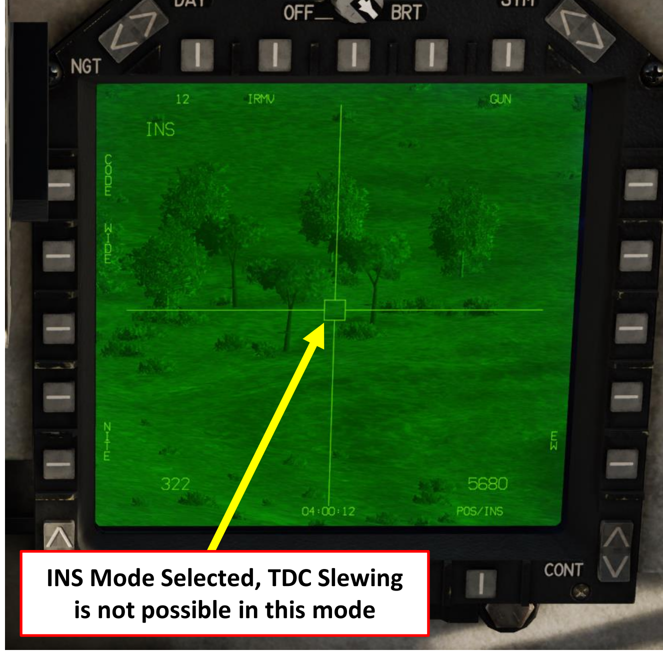
You can use markpoints just like regular waypoints. This means that you can use course lines, track them, and modify their position as desired using the UFC and ODUs.

6.1 – TARGETPOINT CREATION

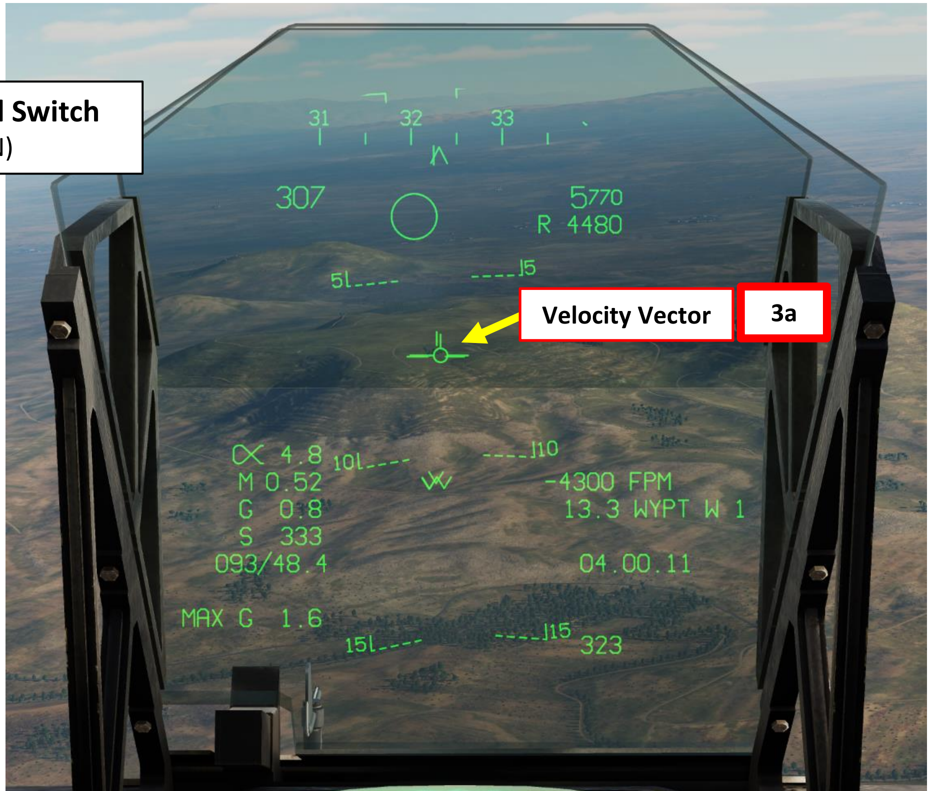
There are many ways to create a target point with sensors like the DMT or the Targeting pod. These methods are listed in existing tutorials in the Weapons section. In this tutorial, will create a Target Point using the HUD and DMT.

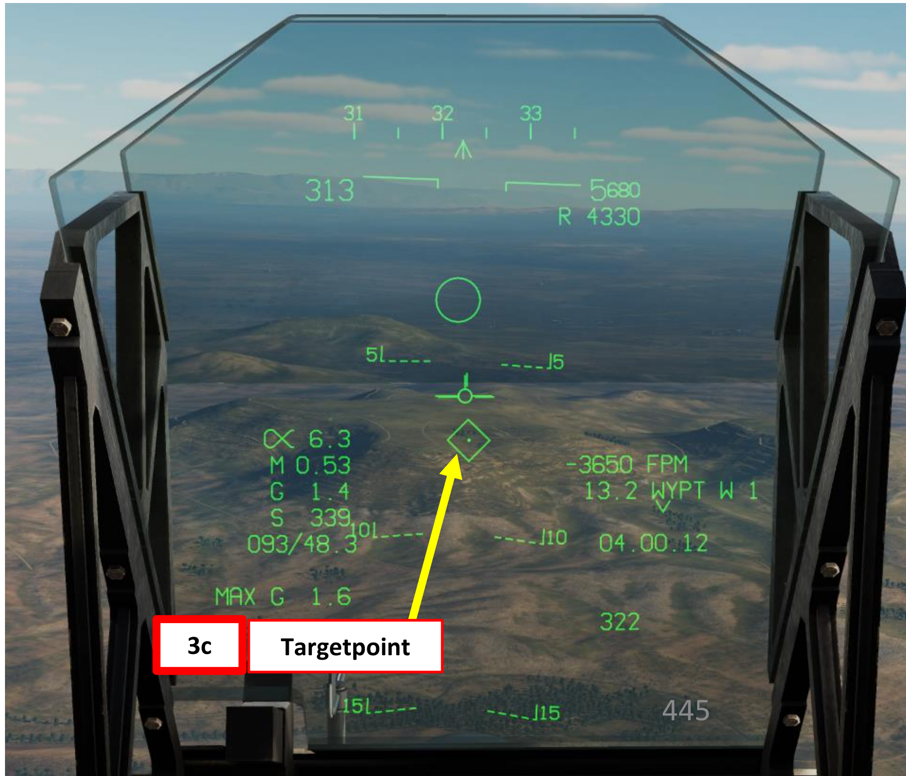
1. Make sure either the DMT (Dual Mode Tracker) is ON or the Targeting Pod is equipped and warmed up.
2. Make sure Master Mode is set to either NAV or A/G.
3. To create a waypoint, press the TDC switch DOWN. This will create a Targetpoint where the velocity vector is pointing on your HUD.





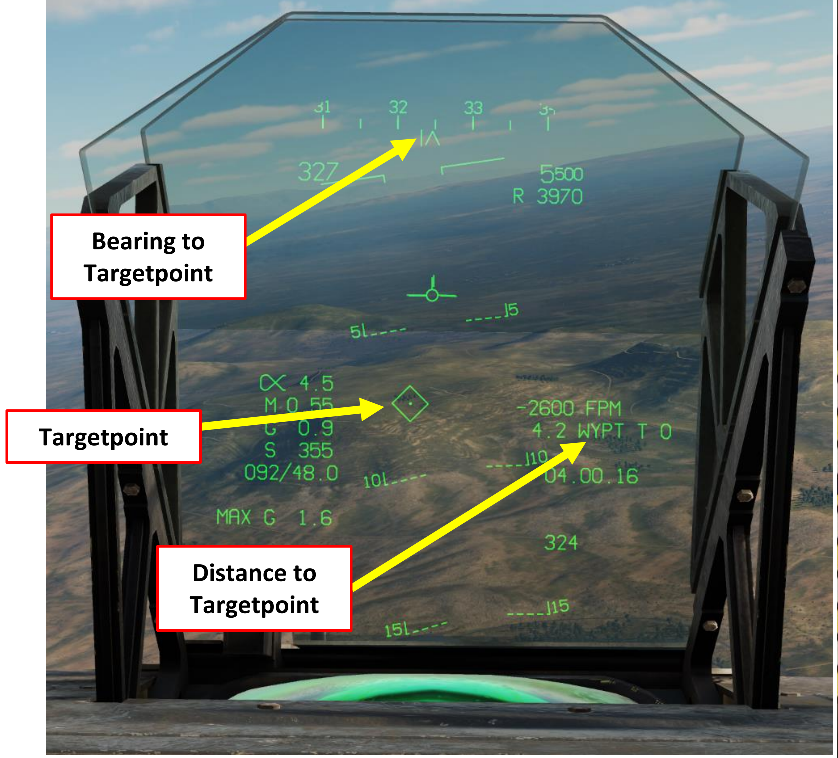
TDC (Target Designation Caret) Control Switch
LEFT/RIGHT/FORWARD/AFT/DOWN (ACTION)

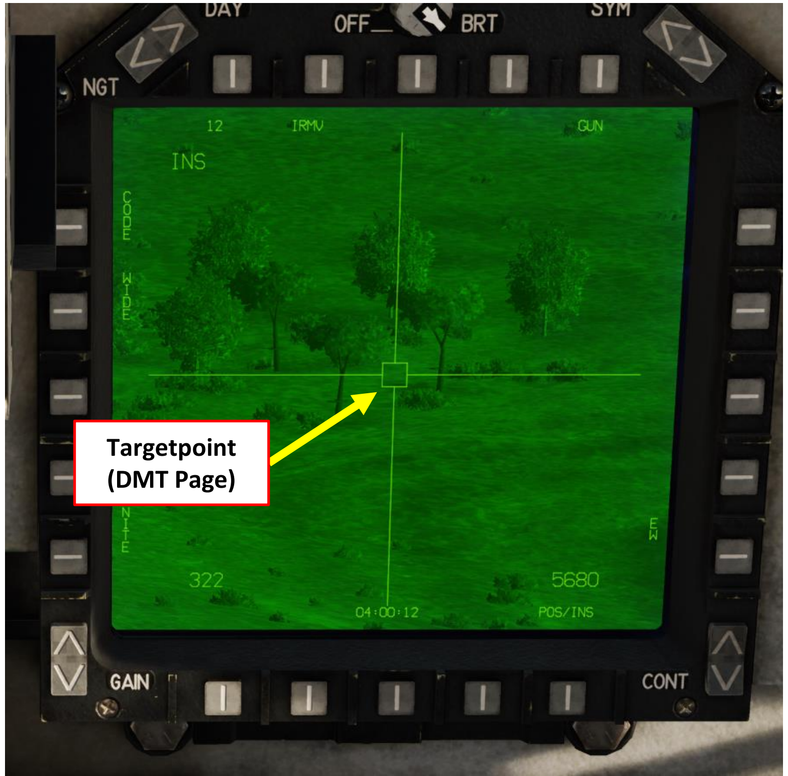


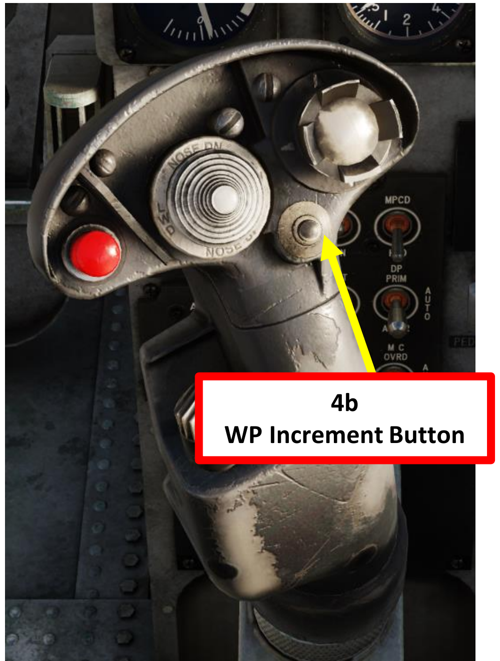


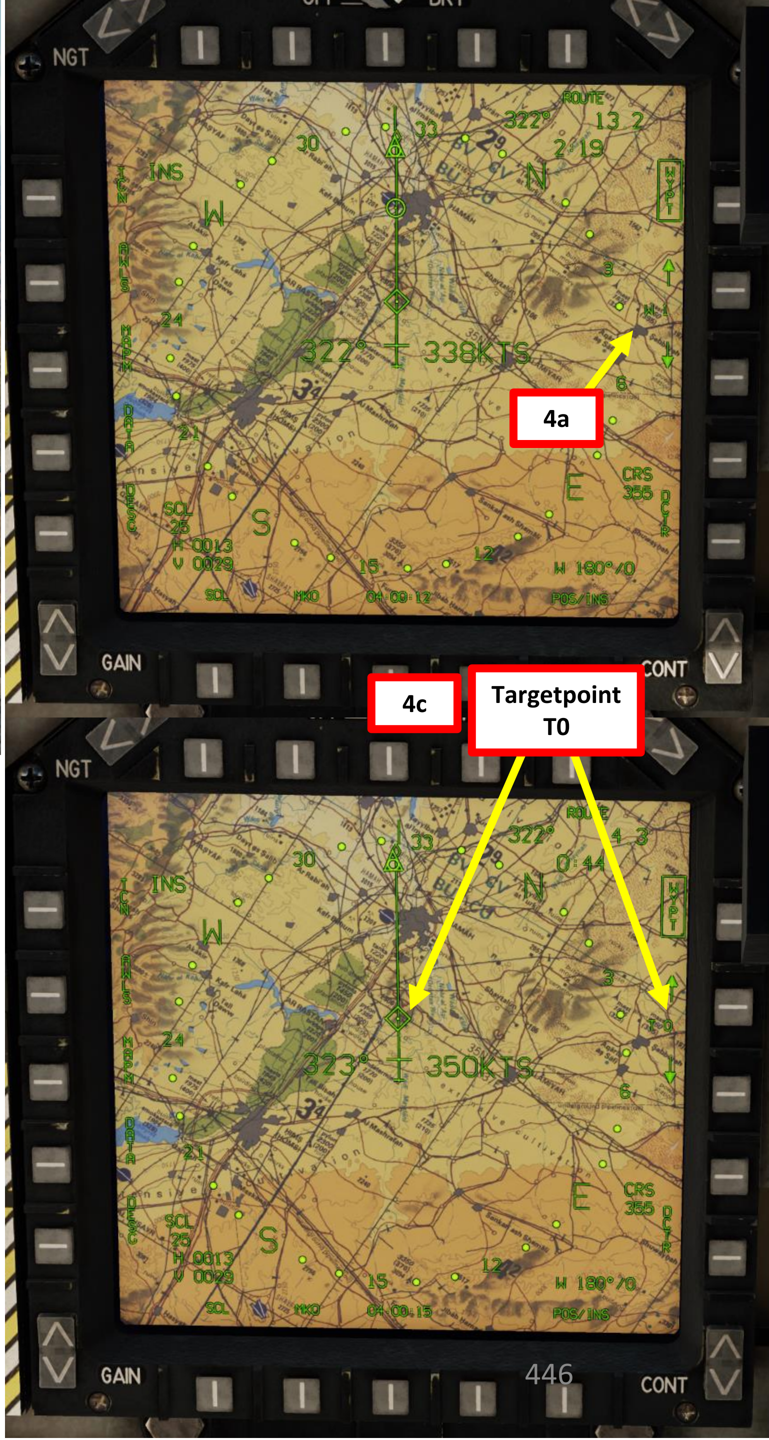
6.1 – TARGETPOINT CREATION

4. Press the WP Increment button LONG to select Target Point T0.
5. When T0 is selected, steering Data for the Target Point will become available.







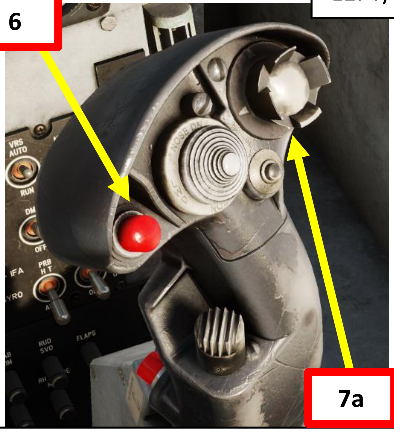


6.1 – TARGETPOINT CREATION

6. Take note that a Targetpoint is created and memorized every time you press the Air-to-Ground Bomb Pickle Button and release a bomb in CCIP. This functionality is quite useful if you need to perform subsequent passes on a single target.
7. You can slew the Targetpoint by pressing the Sensor Select Switch AFT (selects DMT TV mode) and then using the TDC Left/Right/Forward/Aft switch to move the cursor, then pressing the TDC DOWN switch to designate the target. Alternatively, you can also do it by using the targeting pod.

Air-to-Ground Bomb Pickle Button
Releases bombs or launches rockets or Maverick air-to-ground missiles

6



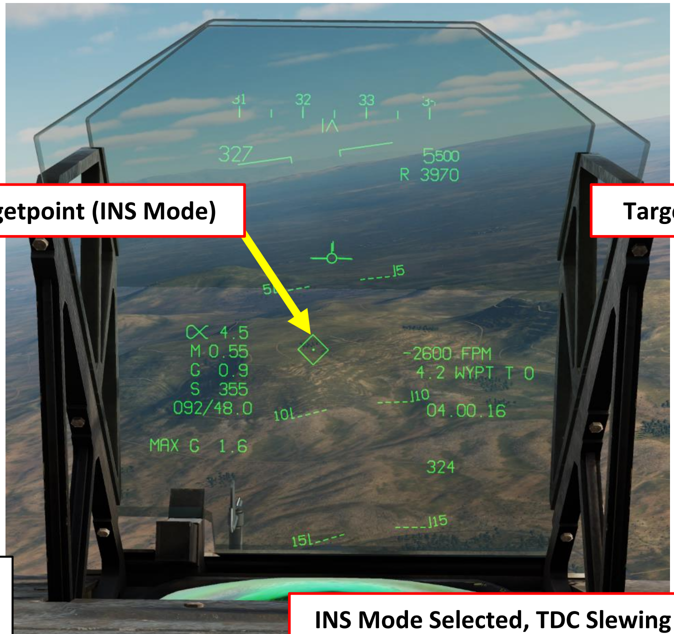
7a

Sensor Select Switch
AFT = DMT: LST/TV
FWD = INS: IRMV/EOMV
LEFT = MAP Center/Decenter
RIGHT = FLIR/HUD-BH/WH
DOWN (PUSHED) = HUD Scene Reject/TPOD

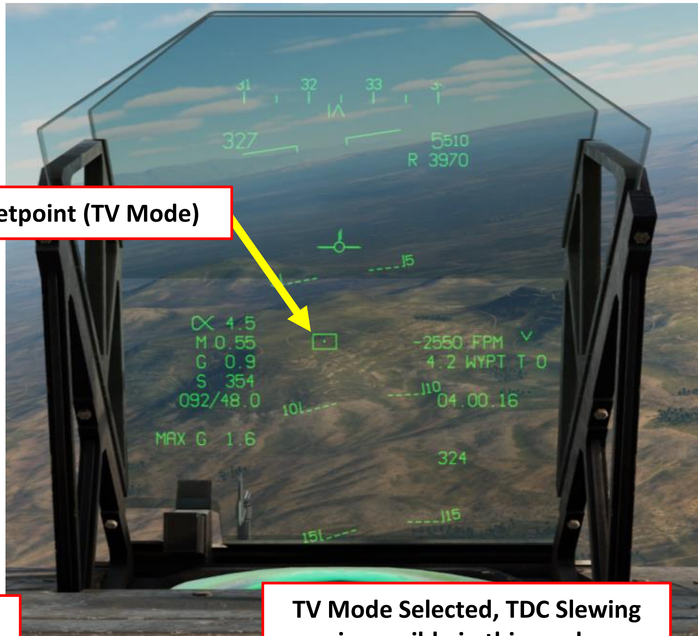
TDC (Target Designation Caret) Control Switch
LEFT/RIGHT/FORWARD/AFT/DOWN (ACTION)

7b 7c

Targetpoint (INS Mode)



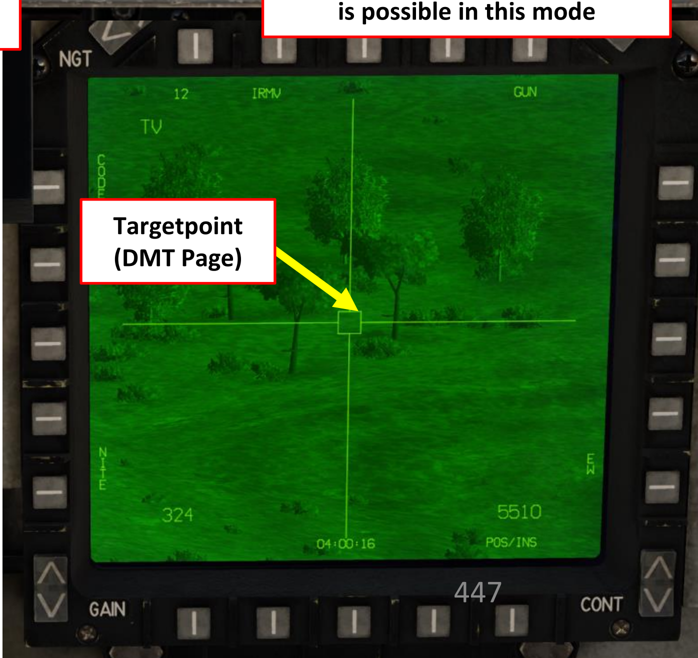
Targetpoint (TV Mode)



INS Mode Selected, TDC Slewing is not possible in this mode

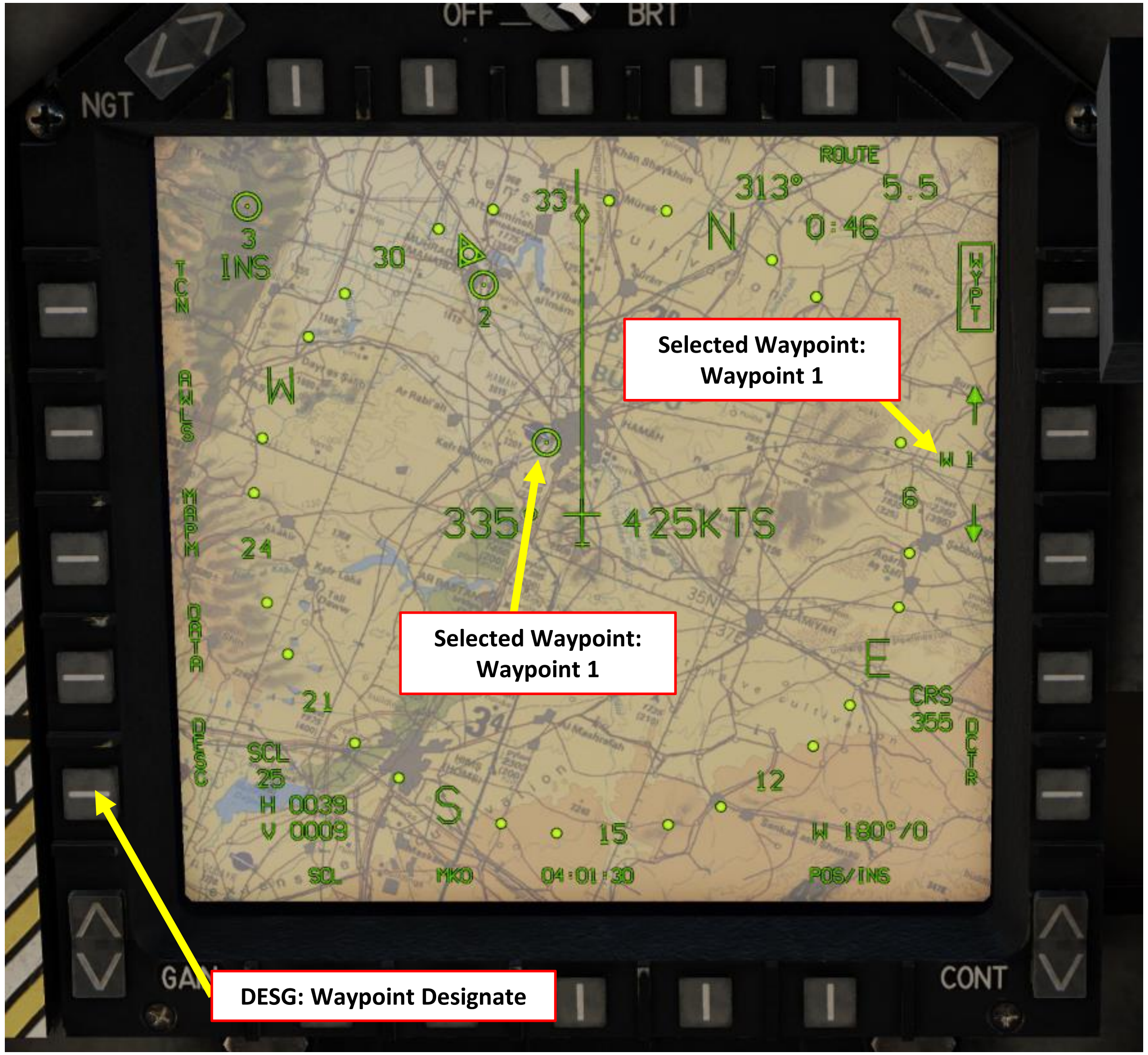
TV Mode Selected, TDC Slewing is possible in this mode

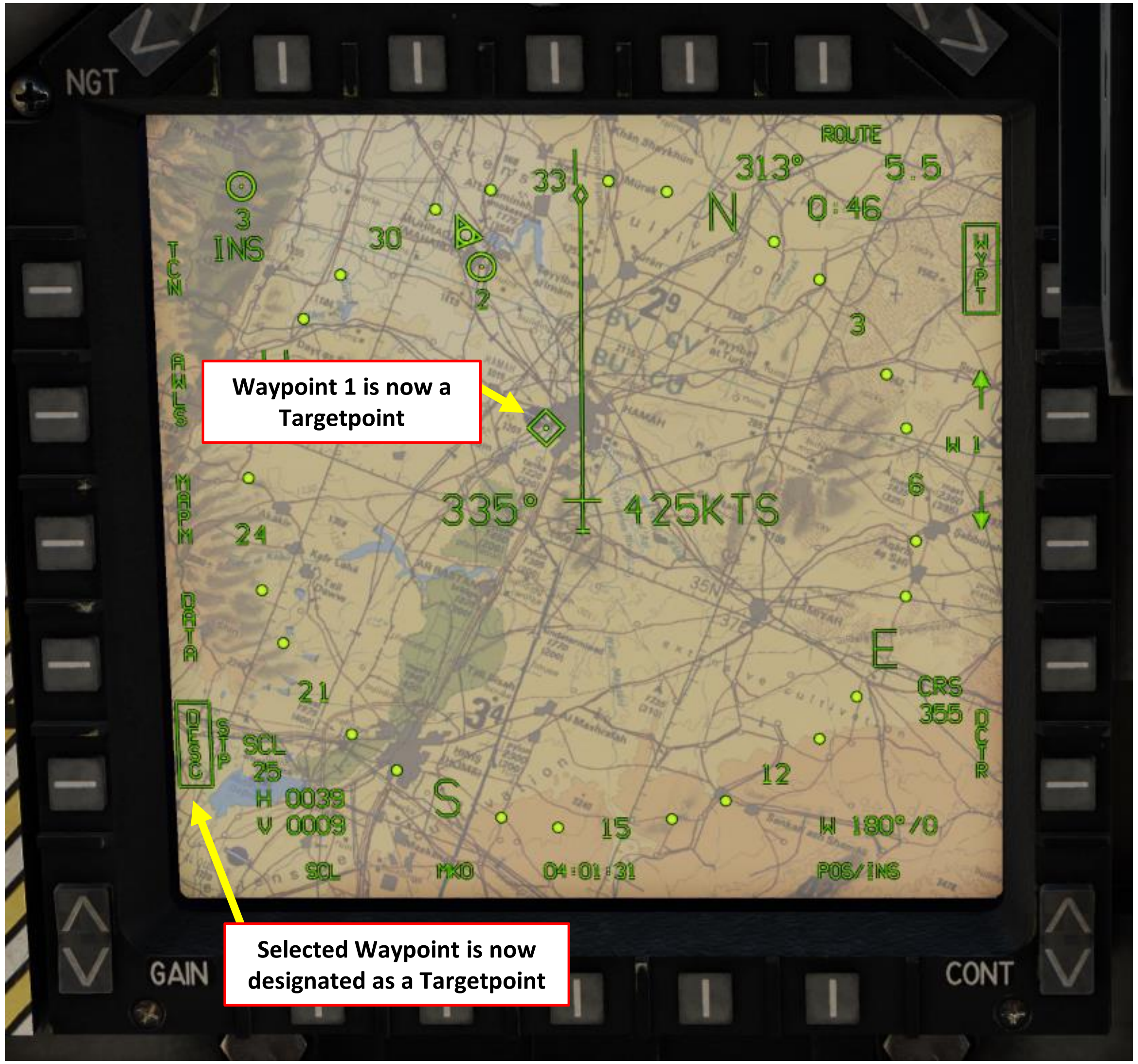
Targetpoint (DMT Page)



6.2 - WAYPOINT DESIGNATE

You can designate a waypoint as a Targetpoint by selecting the desired Waypoint, then pressing the OSB next to “DESG”. This is useful for large targets that are located on an existing waypoint.



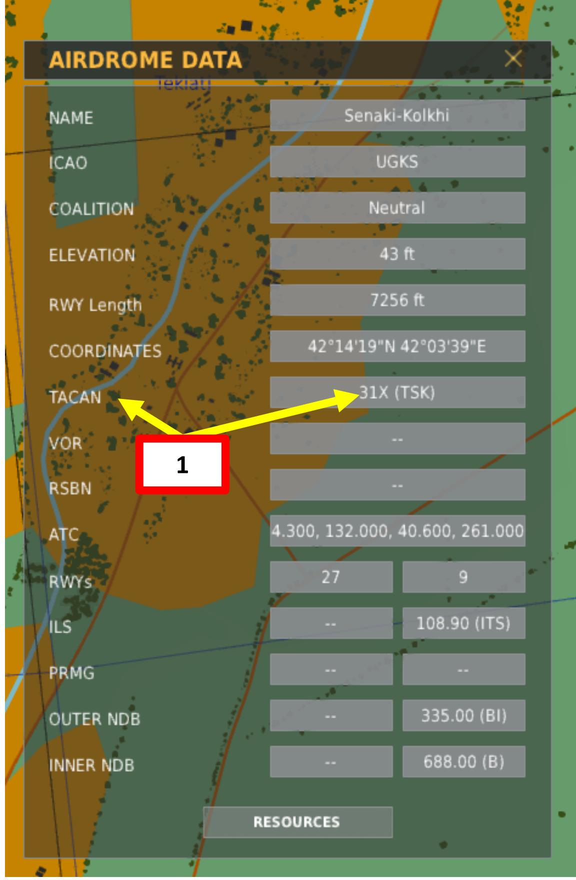


6.3 - USING TARGETPOINTS

Targetpoints are used mainly for weapon release. However, using the EHSD DATA sub-menu when a Targetpoint is selected (T0) allows you to read the target point's coordinates and elevation, which you can relay to friendly aircraft with GPS-guided weapons.

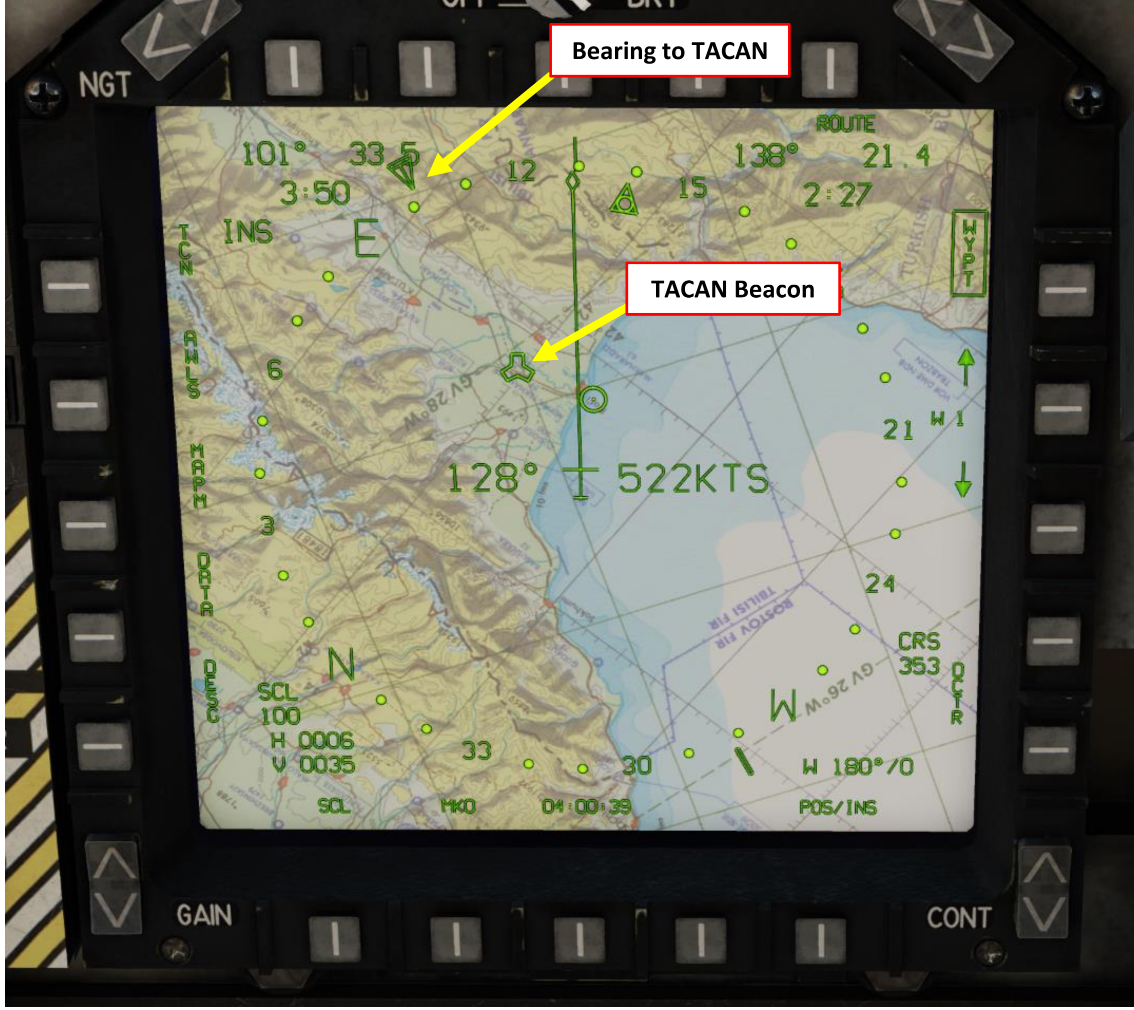
7 - TACAN NAVIGATION

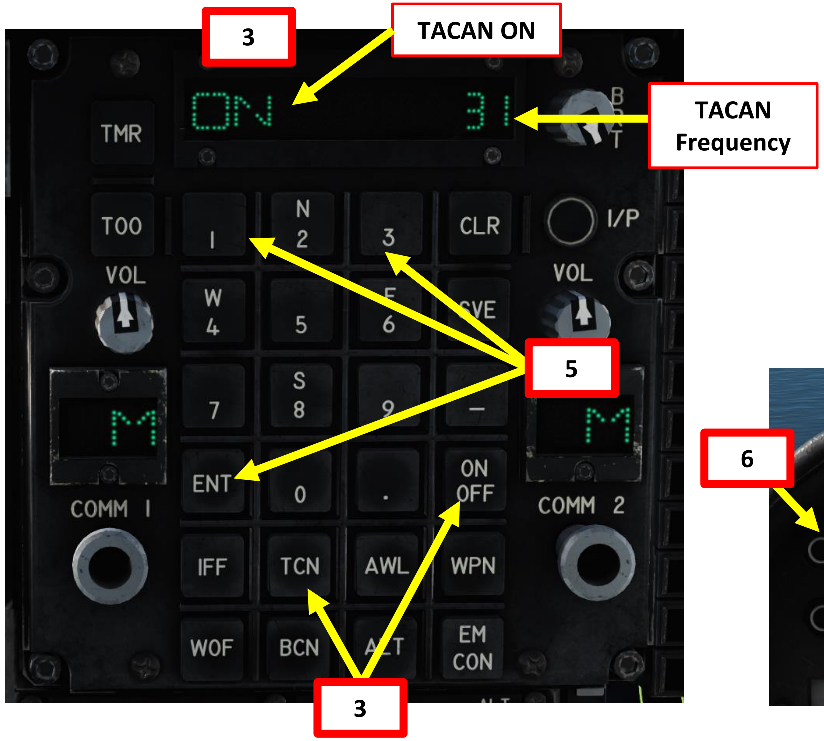
1. Determine the TACAN frequency you want to track by opening the map with F10 and by clicking on the airport you want to track. The frequency of the TACAN beacon for Senaki-Kolkhi is 31X.

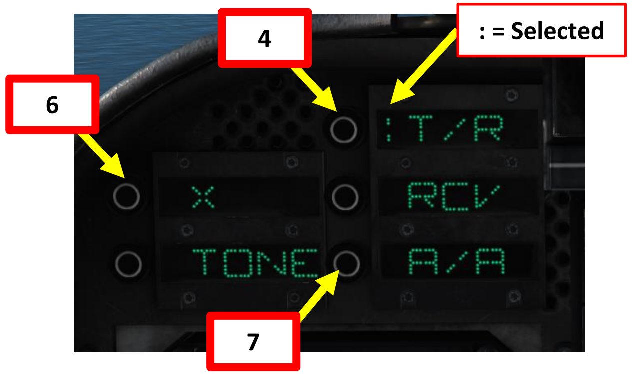


7 - TACAN NAVIGATION

2. Select the EHSD page on either MPCD
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 ODU (Option Display Unit) 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/Y ODU to toggle 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 ODU 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).



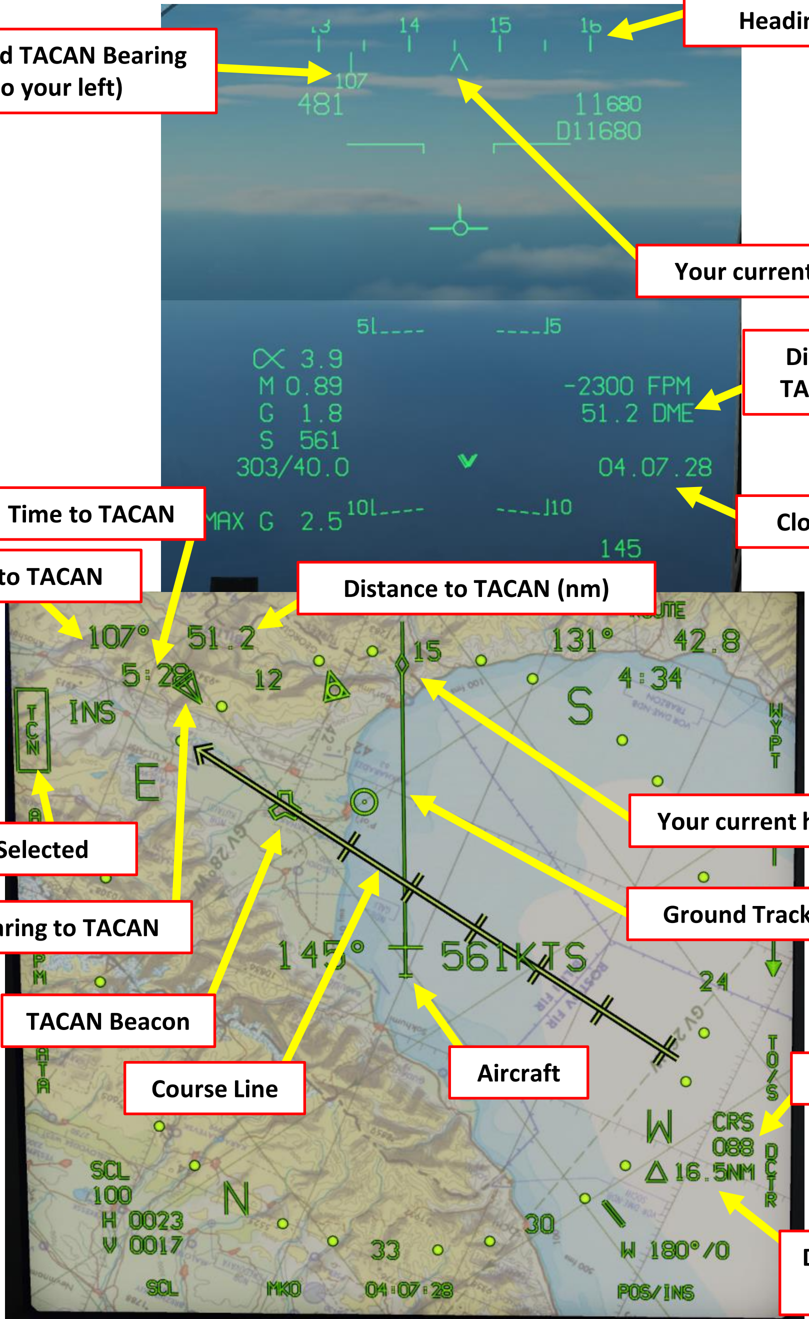




7 - TACAN NAVIGATION

8. Set the Master Mode switch to NAV.
9. Press the OSB next to TACAN to select tracking mode to TACAN. Once selected, TCN should be boxed.
10. Adjust desired radial to TACAN by using the CRS (Course) knob. We will use 095. A course line will appear on the TACAN beacon.
11. Once frequency is set and options are set, you can track the TACAN beacon via the EHSD (Electronic Horizontal Situation Display) page and the HUD (Heads-Up Display).

7 - TACAN NAVIGATION



Heading Tape

Selected TACAN Bearing (to your left)

Your current heading

Distance to TACAN (nm)

Clock

Time to TACAN

Bearing to TACAN

Distance to TACAN (nm)

Your current heading

TACAN Selected

Ground Track Line

Bearing to TACAN

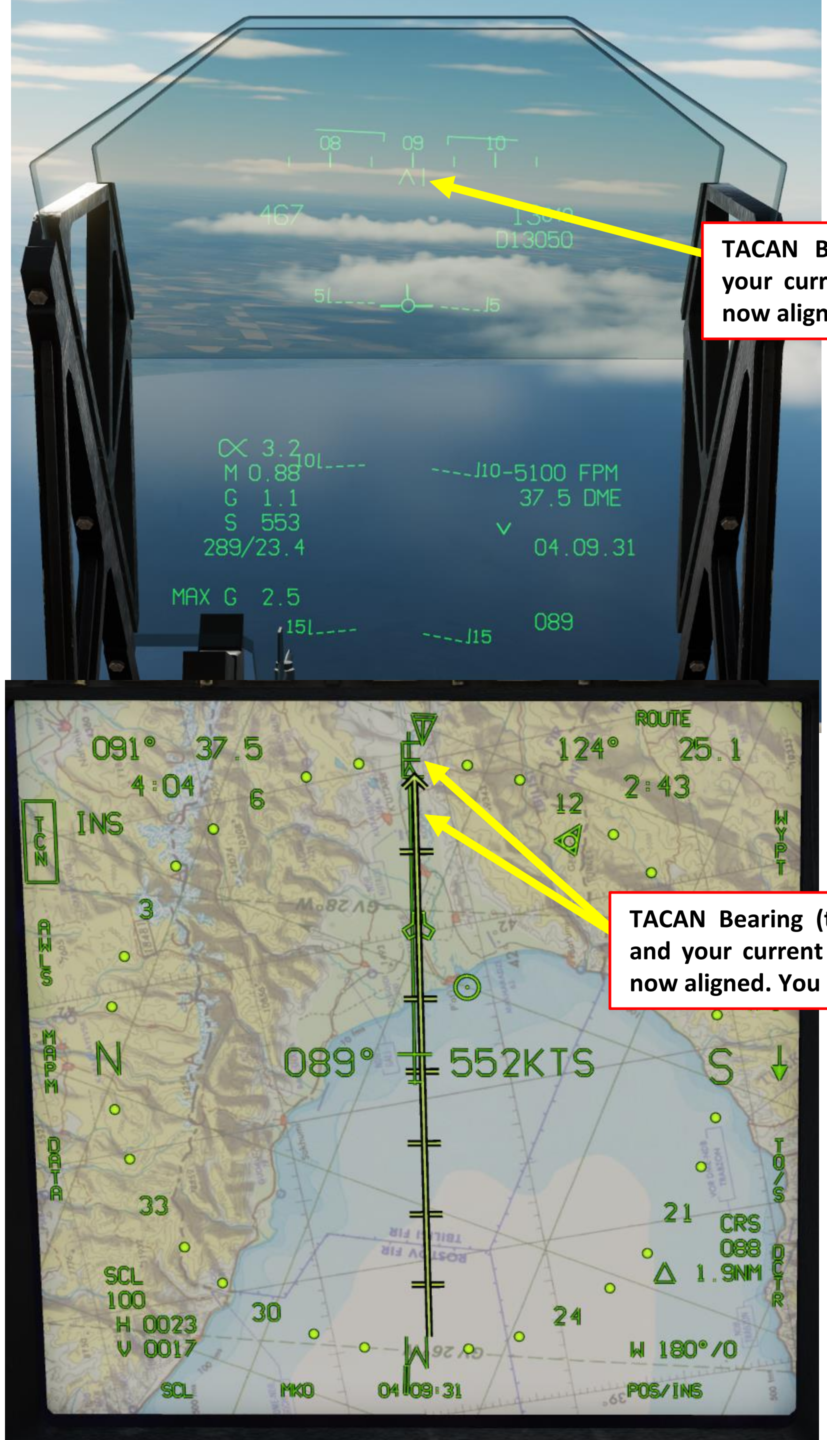
TACAN Beacon

Aircraft

Course Line

TACAN Course Setting

Distance to TACAN Course Line (nm)



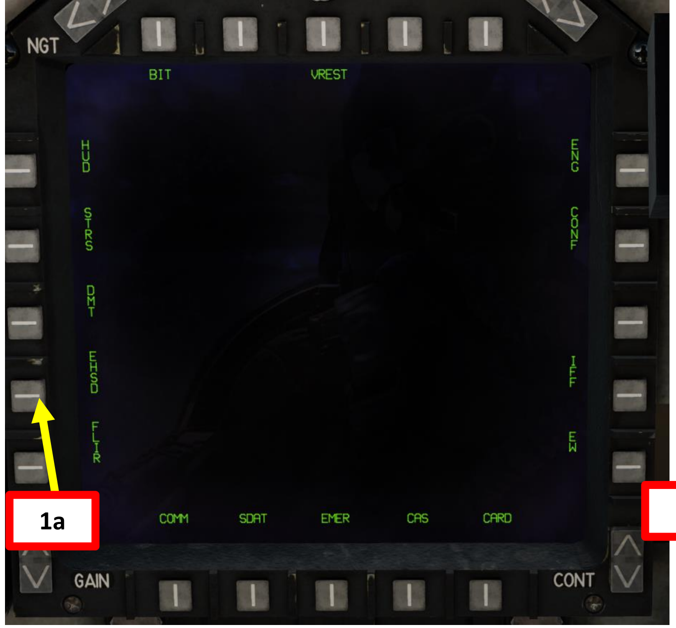
TACAN Bearing (vertical bar) and your current heading (triangle) are now aligned. You are on course!

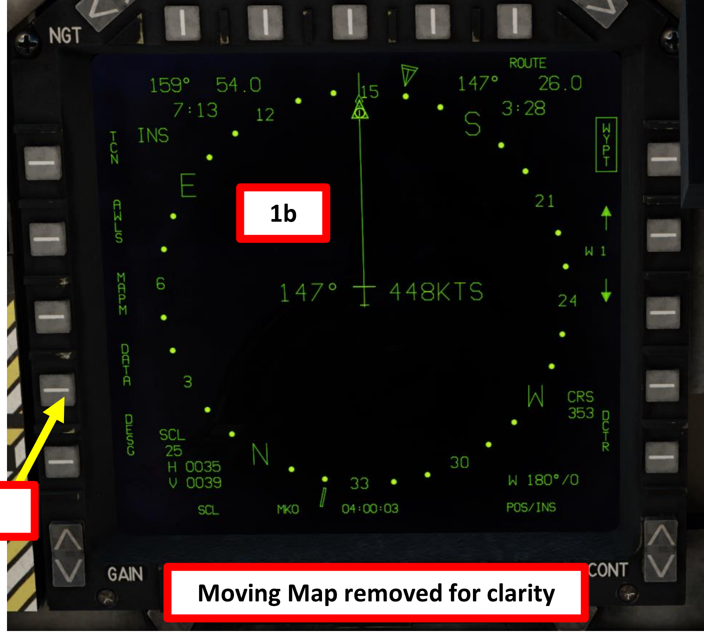
TACAN Bearing (triangle with a T) and your current heading (bar) are now aligned. You are on course!

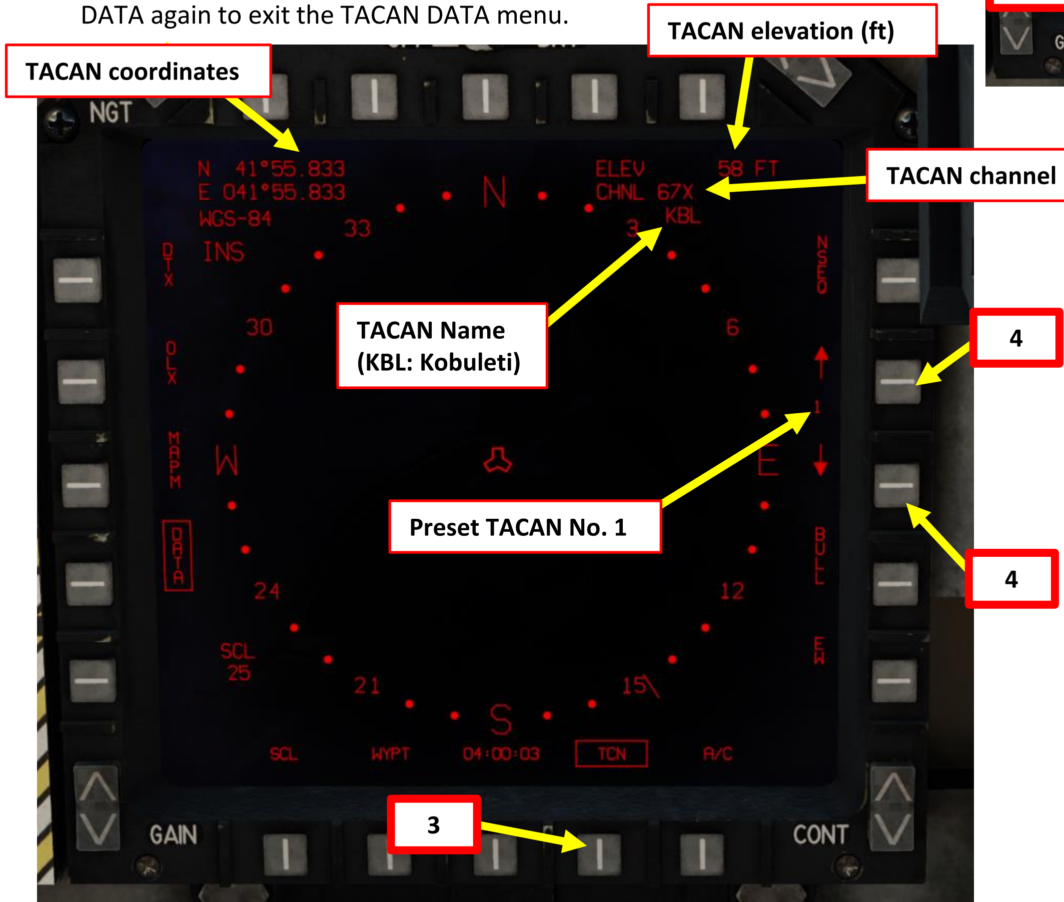
7 - TACAN NAVIGATION

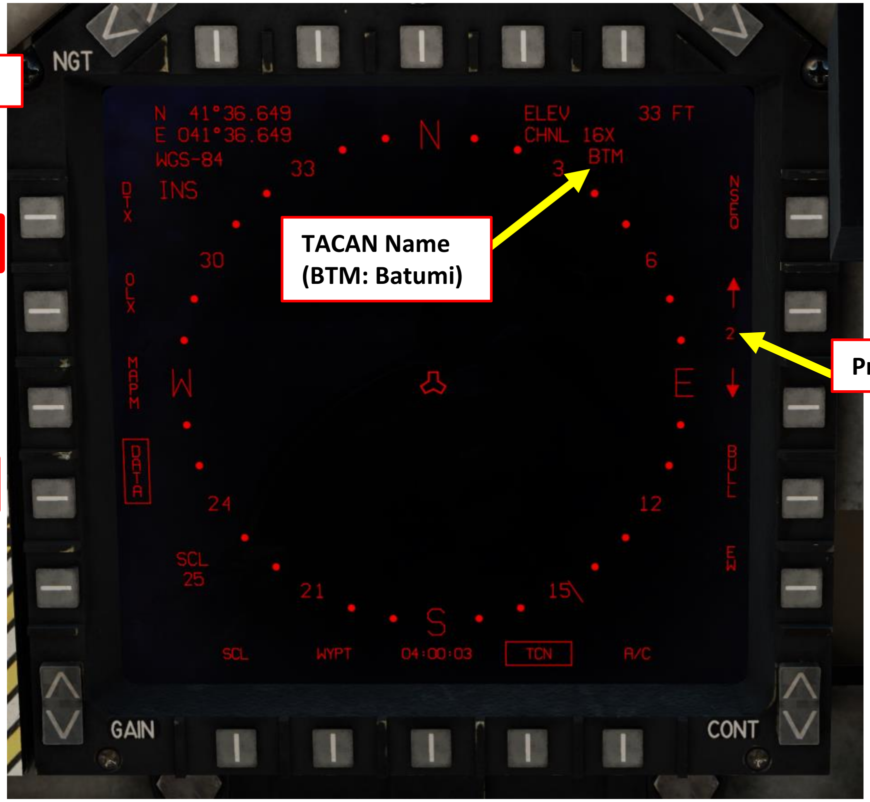
Note:
There are **five TACAN stations already preset**. You can access their information by following these steps:

1. Go in the main MENU page, then select the EHSD page
2. Press the OSB next to DATA (will become boxed when selected)
3. Press the OSB next to TCN (will become boxed when selected)
4. Select desired preset TACAN by using the OSBs next to the arrows. You will have coordinates, elevation, channel, magnetic variation and TACAN beacon name information.
5. Additional information can be displayed on the UFC (Up-Front Control) panel by using the ODU (Option Display Unit) buttons.
6. Once you have the information you need, you can press the OSB next to DATA again to exit the TACAN DATA menu.





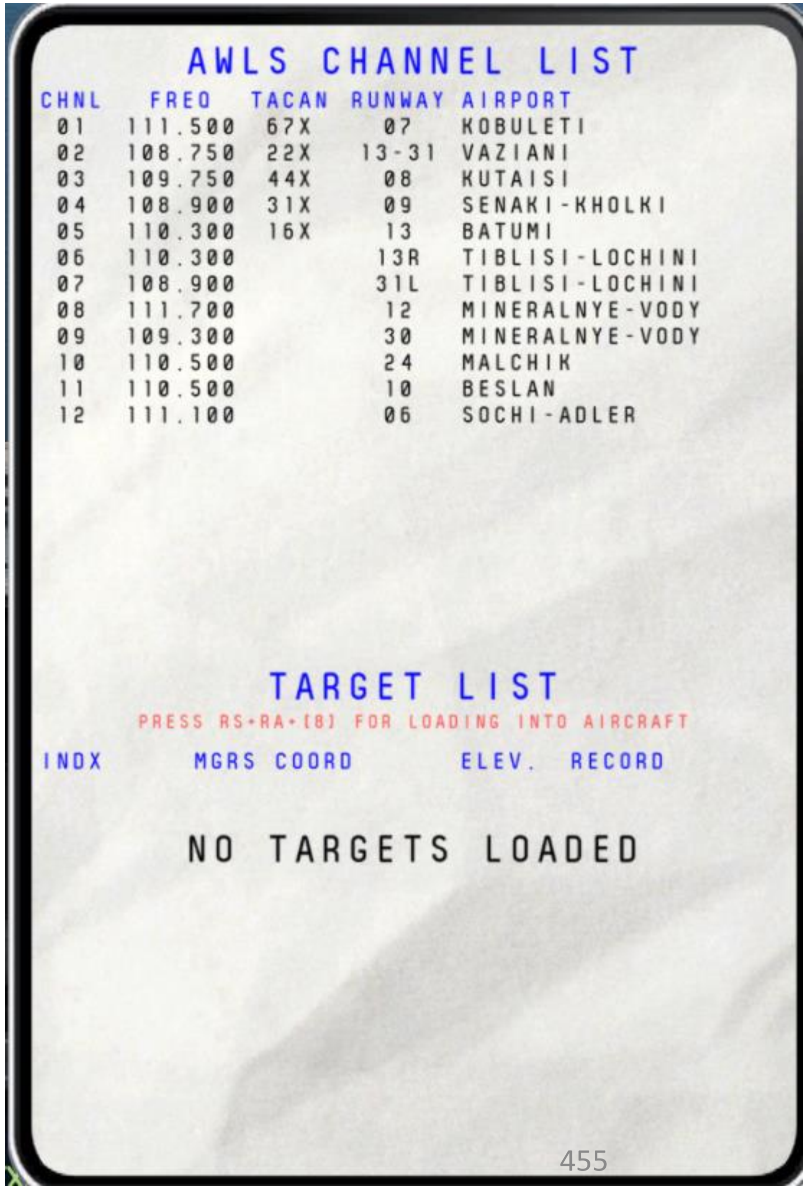




8 - AWLS/ILS TUTORIAL

The AWLS (All-Weather Landing System) is a similar system to the ILS (Instrumented Landing System) in concept. You have a guidance system that will help you to land in bad weather conditions. The AWLS channels are preset; you need to use the ones associated to each airfield using the table to the right. The AWLS can be used with a TACAN station to provide you additional information about range and time to arrival, but the AWLS can also be used as is.

Press « RSHIFT+K » to open up kneeboard and use « [» and «] » to find the AWLS CHANNEL LIST page if required.



AWLS CHANNEL LIST

CHNL	FREQ	TACAN	RUNWAY	AIRPORT
01	111.500	67X	07	KOBULETI
02	108.750	22X	13-31	VAZIANI
03	109.750	44X	08	KUTAISI
04	108.900	31X	09	SENAKI-KHOLKI
05	110.300	16X	13	BATUMI
06	110.300		13R	TIBLISI-LOCHINI
07	108.900		31L	TIBLISI-LOCHINI
08	111.700		12	MINERALNYE-VODY
09	109.300		30	MINERALNYE-VODY
10	110.500		24	MALCHIK
11	110.500		10	BESLAN
12	111.100		06	SOCHI-ADLER

TARGET LIST

PRESS RS+RA+[8] FOR LOADING INTO AIRCRAFT

INDX MGRS COORD ELEV. RECORD

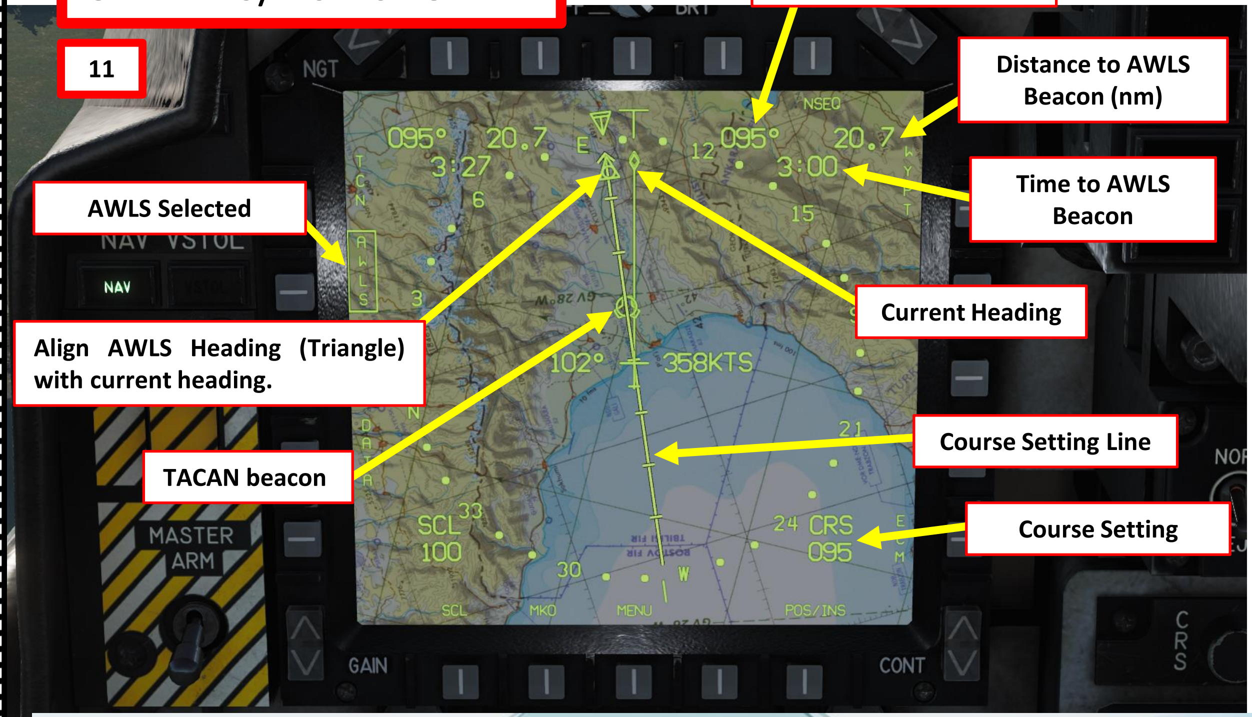
NO TARGETS LOADED

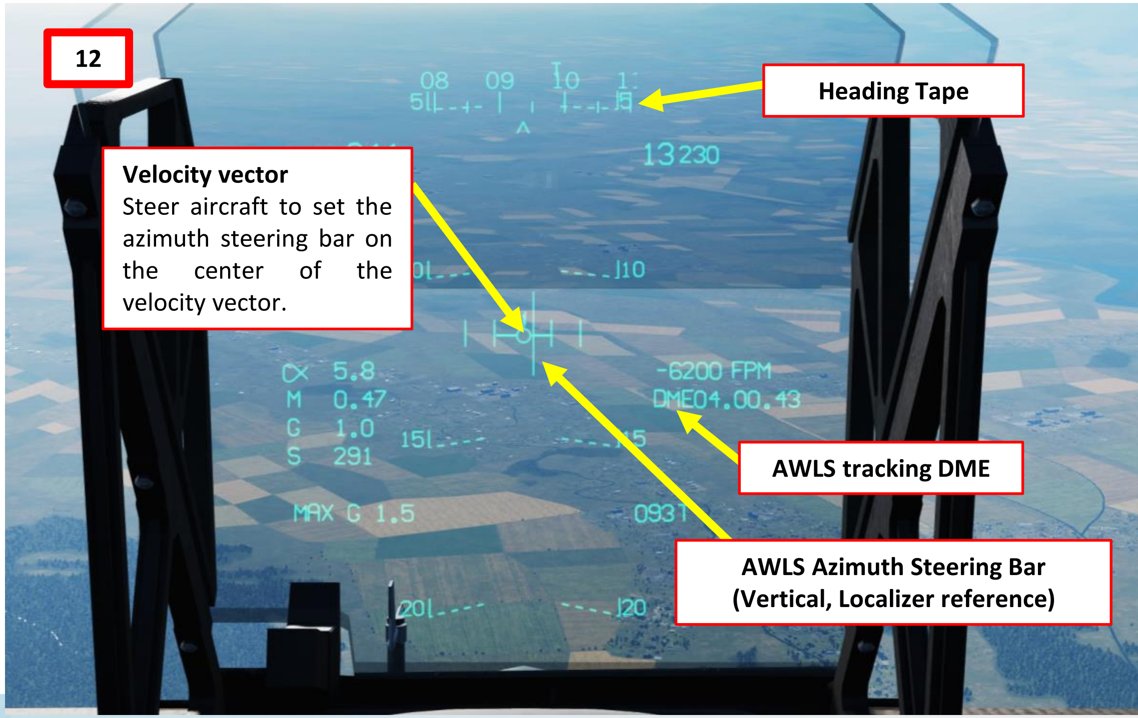
8 - AWLS/ILS TUTORIAL

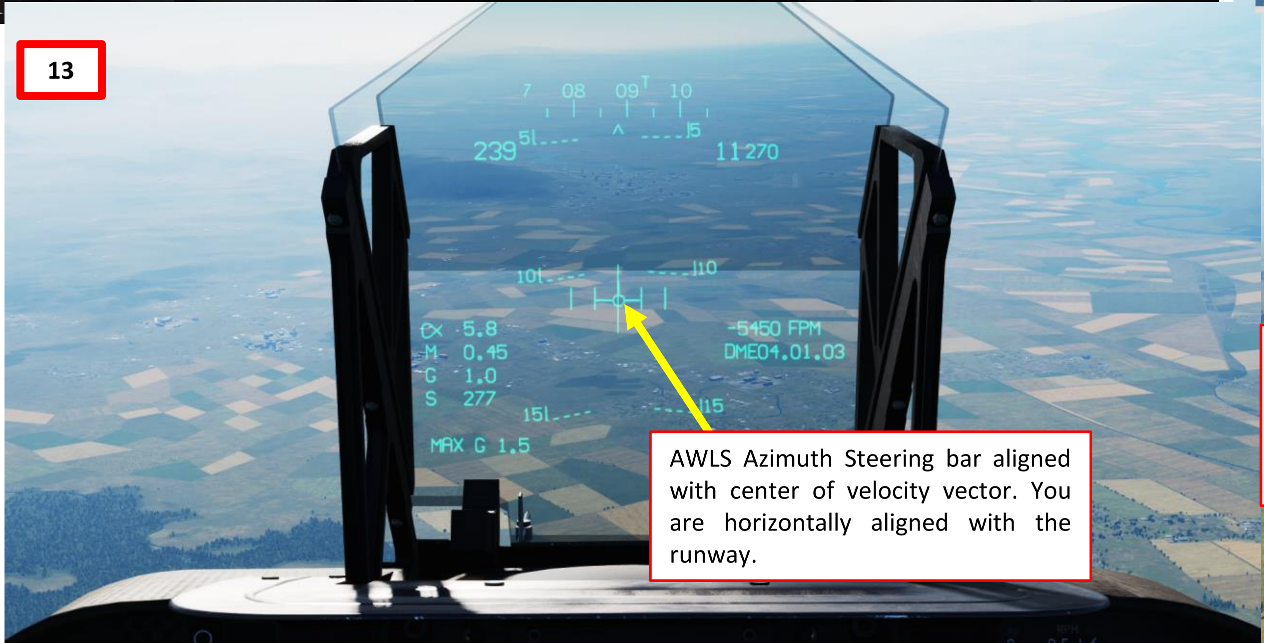
The AWLS tutorial will be set to Senaki-Kolkhi, which is set Channel 4 to runway 09 (course: 095) with a glide slope of 3.0. We will use the TACAN station 31X too even if it is optional.

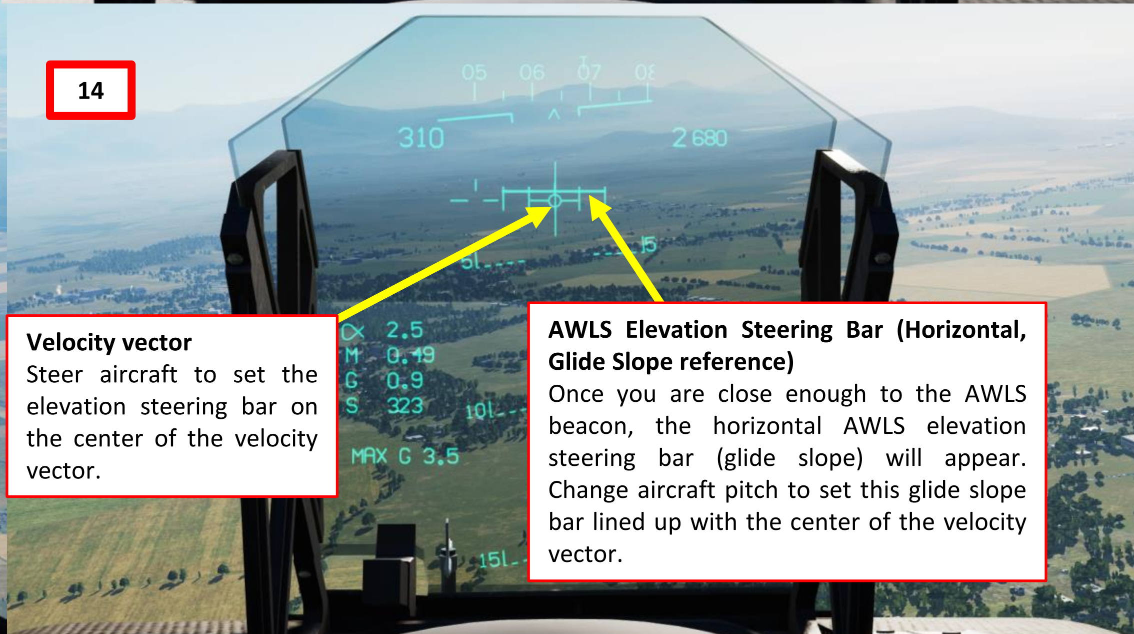
1. On UFC (Up-Front Control) scratchpad, press the AWL button and the ON/OFF button to turn on the ALWS system.
2. Press the ODU (Option Display Unit) button CH01 (it is selected when the “:” symbol is shown) to select your AWLS channel option
3. Press “4” on the UFC scratchpad, then “ENT” to set channel 04.
4. Press the ODU button GS (Glide Slope) and verify that “3.00” is entered correctly. If not, set it as shown in step 3).
5. Press the ODU button AZ (Azimuth) and input desired offset (in feet) to the runway centerline. Negative values are to the left of centerline, positive values are to the right of the centerline. In this tutorial, we will leave it as is with an offset of 0.
6. Press the ODU button TCN and input desired TACAN frequency one is available in the airfield (31X in our case) as shown in step 3).
7. Press the ODU button EL (Elevation) and input desired offset from runway elevation. In our case, we will leave it at 0.
8. Set Master Mode to either NAV or VSTOL.
9. Set the runway course to 095.
10. Set appropriate scale (SCL) and press the OSB next to AWLS on the EHSD page to track the AWLS station.

8 - AWLS/ILS TUTORIAL



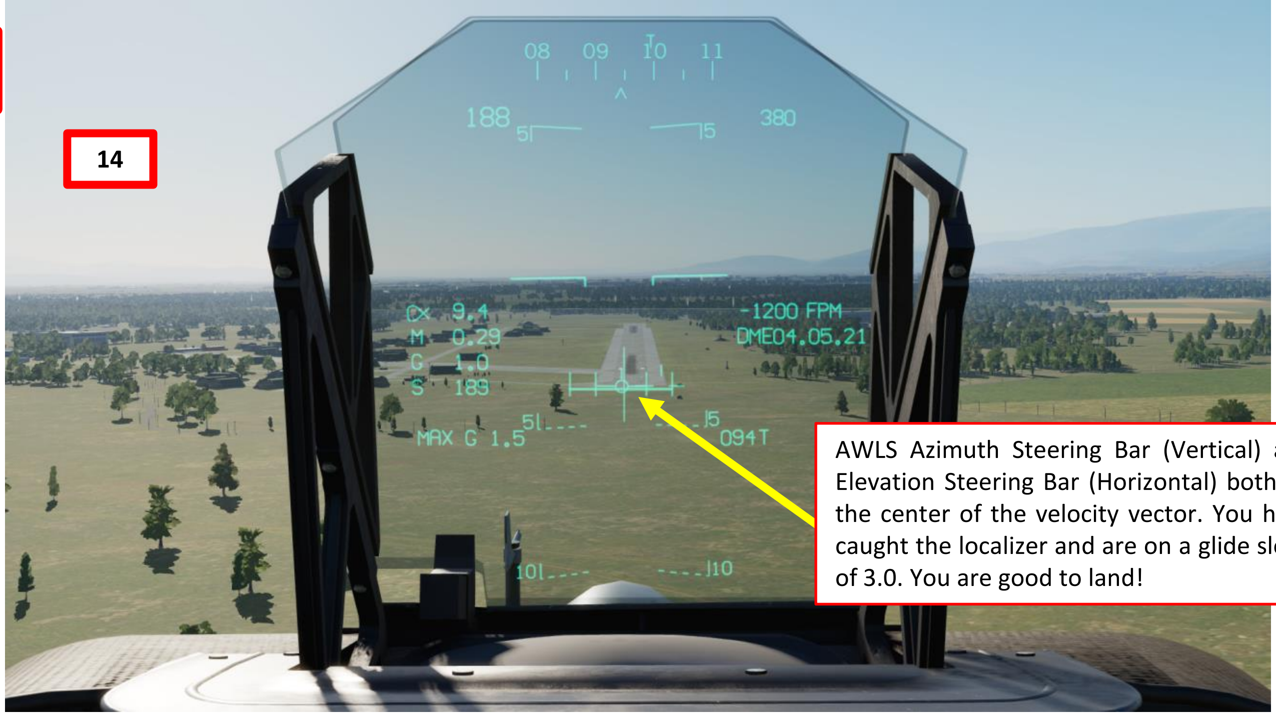






8 - AWLS/ILS TUTORIAL

14



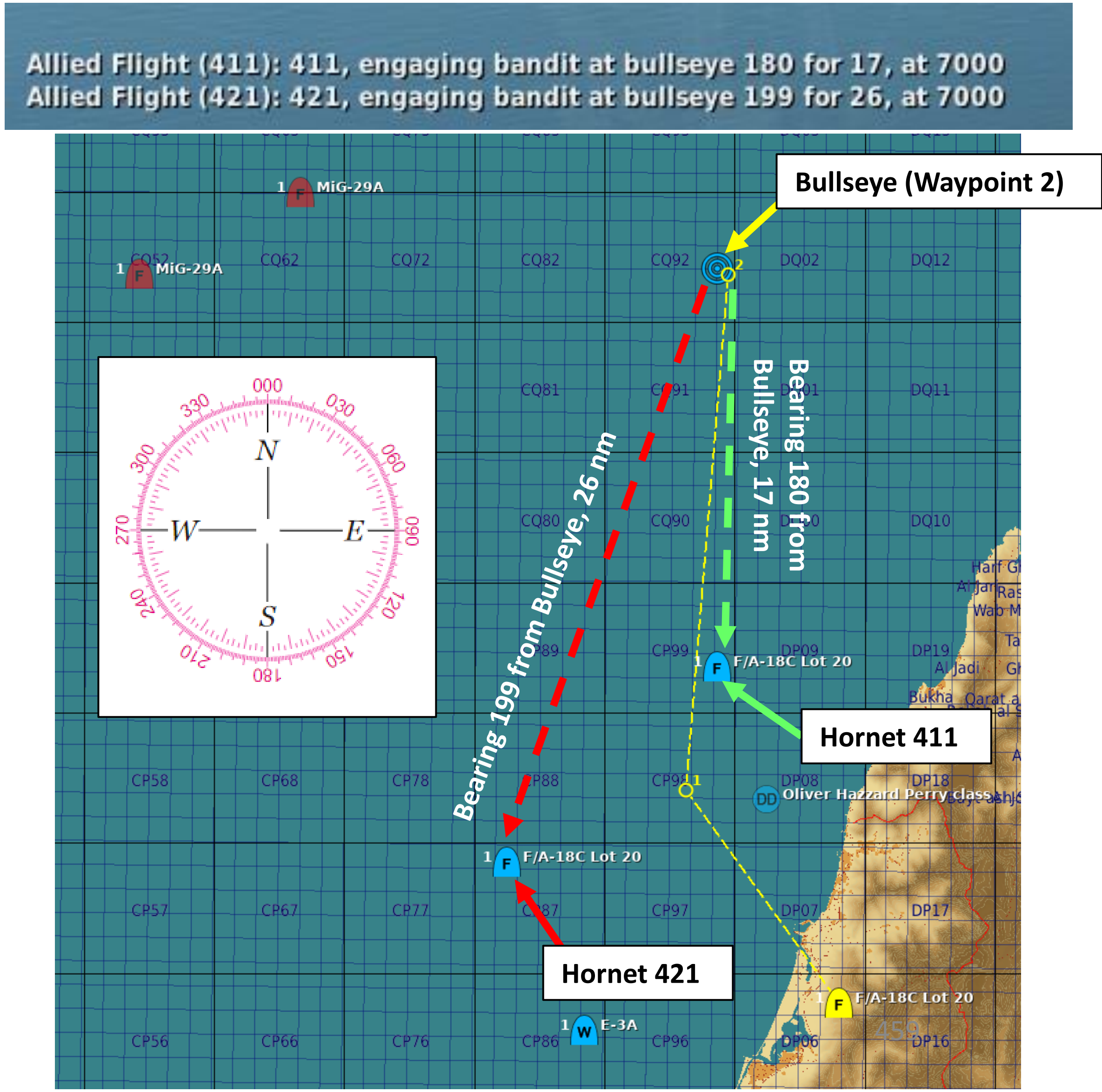
AWLS Azimuth Steering Bar (Vertical) and Elevation Steering Bar (Horizontal) both on the center of the velocity vector. You have caught the localizer and are on a glide slope of 3.0. You are good to land!

9 - 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

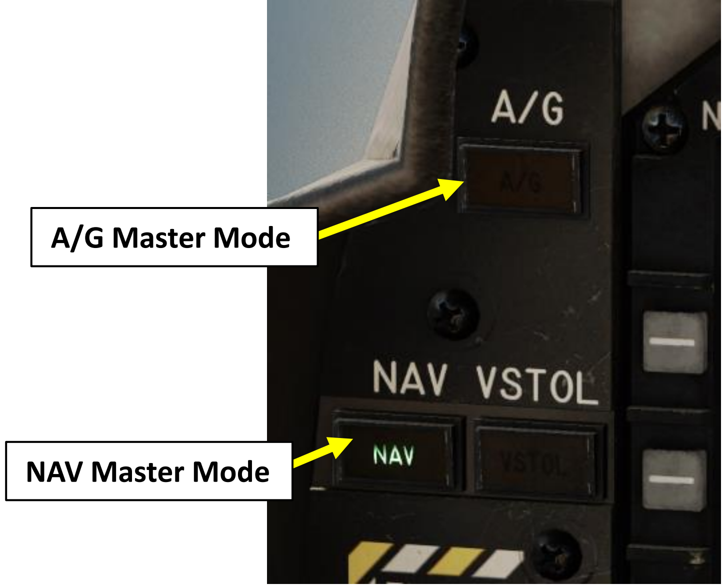


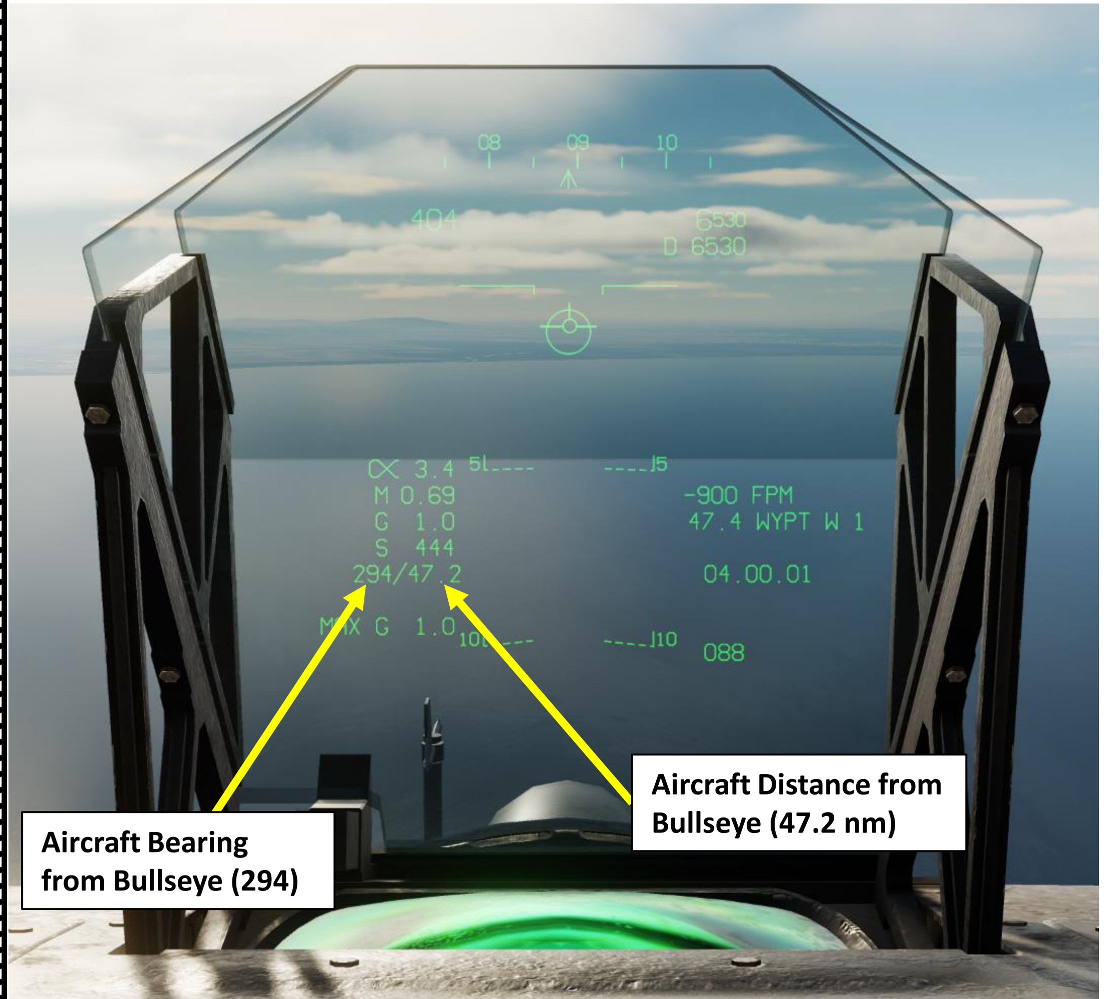
9 - BULLSEYE

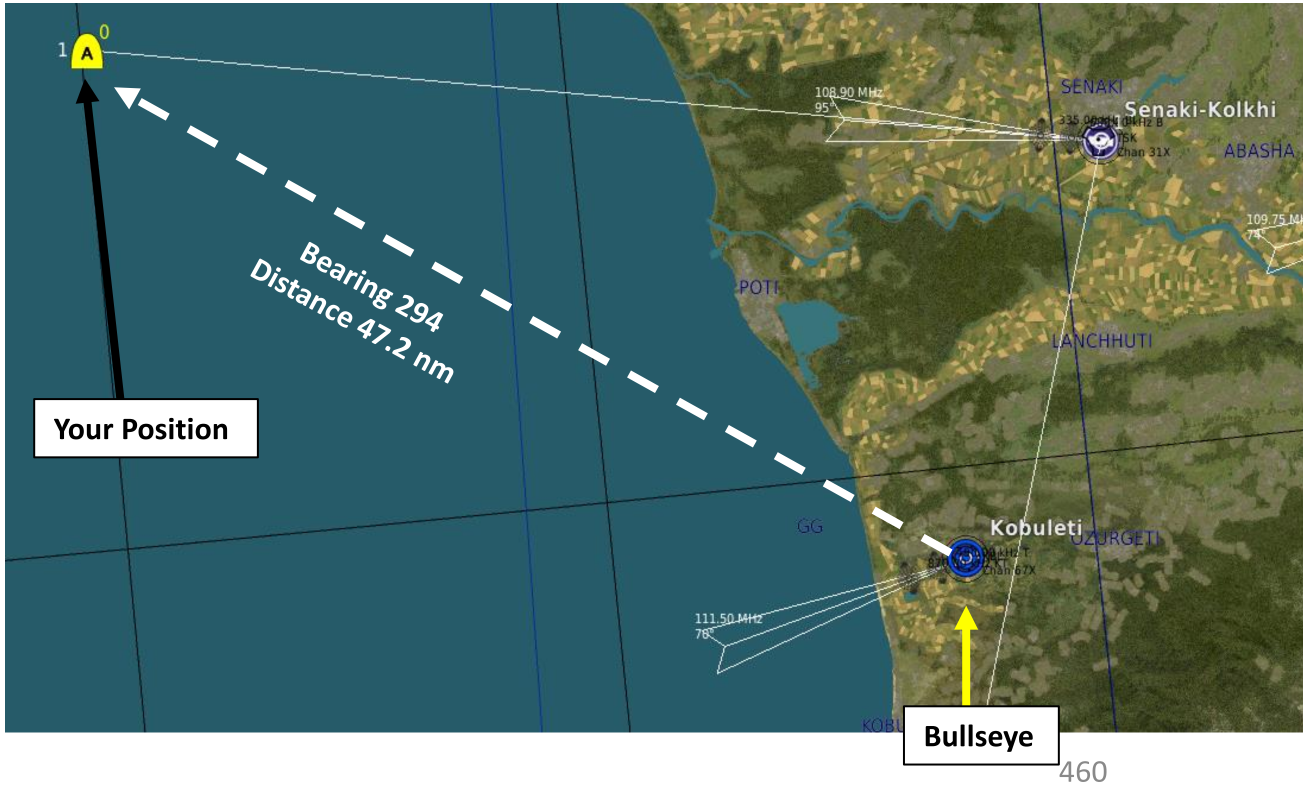
Bullseye information is displayed on the Heads-Up Display while either NAV Master Mode or A/G Master Mode is active.

By default, Bullseye reference is set up on the Bullseye of the Mission Editor. It is however possible to re-define Bullseye location on an existing waypoint (see next page)

Take note that you can also use the Waypoint Offset function to create a reference point from Bearing and Range information from an existing waypoint (that can conveniently be placed on the Bullseye).



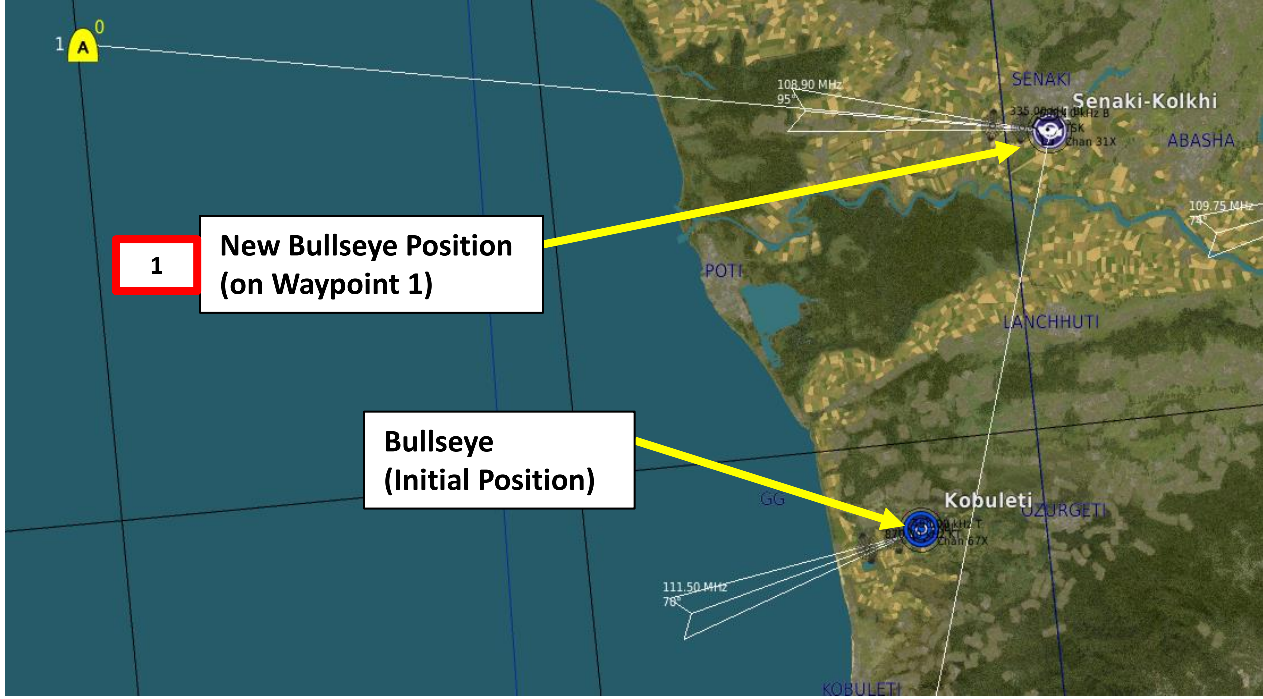


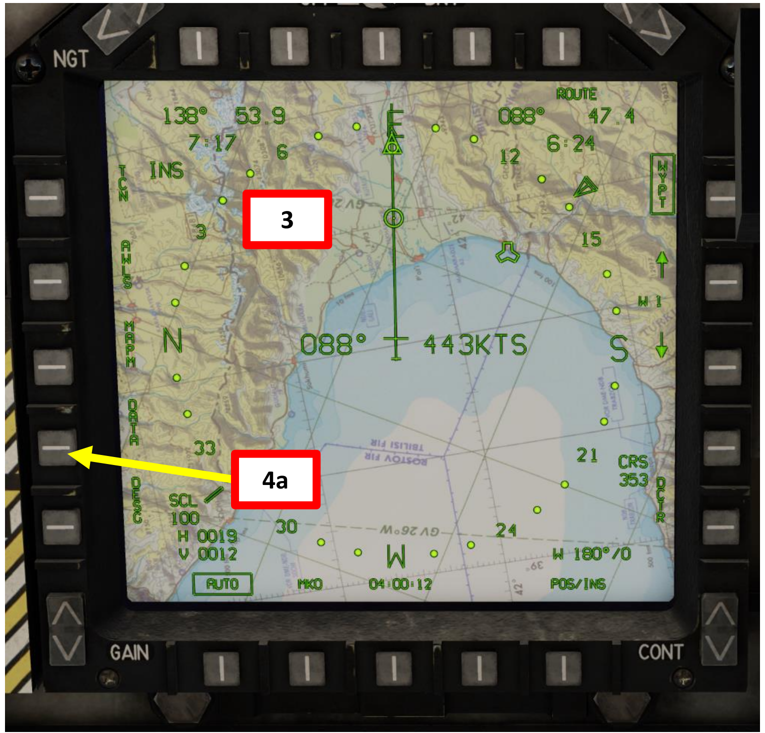


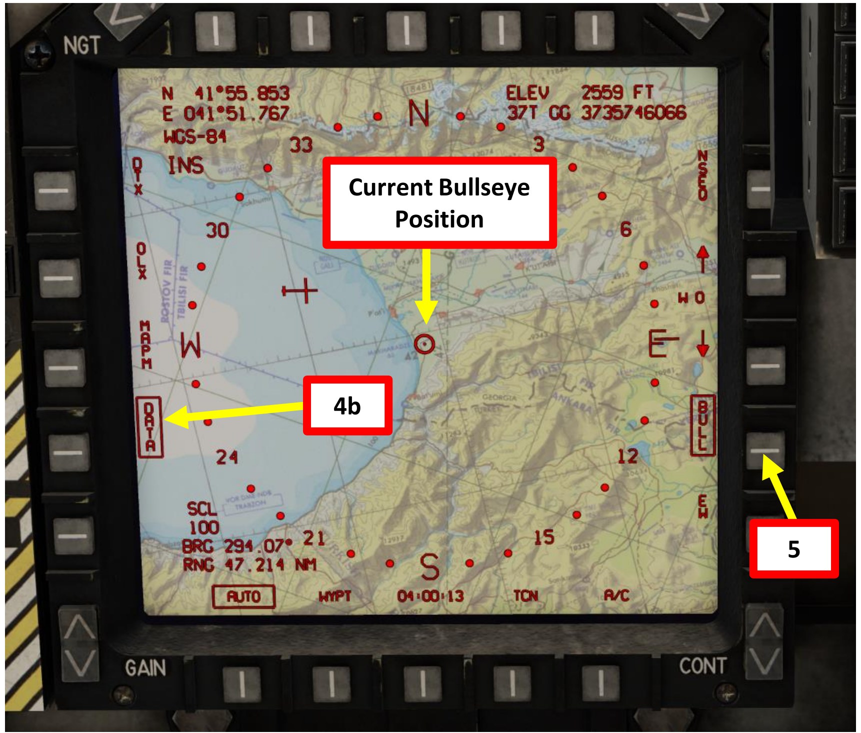
9 - BULLSEYE

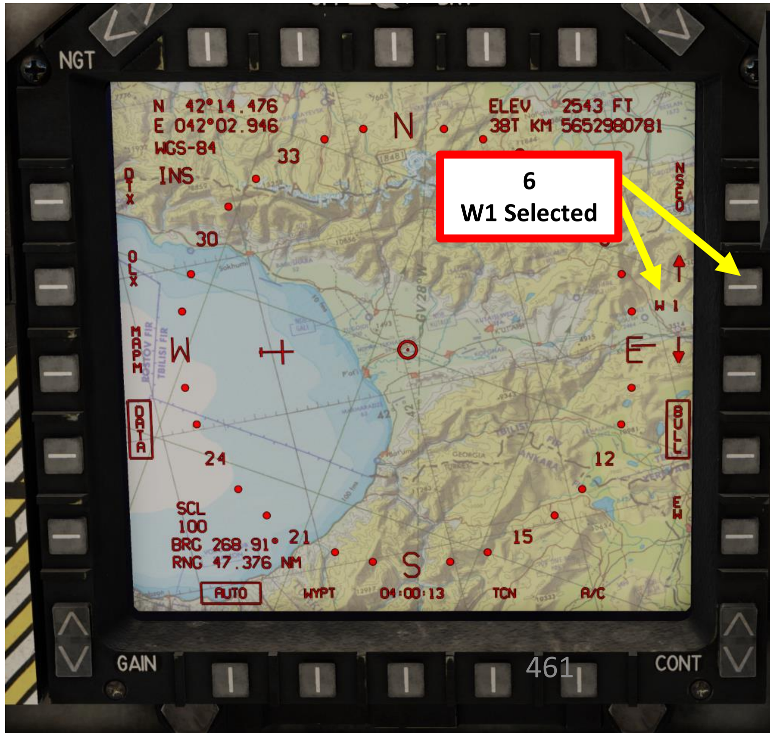
How to change Bullseye Reference

1. We want to set Waypoint 1 as our new Bullseye.
2. Select either NAV or A/G Master Mode
3. Go in EHSD page
4. Select DATA sub-menu (boxed when selected)
5. Select BULL (Bullseye) Option (boxed when selected)
6. Using the OSBs next to the Waypoint Selector Arrows, select the waypoint you want to set as the new Bullseye Reference. In our case, we will select W1 (Waypoint 1).





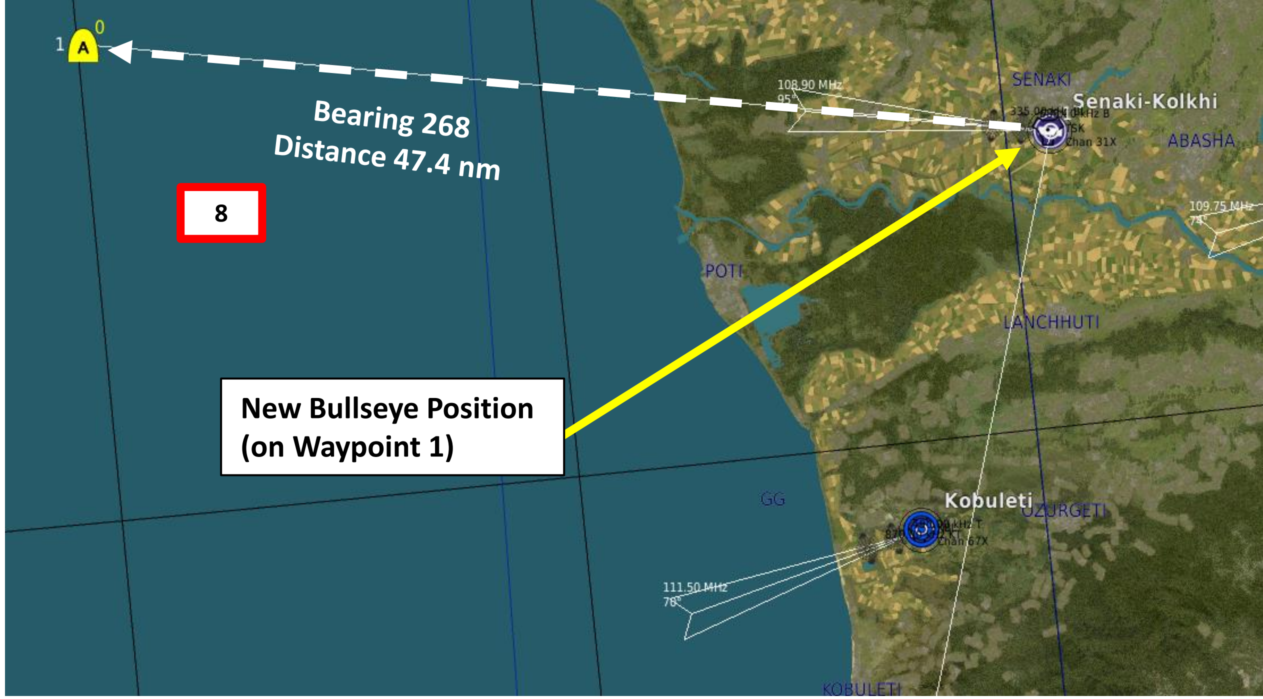


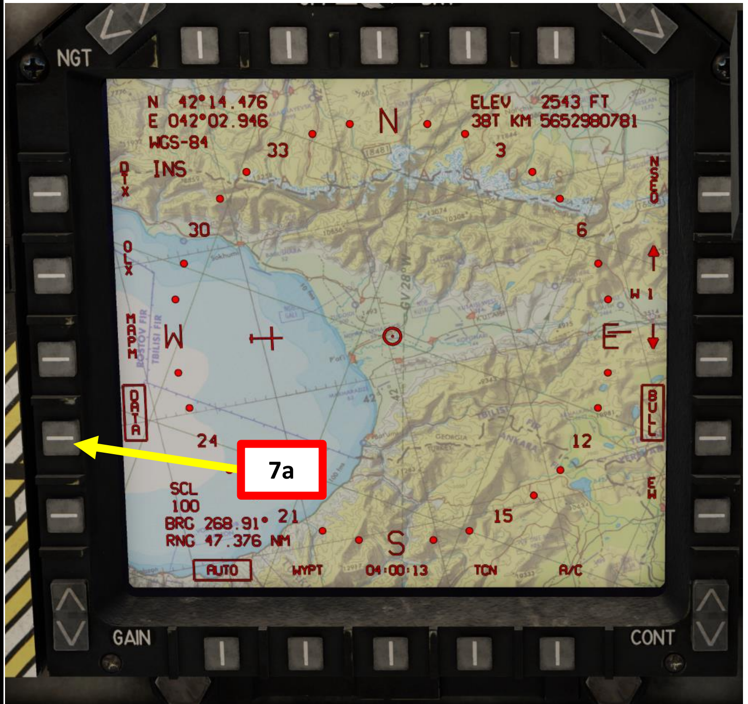


9 - BULLSEYE

How to change Bullseye Reference

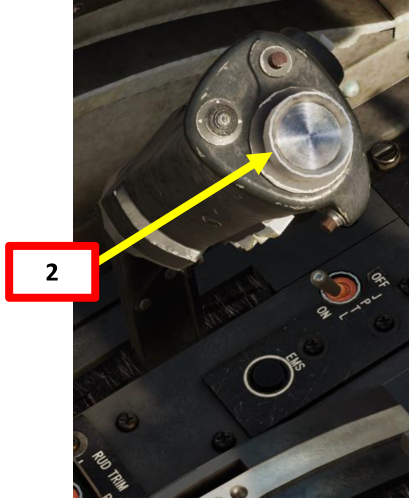
7. Exit DATA menu by pressing OSB next to DATA (un-boxed when de-selected).
8. The Bullseye information will now be displayed using Waypoint 1 as the new Bullseye.





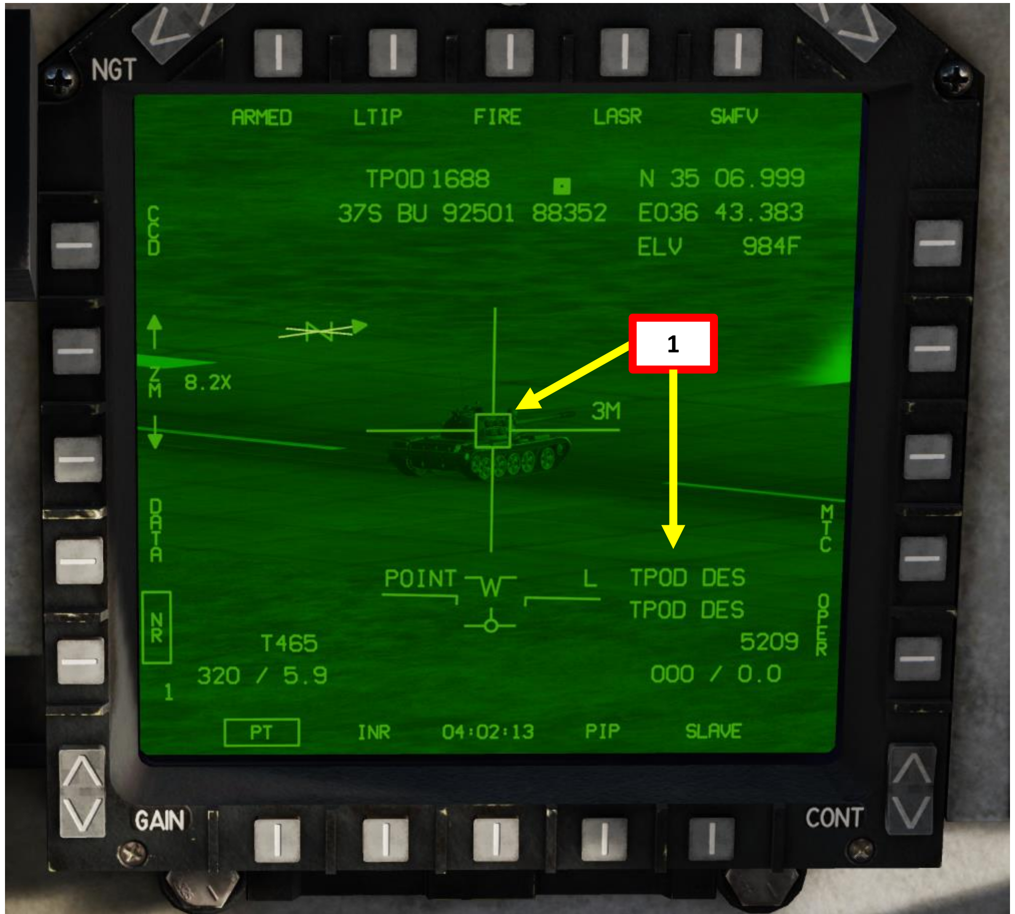
10 - TOO Function

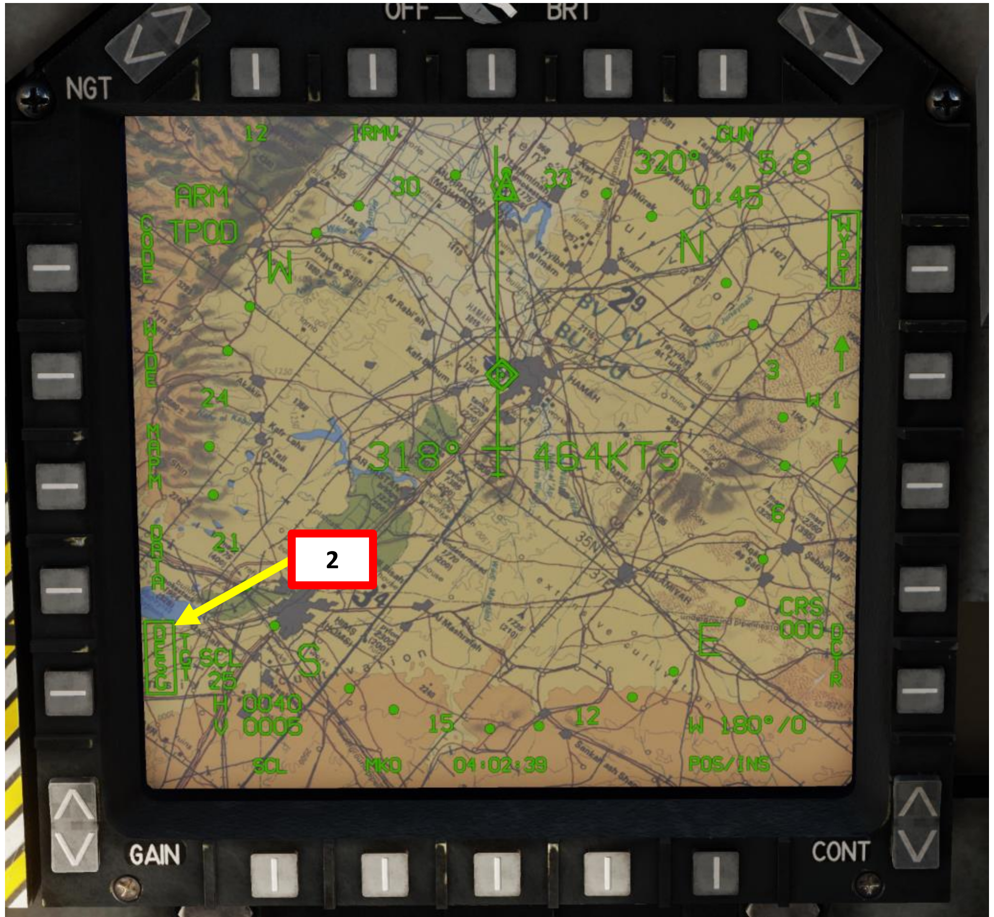
TOO (Target-of-Opportunity) Function
Target Designation



The TOO (Target-of-Opportunity) function is a way to save target coordinates quickly in a Target Point. The method is quite straightforward:

1. Designate a target using any sensor (like the targeting pod)
2. Pressing « TDC DOWN Action » designates the target. The EHSD (Electronic Horizontal Situation Indicator) page automatically enters DESG STP mode.



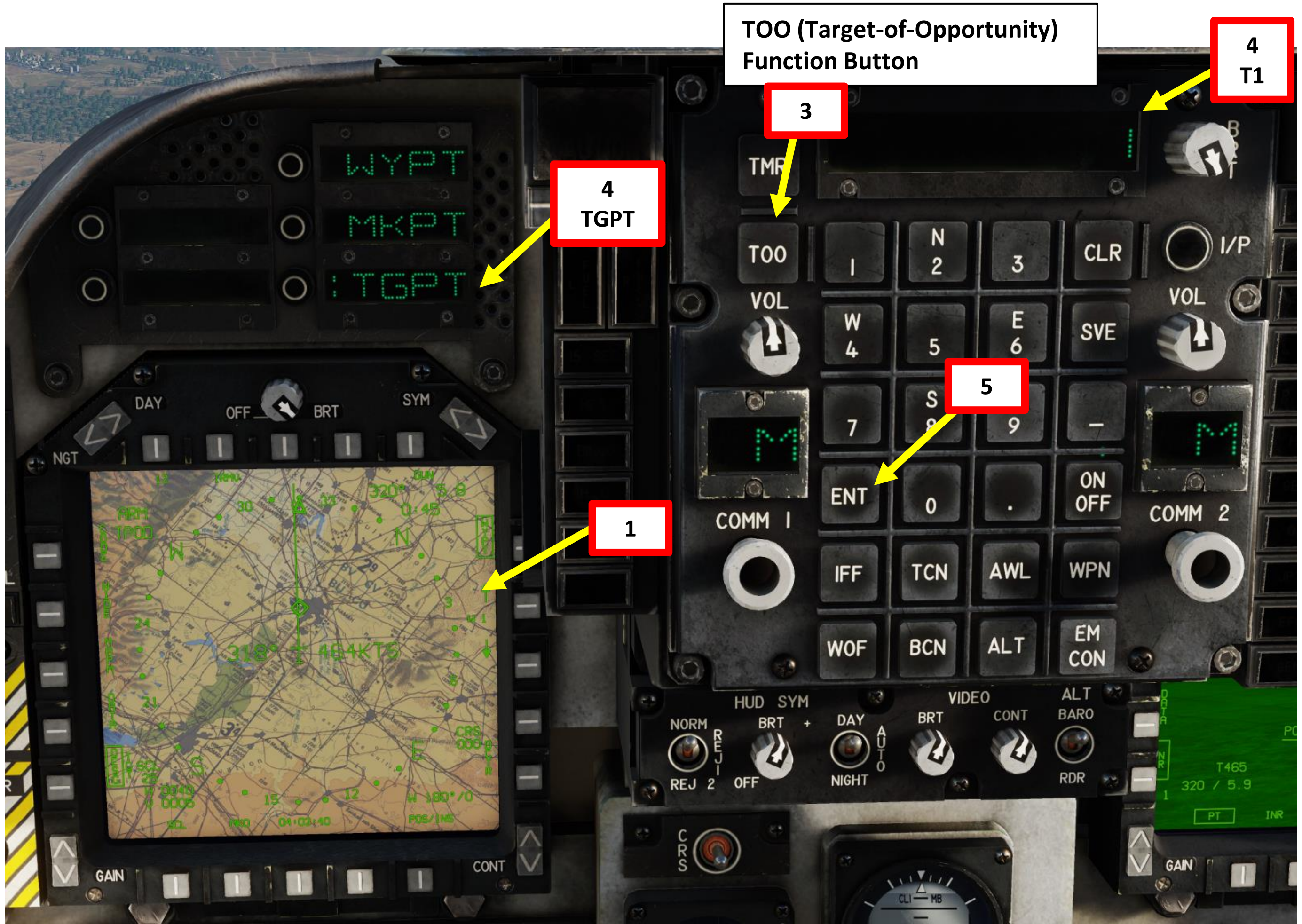


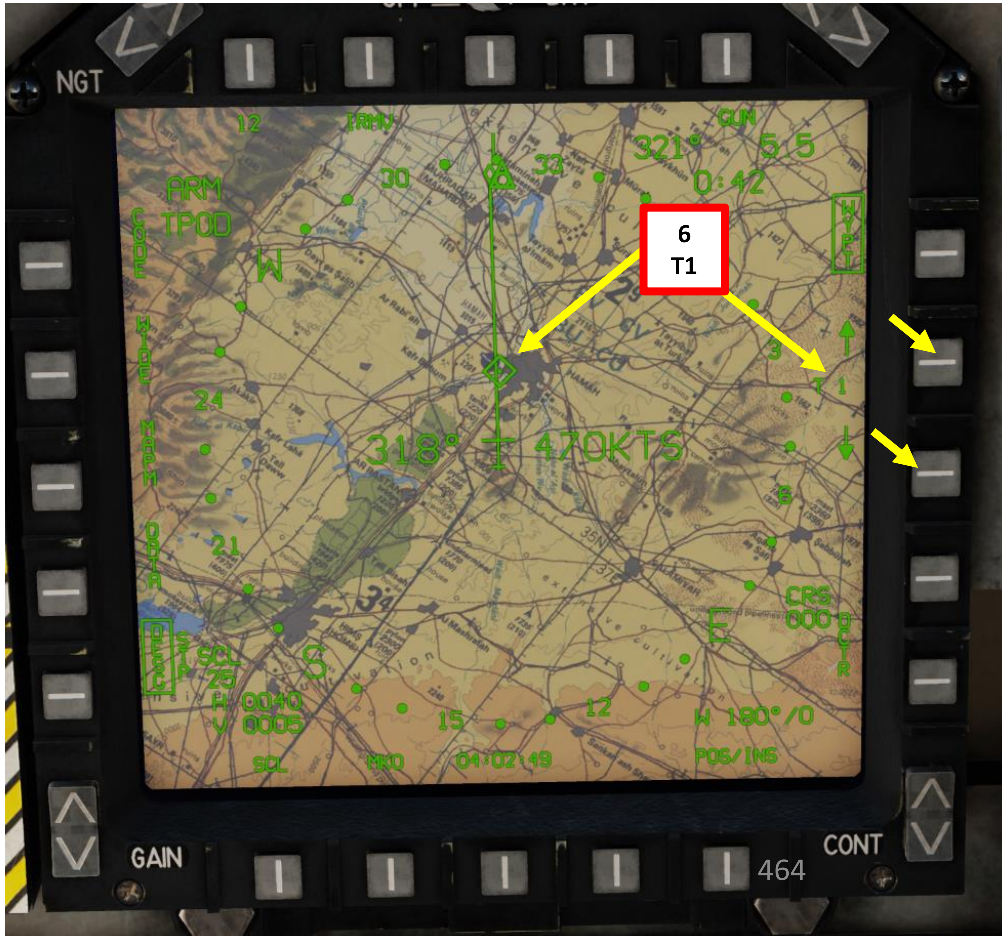
10 - TOO Function

TOO (Target-of-Opportunity) Function
Target Designation

3. Press “TOO” button.
4. The “TGPT” option will be automatically selected, with a Target Point number associated with it.
5. Press “ENT” button to save the target coordinates for the associated Target Point number.
6. In this example, the coordinates are stored in “T1” and are accessible through the EHSD. This process is quite similar to storing data in a markpoint.

Note: Deephack has done a great video about the TOO function: https://youtu.be/DlZiNey61qs



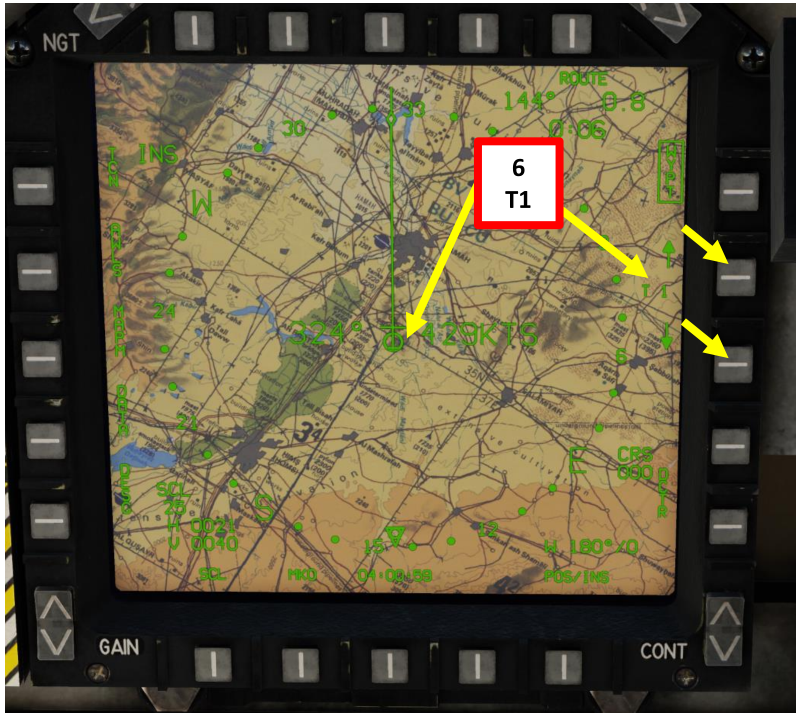


10 - TOO Function

TOO (Target-of-Opportunity) Function
Target Overfly

Another method is to use the TOO function when overflying a target and no target designation has been performed.

1. Make sure no target designation has been performed.
2. Select NAV Master Mode.
3. Fly over a target area.
4. Press "TOO" button.
5. The "TGPT" option will be automatically selected, with a Target Point number associated with it.
6. Press "ENT" button to save the target coordinates for the associated Target Point number. Target Point latitude and longitude is read from the aircraft's INS/GPS, and the terrain/target height is calculated using the radar altimeter and deducted from your aircraft altitude.
7. In this example, the coordinates are stored in "T1" and are accessible through the EHSD.



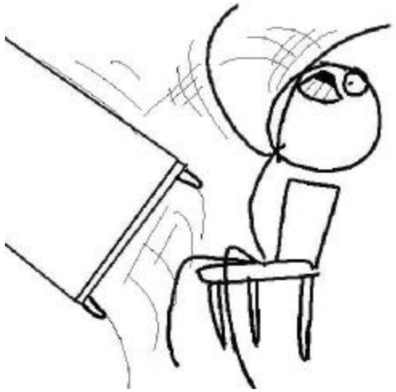
INTRODUCTION

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

Air-to-air refueling is one of the hardest, most hated, and most frustrating tasks in DCS. Ever. Of all time.

Why? Well, one of the main reasons for the difficulty behind refueling is the skill required to do formation flying. Flying in formation with another aircraft requires much more practice than you would initially think. Another reason is pure physics: there is this thing called "wake turbulence". An aircraft flies through a fluid: air. Just like with any fluid, if you have something that displaces itself through it at a certain speed, the fluid will become disrupted (turbulence). Wingtip vortices and jetwash are both effects of this simple concept. Wake turbulence is the reason why airliners need to wait a minimum time between takeoffs: flying through disrupted air will destabilize the aircraft and it is unsafe, especially during critical phases of flight like takeoff and landing.

Unfortunately, wake turbulence is something a pilot **has** to deal with during air-to-air refueling. This is why the aircraft will fly just fine when approaching the tanker, but start wobbling around when flying in close proximity of the refueling basket/drogue and tanker engines.

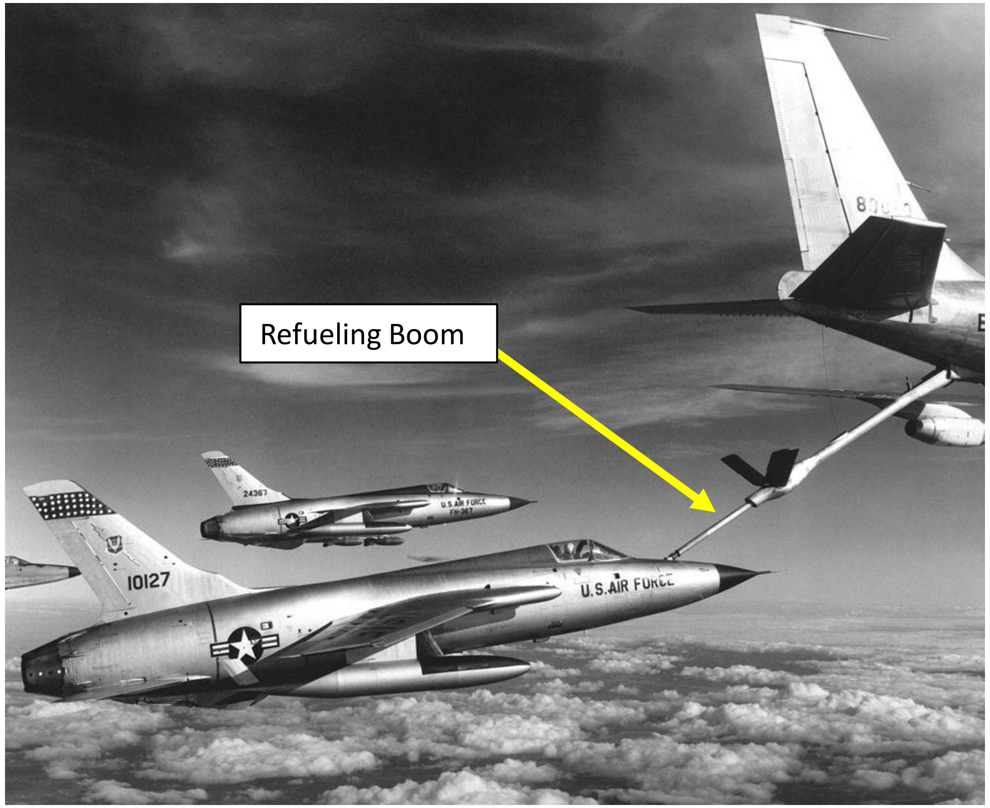


INTRODUCTION

TYPES OF AIR-TO-AIR REFUELING

There are four main air-to-air refueling techniques used in military aviation:

- Probe-and-drogue (refueling probe must be inserted in the tanker's drogue basket)
- Flying Refueling Boom (guided by boom operator aboard the tanker)
- Buddy Refueling (two fighters can refuel one another independently without a tanker)
- Nose-Probe refueling



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

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

INTRODUCTION

TYPES OF AIR-TO-AIR REFUELING

The refueling aircraft available in DCS are:

- The Ilyushin Il-78M "Midas", a russian **probe-and-drogue** tanker, which was developed from the Il-76.
- The Boeing KC-135 "Stratotanker", a US Air Force **flying boom** tanker, which was developed from the Boeing 367-80.
- The KC-135 MPRS (Multi-point Refueling Systems), a US Air Force KC-135 tanker modified to add refueling pods to the KC-135's wings, making it useable as a **probe-and-drogue** tanker.
- The Lockheed S-3B "Viking", a US Navy **probe-and-drogue** tanker.
- The Lockheed KC-130 "Hercules", a USMC **probe-and-drogue** tanker, which was developed from the C-130.

The AV-8B is equipped with a Probe-and-Drogue system, so air-to-air refueling will only be performed from either an Il-78M, a KC-130, a KC-135 MPRS or a S-3B tanker.

KC-135 MPRS

KC-135 Stratotanker

Il-78M

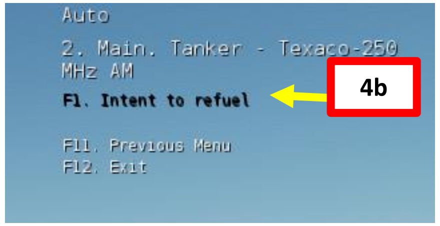
KC-130

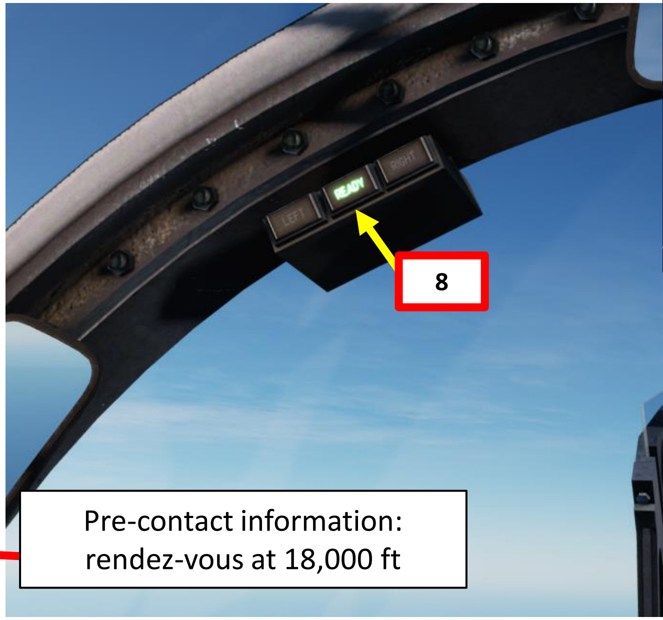
S-3B Viking

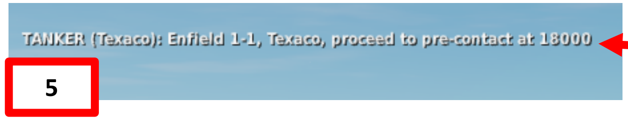
AIR-TO-AIR REFUELING DEMO

1. Consult mission briefing to know on which radio frequency you need to contact the tanker. In our case, we will use the frequency 250 MHz on the V/UHF radio.
2. Find tanker using TACAN frequency as shown in the NAVIGATION - TACAN section.
3. Set your radio to 250 MHz 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 18,000 ft).
6. Set Master Arm Switch – OFF (DOWN)
7. Set Flaps to CRUISE
8. Set A/R switch to OUT. READY light should illuminate.

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.



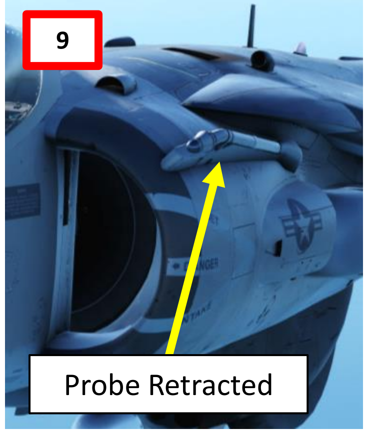


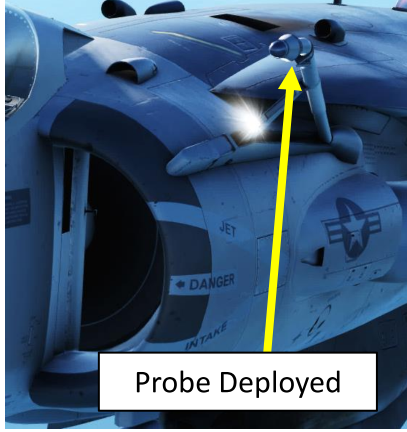


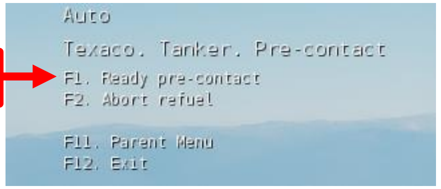
Pre-contact information:
rendez-vous at 18,000 ft

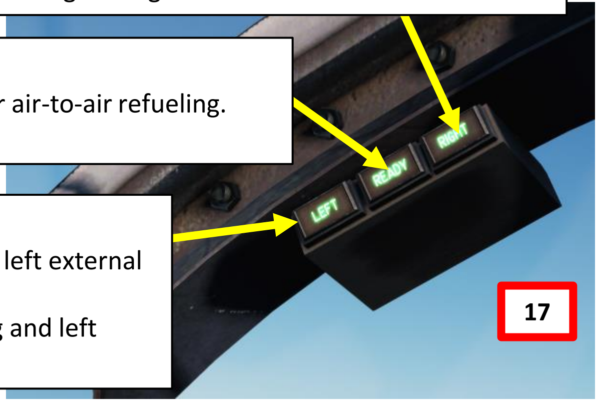
AIR-TO-AIR REFUELING DEMO

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 (between 190-300 KIAS) and approach the drogue basket very slowly (make sure you remain about 2-3 kts faster than the tanker) with gentle inputs. Make sure AOA (Angle of Attack) is within safe operating limits (13 deg max)
14. Keep the aircraft trimmed at ALL TIMES. Approaching untrimmed is living hell.
15. Insert your probe into the drogue basket by using your reference points.
16. Additional drag should be generated by the drogue once you have contact with the drogue: your aircraft will slightly decelerate. Once the probe is taking fuel, the tanker pilot should tell you "You're taking fuel".
17. Keep formation with the tanker until your refueling is complete. Refueling should be complete when the RIGHT and LEFT Refuel lights are flashing or steady.
18. Detach your probe from the basket by throttling down and set A/R switch to IN. READY light should extinguish.





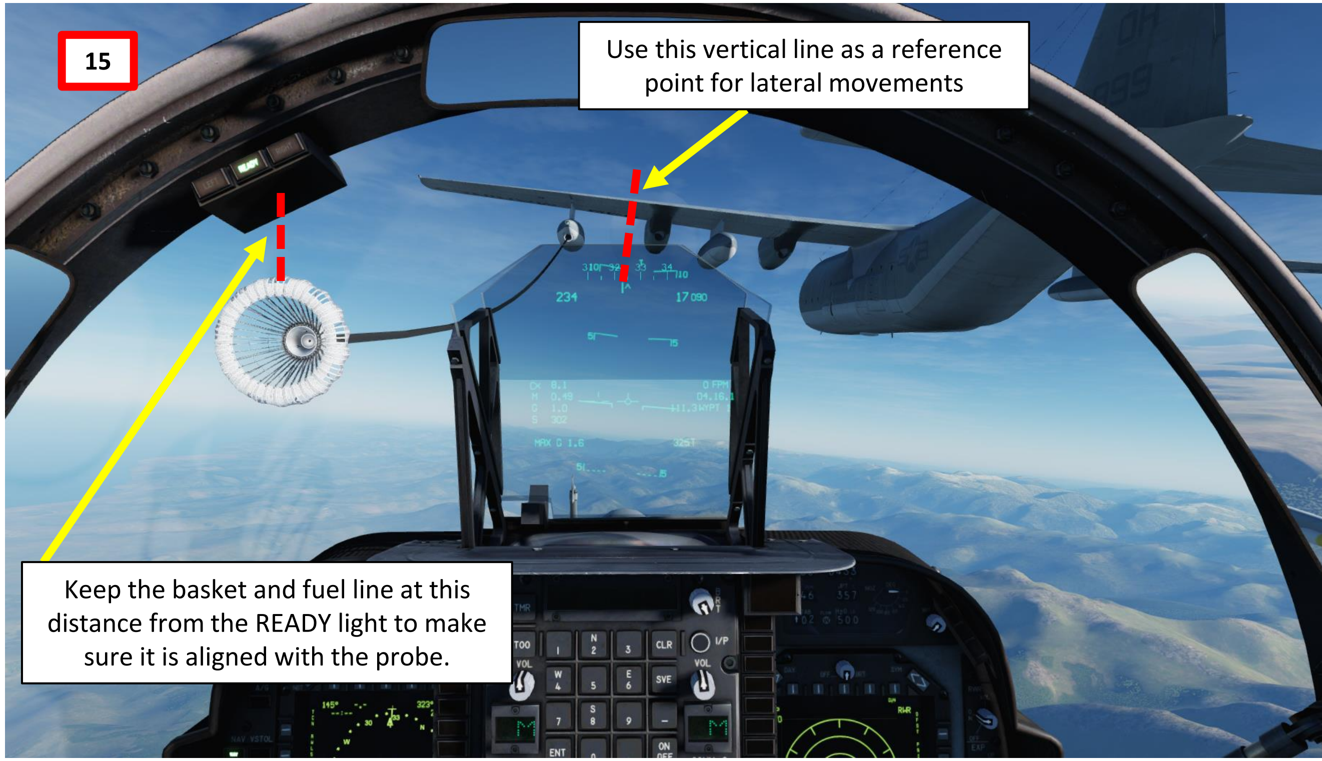




RIGHT Refuel Light
- Flashing: internal right wing tank or right external tank is full.
- Illuminated (steady): both right wing and right external tanks are full.

READY Refuel Light
- Illuminates when you are cleared for air-to-air refueling.
- Extinguishes during contact.

LEFT Refuel Light
- Flashing: internal left wing tank or left external tank is full.
- Illuminated (steady): both left wing and left external tanks are full.



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
- Forget to set the flaps at CRUISE, not AUTO

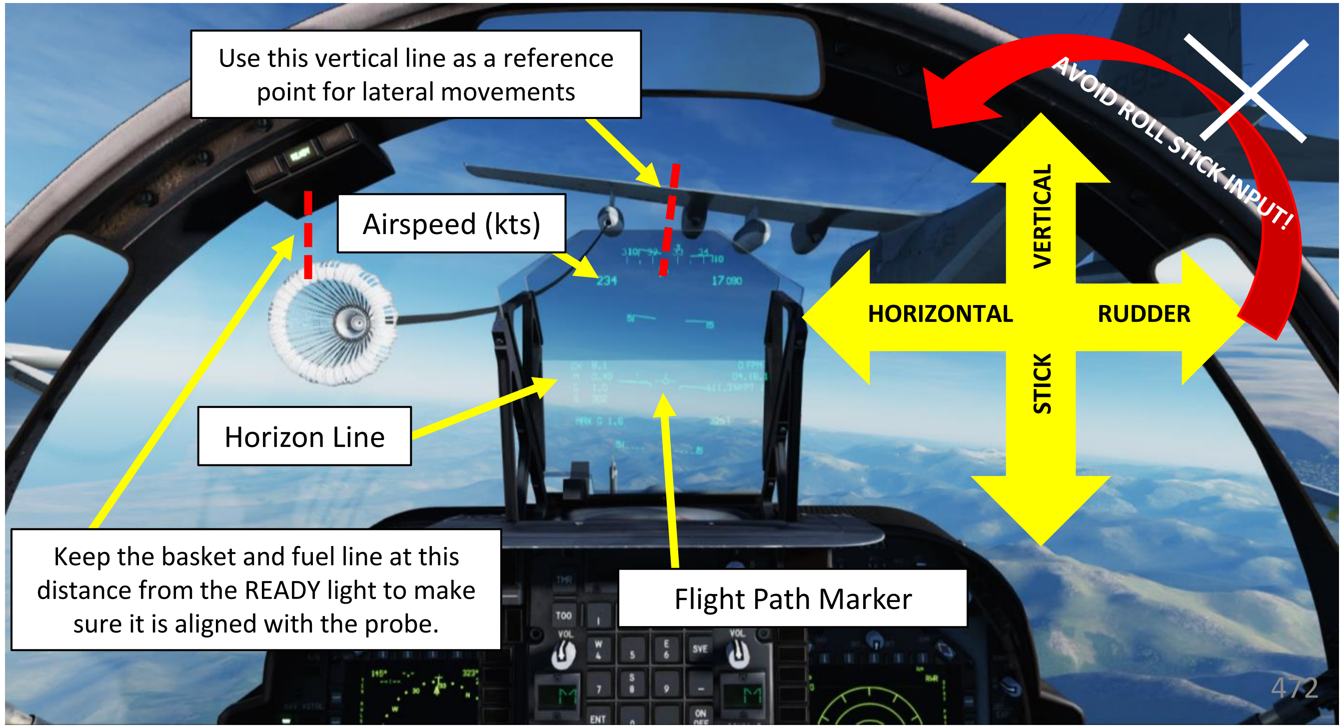
Here are various demos of air-to-air refueling.

- https://www.youtube.com/watch?v=oLx-Q9_4VTU
- https://www.youtube.com/watch?v=JB7qUDBN3yY
- https://www.youtube.com/watch?v=TdJ2qXYdzdw

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 approximately as shown on the picture below, **I gradually throttle up** and increase speed to **match the tanker's speed**. In this case, the tanker's speed is 335 kts. Make sure that you keep a constant speed.
- Once my speed matches the tanker's, I can gradually accelerate to a speed that is 2-3 kts faster (338 in our case), **approaching the basket very slowly**. At that part, the ONLY two things I am watching are my **AIRSPEED** and the **REFERENCE POINT (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.



VREST

If you go in the main Menu page, then select the VREST (Vertical/Short Takeoff & Landing, Range, Endurance , Speed & Time) page, which allows you to determine the operational capability of the aircraft. The VREST mission computer performs vertical takeoff, vertical landing, range endurance, speed and time calculations that can be consulted on the five sub-pages:

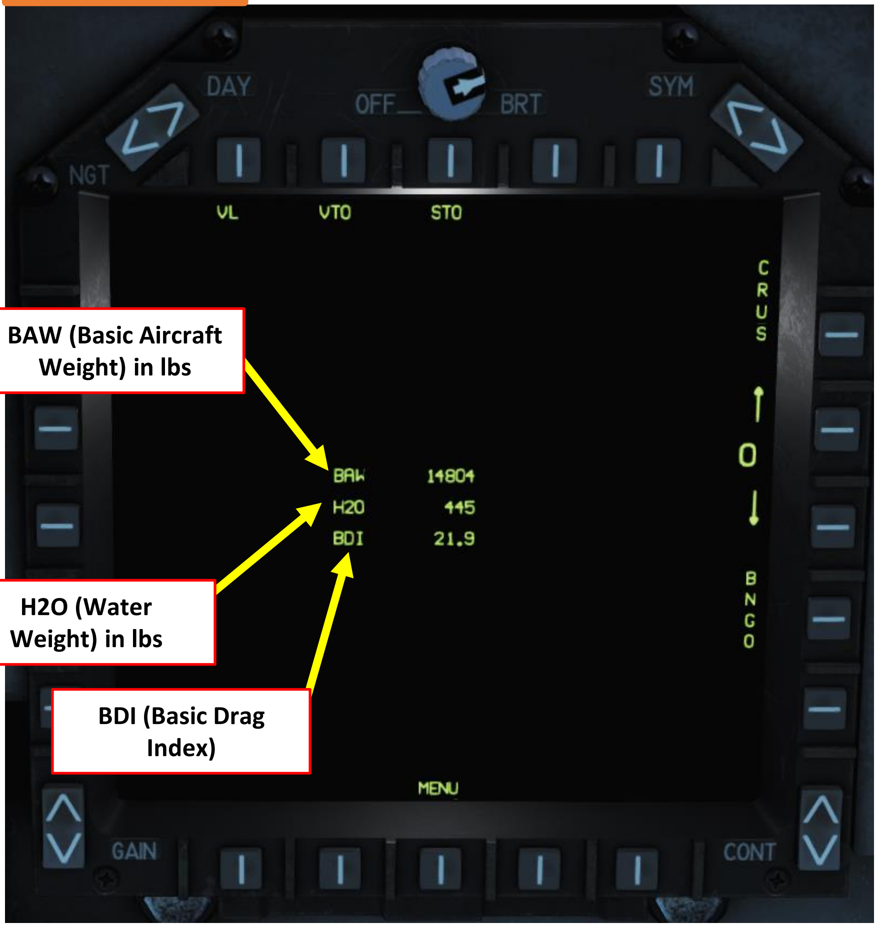
- VL: Vertical Landing Parameters
- VTO: Vertical Takeoff Parameters
- STO: Short Takeoff Parameters
- CRUS: Cruise Parameters
- BNGO: Bingo Fuel Parameters

Note: VREST menu is only visible if the NAV Master Mode or the VSTOL Master Mode is selected.

Main Page

VREST Page Selector

VREST Main Page



BAW (Basic Aircraft Weight) in lbs

H2O (Water Weight) in lbs

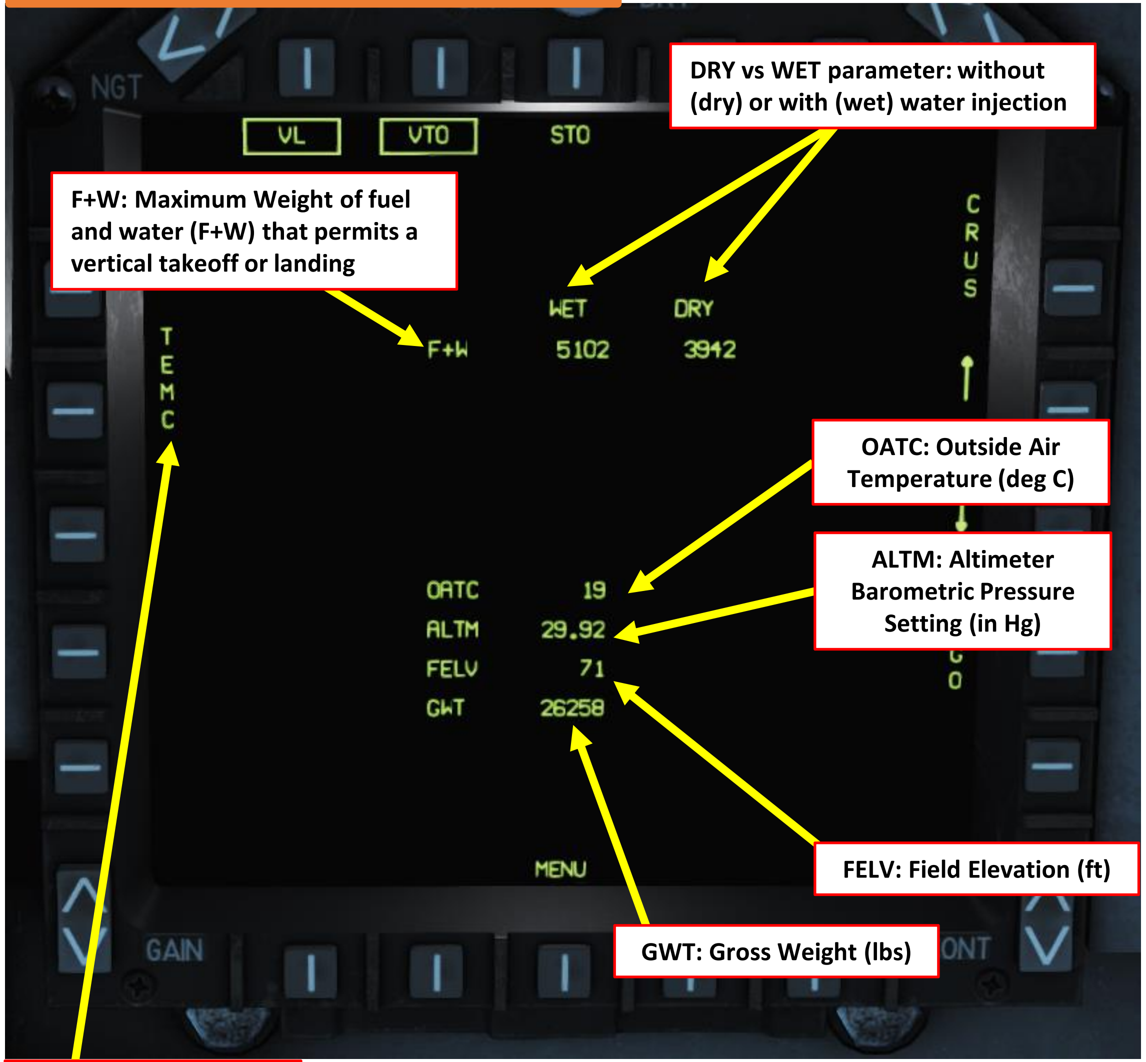
BDI (Basic Drag Index)

VSTOL Master Mode

NAV Master Mode

VREST SUB-MENUS

VL & VTO (VERTICAL LANDING & TAKEOFF) Pages



DRY vs WET parameter: without (dry) or with (wet) water injection

F+W: Maximum Weight of fuel and water (F+W) that permits a vertical takeoff or landing

OATC: Outside Air Temperature (deg C)

ALTM: Altimeter Barometric Pressure Setting (in Hg)

FELV: Field Elevation (ft)

GWT: Gross Weight (lbs)

TEMC: Selects Celsius or Fahrenheit Degrees

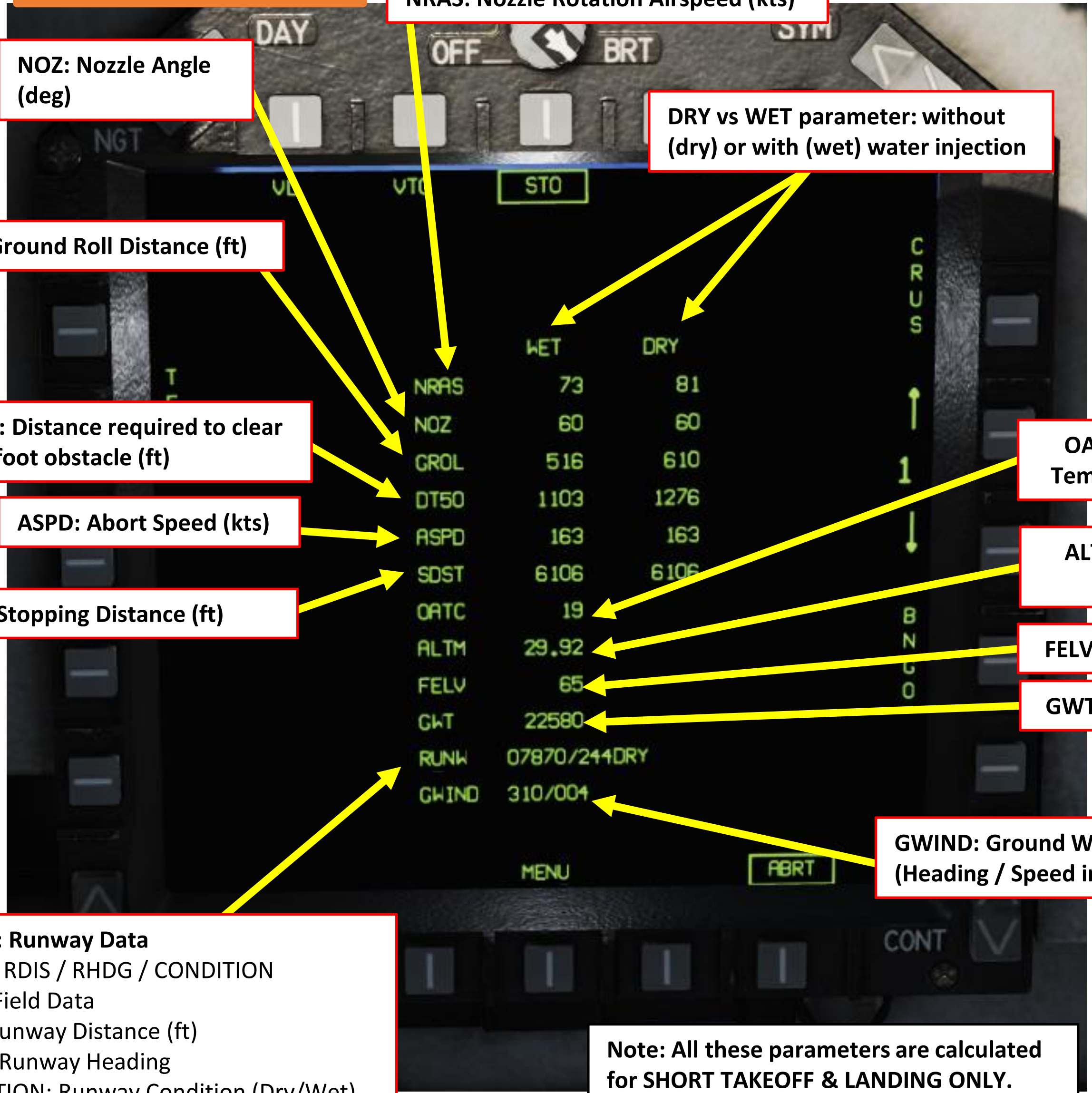
Note: All these parameters are calculated for VERTICAL TAKEOFF & LANDING ONLY.

VL & VTO Pages – Interface with UFC (Up-Front Controller)

Note: Data in certain field parameters can be modified manually via the UFC and the OSBs (Option Select Buttons).

VREST SUB-MENUS

STO (SHORT TAKEOFF) Page



NRAS: Nozzle Rotation Airspeed (kts)

NOZ: Nozzle Angle (deg)

DRY vs WET parameter: without (dry) or with (wet) water injection

GROL: Ground Roll Distance (ft)

DT50: Distance required to clear a 50 foot obstacle (ft)

ASPD: Abort Speed (kts)

SDST: Stopping Distance (ft)

RUNW: Runway Data
FDAT = RDIS / RHDG / CONDITION
FDAT: Field Data
RDIS: Runway Distance (ft)
RHDG: Runway Heading
CONDITION: Runway Condition (Dry/Wet)

Note: All these parameters are calculated for SHORT TAKEOFF & LANDING ONLY.

STO Page – Interface with UFC (Up-Front Controller)

OATC: Outside Air Temperature (deg C)

ALTM: Altimeter Barometric Pressure Setting (in Hg)

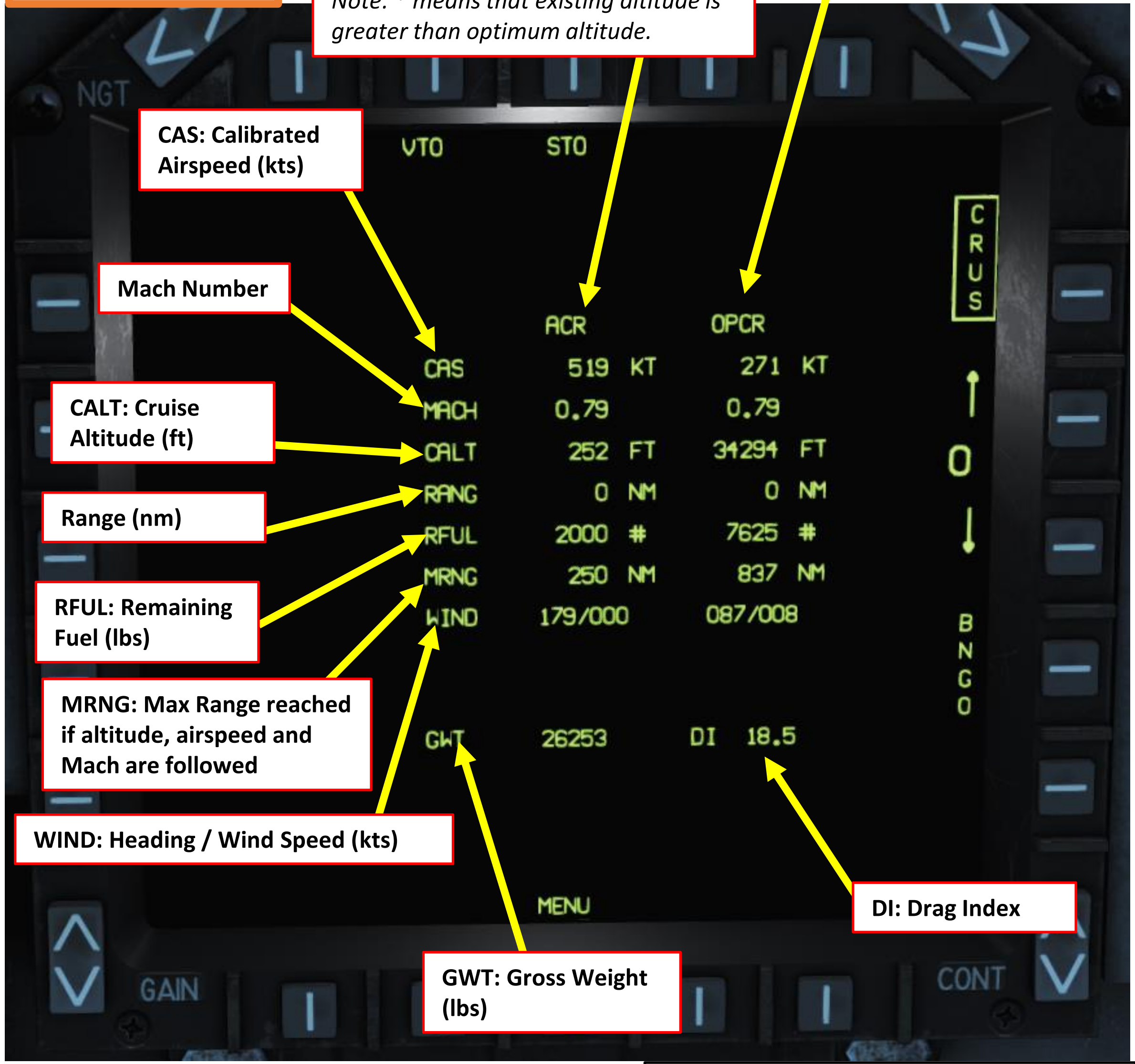
FELV: Field Elevation (ft)

GWT: Gross Weight (lbs)

GWIND: Ground Wind Data (Heading / Speed in kts)

VREST SUB-MENUS

CRUS (CRUISE) Page



ACR: Altitude Cruise (Max Cruise Performance at existing altitude).
*Note: * means that existing altitude is greater than optimum altitude.*

OPCR: Optimum Cruise (Max Cruise Performance at optimal altitude)

CAS: Calibrated Airspeed (kts)

Mach Number

CALT: Cruise Altitude (ft)

Range (nm)

RFUL: Remaining Fuel (lbs)

MRNG: Max Range reached if altitude, airspeed and Mach are followed

WIND: Heading / Wind Speed (kts)

GWT: Gross Weight (lbs)

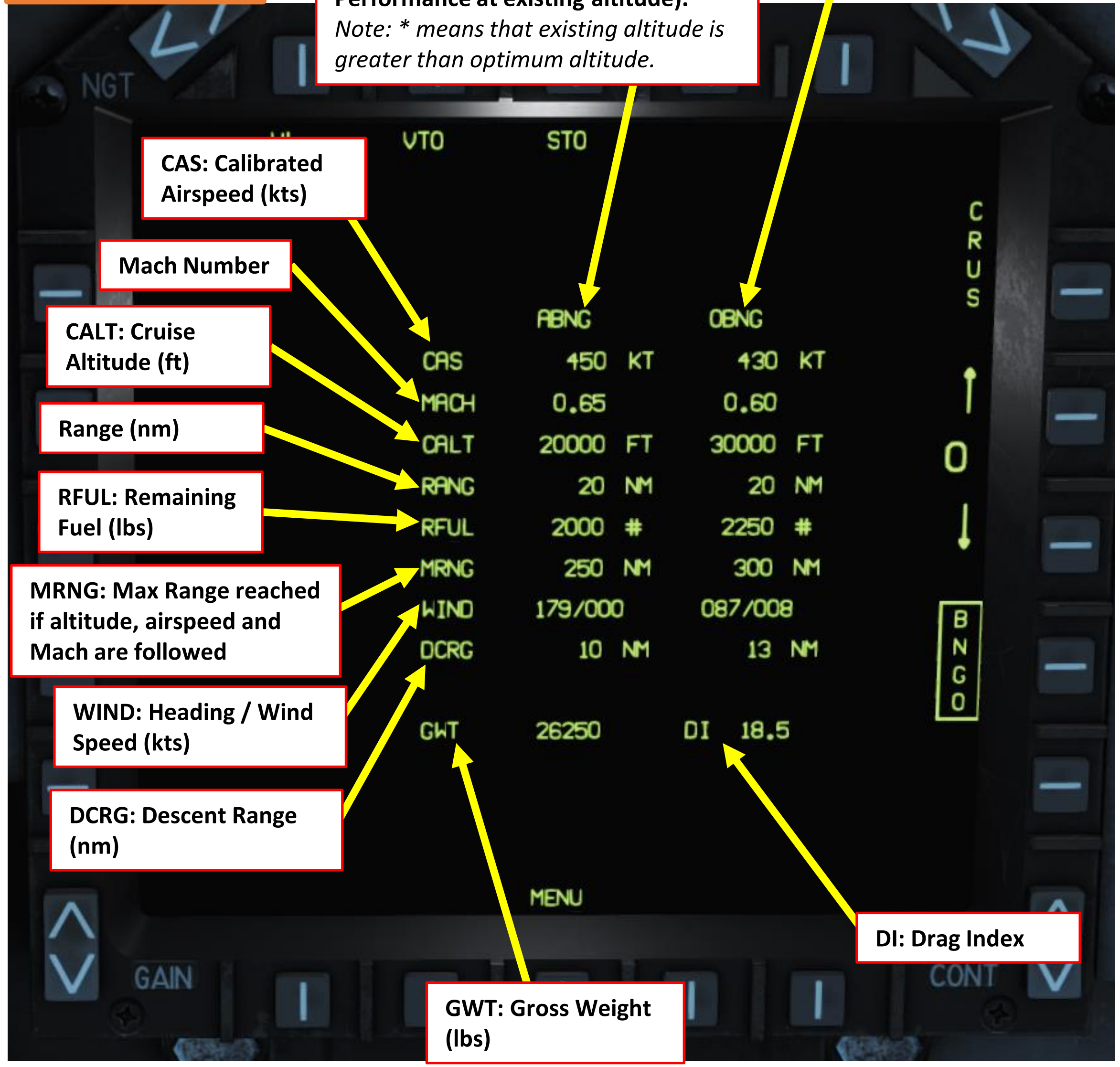
DI: Drag Index

CRUS Page – Interface with UFC (Up-Front Controller)

Note: All these parameters are calculated for the CRUISE phase of flight.

VREST SUB-MENUS

BNGO (BINGO) Page



ABNG: Altitude Bingo (Max Bingo Fuel Performance at existing altitude).
*Note: * means that existing altitude is greater than optimum altitude.*

OBNG: Optimum Cruise (Max Bingo Fuel Performance at optimal altitude)

CAS: Calibrated Airspeed (kts)

Mach Number

CALT: Cruise Altitude (ft)

Range (nm)

RFUL: Remaining Fuel (lbs)

MRNG: Max Range reached if altitude, airspeed and Mach are followed

WIND: Heading / Wind Speed (kts)

DCRG: Descent Range (nm)

GWT: Gross Weight (lbs)

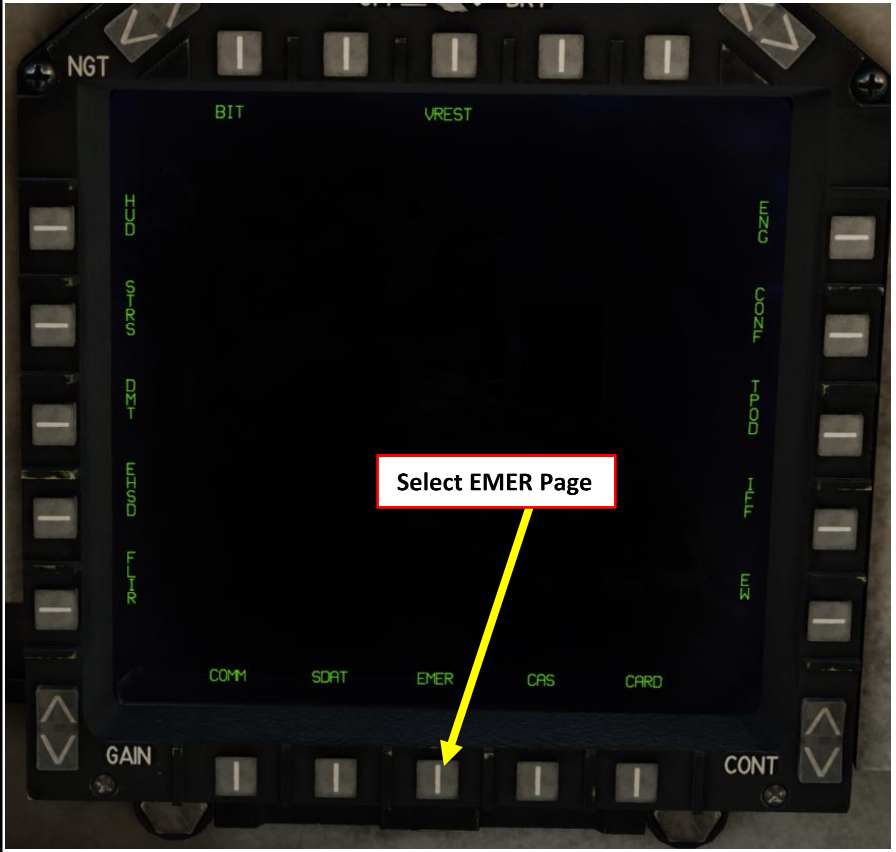
DI: Drag Index

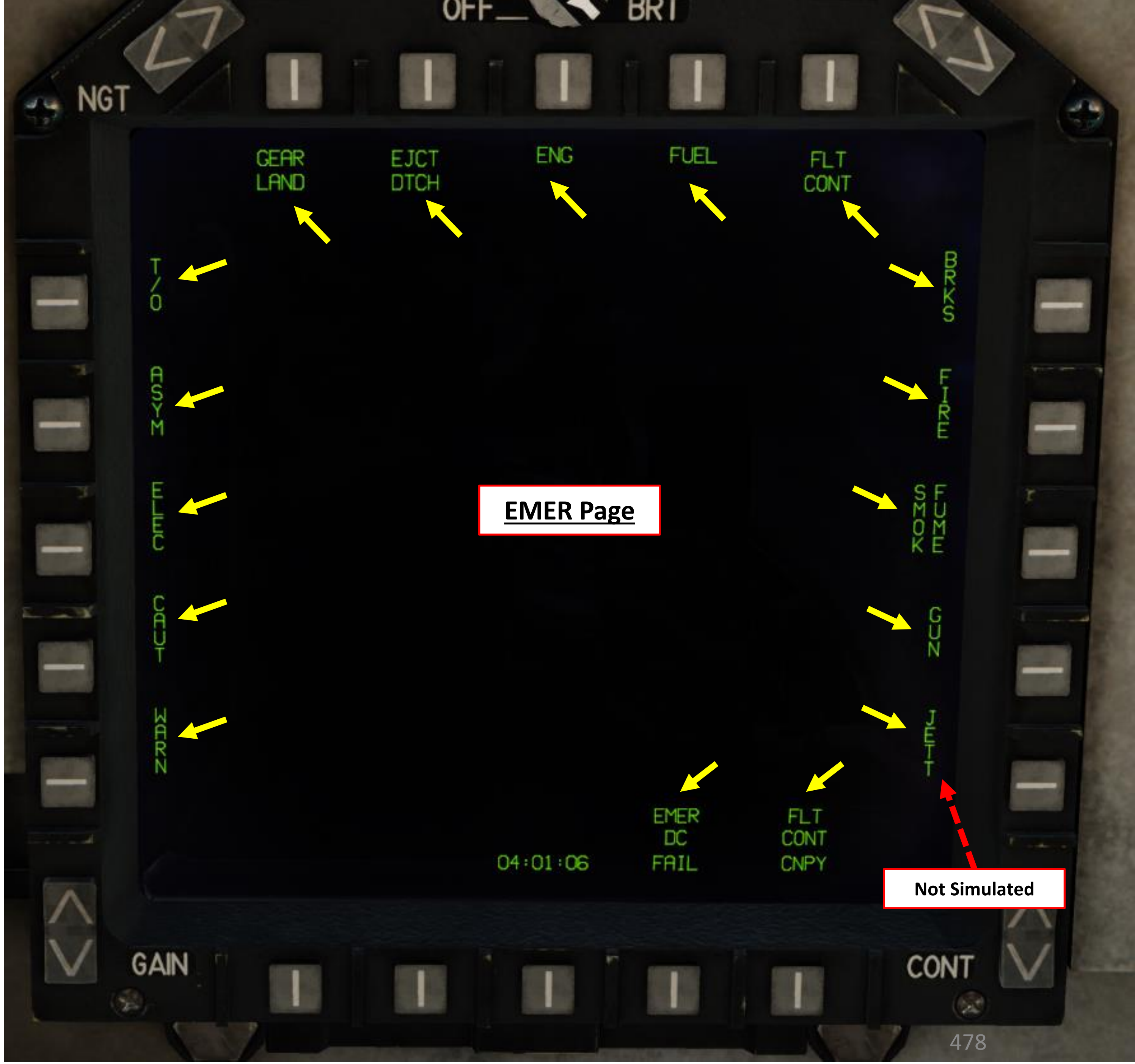
BNGO Page – Interface with UFC (Up-Front Controller)

Note: All these parameters are calculated for the BINGO flight profile. BINGO is “an order to proceed and land at the field specified, utilizing a bingo profile. Aircraft is considered to be in an emergency/fuel critical situation. Bearing, distance, and destination shall be provided."

EMER Main Page

If you go in the main Menu page, then select the EMER (Emergency) page, which contains all sorts of checklists for various emergencies.

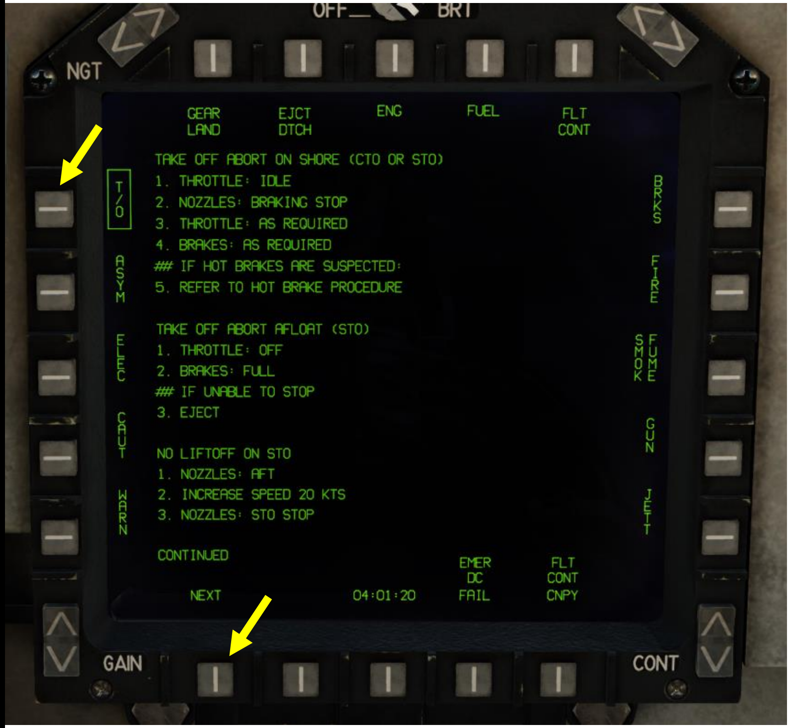




EMER Pages

Here is an overview of various checklists:

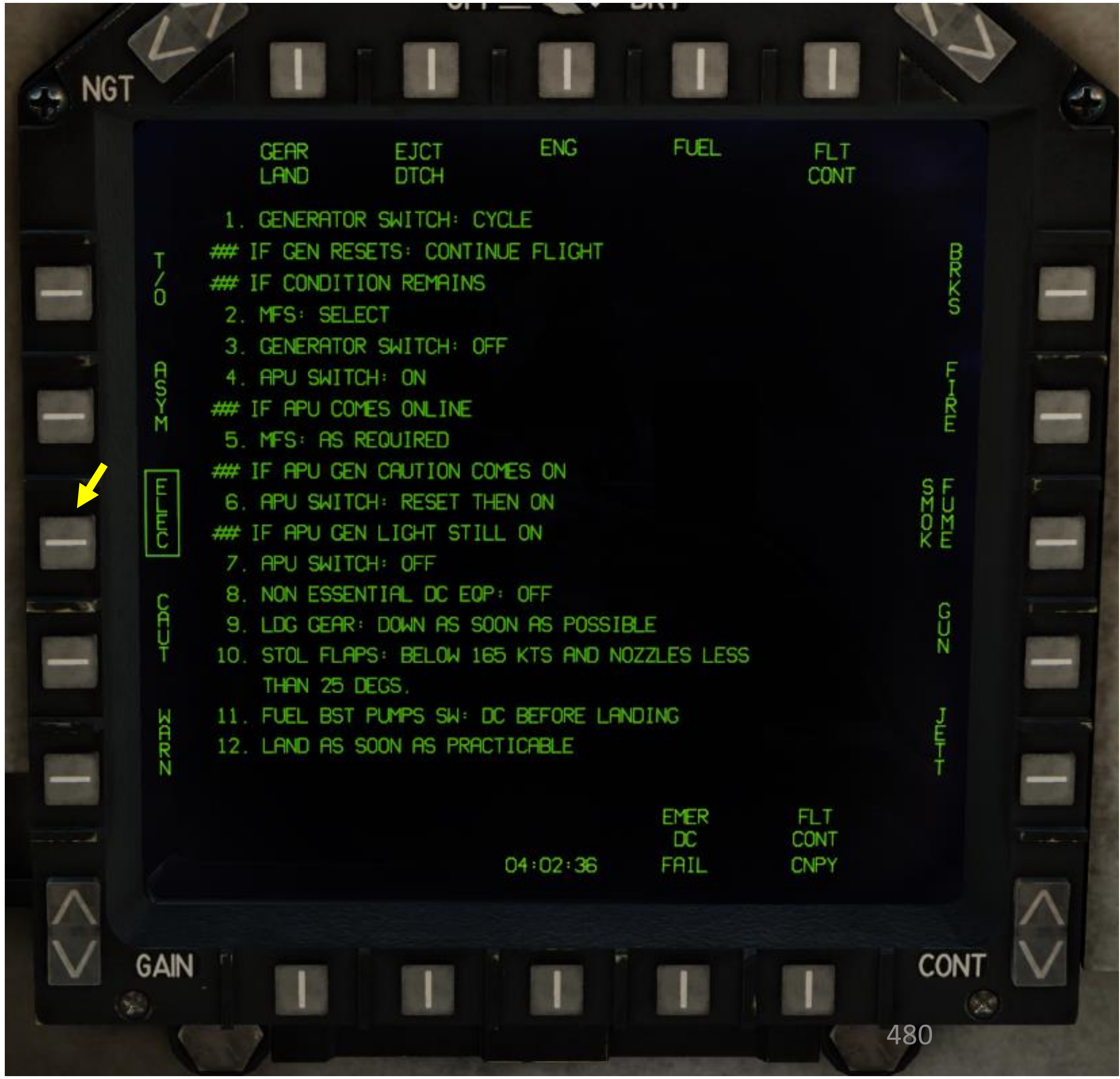
- T/O: Takeoff emergencies



EMER Pages

Here is an overview of various checklists:

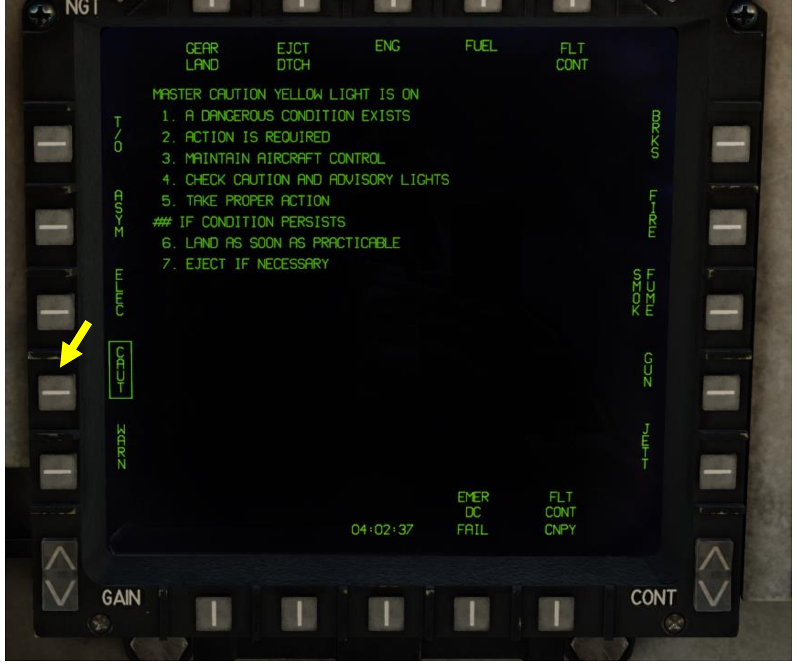
- ASYM: Landing with Assymetrical Loadout
- ELEC: Electrical Emergencies

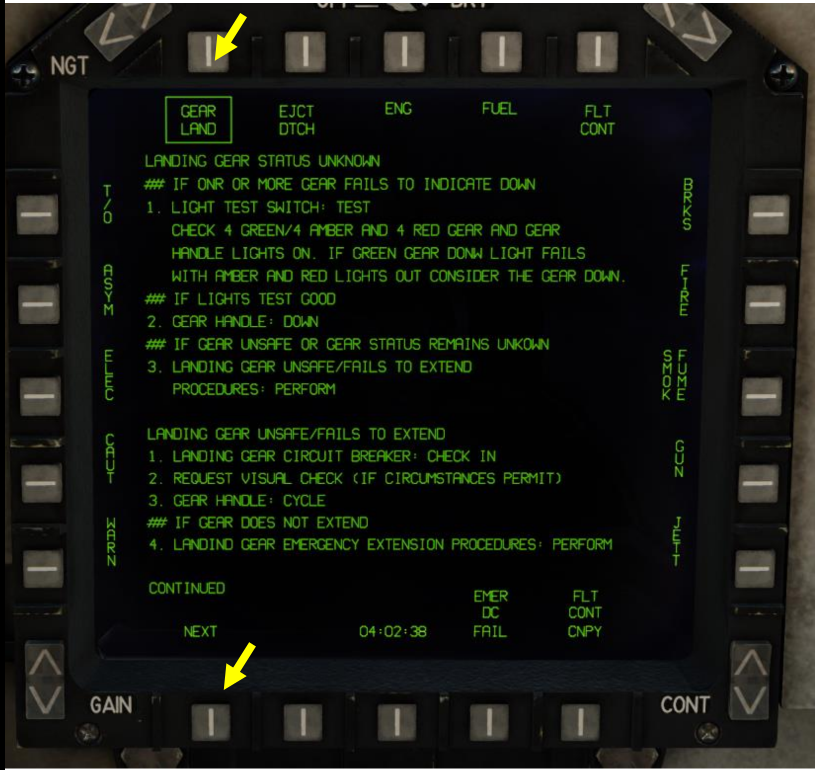


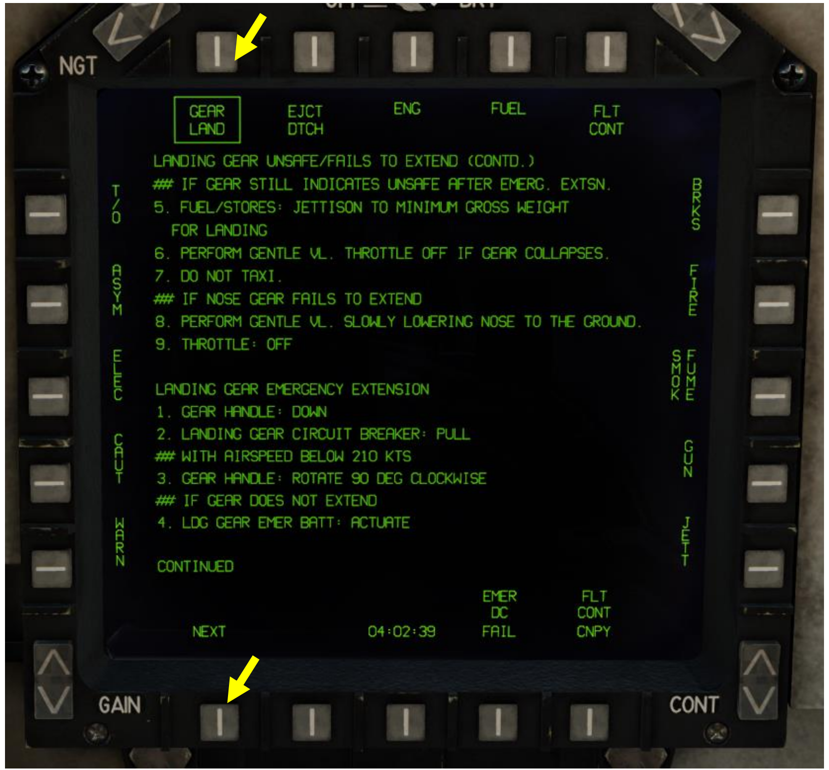
EMER Pages

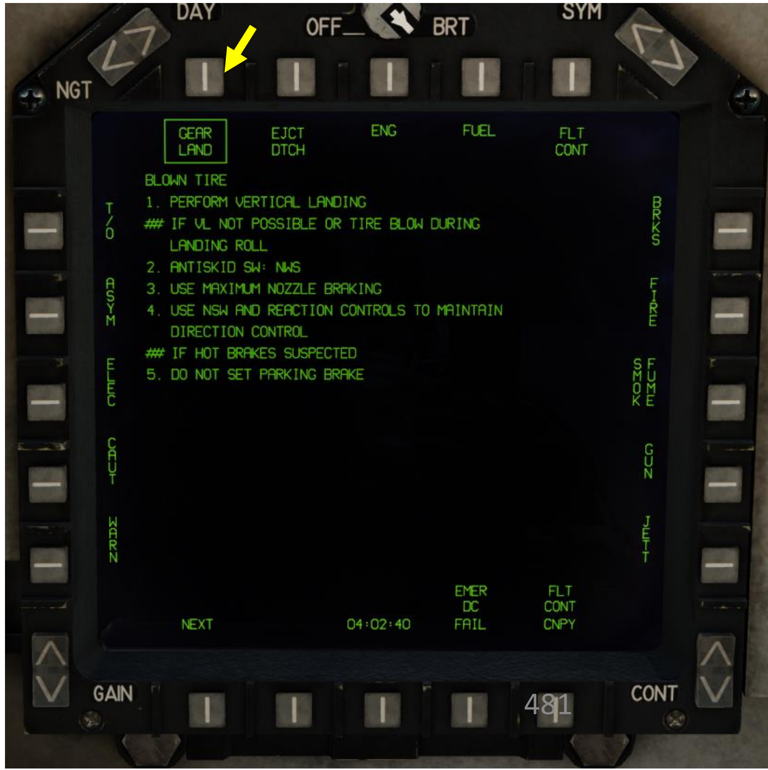
Here is an overview of various checklists:

- CAUT: Master Caution Yellow Light Emergencies
- WARN: Master Warning Red Light Emergencies
- GEAR LAND: Landing Gear Emergencies





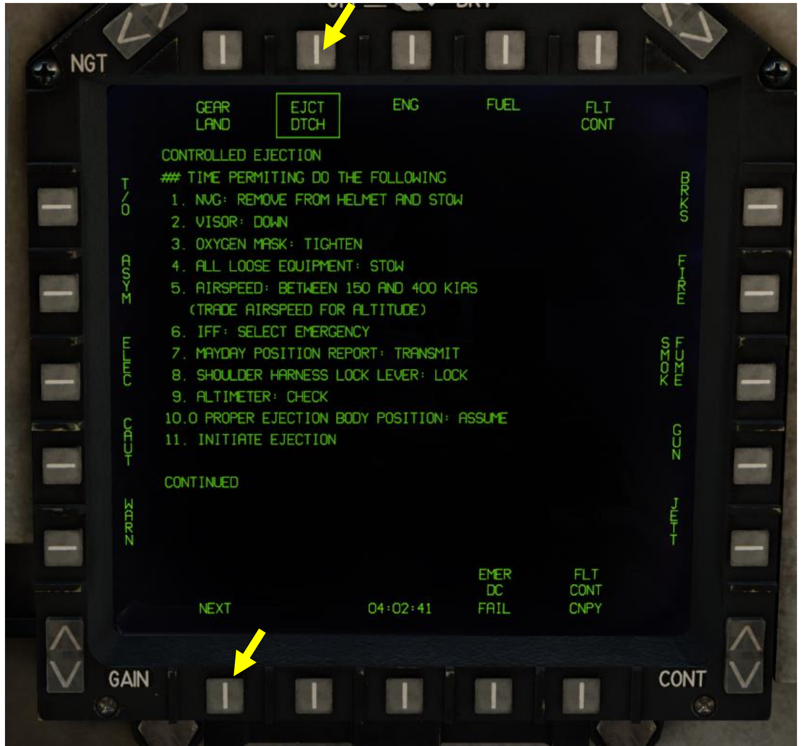


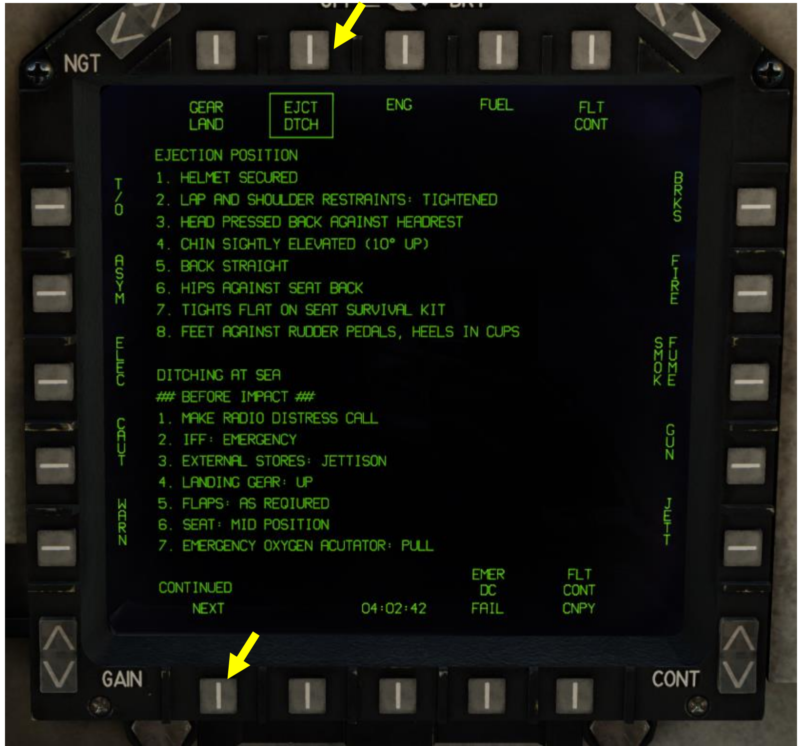


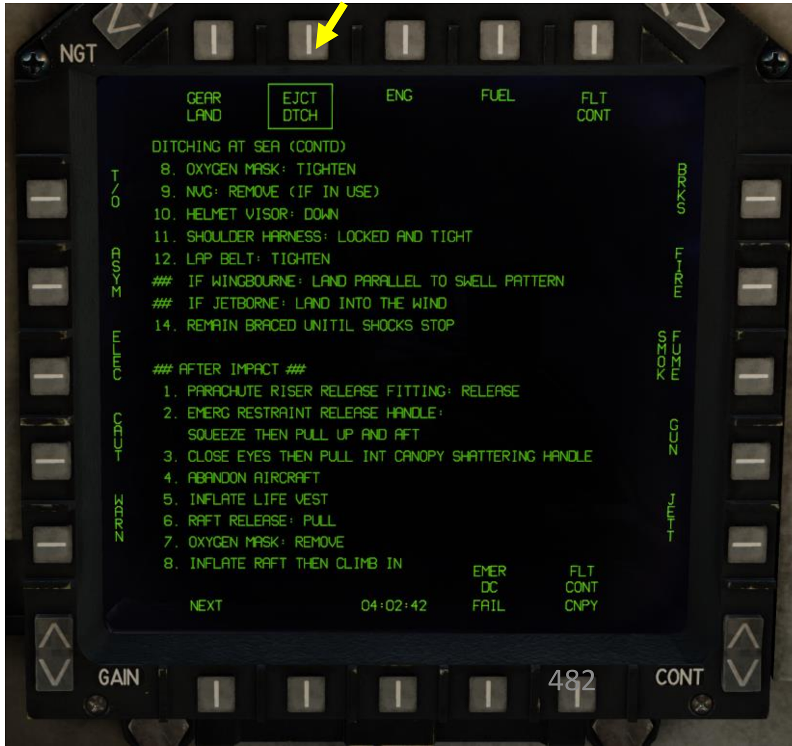
EMER Pages

Here is an overview of various checklists:

- EJCT DTCH: Ejection & Ditching Emergencies



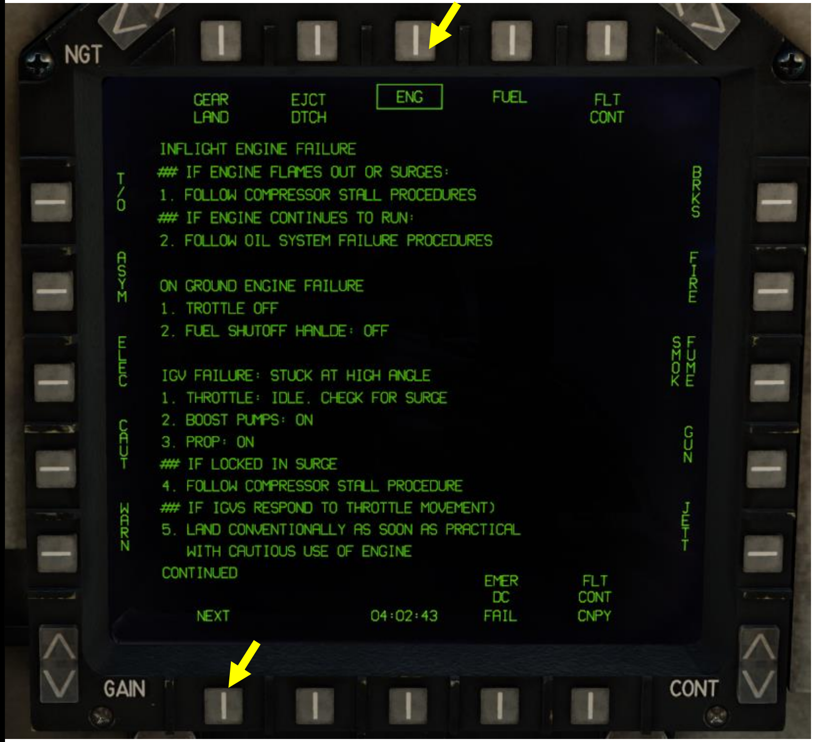


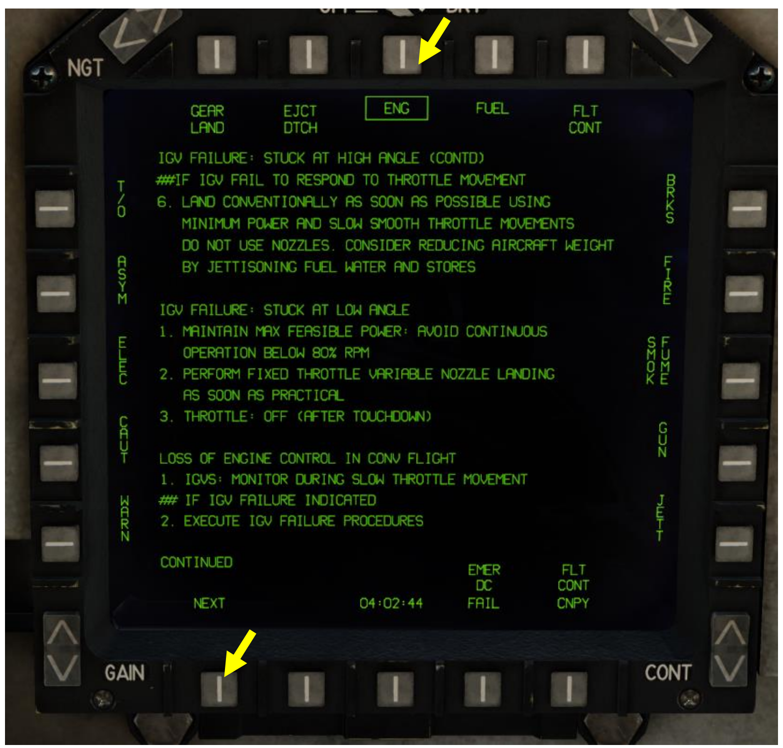


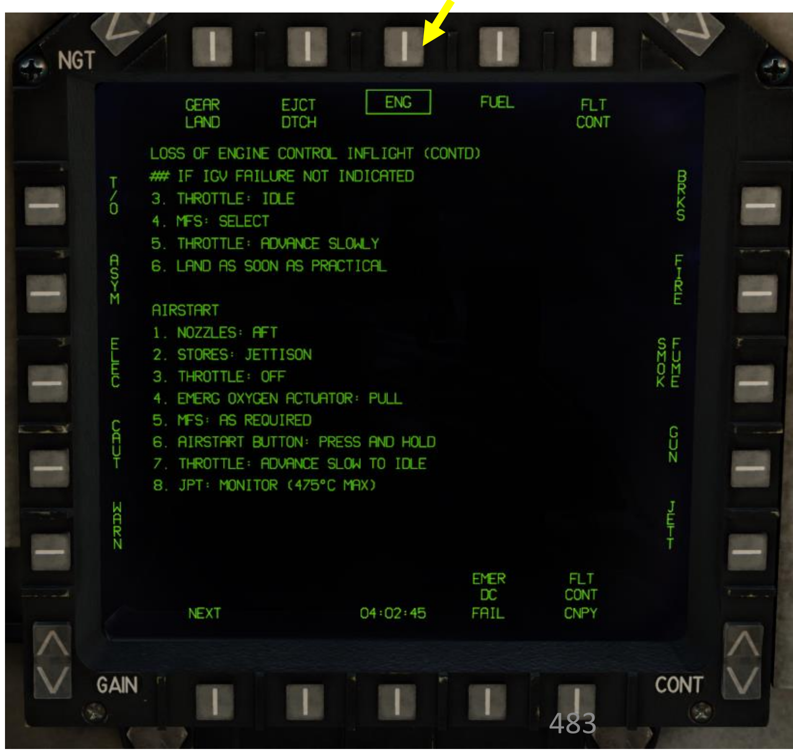
EMER Pages

Here is an overview of various checklists:

- ENG: Engine Emergencies



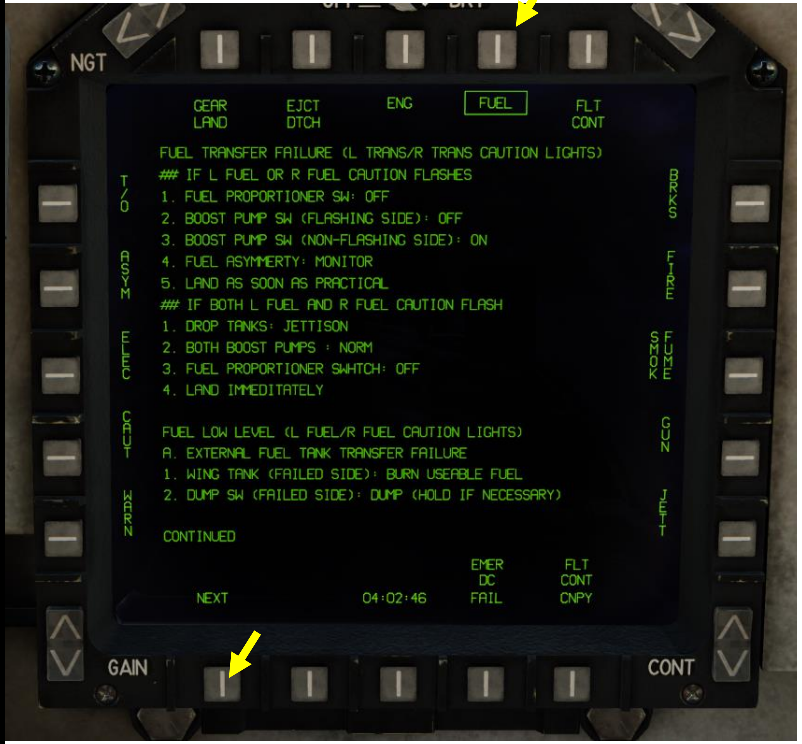


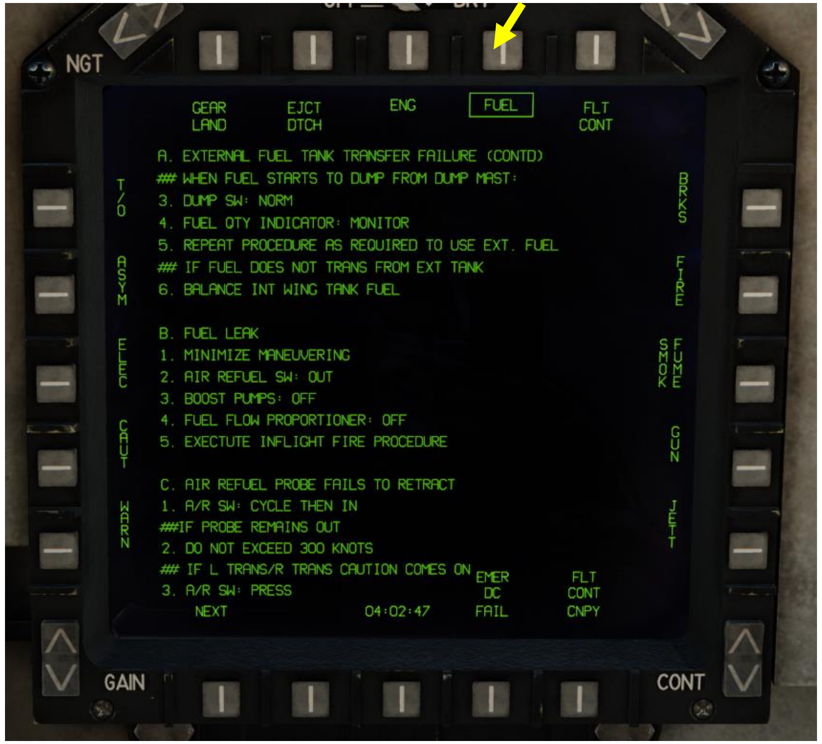


EMER Pages

Here is an overview of various checklists:

- FUEL: Fuel System Emergencies
- FLT CONT: Flight Control System Emergencies

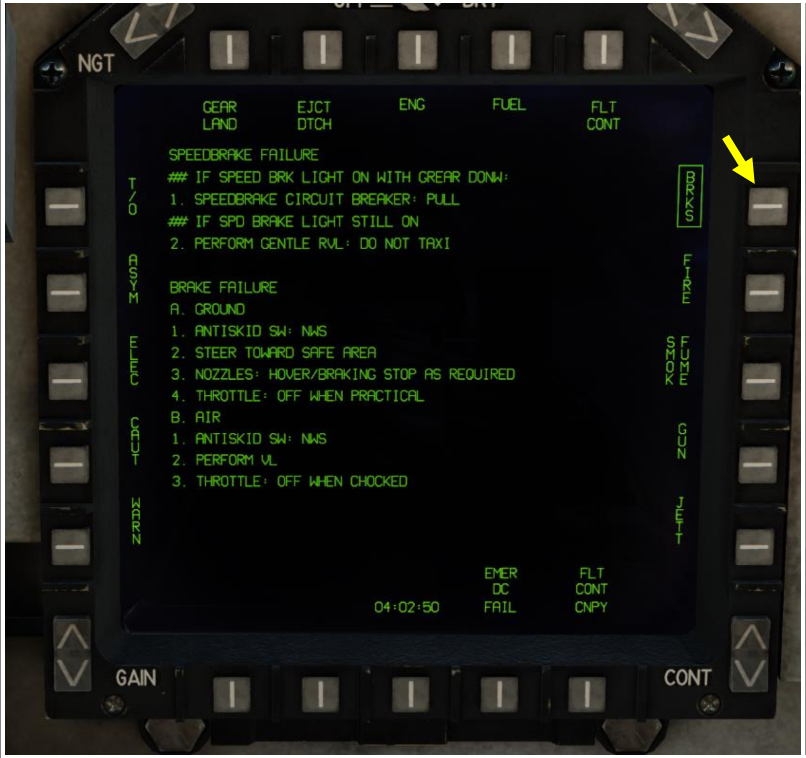


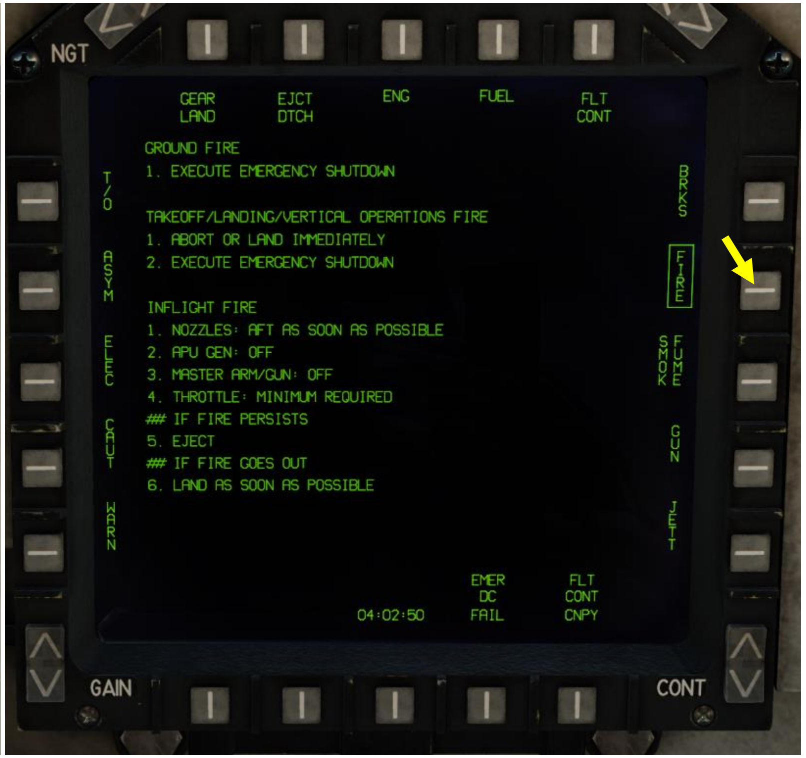


EMER Pages

Here is an overview of various checklists:

- BRKS: Speedbrake and Brakes Emergencies
- FIRE: Fire Emergencies
- SMOK FUME: Smoke & Fumes Emergencies

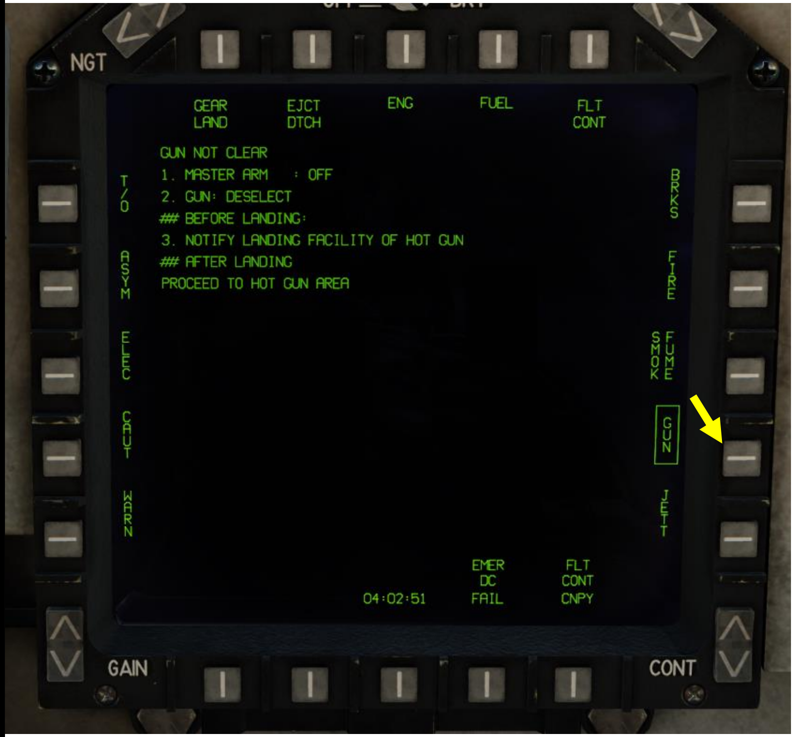


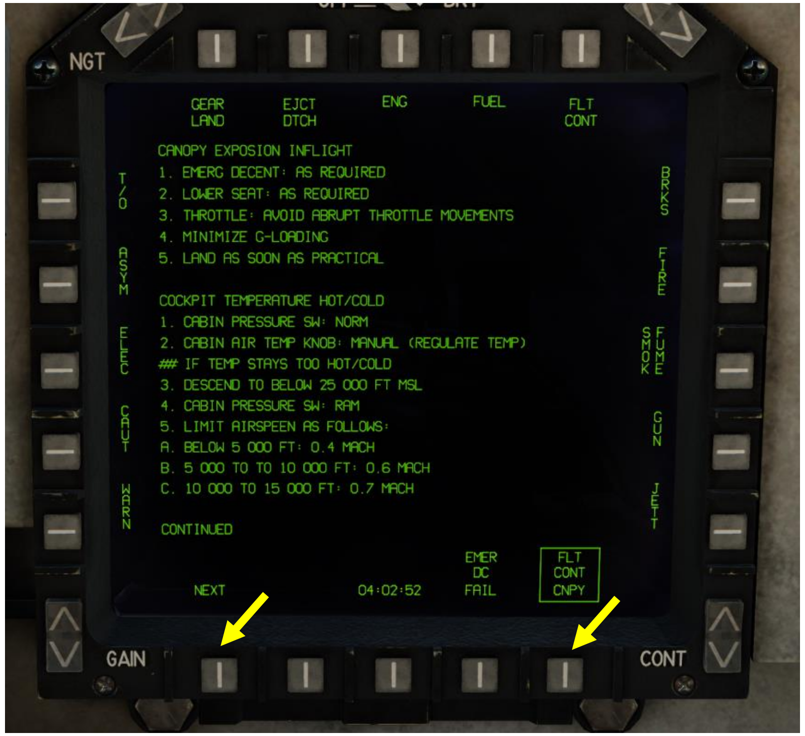


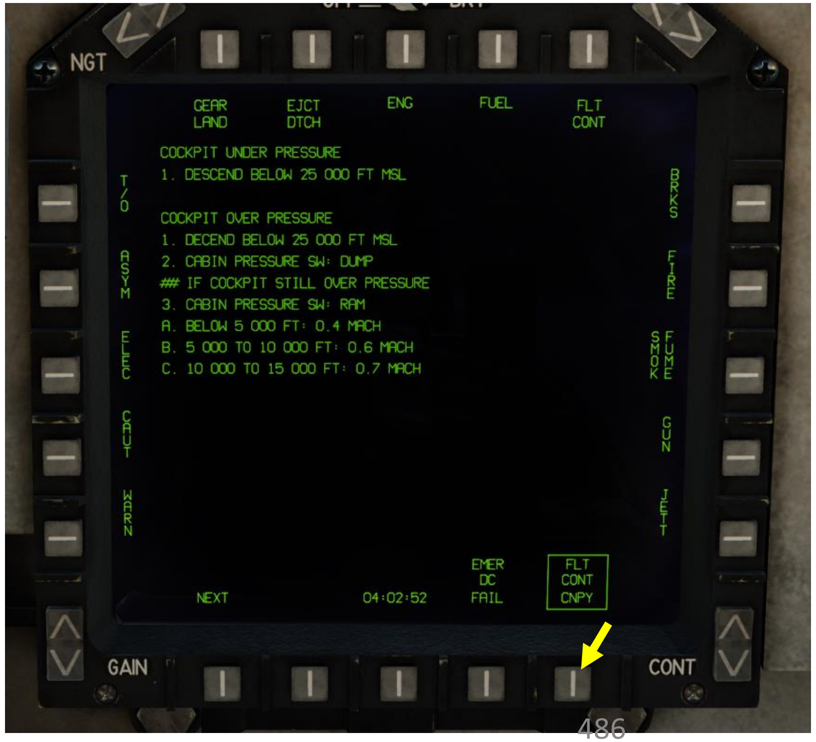
EMER Pages

Here is an overview of various checklists:

- GUN: Gun Emergencies
- FLY CONT CNPY: Cockpit/Canopy Emergencies







EMER Pages

Here is an overview of various checklists:

- EMER DC FAIL: Electrical DC System Failure Emergencies

USEFUL RESOURCES

476th vFG AV-8B Flight Crew Checklist
http://www.476vfightergroup.com/downloads.php?do=file&id=485

RAZBAM (Official Developer) Work-In-Progress Pocket Guide
https://forums.eagle.ru/showthread.php?t=193603

Redkite's Youtube Tutorials
https://www.youtube.com/watch?v=WJBPRZMM-8U&list=PLml_c09ciucvv3ClsWImCEqY5XIdbfPxu

Deephack's Youtube Tutorials
https://www.youtube.com/playlist?list=PLLY_KGBSBGjXR5AgHPbQTs4ib30vyDQum

Jabbers' Youtube Tutorials
https://www.youtube.com/channel/UCvXXUrGCF3wV3bbZ6pFQ00g/videos

Maverick's Air-to-Air Refueling Tutorial
https://www.youtube.com/watch?v=oLx-Q9_4VTU

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:

- ChazFlyz
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- Chris Partridge

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F-86F 2.5.0
FC3 2.5.0
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