DCS GUIDE
F-5E3 TIGER II

LAST UPDATED: 09/08/2016

By Chuck

TABLE OF CONTENT

PART 1 – INTRODUCTION

In the late 1950s, the Air Force required supersonic fighters capable of carrying out ground attacks with conventional (non-nuclear) weapons. The key goal was to combine high combat performance with easy mastering, low cost of maintenance and versatility. It became clear that a mass-produced fighter had to be cheap, simple and low-maintenance aircraft. In 1953 the American Northrop Corporation started designing of a light fighter with a delta wing and bottom-mounted intake. Edgar Schmued, the designer of the famous P-51 Mustang and F-86 Sabre, who had been working at Northrop Corporation since 1950, participated in new fighter concept development. However, in 1955 the project was canceled for a number of reasons. The project continued as a privately funded program and from this the F-5 eventually emerged.

Though primarily designed for the day air superiority role, the aircraft is also a capable ground-attack platform. The F-5A entered service in the early 1960s. During the Cold War, over 800 were produced through 1972 for U.S. allies. Though the USAF had no acknowledged need for a light fighter, it did procure roughly 1,200 Northrop T-38 Talon trainer aircraft, which were directly based on the F-5A.

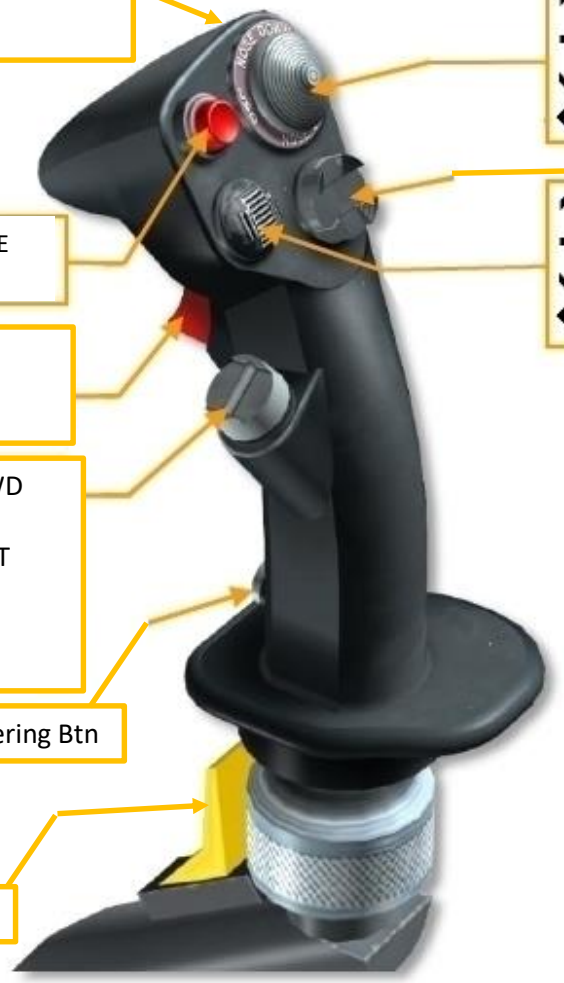
After winning the International Fighter Aircraft competition in 1970, a program aimed at providing effective low-cost fighters to American allies, Northrop introduced the second-generation **F-5E Tiger II** in 1972. This upgrade included more powerful engines, higher fuel capacity, greater wing area and improved leading edge extensions for a better turn rate, optional air-to-air refueling, and improved avionics including air-to-air radar. Primarily used by American allies, it remains in US service to support training exercises. Many of you might be familiar with the infamous “MiG-28” in the movie Top Gun, which was in fact a F-5 aircraft acting as an adversary trainer in Red Flag exercises.

Overall, the Tiger II is an extremely pleasant aircraft to fly. To some, it may seem like an outdated jet, but it has appreciable ground strike capabilities. It has no IFF (Identify-Friend-or-Foe) capabilities and most target acquisition must be done visually. However, the radar installed on the Tiger II gives a well-trained pilot great situational awareness in comparison to its nemesis: the MiG-21.

It is a robust, powerful little jet that has a well laid-out cockpit that makes it very easy to find panels and specific switches. Once you have a couple of flight hours under your belt, you will understand why this jet was such a resounding success in the export market. It is the perfect happy medium for a country that wants to protect its airspace but doesn`t have the financial means to buy top-of-the-line F-15s.

PART 2 – CONTROLS SETUP

WHAT YOU NEED MAPPED



Flare-Chaff Button
(Grey button on RHS)

WEAPON RELEASE
(RALT+SPACE)

GUN TRIGGER
(SECOND DETENT)

↑ Dogfight/Resume Switch FWD
→
↓ Dogfight/Resume Switch AFT
←
P Dogfight/Resume Switch CENTER-PRESSED

Nosewheel Steering Btn

Aileron Limiter OFF (L)

↑ TRIM ELEVATOR PUSH
→ TRIM AILERON RIGHT W DOWN
↓ TRIM ELEVATOR PULL
← TRIM AILERON LEFT W DOWN

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

↑ ZOOM IN SLOW
→ RADAR ACQ BUTTON (ENTER)
↓ ZOOM OUT SLOW
← MISSILE UNCAGE SWITCH

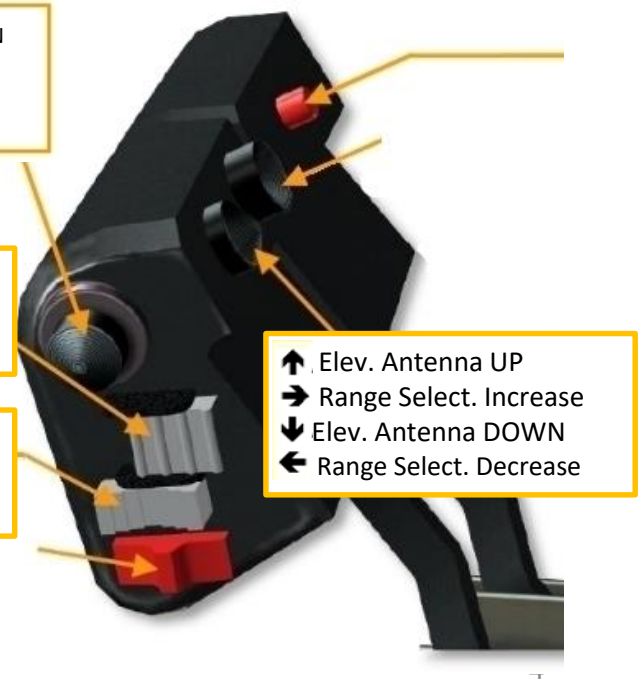
↑ UHF RADIO MICROPHONE BTN
→
↓ COMMUNICATION MENU
←

← SPEED BRAKE IN

→ SPEED BRAKE OUT

← Drag Chute T-Handle

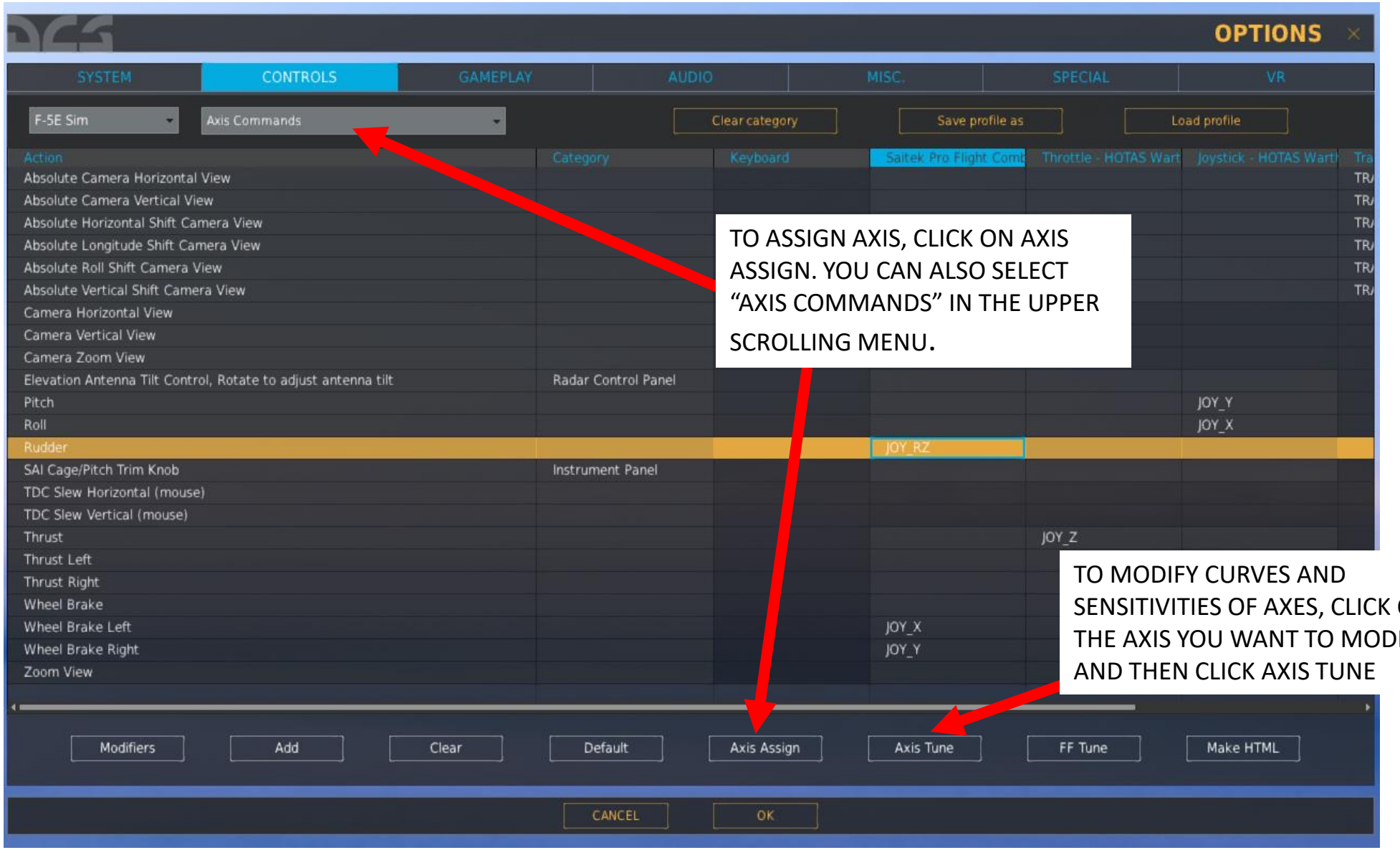
→



↑ Elev. Antenna UP
→ Range Select. Increase
↓ Elev. Antenna DOWN
← Range Select. Decrease

+ TOE BRAKES (MAPPED ON PEDALS)

PART 2 – CONTROLS SETUP



PART 2 – CONTROLS SETUP

BIND THE FOLLOWING AXES:

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

- NOTE: TO TURN ON THE GROUND, MAKE SURE NOSEWHEEL STEERING IS ENGAGED (GREY NOSEWHEEL STEERING BUTTON ON YOUR HOTAS) AND THAT YOU **KEEP IT HELD** AS YOU PERFORM THE TURNS.

PART 3 – COCKPIT & GAUGES

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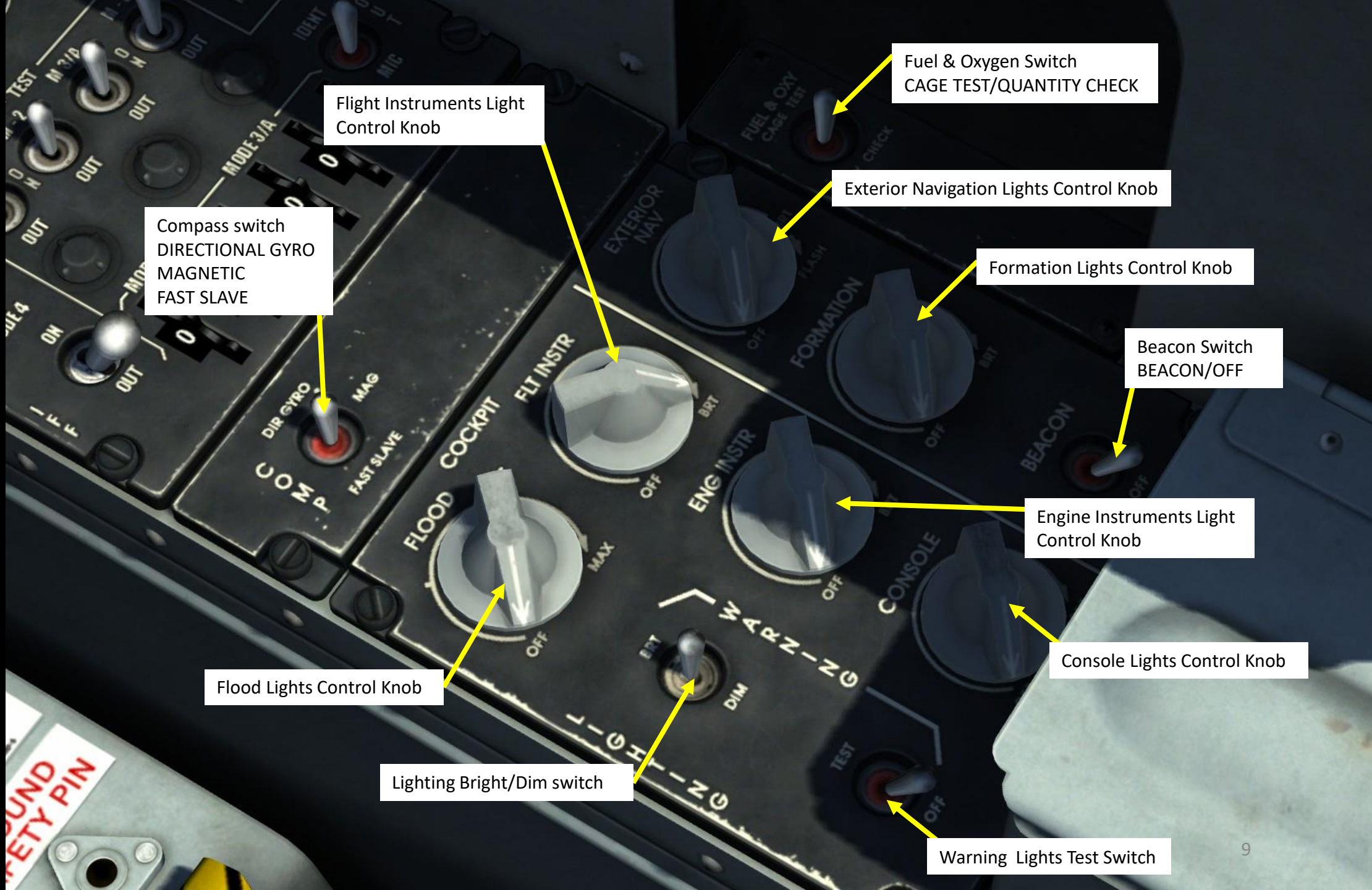

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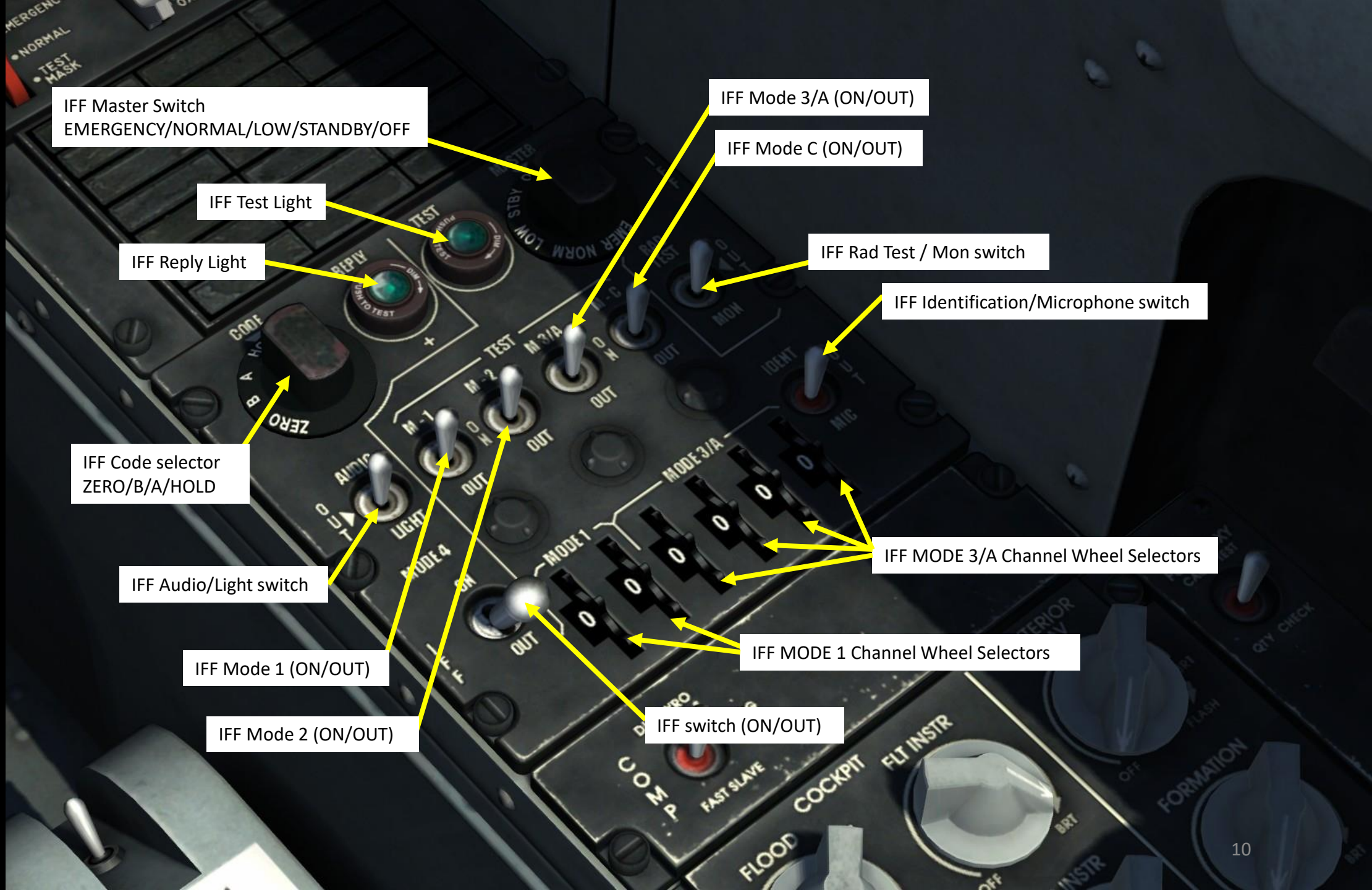

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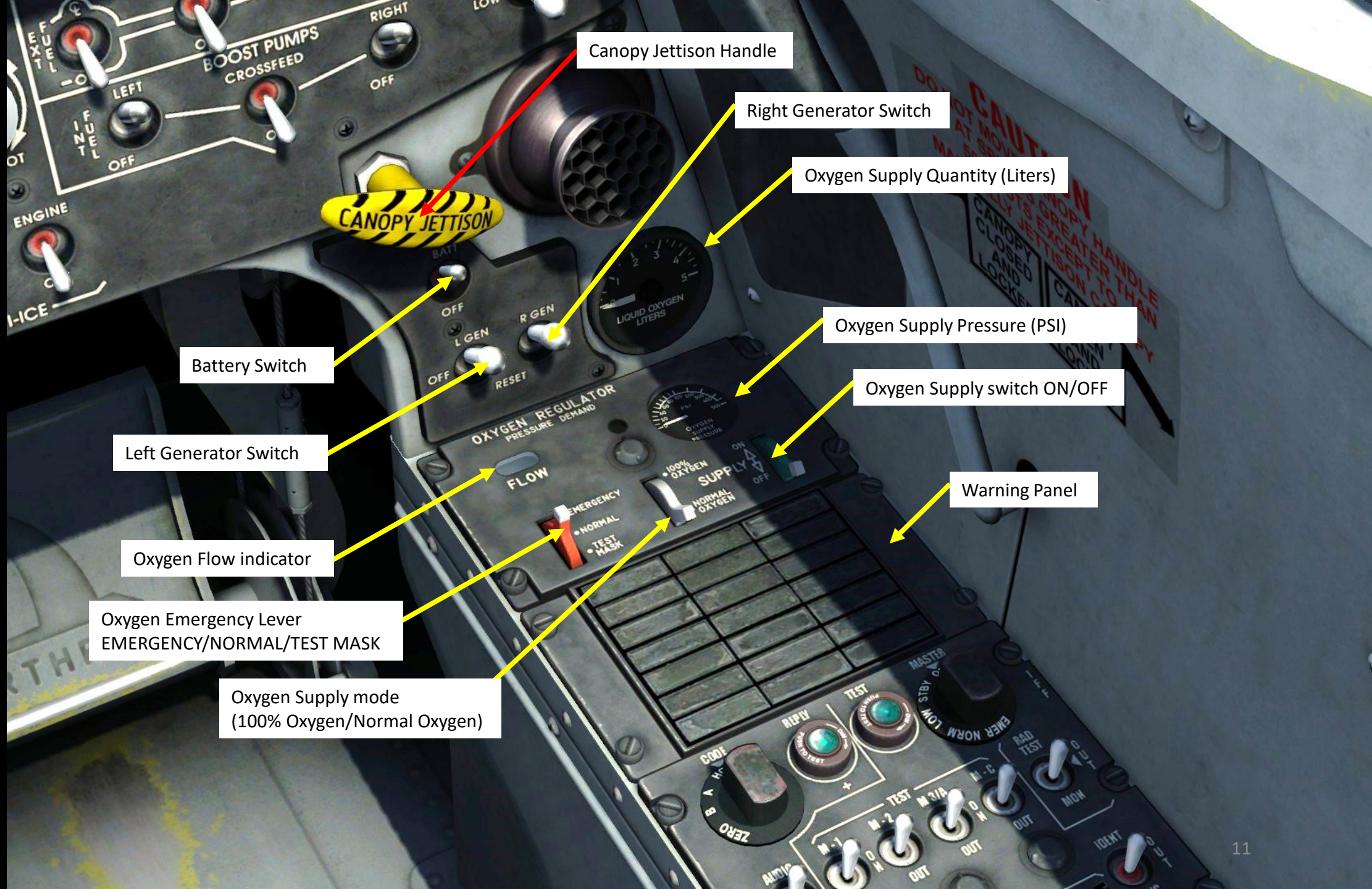

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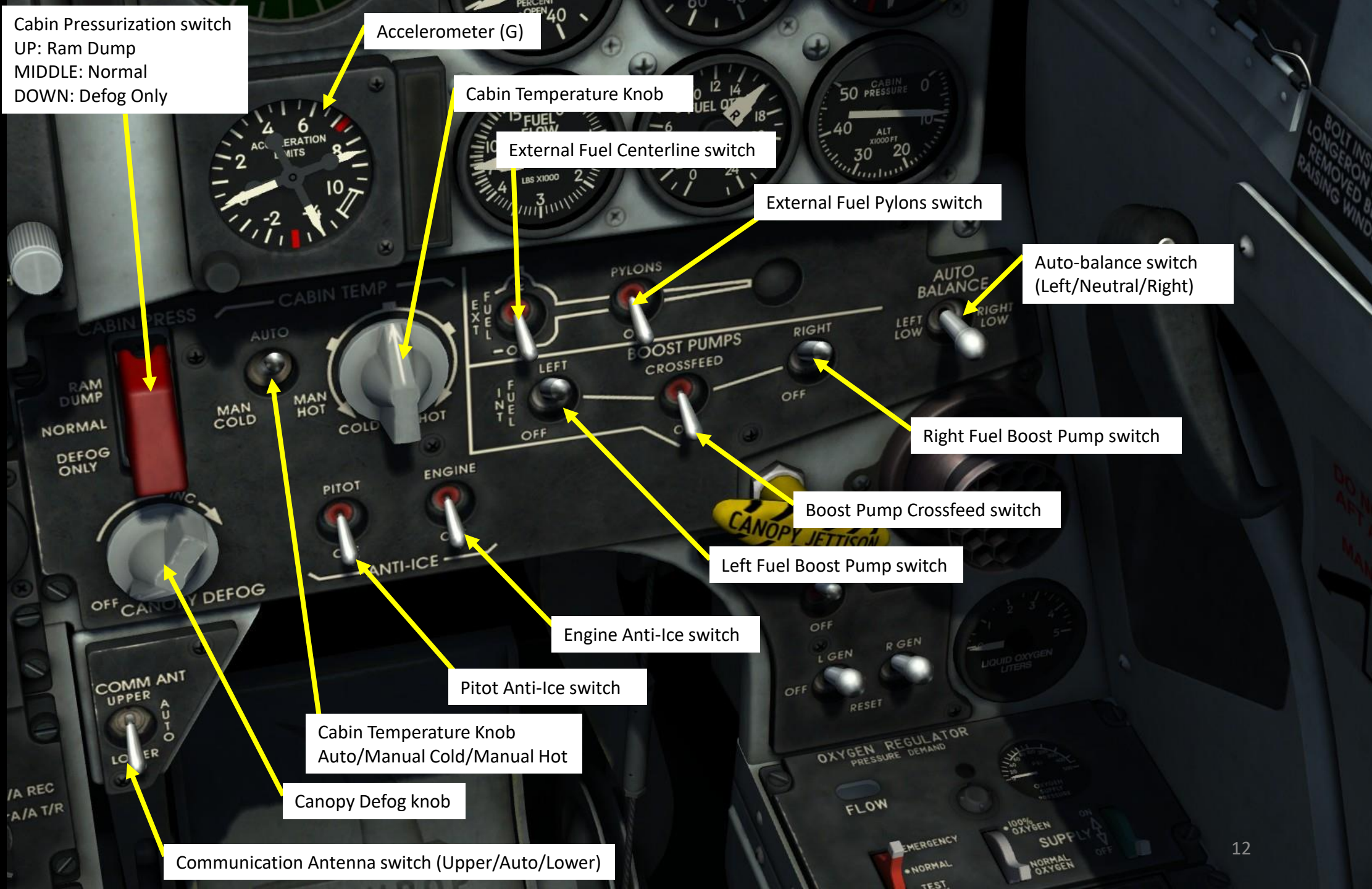

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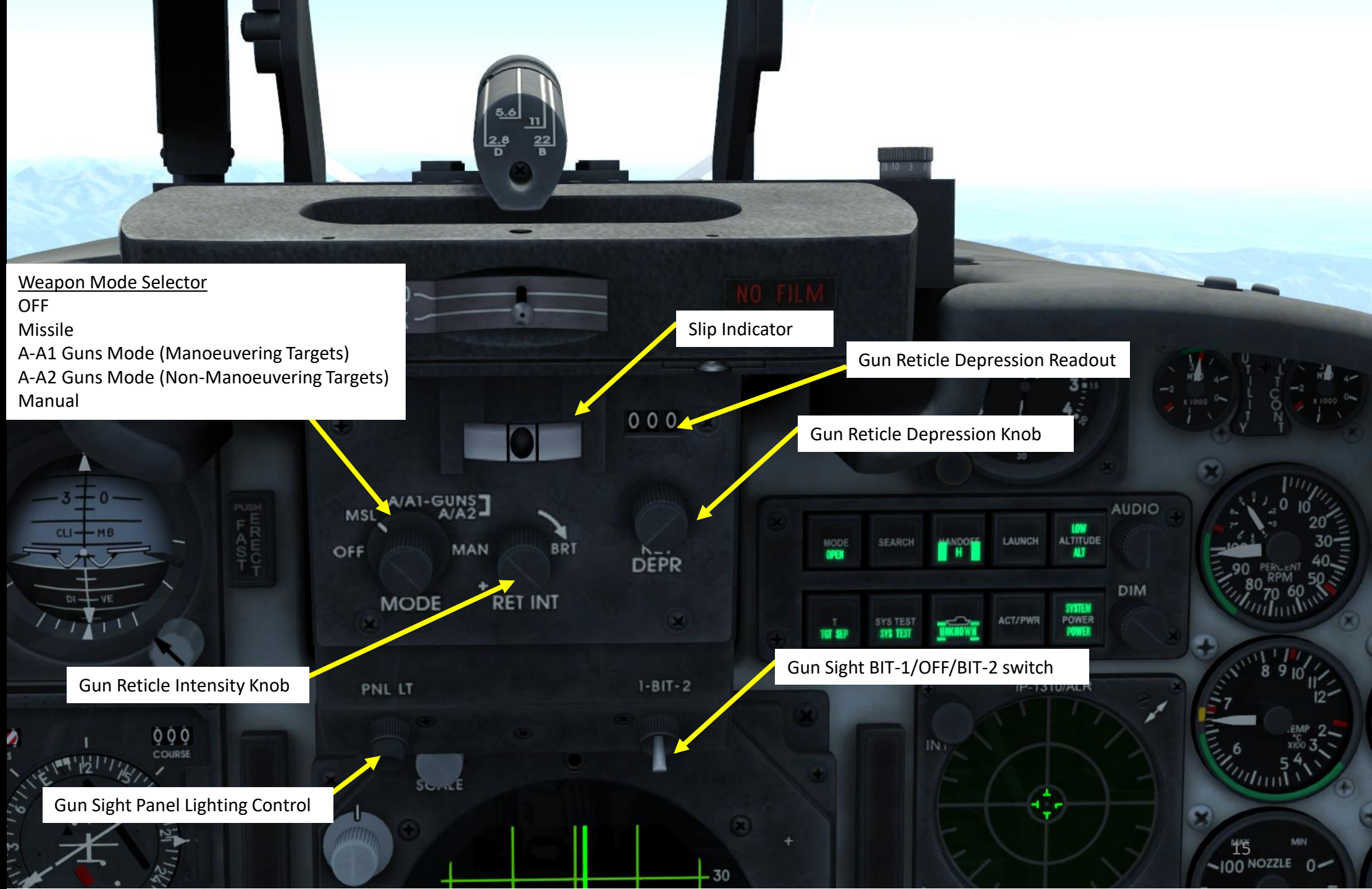


Weapon Mode Selector
OFF
Missile
A-A1 Guns Mode (Manoeuvering Targets)
A-A2 Guns Mode (Non-Manoeuvering Targets)
Manual

Slip Indicator

Gun Reticle Depression Readout

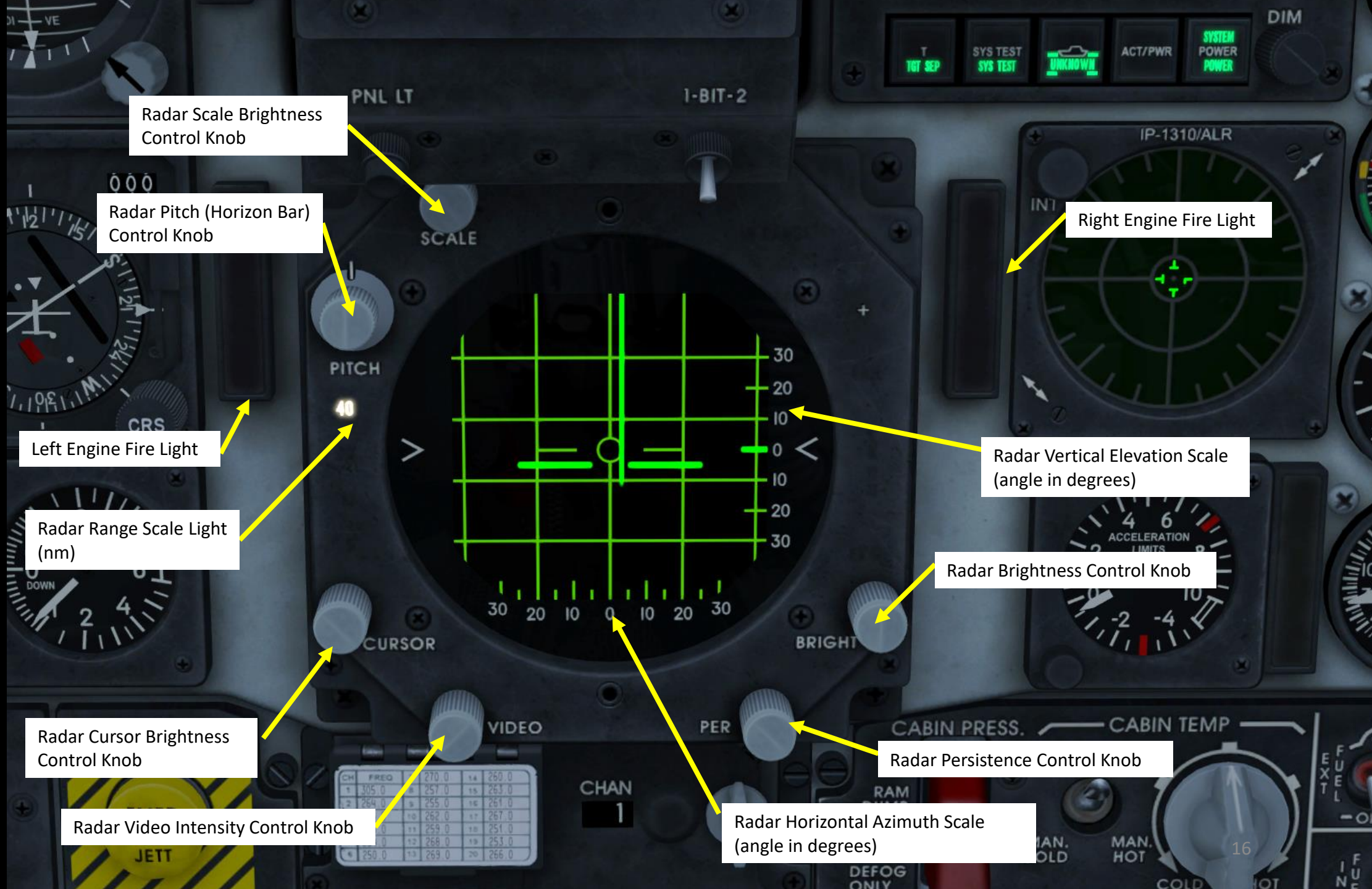
Gun Reticle Depression Knob

Gun Reticle Intensity Knob

Gun Sight BIT-1/OFF/BIT-2 switch

Gun Sight Panel Lighting Control

PART 3 – COCKPIT & GAUGES



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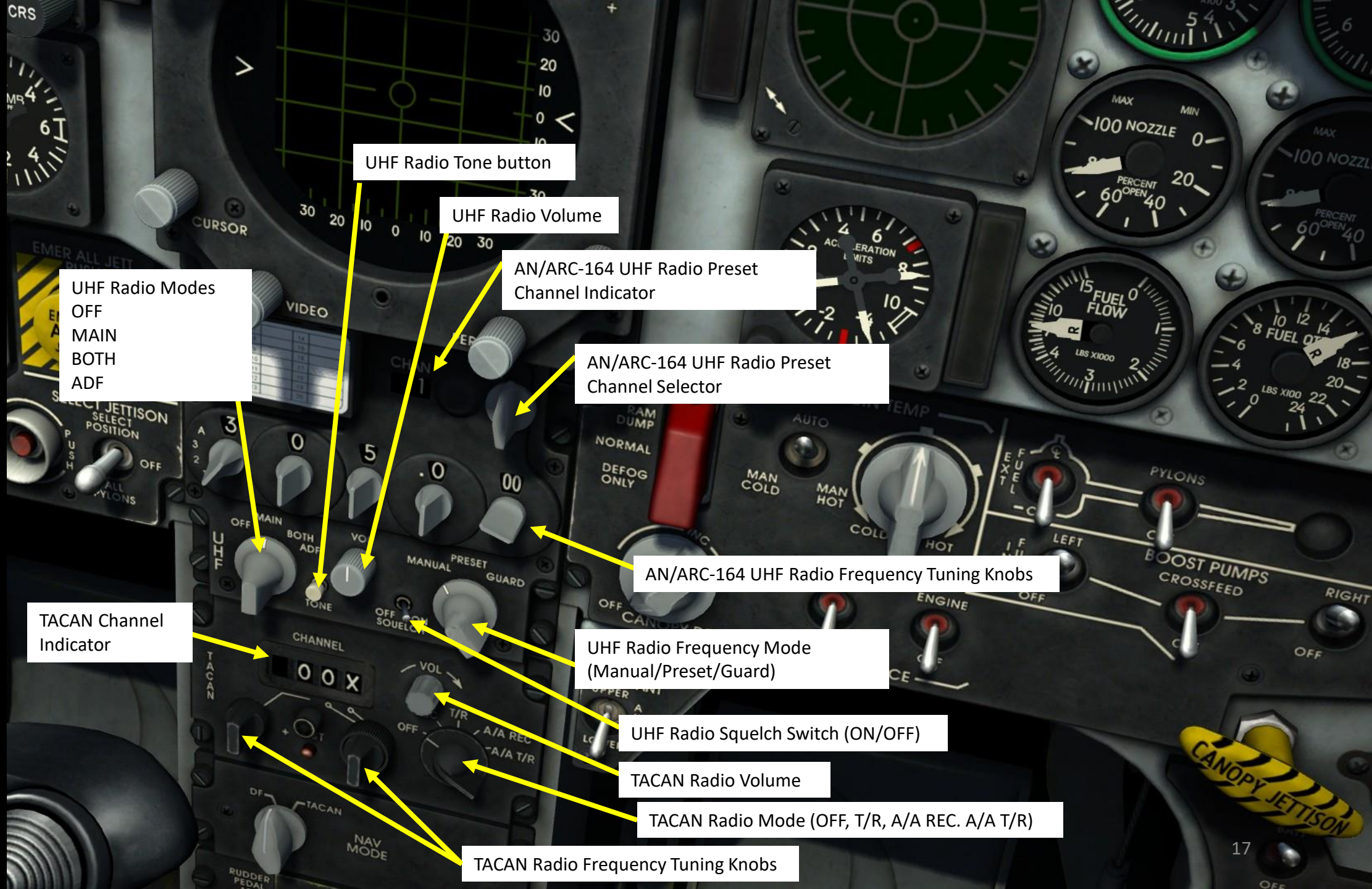

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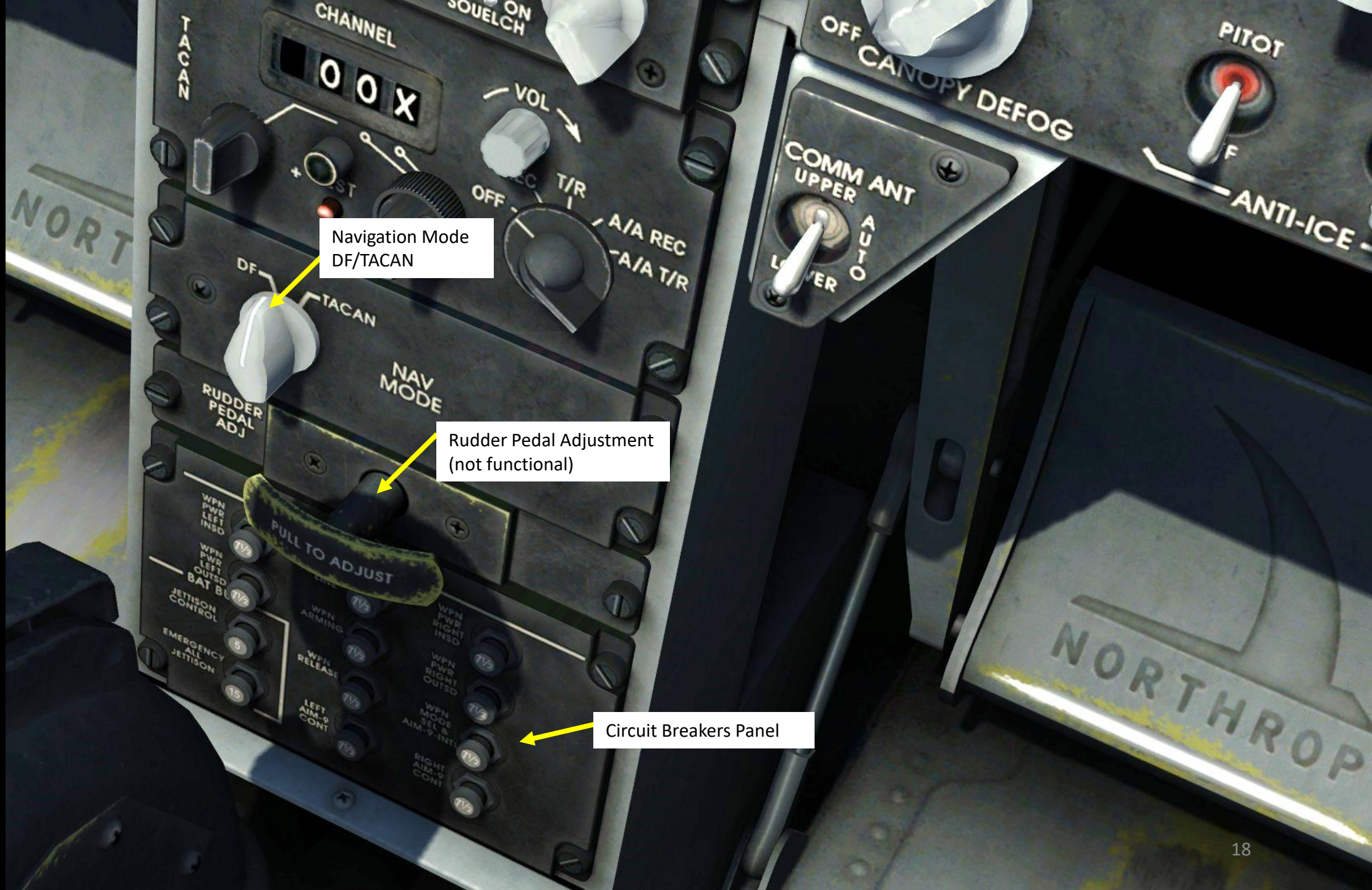

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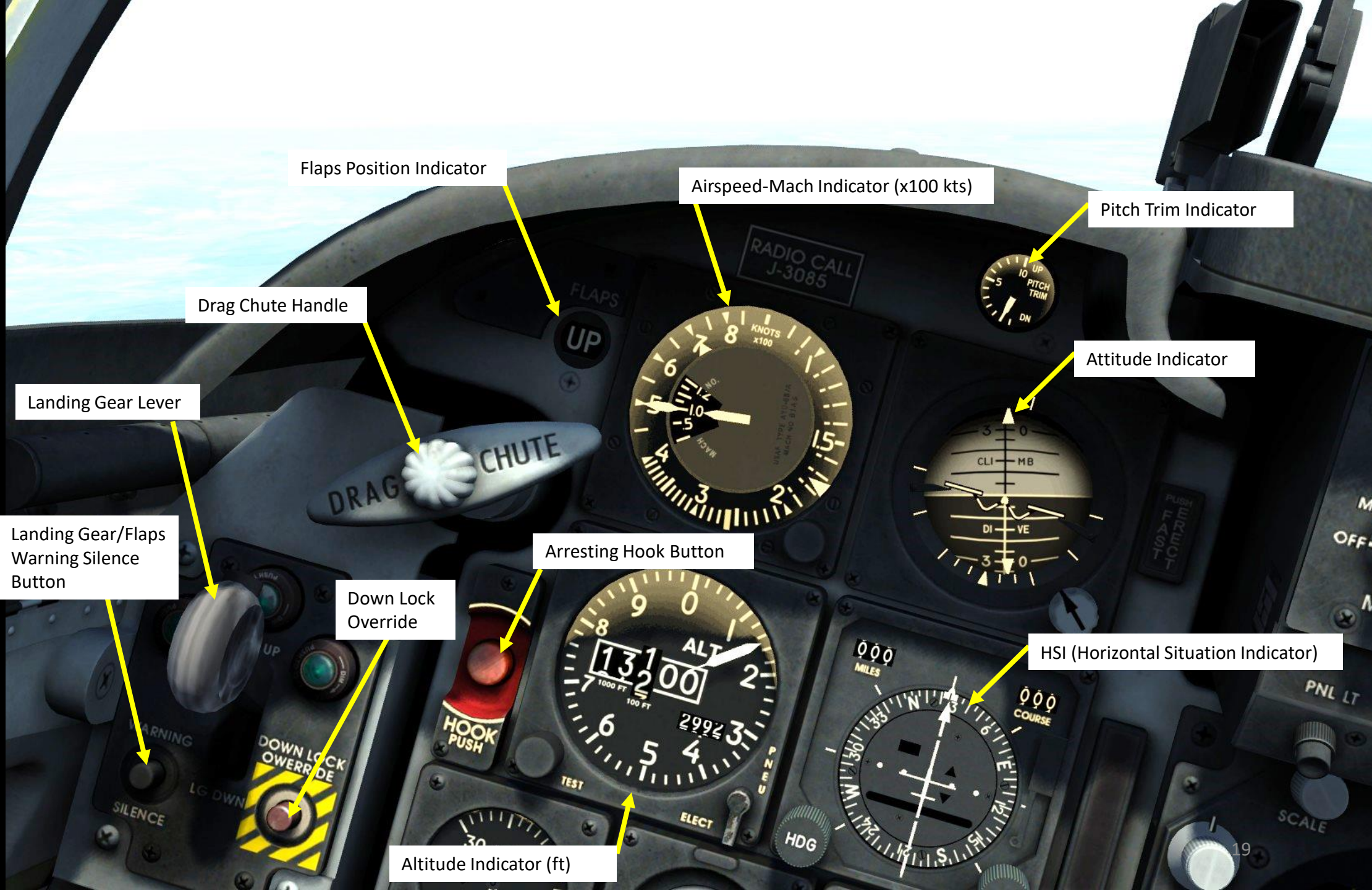

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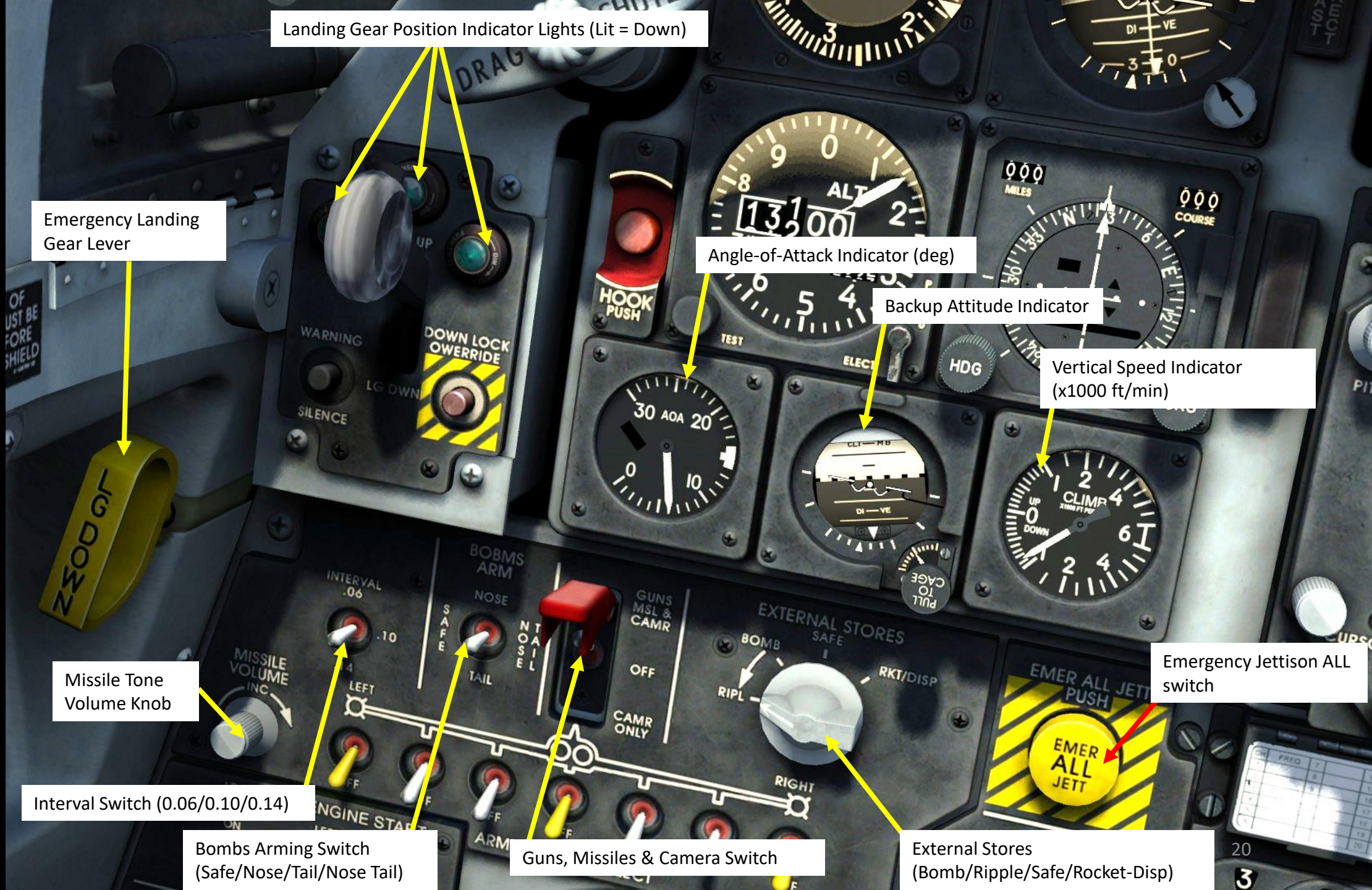

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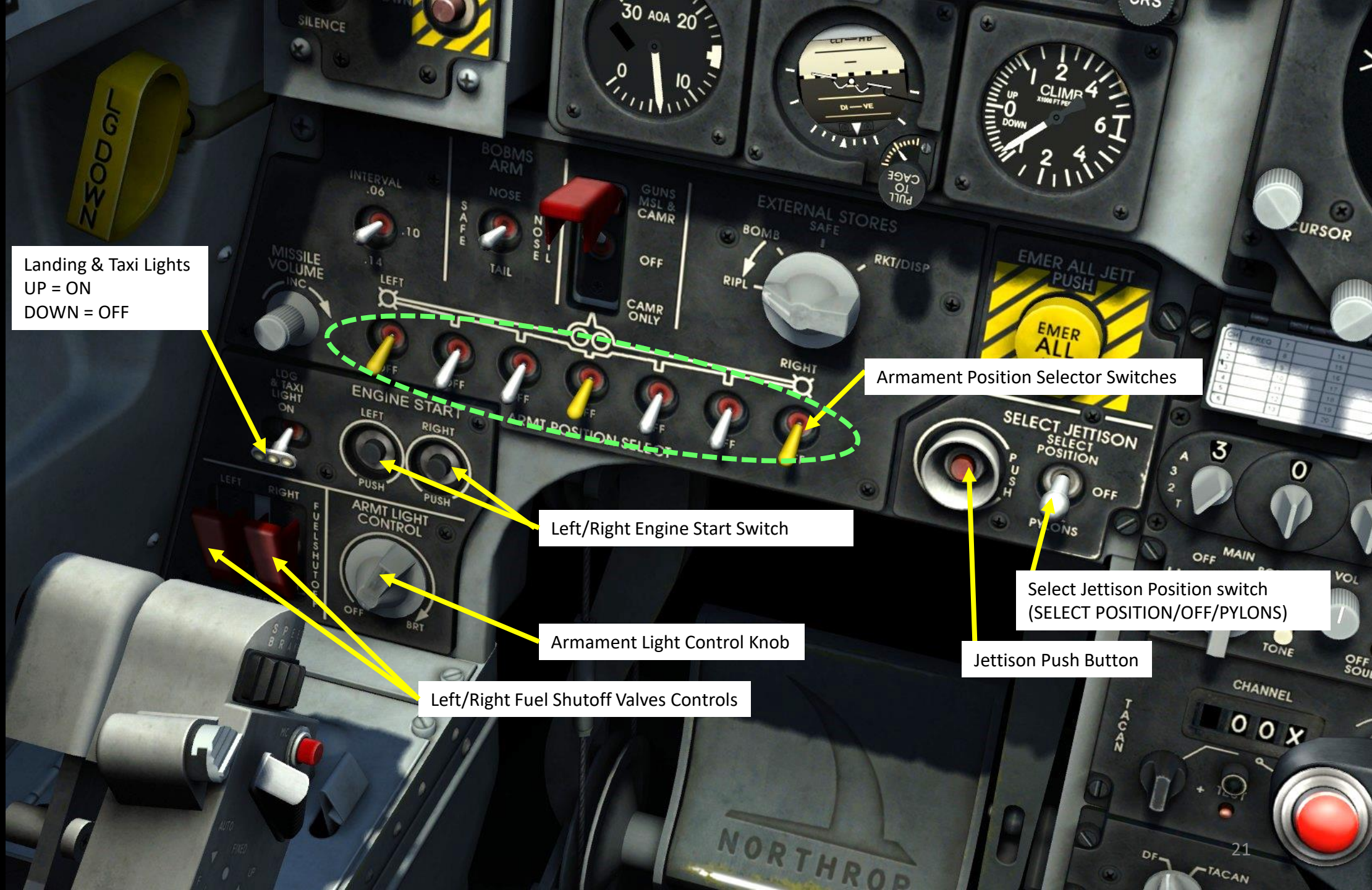

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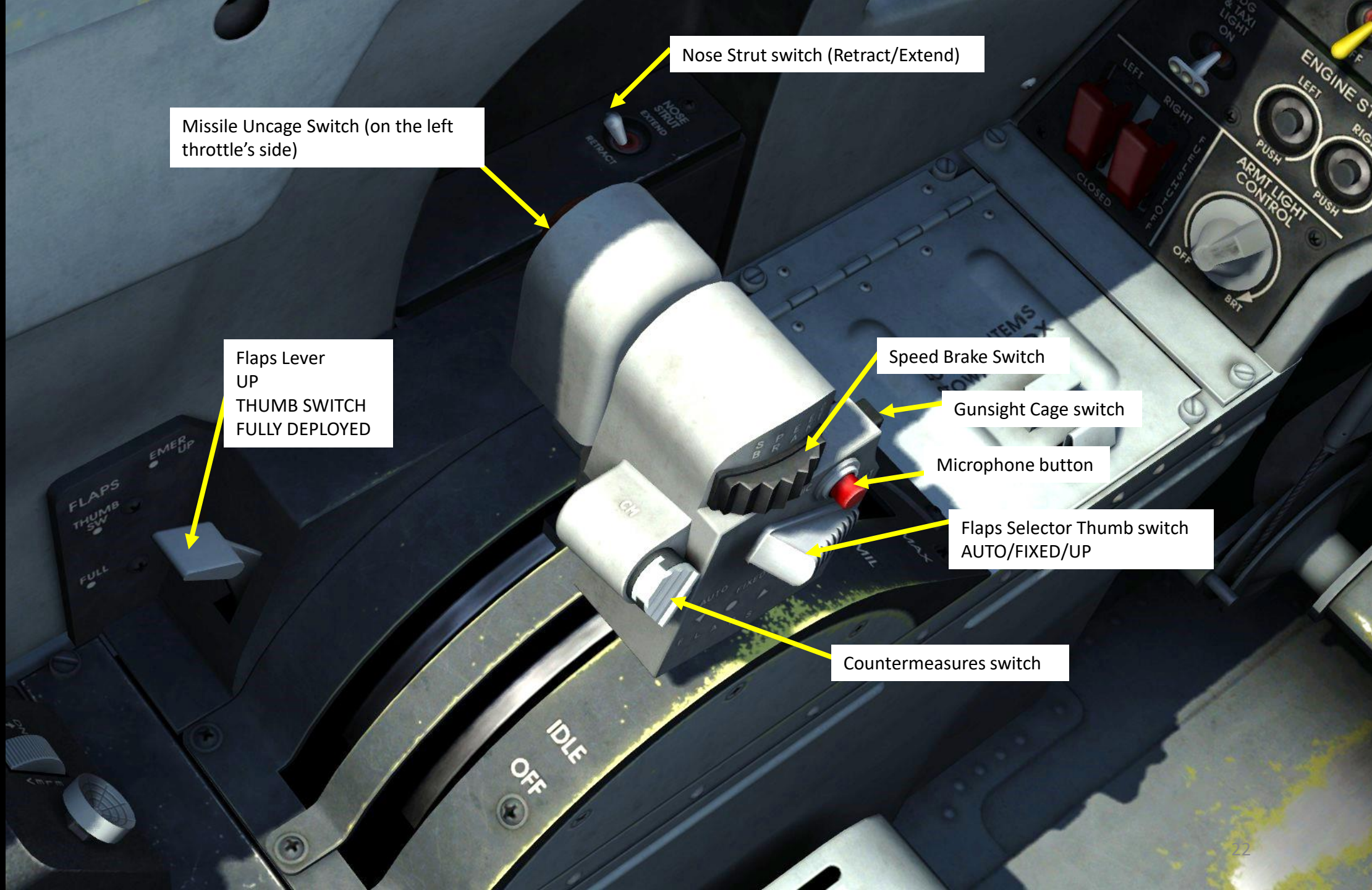

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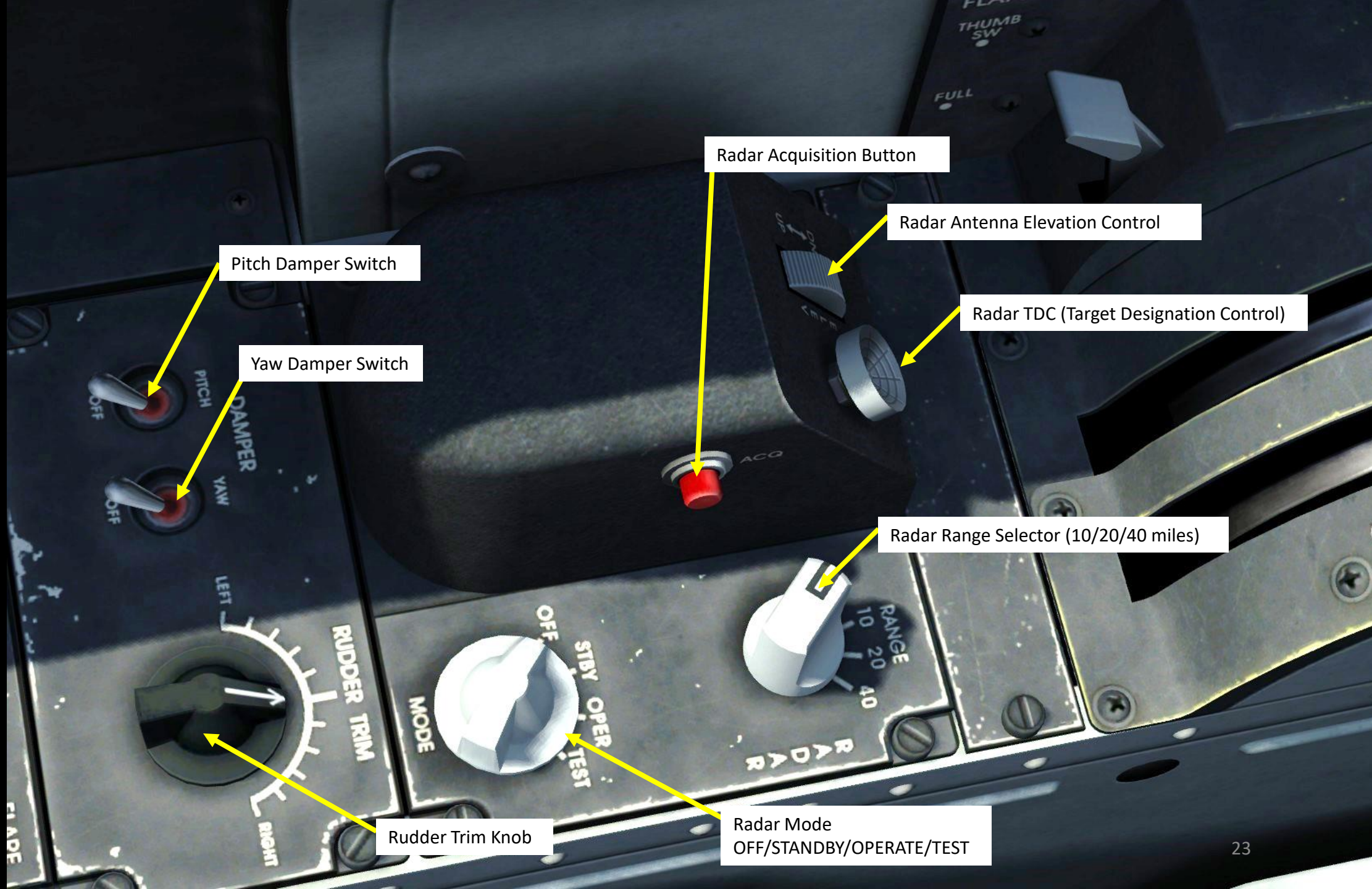

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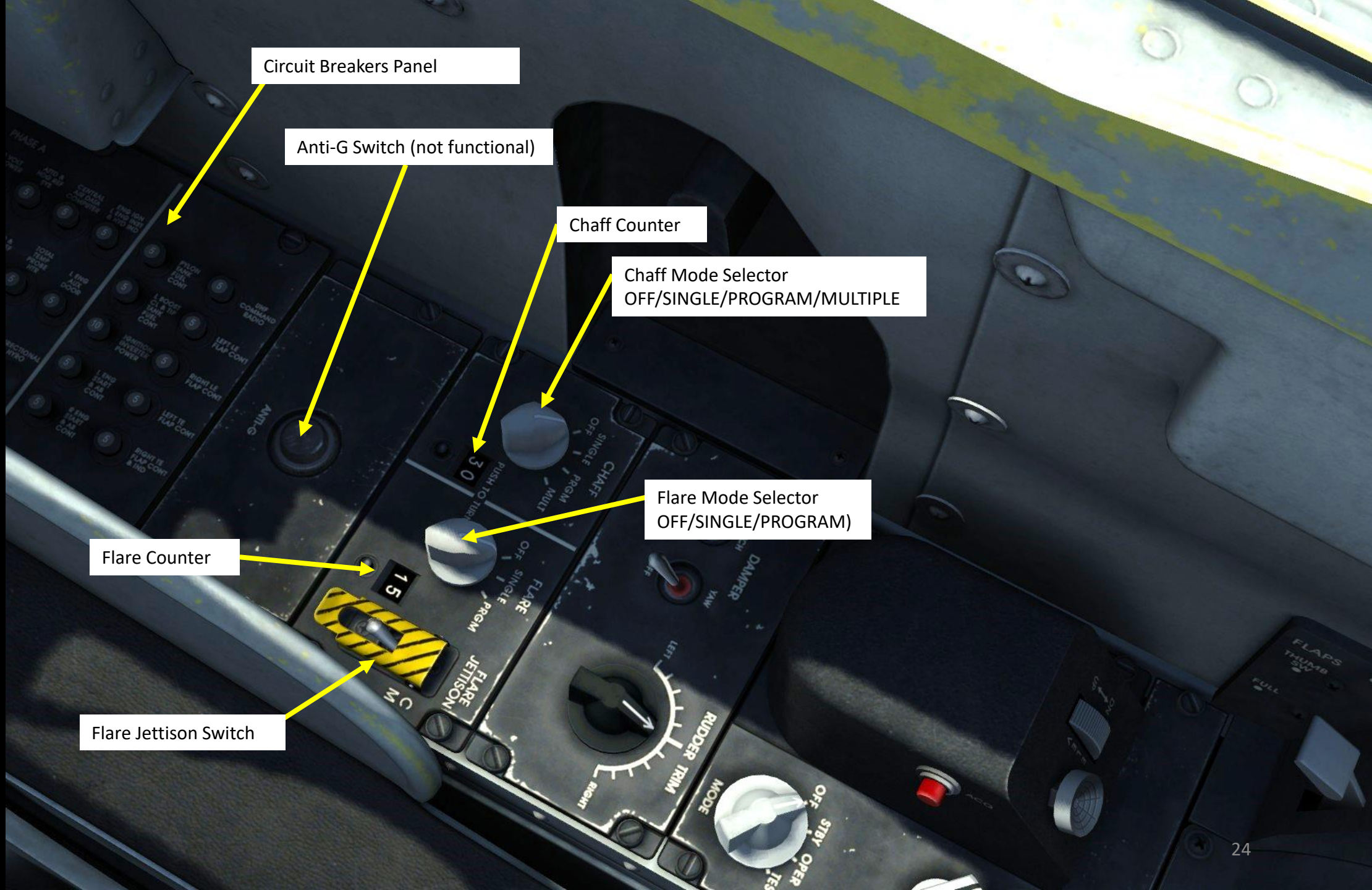
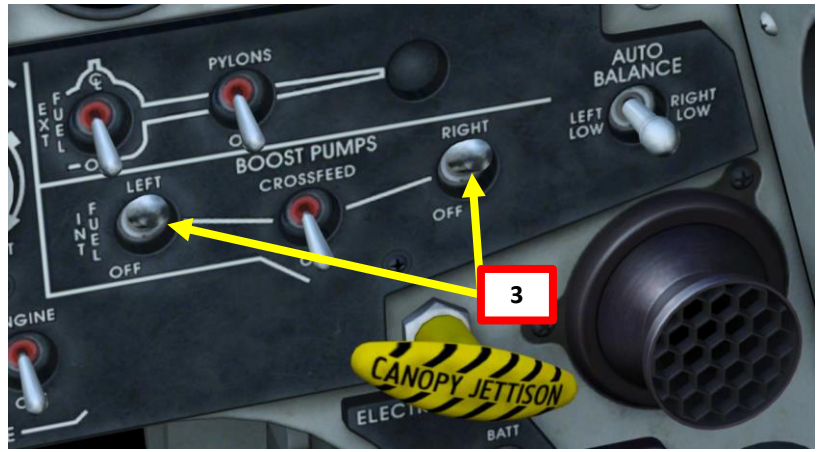


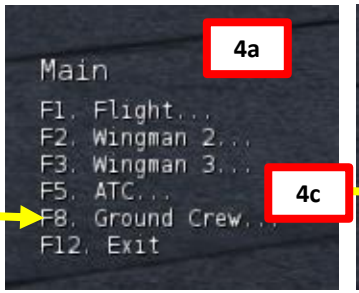
1. Pitch and Aileron Trim Button
   |RCtrl + .| – pull
   |RCtrl + ;| – push
   |RCtrl + '| – move left
   |RCtrl + /| – move right
2. Bomb-Rocket Button |RAlt + Space|
3. Pitch Damper Cutoff Switch |A|;
4. Nosewheel steering button |S|;
5. Radar mode selector switch;
6. Trigger – fires gun, launches missile, runs camera |Space|

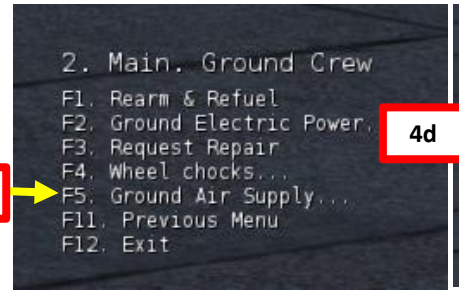
PART 4 – START-UP PROCEDURE

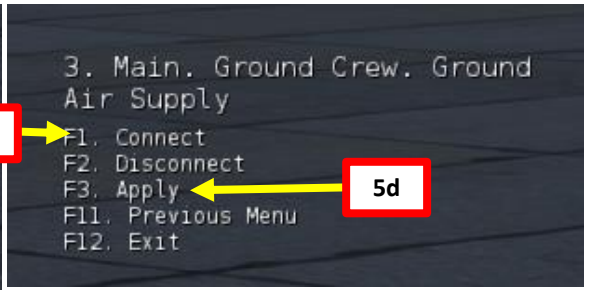
NORMAL ENGINE START

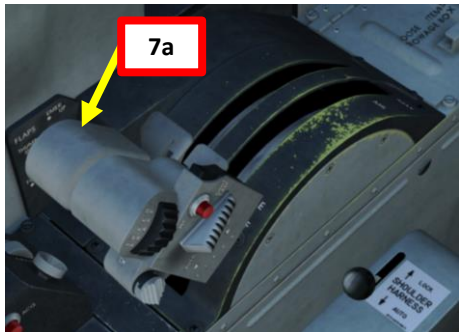
1. Battery – ON (UP)
2. Left and Right Generators – ON (UP)
3. Left and Right Booster Pump – ON (UP)
4. Connect compressed air supply unit:
   a) Press "\" to open radio menu
   b) Press "F8" to select ground crew
   c) Press "F5" to select Ground air supply
   d) Press "F1" to connect air supply unit
5. Give a command to supply air for left engine motoring
   a) Press "\" to open radio menu
   b) Press "F8" to select ground crew
   c) Press "F5" to select Ground air supply
   d) Press "F3" to supply air (*apply*)
6. Once left engine RPM has reached at least 10 %, push the LEFT ENGINE START button.
7. Set left engine throttle to IDLE by pressing "RALT+HOME". [Control: **Throttle (LEFT) – IDLE**)]

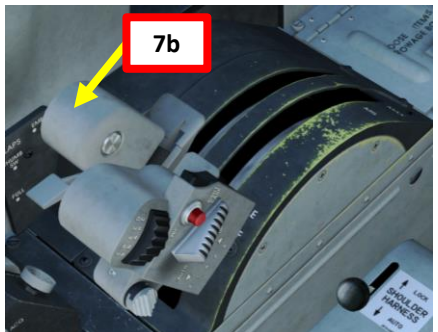








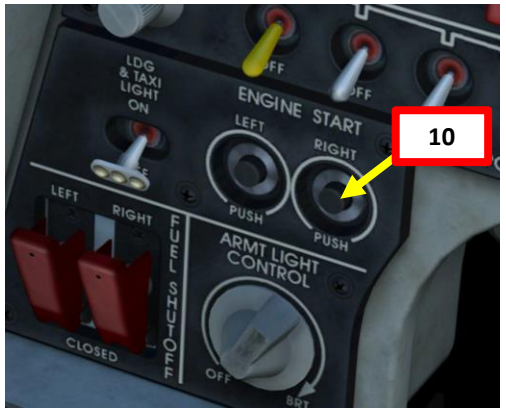


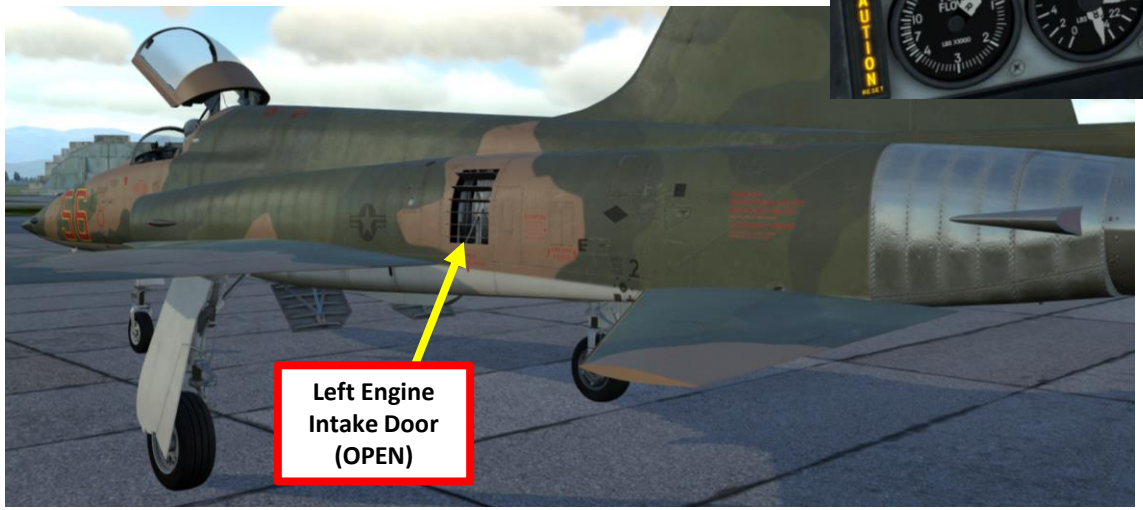


PART 4 – START-UP PROCEDURE

NORMAL ENGINE START

8. Within 35 seconds, left engine will stabilize to the following parameters:
    a) IDLE RPM (49-52 %)
    b) EGT no less than 140 deg C
    c) Nozzle position 60 to 79%
    d) Fuel flow rate about 400 pph
    e) Oil pressure between 5 and 20 psi
    f) UTILITY hydraulic pressure between 2800 and 3200 psi
    g) Auxiliary intake door position set to BARBER POLE (left intake door open, right door closed)
9. Give a command to supply air for right engine motoring
    a) Press "\" to open radio menu
    b) Press "F8" to select ground crew
    c) Press "F5" to select Ground air supply
    d) Press "F3" to supply air (*apply*)
10. Once right engine RPM has reached at least 10 %, push the RIGHT ENGINE START button.
11. Set right engine throttle to IDLE by pressing "RSHIFT+HOME". [Control: **Throttle (RIGHT) – IDLE**)]
12. Within 35 seconds, right engine will stabilize to IDLE parameters as shown in step 8). The Auxiliary intake door position will be then set to OPEN (both intake doors are open).

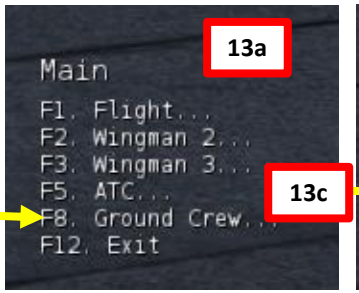


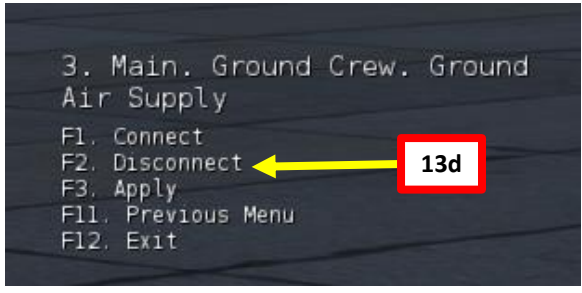


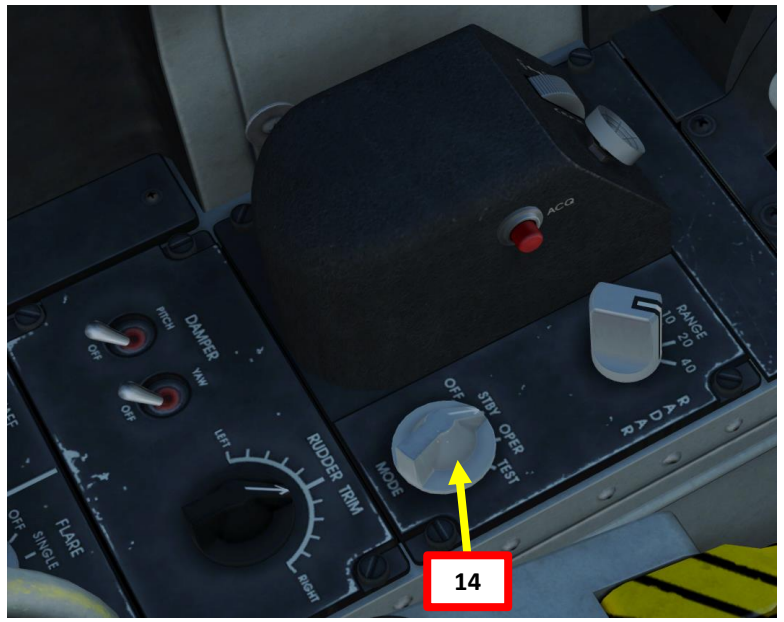
PART 4 – START-UP PROCEDURE

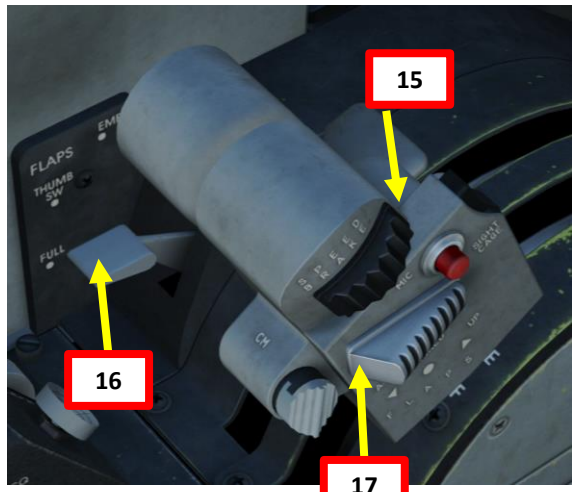
AIRCRAFT PREPARATION

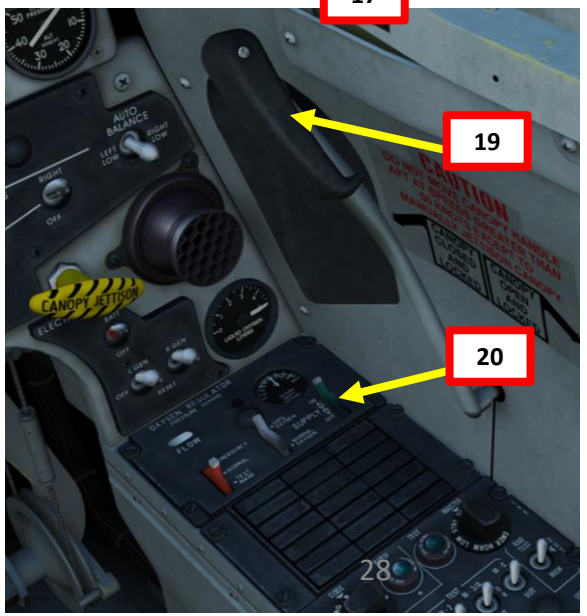
13. Disconnect compressed air supply unit:
    a) Press "\" to open radio menu
    b) Press "F8" to select ground crew
    c) Press "F5" to select Ground air supply
    d) Press "F2" to disconnect air supply unit
14. Set radar MODE switch to STBY.
    - **Caution**: Radar will proceed to a warm-up phase. <u>Radar can overheat after more than 10 minutes spent on the ground</u>. Make sure you are taking off in less than 10 minutes or **simply set the radar MODE switch to OFF** and set it back to STBY before takeoff (recommended).
15. Retract airbrakes by setting airbrake thumb switch FWD
16. Set flap mode to THUMB SWITCH (MIDDLE POSITION)
17. Set flap thumb switch AFT (AUTO)
18. Enable Yaw and Pitch Dampers (FWD)
19. Close canopy (Lever FWD)
20. Set OXYGEN SUPPLY switch to ON (FWD)
21. Set PITCH TRIM for Takeoff using elevator trimmer switch [RCTRL+. And RCTRL+;] on your stick. It will vary with your takeoff configuration.

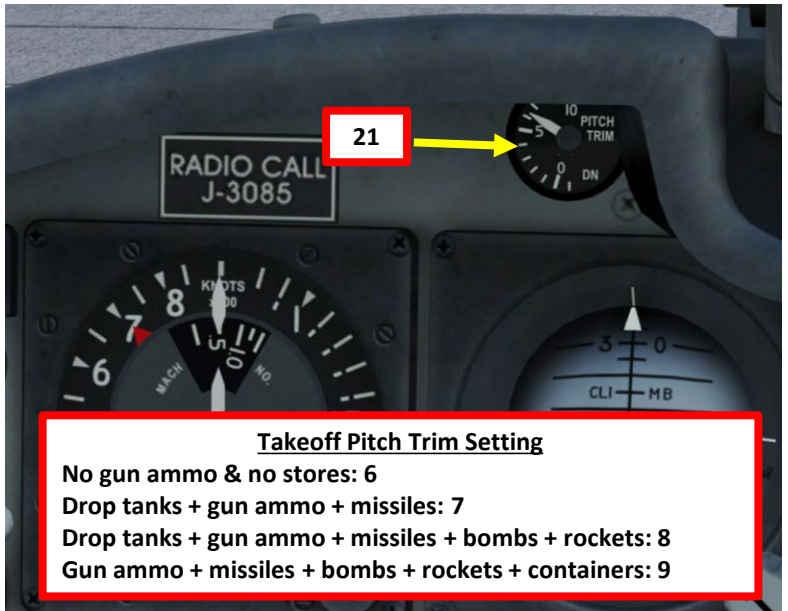












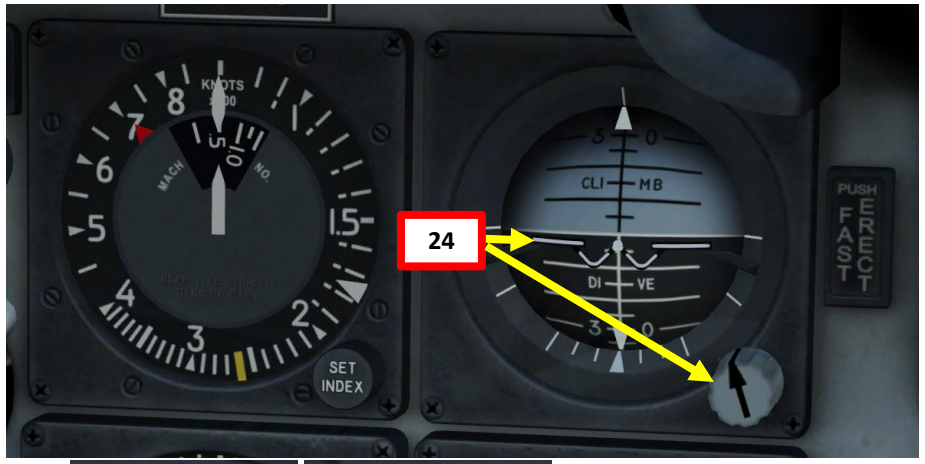
Takeoff Pitch Trim Setting

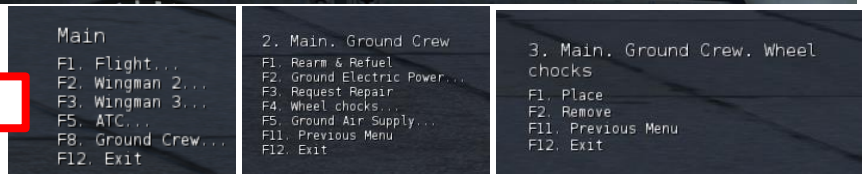
No gun ammo & no stores: 6
Drop tanks + gun ammo + missiles: 7
Drop tanks + gun ammo + missiles + bombs + rockets: 8
Gun ammo + missiles + bombs + rockets + containers: 9

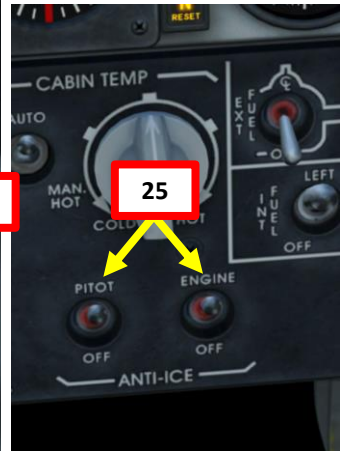
PART 4 – START-UP PROCEDURE

AIRCRAFT PREPARATION

22. Set Altimeter's pressure altitude to 0 using by rotating the TEST knob.
23. Set Standby Attitude Indicator pitch trim to -3 deg as shown by rotating the PULL TO CAGE knob.
24. Set Primary Attitude Indicator pitch trim to -3 deg as shown by rotating its pitch trim knob.
25. Set PITOT HEAT and ENGINE ANTI-ICE switches ON (UP)
26. Remove Wheel Chocks by pressing:
    a) "/"
    b) "F8 – GROUND CREW"
    c) "F4 – WHEEL CHOCKS"
    d) "F2 – REMOVE"
27. Press MASTER CAUTION light to reset it.
28. Press the RWS (Radar Warning System) POWER button



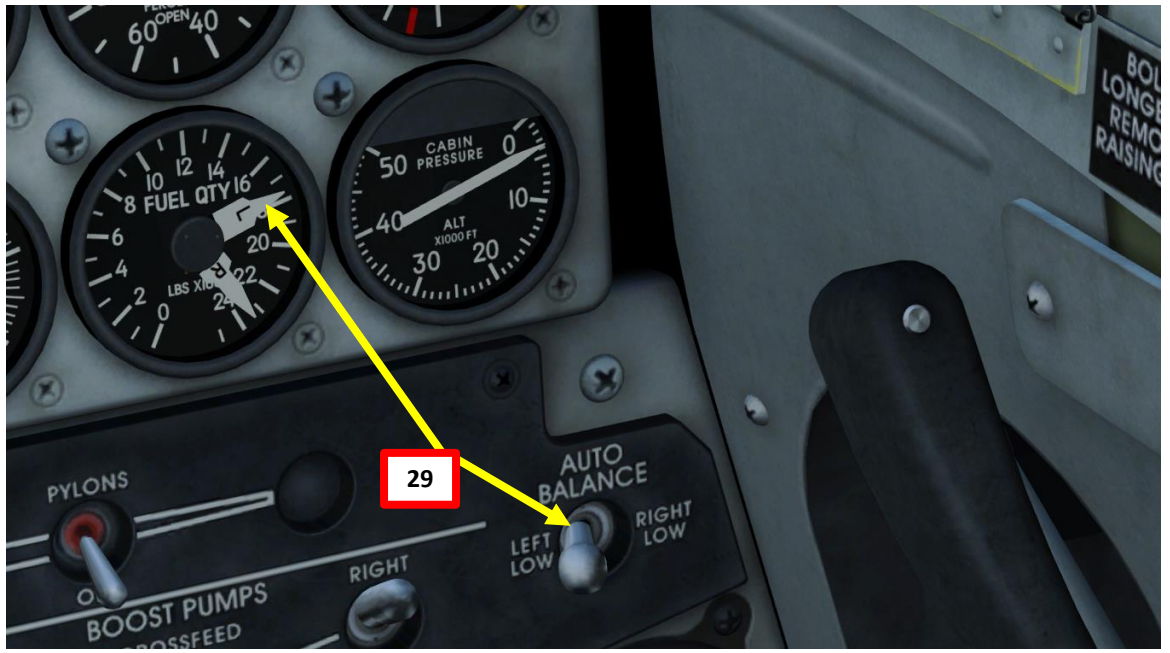




PART 4 – START-UP PROCEDURE

AIRCRAFT PREPARATION

29. The right fuel tank has about 580 lbs more fuel than the left fuel tank for a fully fueled aircraft without drop tanks. Depending on your fuel state during flight, it is important to have a balanced fuel state.
    - Set AUTO-BALANCE switch to LEFT LOW. AUTO-BALANCE switch will automatically revert to MIDDLE position once fuel configuration is balanced.
30. Consult takeoff performance table below to obtain your rotation speed. For a "no guns, no missiles" configuration, our rotation speed will be about **145 kts**.
31. Set throttle to 85 % RPM and start taxiing.



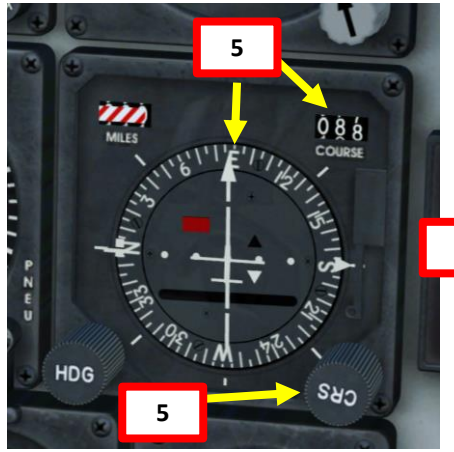
Takeoff Performance Table

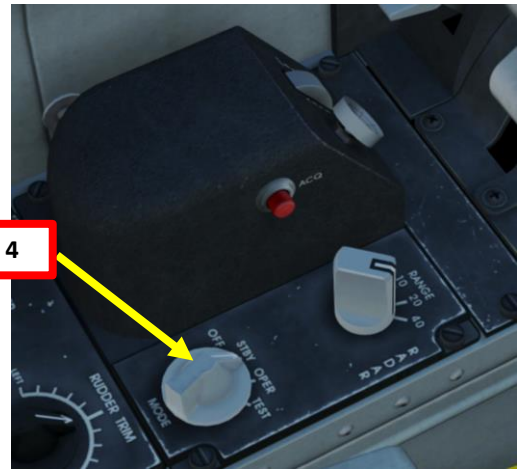
Takeoff weight (lbs)	Stores, ammo	Center-of-Gravity Position, % MAC	Liftoff Speed (kts)
15,000	None	18 to 17	143 to 145
15,500 to 16,000	Gun ammo + Missiles	14 to 13	153 to 155
17,000 to 18,000	Central fuel tank + gun ammo + missiles	12 to 11	164 to 168
19,000	3xFuel Tanks 150 + gun ammo + missiles	15 to 14	166 to 168
19,000 to 21,000	Bombs + rockets + Central fuel tank + gun ammo + missiles	15 to 14	168 to 175
19000 to 21000	Bombs + rockets + center fuel pods + gun ammo + missiles	15 to 13	168 to 175
22,000	3xFuel tanks 275 + gun ammo + missiles	15 to 13	178 to 180
23,000 and more	Bombs + rockets + gun ammo + missiles	15 to 14	185 to 190

PART 5 –TAKEOFF

TAKEOFF

1. Taxi the aircraft by throttling up to 85 % RPM.
2. Steer the aircraft by HOLDING the Nose Wheel Steering button (“S” key binding) as you turn using the rudder pedals.
3. Ensure you align yourself with the runway and advance a couple of yards to keep your nose wheel straight and aligned.
4. Set Radar MODE switch to STBY.
5. On HSI (Horizontal Situation Indicator), set course to the takeoff runway heading (088) by adjusting course with the CRS knob.
6. Set NOSE STRUT switch to EXTEND to gain an additional 3 degrees of Angle of Attack, minimizing the runway length required for takeoff.
7. Set flaps to AUTO and ensure airbrakes are retracted.
8. Hold down brakes, increase throttle to 95 % RPM.
9. Release brakes and start rolling.
10. As the aircraft gains speed, set throttle fully forward to engage afterburners.
11. Rotate at the required rotation speed obtained from the takeoff performance (145 kts for a “no guns, no missiles” configuration) by gently pulling the stick aft.
12. Raise landing Gear.





PART 5 –TAKEOFF

TAKEOFF

PART 6 – LANDING

NORMAL 360-DEGREE LANDING APPROACH

1. Start approach 3 nm from airport @ 1500 ft and 300 kts
2. Start reverse landing course @ 1500 ft and 300 kts
3. Set flap thumb switch to AUTO
4. Extend landing gear
5. Ensure green lights indicate landing is on downlock
6. Decelerate to 165 kts while maintaining 1500 ft. Use airbrakes if necessary.
7. Carry out turning to the landing course @ 1500 ft and 165 kts
8. Descend at a rate of 1000 ft/min and slow down to a final approach speed of 145 kts.

APPROACH SPEED FORMULA:

$V_{APPROACH}$ = 145 + 5 (if gun ammo remaining) + (fuel qty remaining – 1000)/200

Example for approach with 3000 lbs remaining with gun ammo

V_{APP} = 145 + 5 + (3000 - 1000)/200 = 160 kts

Example for approach with 600 lbs remaining without gun ammo

V_{APP} = 145 + 0 + (600 - 1000)/200 = 143 kts

9. On final, decrease vertical speed to 400 ft/min. Flare at 20 ft by gently pulling the stick aft and touchdown at 135 kts.
10. Slowly lower the nose wheel and deploy drag chute by pulling the chute handle. (shortcut: “P”) Tap your toe brakes until you come to a full stop.

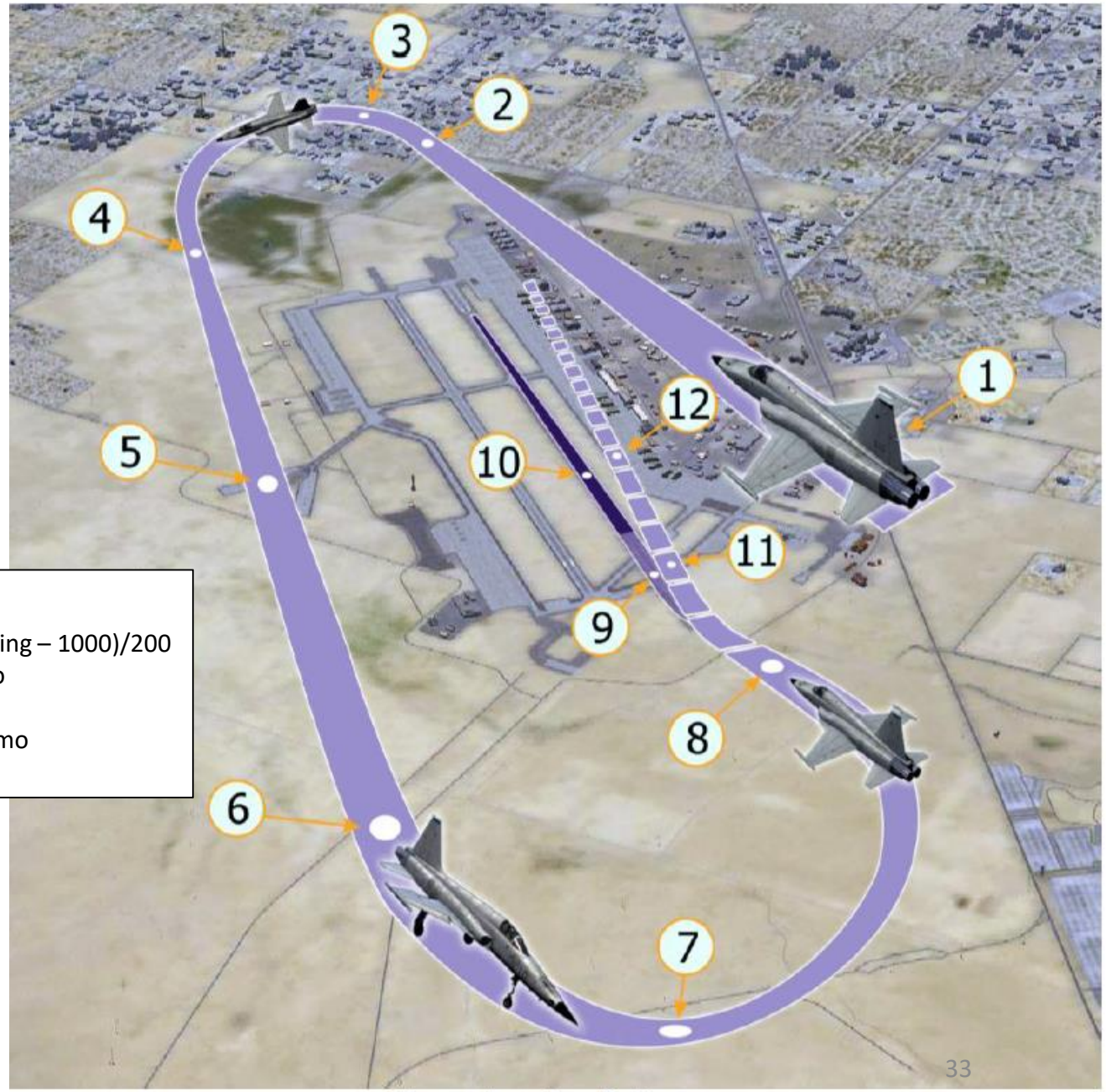
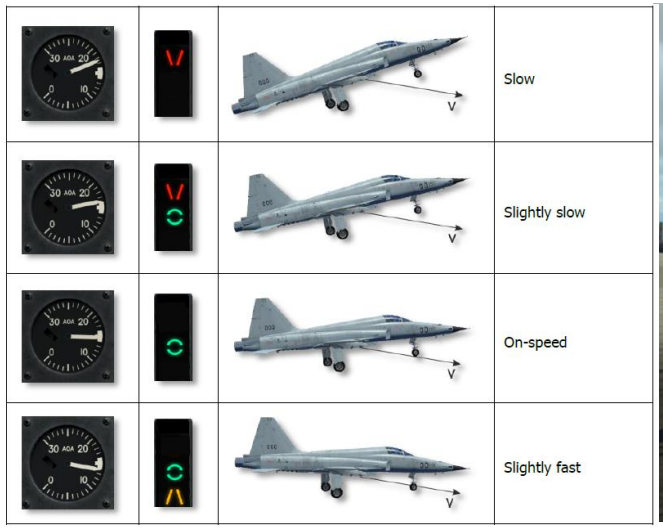


Figure. Landing Pattern

PART 6 – LANDING

NORMAL 360-DEGREE LANDING APPROACH



AERODYNAMICS

The F-5's flight qualities are very good for a plane of this time. It's a high-performance multipurpose tactical fighter with a primary mission of air superiority. It is equipped with wing leading and trailing edge flaps, which provide increased lift and improved maneuvering performance. However, during acceleration flaps are retracted in order to reduce drag and to provide better acceleration. At high Mach numbers, particularly at 0.9-0.95 for clean aircraft or near limiting Mach numbers for aircraft with stores, pitch control sensitivity increases.

At the airspeeds above 360 KIAS the airplane is able to reach structural limiting normal load while below 360 KIAS attainable g's are limited by the stall AOA. For the F-5E-3 with shark-nose forebody and increased-area LEX wing stall occurs at approximately 27-28 units AOA and is accompanied by the wing-rock or by the wing-drop depending on flight conditions and configuration.

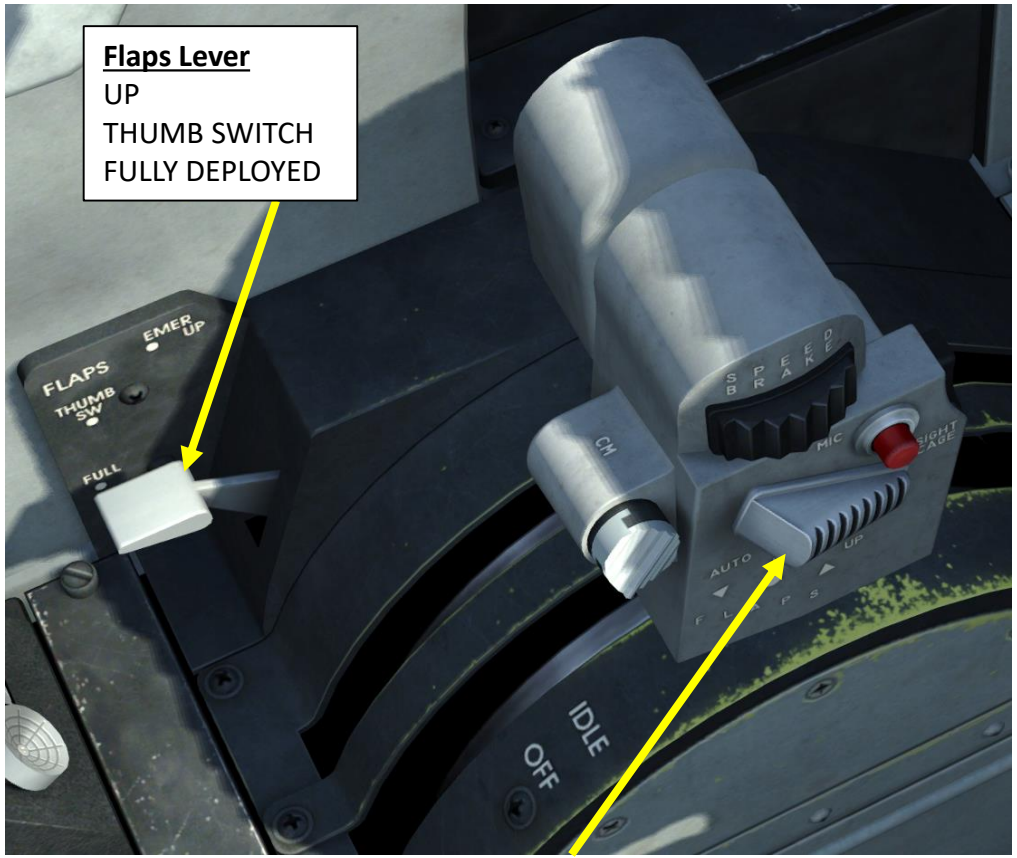
At lower airspeeds airplane maneuvering performance rapidly degrades so it is recommended not to let the airspeed fall below 300 KIAS while maneuvering. This requirement can be neglected during maximum range gliding, landing approaches and when performing tactical maneuvers which involve flying at low airspeeds/high AOA.

The F-5's flaps have five control modes:

- **FULL**: Flaps fully extended
- **EMERGENCY UP**: Flaps fully retracted
- THUMB SWITCH: Control of flaps is done with thumb switch instead.

  The THUMB SWITCH on the throttle has three additional modes:
  - **AUTO**: Flaps operate automatically based on your Angle of Attack and the signals from the CADC (Central Air Data Computer).
  - **FIXED**: Flaps in fixed position, ensuring minimum fuel consumption.
  - **UP**: Flaps fully retracted, ensuring maximum flying range.

I usually recommend to set the flaps lever to THUMB SWITCH and the thumb switch to AUTO mode. It is much more efficient to let the flaps control themselves automatically and reduces your workload significantly.



Flaps Selector Thumb Switch
AUTO
FIXED
UP

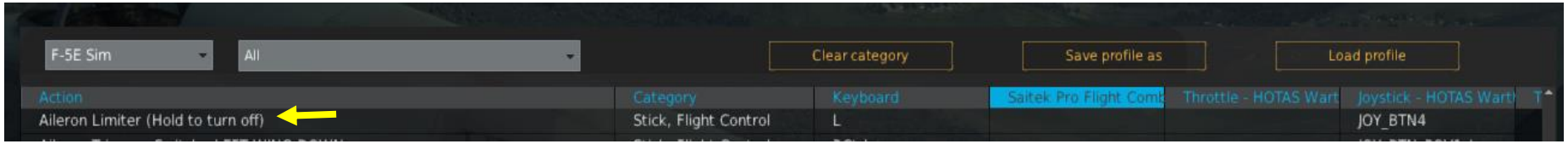
PART 7 – AERODYNAMICS & ENGINE MANAGEMENT

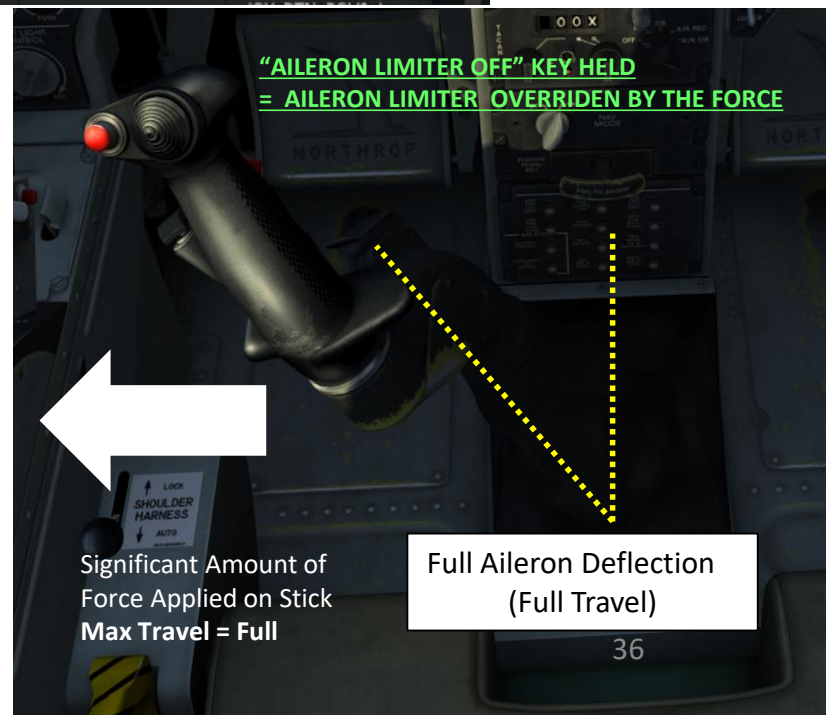
AILERON DEFLECTION LIMITER

An aileron limiter, which is mechanically positioned by retraction of the landing gear, provides a spring stop which limits the aileron to one-half travel (as shown on image B). To obtain full aileron travel, additional stick force must be applied to override the aileron spring stop. The aileron limiter is disengaged when the landing gear is in the extended position, allowing full aileron travel.

In other words, an aileron limiter will mechanically limit your stick movement in order to protect the aircraft against G-overload in normal manoeuvering conditions. This will limit your roll rate. The limiter can be overridden if you apply if you force a little more on the stick; this will allow you to have a much faster roll rate. In real life, the limiter's primary function is used for stall recovery, emergencies and violent manoeuvers that could be necessary during a dogfight.

Most users equipped with a force-feedback stick will immediately notice the difference in the force needed to move the stick from neutral to half-travel and the force needed to move the stick from half-travel to full-travel. However, the majority of users do have a standard non-force-feedback stick. In order to simulate this behaviour, Belsimtek implemented a control that will allow full aileron travel: **AILERON LIMITER (HOLD TO TURN OFF), mapped to the "L" key**. Simply hold this key and you will "virtually" apply enough strength on the stick to override the aileron limiter and perform full stick (aileron) deflection, allowing you to have a much greater roll rate.





ENGINE

The **J85-GE-21** turbojet engine was designed and manufactured by General Electric Company USA. It is a compact, high performance, lightweight turbojet engine comprising a nine-stage axial-flow compressor coupled directly to a two-stage turbine and an afterburner with a variable area exhaust nozzle.

The J85 was originally designed to power a large decoy missile, the McDonnell ADM-20 Quail. The Quail was designed to be released from a B-52 Stratofortress in-flight and fly for long distances in formation with the launch aircraft, multiplying the number of targets facing the SA-2 surface-to-air missile operators on the ground. This mission demanded a small engine that could nevertheless provide enough power to keep up with the jet bomber. Like the similar Armstrong Siddeley Viper being built in England, the engine on a Quail drone had no need to last for extended periods of time, so therefore could be built of low-quality materials.

Auxiliary (aux) intake doors on each side of the fuselage above the wing trailing edge provide additional air to the engines for added thrust during takeoff and low-speed flight (low dynamic pressure). The doors are automatically controlled by a signal from the central air data computer (CADC). An AUX INTAKE DOORS indicator on the instrument panel provides an indication of closed, intermediate, or open position of the doors.

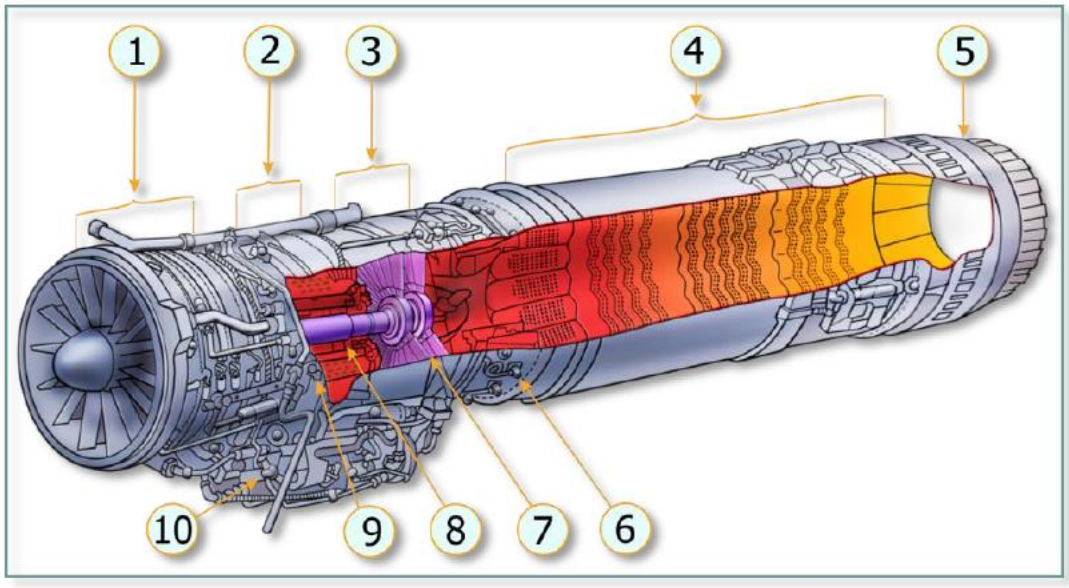
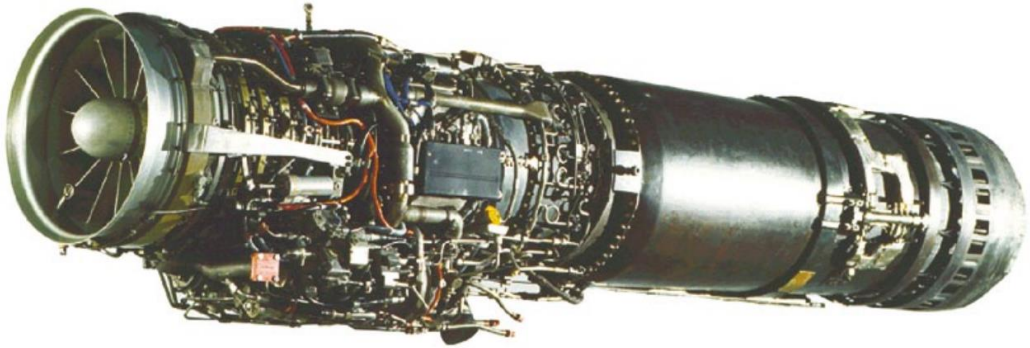


Figure 5.1 J85-GE-21 Engine Cut-Away View

1. COMPRESSOR SECTION
2. COMBUSTOR SECTION
3. TURBINE SECTION
4. AFTERBURNER SECTION
5. VARIABLE EXHAUST NOZZLE
6. AFTERBURNER MAIN FUEL MANIFOLD
7. TURBINE
8. ROTOR
9. FUEL NOZZLES
10. ENGINE ACCESSORY GEARBOX



PART 7 – AERODYNAMICS & ENGINE MANAGEMENT

Air enters into a compressor through air inlet ducts located on the both sides of the fuselage. The nine-stage compressor is equipped with variable stator vanes that reduce the possibility of a **compressor stall**. Turning of the variable vanes is simulated in the game. This has a significant effect on the simulation of the idle power and engine starting.

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

Take note that sometimes you may not always **know if the afterburner engaged correctly**. A good visual cue is to check the **nozzle position indicator**: close to fully open means that the afterburner is engaged.

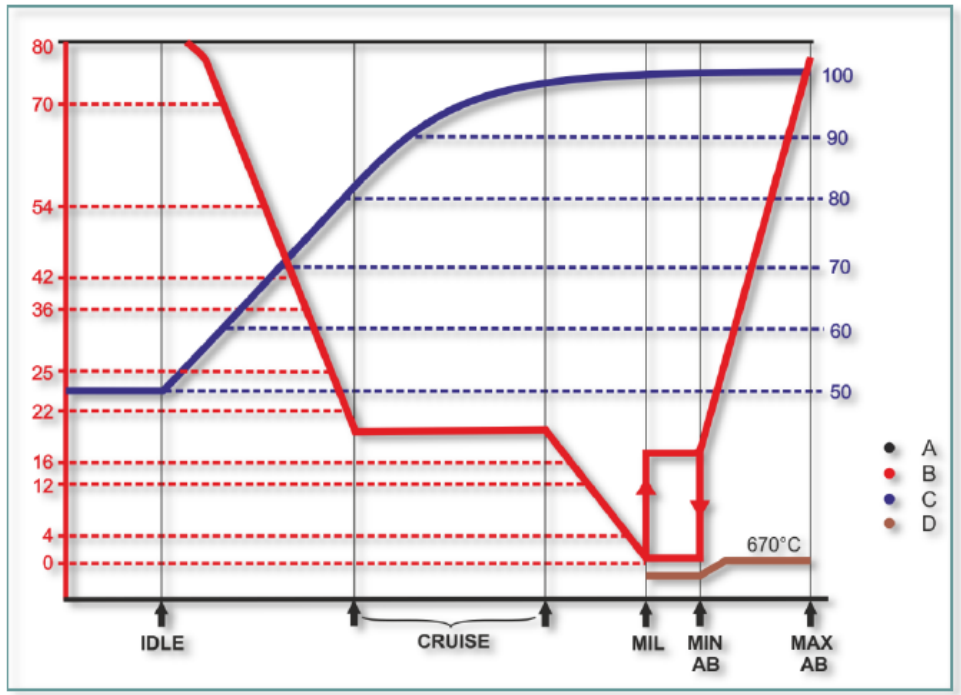


Figure 5.3 Nozzle Operation Schedule

A. Throttle position
B. Nozzle position in percent of fully open position
C. Engine rpm
D. EGT

PART 7 – AERODYNAMICS & ENGINE MANAGEMENT

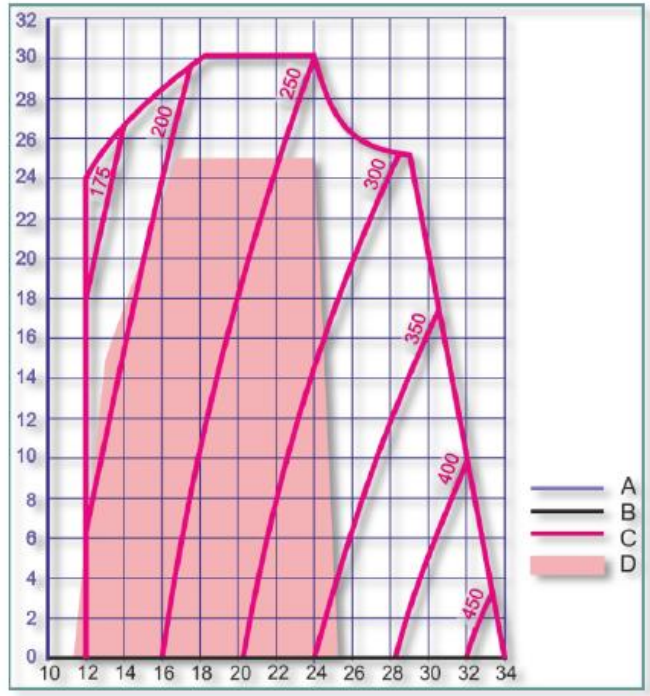
ENGINE RELIGHT PROCEDURE

In case of engine flameout (due to a partial compressor stall or other conditions listed on the previous page), you may be able to restart your engine if the engine didn't seize completely. if the aircraft airspeed is sufficient to provide enough airflow to drive the compressor blades even without combustion, we can perform a "windmilling engine start.

If both engines flamed out, always try to start the left engine first (utility hydraulic system is powered by the left engine hydraulic pump).

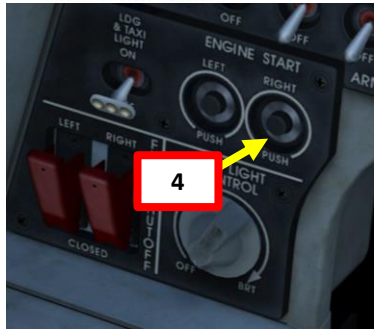
Use the Airspeed Curve chart to determine if you are within a safe setting to restart your engine (ideally, you want to be in the red area).

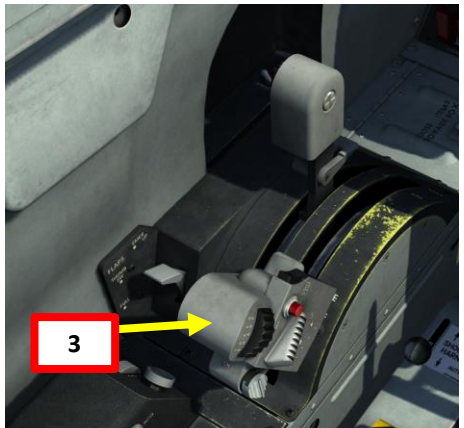
1. According to the graph, if we are flying at 20,000 ft and are flying at 150 kts, we will not have enough airflow to restart it through windmilling.
2. Find desirable airspeed and altitude on the graph and dive to reach the proper airspeed/altitude setting. We can dive to 18,000 ft and gain additional airspeed and reach 250 kts, which will allow us to generate 20 % RPM through windmilling, which puts us in the stable airstart area on the graph.
3. Once airspeed/altitude conditions are respected and enough RPM is generated on the engine, retard the throttle of the flamed out engine and set it to OFF (**RALT+END for Left throttle, RSHIFT+END for Right throttle**).
4. Press the ENGINE START button of the flamed out engine.
5. Set throttle of the flamed out engine to IDLE (**RALT+HOME for Left throttle, RSHIFT+HOME for Right throttle**).
6. Ignition of the flamed out engine should be performed within 25 seconds. Once RPM increases, gradually throttle up.

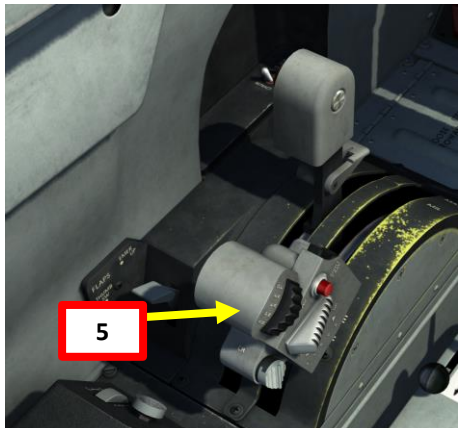


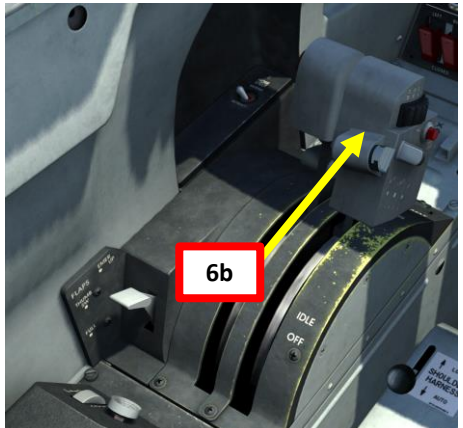
A. Pressure altitude – 1000 ft
B. Engine windmill speed, %
C. Airspeed, KIAS
D. Stable airstart area

Figure 5.4 Engine Windmill Speed - Pressure Altitude - Airspeed Curve



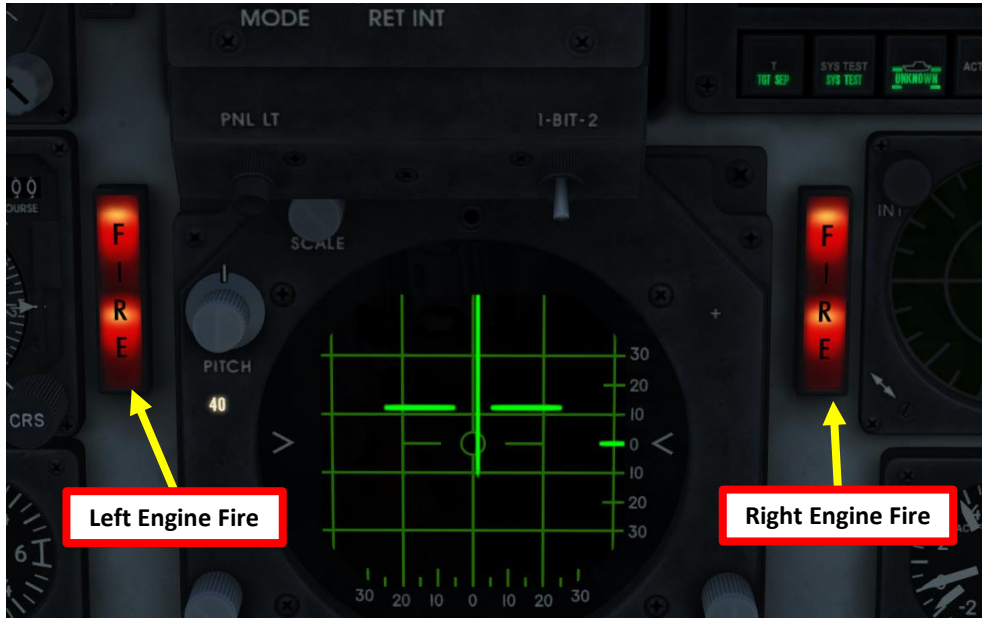






PART 7 – AERODYNAMICS & ENGINE MANAGEMENT

CAUTIONS

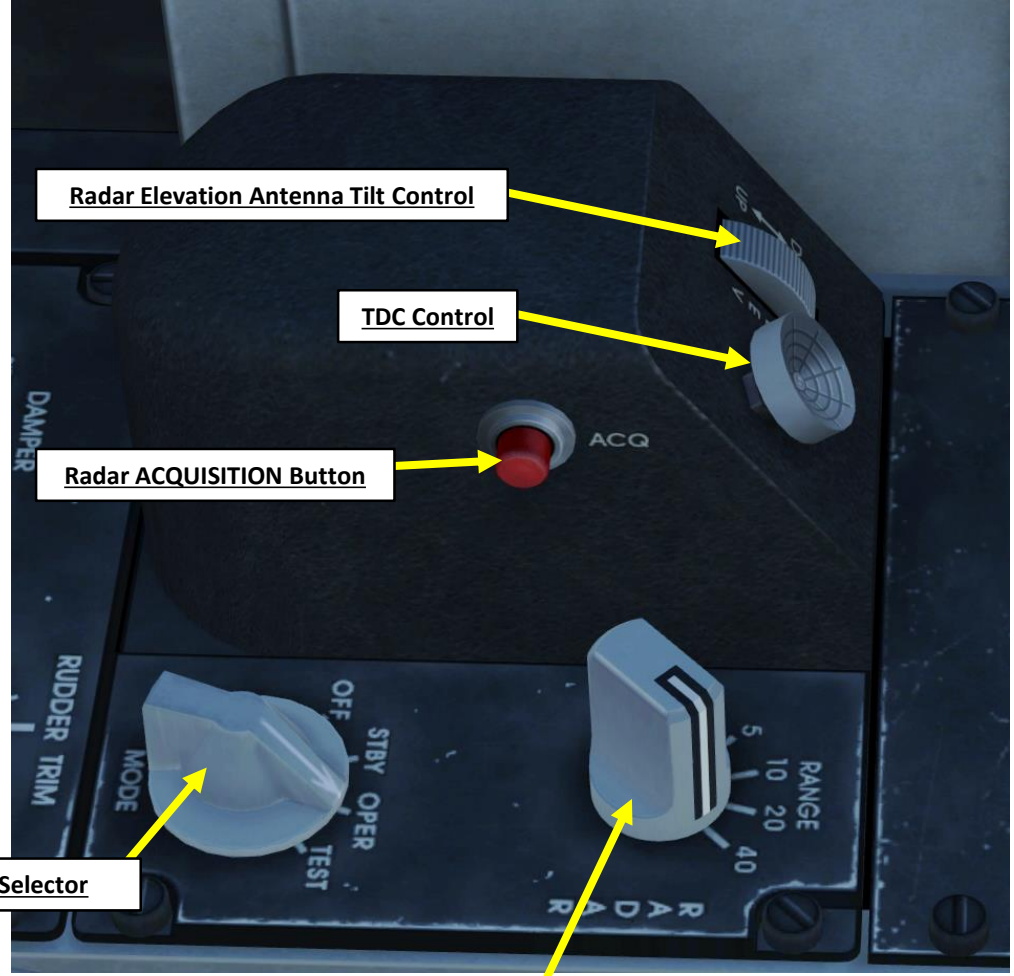


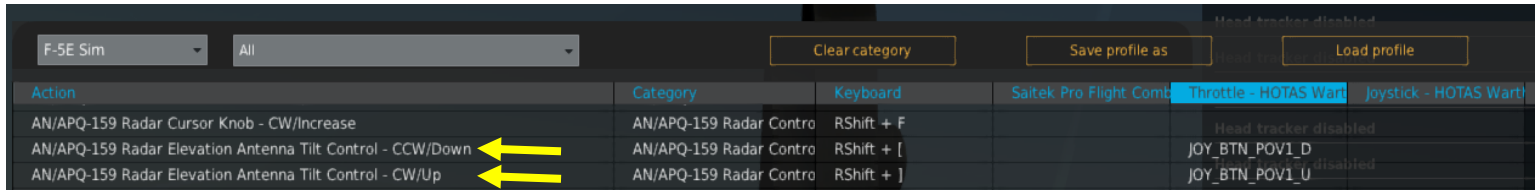
L GENERATOR Left generator failed or OFF	**CANOPY** Canopy unlocked	**R GENERATOR** Right generator failed or OFF
UTILITY HYD Utility Hydraulic Pressure under 1500 psi or hydraulic fluid overheat	**SPARE** Not implemented in this F-5 variant	**FLIGHT HYD** Flight Control Hydraulic Pressure under 1500 psi or hydraulic fluid overheat
EXT TANKS EMPTY Fuel transfer from external tanks complete	**IFF** Not implemented in this F-5 variant	**OXYGEN** Oxygen level below 0.5 L or low oxy pressure
L FUEL LOW Left engine fuel level below 400 lbs	**ENGINE ANTI-ICE ON** Engine Anti-Ice system is on	**R FUEL LOW** Right engine fuel level below 400 lbs
L FUEL PRESS Left fuel boost pump pressure below 66.5 psi	**INS** Not implemented in this F-5 variant	**R FUEL PRESS** Right fuel boost pump pressure below 66.5 psi
AOA/FLAPS Auto-flap system failure	**AIR DATA COMPUTER** CADC or Pitot-static system failure	**DIR GYRO** Not implemented in this F-5 variant
SPARE Not implemented in this F-5 variant	**DC OVERLOAD** DC System failure	**SPARE** Not implemented in this F-5 variant

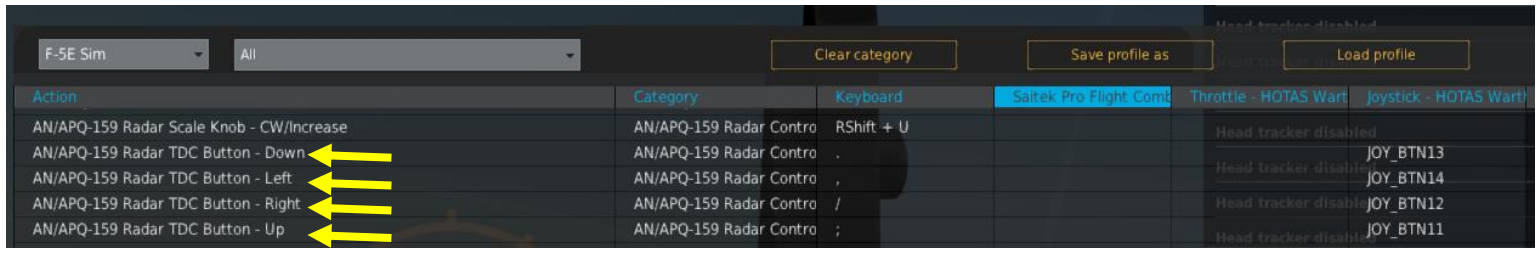
PART 8 – RADAR OPERATION

RADAR CONTROLS

1. To turn on your radar, set the Radar Mode knob to OPER.
2. To control the range of your radar, set the RADAR RANGE to either 40, 20, 10 or 5 nm by using the **Radar Range Cw/Increase or Ccw/Decrease**. Take note that changing this RADAR RANGE will automatically change the grid scale on your radar display.
3. Your radar has a limited elevation angle to scan the sky. You can tilt the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
4. To lock a target spotted on your radar, you can control a TDC (Target Designation Caret) using the **Radar TDC Button Left/Right/Up/Down**.
5. Once your TDC is on the desired target and you are about 10 nm from it, press the ACQ (Acquisition) button to spotlight the target. Radar antenna will then start scanning ±5 degrees in azimuth and ±1.5 degrees in elevation.
6. You can unlock a target by using the DOGFIGHT/RESUME switch ("R" key by default).







PART 8 – RADAR OPERATION

RADAR RANGE

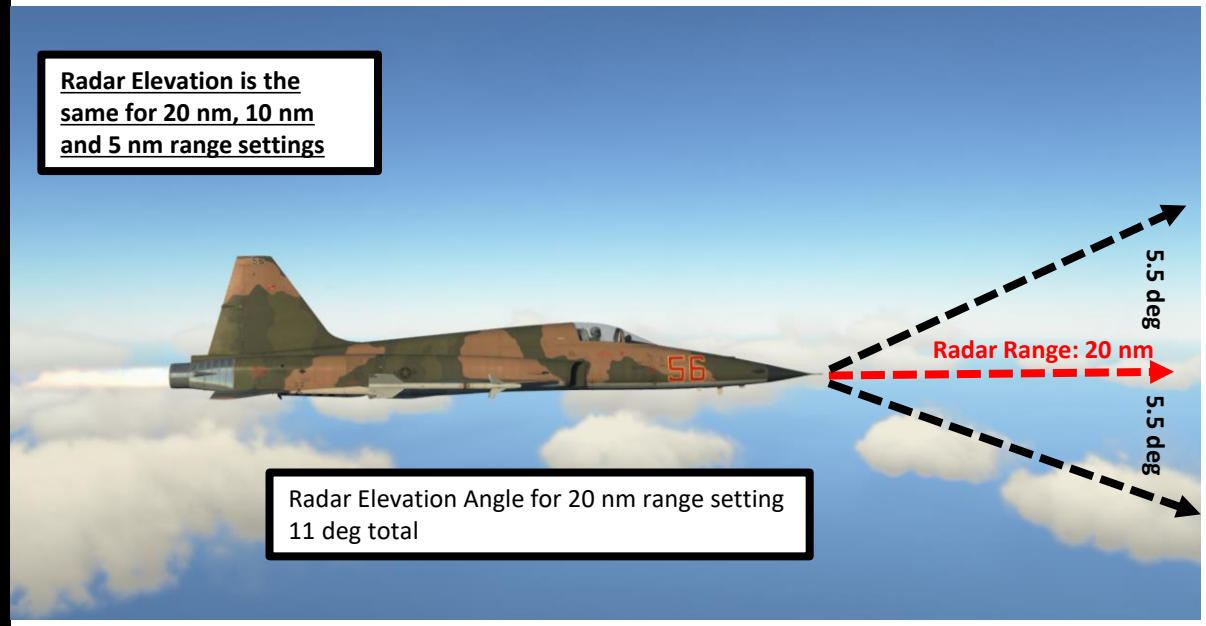
The radar elevation angle can be controlled by tilting the radar antenna. However, your radar scanning cone only covers a definite azimuth and elevation angle as shown below.

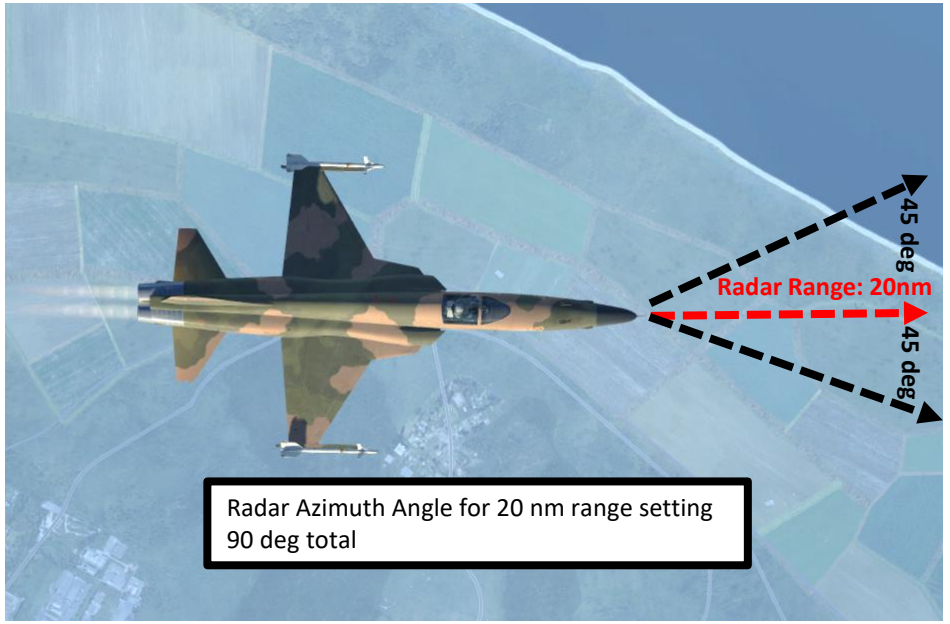
HOW TO FIND TARGET ALTITUDE IN RELATIONSHIP TO YOU

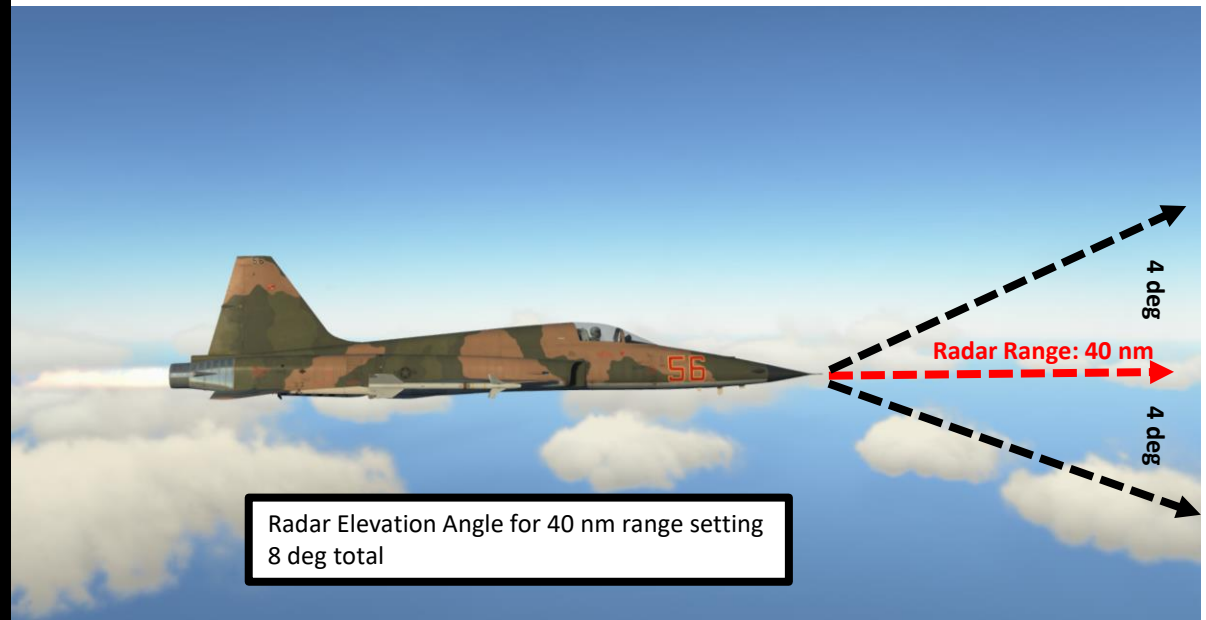
Difference of Height (hundreds of ft) = Elevation Angle (deg) x Range (nm)

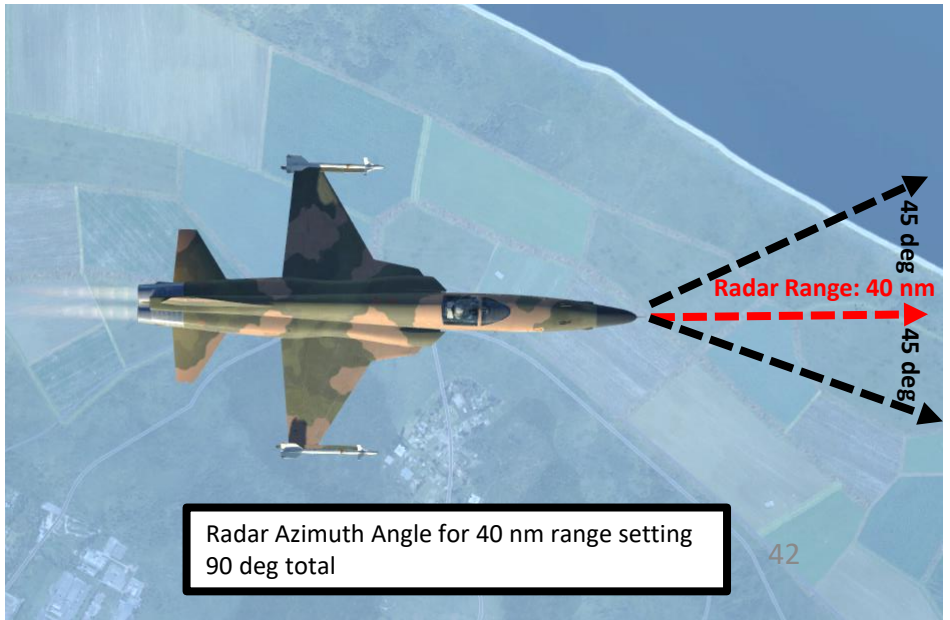
Example: Target Range at 10 nm, spotted at 5 deg UP

H = 5 deg x 10 nm = 50 x 100 ft = Target is 5000 ft above you







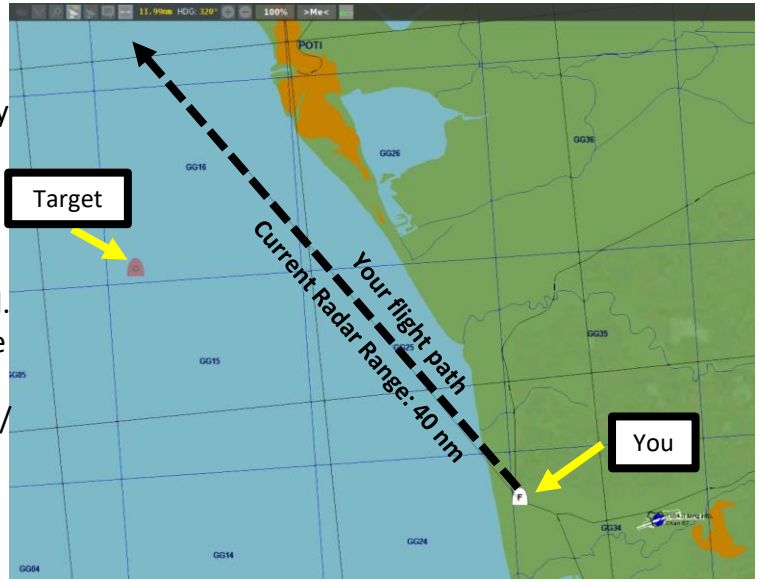


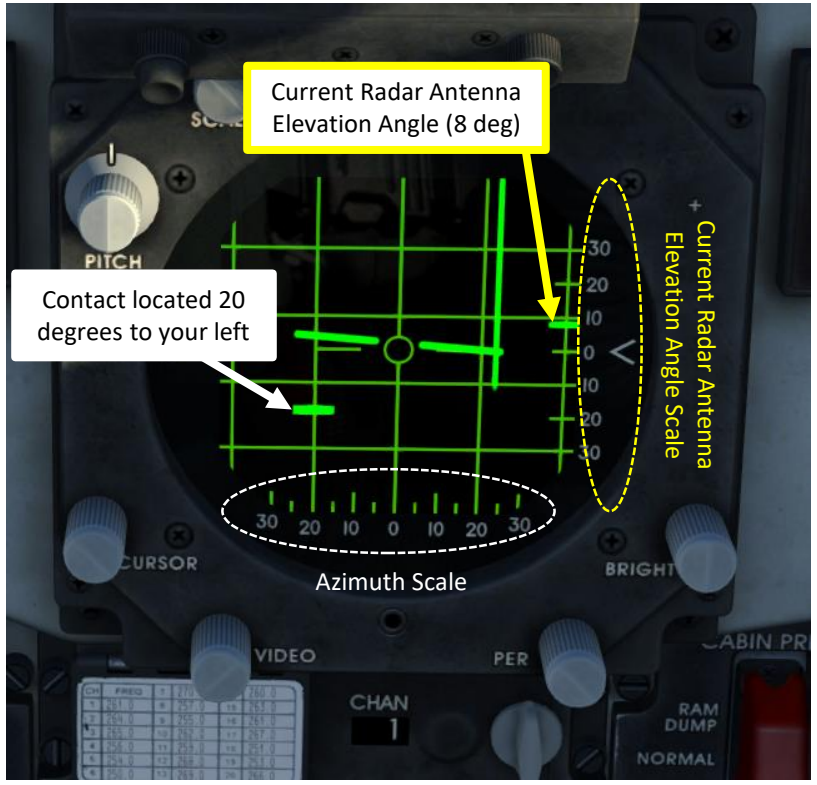
PART 8 – RADAR OPERATION

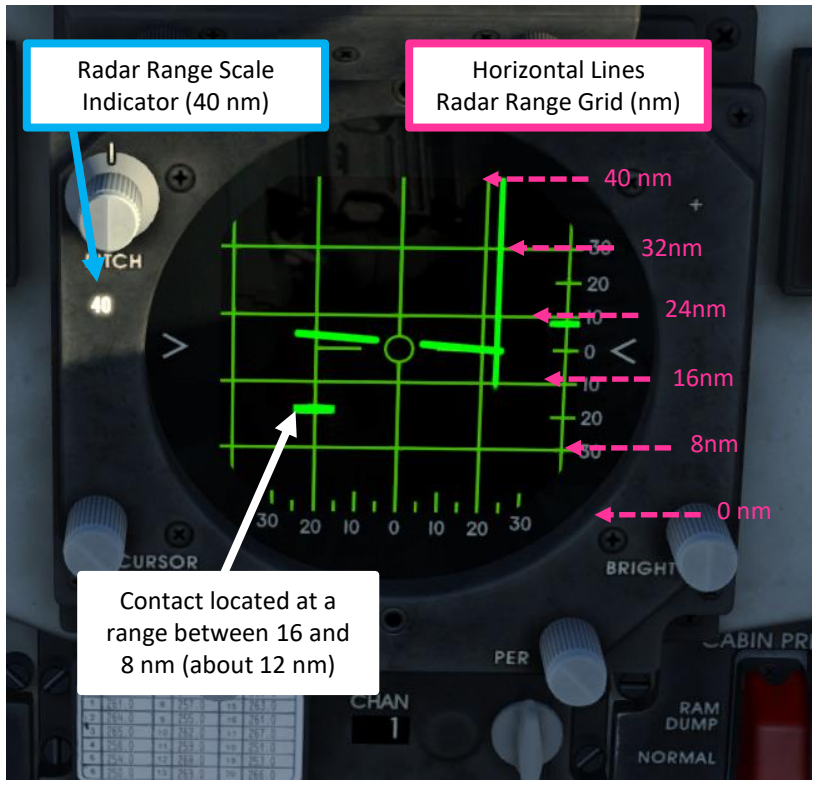
HOW TO INTERPRET THE RADAR

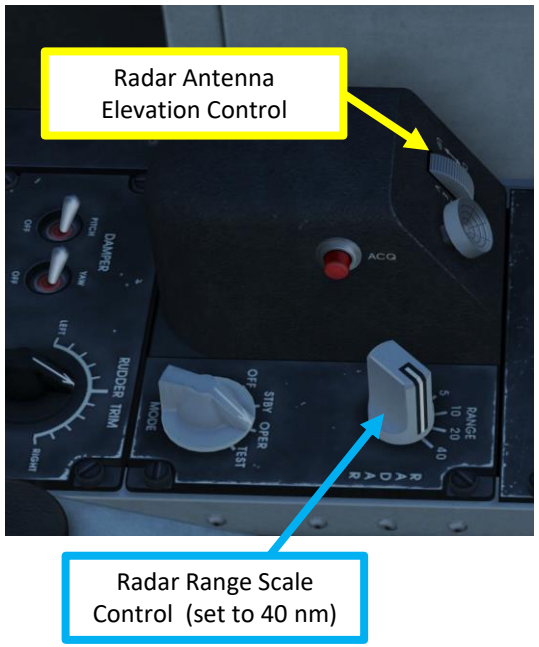
Many people confuse the radar scale with the elevation angle scale. Let's clear things up.
The radar does **not** actually guide your AIM-9 missiles: your missiles track infrared signatures. The radar's only use it to guide you to your target and possibly give you a firing solution.

- The radar view you have is a TOP-DOWN view.
- The horizontal scale will tell you if the target is to your left or right.
- The vertical scale will tell you how far the target is from you.
- The (vertical) radar range grid scale varies if you change the radar range with the Radar Range Scale Control.
  - The uppermost horizontal line on the range scale is the maximal range. The other lines simply divide this distance in fifths of this distance.
  - For example, a set max range of 20 nm would scale its range lines to 20 nm / 16 nm / 12 nm / 8 nm / 4 nm / 0 nm.
- The radar is not able to differentiate between friendly or enemy contacts. Make sure you properly identify your target before firing.
- NOTE: A whole radar lock example will be shown for MSL (Missile), DM (Dogfight Missile) and DG (Dogfight Guns) will be shown in the next WEAPONS AND ARMAMENT SECTION.









PART 9 – OFFENCE
WEAPONS & ARMAMENT

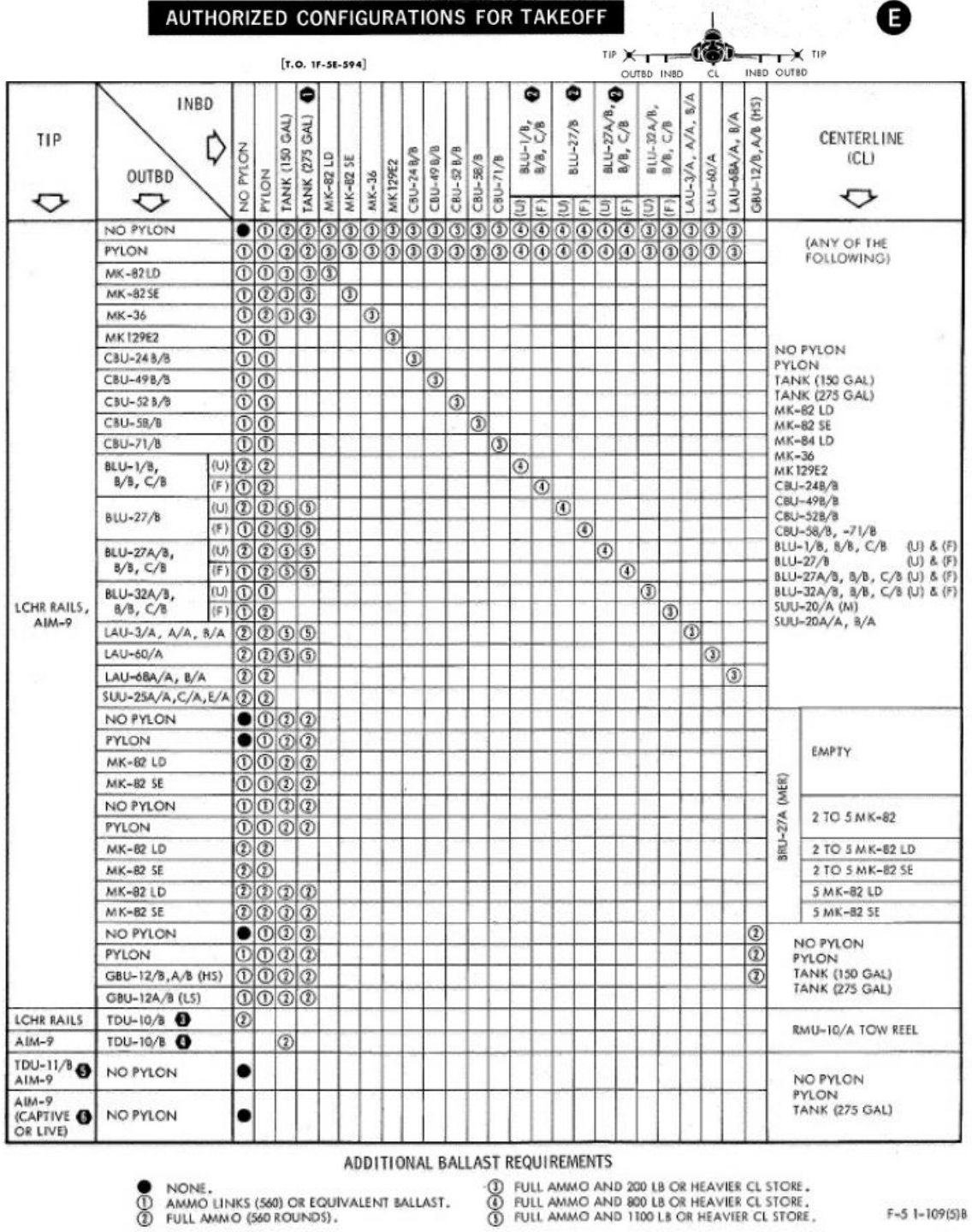
THE WEAPONS

A good loadout is not necessarily the biggest bomb: a good loadout is the one that you know how to use and are most comfortable with… and yet that remains flexible enough to allow you to adapt to different targets and situations.

- Unguided rockets
- Guns
- Air-to-Air Missile
  - AIM-9P SIDEWINDER
- Unguided bombs
  - Ex: Mk-82, Mk-83, Mk-84, M117
- PGM: Precision Guided Munition
  - LGB: Laser-Guided Bombs / GBU (Guided Bomb Unit)
    - Bomb is guided by a laser beam from operators on the ground, a JTAC or your own TGP (targeting pod).
    - Ex: GBU-12

It is important to take note of the following:

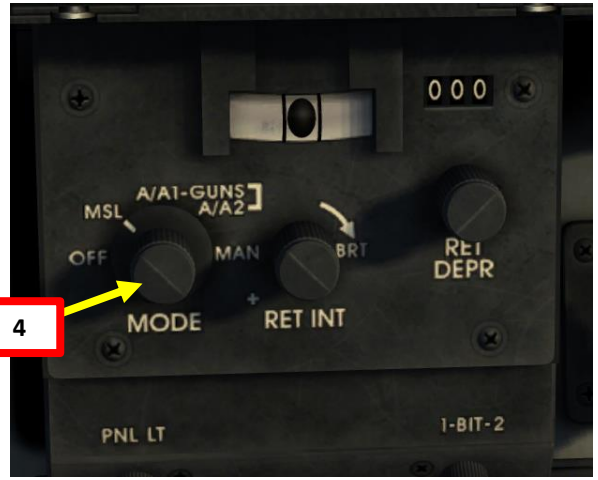
- You will have to acquire all your targets visually before you use your weapons.
- The radar is a tool that will allow you to acquire a target visually. It will NOT guide your missiles: it will only assist you in having a firing solution.
- Your missiles are guided by infrared heat signatures, not radar.
- Bombing is very difficult in the F-5 since you need to enter very precise input parameters. The ones I recommend are those who work most of the time, but if you want to bomb very precisely, I suggest that you consult this bombing chart from the F-5E Weapon Delivery Manual from the 476th Virtual Fighter Group: http://www.476vfightergroup.com/downloads.php?do=file&id=446
- The real-life full flight manual of the F-5E is also available here on the website the 476th Virtual Fighter Group: http://www.476vfightergroup.com/downloads.php?do=file&id=445

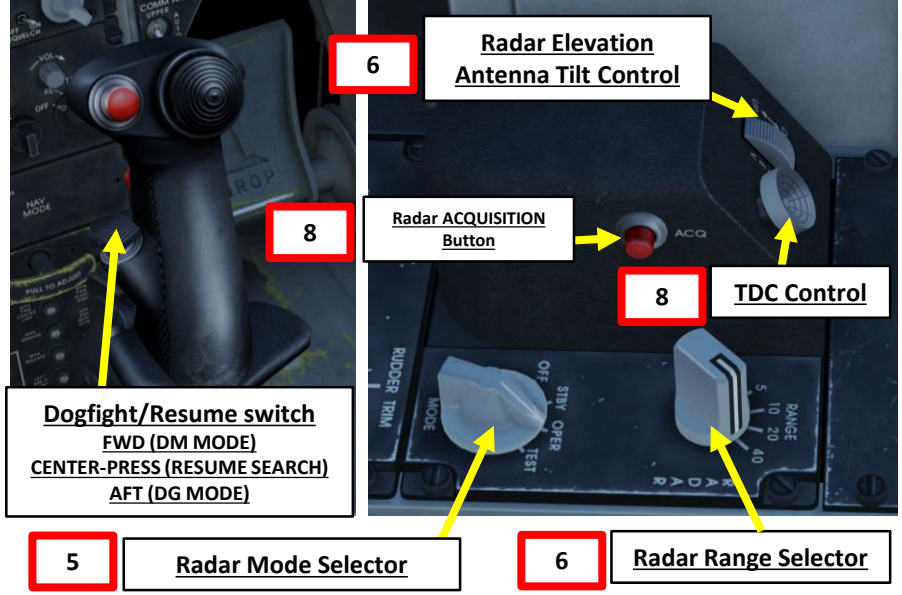


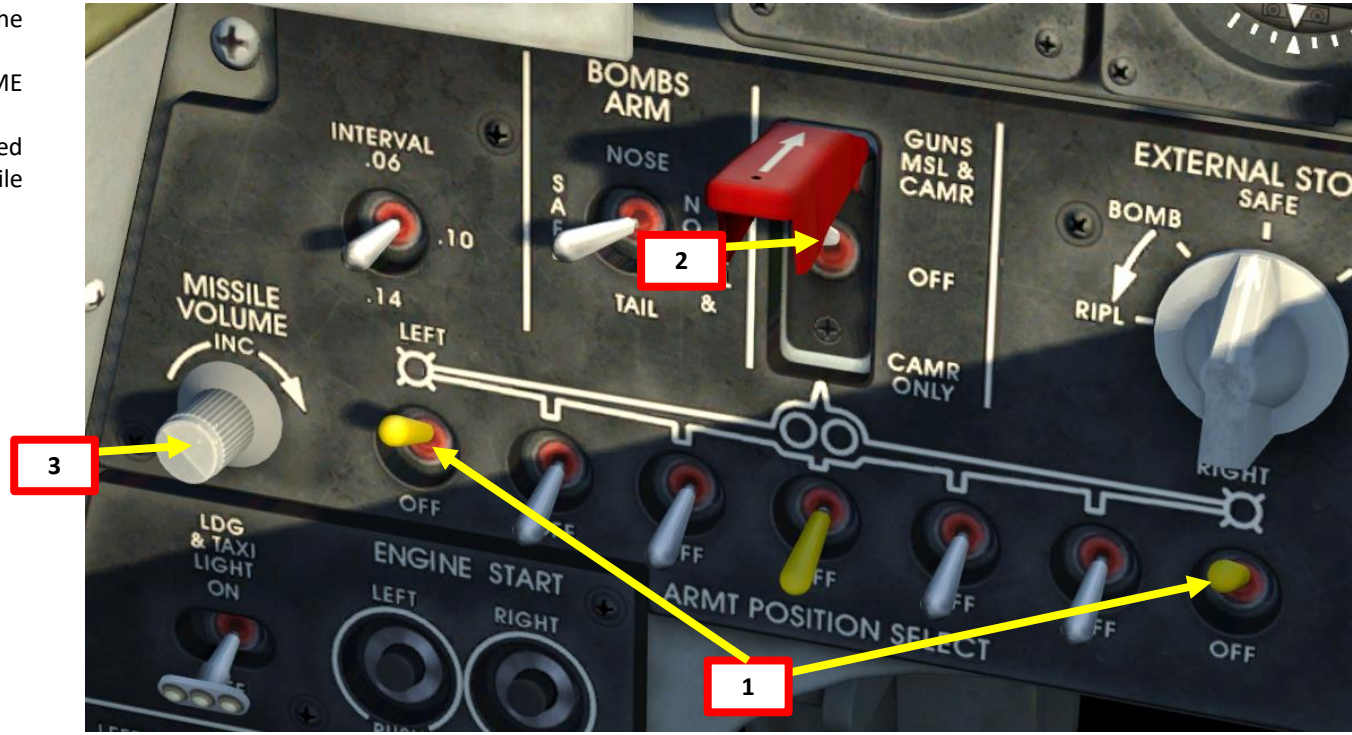
PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-AIR AIM-9 MISSILE – MSL MODE

1. On armament panel, set outer pylon switches UP.
2. Flip safety cover and set weapons arming switch to GUNS MSL & CAMR.
3. Adjust missile volume to your convenience.
4. Select gunsight mode to MSL (right click).
5. Set Radar Mode knob to OPER.
6. Set the RADAR RANGE to either 40 nm with the **Radar Range Cw/Increase or Ccw/Decrease** and spot target by tilting the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
7. Steer aircraft to align the target to the horizontal center of your radar screen. As the target reaches 20 nm (middle of radar), switch RADAR RANGE to 20 nm and keep track of target. Repeat process when target reaches 10 nm and switch RADAR RANGE to 10 nm.
8. Lock target spotted on your radar, by controlling the TDC (Target Designation Caret) using the **Radar TDC Button Left/Right/Up/Down** and press the ACQ (Acquisition) button to spotlight the target.
9. Radar will enter TRACKING mode, which is a chase view instead of the initial TOP DOWN view. Fly the aircraft to put the aiming cross at the center of the radar screen.
10. If you lose lock, you can unlock a target by using the DOGFIGHT/RESUME CENTER-PRESS switch ("R" key by default).
11. When in range, LK ON light and a IN RANGE light will illuminate and a red dot ("in-range marker") will appear next to the gunsight reticle. Missile will have a solid IR lock when the missile growls louder.
12. Press WEAPON RELEASE button ("RAlt+Space") to fire missile.



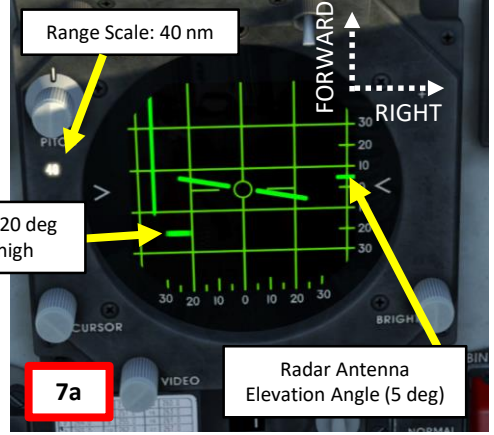


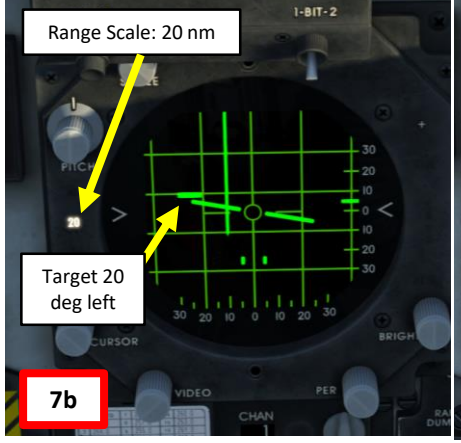


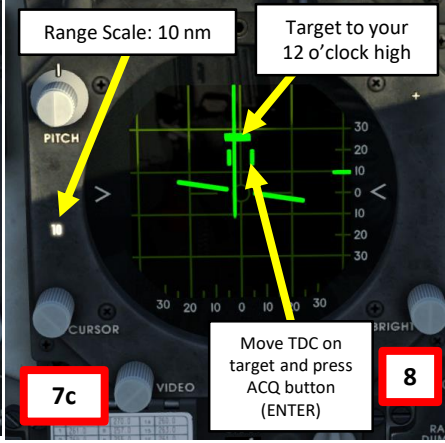
PART 9 – OFFENCE
WEAPONS & ARMAMENT

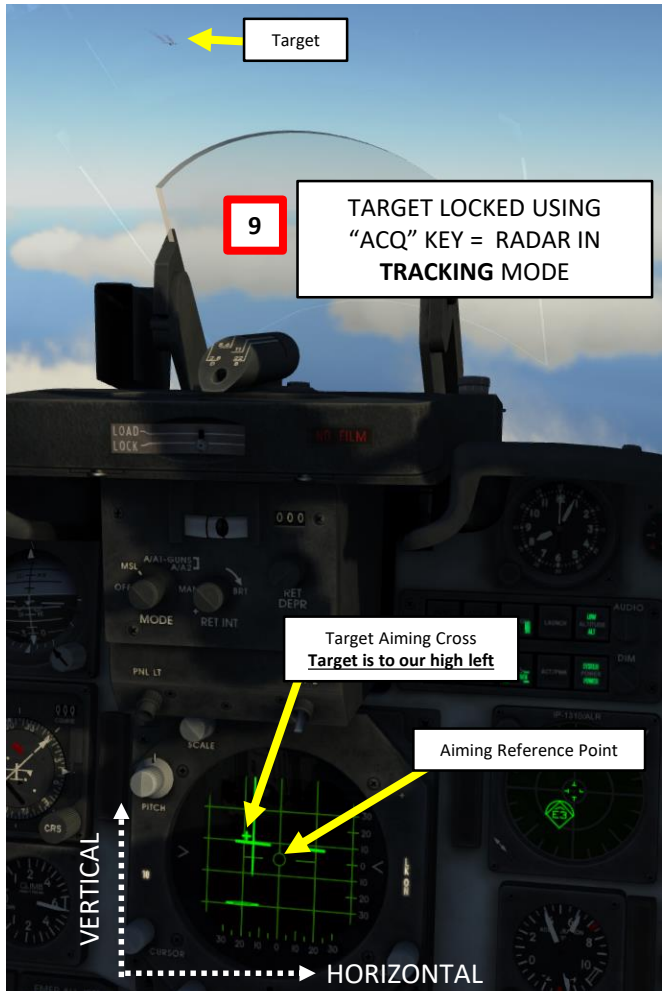
AIR-TO-AIR AIM-9 MISSILE – MSL MODE

1. On armament panel, set outer pylon switches UP.
2. Flip safety cover and set weapons arming switch to GUNS MSL & CAMR.
3. Adjust missile volume to your convenience.
4. Select gunsight mode to MSL (right click).
5. Set Radar Mode knob to OPER.
6. Set the RADAR RANGE to either 40 nm with the **Radar Range Cw/Increase or Ccw/Decrease** and spot target by tilting the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
7. Steer aircraft to align the target to the horizontal center of your radar screen. As the target reaches 20 nm (middle of radar), switch RADAR RANGE to 20 nm and keep track of target. Repeat process when target reaches 10 nm and switch RADAR RANGE to 10 nm.
8. Lock target spotted on your radar, by controlling the TDC (Target Designation Caret) using the **Radar TDC Button Left/Right/Up/Down** and press the ACQ (Acquisition) button to spotlight the target.
9. Radar will enter TRACKING mode, which is a chase view instead of the initial TOP DOWN view. Fly the aircraft to put the aiming cross at the center of the radar screen.
10. If you lose lock, you can unlock a target by using the DOGFIGHT/RESUME CENTER-PRESS switch ("R" key by default).
11. When in range, LK ON light and a IN RANGE light will illuminate and a red dot ("in-range marker") will appear next to the gunsight reticle. Missile will have a solid IR lock when the missile growls louder.
12. Press WEAPON RELEASE button ("RAlt+Space") to fire missile.





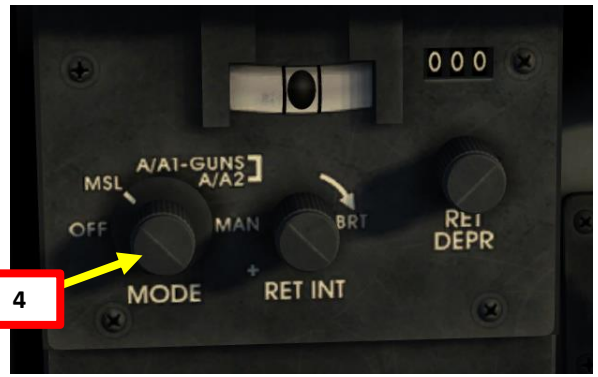


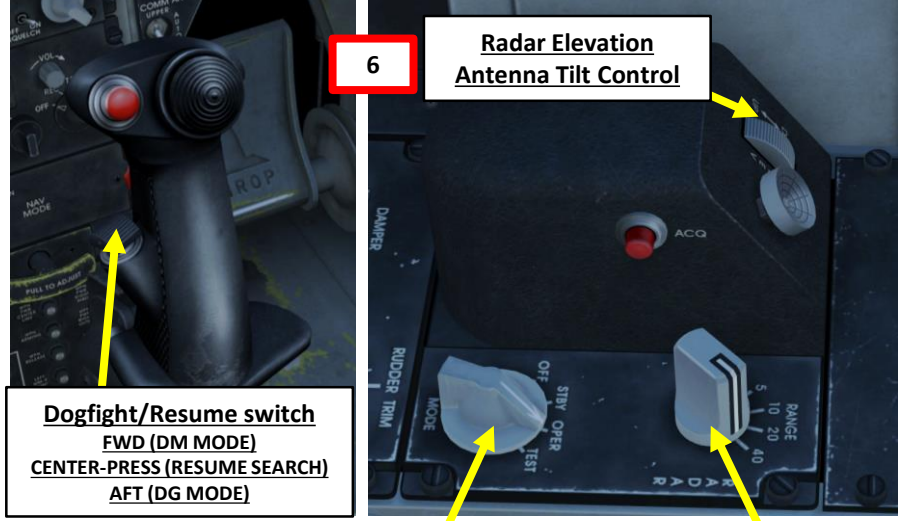


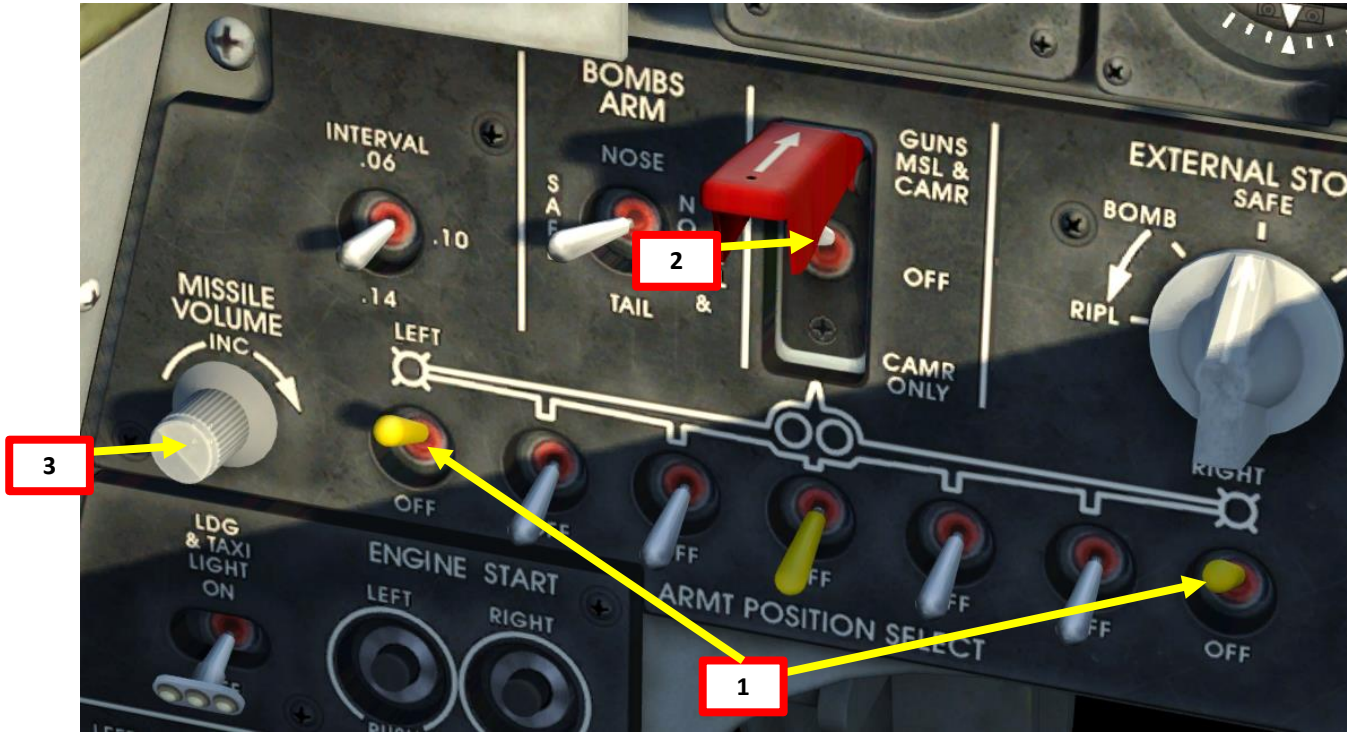
PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-AIR AIM-9 MISSILE – DM MODE

1. On armament panel, set outer pylon switches UP.
2. Flip safety cover and set weapons arming switch to GUNS MSL & CAMR.
3. Adjust missile volume to your convenience.
4. Select gunsight mode to MSL (right click).
5. Set Radar Mode knob to OPER.
6. Set the RADAR RANGE to 10 nm with the **Radar Range Cw/Increase or Ccw/Decrease** and spot target by tilting the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
7. Steer aircraft to align the target to the horizontal center of your radar screen and climb/dive accordingly to ensure a 0 deg elevation difference (center zero elevation zero azimuth line).
8. When at less than 5 nm from target, engage Dogfight Missile (DM) by pressing DOGFIGHT/RESUME SWITCH FORWARD ("5").
9. Radar will automatically look for the nearest target and lock it.
10. Once radar lock has been done automatically in radar Dogfight Mode, radar will then enter TRACKING mode, which is a chase view instead of the initial TOP DOWN view. Fly the aircraft to put the aiming cross at the center of the radar screen.
11. If you lose lock, you can unlock a target by using the DOGFIGHT/RESUME CENTER-PRESS switch ("R" key by default).
12. When in range, LK ON light and a IN RANGE light will illuminate and a red dot ("in-range marker") will appear next to the gunsight reticle. Missile will have a solid IR lock when the missile growls louder.
13. Press WEAPON RELEASE button ("RAlt+Space") to fire missile.



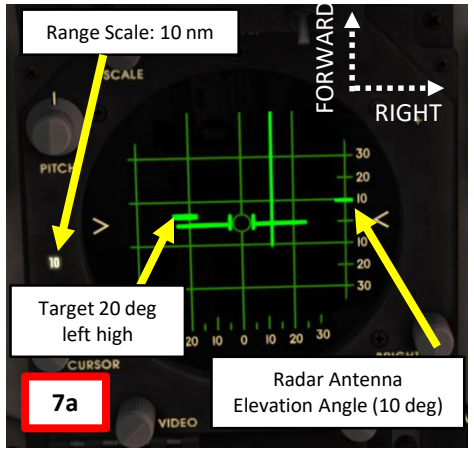


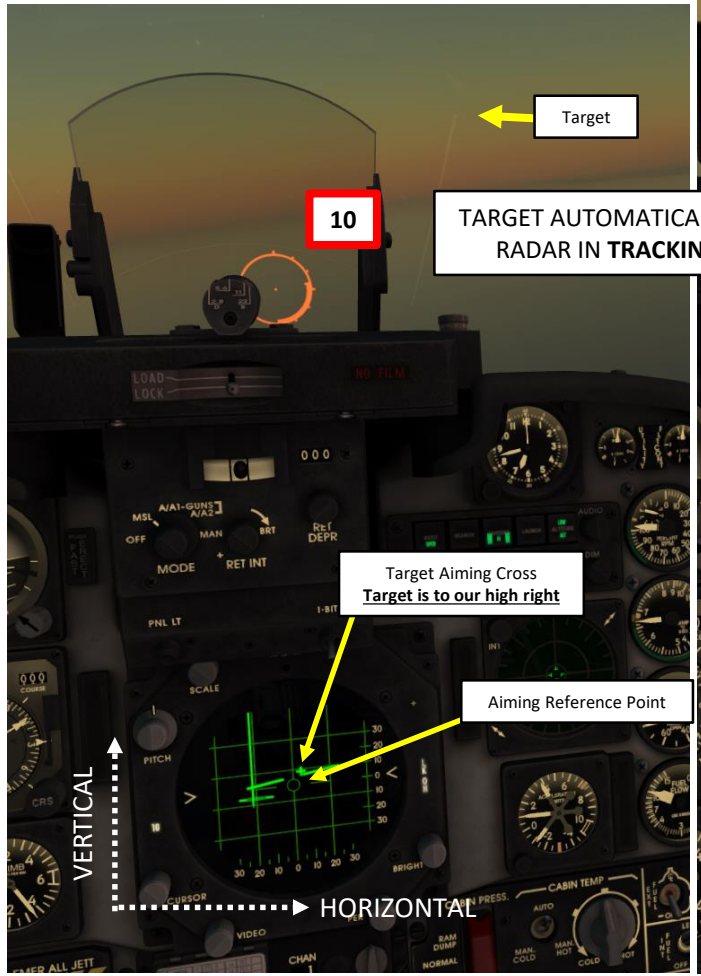


PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-AIR AIM-9 MISSILE – DM MODE

1. On armament panel, set outer pylon switches UP.
2. Flip safety cover and set weapons arming switch to GUNS MSL & CAMR.
3. Adjust missile volume to your convenience.
4. Select gunsight mode to MSL (right click).
5. Set Radar Mode knob to OPER.
6. Set the RADAR RANGE to 10 nm with the **Radar Range Cw/Increase or Ccw/Decrease** and spot target by tilting the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
7. Steer aircraft to align the target to the horizontal center of your radar screen and climb/dive accordingly to ensure a 0 deg elevation difference (center zero elevation zero azimuth line).
8. When at less than 5 nm from target, engage Dogfight Missile (DM) Mode by pressing DOGFIGHT/RESUME SWITCH FORWARD (“5”).
9. Radar will automatically look for the nearest target and lock it.
10. Once radar lock has been done automatically in radar Dogfight Mode, radar will then enter TRACKING mode, which is a chase view instead of the initial TOP DOWN view. Fly the aircraft to put the aiming cross at the center of the radar screen.
11. If you lose lock, you can unlock a target by using the DOGFIGHT/RESUME CENTER-PRESS switch (“R” key by default).
12. When in range, LK ON light and a IN RANGE light will illuminate and a red dot (“in-range marker”) will appear next to the gunsight reticle. Missile will have a solid IR lock when the missile growls louder.
13. Press WEAPON RELEASE button (“RAlt+Space”) to fire missile.

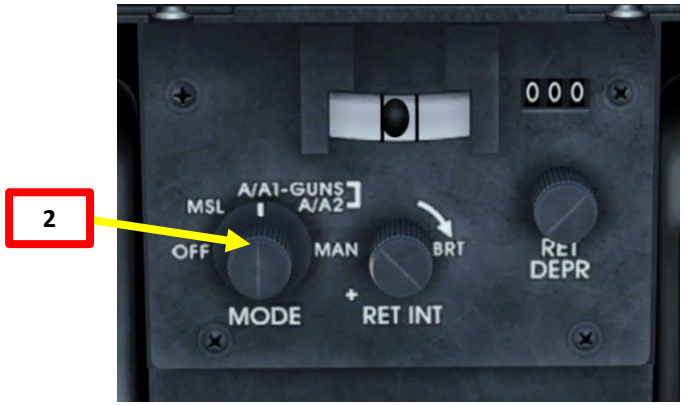


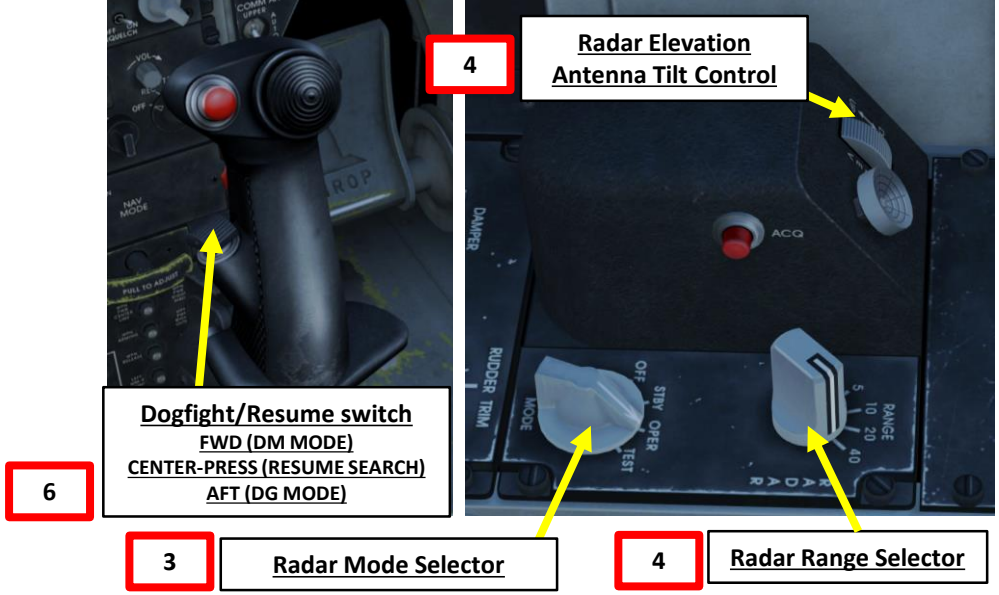


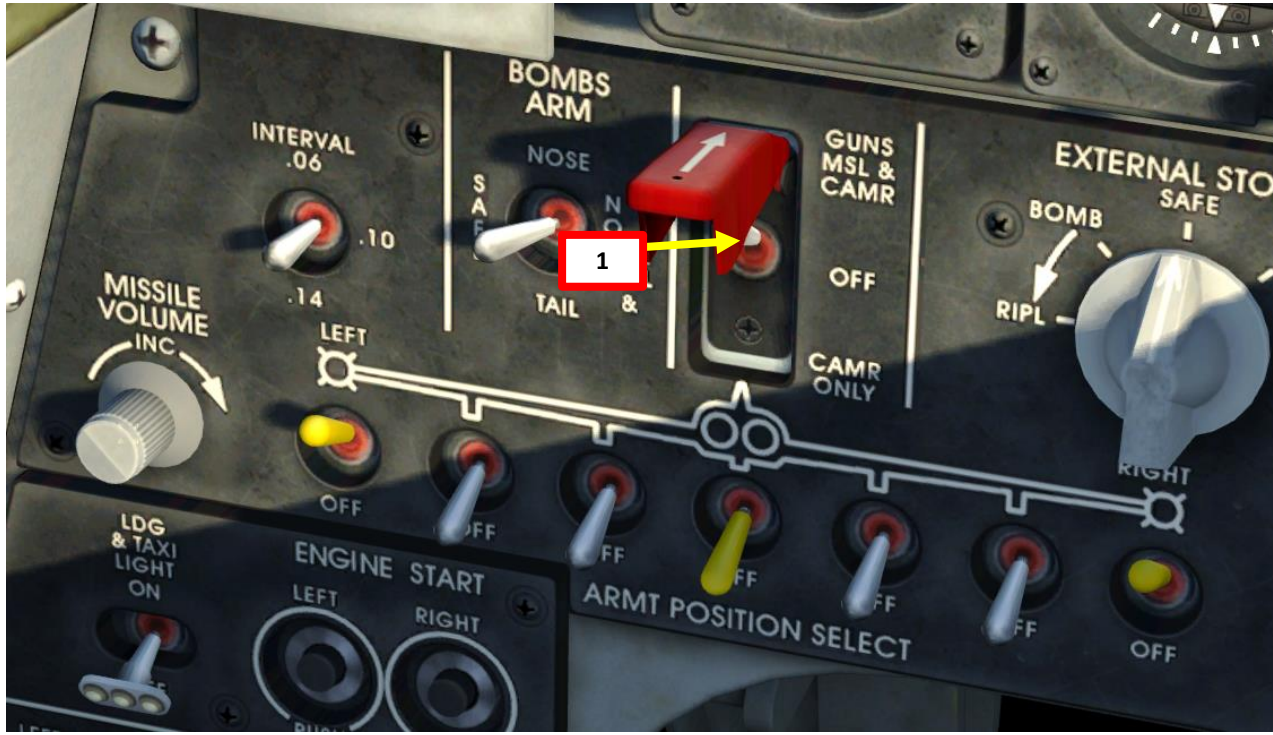
PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-AIR GUNS – DG & A/A1 MODE

1. On armament panel, flip safety cover and set weapons arming switch to GUNS MSL & CAMR.
2. Select gunsight mode to A/A1 GUNS (right click).
3. Set Radar Mode knob to OPER.
4. Set the RADAR RANGE to 10 nm with the **Radar Range Cw/Increase or Ccw/Decrease** and spot target by tilting the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
5. Steer aircraft to align the target to the horizontal center of your radar screen and climb/dive accordingly to ensure a 0 deg elevation difference (center zero elevation zero azimuth line).
6. When at less than 1 nm from target, engage Dogfight Guns (DG) Mode by pressing DOGFIGHT/RESUME SWITCH AFT (“6”).
7. Radar will automatically look for the nearest target and lock it.
8. Once radar lock has been done automatically in radar Dogfight Mode, radar will then enter TRACKING mode. At this point, you should have picked up the target visually and refer to your gunsight.
9. If you lose lock, you can unlock a target by using the DOGFIGHT/RESUME CENTER-PRESS switch (“R” key by default).
10. When in range, LK ON light and a IN RANGE light will illuminate and a red dot (“in-range marker”) will appear next to the gunsight reticle. Align gunsight pipper on target.
11. The F-5’s guns have a 2-stage trigger; first stage deploys the smoke deflectors and second stage fires the guns. To fire guns, Press GUN TRIGGER SECOND DETENT button (“Space”) to fire guns.



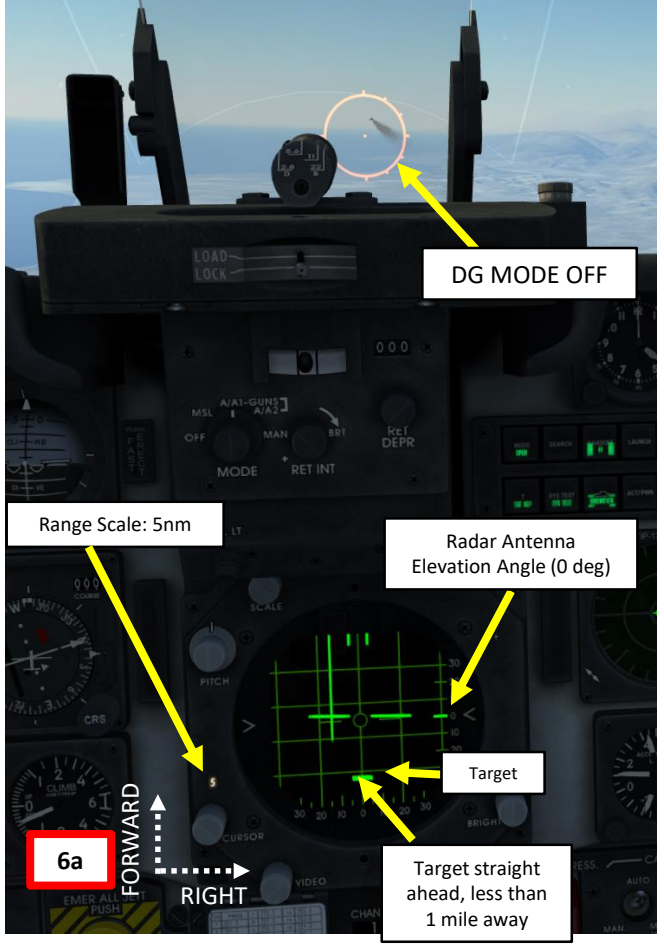


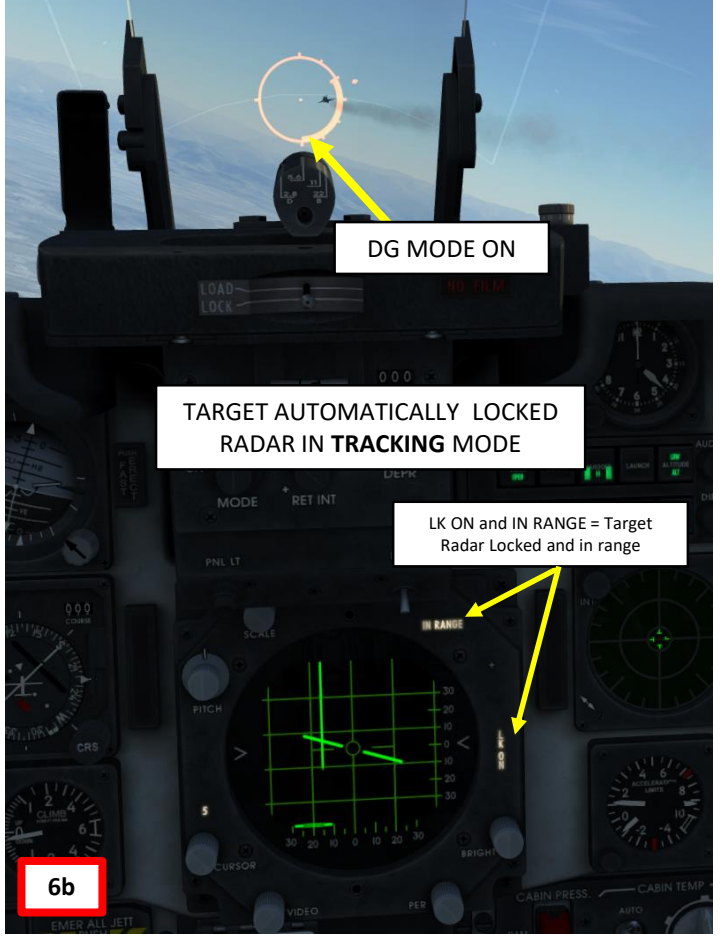


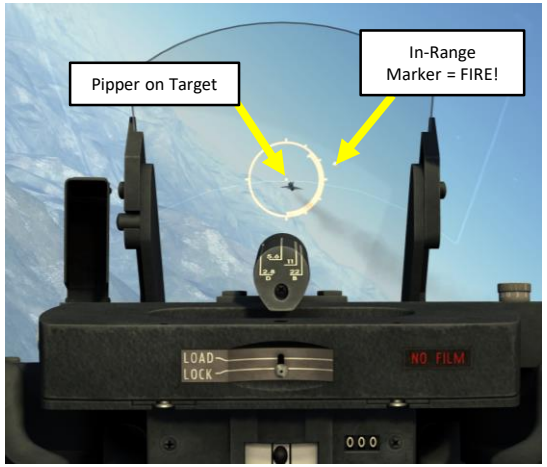
PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-AIR GUNS – DG & A/A1 MODE

1. On armament panel, flip safety cover and set weapons arming switch to GUNS MSL & CAMR.
2. Select gunsight mode to A/A1 GUNS (right click).
3. Set Radar Mode knob to OPER.
4. Set the RADAR RANGE to 10 nm with the **Radar Range Cw/Increase or Ccw/Decrease** and spot target by tilting the radar antenna vertically from -30 to +30 deg by using the **Radar Elevation Antenna Tilt Down/Up.**
5. Steer aircraft to align the target to the horizontal center of your radar screen and climb/dive accordingly to ensure a 0 deg elevation difference (center zero elevation zero azimuth line).
6. When at less than 1 nm from target, engage Dogfight Guns (DG) Mode by pressing DOGFIGHT/RESUME SWITCH AFT (“6”).
7. Radar will automatically look for the nearest target and lock it.
8. Once radar lock has been done automatically in radar Dogfight Mode, radar will then enter TRACKING mode. At this point, you should have picked up the target visually and refer to your gunsight.
9. If you lose lock, you can unlock a target by using the DOGFIGHT/RESUME CENTER-PRESS switch (“R” key by default).
10. When in range, LK ON light and a IN RANGE light will illuminate and a red dot (“in-range marker”) will appear next to the gunsight reticle. Align gunsight pipper on target.
11. The F-5’s guns have a 2-stage trigger; first stage deploys the smoke deflectors and second stage fires the guns. To fire guns, Press GUN TRIGGER







PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-AIR GUNS – A/A1 vs A/A2 GUNSIGHT MODE

To use A/A2 Guns Mode, simply repeat previous procedure but on step 2) select the A/A2 Gunsight mode.

Note: You can either select A/A1 or A/2 guns mode based on the target you are engaging. For fighters like the MiG-21, I recommend A/A1 mode. For bombers or fighter-bomber aircraft like the Su-24, I recommend the A/A2 mode.

A/A1 Guns Mode: Primarily used in short-range air-to-air combats against maneuvering targets with different angular rates.

A/A2 Guns Mode: Primarily used in short-range air-to-air combats against unaccelerated constant rate maneuvering target.

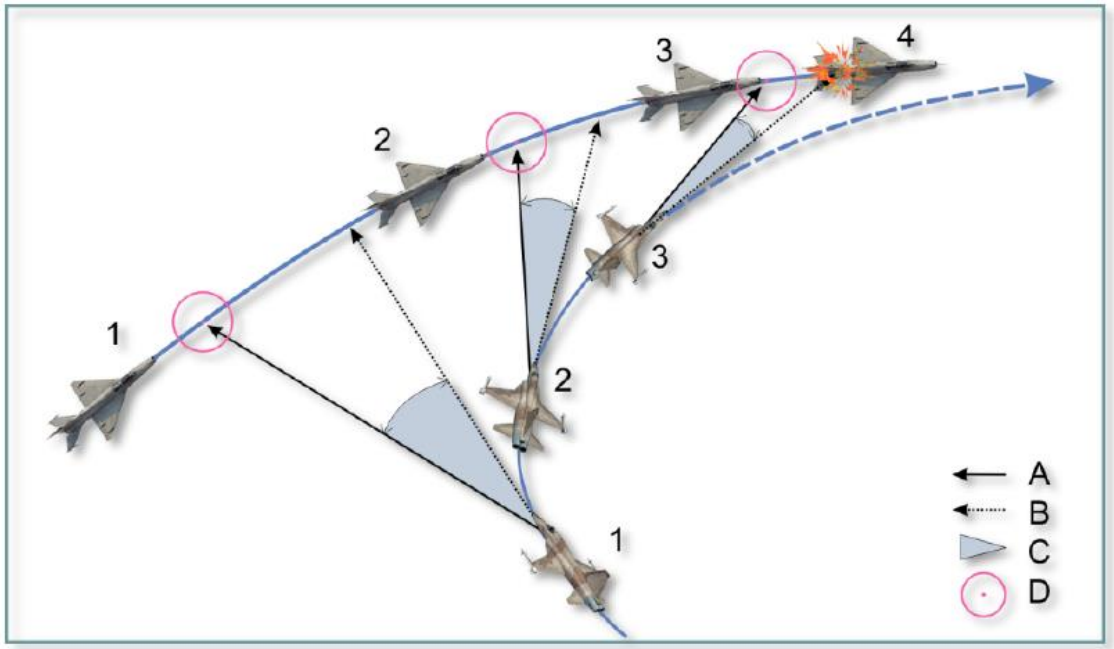


Figure 7.9 Attack in DG and A/A1 Mode

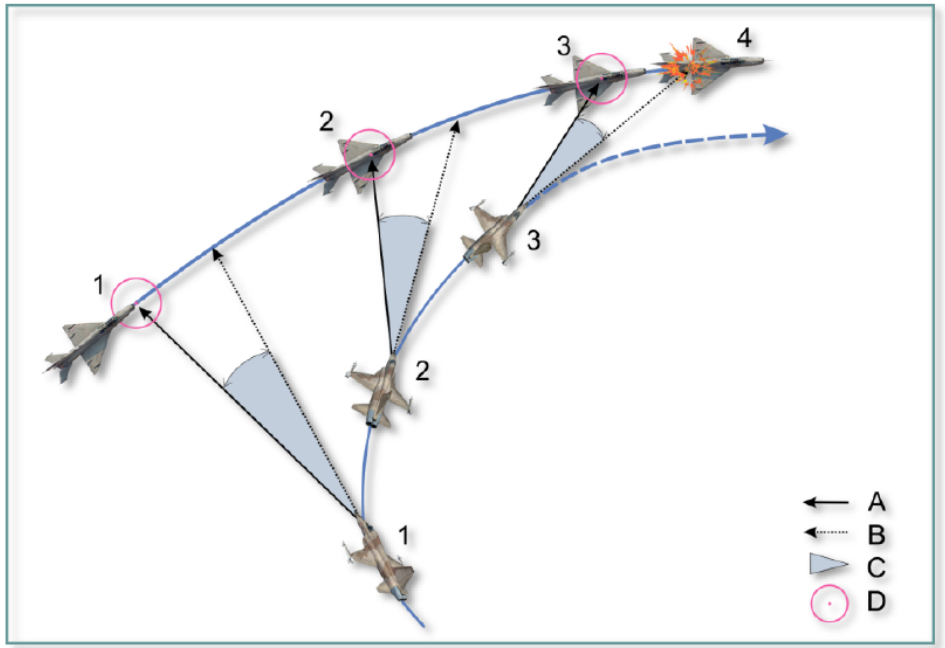


Figure 7.10 Attack in A/A2 Mode

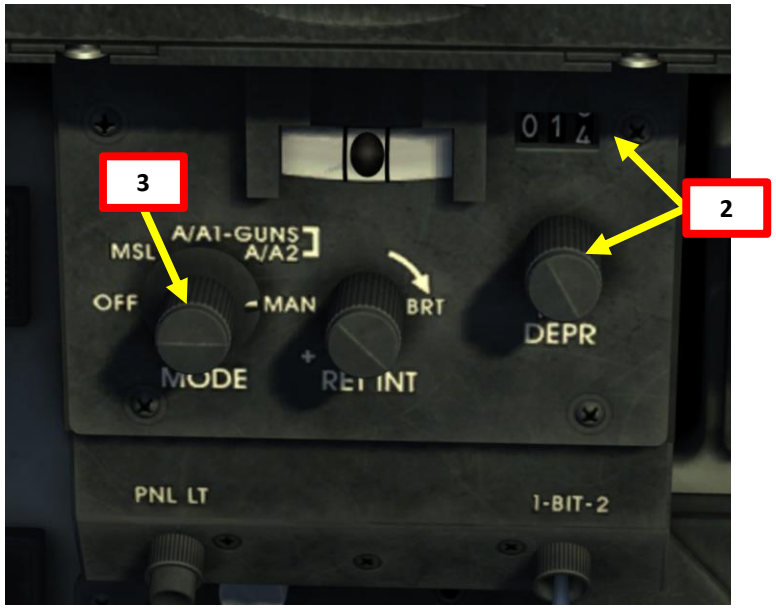
A. Line of sight
B. Gunline
C. Lead angle (with correction for projectile ballistic trajectory)
D. 50-mil reticle

1. Attacker and target positions at attack initiation.
2. Attacker and target positions at aiming.
3. Attacker and target positions at firing.
4. Target impact.

PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-GROUND ROCKETS

1. Determine target altitude using the F10 map (in our case 0 ft). Add target elevation to your dive bombing table altitude parameters in the table below.
2. Set gunsight depression to approx. 14 mil using the DEPR knob for a rocket run done with a 20 deg dive angle
3. Set gunsight mode to MANUAL
4. Power on armament pylons with the rocket pods you want to use.
5. Select external store release (RKT/DISP)
6. For a 20 deg rocket run dive, initiate dive from 5000 ft at 350 kts.
7. Use your altimeter, speed indicator and attitude indicator to fly with correct bombing parameters. For a 20 deg dive, maintain airspeed at 400 kts.
8. Launch rockets at 1500 ft above ground level by pressing the WEAPON RELEASE BUTTON (Ralt+Space).



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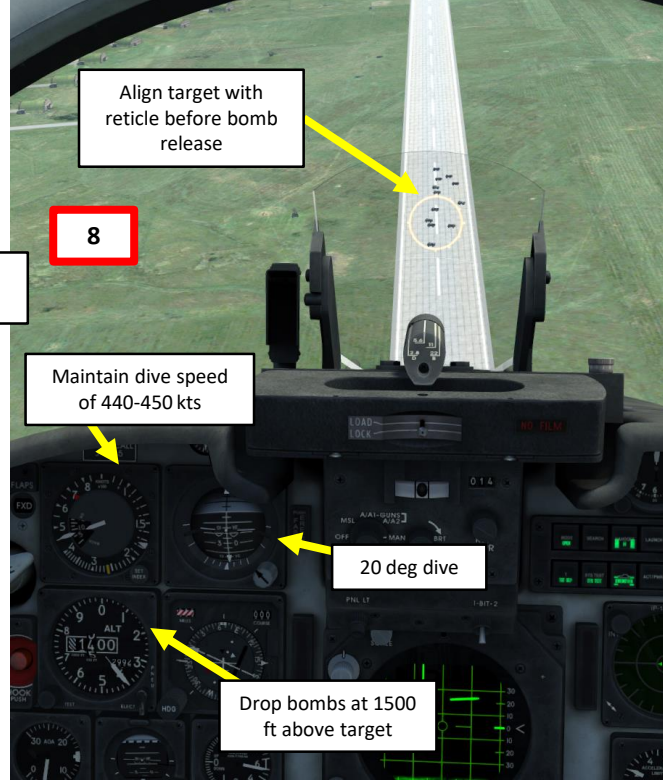
Rocket Table

Parameter	Dive Angles (degrees)	
	20	30
Dive initiation altitude (ft AGL)	5000	6000
Dive initiation speed (kts)	350 to 370	350
Release altitude (ft AGL)	1500	2000
Release speed (kts)	400	400
Reticle Depression (mils)	14	10

PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-GROUND ROCKETS

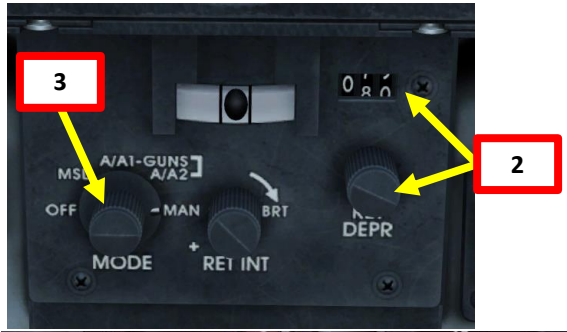
1. Determine target altitude using the F10 map (in our case 0 ft). Add target elevation to your dive bombing table altitude parameters in the table below.
2. Set gunsight depression to approx. 14 mil using the DEPR knob for a rocket run done with a 20 deg dive angle
3. Set gunsight mode to MANUAL
4. Power on armament pylons with the rocket pods you want to use.
5. Select external store release (RKT/DISP)
6. For a 20 deg rocket run dive, initiate dive from 5000 ft at 350 kts.
7. Use your altimeter, speed indicator and attitude indicator to fly with correct bombing parameters. For a 20 deg dive, maintain airspeed at 400 kts.
8. Launch rockets at 1500 ft above ground level by pressing the WEAPON RELEASE BUTTON (Ralt+Space).



PART 9 – OFFENCE
WEAPONS & ARMAMENT

AIR-TO-GROUND UNGUIDED BOMBS
MK-82, MK-83, MK-84, M-117

1. Determine target altitude using the F10 map (in our case 0 ft). Add target elevation to your dive bombing table altitude parameters in the table below.
2. Set gunsight depression to approx. 80 mil using the DEPR knob
3. Set gunsight mode to MANUAL
4. Power on armament pylons with the bombs you want to drop.
5. Arm bomb fuses (NOSE & TAIL recommended)
6. Select external store release (BOMB for single bomb release or RIPL for ripple bomb release)
7. If RIPL selected, set desired bomb release interval
8. For a 30 deg bomb run dive, initiate dive from 6000 ft at 350 kts.
9. Use your altimeter, speed indicator and attitude indicator to fly with correct bombing parameters. For a 30 deg dive, maintain airspeed between 440 and 450 kts.
10. Release bombs at 2000 ft above ground level by holding the WEAPON RELEASE BUTTON (Ralt+Space).



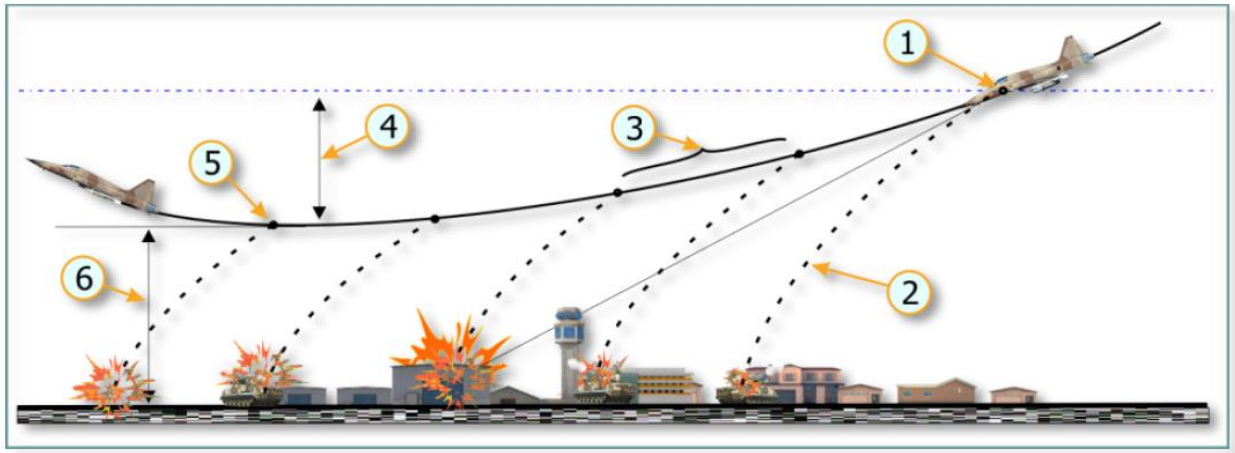


Figure 10.2 Ripple release bombing

8. FIRST BOMB RELEASE
9. BOMB TRAJECTORY
10. BOMB RELEASE INTERVAL
11. ALTITUDE LOST
12. LAST BOMB RELEASE
13. MINIMUM ALTITUDE AGL

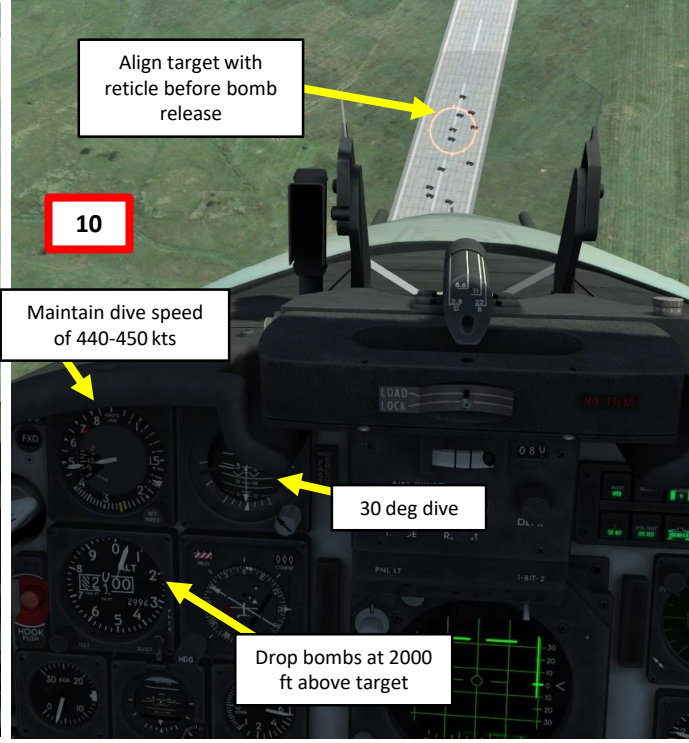
1

Dive Bombing Table

Parameter	Dive Angles (degrees)	
	20	30
Dive initiation altitude (ft AGL)	5000	6000
Dive initiation speed (kts)	350	350
Release altitude (ft AGL)	1500	2000
Release speed (kts)	380 to 400	440 to 450
Reticle Depression (mils)	80	79

PART 9 – OFFENCE
WEAPONS & ARMAMENT

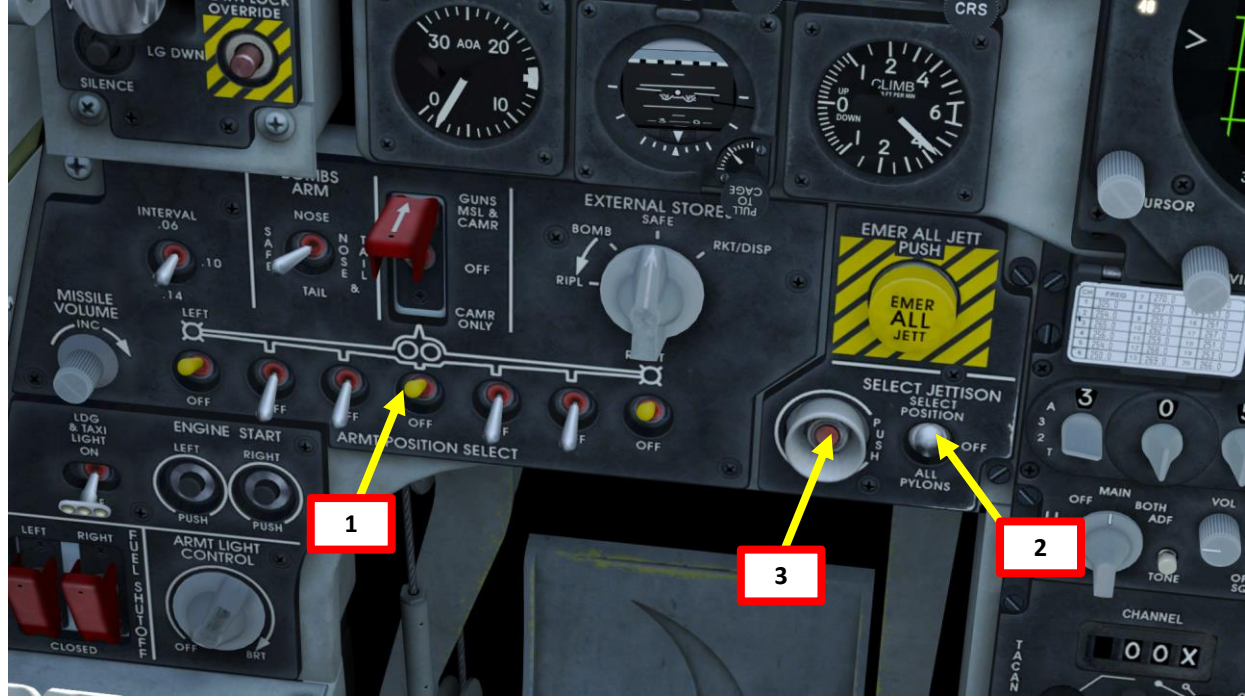
AIR-TO-GROUND UNGUIDED BOMBS
MK-82, MK-83, MK-84, M-117



PART 9 – OFFENCE
WEAPONS & ARMAMENT

HOW TO JETTISON ORDNANCE

1. Select the pylon that you want to jettison (in our case, we will select the central one).
2. Set the SELECT JETTISON selector to “SELECT POSITION”
3. Press the “PUSH” button.



PART 10 – DEFENCE
RWS & COUNTERMEASURES

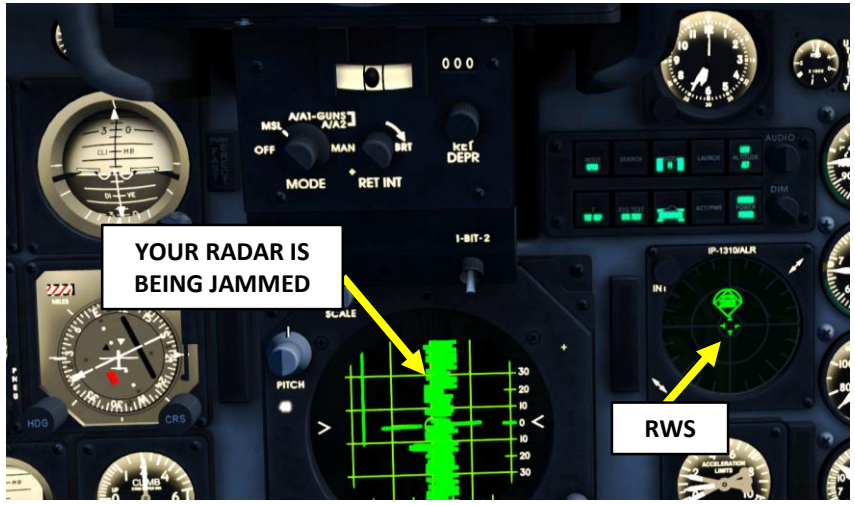
COUNTERMEASURES – INTRODUCTION

Countermeasures are very simple to use. You have two countermeasure types at your disposal: flares and chaff. We will explore together what is used against what, and how.

Missiles can generally track you using 2 things: radar signature (radar waves are sent on you and you reflect them, which is called a "radar signature") and heat signature (like the exhaust of your 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 RWS (Radar Warning System) is for: to help you know what is firing at you so you can take the adequate action to counter it.

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

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



PART 10 – DEFENCE
RWS & COUNTERMEASURES

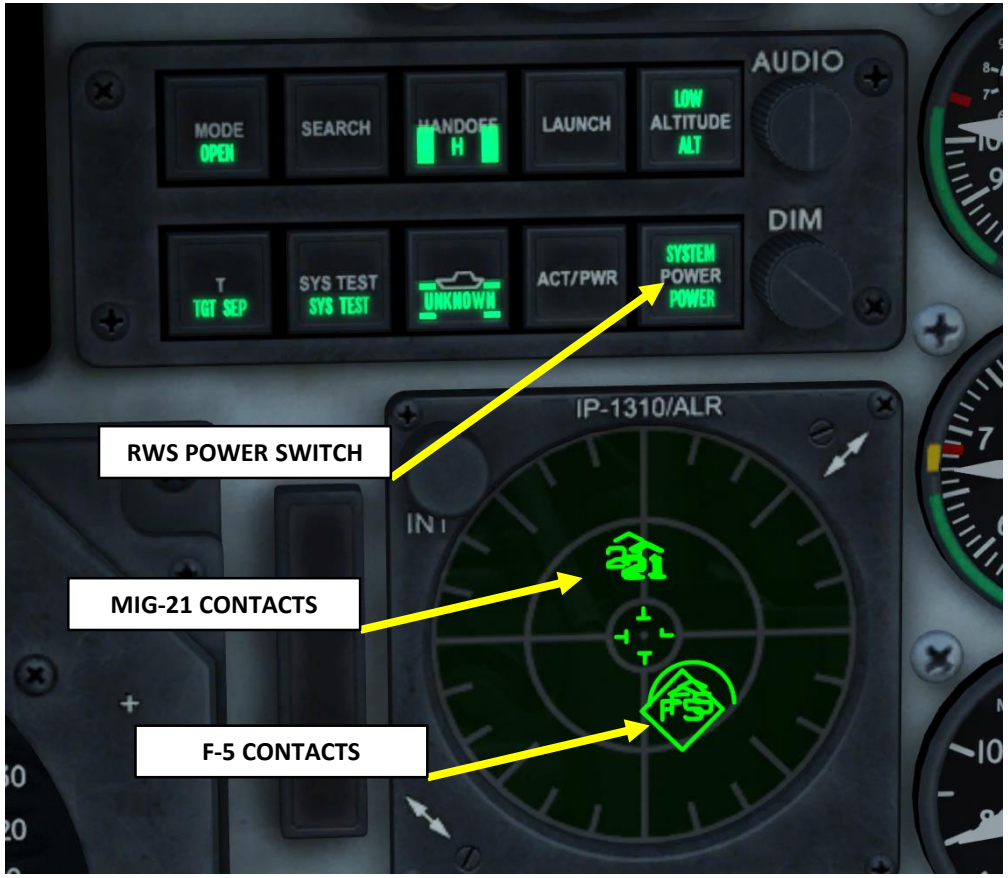
RWS – RADAR WARNING SYSTEM

The RWS is basically a top-down view of your aircraft. The aircraft in the upper quadrants are to your front while the aircraft on the lower quadrants are to your rear. To power the RWS, simply press the POWER button.

Each symbol on the RWS has three states:

- Symbol without circle: someone's radar is looking for you but has no lock.
- Symbol with circle: someone's radar has a lock on you.
- Symbol with flashing circle: a radar-guided weapon has been fired and is heading straight to you.

Note: The symbol with a diamond represents the biggest threat to you. Keep in mind that the RWS cannot distinguish between friendly or enemy contacts or missile launches.



Symbol	Identification
	Ground-to-Air Radars
A	Gepard and ZSU-23-4 Shilka self-propelled antiaircraft guns
S6	2S6 Tunguska self-propelled antiaircraft gun
3	S-125 Neva (SA-3) surface-to-air missile system
6	Kub (SA-6) surface-to-air missile system
8	Osa (SA-8) surface-to-air missile system
10	Acquisition radar of S-300 (SA-10) surface-to-air missile system
CS	Low-altitude acquisition radar (Clam Shell) of S-300 (SA-10) surface-to-air missile system
BB	Acquisition radar (Big Bird) of S-300 (SA-10) surface-to-air missile system
11	Acquisition radar of Buk (SA-11/17) self-propelled, medium-range surface-to-air missile systems
SD	Search radar (Snow Drift) of Buk (SA-11/17) self-propelled, medium-range surface-to-air missile systems
13	Strela-10 (SA-13) surface-to-air missile system
DE	Search radar of Sborka mobile reconnaissance and command center (Dog Ear)
15	Tor (SA-15) surface-to-air missile system
RO	Roland surface-to-air missile system
PA	Patriot surface-to-air missile system
HA	Hawk surface-to-air missile system
S	Ground-based early warning systems

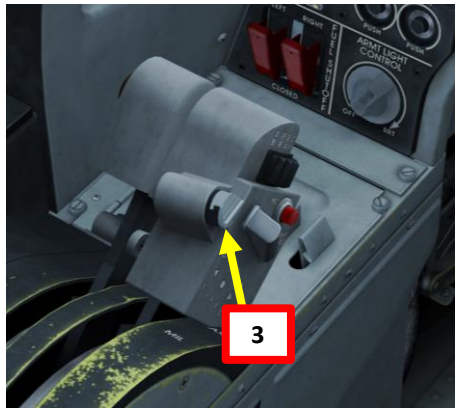
	Air-to-air radars
E3	E-3A airborne early warning and control aircraft
E2	E-2C airborne early warning and control aircraft
50	A-50U airborne early warning and control aircraft
21	MiG-21
23	MiG-23ML
25	MiG-25PD
29	MiG-29, Su-27, and Su-33
31	MiG-31
30	Su-30
34	Su-34
M2	Mirage 2000-5
F4	F-4
F5	F-5
14	F-14
15	F-15
16	F-16
18	F/A-18

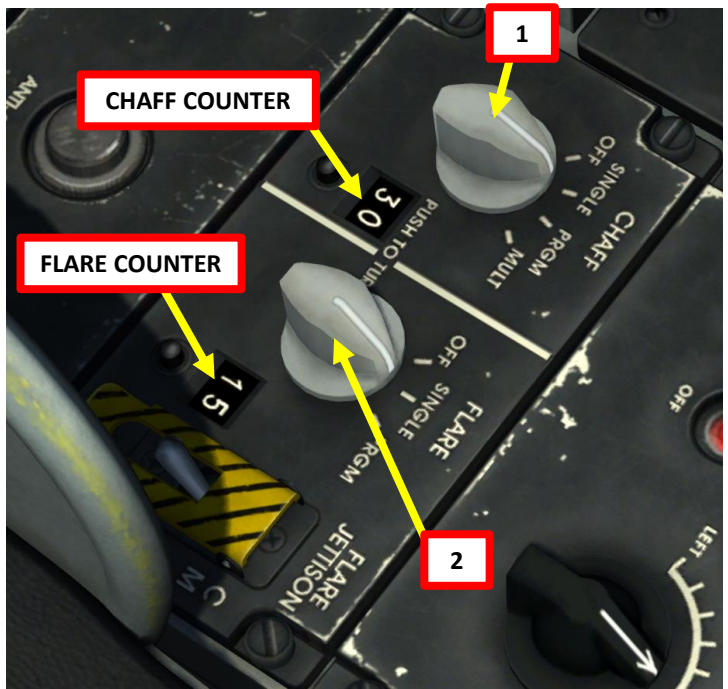
PART 10 – DEFENCE
RWS & COUNTERMEASURES

CHAFF AND FLARES

To deploy chaff and flares, you have to do the following:

1. Select the CHAFF mode selector and set it to SINGLE.
2. Select the FLARE mode selector and set it to SINGLE.
3. Press the FLARE CHAFF button on your throttle (“Q”) to pop flares and chaff.

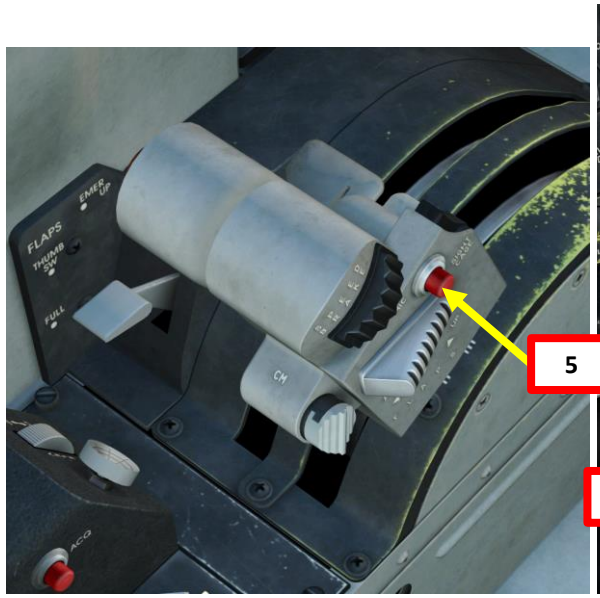




PART 11 – RADIO TUTORIAL

- The **AN/ARC-164 UHF** radio set is used for wingmen, support flights, air traffic controllers
  - Frequencies between 225.000 and 399.975 MHz
- To communicate:
  1. Set COMMUNICATIONS ANTENNA to AUTO
  2. Set UHF mode to MAIN
  3. Set UHF frequency mode to MANUAL
  4. Set UHF frequency manually
  5. Transmit using the UHF RADIO MICROPHONE BUTTON (RAlt+\ ).

  NOTE: while you are in the air, the nose wheel steering button on the stick [key binding: “S”] can also be used as a push-to-talk button. This is a real-life feature of the aircraft.



PART 11 – RADIO TUTORIAL

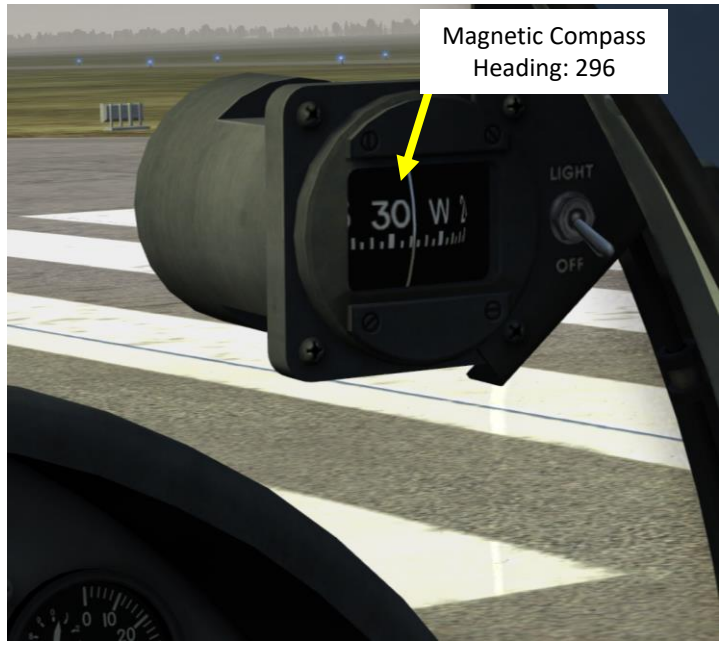
PART 12 – NAVIGATION

NAVIGATION - INTRODUCTION

The F-5 does not come with fancy avionics: most of your navigation has to be done visually. In order to know your heading, you have the Magnetic Compass and the HSI (Horizontal Situation Indicator) at your disposal.

You can track TACAN beacons. The TACAN is a Tactical Air Navigation System used by the military. TACAN beacons can be placed on ground stations, airfields or even aircraft themselves like tankers. A TACAN beacon will provide you line-of-sight bearing and range to the selected TACAN station.

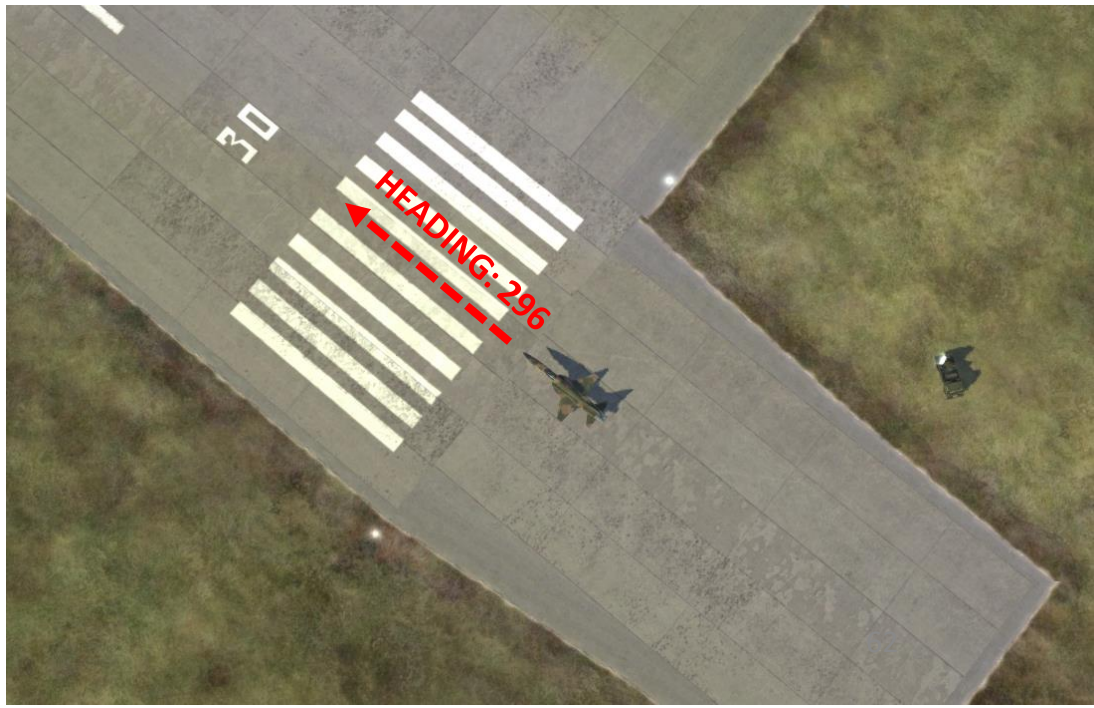
You can also use the UHF/ADF (Automatic Direction Finder) radio, which provides direction-finding capability but no range unlike the TACAN.



Take note that there are only five airfields equipped with TACAN beacons:

Kobuleti - 67X "KBL"
Vaziani - 22X "VAS"
Kutaisi - 44X "KTS"
Senaki - Kolkhi - 31X "TSK"
Batumi - 16X "BTM

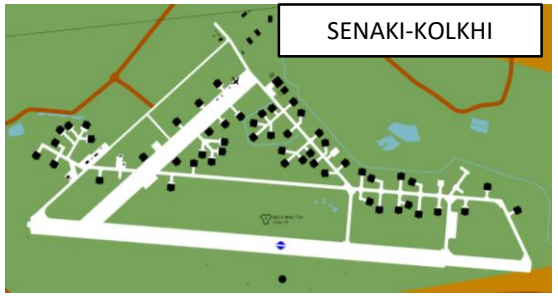
The vertical gyro may tilt and pitch and roll readings of your attitude instruments (mainly ADI and HSI) will accumulate drift errors as you fly and manoeuver. To reset the AHRS (Attitude and Heading Reference System), press the “FAST ERECT” button.

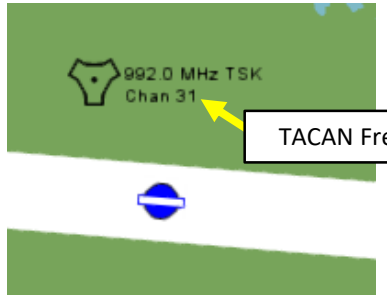


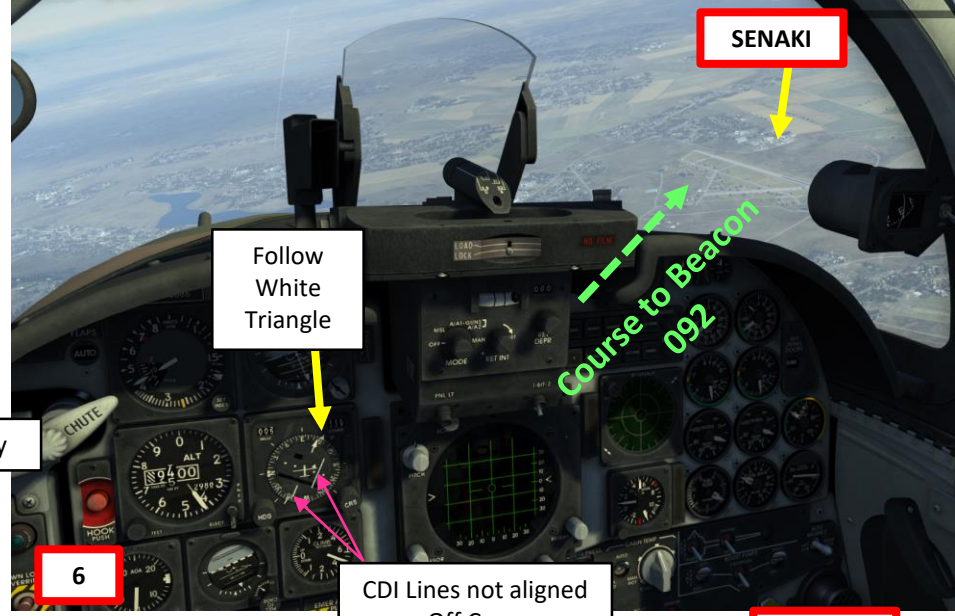
PART 12 – NAVIGATION

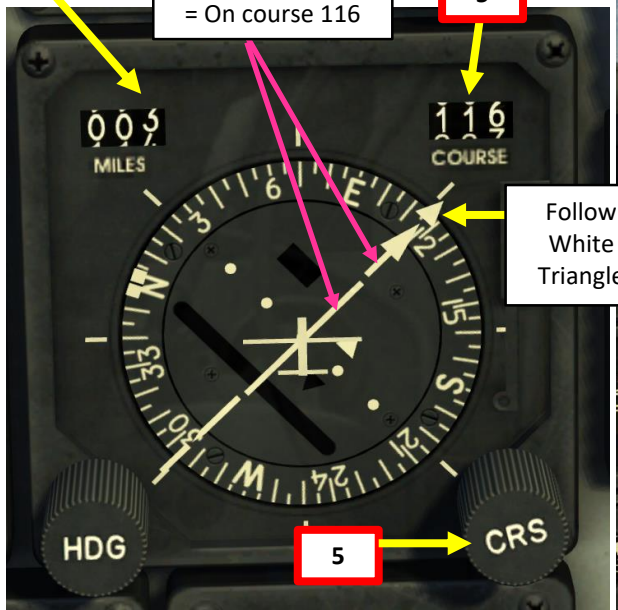
TACAN NAVIGATION TUTORIAL

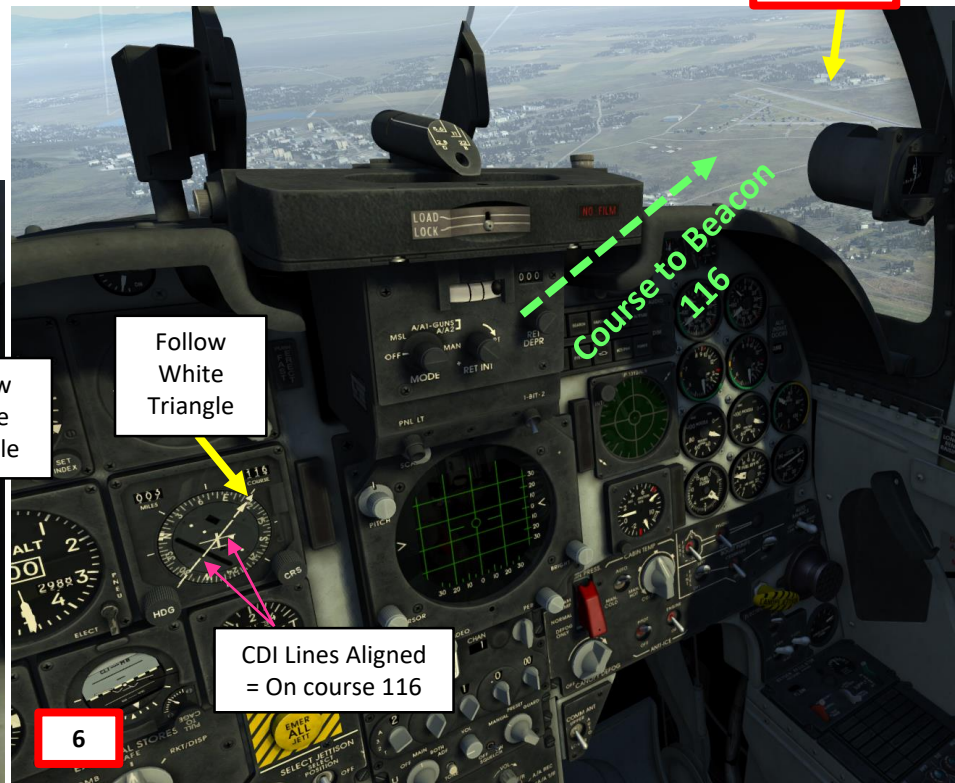
1. In this tutorial, we will be tracking a TACAN beacon located on Senaki-Kolkhi Airport (freq. 31X) while following a course of 116. We do not necessarily have to follow a course of 116 but this exercise will show you how to track a beacon using a given course, which can be useful when planning multiple legs during a flight.
2. Set TACAN Mode to Transmit/Receive (T/R).
3. Set TACAN frequency to 31X. (Scroll mousewheel on left and right knobs to set 31 and right click on right knob to set X).
4. Set NAVIGATION MODE to TACAN.
5. On HSI, set course to 116 using the CRS knob.
6. Fly towards the direction indicated by the small white triangle on the HSI. Align the CDI (Course Deviation Indicator) lines to follow course 116.







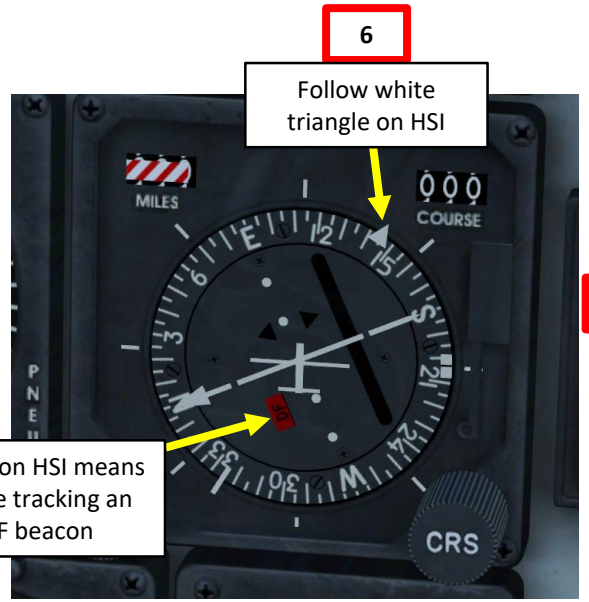


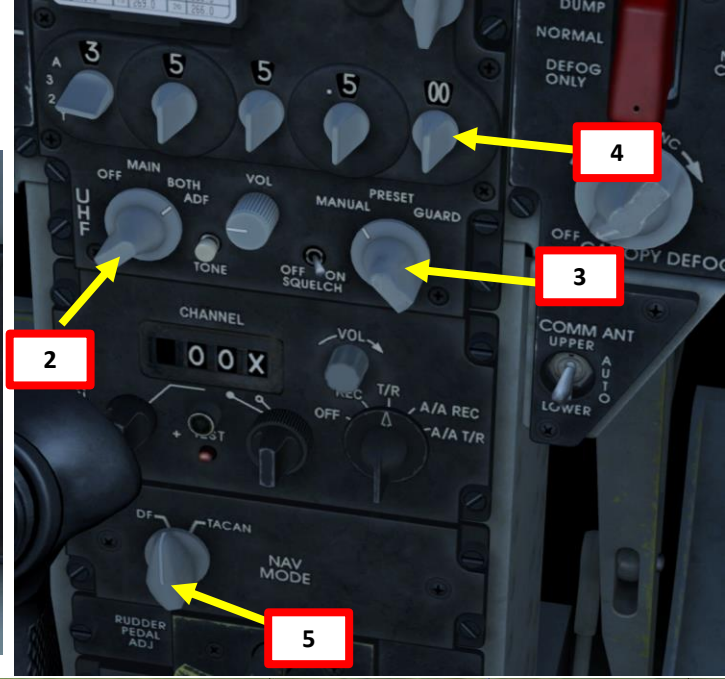


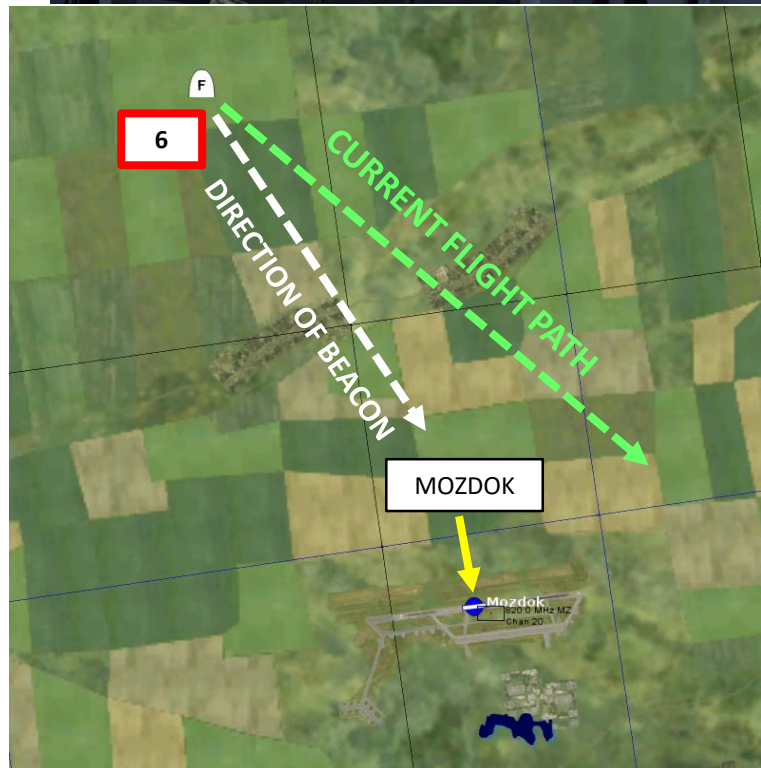
PART 12 – NAVIGATION

ADF NAVIGATION TUTORIAL

1. Read mission briefing to determine on what UHF frequency the beacon will transmit. In our case, the beacon is located in a truck placed NEAR Mozdok Airport and has a frequency of 355.5 MHz. Take note that these special beacons are usually triggers done via the mission editor and are not NDBs (Non-Directional Beacons) available in the map.
2. Set UHF Radio Mode to ADF
3. Set UHF Frequency Mode to MANUAL
4. Set UHF frequency to 355.5 MHz
5. Set NAVIGATION MODE to DF (Direction Finder)
6. Fly towards the direction indicated by the small white triangle on the HSI.







PART 13 – AIR COMBAT TIPS

Since you will most likely be facing the MiG-21 in combat, here are a couple of tips.

The MiG-21 is all about energy and acceleration using hit and run tactics, while the F-5 has excellent agility that makes it surprisingly dangerous in the turning fight.

The main advantage of the F-5 is that it can detect the MiG-21 more easily with its radar. This allows you to plan your ambushes carefully. The MiG-21 is a superb climber, so don't try to follow it in a climb. The F-5's roll rate can be very useful in scissor fights: use this to your advantage.

Here is a very instructive video by WAT on the art of fighting in the MiG-21, which shows the strengths and weaknesses of the F-5 as well.
https://www.youtube.com/watch?v=Ibrvzon1ByA

MiG-21

- Faster Acceleration
- Great energy fighter
- Faster but has a 1300 KIAS Speed limit before compressor stall occurs
- Radar Guided missiles and Rear Aspect R-60 Fox-2's (Infrared-guided missiles)
- Less Situation Awareness since radar is a little more primitive than the F-5E's
- More important workload
- Has IFF (Can identify Friend or Foe with the Radar)
- Smaller Roll Rate than the F-5

F-5E

- Simpler to use and operate
- Better Canopy view for Situation Awareness
- All-aspect Aim-9P5 Fox 2's (Infrared-guided missiles)
- No Radar-guided Missiles
- Has a slightly better turn rate than the MiG-21
- Better Radar than the MiG-21, but cannot identify friend from foe (no IFF)
- Can carry a lot of Air-to-Ground ordnance

More MiG-21 videos by Hadwell, one of the best MiG pilots in multiplayer

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

https://www.youtube.com/watch?v=OPh24YChcQw

https://www.youtube.com/watch?v=W0fHJUzb2E8

https://www.youtube.com/watch?v=8gH5cR7-x_Y

PART 14 – OTHER RESOURCES

RESOURCES

Belsimtek's F-5E3 Manual
https://drive.google.com/open?id=0B-uSpZROuEd3OEQtanFyQW01dE0

Full flight manual of the F-5E
http://www.476vfightergroup.com/downloads.php?do=file&id=445

476th Virtual Fighter Group Database
http://www.476vfightergroup.com/downloads.php

F-5E Weapon Delivery Manual from the 476th Virtual Fighter Group
http://www.476vfightergroup.com/downloads.php?do=file&id=446

476th Virtual Fighter Group Youtube Channel
https://www.youtube.com/user/476vFG/videos

Bunyap Sims Test Flight Series – F-5E Tiger II
https://www.youtube.com/playlist?list=PLoiMNu5jyFzTWpTVFFz9wls4woqHzRloY

WinchesterDelta's F-5E Tiger II Tutorial
https://www.youtube.com/watch?v=h_AOkCka1dg

Northrop F-5 Freedom Fighter Documentary
https://www.youtube.com/watch?v=AvDfs6s4tbA


DCS digital combat series
Chuck_Owl
F-5E TIGER II
INSTANT ACTION
CREATE FAST MISSION
MISSION
CAMPAIGN
MULTIPLAYER
LOGBOOK
ENCYCLOPEDIA
TRAINING
REPLAY
MISSION EDITOR
CAMPAIGN BUILDER
EXIT
A-10C 1.5.4
Bf 109 K-4 1.5.4 beta
C-101 2.1.0 Beta
CA 1.5.4
F-5E 1.5.4 WIP
F-86F 1.5.4
FC3 1.5.4
Fw 190 D-9 1.5.4
Hawk 1.5.4 Beta
Ka-50 1.5.4
L-39 1.5.4
M-2000C 1.5.4 Beta
Mi-8MTV2 1.5.4 beta
MiG-15bis 1.5.4
MiG-21bis 1.5.4
P-51D 1.5.4
SA342 1.5.4 beta
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