DCS GUIDE

MiG-19P

BY CHUCK LAST UPDATED: 6/06/2019

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

The **Mikoyan-Gurevich MiG-19P** (МИГ-19П) is a Soviet second generation, single-seat, twin jet-engined fighter aircraft. The P stands for “Perekhvahtchik” or “Interceptor”. With a NATO reporting name of “Farmer”, the MiG-19 was the first Soviet production aircraft capable of supersonic speeds in level flight. A comparable U.S. "Century Series" fighter was the North American F-100 Super Sabre, although the MiG-19 would primarily oppose the more modern McDonnell Douglas F-4 Phantom II and Republic F-105 Thunderchief over North Vietnam.

On 20 April 1951, OKB-155 was given the order to develop the MiG-17 into a new fighter called "I-340", which was to be powered by two Mikulin AM-5 non-after-burning jet engines (a scaled-down version of the Mikulin AM-3) delivering 19.6 kN of thrust. The I-340 was supposed to attain 1,160 km/h (Mach 1) at 2,000 m, 1,090 km/h (Mach 0.97) at 10,000 m, climb to 10,000 m in 2.9 minutes, and have a service ceiling of no less than 17,500 m. The new fighter, internally designated "SM-1", was designed around the "SI-02" airframe (a MiG-17 prototype) modified to accept two engines in a side-by-side arrangement and was completed in March 1952.

The I-340 suffered from poor cockpit pressurization and the engines proved temperamental with frequent flameouts and surges with rapid throttle movements. The engines were upgraded to the AM-5A standard delivering 21.1 kN of thrust each, which exceeded the power output of the Klimov VK-1F in afterburner while providing better fuel economy. The SM-1 was barely supersonic, reaching 1,193 km/h at 5,000 m (Mach 1.03). This performance was deemed insufficient for the new supersonic fighter and an after-burning version of the engine, the AM-5F, was proposed. While not implemented, the AM-5F served as the basis for the Tumansky RD-9 which powered production aircraft. Further development of the twin-engine concept resulted in a government request for the "I-360", internally designated "SM-2", powered by the AM-5F engines, but featured a highly swept wing.

The I-360 (SM-2), built in 1952, had a 1.6 m (5.2 ft) longer fuselage, wingspan reduced to 9.04 m (29.7 ft), and its weight increased to 6,802 kg and a new 55° sweep wing. The Nudelman N-37D cannon were moved to the wing roots to open up space in the nose for the radar. The cockpit and landing gear were redesigned and a vertical stabilizer of increased area mounting a T-tail was fitted. In April 1952, the first prototype was sent to the *Letno-Issledovatel'skiy Institut* (Flight Research Institute) (LII), flying for the first time on 27 May 1952 by G. A. Sedov. It was immediately clear that the AM-5A engines were not powerful enough, and they were replaced with AM-5F delivering 21.09–26.49 kN (dry – wet thrust), allowing a maximum speed of Mach 1.19 in horizontal flight. Flight testing prompted modifications to the air-brakes and control surfaces, re-designated as the SM-2A and after further modifications the prototype was re-designated again as the SM-2B.

The second prototype, SM-2/2 introduced horizontal stabilizers mounted on the upper rear fuselage and guns with shorter barrels. However, the AM-5F engine was still not considered powerful enough, and both prototypes received yet more powerful 25.5–31.9 kN (dry – wet) Mikulin AM-5B engines. Production versions of the AM-5 (Tumansky RD-9) were re-designated RD-9B and the SM-2B was re-designated SM-9/1 when these engines were fitted, effectively becoming the prototype of the MiG-19 series, flying for the first time on 5 January 1954, piloted by G. A. Sedov, making a total of 132 flights. Final changes included a modified air intake, new 23 mm (0.906 in) Nudelman-Rikhter NR-23 guns with 340 rpg, RSIU-3M "Klen" radio, "Uzel-1" transponder, and SRDM-1M "Konus" radio-rangefinder.

Initial enthusiasm for the aircraft was dampened by several problems, the most alarming inherited from MiG-15/MiG-17 was the danger of mid-air tank implosions when more than half of the fuel had been used—the leaking fuel of the crushed fuselage fuel tanks located between the engines would then ignite, leading to a fatal explosion. Furthermore, deployment of air-brakes at high speeds caused a high-g pitch-up, elevators lacked authority at supersonic speeds, and the aircraft possessed a high landing speed of 230 km/h. Absence of a two-seat trainer version slowed pilot transition to the type. Handling problems were addressed with the second prototype, SM-9/2, which added a third ventral air-brake and introduced all-moving tail-planes with a damper to prevent pilot-induced oscillations (PIO) at subsonic speeds, flying for the first time on 16 September 1954, and entering initial production as the MiG-19.

The Council of Ministers of the Soviet Union issued an order #286-133 to start serial production on 17 February 1954 at factories in Gorkiy and Novosibirsk. Factory trials were completed on 12 September 1954, and government trials started on 30 September. Problems with the initial production MiG-19, were addressed in the SM-9/3 prototype which presaged the MiG-19S production version, which supplanted the initial MiG-19 in production at Gorkiy and Novosibirsk from June 1956.

Approximately 5,500 MiG-19s of all versions were produced, in the USSR, Czechoslovakia as the Aero S-105 and People's Republic of China as the Shenyang J-6. The aircraft saw service with a number of other national air forces, including those of Cuba, North Vietnam, Egypt, Pakistan, and North Korea. The aircraft saw combat during the Vietnam War, the 1967 Six-Day War, and the 1971 Bangladesh War. All Soviet-built MiG-19 variants were single-seaters only, although the Chinese developed the Shenyang JJ-6 trainer version of the Shenyang J-6. With stabilization problems and "numerous crashes", the Russians had lost faith in the MiG-19, and moved on to the newly emerging MiG-21.

The J-6 remained a staple of the Chinese People's Liberation Army Air Force (PLAAF) until the 1980s and has also been developed into the Nanchang Q-5 (NATO reporting name "Fantan") attack aircraft. Despite its age, the MiG-19 and its descendants exhibit good handling characteristics at low altitude and a surprisingly high rate of climb, and their heavy cannon armament, (a one-second burst from three 30 mm Nudelman-Rikhter NR-30 cannon had a total projectile mass of 18 kg (40 lb) making the MiG-19 a formidable adversary in close combat. The MiG-19P simulated in DCS has these powerful NR-30 cannons.

The Vietnam People's Air Force (VPAF) began receiving the MiG-19 at the end of Operation Rolling Thunder, which ended in 1968. Despite their limited numbers, MiG-19s were involved in extensive combat during Operations Linebacker and Linebacker 2. The VPAF claimed only seven victories over U.S. aircraft, using the MiG-19, all of which were F-4 Phantom IIs. The MiG-19 was tested by U.S. pilots in the United States in 1969 after receiving a Chinese J-6 (F-6 exported model) from Pakistan. In addition to finding the aircraft to have a good canopy allowing good visibility for the pilot, along with three hard hitting 30 mm cannons, U.S. pilots found the MiG-19 (J6/F6) to be an excellent fighter, "like the MiG-17, it could easily out-turn the Phantom...and could out-accelerate the F-4 out to Mach 1.2, but was slower than the MiG-21." However, the MiG-19's strongest fault was its extremely short range, as one U.S. test pilot remarked, "after going in full after-burner at low altitude for five minutes, the MiG driver will be looking for a place to land!" This, combined with the aircraft's twin engines, which were difficult to maintain, made the MiG-19 unpopular with North Vietnamese pilots.

PART 1 – INTRODUCTION

Above: A MiG-19S with undercarriage extended on final approach. The barrel of the massive NR-30 cannon in the starboard wing root may be clearly seen.

Key to Mikoyan-Gurevich MiG-19S

1 *Pitot tube (hinged)*
2 *Bifurcated intake*
3 *Combat camera (offset to starboard)*
4 *Nose intake ring*
5 *Access panel*
6 *Nosewheel retraction cylinder*
7 *Nudelmann-Rikhter NR-30 revolver-type cannon (starboard lower fuselage) of 30-mm calibre*
8 *Nosewheel doors*
9 *Taxying light*
10 *Nosewheel leg assembly*
11 *Axle fork*
12 *Forward-retracting nosewheel (500 × 180 mm tyre)*
13 *Shock absorber*
14 *Ranging aerial*
15 *Oxygen bottles*
16 *Intake trunking (port)*
17 *RSIU-4 VHF receiver*
18 *RSIU-4 VHF transmitter*
19 *Accumulator*
20 *RV-2 radio altimeter transmitter/receiver*
21 *Windscreen*
22 *ASP-5N automatic gyroscopic gunsight (coupled with SRD rangefinder)*
23 *Instrument panel shroud*
24 *Starboard console*
25 *Control column*
26 *Rudder pedal assembly*
27 *Intake duct section*
28 *NR-30 cannon muzzle*
29 *Landing light*
30 *NR-30 cannon barrel fairing*
31 *Ejector seat pan*
32 *Canopy external release/lock*
33 *Ejection seat*
34 *Headrest*
35 *Single-piece jettisonable canopy*
36 *ARK-5 radio compas antennae (in canopy)*
37 *Cabin pressurization compressed air system*
38 *RSIU-4 VHF antenna*
39 *Four-spar wing structure (main and three auxiliary)*
40 *Mainspar (inboard section)*
41 *Starboard mid-span full-chord boundary layer fence*
42 *Wing skinning*
43 *Starboard navigation light*
44 *Starboard aileron*
45 *Fuel dump vents*
46 *Starboard auxiliary fuel tank of 167 Imp gal (760 l) capacity*
47 *Starboard hydraulically-powered Fowler-type flap*
48 *Flap hinge fairing*
49 *Ram air intakes*
50 *Dorsal spine housing control rod tunnel*
51 *Fuel filler cap*
52 *Main (Nos 1 and 2) fuel tanks of 323 Imp gal (1 470 l) and 72·6 Imp gal (330 l) capacity*
53 *Intake cut-out frames*
54 *Hydraulics accumulator*
55 *Port Tumanski RD-9B turbojet*
56 *Slot intakes*
57 *Air conditioning system*
58 *Slab-type tailplane control rod linkage*
59 *Fuselage break point*
60 *Air intake*
61 *Hydraulics tank*
62 *Oil tanks*
63 *Rudder control linkage*
64 *Fuselage aft frames*
65 *Filler cap for aft tanks (Nos 3 and 4) of 39·6 Imp gal (180 l) and 38·4 Imp gal (175 l) capacity*
66 *Air intake*
67 *Tailplane control hydraulic actuator*
68 *Tailfin front spar*
69 *Starboard hydraulically-actuated one-piece tailplane*
70 *Anti-flutter weight*
71 *Tailfin structure*
72 *ARK-5 radio compass mounting*
73 *Tail warning radar amplifier*
74 *Rudder balance*
75 *Tail warning antenna fairing*
76 *Rear navigation light*
77 *Rudder hinges*
78 *Tailfin rear spar*
79 *Rudder tab*
80 *Pen-nib exhaust fairing*
81 *Anti-flutter weight*
82 *One-piece tailplane structure*
83 *Exhaust nozzle (three position) hydraulic control*
84 *Afterburner*
85 *Afterburner cooling air intakes*
86 *Tail bumper*
87 *Slab tailplane spigot*
88 *Slab tailplane actuator fairing*
89 *Tailplane (fixed) fillet*
90 *PR-19 braking chute packing panel*
91 *Ventral strake*
92 *Aft (No 4) fuel tank of 38·4 Imp gal (175 l) capacity*
93 *Filler neck*
94 *Air brake hydraulic actuating ram*
95 *Air brake (port and starboard)*
96 *Wing root fillet*
97 *Flap hinge fairing*
98 *Port flap structure*
99 *Aileron control linkage*
100 *Mainspar (inboard section)*
101 *Port mainwheel retraction cylinder*
102 *Port mainwheel well*
103 *Ammunition track*
104 *Ammunition feed*
105 *Undercarriage door (inboard section)*
106 *Angled rib*
107 *Mainspar/fuselage attachment*
108 *Port wing root cannon bay*
109 *Cannon cooling louvres*
110 *Port 30-mm Nudelmann-Rikhter NR-30 revolver-type cannon*
111 *Compressed air bottle*
112 *RV-2 radio altimeter dipole*
113 *Perforated ventral air brake*
114 *Weapons pylon (port and starboard inboard wing)*
115 *ORO-57K eight-rocket launcher*
116 *Frangible nose cap*
117 *Port auxiliary fuel tank of 167 Imp gal (760 l) capacity*
118 *Mainwheel leg fairing*
119 *Levered suspension mainwheel gear assembly*
120 *Port mainwheel (660 × 200 mm tyre)*
121 *Mainwheel door*
122 *Auxiliary tank bracing struts*
123 *Mainwheel leg pivot*
124 *Port mid-span full-chord boundary layer fence*
125 *Auxiliary tank pylon*
126 *Fuel dump vents*
127 *Port aileron*
128 *Inspection/access panel*
129 *Aileron control rod linkage*
130 *Radio altimeter dipole*
131 *Wing outboard structure*
132 *Port navigation light*

WHAT YOU NEED MAPPED (MIG-19P CONTROLS)

ASP-5 Sight Cage - Toggle
(Grey button on RHS)

↑ TRIM (NOSE) DOWN
→ TRIM RIGHT
↓ TRIM (NOSE) UP
← TRIM LEFT

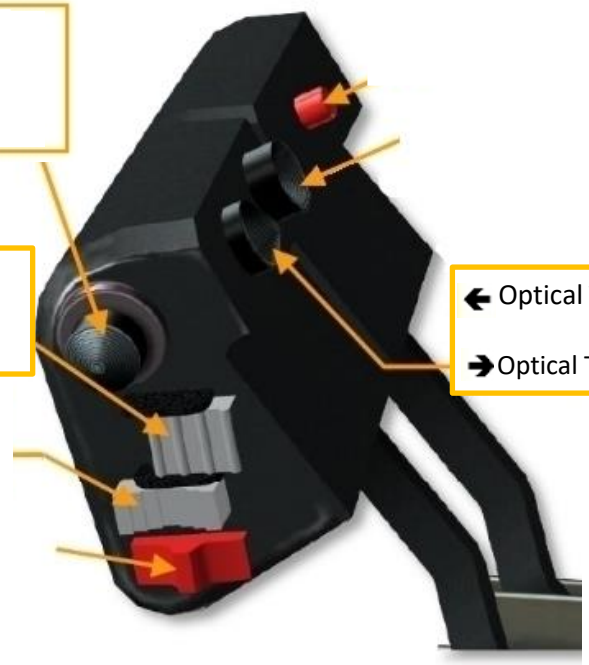
↑ Horizon Elevation Increase
→ ASP5 Sight Aiming Mode – Rockets/Bombs/NR30/Missiles
↓ Horizon Elevation Decrease
← ASP5 Sight Aiming Mode – Missiles/NR30/Bombs/Rockets

↑ ZOOM IN SLOW
→
↓ ZOOM OUT SLOW
← ASP-5 Reticle – Temporary Cage

Trigger

↑
→ COMMUNICATION MENU (\)
↓
←

←
→ Speed Brake Switch - Cycle



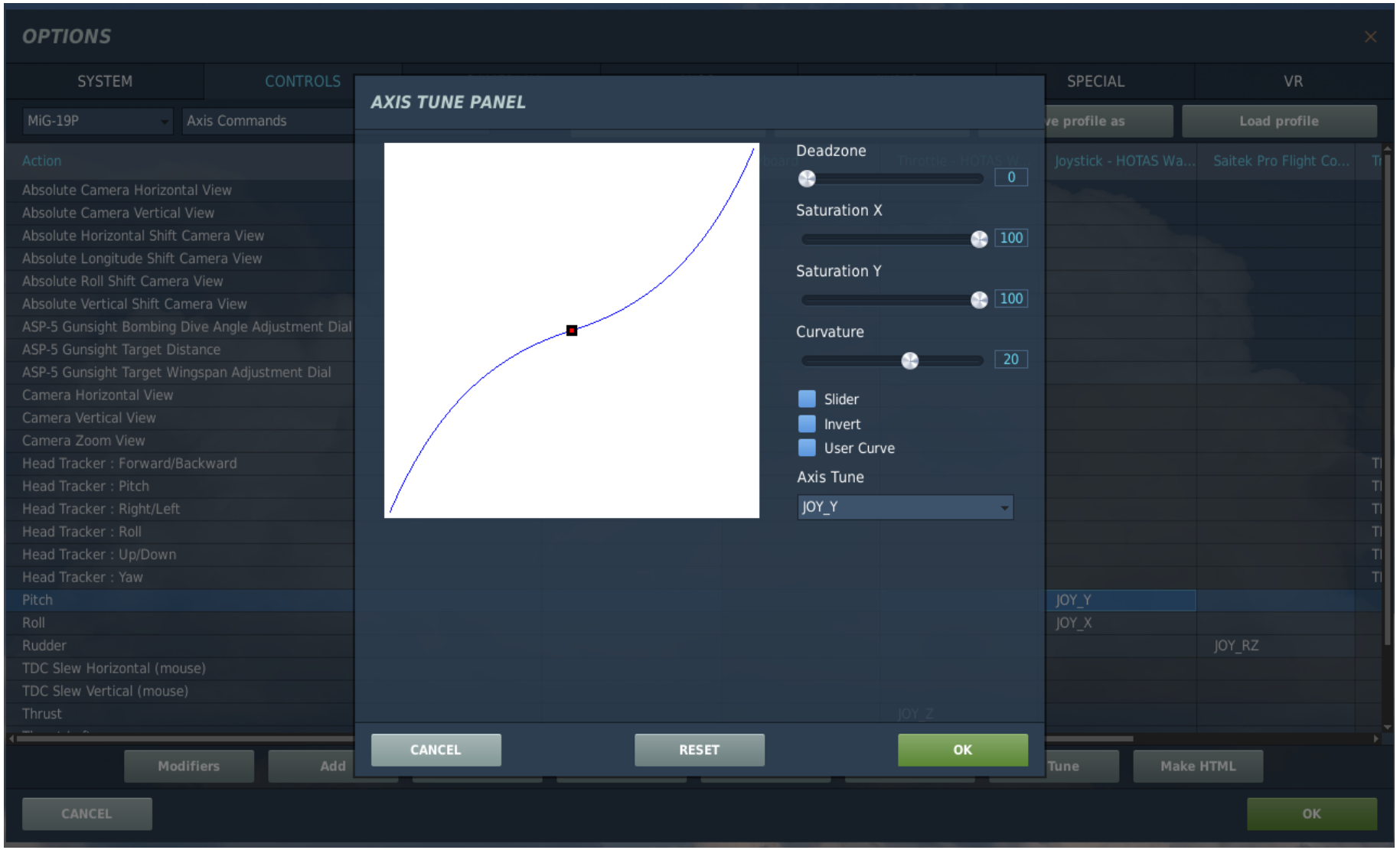
← Optical Target Range Decrease

→ Optical Target Range Increase

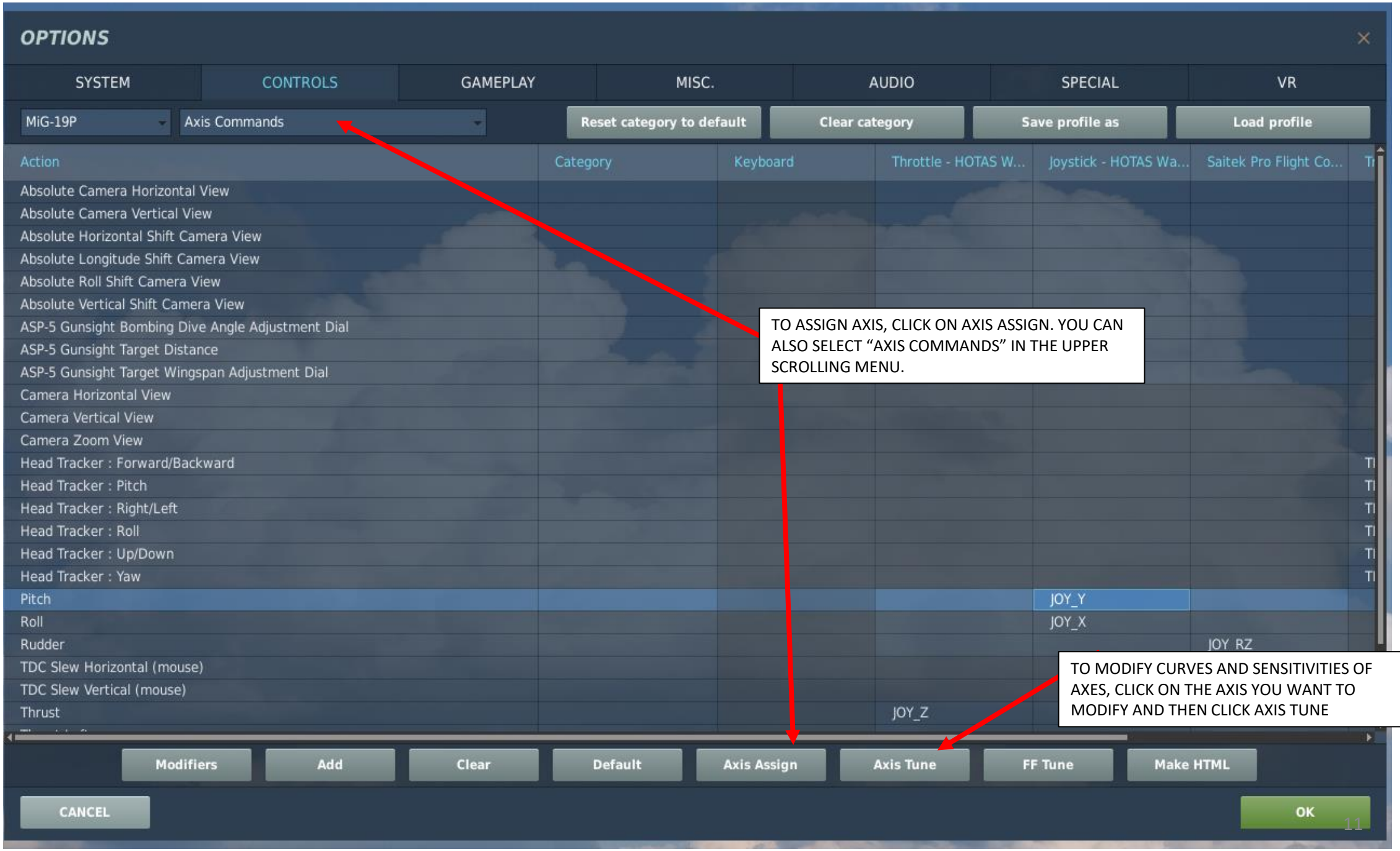
Wheel Brake – ON/OFF

Bind the following axes:

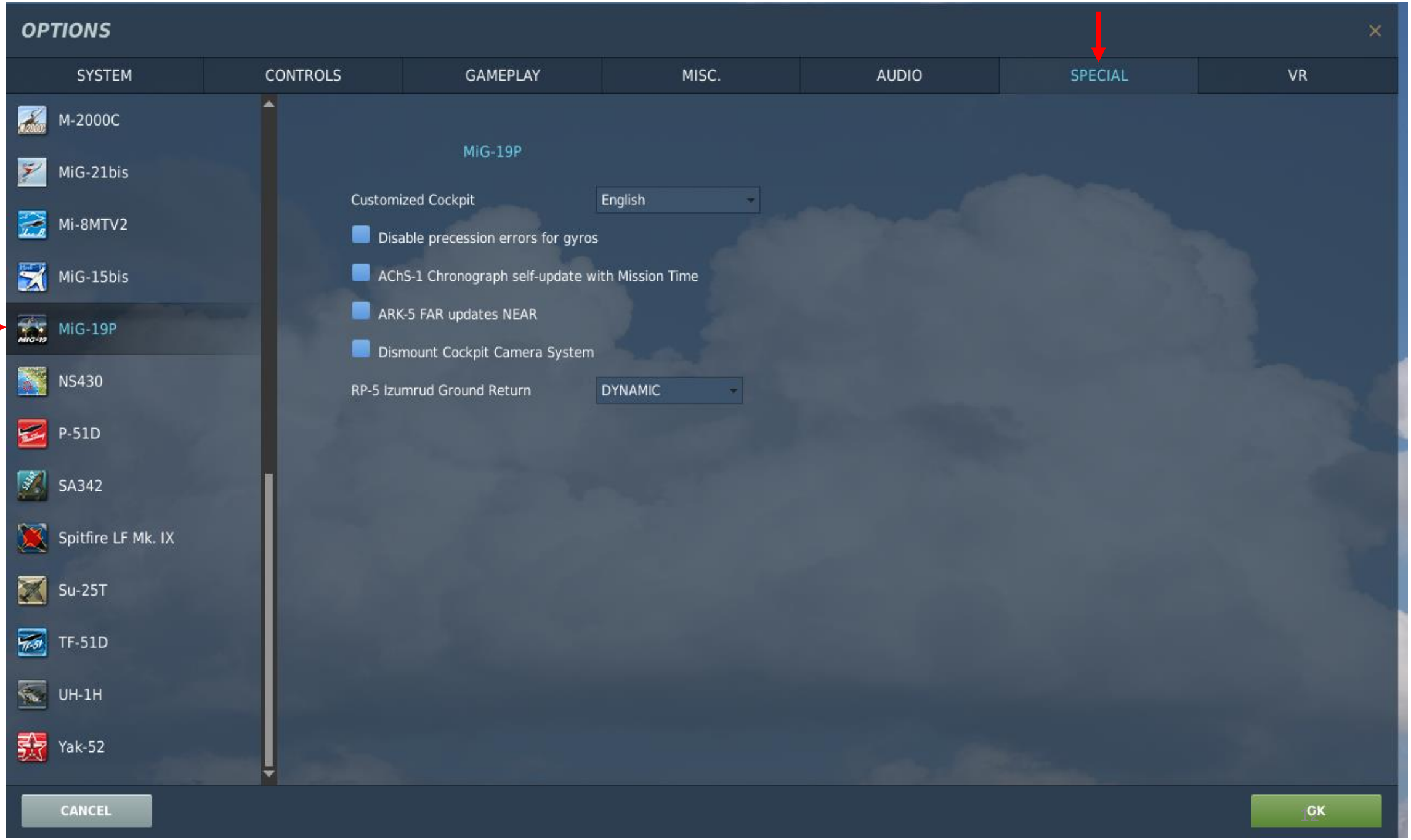
- THRUST – CONTROLS ENGINE RPM
- PITCH, ROLL, RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 20)



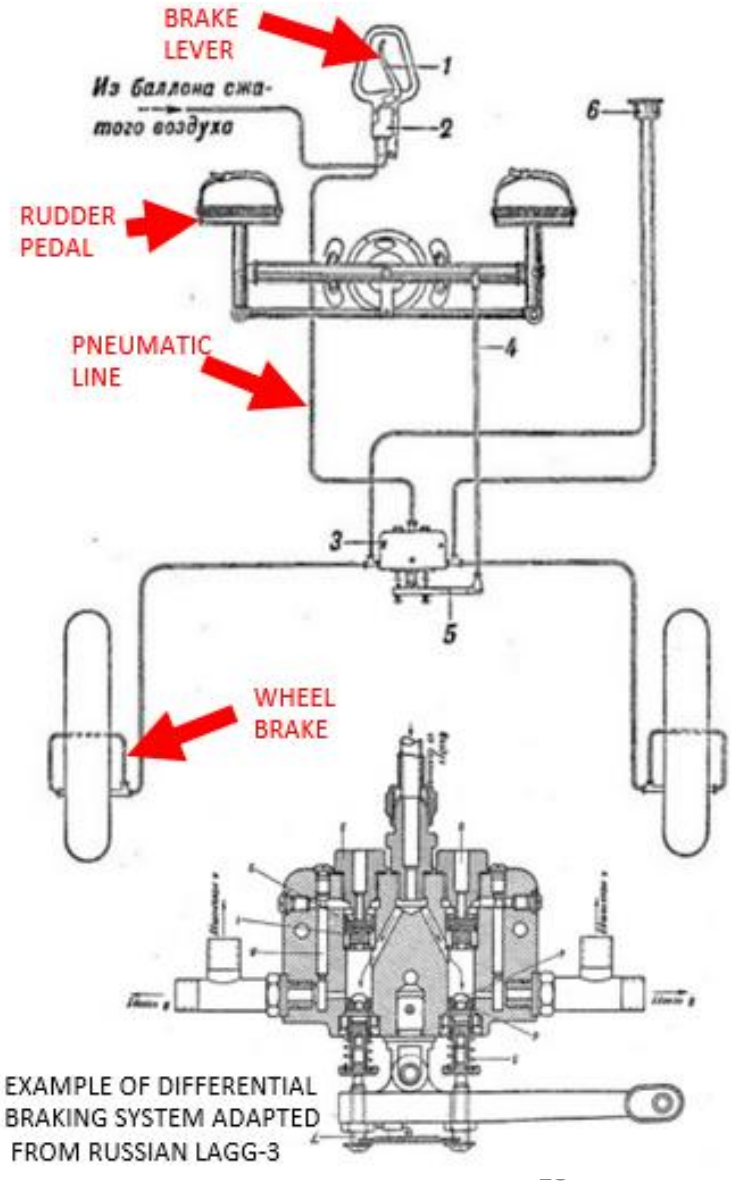
PART 2 – CONTROLS SETUP



PART 2 – CONTROLS SETUP



Braking is done by holding the braking lever while giving rudder input to steer the aircraft in the direction you want to turn. Make sure you have adequate RPM settings or your turn radius will suffer. The best way to move safely on the tarmac is to give very gentle throttle input to ensure you maintain control of the aircraft while steering left and right once in a while to check for obstacles. It is best to turn while moving and then straighten nose wheel prior to stopping.

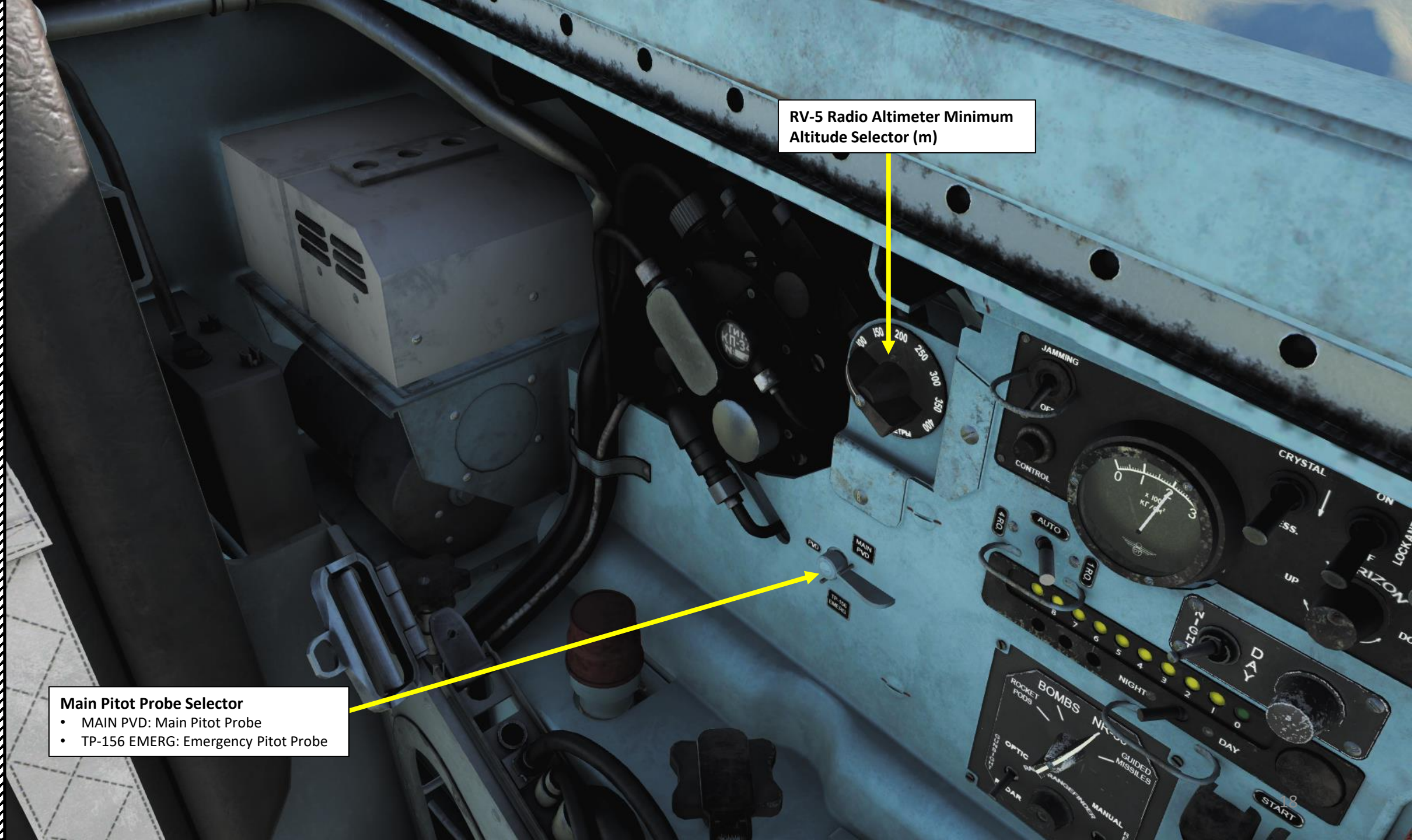


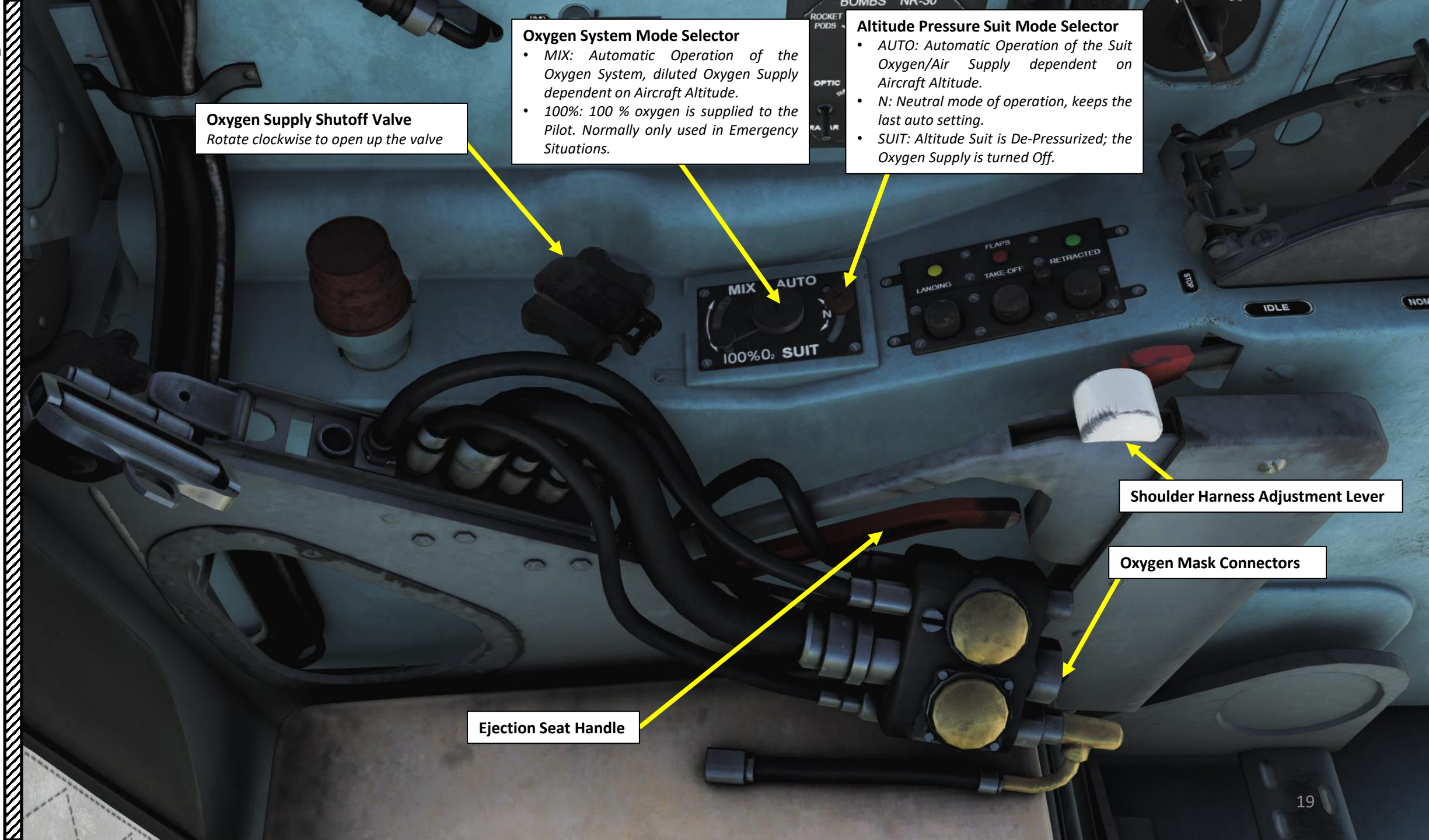
EXAMPLE OF DIFFERENTIAL BRAKING SYSTEM ADAPTED FROM RUSSIAN LAGG-3


CANOPY EMERG. JETT.
EMERG GEARS
HOMING
TARGET SPAN (M)
ANGLE
CAGE
АСП-5Н 111282


Canopy Locking Handle
FWD = LOCKED / AFT = UNLOCKED
Canopy Pressurization Switch
UP = Valve Closed (Pressurization Off)
DOWN = Valve Open (Pressurization On)
Aft Canopy Handle
Grab this handle to close the canopy
Canopy Locking Handle
FWD = LOCKED / AFT = UNLOCKED
CANOPY CLOSED PUSH HANDLE
CANOPY EMERG JETT
EMERG GEARS


HERMETIZATION
CANOPY CLOSED PUSH HANDLE
HOMING
NEAR
EMERG. JETT. BOMBS TANKS
MIX
AUTO
100%O
SUIT
IDLE
NOMINAL
M.POWER


RV-5 Radio Altimeter Minimum Altitude Selector (m)
Main Pitot Probe Selector
• MAIN PVD: Main Pitot Probe
• TP-156 EMERG: Emergency Pitot Probe
JAMMING
CONTROL
CRYSTAL
AUTO
BOMBS
ROCKET PODS
GUIDED MISSILES
OPTIC
MANUAL
NIGHT
DAY
START



Oxygen Supply Shutoff Valve
Rotate clockwise to open up the valve

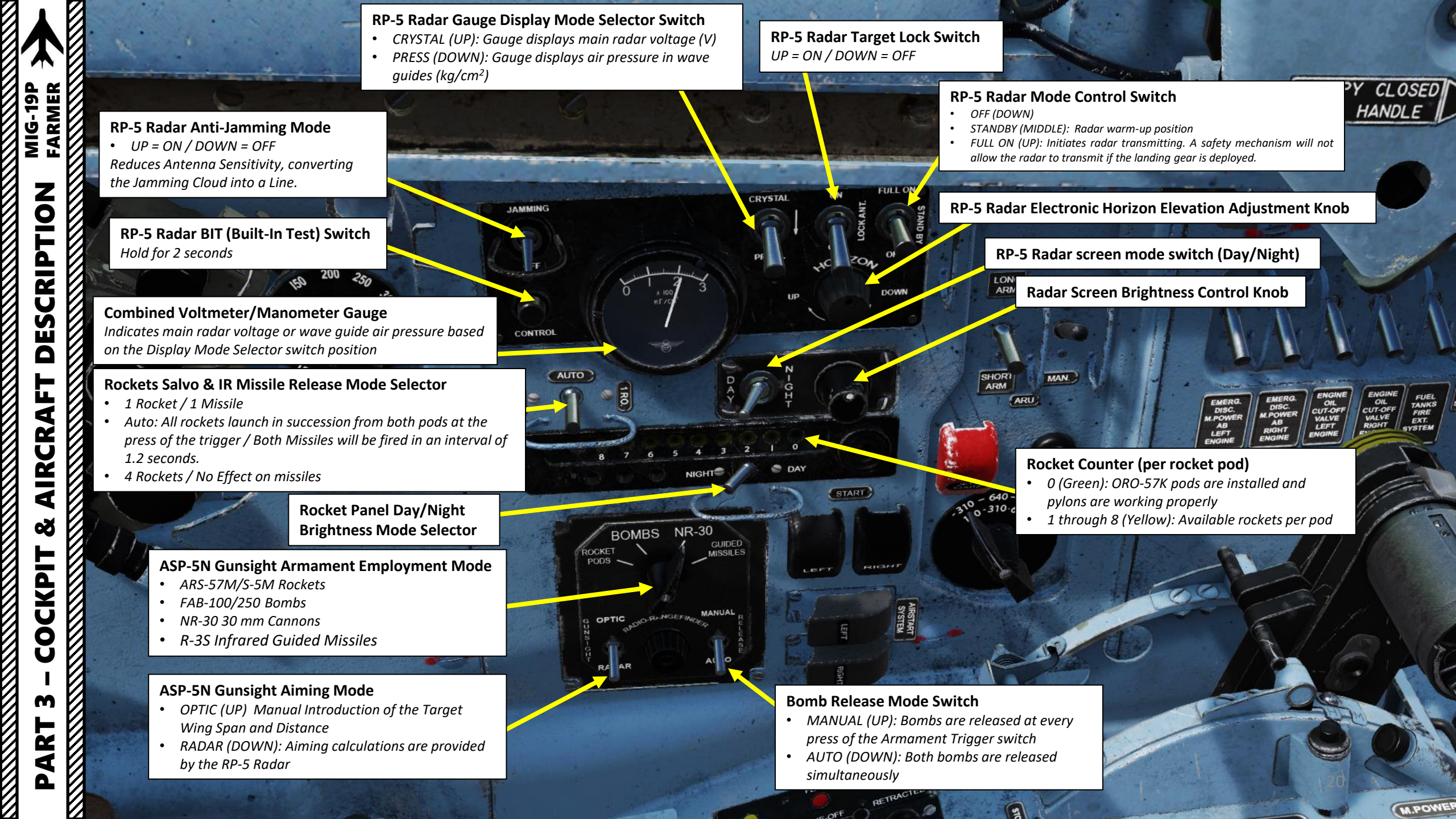
Oxygen System Mode Selector
- *MIX: Automatic Operation of the Oxygen System, diluted Oxygen Supply dependent on Aircraft Altitude.*
- *100%: 100 % oxygen is supplied to the Pilot. Normally only used in Emergency Situations.*

Altitude Pressure Suit Mode Selector
- *AUTO: Automatic Operation of the Suit Oxygen/Air Supply dependent on Aircraft Altitude.*
- *N: Neutral mode of operation, keeps the last auto setting.*
- *SUIT: Altitude Suit is De-Pressurized; the Oxygen Supply is turned Off.*

Shoulder Harness Adjustment Lever

Oxygen Mask Connectors

Ejection Seat Handle



RP-5 Radar Gauge Display Mode Selector Switch
- *CRYSTAL (UP): Gauge displays main radar voltage (V)*
- *PRESS (DOWN): Gauge displays air pressure in wave guides (kg/cm²)*

RP-5 Radar Target Lock Switch
UP = ON / DOWN = OFF

RP-5 Radar Mode Control Switch
- *OFF (DOWN)*
- *STANDBY (MIDDLE): Radar warm-up position*
- *FULL ON (UP): Initiates radar transmitting. A safety mechanism will not allow the radar to transmit if the landing gear is deployed.*

RP-5 Radar Anti-Jamming Mode
- *UP = ON / DOWN = OFF*

Reduces Antenna Sensitivity, converting the Jamming Cloud into a Line.

RP-5 Radar Electronic Horizon Elevation Adjustment Knob

RP-5 Radar BIT (Built-In Test) Switch
Hold for 2 seconds

RP-5 Radar screen mode switch (Day/Night)

Radar Screen Brightness Control Knob

Combined Voltmeter/Manometer Gauge
Indicates main radar voltage or wave guide air pressure based on the Display Mode Selector switch position

Rockets Salvo & IR Missile Release Mode Selector
- *1 Rocket / 1 Missile*
- *Auto: All rockets launch in succession from both pods at the press of the trigger / Both Missiles will be fired in an interval of 1.2 seconds.*
- *4 Rockets / No Effect on missiles*

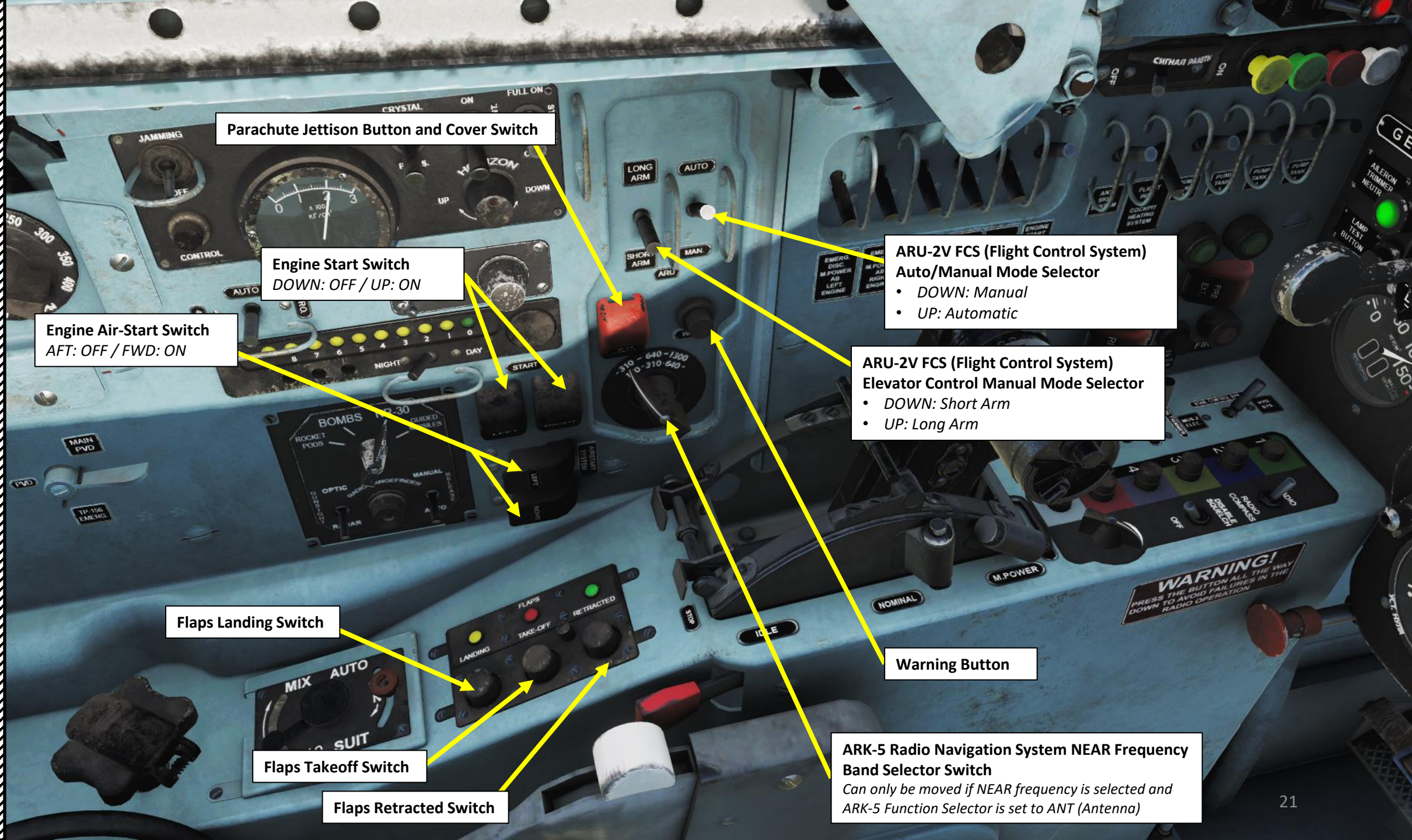
Rocket Counter (per rocket pod)
- *0 (Green): ORO-57K pods are installed and pylons are working properly*
- *1 through 8 (Yellow): Available rockets per pod*

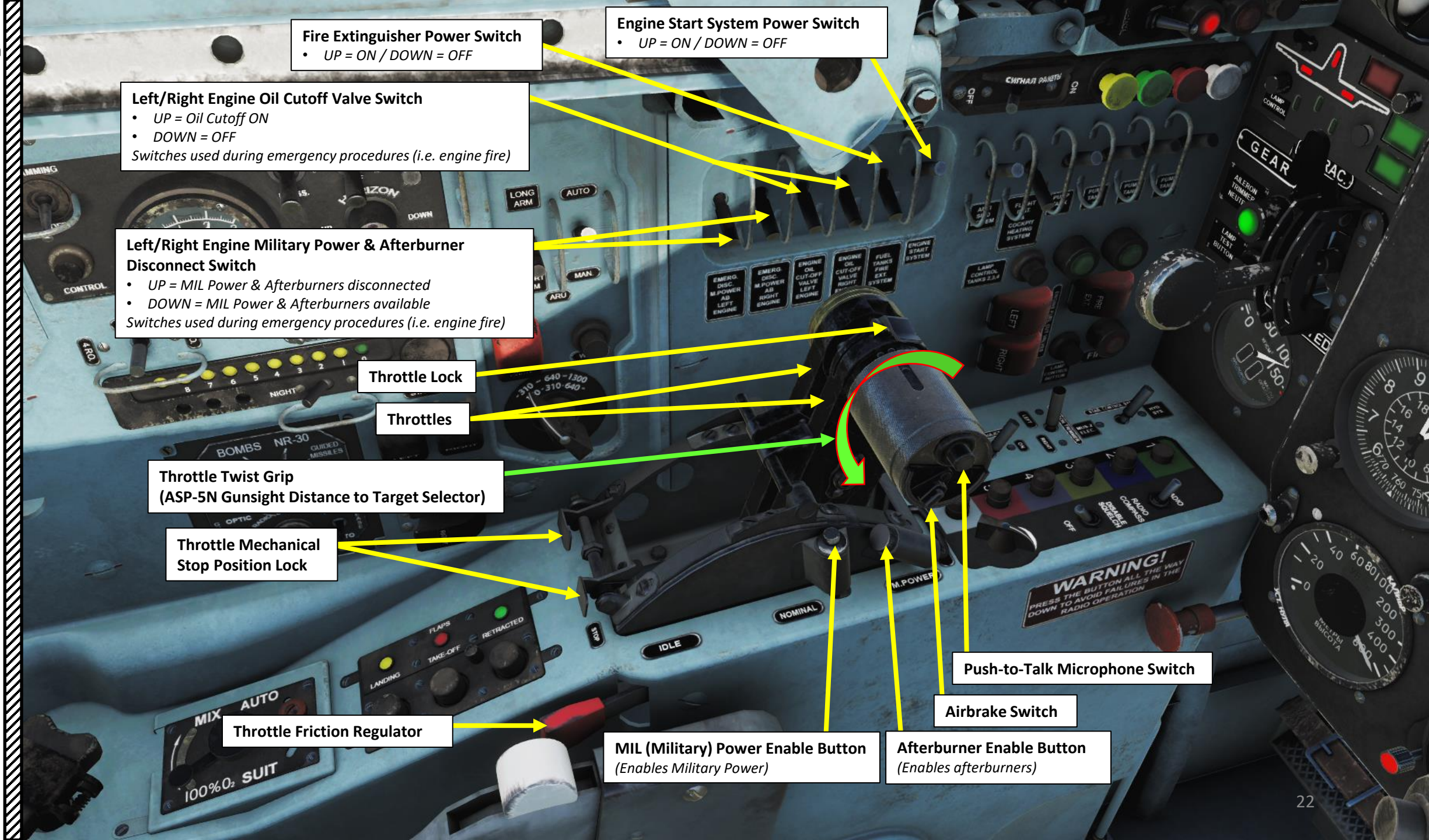
Rocket Panel Day/Night Brightness Mode Selector

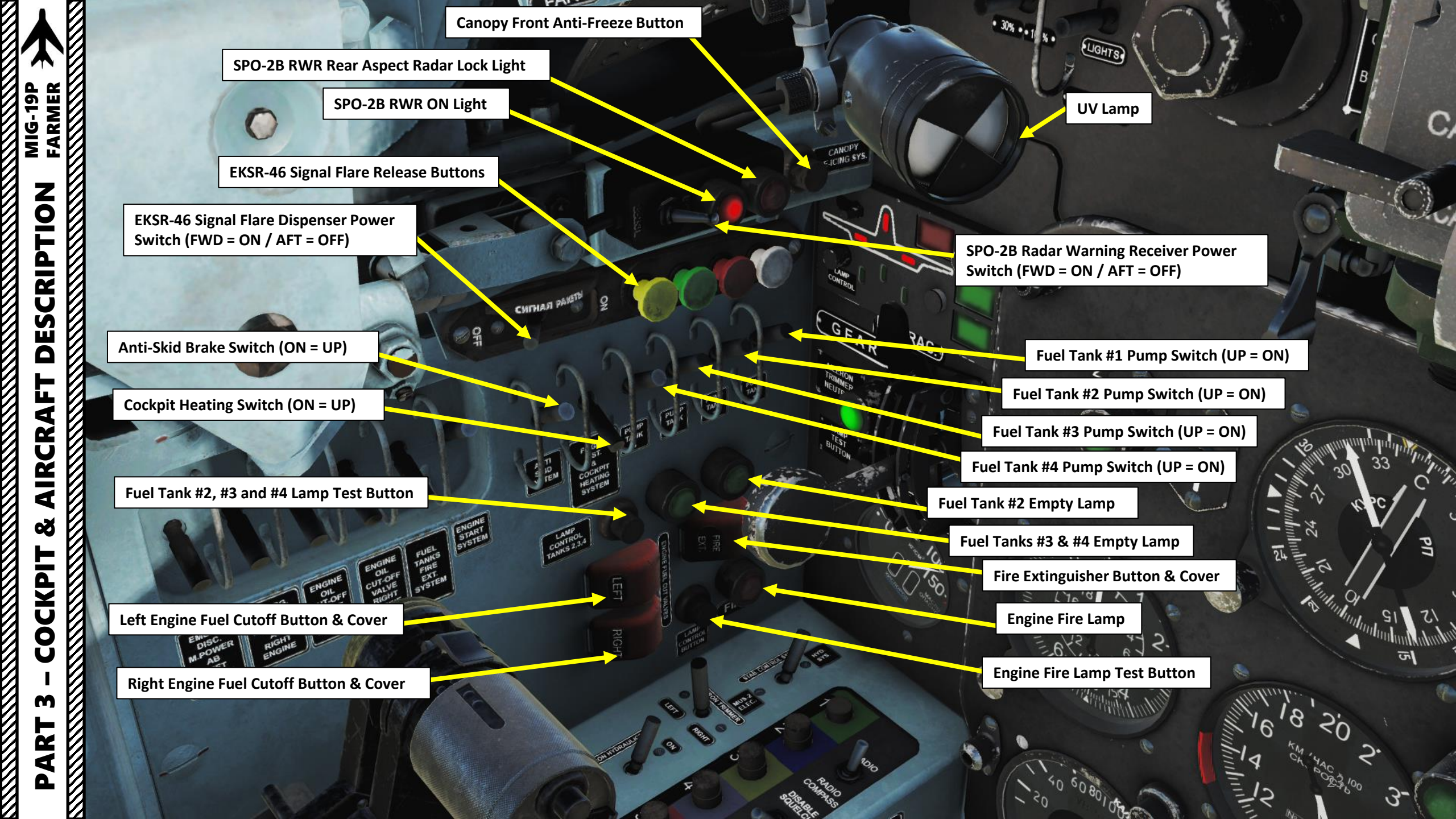
ASP-5N Gunsight Armament Employment Mode
- *ARS-57M/S-5M Rockets*
- *FAB-100/250 Bombs*
- *NR-30 30 mm Cannons*
- *R-3S Infrared Guided Missiles*

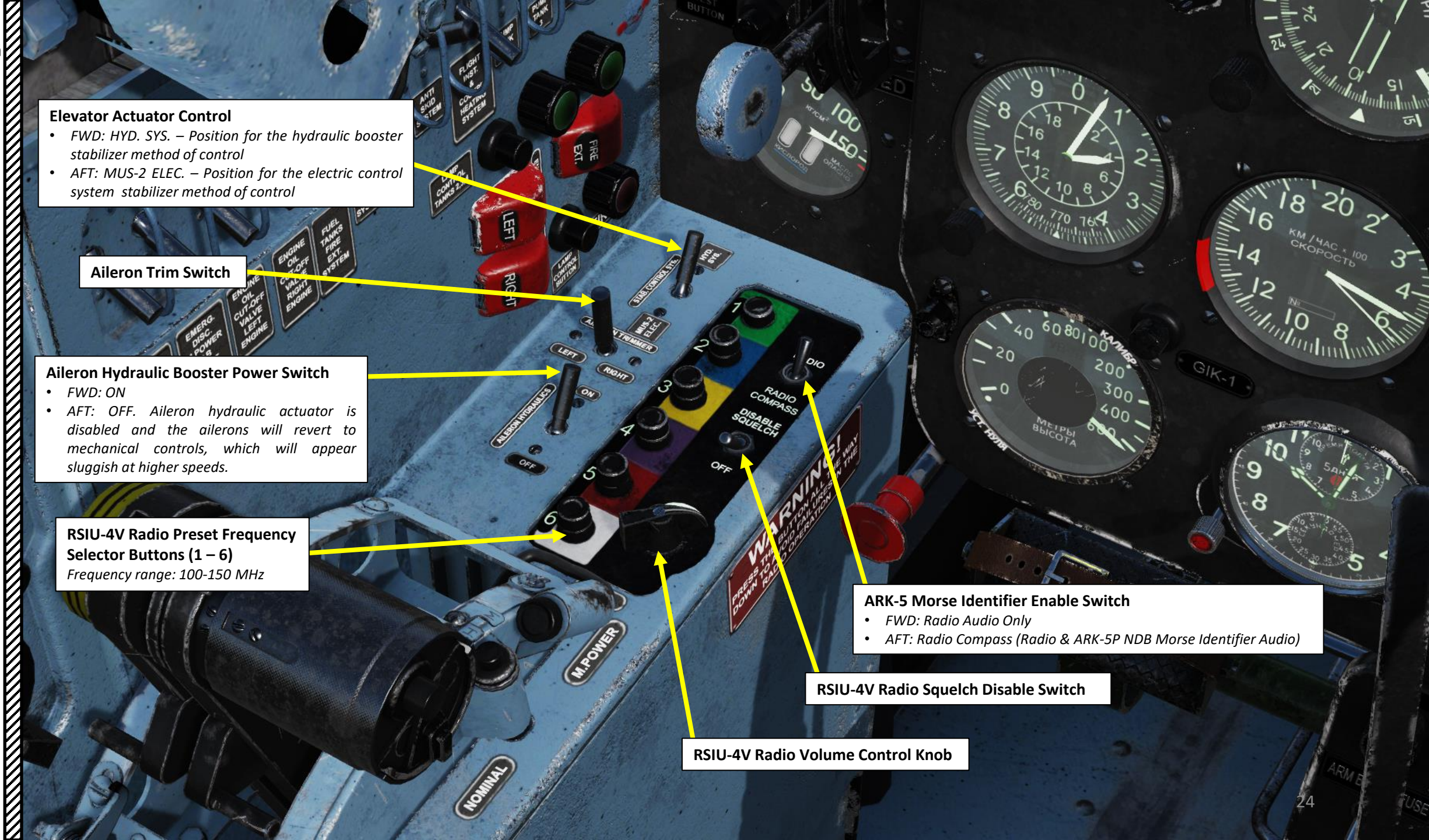
ASP-5N Gunsight Aiming Mode
- *OPTIC (UP) Manual Introduction of the Target Wing Span and Distance*
- *RADAR (DOWN): Aiming calculations are provided by the RP-5 Radar*

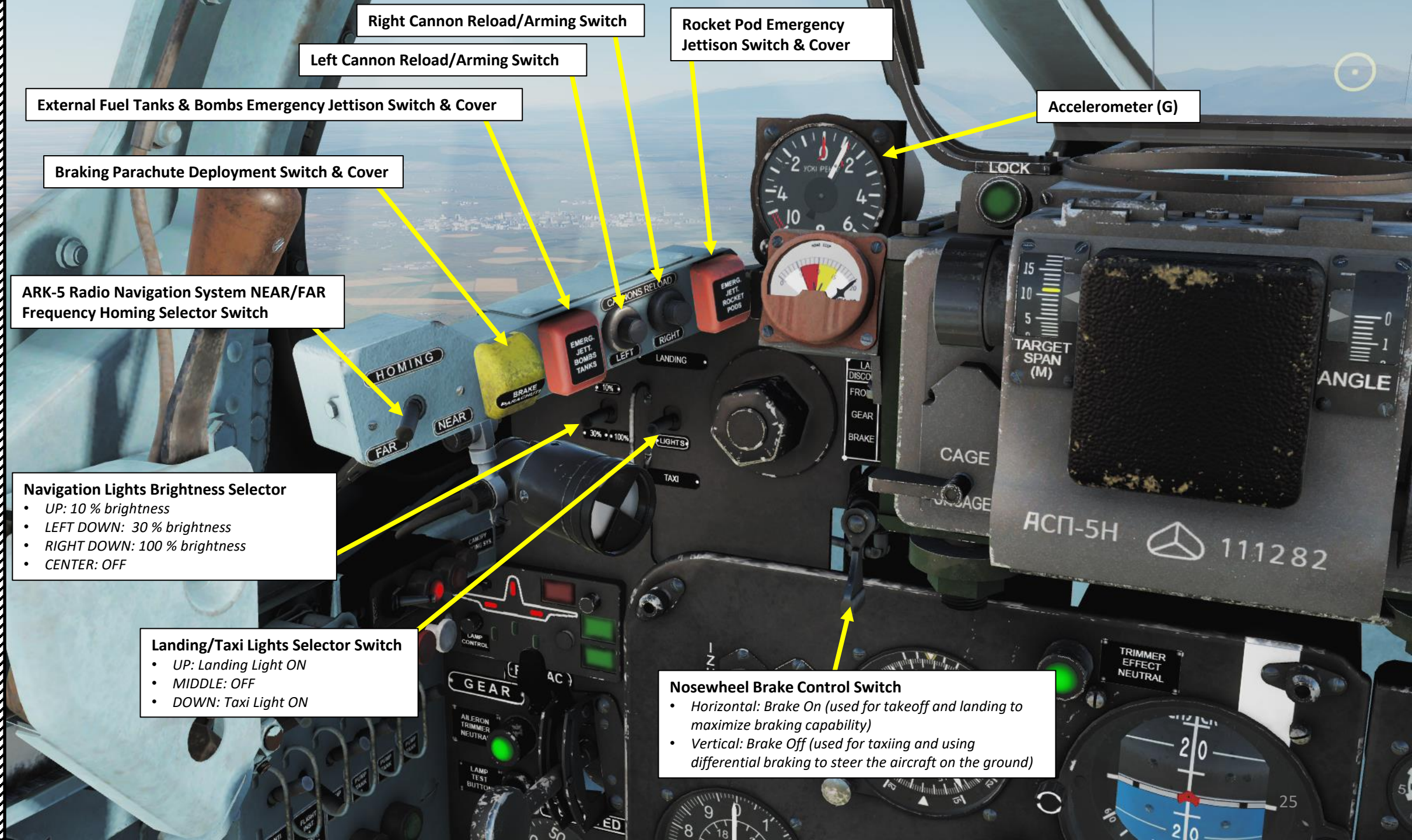
Bomb Release Mode Switch
- *MANUAL (UP): Bombs are released at every press of the Armament Trigger switch*
- *AUTO (DOWN): Both bombs are released simultaneously*

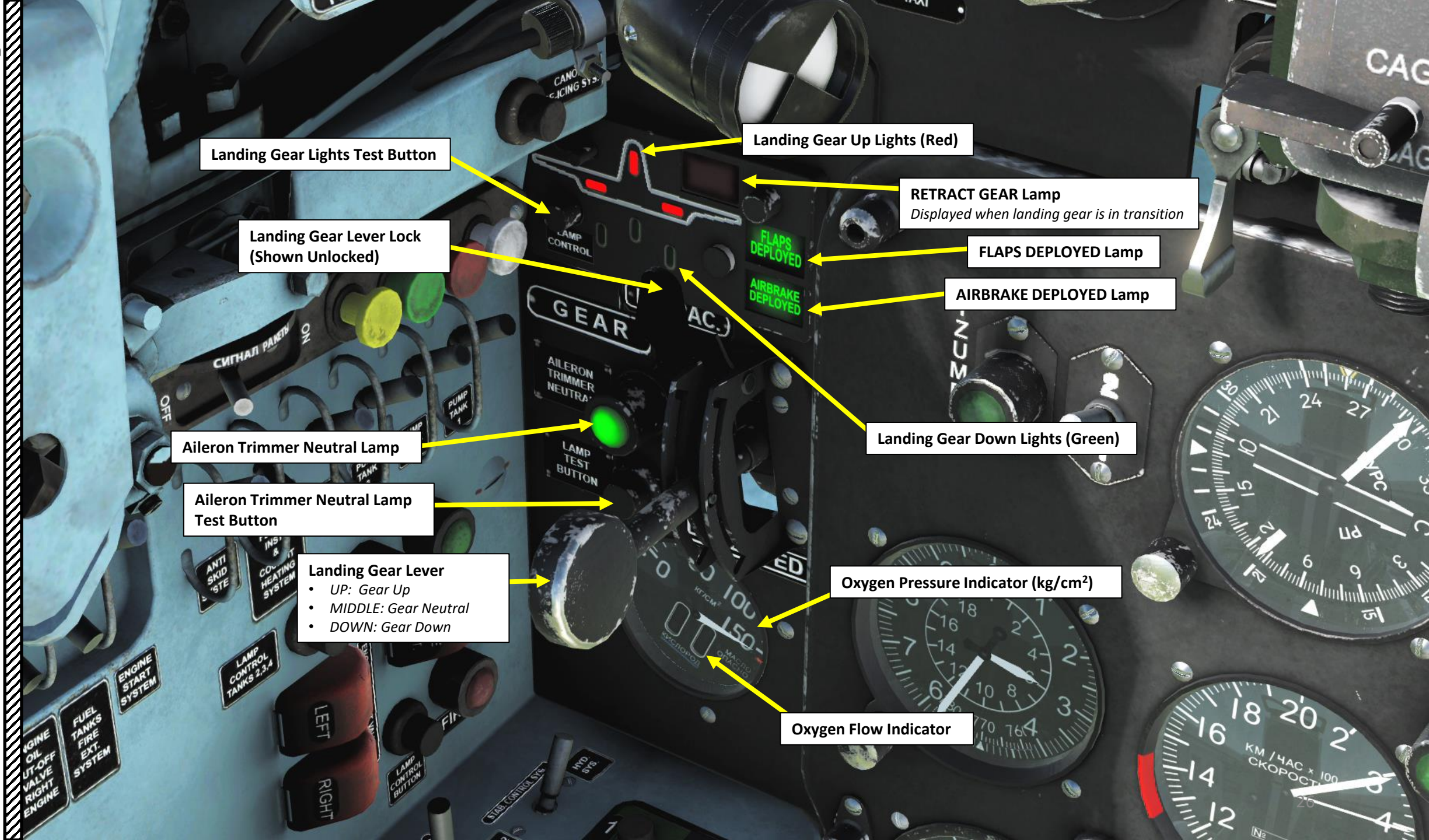

Parachute Jettison Button and Cover Switch
Engine Start Switch
DOWN: OFF / UP: ON
Engine Air-Start Switch
AFT: OFF / FWD: ON
ARU-2V FCS (Flight Control System)
Auto/Manual Mode Selector
• DOWN: Manual
• UP: Automatic
ARU-2V FCS (Flight Control System)
Elevator Control Manual Mode Selector
• DOWN: Short Arm
• UP: Long Arm
Warning Button
Flaps Landing Switch
Flaps Takeoff Switch
Flaps Retracted Switch
ARK-5 Radio Navigation System NEAR Frequency Band Selector Switch
Can only be moved if NEAR frequency is selected and ARK-5 Function Selector is set to ANT (Antenna)

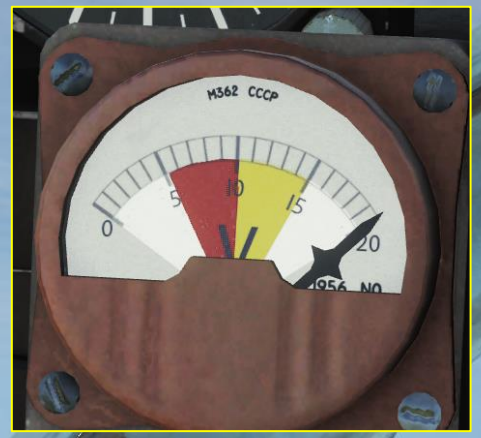

Fire Extinguisher Power Switch
• UP = ON / DOWN = OFF
Engine Start System Power Switch
• UP = ON / DOWN = OFF
Left/Right Engine Oil Cutoff Valve Switch
• UP = Oil Cutoff ON
• DOWN = OFF
Switches used during emergency procedures (i.e. engine fire)
Left/Right Engine Military Power & Afterburner Disconnect Switch
• UP = MIL Power & Afterburners disconnected
• DOWN = MIL Power & Afterburners available
Switches used during emergency procedures (i.e. engine fire)
Throttle Lock
Throttles
Throttle Twist Grip
(ASP-5N Gunsight Distance to Target Selector)
Throttle Mechanical Stop Position Lock
Throttle Friction Regulator
MIL (Military) Power Enable Button
(Enables Military Power)
Afterburner Enable Button
(Enables afterburners)
Airbrake Switch
Push-to-Talk Microphone Switch


Canopy Front Anti-Freeze Button
SPO-2B RWR Rear Aspect Radar Lock Light
SPO-2B RWR ON Light
EKSR-46 Signal Flare Release Buttons
EKSR-46 Signal Flare Dispenser Power Switch (FWD = ON / AFT = OFF)
Anti-Skid Brake Switch (ON = UP)
Cockpit Heating Switch (ON = UP)
Fuel Tank #2, #3 and #4 Lamp Test Button
Left Engine Fuel Cutoff Button & Cover
Right Engine Fuel Cutoff Button & Cover
UV Lamp
SPO-2B Radar Warning Receiver Power Switch (FWD = ON / AFT = OFF)
Fuel Tank #1 Pump Switch (UP = ON)
Fuel Tank #2 Pump Switch (UP = ON)
Fuel Tank #3 Pump Switch (UP = ON)
Fuel Tank #4 Pump Switch (UP = ON)
Fuel Tank #2 Empty Lamp
Fuel Tanks #3 & #4 Empty Lamp
Fire Extinguisher Button & Cover
Engine Fire Lamp
Engine Fire Lamp Test Button


Elevator Actuator Control
• FWD: HYD. SYS. – Position for the hydraulic booster stabilizer method of control
• AFT: MUS-2 ELEC. – Position for the electric control system stabilizer method of control
Aileron Trim Switch
Aileron Hydraulic Booster Power Switch
• FWD: ON
• AFT: OFF. Aileron hydraulic actuator is disabled and the ailerons will revert to mechanical controls, which will appear sluggish at higher speeds.
RSIU-4V Radio Preset Frequency Selector Buttons (1 – 6)
Frequency range: 100-150 MHz
ARK-5 Morse Identifier Enable Switch
• FWD: Radio Audio Only
• AFT: Radio Compass (Radio & ARK-5P NDB Morse Identifier Audio)
RSIU-4V Radio Squelch Disable Switch
RSIU-4V Radio Volume Control Knob


Right Cannon Reload/Arming Switch
Left Cannon Reload/Arming Switch
Rocket Pod Emergency Jettison Switch & Cover
External Fuel Tanks & Bombs Emergency Jettison Switch & Cover
Accelerometer (G)
Braking Parachute Deployment Switch & Cover
ARK-5 Radio Navigation System NEAR/FAR Frequency Homing Selector Switch
Navigation Lights Brightness Selector
• UP: 10 % brightness
• LEFT DOWN: 30 % brightness
• RIGHT DOWN: 100 % brightness
• CENTER: OFF
Landing/Taxi Lights Selector Switch
• UP: Landing Light ON
• MIDDLE: OFF
• DOWN: Taxi Light ON
Nosewheel Brake Control Switch
• Horizontal: Brake On (used for takeoff and landing to maximize braking capability)
• Vertical: Brake Off (used for taxiing and using differential braking to steer the aircraft on the ground)
HOMING
FAR
NEAR
BRAKE PARACHUTE
EMERG. JETT. BOMBS TANKS
CANNONS RELOAD
LEFT
RIGHT
EMERG. JETT. ROCKET PODS
LANDING
TAXI
LIGHTS
GEAR
BRAKE
LOCK
CAGE
TARGET SPAN (M)
ANGLE
АСП-5Н
111282
TRIMMER EFFECT NEUTRAL


Landing Gear Lights Test Button
Landing Gear Up Lights (Red)
RETRACT GEAR Lamp
Displayed when landing gear is in transition
Landing Gear Lever Lock
(Shown Unlocked)
FLAPS DEPLOYED Lamp
AIRBRAKE DEPLOYED Lamp
Landing Gear Down Lights (Green)
Aileron Trimmer Neutral Lamp
Aileron Trimmer Neutral Lamp
Test Button
Landing Gear Lever
UP: Gear Up
MIDDLE: Gear Neutral
DOWN: Gear Down
Oxygen Pressure Indicator (kg/cm²)
Oxygen Flow Indicator
LAMP CONTROL
FLAPS DEPLOYED
AIRBRAKE DEPLOYED
GEAR
AILERON TRIMMER NEUTRAL
LAMP TEST BUTTON
LAMP CONTROL TANKS 2,3,4
LAMP CONTROL BUTTON
ENGINE START SYSTEM
FUEL TANKS FIRE EXT. SYSTEM
ENGINE OIL SHUT-OFF VALVE RIGHT ENGINE
LEFT
RIGHT
ANTI SKID
HEATING SYSTEM
PUMP TANK 1
OFF
ON



Cockpit Gunsight Camera

Radar Lock Lamp

ASP-5N Gunsight Target Distance indicator (x100 m)

ASP-5N Gunsight Target Wingspan Control (m)

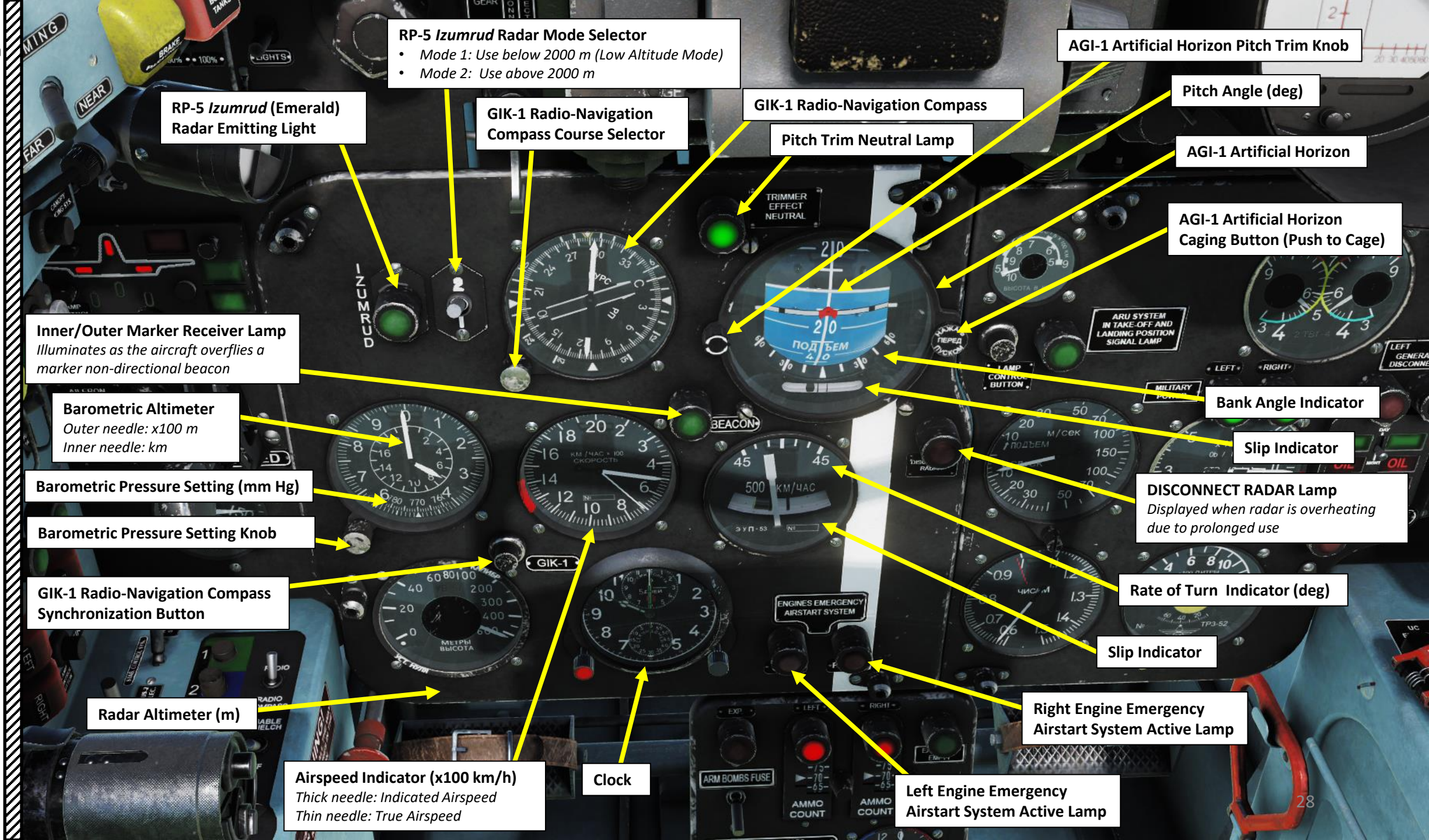
Gunsight Reticle

Gunsight Proximity Alert (BREAK) Light

ASP-5N Gunsight Target Dive Bombing Angle Control (x 10 deg)
Note: bombing angle is recommended between 20 and 50 deg

ASP-5N Gunsight Reticle Brightness Control

ASP-5N Gunsight Cage/Uncage Selector
- *Horizontal: Caged*
- *Vertical: Uncaged*

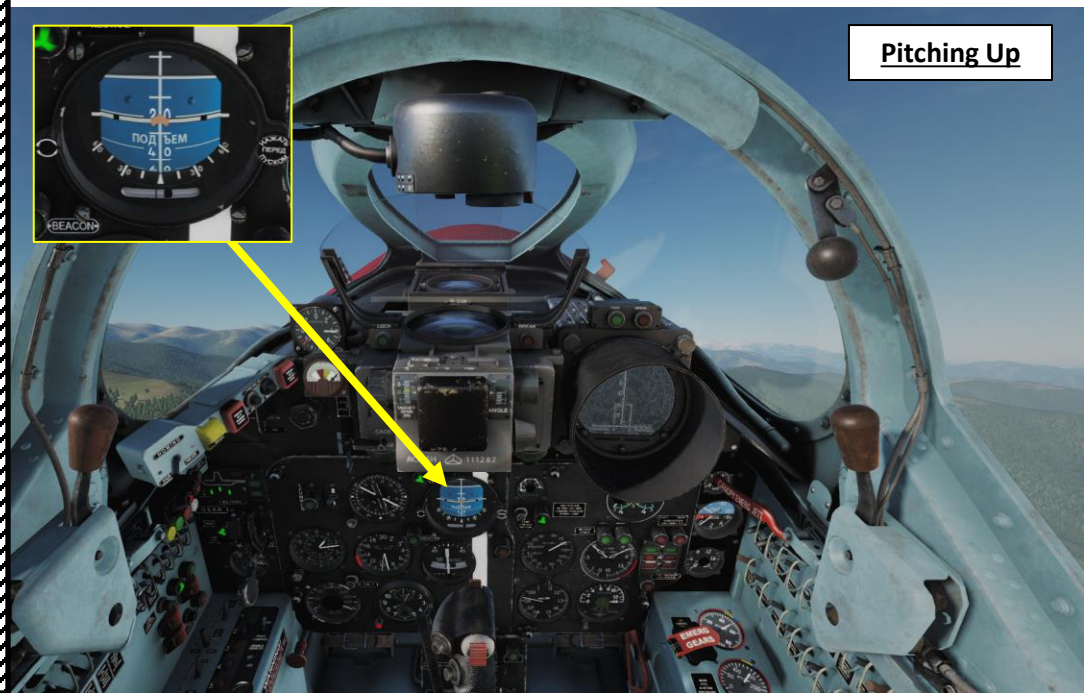

RP-5 *Izumrud* Radar Mode Selector
• *Mode 1: Use below 2000 m (Low Altitude Mode)*
• *Mode 2: Use above 2000 m*
AGI-1 Artificial Horizon Pitch Trim Knob
Pitch Angle (deg)
RP-5 *Izumrud* (Emerald) Radar Emitting Light
GIK-1 Radio-Navigation Compass Course Selector
GIK-1 Radio-Navigation Compass
Pitch Trim Neutral Lamp
AGI-1 Artificial Horizon
AGI-1 Artificial Horizon Caging Button (Push to Cage)
Inner/Outer Marker Receiver Lamp
Illuminates as the aircraft overflies a marker non-directional beacon
Barometric Altimeter
Outer needle: x100 m
Inner needle: km
Bank Angle Indicator
Slip Indicator
Barometric Pressure Setting (mm Hg)
DISCONNECT RADAR Lamp
Displayed when radar is overheating due to prolonged use
Barometric Pressure Setting Knob
GIK-1 Radio-Navigation Compass Synchronization Button
Rate of Turn Indicator (deg)
Slip Indicator
Radar Altimeter (m)
Right Engine Emergency Airstart System Active Lamp
Airspeed Indicator (x100 km/h)
Thick needle: Indicated Airspeed
Thin needle: True Airspeed
Clock
Left Engine Emergency Airstart System Active Lamp
TRIMMER EFFECT NEUTRAL
IZUMRUD
BEACON
GIK-1
ENGINES EMERGENCY AIRSTART SYSTEM
ARU SYSTEM IN TAKE-OFF AND LANDING POSITION SIGNAL LAMP
LAMP CONTROL BUTTON
ARM BOMBS FUSE
AMMO COUNT
AMMO COUNT

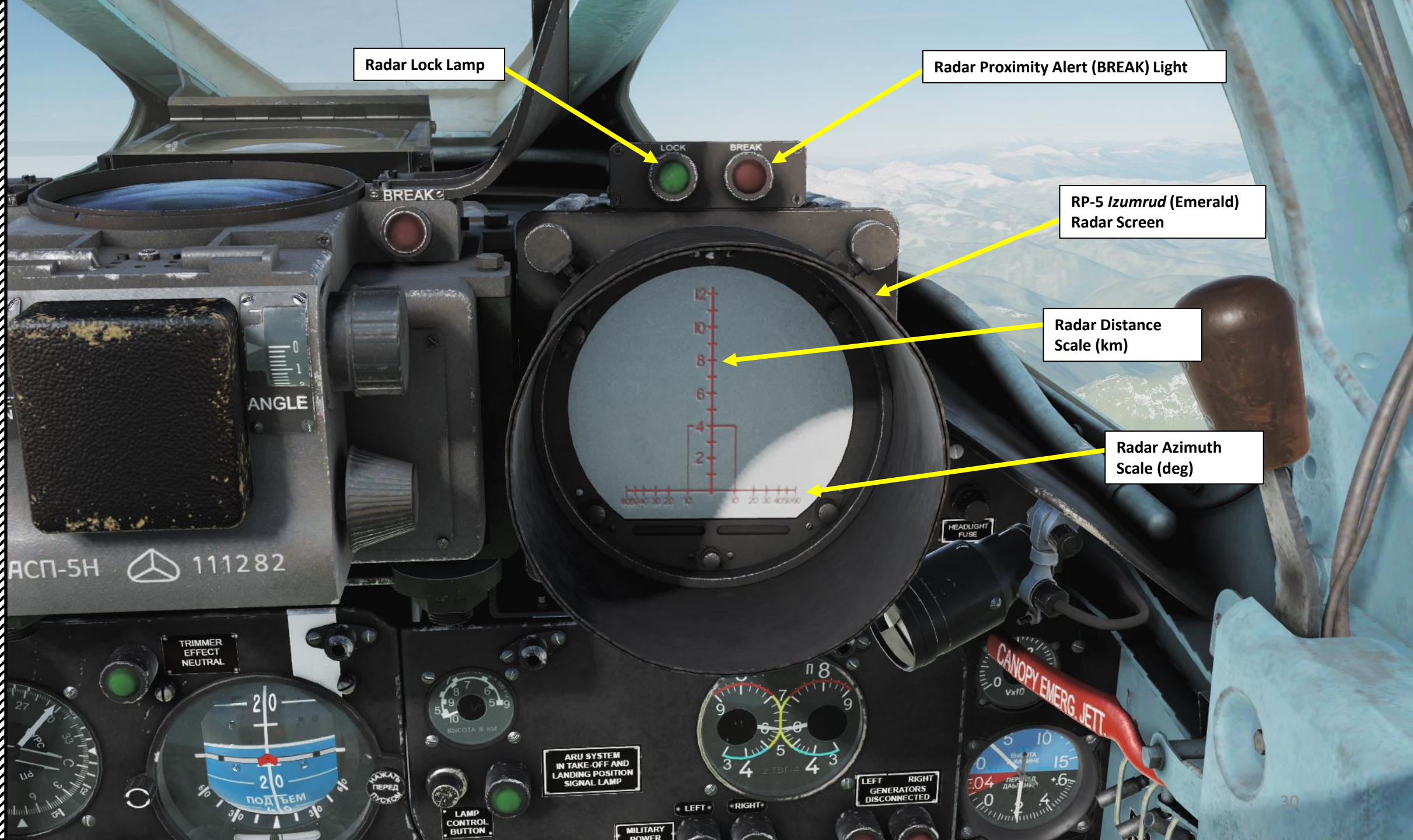
AGI-1 Artificial Horizon

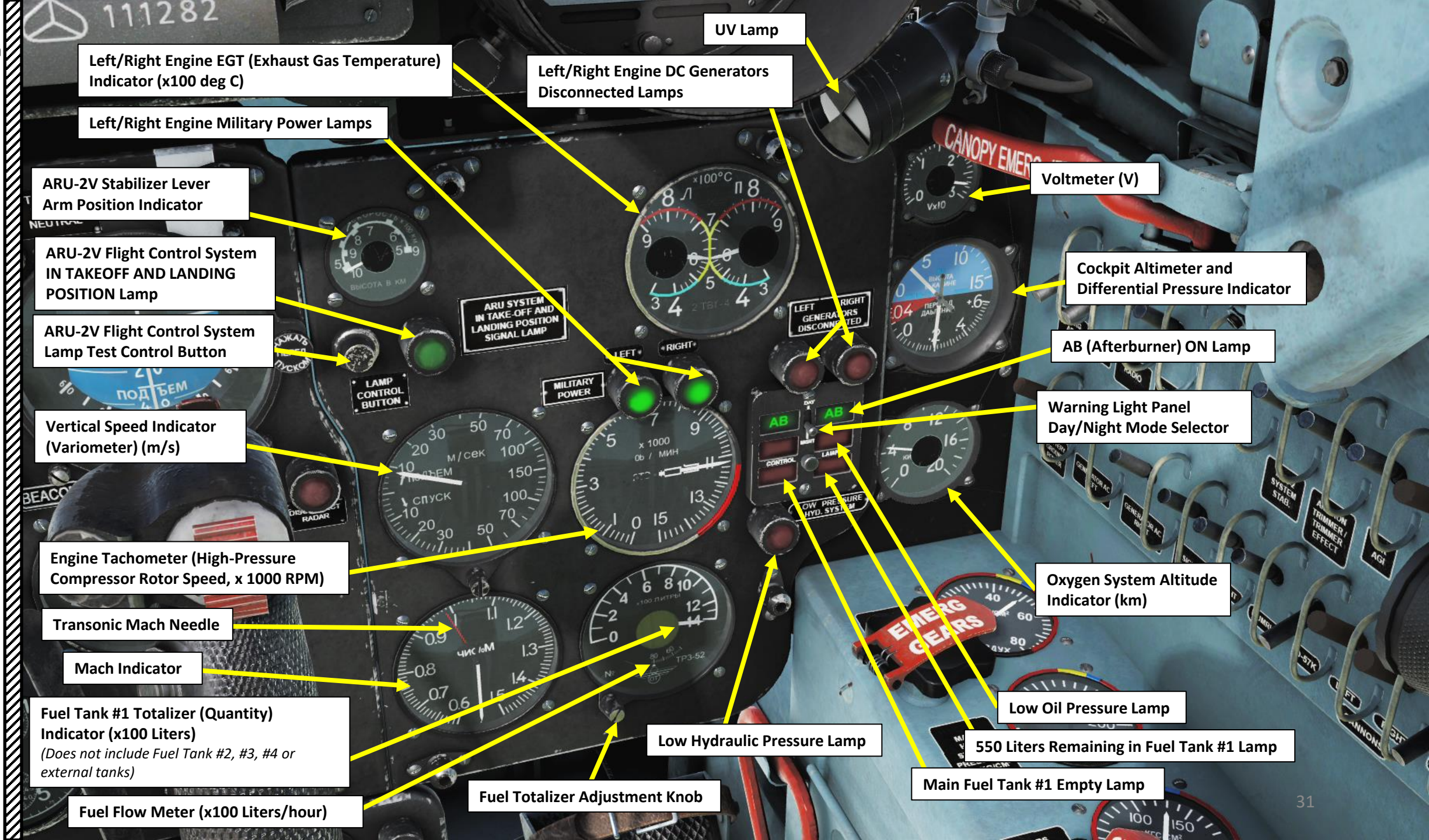
The artificial horizon in the MiG works differently from 'western' ones, mainly in the way the sky and ground are represented.

In the MiG, the gyro keeps the instrument's 'globe' level with the local horizon - whereas 'western' instruments use a system of pivots and levers on the outer gimbal to cause the movement of the gyro to appear in a 'reverse' sense. In the MiG, in level flight, the aircraft symbol is just about on the horizon line. There is brown above and blue below.

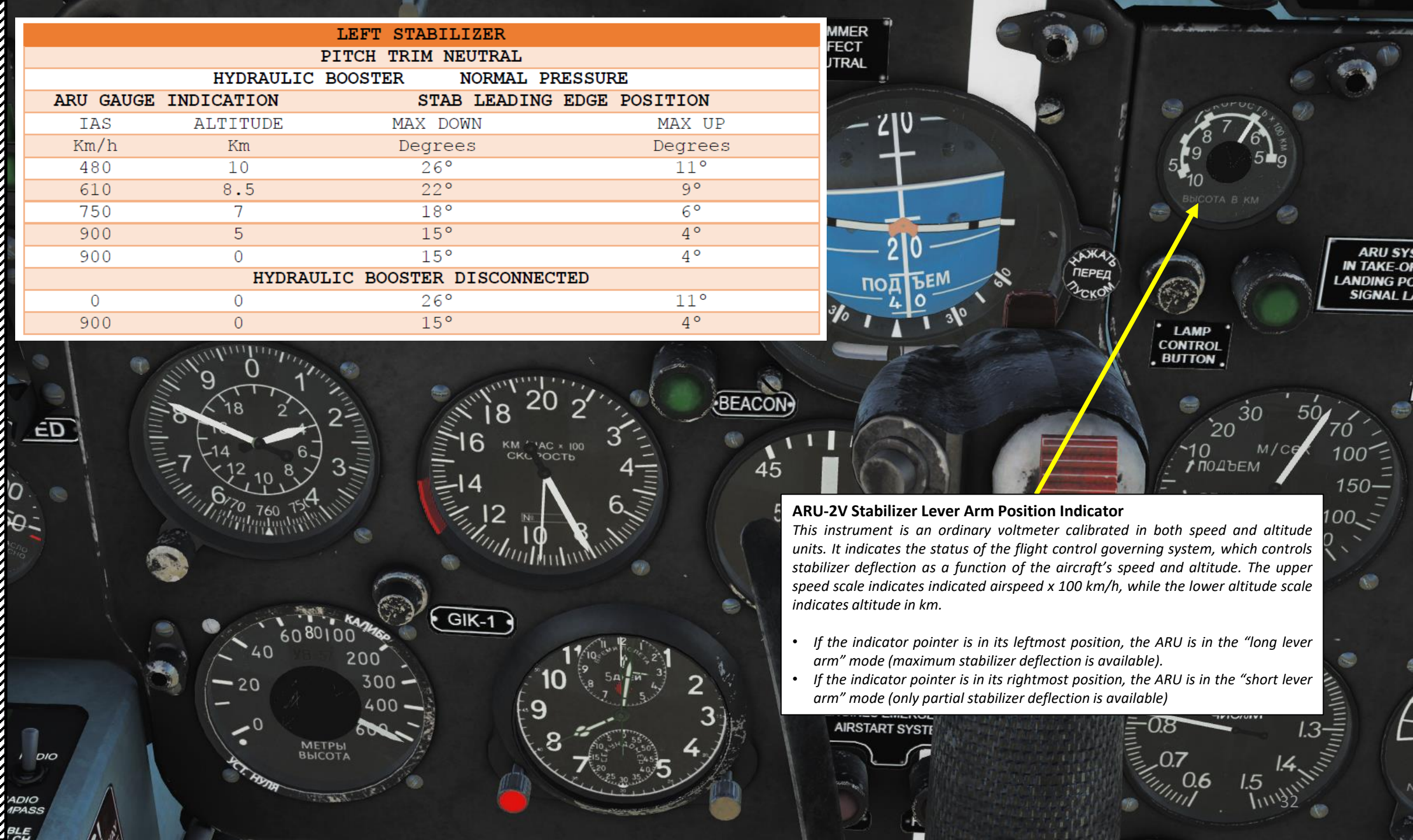
If we fly a Pitch Up attitude, the horizon 'globe' remains static, under the influence of its gyro, but the aircraft rotates around the 'globe' in pitch. In a case where the aircraft is pitching up but the globe is still static, you will see there is now MORE blue and LESS brown visible. You are 'looking at' more 'sky', and you can 'see' less 'ground', as you would expect.




Radar Lock Lamp
Radar Proximity Alert (BREAK) Light
RP-5 *Izumrud* (Emerald) Radar Screen
Radar Distance Scale (km)
Radar Azimuth Scale (deg)
LOCK
BREAK
ANGLE
АСП-5Н
111282
TRIMMER EFFECT NEUTRAL
ARU SYSTEM IN TAKE-OFF AND LANDING POSITION SIGNAL LAMP
LAMP CONTROL BUTTON
LEFT
RIGHT
MILITARY POWER
LEFT RIGHT GENERATORS DISCONNECTED
HEADLIGHT FUSE
CANOPY EMERG. JETT.


Left/Right Engine EGT (Exhaust Gas Temperature) Indicator (x100 deg C)
Left/Right Engine Military Power Lamps
ARU-2V Stabilizer Lever Arm Position Indicator
ARU-2V Flight Control System IN TAKEOFF AND LANDING POSITION Lamp
ARU-2V Flight Control System Lamp Test Control Button
Vertical Speed Indicator (Variometer) (m/s)
Engine Tachometer (High-Pressure Compressor Rotor Speed, x 1000 RPM)
Transonic Mach Needle
Mach Indicator
Fuel Tank #1 Totalizer (Quantity) Indicator (x100 Liters)
(Does not include Fuel Tank #2, #3, #4 or external tanks)
Fuel Flow Meter (x100 Liters/hour)
Fuel Totalizer Adjustment Knob
Low Hydraulic Pressure Lamp
UV Lamp
Left/Right Engine DC Generators Disconnected Lamps
Voltmeter (V)
Cockpit Altimeter and Differential Pressure Indicator
AB (Afterburner) ON Lamp
Warning Light Panel Day/Night Mode Selector
Oxygen System Altitude Indicator (km)
Low Oil Pressure Lamp
550 Liters Remaining in Fuel Tank #1 Lamp
Main Fuel Tank #1 Empty Lamp
ARU SYSTEM IN TAKE-OFF AND LANDING POSITION SIGNAL LAMP
LAMP CONTROL BUTTON
MILITARY POWER
LEFT
RIGHT
LEFT RIGHT GENERATORS DISCONNECTED
AB
CANOPY EMER
EMERG GEARS

LEFT STABILIZER			
PITCH TRIM NEUTRAL			
HYDRAULIC BOOSTER NORMAL PRESSURE			
ARU GAUGE INDICATION		STAB LEADING EDGE POSITION	
IAS	ALTITUDE	MAX DOWN	MAX UP
Km/h	Km	Degrees	Degrees
480	10	26°	11°
610	8.5	22°	9°
750	7	18°	6°
900	5	15°	4°
900	0	15°	4°
HYDRAULIC BOOSTER DISCONNECTED			
0	0	26°	11°
900	0	15°	4°

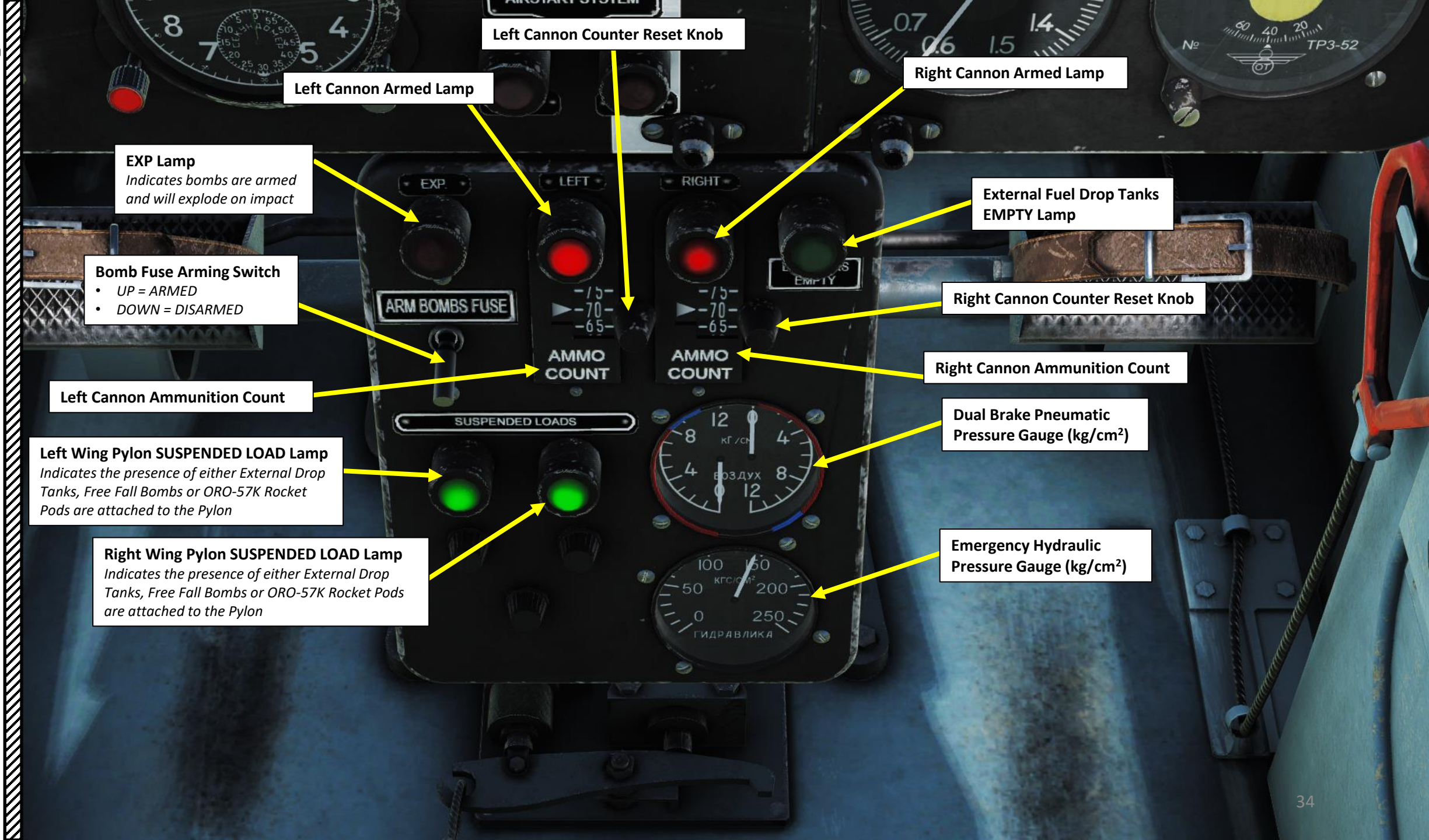


ARU-2V Stabilizer Lever Arm Position Indicator

This instrument is an ordinary voltmeter calibrated in both speed and altitude units. It indicates the status of the flight control governing system, which controls stabilizer deflection as a function of the aircraft's speed and altitude. The upper speed scale indicates indicated airspeed x 100 km/h, while the lower altitude scale indicates altitude in km.

- *If the indicator pointer is in its leftmost position, the ARU is in the "long lever arm" mode (maximum stabilizer deflection is available).*
- *If the indicator pointer is in its rightmost position, the ARU is in the "short lever arm" mode (only partial stabilizer deflection is available)*


Emergency Landing Gear Deployment Handle
Emergency Brake Lever
Pneumatic pressure goes directly to wheel brakes when pulled
ARU SYSTEM IN TAKE-OFF AND LANDING POSITION SIGNAL LAMP
LAMP CONTROL BUTTON
LEFT RIGHT GENERATORS DISCONNECTED
MILITARY POWER
BEACON
GIK-1
ENGINES EMERGENCY AIRSTART SYSTEM
ARM BOMBS FUSE
AMMO COUNT
AMMO COUNT
EMERG GEARS
EMERG FLAPS
MAIN HYD. SYSTEM PRESSURE 142 KG/CM²
MAIN PNEUMATIC SYSTEM 150 KG/CM²
OIL
OIL
WARNING!
NOMINAL
M.POWER
RADIO COMPASS
CANOPY EMERG



Left Cannon Counter Reset Knob

Left Cannon Armed Lamp

Right Cannon Armed Lamp

EXP Lamp
Indicates bombs are armed and will explode on impact

External Fuel Drop Tanks EMPTY Lamp

Bomb Fuse Arming Switch
- *UP = ARMED*
- *DOWN = DISARMED*

Right Cannon Counter Reset Knob

Left Cannon Ammunition Count

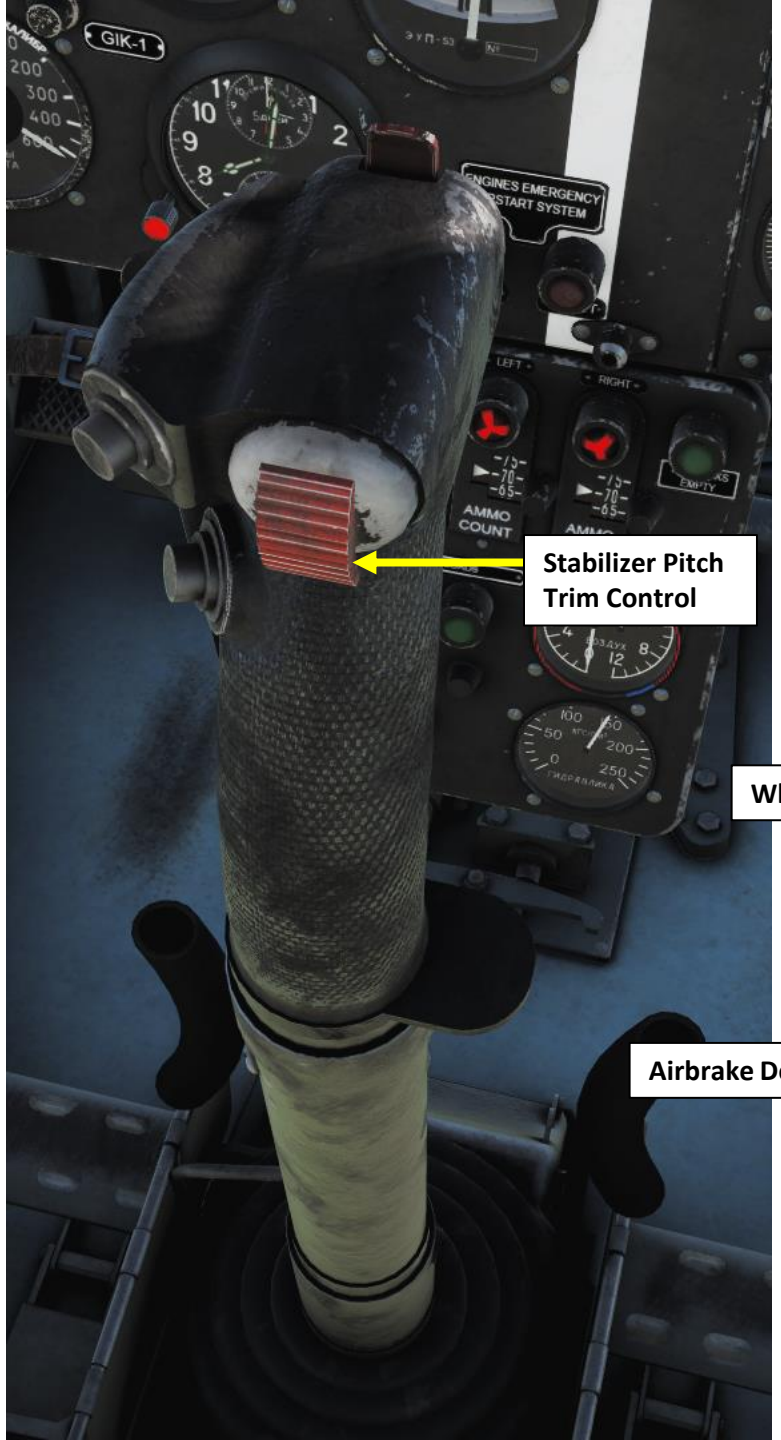
Right Cannon Ammunition Count

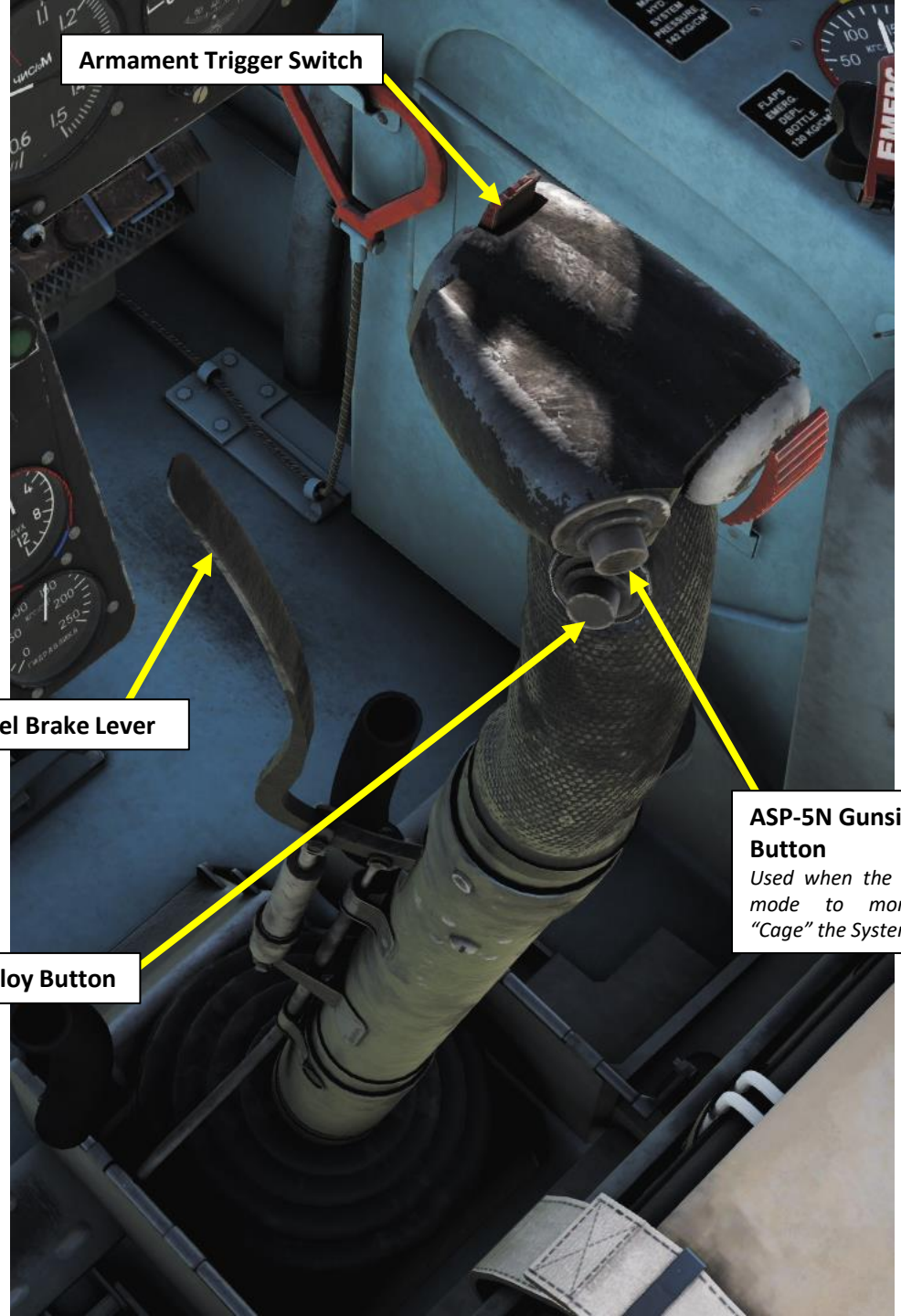
Dual Brake Pneumatic Pressure Gauge (kg/cm²)

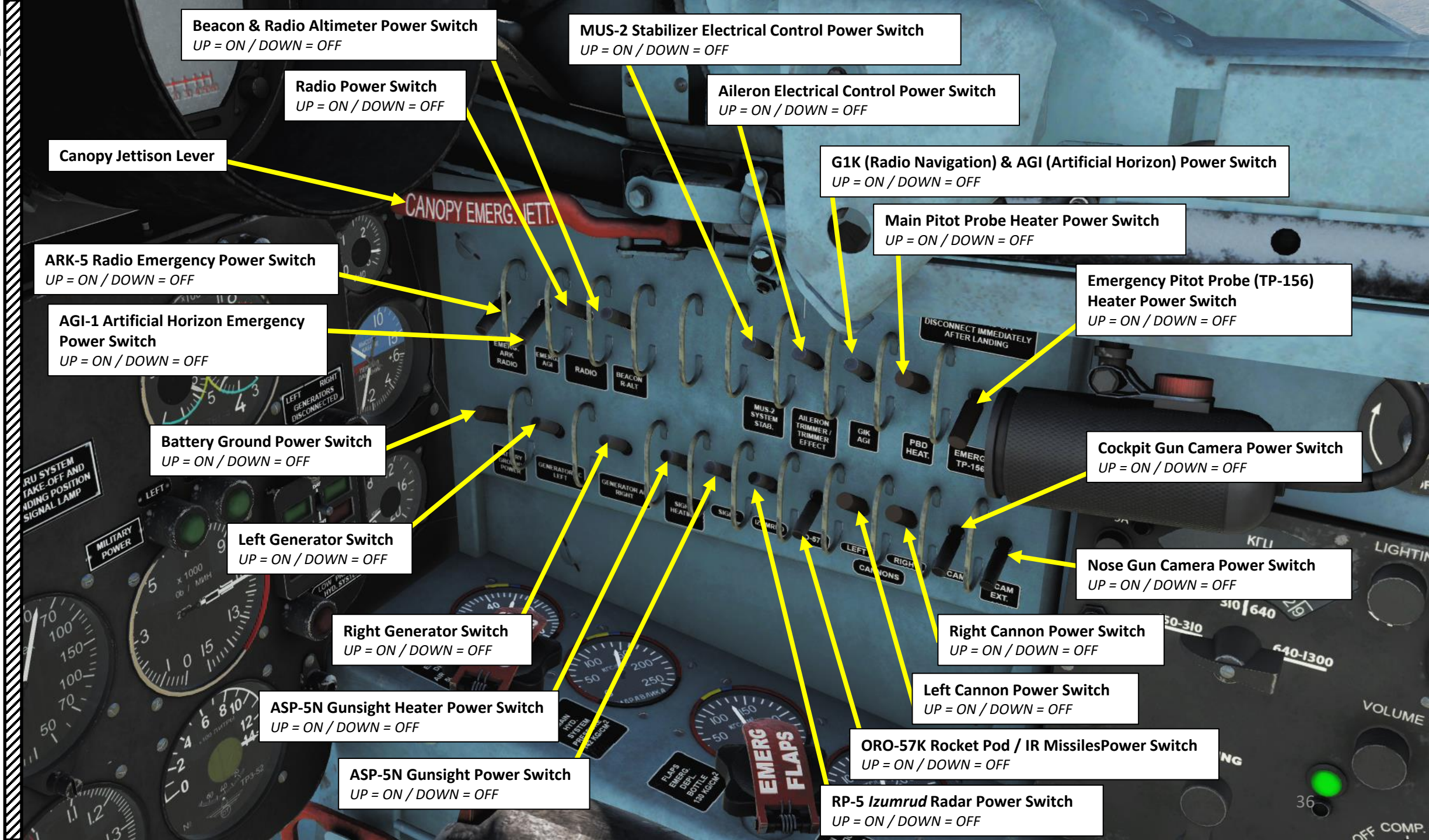
Left Wing Pylon SUSPENDED LOAD Lamp
Indicates the presence of either External Drop Tanks, Free Fall Bombs or ORO-57K Rocket Pods are attached to the Pylon

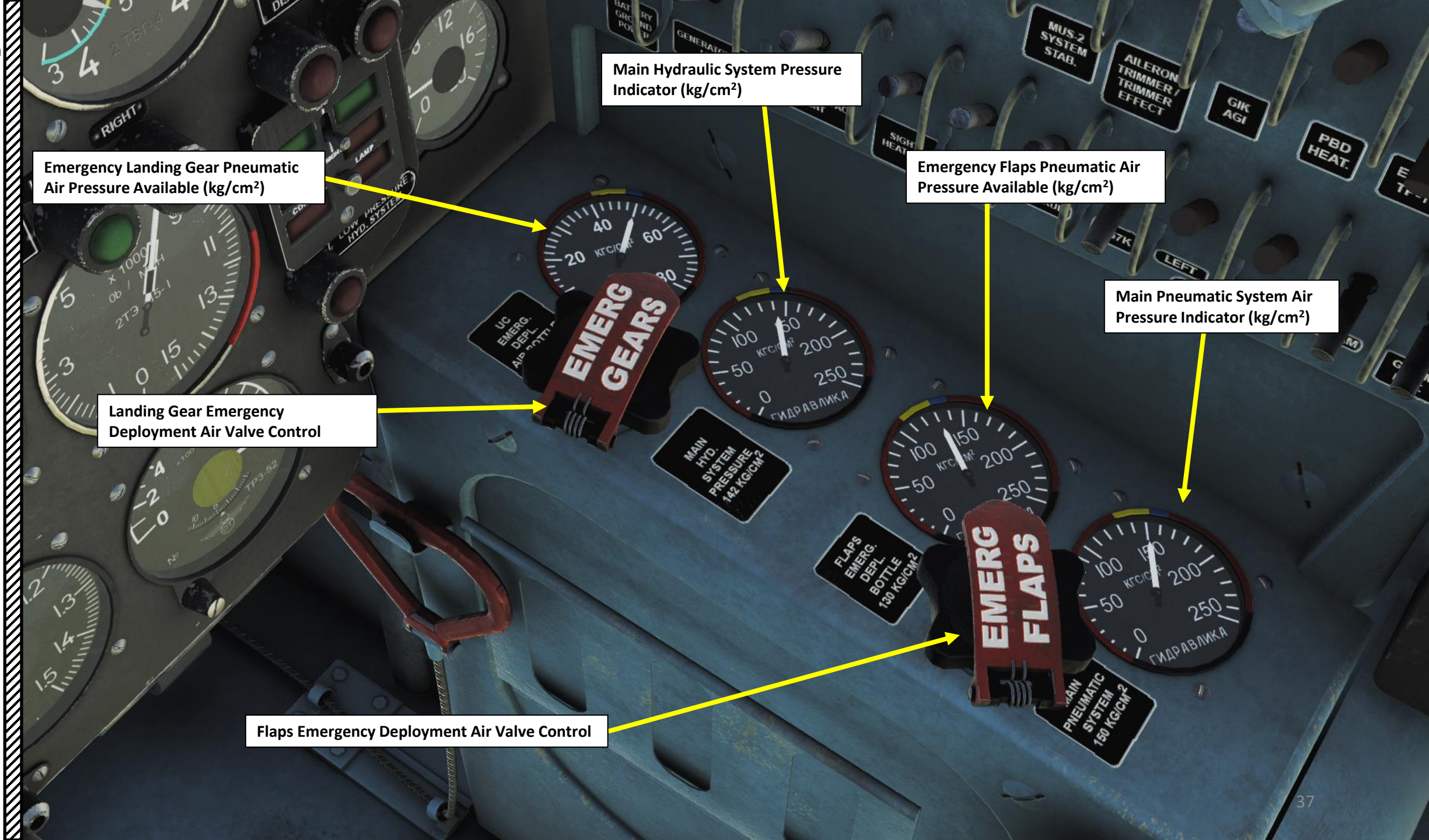
Emergency Hydraulic Pressure Gauge (kg/cm²)

Right Wing Pylon SUSPENDED LOAD Lamp
Indicates the presence of either External Drop Tanks, Free Fall Bombs or ORO-57K Rocket Pods are attached to the Pylon


GIK-1
ENGINES EMERGENCY RESTART SYSTEM
AMMO COUNT
Stabilizer Pitch Trim Control


Armament Trigger Switch
Wheel Brake Lever
Airbrake Deploy Button
ASP-5N Gunsight Dampening Button
Used when the sight is in "Uncaged" mode to momentarily electrically "Cage" the System


Beacon & Radio Altimeter Power Switch
UP = ON / DOWN = OFF
Radio Power Switch
UP = ON / DOWN = OFF
Canopy Jettison Lever
CANOPY EMERG. JETT.
ARK-5 Radio Emergency Power Switch
UP = ON / DOWN = OFF
AGI-1 Artificial Horizon Emergency Power Switch
UP = ON / DOWN = OFF
Battery Ground Power Switch
UP = ON / DOWN = OFF
Left Generator Switch
UP = ON / DOWN = OFF
Right Generator Switch
UP = ON / DOWN = OFF
ASP-5N Gunsight Heater Power Switch
UP = ON / DOWN = OFF
ASP-5N Gunsight Power Switch
UP = ON / DOWN = OFF
MUS-2 Stabilizer Electrical Control Power Switch
UP = ON / DOWN = OFF
Aileron Electrical Control Power Switch
UP = ON / DOWN = OFF
G1K (Radio Navigation) & AGI (Artificial Horizon) Power Switch
UP = ON / DOWN = OFF
Main Pitot Probe Heater Power Switch
UP = ON / DOWN = OFF
Emergency Pitot Probe (TP-156) Heater Power Switch
UP = ON / DOWN = OFF
Cockpit Gun Camera Power Switch
UP = ON / DOWN = OFF
Nose Gun Camera Power Switch
UP = ON / DOWN = OFF
Right Cannon Power Switch
UP = ON / DOWN = OFF
Left Cannon Power Switch
UP = ON / DOWN = OFF
ORO-57K Rocket Pod / IR MissilesPower Switch
UP = ON / DOWN = OFF
RP-5 Izumrud Radar Power Switch
UP = ON / DOWN = OFF
DISCONNECT IMMEDIATELY AFTER LANDING
EMERG ARK RADIO
EMERG AGI
RADIO
BEACON R-ALT
MUS-2 SYSTEM STAB.
AILERON TRIMMER / TRIMMER EFFECT
GIK AGI
PBD HEAT.
EMERG TP-156
BATTERY GROUND POWER
GENERATOR LEFT
GENERATOR RIGHT
LEFT CANNONS
RIGHT CANNONS
CAM EXT.
LEFT GENERATORS DISCONNECTED
MILITARY POWER
EMERG FLAPS
VOLUME


Main Hydraulic System Pressure Indicator (kg/cm²)
Emergency Landing Gear Pneumatic Air Pressure Available (kg/cm²)
Emergency Flaps Pneumatic Air Pressure Available (kg/cm²)
Main Pneumatic System Air Pressure Indicator (kg/cm²)
Landing Gear Emergency Deployment Air Valve Control
Flaps Emergency Deployment Air Valve Control
EMERG GEARS
EMERG FLAPS
MAIN HYD. SYSTEM PRESSURE 142 KG/CM²
FLAPS EMERG. DEFL. BOTTLE 130 KG/CM²
MAIN PNEUMATIC SYSTEM 150 KG/CM²
MUS-2 SYSTEM STAB.
AILERON TRIMMER / TRIMMER EFFECT
GIK AGI
PBD HEAT.
LEFT
RIGHT
ГИДРАВЛИКА


EMERG GEAR
EMERG FLAPS

ARK-5 Frequency Band Selected Indicator (used for both FAR and NEAR frequencies)

ARK-5 Frequency Scale Backlight Control

ARK-5 Radio Navigation System NEAR Frequency Band Selector Switch
Can only be moved if NEAR frequency is selected and ARK-5 Function Selector is set to ANT (Antenna)

ARK-5 Receiver Identification Mode Switch
- *TLG (ТЛГ): Telegraph/Morse Code Identification*
- *TLF (ТЛФ): Telephony/Voice*

ARK-5 Received Signal Strength

ARK-5 Radio Navigation System FAR Frequency Band Selector Switch
Can only be moved if FAR frequency is selected and ARK-5 Function Selector is set to ANT (Antenna)
150-310 kHz / 310-640 kHz / 640-1300 kHz

ARK-5 Loop Antenna Rotation Switch (Spring-loaded to center position)

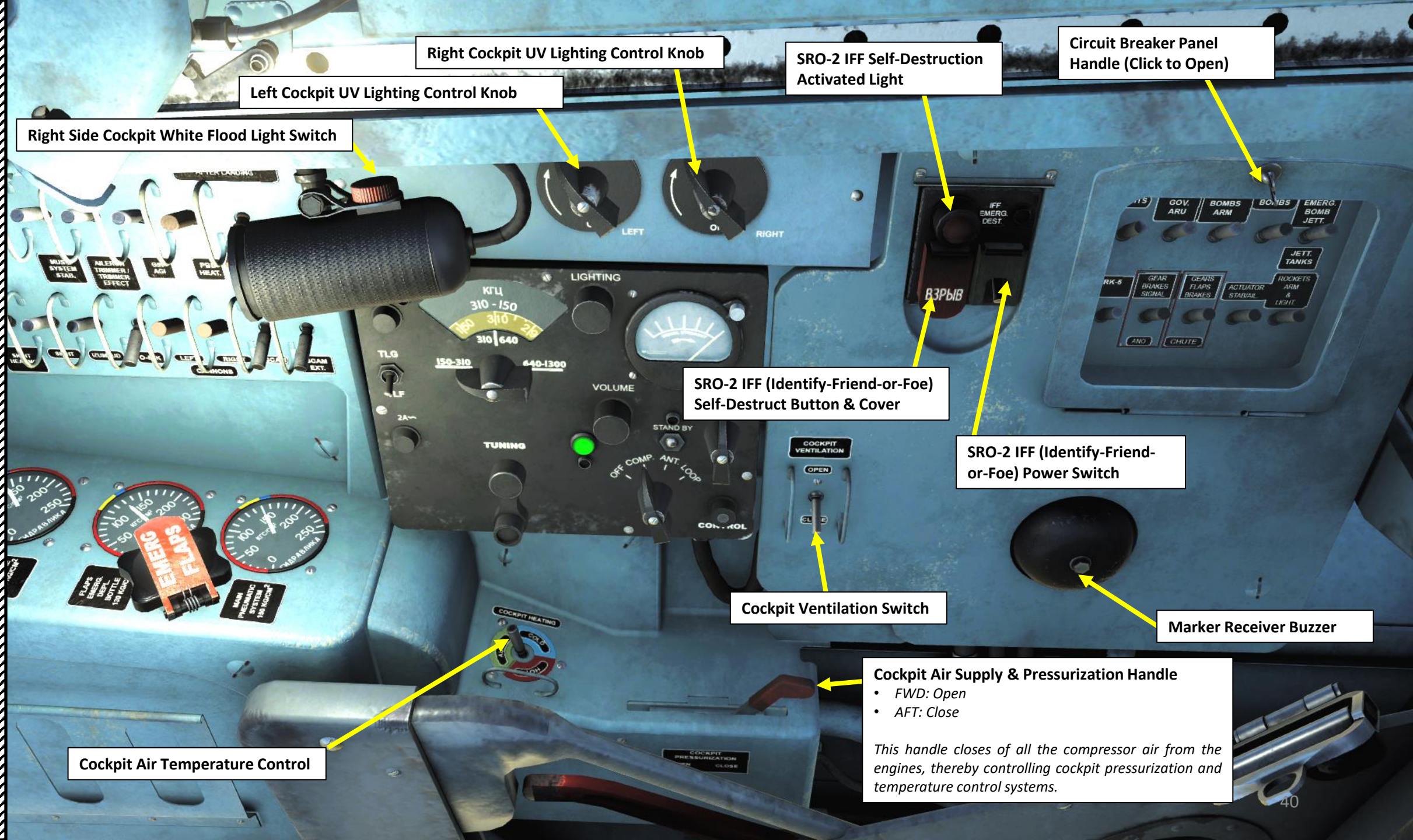
ARK-5 Frequency Fine Tuning Knob

ARK-5 System ON Lamp

ARK-5 Volume Control

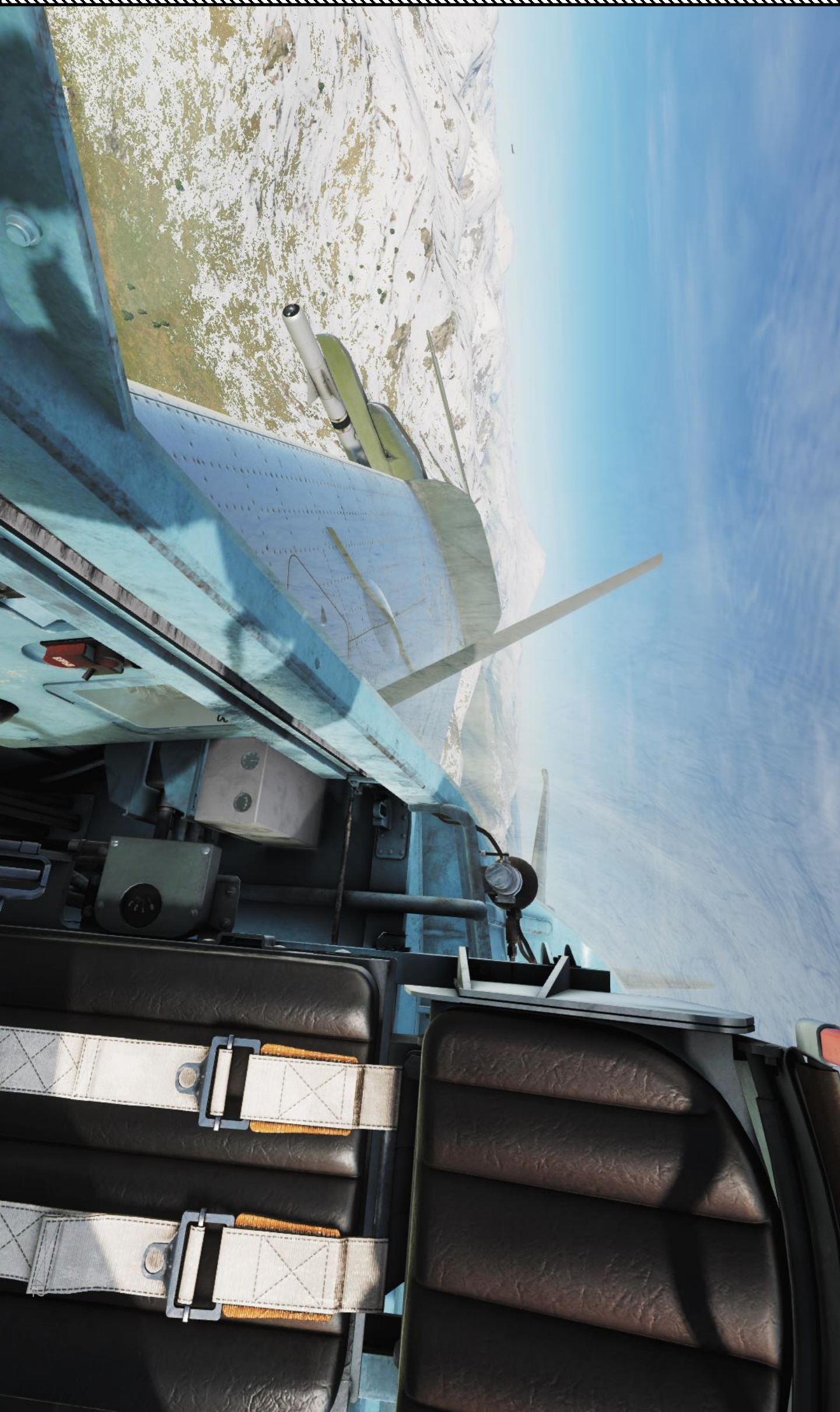
ARK-5 Radio Navigation System Function Selector Switch
- *OFF*
- *COMP: Compass Direction finder Mode. The ARK-5P will use the pre-set or manually tuned Frequencies to automatically indicate the NDB (Non-Directional Beacon) Bearing*
- *ANT: Antenna Mode enables the Audio of the NDB Morse Identifiers (using the Non-Directional Sense Antenna). In this Mode, the Morse Identifiers are heard more clearly than in COMP Mode.*
- *LOOP: Used to manually Rotate the Directional Loop Antenna Frame to the Null Signal Position.*

ARK-5 Radio Navigation System NEAR/FAR Frequency Homing Selector Switch

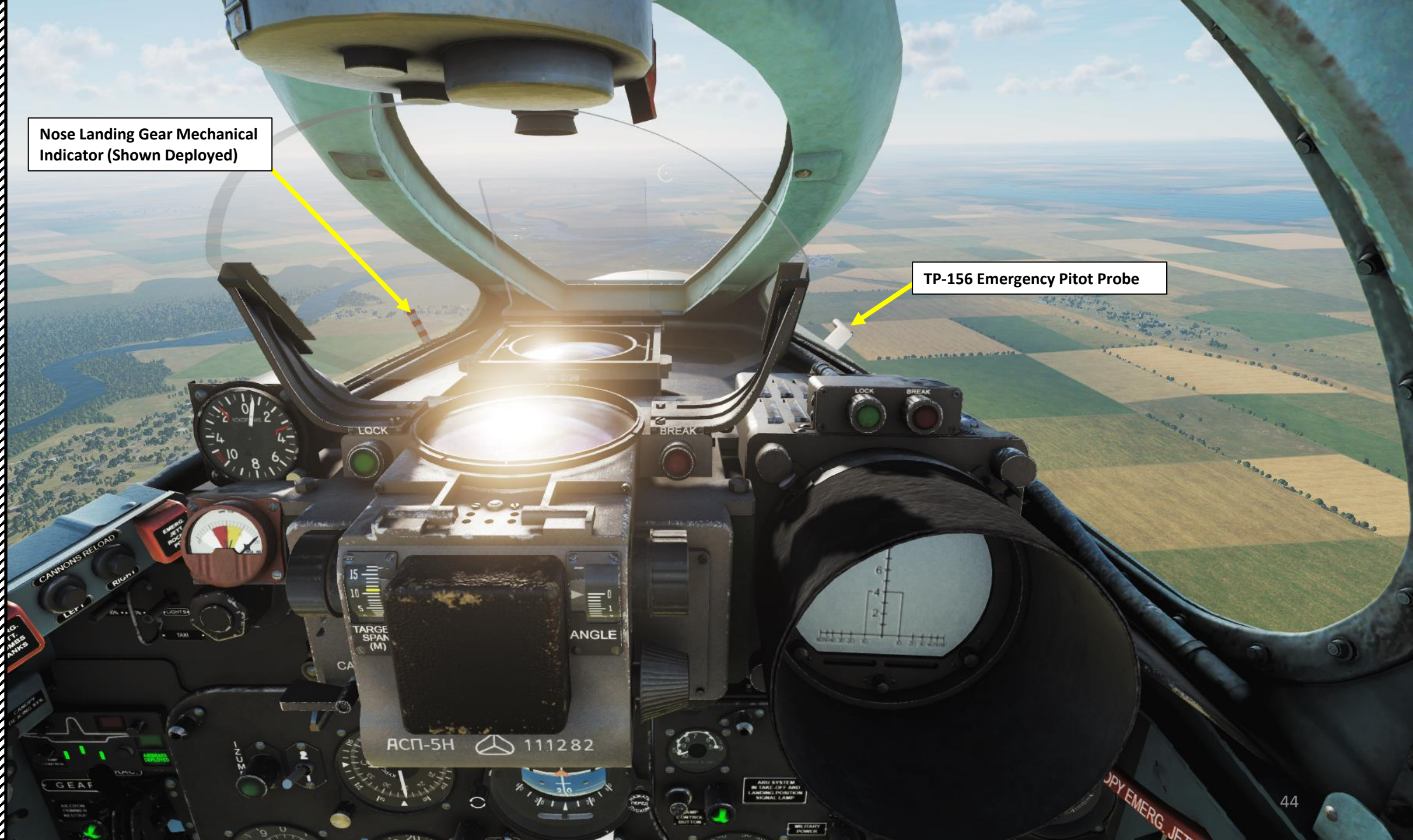

Right Cockpit UV Lighting Control Knob
Left Cockpit UV Lighting Control Knob
Right Side Cockpit White Flood Light Switch
SRO-2 IFF Self-Destruction Activated Light
Circuit Breaker Panel Handle (Click to Open)
SRO-2 IFF (Identify-Friend-or-Foe) Self-Destruct Button & Cover
SRO-2 IFF (Identify-Friend-or-Foe) Power Switch
Cockpit Ventilation Switch
Marker Receiver Buzzer
Cockpit Air Temperature Control
Cockpit Air Supply & Pressurization Handle
• FWD: Open
• AFT: Close
This handle closes of all the compressor air from the engines, thereby controlling cockpit pressurization and temperature control systems.
LEFT
RIGHT
LIGHTING
VOLUME
TUNING
STAND BY
COCKPIT VENTILATION
OPEN
COCKPIT HEATING
EMERG FLAPS
IFF EMERG. DEST.
ВЗРЫВ
GOV. ARU
BOMBS ARM
EMERG. BOMB JETT.
JETT. TANKS
GEAR BRAKES SIGNAL
GEARS FLAPS BRAKES
ROCKETS ARM & LIGHT
ANO
CHUTE

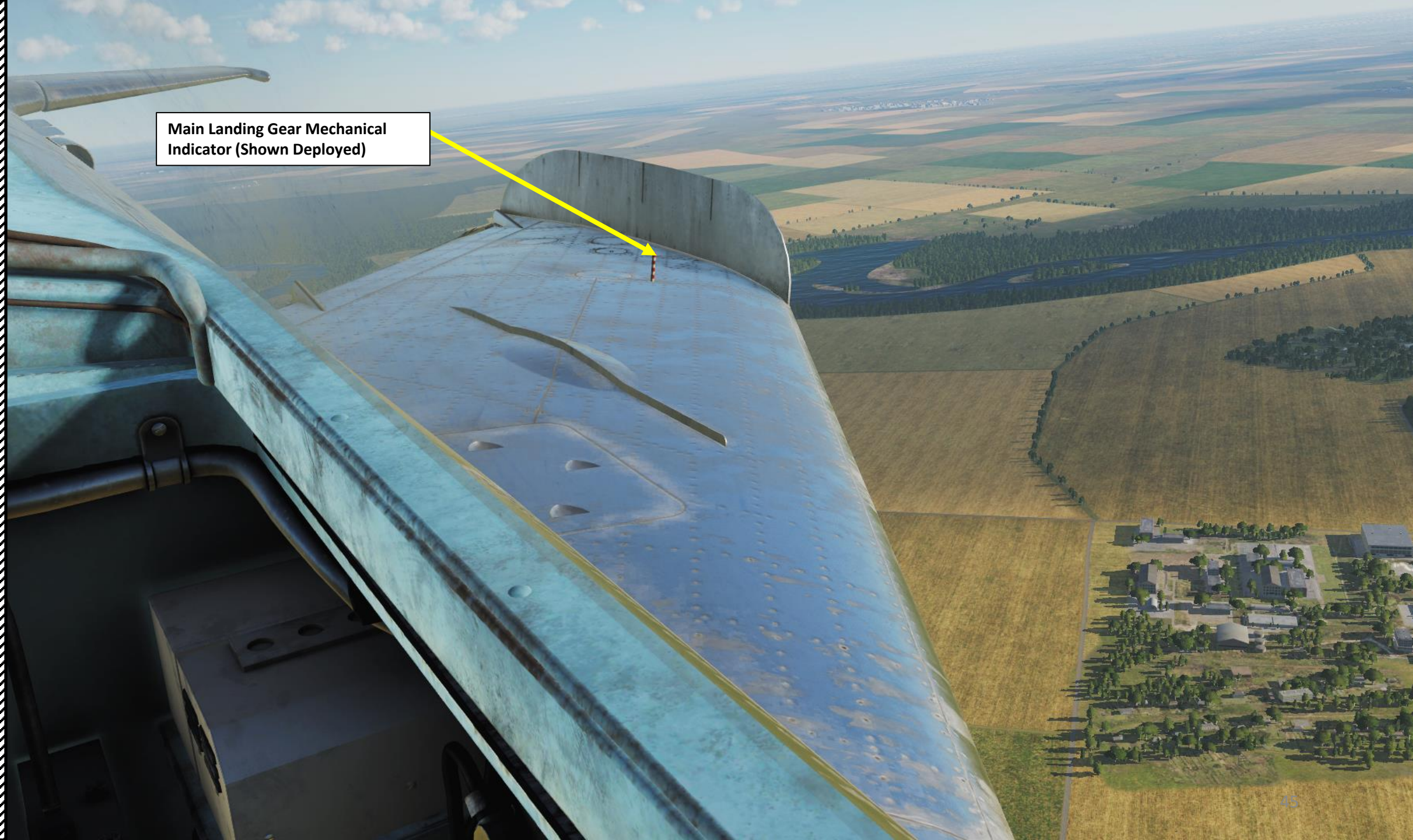
Circuit Breaker Panel (UP = Circuit Closed / ON)

- ***LIGHTS***: *external lights*
- ***GOV ARU***: *ARU-2V Flight Control System Governor*
- ***BOMBS ARM***: *Bomb Fuzing System*
- ***BOMBS***: *Bomb Release System*
- ***EMERG BOMB JETT / JETT TANKS***: *Bomb, Rocket & Drop Tank emergency jettison system*
- ***ARK-5***: *Radio-Navigation system*
- ***GEAR BRAKES SIGNAL ANO***: *Landing Gear, Airbrake and Flaps annunciator lights + navigation lights*
- ***GEARS FLAPS BRAKES CHUTE***: *Landing Gear, Airbrake, Flaps and Drag Chute systems*
- ***ACTUATOR STAB/AIL***: *BU-13M and BU-14M Aileron and Stabilizer Hydraulic Booster System*
- ***ROCKETS ARM & LIGHT***: *Rocket Launching System & Cockpit Lighting*

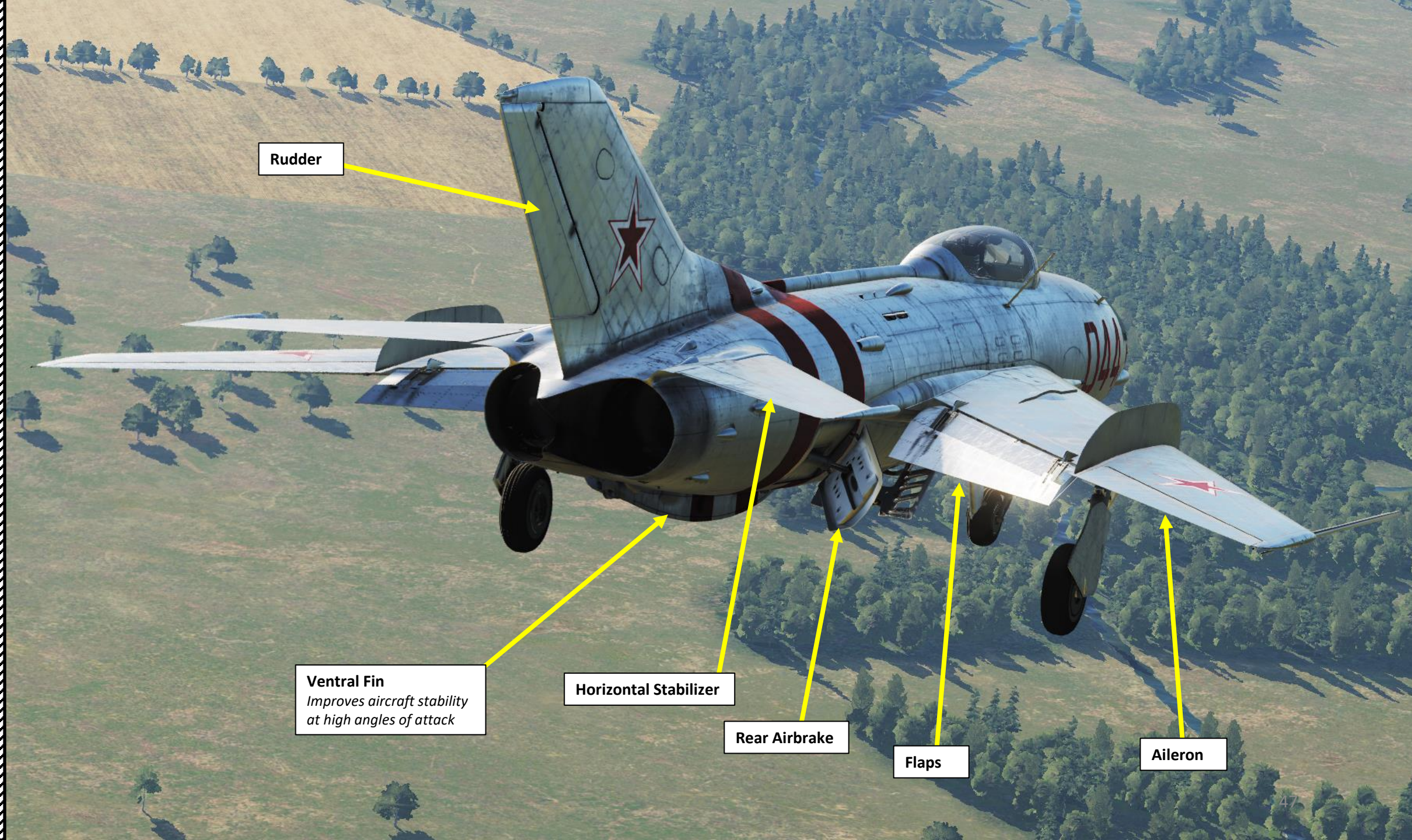


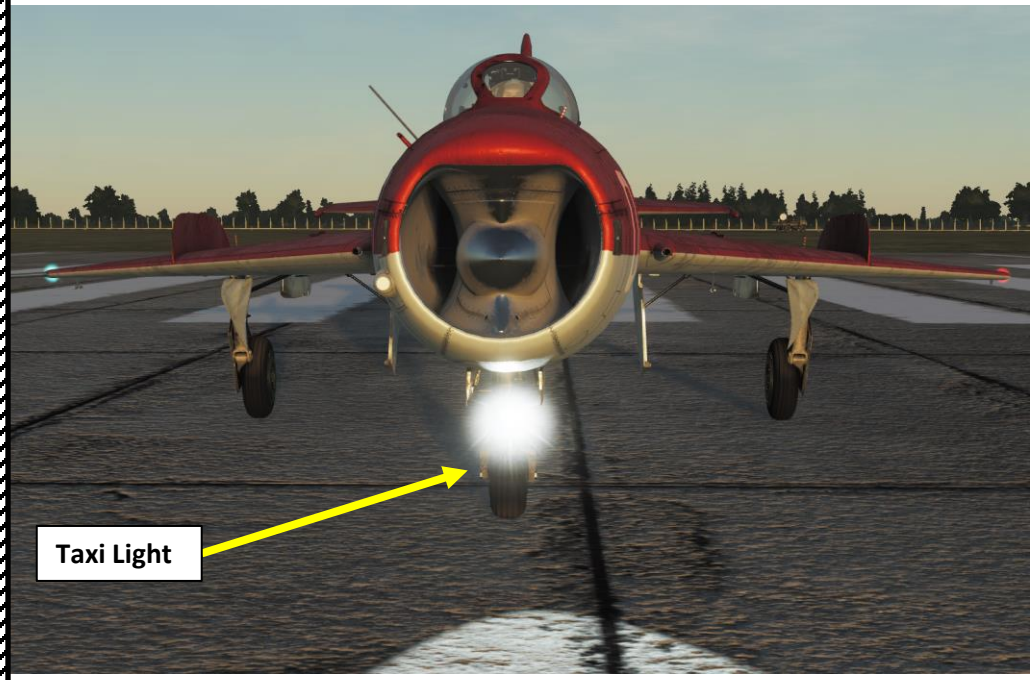

EMERG FLAPS
EMERG GEARS

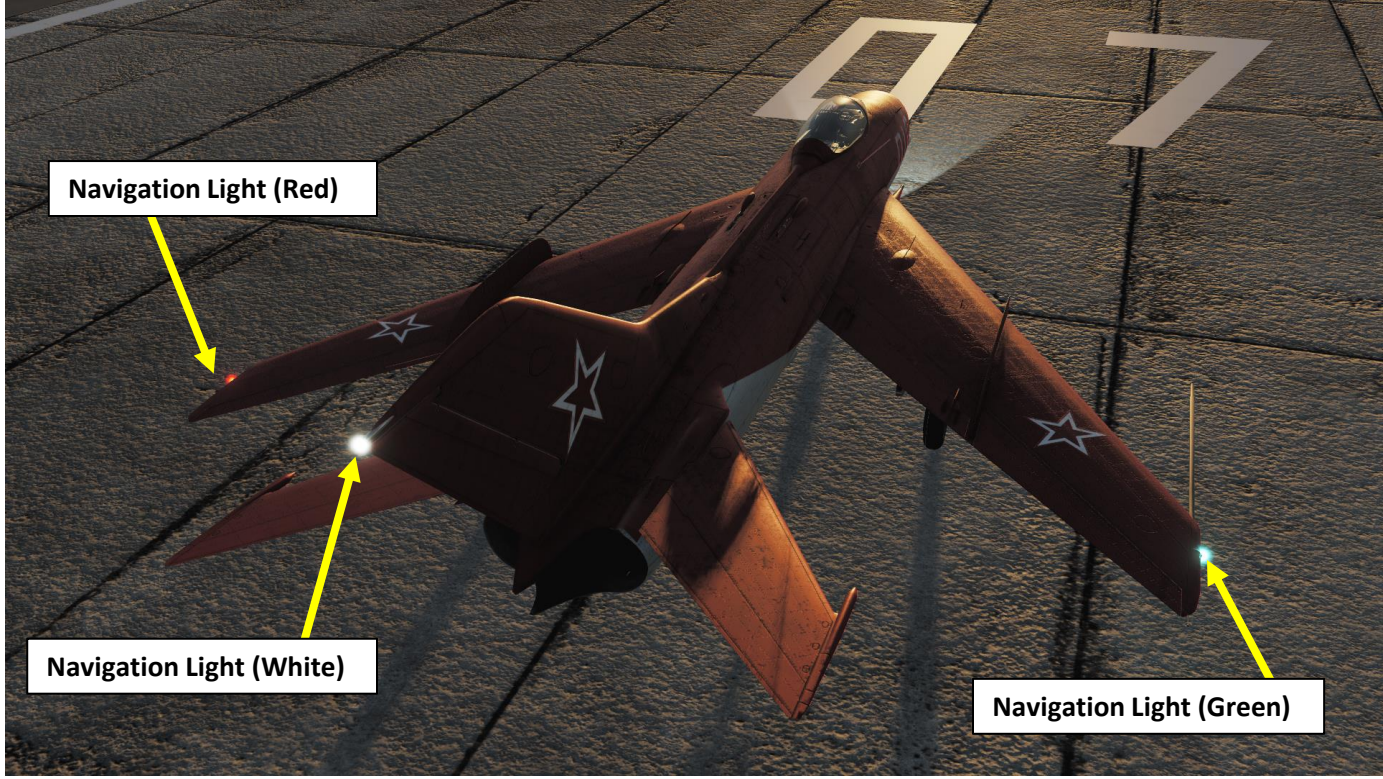

Nose Landing Gear Mechanical Indicator (Shown Deployed)
TP-156 Emergency Pitot Probe
LOCK
BREAK
CANNONS RELOAD
ANGLE
АСП-5Н
111282


Main Landing Gear Mechanical Indicator (Shown Deployed)

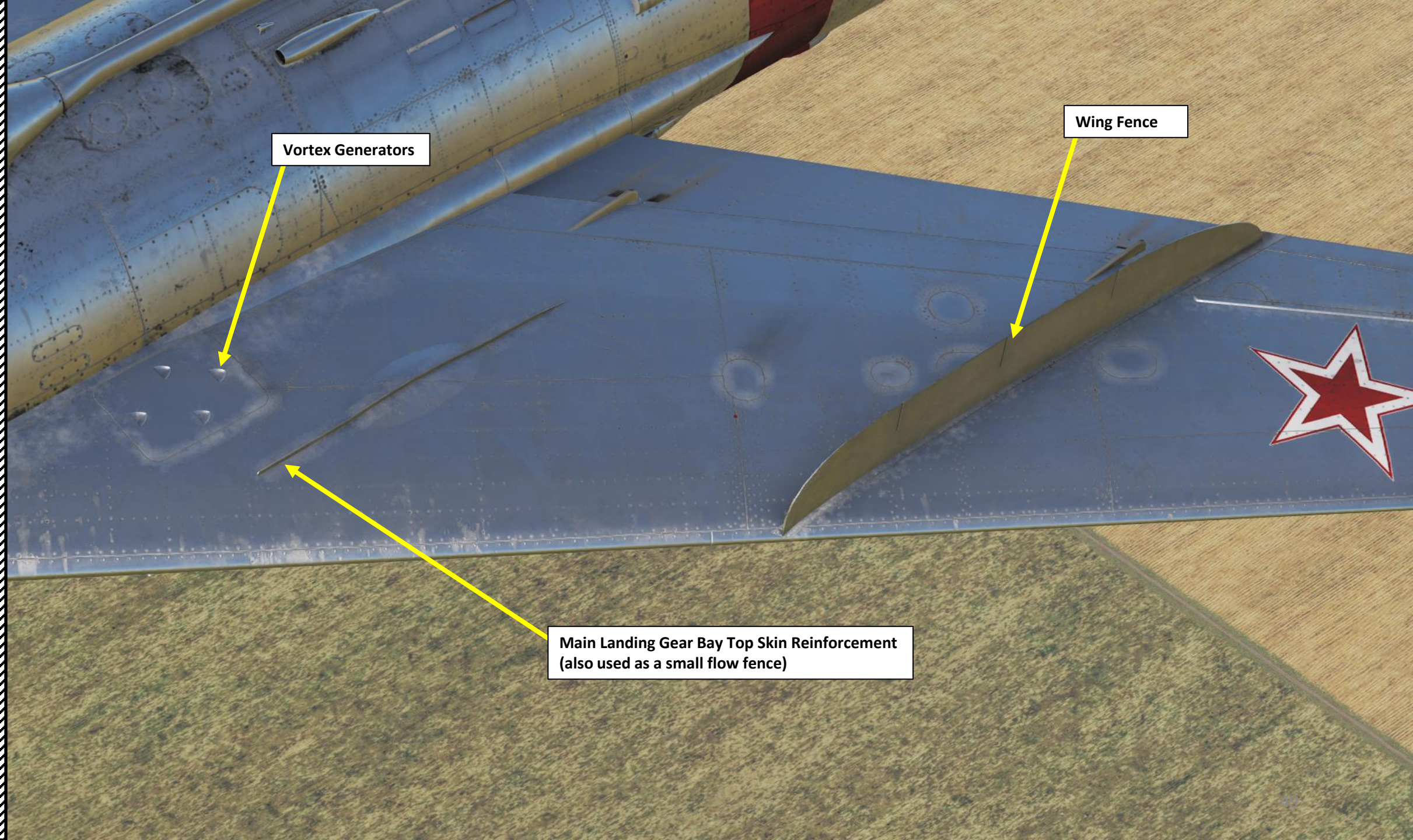

D44
Front Airbrake

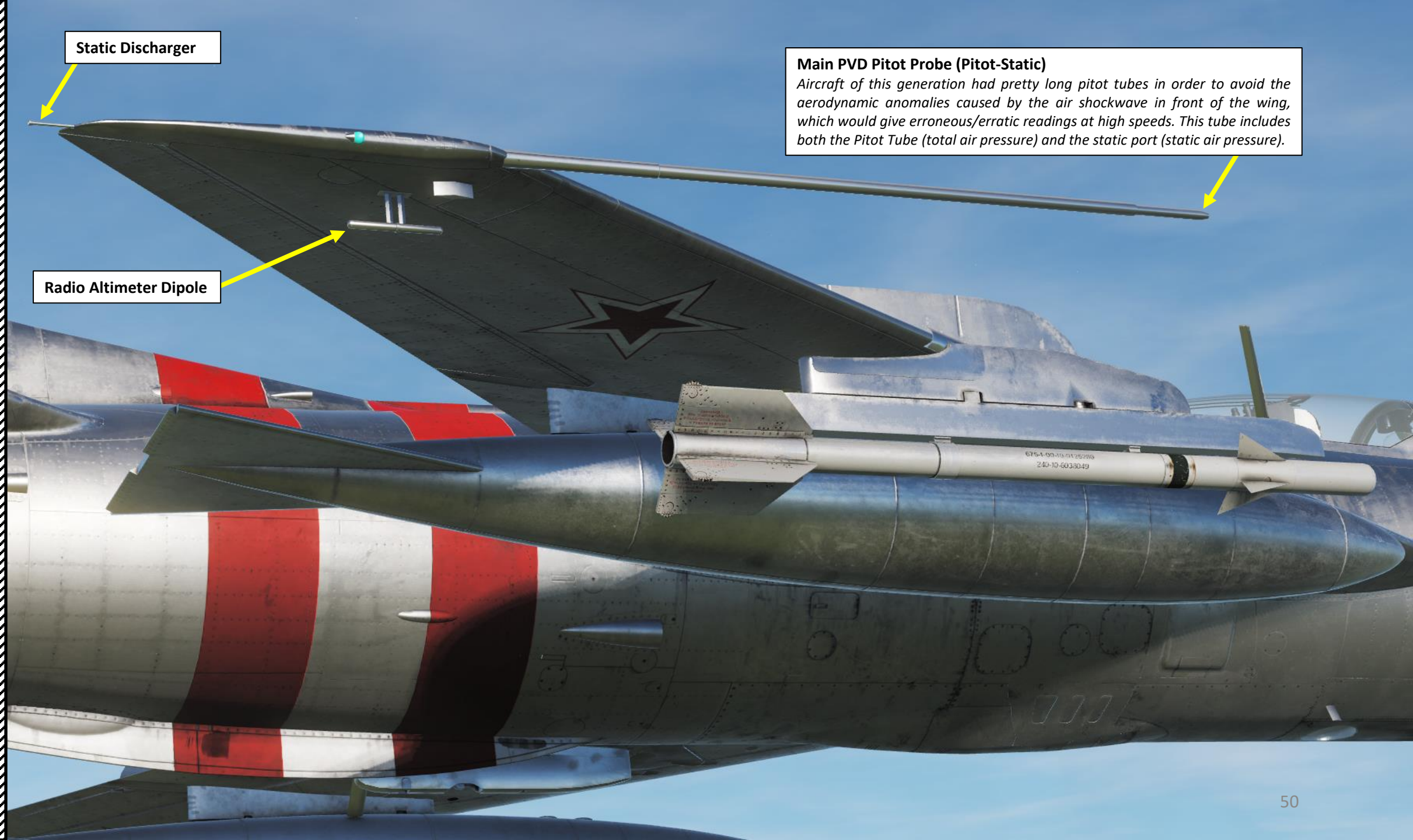

Rudder
Ventral Fin
Improves aircraft stability at high angles of attack
Horizontal Stabilizer
Rear Airbrake
Flaps
Aileron

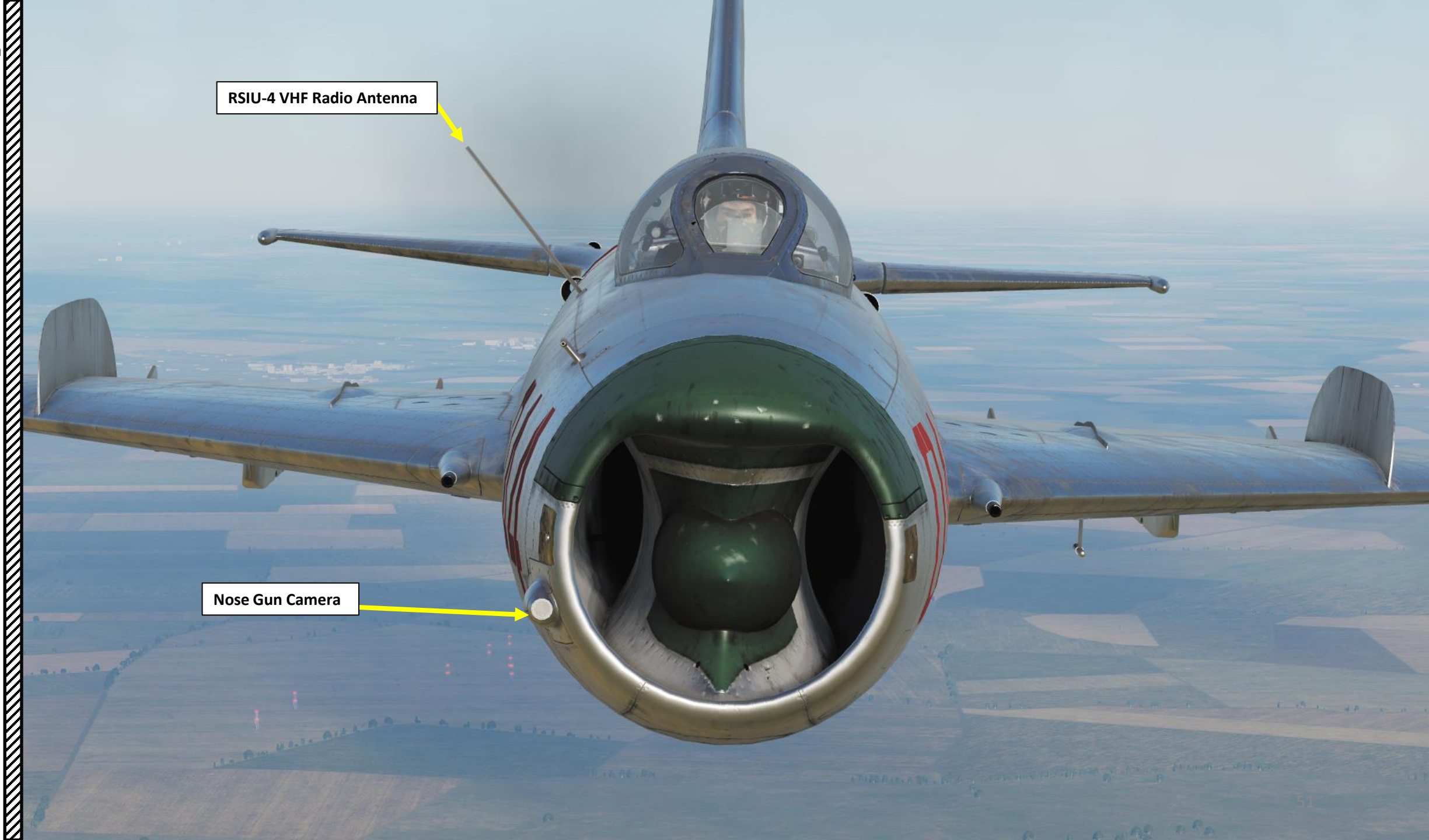

Taxi Light

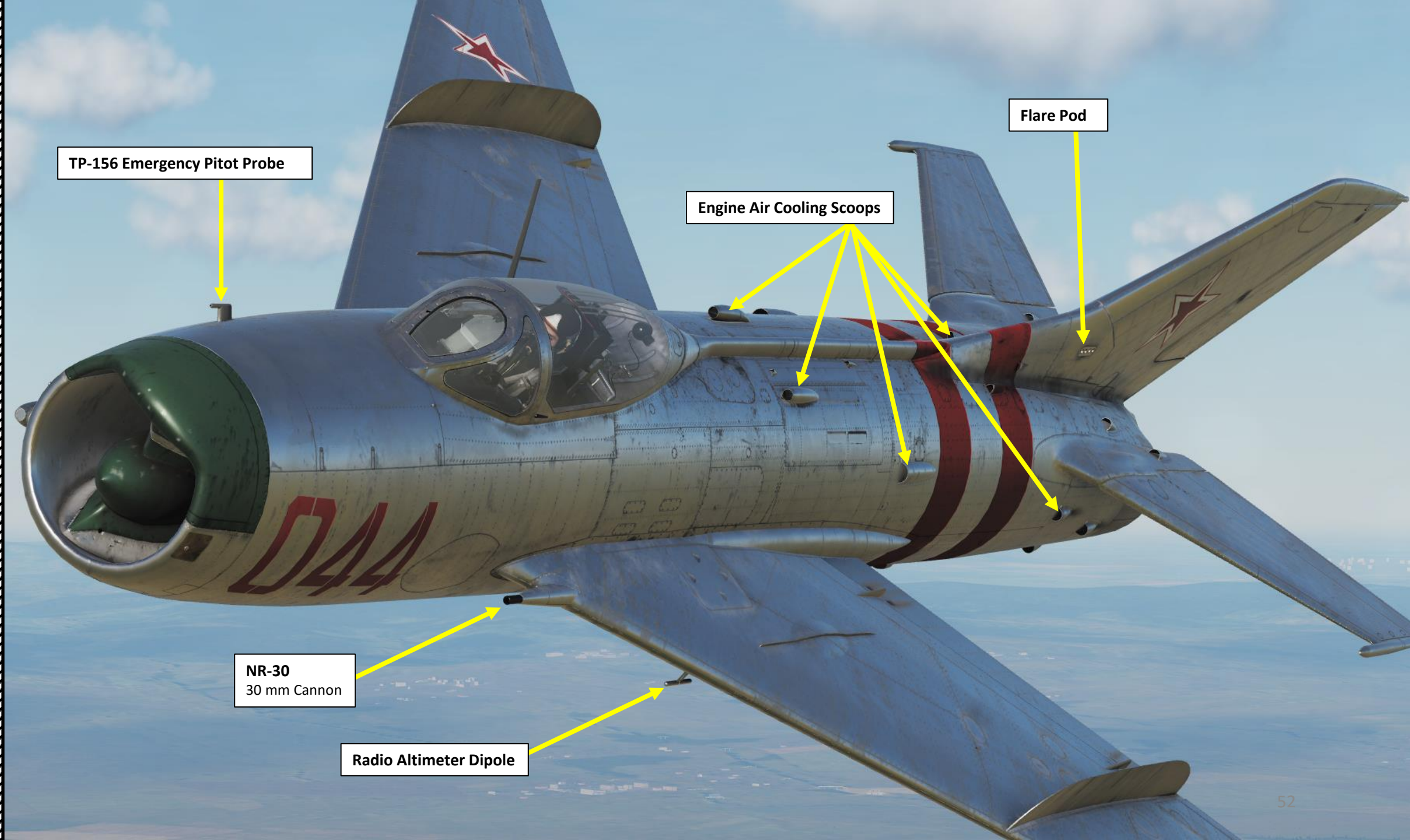

Navigation Light (Red)
Navigation Light (White)
Navigation Light (Green)


Landing Light


Vortex Generators
Wing Fence
Main Landing Gear Bay Top Skin Reinforcement
(also used as a small flow fence)


Static Discharger
Main PVD Pitot Probe (Pitot-Static)
Aircraft of this generation had pretty long pitot tubes in order to avoid the aerodynamic anomalies caused by the air shockwave in front of the wing, which would give erroneous/erratic readings at high speeds. This tube includes both the Pitot Tube (total air pressure) and the static port (static air pressure).
Radio Altimeter Dipole


RSIU-4 VHF Radio Antenna
Nose Gun Camera


TP-156 Emergency Pitot Probe
Engine Air Cooling Scoops
Flare Pod
NR-30
30 mm Cannon
Radio Altimeter Dipole

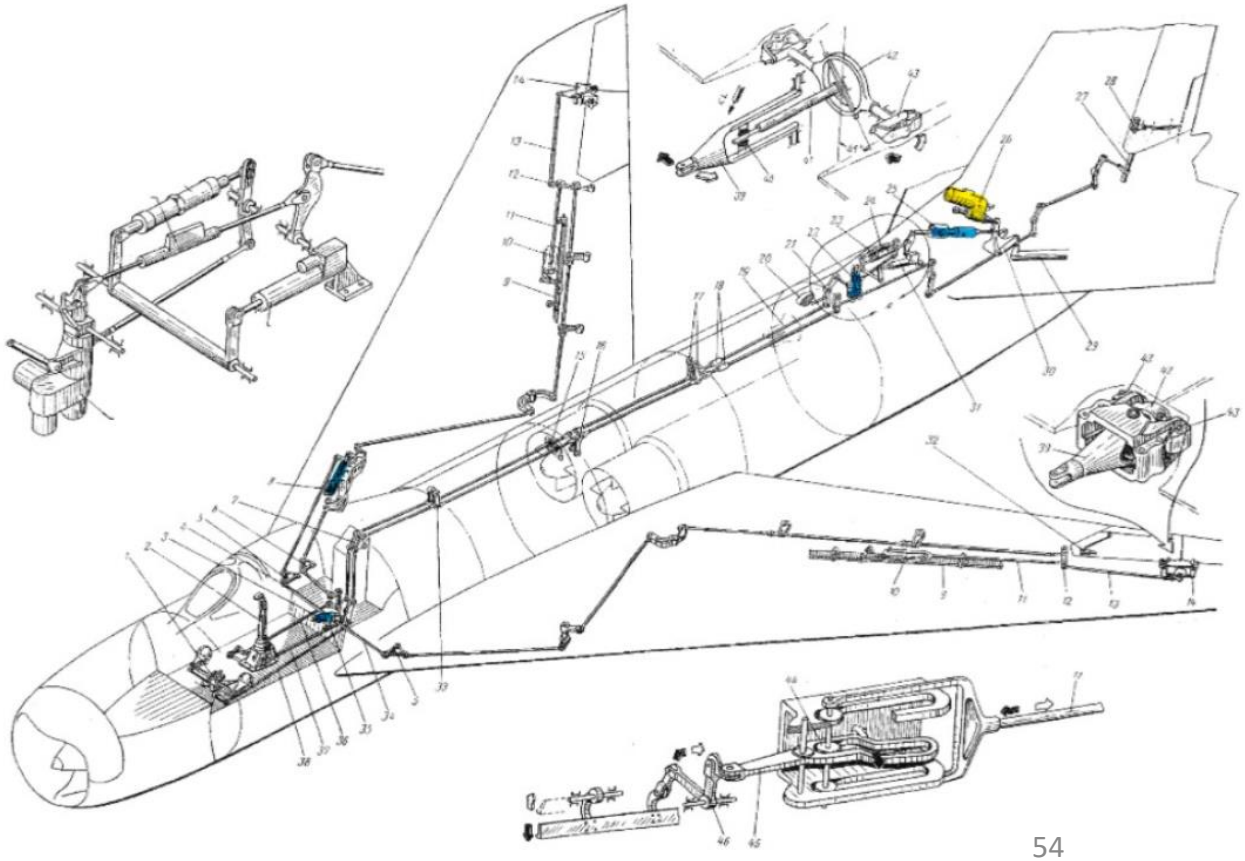

044
NR-30
30 mm Cannon

The Aircraft Flight Control system is a conventional mechanical type, with push-pull rods, cranks and levers. The Ailerons and Stabilizers are moved by irreversible Hydraulic Boosters while the Rudder is moved manually. The Ailerons are powered by a single BU-13M Booster located in the Right Wing, close to the wing root. The Stabilizers are powered by a single BU-14M booster, located in the base of the Vertical Tail or by the MUS-2 electrical system.

The **ARU-2V** flight control system is provided to control the ratio between control stick movement and stabilizer angles, so the aircraft can maneuver within safe limits over a wide range of airspeeds and altitudes. This system provides automatic adjustment (manual backup) of control stick-to-stabilizer gearing and stick forces depending on the aircraft's speed and altitude. The system samples dynamic and static air pressure and changes the transmission relation between the control stick and BU-14M booster by means of a device that increases or decreases the arm between them. The ARU can be controlled manually with controls in the cockpit in case of a failure of the automatic system. A table is provided to the pilot, so they know the correct position for every speed and altitude.

The ARU will work only for speed under the altitude of 5,000 meters. It will be in long arm from take-off to the speed of 480 km/h and start regulating until the speed of 900 km/h, when it will be at the shortest arm. Starting at 5,000 meters to the altitude of 10,000 meters it will start increasing the arm.

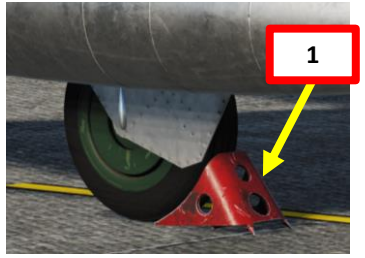
- Long arm = bigger stabilizer deflection angle
- Short arm = smaller stabilizer deflection angle

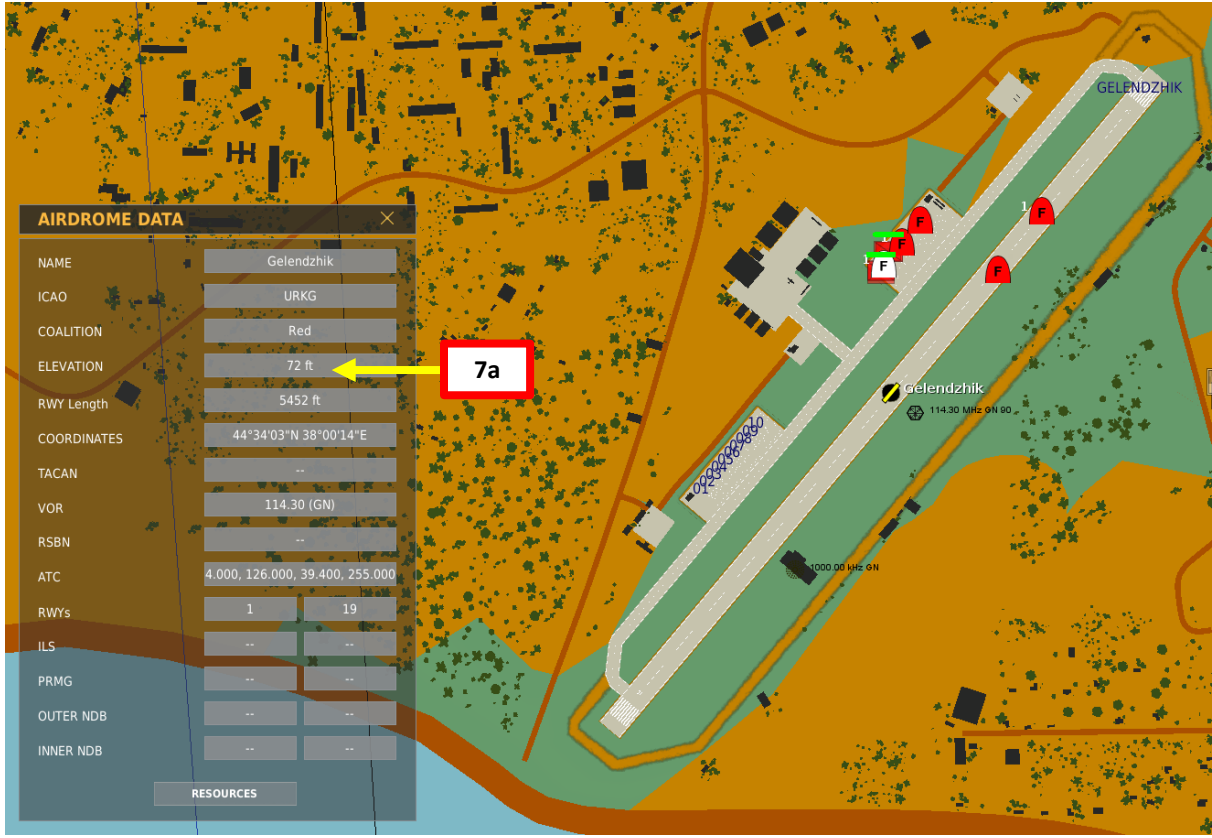


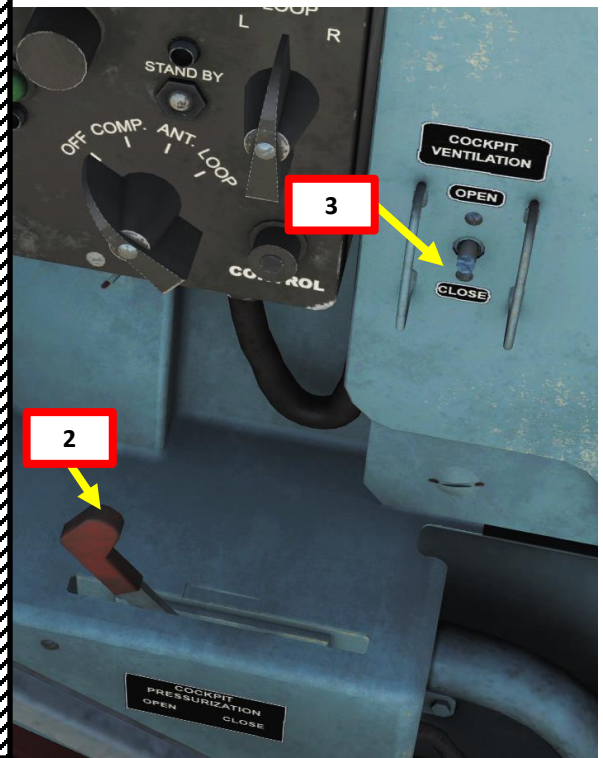
PART 4 – START-UP PROCEDURE

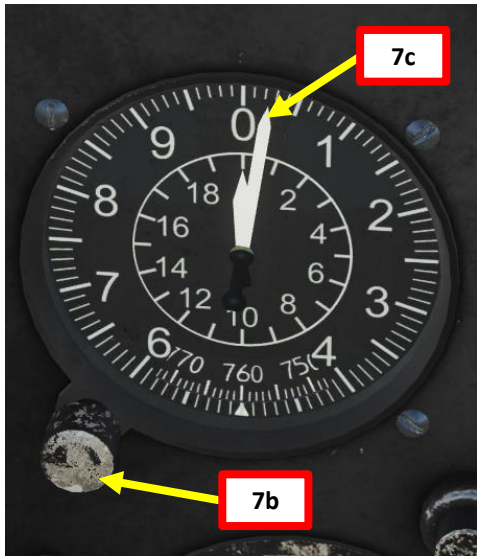
COCKPIT INSPECTION

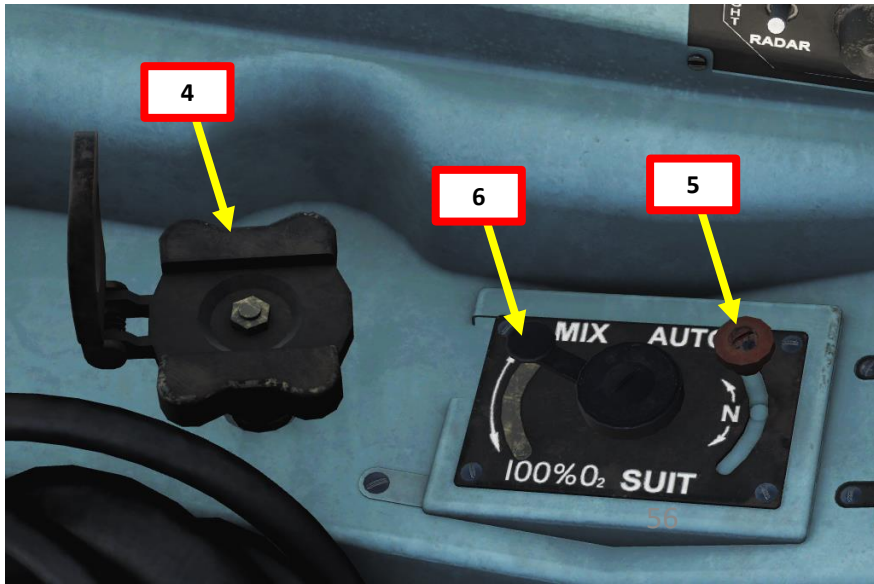
1. Wheel chocks are installed by default when you spawn
2. Set Cockpit Pressurization Lever – OPEN (FWD)
3. Set Cockpit Ventilation Switch – OPEN (UP)
4. Open the Oxygen Shutoff Valve
5. Set Oxygen Air Diluter Selector – MIX
6. Set Altitude Pressure Suit Oxygen Supply Lever – AUTO
7. Set Barometric Altimeter Pressure Setting to match the Altimeter's Altitude with the Airport Elevation (available by using the F10 map).
8. Set ARU-2V Elevator Flight Control System Mode Switch – AUTO (UP).
9. Set Aileron Hydraulic Booster Pump Switch – ON (FWD)





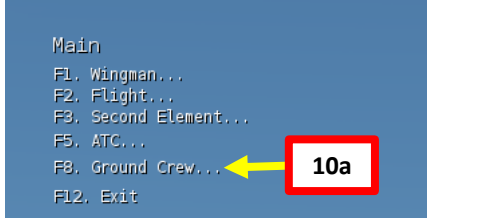


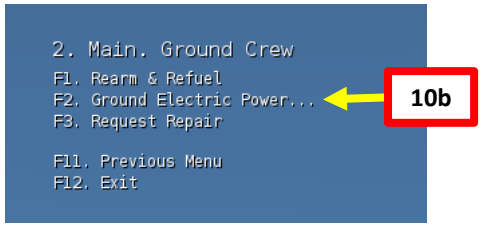


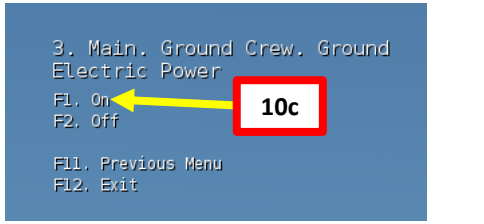


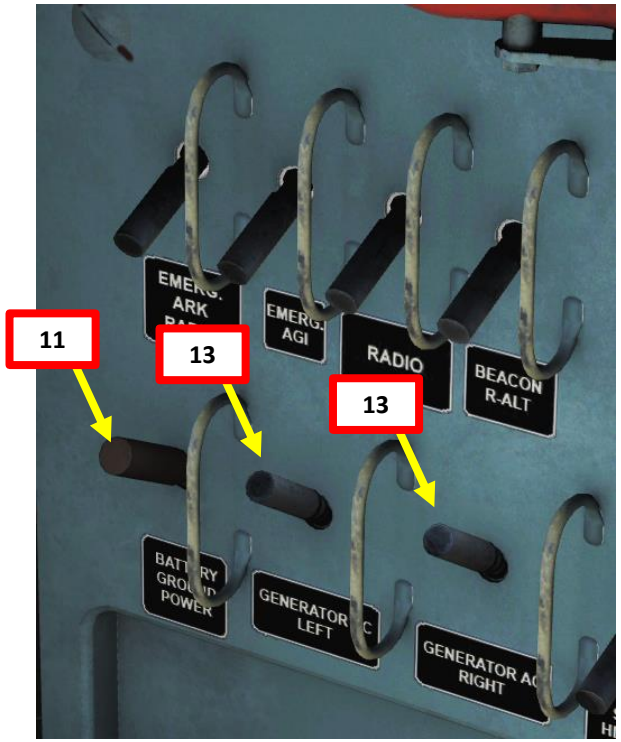
AIRCRAFT POWER UP

10. Call ground crew to connect Ground Electric Power
    a) Press "\" (Communication Menu) and "F8" to select ground crew
    b) Select "Ground Electric Power" by pressing "F2"
    c) Select "ON" by pressing "F1" to turn on ground power
11. Set Battery Switch – ON (UP)
12. Verify that the LOW OIL PRESSURE, LEFT & RIGHT GENERATOR, and LOW HYDRAULIC PRESSURE lamps are illuminated. If external tanks or bombs are equipped, the SUSPENDED LOAD lamps will illuminated.
13. Set Left & Right AC Generator switches – ON (UP)



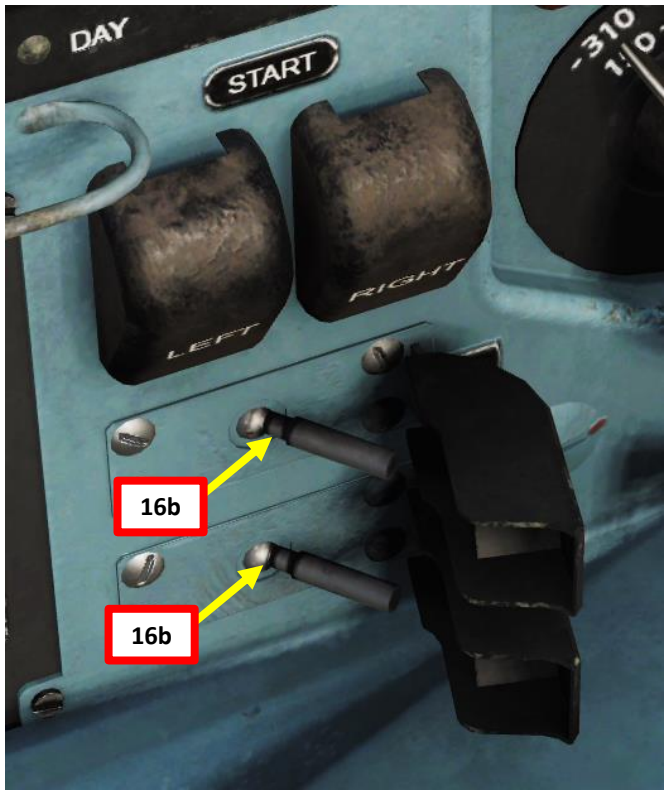






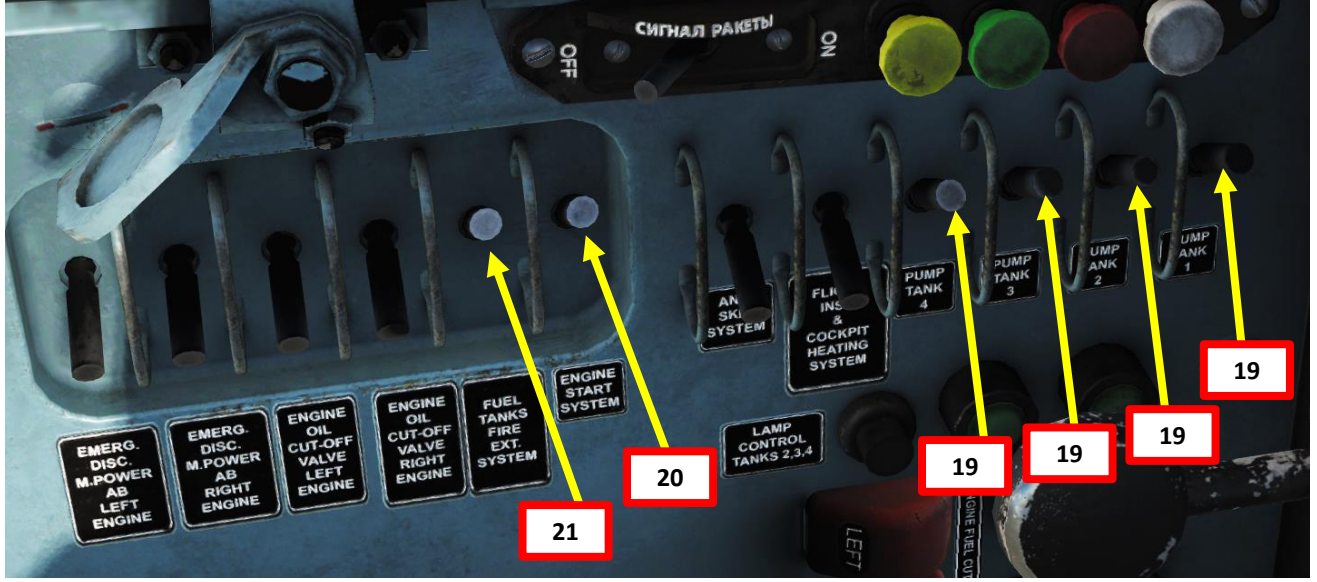
AIRCRAFT POWER UP

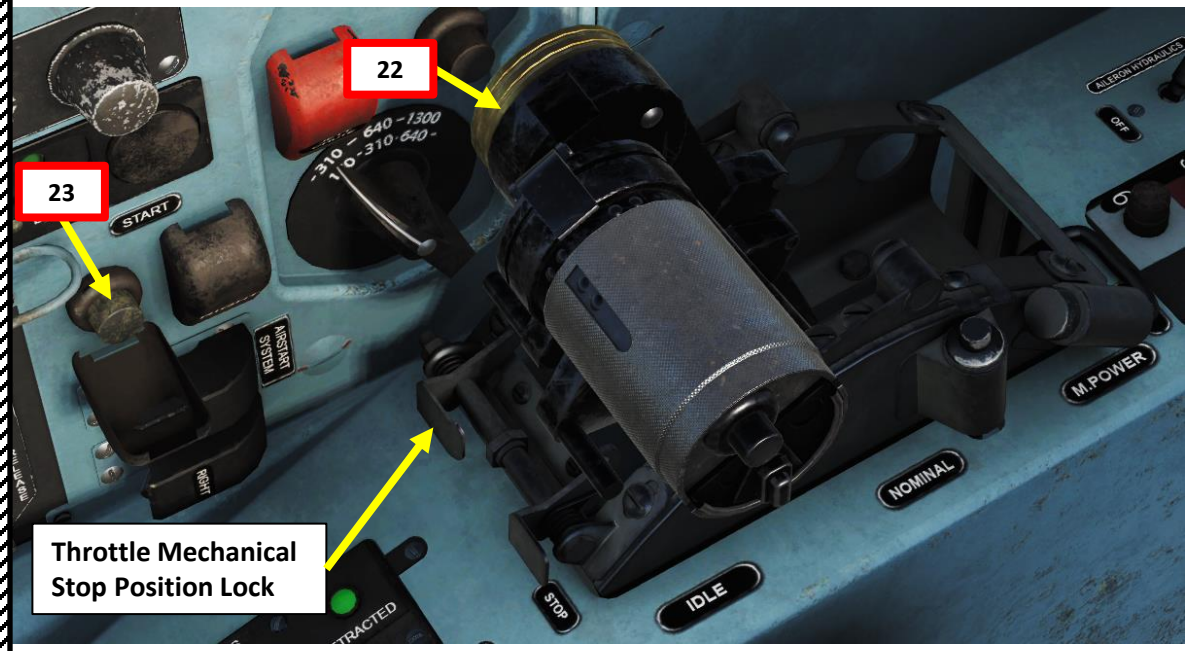
14. (*Optional*) Press the Landing Gear Lamp Test button and confirm that the status lights illuminate properly
15. (*Optional*) Press the Engine Fire Lamp Test button and confirm that the Engine Fire Lamp illuminates. This confirms that our engine fire detectors are working properly.
16. (*Optional*) Lift covers of the Engine Airstart switches and set them FORWARD (ON). Confirm that the AIRSTART lamps illuminate properly, then set both Engine Airstart switches back to AFT (OFF) and close the covers.
17. (*Optional*) Press the Fuel Tanks #2-3-4 Lamp Test button and confirm that the Fuel Tank #2 EMPTY and Fuel Tank #3 & #4 EMPTY lamps illuminate.



ENGINE START

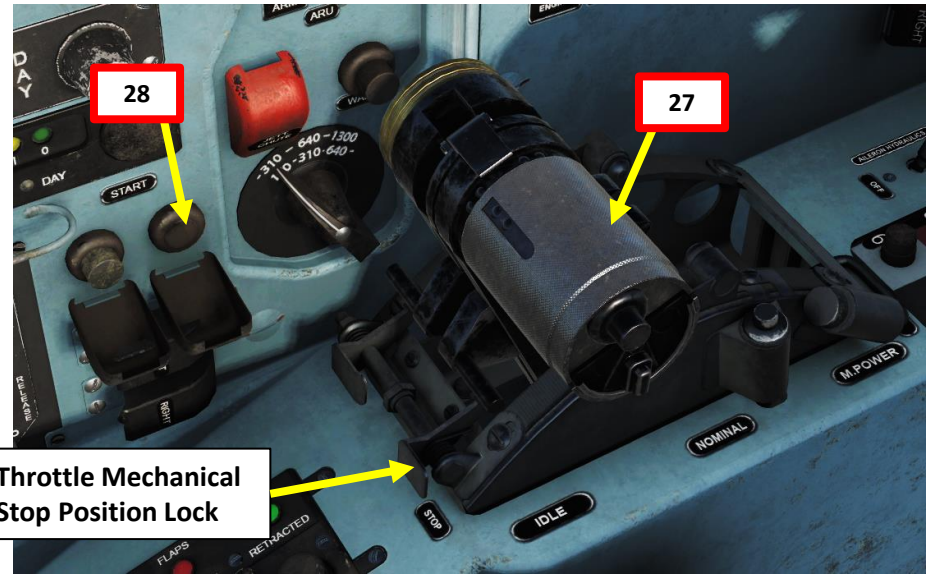
18. Make sure the Ground Electric Power is connected and the battery switch is ON; the engine starter requires electrical power.
19. Set Fuel Pumps #1, #2, #3 & #4 switches – ON (UP)
20. Set Engine Start System Power switch – ON (UP)
21. Set Fire Extinguisher System Power switch – ON (UP)
22. Lift Throttle Mechanical Stopper and set Left Throttle – IDLE Position (RALT+HOME).
23. Lift the Left Engine Starter cover and press the starter button for approx. 3 seconds.
24. Confirm positive RPM increase
25. As the engine RPM reaches 4000, confirm that the left LOW OIL PRESSURE lamp disappears. Engine stabilization should happen within 80 seconds.
26. Confirm that the Left GENERATOR DISCONNECTED lamp is extinguished, which means that the generator has kicked in.

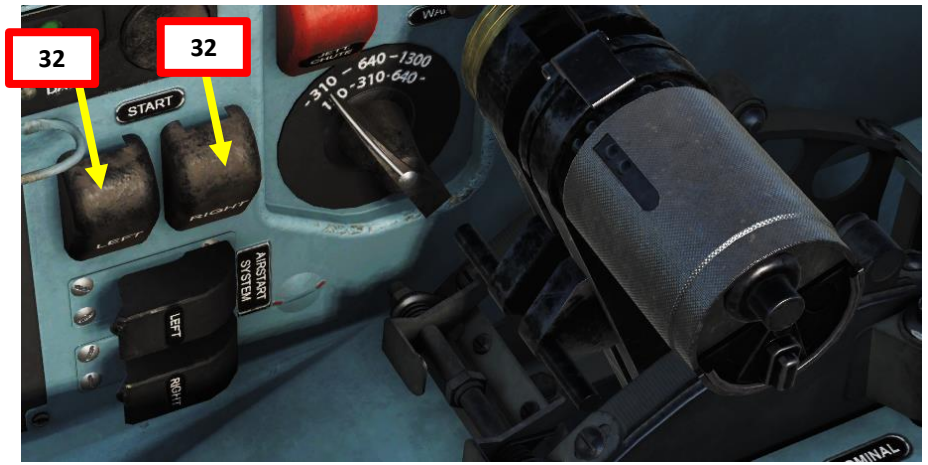




ENGINE START

27. Lift Throttle Mechanical Stopper and set Right Throttle – IDLE Position (RSHIFT+HOME)
28. Lift the Right Engine Starter cover and press the starter button for approx. 3 seconds.
29. Confirm positive RPM increase
30. As the engine RPM reaches 4000, confirm that the right LOW OIL PRESSURE lamp disappears. Engine stabilization should happen within 80 seconds.
31. Confirm that the Right GENERATOR DISCONNECTED lamp is extinguished, which means that the generator has kicked in.
32. Close both Engine Starter covers.
33. Confirm that the LOW PRESSURE HYDRAULIC SYSTEM lamp extinguishes once both engines are at IDLE RPM
34. Call ground crew to remove Ground Electric Power
    a) Press "\" (Communication Menu) and "F8" to select ground crew
    b) Select "Ground Electric Power" by pressing "F2"
    c) Select "OFF" by pressing "F2" to turn off ground power

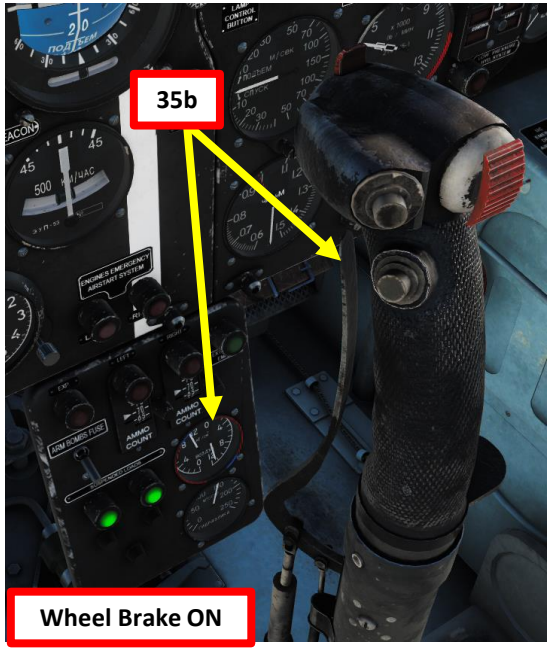


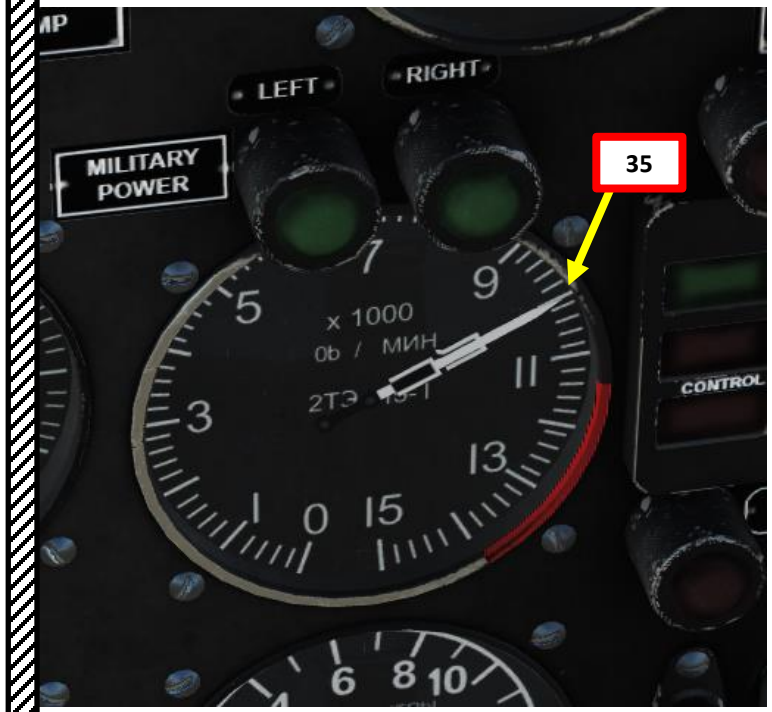


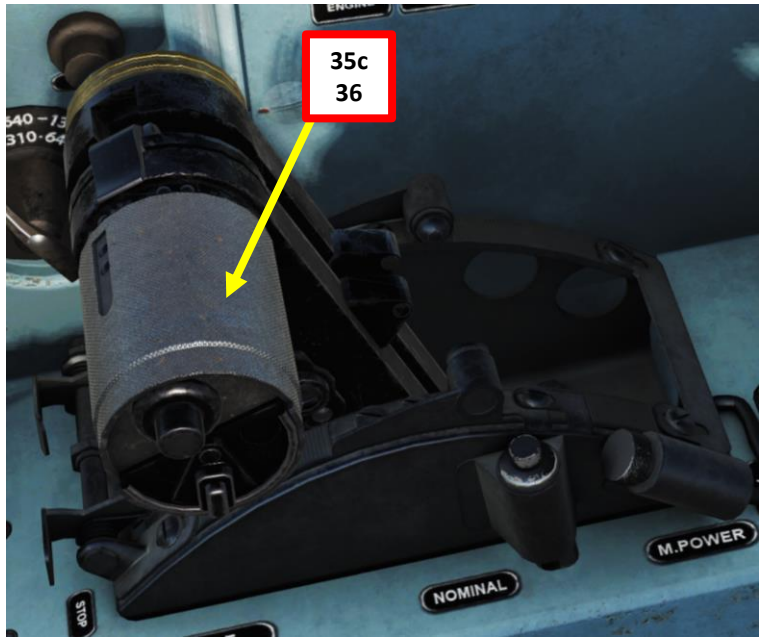
ENGINE RUN-UP

35. *NOMINAL POWER CHECK:*
While holding the Wheel Brake lever, increase throttles to bring both engines to 10,000 RPM. Keep it there for 30-40 seconds to warm up the engines.

36. Throttle down to IDLE.



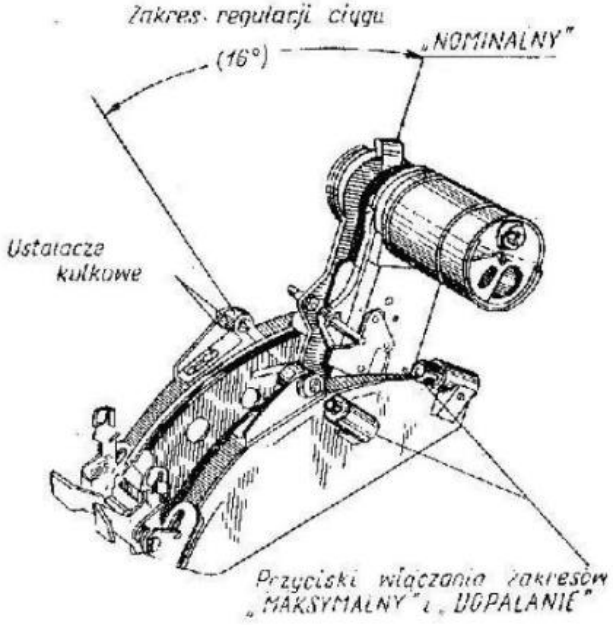


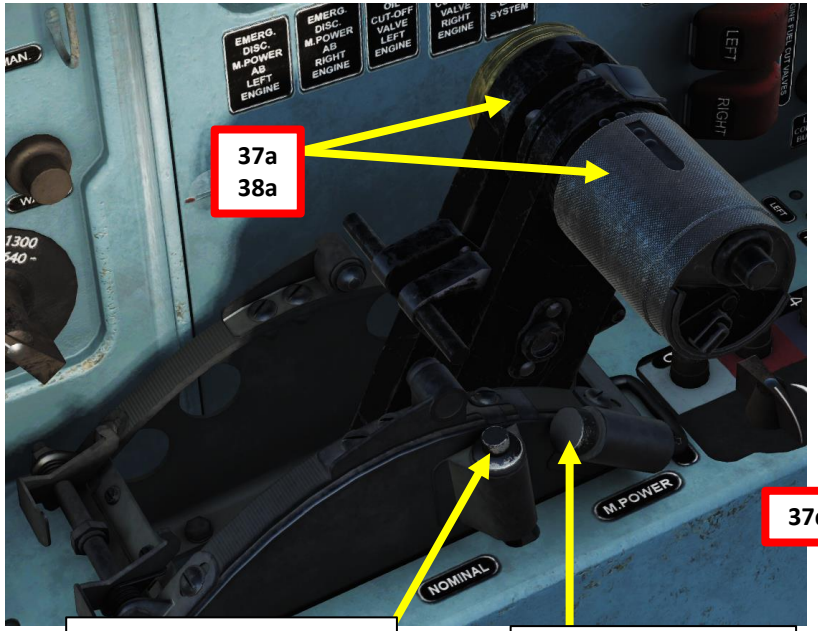


ENGINE RUN-UP

37. *(Optional) MILITARY POWER CHECK:*
   a) While holding the Wheel Brake lever, advance both throttles fully forward, then press the MIL (Military Power) Enable Button for 2 seconds once the throttles reach the NOMINAL position (Fully Forward).
   b) Confirm that engine RPM stabilizes between 11,100 and 11,200 RPM
   c) Confirm that EGT (Exhaust Gas Temperature) does not exceed 650 deg C
   d) Confirm that both Military Power lamps illuminate and that the AB (Afterburner) lamps remain extinguished.
   e) Throttle down to IDLE to disengage MIL Power and confirm that the left and right Military Power lamps extinguish when the throttles go below the 16 degrees position detent.

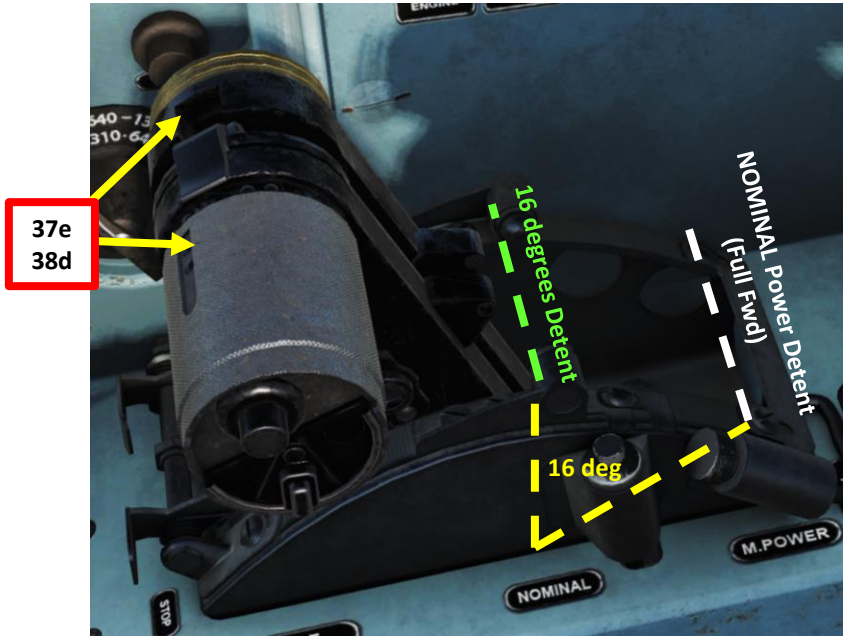
38. *(Optional) AFTERBURNER POWER CHECK:*
   a) While holding the Wheel Brake lever, advance both throttles fully forward, then press the Afterburner Enable Button for 2 seconds once the throttles reach the NOMINAL position (Fully Forward).
   b) Confirm that EGT (Exhaust Gas Temperature) does not exceed 680 deg C
   c) Confirm that both Military Power lamps illuminate and that the AB (Afterburner) lamps illuminate as well.
   d) Throttle down to IDLE to disengage afterburners and confirm that the left and right Military Power lamps and the AB (Afterburner) lamps extinguish when the throttles go below the 16 degrees position detent.

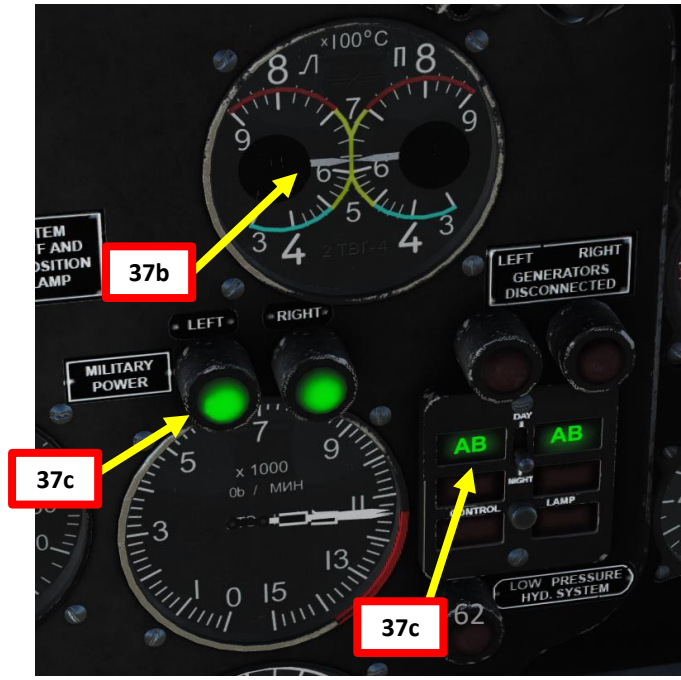




37a **MIL (Military) Power Enable Button** *(Enables Military Power)*

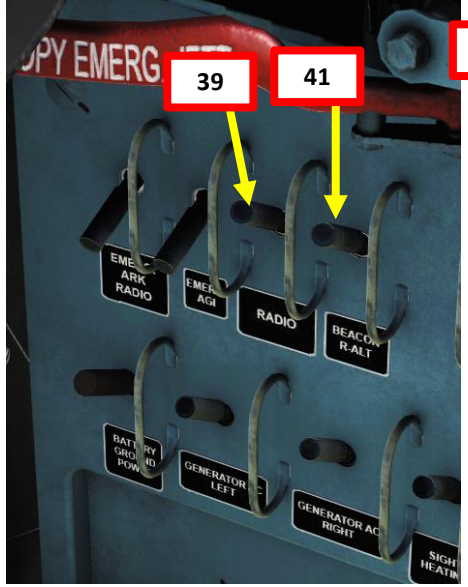
38a **Afterburner Enable Button** *(Enables afterburners)*

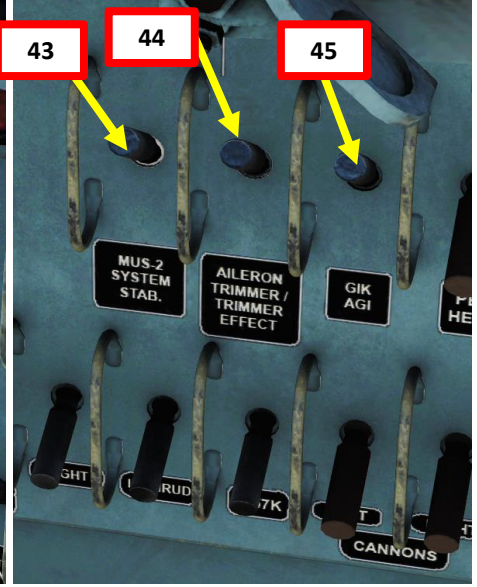


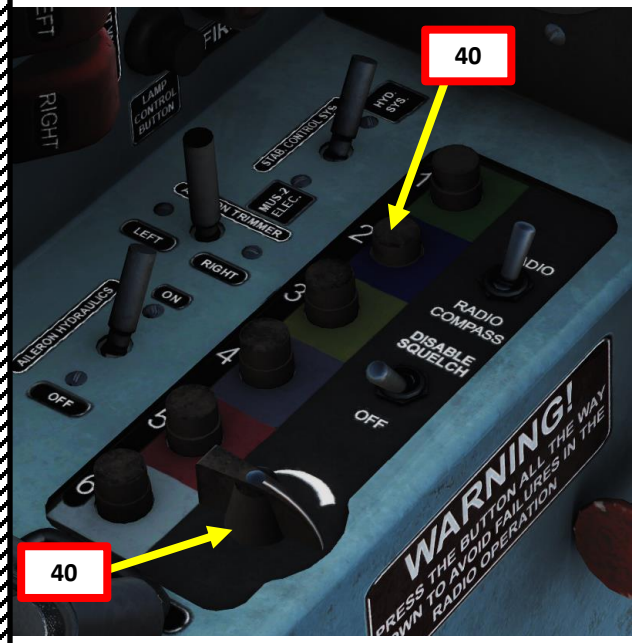


PRE-FLIGHT CHECKS

39. Set Radio Power Switch – ON (UP)
40. Select desired radio channel to communicate with the tower and adjust radio volume knob
41. Set Beacon & Radio Altimeter Power Switch – ON (UP)
42. Set Minimum Radar Altimeter Setting Knob – As Required (300 m)
43. Set MUS-2 Stabilizer Electrical Control Power Switch – ON (UP)
44. Set Aileron Electrical Control Power Switch – ON (UP)
45. Set GIK (Radio Navigation Indicator) & AGI (Artificial Horizon) Power Switch – ON (UP)
46. Press the GIK-1 (Radio Navigation Indicator) Alignment Button for at least 5 seconds
47. Press the AGI-1 (Artificial Horizon) Alignment Button for at least 5 seconds
48. Wait 2-3 minutes for both the GIK and AGI instruments to align and provide correct readings.
49. Set Anti-Skid Power Switch – ON (UP)
50. Set Flight Instruments & Cockpit Heating Power Switch – ON (UP)

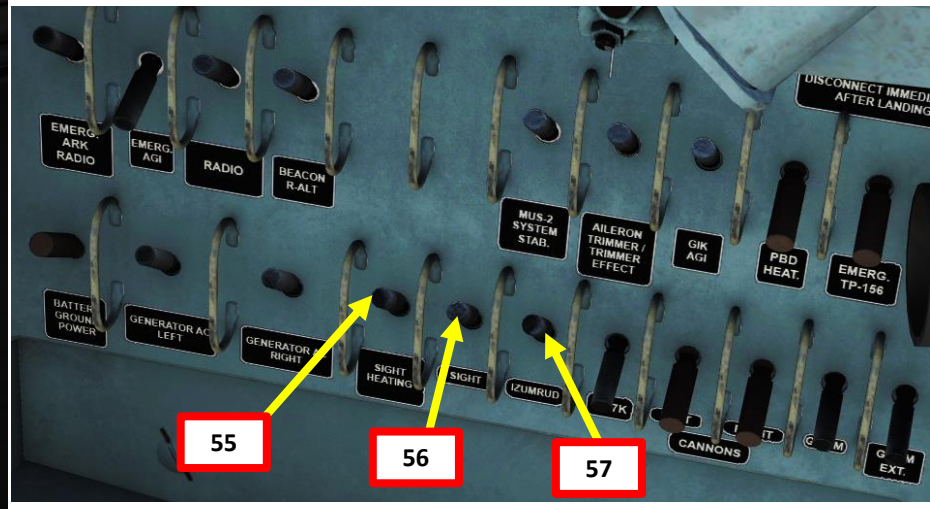


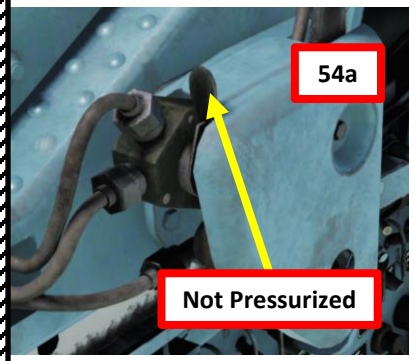


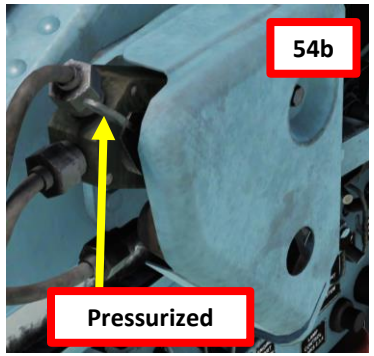


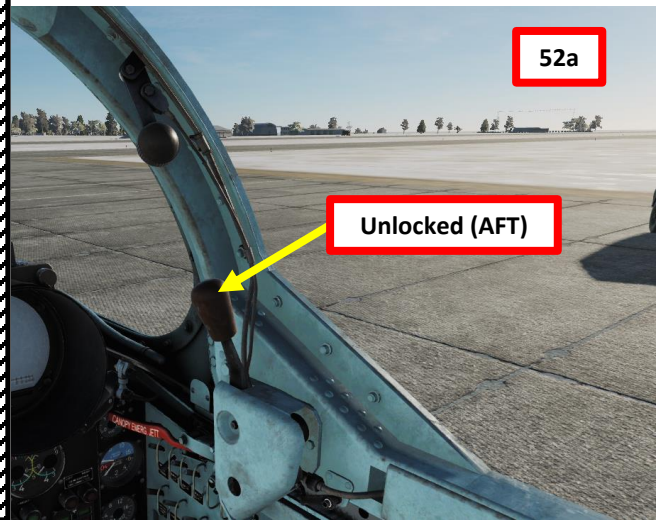
PRE-FLIGHT CHECKS

51. Close the canopy (LCTRL+C)
52. Lock the canopy (Locking Handle FWD)
53. Pressurize the cockpit by setting the Cockpit Pressurization Lever to CLOSE (AFT)
54. Set Pressurization Switch to PRESSURIZED (AFT)
55. Set ASP-5 Gunsight Power Switch – ON (UP)
56. Set ASP-5 Gunsight Heating Power Switch – ON (UP)
57. Set RP-5 IZUMRUD Radar Power Switch – ON (UP)
58. If you need the radar after takeoff, set Radar Mode to Standby (MIDDLE position) to allow the radar to warm up. Warm-up time is 3 minutes. Leave the switch to OFF otherwise.



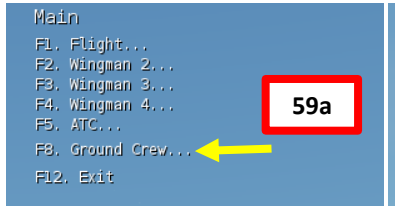


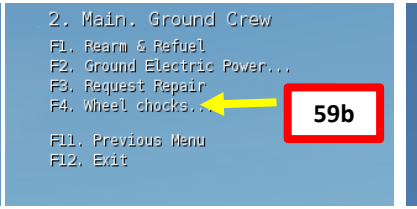


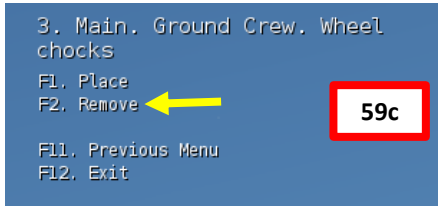


PRE-FLIGHT CHECKS

59. Remove Wheel Chocks by contacting ground crew
    a) Press "\" (Communication Menu) and "F8" to select ground crew
    b) Select "Wheel Chocks" by pressing "F4"
    c) Select "REMOVE" by pressing "F2" to remove wheel chocks

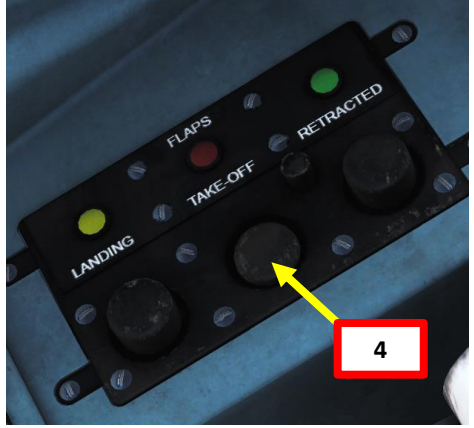


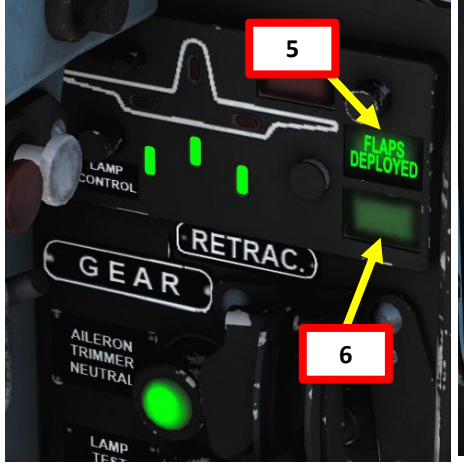


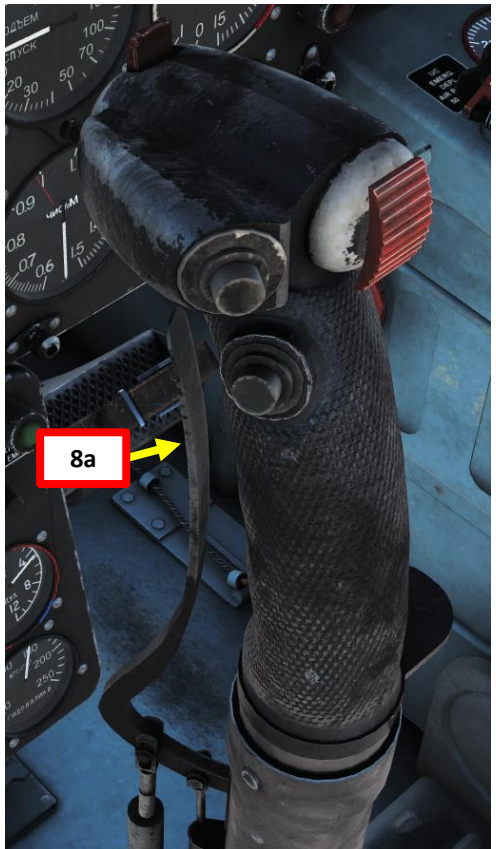


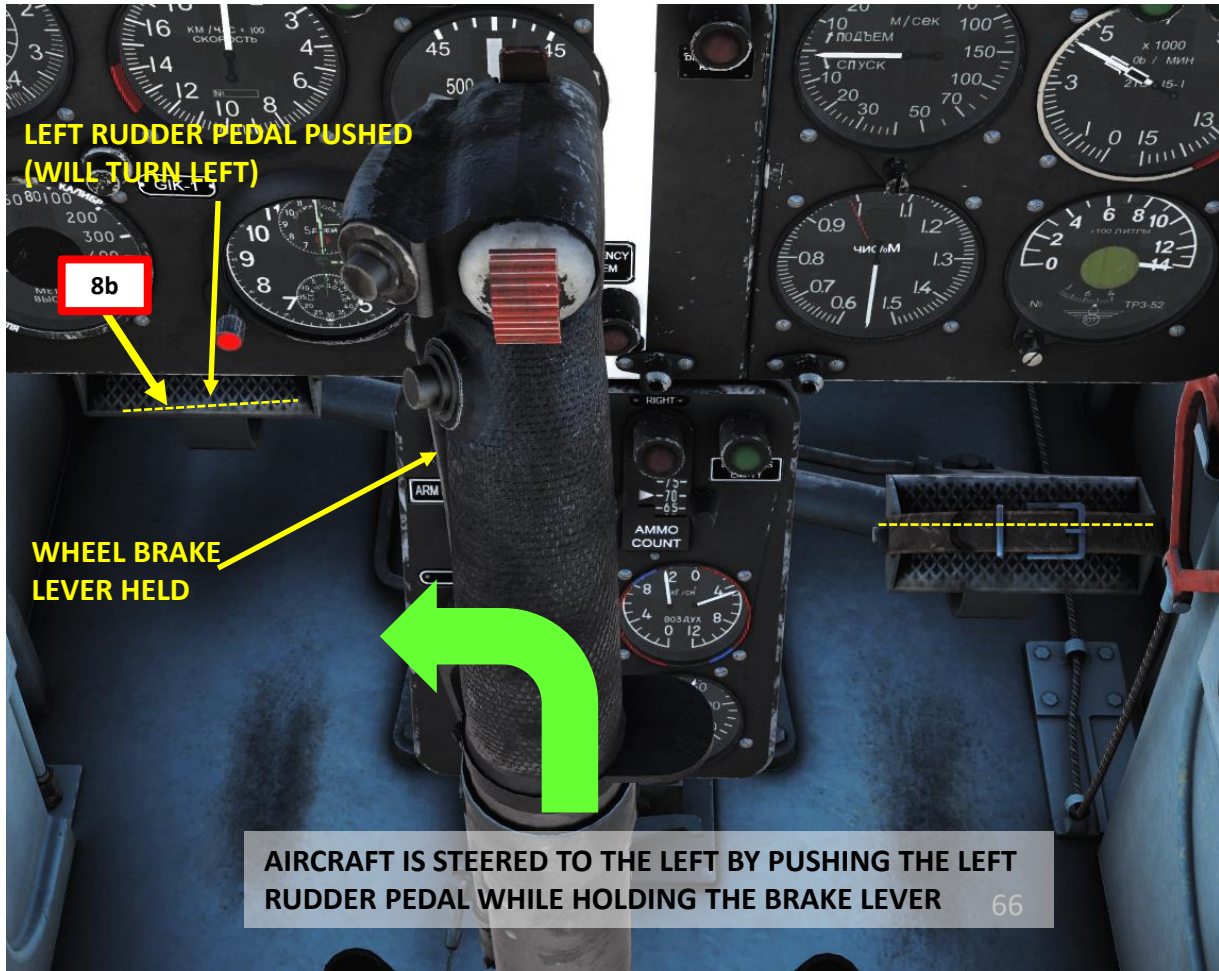
TAXI

1. Make sure wheel chocks are removed
2. Check that Stabilizer Mode Control switch is in HYDRAULIC (FWD) position
3. Check that the “ARU System Takeoff & Landing Position” Signal Lamp is illuminated
4. Set Flaps to 15 deg (Takeoff) Position
5. Confirm that FLAPS DEPLOYED indication is illuminated
6. Confirm that Airbrakes are retracted and AIRBRAKE indication is extinguished
7. Check that Nosewheel Brake Control Switch is DISCONNECTED (Vertical position)
8. Increase throttle to taxi to a speed no higher than 30 km/h
9. Turn by holding the Wheel Brake lever and using the rudder pedals to steer the aircraft. As an example, you can steer left by holding the brake lever while pushing the left rudder pedal.





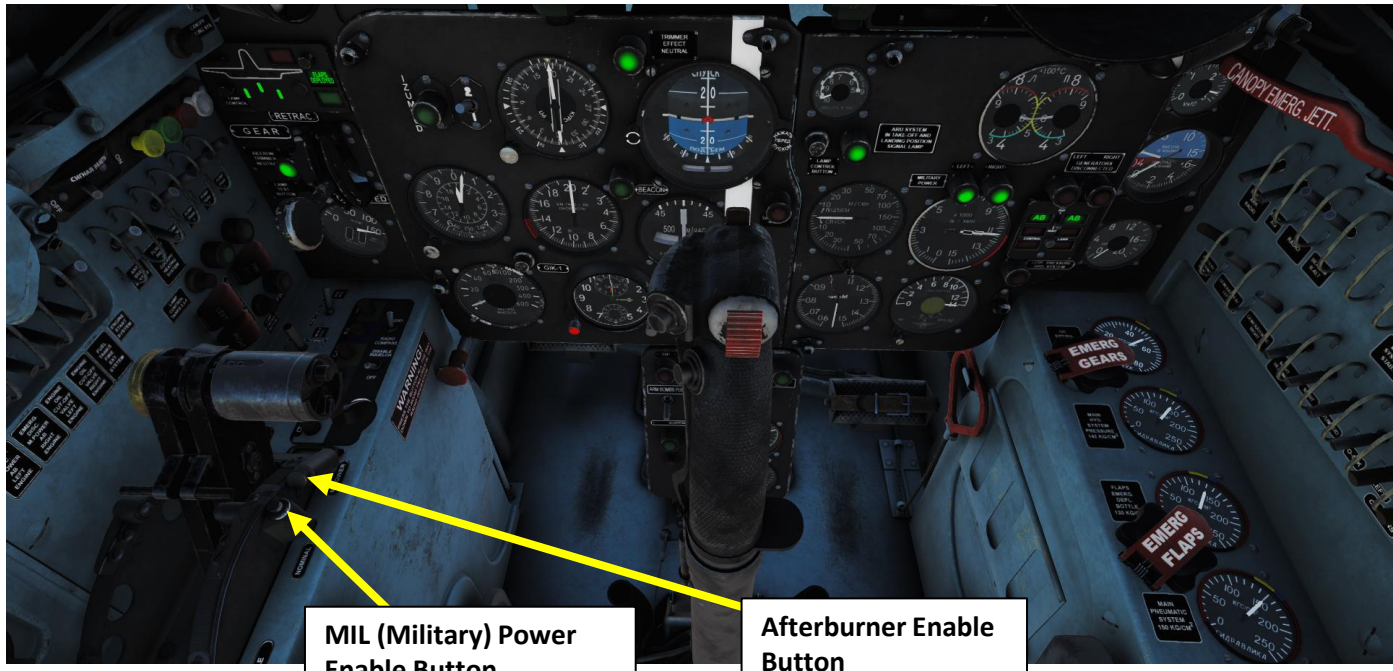


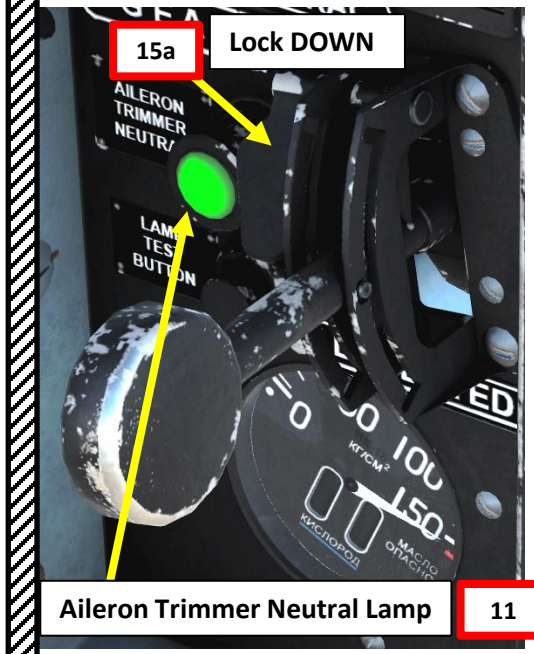


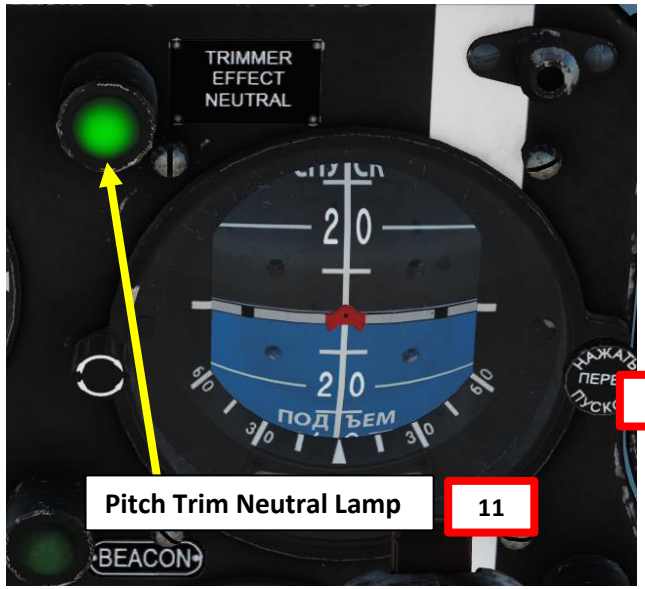
AIRCRAFT IS STEERED TO THE LEFT BY PUSHING THE LEFT RUDDER PEDAL WHILE HOLDING THE BRAKE LEVER

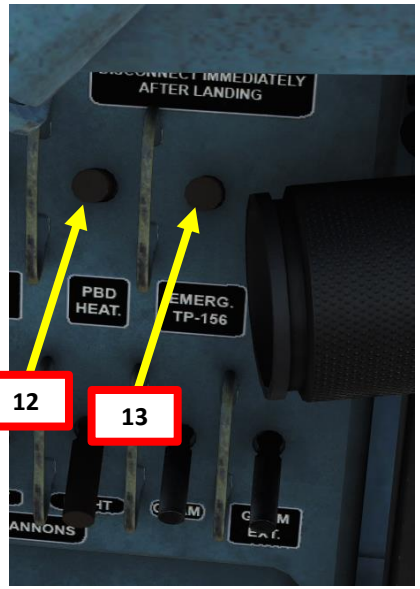
TAKEOFF

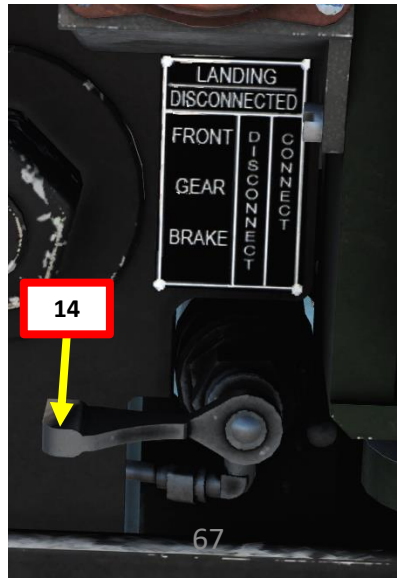
10. Line up on the runway centerline
11. Adjust stabilizer trim and aileron trim to NEUTRAL. Pitch Trim Neutral and Aileron Trimmer Neutral Lamps should be illuminated.
12. Set Main Pitot Tube Heating Switch – ON (UP)
13. Set TP-156 Emergency Pitot Tube Heating Switch – ON (UP)
14. Set Nosewheel Brake Control Switch to CONNECTED (Horizontal position). This will maximize your braking capability in case of a rejected takeoff.
15. Raise landing gear lever mechanical lock
16. Hold your Wheel Brake lever and throttle up to 10,000 RPM.
17. Once engine is stabilized, release wheel brake lever, set throttle to NOMINAL power (fully forward), then engage either the MILITARY Power Enable button or the AFTERBURNER Enable button based on the length available of the runway.
    Note: Takeoff run with MIL power and 15 deg flaps is 600-650 meters. Takeoff run with Afterburners and 15 deg flaps is 515-520 meters.











TAKEOFF

18. At the beginning of the takeoff roll, use differential braking to keep the aircraft centered on the runway. As you pick up speed and rudder effectiveness increases, use the rudder to make corrections.
19. As you reach 200 km/h, pull the stick back approx. 2/3 of its travel
20. Nosewheel will start lifting off at 230 km/h
21. Aircraft rotation occurs at around 280 km/h
22. At 15 meters of altitude, raise landing gear by setting the landing gear lever UP.
23. Once the landing gear is retracted (red indicator lights illuminated), set landing gear lever back in the NEUTRAL position (Middle).
24. At 100 meters of altitude, retract flaps. Confirm that the FLAPS DEPLOYED indication extinguishes.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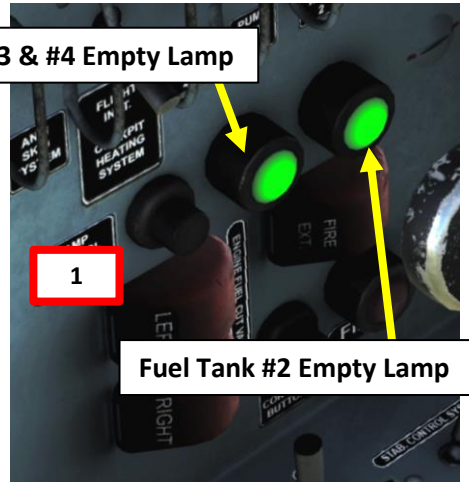
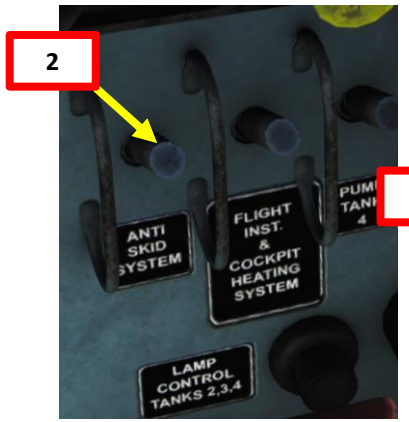
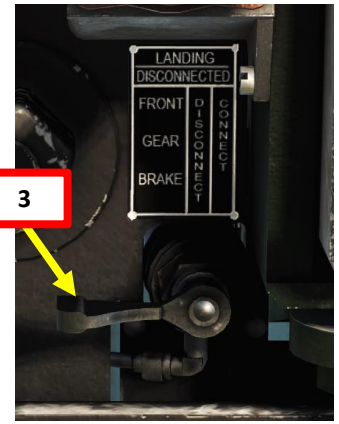
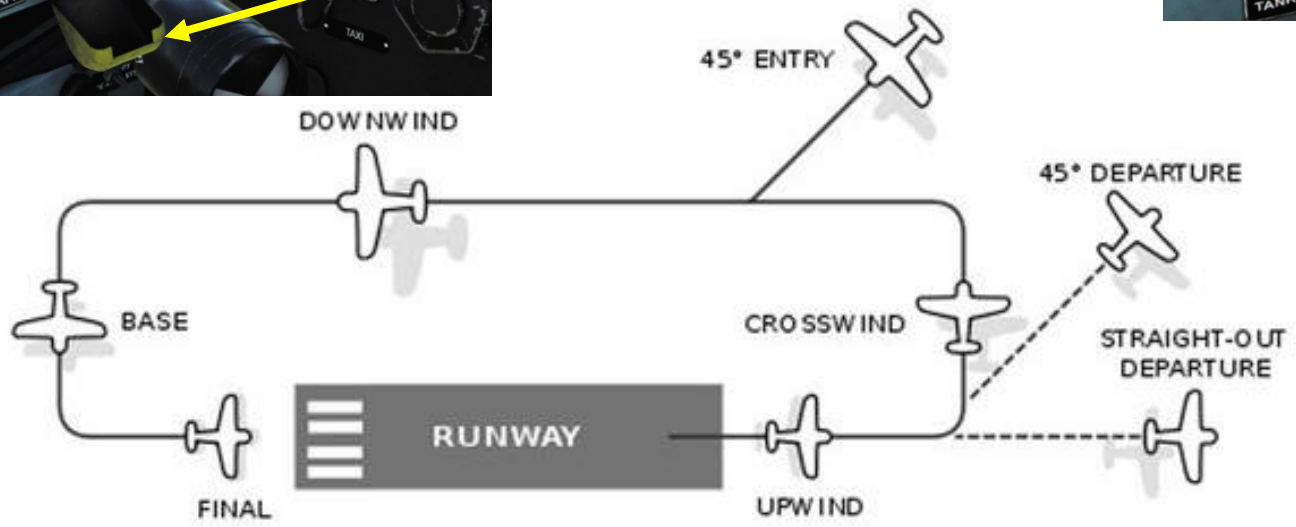
APPROACH

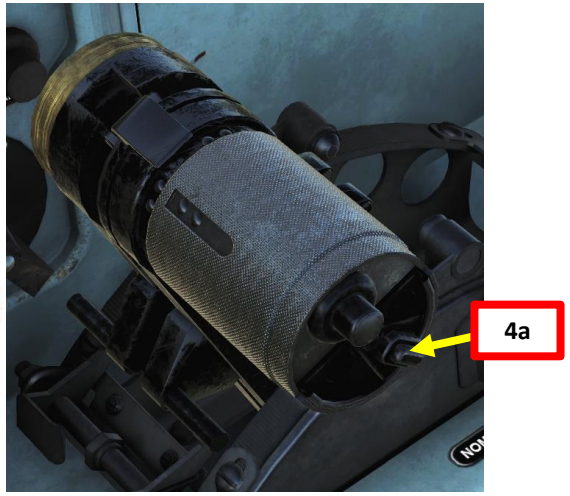
1. Check that your remaining fuel load is 1,500 liters or less. **NOTE:** In case of an emergency, an aircraft with external fuel drop tanks can land with less than 2,500 liters of fuel. If the fuel quantity is above 2,500 liters, jettison external fuel drop tanks and increase your approach speed by 15 km/h to compensate for the heavy weight configuration.
2. Verify that Anti-Skid switch is ON (UP)
3. Set Nosewheel Brake Control Switch to CONNECTED (Horizontal position). This will maximize your braking capability for landing if you have a short runway.
4. Deploy airbrakes and decrease speed to 500 km/h by throttling down.
5. Enter the landing circuit of the airfield at an altitude of 500 meters.
6. Flip the Drag Chute switch's cover prior to landing.





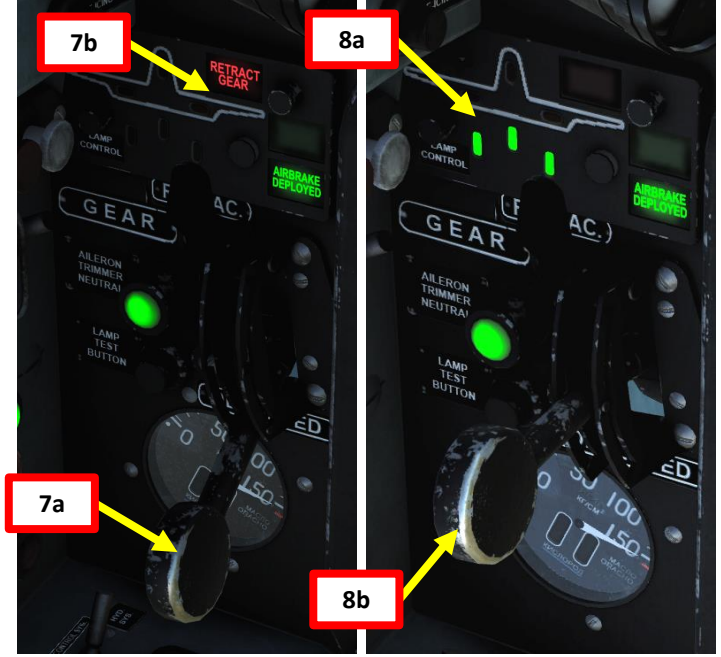


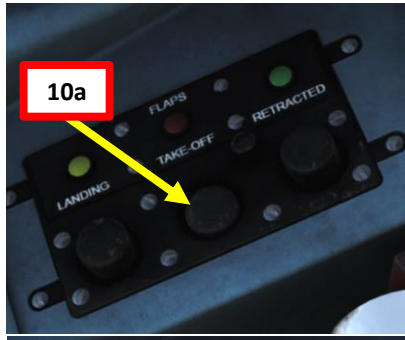


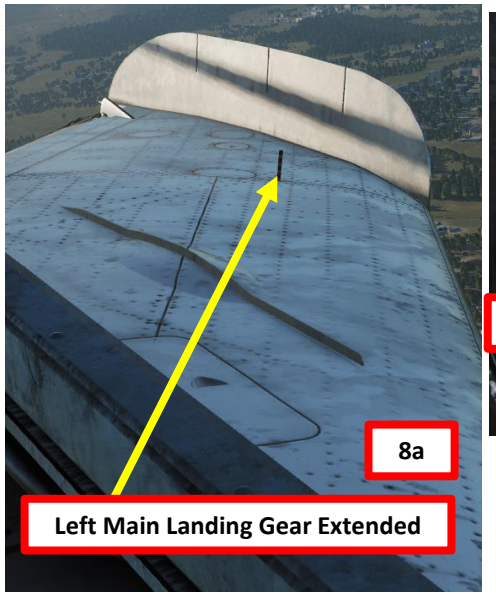


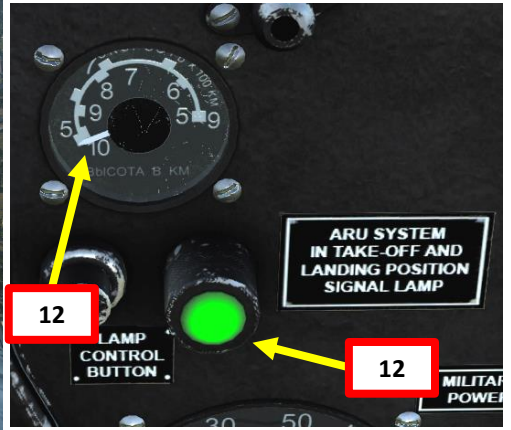
APPROACH

7. Lower landing gear lever in the downwind leg below 500 km/h. The RETRACT GEAR lamp will illuminate during landing gear extension and extinguish once the extension is complete.
8. Confirm that the green landing gear indicator lights illuminate and the landing gear pins are visible. Once the landing gear is confirmed extended, set landing gear lever to NEUTRAL (Middle) position.
9. Before turning on final, slow down to 400 km/h.
10. Once you are at 400 km/h or below, set flaps in Takeoff Position. Verify that the FLAPS DEPLOYED lamp illuminates to confirm flaps extension.
11. Set Flaps in Landing Position.
12. Check that the “ARU System In Takeoff & Landing Position” is illuminated and that the Indicator Pointer is in the leftmost position, indicating a “Long Lever Arm” position of the system. Take note that the lamp may not illuminate at speeds above 420 km/h.
13. Final turn must be performed at a speed above 380 km/h. The recovery from this turn should be completed at an altitude of 250 meters.
14. After the final turn, decrease the speed to 300-310 km/h for the Final Approach.



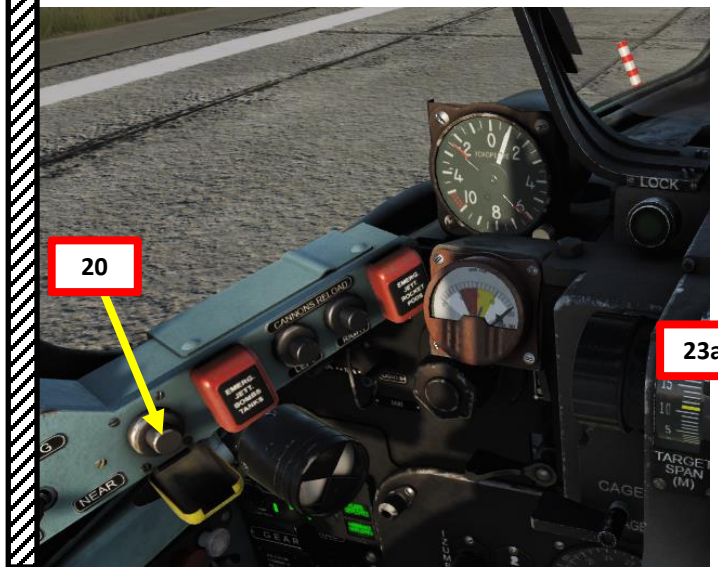


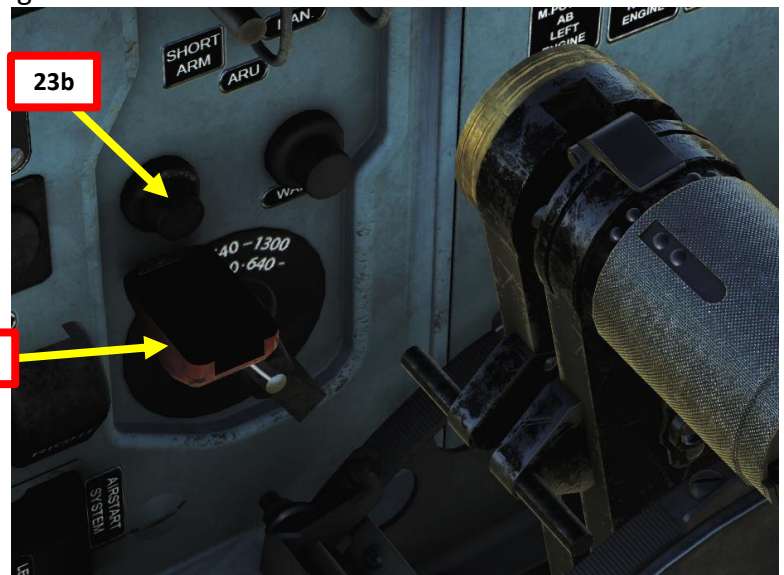




LANDING

15. On final approach, the aircraft loses its speed rather slowly and has a shallow approach angle.
16. At an altitude of 20-30 meters until touchdown, look down to the ground, forward left at an angle of 15-20 deg, checking the altimeter and variometer periodically.
17. At an altitude of 7-8 meters, pull the control stick slightly back and stop the descent around an altitude of 1 meter. After this, close the throttle to IDLE and proceed with levelling off.
18. While floating, apply the necessary back stick as to touch the runway with only the two main wheels.
19. Normal landing/touchdown speed with flaps extended is 235 km/h.
20. Once the nose wheel is in contact with the ground, retract the flaps and deploy the drag chute.
21. To avoid overheating the brakes, start to brake when the speed decreases to 200 km/h.
22. Landing distance with all three wheel brakes is about 890 meters. Landing distance with all three wheel brakes and the drag chute is 610 meters.
23. Once you have slowed down, flip Drag Chute jettison cover switch and press the Jettison button.
24. When taxiing, set nosewheel Brake Control Switch to DISCONNECTED (Vertical position) to enable differential braking





PART 6 – LANDING

AERODYNAMIC DESIGN

The way the MiG-19 is designed is pretty interesting. The F-100 Super Sabre and the MiG-19 were comparable aircraft racing to be the first supersonic fighter jet. Both aircraft faced the same aerodynamic dilemma: how to maximize speed while retaining good turning capabilities.

The swept-wing design used by the MiG-15, MiG-17 and F-86 Sabre was meant to make the aircraft more aerodynamic, but this increase in speed had the side effect of giving the aircraft worse turning capabilities at high angles of attack. At high speeds, this issue was even more critical with the era of Interceptors of the 60's. To minimize this loss in turning rate, the Super Sabre used wing slats that extended forward, while the MiG-19 used wing fences to control the air's boundary layer. It's interesting to see how the MiG-19 and the Super Sabre provided two radically different solutions to the same aerodynamic problem.

During the Vietnam war, the MiG-19 was one of the most manoeuverable fighters of its time. With powerful afterburners and an aircraft shape designed to out-turn its opponents, use the MiG's attributes to your advantage.

OPERATIONAL SPECIFICATIONS

- Extension of airbrakes is allowed at all permissible airspeeds but may cause a slight vibration of the aircraft
- Keep your airspeed above 350 km/h to ensure aircraft is stable and controllable
- When the aircraft reaches transonic speeds in level flight (between Mach 0.97 – 1.02), the altimeter will display an increase in altitude of about 600 meters and the variometer might display as much as a 100 m/s climb due to the turbulence cause by the transonic shockwave. The altimeter and variometer will return to accurate readings after the aircraft transits this speed zone.
- At altitudes above 16000 meters, throttles should not be moved below Military (MIL) Power or the engines will shut down.
- At altitudes from 14000 to 16000 meters, throttles should be moved slowly, taking a time of no less than 5 sec to move from IDLE to Military Power positions.
- Flight time under negative G conditions must be limited to 10 sec if the engines are operating in MIL or Afterburner.
- Flight time under negative G conditions must be limited to 15 sec if the engines are operating at any other throttle setting than MIL or Afterburner.
- With afterburners ON, the best climb speed is between Mach 0.88 and Mach 0.9. If you enable them between 7000 and 8000 m, the fuel consumption will be lower than with keeping the Military power all the time.
- Maximum permissible airspeed with External Fuel Drop Tanks installed is 1000 km/h.
- 760-Liter External Fuel Drop Tanks should be jettisoned in the speed range of 400-800 km/h.

RANGE	VALUE
Internal Fuel Only, km	1,474
With 2xPTB760 Drop Tanks fitted, km	2,218
Endurance on Internal Fuel Only) at 14,000 m	1 h 43 min
Endurance (2xPTB760 Drop Tanks fitted)	2 h 38 min

AERODYNAMIC DEVICES

Vortex Generators

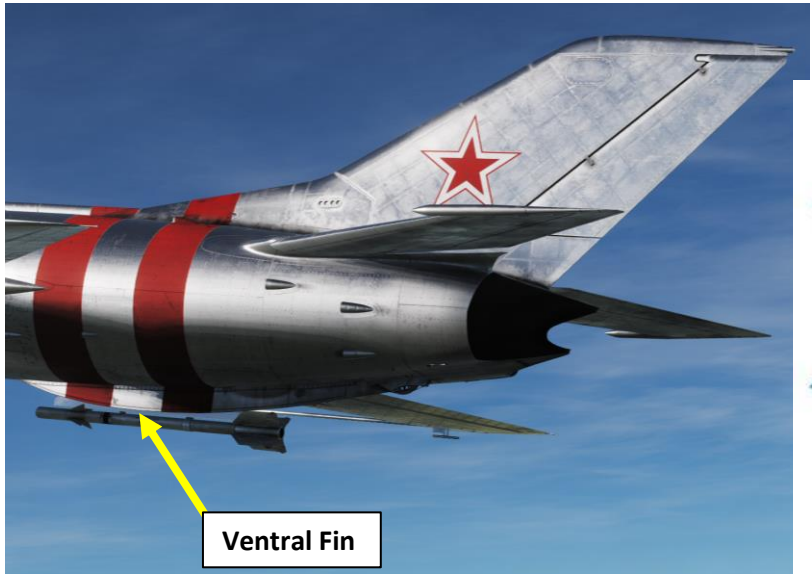
Vortex generators are small components deployed on the wings and stabilizers surfaces. They modify the flow around these surfaces affecting boundary layer. Properly arranged, they improve the performance and controllability of the aircraft, particularly at low flight speeds, climb, and high angles of attack. A turbulent boundary layer is more resistant to airflow separation. This way, wing vortex generators allow the aircraft to fly at a slower speed and higher angles of attack, while vortex generators on stabilizers act similarly, improving the effectiveness of control at low speeds and with high deflections of control surfaces.

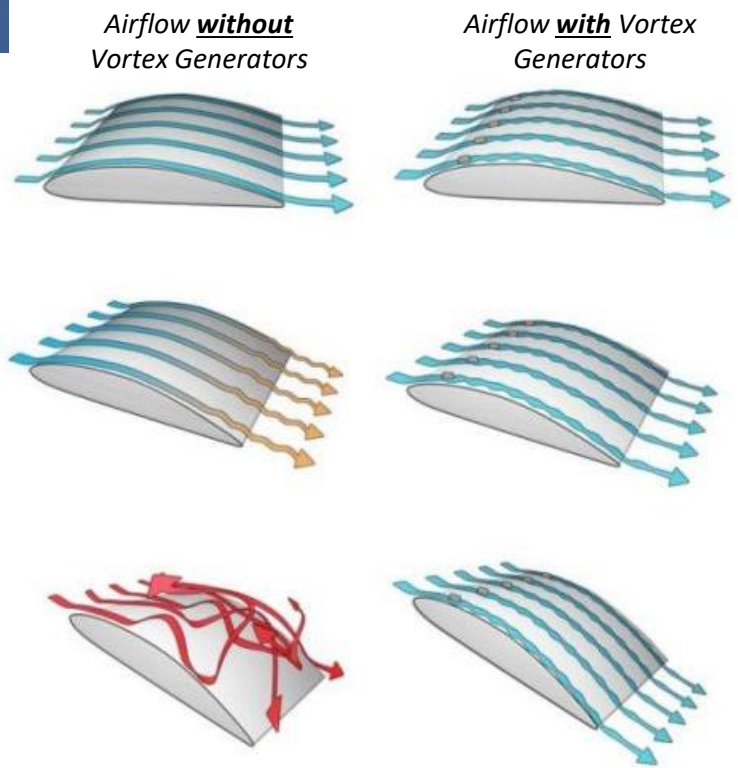
Ventral Fin

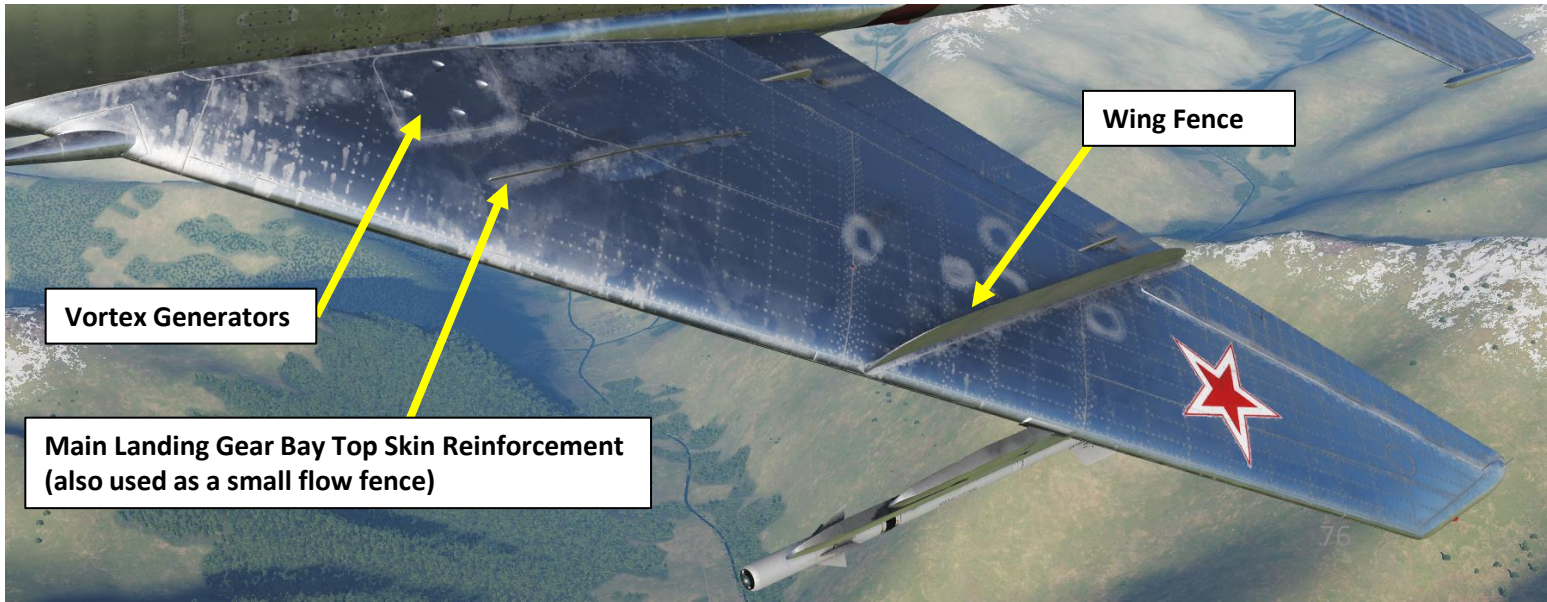
Ventral Fins (or “Strakes”) are used to provide adequate stability at high angles of attack when the ventral fin is shielded from the main airstream by the fuselage and/or the wing wake.

Wing Fences

Also known as “boundary layer fences” or “potential fences”, wing fences obstruct the span-wise air flow from moving too far along the wing and gaining speed, preventing the entire wing from stalling at once, as opposed to wingtip devices, which increase aerodynamic efficiency by seeking to recover wing vortex energy. When meeting the fence, the air is directed back over the wing surface and delays or eliminates the “sabre dance” aerodynamic effect.







AERODYNAMIC DEVICES

Effects of Vortex Generators, Ventral Fins and Wing Fences

Historically, the optimal location of these devices was determined empirically by observing aerodynamic effects through a process of trial and error. As technology and computing power evolved, wind tunnel testing and CFD analyses allowed engineers to study these phenomenon with more accuracy.

The effects of all these aerodynamic devices are translated through the following aspects of the MiG's flight model:

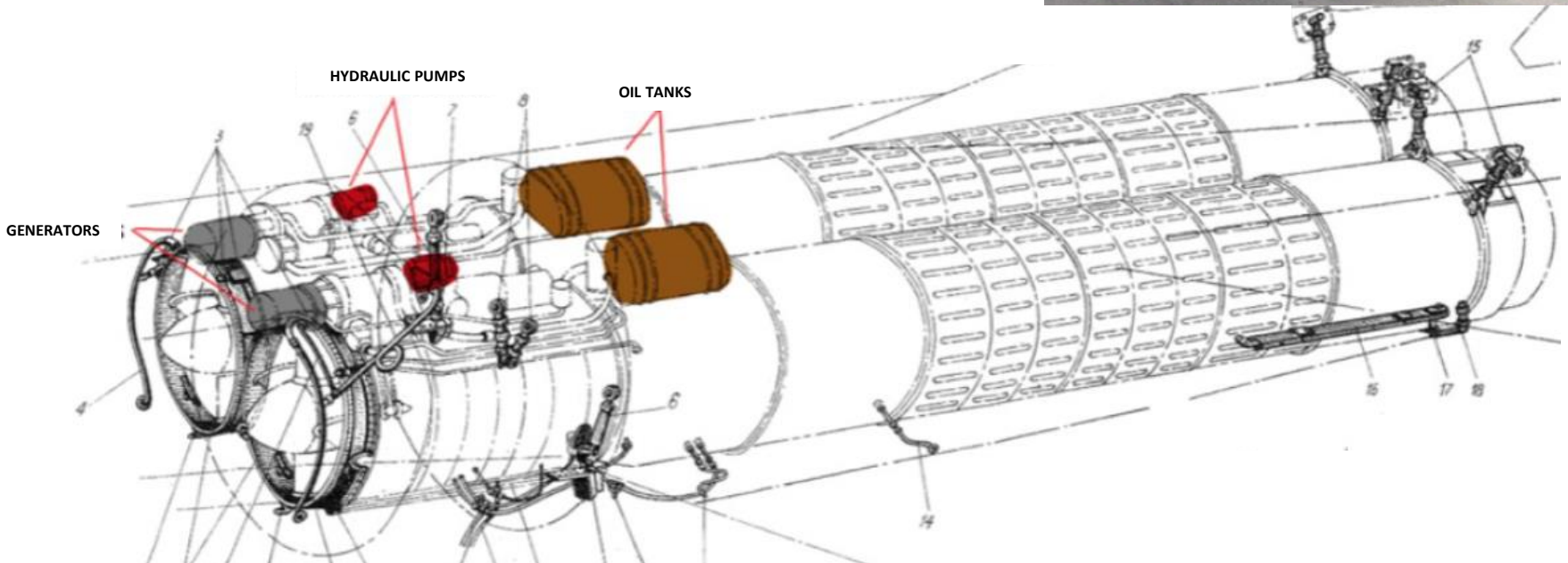
- Lower stall speed at high AoAs (angle of attack)
- Buffet effect when pulling back the stick at high AoA
- A secondary stall occurs when attempting to hasten the completion of a stall recovery before the aircraft has regained sufficient airspeed
- "Departure stall" (or "power-on" stall) occurs when the pilot fails to maintain positive pitch control due to a nose-high trim setting or premature flap retraction
- "Arrival stall" (or "power-off" stall") occurs when the pilot attempts to recover from a high sink rate and improper airspeed control on final approach
- "Accelerated stall" occurs at higher-than-normal airspeeds due to abrupt and/or excessive control applications during steep turns, pull-ups or abrupt changes in flight path.

The Tumansky RD-9B (formerly Mikulin AM-5)

The MiG-19P is powered by two RD-9B single-shaft axial-flow afterburning turbojets installed side-by-side in the center fuselage. The Tumansky RD-9 (initially designated Mikulin AM-5) was an early Soviet turbojet engine, not based on pre-existing German or British designs. The AM-5 was available in 1952 and completed testing in 1953; it produced 25.5 kN (5,700 lbf) thrust without afterburner. AM-5 engine is notable for making the first Soviet supersonic interceptor possible, the MiG-19 and the first all-weather area interceptor, the Yak-25. When Sergei Tumansky replaced Alexander Mikulin as the OKB-24's chief designer in 1956, the engine was renamed RD-9.

Each engine has a two-stage turbine driving a nine-stage compressor via a single shaft. The afterburner has 10 adjustable nozzle flaps. In full afterburner, the nozzle diameter is 498 mm, at max. thrust it is 442 mm. The engines and their accessories are accessible via panels in the upper central fuselage. For engine starting an external power source is used. Normally, the left engine is started first, but in case of cross winds the one on the right side can be started first.

Photo by Kamil Pankuch
http://airmuseum.netkosice.sk/



ENGINE SPECIFICATIONS

RD-9B ENGINE CHARACTERISTICS

Engine Regime	RPM	Thrust (Kg)	Fuel Consumption (Kg/h)	Specific Fuel Consumption (SFC)	Time limits
Afterburner	11,150+50	3250	5200	1.6	<6,000 m = 6 min >6,000 m = 10 min
Military Power	11,150+50	2600	2420	0.93	<6,000 m = 6 min >6,000 m = 10 min
Nominal	11,150+50	2150	1910	0.89	Not limited
Idle	4,100+200	100	300	-	10 min

ACCELERATION CHARACTERISTICS

PARAMETER	LIMIT
From IDLE to NOMINAL	9 – 12 s
From IDLE to MILITARY POWER	9 – 13 s
From IDLE to AFTERBURNER	Not more than 15 s
From automatic regulation start to NOMINAL	9 – 12 s
Permissible EGT rise after acceleration check	750 °C
Permissible surge in RPM (3-5 s) after AB is turned ON/OFF	11,600 RPM
From Military Power to AFTERBURNER (AB connection)	Not over 6 s

ENGINE SYSTEMS CHARACTERISTICS

PARAMETER	VALUE
Beginning of automatic RPM regulation	8,200 ±100 RPM
Fuel pressure in engine main pump	2.6 kg/cm²
Fuel pressure in main combustion chamber	<80 kg/cm²
Fuel pressure in AB chamber	<90 kg/cm²
Oil consumption	<0.5 kg/h
Oil pressure at IDLE	>1 kg/cm²
Oil pressure at MILITARY POWER	4 – 4.5 kg/cm²
Min/Max permissible oil temperature at all regimes	-40 °C/+85 °C
Oil output under NOMINAL and P = 4 kg/cm²	25 L/min
Oil warning lamps activation pressure:	
IDLE	<1.3 Kg/cm²
OTHER	<3 Kg/cm²
Max oil tank capacity	7.5 L
Min at which engine operation is allowed	5 L

ENGINE POWER SETTINGS

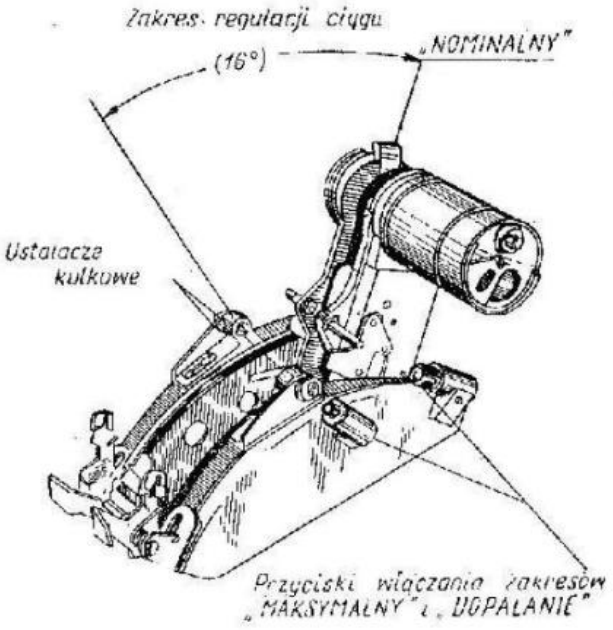
There are four main power settings: Idle Power, Nominal Power, Military (MIL/MAX) Power and Afterburners.

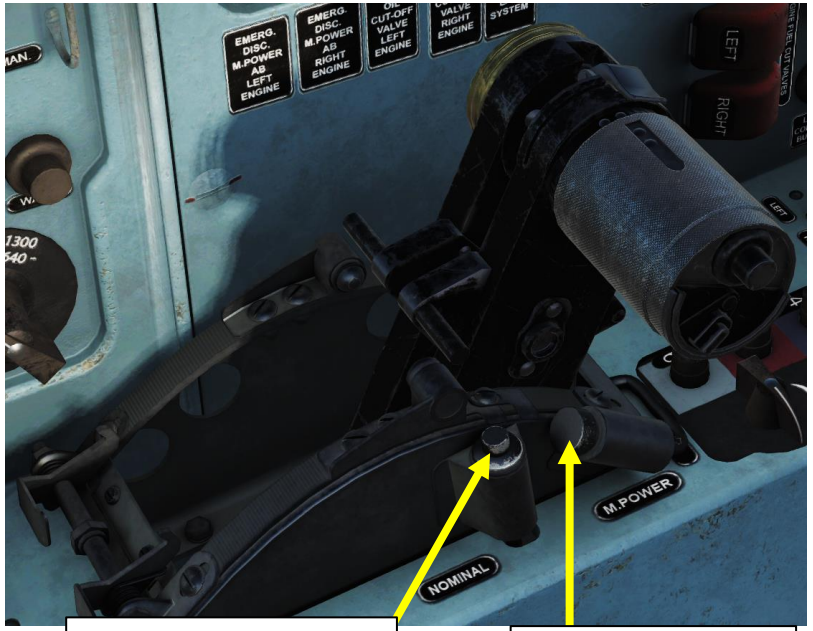
TO ENGAGE MILITARY (MIL/MAX) POWER :

a) Advance both throttles fully forward, then press the MIL (Military Power) Enable Button for 2 seconds once the throttles reach the NOMINAL position (Fully Forward).
b) Military Power lamps illuminate and the AB (Afterburner) lamps remain extinguished.
c) To disengage MIL Power, throttle down below the 16 degrees position detent. The left and right Military Power lamps will extinguish

TO ENGAGE AFTERBURNERS:

1. Advance both throttles fully forward, then press the Afterburner Enable Button for 2 seconds once the throttles reach the NOMINAL position (Fully Forward).
2. Both Military Power lamps illuminate and the AB (Afterburner) lamps illuminate as well.
3. To disengage afterburners, throttle down below the 16 degrees position detent. The left and right Military Power lamps and the AB (Afterburner) lamps will extinguish



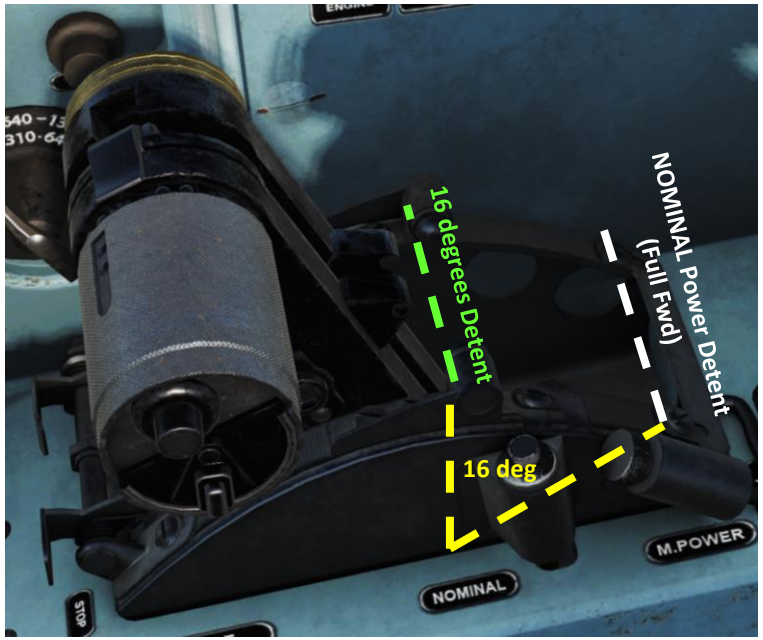


MIL (Military) Power Enable Button
(Enables Military Power)

Afterburner Enable Button
(Enables afterburners)

Left/Right Engine Military Power Lamps

MIL Power



AB (Afterburner) ON Lamp

Afterburners ON

ENGINE POWER SETTINGS

The main difference between Nominal and Military (MIL, or MAX) power settings is that in Nominal the nozzles are half-way open… while in Military the nozzles are fully closed. With afterburners, the nozzles are fully open when the reheaters are engaged.

The system was designed in a way that the pilot still had fine throttle control even in MIL/Afterburner, mostly for flying in formation at full power. It was done by varying engine RPM while afterburners are still engaged (in AB mode), or nozzles fully closed (in MIL mode).

Here are some important points about how the system works:

- Even if the pilot slams the throttle full forward, he only gets Nominal thrust.
- To engage either MIL or AFTERBURNER, the pilot has to hold the respective power setting button for 1-2 sec and observe the correct lamp on the front panel illuminate.
- As long the throttles stay in the first 16 degrees of travel from the full forward position, the engines will stay in MIL or AB mode, while the pilot can smoothly control engine RPM.
- If the pilot throttles back past the 16 degrees position (there are physical detents at this position) it will disengage the MIL or AB mode and the nozzles will return to their normal position. That 16 degrees throttle angle corresponds to 10'400 RPM, +- 200.
- The MIL and AB systems will engage only if at least one of the throttles is in the Nominal position (full forward). If the other throttle is not further back than 16 degrees from the top, the system will also engage on that engine too.
- To engage MIL or AFTERBURNER again, the process has to be repeated every time once the throttles go below the 16 deg detent.
- Going from MIL to AB should be possible by pressing the AFTERBURNER button
- Going from AB to MIL is not possible directly; it requires throttling back past 16 deg detent, and then repeating the process.

ENGINE LIMITS

Engine limits are monitored by watching the EGT (Exhaust Gas Temperature) dual indicator. However, you must make sure to use your throttle smoothly and to avoid erratic or abrupt throttle movements. Like most engines of the early 60's, the RD-9 engine's has a very slow response time. At altitudes from 14000 to 16000 meters, throttles should be moved slowly, taking a time of no less than 5 sec to move from IDLE to Military Power positions.

When checking engine RPM acceleration or in flight, the engine throttles should be shifted within 1.5 to 2 seconds through its path. Otherwise, the engine may surge and shut down. In case of a compressor stall, pull the throttle to Idle and slowly throttle up. Major compressor failure may result in an engine flameout.

A **compressor stall** is a local disruption of the airflow in the compressor of a gas turbine or turbocharger. A stall that results in the complete disruption of the airflow through the compressor is referred to as a **compressor surge**. The severity of the phenomenon ranges from a momentary power drop barely registered by the engine instruments to a complete loss of compression in case of a surge, requiring adjustments in the fuel flow to recover normal operation.

Compressor stall was a common problem on early jet engines with simple aerodynamics and manual or mechanical fuel control units, but has been virtually eliminated by better design and the use of hydromechanical and electronic control systems such as Full Authority Digital Engine Control (FADEC). Modern compressors are carefully designed and controlled to avoid or limit stall within an engine's operating range.

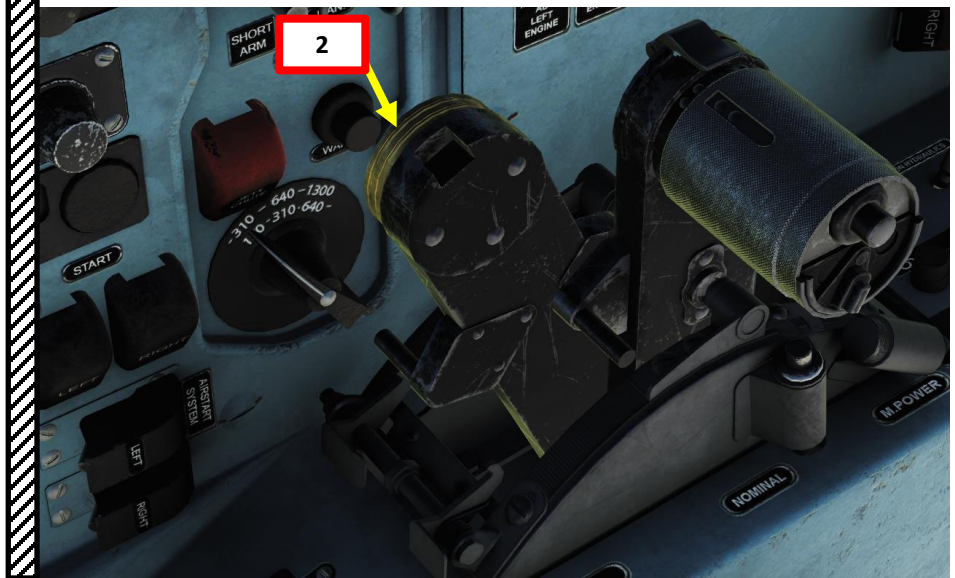
MAIN OPERATING CONDITIONS

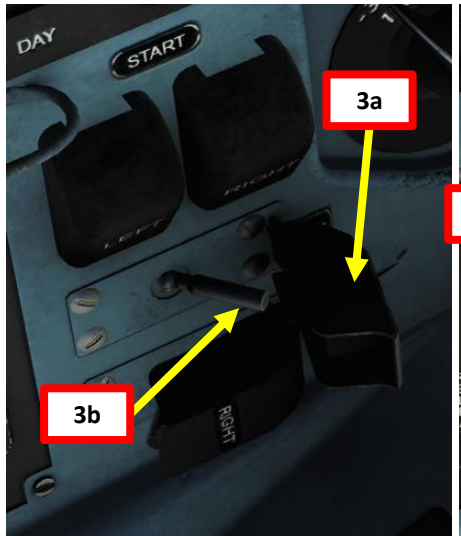
PARAMETER	LIMIT
MILITARY POWER AND AFTERBURNER	
Exhaust Gas Temperature (ambient temperature <15 °C)	650 °C
Exhaust Gas Temperature (ambient temperature >15 °C)	680 °C
In flight at all altitudes	680 °C
NOMINAL	
Exhaust Gas Temperature	550 °C
RPM at 0.8 of Nominal	10,400 ±50
IDLE	
Exhaust Gas Temperature	650 °C

IN-AIR ENGINE RESTART PROCEDURE

Note: The lower the altitude and the greater the airspeed, then the greater reliability of the engine re-start will be successful.

1. When attempting an in-flight engine re-light, make sure that you respect the following flight parameters to ensure the windmilling effect can drive the compressor blades during the engine re-start:
   - Altitude: 9000 m or lower (air density)
   - Airspeed: 400 km/h or faster (air speed driving compressor blades)
   - Engine RPM: 1600 RPM or higher (compressor shaft rotation)
2. Set Throttle to IDLE position
3. Flip Engine Air Re-Light Start cover and set the switch ON (FWD)
4. Confirm that the affected engine's ENGINE EMERGENCY AIRSTART SYSTEM lamp illuminates.
5. Within 20-25 seconds, the engine should reach an IDLE RPM of approx. 4100-4300 RPM
6. When engine has stabilized at the IDLE RPM, turn off the Engine Air Re-Light Start Switch (AFT)
7. After a successful relight, ensure that you wait 30 seconds after the engine has stabilized at IDLE RPM before moving the throttle to the desired thrust position. The Low Oil Pressure Lamp should be extinguished. Avoid Afterburner and Military power settings until 1 minute after reaching IDLE RPM.



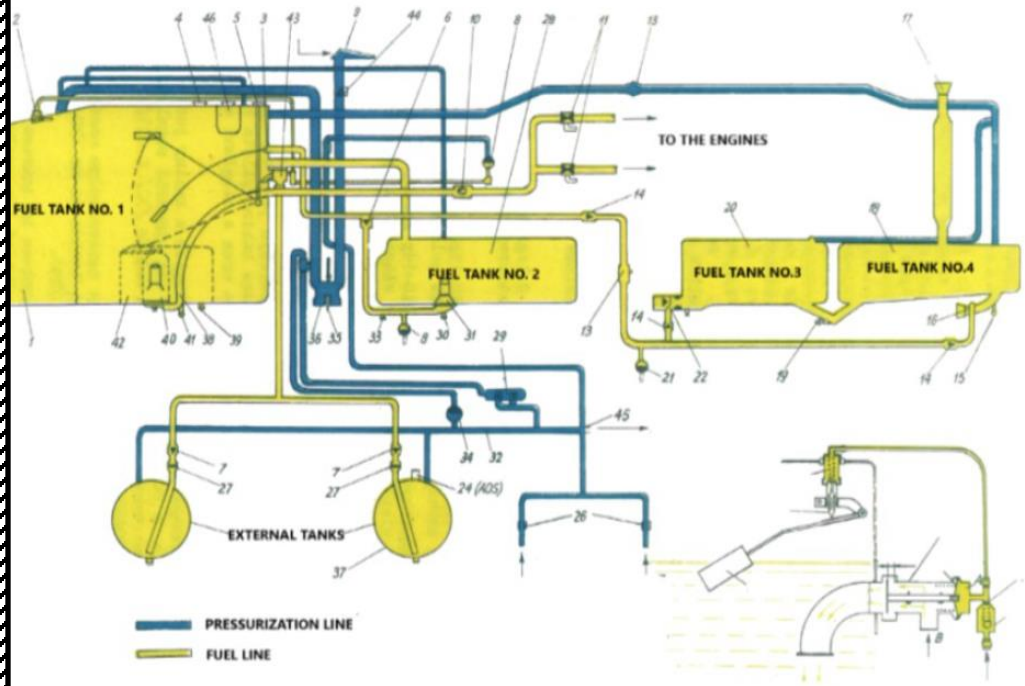


FUEL MANAGEMENT

The MiG-19 has four internal fuel tanks. No. 1 and No.2 Fuel Tanks are rubber-bag type tanks that use an electrical pump, while No. 3 and No. 4 Tanks are drained by bleed air pressure drawn from the engines, just like the external fuel tanks (760 liters each).

The MIG-19 was designed to be a supersonic interceptor, so it is a real gas-guzzler. Fuel consumption for Max Nominal Power is about 5000 liters/hour, Military Power is about 6000 liters/hour and Afterburners use about 8000 liters/hour. Using afterburners burns about 135 liters per minute, which gives you about 20 minutes worth of fuel with external tanks equipped.

The initial climb should be performed at Max Nominal Engine Power to conserve time and fuel. However, the best climb speed is obtained with afterburners engaged at Mach 0.89 - 0.9. The best altitude for afterburner engagement is 7-8 km; the climb will require less time and fuel than with Military Power selected.



Total Internal Fuel Capacity: 2170 Liters (1700 kg)

Total Capacity with External Tanks: 3690 Liters (2890 kg)

Note: There is at least 80 liters of unusable fuel in the Fuel System.

FUEL MANAGEMENT

The only fuel quantity indicator you have is the No. 1 (Main) Fuel Tank Indicator in liters. For Tanks No. 2, No. 3, No. 4 and External Tanks, there are lamps indicating when these tanks are empty.

- Maximum permissible airspeed with External Fuel Drop Tanks installed is 1000 km/h.
- 760-Liter External Fuel Drop Tanks should be jettisoned in the speed range of 400-800 km/h.

Fuel Supply to the Engines

On an Aircraft with no External Drop Tanks installed:

- 100 Liters will be consumed from Fuel Tank No. 1
- Fuel Tanks No. 3, 4 and 2 will be Emptied concurrently
- Remaining Fuel in Tank No. 1.

On an aircraft with External Drop Tanks fitted:

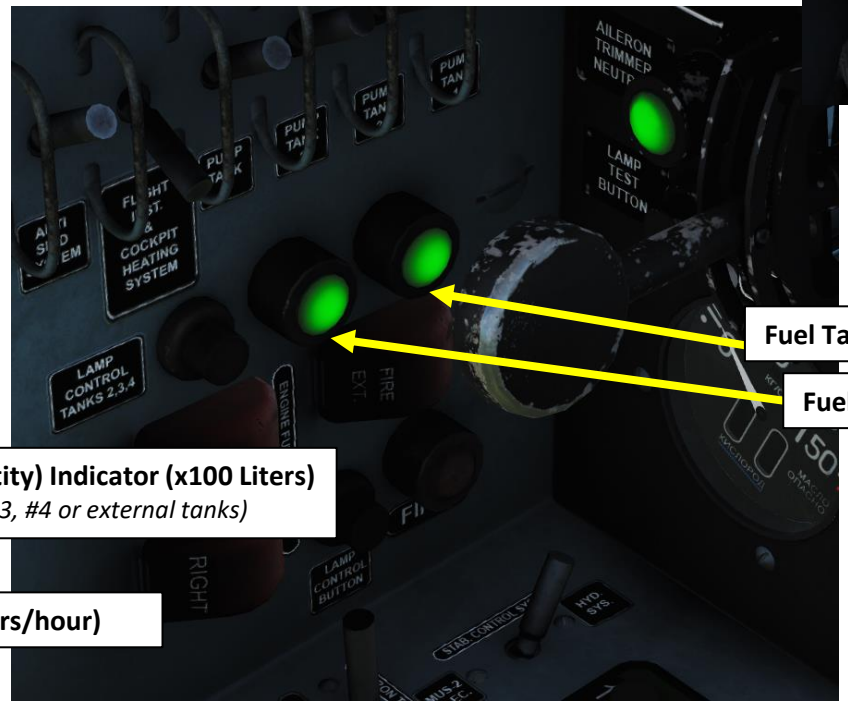
- 100 liters will be consumed from Fuel Tank No. 1
- All the Fuel from the External Drop Tanks will be consumed
- Another 100 liters will be consumed from fuel tank No. 1
- Fuel Tanks No. 3, 4 and 2 will be Emptied concurrently
- Remaining Fuel in Tank No. 1.

550 Liters Remaining in Fuel Tank #1 Lamp
When illuminated, you have about 20 minutes of fuel remaining if you fly at an altitude of 500 meters and a speed of 500 km/h.

Fuel Tank #1 Empty (TANK 1) Lamp
When illuminated, you have about 5 minutes of fuel remaining.

Fuel Tank #1 Totalizer (Quantity) Indicator (x100 Liters)
(Does not include Fuel Tank #2, #3, #4 or external tanks)

Fuel Flow Meter (x100 Liters/hour)



Fuel Tank #2 Empty Lamp

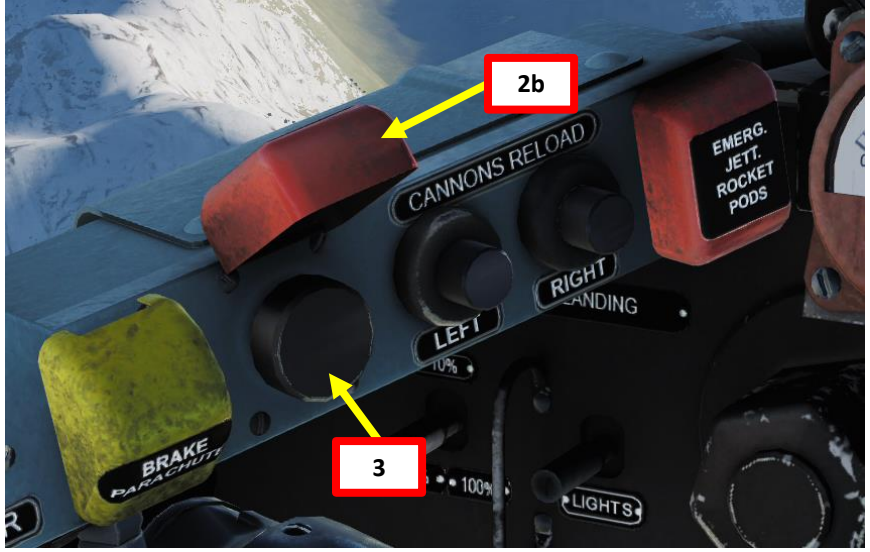
Fuel Tanks #3 & #4 Empty Lamp

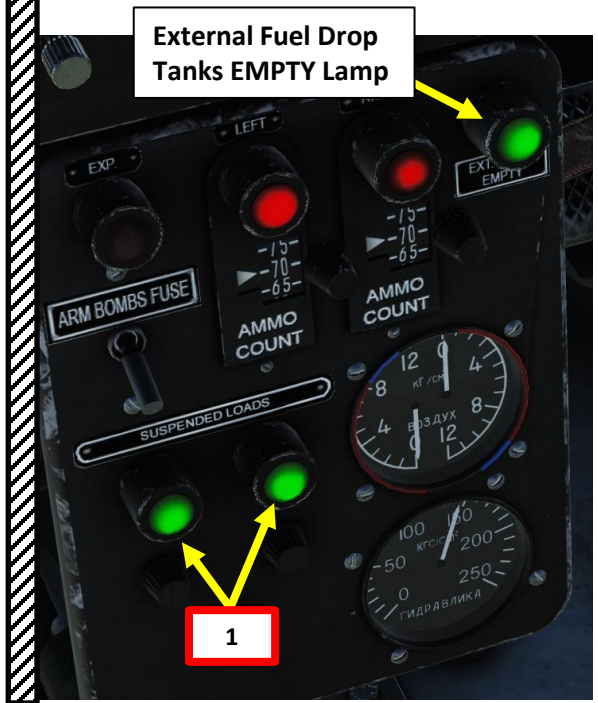
External Fuel Drop Tanks EMPTY Lamp

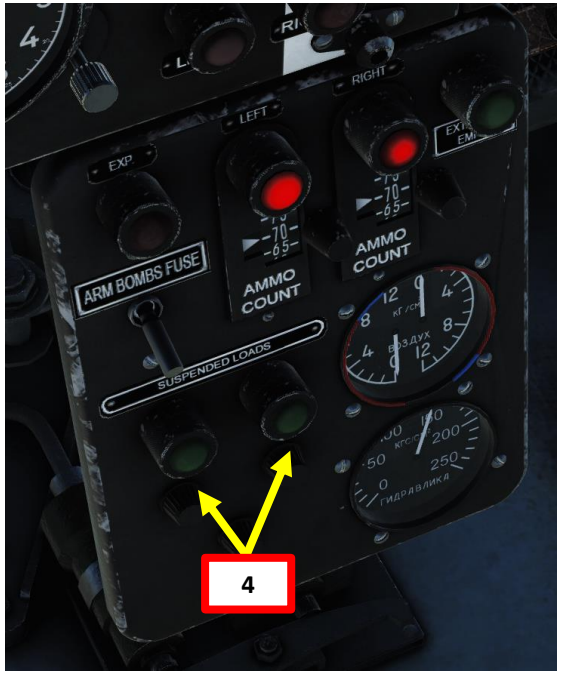
Left & Right Wing Pylon SUSPENDED LOAD Lamps
Indicates the presence of either External Drop Tanks, Free Fall Bombs or ORO-57K Rocket Pods are attached to the Pylon

EXTERNAL FUEL TANK JETTISON

1. External Fuel Tanks are equipped when the SUSPENDED LOADS lamps are illuminated.
2. To jettison external fuel tanks, flip the EMERG JETT BOMBS TANKS switch cover guard.
3. Press the EMERG JETT BOMBS TANKS button to jettison external tanks
4. Confirm that the external tanks have dropped visually and by watching the extinguished SUSPENDED LOADS lamps.



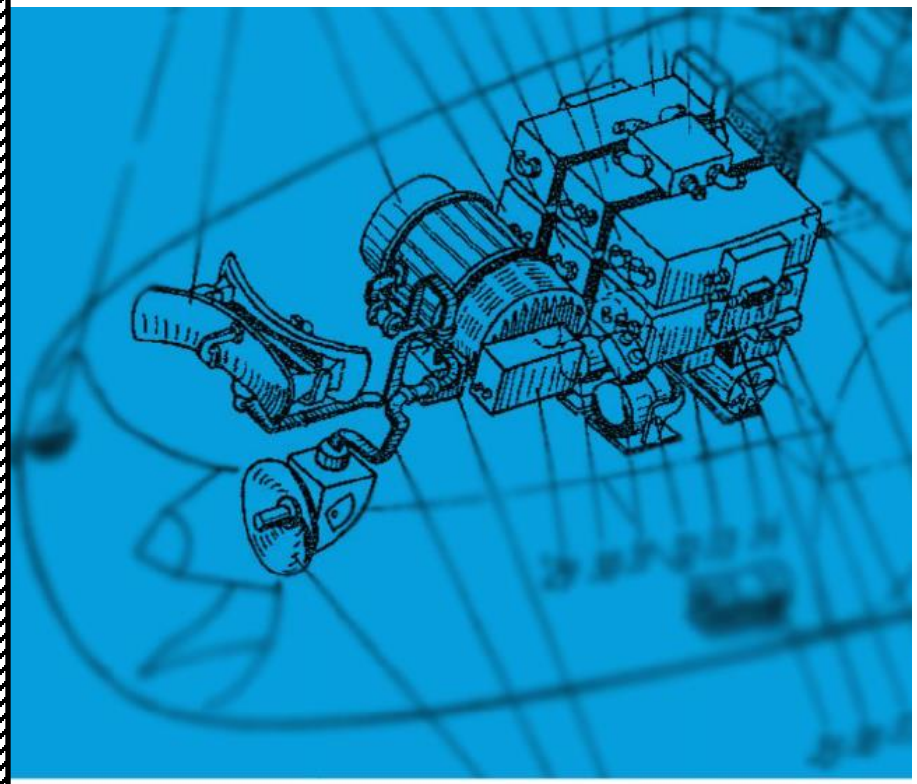




RP-5 RADAR INTRODUCTION

The MiG-19P is equipped with the RP-5 “Izumrud” (Emerald) radar. The RP-5 is an update of the RP-1, installed in the MiG-17PF and early production MiG-19P Aircraft. It increased the detection range from 10 to 12 kilometers and the Lock Range from 2 to 4 kilometers. In practice, big contacts like bombers could be detected from a range of up to 12 km (6.5 nm) and fighter-sized contacts could be detected from 9 km (4.8 nm) away. It is used to Search and Track Air Targets and provide a firing solution to destroy them if necessary.

Keep in mind that the RP-5 works in a similar fashion as the F-5E’s radar: it can help you find a target and it can also help you to aim… but it will not provide any guidance or tracking capabilities to your weapons themselves as the MiG’s air-to-air armament consists of 30 mm cannons and infrared-seeking missiles.



The Radar cannot be used in the Air-to-Ground role. Because it uses two different antennas to Search and Track, it can Lock onto a Target while still displaying Search Data on the Radar Screen. It could be argued that it’s a primitive sort of a Track-While-Scan (TWS) capability. However, the early 60’s radar capabilities are very limited, as it´s only capable of displaying as much as 10 contacts and can only Lock one single target.

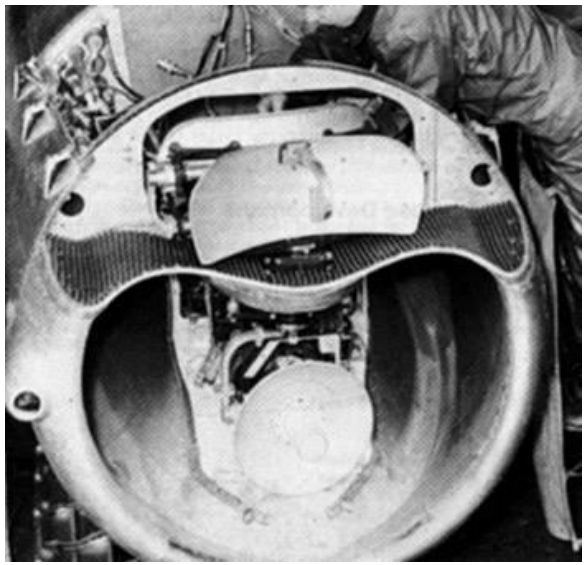
Like all first-generation radars, it was prone to ground cluttering, which limited its use to altitude above 2000 m (6,600 ft) above the ground. Its best operational altitudes are above 3600 m (11,800 ft) AGL.

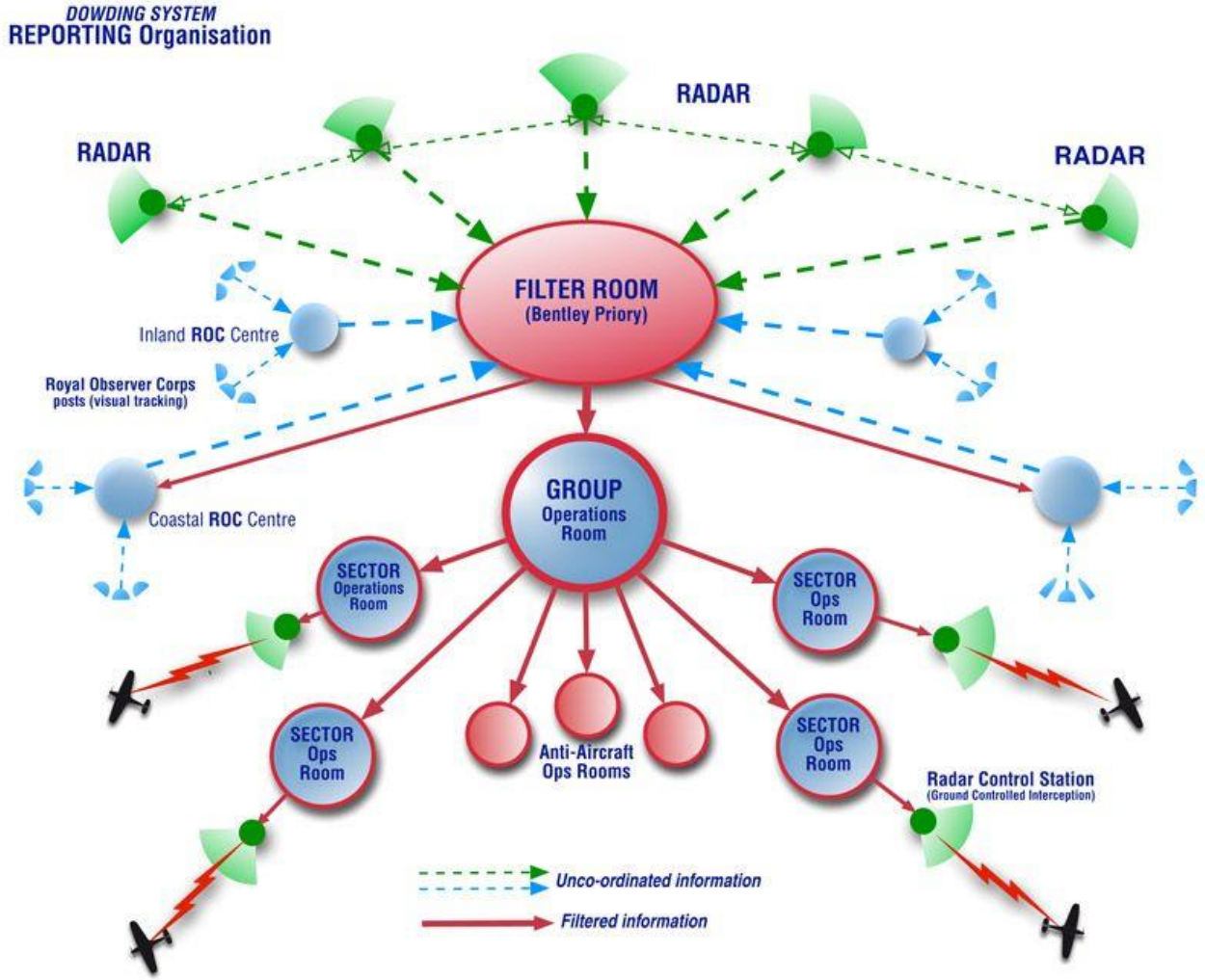
RP-5 RADAR CONSIDERATIONS

The radar needs a **3-minute warm-up time**. The radar **can only be used continuously for about 15 minutes, then it needs a 1-minute Cooling down time**. Also, the radar is automatically turned OFF when the landing gear is deployed or when the aircraft is on the ground. This automatic radar inhibit is a safety feature.

The SM-7 (initial MiG-19 prototype) was designed to be an all-weather interceptor and came equipped with the RP-1 Izumrud-1. However, a maneuvering limitation of 3.5 G was imposed onto the MiG-19P in the beginning due to radar operability and reliability concerns. The chief reason was the rather primitive and unreliable vacuum tube technology available in the Soviet Union in the 1950s. The RP-5 air-intercept radar was a development of the RP-2 (tested before on the MiG-17P/PF) and it was still plagued with similar reliability issues, which significantly affected the MiG-19P's real-world all-weather operational capabilities.

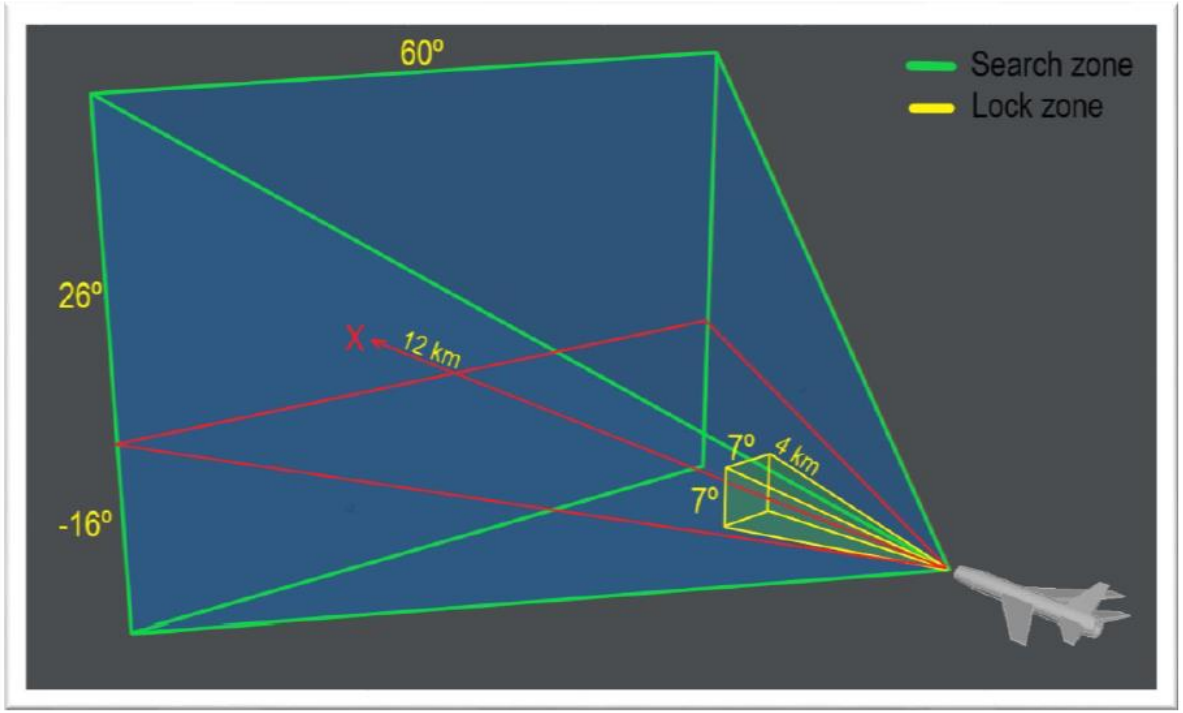
The RP-5's design is practical in the sense that the USSR used interception tactics based on the GCI (Ground-Controlled Interception) model: flights of interceptors would be scrambled and directed to targets by ground controllers, like the British were during the Battle of Britain with the Dowding System. By turning on their radars in the vicinity of targets only, interceptors could minimize their detectability (since your radar radiation "warns" the enemy Radar Warning Receiver when it is scanning) and use surprise to their advantage. This strategy proved to be rather effective during the Vietnam war.





RP-5 RADAR CAPABILITIES

The RP-5's has a fixed elevation and scanning range. In the MiG-19P, the Radar Data is displayed on a CRT (Cathode Ray Tube) Screen which has the Radar Scale marked into a Glass Panel that is in Front of the Main Screen. This Scale is backlit by a Red light. The Main Radar Screen is yellow when powered on, displaying the Contacts and the Electronic Horizon in White.

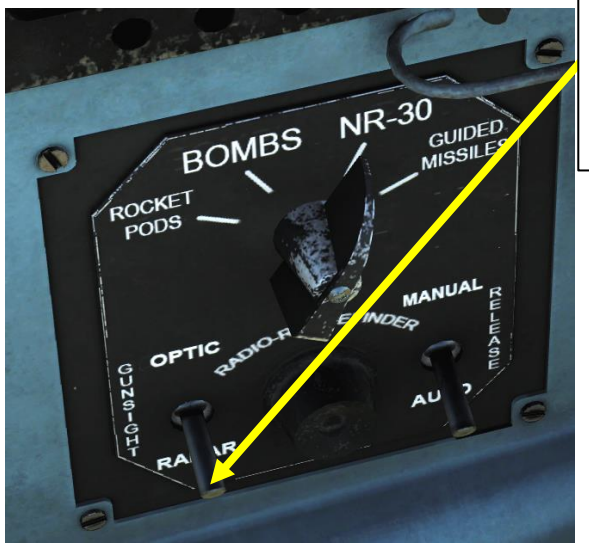


RP-5 RADAR CHARACTERISTICS

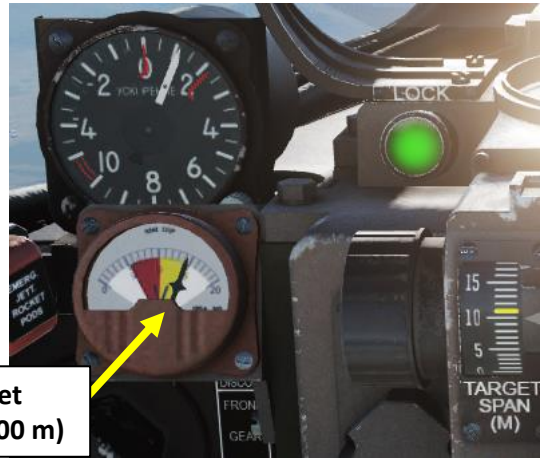
PARAMETER	VALUE
Max Search Range, Km	12
Max Lock Range, Km	4
Detection Range for a Tu-16 Bomber, Km	10 - 11
Detection Range for a MiG-21 Fighter, Km	8 - 9
Lock range for Tu-16, Km	4
Lock range for MiG-21, Km	3 - 3.5
Altitude of operation, m	Above 2,000
Time to complete a full scan	1.3 seconds
Coverage in Azimuth	60°
Coverage in Elevation	+26°/-16°
Max time of continuous operation	15 minutes

RP-5 RADAR COMPONENTS

The radar has two antennas: a **Tracking** antenna and a **Search** antenna. The search antenna finds contacts and displays them on your radar display screen. The tracking antenna locks your contact and gives you a target ranging and firing solution.

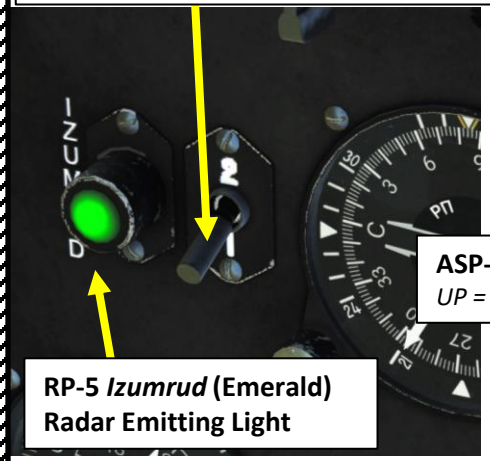


ASP-5N Gunsight Aiming Mode
- *OPTIC (UP) Manual Introduction of the Target Wing Span and Distance*
- *RADAR (DOWN): Aiming calculations are provided by the RP-5 Radar*

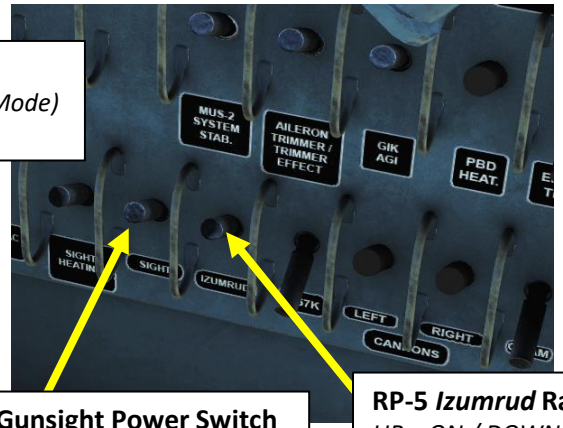


ASP-5N Gunsight Target Distance indicator (x100 m)

RP-5 *Izumrud* Radar Mode Selector
- *Mode 1: Use below 2000 m (Low Altitude Mode)*
- *Mode 2: Use above 2000 m*



RP-5 *Izumrud* (Emerald) Radar Emitting Light



ASP-5N Gunsight Power Switch
UP = ON / DOWN = OFF

RP-5 *Izumrud* Radar Power Switch
UP = ON / DOWN = OFF

RP-5 Radar Target Lock (Tracking Antenna) Switch
UP = ON / DOWN = OFF

DISCONNECT RADAR Lamp
Displayed when radar is overheating due to prolonged use (over 15 min)

RP-5 Radar Gauge Display Mode Selector Switch
- *CRYSTAL (UP): Gauge displays main radar voltage (V)*
- *PRESS (DOWN): Gauge displays air pressure in wave guides (kg/cm²)*

RP-5 Radar Mode Control Switch
- *OFF (DOWN)*
- *STANDBY (MIDDLE): Radar warm-up position*
- *FULL ON (UP): Initiates radar transmitting. A safety mechanism will not allow the radar to transmit if the landing gear is deployed.*

RP-5 Radar Anti-Jamming Mode
- *UP = ON / DOWN = OFF*

Reduces Antenna Sensitivity, converting the Jamming Cloud into a Line.

RP-5 Radar BIT (Built-In Test) Switch
Hold for 2 seconds

RP-5 Radar Electronic Horizon Elevation Adjustment Knob

Combined Voltmeter/Manometer Gauge
Indicates main radar voltage or wave guide air pressure based on the Display Mode Selector switch position

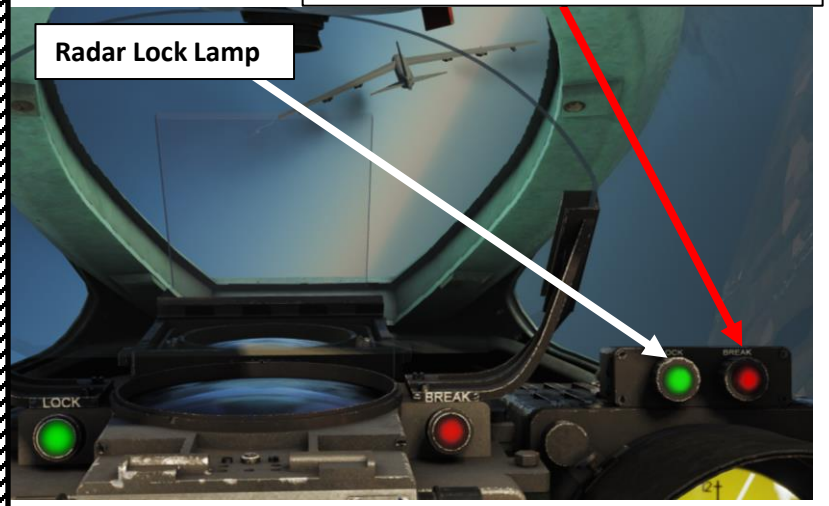
RP-5 Radar screen mode switch (Night/Day)

Radar Screen Brightness Control Knob

RP-5 RADAR COMPONENTS

Note: Keep in mind that the radar has no IFF (Identify-Friend-or-Foe) capabilities. This means you have to confirm visually whether or not the target is a friendly or a hostile contact.

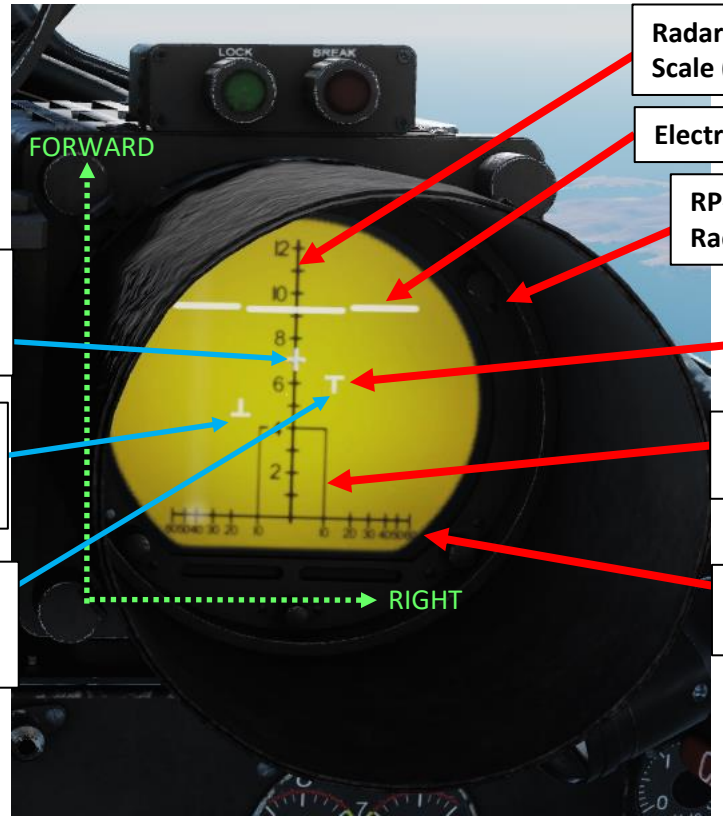
Radar Proximity Alert (BREAK) Light
Illuminates when you are at 300 m away from a radar contact to avoid a collision

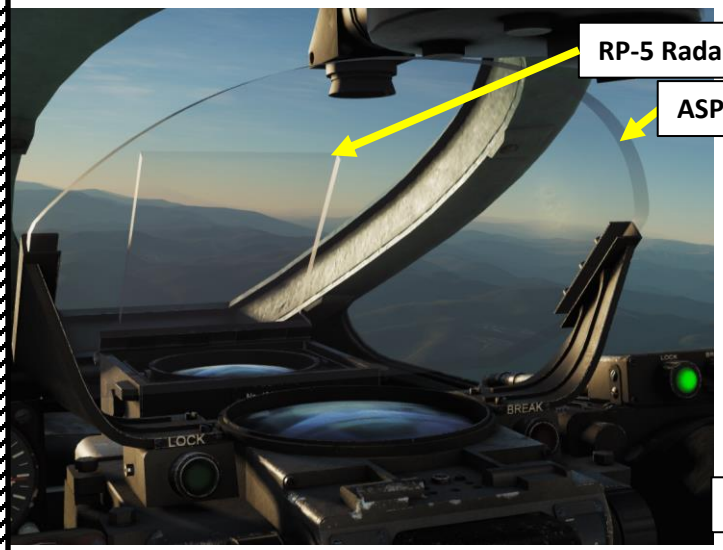


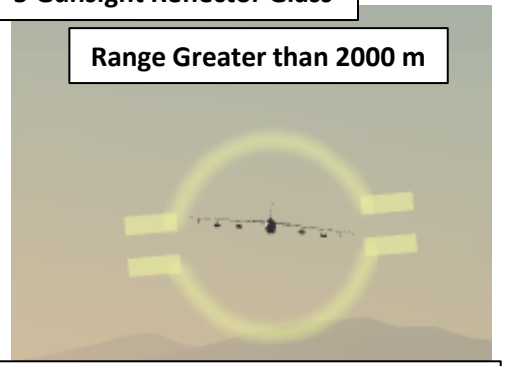
Target 1:
- *7 km straight ahead*
- *Same altitude as you (co-altitude)*

Target 2:
- *5 km ahead, 20 degrees to your left*
- *Target is above you*

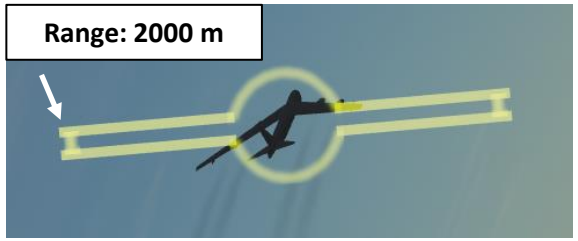
Target 3:
- *6 km ahead, 10 degrees to your right*
- *Target is below you*

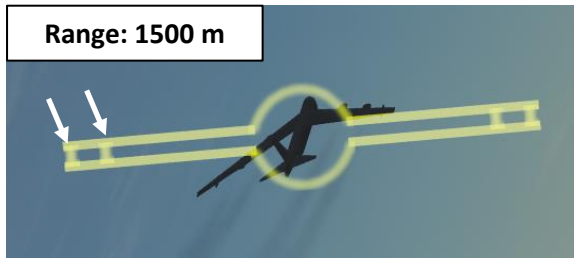


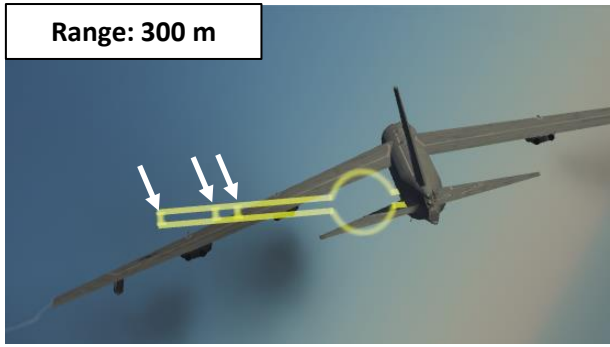




RP-5 Radar Contact & Range Indicator







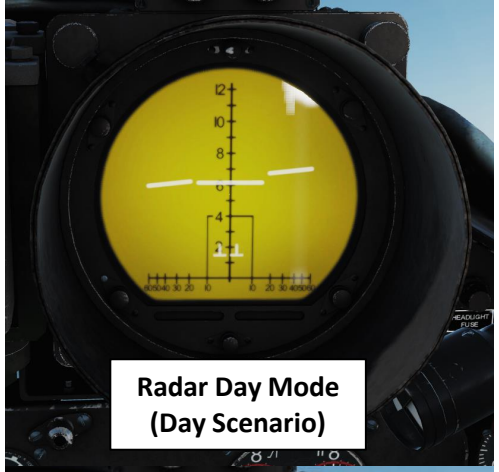
RP-5 RADAR MODES

It's important to know what radar modes are available at your disposal. The Screen Mode switch allows you to toggle between Day and Night modes, which adjusts the brightness of the radar display.

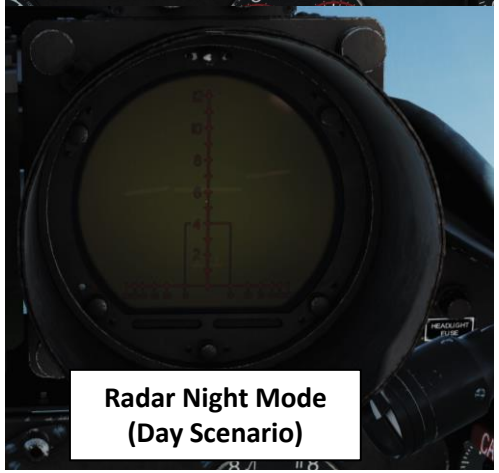
You can use two main modes: Mode 2 (High Altitude Mode) and Mode 1 (Low Altitude Mode). "**High Altitude"** mode works as you would expect: the Search Antenna gives you contact position on the radar screen and the Tracking Antenna gives you a lock and a firing solution on the radar reflector glass.

However… at low altitudes (below 2000 m), the RP-5 radar ground returns of the Search Antenna completely clutters your display and makes it virtually unusable.

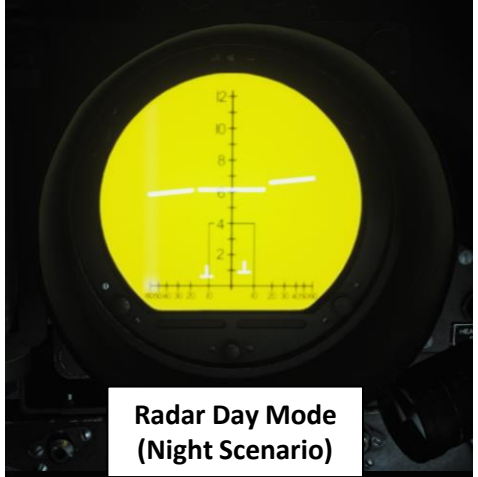
A work-around for this limitation was the "**Low Altitude**" mode, which shuts down the Search Antenna (shutting down the Radar Display in the process) and uses the Tracking Antenna. The Tracking Antenna can lock targets but at very close distances. The only valuable information you will be able to get from this mode is an approximate ranging distance from a locked contact, which can be useful during dogfights. In this mode, the Tracking (Locking) Antenna needs to be turned on. The RP-5 Radar Emitting lamp will confirm that the radar Low Altitude mode is working properly.



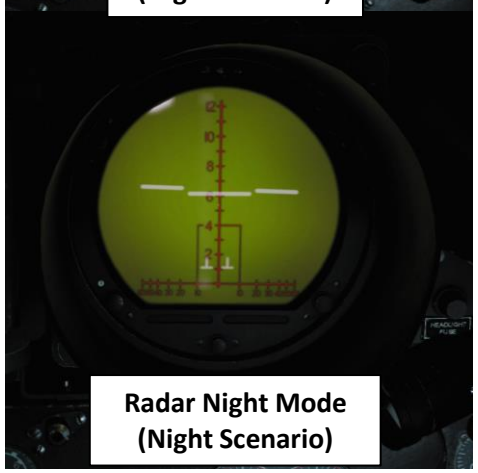
Radar Day Mode (Day Scenario)



Radar Night Mode (Day Scenario)



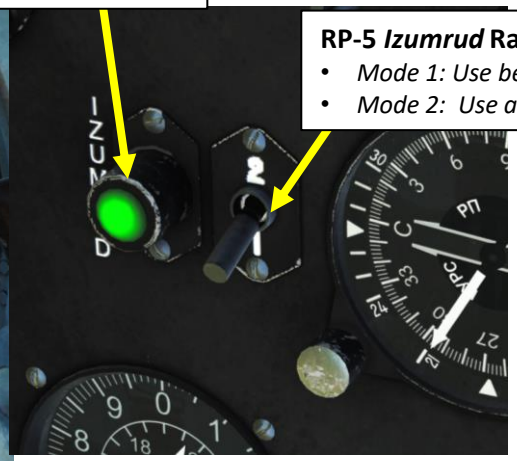
Radar Day Mode (Night Scenario)



Radar Night Mode (Night Scenario)

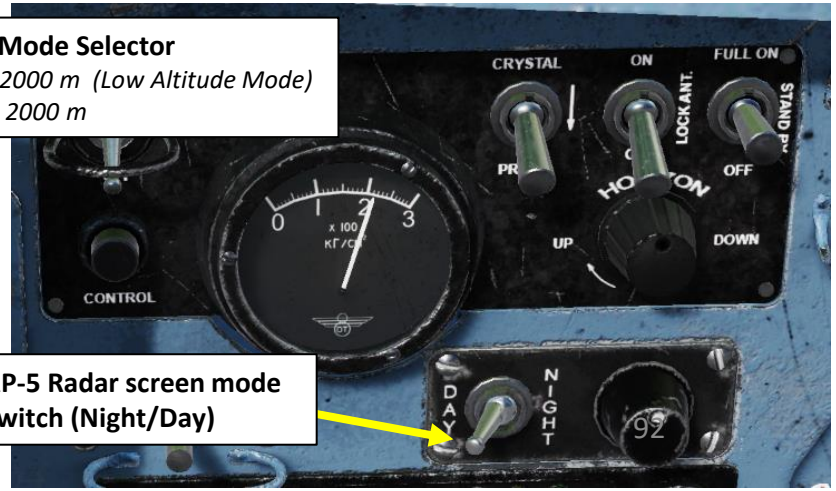
Radar ground clutter returns

RP-5 *Izumrud* (Emerald) Radar Emitting Light



RP-5 *Izumrud* Radar Mode Selector

- *Mode 1: Use below 2000 m (Low Altitude Mode)*
- *Mode 2: Use above 2000 m*



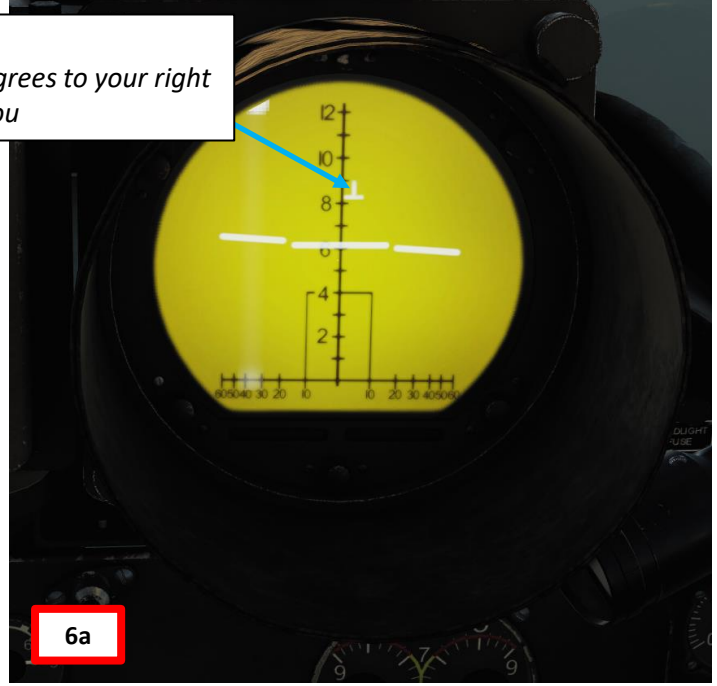
RP-5 Radar screen mode switch (Night/Day)

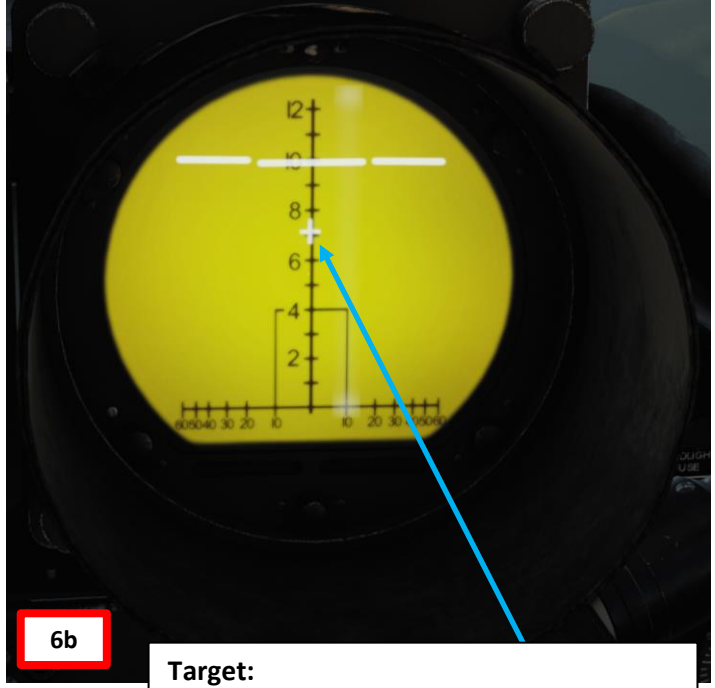
RP-5 RADAR OPERATION

HIGH ALTITUDE MODE (2)

1. Set Radar Power and Gunsight Power Switches ON (UP)
2. Set ASP-5N Gunsight Aiming Mode – RADAR (DOWN)
3. Set Radar Mode Control Switch – STANDBY (MIDDLE). Wait 3 minutes for the radar to warm up.
4. When radar is warmed up, set Radar Mode Control Switch – ON (UP)
5. Set Radar Mode Selector Switch to Mode 2 (High Altitude) – UP. This will turn on the radar display and the Search Antenna.
6. Spot a radar contact on the radar screen, then steer the aircraft:
   - Get within 10 degrees of lateral deviation
   - Become co-altitude with the contact.

Target:
- *8 km ahead, 5 degrees to your right*
- *Target is above you*

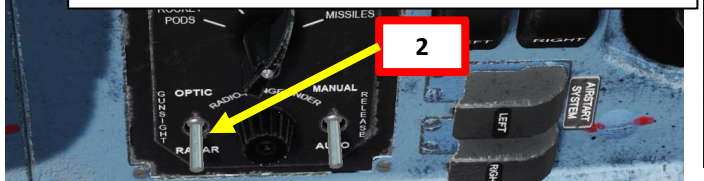




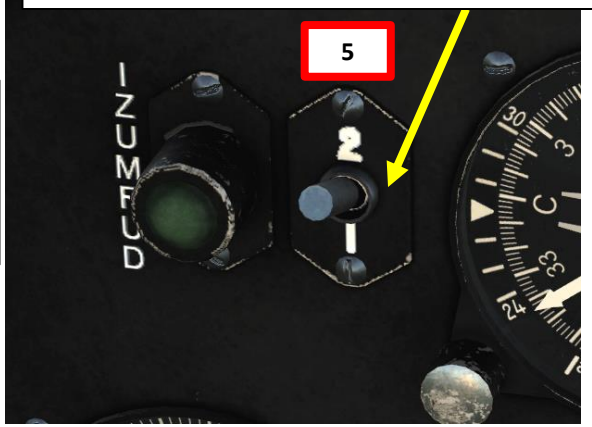
Target:
- *7 km ahead, straight ahead*
- *Target is at your altitude (co-altitude)*

RP-5 Radar Mode Control Switch 3 4
- *OFF (DOWN)*
- *STANDBY (MIDDLE): Radar warm-up position*
- *FULL ON (UP): Initiates radar transmitting. A safety mechanism will not allow the radar to transmit if the landing gear is deployed.*

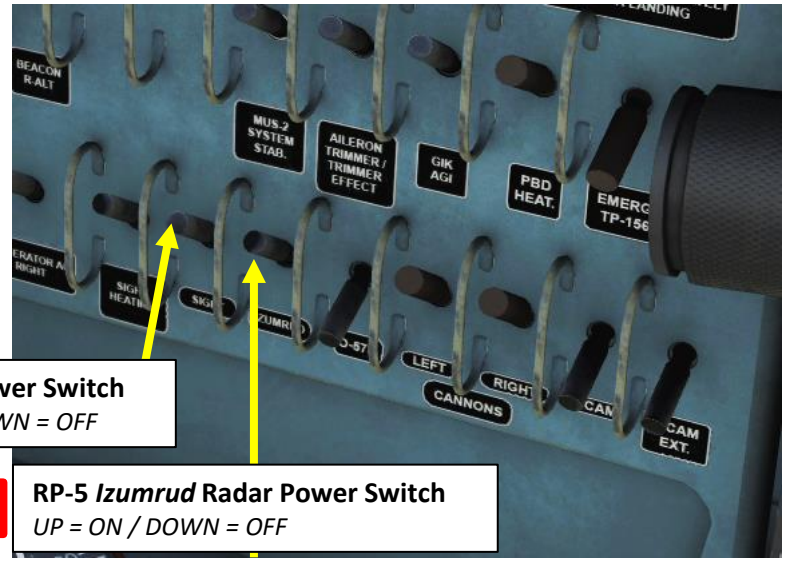
ASP-5N Gunsight Aiming Mode
- *OPTIC (UP) Manual Introduction of the Target Wing Span and Distance*
- *RADAR (DOWN): Aiming calculations are provided by the RP-5 Radar*



RP-5 *Izumrud* Radar Mode Selector
- *Mode 1: Use below 2000 m (Low Altitude Mode)*
- *Mode 2: Use above 2000 m*



Contact is under you	— |
Contact is above you	| —
Contact is at your altitude	—



Gunsight Power Switch
UP = ON / DOWN = OFF

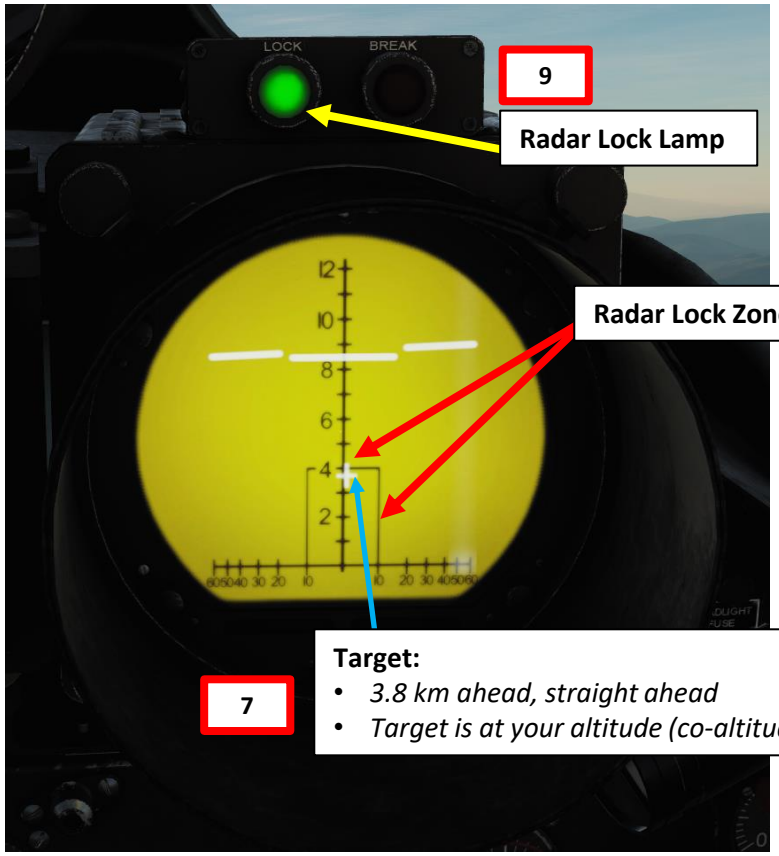
1

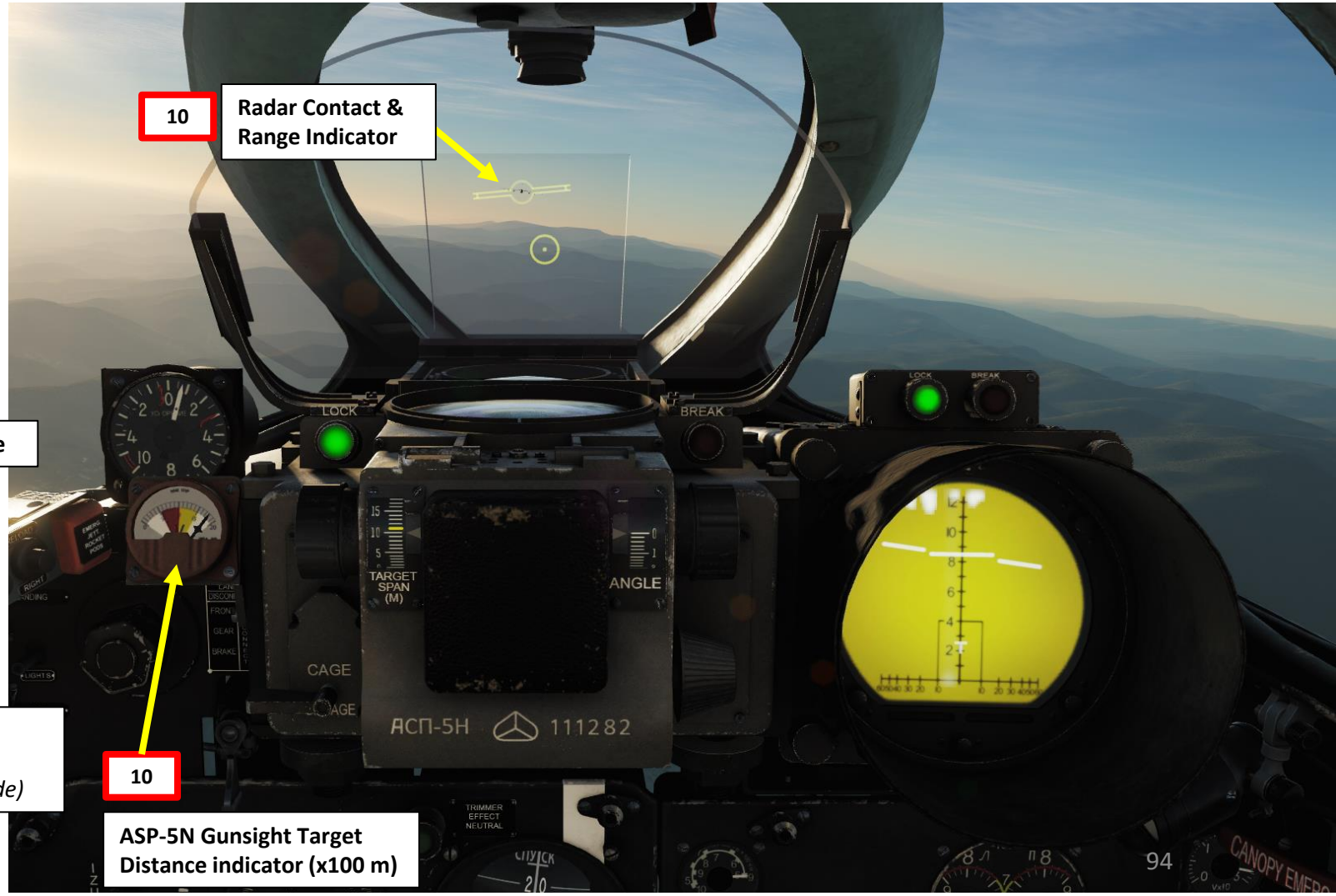
RP-5 *Izumrud* Radar Power Switch
UP = ON / DOWN = OFF

RP-5 RADAR OPERATION

HIGH ALTITUDE MODE (2)

7. Approach the target until the "Bird" becomes trapped in the Radar Lock zone (within 10 degrees, less than 4 km away).
8. Set Radar Target Lock (Tracking Antenna) Switch – ON (UP)
9. When you are 4000 meters from a distance, the Tracking Antenna will lock the nearest target. Check the RADAR LOCK lamp.
10. Ranging Distance can be seen on the ASP-5 Gunsight Target Distance indicator.

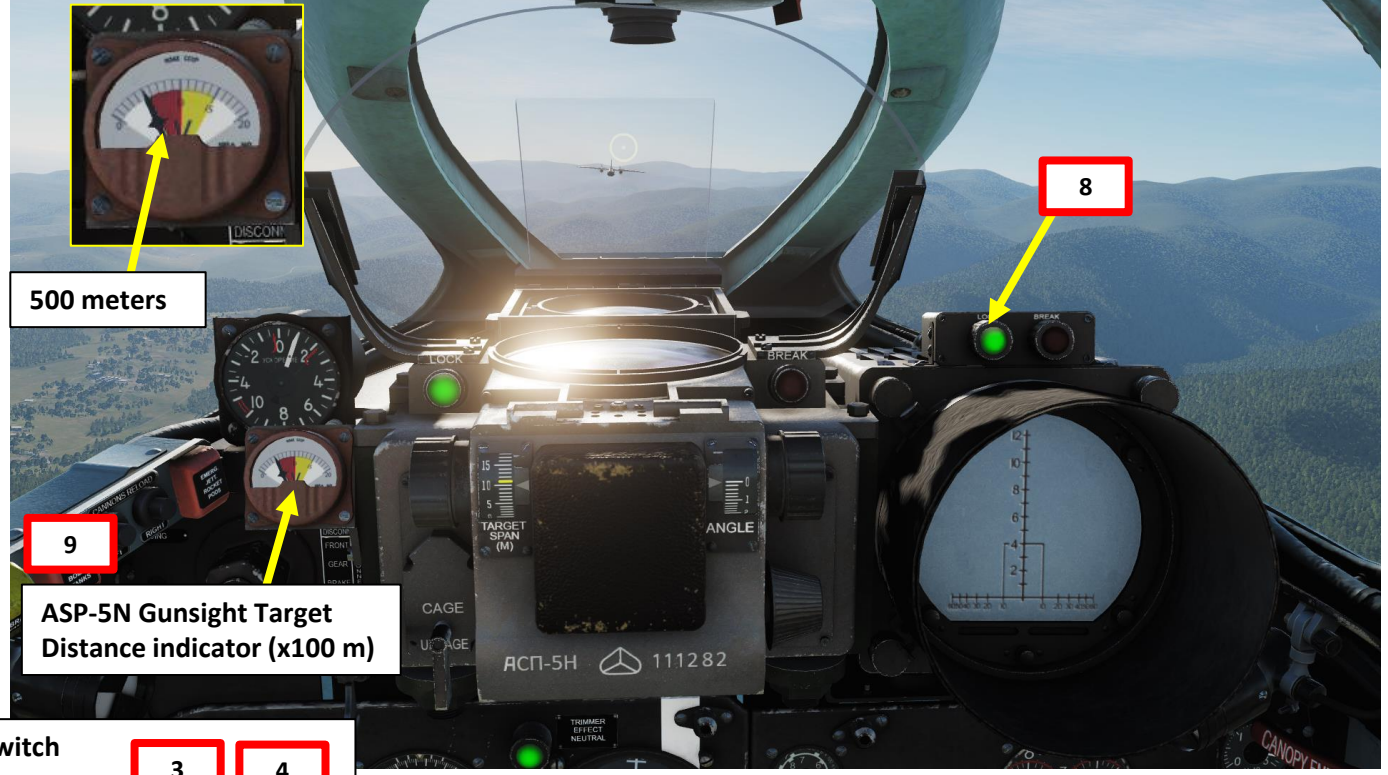




RP-5 RADAR OPERATION

LOW ALTITUDE MODE (1)

1. Set Radar Power and Gunsight Power Switches ON (UP)
2. Set ASP-5N Gunsight Aiming Mode – RADAR (DOWN)
3. Set Radar Mode Control Switch – STANDBY (MIDDLE). Wait 3 minutes for the radar to warm up.
4. When radar is warmed up, set Radar Mode Control Switch – ON (UP)
5. Set Radar Target Lock (Tracking Antenna) Switch – ON (UP)
6. Set Radar Mode Selector Switch to Mode 1 (Low Altitude) – DOWN. This will turn off the radar display and the Search Antenna.
7. Confirm that the Radar Emitting Light is illuminated.
8. When you are 1200 meters from a distance, the Tracking Antenna will lock the nearest target. Check the RADAR LOCK lamp.
9. Ranging Distance can be seen on the ASP-5 Gunsight Target Distance indicator.



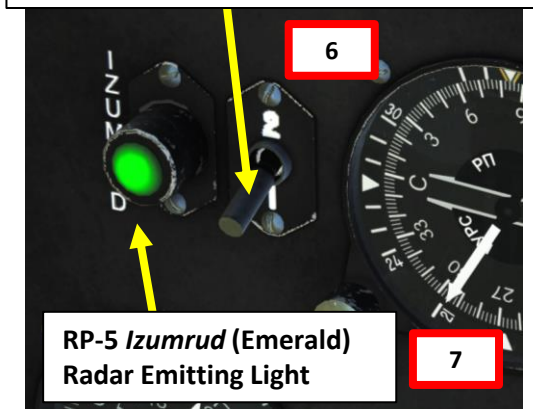
RP-5 Radar Target Lock (Tracking Antenna) Switch 5
UP = ON / DOWN = OFF

RP-5 Radar Mode Control Switch 3 4
- *OFF (DOWN)*
- *STANDBY (MIDDLE): Radar warm-up position*
- *FULL ON (UP): Initiates radar transmitting. A safety mechanism will not allow the radar to transmit if the landing gear is deployed.*

ASP-5N Gunsight Aiming Mode
- *OPTIC (UP) Manual Introduction of the Target Wing Span and Distance*
- *RADAR (DOWN): Aiming calculations are provided by the RP-5 Radar*

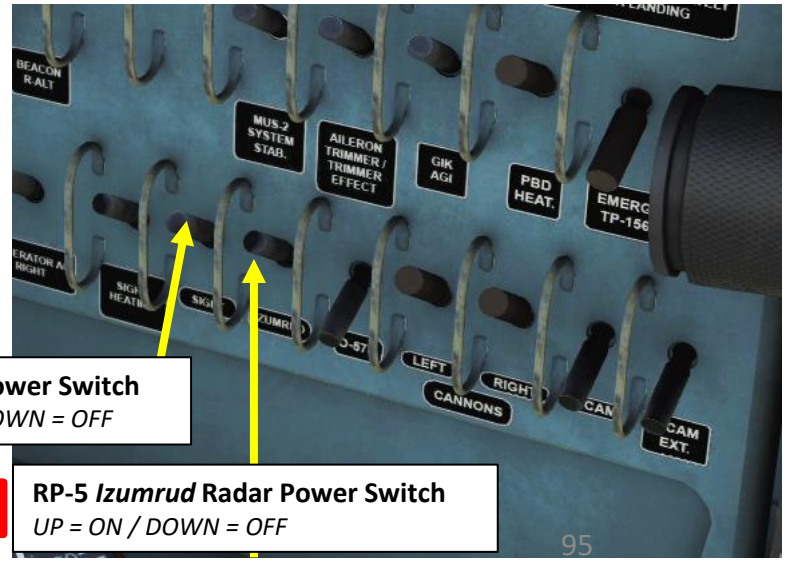
2

RP-5 *Izumrud* Radar Mode Selector
- *Mode 1: Use below 2000 m (Low Altitude Mode)*
- *Mode 2: Use above 2000 m*



6

RP-5 *Izumrud* (Emerald) Radar Emitting Light 7



Gunsight Power Switch
UP = ON / DOWN = OFF

1 **RP-5 *Izumrud* Radar Power Switch**
UP = ON / DOWN = OFF

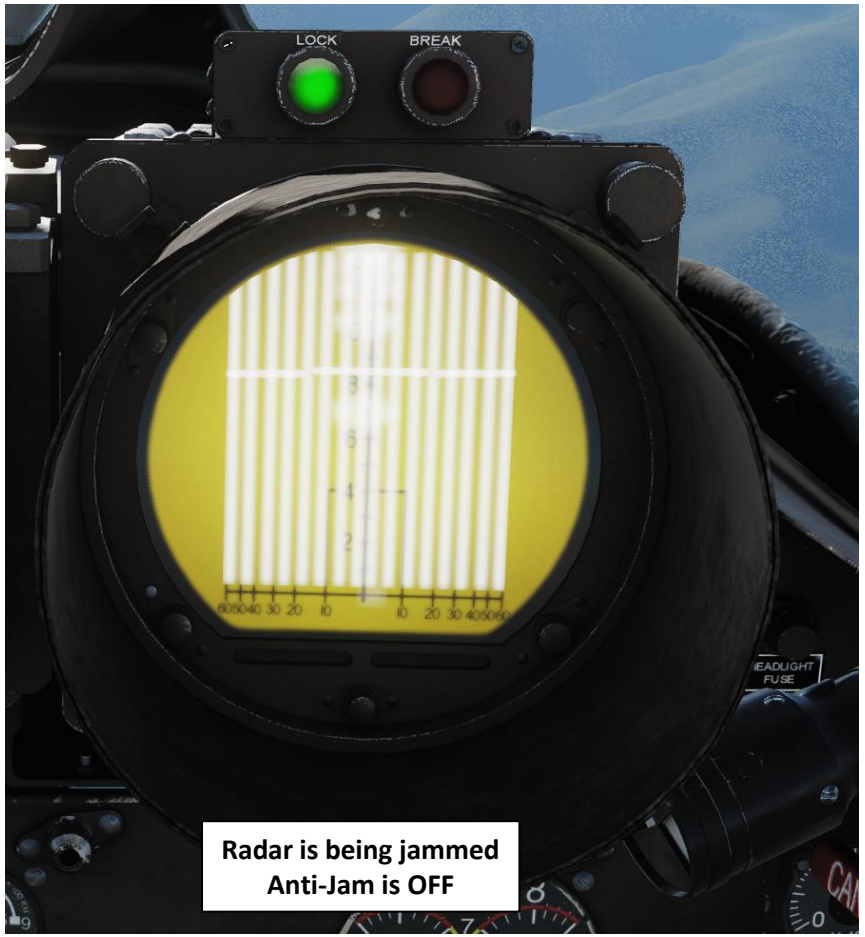
RP-5 RADAR ANTI-JAMMING

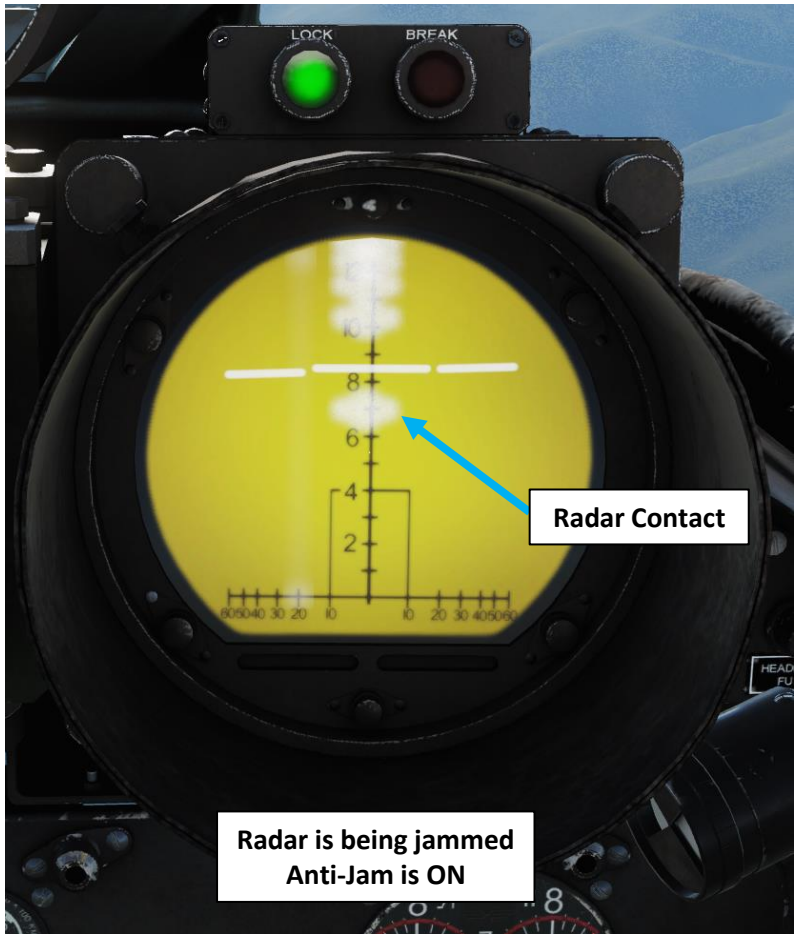
Many aircraft have radar jamming systems, which basically drowns your radar waves in “white noise”. Many aircraft like the B-52 and the Mirage 2000 have such jamming capabilities. However, you can still use the “Anti-Jamming” switch, which reduces your Search antenna sensitivity, converting the Jamming Cloud into a Line. This way, the smudge can still give you a ballpark idea of the current target’s range and location.

RP-5 Radar Anti-Jamming Mode

- *UP = ON / DOWN = OFF*

Reduces Antenna Sensitivity, converting the Jamming Cloud into a Line.





WEAPONS & ARMAMENT

ARMAMENT OVERVIEW

AIR-TO-AIR MISSILES

NAME	DESCRIPTION
K-13A / R-3S ATOLL	Infrared Seeker, 1962, Rear Aspect, Similar to AIM-9B (GAR-8) SIDEWINDER. Best used against small targets like fighters but unreliable against maneuvering targets. Effective Range: 2 km Maximum Range: 7 km

ROCKETS

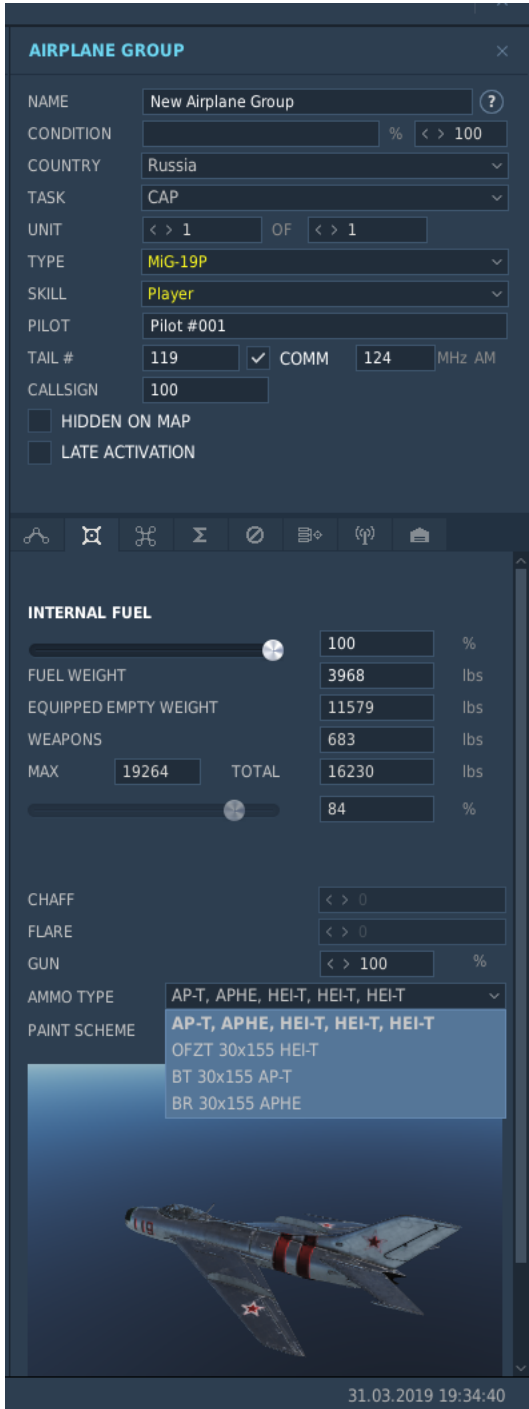
NAME	DESCRIPTION
ARS-57M (S-5M)	8 x 55 mm (2.2 in) unguided rockets

BOMBS (UNGUIDED)

NAME	DESCRIPTION
FAB-50	50 kg (110 lbs) unguided low-drag general-purpose bomb
FAB-100M	100 kg (221 lbs) unguided low-drag general-purpose bomb
FAB-250	250 kg (451 lbs) unguided low-drag general-purpose bomb

GUNS

NAME	DESCRIPTION
NR-30	2 x Nudelman-Rikhter 30 mm cannon (73 rounds each) Available round types: • AP-T, APHE, HEI-T, HEI-T, HEI-T • OFZT 30x155 HEI-T (High-Explosive Incendiary – Tracer) • BT 30x155 AP-T (Armor-Piercing – Tracer) • BR 30x155 APHE (Armor-Piercing High Explosive)



NR-30 CANNONS
WITH OPTICAL SIGHT

1. Set Gunsight Power Switch ON (UP)
2. Set ASP-5N Gunsight Aiming Mode – OPTIC (UP)
3. Twist your Throttle Grip to manually set the Gunsight Reticle Range. In our case, we will use a range of 1000 meters.
4. Set Left & Right Cannon Power Switches – ON (UP)
5. Press and hold Left & Right CANNON RELOAD buttons for at least 2 seconds each to arm each cannon. Confirm that cannons are armed with the red arming lights.
6. Set Gunsight Mode to NR-30 to select Cannons

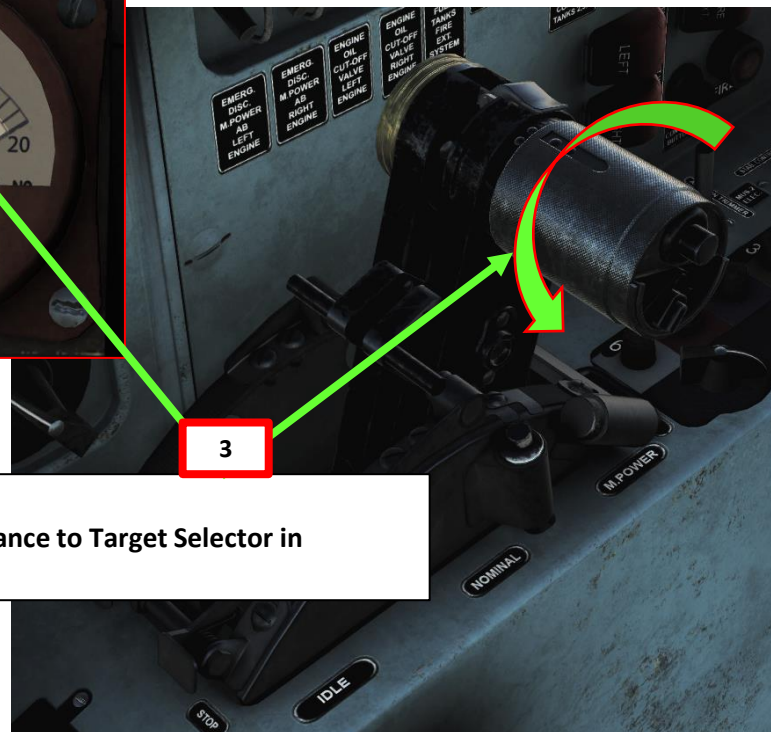
Note

Russian cannons of this era use a "pyrotechnical" reload system, which means that a cassette equipped with a pyrocartridge will detonate a charge to "reload" a gun. The MiG-21bis, MiG-15 and the L-39ZA use a similar system.

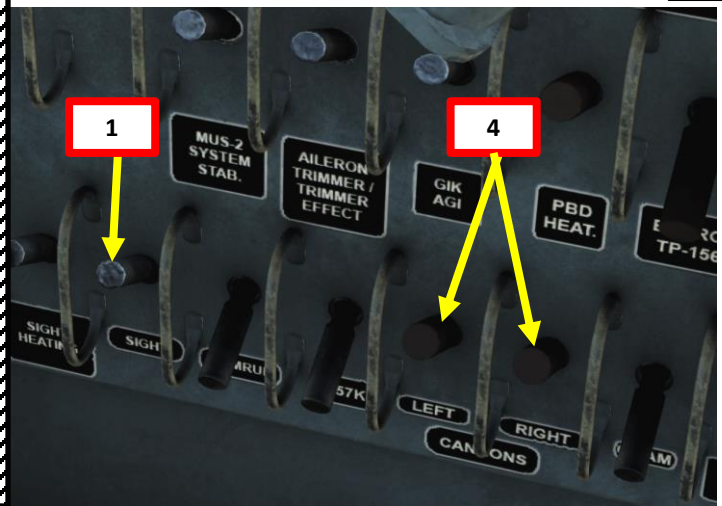
ASP-5N Gunsight Armament Employment Mode

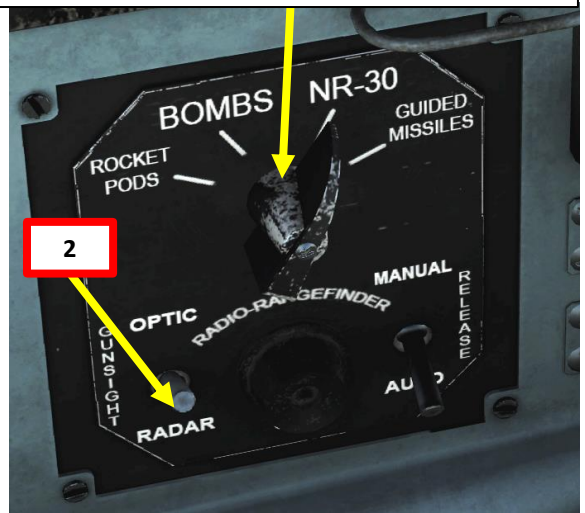
- *ARS-57M/S-5M Rockets*
- *FAB-100/250 Bombs*
- *NR-30 30 mm Cannons*
- *R-3S Infrared Guided Missiles*

6



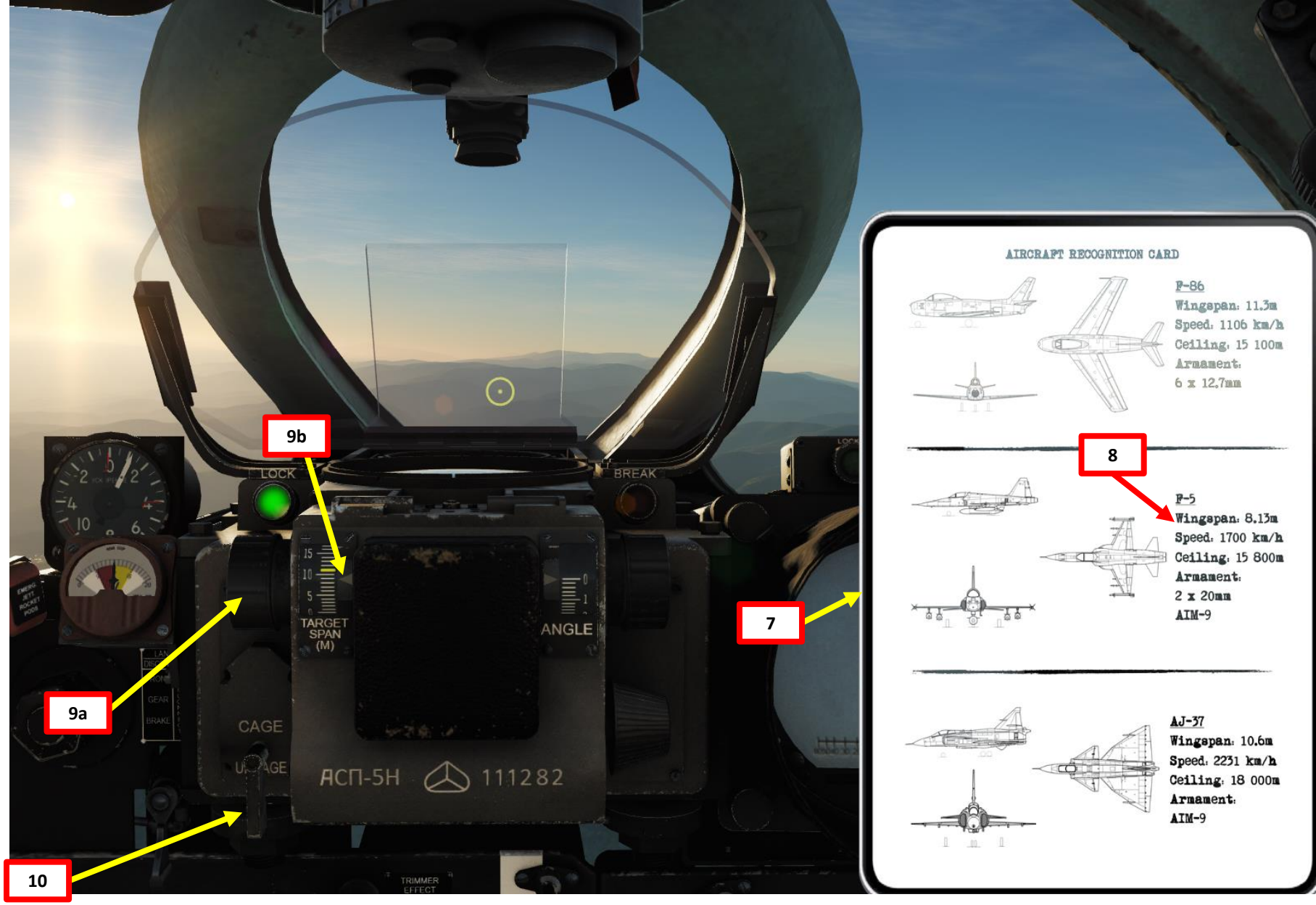
Throttle Twist Grip
(ASP-5N Gunsight Distance to Target Selector in hundreds of meters)





NR-30 CANNONS
WITH OPTICAL SIGHT

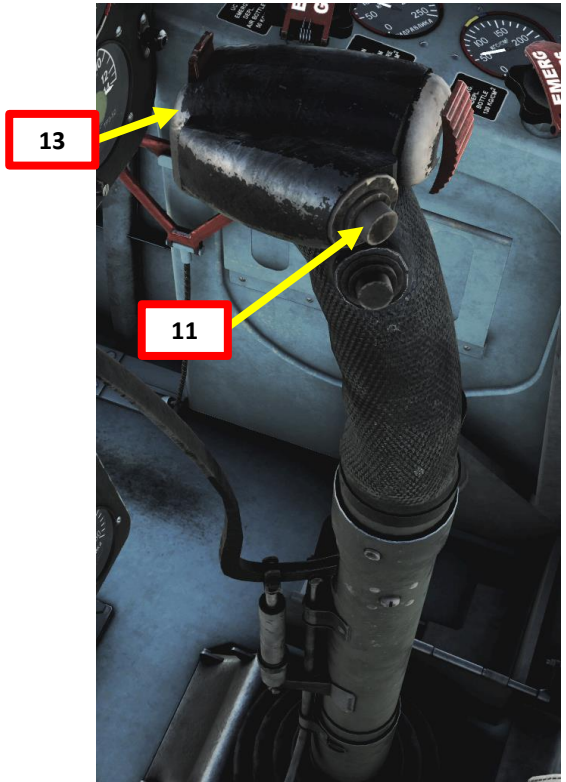
7. Press “RSHIFT+K” to display kneeboard and use “[” and “]” to cycle pages to the AIRCRAFT RECOGNITION CARDS
8. If you are being vectored by the GCI (Ground-Controller Intercept), he may also have already told you of the target type. In our case, we know we will go for a F-5E, which has a wingspan of 8.15 meters.
9. Adjust Target Wingspan to 8.15 meters as per the aircraft recognition card.
10. Uncage the ASP-5 Gunsight Gyro. **Note**: Moving the lever to the Uncage Position allows the Sight to use its Gyros to start Calculating the Cannon Aiming Point based on Angular Velocity, Target Wing Span and the Distance to Target that has been selected. In this Mode, the Reticle will move on the Sight Glass, displaying the correct bullet arc for a preselected Distance.

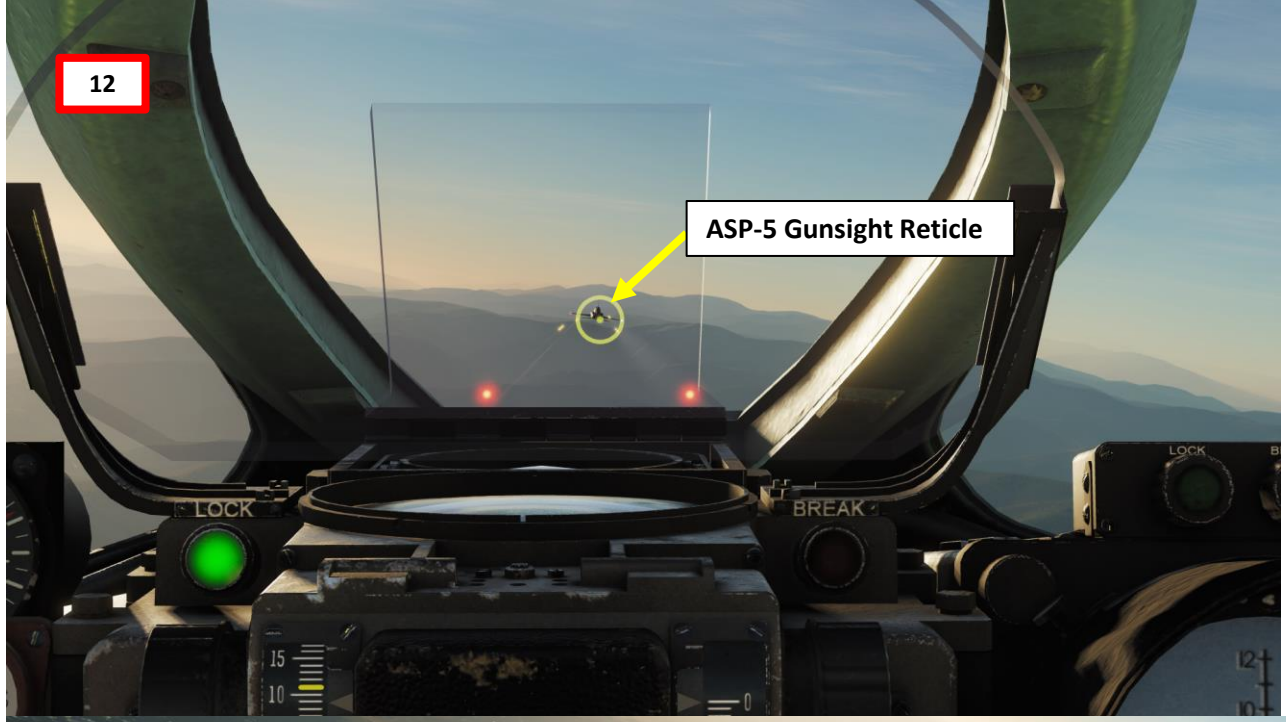


NR-30 CANNONS

WITH OPTICAL SIGHT

11. You can use the Electrical Caging button to center the Gunsight Reticle while the button is pressed. This way, the Pilot can introduce the correct Distance into the Sight during intense maneuvering while the Lead Angle Calculations for the selected Distance are still made. When the button is released, the Reticle returns to the Calculated Impact Point Position.
12. Fly the aircraft to line up the Gunsight reticle on the target. The target's wing should fit within the reticle to be "in range" of the range selected in step 9).
13. When you are within range to the target (1 km), lift the Gun safety guard and press the Gun Trigger (Space) to fire cannons.





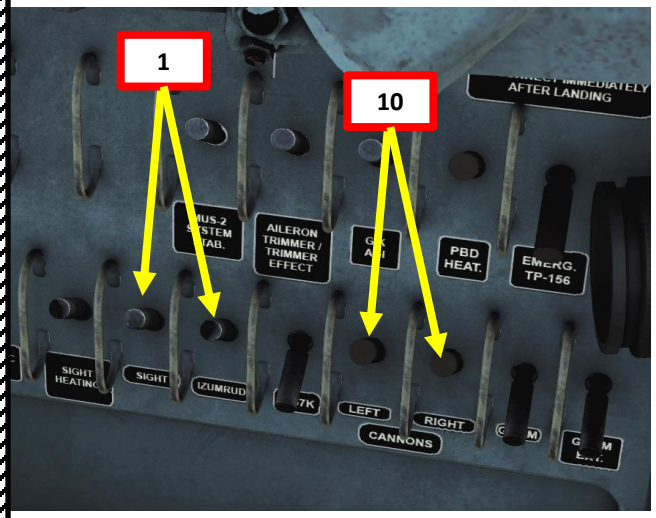
NR-30 CANNONS

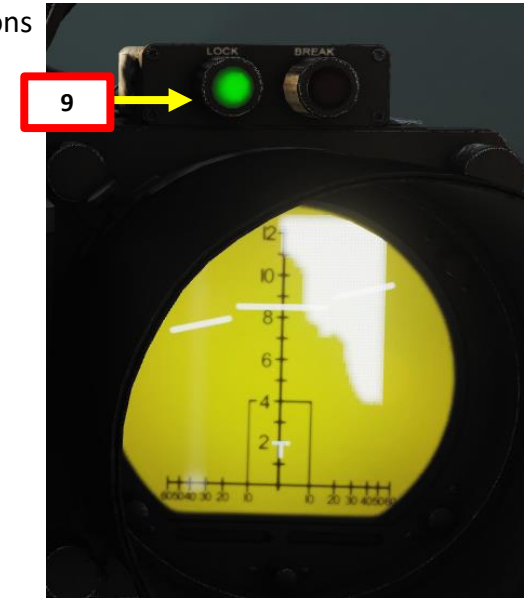
WITH RADAR

1. Set Radar Power and Gunsight Power Switches ON (UP)
2. Set ASP-5N Gunsight Aiming Mode – RADAR (DOWN)
3. Set Radar Mode Control Switch – STANDBY (MIDDLE). Wait 3 minutes for the radar to warm up.
4. When radar is warmed up, set Radar Mode Control Switch – ON (UP)
5. Set Radar Mode Selector Switch to Mode 2 (High Altitude) – UP. This will turn on the radar display and the Search Antenna.
6. Spot a radar contact on the radar screen, then steer the aircraft:
   - Get within 10 degrees of lateral deviation
   - Become co-altitude with the contact.
7. Approach the target until the "Bird" becomes trapped in the Radar Lock zone (within 10 degrees, less than 4 km away).
8. Set Radar Target Lock (Tracking Antenna) Switch – ON (UP)
9. When you are 4000 meters from a distance, the Tracking Antenna will lock the nearest target. Check the RADAR LOCK lamp.
10. Set Left & Right Cannon Power Switches – ON (UP
11. Press and hold Left & Right CANNON RELOAD buttons for at least 2 seconds each to arm each cannon. Confirm that cannons are armed with the red arming lights.
12. Set Gunsight Mode to NR-30 to select Cannons

Note

Russian cannons of this era use a "pyrotechnical" reload system, which means that a cassette equipped with a pyrocartridge will detonate a charge to "reload" a gun. The MiG-21bis, MiG-15 and the L-39ZA use a similar system.

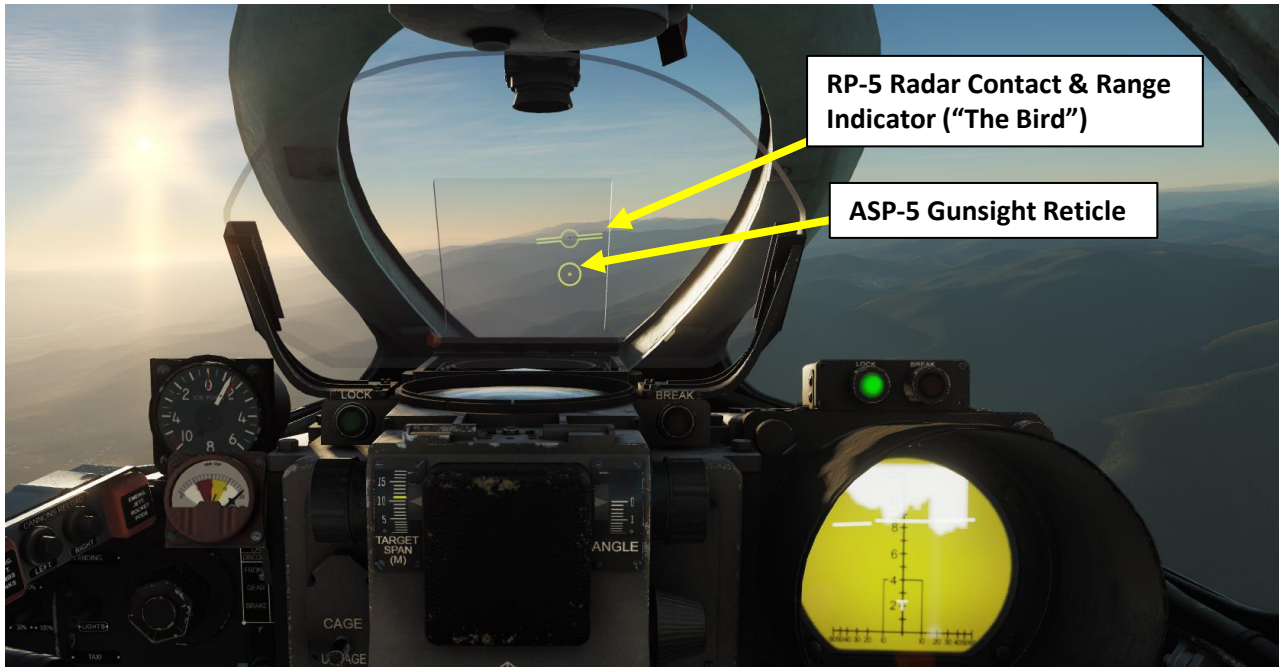


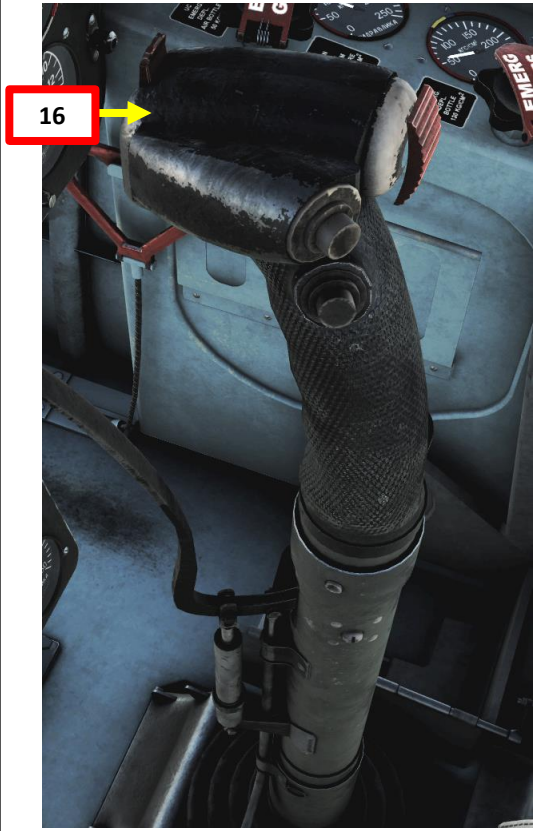


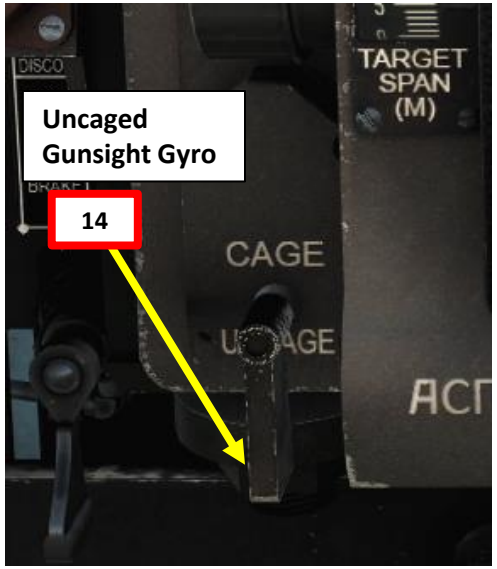
NR-30 CANNONS

WITH RADAR

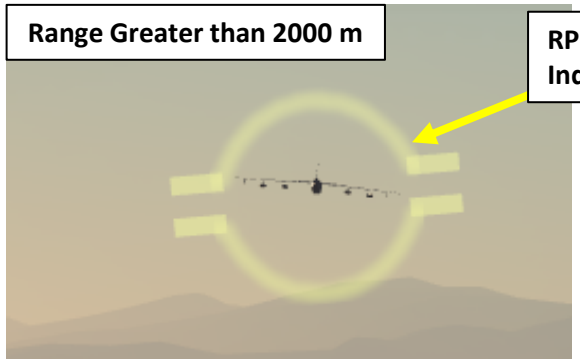
13. Ranging Distance can be seen on the ASP-5 Gunsight Target Distance indicator.
14. Uncage the ASP-5 Gunsight Gyro.
    Note: Moving the lever to the Uncage Position allows the Sight to use its Gyros to start Calculating the Cannon Aiming Point based on Angular Velocity, Target Wing Span and the Distance to Target that has been selected. In this Mode, the Reticle will move on the Sight Glass, displaying the correct bullet arc for a preselected Distance.
15. Fly the aircraft to line up the Gunsight reticle on the "Bird" (Radar reticle).
16. When you are sufficiently close to the target (about 1 km – 500 m), lift the Gun safety guard and press the Gun Trigger (Space) to fire cannons.

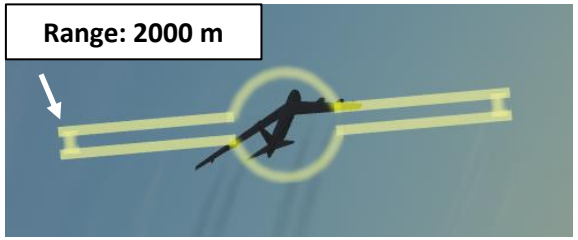


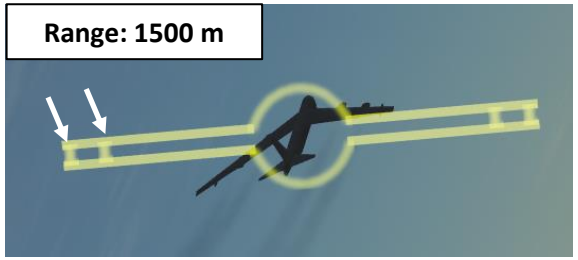


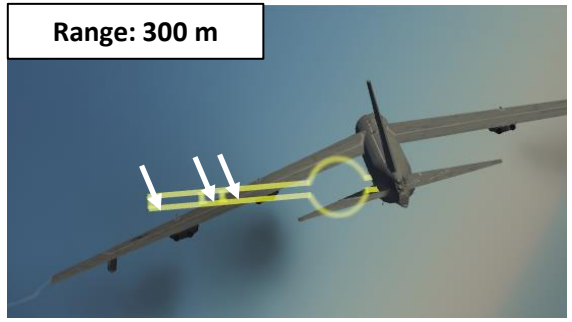


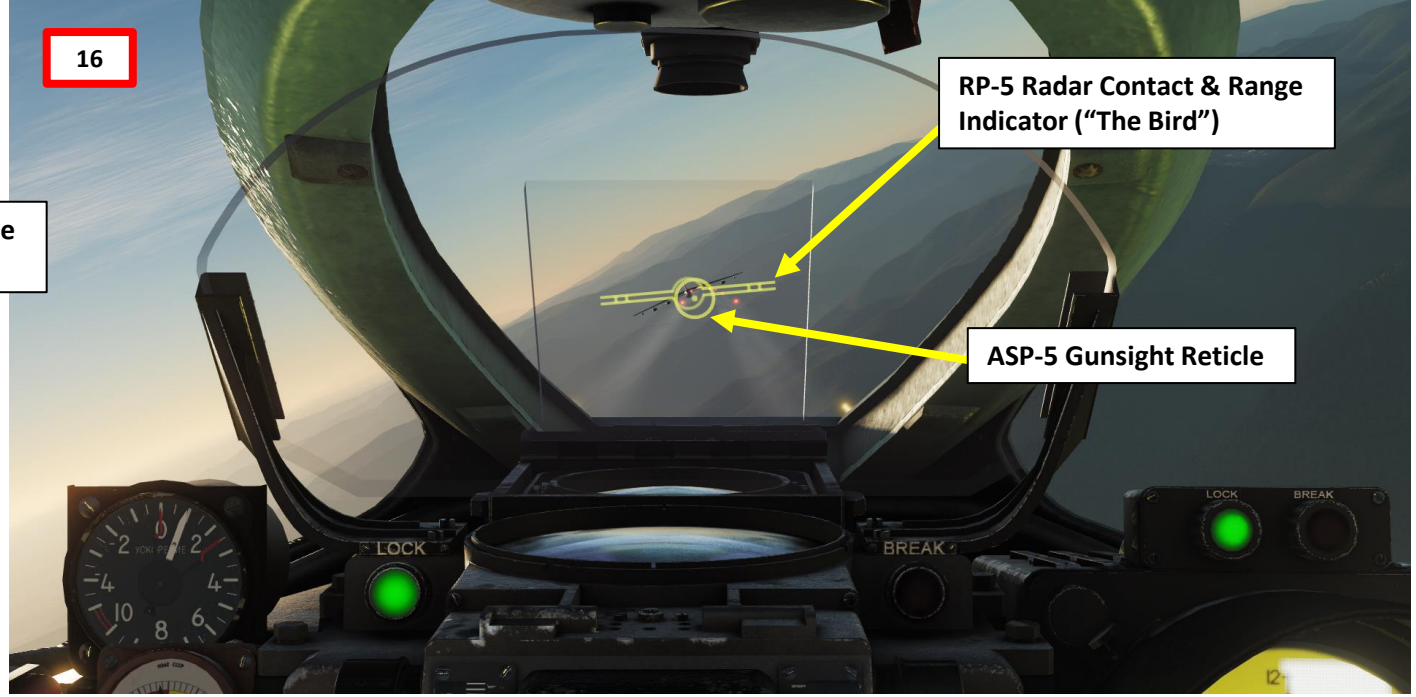
NR-30 CANNONS
WITH RADAR







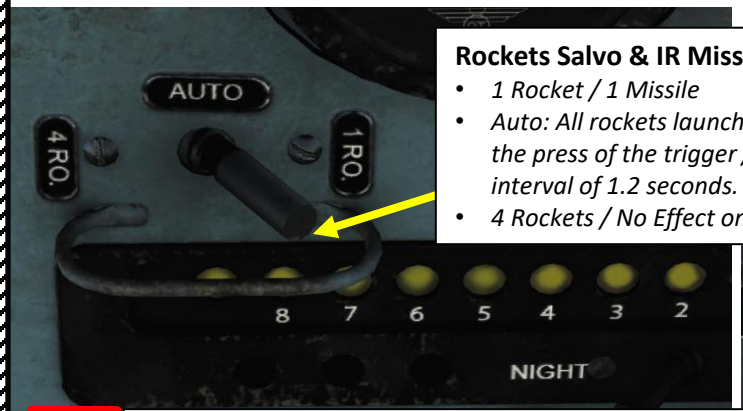




K-13A / R-3S "ATOLL" AIR-TO-AIR IR MISSILE

1. Set O-57K Power Switch – ON (UP)
2. Set Gunsight Mode to GUIDED MISSILES to select IR missiles. A low-pitch growl will be audible.
3. Select desired Release Mode using the Release Mode Selector (select AUTO to launch both missiles or 1 RO for a single missle launch)
4. When missiles are close enough to track a heat signature (you will hear a high-pitch growl), lift the Gun safety guard and press the Gun Trigger (Space) to fire missile.

Note: you can also use the radar to get ranging information

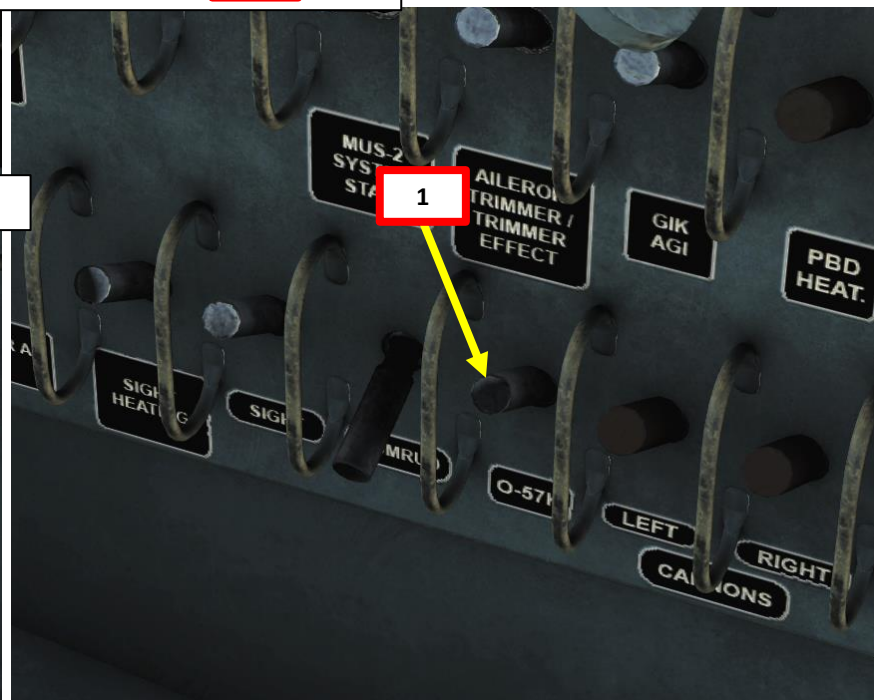


Rockets Salvo & IR Missile Release Mode Selector

- *1 Rocket / 1 Missile*
- *Auto: All rockets launch in succession from both pods at the press of the trigger / Both Missiles will be fired in an interval of 1.2 seconds.*
- *4 Rockets / No Effect on missiles*

3

2 **ASP-5N Gunsight Armament Employment Mode**



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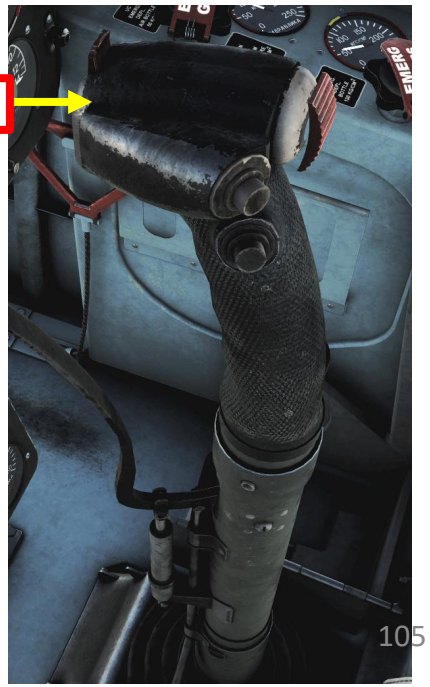
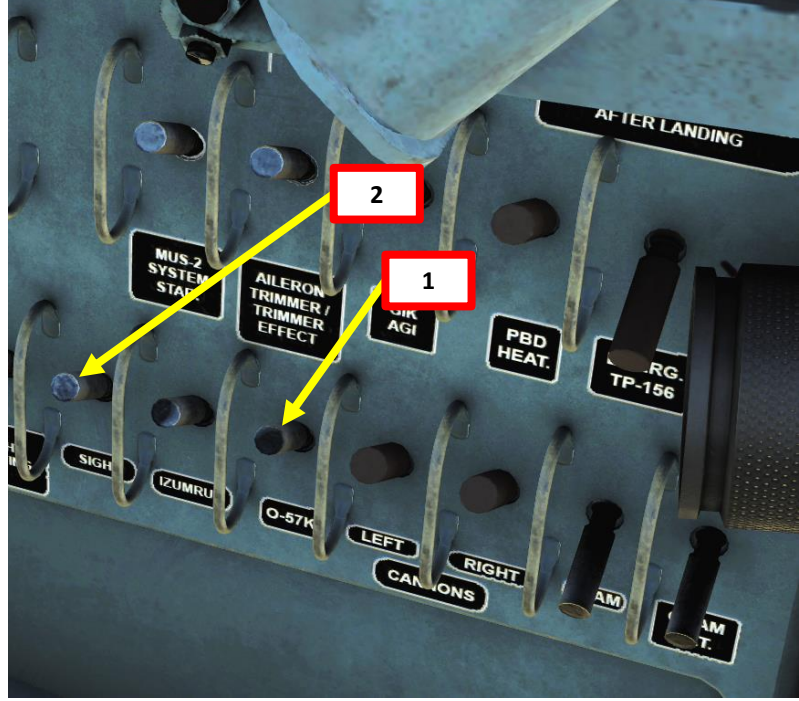
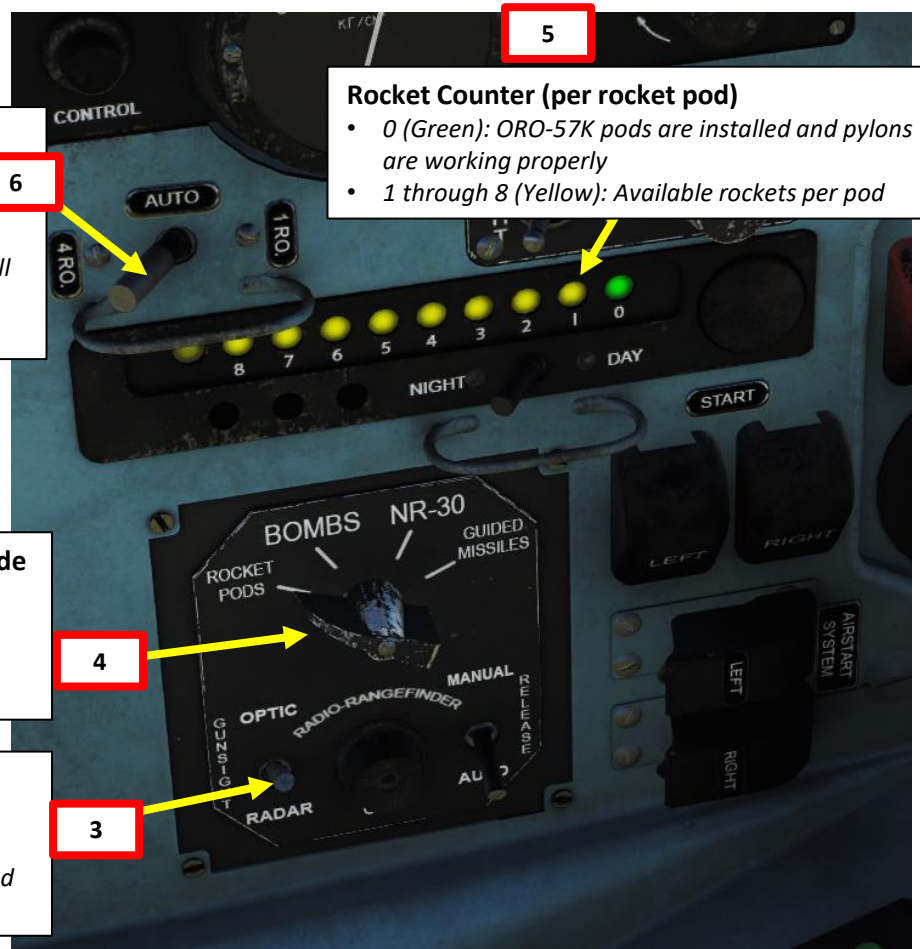


K-13A / R-3S “ATOLL” AIR-TO-AIR IR MISSILE

ARS-57M / S-5M ROCKETS

1. Set O-57K Power Switch – ON (UP)
2. Set Gunsight Power Switch ON (UP)
3. Set ASP-5N Gunsight Aiming Mode – OPTIC (UP)
4. Set Gunsight Mode to ROCKET PODS to select rockets.
5. On the ORO-57 Control Panel, check that the Green Light above "0" is illuminated, indicating the suspension of both rocket pods. The remaining quantity of rockets per pod (8) is indicated by the yellow lights.
6. Select desired Release Mode using the Release Mode Selector
   - AUTO : all rockets launch in succession from both pods at the press of Gun Trigger
   - 1: single rocket fired at the press of Gun Trigger
   - 4: four rockets fired at the press of Gun Trigger





Rocket Counter (per rocket pod)
- *0 (Green): ORO-57K pods are installed and pylons are working properly*
- *1 through 8 (Yellow): Available rockets per pod*

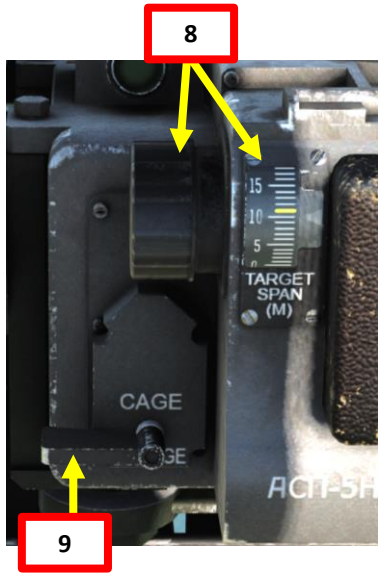
Rockets Salvo & IR Missile Release Mode Selector
- *1 Rocket / 1 Missile*
- *Auto: All rockets launch in succession from both pods at the press of the trigger / Both Missiles will be fired in an interval of 1.2 seconds.*
- *4 Rockets / No Effect on missiles*

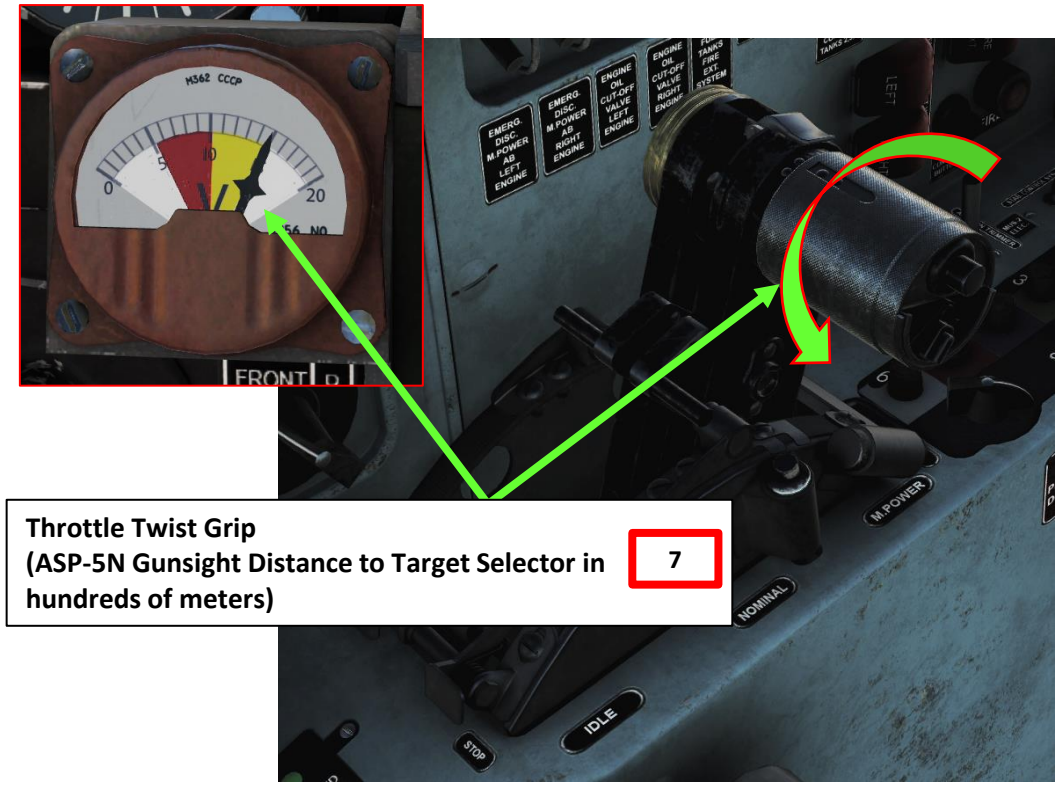
ASP-5N Gunsight Armament Employment Mode
- *ARS-57M/S-5M Rockets*
- *FAB-100/250 Bombs*
- *NR-30 30 mm Cannons*
- *R-3S Infrared Guided Missiles*

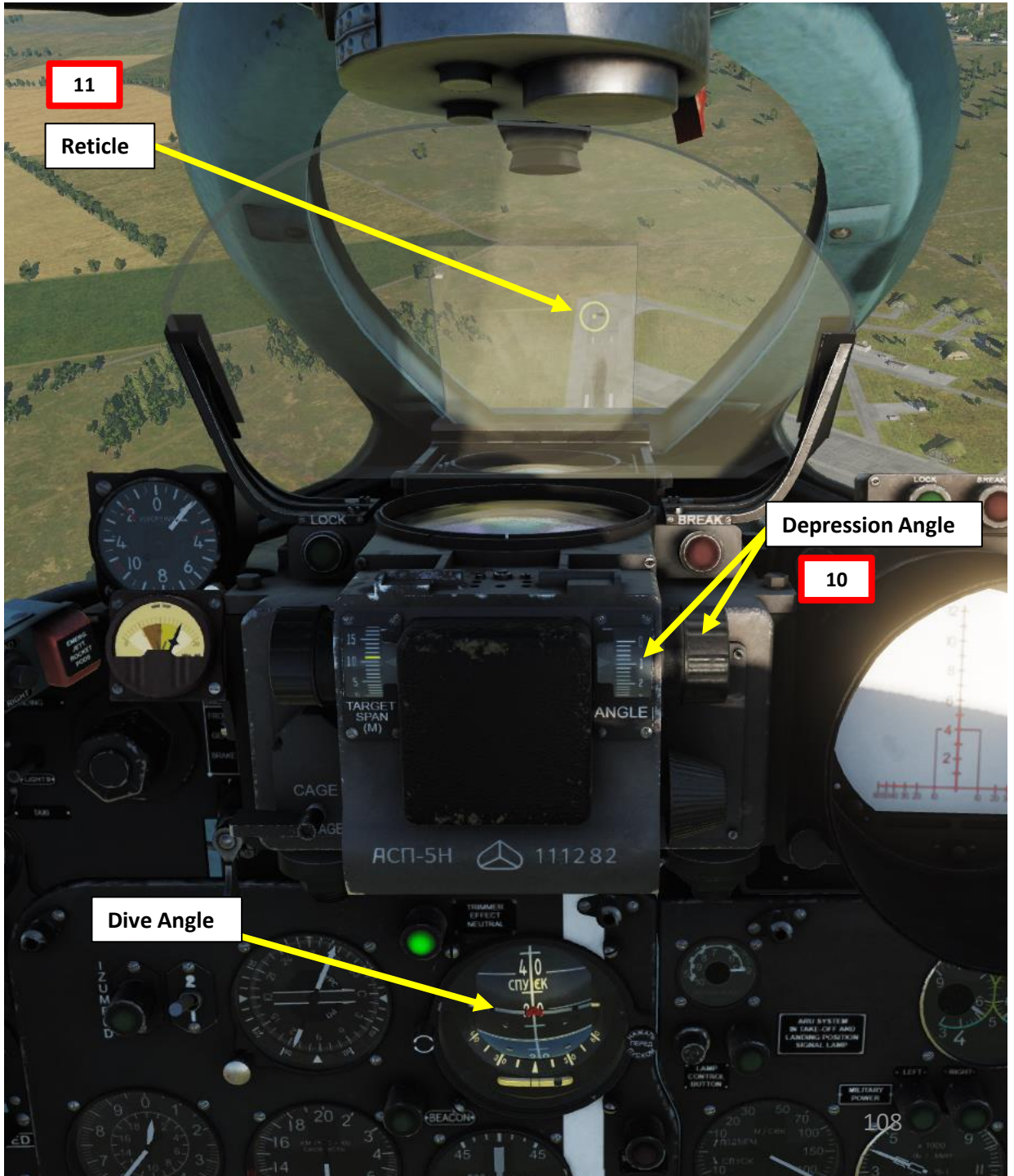
ASP-5N Gunsight Aiming Mode
- *OPTIC (UP) Manual Introduction of the Target Wing Span and Distance*
- *RADAR (DOWN): Aiming calculations are provided by the RP-5 Radar*

ARS-57M / S-5M ROCKETS

7. Twist your Throttle Grip to manually set the Gunsight Reticle Range. In our case, we will use a range of 1500 meters.
8. Adjust Target Wingspan to the target's size (we will assume 10 meters).
9. Cage the ASP-5 Gunsight Gyro.
10. Adjust Reticle Depression as per the parameters recommended in the rocket attack profile table (1 deg).
11. Perform the dive as per the parameters recommended in the rocket attack profile table (release at 1500 meters with a dive angle of 15 deg). Best dive speed is between 700 and 750 km/h.
12. Lift the Gun safety guard and press the Gun Trigger (Space) to fire rockets when the targets fills the reticle.







ARS-57M / S-5M ROCKETS

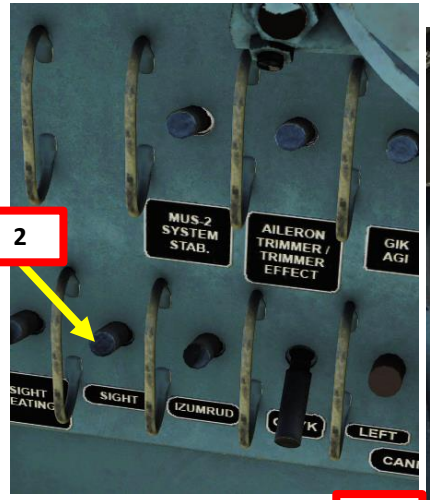
ARS-57M / S-5M ROCKETS

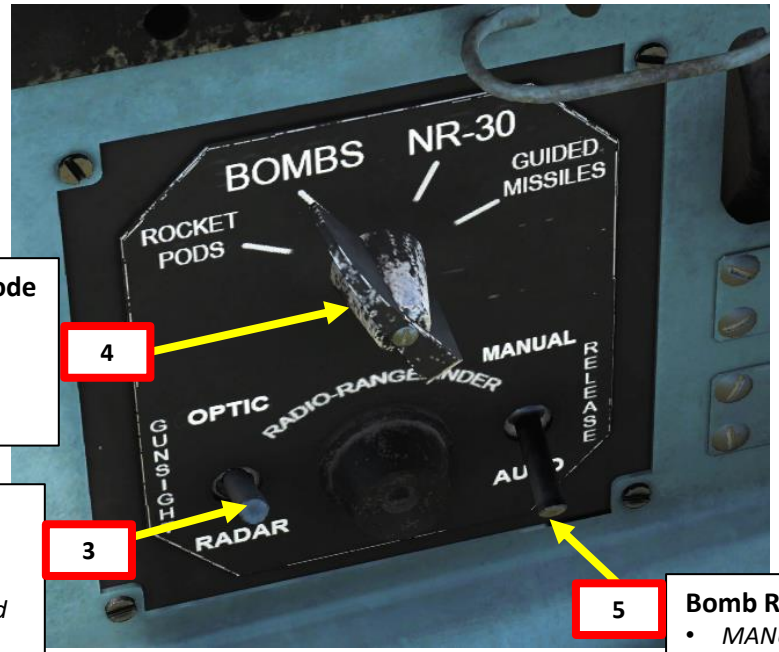
ROCKET ATTACK PROFILE TABLE

DEPRESSION TABLE – S-5M ROCKETS			
Airspeed	**Distance (in relation to target)**	**Dive Angle**	**Reticle Depression**
700 – 750 km/h	1500 m	15 deg	1 deg
700 – 750 km/h	2000 m	20 deg	2 deg

UNGUIDED BOMBS

1. Set ARM BOMBS FUSE Switch – ON (UP). Confirm that the EXP (Explosion) red lamp illuminates.
2. Set Gunsight Power Switch ON (UP)
3. Set ASP-5N Gunsight Aiming Mode – OPTIC (UP)
4. Set Gunsight Mode to BOMBS to select bombs.
5. Select desired Bomb release Mode using the Bomb Release Mode Selector
   - MANUAL : Bombs are released at every press of the Trigger (Single Drop)
   - AUTO: Both bombs are released simultaneously when Trigger is pressed





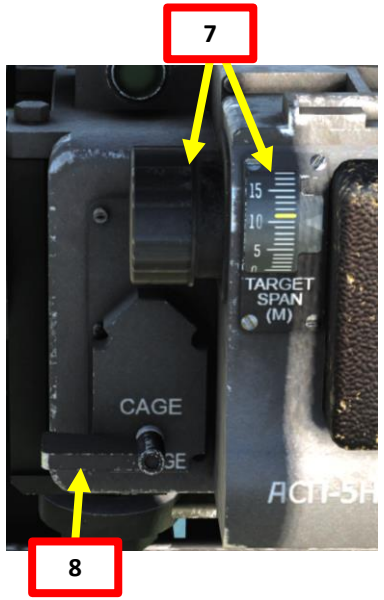
ASP-5N Gunsight Armament Employment Mode
- *ARS-57M/S-5M Rockets*
- *FAB-100/250 Bombs*
- *NR-30 30 mm Cannons*
- *R-3S Infrared Guided Missiles*

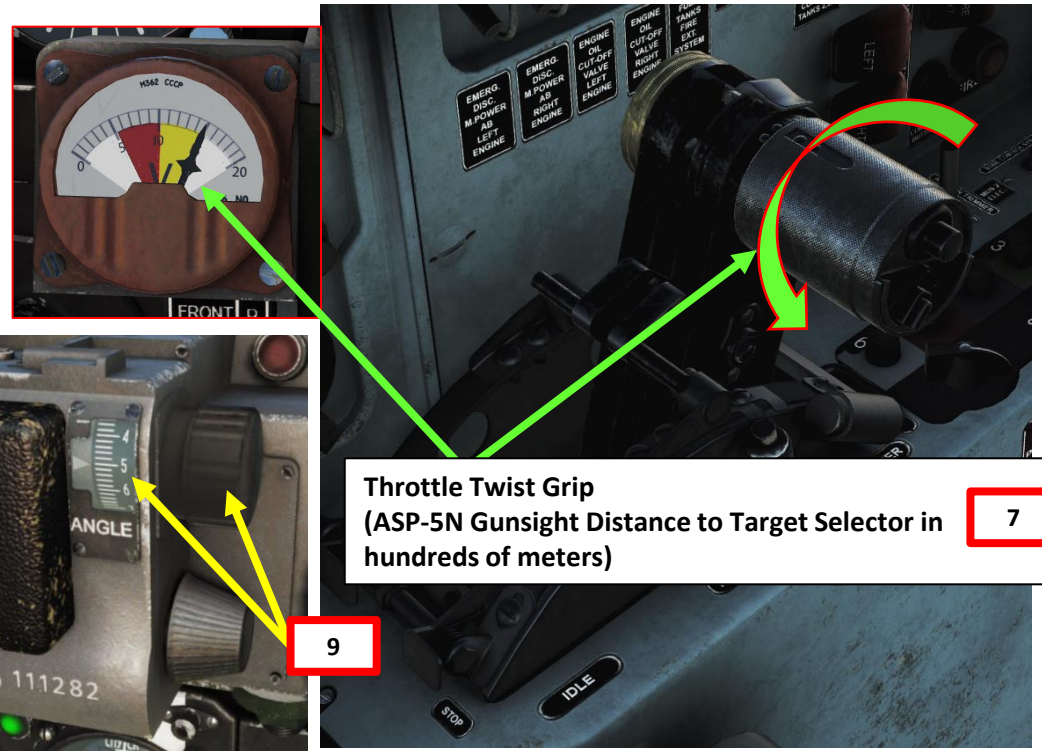
ASP-5N Gunsight Aiming Mode
- *OPTIC (UP) Manual Introduction of the Target Wing Span and Distance*
- *RADAR (DOWN): Aiming calculations are provided by the RP-5 Radar*

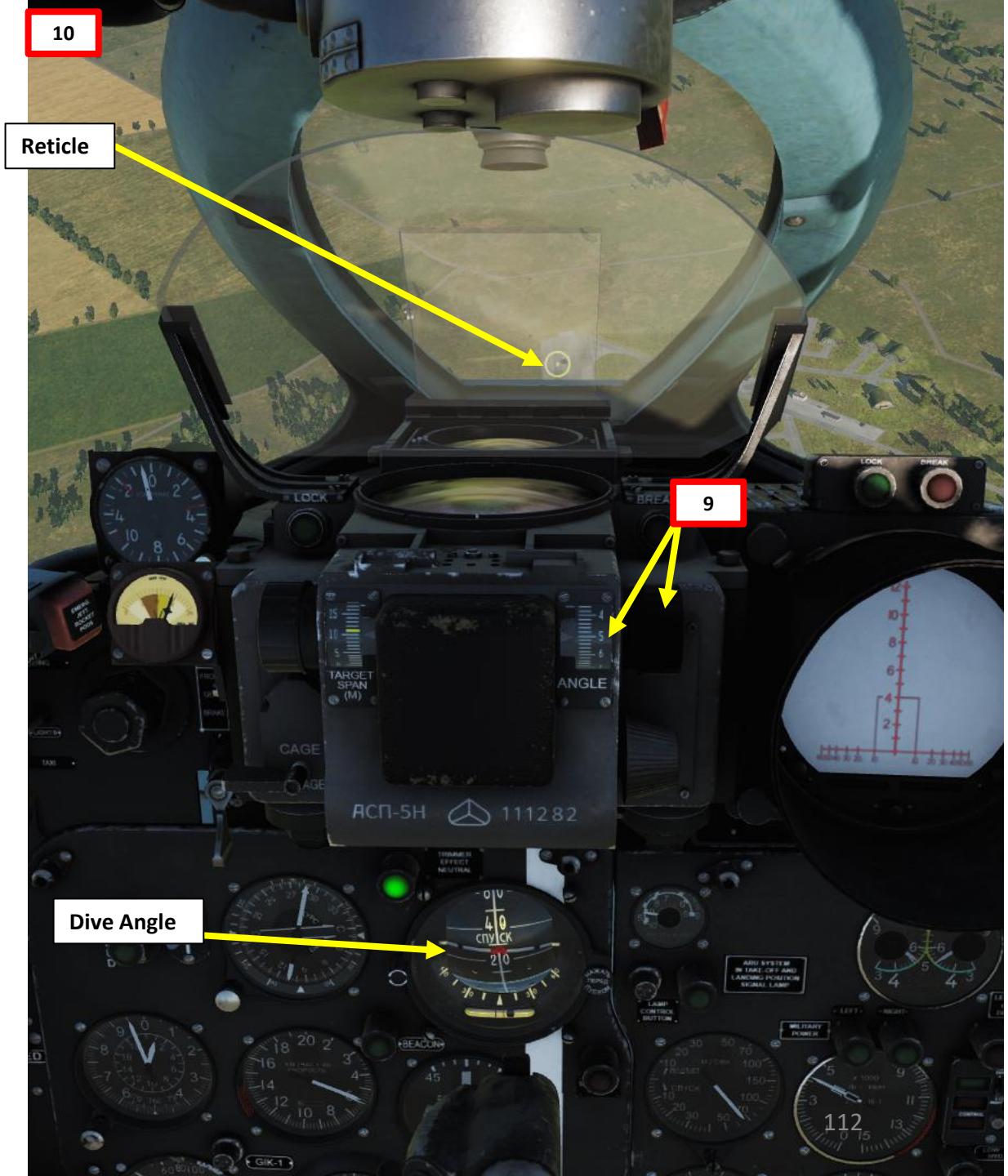
Bomb Release Mode Switch
- *MANUAL (UP): Bombs are released at every press of the Armament Trigger switch*
- *AUTO (DOWN): Both bombs are released simultaneously*

UNGUIDED BOMBS

6. Twist your Throttle Grip to manually set the Gunsight Reticle Range. In our case, we will use a range of 1500 meters.
7. Adjust Target Wingspan to the target's size (we will assume 10 meters).
8. Cage the ASP-5 Gunsight Gyro.
9. Adjust Depression Angle as per the parameters recommended in the bomb attack profile table (5 deg).
10. Perform the dive as per the parameters recommended in the rocket attack profile table (release at 1500 meters with a dive angle of 30 deg). Best dive speed is between 650 and 700 km/h.
11. Lift the Gun safety guard and press the Gun Trigger (Space) to drop bombs when the target fills the reticle.







UNGUIDED BOMBS

UNGUIDED BOMBS

BOMBING ATTACK PROFILE TABLE

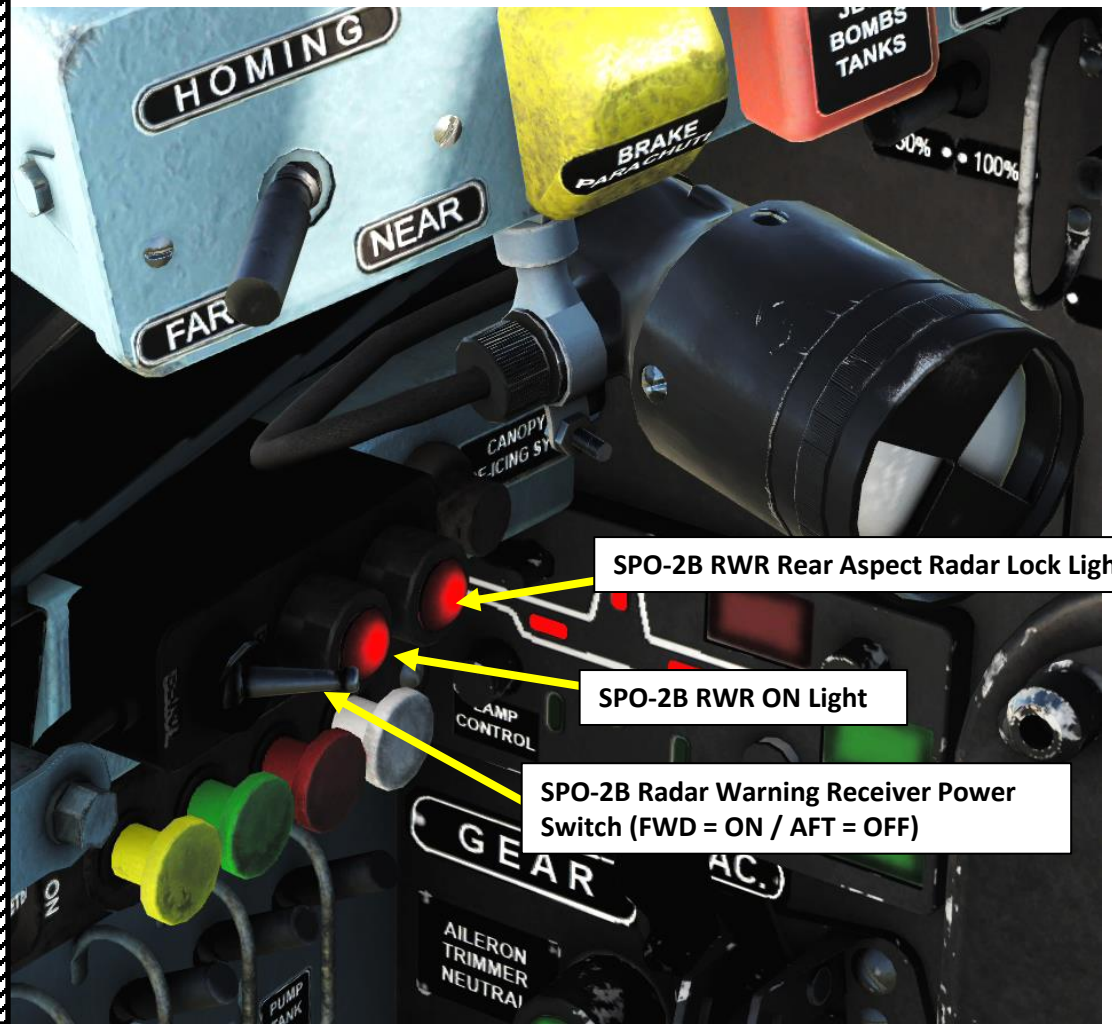
DEPRESSION TABLE – BOMBS			
Airspeed	**Distance (in relation to target)**	**Dive Angle**	**Reticle Depression**
650 – 700 km/h	1300 m	30 deg	5 deg
650 – 700 km/h	1500 m	30 deg	5 deg
650 – 700 km/h	2000 m	40 deg	5 deg

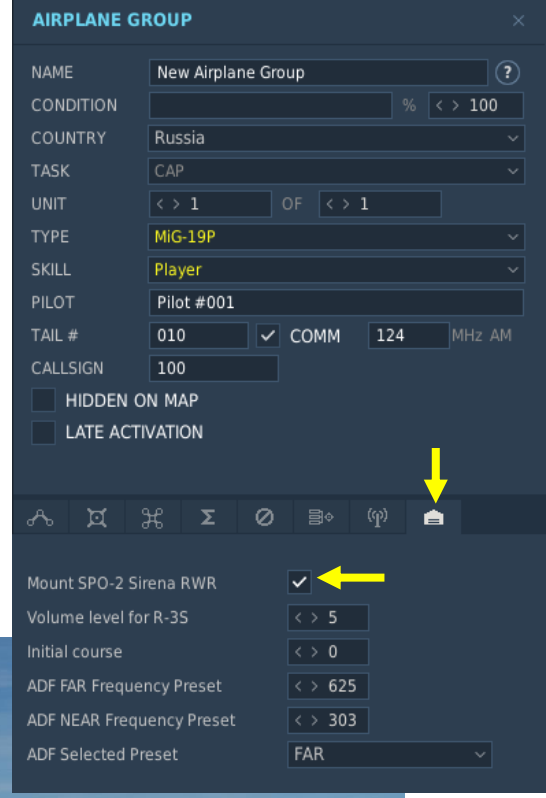
SPO-2B SIRENA RADAR WARNING RECEIVER (RWR)

The MiG-19 was retrofitted with an early radar warning receiver: the SPO-2B. It was only capable of detecting a radar signal in the rear hemisphere (aspect), and as such its capabilities were very limited.

The controls and indications consisted of a power ON/OFF switch, a red light indicating that the RWR is active and a second red light that indicates that you are being locked by a radar. The sensor itself was mounted on the top of the Tail Fin assembly.

Note: To be equipped in DCS, the “MOUNT SPO-2 SIRENA RWR” option need to be enabled via the Mission Editor.



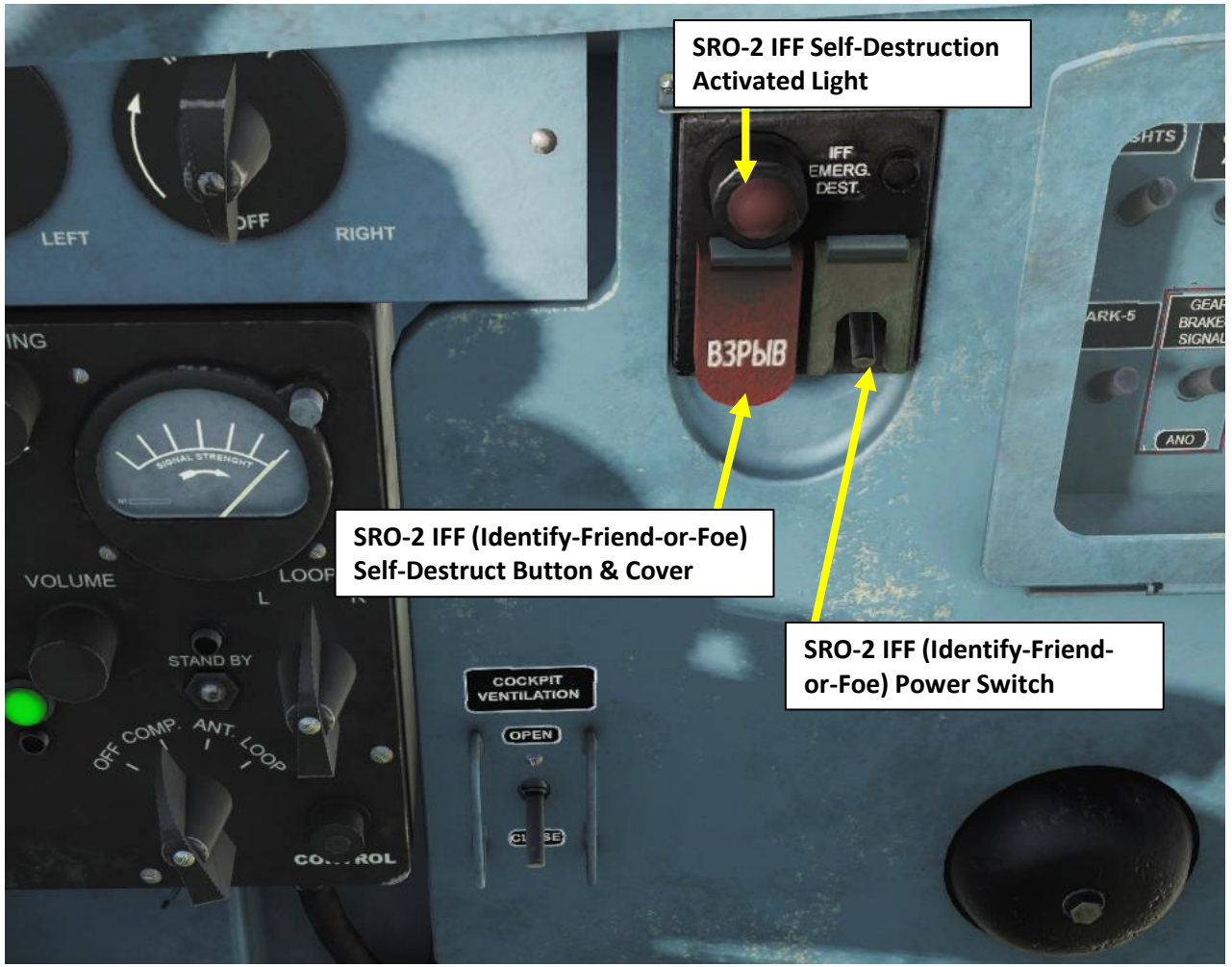


SRO-2 KHROM IFF (IDENTIFY-FRIEND-OR-FOE)

The SRO-2 “Khrom” (Chrome) is one of the early IFF (Identification of Friend or Foe) systems used in early cold war era soviet aircraft.

In the case of the MiG-19P, the system consists of a power switch and a self-destruction button in case the aircraft was forced down over an enemy country. A more modernized IFF system was installed on the MiG-19S and MiG-19PM, which allowed the use of different modes and the input of several codes as well.

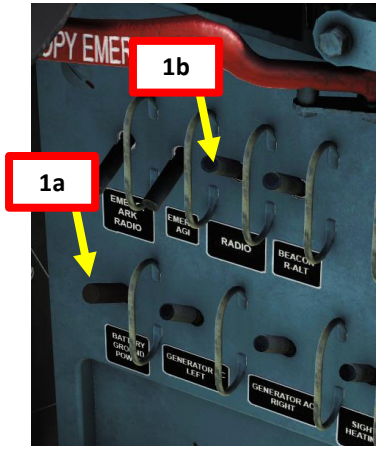
The system we have is mostly a transmitter… you do not have a receiver which allows you to interrogate targets or to detect a friendly or hostile contact. Therefore, target identification must be done visually or via the GCI (Ground Controller Intercept).



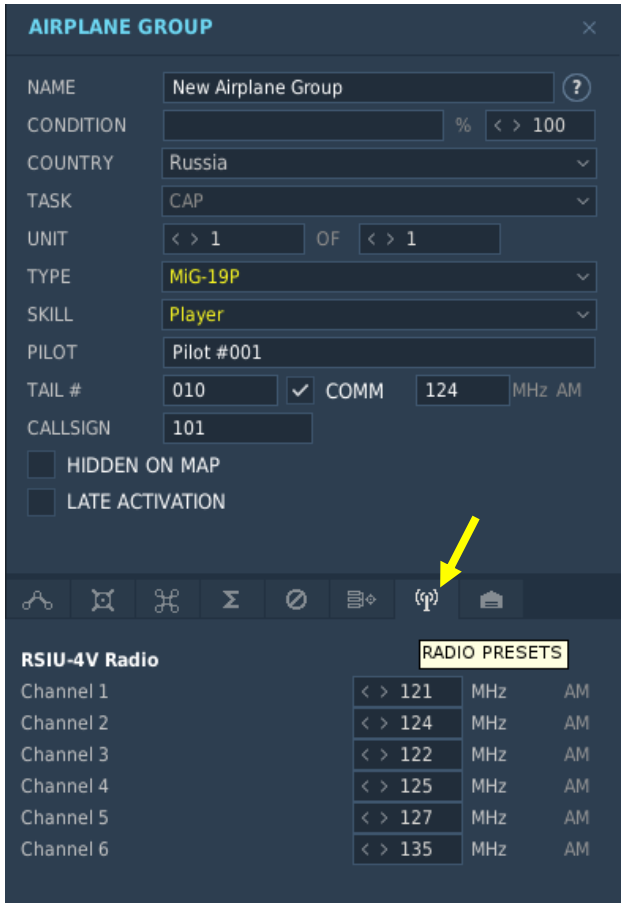
RSIU-4V VHF RADIO

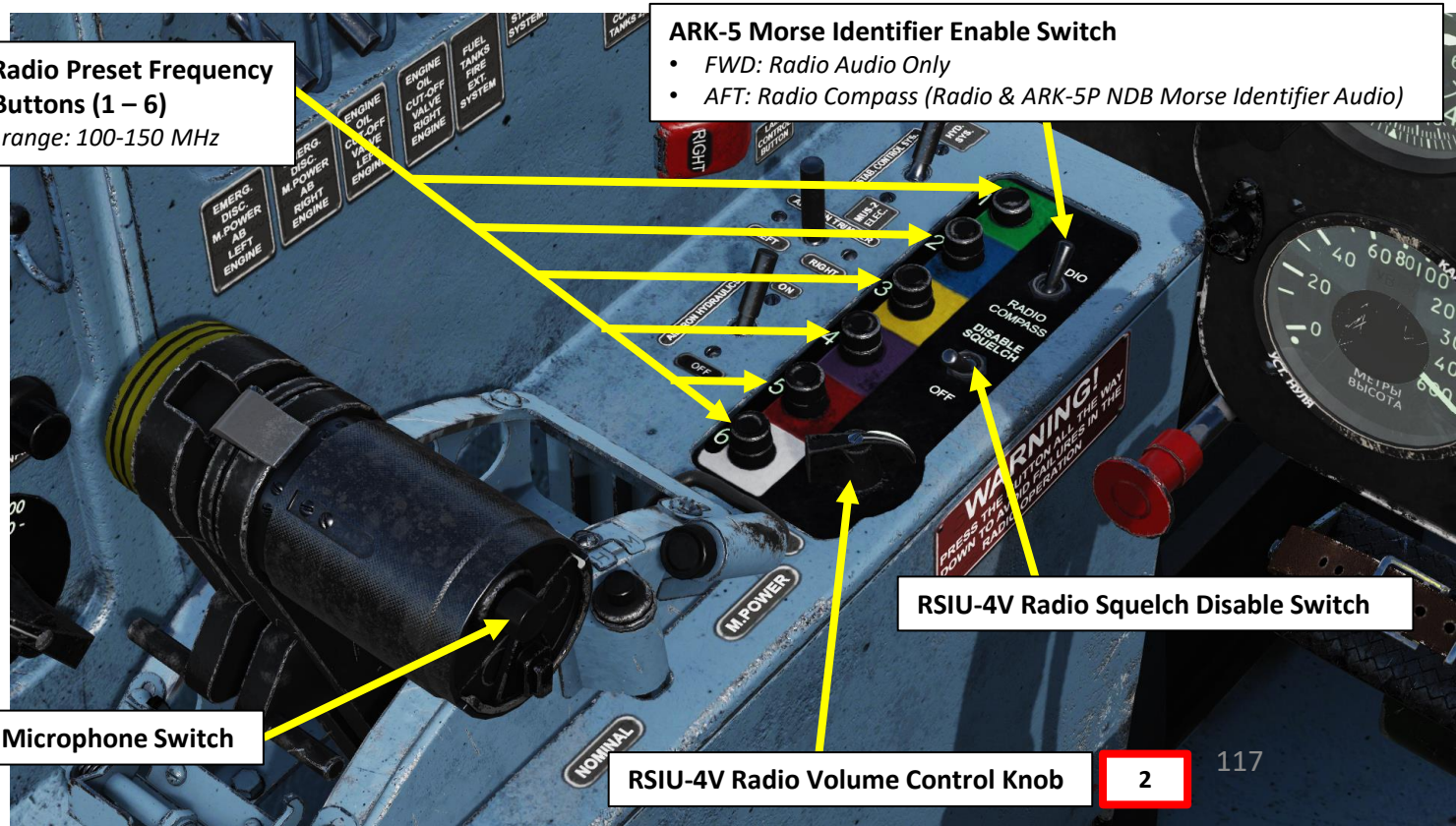
The RSIU-4V VHF radio has six pre-defined frequencies which are set up in the Mission Editor. It is connected to the ARK-5P Radio Navigation system to allow for the reception of morse codes transmitted from NDBs (Non-Directional Beacons).

1. Make sure the Battery switch and Radio Power switch are ON (UP)
2. Set Radio Volume Control Knob to the desired volume level
3. Select desired Preset Frequency button
4. Transmit using the Push-to-Talk Microphone Switch (Communication Menu Binding: "\")



RADIO FREQUENCY RANGE: 100 - 150 MHz





UNDERSTANDING THE ARK-5

Navigation is an extensive subject. You can check chapter 15 of FAA manual for more details on navigation.

LINK: http://www.faa.gov/regulations_policies/handbooks_manuals/aviation/pilot_handbook/media/PHAK%20-%20Chapter%2015.pdf

- "NDB" is what we call a non-directional beacon. It transmits radio waves on a certain frequency on long distances. These waves are read by an ADF (automatic direction finder). NDBs are typically used for radio navigation and provide a bearing to the station but no actual range.
- "VOR" is what we call a VHF Omnidirectional Range system. It transmits radio waves on a certain frequency. These waves are read by a VOR receiver. VOR systems, just like NDBs, can be used for radio navigation.
- NDB and VOR are used just like lighthouses were used to guide ships. This way, air corridors and airways are created to help control an increasingly crowded sky.
- The ARK or ARC (Automated Radio Compass) is the russian equivalent of an ADF (Automatic Direction Finder), which can help you track NDB stations. ARC stations are basically NDB navigation aids and have a max range of approximately 120 km.

Before Russian VOR (RSBN) beacons were installed as navigation aids by the Soviet Union, NDBs were routinely used to get a bearing towards a specific station (mostly placed near airports). However, from the 1960s NDBs have become increasingly limited in comparison to ILS (Instrument Landing System) approach installations. NDBs are now very gradually being phased out of service. In our tutorial, we will do an old school approach using two NDBs, referred to as an Outer Marker and an Inner Marker. A switch in the cockpit allows us to toggle between the Outer (FAR) marker and the Inner (NEAR) marker.

The Outer Marker, which normally identifies the final approach fix (FAF), is located on the same course/track as the runway center-line, four to seven nautical miles before the runway threshold. The Inner Marker is located at the beginning (threshold) of the runway on some ILS approach systems having decision heights of less than 200 ft (60 m) above ground level.

ARK (NDB) RANGE IN FUNCTION OF MINIMUM ALTITUDE						
Distance from station (km)	20	40	60	80	100	120
Minimum altitude (m)	350	700	1050	1400	1750	2100

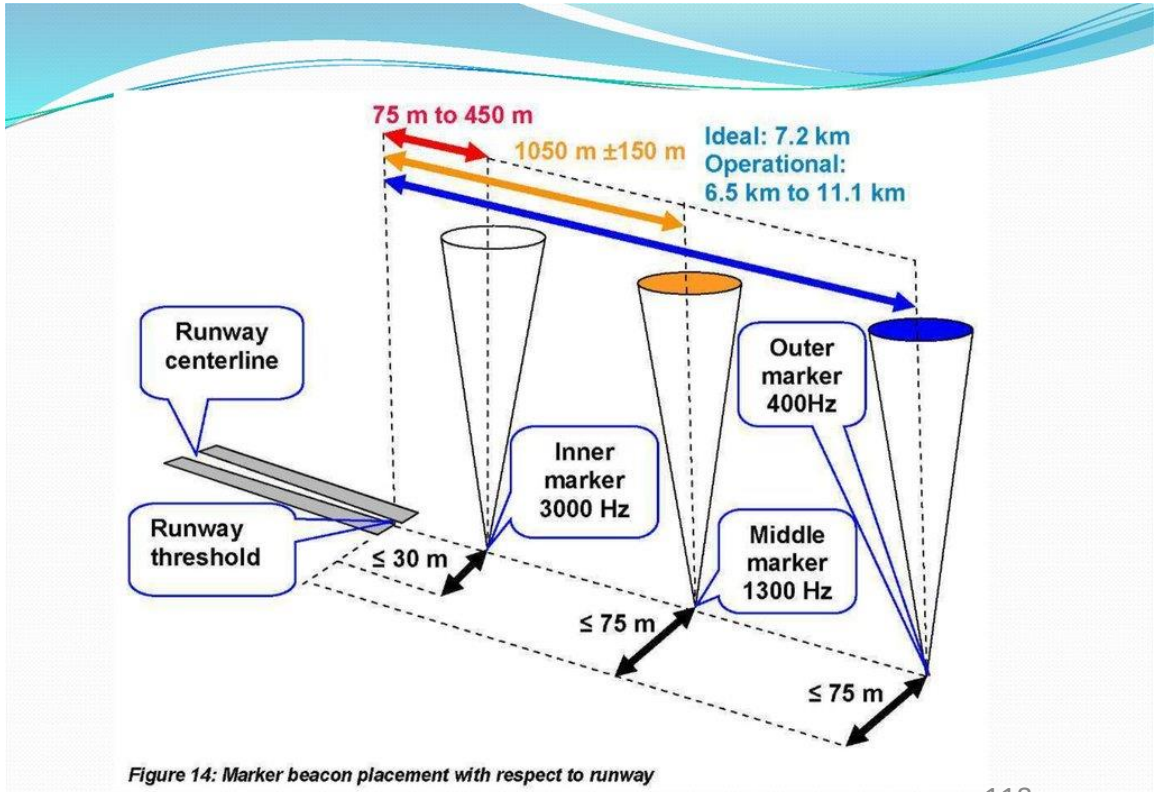
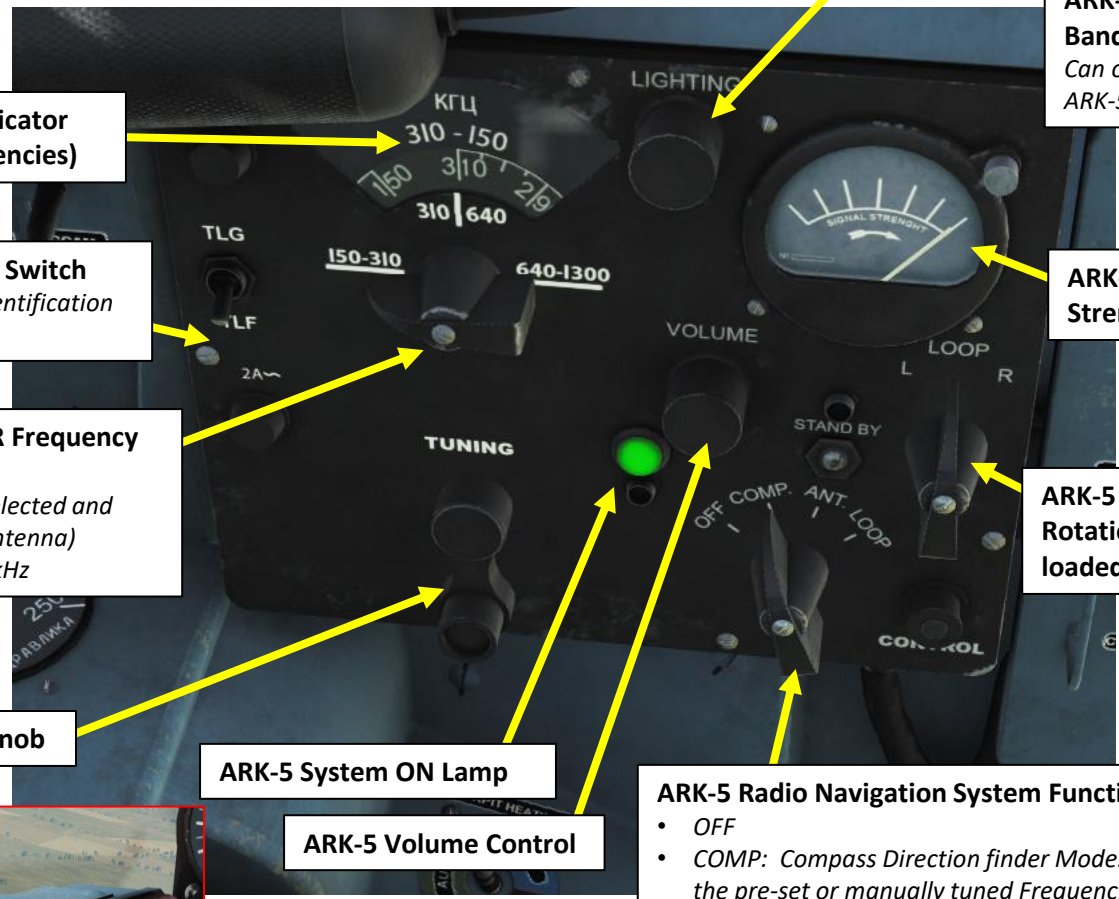


Figure 14: Marker beacon placement with respect to runway

ARK-5 COMPONENTS

The ARK-5 Radio-Navigation kit can track two frequencies: one for the Outer (FAR) Marker and one for the Inner (NEAR) Marker. These frequencies can also be preset in the Mission Editor or tuned manually.



ARK-5 Frequency Band Selected Indicator (used for both FAR and NEAR frequencies)

ARK-5 Receiver Identification Mode Switch
- *TLG (ТЛГ): Telegraph/Morse Code Identification*
- *TLF (ТЛФ): Telephony/Voice*

ARK-5 Radio Navigation System FAR Frequency Band Selector Switch
Can only be moved if FAR frequency is selected and ARK-5 Function Selector is set to ANT (Antenna)
150-310 kHz / 310-640 kHz / 640-1300 kHz

ARK-5 Frequency Fine Tuning Knob

ARK-5 System ON Lamp

ARK-5 Volume Control

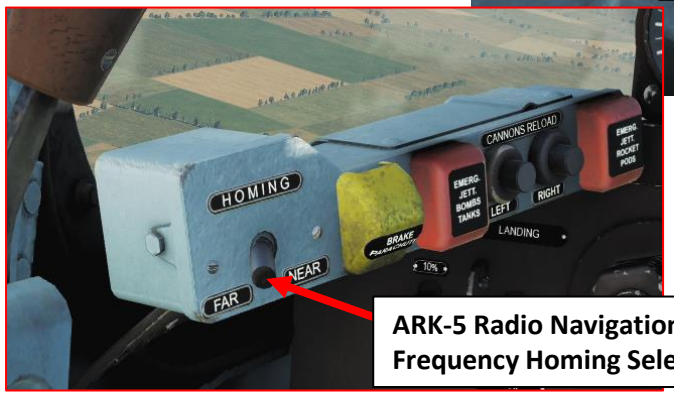
ARK-5 Frequency Scale Backlight Control

ARK-5 Radio Navigation System NEAR Frequency Band Selector Switch
Can only be moved if NEAR frequency is selected and ARK-5 Function Selector is set to ANT (Antenna)

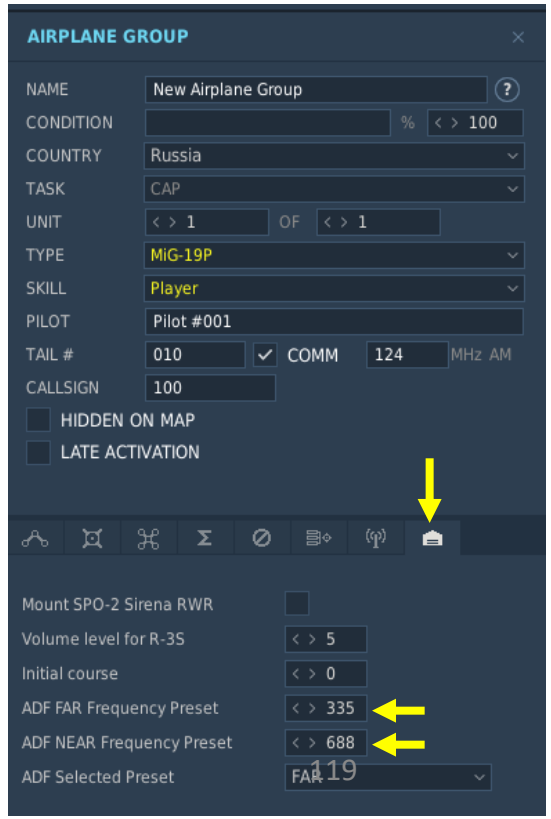
ARK-5 Received Signal Strength

ARK-5 Loop Antenna Rotation Switch (Spring-loaded to center position)

ARK-5 Radio Navigation System Function Selector Switch
- *OFF*
- *COMP: Compass Direction finder Mode. The ARK-5P will use the pre-set or manually tuned Frequencies to automatically indicate the NDB (Non-Directional Beacon) Bearing*
- *ANT: Antenna Mode enables the Audio of the NDB Morse Identifiers (using the Non-Directional Sense Antenna). In this Mode, the Morse Identifiers are heard more clearly than in COMP Mode.*
- *LOOP: Used to manually Rotate the Directional Loop Antenna Frame to the Null Signal Position.*

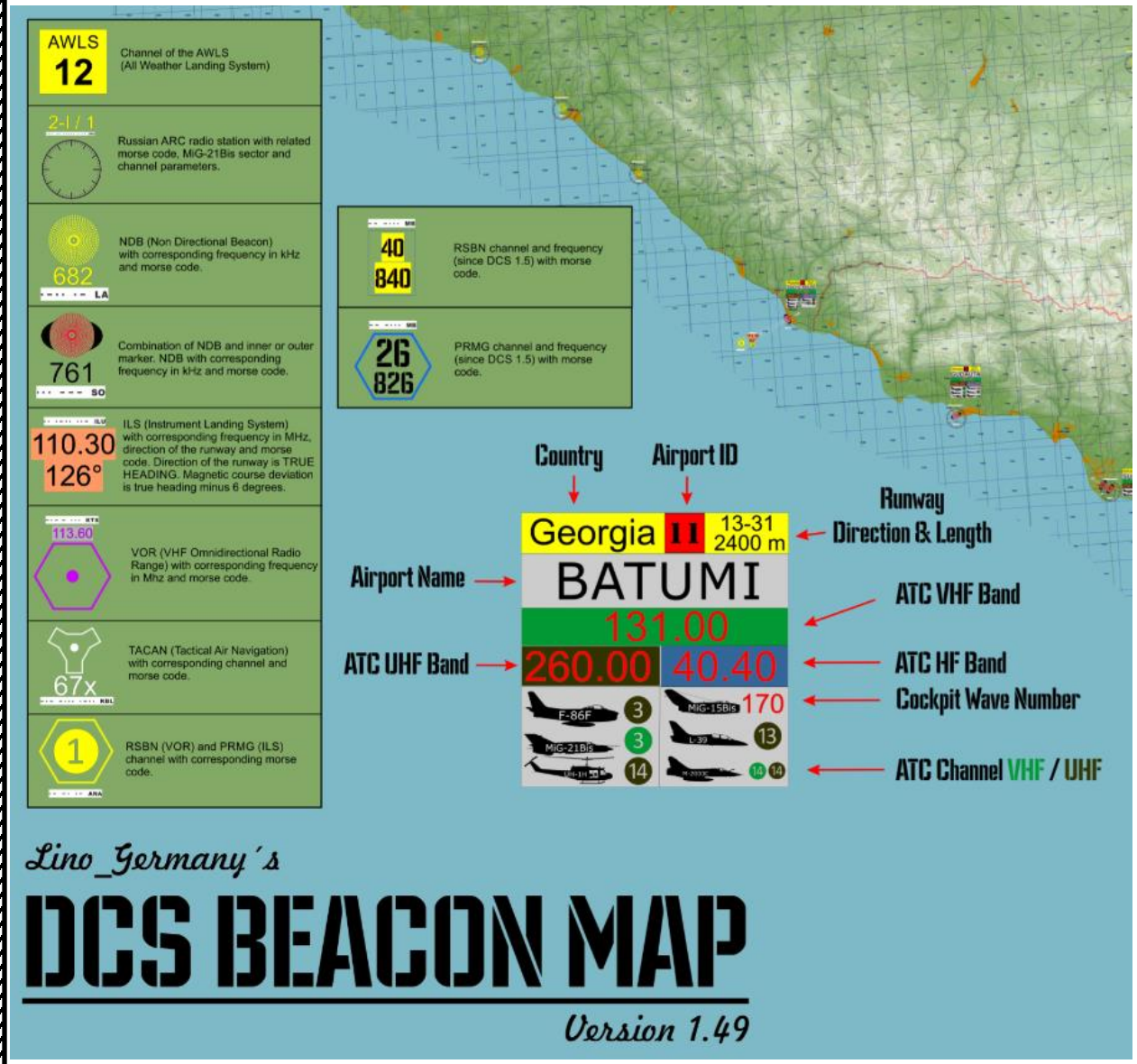


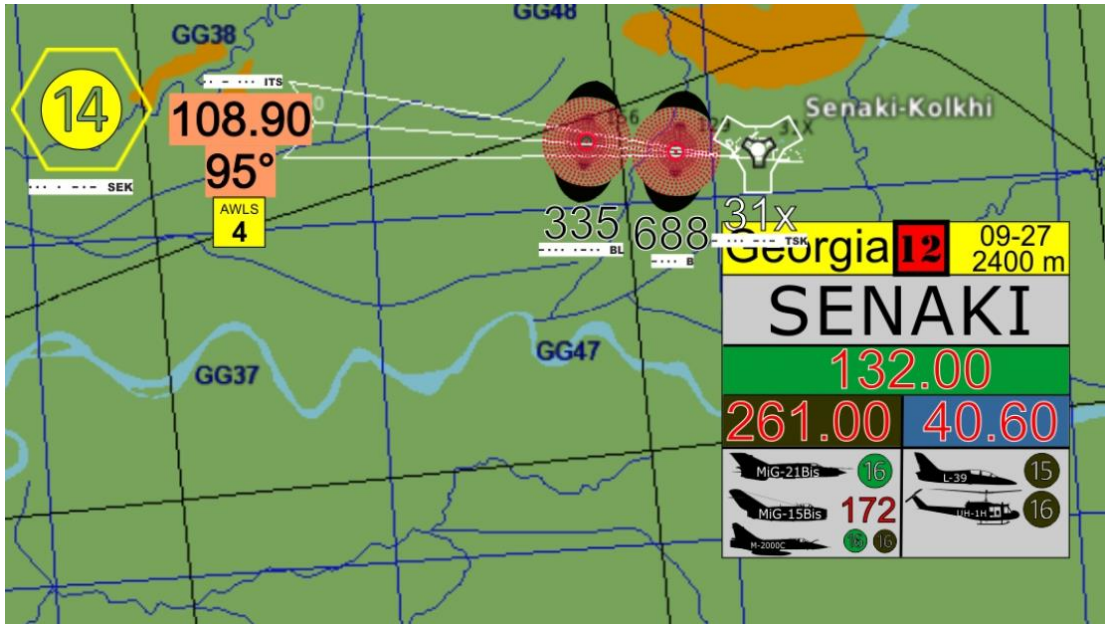
ARK-5 Radio Navigation System NEAR/FAR Frequency Homing Selector Switch

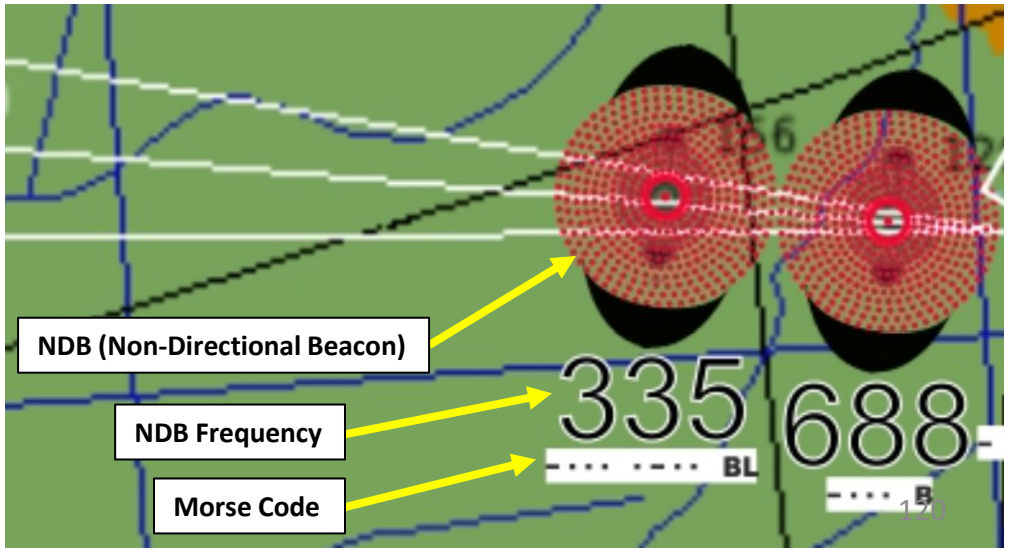


ARK-5 FREQUENCIES

Check out Lino_Germany's thread on Navigation Aids: https://drive.google.com/file/d/0B-uSpZROuEd3YWJBUmZTazBGajQ/view







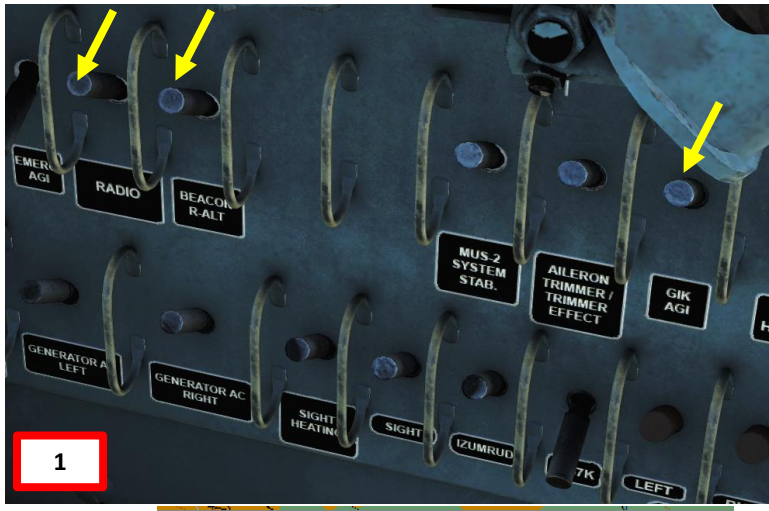
MIG-19P FARMER

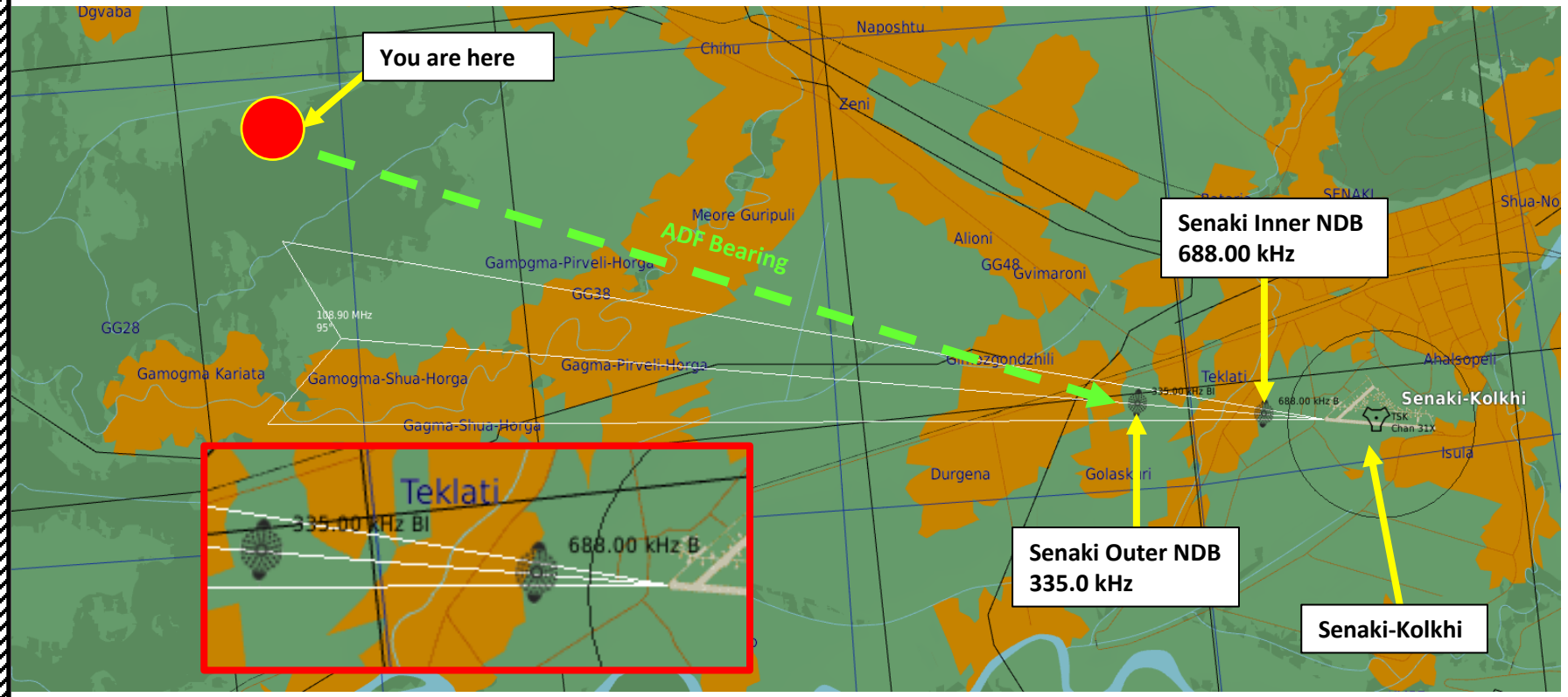
PART 13 – NAVIGATION

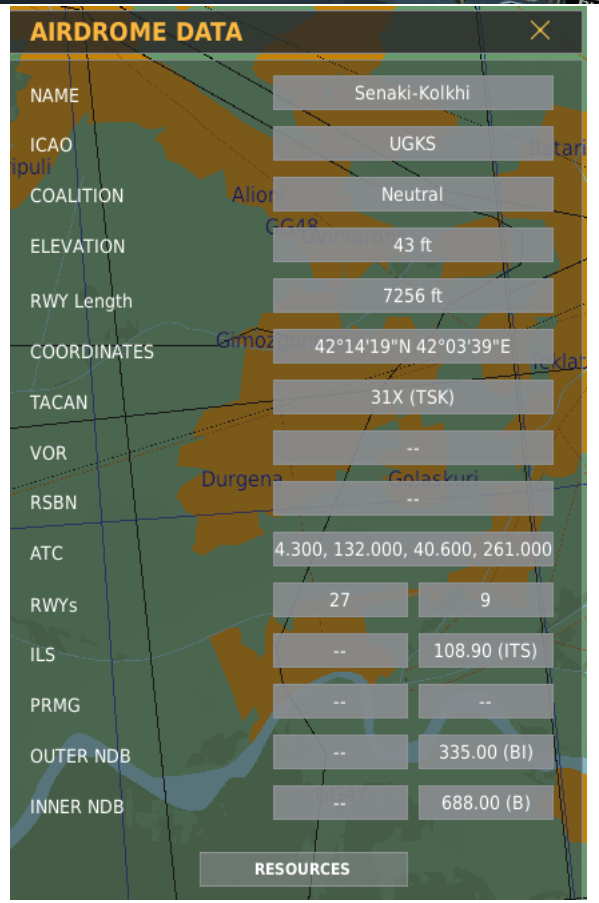
ARK-5 NDB NAVIGATION TUTORIAL

We will approach Senaki-Kolkhi and track its two NDB (Non-Directional Beacon) markers: the Outer/Far Marker (335.00 kHz) and the Inner/Near Marker (688.00 kHz). We will assume that we need to tune both the outer and inner marker frequencies.

1. Make sure the RADIO, BEACON R ALT and GIK AGI (Radio-Navigation Power) switches are ON (UP)
2. Set the Radio Audio Selector Switch to RADIO COMPASS to be able to hear the morse signal emitted by the NDBs.



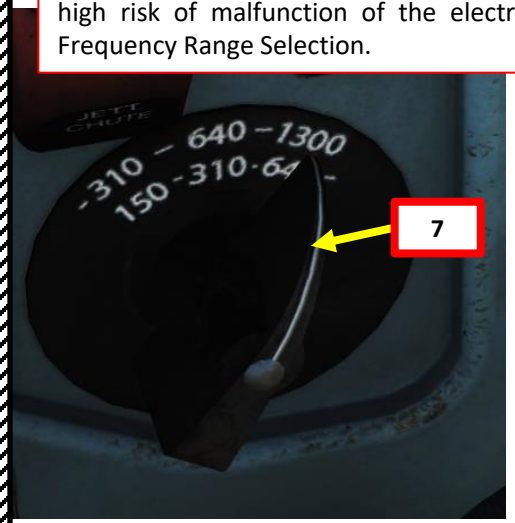


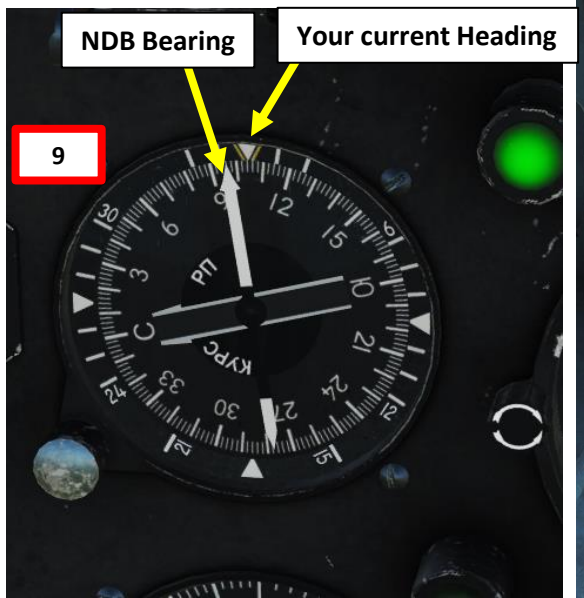


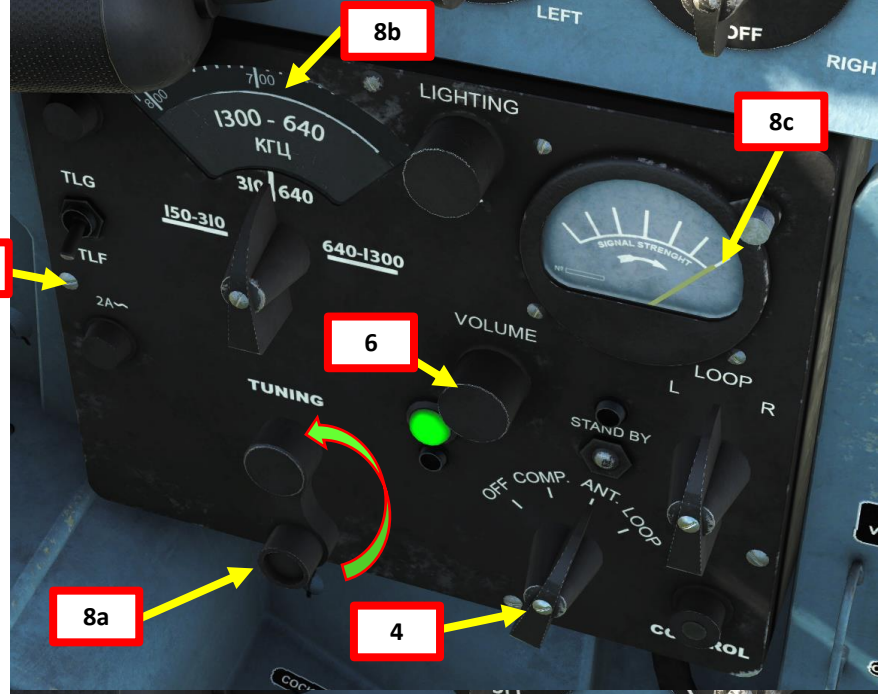
ARK-5 NDB NAVIGATION TUTORIAL (TUNING NEAR FREQUENCY)

3. To set the NEAR (Inner NDB) frequency, set the NEAR/FAR Homing switch to NEAR (FWD).
4. Set the ARK Function mode to ANT (Antenna)
5. Set the TLG-TLF (Telegraphy-Telephony) Receiver Mode to Telephony (TLF).
6. Adjust volume as required.
7. Set the NDB range according to the NDB frequency we are looking for (in our case, we want 688.00 kHz, which is in the 640-1300 kHz range). The ranges go from 150-310 kHz, 310-640 kHz and 640-1300 kHz. Be careful: for the NEAR frequencies, you need to select the Range Selector from the left side of the cockpit. The right side Range Selector is reserved for the FAR frequencies.
8. Fine tune the frequency and find the good frequency by listening to the audio tone and monitoring the signal strength gauge. You should keep tuning until you hear the correct morse code beeps. Take note that there are many NDBs with frequencies close to each other, so it can be difficult to find the correct one.
9. Once you found the correct frequency (good intensity + correct audio morse code), set the ARK Function mode to COMP (Compass). This will lock the frequency in place and display the bearing to the NDB on your GIK (Radio-Magnetic Indicator).
10. Confirm that the ARK-5 needle points in the correct direction.

Note: Trying to manually move the Frequency Fine Tuning Handle, when Automatic Compass Mode (COMP) is selected, is forbidden. This is due to high risk of malfunction of the electrical motor, which is controlling the Frequency Range Selection.



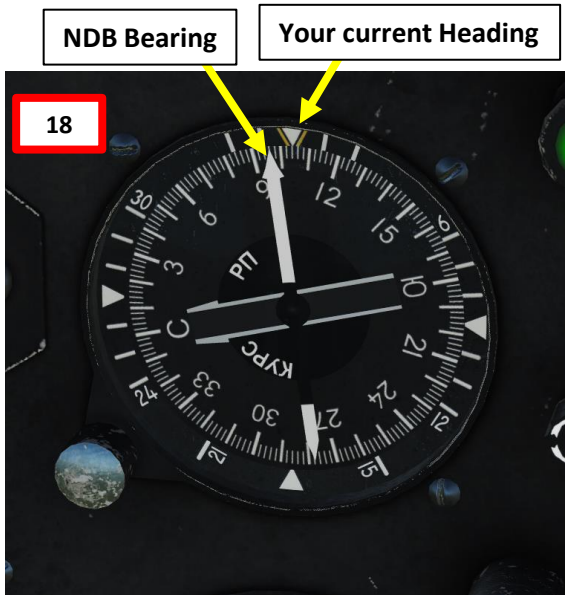


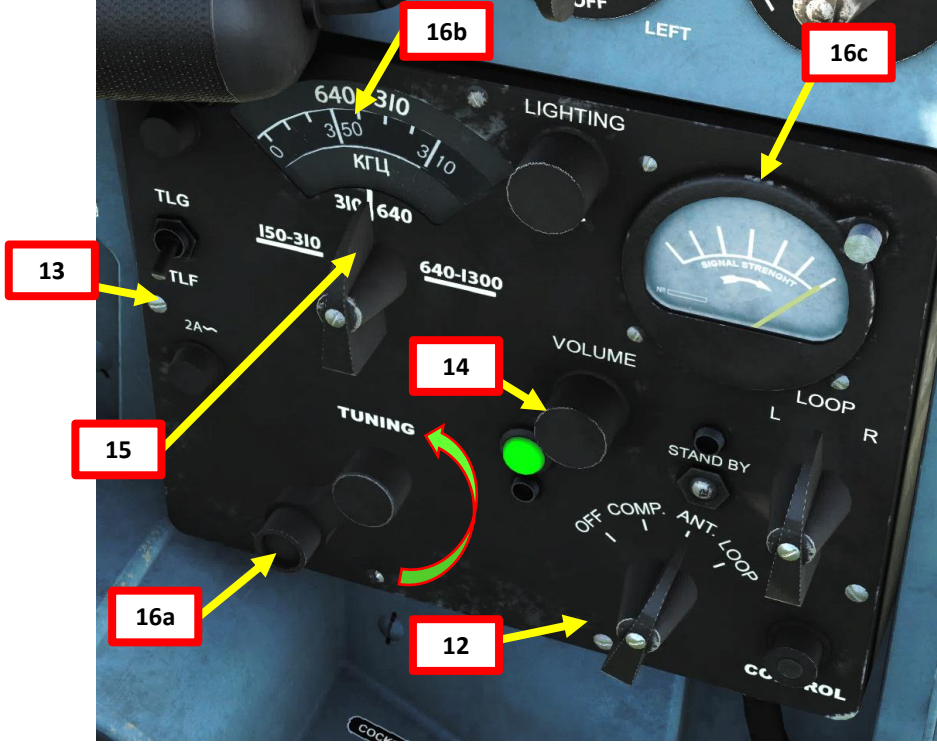


ARK-5 NDB NAVIGATION TUTORIAL (TUNING FAR FREQUENCY)

11. To set the FAR (Outer NDB) frequency, set the NEAR/FAR Homing switch to FAR (AFT).
12. Set the ARK Function mode to ANT (Antenna)
13. Confirm the TLG-TLF (Telegraphy-Telephony) Receiver Mode is set to Telephony (TLF).
14. Adjust volume as required.
15. Set the NDB range according to the NDB frequency we are looking for (in our case, we want 335.00 kHz, which is in the 310-640 kHz range). The ranges go from 150-310 kHz, 310-640 kHz and 640-1300 kHz. Be careful: for the FAR frequencies, you need to select the Range Selector from the right side of the cockpit. The left side Range Selector is reserved for the NEAR frequencies.
16. Fine tune the frequency and find the good frequency by listening to the audio tone and monitoring the signal strength gauge. You should keep tuning until you hear the correct morse code beeps. Take note that there are many NDBs with frequencies close to each other, so it can be difficult to find the correct one.
17. Once you found the correct frequency (good intensity + correct audio morse code), set the ARK Function mode to COMP (Compass). This will lock the frequency in place and display the bearing to the NDB on your GIK (Radio-Magnetic Indicator).
18. Confirm that the ARK-5 needle points in the correct direction.

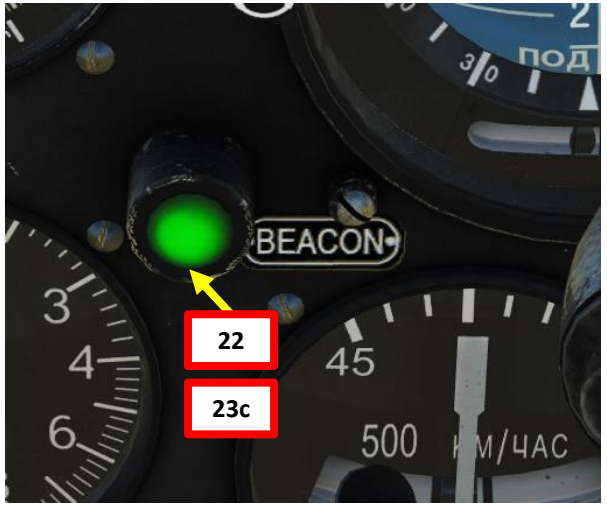
Note: Trying to manually move the Frequency Fine Tuning Handle, when Automatic Compass Mode (COMP) is selected, is forbidden. This is due to high risk of malfunction of the electrical motor, which is controlling the Frequency Range Selection.

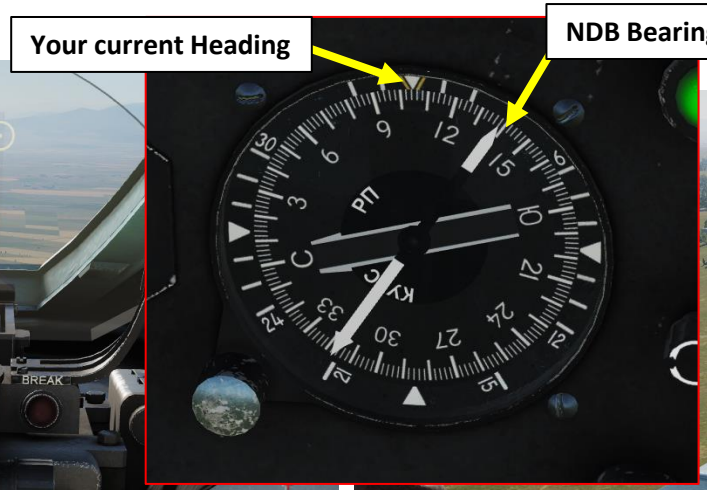


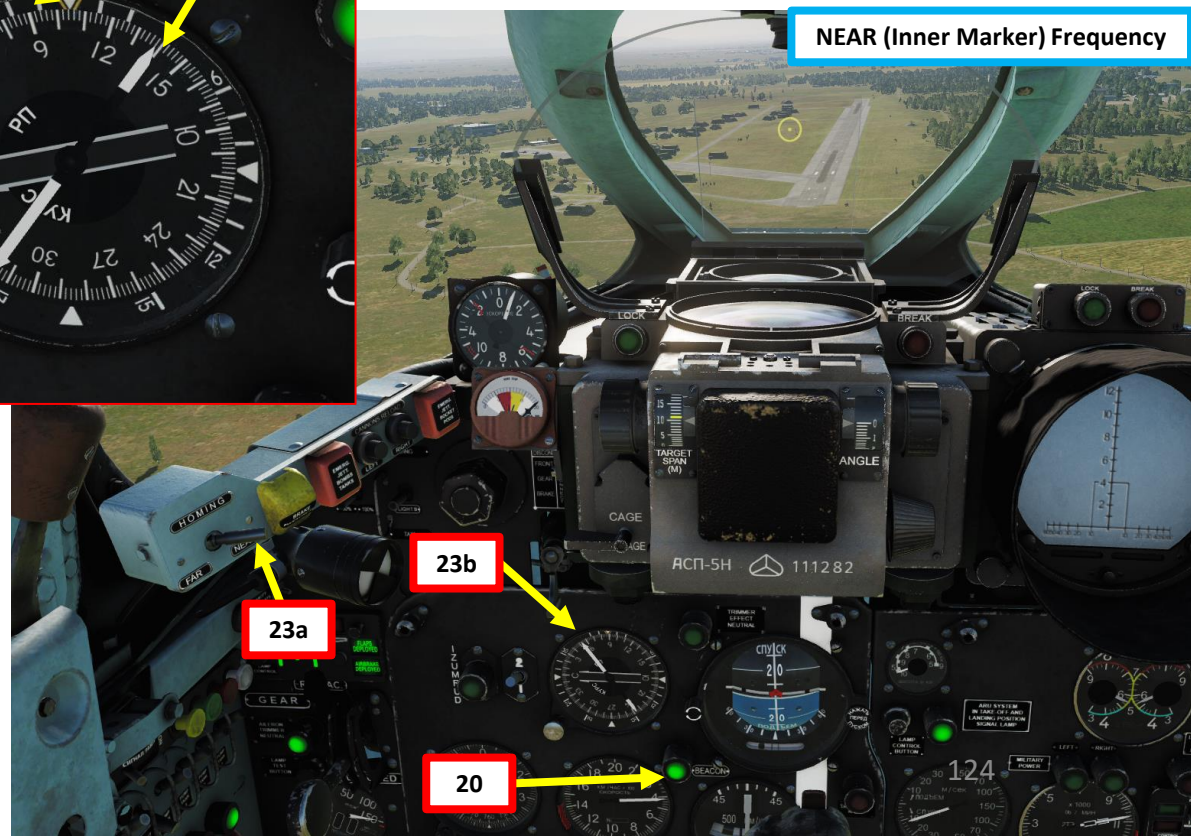


ARK-5 NDB NAVIGATION TUTORIAL (TRACKING OUTER & INNER MARKERS)

19. Now that we have our Far and Near frequencies dialed in, we can track the Outer and Inner markers properly.
20. Set the Homing Frequency selector to FAR to track the Outer Marker.
21. Follow the NDB Bearing needle on the GIK Radio-Magnetic Indicator.
22. Once you fly over the Outer Marker, the BEACON lamp will flash, a ringing sound will be audible and the NDB Bearing needle will do a 180 deg as the navigation aid goes behind you.
23. Set the Homing selector to NEAR to track the Inner Marker. Follow the NDB Bearing needle on the GIK Radio-Magnetic Indicator. Once you fly over the Inner Marker, the BEACON lamp will flash, a ringing sound will be audible and the NDB Bearing needle will do a 180 deg as the navigation aid goes behind you.







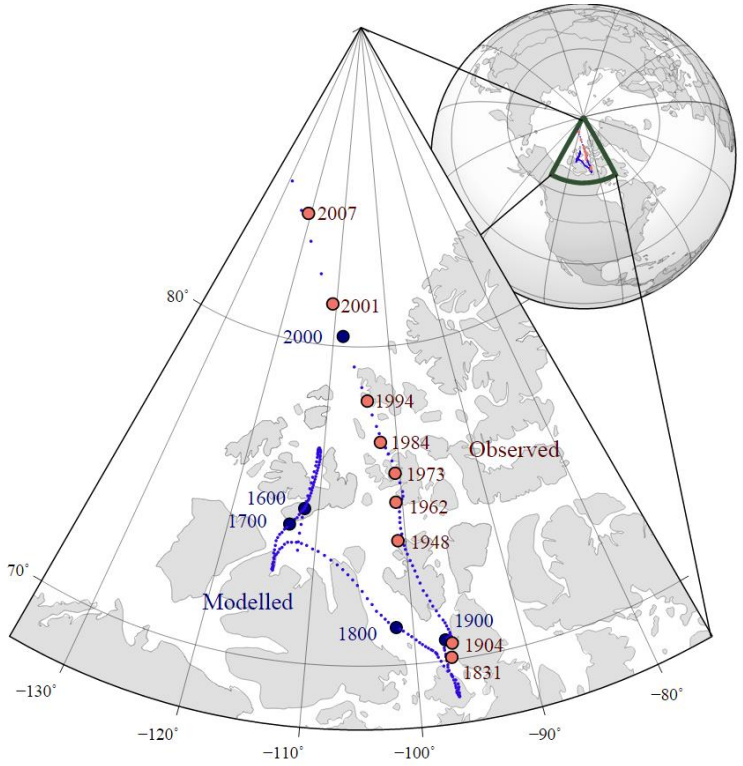
MAGNETIC VARIATION

The direction in which a compass needle points is known as magnetic north. In general, this is not exactly the direction of the North Magnetic Pole (or of any other consistent location). Instead, the compass aligns itself to the local geomagnetic field, which varies in a complex manner over the Earth's surface, as well as over time. The local angular difference between magnetic north and true north is called the magnetic variation. Most **map coordinate** systems are based on **true north**, and magnetic variation is often shown on map legends so that the direction of true north can be determined from north as indicated by a compass. This is the reason why in DCS the course to a runway needs to be "adjusted" to take into account this magnetic variation of the magnetic North pole (actually modelled in the sim, which is pretty neat).

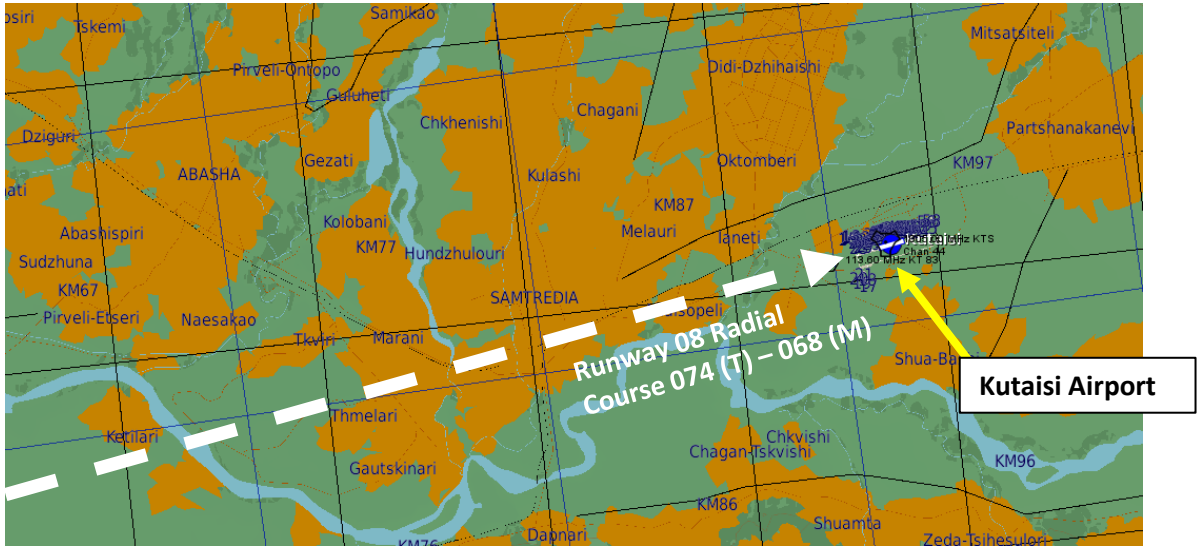
True Heading = Magnetic Heading + Magnetic Variation

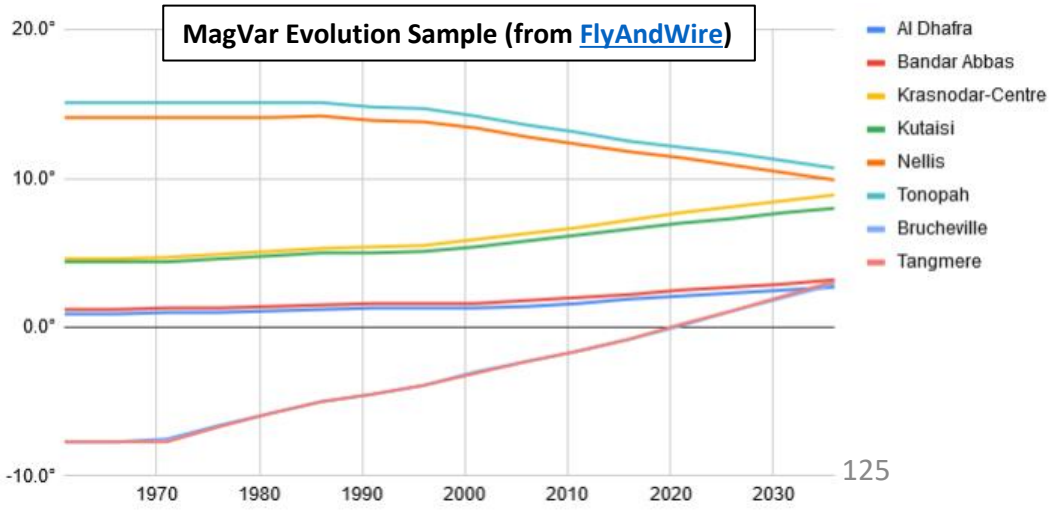
As an example, if the runway heading that you read on the F10 map in Kutaisi is 074 (True Heading), then the direction you should take with your magnetic compass course should be 074 subtracted with the Magnetic Variation (+6 degrees), or 068. In other words, you would need to use a course of 068 (M) with your compass.

Magnetic variation varies from place to place, but it also changes with time. This means this value will be highly dependent on the mission time and map.



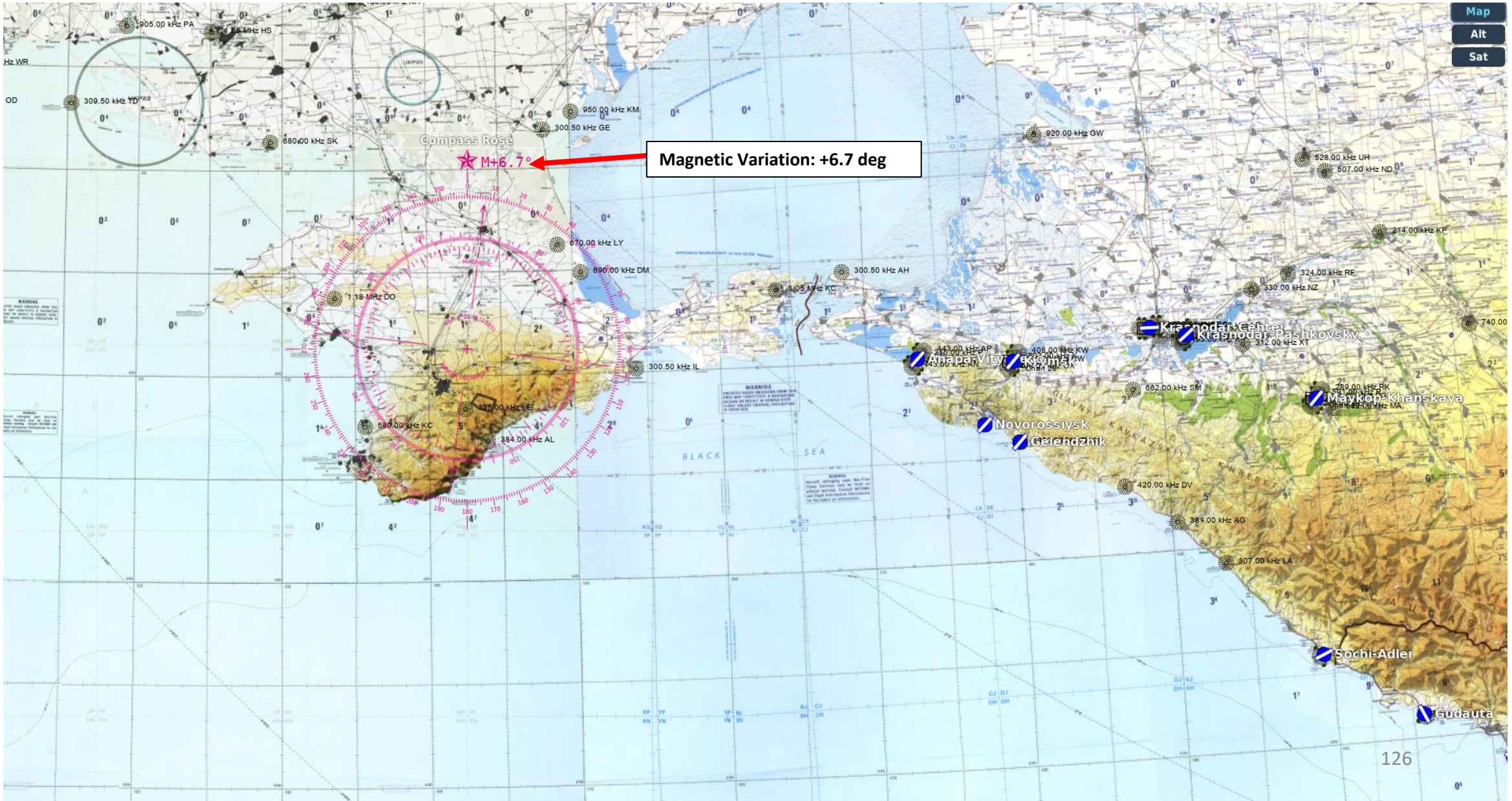
The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007.





MAGNETIC VARIATION

Checking the magnetic variation is now very easy: you can access it directly from the F10 map, shown with the Compass Rose.



Fighting in the MiG-19 is both an exciting and a foolish endeavour.

The Good:

The MiG-19's cannons really pack a punch. A single well-placed burst can neutralize pretty much anything in the air. The MiG-19 also has powerful engines, which provide great acceleration and climb capabilities. The MiG is also one of the best aircraft suited for "turn-and-burn" engagements. Fighting in the vertical plane against the F-5 and using high yo-yo manoeuvres are great tactics to use against it.

The Bad:

Most modern jets (F/A-18 or F-14) will out-range you both in terms of armament and in terms of sensor capabilities. The MiG-19's radar has a relatively short range and the antenna elevation cannot be tuned manually, which severely limits your situational awareness. While the MiG-19 outperforms 1950's aircraft like the F-86 Sabre and the MiG-15, Vietnam-era aircraft like the F-5E Tiger II and the MiG-21bis are fierce competitors with better radars and RWR (Radar Warning Receiver) systems. Keep in mind that the MiG-19's Sirena rear-aspect system only detects radar signatures coming from behind and the only warning you have is a faint red light placed in the cramped left side of the cockpit .

Now what?

The MiG-19 is meant to find its enemies visually while being guided via GCI (Ground-Controlled Interception) or AWACS (Airborne Warning & Control System) aircraft. I suggest that you use the radar as a last resort only since locking on a target will very likely alert its RWR (Radar Warning Receiver) since it has limited use against maneuvering targets that already know you are there. In order to increase your survivability in the MiG, I suggest you use surprise to your advantage by coming by behind with lights off and radar off. The MiG's performance is also an advantage since it retains the manoeuverability of swept-wing fighters with the raw speed and power of interceptors. However, keep in mind that this performance is a double-edged sword since the Tumansky RD-9 is a very thirsty engine, especially in Military or Afterburner power settings. Fuel management is a critical part of flying this plane, so I suggest that you keep an eye on the fuel gauge and indicator lamps every 30 seconds or so. The K-13 IR-seeking missiles are also best used against non-maneuvering targets like bombers. Fire them ONLY when you are not pulling anything ore than 2 Gs... otherwise they will simply not be able to track anything. One last point: aerodynamically speaking, the MiG is very hard to slow down, even with airbrakes deployed. The MiG does not like to be slow: try to stay fast at all times. It is better to overshoot and maintain your energy than to waste precious speed trying to get that million dollar deflection shot.

GCI: GROUND-CONTROLLED INTERCEPTION

- The USSR used interception tactics based on the GCI (Ground-Controlled Interception) model: flights of interceptors would be scrambled and directed to targets by ground controllers, like the British were during the Battle of Britain with the Dowding System. By turning on their radars in the vicinity of targets only, interceptors could minimize their detectability (since your radar radiation "warns" the enemy RWR when it is scanning) and use surprise to their advantage. This strategy proved to be rather effective during the Vietnam war.

- If you are having a hard time finding targets, do like the real MiG pilots did: use AWACS (or radar stations you can communicate with) to give you bearings towards targets. Request BOGEY DOPE.

- The AWACS will often give you a BRA (Bearing, Range, Altitude) callout relative to your position if it is at a range of 50 nautical miles or less.

- Example: "117, 1, BRA, 265 for 130, at 11000, flanking.".
  - In this case, 117 is your 3-digit designation number. BRA means "Bearing Range Altitude". The alternative to BRA is BULLSEYE.
  - 265 for 130 means the target is at a heading of 265 in relationship to you at 130 km.
  - At 11,000 means an altitude of 11 km (11000 m).
  - "Flanking" refers to the target's aspect (where is it going in relationship to you?). A "flanking" bandit is showing his side to you, a "hot" bandit is heading straight to you and a "cold" bandit is flying away from you.

- If the target's range is more than 50 nm, the AWACS will give you a bullseye callout. This callout is not much different from a BRA callout: the locations are simply given in relationship to a reference point in space other than yourself. This is what people call a "bullseye" in pilot lingo.

- Here is a quick n' dirty tutorial about BULLSEYE by JEDILINKS from the 104th Phoenix Virtual Fighter Bomber Squadron: https://www.youtube.com/watch?v=vgcXcfeGb2M

RESOURCES

RAZBAM MiG-19P Flight Manual
https://drive.google.com/open?id=1SF-UsjbKvMYnyxgV8js9W_1UWQz4SiEE

RAZBAM's DCS MiG-19 Tutorial Playlist (Youtube)
https://www.youtube.com/playlist?list=PLwKSNTU2afuDA9nMOHLZrL5fCRIuSrTiY

Spudknocker's DCS MiG-19 Tutorial Playlist (Youtube)
https://www.youtube.com/playlist?list=PLZ8X4p18pdbmh20hfzcrGGGM6XUDMisBG

Grim Reapers' DCS MiG-19 Tutorial Playlist (Youtube)
https://www.youtube.com/playlist?list=PL3kOAM2N1YJdw7lkESvpecMrubZyfWGoW

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
- Cpt. Puffington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MISSION
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LOGBOOK
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MISSION EDITOR
CAMPAIGN BUILDER
EXIT
AV8BNA
Dev 2.5.x
Bf 109 K-4
C-101
Beta
CA
Caucasus
2.5.0
Christen Eagle II
F-5E
F-86F
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