DCS GUIDE

MiG-15BIS

BY CHUCK

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

The **Mikoyan-Gurevich MiG-15** (Russian: Микоя́н и Гуре́вич МиГ-15) is a jet fighter aircraft developed by Mikoyan-Gurevich for the Soviet Union. The USAF/DoD designated the MiG-15 as the ”Type 14”, while NATO use the reporting name ”Fagot”.

The MiG-15bis was once the Soviet Union's vanguard jet fighter and one of the most mass-produced jets in history. The MiG-15 gained fame in the skies over Korea where it battled the American F-86 Sabre and other allied aircraft during the Korean War (1950-1953). The MiG-15's appearance in Korea became known as the "Korean surprise" due to its unexpected combat effectiveness. From late December 1950 up to the end of war in July 1953, the MiG-15 proved to be the primary aerial opponent of the equally distinguished F-86 Sabre.

The MiG-15 is a swept-wing jet fighter developed by the Mikoyan-Gurevich experimental design bureau (OKB) in the late 1940s, entering service with the Soviet Air and Air Defense Forces in 1949. The aircraft has an extensive combat history that includes several conflicts apart from the Korean War, such as the Arab-Israeli wars. Thanks to its high reliability, remarkable performance and ease of use (both in flight training and operation), the MiG-15 remained in service with the USSR for nearly 20 years and in foreign service until 2006 with the Albanian Air Force. There were numerous modifications; apart from its main purpose as a fighter, it was used as a reconnaissance aircraft, target aircraft and prototype for a variety of weapons and systems tests.

The first turbojet fighter developed by Mikoyan-Gurevich OKB was the Mikoyan-Gurevich MiG-9, which appeared in the years immediately after World War II. It used a pair of reverse-engineered German BMW 003 engines. The MiG-9 was a troublesome design that suffered from weak, unreliable engines and control problems. Categorized as a first-generation jet fighter, it was designed with the straight-style wings common to piston-engined fighters. The Soviet Union's first swept-wing jet fighter had been the underpowered Lavochkin La-160, which was otherwise more similar to the MiG-9. The Lavochkin La-168, which reached production as the Lavochkin La-15, used the same engine as the MiG but used a shoulder-mounted wing and t-tail; it was the main competitive design. Eventually, the MiG design was favoured for mass production.

The I-310 S01 was the first prototype of the MiG-15. It was powered by a Rolls-Royce Nene turbojet engine, one of 55 purchased from Rolls-Royce in 1947, then reverse-engineered by Vladimir Yakovlevich Klimov as the Klimov RD-45. The first production example flew on 31 December 1948. It entered Soviet Air Force service in 1949.


I-310 Prototype

An improved variant, the MiG-15bis ("second"), entered service in early 1950 with a Klimov VK-1 engine, another version of the Nene with improved metallurgy over the RD-45, plus minor improvements and upgrades. Visible differences were a headlight in the air intake separator and horizontal upper edge airbrakes. The 23 mm cannon were placed more closely together in their undercarriage. Some "bis" aircraft also adopted under-wing hardpoints for unguided rocket launchers or 50–250 kg (110–550 lb) bombs. Fighter-bomber modifications were dubbed "IB", "SD-21", and "SD-5". About 150 aircraft were upgraded to SD-21 specification during 1953–1954.

The USSR built 1344 MiG-15, 8352 MiG-15bis and 3434 two-seaters. It was also built under license in Czechoslovakia as the S-102 (MiG-15, 821 aircraft), S-103 (MiG-15bis, 620 aircraft) and CS-102 (MiG-15UTI, 2012 aircraft) and Poland as the Lim-1 (MiG-15, 227 aircraft) and Lim-2 (MiG-15bis, 500 aircraft). No two-seaters have been built in Poland as such – the SB Lim-1 and SB Lim-2 variants were remanufactured from hundreds of Polish-, Czech- and Soviet-built single-seaters. In the early 1950s, the Soviet Union delivered hundreds of MiG-15s to China, where they received the designation J-2. The Soviets also sent almost a thousand MiG-15 engineers and specialists to China, where they assisted China's Shenyang Aircraft Factory in building the MiG-15UTI trainer (designated JJ-2). China never produced a single-seat fighter version, only the two-seat JJ-2. The number of JJ-2s built remains unknown and the estimates vary between 120 and 500 aircraft.

The MiG-15 arguably had sufficient power to dive at supersonic speeds, but the lack of an "all-flying" tail greatly diminished the pilot's ability to control the aircraft as it approached Mach 1. As a result, pilots understood they must not exceed Mach 0.92, where the flight surfaces became ineffective. Additionally, the MiG-15 tended to spin after it stalled, and often the pilot could not recover. Later MiGs incorporated all-flying tails.

The MiG-15 was originally intended to intercept American bombers like the B-29. It was even evaluated in mock air-to-air combat trials with a captured U.S. B-29, as well as the later Soviet B-29 copy, the Tupolev Tu-4. To ensure the destruction of such large bombers, the MiG-15 carried autocannons: two 23 mm with 80 rounds per gun and a single 37 mm with 40 rounds. These weapons provided tremendous punch in the interceptor role, but their limited rate of fire and relatively low velocity made it more difficult to score hits against small and manoeuvrable enemy jet fighters in air-to-air combat. The 23 mm and 37 mm also had radically different ballistics, and some United Nations pilots in Korea had the unnerving experience of 23 mm shells passing over them while the 37 mm shells flew under. The cannon were fitted into a simple pack that could be winched out of the bottom of the nose for servicing and reloading, allowing pre-prepared packs to be rapidly swapped out.

For many years, the Soviet Union actively denied that its pilots flew in Korea during the Korean War; only China and North Korea took responsibility for Korean War operations. After the end of the Cold War, Soviet pilots who participated in the conflict began to reveal their roles. Books by Chinese, Russian and ex-Soviet authors, such as Zhang Xiaoming, Leonid Krylov, Yuriy Tepsurkaev and Igor Seydov revealed details of the actual pilots and operations. From the beginning, Soviet pilots were ordered to avoid flying over areas in which they might be captured. Soviet aircraft were adorned with North Korean or Chinese markings and pilots wore either North Korean uniforms or civilian clothes to disguise their nationality. For radio communication, they were given cards with common Korean words for various flying terms spelled out phonetically in Cyrillic letters.

These subterfuges did not long survive the stresses of air-to-air combat, however. Pilots often inadvertently reverted to their native language. UN forces widely suspected the participation of Soviet aircrews, and intercepted radio traffic appeared to include combat pilots speaking Russian. In addition, USAF pilots claimed to have recognized techniques and tactics used by Soviet pilots, whom they referred to as "honchos" (from Japanese/Chinese terms meaning "squad leader").

During 1950, the Kremlin agreed to supply China and North Korea with MiG-15s, as well as train their pilots. The 50th Fighter Aviation Division (50 IAD), equipped with the MiG-15, was already based near Shanghai, as it had taken part in the Chinese Civil War (see previous section). A detachment from the 50 IAD was moved to Antung, next to the border with North Korea in August 1950. They formed the 29th Guards Fighter Regiment (29 GvIAP).

When China entered the war in support of North Korea, the Soviets agreed to provide 16 operational air regiments of MiG-15s, including combat pilots. In the meantime, more MiG-15 pilots were recruited; the squadrons earmarked for Korea were drawn from elite units. The pilots had to be younger than 27, and priority was given to World War II veterans. The first large Soviet aviation unit sent to Korea, the 324th IAD, was an air defense interceptor division commanded by Colonel Ivan Kozhedub, who, with 62 victories, was the top Allied (and Soviet) ace of World War II. In November 1950, the 151st and 28th IADs plus the veteran 50th IAD were reorganized into the 64th Fighter Aviation Corps (64 IAK).

Initially, the Soviet fighters operated close to their bases, limited by the range of their aircraft, and were guided to the air battlefield by good ground control, which directed them to the most advantageous positions. For political, security and logistical reasons, they were not allowed to cross an imaginary line drawn from Wonsan to Pyongyang, and never to fly over the sea. The MiG-15s always operated in pairs, with an attacking leader covered by a wingman. The northwestern portion of North Korea where the Yalu River empties into the Yellow Sea was dubbed "MiG Alley" and became the site of numerous dogfights.

MiG-15 pilots also proved very effective in the specific role for which the type was originally designed: intercepting formations of B-29s. At the tactical level, large formations of MiGs would wait on the Chinese side of the border. When UN aircraft entered MiG Alley, the MiGs would swoop down from high altitude to attack. If they ran into trouble, they would try to escape back over the border into China. Soviet MiG-15 squadrons operated in big groups, but the basic formation was a six-aircraft group, divided into three pairs, each composed of a leader and a wingman.

After the MiG-15 entered the war, it was shown to be clearly superior to the best straight-wing jets operated by other countries, including the Gloster Meteor, Lockheed F-80, Republic F-84 and Grumman F9F. In most measures of performance, the North American F-86 Sabre (which was also a swept-wing design) was the only close contemporary that could match the MiG-15.

The Soviet VVS and PVO were the primary users of the MiG-15 during the war, but not the only ones; it was also used by the PLAAF and KPAF (known as the United Air Army). Despite bitter complaints from the Soviet Union, which repeatedly requested the Chinese to accelerate the introduction of MiG-15 new units, the Chinese were relatively slow in this process at the time, and by 1951 there were only two regiments flying MiG-15bis as night fighters. Being not completely trained and equipped, both units were used only for the defence of China, but they became involved in the interception of USAF reconnaissance aircraft, some of which went very deep over China.

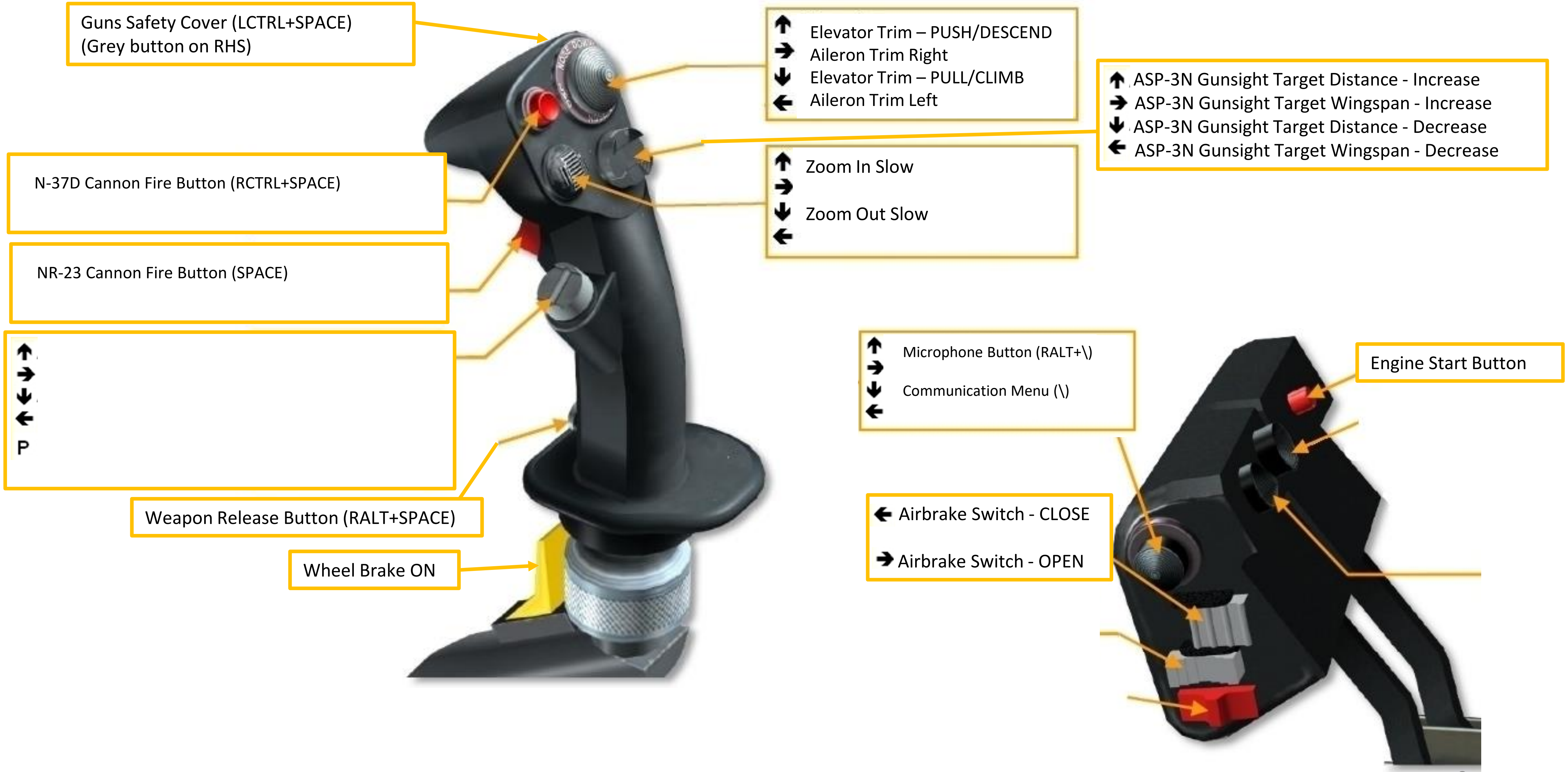
Major Nikolai Sutyagin
22 Victories

Colonel Yevgeny Pepelyaev
19 Victories

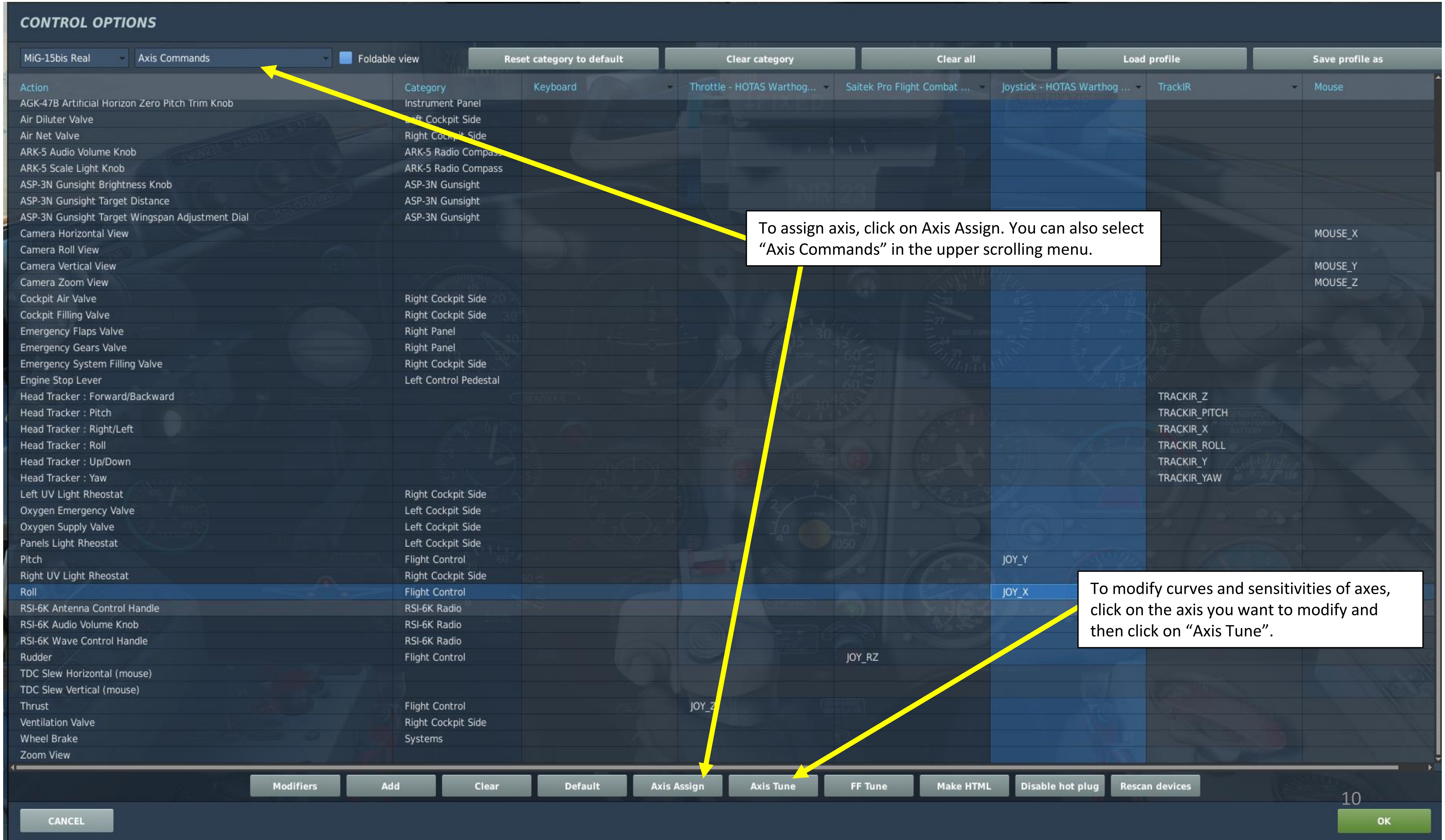
Overall, I think the DCS MiG-15 is a real gem. Dogfighting at speeds over 700 km/h against Sabres is a unique experience that gives you a WWII-style air combat at breakneck speeds. It is a product of a time when fighter jet combat was still in its infancy, and aircraft design was still evolving at an unprecedented pace. The 1950s have a special place in my heart when it comes to aircraft design due to the sheer variety of outlandish designs. Most aircraft of the time looked aggressive, dangerous and experimental in nature.

I hope you will enjoy reading this guide as much as I had fun writing it. So, put on those aviator sunglasses, crank the time machine and let's learn the MiG-15 together!

WHAT YOU NEED MAPPED

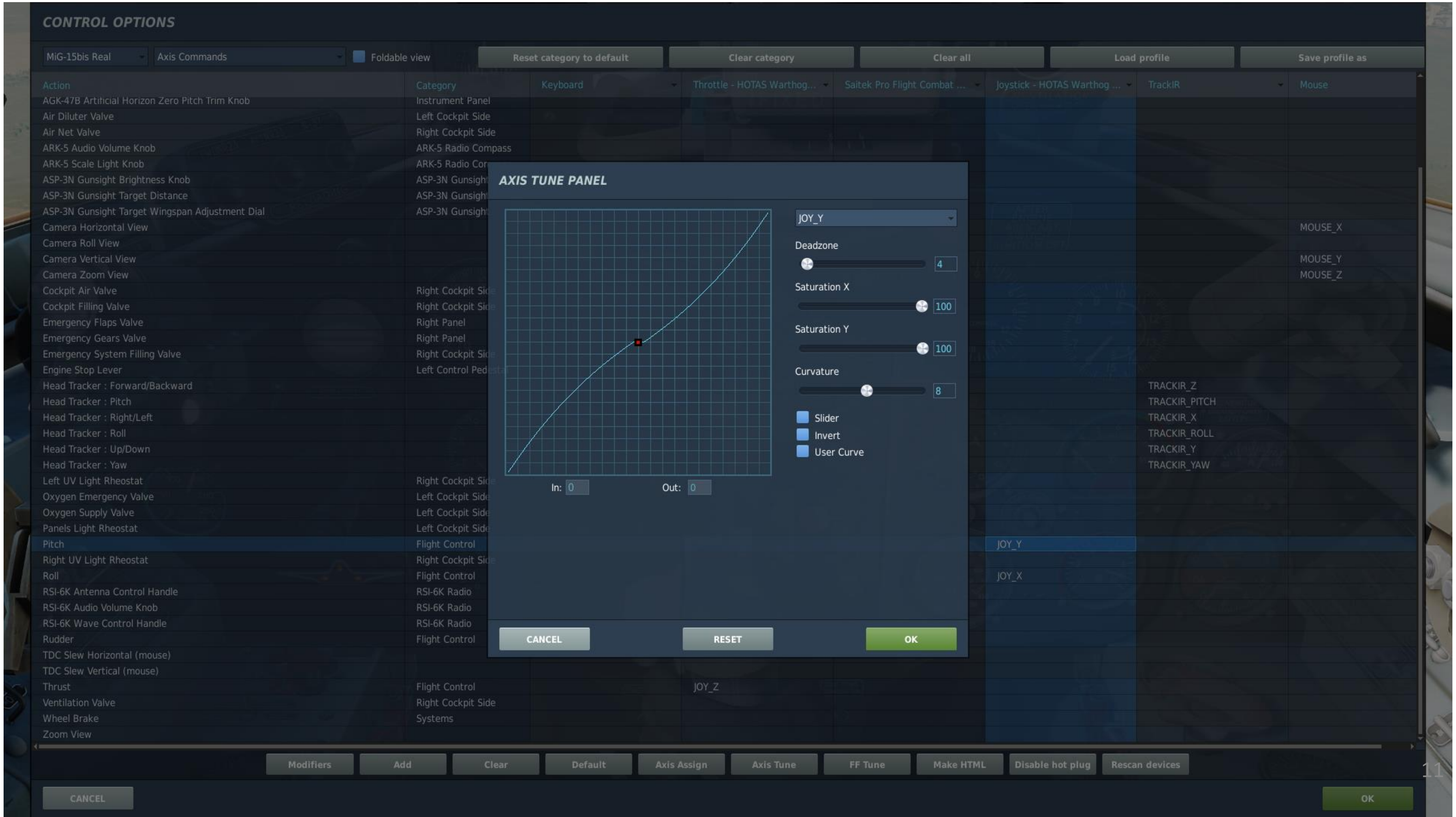


Note: In your controls, make sure you check your "Trim" controls since the default version of the game has your trim hat set to changing your view rather than trim the aircraft. Since most of you are probably equipped with a TRACKIR already, I suggest you make sure the Trim Hat Switch is set up properly.

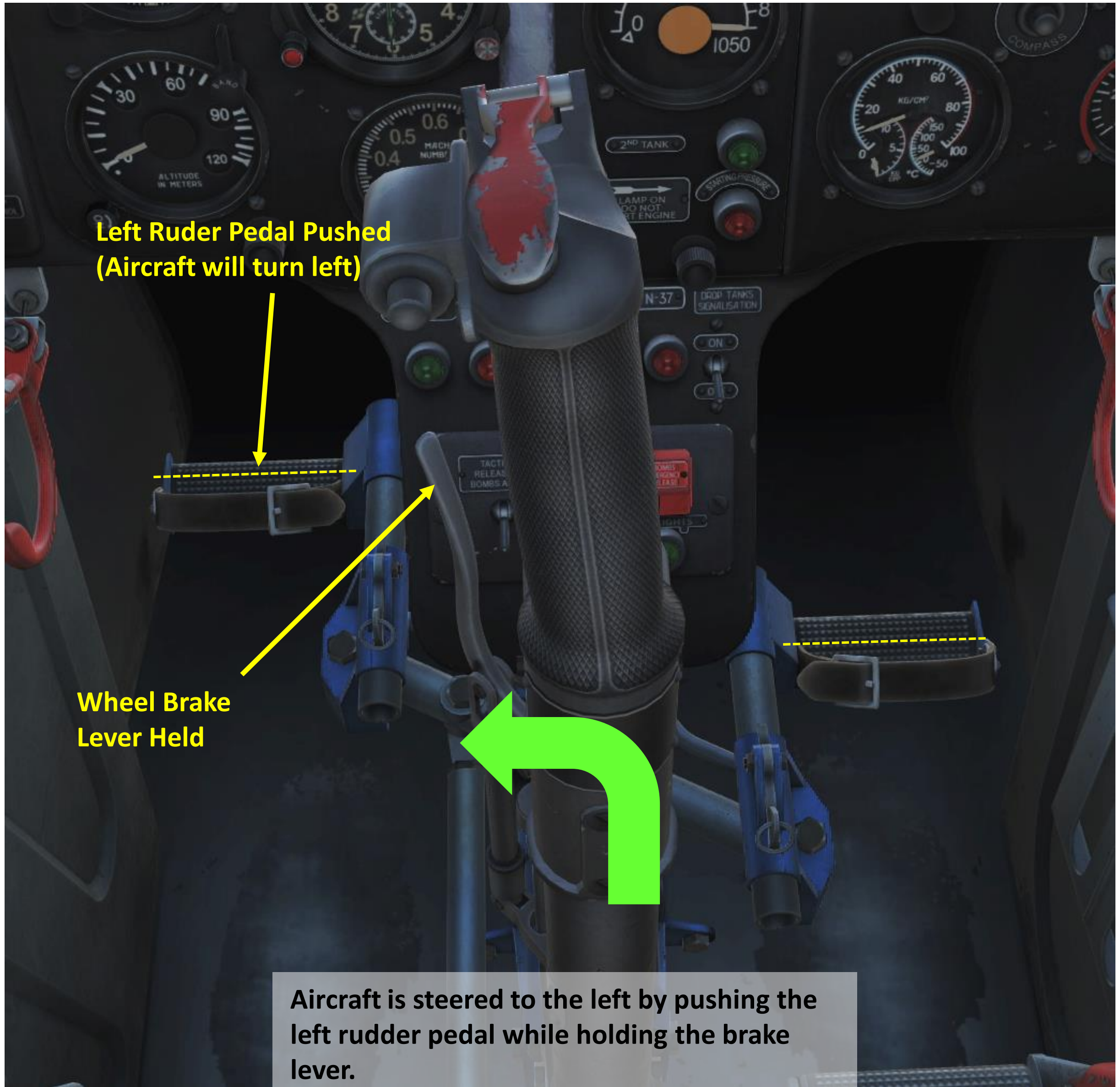


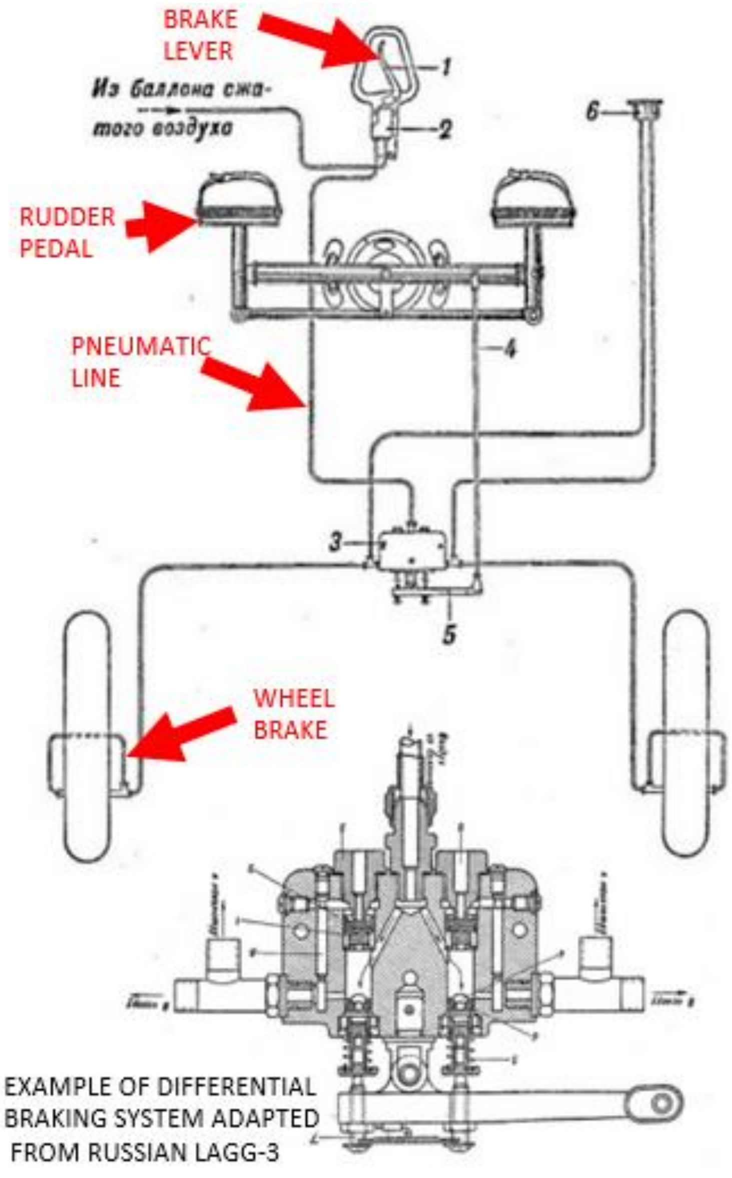
Bind the following axes:

- PITCH (DEADZONE AT 5, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 20)
- ROLL (DEADZONE AT 5, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 20)
- RUDDER (DEADZONE AT 0, SATURATION X AT 100, SATURATION Y AT 100, CURVATURE AT 0)
- THROTTLE – CONTROLS ENGINE RPM



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.



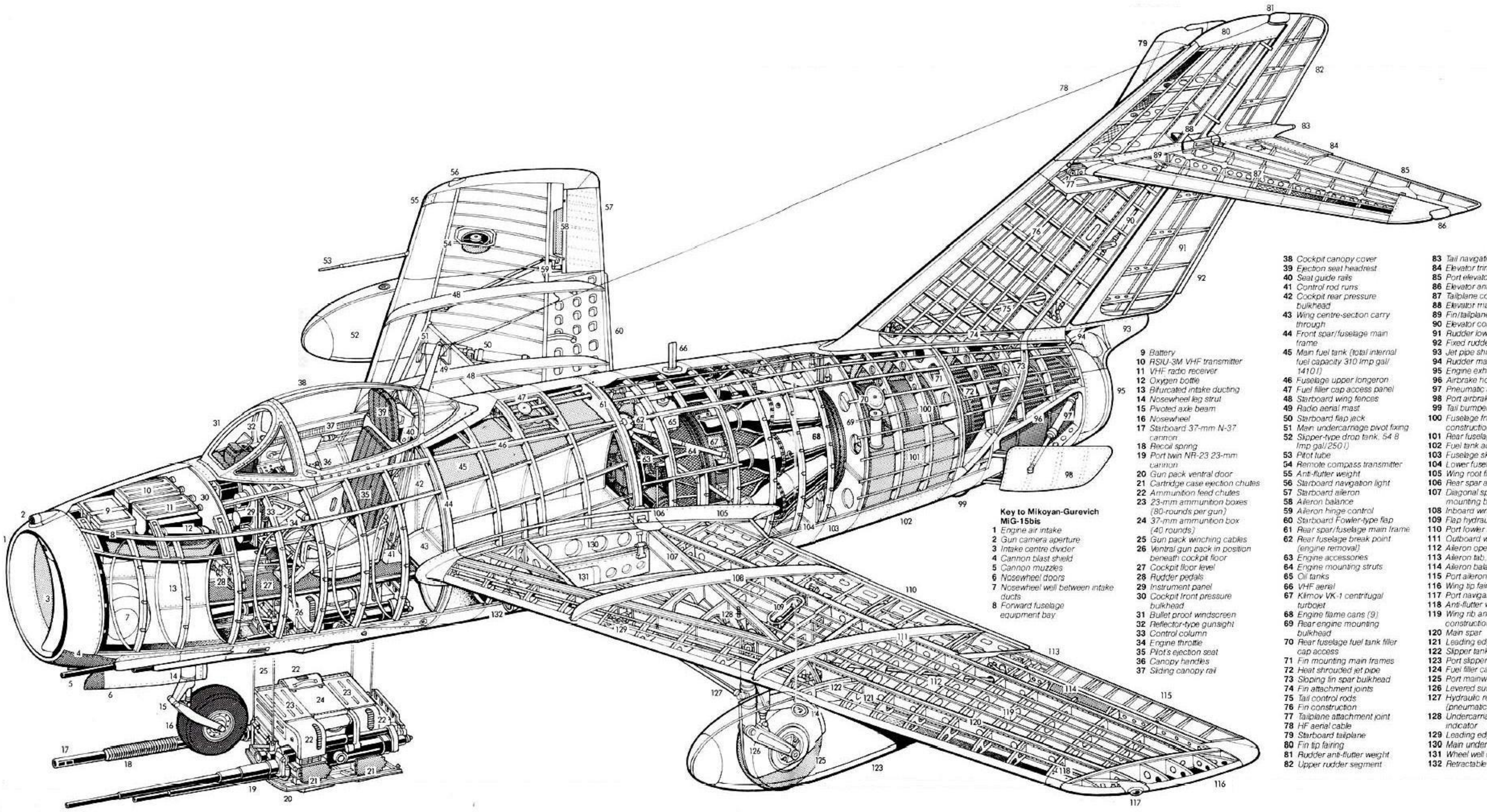


EXAMPLE OF DIFFERENTIAL BRAKING SYSTEM ADAPTED FROM RUSSIAN LAGG-3


GYRO
FIXED
NR-23
EMERG FLAPS

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

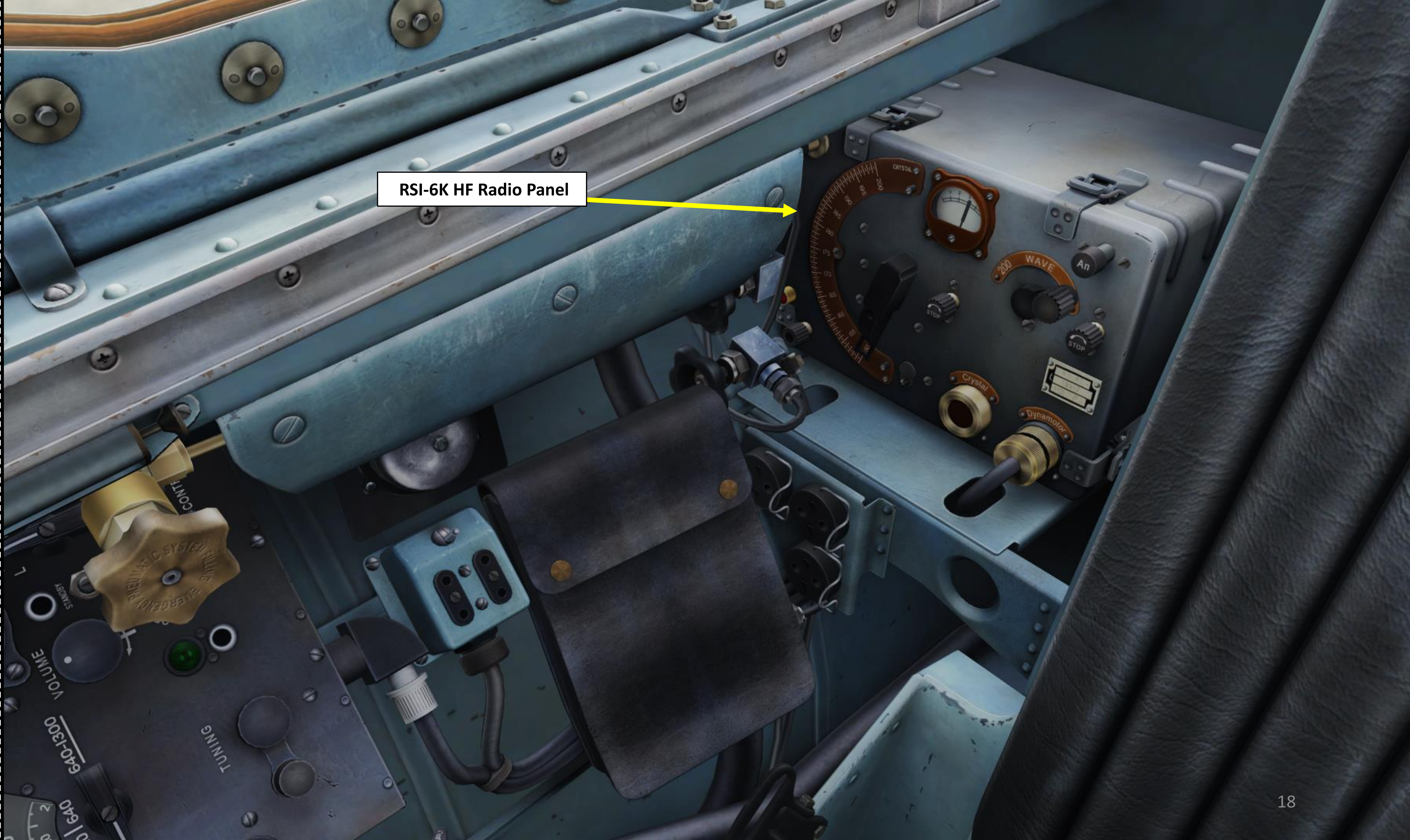
MIG-15 bis

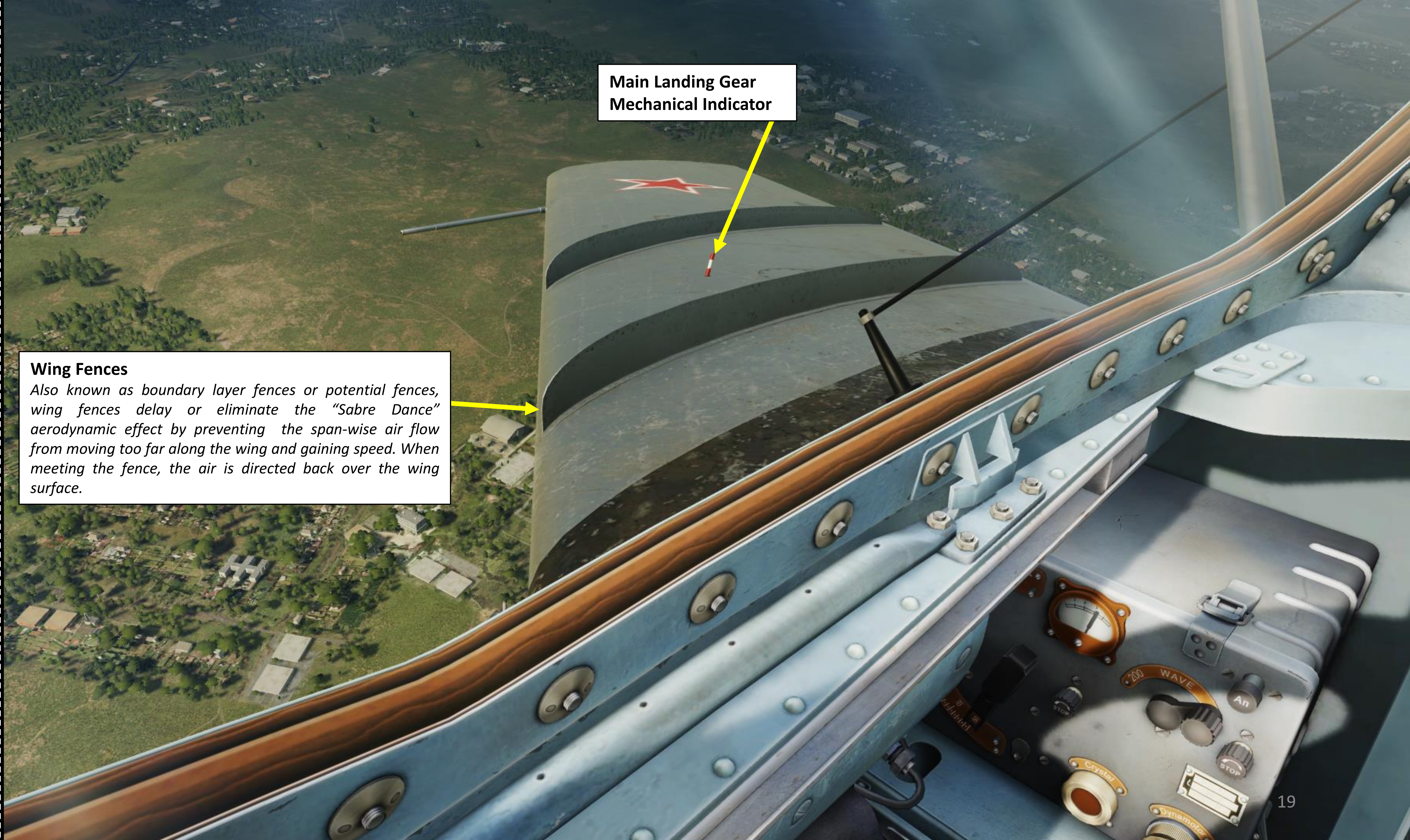


Key to Mikoyan-Gurevich MiG-15bis

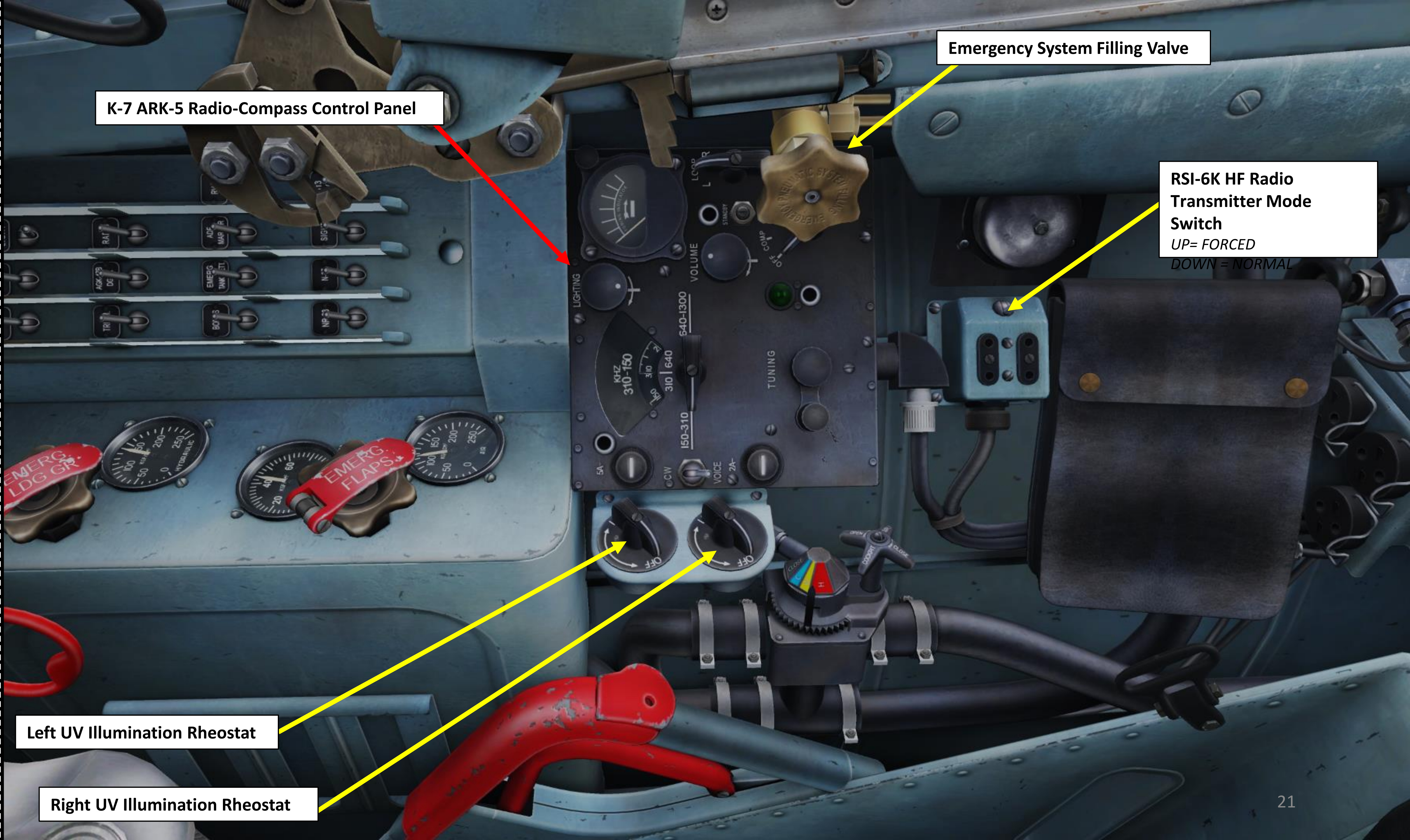
1 Engine air intake
2 Gun camera aperture
3 Intake centre divider
4 Cannon blast shield
5 Cannon muzzles
6 Nosewheel doors
7 Nosewheel well between intake ducts
8 Forward fuselage equipment bay
9 Battery
10 RSIU-3M VHF transmitter
11 VHF radio receiver
12 Oxygen bottle
13 Bifurcated intake ducting
14 Nosewheel leg strut
15 Pivoted axle beam
16 Nosewheel
17 Starboard 37-mm N-37 cannon
18 Recoil spring
19 Port twin NR-23 23-mm cannon
20 Gun pack ventral door
21 Cartridge case ejection chutes
22 Ammunition feed chutes
23 23-mm ammunition boxes (80-rounds per gun)
24 37-mm ammunition box (40 rounds)
25 Gun pack winching cables
26 Ventral gun pack in position beneath cockpit floor
27 Cockpit floor level
28 Rudder pedals
29 Instrument panel
30 Cockpit front pressure bulkhead
31 Bullet proof windscreen
32 Reflector-type gunsight
33 Control column
34 Engine throttle
35 Pilot's ejection seat
36 Canopy handles
37 Sliding canopy rail
38 Cockpit canopy cover
39 Ejection seat headrest
40 Seat guide rails
41 Control rod runs
42 Cockpit rear pressure bulkhead
43 Wing centre-section carry through
44 Front spar/fuselage main frame
45 Main fuel tank (total internal fuel capacity 310 Imp gal/ 1410 l)
46 Fuselage upper longeron
47 Fuel filler cap access panel
48 Starboard wing fences
49 Radio aerial mast
50 Starboard flap jack
51 Main undercarriage pivot fixing
52 Slipper-type drop tank, 54 8 Imp gal/250 l)
53 Pitot tube
54 Remote compass transmitter
55 Anti-flutter weight
56 Starboard navigation light
57 Starboard aileron
58 Aileron balance
59 Aileron hinge control
60 Starboard Fowler-type flap
61 Rear spar/fuselage main frame
62 Rear fuselage break point (engine removal)
63 Engine accessories
64 Engine mounting struts
65 Oil tanks
66 VHF aerial
67 Klimov VK-1 centrifugal turbojet
68 Engine flame cans (9)
69 Rear engine mounting bulkhead
70 Rear fuselage fuel tank filler cap access
71 Fin mounting main frames
72 Heat shrouded jet pipe
73 Sloping fin spar bulkhead
74 Fin attachment joints
75 Tail control rods
76 Fin construction
77 Tailplane attachment joint
78 HF aerial cable
79 Starboard tailplane
80 Fin tip fairing
81 Rudder anti-flutter weight
82 Upper rudder segment
83 Tail navigation light
84 Elevator trim tab (port only)
85 Port elevator
86 Elevator anti-flutter weight
87 Tailplane construction
88 Elevator mass balance
89 Fin/tailplane spar joint
90 Elevator control rod
91 Rudder lower segment
92 Fixed rudder tab
93 Jet pipe shroud
94 Rudder mass balance
95 Engine exhaust nozzle
96 Airbrake housing
97 Pneumatic airbrake jack
98 Port airbrake, open
99 Tail bumper
100 Fuselage frame and stringer construction
101 Rear fuselage fuel tank
102 Fuel tank access panel
103 Fuselage skin plating
104 Lower fuselage longeron
105 Wing root fillet
106 Rear spar attachment joint
107 Diagonal spar/undercarriage mounting beam
108 Inboard wing fence
109 Flap hydraulic jack
110 Port fowler flap
111 Outboard wing fence
112 Aileron operating rod
113 Aileron tab, port only
114 Aileron balance
115 Port aileron construction
116 Wing tip fairing
117 Port navigation light
118 Anti-flutter weight
119 Wing rib and stringer construction
120 Main spar
121 Leading edge nose ribs
122 Slipper tank fixing
123 Port slipper-type drop tank
124 Fuel filler cap
125 Port mainwheel
126 Levered suspension axle beam
127 Hydraulic retraction jack (pneumatic standby)
128 Undercarriage position indicator
129 Leading edge, control rod runs
130 Main undercarriage wheel well
131 Wheel well door
132 Retractable landing lamp

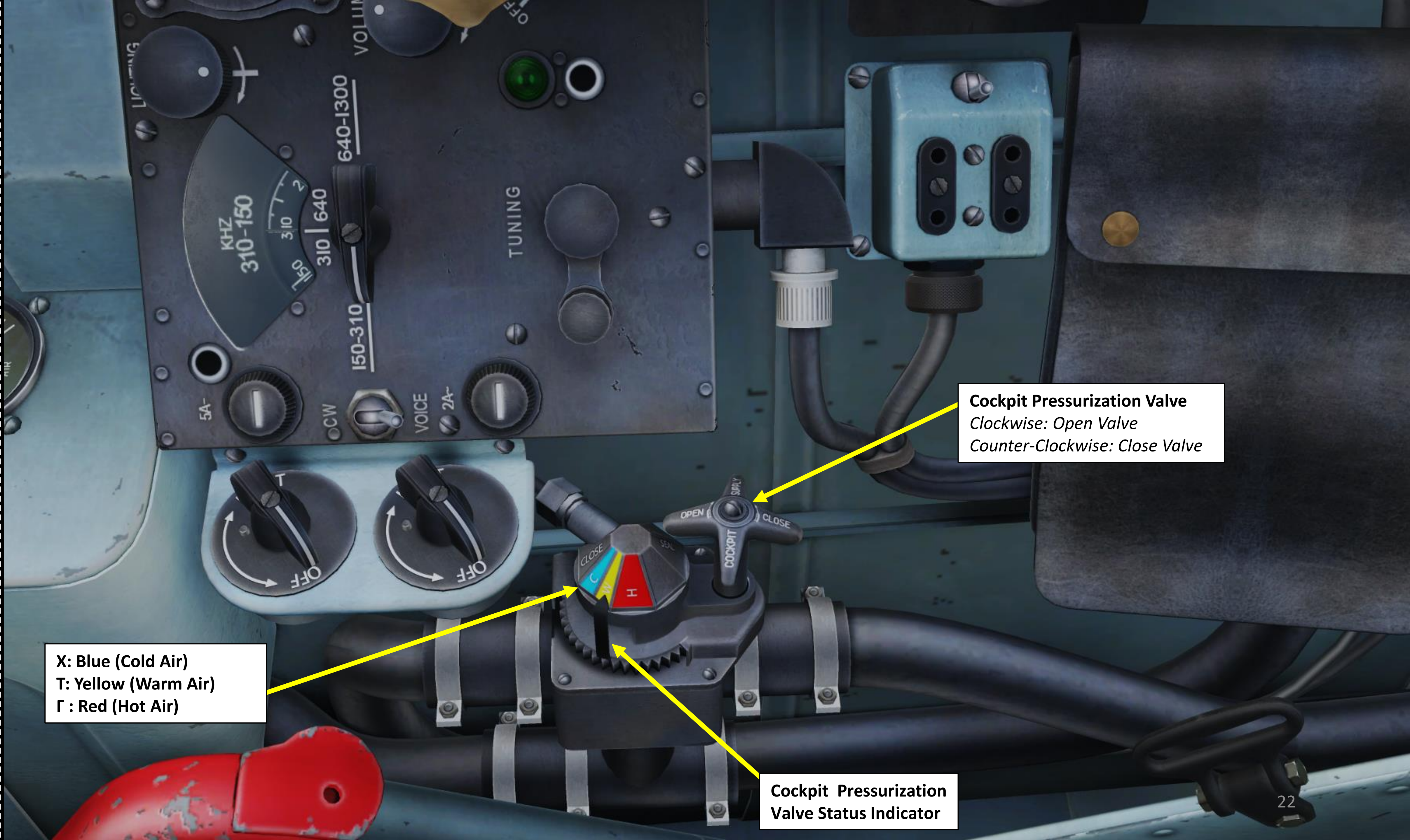

WAVE


RSI-6K HF Radio Panel
CRYSTAL
WAVE
200
An
STOP
STOP
Crystal
Dynamotor
CONTR
STANDBY
VOLUME
640-1300
TUNING
640

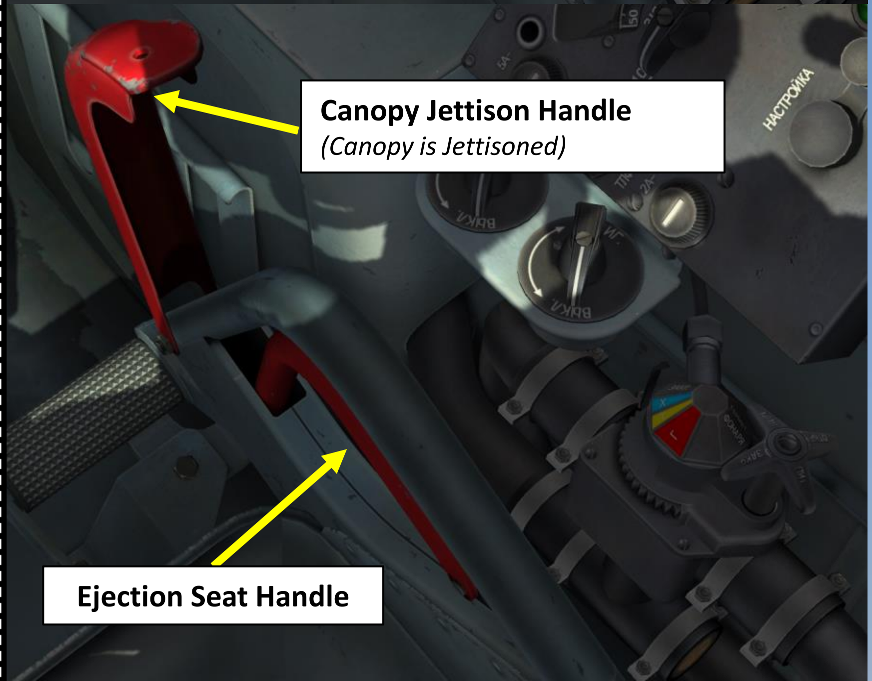

Main Landing Gear Mechanical Indicator
Wing Fences
Also known as boundary layer fences or potential fences, wing fences delay or eliminate the “Sabre Dance” aerodynamic effect by preventing the span-wise air flow from moving too far along the wing and gaining speed. When meeting the fence, the air is directed back over the wing surface.
WAVE
200
An
STOP
Crystal
Dynamotor


EMERG. LDG GR.
EMERG. FLAPS.
VOLUME
TUNING
WAVE

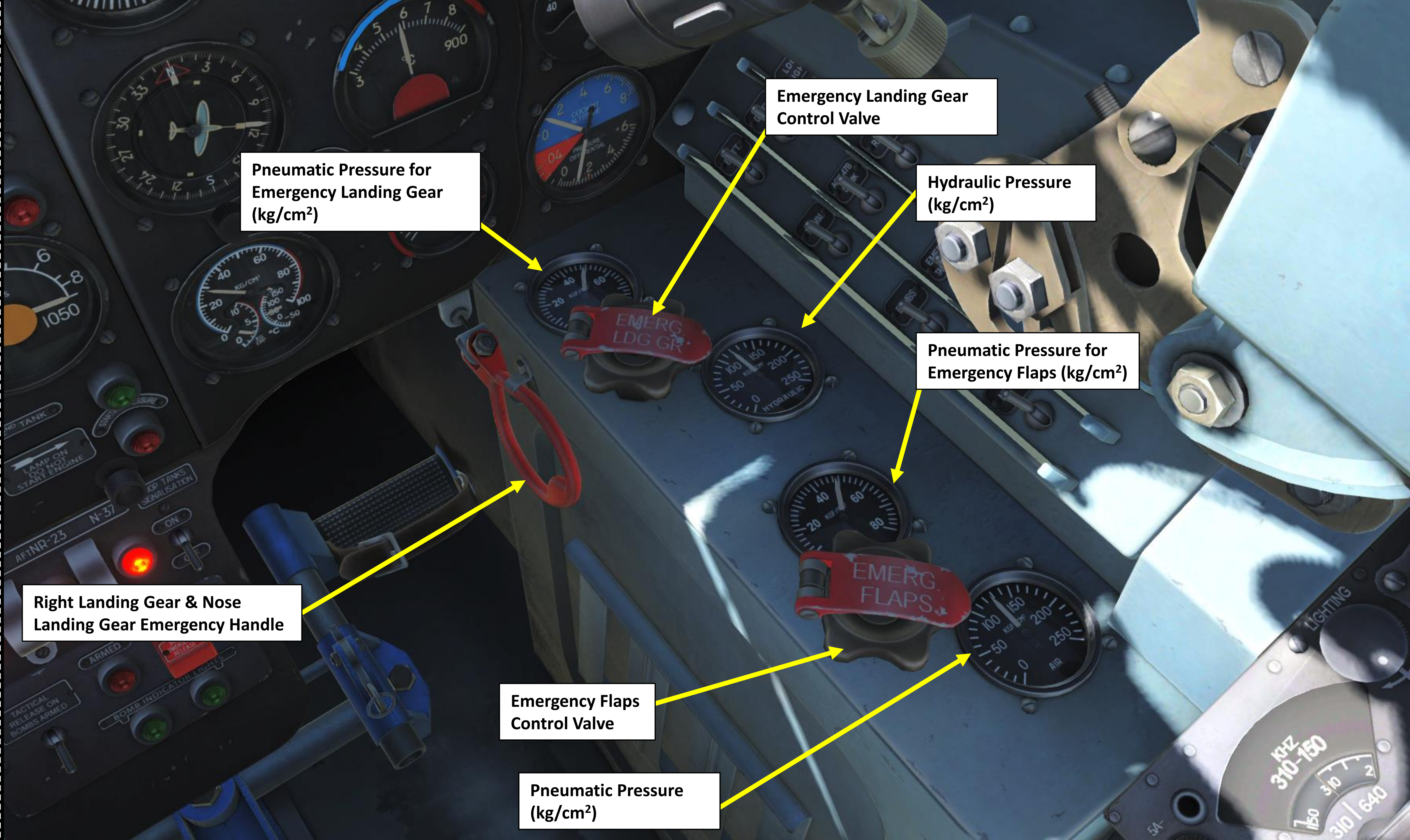

K-7 ARK-5 Radio-Compass Control Panel
Emergency System Filling Valve
RSI-6K HF Radio Transmitter Mode Switch
UP= FORCED
DOWN = NORMAL
Left UV Illumination Rheostat
Right UV Illumination Rheostat

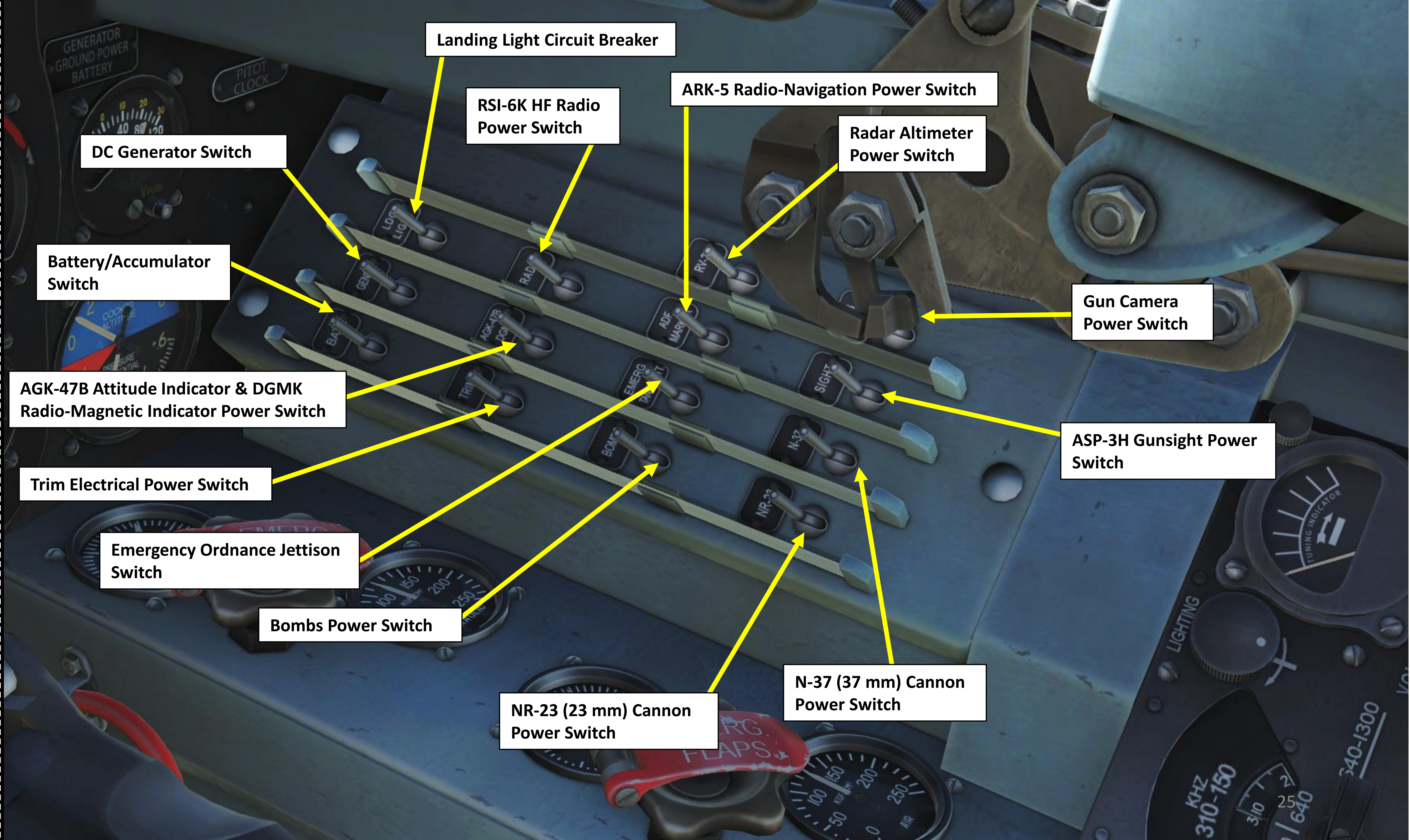

Cockpit Pressurization Valve
Clockwise: Open Valve
Counter-Clockwise: Close Valve
X: Blue (Cold Air)
T: Yellow (Warm Air)
Г : Red (Hot Air)
Cockpit Pressurization Valve Status Indicator


Canopy Jettison Handle
(Safety Position)


Canopy Jettison Handle
(Canopy is Jettisoned)
Ejection Seat Handle

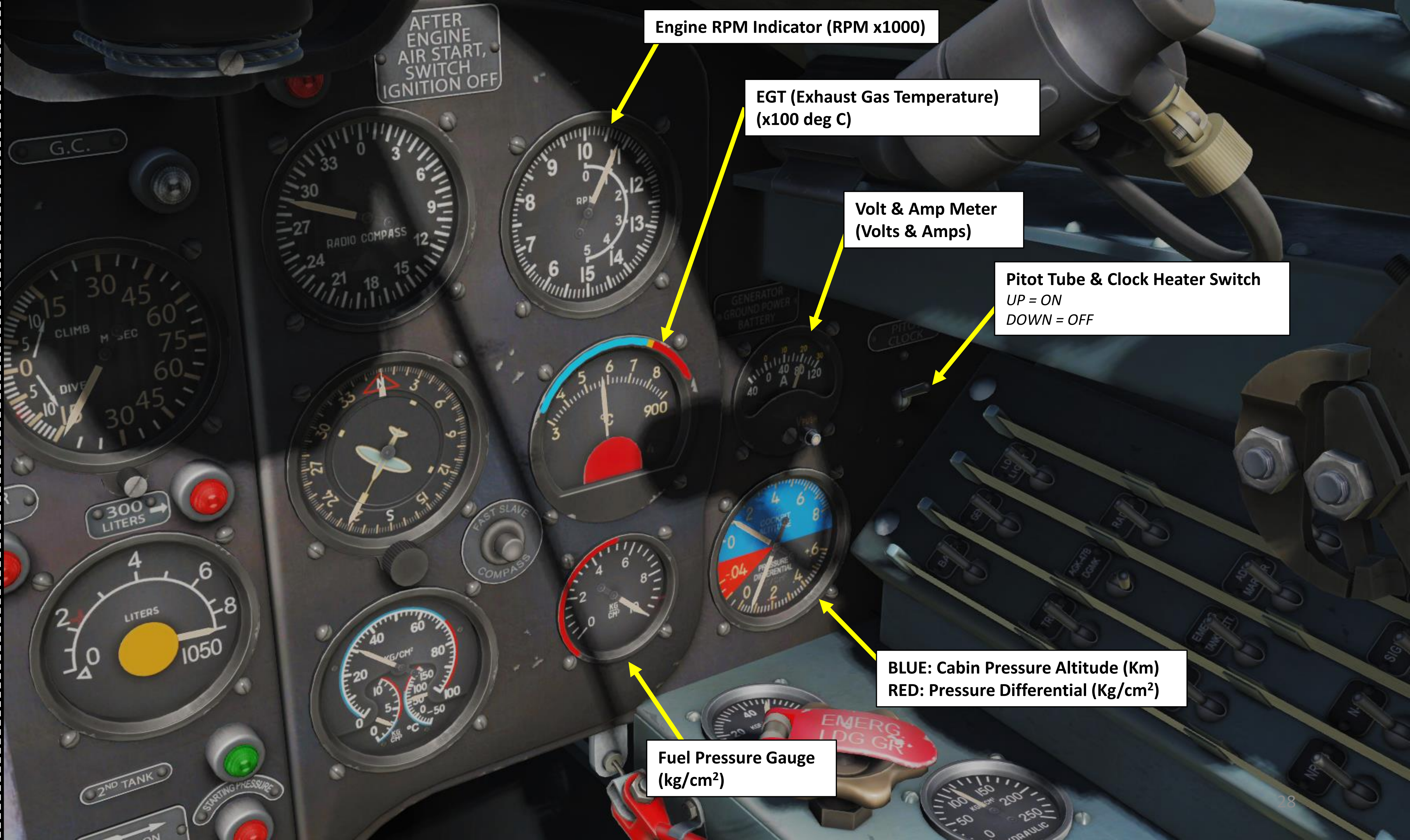

Ejection Seat Handle
Press LCTRL + E three times to eject after you jettisoned the canopy

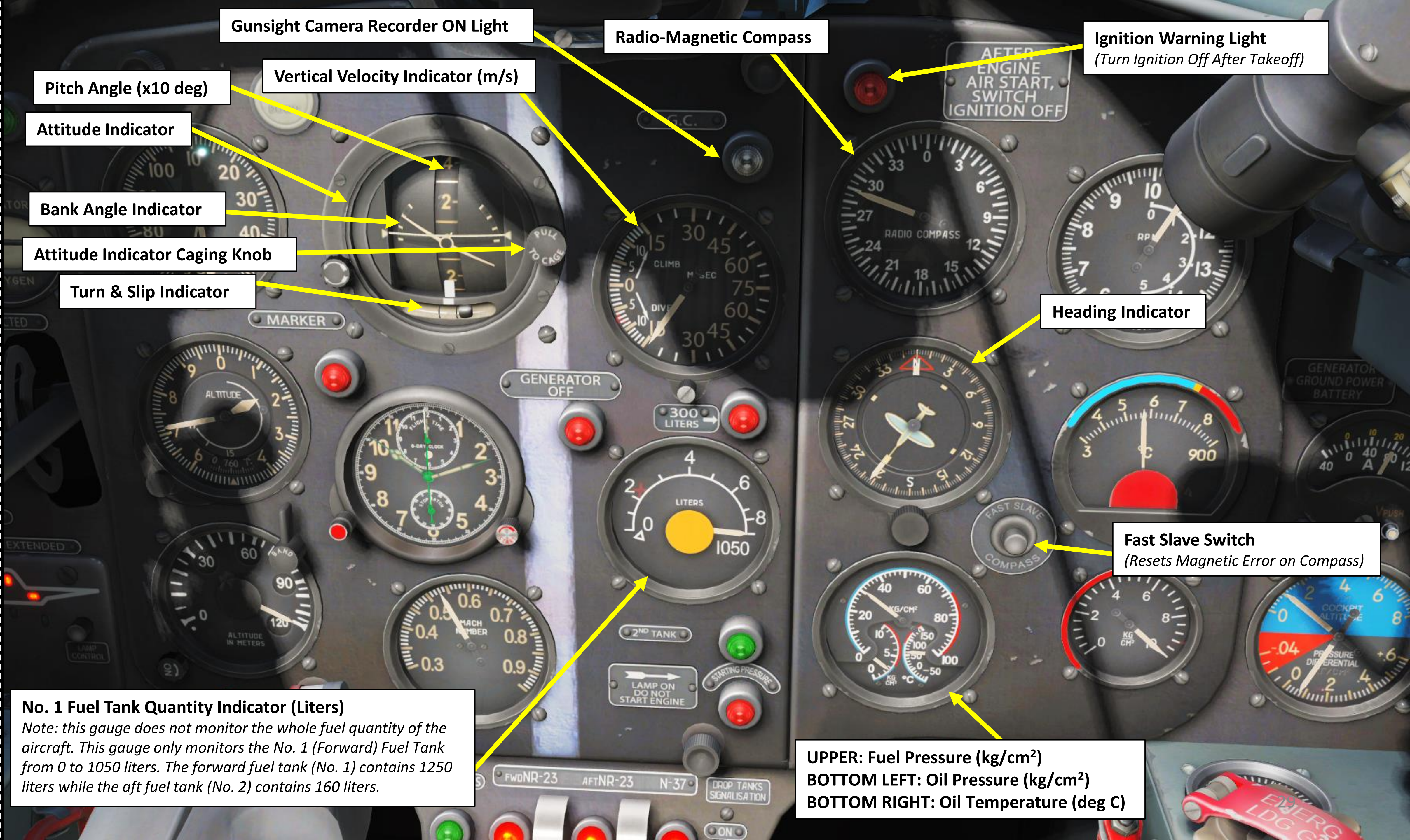

Emergency Landing Gear Control Valve
Pneumatic Pressure for Emergency Landing Gear (kg/cm²)
Hydraulic Pressure (kg/cm²)
Pneumatic Pressure for Emergency Flaps (kg/cm²)
Right Landing Gear & Nose Landing Gear Emergency Handle
Emergency Flaps Control Valve
Pneumatic Pressure (kg/cm²)
EMERG. LDG GR
EMERG. FLAPS
HYDRAULIC
AIR

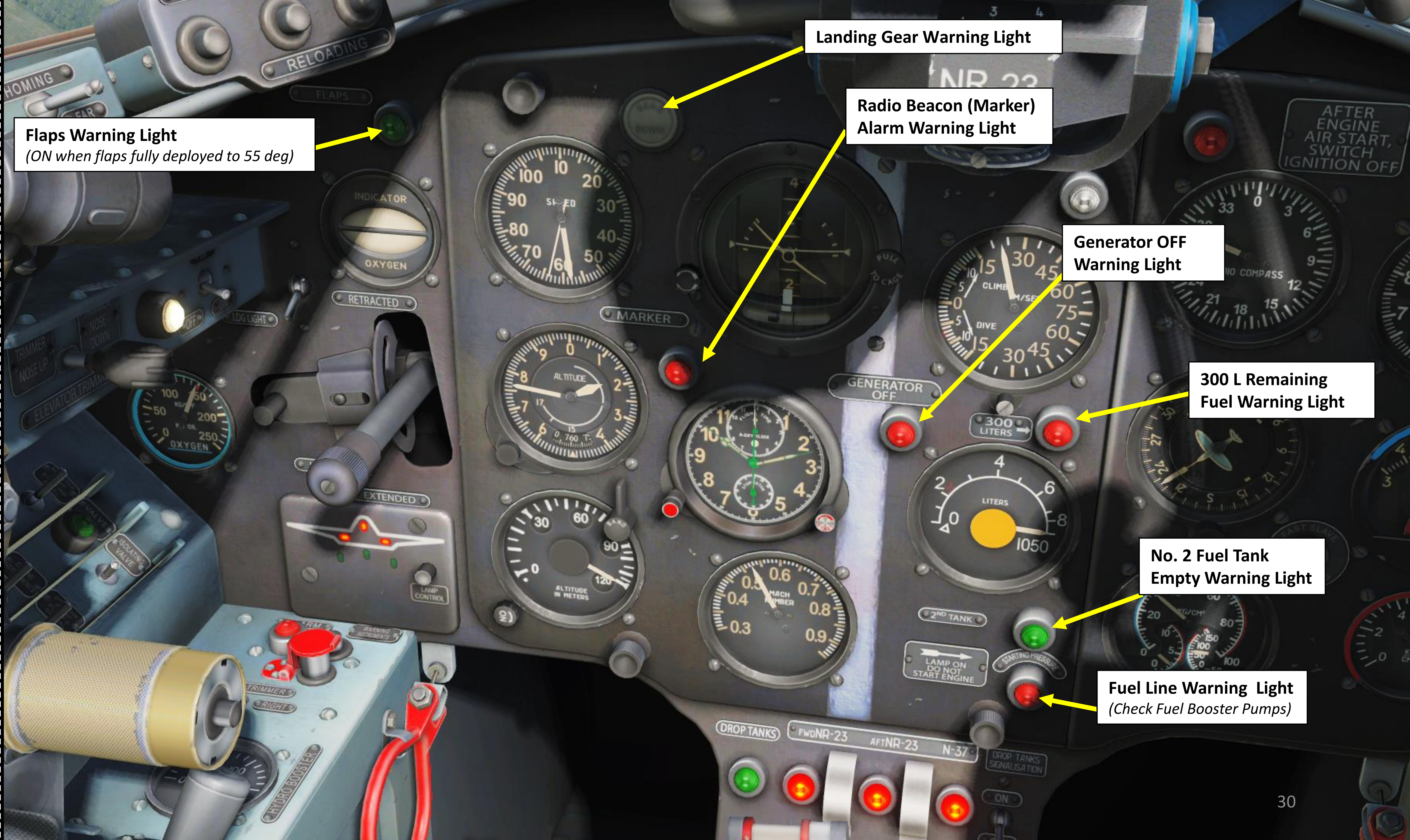

Landing Light Circuit Breaker
RSI-6K HF Radio Power Switch
ARK-5 Radio-Navigation Power Switch
Radar Altimeter Power Switch
DC Generator Switch
Battery/Accumulator Switch
Gun Camera Power Switch
AGK-47B Attitude Indicator & DGMK Radio-Magnetic Indicator Power Switch
ASP-3H Gunsight Power Switch
Trim Electrical Power Switch
Emergency Ordnance Jettison Switch
Bombs Power Switch
NR-23 (23 mm) Cannon Power Switch
N-37 (37 mm) Cannon Power Switch
GENERATOR
GROUND POWER
BATTERY
PITOT
CLOCK
LIGHTING

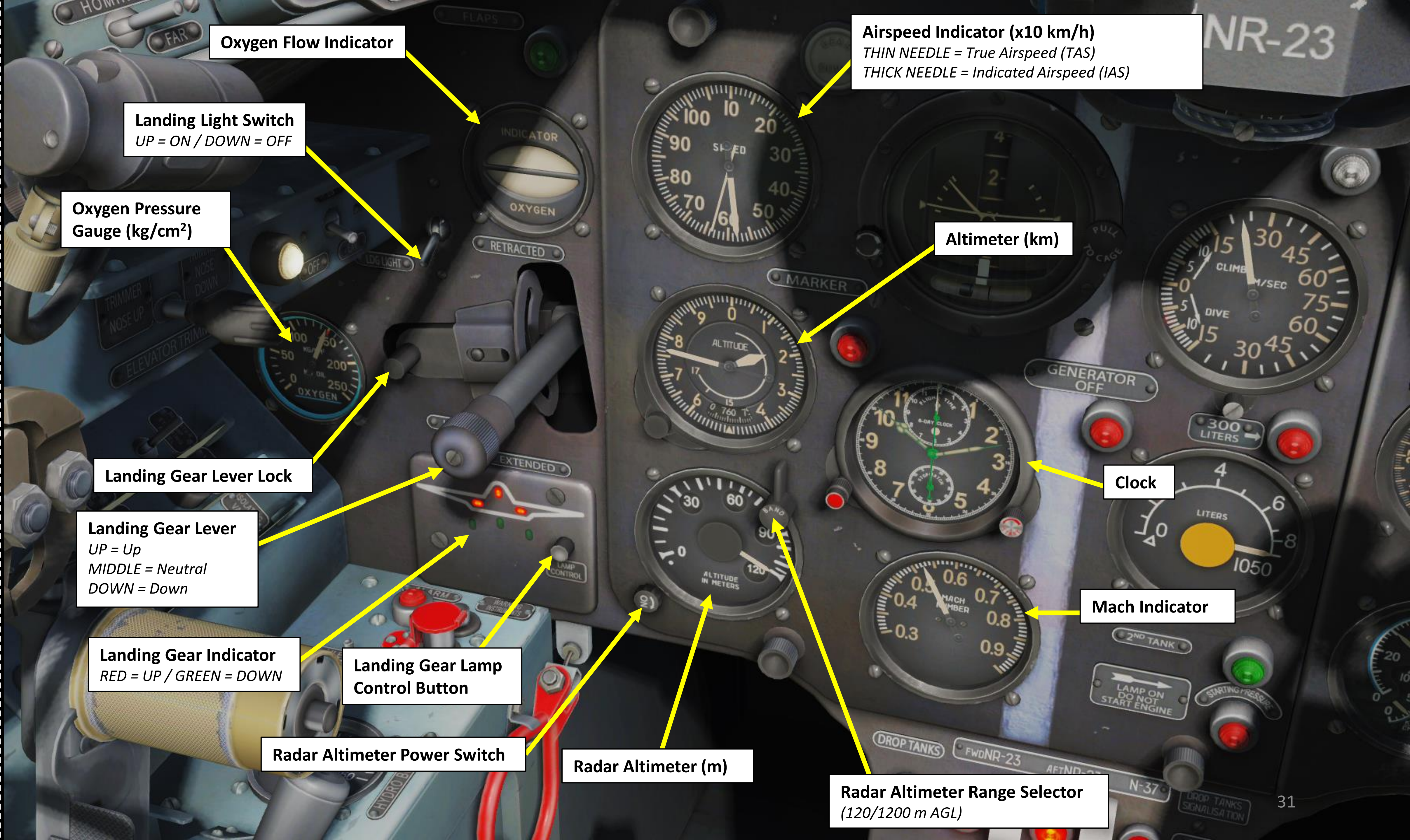

Utility Light
GYRO
FIXED
BRIGHT
NR-23
MARKER
GENERATOR OFF

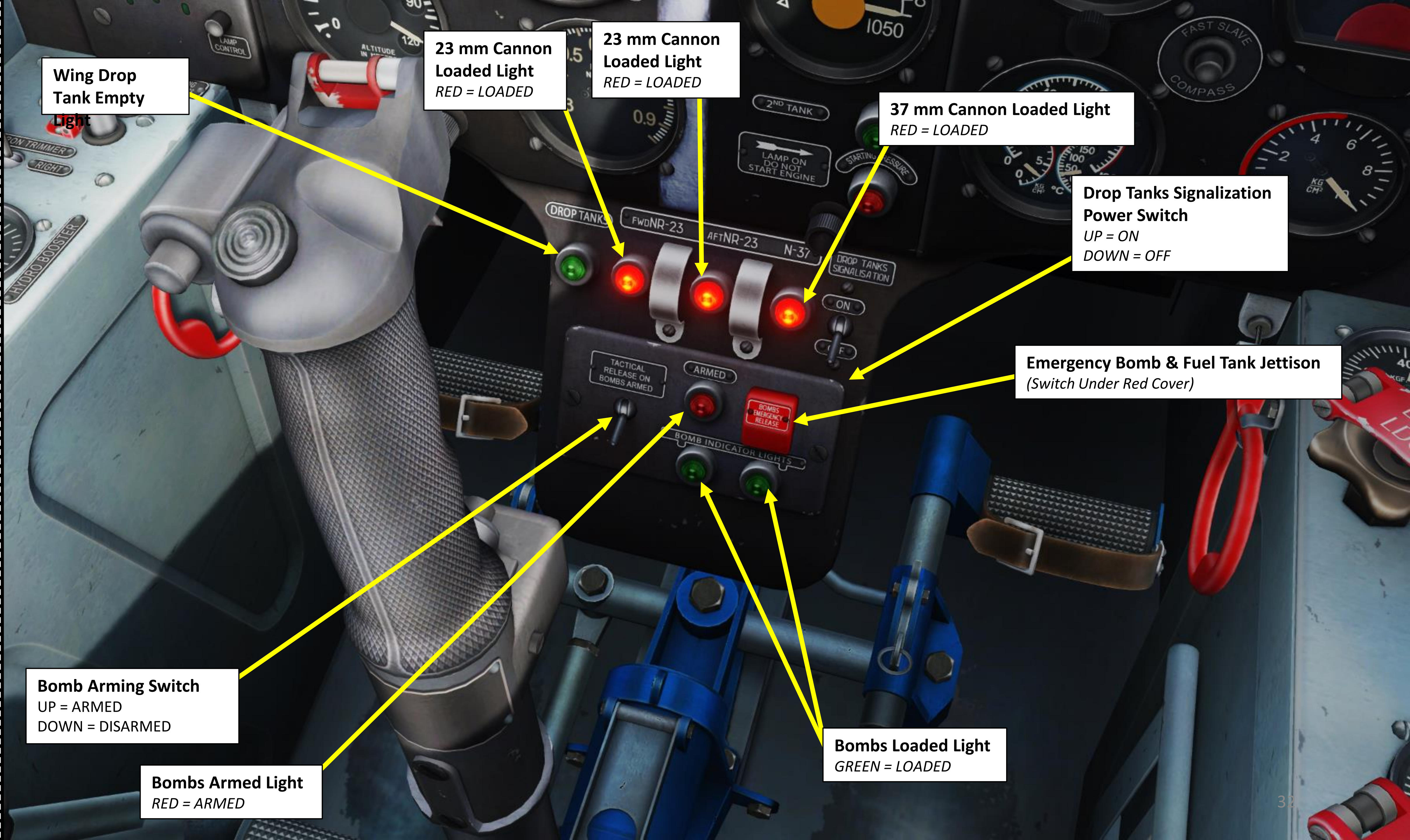

RELOADING
FLAPS
GEAR DOWN
INDICATOR
OXYGEN
RETRACTED
LDG LIGHT
MARKER
EXTENDED
LAMP CONTROL
ALTITUDE
ALTITUDE IN METERS
PULL TO CAGE
GENERATOR OFF
G.C.
CLIMB
DIVE
300 LITERS
LITERS
2ND TANK
LAMP ON DO NOT START ENGINE
STARTING PRESSURE
AFTER ENGINE AIR START, SWITCH IGNITION OFF
RADIO COMPASS
RPM
GENERATOR GROUND POWER BATTERY
FAST SLAVE COMPASS
N-37
DROP TANKS SIGNALISATION
ON
AILERON TRIMMER
RIGHT
HYDRO BOOSTER
WARNING INSTRUMENTS
BOMBS EMERGENCY RELEASE
EMERG. LDG GR.
HYDRAULIC

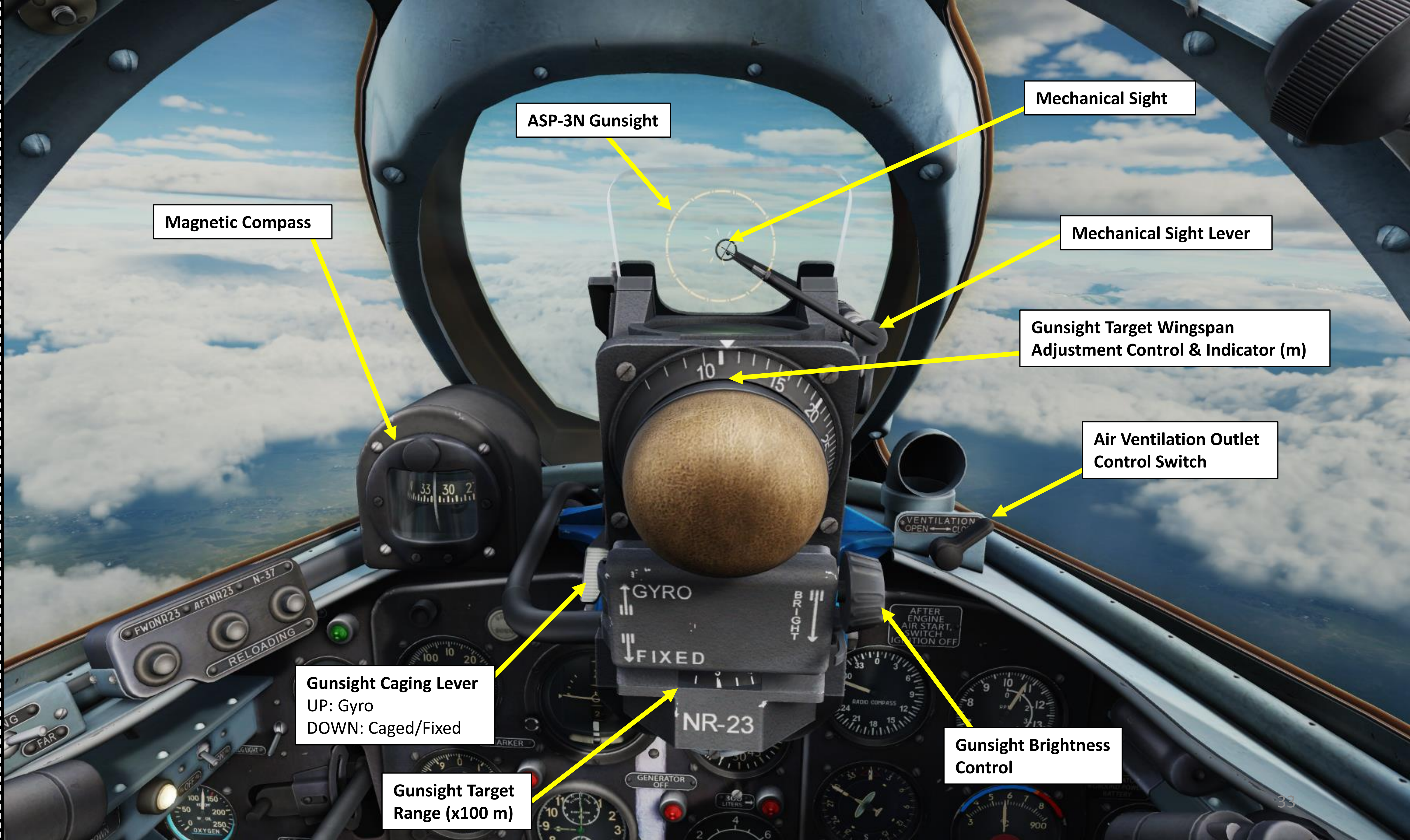

Engine RPM Indicator (RPM x1000)
EGT (Exhaust Gas Temperature) (x100 deg C)
Volt & Amp Meter (Volts & Amps)
Pitot Tube & Clock Heater Switch
UP = ON
DOWN = OFF
BLUE: Cabin Pressure Altitude (Km)
RED: Pressure Differential (Kg/cm²)
Fuel Pressure Gauge (kg/cm²)
AFTER ENGINE AIR START, SWITCH IGNITION OFF
RADIO COMPASS
300 LITERS
LITERS
1050
2ND TANK
STARTING PRESSURE
FAST SLAVE
COMPASS
EMERG LDG GR


Gunsight Camera Recorder ON Light
Radio-Magnetic Compass
Ignition Warning Light
(Turn Ignition Off After Takeoff)
Vertical Velocity Indicator (m/s)
Pitch Angle (x10 deg)
Attitude Indicator
Bank Angle Indicator
Attitude Indicator Caging Knob
Turn & Slip Indicator
Heading Indicator
Fast Slave Switch
(Resets Magnetic Error on Compass)
No. 1 Fuel Tank Quantity Indicator (Liters)
Note: this gauge does not monitor the whole fuel quantity of the aircraft. This gauge only monitors the No. 1 (Forward) Fuel Tank from 0 to 1050 liters. The forward fuel tank (No. 1) contains 1250 liters while the aft fuel tank (No. 2) contains 160 liters.
UPPER: Fuel Pressure (kg/cm²)
BOTTOM LEFT: Oil Pressure (kg/cm²)
BOTTOM RIGHT: Oil Temperature (deg C)
AFTER ENGINE AIR START, SWITCH IGNITION OFF
RADIO COMPASS
ALTITUDE
MARKER
GENERATOR OFF
300 LITERS
LITERS
1050
MACH NUMBER
2ND TANK
LAMP ON DO NOT START ENGINE
STARTING PRESSURE
FAST SLAVE COMPASS
PULL TO CAGE
FWD NR-23
AFT NR-23
N-37
DROP TANKS SIGNALISATION
ALTITUDE IN METERS
EXTENDED

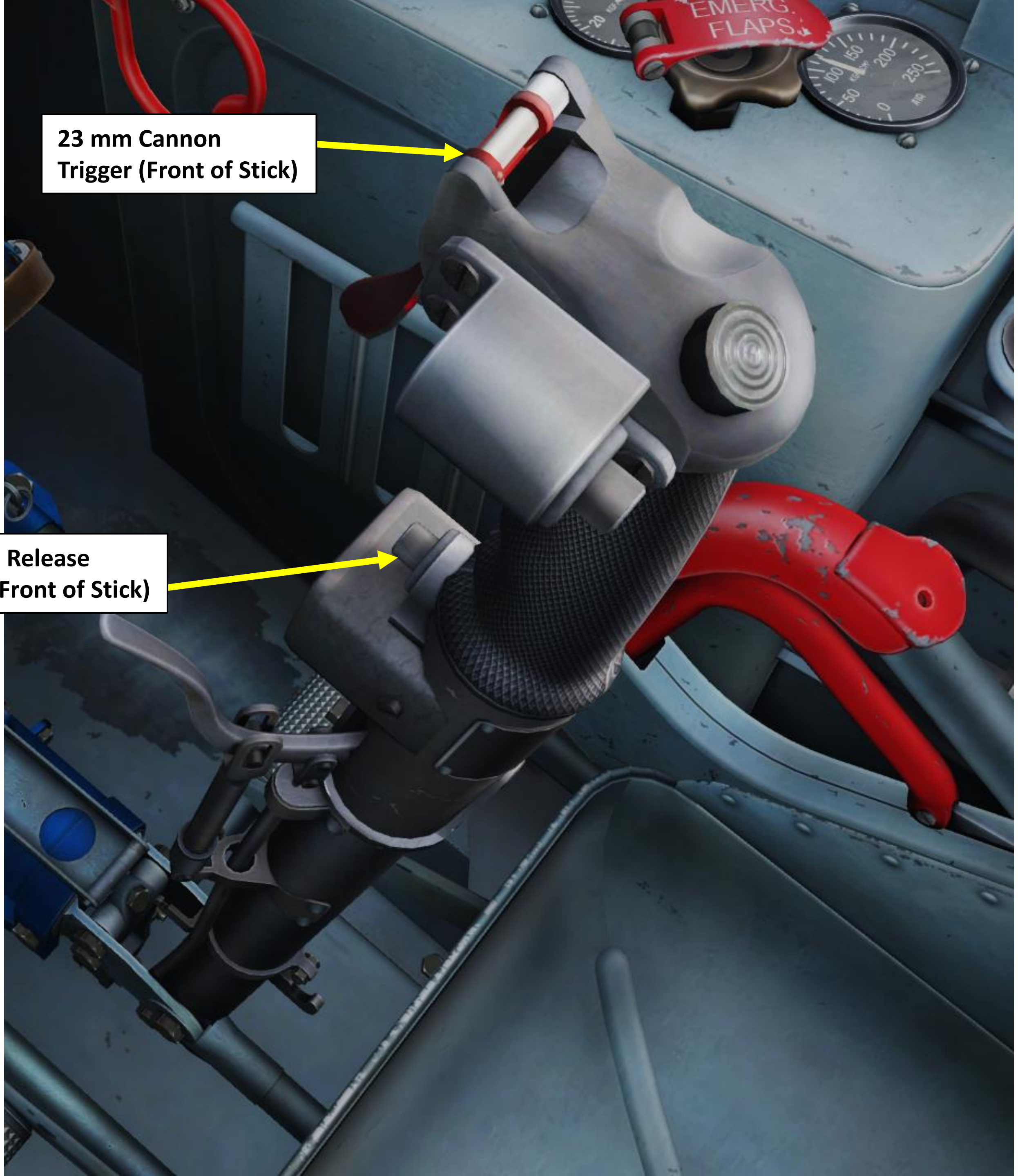

Landing Gear Warning Light
Radio Beacon (Marker) Alarm Warning Light
Flaps Warning Light
(ON when flaps fully deployed to 55 deg)
Generator OFF Warning Light
300 L Remaining Fuel Warning Light
No. 2 Fuel Tank Empty Warning Light
Fuel Line Warning Light
(Check Fuel Booster Pumps)

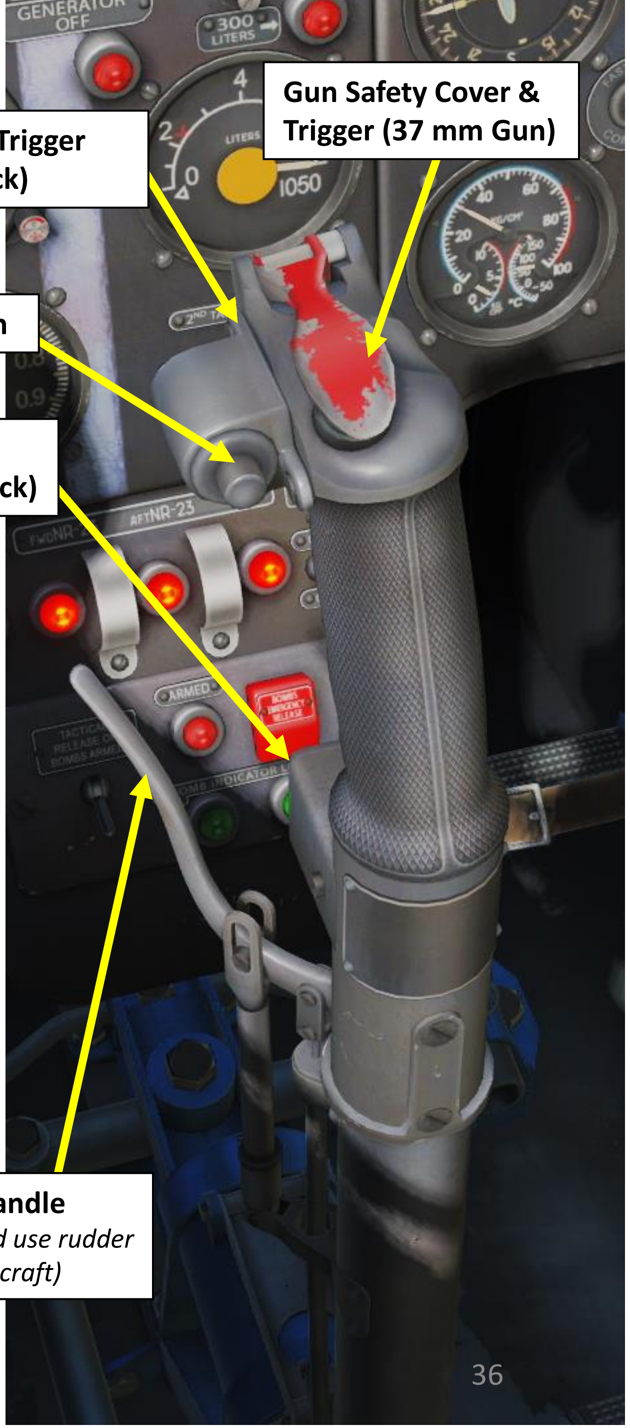

Oxygen Flow Indicator
Landing Light Switch
UP = ON / DOWN = OFF
Oxygen Pressure Gauge (kg/cm²)
Landing Gear Lever Lock
Landing Gear Lever
UP = Up
MIDDLE = Neutral
DOWN = Down
Landing Gear Indicator
RED = UP / GREEN = DOWN
Landing Gear Lamp Control Button
Radar Altimeter Power Switch
Radar Altimeter (m)
Radar Altimeter Range Selector
(120/1200 m AGL)
Airspeed Indicator (x10 km/h)
THIN NEEDLE = True Airspeed (TAS)
THICK NEEDLE = Indicated Airspeed (IAS)
Altimeter (km)
Clock
Mach Indicator


Wing Drop Tank Empty Light
23 mm Cannon Loaded Light
RED = LOADED
23 mm Cannon Loaded Light
RED = LOADED
37 mm Cannon Loaded Light
RED = LOADED
Drop Tanks Signalization Power Switch
UP = ON
DOWN = OFF
Emergency Bomb & Fuel Tank Jettison
(Switch Under Red Cover)
Bomb Arming Switch
UP = ARMED
DOWN = DISARMED
Bombs Armed Light
RED = ARMED
Bombs Loaded Light
GREEN = LOADED
DROP TANKS
FWD NR-23
AFT NR-23
N-37
DROP TANKS SIGNALISATION
ON
TACTICAL RELEASE ON BOMBS ARMED
ARMED
BOMB INDICATOR LIGHTS
2ND TANK
LAMP ON DO NOT START ENGINE
FAST SLAVE COMPASS
HYDRO BOOSTER

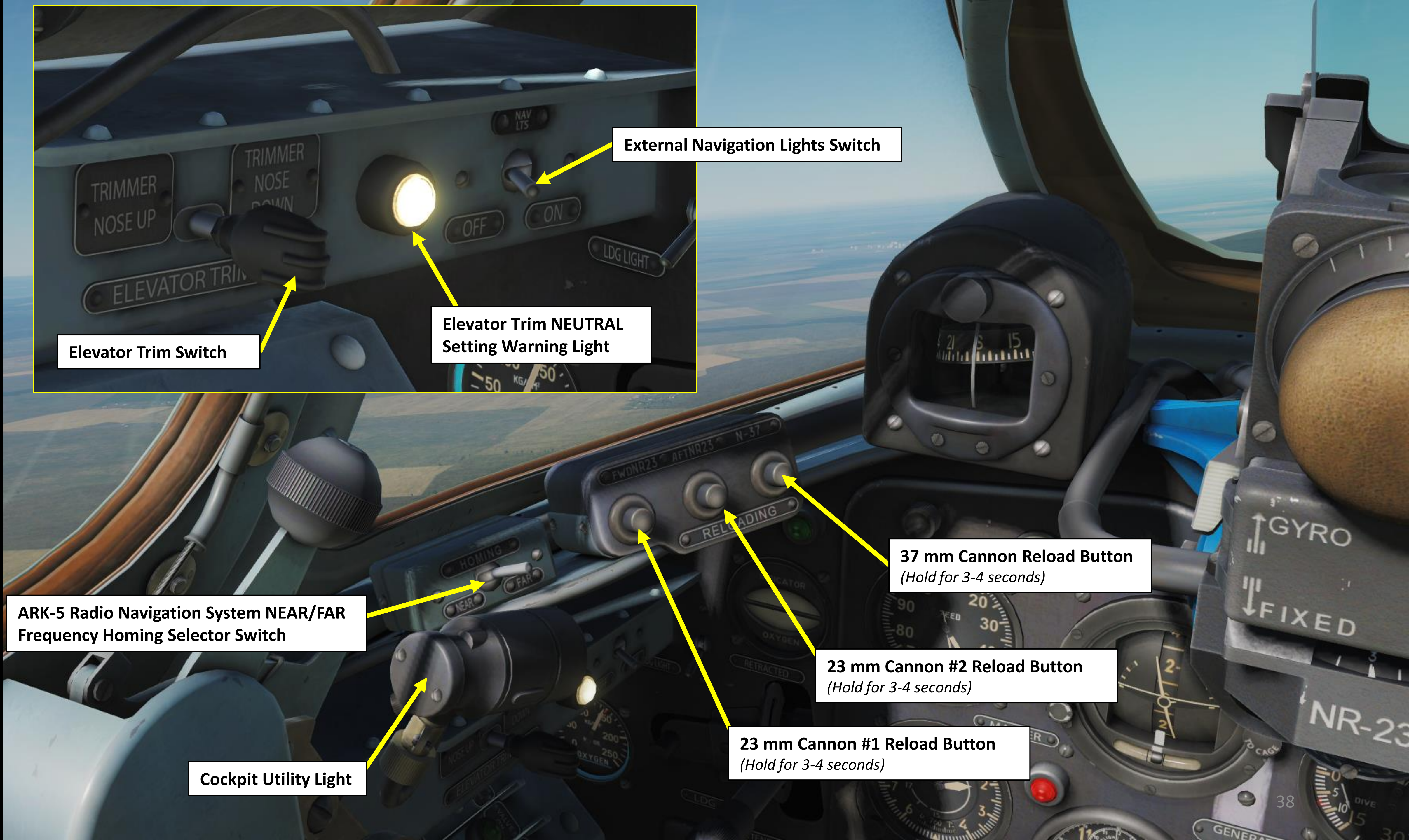

ASP-3N Gunsight
Mechanical Sight
Magnetic Compass
Mechanical Sight Lever
Gunsight Target Wingspan Adjustment Control & Indicator (m)
Air Ventilation Outlet Control Switch
Gunsight Caging Lever
UP: Gyro
DOWN: Caged/Fixed
Gunsight Target Range (x100 m)
Gunsight Brightness Control
GYRO
FIXED
BRIGHT
NR-23
VENTILATION
FWDNR23
AFTNR23
N-37
RELOADING
AFTER ENGINE AIR START, SWITCH IGNITION OFF
GENERATOR OFF

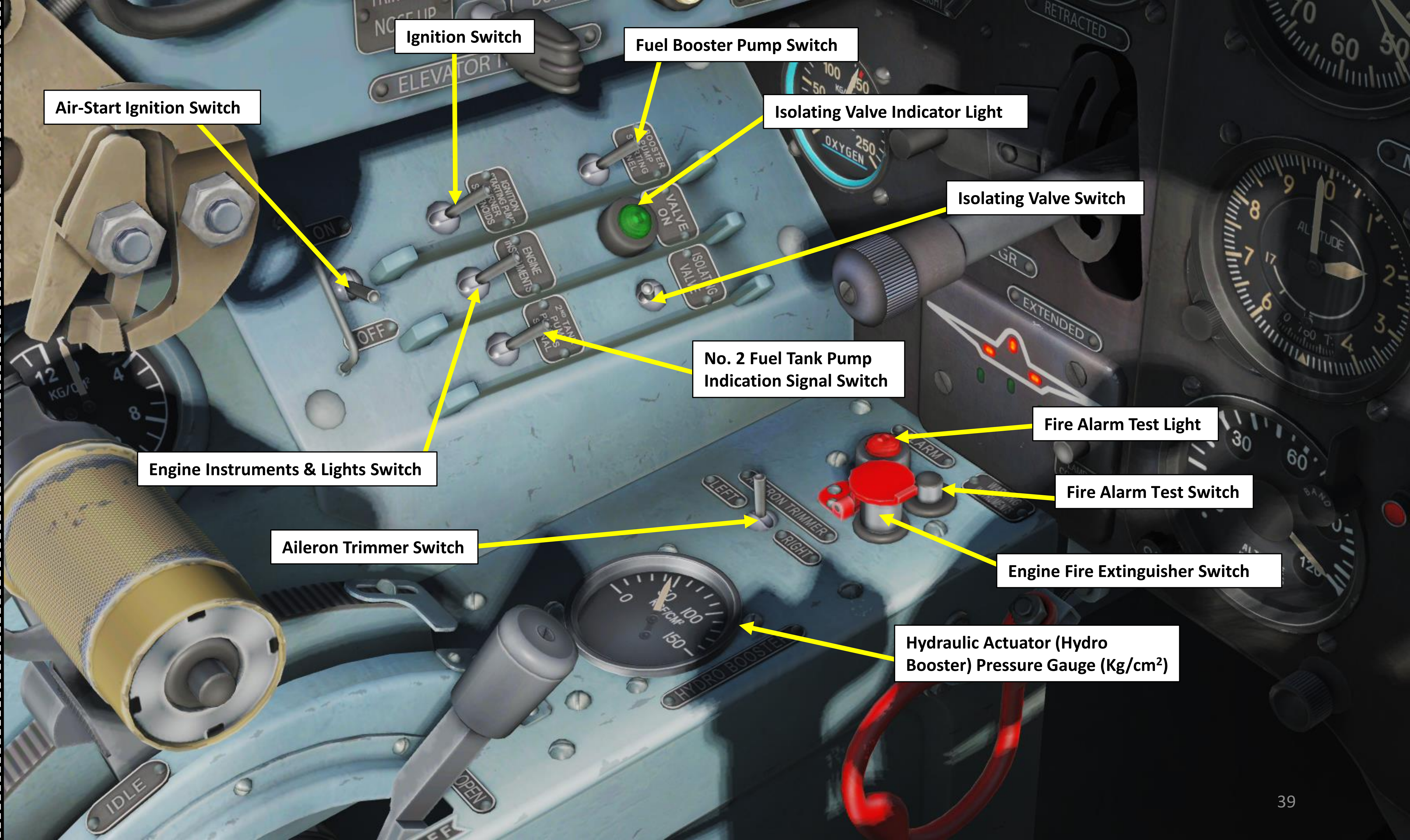

Canopy Lever
Canopy Handle
FWD: Locked
AFT: Unlocked
Canopy Handle
FWD: Locked
AFT: Unlocked
GYRO
FIXED
NR-23

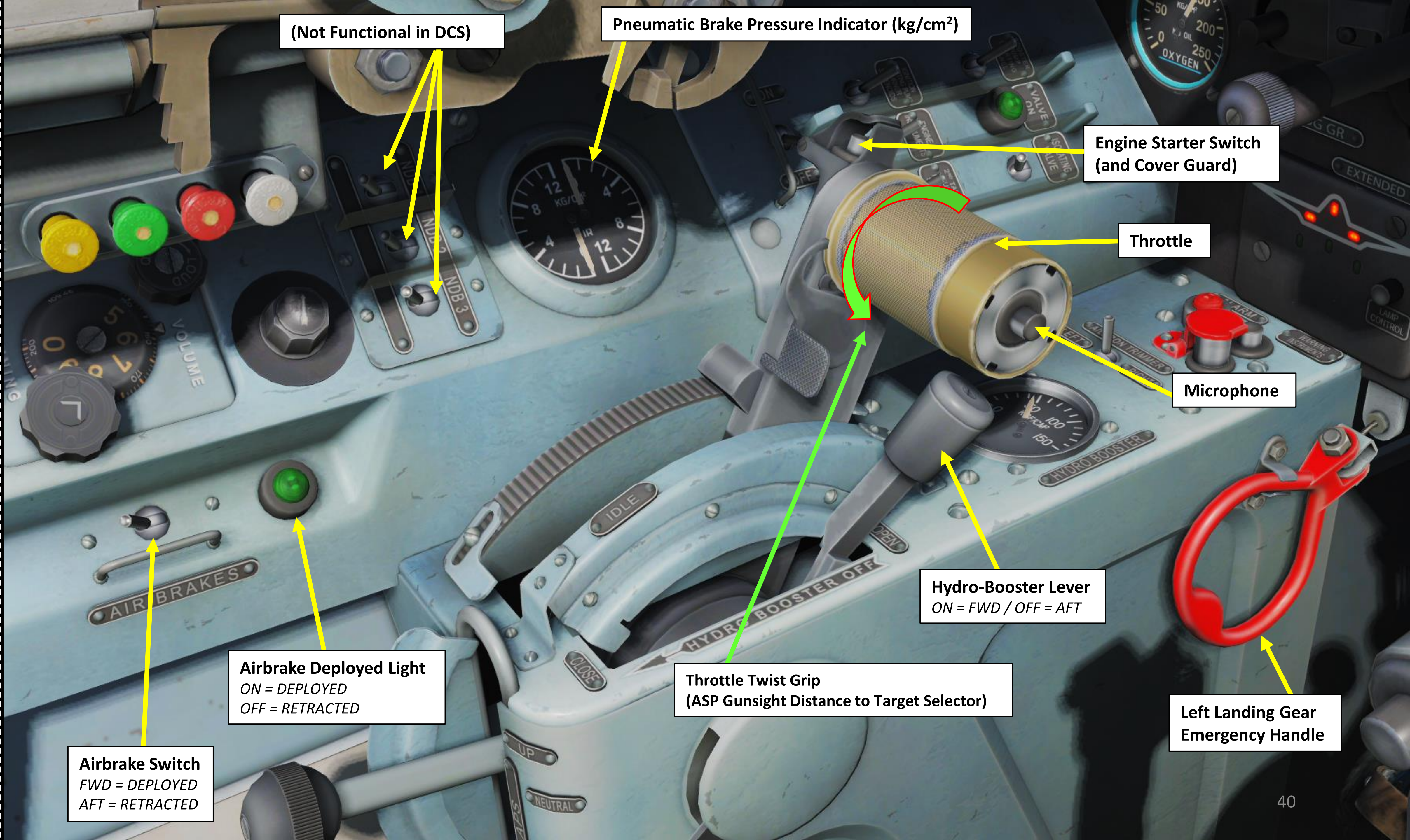

23 mm Cannon Trigger (Front of Stick)
Weapon Release Button (Front of Stick)
EMERG. FLAPS

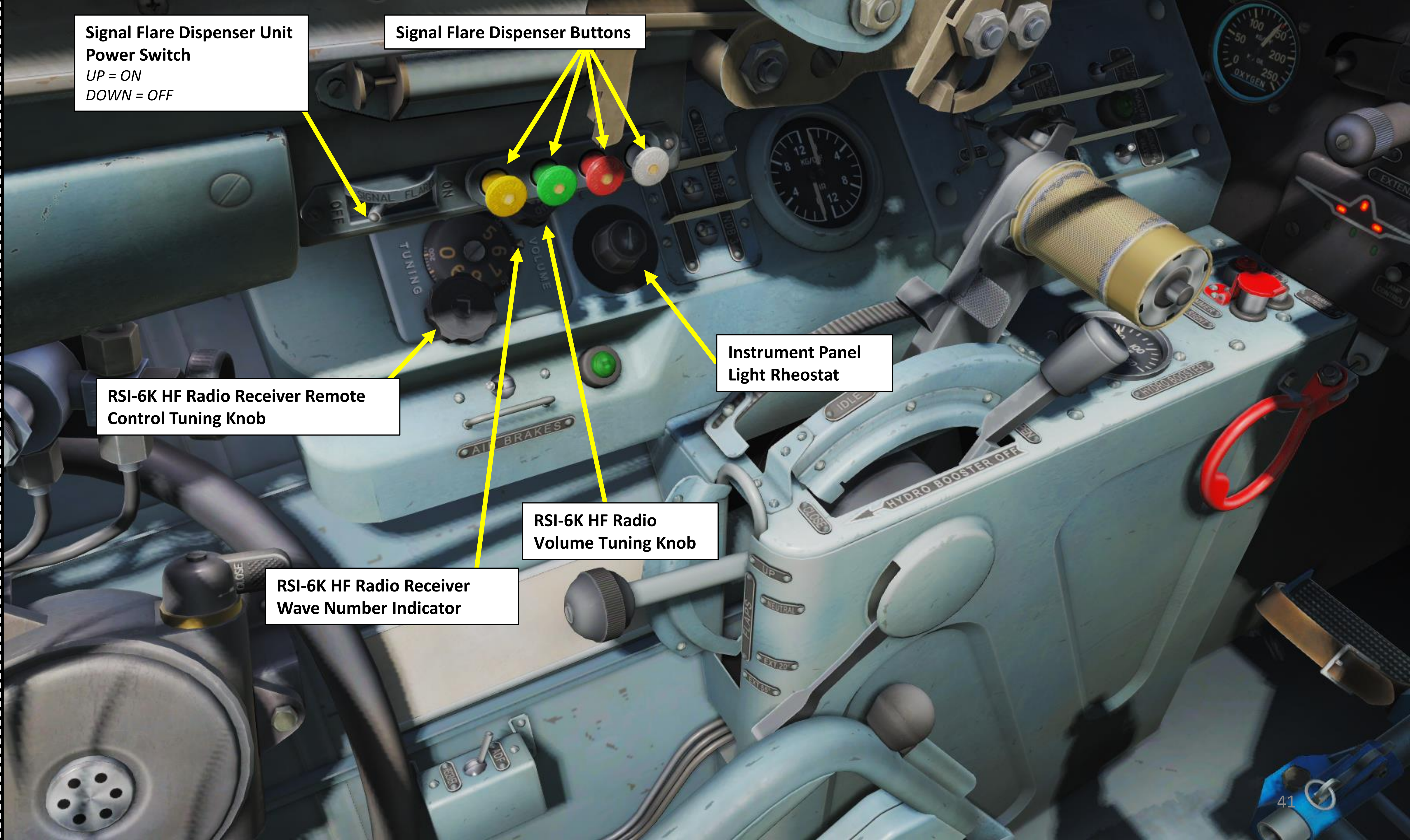

23 mm Gun Trigger (Front of Stick)
Gun Safety Cover & Trigger (37 mm Gun)
Airbrake Switch
Weapon Release Button (Front of Stick)
Wheel Brake Handle
(Hold to brake and use rudder pedals to steer aircraft)

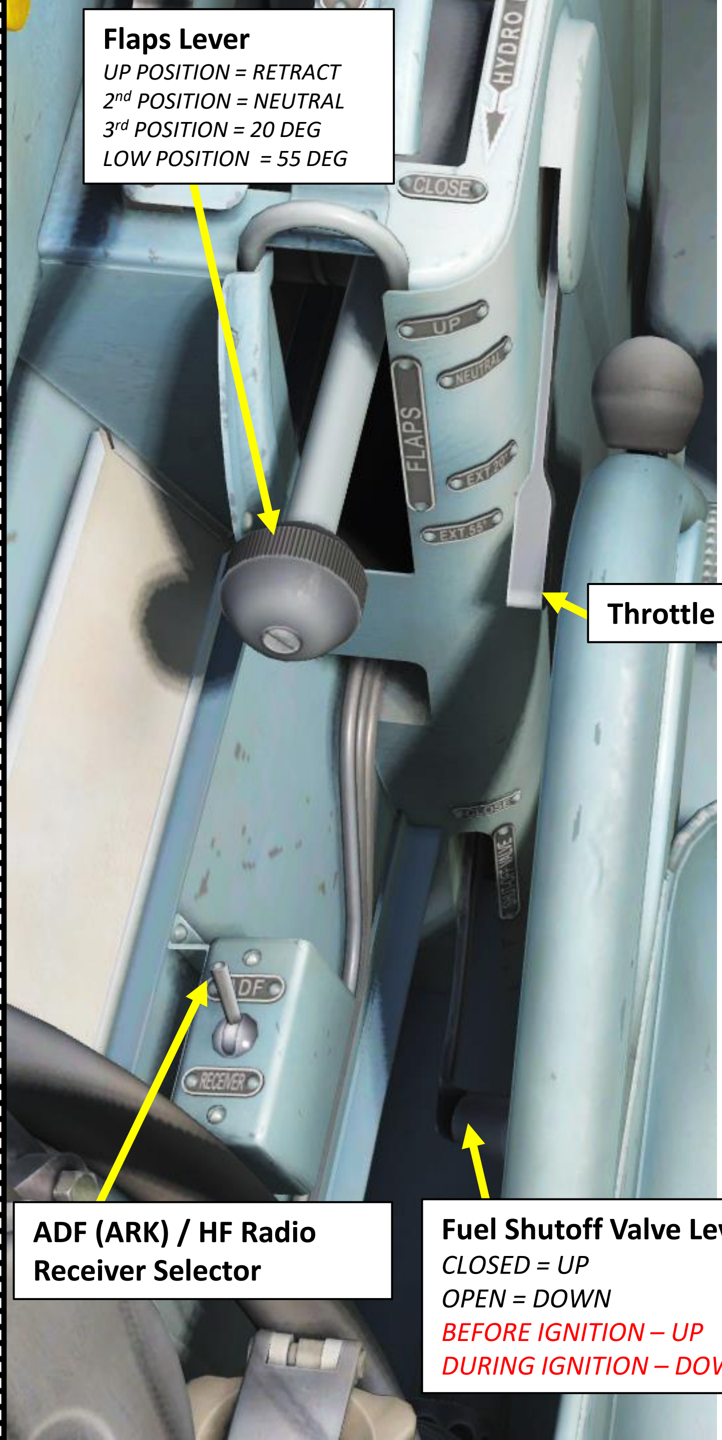

RELOADING
HOMING
MARKER
GENERATOR OFF

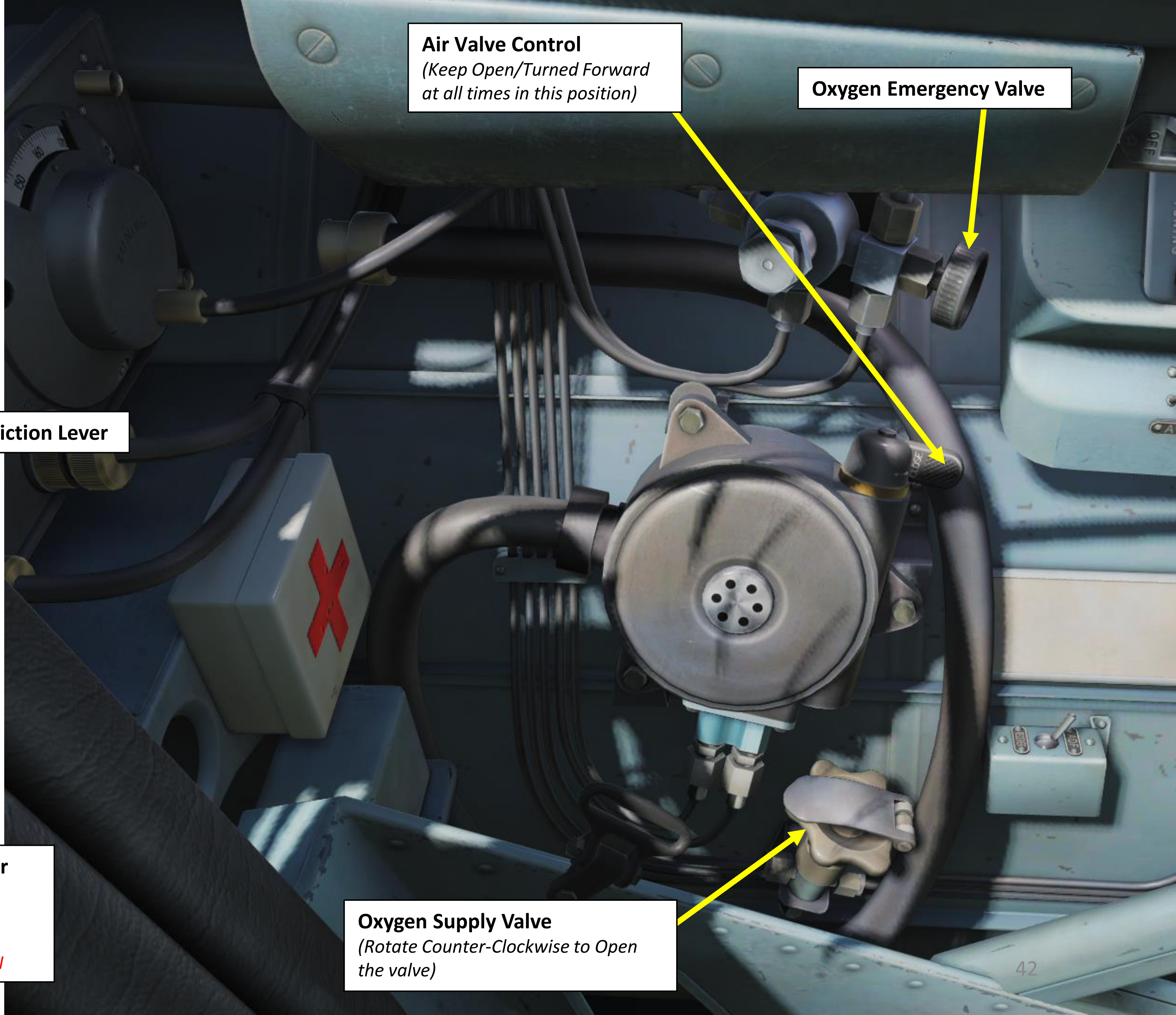

External Navigation Lights Switch
Elevator Trim Switch
Elevator Trim NEUTRAL Setting Warning Light
37 mm Cannon Reload Button
(Hold for 3-4 seconds)
ARK-5 Radio Navigation System NEAR/FAR Frequency Homing Selector Switch
23 mm Cannon #2 Reload Button
(Hold for 3-4 seconds)
23 mm Cannon #1 Reload Button
(Hold for 3-4 seconds)
Cockpit Utility Light

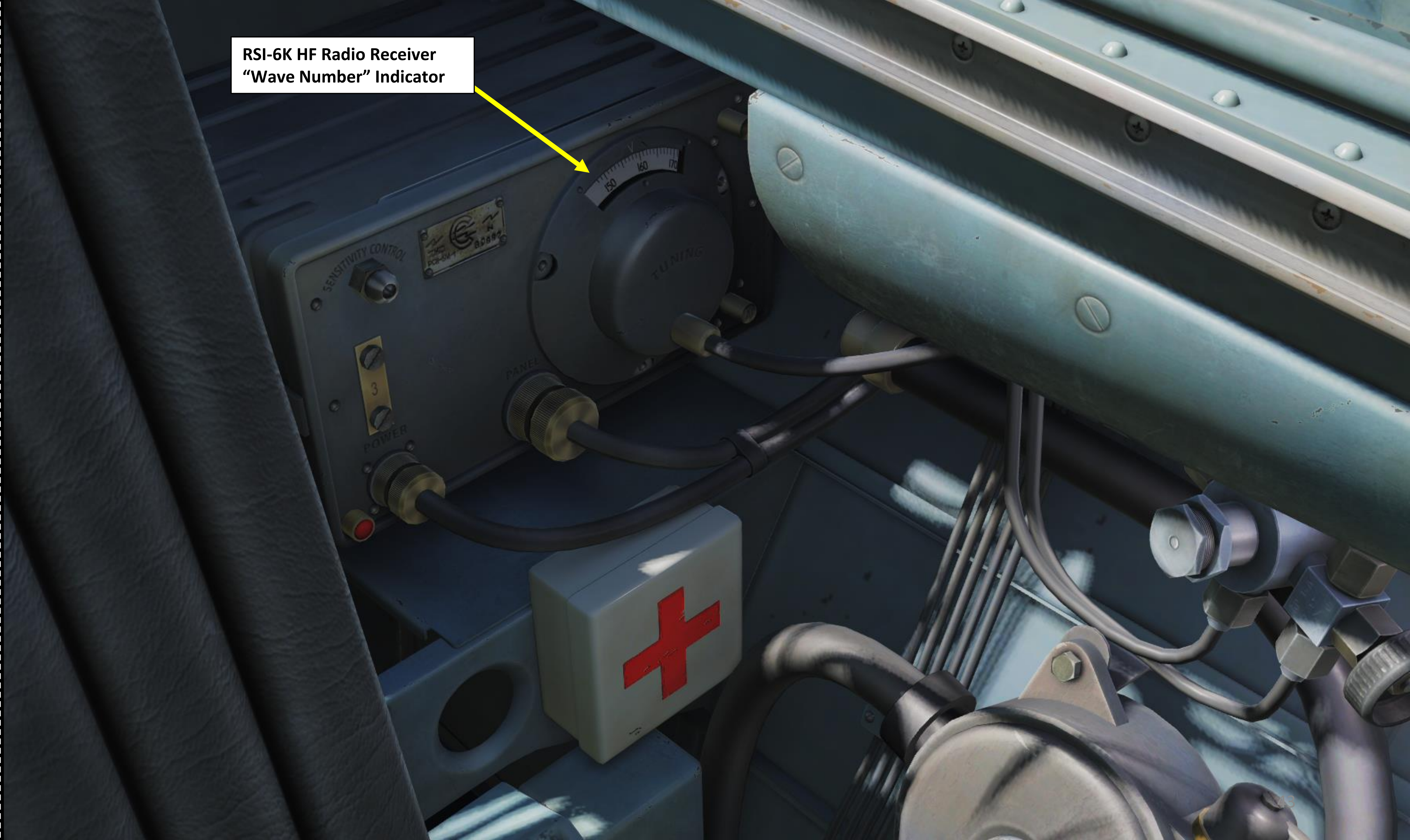

Ignition Switch
Fuel Booster Pump Switch
Air-Start Ignition Switch
Isolating Valve Indicator Light
Isolating Valve Switch
No. 2 Fuel Tank Pump Indication Signal Switch
Fire Alarm Test Light
Engine Instruments & Lights Switch
Fire Alarm Test Switch
Aileron Trimmer Switch
Engine Fire Extinguisher Switch
Hydraulic Actuator (Hydro Booster) Pressure Gauge (Kg/cm²)


(Not Functional in DCS)
Pneumatic Brake Pressure Indicator (kg/cm²)
Engine Starter Switch (and Cover Guard)
Throttle
Microphone
Hydro-Booster Lever
ON = FWD / OFF = AFT
Throttle Twist Grip
(ASP Gunsight Distance to Target Selector)
Left Landing Gear Emergency Handle
Airbrake Deployed Light
ON = DEPLOYED
OFF = RETRACTED
Airbrake Switch
FWD = DEPLOYED
AFT = RETRACTED
AIR BRAKES
HYDRO BOOSTER OFF
IDLE
OXYGEN


Signal Flare Dispenser Unit Power Switch
UP = ON
DOWN = OFF
Signal Flare Dispenser Buttons
Instrument Panel Light Rheostat
RSI-6K HF Radio Receiver Remote Control Tuning Knob
RSI-6K HF Radio Volume Tuning Knob
RSI-6K HF Radio Receiver Wave Number Indicator
SIGNAL FLARE
OFF
ON
TUNING
VOLUME
AIR BRAKES
HYDRO BOOSTER OFF
IDLE
UP
NEUTRAL
FLAPS
OXYGEN


Flaps Lever
UP POSITION = RETRACT
2nd POSITION = NEUTRAL
3rd POSITION = 20 DEG
LOW POSITION = 55 DEG
Throttle Friction Lever
ADF (ARK) / HF Radio Receiver Selector
Fuel Shutoff Valve Lever
CLOSED = UP
OPEN = DOWN
BEFORE IGNITION – UP
DURING IGNITION – DOWN
HYDRO
CLOSE
UP
NEUTRAL
FLAPS
EXT 20
EXT 55
DF
RECEIVER

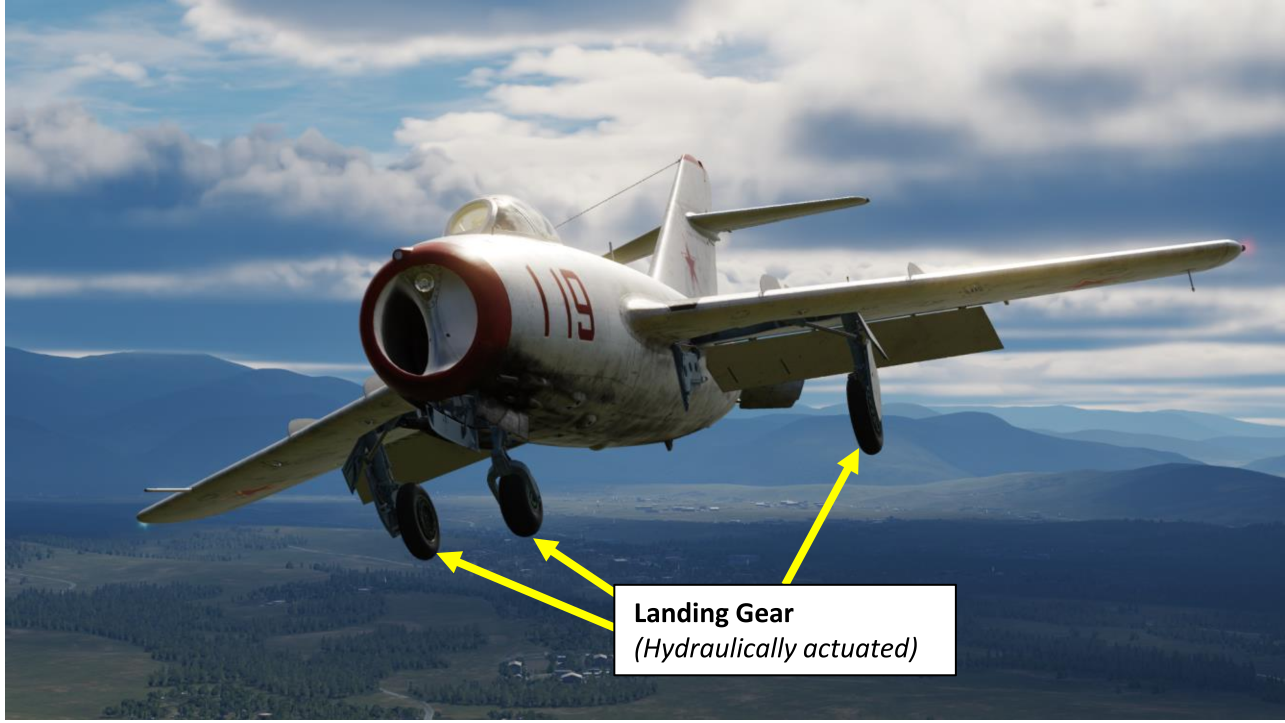

Air Valve Control
(Keep Open/Turned Forward at all times in this position)
Oxygen Emergency Valve
Oxygen Supply Valve
(Rotate Counter-Clockwise to Open the valve)

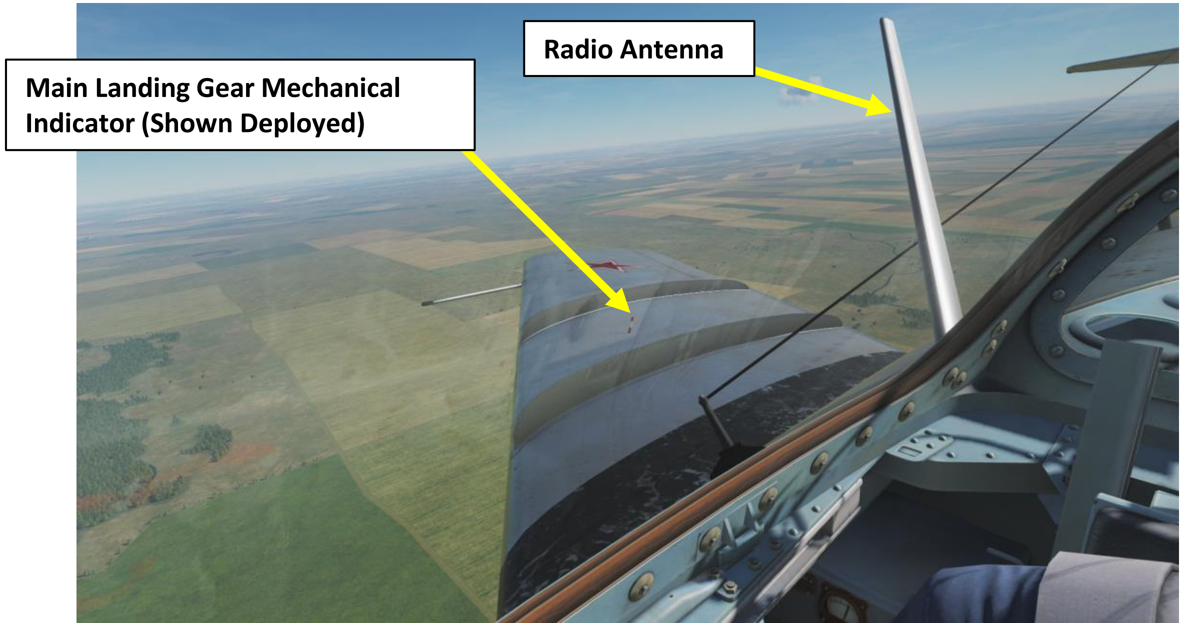

RSI-6K HF Radio Receiver
“Wave Number” Indicator
SENSITIVITY CONTROL
TUNING
PANEL
POWER
150
160
170

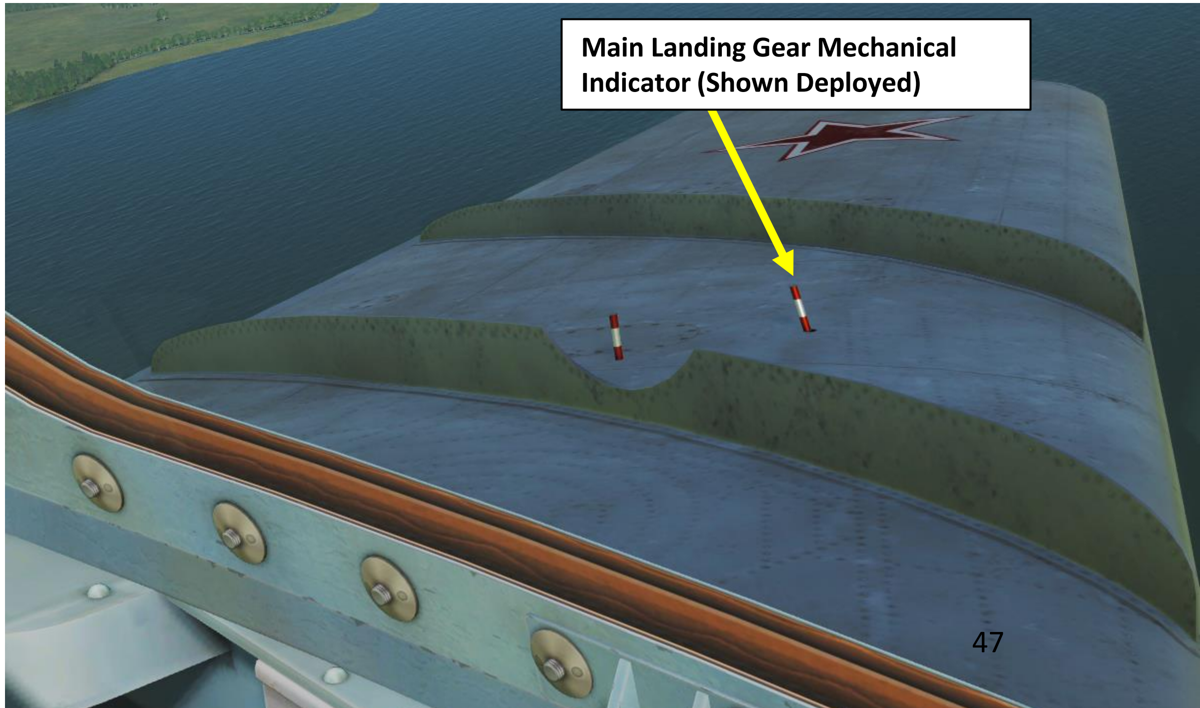

Flashlight
• ON/OFF: LALT + L

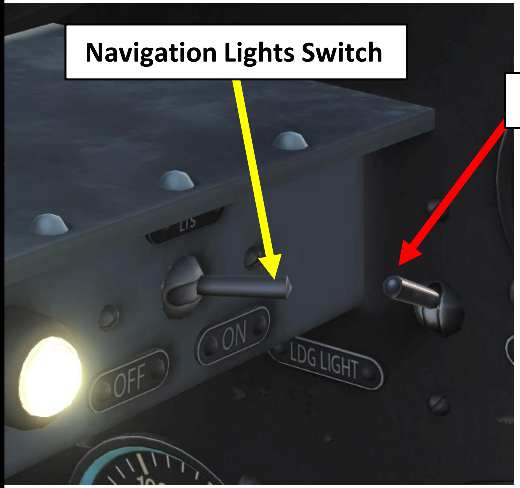

Signal Flare Dispenser Unit


Nose Landing Gear Mechanical Indicator (Shown Deployed)
GYRO
FIXED
NR-23


Landing Gear
(Hydraulically actuated)

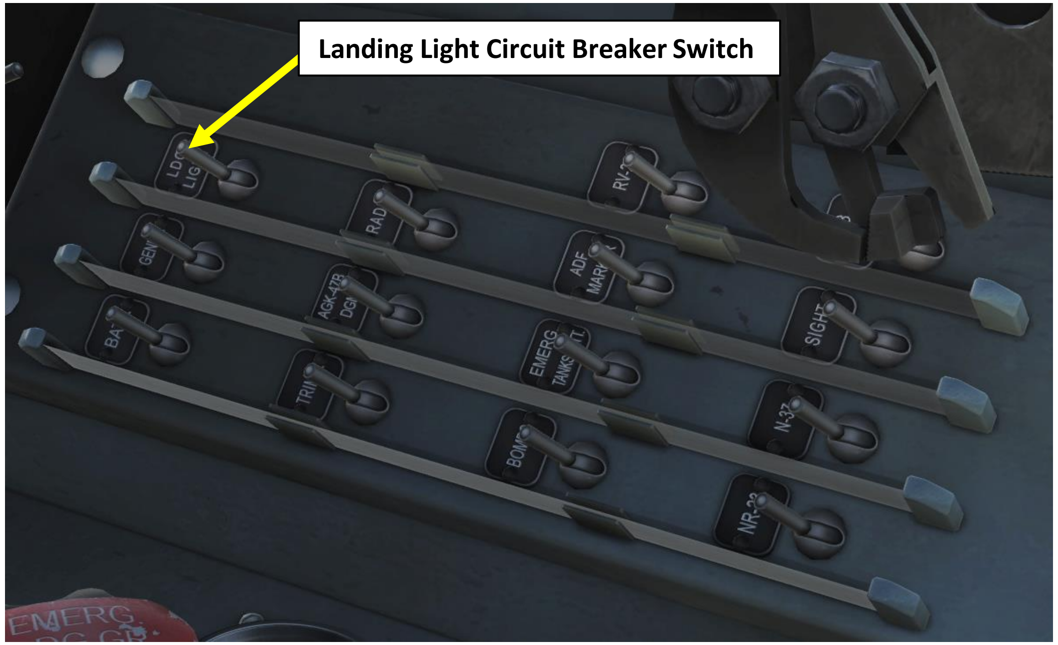

Main Landing Gear Mechanical Indicator (Shown Deployed)
Radio Antenna


Main Landing Gear Mechanical Indicator (Shown Deployed)


Navigation Lights Switch
Nose Landing Light Switch
OFF
ON
LDG LIGHT


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

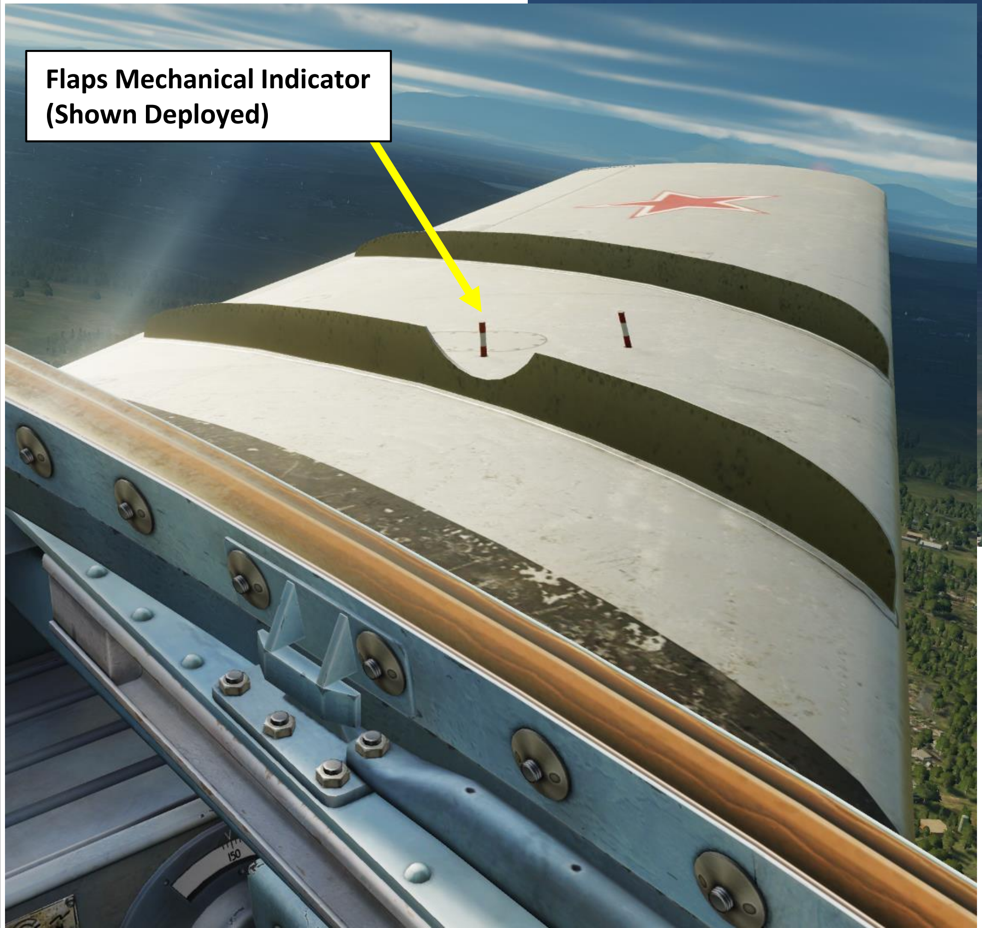

Nose Landing Light

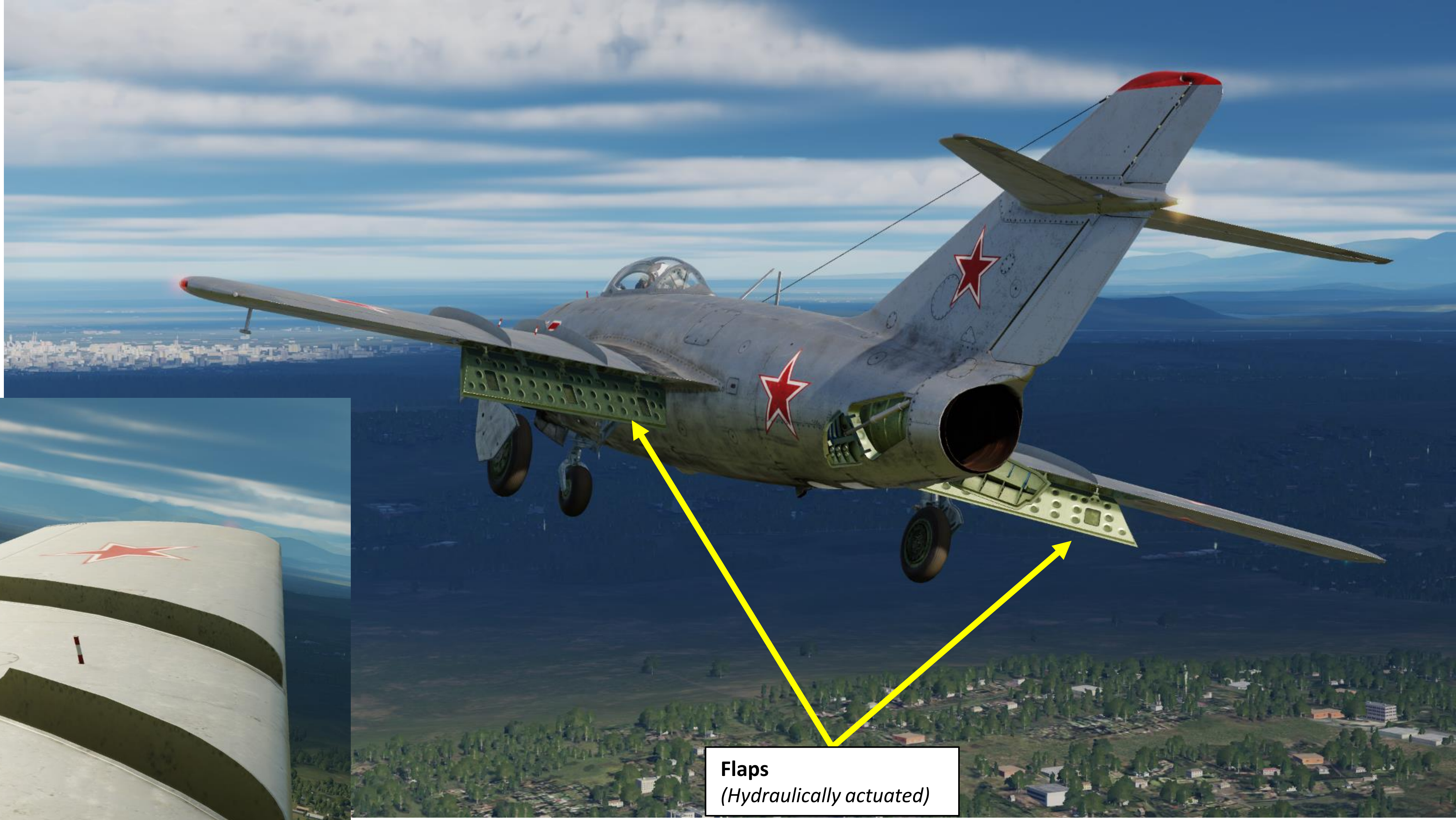

Landing Light Circuit Breaker Switch

Main 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).


Airbrakes
(Hydraulically actuated)


Flaps Mechanical Indicator
(Shown Deployed)


Flaps
(Hydraulically actuated)

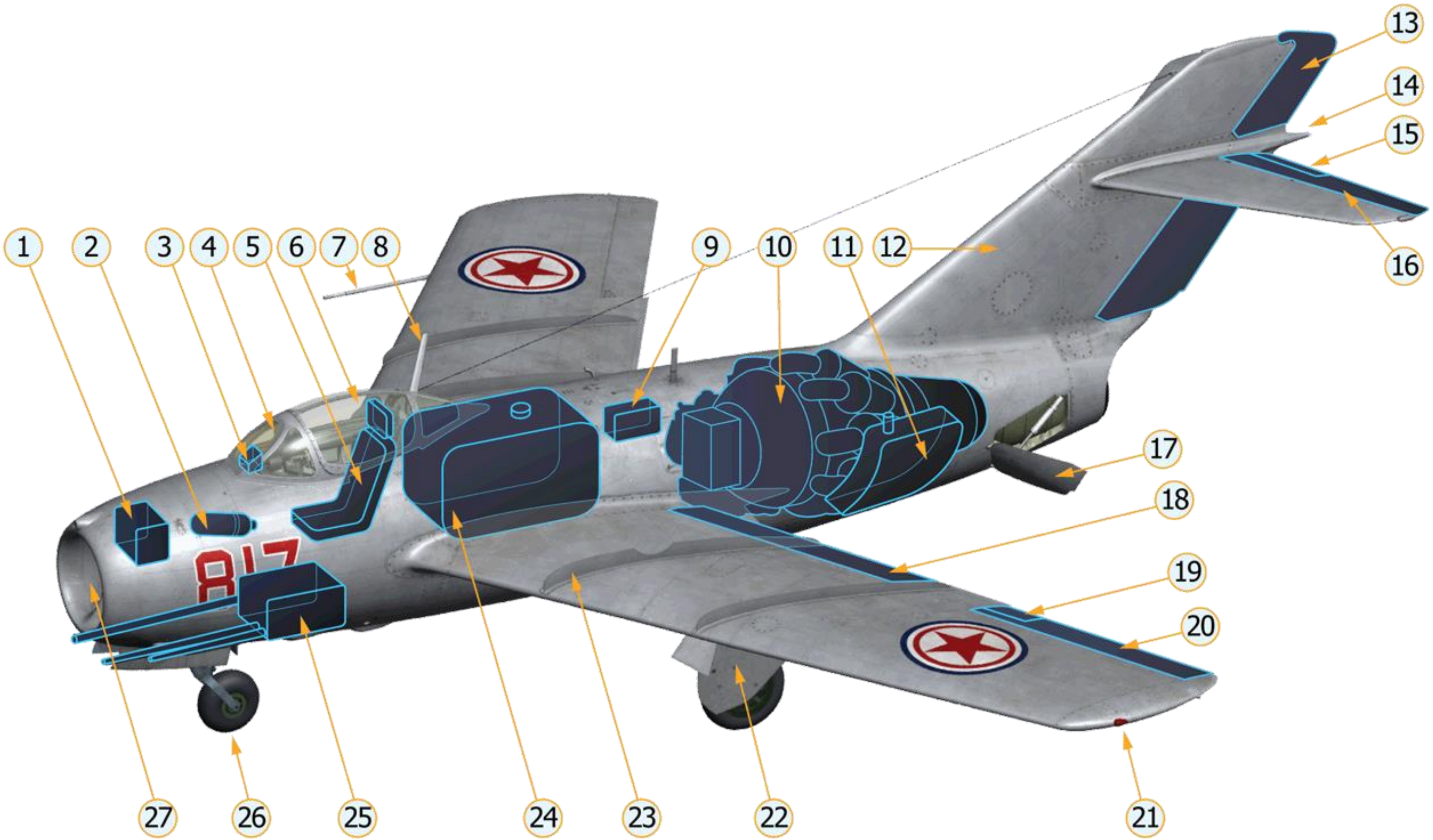
HOW TO READ THE BAROMETRIC ALTIMETER

1. Knob to set QFE (Barometric) Altimeter Setting
2. Altitude in 100 meters
3. Altitude scale from 10 to 17 kilometers
4. QFE (Barometric) Altimeter setting (mm Hg)
5. Altitude in kilometers
6. Altitude scale from 0 to 10 kilometers

HOW TO READ THE RADAR ALTIMETER

The radar altimeter gives you the height above the ground in meters. It has two measuring ranges: from 0 to 120 meters, and from 100 to 1200 meters.

1. PRB-46 Radar Altimeter Power Switch
2. Height Scale Indicator
3. Height Range Selector (0-120 m vs 120-1200 m)

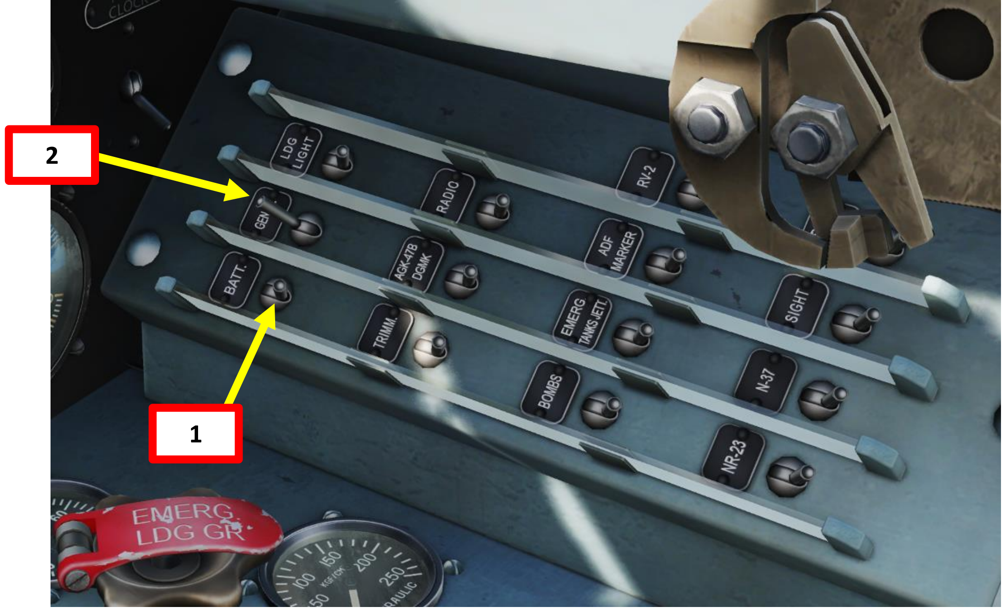


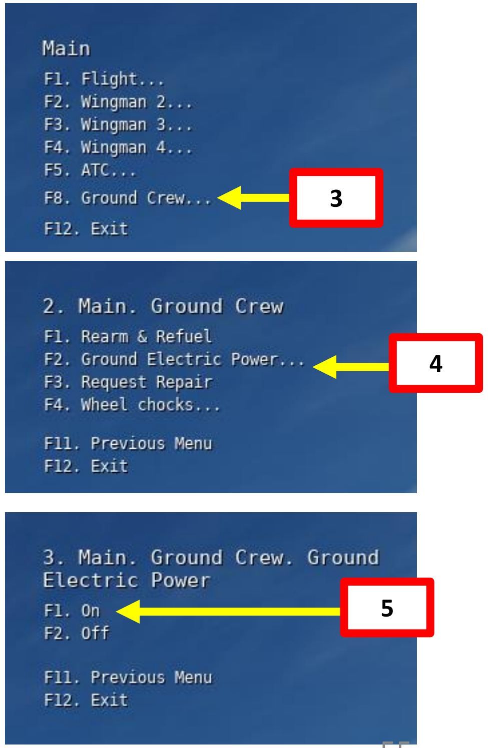
1. Battery
2. Oxygen bottles
3. ASP-3N automatic gunsight
4. Armoured windshield
5. Pilot's ejection seat
6. Sliding portion of the canopy
7. Pitot tube
8. Radio antenna
9. Hydraulic fluid tank
10. VK-1 engine and gearbox
11. Rear fuel tank
12. Vertical stabilizer
13. Rudder
14. Tail navigation light
15. Elevator trim tab
16. Elevator
17. Speed break
18. Flap
19. Aileron trim tab
20. Aileron
21. Left wingtip navigation light
22. Main landing gear
23. Wing fence
24. Forward fuel tank
25. Extendable armament undercarriage
26. Nose landing gear
27. Nose cone with headlight

START-UP

START-UP

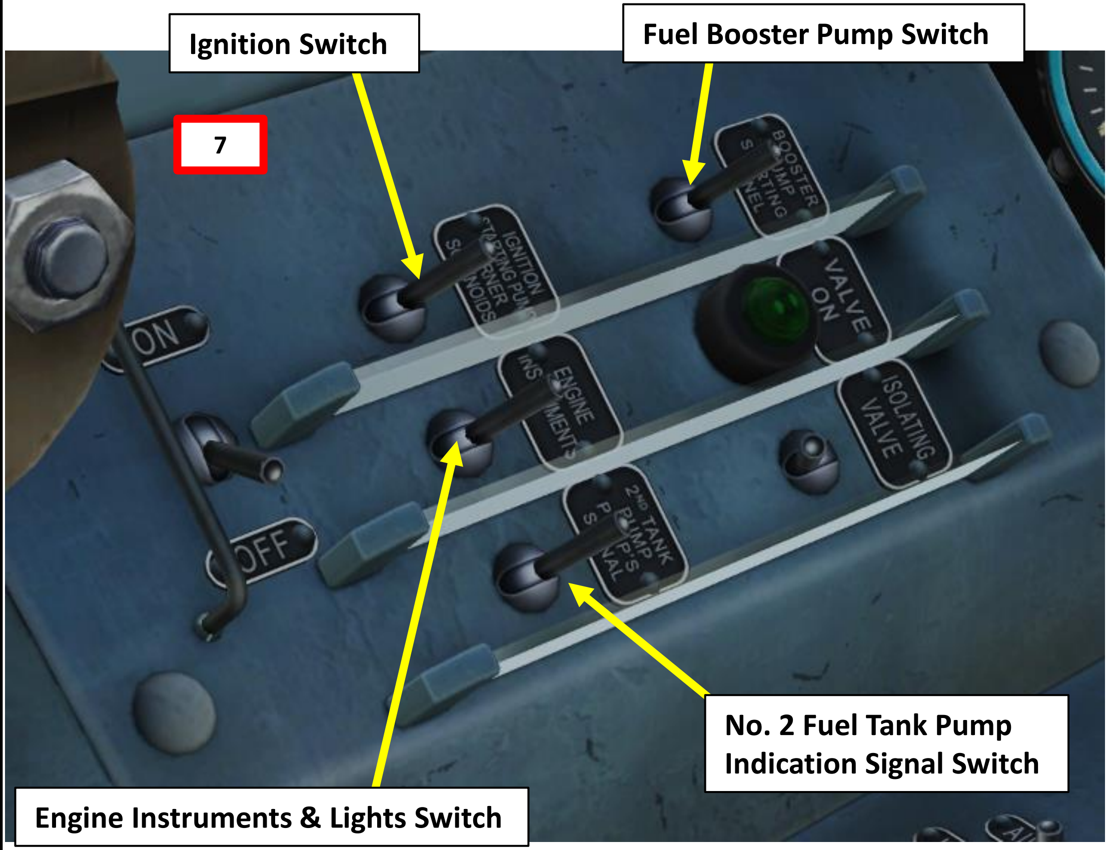
1. Set АККУМ / Battery / Accumulator Switch OFF (AFT)
2. Set ГЕНЕР / Generator Switch ON (FWD)
3. Select your ground crew by pressing "\" AND F8.
4. Select "GROUND ELECTRIC POWER" by pressing F2
5. Select "ON" by pressing F1 to turn on ground power

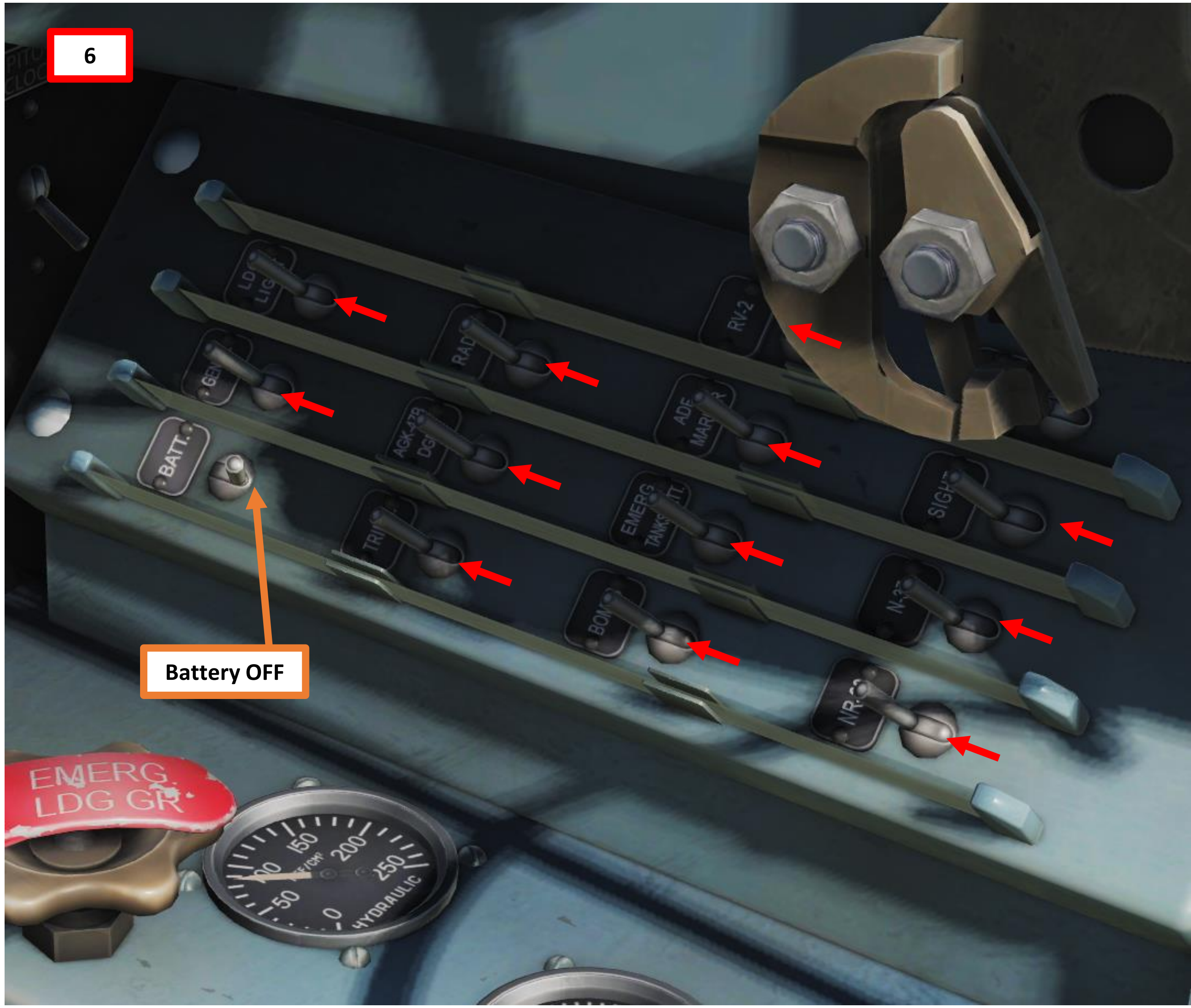




START-UP

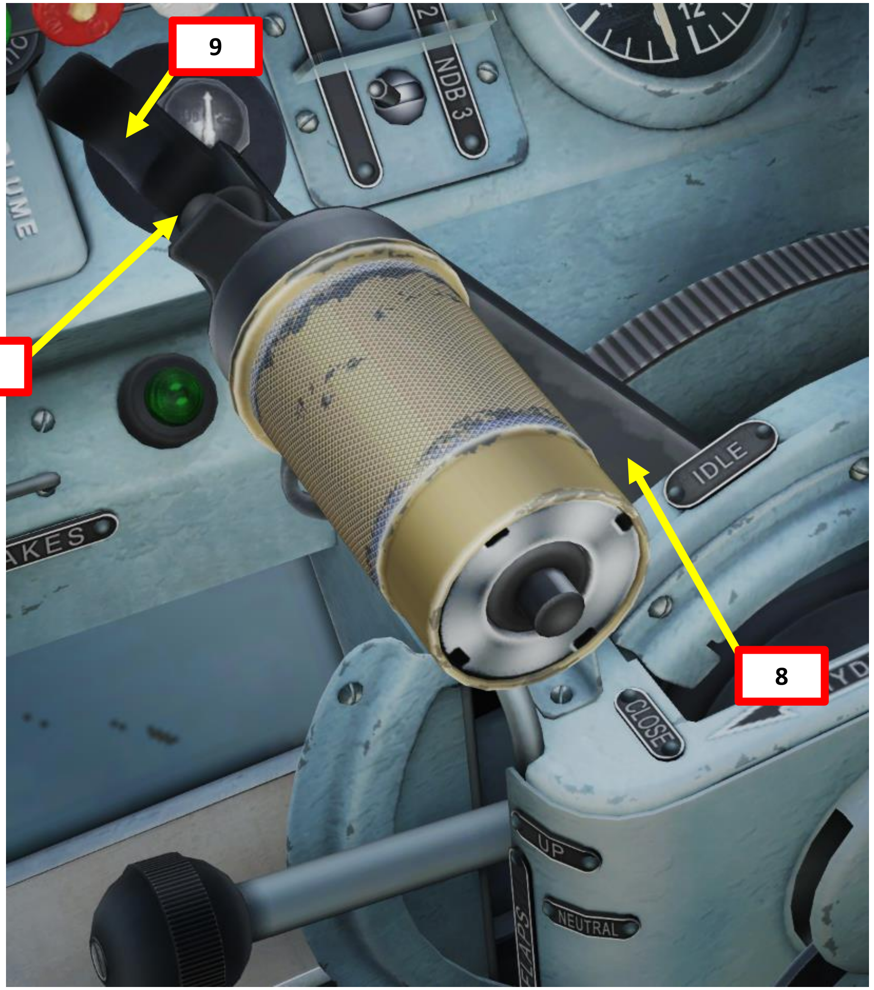
6. Turn ON (FWD) all switches on the right circuit breaker panel except the Battery/Accumulator (АККУМ) Switch.
    - The reason why we keep the battery OFF is that the ground power connected to the aircraft is currently providing electrical power.
7. Turn ON (FWD) the Fuel Boost Pump Switch, the Ignition Switch, the Fuel Transfer Pump Switch and the Instruments/Lights Switch.

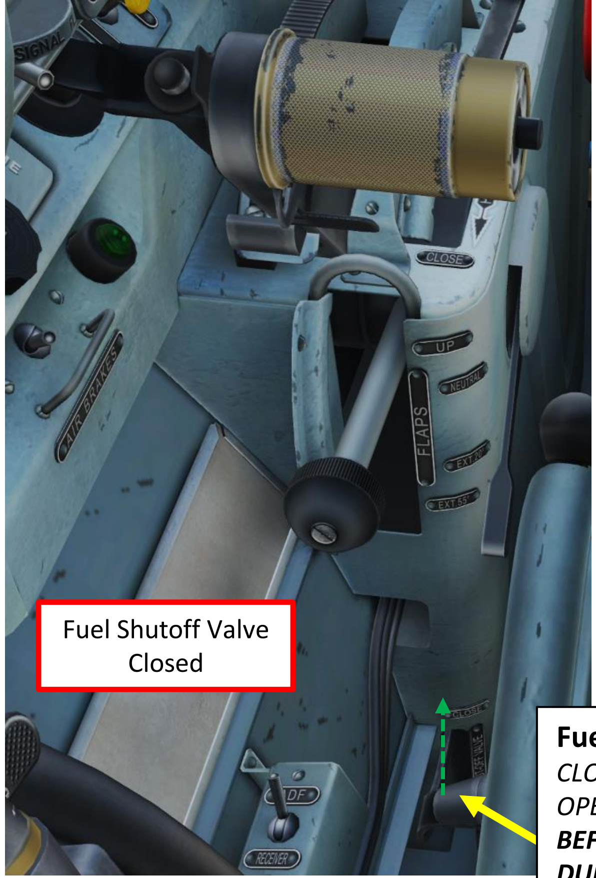


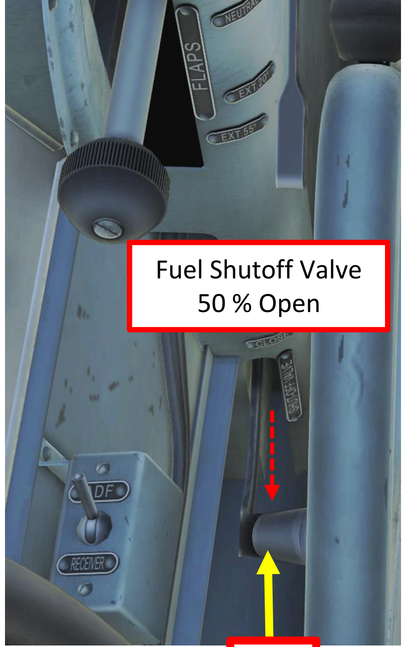


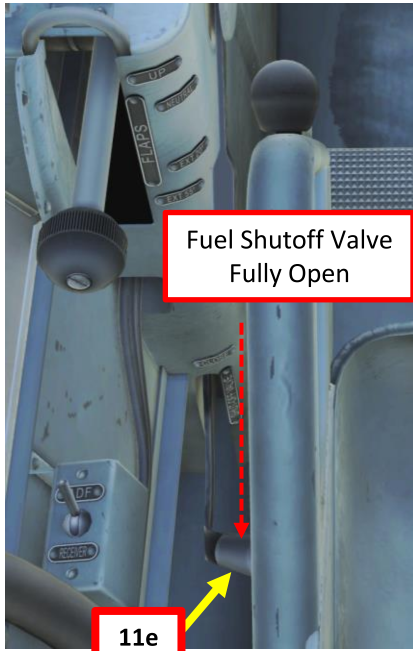
START-UP

8. Set Throttle to IDLE (Fully Aft)
9. Lift the Starter safety cover (Left Click)
10. Hold the Starter Switch for 1-2 seconds to engage the Engine Starter
11. Open Fuel Shutoff Valve to 50 % (HOME key binding) when engine reaches 600 RPM. When engine reaches 900-1200 RPM, fully open the valve by either scrolling the mousewheel or holding RSHIFT+HOME. During this whole process, the Fuel Shutoff Valve should open up by setting the lever from UP to DOWN.



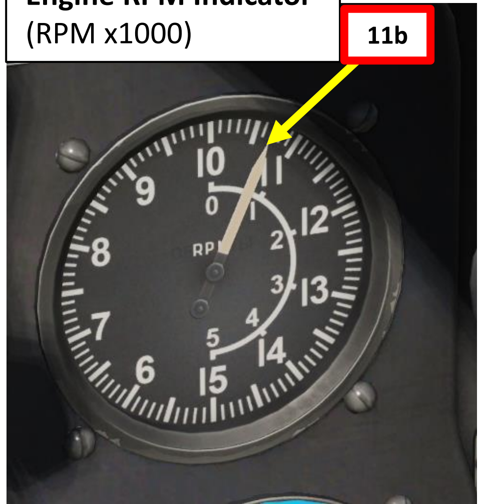






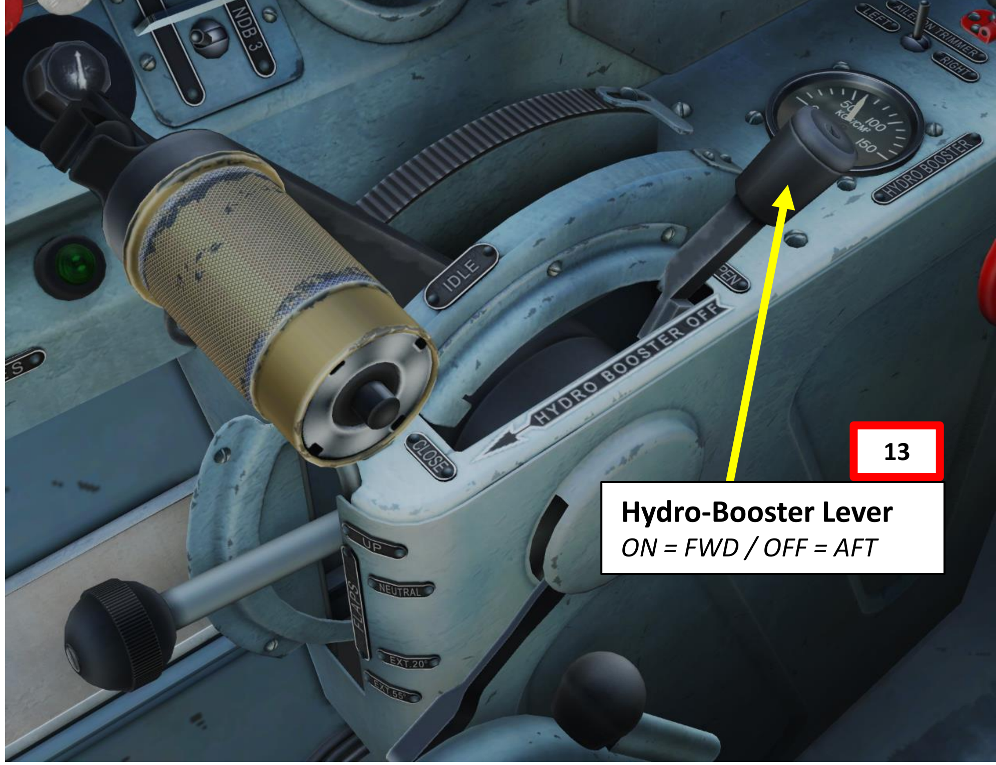
Fuel Shutoff Valve 11a
CLOSED = UP
OPEN = DOWN
BEFORE IGNITION – UP
DURING IGNITION – DOWN

Engine RPM Indicator
(RPM x1000)



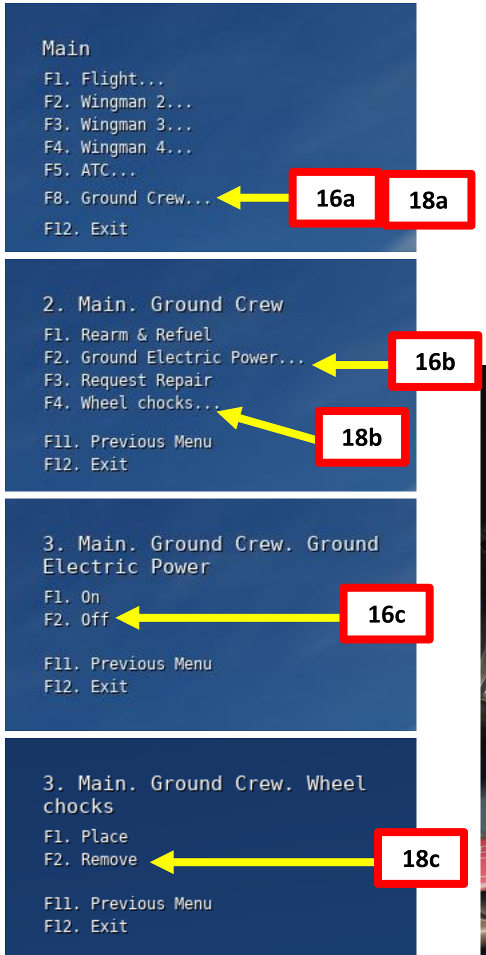
START-UP

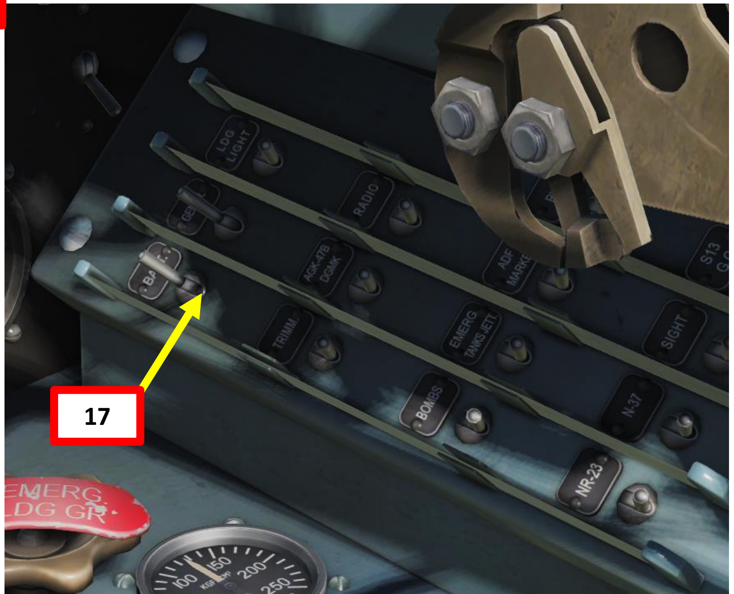
12. Wait until IDLE engine RPM stabilizes around 2400-2600 RPM and EGT (Exhaust Gas Temperature) is no greater than 650 deg C.
13. Make sure Hydro-Booster Lever is ON (FWD)
14. Increase Engine Power to 5000 RPM.
15. Make sure the “GENERATOR OFF” (ГЕНЕРАТОР ВЫКЛЮЧЕН) Warning Light extinguishes once engine reaches 4500 RPM or higher.



START-UP

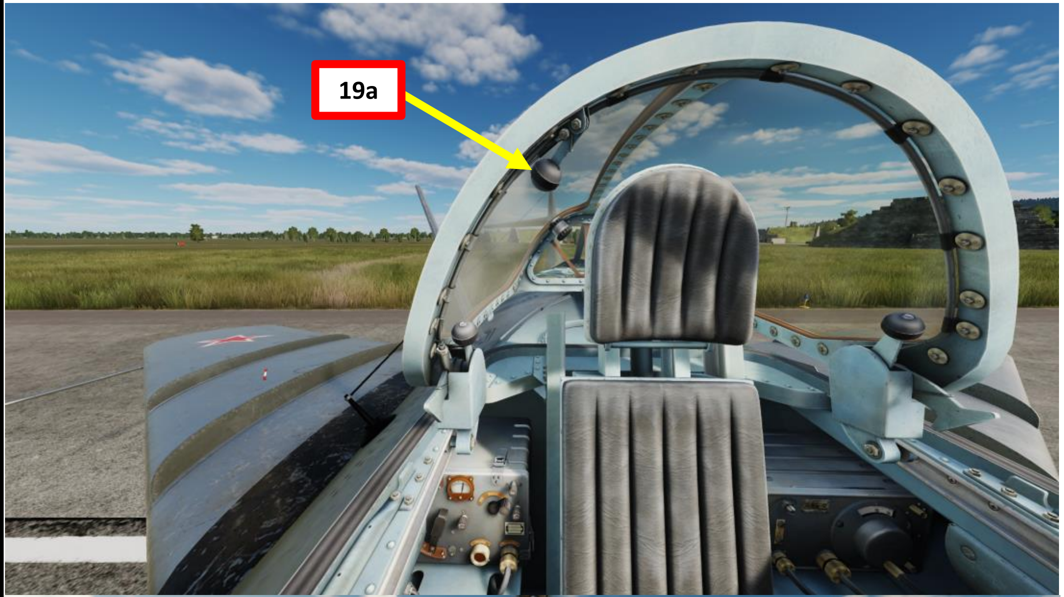
16. Disconnect ground electrical power
    a) Select ground crew by pressing “\” and F8.
    b) Select “GROUND ELECTRIC POWER” by pressing F2
    c) Select “OFF” by pressing F2 to disconnect ground power
17. АККУМ / Battery/Accumulator Switch ON (FWD)
18. If wheel chocks are installed, ask the ground crew to remove them.
    a) Select ground crew by pressing “\” and F8.
    b) Select “WHEEL CHOCKS” by pressing F4
    c) Select “REMOVE” by pressing F2 to remove wheel chocks





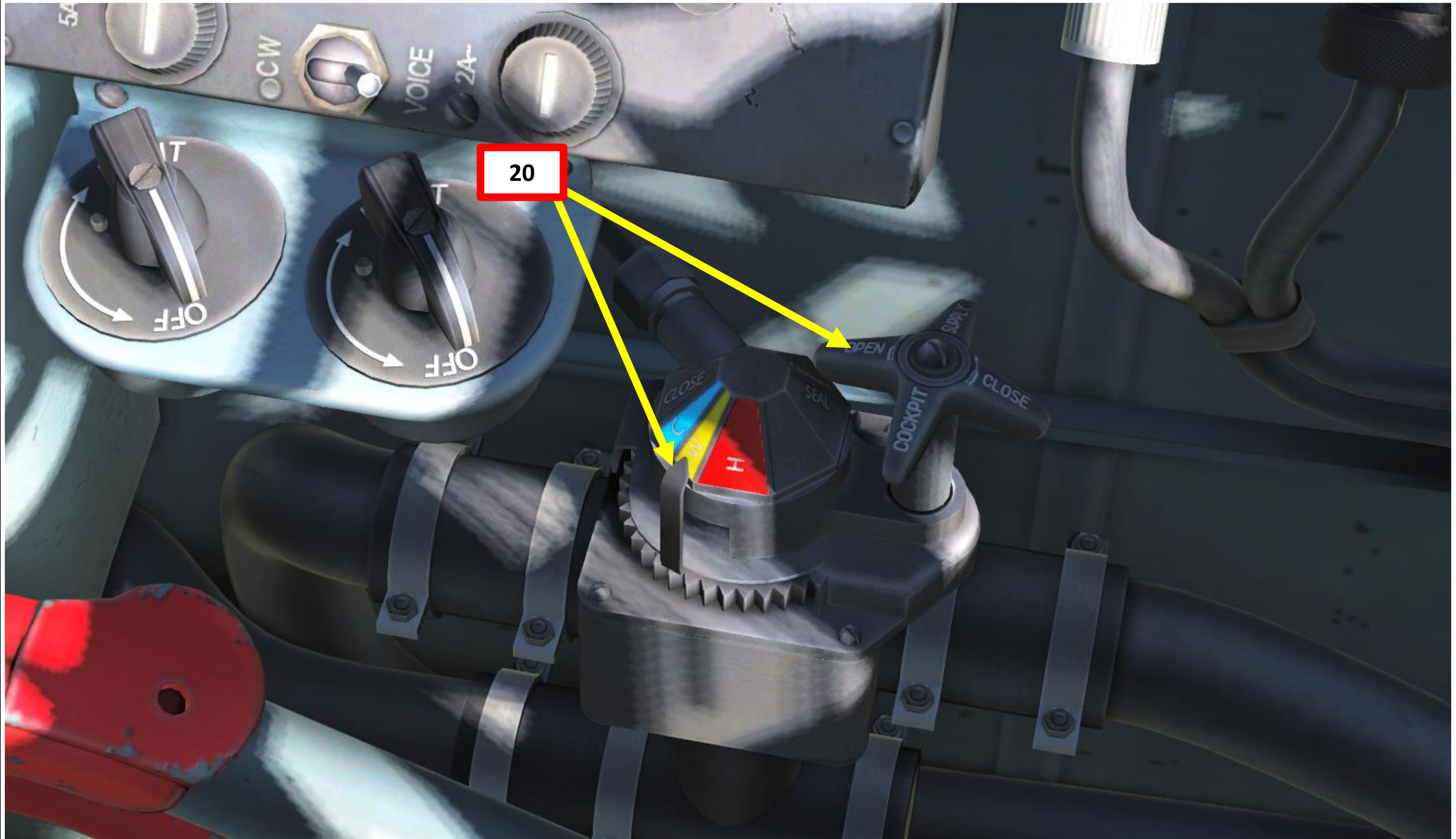
START-UP

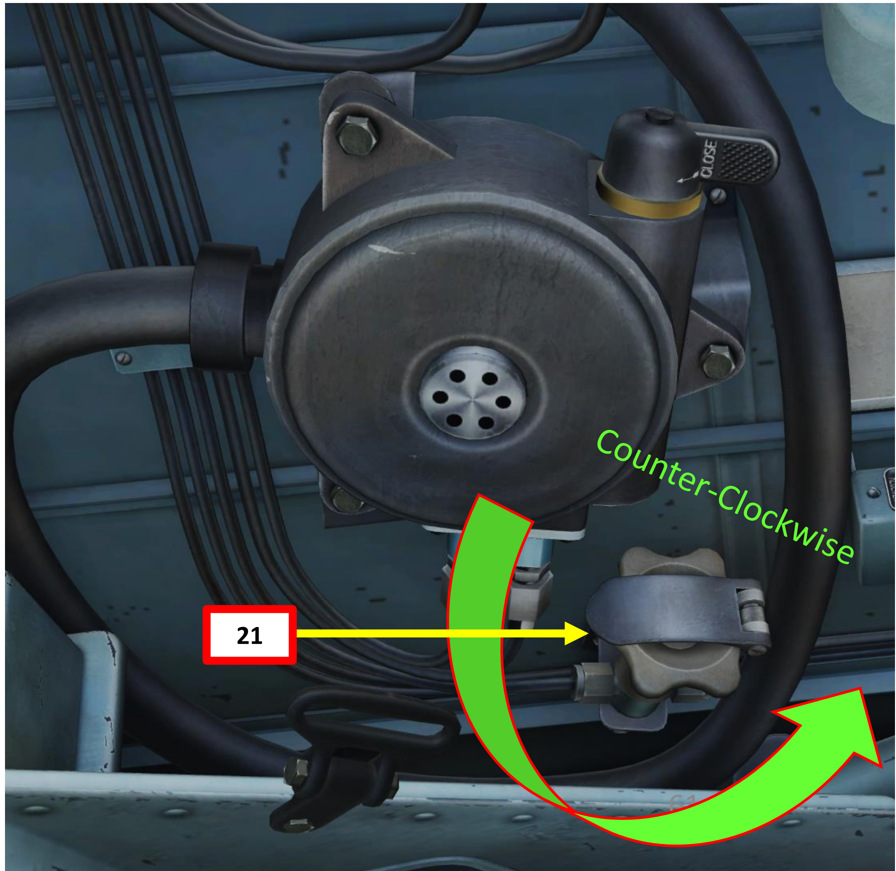
19. Close Canopy (LCTRL + C by default). If cockpit pressurization is ON, a locking mechanism will prevent the canopy from closing.



START-UP

20. Pressurize the Cockpit using the Pressurization Control Valve (Index must be set to Blue, Yellow or Red)
21. Turn Oxygen ON by rotating the valve Counter-Clockwise



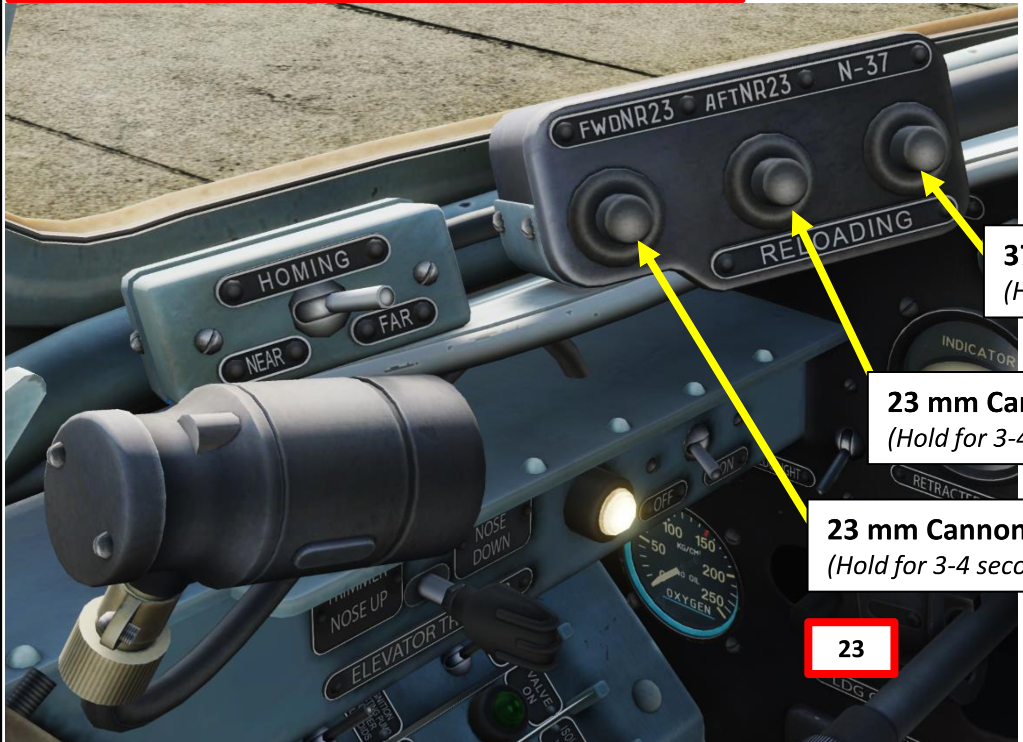


START-UP

22. Unlock your landing gear lever
23. Arm your 23 mm and 37 mm Cannons by holding 3-4 seconds the reload switches, which control the explosive pyrotechnical charges.
24. Confirm that the "ARMED" lights are illuminated.
25. Turn on your Pitot & Clock Heater Switch (UP)
26. You may now start taxiing. Use your wheel brake lever and rudder pedals to steer the aircraft.

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-19 and the L-39ZA use a similar system.



37 mm Cannon Reload Button
(Hold for 3-4 seconds)

23 mm Cannon #2 Reload Button
(Hold for 3-4 seconds)

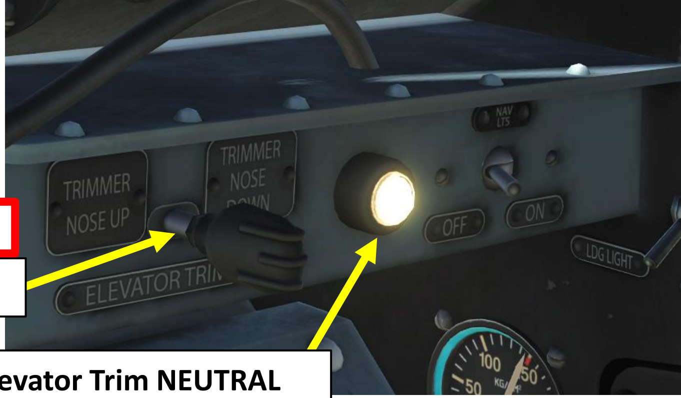
23 mm Cannon #1 Reload Button
(Hold for 3-4 seconds)

START-UP

TAKEOFF

TAKEOFF

1. Line up on the runway using your wheel brake lever and rudder pedals to steer the aircraft.
2. Set elevator trim to NEUTRAL. Confirm the Elevator Trim NEUTRAL Setting Warning light is illuminated.
3. Make sure your flaps are up and your airbrakes are retracted. If you have a short runway, you can use 20 degrees of flaps.



2

Elevator Trim Switch

Elevator Trim NEUTRAL Setting Warning Light

Wheel Brake Lever

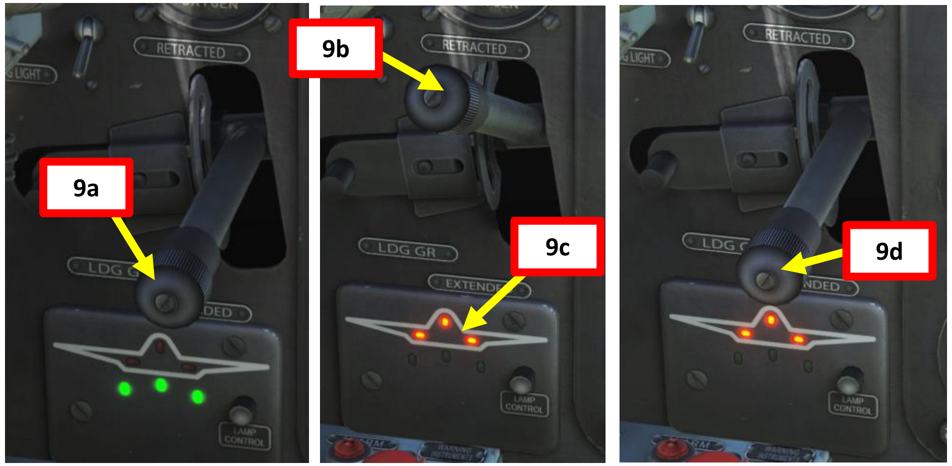
1

TAKEOFF

4. Hold wheel brake lever and throttle up to 8000-9000 RPM.
5. Release brake and throttle up to Maximum RPM.
6. From 0 to 80 km/h, use your brake and rudder pedals to steer the aircraft. Your rudder alone is ineffective at these low speeds. Use your rudder to steer once you reach 80 km/h or higher.
7. Pull your stick slightly back when you reach 180-190 km/h to gently lift the nosewheel.
8. Rotate at 220-230 km/h. Take special care not to pull too hard on the stick on you will stall, crash and burn.

TAKEOFF

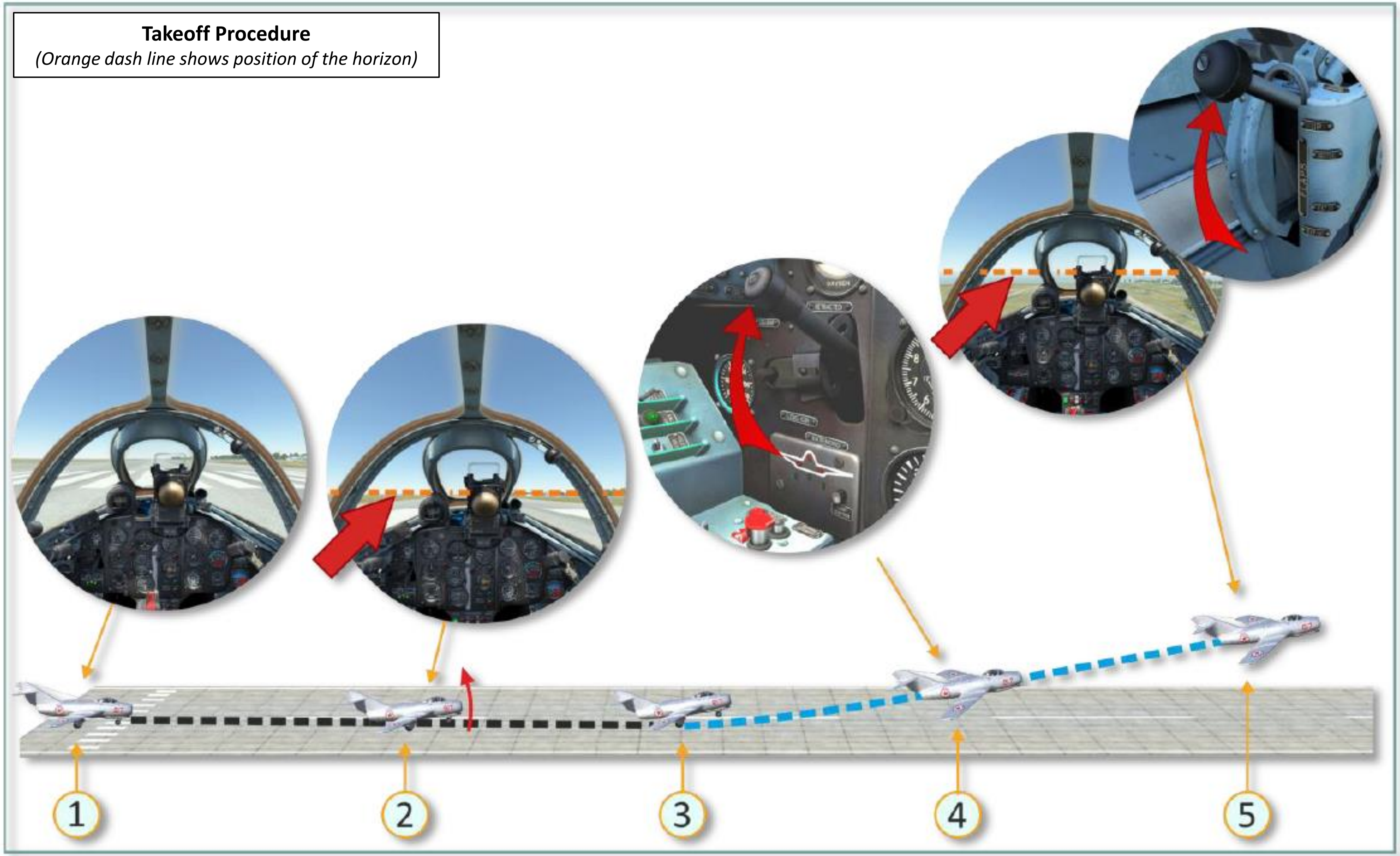
9. When airspeed is between 350 and 400 km/h, set your landing gear lever UP, wait for the indicator lights to go from green to red, then set the landing gear lever to NEUTRAL.



TAKEOFF

10. Once airborne, make sure your flaps are retracted (if they were deployed) and set the flaps lever to NEUTRAL.
11. Maintain a vertical speed of around 7 to 8 m/s initially. Recommended climb speed is 500 km/h.

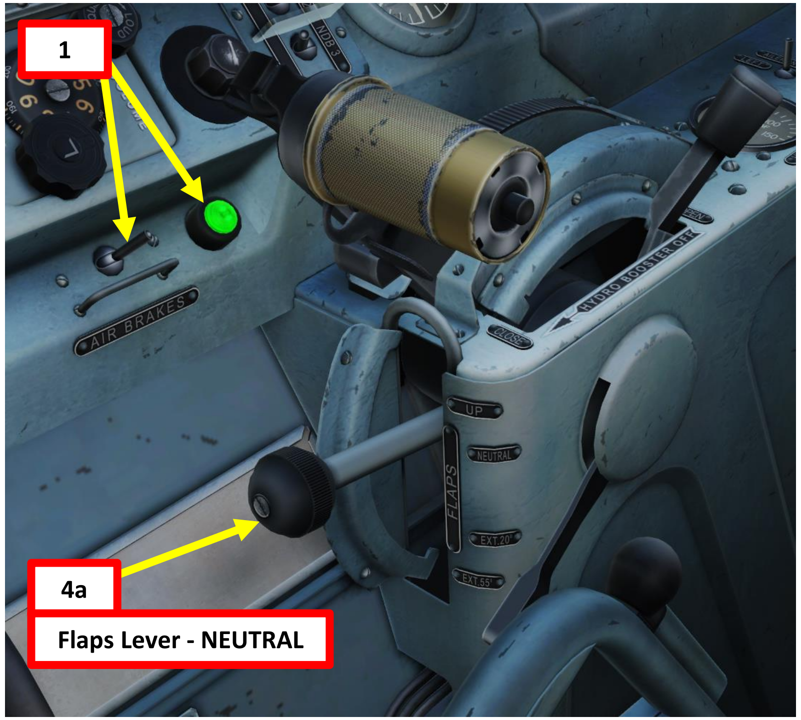
TAKEOFF

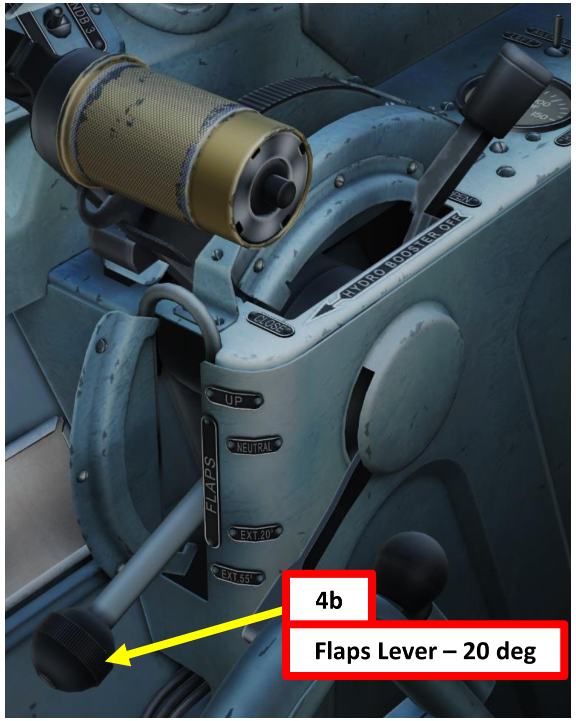

Takeoff Procedure
(Orange dash line shows position of the horizon)
1
2
3
4
5

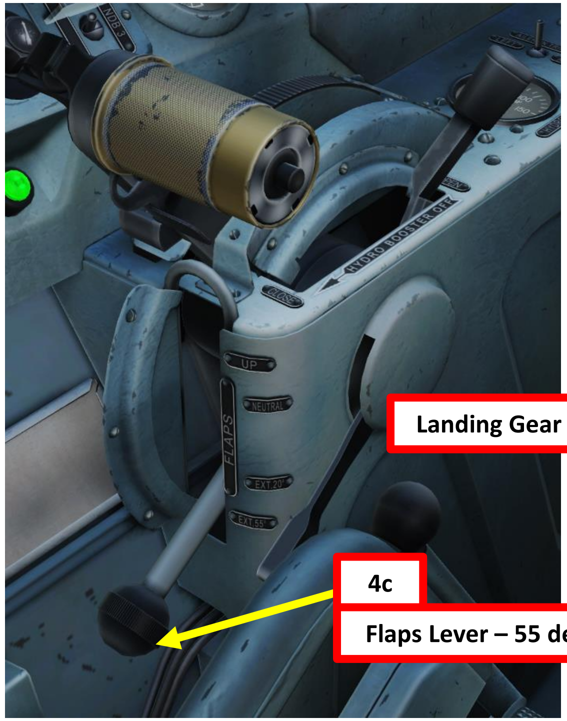
LANDING

LANDING

1. Deploy airbrakes (“Air Brakes” Switch FWD) and line up with the runway. Confirm that the Airbrake light illuminates
2. Reduce airspeed to 400-450 km/h.
3. Set engine RPM to approximately 9000. Deploy landing gear once airspeed is below 400-450 km/h. Landing gear extension time should be about 10 seconds.
4. Slow down to 320-350 km/h, then deploy flaps to 20 deg. Wait for 2-3 seconds, then set flaps lever to 55 deg.

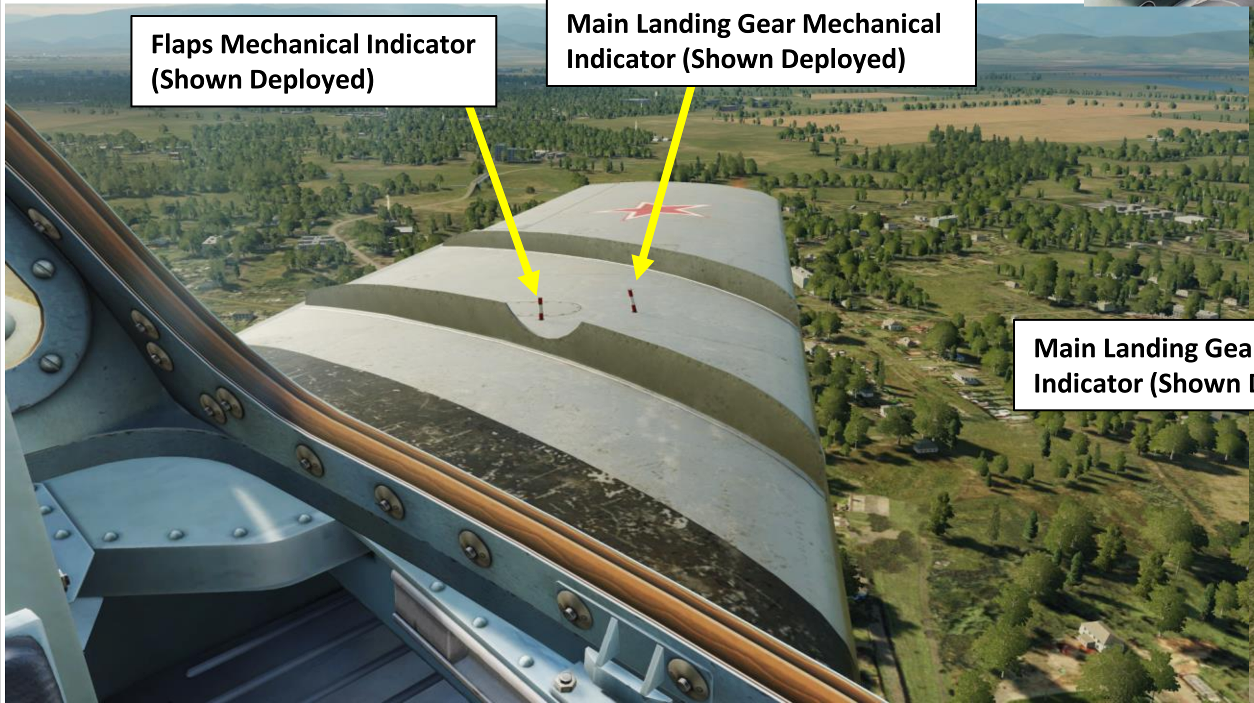


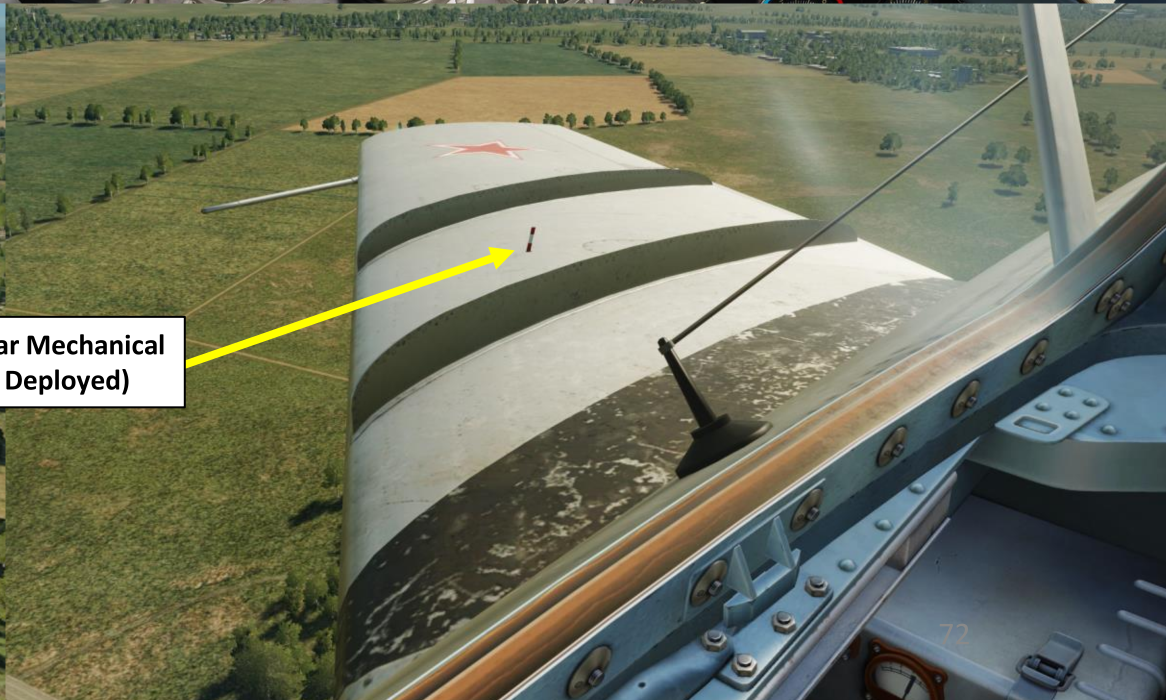




LANDING

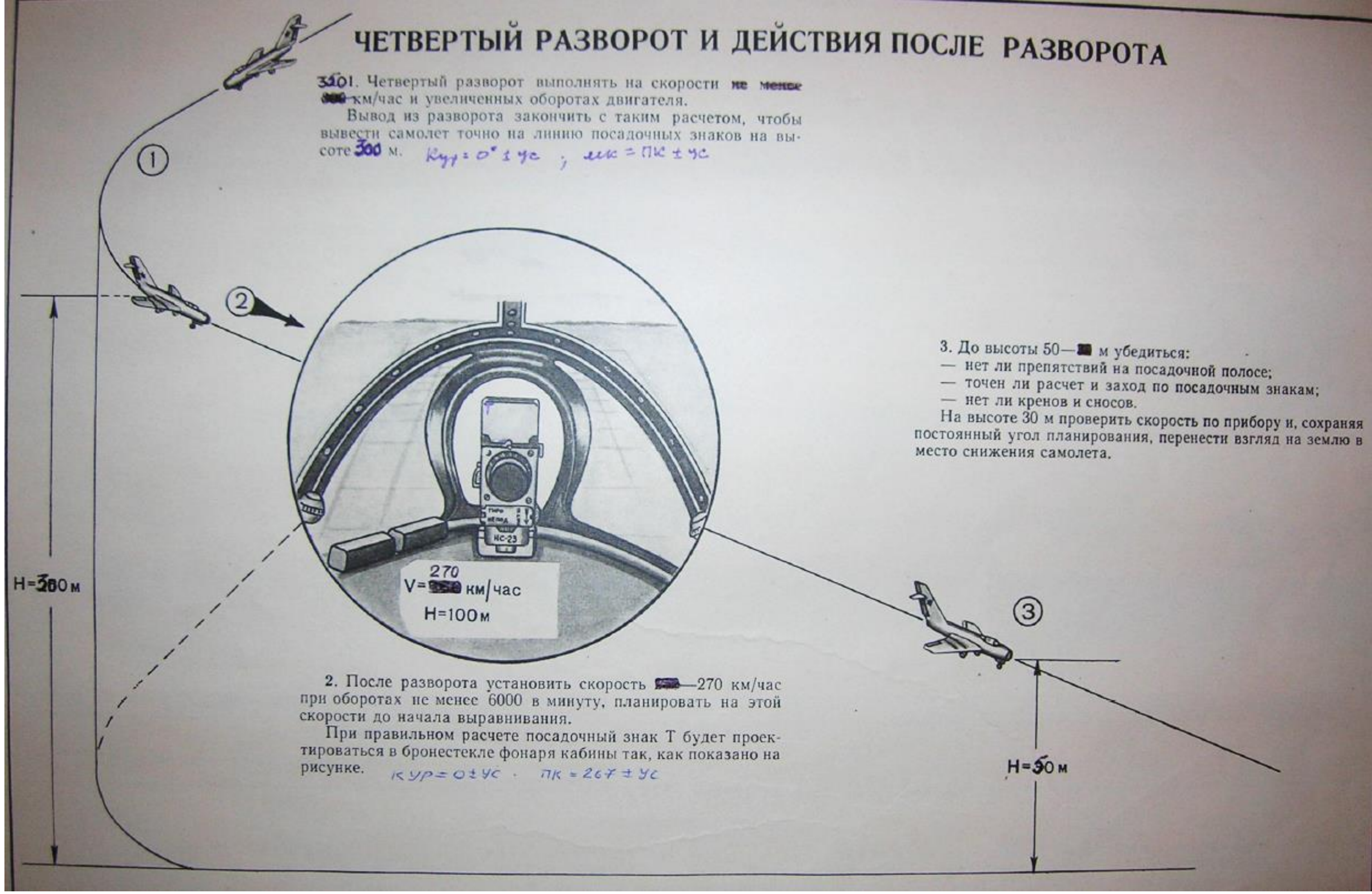
5. Confirm that the Flaps light is illuminated, and that the Landing Gear indicator lights are green. Confirm flaps and landing gear deployment by checking the flaps, main gear and nose gear pins on the wing and aircraft nose.

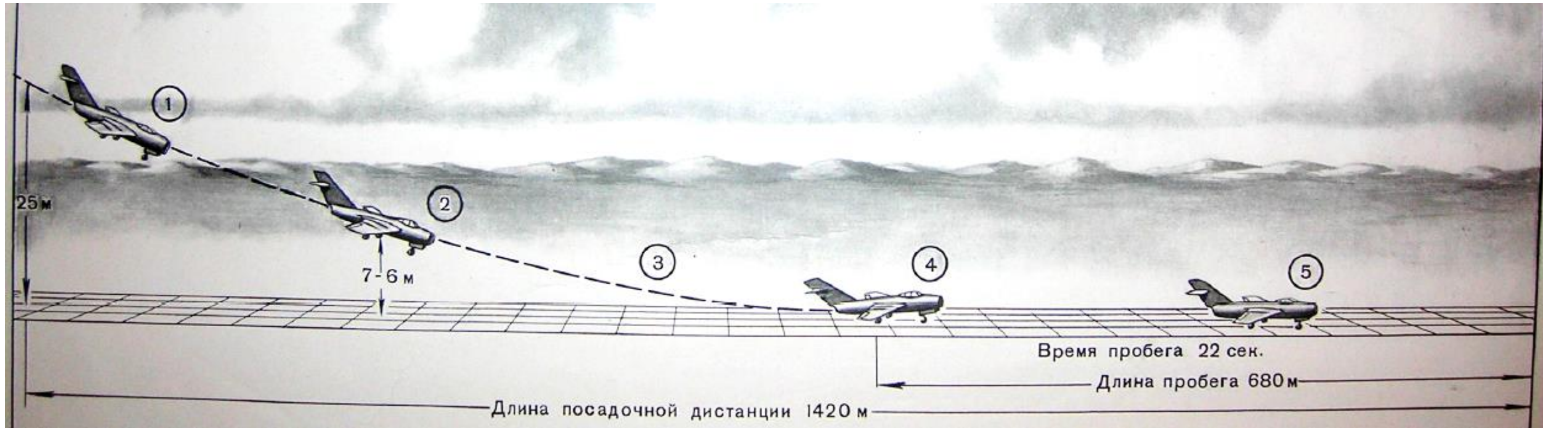




LANDING

6. Final approach is at 250-270 km/h.
7. Set engine power around 7000-9000 RPM. Avoid reducing power below 6000 RPM and keep your airspeed higher than 200 km/h at all times during the approach. This will reduce the risk of inducing a nasty stall.
8. With a speed of 260-270 km/h (engine RPM at least 6000, descent rate of 7-8 m/s), glide to the beginning of the landing flare.
9. At an altitude of 6-7 m, slightly pull back the stick to start decreasing the descent rate in such a way that the aircraft stops descending at an altitude of not more than 1 m. During the flare, decrease engine RPM to the minimum and maintain constant pitch and roll.
10. Touchdown speed is 200-220 km/h.
11. During the flare, speed gradually decreases to 180-200 km/h. As the speed decreases, the pilot increases pitch by pulling the stick towards him and thus deflecting the elevators upwards to keep the lift force counteracting the aircraft's weight constant. The airplane gradually and smoothly descends from 1 m altitude to touchdown.
12. Set throttle to IDLE after touchdown.
13. Gently press the wheel brake lever to slow down.
14. Once runway is cleared, retract flaps and airbrakes. Taxi to parking area, then perform aircraft shutdown.





LANDING

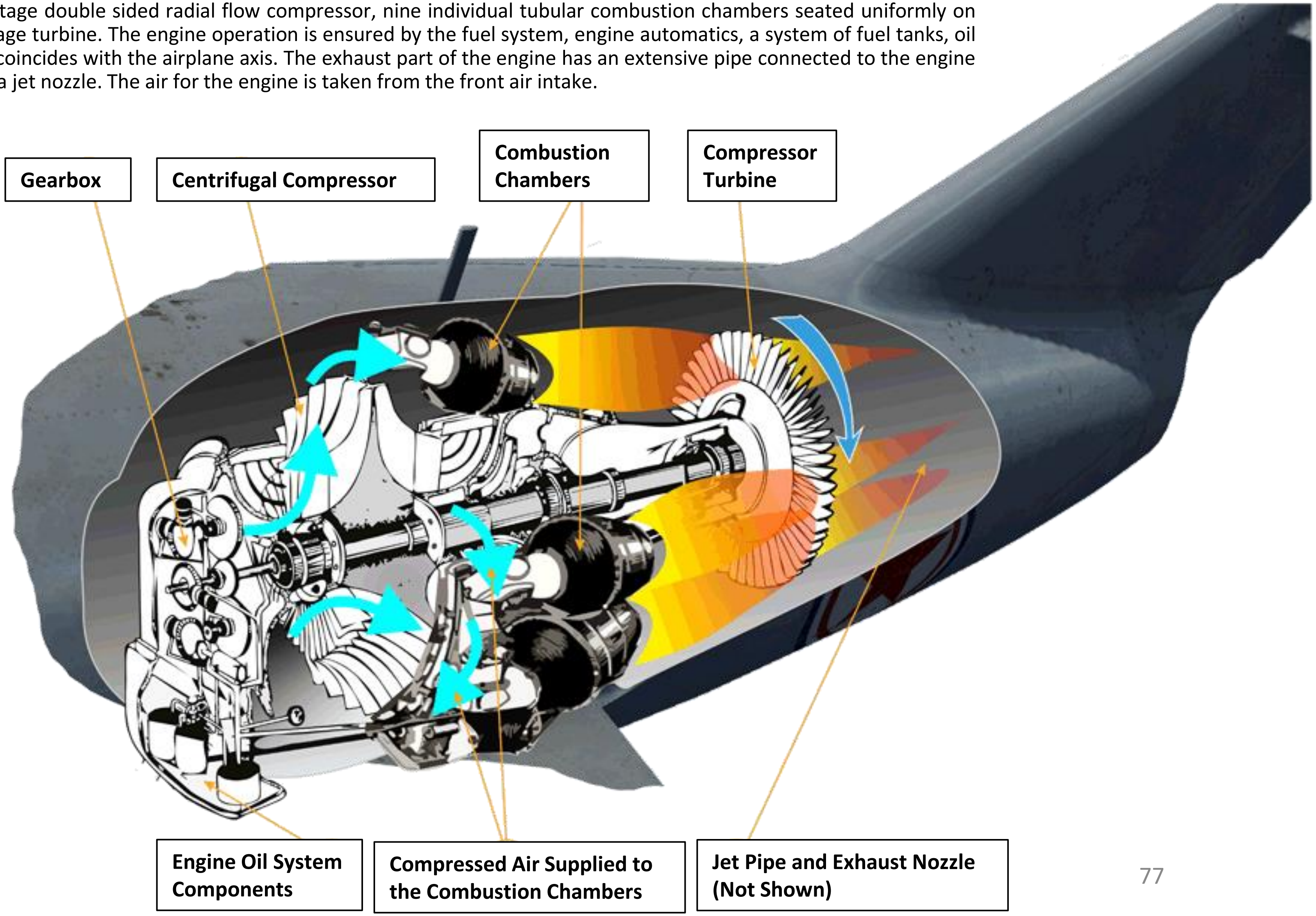
LANDING

KLIMOV VK-1 ENGINE

The **Klimov VK-1** ("Vladimir Klimov-1") was the first Soviet jet engine to see significant production and was first produced by the GAZ 116 works. It was derived from the British Rolls-Royce Nene.

The VK-1 is a single shaft turbojet engine with a single stage double sided radial flow compressor, nine individual tubular combustion chambers seated uniformly on the outer part of the compressor housing and a single stage turbine. The engine operation is ensured by the fuel system, engine automatics, a system of fuel tanks, oil system, and a fire extinguishing system. The engine axis coincides with the airplane axis. The exhaust part of the engine has an extensive pipe connected to the engine by a special movable joint. The extensive pipe ends with a jet nozzle. The air for the engine is taken from the front air intake.

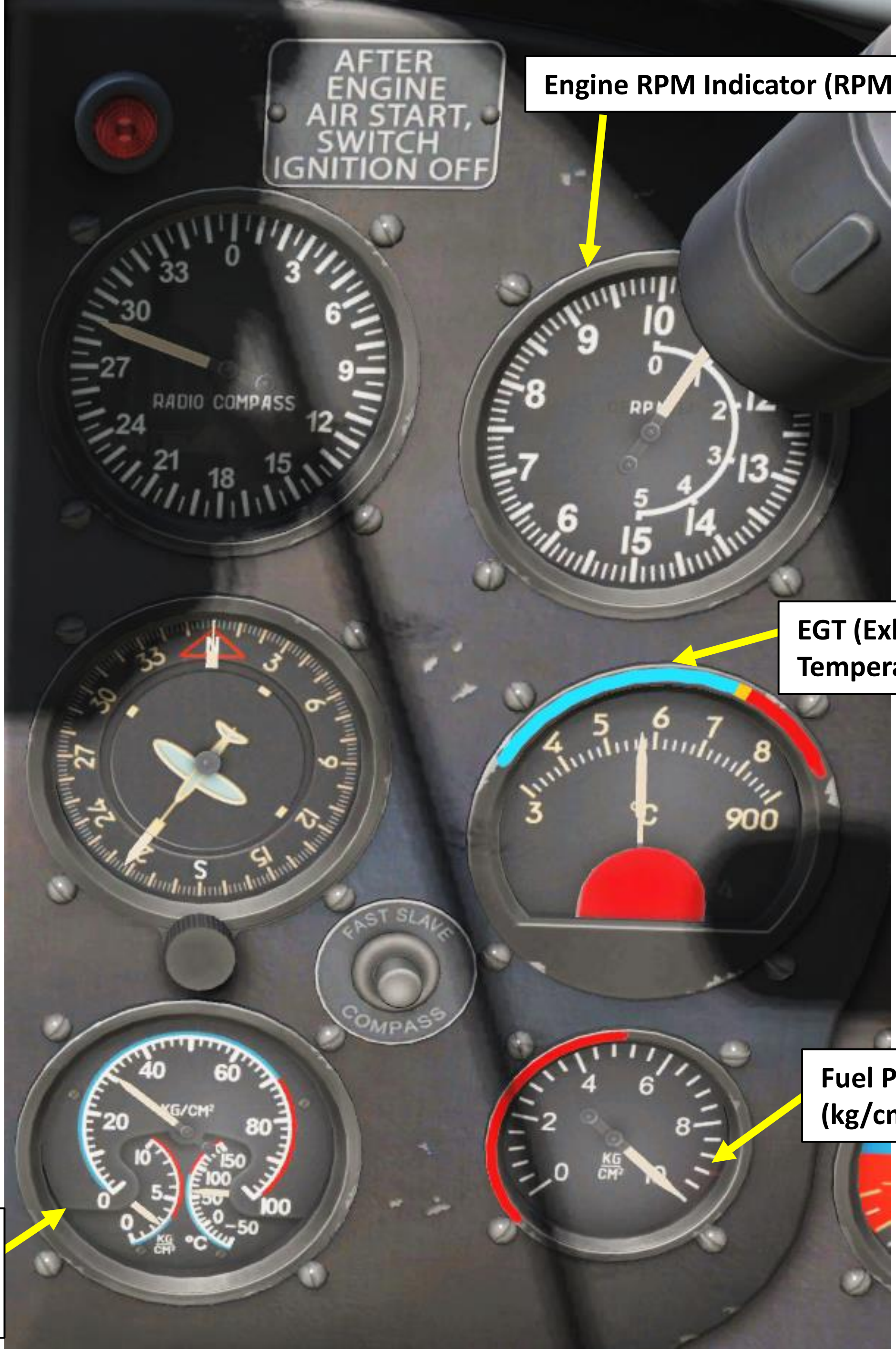
VK-1 Engine Characteristics	
Maximum Thrust	2700 kg
Specific Fuel Consumption	1.07 kg/(kgf*h)
Airflow Rate	48.2 kg/s
Compression Ratio	4.2 – 4.5
Tc Max	1170 Kelvins
Length	2640 mm
Diameter	1270 mm
Dry Weight	870 kg
Service Life	200 hours



ENGINE INDICATIONS

Here is an overview of the different engine parameters you need to monitor:

- Tachometer: Engine RPM in thousands
- Exhaust Gas Temperature (EGT) in deg C
- Fuel Pressure (kg/cm^2)
- Engine Oil Pressure (kg/cm^2)
- Engine Oil Temperature (deg C)



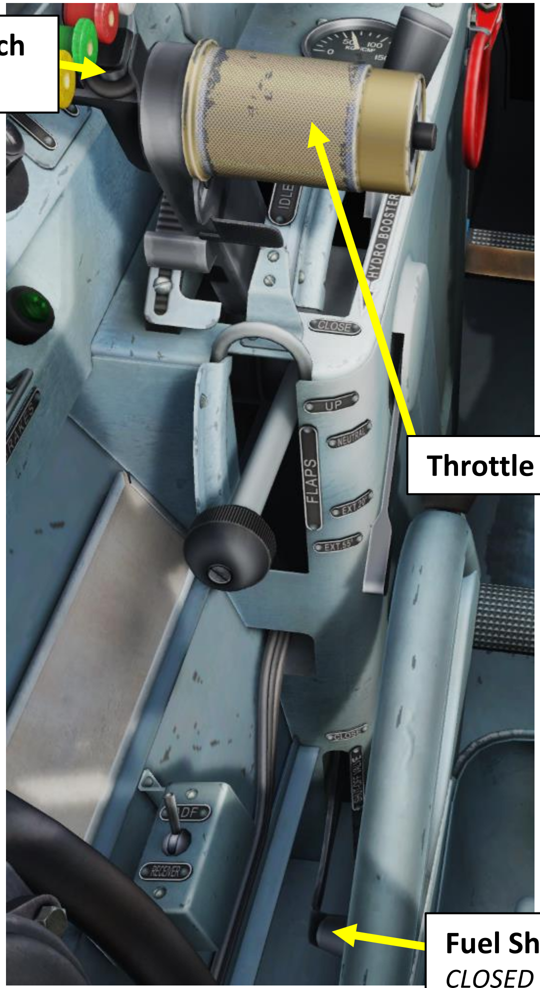
ENGINE CONTROLS & MANAGEMENT

The engine is managed with the **throttle**. The engine throttle is connected with the **butterfly valve lever** on the right side of the engine by a system of rigid rods.

The butterfly valve lever has two positions: one for engine start on the ground and one for restart in the air. The shut-off valve disconnects the fuel flow in case of engine shutdown or engine fire. The shut-off valve itself performs the function of opening/closing the fuel line for the engine. It is installed on the left side of the engine. The engine is controlled by the throttle from the cockpit. By moving the throttle forward the pilot affects the fuel supply to the combustion chamber. More fuel to burn causes the increase of the exhaust gas energy which increases the rpm of the compressor turbine and the air flow rate, so the combustion chamber is now “ready” to take more fuel. It is the “readiness” of the combustion chamber to take a certain amount of fuel based on the minimum possible amount of air for a stable burning of this fuel that requires that the throttle be moved smoothly.

The only temperature you need to keep an eye on is the EGT (Exhaust Gas Temperature). Make sure the temperature is within serviceability and safety limits (blue zone). Engine temperature can only be controlled by reducing or augmenting engine RPM with the throttle.

Max Engine EGT should be no more than **650-700 deg C** at all times.



ENGINE COMPRESSOR STALL

Compressor stall may occur when you move the throttle too quickly. You will notice a sudden loss in engine RPM and hear a loud “BANG”. The VK-1 engine is slow to respond to throttle input, so it should be treated gently. In case of compressor stall, pull throttle to back 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.

Engine Stall Signs (possible manifestation of one or more issues at the same time):

- Engine RPM hang (reduction)
- RPM unresponsiveness to throttle movements
- Engine overheat.

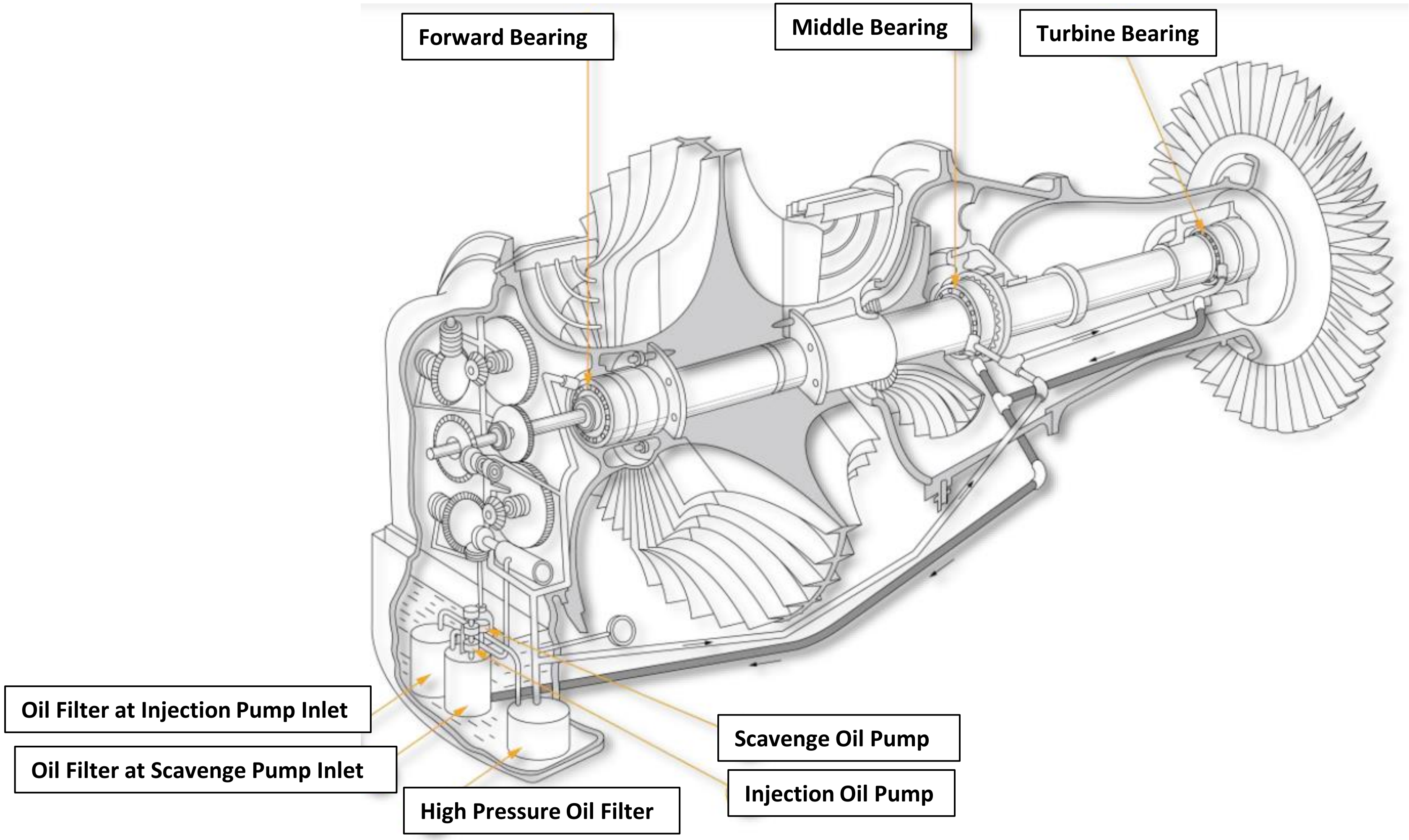
Engine Stall Recovery Actions:

1. Move throttle to idle until normal temperature and RPM values are reached (possible before the stable RPM reduction to idle position).
2. Move throttle smoothly after.

ENGINE OIL SYSTEM

The engine oil system is mounted fully on the engine and does not have any elements on the aircraft. The engine oil system does not require a heat exchanger. As a grease oil, the engine uses the GOST 382-43 oil with a 0.05-0.1% additive of stearin acid.

The box of oil pumps attached to the lower flange of the gearbox serves as an oil tank and can take approx. 7 liters of oil. This box also serves as a housing for two oil pumps, three filters and a pressure reducer valve.

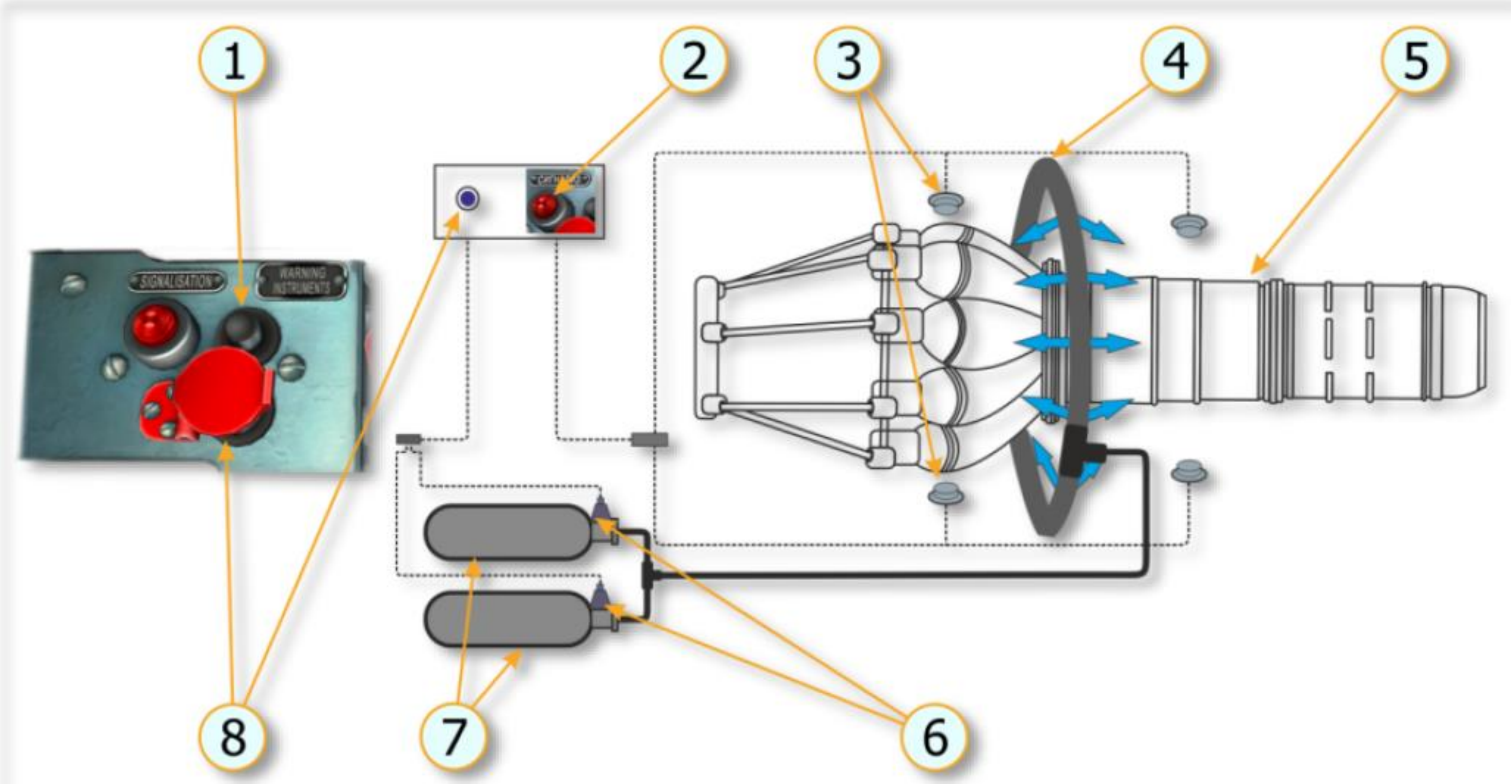


ENGINE FIRE DETECTION & EXTINGUISHER SYSTEMS

The fire extinguishers are designed to extinguish fire in the engine fire risk zone, i.e. in the zone where engine damage leads to an open flame. This zone encompasses the end of the combustion chambers and the turbine housing.

The fire extinguishing system includes:
- Two three-liter pressured bottles with CO2 and squibs;
- Manifold with gas escape ports for dissemination of extinguishing gas;
- Four fire detectors;
- ПОЖАР (FIRE) warning light with corresponding switch in the cockpit.

In case of fire, when the temperature in the engine compartment reaches 120-140°C, a signal from the fire detectors illuminates the ПОЖАР (FIRE) warning light.

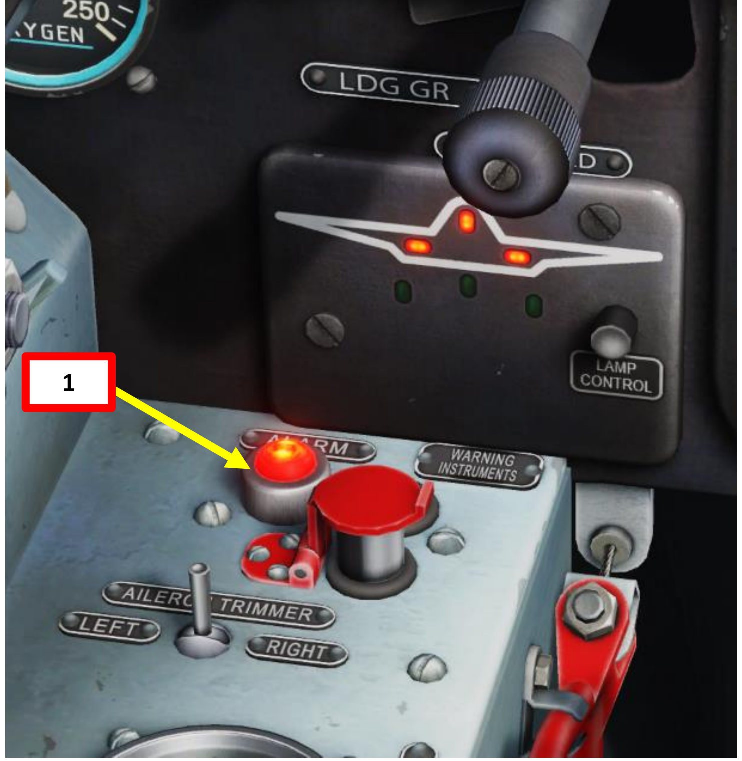


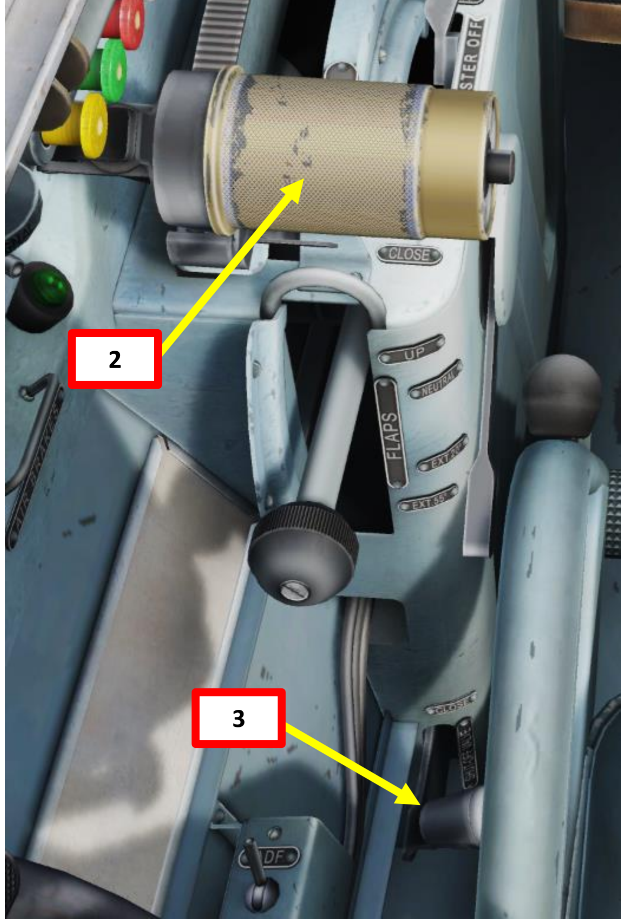
1. **Engine fire warning light test button**
2. **Engine fire warning light**
3. **Fire detectors (4)**
4. **Manifold with gas escape ports for dissemination of extinguishing gas**
5. **Engine**
6. **Squibs**
7. **Extinguisher bottles (filled with CO2)**
8. **Engine fire extinguisher button**

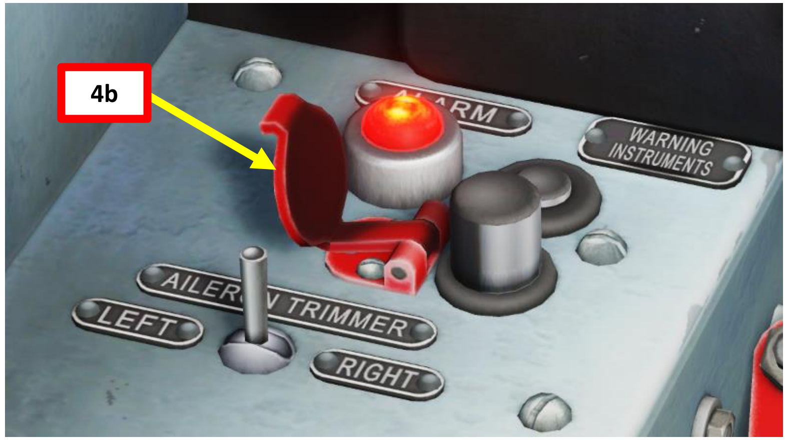
ENGINE FIRE EMERGENCY PROCEDURE

When a fire is detected:

1. The ПОЖАР (FIRE) warning light illuminates.
2. Set throttle to IDLE Detent (FULLY AFT)
3. Switch off the engine by stopping engine fuel supply – set the Shut-off fuel valve lever FULLY UP.
4. Enable the fire extinguishing system by pressing the engine fire extinguisher button – remove the safety cover and then push the button.
5. By pressing the button, each squib fires and moves a piston with a needle, which breaks the membrane and connects the CO_2 tanks with the extinguishing lines. Released from the tanks, the gas is fed into the fire extinguishing manifold via fire extinguishing lines and kills the fire in the engine compartment by being sprayed over.
6. When the fire is stopped, do not attempt to start the engine. Decide whether to land with the engine dead or bail out.







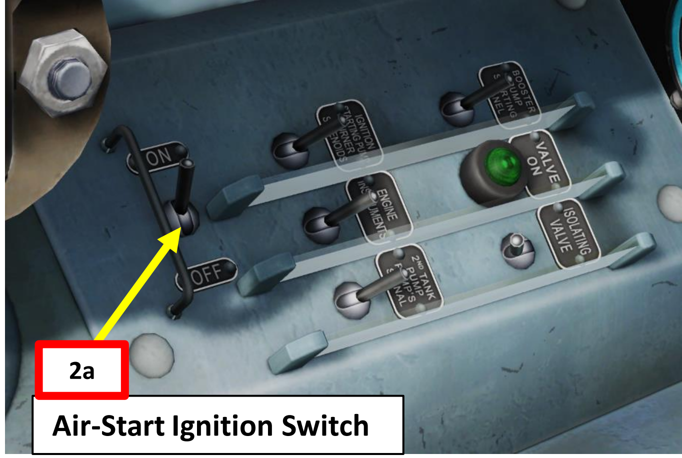
ENGINE RELIGHT (AIR START) PROCEDURE

If you have an engine failure in flight:

1. Decrease altitude and increase airspeed to improve your chances of restarting the engine in-air. Do not attempt to restart an engine at an altitude of more than 6000 m. Before restarting the engine, obtain an airspeed of 300-320 km/h minimum.
2. Set the Air-Start Ignition switch to ON (UP). Simultaneously, the Air-Start Ignition red light should illuminate.
3. Open the shut-off valve 10-15 seconds after engaging the engine starter: Set the Fuel Shutoff Valve Lever DOWN.
    - If the engine won’t start, smoothly move the throttle forward, then backward, to provide the optimal engine restart conditions.
4. When engine RPM starts to increase, deflect the throttle to the IDLE detent and monitor the exhaust gas temperature.
5. Set the Air-Start Ignition switch to OFF (DOWN). Simultaneously, the Air-Start Ignition red light should extinguish.
6. Set the required engine operation mode and switch on the circuit breakers that were switched off earlier.

Notes.

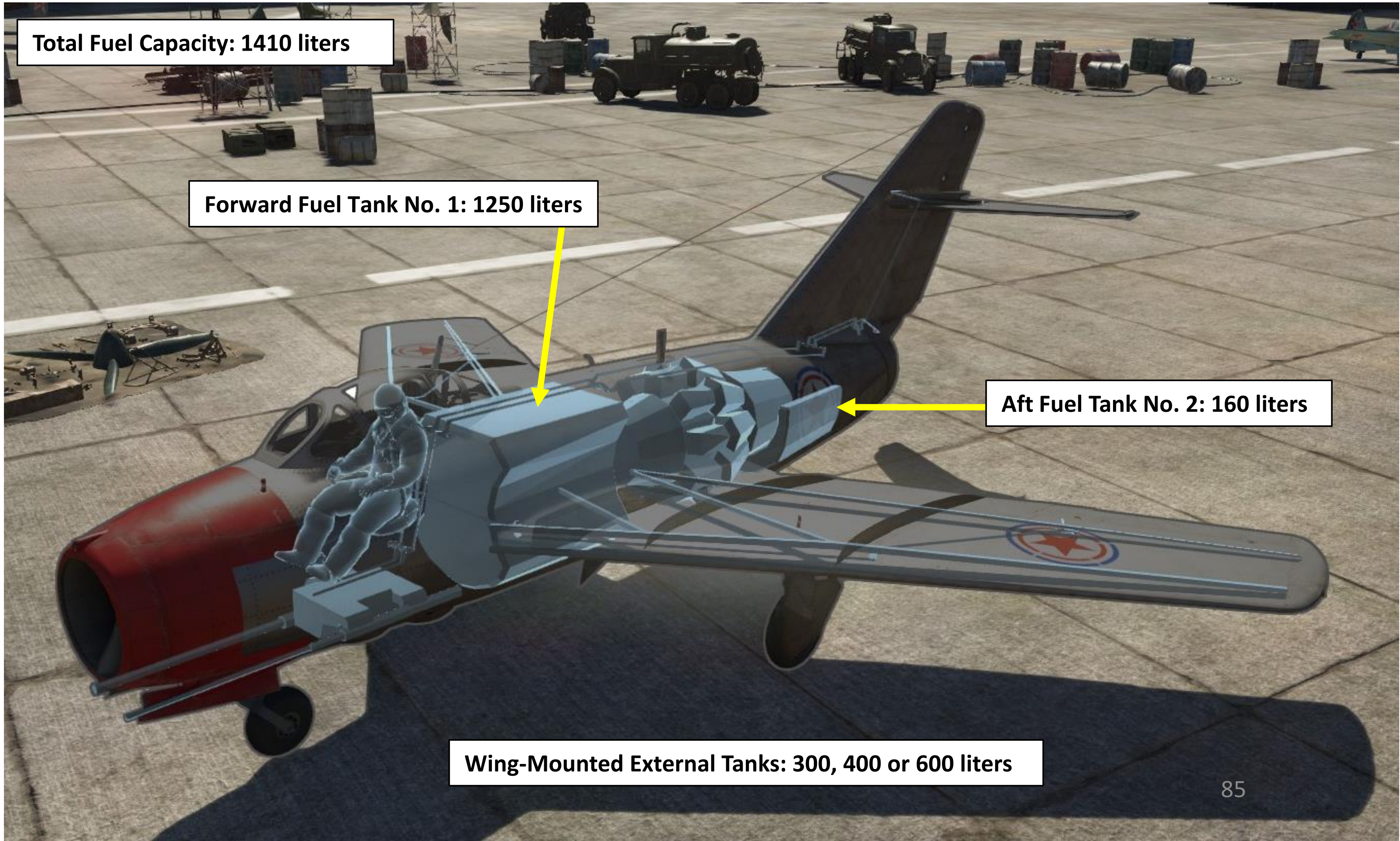
- Before switching off the start ignition, setting the engine to an operation mode (cruise, etc.) is prohibited.
- If the engine won’t start in 40-45 s, close the shut-off valve and switch on the “air ignition”; check if the throttle is on the idle detent.
- Restart the engine at a lower altitude, but not earlier than 20-30 s after closing the shut-off valve.
- If the engine won’t start before an altitude of 2000 m, stop further restart attempts and bail out if there is no suitable area for landing or if it is impossible to land on your aerodrome at night.
- In case of engine shutdown while orbiting, quickly consider your chances of landing at an aerodrome or a previously explored area near the aerodrome.
- Bail out if you have doubts about being able to perform a safe landing.



FUEL TANKS

In the forward fuel tank, the return fuel collector (7) is set to a certain level. Therefore, the fuel is taken from the tanks in the following sequence:

1. 345 liters from the forward tank;
2. From the rear tank (until it will be empty);
3. Remaining fuel from the forward tank.



FUEL INDICATORS

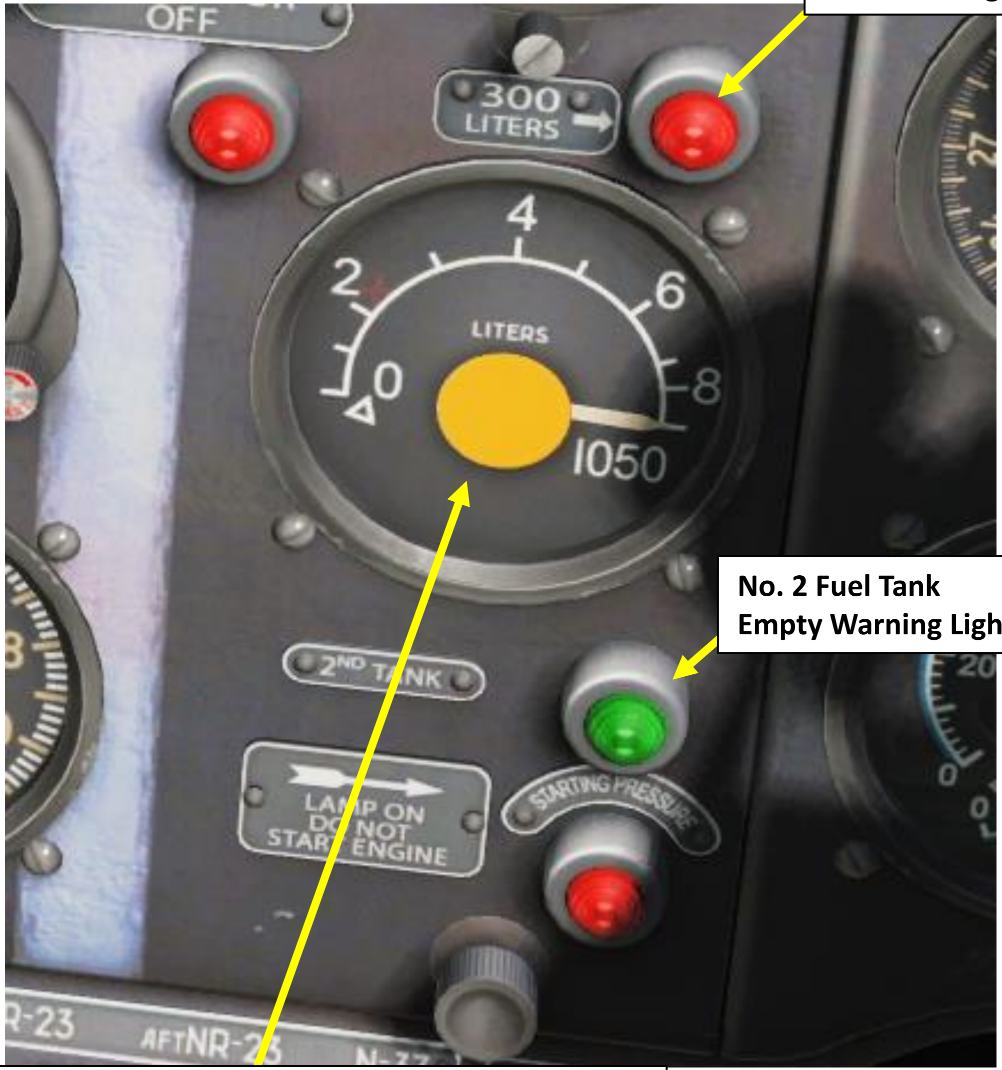
The fuel system consists of two tanks with a total capacity of 1410 liters.

- The forward tank (tank 1) contains 1250 liters
- The rear tank (tank 2) contains 160 liters.

The rear tank consists of two halves – left and right – each of which has a capacity of 80 liters. The fuel quantity is monitored (not fully) by the fuel quantity probe installed in the forward tank and able to measure the fuel quantity from 0 to 1050 liters.

When only 300 liters of fuel are remaining in the forward tank, the fuel meter illuminates the 300 liters warning lamp on the instrument panel.

Wing Drop Tank Empty Light



300 L Remaining Fuel Warning Light

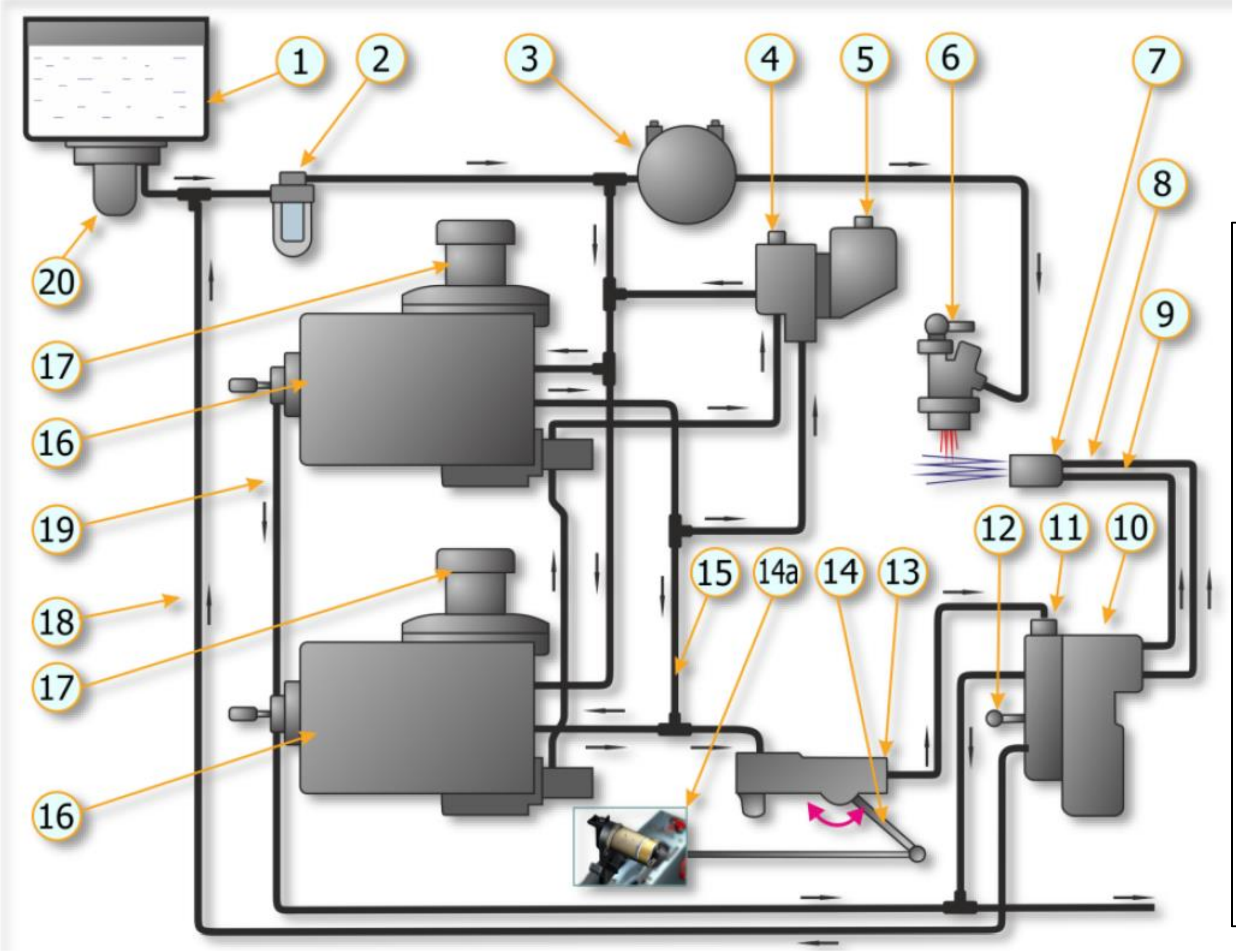
No. 2 Fuel Tank Empty Warning Light

No. 1 Fuel Tank Quantity Indicator (Liters)
Note: this gauge does not monitor the whole fuel quantity of the aircraft. This gauge only monitors the No. 1 (Forward) Fuel Tank from 0 to 1050 liters. The forward fuel tank (No. 1) contains 1250 liters while the aft fuel tank (No. 2) contains 160 liters.

FUEL AUTOMATION SYSTEM

The engine fuel automatics supplies combustion chambers with a certain amount of well atomized fuel needed for normal engine operation. Fuel supply is controlled by fuel pumps. The pilot can set the amount of fuel to be consumed by the engine using the throttle handle, precise fuel dosage is controlled by special regulators.

VKI-1 Engine Fuel Automatics

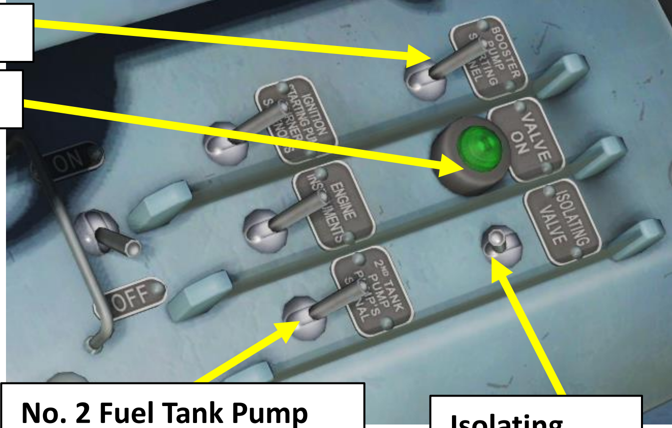


1. Fuel tank
2. Filter
3. Starting fuel pump
4. Barostat isolation valve (servo)
5. Barostatic regulator
6. Igniter
7. Fuel nozzle
8. Large slot manifold (operating)
9. Small slot manifold (starting and operating)
10. Flow divider
11. Shut-off valve
12. Shut-off valve lever
13. Fuel control valve
14. Main fuel regulator

14a. Throttle

15. High pressure line
16. High pressure pump
17. RPM governor
18. Fuel bypass line
19. Fuel drain line
20. Fuel tank boost pump (forward tank)

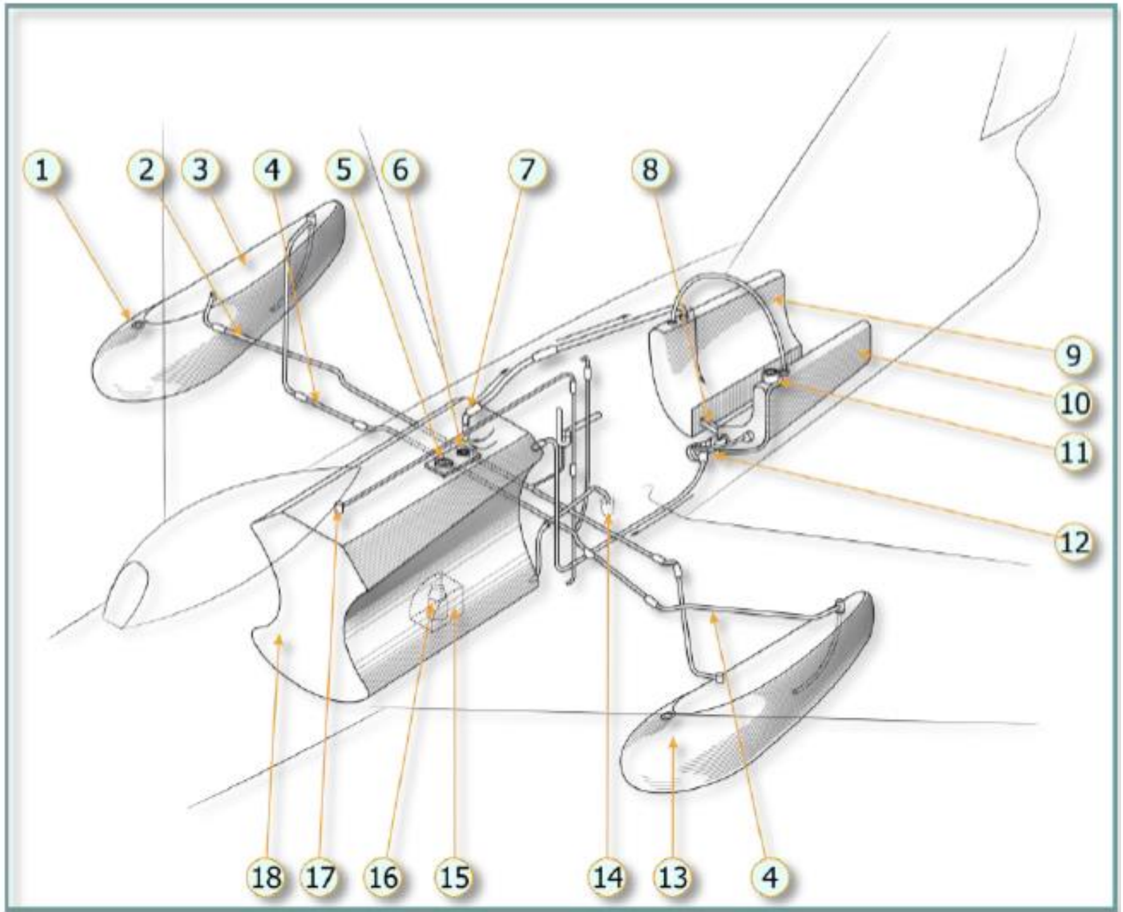
FUEL MANAGEMENT



With the PTsR-1 fuel pump, the fuel is continuously transferred from the rear left tank to the forward tank, and from the upper part of the forward tank through the collector of returned fuel to the rear right tank (this is done to prevent overpressure in the forward tank). At the bottom of the forward tank there is a negative G compartment. From there, fuel through the booster pump is supplied to the engine filter. Note that in case of a full power loss, if there still is fuel in the forward fuel tank, the fuel will continue to be supplied to the engine due to the suction pressure created in the fuel lines by the high pressure fuel pumps that are rotated by the gearbox.

The pump is located in the engine bay and is attached to the engine body. Near the pump there is a pump sensor of the SD-3 type. When the pump is on and the pressure in it is above 0.3 kg/cm², the signal lamp in the cockpit is off. When the fuel in the tank has been consumed and the fuel pressure becomes less than 0.3 kg/cm², the lamp illuminates. After that the pump must be turned off. The Negative G compartment, with a capacity of 26 liters, is located below the front tank and provides fuel for negative G flight including inverted flight for 15 sec.

Fuel System Overview



1. **Drop tank fueling inlet**
2. **Pressurized air line**
3. **Right drop tank**
4. **Fuel line to forward tank**
5. **Forward tank fueling inlet**
6. **Fuel quantity probe**
7. **Forward tank fuel return line**
8. **Rear left and right fuel tank connecting line**
9. **Rear right fuel tank**
10. **Rear left fuel tank**
11. **Rear left fuel tank filling inlet**
12. **PTsR-1 fuel pump (rear tank to forward tank)**
13. **Left drop tank**
14. **Engine filter**
15. **Negative G compartment**
16. **PNV-2 booster pump**
17. **Drain line nozzle**
18. **Forward main tank**

EXTERNAL FUEL TANK OPERATION

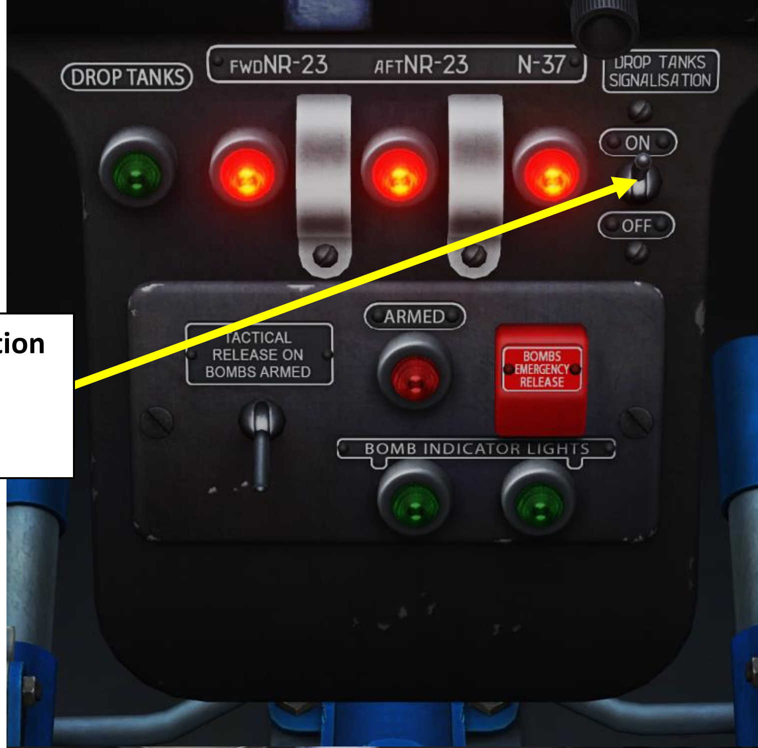
When the aircraft flies with external tanks, the fuel is consumed automatically from the tanks in the following sequence:

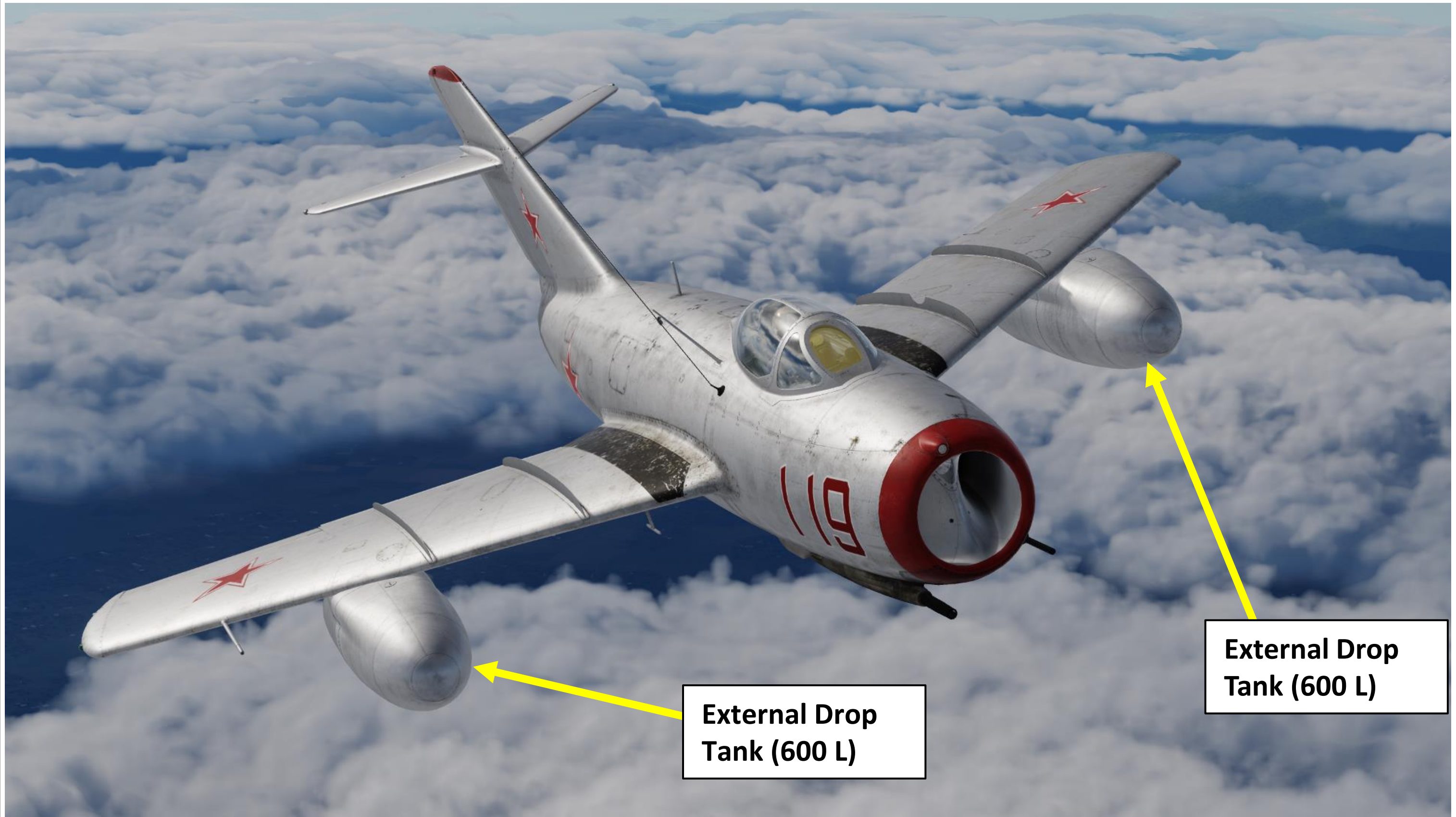
1. 100 liters from forward tank.
2. All fuel from external tanks.
3. 245 liters from forward tank.
4. All fuel from rear tank.
5. Remaining fuel from forward tank.

When the **ПОДВ. БАКИ (DROP TANKS) warning light** on the armament control panel goes out, it means that the process of supplying fuel from external tanks is on.

- Note: The **Drop Tanks Signalization Power switch** must be set to UP (ON) in order to have the Drop Tank Empty Light (DROP TANKS) illuminate once the external drop tanks are empty.

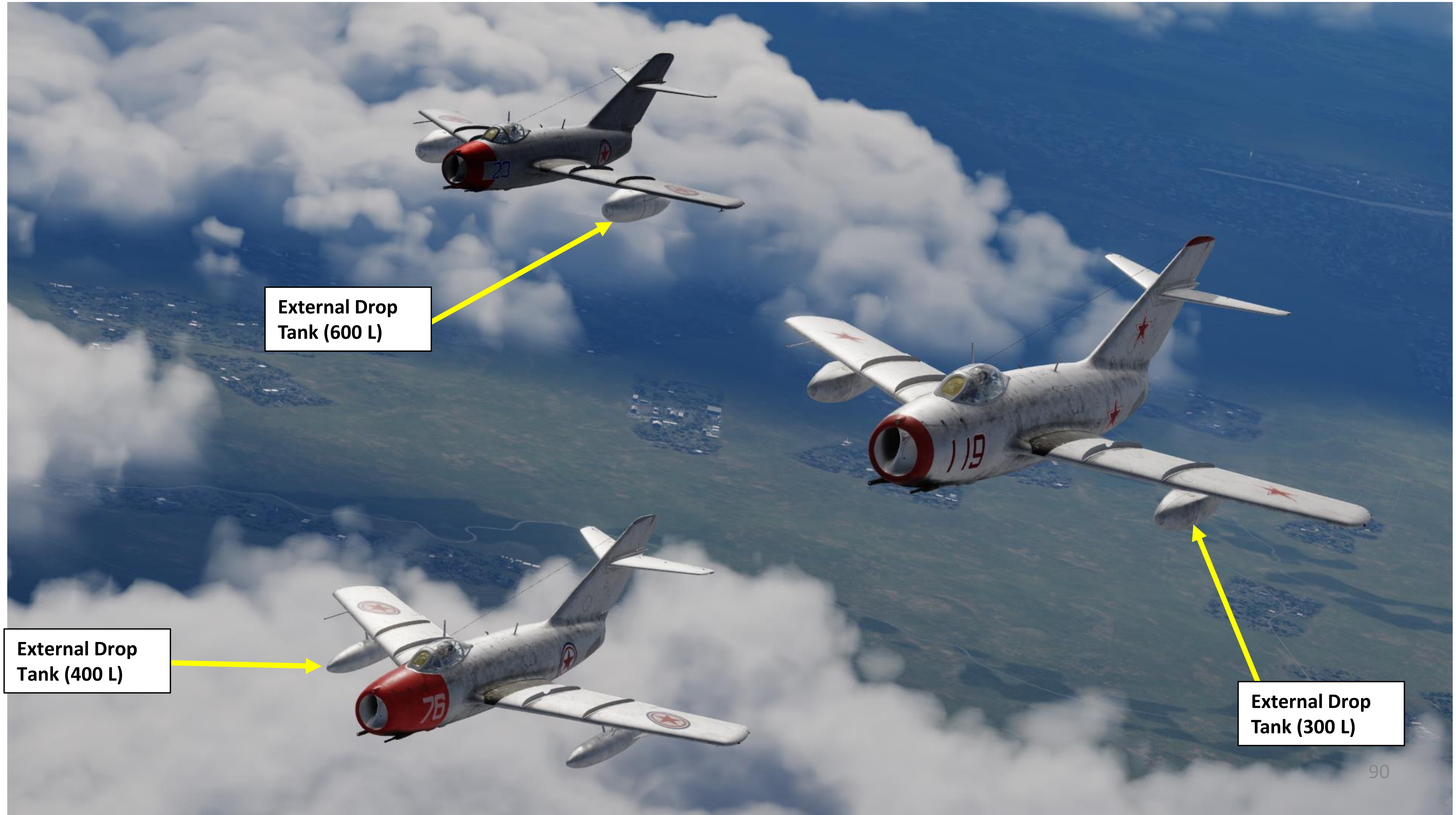
Drop Tanks Signalization Power Switch
UP = ON
DOWN = OFF





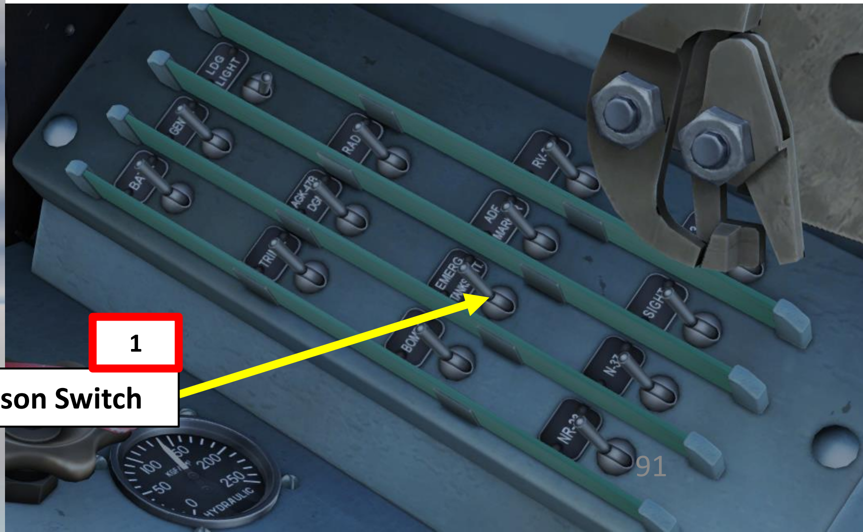
EXTERNAL FUEL TANK OPERATION

You can equip either 300 L, 400 L or 600 L external fuel drop tanks.



HOW TO JETTISON EXTERNAL FUEL DROP TANKS

1. Turn on the “EMERGENCY JETTISON” switch (FWD)
2. Flip the safety cover UP and press the “BOMBS EMERGENCY RELEASE” button

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OPERATIONAL CHARACTERISTICS

Operational Characteristics	Unit	Value
Max allowable gross weight	lbs / kg	13459 / 6105
Basic weight	lbs / kg	7892 / 3580
Useful load (with pilot 100 kg)	lbs / kg	2983 / 1353
Weight with payload for normal mission	lbs / kg	11120 / 5044
Fuel usable capacity internal (0.83 kg/l)	lbs/gal // kg/l	2584/373 // 1172 / 1412
Normal cruise speed (for max range at 10000 m, gross weight 4600-4900 kg)	indicated air speed (IAS) kts / km/h	243-254 / 450-470
Fuel consumption rate (for loiter at 10,000 m, 350 km/h IAS, gross weight 4,600-4,900 kg, fuel density 0.83 kg/l)	lbs/h // kg/h	1464 // 664
Maximum speed at sea level, true air speed (TAS)	kts / km/h	581 / 1076
Maximum speed at 10000 m (33.000 feet)	TAS kts / km/h	535 / 990
Service ceiling (for take-off weight 5044 kg)	ft / m	51016 / 15550
Time of climb altitude up to 5000 m (at 11560 RPM and 680-560 km/h TAS)	m/min	around 2 min
Maximum rate-of-climb (at 11560 RPM): at 1000m altitude at 5000m altitude	m/min // maximum lift-to-drag ratio airspeed, TAS km/h	 2790 // 710 2100 // 710
Maximum range (w/o drop tank), altitude 10000m, 450-470 km/h IAS	nm / km	648 / 1200
Maximum range (with drop tank 300L), altitude 10000m, 460-480 km/h IAS	nm / km	944 / 1749
Maximum range (with drop tank 600L), altitude 10000m, 440-460 km/h IAS	nm / km	1199 / 2220
Maximum endurance (w/o drop tank): altitude 10000 m, 330-350 km/h IAS altitude 5000 m, 330-350 km/h IAS	hour.min	 2.05 1.45
Maximum maneuvering load factor	G	8
Ultimate load factor	G	12

AIRCRAFT LIMITATIONS

- **SERVICE CEILING**
  - 15500 m (50850 ft)
- **MAX AIRSPEED LIMITATIONS**
  - @ LOW ALT: 1070 km/h TAS, 1060 km/h IAS
  - @ SERVICE CEILING: 720 km/h TAS, 300 km/h IAS
- **MACH NUMBER LIMITATIONS**
  - IN LEVEL FLIGHT: 0.919 M
  - @ LOW ALTITUDES: 0.866 M
  - @ SERVICE CEILING : 0.7 M
- **FLAPS AIRSPEED LIMITATIONS**
  - MAX AIRSPEED WITH FLAPS FULLY EXTENDED: 400 km/h IAS
- **LANDING GEAR AIRSPEED LIMITATIONS**
  - MAX AIRSPEED FOR LANDING GEAR EXTENSION: 500 hm/h IAS
- **DROP TANKS AIRSPEED LIMITATIONS**
  - 200 L DROP TANKS: 820 km/h TAS / 700 km/h IAS @ 3500 m, 1015 km/h TAS @ 5000 m
  - 600 L DROP TANKS: 990 km/h TAS / 800 km/h IAS @ 4600 m
- **AIRBRAKE AIRSPEED LIMITATIONS**
  - @ GROUND LEVEL: 750 km/h TAS / 750 km/h IAS
  - @ 10000 m: 790 km/h TAS / 482 km/h IAS
- **MINIMUM SPEEDS (STALL)**
  - @IDLE POWER, FLAPS + GEAR EXTENDED: 190 km/h
  - @IDLE POWER, FLAPS + GEAR RETRACTED: 200-220 km/h BELOW 10000m, 230-240 km/h ABOVE 10000 m
  - @IDLE POWER, AIRBRAKES DEPLOYED: 200-210 km/h
  - @MAX POWER, CLIMBING: 200-210 km/h

NOTE: TAS means "True Airspeed" and IAS means "Indicated Airspeed". To learn more about the difference between IAS and TAS, please consult the following link:
http://en.wikipedia.org/wiki/Airspeed

AIRCRAFT OPERATION

Your aircraft can easily go more than 600 km/h in level flight, which means that you can very easily black out if you do not pay attention to your speed and accelerometer in turning manoeuvres. Be gentle with the stick.

Speed is very important in combat, but also during landing. Pay attention to the yellow index on the airspeed indicator to know when you can safely deploy your flaps and landing gear. Deploying those at high speeds will make them jam in inconvenient positions, as shown in the picture on the right.

During a normal patrol, you do not need to go full throttle all the time. It needlessly wears the engine down and can create problems with formation flying.

At high Mach numbers (between Mach 0.86 and Mach 0.9) you can lock up your controls very easily (especially ailerons) due to compressibility effects. You also develop unwanted aerodynamic behaviours like uncontrolled roll or sudden loss of control in a dive. If you want to remain in full control of your plane at all times, it is better to fly a little bit slower (Mach 0.7 – 0.8) but keep full authority over your controls.

Use your airbrakes if you are going too fast. Airbrakes are very useful to bleed off airspeed quickly and control your diving speed.

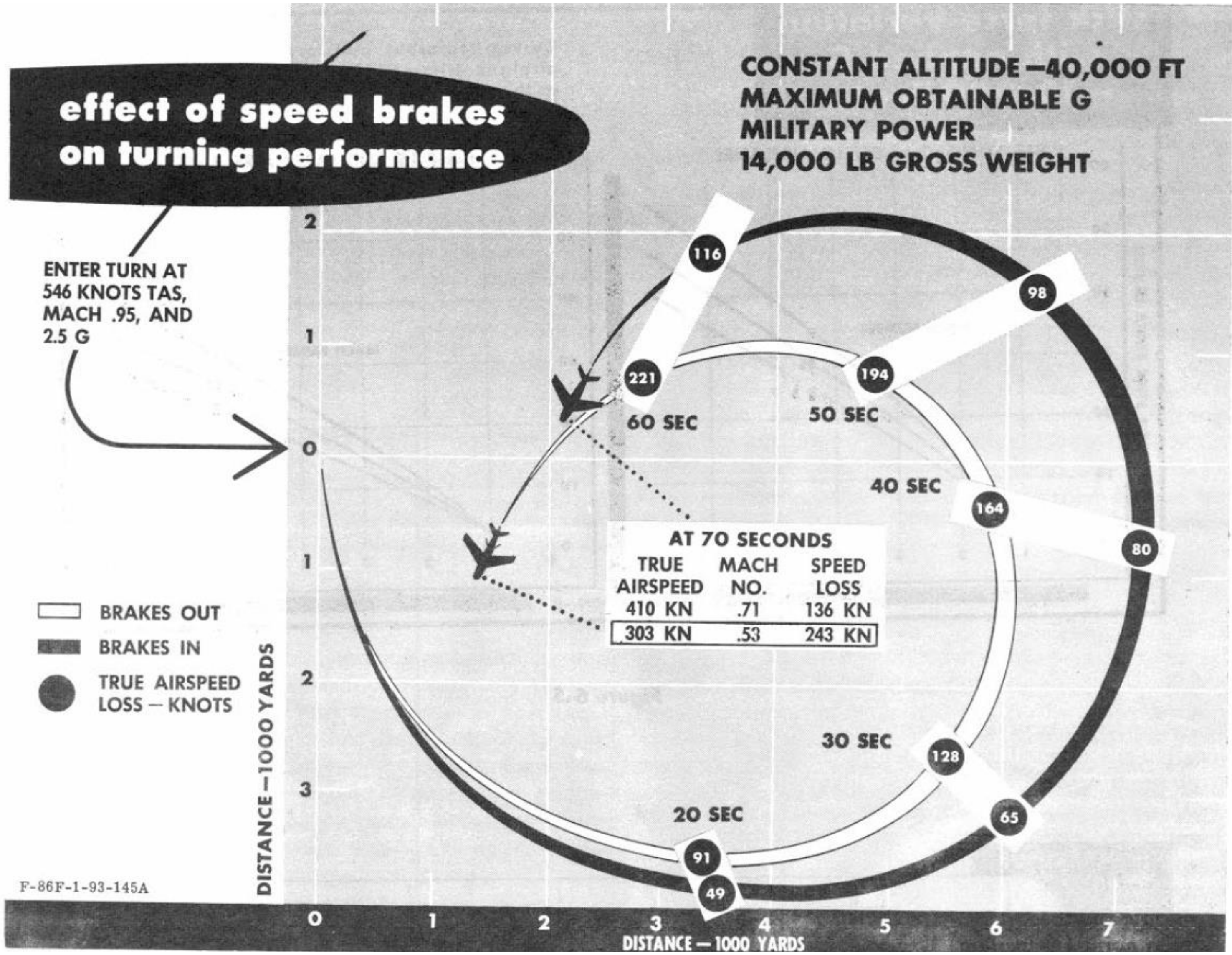
AIRCRAFT OPERATION

Typically in World War II fighters, flaps were used to make tighter turns in combat. However, use of flaps during combat is strictly prohibited in the Sabre.

Use of airbrakes can help you turn much tighter if you need to bleed airspeed quickly. They come in very handy in dive bombing and defensive manoeuvres, especially when you have a Sabre on your tail that you just can't shake off (Yes, I know, it's a chart for a Sabre… sue me!).

Use airbrakes only when you need to. Bleed off too much speed in the MiG can quickly become fatal. Take note that:

1. The MiG-15 outclimbs the F-86
2. The F-86 outperforms the MiG-15 in a dive
3. The F-86 is generally slightly more maneuverable than the MiG-15
4. The F-86 is very vulnerable at low speeds
5. The MiG-15Bis has a slower roll rate than the Sabre.



AIRCRAFT OPERATION

Some tips when fighting the Sabre:

- Good Sabre pilots will often use their superior dive speed to outrun you. Don’t take the bait: do not follow them to the deck and maintain your high altitude advantage. Compressibility will affect your control surfaces earlier than the Sabre’s, which means you can enter a nasty spin or deep stall if you try to keep up with him.
- Sabre pilots had G suits, which allowed them to have a better tolerance to high-G manoeuvres. The MiG-15 pilots did not have access to G suits, which means that you are at a slight disadvantage when it comes to pulling Gs. This means that the MiG has to be flown like an energy fighter instead of a “turn and burn” fighter.
- Do not fight a Sabre below 2000 m. He will eat you for breakfast. The MiG-15 was built to be a high-altitude interceptor, while the Sabre excels at low altitudes.
- A good combat speed to maintain is anything higher than 400 km/h. If you go any slower than that, you will get in trouble.
- Experienced Sabre pilots will often use their superior roll rate to get you into scissor fights. Avoid them like the plague. The MiG-15’s roll rate is sluggish compared to the F-86; remember that it was built to be a high-altitude bomber interceptor, not a dogfighter.
- Always use your airbrakes during a dive or a sharp turn. They will prevent you from overspeeding if you lose tracking of your airspeed.
- The MiG-15 has a very low ammo capacity and a low cannon shell velocity compared to the Sabre’s 0.50 cal ammunition. You can shoot down a Sabre with just a single well-placed cannon round or two.
- Use your superior climbing speed to your advantage.
- Be very wary of compressibility. Always keep an eye on your Mach indicator. It will save your life.
- **Very important**: if you start losing control of your aircraft in a dive, deploy airbrakes as soon as possible and throttle back to around 5000 RPM. The airbrakes will slow you down and make the aircraft controllable again as your airspeed decreases. Once you gain back effective control on your flight control surfaces, throttle up and pull up simultaneously while keeping the airbrake deployed.

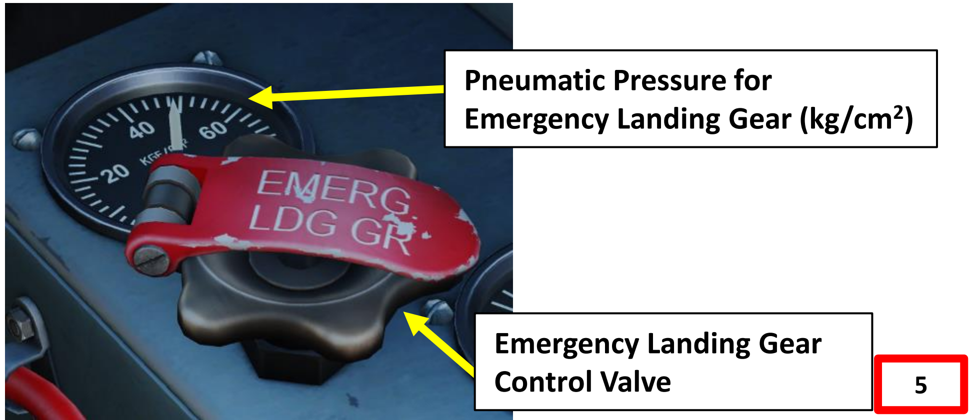
EMERGENCY LANDING GEAR DEPLOYMENT

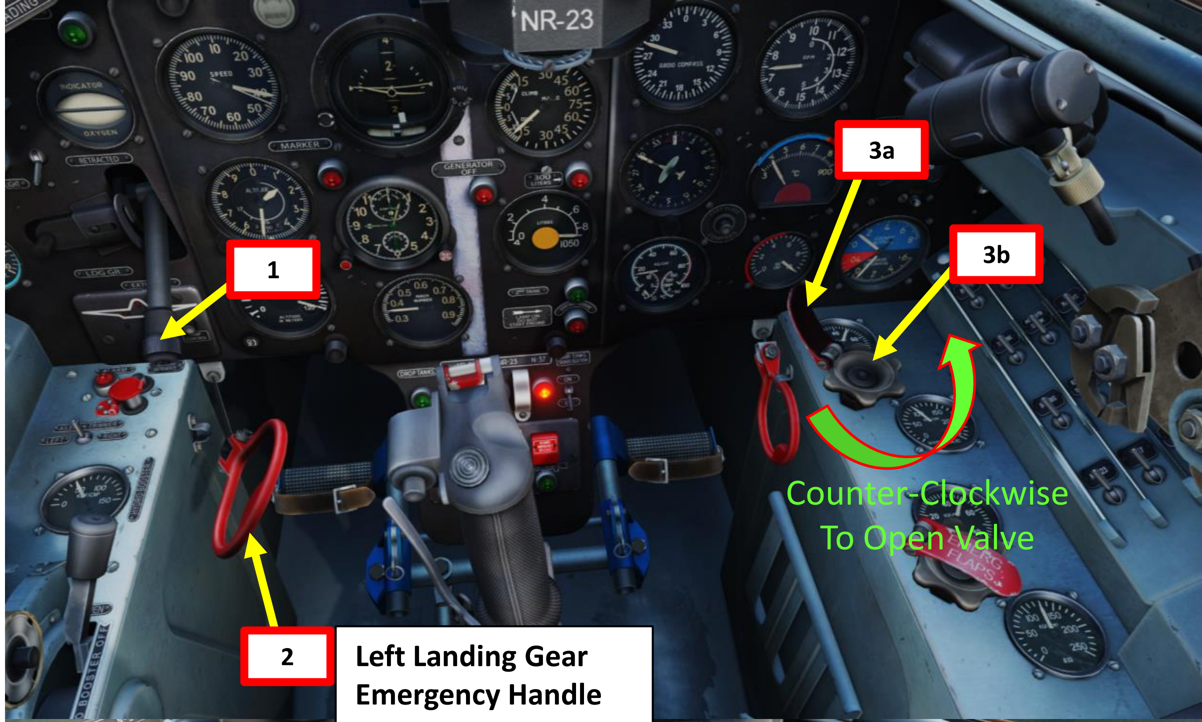
Emergency extension of the landing gear is achieved using **compressed air from the emergency air tanks**, which are stored in the inner space of the main landing gear struts. The pressure in the emergency air tanks is 50 kg/cm^2, their total capacity is 5.5 liters.

The procedure for emergency landing gear extension is as follows:

1. Move the **landing gear lever in DOWN/EXTENSION** position to enable liquid displacement from retraction cavities.
2. **Open the gear locks by pulling on the emergency landing gear mechanical cables** (non-operating hydraulic system cannot open gear locks, keeping gear in retracted position).
3. **Open the landing gear emergency valve (turn counter-clockwise)**, located on the right panel.
4. When the emergency valve is opened, air flows to the main gear cylinder through the emergency check valve in distribution box and to the nose landing gear via the emergency hydraulic lock valve. During this process ball valves of hydraulic locks shut off under air pressure. Hydraulic fluid under air pressure flows to air tank from internal cavities via gear valve and stop blocking filling of landing gear extension cylinders with air, landing gear extends. When the landing gear is fully extended, the air pressure seen on the emergency pressure gauge stabilizes at 25-28 kg/cm^2. Pressure reduces due to leakage via hydraulic lock ball check valves. Nevertheless, it does not impact on landing gear extension, because fully extended rod is fixed by ball lock, which can be opened only by feeding hydraulic mixture in Landing gear RETRACTION position.
5. When emergency landing gear extension is completed, **close the emergency gear valve (turn clockwise)** and set the **landing gear lever in neutral position**.

Note: Emergency landing gear and flaps extension systems are not connected with each other because of one-way valves.





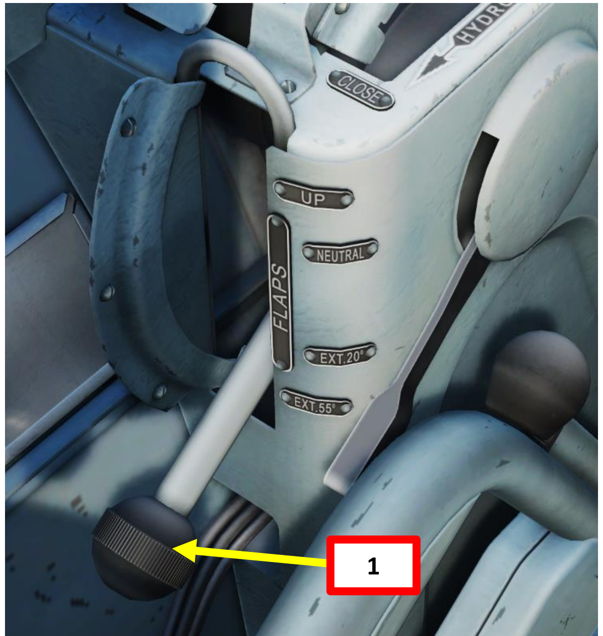
EMERGENCY FLAPS EXTENSION

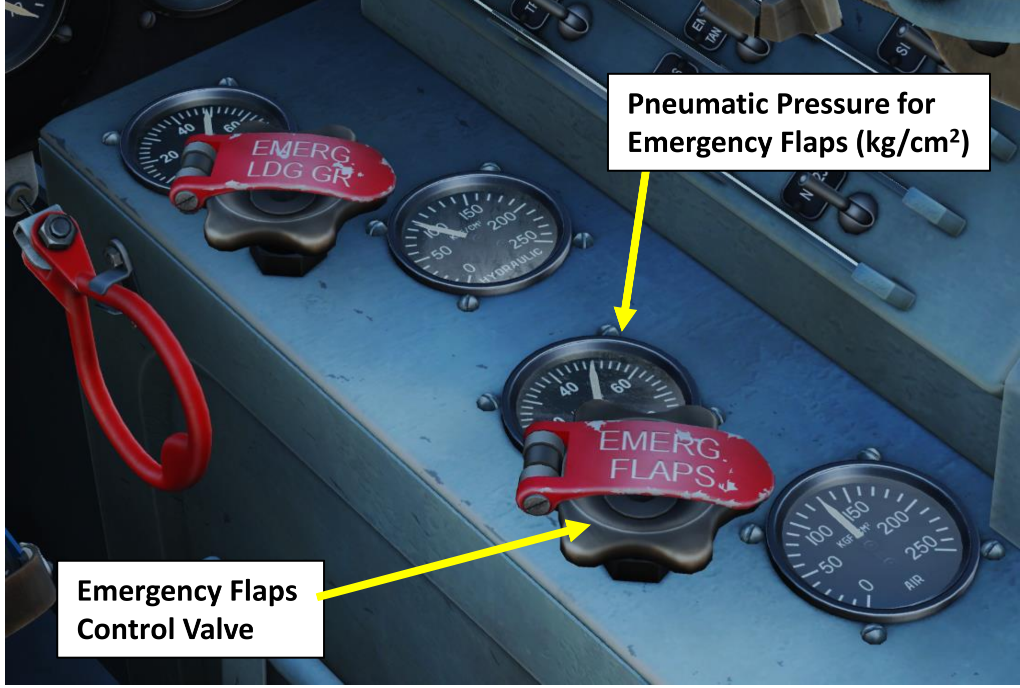
Emergency extension of the flaps is achieved with compressed air. The compressed air used for emergency extension of the flaps is stored in a separate 4-liter air tank.

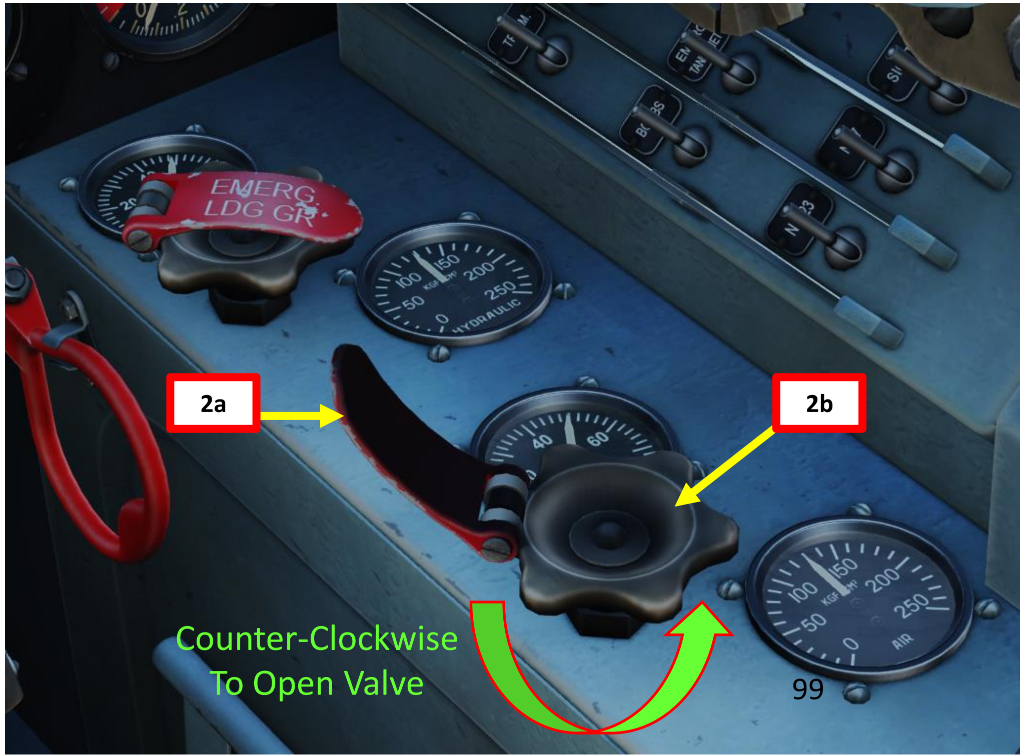
The procedure for emergency flaps extension is as follows:

1. Set flaps lever to НЕЙТР (NEUTRAL) or ВЫП. 55° (EXTEND 55°) to provide the possibility of liquid displacement from retraction cavities.
    - In the hydraulic circuit on the 20° flap extension line before lock cylinders, special emergency valves are installed for emergency opening of mount locks connected to the emergency extension system in parallel with emergency valves on hydraulic locks.
2. Open emergency flaps valve (turn counter-clockwise).
3. When the emergency flaps valve is opened, the air in the cylinders flows through the hydraulic locks emergency valves. In the extended position, flaps are held by air pressure and hydraulic locks.
4. After emergency extension of flaps, the pressure indicated on the emergency pressure gauge has to be around 35-40 kg/cm^2 initially. Leakages should not exceed 2 kg/cm^2 per 10 minutes. This can be checked on the emergency flaps pressure gauge.

Note: Emergency landing gear and flaps extension systems are not connected with each other because of one-way valves.

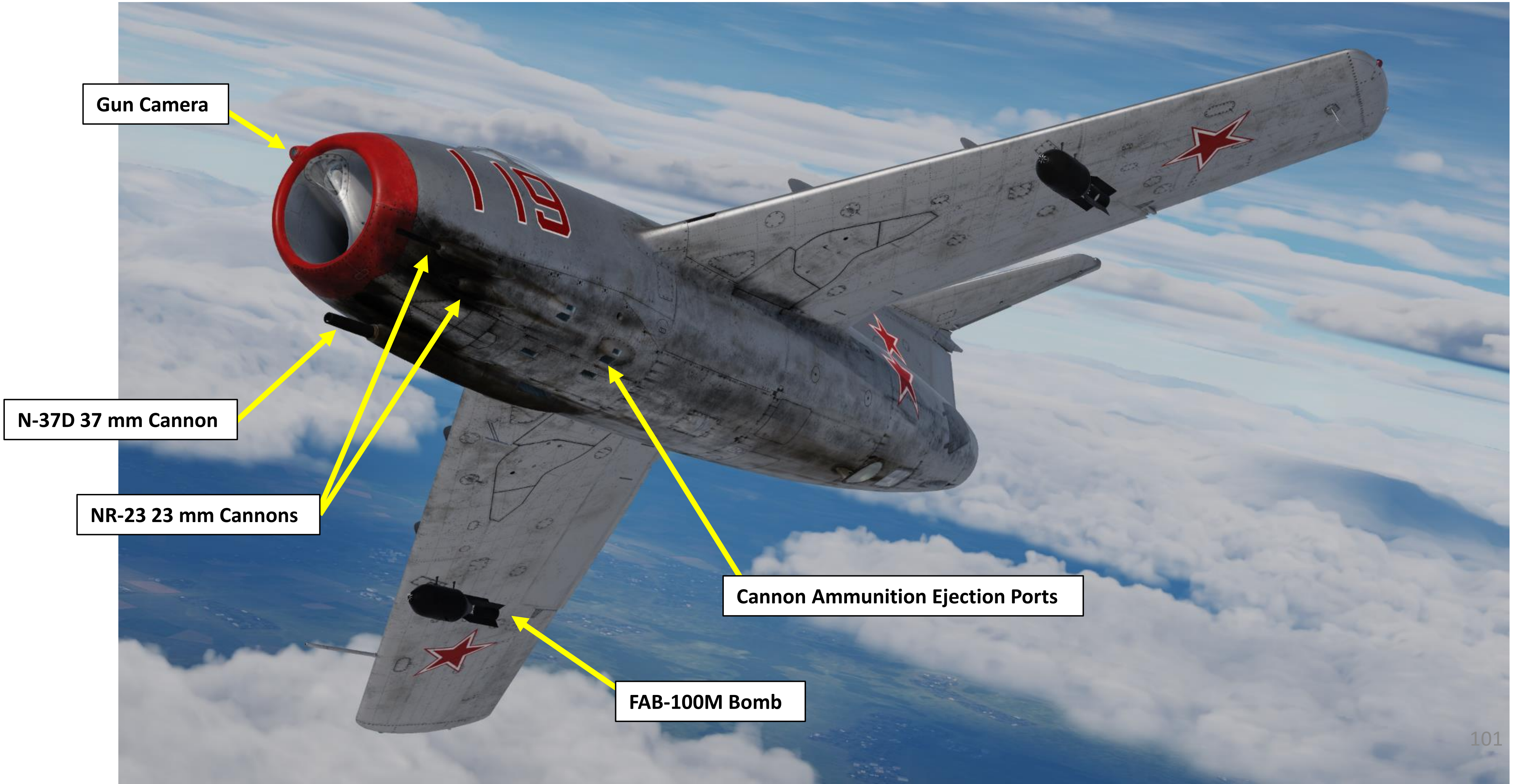






ARMAMENT OVERVIEW

- Nudelman N-37D 37 mm Cannon (40 rounds)
- 2 x Nudelman-Richter NR-23 23 mm Cannons (80 rounds per cannon)
- 2 x FAB-100M Bombs (100 kg)



ARMAMENT OVERVIEW

NR-23 23 mm Cannon

Nudelman-Richter NR-23 Automatic Cannon Characteristics	
Year	1944
Caliber	23 mm
Weight Shell/Cartridge	0.2 / 0.311 kg
Rate of Fire	800 – 950 rounds/minute
Muzzle Velocity • FI Shell (Fragmentation Incendiary) • AP-I Shell (Armor-piercing Incendiary)	 680 m/s 680 m/s
Shell weight (explosive / incendiary mixture) • FI Shell • AP-I Shell	 0.2 / 0.015 0.2 / 0.007
Armor Penetration (normal to the piercing surface)	25 mm at 200 m
Cannon Weight	39 kg
Barrel Length	1450 mm
Total Length	1985 mm
Width	165 mm
Guaranteed barrel life / max burst length	600 shots / 80 shells
Pneumatic pressure needed for cannon reloading	Not less than 35 kg/cm^2

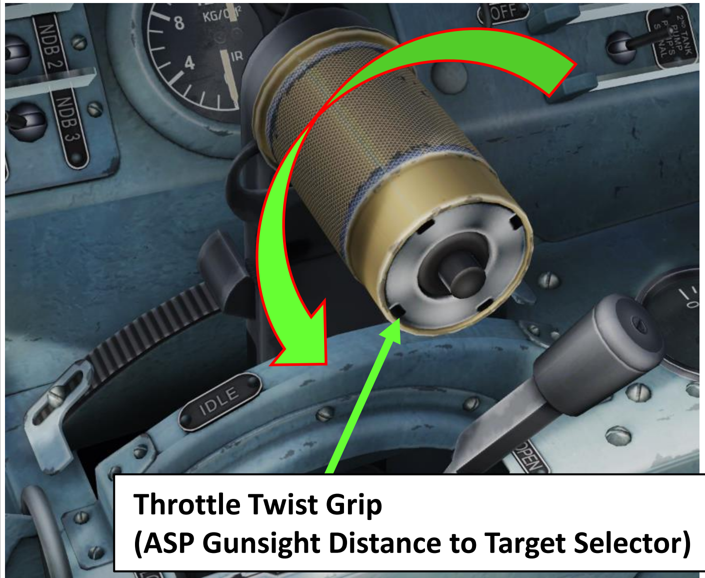
N-37D 37 mm Cannon

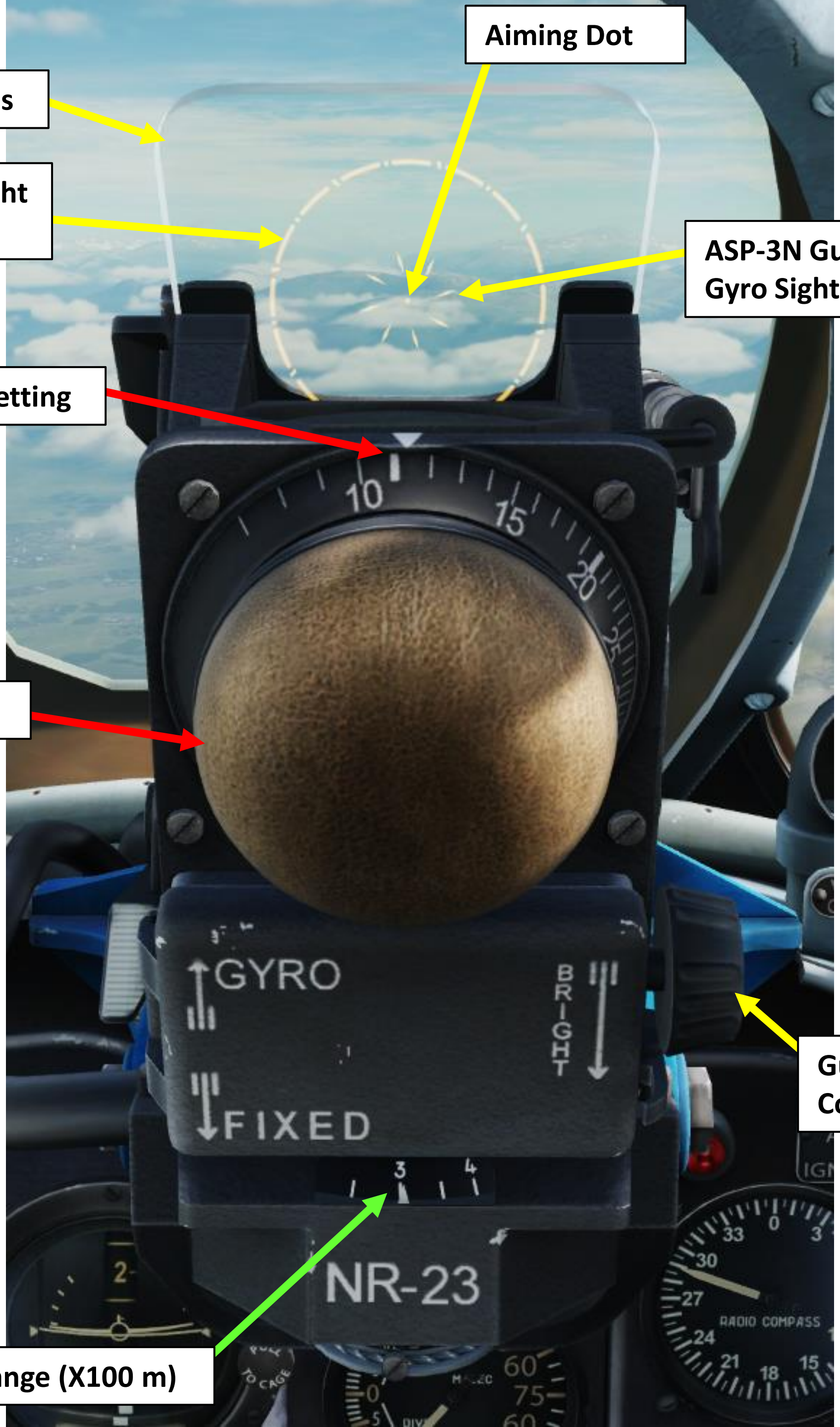
Nudelman N-37D Automatic Cannon Characteristics	
Year	1946
Caliber	37 mm
Shell Weight	0.735 kg
Rate of Fire	400 rounds/minute
Muzzle Velocity • FI-T Shell (Fragmentation Incendiary tracer) • AP-I-T Shell (Armor-piercing Incendiary tracer)	 690 m/s 675 m/s
Armor Penetration • Angle: normal to the piercing surface	40 mm at 400 m
Armor Penetration • Angle: 30 deg to the normal to the piercing surface	20 mm at 400 m
Cannon Weight	103 kg
Barrel Length	1361 mm
Total Length	2455 mm
Pneumatic pressure needed for cannon reloading	Not less than 35-70 kg/cm^2

ASP-3N GYRO GUNSIGHT

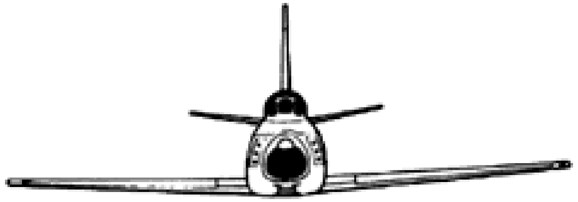
Your ASP-3N gunsight will show you where and when to shoot a target. The gunsight has optics of collimator type with a backlight, which allows aiming independently from conditions of target and background light. A target distance measurement device allows distance ranging from 180 and up to 800 meters with a target size (wingspan) from 7 to 45 meters.

The gunsight has simple functions for calculating a firing solution and automatically computes target lead angles for the fixed onboard armament. Therefore, in the gunsight head's field of view there are two aiming marks: a fixed one with a fixed-radius circle and a central dot and a moving one (gyro) with a ranging circle consisting of 8 diamonds.





ASP-3N GYRO GUNSIGHT



Wingspan of a F-86 Sabre: 11 m
(Value to enter in gunsight wingspan)

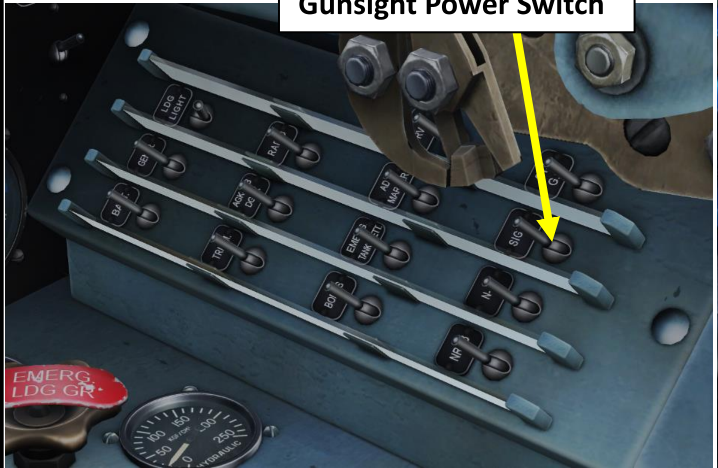
Sun Filter Glass

Sun Filter Glass Lever

Gunsight Caging Lever
UP: Gyro
DOWN: Caged/Fixed

Mechanical Sight

Mechanical Sight Lever



Gunsight Power Switch

ASP-3N GYRO GUNSIGHT

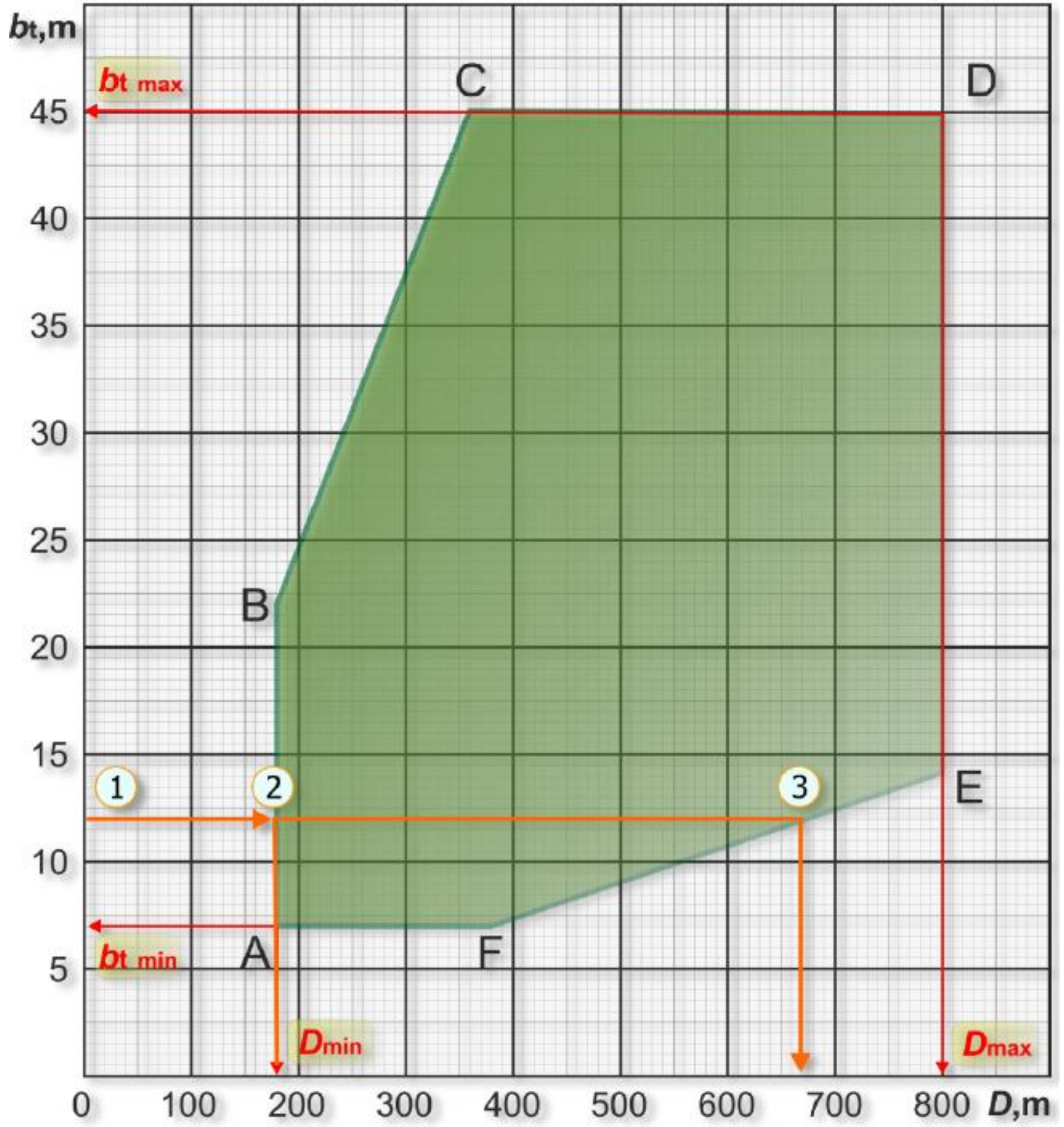
Procedure for finding operating ranges for accurate distance measurement

Example: The target datum is 12 m. Let's determine the range interval for precise operation of the ASP-3N.

1. In accordance with the known target datum (in m) represented on the vertical axis, draw a horizontal line until it intersects the ABCDEF polygon.
2. From the intersecting point of the ABC segment, drop a perpendicular to the range axis to obtain the **minimum range** value (**180 m**).
3. From the intersecting point of the DEF segment, drop a perpendicular to the range axis to obtain the **maximum range** value (**670 m**).

When parameters of the datum or range differ from the calculated ones, inaccuracy will reveal itself as the impossibility to frame the target when rotating the handle to increase the range (irremovable yawn between the diamonds and target will remain) or as placing the range to the locking stop with the target size surpassing the diamonds when rotating the handle to decrease the range.

Dependence of operating ranges for accurate distance measurement on wingspan/target base



ASP-3N GYRO GUNSIGHT

Shooting at ground targets

When shooting at ground targets with **sizes of more than 14 m**, it is necessary to set the target base, corresponding to the target dimensions, and before diving set the gunsight to the minimum distance. After the turn towards the target with the minimum distance set in the gunsight, the pilot has to put the reticle over the target and keeping it in this position, continue diving for 1-2 seconds. Set the maximum distance by rotating the handle and shoot a short burst when the target is framed by the diamond circle. Immediately after that, start exiting from dive and set the minimum distance on the gunsight.

When shooting at ground targets with **sizes of more than 18 m** at higher speeds or with drop tanks (non-empty) from approximately 1000 m distance, it is recommended to set a target base which is 20% less than the true size of the target. Start shooting when the target is framed accurately.

When shooting at ground targets with **sizes less than 14 m**, set 14 m target base on the gunsight. Rangefinder operation is similar to the one described above.

The shooting moment is determined based on target position in the aiming mesh at a distance of 800 m (i.e. rotating handle is on detent). Never should the pilot wait for precise target framing, because distance in this case will be as many times less than 800 m, how many times the size of the target is less than 14 m.

When shooting at **small dimension targets** at higher speed or with drop tanks (with fuel) present, from approximately 1000 m, the moment of shooting can be determined based on central aiming mark projection onto the target, taking into account that angular size of central mark is 2 mil. For example, when shooting at a car from a distance of 1000 m, central mark projection diameter is approximately equal to the transverse dimension of the car.

ASP-3N GYRO GUNSIGHT

Shooting at air targets

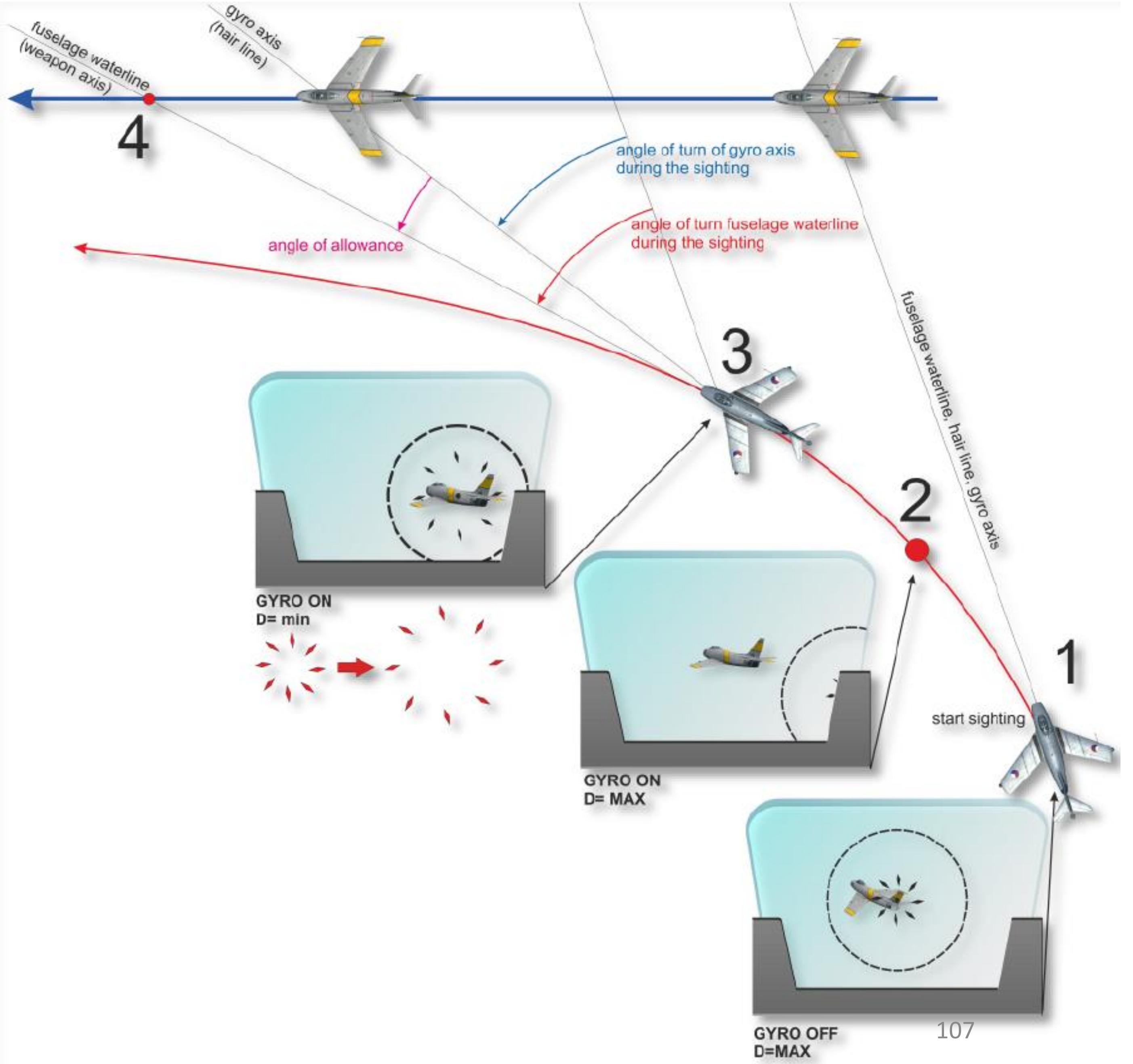
Point/Position 1: Start of an engagement. Gyro is caged, the pilot observes the target through central gunsight mark. Distance to target is set to 800 m (for example).

Point/Position 2: Pilot uncaged gunsight gyro and turned aircraft to keep target in field of view. Since in point 2 aircraft got angular velocity gunsight gyro precession begins. For entered target distance (800 m) gunsight computer calculated maximum leading angle, which at certain value of angular velocity during turn can move aiming mark out of gunsight field of view. Aiming mark will be seen behind target (gunsight reflector view for point 2).

Point/Position 3: Pilot reduced distance on rheostat to a minimum value (diamonds dispersed). The gunsight computer reduced angular adjustment, aiming mark moved closer to gunsight center, making it easier for the pilot to keep the target inside the area framed by the diamonds. When the target is correctly framed and seen inside internal diamonds vertices, the correct aiming angle (angle of allowance in the schematic) will be automatically computed. Angle of allowance is the angle between the gyro axis pointed at target and the fuselage axis (weapon axis).

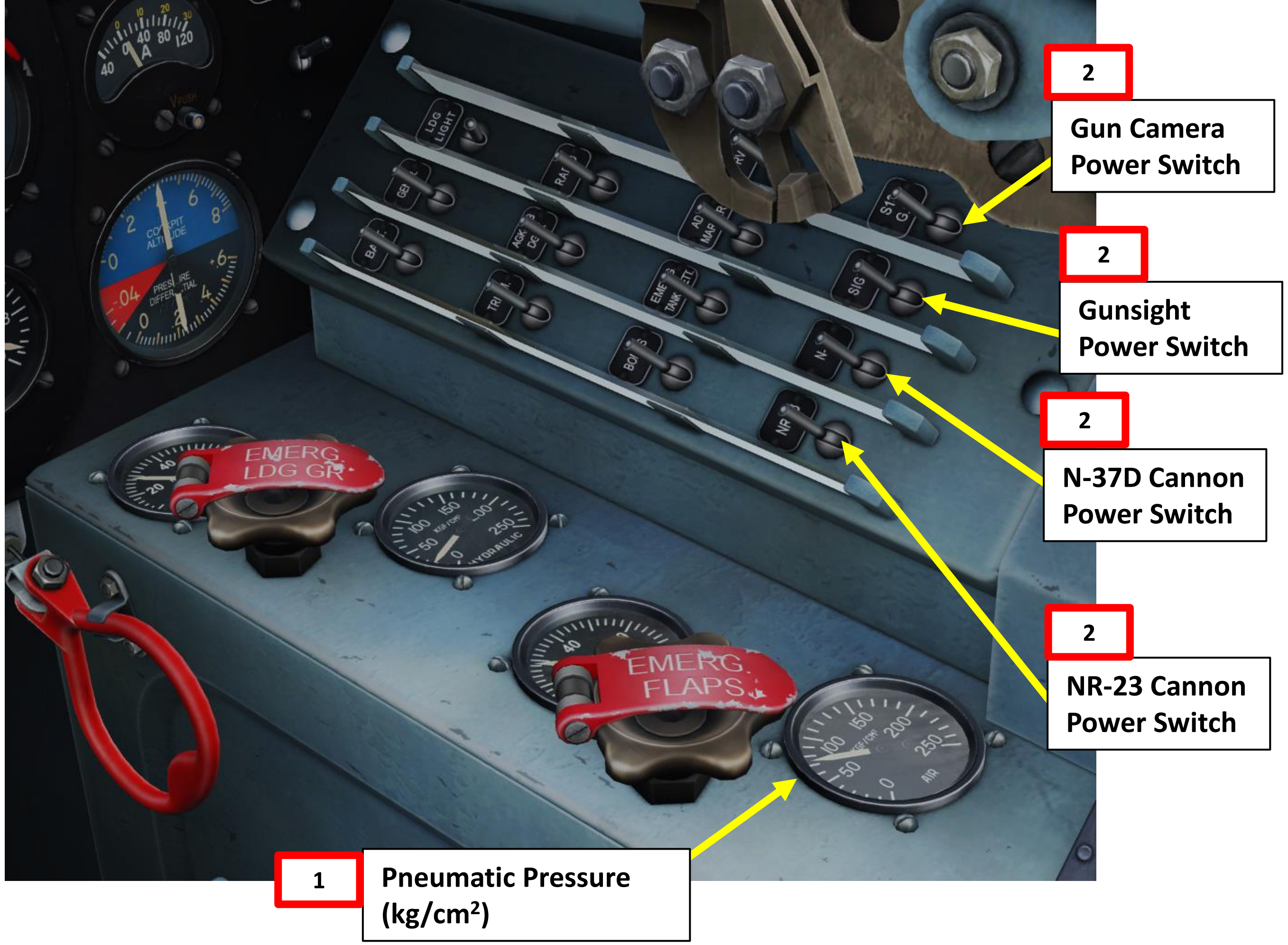
Point/Position 4: Place where shells hit target if fired.

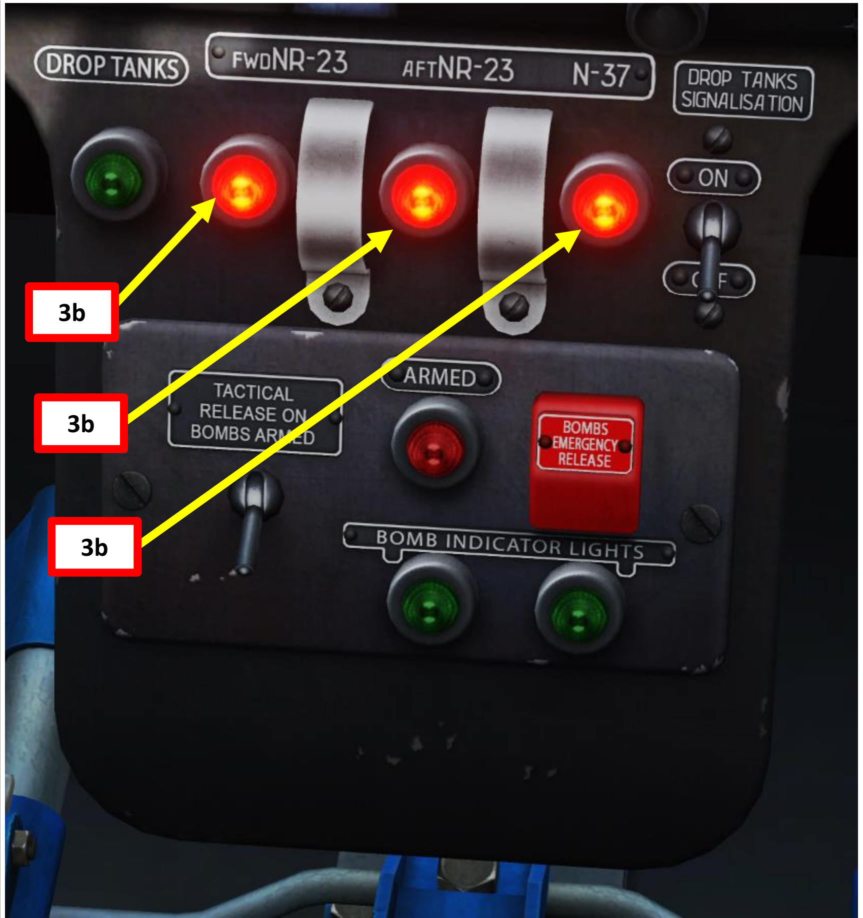
Aiming technique with the use of the gyro gunsight

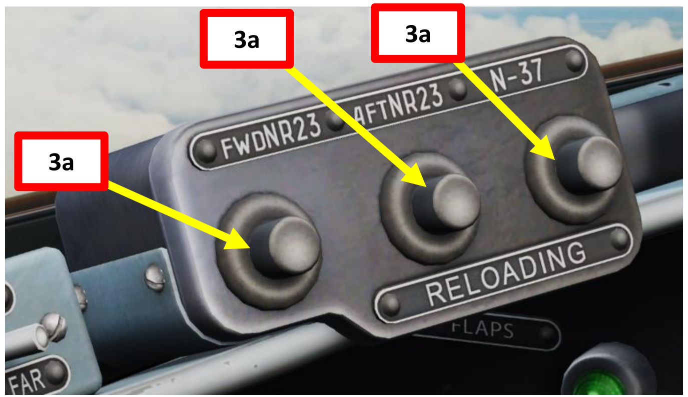


N-37D (37 MM) & NR-23 (23 MM) CANNONS

1. Pneumatic pressure is used by the cannon reloading mechanism. Verify sufficient air pressure is available:
   - N-37D Cannon requires a pneumatic pressure above 35-70 kg/cm²
   - NR-23 Cannons require a pneumatic pressure above 35 kg/cm²
2. Make sure the Gunsight Power switch and Gun Power switch are turned ON (FWD). The Gun Camera Power switch is optional.
3. The cannons are armed by pressing the RELOAD buttons for 3-4 seconds. Make sure your guns are loaded by checking the RELOAD Lights. The Lights should be illuminated in red.



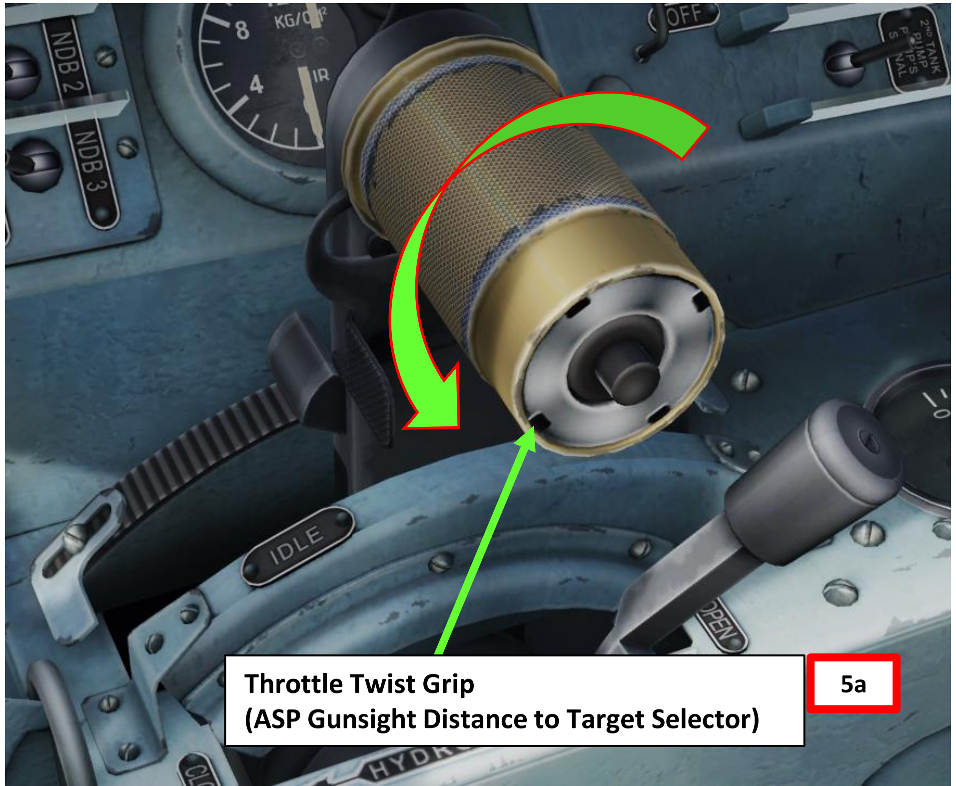




Note
Russian cannons of this era use a "pyrotechnical" reload system, which means that a cassette equipped with a pyrocartridge will detonate a charge to "reload" a gun. The MiG-21bis, MiG-19 and the L-39ZA use a similar system.

N-37D (37 MM) & NR-23 (23 MM) CANNONS

4. Set Target Wingspan Setting as required (11 m for Sabre) by turning the target wingspan adjustment control on the gunsight.
5. Set Target Range as required on gunsight using the twist grip on the throttle. As an example, we will use 400 m.
6. Adjust gunsight brightness as required.
7. When you have the target in sight, set gunsight to Gyro Mode by moving the Caging Lever UP. Otherwise, keep gunsight Mode set to Fixed Mode (DOWN).

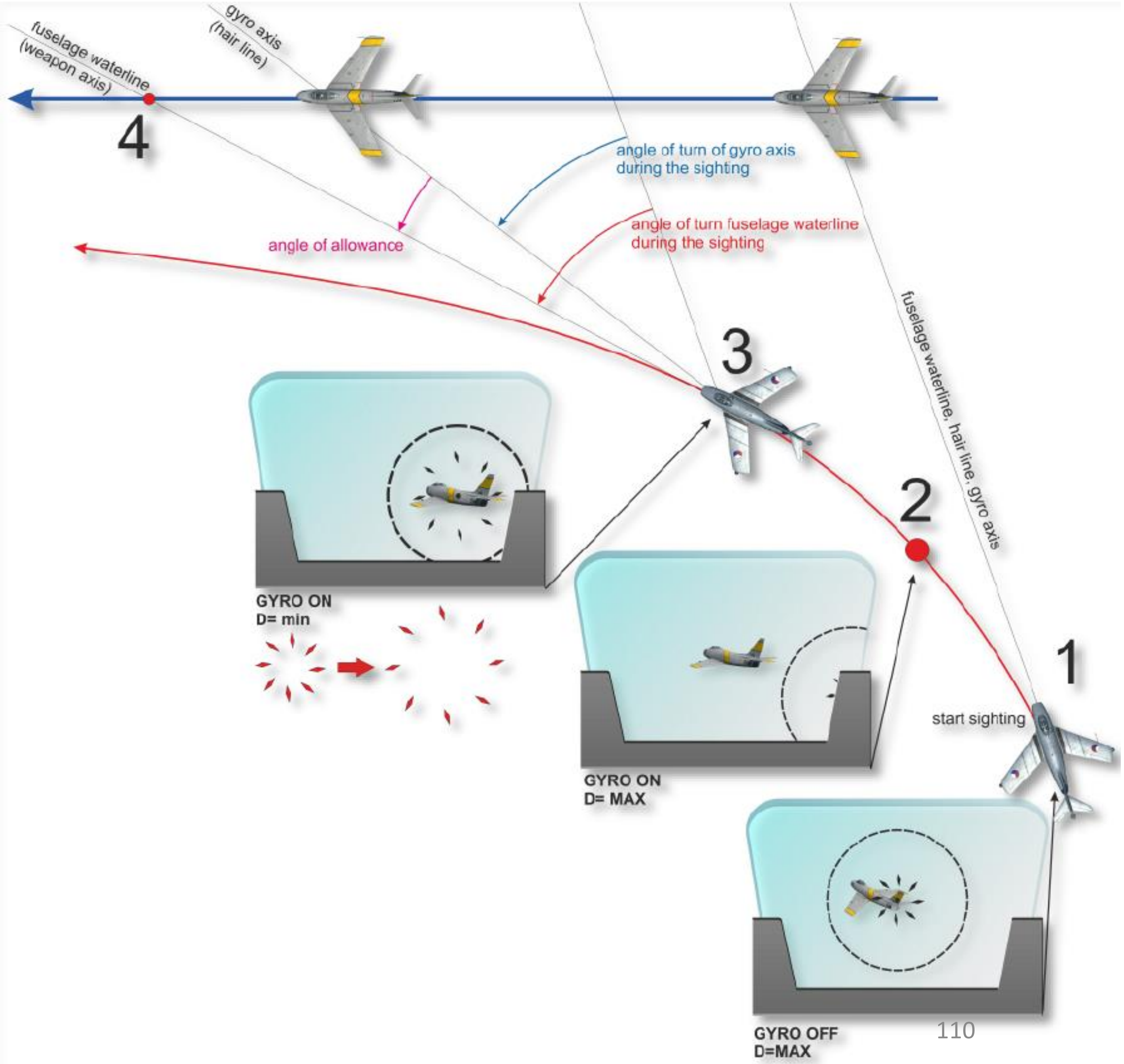


N-37D (37 MM) & NR-23 (23 MM) CANNONS

8. During target engagement, the pilot observes the target through the reflector of the gunsight collimator head. Also in the pilot's field of view is the distance measuring ring formed by eight diamonds. The distance measuring ring changes its size when the pilot twists the ranging handle mounted on the throttle handle.
9. During target pursuit, the pilot has to maneuver the airplane to keep the central dot on a target. Besides that, the pilot has to constantly frame the enemy aircraft with the ranging circle (diamonds) by twisting the throttle handle.
10. The relative angular velocity of the target is being automatically measured and entered into the computing part of the gunsight by the three-axis gyroscope during target pursuit due to gyro precession.

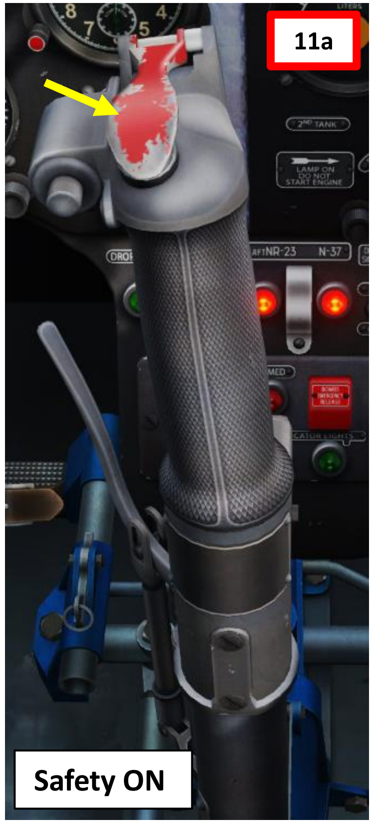
Throttle Twist Grip
(ASP Gunsight Distance to Target Selector)

Aiming technique with the use of the gyro gunsight

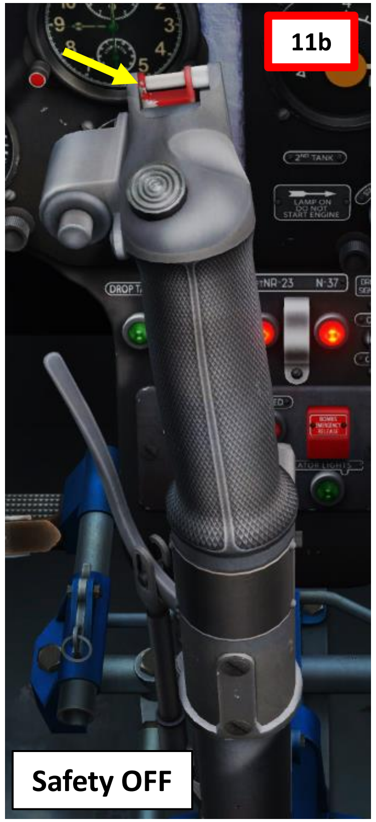


N-37D (37 MM) & NR-23 (23 MM) CANNONS

11. Set Cannon Safety OFF (“LCTRL + SPACE” binding by default)
12. Fire when ready by pressing the desired cannon trigger:
    - N-37D (37 mm Cannon) Fire Button (RCTRL+SPACE)
    - NR-23 (23 mm Cannons) Fire Trigger (SPACE)

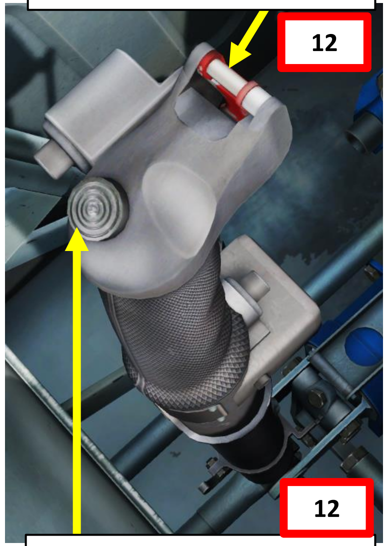


Safety ON



Safety OFF

23 mm Cannon Trigger (Front of Stick)



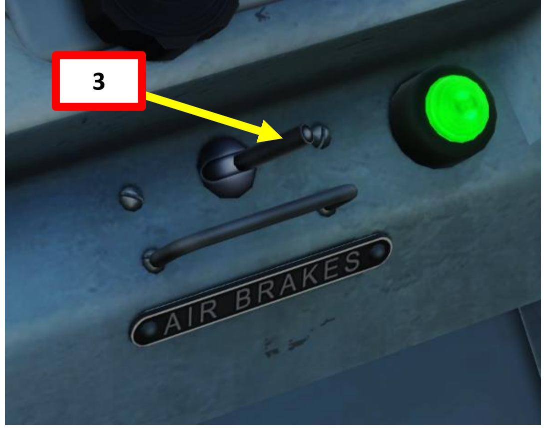
37 mm Cannon Button

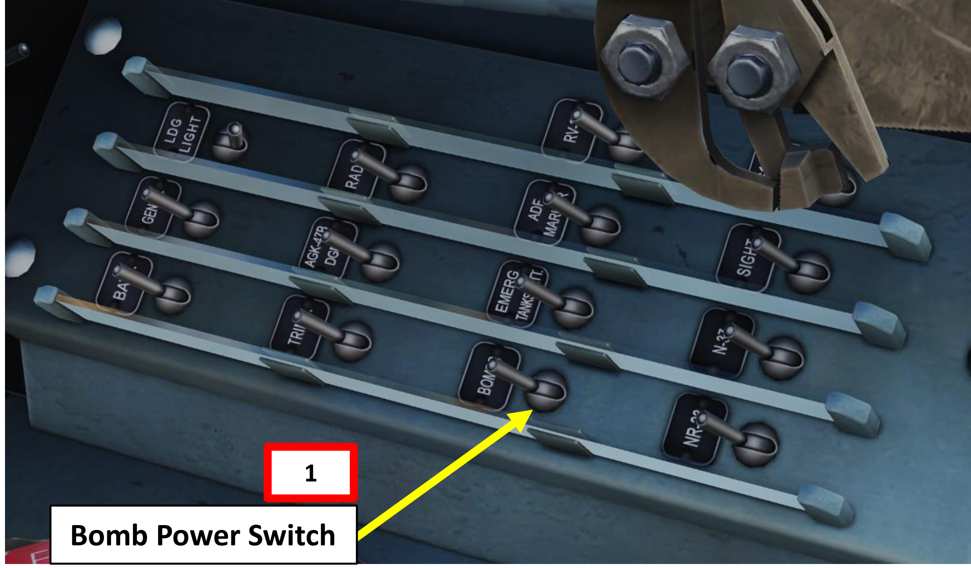
N-37D (37 MM) & NR-23 (23 MM) CANNONS

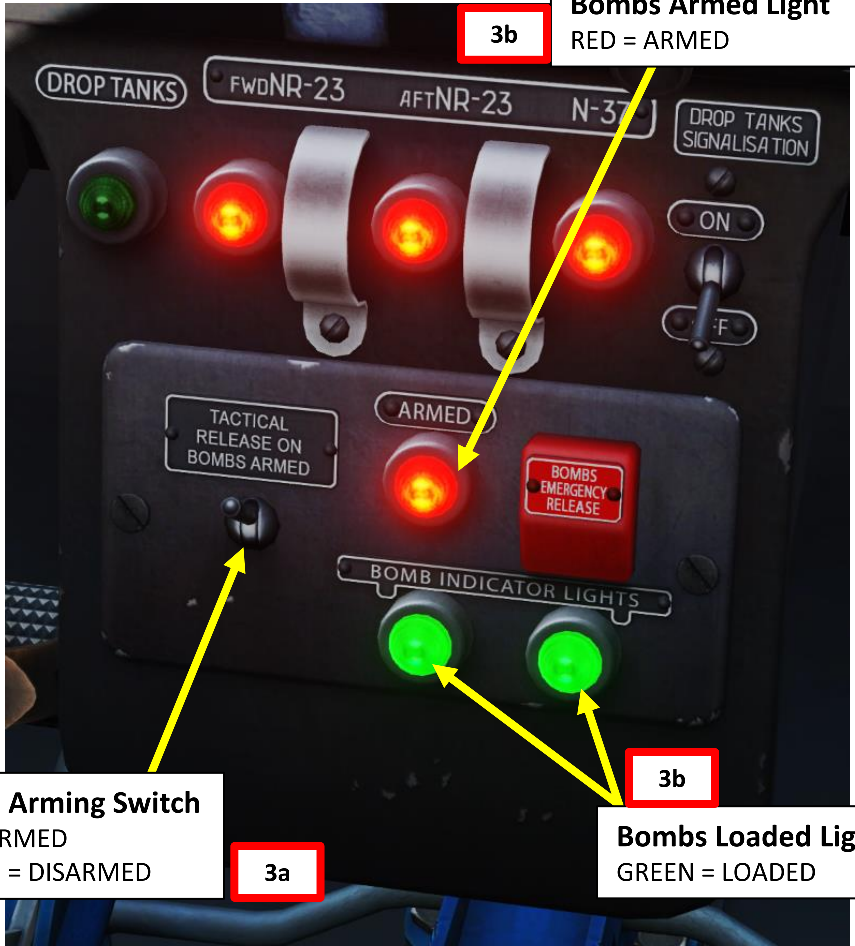
FAB-100M BOMBS – DIVE BOMBING

Bombing Profile: from 2000 m @ 40 deg dive

1. Set Bombs Power Switch to ON (FWD)
2. Arm Bombs using the Bomb Arming Switch (UP). You should see a red light and two green lights illuminate, confirming that the bombs are loaded and armed.
3. Deploy airbrakes and set engine RPM to 6000 or less.







FAB-100M BOMBS – DIVE BOMBING

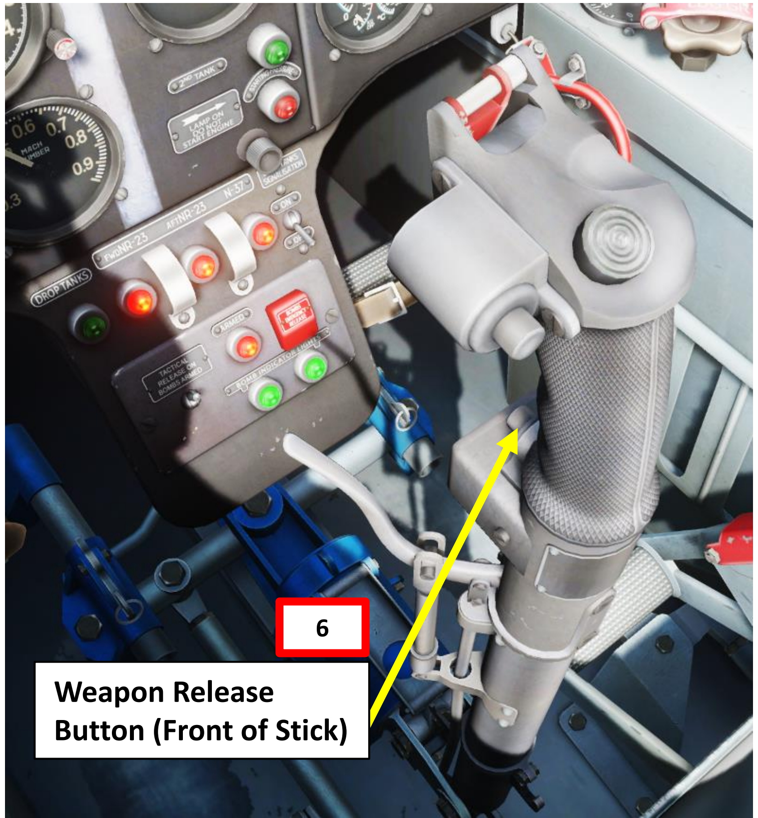
Bombing Profile: from 2000 m @ 40 deg dive

4. Set Gunsight Mode to Fixed (Caged, Switch DOWN)
5. Start a 40-50 deg dive.

FAB-100M BOMBS – DIVE BOMBING

Bombing Profile: from 2000 m @ 40 deg dive

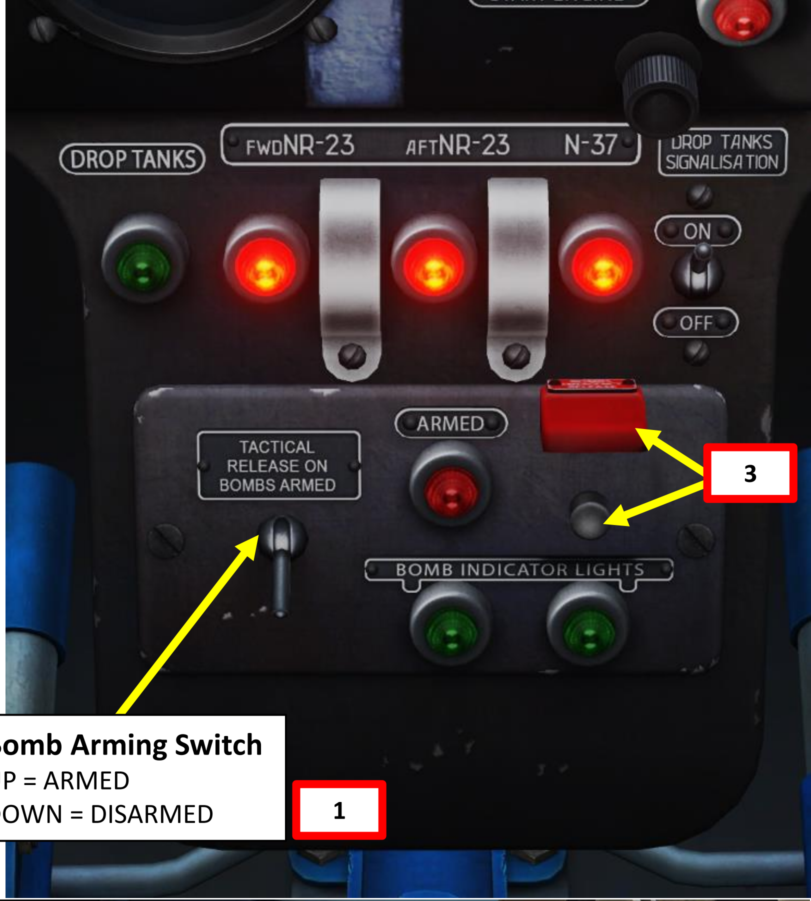
6. Release bomb using the WEAPONS RELEASE button at 800-1200 m. Use the lower line of the gunsight as a reference.

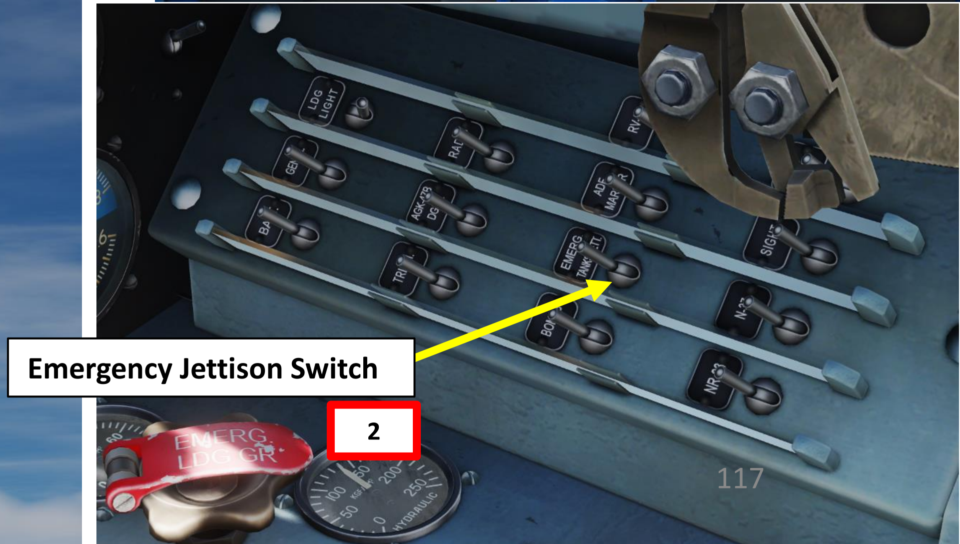


FAB-100M BOMBS – DIVE BOMBING

ORDNANCE JETTISON

1. If bombs are equipped, set Bomb Arming Switch – DOWN (DISARMED)
2. Turn on the “EMERGENCY JETTISON” switch (FWD)
3. Flip the safety cover UP and press the “BOMBS EMERGENCY RELEASE” button

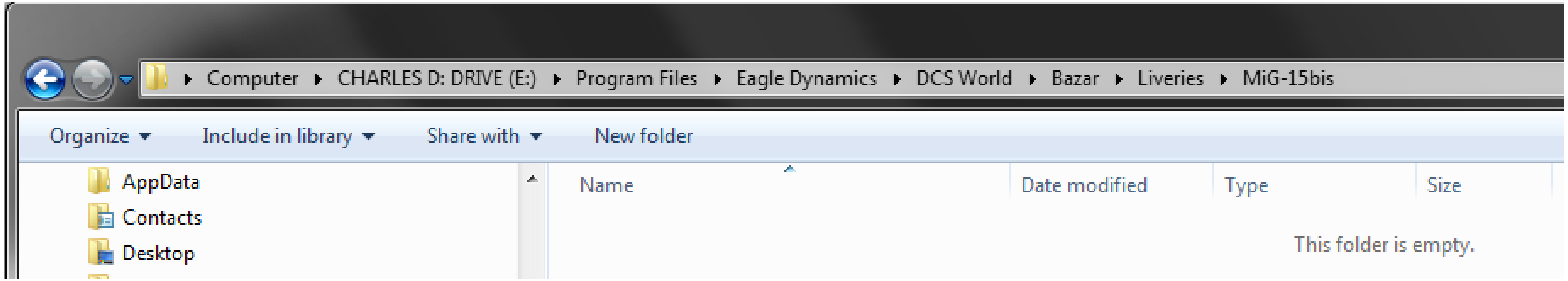




SKINS

Skins must be installed in the directory shown in the picture below.

Sometimes the folder is not there. Create one manually called “MiG-15bis” to be able to stock these sweet skins.

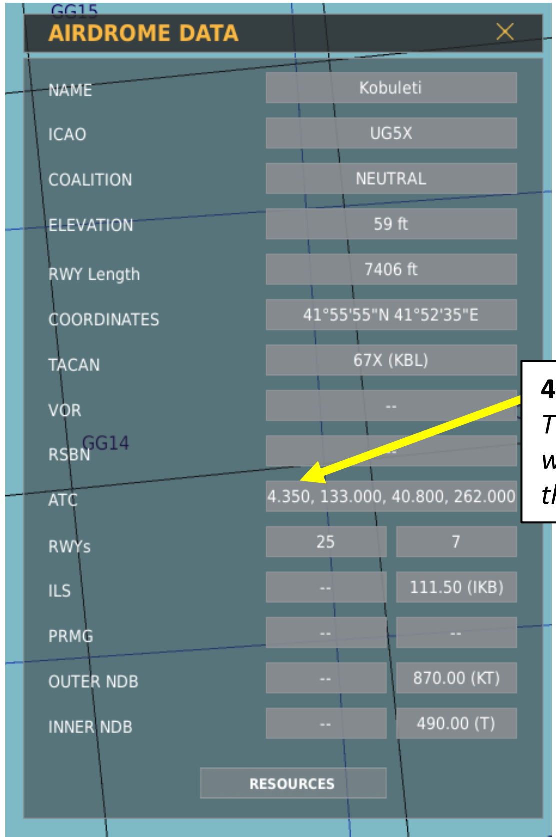


SKINS

RSI-6K HF RADIO INTRODUCTION

Note: the term "Frequency" used here actually refers to the "Wave Number" mentioned in the next slide. The term "Frequency" is used for the sake of simplicity.

1. Radio Transmitter Frequency Scale
2. Radio Transmitter Frequency Tuner
3. Radio Transmitter Frequency Intensity Indicator
4. Radio Transmitter Frequency Selector Lock
5. Antenna Tuner
6. КВАРЦА Jack (not functional in game)
7. Antenna Lock
8. УМФОРМЕРА Converter Cable Jack (not functional in game)



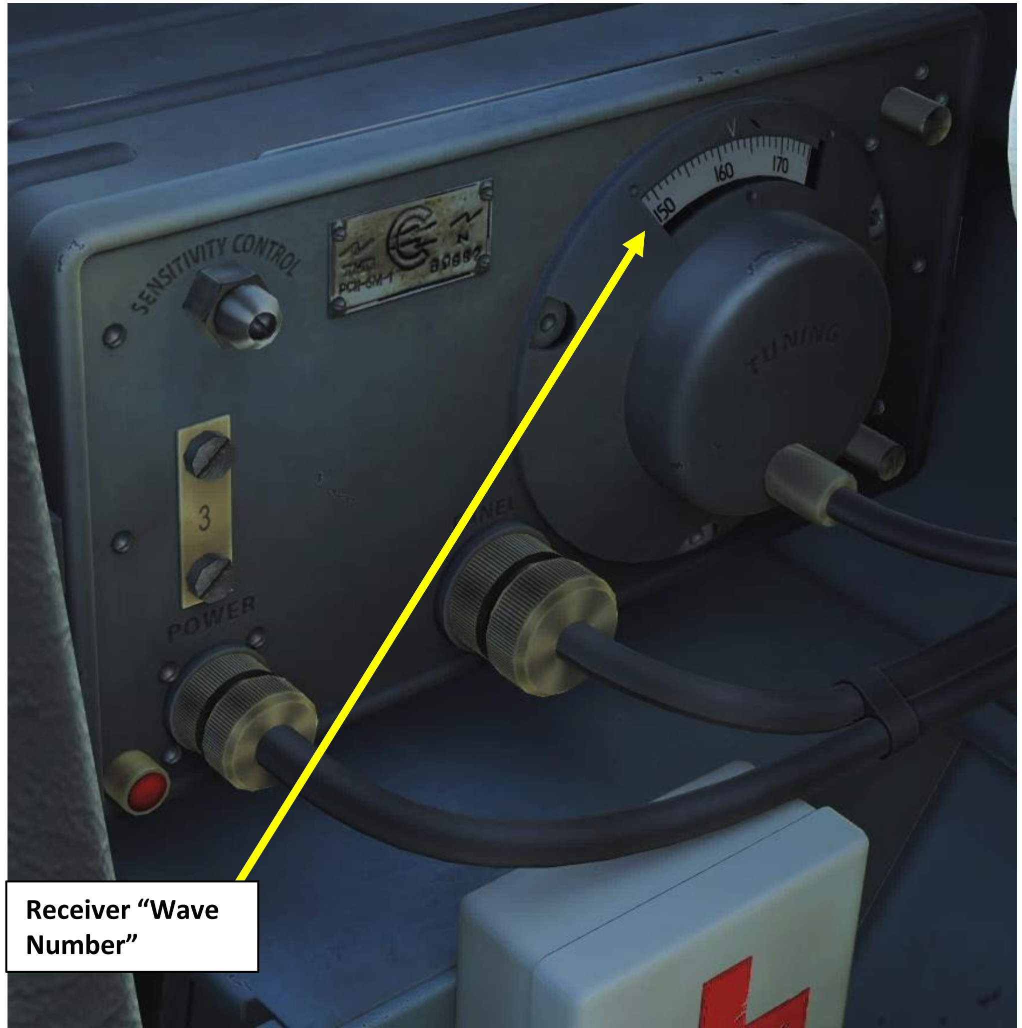
4.350 MHz
This is the frequency we will want to communicate on with the Kobuleti Control Tower.

RSI-6K HF RADIO INTRODUCTION

Notes:

You can tune the radio transmitter, receiver and antenna separately.

The frequency range of the RSI-6 receiver goes from 3.750 MHz to 5.000 MHz. However, what you see on your receiver is not the frequencies themselves. The “Wave Numbers” are distinct numerical identification codes for each MHz frequency going from 150 to 200. For instance, 3.750 MHz is translated into a Wave ID Code of 150. A wave ID code of 151 would mean a frequency of 3.775 MHz (increment of 25 KHz), and 152 would be 7.780 MHz. The conversion table is available to your right.



RSI-6K FREQUENCY / WAVE NUMBER CONVERSION TABLE

FREQUENCY MHz	*WAVE #*	*FREQUENCY MHz*	*WAVE #*	*FREQUENCY MHz*	*WAVE #*
3.750	150	**4.250**	170	**4.750**	190
3.775	151	**4.275**	171	**4.775**	191
3.800	152	**4.300**	172	**4.800**	192
3.825	153	**4.325**	173	**4.825**	193
3.850	154	**4.350**	174	**4.850**	194
3.875	155	**4.375**	175	**4.875**	195
3.900	156	**4.400**	176	**4.900**	196
3.925	157	**4.425**	177	**4.925**	197
3.950	158	**4.450**	178	**4.950**	198
3.975	159	**4.475**	179	**4.975**	199
4.000	160	**4.500**	180	**5.000**	200
4.025	161	**4.525**	181		
4.050	162	**4.550**	182		
4.075	163	**4.575**	183		
4.100	164	**4.600**	184		
4.125	165	**4.625**	185		
4.150	166	**4.650**	186		
4.175	167	**4.675**	187		
4.200	168	**4.700**	188		
4.225	169	**4.725**	189		

MiG-15bis Default ATC Channel List (Russia)

Airfield	ATC Stations (MHz)	ATC Wave Number	NDB Stations (Inner)	NDB Stations (Outer)
Anapa	3.75	150	215.0 kHz	443.0 kHz ·– –·
Beslan	4.75	190	250.0 kHz	1050.0 kHz –·–· ····
Gelendzhik	4.00	160		
Krasnodar-C	3.80	152	303.0 kHz	625.0 kHz ––– –––
Krasnodar-P	4.10	164	240.0 kHz	493.0 kHz –·– ·–·
Krymsk	3.90	156	830.0 kHz	408.0 kHz –·– ·––
Maykop	3.95	158	591.0 kHz	288.0 kHz ·–· –·–
Min Vody	4.45	178	283.0 kHz	583.0 kHz –· ·–·
Mozdok	4.55	182	1065.0 kHz	525.0 kHz –·· –––
Nalchik	4.50	180	350.0 kHz	718.0 kHz –– ·–··
Sochi	4.05	162	761.0 kHz	761.0 kHz ··· –––

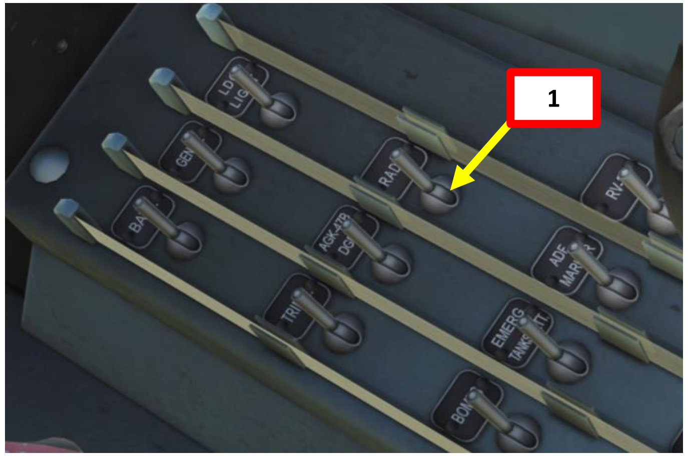
MiG-15bis Default ATC Channel List (Georgia)

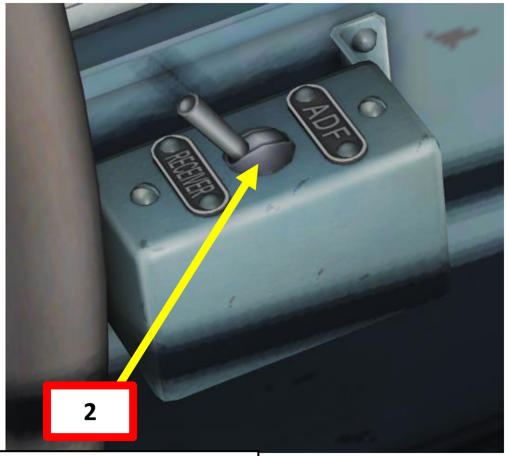
Airfield	ATC Stations (MHz)	ATC Wave Number	NDB Stations (Inner)	NDB Stations (Outer)
Batumi	4.25	170		
Gudauta	4.20	168	395.0 kHz	395.0 kHz ––·· –·–·
Kobuleti	4.35	174	490.0 kHz	870.0 kHz –·– –
Kutaisi	4.40	176	477.0 kHz	477.0 kHz – ·· ––·
Senaki	4.30	172	129.0 kHz	156.0 kHz – ··
Soganlug	4.65	186		
Sukhumi	4.15	166	489.0 kHz	489.0 kHz ·– ···–
Tbilisi	4.60	184	435.0 kHz	211.0 kHz –· ·–
Vaziani	4.70	188		

List of Airfield Air Traffic Controller (ATC) frequencies and wave numbers. Thanks, Uboats!
https://www.digitalcombatsimulator.com/en/files/1303678/

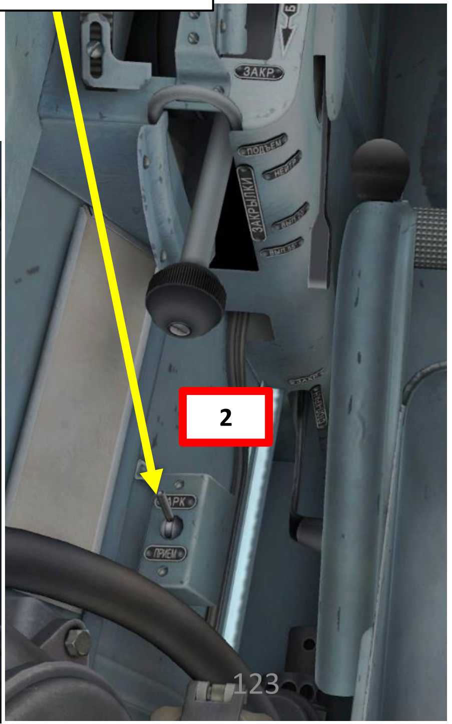
RSI-6K HF RADIO TUTORIAL

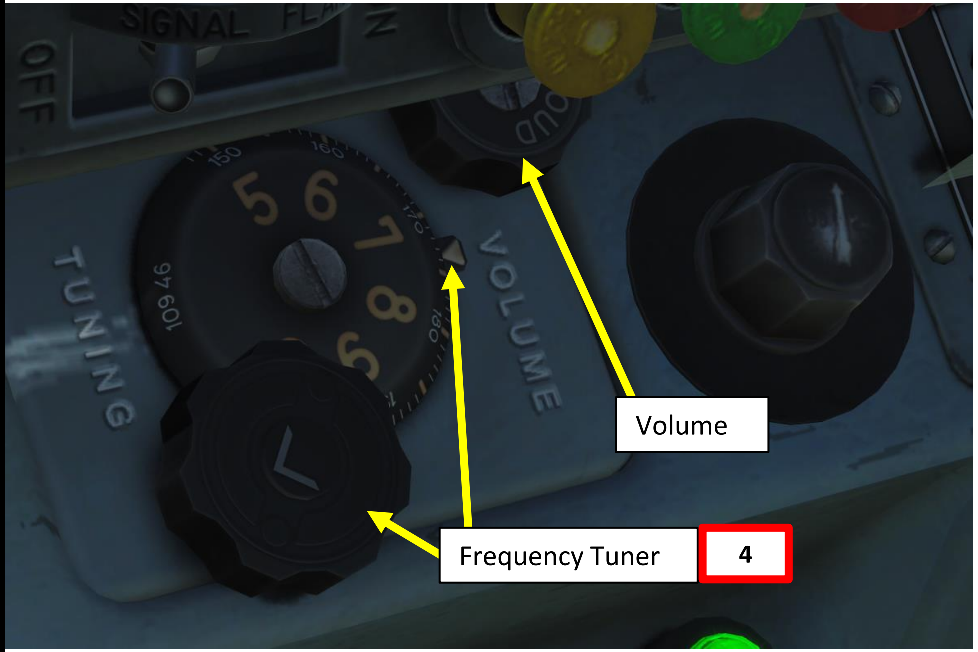
1. Turn on the Radio Switch (FWD)
2. Set the Radio Selector Switch to ПРИЕМ / “RECEIVER” (AFT)
3. Use the Conversion Table to find the correct Wave Number as shown in the previous page. For example, Kobuleti has a frequency of 4.35 MHz, which gives a Wave Number of 174.
4. Tune receiver to desired radio frequency using the Receiver Knob on the cockpit left hand side next to the flare buttons.
5. You can check the receiver “Wave Number” using the indicator.
6. Excellent! You can now receive transmissions from Kobuleti or whoever is transmitting on this frequency! However, you can’t transmit anything yet. Hold on, we’ll come to that in a second.

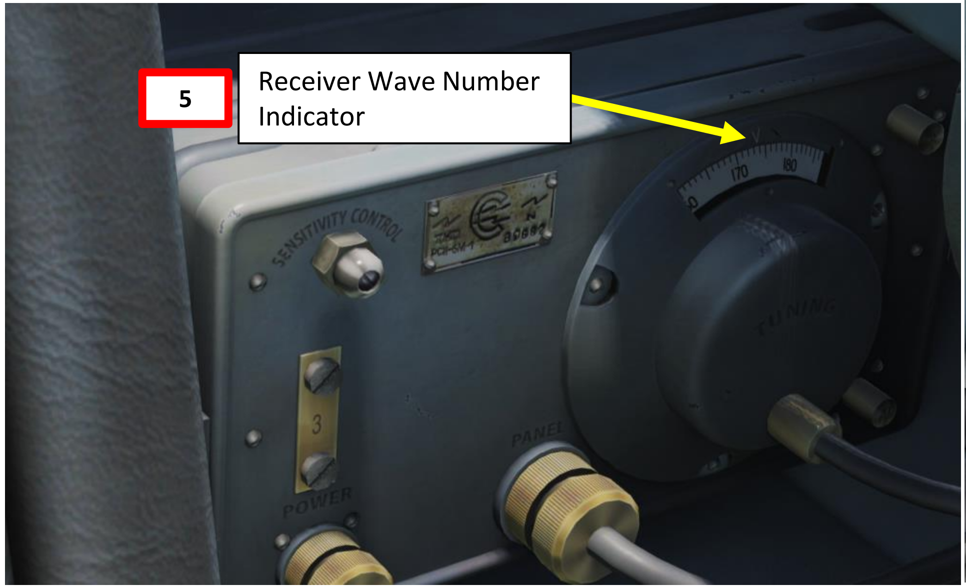




Radio Receiver / ARK Selector

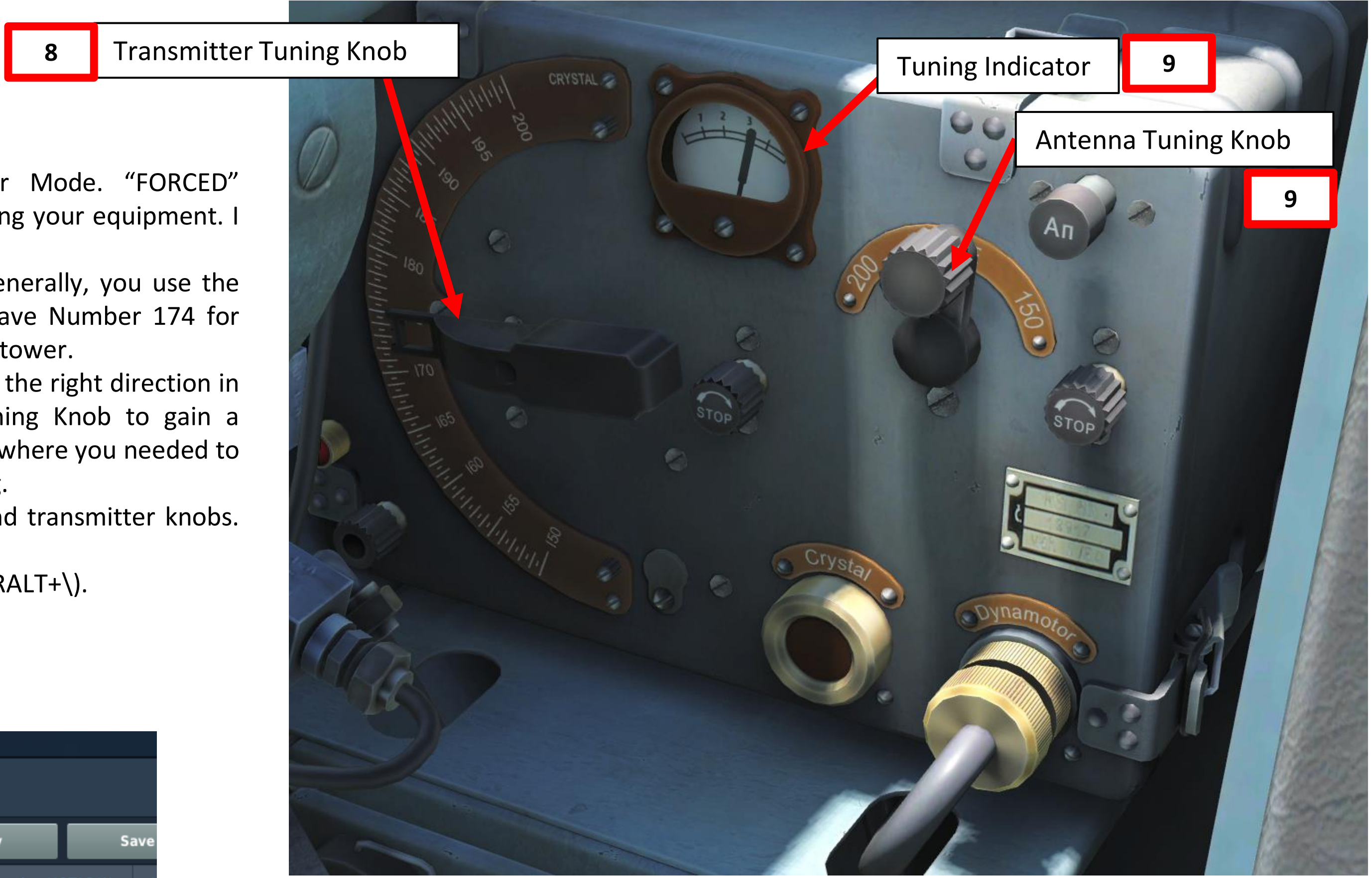


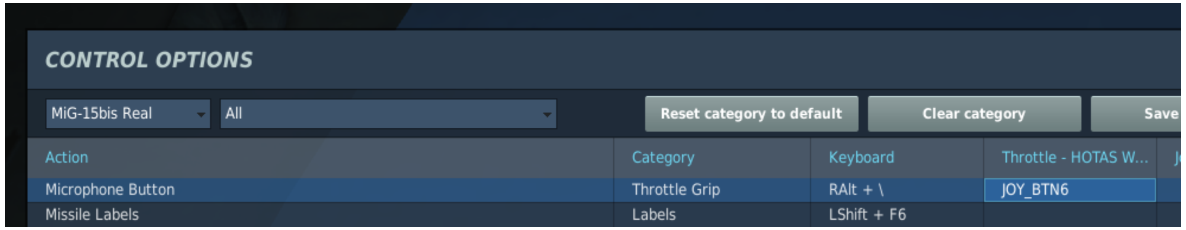


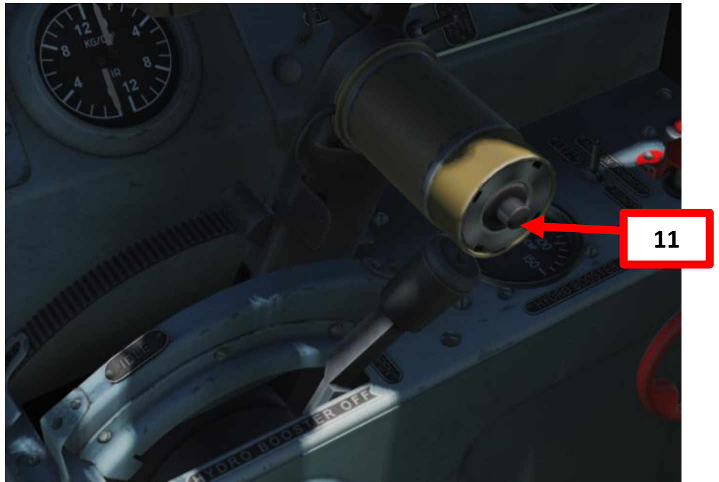


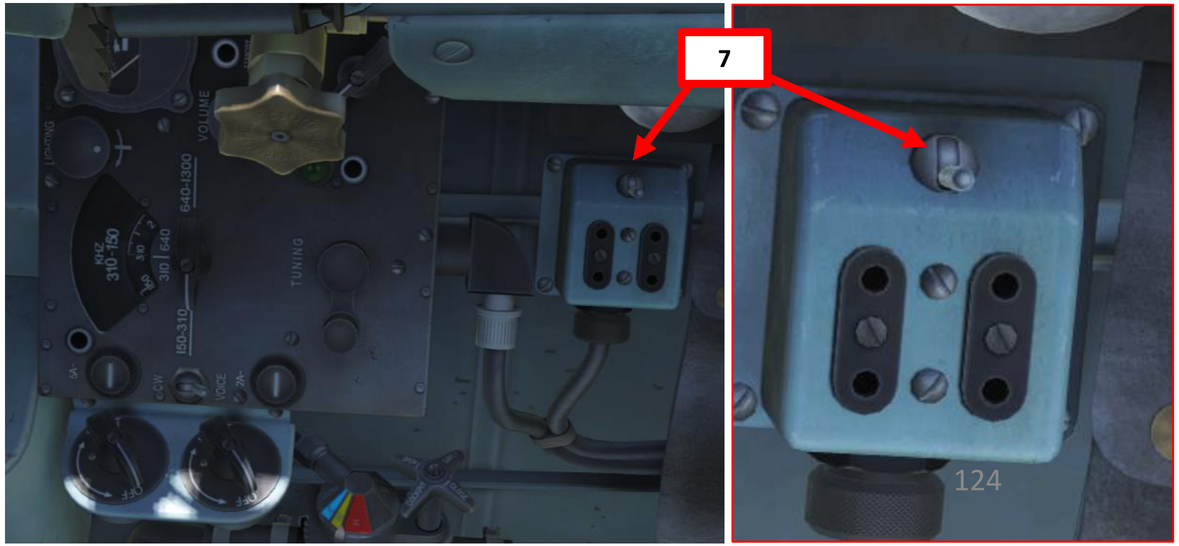
RSI-6K HF RADIO TUTORIAL

7. Choose between "NORMAL" (DOWN) and "FORCED" (UP) Transmitter Mode. "FORCED" transmitter mode will give you extra transmitting range but you risk damaging your equipment. I recommend you stick to "NORMAL" mode.
8. Set your transmitter tuning knob to the desired transmitting frequency. Generally, you use the same "Wave Number" (Frequency ID that you set in Step #3, which is Wave Number 174 for Kobuleti) that you receive on if you want to communicate with, say, a control tower.
9. You need to tune your antenna in order to make sure you are transmitting in the right direction in relationship to whoever you are transmitting to. Use your Antenna Tuning Knob to gain a maximum intensity on the tuning indicator. It's just like the old-school radios where you needed to unfold the antenna and toy with it during hours to be able to receive anything.
10. Once you have an acceptable tuning intensity, you can lock the antenna and transmitter knobs. However, this step is not mandatory.
11. You can now transmit using the Microphone button on your throttle Button (RALT+\).



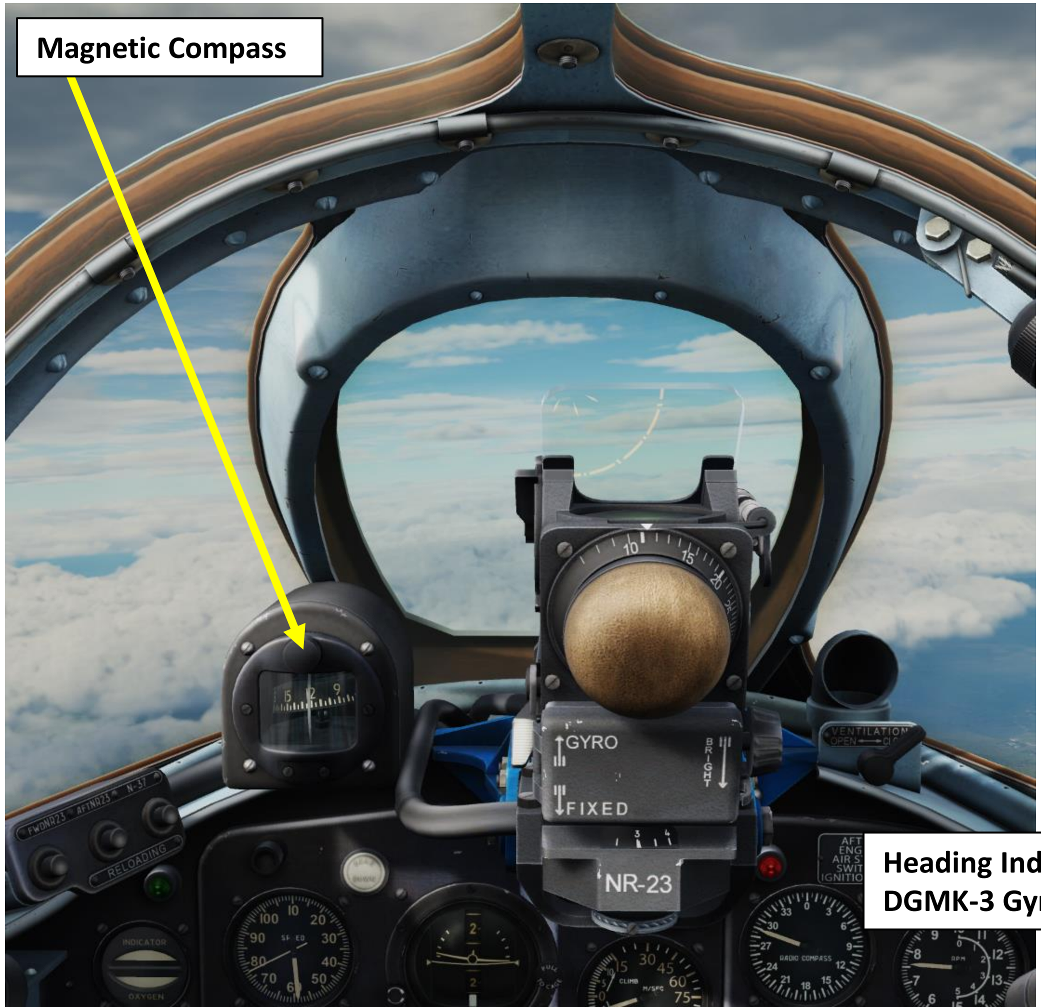


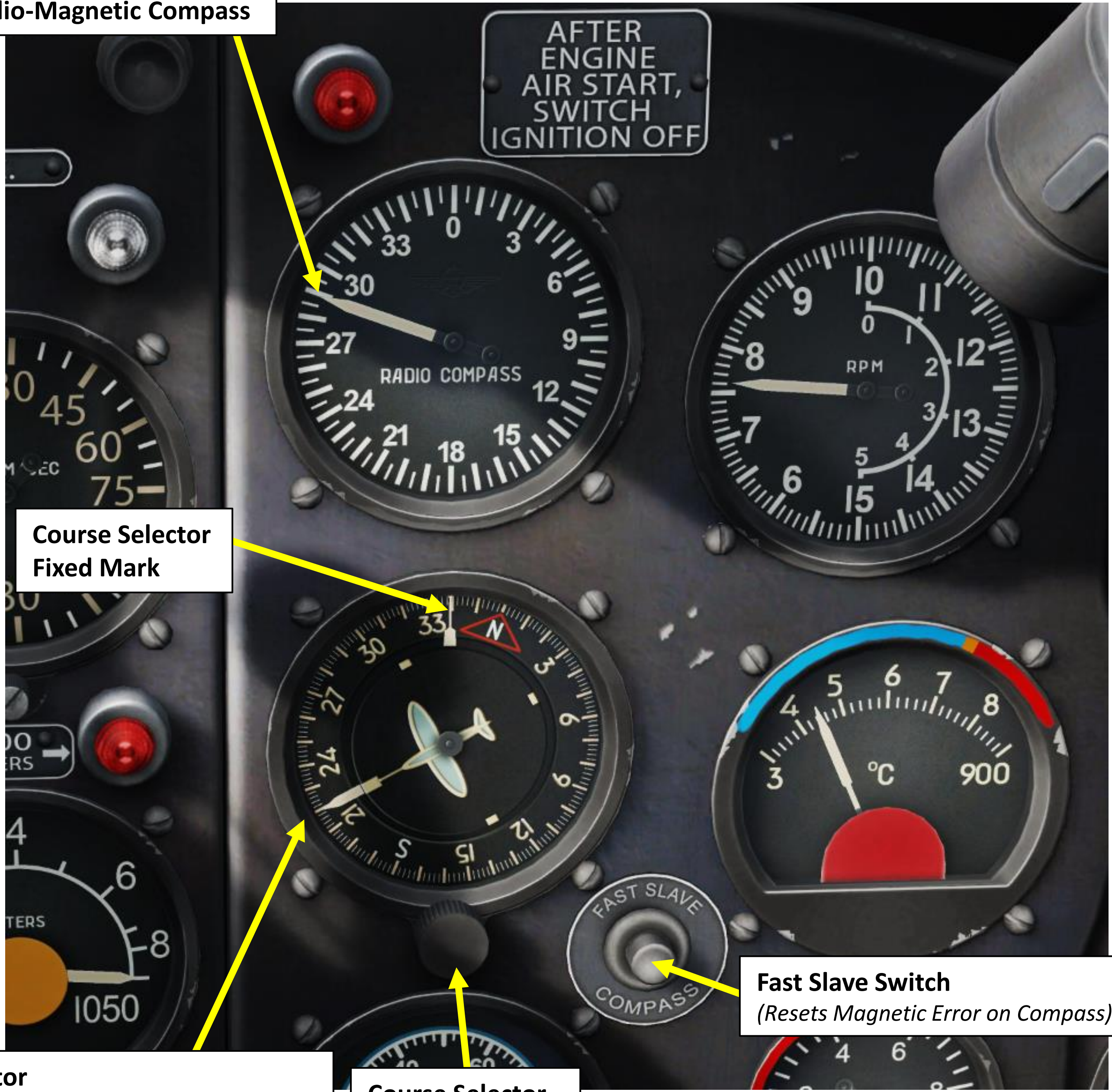




BASIC NAVIGATION EQUIPMENT

In the MiG-15, navigation is mostly done visually, as was the case in the 1950's. The Gyro-Magnetic Compass provides you with your current magnetic heading. The conventional magnetic compass is a back-up device for determining the aircraft's magnetic heading. It is installed to allow navigation in case of instrument or electrical system failure. The Radio-Compass pointer is used for radio-navigation.





BASIC NAVIGATION EQUIPMENT

Point 1: Initial position. Current magnetic heading (MH) is 17°, fixed mark (CS) is over 64°.

Positions 1a-2: pilot rotates CS knob, setting new heading (in our case it is 312°) and arrow with airplane symbol will follow the moving scale (i.e. MH was 17° and will remain the same if there were no maneuvering).

Position 3: By rolling to the left (the shortest possible way in this case) pilot performs turn to the new heading.

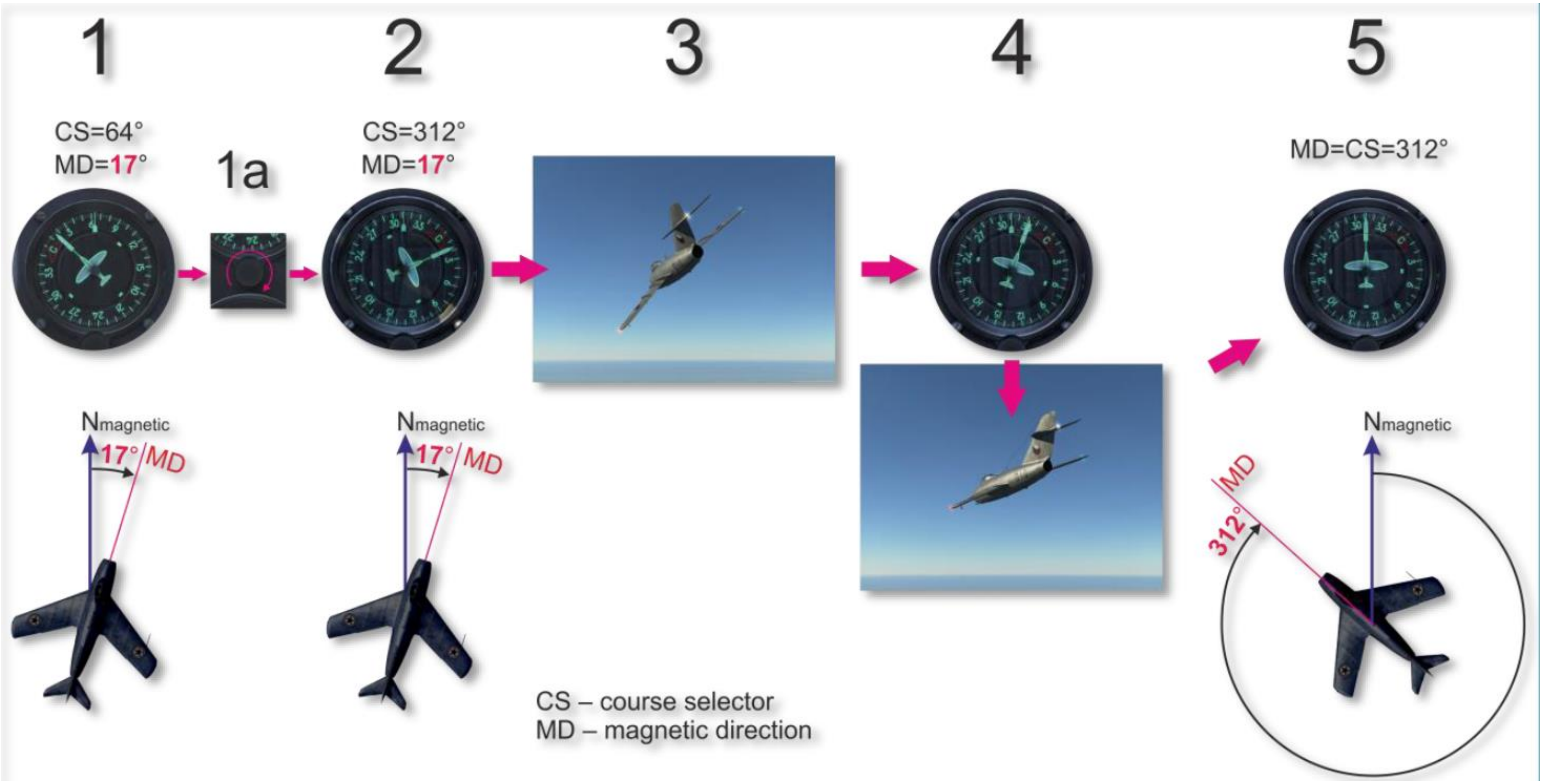
Position 4: Intermediate position. Being closer (MH=332°) to desired heading (CS=312°) pilot reduces the roll.

Position 5. Airplane is on new heading: MH=CS=312°.

Notes:

- To simplify understanding, one could imagine that during pilot turns the airplane and the aircraft-arrow on the DGMK-3 gauge. Other main elements of the compass are magnetic sensor, gyro unit, current converter, and slave button.
- The operation of the DGMK-3 is based on the ability of a floating magnet to orient itself in the plane of the magnetic meridian and on the potentiometric principle of remote transfer of the current position of the induction sensor (coil) to the gyro unit. The gyro unit filters out the vertical component of the Earth's magnetic field during aircraft maneuvering (pitch and roll variations). The position of the gyro unit is continuously aligned with that of the induction sensor. Only the horizontal component of the Earth's magnetic field is recorded, irrespective of aircraft position and attitude. The gyro unit also smoothes the alignment of the potentiometer positions of the magnetic sensor and the gyro unit, thereby preventing tremor of the compass needle during aircraft shaking.

DGMK-3 Gyro-Magnetic Compass Usage



UNDERSTANDING THE ARK-5 AUTOMATIC DIRECTION FINDER

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

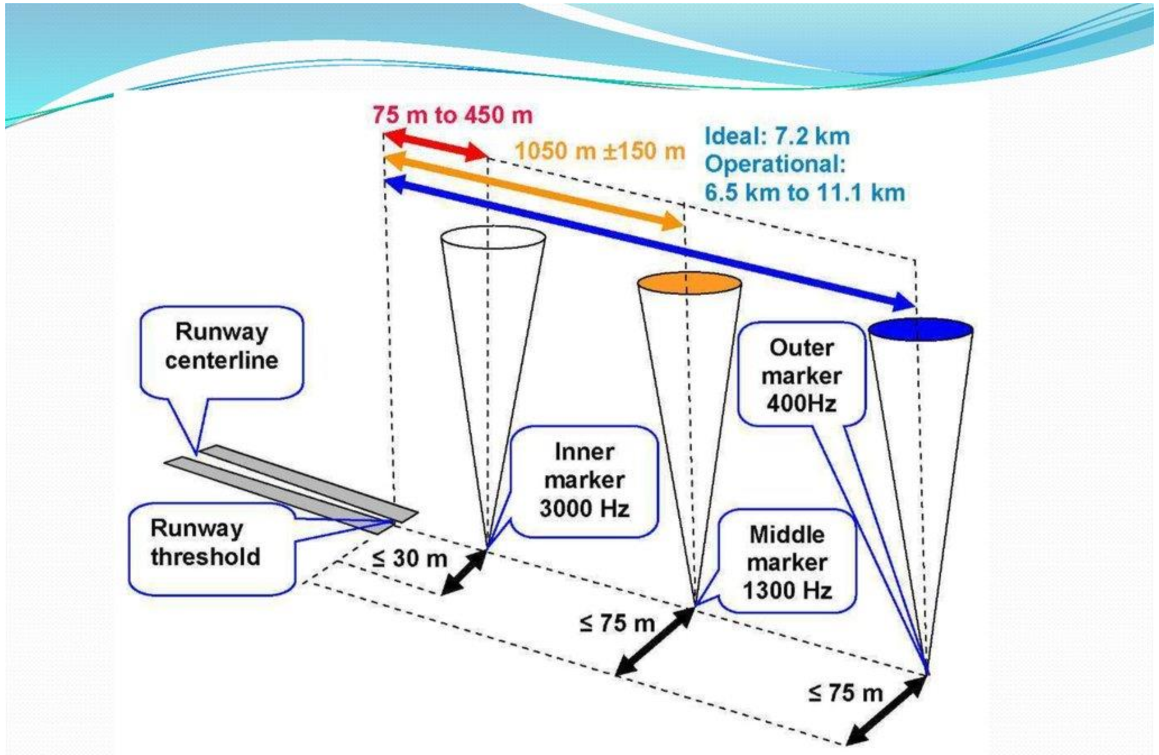


Figure 14: Marker beacon placement with respect to runway

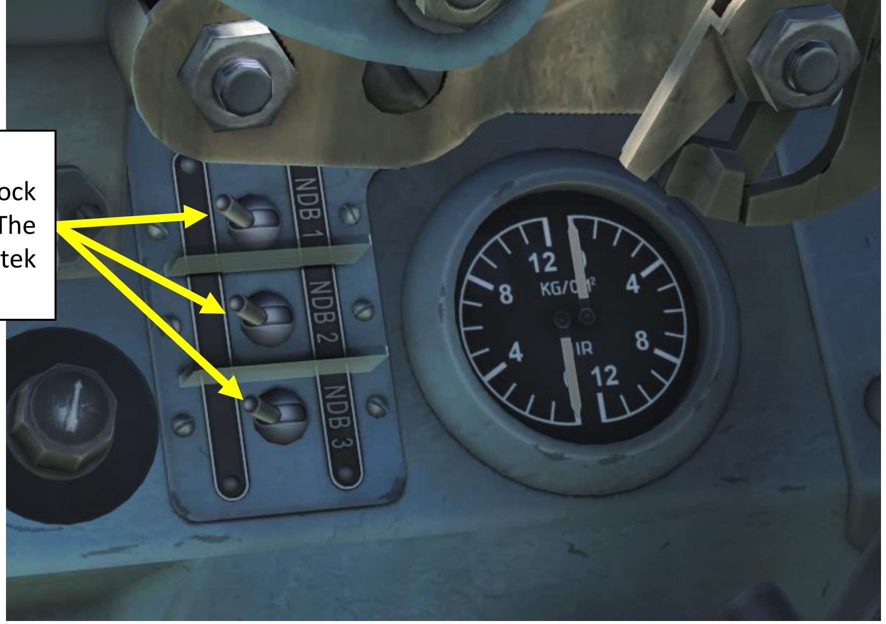
K-7 ARK-5 COMPONENTS

1. Receiver Mode Switch
   - ТЛГ-ТЛФ/TLG-TLF (Telegraph/Telephony)
2. 3-position frequency range selector switch
3. Frequency Range Indicator
4. Panel illumination dimmer
5. Volume knob
6. Frequency Intensity Indicator
7. Antenna Mode
8. Radio Compass Mode Selector
   - КОМП = COMP (Auto Compass mode)
9. ARK-5 ON/OFF Light
10. Frequency Fine Tuning Handle

ARK-5 PANEL OVERVIEW

K-7 ARK-5 COMPONENTS

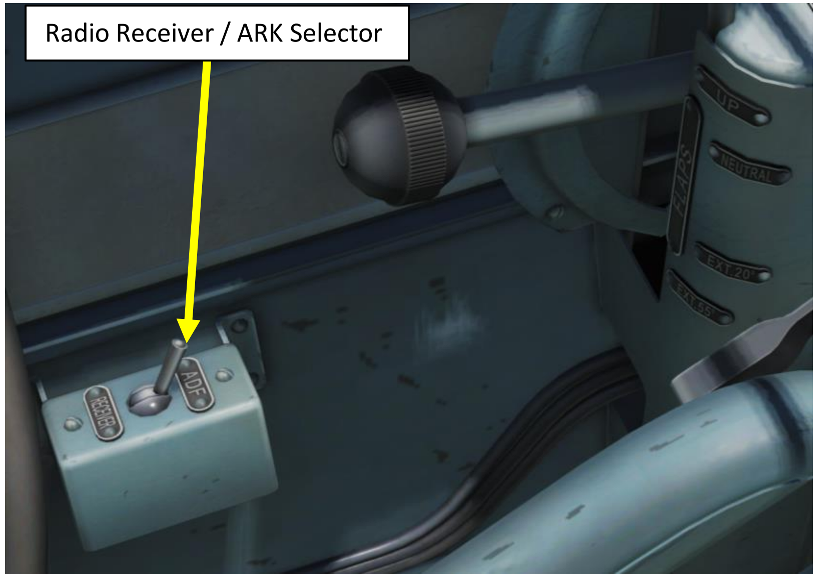
No Function in DCS.
In previous versions, these switches were used to stock preset NDB frequencies set through the Mission Editor. The functionality has been changed since, but the Belsimtek Manual has not been updated yet to reflect this.



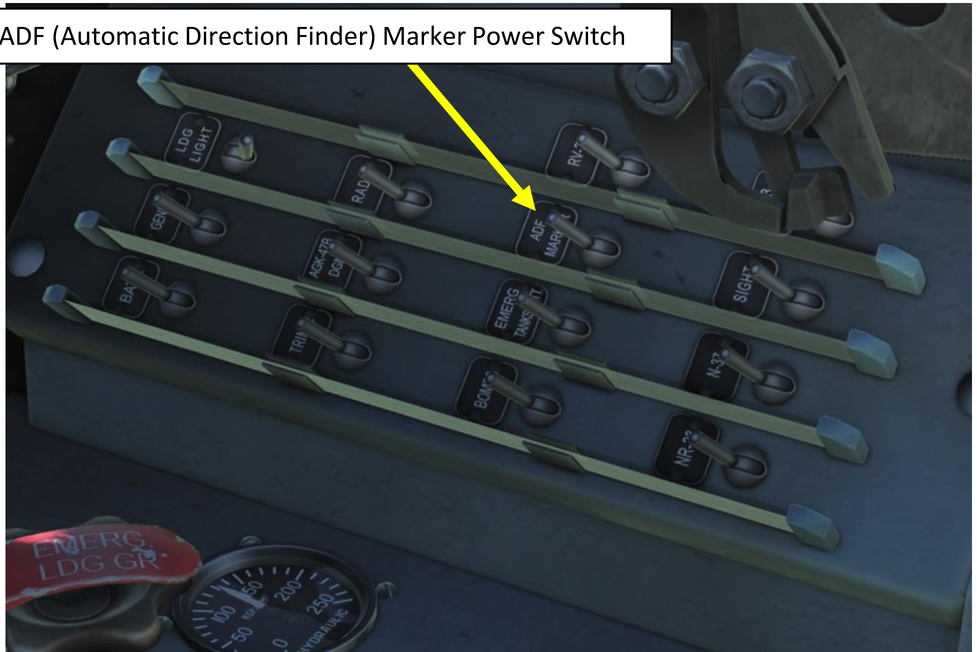
ARK-5 Radio Navigation System NEAR/FAR Frequency Homing Selector Switch

Radio-Compass

Radio Receiver / ARK Selector



ADF (Automatic Direction Finder) Marker Power Switch

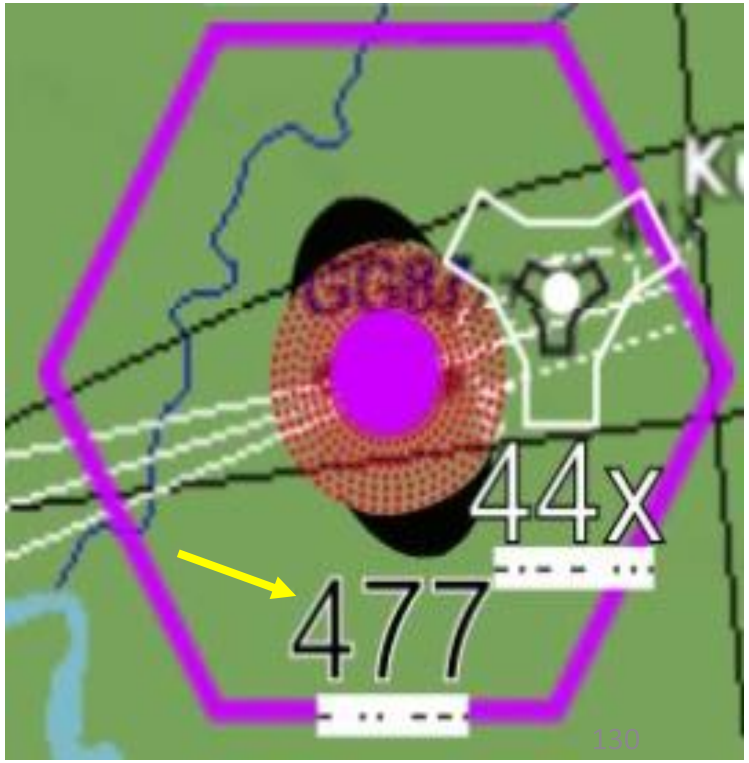


K-7 ARK-5 RADIO NAVIGATION

- We will use a “NDB” (Non-Directional Beacon) for radio compass navigation. These NDBs are located at various airfields and certain places. Take note that they are hardcoded in the map.
- A NDB Frequencies List is available in the next page
- NDBs transmit a morse code on a set frequency that can be heard with the ARK (Automatic Radio Compass). The source of the signal can be detected with the radio compass on the main instrument panel (its arrow will tell you where the signal you are receiving is coming from).
- There can be many NDBs transmitting at frequencies that are very close to one another, so it can be easy to follow another signal by mistake.
- Radio tuning is very precise and sensitive. The only reliable way to know if you are tracking the good signal is to listen to the morse code signal emitted by the beacon and verify that it matches.
- All Beacons and their respective morse codes are listed in **LINO_GERMANY’S BEACON MAP** available here:

DIRECT DOWNLOAD: https://drive.google.com/open?id=0B-uSpZROuEd3YWJBUmZTazBGajQ&authuser=0

- In the following example, I will fly from the West of the airfield at Kutaisi (which already has two NDBs next to it transmitting other signals on their own frequencies).
- The signal I will track is a NDB near the small town of Kutaisi. The beacon map tells us that the beacon is transmitting on **a frequency of 477.00 MHz and the Morse Code is – . . – – .**
- I can associate the morse code with one long beep, followed by a pause, followed by two short beeps, followed by a pause, followed by two long beeps and followed by a short beep.
- Takeof note that if you fly under 2000 meters, there might be interferences from ground clutter.
- **IMPORTANT NOTE**: 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.



MiG-15bis Default ATC Channel List (Russia)

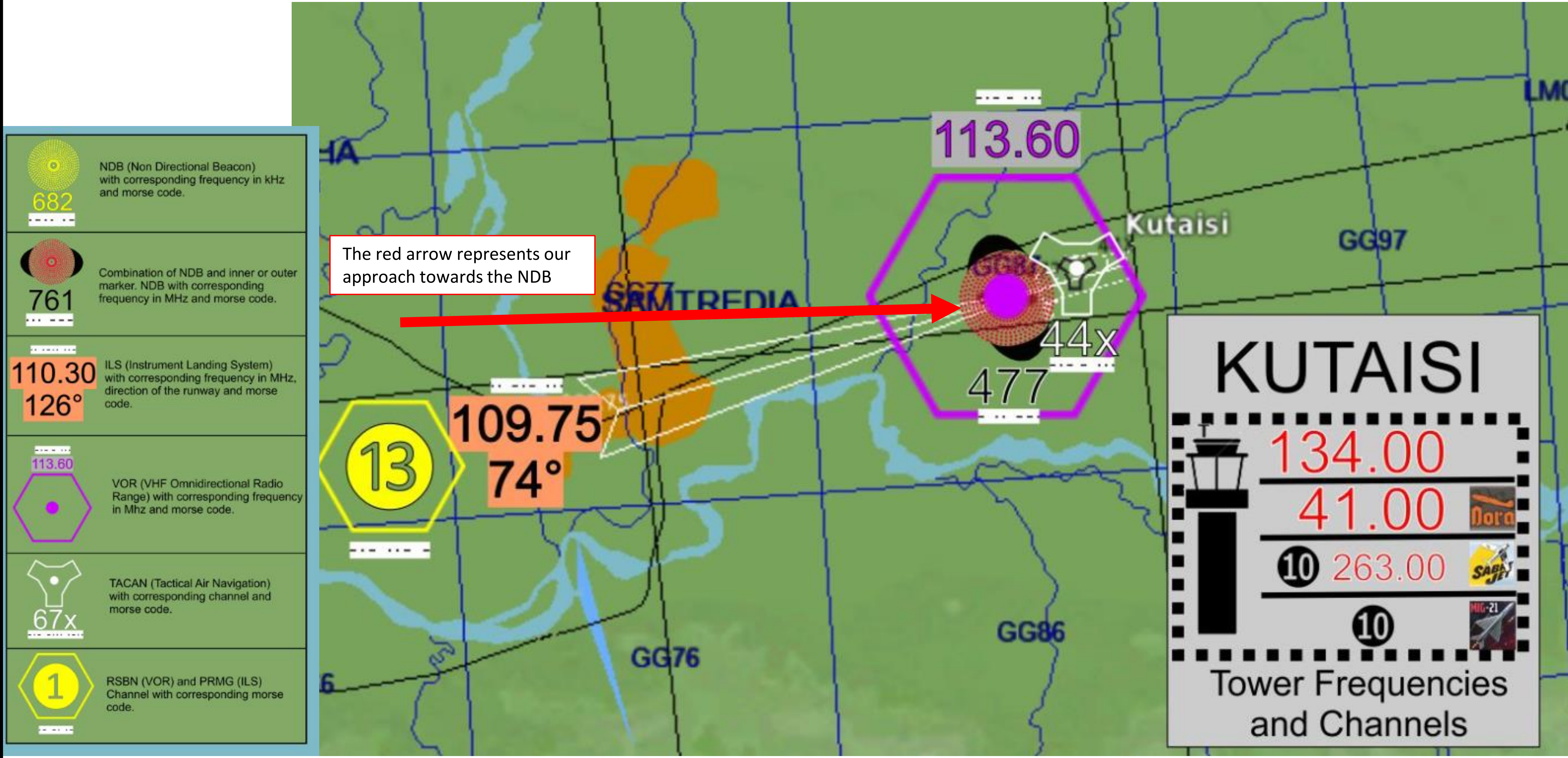
Airfield	ATC Stations (MHz)	ATC Wave Number	NDB Stations (Inner)	NDB Stations (Outer)
Anapa	3.75	150	215.0 kHz	443.0 kHz ·_ _·
Beslan	4.75	190	250.0 kHz	1050.0 kHz _·_· ····
Gelendzhik	4.00	160		
Krasnodar-C	3.80	152	303.0 kHz	625.0 kHz ___ ___
Krasnodar-P	4.10	164	240.0 kHz	493.0 kHz _·_ ·_·
Krymsk	3.90	156	830.0 kHz	408.0 kHz _·_ ·__
Maykop	3.95	158	591.0 kHz	288.0 kHz ·_· _·_
Min Vody	4.45	178	283.0 kHz	583.0 kHz _· ·_·
Mozdok	4.55	182	1065.0 kHz	525.0 kHz _·· ___
Nalchik	4.50	180	350.0 kHz	718.0 kHz __ ·_··
Sochi	4.05	162	761.0 kHz	761.0 kHz ··· ___

MiG-15bis Default ATC Channel List (Georgia)

Airfield	ATC Stations (MHz)	ATC Wave Number	NDB Stations (Inner)	NDB Stations (Outer)
Batumi	4.25	170		
Gudauta	4.20	168	395.0 kHz	395.0 kHz __·· _·_·
Kobuleti	4.35	174	490.0 kHz	870.0 kHz _·_ _
Kutaisi	4.40	176	477.0 kHz	477.0 kHz _ ·· __·
Senaki	4.30	172	129.0 kHz	156.0 kHz _ ··
Soganlug	4.65	186		
Sukhumi	4.15	166	489.0 kHz	489.0 kHz ·_ ···_
Tbilisi	4.60	184	435.0 kHz	211.0 kHz _· ·_
Vaziani	4.70	188		

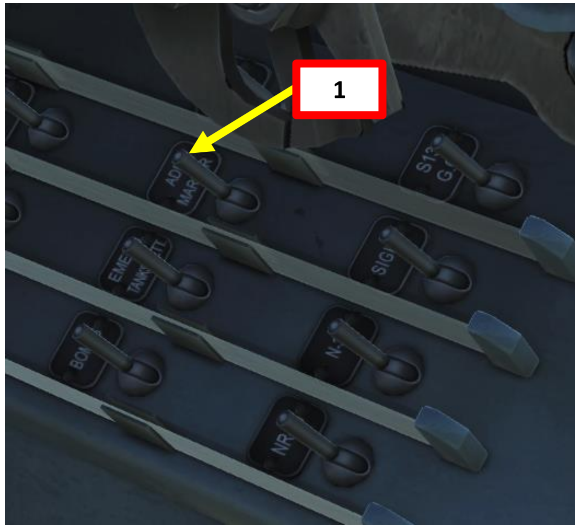
List of Airfield Air Traffic Controller (ATC) frequencies and wave numbers. Thanks, Uboats!
https://www.digitalcombatsimulator.com/en/files/1303678/

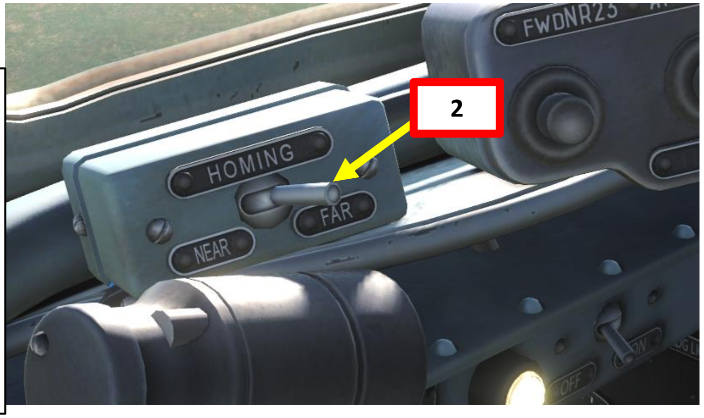
K-7 ARK-5 RADIO NAVIGATION

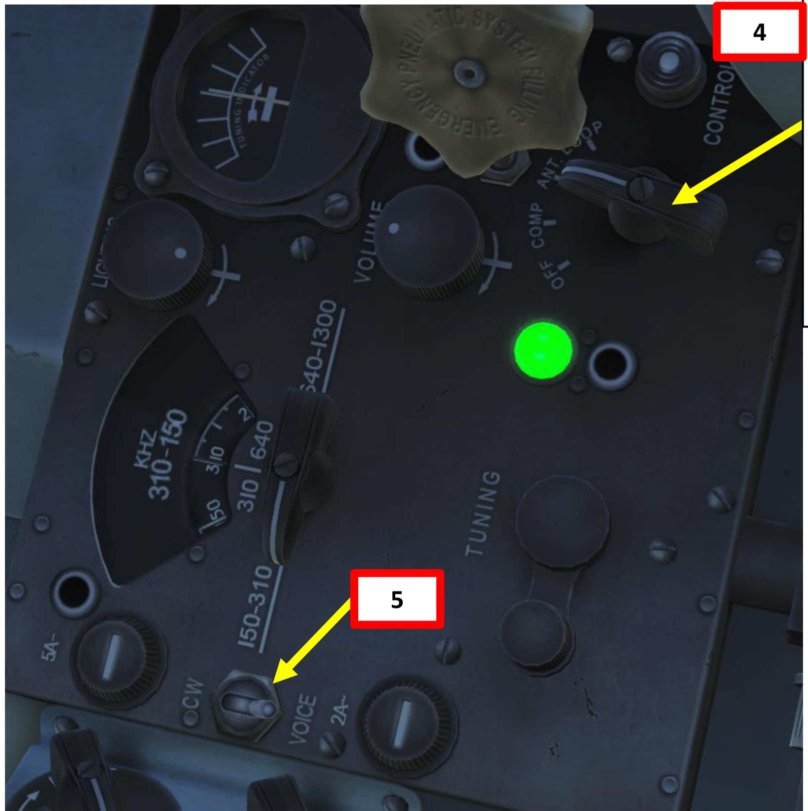


K-7 ARK-5 RADIO NAVIGATION TUTORIAL

1. Turn on the ARK-5 ADF Marker Power Switch (FWD)
2. Set the ARK-5 Near/Far Homing Selector Switch to the desired NDB (NEAR = AFT, FAR = FWD). We will use "FAR" in this case since we will only track a single NDB. If we wanted to track two NDBs near an airport (an Outer and an Inner marker), we would tune the ARK-5 to the Outer Marker NDB frequency while the Homing Selector is set to FAR. After, we would tune the ARK-5 to the Inner Marker NDB frequency while the Homing Selector is set to NEAR. Both frequencies being saved, we can then switch between NEAR and FAR frequencies using the Homing selector instead of having to re-tune every time manually.
3. Set the ARK/RECEIVER switch to "ARK/ADF" (FWD).
4. Set the Antenna Mode to AHT (ANT).
5. Set the ТЛГ-ТЛФ (TLG-TLF, or Telegraphy-Telephony) Receiver Mode to Telephony/Voice (ТЛФ) Mode (AFT). No NDBs in DCS require the ТЛГ/Telegraphy Mode so far.

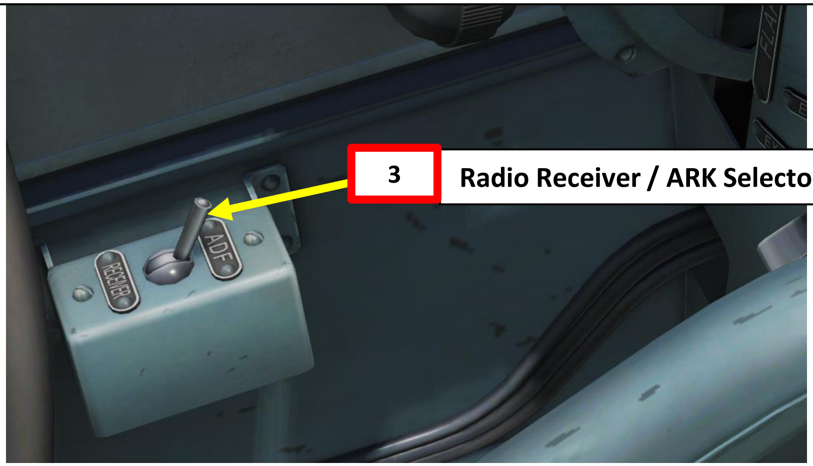






ARK-5 Radio Navigation System Function Selector Switch

- *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.*



Radio Receiver / ARK Selector

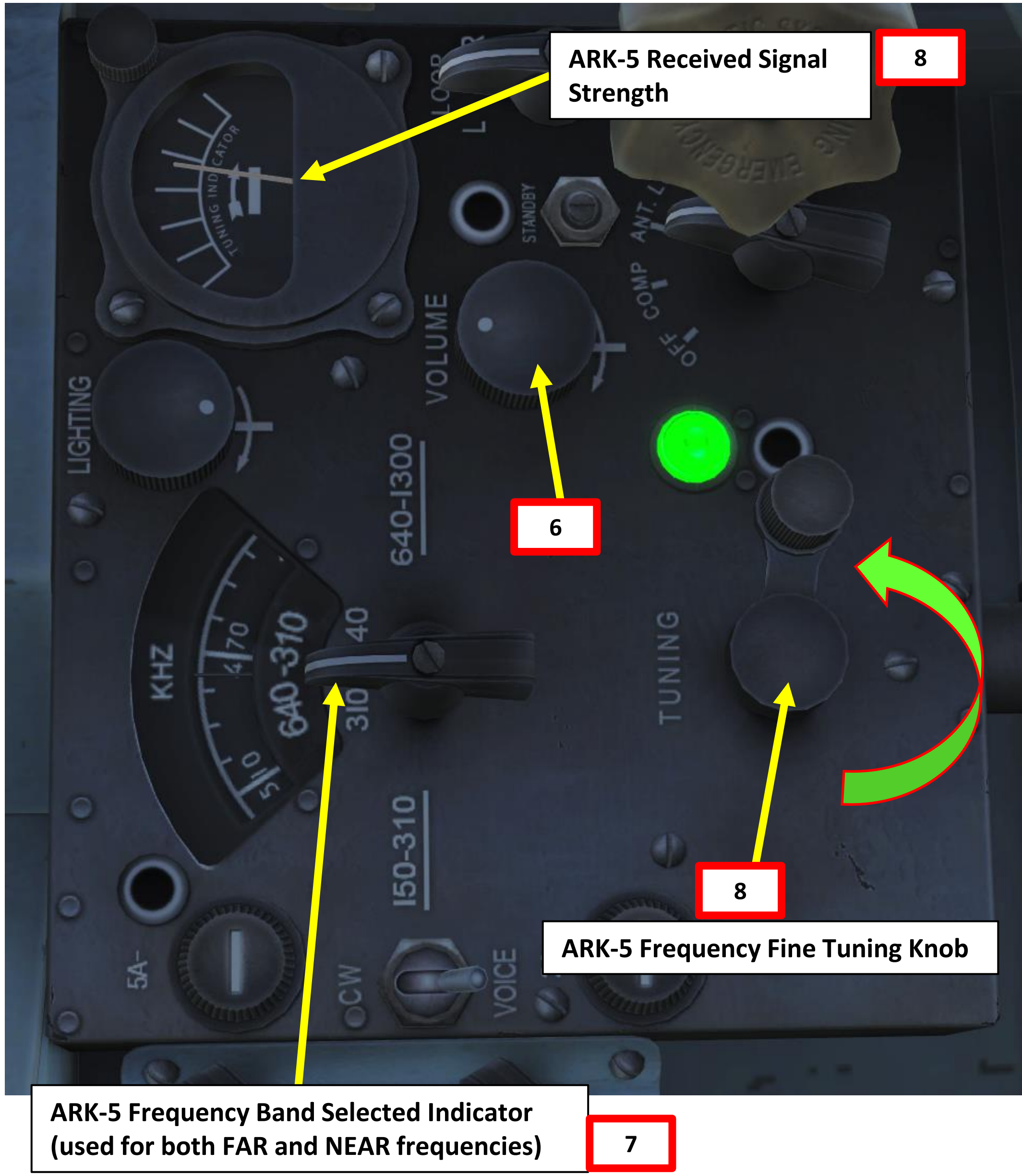
K-7 ARK-5 RADIO NAVIGATION TUTORIAL

6. Adjust Volume as required
7. Set the NDB range according to the NDB frequency we are looking for. In our case, we want 477.0 KHz, which is in the 310-640 KHz range. The ranges go from 150-310 KHz, 310-640 KHz and 640-1300 KHz.
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.

150–310kHz

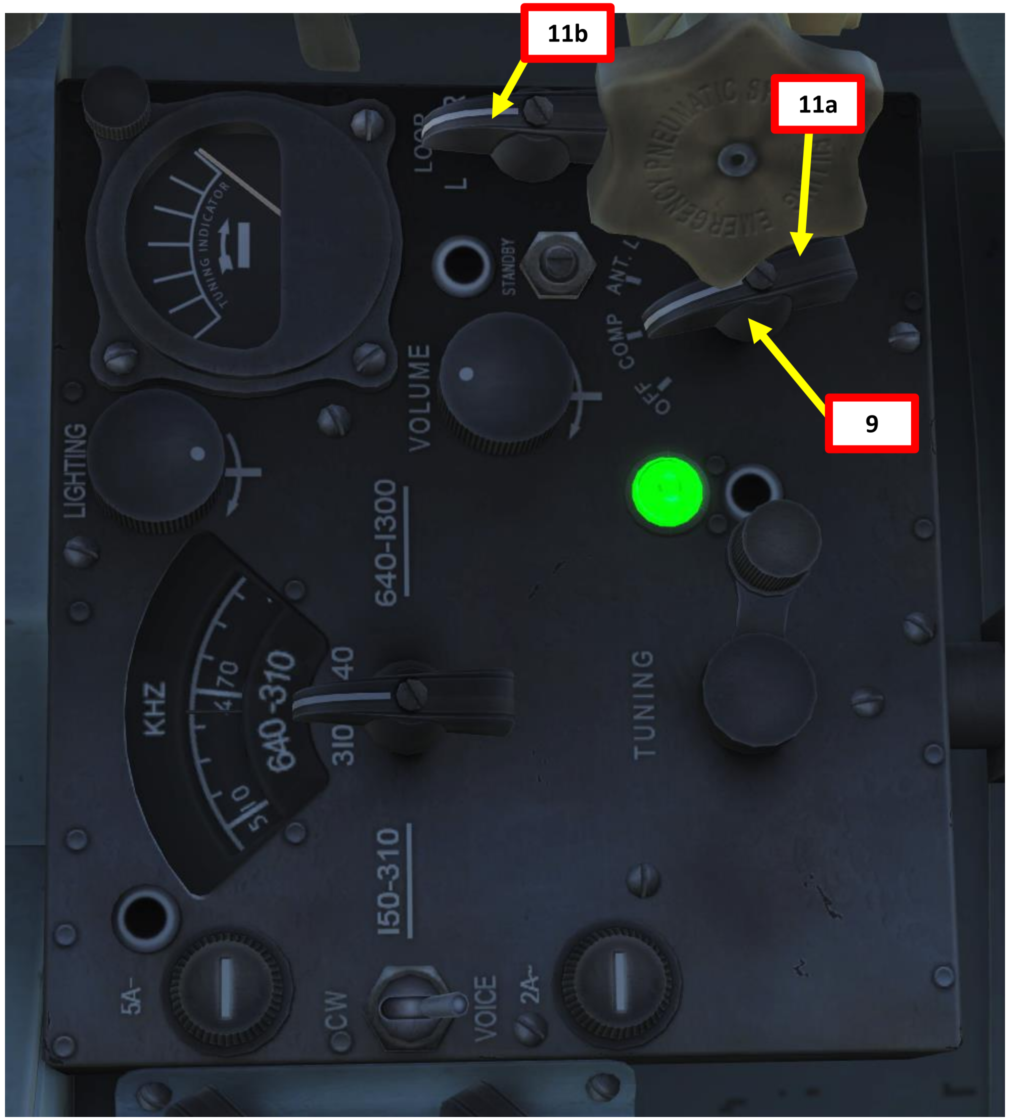
310–640khz

640–1300khz



K-7 ARK-5 RADIO NAVIGATION TUTORIAL

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 Radio-Magnetic Indicator.
10. Confirm that the ARK-5 needle points in the correct direction.
11. (Optional) Test the Antenna "COMP" mode by holding the "Antenna Loop" Switch left or right. This will make the antenna twist left or right. Look to the rear to your right and make sure the antenna comes back when you release the loop switch.
12. Follow the NDB Bearing needle on the Radio-Magnetic Indicator.
13. Once you fly over the Outer Marker (477.000 KHz NDB) near Kutaisi, the BEACON lamp will illuminate, a ringing sound will be audible and the NDB Bearing needle will do a 180 deg as the navigation aid goes behind you.



MiG-15bis Default ATC Channel List (Georgia)

Airfield	ATC Stations (MHz)	ATC Wave Number	NDB Stations (Inner)	NDB Stations (Outer)
Batumi	4.25	[illegible]	[illegible]	
Gudauta	4.20	168	395.0 kHz	395.0 kHz --·· -·-·
Kobuleti	4.35	174	490.0 kHz	870.0 kHz -·- -
Kutaisi	4.40	176	477.0 kHz	477.0 kHz -·· --·
Senaki	4.30	172	129.0 kHz	[illegible]56.0 kHz - ··
Soganlug	4.65	186	[illegible]	
Sukhumi	4.15	[illegible]	[illegible]	489.0 kHz ·- ···-
Tbilisi	4.60	184	435.0 kHz	211.0 kHz -· ·-
Vaziani	4.70	188		

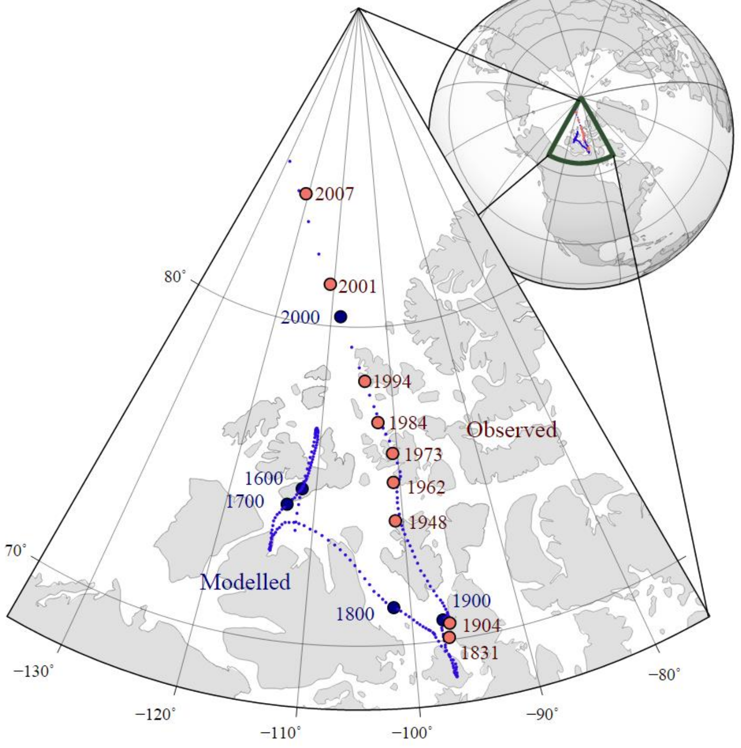
MAGNETIC VARIATION

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).

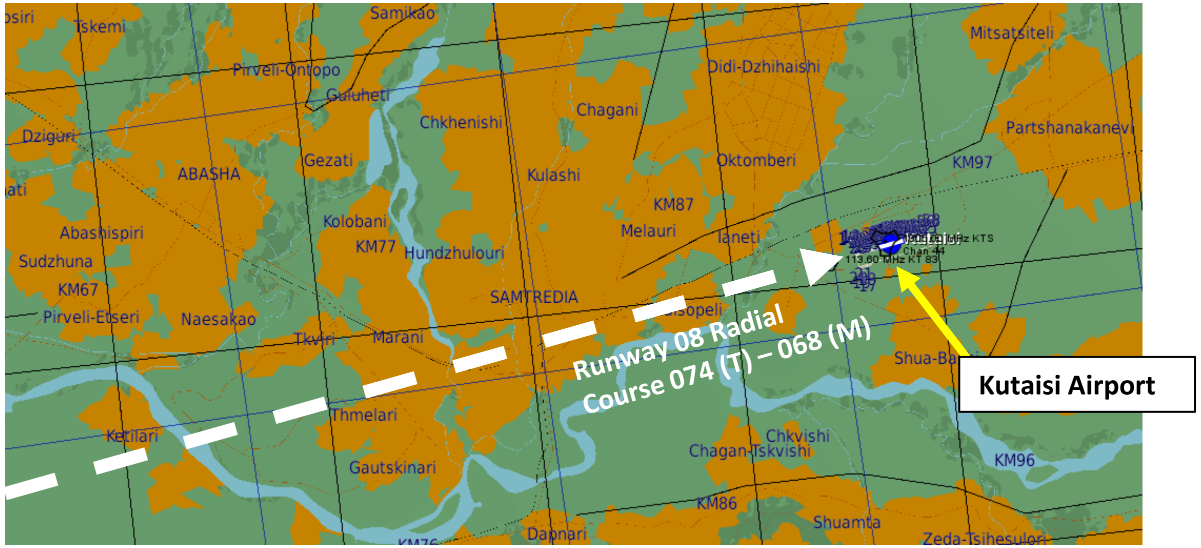
True Heading = Magnetic Heading + Magnetic Variation

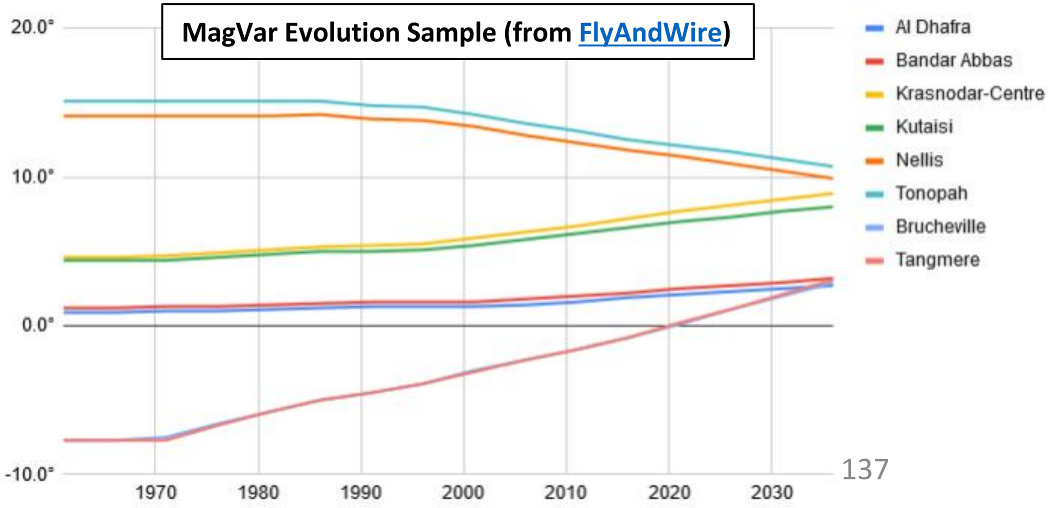
As an example, if the runway heading that you read on the F10 map in Kutaisi is 074 (True Heading), then the direction you should take with your magnetic compass course should be 074 subtracted with the Magnetic Variation (+6 degrees), or 068. In other words, you would need to use a course of 068 (M)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



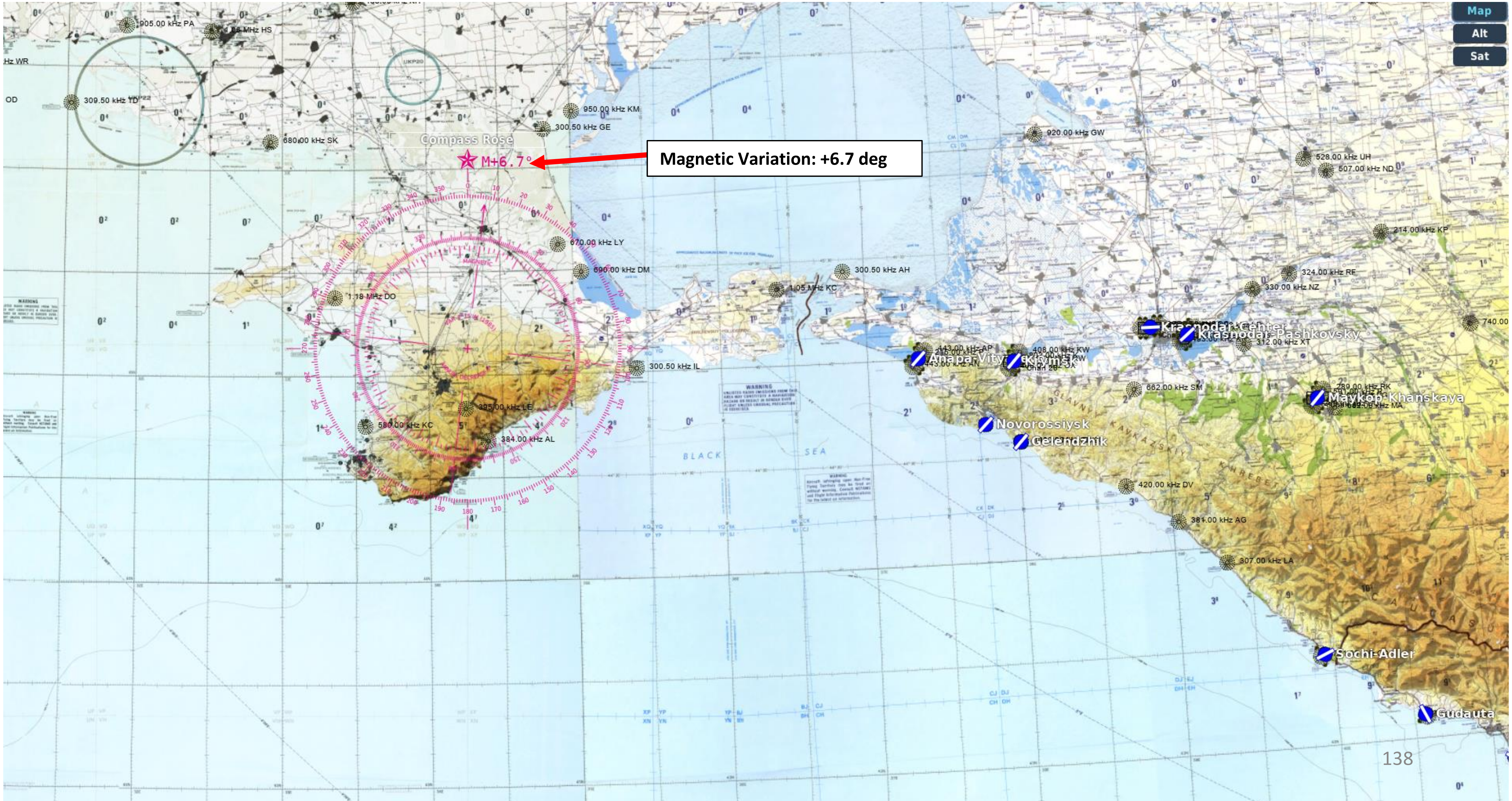
The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007.





MAGNETIC VARIATION

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

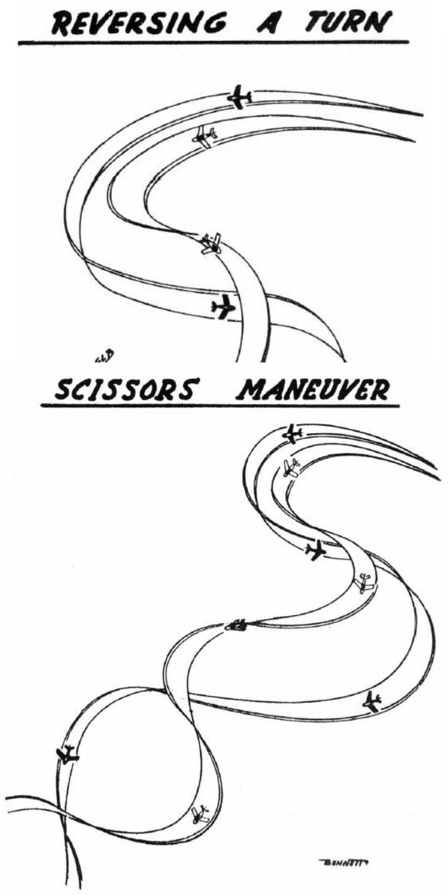


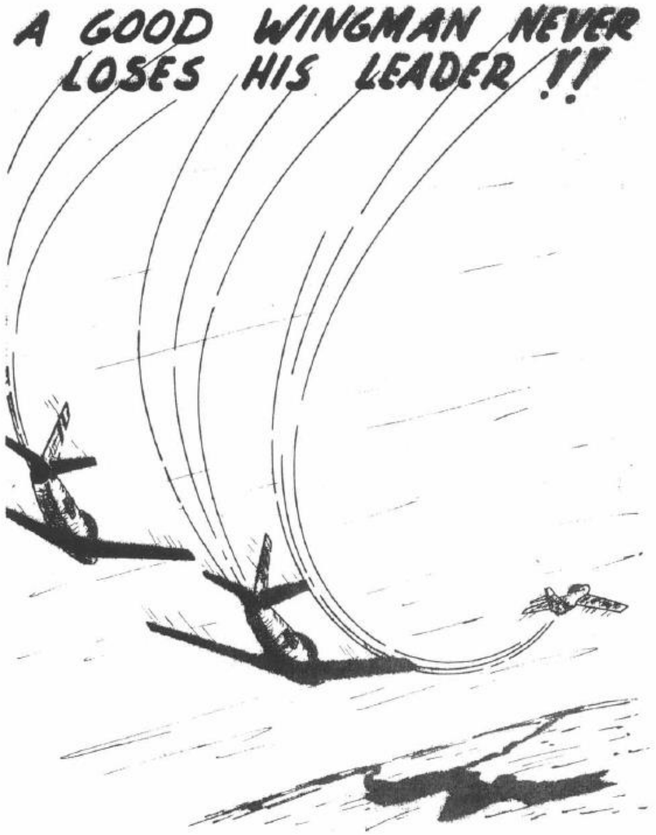
COMBAT TIPS & TRICKS

COMBAT TIPS & TRICKS

You should consult “No Guts, No Glory”, an excellent textbook written by USAF Major General Frederick C. Blesse (Ret.). It has excellent insight on how the Sabre should be flown in combat scenarios. It is also applicable to the MiG-15 as it gives you tricks on what to expect from competent Sabre pilots. The rules of wingmanship still apply all the same.

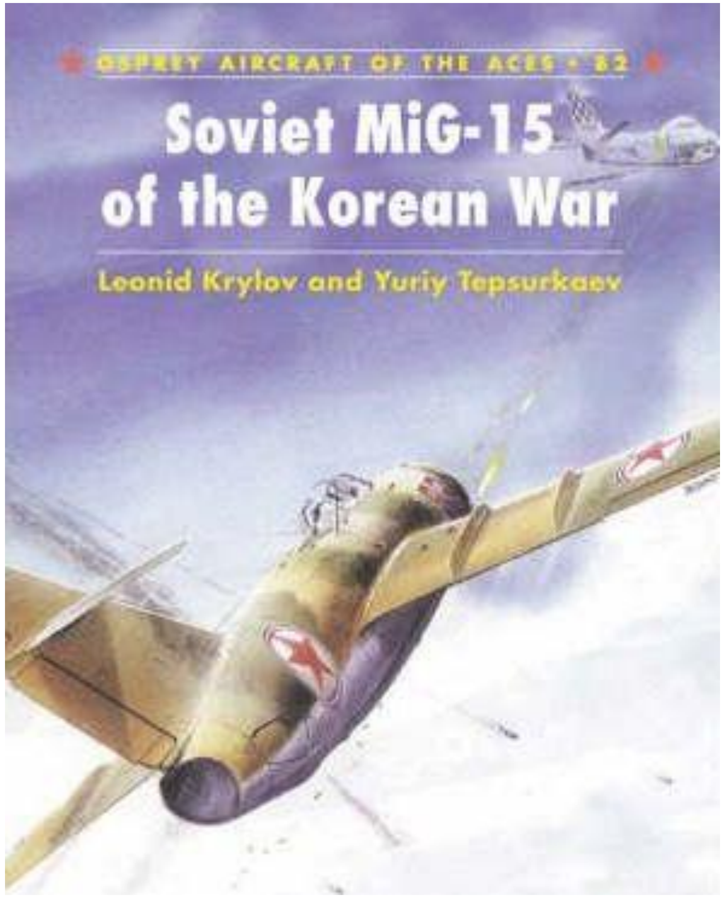
LINK: https://drive.google.com/open?id=0B-uSpZROuEd3T1RudnlMWGZ6OVE&authuser=0

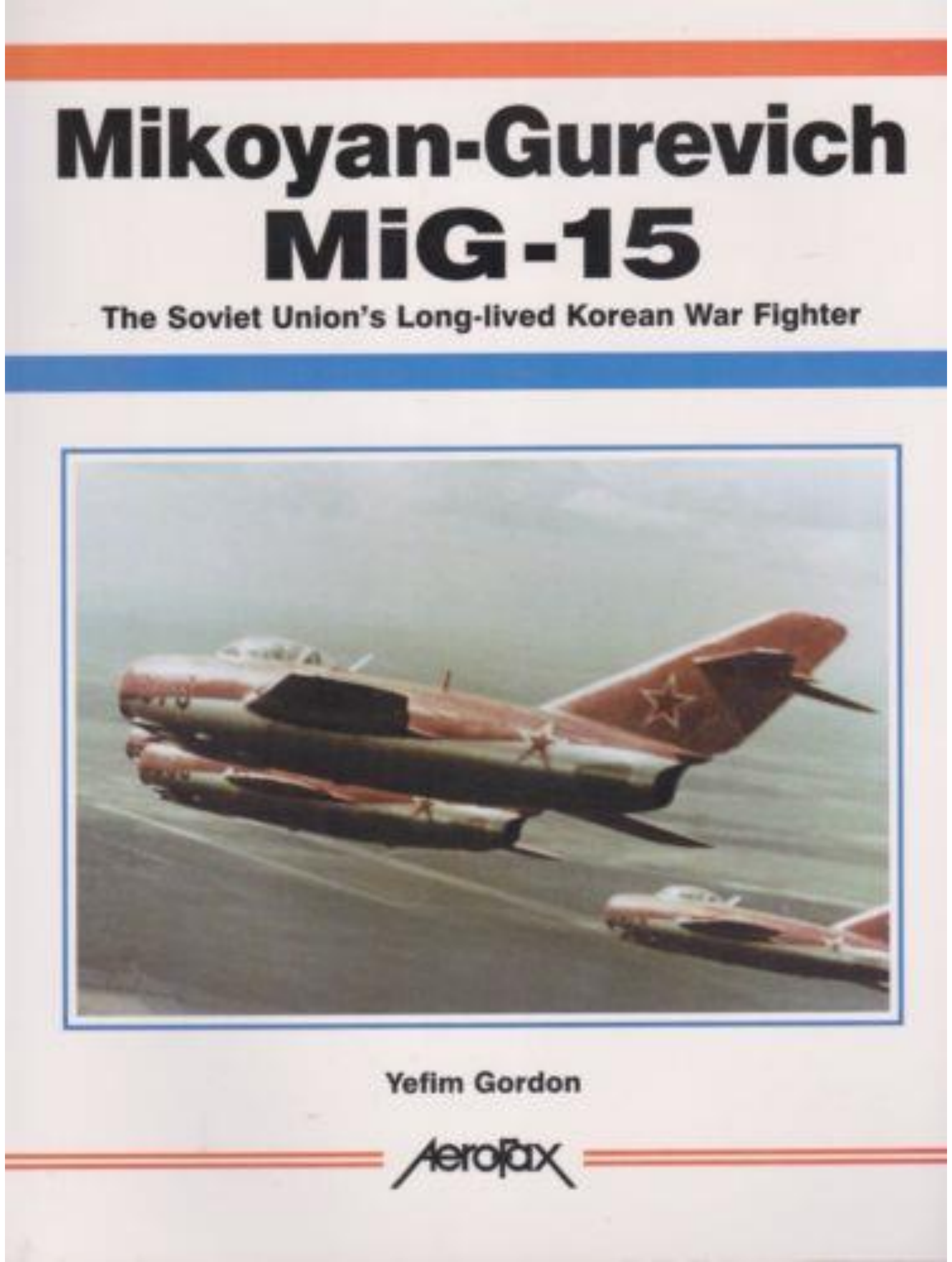




RESOURCES

- **BUNYAP SIMS YOUTUBE CHANNEL**
  - MAIN CHANNEL: https://www.youtube.com/user/4023446/videos
- **LINO_GERMANY BEACON MAP**
  - https://drive.google.com/open?id=0B-uSpZROuEd3YWJBUmZTazBGajQ&authuser=0





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


DCS digital combat series
Chuck_Owl
MiG-15bis FAGOT
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MISSION
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MULTIPLAYER
LOGBOOK
ENCYCLOPEDIA
TRAINING
REPLAY
MISSION EDITOR
CAMPAIGN BUILDER
EXIT
A-10C 1.5.5
Bf 109 K-4 1.5.5
C-101 1.5.5 Beta
CA 1.5.5
F-5E 1.5.5
F-86F 1.5.5
FC3 1.5.5
Fw 190 D-9 1.5.5
Hawk 1.5.5 Beta
Ka-50 1.5.5
L-39 1.5.5
M-2000C 1.5.5 Beta
Mi-8MTV2 1.5.5
MiG-15bis 1.5.5
MiG-21bis 1.5.4
P-40F 1.5.4 Beta
P-51D 1.5.5
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