DCS GUIDE
BF.109K-4 KURFÜRST

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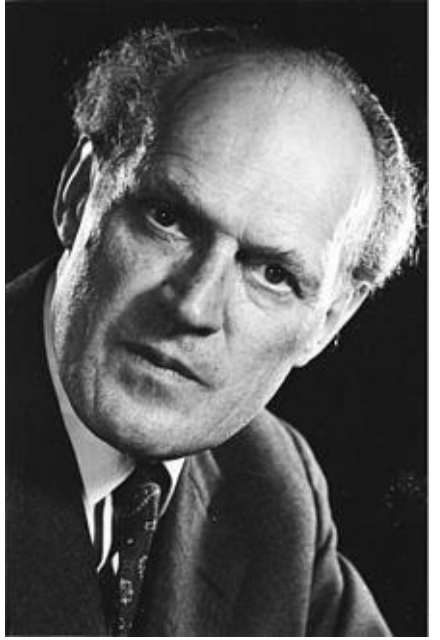
Special thanks to Paul "Goldwolf" Whittingham for creating the guide icons.

PART 1 – INTRODUCTION

The **Messerschmitt Bf.109** is a German World War II fighter aircraft that was the backbone of the Luftwaffe's fighter force. The Bf.109 first saw operational service during the Spanish Civil War in 1939 and was still in service at the dawn of the jet age at the end of World War II in 1945. It was one of the most advanced fighters of the era, including such features as all-metal monocoque construction, a closed canopy, and retractable landing gear. It was powered by a liquid-cooled, inverted-V12 aero engine. From the end of 1941, the Bf.109 was steadily being supplemented by the superior Focke-Wulf FW190.

Originally conceived as an interceptor, later models were developed to fulfill multiple tasks, serving as bomber escort, fighter-bomber, day-, night-, all-weather fighter, ground-attack aircraft, and as reconnaissance aircraft. The Bf.109 was designed by Willy Messerschmitt and Robert Lusser, who worked at *Bayerische Flugzeugwerke*, during the early to mid-1930s. It was supplied to and operated by several states during World War II, and served with several countries for many years after the war. The Bf.109 was the most produced fighter aircraft in history, with a total of 33,984 airframes produced from 1936 up to April 1945.



Willy Messerschmitt
(1898-1978)

Robert Lusser
(1899-1969)

PART 1 – INTRODUCTION

The names "Anton", "Berta", "Caesar", "Dora", "Emil", "Friedrich", "Gustav" and "Kurfürst" were derived from the variant's official letter designation (e.g. Bf 109G – "Gustav"), based on the German spelling alphabet of World War II, a practice that was also used for other German aircraft designs. The final production version of the Bf 109 was the K series, or "Kurfürst", introduced in late 1944, powered by the DB 605D engine with up to 2,000 PS (1,973 HP). Though externally akin to the late production Bf 109G series, a large number of internal changes and aerodynamic improvements were incorporated that improved its effectiveness and remedied existing flaws, keeping it competitive with the latest Allied and Soviet fighters.

An advantage of the 109's design was that the main landing gear, which retracted through an 85-degree angle, was attached to the fuselage, making it possible to completely remove the wings for servicing without additional equipment to support the fuselage. It also allowed simplification of the wing structure, since it did not have to bear the loads imposed during takeoff or landing. The one major drawback of this landing gear arrangement was its narrow wheel track, making the aircraft unstable while on the ground. To increase stability, the legs were splayed outward somewhat, creating another problem in that the loads imposed during takeoff and landing were transferred up through the legs at an angle. The small rudder of the Bf 109 was relatively ineffective at controlling the strong swing created by the powerful slipstream of the propeller during the early portion of the takeoff roll, and this sideways drift created disproportionate loads on the wheel opposite to the swing. If the forces imposed were large enough, the pivot point broke and the landing gear leg would collapse outward into its bay. Experienced pilots reported that the swing was easy to control, but some of the less-experienced pilots lost fighters on takeoff.

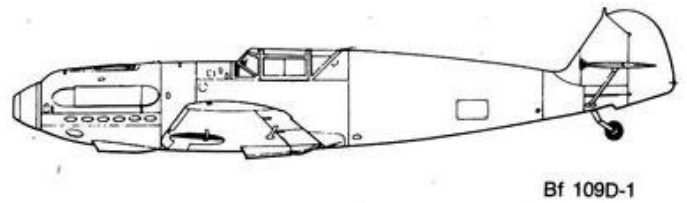
The Bf.109's difficult handling on takeoff became a problem in the final years of the war. Unlike the American and British pilots, the German pilots were constantly sent on combat missions, and did rarely rotate home to take positions as flying instructors. As the war dragged on and casualties mounted, the number of veteran pilots, also known as "*Experten*" or "*Fliegerasse*" (Flying Aces), dwindled to a point where only the *crème de la crème* and/or the luckiest remained. Experience became a scarce resource; the Luftwaffe at the end of the war consisted of a disproportionate amount of poorly trained pilots with very few flight hours, some of them being sent to combat after 8 hours of flight training time. The Bf.109 was notoriously difficult for rookie pilots, which meant that many accidents occurred during takeoff and during landing.

The Bf.109 was instrumental in gaining air superiority for the Wehrmacht during the early stages of the war. The initial production models of the A, B, C and D series were powered by the relatively low-powered, 670–700 PS (661–690 hp) Junkers Jumo 210 series engines. The first redesign came with the E series. The Bf 109E "**Emil"** introduced structural changes to accommodate the heavier and more powerful 1,100 PS (1,085 hp) Daimler-Benz DB 601 engine, heavier armament and increased fuel capacity. Partly due to its limited 300 kilometres combat radius on internal fuel alone, resulting from its 660 km range limit, later variants of the E series had a fuselage ordnance rack for fighter-bomber operations or provision for a long-range, standardized 300 litres drop-tank and used the DB 601N engine of higher power output. During the Battle of Britain, the Bf.109E was pressed into the role of escort fighter, a role for which it was not originally designed, and it was widely employed as a fighter-bomber, as well as a photo-reconnaissance platform.

The second big redesign during 1939–40 gave birth to the F series. The "**Friedrich"** had new wings, cooling system and fuselage aerodynamics, with the 1,175 PS (1,159 hp) DB 601N (F-1, F-2) or the 1,350 PS (1,332 hp) DB 601E (F-3, F-4). Considered by many as the high-water mark of Bf 109 development, the F series abandoned the wing cannon and concentrated all armament in the forward fuselage with a pair of synchronized machine guns above and a single 15 or 20 mm Motorkanone-mount cannon behind the engine, the latter firing between the cylinder banks and through the propeller hub, itself covered by a more streamlined, half-elliptical shaped spinner that better matched the streamlining of the reshaped cowling, abandoning the smaller, conical spinner of the Emil subtype. The F-type also omitted the earlier stabilizer lift strut on either side of the tail. The improved aerodynamics were used by all later variants. Despite mixed results over Britain, with the introduction of the improved Bf 109F, the type again proved to be an effective fighter during the Invasion of Yugoslavia (where it was used by both sides), the Battle of Crete, Operation Barbarossa (the invasion of the USSR) and the Siege of Malta.

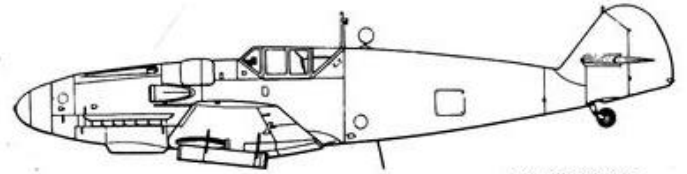
The G series, or "**Gustav**", was introduced in mid-1942. Its initial variants (G-1 through G-4) differed only in minor details from the Bf 109F, most notably in the more powerful 1,475 PS (1,455 hp) DB 605 engine. The later G series (G-5 through G-14) was produced in a multitude of variants, with uprated armament and provision for kits of packaged, generally factory-installed parts known as *Umrüst-Bausätze* (usually contracted to Umbau) and adding a "/U" suffix to the aircraft designation when installed. Field kits known as "*Rüstsätze*" were also available for the G-series but those did not change the aircraft title. By early 1944, tactical requirements resulted in the addition of MW-50 water injection boost and high-performance superchargers, boosting engine output to 1,800–2,000 PS (1,775–1,973 hp).

The final production version of the Bf 109 was the K series or "**Kurfürst"**, introduced in late 1944, powered by the DB 605D engine with up to 2,000 PS (1,973 hp). Though externally akin to the late production Bf 109G series, a large number of internal changes and aerodynamic improvements were incorporated that improved its effectiveness and remedied flaws, keeping it competitive with the latest Allied and Soviet fighters. The Bf 109's outstanding rate of climb was superior to many Allied adversaries including the P-51D Mustang, Spitfire Mk. XIV and Hawker Tempest Mk. V.



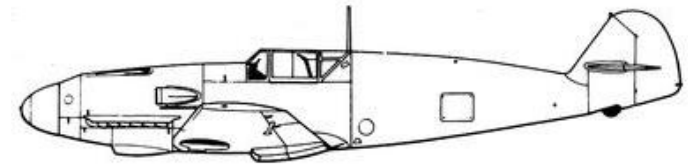
Bf 109D-1

Bf 109F-4

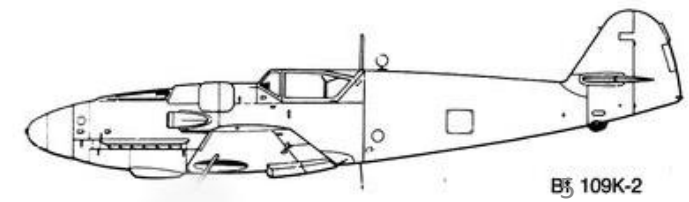


Bf 109G-6/R2

Bf 109B-1



Bf 109F-1



Bf 109K-2

The Bf.109 was flown by the three top-scoring German fighter aces of World War II, who claimed 928 victories among them while flying with Jagdgeschwader 52, mainly on the Eastern Front. The highest scoring fighter ace of all time, Erich Hartmann, flew the Bf 109 and was credited with 352 aerial victories. The aircraft was also flown by Hans-Joachim Marseille, the highest scoring German ace in the North African Campaign who achieved 158 aerial victories. Through constant development, the Bf.109 remained very competitive with the latest Allied fighter aircraft until the end of the war. Experienced Bf.109 pilots were known to be masters of energy fighting and marksmanship. The Luftwaffe had a strong emphasis on tactical innovation and flexibility. Pilots were encouraged to think independently and adapt to changing circumstances, and such thinking is evident in the pilot's biographies written after the war. Most "*Jagdgeschwaders*" (Fighter Wings) prioritized loose and flexible formations over the ones used for military parades, to great effect.

More aerial kills were made with the Bf.109 than any other aircraft of World War II. Many of the aerial victories were accomplished against poorly trained and badly organized Soviet forces in 1941 during Operation Barbarossa. The Soviets lost 21,200 aircraft at this time, about half to combat. If shot down, the Luftwaffe pilots might land or parachute to friendly territory and return to fight again. Later in the war, when Allied victories began to bring the fight closer, and then in German territory, bombing raids supplied plenty of targets for the Luftwaffe.

This unique combination of events — until a major change in American fighter tactics occurred very early in 1944, that steadily gave the Allies daylight air supremacy over the Reich — led to the highest-ever individual pilot victory scores. One hundred and five Bf.109 pilots were each credited with the destruction of 100 or more enemy aircraft. Thirteen of these men scored more than 200 kills, while two scored more than 300. Altogether, this group of pilots was credited with a total of nearly 15,000 kills.

Erich "Bubi" Hartmann
(1922-1993)
352 Aerial Victories

Hans-Joachim "Jochen" Marseille
(1919-1942)
158 Aerial Victories

Gerhard "Gerd" Barkhorn
(1919-1983)
301 Aerial Victories

Günther Rall
(1918-2009)
275 Aerial Victories

Walter Nowotny
(1920-1944)
258 Aerial Victories

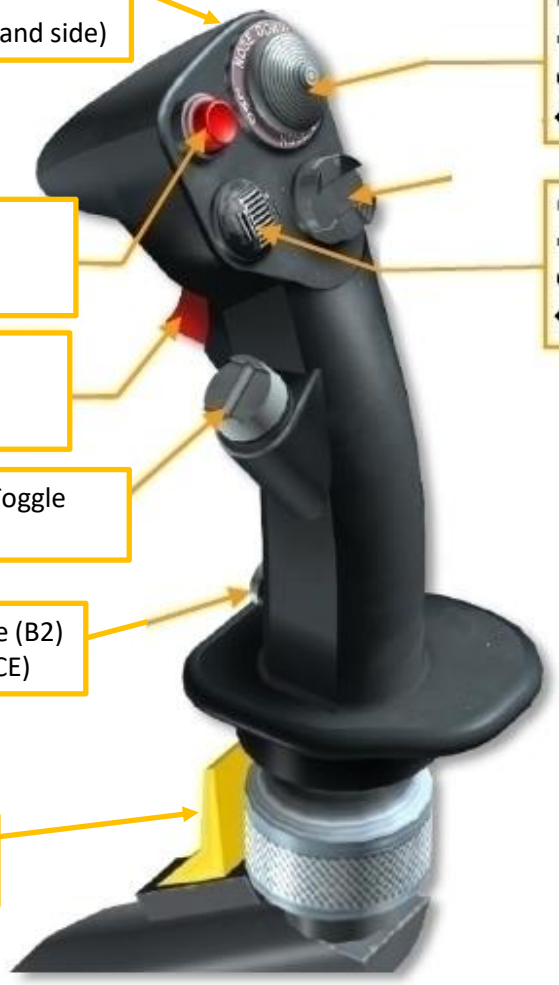
In 1942, the Bf.109 began to be partially replaced in Western Europe by a new German fighter, the Focke-Wulf Fw190, but it continued to serve in a multitude of roles on the Eastern Front and in the Defense of the Reich, as well as in the Mediterranean Theatre of Operations and with Erwin Rommel's Afrikakorps. It was also supplied to several of Germany's allies, including Italy, Finland, Hungary, Romania, Bulgaria, Croatia and Slovakia.

In a strange twist of fate, the Israeli Air Force operated the Avia S-199 derivative during the 1948 Arab-Israeli War, bought from Czechoslovakia. The S-199 used the Bf 109G airframe, but with none of the original DB 605 engines available, an alternative power unit had to be sourced. It was decided that the aircraft would use the Junkers Jumo 211F engine and same propeller type, both as fitted to the Heinkel He-111 bomber. However, the results were far from satisfactory and the outcome was an aircraft that displayed some quite alarming handling characteristics. The substitute engine with the propeller lacked the responsiveness of the Daimler-Benz unit and the torque created by the massive paddle-bladed propeller made control very difficult. This, in combination with the 109's narrow-track undercarriage, made landings and takeoffs extremely hazardous. Despite the type's shortcomings the Israelis scored 8 victories in the "*Sakeen*" ("Knife" in Hebrew).

Overall, the Bf.109 is truly one of the deadliest World War II aircraft available in DCS. Its great firepower, superb climb rate and airspeed make it a formidable opponent against Mustang, Spitfire, and Thunderbolt pilots. Despite the cockpit's limited visibility, the configuration of the machineguns and cannon make it easy to aim and predict where you are shooting. In capable hands, the Kurfürst is an incredible fighter aircraft that sends shivers down your spine once you line up a desperate Allied fighter at breakneck speed. Stay high, stay fast, and strike the enemy when he is not expecting you by using surprise to your advantage. These were the core principles used by Erich Hartmann in combat; "See, Decide, Attack, Leave." Modern air forces still apply these concepts to this day. Apply those in multiplayer, and you have a solid recipe for success.


7

WHAT YOU NEED MAPPED



MW50 Boost System (E)
(hidden grey button on right hand side)

Fire Cannon / Rockets (B1)
(RALT+SPACE)

Fire Machineguns (A)
(SPACE)

Gun Safety Lever Toggle
(LSHIFT+SPACE)

Bomb Release (B2)
(RSHIFT+SPACE)

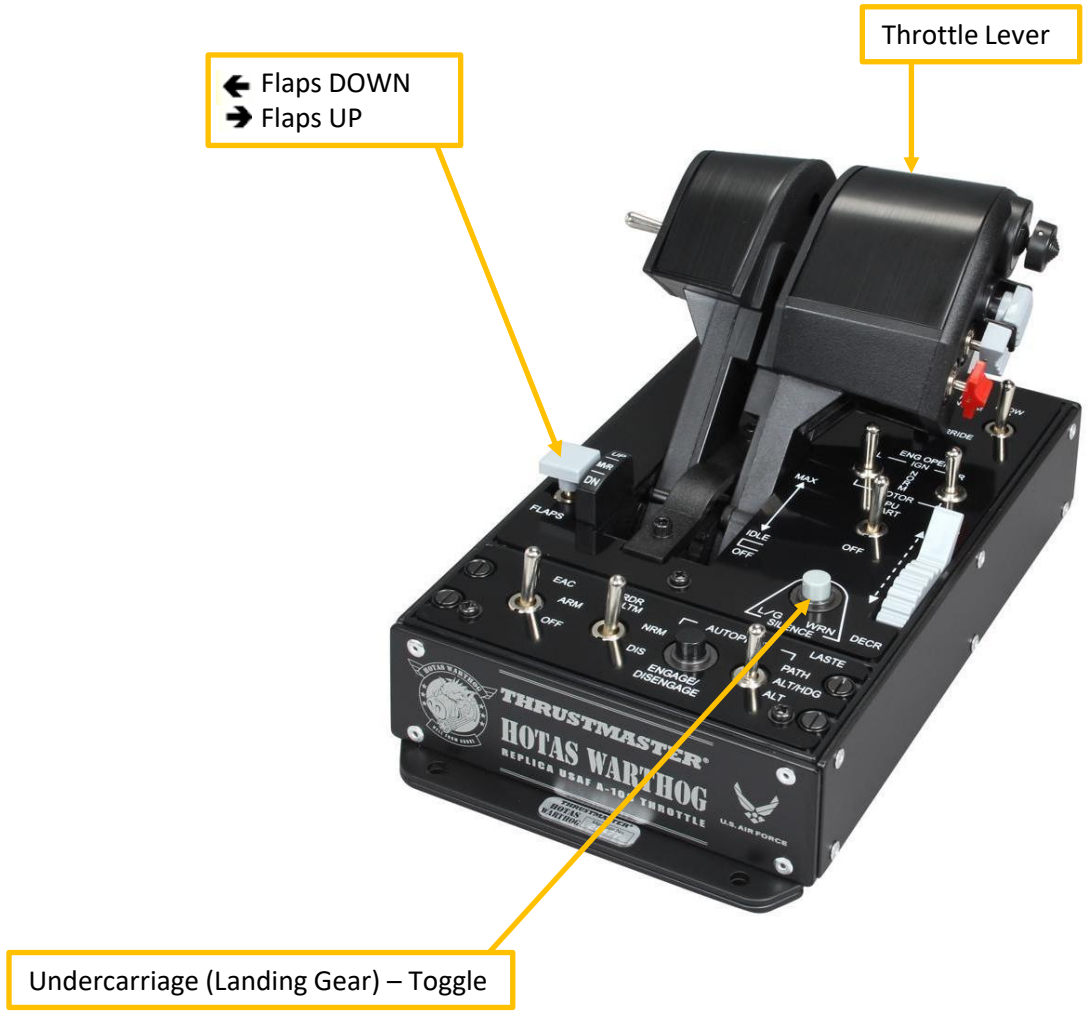
Charge MK 108 (D)
(LALT+SPACE)

↑ Trim Stabilizer Nose DOWN
→
↓ Trim Stabilizer Nose UP
←

↑ Zoom In Slow
→
↓ Zoom Out Slow
←

+ TOE BRAKES (MAPPED ON PEDALS)

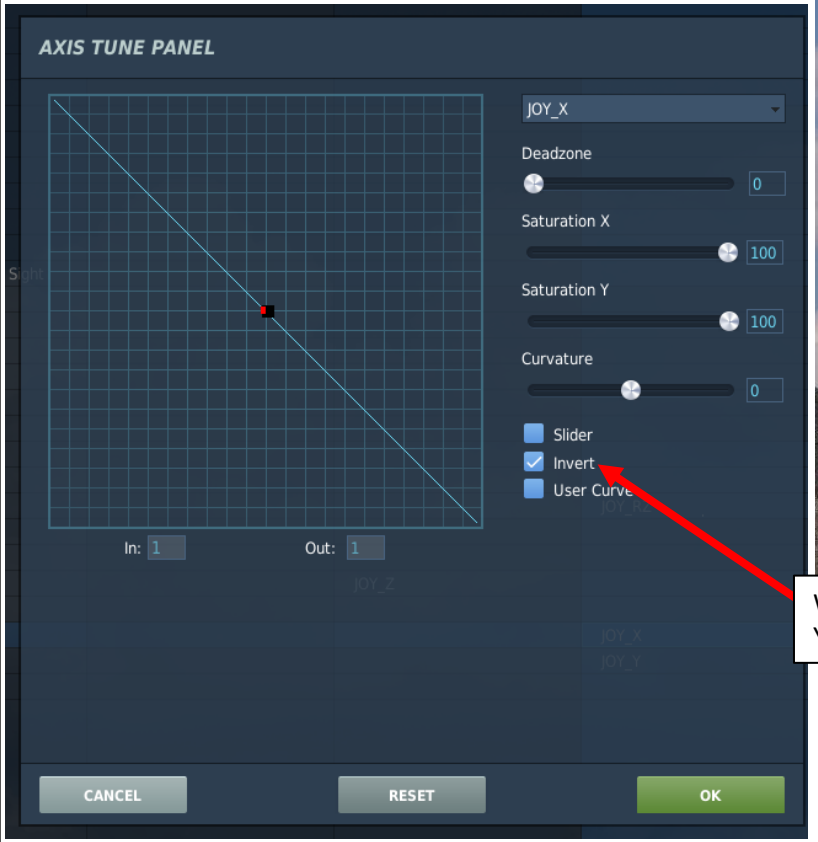
WHAT YOU NEED MAPPED



PART 2 – CONTROLS SETUP

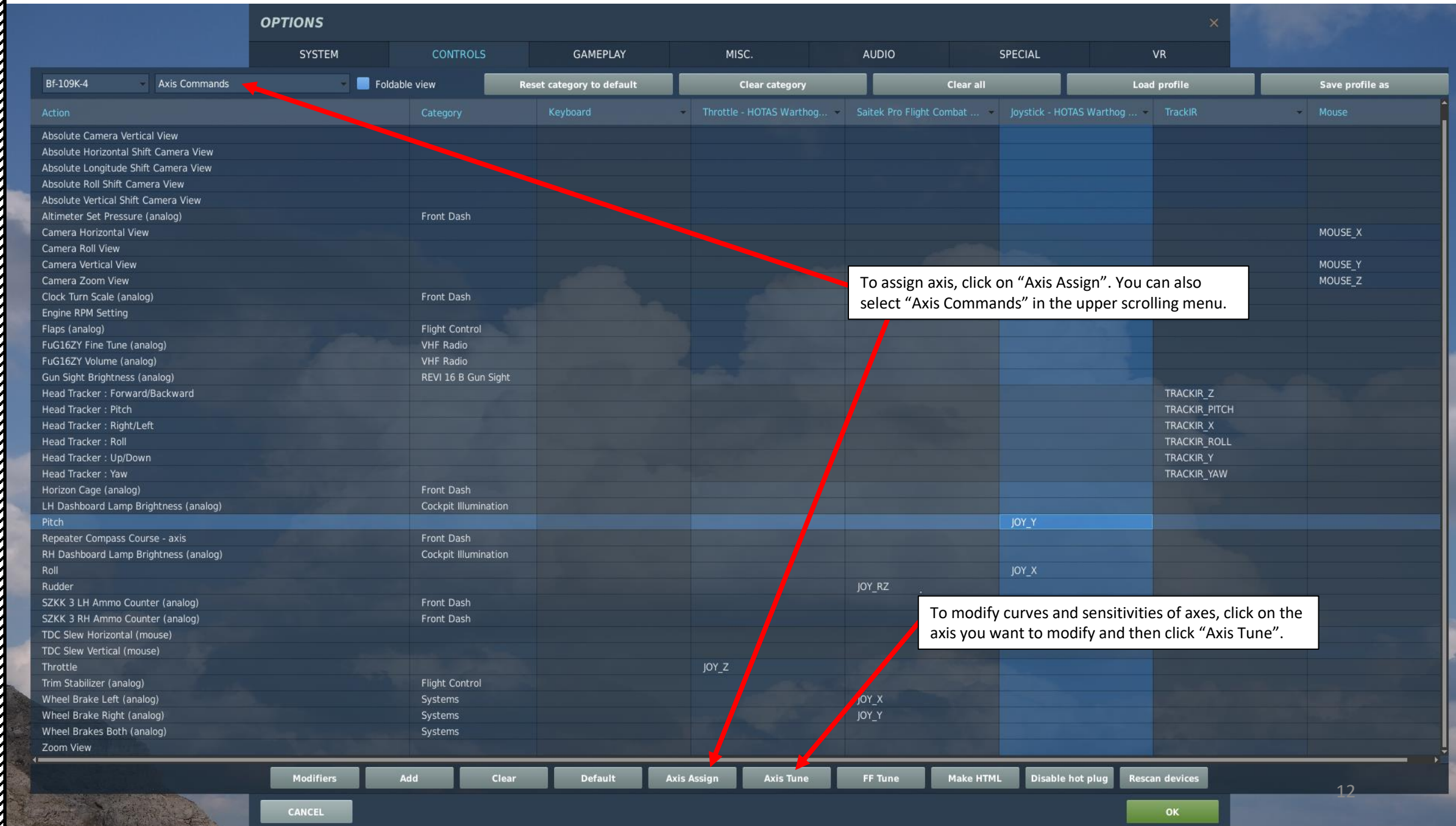
Bind the following axes:

- Pitch, Roll, Rudder (Deadzone at 0, Saturation X at 100, Saturation Y at 100, Curvature at 0)
- Throttle – Controls Manifold Pressure / Boost / ATA
- Wheel Brake Left
- Wheel Brake Right

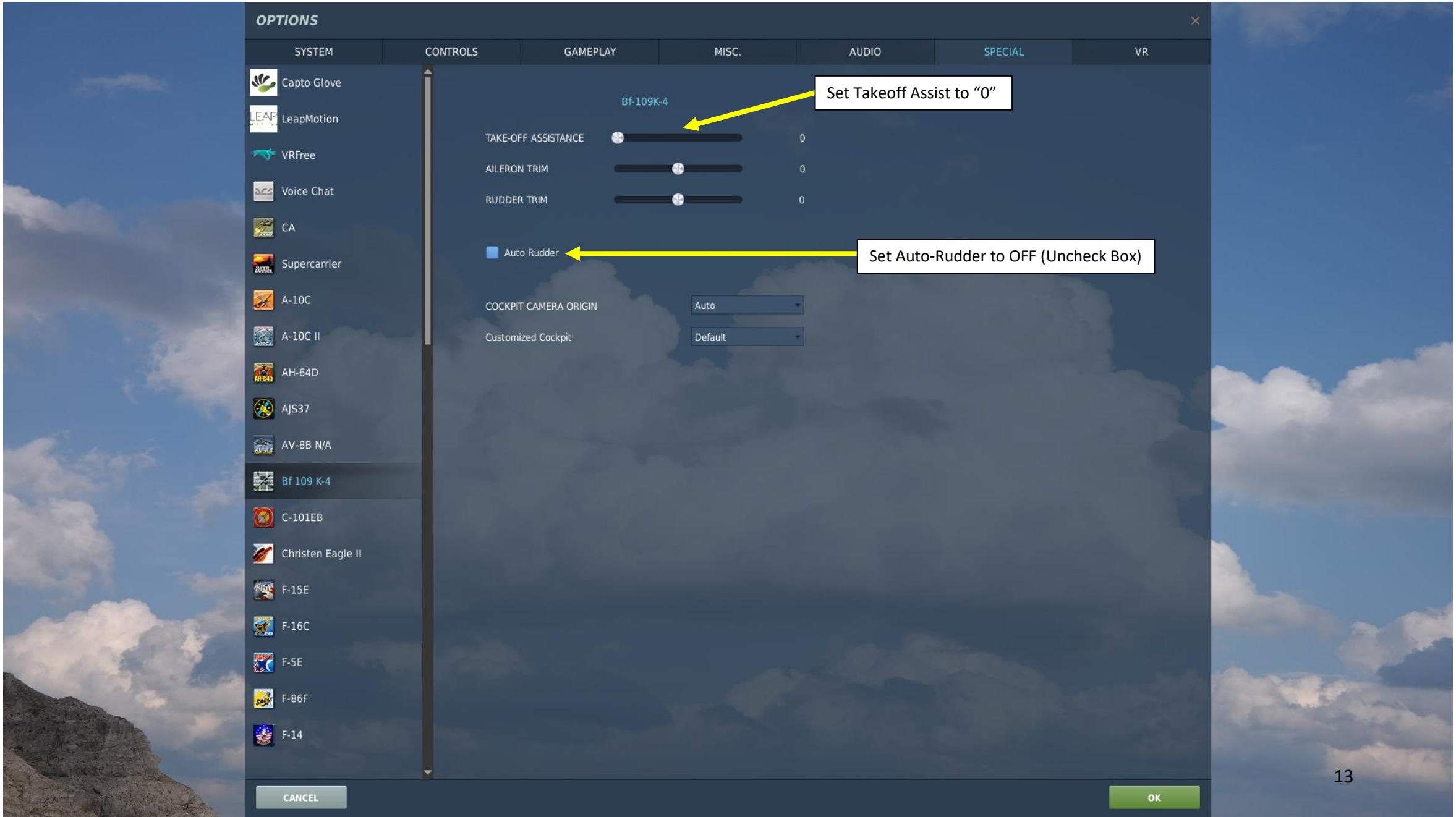


When setting wheel brake axis, they are not set to “INVERT” by default. You need to click on INVERT in the Axis Tune menu for each wheel brake.

PART 2 – CONTROLS SETUP



In the “Special” menu in Options, select the Bf 109 K-4 menu. Make sure to have Takeoff Assist set to “0” (turned off). By default it is set to 100 (ON). This will cause you to crash and burn inexplicably during takeoff. Also uncheck the Auto-Rudder box.




Kabinenabwurf

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

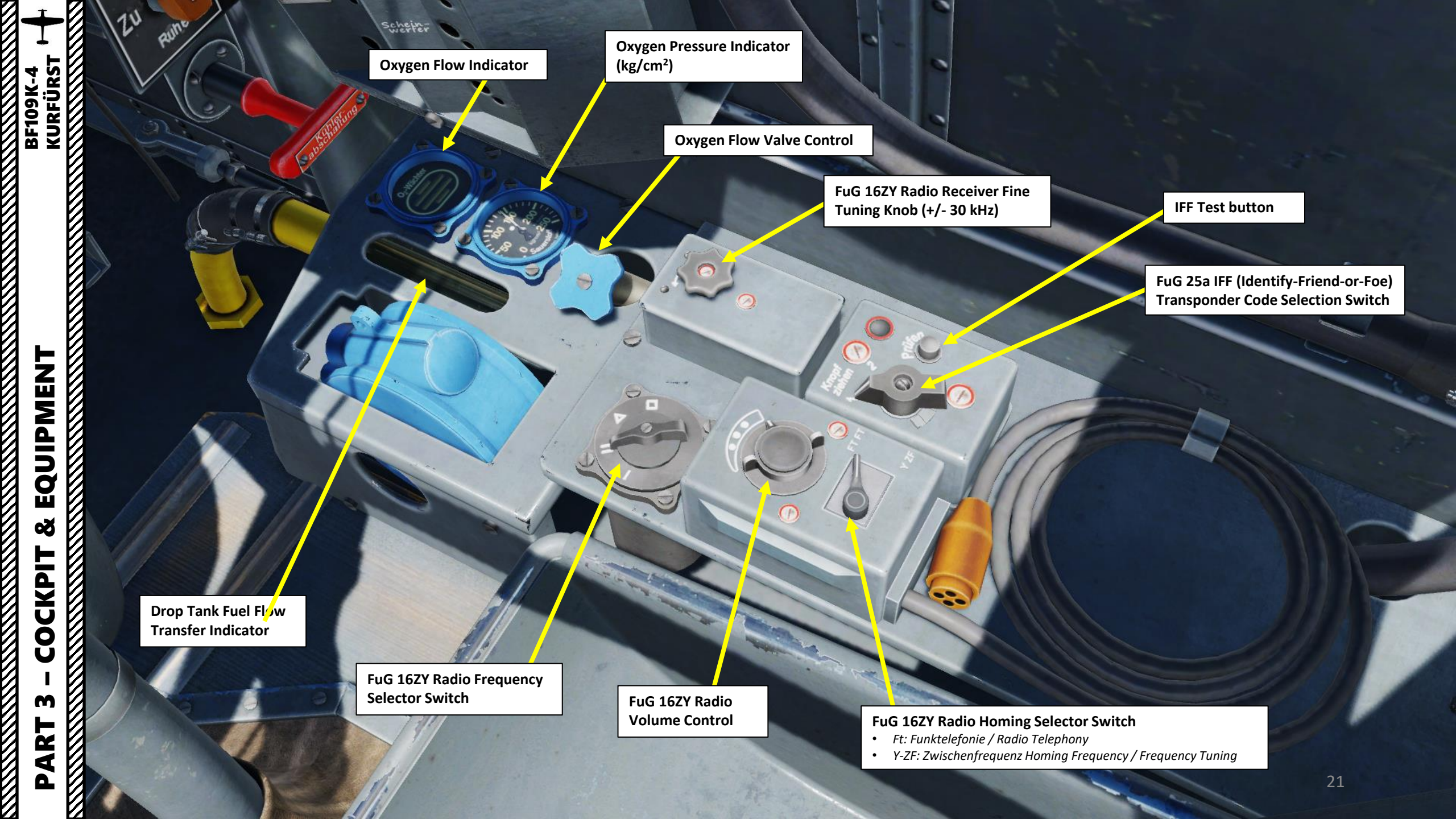

Kabinenabwurf
Hebel ziehen!
Wenn Kabine nicht abgeht,
Verriegelung lösen,
Kopf vorhalten!


Armored Headrest

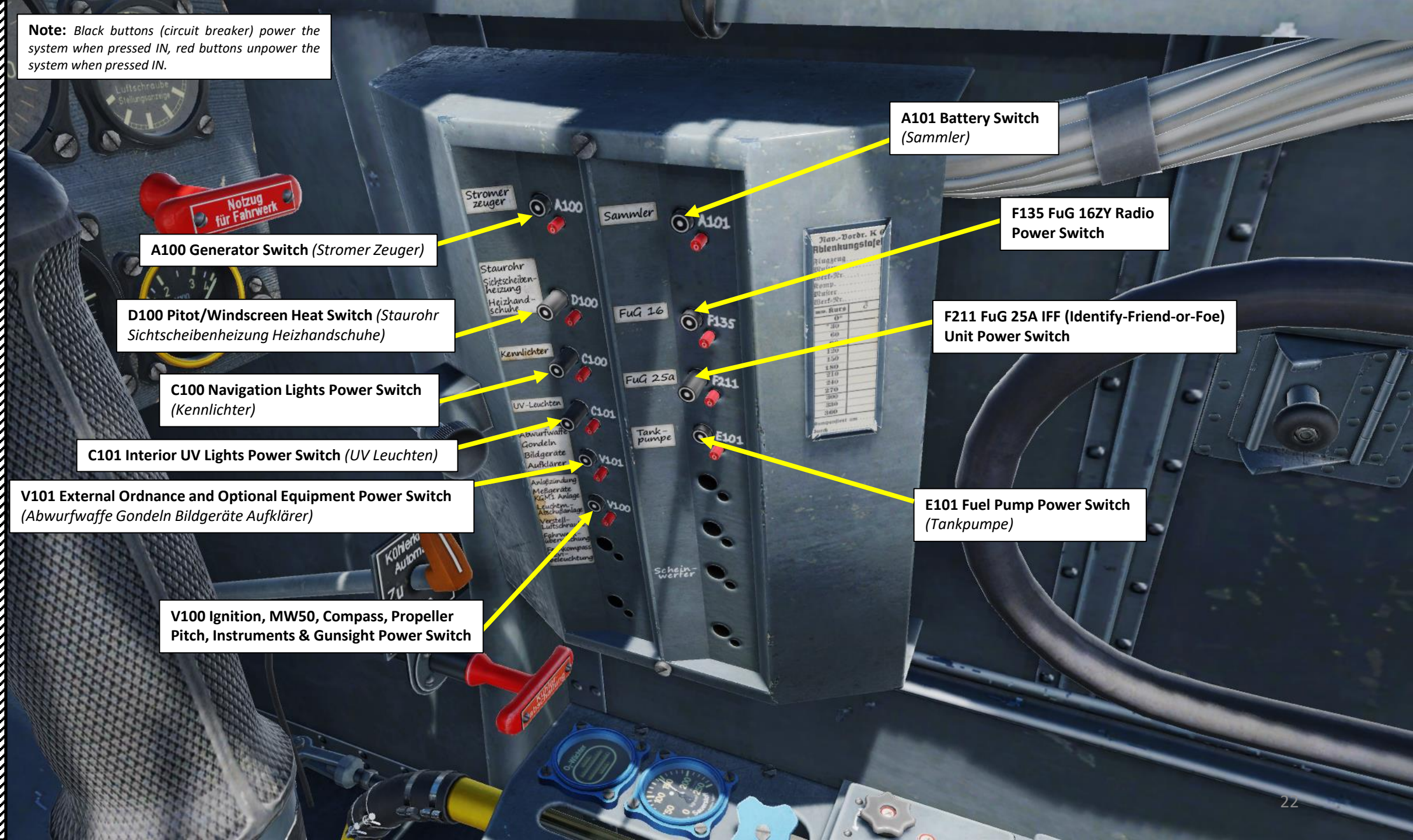
PART 3 – COCKPIT & EQUIPMENT


0V
mV
Wagerecht
0V
ZU

PART 3 – COCKPIT & EQUIPMENT



Note: *Black buttons (circuit breaker) power the system when pressed IN, red buttons unpower the system when pressed IN.*



A100 Generator Switch *(Stromer Zeuger)*

D100 Pitot/Windscreen Heat Switch *(Staurohr Sichtscheibenheizung Heizhandschuhe)*

C100 Navigation Lights Power Switch *(Kennlichter)*

C101 Interior UV Lights Power Switch *(UV Leuchten)*

V101 External Ordnance and Optional Equipment Power Switch *(Abwurfwaffe Gondeln Bildgeräte Aufklärer)*

V100 Ignition, MW50, Compass, Propeller Pitch, Instruments & Gunsight Power Switch

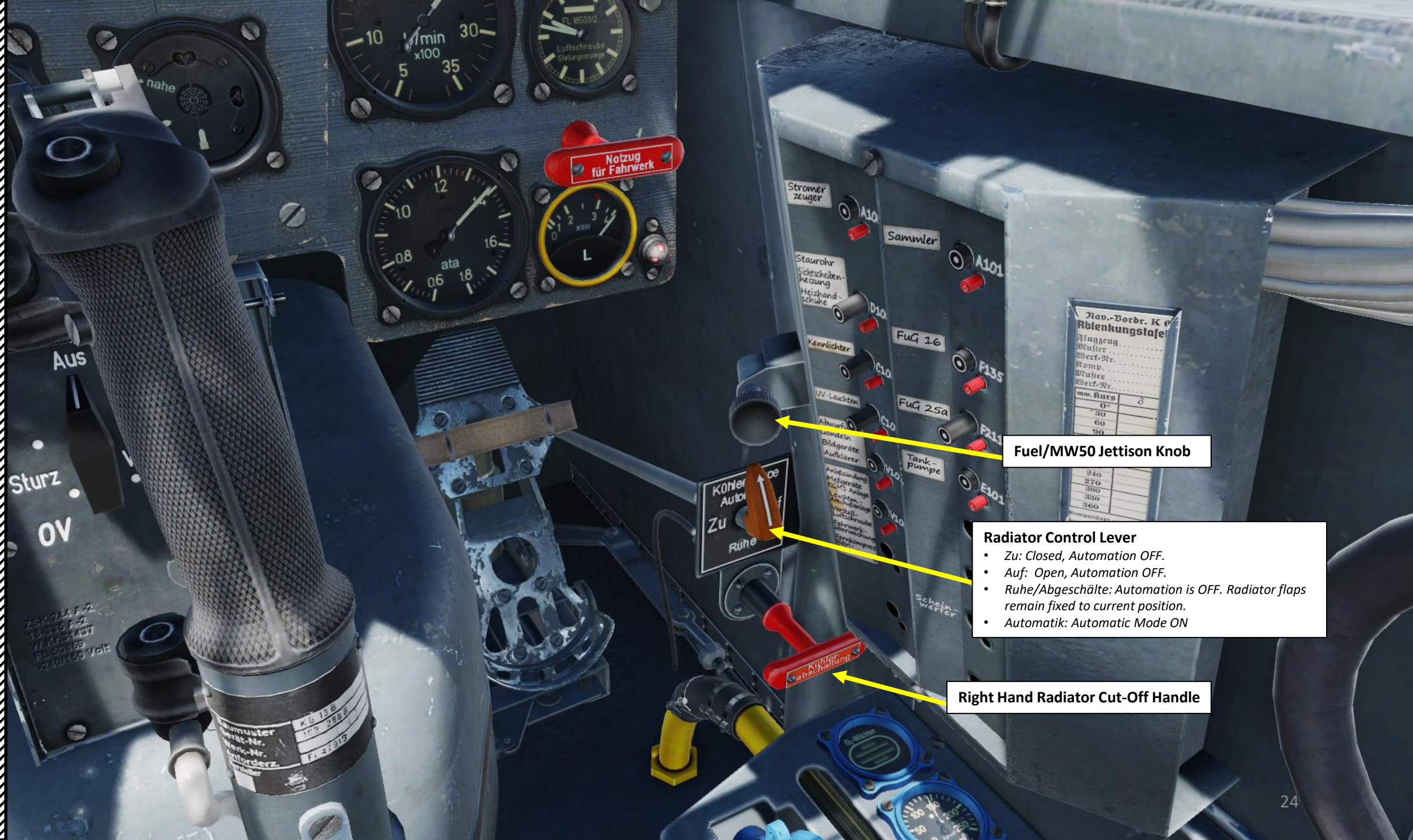
A101 Battery Switch *(Sammler)*

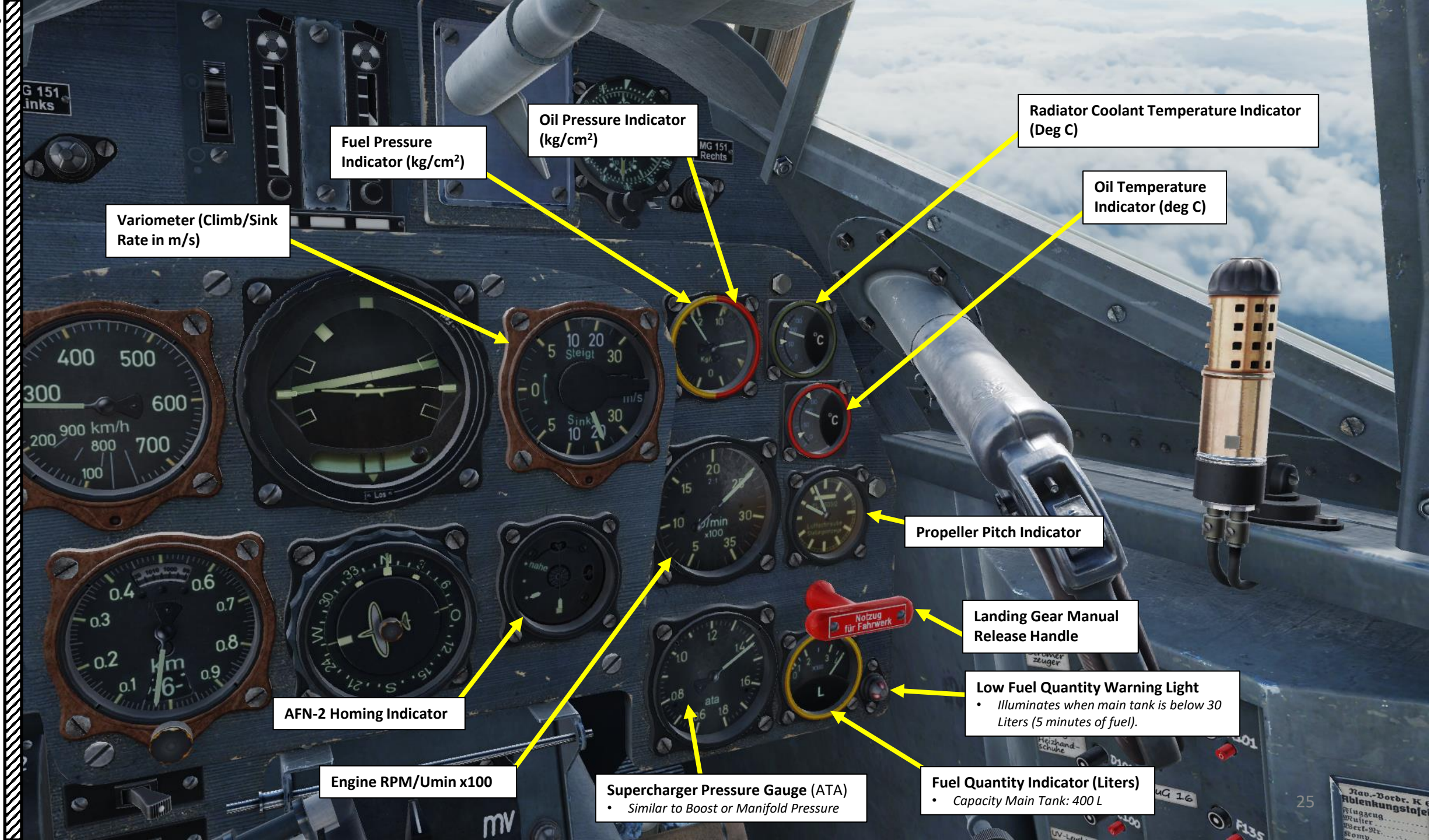
F135 FuG 16ZY Radio Power Switch

F211 FuG 25A IFF (Identify-Friend-or-Foe) Unit Power Switch

E101 Fuel Pump Power Switch *(Tankpumpe)*

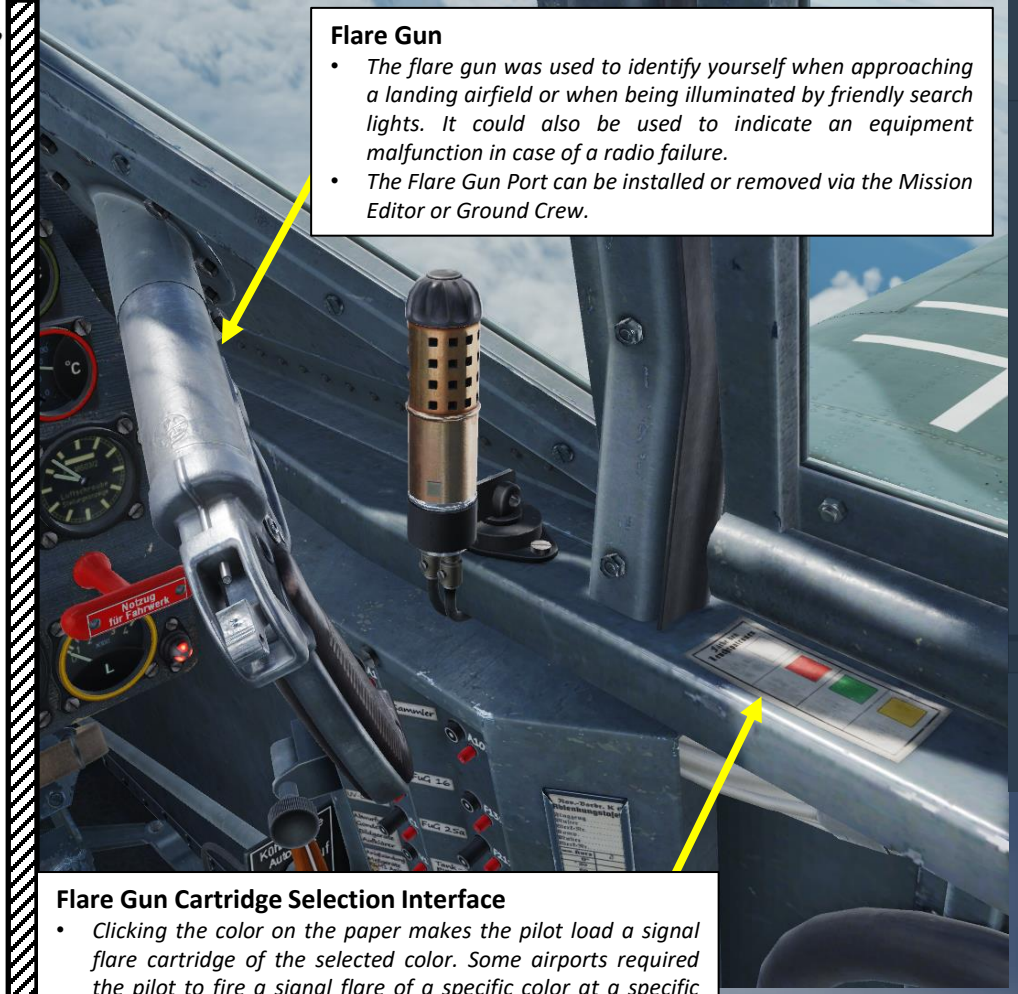

Kabinenabwurf
Hebel ziehen!
Wenn Kabine nicht abgeht,
Verriegelung lösen,
Kopf vorbeugen!
Kabine-Notabwurf
Notzug für Fahrwerk
Kühlerabschaltung
Ein
Aus
Wagerecht
MG 151 Links

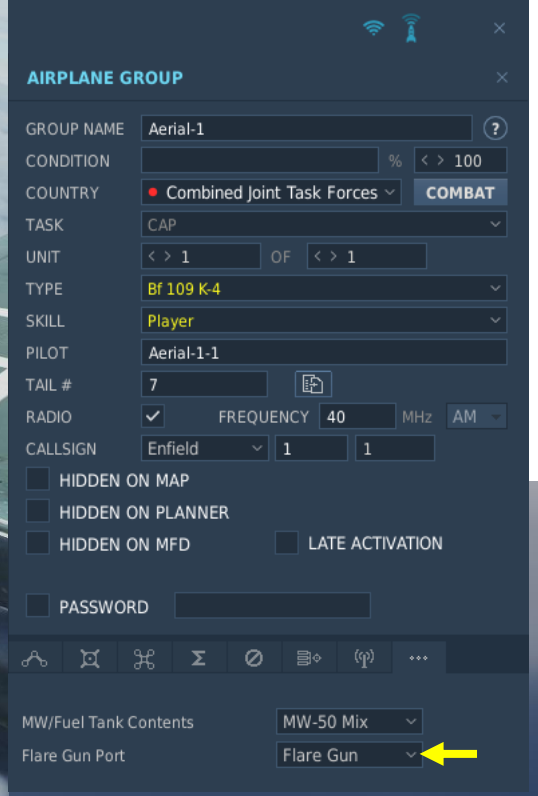

Fuel/MW50 Jettison Knob
Radiator Control Lever
• Zu: Closed, Automation OFF.
• Auf: Open, Automation OFF.
• Ruhe/Abgeschälte: Automation is OFF. Radiator flaps remain fixed to current position.
• Automatik: Automatic Mode ON
Right Hand Radiator Cut-Off Handle


Fuel Pressure Indicator (kg/cm²)
Oil Pressure Indicator (kg/cm²)
Radiator Coolant Temperature Indicator (Deg C)
Variometer (Climb/Sink Rate in m/s)
Oil Temperature Indicator (deg C)
Propeller Pitch Indicator
Landing Gear Manual Release Handle
Low Fuel Quantity Warning Light
• Illuminates when main tank is below 30 Liters (5 minutes of fuel).
AFN-2 Homing Indicator
Engine RPM/Umin x100
Supercharger Pressure Gauge (ATA)
• Similar to Boost or Manifold Pressure
Fuel Quantity Indicator (Liters)
• Capacity Main Tank: 400 L

Flare Gun

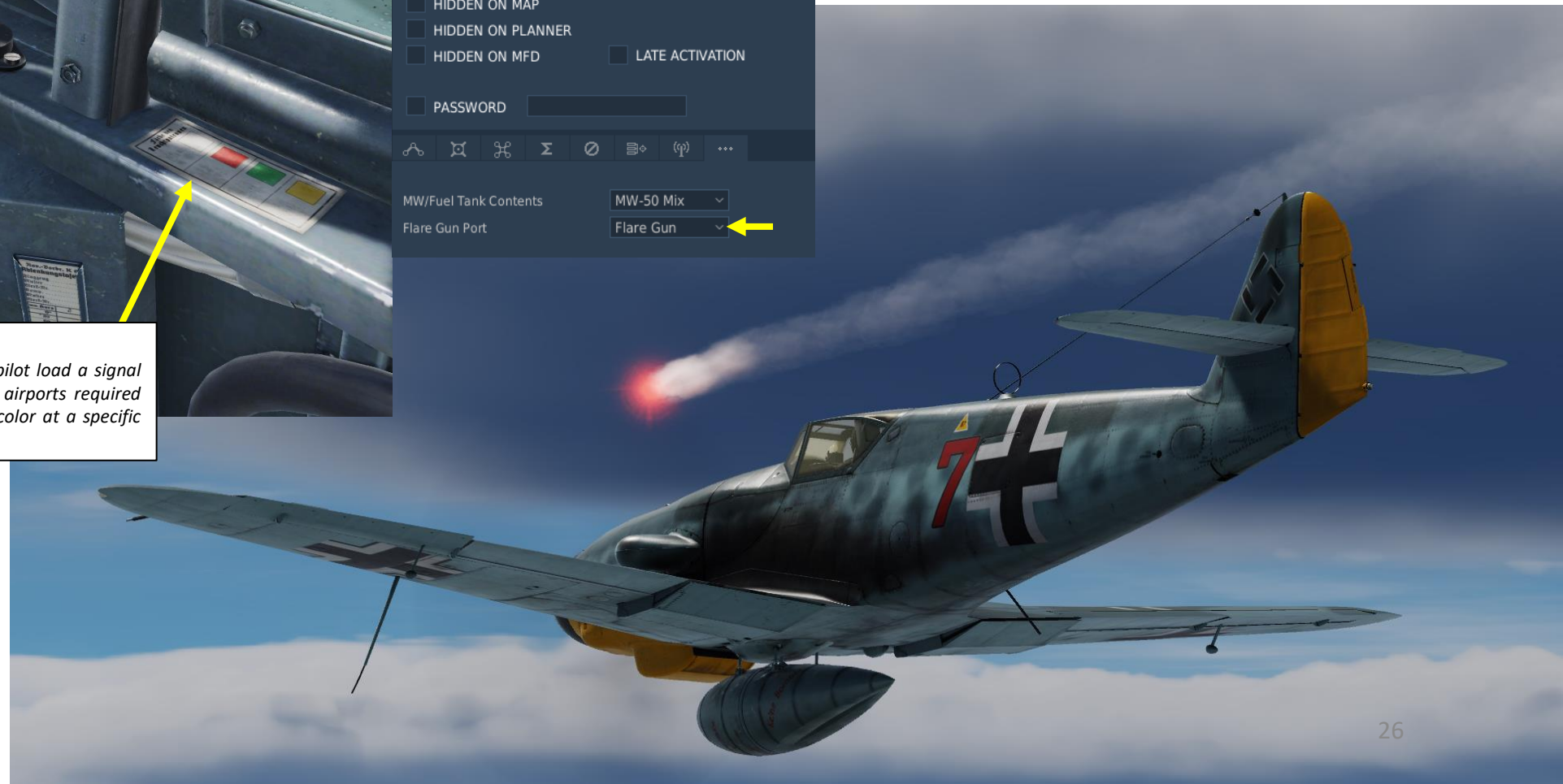
- *The flare gun was used to identify yourself when approaching a landing airfield or when being illuminated by friendly search lights. It could also be used to indicate an equipment malfunction in case of a radio failure.*
- *The Flare Gun Port can be installed or removed via the Mission Editor or Ground Crew.*





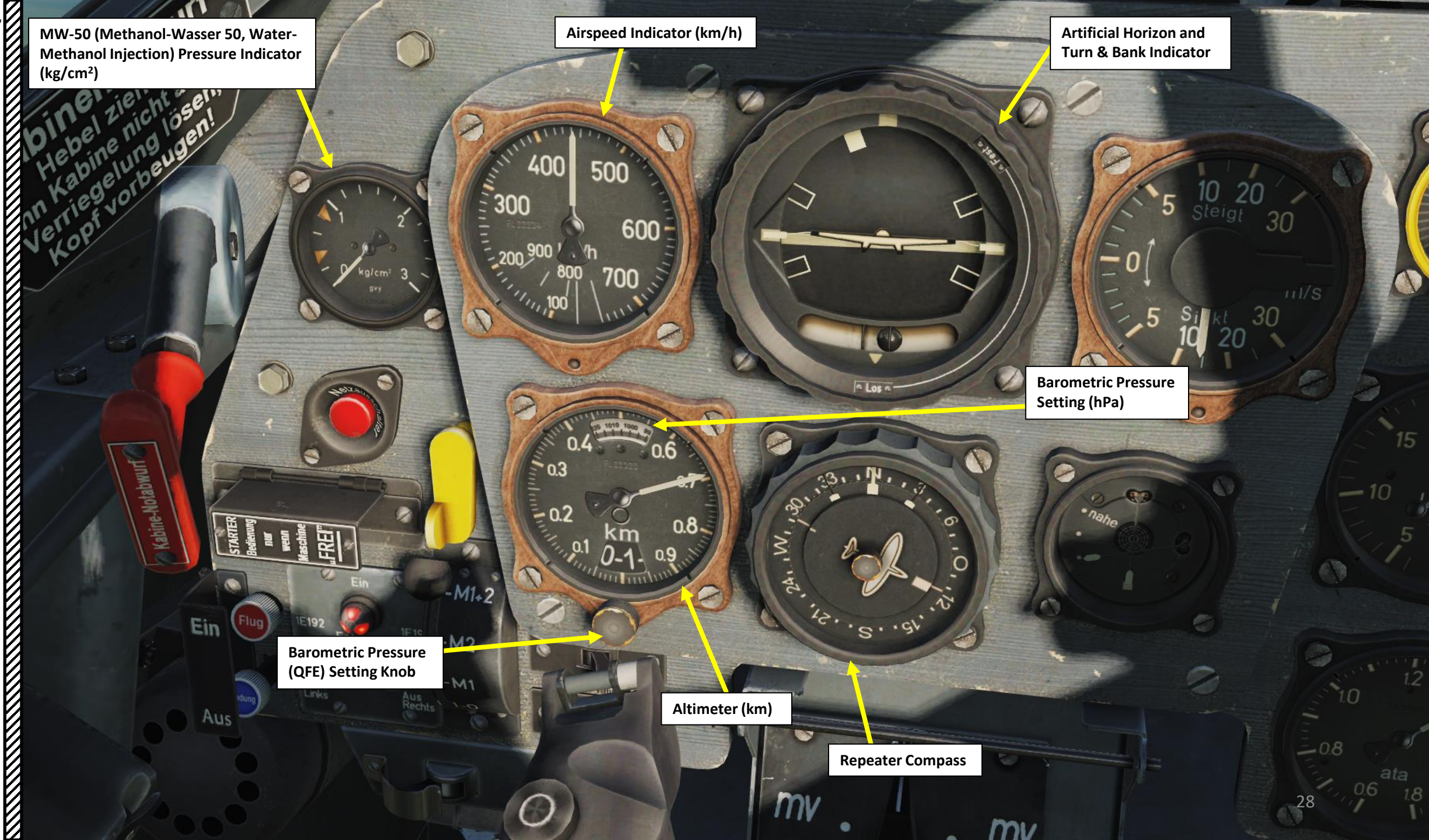
Flare Gun Cartridge Selection Interface

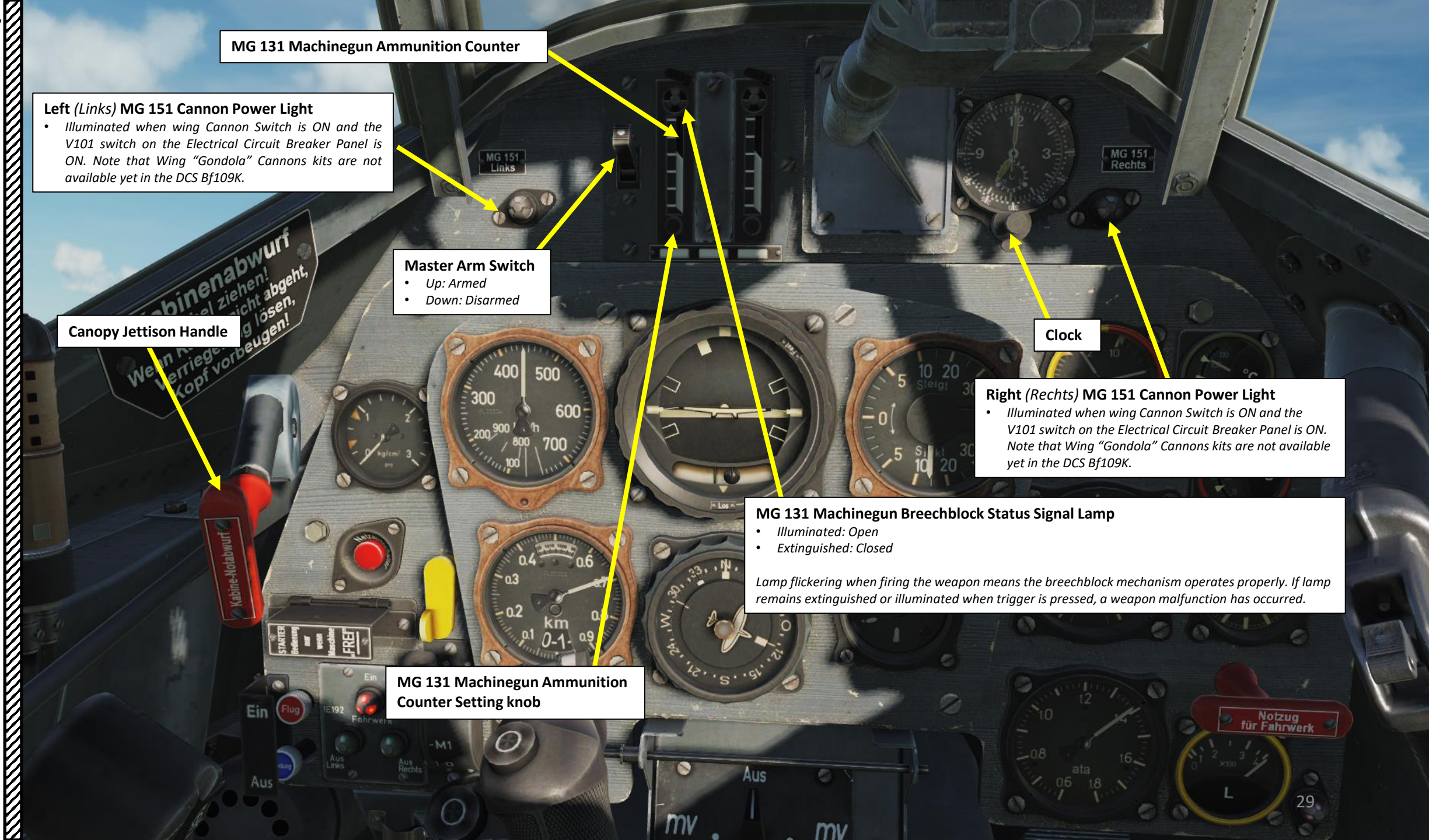
- *Clicking the color on the paper makes the pilot load a signal flare cartridge of the selected color. Some airports required the pilot to fire a signal flare of a specific color at a specific time of day for identification purposes.*




Flare Gun Port

PART 3 – COCKPIT & EQUIPMENT

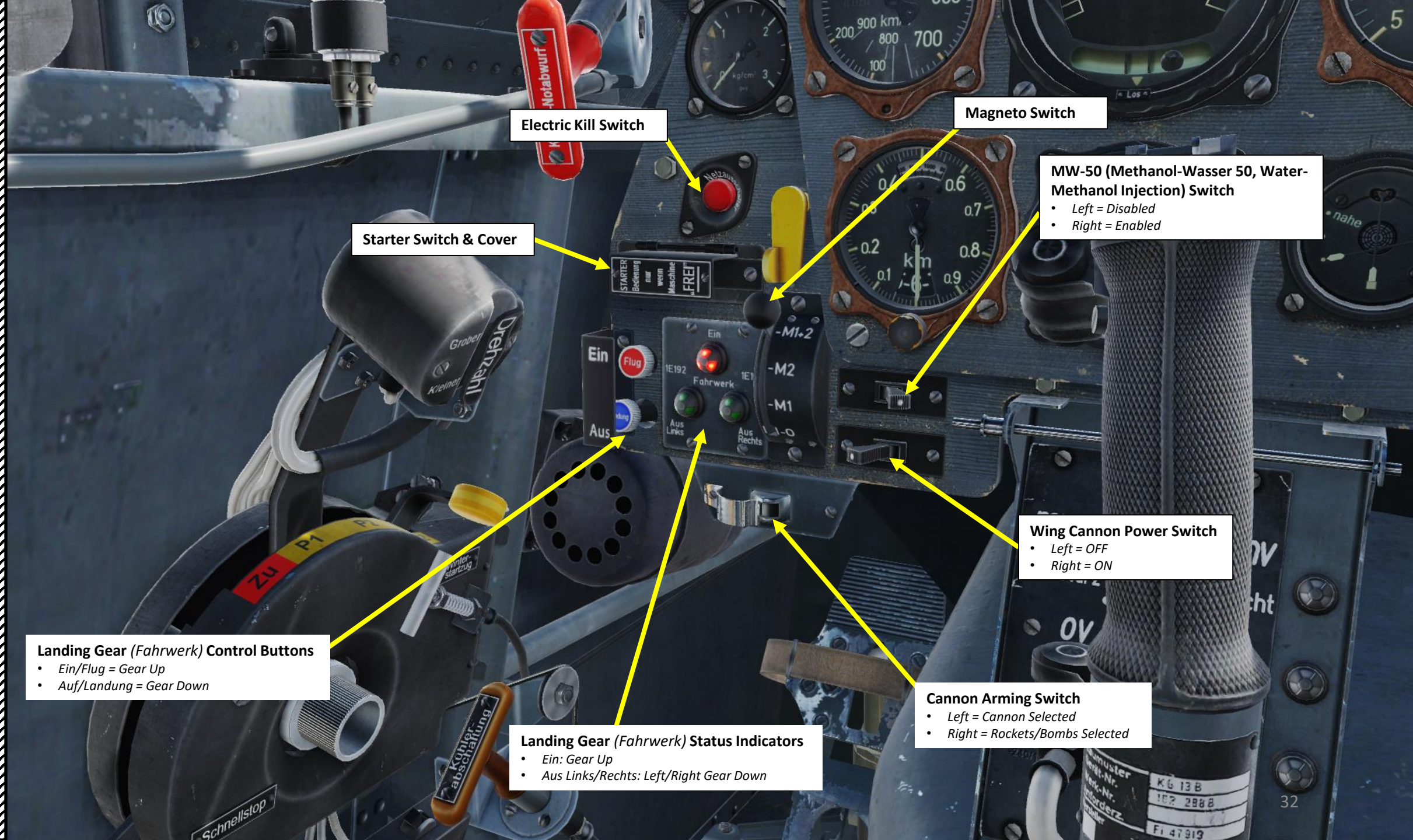



MG 131 Machinegun Ammunition Counter
Left (Links) MG 151 Cannon Power Light
• Illuminated when wing Cannon Switch is ON and the V101 switch on the Electrical Circuit Breaker Panel is ON. Note that Wing "Gondola" Cannons kits are not available yet in the DCS Bf109K.
Master Arm Switch
• Up: Armed
• Down: Disarmed
Canopy Jettison Handle
Clock
Right (Rechts) MG 151 Cannon Power Light
• Illuminated when wing Cannon Switch is ON and the V101 switch on the Electrical Circuit Breaker Panel is ON. Note that Wing "Gondola" Cannons kits are not available yet in the DCS Bf109K.
MG 131 Machinegun Breechblock Status Signal Lamp
• Illuminated: Open
• Extinguished: Closed
Lamp flickering when firing the weapon means the breechblock mechanism operates properly. If lamp remains extinguished or illuminated when trigger is pressed, a weapon malfunction has occurred.
MG 131 Machinegun Ammunition Counter Setting knob
MG 151 Links
MG 151 Rechts
Kabine-Notabwurf
Notzug für Fahrwerk

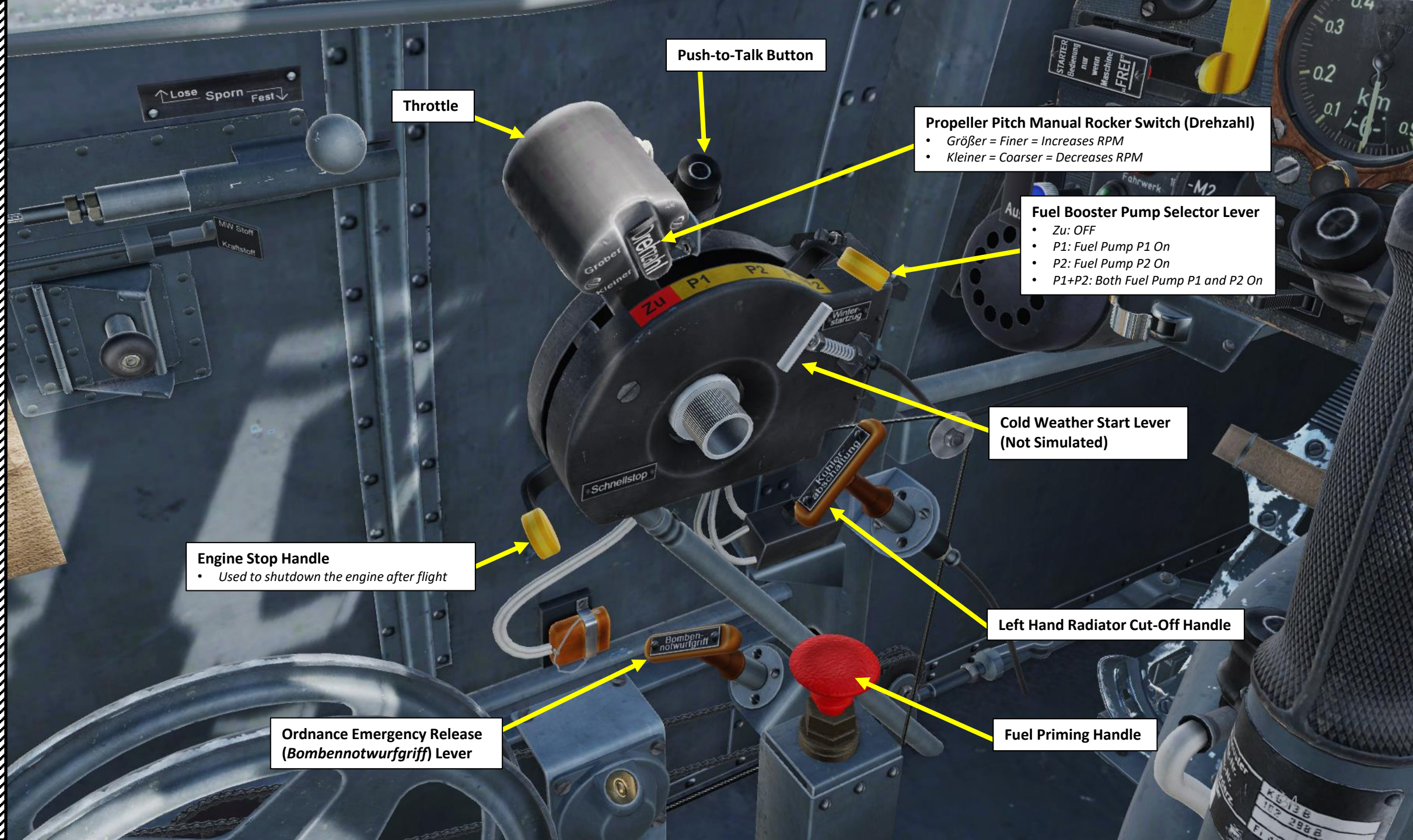

Kabinenabwurf
Hebel ziehen!
Wenn Kabine nicht abgeht,
Verriegelung lösen,
Kopf vorbeugen!

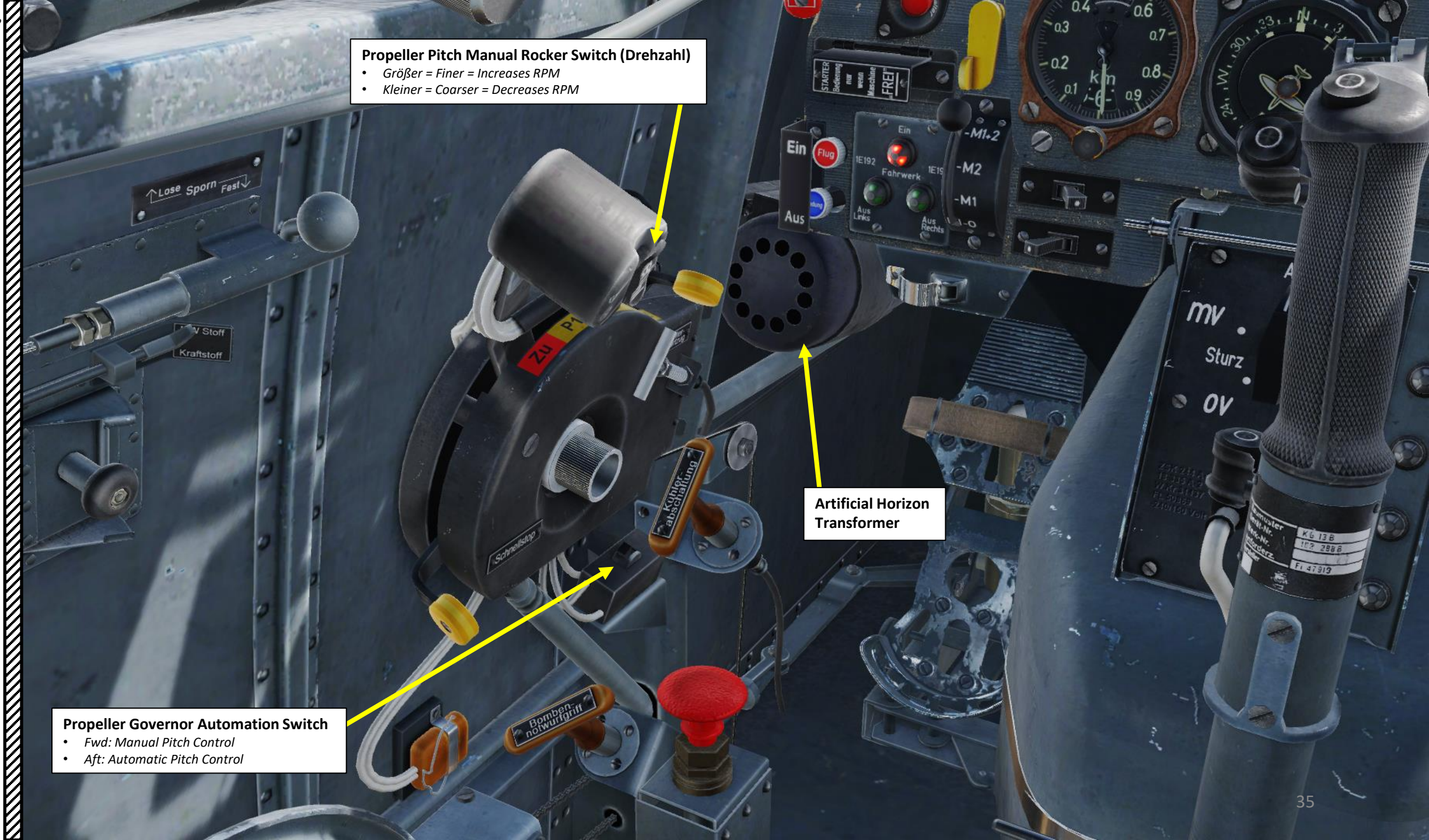

Revi 16B Fixed Gunsight

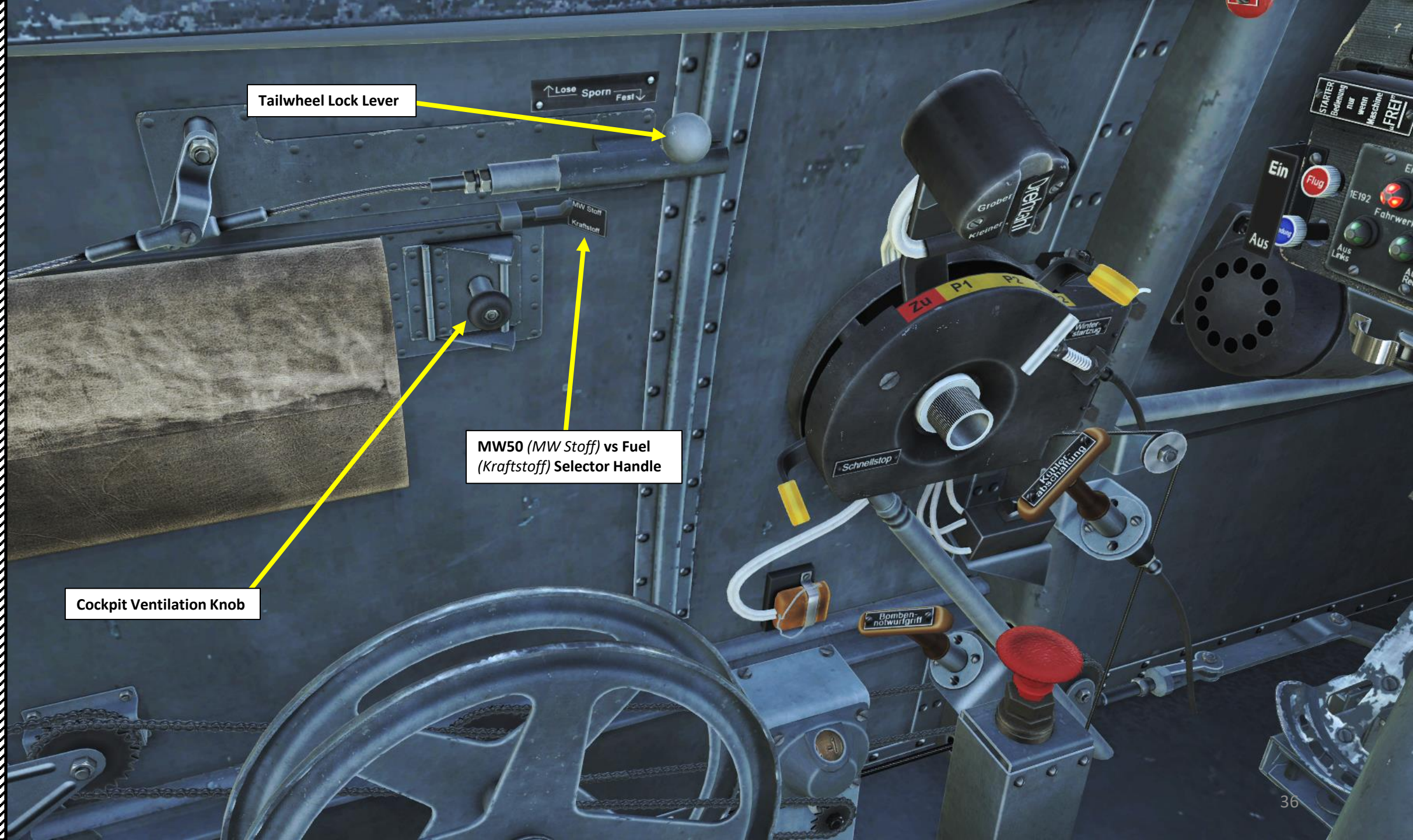

Revi 16B Fixed Gunsight
(Click to Stow)

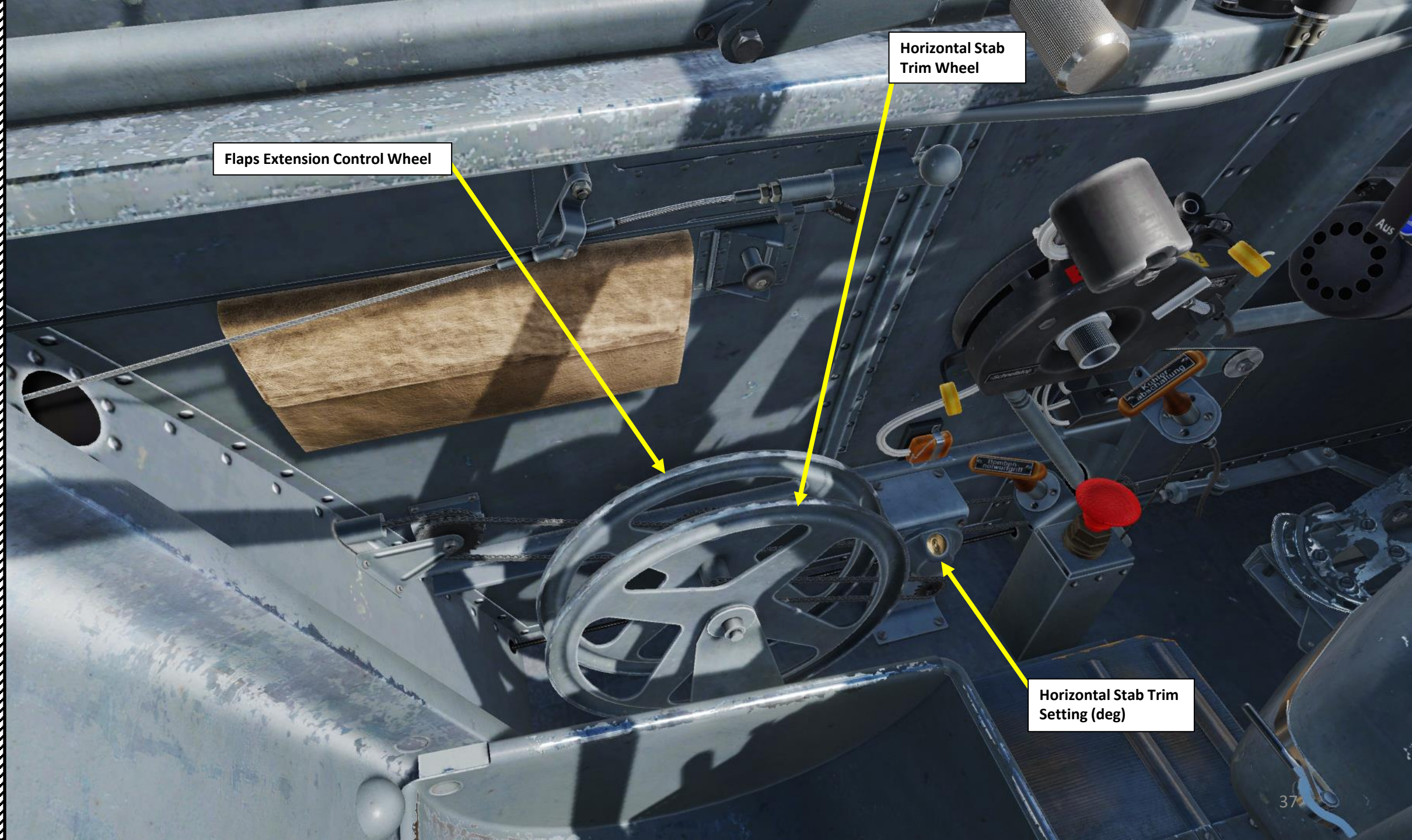

Electric Kill Switch
Magneto Switch
MW-50 (Methanol-Wasser 50, Water-Methanol Injection) Switch
• Left = Disabled
• Right = Enabled
Starter Switch & Cover
Wing Cannon Power Switch
• Left = OFF
• Right = ON
Landing Gear (Fahrwerk) Control Buttons
• Ein/Flug = Gear Up
• Auf/Landung = Gear Down
Landing Gear (Fahrwerk) Status Indicators
• Ein: Gear Up
• Aus Links/Rechts: Left/Right Gear Down
Cannon Arming Switch
• Left = Cannon Selected
• Right = Rockets/Bombs Selected

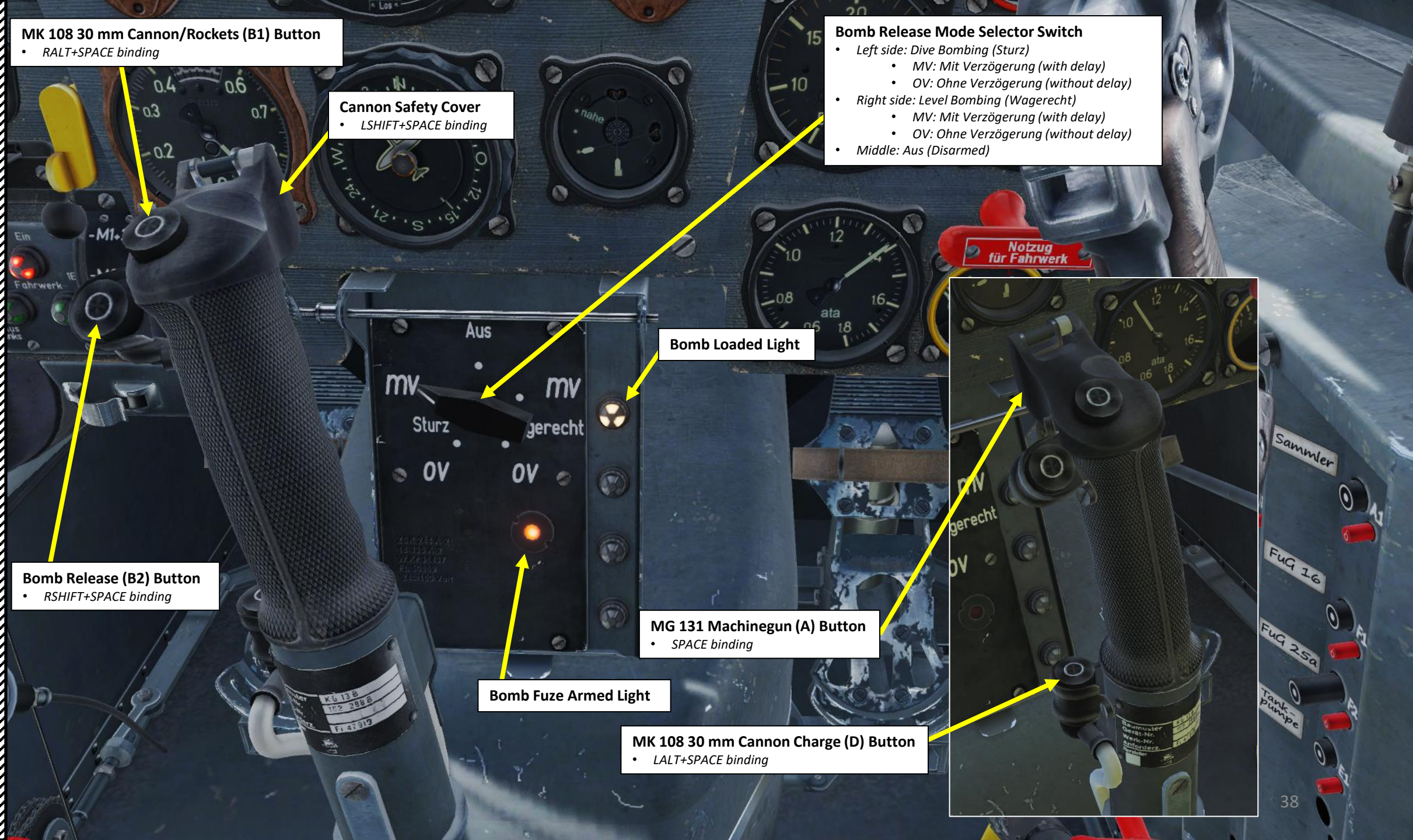

Canopy Lever
Kabinenabwurf
Hebel ziehen!
Wenn Kabine nicht abgeht,
Verriegelung lösen,
Kopf vorbeugen!
Ein
Aus
Sturz
ov


Push-to-Talk Button
Throttle
Propeller Pitch Manual Rocker Switch (Drehzahl)
• Größer = Finer = Increases RPM
• Kleiner = Coarser = Decreases RPM
Fuel Booster Pump Selector Lever
• Zu: OFF
• P1: Fuel Pump P1 On
• P2: Fuel Pump P2 On
• P1+P2: Both Fuel Pump P1 and P2 On
Cold Weather Start Lever (Not Simulated)
Engine Stop Handle
• Used to shutdown the engine after flight
Left Hand Radiator Cut-Off Handle
Ordnance Emergency Release (Bombennotwurfgriff) Lever
Fuel Priming Handle


Propeller Pitch Manual Rocker Switch (Drehzahl)
• Größer = Finer = Increases RPM
• Kleiner = Coarser = Decreases RPM
Artificial Horizon Transformer
Propeller Governor Automation Switch
• Fwd: Manual Pitch Control
• Aft: Automatic Pitch Control
Lose Sporn Fest
Kraftstoff
Ein
Aus
Flug
Fahrwerk
-M1+2
-M2
-M1
Sturz
ov
Schnellstop
Bombennotwurfgriff

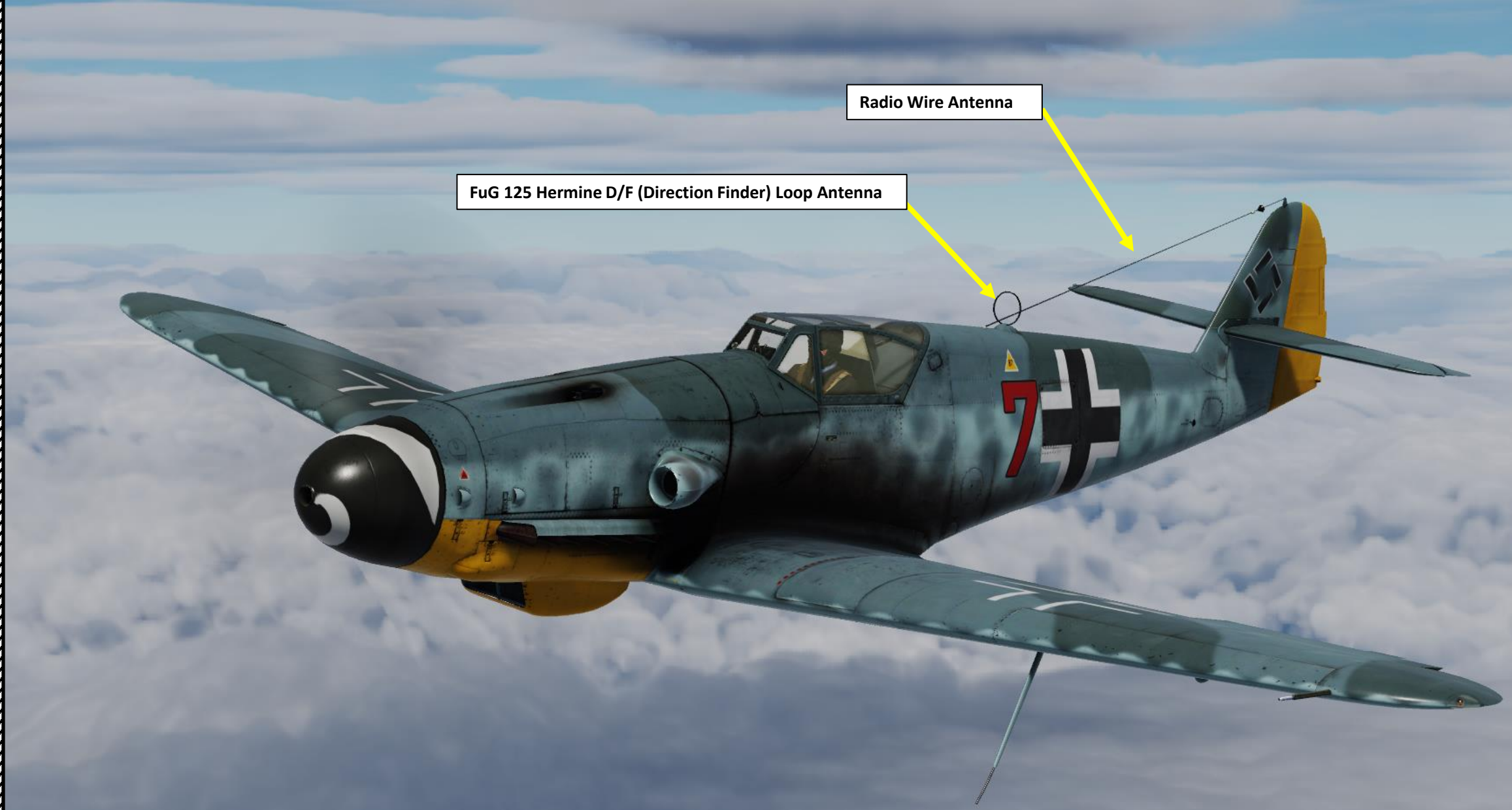

Tailwheel Lock Lever
MW50 (MW Stoff) vs Fuel (Kraftstoff) Selector Handle
Cockpit Ventilation Knob
Lose
Sporn
Fest
MW Stoff
Kraftstoff
Zu
P1
Schnellstop
Bomben-notwurfgriff
Ein
Aus
Flug
Fahrwerk

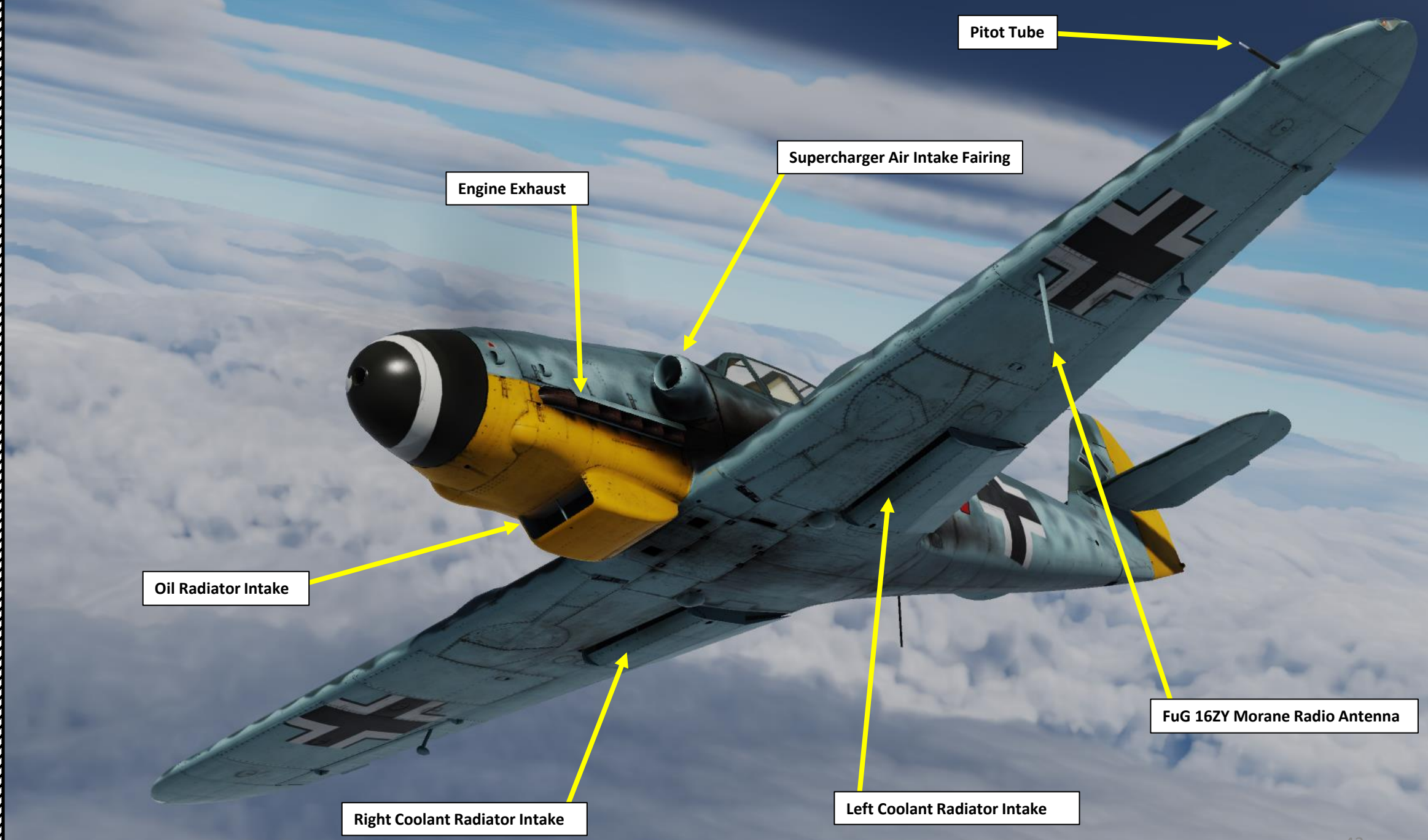

Horizontal Stab Trim Wheel
Flaps Extension Control Wheel
Horizontal Stab Trim Setting (deg)

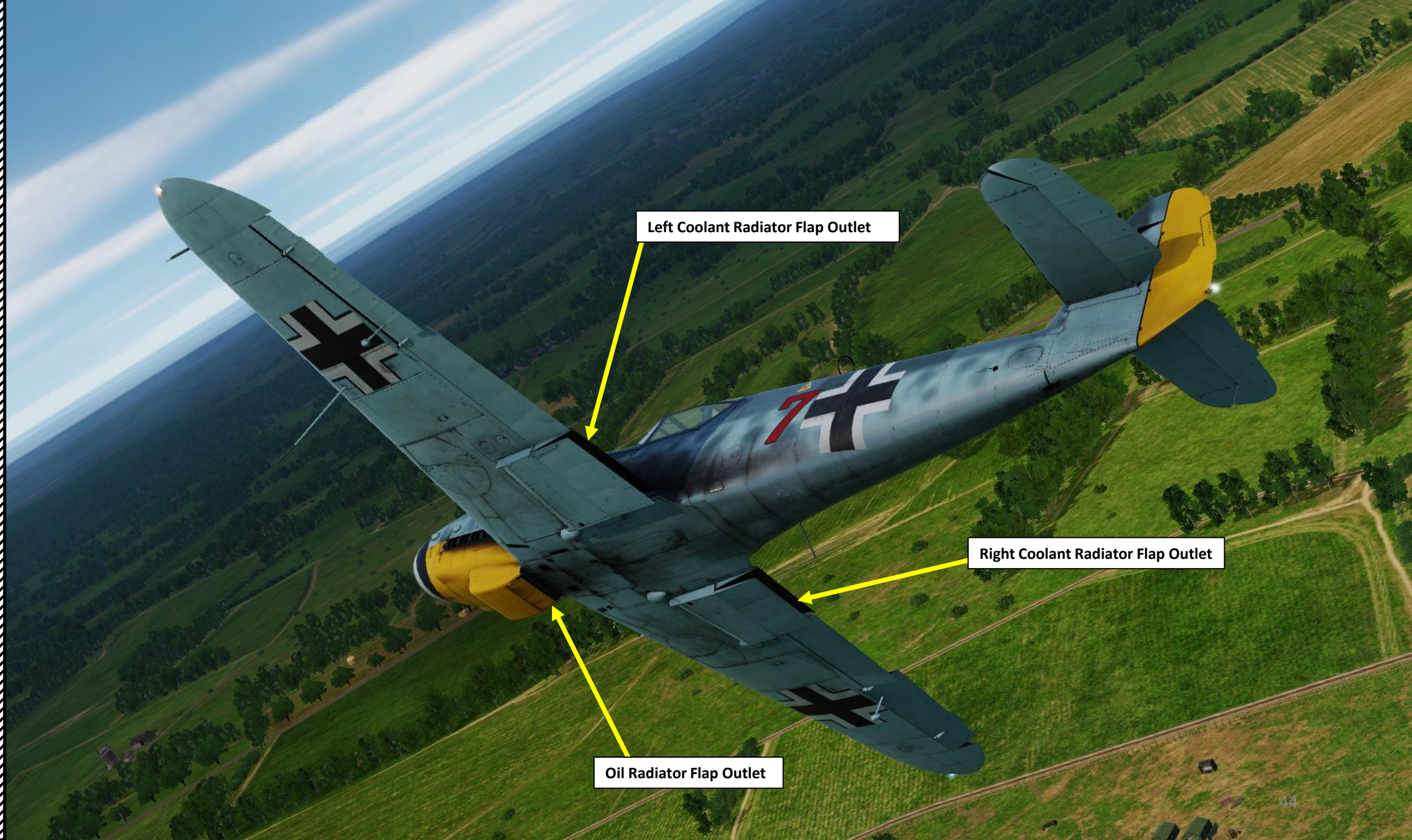

MK 108 30 mm Cannon/Rockets (B1) Button
• RALT+SPACE binding
Cannon Safety Cover
• LSHIFT+SPACE binding
Bomb Release Mode Selector Switch
• Left side: Dive Bombing (Sturz)
• MV: Mit Verzögerung (with delay)
• OV: Ohne Verzögerung (without delay)
• Right side: Level Bombing (Wagerecht)
• MV: Mit Verzögerung (with delay)
• OV: Ohne Verzögerung (without delay)
• Middle: Aus (Disarmed)
Bomb Loaded Light
Bomb Release (B2) Button
• RSHIFT+SPACE binding
MG 131 Machinegun (A) Button
• SPACE binding
Bomb Fuze Armed Light
MK 108 30 mm Cannon Charge (D) Button
• LALT+SPACE binding
Aus
mv
Sturz
ov
Notzug für Fahrwerk
Sammler
FuG 16
FuG 25a
Tank-pumpe


Kabinenabwurf
Hebel ziehen!
Wenn Kabine nicht abgeht,
Verriegelung lösen,
Kopf vorbeugen!
Flight Control Stick
Rudder Pedal
Rudder Pedal


Zu
P1
Nur hier betreten


Radio Wire Antenna
FuG 125 Hermine D/F (Direction Finder) Loop Antenna


Pitot Tube
Supercharger Air Intake Fairing
Engine Exhaust
Oil Radiator Intake
Right Coolant Radiator Intake
Left Coolant Radiator Intake
FuG 16ZY Morane Radio Antenna


Left Coolant Radiator Flap Outlet
Right Coolant Radiator Flap Outlet
Oil Radiator Flap Outlet


Slat
• Deploys automatically at high angles of attack
Slat
• Deploys automatically at high angles of attack

PART 3 – COCKPIT & EQUIPMENT


Flaps Position Indicator (deg)
Lines = 30/20/10/5 deg


Retractable Tailwheel
• Hydraulically actuated
Main Landing Gear
• Hydraulically actuated

C100 Navigation Lights Power Switch
(Kennlichter)

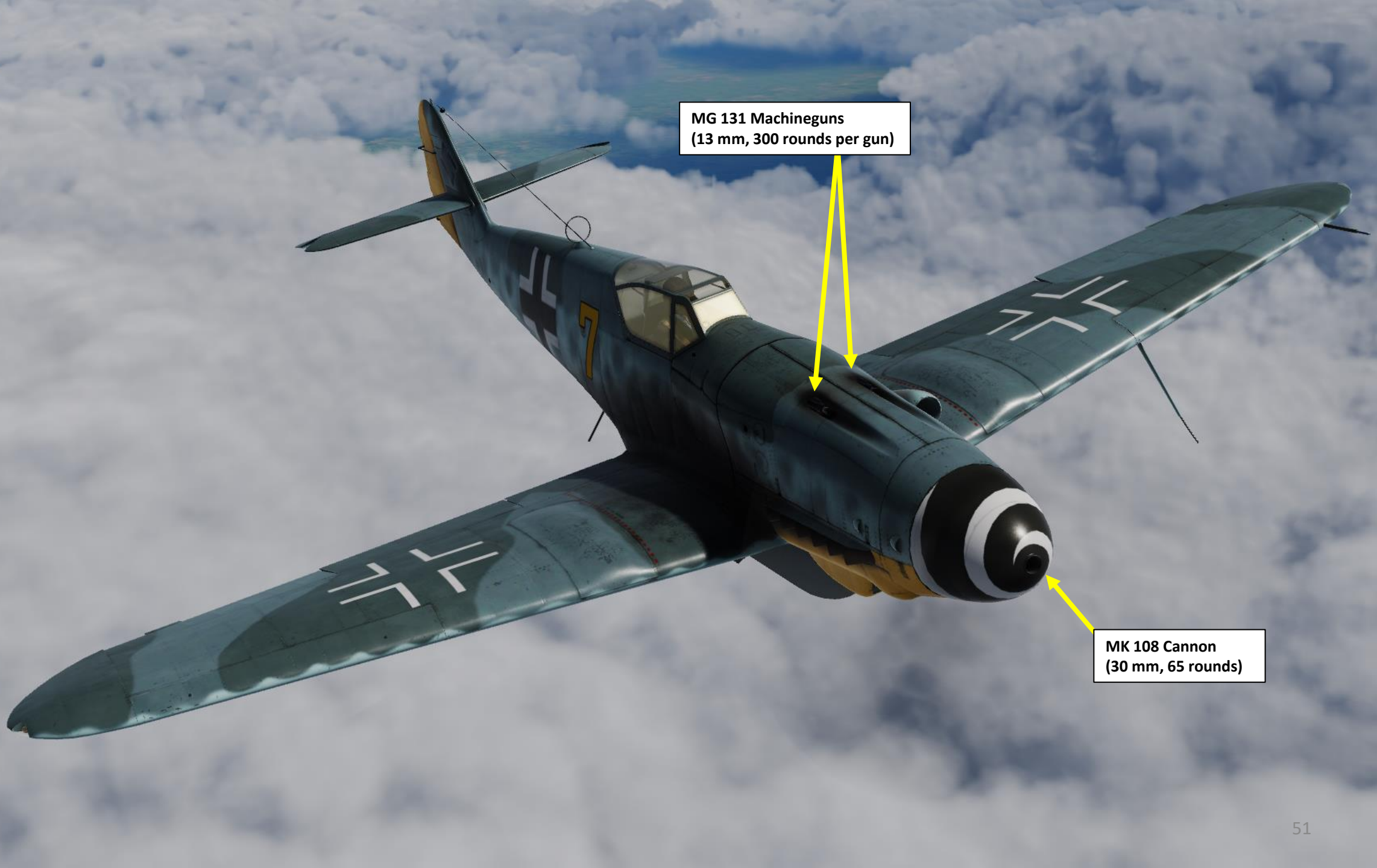
Green Navigation Light

Red Navigation Light

White Navigation Light

C101 Interior UV Lights Power Switch
(UV Leuchten)

PART 3 – COCKPIT & EQUIPMENT




MG 131 Machinegun
Cartridge Ejection Ports

PART 3 – COCKPIT & EQUIPMENT

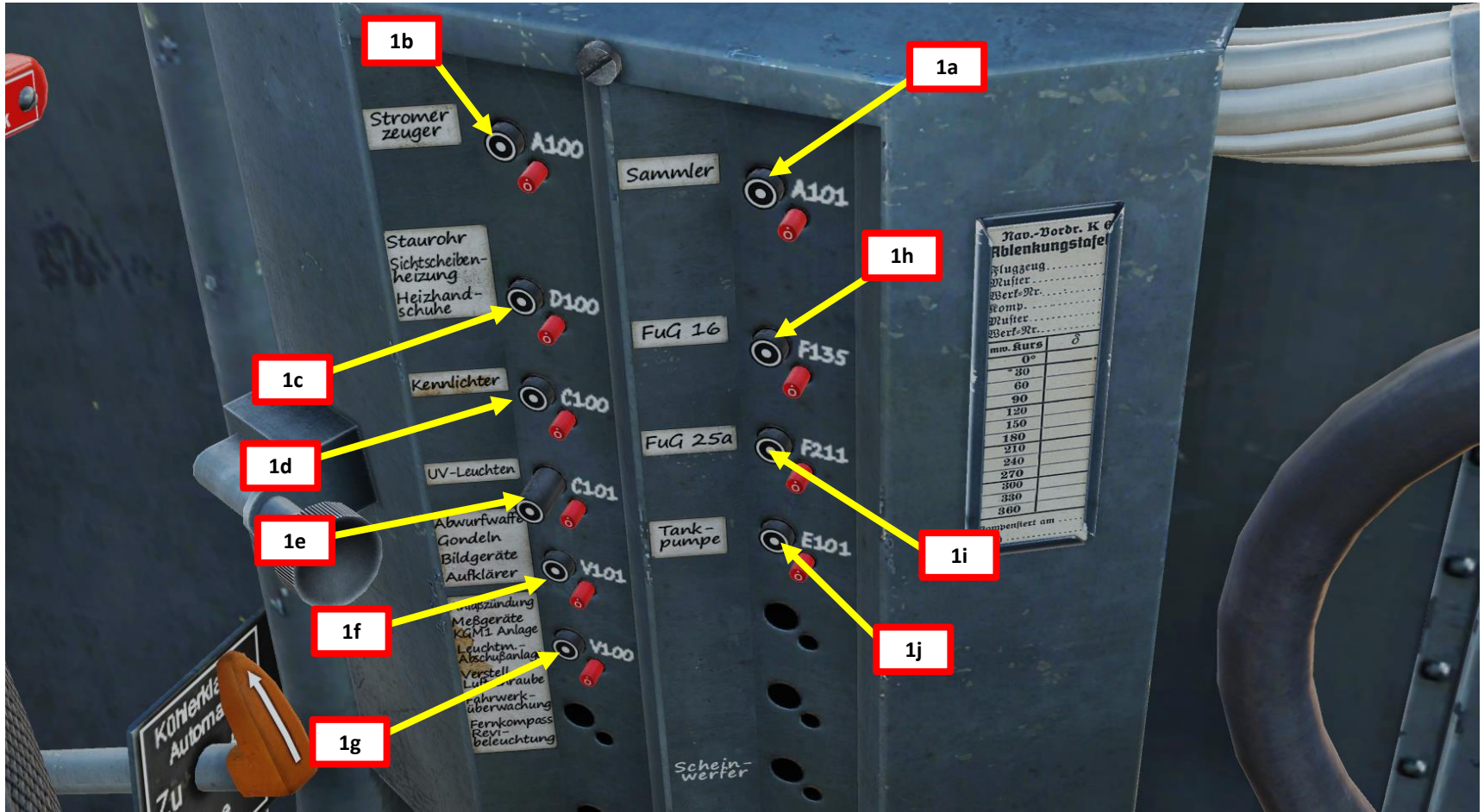

External Fuel Drop Tank
(300 L)


EADS
MESSERSCHMITT STIFTUNG

PRE-FLIGHT

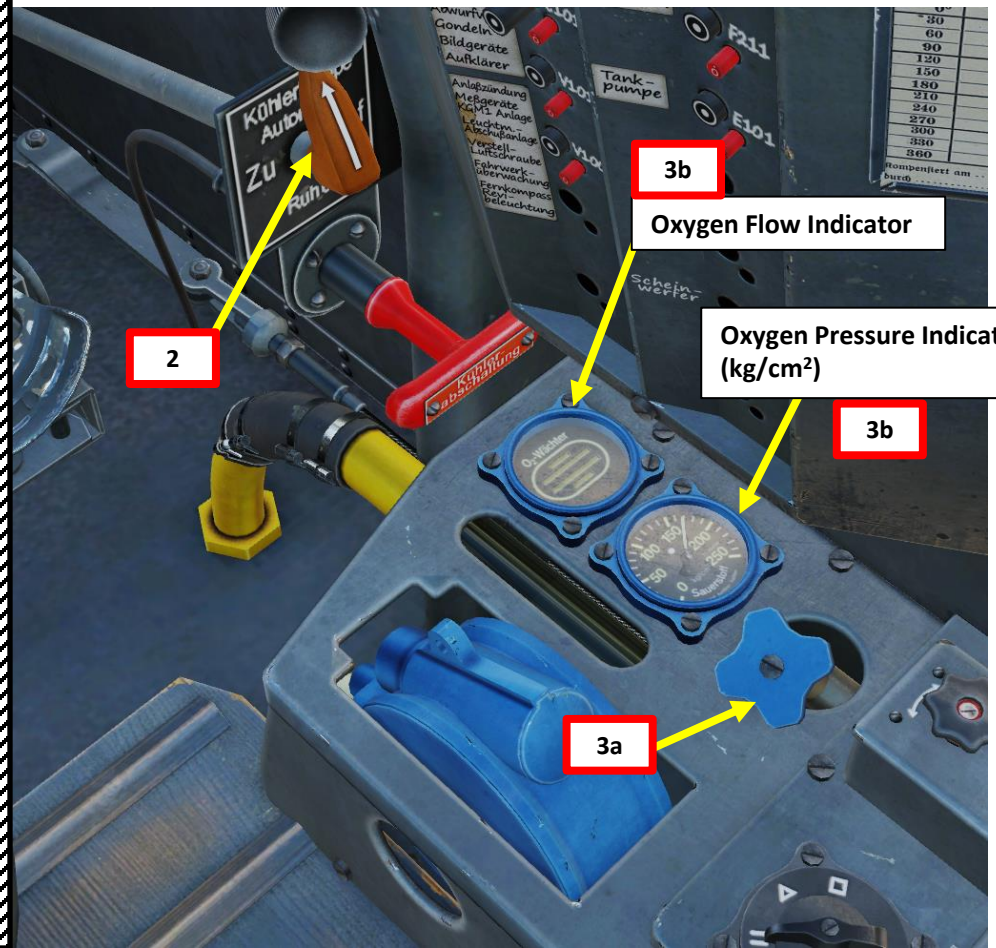
PRE-FLIGHT

1. Set Circuit Breakers – ON (IN)
    a) A101 Battery *(Sammler)*
    b) A100 Generator *(Stromer Zeuger)*
    c) D100 Pitot/Windscreen Heat *(Staurohr Sichtscheibenheizung Heizhandschuhe)*
    d) Optional: C100 Navigation Lights Power *(Kennlichter)*
    e) Optional: C101 Interior UV Lights Power *(UV Leuchten)*
    f) V101 External Ordnance and Optional Equipment Power *(Abwurfwaffe Gondeln Bildgeräte Aufklärer)*
    g) V100 Ignition, MW50, Compass, Propeller Pitch, Instruments & Gunsight Power
    h) F135 FuG 16ZY Radio Power
    i) F211 FuG 25A IFF (Identify-Friend-or-Foe) Unit Power
    j) E101 Fuel Pump Power *(Tankpumpe)*



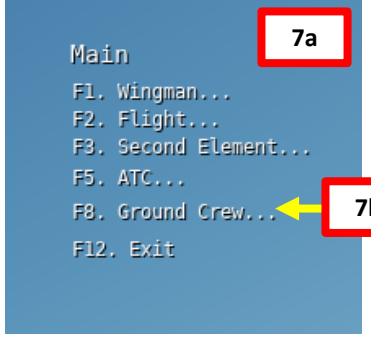
PRE-FLIGHT

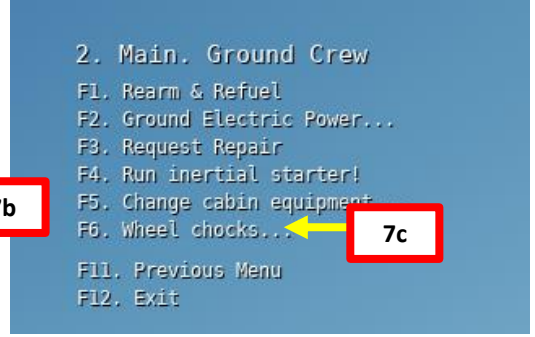
2. Set Radiator Control Lever– AUTOMATIK (UP)
3. Set Oxygen Valve – OPEN
    - Confirm valve opens correctly with the Oxygen Flow Indicator and Oxygen Pressure Indicator gauges
4. Set Governor Automation System Switch – AUTOMATIC (AFT)
5. Verify that propeller pitch adjusts accordingly to a 12:30 position (Needles should be moving and audible)
6. Ensure elevator, aileron and rudder controls are working by moving stick and rudder pedals

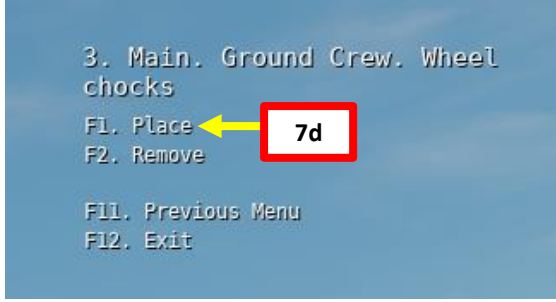


PRE-FLIGHT

7. Verify that wheel chocks are installed. If not, call your ground crew (Press "\" and then press "F8") and press "F6" and "F1" to ask the crew to place the wheel chocks.

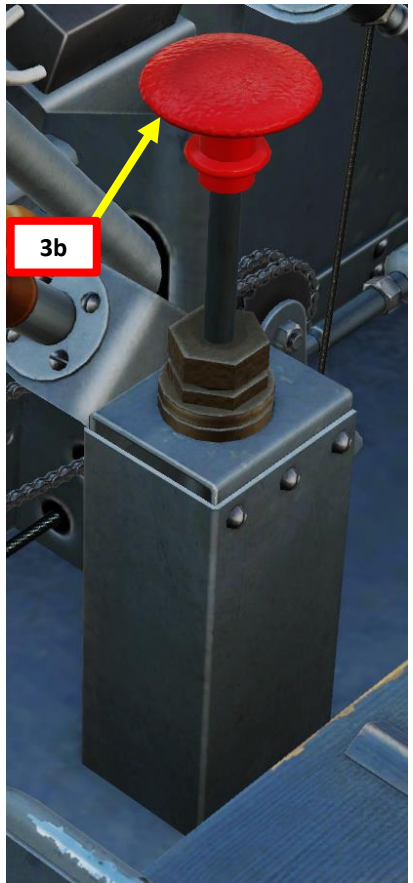


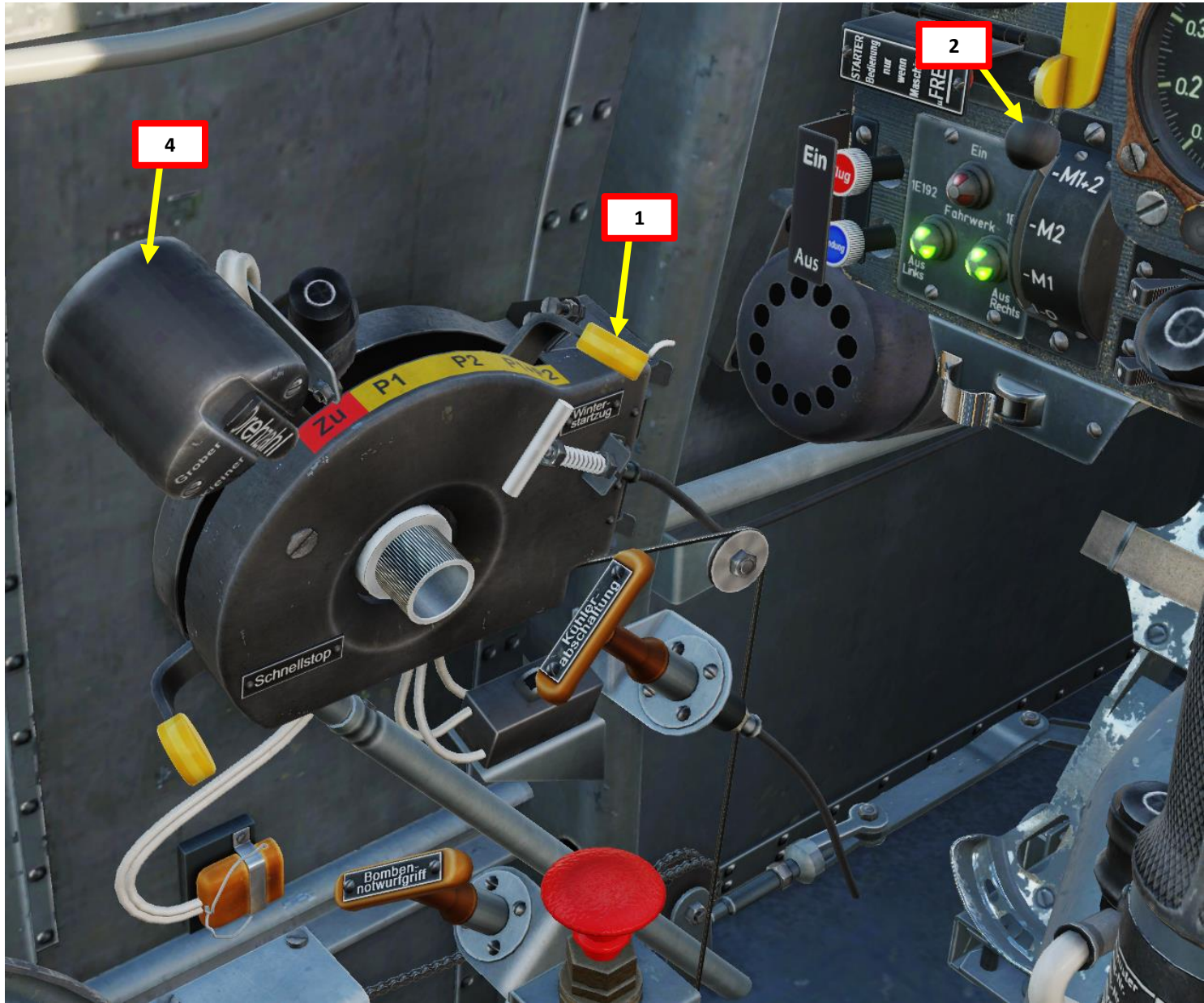




ENGINE START

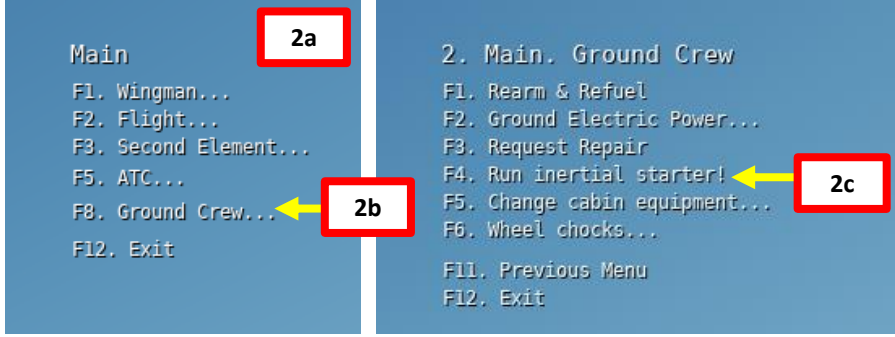
1. Set Fuel Booster Pump Selector – P1+P2 (FULLY OPEN)
    - Note: You may need to move your throttle to access the fuel pump lever
2. Set Magnetos (Ignition) switch – M1+2 (LEFT CLICK)
3. Prime engine until the fuel pressure gauge is sufficient by repeatedly left-clicking and holding on the fuel priming pump handle 3 to 4 times.
4. Set throttle to IDLE (FULLY AFT).

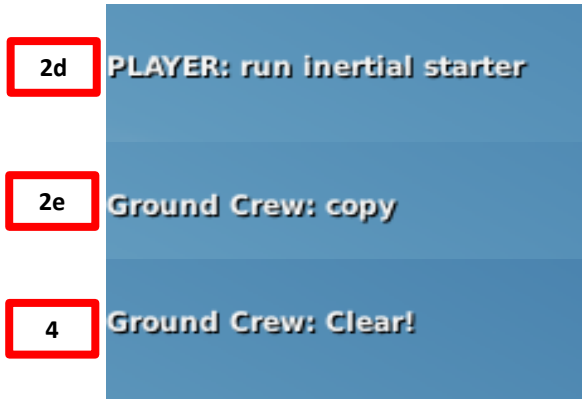


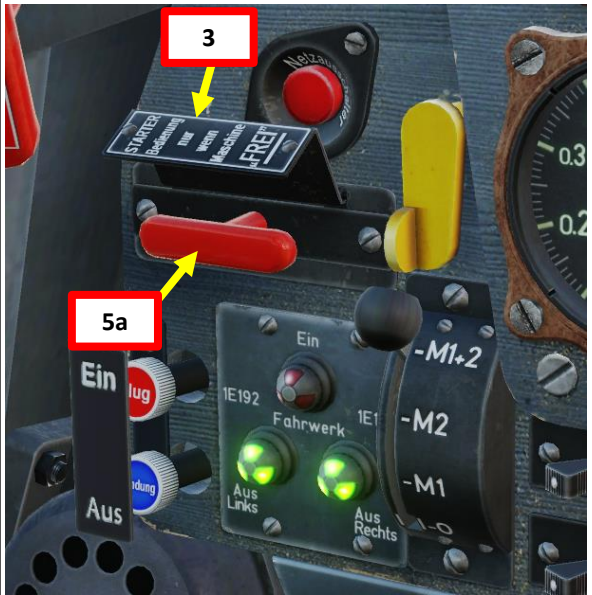


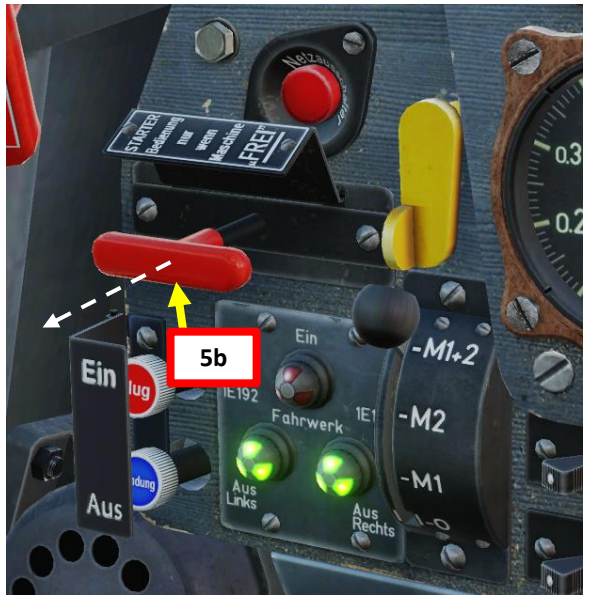
ENGINE START

1. Verify that the propeller is clear and command « Clear prop! » to warn people around you that you are about to start the engine.
2. Call your ground crew (Press “\” and then press “F8”) and press “F4” to ask the crew to run the manual inertial starter crank.
3. Flip the cover switch on the starter.
4. Once the inertial starter has been running for more than 10 seconds, the ground crew will give you the signal to pull the starter lever aft (“Clear!”).
5. Pull the starter handle until successful engine ignition.





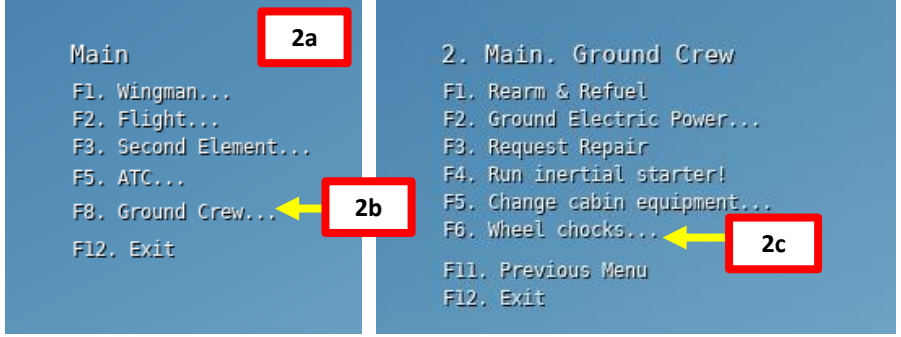


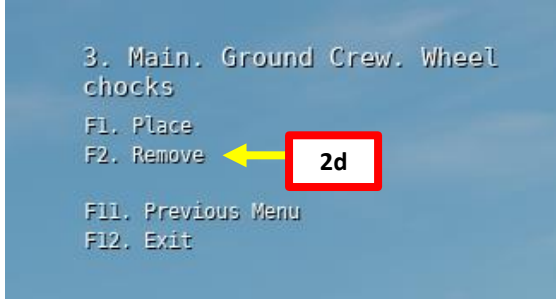


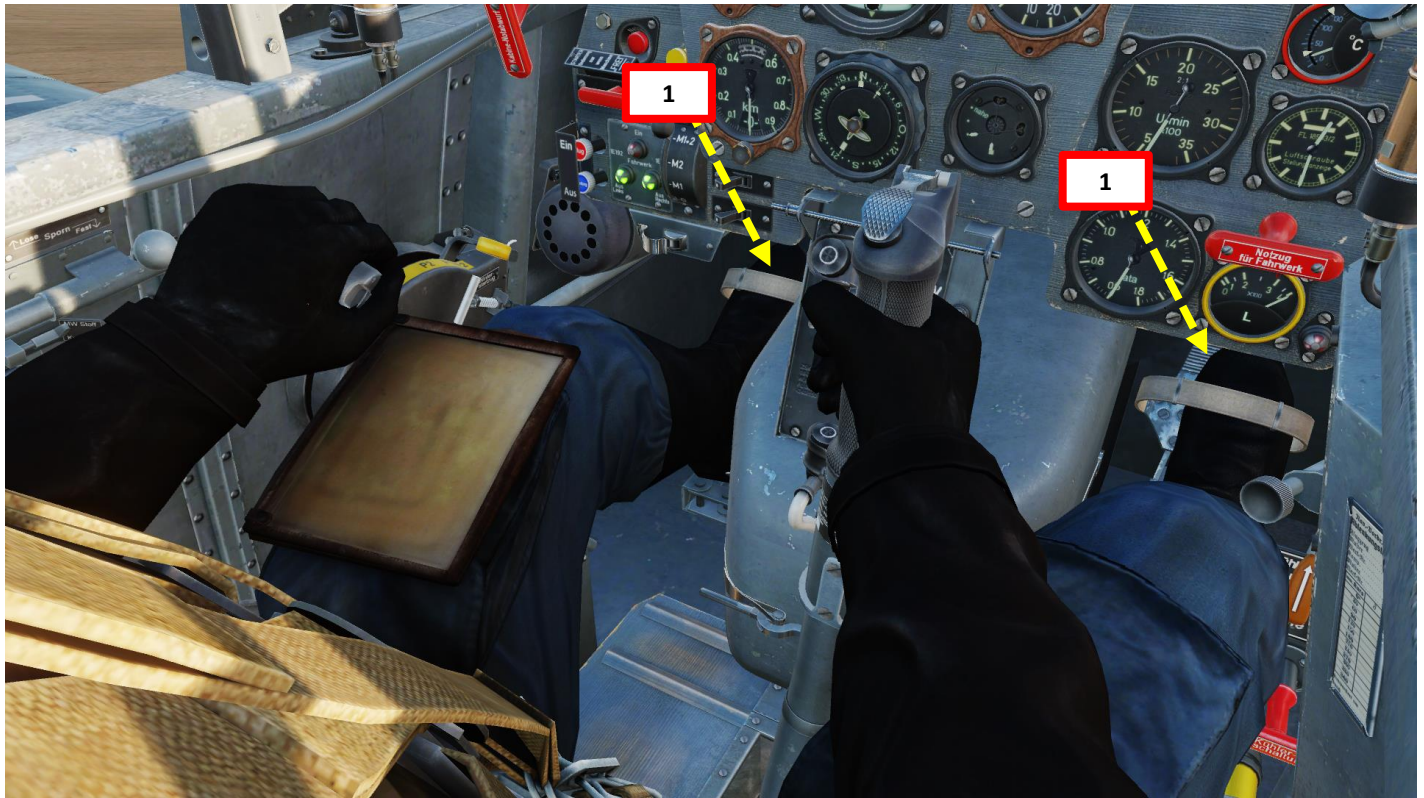
ENGINE START

POST-START

1. Engage wheel brakes by pressing down and holding the toe brake pedals.
2. Call your ground crew (Press “\” and then press “F8”) and press “F6” and “F2” to ask the crew to remove the wheel chocks.

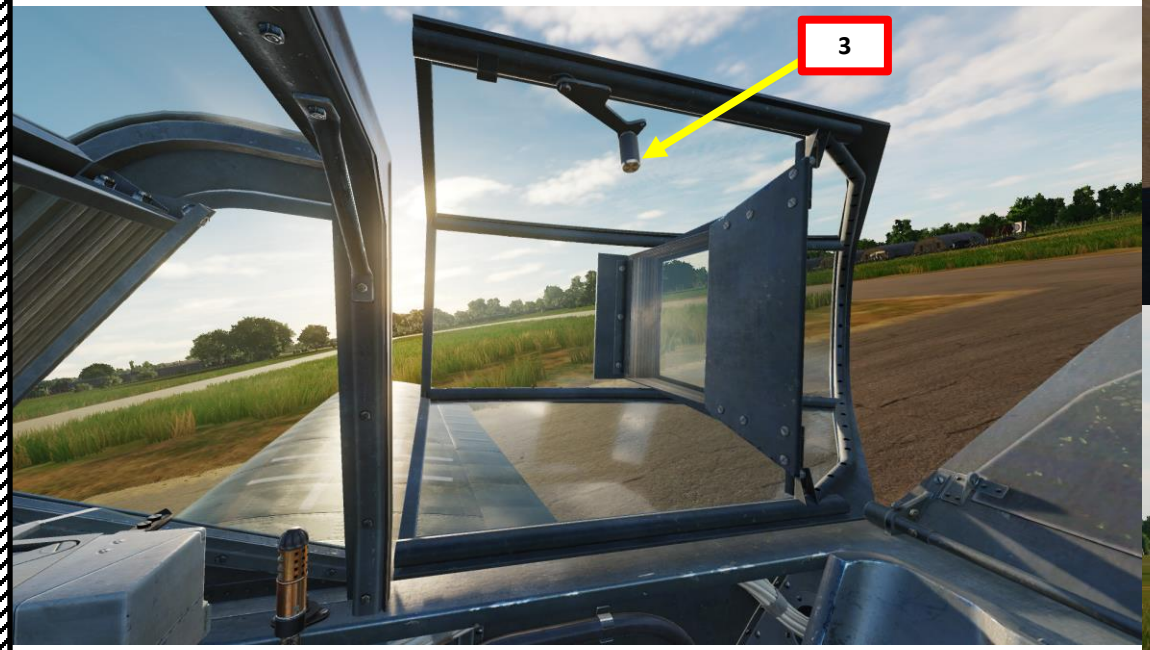






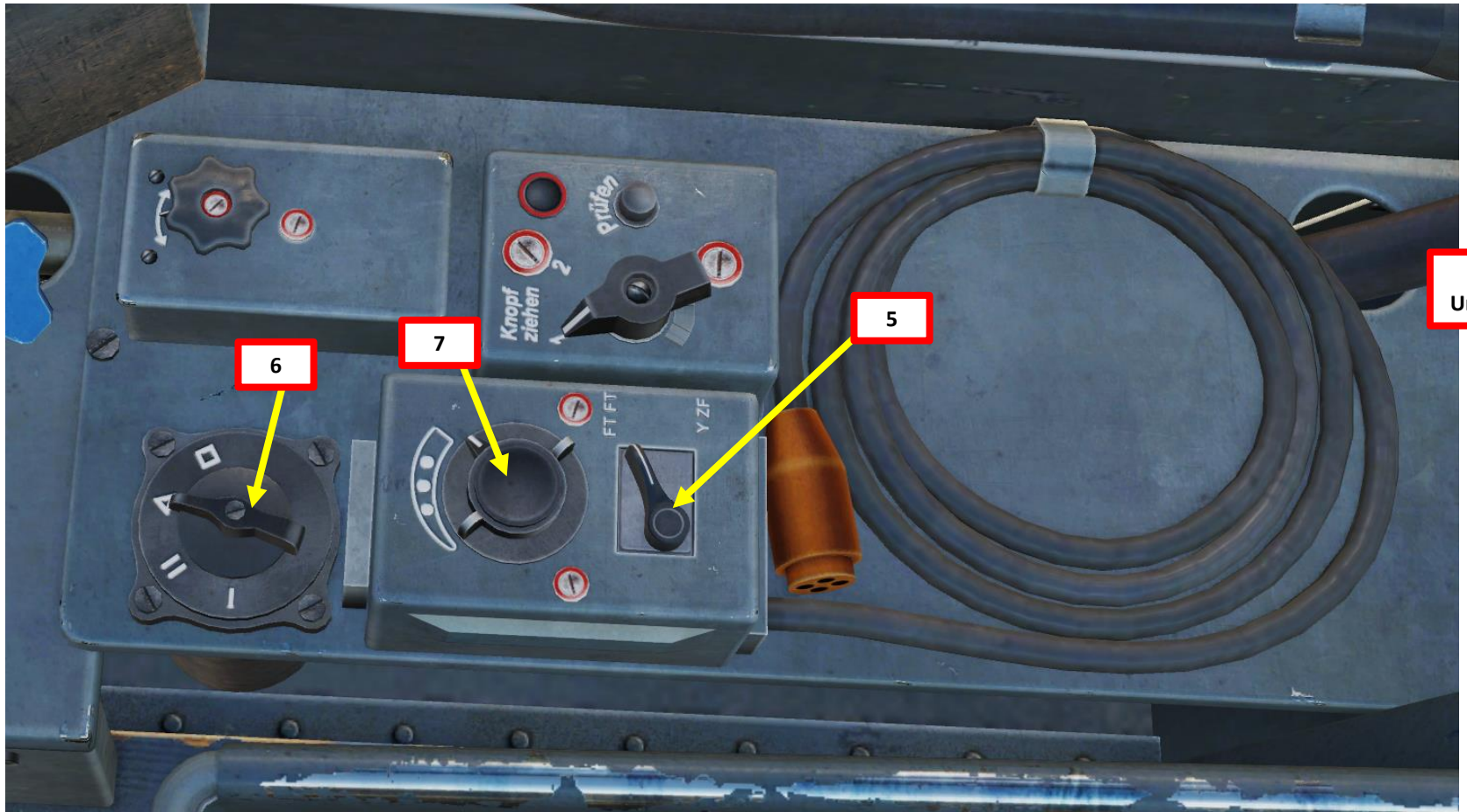
POST-START

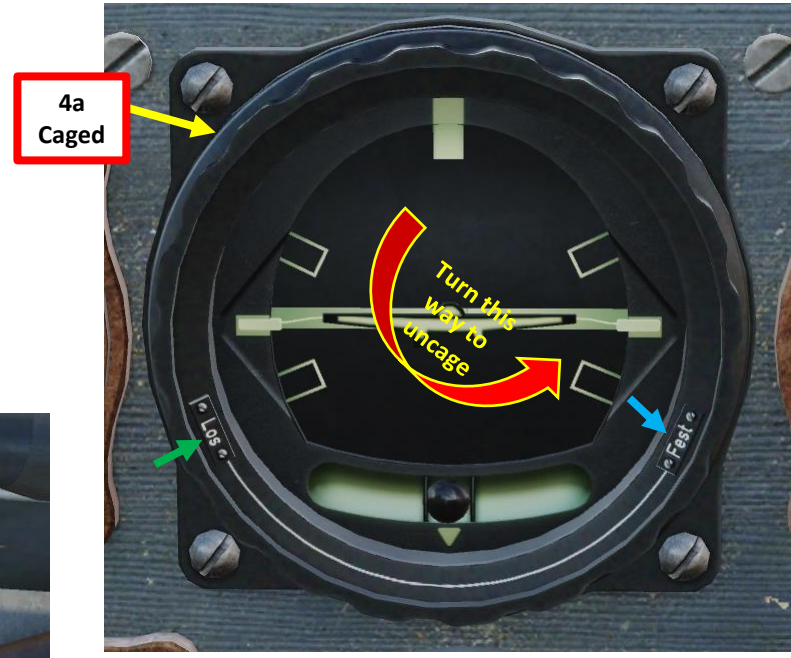
3. Close your canopy (“LCtrl+C” or by clicking on canopy handle).

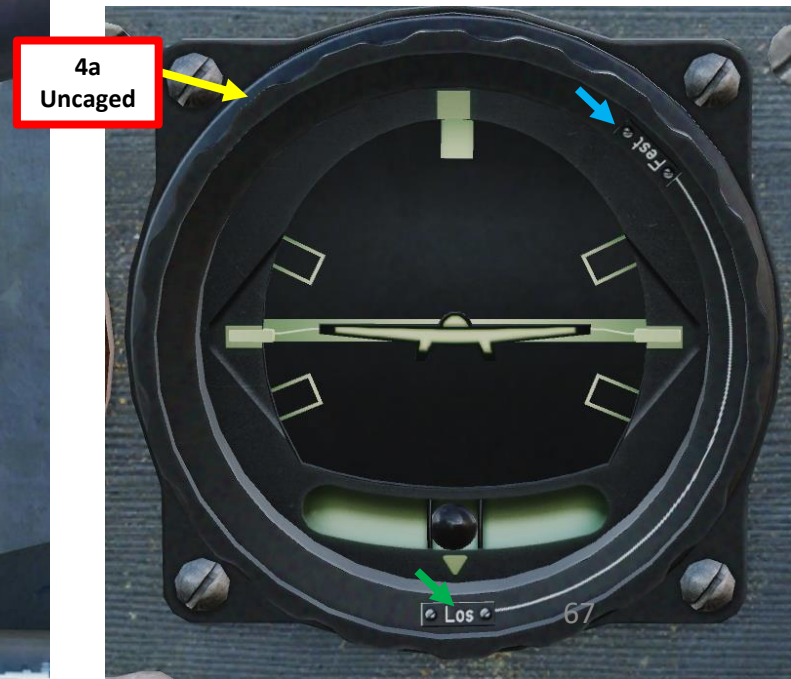


POST-START

4. Uncage the Artificial Horizon by rotating the outer ring. In UNCAGED position, the *Los* (Uncaged) letters should be at the bottom and the *Fest* (Caged) letters should be at the top.
5. Set FuG 16ZY Radio Homing Selector Switch - *Ft: Funktelefonie /* Radio Telephony
6. Set FuG 16ZY Radio Frequency Selector Switch – As required by mission briefing.
    - **The "I" position** is for "Y-Führungsfrequenz", or Management frequency, is used for communication within the **flight or squadron**.
    - **The "II" position** is for "Gruppenbefehlsfrequenz", or Group Order frequency, is used to communicate between **several flights from different squadrons** participating in a single raid.
    - **The "Δ" position** is for "Nah-Flugsicherungsfrequenz", or the **Air Traffic Control** frequency. It is used to communicate with the designated Air Traffic Controller.
7. Adjust FuG 16ZY Radio Volume Control – As required

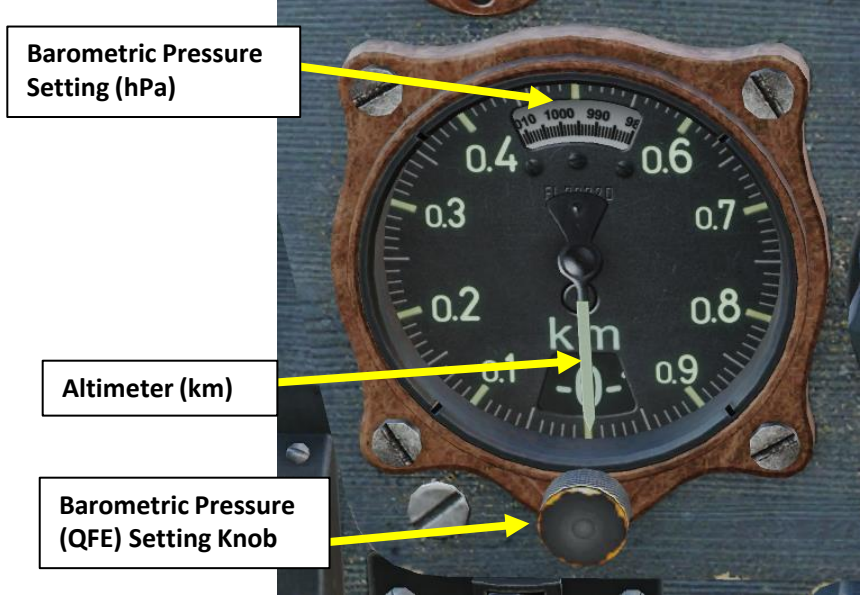


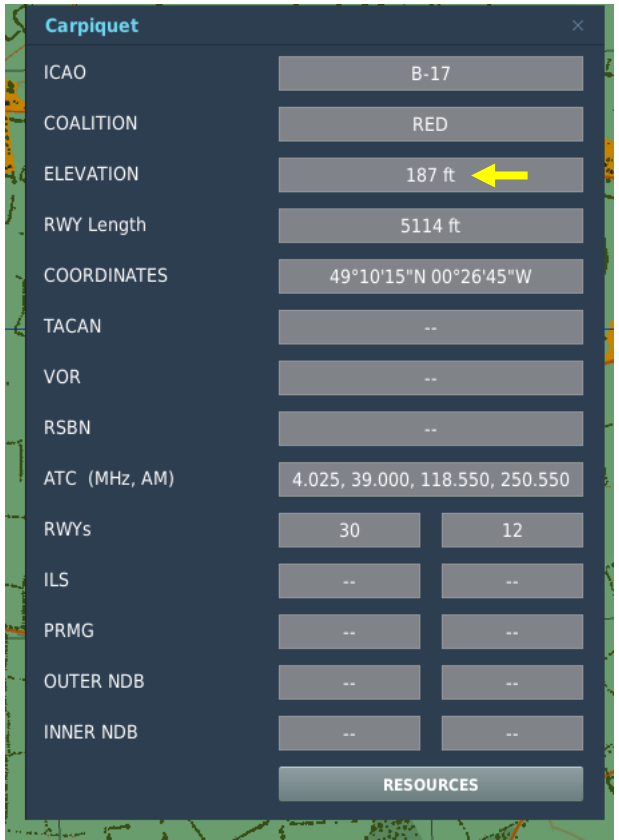




POST-START

8. Use F10 key to display your map and airport information. Adjust QFE (Barometric Pressure) Setting to “0”. Alternatively, you can also match the altimeter reading to the airport elevation in meters.
9. Perform engine warm-up.

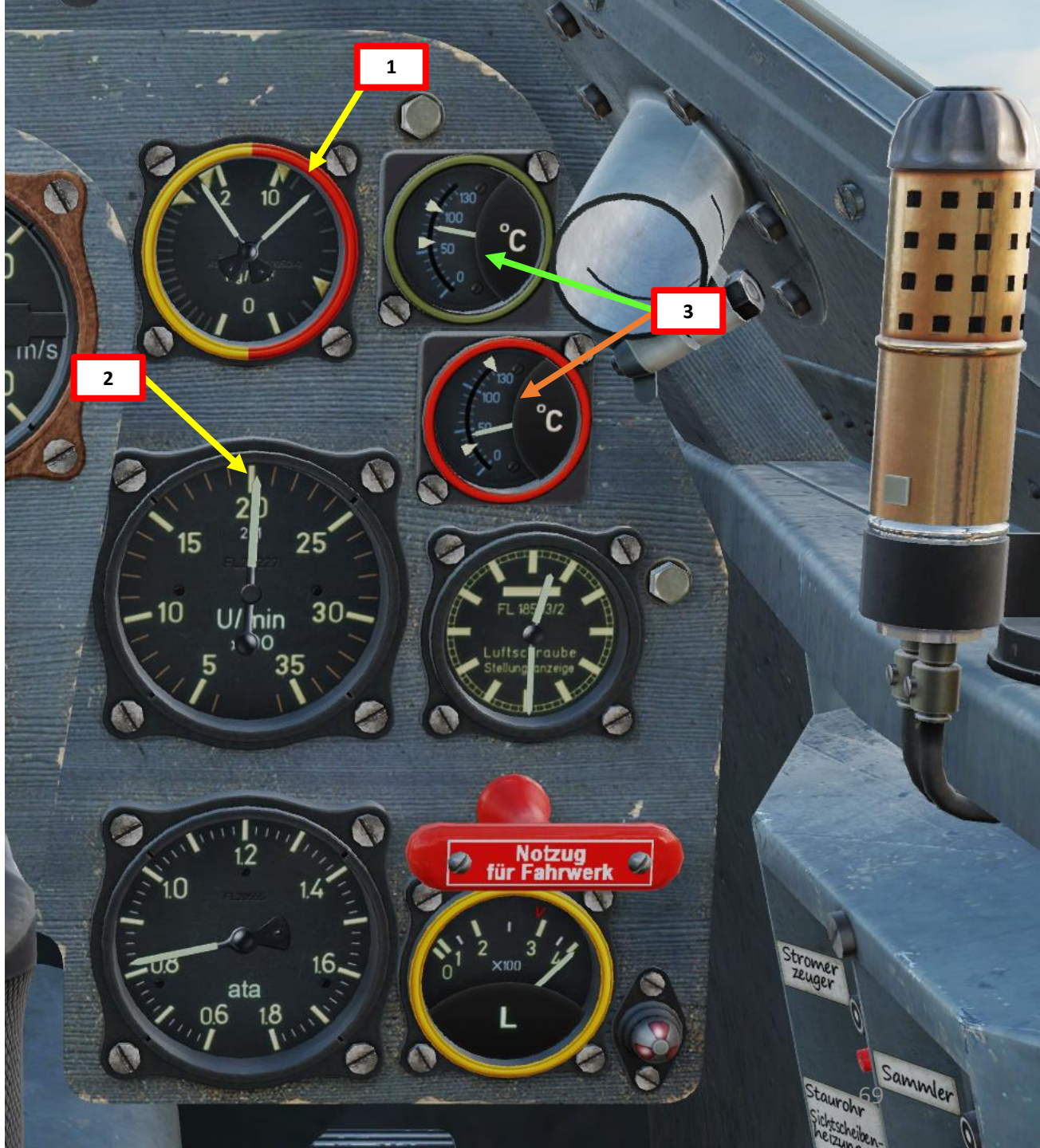




ENGINE WARM-UP

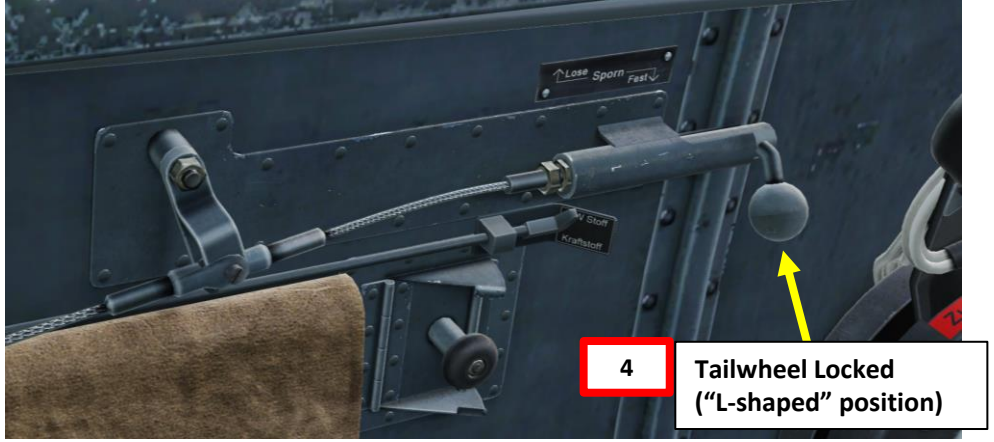
1. Ensure oil pressure is between 3 and 9.5 kg/cm^2.
2. Hold wheel brakes and adjust throttle to reach a RPM of about 2000.
3. Wait until engine oil warms up to at least 30 deg C and coolant temperature is at least 60 deg C.
4. Start taxiing when engine is warmed up.

Note: *Attempting a takeoff with low oil or coolant temperature can lead to dire consequences. Waiting for proper engine warm-up is often overlooked by virtual pilots and the engine leaves no room for error when engine temperatures are concerned.*



TAXI PROCEDURE

1. Verify that wheel chocks are removed.
2. Taxi to the runway when ready. Be careful not to overheat your engine on the ground.
3. Release wheel brakes, then throttle up to gain forward motion. Taxiing should be done at 15-20 km/h maximum.
4. Lock your tailwheel with the Tailwheel Locking Lever in the “L-shaped” (Locked) position if you want to go straight.

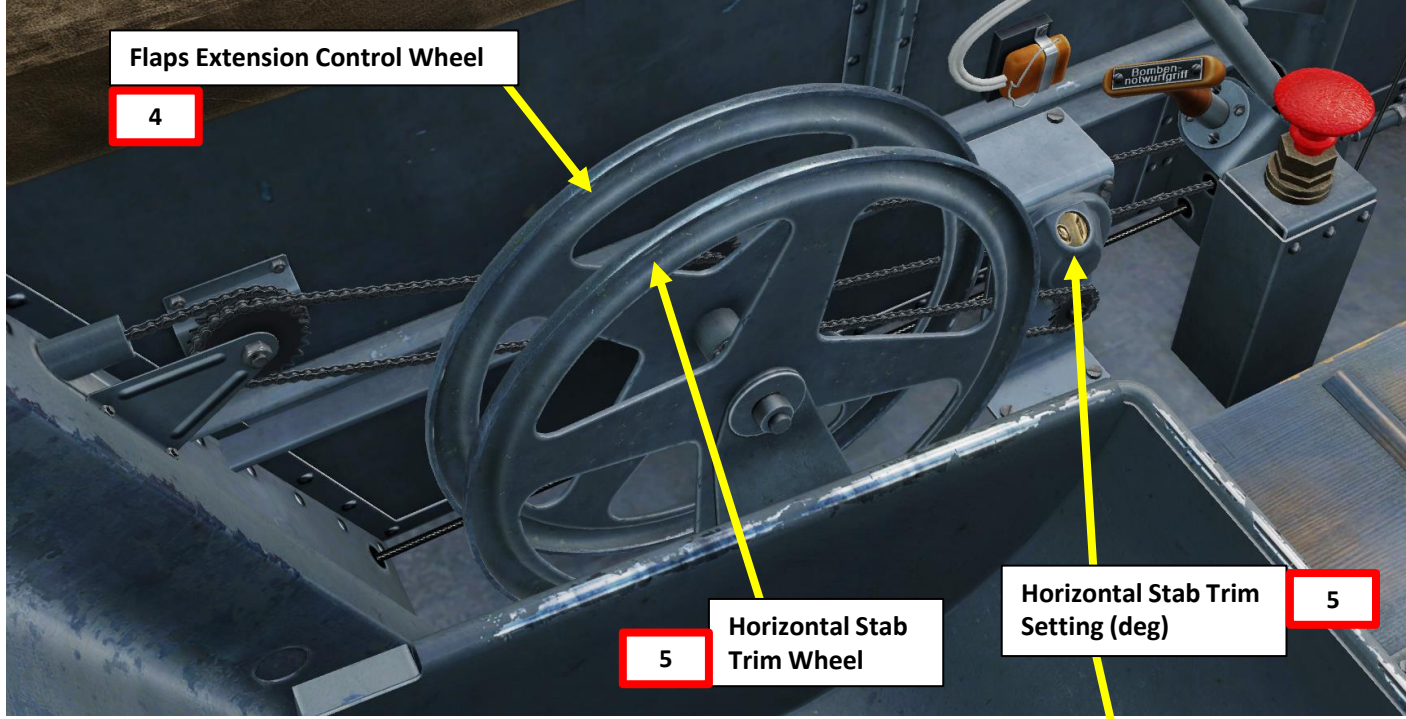


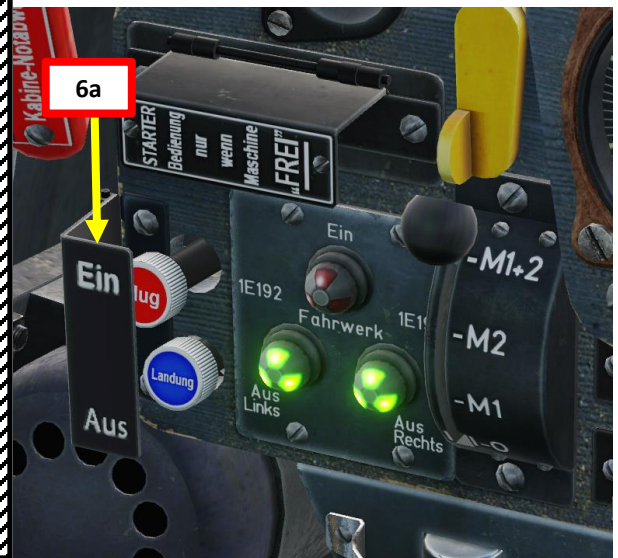
TAXI PROCEDURE

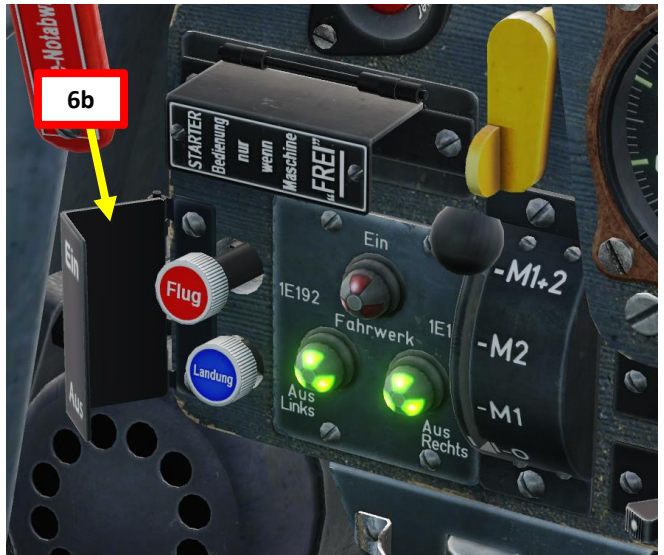
5. The nose restricts forward visibility. This means that in taxiing, you must zig-zag (or "S-turn") continually.
6. Unlock your tailwheel with the Tailwheel Locking Lever if you want to turn.
7. To perform a turn, use differential braking by gently tapping the wheel brake pedal on the side you wish to turn. The disc-type wheel brakes are hydraulically actuated.
8. Counter engine torque by applying full right stick when throttling up.

TAKEOFF PROCEDURE

1. Line up on the runway and verify the canopy is closed.
2. Once you are lined up with the runway, make sure your tailwheel is straight by moving in a straight line to straighten the wheel.
3. Lock your tailwheel with the Tailwheel Locking Lever in the “L-shaped” (Locked) position if you want to go straight.
4. Fully retract flaps
5. Set Horizontal Stab trim to +0.5 deg Nose Down for light payloads.
    - Note: Use +1 deg Nose Down for heavy payloads.
6. Flip Landing Gear Safety Cover
7. Set Radiator Control Lever– AUTOMATIK (UP)

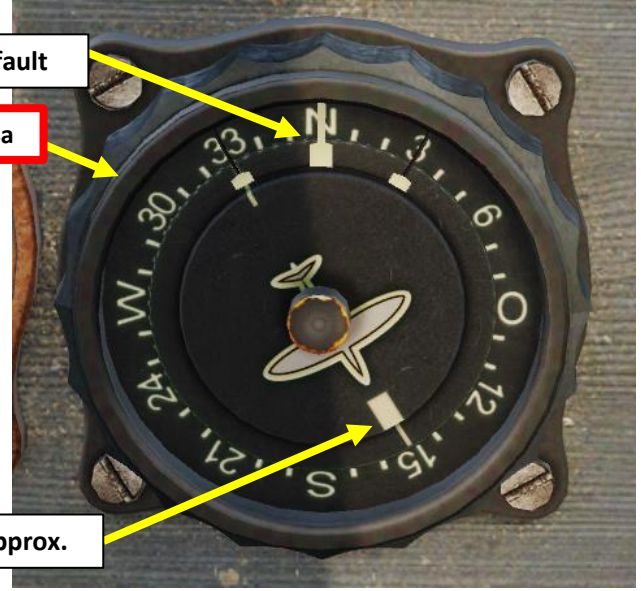


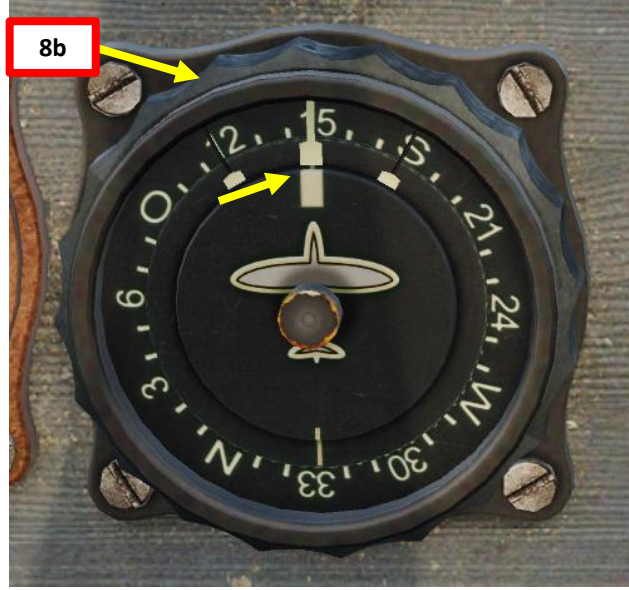


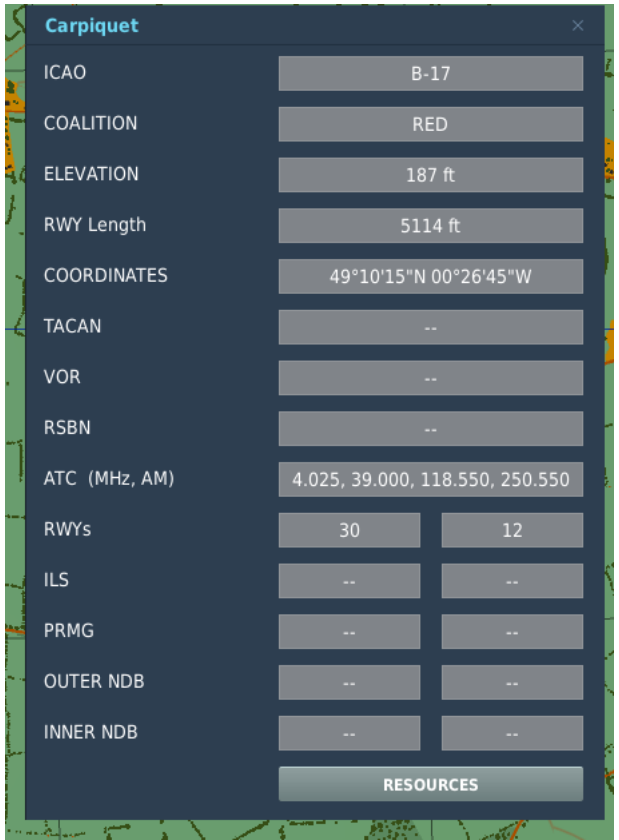


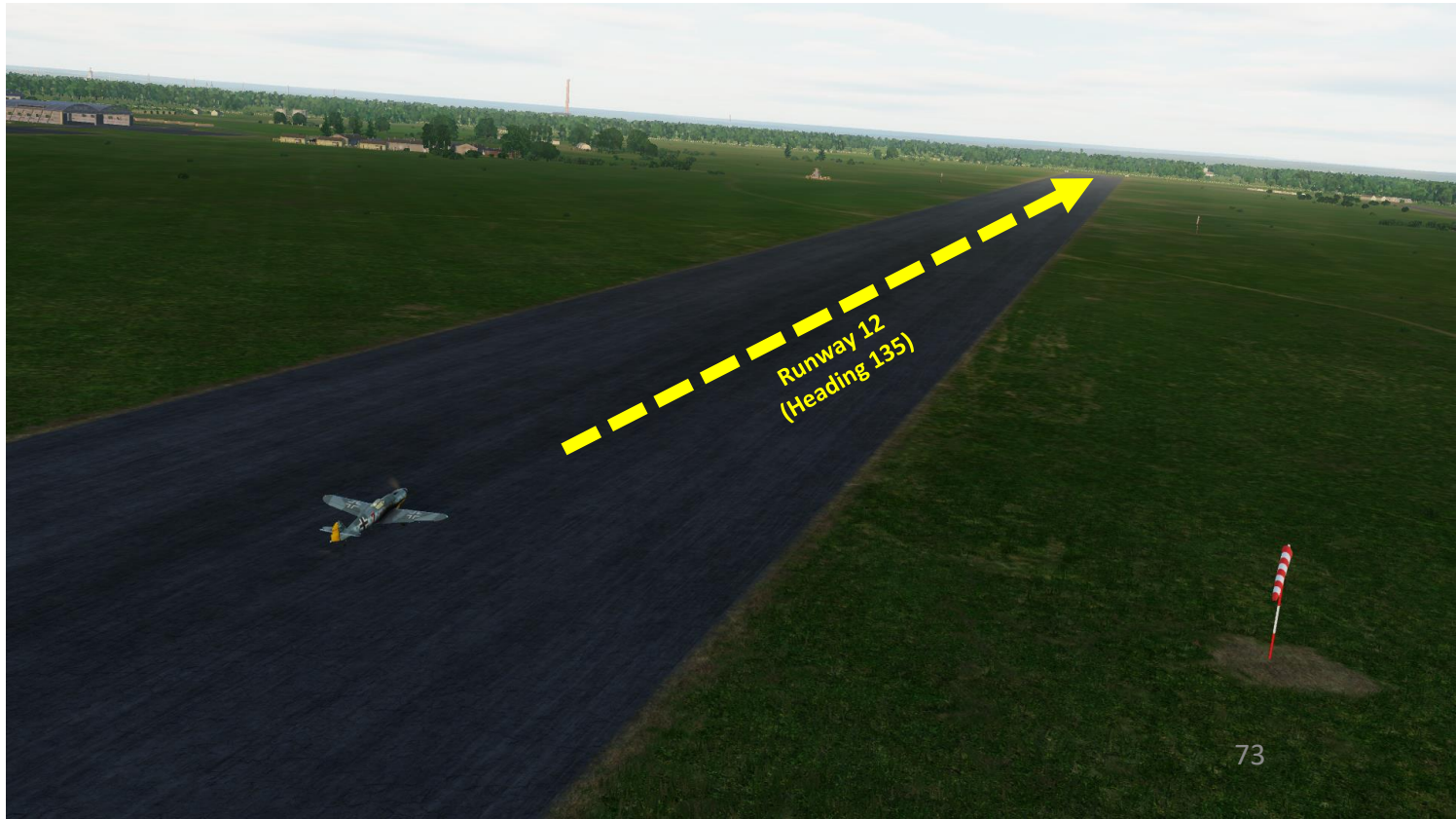
TAKEOFF PROCEDURE

8. Adjust your course setting to the desired departure course (typically aligned with the runway's heading) by rotating the outer ring of the Repeater Compass.







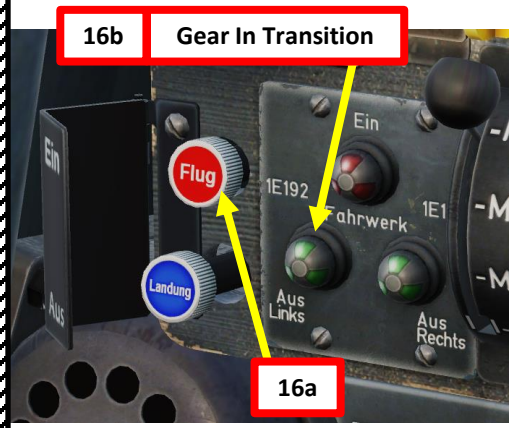


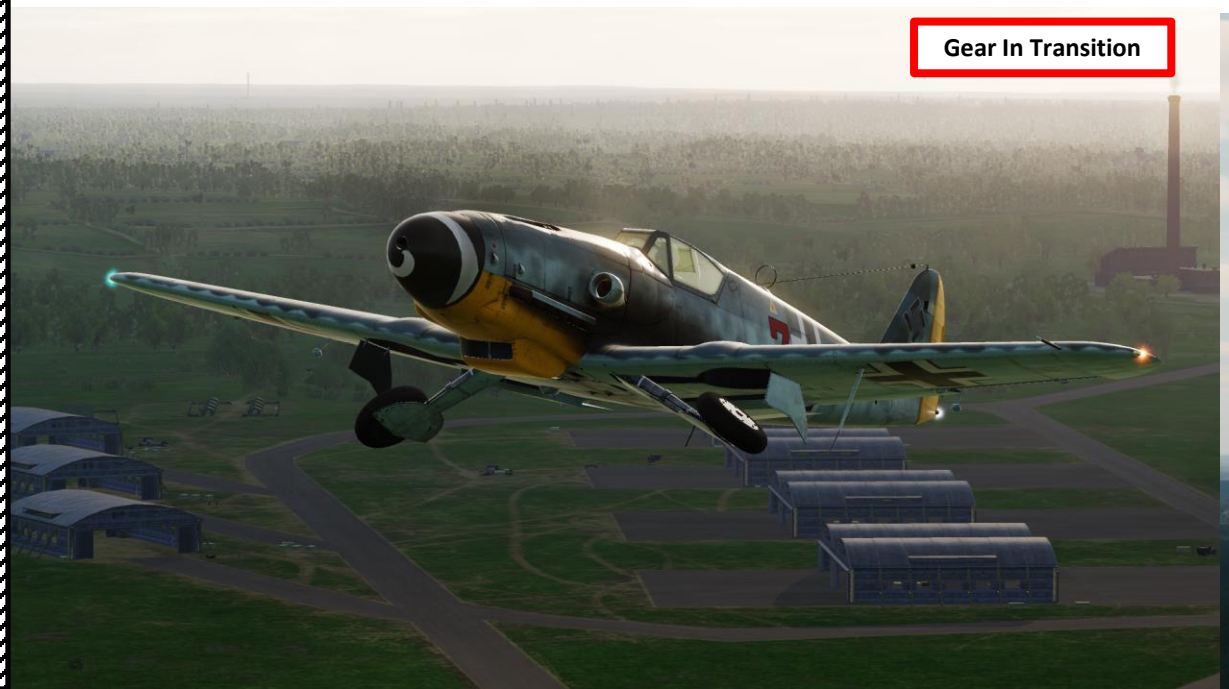
TAKEOFF PROCEDURE

9. Ensure the tailwheel is straight by advancing the aircraft a few meters.
10. Hold wheel brakes.
11. Set your stick fully right and slightly back to counter engine torque.
12. Release brakes, then slowly increase throttle to 2300-2400 RPM (1.35 ATA).
13. As you gain speed, keep your stick right but gradually push it forward as you feel the nose going up.
    - Note: The 109 is a superb climber, but stalls very easily on takeoff if you don't force the nose down.
14. Do not use your rudder to steer at low speeds, gently tap your brakes instead.
15. The aircraft should rotate by itself naturally. Let the aircraft lift off instead of looking at the speed gauge. Adjust stick to counter engine torque accordingly.
    - Nose down trim is often not enough to keep you completely level at high RPMs. Keep that in mind when you leave the ground.

TAKEOFF PROCEDURE

16. Raise landing gear before reaching 350 km/h.





TAKEOFF PROCEDURE

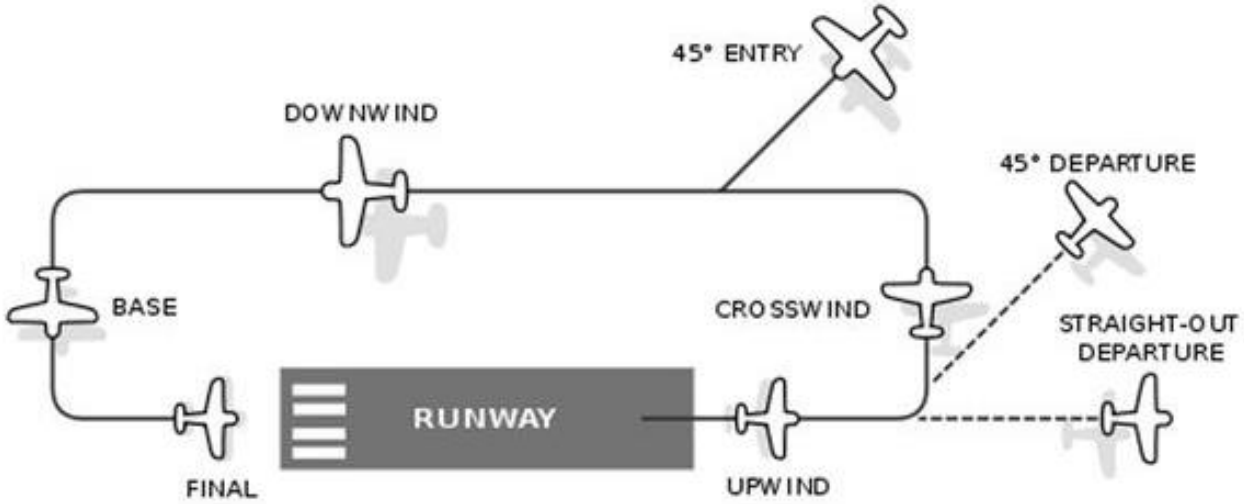
17. Reduce power to maintain 270 km/h for optimal climb.
18. Optimal cruising speed is 420 km/h.

Video Demo: https://www.youtube.com/watch?v=VXCGwgW6GNY

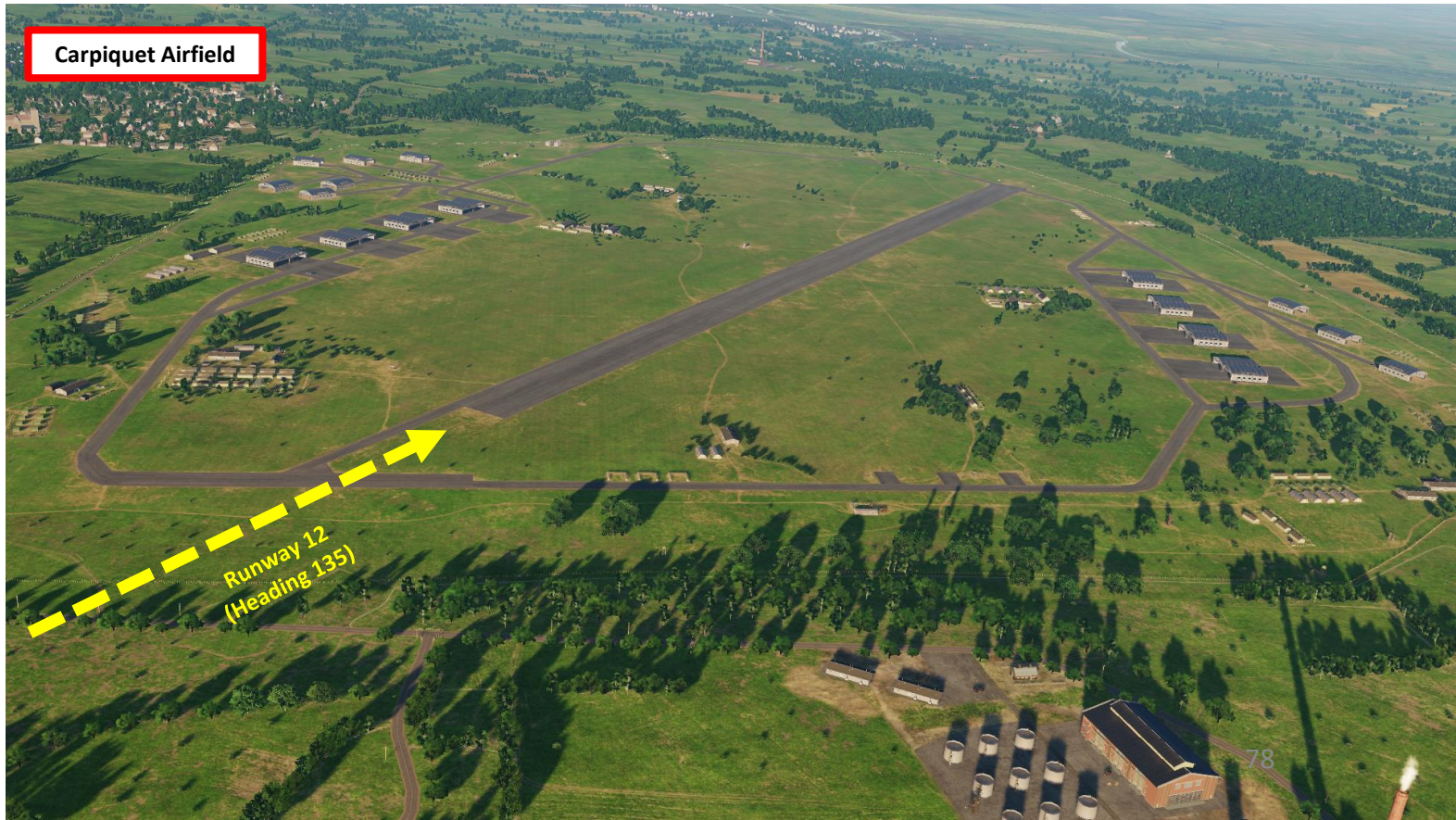
LANDING PROCEDURE

LANDING PROCEDURE

1. Enter downwind leg at 300 m altitude.
2. Lock your tailwheel with the Tailwheel Locking Lever in the “L-shaped” (Locked) position.

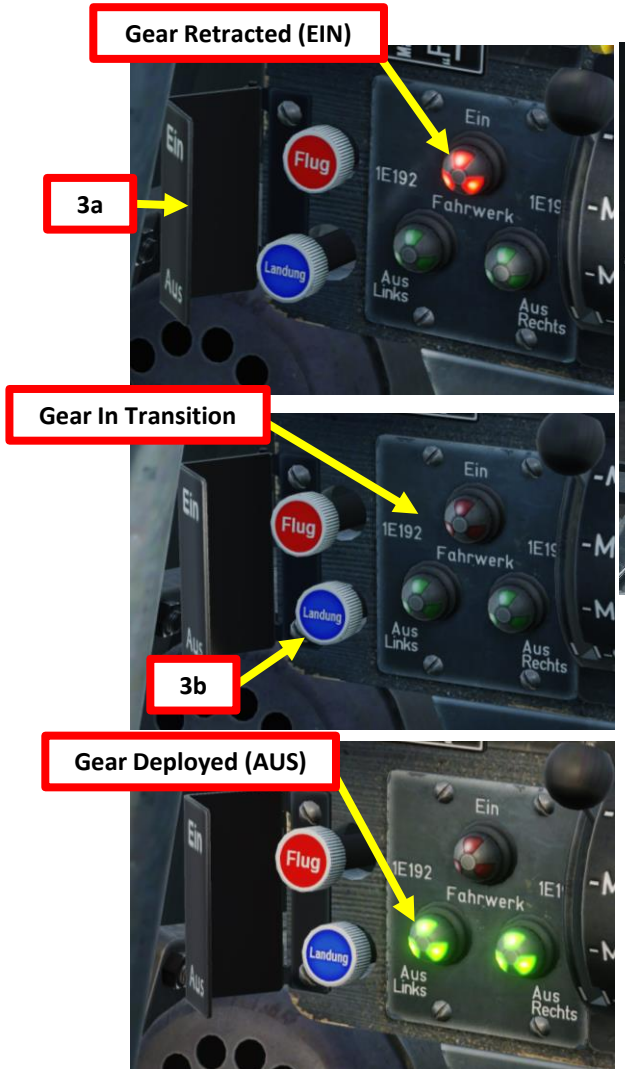


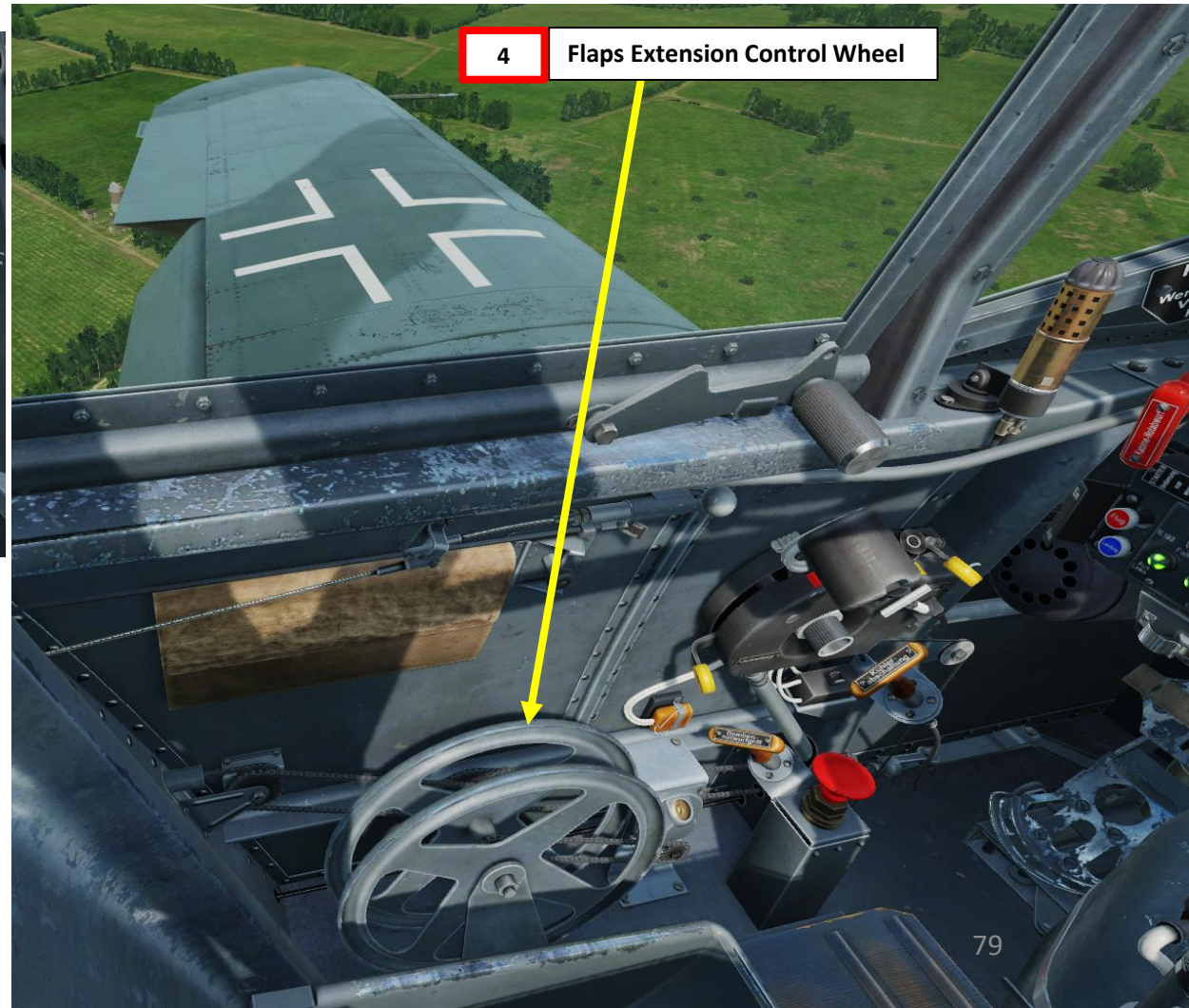
2 **Tailwheel Locked (“L-shaped” position)**



LANDING PROCEDURE

3. Flip Landing Gear Safety Cover, then deploy landing gear in LANDING (*AUS*) position when below 350 km/h.
4. Fully extend flaps when below 250 km/h.
5. Set Radiator Control Lever– AUTOMATIK (UP).
    - Alternatively, you can also set the radiators to AUF (OPEN) by setting the swit.





LANDING PROCEDURE

6. After turning on final, keep your nose aimed to the end of the runway, not the beginning. You tend to go where you aim.
7. Approach the airfield with a speed of 220 km/h, and a sink rate between 2.5 and 5 m/s.
8. The 109 has a very narrow undercarriage. Try to land with as little slip on the slip indicator as possible as crab approaches are very dangerous… unless you have a lot of experience.
9. Touchdown with a speed of 180 km/h with the throttle at IDLE (aft). Do not start pulling on the stick to smack your tailwheel down: you can still generate enough thrust to bounce, stall and crash if you are not careful.
10. Gently tap your brakes to steer the airplane on landing. Rudder input should be avoided unless absolutely necessary.
11. Tap brakes to slow down a bit more and come to a full stop. Remember: the undercarriage is very narrow so the aircraft is very sensitive to yaw and brake input on the ground.
12. When taxiing, unlock your tailwheel with the Tailwheel Locking Lever if required.

LANDING PROCEDURE

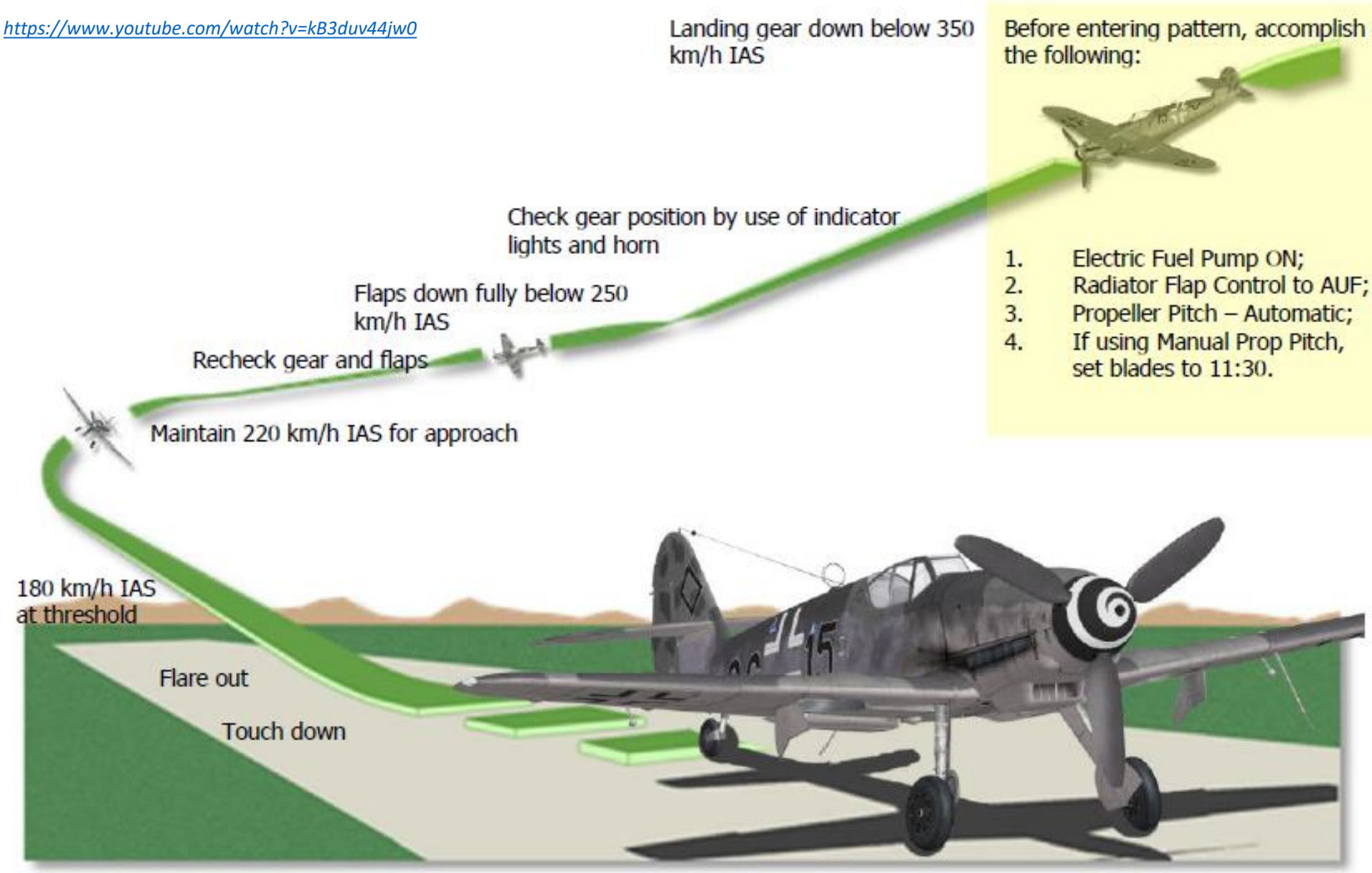
LANDING PROCEDURE

LANDING PROCEDURE

LANDING PROCEDURE

This picture is a good overview of the landing procedure.

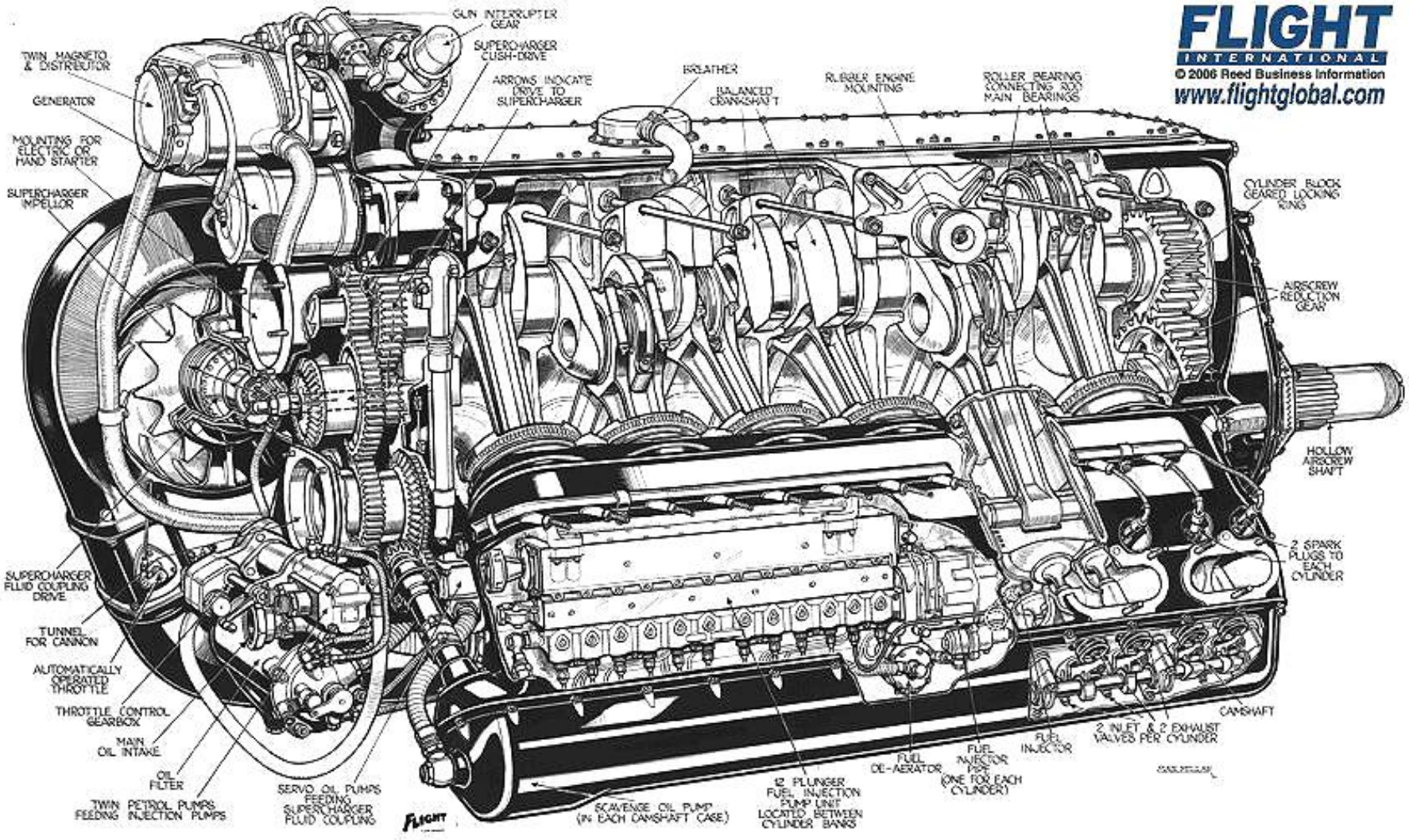
Video Demo: https://www.youtube.com/watch?v=kB3duv44jw0



DAIMLER-BENZ DB 605 ENGINE

Bf.109K-4 is powered by a 12-cylinder liquid-cooled supercharged inverted Vee Daimler-Benz DB 605 piston engine. The engine is equipped with a hydraulically-driven single-stage centrifugal supercharger with a MW-50 injection into the supercharger intake. The engine spins a three blade constant speed propeller.

The powerplant consists of a Daimler-Benz DB 605 engine that delivers approximately 1,430 horsepower at 2,800 RPM at sea level. This could be further increased to 1850 horsepower by the use of MW-50 water-methanol injection. Maximum emergency power in level flight was 1,600 horsepower at 2,800 RPM at 6000 meters.



DAIMLER-BENZ DB 605 ENGINE

DAIMLER-BENZ DB 605 ENGINE

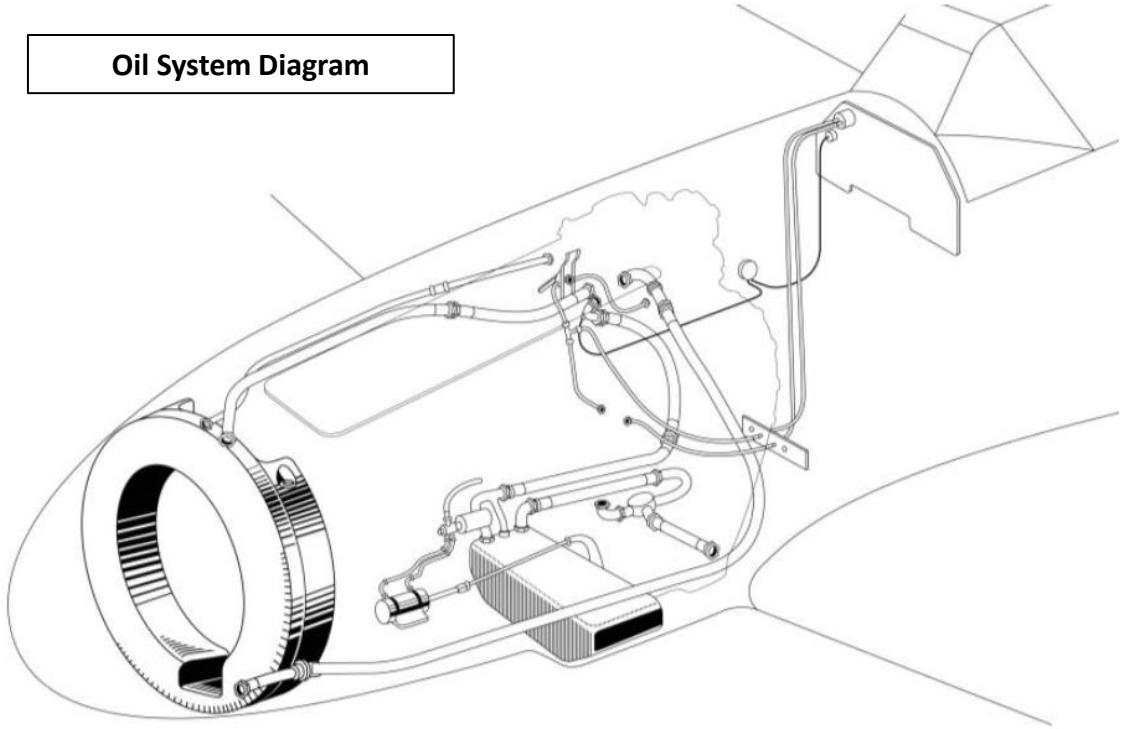
The oil system of the DB 605 has a dry sump with one pressure and two scavenge pumps. A circular oil tank is located in the nose. As no armor protection is provided for the oil system, the oil tank and the oil cooler are some of the aircraft's most vulnerable spots.

The Bf 109 K-4 uses two matching radiators partially recessed in the wings for cooling. First introduced during a radical redesign of the F (for Friedrich) variant, the system used a system of interconnected flaps to efficiently regulate cooling while providing the least possible drag. The flaps are controlled automatically by a thermostat that works to provide maximum cooling by moving the flaps in unison as needed.

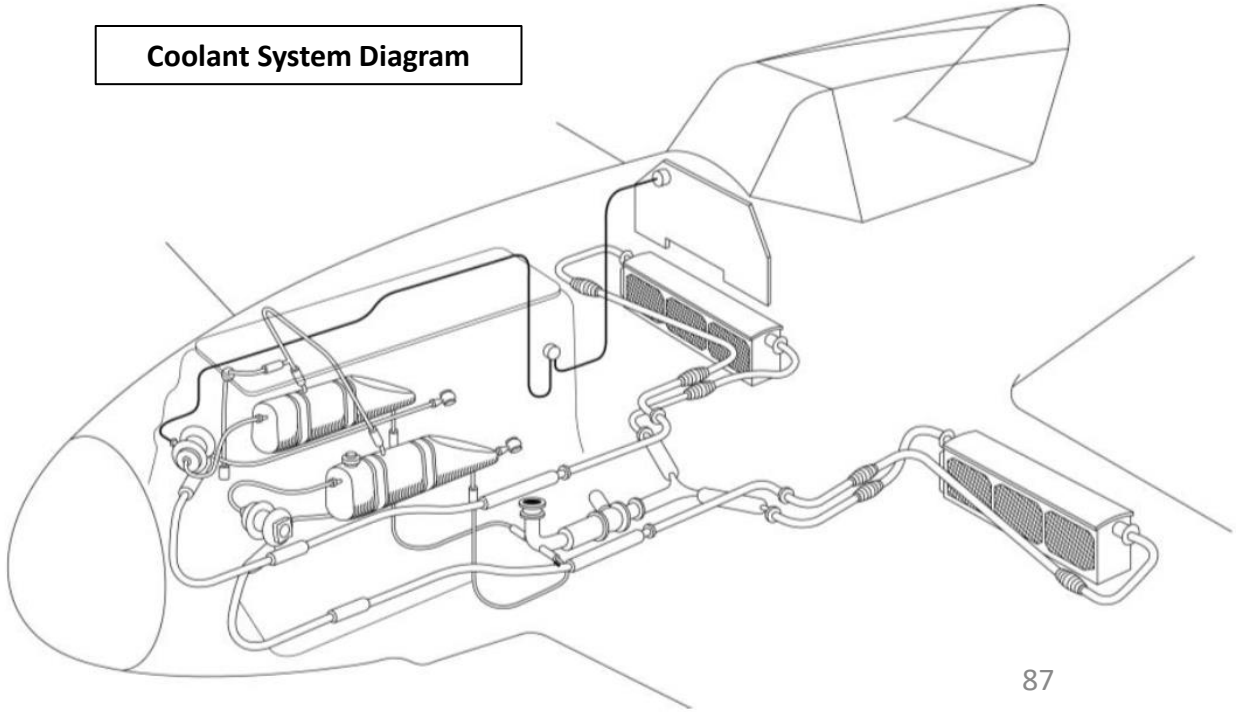
The automatic system can be somewhat sluggish, especially on the ground. Common pilot tactic is to nudge the throttle slightly on take-off to reach the proper temperature limit, causing the automatic cooler flaps to open or close as needed.

Manual override for the system is also provided, but should be used only in the case of emergency; during normal operation it is highly recommended to use the automatic system.

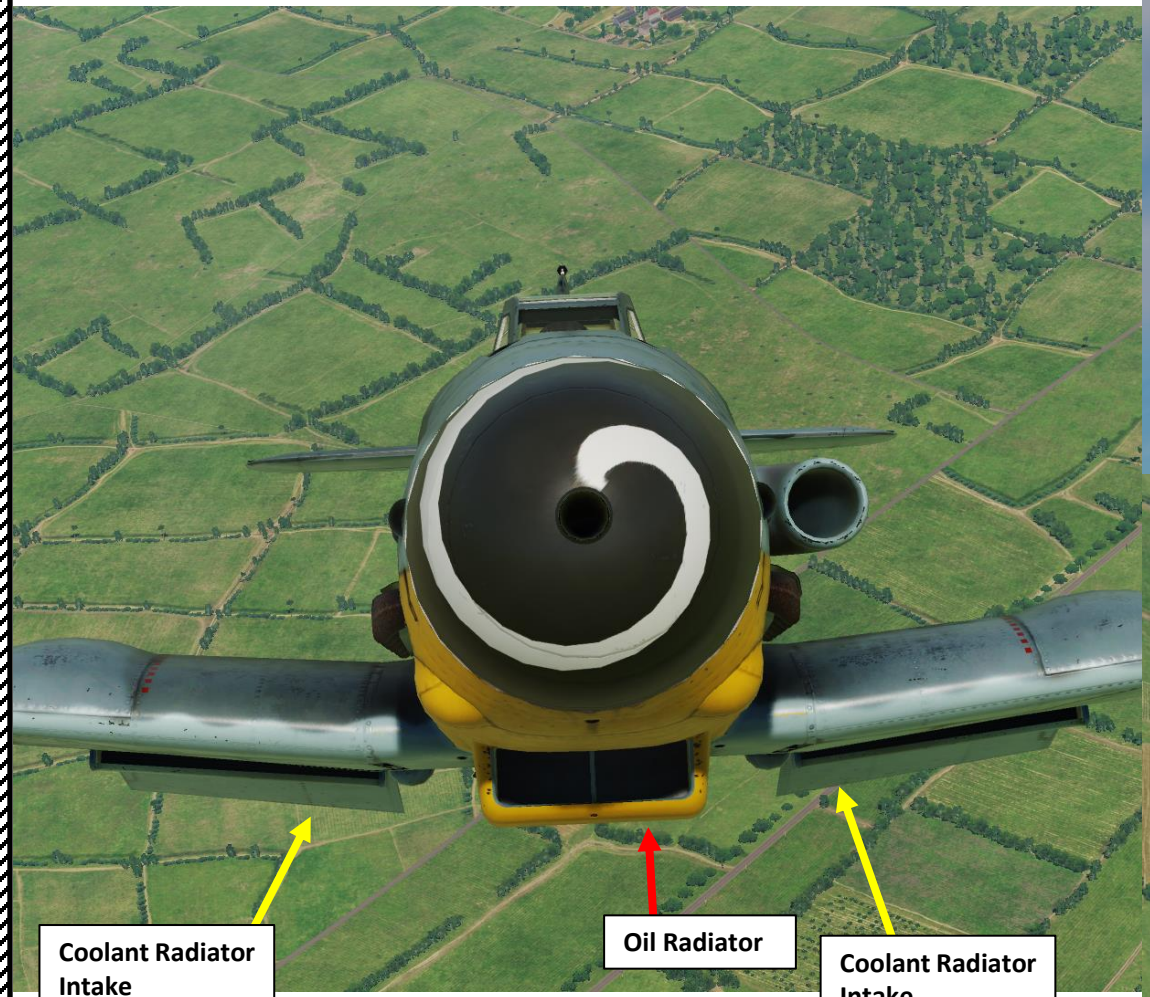
Oil System Diagram



Coolant System Diagram



DAIMLER-BENZ DB 605 ENGINE

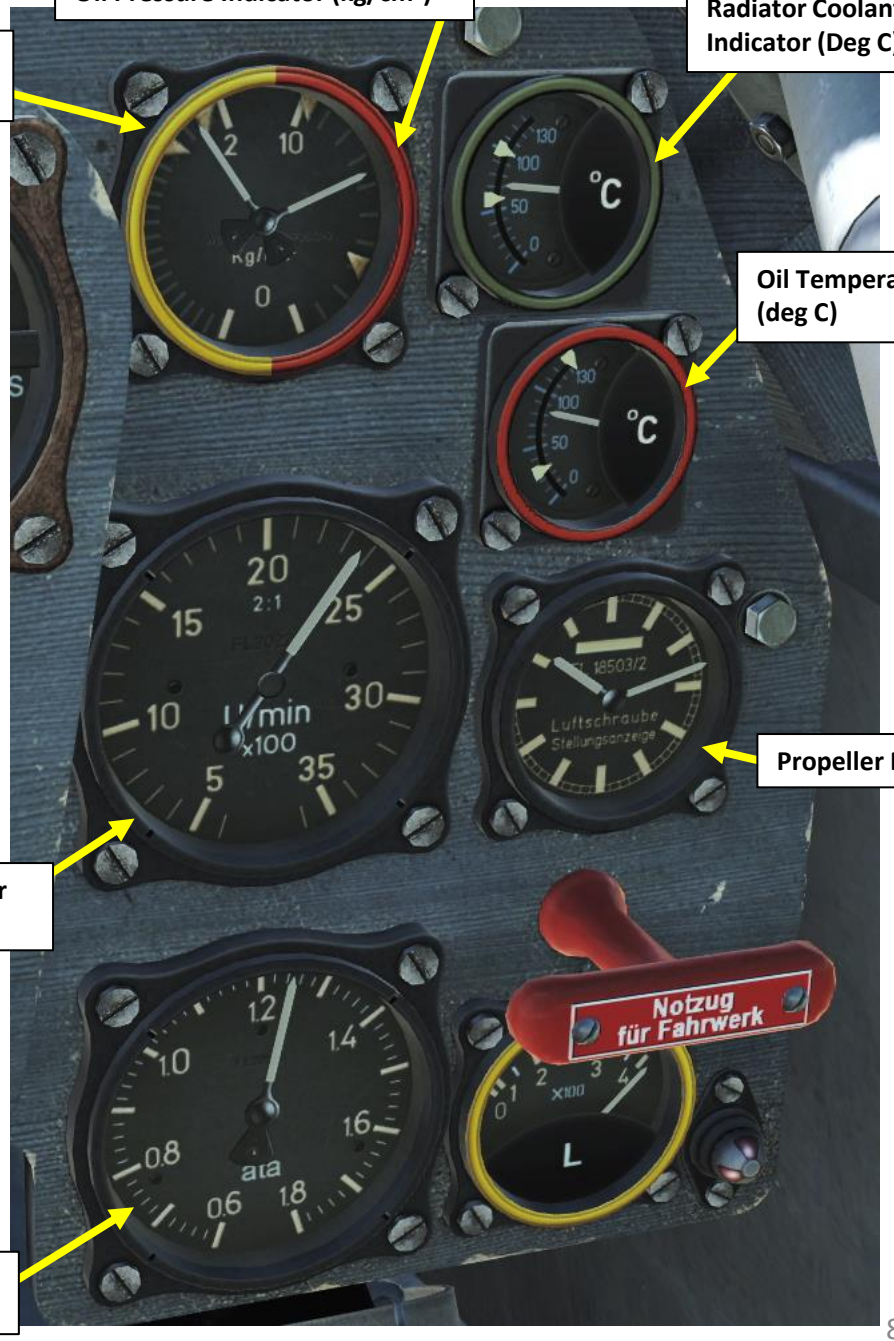


ENGINE INDICATIONS

Here is an overview of the various engine indications you have to monitor:

- **Engine Tachometer (x100 RPM):** Controlled by the throttle. Indicates engine speed turning the constant speed propeller.
- **Supercharger Pressure Gauge (ATA):** Similar to a Boost or Manifold Pressure indicator, supercharger pressure indicates the ratio between the absolute pressure after the supercharger and the atmospheric pressure in atmospheres (ATA). Values greater than 1 ATA indicate a pressure higher than atmospheric pressure, while values below 1 ATA indicate a pressure below atmospheric pressure. In ISA (standard) conditions, 1 ATA at sea level is roughly +0 Boost, 14.7 psi, 760 mm Hg, 29.92 in Hg, 1013.25 mBar, or 101.325 kPa.
- **Coolant Temperature (deg C):** indicates the water-glycol coolant temperature. A high temperature may indicate a perforation in the system, leaking coolant.
- **Oil Temperature (deg C):** indicates the oil temperature in the engine lubrication system.
- **Oil Pressure Indicator (kg/cm²):** indicates the oil pressure of the engine lubrication system.
- **Engine Fuel Pressure Indicator (kg/cm²):** indicates the fuel pressure of the fuel pump system.
- **MW-50 (Water-Methanol Injection) Pressure Indicator (kg/cm²):** indicates the MW-50 pressure.
- **Propeller Pitch Indicator**: displays the position of the propeller blades. The hands of the device are like the hands of a clock: the 6:00 position corresponds to 100% (fine) pitch, and 12:30 - 0% (coarse) pitch.

MW-50 Pressure Indicator (kg/cm²)



Oil Pressure Indicator (kg/cm²)

Fuel Pressure Indicator (kg/cm²)

Radiator Coolant Temperature Indicator (Deg C)

Oil Temperature Indicator (deg C)

Propeller Pitch Indicator

Engine Tachometer (RPM/Umin x100)

Supercharger Pressure Gauge (ATA)
- *Similar to Boost or Manifold Pressure*

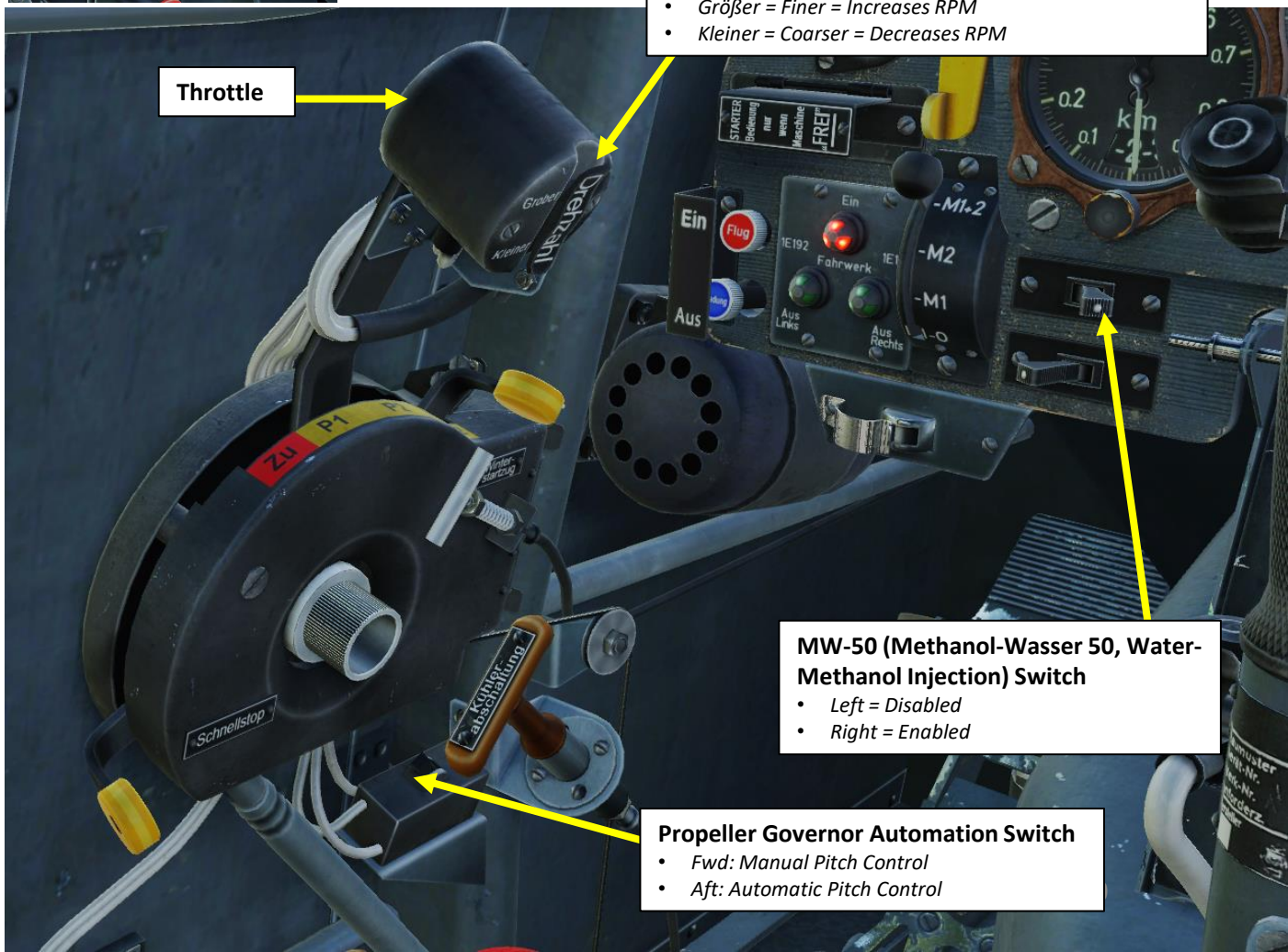
ENGINE CONTROLS

The main engine controls are:

- **Throttle**: Controls supercharger pressure (manifold pressure)
- **Propeller Governor Automation Switch and Propeller Pitch Manual Rocker Switch (*Drehzahl*):** Allows manual operation of propeller pitch.
- **MW-50 (Methanol-Wasser 50, Water-Methanol Injection) Switch:** Controls injection of water-methanol, which allows the increase of manifold pressure.
- **MW50** *(MW Stoff)* **vs Fuel** *(Kraftstoff)* **Selector Handle:** This switch should be set to MW Stoff if MW-50 mixture is in the auxiliary tank. If fuel is in the auxiliary tank instead, set switch to Kraftstoff instead.
- **Fuel/MW50 Jettison Knob:** This begins dumping fuel or MW-50 mixture from rear auxiliary tank .

MW50 *(MW Stoff)* **vs Fuel** *(Kraftstoff)* **Selector Handle**

Fuel/MW50 Jettison Knob



Throttle

Propeller Pitch Manual Rocker Switch (Drehzahl)
- *Größer = Finer = Increases RPM*
- *Kleiner = Coarser = Decreases RPM*

MW-50 (Methanol-Wasser 50, Water-Methanol Injection) Switch
- *Left = Disabled*
- *Right = Enabled*

Propeller Governor Automation Switch
- *Fwd: Manual Pitch Control*
- *Aft: Automatic Pitch Control*

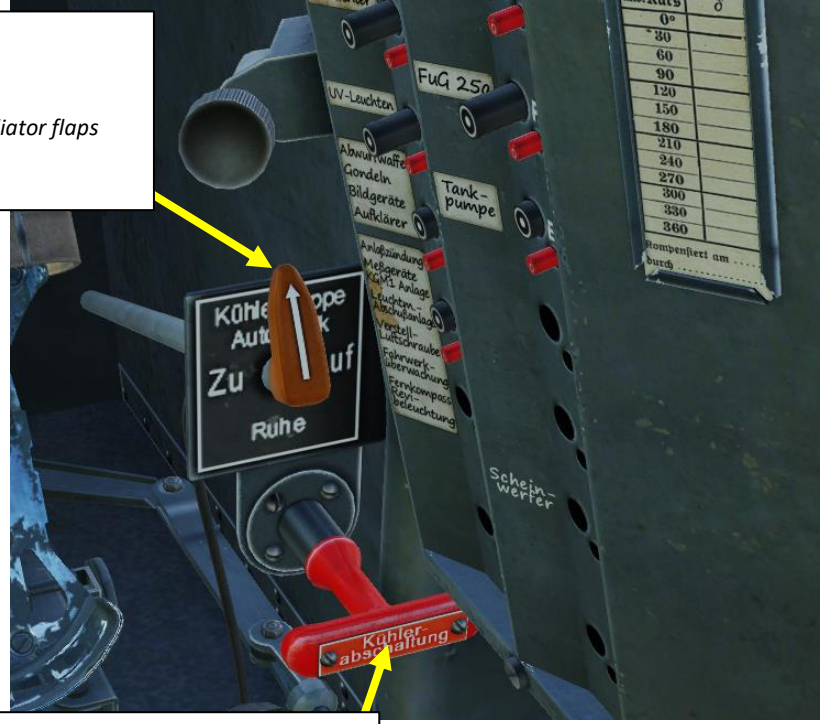
ENGINE CONTROLS

The main engine controls are:

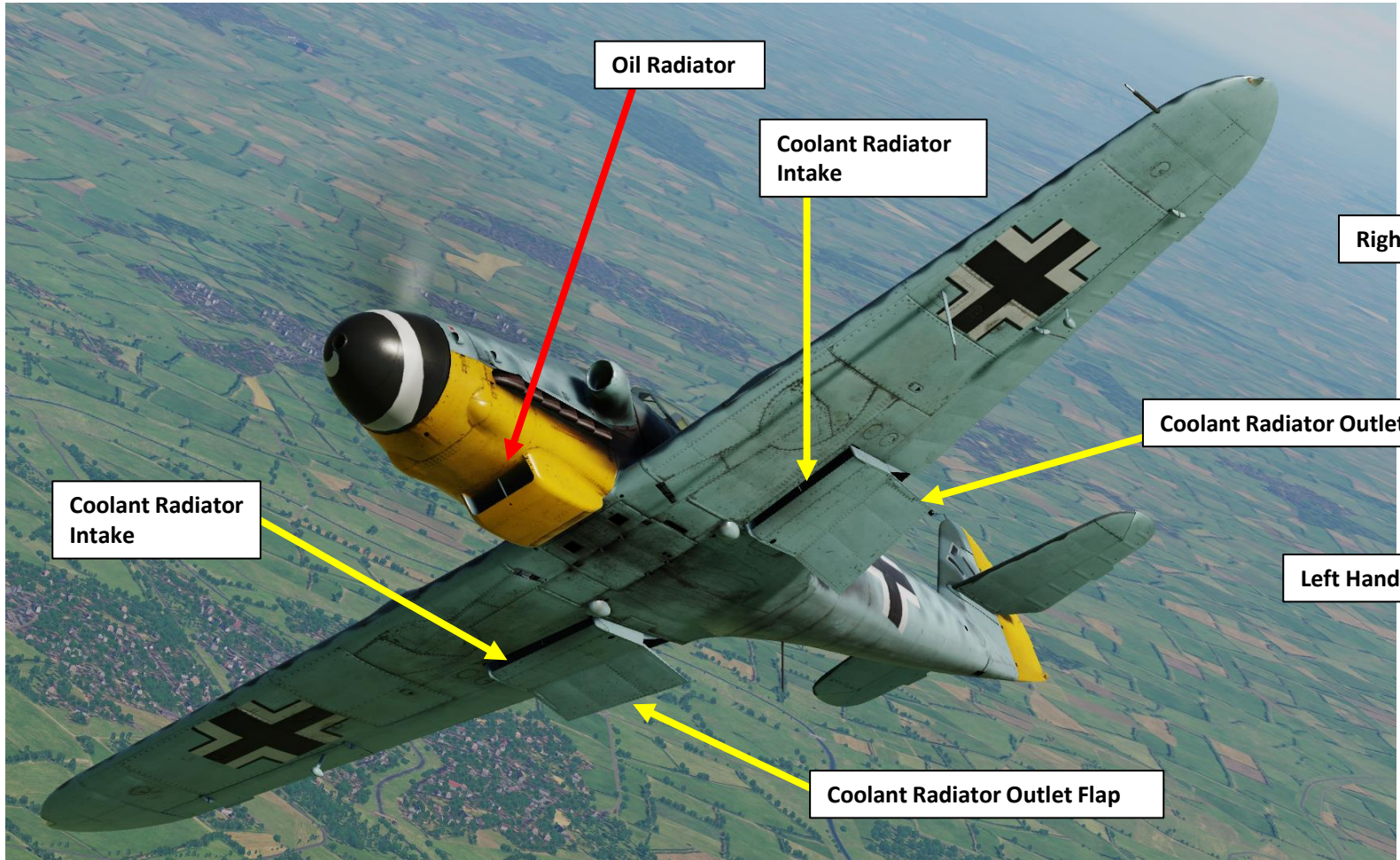
- **Radiator Mode Selector:** Controls engine radiator, allowing to cool the engine. It is generally recommended to leave the lever to AUTOMATIK.
- **Radiator Cut-Off Handles**: In the event of an emergency, damage to the coolant system, or when the normal automation does not lead to desired results, the Radiator Cut-Off Handle can be used to cut off the corresponding radiator. Damage to a radiator can be noticed by a wingman seeing you are leaking glycol from one of the two radiators.

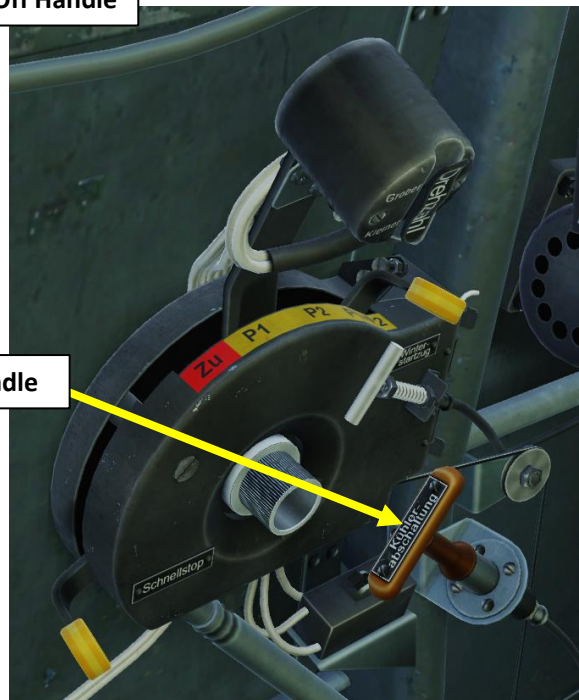
Radiator Mode Selector

- *Zu: Closed, Automation OFF.*
- *Auf: Open, Automation OFF.*
- *Ruhe/Abgeschälte: Automation is OFF. Radiator flaps remain fixed to current position.*
- *Automatik: Automatic Mode ON*



Right Hand Radiator Cut-Off Handle





Left Hand Radiator Cut-Off Handle

ENGINE OPERATION & LIMITS

Engine Power Settings:

- **TAKEOFF**: 2700 RPM
- **LANDING**: 1000 RPM
- **NORMAL OPERATION**: 2300 RPM

General Rule for Oil and Coolant Temperatures:

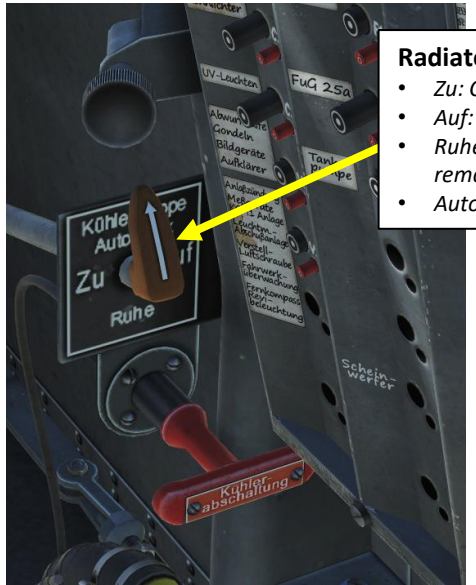
You do not have to use your radiator flaps if they are set in AUTOMATIK. Only open them if you are having a hot engine and need to cool it down quickly.

Engine Limits:

- Coolant Temperature: Min 30 deg C – Max 100 deg C
- Oil Temperature: Min 30 deg C – Max 130 deg C
- Oil Pressure: Min 3 kg/cm^2 – Max 9.5 kg/cm^2

If engine overheats, you can:
1. Enter a dive to increase airspeed and airflow to the engine intake.
2. Reduce throttle
3. Decrease rate of climb
4. Set radiator flaps to the Maximal "*Auf (Open)*" position.

CHECK YOUR ENGINE TEMPERATURES EVERY 30 SECONDS OR SO. IT WILL SAVE YOUR LIFE.



Radiator Mode Selector
- *Zu: Closed, Automation OFF.*
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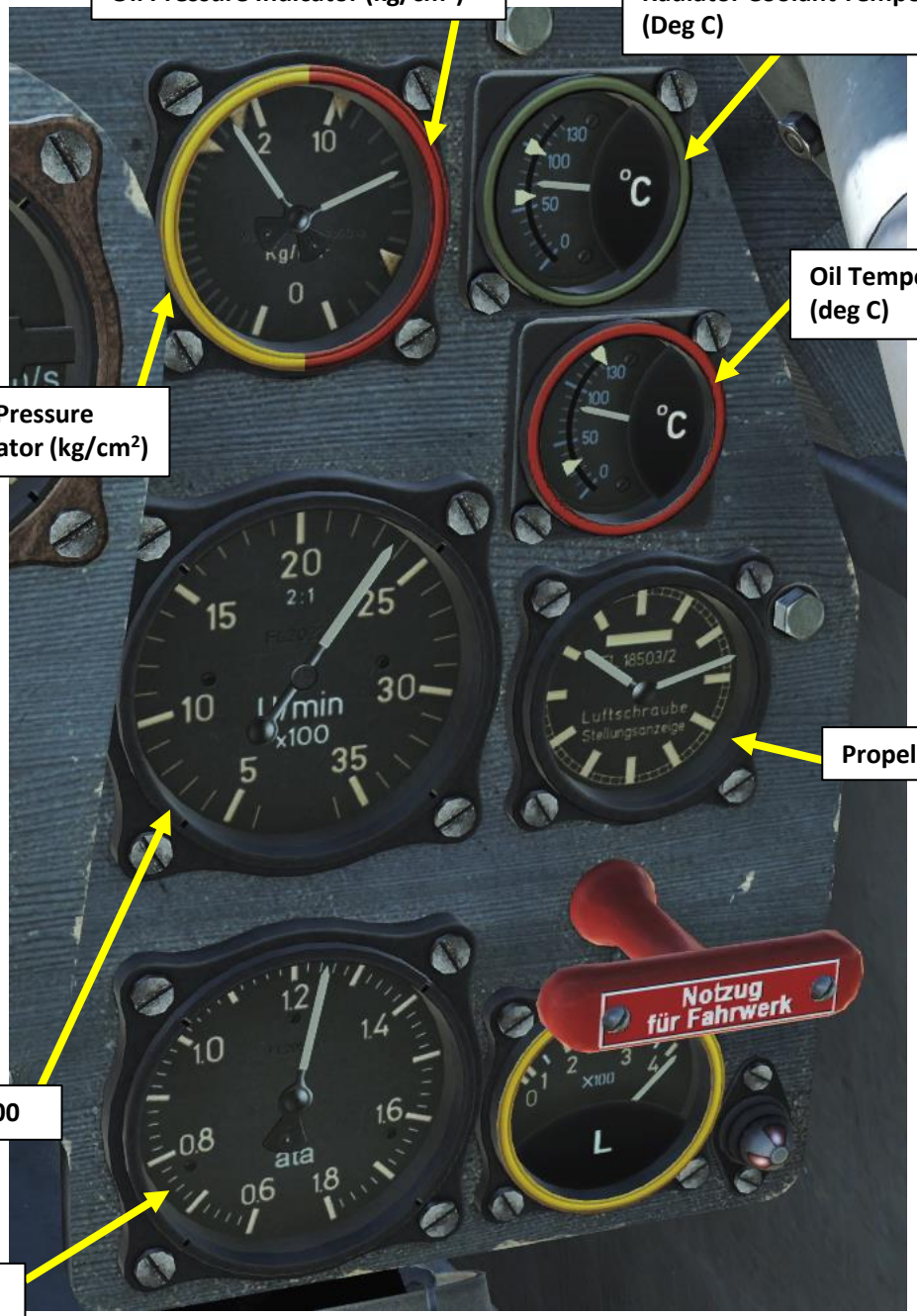
- *Automatik: Automatic Mode ON*



Oil Pressure Indicator (kg/cm^2)

Radiator Coolant Temperature Indicator (Deg C)

Oil Temperature Indicator (deg C)

Fuel Pressure Indicator (kg/cm^2)

Propeller Pitch Indicator

Engine RPM/Umin x100

Supercharger Pressure Gauge (ATA)
Similar to Boost or Manifold Pressure

ENGINE OPERATION & LIMITS

POWER SETTINGS

Operating Condition	RPM	ATA (Manifold Boost Pressure)	Maximum Permissible Time
WEP (War Emergency Power, with MW-50)	2800 +/- 50	1.75 +/- 0.01	10 min
Takeoff & WEP	-	-	-
Combat	2600 +/- 50	1.35 +/- 0.01 (see note 1)	30 min
Cruise	2400 +/- 65	1.25 +/- 0.01	Continuous
Economy	2000 +/- 80	1.05 +/- 0.01	Continuous

Notes

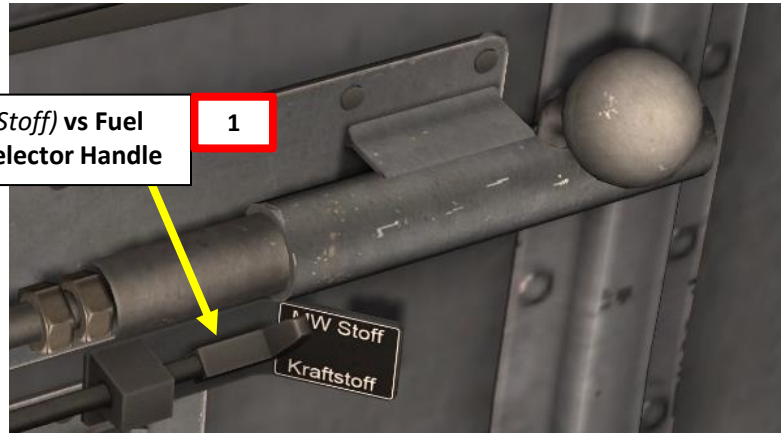
Note 1: During climb, boost pressure may be regulated by a further 0.03 ATA to between 1.31 and 1.39 ATA.

Note 2: With the MW-50 system installed, normal Takeoff and Emergency Power is no longer attainable. Combat mode should be used instead.

MW-50 METHANOL-WATER INJECTION

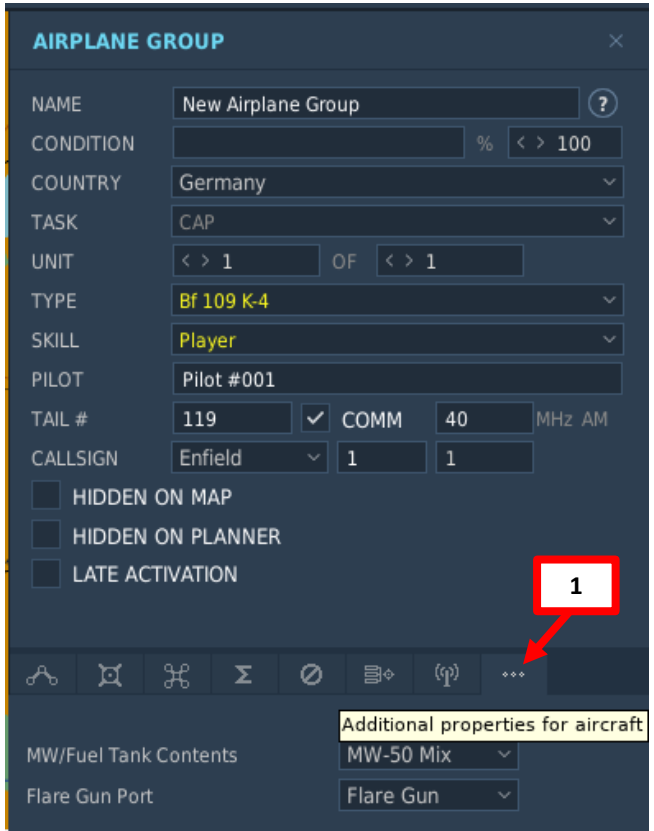
Water-Methanol is stocked in a separate tank and the mission builder chooses whether this tank can be loaded with either regular fuel or with water-methanol mixture. Make sure MW-50 Mix is enabled in the MW/Fuel Tank via the Mission Editor, or else the tank will be filled with fuel and MW50 will not be available.

1. Ensure the fuel selector handle is properly set to MW STOFF if the MW-50 tank is filled with MW mixture.
2. **Enable MW-50 using the MW-50 switch**: RIGHT position is ON, LEFT position is OFF.
3. You will only see the MW-50 injection pressure increase when you **apply max throttle**.
4. Check the MW-50 pressure gauge to see if it is engaged.



MW50 *(MW Stoff)* **vs Fuel** *(Kraftstoff)* **Selector Handle** — **1**

Fuel/MW50 Jettison Knob



2 **MW-50 (Methanol-Wasser 50, Water-Methanol Injection) Switch**
- *Left = Disabled*
- *Right = Enabled*

MW-50 Pressure Indicator (kg/cm²)

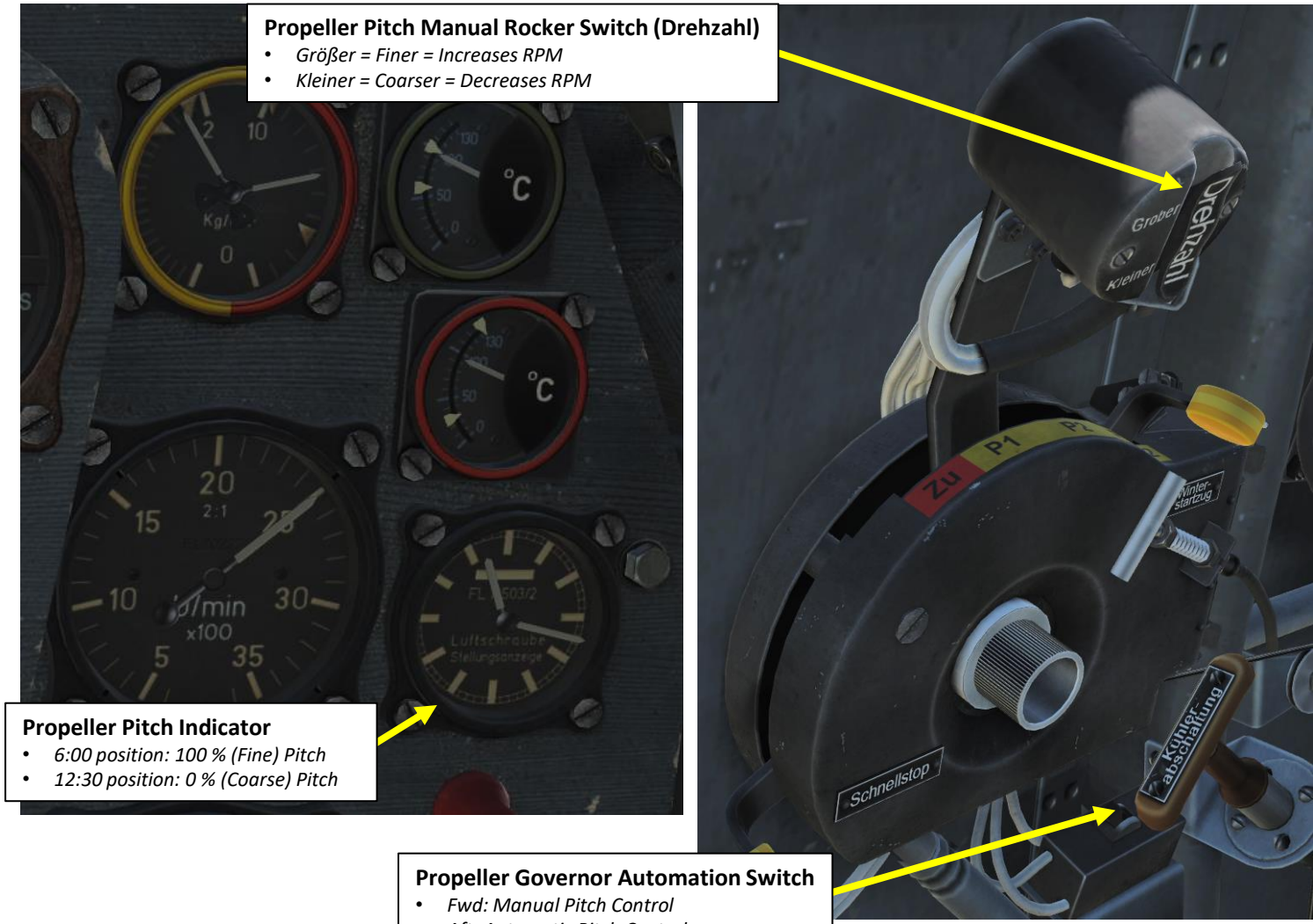
MW50 Injection ON

MW50 Injection OFF

PROPELLER GOVERNOR AUTOMATION

The propeller pitch is usually automatically controlled by the Propeller Governor. However, the governor can be manually overridden via Governor Automation Switch located alongside the throttle lever. The switch is normally set to the lower (Automatic), but can be manually set to the upper (Manual) position. That enables the "Drehzahl" Propeller Pitch Rocker Switch on the throttle lever. It is recommended to keep the Governor Automation Switch in the Automatic position during normal engine operation, and only switch to manual in case of an emergency.

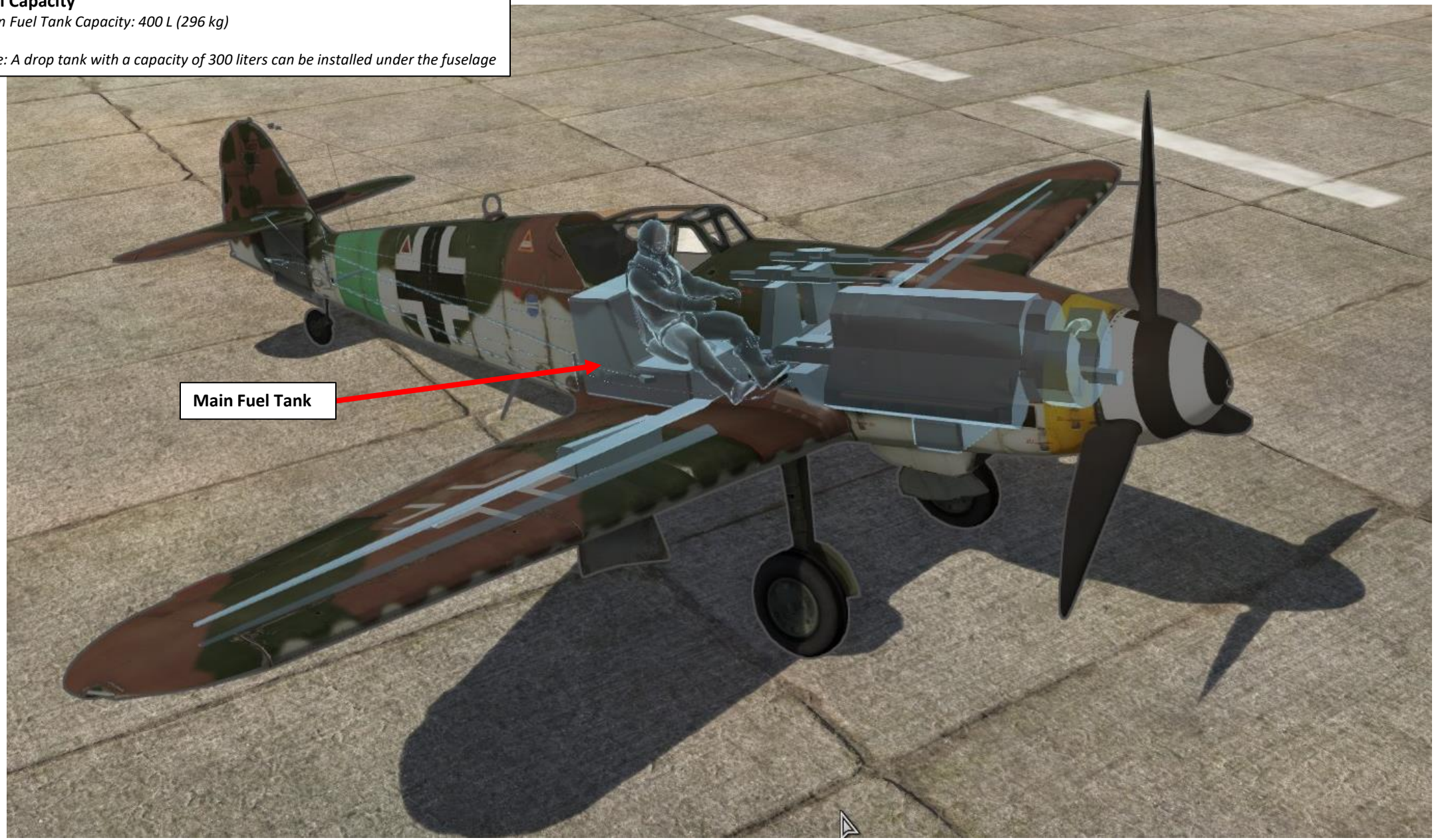
The "Drehzahl" Propeller Pitch Rocker Switch on the throttle lever can be used to manually change propeller pitch when the propeller automation is switched off. Then, the "Drehzahl" rocker switch on the throttle can be moved to "Größer" (Higher RPM) or "Kleiner" (Lower RPM). Holding the thumb button in one of these positions continues to modify the prop pitch for as long as the button is depressed, and until the limit is reached. Therefore, this switch can be used to feather the propeller.



FUEL TANKS

Fuel Capacity
Main Fuel Tank Capacity: 400 L (296 kg)

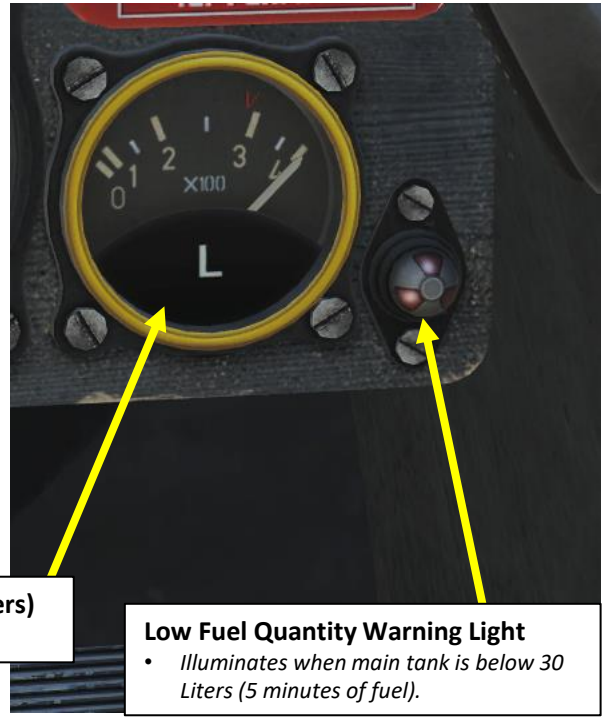
Note: A drop tank with a capacity of 300 liters can be installed under the fuselage



FUEL MANAGEMENT

When a drop tank is used, it constantly feeds the main tank via a pressurized fuel hose. The Fuel Contents Gauge will continue to display full for as long as the drop tanks continue to feed the main tank. Once the drop tank is emptied, the fuel quantity in the main tank begins to decrease. There is no fuel content information for drop tanks. The Fuel Warning Light illuminates when the fuel level in the main tank reaches approximately 30 liters, equal to about 5 minutes of flight time.

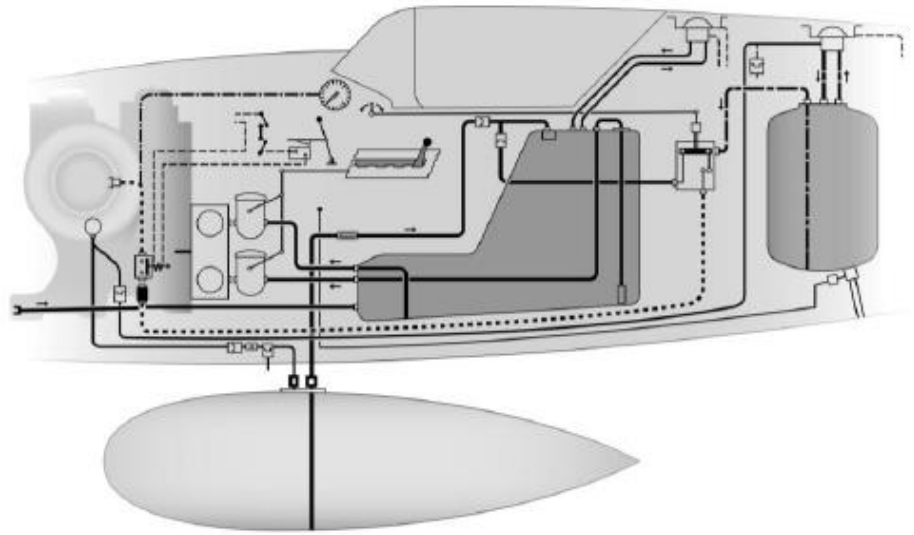
Drop Tank Fuel Flow Transfer Indicator
- *Presence of bubbles means the drop tank's fuel is transferring to the main fuel tank properly.*



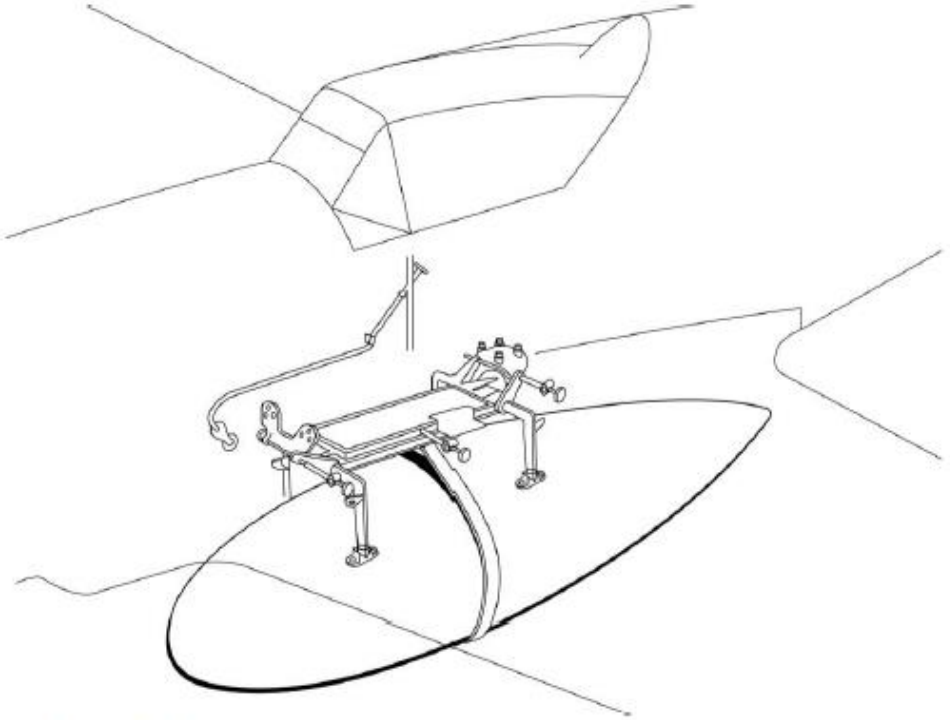
Fuel Quantity Indicator (Liters)
- *Capacity Main Tank: 400 L*

Low Fuel Quantity Warning Light
- *Illuminates when main tank is below 30 Liters (5 minutes of fuel).*

Ordnance Emergency Release Lever
- *Jettisons Drop Tank*



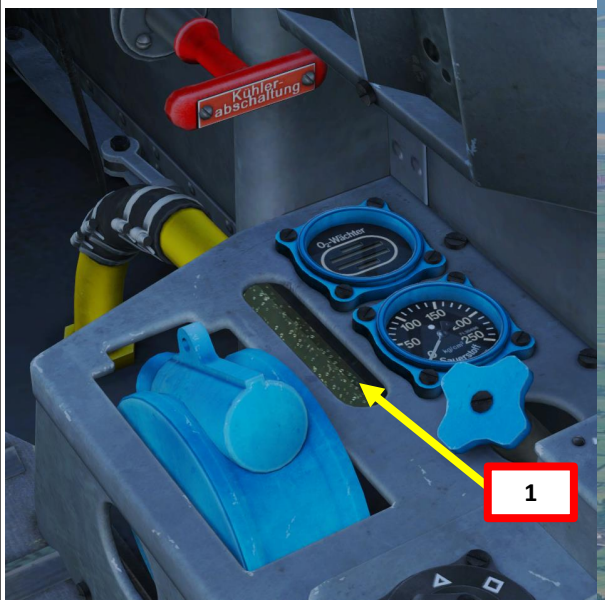
Fuel System Diagram



Drop Tank Fuel System

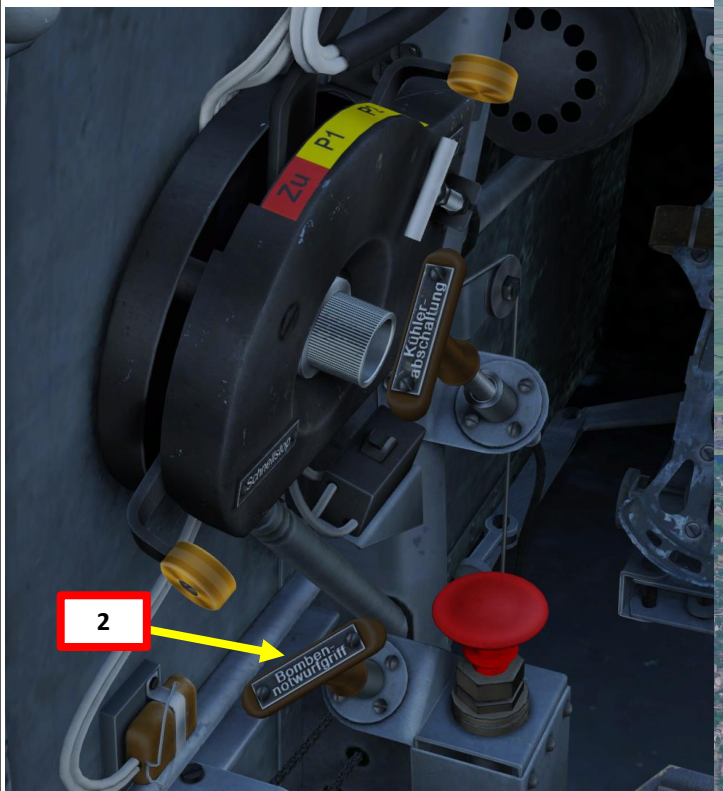
FUEL DROP TANK OPERATION

1. Fuel from the drop tank goes directly through the main fuel tank. You can monitor fuel flow being transferred from the drop tank to the main tank. Presence of bubbles means the drop tank's fuel is transferring to the main fuel tank properly.



FUEL DROP TANK OPERATION

2. To jettison fuel drop tank, pull the “BOMBEN-NOTWURFGRIFF” (ORDNANCE JETTISON) lever.



AIRSPEED LIMITS

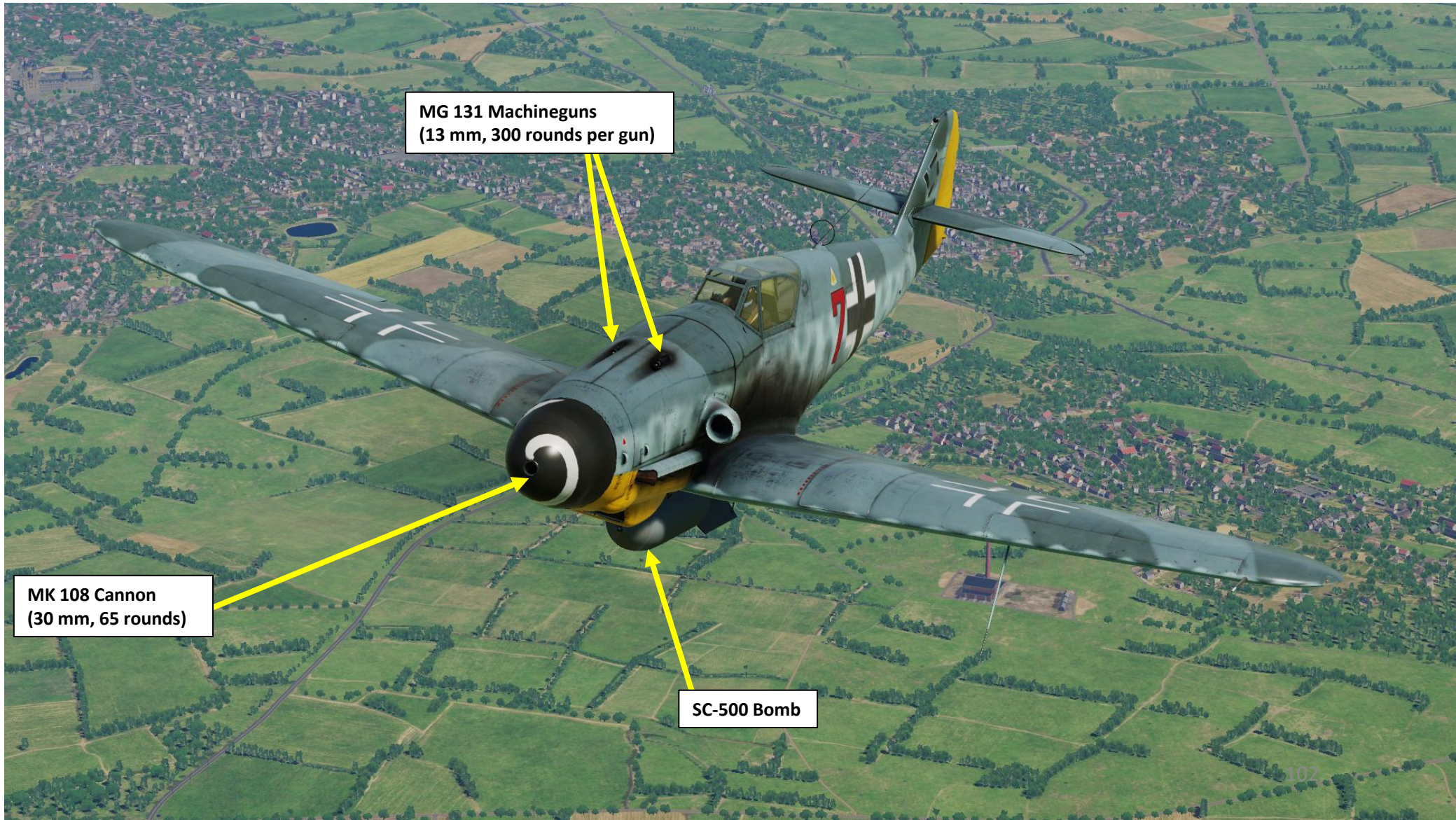
Here is an overview of some of the important airspeeds to remember.

- Maximum Flaps Extension Speed: 250 km/h
- Maximum Landing Gear Extension Speed: 350 km/h
- Optimal Climb Speed: 270 km/h
- Optimal Cruise Speed: 420 km/h
- Do-Not-Exceed Airspeed (V_{NE}): See Airspeed Limit Table Below

Maximum Diving Speeds (km/h)		
Altitude (km)	**With or Without Underwing Weapon Gondolas**	**With other *Rüstsatz* (including drop tanks) (*Rüstsatz:* Equipment Kit/Field Modifications)**
11	400	400
9	500	500
7	600	600
5	700	700
3	800	700
1	850	700

ARMAMENT OVERVIEW

- 1 x Rheinmetall-Borsig MK 108 30 mm *Motorkanone*/Engine-Mounted Cannon (65 rounds)
- 2 x Rheinmetall-Borsig MG 131 13 mm Machineguns (300 rounds per gun)
- 1 x SC-500 kg bomb
- 1 x SC-250 kg bomb



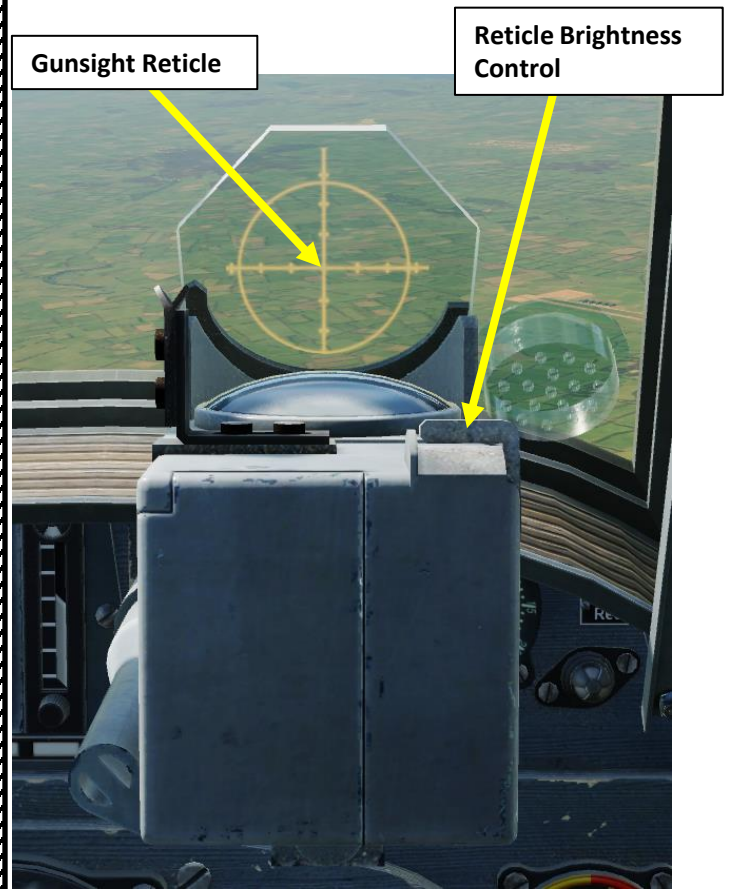
REVI-16B (REFLEXVISIER) GUNSIGHT

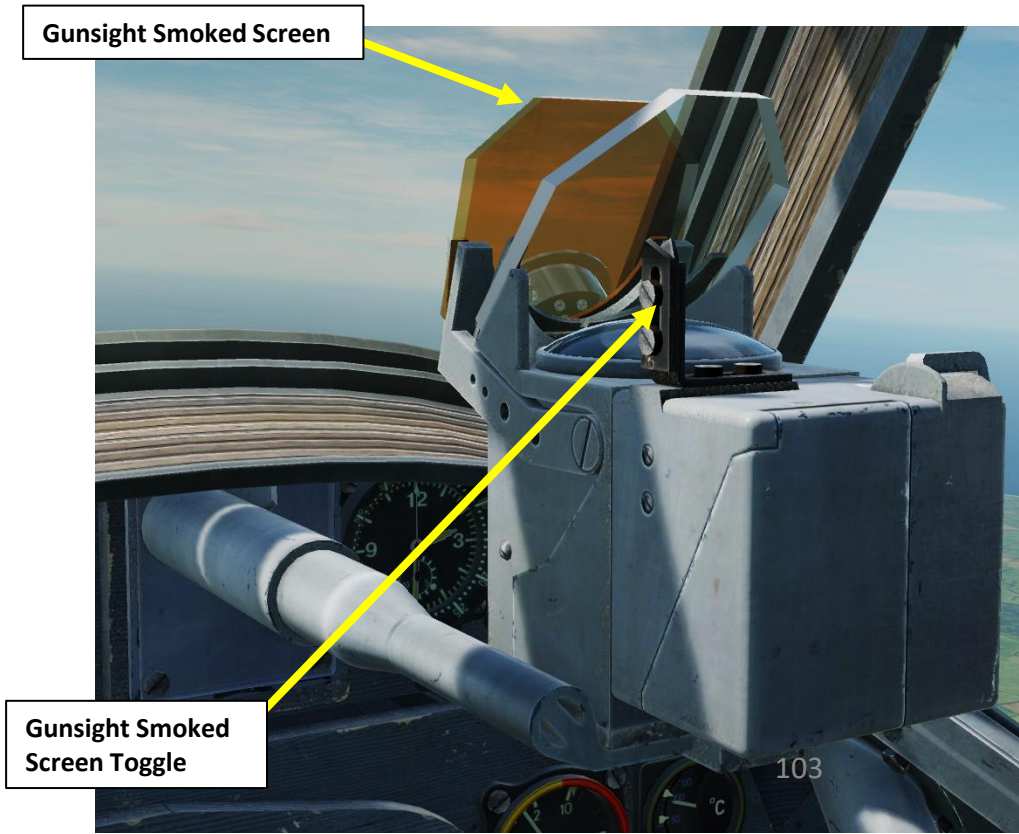
For weapon targeting, the Bf109-K4 came equipped with the standard Revi 16B gunsight that was installed on the vast majority of Luftwaffe combat aircraft.

The Revi 16B is a sight designed for use with both synchronized and unsynchronized aircraft weaponry and is equipped with both a built-in dimming rheostat for adjusting the crosshair brightness and a night filter.

Reflector sights work by projecting an image of the targeting reticle onto the reflector glass such that the reticle appears at infinity, providing a fixed aiming point relative to the weapon's line of fire. Alternatively, you can use the Mechanical Sight to aim.

When using the Revi 16B in combat, the pilot must independently make corrections for the target lead and distance, G-loads, and other parameters necessary for accurate fire.





REVI-16B (REFLEXVISIER) GUNSIGHT

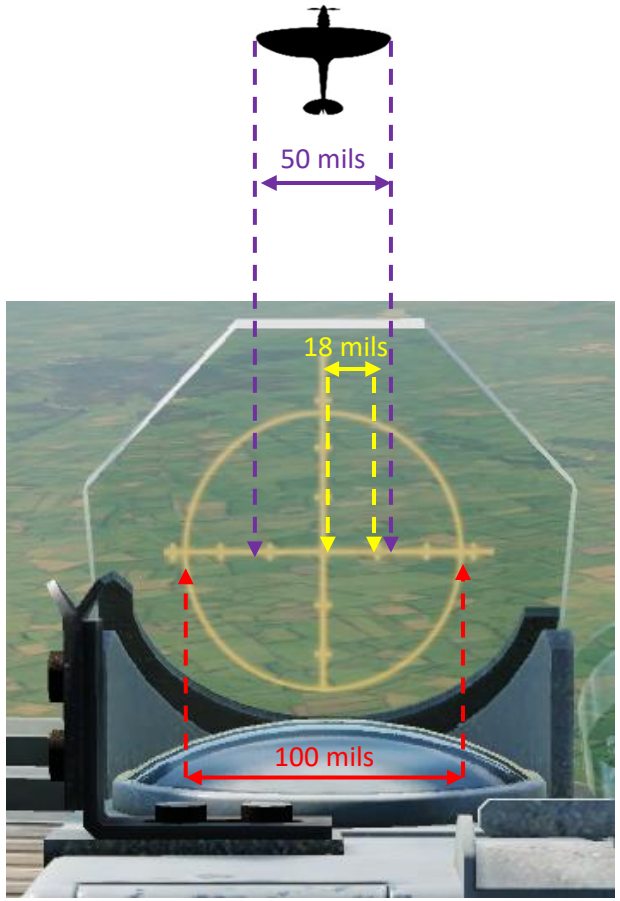
The ring of the REVI-16B gunsight is 100 mils in diameter. Each tick mark along the horizontal and vertical axis represents 18 mils. One mil (or "milliradian", an angle unit) represents approximately 1 m of length, width or height of an object. Here is an excellent video by "The Air Combat Tutorial Library" on gunsight employment: https://youtu.be/MaWB3uAkycs

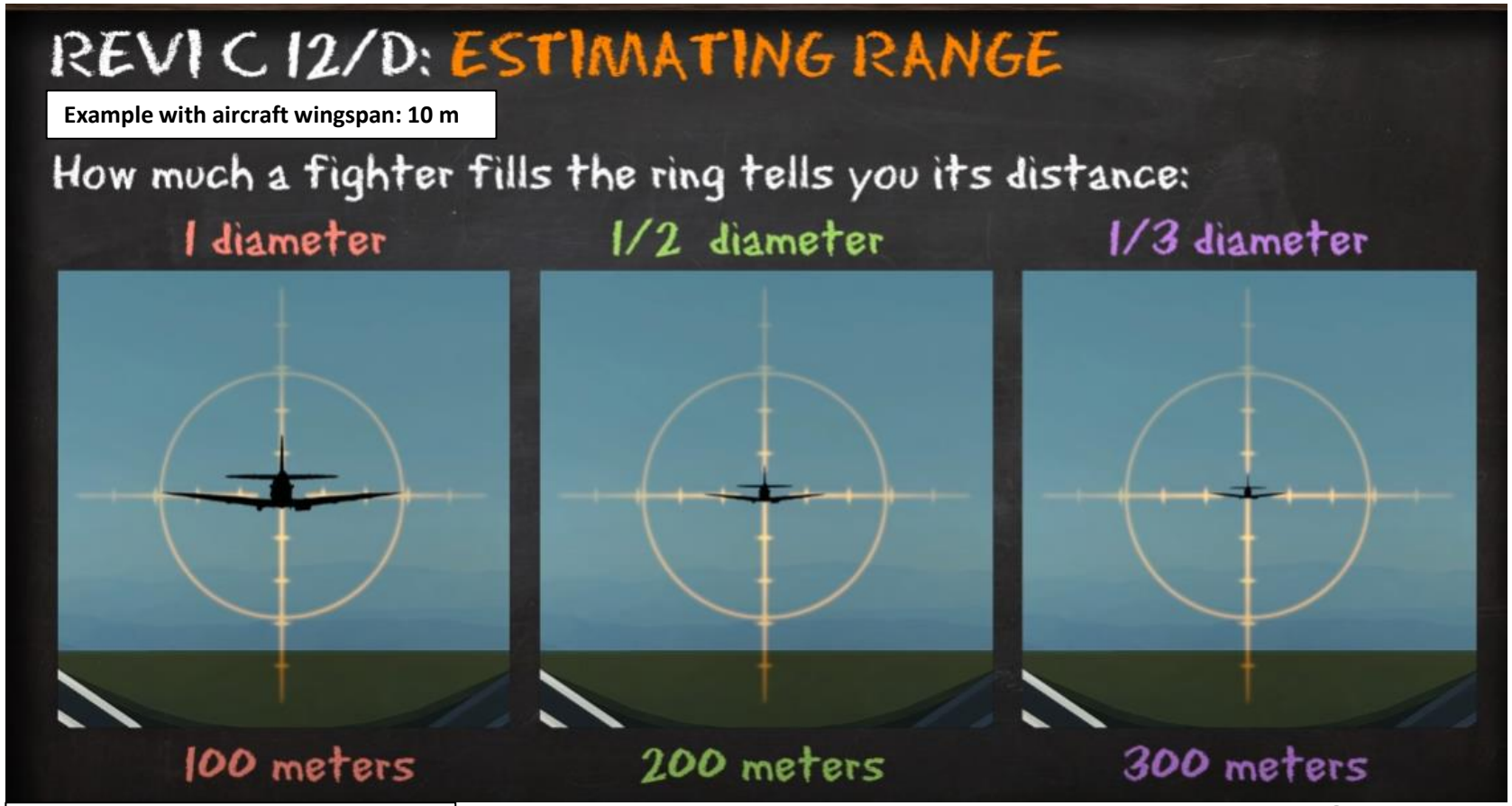
A good rule of thumb to range a target is:

- Target Range (in meters) = Wingspan (in meters) x (number of times it fills the ring) x 10

As an example (see **purple** lines below): The Spitfire has a wingspan of 11 m. If its wingspan fits 2 times inside the ring, the range can be estimated as follows:

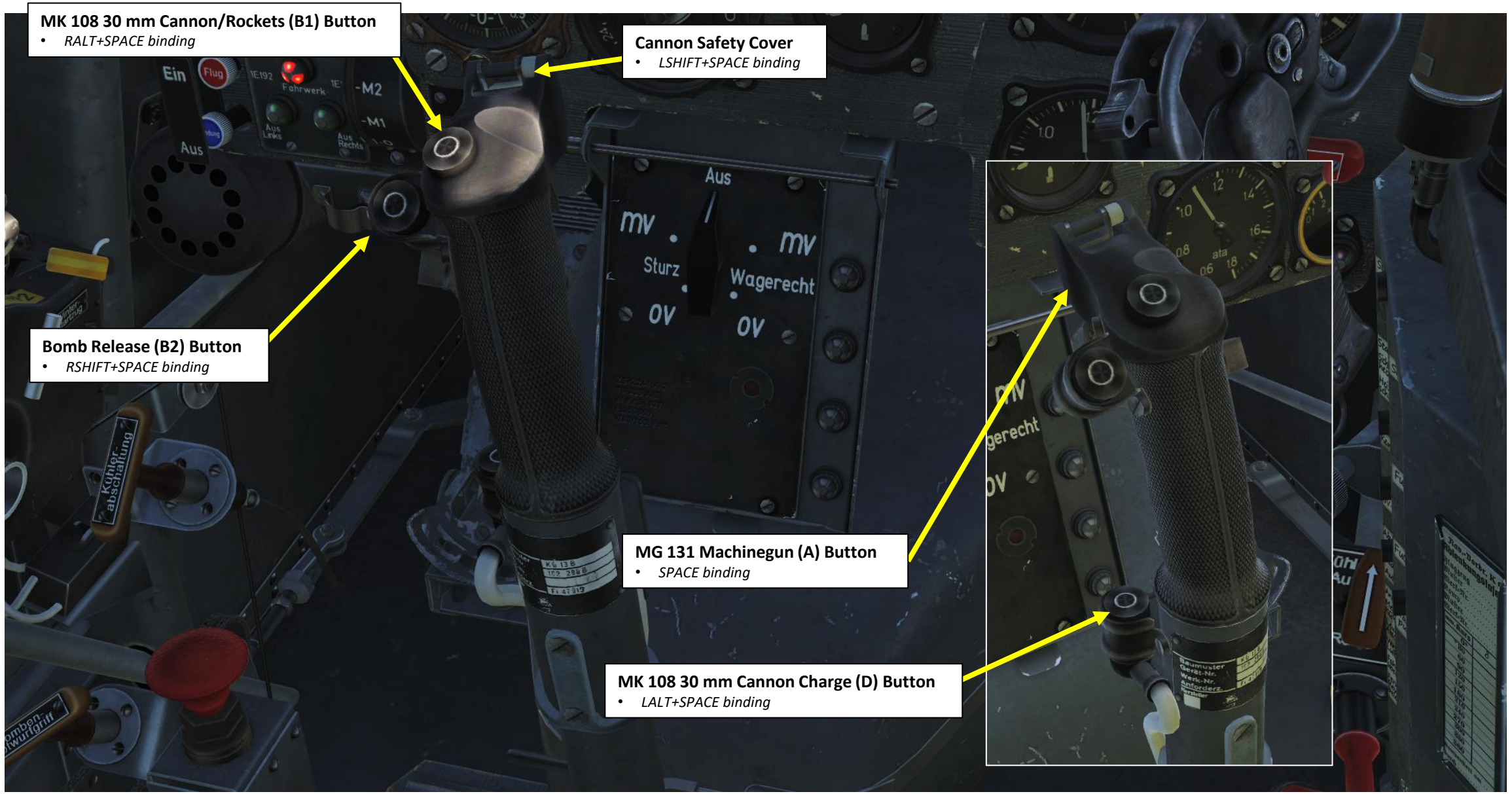
- Range = 11 m x 2 x 10 = 220 m



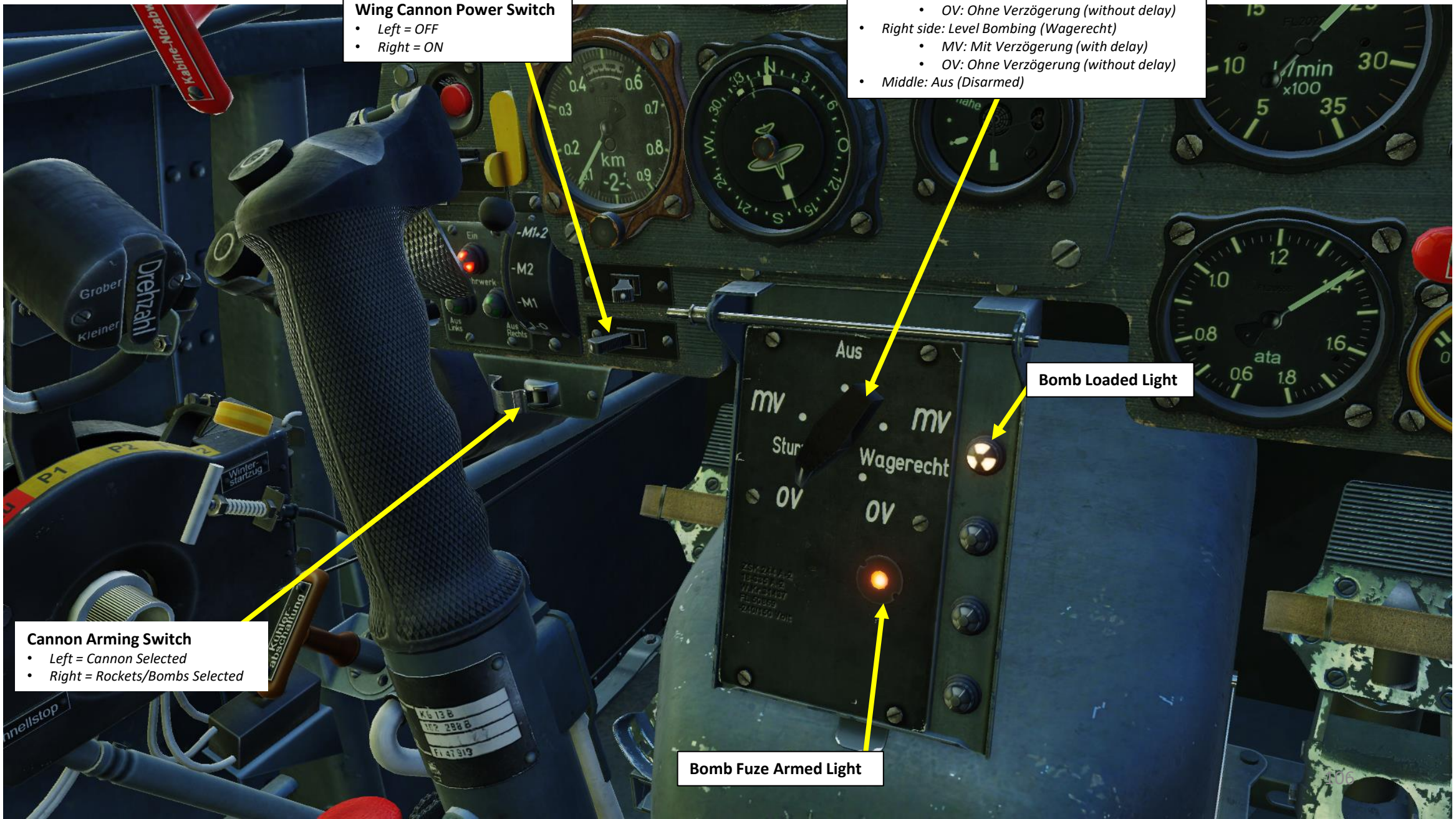


Source: The Air Combat Tutorial Library

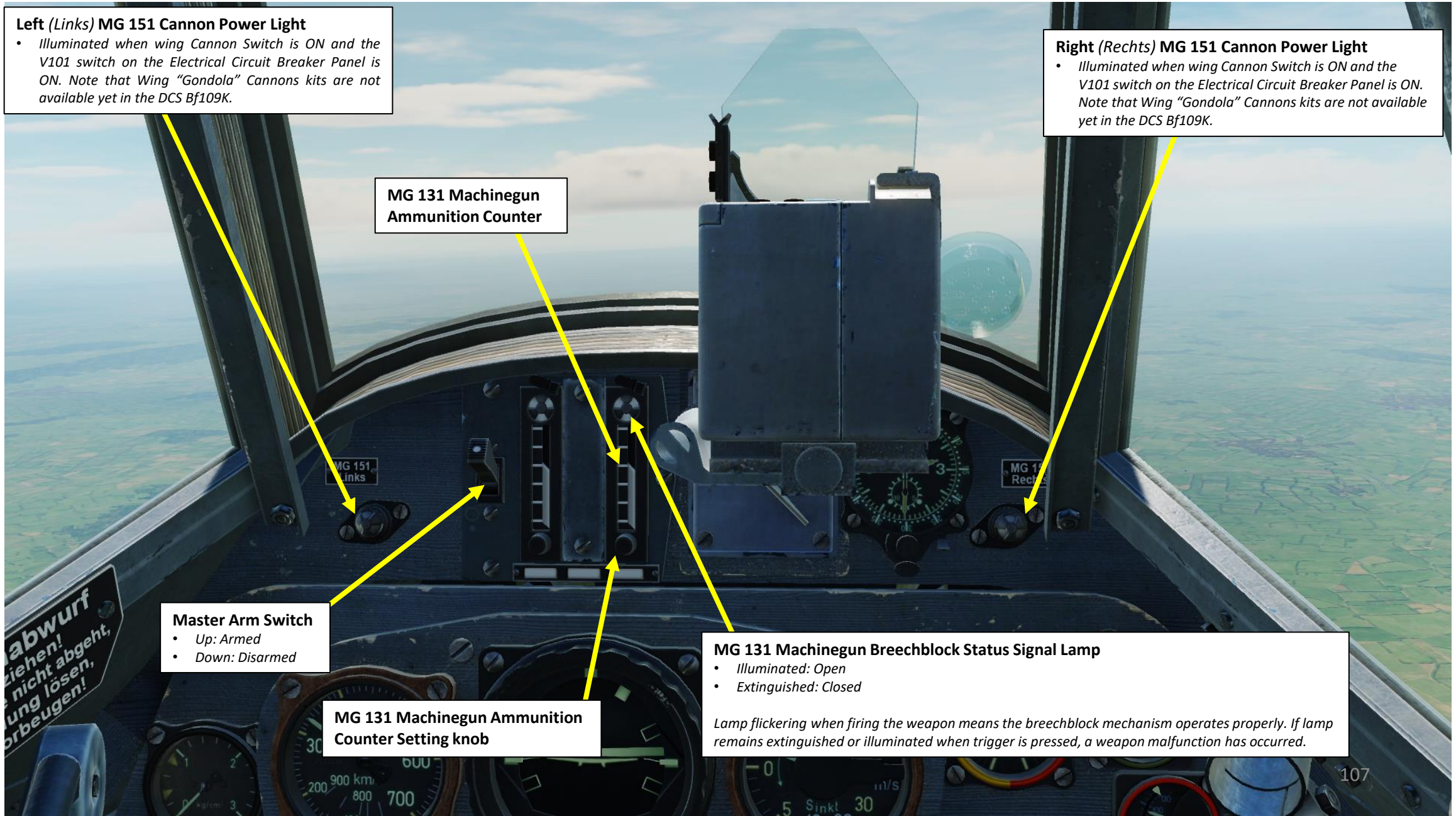
WEAPON CONTROLS



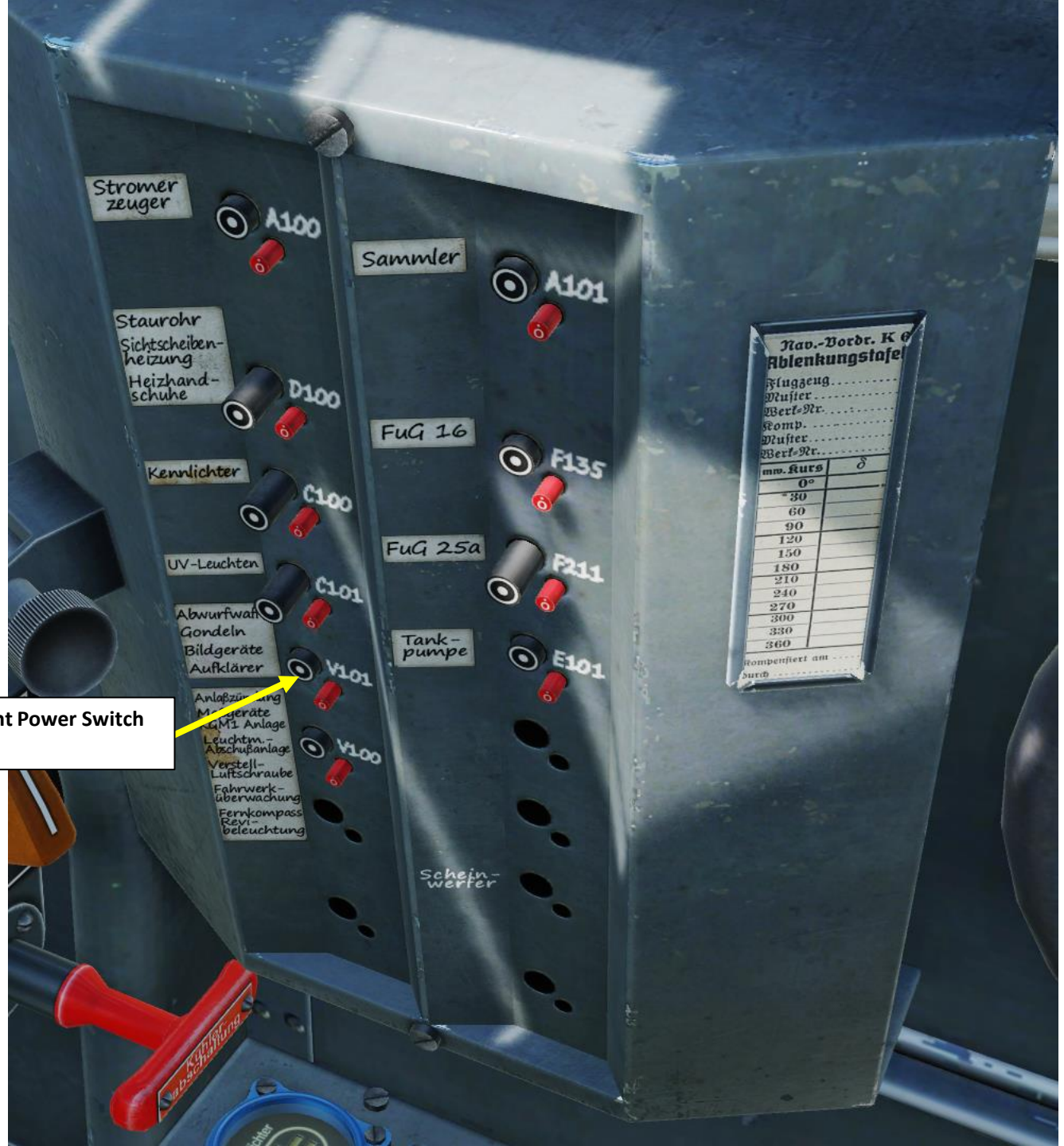
WEAPON CONTROLS



WEAPON CONTROLS



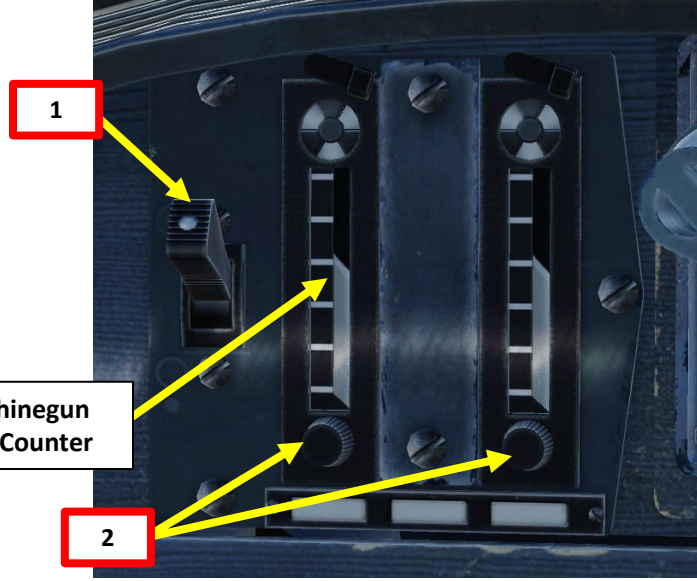
WEAPON CONTROLS

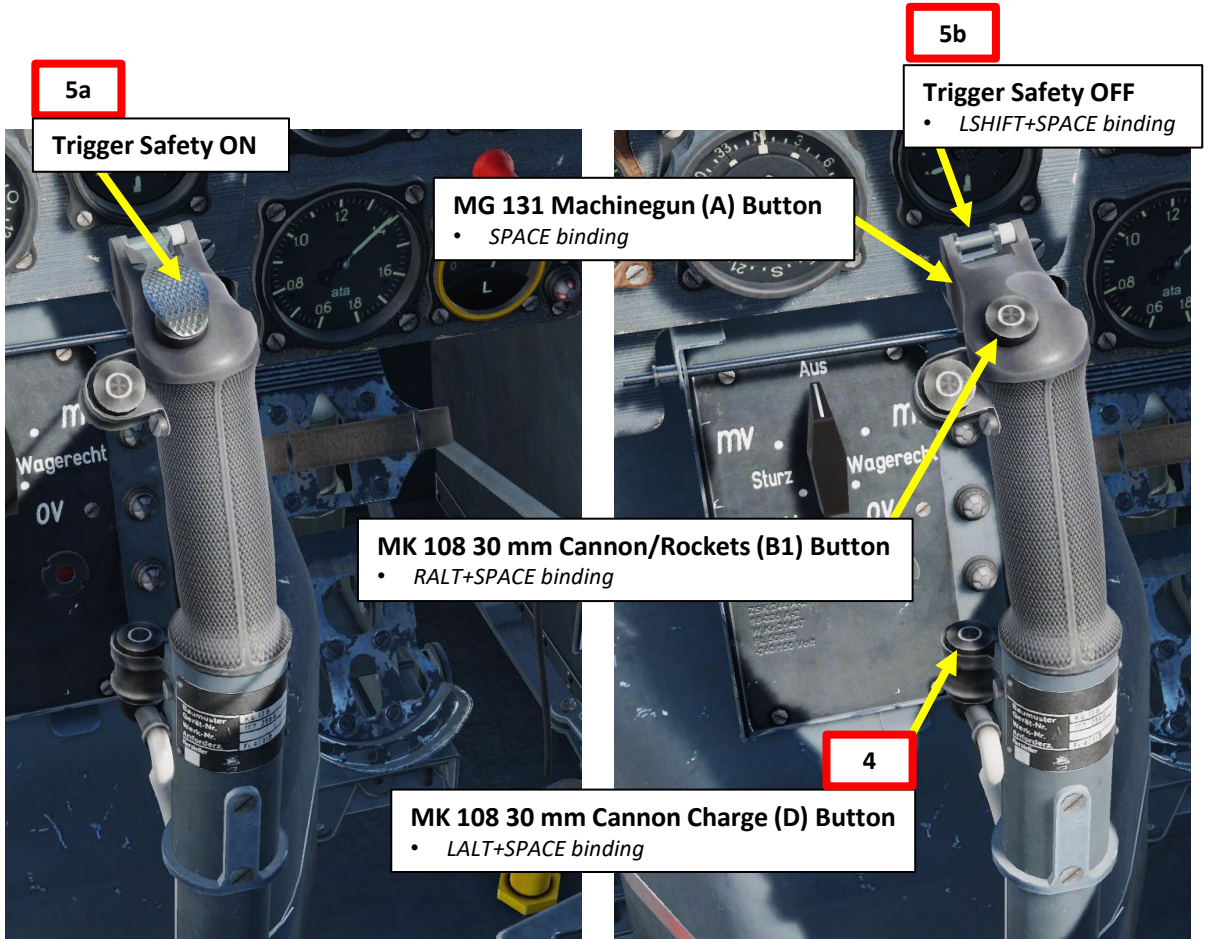


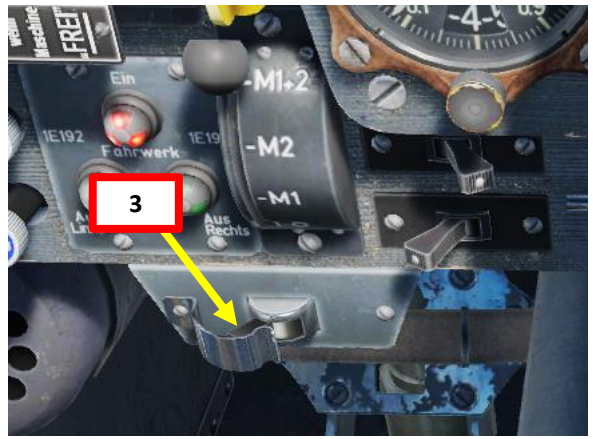
V101 External Ordnance and Optional Equipment Power Switch
(Abwurfwaffe Gondeln Bildgeräte Aufklärer)

MG 131 MACHINEGUNS (13 MM) & MK 108 CANNON (30 MM)

1. Arm your two MG 131 machineguns using the MASTER ARM (Weapons) switch (UP = ON, DOWN = OFF)
2. Set your ammo counters manually to 3 notches (WHITE = ammo available for machineguns only). Left click and drag on the rotary knobs. This should be done on ground.
3. Arm MK108 cannon by setting the Cannon Arming Switch LEFT.
4. Press the MK108 Cannon Charge Button (D) for a few seconds to charge air pressure in the MK108 cannon's pneumatic system. Binding is "LALT+SPACE" (CHARGE MK 108 (D)).
5. Flip trigger safety using LSHIFT+SPACE.
6. Adjust Gunsight Brightness – As desired.





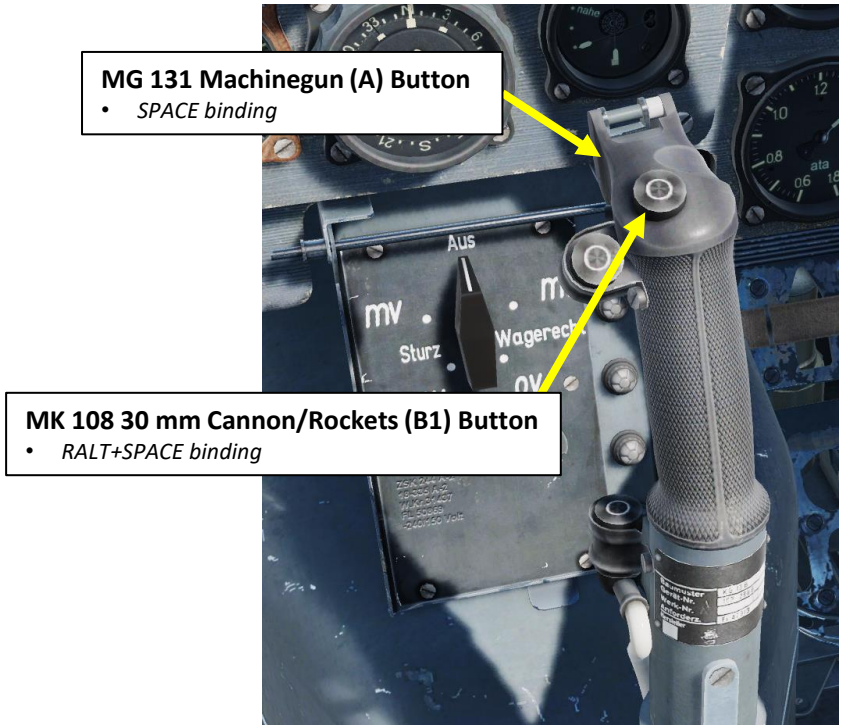


MG 131 MACHINEGUNS (13 MM) & MK 108 CANNON (30 MM)

7. Place the wings of the target within your gunsight and estimate its range accordingly.

MG 131 MACHINEGUNS (13 MM) & MK 108 CANNON (30 MM)

8. Fire machineguns and cannon when in range.
    - MG 131 Machineguns: MG 131 Machinegun (A) Button (SPACE)
    - MK 108 Cannon: MK 108 30 mm Cannon/Rockets (B1) Button (RALT+SPACE)



MG 131 MACHINEGUNS (13 MM) & MK 108 CANNON (30 MM)

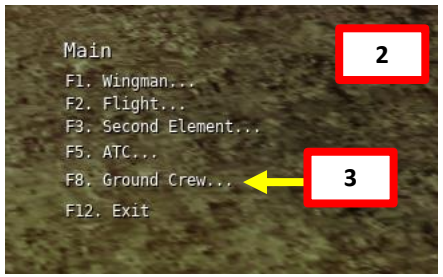
BOMB FUZES

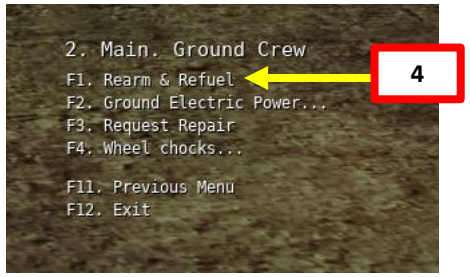
To equip bombs with a fuze delay, contact the ground crew.

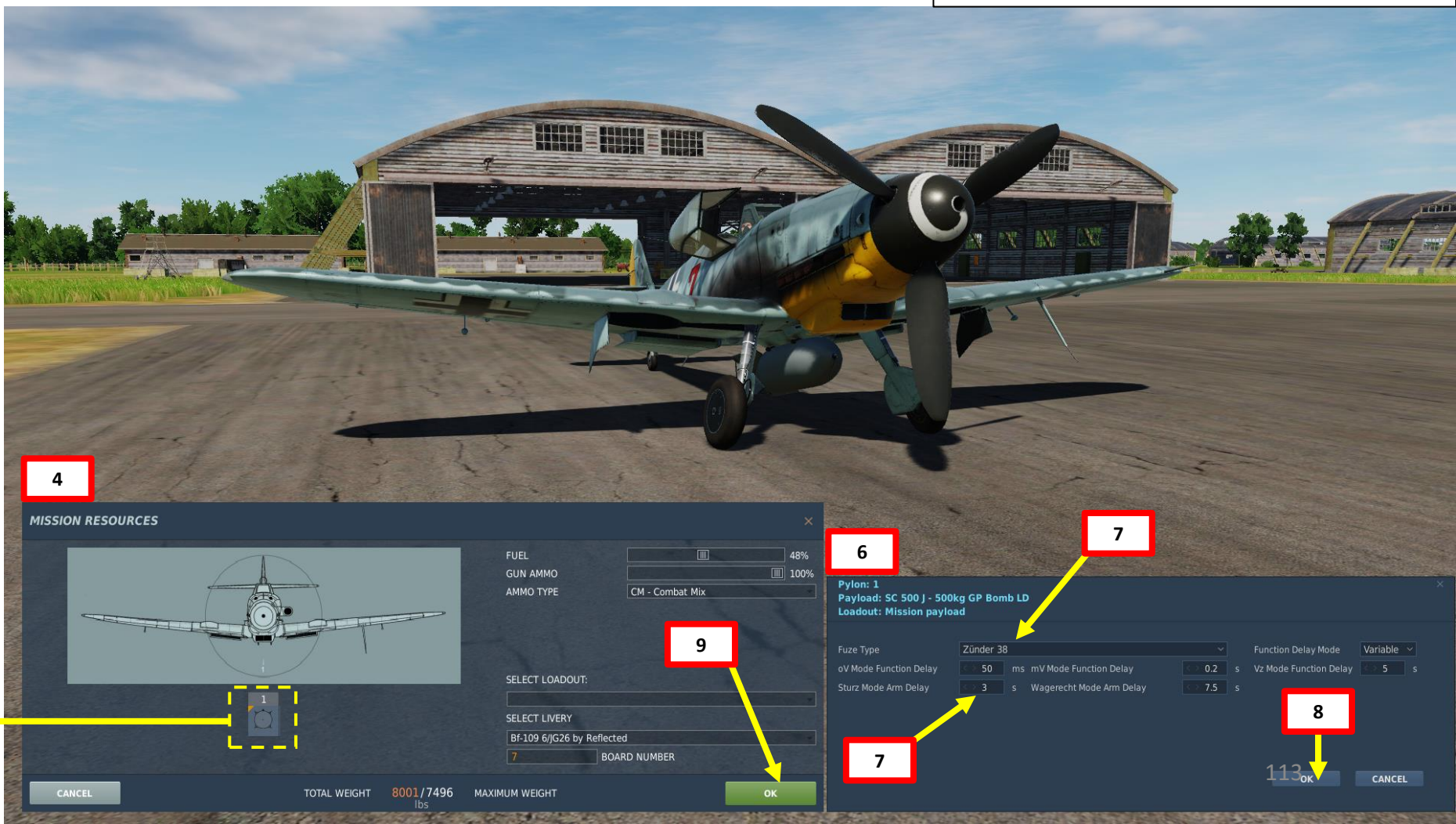
1. Open canopy
2. Press “RALT + \” (Communication Push-to-Talk)
3. Select ground crew by pressing “F8”
4. Select “Rearm & Refuel” by pressing “F1”.
5. Equip bomb on desired pylon.
6. Click on the yellow triangle on the bomb to set fuze type and delay.
7. Set fuze type and delay.
8. Click OK on the Fuze panel.
9. Click OK on the Re-Arming panel.

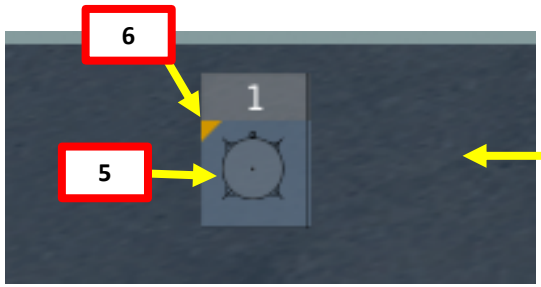
Terminology

- *Sturz: Dive Bombing*
- *MV: Mit Verzögerung (with fuze delay)*
- *OV: Ohne Verzögerung (without fuze delay)*
- *Wagerecht: Low Level*





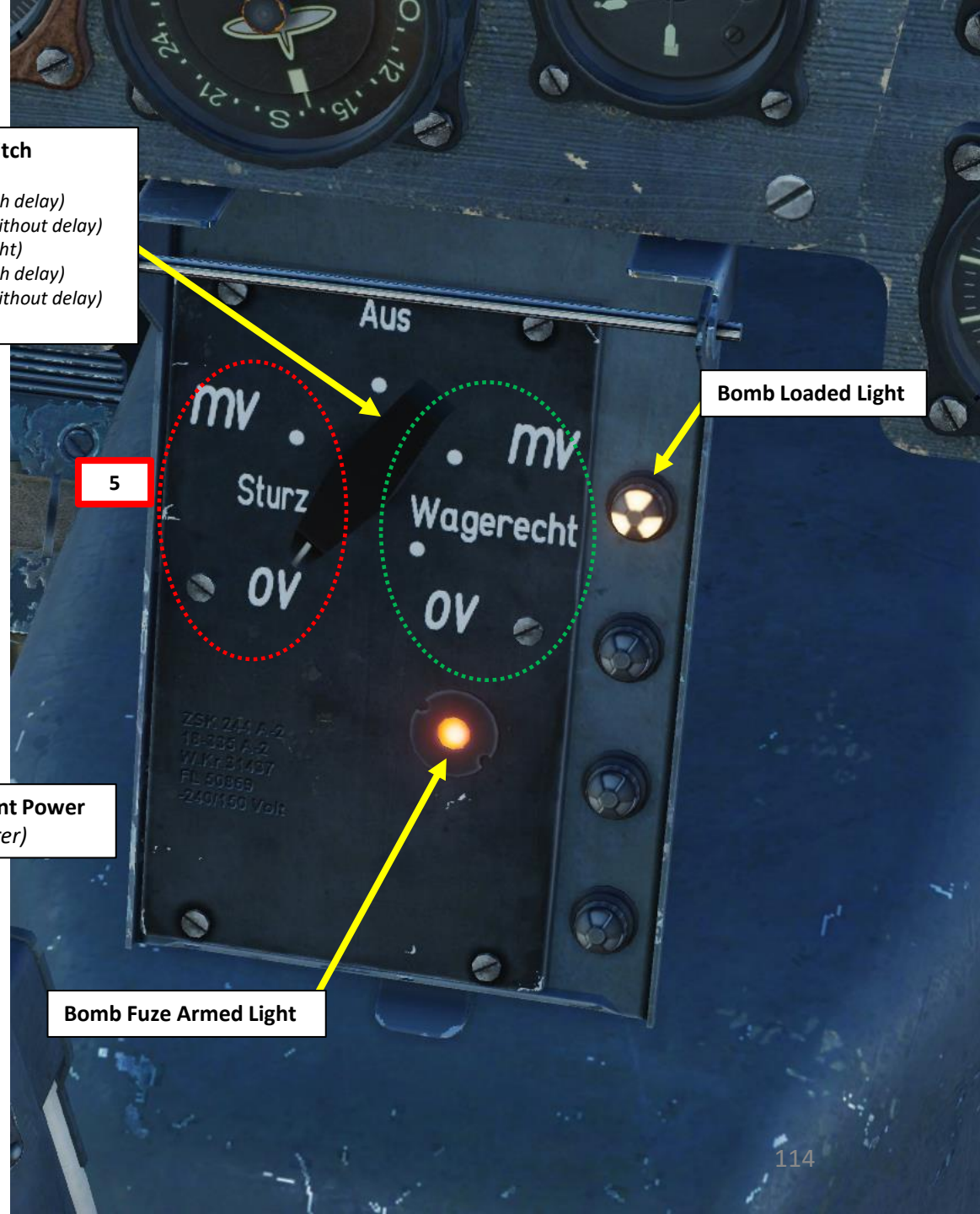


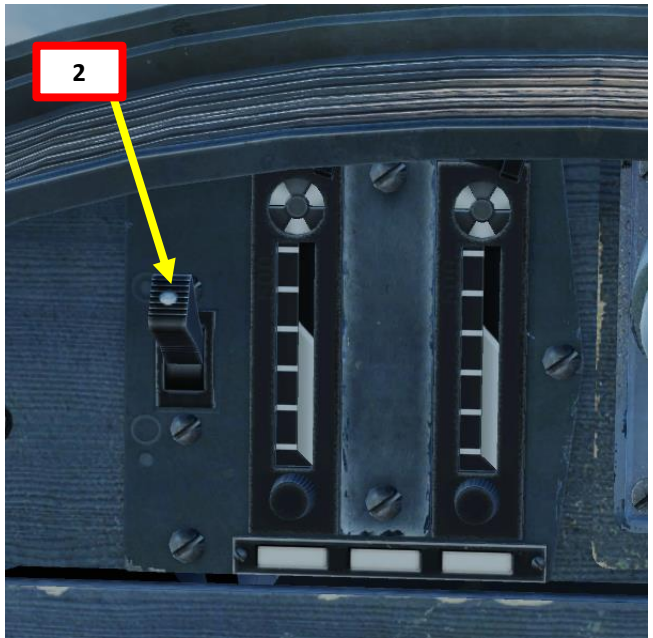


SC-500 BOMB (DIVE BOMBING PROFILE)

1. Verify that External Ordnance Breaker V101 is ON (IN)
2. Set Master Arm Safety Switch – ON (UP)
3. Choose bomb release mode
   - Left Side (Red) = *Sturz* = Dive Bombing
   - Right Side (Green) = *Wagerecht* = Level Bombing
4. Choose desired fuse delay
   - MV = *Mit Verzögerung* = With Delay
   - OV = *Ohne Verzögerung* = Without Delay
5. Select appropriate release mode on console.
   - Example: Sturz OV= Dive Bombing Without Delay

Bomb Release Mode Selector Switch
- *Left side: Dive Bombing (Sturz)*
  - *MV: Mit Verzögerung (with delay)*
  - *OV: Ohne Verzögerung (without delay)*
- *Right side: Level Bombing (Wagerecht)*
  - *MV: Mit Verzögerung (with delay)*
  - *OV: Ohne Verzögerung (without delay)*
- *Middle: Aus (Disarmed)*





V101 External Ordnance and Optional Equipment Power Switch *(Abwurfwaffe Gondeln Bildgeräte Aufklärer)*

SC-500 BOMB (DIVE BOMBING PROFILE)

6. Approach the target by flying level at an altitude of 2 km, with an airspeed of 350 km/h.
7. When the target disappears under the wing on a line of about 1/3 from the end of the wing-tip, perform a gentle turn under the horizon in the direction of the target.
8. While turning, regulate speed so that the target remains visible. This turn has to be very steady and made without excessive use of the rudder.

SC-500 BOMB (DIVE BOMBING PROFILE)

9. Throttle back at idle power and perform a dive between 45 and 60 degrees. The steeper the dive angle the better precision you will have.
10. Make sure not to exceed maximum diving speeds, as indicated on the table below.
11. Line up the target with the center of the gunsight reticle.
12. Pull lead to bring the target slightly under the aircraft nose.
13. When target is lined up under the aircraft nose and aircraft is between an altitude of 500 m and 1 km, release bomb.

Maximum Diving Speeds Table

Airspeed @ Altitude

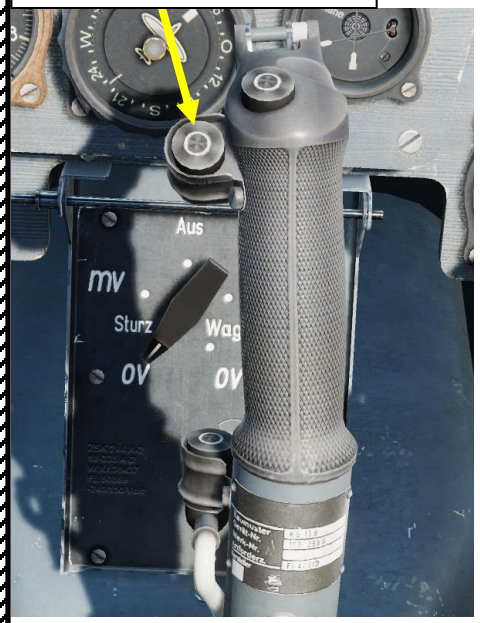
- *400 km/h @ 11 km*
- *500 km/h @ 9 km*
- *600 km/h @ 7 km*
- *700 km/h @ 5 km*
- *800 km/h @ 3 km*
- *850 km/h @ 1 km*

SC-500 BOMB (DIVE BOMBING PROFILE)

14. Release bomb using “BOMB RELEASE (B2)” button (RSHIFT+SPACE).
15. Apply full power and pull away from the blast while maintaining level flight. This will allow you to get out as quickly as possible from the orbit of enemy anti-air defences.
16. After having travelled enough distance, start climbing. Climbing immediately after the release of bombs was one of the most common mistakes and resulted in:
    - Unnecessary danger to the pilot from the enemy anti-air batteries
    - Black-out
    - Wing wrinkling

14

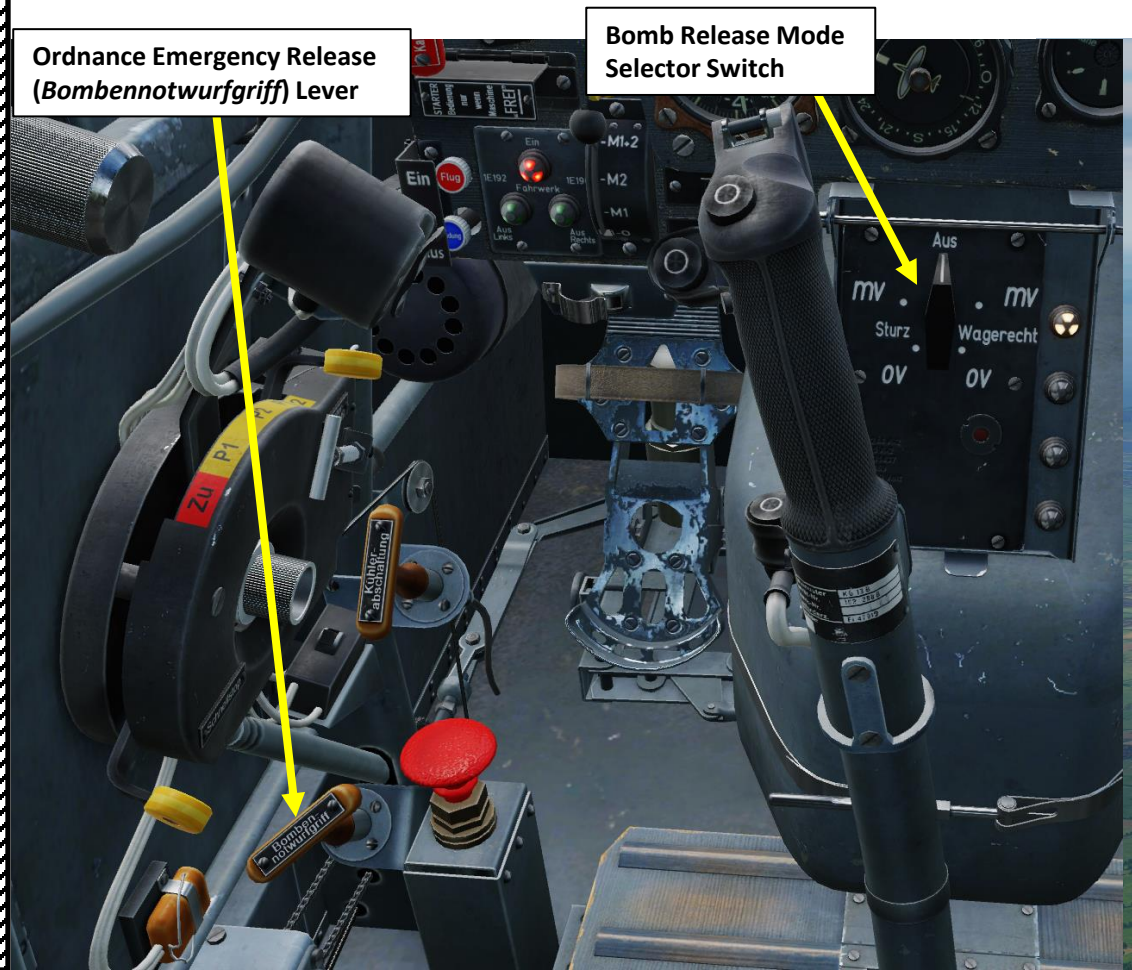
Bomb Release (B2) Button
- *RSHIFT+SPACE binding*



SC-500 BOMB (DIVE BOMBING PROFILE)

ORDNANCE JETTISON

- To **jettison a bomb**, set Bomb Release Mode Selector Switch to AUS (Disarmed), then pull ***Bombennotwurfgriff*** *(***Ordnance Emergency Release***)* handle to jettison Fuselage Stores.
- To **jettison an external fuel drop tank**, pull ***Bombennotwurfgriff*** *(***Ordnance Emergency Release***)* handle.

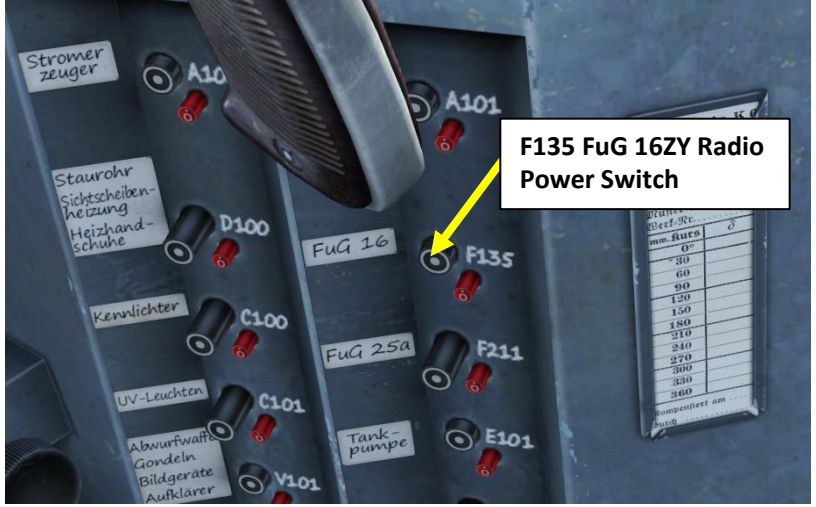


FUG 16ZY VHF RADIO OVERVIEW

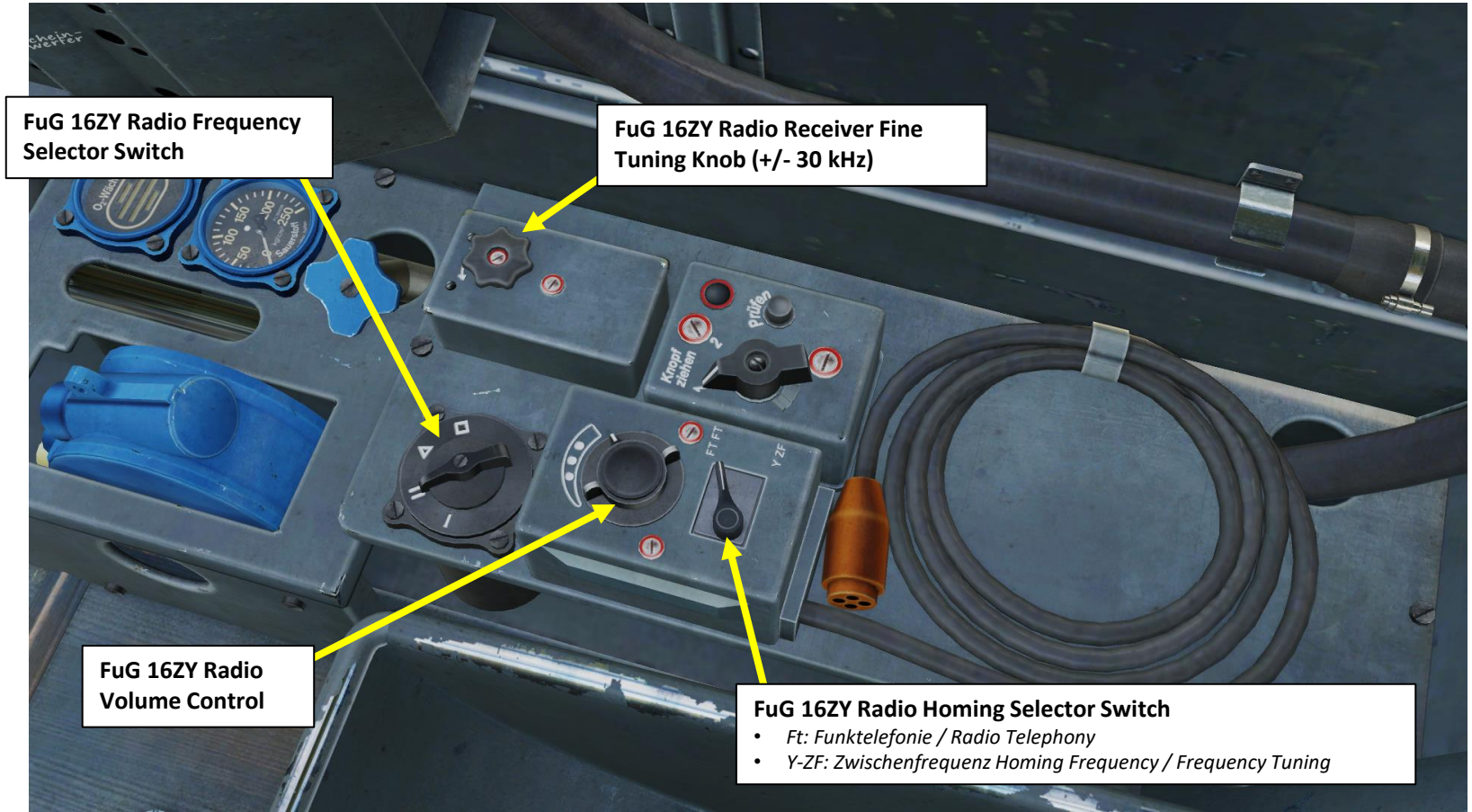
The Bf.109K-4 is equipped with a FuG 16ZY radio, a specially-designed airborne VHF transceiver. The FuG 16 can be used for in-flight communication as well as for IFF identification and DF homing. The set operates in the frequency range between 38.4 and 42.4 MHz.

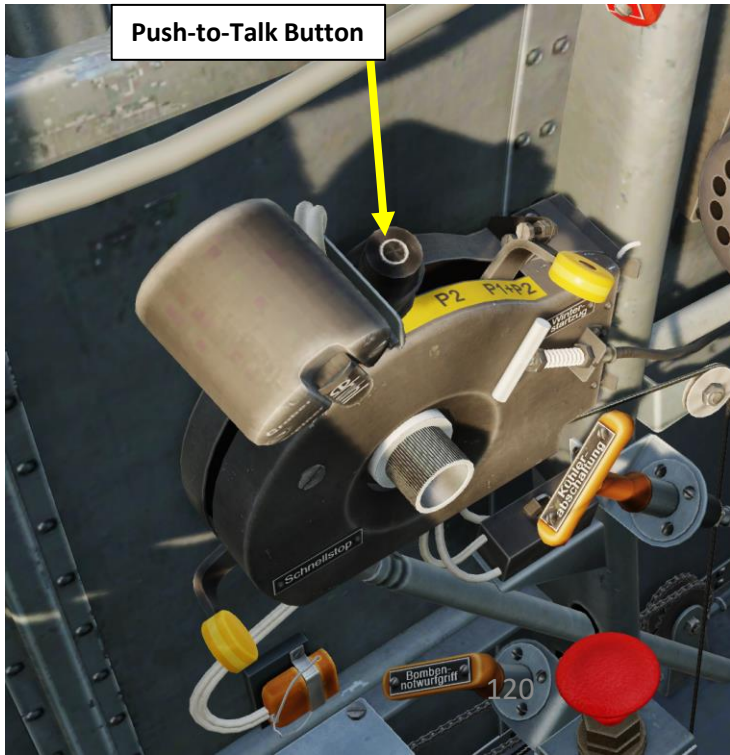
The FuG 16ZY can also be set to *Leitjäger* or Fighter Formation Leader mode that allows it to use a special *Y-Verfahren* ground tracking and direction homing via the normal headphones.

Radio frequencies are **preset** in the mission editor in **4 different channels** and **cannot be tuned manually during flight**.



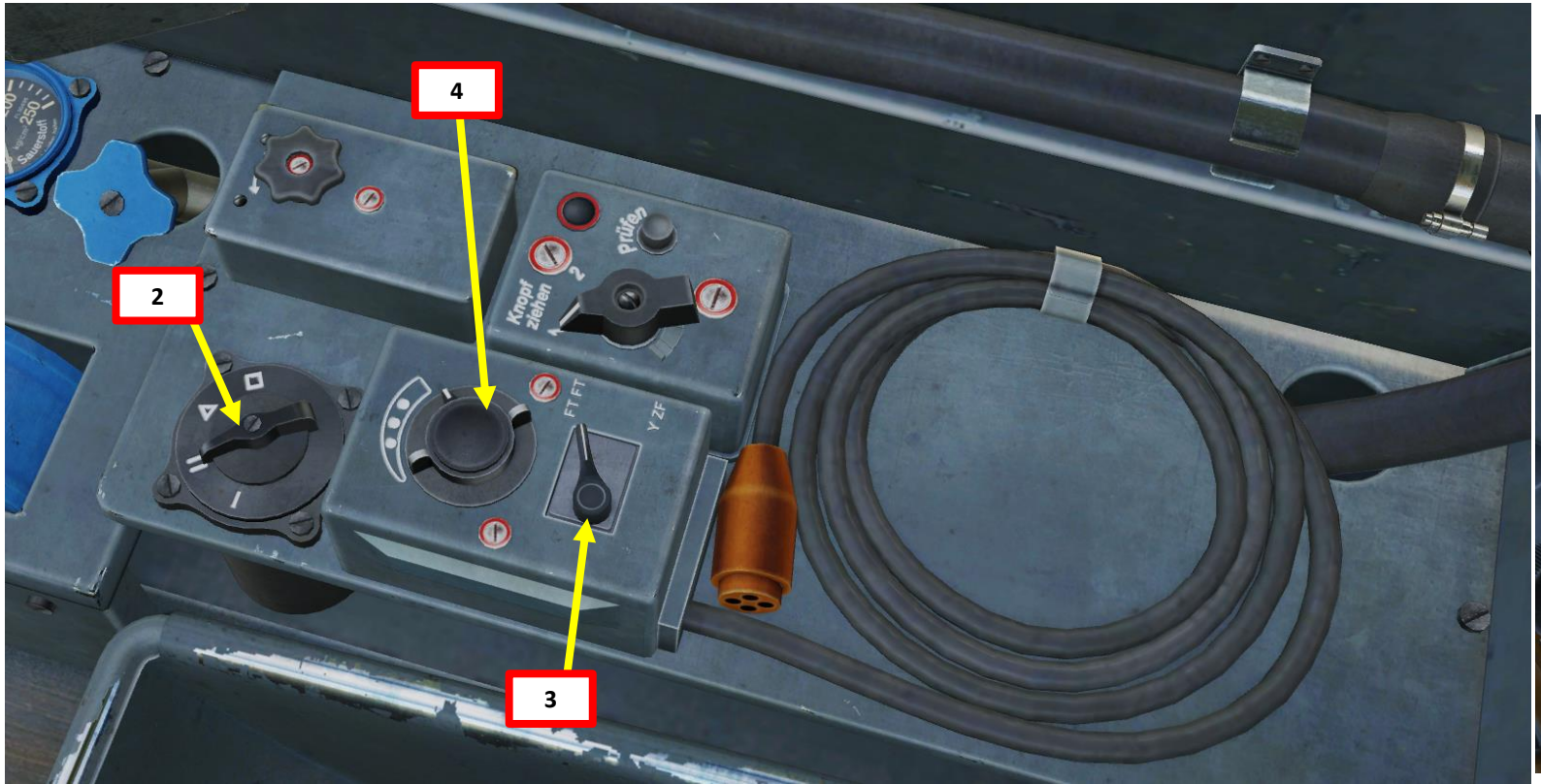
RADIO FREQUENCY RANGE: 38.4- 42.4 MHz

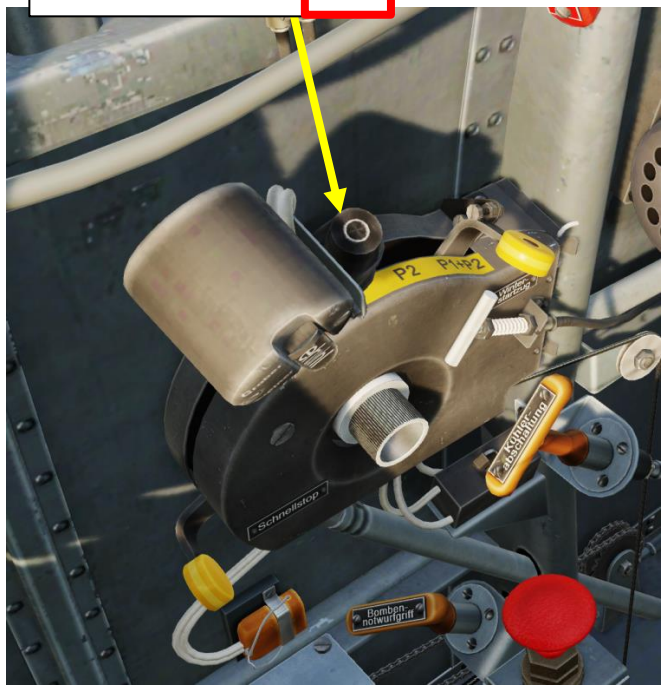


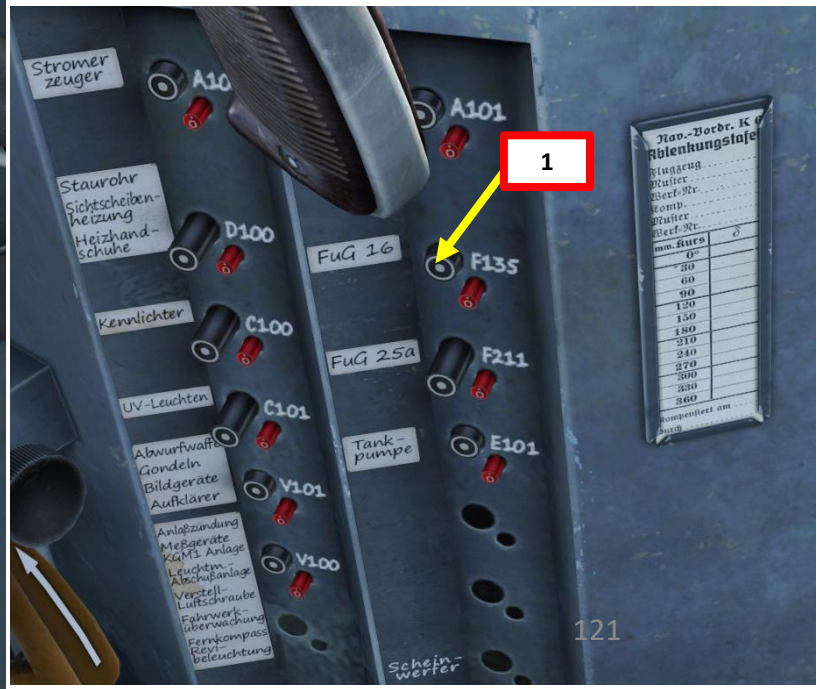


HOW TO TRANSMIT ON FUG 16ZY VHF RADIO

1. Set FUG 16ZY Power Switch (F135) ON.
2. Set radio channel selector to the desired frequency (I, II, Δ or □).
   - See note on next page about the real-life functions of these frequencies.
3. Set radio mode to “FT” (FUNKTELEFONIE: RADIO TELEPHONY)
4. Adjust radio volume as desired.
5. Press the Push-to-Talk Button on your throttle to transmit (“COMM PUSH TO TALK” Binding, or “RALT+\”)







FUG 16ZY RADIO CHANNELS

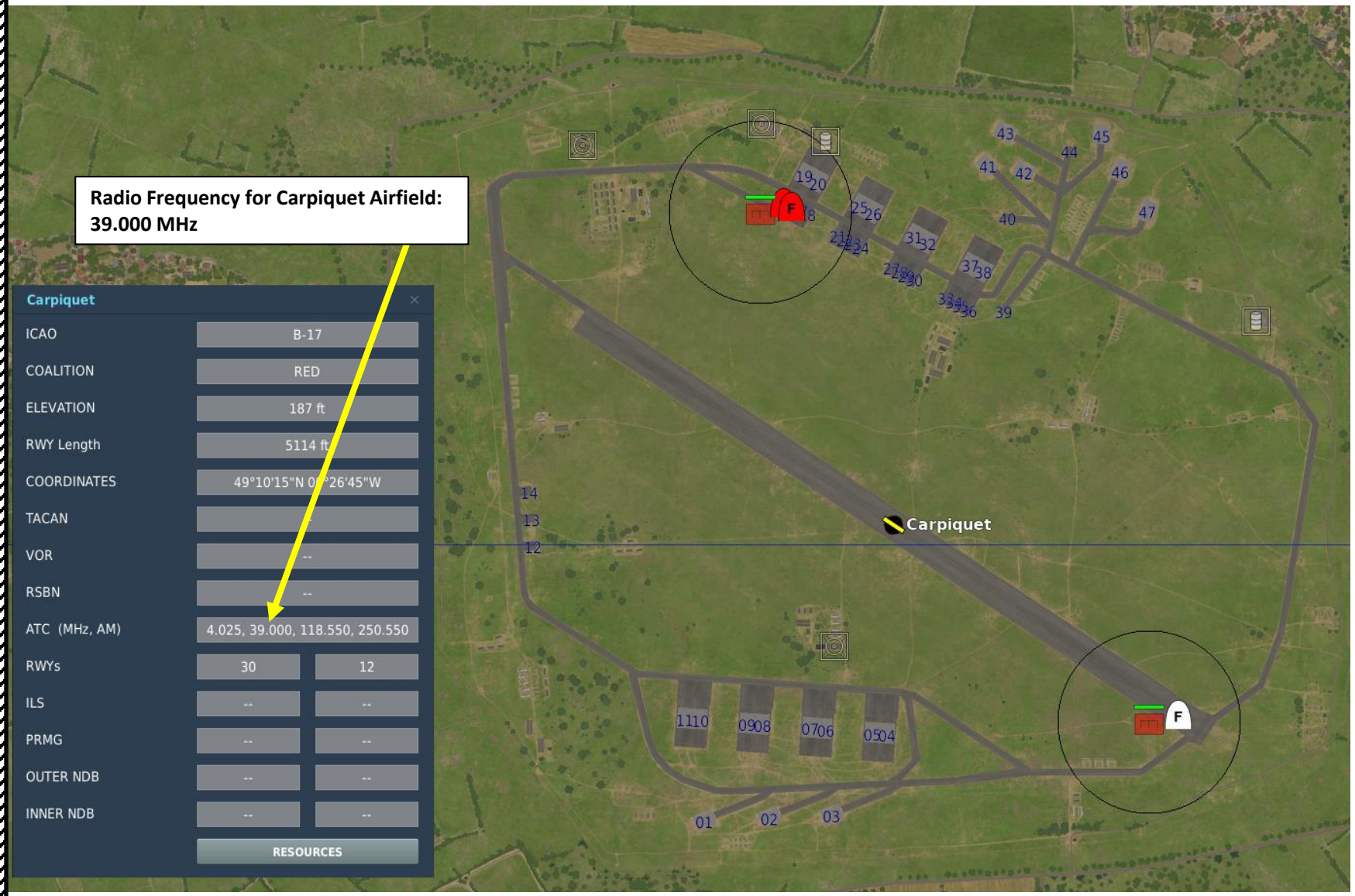
- The "I" position is for "*Y-Führungsfrequenz*", or Management frequency, is used for communication within the flight or squadron. A mission maker will typically preset this frequency to the same frequency used by your wingmen of your flight and mention it in the mission briefing.
- The "II" position is for "*Gruppenbefehlsfrequenz*", or Group Order frequency, is used to communicate between several flights from different squadrons participating in a single raid. A mission maker will typically preset this frequency to the same frequency used by other flights or friendly units and mention it in the mission briefing.
- The "Δ" position is for "*Nah-Flugsicherungsfrequenz*", or the Air Traffic Control frequency. It is used to communicate with the designated Air Traffic Controller. A mission maker will typically preset this frequency to the same frequency used by your departure airfield and mention it in the mission briefing.
- The "□" position is for "*Reichsjägerfrequenz*", or Reich Fighter Defense Frequency, and is used to coordinate country-wide air defense efforts in large scale raids.

These frequencies should be listed in your mission briefing.

Homing Switch	*Freq*	*Push-to-Talk Open*	*Push-To-Talk Depressed*	*Transm*	*Recvr*
FT FT	I	Listen	Talk	I	II
Y ZF	I	E-Meßbetrieb Listen	E-Meßbetrieb Listen+Talk	I	II
FT FT	II, Δ or □	Listen	Talk	II, Δ or □	
Y ZF	II, Δ or □	Listen to AFN-2 Targeting	Talk	II, Δ or □	

AIRPORT RADIO FREQUENCIES

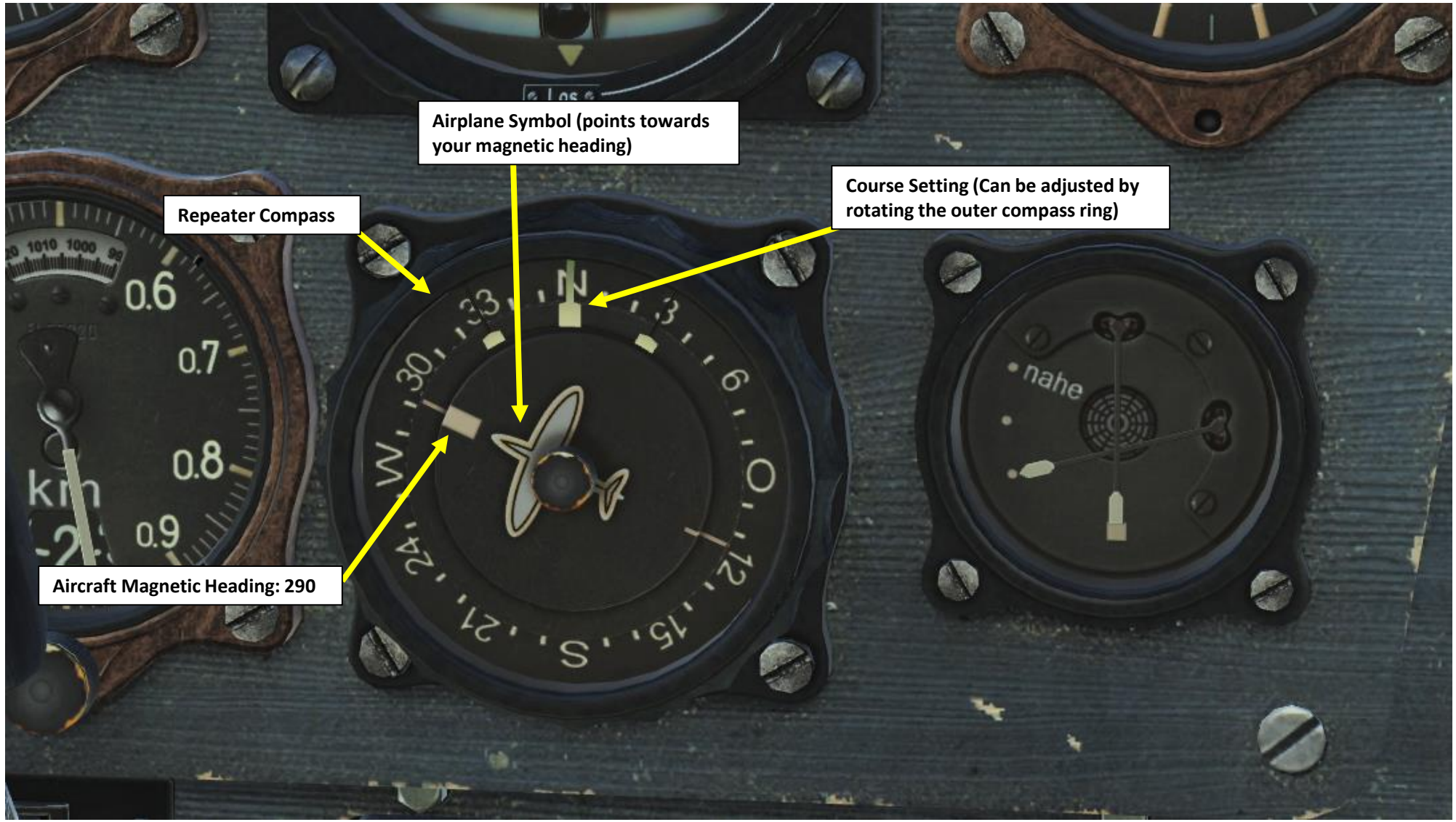
To determine airport radio frequencies, use the F10 map.



AIRFIELD	FREQUENCY
Anapa	38.40 MHz
Batumi	40.40 MHz
Beslan	42.40 MHz
Gelendzhik	39.40 MHz
Gudauta	40.20 MHz
Kobuleti	40.80 MHz
Kutaisi	41.00 MHz
Krasnodar-Center	38.60 MHz
Krasnodar-Pashkovsky	39.80 MHz
Krymsk	39.00 MHz
Maykop	39.20 MHz
Mineralnye Vody	41.20 MHz
Mozdok	41.60 MHz
Nalchik	41.40 MHz
Novorossiysk	38.80 MHz
Senaki	40.60 MHz
Sochi	39.60 MHz
Soganlug	42.00 MHz
Sukhumi	40.00 MHz
Tbilisi	41.80 MHz
Vaziani	42.20 MHz

THE REPEATER COMPASS

Most of the navigation must be done visually in the Bf109. Consult the Repeater Gyrocompass. If desired, you can adjust your course setting by rotating the outer ring of the Repeater Compass. You can then steer the aircraft until the Aircraft Magnetic Heading needle (front of the airplane symbol) is lined up with the Course Setting reference mark.



LORENZ BEAM BLIND-LANDING RADIO NAVIGATION (THEORY)

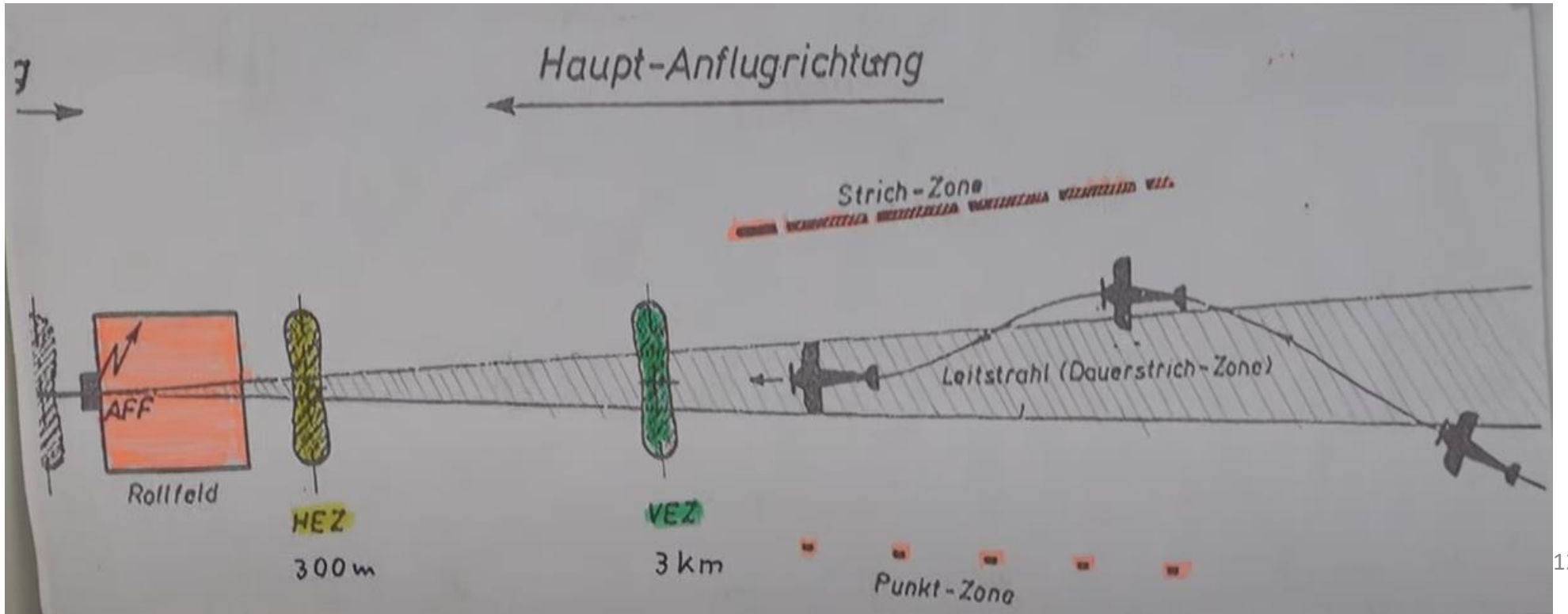
The During the 1930s and 1940s, a Standard Beam Approach (SBA) receiver was used by aircraft, to land when visual conditions were poor (due to rain, low cloud, or fog). It was a navigation receiver, and allowed the pilot to line the aircraft up on the runway when preparing in to land. You can think of it like a primitive form of ILS (Instrument Landing System), but only with a lateral component.

The most important pre-war Navigation Aid (navaid) was the Lorenz Radio Range, developed in Germany as a Blind Landing System (BLS), and was used extensively in Europe. It was developed starting in 1932 by Dr. Ernst Kramar of the Lorenz company. It was adopted by Lufthansa in 1934 and installed around the world. Lorenz used a 33.33 MHz radio transmitter, which projected two overlapping beams down the runway. The beams were switched on and off alternately, the left beam creating "*dits*" (morse letter E), the right beam creating "*dahs*" (morse letter T). Where the beams overlapped along the runway centerline, a continuous tone was heard.

On approach, when the pilot heard *dits*, he turned right until he heard the steady tone. Similarly if he heard dahs, he turned left. This was an aural navigation method, meaning that you used the morse signal sounds to determine whether you were to the left, to the right or directly lined up with the runway center. The pilot had to listen to the tones in his earphones and fly accordingly.

The Lorenz system was installed at many British airfields and called Standard Beam Approach (SBA). It used the morse letter A (*dit dah*) for the left beam, and the morse letter N (*dah dit*) for the right beam. In the middle, these overlapped to form the steady tone.

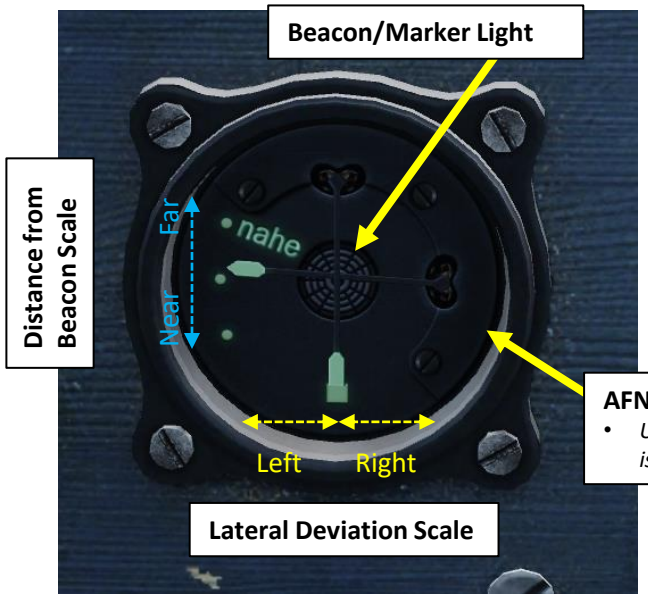
Reference: http://www.tuberadio.com/robinson/museum/command_SBA/



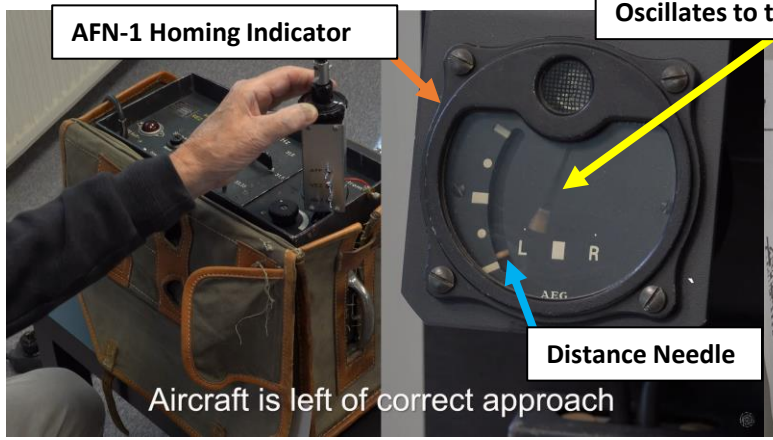
LORENZ BEAM BLIND-LANDING RADIO NAVIGATION (THEORY)

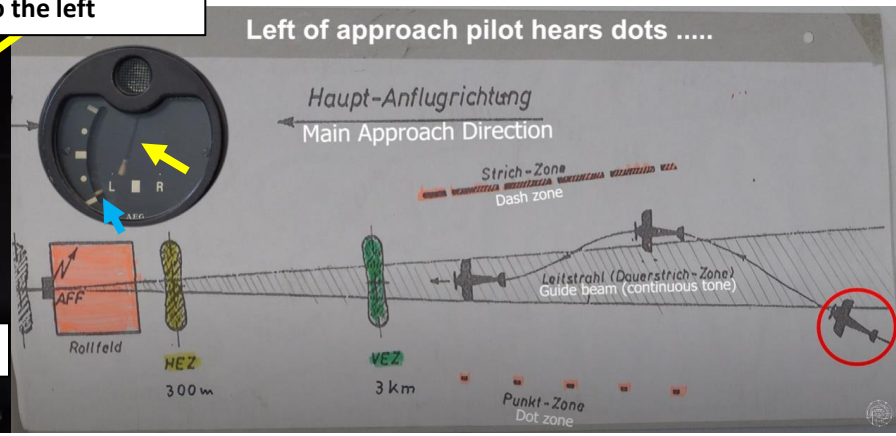
Consult this video for a great explanation of how the Lorenz "Beam" Blind Landing System FuBl 2 was used with the AFN-1 Indicator: https://youtu.be/6ReAJWnFGpg

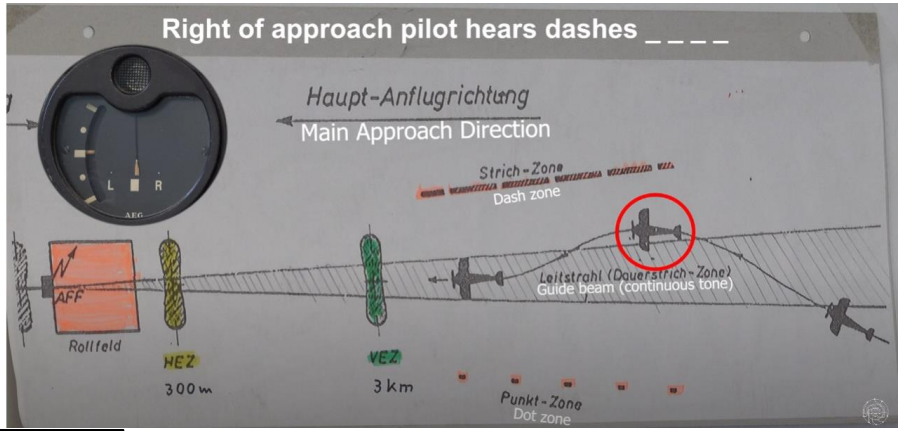
An important point to remember is that **beam landing is not fully functional in DCS yet**, so all these concepts are only the theory of what you would expect.



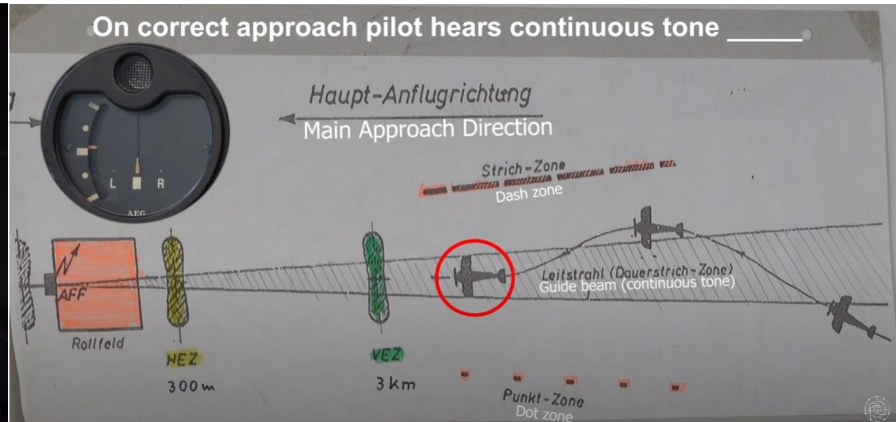
AFN-2 Homing Indicator
- *Used to determine where aircraft is in relationship to airport.*







Marker Light
- *Illuminates when flying over marker beacon (VEZ or HEZ)*



LORENZ BEAM BLIND-LANDING RADIO NAVIGATION (THEORY)

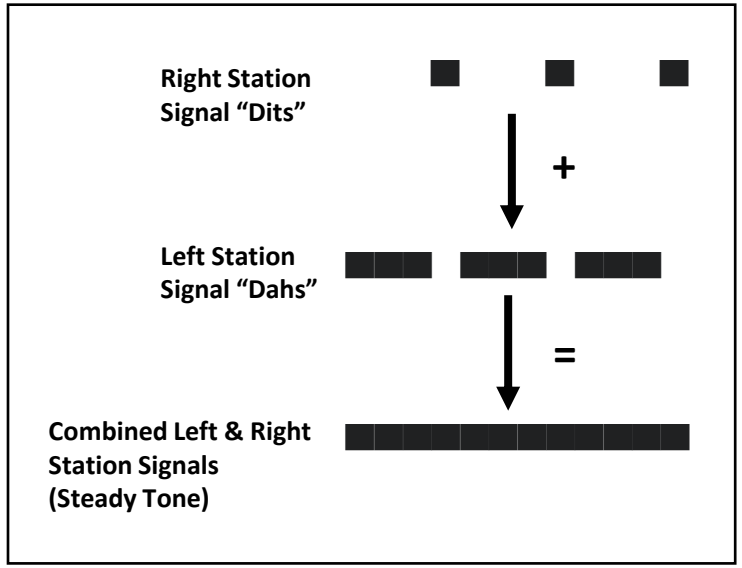
Here is an example of the concept behind the Standard Beam Approach (SBA).

The Standard Beam Approach system currently simulated in DCS is based on the Lorenz signals: a series of “dits” (Morse code for “E”) for the station right of the runway and a series of “dahs” (Morse code for “T”) for the station left of the runway.

The signal codes might change eventually, but the method remains the same: use audio signals to determine where you are in relationship to the runway, and steer the aircraft until both signals overlap and create a steady aural tone.

You can also use the AFN-2 Homing Indicator for visual guidance, which provides direction and range information to the runway.

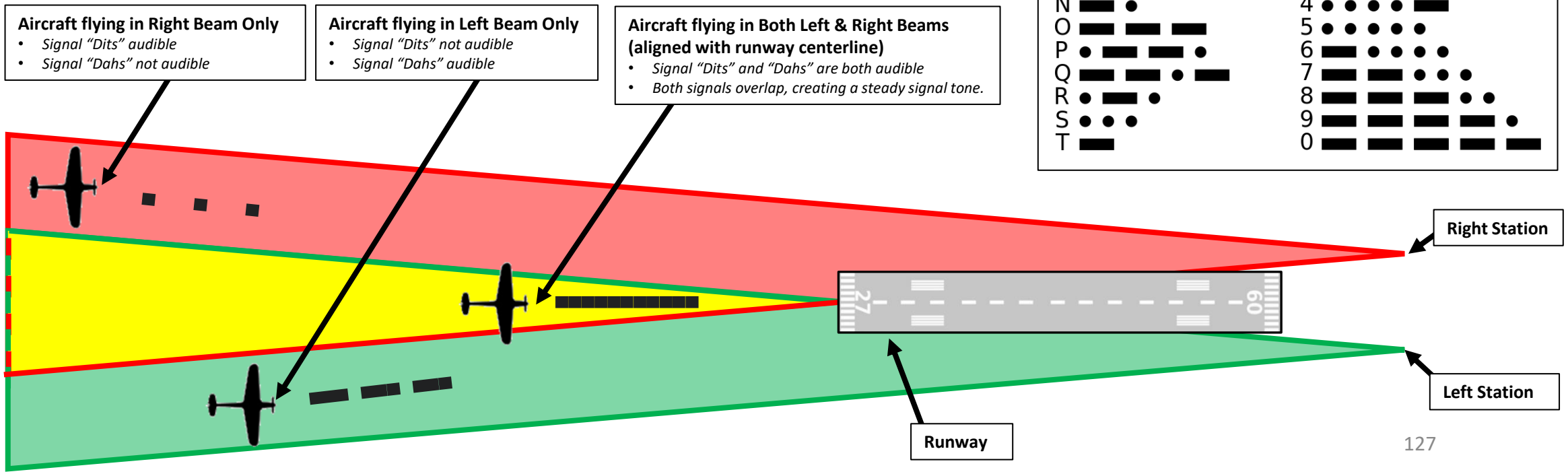
Here is a useful tutorial by Reflected Simulations for the Mosquito:
https://youtu.be/tGXSLLKSiRk?t=737



International Morse Code

1. The length of a dot is one unit.
2. A dash is three units.
3. The space between parts of the same letter is one unit.
4. The space between letters is three units.
5. The space between words is seven units.

A	● —	U	● ● —
B	— ● ● ●	V	● ● ● —
C	— ● — ●	W	● — —
D	— ● ●	X	— ● ● —
E	●	Y	— ● — —
F	● ● — ●	Z	— — ● ●
G	— — ●		
H	● ● ● ●		
I	● ●		
J	● — — —		
K	— ● —	1	● — — — —
L	● — ● ●	2	● ● — — —
M	— —	3	● ● ● — —
N	— ●	4	● ● ● ● —
O	— — —	5	● ● ● ● ●
P	● — — ●	6	— ● ● ● ●
Q	— — ● —	7	— — ● ● ●
R	● — ●	8	— — — ● ●
S	● ● ●	9	— — — — ●
T	—	0	— — — — —

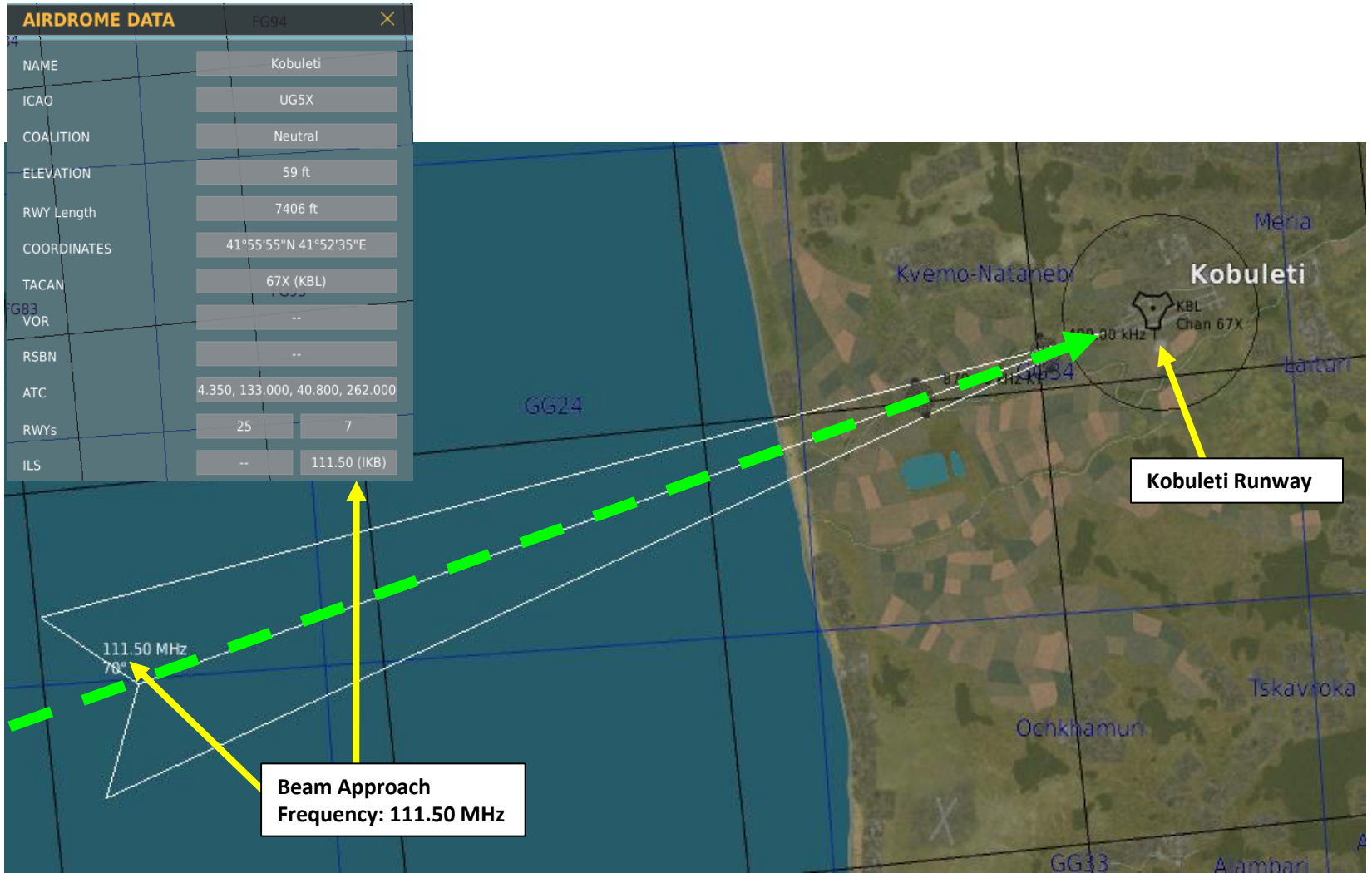


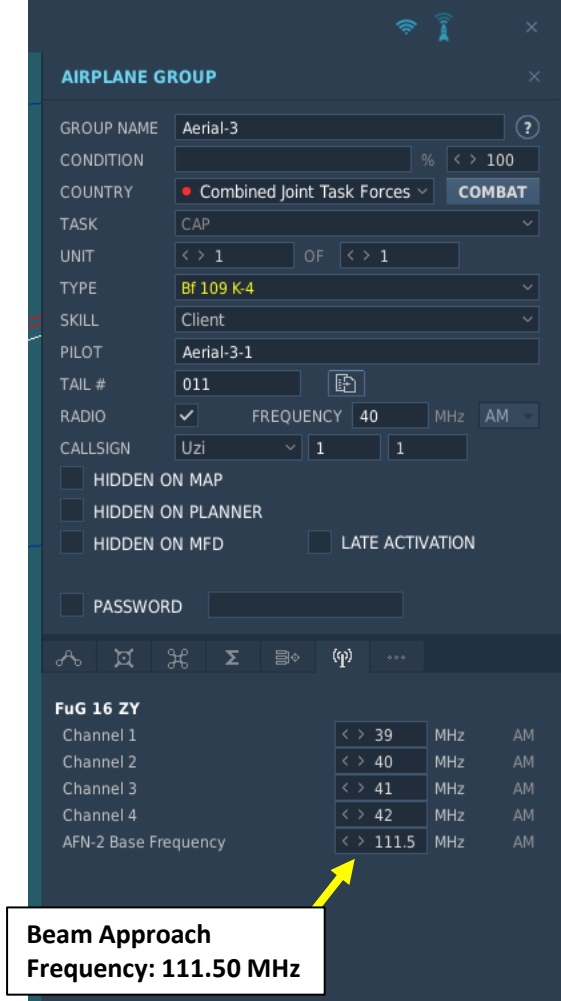
AFN-2 HOMING TUTORIAL (THEORY)

In the aircraft, there is no way to manually tune the frequency use for the Beam Approach system. The frequency is preset via the Mission Editor for the airfield you plan to return to. Since each frequency is different from airfield to airfield, you can only use the beam approach for one single runway.

DCS currently simulates the Beam Approach frequency by using the ILS (Instrument Landing System) frequency of airfields equipped with ILS equipment. The frequencies are not compatible with the frequency range of the FuG 16 radio, but this example is just for illustrative purposes.

- Take note that the **Normandy and Channel maps do not have the Beam Approach beacons yet**.

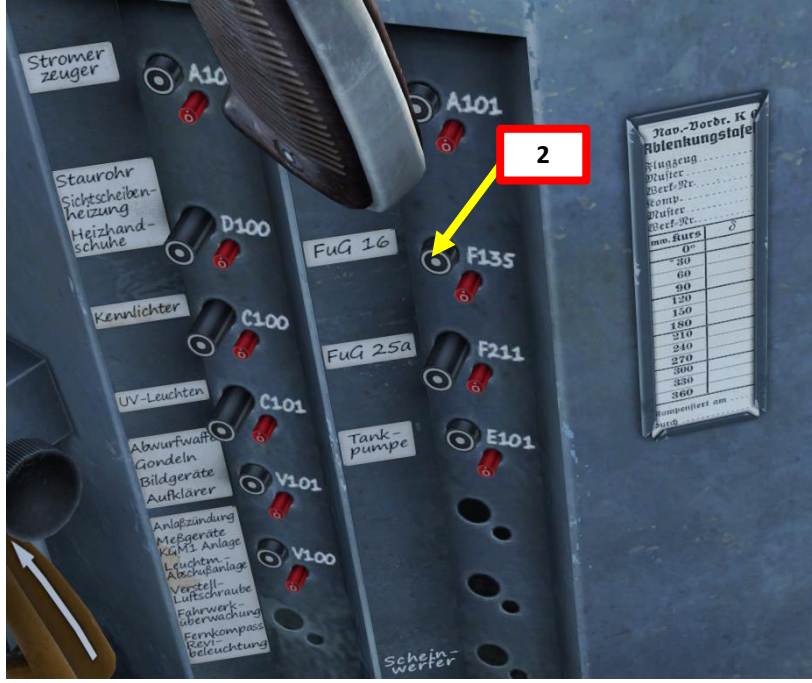


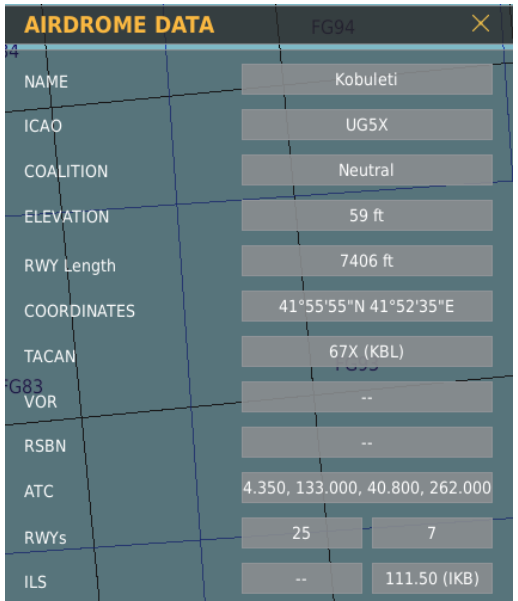


AFN-2 HOMING TUTORIAL (THEORY)

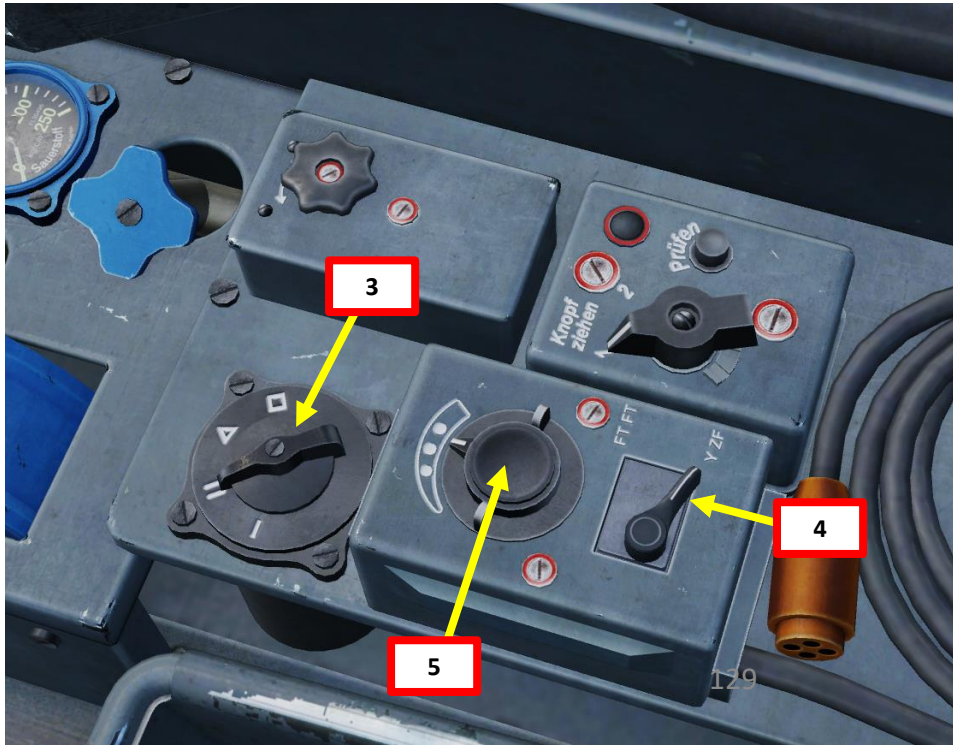
In this tutorial, we will use the Beam Approach system for Kobuleti's runway (frequency 111.50 MHz).

1. Make sure the AFN-2 Base Frequency for the Beam Approach system is set up correctly via the Mission Editor. The AFN-2 Base Frequency should match the Kobuleti ILS frequency, which is 111.50 MHz.
2. Set FUG 16ZY Power Switch (F135) ON.
3. Set radio channel selector to II.
4. Set radio mode to "Y-ZF" (*Zwischenfrequenz:* Homing Frequency)
5. Adjust radio volume to hear the morse signals from the runway.





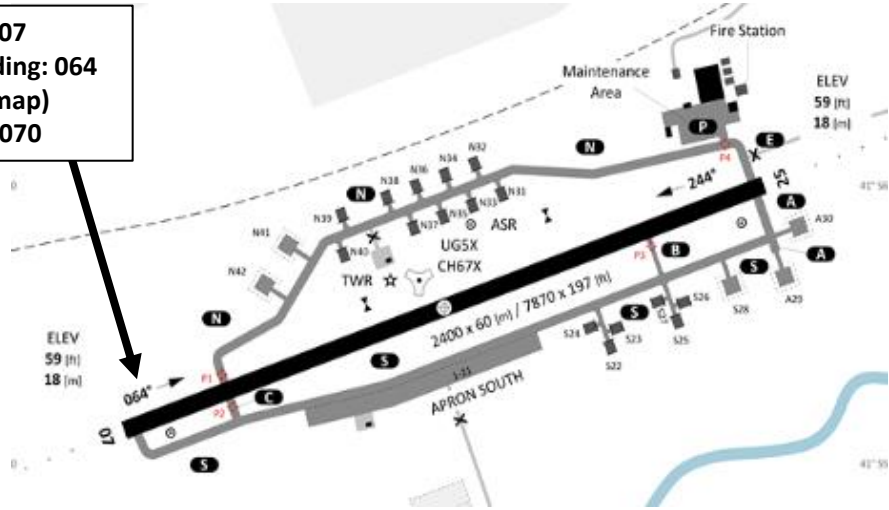
Beam Approach Frequency: 111.50 MHz

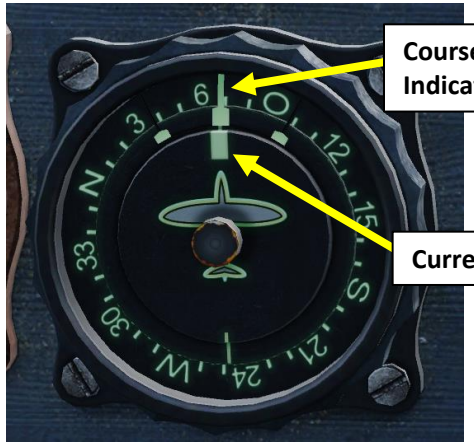


AFN-2 HOMING TUTORIAL (THEORY)

6. Determine your current position based on what kind of audio signal you hear:
   - A series of short “dits” (Morse code for “E”) is for the station right of the runway. This means the runway is further to your right.
   - A series of long “dahs” (Morse code for “T”) for the station left of the runway. This means the runway is further to your left.
   - A steady tone means both the left and right station signals overlap, which means that you are lined up with the runway.
7. The AFN-2 Homing Indicator will also provide you guidance towards the runway. See next page for more information.
8. The Beam Approach gives you your position relative to the runway, but it does not indicate whether you are flying in the correct direction or not. To ensure the aircraft heading is correct, make sure to use the Repeater Compass to follow the Magnetic Heading of Kobuleti’s runway (064).
9. Fly the aircraft while the tone is steady and perform the landing approach as per the procedure in the landing tutorial.

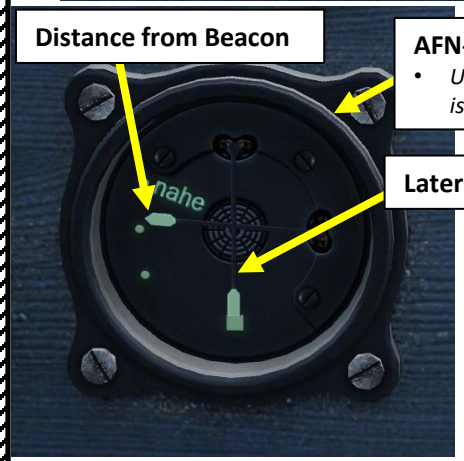
Kobuleti Runway 07
- **Magnetic Heading: 064 (indicated on map)**
- **True Heading: 070**





Course Reference Indicator (064)

Current Aircraft Heading



Distance from Beacon

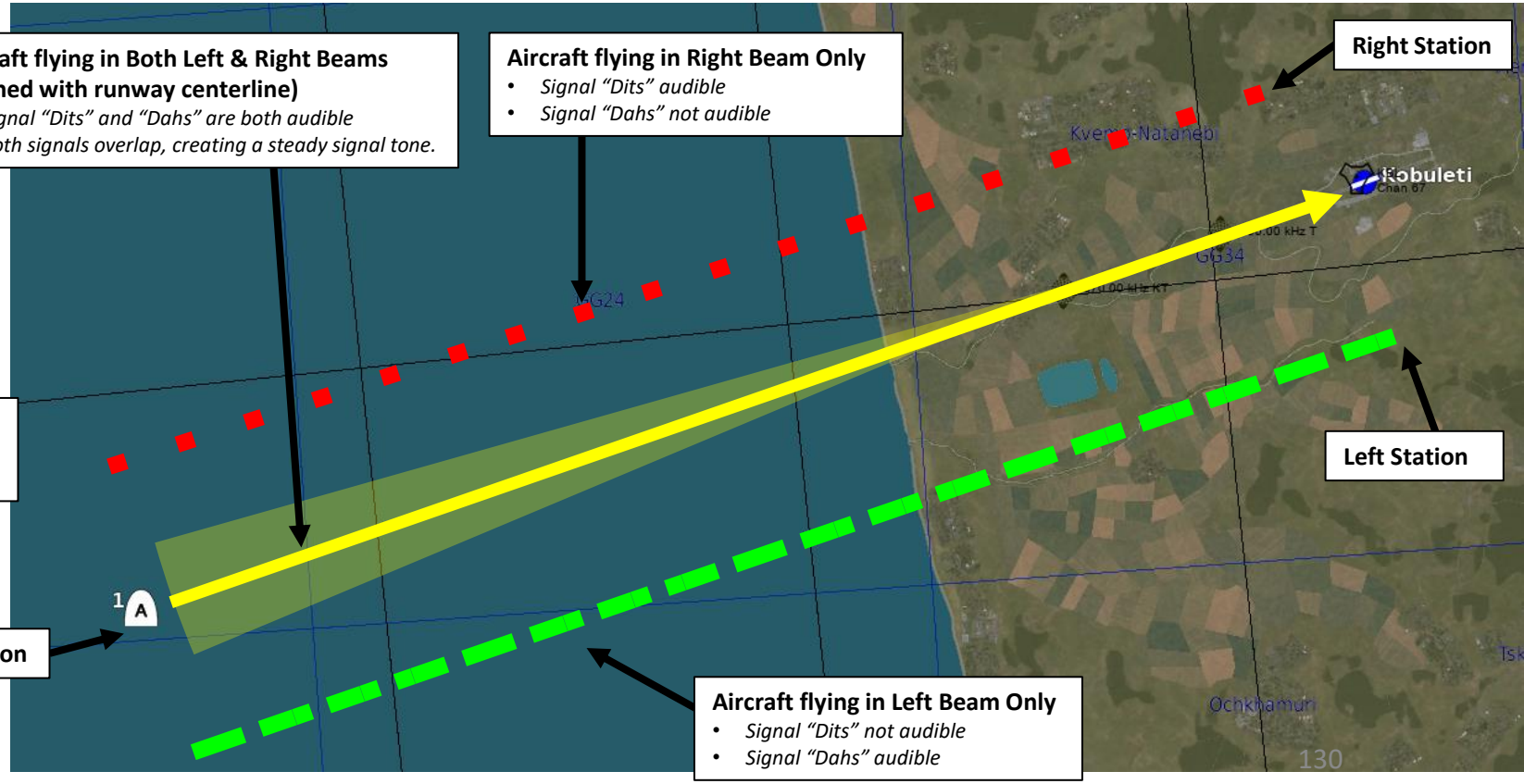
AFN-2 Homing Indicator
- *Used to determine where aircraft is in relationship to airport.*

Lateral Deviation

Aircraft Position

Aircraft flying in Both Left & Right Beams (aligned with runway centerline)
- *Signal “Dits” and “Dahs” are both audible*
- *Both signals overlap, creating a steady signal tone.*

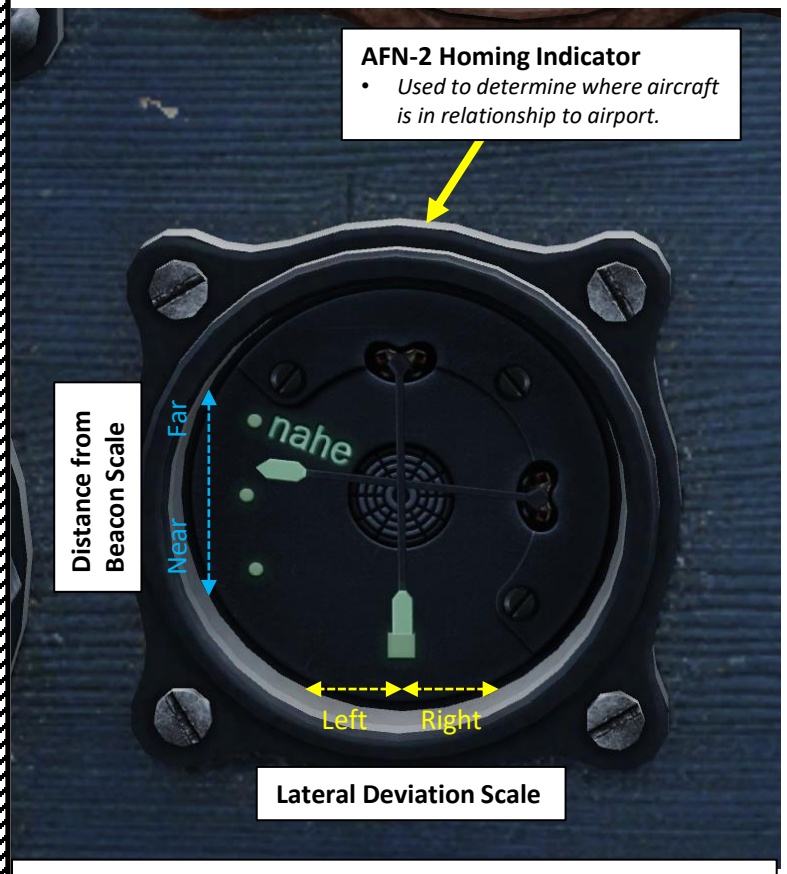
Aircraft flying in Right Beam Only
- *Signal “Dits” audible*
- *Signal “Dahs” not audible*



Aircraft flying in Left Beam Only
- *Signal “Dits” not audible*
- *Signal “Dahs” audible*

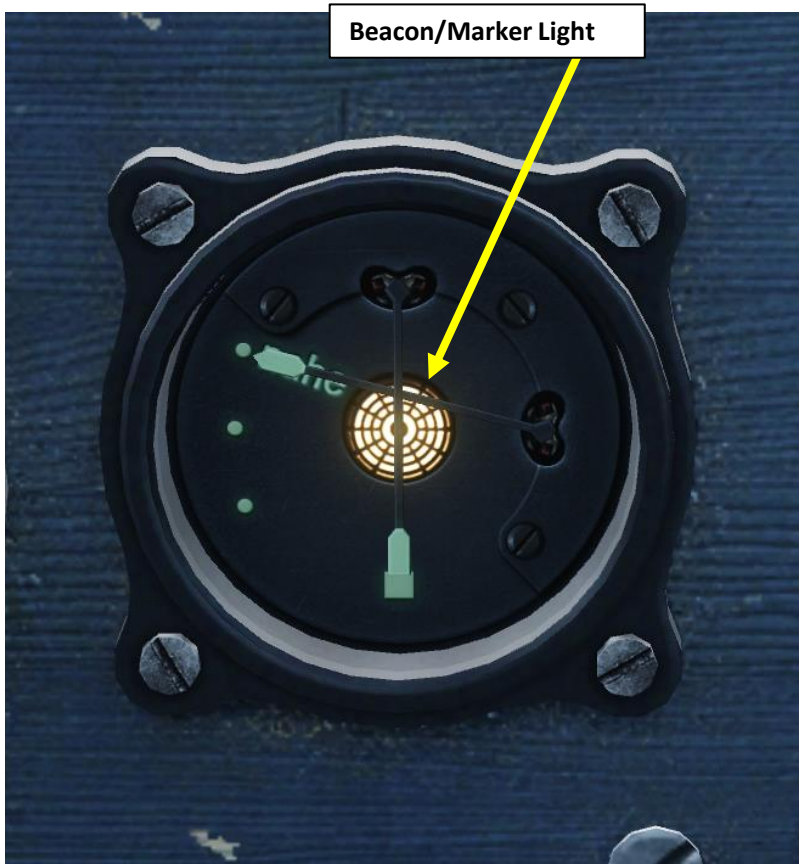
AFN-2 HOMING TUTORIAL (THEORY)

10. In addition to the audio signal cues, you can use the AFN-2 Homing Indicator to help you navigate towards the airport. The AFN-2 provides both direction and range information.
    - The device has two moving bars that indicate homing beacon information. Each is similar to modern-day equipment, the VHF omnidirectional range – VOR – (vertical bar) and the distance measuring equipment – DME (horizontal bar).
    - The **vertical bar** indicates the **general direction** of the homing beacon in relation to the aircraft's nose.
    - The **horizontal bar** indicates the **distance** from the beacon. (current axis is incorrectly reversed as of 2023/09/09)
11. When you are flying over a beacon, the Beacon/Marker Light should illuminate.



Example: Aircraft is lined up with the runway, 3 km away.

Example: Aircraft is left of the runway, 3 km away.



AFN-2 HOMING TUTORIAL (THEORY)

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).

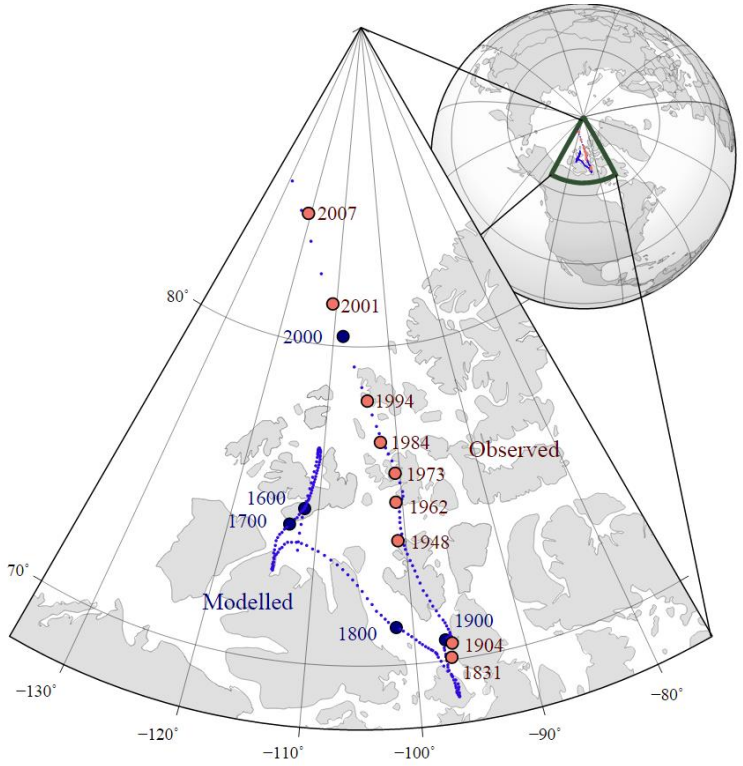
True Heading = Magnetic Heading + Magnetic Variation

As an example, if the runway heading that you read on the F10 map in Azeville is 071 (True Heading), then the direction you should take with your magnetic compass course should be 071 subtracted with the Magnetic Variation (-11 degrees), or 082. In other words, you would need to use a course of 082 (M) with your compass.

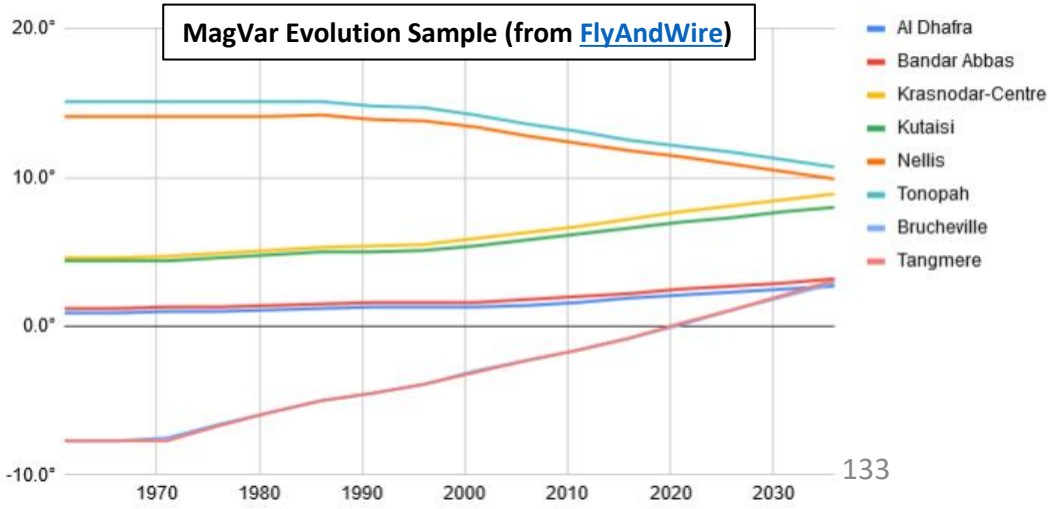
Magnetic variation varies from place to place, but it also changes with time. This means this value will be highly dependent on the mission time and map.

Magnetic Variation:

- **-11 deg for Normandy in 1944**
- **-11 deg for the English Channel in 1944**

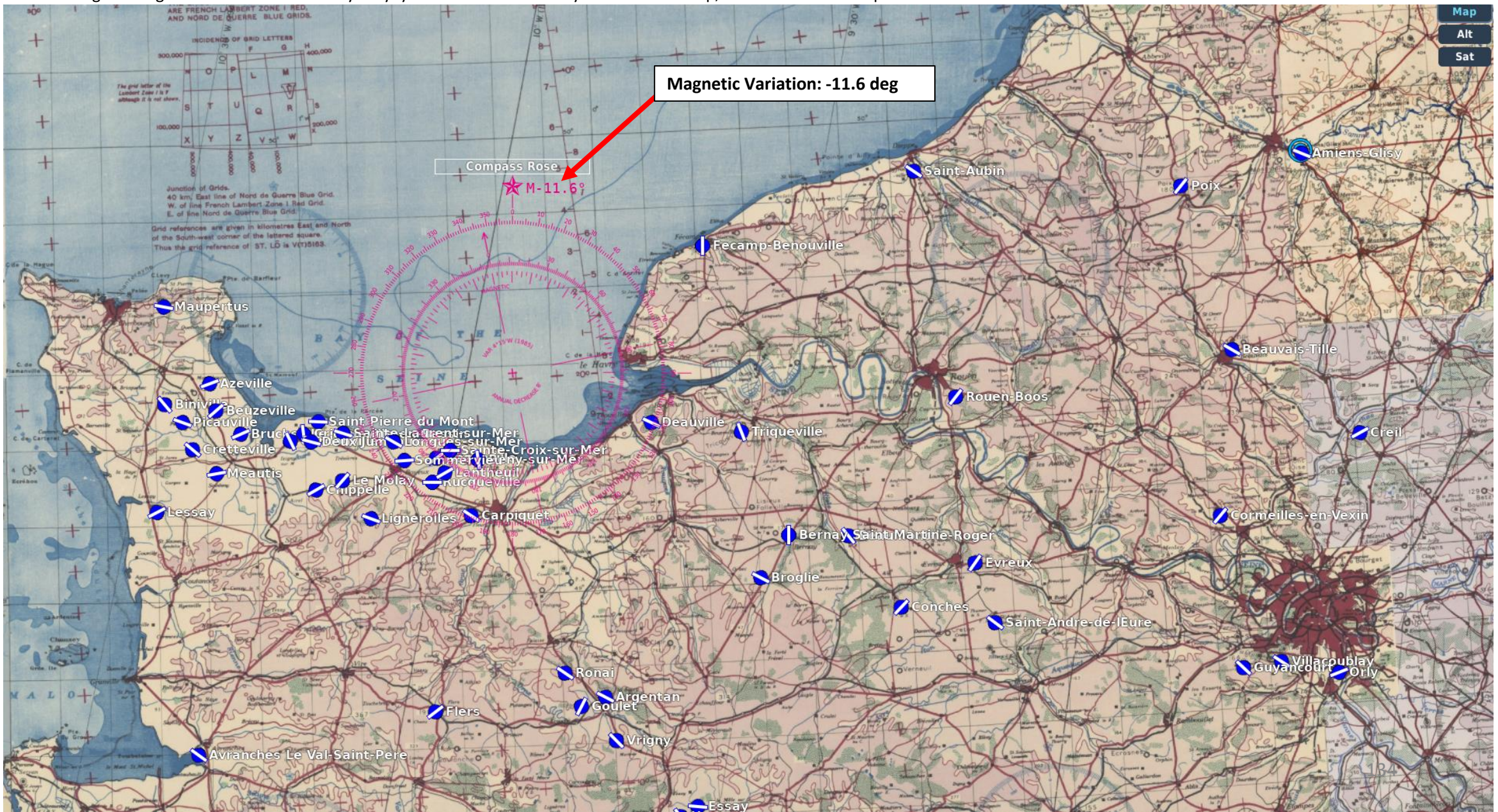


The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007.



MAGNETIC VARIATION

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



AIRPORT DATA NORMANDY 1944

By Minsky
https://www.digitalcombatsimulator.com/en/files/3312200/

AD Normandy 2.0, Part 1

Average magvar: −9° (1944) / +1° (2023)
The magnetic headings below are valid from 1942 to 1950

DimOn

ID	England	ELEV. FEET / METERS	VHF UHF / HF FM	DOT - PRIMARY / LENGTH, feet / GRASS RWY	MAG HDG / 3500 ft (1000 m) OR LESS
71	**Biggin Hill** N51°19'38/.646 E00°01'57/.954	568 173	134.80 5.475 253.45 41.85	BROKEN SPAWNS	033° ~~XX~~ 4800 ~~XX~~ 213° 053° ~~XX~~ 2500 ~~XX~~ 233° 113° ~~XX~~ 2800 ~~XX~~ 293°
27	**Chailey** N50°57'08/.149 W00°02'50/.844	95 29	119.15 4.275 251.05 39.50		082° 07 4200 25 262° 161°•15 3500 33•341°
54	**Deanland** N50°53'03/.059 E00°09'40/.680	72 22	120.60 5.000 252.50 40.95	RWY 34: HUGE BUMP	063° ~~22~~ 3800 ~~34~~ 243°
73	**Detling** N51°18'20/.346 E00°36'05/.092	593 181	118.45 5.525 253.55 41.95		051° 04 3700 22 231°
52	**Farnborough** N51°16'43/.722 W00°46'28/.480	246 75	120.50 4.950 252.40 40.85	17 06 28	071° 06 4700 24 251° 116° 10 3000 28 296° 182°•17 4000 35•002°
31	**Ford** N50°49'05/.085 W00°35'26/.443	29 9	119.40 4.400 251.30 39.75		067° 05 5600 23 247° 153°•14 4500 32•333°
53	**Friston** N50°45'42/.704 E00°10'17/.289	309 94	120.55 4.975 252.45 40.90		069° 06 3700 24 249°
29	**Funtington** N50°52'05/.088 W00°52'08/.144	125 38	119.25 4.325 251.15 39.60		095° 08 6700 26 275° 160°•15 5000 33•340°
66	**Gravesend** N51°25'04/.079 E00°23'48/.802	232 71	121.25 5.325 253.15 41.55	UNEVEN	187° 18 5000 36 007°
50	***Heathrow*** N51°28'39/.657 W00°27'12/.216	89 27	CLOSED, NO ATC		098° 12 8700 30 278°
43	**Kenley** N51°18'14/.240 W00°05'47/.794	561 171	120.05 4.725 251.95 40.40	RWY 30: NO LAND	031° 02 3000 20 211° 131°•~~02~~ 2100 30•311°
37	**Lymington** N50°45'44/.748 W01°30'51/.863	20 6	119.70 4.550 251.60 40.05		068° 06 4200 24 248° 147°•12 3500 30•327°
74	**Lympne** N51°04'58/.969 E01°01'10/.178	225 68	NO ATC		028° 02 3500 20 208° 119°•~~07~~ 3000 ~~25~~•290°
72	**Manston** N51°20'32/.539 E01°20'46/.769	157 48	118.25 5.500 253.50 41.90		060° 05 5000 23 240° 107°•~~XX~~ 8700 ~~XX~~•287°
28	**Needs Oar Point** N50°46'17/.299 W01°26'04/.071	20 6	119.20 4.300 251.10 39.55		071°•06 4200 24•251° 180° 17 4700 35 000°
39	**Odiham** N51°14'03/.065 W00°56'30/.504	366 112	119.80 4.600 251.70 40.15		105° 10 5100 28 285°
58	**Stoney Cross** N50°54'40/.667 W01°39'29/.486	384 117	120.80 5.100 252.70 41.15		073°•06 5800 24•253° 192° 18 4800 36 012°
30	**Tangmere** N50°50'44/.744 W00°42'06/.113	48 15	119.35 4.375 251.25 39.70		072° 06 5700 24 252° 162°•~~03~~ 4400 ~~21~~•332°
41	**West Malling** N51°16'13/.221 E00°24'16/.281	305 93	119.95 4.675 251.85 40.30		074° ~~15~~ 5700 ~~33~~ 254°

DEG°MIN'SEC/.DCML

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

Adjust the above magnetic headings when flying in the following years (expect 1–2 degrees of error):

1935-1941 +1° 1951-1959 -1° 1960-1971 -2° 1972-1979 -3° 1980-1985 -4° 1986-1995 -5°
1996-2001 -6° 2002-2009 -7° 2010-2016 -8° 2017-2020 -9° 2021-2026 -10°

AD Normandy 2.0, Part 2

Average magvar: −9° (1944) / +1° (2023)
The magnetic headings below are valid from 1942 to 1950

DimOn

ID	France A—Deauv	ELEV. FEET / METERS	VHF UHF / HF FM		MAG HDG / 3500 ft (1000 m) OR LESS DOT - PRIMARY / LENGTH, feet / GRASS RWY
75	**Abbeville Drucat** N50°08'16/.274 E01°50'17/.295	217 66	121.55 5.550 253.60 42.00		027° 02 5000 20 207° 093° 09 5000 27 273° 135°•13 5200 31•315°
59	**Amiens-Glisy** N49°52'17/.290 E02°23'30/.513	216 66	120.85 5.125 252.75 38.40		049° 04 5100 22 229° 120°•11 5100 29•300°
32	**Argentan** N48°46'07/.126 W00°01'49/.826	640 195	119.45 4.425 251.35 39.80	AERODROME LOCATED IN THE WESTERN CLUSTER	127° 12 3800 30 307°
65	**Avranches Le Val-Saint-Pere** N48°40'05/.091 W01°22'50/.837	47 14	121.20 5.300 253.10 41.50		137° 13 3800 31 317°
15	**Azeville** A-7 N49°28'51/.859 W01°19'03/.057	75 23	118.50 3.950 250.40 38.85		080° 07 3600 25 260°
34	**Barville** N48°28'48/.807 E00°18'50/.837	463 141	119.55 4.475 251.45 39.90		105° 10 4000 28 285° 156°•15 4100 33•336°
20	**Bazenville** B-2 N49°18'14/.236 W00°33'53/.884	200 61	118.80 4.100 250.70 39.15		063° 05 5400 23 243°
67	**Beaumont-le-Roger** N49°05'46/.780 E00°47'48/.814	489 149	121.30 5.350 253.20 41.60		060° 04 2900 22 240° 092° 07 2400 25 272° 150°•13 2600 31•330°
44	**Beauvais-Tille** N49°27'14/.249 E02°06'47/.792	331 101	120.10 4.750 252.00 40.45		046° 04 5500 22 226° 128°•12 5300 30•308°
21	**Beny-sur-Mer** B-4 N49°17'52/.878 W00°25'35/.597	199 61	118.90 4.150 250.80 39.25		181° 17 4200 35 001°
69	**Bernay Saint Martin** N49°06'15/.264 E00°35'54/.905	512 156	121.40 5.400 253.30 41.70	MESH ISSUES	189° 18 3500 36 009°
14	**Beuzeville** A-6 N49°25'13/.231 W01°17'54/.913	114 35	118.40 3.925 250.35 38.80		059° 05 4300 23 239°
10	**Biniville** A-24 N49°26'12/.202 W01°28'08/.138	107 32	118.15 3.825 250.15 38.60		150° 14 3500 32 330°
68	**Broglie** N49°00'56/.939 E00°29'55/.932	595 181	121.35 5.375 253.25 41.65		127° 12 3700 30 307°
5	**Brucheville** A-16 N49°22'06/.111 W01°12'58/.976	46 14	120.90 5.150 252.80 41.20		076° 07 4800 28 256°
19	**Carpiquet** B-17 N49°10'30/.507 W00°27'16/.268	187 57	118.70 4.050 250.60 39.05		133° 12 5100 30 313°
11	**Cardonville** A-3 N49°21'03/.060 W01°03'03/.060	102 31	118.20 3.850 250.20 38.65		164° 15 4800 33 344°
13	**Chippelle** A-5 N49°14'30/.513 W00°58'17/.299	125 38	118.35 3.900 250.30 38.75		070° 06 4900 24 250°
40	**Conches** N48°56'05/.086 E00°57'40/.676	541 165	119.90 4.650 251.80 40.25		052° 04 5100 22 232°
45	**Cormeilles-en-Vexin** N49°05'35/.594 E02°02'07/.124	312 95	120.15 4.775 252.05 40.50		048°•04 5300 22•228° 122° 11 5200 29 302°
46	**Creil** N49°15'12/.208 E02°31'08/.136	269 82	120.20 4.800 252.10 40.55		069°•~~15~~ 7600 ~~33~~•249° 138° 13 4000 31 318°
3	**Cretteville** A-14 N49°20'11/.194 W01°22'45/.761	95 29	119.85 4.625 251.75 40.20		140° 13 4800 31 320°
7	**Cricqueville-en-Bessin** A-2 N49°21'52/.872 W01°00'24/.414	81 25	121.70 5.625 253.75 42.15		183° 17 4900 35 003°
62	**Deauville** N49°21'51/.855 E00°09'26/.434	459 140	121.05 5.225 252.95 41.35	DAMAGED, LANDABLE	125° 12 3500 30 305°

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

Adjust the above magnetic headings when flying in the following years (expect 1–2 degrees of error):

1935-1941 +1° 1951-1959 -1° 1960-1971 -2° 1972-1979 -3° 1980-1985 -4° 1986-1995 -5°
1996-2001 -6° 2002-2009 -7° 2010-2016 -8° 2017-2020 -9° 2021-2026 -10°

AIRPORT DATA NORMANDY 1944

By Minsky
https://www.digitalcombatsimulator.com/en/files/3312200/

AD Normandy 2.0, Part 3

Average magvar: −9° (1944) / +1° (2023)
The magnetic headings below are valid from 1942 to 1950

DimOn

France — Deux–R

ID		ELEV. FEET / METERS	VHF / UHF	HF / FM	DOT	MAG HDG / 3500 ft (1000 m) OR LESS — PRIMARY / LENGTH, feet / GRASS RWY
12	**Deux Jumeaux** A-4 N49°20'50/.838 W00°58'50/.849	124 38	118.30 3.875 250.25 38.70			115° 10 4800 28 295°
49	**Dinan-Trelivan** N48°26'36/.602 W02°06'11/.187	377 115	120.35 4.875 252.25 40.70			081° 07 2800 25 261°
35	**Essay** N48°31'14/.235 E00°15'27/.461	507 155	119.60 4.500 251.50 39.95			104° 09 3500 27 284°
26	**Evreux** N49°01'25/.426 E01°12'47/.789	423 129	119.10 4.250 251.00 39.45			044°•~~21~~ 4800 ~~35~~•224° 173° 16 5000 34 353°
51	**Fecamp-Benouville** N49°44'46/.776 E00°21'21/.365	295 90	120.45 4.925 252.35 40.80			189° 18 3600 36 009°
64	**Flers** N48°44'57/.952 W00°35'44/.737	661 202	121.15 5.275 253.05 41.45		BUMPY, UNEVEN	063° 05 3800 23 243°
33	**Goulet** N48°44'58/.979 W00°06'41/.688	617 188	119.50 4.450 251.40 39.85			036° ~~21~~ 3700 ~~35~~ 216°
47	**Guyancourt** N48°45'31/.523 E02°04'47/.794	525 160	120.25 4.825 252.15 40.60			051° 04 2900 22 231° 082° 07 2400 25 262° 142°•13 2600 31•322°
36	**Hauterive** N48°29'59/.995 E00°12'00/.004	476 145	119.65 4.525 251.55 40.00			151° ~~15~~ 3700 32 331°
25	**Lantheuil** B-9 N49°16'17/.286 W00°32'18/.304	175 53	119.05 4.225 250.95 39.40			070° 06 3800 24 250°
17	**Le Molay** A-9 N49°15'41/.691 W00°52'54/.900	105 32	118.60 4.000 250.50 38.95			051° 04 4400 22 231°
8	**Lessay** A-20 N49°12'05/.096 W01°30'07/.133	66 20	121.75 5.650 253.80 42.20			073°•06 4800 24•253° 134° 12 5800 30 314°
2	**Lignerolles** A-12 N49°10'30/.513 W00°47'21/.361	405 123	119.30 4.350 251.20 39.65			120° 11 4800 29 300°
18	**Longues-sur-Mer** B-11 N49°20'34/.573 W00°42'21/.357	225 69	118.65 4.025 250.55 39.00			130° 12 4300 30 310°
48	**Lonrai** N48°28'03/.060 E00°02'14/.242	515 157	120.30 4.850 252.20 40.65			069° 06 4700 24 249°
4	**Maupertus** A-15 N49°38'59/.987 W01°28'01/.017	441 134	120.40 4.900 252.30 40.75			111° 10 4800 28 291°
6	**Meautis** A-17 N49°16'59/.990 W01°18'00/.014	83 25	121.45 5.425 253.35 41.75			090° 08 4400 26 270°
77	**Merville Calonne** N50°37'13/.233 E02°39'12/.205	131 40	121.65 5.600 253.70 42.10			042° 03 4900 21 222° 082°•~~XX~~ 4900 ~~XX~~•262° 145° 14 5100 32 325°
57	**Orly** N48°44'06/.108 E02°23'30/.508	272 83	120.75 5.075 252.65 41.10			022° 01 3600 19 202° 076°•07 3600 25•256°
16	**Picauville** A-8 N49°23'46/.782 W01°24'40/.669	73 22	118.55 3.975 250.45 38.90			120° 11 4400 29 300°
56	**Poix** N49°49'07/.130 E01°58'38/.636	547 167	120.70 5.050 252.60 41.05			047°•04 5100 22•227° 098° 09 5100 27 278°
60	**Ronai** N48°49'24/.403 W00°09'40/.673	860 262	120.95 5.175 252.85 41.25			083° 07 4100 25 263° 134°•12 4500 30•314°
61	**Rouen-Boos** N49°23'13/.232 E01°10'44/.737	493 150	121.00 5.200 252.90 41.30			047° 04 3500 22 227°
23	**Rucqueville** B-7 N49°15'05/.085 W00°34'49/.819	193 59	118.95 4.175 250.85 39.30			100° 09 4700 27 280°

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

Adjust the above magnetic headings when flying in the following years (expect 1–2 degrees of error):
1935-1941 +1° 1951-1959 -1° 1960-1971 -2° 1972-1979 -3° 1980-1985 -4° 1986-1995 -5°
1996-2001 -6° 2002-2009 -7° 2010-2016 -8° 2017-2020 -9° 2021-2026 -10°

AD Normandy 2.0, Part 4

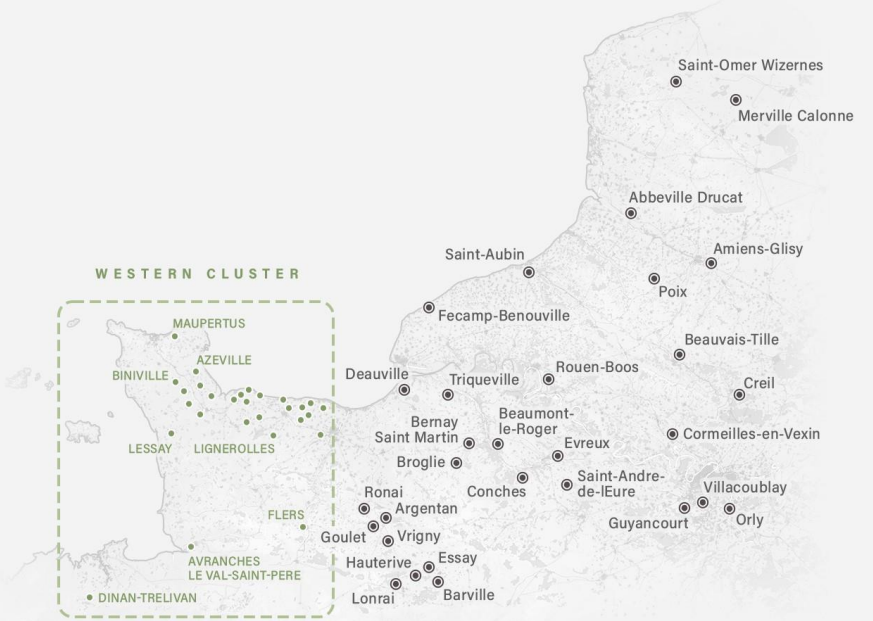
Average magvar: −9° (1944) / +1° (2023)
The magnetic headings below are valid from 1942 to 1950

DimOn

France — S–V

ID		ELEV. FEET / METERS	VHF / UHF	HF / FM	DOT	MAG HDG / 3500 ft (1000 m) OR LESS — PRIMARY / LENGTH, feet / GRASS RWY
1	**Saint Pierre du Mont** A-1 N49°23'25/.430 W00°57'25/.425	103 31	118.75 4.075 250.65 39.10			102° 09 4900 27 282°
70	**Saint-Andre-de-lEure** N48°53'28/.475 E01°16'05/.099	473 144	121.50 5.450 253.40 41.80			058° 05 5000 23 238° 136°•13 5000 31•316°
63	**Saint-Aubin** N49°53'06/.100 E01°04'/49.825	312 95	121.10 5.250 253.00 41.40		DAMAGED, LANDABLE	133° 12 3500 ~~31~~ 313°
76	**Saint-Omer Wizernes** N50°43'43/.729 E02°13'55/.932	213 65	121.60 5.575 253.65 42.05			039° 03 1700 21 219° 099°•~~XX~~ 2000 ~~XX~~•279°
21	**Sainte-Croix-sur-Mer** B-3 N49°19'13/.216 W00°31'02/.035	160 49	118.85 4.125 250.75 39.20			100° 09 4500 27 280°
9	**Sainte-Laurent-sur-Mer** A-21 N49°21'52/.867 W00°52'24/.409	62 19	121.80 5.675 253.85 42.25			117° 11 4800 29 297°
24	**Sommervieu** B-8 N49°18'00/.013 W00°40'15/.257	187 57	119.00 4.200 250.90 39.35			096° 09 4500 27 276°
55	**Triqueville** N49°20'10/.172 E00°27'29/.496	404 123	120.65 5.025 252.55 41.00			168° ~~15~~ 3800 34 348°
42	**Villacoublay** N48°46'02/.040 E02°12'18/.300	558 170	120.00 4.700 251.90 40.35			131° 12 3900 30 311°
38	**Vrigny** N48°40'20/.336 W00°00'07/.129	581 180	119.75 4.575 251.65 40.10			145° 14 3800 32 325°

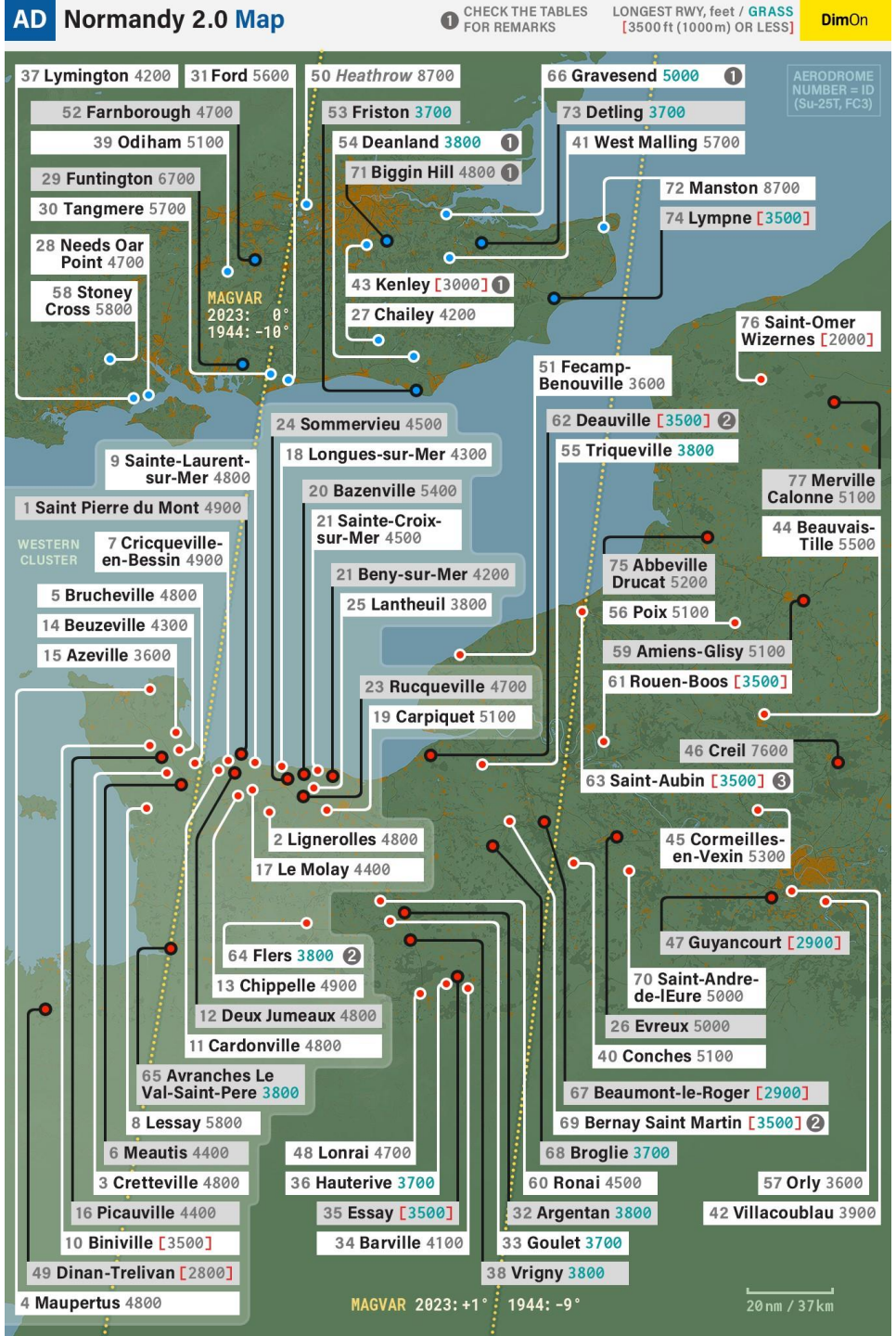
IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH



Adjust the above magnetic headings when flying in the following years (expect 1–2 degrees of error):
1935-1941 +1° 1951-1959 -1° 1960-1971 -2° 1972-1979 -3° 1980-1985 -4° 1986-1995 -5°
1996-2001 -6° 2002-2009 -7° 2010-2016 -8° 2017-2020 -9° 2021-2026 -10°

AIRPORT DATA NORMANDY 1944

By Minsky
https://www.digitalcombatsimulator.com/en/files/3312200/



AIRPORT DATA ENGLISH CHANNEL 1944

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https://www.digitalcombatsimulator.com/en/files/3312200/

AD The Channel

Average magvar: −11° (1944) / +1° (2023)
The magnetic headings below are valid from 1938 to 1950

DimOn

ID		DEG° MIN'SEC/.DCML	ELEV. FEET METERS	VHF UHF	HF FM	MAG HDG / 3500 ft (1000 m) OR LESS DOT – PRIMARY / LENGTH, feet / GRASS RWY
	England					
1	**Biggin Hill**	N51°19'36/.602 E00°01'51/.866	553 169	118.20 250.20	3.850 38.60	040° 04 4700 22 220° 059°•05 2300 23•239° 119° 12 2500 30 299°
8	**Detling**	N51°18'18/.302 E00°35'59/.991	623 190	118.60 250.60	4.050 39.00	058° 05 3700 23 238°
9	**Eastchurch**	N51°23'24/.408 E00°50'48/.814	40 13	118.05 250.05	3.775 38.45	034° 02 3100 20 214° 109°•10 3500 28•289°
6	**Hawkinge**	N51°06'42/.714 E01°09'36/.615	525 160	118.50 250.50	4.000 38.90	011°•01 2500 19•191° 050° 05 3100 23 230°
11	**Headcorn**	N51°10'57/.956 E00°41'22/.369	115 35	118.15 250.15	3.825 38.55	024° 02 3800 20 204° 104°•10 4100 ~~29~~•284°
10	**High Halden**	N51°07'17/.298 E00°41'37/.624	105 32	118.10 250.10	3.800 38.50	042° 04 4300 22 222° 113°•11 3900 29•293°
7	**Lympne**	N51°04'50/.839 E01°01'01/.022	351 107	118.55 250.55	4.025 38.95	031° 02 2600 20 211° 145°•13 3200 31•325° 169° 16 3500 34 349°
5	**Manston**	N51°20'31/.518 E01°20'46/.768	161 50	118.45 250.45	3.975 38.85	067° ~~04~~ 4800 ~~22~~ 247° 113°•10 9000 28•293°
	France					
1	**Abbeville Drucat**	N50°08'36/.607 E01°49'55/.916	184 56	118.25 250.25	3.875 38.65	034°•02 5100 20•214° 100° 09 5100 27 280° 142° 13 5100 31 322°
4	**Dunkirk Mardyck**	N51°01'46/.777 E02°15'08/.147	16 5	118.40 250.40	3.950 38.80	091° 08 2000 26 271°
2	**Merville Calonne**	N50°37'10/.170 E02°38'17/.287	52 16	118.30 250.30	3.900 38.70	048° 04 5100 22 228° 088° 08 5100 26 268° 149°•14 5000 32•329°
3	**Saint Omer Longuenesse**	N50°43'43/.721 E02°13'54/.915	220 67	118.35 250.35	3.925 38.75	040° 03 1600 21 220° 097°•08 2000 26•277°

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

Adjust the above magnetic headings when flying in the following years (expect about 1 degree of error):

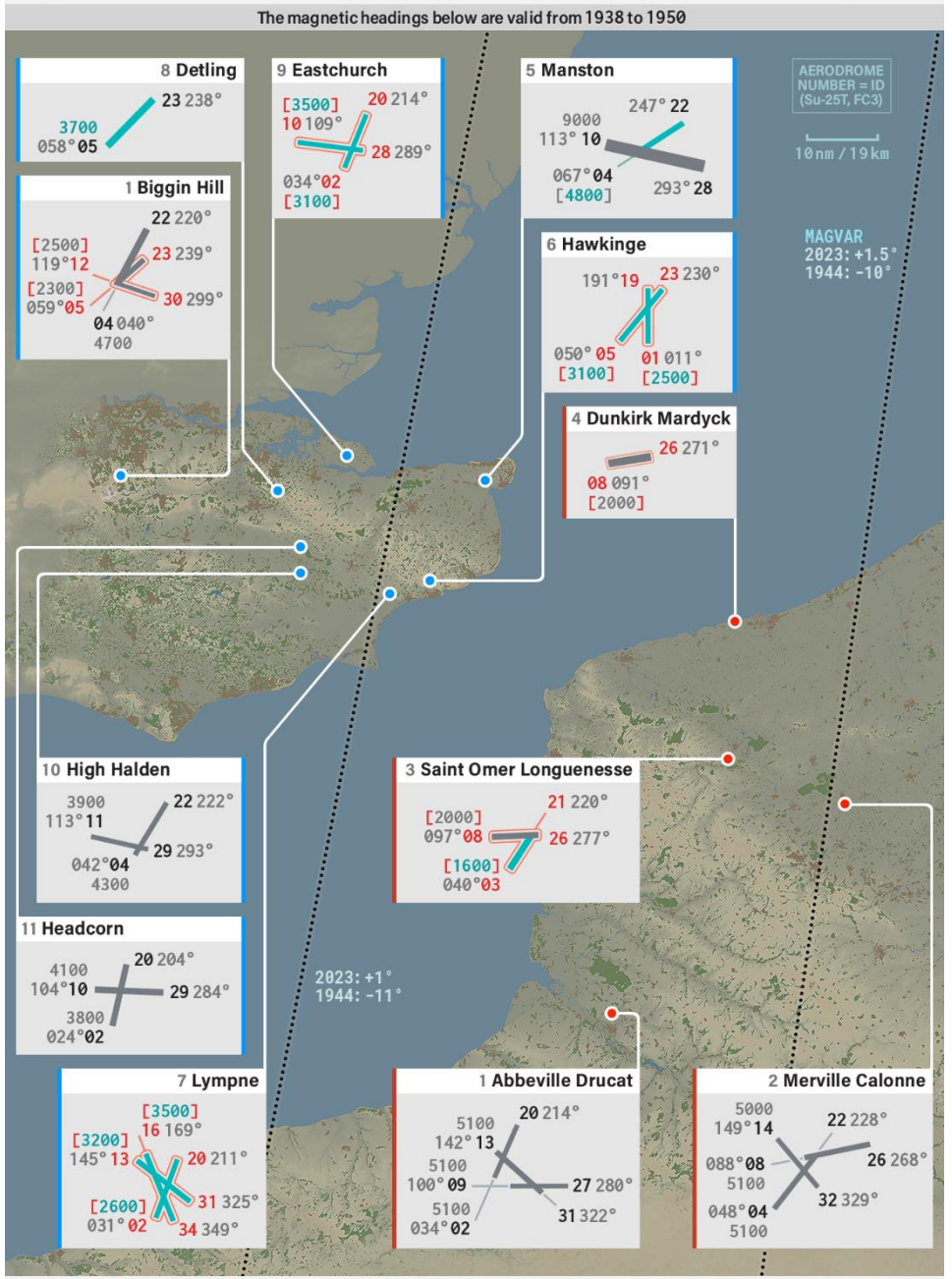
1951–1954 −1° 1955–1961 −2° 1962–1967 −3° 1968–1972 −4° 1973–1979 −5° 1980–1987 −6°
1988–1995 −7° 1996–2001 −8° 2002–2009 −9° 2010–2015 −10° 2016–2021 −11° 2022–2026 −12°

AD The Channel Map

RUNWAY LENGTH, feet / GRASS [3500 ft (1000 m) OR LESS]

DimOn

The magnetic headings below are valid from 1938 to 1950



Adjust the above magnetic headings when flying in the following years (expect about 1 degree of error):

1951–1954 −1° 1955–1961 −2° 1962–1967 −3° 1968–1972 −4° 1973–1979 −5° 1980–1987 −6°
1988–1995 −7° 1996–2001 −8° 2002–2009 −9° 2010–2015 −10° 2016–2021 −11° 2022–2026 −12°

AIR COMBAT TIPS

The Bf.109K-4 variant modelled in DCS is one of the deadliest WWII fighters when flown properly.

The way to fly a Bf.109 is pretty much the same in every simulator: keep your energy state high (meaning that you must keep your airspeed and your altitude up) at all times and avoid turning with an enemy fighter that turns hard to try to make you bleed your energy. In most situations, a Bf.109 will easily outclimb a P-51 Mustang or a Spitfire. Use this to your advantage.

The 109 is first and foremost an energy fighter. In combat, a pilot is faced with a variety of limiting factors. Some limitations are constant such as gravity, drag, and thrust-to-weight-ratio. Other limitations vary with speed and altitude, such as turn radius, turn rate, and the specific energy of the aircraft. The fighter pilot uses BFM (Basic Flight Manoeuvers) to turn these limitations into tactical advantages. A faster, heavier aircraft may not be able to evade a more maneuverable aircraft in a turning battle (like the Spitfire), but can often choose to break off the fight and escape by diving or using its thrust to provide a speed advantage. A lighter, more maneuverable aircraft can not usually choose to escape, but must use its smaller turning radius at higher speeds to evade the attacker's guns, and to try to circle around behind the attacker. This is the principle behind “energy fighting”: use boom and zoom tactics instead of trying to turn with an enemy aircraft that has a smaller turn radius.

The 109 is blessed with a very high power-to-weight ratio, meaning that it has a great acceleration. It is equally quite manoeuverable and can reach higher airspeeds than the Mustang at altitudes under 20,000 ft (6 km). I would recommend avoiding dogfights above these altitudes since this is where the Mustang has the advantage.

ADVICE ON HOW TO FLY TAILDRAGGER AIRCRAFT

Taming taildraggers is much more difficult than meets the eye, especially during the takeoff and landing phase. Here is a useful and insightful essay on the art of flying taildraggers wonderfully written by *Chief Instructor*. I highly recommend you give it a read.

Link: https://drive.google.com/open?id=0B-uSpZROuEd3V3Jkd2pfa0xRRW8

TAMING TAILDRAGGERS

Essay by Chief Instructor (CFI)

PART 1

Why taildraggers are tricky and how to overcome it

What do I know about it? Well, I have spent a significant proportion of my professional flying career teaching both experienced and novice pilots how to fly and handle tail-dragging aircraft. This amounts to several thousand hours of tailwheel training alone, though who's counting! These aircraft include among them modern high performance aerobatic aircraft and a variety of more vintage types from DH Tiger Moths, to Harvards. I can't recall off the top of my head exactly how many students I've worked with over the years, but it's well over 200! Best of all, they have all gone on to fly extensive tailwheel ops in a variety of types and to the best of my knowledge, only 2 of them have crashed anything since!

As a significant number of pilots here are expressing difficulties with tailwheel handling,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CA 1.5.3
F-86F 1.5.3
FC3 1.5.3
Fw 190 D-9 1.5.3
Hawk l.5.3 Beta EFM
Ka-50 1.5.3
L-39 1.5.3
M-2000C 1.5.3 Beta
Mi-8MTV2 1.5.3 beta
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MiG-21bis 1.5.3
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