DCS GUIDE
FW190-D9 DORA

By Chuck
LAST UPDATED: 20/09/2023

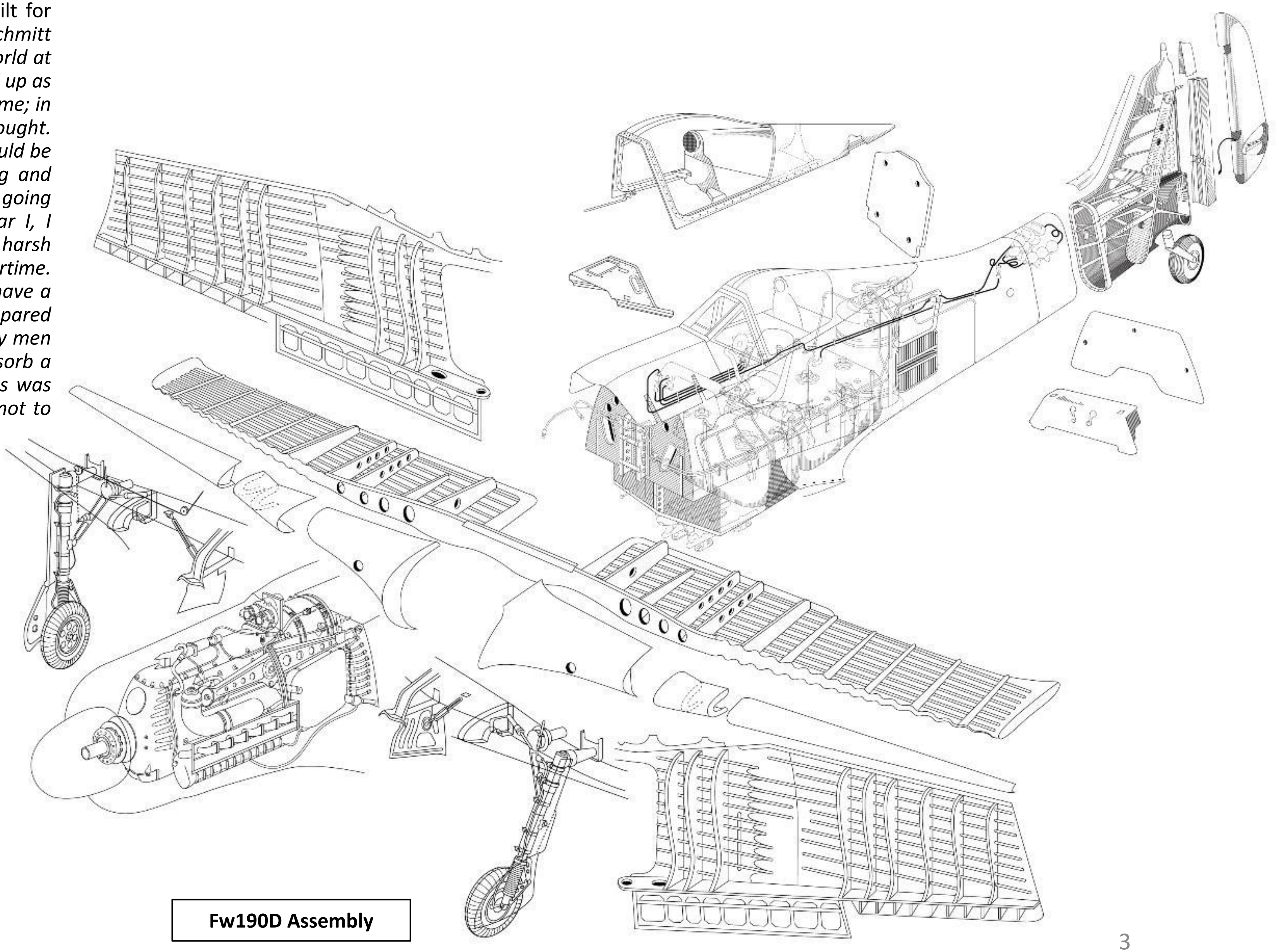
TABLE OF CONTENTS

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

The **Focke-Wulf Fw190** *Würger* (English: Shrike) is a German single-seat, single-engine fighter aircraft designed by Kurt Tank in the late 1930s and widely used during World War II. Along with its well-known counterpart, the Messerschmitt Bf.109, the Fw190 became the backbone of the Luftwaffe's Jagdwaffe (Fighter Force). The twin-row BMW 801 radial engine that powered most operational versions enabled the Fw190 to lift larger loads than the Bf.109, allowing its use as a day fighter, fighter-bomber, ground-attack aircraft and, to a lesser degree, night fighter.

Kurt Tank wanted something more than an aircraft only built for speed. He outlined his design philosophy as: "*The Messerschmitt 109 [sic] and the British Spitfire, the two fastest fighters in world at the time we began work on the Fw190, could both be summed up as a very large engine on the front of the smallest possible airframe; in each case armament had been added almost as an afterthought. These designs, both of which admittedly proved successful, could be likened to racehorses: given the right amount of pampering and easy course, they could outrun anything. But the moment the going became tough they were liable to falter. During World War I, I served in the cavalry and in the infantry. I had seen the harsh conditions under which military equipment had to work in wartime. I felt sure that a quite different breed of fighter would also have a place in any future conflict: one that could operate from ill-prepared front-line airfields; one that could be flown and maintained by men who had received only short training; and one that could absorb a reasonable amount of battle damage and still get back. This was the background thinking behind the Focke-Wulf 190; it was not to be a racehorse but a Dienstpferd, a cavalry horse.*"

Kurt Tank
(1898-1983)



Fw190D Assembly

The Focke-Wulf 190 project began in the summer of 1938. The head of the aircraft design team, Kurt Tank, put forward two proposals: one variant of the aircraft outfitted with a Daimler-Benz DB 601 liquid cooled engine, and a second outfitted with the new air-cooled BMW 139 radial engine. The FW190 V-1 prototype was a cantilevered low-wing aircraft with a stressed-skin wing. Its maiden flight took place on July 1, 1939. The second prototype, the Fw190 V-2, took off in October 1939. This variant was armed with two 13-mm MG 131 machine guns and two MG 17 7.92 mm machine guns. Both aircraft were equipped with large propeller domes which would later on be replaced with NACA propeller domes.

Before the second prototype made its first flight, the decision was made to replace the BMW 139 engine with the more powerful, but longer and heavier BMW 801 engine. The first seven units of the pre-production batch of what became the Fw190 A-0 were outfitted with the original wing, while the rest had the longer wing design. The first combat unit was equipped with these aircraft in August 1941.

The work on the D (Dora) series began in 1942. As the new Junkers Jumo 213 engine offered clear improvements in performance, the decision was made to use it with the 190 airframe. While Kurt Tank, the Fw 190's lead designer, preferred the Daimler-Benz DB 600 series, the engines were already used in Messerschmitt fighters, while a surplus of the Jumo 213 bomber engines were readily available. The brand-new 213, an improvement on the earlier Jumo 211, offered 1,750 hp of take-off power that could be boosted up to an astonishing 2,100 hp of emergency power with MW-50 injection.

A Fw190 A-8 airframe was used as a basis for the new D-series design. While the earlier radial engine was air-cooled, the liquid-cooled Jumo 213 required a radiator, which further added to airframe length and weight. Kurt Tank chose to go with a simple annular radiator design. The airframe was strengthened, and both the nose and the tail sections were increased in length by almost 1.52 meters. The canopy design on the Dora series was changed during the production run. The first production examples used a flat-top canopy used on earlier A-series, the later Doras were upgraded to the advanced rounded-top canopy similar to Allied bubble canopies which offered improved all-around visibility. Other airframe improvements included a smaller streamlined center weapons rack.

While originally intended to serve as a bomber interceptor, changing realities of the war in the air meant that by the time the Dora entered production in August of 1944, it mostly saw combat against enemy fighters or in a ground attack role. The earliest pre-production variants designated D-0 had the external wing guns removed; this was often reversed and future D variants were produced with the wing guns. Most D-9s intended for lighter anti-fighter role were still built without the outer wing guns, featuring a pair of 13 mm MG 131 machine guns and twin 20 mm MG 151/20E cannons.

The first production variants were designated D-9; there was no production of any interim designations between D-1 to D-8. The initial D-9 variants were rushed into service without the crucial MW-50 water injection. By December of 1944, all early variants were field-converted to spec. Later production D-9 variants built with the MW-50 at the factory had the tank that could be used for dual purposes, either for the methanol water injection or as an additional fuel tank.

In 1942, the Bf.109 began to be partially replaced in Western Europe by the Focke-Wulf; many Bf.109 pilots transitioned to the Fw190. At that time, the Fw190 had greater firepower than the Bf.109 and, at low to medium altitude, superior manoeuvrability, which explains the logic behind this decision. The Fw190 would prove to be a more reliable aircraft, in some respects, than the Bf.109. It handled well on the ground, and its wide undercarriage made it more suited to the often primitive conditions on the Eastern Front (providing an easier and relatively safer takeoff and landing compared to a narrower landing gear). It could also sustain heavier damage than the Bf.109 and survive owing to its radial engine.

The Fw190A series' performance decreased at high altitudes (usually 6,000 m (20,000 ft) and above), which reduced its effectiveness as a high-altitude interceptor. From the Fw190's inception, there had been ongoing efforts to address this with a turbosupercharged BMW 801 in the B model, the much longer-nosed C model with efforts to also turbocharge its chosen Daimler-Benz DB 603 inverted V12 powerplant, and the similarly long-nosed D (Dora) model with the Junkers Jumo 213. Problems with the turbocharger installations on the -B and -C subtypes meant only the D model would see service, entering service in September 1944.

Initial opinion of the Dora was not very high. Kurt Tank always stated that the D-9 was intended only as an interim stop-gap until a more perfect Ta152 design could enter production. However, once Luftwaffe pilots got their hands on the stop-gap Long-Nosed Dora, they were pleasantly surprised. Performance and handling were good. When flown by capable pilots, the aircraft was more than a match to Allied fighters. The Long-Nosed Dora is considered the best mass-produced late-war Luftwaffe fighter. In total, over 700 Doras were produced out of a total Fw190 production run of over 20,000. To this day, it remains one of the most recognizable shapes in the skies, and one of the most influential aircraft designs of the entire aviation era.

While the Dora gave german pilots parity with Allied opponents, it arrived far too late in the war to have any real effect. The D-9 series was rarely used against heavy-bomber raids, as the circumstances of the war in late 1944 meant that fighter-versus-fighter combat and ground attack missions took priority.

The Ta152 was a further development of the Fw190 aircraft, and it was intended to be made in at least three versions – the Ta152H *Höhenjäger* ("high-altitude fighter"); the Ta152C designed for medium-altitude operations and ground-attack, using a Daimler-Benz DB 603 and smaller wings; and the Ta152E fighter-reconnaissance aircraft with the engine of the H model and the wing of the C model. The first Ta152H entered service with the Luftwaffe in January 1945... But in too few numbers to alter the course of the war.

Overall, the Fw109 was produced in the following variant "families":

- A-0: Pre-Production variant
- A1-A9: "Anton" variant, initial production models, used for low to medium altitude in both air-to-air and ground attack roles
- F: "Friedrich" variant, mainly used for ground attack roles.
- G: "Gustav" variant, used for long-range attack missions.
- D: "Dora" variant, used for high altitude with a Junkers Jumo 213 liquid-cooled engine.
- S: re-designated trainers from Anton models.
- Ta152: Late Fw190 variant that was developed after the Dora.

Fw190 Production

Variant	Amount	Years produced
Fw 190 A-1	102	1941 June – 1941 October
Fw 190 A-2/A-3	909	1941 October – 1943 August
Fw 190 A-4	975	1942 June – 1943 August
Fw 190 A-5	1,752	1942 November – 1943 August
Fw 190 A-6	1,052	1943 May – 1944 March
Fw 190 A-7	701	1943 November – 1944 March
Fw 190 A-8	6,655	1944 February – 1945 February
Fw 190 A-9	930	1944 September – 1945 February
Total (including prototypes and pre-production aircraft)	**13,291**	—
Fw 190 F-1/F-2(A-4)	18 & 271	1942 May – 1943 May
Fw 190 F-3(A-5)	432	1943 May – 1944 April
Fw 190 F-8(A-8)	6,143	1944 March – 1945 February
Fw 190 F-9(A-9)	415	1944 September – 1945 February
Totals	**7,279**	—
Fw 190 G-1(A-4)	183	1942 August – 1942 November
Fw 190 G-2(A-5)	235	1942 July – 1943 May
Fw 190 G-3(A-6)	214	1943 June – 1943 December
Fw 190 G-8(A-8)	689	1943 August – 1944 February
Totals	**approx. 1,300**	—
Fw 190 D-9	1,805	1944 August – 1945 April [nb 1]
Fw 190 D-11	20	1945 February – 1945 March
Fw 190 D-13	1	1945 April – 1945 April
Totals	**1,826**	—
Fw 190 S-5 converted from A-5 or built	c. 20	1944 late
Fw 190 S-8 converted from A-8 or built	c. 38	1944 late
Totals	**58**	—
Ta 152 V/H-0	18/26	1944 December – 1945 January
Ta 152 H-1	25	1945 January – 1945 April
Totals	**69**	—
Total (all variants)	**23,823**	—

Records indicate that the majority of Fw190 air victories were achieved in the “A” (also referred as “Anton”) variants since it was the most produced (13,291 Antons vs 1,300 Doras). The Fw190 was well-liked by its pilots. 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.

The top scoring pilot in the FW190D was Oberleutnant Hans Dortenmann. The first Gruppe to convert to the "Dora" was III/JG 54 followed by JG 26. Dortenmann flew with both JG 54 and JG 26. Transitioning from other aircraft types (like the Bf.109) to the Dora was sometimes difficult for certain pilots, a prime example being the famous Gerd Barkhorn, who had trouble adapting to the new aircraft despite his spectacular amount of victories in the Bf.109.

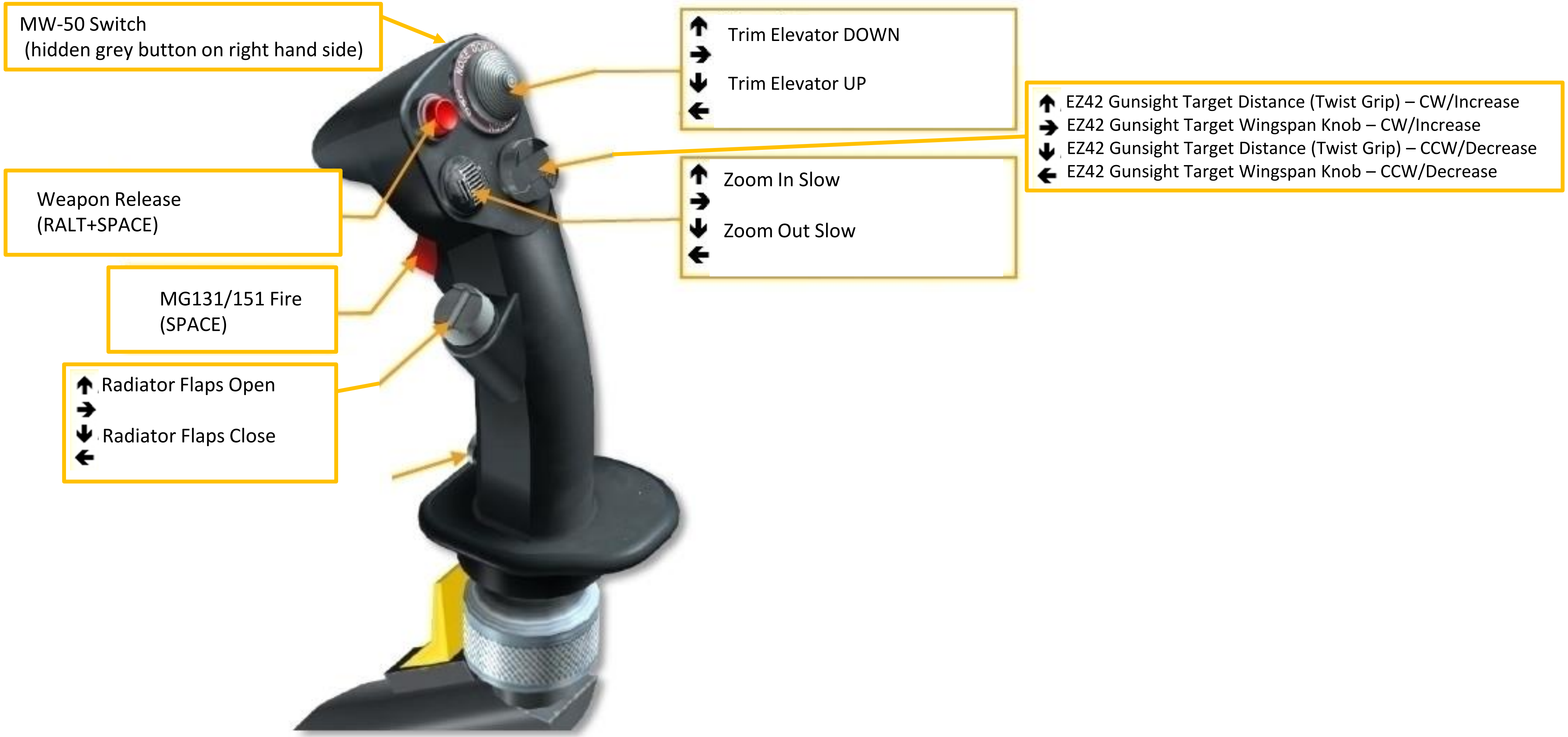
Flying ace Heinz Marquardt has a very interesting story as well. On 1 May 1945 Marquardt became Jagdgeschwader 51's last casualty of the war when he was shot down by Royal Air Force Spitfires north of Berlin. Marquardt had led a flight of six Focke-Wulf Fw190 D-9 on an escort mission of 12 Fw 190 F-8 ground attack aircraft from Redlin on a mission to Berlin. After completing the mission the aircraft returned to Schwerin. During the landing approach the flight came under attack of 6 Spitfire Mk XIV from No. 41 Squadron. Marquardt ordered his flight to cover the landing of the ground attack fighters while he and his wingman, Feldwebel Radlauer, attacked the Spitfires from below. Marquardt claimed one of the attackers but was shot down as well along with two other Fw190s. Radlauer saw Marquardt's Fw190 crash in flames but did not observe any sign of life. Marquardt was initially reported as killed in action but he had bailed out injured and was taken to a hospital in Schwerin, where he was taken prisoner of war shortly after. Following World War II, Marquardt served in the newly established German Air Force of West Germany with the rank of Leutnant (Second Lieutenant) on 16 August 1956. He served with Jagdgeschwader 73 (JG 73) and *Leichtes Kampfgeschwader* 42 (LeKG 42). Marquardt retired on 30 September 1973, having risen to the rank of Oberstleutnant (Lieutenant Colonel).

Hans Dortenmann
(1921-1973)
39 Aerial Victories

Heinz Marquardt
(1922-2003)
121 Aerial Victories

In DCS, I realized after a couple of sorties in the FW190 that Kurt was indeed quite right: the ergonomic cockpit layout is a refreshing change from the cluttered interior of the 109 and you can clearly see that the Dora, just like the Anton, was built as a functional, high-powered war machine. You inevitably feel like you are sitting in a high-performance flying tank. And this feeling is pretty awesome.

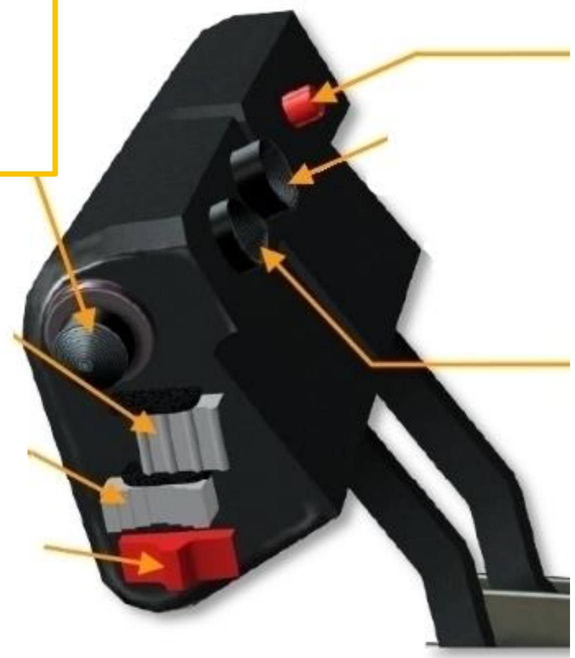
WHAT YOU NEED MAPPED



+ TOE BRAKES (MAPPED ON PEDALS)

WHAT YOU NEED MAPPED

↑
→ COMM – Push-to-Talk
↓
←
P

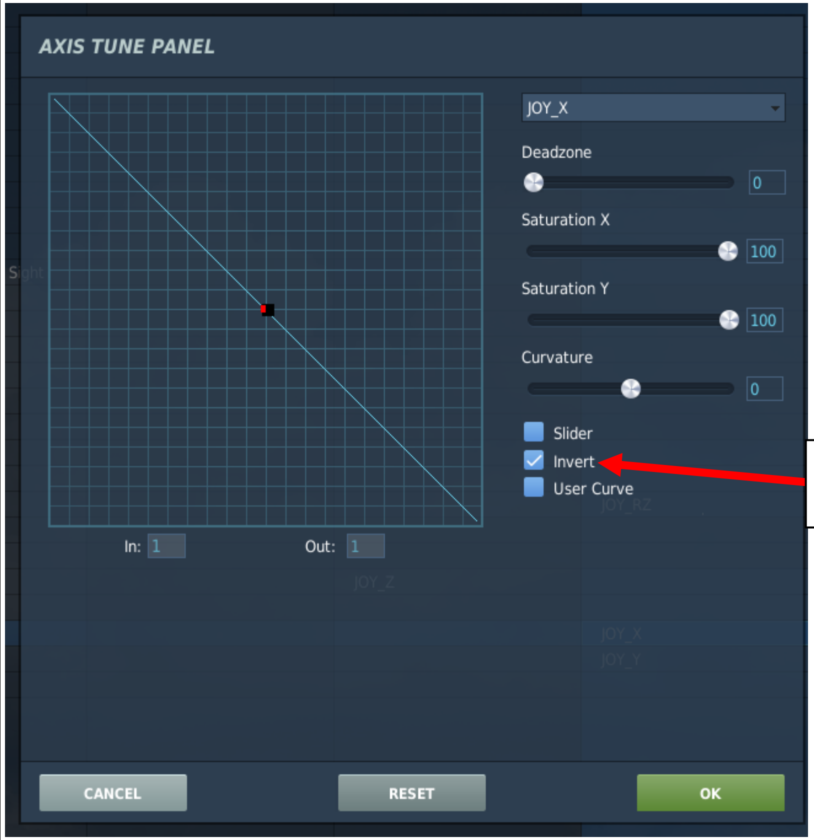


Throttle Lever

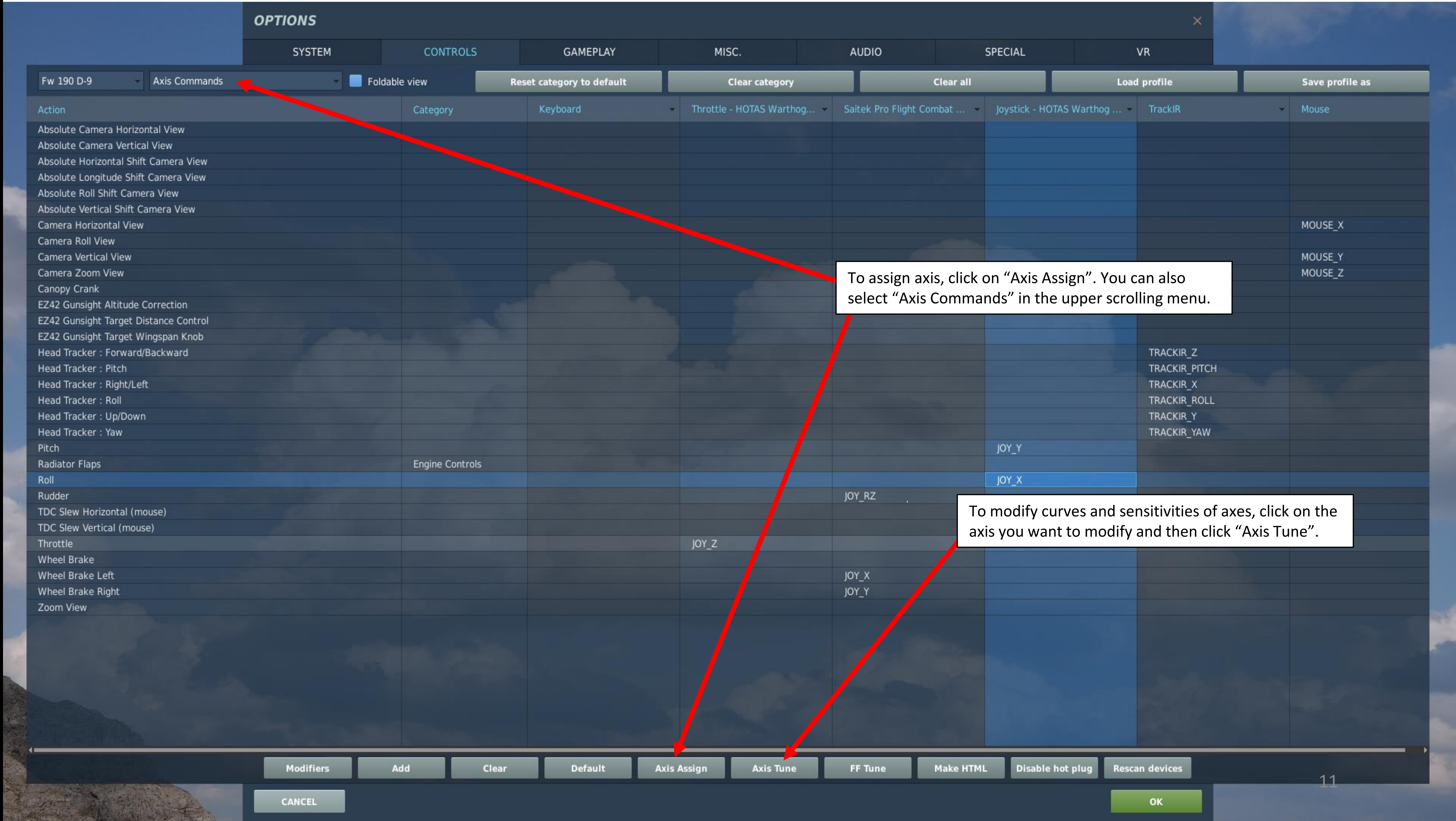
Landing Gear – Up/Down

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



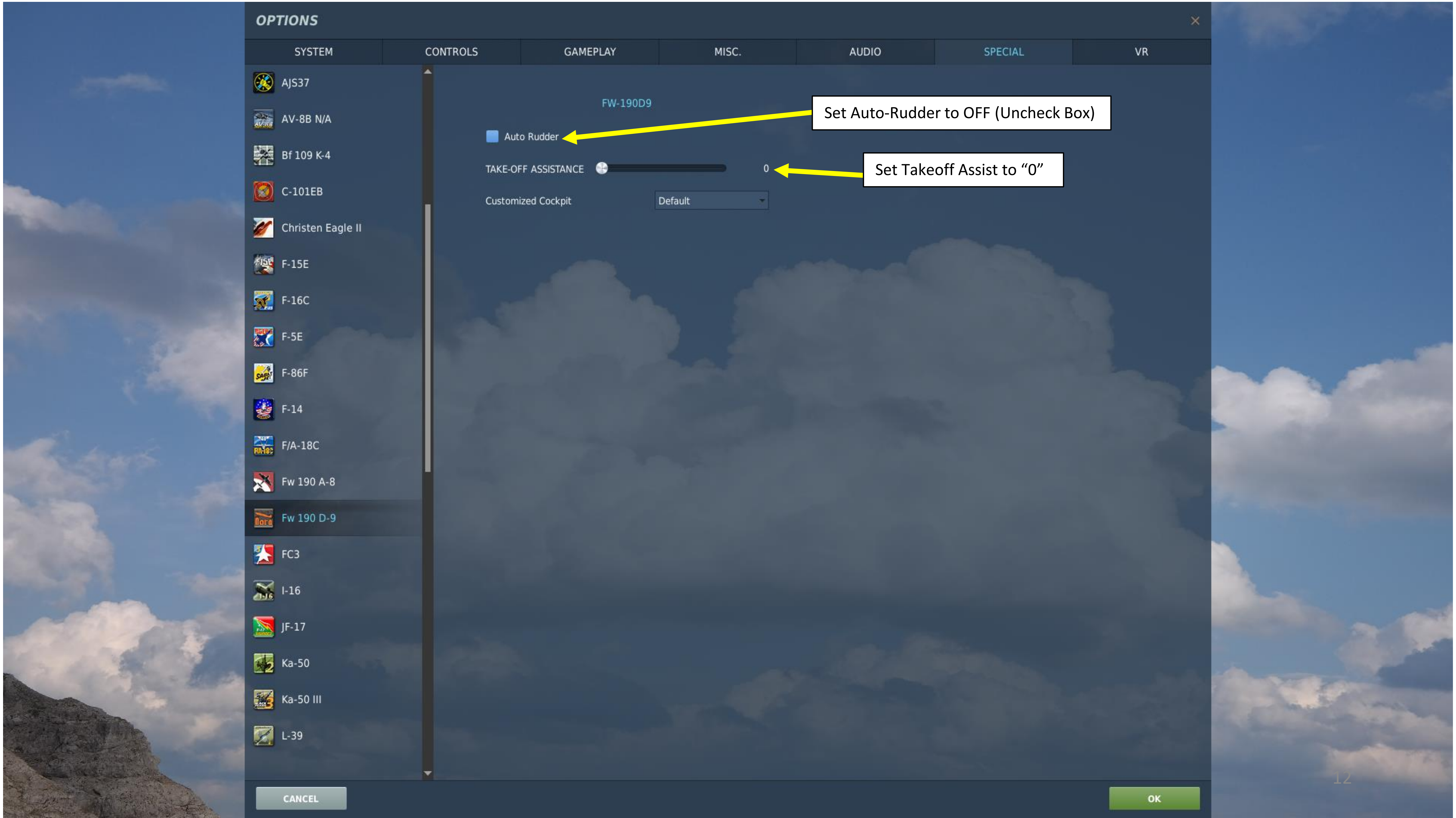
When setting wheel brake axis, they are not set to "INVERT" by default. You need to click on INVERT in the Axis Tune menu for each wheel brake.



To assign axis, click on “Axis Assign”. You can also select “Axis Commands” in the upper scrolling menu.

To modify curves and sensitivities of axes, click on the axis you want to modify and then click “Axis Tune”.

In the “Special” menu in Options, select the FW190 D-9 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.

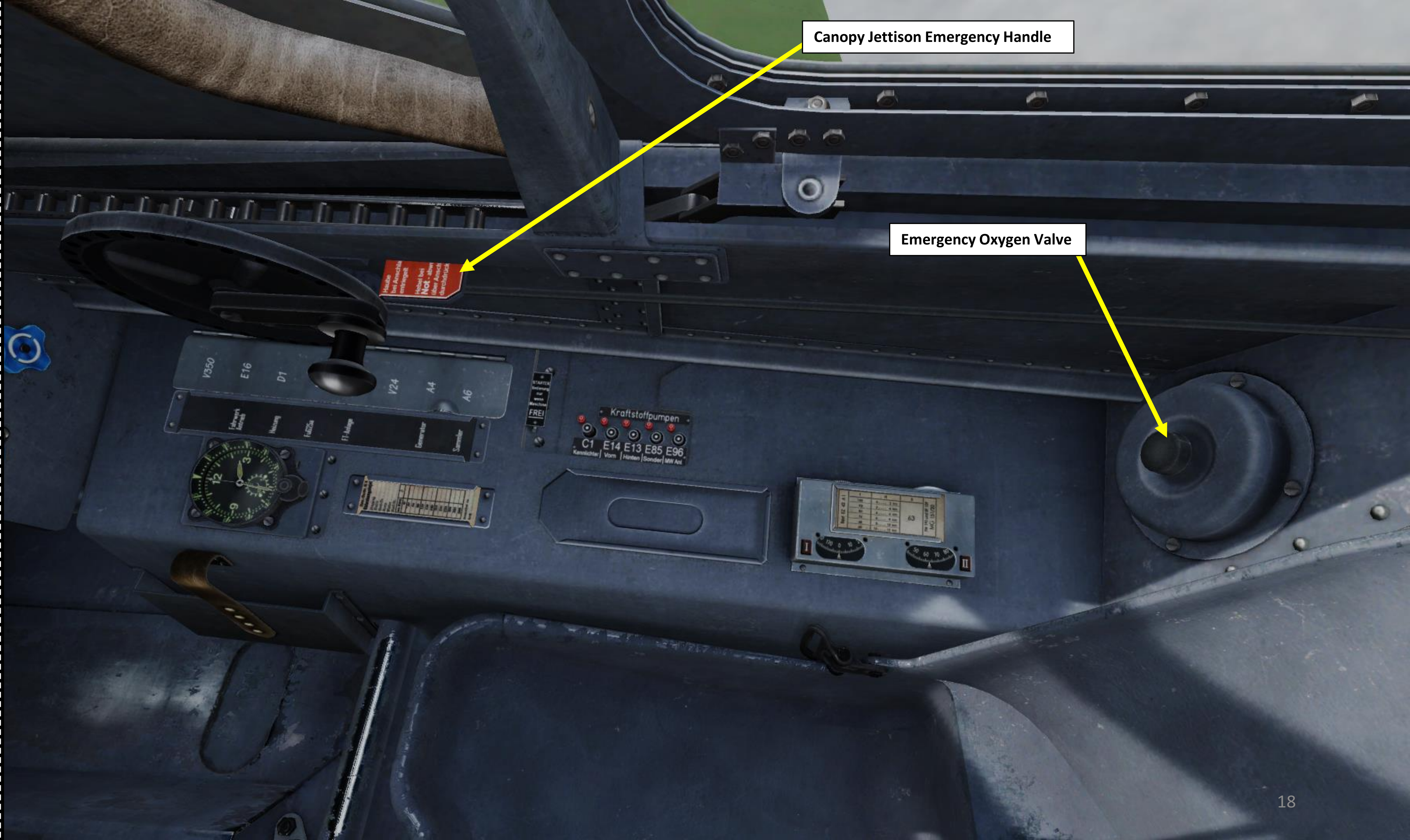


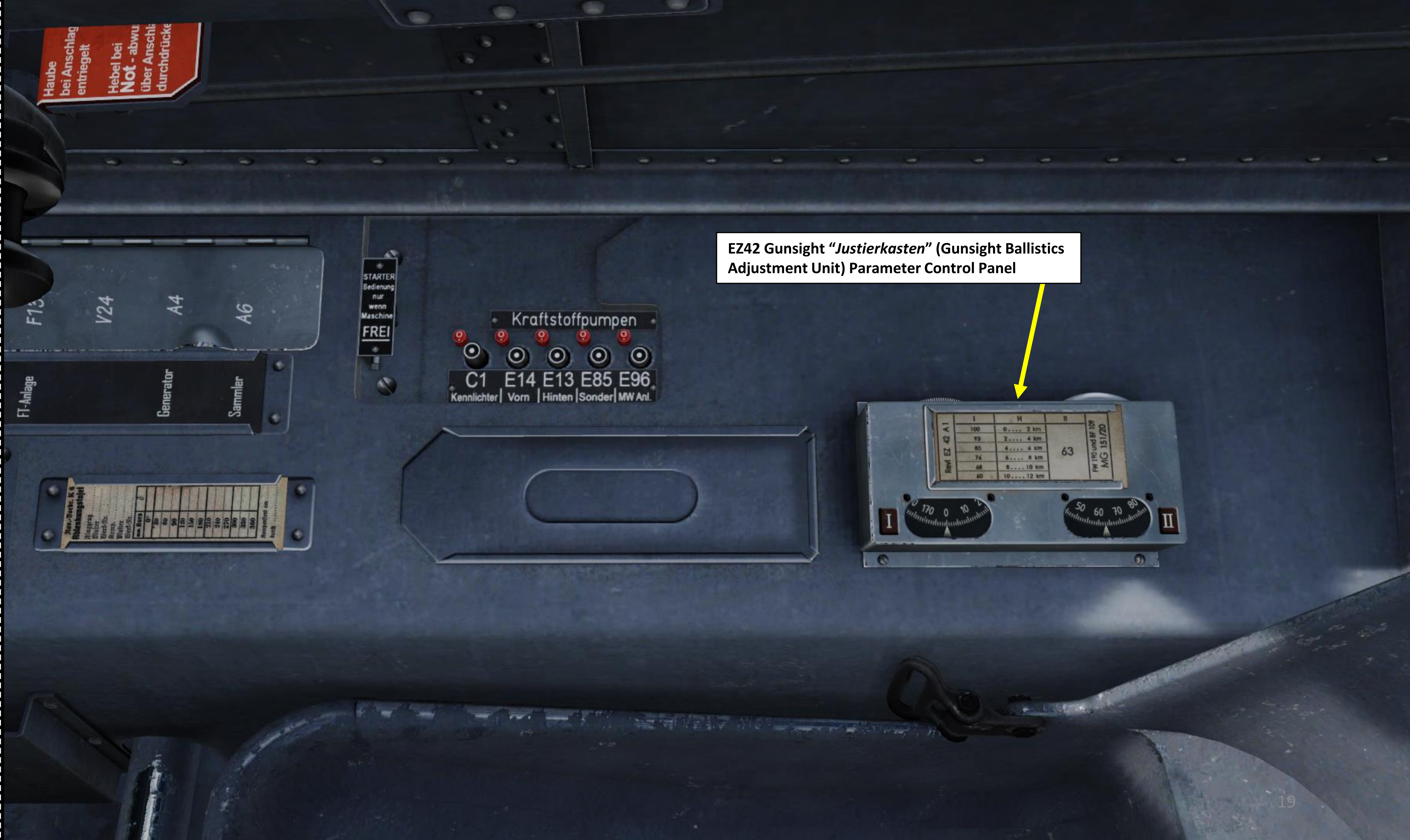
Tip: Pilot body can be toggled ON/OFF with “RSHIFT+P”

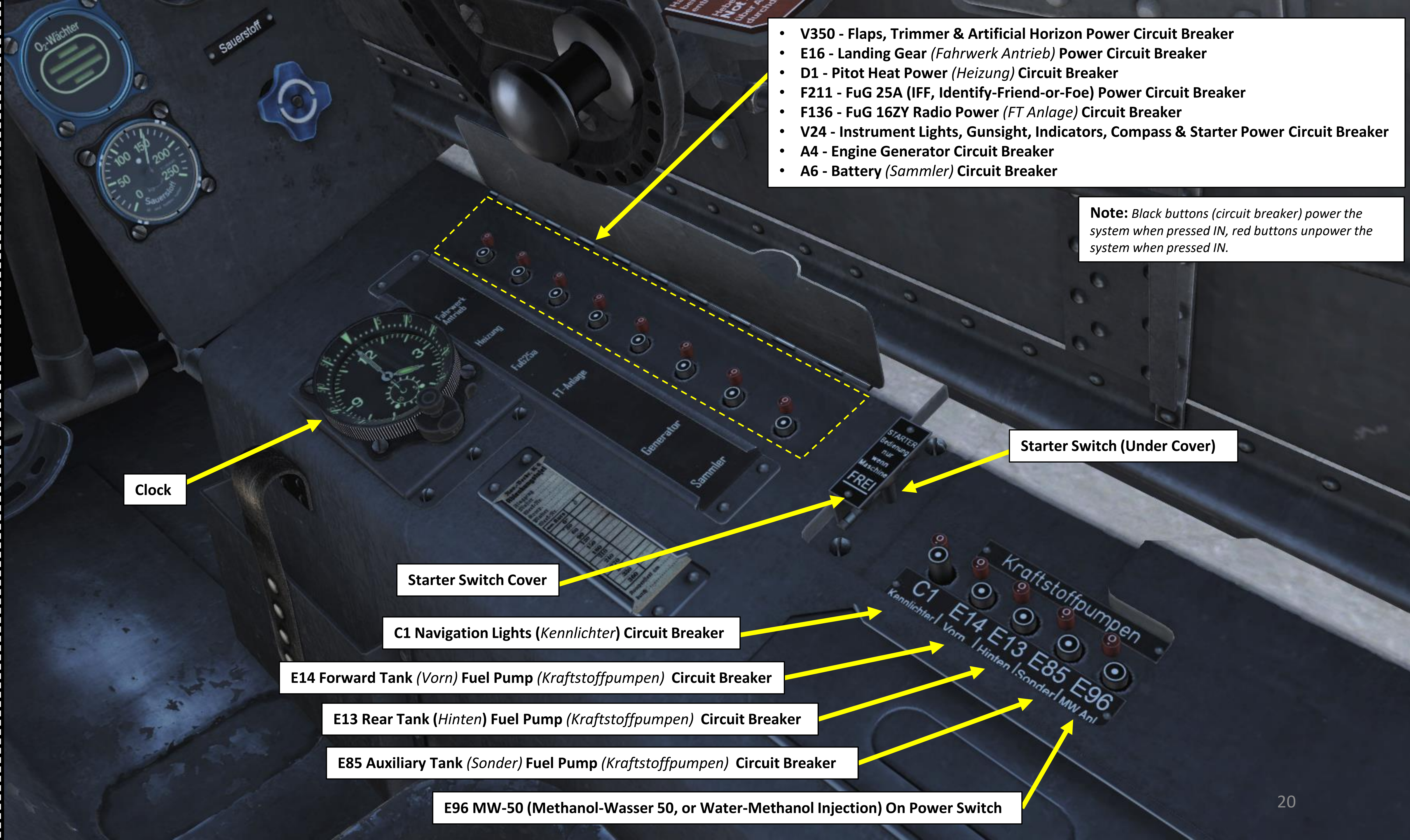

Achtung!
Haubenabwurf durch Sprengladung
Abwurfhebel nicht berühren. Im Probefall vorherige Einstellung des Schlagbolzens.


Kraftstoffpumpen
C1 E14 E13 E85 E96
Kontrollieren


Umin
x100
V350
F136
V24
A4
A6
Kraftstoffpumpen
C1 E14 E13 E85 E96


Canopy Jettison Emergency Handle
Emergency Oxygen Valve
V350 E16 D1 V24 A4 A6
FREI
Kraftstoffpumpen
C1 E14 E13 E85 E96

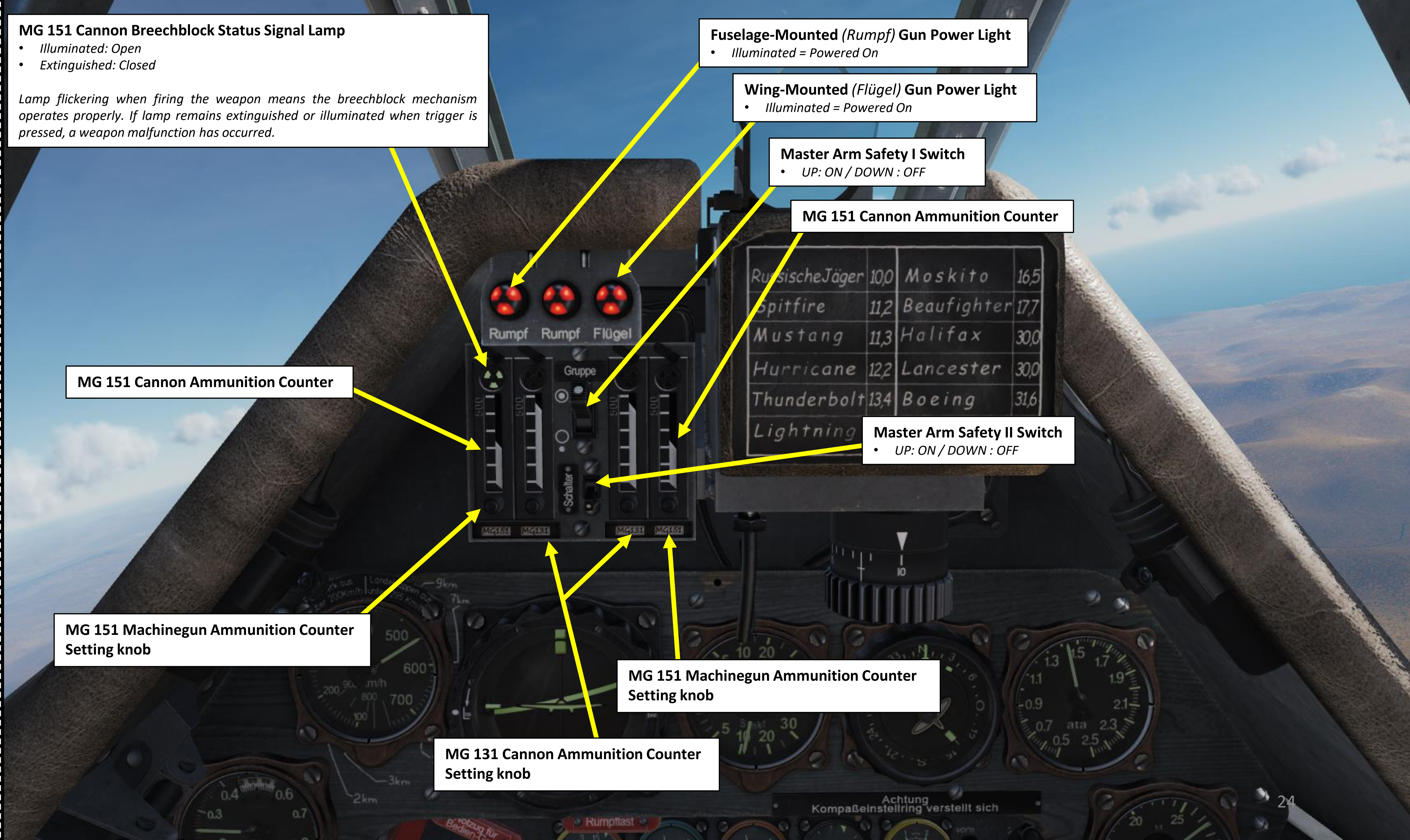

EZ42 Gunsight "*Justierkasten*" (Gunsight Ballistics Adjustment Unit) Parameter Control Panel
Haube bei Anschlag entriegelt
Hebel bei Not - abwu über Anschl durchdrücke
STARTER Bedienung nur wenn Maschine FREI
Kraftstoffpumpen
C1 Kennlichter
E14 Vorn
E13 Hinten
E85 Sonder
E96 MW Anl.
V24
A4
A6
FT-Anlage
Generator
Sammler
63
I
II


V350 - Flaps, Trimmer & Artificial Horizon Power Circuit Breaker
E16 - Landing Gear (Fahrwerk Antrieb) Power Circuit Breaker
D1 - Pitot Heat Power (Heizung) Circuit Breaker
F211 - FuG 25A (IFF, Identify-Friend-or-Foe) Power Circuit Breaker
F136 - FuG 16ZY Radio Power (FT Anlage) Circuit Breaker
V24 - Instrument Lights, Gunsight, Indicators, Compass & Starter Power Circuit Breaker
A4 - Engine Generator Circuit Breaker
A6 - Battery (Sammler) Circuit Breaker
Note: Black buttons (circuit breaker) power the system when pressed IN, red buttons unpower the system when pressed IN.
Starter Switch (Under Cover)
Clock
Starter Switch Cover
C1 Navigation Lights (Kennlichter) Circuit Breaker
E14 Forward Tank (Vorn) Fuel Pump (Kraftstoffpumpen) Circuit Breaker
E13 Rear Tank (Hinten) Fuel Pump (Kraftstoffpumpen) Circuit Breaker
E85 Auxiliary Tank (Sonder) Fuel Pump (Kraftstoffpumpen) Circuit Breaker
E96 MW-50 (Methanol-Wasser 50, or Water-Methanol Injection) On Power Switch
Sauerstoff
Fahrwerk Antrieb
Heizung
FuG25a
FT-Anlage
Generator
Sammler
Kraftstoffpumpen
C1 E14 E13 E85 E96
Kennlichter Vorn Hinten Sonder MW Anl


Canopy Crank
Achtung
Liter
vorn
hinten
Generator
Sammler
FREI
Kraftstoffpumpen
C1 E14 E13 E85 E96


Rumpf
Rumpf
Flügel
RussischeJäger 10,0
Spitfire 11,2
Mustang 11,3
Hurricane 12,2
Thunderbolt 13,4
Lightning 14,8
Moskito 16,5
Beaufighter 17,7
Halifax 30,0
Lancester 30,0
Boeing 31,6
Liberator 33,5


Gunsight
Target Range Scale (m)
EZ42 Gunsight Gyro Power Switch
Target Wingspan Scale (m)
Target Wingspan Setting Knob
RussischeJäger 10,0
Moskito 16,5
Spitfire 11,2
Beaufighter 17,7
Mustang 11,3
Halifax 30,0
Hurricane 12,2
Lancester 30,0
Thunderbolt 13,4
Boeing 31,6
Lightning 14,8
Liberator 33,5
Rumpf
Rumpf
Achtung
Kompaßeinstellring verstellt sich



MG 151 Cannon 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.

Fuselage-Mounted *(Rumpf)* Gun Power Light

- *Illuminated = Powered On*

Wing-Mounted *(Flügel)* Gun Power Light

- *Illuminated = Powered On*

Master Arm Safety I Switch

- *UP: ON / DOWN : OFF*

MG 151 Cannon Ammunition Counter

MG 151 Cannon Ammunition Counter

Master Arm Safety II Switch

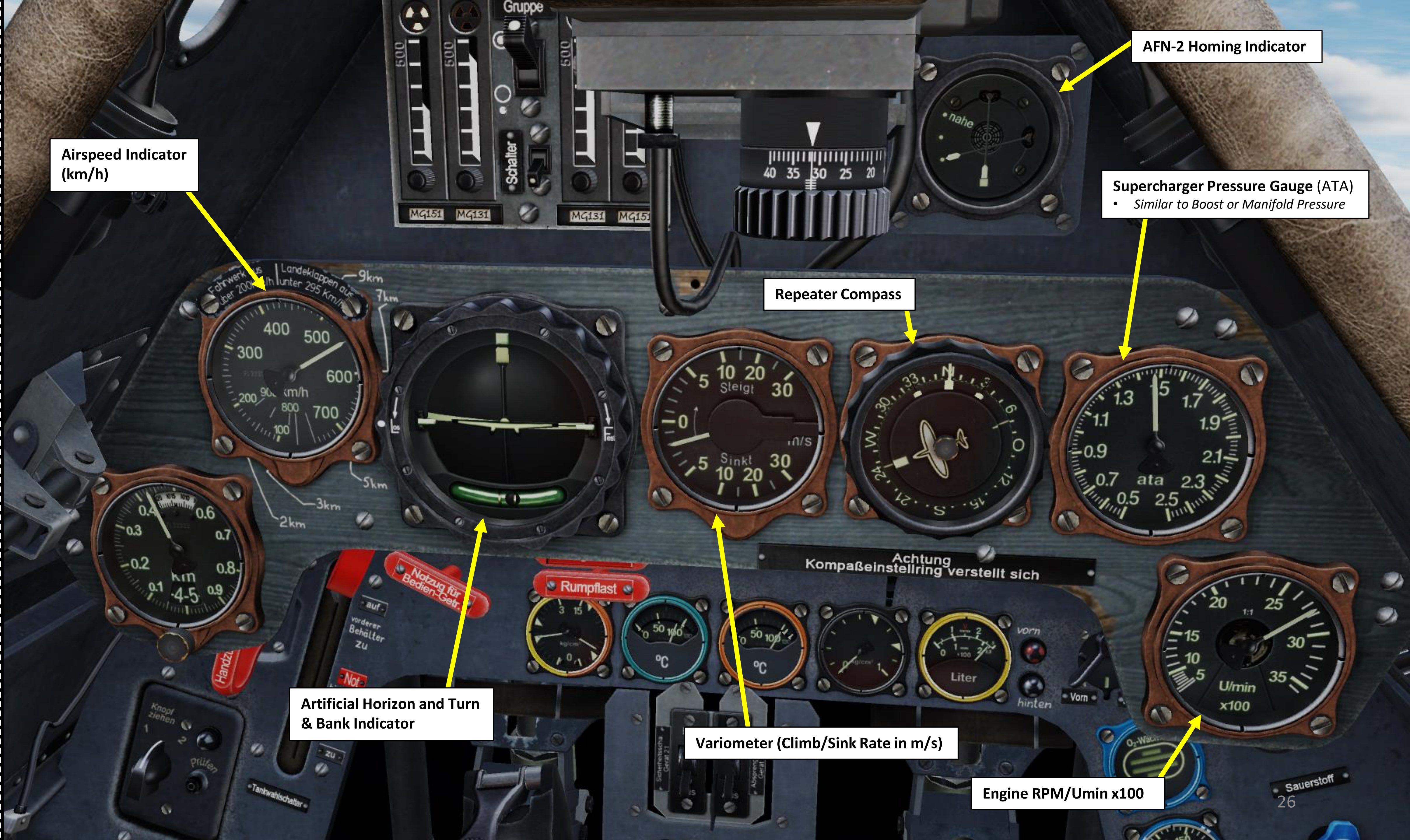
- *UP: ON / DOWN : OFF*

MG 151 Machinegun Ammunition Counter Setting knob

MG 151 Machinegun Ammunition Counter Setting knob

MG 131 Cannon Ammunition Counter Setting knob


Rumpf
Rumpf
Flügel
RussischeJäger 10,0
Spitfire 11,2
Mustang 11,3
Hurricane 12,2
Thunderbolt 13,4
Lightning 14,8
Moskito 16,5
Beaufighter 17,7
Halifax 30,0
Lancester 30,0
Boeing 31,6
Liberator 33,5
Achtung
Kompaßeinstellung verstellt sich
Rumpflast
U/min
x100
Liter
Aus


Airspeed Indicator (km/h)
AFN-2 Homing Indicator
Supercharger Pressure Gauge (ATA)
• Similar to Boost or Manifold Pressure
Repeater Compass
Artificial Horizon and Turn & Bank Indicator
Variometer (Climb/Sink Rate in m/s)
Engine RPM/Umin x100
Achtung
Kompaßeinstellring verstellt sich
Rumpflast

Airspeed Indicator (km/h)

Not to Exceed diving speeds are handwritten on the airspeed gauge

Airspeed @ Altitude

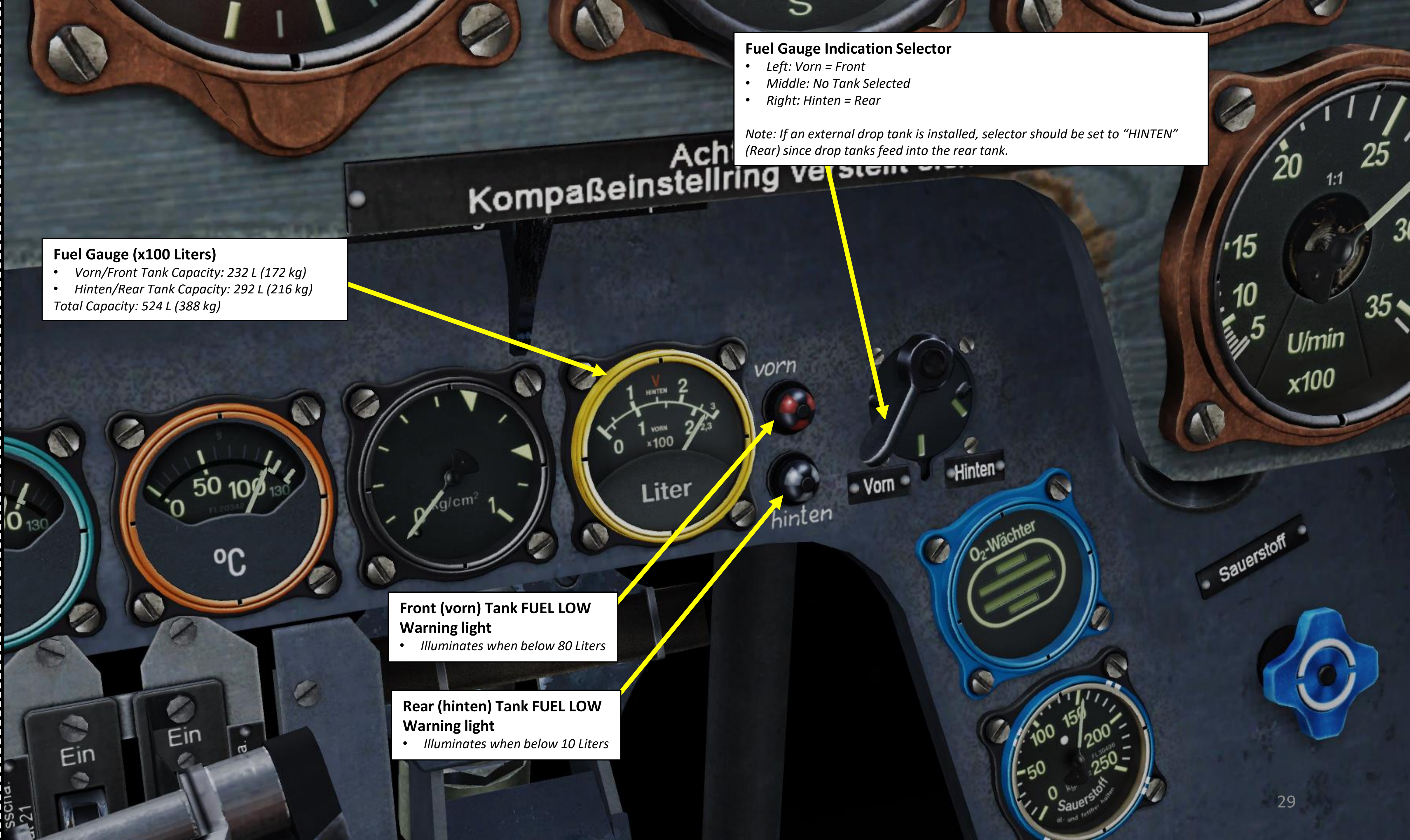
- *500 km/h @ 9 km*
- *600 km/h @ 7 km*
- *700 km/h @ 5 km*
- *800 km/h @ 3 km*
- *850 km/h @ 2 km*

Barometric Pressure Setting (hPa)

Altimeter (km)

Barometric Pressure (QFE) Setting Knob


Achtung
Kompaßeinstellring verstellt sich
Kühlerklappen
Auf
Mischanlage
Scheibenspül
Flügellast
Rumpflast
Liter
vorn
hinten
Vorn
Hinten
U/min
x100
O2-Wächter
Sauerstoff
Oxygen Flow Indicator
Oxygen Flow Valve Control
Oxygen Pressure Indicator (kg/cm²)



Fuel Gauge Indication Selector

- *Left: Vorn = Front*
- *Middle: No Tank Selected*
- *Right: Hinten = Rear*

Note: If an external drop tank is installed, selector should be set to "HINTEN" (Rear) since drop tanks feed into the rear tank.

Fuel Gauge (x100 Liters)

- *Vorn/Front Tank Capacity: 232 L (172 kg)*
- *Hinten/Rear Tank Capacity: 292 L (216 kg)*

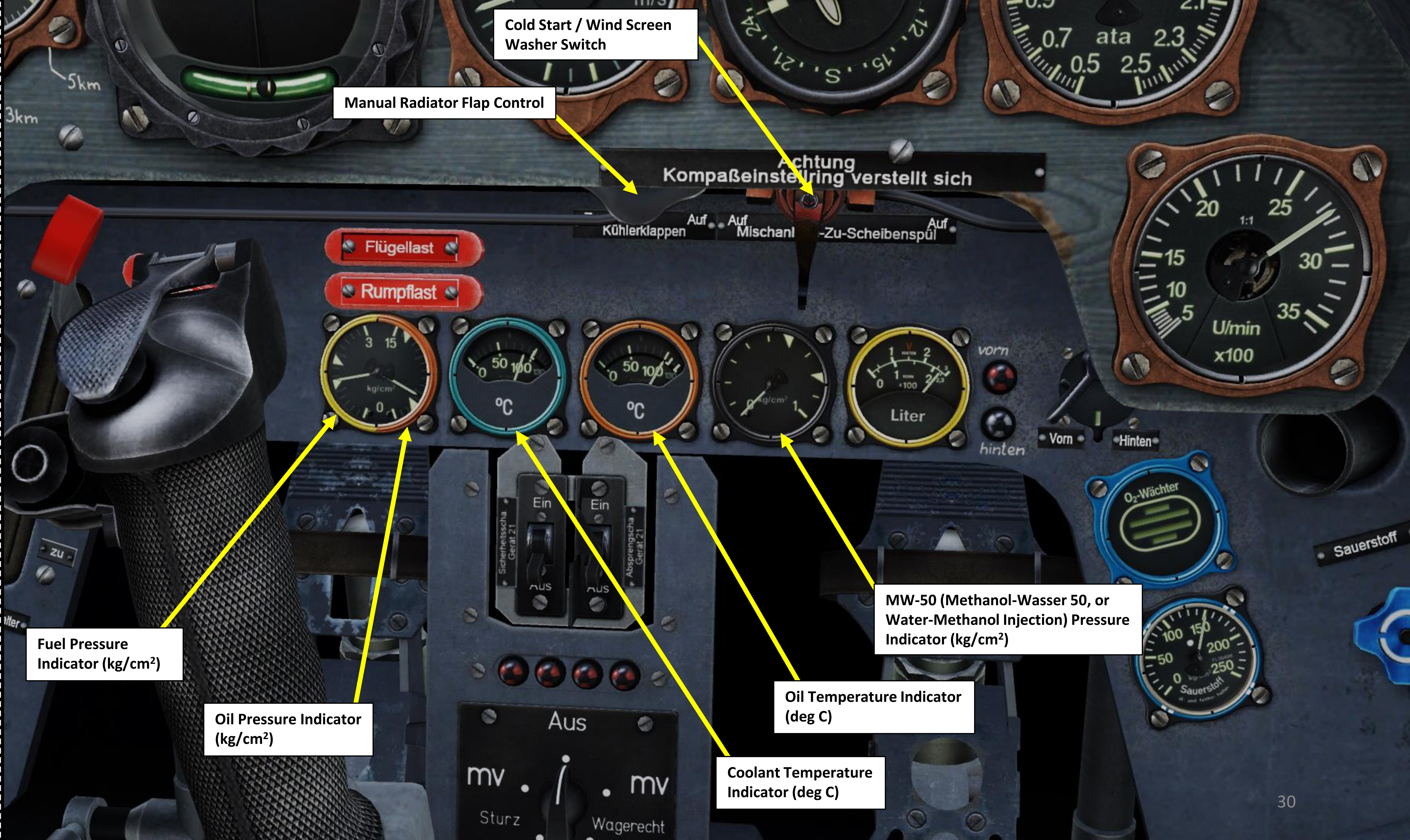
Total Capacity: 524 L (388 kg)

Front (vorn) Tank FUEL LOW Warning light

- *Illuminates when below 80 Liters*

Rear (hinten) Tank FUEL LOW Warning light

- *Illuminates when below 10 Liters*

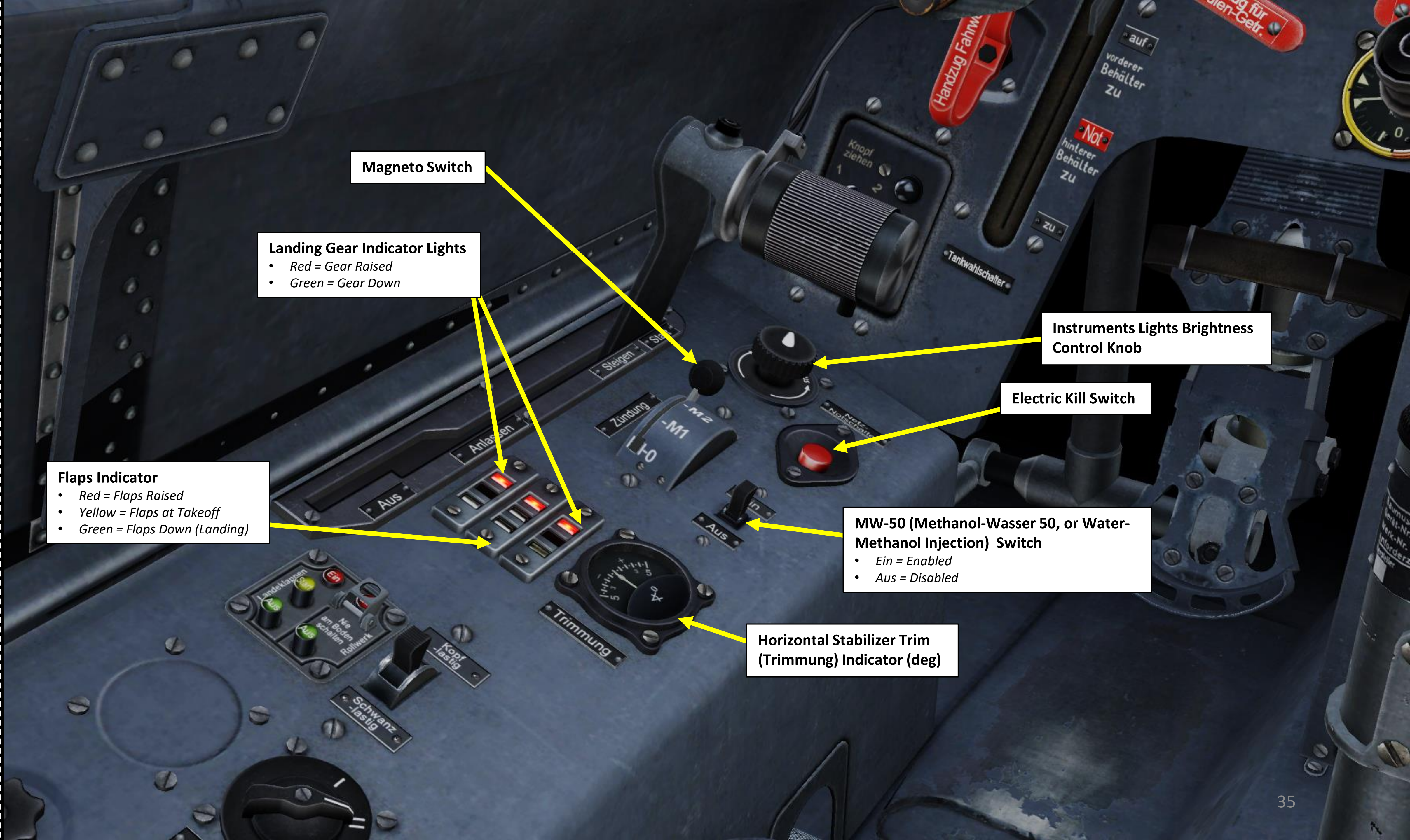

Cold Start / Wind Screen Washer Switch
Manual Radiator Flap Control
Achtung
Kompaßeinstellring verstellt sich
Kühlerklappen
Flügellast
Rumpflast
Fuel Pressure Indicator (kg/cm²)
Oil Pressure Indicator (kg/cm²)
Coolant Temperature Indicator (deg C)
Oil Temperature Indicator (deg C)
MW-50 (Methanol-Wasser 50, or Water-Methanol Injection) Pressure Indicator (kg/cm²)
Liter
Vorn
Hinten
Ein
Aus
Sturz
Wagerecht
Sauerstoff

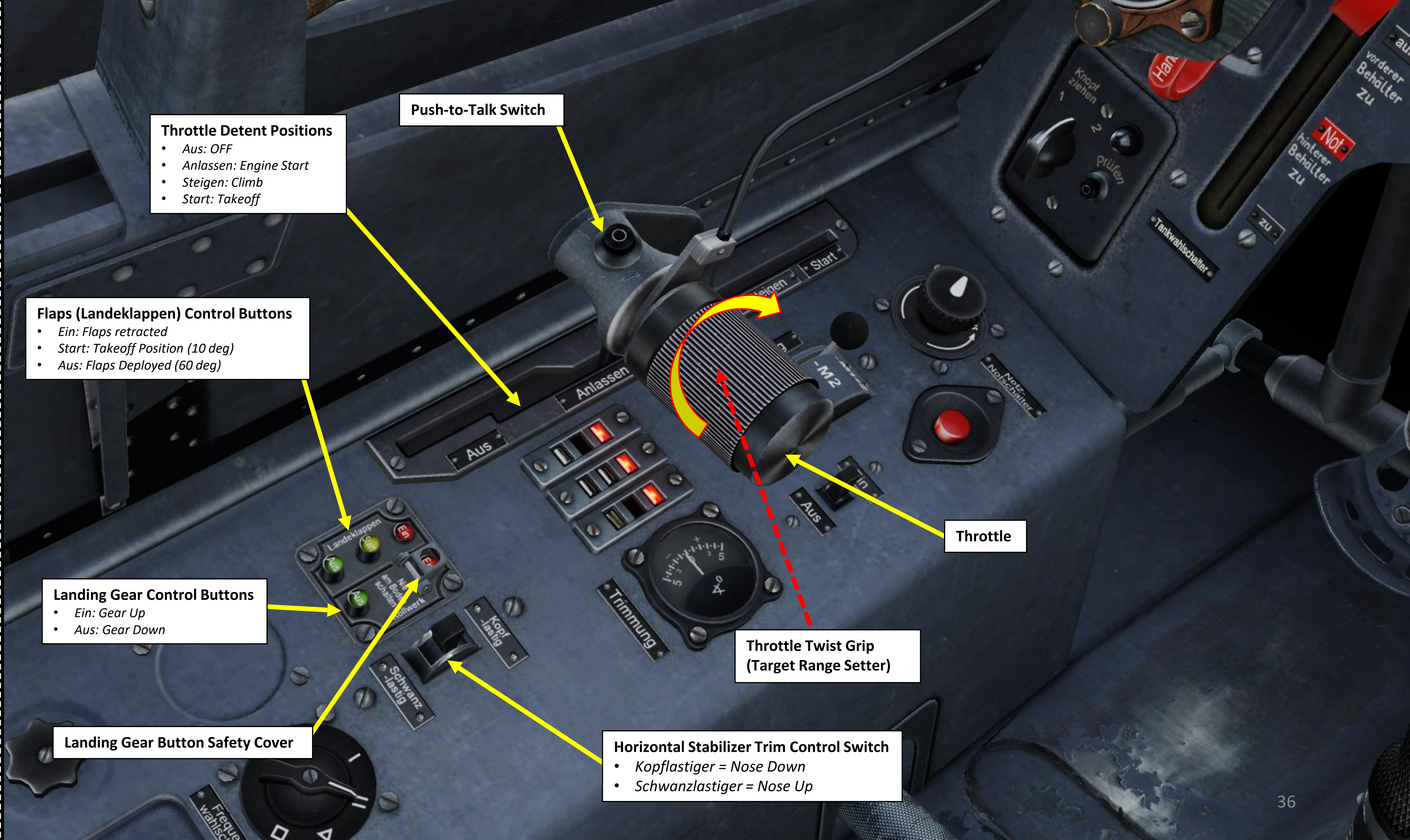

Jettison Wing Stores *(Flügellast)* Handle
Jettison Fuselage Stores *(Rumpflast)* Handle
MBG (*Motorbediengerät, or Engine Control Unit*) Emergency Mode Handle
Flügellast
Rumpflast
Notzug für Bedien-Getr.
Achtung
Kompaßeinstellring verstellt sich
Fahrwerk aus über 200Km/h
Landeklappen aus unter 295 Km/h
Steigt
Sinkt
m/s
ata
Liter
O2-Wächter
Aus
Sturz
Wagerecht
Zündung
Steigen


Landing Gear Emergency Release Handle
FuG 25a IFF (Identify-Friend-or-Foe) Transponder Code Selection Switch
IFF Test Button
Fuel Tank Selector Lever
• Auf: Open (engine draws from both tanks)
• Vorderer Behälter zu: Forward Tank Closed
• Hinterer Behälter zu: Rear Tank Closed
• Zu: Closed (both fuel lines to booster pump are closed)
Handzug Fahrwerk
Notzug für Bedien-Getr.
Flügellast
Rumpflast
Kühlerklappen
Tankwahlschalter
Zündung
Anlassen

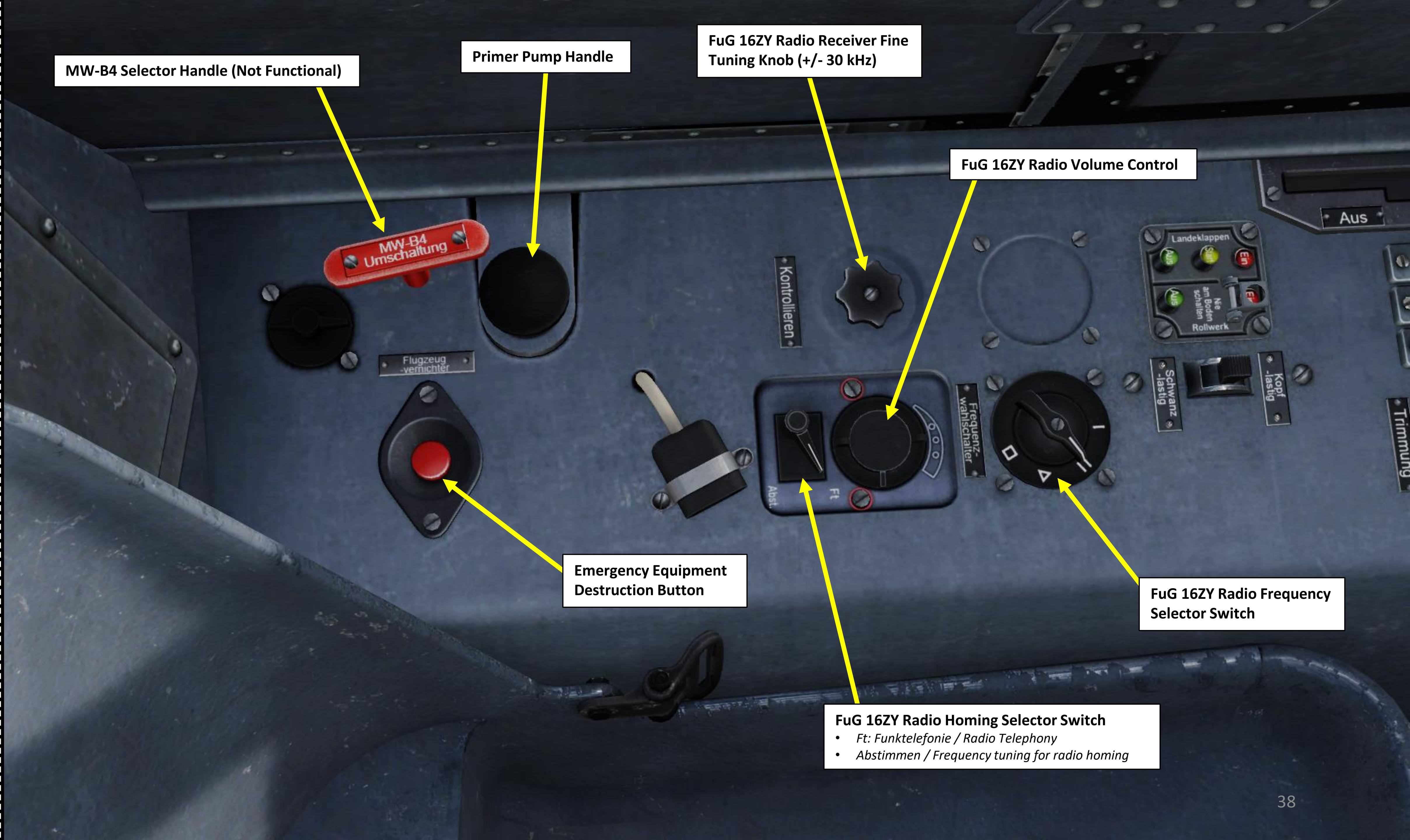

Fahrwerk aus
über 200Km/h
Landeklappen aus
unter 295 Km/h
Aus
Anlassen
Zündung


MW-B4 Umschaltung
Anlassen
Aus
Zündung
Trimmung
Kontrollleuchten
Not
hinterer Behälter zu
zu

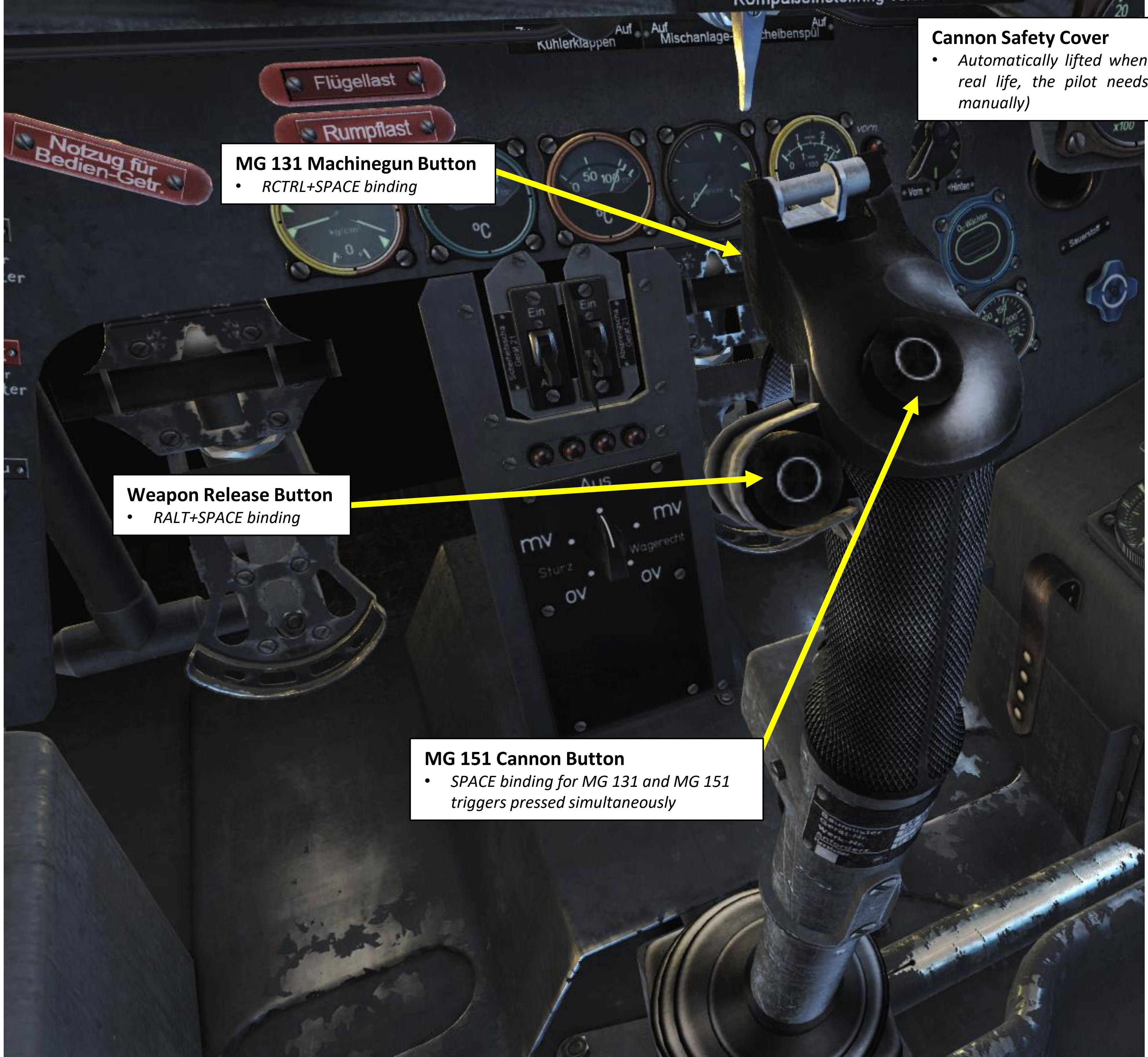

Magneto Switch
Landing Gear Indicator Lights
• Red = Gear Raised
• Green = Gear Down
Instruments Lights Brightness Control Knob
Electric Kill Switch
Flaps Indicator
• Red = Flaps Raised
• Yellow = Flaps at Takeoff
• Green = Flaps Down (Landing)
MW-50 (Methanol-Wasser 50, or Water-Methanol Injection) Switch
• Ein = Enabled
• Aus = Disabled
Horizontal Stabilizer Trim (Trimmung) Indicator (deg)


Throttle Detent Positions
• Aus: OFF
• Anlassen: Engine Start
• Steigen: Climb
• Start: Takeoff
Push-to-Talk Switch
Flaps (Landeklappen) Control Buttons
• Ein: Flaps retracted
• Start: Takeoff Position (10 deg)
• Aus: Flaps Deployed (60 deg)
Landing Gear Control Buttons
• Ein: Gear Up
• Aus: Gear Down
Landing Gear Button Safety Cover
Throttle
Throttle Twist Grip
(Target Range Setter)
Horizontal Stabilizer Trim Control Switch
• Kopflastiger = Nose Down
• Schwanzlastiger = Nose Up


Throttle Lock
• *Down: Locked*
• *Up: Unlocked*
Rumpflast
Kontrollieren
Trimmung
Anlassen
Zündung
Steigen
Aus
Ein
mv
Wagerecht
ov


MW-B4 Selector Handle (Not Functional)
Primer Pump Handle
FuG 16ZY Radio Receiver Fine Tuning Knob (+/- 30 kHz)
FuG 16ZY Radio Volume Control
Emergency Equipment Destruction Button
FuG 16ZY Radio Frequency Selector Switch
FuG 16ZY Radio Homing Selector Switch
• Ft: Funktelefonie / Radio Telephony
• Abstimmen / Frequency tuning for radio homing
MW-B4 Umschaltung
Flugzeug -vernichter
Kontrollieren
Frequenz-wahlschalter
Landeklappen
Rollwerk
Schwanz -lastig
Kopf -lastig
Aus
Trimmung


Rocket Jettison Switch
(ABSPRENGSCHA. GERÄT 21)
• Ein: Armed
• Aus: Disarmed
Rocket Arming Switch
(SICHERHEITSSCHA. GERÄT 21)
• Ein: Armed
• Aus: Disarmed
Bomb Loaded Lights
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)
Achtung
Kompaßeinstellring verstellt sich
Flügellast
Rumpflast
Aus
Sturz
Wagerecht



Cannon Safety Cover

- *Automatically lifted when firing weapons (in real life, the pilot needs to lift the safety manually)*

MG 131 Machinegun Button

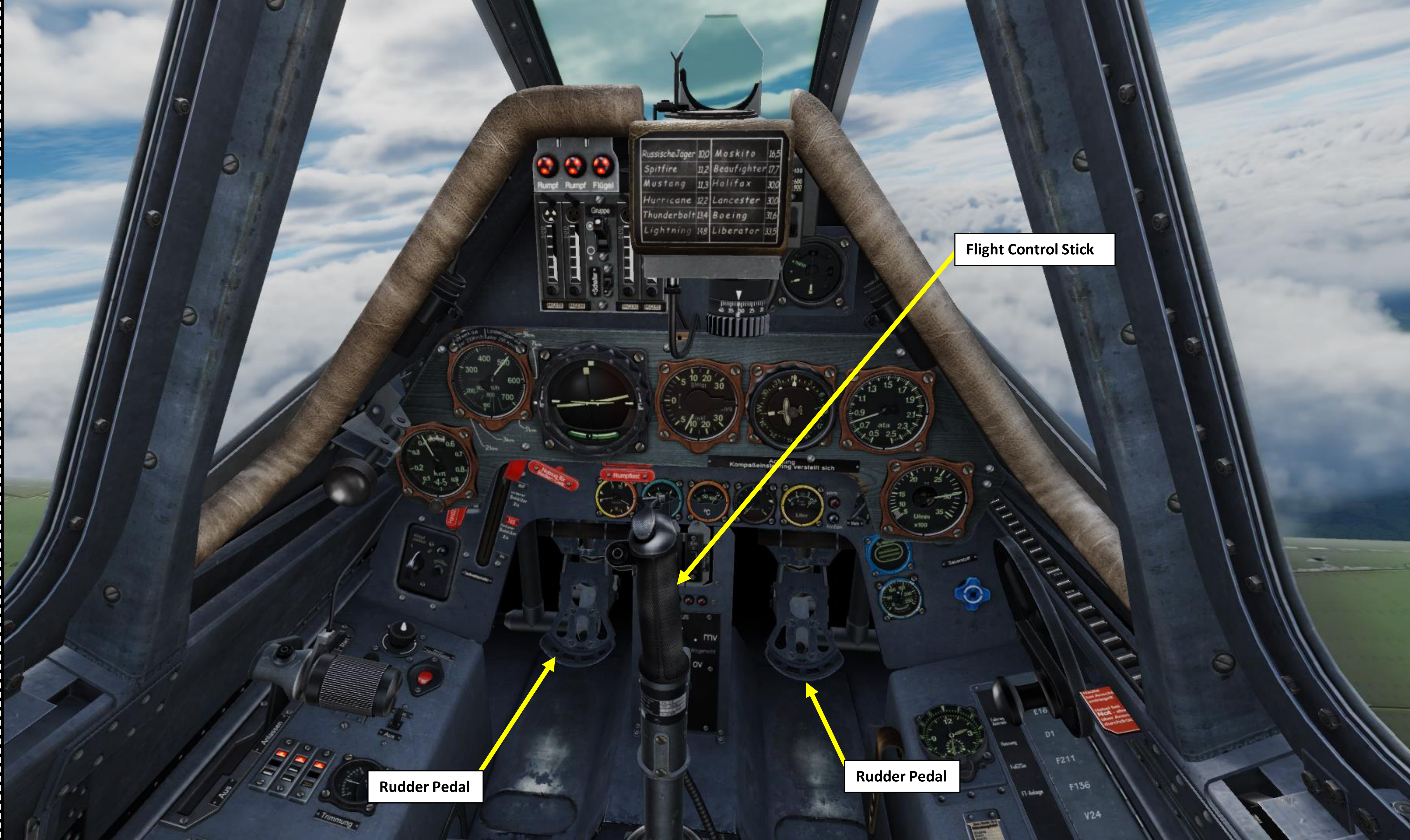
- *RCTRL+SPACE binding*

Weapon Release Button

- *RALT+SPACE binding*

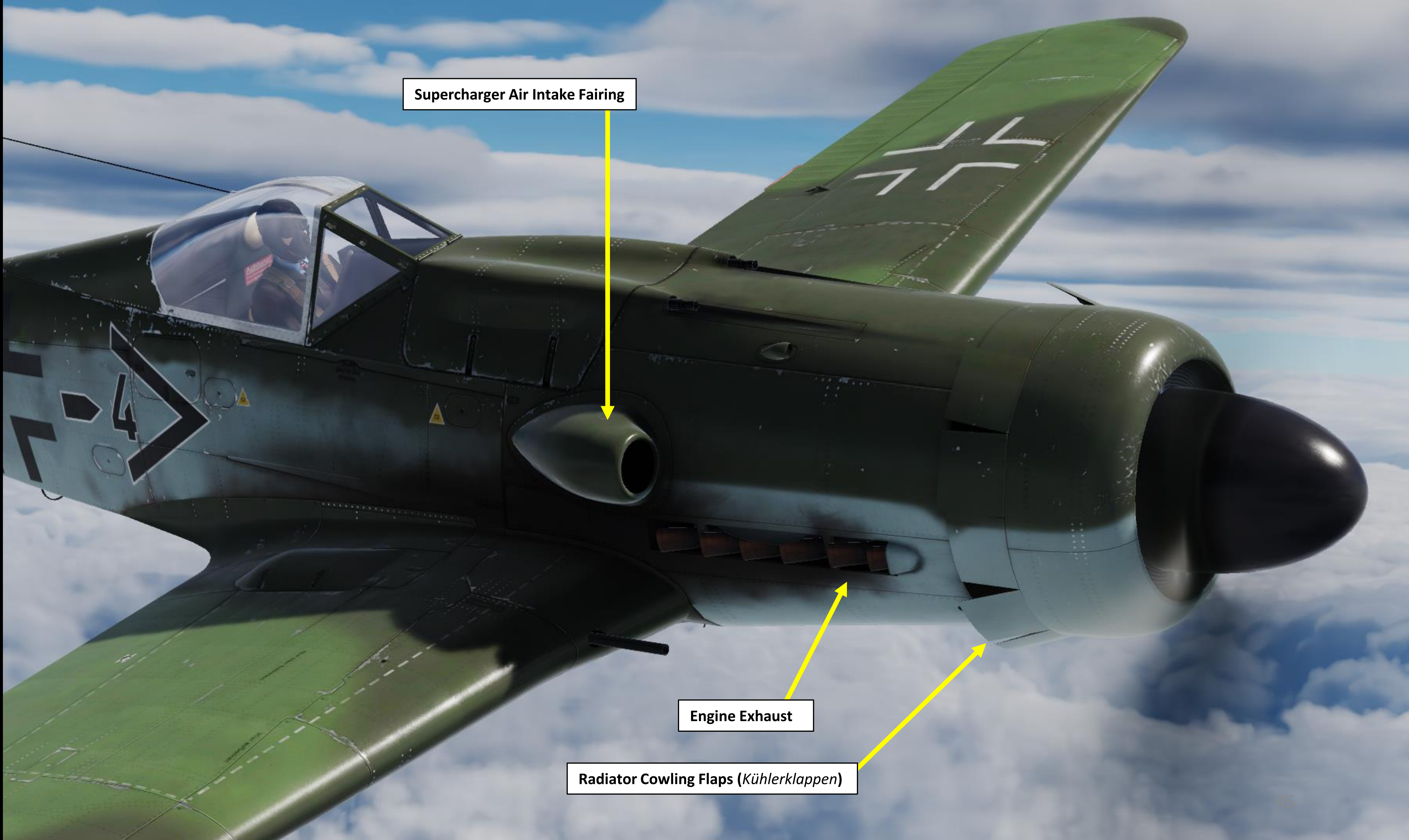
MG 151 Cannon Button

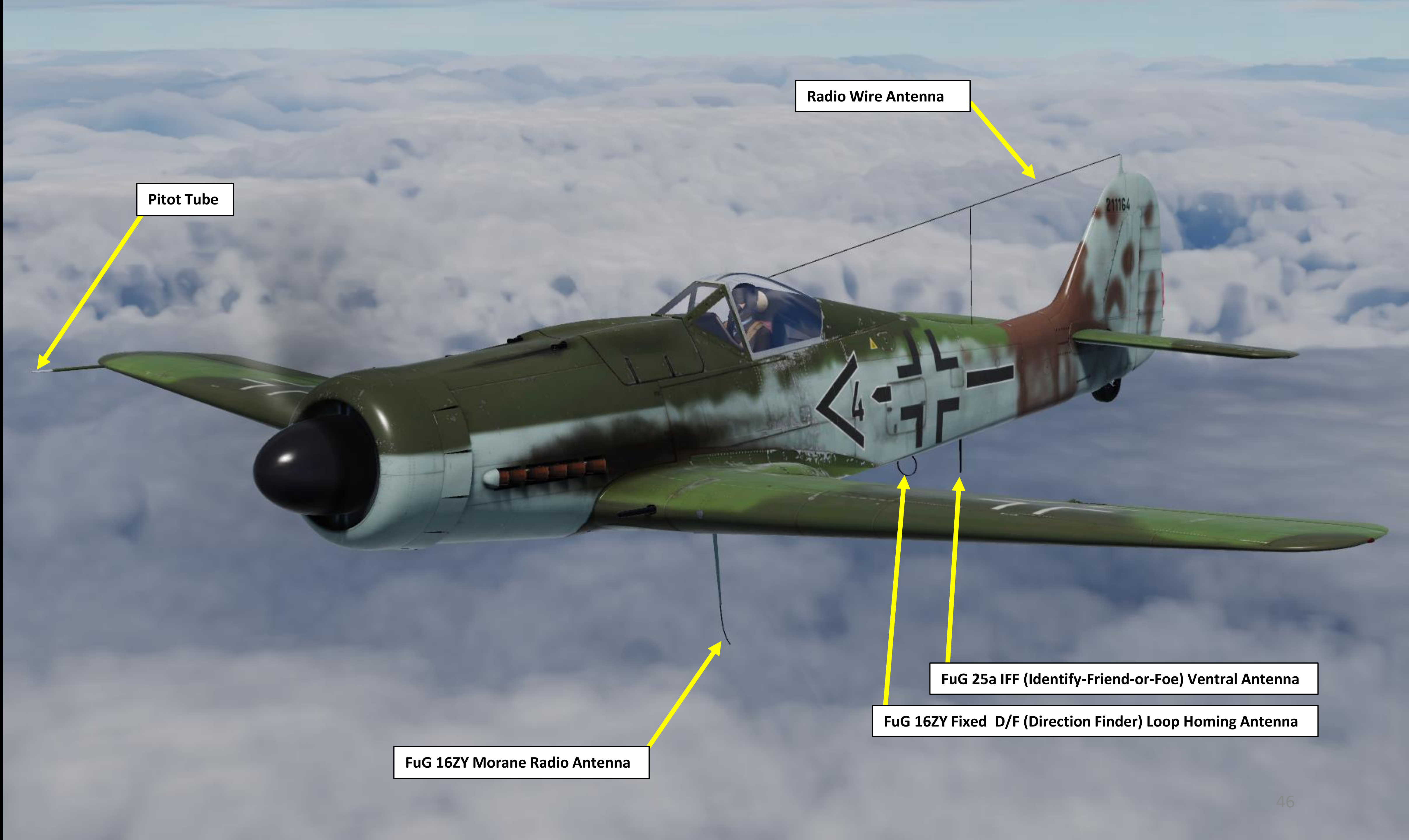
- *SPACE binding for MG 131 and MG 151 triggers pressed simultaneously*


Flight Control Stick
Rudder Pedal
Rudder Pedal

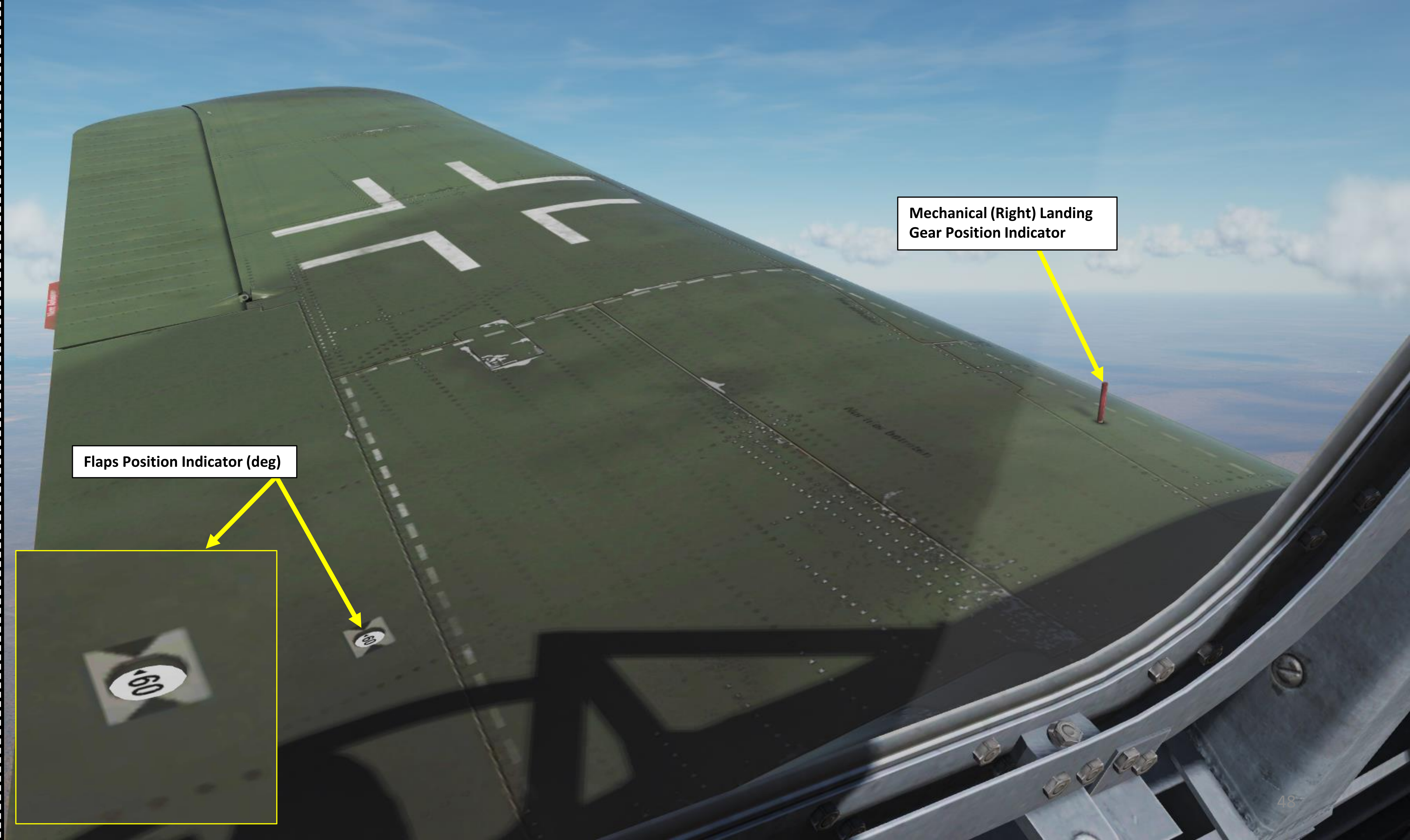

Achtung
Kompaßeinstellring verstellt sich
Trimmung
Kontrollieren
MW-50 Umschaltung

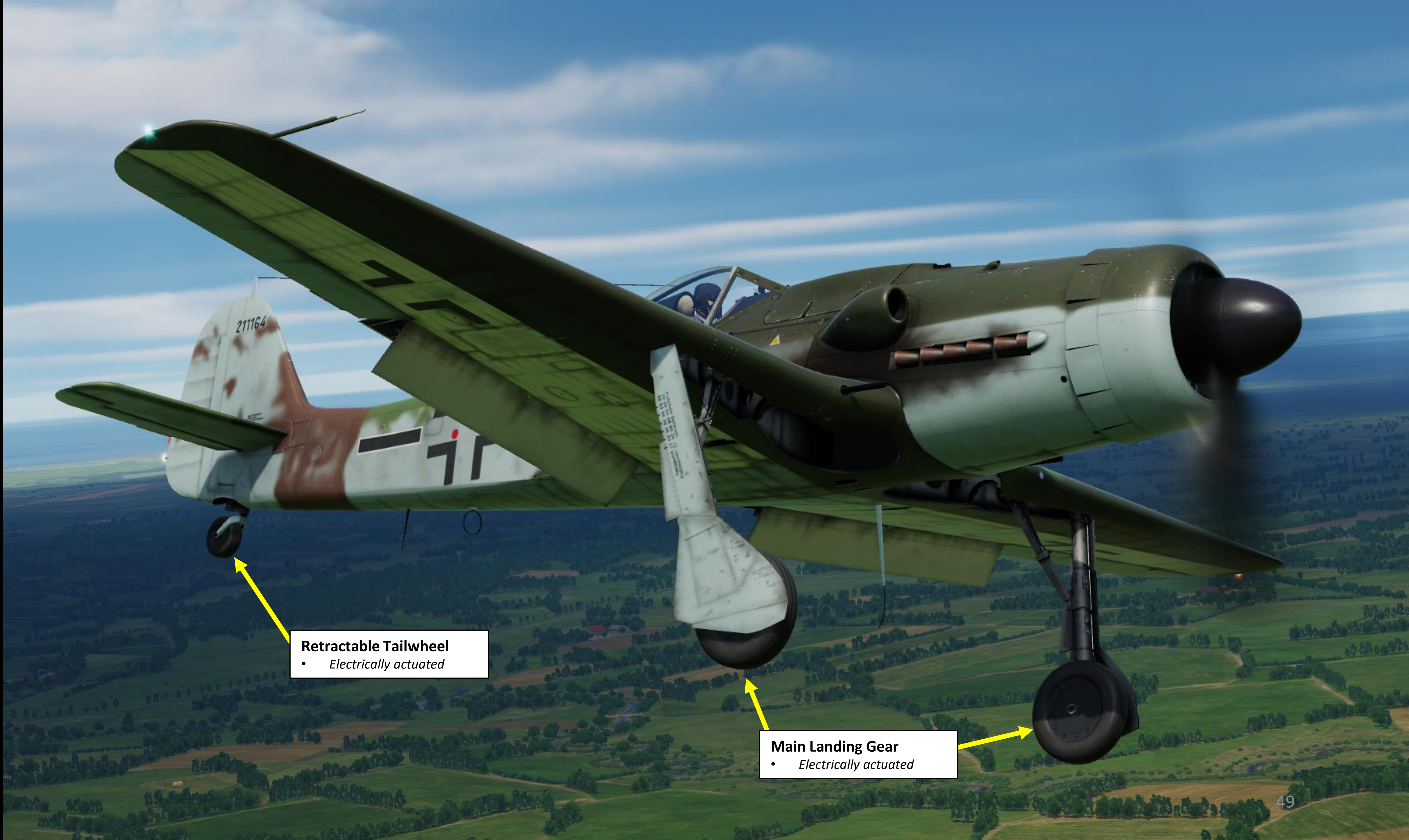

Achtung!
Haubenabwurf
durch Sprengladung
Abwurfhebel nicht berühren. Im Probefall
vorherige Einstellung des Schlagbolzens.


Supercharger Air Intake Fairing
Engine Exhaust
Radiator Cowling Flaps (*Kühlerklappen*)


Radio Wire Antenna
Pitot Tube
211164
FuG 25a IFF (Identify-Friend-or-Foe) Ventral Antenna
FuG 16ZY Fixed D/F (Direction Finder) Loop Homing Antenna
FuG 16ZY Morane Radio Antenna


211164
Flaps
• *Electrically actuated*

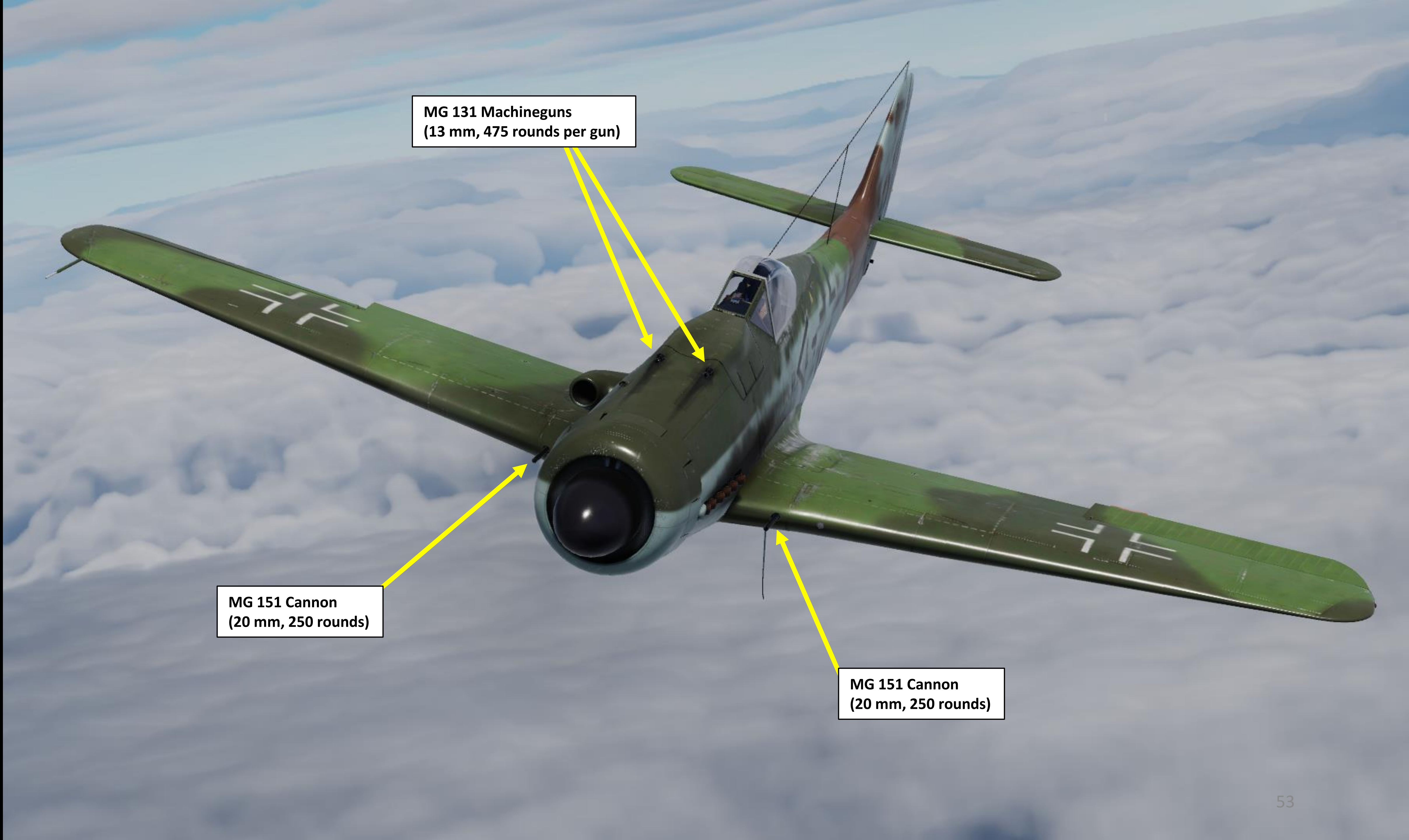

Mechanical (Right) Landing Gear Position Indicator
Flaps Position Indicator (deg)

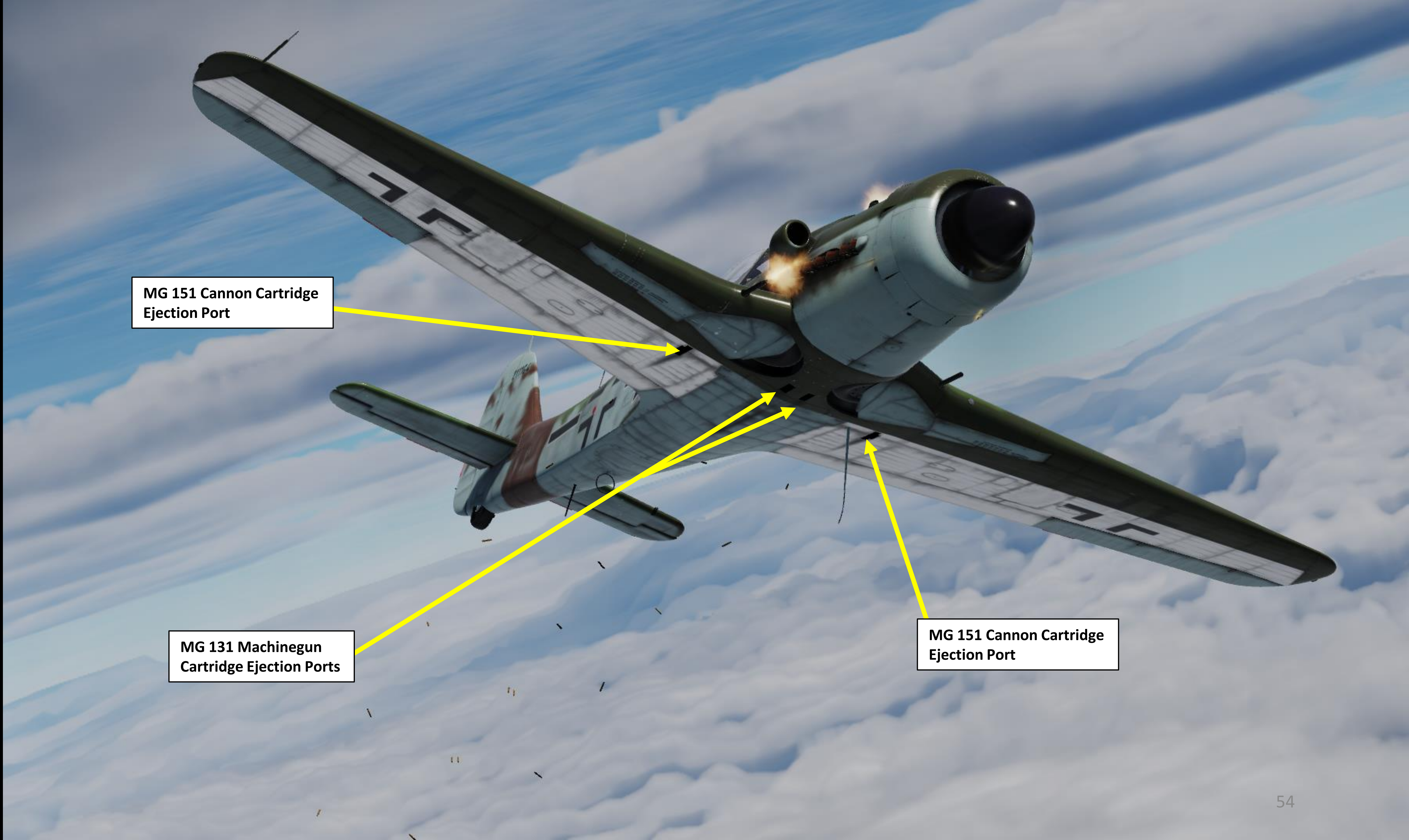

211164
Retractable Tailwheel
• Electrically actuated
Main Landing Gear
• Electrically actuated

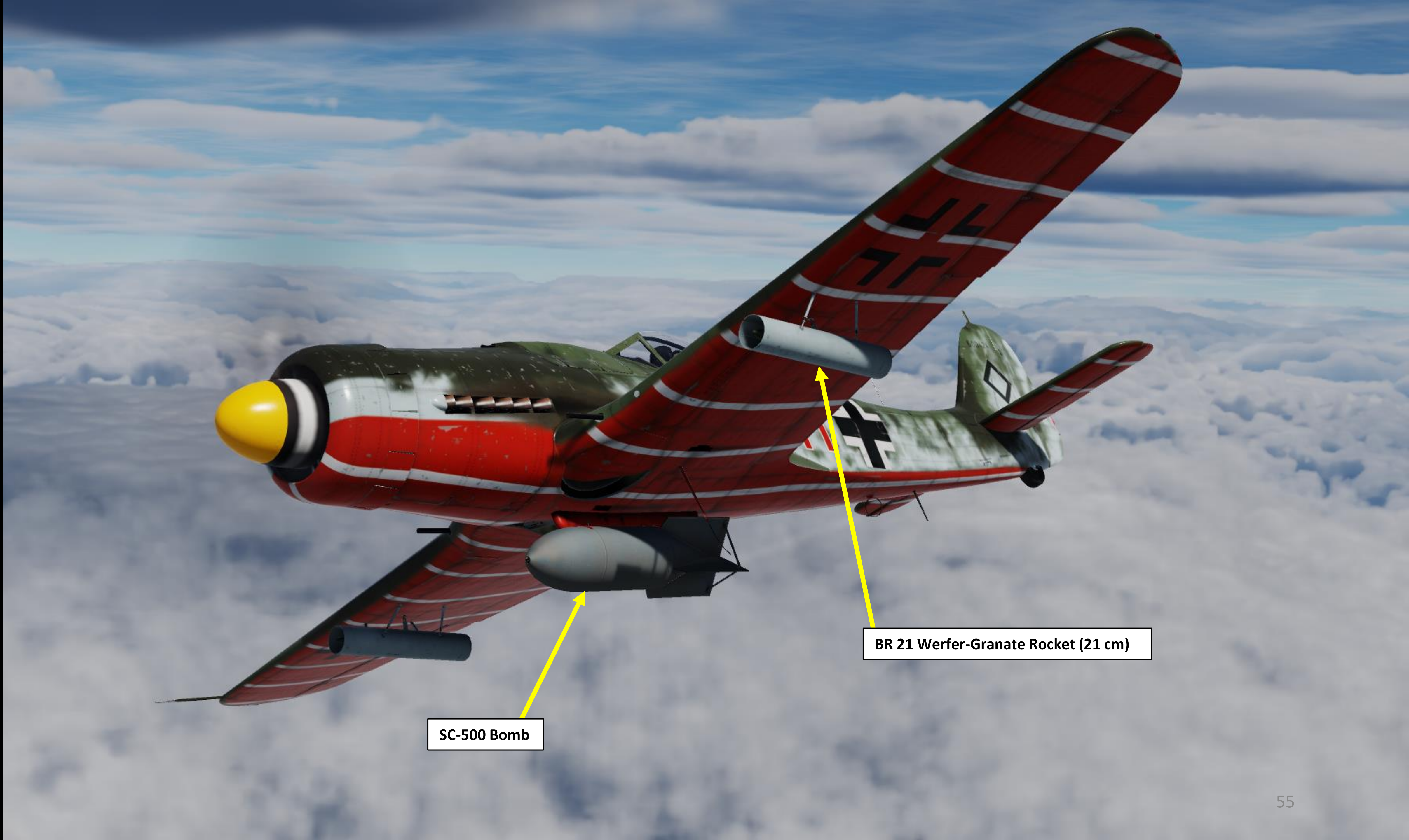

Green Navigation Light
White Navigation Light
Red Navigation Light
C1 Navigation Lights (*Kennlichter*) Circuit Breaker
Kraftstoffpumpen
C1 E14 E13 E85 E96
Kennlichter Vorn Hinten Sonder MW Anl.


Rumpf
Rumpf
Flügel
RussischeJager 100
Moskito 165
Spitfire 112
Beaufighter 177
Mustang 113
Halifax 300
Hurricane 122
Lancaster 300
Thunderbolt 134
Boeing 316
Lightning 148
Liberator 335
Achtung
Kompaßeinstellring verstellt sich
Rumpflast


Cockpit Illumination Lamp
Cockpit Illumination Lamp
Instruments Lights Brightness Control Knob


MG 131 Machineguns
(13 mm, 475 rounds per gun)
MG 151 Cannon
(20 mm, 250 rounds)
MG 151 Cannon
(20 mm, 250 rounds)


MG 151 Cannon Cartridge Ejection Port
MG 131 Machinegun Cartridge Ejection Ports
MG 151 Cannon Cartridge Ejection Port

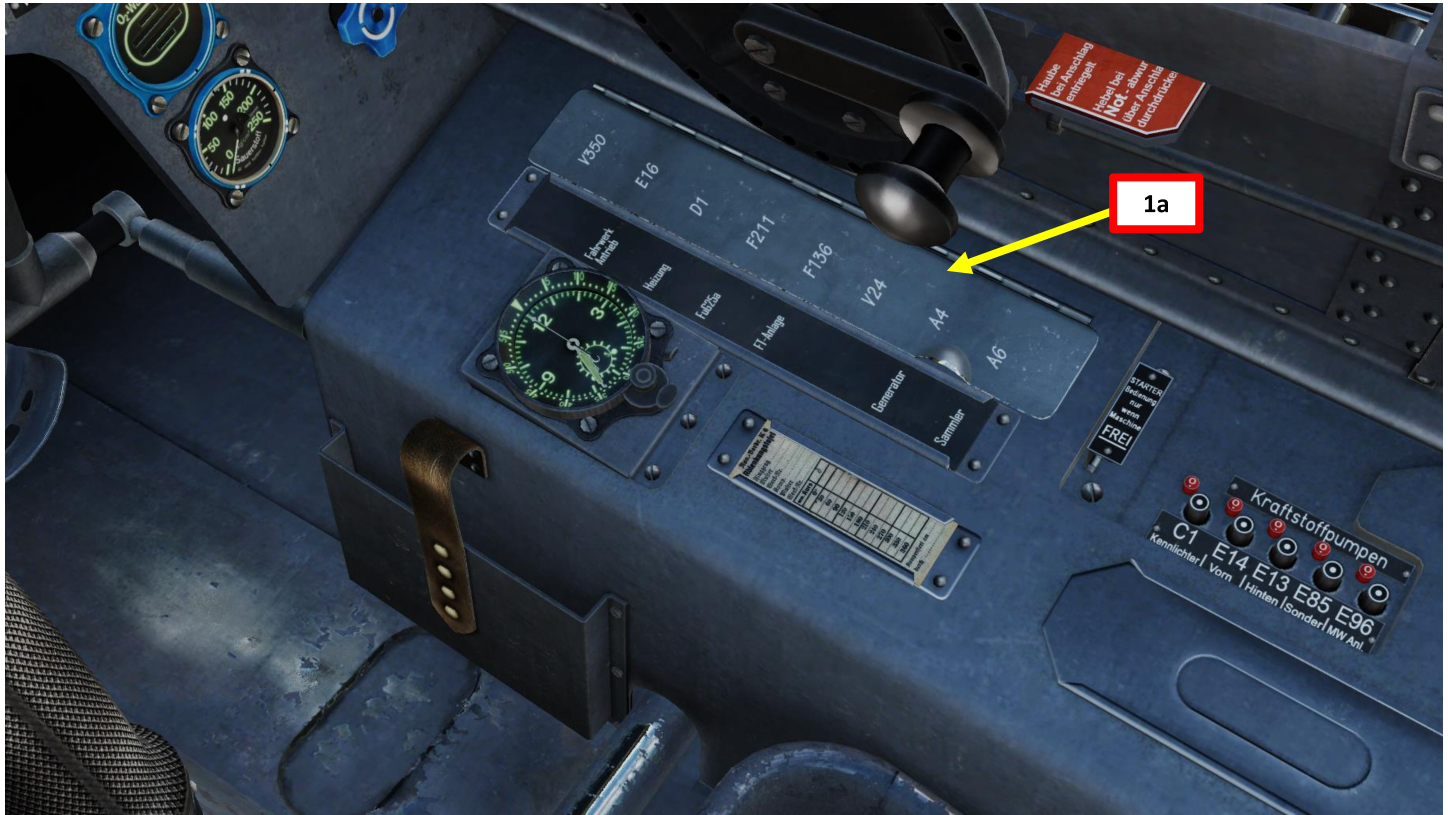

BR 21 Werfer-Granate Rocket (21 cm)
SC-500 Bomb

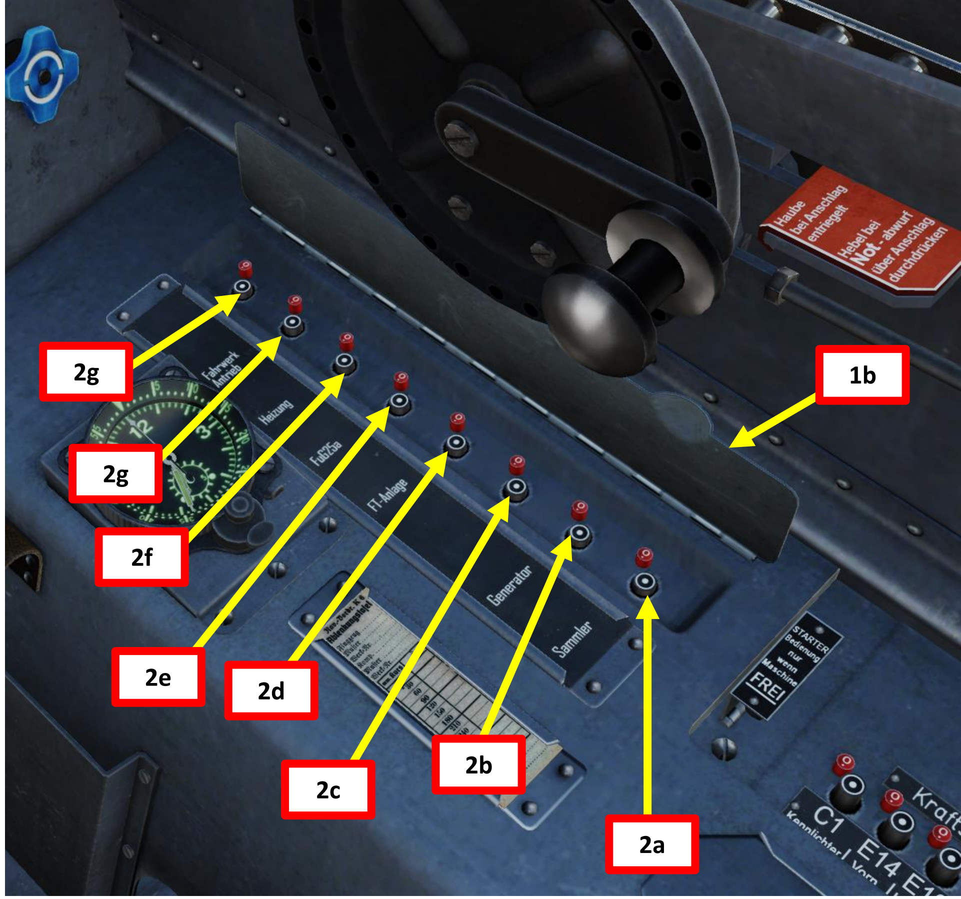

External Fuel Drop Tank (300 L)

PRE-FLIGHT

PRE-FLIGHT

1. Click on the Circuit Breaker panel to open it
2. Set all forward circuit breakers – ON (IN)
    a) A6 - Battery *(Sammler)*
    b) A4 - Engine Generator
    c) V24 - Instrument Lights, Gunsight, Indicators, Compass & Starter Power
    d) F136 - FuG 16ZY Radio Power *(Funktelefonie Anlage)*
    e) F211 - FuG 25A (IFF, Identify-Friend-or-Foe) Power
    f) D1 - Pitot Heat Power *(Heizung)*
    g) E16 - Landing Gear *(Fahrwerk Antrieb)* Power
    h) V350 - Flaps, Trimmer & Artificial Horizon Power





PRE-FLIGHT

3. Check fuel in Rear (*Hinten*) and Forward (*Vorn*) tanks
4. Set Oxygen Valve – OPEN (Rotate handle clockwise)
    - Confirm valve opens correctly with the Oxygen Flow Indicator and Oxygen Pressure Indicator gauges
5. Optional: Set C1 Navigation Lights Power (*Kennlichter*) – ON (IN)
6. Ensure elevator, aileron and rudder controls are working by moving stick and rudder pedals

Fuel Gauge Indication Selector 3

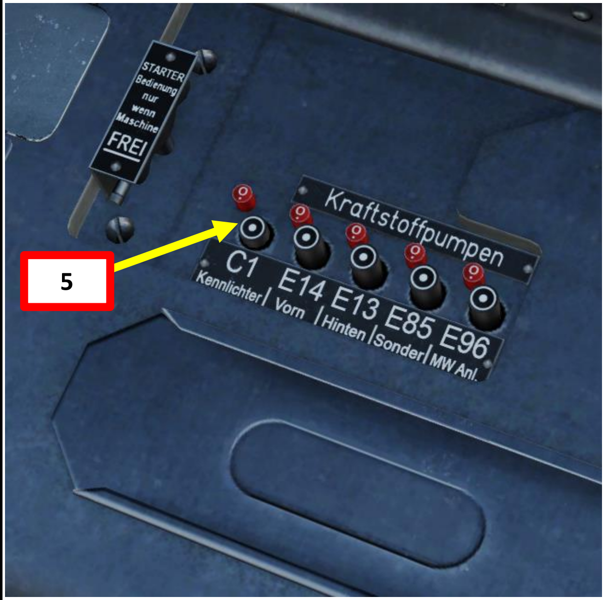
- *Left: Vorn = Front*
- *Middle: No Tank Selected*
- *Right: Hinten = Rear*

Note: If an external drop tank is installed, selector should be set to "HINTEN" (Rear) since drop tanks feed into the rear tank.

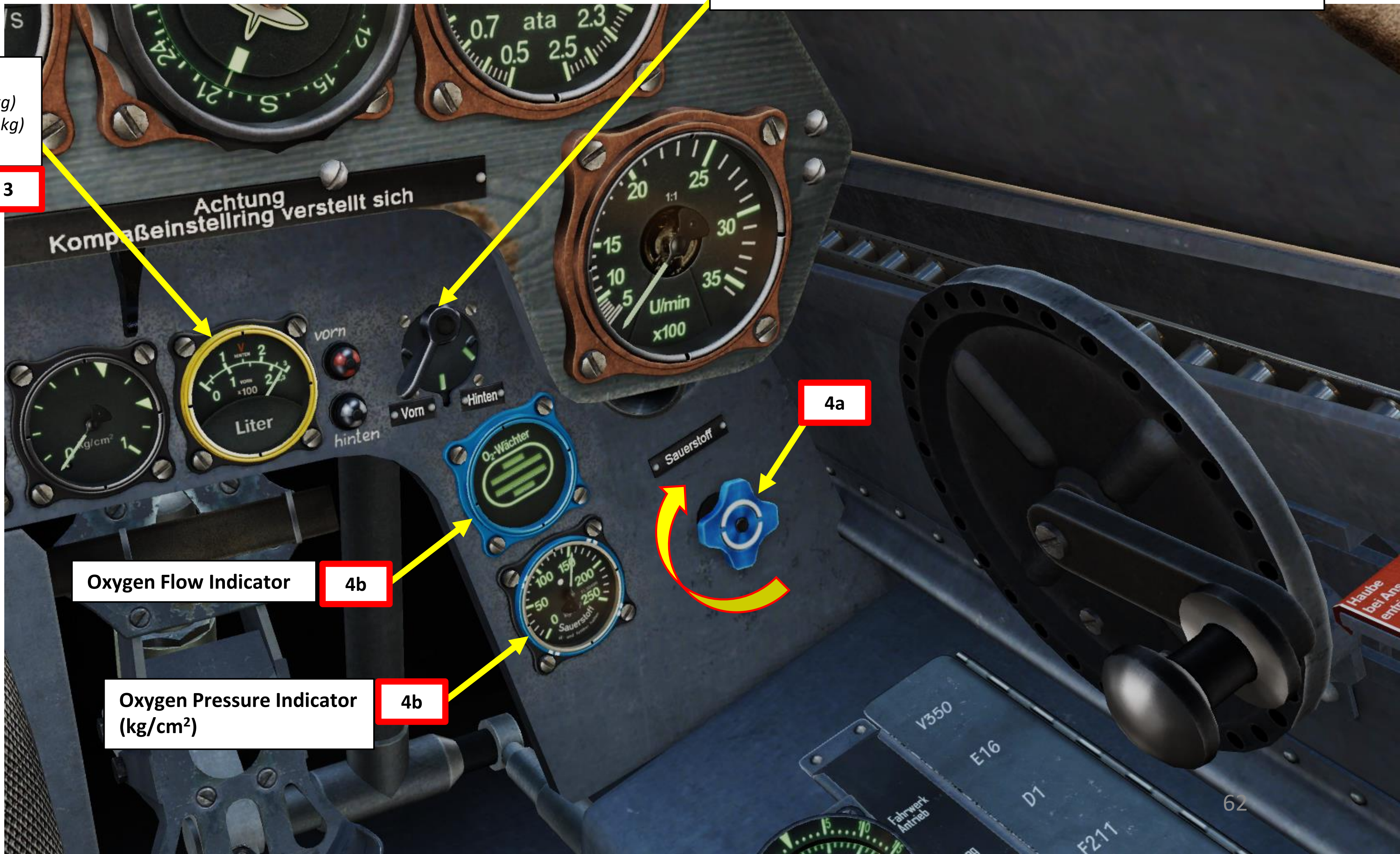
Fuel Gauge (x100 Liters) 3

- *Vorn/Front Tank Capacity: 232 L (172 kg)*
- *Hinten/Rear Tank Capacity: 292 L (216 kg)*

Total Capacity: 524 L (388 kg)



5



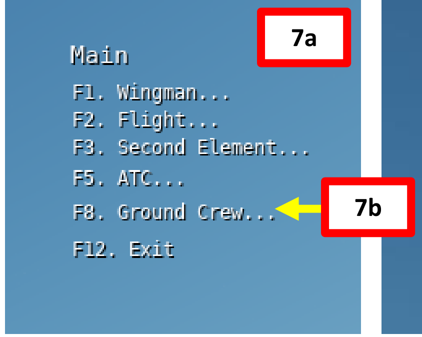
Oxygen Flow Indicator 4b

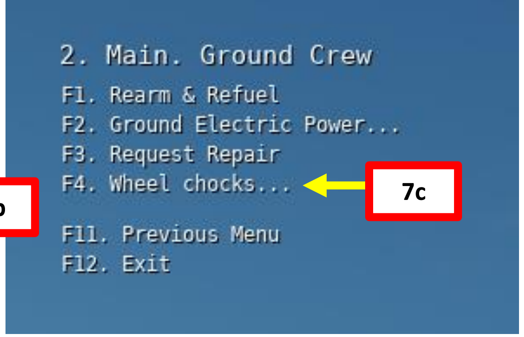
Oxygen Pressure Indicator (kg/cm²) 4b

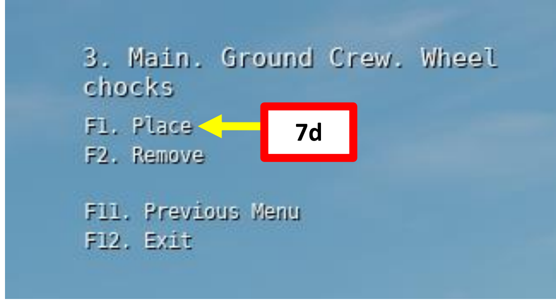
4a

PRE-FLIGHT

7. Verify that wheel chocks are installed. If not, call your ground crew (Press “\” and then press “F8”) and press “F4” and “F1” to ask the crew to place the wheel chocks.

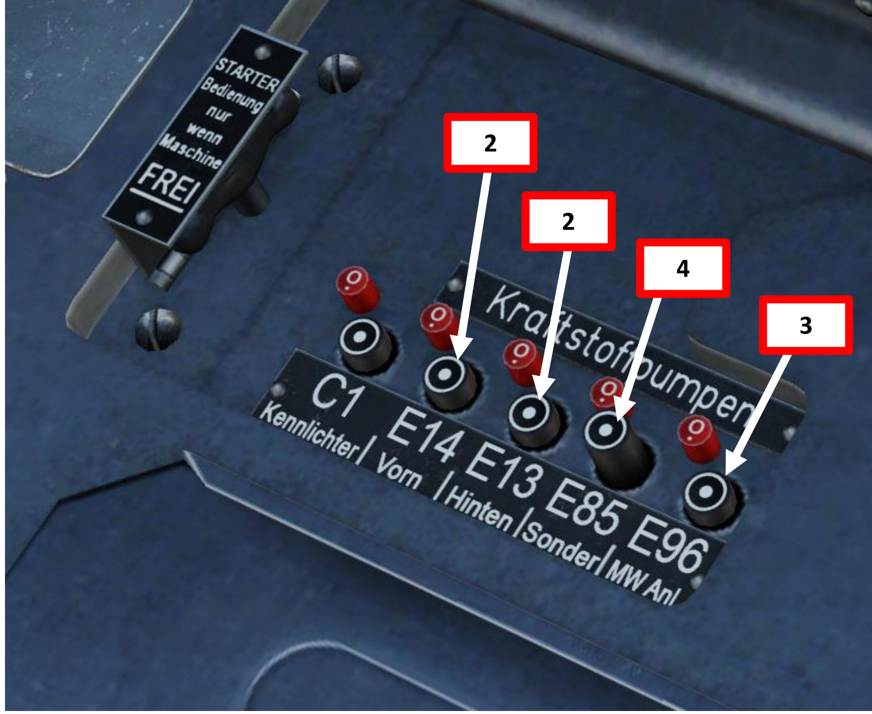


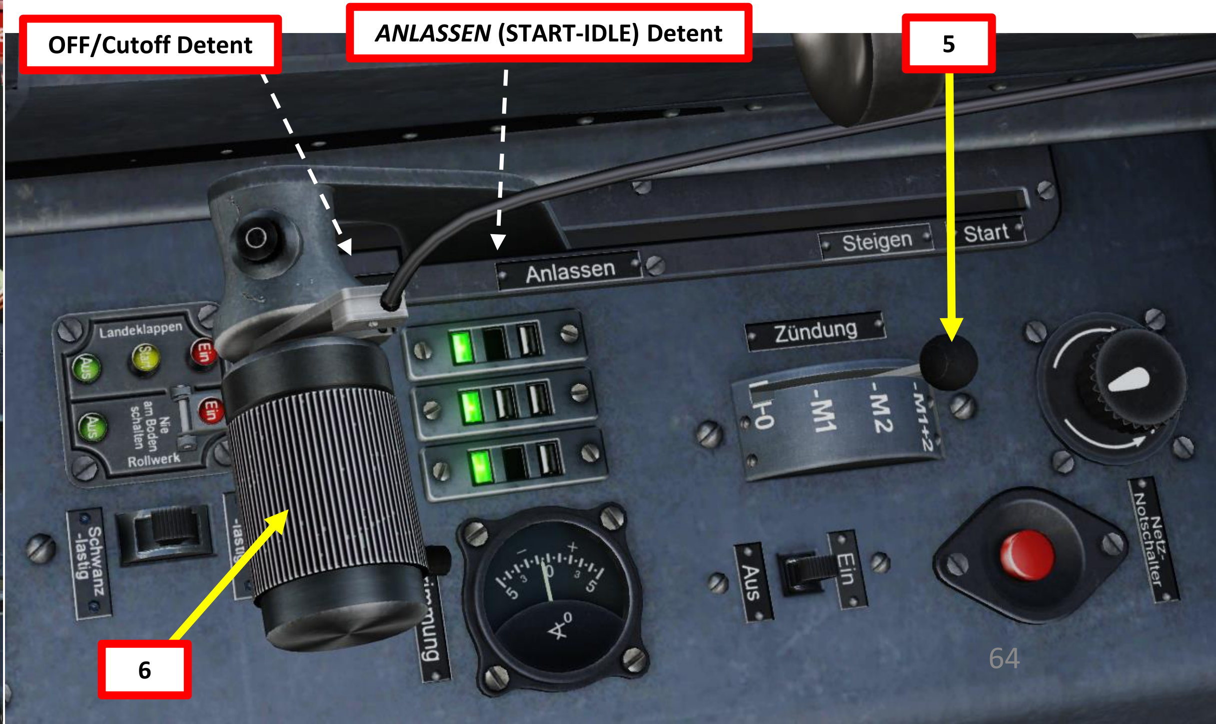




ENGINE START

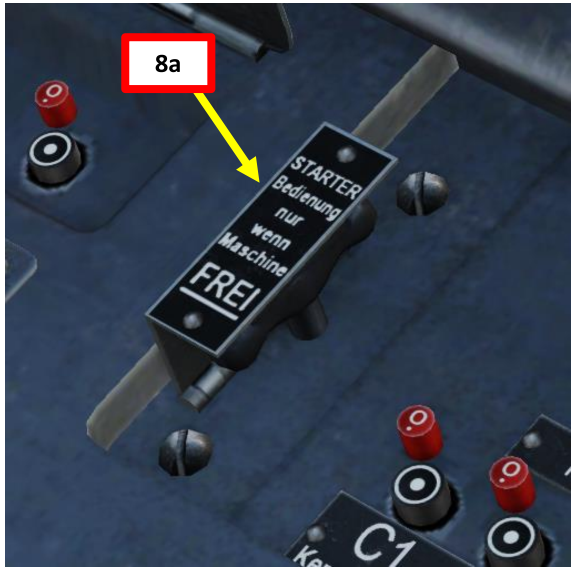
1. Set fuel selector lever – “AUF” (OPEN, FULLY UP)
2. Set E14 (Forward Tank, *vorderer Behälter*) and E13 (Rear Tank, *hinterer Behälter*) Fuel Pump Power Switches – ON (IN)
3. Set E96 (MW-50) Power switch – ON (IN)
4. If external drop tank is equipped, set E85 (Auxiliary Tank, *Sonder)* Fuel Pump Power Switch – ON (IN).
    - If no external drop tank is equipped, leave E85 Switch to OFF (OUT).
5. Set Magnetos (Ignition) Switch – M1+M2
6. Set throttle to *ANLASSEN* (START-IDLE) by pressing “RALT+HOME”.

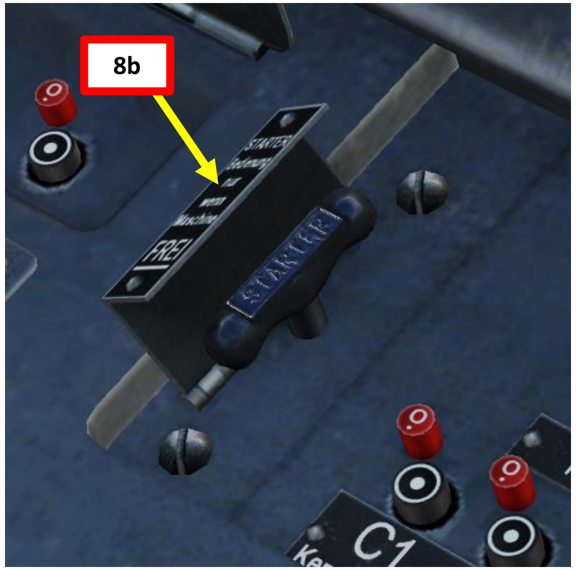


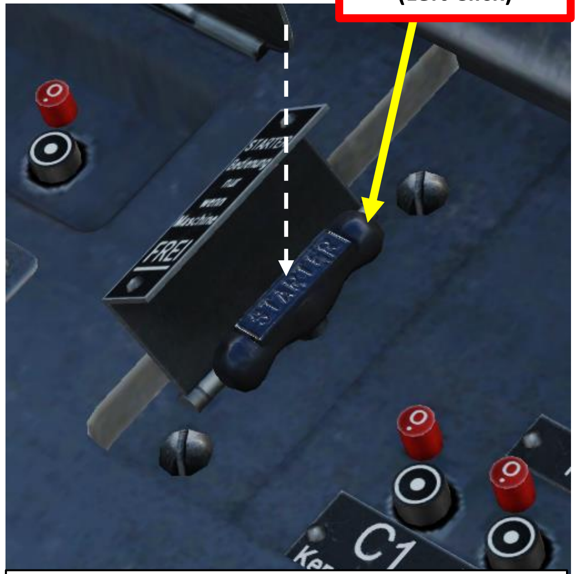


ENGINE START

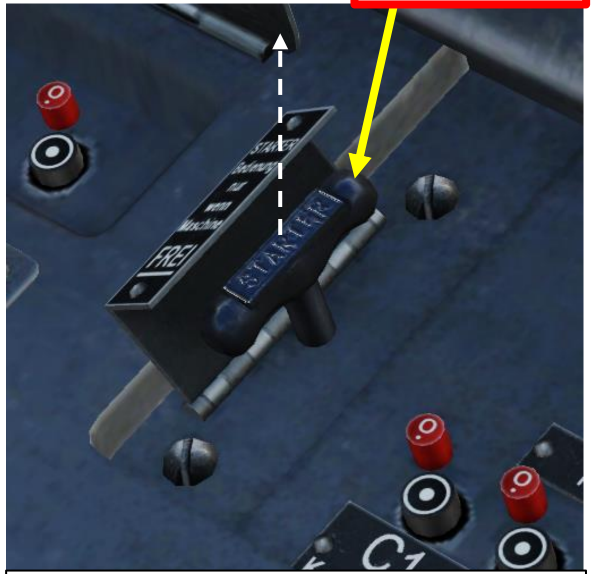
7. Verify that the propeller is clear and command « Clear prop! » to warn people around you that you are about to start the engine.
8. Flip starter cover.
9. Push down and hold the starter lever (left click) for 25 seconds. The inertial flywheel will crank up.
10. Pull the Starter Lever (Right Click) and hold it until the engine fires up.







Inertial Flywheel Cranking Up

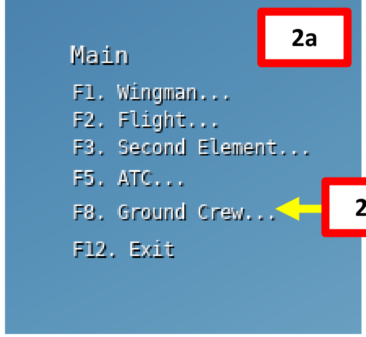


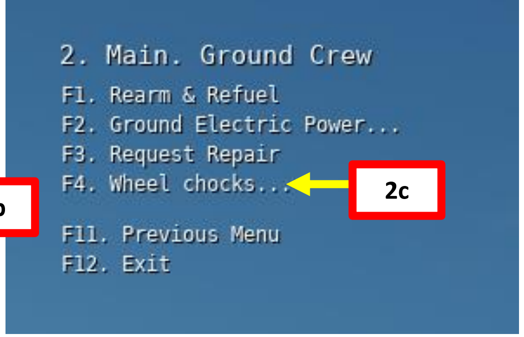
Engine Firing Up

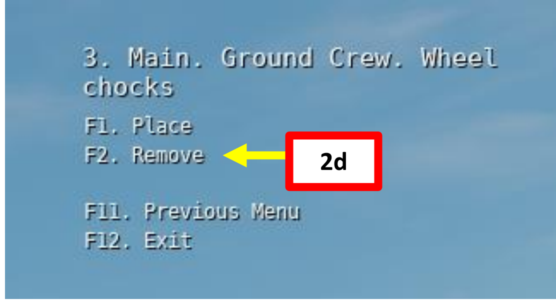
ENGINE START

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 “F4” and “F2” to ask the crew to remove the wheel chocks.





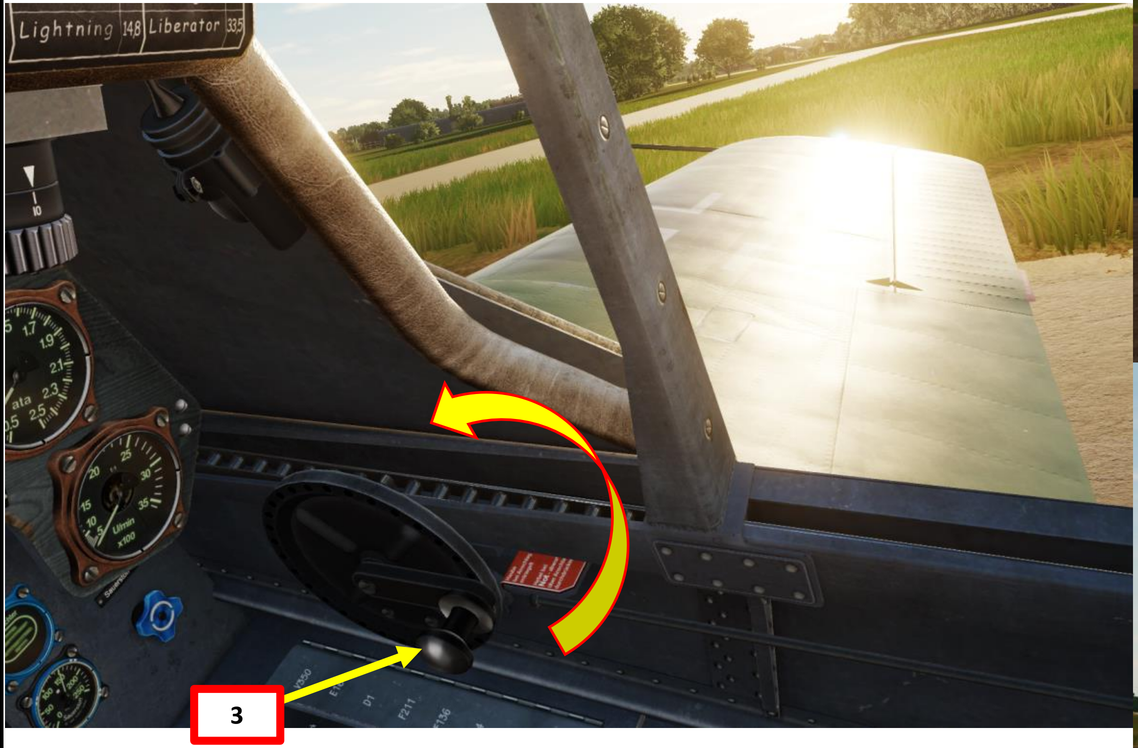



Wheel Chocks Installed


Wheel Chocks Removed

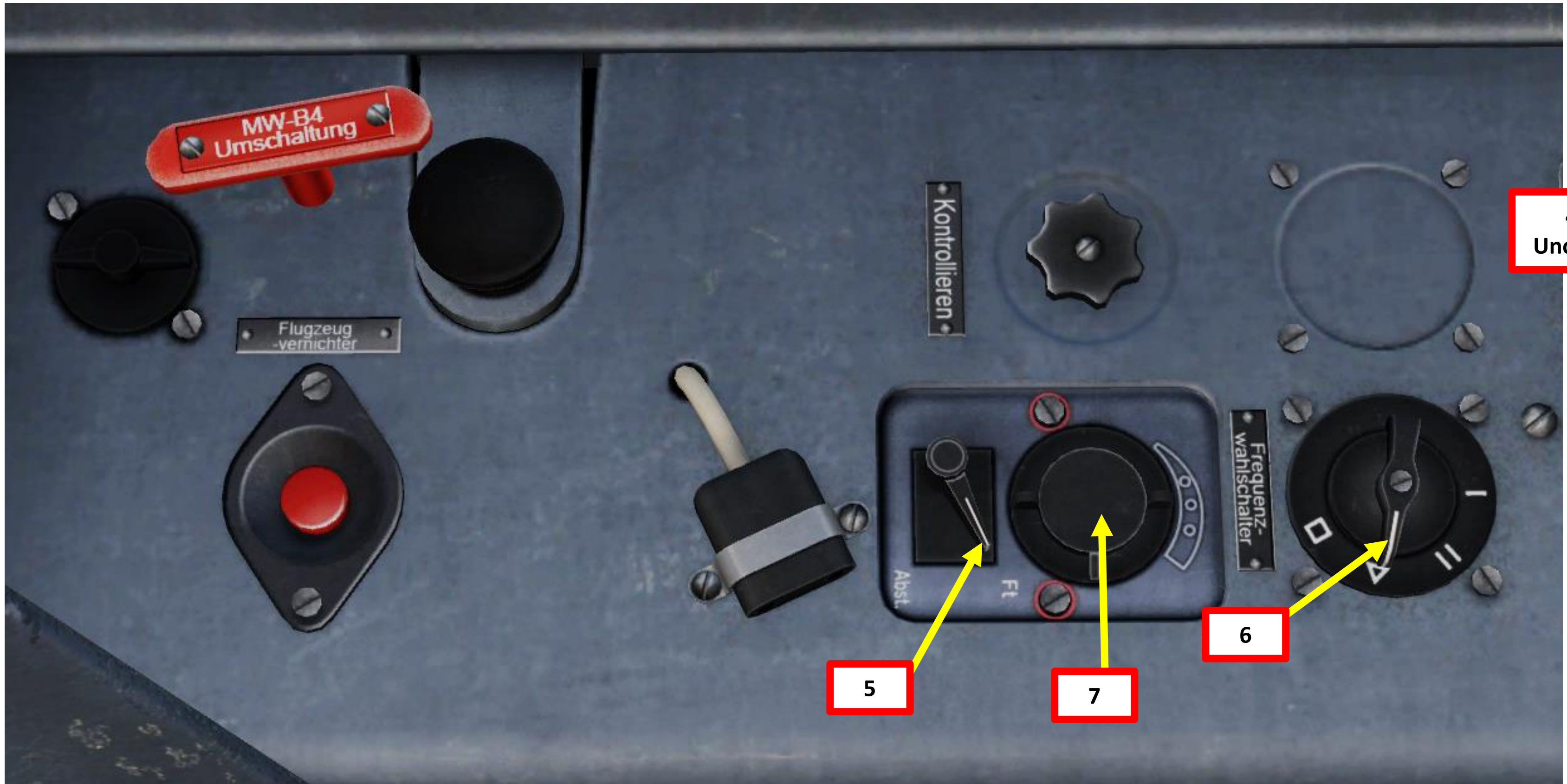
POST-START

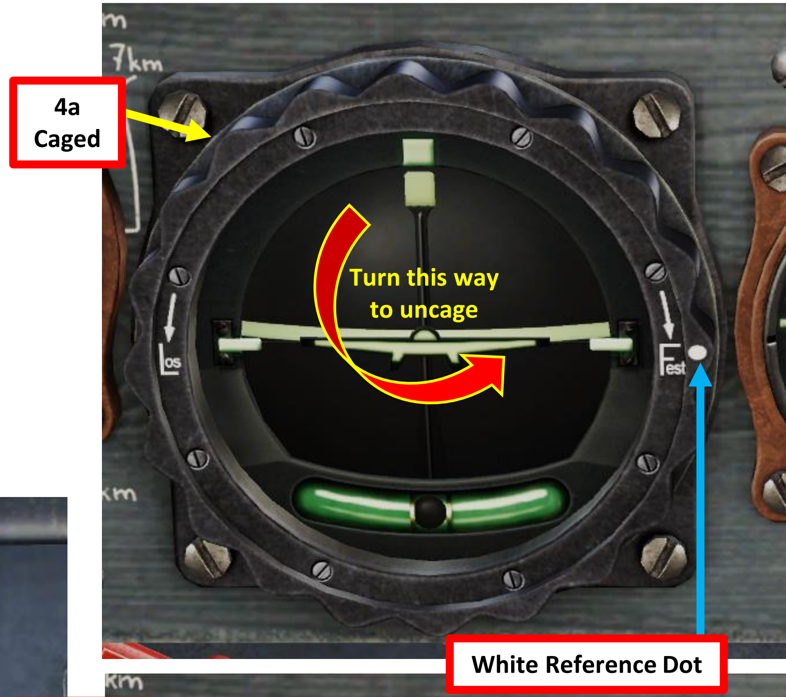
3. Close your canopy by cranking the canopy handle (“LCtrl+C”).

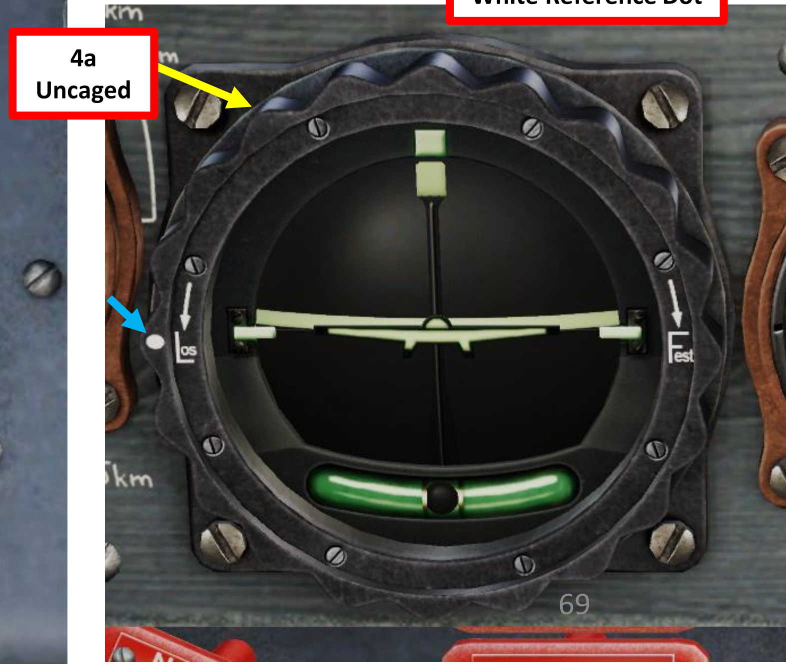


POST-START

4. Uncage the Artificial Horizon by rotating the outer ring. In the caged position, the white reference dot should be to the rightmost position (*Fest*). In the uncaged position, the *white reference dot* should be to the leftmost position (*Los*).
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

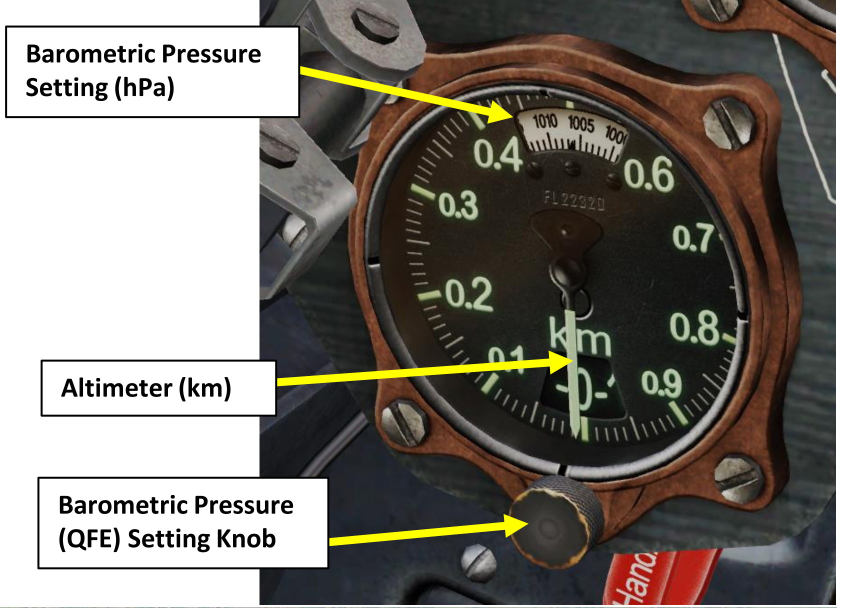


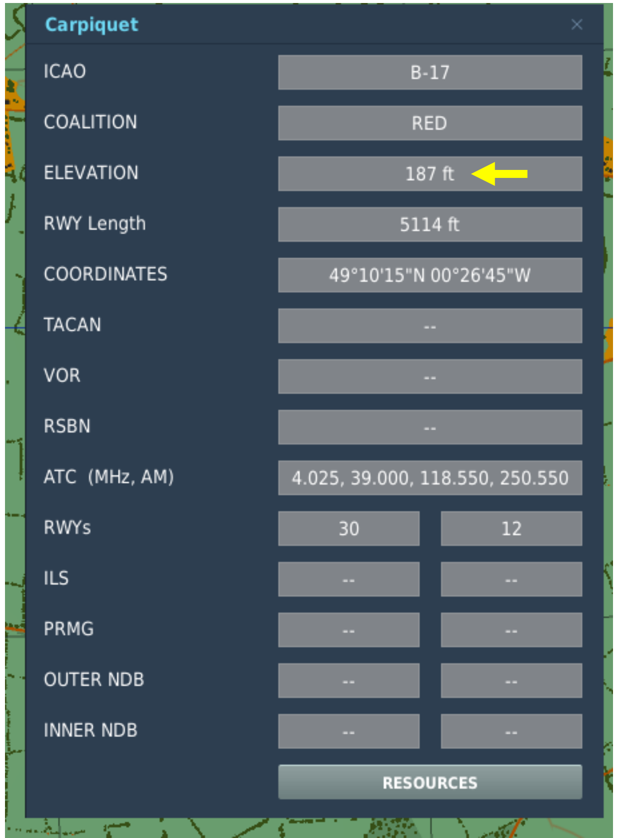




POST-START

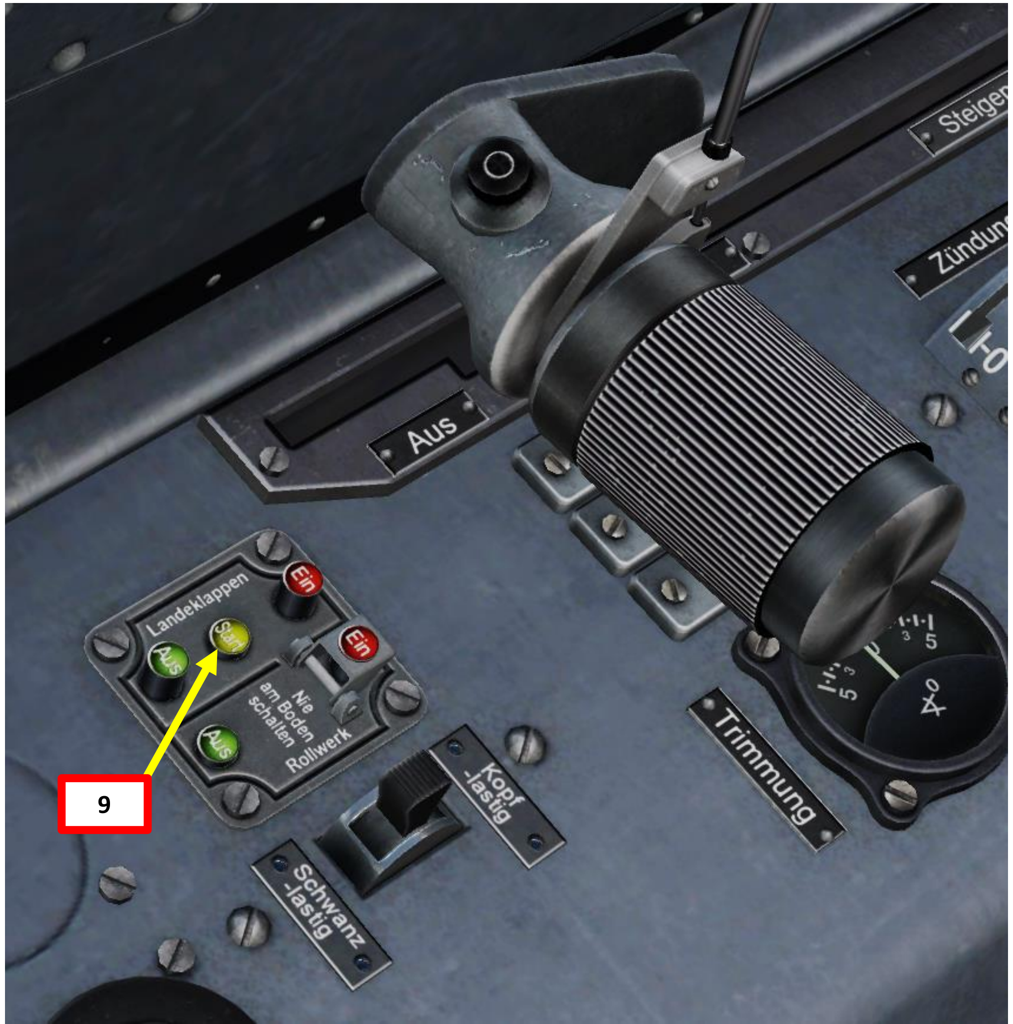
8. Use F10 key to display your map and airport information. Adjust QFE (Barometric Pressure) Setting to “0”. Alternatively, you can also match the altimeter reading to the airport elevation in meters.





POST-START

9. Set Flaps (*Landeklappen*) – TAKEOFF (START) Position.
10. Verify that flaps position is 10 deg on the wing indicator.
11. Perform engine warm-up.



ENGINE WARM-UP

1. Ensure oil pressure is between 3 and 13 kg/cm^2.
2. Hold pedal brakes, then increase throttle to reach a RPM of about 2000.
3. Open cowling flaps by scrolling mousewheel on the *Kühlerklappen*.
4. Wait until engine oil warms up to at least 110-130 deg C and coolant temperature is at least 70-120 deg C.
5. Start taxiing when engine is warmed up.

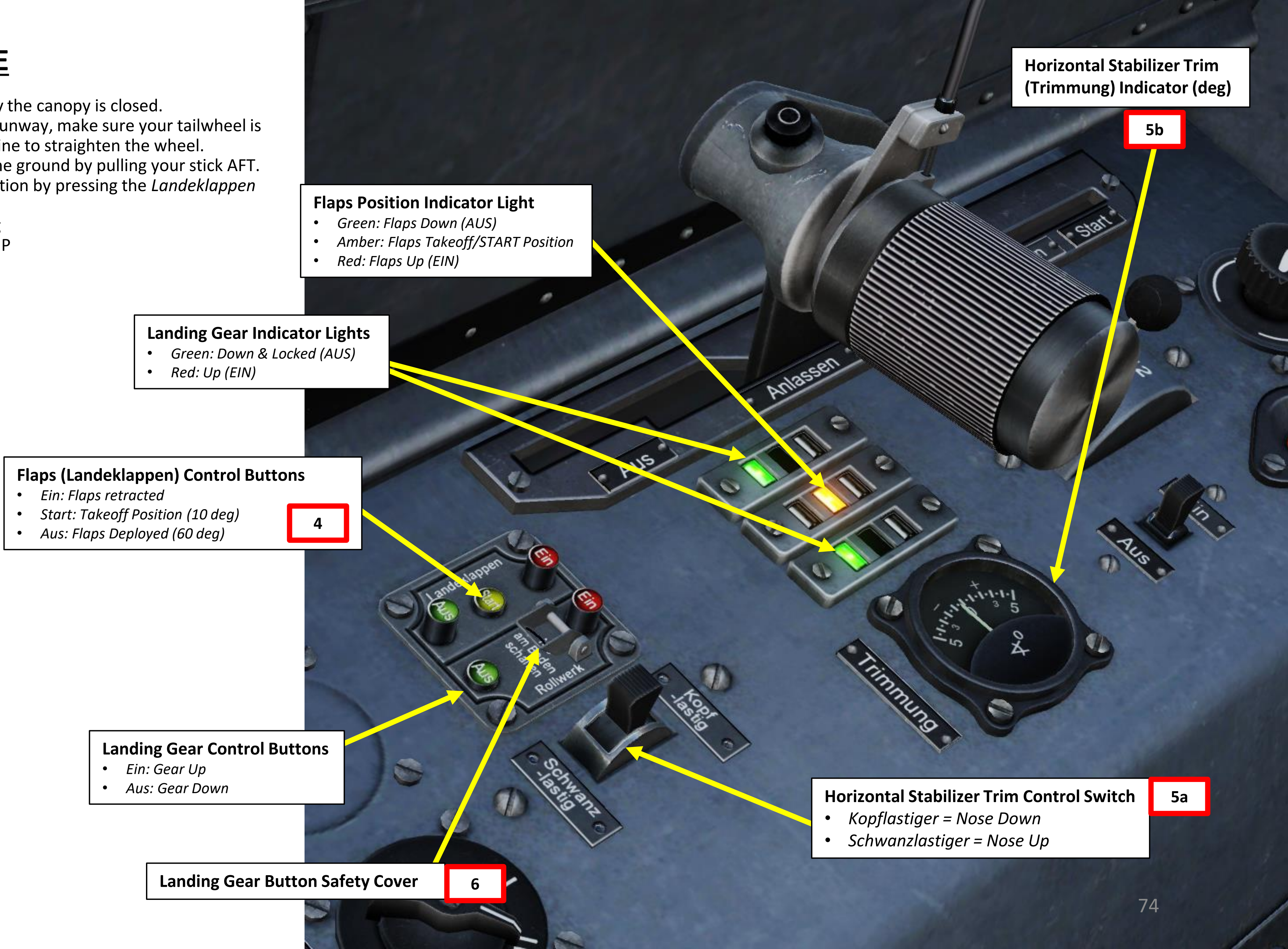
Note: *Attempting a takeoff with low oil or coolant temperature can lead to dire consequences. Waiting for proper engine warm-up is often overlooked by virtual pilots and the engine leaves no room for error when engine temperatures are concerned.*

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. The nose restricts forward visibility. This means that in taxiing, you must zig-zag (or "S-turn") continually. If you want to go straight, pull the stick fully back to lock the tailwheel in position.
5. 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.

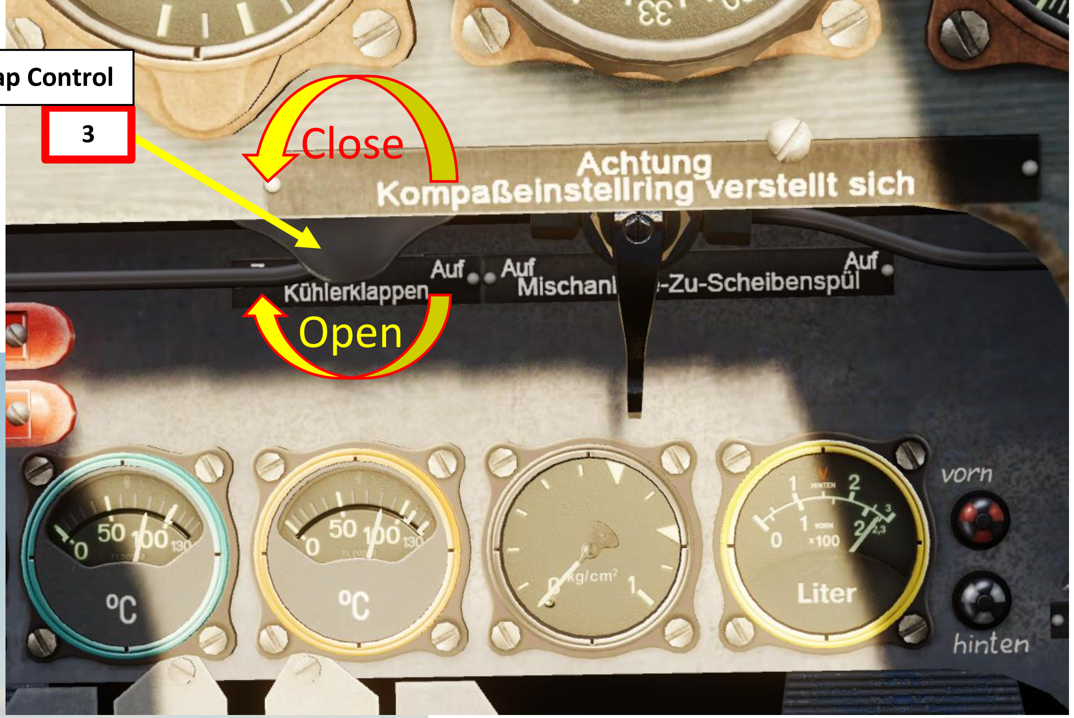
TAKEOFF PROCEDURE

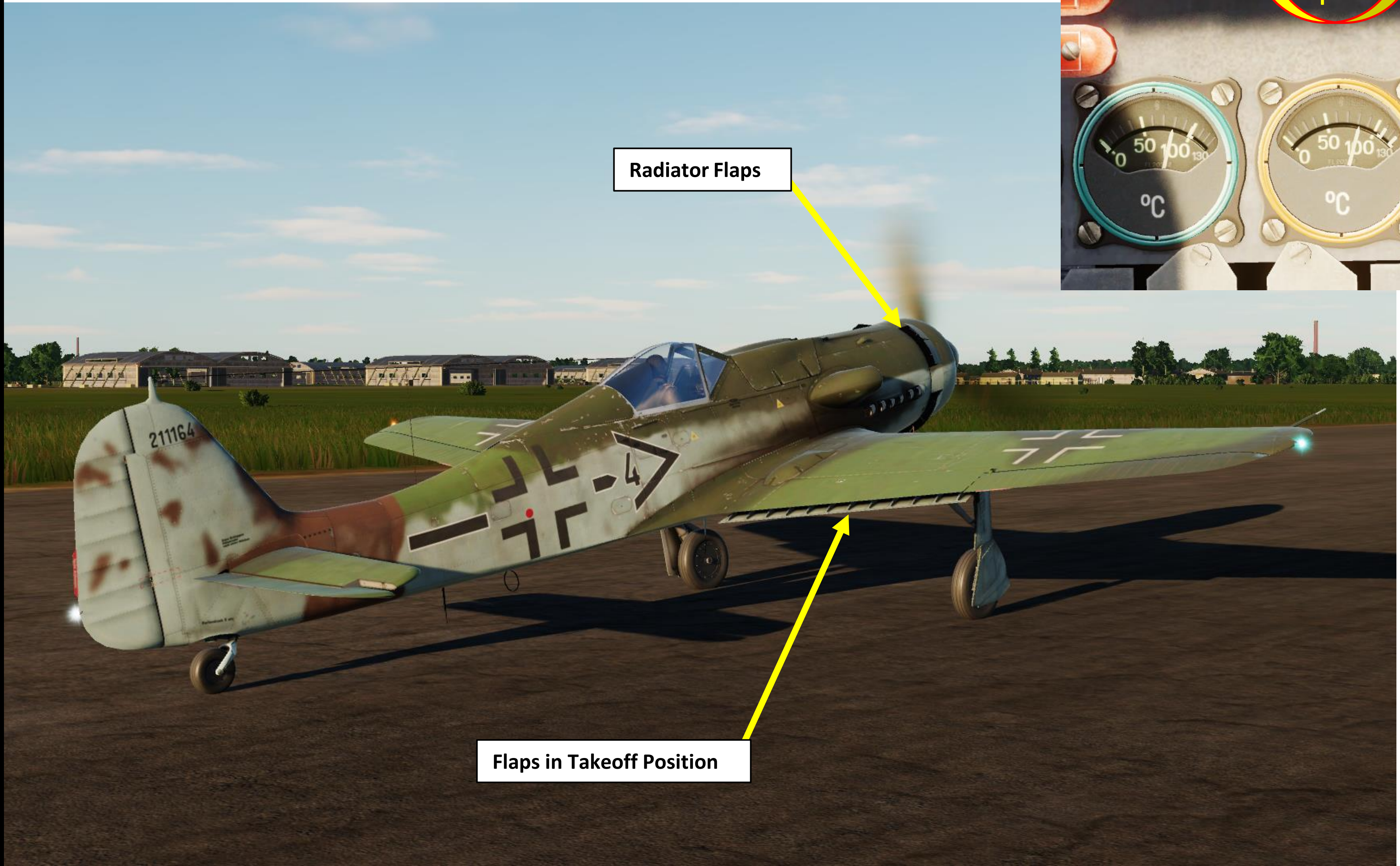
1. Line up on the runway and verify the canopy is closed.
2. Once you are lined up with the runway, make sure your tailwheel is straight by moving in a straight line to straighten the wheel.
3. Keep your tailwheel locked on the ground by pulling your stick AFT.
4. Set flaps to TAKEOFF (Start) position by pressing the *Landeklappen* START button IN
5. Set Horizontal Stab trim to 0 deg
6. Flip Landing Gear Safety Cover UP



TAKEOFF PROCEDURE

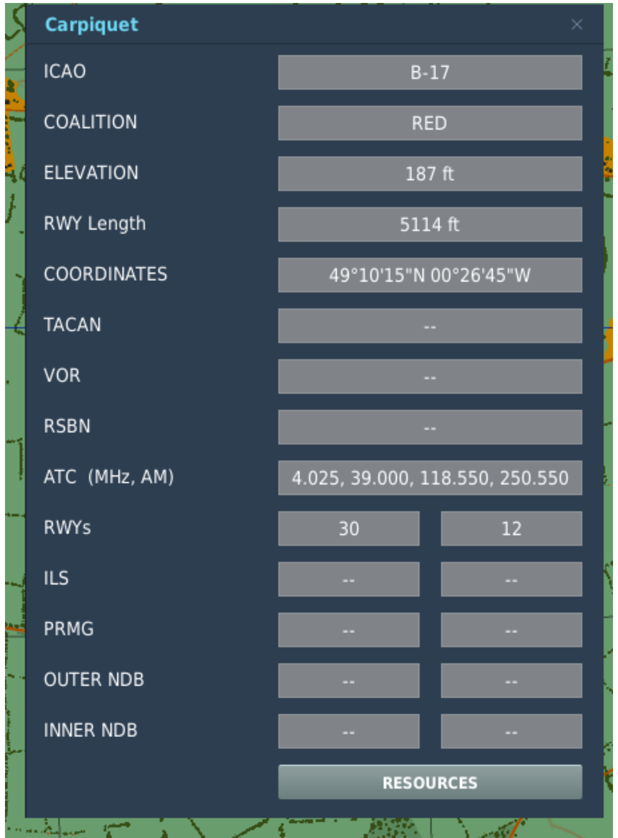
7. Open radiator flaps fully by rotating the Manual Radiator Flap Control (*Kühlerklappen*) clockwise.
    - Open position is AUF.
    - Closed position is ZU.



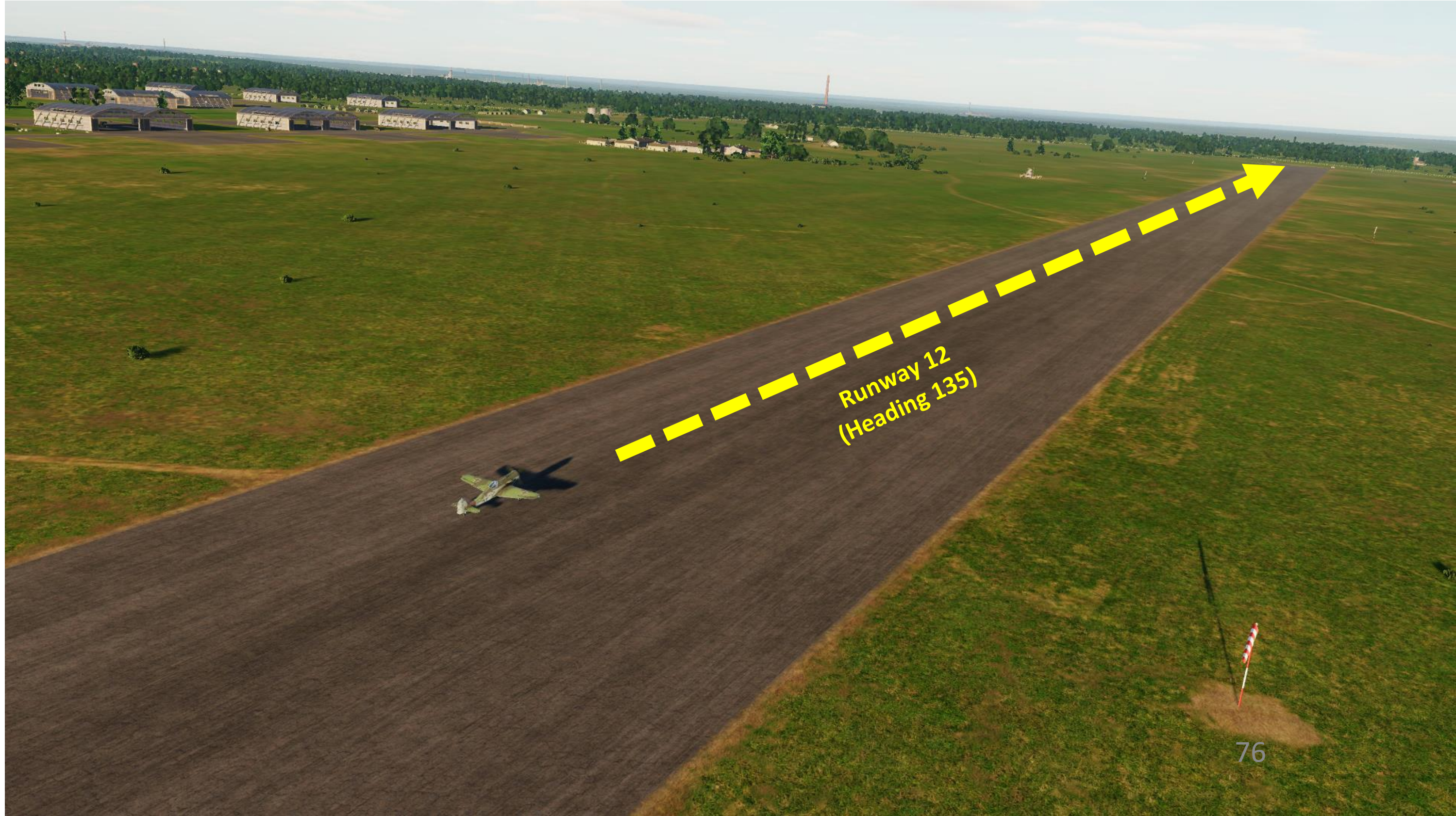


TAKEOFF PROCEDURE

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.



Carpiquet		
ICAO	B-17	
COALITION	RED	
ELEVATION	187 ft	
RWY Length	5114 ft	
COORDINATES	49°10'15"N 00°26'45"W	
TACAN	--	
VOR	--	
RSBN	--	
ATC (MHz, AM)	4.025, 39.000, 118.550, 250.550	
RWYs	30	12
ILS	--	--
PRMG	--	--
OUTER NDB	--	--
INNER NDB	--	--
	RESOURCES	

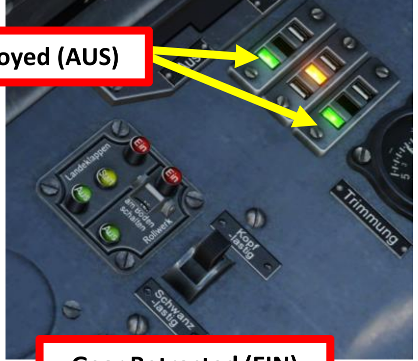


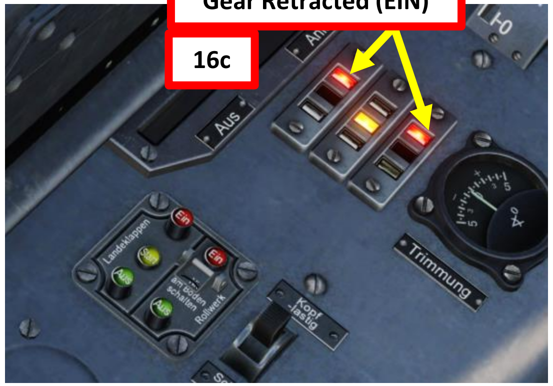
TAKEOFF PROCEDURE

9. Pull your stick fully AFT and hold it there to ensure the tailwheel stays straight.
10. Hold wheel brakes.
11. Throttle up to 2000 RPM, ensure engine parameters are within safety limits, and then throttle up to 2500 RPM.
12. Release brakes and slowly throttle up to 3300 RPM.
13. Do not use your brakes to steer your aircraft: use your rudder instead to make small adjustments.
14. At 170-180 km/h, center your control stick to allow you to pick up more airspeed. Your tailwheel should begin to rise. Make sure that your propeller does not strike the ground.
15. Rotate at 200 km/h.

TAKEOFF PROCEDURE

16. Raise landing gear by pressing the *Rollwerk* EIN button IN before reaching 250 km/h.





TAKEOFF PROCEDURE

17. Raise flaps by pressing the *Landeklappen* EIN button IN before reaching 250 km/h.
18. Set radiator flaps to Automatic Mode by rotating the Manual Radiator Flap Control (*Kühlerklappen*) until it is turned half-way through the FULLY OPEN (AUF) and FULLY CLOSED (ZU) position.

Manual Radiator Flap Control

Flaps Position Indicator Light

- *Green: Flaps Down (AUS)*
- *Amber: Flaps Takeoff/START Position*
- *Red: Flaps Up (EIN)*

TAKEOFF PROCEDURE

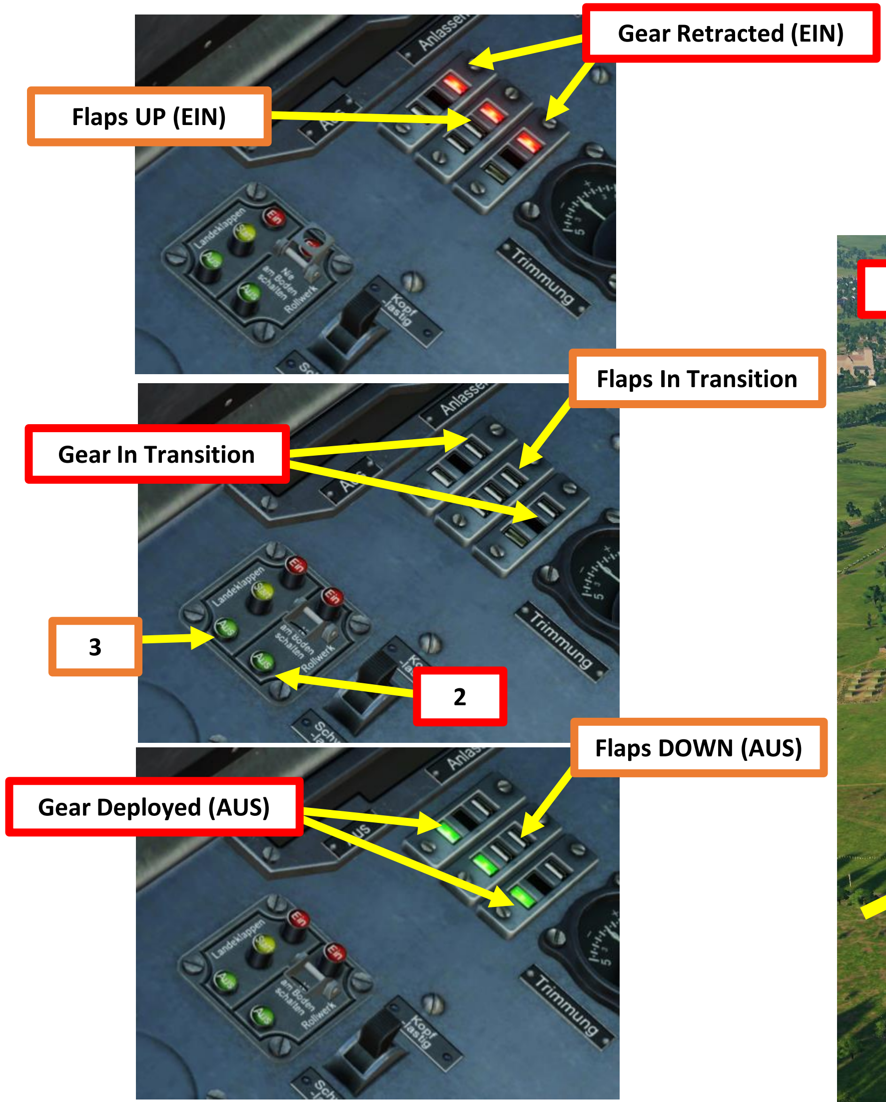
19. Within three minutes after takeoff, reduce power to 3000 RPM and start climbing.
20. Optimal climb speed is 280-290 km/h with a climb power of 3250 RPM.
21. At an altitude of approximately 3,300 +/-200 m, automatic switching from low to high blower occurs noticeably. Avoid cruising or frequent change of altitude around blower switching altitude.

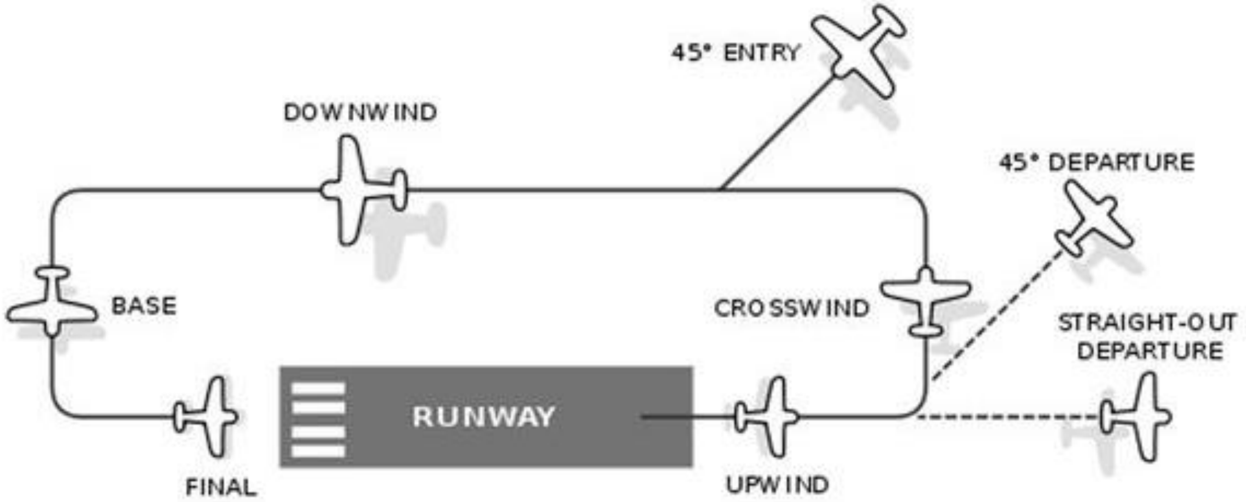
Video Demo: https://www.youtube.com/watch?v=ArgtdYGiuaI

LANDING PROCEDURE

LANDING PROCEDURE

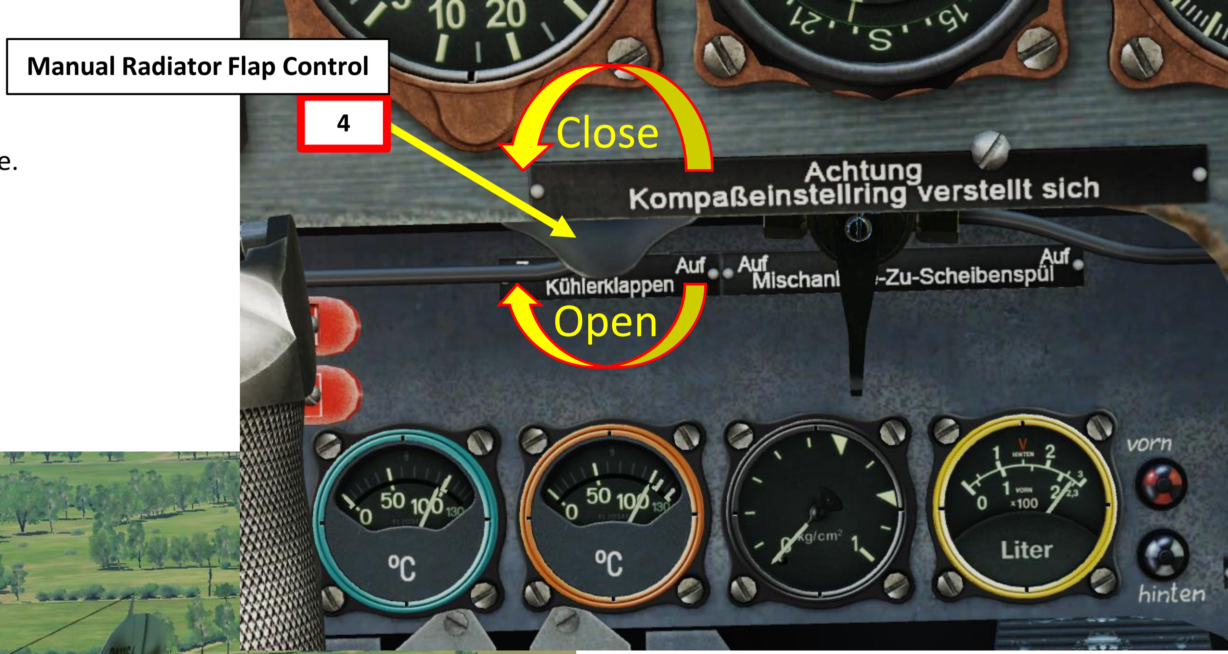
1. Enter downwind leg at 300 m altitude.
2. Deploy landing gear in LANDING (*AUS*) position when below 250 km/h.
3. Extend flaps in LANDING (*AUS*) position when below 250 km/h.





LANDING PROCEDURE

7. Open radiator flaps fully by rotating the Manual Radiator Flap Control (*Kühlerklappen*) clockwise.
    - Open position is AUF.
    - Closed position is ZU.



LANDING PROCEDURE

5. After turning on final, keep your nose aimed to the end of the runway, not the beginning. You tend to go where you aim.
6. Approach the airfield with a speed of 220 km/h, and a sink rate between 2.5 and 5 m/s.
7. Reach the runway with a speed of approx. 200 km/h and a sink rate of 2.5 m/s.
8. Touchdown with a speed of 160-180 km/h with IDLE throttle. Do not start pulling on the stick to lock your tailwheel down yet: you can still generate enough thrust to bounce, stall and crash at any speed over 170 km/h if you are not careful. Glide your way through the runway… gravity and deceleration will keep you on a straight trajectory.
9. When decelerating to 100 km/h or less, lock your tailwheel by pulling back on your stick.
10. Do not use your brakes to steer the aircraft yet: use small rudder input instead.
11. When you start losing rudder authority (due to the decreasing airspeed), gently tap your brakes to slowly bring the airplane to a full stop.

Video Demo: https://www.youtube.com/watch?v=uSHRl1u5zKM

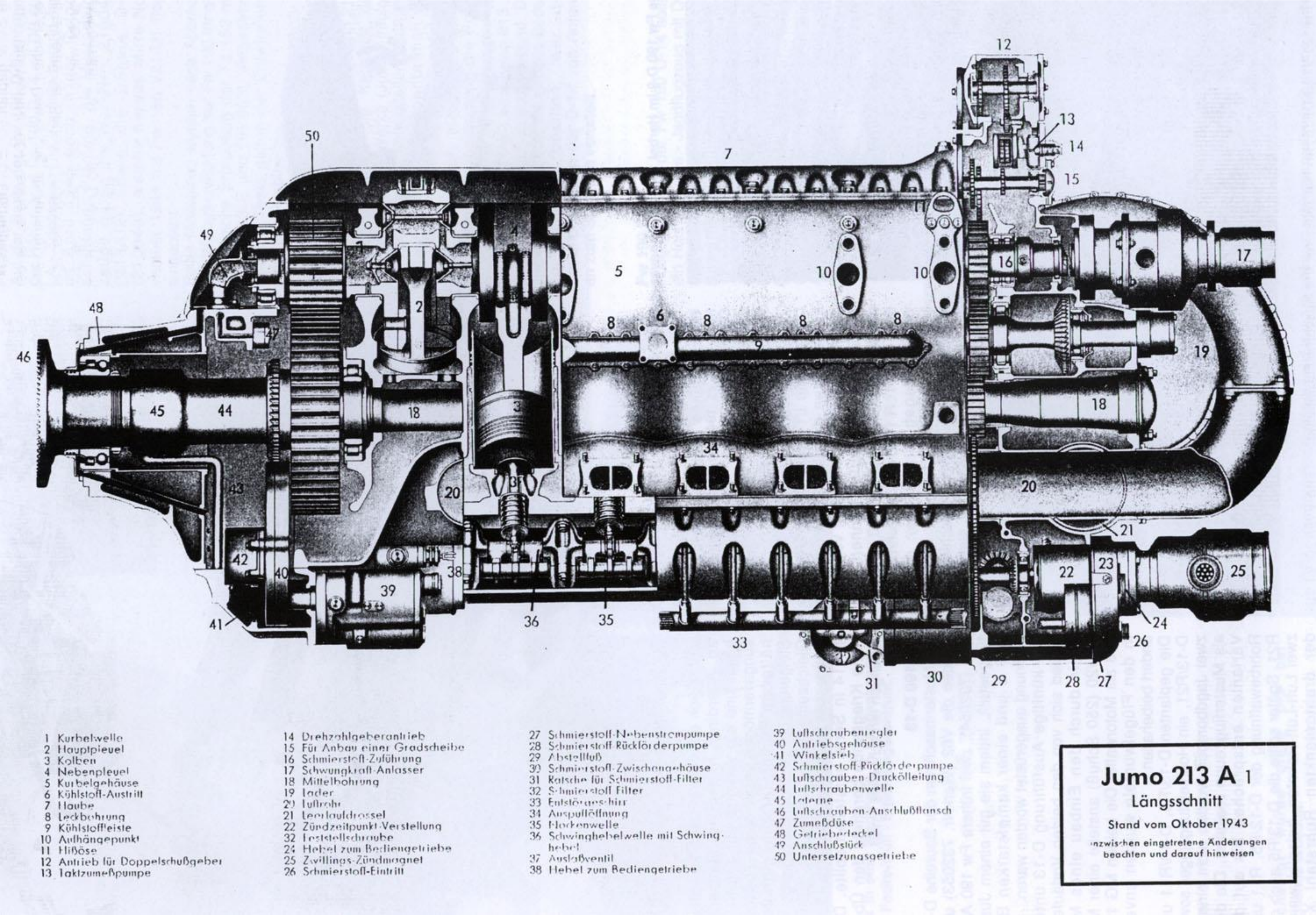
LANDING PROCEDURE

LANDING PROCEDURE

LANDING PROCEDURE

JUNKERS JUMO 213 A-1 ENGINE

The Fw190 D-9 “Dora” is powered by a Junkers Jumo 213 A-1 engine, a 12-cylinder liquid-cooled inverted inline Vee. The Jumo 213 features a single stage, two-speed supercharger and an automatic manifold pressure regulator. The engine drives a three-blade constant-speed propeller. The Jumo engine delivers approximately 1,776 horsepower at 3,250 RPM. This can be further increased to 2,240 horsepower by the use of MW-50 water-methanol injection. Maximum emergency power in level flight is 1,600 horsepower at 3,250 RPM.



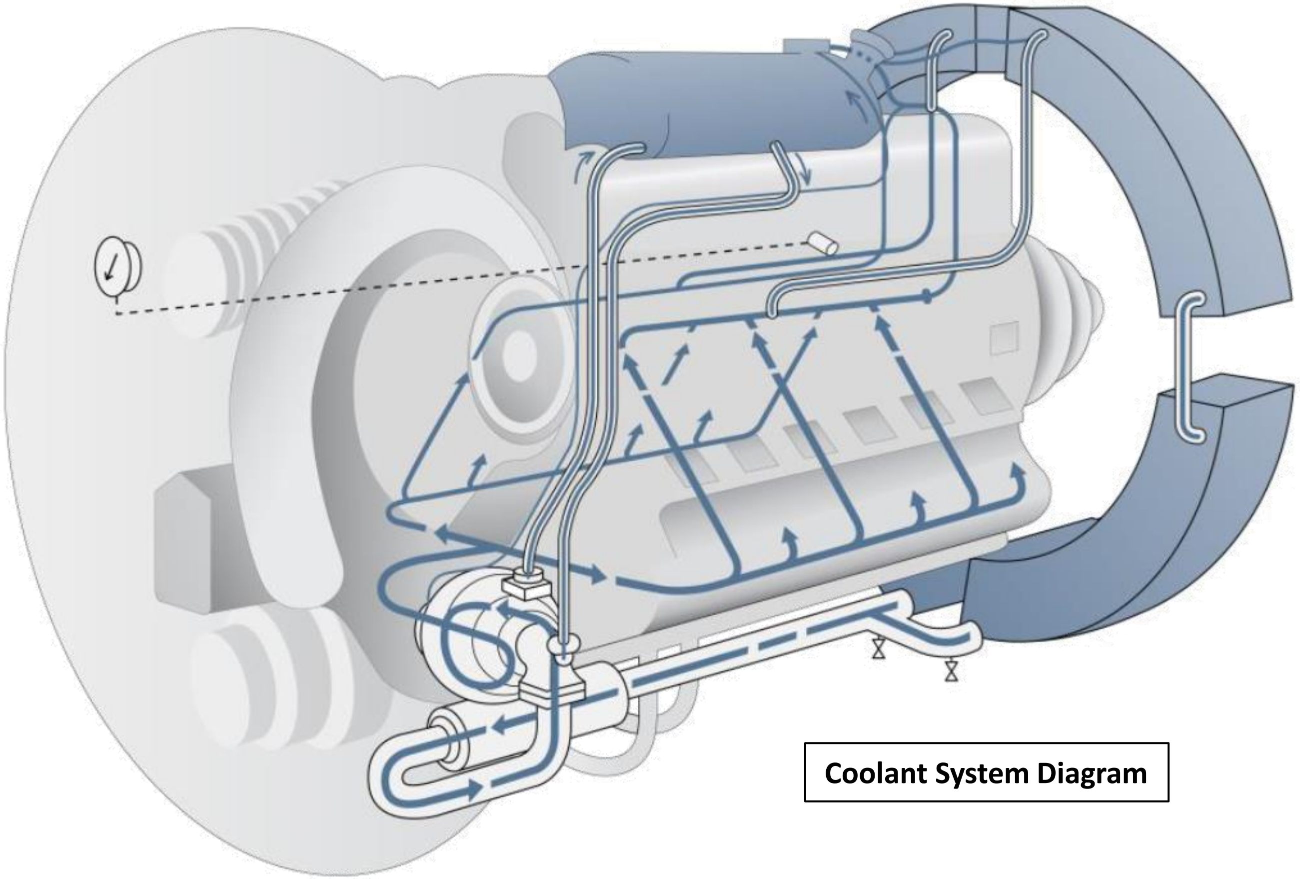
JUNKERS JUMO 213 A-1 ENGINE

Coolant System

The D-series of the Fw 190 uses the AJA 180 annular radiator with a capacity of 115 liters. It is installed in front of the engine. The Jumo 213 coolant system has both the main system, consisting of the coolant pump, engine, radiator, and the heat exchanger; as well as the secondary system with the secondary flow pump, coolant pump, and the coolant tank. The two systems only interact within the coolant pump. The coolant system attempts to operate at a temperature of about 100 °C at all altitudes. A built-in electric temperature sensor between the engine and the radiator is used to control the temperature.

Proper pressure is required in the cooling system to prevent unwanted vapor formation. Any steam that may occur is separated in the vapor air separator of the coolant pump and then sent to the secondary system coolant tank where it is condensed. However, if the boiling limit in the coolant tank is exceeded, the pressure begins to rise. Therefore, the pressure and temperature gauges should be watched at all times to avoid overheating and possible engine damage.

To avoid excessive pressure, the cooling system has a pressure-controlled pressure regulating valve which also performs the task of maintaining pressure at greater altitudes via the evaporation of the coolant in the coolant tank.



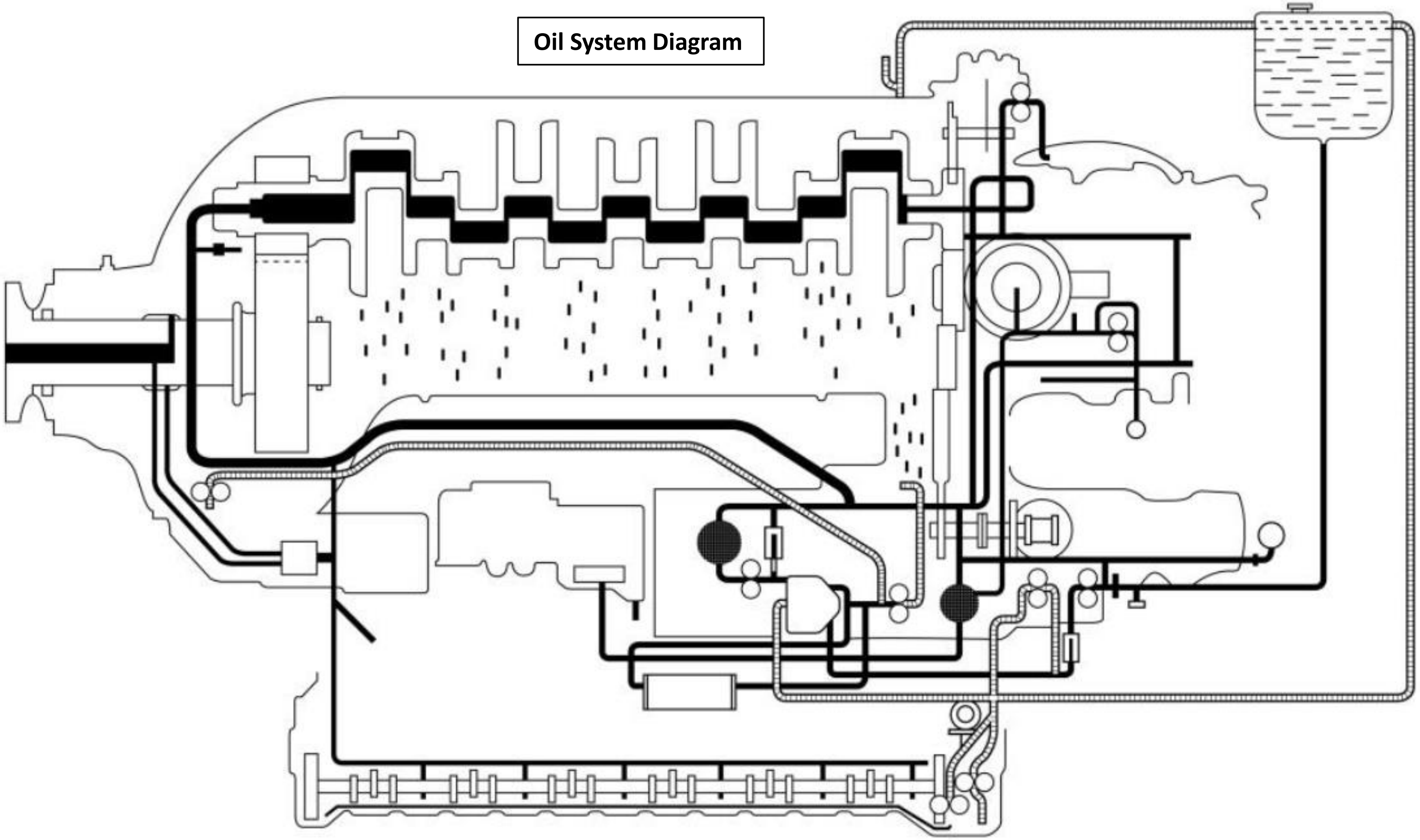
Coolant System Diagram

JUNKERS JUMO 213 A-1 ENGINE

Oil System

A 55-liter oil tank is located in the left side of the engine. There is no air oil cooler - oil is cooled by engine coolant in the special heat exchanger. Two cockpit gauges are provided, both located on the front dash. The oil temperature gauge monitors the system with the normal operating temperature range of 110 to 130 degrees Celsius (min. 40°C, max. 135°C). The right-hand side of the fuel and oil pressure gauge monitors the oil system with the normal operating pressure of 5 – 11 kg/cm^2.

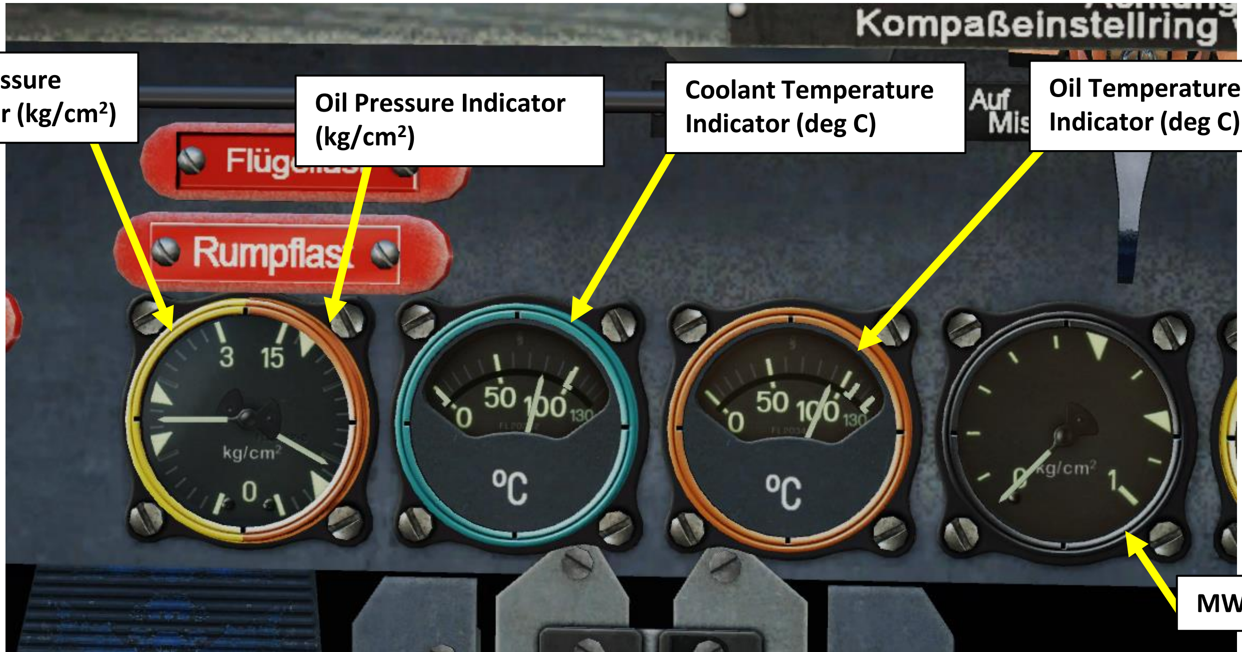
Oil System Diagram



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.



ENGINE CONTROLS

The main engine controls are:

- **Throttle**: Controls supercharger pressure (manifold pressure)
- **MW-50 (Water-Methanol Injection) Switch**: Controls injection of water-methanol, which allows the increase of manifold pressure.
- **MBG (*Motorbediengerät, or Engine Control Unit*) Emergency Mode Handle**: Allows the aircraft to operate at higher boost pressure than normal

Throttle

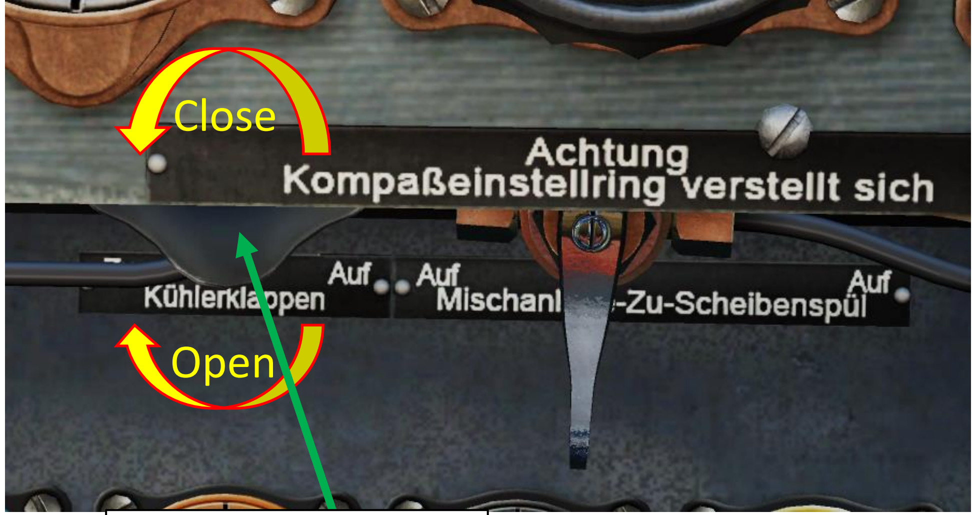
MW-50 (Methanol-Wasser 50, or Water-Methanol Injection) Switch
- *Ein = Enabled*
- *Aus = Disabled*

MBG (*Motorbediengerät, or Engine Control Unit*) Emergency Mode Handle

ENGINE CONTROLS

The main engine controls are:

- **Manual Radiator Flap Control (*Kühlerklappen*) :** Controls engine radiator cowling flaps, allowing to cool the engine. Radiator flaps are set to Automatic Mode by rotating the Manual Radiator Flap Control until it is turned half-way through the FULLY OPEN (AUF) and FULLY CLOSED (ZU) position.
    - Turning the control wheel to AUF or ZU allows for manual control if temperature exceedances are noticed and you need to override the automatic control.



ENGINE OPERATION & LIMITS

Engine Power Settings:

- **TAKEOFF**: 3250 RPM (Throttle Fully Forward)
- **LANDING**: 1000 RPM
- **NORMAL OPERATION**: 3000 RPM

General Rule for Coolant and Oil Temperatures:

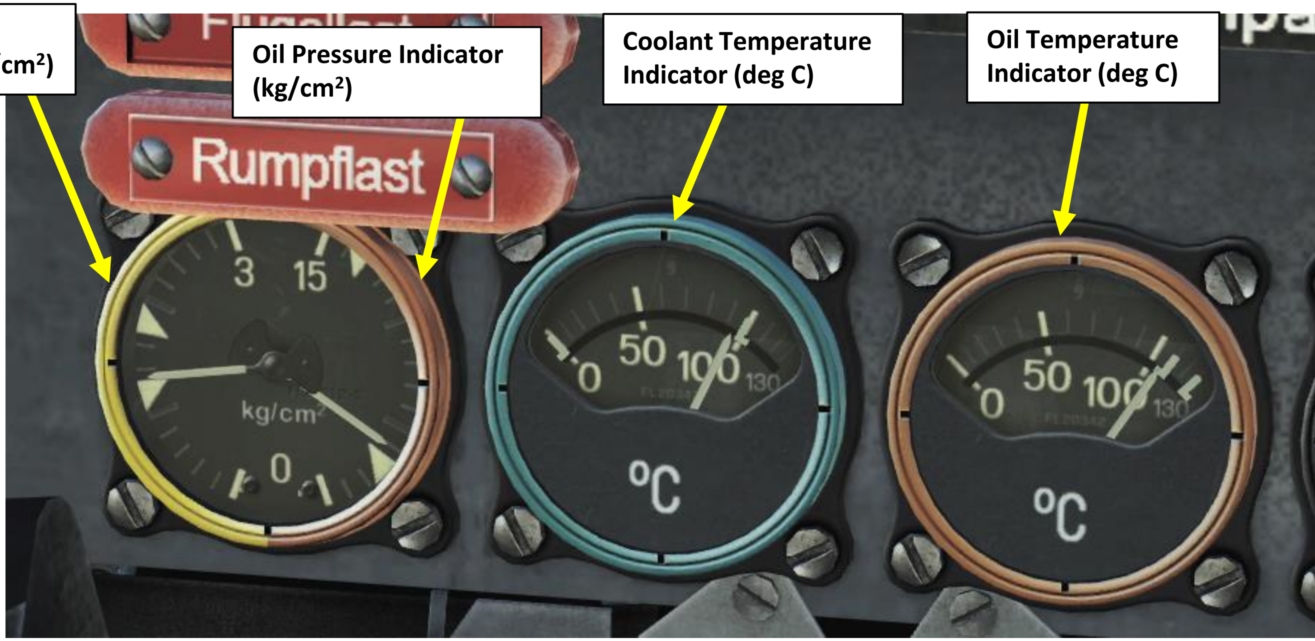
Keep coolant and oil temperatures in the “Safe Region” on the scales as shown. When oil temperature is above 120 deg C, make sure your Radiator Flaps are Open or you risk overheating. When oil temperature is below 70, close it to prevent overcooling.

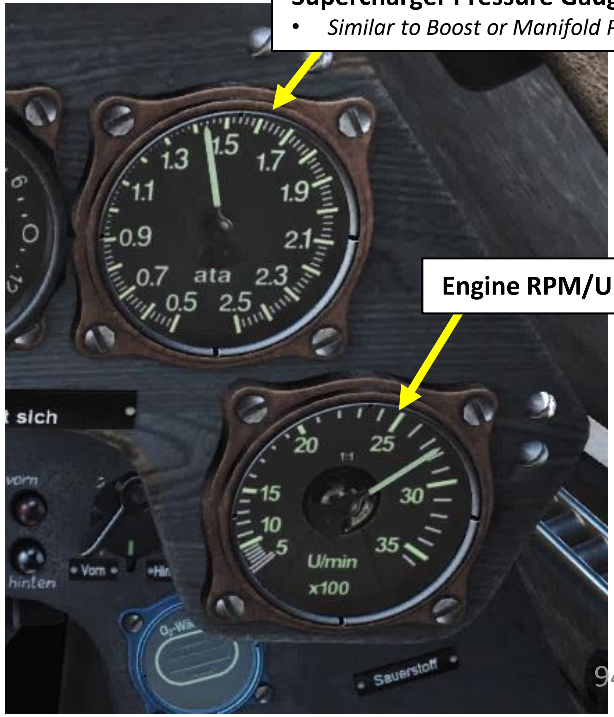
Engine Limits:

- Coolant Temperature: Min 70 deg C – Max 120 deg C
- Oil Temperature: Min 110 deg C – Max 130 deg C
- Oil Pressure: Min 3 kg/cm² – Max 13 kg/cm²

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.





ENGINE OPERATION & LIMITS

POWER SETTINGS				
Throttle Position (deg)	Power Output	RPM	Permissible Time	Fuel Consumption (Liter/Hour)
90	Emergency Power (increased take-off power)	3250	3 min	620
90	Take-Off, Combat and Climb Power	3250	30 min	590
75	Continuous Power	3000	Constant	530
60	Economy I	2700	Constant	375
47	Economy II	2400	Constant	285
34	Economy III	2100	Constant	215
0	Idle (In-Flight)	Approx. 1200	-	-
-10	Engine Stop Position		-	-

BEDIENGERÄT ENGINE CONTROL UNIT

The Junkers Jumo 213 engine comes equipped with a "Bediengerät" (engine control unit), which is similar in function to the "Kommandogerät" (command device) used on BMW-801-powered earlier variants of the Fw 190.

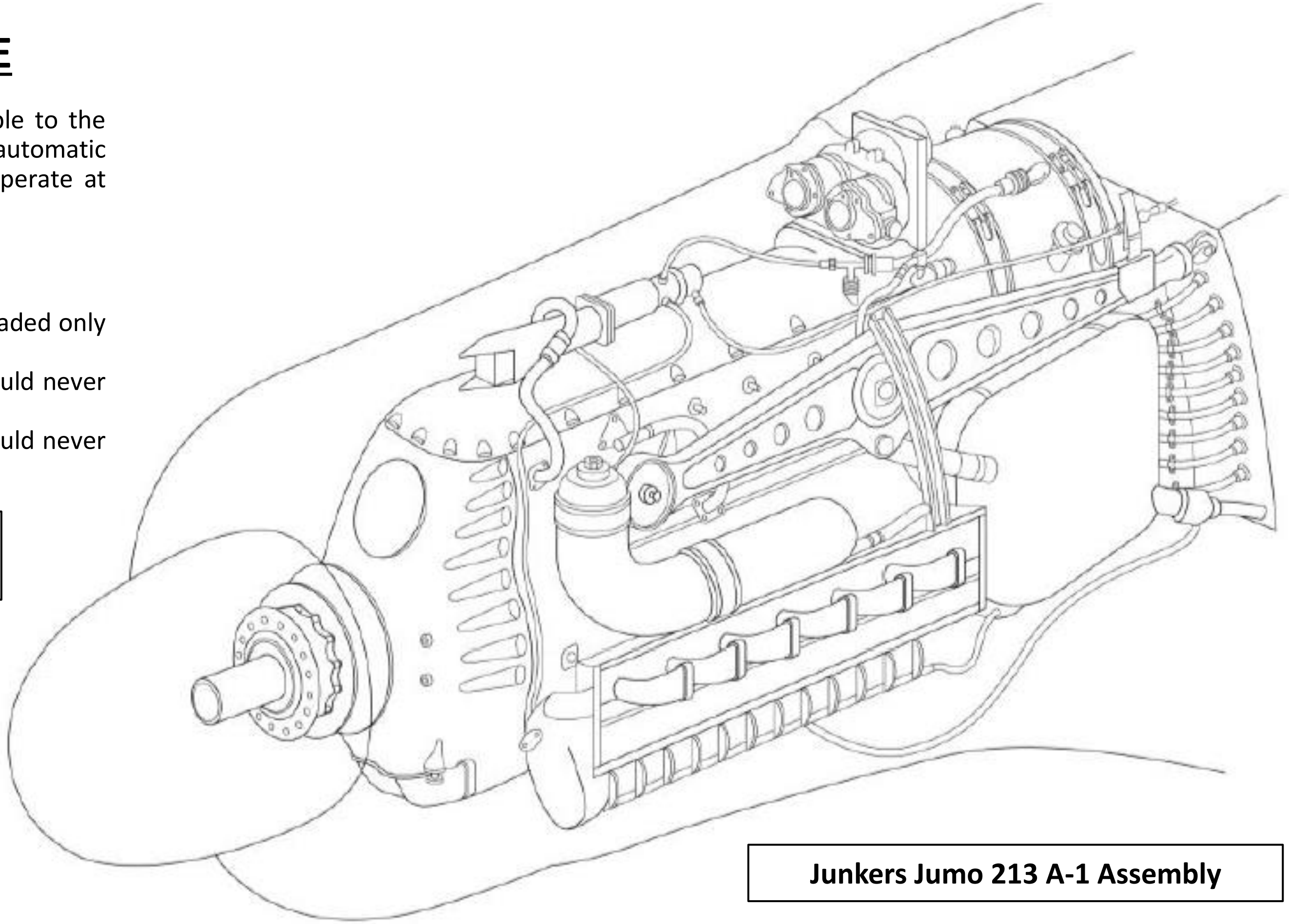
The "Bediengerät" is a hydromechanical multifunction integrator that dramatically simplifies engine control. While in most other contemporary aircraft the pilot had to constantly operate a slew of levers to manage throttle level, propeller pitch, fuel mixture, and supercharger stages, the "Bediengerät" takes the majority of the workload away. The pilot simply has to move the throttle lever to set the desired manifold pressure. The "Bediengerät" takes care of the rest, setting all other parameters to allow the engine to properly operate at the desired manifold pressure, given the current flight conditions.

MBG (MOTORBEDIENGERÄT) EMERGENCY MODE

The Jumo 213 engine also has a "MBG" handle. This handle is connected via cable to the aircraft's "Motorbediengerät" (MBG). In normal position the MBG operates in automatic mode. In case of emergency, the handle can be pulled to allow the engine to operate at higher boost pressure than normal.

- If at all possible, the handle should be pulled when the throttle is in Idle setting.
- Speed control remains automatic.
- Please take extra care to watch engine speed and boost. The engine must be loaded only as far as absolutely necessary in "*Notzug*" mode.
- When flying in "Notzug" mode (handle pulled), boost pressure of 1.55 ATA should never be exceeded!
- When flying in "Notzug" mode (handle pulled), engine speed of 2,700 RPM should never be exceeded!

MBG (*Motorbediengerät, or Engine Control Unit*)
Emergency Mode Handle



Junkers Jumo 213 A-1 Assembly

MW-50 METHANOL-WATER INJECTION

The primary effect of the MW-50 mixture spray is cooling of the air-fuel mixture.

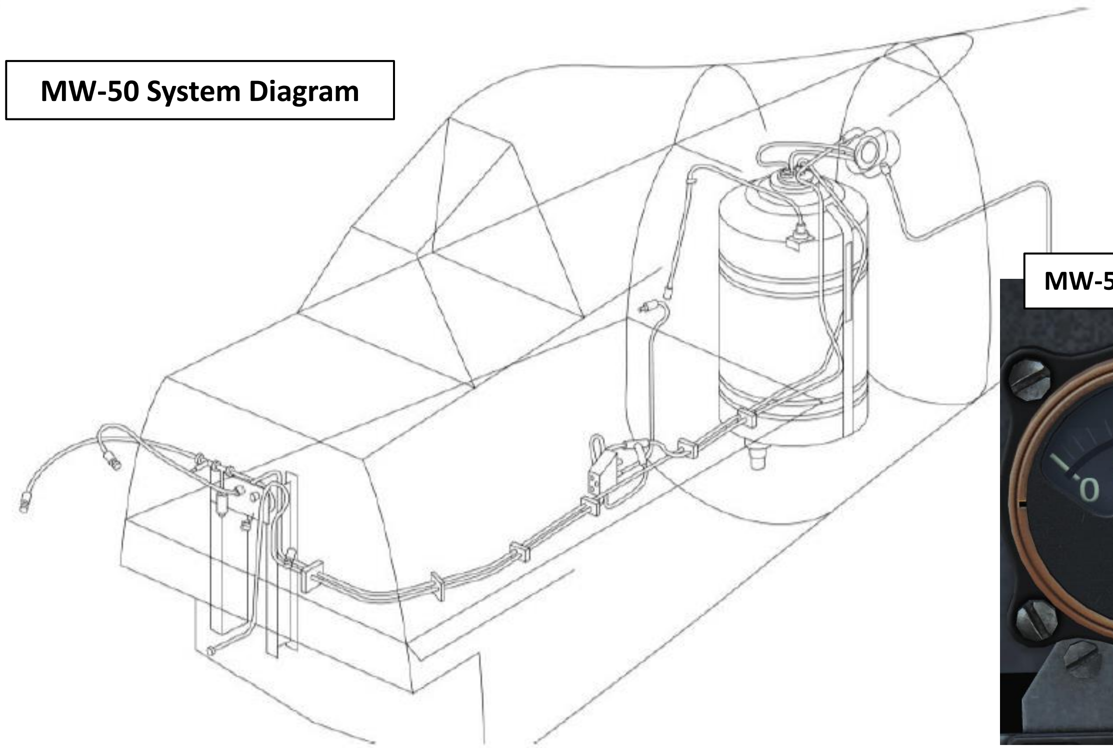
The secondary effect of the MW-50 mixture spray is its anti-detonant effect, which is how the increase in boost pressure is achieved.

While the secondary boost-increasing effects deteriorate with altitude, the primary cooling effects are still noticeable. Therefore, the MW-50 system can be used to cool down the air-fuel mixture at all altitudes in the event of an emergency.

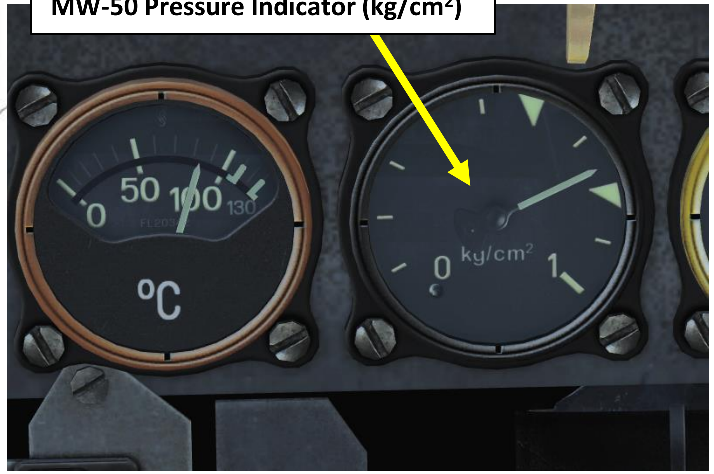
The boost provided by the MW-50 begins to decrease in power at altitudes above 6,000 meters.

Note: 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.

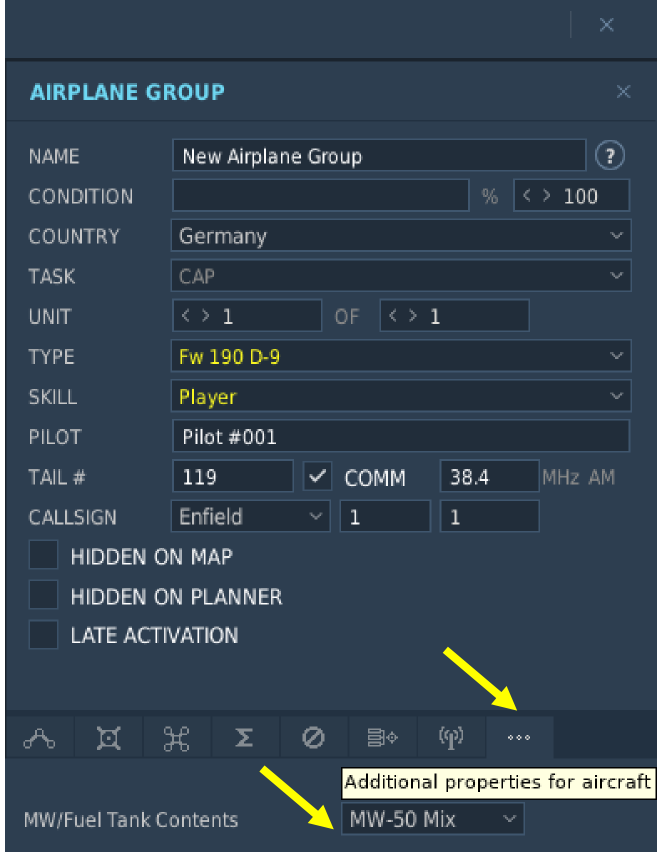
MW-50 System Diagram

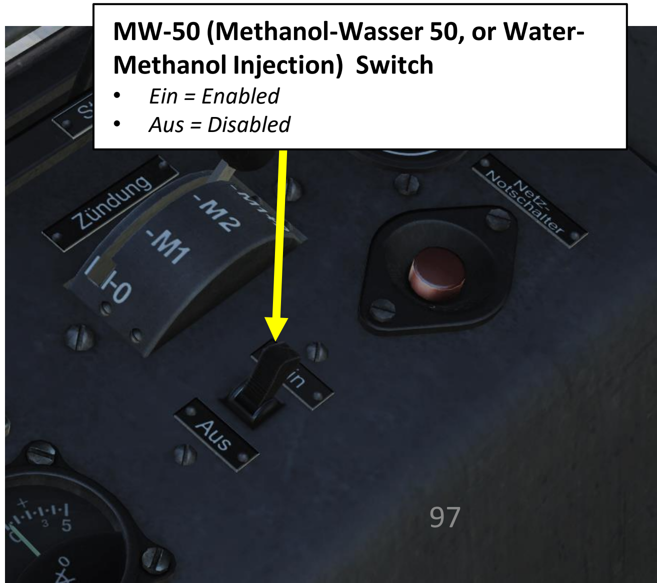


E96 MW-50 On Power Switch



MW-50 Pressure Indicator (kg/cm²)





MW-50 (Methanol-Wasser 50, or Water-Methanol Injection) Switch

- *Ein = Enabled*
- *Aus = Disabled*

SUPERCHARGER BASICS

A **supercharger is an engine-driven air pump or compressor that provides compressed air to the engine to provide additional pressure to the induction air so the engine can produce additional power.** It increases manifold pressure and forces the fuel/air mixture into the cylinders. The higher the manifold pressure, the more dense the fuel/air mixture, and the more power an engine can produce.

With a normally aspirated engine, it is not possible to have manifold pressure higher than the existing atmospheric pressure. A supercharger is capable of boosting manifold pressure above 1.0 ATA (30 in Hg). For example, at 2500 meters (8000 ft) a typical engine may be able to produce 75 percent of the power it could produce at mean sea level (MSL) because **the air is less dense at the higher altitude**. The supercharger compresses the air to a higher density allowing a supercharged engine to produce the same manifold pressure at higher altitudes as it could produce at sea level.

Thus, an engine at 8,000 feet MSL could still produce 0.85 ATA of manifold pressure whereas without a supercharger it could produce only 0.75 ATA. Superchargers are especially valuable at high altitudes (such as 18,000 feet / 5500 m) where the air density is 50 percent that of sea level. The use of a supercharger in many cases will supply air to the engine at the same density it did at sea level. With a normally aspirated engine, it is not possible to have manifold pressure higher than the existing atmospheric pressure.

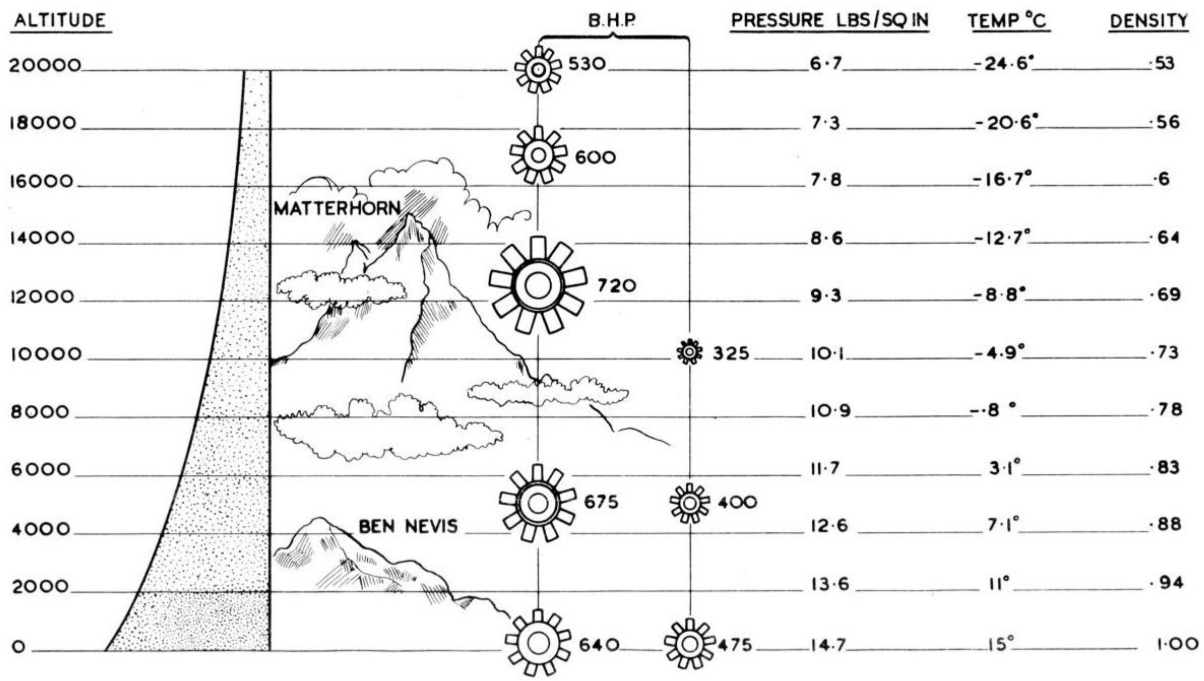
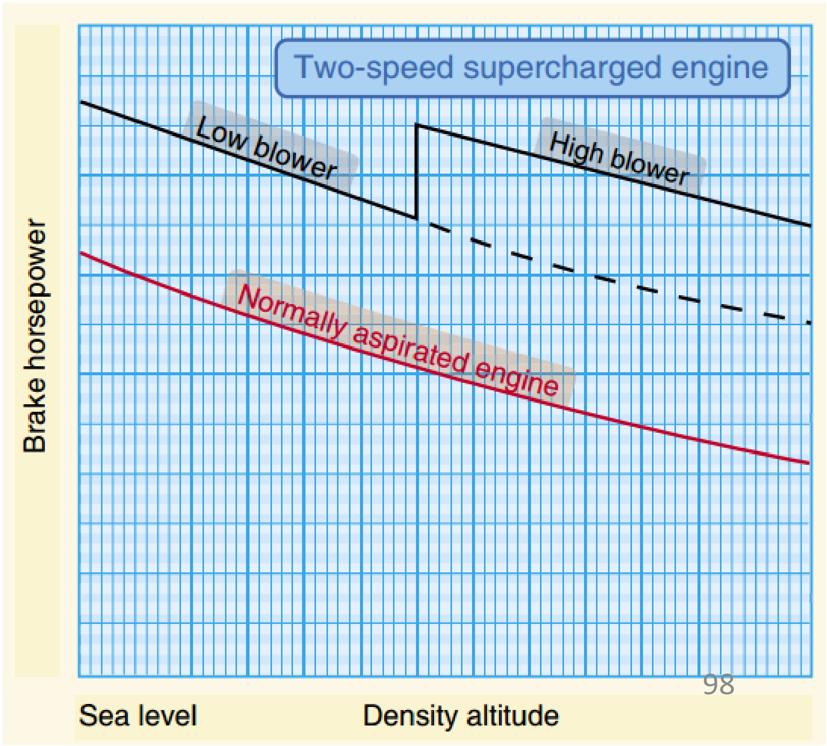


DIAGRAM SHOWING ATMOSPHERIC AND POWER VARIATIONS

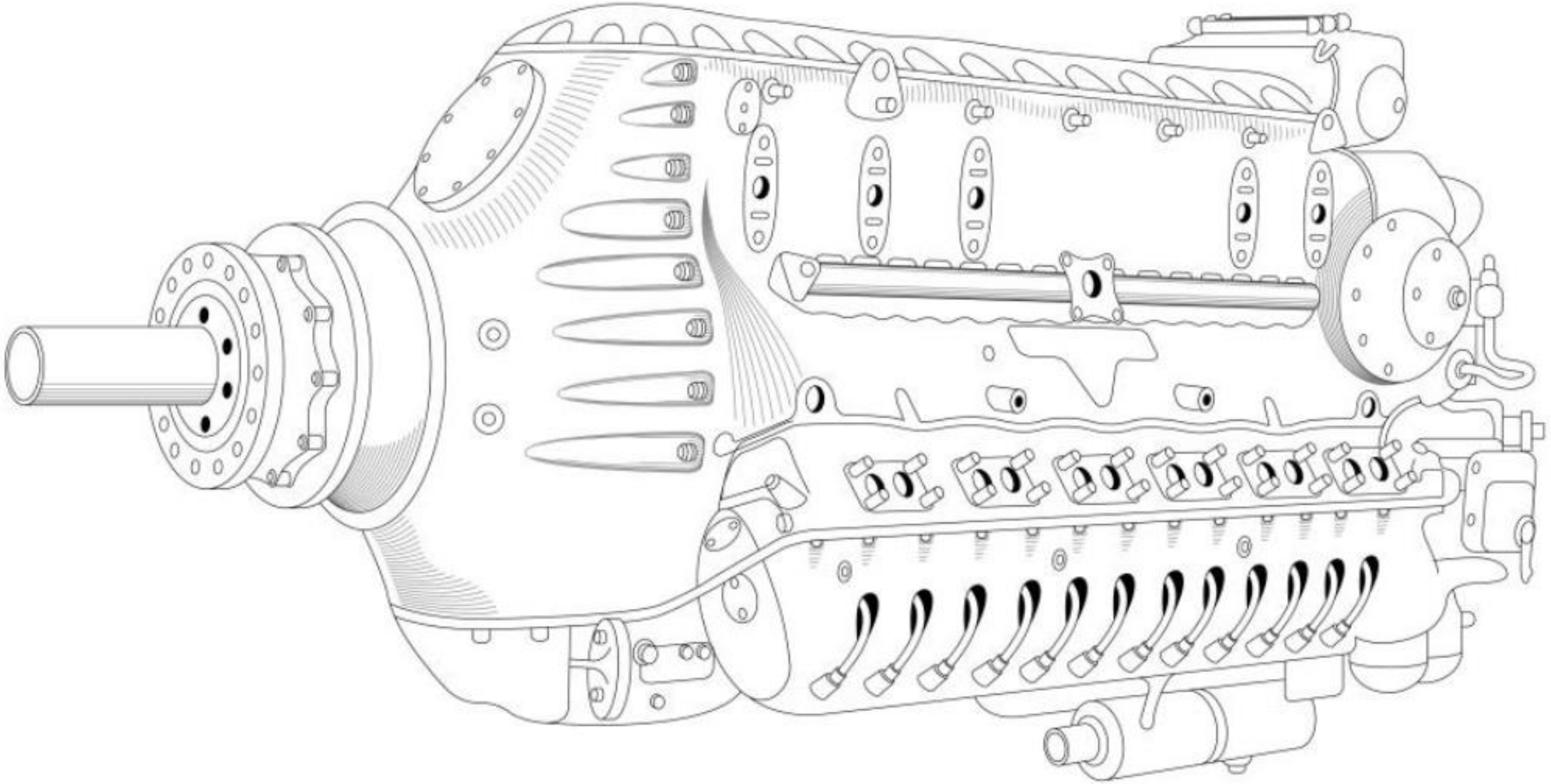


SUPERCHARGER OPERATION

The Junkers Jumo 213 engine is equipped with a single stage, two-speed centrifugal supercharger with MW-50 water-methanol injection. In the 1930's-1940's, the first few aircraft that had a two-speed supercharger had a manual control that had to be set once the aircraft was high enough (air density was low enough to see a noticeable difference once the supercharger is shifted into second gear). In our case, the **supercharger shifts gear automatically** (managed by the Bediengerät Control Unit) once a threshold altitude is reached. There is no supercharger gear indicator. In practice, you will notice the manifold pressure gauge (ATA) will suddenly increase once the supercharger shifts into high gear.

At an altitude of approximately 5500 +/- 200 meters, the supercharger automatically switches supercharger speed from low to high. Try not to fly or frequently change your altitude within this threshold.

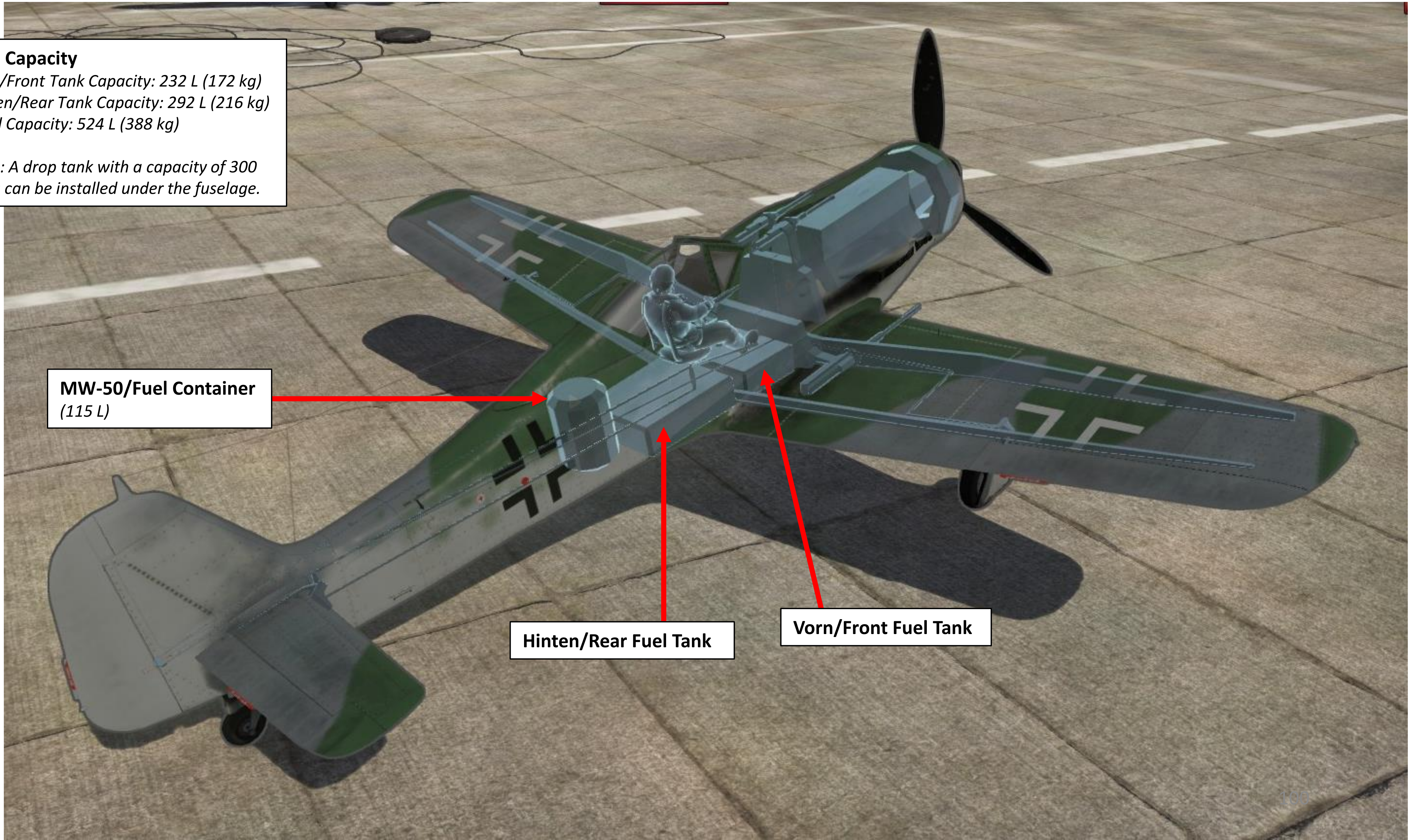
Junkers Jumo 213 A-1



FUEL TANKS

Fuel Capacity
Vorn/Front Tank Capacity: 232 L (172 kg)
Hinten/Rear Tank Capacity: 292 L (216 kg)
Total Capacity: 524 L (388 kg)

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

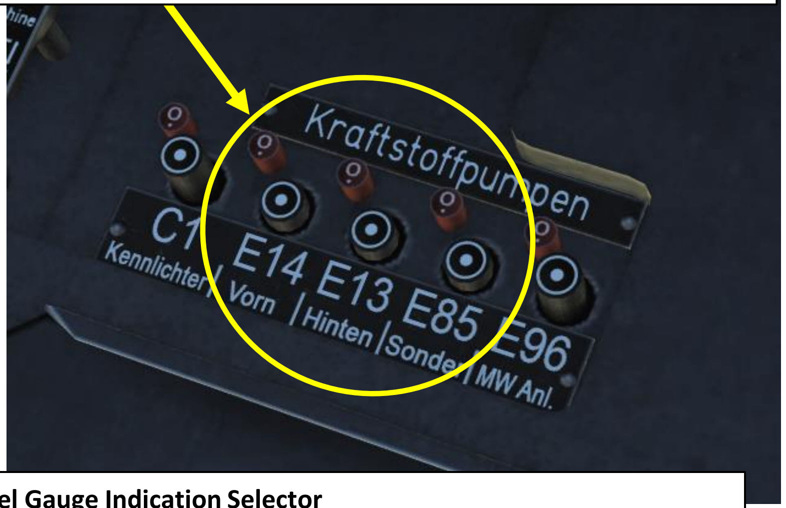


FUEL MANAGEMENT

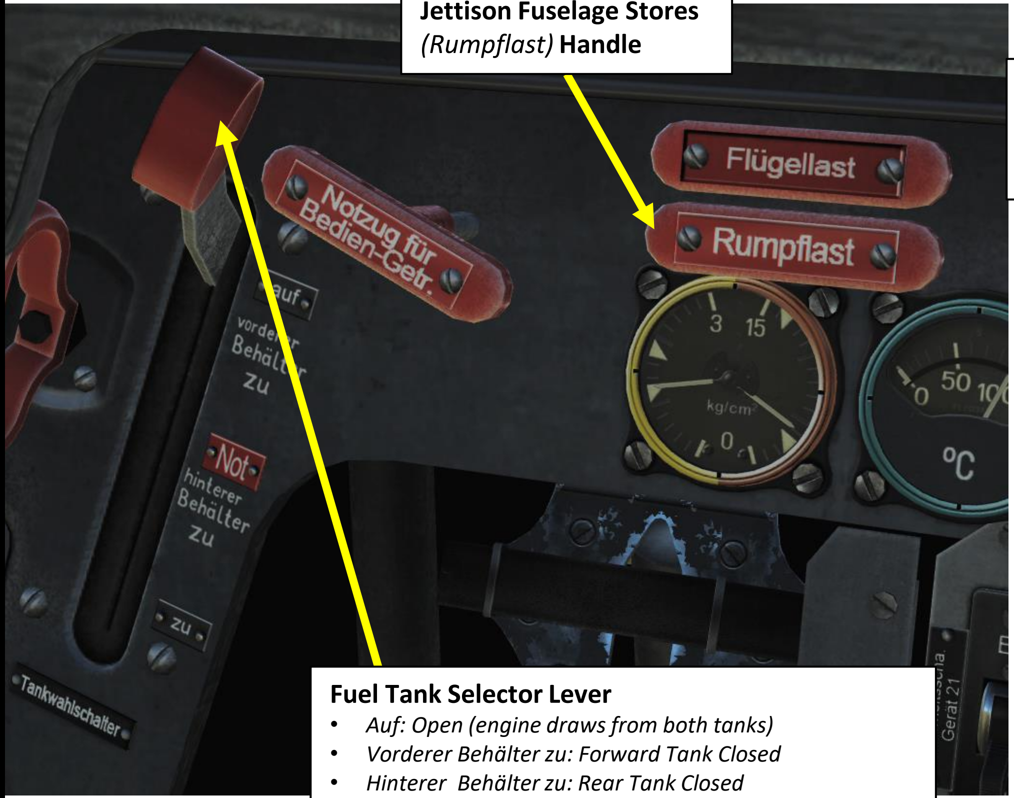
Since If there are additional fuel tanks (auxiliary fuselage and/or external drop tank), the fuel from them enters the rear fuel tank via two lines. When the fuel level in the aft tank reaches exactly 240 liters, the restrictor valve opens up the auxiliary line. The additional tanks continue to feed the aft tank until they are fully depleted. The additional tanks are not equipped with any fuel gauge sensors, and so the only way to tell that they have been fully depleted is when the aft tank's fuel level begins to drop below 240 liters.

When flying with drop tanks, drop tank fuel should be used first (Set Fuel Tank Selector to “*Vorderer Behälter zu”* to close the forward tank and use fuel from the drop tank, which feeds into the rear tanks). When the fuel inside the drop tank is exhausted, the fuel tank selector lever is set to “Auf” and the E85 Auxiliary Drop Tank Fuel Pump should be turned off.

E14 Forward Tank *(vorderer Behälter)* **Fuel Pump Circuit Breaker**
E13 Rear Tank (*hinterer Behälter***) Fuel Pump Circuit Breaker**
E85 Auxiliary Tank *(Sonder)* **Fuel Pump Circuit Breaker**



Jettison Fuselage Stores *(Rumpflast)* **Handle**

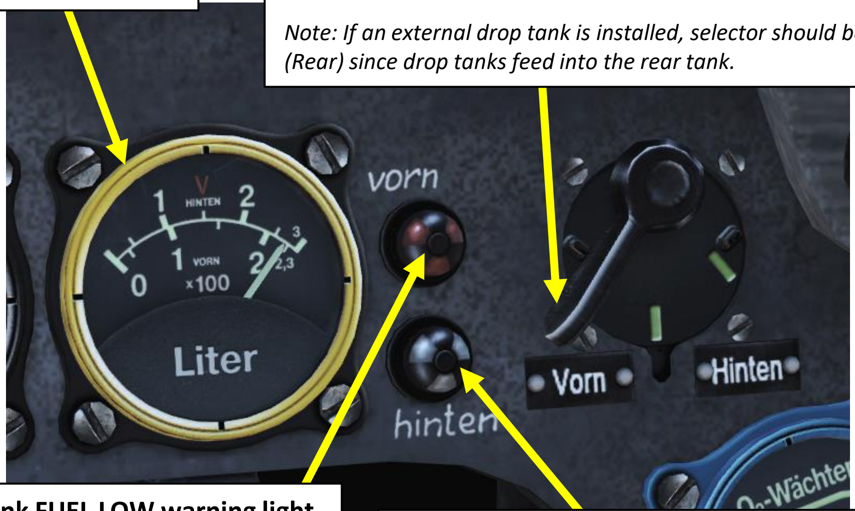


Fuel Tank Selector Lever
- *Auf: Open (engine draws from both tanks)*
- *Vorderer Behälter zu: Forward Tank Closed*
- *Hinterer Behälter zu: Rear Tank Closed*
- *Zu: Closed (both fuel lines to booster pump are closed)*

Fuel Gauge (x100 Liters)
- *Vorn/Front Tank Capacity: 232 L (172 kg)*
- *Hinten/Rear Tank Capacity: 292 L (216 kg)*
- *Total Capacity: 524 L (388 kg)*

Fuel Gauge Indication Selector
- *Left: Vorn = Front*
- *Middle: No Tank Selected*
- *Right: Hinten = Rear*

Note: If an external drop tank is installed, selector should be set to “HINTEN” (Rear) since drop tanks feed into the rear tank.



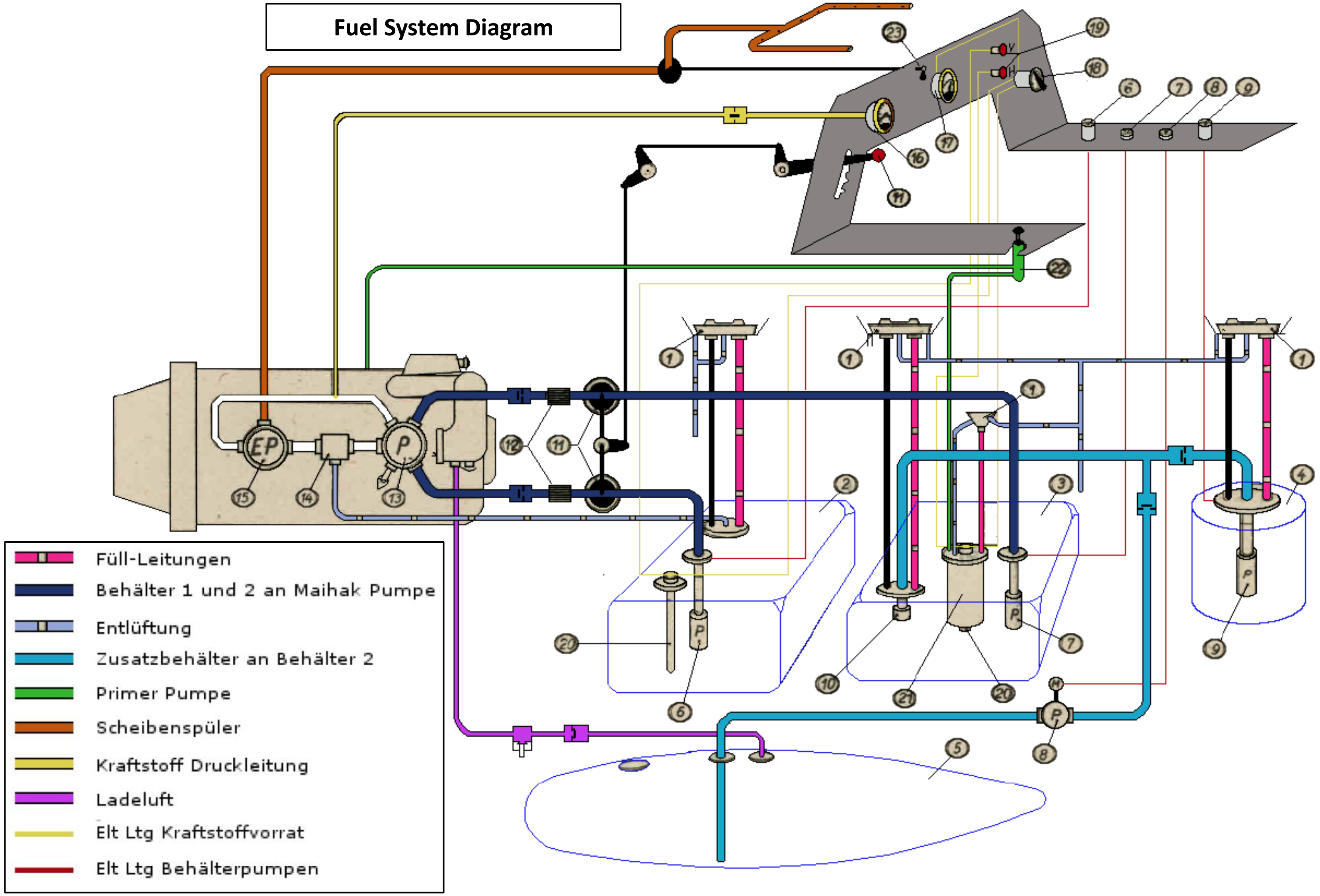
Front (vorn) Tank FUEL LOW warning light
- *Illuminates when below 80 Liters*

Rear (hinten) Tank FUEL LOW warning light
- *Illuminates when below 10 Liters*

FUEL MANAGEMENT

The fuel system operates on a simple principle. The internal feeder pumps of the front [6] and rear [7] fuselage tanks feed into the engine's booster pump [13]. When the fuel selector (fuel cock) [11] is set to "Auf", both fuel lines from the forward and rear tanks are allowed to feed fuel to the booster pump. The booster pump draws more fuel than actually needed from both tanks and the surplus is routed back into the forward tank, thereby closing the valve for the forward tank. With this mechanism fuel effectively is drawn only from the rear tank as long as the engine gets enough fuel from it. When the engine pump starts to starve, the forward tank is "opened".

Fuel System Diagram

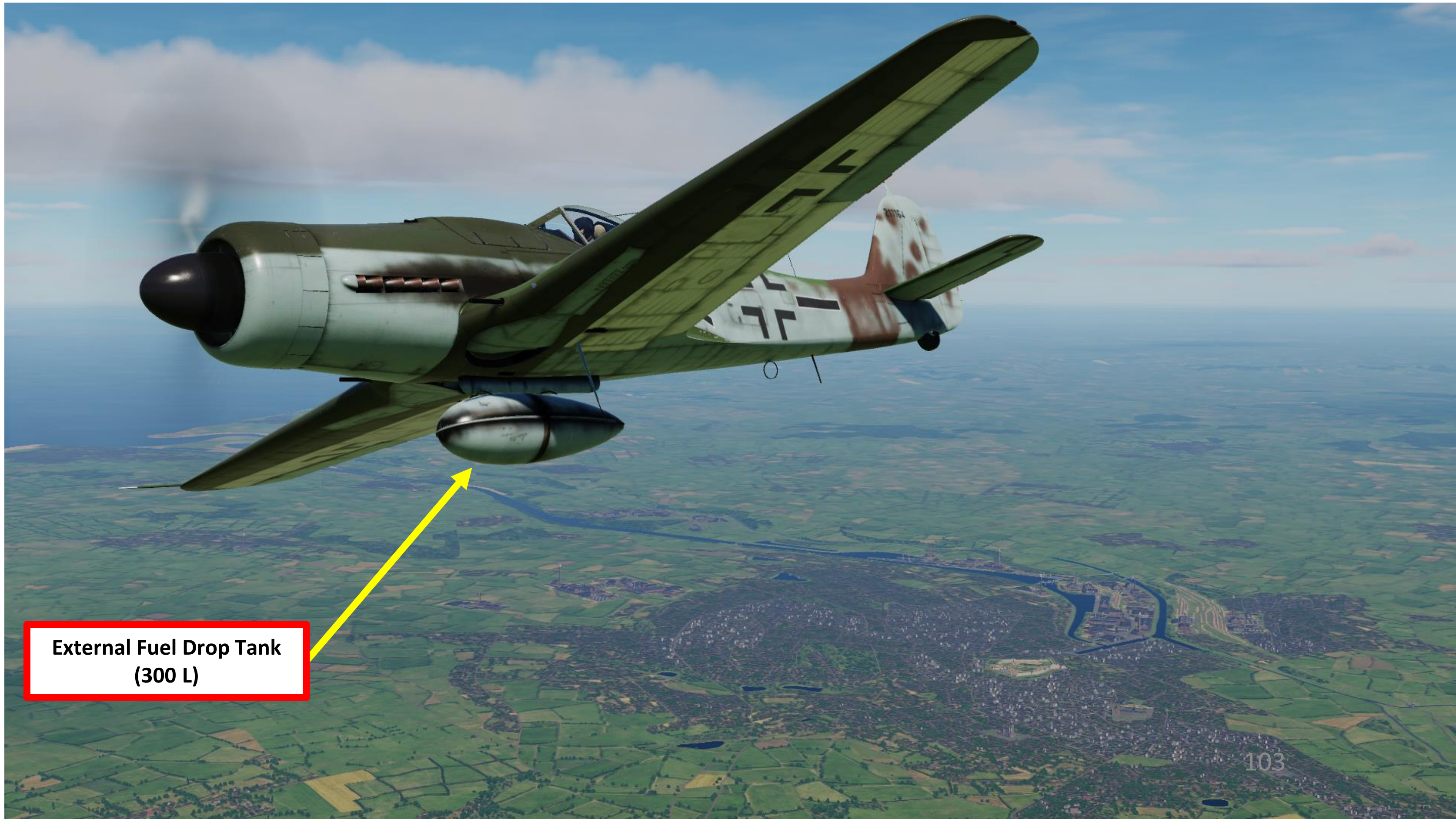


1. Filling port
2. Forward tank (232 l)
3. Aft tank (292 l)
4. Auxiliary fuselage tank (115 l)
5. Auxiliary jettisonable tank
6. Forward tank feeder pump
7. Aft tank feeder pump
8. Auxiliary jettisonable tank feeder pump
9. Auxiliary fuselage tank feeder pump
10. Shutter valve (shuts at 240 l)
11. Fuel selector
12. Fuel filter
13. Booster pump
14. Vapor separator
15. Fuel injection
16. Fuel pressure gauge
17. Fuel content gauge
18. Fuel gauge selector switch
19. Fuel warning lights
20. Fuel level sender
21. Primer fuel canister (3 l)
22. Primer pump
23. Windscreen cleaner

FUEL DROP TANK OPERATION

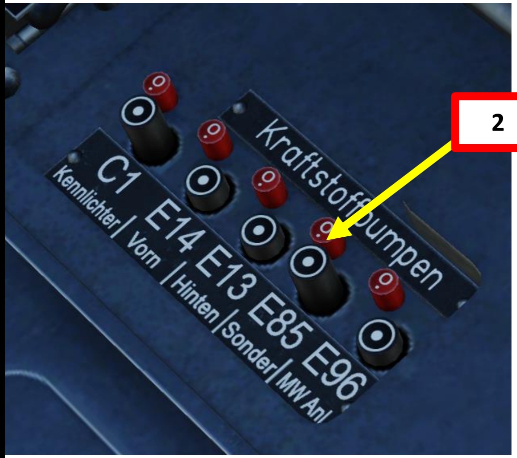
1. Since the drop tank feeds into the rear fuel tank, set fuel tank selector lever to "VORDERER BEHÄLTER ZU" (FORWARD TANK CLOSED) and turn on the E85 Auxiliary Drop Tank Fuel Circuit Breaker to consume fuel from the drop tank first.

E14 Forward Tank *(vorderer Behälter)* **Fuel Pump Circuit Breaker**
E13 Rear Tank (*hinterer Behälter***) Fuel Pump Circuit Breaker**
E85 Auxiliary Tank *(Sonder)* **Fuel Pump Circuit Breaker**

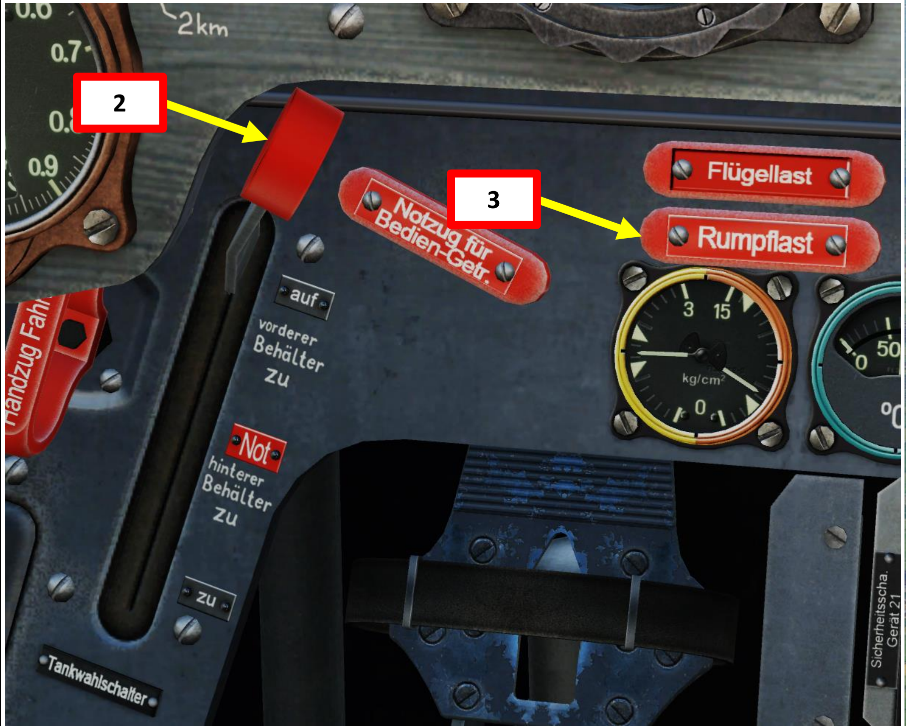


FUEL DROP TANK OPERATION

2. When ready to jettison drop tank, make sure that your fuel tank selector is set to “AUF” (OPEN) and turn off the E85 Auxiliary Drop Tank Fuel Circuit Breaker.
3. To jettison fuel drop tank, pull the “RUMPFLAST” (FUSELAGE JETTISON) handle.



2 **E85 Auxiliary Tank** ***(Sonder)*** **Fuel Pump Circuit Breaker**



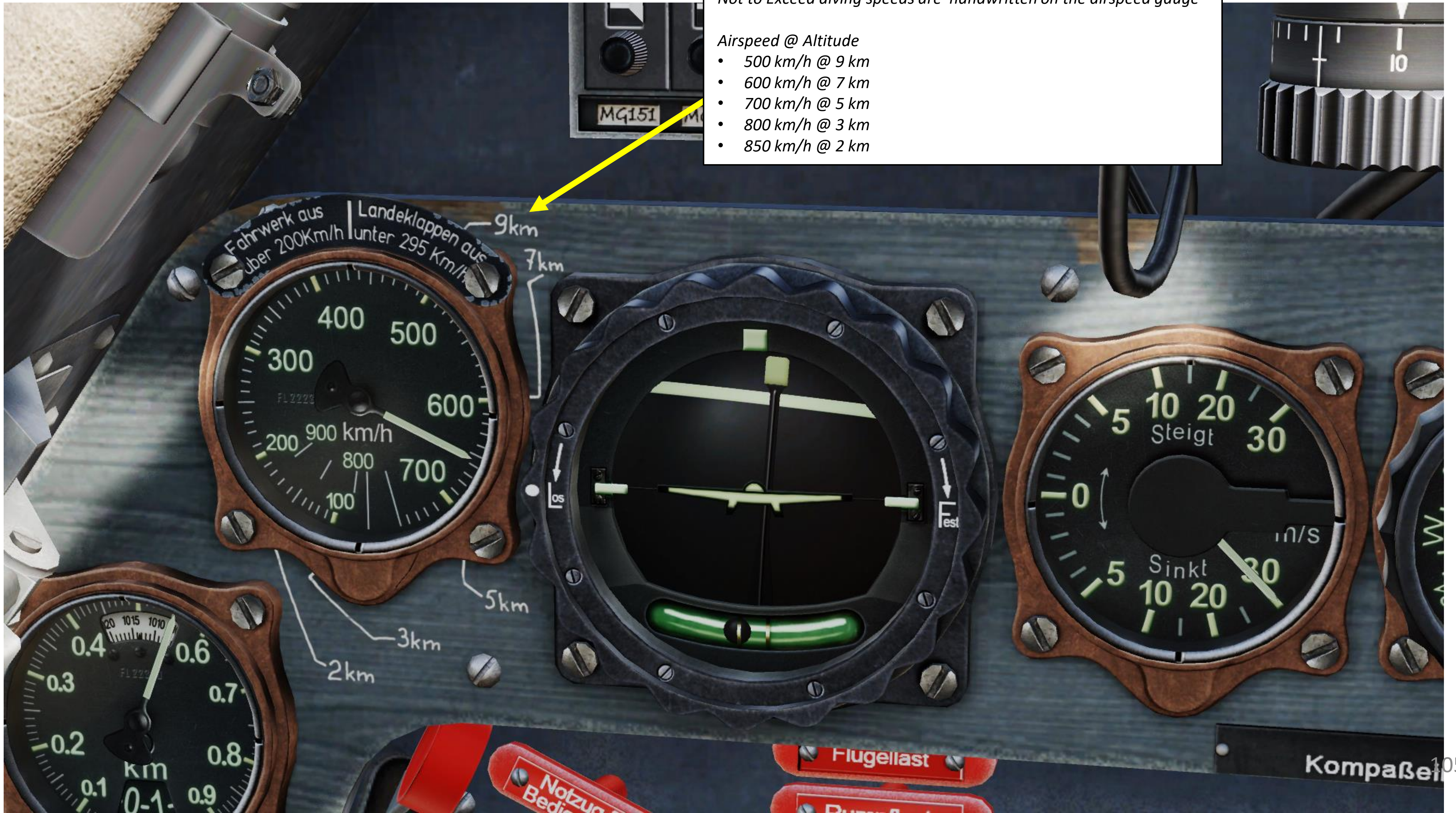
AIRSPEED LIMITS

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

- Maximum Flaps Extension Speed: 250 km/h
- Maximum Landing Gear Extension Speed: 250 km/h
- Optimal Climb Speed: 280-290 km/h
- Do-Not-Exceed Airspeed (V_{NE}): See Airspeed Indicator

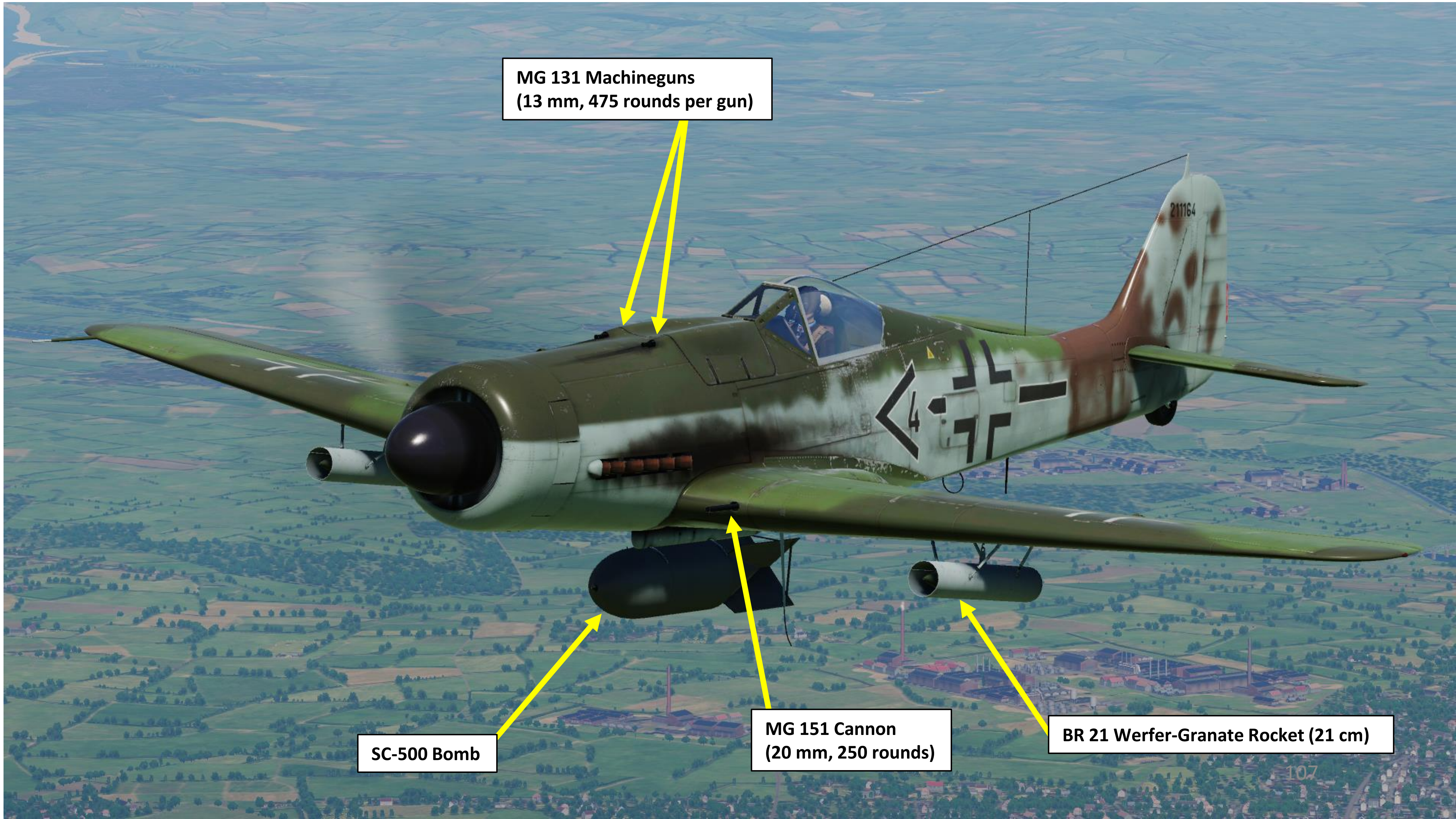
Airspeed Indicator (km/h)
Not to Exceed diving speeds are handwritten on the airspeed gauge

Airspeed @ Altitude
- *500 km/h @ 9 km*
- *600 km/h @ 7 km*
- *700 km/h @ 5 km*
- *800 km/h @ 3 km*
- *850 km/h @ 2 km*



ARMAMENT OVERVIEW

- 2 x Mauser MG 151 20 mm Cannons (250 rounds per cannon)
- 2 x Rheinmetall-Borsig MG 131 13 mm Machineguns (475 rounds per gun)
- 26 x R4M 4 kg anti-air Rockets (13 rockets per rack)
- 2 x BR 21 Werfer-Granate 21-cm anti-air Rockets
- 4 x SC-50 kg bombs
- 1 x SC-500 kg bomb

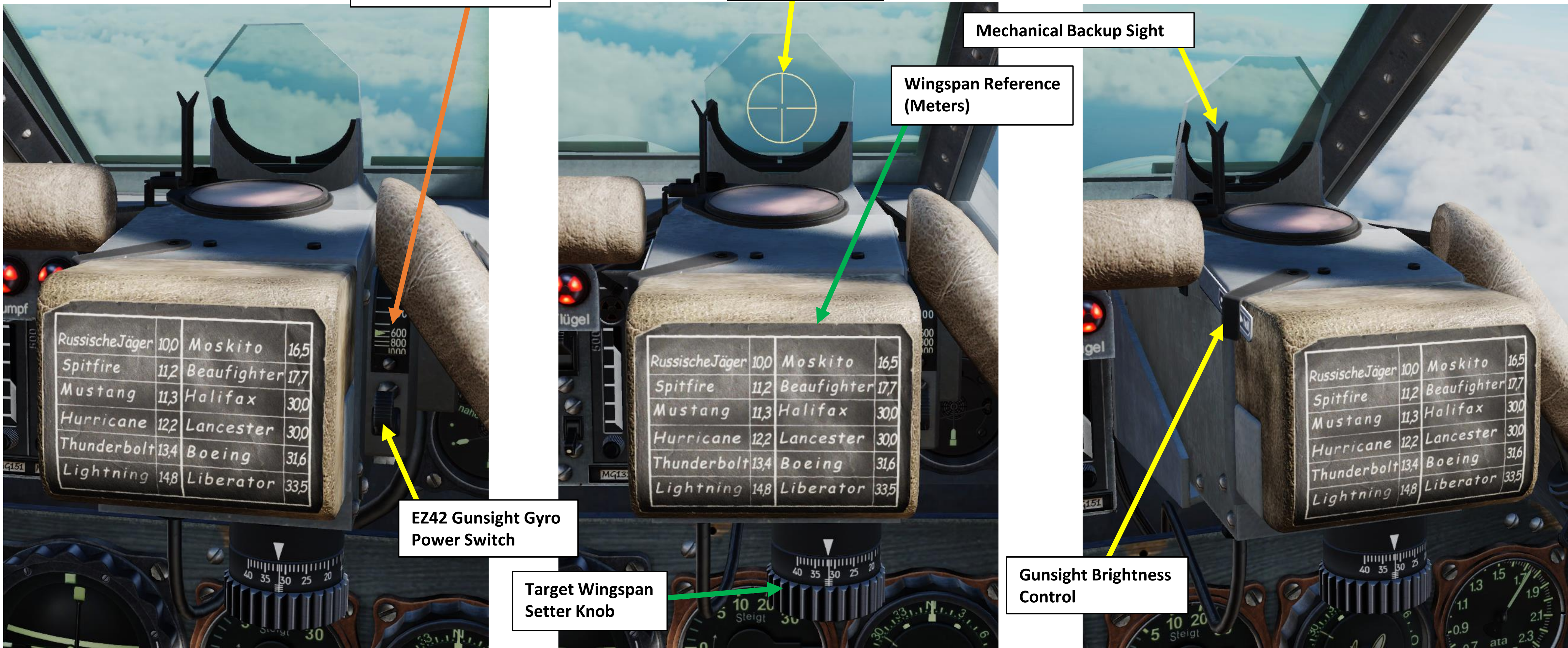


EZ42 GUNSIGHT

The Fw190-D9 is equipped with the pioneering EZ42 gunsight, which is roughly equivalent to the well-known K-14 gunsight used on the North American P-51D Mustang. The design history of the EZ gunsight began before the war, but the Reich Air Ministry continued to focus on conventional reflector sights, installing the ubiquitous Revi (*Reflexvisier*) sight on most aircraft.

The EZ42 gyroscopic gunsight allows the pilot to measure the aircraft angular velocity to automatically plot both bullet drop and target lead for on-board armament. This sight is better used against slow-maneuvering targets like bombers rather than against nimble fighters.

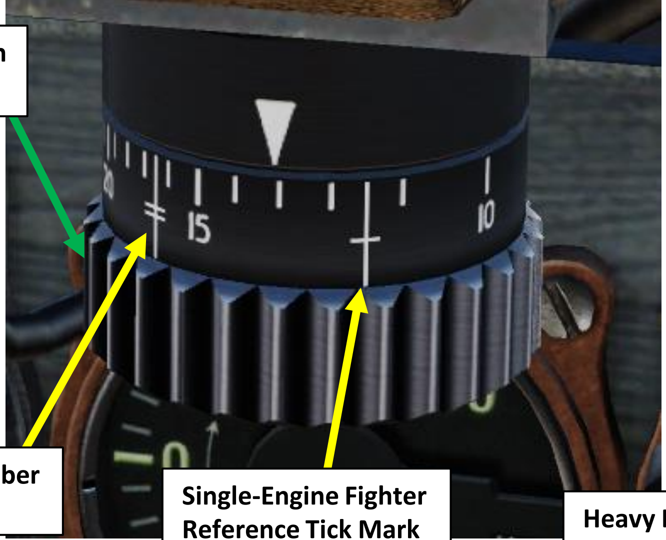
The gunsight range is controlled with the Throttle Twist Grip, while the Target Wingspan is controlled with the Target Wingspan Setter Knob.

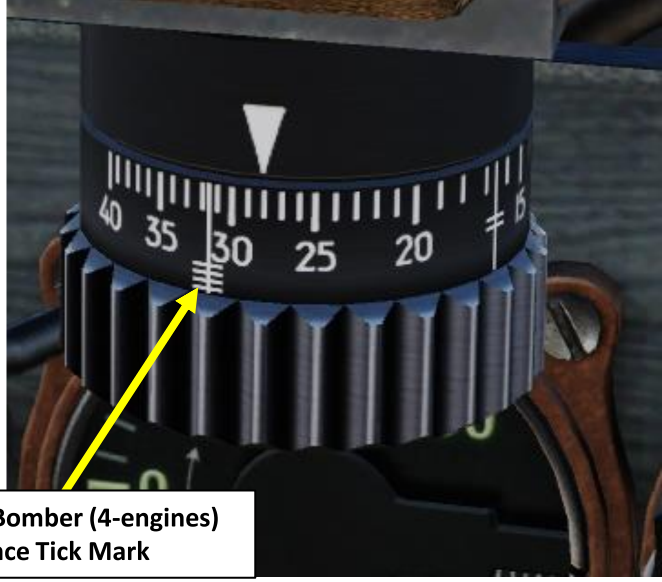


EZ42 GUNSIGHT

An interesting fun fact about the Target Wingspan Setter knob is that there are small tick marks. There is a bar with a single tick, another with two ticks and another one with four ticks. These are reference marks used as reminders to help the pilot remember the wingspan size of allied single-engine fighters, twin-engine aircraft and heavy four-engine bombers.

Take note that a night filter can also be installed on the sight.

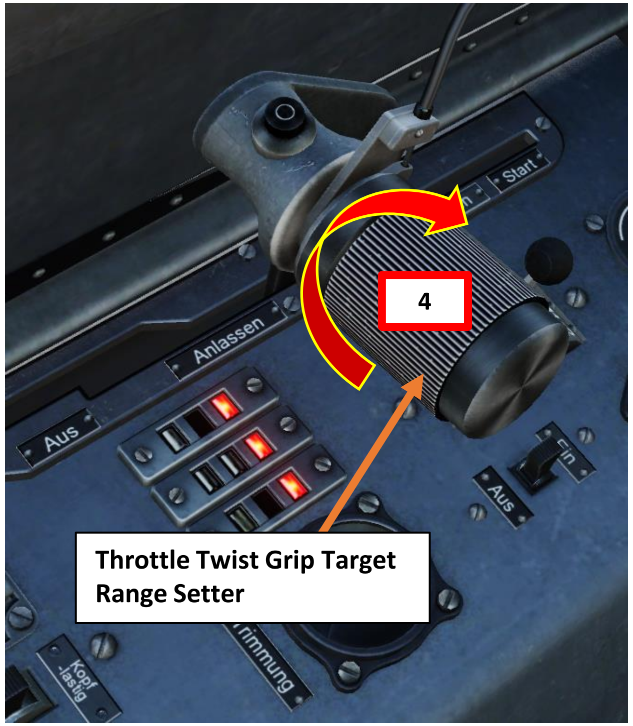


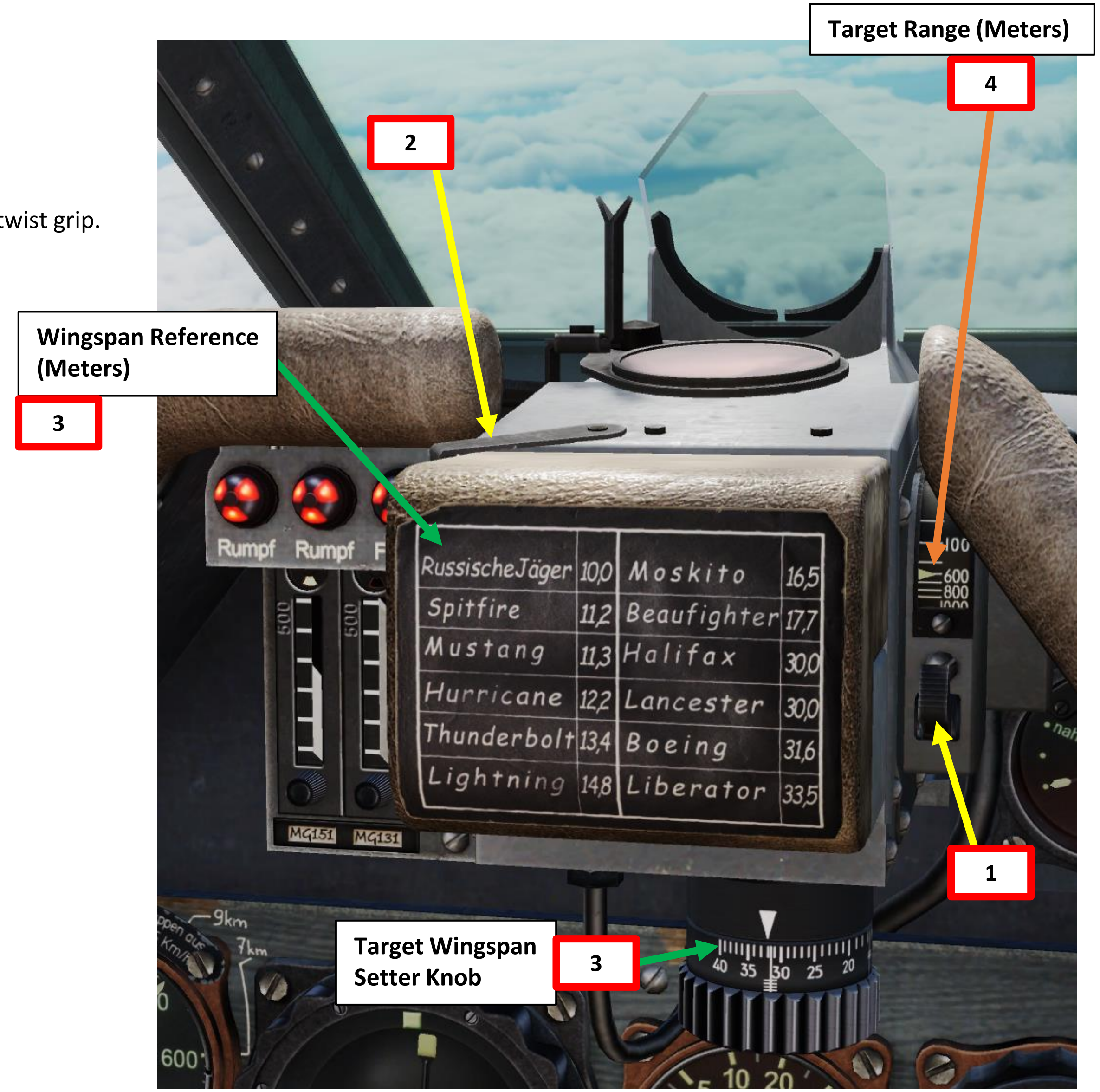


EZ42 GUNSIGHT

Here is a quick procedure that explains how to use the gunsight:

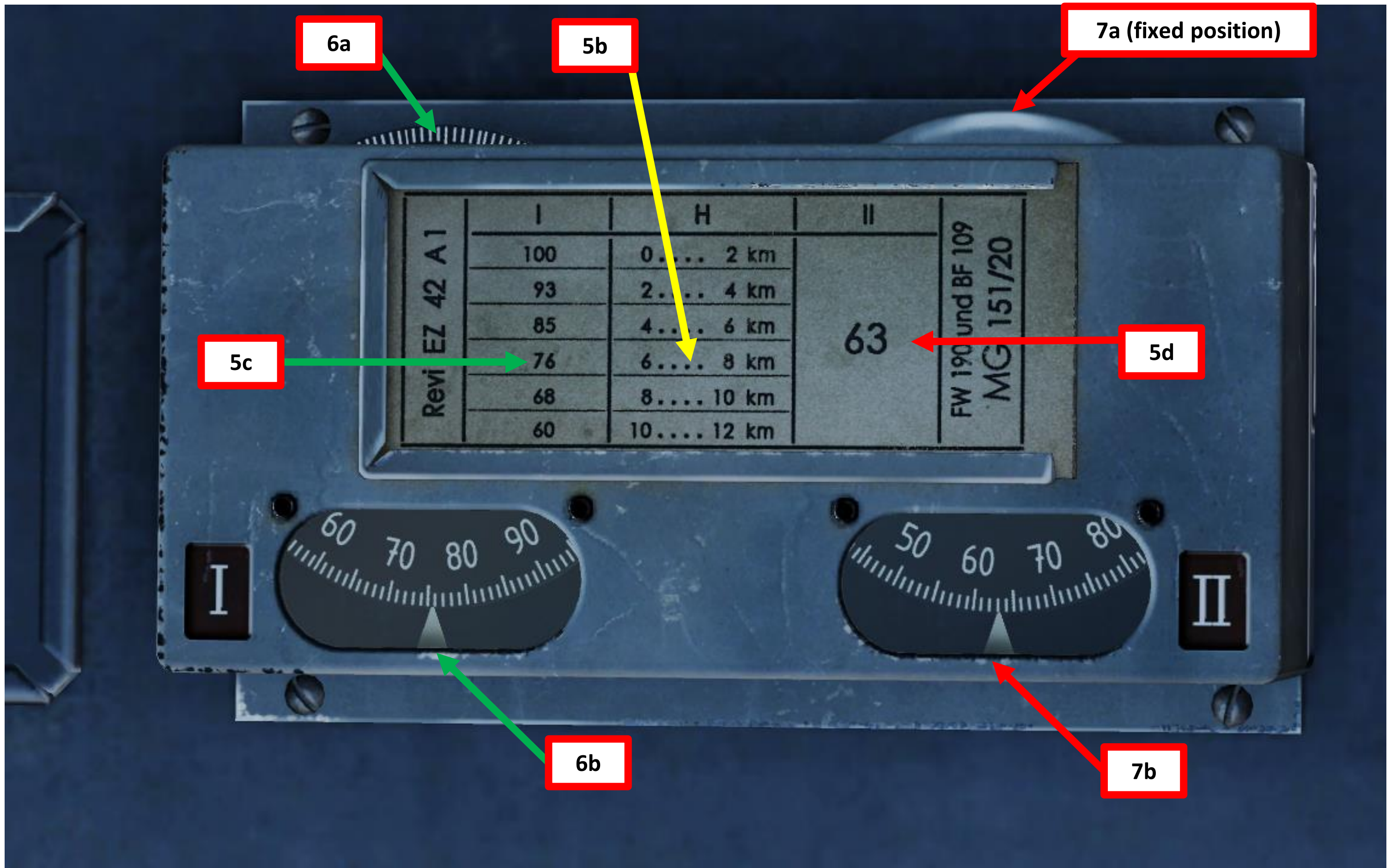
1. Turn ON your gunsight Gyro Power switch (UP)
2. Adjust Gunsight Brightness – As desired.
3. Set Gunsight Wingspan to your target's wingspan. We will set 31.6 m since our target is a B-17.
   - 11.2 meters is a typical Spitfire and Mustang wingspan
   - 31.6 meters is the wingspan of a B-17 heavy bomber.
4. Set Gunsight Range to 600 m (optimal range for horizontal gun convergence) by using the throttle twist grip.





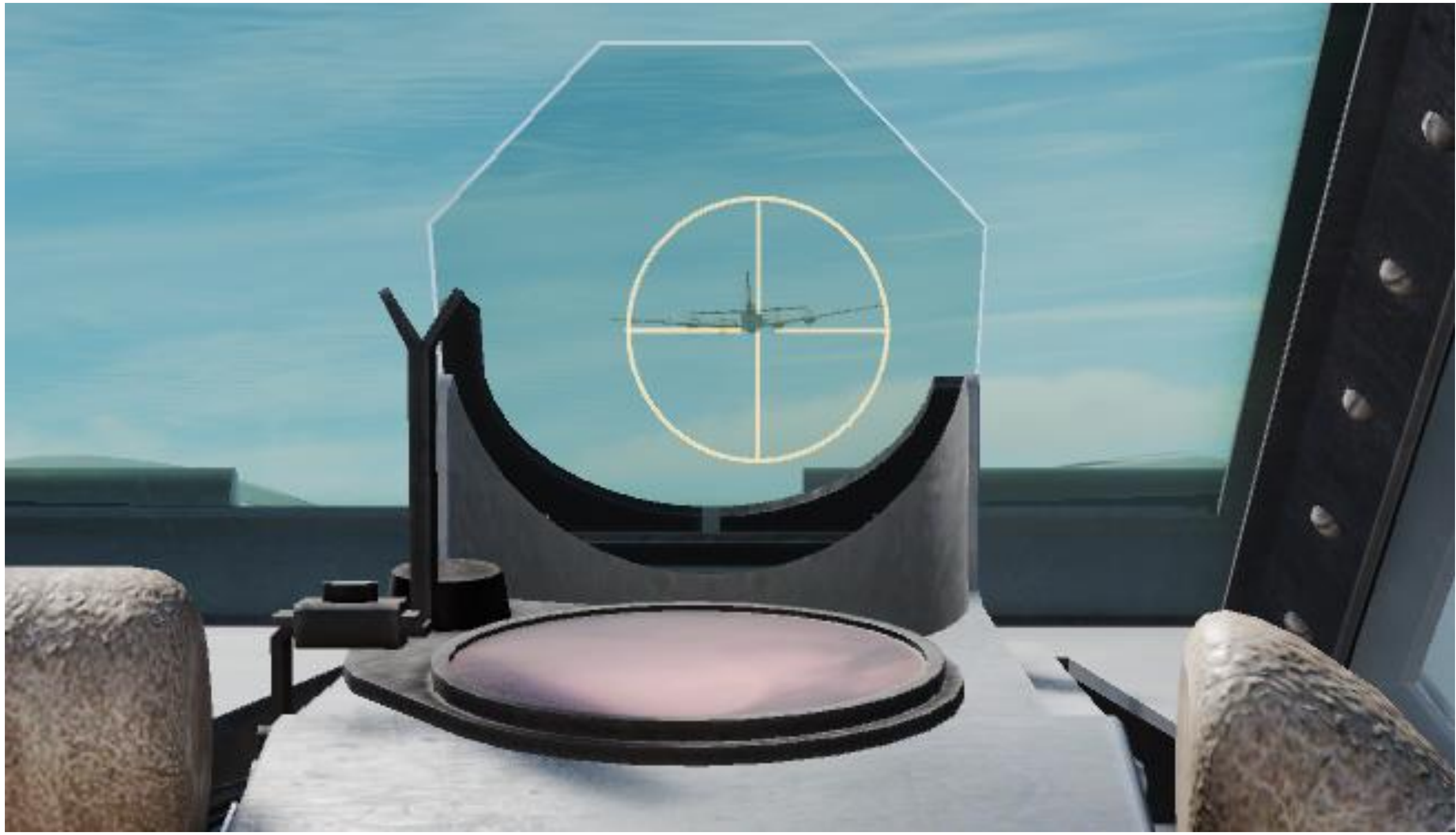
EZ42 GUNSIGHT

5. The EZ42 Gunsight "*Justierkasten*" (gunsight ballistics adjustment unit) requires two parameters to be set, which are a function of your current altitude. Consult the altimeter, then consult the EZ42 Parameter Table.
   a) Our altitude is between 6 and 8 km.
   b) Go to the EZ42 Parameter Table at the "H 4 – 8 km" line. The "H" value refers to "Höhe" (Altitude).
   c) Parameter I is 76.
   d) Parameter II is 63 at all altitudes.
6. Adjust EZ42 Parameter I Rotary to the value obtained in the EZ42 Parameter Table, which is 76.
7. The EZ42 Parameter II Rotary is fixed to the 63 value obtained previously.

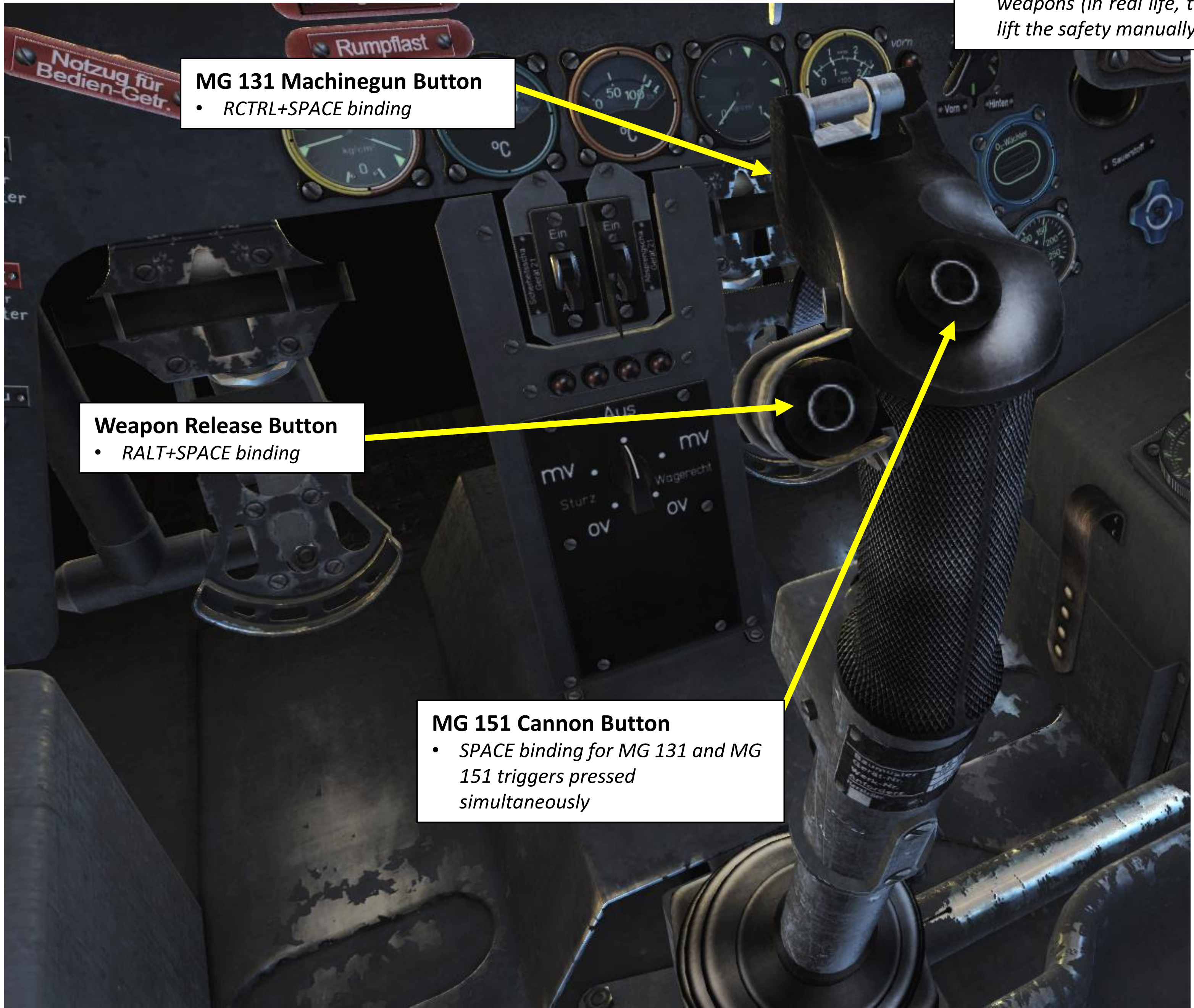


EZ42 GUNSIGHT

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



WEAPON CONTROLS



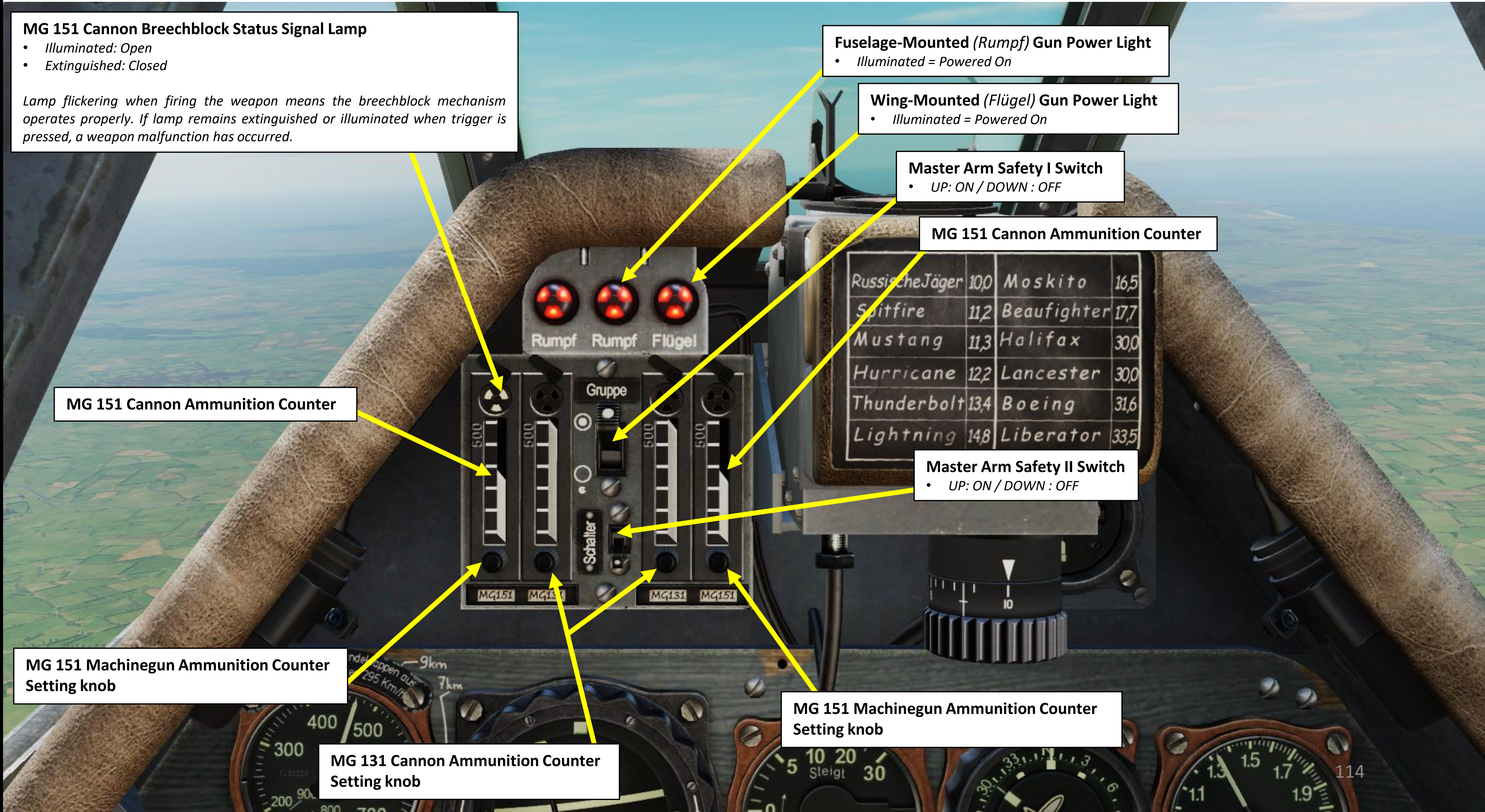
MG 131 Machinegun Button
- *RCTRL+SPACE binding*

Weapon Release Button
- *RALT+SPACE binding*

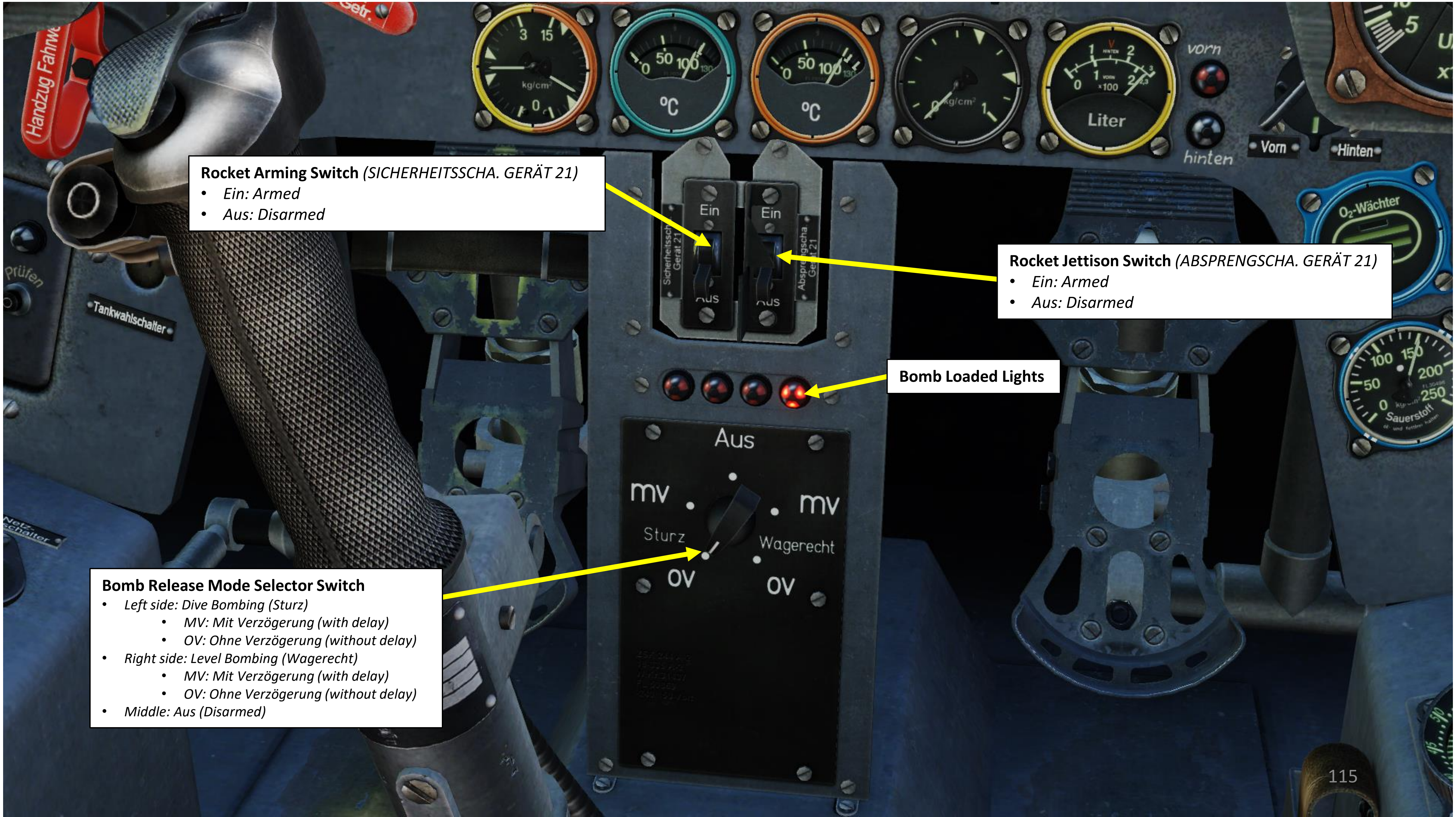
MG 151 Cannon Button
- *SPACE binding for MG 131 and MG 151 triggers pressed simultaneously*

Cannon Safety Cover
- *Automatically lifted when firing weapons (in real life, the pilot needs to lift the safety manually)*

WEAPON CONTROLS



WEAPON CONTROLS



Rocket Arming Switch *(SICHERHEITSSCHA. GERÄT 21)*
- *Ein: Armed*
- *Aus: Disarmed*

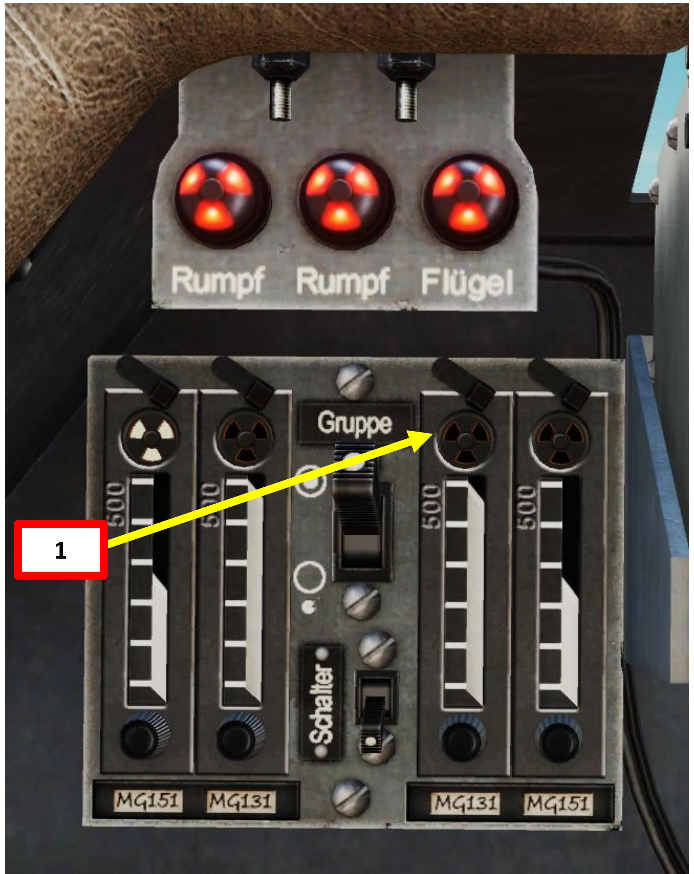
Rocket Jettison Switch *(ABSPRENGSCHA. GERÄT 21)*
- *Ein: Armed*
- *Aus: Disarmed*

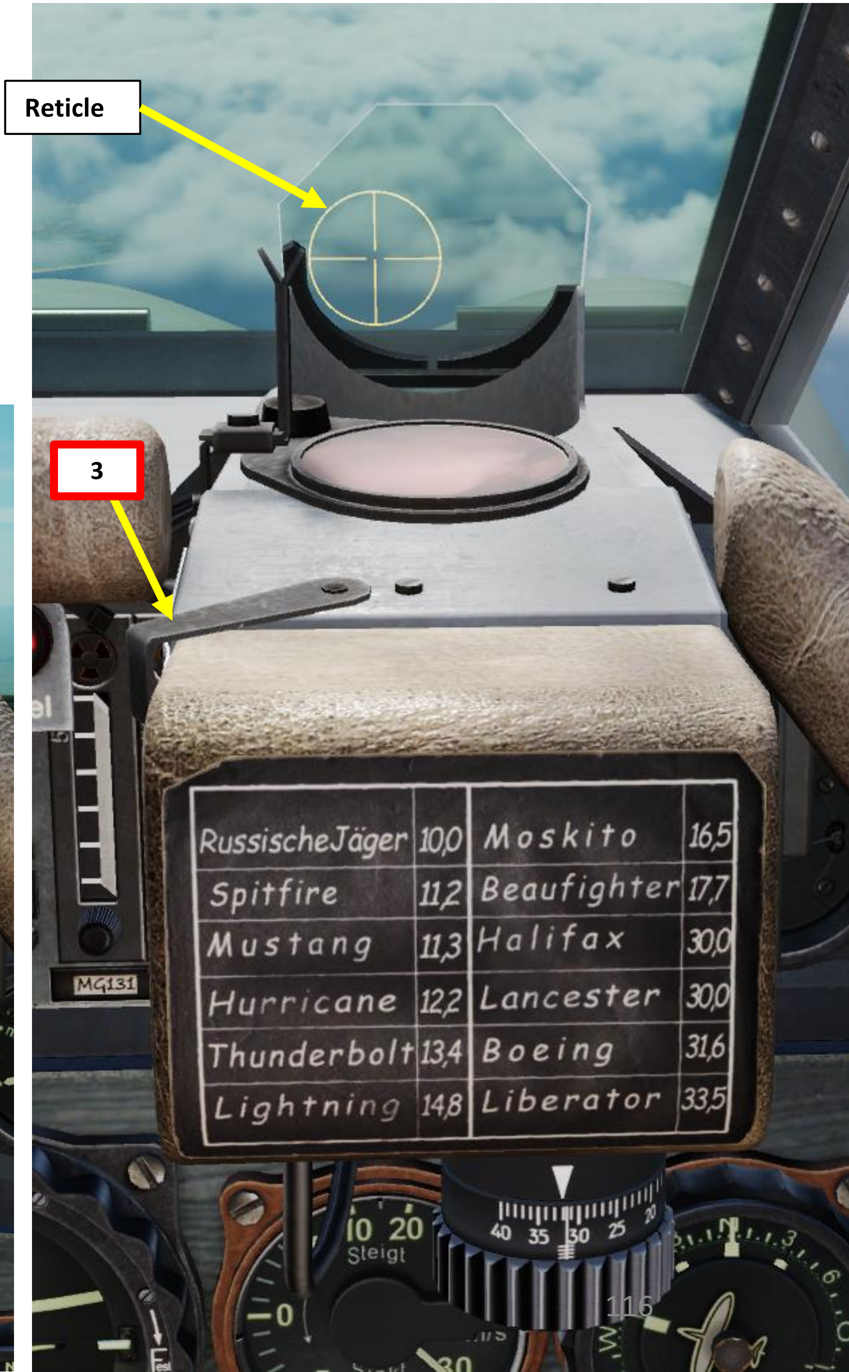
Bomb Loaded Lights

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)*

MG 131 MACHINEGUNS (13 MM) & MG 151 CANNONS (20 MM)

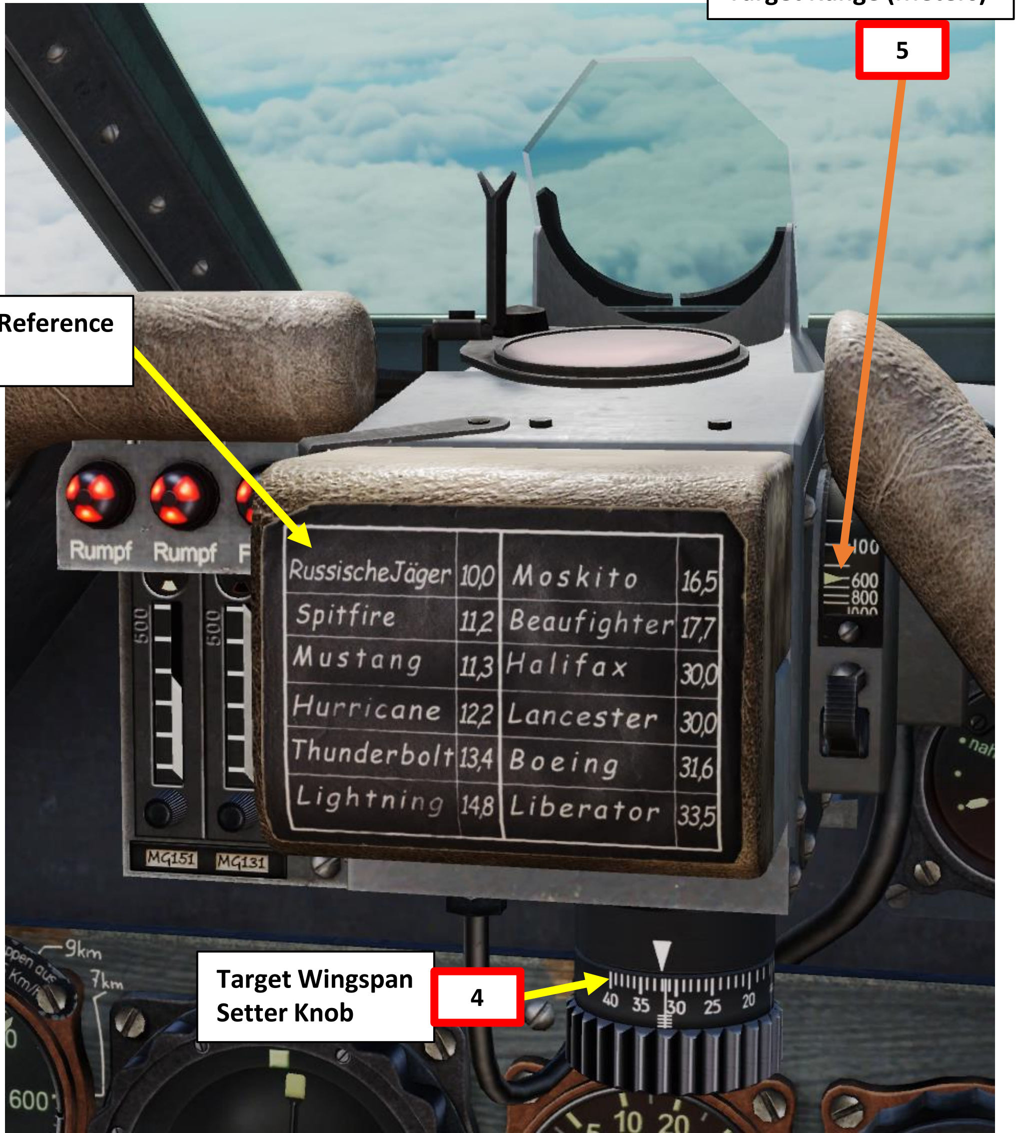
1. Arm your guns using the "GRUPPE" Safety Switch (UP)
2. Turn ON your gunsight Gyro Power switch (UP)
3. Adjust Gunsight Brightness – As desired.

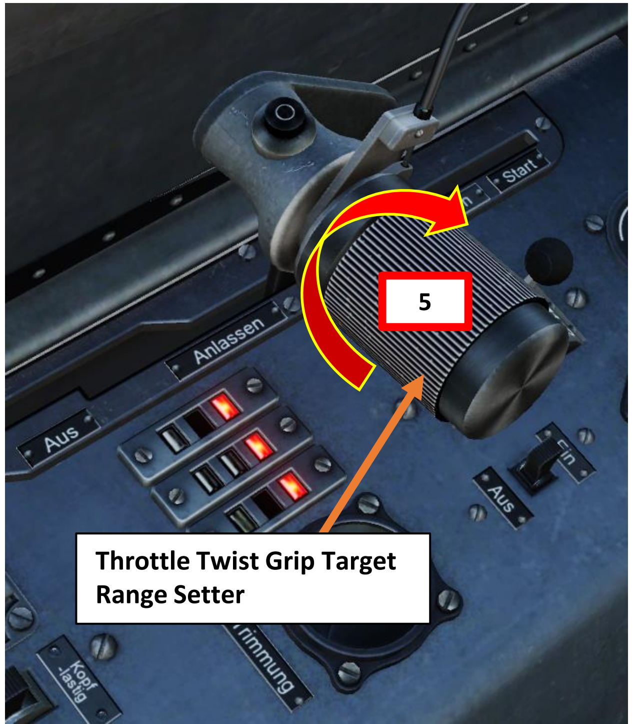




MG 131 MACHINEGUNS (13 MM) & MG 151 CANNONS (20 MM)

4. Set Gunsight Wingspan to your target's wingspan. We will set 31.6 m since we are attacking B-17s.
    - 11.2 meters is a typical Spitfire and Mustang wingspan
    - 31.6 meters is the wingspan of a B-17 heavy bomber.
5. Set Gunsight Range to 600 m (optimal range for horizontal gun convergence) by using the throttle twist grip.





MG 131 MACHINEGUNS (13 MM) & MG 151 CANNONS (20 MM)

6. The EZ42 Gunsight “*Justierkasten*” (gunsight ballistics adjustment unit) requires two parameters to be set, which are a function of your current altitude. Consult the altimeter, then consult the EZ42 Parameter Table.
    a) Our altitude is between 6 and 8 km.
    b) Go to the EZ42 Parameter Table at the “H 4 – 8 km” line. The “H” value refers to “Höhe” (Altitude).
    c) Parameter I is 76.
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7. Adjust EZ42 Parameter I Rotary to the value obtained in the EZ42 Parameter Table, which is 76.
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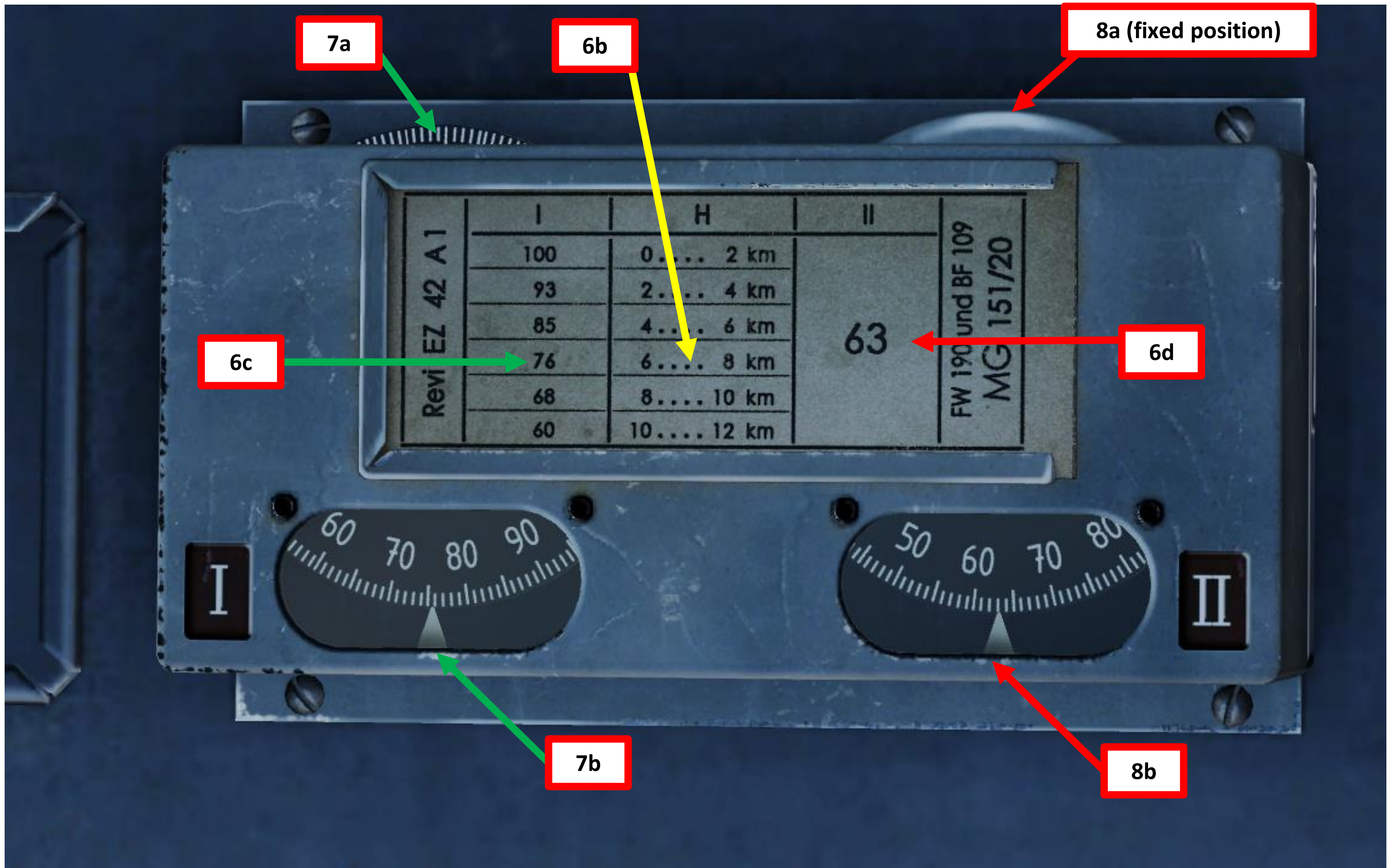


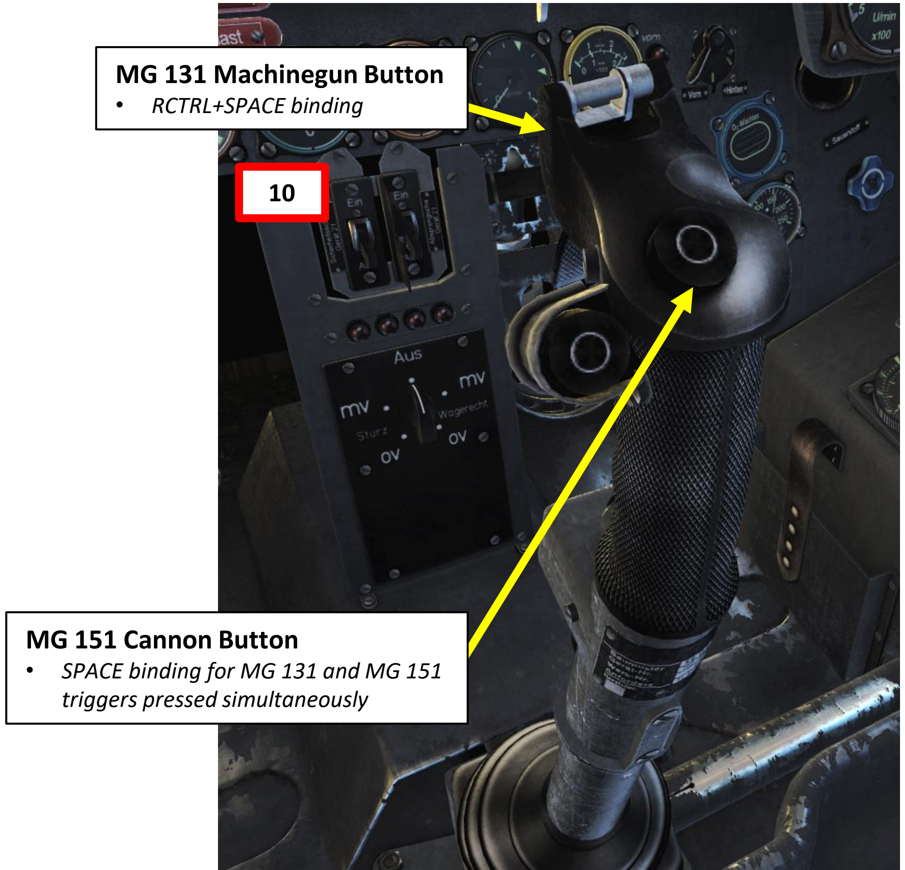
MG 131 MACHINEGUNS (13 MM) & MG 151 CANNONS (20 MM)

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

MG 131 MACHINEGUNS (13 MM) & MG 151 CANNONS (20 MM)

10. Press the “MG 131/151 FIRE” button (SPACE) to press both the MG 131 Machineguns and MG 151 Cannon Triggers. Alternatively, you can press on the MG 131 Machinegun trigger alone (RCTRL+SPACE) to fire machineguns only.

Take note that the Cannon Safety cover will automatically be lifted when you press the triggers (in real life you would need to lift it by yourself).



MG 131 MACHINEGUNS (13 MM) & MG 151 CANNONS (20 MM)

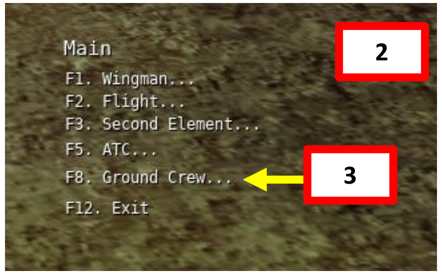
BOMB FUZES

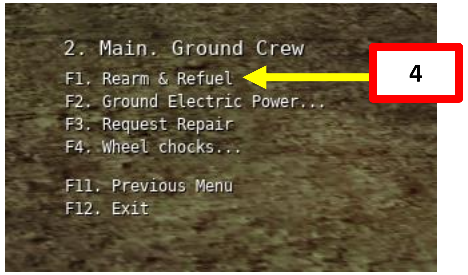
To equip bombs with a fuze delay, contact the ground crew.

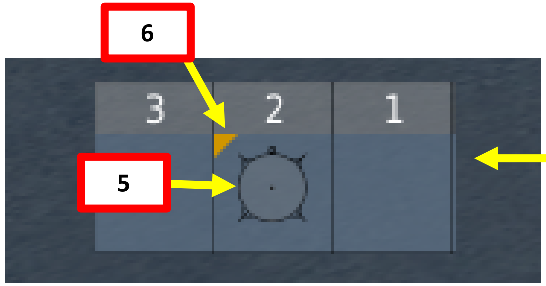
1. Open canopy
2. Press "RALT + \" (Communication Push-to-Talk)
3. Select ground crew by pressing "F8"
4. Select "Rearm & Refuel" by pressing "F1".
5. Equip bomb on desired pylon.
6. Click on the yellow triangle on the bomb to set fuze type and delay.
7. Set fuze type and delay.
8. Click OK on the Fuze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

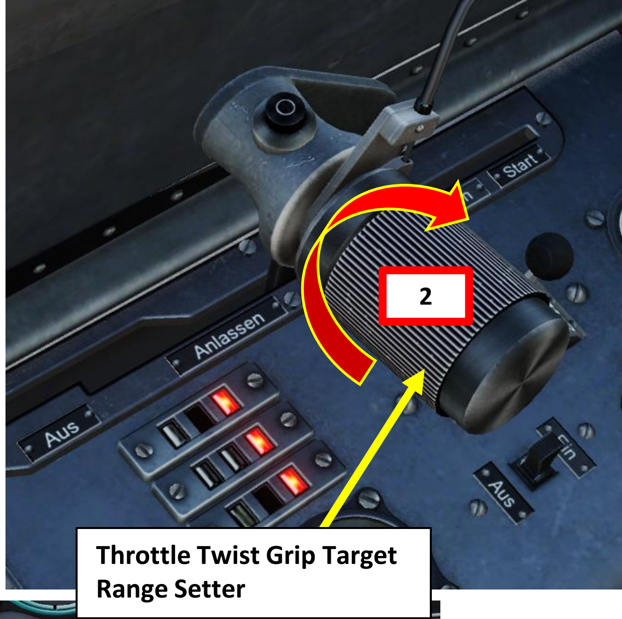


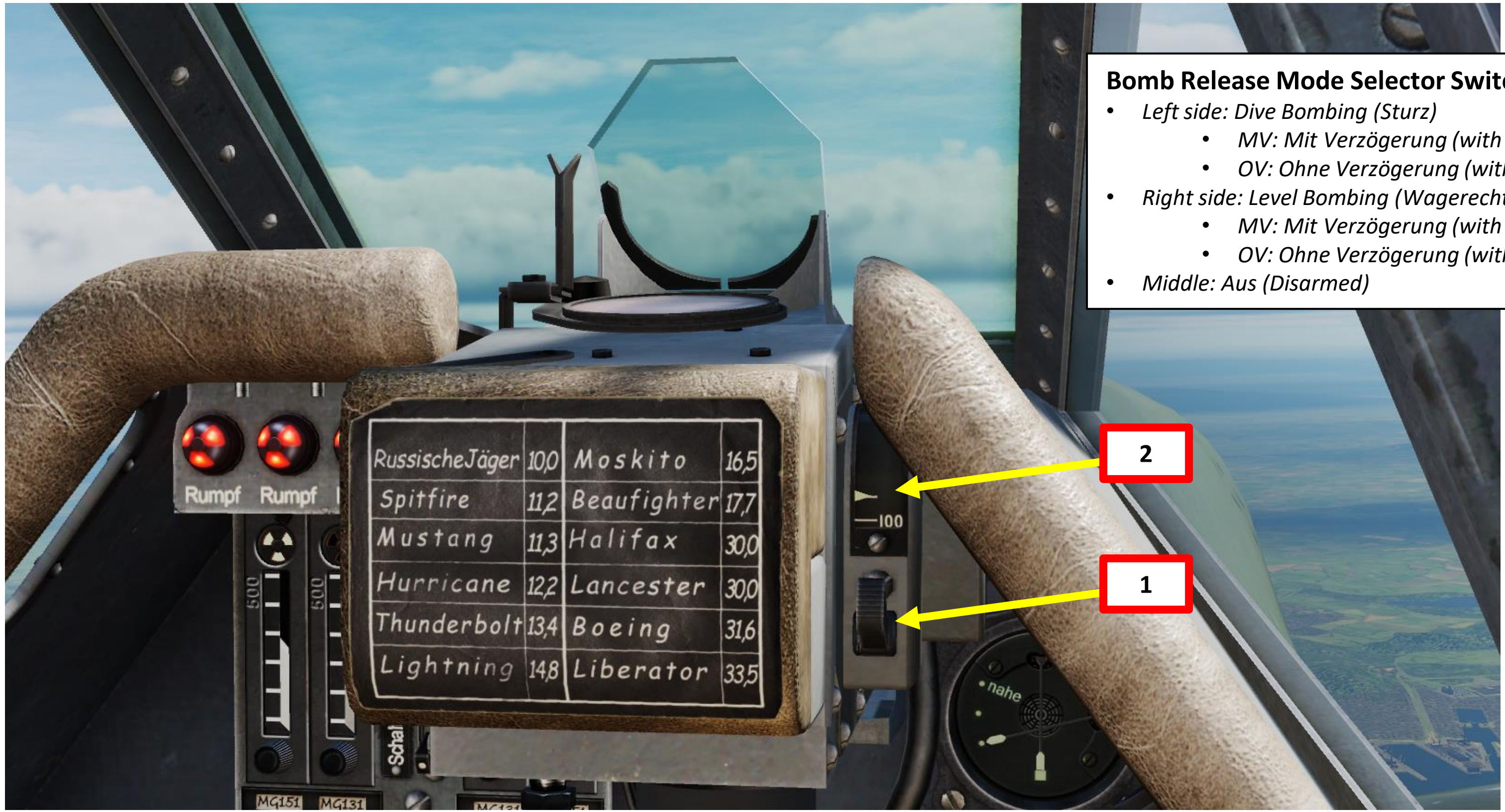


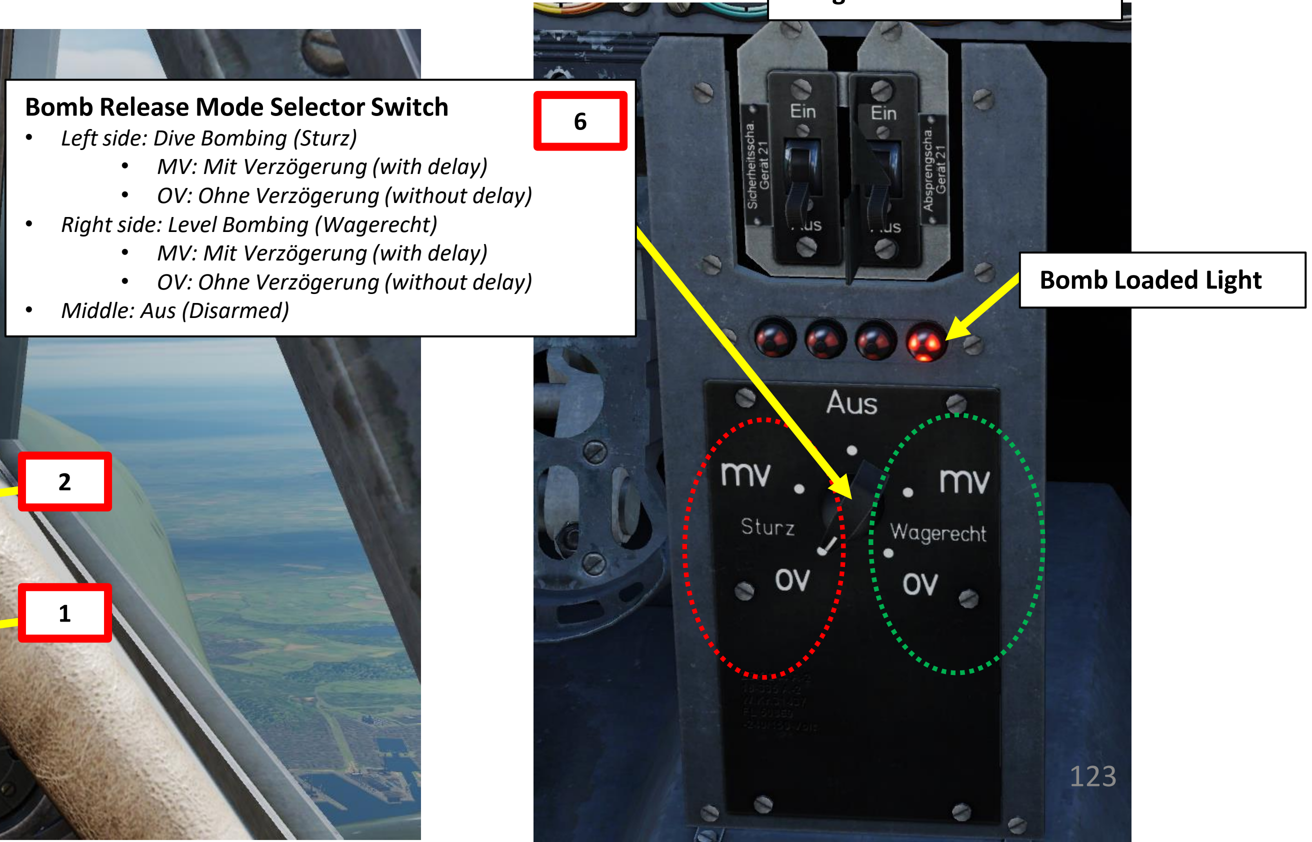


SC-500 BOMB (DIVE BOMBING PROFILE)

1. Set Gunsight Gyro Power switch – ON (UP)
2. Set Gunsight Range to 0 m by using the throttle twist grip.
3. Arm your guns using the "GRUPPE" Safety Switch (UP)
4. Choose bomb release mode
   - Left Side (Red) = *Sturz* = Dive Bombing
   - Right Side (Green) = *Wagerecht* = Level Bombing
5. Choose desired fuse delay
   - MV = *Mit Verzögerung* = With Delay
   - OV = *Ohne Verzögerung* = Without Delay
6. Select appropriate release mode on console.
   - Example: Sturz OV= Dive Bombing Without Delay

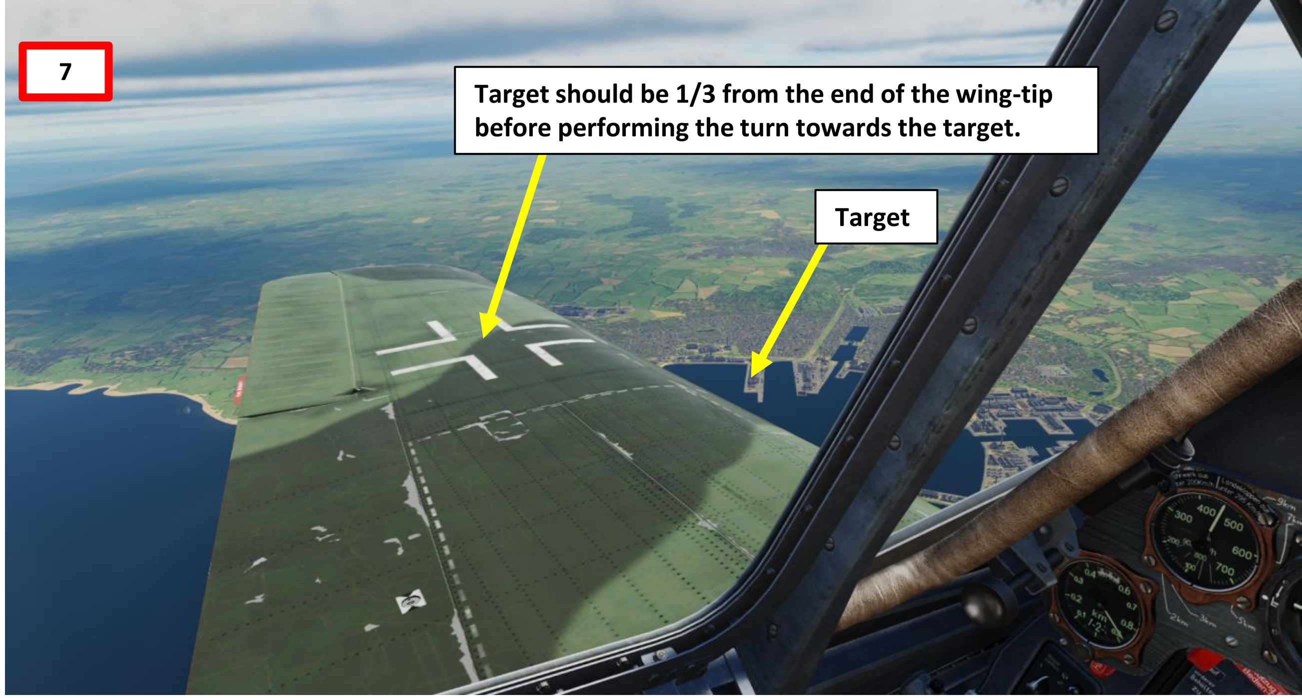


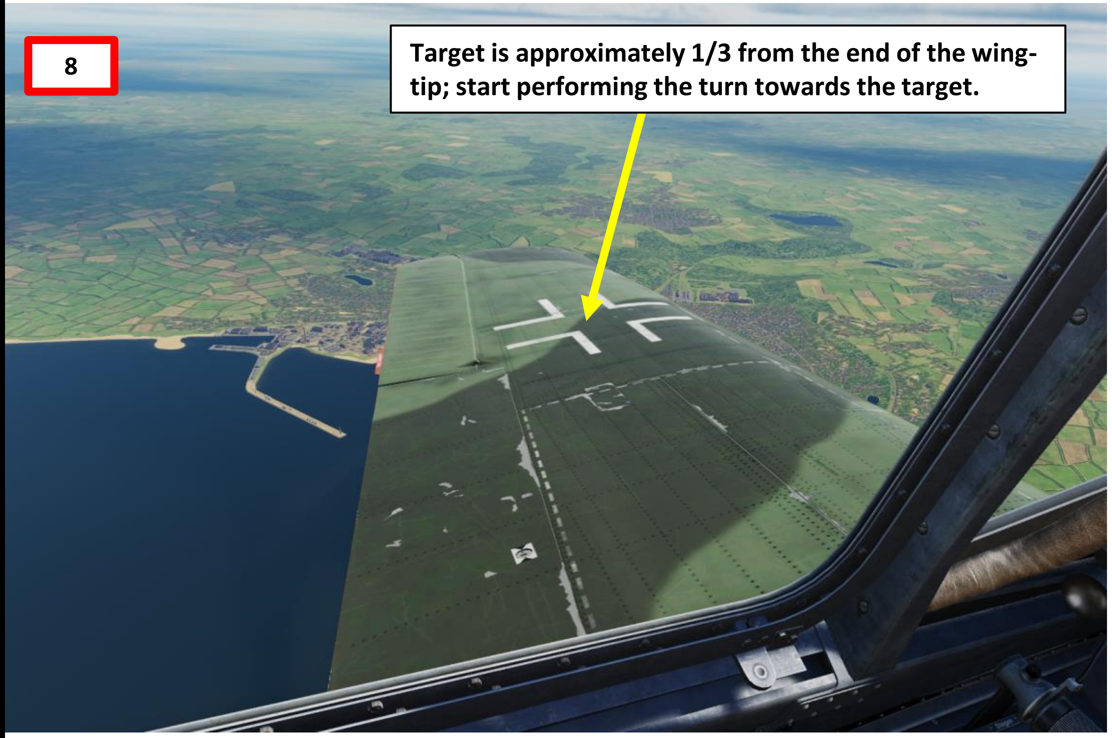




SC-500 BOMB (DIVE BOMBING PROFILE)

7. Approach the target by flying level at an altitude of 2 km, with an airspeed of 350 km/h.
8. 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.
9. 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.



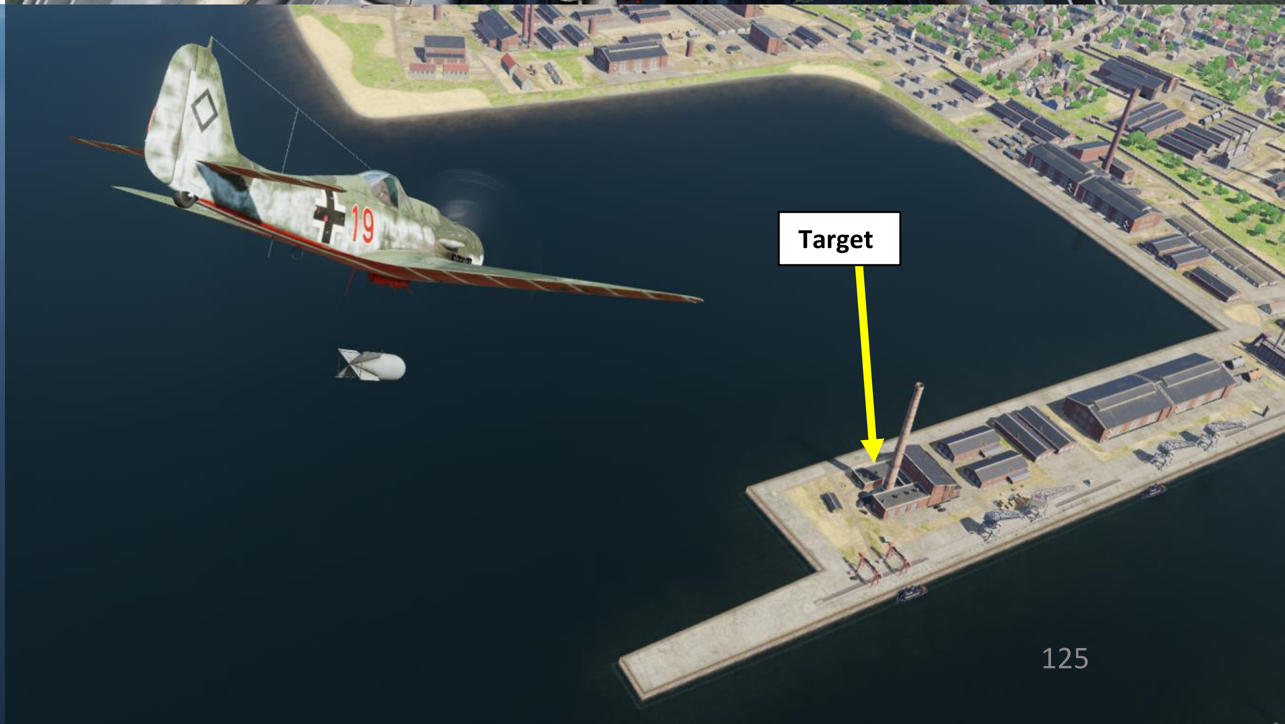


SC-500 BOMB (DIVE BOMBING PROFILE)

10. 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.
11. Make sure not to exceed maximum diving speeds, as indicated on your airspeed gauge.
12. Line up the target with the center of the gunsight reticle.
13. Pull lead to bring the target slightly under the aircraft nose.
14. When target is lined up under the aircraft nose and aircraft is between an altitude of 500 m and 1 km, release bomb.

Airspeed Indicator (km/h)
Not to Exceed diving speeds are handwritten on the airspeed gauge

Airspeed @ Altitude
- *500 km/h @ 9 km*
- *600 km/h @ 7 km*
- *700 km/h @ 5 km*
- *800 km/h @ 3 km*
- *850 km/h @ 2 km*



SC-500 BOMB (DIVE BOMBING PROFILE)

15. Release bomb using the “WEAPON RELEASE” button (RALT+SPACE).
16. 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.
17. 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

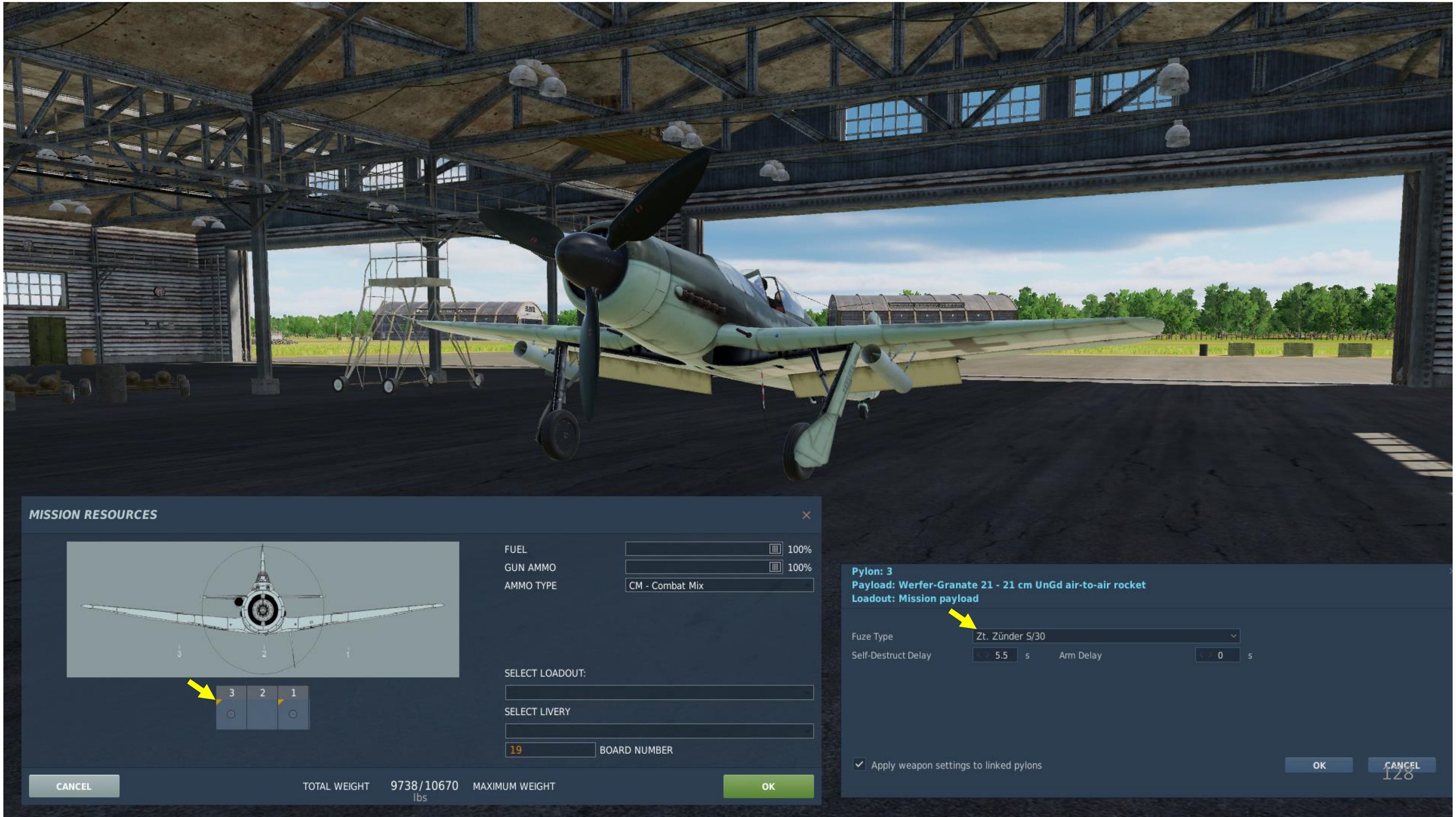
15

Weapon Release Button
- *RALT+SPACE binding*

SC-500 BOMB (DIVE BOMBING PROFILE)

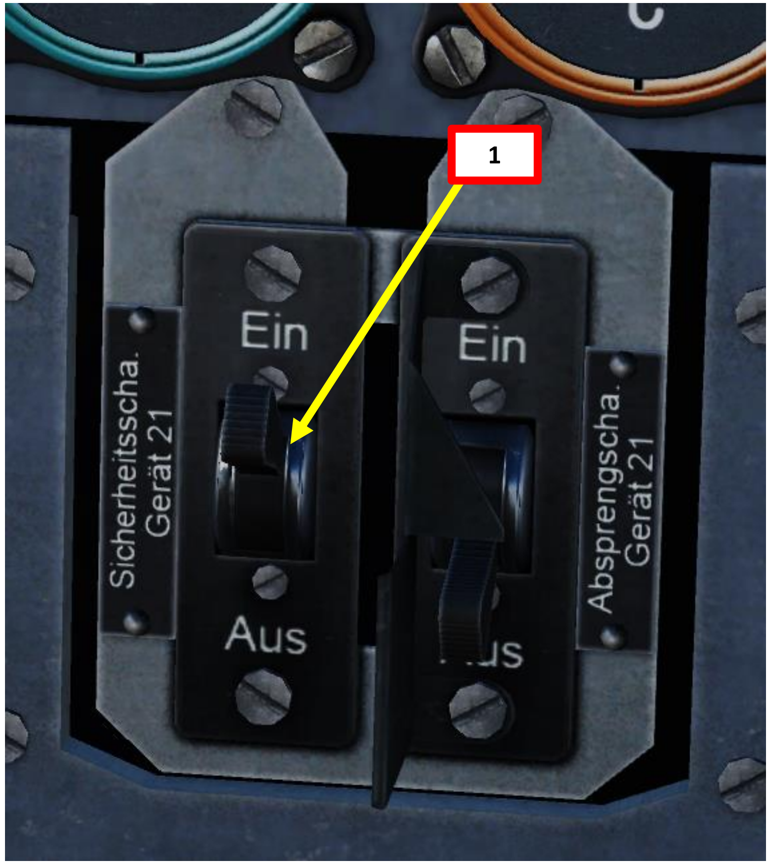
BR 21 WERFER-GRANATE 21-CM ANTI-AIR ROCKETS

You can set anti-air rockets with a fuze delay and a self-destruct delay as well. Similarly to the bomb fuze setup, contact the ground crew and click on the yellow triangle on the rocket to set fuze type and delay.



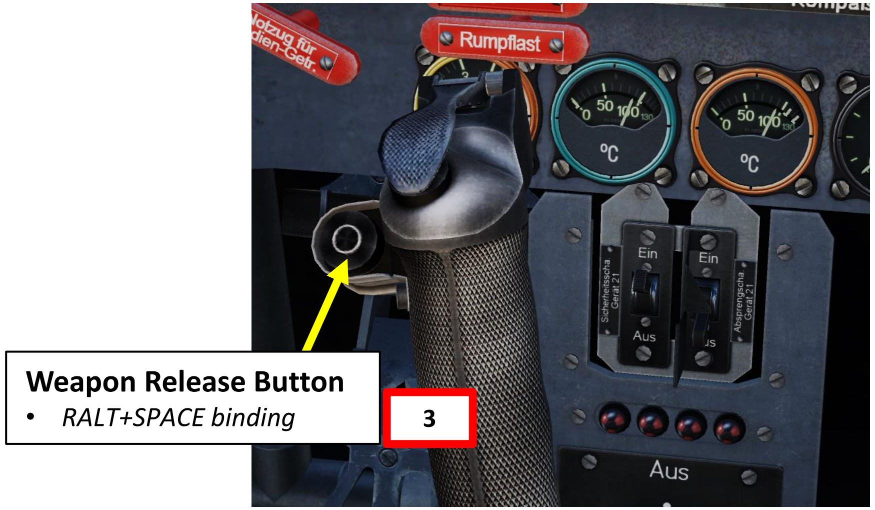
BR 21 WERFER-GRANATE 21-CM ANTI-AIR ROCKETS

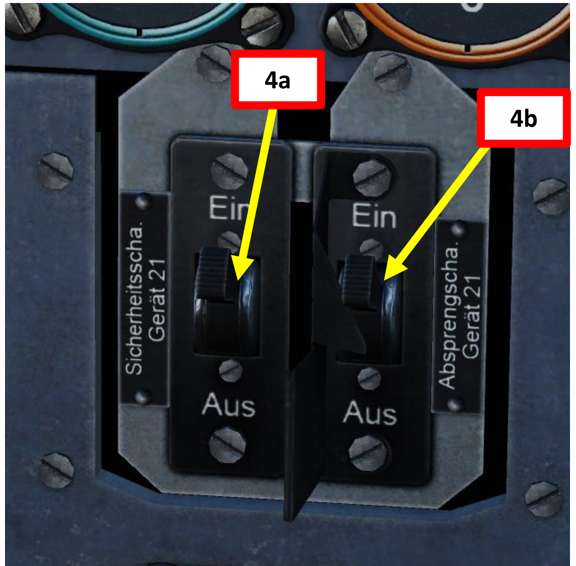
1. Arm rockets by setting the “SICHERHEITSSCHA. GERÄT 21” switch to EIN (UP).
2. The aiming process is very imprecise. 21-cm Werfer-Granate Rockets were designed to be used as anti-air rockets against the allied heavy bomber combat boxes. The shots were meant to be taken from a longer range, providing (in theory) a safer alternative to exposed attacks with cannons. The angled-up rocket tubes provided the rocket with an arced trajectory… and the rockets would hopefully damage bombers when exploding in mid-air. Needless to say, this concept was better in theory than in practice since the rockets themselves were not very accurate.



BR 21 WERFER-GRANATE 21-CM ANTI-AIR ROCKETS

3. Press the “WEAPON RELEASE” button (RALT+SPACE) to fire rockets.
4. To jettison rocket racks (which generate a lot of drag):
    a) Verify that Rocket Arming Switch *(SICHERHEITSSCHA. GERÄT 21)* is set to EIN/ARMED (UP)
    b) Set the “ABSPRENGSCHA. GERÄT 21” switch to EIN (UP) after lifting the safety cover.



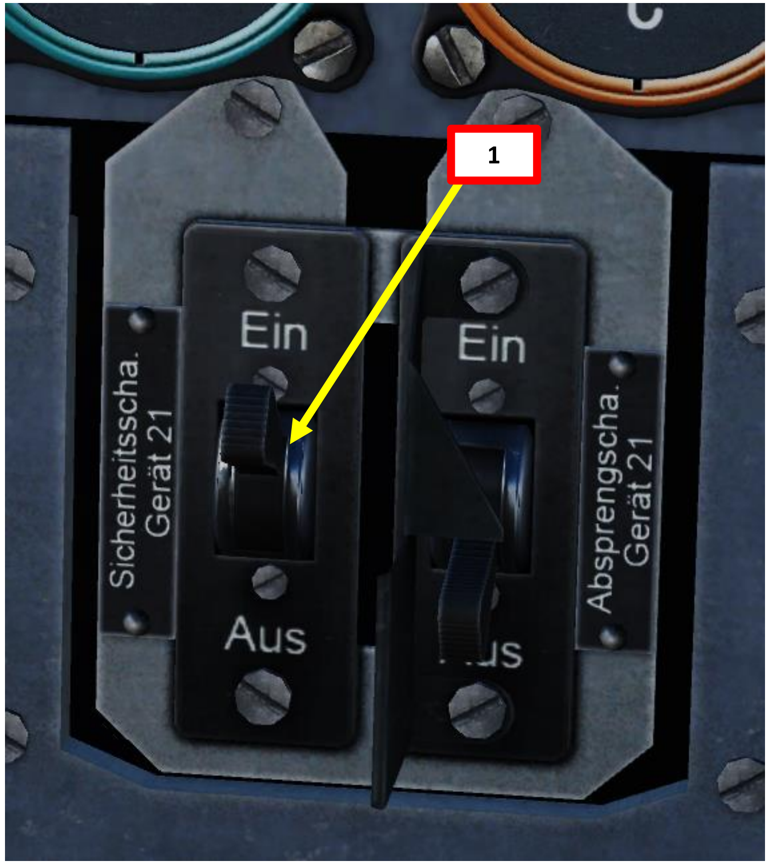


R4M (RACKETE 4-KILOGRAMM MINENKOPF) ANTI-AIR ROCKETS

Unlike the BR 21 Werfer-Granate anti-air rocket, the R4M rockets do not have customizable fuzes or a self-destruct delay.

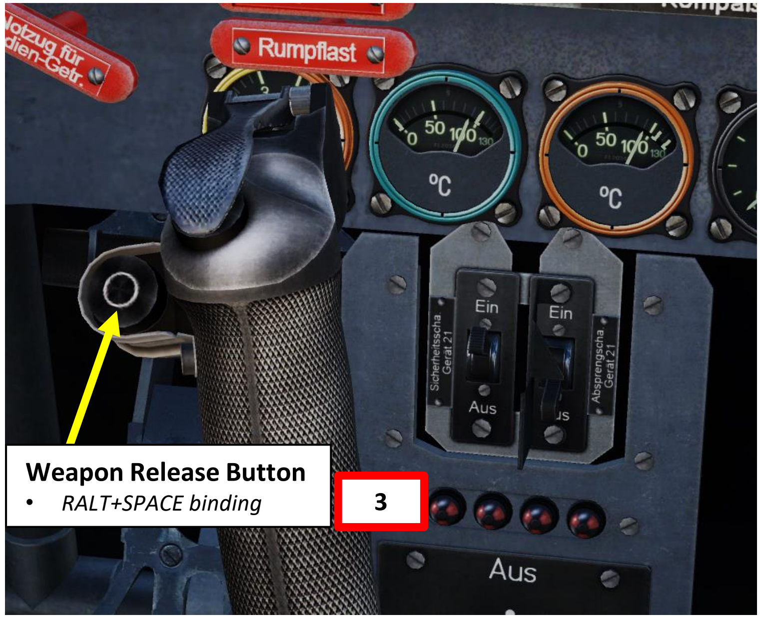
R4M (RACKETE 4-KILOGRAMM MINENKOPF) ANTI-AIR ROCKETS

1. Arm rockets by setting the “SICHERHEITSSCHA. GERÄT 21” switch to EIN (UP).
2. The aiming process for the R4M rockets is a bit more straightforward than its Werfer-Granate 21 cm counterpart. The racks contain 13 rockets each. Rockets have to be fired from close range and require a direct hit. In a way, using R4M rockets is easier than using the Werfer-Granate 21 cm rockets since their trajectory is more predictable and you have more at your disposal to adjust your aim if you miss.



R4M (RACKETE 4-KILOGRAMM MINENKOPF) ANTI-AIR ROCKETS

3. Press the “WEAPON RELEASE” button (RALT+SPACE) to fire rockets.

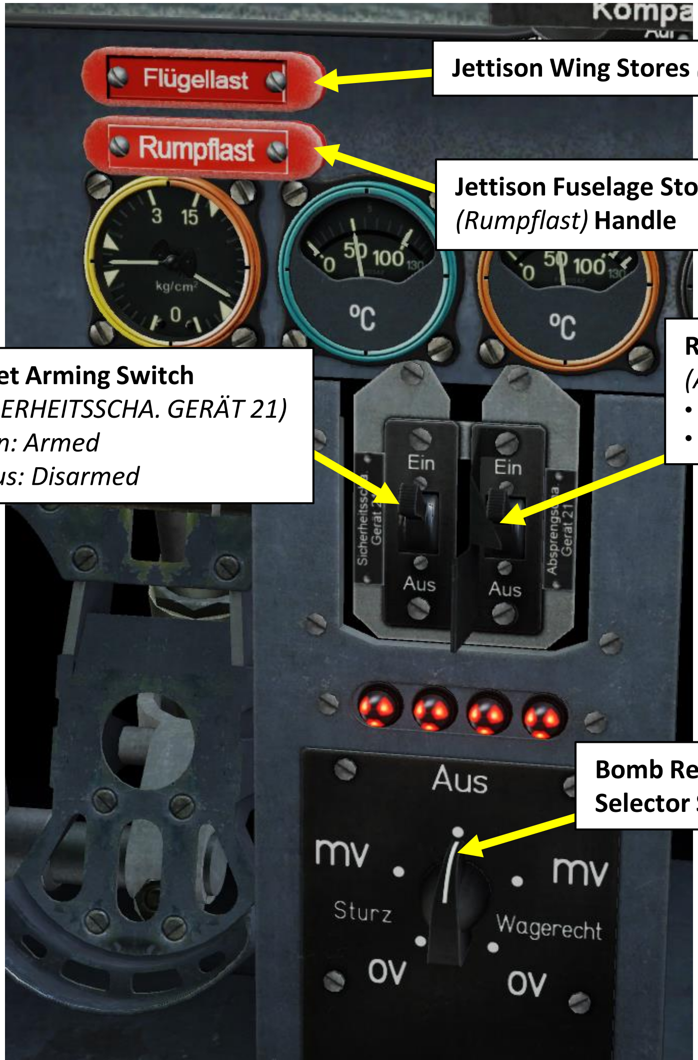


R4M (RACKETE 4-KILOGRAMM MINENKOPF) ANTI-AIR ROCKETS

Note: The R4M rocket racks are not jettisonable.

ORDNANCE JETTISON

- To **jettison a bomb**, set Bomb Release Mode Selector Switch to AUS (Disarmed), then:
  - Pull *Rumpflast* handle to jettison Fuselage Stores
  - Pull *Flügellast* handle to jettison Wing Stores .
- To **jettison an external fuel drop tank**, pull "*Rumpflast*" handle.
- To **jettison rocket racks**, set Rocket Arming Switch *(SICHERHEITSSCHA. GERÄT 21)* to EIN/ARMED (UP) then set the "ABSPRENGSCHA. GERÄT 21" switch to EIN (UP) after lifting the safety cover.



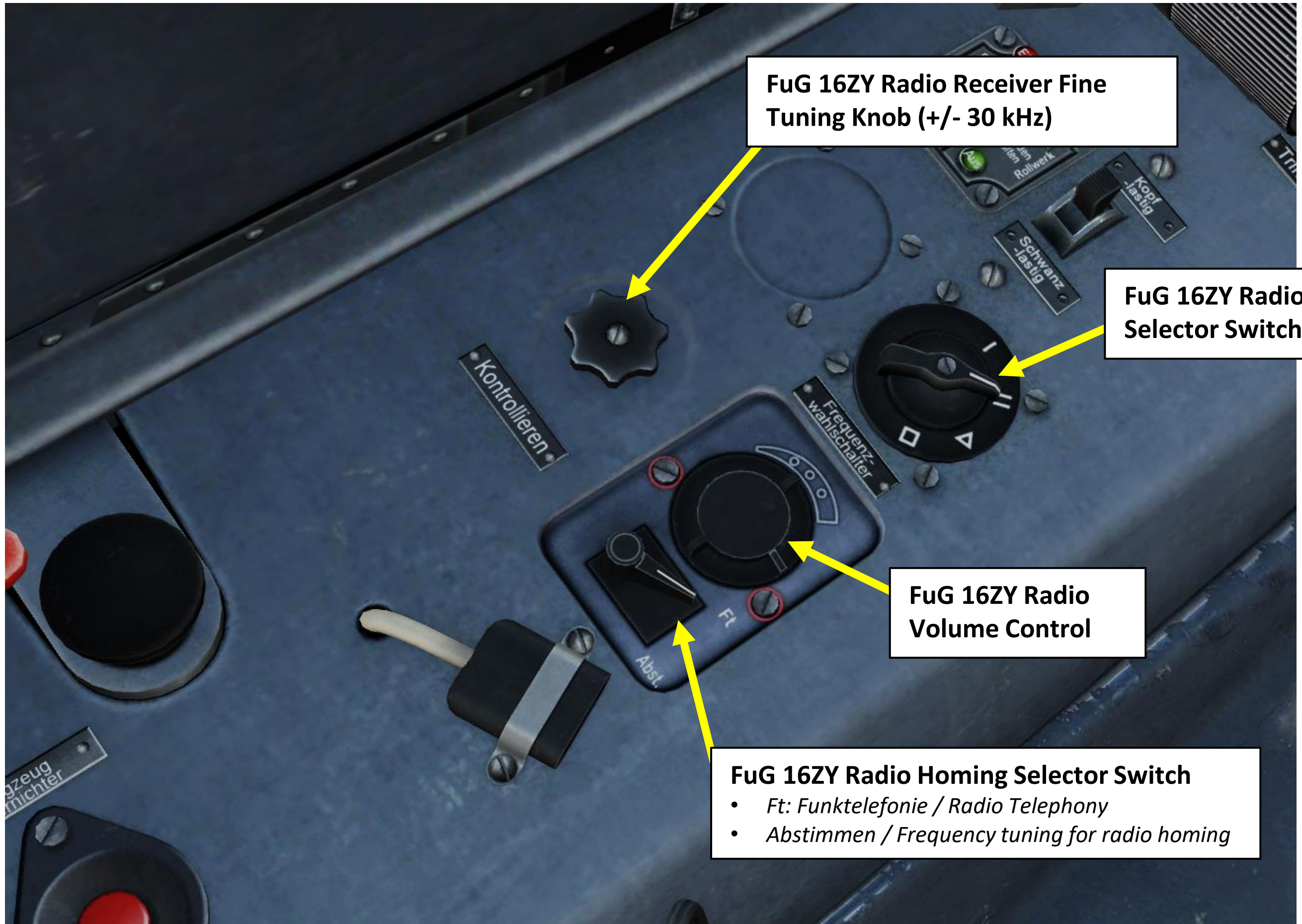
FUG 16ZY VHF RADIO OVERVIEW

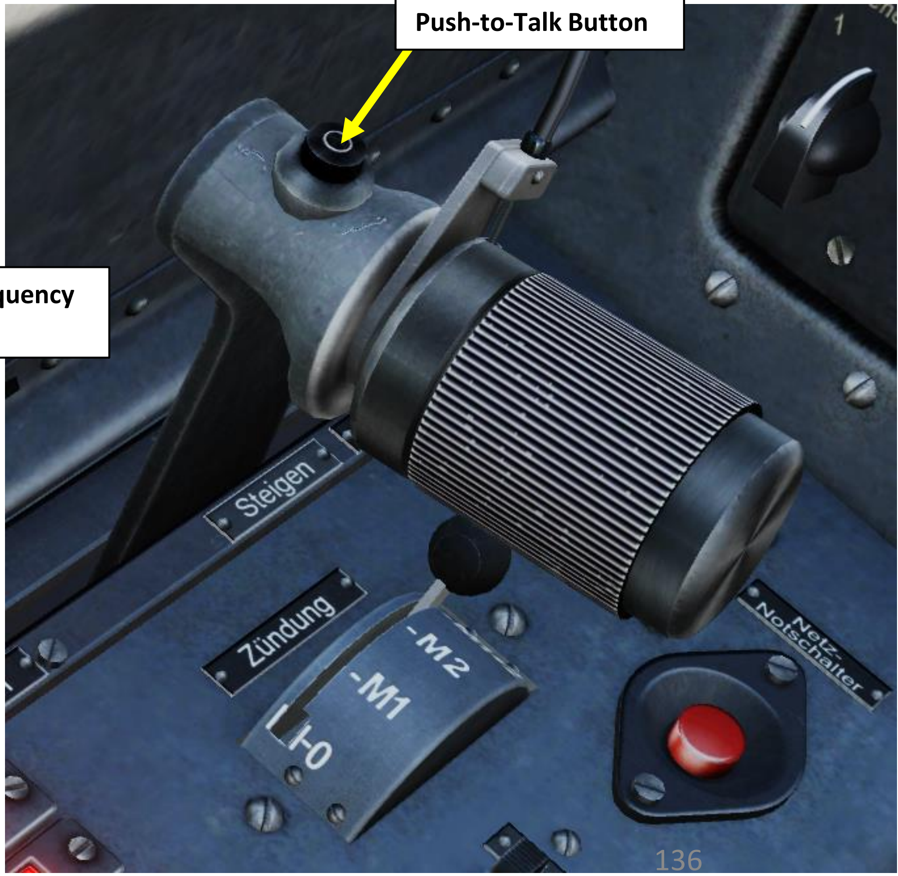
The FW190-D9 is equipped with a FuG 16ZY radio, a specially-designed airborne VHF transceiver. The FuG 16 can be used for in-flight communication as well as for IFF identification and DF homing. The set operates in the frequency range between 38.4 and 42.4 MHz.

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**.

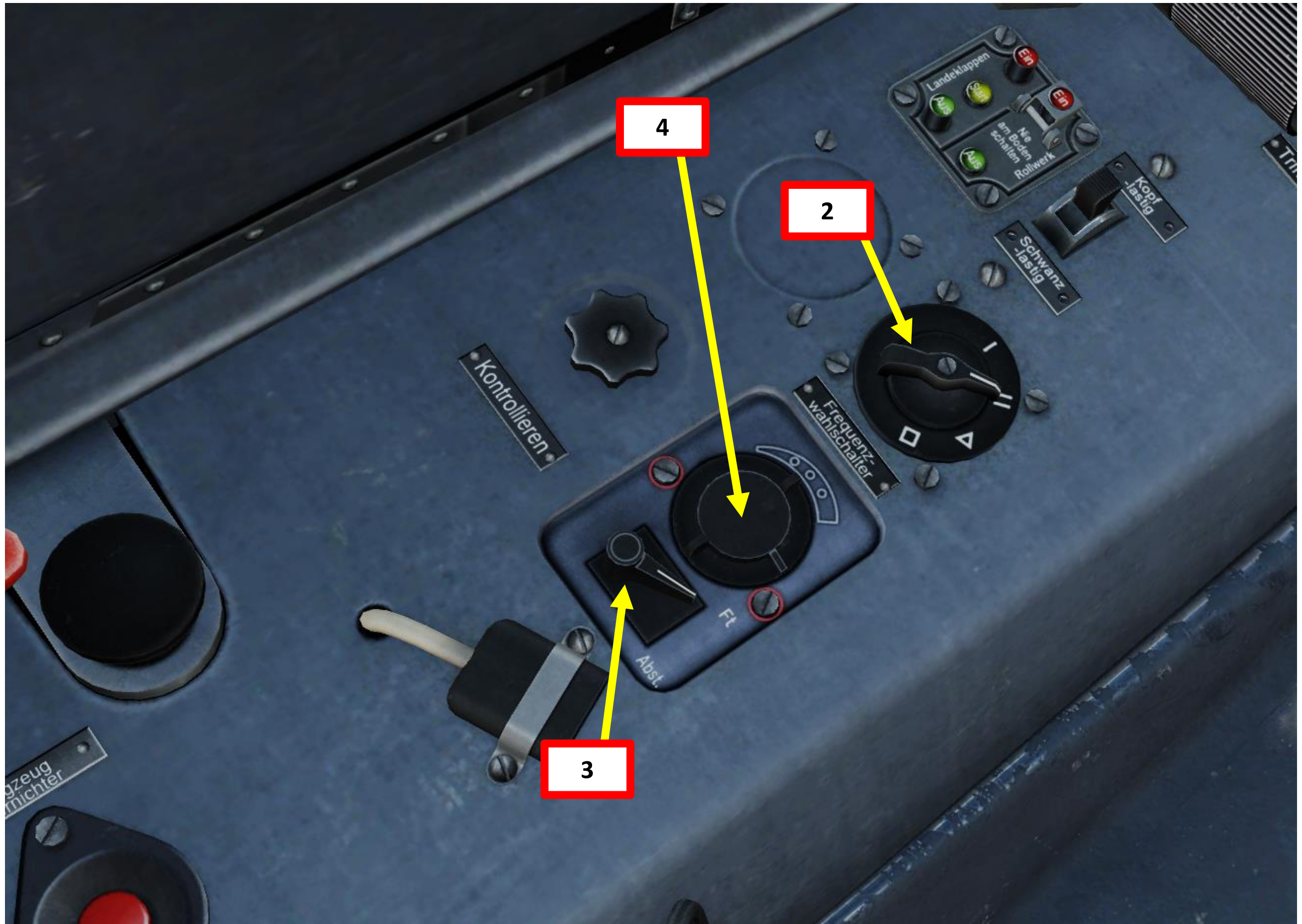
RADIO FREQUENCY RANGE: 38.4- 42.4 MHz

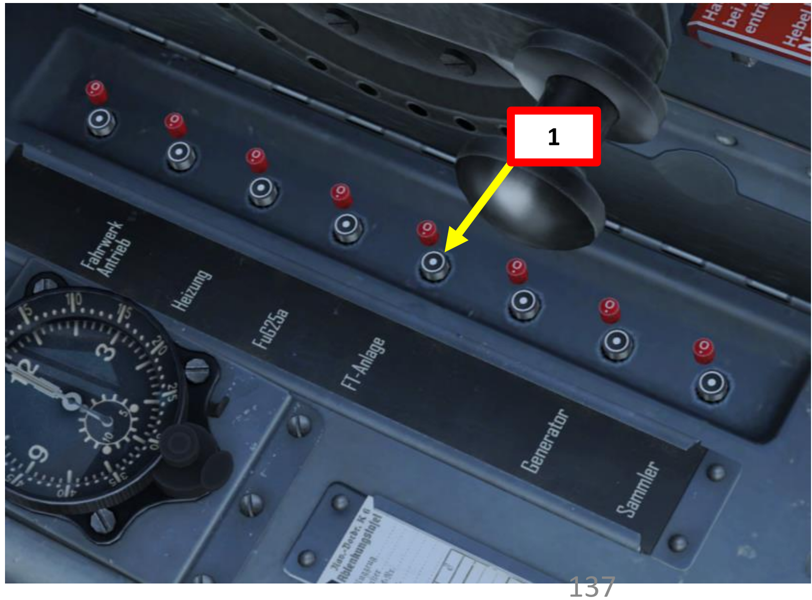




HOW TO TRANSMIT ON FUG 16ZY VHF RADIO

1. Set FUG 16ZY Power Switch (F136, *FT Anlage*) 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

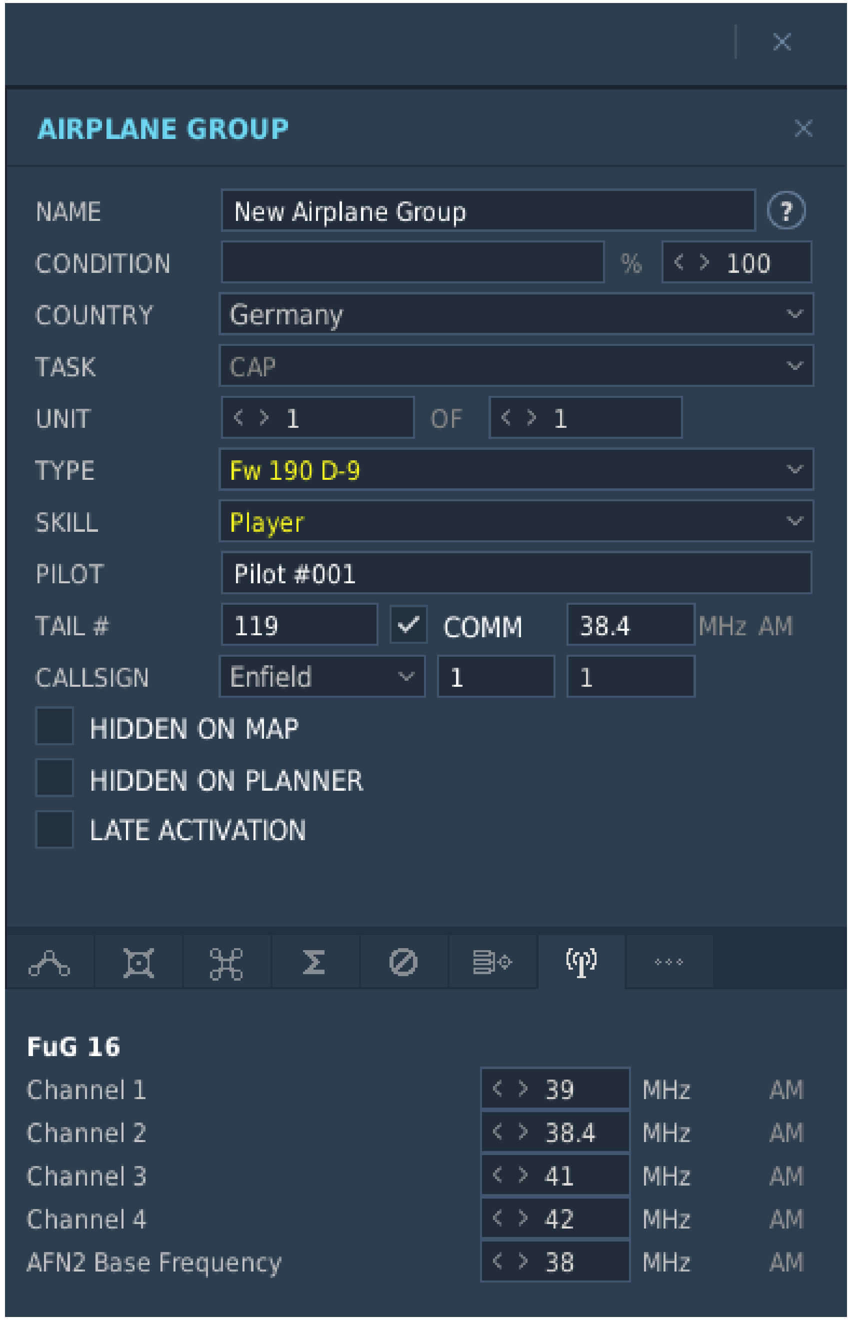
- The "I" position is for "*Y-Führungsfrequenz*", or Management frequency, is used for communication within the flight or squadron. A mission maker will typically preset this frequency to the same frequency used by your wingmen of your flight and mention it in the mission briefing.
- The "II" position 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	Frequency Selector	Push-To-Talk Open	Push-To-Talk Depressed	Transm	Recvr
"Ft"	I	Listen	Talk	I	II
"Abst"	I	Homing Listen	Homing Listen+Talk	I	II
"Ft"	II, Δ or □	Listen	Talk	II, Δ or □	
"Abst"	II, Δ or □	Listen to loop antenna Targeting	Talk	II, Δ or □	

Because on the first frequency selector position (I) sending and receiving are conducted at different frequencies, it is not used in this simulation.

For communication, use II, Δ or □ selector positions with "Ft" position of communications - homing switch.



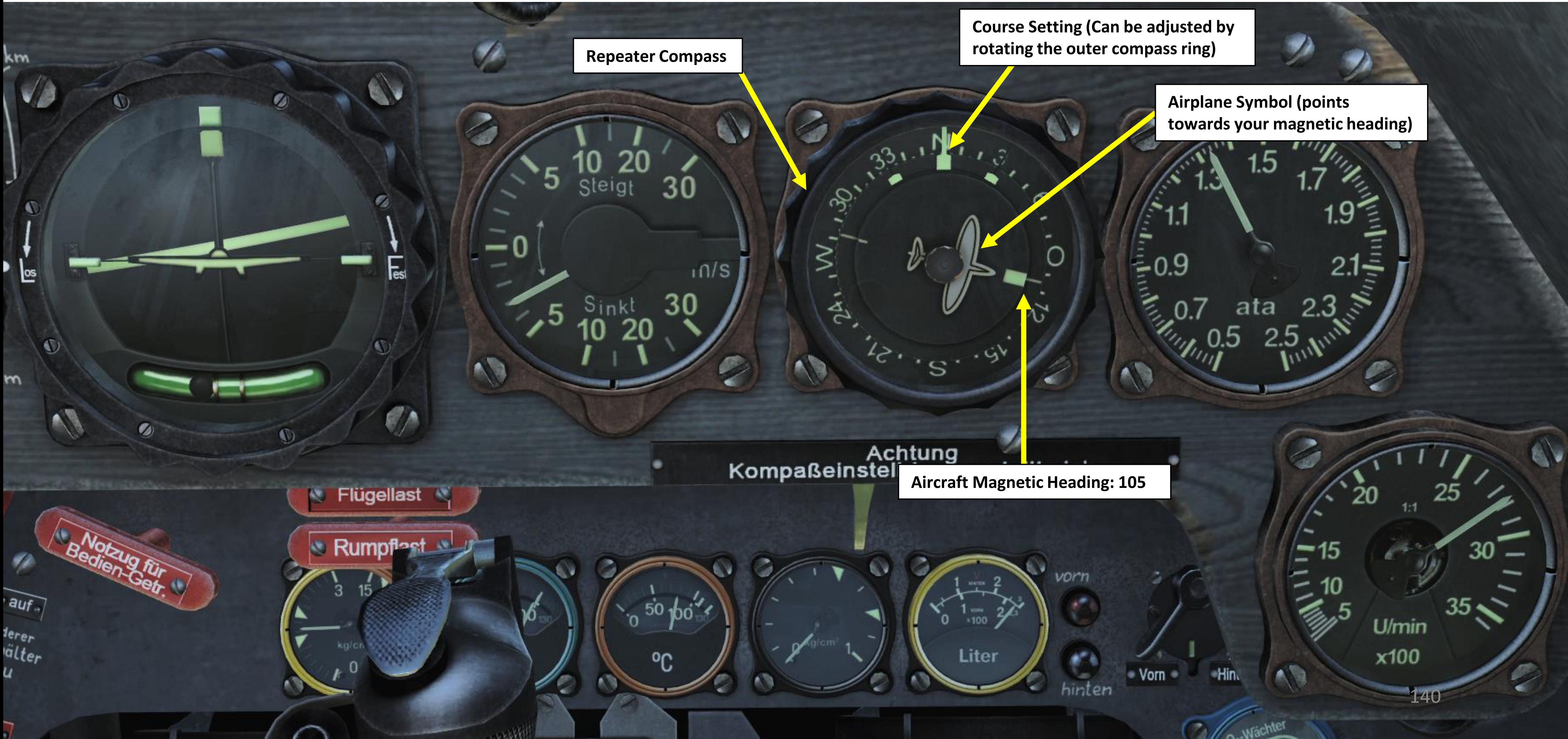
AIRPORT RADIO FREQUENCIES

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 FW190. 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)

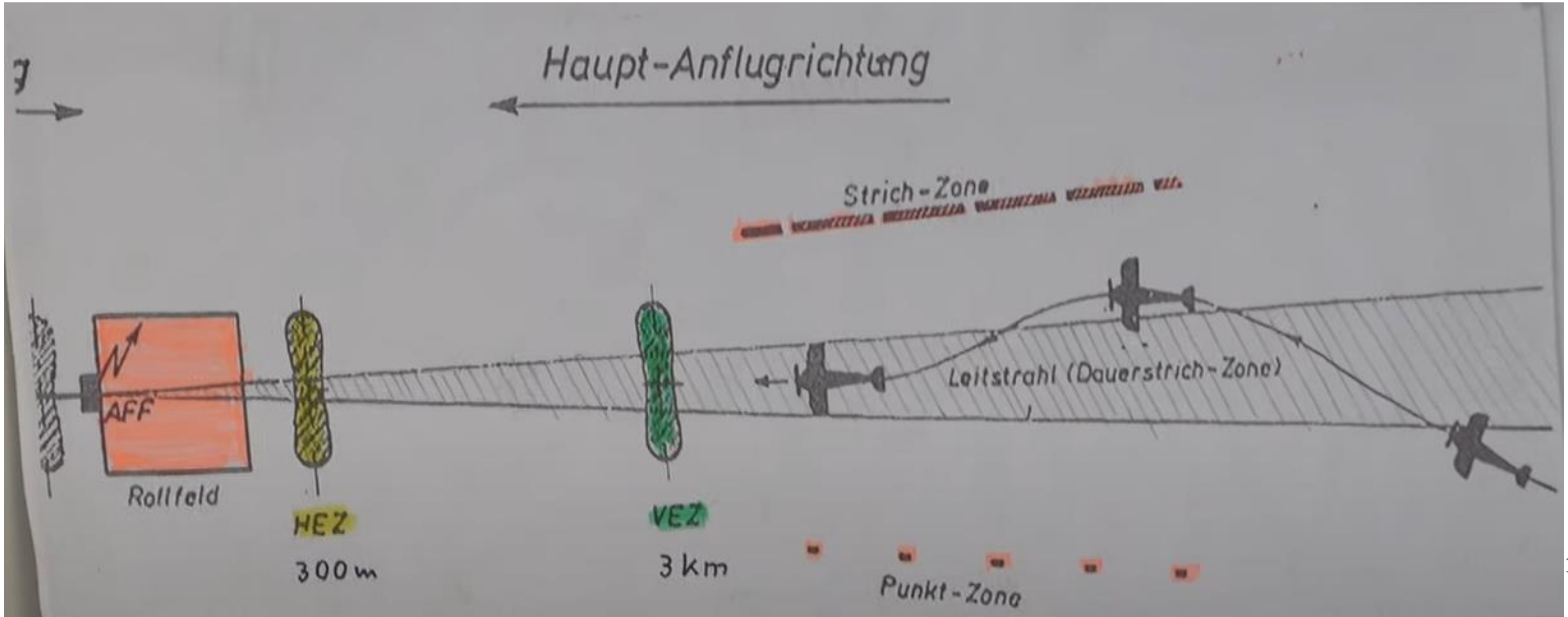
The During the 1930s and 1940s, a Standard Beam Approach (SBA) receiver was used by aircraft, to land when visual conditions were poor (due to rain, low cloud, or fog). It was a navigation receiver, and allowed the pilot to line the aircraft up on the runway when preparing in to land. You can think of 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.

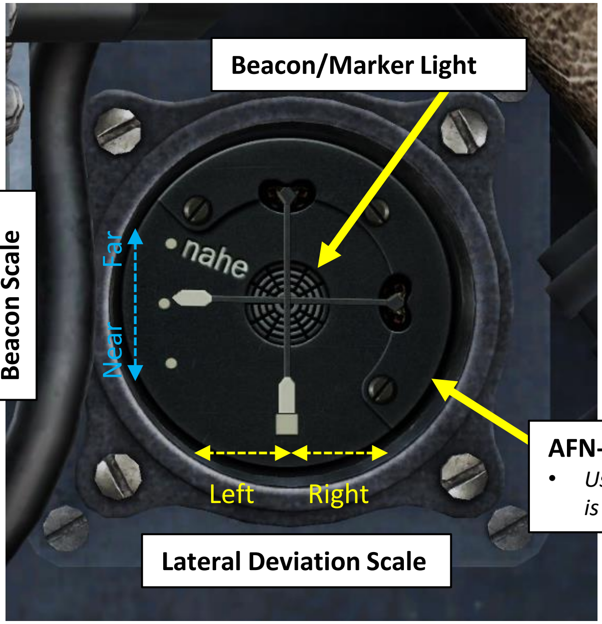
Reference: http://www.tuberadio.com/robinson/museum/command_SBA/

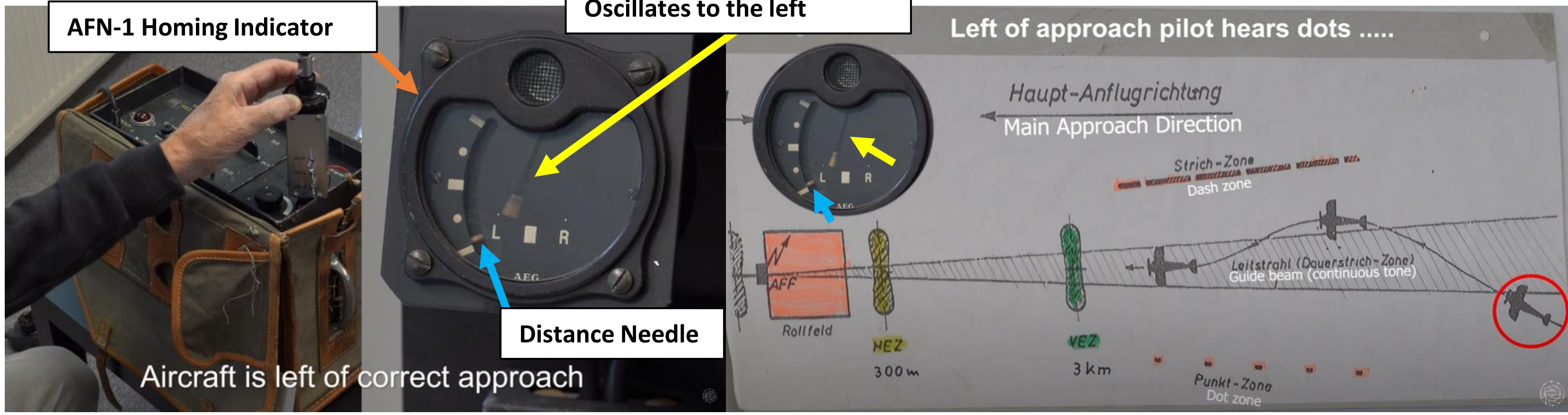


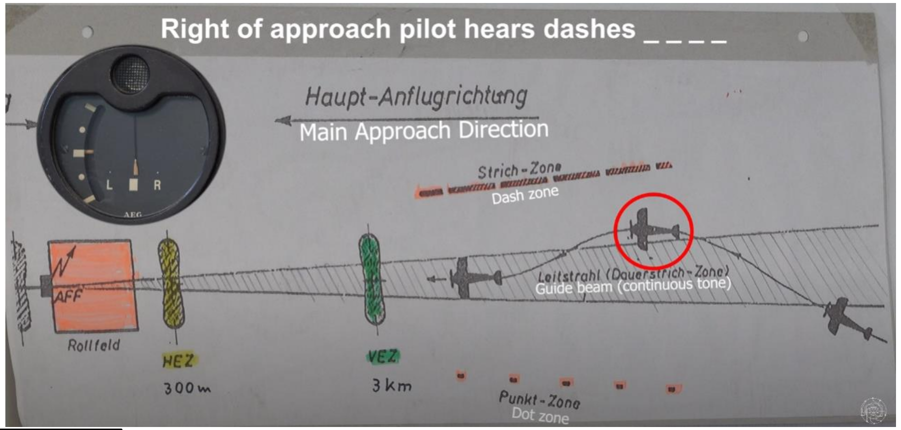
LORENZ BEAM BLIND-LANDING RADIO NAVIGATION (THEORY)

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.







LORENZ BEAM BLIND-LANDING RADIO NAVIGATION (THEORY)

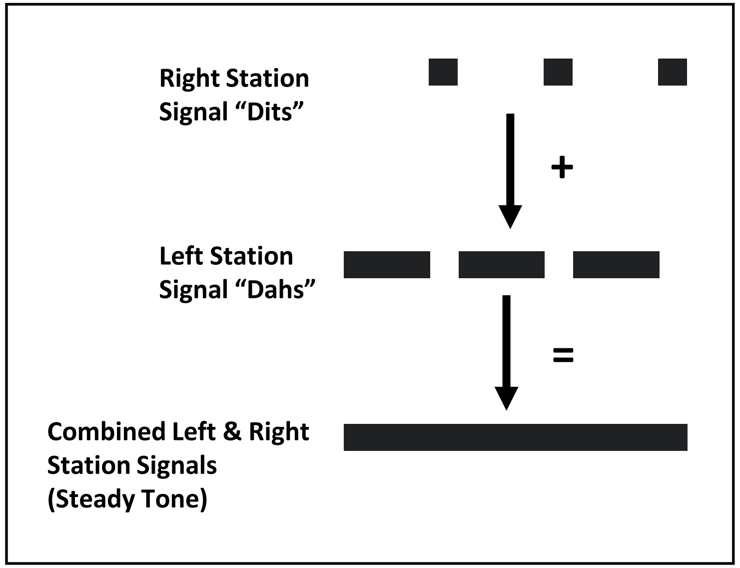
Here is an example of the concept behind the Standard Beam Approach (SBA).

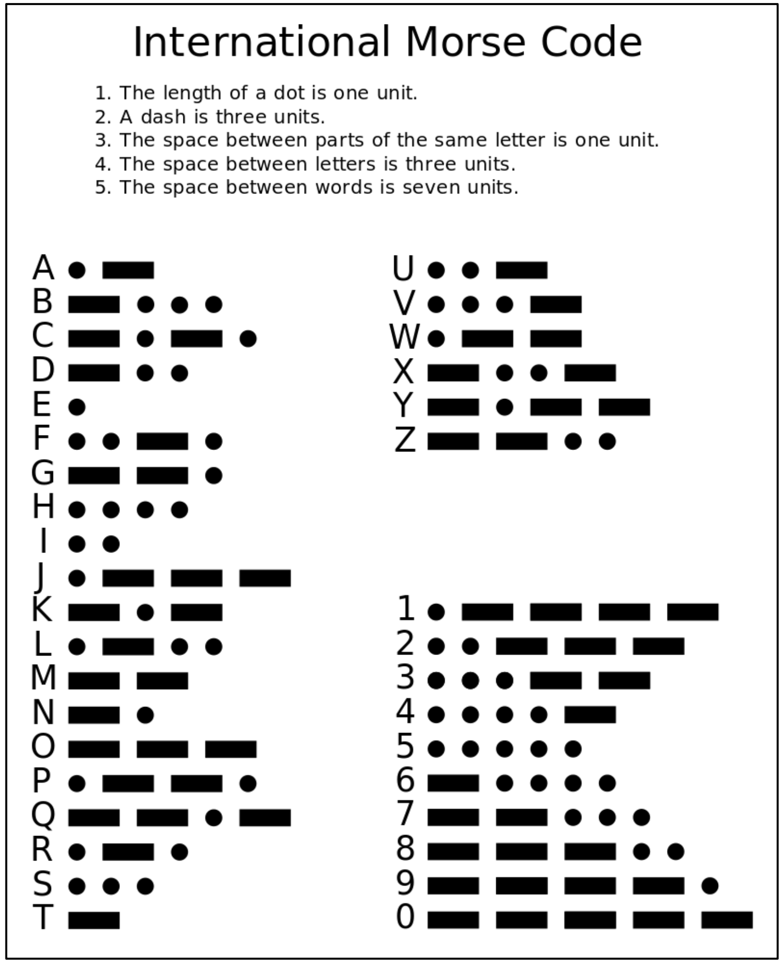
The Standard Beam Approach system currently simulated in DCS is based on the Lorenz signals: a series of "dits" (Morse code for "E") for the station right of the runway and a series of "dahs" (Morse code for "T") for the station left of the runway.

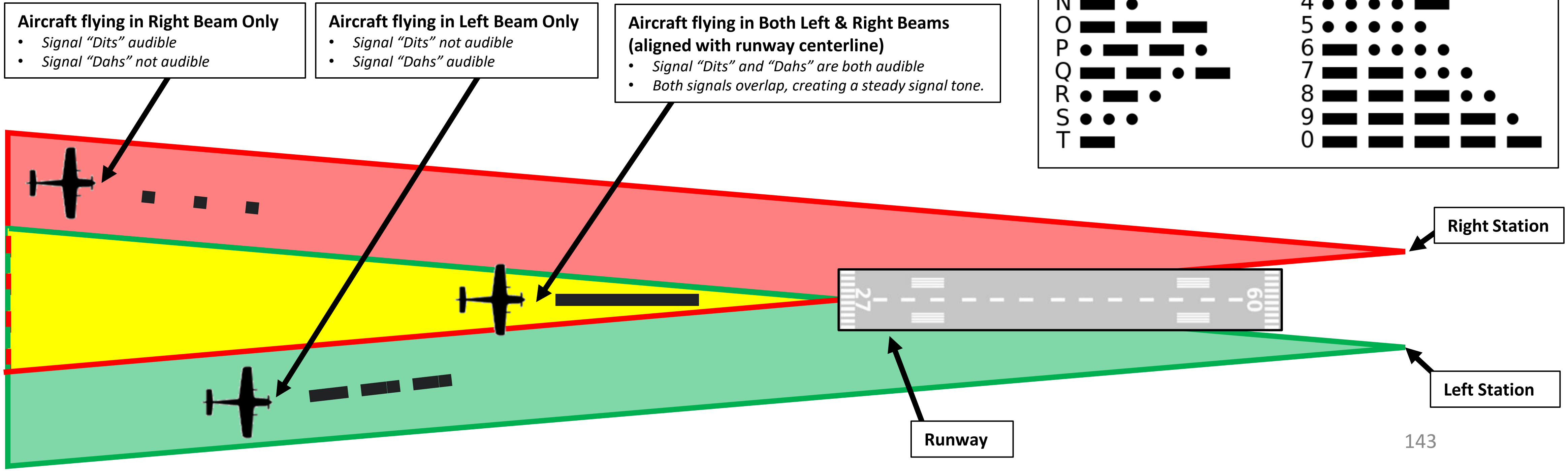
The signal codes might change eventually, but the method remains the same: use audio signals to determine where you are in relationship to the runway, and steer the aircraft until both signals overlap and create a steady aural tone.

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





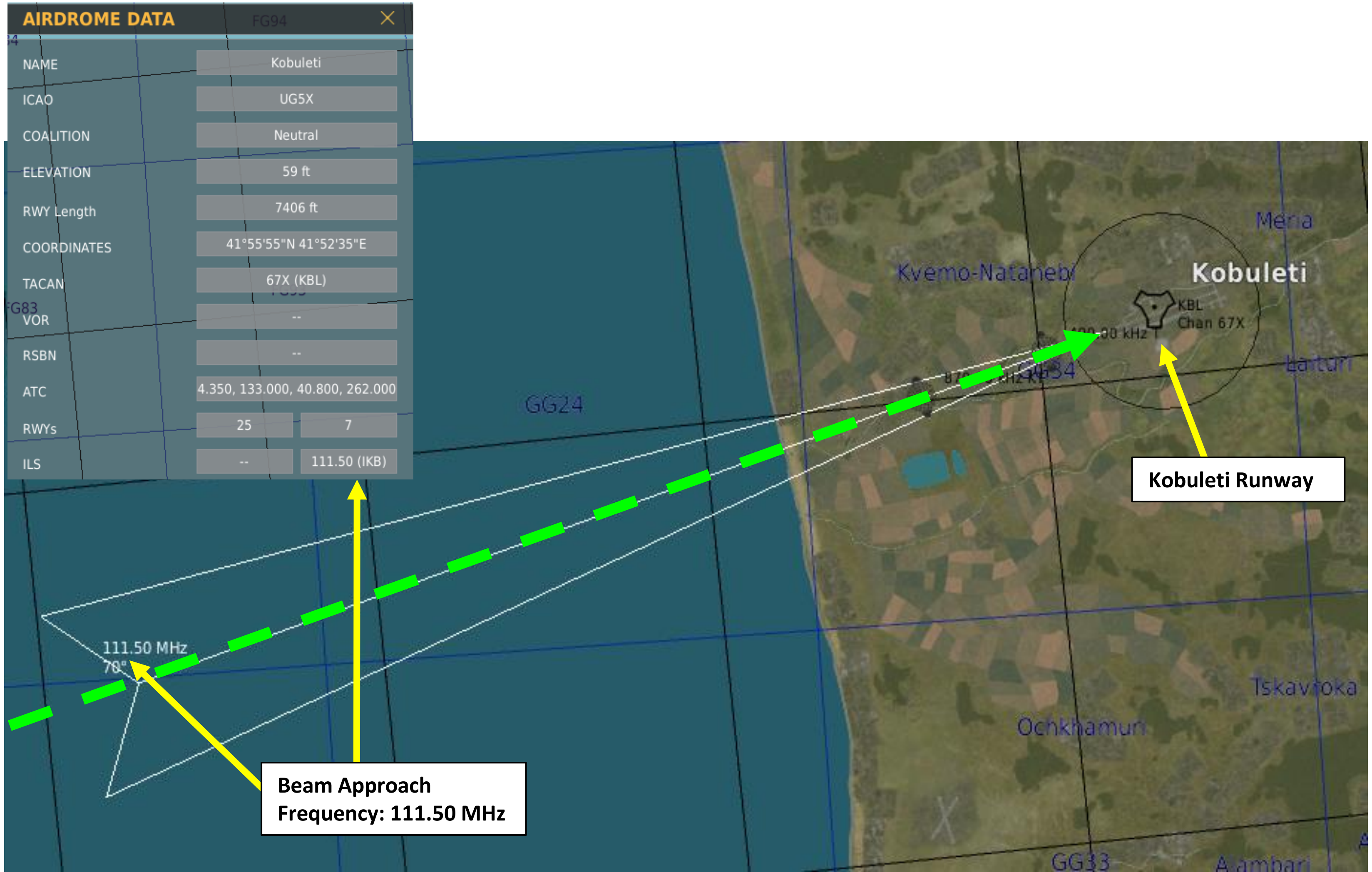


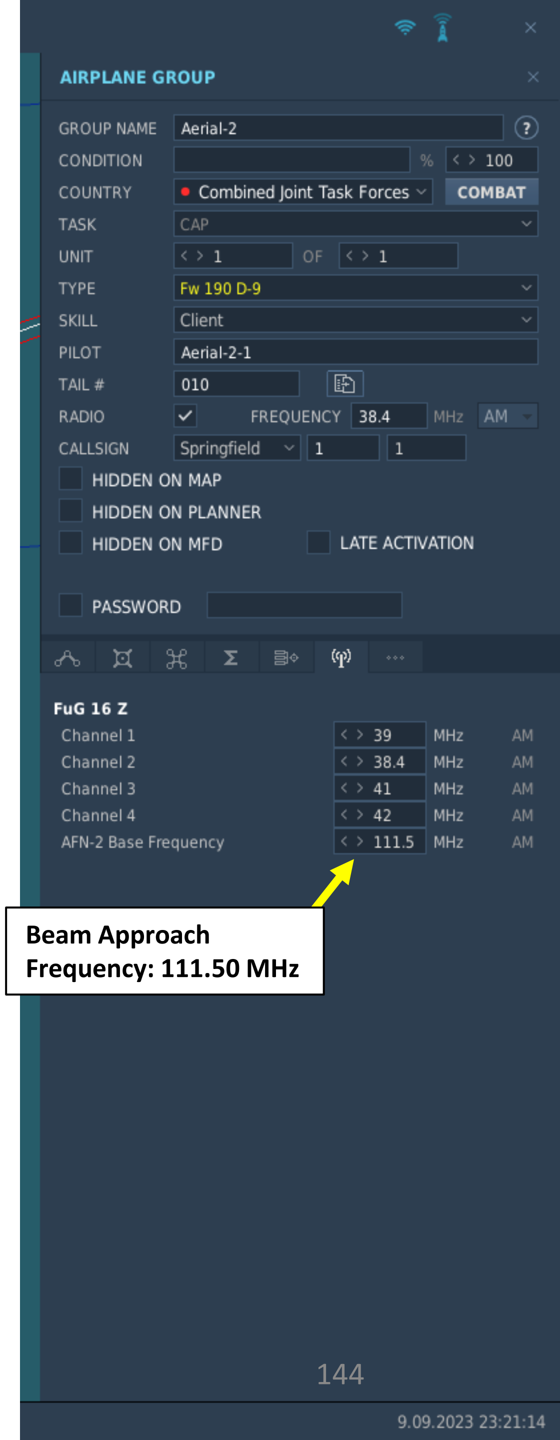
AFN-2 HOMING TUTORIAL (THEORY)

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**.

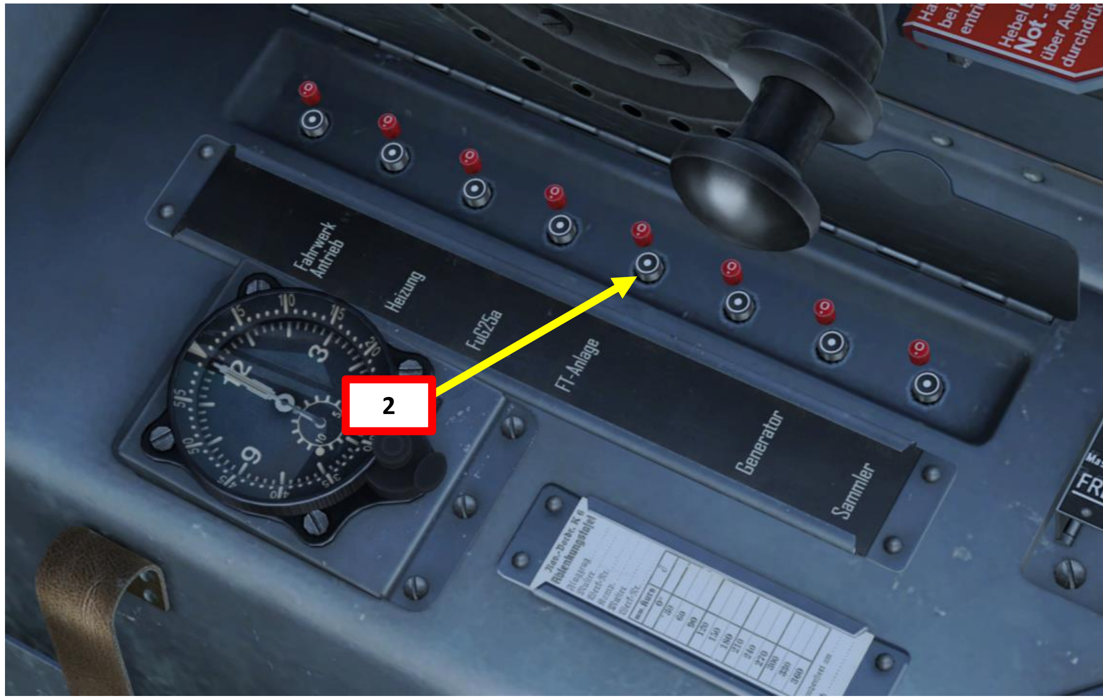


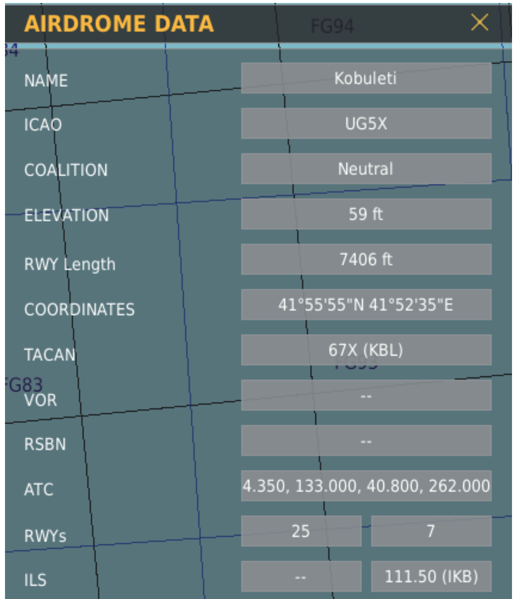


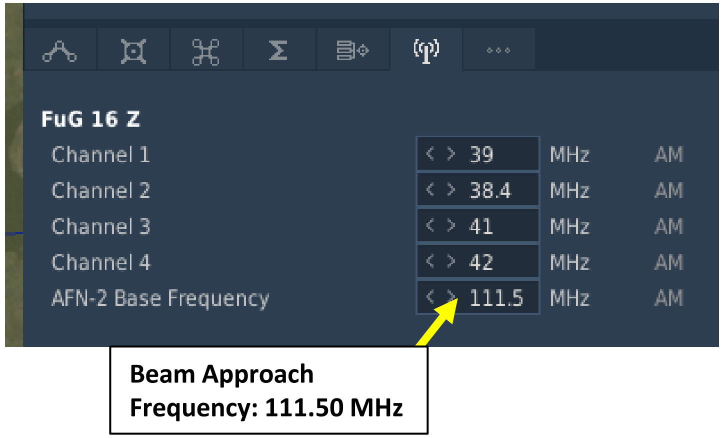
AFN-2 HOMING TUTORIAL (THEORY)

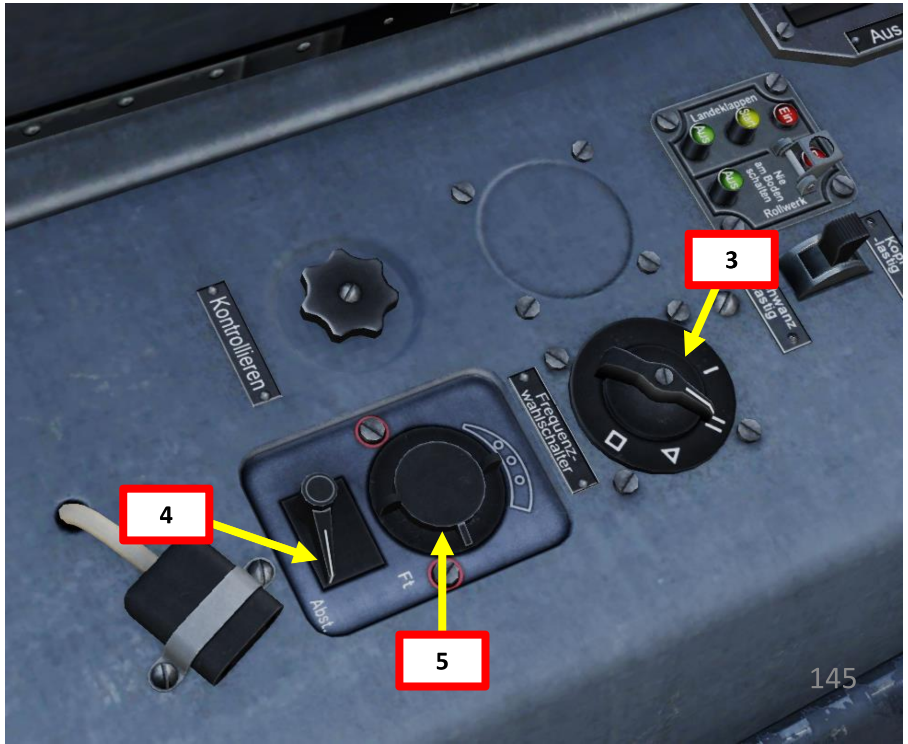
In this tutorial, we will use the Beam Approach system for Kobuleti's runway (frequency 111.50 MHz).

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 (F136, *FT Anlage*) ON.
3. Set radio channel selector to II.
4. Set radio mode to "ABST" (*Abstimmen:* Frequency tuning for radio homing*)*
5. Adjust radio volume to hear the morse signals from the runway.





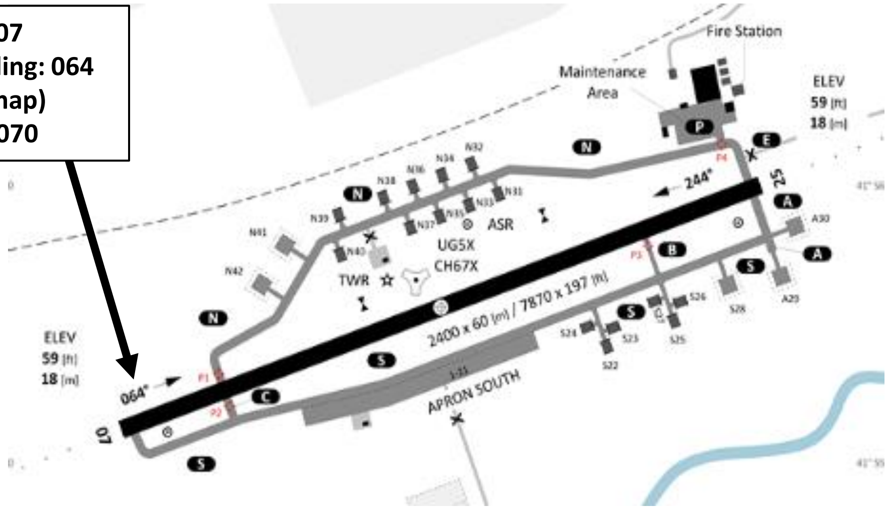


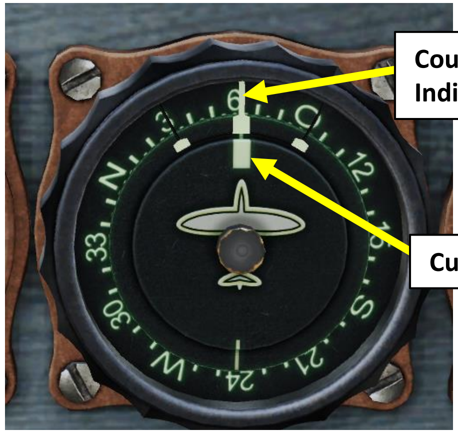


AFN-2 HOMING TUTORIAL (THEORY)

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**



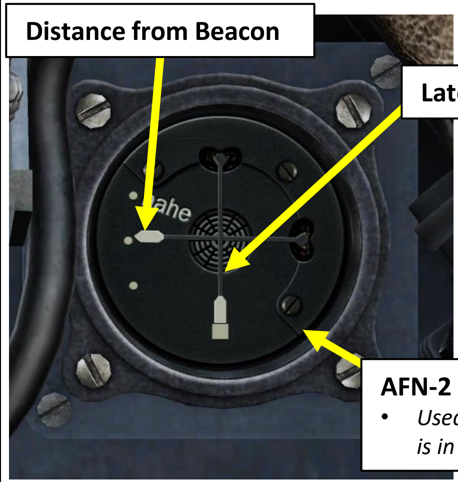


Course Reference Indicator (064)

Current Aircraft Heading

Distance from Beacon

Lateral Deviation

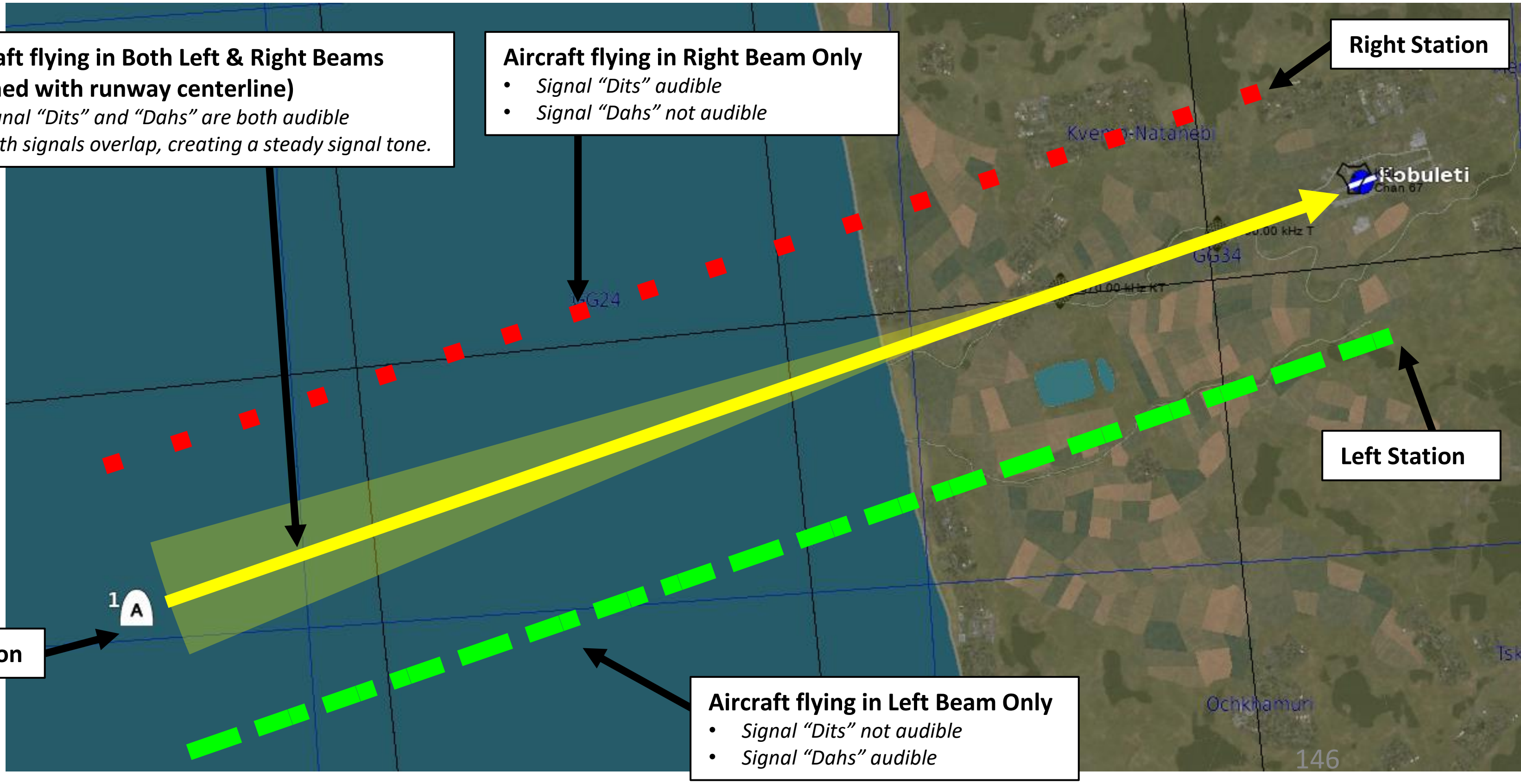


AFN-2 Homing Indicator
- *Used to determine where aircraft is in relationship to airport.*

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*

Right Station



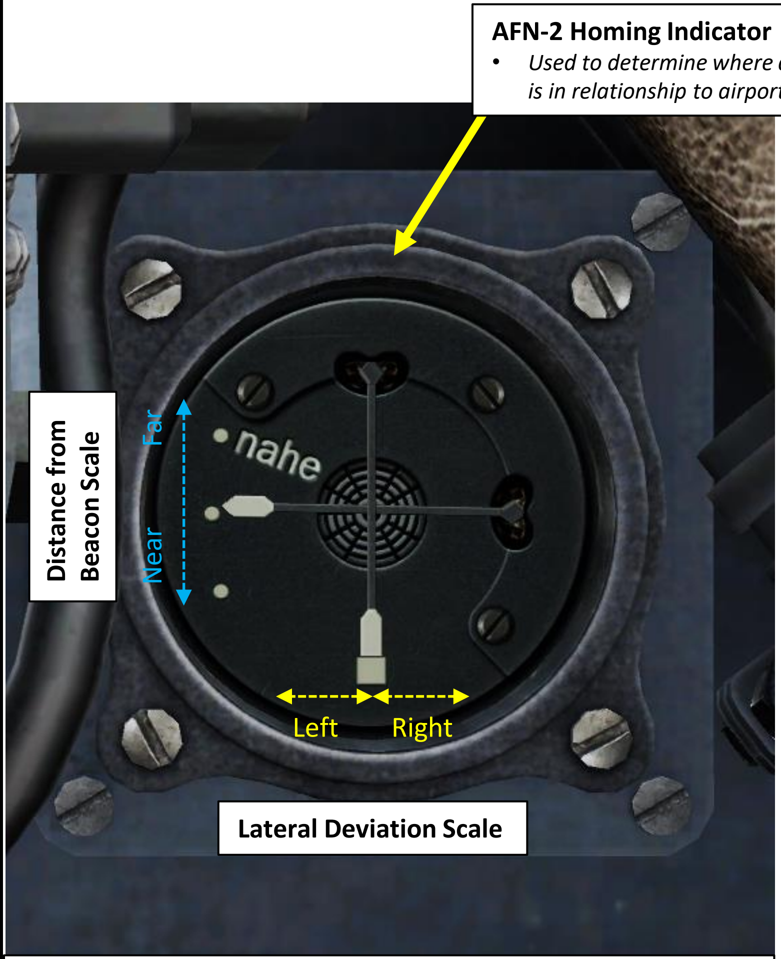
Left Station

Aircraft Position

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 ba**r 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 (not simulated yet).



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 DECLINATION

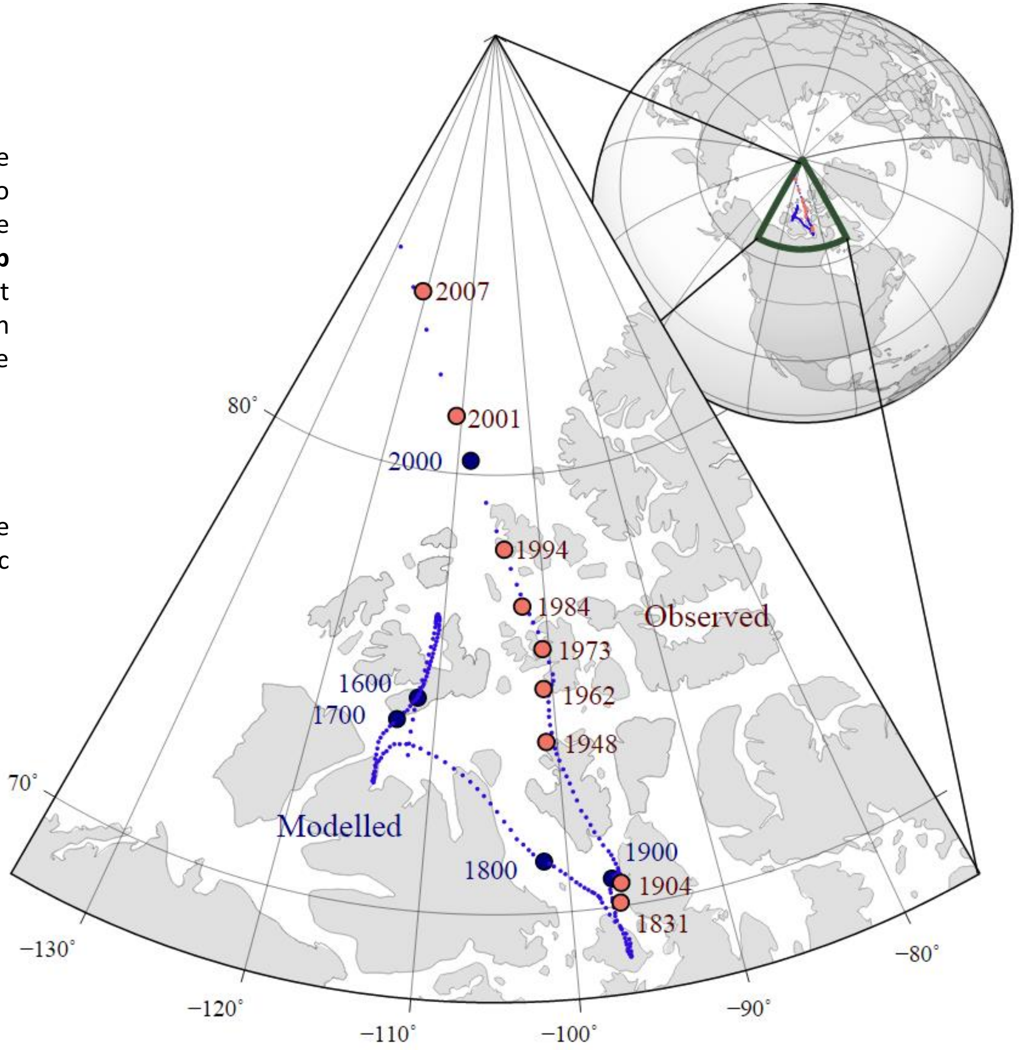
The direction in which a compass needle points is known as magnetic north. In general, this is not exactly the direction of the North Magnetic Pole (or of any other consistent location). Instead, the compass aligns itself to the local geomagnetic field, which varies in a complex manner over the Earth's surface, as well as over time. The local angular difference between magnetic north and true north is called the magnetic declination. Most **map coordinate** systems are based on **true north**, and magnetic declination 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 declination of the magnetic North pole (which is actually modelled in the sim, which is pretty neat).

True Heading = Magnetic Heading + Magnetic Deviation

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 Deviation (-11 degrees), or 082. In other words, you would need to use a course of 082 (M) with your compass.

Magnetic Declination:

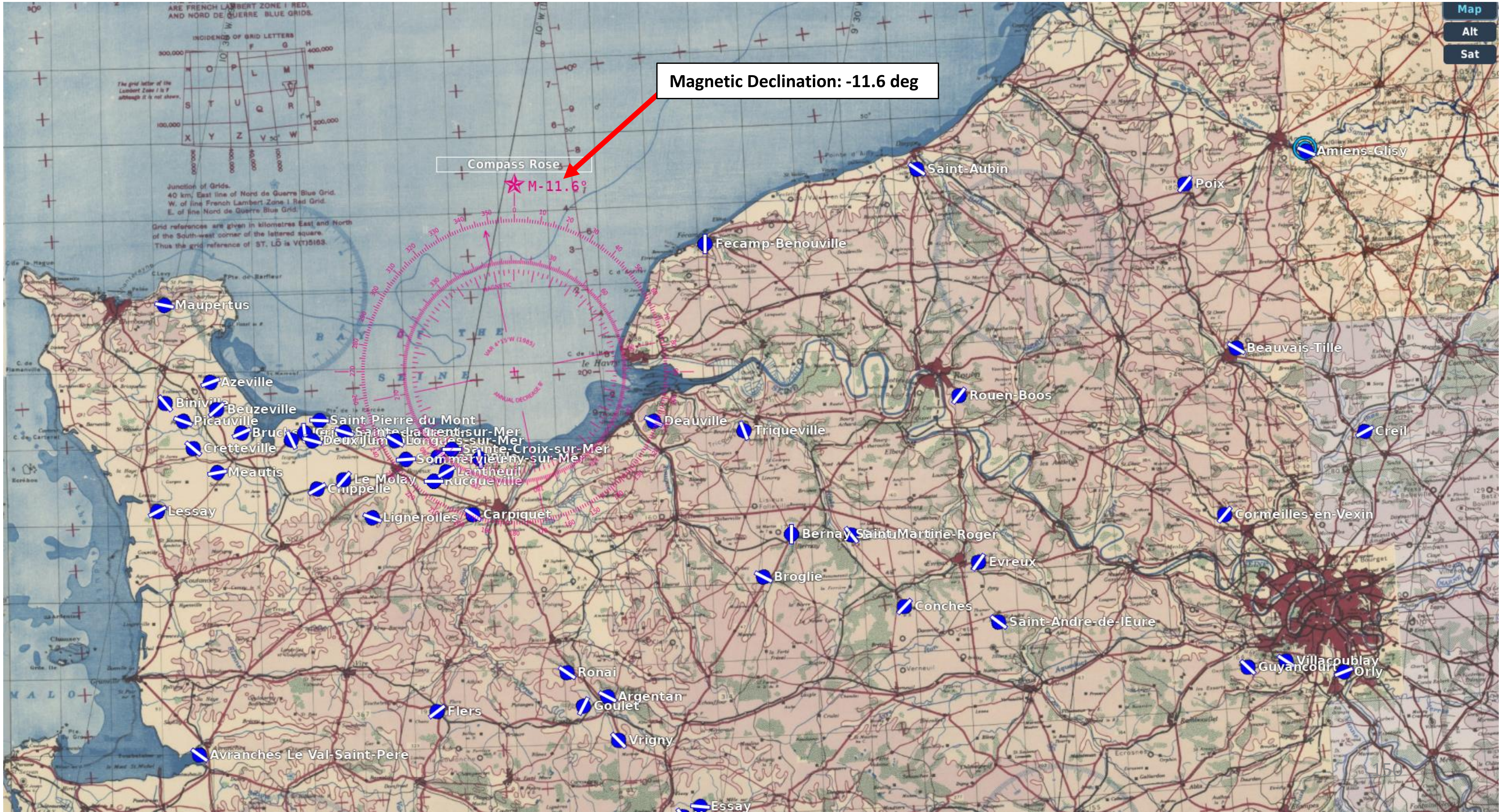
- **-11 deg for Normandy in 1944**
- **-11 deg for the English Channel in 1944**



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

MAGNETIC DECLINATION

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



FW190-D9 DORA

PART 11 – NAVIGATION

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

England

ID		ELEV. FEET / METERS	VHF / UHF	HF / FM		MAG HDG / 3500 ft (1000 m) OR LESS · DOT - PRIMARY / LENGTH, feet / GRASS RWY
71	**Biggin Hill** N51°19'38/.646 E00°01'57/.954	568 173	134.80 253.45	5.475 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	119.15 251.05	4.275 39.50		082° 07 4200 25 262° 161°•15 3500 33•341°
54	**Deanland** N50°53'03/.059 E00°09'40/.680	72 22	120.60 252.50	5.000 40.95	RWY 34: HUGE BUMP	063° ~~22~~ 3800 ~~34~~ 243°
73	**Detling** N51°18'20/.346 E00°36'05/.092	593 181	118.45 253.55	5.525 41.95		051° 04 3700 22 231°
52	**Farnborough** N51°16'43/.722 W00°46'28/.480	246 75	120.50 252.40	4.950 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	119.40 251.30	4.400 39.75		067° 05 5600 23 247° 153°•14 4500 32•333°
53	**Friston** N50°45'42/.704 E00°10'17/.289	309 94	120.55 252.45	4.975 40.90		069° 06 3700 24 249°
29	**Funtington** N50°52'05/.088 W00°52'08/.144	125 38	119.25 251.15	4.325 39.60		095° 08 6700 26 275° 160°•15 5000 33•340°
66	**Gravesend** N51°25'04/.079 E00°23'48/.802	232 71	121.25 253.15	5.325 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	120.05 251.95	4.725 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	119.70 251.60	4.550 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	118.25 253.50	5.500 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	119.20 251.10	4.300 39.55		071°•06 4200 24•251° 180° 17 4700 35 000°
39	**Odiham** N51°14'03/.065 W00°56'30/.504	366 112	119.80 251.70	4.600 40.15		105° 10 5100 28 285°
58	**Stoney Cross** N50°54'40/.667 W01°39'29/.486	384 117	120.80 252.70	5.100 41.15		073°•06 5800 24•253° 192° 18 4800 36 012°
30	**Tangmere** N50°50'44/.744 W00°42'06/.113	48 15	119.35 251.25	4.375 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	119.95 251.85	4.675 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

France A—Deauv

ID		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	121.55 253.60	5.550 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	120.85 252.75	5.125 38.40	AERODROME LOCATED IN THE WESTERN CLUSTER	049° 04 5100 22 229° 120°•11 5100 29•300°
32	**Argentan** N48°46'07/.126 W00°01'49/.826	640 195	119.45 251.35	4.425 39.80		127° 12 3800 30 307°
65	**Avranches Le Val-Saint-Pere** N48°40'05/.091 W01°22'50/.837	47 14	121.20 253.10	5.300 41.50		137° 13 3800 31 317°
15	**Azeville** A-7 N49°28'51/.859 W01°19'03/.057	75 23	118.50 250.40	3.950 38.85		080° 07 3600 25 260°
34	**Barville** N48°28'48/.807 E00°18'50/.837	463 141	119.55 251.45	4.475 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	118.80 250.70	4.100 39.15		063° 05 5400 23 243°
67	**Beaumont-le-Roger** N49°05'46/.780 E00°47'48/.814	489 149	121.30 253.20	5.350 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	120.10 252.00	4.750 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	118.90 250.80	4.150 39.25		181° 17 4200 35 001°
69	**Bernay Saint Martin** N49°06'15/.264 E00°35'54/.905	512 156	121.40 253.30	5.400 41.70	MESH ISSUES	189° 18 3500 36 009°
14	**Beuzeville** A-6 N49°25'13/.231 W01°17'54/.913	114 35	118.40 250.35	3.925 38.80		059° 05 4300 23 239°
10	**Biniville** A-24 N49°26'12/.202 W01°28'08/.138	107 32	118.15 250.15	3.825 38.60		150° 14 3500 32 330°
68	**Broglie** N49°00'56/.939 E00°29'55/.932	595 181	121.35 253.25	5.375 41.65		127° 12 3700 30 307°
5	**Brucheville** A-16 N49°22'06/.111 W01°12'58/.976	46 14	120.90 252.80	5.150 41.20		076° 07 4800 28 256°
19	**Carpiquet** B-17 N49°10'30/.507 W00°27'16/.268	187 57	118.70 250.60	4.050 39.05		133° 12 5100 30 313°
11	**Cardonville** A-3 N49°21'03/.060 W01°03'03/.060	102 31	118.20 250.20	3.850 38.65		164° 15 4800 33 344°
13	**Chippelle** A-5 N49°14'30/.513 W00°58'17/.299	125 38	118.35 250.30	3.900 38.75		070° 06 4900 24 250°
40	**Conches** N48°56'05/.086 E00°57'40/.676	541 165	119.90 251.80	4.650 40.25		052° 04 5100 22 232°
45	**Cormeilles-en-Vexin** N49°05'35/.594 E02°02'07/.124	312 95	120.15 252.05	4.775 40.50		048°•04 5300 22•228° 122° 11 5200 29 302°
46	**Creil** N49°15'12/.208 E02°31'08/.434	269 82	120.20 252.10	4.800 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	119.85 251.75	4.625 40.20		140° 13 4800 31 320°
7	**Cricqueville-en-Bessin** A-2 N49°21'52/.872 W01°00'24/.414	81 25	121.70 253.75	5.625 42.15		183° 17 4900 35 003°
62	**Deauville** N49°21'51/.855 E00°09'26/.434	459 140	121.05 252.95	5.225 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°

FW190-D9 DORA

PART 11 – NAVIGATION

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

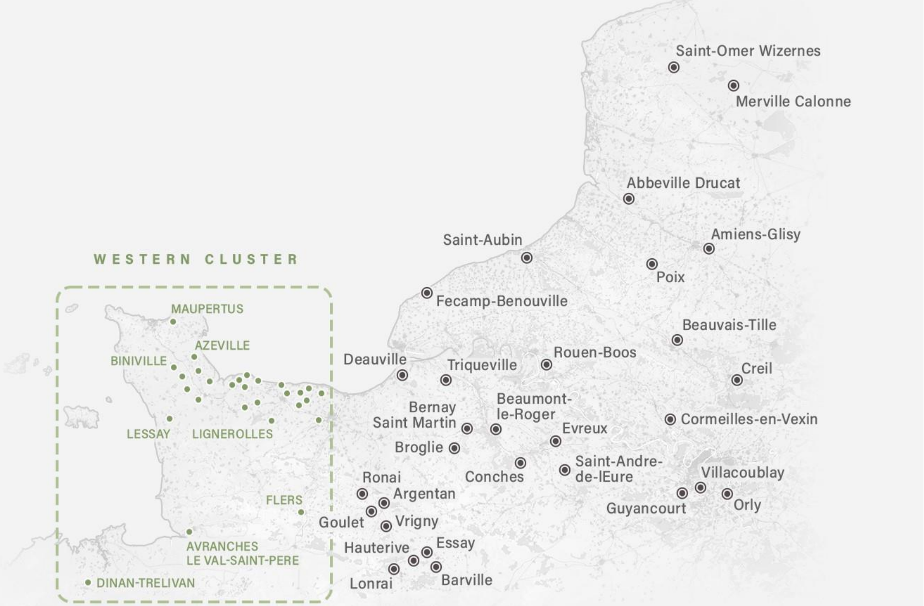
AD Normandy 2.0, Part 4

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

France — S–V

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

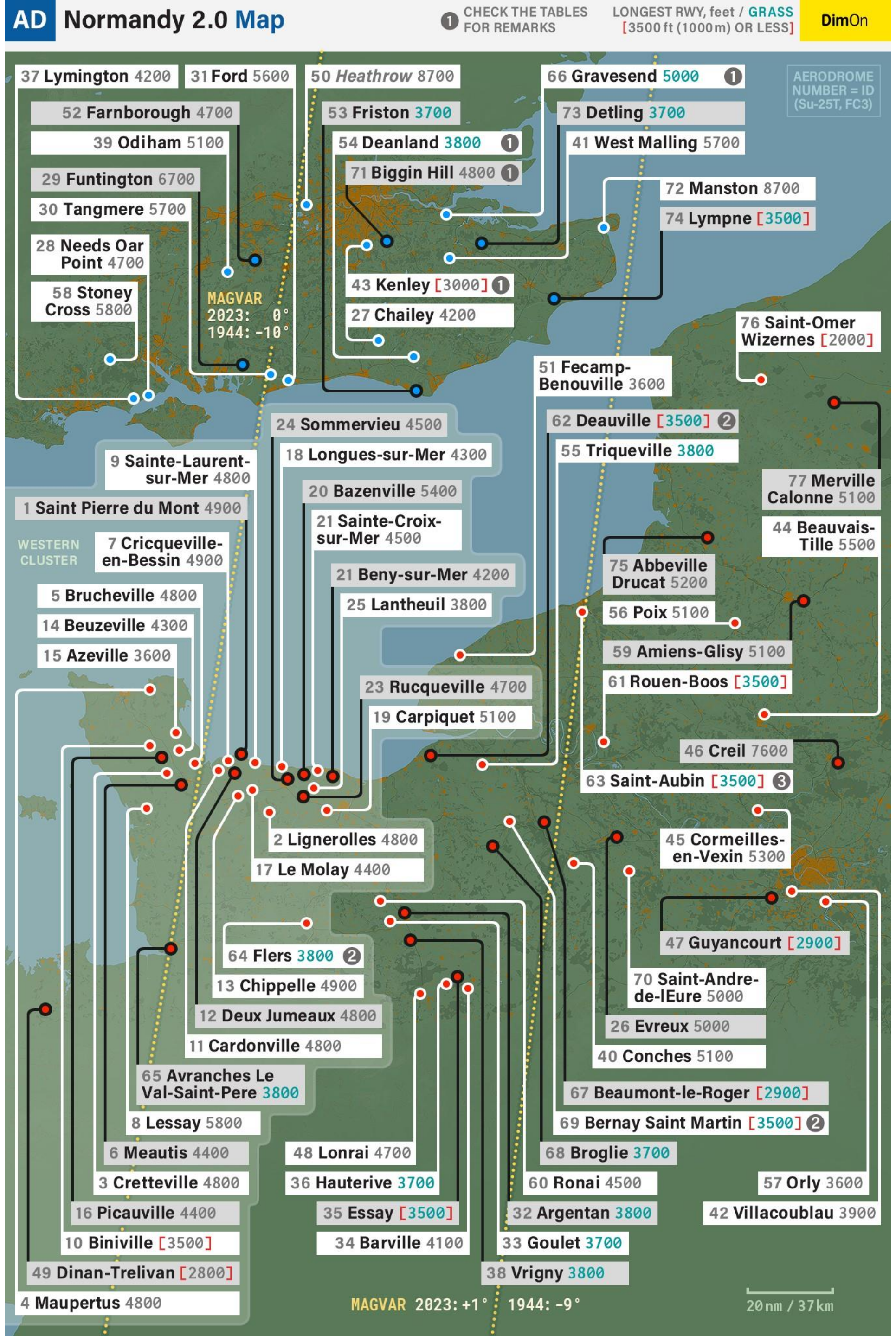
IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH



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

By Minsky
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	Airfield / 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

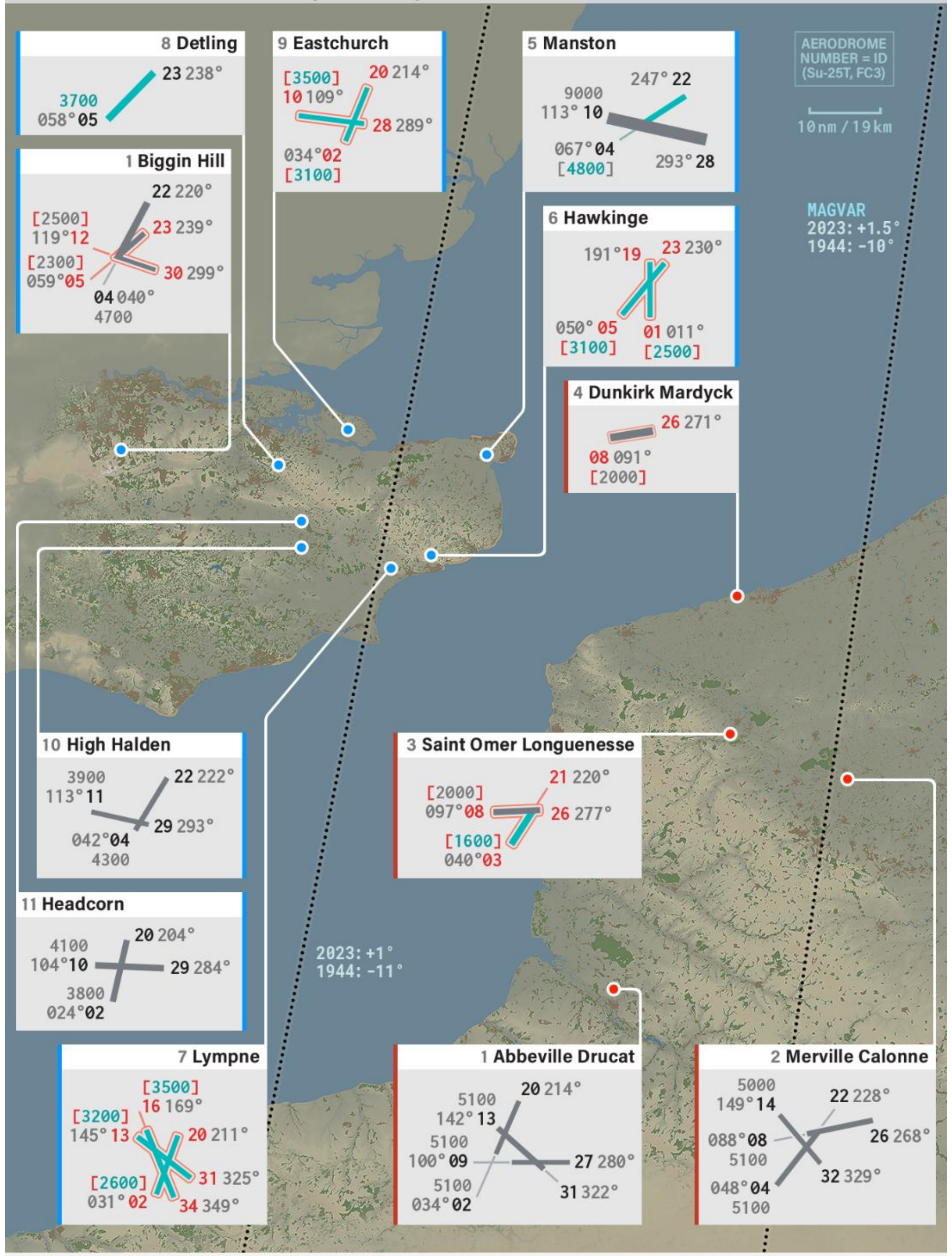
Adjust the above magnetic headings when flying in the following years (expect about 1 degree of error):
1951-1954 -1° 1955-1961 -2° 1962-1967 -3° 1968-1972 -4° 1973-1979 -5° 1980-1987 -6°
1988-1995 -7° 1996-2001 -8° 2002-2009 -9° 2010-2015 -10° 2016-2021 -11° 2022-2026 -12°

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 FW190D-9 variant modelled in DCS is one of the deadliest WWII fighters when flown properly.

The way to fly a FW.190 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 Focke-Wulf will easily outclimb a P-51 Mustang or a Spitfire. Use this to your advantage.

The 190 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 190 has a high power-to-weight ratio, meaning that it has a good 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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CAMPAIGN BUILDER
EXIT
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C-101 1.5.3 Beta
CA 1.5.3
F-86F 1.5.3
FC3 1.5.3
Fw 190 D-9 1.5.3
Hawk 1.5.3 Beta EFM
Ka-50 1.5.3
L-39 1.5.3
M-2000C 1.5.3 Beta
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MiG-21bis 1.5.3
P-51D 1.5.3
SA342 1.5.3 beta
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TF-51D 1.5.3
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