JUNKERS JU-87 B-2 "STUKA"

GUIDE BY CHUCK

PERFORMANCE SHEET

	(Unit)	SPITFIRE Mk Ia 100 oct	HURRICANE Mk IA Rotol 100oct	BLENHEIM Mk IV	TIGER MOTH DH.82	BF.109 E-4	BF.110 C-7	JU-87B-2 STUKA	JU-88 A-1	HE-111 H-2	G.50 SERIE II	BR.20M
TEMPERATURES												
Water Rad Min Max	Deg C	60 115	60 115	-	-	40 100	60 90	38 95	40 90	38 95	-	-
Oil Rad (OUTBOUND) Min Max	Deg C	40 95	40 95	40 85	-	40 105	40 85	30 95	40 80	35 95	50 90	50 90
Cylinder Head Temp Min Max	Deg C	-	-	100 235	-	-	-	-	-	-	140 240	140 240
ENGINE SETTINGS												
Takeoff RPM	RPM	3000	3000	2600 FINE	2350	2400	2400	2300	2400	2400	2520	2200
Takeoff Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+6	+6	+9 BCO ON	See RPM Gauge	1.3	1.3	1.35	1.35	1.35	890	820 BCO ON
Climb RPM	RPM	2700	2700	2400 COARSE	2100	2300 30 min MAX	2300 30 min MAX	2300 30 min MAX	2300 30 min MAX	2300 30 min MAX	2400 30 min MAX	2100 30 min MAX
Climb Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+6	+6	+5	See RPM Gauge	1.23	1.2	1.15	1.15	1.15	700	740
Normal Operation/Cruise RPM	RPM	2700	2600	2400 COARSE	2000	2200	2200	2200	2100	2200	2100	2100
Normal Operation/Cruise Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+3	+4	+3.5	See RPM Gauge	1.15	1.15	1.1	1.1	1.10	590	670
Combat RPM	RPM	2800	2800	2400 COARSE	2100	2400	2400	2300	2300	2300	2400	2100
Combat Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	+6	+6	+5	See RPM Gauge	1.3 5 min MAX	1.3 5 min MAX	1.15	1.15	1.15	700	740
Emergency Power/ Boost RPM @ km	RPM	2850 5 min MAX	2850 5 min MAX	2600 COARSE 5 min MAX	2350	2500 1 min MAX	2400 5 min MAX	2300 1 min MAX	2400 1 min MAX	2400 1 min MAX	2520 3 min MAX	2200 5 min MAX
Emergency Power / Boost Manifold Pressure @ Sea Level	UK: PSI GER: ATA ITA: mm HG	+12 BCO ON	+12 BCO ON	+9 BCO ON	See RPM Gauge	1.40 1 min MAX	1.3 5 min MAX	1.35 1 min max	1.35 1 min max	1.35 1 min max	890 3 min max	820 BCO ON 5 min MAX
Supercharger Stage 1 Operation Altitude	UK: ft GER: M	-	-	-	-	-	-	0 1500	0 1220	0 1220	-	-
Supercharger Stage 2 Operation Altitude	UK: ft GER: M ITA: M	-	-	-	-	-	-	1500+ (AUTO/MAN MODES)	1220+	1220+	-	-
Landing Approach RPM	RPM	3000	3000	2400	As required	2300	2300	2000	2100	2300	2400	2200
Landing Approach Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	As required	As required	As required	See RPM Gauge	As required	As required	As required	As required	As required	As required	As required
Notes		Use "Rich" mixture for normal operation. Use "Lean" mixture for fuel conservation for RPM under 2600 & boost @ +1 or lower.		Boost Cut-Out Override (BCO) during takeoff often required	**Min Oil Press: 35 psi** **Max Oil Press: 45 psi**			No Abrupt Throttling	Eng. very sensitive to ata/rpm	Eng. very sensitive to ata/rpm		Boost Cut-Out Override (BCO) during takeoff often required
AIRSPEEDS												
Takeoff – Rotation	UK: mph GER/ITA: km/h	120	120	110	55	180	190	170	185	150	170	175
Max Dive Speed		420	390	260	160	750	620	720	675	600	410	600
Optimal Climb Speed		165	175	135	66	240	270	215	250	240	240	210
Landing – Approach		160	160	140	55	200	220	170	200	200	175	175
Landing – Touchdown		90	90	85	50	160	180	150	180	140	160	160

TABLE OF CONTENT – JU-87 STUKA

PART 1: AIRCRAFT HISTORY

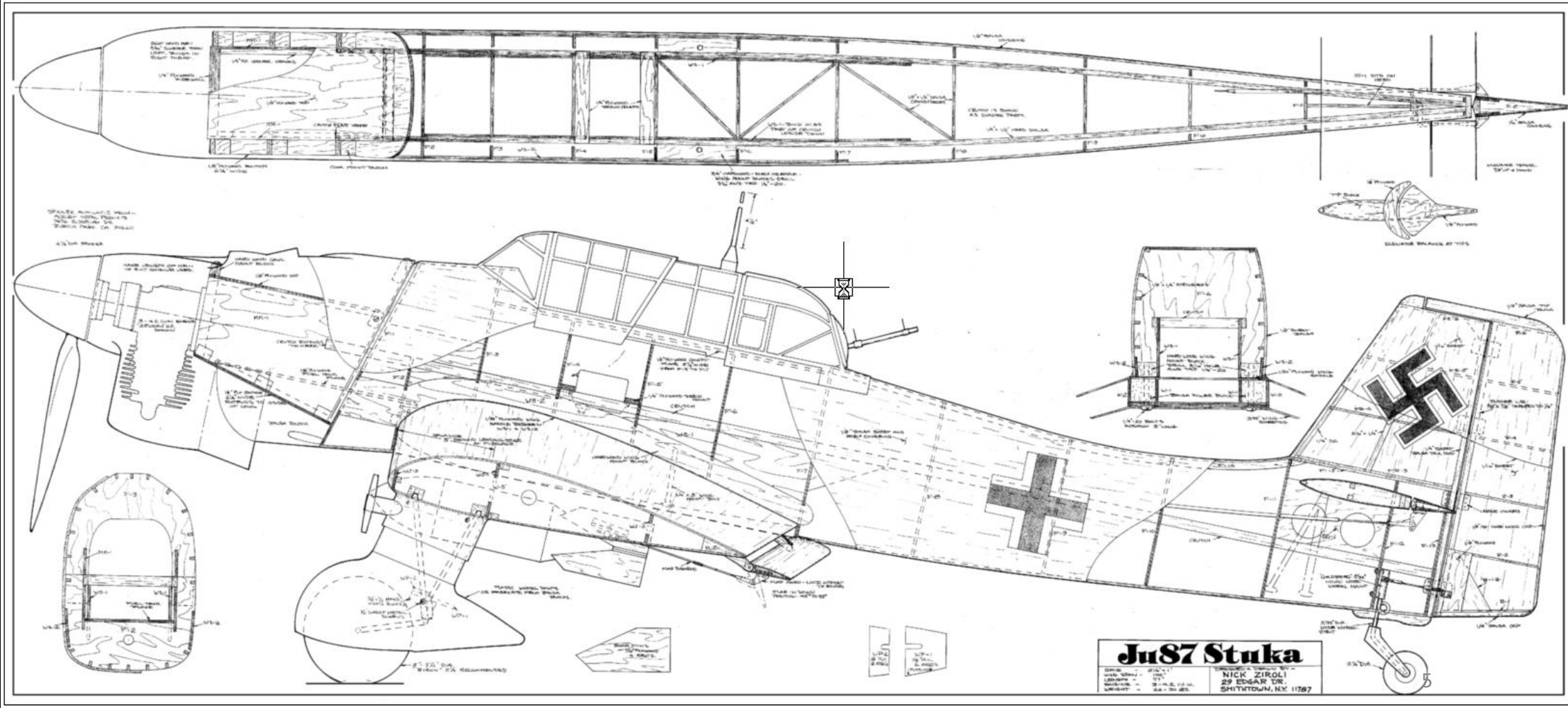
The **Junkers Ju-87** or **Stuka** (from ***Stu**rz**ka**mpfflugzeug*, "dive bomber") was a two-man (pilot and rear gunner) German dive bomber and ground-attack aircraft. Designed by Hermann Pohlmann, the Stuka first flew in 1935 and made its combat debut in 1936 as part of the Luftwaffe's Condor Legion during the Spanish Civil War.

The aircraft was easily recognisable by its inverted gull wings and fixed spatted undercarriage. Upon the leading edges of its faired maingear legs were mounted the *Jericho-Trompete* ("Jericho Trumpet") wailing sirens, becoming the propaganda symbol of German air power and the Blitzkrieg victories of 1939–1942. The Stuka's design included several innovative features, including automatic pull-up dive brakes under both wings to ensure that the aircraft recovered from its attack dive even if the pilot blacked out from the high g-forces.

PART 1: AIRCRAFT HISTORY

The Ju-87 was a single-engined all-metal cantilever monoplane. It had a fixed undercarriage and could carry a two-person crew. The main construction material was duralumin, and the external coverings were made of Duralumin sheeting. Parts that were required to be of strong construction, such as the wing flaps, were made of Pantal (a German aluminum alloy containing titanium as a hardening element) and its components made of Elektron. Bolts and parts that were required to take heavy stress were made of steel.

The Stuka was fitted with detachable hatches and removable coverings to aid and ease maintenance and overhaul. The designers avoided welding parts wherever possible, preferring moulded and cast parts instead. Large airframe segments were interchangeable as a complete unit, which increased speed of repair. The airframe was also subdivided into sections to allow transport by road or rail. The wings were of standard Junkers double-wing construction. This gave the Ju-87 considerable advantage on take-off; even at a shallow angle, large lift forces were created through the aerofoil, reducing take-off and landing runs.



PART 1: AIRCRAFT HISTORY

Some notable airmen flew the Ju-87. *Oberst* Hans-Ulrich Rudel was the most successful Stuka ace and the most highly decorated German serviceman of the Second World War. The vast majority of German ground attack aces flew this aircraft at some point in their careers.

PART 1: AIRCRAFT HISTORY

The Stuka operated with further success after the Battle of Britain, and its potency as a precision ground-attack aircraft became valuable to German forces in the Balkans Campaign, the African and Mediterranean theaters and the early stages of the Eastern Front campaigns where Soviet fighter resistance was disorganised and in short supply.

Although sturdy, accurate, and very effective against ground targets, the Ju-87, like many other dive bombers of the war, was vulnerable to modern fighter aircraft. Its flaws became apparent during the Battle of Britain; poor manoeuvrability and a lack of both speed and defensive armament meant that the Stuka required heavy fighter escort to operate effectively.

PART 2: AIRCRAFT VARIANTS

	(Unit)	JU-87 B-2
TEMPERATURES		
Water Rad Min Max	Deg C	38 95
Oil Rad (OUTBOUND) Min Max	Deg C	30 95
ENGINE SETTINGS		
Engine & Fuel grade		Jumo 211 D-1 B-4 - 87 octane fuel
Takeoff RPM	RPM	2300
Takeoff Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.35
Climb RPM	RPM	2300 30 min MAX
Climb Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.15
Normal Operation/Cruise RPM	RPM	2200
Normal Operation/Cruise Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.1
Combat RPM	RPM	2300
Combat Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.15
Emergency Power/ Boost RPM @ km	RPM	2300 1 min MAX
Emergency Power / Boost Manifold Pressure @ Sea Level	UK: PSI GER: ATA ITA: mm HG	1.35 1 min max
Supercharger Stage 1 Operation Altitude	UK: ft GER: M	0 1500
Supercharger Stage 2 Operation Altitude	UK: ft GER: M ITA: M	1500+ (AUTO/MAN MODES)
Landing Approach RPM	RPM	2000
Landing Approach Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	As required
Notes & Peculiarities		No Abrupt Throttling

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

CREW MEMBERS

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

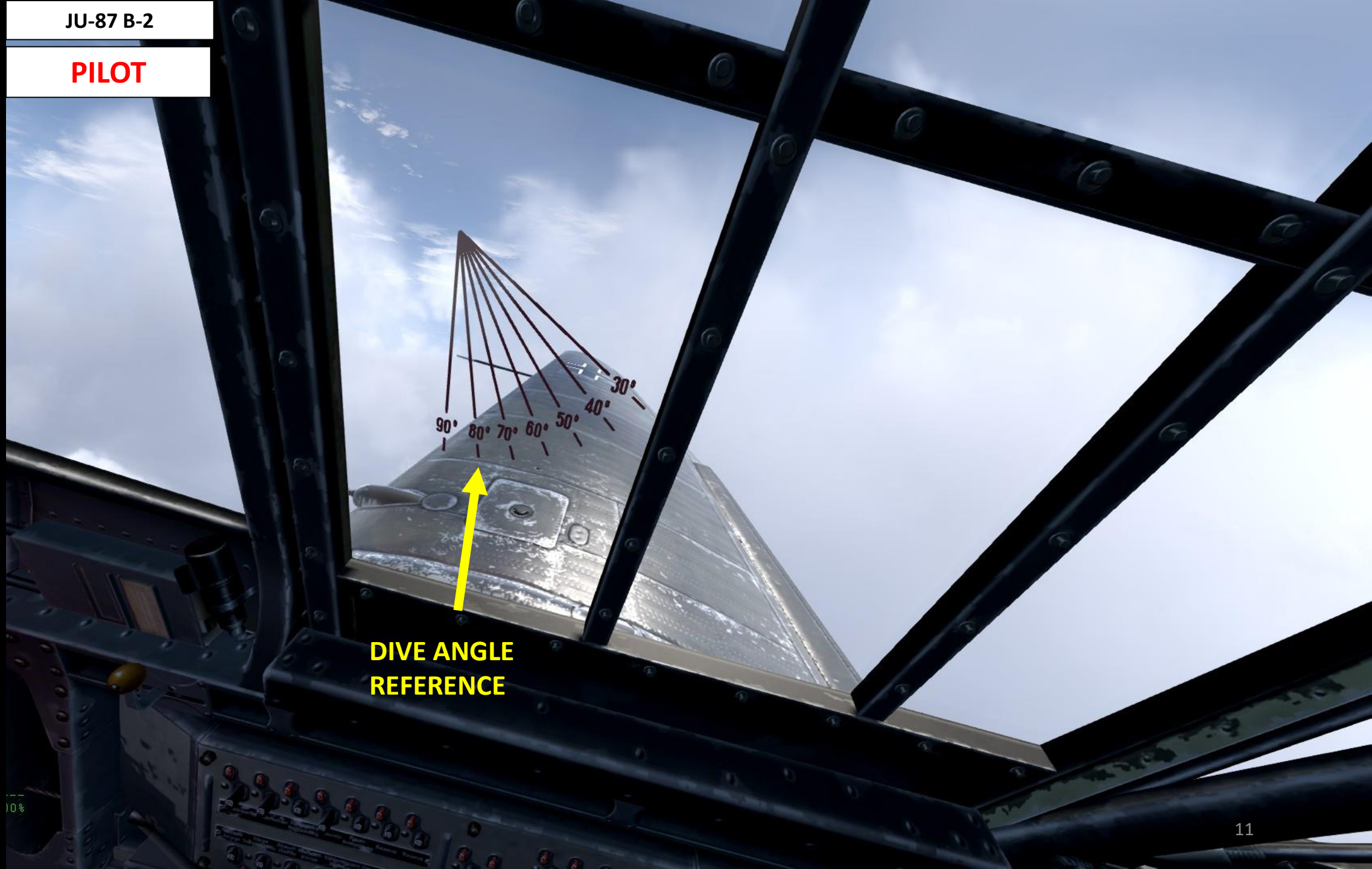
JU-87 B-2

PILOT

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

JU-87 B-2

PILOT



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

JU-87 B-2

PILOT

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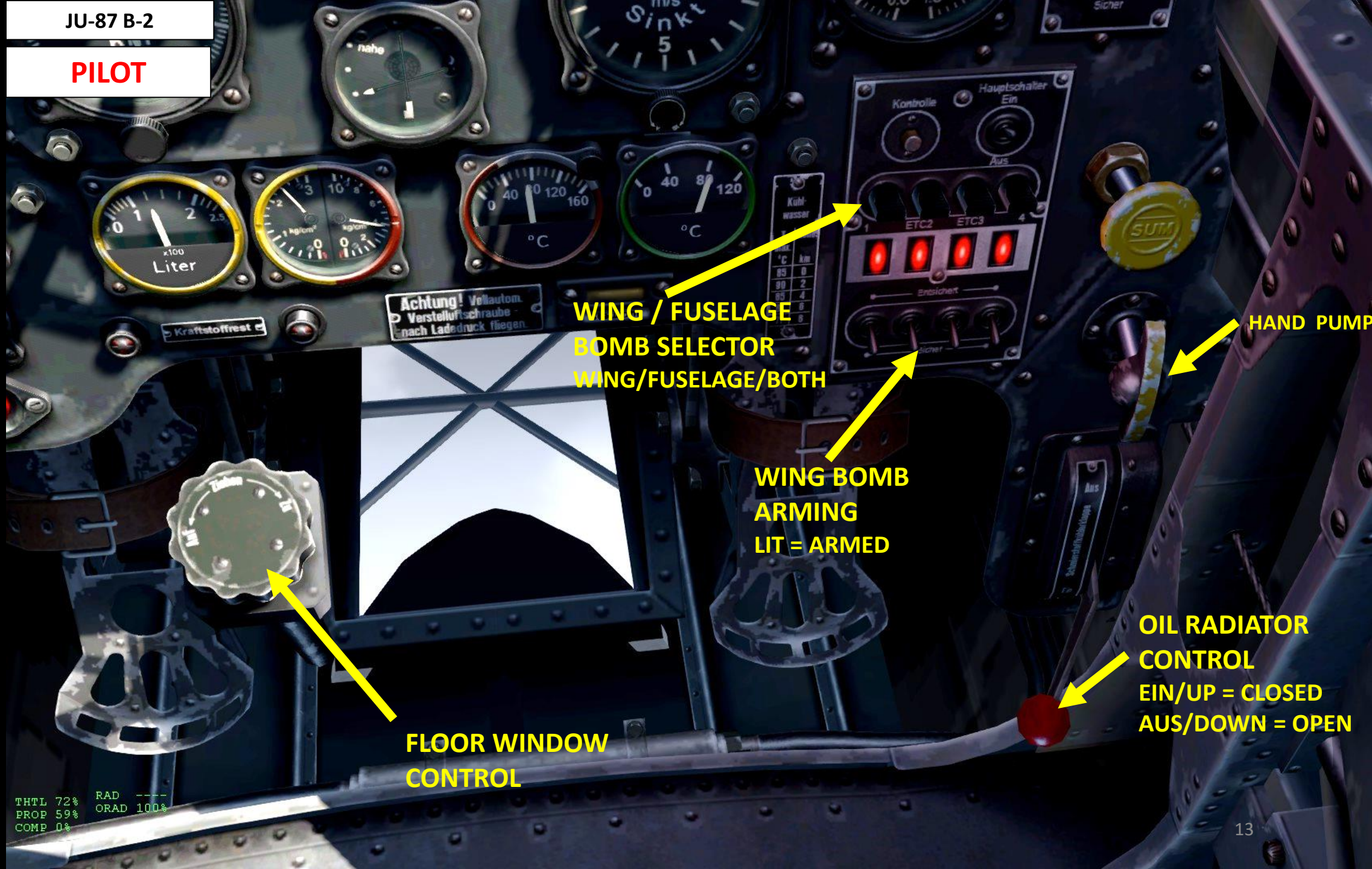

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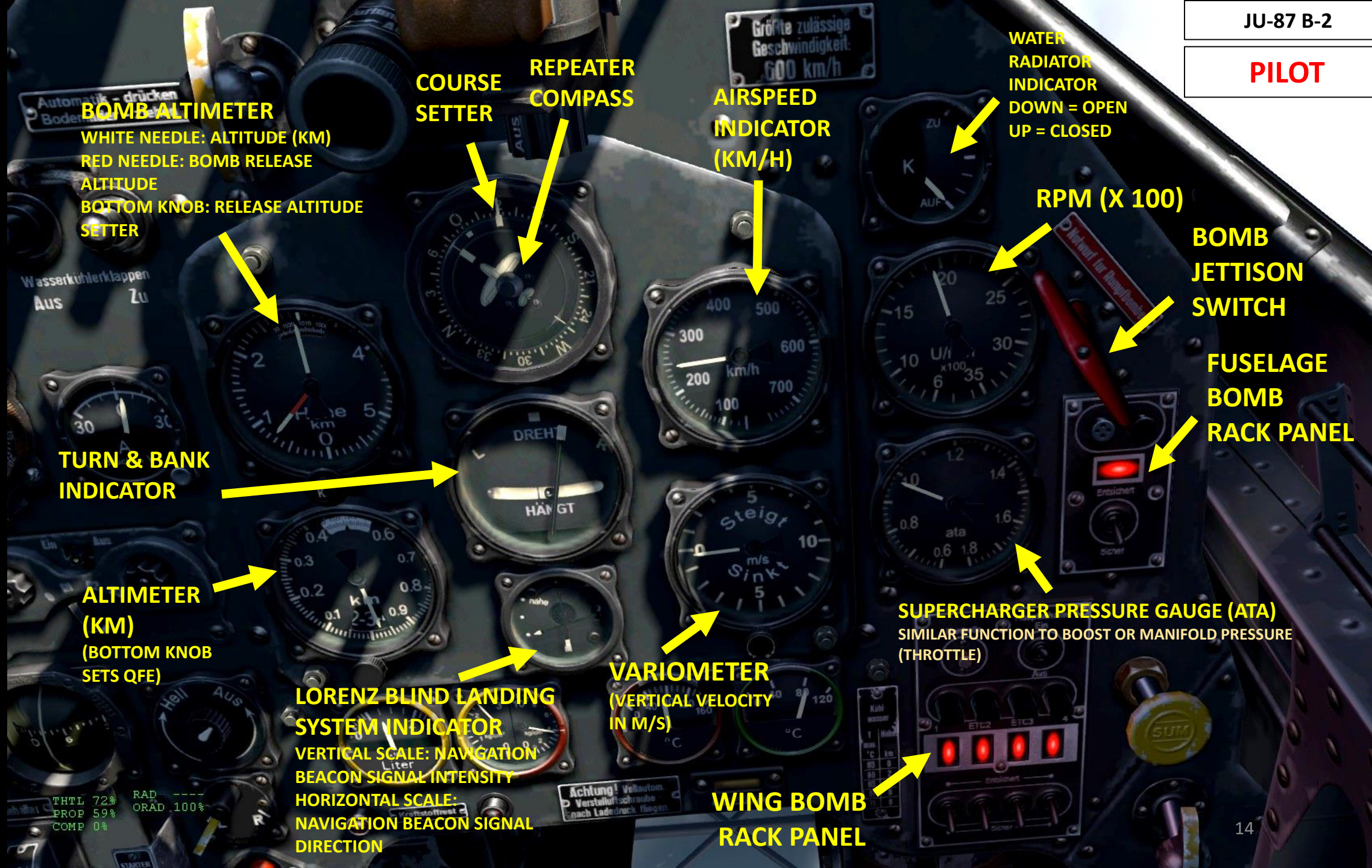
JU-87 B-2

PILOT



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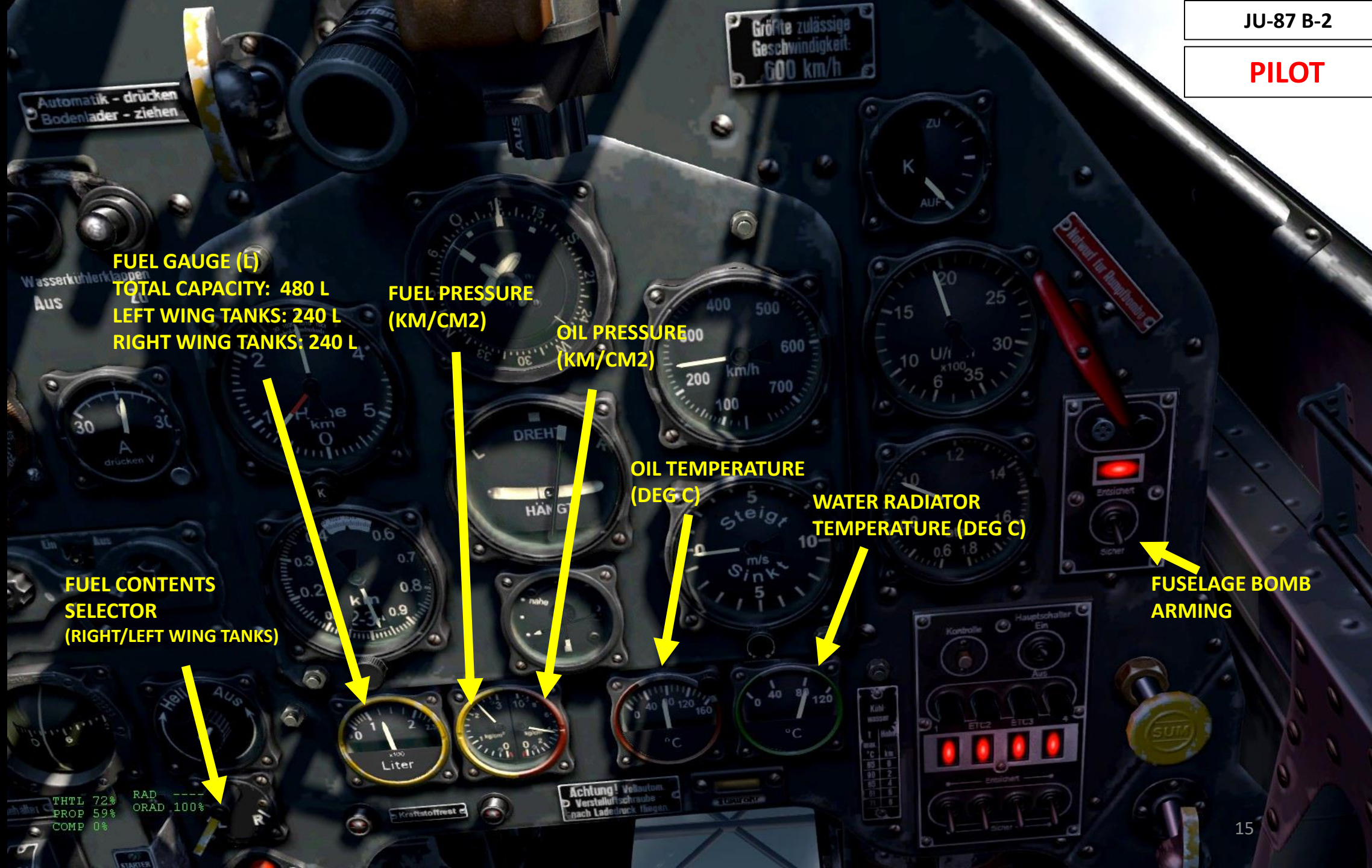

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JU-87 B-2

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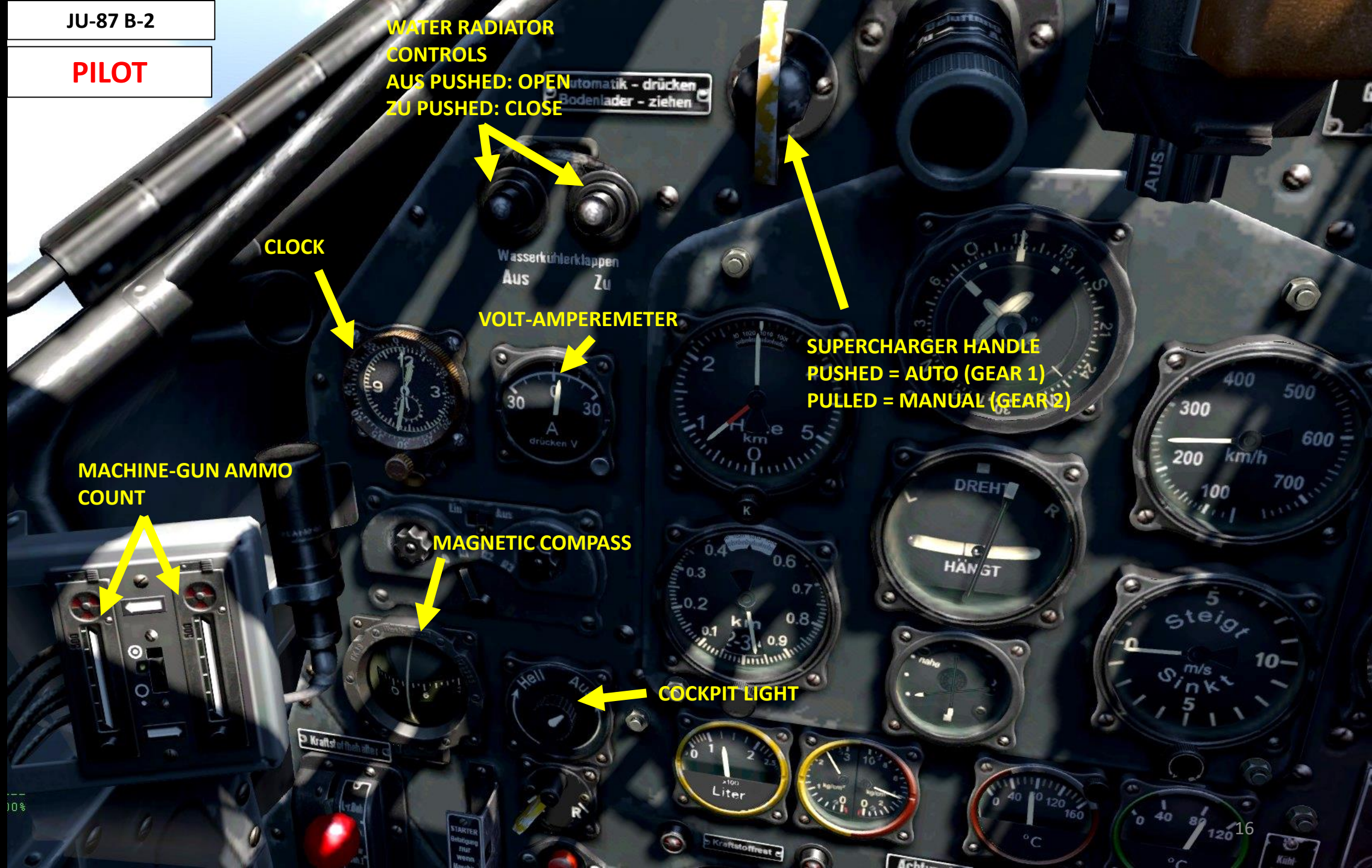

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JU-87 B-2

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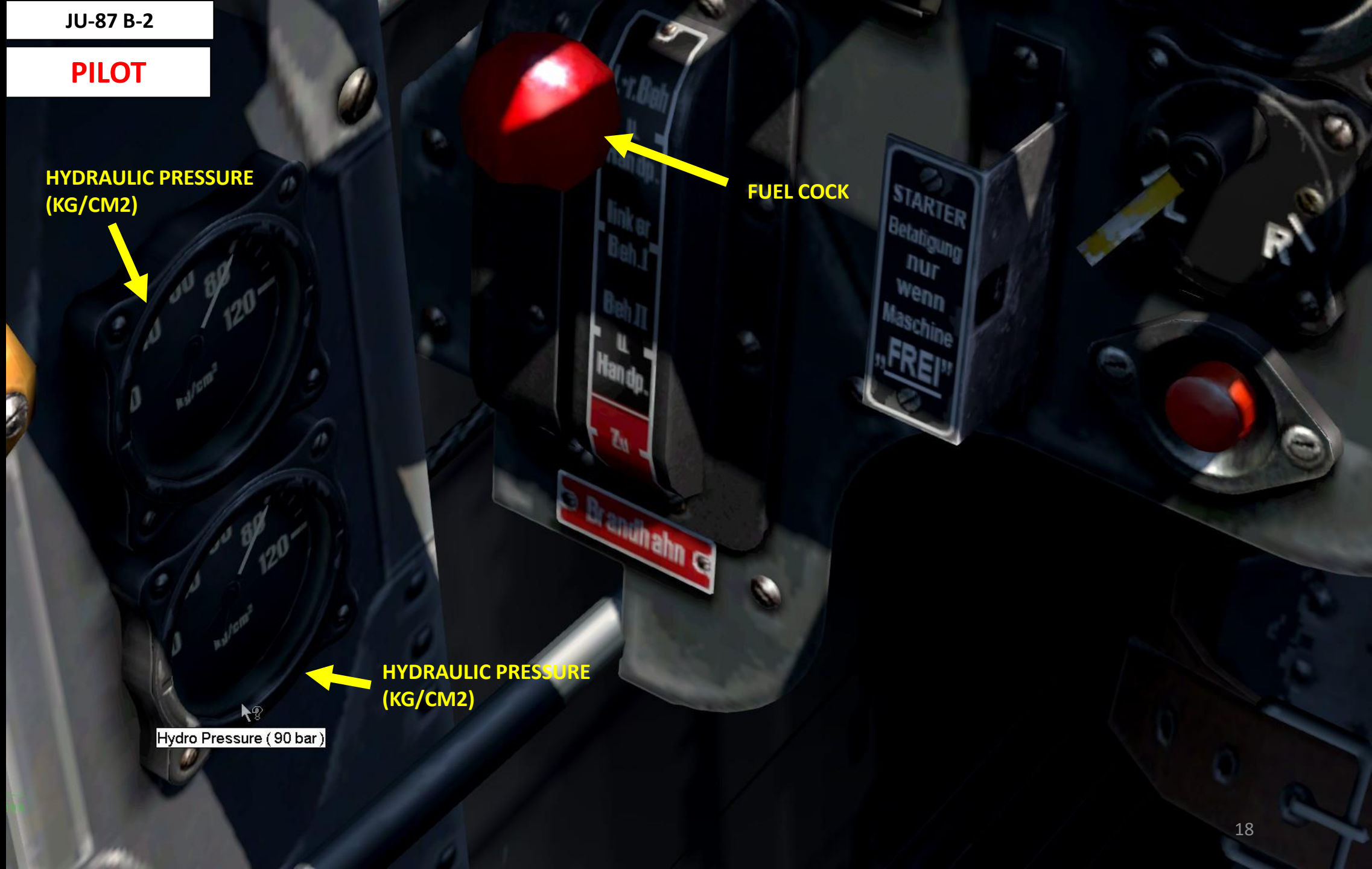

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JU-87 B-2

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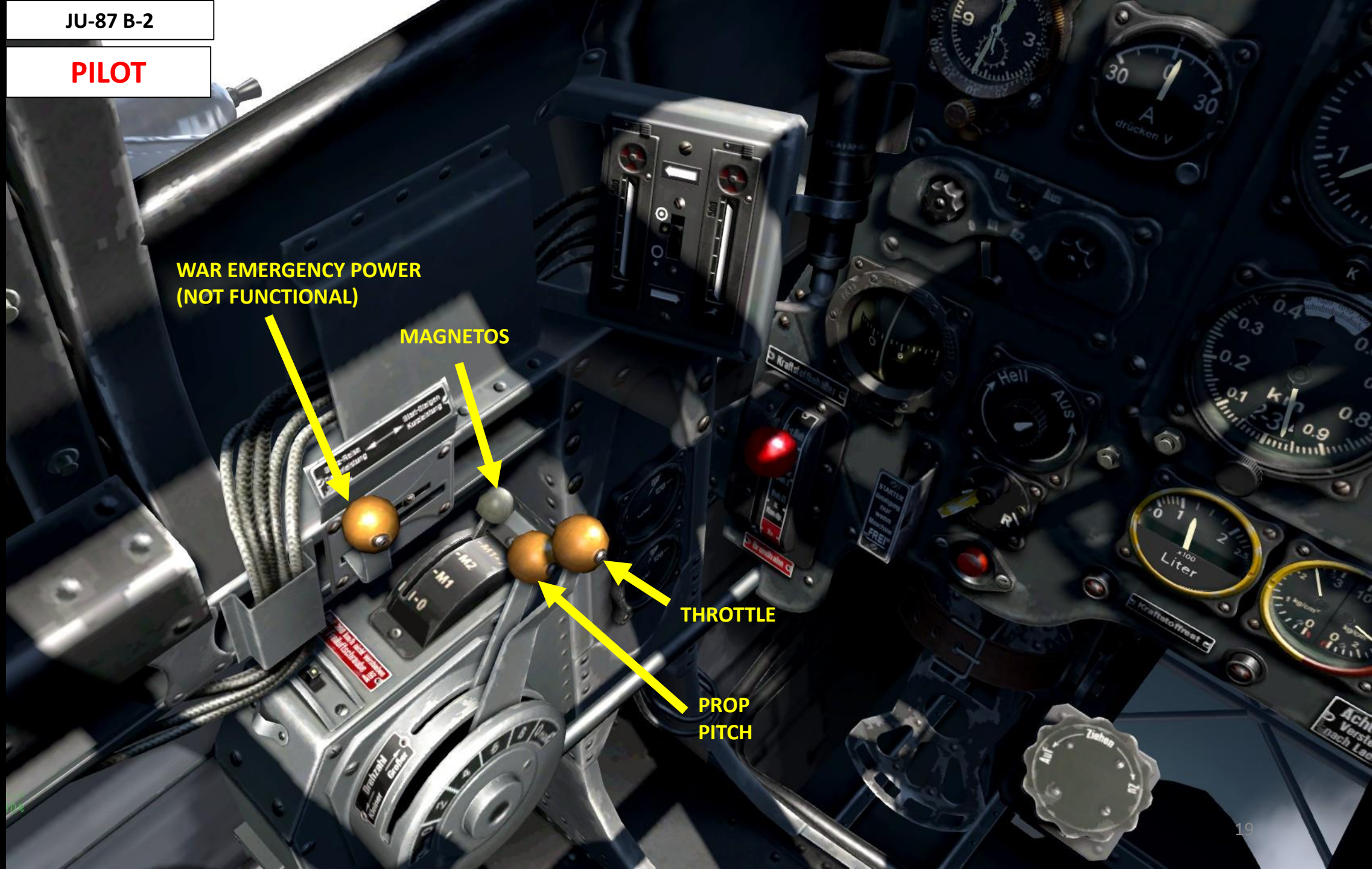

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JU-87 B-2

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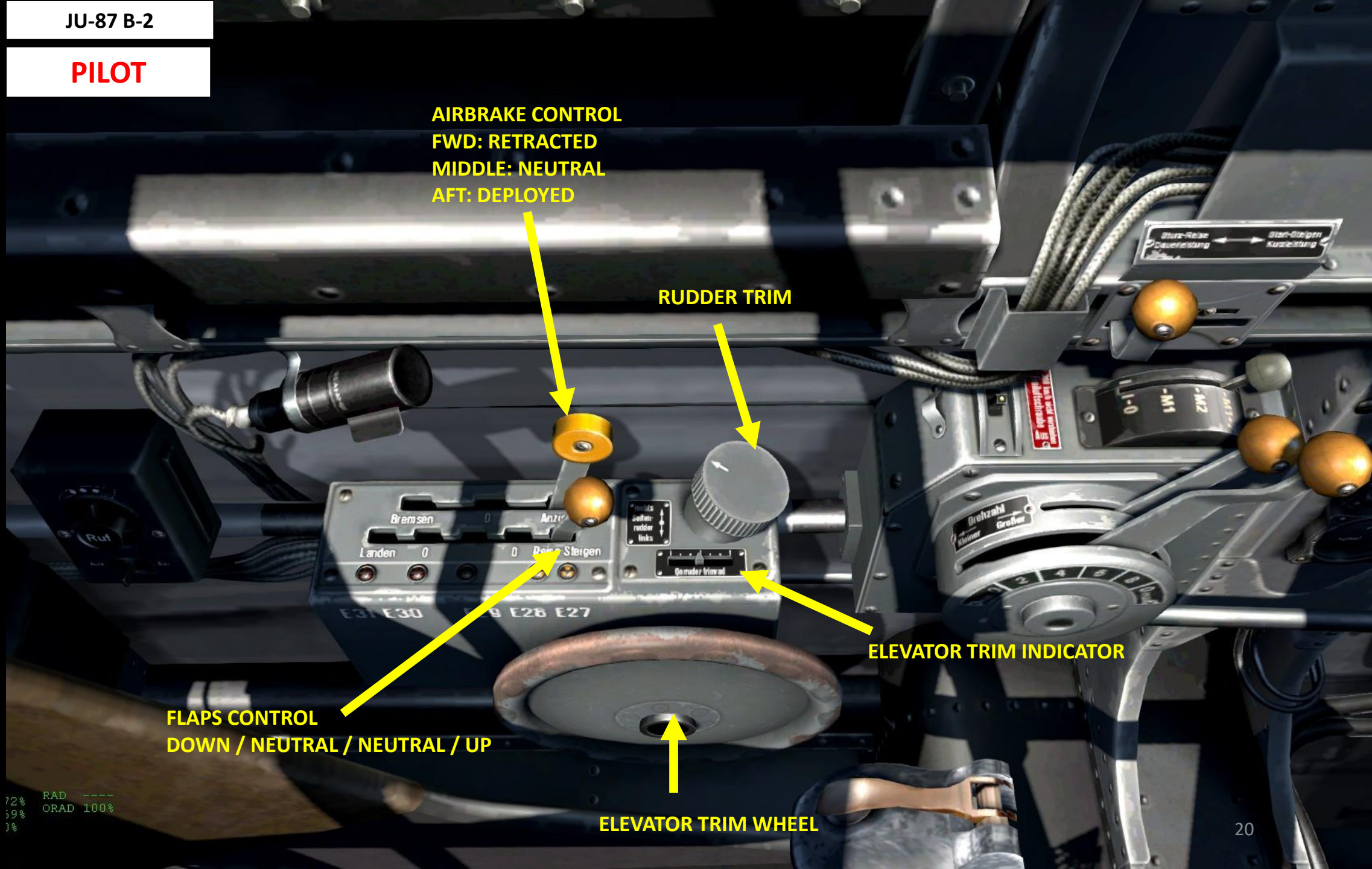

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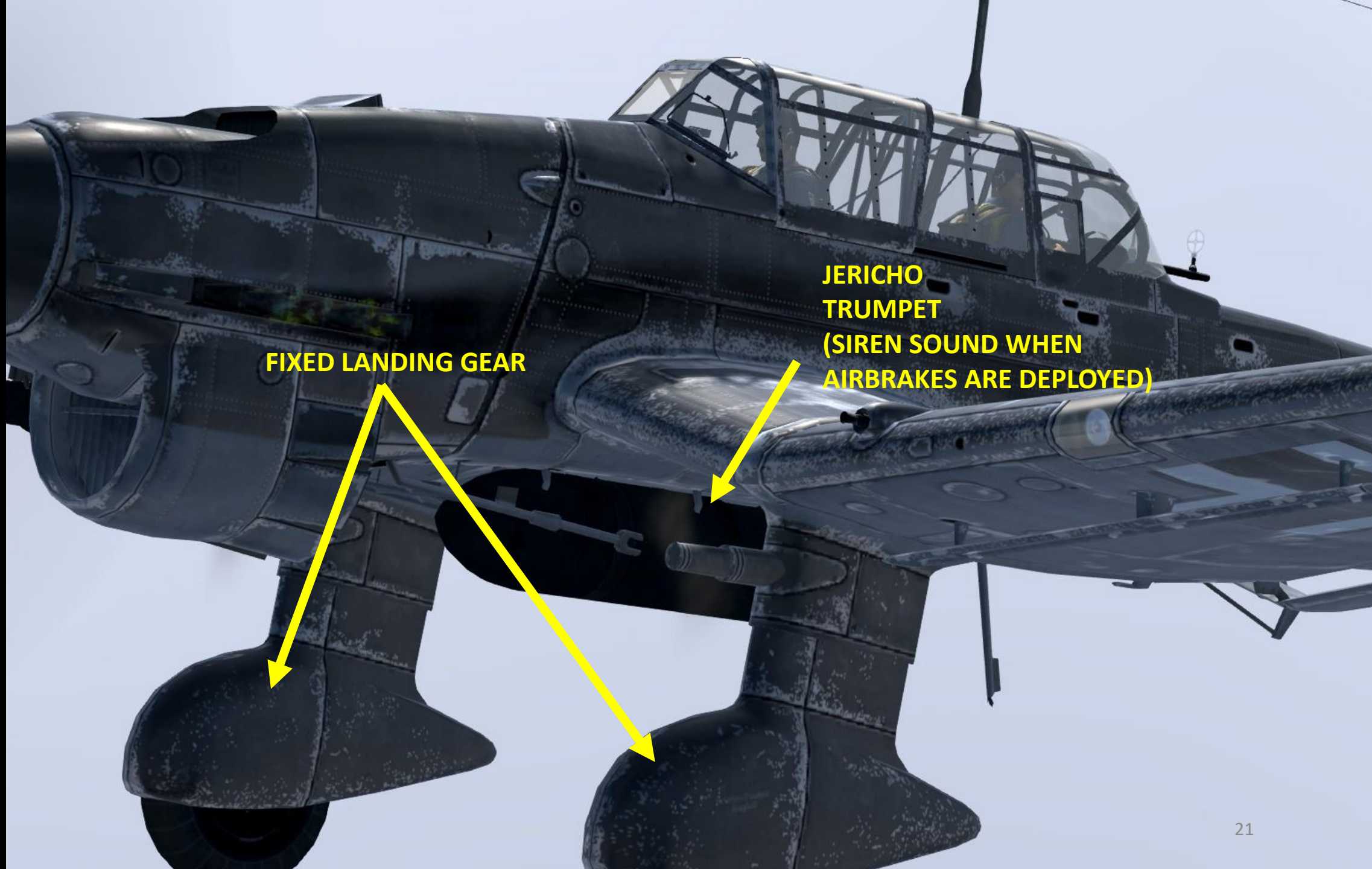
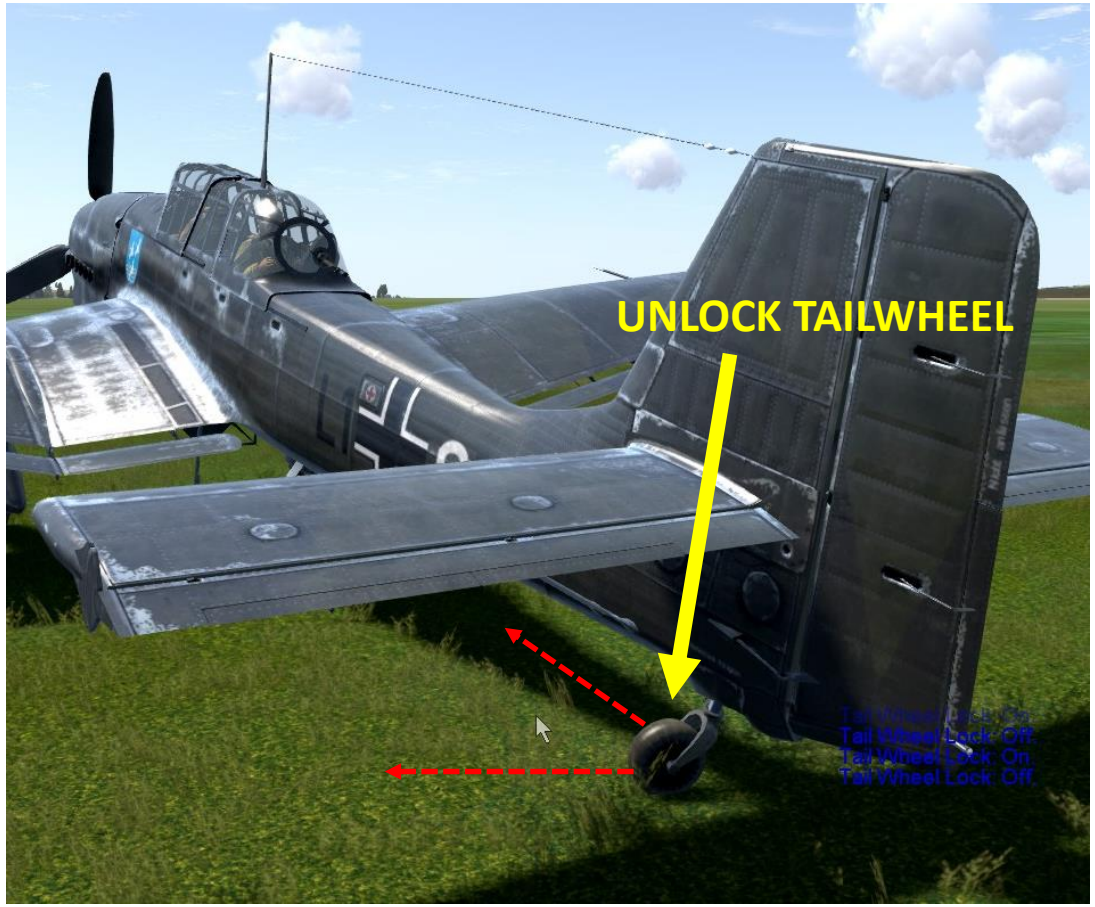
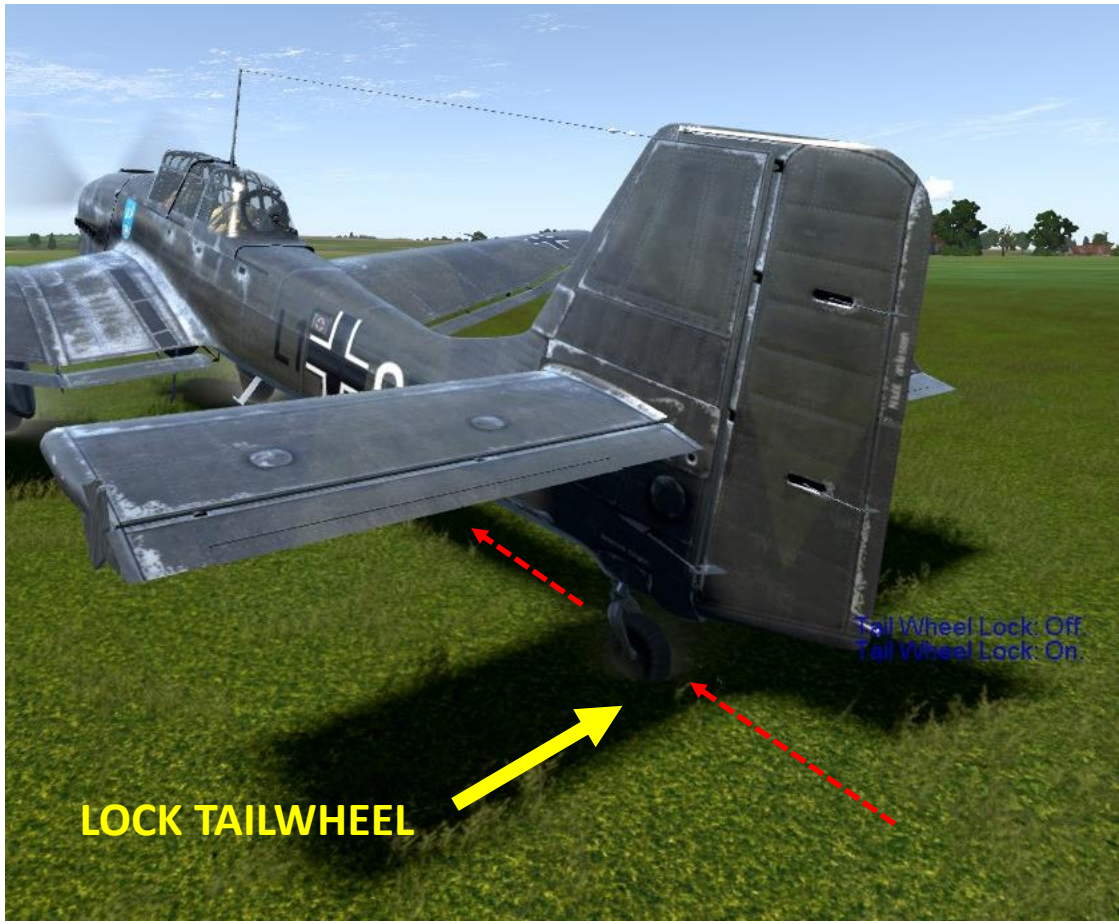




TAILWHEEL IS NOT STRAIGHT: KEEP TAIL SKID UNLOCKED



TAILWHEEL IS STRAIGHT: YOU CAN NOW LOCK TAIL SKID

NOTE: THERE IS NO VISIBLE LEVER FOR TAILWHEEL LOCK IN THE COCKPIT. USE A CUSTOM KEY BINDING FOR IT (“TAIL SKID LOCK”)


AIRBRAKES RETRACTED


AIRBRAKES DEPLOYED

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

DORSAL GUNNER

DORSAL GUNNER CONTROLS

--CRUISE POSITION: **O**
-FIRING POSITION: **CUSTOM KEY**
-LEAN TO GUNSIGHT: **CUSTOM KEY**
-FIRE WEAPON: **LEFT MOUSE BUTTON**
-SWITCH GUNNER/BOMBARDIER POSITION: **C**
-CHANGE MANNED POSITION: **L_SHIFT_C**
-GIVE GUNNER CONTROL TO AI: **L_ALT+F2**
-TAKE CONTROL OF GUN (TOGGLE INDEPENDENT MODE): **F10**

TURRET IN "CRUISE" POSITION

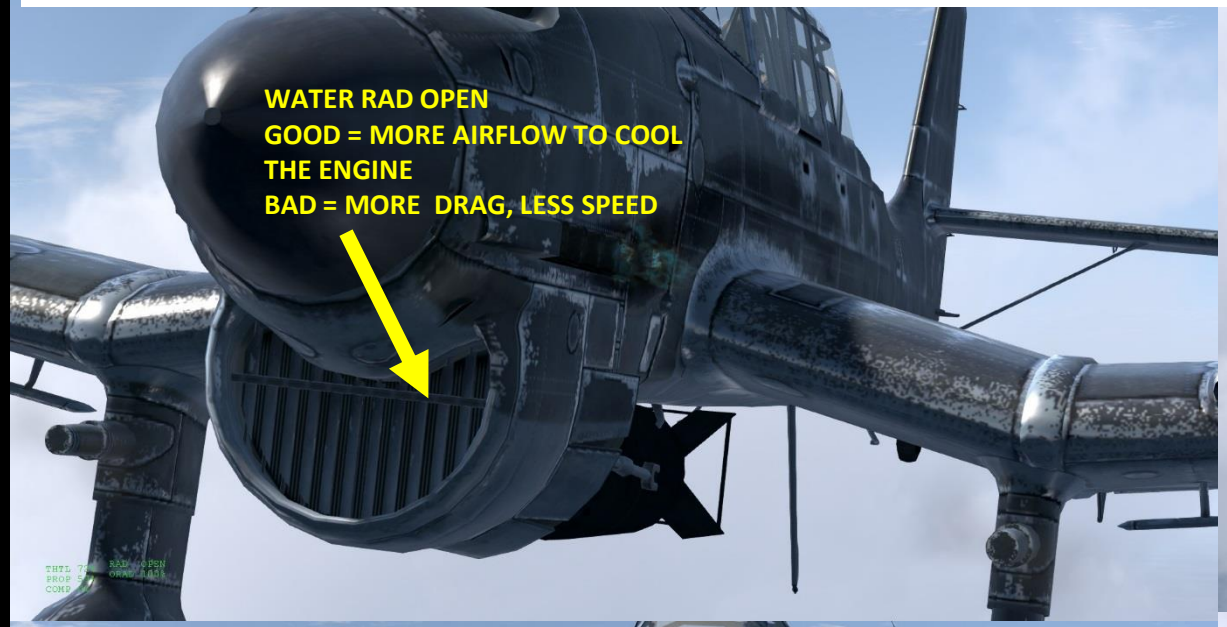
TURRET IN "FIRING" POSITION

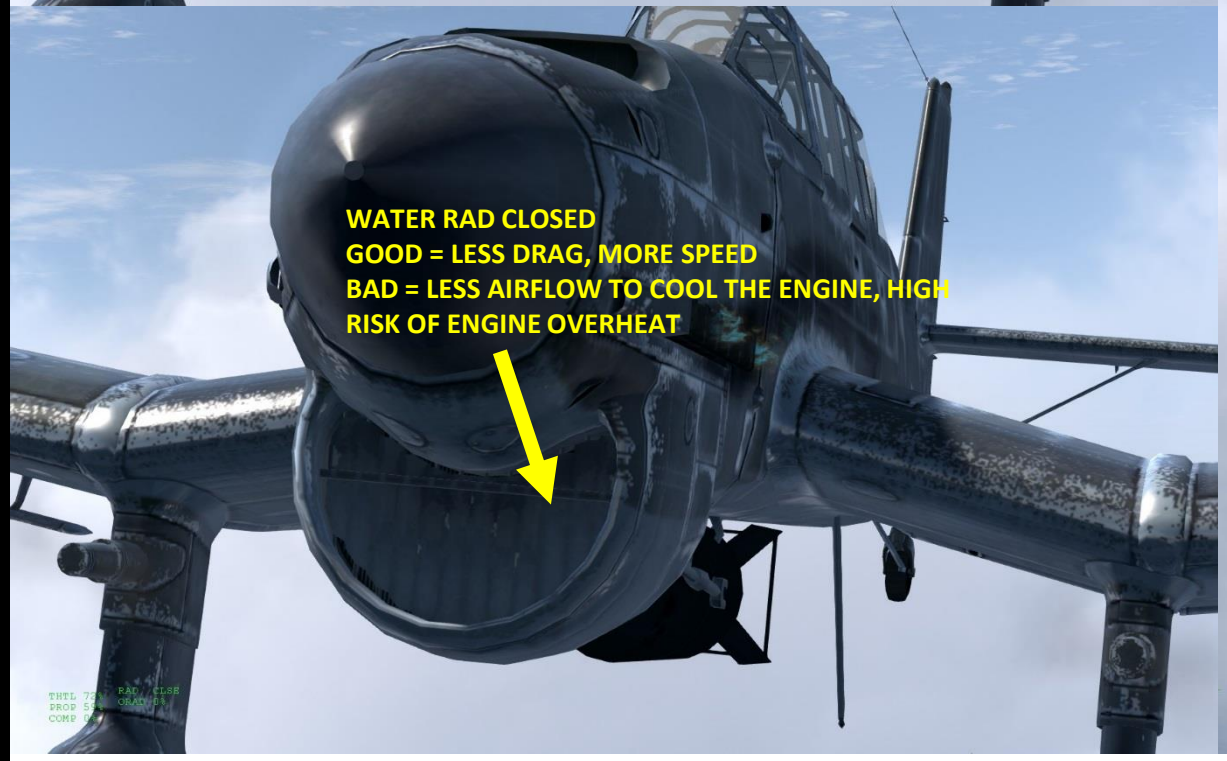
NOTES

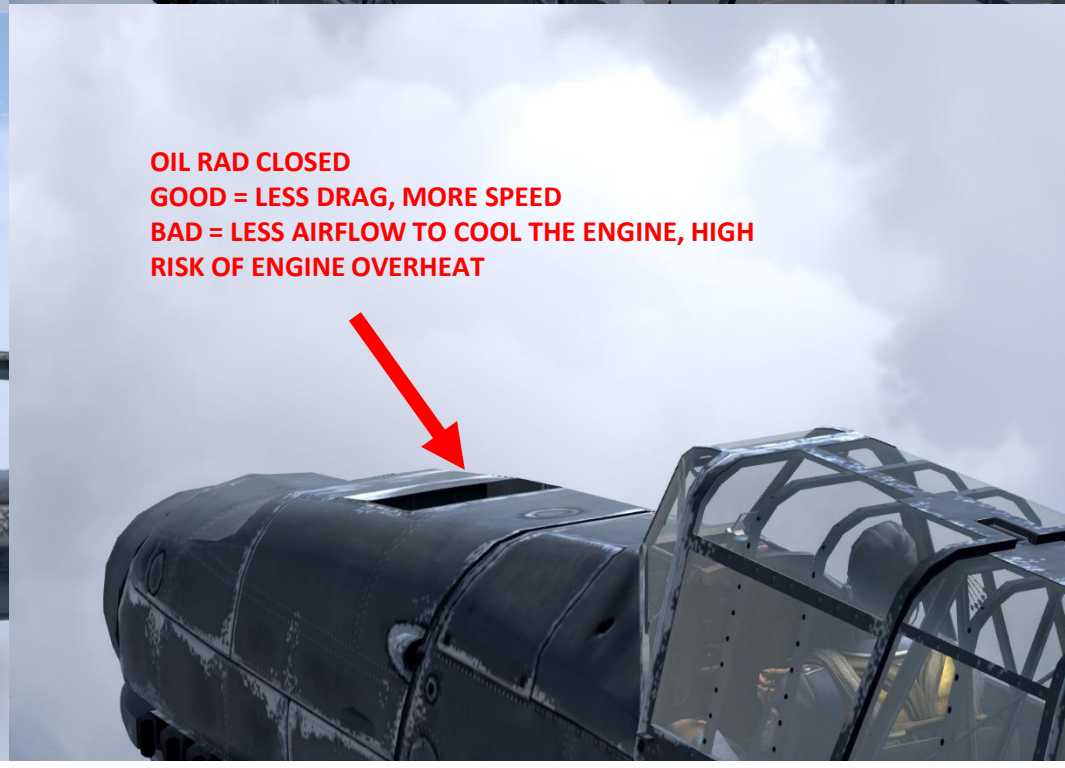
- Your gunner can call out fighters if you have your in-game chat info window enabled. However, if you switcher to your gunner position and switched back to your pilot seat, it is possible that the AI gunner will not take control of the gun. In other words, your gunner will not fire unless the AI takes control of it. To give back the AI control of your turret, you should use the "L_ALT+F2".
- Your turret has 2 positions: CRUISE and FIRING. During aircraft cold start, you start in "CRUISE/PARKED" position. In this mode, the gunner cannot fire his gun nor move his turret. This mode is primarily used to generate less drag. "FIRING" position, on the other hand, allows you to use your gun and rotate your turret to get a better view angle. It is useful to track targets or examine damage on the wings or upper forward fuselage. Your gunner will only fire when the turret is in "FIRING" position.
- Any turret or other air crew position (like the bombardier) can be manned by other players in multiplayer. They just need to **double-click on the available slot in multiplayer** once they clicked on the "flag".

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

CHECK THE "ENGINE MANAGEMENT" SECTION FOR RECOMMENDED RADIATOR SETTINGS.







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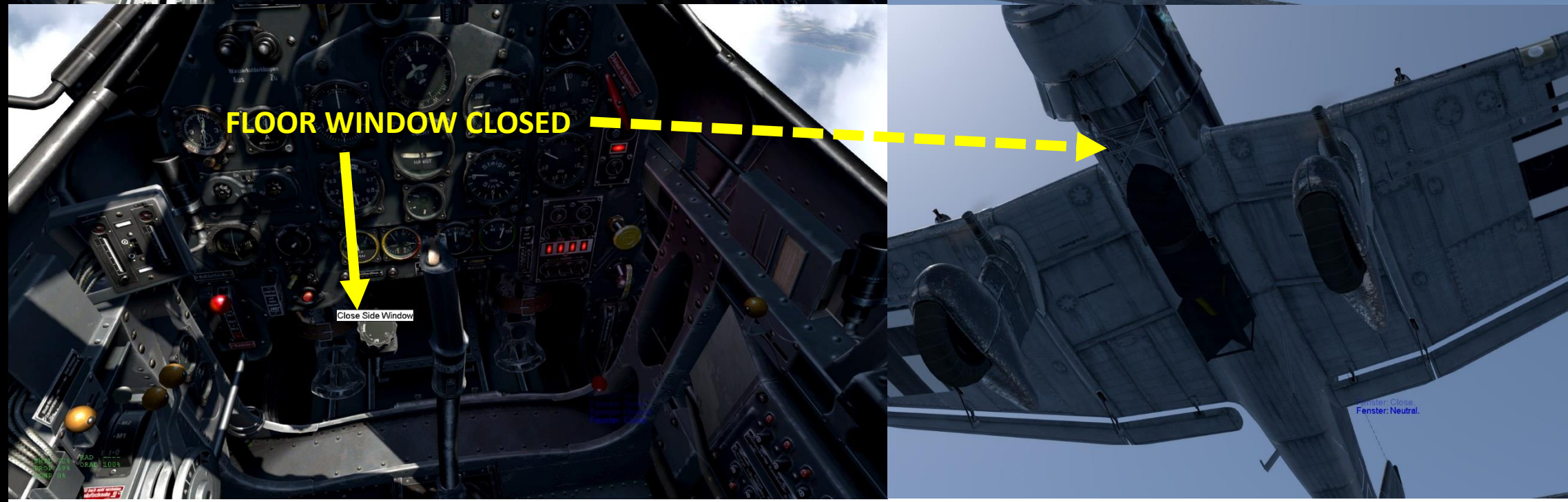
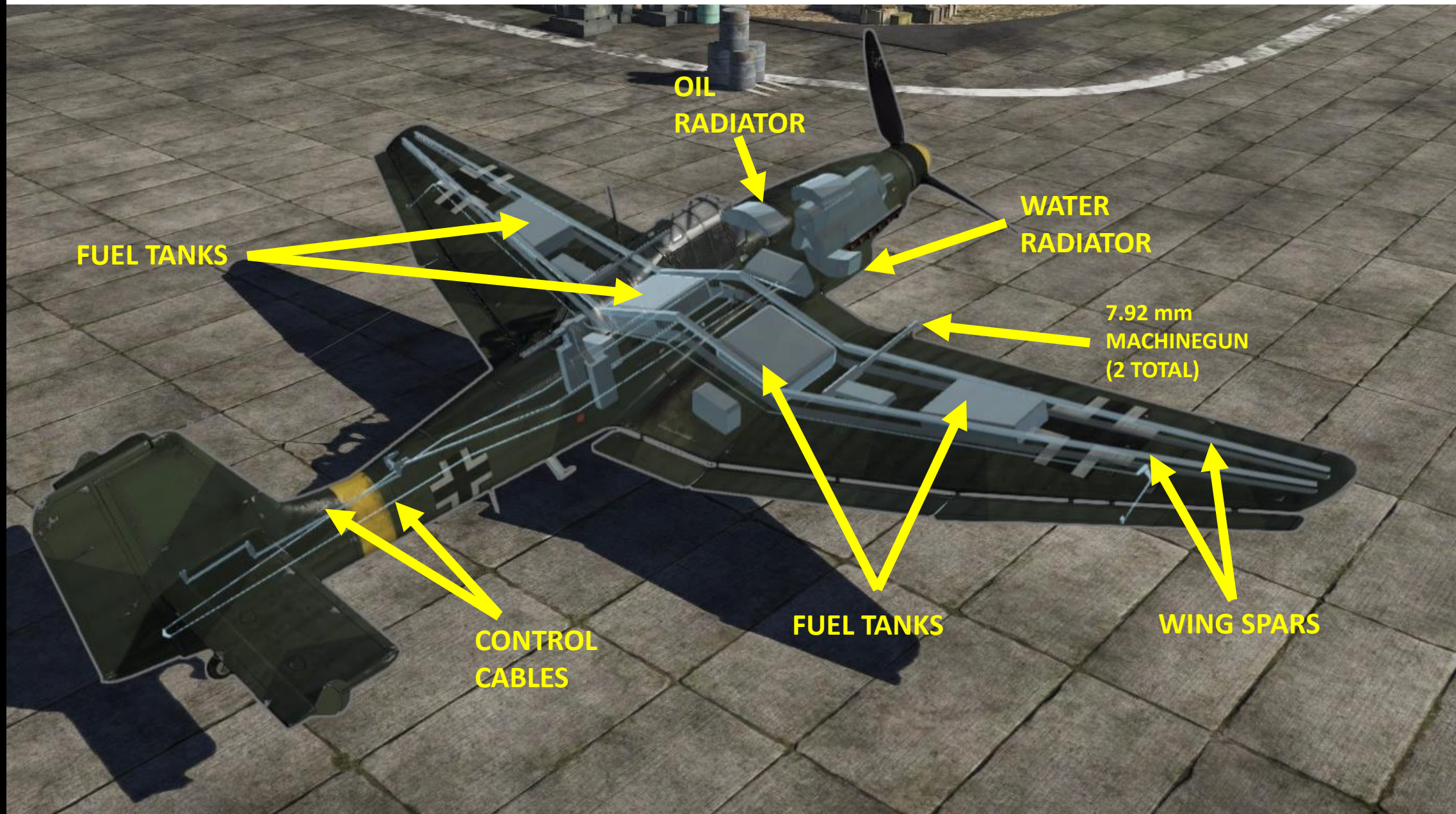


PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

CRITICAL COMPONENTS



HOW TO RECOGNIZE A TAIL NUMBER

LUFTWAFFE

The tactical markings system for the Luftwaffe in WWII must have been designed by a mad genius. Comparative simplicity of the systems used by Italy and the British is a further testament to the fact.

The system will seem extremely convoluted to most everyone who reads this guide; imagine programming all that into the sim!

Serial Number or Werknummer: usually a four-digit number.

Some Examples (symbols in **bold** can be set by the player, symbols in *italics* are automatically set by Cliffs of Dover)

Plane	Squadron	Tactical #	Serial #
Bf-109E-3	II./JG26	<<+-	**1542**
Bf-109E-3	7./JG26	**7**+|	**1195**
Bf-110	5./ZG1	*G9*+**I***N*	**4277**
Bf-110	Stab II./ZG76	*M8*+**K***C*	**3863**
He-111	Stab./KG55	*G1*+**F***A*	**1582**
Ju-87	III./StG51	*6G*+**A***D*	**5338**

Tail Number. Two completely different systems were used for bomber and fighter aircraft.

Fighters: Squadron designated by squadron badge. Tactical number either consists of a one- or two-digit number, or a special symbol such as double chevron for a group commander. See below for all symbols supported by Cliffs of Dover.

Colour of the tactical number determines the Staffel within the squadron the aircraft belongs to. Some Gruppen are also marked with another special symbol aft of the fuselage cross, such as a horizontal line for II. Gruppe or a curvy line for the III. Gruppe.

Bombers: a four character string, in which the first two symbols are the squadron code, usually a number and a letter. The next symbol is the individual aircraft letter, and the final is the letter that identifies which Gruppe and Staffel the aircraft belongs to. The final letter also determines the colour of the individual aircraft letter.

Luftwaffe Fighter Symbols

Note that there are multiple variants for some positions, which give similar but distinct markings. For example both <|- and <I mean Geschwader Adjutant, but display different graphics on the aircraft. These variations were generally created and used by individual squadrons.

Symbol	Deciphered	Meaning
<|-	[less than] [vert line] [dash]	Geschwader Adjutant
<|	[less than] [vert line]	Geschwader Adjutant
<I	[less than] [capital I]	Geschwader Adjutant
--	[dash] [dash]	Geschwader Adjutant
-o	[dash] [lower case o]	Geschwader Adjutant
<--	[less than] [dash] [dash]	Geschwader Commodore
<_1	[less than] [underscore] [number 1]	Geschwader Commodore
<-	[less than] [dash]	Geschwader Commodore
<.-	[less than] [period] [dash]	Geschwader Commodore
<<-	[less than] [less than] [dash]	Geschwader Commodore
<<<4	[less than] [less than] [less than]	Geschwader Commodore
K<<	[less than] [less than]	Geschwader Commodore Kuban
<||	[less than] [vert line] [vert line]	Geschwader Major Beim Stab
<o-	[less than] [lower case o] [dash]	Geschwader Technical Officer
<O-	[less than] [capital O] [dash]	Geschwader Technical Officer
<|o	[less than] [vert line] [lower case o]	Geschwader Technical Officer
<Io	[less than] [capital I] [lower case o]	Geschwader Technical Officer
<|O	[less than] [vert line] [capital O]	Geschwader Technical Officer
<IO	[less than] [capital I] [capital O]	Geschwader Technical Officer
<	[less than]	Gruppen Adjutant
_<	[underscore] [less than]	Gruppen Adjutant
<1	[less than] [one]	Gruppen Beim Stab
<.	[less than] [period]	Gruppen Kommandeur
_<.	[underscore] [less than] [period]	Gruppen Kommandeur
<<	[less than] [less than]	Gruppen Kommandeur
I<<	[capital I] [less than] [less than]	Gruppen Kommandeur
<o	[less than] [lower case o]	Gruppen Technical Officer
<O	[less than] [capital O]	Gruppen Technical Officer
T	[capital T]	Gruppen Technical Officer
<*	[less than] [asterisk]	Gruppen Technical Officer
<t	[less than] [lower case T]	Kommodore
<0	[less than] [zero]	Kuban
-A-	[dash] [capital A] [dash]	Stab.
I_	[capital I] [underscore]	Stab.

NOTE: Many of these symbols were historically meant for Stab aircraft only; however you can still assign them to other Staffeln, which may colour these symbols in non-historical Staffel colours.

PART 4: CONTROLS

JUNKERS JU-87 B-2		
DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
Wheel Chocks		ESSENTIAL
toggle primary cockpit illumination		CLICKABLE IN COCKPIT
fire machine guns	Joystick Gun Trigger	ESSENTIAL
toggle gunsight illumination		ESSENTIAL
toggle selected engine (ignition)	“I” by default	ESSENTIAL
directional controls (ailerons, elevators, and rudder)	Joystick & Rudder Pedal axes	ESSENTIAL
Trim controls (elevator/Horizontal Stab)	Joystick hat switch	ESSENTIAL
Field of View + (allows you to zoom out)		ESSENTIAL
Field of View – (allows you to zoom in)		ESSENTIAL
Fuel Cock Toggle #1		CLICKABLE IN COCKPIT
Extend /Retract Airbrake	SEE BOMBER NUMPAD	ESSENTIAL
course setter – increase	NUMPAD + (CUSTOM)	ESSENTIAL
course setter – decrease	NUMPAD - (CUSTOM)	ESSENTIAL
Open/Close Window Toggle (floor window used for dive bombing)		CLICKABLE IN COCKPIT
Close Window (floor window used for dive bombing)	SEE BOMBER NUMPAD	CLICKABLE IN COCKPIT

PART 4: CONTROLS

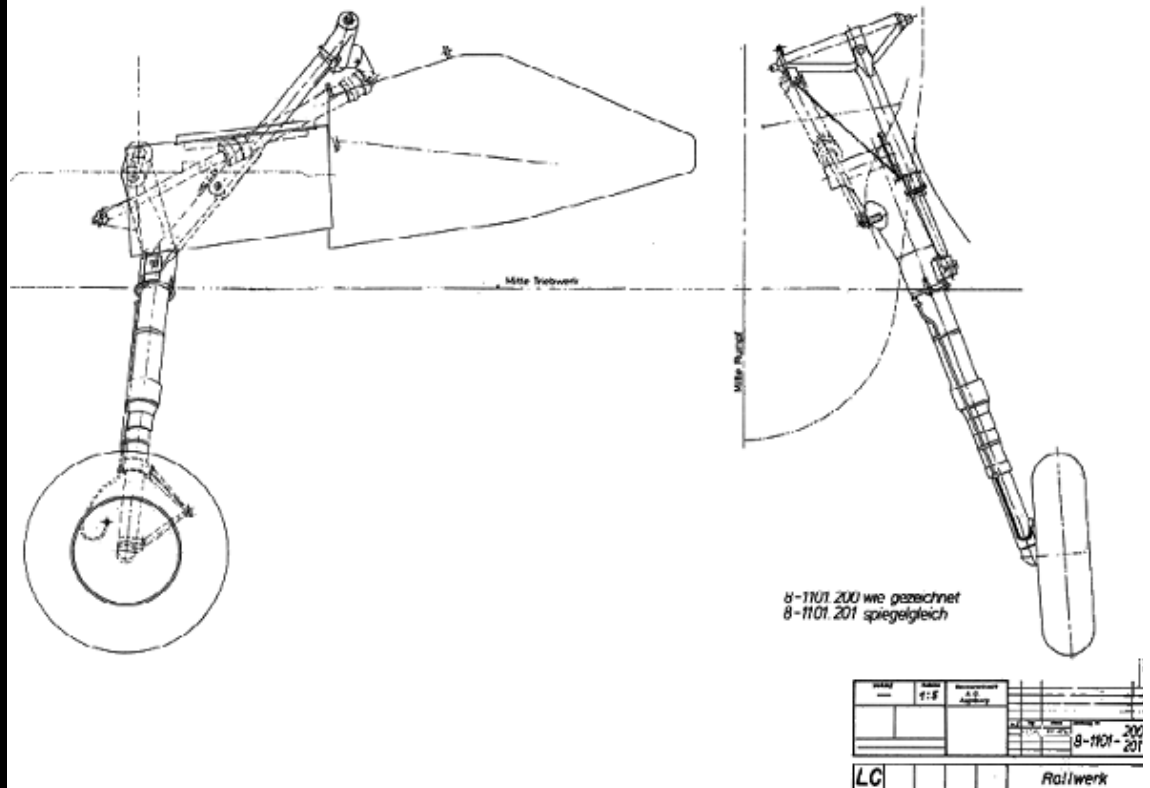
JUNKERS JU-87 B-2		
DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
lean to gunsight		NOT ESSENTIAL
throttle	Throttle axis	ESSENTIAL
War Emergency Power		ESSENTIAL
toggle canopy/hatch		ESSENTIAL
Jettison canopy		ESSENTIAL
Open oil radiator	Right Arrow keyboard	ESSENTIAL
close oil radiator	Left Arrow keyboard	ESSENTIAL
open radiator	Up Arrow keyboard	ESSENTIAL
close radiator	Down Arrow keyboard	ESSENTIAL
increase propeller pitch	**CUSTOM. DO NOT MAP TO AXIS LIKE FOR THE RAF A/C. MAP TO KEYS INSTEAD.**	ESSENTIAL
decrease propeller pitch		ESSENTIAL
Left / Right Wheel brake	Map in AXES if pedals	ESSENTIAL
bail out		ESSENTIAL
Toggle Independent Mode (allows you to use/hide mouse cursor)	F10	ESSENTIAL
increase /decrease sight altitude (sets bomb altimeter release altitude)		CLICKABLE IN COCKPIT
Lock Tail Skid (Tailwheel lock toggle not visible in cockpit)		ESSENTIAL

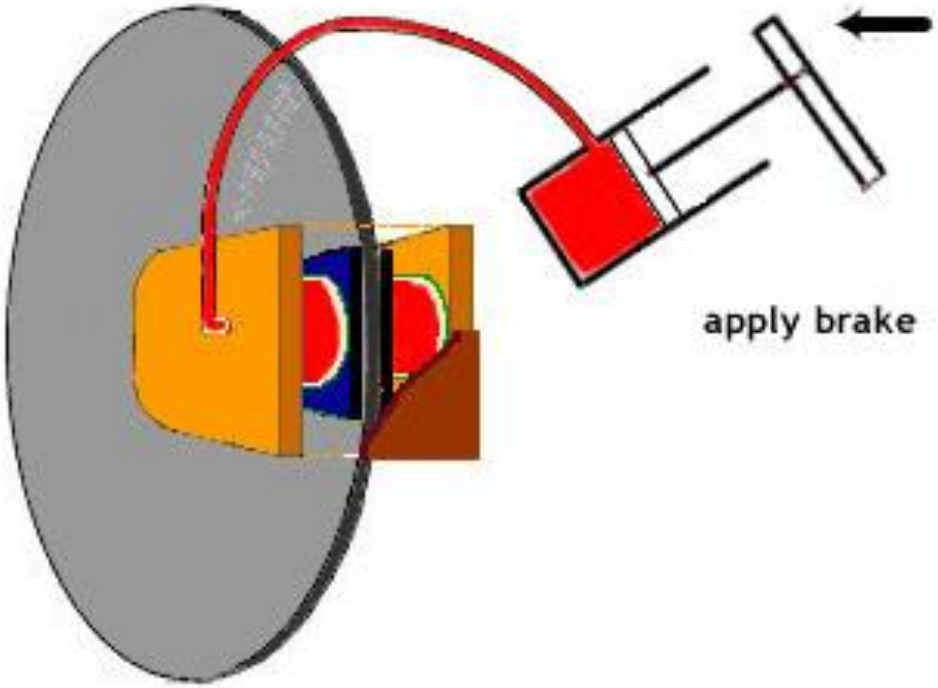
PART 4: CONTROLS

JUNKERS JU-87 B-2		
DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
Turret – Cruise Position	O	ESSENTIAL
Turret – Firing Position	L_SHIFT+O (CUSTOM)	ESSENTIAL
External View (Give Turret Gunner Control to AI)	L_ALT+F2	ESSENTIAL
View-Position #1 (pilot)	L_ALT+1	ESSENTIAL
View-position #2 (dorsal gunner)	L_ALT+2	ESSENTIAL
Next Manned Position (Cycles through air crew)	C	ESSENTIAL
bomb mode selector – next / previous (salvo/single)	SEE BOMBER NUMPAD	ESSENTIAL
Select bomb bay previous/Next	SEE BOMBER NUMPAD	ESSENTIAL
Selected Supercharger – Previous Step	L_CTRL+Q (CUSTOM)	ESSENTIAL
Selected Supercharger – Next Step	Q (CUSTOM)	ESSENTIAL
toggle bombs armed	SEE BOMBER NUMPAD	ESSENTIAL
Drop ordnance (bombs)	B	ESSENTIAL
Bombsight altitude + / -	SEE BOMBER NUMPAD	CLICKABLE IN COCKPIT

PART 4: CONTROLS

- Most german aircraft, unlike the majority of British and Russian planes, has a “toe brake” or “heel brake” system, which is linked to each individual wheel of your landing gear.
- In order to brake, you need to hold either your left or right wheel toe brake key to steer your aircraft. Applying rudder will also help you turn tighter.
- The main landing wheel brake system employs hydraulically actuated disc-type brakes. Each brake is operated by individual master brake cylinders located directly forward of the instrument panel. The brakes are selectively controlled by means of toe pedals incorporated into the rudder pedal assembly.
- Be careful: your “wheel brake” command used for Differential braking aircraft will lock both your brakes in a german plane. You can map “left/right wheel brake” axes if you have rudder pedals.
- NOTE: The landing gear is FIXED on the Stuka. Don’t look for an undercarriage lever… there isn’t any. ☺



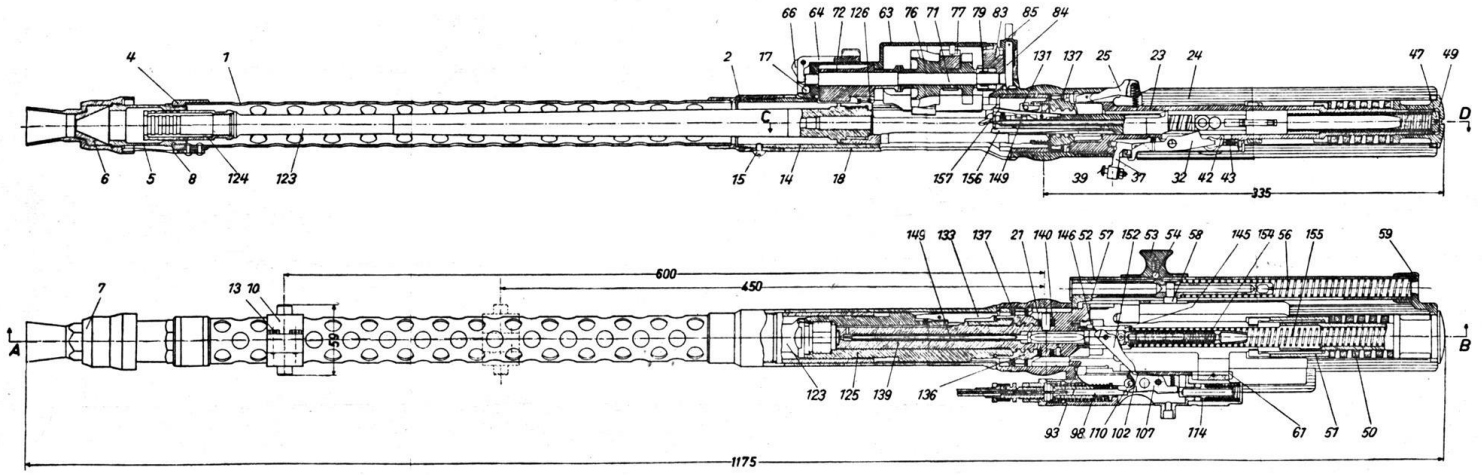


Recommended Machine-Gun Belt Loadout – **Rheinmetall-Borsig MG 17 (7.92 mm)**

1. 7.92×57, S.m.K.H. - Spitzgeschoss mit Kern, Hart- Improved AP round with tungsten core. Highly recommended if you want a straight AP. However, the S.m.K.H. **in-game is in fact a duplicate of the S.m.K**., because the S.m.K.H. was never used on a fighter aircraft. Tungsten is a precious and expensive metal that was much needed elsewhere for the german war effort.
2. 7.92×57, P.m.K. - Phosphor mit Stahlkern- Standard AP with an incendiary composition. A great round, can still pierce armor and set fires
3. 7.92×57, S.m.K. L'spur (gelb) OR 7.92×57, S.m.K. L'spur (Weiss)- Standard AP with yellow (gelb) or white (Weiss) tracers. Good for aiming.

PART 5: WEAPONS AND ARMAMENT

ONE	LUFTWAFFE SIGHT DATA					ONE
Royal Air Force Aircraft	Wingspan			REVI C12 SIGHT (100 mils)		
	Meters	Yards	Feet	Range (m)	Range (yds)	Range (ft)
Tiger Moth	8.94	9.78	29.3	89	98	293
Gladiator Mk.I	9.80	10.72	32.2	98	107	322
Spitfire MK.I	11.23	12.28	36.8	112	123	368
Defiant MkI	11.99	13.11	39.3	120	131	393
Hurricane Mk.I	12.19	13.33	40.0	122	133	400
Walrus MkI	14.00	15.31	45.9	140	153	459
Blenheim MkI	17.17	18.78	56.3	172	188	563
Anson MkI	17.22	18.83	56.5	172	188	565
Beaufighter MkIF	17.65	19.30	57.9	177	193	579
Wellington MkIc	26.27	28.73	86.2	263	287	862
Sunderland MkI	34.39	37.61	112.8	344	376	1128



7.92 mm MG17

Schnittzeichnung des M.G.17.

PART 5: WEAPONS AND ARMAMENT

TWO	LUFTWAFFE WEAPON DATA						TWO
Luftwaffe Machinegun and Cannon Ammunition							
Weapon	**Nomen**	**Type**	**Fill**	**Burnout**	**Tracer Color**	**Smoke Trail**	**Notes**
MG 17 7.92mm	SmK v	AP					Steel Core
	SmK (H) v	AP (Super)					WC Core
	SmK L'Spur v	AP-T		900 m	Yellow		
	SmK L'Spur v	AP-T		900 m	White		
	SmK Ub m Zer	SAPHE w SD					Flash
	PmK v	API	Ph			Yes	Burns
	B Patr v	HEI	Ba				Flash
MG FF 20mm	Brsprgr L'Spur	HEI-T / SD	PETN, Mg/Thm	1100 m			750m SD
	Brgr L'Spur	Incend -T / SD		1100 m		Yes	750m SD, Burns
	Pzbrgr	API / SD					750m SD
	PzBrgr (Elek)	API / SD	Mg				750m SD
	Pzbrgr (Phos)	API / SD	Ph				750m SD
MG FFM	M'gesch.	HE	RDX / Al				750m SD
German Ammunition Types	**SmK - Spitzgeschoss mit Stahlkern** = Pointed bullet with Steel Core						
	v - Verbesserte = Improved - increased propellant for increased muzzle velocity. Aircraft use only						
	L'Spur - Leuchtspur = Tracer						
	Ub. - Ubung = Training Ammo containing a small bursting charge						
	m. Zerl - mit Zerleger = with Burster = SD = Self Destruct Mechanism						
	PmK - Phospor mit Stahlkern = Phosphorus with Steel Core						
	B Patr - Beobachtung Patrone = Observation Cartridge						
	Brsprgr - Brandsprenggranate = Incendiary Explosive Grenade						
	Brgr - Brandgranate = Incendiary Grenade						
	Pzbrgr - Panzerbrandgranate = Armor peircing Incendiary Grenade						
	M'gesch. - Minengeschoß = Mine Projectile - High Capacity HE						
Notes	**Fill**: Ph (Phosph.), Mg (Magnes.), Al (Alum.), Ba (Barium), WC (Tunsten Carbide), Thm (Thermite)						
	Burns = Incendiary Composition (usually Phosphorus) is ignited on firing and burns during flight						
	Flash = Incendiary Ignition or small HE Burst on impact with target						
	Slow Tracer = Delayed tracer ignition for Night use						

PART 8: ENGINE MANAGEMENT

Recommended Bomb Loadout

1. **For low-level bombing:**
   1. 4 X SC50 GP bomb, Low Level Fuse, 14 sec delay
   2. 1 X SC-500 GradeIII-J bomb, Low Level Fuse, 14 sec delay
2. **For dive bombing:**
   1. 4 X SC50 GP bomb, Low Level Fuse, 14 sec delay
   2. 1 X SC250 GP bomb, Dive Bombing Altitude Fuse, 8 sec delay

BOMB DROP PROCEDURE:

1) Arm Bombs
2) Choose Bomb Bay (Wing bombs or Fuselage rack)
3) Drop bombs ("drop ordnance" key)

PART 5: WEAPONS AND ARMAMENT

Bombs					
Country	**Nomen**	**Type**	**WT (lbs/kg)**	**Fuze**	**Aircraft**
Luftwaffe	SC 50	GP	110 / 50	5, 25B	Ju87B, Ju88, Me109, He111
	SC 250	GP	551 / 250	5, 15, 25B	Ju87B, Ju88, Me109, Me110, He111
	SD 250	Semi-AP Frag	551 / 250	5	Ju87B, Ju88, Me110, He111
	SC 500	GP	1102 / 500	25B	Ju87B, Ju88
	SD 500	Semi-AP Frag	1102 / 500	5	Ju87B, Ju88
Notes	**SC - Sprengcylindrische** = Cylindrical Explosive: GP - General Pupose HE				
	SD - Spreng Dickenwand = Thick wall Explosive: Semi AP Frag - Thick walled case HE				

Pistols					
Weapon	**Nomen**	**Type**		**Settings (oV, mV, Vz)**	**Bomb Type**
Luftwaffe Fuzes	5	High Alt		0, .8sD	SC50, SC250, SD500
	15	Dive		0, .05sD, 8sD	SC250
	25B	Low Alt		0, .8sD, 14sD	SC50, SC250, SC500
Notes	**Settings**: 0 = Instantaneous; 8sD = 8 second Delay; etc				
	LW High Alt = High Altitude Release - Greater Than 1km				
	LW Low Alt = Low Altitude Release - Less Than 1km				
	LW Dive = Automatic Delay in Dive Release of 14 seconds				
TWO					**TWO**

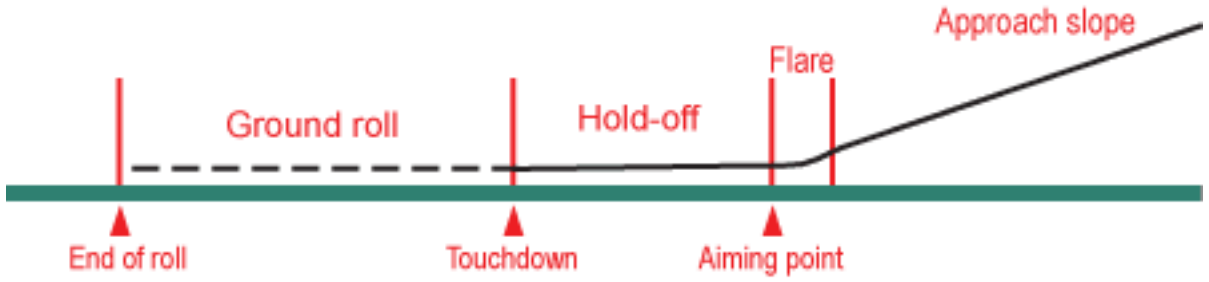
PART 6: TAKEOFF

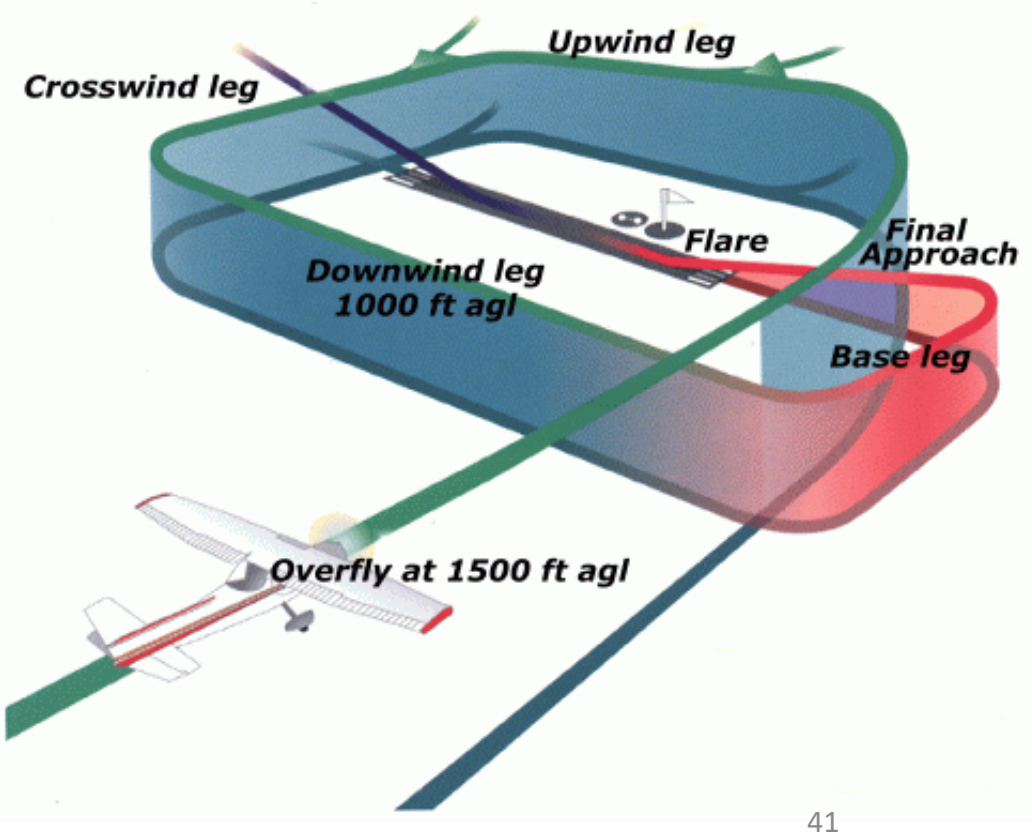
NOTE: This procedure is NOT the real-life start-up procedure, it has been simplified in the sim.

1. Fuel cock ON
2. Oil rad and water rad fully closed (0 %)
3. Prop pitch full fine
4. Crack throttle about an inch
5. Switch Magnetos to M1+M2
6. Make sure your propeller is clear (“Clear prop!”)
7. Engine ignition! (press “I” by default)
8. Wait for oil temperature to reach at least 30 deg C and water rad temperature to reach at least 40 deg C.
9. Oil & water radiators fully open (100 %)
10. Taxi to the runway.
11. Make sure you are facing yellow panels on the runway. This means you are facing the right direction for takeoff.
12. Line up on the runway and straighten up your tailwheel by moving forward in a straight line. Lock your tailwheel by pressing a custom key binding for “Tail Skid Lock” (lever not visible in cockpit).
13. Perform last takeoff checks: Canopy Closed, flaps up, Water & Oil Rads fully open, Full Fine prop pitch, good oil & water rad temperatures.
14. Gradually throttle up. Do not throttle too fast: the engine is sensitive to abrupt changes in manifold pressure. Compensate for engine torque and wind using rudder pedals and small brake input to keep the aircraft straight. Slightly push the control column forward to lift the tail.
15. Rotation is at 170 km/h.
16. You don’t need to retract your landing gear: it is fixed! ☺
17. Throttle back to approx. 1.15 ATA. Lower prop pitch until engine is operating at 2300 RPM while you are beginning your climb.

PART 7: LANDING

1. Start your approach at 170 km/h @ approx. 800 m (1500 ft AGL).
2. Water and oil rads fully open (100 %) and set prop pitch to full fine (100 %).
3. Deploy flaps (fully down).
4. Cut throttle and try to keep your nose pointed to the end of the runway.
5. Touchdown at 150 km/h in a 3-point landing.
6. Stick fully back.
7. Tap your brakes until you come to a full stop. Be careful not to overheat your brakes or force your aircraft to nose over into a prop strike.

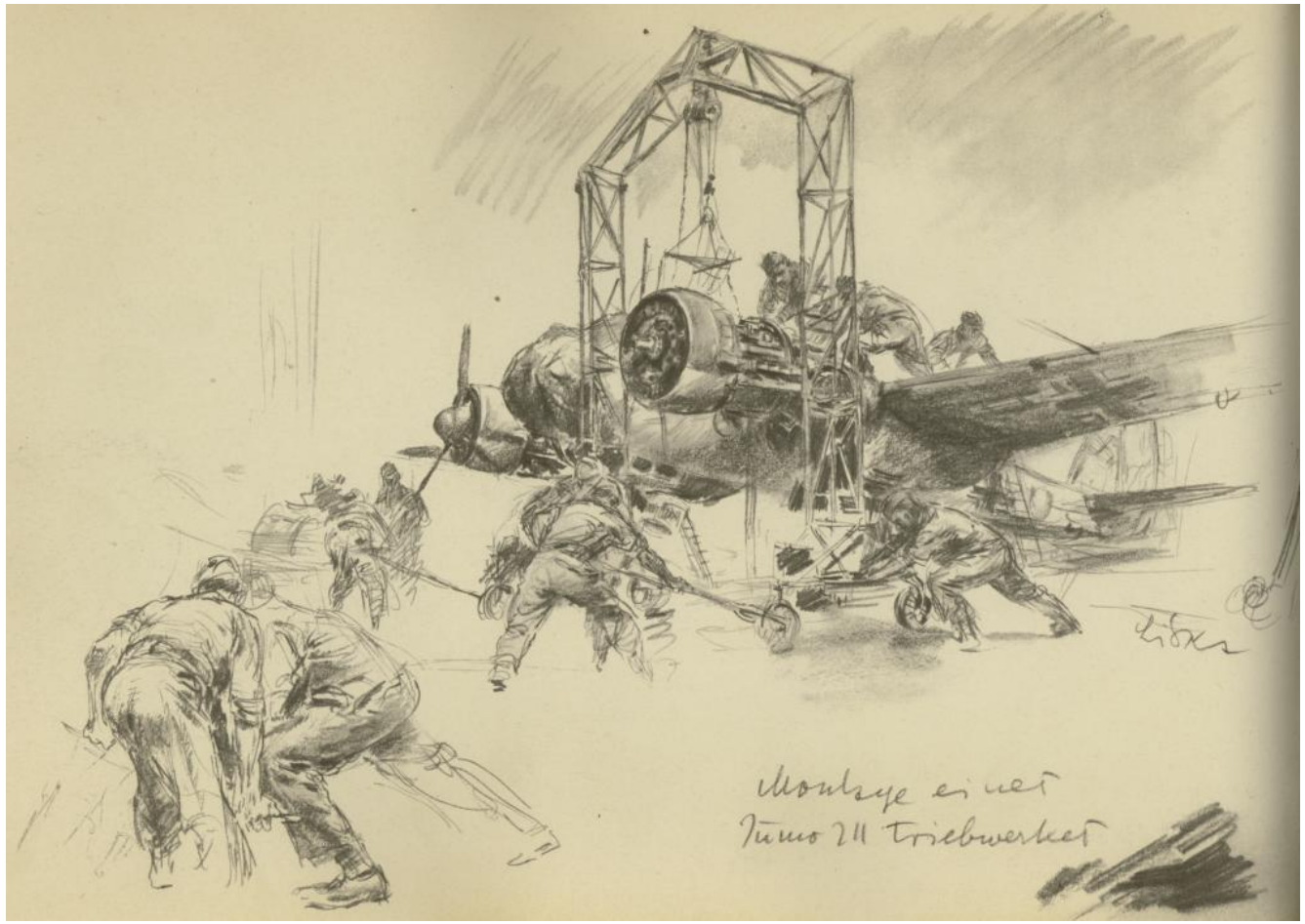




PART 8: ENGINE MANAGEMENT

The **Jumo 211** was an inverted V-12 aircraft engine, Junkers Motoren's primary aircraft engine of World War II. It was the direct competitor to the famous Daimler-Benz DB 601 and closely paralleled its development. While the Daimler-Benz engine was mostly used in single-engined and twin-engined fighters, the Jumo engine was primarily used in bombers such as Junkers' own Ju-87 and Ju-88, and Heinkel's H-series examples of the Heinkel He 111 medium bomber. It was the most-produced German aero engine of the war, with almost 70,000 examples completed.

PART 8: ENGINE MANAGEMENT



The Jumo 211 was developed by Dr. Franz Josef Neugebauer as scaled-up successor to the earlier Jumo 210. In 1934, even before the new Jumo 210 had completed its acceptance tests, the RLM sent out a request for a new 1,000 PS-class engine of about 500 kg weight. Both Jumo and Daimler-Benz responded, and in order to reach service before the new Daimler-Benz DB 600, the Jumo team decided to make their new design as similar as possible to their 210H model, currently in testing. The resulting Jumo 211 was first prototyped at Jumo's Dessau plant in 1935 and started testing in April 1936. Like the 210H, it featured a mechanical direct fuel injection system using small pistons driven off the crankshaft, three valves per cylinder, and an inverted V layout. It also had an open-cycle cooling system, not pressurized.

PART 8: ENGINE MANAGEMENT

Development of the 211 continued with the 211B being released in 1938, with a slightly increased maximum RPM of 2,400 which boosted power to 1,200 PS (1,200 hp; 880 kW). The later 211C and 211D differed primarily in the propeller gear ratios and other features.

A major upgrade was started in 1940 in order to better compete with the 601, following in its footsteps with a pressurized cooling system. The resulting 211E proved to be able to run at much higher power settings without overheating, so it was quickly followed by the 211F which included a strengthened crankshaft and a more efficient supercharger.

The Jumo 211 became the major bomber engine of the war, in no small part due to Junkers also building a majority of the bombers then in use. Of course, since it was the Luftwaffe that selected the final engine to be used after competitive testing on prototypes (such as the Dornier Do 217), there is certainly more to it. Limited production capacity for each type, and the fact that the Jumo was perfectly capable (if not superior) in a bomber installation meant that it made sense to use both major types to the fullest; since the Daimler had a slight edge in a lightweight, single-engine application, that left the Jumo to fill in the remaining roles as a bomber engine. Even this wasn't enough in the end, and radial engines like the BMW 801 were increasingly put into service alongside the Jumo and DB series, most often in multi-engine installations like the Jumo.

PART 8: ENGINE MANAGEMENT

FOUR	ENGINES IN CLIFFS OF DOVER	FOUR
Mixture Control		
Engine	**Operation**	
Gypsy Major	Mixture Lever in rear cockpit has 2 operating positions only: RICH and WEAK. The mixture should be set to RICH at all times under 5000 feet. Above 5000 feet, mixture ajustment should not cause a drop in RPM.	
Merlin II - XII	Mixture Lever has 2 operating positions only: RICH (NORMAL) and WEAK. An interlocking arrangement returns the mixture control to RICH when the throttle is closed. **Note: Mixture Control moves AFT for RICH and FORWARD for WEAK.**	
Mercury XV	Mixture Lever has 2 operating positions only: RICH (NORMAL) and WEAK. An interlocking arrangement returns the mixture control to RICH when the throttle is closed. **Note: Mixture Control moves AFT for RICH and FORWARD for WEAK.**	
DB 601 A - A1	The DB 601 Series engines are Direct Fuel Injection engines and do not have a pilot selectable mixture control.	
Jumo 211 B/D	The Jumo 211 B/D Series engines are Direct Fuel Injection engines and do not have a pilot selectable mixture control.	

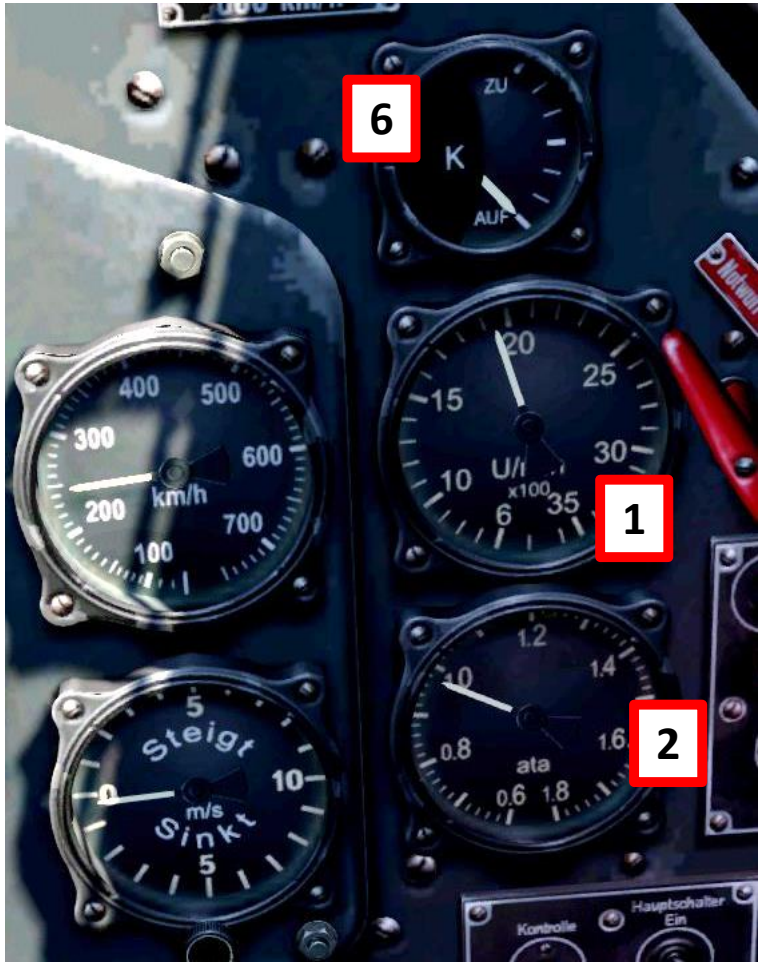
PART 8: ENGINE MANAGEMENT

During a mission, the flight lead usually calls out his engine settings once in a while for the pilots to know what settings they should use. You can read your engine settings from the gauges in the cockpit or from an info window.

- The RPM indicator (1) and the manifold pressure (2) are what you should check every minute. Constantly monitor oil (3) and water (4) rad temperatures. Oil rad position (5) can be seen on the info window and water rad position (6) can be seen on the water rad position indicator.
- The resulting RPM is affected by both manifold pressure and prop pitch (5). Be careful with manifold pressure input: the engine is very sensitive to abrupt throttling.

- Radiator settings:
  - 75 % WATER / 50 % OIL during **climb & normal operation**
  - 100 % WATER / 100 % OIL during **takeoff & landing**
  - 0 % WATER / 0 % OIL during **engine warm-up**

	(Unit)	JU-87 B-2
TEMPERATURES		
Water Rad Min	Deg C	38
Max		95
Oil Rad (OUTBOUND) Min	Deg C	30
Max		95



PART 8: ENGINE MANAGEMENT

SUPERCHARGER OPERATION

- There are a lot of misconceptions and rumours about the use of superchargers. Time to reveal the truth!
- 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 30 "Hg (for german planes it would be an ATA value). For example, at 8,000 feet 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 25 "Hg of manifold pressure whereas without a supercharger it could produce only 22 "Hg. Superchargers are especially valuable at high altitudes (such as 18,000 feet) 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.

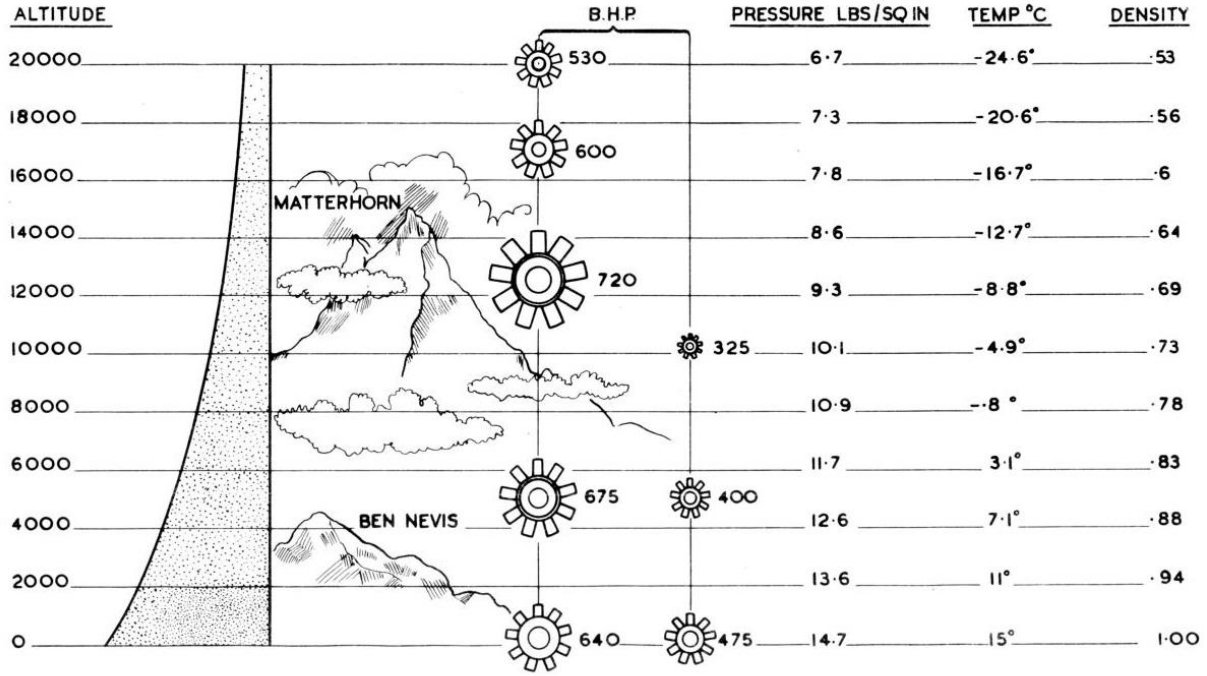
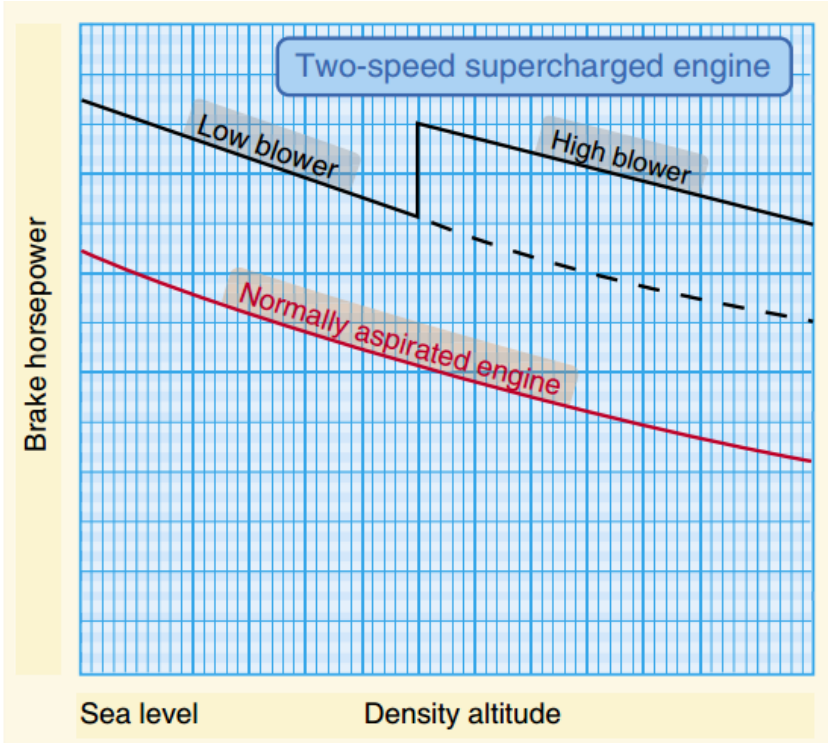


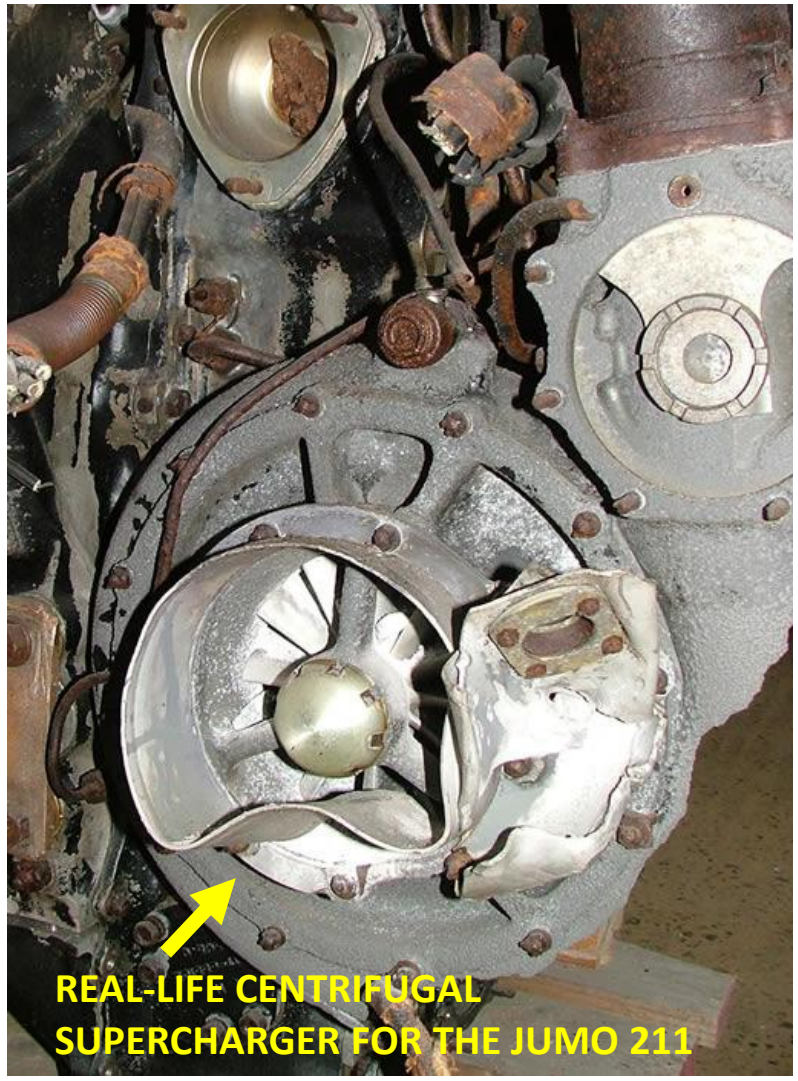
DIAGRAM SHOWING ATMOSPHERIC AND POWER VARIATIONS

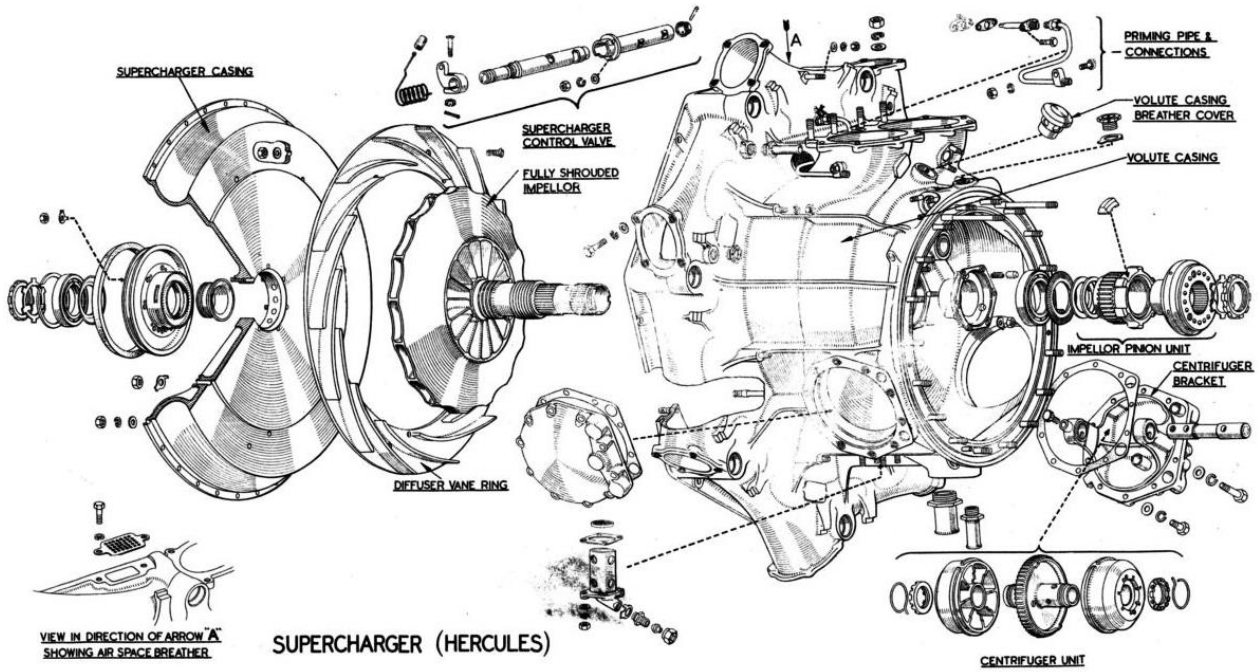


PART 8: ENGINE MANAGEMENT

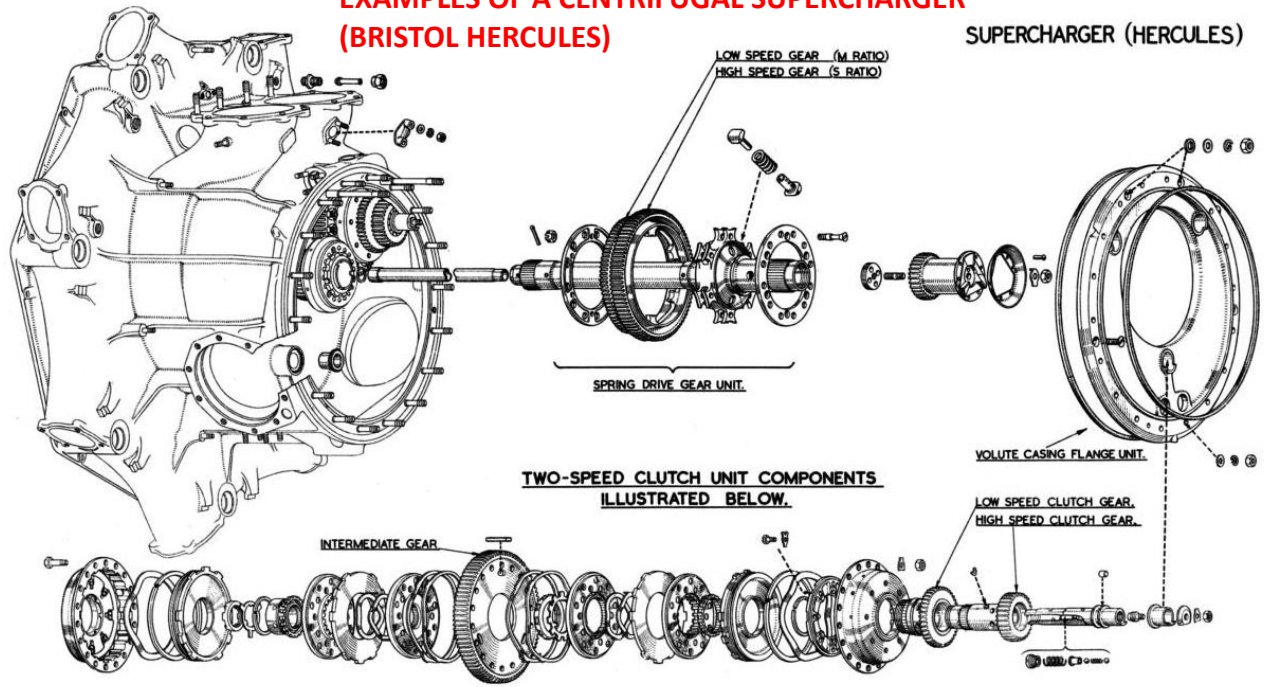
SUPERCHARGER OPERATION

- This is what a two-speed centrifugal supercharger looks like.





EXAMPLES OF A CENTRIFUGAL SUPERCHARGER (BRISTOL HERCULES)



PART 8: ENGINE MANAGEMENT

SUPERCHARGER OPERATION

- Some of the large radial engines developed during World War II have a single-stage, two-speed supercharger. This is what we have on the Jumo 211. With this type of supercharger, a single impeller may be operated at two speeds.
- The low impeller speed is often referred to as the low blower setting, while the high impeller speed is called the high blower setting. On engines equipped with a two-speed supercharger, a lever or switch in the flight deck activates an oil-operated clutch that switches from one speed to the other.

Supercharger vs Turbosupercharger (or Turbocharger)

- While there is no turbocharger installed on the Jumo 211, it is interesting to explain the differences between a turbocharger (installed on the P-47 Thunderbolt for example) and a supercharger. Why? Simply because people often confuse them.
- The most efficient method of increasing horsepower in an engine is by use of a turbosupercharger or turbocharger. Installed on an engine, this booster **uses the engine's exhaust gases to drive an air compressor to increase the pressure of the air** going into the engine through the carburetor or fuel injection system to boost power at higher altitude.
- The major disadvantage of the gear-driven supercharger – use of a large amount of the engine's power output for the amount of power increase produced – is avoided with a turbocharger, because turbochargers are powered by an engine's exhaust gases. This means a turbocharger recovers energy from hot exhaust gases that would otherwise be lost.
- A second advantage of turbochargers over superchargers is the ability to maintain control over an engine's rated sea level horsepower from sea level up to the engine's critical altitude. Critical altitude is the maximum altitude at which a turbocharged engine can produce its rated horsepower. Above the critical altitude, power output begins to decrease like it does for a normally aspirated engine.

PART 8: ENGINE MANAGEMENT

SUPERCHARGER OPERATION TUTORIAL (PART 1)

- The supercharger on the Jumo 211 is a two-speed centrifugal type supercharger with automatic boost control
- There is a slight difference in terminology between the supercharger used in the Stuka and the one used in the Ju-88.
- The Stuka supercharger has AUTOMATIC and MANUAL modes. AUTOMATIC mode is used under 1500 m (which will leave the supercharger in first gear) while the MANUAL mode (which will engage the second gear) is used over 1500 m.
- You switch between first (low blower - AUTO) and second (high blower - MANUAL) supercharger gears using the “Selected Supercharger – Previous / Next Step” controls.
- Do not use the “Selected Supercharger – Cycle” control. It is bugged and does not work.
- My key custom bindings are: “Selected Supercharger – Previous Step” mapped to “LCTRL+Q” and “Selected Supercharger – Next Step” mapped to “Q”.
- Supercharger has no effect at low altitudes (under 1500 m), whether in AUTO or MANUAL mode. You need to be above 1500 m to see a difference: AUTO mode will MANUAL mode.
- “COMP” at 0 % means the supercharger is in first gear / AUTO. “COMP” at 100 % means the supercharger is in second gear / MANUAL.

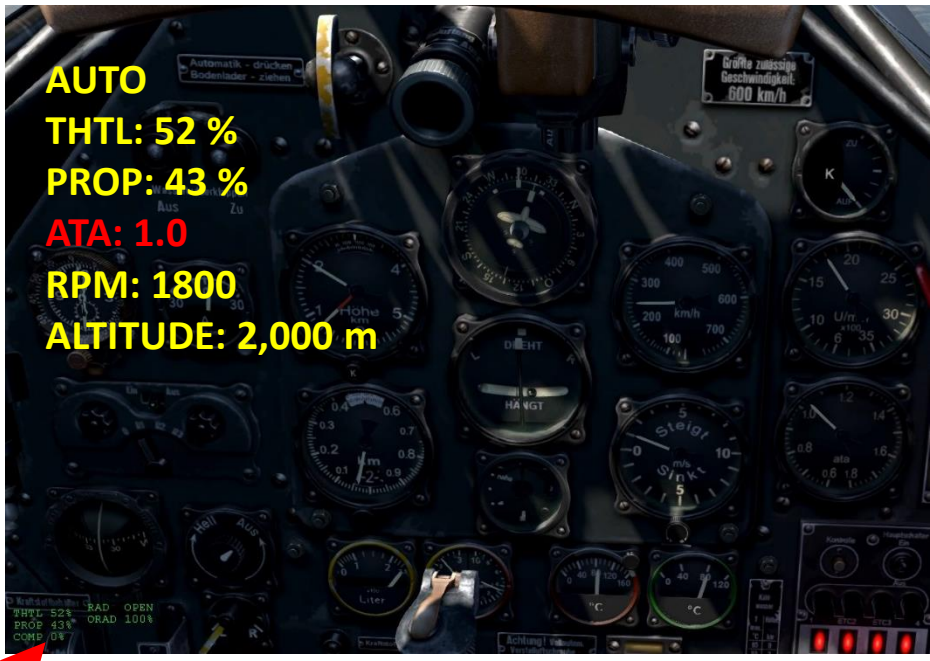
	(Unit)	JU-87 B-2
TEMPERATURES		
Supercharger Stage 1 (AUTOMATIC) Operation Altitude	UK: ft GER: M	0 1500
Supercharger Stage 2 (MANUAL) Operation Altitude	UK: ft GER: M ITA: M	1500+

- **AUTO MODE = GEAR 1 = LOW BLOWER = LOW MANIFOLD PRESSURE = COMP 0 % = USED BETWEEN 0 AND 1,500 M.**
- **MANUAL MODE = GEAR 2 = HIGH BLOWER = HIGH MANIFOLD PRESSURE = COMP 100 % = USED AT 1,500 M OR HIGHER.**
- **DURING DIVE BOMBING, LEAVE SUPERCHARGER IN AUTO (GEAR 1).**

PART 8: ENGINE MANAGEMENT

SUPERCHARGER OPERATION TUTORIAL (PART 2)

- To switch gears, you need to do it individually for each engine:
  1. *Check your altitude. If you are under 1500 m or you are about to go on a dive bombing run, you need to have your supercharger in first gear (AUTO). If you are over 1500 m, you need to have your supercharger in second gear.*
  2. *Hit "Q" to switch to second gear (high blower - MANUAL) or hit "LCTRL+Q" to switch to first gear (low blower - AUTO).*
  3. *If you switch to second gear, you will see an increase in manifold pressure (ATA) and RPM (but only if you are over 1,500 m). Make sure to adjust throttle so your ATA and RPM are not over safety limits. If you ATA is too high, you can cook the engine very easily in the Stuka.*
- In this example, I deliberately chose to fly high (2000+ m) and run the engine on the first supercharger gear (low blower - AUTO) and switched the second supercharger gear (high blower - MANUAL) to show you the difference between supercharger gear behaviour.
- In AUTO mode, engine has an ATA of 1.0 and a RPM of 1800. (supercharger gear 1)
- In MANUAL mode, engine has an ATA of 1.3 and a RPM of 1800. (supercharger gear 2)
- And yet, **<u>both situations had the engine at the same throttle & prop pitch settings</u>**!
- Had we been flying lower (under 1,500 m), we would not have seen any difference in manifold pressure or RPM, no matter the supercharger mode selected.



	(Unit)	JU-87 B-2
ALTITUDE		
Supercharger Stage 1 (AUTOMATIC) Operation Altitude	UK: ft GER: M	0 1500
Supercharger Stage 2 (MANUAL) Operation Altitude	UK: ft GER: M ITA: M	1500+

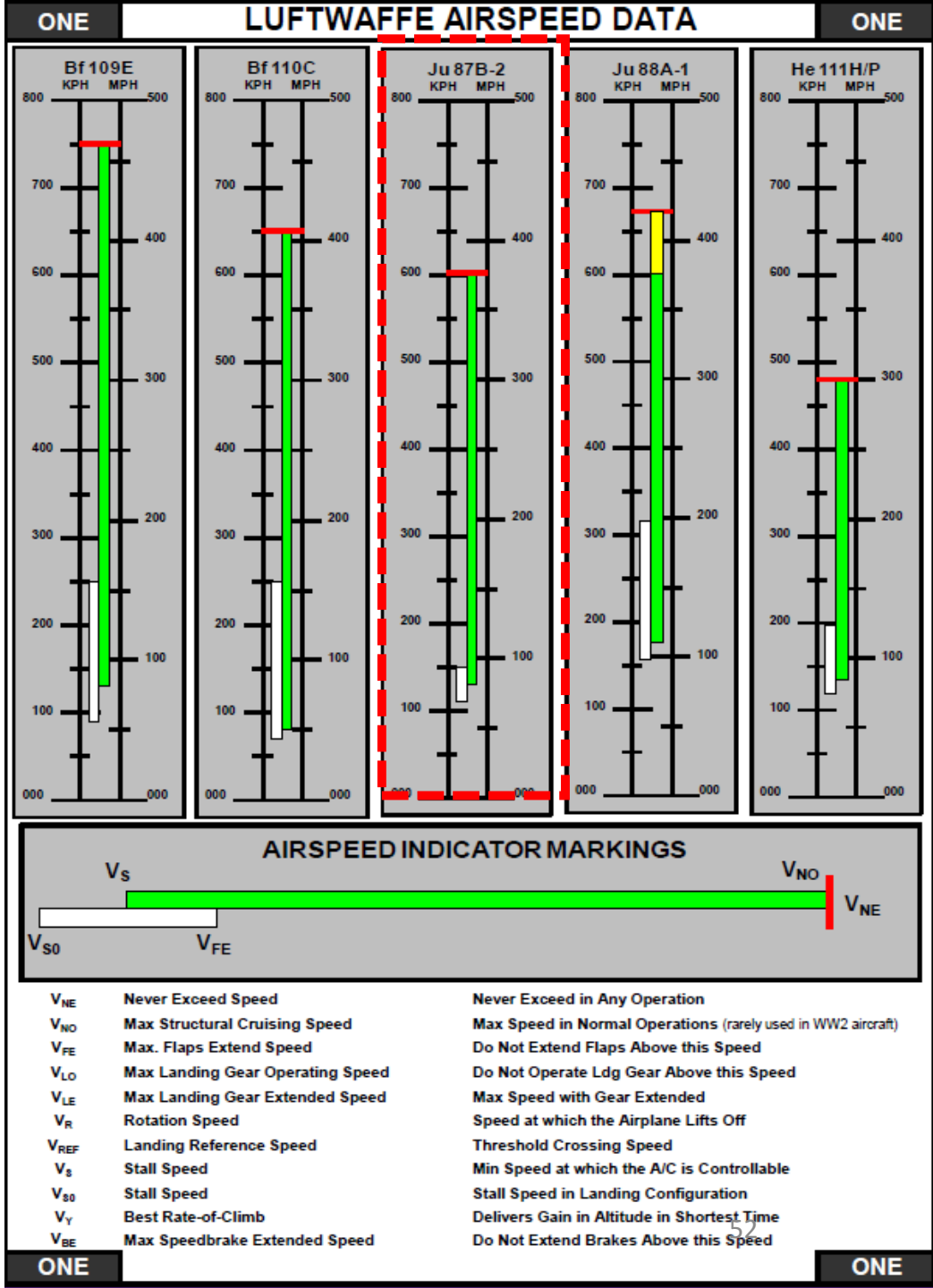
PART 9: AIRCRAFT PERFORMANCE

AIRSPEEDS

Takeoff – Rotation	UK: mph GER/ITA: km/h	170
Max Dive Speed		720
Optimal Climb Speed		215
Landing – Approach		170
Landing – Touchdown		150

- For more information on either aircraft or engine performance, consult the **2nd Guards Composite Aviation Regiment** Operations Checklist. It is a fantastic resource (link below).

https://drive.google.com/open?id=0B-uSpZROuEd3NGN4c0JRNHJpYkk&authuser=0



PART 9: AIRCRAFT PERFORMANCE

ONE	Ju 87B	ONE

Aircraft Type	Engine & Prop	Fuel	Reference
Ju 87B-2	Jumo 211 D / Ju VS5 VP	87 Oct	Ju 87B-2 Betriebsanleitung Jun 1940

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V_{NE}	Never Exceed Speed	600	Never Exceed in Any Operation
V_{FE}	Max. Flaps Extend Speed	150	Do Not Extend Flaps Above this Speed
V_{FO}	Max Flaps Operating Speed	125	Do Not Operate Ldg Gear Above this Speed
V_{LE}	Max Landing Gear Extended Speed	NA	Max Speed with Gear Extended
V_R	Rotation Speed	115	Speed at which the Airplane Lifts Off
V_{REF}	Landing Reference Speed	150	Threshold Crossing Speed
V_S	Stall Speed	130	Min Speed at which the A/C is Controllable
V_{S0}	Stall Speed	110	Stall Speed in Landing Configuration
V_Y	Best Rate-of-Climb	215	Delivers Gain in Altitude in Shortest Time
V_{BE}	Max Speedbrake Extended Speed	430	Do Not Extend Brakes Above this Speed

AIRSPEED INDICATOR OPERATING RANGES

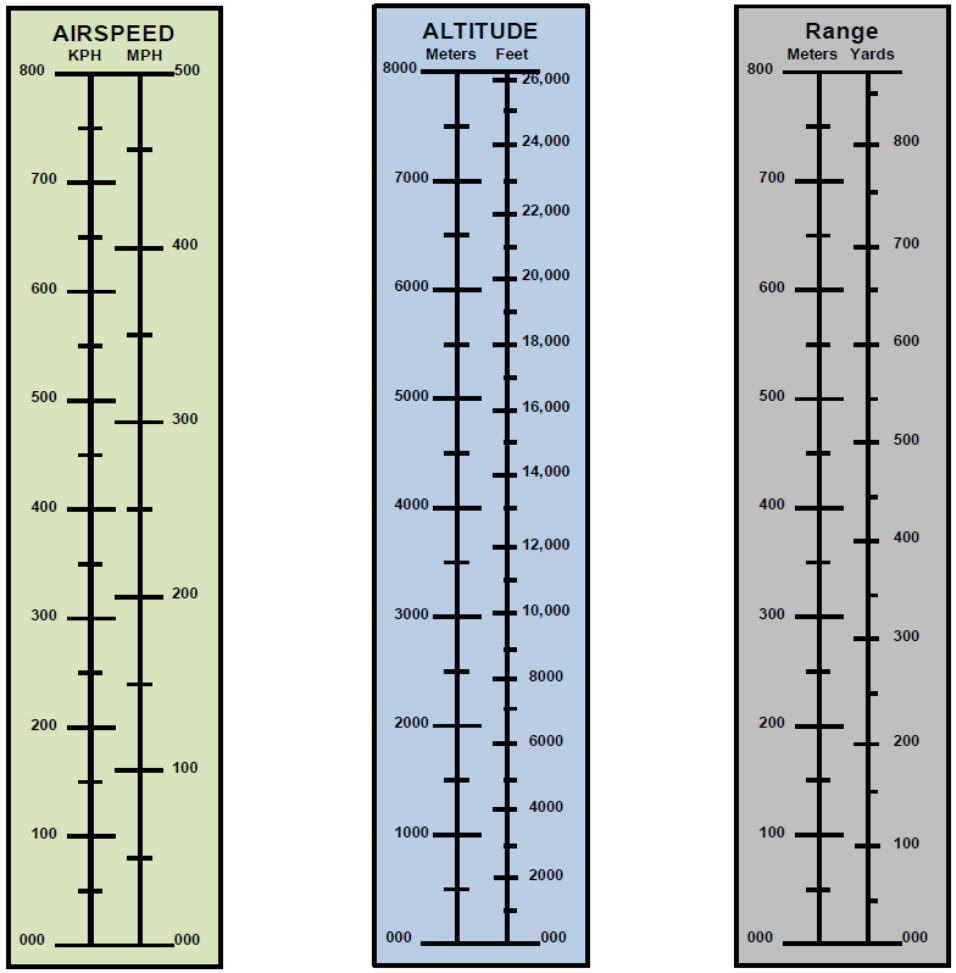
ASI MARKING	KPH Range	Description
White Arc	110 - 150 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V_{S0} . Upper Limit Max Speed w/Flaps Extended.
Green Arc	130 - 600 KPH	Normal Operating Range. Lower Limit is Max. Weight V_S . Upper limit Is Max Structural Cruising Speed.
Red Line	600 KPH	Maximum Speed for ALL operations.

OPERATING DATA

Best Airspeed for Climb							
Sea Level	1000 m	2000 m	3000 m	4000 m	5000 m	6000 m	7000 m
215 kph	205 kph	195kph	185 kph	175 kph	165 kph	155 kph	145kph

PART 9: AIRCRAFT PERFORMANCE

ONE **CONVERSION DATA** ONE



International Civil Aviation Organization International Standard Atmosphere							
Temperature		Altitude Above Sea Level		Atmospheric Pressure			Mach 1
°F	°C	feet	meters	inches Hg	mm Hg	psia	mph
59	15	SL	0	29.92	760	14.70	761
55	13	1000	305	28.86	733	14.17	758
52	11	2000	610	27.82	706	13.67	755
48	9	3000	914	26.82	681	13.17	752
45	7	4000	1219	25.84	656	12.69	750
41	5	5000	1524	24.90	632	12.23	748
38	3	6000	1829	23.98	609	11.78	745
34	1	7000	2134	23.09	586	11.34	742
31	-1	8000	2438	22.22	564	10.92	740
27	-3	9000	2743	21.39	543	10.51	736
23	-5	10000	3048	20.58	523	10.10	734
5	-15	15000	4572	16.89	429	8.29	720
-13	-25	20000	6096	13.75	349	6.75	706
-31	-35	25000	7620	11.10	282	5.45	693
ONE							ONE

PART 10: DIVE BOMBING TUTORIAL

- Dive bombing is an art that was perfected by Stuka pilots of the Blitzkrieg such as the famous Hans-Ulrich Rudel. Here is a tutorial on how to dive bomb using the “Automatic Recovery” system. Don’t worry, it is very simple.

- The “Automatic Recovery System” was a system implemented specifically for dive bombing. But… what is it, and why should you care?

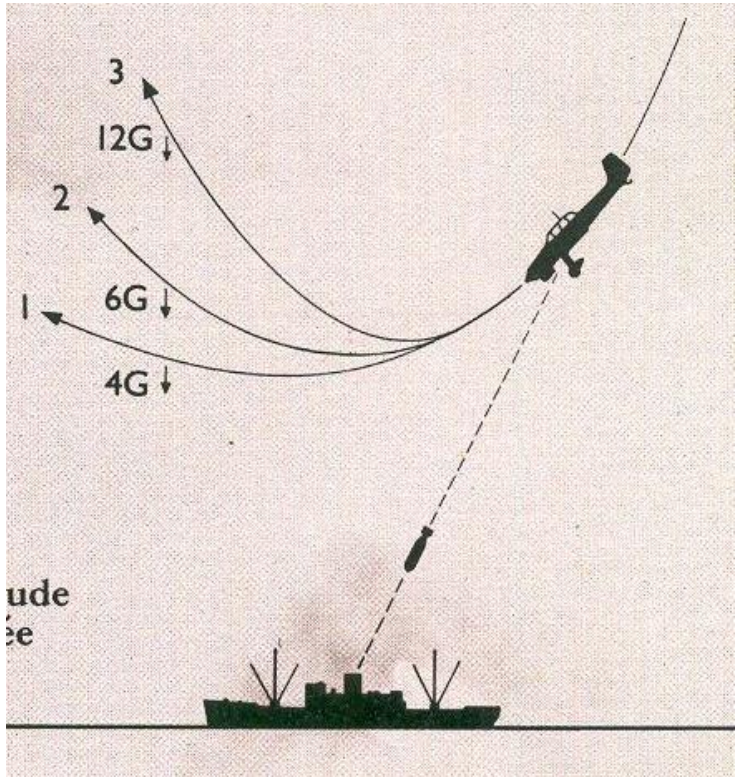
- Dive bombing requires you to dive straight to the ground. In the process, you gain a considerable amount of airspeed. Gaining airspeed isn’t a problem unless you need to change direction. Think of it as a rollercoaster: you are feeling fine when you are at the top, but when you start doing sharp turns, you will feel yourself being crushed into your seat: this is what we call “G” acceleration forces. These g-forces drain blood away from the brain and cause cerebral hypoxia (the pilot will see a black veil, “blacking out”). Pilots could then enter a G-LOC state, which means a “*G-force induced Loss Of Consciousness“.*

- During dive bombing runs, some pilots blacked out because the G-forces were too much for them to handle. A solution was proposed by german engineers: to create a system to force the aircraft to pull away from the dive automatically – which means that even if the pilot momentarily blacks out and cannot control his plane, the aircraft will “naturally” climb back up to safety.

PART 10: DIVE BOMBING TUTORIAL

THIS IS WHAT THEY TEACH IN HOLLYWOOD FLIGHT SCHOOL.

THIS IS HOW PILOTS REALLY DID IT.



- Movies often show the famous “Split S” reversed roll being used as a dive bombing tactic. While it is pretty and cool to look at, it is not very practical as it disorients the pilot needlessly and puts him at risk.
- In real life, pilots would simply spot their target with the floor window open, arm their bombs, set their release altitude and start diving right away by pushing the aircraft’s nose down (by doing it manually or by using the airbrakes, more on that later).
- Always plan your bomb run ahead: know at which altitude you intend to start your dive, and at which altitude you want to pull out of the dive.
- You can set your “bomb release” altitude with the knob under the Bomb Altimeter and the red/white needle. This is when your bombs will be dropped and the aircraft will pull up.
- Typically, bomb runs would be started from about 4,500 m.
- Bomb release altitude is critical: make sure you know what is your target’s altitude so the Automatic Recovery System doesn’t send you crashing into the ground. For instance, if you set your bomb release altitude at 750 m and your target is actually at 800 m, the Automatic Recovery System will only work when it is too late… which is 50 m under the ground. Approximate your target’s altitude using tables next page.
- A minimum **bomb release altitude of 650 m above target** is recommended if you want to stay clear of the bomb blast.
- **Recommended bomb release altitude = Target Altitude + 650 m**

PART 10: DIVE BOMBING TUTORIAL

IL2 STURMOVIK CLIFFS OF DOVER AIRFIELD ELEVATIONS

UK AIRFIELDS

Bembridge	13m	43ft	Manston	44m	14ft
Biggin Hill	179m	587ft	Netheravon	119m	390ft
Boscombe Down	127m	417ft	North Weald	80m	262ft
Canterbury	51m	167ft	Northolt	37m	121ft
Croydon	101m	331ft	Old Sarum	79m	259ft
Eastchurch	7m	23ft	Portsmouth	1m	3ft
Farnborough	77m	253ft	Ramsgate	47m	154ft
Ford	1m	3ft	Reading	46m	151ft
Gatwick	60m	197ft	Redhill	24m	79ft
Gosport	1m	3ft	Rochester	130m	426ft
Gravesend	63m	207ft	Rochford	10m	33ft
Hamble	20m	66ft	Ryde	52m	171ft
Harewell	120m	394ft	Salisbury	131m	430ft
Hawkinge	158m	518ft	Sandown	21m	69ft
Heathrow	23m	75ft	Southhampton	9m	30ft
Hendon	50m	163ft	Tangmere	12m	40ft
Heston	30m	98ft	Thorney Island	1m	3ft
Hornchurch	10m	33ft	Upavon	147m	482ft
Kenley	174m	571ft	Watchfield	100m	328ft
Larkhill	114m	374ft	West Hampnett	21m	69ft
Lee On Solent	10m	33ft	White Waltham	36m	118ft
Littlestone	22m	72ft	Willimington	22m	72ft
Lympne	100m	328ft	Yatesbury	170m	558ft
Maidstone	84m	275ft			

IL2 STURMOVIK CLIFFS OF DOVER AIRFIELD ELEVATIONS

FRENCH AIRFIELDS

Abbeville	61m	200ft	Guines	46m	151ft
Achiet Grevillers	127m	417ft	Haute Fontaine	180m	590ft
Amiens Allonville	89m	292ft	Horm Elingen	161m	528ft
Amiens Glisy	59m	194ft	Hydrequent	78m	256ft
Aras St Liger	109m	358ft	Le Havre Octeville	96m	314ft
Arras	98m	321ft	Le Touquet	1m	3ft
Audembert	42m	138ft	Licescourt	70m	230ft
Barly	122m	400ft	Marquise West	24m	79ft
Barly	112m	367ft	Merville calonne	9m	30ft
Beamont Le Roger	139m	456ft	Monchy Briton	150m	492ft
Beauvais Nivllers	120m	394ft	Montdidier	108m	354ft
Beauvais Tille	99m	325ft	Oye- Plage	2m	7ft
Berk	1m	3ft	Persan Beaumont	42m	138ft
Bernay St Martin	161m	528ft	Peuplinguess	101m	331ft
Bolsjean Ecuires	57m	187ft	Pihen	96m	315ft
Brias	150m	492ft	Plumetot	40m	131ft
Brombos	191m	627ft	Poiy Nord	171m	561ft
Bulougne Alperch	69m	226ft	Querqueville	1m	3ft
Caen Carpiquet	61m	200ft	Rezy Norrent fontes	94m	308ft
Caffiers	112m	367ft	Rosieres En Santifer	82m	269ft
Calais Marck	2m	7ft	Rouen Boos	140m	459ft
Carquebut	20m	197ft	Roye Amy	83m	272ft
Champ Les Guines	75m	246ft	Samer	61m	200ft
Colembert	198m	649ft	Sempy	120m	394ft
Coquelles	13m	43ft	St Inglewert	129m	423ft
Cramont Yurtench	121m	397ft	St Omer Arques	29m	95ft
Crecy	141m	462ft	St Omer Clairmarrias	9m	29ft
Creil	101m	331ft	St Omer Wizennes	78m	256ft
Crepon	59m	194ft	Theville	135m	443ft
Deanville St Gatien	140m	459ft	Tramecourt	126m	413ft
Desures	200m	656ft	Wailly Beauchamp	51m	167ft
Dieppe	101m	331ft	Wissant	21m	69ft
Estree	80m	262ft	Yvrench	110m	361ft
Grandvilliers	180m	590ft	Zuterque	36m	118ft

NOTES

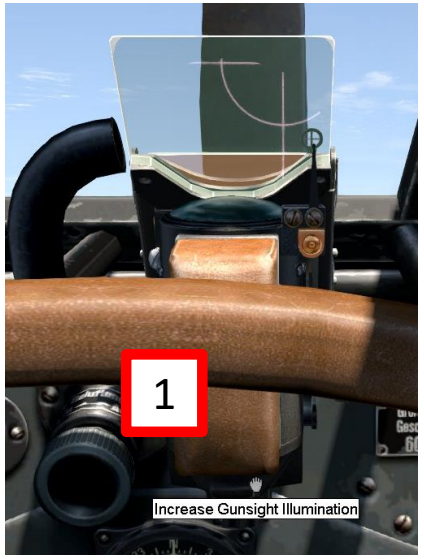
To determine Map QNH. Park on the airfield. Set Altimeter to read the values above. Pressure sub scale is now set to correct QNH for the map.

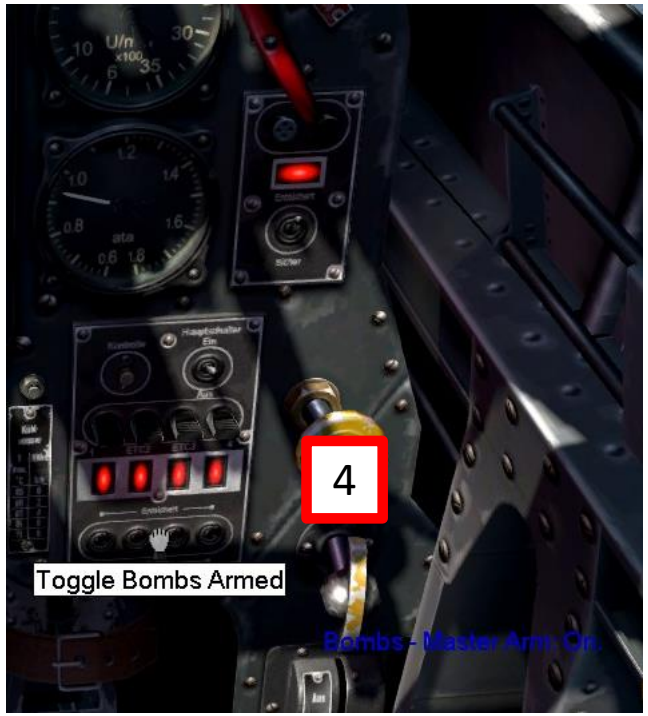
SC/JG_Ivank Oct 2012

PART 10: DIVE BOMBING TUTORIAL

DIVE BOMBING PROCEDURE

1. Make sure your gunsight illumination is ON
2. Open up your floor window (hold left mouse btn)
3. Select the bombs you want to drop on the bomb arming panel (wing bombs or fuselage bomb or both)
4. Arm your bombs (either wing or fuselage bomb arming buttons will do)
5. Set bomb release altitude with the knob on the bomb altimeter. 650 m or more is recommended.
6. Make sure you are trimmed for level flight by using your elevator trim and your variometer (vertical velocity = 0 m/s).
7. Ensure supercharger is in “AUTO” mode.

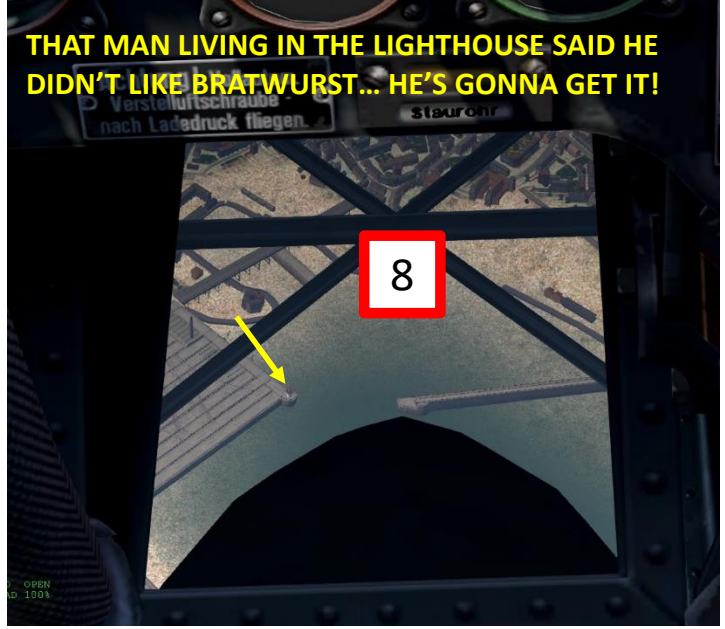


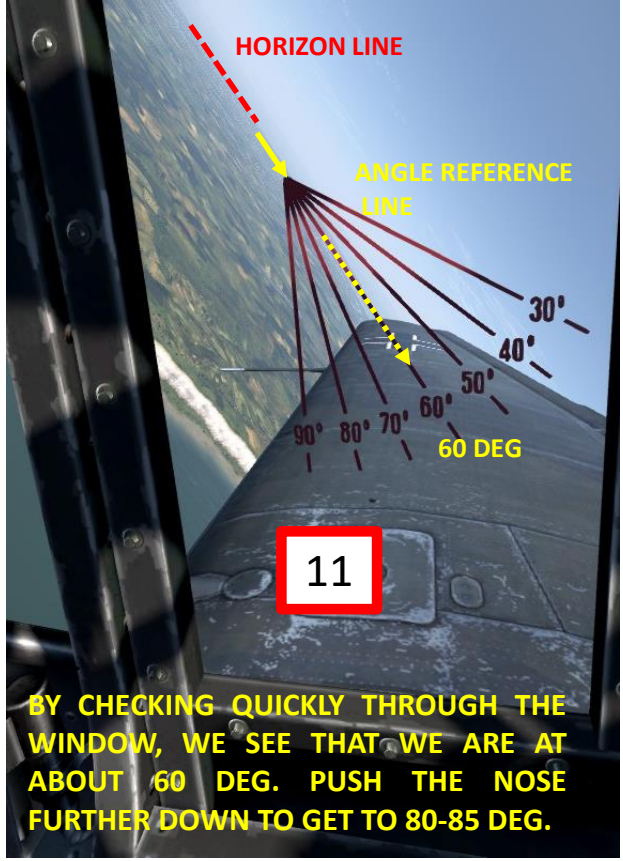


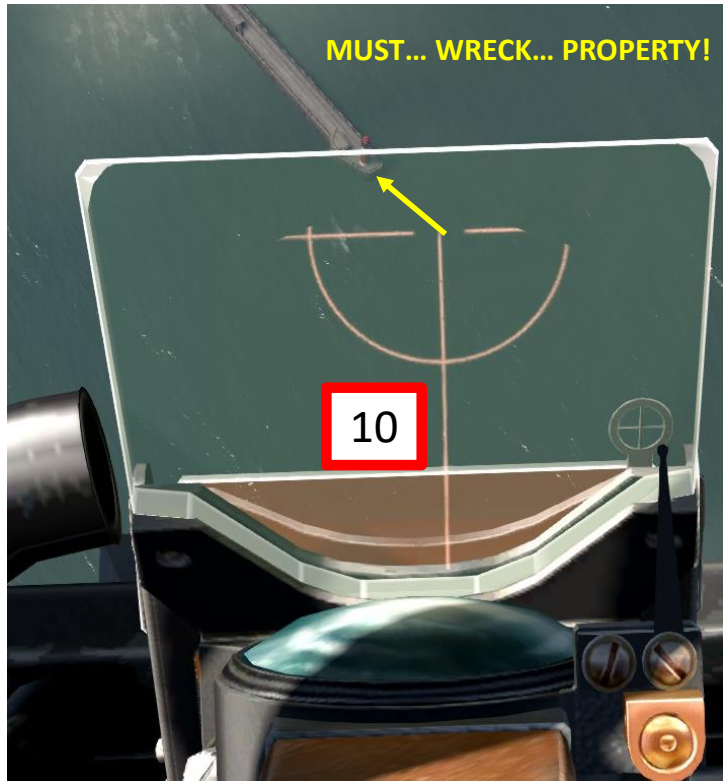
PART 10: DIVE BOMBING TUTORIAL

DIVE BOMBING PROCEDURE

8. Spot your target through the floor window
9. Wait until it disappears, cut throttle to idle and **deploy airbrakes!**
10. Aircraft will start nosing down. Do not touch your elevator trim: use rudder, aileron and elevator input to keep gunsight on target.
11. Maintain optimal dive angle around 85 deg.
12. At 650 m, bombs are dropped and your aircraft will automatically pull up. Retract dive brakes, throttle up and enjoy the fireworks.







PART 10: DIVE BOMBING TUTORIAL

OTHER USEFUL COMMANDS (APPLICABLE TO JU-87)	
DROP BOMBS	B
ARM BOMBS (AXIS BOMBERS ONLY)	L_CTRL+W
SWITCH CREW POSITION (BOMBARDIER/PILOT)	C
LEAN TO GUNSIGHT	JOYSTICK BTN (CUSTOM KEY)
AIRBRAKES TOGGLE	L_CTRL + F
OPEN / CLOSE WINDOW	CUSTOM KEY R_CTRL + N

This layout is created with ease of access in mind. Bombsight altitude, velocity and wind correction are already clickable on the sight itself. This layout should allow the user to go through everything he needs set up instinctively following the numpad from 0 to 9.

CAUTION: MAKE SURE THERE ARE NO CONFLICTS BETWEEN THESE KEYS AND OTHER CONTROLS. YOU WILL HEAR A "PING" WHEN YOU MAP A CONTROL IF THERE IS SUCH A CONFLICT.

CHUCK'S BOMBER NUMPAD (APPLICABLE TO JU-87)

NUM	/ INCREASE DIRECTIONAL GYRO	* DECREASE DIRECTIONAL GYRO	- DECREASE COURSE SETTER
7 BOMB DISTRIBUTOR MODE PREVIOUS	8 BOMB DISTRIBUTOR MODE NEXT	9 TOGGLE BOMB DISTRIBUTOR SHORT DELAY	+ INCREASE COURSE SETTER
4 DECREASE BOMB DISTRIBUTOR DELAY	5 INCREASE BOMB DISTRIBUTOR DELAY	6 INCREASE SIGHT DISTANCE	
1 DECREASE BOMB SALVO QUANTITY	2 INCREASE BOMB SALVO QUANTITY	3 DECREASE SIGHT DISTANCE	ENTER TOGGLE BOMBSIGHT AUTOMATION
0 SELECT BOMB BAY PREVIOUS		. SELECT BOMB BAY NEXT