HEINKEL HE-111 H-2

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 – HE-111

PART 1: AIRCRAFT HISTORY

The **Heinkel He-111** was a German aircraft designed by Siegfried and Walter Günter at Heinkel Flugzeugwerke in the early 1930s. It has sometimes been described as a "wolf in sheep's clothing" because it masqueraded as a cargo plane though its actual purpose was to provide the nascent Luftwaffe with a fast medium bomber… since Germany had been prohibited by the 1919 Treaty of Versailles from having an air force.

PART 1: AIRCRAFT HISTORY

Perhaps the best-recognised German bomber due to the distinctive, extensively glazed "greenhouse" nose of later versions, the Heinkel 111 was the most numerous and the primary Luftwaffe bomber during the early stages of World War II. It fared well until the Battle of Britain, when its weak defensive armament, relatively low speed, and poor manoeuvrability were exposed.

Nevertheless, it proved capable of sustaining heavy damage and remaining airborne. As the war progressed, the He-111 was used in a variety of roles on every front in the European theatre. It was used as a strategic bomber during the Battle of Britain, a torpedo bomber during the Battle of the Atlantic, and a medium bomber and a transport aircraft on the Western, Eastern, Mediterranean, Middle Eastern, and North African Fronts.

PART 1: AIRCRAFT HISTORY

In February 1937, the German Condor Legion began flying in Spain, in support of Franco's Nationalists in the Civil War. The B-2, equipped with 950hp DB 600CG engines, met considerable success in this conflict, infamously with the indiscriminate bombing of Guernica in July. As a result, the Luftwaffe drew exaggerated conclusions from this experience, thinking that masses of medium bombers like the He 111 would be irresistible. In fact, even the vastly more lethal four-engine heavy bombers of the U.S. Eighth Air Force were not sufficient, by themselves, to bring an industrial country to its knees.

In the late 1930s, these early models of the He 111 (the B, D, and E) were considered very fast for the time. Only carrying three machines, they could make a respectable speed. But, in the Battle of Britain, the Hurricanes and Spitfires cut them down, leaving the Luftwaffe with no recourse but to arm the bombers with more defensive firepower: additional machine guns in the nose and tail, and a 20mm cannon in the ventral gondola, necessarily with more crew to serve the guns. And all this slowed the Heinkels considerably. In short, by 1942, the He 111 was an outmoded design, no longer capable of supporting powerful enough engines. And by this time, it was too late to begin development of a replacement, and the Reich continued to crank them out, about 7,000 overall, by late 1944 when almost all bomber production ceased, in favor of desperately needed fighters.

PART 1: AIRCRAFT HISTORY

The H variant of the He 111 series was more widely produced and saw more action during World War II than any other Heinkel variant. Owing to the uncertainty surrounding the delivery and availability of the DB 601 engines, Heinkel switched to 820 kW (1,100 hp) Junkers Jumo 211 powerplants, whose somewhat greater size and weight were regarded as unimportant considerations in a twin-engine design. When the Jumo was fitted to the P model it became the He-111 H.

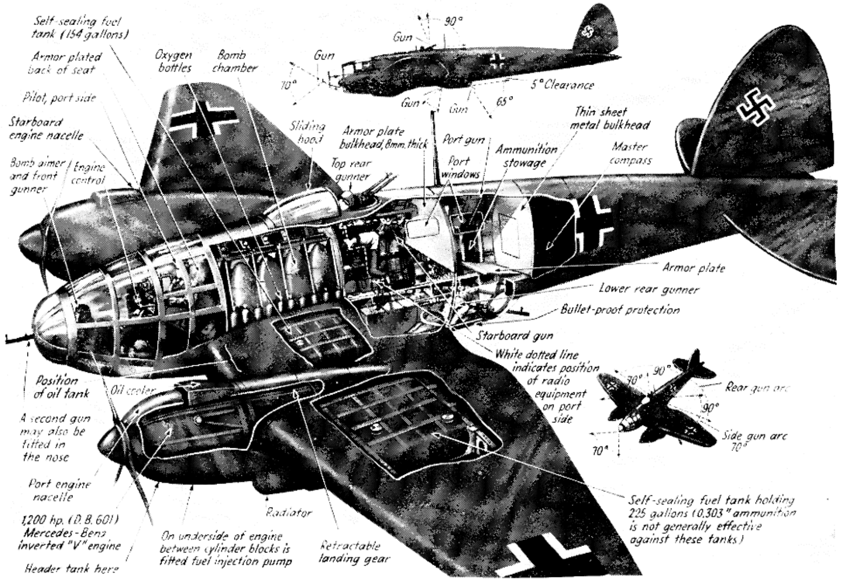
To meet demand for numbers, Heinkel constructed a factory at Oranienburg. On 4 May 1936, construction began, and exactly one year later the first He 111 rolled off the production line. The Ministry of Aviation Luftwaffe administration office suggested that Ernst Heinkel lend his name to the factory. The "Ernst Heinkel GmbH" was established with a share capital of 5,000,000 Reichsmarks (RM). Heinkel was given a 150,000 RM share. The factory itself was built by, and belonged to, the German state. Heinkel wrote in his memoirs: “"1940s production suffered extreme losses during the Battle of Britain, with 756 bombers lost“.

PART 1: AIRCRAFT HISTORY

Although constantly upgraded, the Heinkel He-111 became obsolete during the latter part of the war. It was intended to be replaced by the Luftwaffe's Bomber B project, but the delays and eventual cancellation of the project forced the Luftwaffe to continue using the He-111 until the end of the war.

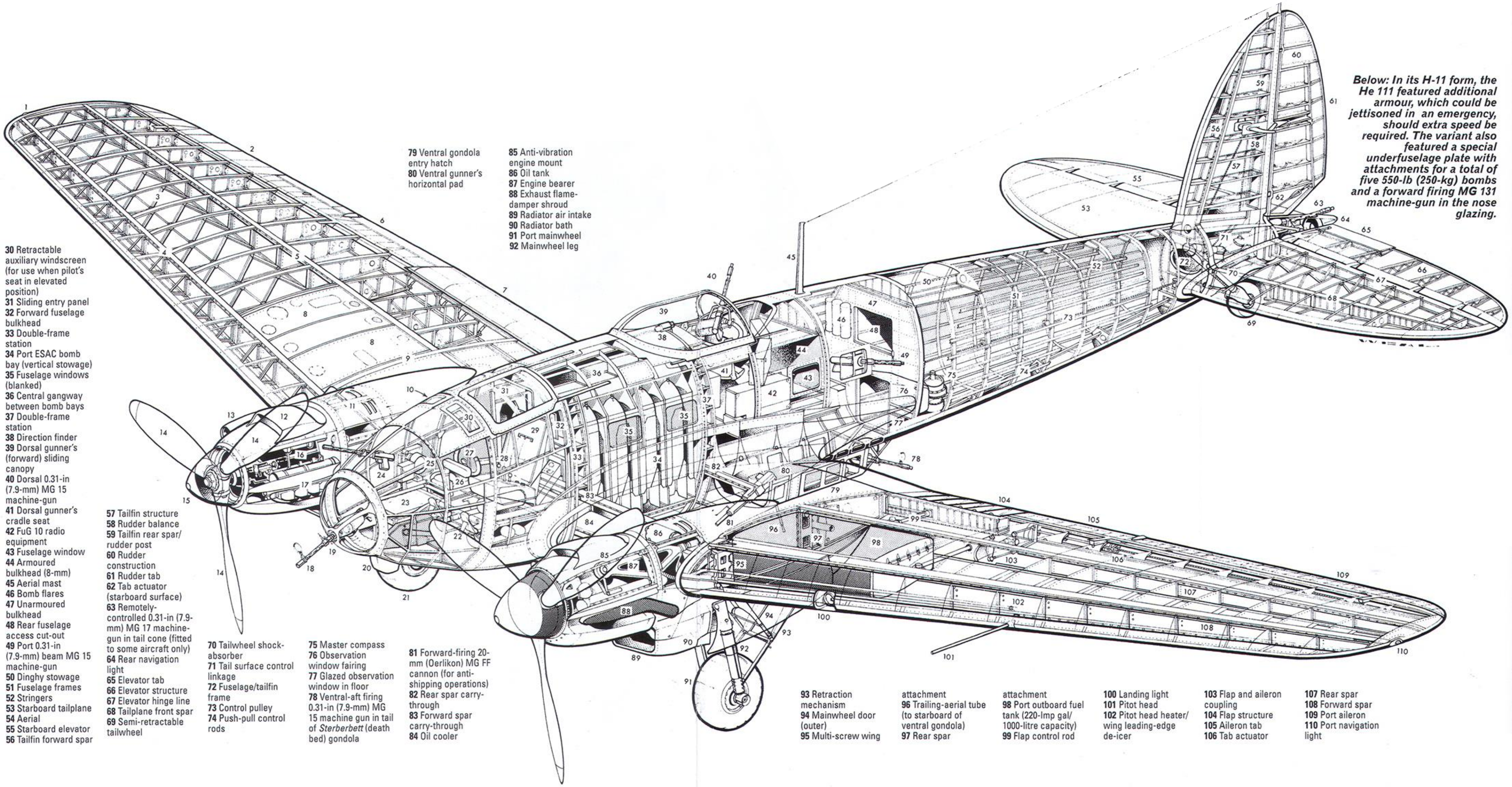
PART 2: AIRCRAFT VARIANTS

	(Unit)	HE-111 H-2	HE-111 P-2
TEMPERATURES			
Water Rad Min Max	Deg C	38 95	40 100
Oil Rad (OUTBOUND) Min Max	Deg C	35 95	40 105
ENGINE SETTINGS			
Engine & Fuel grade		Jumo 211 A-1 B-4 - 87 octane fuel	DB601 A-1 B-4 - 87 octane fuel
Takeoff RPM	RPM	2400	2400
Takeoff Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.35	1.3
Climb RPM	RPM	2300 30 min MAX	2300 30 min MAX
Climb Manifold Pressure	UK: PSI GER: ATA	1.15	1.23
Normal Operation/Cruise RPM	RPM	2200	2200
Normal Operation/Cruise Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.10	1.15
Combat RPM	RPM	2300	2400 5 min MAX
Combat Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	1.15	1.3 5 min MAX
Emergency Power/ Boost RPM @ km	RPM	2400 1 min MAX	2400 1 min MAX
Emergency Power / Boost Manifold Pressure @ Sea Level	UK: PSI GER: ATA ITA: mm HG	1.35 1 min MAX	1.4 1 min MAX
Supercharger Stage 1 Operation Altitude	UK: ft GER: M	0 1220	N/A
Supercharger Stage 2 Operation Altitude	UK: ft GER: M ITA: M	1220+	N/A
Landing Approach RPM	RPM	2300	2300
Landing Approach Manifold Pressure	UK: PSI GER: ATA ITA: mm HG	As required	As required
Notes & Peculiarities		Eng. very sensitive to ata/rpm	Eng. very sensitive to ata/rpm One less gun in nose turret



The HE 111 mounts two 7.9 mm. guns forward in the fuselage; two 7.9's at top rear; one or two 7.9's or one 7.9 and a 20 mm. cannon in the belly; a 7.9 for each side; and sometimes a 7.9 or grenade tube in the tail. The latter is fired by a remote control device.

PART 2: AIRCRAFT VARIANTS



He 111H-3

Cutaway key
1 Starboard navigation light
2 Starboard aileron
3 Wing ribs
4 Forward spar
5 Rear spar
6 Aileron tab
7 Starboard flap
8 Fuel tank access panel
9 Wing centre section/outer panel break line
10 Inboard fuel tank (154-Imp gal/700-litre capacity) position between nacelle and fuselage
11 Oil tank cooling louvres
12 Oil cooler air intake
13 Supercharger air intake
14 Three-bladed VDM airscrew
15 Airscrew pitch-change mechanism
16 Junkers Jumo 211D-1 12-cylinder, inverted-vee, liquid-cooled engine
17 Exhaust manifold
18 Nose-mounted 0.31-in (7.9-mm) MG 15 machine-gun
19 Ikaria ball-and-socket gun mounting (offset to starboard)
20 Bomb sight housing (offset to starboard)
21 Starboard mainwheel
22 Rudder pedals
23 Bomb aimer's horizontal pad
24 Additional 0.31-in (7.9-mm) MG-15 machine-gun (fitted by forward maintenance units)
25 Repeater compass
26 Bomb aimer's folding seat
27 Control column
28 Throttles
29 Pilot's seat
30 Retractable auxiliary windscreen (for use when pilot's seat in elevated position)
31 Sliding entry panel
32 Forward fuselage bulkhead
33 Double-frame station
34 Port ESAC bomb bay (vertical stowage)
35 Fuselage windows (blanked)
36 Central gangway between bomb bays
37 Double-frame station
38 Direction finder
39 Dorsal gunner's (forward) sliding canopy
40 Dorsal 0.31-in (7.9-mm) MG 15 machine-gun
41 Dorsal gunner's cradle seat
42 FuG 10 radio equipment
43 Fuselage window
44 Armoured bulkhead (8-mm)
45 Aerial mast
46 Bomb flares
47 Unarmoured bulkhead
48 Rear fuselage access cut-out
49 Port 0.31-in (7.9-mm) beam MG 15 machine-gun
50 Dinghy stowage
51 Fuselage frames
52 Stringers
53 Starboard tailplane
54 Aerial
55 Starboard elevator
56 Tailfin forward spar
57 Tailfin structure
58 Rudder balance
59 Tailfin rear spar/rudder post
60 Rudder construction
61 Rudder tab
62 Tab actuator (starboard surface)
63 Remotely-controlled 0.31-in (7.9-mm) MG 17 machine-gun in tail cone (fitted to some aircraft only)
64 Rear navigation light
65 Elevator tab
66 Elevator structure
67 Elevator hinge line
68 Tailplane front spar
69 Semi-retractable tailwheel
70 Tailwheel shock-absorber
71 Tail surface control linkage
72 Fuselage/tailfin frame
73 Control pulley
74 Push-pull control rods
75 Master compass
76 Observation window fairing
77 Glazed observation window in floor
78 Ventral-aft firing 0.31-in (7.9-mm) MG 15 machine gun in tail of *Sterberbett* (death bed) gondola
79 Ventral gondola entry hatch
80 Ventral gunner's horizontal pad
81 Forward-firing 20-mm (Oerlikon) MG FF cannon (for anti-shipping operations)
82 Rear spar carry-through
83 Forward spar carry-through
84 Oil cooler
85 Anti-vibration engine mount
86 Oil tank
87 Engine bearer
88 Exhaust flame-damper shroud
89 Radiator air intake
90 Radiator bath
91 Port mainwheel
92 Mainwheel leg
93 Retraction mechanism
94 Mainwheel door (outer)
95 Multi-screw wing attachment
96 Trailing-aerial tube (to starboard of ventral gondola)
97 Rear spar attachment
98 Port outboard fuel tank (220-Imp gal/1000-litre capacity)
99 Flap control rod
100 Landing light
101 Pitot head
102 Pitot head heater/wing leading-edge de-icer
103 Flap and aileron coupling
104 Flap structure
105 Aileron tab
106 Tab actuator
107 Rear spar
108 Forward spar
109 Port aileron
110 Port navigation light

Below: In its H-11 form, the He 111 featured additional armour, which could be jettisoned in an emergency, should extra speed be required. The variant also featured a special underfuselage plate with attachments for a total of five 550-lb (250-kg) bombs and a forward firing MG 131 machine-gun in the nose glazing.

PART 2: AIRCRAFT VARIANTS

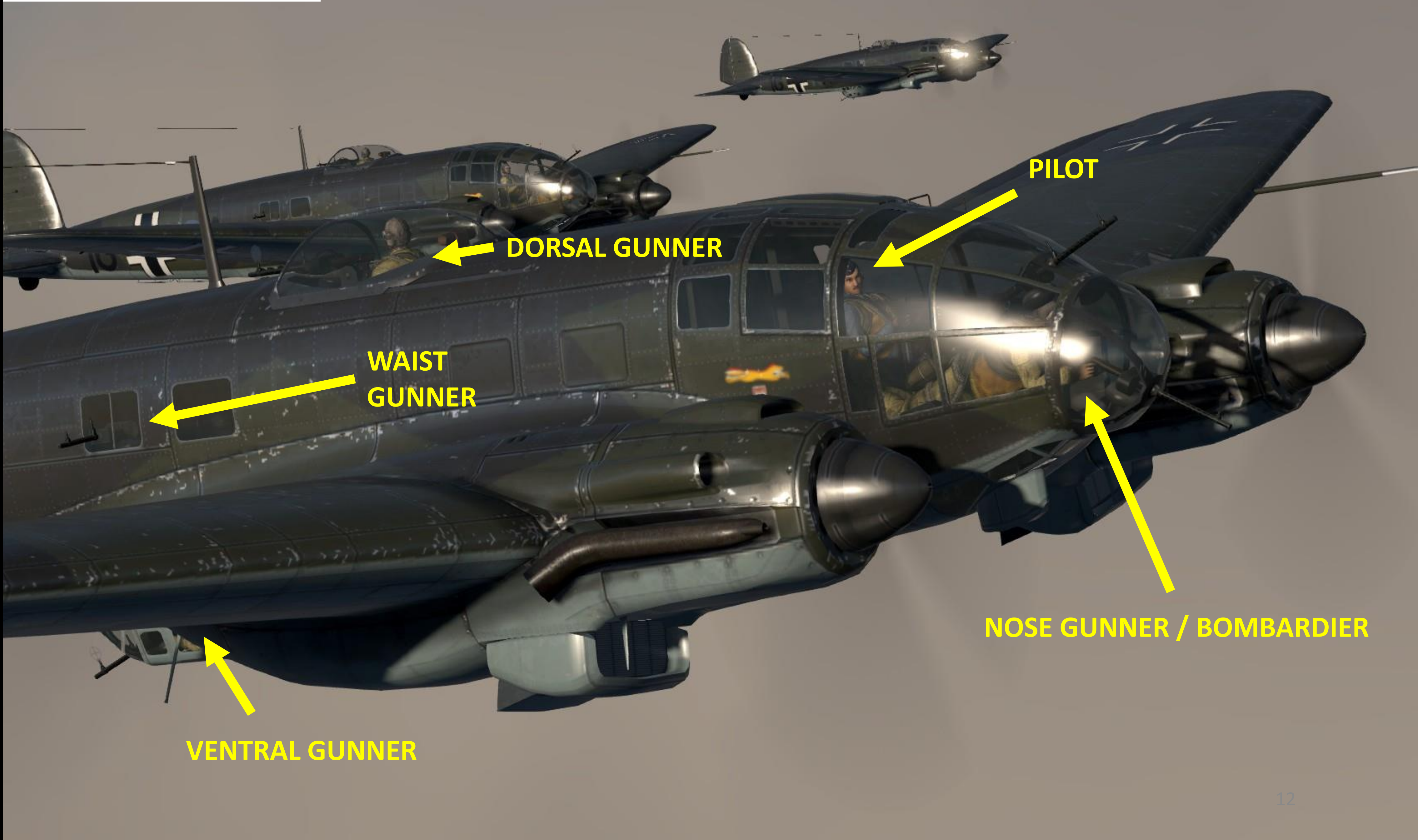
HE-111H-2

HE-111P-2

The P-2 version, unlike its name might suggest, is in fact an earlier version of the H-2.
Differences with H-2 are: Different engine, less guns in nose, different supercharger.

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

CREW MEMBERS



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

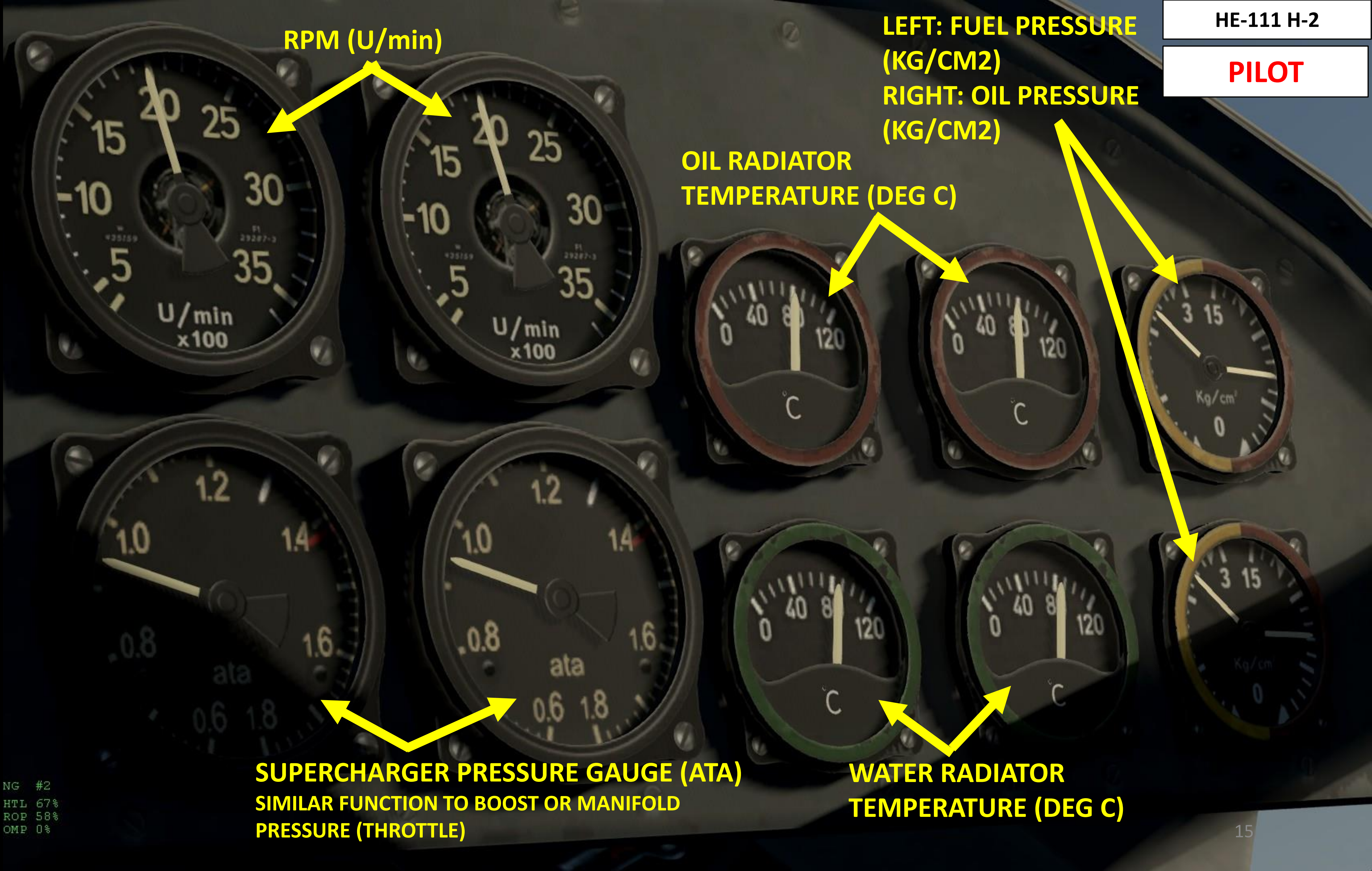
HE-111 H-2

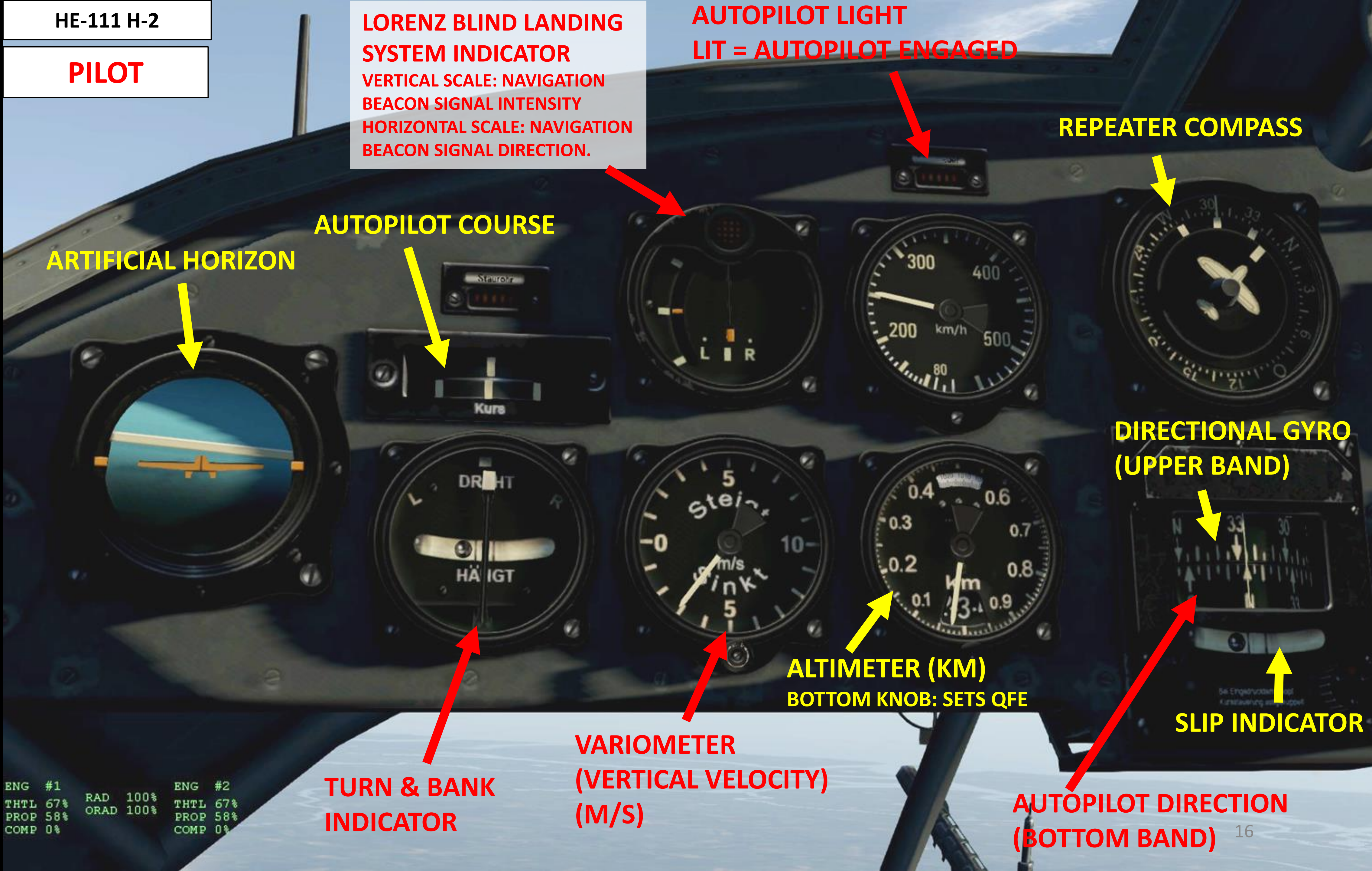
PILOT

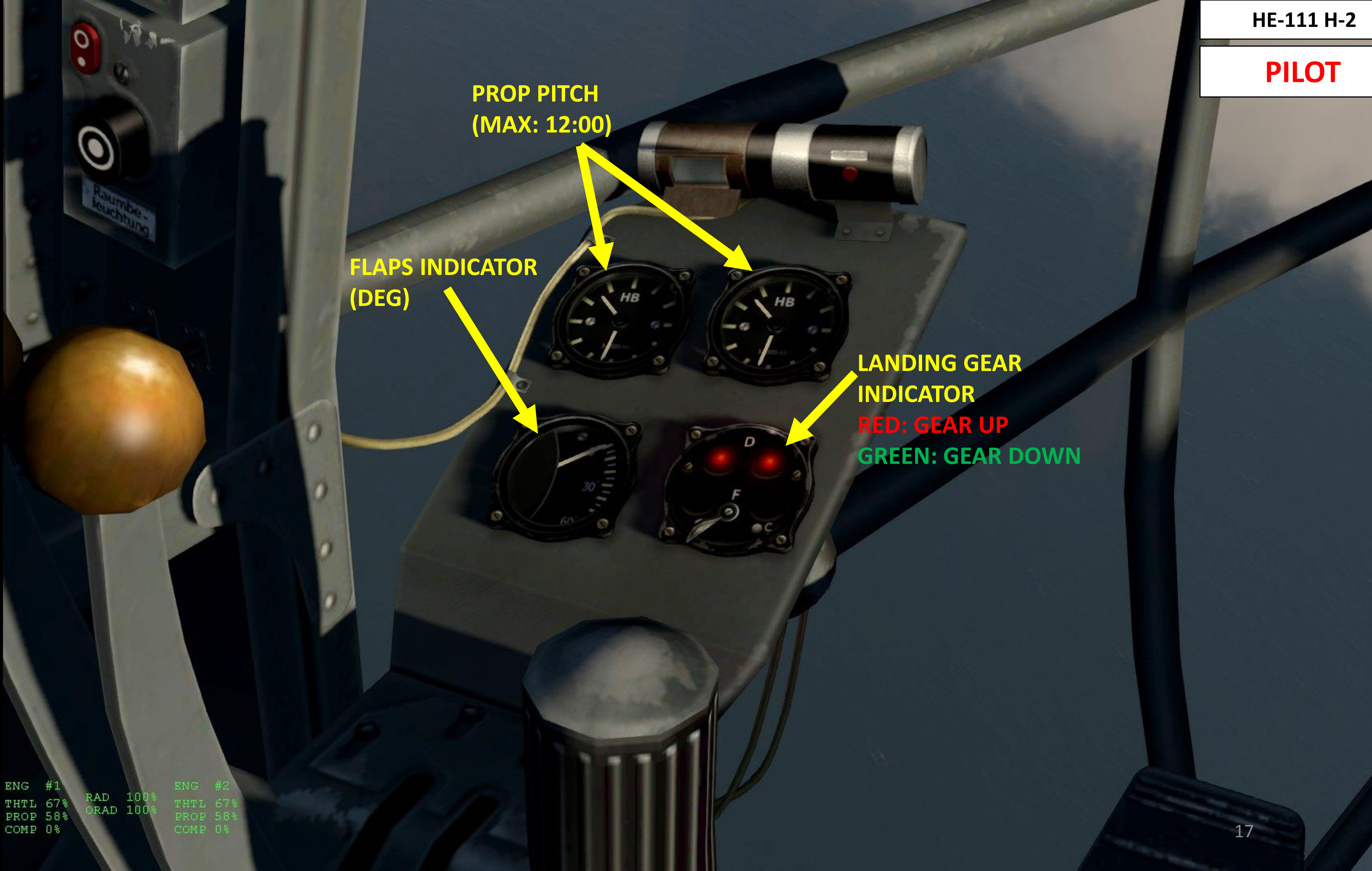
HE-111 H-2

PILOT

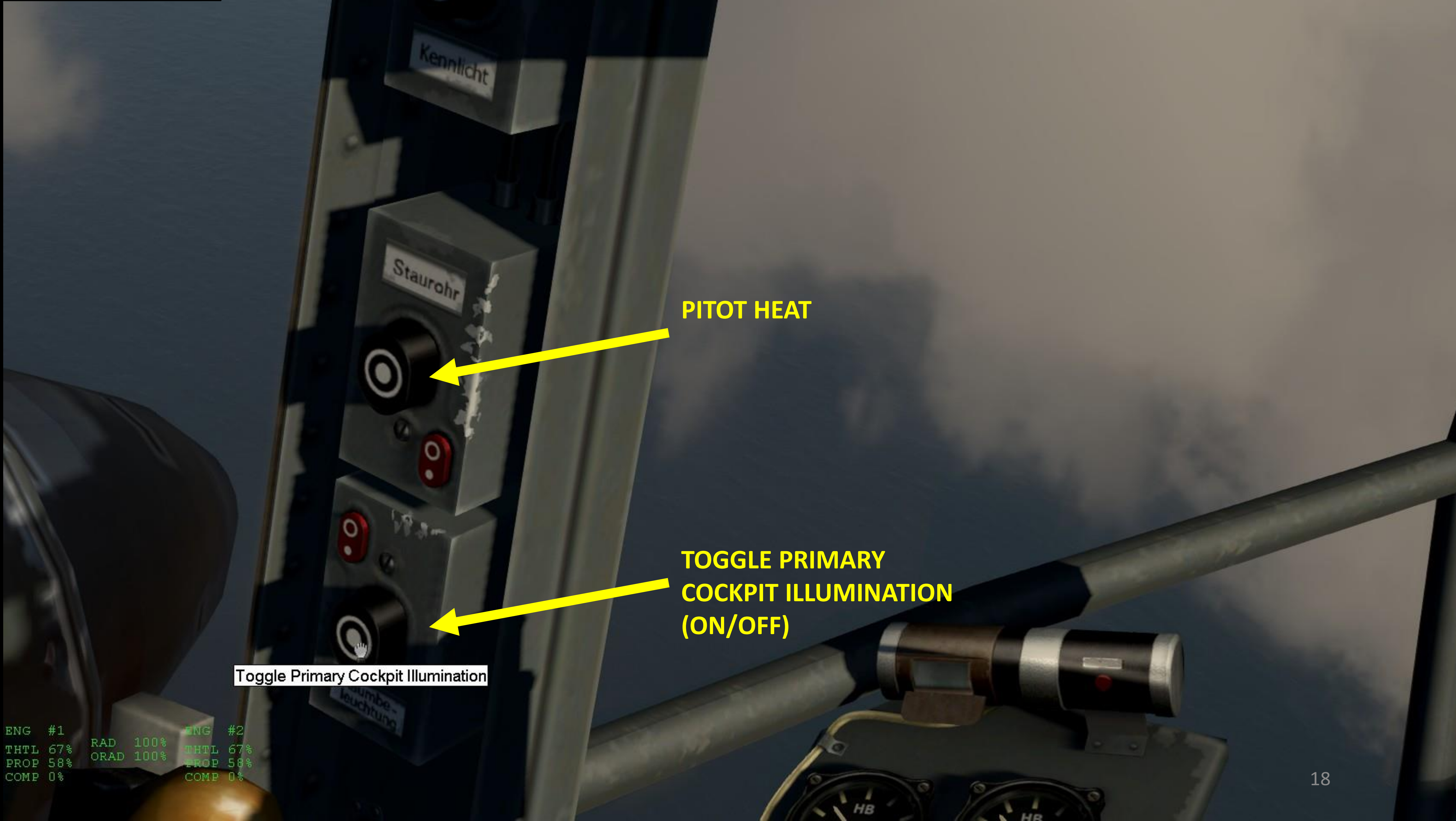
PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION




HE-111 H-2
PILOT
LORENZ BLIND LANDING SYSTEM INDICATOR
VERTICAL SCALE: NAVIGATION BEACON SIGNAL INTENSITY
HORIZONTAL SCALE: NAVIGATION BEACON SIGNAL DIRECTION.
AUTOPILOT LIGHT
LIT = AUTOPILOT ENGAGED
REPEATER COMPASS
AUTOPILOT COURSE
ARTIFICIAL HORIZON
DIRECTIONAL GYRO (UPPER BAND)
ALTIMETER (KM)
BOTTOM KNOB: SETS QFE
SLIP INDICATOR
VARIOMETER (VERTICAL VELOCITY) (M/S)
TURN & BANK INDICATOR
AUTOPILOT DIRECTION (BOTTOM BAND)
ENG #1
THTL 67%
PROP 58%
COMP 0%
RAD 100%
ORAD 100%
ENG #2
THTL 67%
PROP 58%
COMP 0%


PROP PITCH
(MAX: 12:00)
FLAPS INDICATOR
(DEG)
LANDING GEAR
INDICATOR
RED: GEAR UP
GREEN: GEAR DOWN
ENG #1
THTL 67%
PROP 58%
COMP 0%
RAD 100%
ORAD 100%
ENG #2
THTL 67%
PROP 58%
COMP 0%

PILOT


Kennlicht
Staurohr
PITOT HEAT
TOGGLE PRIMARY COCKPIT ILLUMINATION (ON/OFF)
Toggle Primary Cockpit Illumination
ENG #1
THTL 67%
PROP 58%
COMP 0%
RAD 100%
ORAD 100%
ENG #2
THTL 67%
PROP 58%
COMP 0%

PILOT

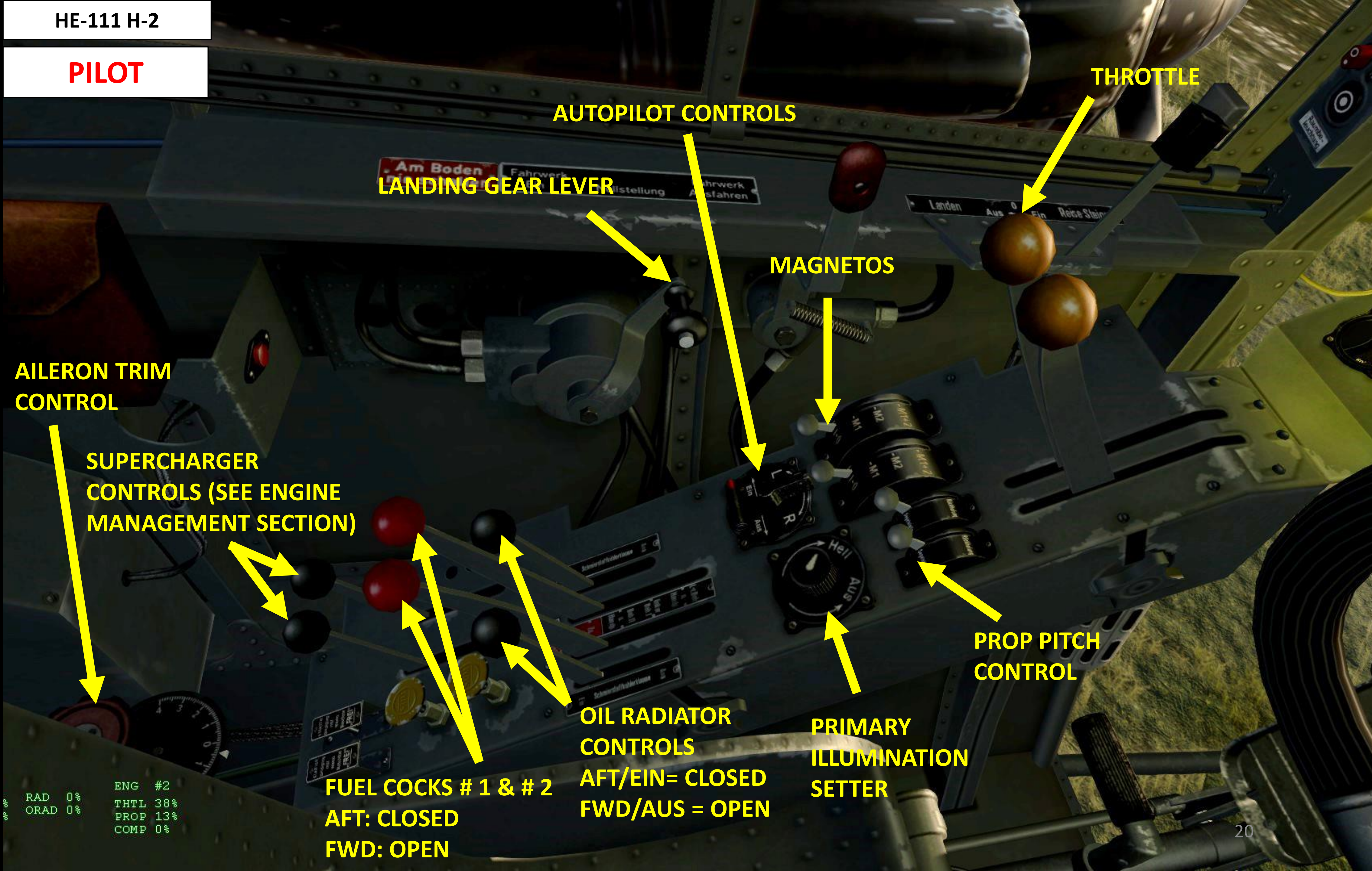
FLAPS LEVER
LANDEN: DOWN
0: NEUTRAL
REISE: UP

NOTE: FLAPS USE HYDRAULIC POWER. YOU HAVE THREE SETTINGS: UP, NEUTRAL AND DOWN. IN REAL LIFE, YOU WOULD OPERATE FLAPS BY HOLDING THE LEVER IN THE UP OR DOWN POSITION, AND RETURN THE LEVER IN THE "NEUTRAL" POSITION ONCE THE FLAPS ARE IN THE DESIRED POSITION. OBVIOUSLY, YOU WILL SIMPLY WEAR DOWN YOUR HYDRAULIC PUMPS IF YOU KEEP YOUR FLAPS IN THE "UP" POSITION INSTEAD OF THE CORRECT "NEUTRAL" POSITION.

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

HE-111 H-2

PILOT



PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

HE-111 H-2

PILOT

RUDDER TRIM CONTROL

FUEL COCK # 4 (SHORT)
SELECTS WHERE TO TRANSFER FUEL TO
SEE ENGINE MANAGEMENT SECTION

WATER RADIATOR CONTROLS

FUEL COCK # 3 (LONG)
SELECTS WHERE TO TRANSFER FUEL FROM
SEE ENGINE MANAGEMENT SECTION

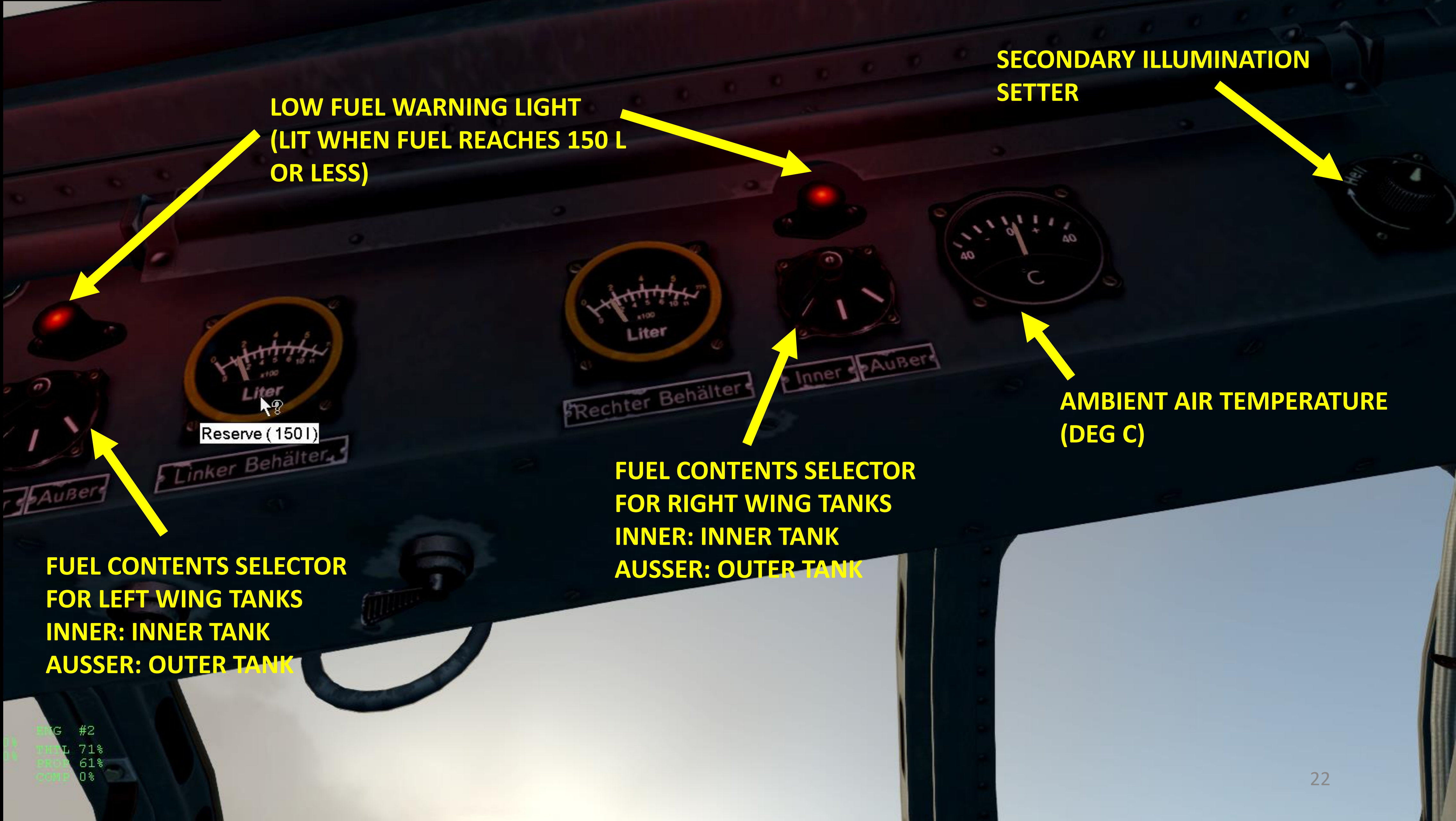
HAND PUMP
USE WHEN LANDING GEAR FAILS TO RETRACT COMPLETELY. YOU WILL NOTICE THAT THE LANDING GEAR INDICATOR LIGHT WILL BE NEITHER RED NOR GREEN, WHICH MEANS THAT THE LANDING IS NOT COMPLETELY RETRACTED AND NOT COMPLETELY DEPLOYED.

ELEVATOR TRIM WHEEL

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

HE-111 H-2

PILOT



HE-111 H-2

PILOT

HOW TO READ A FUEL GAUGE:

- FUEL CONTENT SELECTOR SET TO “INNER” FOR INNER TANKS OR “AUSSER” FOR OUTER TANKS.
- FUEL GAUGE READS “LINKER” FOR THE LEFT TANKS OR “RECHTER” FOR THE RIGHT TANKS.
- READ THE UPPER SCALE OF THE FUEL GAUGE IF THE INNER TANK IS SELECTED (GOES FROM 0 TO 6 x 100 L)
- READ THE LOWER SCALE OF THE FUEL GAUGE IF THE OUTER TANK IS SELECTED (GOES FROM 0 TO 10 X 100 L)

HE-111 H-2

PILOT

A sweet feature of the He-111 is the sliding hatch. If you press your "**hatch toggle**" key and hit the "**Raise Seat**" (custom key needs to be mapped for that one in
CONTROLS OPTIONS –> VIEW -> RAISE SEAT
You will be able to look above the fuselage. It`s useful if you are having visibility issues during critical phases of flight.

The pilot's seat could actually be elevated, with the pilot's eyes above the level of the upper glazing, complete with a small pivoted windscreen panel, to get the pilot's head above the level of the top of the "glass tunnel" for a better forward view during takeoffs and landings.

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

HE-111 H-2

BOMBARDIER

HE-111 H-2

BOMBARDIER LOWER NOSE GUN

NOSE GUNNER CONTROLS

- -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**

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

HE-111 H-2

BOMBARDIER UPPER NOSE GUN

NOSE GUNNER CONTROLS

-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**

HE-111 H-2

DORSAL GUNNER

DORSAL GUNNER CONTROLS

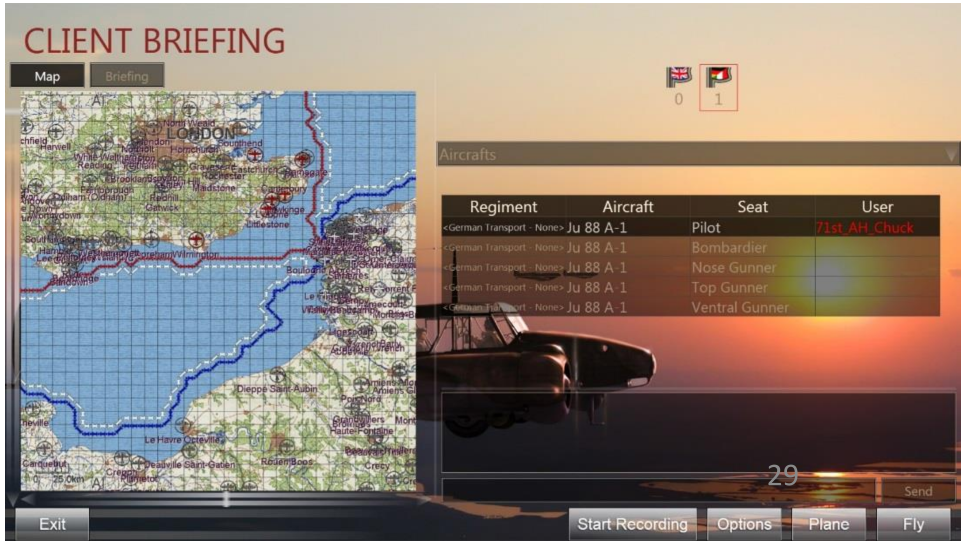
-CRUISE POSITION: **O**
-FIRING POSITION: **CUSTOM KEY**
-LEAN TO GUNSIGHT: **CUSTOM KEY**
-FIRE WEAPON: **LEFT MOUSE BUTTON**
-SWITCH GUNNER/BOMBARDIER POSITION: **C**
-CHANGE MANNED POSITION: **L_SHIFT_C**
-GIVE GUNNER CONTROL TO AI: **L_ALT+F2**
-TAKE CONTROL OF GUN (TOGGLE INDEPENDENT MODE): **F10**

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

TURRET IN
“FIRING” POSITION

TURRET IN
“CRUISE” POSITION

- Your dorsal 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.
- 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”.



HE-111 H-2

VENTRAL GUNNER

VENTRAL GUNNER CONTROLS

-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**

HE-111 H-2

WAIST GUNNER STARBOARD GUN

WAIST GUNNER CONTROLS

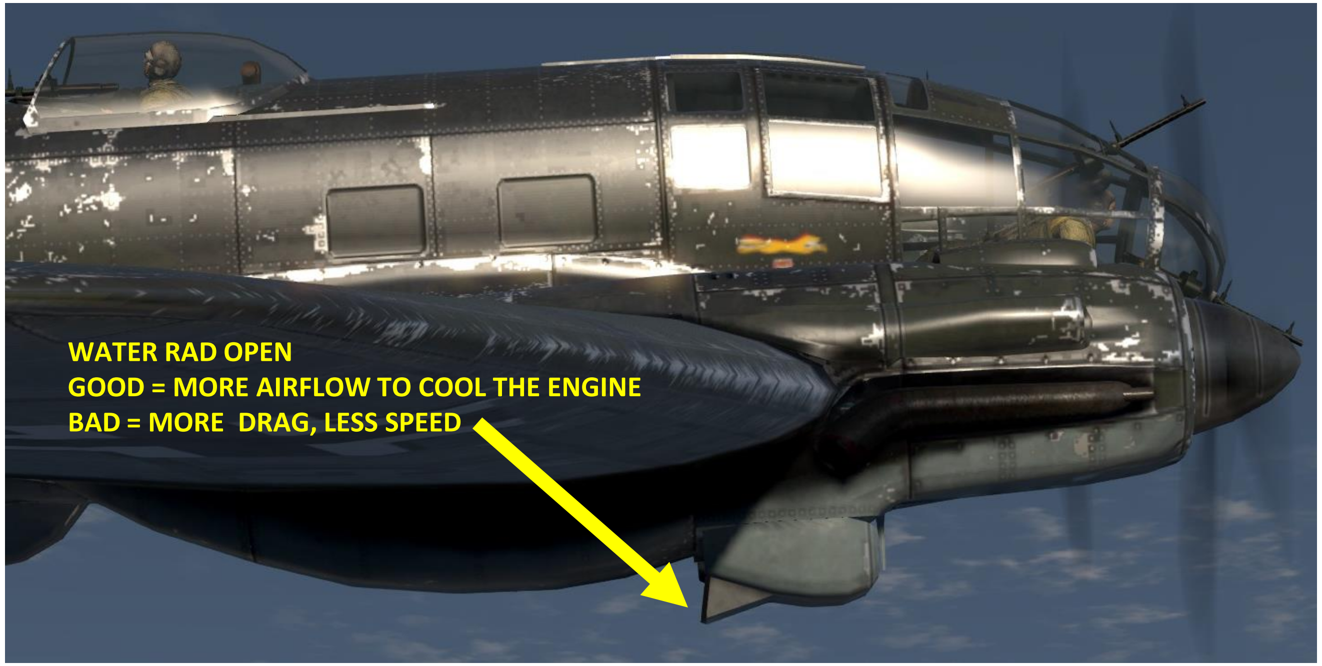
- -LEAN TO GUNSIGHT: **CUSTOM KEY**
- -FIRE WEAPON: **LEFT MOUSE BUTTON**
- -SWITCH GUNNER/BOMBARDIER POSITION: **C**
- -CHANGE MANNED POSITION: **L_SHIFT_C**
- -GIVE GUNNER CONTROL TO AI: **L_ALT+F2**
- -TAKE CONTROL OF GUN (TOGGLE INDEPENDENT MODE): **F10**

PART 3: AIRCRAFT & COCKPIT FAMILIARIZATION

HE-111 H-2

WAIST GUNNER PORTSIDE GUN

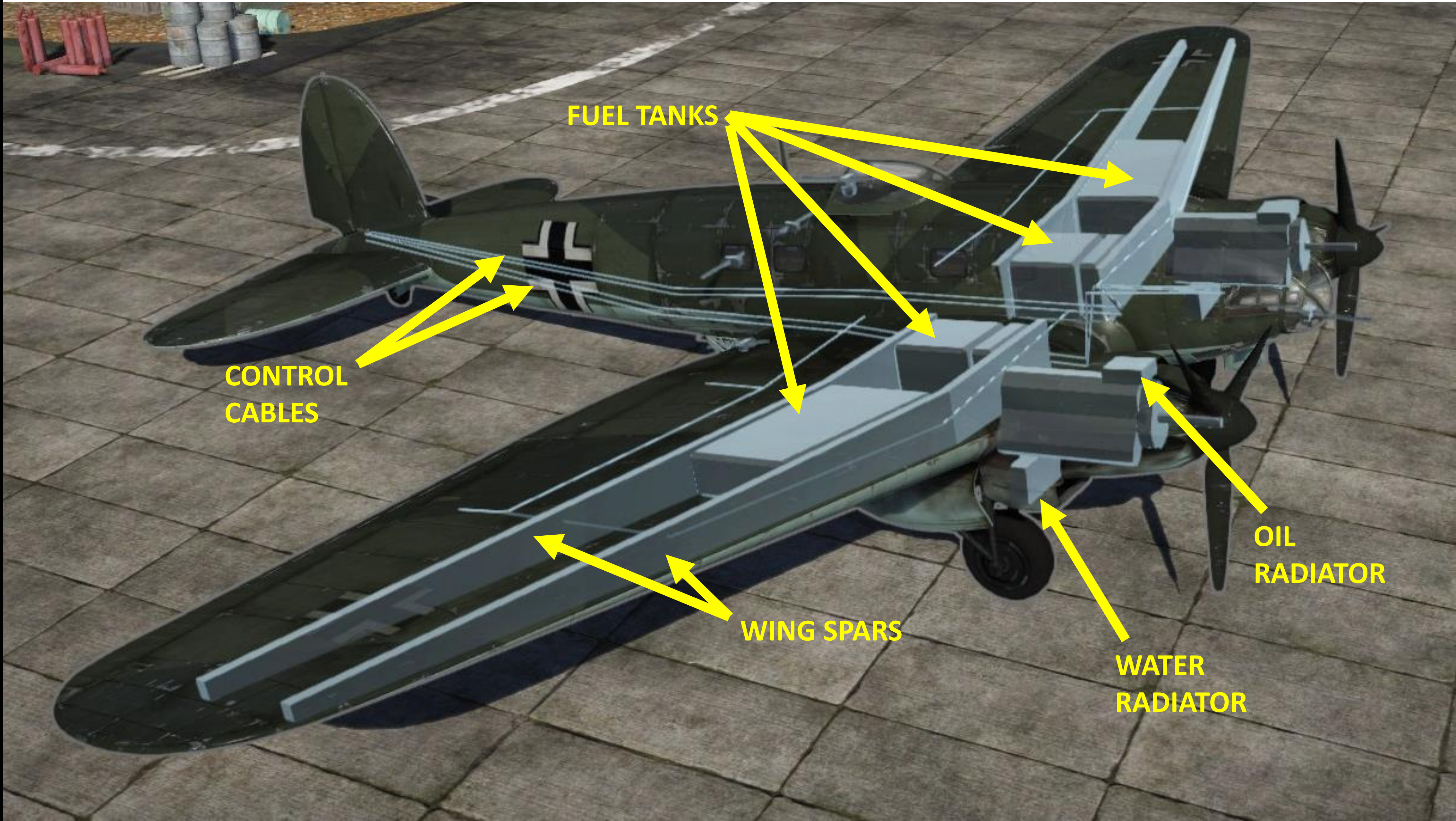
WAIST GUNNER CONTROLS
-LEAN TO GUNSIGHT: **CUSTOM KEY**
-FIRE WEAPON: **LEFT MOUSE BUTTON**
-SWITCH GUNNER/BOMBARDIER POSITION: **C**
-CHANGE MANNED POSITION: **L_SHIFT_C**
-GIVE GUNNER CONTROL TO AI: **L_ALT+F2**
-TAKE CONTROL OF GUN (TOGGLE INDEPENDENT MODE): **F10**


WATER RAD OPEN
GOOD = MORE AIRFLOW TO COOL THE ENGINE
BAD = MORE DRAG, LESS SPEED


WATER RAD CLOSED
GOOD = LESS DRAG, MORE SPEED
BAD = LESS AIRFLOW TO COOL THE ENGINE,
HIGH RISK OF ENGINE OVERHEAT

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 HE-111 (ALL VARIANTS)

DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
Wheel Chocks		ESSENTIAL
toggle primary cockpit illumination		CLICKABLE IN COCKPIT
toggle secondary cockpit illumination		CLICKABLE IN COCKPIT
Drop ordnance (bombs)	B	ESSENTIAL
Fuel Cock Toggle #1 #2		CLICKABLE IN COCKPIT
Fuel Cock Toggle #3 #4		CLICKABLE IN COCKPIT
toggle selected engine (ignition)	"I" by default	ESSENTIAL
directional controls (ailerons, elevators, and rudder)	Joystick & Rudder Pedal axes	ESSENTIAL
Trim controls (elevator/rudder)	Joystick hat switch	ESSENTIAL
Field of View + (allows you to zoom out)		ESSENTIAL
Field of View – (allows you to zoom in)		ESSENTIAL
engine #1 select	L_SHIFT+1	ESSENTIAL
engine #2 select	L_SHIFT+2	ESSENTIAL
all engines select	L_SHIFT+3 (CUSTOM)	ESSENTIAL

PART 4: CONTROLS

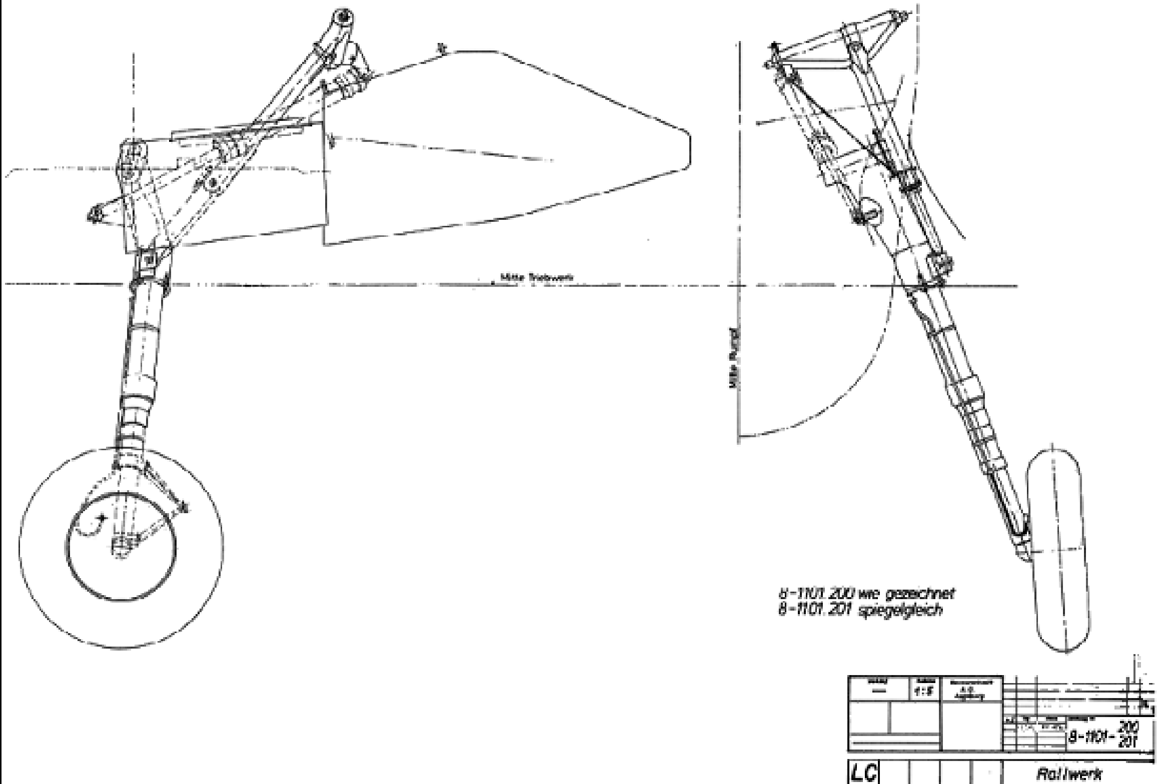
JUNKERS HE-111 (ALL VARIANTS)		
DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
lean to gunsight		ESSENTIAL
throttle	Throttle axis	ESSENTIAL
toggle canopy/hatch		ESSENTIAL
Jettison canopy		ESSENTIAL
Open oil radiator	Right Arrow keyboard	ESSENTIAL
close oil radiator	Left Arrow keyboard	ESSENTIAL
open radiator	Up Arrow keyboard	ESSENTIAL
close radiator	Down Arrow keyboard	ESSENTIAL
increase propeller pitch	Usually set to Axis for second throttle. Set to keyboard otherwise.	ESSENTIAL
decrease propeller pitch		ESSENTIAL
Toggle undercarriage (landing gear)		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
External View (Give Turret Gunner Control to AI)	L_ALT+F2	ESSENTIAL
View-Position #1 (pilot)	L_ALT+1	ESSENTIAL
View-position #2 (bombardier)	L_ALT+2	ESSENTIAL
View-position #6 (ventral gunner)	L_ALT+4	ESSENTIAL
Next Manned Position (Cycles through air crew)	C	ESSENTIAL

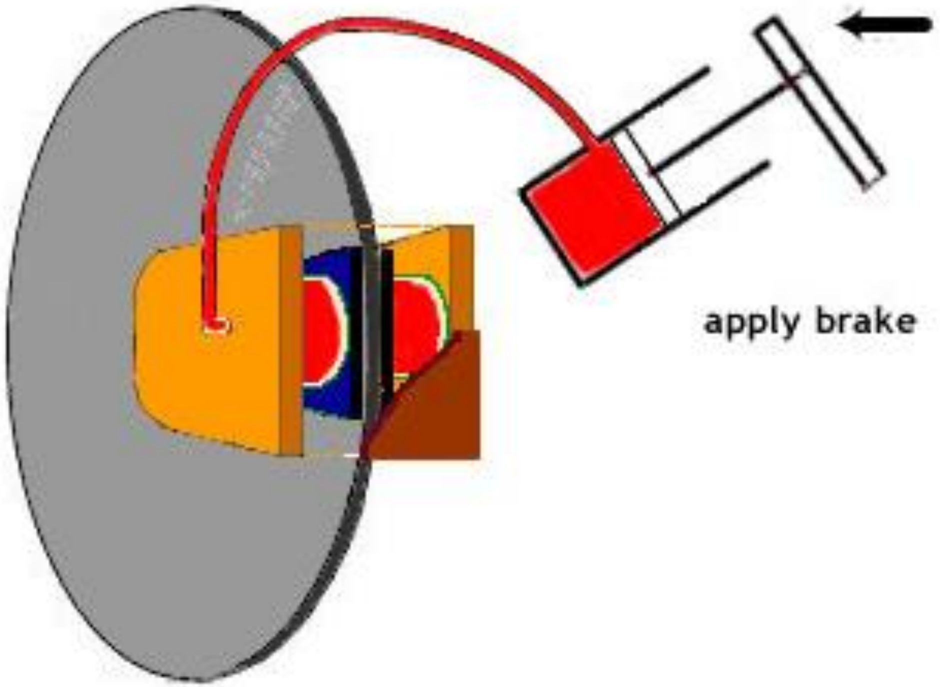
JUNKERS HE-111 (ALL VARIANTS)

DESCRIPTION	MAPPED TO	ESSENTIAL / NON-ESSENTIAL
Course autopilot – Previous Mode	A	ESSENTIAL
Course autopilot – Next Mode	S	ESSENTIAL
course setter – increase	NUMPAD + (CUSTOM)	ESSENTIAL
course setter – decrease	NUMPAD - (CUSTOM)	ESSENTIAL
directional gyro – increase	NUMPAD / (CUSTOM)	ESSENTIAL
directional gyro – decrease	NUMPAD * (CUSTOM)	ESSENTIAL
Autopilot left (aircraft turns left while in autopilot)	L_CTRL + A (CUSTOM)	ESSENTIAL
Autopilot right (aircraft turns right while in autopilot)	L_CTRL + S (CUSTOM)	ESSENTIAL
bomb mode selector – next / previous (salvo/series/single)	SEE BOMBER NUMPAD	ESSENTIAL
Increase/decrease bomb distributor salvo quantity	SEE BOMBER NUMPAD	ESSENTIAL
toggle bombs armed	SEE BOMBER NUMPAD	ESSENTIAL
Increase/decrease bomb distributor delay	SEE BOMBER NUMPAD	ESSENTIAL
Increase/decrease sight distance	SEE BOMBER NUMPAD	ESSENTIAL
Bombsight altitude + / -	SEE BOMBER NUMPAD	CLICKABLE IN COCKPIT
Bombsight velocity + / -	SEE BOMBER NUMPAD	CLICKABLE IN COCKPIT
Toggle bombsight automation	SEE BOMBER NUMPAD	ESSENTIAL
Selected Supercharger – Previous Step	L_CTRL+Q (CUSTOM)	ESSENTIAL
Selected Supercharger – Next Step	Q (CUSTOM)	ESSENTIAL

PART 4: CONTROLS

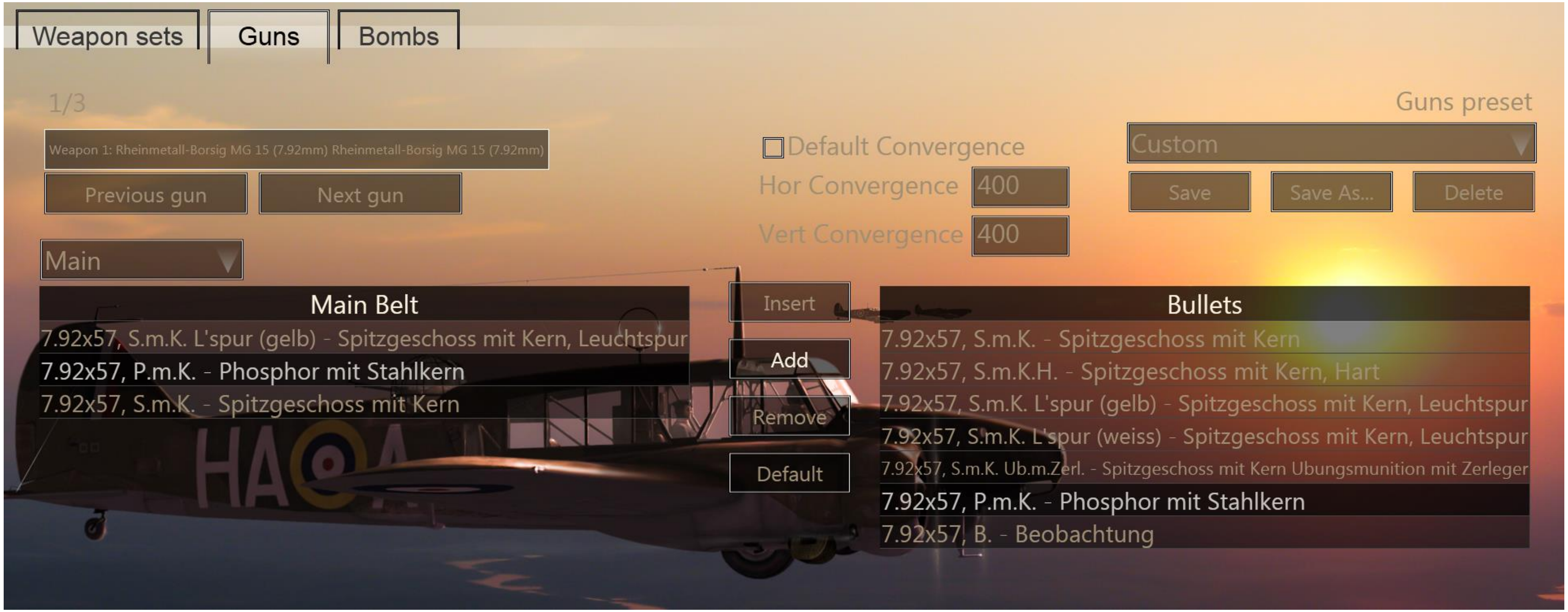
- Most german aircraft, unlike the majority of British and Russian planes, has a “toe brake” or “heel brake” system, which is linked to each individual wheel of your landing gear.
- In order to brake, you need to hold either your left or right wheel toe brake key to steer your aircraft. Applying rudder 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.





Recommended Gunner Machine-Gun Belt Loadouts – **Rheinmetall-Borsig MG 15 (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.



TWO LUFTWAFFE WEAPON DATA TWO

Luftwaffe Machinegun and Cannon Ammunition

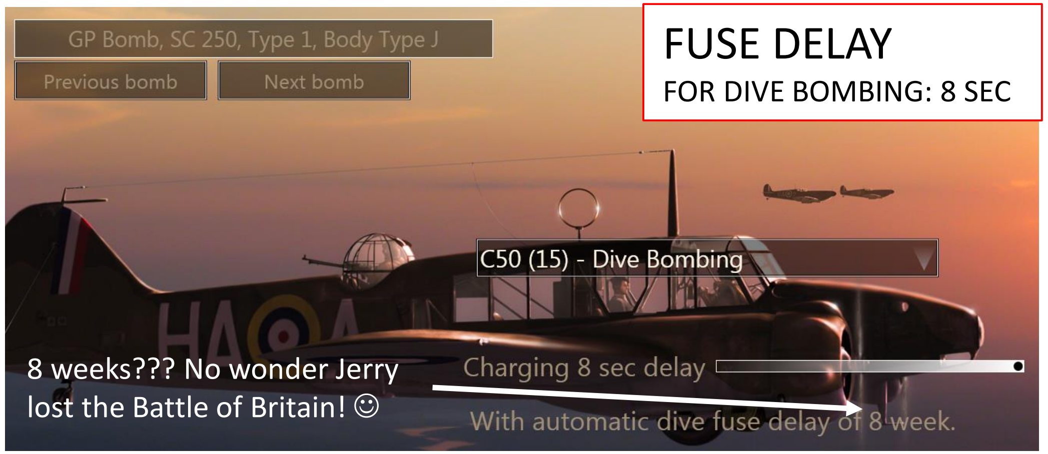
Weapon	Nomen	Type	Fill	Burnout	Tracer Color	Smoke Trail	Notes
MG 17 7.92mm	SmK v	AP					Steel Core
	SmK (H) v	AP (Super)					WC Core
	SmK L'Spur v	AP-T		900 m	Yellow		
	SmK L'Spur v	AP-T		900 m	White		
	SmK Ub m Zer	SAPHE w SD					Flash
	PmK v	API	Ph			Yes	Burns
	B Patr v	HEI	Ba				Flash
MG FF 20mm	Brsprgr 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

Recommended Bomb Loadout

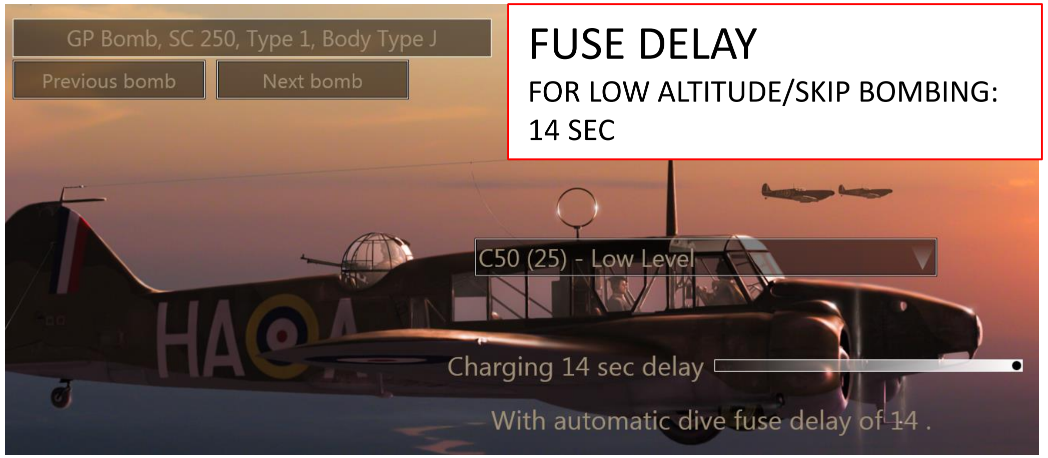
- 8 x GP SC 250 bombs is the more popular loadout.
- Why? Simply because GP SC 250 bombs has more explosive power than 32 x SC 50 bombs and has more flexibility in fuse choice (can be used for high altitude, dive bombing or skip bombing) than SC 250 Semi-AP bombs, which are suited for high altitude only.

FUSE DELAY
FOR HIGH ALTITUDE: 0 SEC



FUSE DELAY
FOR DIVE BOMBING: 8 SEC

8 weeks??? No wonder Jerry lost the Battle of Britain! ☺



FUSE DELAY
FOR LOW ALTITUDE/SKIP BOMBING: 14 SEC

PART 5: WEAPONS AND ARMAMENT

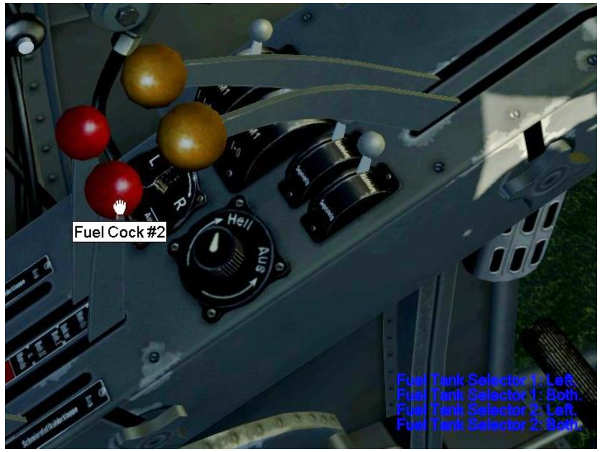
Bombs					
Country	**Nomen**	**Type**	**WT (lbs/kg)**	**Fuze**	**Aircraft**
Luftwaffe	SC 50	GP	110 / 50	5, 25B	Ju87B, Ju88, Me109, He111
	SC 250	GP	551 / 250	5, 15, 25B	Ju87B, Ju88, Me109, Me110, He111
	SD 250	Semi-AP Frag	551 / 250	5	Ju87B, Ju88, Me110, He111
	SC 500	GP	1102 / 500	25B	Ju87B, Ju88
	SD 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

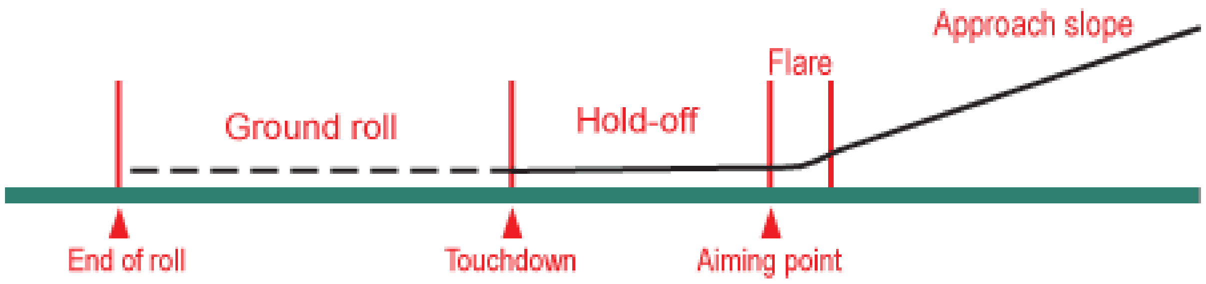
NOTE: This procedure is NOT the real-life start-up procedure, it has been simplified in the sim.

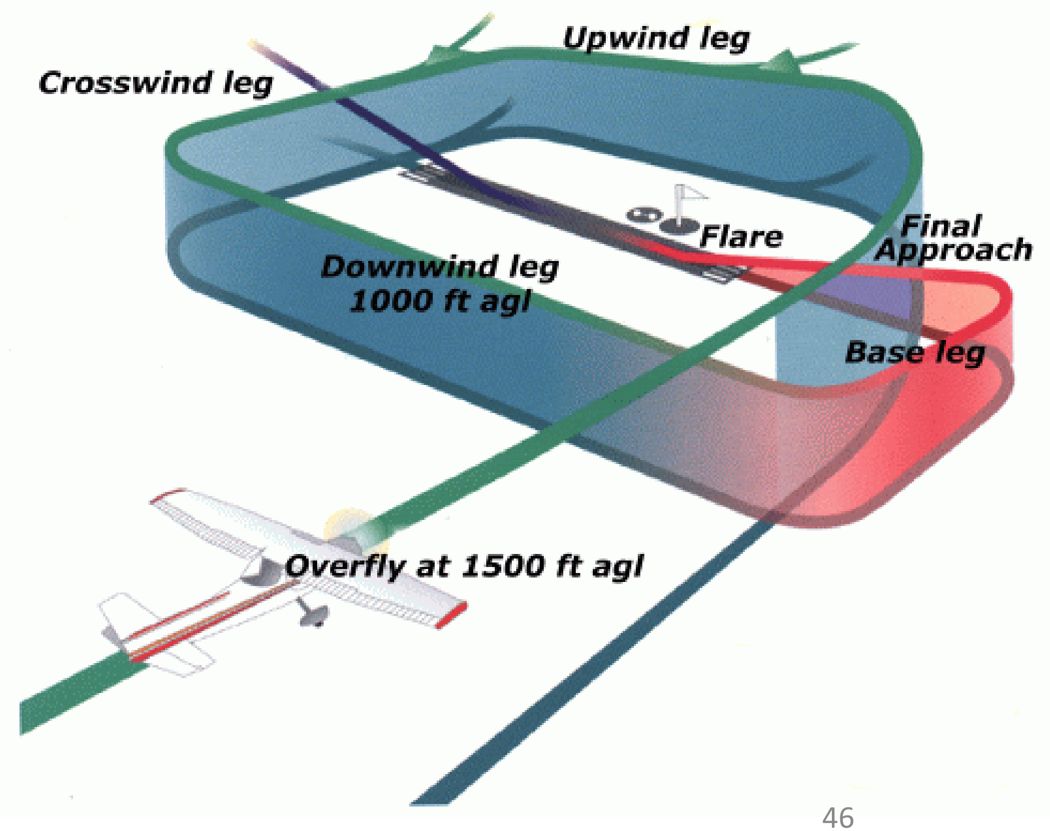
1. Drag fuel cocks #1 and # 2 all the way forward with your left mouse button. Make sure that your engine fuel tanks are filled by selecting inner tanks with the Fuel Contents Gauge Selector (INNER = main inner fuel tanks).
2. Select Engine # 1 (L_Shift + 1).
3. Oil rad and water rad fully open (100 %)
4. Prop pitch full fine (RPM @ 100 %).
5. Crack throttle about an inch
6. Switch Magnetos to M1+M2
7. Make sure your propeller is clear (“Clear prop!”)
8. Engine ignition! (press “I” by default)
9. Select Engine # 2 (L_Shift + 2) and repeat steps 3 to 8.
10. Select both engines (L_Shift + 3).
11. Wait for oil temperature to reach at least 40 deg C and water rad temperature to reach at least 40 deg C.
12. Taxi to the runway.
13. Make sure you are facing yellow panels on the runway. This means you are facing the right direction for takeoff.
14. Perform last takeoff checks: Canopy Closed, Water & Oil Rads fully open, Full Fine prop pitch (100 %), good oil & water rad temperatures.
15. Gradually throttle up. Compensate for engine torque and wind using rudder pedals and small brake input to keep the aircraft straight. Slightly push the yoke forward to lift the tail, which should lift off by itself naturally.
16. Rotation is at 150 km/h. Be very careful as your tyres will burst at around 200 km/h.
17. Raise landing gear and flaps and throttle back to approx. 1.15 ATA. Lower prop pitch until engine is operating at 2300 RPM while you are beginning your climb. Your best climb rate is at 240 km/h.



PART 7: LANDING

1. Start your approach at 200 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) and landing gear.
4. Cut throttle and try to keep your nose pointed to the end of the runway.
5. Touchdown at 140 km/h in a 3-point landing.
6. Yoke 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.

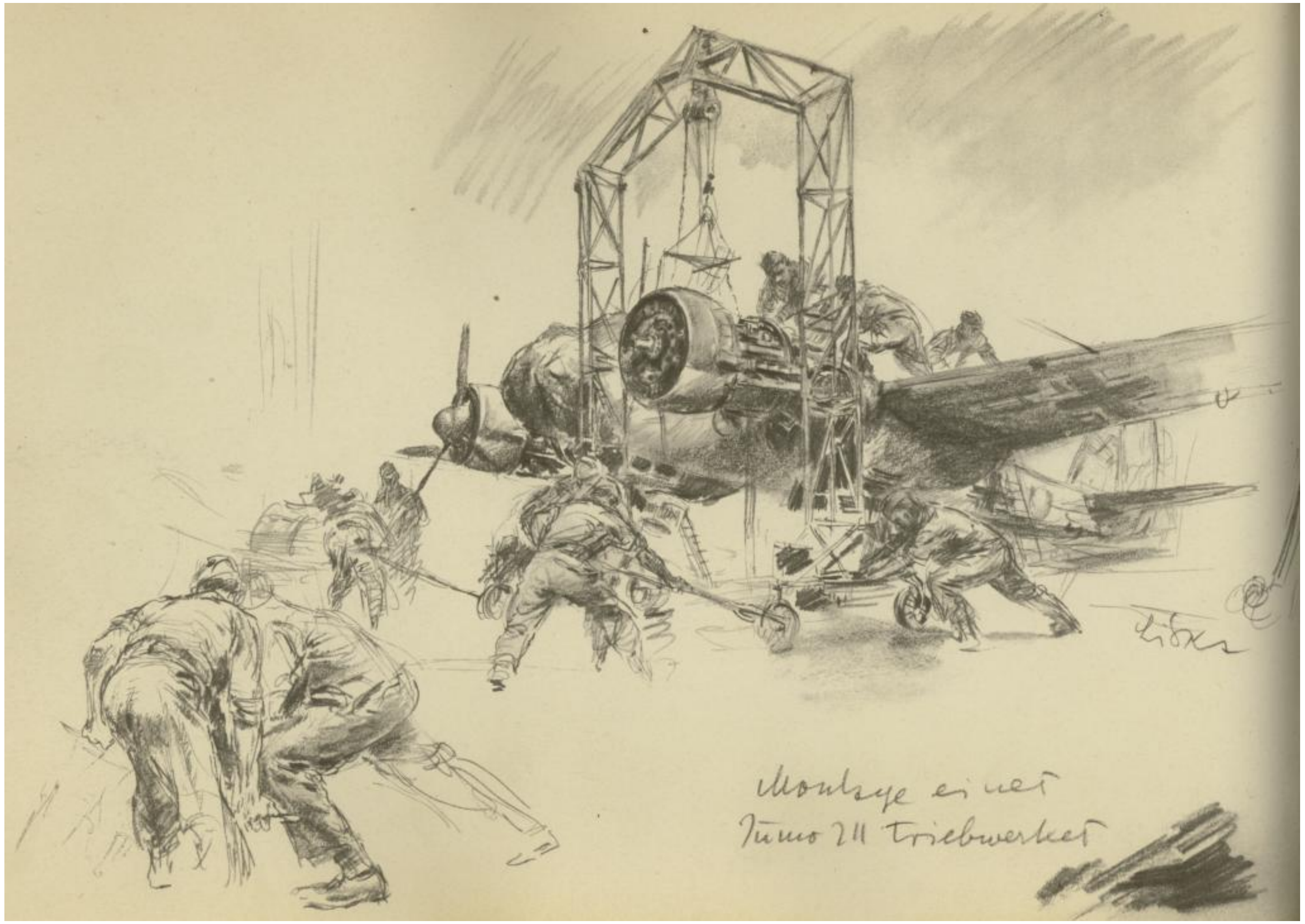




PART 8: ENGINE MANAGEMENT

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

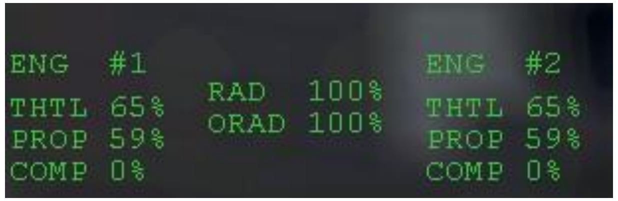
Mixture Control

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. The red indexes are visual markers to remind you of the limits for 1 min operation (red). The oil (3) and water (4) radiators can be approximated from the crank position or read from the info window in % (only the oil radiator can be read though as the water rad info window will only tell you if you are opening or closing them). Note: 100 % = fully open
- The resulting RPM is affected by both manifold pressure and prop pitch (5).
- Radiator settings:
    - 75 % WATER / 50 % OIL during **climb & normal operation**
    - 100 % WATER / 100 % OIL during **takeoff & landing**

	(Unit)	HE-111 H-2	HE-111 P-2
TEMPERATURES			
Water Rad Min **Max**	Deg C	38 95	40 100
Oil Rad (OUTBOUND) Min **Max**	Deg C	35 95	40 105



SUPERCHARGER OPERATION

- There are a lot of misconceptions and rumours about the use of superchargers. Time to reveal the truth!
- A **<u>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.</u>** 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 **<u>the air is less dense at the higher altitude</u>**. 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.

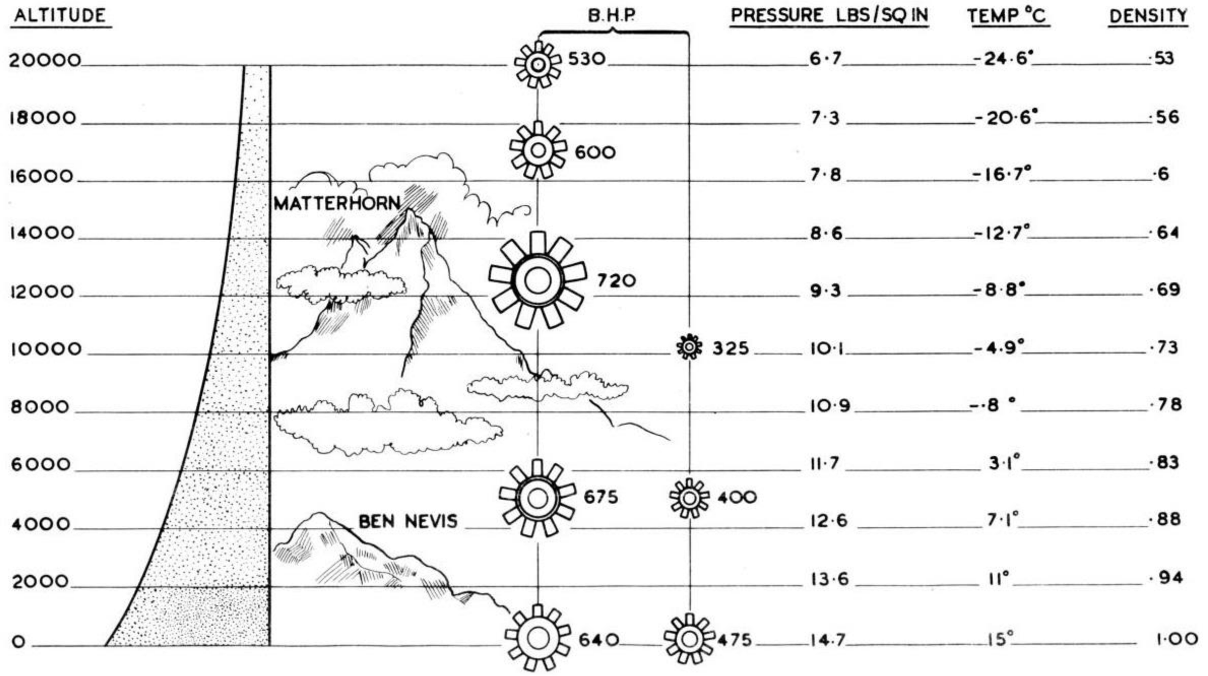
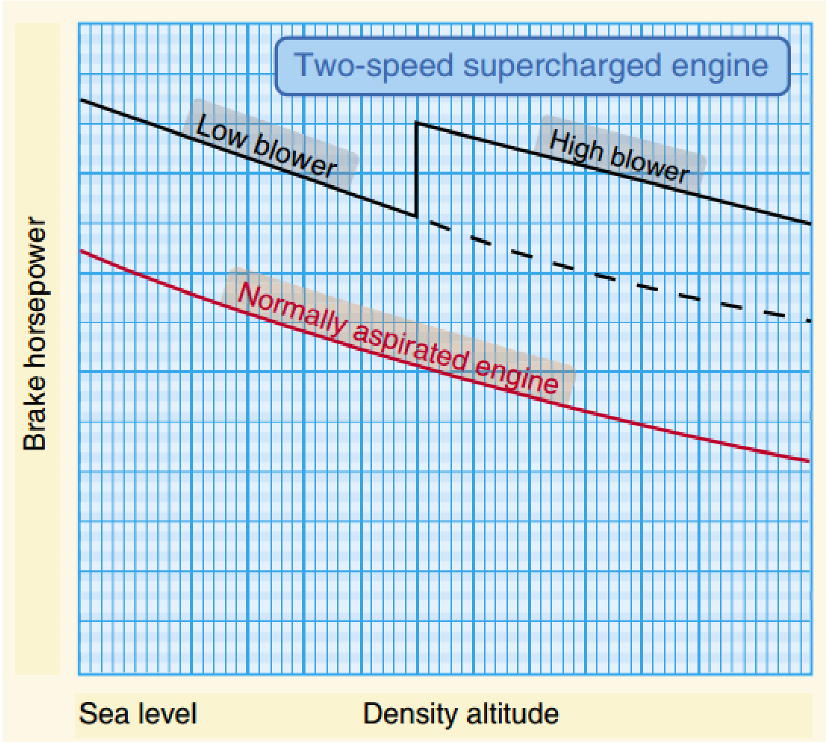


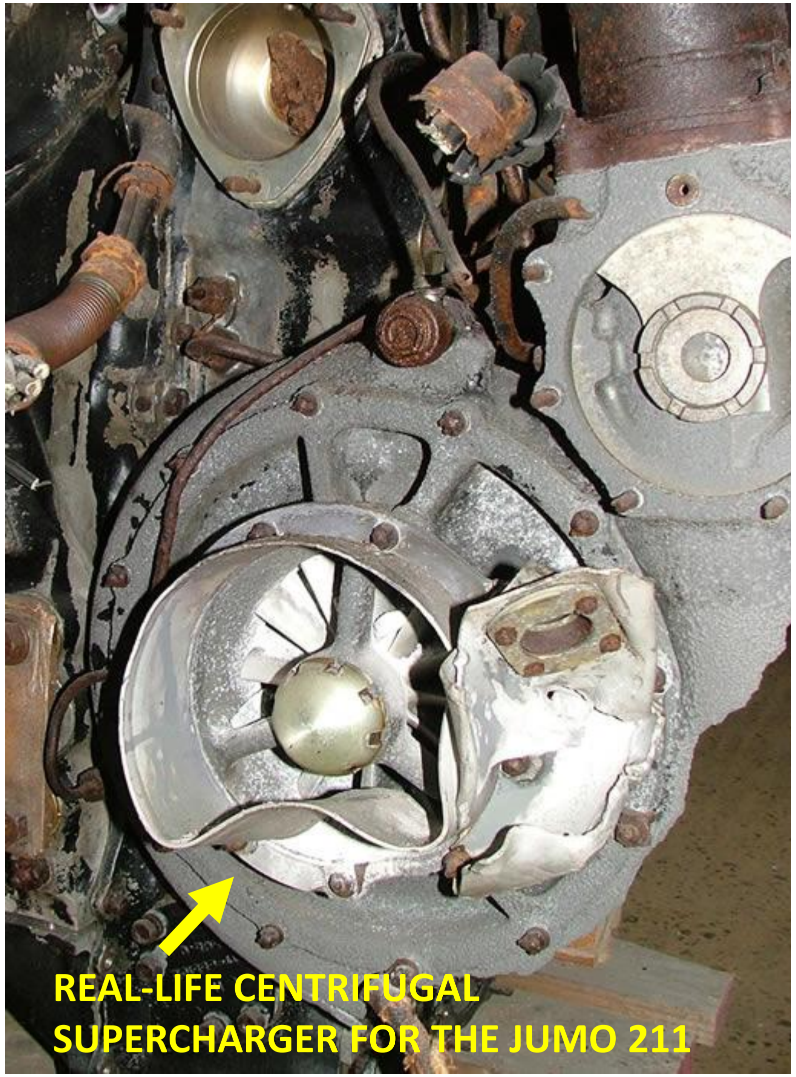
DIAGRAM SHOWING ATMOSPHERIC AND POWER VARIATIONS



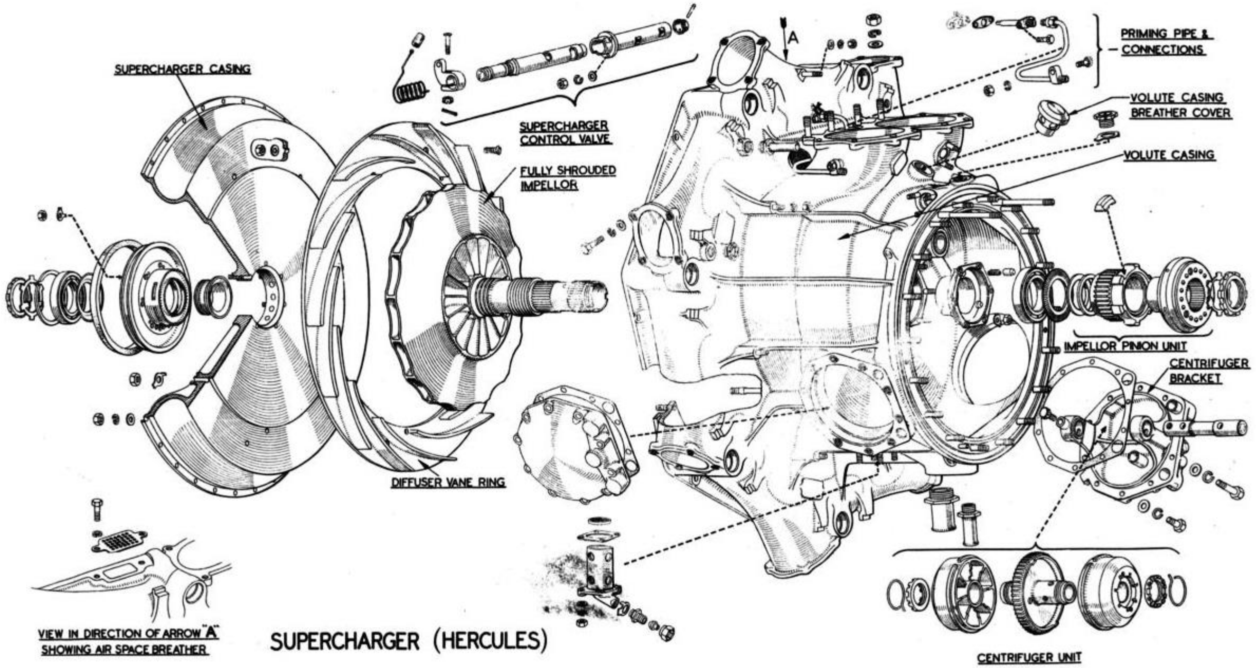
PART 8: ENGINE MANAGEMENT

SUPERCHARGER OPERATION

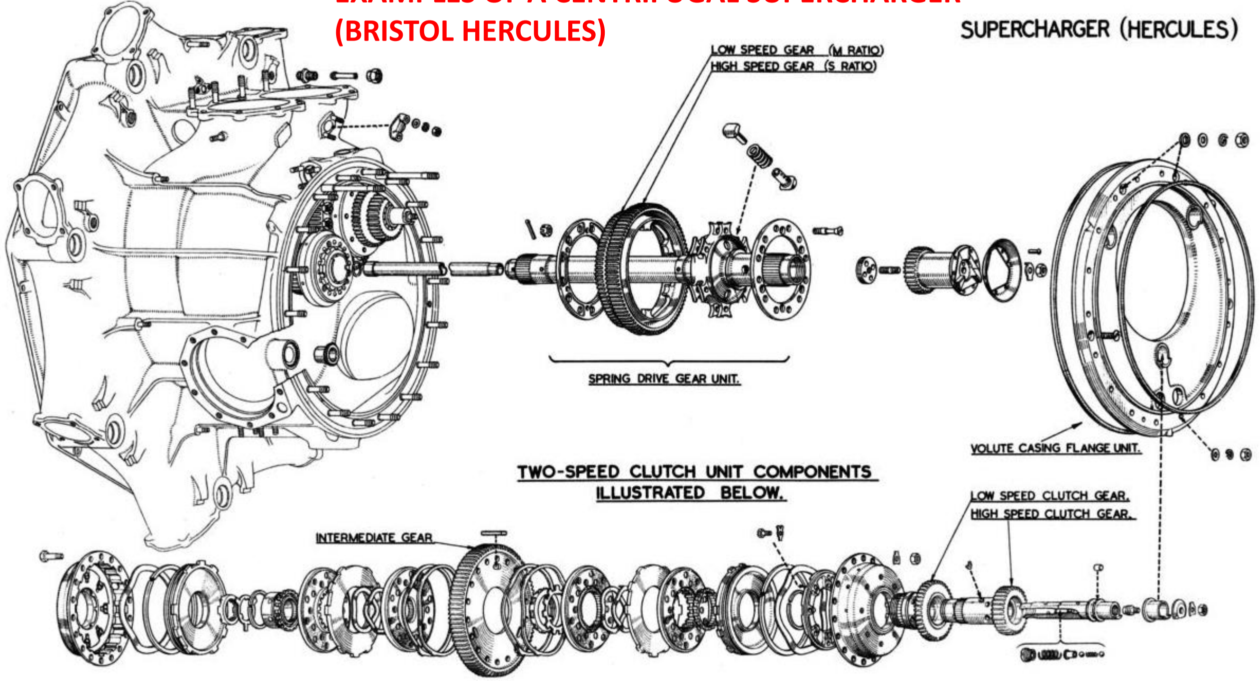
- This is what a two-speed centrifugal supercharger looks like.



REAL-LIFE CENTRIFUGAL SUPERCHARGER FOR THE JUMO 211



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.

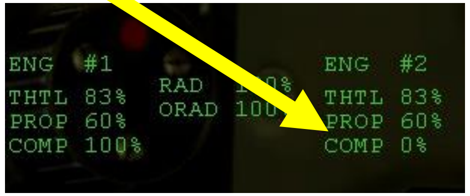
Supercharger vs Turbosupercharger (or Turbocharger)

- 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.

SUPERCHARGER OPERATION TUTORIAL (PART 1)

- The supercharger on the Jumo 211 is a two-speed centrifugal type supercharger with automatic boost control, which is installed on the He-111 H-2.
- NOTE: a different type of supercharger is installed for the He-111 P-2 (with DB 601 engines). Disregard this section for the P-2: you do not need to control the supercharger.
- You switch between first (low blower) and second (high blower) 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 1200 m). You need to be above 1500 m to see a difference.
- “COMP” at 0 % means the supercharger is in first gear. “COMP” at 100 % means the supercharger is in second gear.

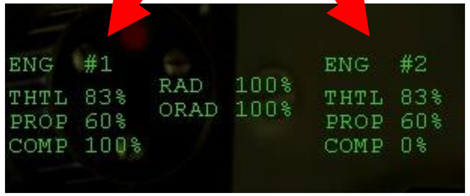
	(Unit)	HE-111 H-2	HE-111 P-2
ALTITUDE			
Supercharger Stage 1 Operation Altitude	UK: ft GER: M	0 1220	N/A
Supercharger Stage 2 Operation Altitude	UK: ft GER: M ITA: M	1220+	N/A



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 1200 m, you need to have your supercharger in first gear. If you are over 1500 m, you need to have your supercharger in second gear.*
  2. *Select Engine # 1 (LSHIFT+1)*
  3. *Hit "Q" to switch to second gear (high blower) or hit "LCTRL+Q" to switch to first gear (low blower).*
  4. *If you switch to second gear, you will see an increase in manifold pressure (ATA) and RPM. Make sure to adjust throttle so your ATA and RPM are not over the orange index. If you ATA is too high, you can cook the engine.*
  5. *Select Engine # 2 (LSHIFT+2) and repeat steps 2 to 4.*
  6. *Select all engines (LSHIFT+3) and you're done!*
- In this example, I deliberately chose to fly high (4000+ m) and run the right engine on the first supercharger gear (low blower) and the left engine on the second supercharger gear (high blower) to show you the difference between supercharger gear behaviour.
- Right engine has an ATA of 0.65 and a RPM of 2150. (supercharger gear 1)
- Left engine has an ATA of 1.0 and a RPM of 2600. (supercharger gear 2)
- And yet, **both engines have their throttle & prop pitch at the same position**!

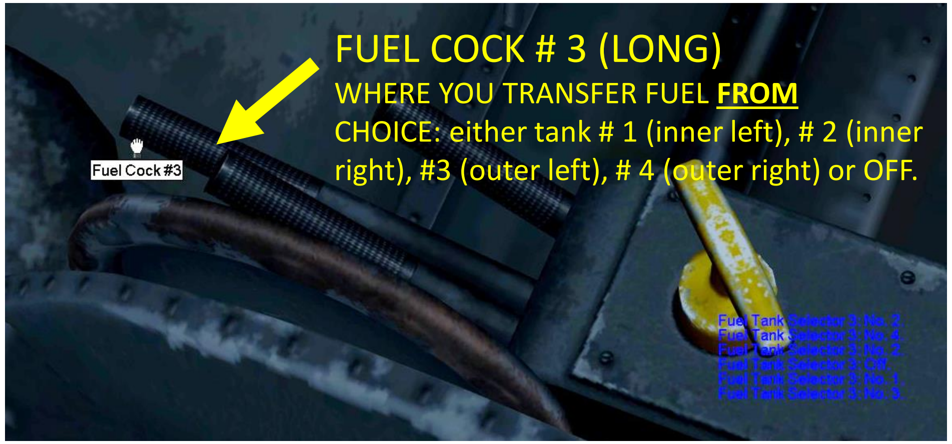


	(Unit)	HE-111 H-2	HE-111 P-2
ALTITUDE			
Supercharger Stage 1 Operation Altitude	UK: ft GER: M	0 1220	N/A
Supercharger Stage 2 Operation Altitude	UK: ft GER: M ITA: M	1220+	N/A

FUEL MANAGEMENT SYSTEM

- Your engines take fuel from your (main) inner wing tanks **only**. Once you dry these up, you will need to transfer fuel from your (reserve) outer tanks to your inner tanks.
- Fuel cocks # 1 and # 2 are the red levers on your throttle quadrant. You are already familiar with them.
- But what about these 2 obscure black levers on the right side of your seat, also called fuel cock # 3 and # 4? Time to solve this mystery.

1. You can move these levers by left clicking on them and dragging them with the mouse. Clicking alone will not be enough: you need to physically move them with the left mouse button held, and either drag it UP or DOWN.
2. Fuel Cock # 3 (long lever) is used to select from which tank you want to pump your fuel. Where do you want to grab your fuel from? Fuel tanks # 1 and # 2 are the left and right inner tanks, while fuel tanks # 3 and # 4 are the left and right outer wing tanks.
3. Fuel Cock # 3 (short lever) is used to select where you want to transfer your fuel to. You can select either fuel tanks # 1 (inner left) or # 2 (inner right)… or you can simply send fuel to BOTH your inner tanks at once!



EXAMPLE

SITUATION: Inner tanks show 100 L remaining… almost empty!

ACTIONS:

1. Drag Fuel cock # 3 (long) to position “No. 4”. We want to take fuel from the outer right tank.
2. Drag Fuel cock # 4 (short) to position “BOTH”. We want the pumps to transfer fuel to both left and right inner wing tanks.
3. Once the inner tanks are half full, drag Fuel cock # 3 (long) to position “No. 3”. We want to take fuel from the outer left tank this time. Why? Simply because the aircraft will be unbalanced and harder to control if one side is full of fuel and the other side is empty.
4. Select Fuel cock # 3 (long) and drag it to “OFF” once you’re done.

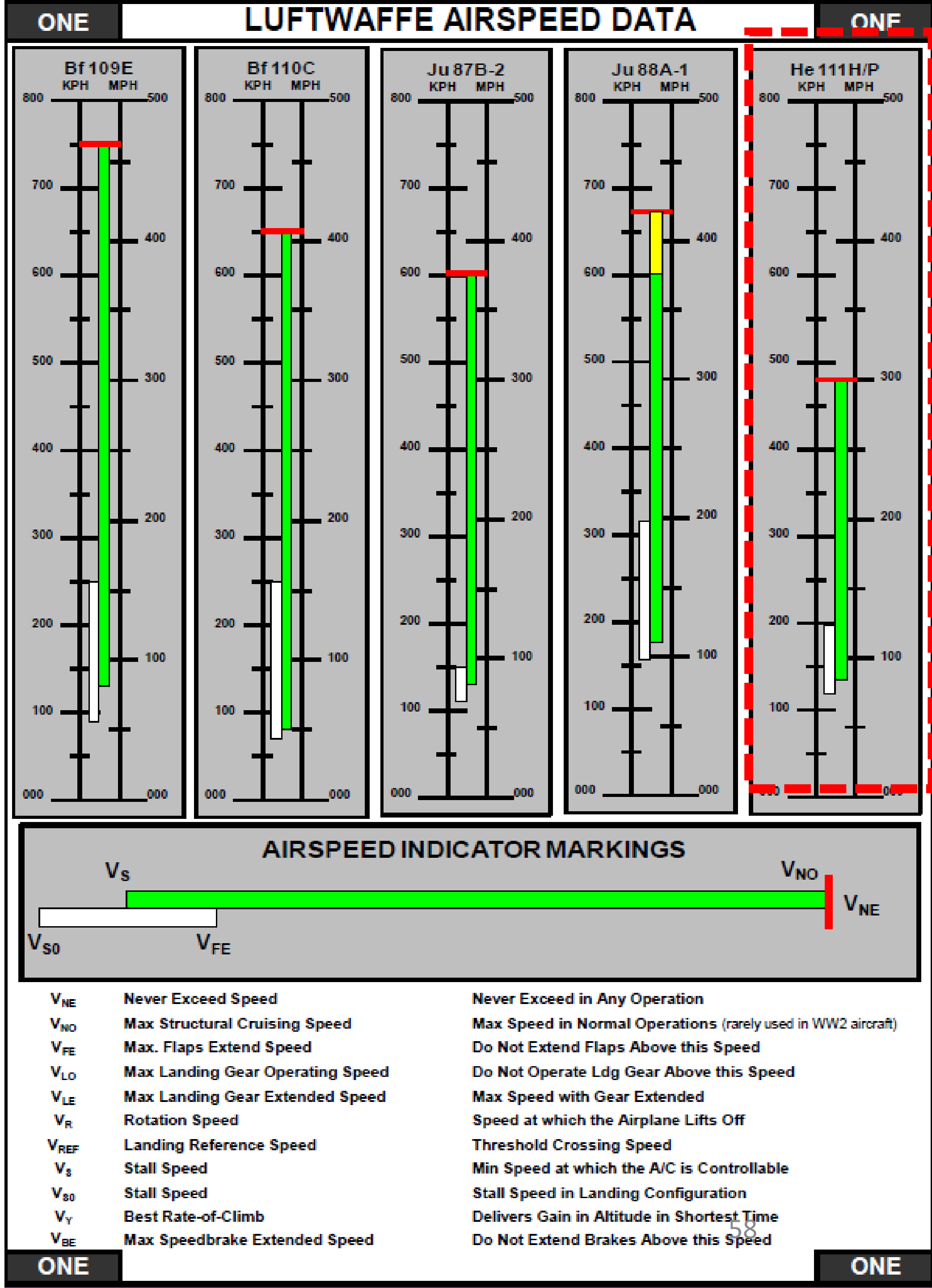
PART 9: AIRCRAFT PERFORMANCE

AIRSPEEDS

Takeoff – Rotation	UK: mph GER/ITA: km/h	150
Max Dive Speed		600
Optimal Climb Speed		240
Landing – Approach		200
Landing – Touchdown		140

- Best airspeed for climb: 240 km/h
- It 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	He 111H		ONE
Aircraft Type	**Engine & Prop**	**Fuel**	**Reference**
He 111H-2	Jumo 211A-1	87 Oct	D. (Luft) T 2220/1; June 1940

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V_{NE}	Never Exceed Speed	480	Never Exceed in Any Operation
V_{FE}	Max. Flaps Extend Speed	200	Do Not Extend Flaps Above this Speed
V_{LO}	Max Landing Gear Operating Speed	200	Do Not Operate Ldg Gear Above this Speed
V_{LE}	Max Landing Gear Extended Speed	250	Max Speed with Gear Extended
V_R	Rotation Speed	150	Speed at which the Airplane Lifts Off
V_{REF}	Landing Reference Speed	180	Threshold Crossing Speed
V_S	Stall Speed	135	Min Speed at which the A/C is Controllable
V_{S0}	Stall Speed	115	Stall Speed in Landing Configuration
V_Y	Best Rate-of-Climb	200	Delivers Gain in Altitude in Shortest Time
V_{BE}	Max Speedbrake Extended Speed	NA	Do Not Extend Brakes Above this Speed

AIRSPEED INDICATOR OPERATING RANGES

ASI MARKING	KPH Range	Description
White Arc	115 - 200 KPH	Full Flap Operating Range. Lower Limit is Max. Weight V_{S0}. Upper Limit Max Speed w/Flaps Extended.
Green Arc	135 - 480 KPH	Normal Operating Range. Lower Limit is Max. Weight V_S. Upper limit Is Max Structural Cruising Speed.
Red Line	480 KPH	**Maximum Speed for ALL operations.**

ONE	He 111P		ONE
Aircraft Type	**Engine & Prop**	**Fuel**	**Reference**
He 111P-2	DB 601A-1	87 Oct	D. (Luft) T 2220/1; June 1940

AIRSPEED LIMITATIONS

	Design Speeds	KPH	
V_{NE}	Never Exceed Speed	480	Never Exceed in Any Operation
V_{FE}	Max. Flaps Extend Speed	200	Do Not Extend Flaps Above this Speed
V_{LO}	Max Landing Gear Operating Speed	200	Do Not Operate Ldg Gear Above this Speed
V_{LE}	Max Landing Gear Extended Speed	250	Max Speed with Gear Extended
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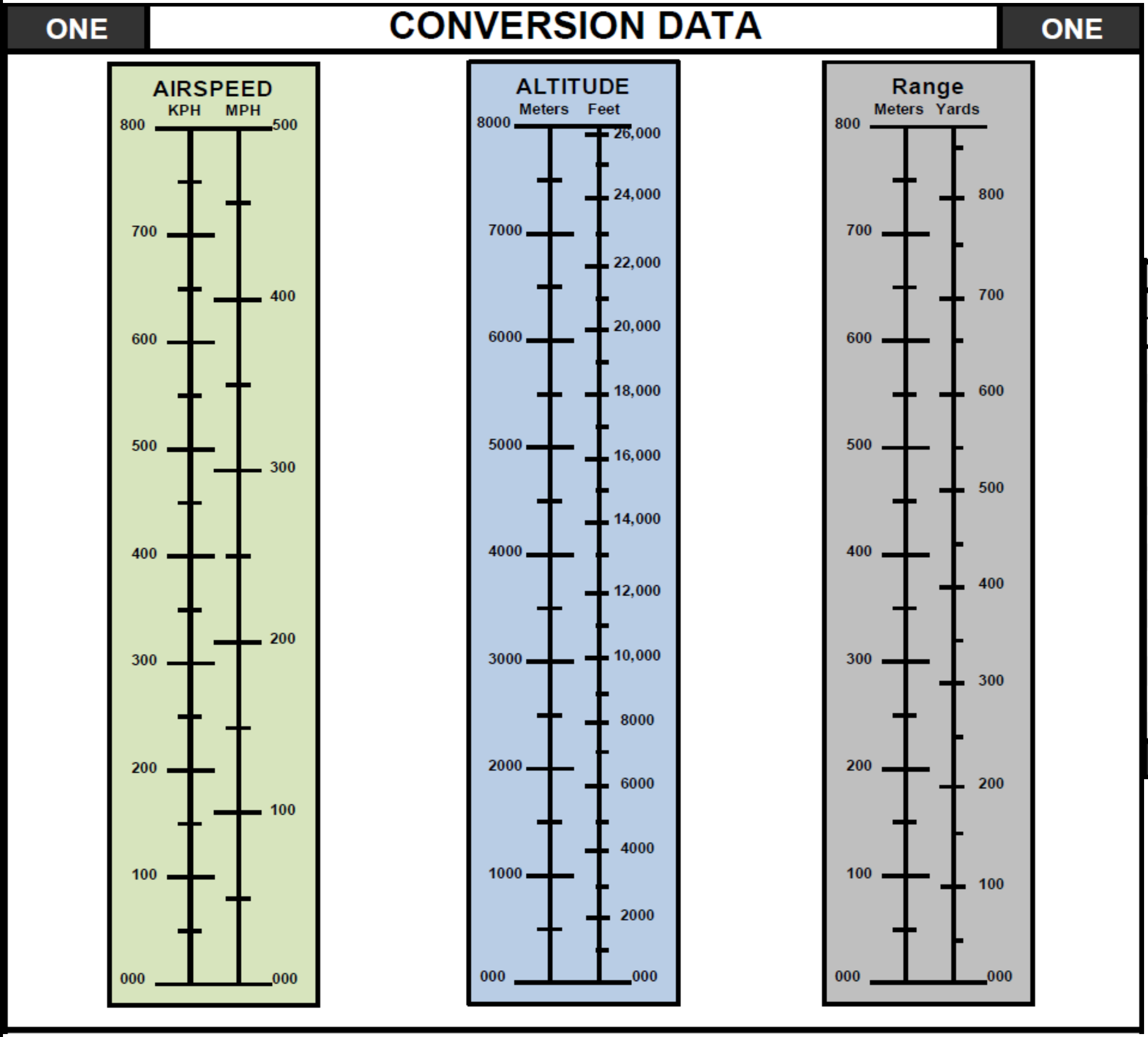
PART 9: AIRCRAFT PERFORMANCE



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: COMPASS TUTORIAL

MAGNETIC COMPASS (MC)

GIVES YOU YOUR MAGNETIC HEADING. THE WHITE INDICATOR IS YOUR COURSE SETTER AND THE RED TRIANGLE IS YOUR ACTUAL HEADING.

WHEN YOU SET A COURSE WITH THE COURSE SETTER AND THE RED TRIANGLE AND THE WHITE INDICATOR ARE ALIGNED, IT MEANS THAT YOU ARE ON COURSE.

REPEATER COMPASS (RC) + COURSE SETTER (CS)

“REPEATS” WHAT THE MAGNETIC COMPASS IS SHOWING (SINCE YOU DON’T HAVE AN EXTRA SET OF EYES)

COURSE SETTER ALLOWS YOU TO CREATE A REFERENCE MARK ON THE COMPASS TO A HEADING OF YOUR CHOICE. THIS WAY, YOU JUST NEED TO STEER THE AIRCRAFT (AND MOVE THE REPEATER NEEDLE) TOWARDS THE “COURSE” SET ON THE COURSE SETTER.

DIRECTIONAL GYRO (TOP BAND)
AUTO-PILOT SETTER (BOTTOM BAND)

DIRECTIONAL GYRO (DG) CAN BE SET TO ANY HEADING YOU WANT. IT IS RECOMMENDED FOR THE DG TO BE SET TO YOUR CURRENT HEADING SHOWN BY THE MAGNETIC COMPASS (AND REPEATER). THIS WAY, YOUR MG, RC AND DG ALL SHOW THE SAME HEADING, WHICH IS A MAGNETIC HEADING, NOT GEOGRAPHIC.
THE AUTO-PILOT “SETTER” MUST BE LINED UP WITH THE DIRECTIONAL GYRO. THE AUTO-PILOT WILL STEER THE AIRCRAFT TO LINE UP BOTH TOP AND BOTTOM BANDS.

MAGNETIC COMPASS (MC)

REPEATER COMPASS (RC) + COURSE SETTER (CS)

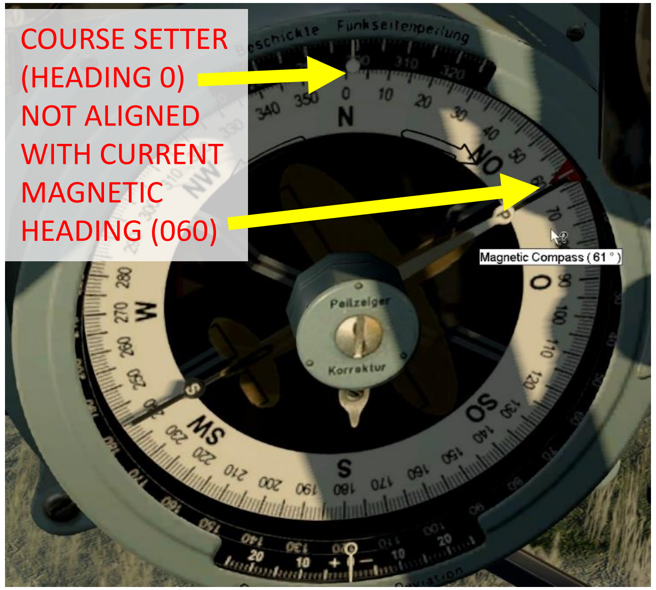
DIRECTIONAL GYRO (TOP BAND)
AUTO-PILOT SETTER (BOTTOM BAND)

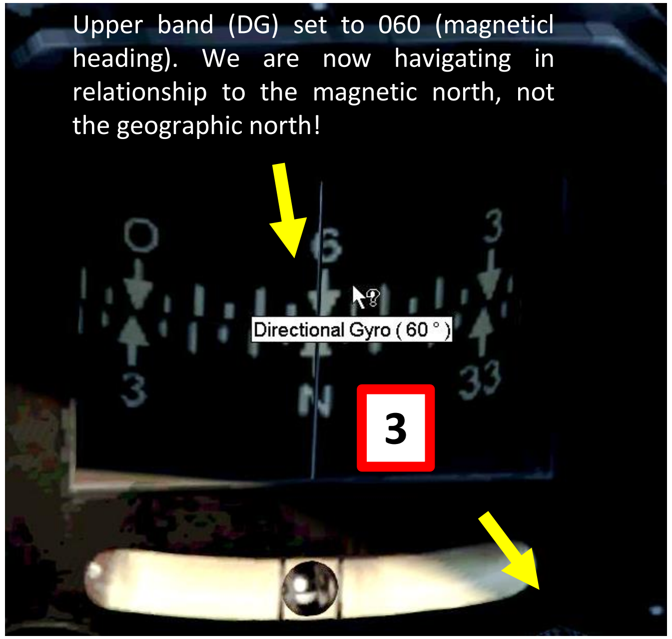
There is no mechanical/electrical relationship between the directional gyro and the compasses. The autopilot could be set without any reference to the magnetic compass. However, it is good practice to align the compasses with the directional gyro. In practice, only the lead aircraft has the option of engaging the autopilot. The other planes in the formation fly manually due to the demands of formation flying. Having the magnetic/repeater compass setup gives the pilot a visual reference to the current course. In some cases the leader may prefer to fly using the magnetic/repeater compass rather than setting up the auto-pilot. The complexity of the mission plan (course), length of leg (etc.) will usually dictate the practicality of employing the auto-pilot.

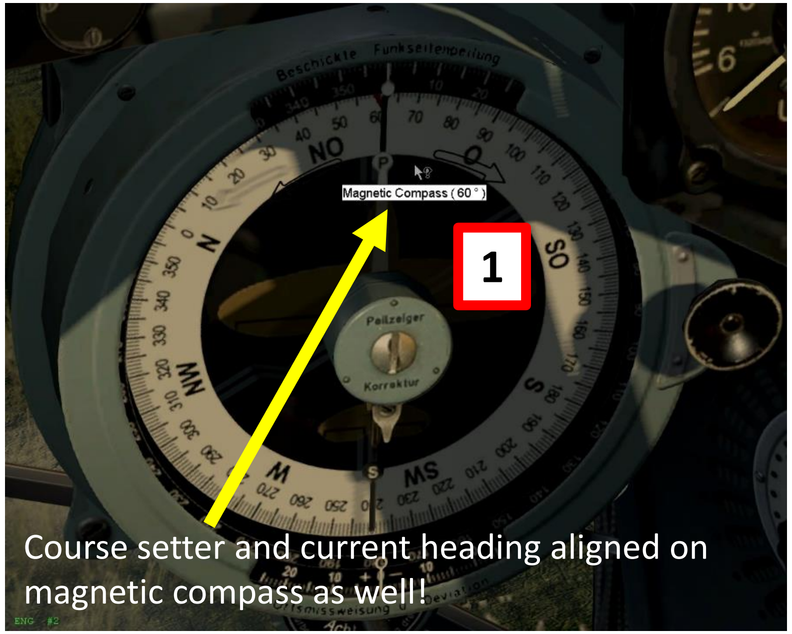
HOW TO SET UP YOUR GYRO & COMPASS

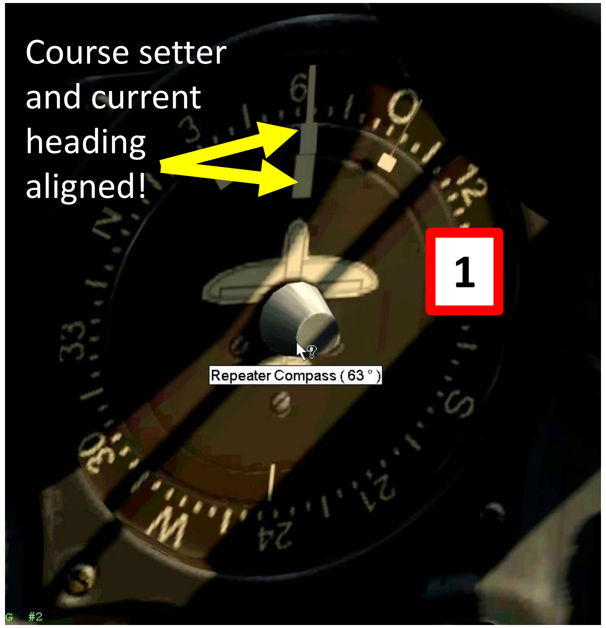
1. Align your Course Setter with the heading you are facing. You can do that by either consulting the magnetic compass (red triangle) or the repeater compass. You will see a value in blue text pop up: that value is your current magnetic heading. Remember this value.
2. In our case, the number is a heading of 060. This heading is in reference to the magnetic north, NOT the geographic north.
3. Set your directional **directional gyro compass** by clicking on the rotary knob to reflect the magnetic heading obtained on your magnetic compass. In our case, set the gyro to 060. This way, the directional gyro will give us a magnetic heading that is correct. You will see the blue numbers pop again. You can use them as a way to fine tune your gyro.
4. And that's it! You will now be able to use your directional gyro to orient yourself. If your gyro accumulates error after high-G manoeuvers, you can try to re-set it using steps 1 to 3.
5. You could also set your directional gyro to 050 (060 minus 10 deg of magnetic declination) instead if you wanted to, which would give you your geographical heading instead of your magnetic one. But for simplicity's sake, we will use the DG, MC and RC all synchronized.

NOTE: To navigate from point A to point B, open the map, find a geographical heading to follow, add 10 degrees to this heading and it will give you the magnetic heading to follow on your MG, RC and DG (if they are all synchronized, of course).









COMPASS NAVIGATION TUTORIAL

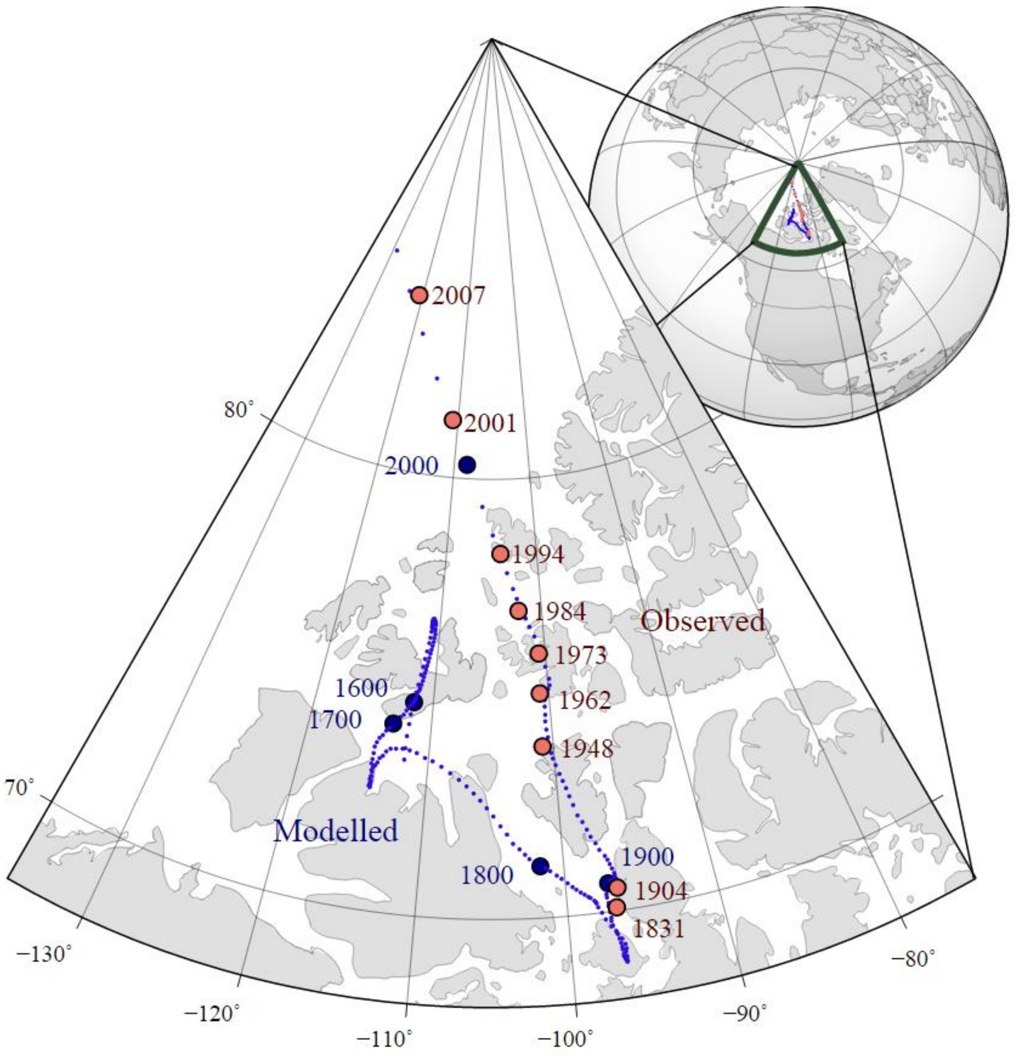
- Using the magnetic compass and the directional gyro is quite useful to know where you are going.
- The directional gyro indicator itself does not indicate your heading. You need to set it manually in order to translate what the magnetic compass and the repeater compass are telling you.
- Typically, you set your compass and gyro on the ground. It is not the kind of stuff you want to do when you are flying 6,000 m over England.
- High-G manoeuvers can decalibrate your gyro and give you a wrong reading. Be aware that once you start a dogfight, your gyro can give you readings that don’t make sense. It’s normal: it is one of the real-life drawbacks of this navigation system. The same issue is also recurrent in today’s civilian acrobatic prop planes.
- There is a difference between a **magnetic heading** and a **geographical heading**. If you follow a magnetic heading of 0 (which is what you read on your magnetic and repeater compasses), you will be following the magnetic North Pole, not the geographical one. Keep that in mind when you are navigating.
- If you consult your in-game map and want to go North, in fact you will have to take into account **magnetic declination**, which means that you will have to navigate to a magnetic heading of 0 + 10 deg = 010 deg.
- In other words, if you want to follow a specific heading, take that heading and add 10 degrees. This value is what you will have to follow on your magnetic and repeater compass.
- You can also look at it the other way: if you want to go North and you decide to follow your compass to “0” (magnetic North), you will in fact be 10 degrees off course. The next slide will explain why.

About 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 Cliffs of Dover, the magnetic compass 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).

In 1940, the magnetic declination required an adjustment of 10 degrees and 8 minutes. We round that to 10 deg.



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

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL - INTRO

- Bombing is one of the most complex and rewarding features of flight simulators. The bomber pilot has a thankless job, yet bombing is an art form in itself.
- This tutorial will be for high-altitude bombing as it encompasses all aspects of bombing and navigation.
- Bombers should work as a team. Not only with other bombers, but with fighter escorts as well to keep them alive.
- The mind of a bomber pilot is a patient and organized one. If you fail to plan your mission properly, you certainly plan to fail and end up in a smoldering pile of ashes.

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL - INTRO

- A bombing operation can be separated in 6 phases:
    1. Planning the mission
    2. Takeoff and assembly of bomber force
    3. Rendezvous with fighter escorts
    4. Fly to target
    5. Bombing run
    6. Return to Base
- We will explore phases 1, 4 and 5 together.

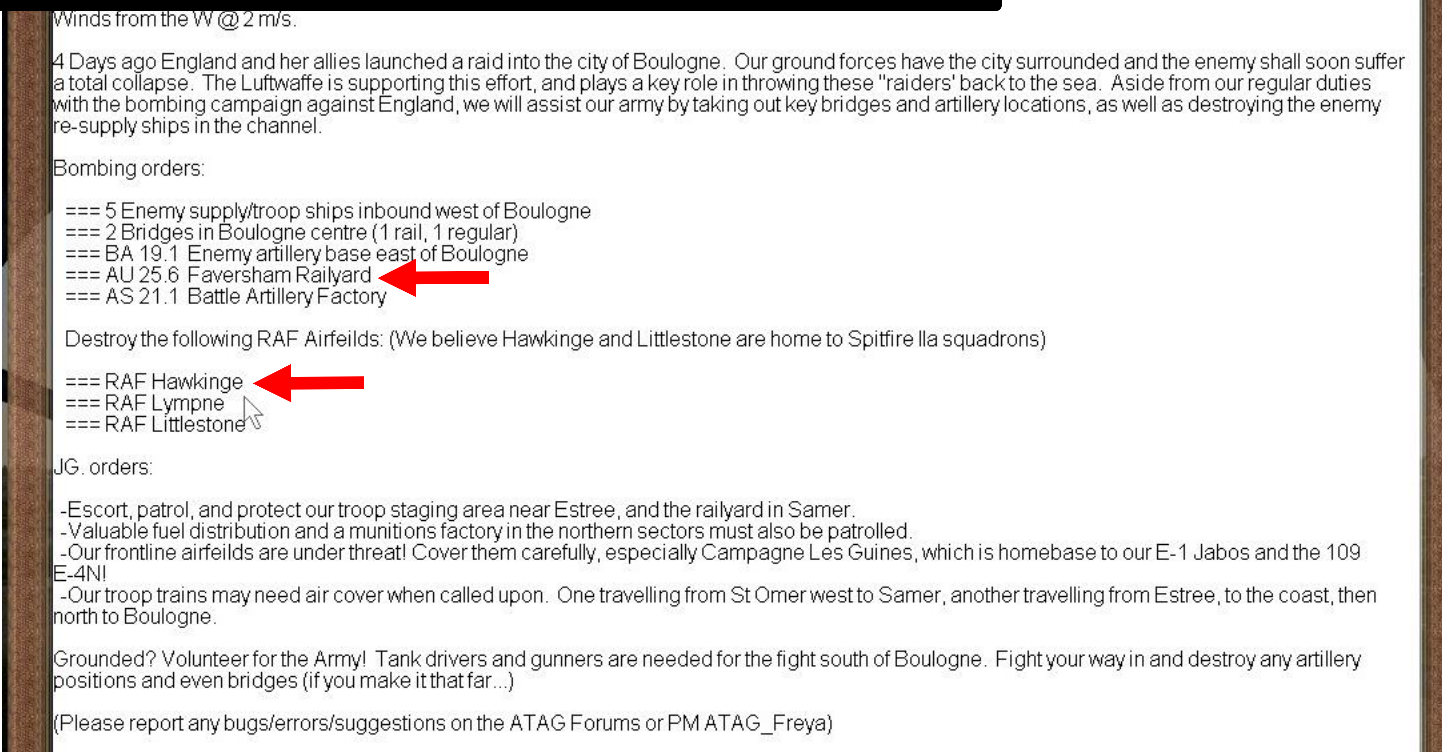
BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION

- Before you even take off, you need to make sure you know the following:
    1. Where am I?
    2. Where am I going?
    3. How much fuel do I need?
    4. What am I doing?
    5. How am I doing it?
    6. What can help me?
    7. What can kill me?
    8. How do I get home?
- Once you have all that stuff figured out, THEN you can takeoff.
- The following example will show you a typical mission planning.

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION WHERE AM I? WHERE AM I GOING?

- Reading the bomber objectives always helps to find a high-priority target.
- You can look at the bombing objectives in the mission briefing (can be accessed via aircraft selection menu or by right-clicking, opening the map, right-clicking on the map and choosing “Briefing”).
- **<u>Hawkinge will be our target for today.</u>**



Winds from the W @ 2 m/s.

4 Days ago England and her allies launched a raid into the city of Boulogne. Our ground forces have the city surrounded and the enemy shall soon suffer a total collapse. The Luftwaffe is supporting this effort, and plays a key role in throwing these "raiders' back to the sea. Aside from our regular duties with the bombing campaign against England, we will assist our army by taking out key bridges and artillery locations, as well as destroying the enemy re-supply ships in the channel.

Bombing orders:

=== 5 Enemy supply/troop ships inbound west of Boulogne
=== 2 Bridges in Boulogne centre (1 rail, 1 regular)
=== BA 19.1 Enemy artillery base east of Boulogne
=== AU 25.6 Faversham Railyard
=== AS 21.1 Battle Artillery Factory

Destroy the following RAF Airfeilds: (We believe Hawkinge and Littlestone are home to Spitfire IIa squadrons)

=== RAF Hawkinge
=== RAF Lympne
=== RAF Littlestone

JG. orders:

-Escort, patrol, and protect our troop staging area near Estree, and the railyard in Samer.
-Valuable fuel distribution and a munitions factory in the northern sectors must also be patrolled.
-Our frontline airfeilds are under threat! Cover them carefully, especially Campagne Les Guines, which is homebase to our E-1 Jabos and the 109 E-4N!
-Our troop trains may need air cover when called upon. One travelling from St Omer west to Samer, another travelling from Estree, to the coast, then north to Boulogne.

Grounded? Volunteer for the Army! Tank drivers and gunners are needed for the fight south of Boulogne. Fight your way in and destroy any artillery positions and even bridges (if you make it that far...)

(Please report any bugs/errors/suggestions on the ATAG Forums or PM ATAG_Freya)

Read bomber objectives and pick your targets.
For instance: the Faversham Railyard is located in grid AU25.6, which means it is located in the middle-right corner of the Alpha-Uniform 25 grid square. .6 is the location in the square based on the referential of a numpad for the designated grid square (1 is lower left, 5 is center, 6 is middle right, 9 is upper right, etc…)

However, Hawkinge seems like a juicier target. We’ll choose this one instead.

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION WHERE AM I? WHERE AM I GOING?

- Good! We now have a target (Hawkinge airfield), and we decided that we would spawn at Calais-Marck.
- Now, it is time to figure out how we get there and drop them cabbage crates. We need a heading and a distance.
- Open your map and select (left click) your Protractor tool to obtain your heading to target.

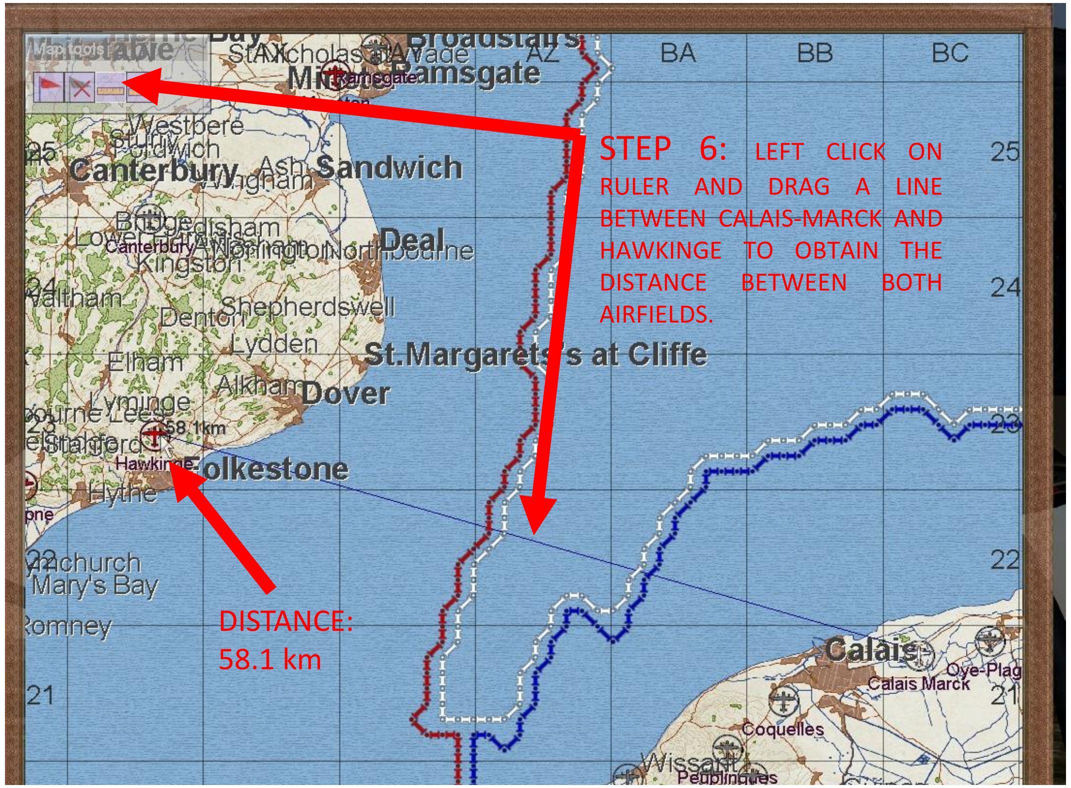
While map is selected, open up your "Tools" menu (right click) and use your protractor to find the correct heading.

Left-Click on the protractor icon.

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION
WHERE AM I? WHERE AM I GOING?

1) Click and hold left mouse button on Calais-Marck and drag a vertical line. Once line is parallel with the North, release mouse button.
2) Click and hold left mouse button on Calais and drag a line to Hawkinge Airfield. Once line is crossing the center of the airfield icon, release mouse button.

3) A heading number should pop next to Calais. Remember this number. In our case, we get 074 degrees.
4) In case your target is West (to the left) to your home base, the number that pops up will not be your heading. The proper heading will be 360 minus the number that popped up. In our case, the proper heading will be 360 – 74 = 286 Geographic (map) Heading.



5) Since the heading we obtained on the map is geographic and not magnetic, the **magnetic course** we will need to follow on our compasses is **286 + 10 = 296 deg**. This is the heading we will follow on our compass, course setter, DG and repeater compass. We added 10 degrees to take into account magnetic declination as shown in previous compass navigation tutorial.
6) Obtain distance to target by clicking on the ruler and dragging a line from Calais to Hawkinge. In our case, we get a **distance of approx. 58 km**.

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION WHERE AM I? WHERE AM I GOING?

- We now know our target: Hawkinge. We must know how high it is to take into account target elevation when we will be bombing.
- You can use the LOFTE tool available on ATAG: theairtacticalassaultgroup.com/utils/lotfe7.html
- A tutorial on how to use this tool is available in Chuck's Blenheim High Altitude Bomber Guide 2.0 available here: https://drive.google.com/open?id=0B-uSpZROuEd3MDEwaDZXdmNSdnM&authuser=0
- One quicker way to do it is to get the airfield's altitude directly from the list on the next page made by Ivank.
- LOFTE's values tend to vary from point to point: values you get from this tool are an approximation that must sometimes be taken with a grain of salt.
- Hawkinge's altitude in the table is 158 m (518 ft).

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

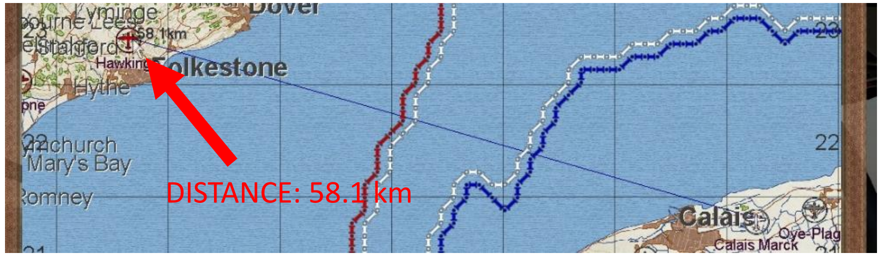
NOTES

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

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION HOW MUCH FUEL DO I NEED?

- The heavier you are, the slower you are and the more vulnerable you are.
- Calculating your required fuel is easy.
- Based on in-game tests I performed, the He-111 consumes approximately 500 Liters of fuel per hour if we stay at engine settings for a max climb rate.
- If we fly at 300 km/h, based on fuel capacity, we can deduce that @ 100 % fuel we can fly around for 6.8 hours of flight time, which gives us a max flying distance of 2040 km (which is 2 times the max range).
- Use the “Map Tool Ruler” to get our target’s range. Hawkinge is about 60 km away from Calais. Since we plan to return to base, we add another 60 km. We can add about 40 km for loitering time, assembly and rendezvous with fighters and another 40 km for reserve fuel in case we need to find a secondary airfield. We have a grand total of 200 km.
- To fly for 200 km at 2300 RPM at 300 km/h, we simply multiply our max takeoff fuel load (100 %) by the ratio of the distance we need to fly on the maximum range @ max takeoff weight (2040 km):
- 100 % * 200 km / 2040 km = 10 % fuel approx. That is what we need.
- We can round that up to 15 % to be very conservative. So there we go, we need roughly 15 % fuel.
- Note: you could also takeoff with a full fuel load and full bomb load if you wanted to. The He-111 can still fly. This practice is simply to teach you how to plan your fuel for a real mission intelligently.



Left click and drag from point A to point B to get a distance.

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION WHAT AM I DOING?

- Now that we know where we are and where we are going and how much fuel we need, we need to know what we will be doing.
- We will load up **8 X SC 250 GP bombs with a C-50 fuse (high altitude) with a 0 sec fuse delay**. See the Weapons and Armament section to know more.
- Our bombing altitude will be 6,000 m. We could go as high as 8,000 if we wanted to.
- Why do we ask ourselves this question? Simply because the challenge of a bomber pilot is the sheer workload behind it. You are doing by yourself the task that took two dedicated guys or more to do. Therefore, our goal is to reduce the workload as much as possible by doing as much as we can on the ground so we can concentrate on what's going on during the flight rather than prepare our instruments in a hurry.
- In a bomber flight, generally half the guys do not know how to use a bomb sight: they simply drop their bombs on the bomber lead's command. Keep in mind that having a bomber lead is not enough to have a proper mission: fighter interceptors always go for the bomber lead because odds are that he is the most experienced bomber pilot. Good bomber operations generally have a second or a third leader to take No. 1's place in case he gets shot down or runs into engine trouble.
- If you have 9 guys flying for an hour to get to a target that are waiting on your command to drop their bombs, you better make sure that you know where you're aiming…
- Therefore, it is important to know at what speed and what altitude you plan to do your bomb run so you can set up your bombsight in advance. I usually set my bombsight when I am on the ground. This way, you just need to make small adjustments when you get to target rather than set everything up in a hurry.
- You will need your target elevation to set up your bombsight properly.

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION HOW AM I DOING?

- Here is why you need to take into account target elevation in your bombsight:
- Pressure altitude and Height are related to one another, but keep in mind that they are two completely different things.
- Height is the vertical physical distance between your aircraft and the ground. Pilots often refer to height as “AGL” (Above Ground Level).
- Pressure altitude is the altitude measured using a pressure datum reference. Pilots often refer to altitude as “AMSL” (Above Mean Sea Level). Pressure Altitude reading can vary based on meteorological conditions.
- Bombsight height setting can be determined by simply reading the altimeter and substracting the target elevation (assuming the altimeter pressure altitude was set correctly for the pressure conditions in Home Base).
- The bombsight height, in our case will be our altimeter altitude (6,000 m) minus the target elevation (158 m). The bombsight height will have to be set at more or less 5,840 m. Keep in mind that the altitude can change due to many factors and that your bombsight height is AGL, and will always require you to substract target elevation to be accurate.

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION
HOW AM I DOING IT?

ALTITUDE: 6,000 M AMSL
ABOVE SEA LEVEL

BOMBSIGHT HEIGHT
5,842 m AGL

The bombsight height, in our case will be our altimeter altitude (6000 m) minus the target elevation (158 m). The bombsight height will have to be set at more or less 5840 m. Keep in mind that the altitude can change due to many factors and that your bombsight height is AGL (above ground level), and will always require you to substract target elevation to be accurate.

NOTE: the max bombsight altitude for the He-111 is 6,000 m.

TARGET ELEVATION: 158 m

HAWKINGE
ALTITUDE: 158 m AMSL

ENGLISH CHANNEL
ALTITUDE: 0 m AMSL

CALAIS MARCK
ALTITUDE: 2 m AMSL

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION HOW AM I DOING?

- Caution: our altitude and speed set on the bombsight will **<u>not</u>** be the values read on the altimeter and airspeed indicators.
- We have already seen why the bombsight height must be the altitude value read on the altimeter minus the target elevation.
- **<u>Indicated Airspeed</u>** (IAS) is the speed you read on your airspeed indicator. It is driven by your Pitot tube and a barometric static port. Air pressure varies with altitude (the higher you go, the less air there is). IAS is corrected for the surrounding air pressure but **<u>not</u>** for air density.
- **<u>True Airspeed</u>** (TAS) is indicated airspeed corrected to take into account air density (which, like we said, depends on your current altitude).
- The bombsight requires a True Airspeed input, **<u>not</u>** an indicated airspeed.
- Fortunately, there is an interpolation table available in the Cliffs of Dover manual to help you get an approximation of TAS. We will see how to use this table in the next page.

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION
HOW AM I DOING?

We will aim for an indicated airspeed (IAS) of 300 km/h (read on the airspeed gauge) at an altitude of 5,840 m.

1. Pick the appropriate row for IAS (300 km/h).
2. Pick the appropriate columns for nearest altitudes (5,000 and 6,000 m)
3. Take note of the TAS values in the table 386 km/h and 407 km/h)
4. Because the TAS values are close enough and that bombsight airspeed only goes into increments of 10, we can approximate the resulting TAS value to approx. an average value of **400 km/h**. It is not the exact value, but in our case, since we are too lazy to take a calculator and do the interpolation manually, it should be precise enough.

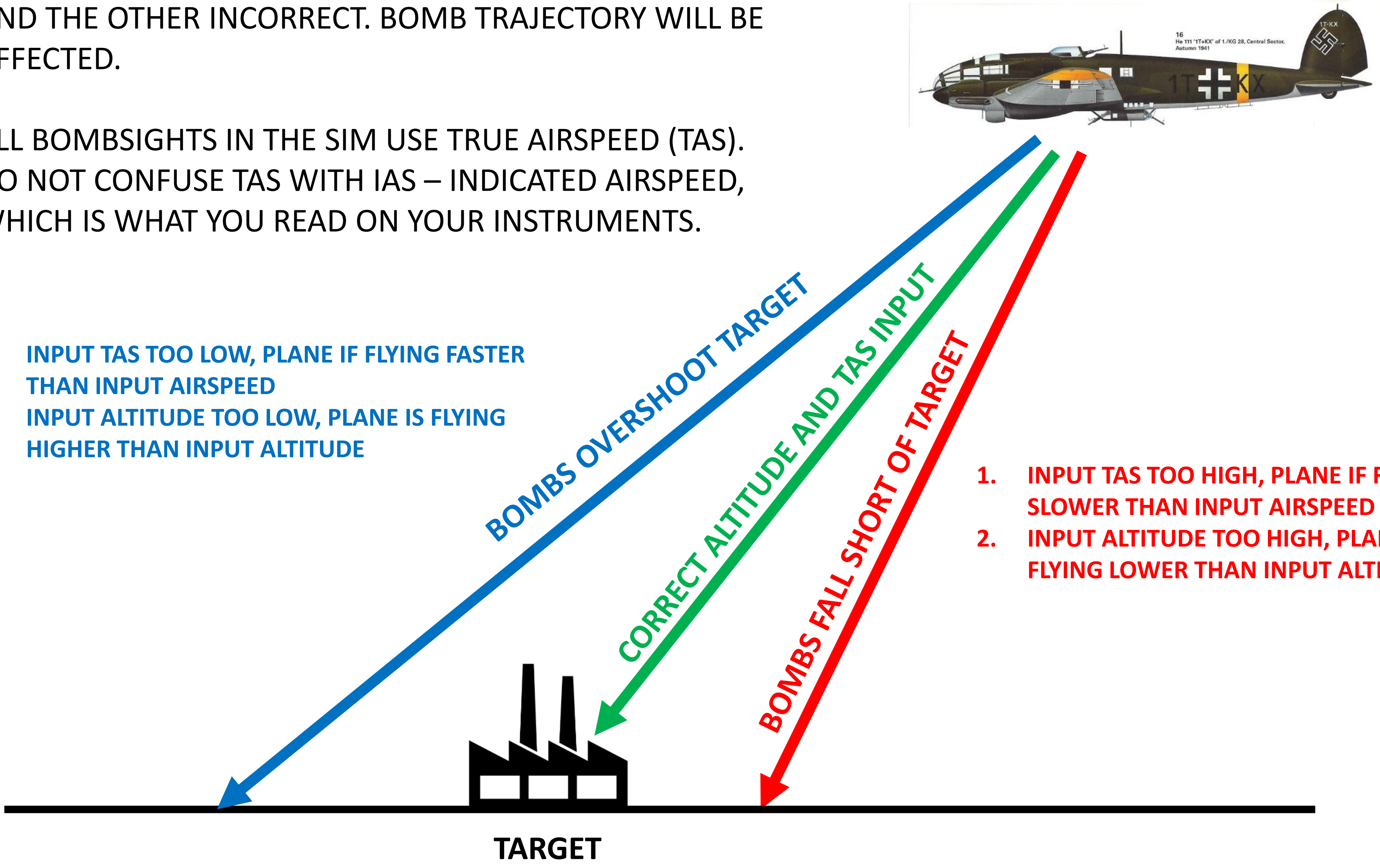
Metric (speed in km/h, altitude in metres)

Km/h \ Metres	1,000	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
200	210	220	232	244	257	271	286	301	317	334
250	262	276	290	305	322	339	357	376	396	418
300	315	331	348	366	386	407	428	451	476	501
325	341	358	377	397	418	440	464	489	515	543
350	367	385	404	425	448	471	496	521	549	577
375	393	413	433	456	480	505	531	559	588	618
400	419	440	462	486	512	538	566	596	627	660
425	446	468	491	516	544	572	602	633	666	701
450	472	495	520	547	576	605	637	670	705	742
500	524	549	575	604	634	666	699	734	771	810
550	576	604	633	664	698	733	769	808	848	891
600	628	658	690	725	761	799	839	881	925	972
650	681	713	748	785	825	866	909	955	1003	1053

PART 11: BOMBING TUTORIAL

PRESUME ONE FACTOR, ALTITUDE OR TAS, IS CORRECT AND THE OTHER INCORRECT. BOMB TRAJECTORY WILL BE AFFECTED.

ALL BOMBSIGHTS IN THE SIM USE TRUE AIRSPEED (TAS). DO NOT CONFUSE TAS WITH IAS – INDICATED AIRSPEED, WHICH IS WHAT YOU READ ON YOUR INSTRUMENTS.



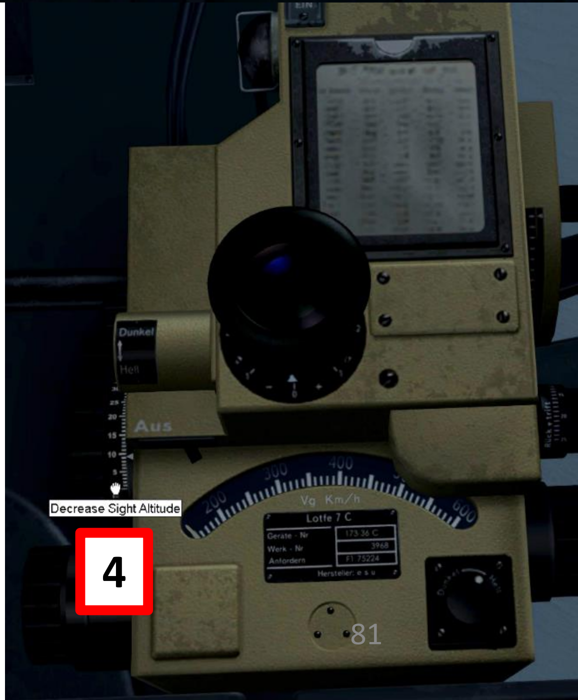
1. INPUT TAS TOO LOW, PLANE IF FLYING FASTER THAN INPUT AIRSPEED
2. INPUT ALTITUDE TOO LOW, PLANE IS FLYING HIGHER THAN INPUT ALTITUDE

1. INPUT TAS TOO HIGH, PLANE IF FLYING SLOWER THAN INPUT AIRSPEED
2. INPUT ALTITUDE TOO HIGH, PLANE IS FLYING LOWER THAN INPUT ALTITUDE

BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION HOW AM I DOING?

Be smart: set up your bombsight in advance (set airspeed and altitude at which you want to bomb) while you are still on the ground. This will save you time and trouble. In our case, we will enter a bombsight airspeed of 400 km/h and an altitude of 5840 m.

1. **AIRSPEED INDICATOR (IAS)**
2. **ALTIMETER (AMSL)**
3. **BOMBSIGHT AIRSPEED INPUT (TAS)**
4. **BOMBSIGHT ALTITUDE INPUT (AGL)**
5. **BOMB DISTRIBUTOR SALVO QTY**



BOMBING TUTORIAL – PHASE 1: PLANNING THE MISSION WHAT CAN HELP ME OR KILL ME? HOW DO I GET HOME?

- WHAT CAN HELP ME OR KILL ME?
  - Know where your enemy patrol routes are, where battles usually take place and avoid these places when you are doing your flight plan.
  - Give fighter escorts a rendezvous point so they can link up with you and protect you.

- HOW DO I GET HOME?
  - In our case, we will simply do a 180 once we dropped our bombs and head back home.

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL
PHASE 4: FLYING TO TARGET

- Once we have taken off, we will follow a magnetic heading of 296 to Hawkinge.
- You can use the compass traditionally to fly there manually, but you can also use the auto-pilot.
- In order to use the auto-pilot and know where you are going, you will need to set up your magnetic compass and directional gyro differently than shown in the compass navigation section.
- **Course Mode** is a mode where auto-pilot takes over rudder control to make your aircraft travel following a given heading. You still have control over ailerons and elevator. Course mode is generally used when climbing or descending. In this mode, climb rate is better controlled through elevator trim rather than pure elevator input.
- **Mode 22 (Straight n' Level)** is a mode where auto-pilot takes over rudder, elevator and aileron controls to make your aircraft travel following a given heading. You will have no control over any of your control surfaces. Mode 22 is used when cruising or when level-bombing as this mode will want to make you stay level at a given heading.

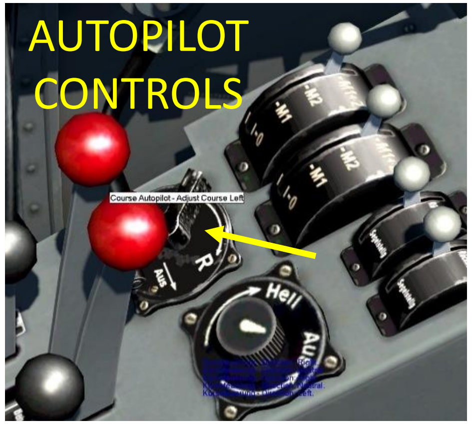
  Note: Mode 22 will often make your aircraft go into a dive (- 5 m/s approx) for approximately one minute. It is normal: the aircraft will try to gain speed in the process. You should lose from 500 to 800 m after Mode 22 is engaged. The climb rate will eventually stabilize to "0". If you intend on bombing the target from 6,000 m, make sure you are 500-800 m higher before you engage Mode 22.

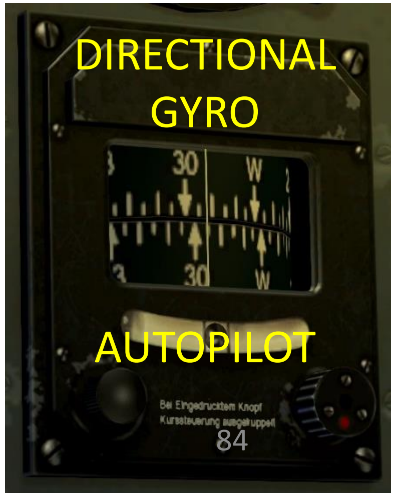
PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL
PHASE 4: FLYING TO TARGET

HE-111 AUTOPILOT OPERATION TABLE

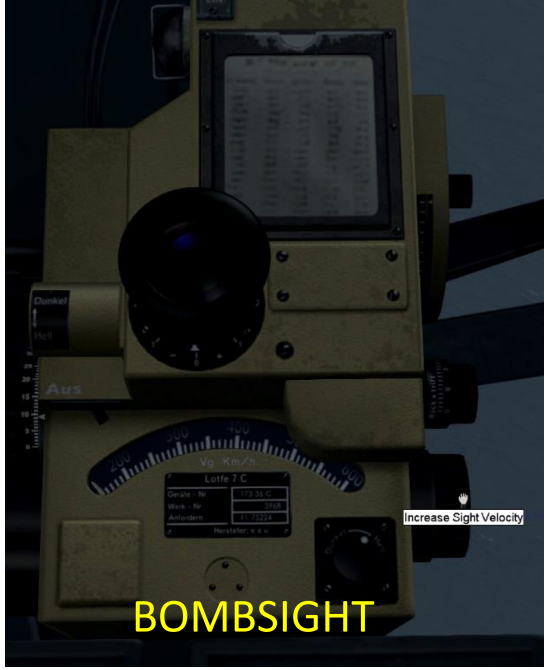
STEP	ACTION
1	SET/SYNCHRONIZE DIRECTIONAL GYRO TO THE SAME HEADING READ ON THE MAGNETIC COMPASS.
2	SET A COURSE TO DESIRED HEADING USING THE COURSE SETTER ON THE REPEATER COMPASS
3	ALIGN AIRCRAFT WITH COURSE SETTER BY CONSULTING THE REPEATER COMPASS (FOLLOW THE WHITE INDICATOR).
4	WHEN AIRCRAFT IS ALIGNED WITH COURSE SETTER, ALIGN AUTOPILOT BAND WITH THE DIRECTIONAL GYRO band USING THE “AUTOPILOT RIGHT” OR “AUTOPILOT LEFT” CONTROLS.
5	WHEN AUTOPILOT/GYRO BANDS ARE LINED UP, ENGAGE DESIRED AUTOPILOT MODE (COURSE MODE OR MODE 22)
6	WHEN AUTOPILOT IS ENGAGED, STEER AIRCRAFT USING THE “AUTOPILOT RIGHT” OR “AUTOPILOT LEFT” CONTROLS FOR BIG CORRECTIONS. STEER AIRCRAFT USING THE “DIRECTIONAL GYRO INCREASE/DECREASE” CONTROLS FOR SMALL COURSE CORRECTIONS. USING THE DIRECTIONAL GYRO IS USUALLY A BETTER WAY TO USE THE AUTOPILOT AS THE PILOT HAS BETTER CONTROL OVER HIS SHIP.





BOMBING TUTORIAL
PHASE 5: BOMBING RUN

HE-111 BOMBSIGHT OPERATION TABLE HIGH ALTITUDE LEVEL BOMBING (AUTO MODE)	
STEP	ACTION
1	ENGAGE AUTO-PILOT IN MODE 22 WHEN YOU HAVE SIGHT ON TARGET AND YOU ARE ALIGNED WITH IT. (SEE AUTOPILOT TABLE)
2	FIND YOUR TARGET USING THE “INCREASE/DECREASE SIGHT DISTANCE” CONTROLS AND YOUR AUTOPILOT CONTROLS.
3	OPEN BOMB BAY DOORS AND ARM YOUR BOMBS IF NOT DONE ALREADY ON THE GROUND.
4	SELECT BOMB DISTRIBUTOR DELAY (“0” IS RECOMMENDED FOR HIGH ALTITUDE PRECISION BOMBING)
5	SELECT BOMB SALVO QTY (“MAX” IS RECOMMENDED IF YOU WANT TO DROP ALL YOUR PAYLOAD).
6	CHECK AIRSPEED AND ALTITUDE IN THE BOMBARDIER SEAT.
7	CONVERT READ INDICATED AIRSPEED INTO TRUE AIRSPEED AND USE THIS VALUE FOR BOMBSIGHT AIRSPEED INPUT.
8	CONVERT ALTITUDE INTO HEIGHT (READ ALTITUDE MINUS TARGET ELEVATION) AND USE THIS VALUE FOR BOMBSIGHT ALTITUDE INPUT.
9	STEER THE AIRCRAFT USING THE “AUTOPILOT RIGHT” OR “AUTOPILOT LEFT” CONTROLS (SEE AUTOPILOT TABLE) AND USE YOUR “INCREASE/DECREASE BOMBSIGHT DISTANCE” CONTROLS TO LINE UP BOMBSIGHT RETICLE ON THE TARGET. YOU CAN FINE-TUNE COURSE CORRECTIONS WITH THE DIRECTIONAL GYRO INCREASE/DECREASE CONTROLS.
10	TOGGLE BOMBSIGHT AUTOMATION, MAKE SURE THE BOMBSIGHT IS TRACKING THE TARGET. IN AUTO MODE, RETICLE DRIFT WILL OCCUR IF WRONG BOMBSIGHT INPUT IS ENTERED OR IF THE AIRCRAFT IS DRIFTING LATERALLY FROM THE TARGET. YOU CAN COMPENSATE FOR SMALL DRIFT BY INCREASING SLIGHTLY BOMBSIGHT AIRSPEED INPUT WITHOUT A MAJOR IMPACT ON DROP PRECISION. YOU CAN FINE-TUNE COURSE CORRECTIONS WITH THE DIRECTIONAL GYRO INCREASE/DECREASE CONTROLS.
11	WAIT FOR THE FIREWORKS. BOMBS SHOULD BE RELEASED AUTOMATICALLY BETWEEN APPROX. 28 DEG @ 4,000 METERS AND 22 DEG FOR 6,000 METERS. **THE BOMBSIGHT RETICLE IS WHERE THE LAST BOMB WILL HIT.**



BOMBING TUTORIAL
PHASE 5: BOMBING RUN

OTHER USEFUL COMMANDS (APPLICABLE TO HE-111)	
DROP BOMBS	B
OPEN BOMB BAY DOOR	N
CLOSE BOMB BAY DOOR	L_CTRL+N
ARM BOMBS (AXIS BOMBERS ONLY)	L_CTRL+W
SWITCH CREW POSITION (BOMBARDIER/PILOT)	C
LEAN TO GUNSIGHT	JOYSTICK BTN (CUSTOM KEY)
COURSE AUTO-PILOT MODE - PREVIOUS	A
COURSE AUTO-PILOT MODE – NEXT	S
COURSE AUTO-PILOT ADJUST COURSE LEFT	L_CTRL+A
COURSE AUTO-PILOT ADJUST COURSE RIGHT	L_CTRL+S

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 HE-111)

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	

BOMBING TUTORIAL
PHASE 5: BOMBING RUN

So here is a quick reminder:

- ON THE GROUND

1. Set your predicted bomb run altitude and airspeed in your bombsight while on the ground.
2. For He-111, you only have one bomb bay (unlike the Ju-88, which has 2 bomb bay and one bomb rack).
3. Select desired salvo quantity, release delay, distributor release mode (Salvo? Single?).
4. ARM bombs and fly to target.

- IN THE AIR

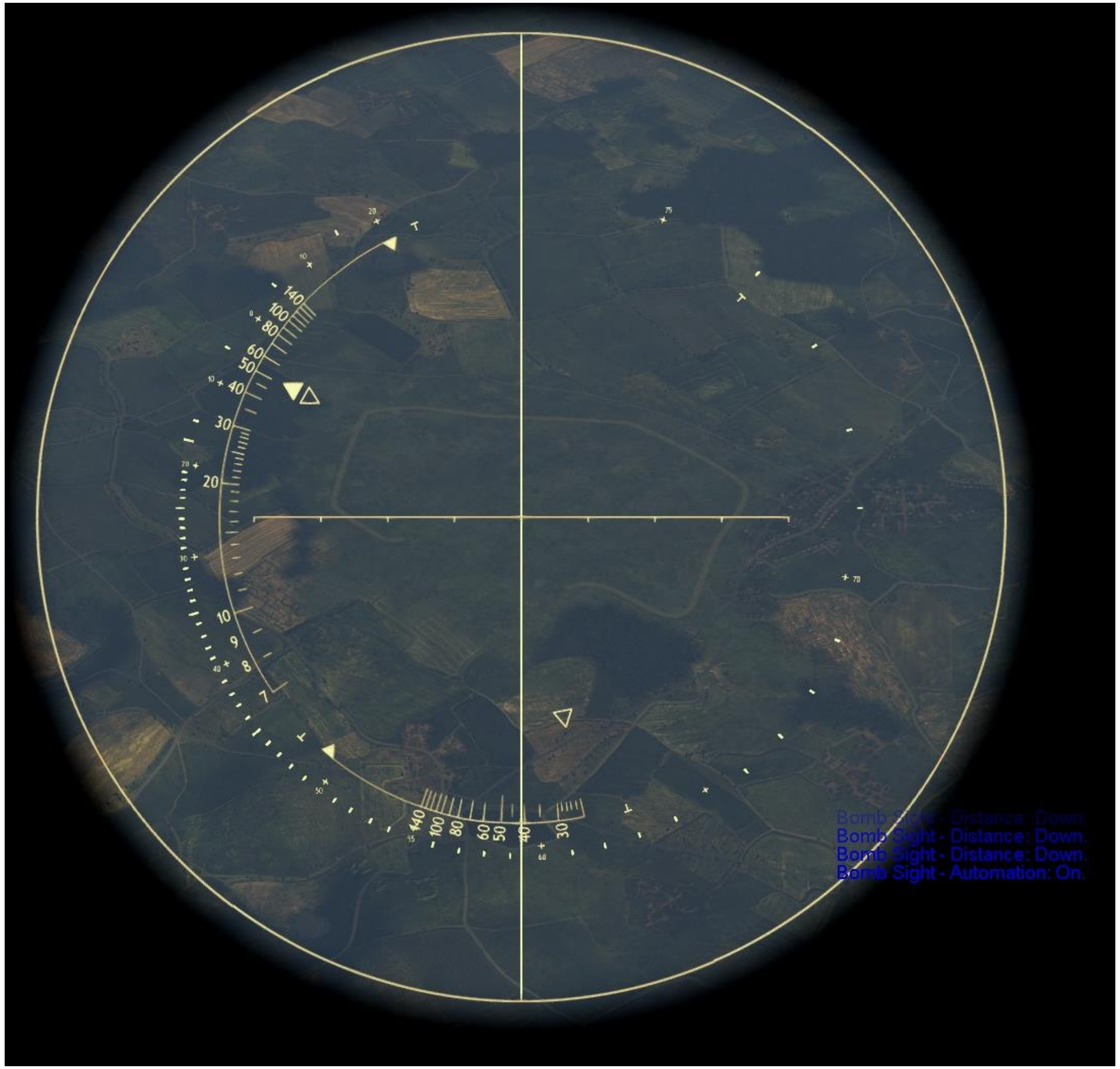
5. Find target and reach targeted altitude and airspeed
6. Open bomb bay doors
7. Follow steps detailed in the BOMBSIGHT OPERATION TABLE.
8. Thanks to all the work you did on the ground, you will see that there is not a whole lot to do in previous step apart from putting your bombsight cursor on the target, adjust slightly bombsight airspeed & altitude and press the Bombsight Automation key.
9. Jump into your ventral gunner to see hits on target.
10. Close bomb bay doors.
11. Go home for cookies and bratwurst.

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL
PHASE 5: BOMBING RUN

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL
PHASE 5: BOMBING RUN



BOMBSIGHT AUTOMATION ENABLED

BOMBS ARE DROPPED AT APPROX 22 DEG

PART 11: BOMBING TUTORIAL

BOMBING TUTORIAL
PHASE 5: BOMBING RUN