

CHUCK'S GUIDE

IL-2 BATTLE OF STALINGRAD



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	(Unit)	LaGG-3	Yak-1	La-5	Il-2	Pe-2	Bf.109F4	Bf.109G2	Fw190A3	Ju-87	He-111
TEMPERATURES											
Water Rad Min Max	Deg C	80 100	80 100	- 	80 110	40 100	40 100	40 100	- 	60 100-110	40 95
Oil Rad (OUTBOUND) Min Max	Deg C	40 100	40 100	55 75	70 115	- 	40 80	40 80	40 110	30 105	35 95
Oil Rad (INBOUND) Min Max	Deg C	- 	- 	- 	40 80	- 	- 	- 	- 	- 	-
Cylinder Head Temp Min Max	Deg C	- 	- 	120 200	- 	- 	- 	- 	- 	- 	-
ENGINE SETTINGS											
Takeoff RPM	RPM	2700	2700	2400	2200	2700	2600	2500	2500	2500	2400
Takeoff Manifold Pressure	RU: mm Hg GER: ATA	1050	1050	1150	1150	1050	1.3	1.3	1.3	1.3	1.35
Climb RPM	RPM	2600	2650	2300	2050	2600	2600 30 min	2500	2400	2450 30 min	2300 30 min
Climb Manifold Pressure	RU: mm Hg GER: ATA	1020	1050	1150	1050	1050	1.3 30 min	1.3	1.3	1.25 30 min	1.15 30 min
Normal Operation/Cruise RPM	RPM	1700	1850	2300	1850	2200	2200	1900	2200	2100	2200
Normal Operation/Cruise Manifold Pressure	RU: mm Hg GER: ATA	1020	850	900	850	1020	1.0	1.0	1.1	1.2	1.10
Combat RPM	RPM	2650	2650	2400	2050	2600	2600	2500	2400	2250	2300
Combat Manifold Pressure	RU: mm Hg GER: ATA	1050	1050	1150	1050	1050	1.3	1.3	1.32	1.2	1.15
Emergency Power/ Boost RPM @ km	RPM	2700	2700	2400 10 min max	2200	2700	2700 1 min max	2500	2600 7-8 min max	2600 1 min max	2400 1 min max
Emergency Power / Boost Manifold Pressure @ 1 km	RU: mm Hg GER: ATA	1050	1050	1150 10 min max	1150	1050	1.42 1 min max	1.3	1.42 7-8 min Max	1.4 1 min max	1.35 1 min max
Supercharger Stage 1 Operation Altitude	m	0 2000	0 2500	0 2000	-	0 2000	-	-	-	Auto/man modes	Auto/man modes
Supercharger Stage 2 Operation Altitude	m	2000+	2500+	2000+	-	2000+	-	-	-	Auto/man modes	Auto/man modes
*Landing Approach RPM	RPM	2600	2200	2400	1800	2700	1500	1500	-	2000	2300
*Landing Approach Manifold Pressure	RU: mm Hg GER: ATA	As required	600	As required	600	As required	0.6	0.6	-	0.6	As required
Notes				Open Oil Radiator at all times	Close Oil radiator in combat	Flaps 30 on Takeoff & 15 on Landing			Lock tailwheel on takeoff	No Abrupt Throttling	Eng. very sensitive to ata/rpm
AIRSPEEDS											
Takeoff – Rotation	km/h	190	200	180	190	250	180	180	200	170	150
Optimal Climb Speed	km/h	270	260	250	250	240	280	280	270	230	N/A
Landing – Approach	km/h	200	180	200	200	200	180	180	190	190	200
Landing – Touchdown	km/h	170	150	170	150	160	160	160	150	150	140-150

Lavochkin-Gorbunov-Gudkov
LaGG-3



Лавочкин-Горбунов-Гудков
ЛаГГ-3



By Chuck

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- PART II: THE CONTROLS
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- PART VI: AIRCRAFT PERFORMANCE

History

IL★2 Chuck O.

The LaGG-3 was a refinement of the earlier LaGG-1, and was one of the most modern aircraft available to the Soviet Air Force at the time of Germany's invasion in 1941. Overweight despite its wooden construction, at one stage 12 LaGG-3s were being completed daily and 6,528 had been built when factory 31 in Tbilisi switched to Yak-3 production in 1944.



The prototype of the LaGG-3, I-301, was designed by Semyon A. Lavochkin, Vladimir P. Gorbunov and Mikhail I. Gudkov. It was designated LaGG-3 in serial production. Its airframe was almost completely made of timber, with crucial parts processed with Bakelite lacquer. This novel wood-laminate construction was more durable than regular timber, was incombustible, and didn't rot.

It was, however, much heavier and pilots joked that rather than being an acronym of the designers' names (Lavochkin, Gorbunov, and Gudkov) "LaGG" stood for lakirovanny garantirovanny grob ("varnished guaranteed coffin") due to its performance relative to its opponent's aircraft at the time of its introduction (later variants were more capable). The full wooden wing (with plywood surfaces) was analogous to that of the Yak-1. The only difference was that the LaGG's wings were built in two sections. Even with the lighter airframe and supercharged engine, the LaGG-3 was seriously underpowered, which led to many performance issues during combat.

The LaGG-3 proved immensely unpopular with pilots. Some aircraft supplied to the front line were up to 40 km/h (25 mph) slower than they should have been and some were not airworthy. In combat, the LaGG-3's main advantage was its strong airframe. Although the laminated wood did not burn it shattered when hit by high explosive rounds. However, the LaGG-3's armament was considered formidable (23 mm or 37 mm cannon).

The LaGG-3 was improved during production, resulting in 66 minor variants in the 6,528 that were built. Experiments with fitting a Shvetsov M-82 radial engine to the LaGG-3 airframe finally solved the power problem, and led to the Lavochkin La-5.

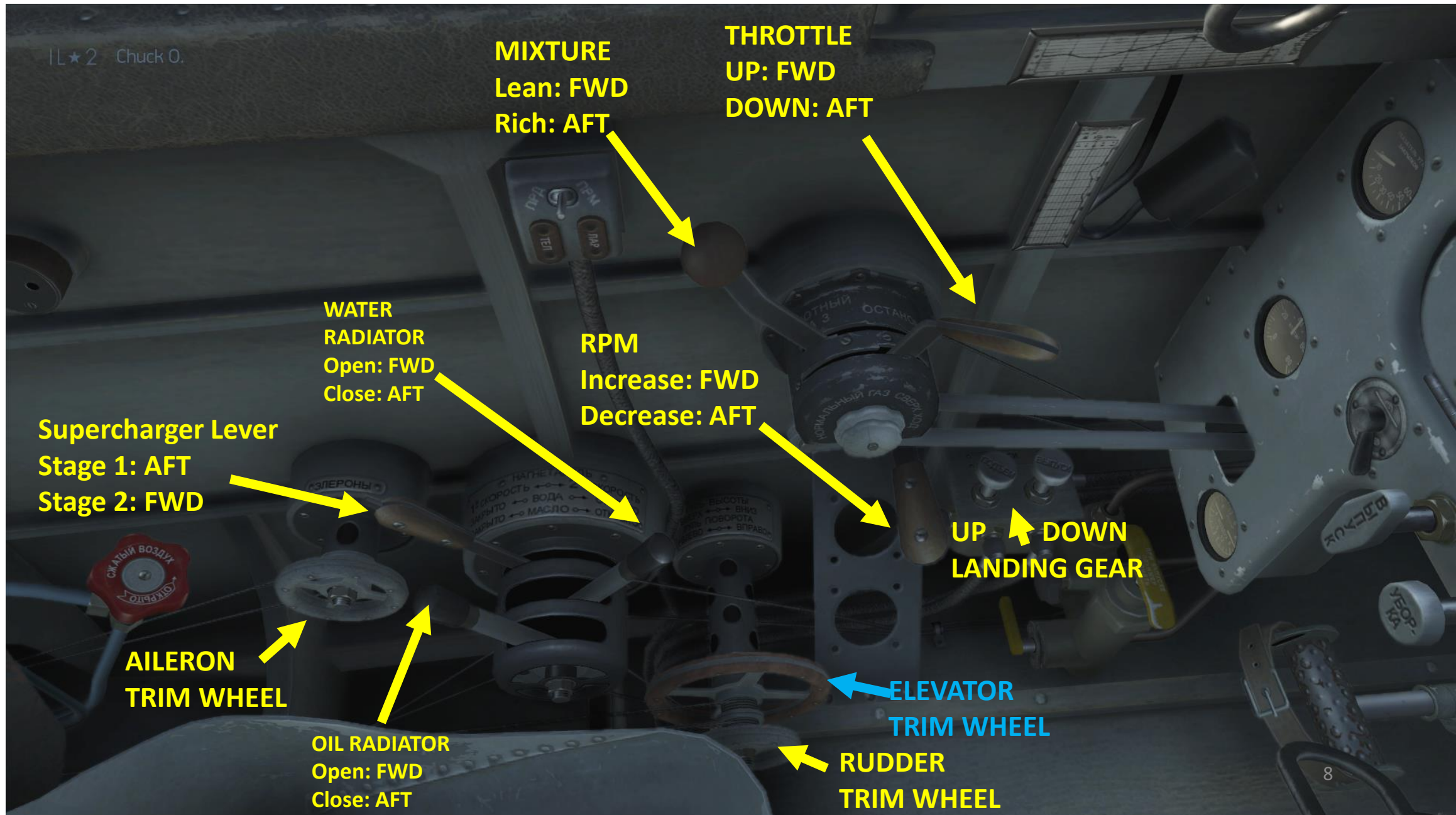
PART I: THE AIRCRAFT

The Cockpit



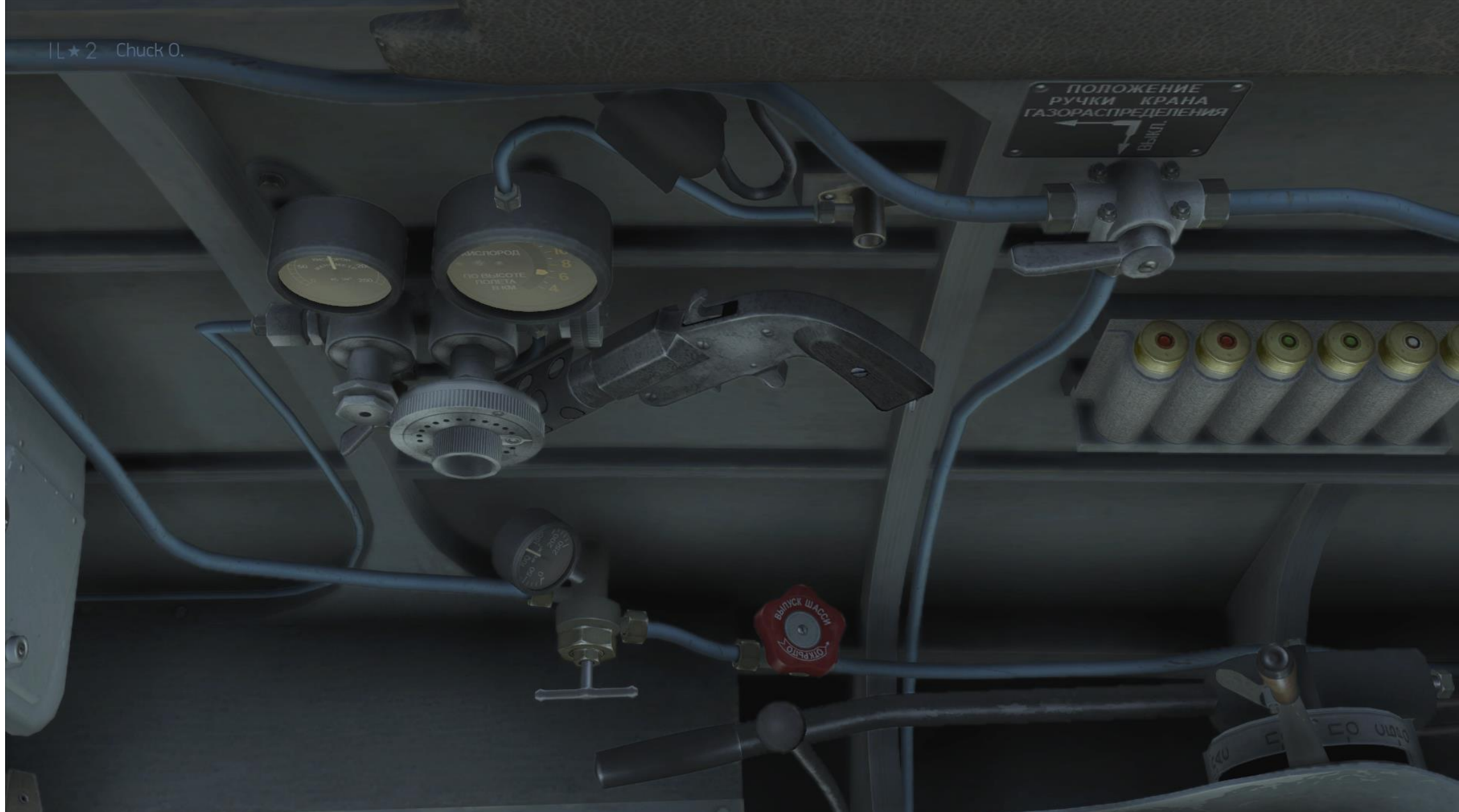
PART I: THE AIRCRAFT

Left Side



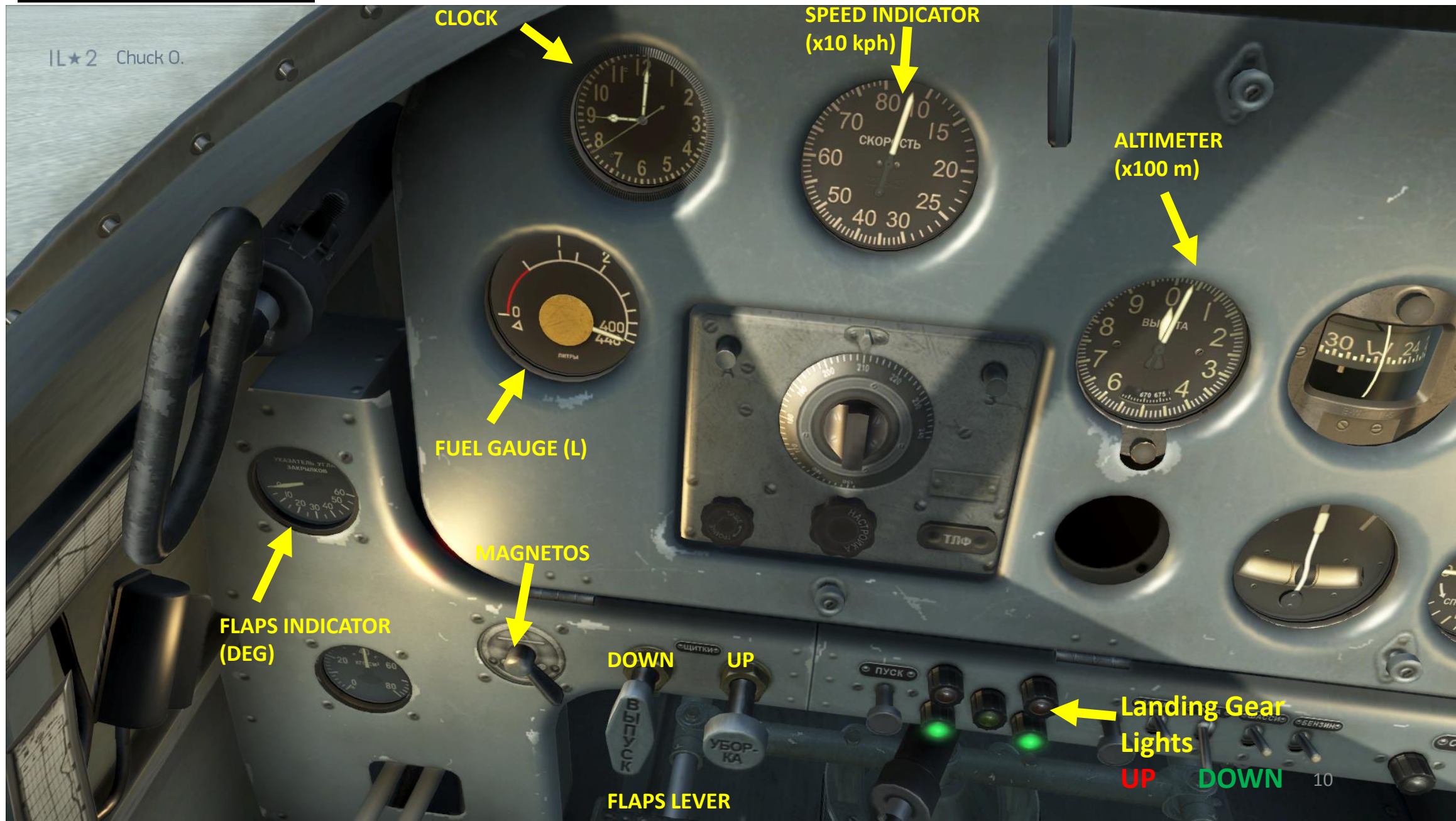
PART I: THE AIRCRAFT

Right Side

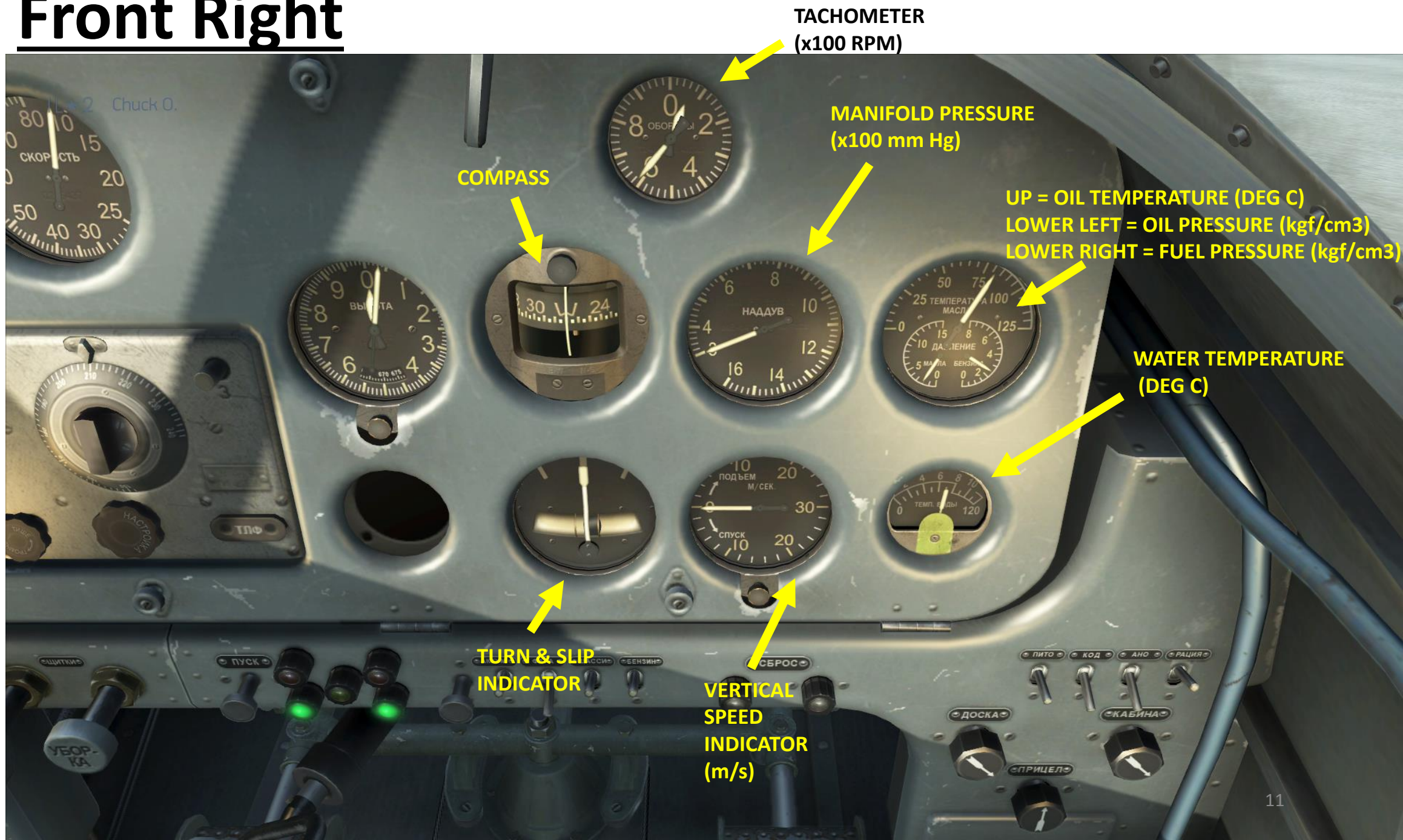


PART I: THE AIRCRAFT

Front Left



Front Right



Wings

MECHANICAL LANDING GEAR INDICATOR
VISIBLE = GEAR DOWN
RETRACTED = GEAR UP



TO SEE THE MECHANICAL LANDING GEAR INDICATORS,
YOU NEED TO OPEN YOUR CANOPY (RALT+C)

Important key bindings

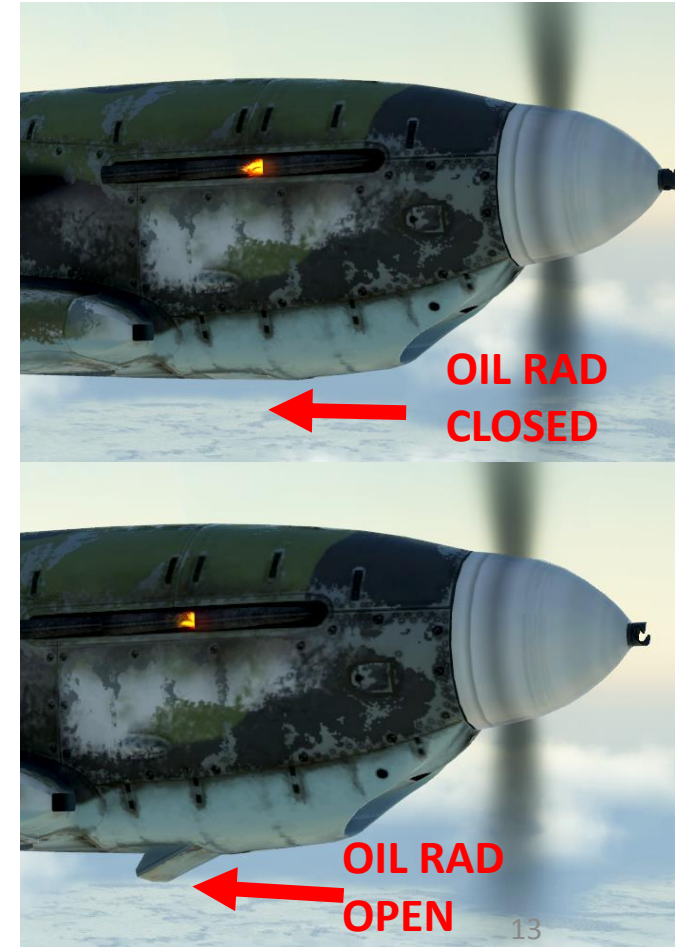
- What you have to cool down your engine are water radiator and oil radiator flaps. Don't forget to set your controls accordingly.



WATER RADIATOR
CLOSED



WATER RADIATOR
OPEN



Important key bindings

- The LaGG-3, like most Russian planes, has a brake system similar to what you would find in your car.
- In order to brake, you need to hold your wheel brake key while you give rudder input to steer your aircraft. Make sure you have adequate mixture, RPM and Manifold Pressure settings or your turn radius will suffer. These factors matter in heavier planes like the Il-2 Sturmovik.

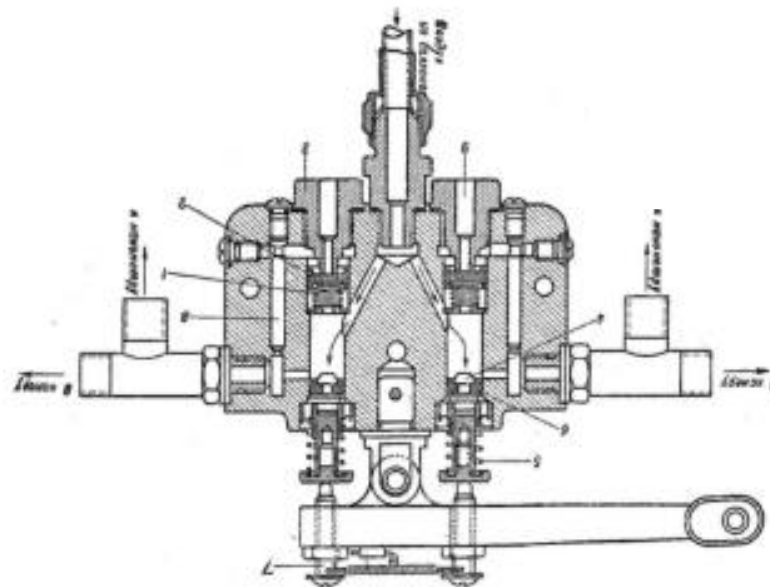
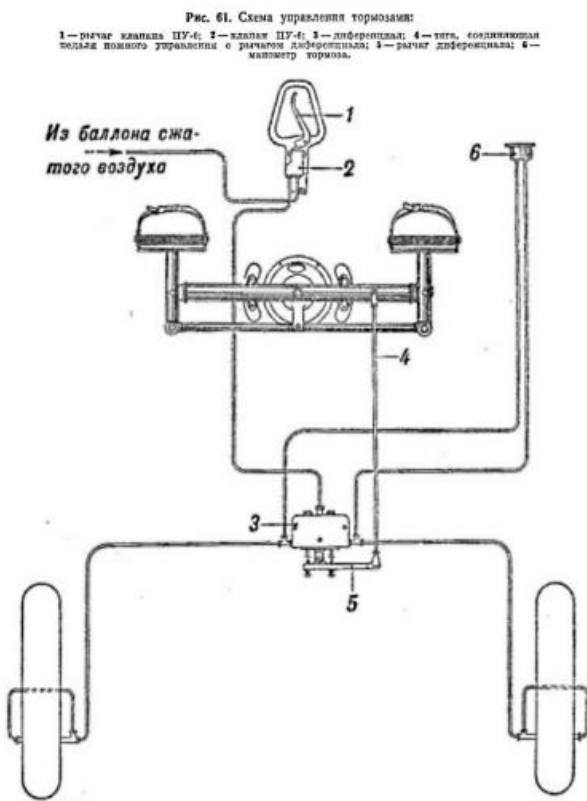
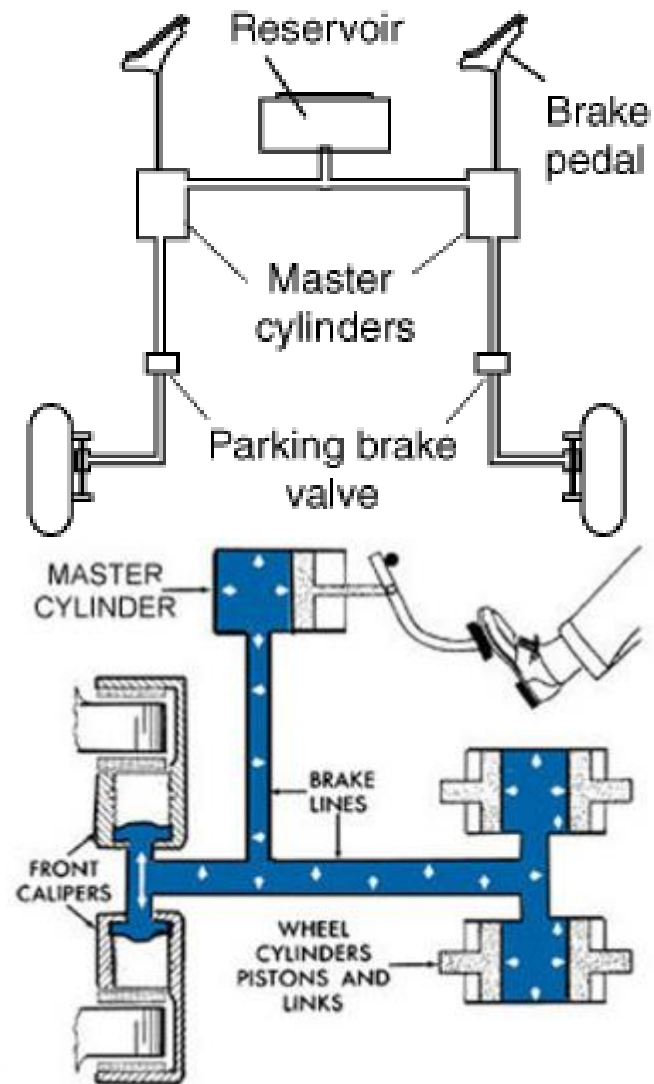


Рис. 62. Дифференциал пневматического управления тормозами:

— пружина предохранительного клапана; 2 — манжета предохранительного клапана; — штуцер; 4 — шток поршня управляющего клапана; 5 — пружина управляющего клапана; 6 — манжета поршня; 7 — толкатель; 8 — канал, сообщаящий тормоз с предохранительным клапаном; 9 — отверстие штуцера предохранительного клапана.



PART III: TAKEOFF

- Taking off in the LaGG-3 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your mixture to full rich
 - 3) Close your water and oil radiator flaps
 - 4) Set minimum RPM
 - 5) Ignite (“E” key by default)!
 - 6) Set your flaps to 20 degrees.

PART III: TAKEOFF

- 7) Wait for your oil radiator temperatures to reach 40 degrees C and your water radiator temperature to reach 80 degrees C.
- 8) Line yourself up on the runway and lock your tailwheel by pulling your stick back to keep your tailwheel down.
- 9) Fully open your water and oil radiator flaps.
- 10) Throttle up full power, max RPM. Correct heading with small rudder input.
- 11) As soon as you reach 140 kph, center the stick and level out to pick some speed.
- 12) When you reach 190 kph, rotate gently.
- 13) Once you are up in the air, pull your gear up and start climbing. Adjust RPM and manifold pressure accordingly (see engine management in part V).

PART IV: LANDING

- 1) Deploy landing gear when going slower than 300 kph.
- 2) Deploy full flaps when going slower than 250 kph.
- 3) Set your RPM to 2600 and adjust throttle as required to maintain approach speed at 200 kph.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and let yourself glide until you touch the ground naturally.
- 6) Touchdown at 170 kph.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



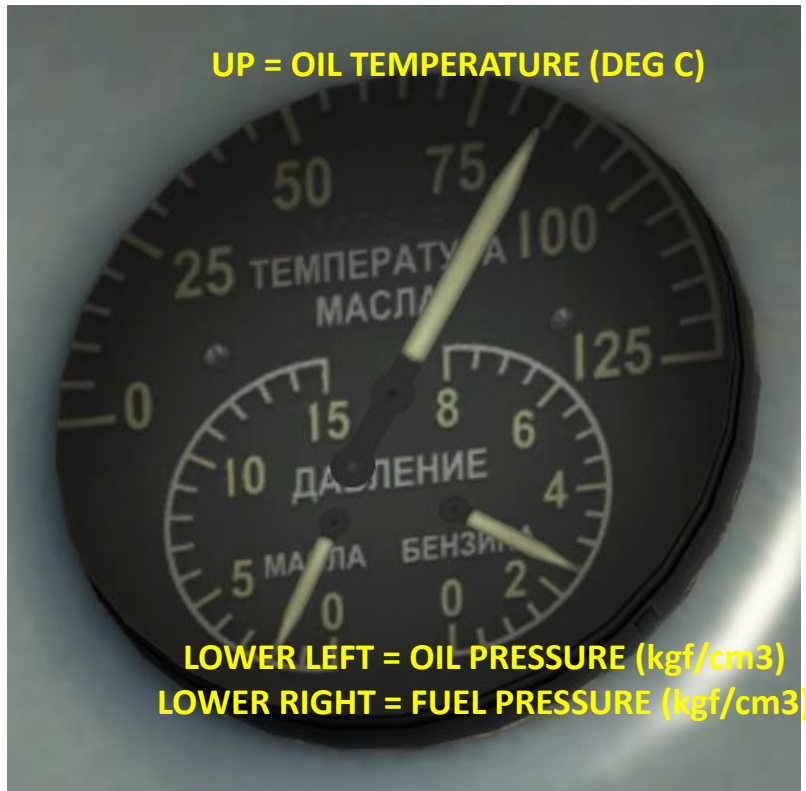
Powerplant

- The LaGG-3 is powered by the **Klimov M-105**. It is a V-12 liquid-cooled piston engine. The M-105, designed in 1940, drew heavily on Vladimir Klimov's experience with the Hispano-Suiza 12Y (license-built as the M-100).
- In addition to a two-speed supercharger, the M-105 had several improvements like two intake valves per cylinder and a counterbalanced crankshaft.
- About 129,000 M-105 and its variants were built. During the war, Klimov's engines were redesignated from "M" (for "motor," engine) to "VK" for the lead designer's initials.



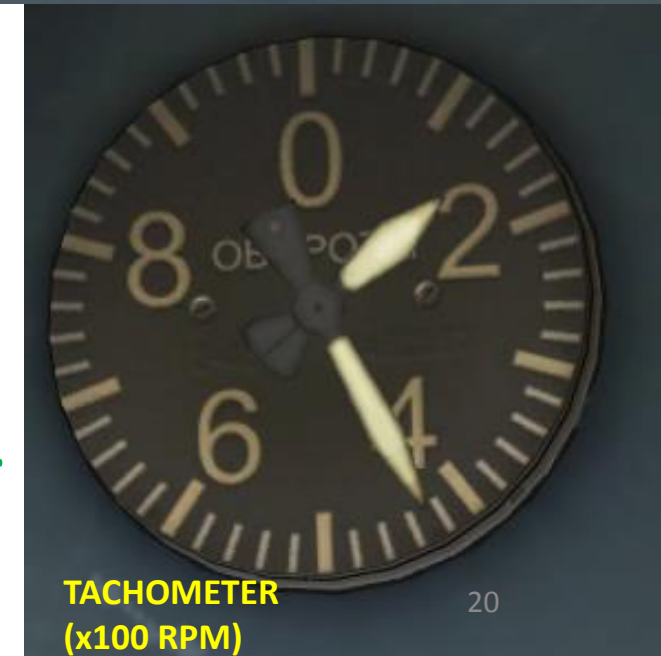
Operating Limits

- Min oil temperature: 40 deg C.
- Max oil temperature: 100 deg C.
- Min water temperature: 80 deg C.
- Max water temperature: 100 deg C.



Recommended Settings

- **Pro Tip:** Progressively lean your mixture as you gain altitude in order to gain maximal power.
- **Takeoff**
 - Water and Oil rads fully open
 - Max RPM, Max Manifold Pressure (MP)
- **Climb**
 - Optimal climb speed: 270 kph
 - 2550-2700 RPM
- **Normal Operation (Cruise)**
 - 1700 RPM
- **Combat**
 - 2650-2700 RPM
- **Supercharger** (increases Manifold Pressure @ higher altitudes)
 - **Stage 1 below 2000 m altitude. Stage 2 over 2000 m.**
 - Lshift + S to toggle supercharger stages



PART VI: AIRCRAFT PERFORMANCE

- Range: 650 km
- Fuel Max Capacity: ~440L
- Endurance: 75 min (1h15)
- Operational ceiling: 10000 m
- Optimal Climb Speed: 270 kph
- Best Climb Rate: 700 m/min
- Turn time: 21-22 s
- Note: Your fuel loadout will impact your aircraft's performance, but also your water and oil radiator flaps, your trim, the air temperature and many other factors. Keeping your speed up without blowing your engine will require a heavy workload that will diminish with practice and experience. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.

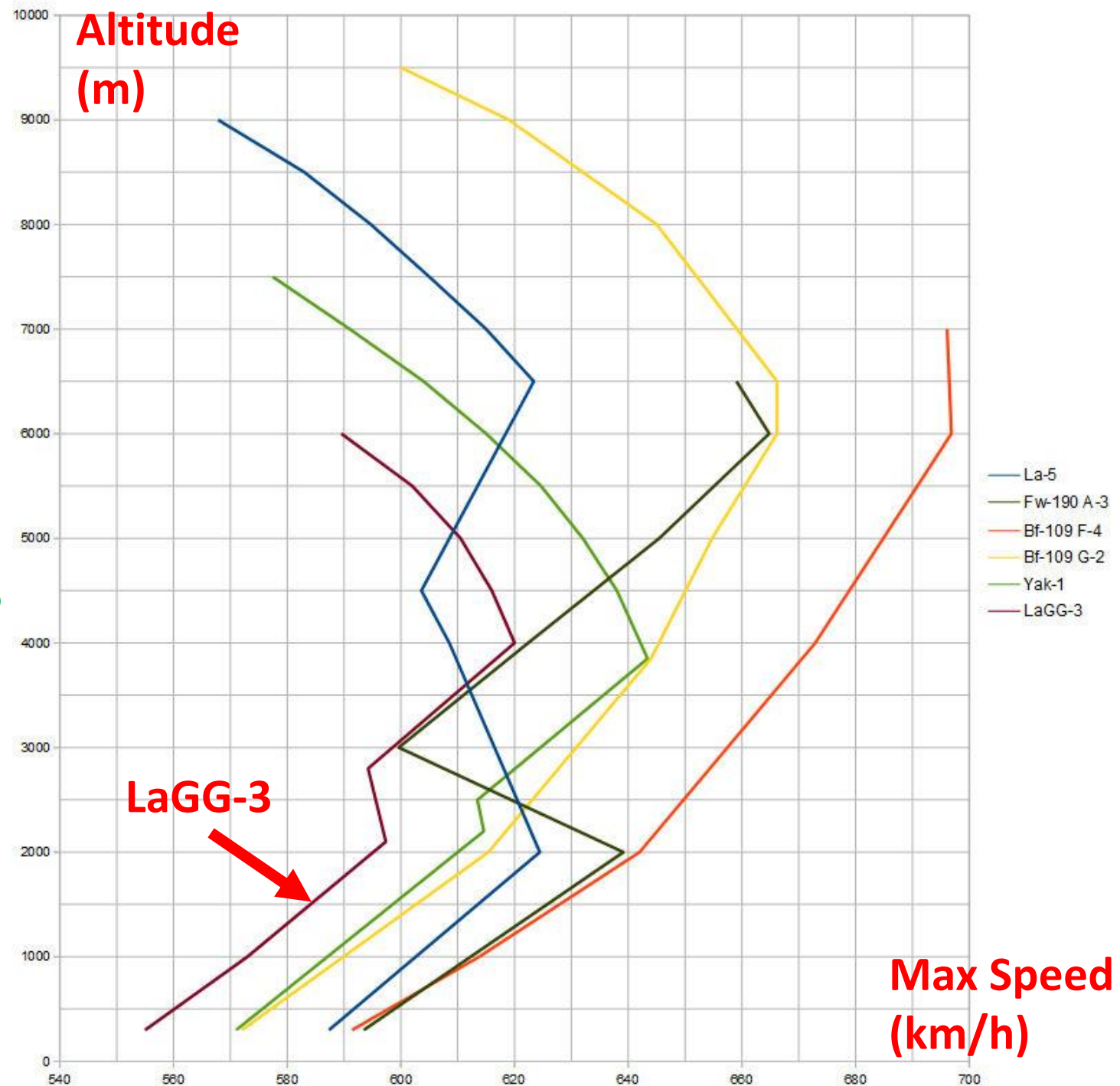


PART VI: AIRCRAFT PERFORMANCE

- Cold weather conditions modeled in Battle of Stalingrad allow superior engine power in comparison to values obtained for standard atmosphere.
- LaGG-3 is heavier, slower and has overall worse performance than any other fighter in the sim. Be gentle on the elevator and maintain high speed at all times. The LaGG has a great roll rate: use it to your advantage.
- LaGG-3 can take more punishment than the 109. Don't put their cannons to the test, though.
- The LaGG-3 is not an agile plane and bleeds a lot of energy during sustained turns. Your best chance is to fight under 5000 m, which is where the 109s performance are not optimal. Gain energy advantage as soon as you can: the 109 will not want to engage you on even terms. The 109 has slats on his wings that allow him to be much more agile at low speeds than you might think: it can and will probably out-turn you.
- ALWAYS fly with a wingman. Forcing the 109 to bleed his energy is the only way you have a chance against him. However, the LaGG-3 is very potent against enemy bombers.
- Do not attempt to outclimb a 109 unless you have a (very) serious speed advantage.
- Moderate use of flaps during low-speed turns can help you get an angle for a deflection shot.
- Do not engage a 109 in scissors: its slats give him the advantage during low-speed rolling manoeuvres.

PART VI: AIRCRAFT PERFORMANCE

MAXIMUM SPEED QMB CONDITIONS (Graph by Matt)



Yakovlev Yak-1 ★ Яковлев Як-1

SERIES 69



By Chuck

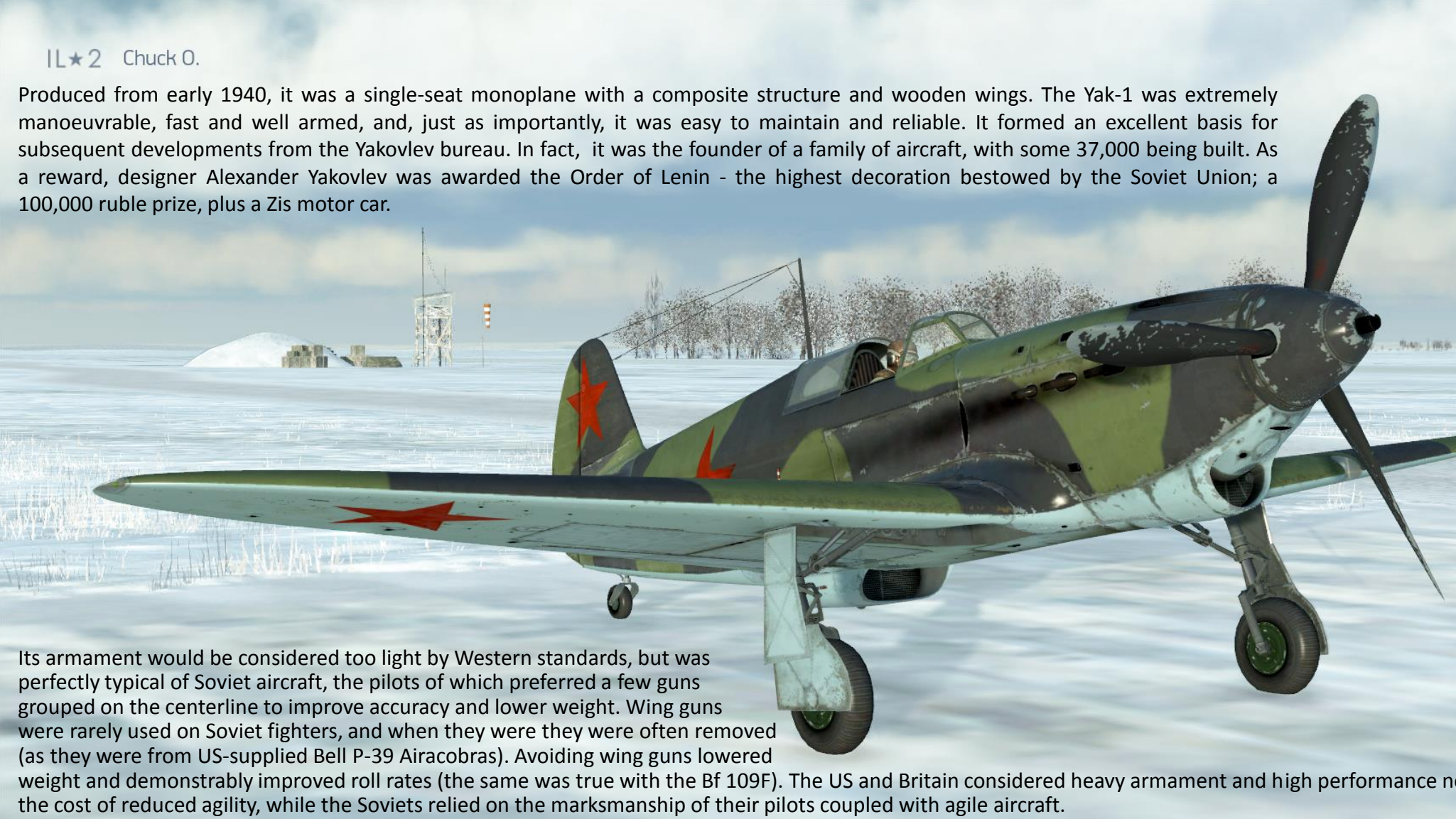
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History

IL★2 Chuck O.

Produced from early 1940, it was a single-seat monoplane with a composite structure and wooden wings. The Yak-1 was extremely manoeuvrable, fast and well armed, and, just as importantly, it was easy to maintain and reliable. It formed an excellent basis for subsequent developments from the Yakovlev bureau. In fact, it was the founder of a family of aircraft, with some 37,000 being built. As a reward, designer Alexander Yakovlev was awarded the Order of Lenin - the highest decoration bestowed by the Soviet Union; a 100,000 ruble prize, plus a Zis motor car.

A Yakovlev Yak-1 fighter aircraft is shown in a snowy field. The aircraft is painted in a camouflage pattern of olive green and dark grey, with red stars on the wings and tail. It has a single propeller and a single seat. The background shows a snowy landscape with some trees and a small structure in the distance.

Its armament would be considered too light by Western standards, but was perfectly typical of Soviet aircraft, the pilots of which preferred a few guns grouped on the centerline to improve accuracy and lower weight. Wing guns were rarely used on Soviet fighters, and when they were they were often removed (as they were from US-supplied Bell P-39 Airacobras). Avoiding wing guns lowered weight and demonstrably improved roll rates (the same was true with the Bf 109F). The US and Britain considered heavy armament and high performance necessary even at the cost of reduced agility, while the Soviets relied on the marksmanship of their pilots coupled with agile aircraft.

The importance of this type in World War II is often underestimated. Soviet naming conventions obscure the fact that the Yak-1 and its successors — the Yak-7, Yak-9 and Yak-3 — are essentially the same design, comparable to the numerous Spitfire or Bf 109 variants. Were the Yaks considered as one type, the 37,000 built would constitute the most produced fighter in history.

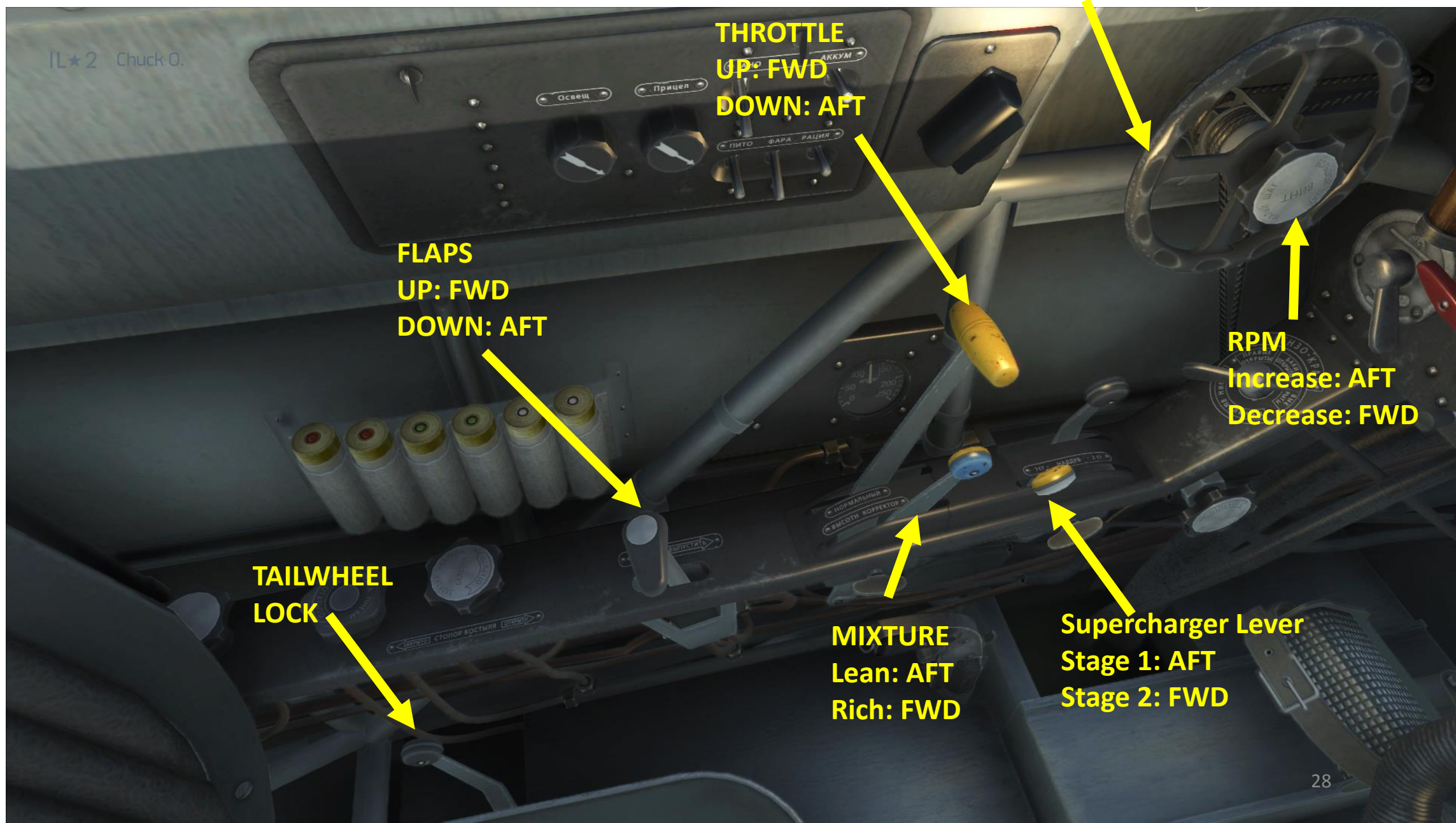
PART I: THE AIRCRAFT

The Cockpit

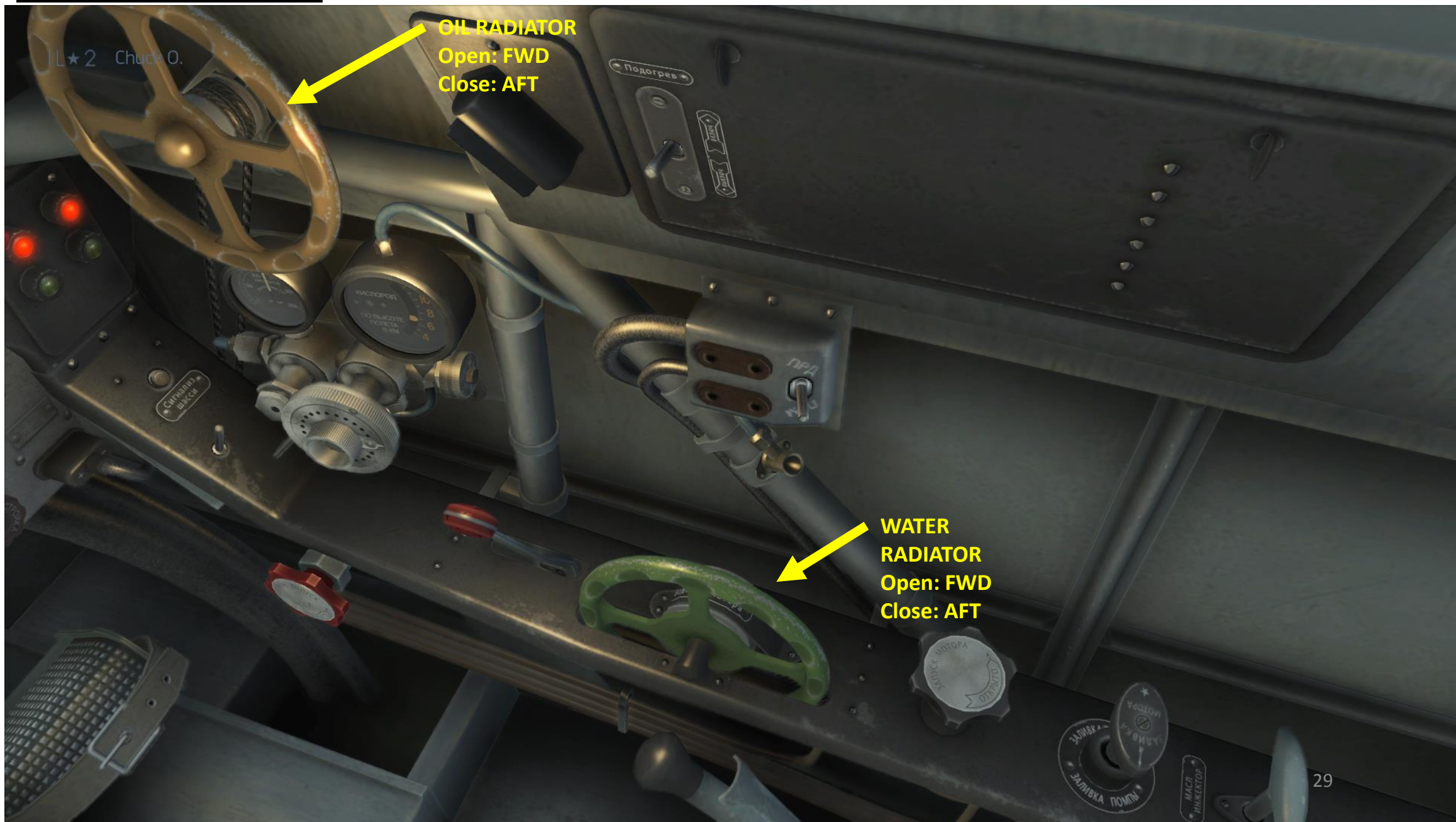


PART I: THE AIRCRAFT

Left Side



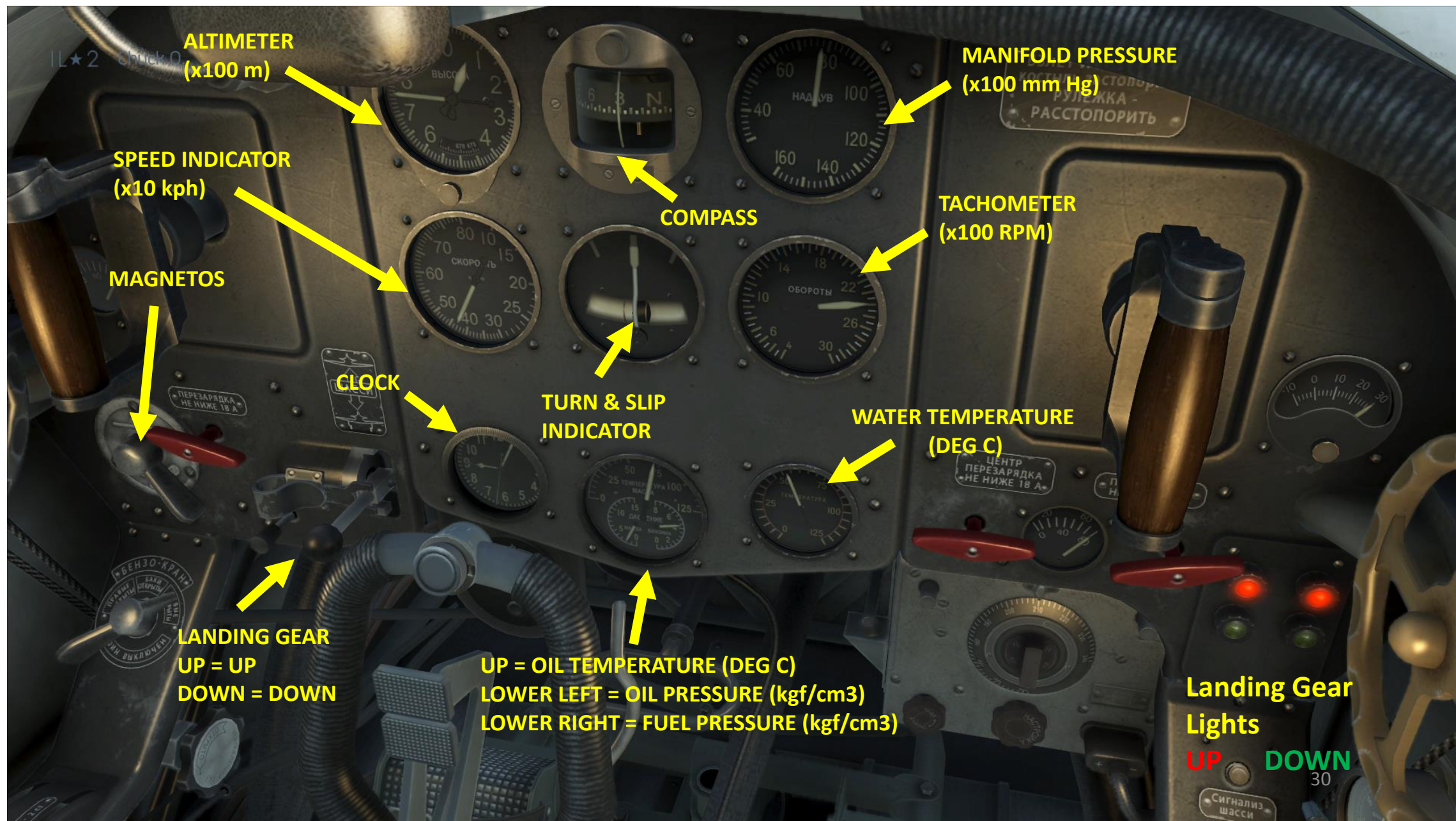
Right Side



PART I: THE AIRCRAFT

Front

- RPK-10 RADIO HOMING COMPASS CURRENTLY NOT IMPLEMENTED IN COCKPIT.
- See Pe-2 Guide for Blind Approach Tutorial for the RPK-10



PART I: THE AIRCRAFT

Wings

MECHANICAL LANDING GEAR
INDICATOR
VISIBLE = GEAR DOWN
RETRACTED = GEAR UP



FUEL GAUGE FOR EACH WING
SHOWS THE LAST 80 LITERS AVAILABLE (RESERVE).



Important key bindings

- What you have to cool down your engine are water radiator and oil radiator flaps. Don't forget to set your controls accordingly.



WATER RADIATOR
CLOSED



WATER RADIATOR
OPEN



OIL RAD
CLOSED



OIL RAD
OPEN

Important key bindings

- The Yak-1, like most Russian planes, has a brake system similar to what you would find in your car.
- In order to brake, you need to hold your wheel brake key while you give rudder input to steer your aircraft. Make sure you have adequate mixture, RPM and Manifold Pressure settings or your turn radius will suffer. These factors matter in heavier planes like the Il-2 Sturmovik.

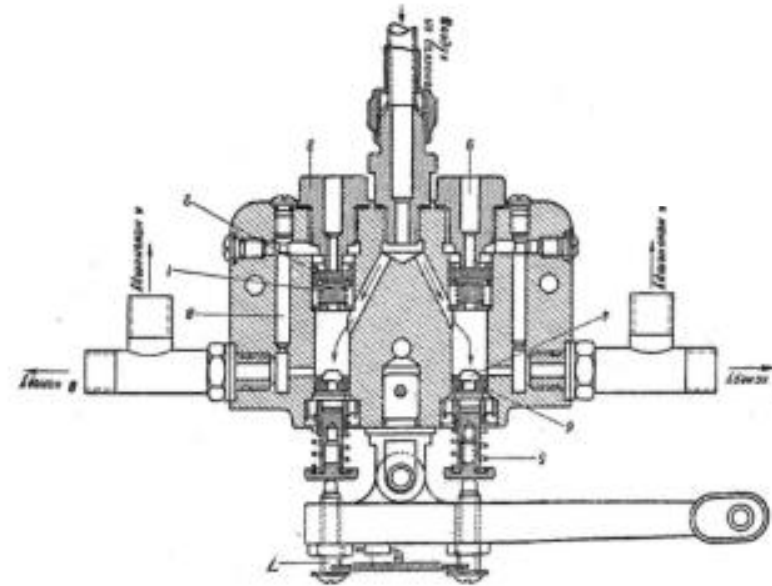
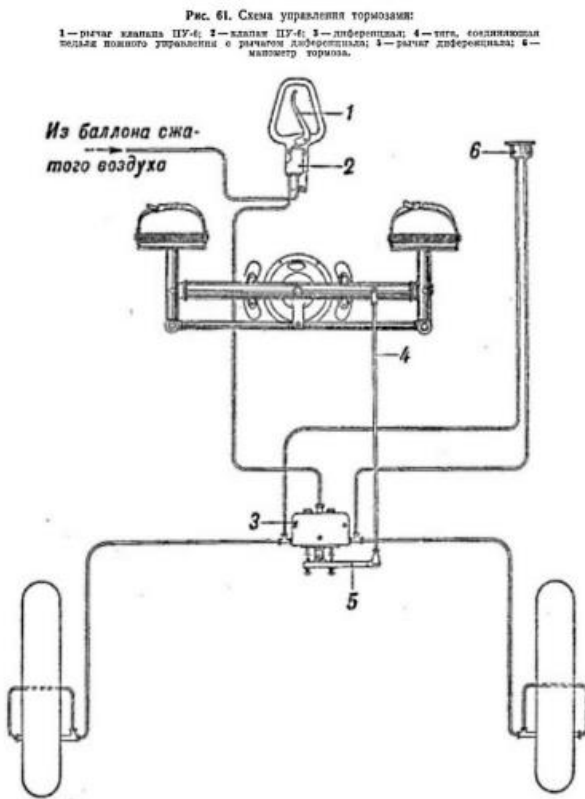
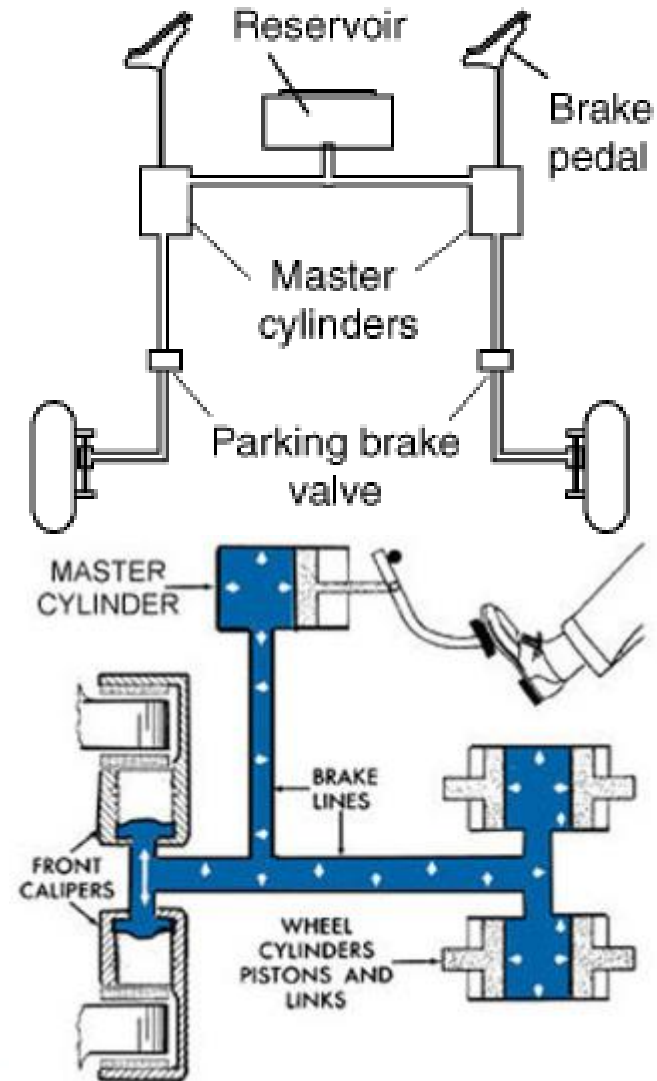


Рис. 62. Дифференциал пневматического управления тормозами:

— пружина предохранительного клапана; 2 — магнет предохранительного клапана; — штиф; 4 — шток поршня управляющего клапана; 5 — пружина управляющего клапана; 6 — магнет поршня; 7 — толкатель; 8 — канал, сообщаящий тормоз с предохранительным клапаном; 9 — отверстие штуцера предохранительного клапана.



PART III: TAKEOFF

- Taking off in the Yak-1 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your mixture to full rich
 - 3) Close your water and oil radiator flaps
 - 4) Set minimum RPM
 - 5) Ignite (“E” key by default)!
 - 6) Set your flaps in the UP position.

PART III: TAKEOFF

- 7) Wait for your oil radiator temperatures to reach 40 degrees C and your water radiator temperature to reach 80 degrees C.
- 8) Line yourself up on the runway and lock your tailwheel by pressing “LCtrl+G” and by pulling your stick back to keep your tailwheel down.
- 9) Fully open your water and oil radiator flaps.
- 10) Throttle up full power, max RPM. Correct heading with small rudder input.
- 11) As soon as you reach 140 kph, center the stick and level out to pick some speed.
- 12) When you reach 200 kph, rotate gently.
- 13) Once you are up in the air, pull your gear up and start climbing. Adjust RPM and manifold pressure accordingly (see engine management in part V).

PART IV: LANDING

- 1) Deploy landing gear when going slower than 300 kph.
- 2) Deploy flaps when going slower than 250 kph.
- 3) Setting your RPM to 2200 and your manifold pressure to 600 mm Hg on approach is recommended. Adjust throttle as required to maintain approach speed at 180 kph.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and let yourself glide until you touch the ground naturally.
- 6) Touchdown at 150 kph with a 3-point attitude.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



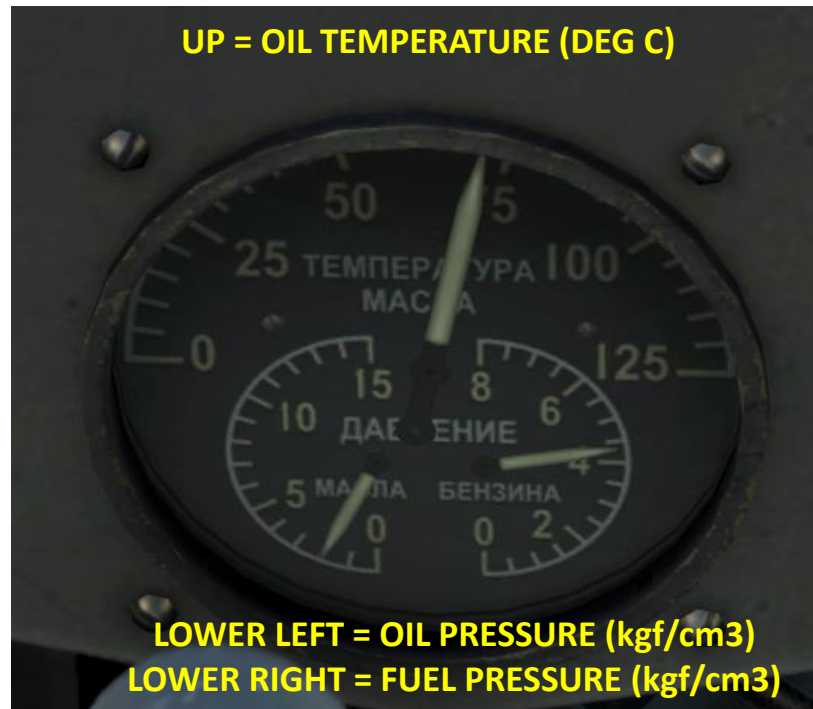
Powerplant

- The Yak-1 is powered by the **Klimov M-105**. It is a V-12 liquid-cooled piston engine. The M-105, designed in 1940, drew heavily on Vladimir Klimov's experience with the Hispano-Suiza 12Y (license-built as the M-100).
- In addition to a two-speed supercharger, the M-105 had several improvements like two intake valves per cylinder and a counterbalanced crankshaft.
- About 129,000 M-105 and its variants were built. During the war, Klimov's engines were redesignated from "M" (for "motor," engine) to "VK" for the lead designer's initials.



Operating Limits

- Min oil temperature: 40 deg C.
- Max oil temperature: 100 deg C.
- Min water temperature: 80 deg C.
- Max water temperature: 100 deg C.



WATER TEMPERATURE (DEG C)

Recommended Settings

- **Pro Tip:** Progressively lean your mixture as you gain altitude in order to gain maximal power.
- **Takeoff**
 - Water and Oil rads fully open
 - Max RPM, Max Manifold Pressure (MP)
- **Climb**
 - Optimal climb speed: 250 kph
 - 2600 RPM
 - 1050 mm Hg Manifold Pressure
- **Normal Operation (Cruise)**
 - 1850 RPM
 - 850 mm Hg
- **Combat**
 - 2650 RPM
 - 1050 mm Hg
- **Supercharger** (increases Manifold Pressure @ higher altitudes)
 - Stage 1 below 2500 m altitude. Stage 2 over 2500 m.
 - Lshift + S to toggle supercharger stages



PART VI: AIRCRAFT PERFORMANCE

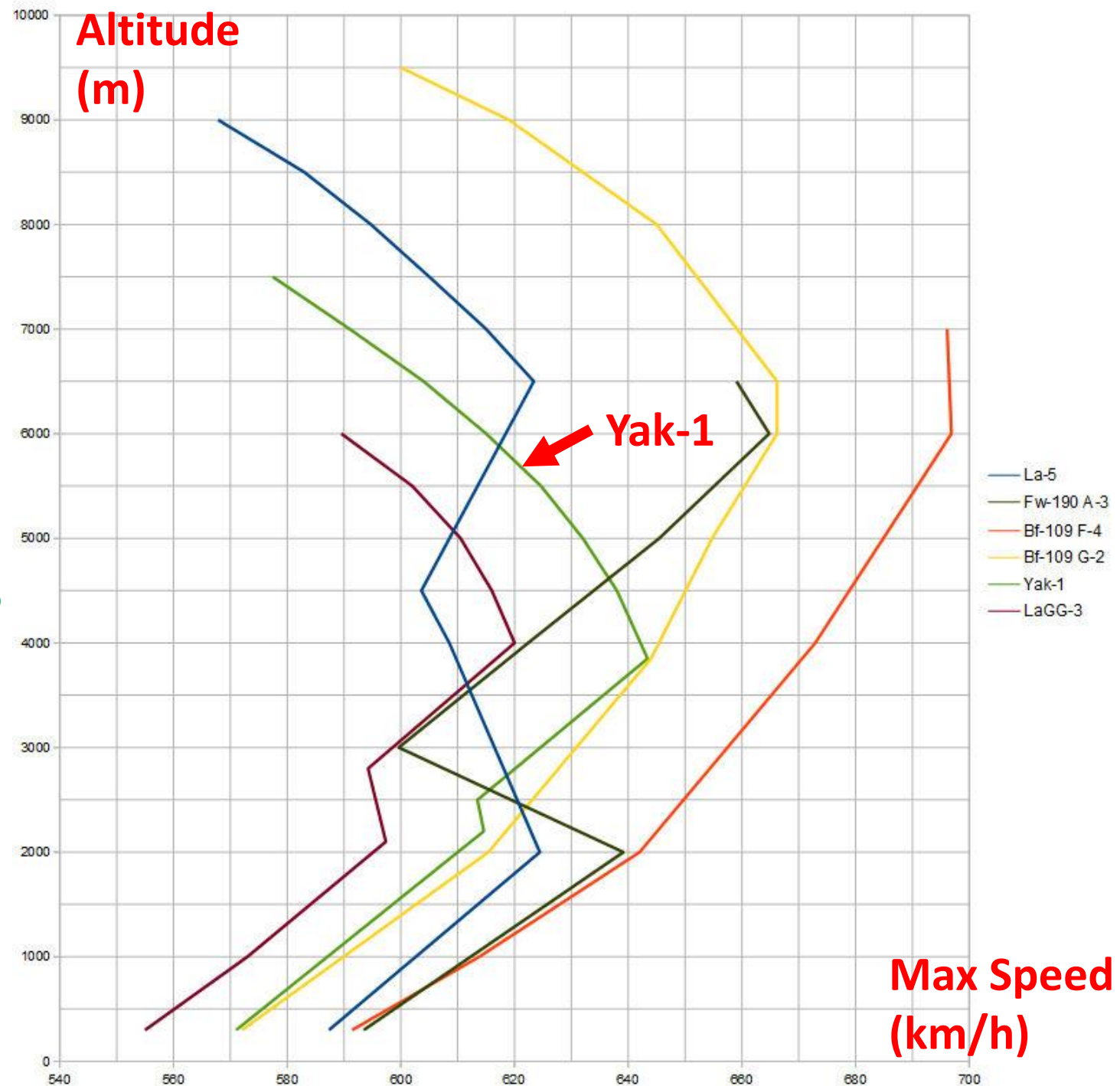
- Range: 700 km
- Fuel Max Capacity: ~410L
- Endurance: 90 min (1h30)
- Operational ceiling: 10000m
- Optimal Climb Speed: 260 kph
- Best Climb Rate: 800 m/min
- Turn time: 19 s
- Note: Your fuel loadout will impact your aircraft's performance, but also your water and oil radiator flaps, your trim, the air temperature and many other factors. Keeping your speed up without blowing your engine will require a heavy workload that will diminish with practice and experience. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



- Cold weather conditions modeled in Battle of Stalingrad allow superior engine power in comparison to values obtained for standard atmosphere.
- Yak-1 is lighter than the LaGG-3 and has much better acceleration even if it has the same engine.
- Yak-1 can take more punishment than the 109. Don't put their cannons to the test, though.
- The Yak is an agile plane and bleeds little energy during sustained turns. Under 5000 m, which is where the Yak excels, the 109 will not want to engage you on even terms. The Yak will have a slight advantage at low altitude levels and in tight turn fights. Don't get cocky though: the 109 has slats on his wings that allow him to be much more agile at low speeds than you might think.
- Do not attempt to outclimb a 109 unless you have a serious speed advantage.
- Moderate use of flaps during low-speed turns can help you get an angle for a deflection shot.
- Be very careful if you engage a 109 in scissors: its slats give him the advantage during low-speed rolling manoeuvres.

PART VI: AIRCRAFT PERFORMANCE

MAXIMUM SPEED QMB CONDITIONS (Graph by Matt)



Lavochkin La-5 ★ Лавочкин Ла-5

SERIES 8



By Chuck

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History



In early 1942, two of the LaGG-1 and -3's designers, Semyon Lavochkin and Vladimir Gorbunov, attempted to correct this deficiency by experimentally fitting a LaGG-3 with the more powerful Shvetsov ASh-82 radial engine.

By now, the shortcomings of the LaGG-3 had caused Lavochkin to fall out of Joseph Stalin's favour, and factories previously assigned to LaGG-3 construction had been turned over to building the rival Yakovlev Yak-1 and Yak-7. The design work required to adapt the LaGG-3 to the new engine and still maintain the aircraft's balance was undertaken by Lavochkin in a small hut beside an airfield over the winter of 1941-1942, all completely unofficially.

When the prototype took flight in March, the result was extremely pleasing - the fighter finally had a powerplant that allowed it to perform as well in the air as it had been supposed to on paper. While still inferior to the best German fighters at high altitudes, the La-5 proved to be every bit their match closer to the ground. With most of the air combat over the Eastern Front taking place at altitudes of under 5,000 m (16,404 ft), the La-5 was very much in its element.

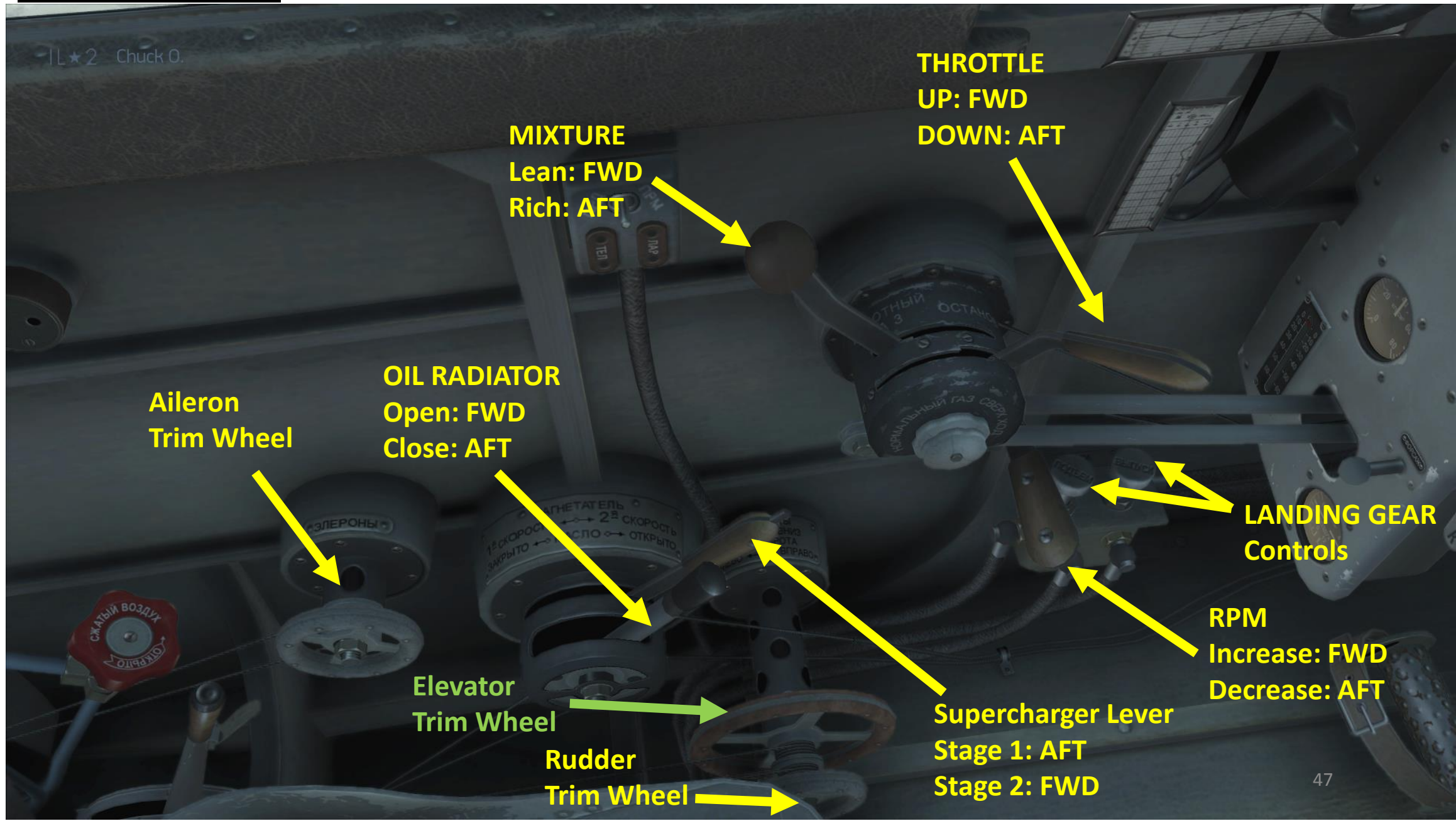
PART I: THE AIRCRAFT

The Cockpit



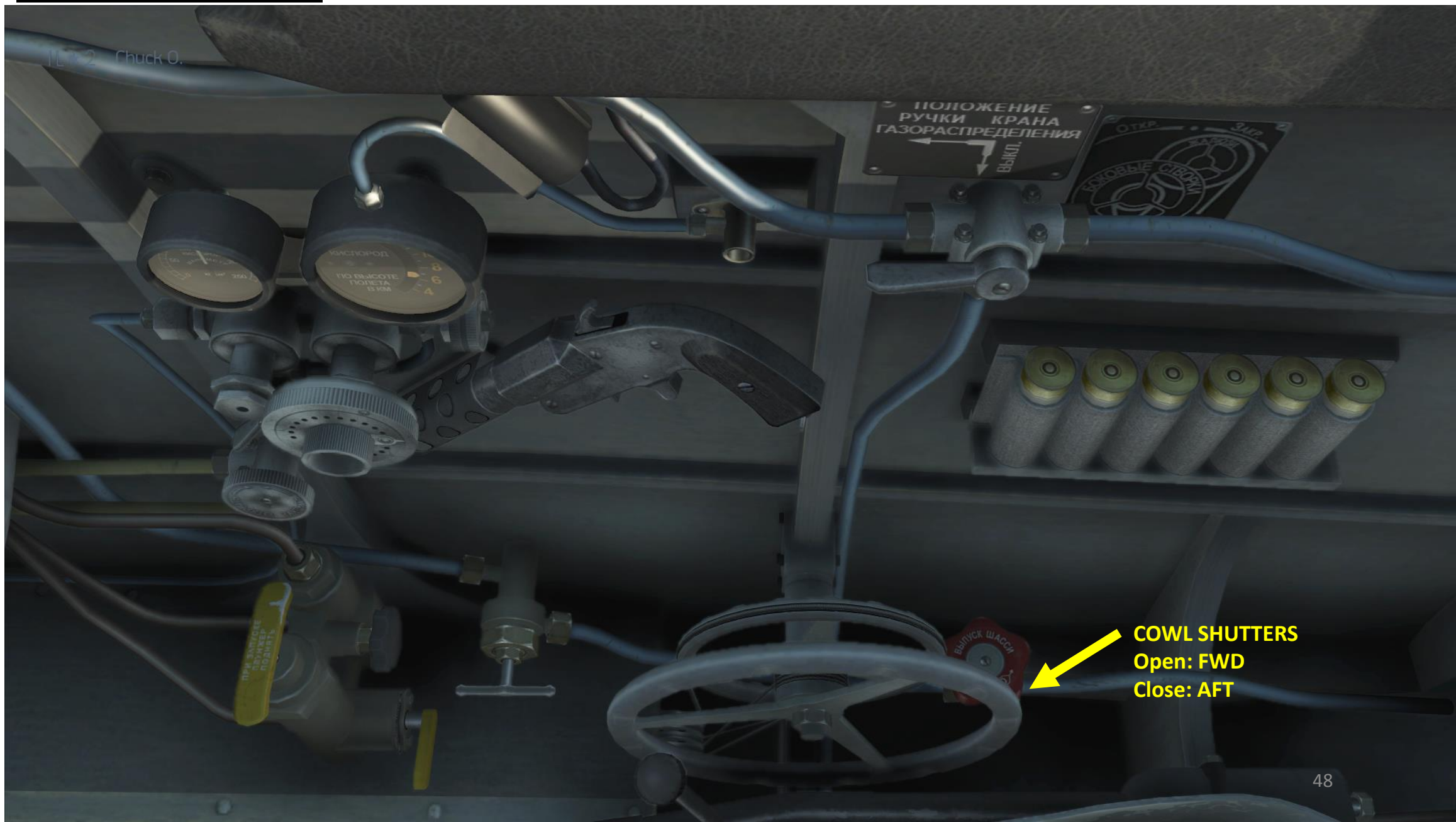
PART I: THE AIRCRAFT

Left Side



PART I: THE AIRCRAFT

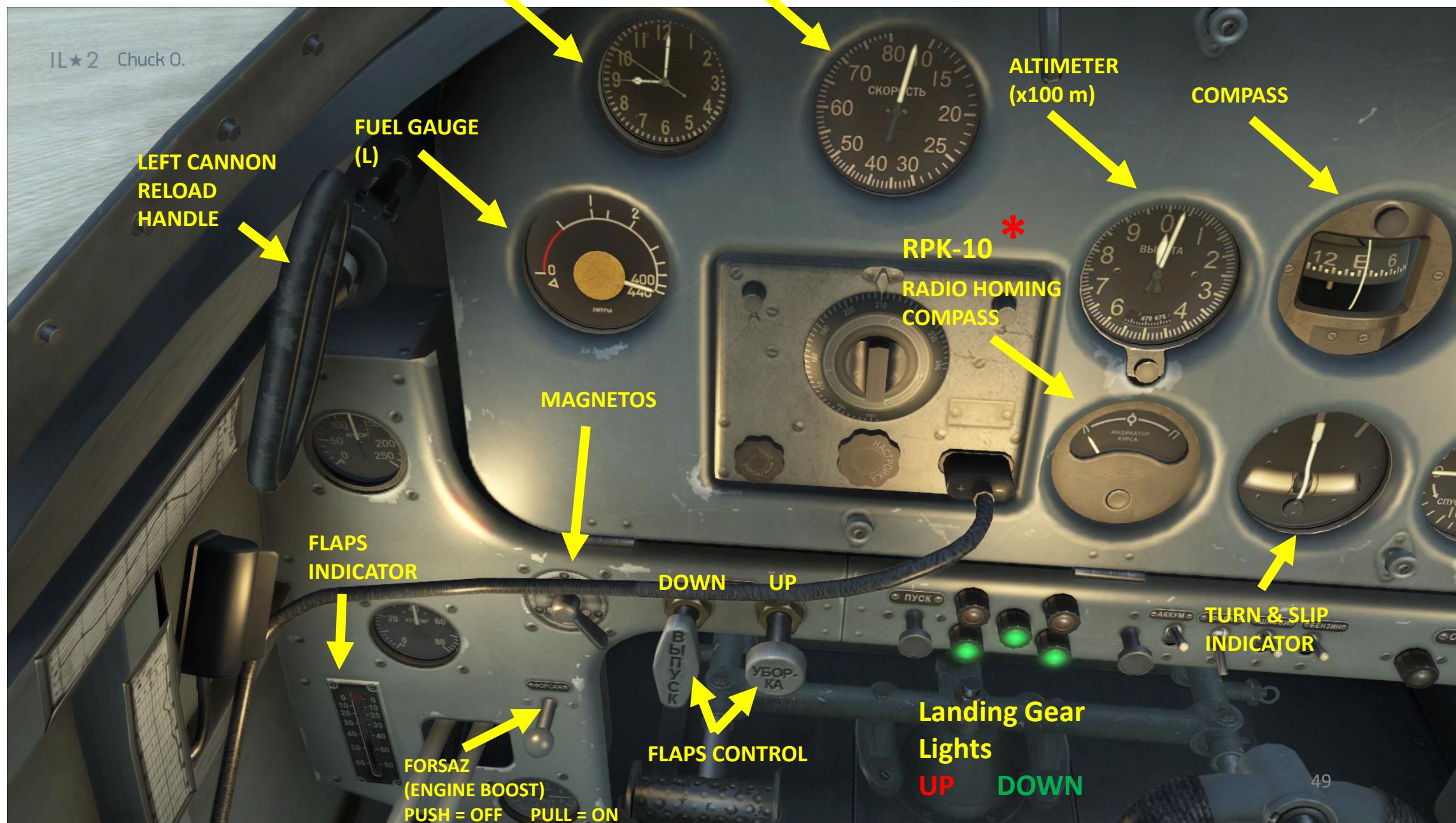
Right Side



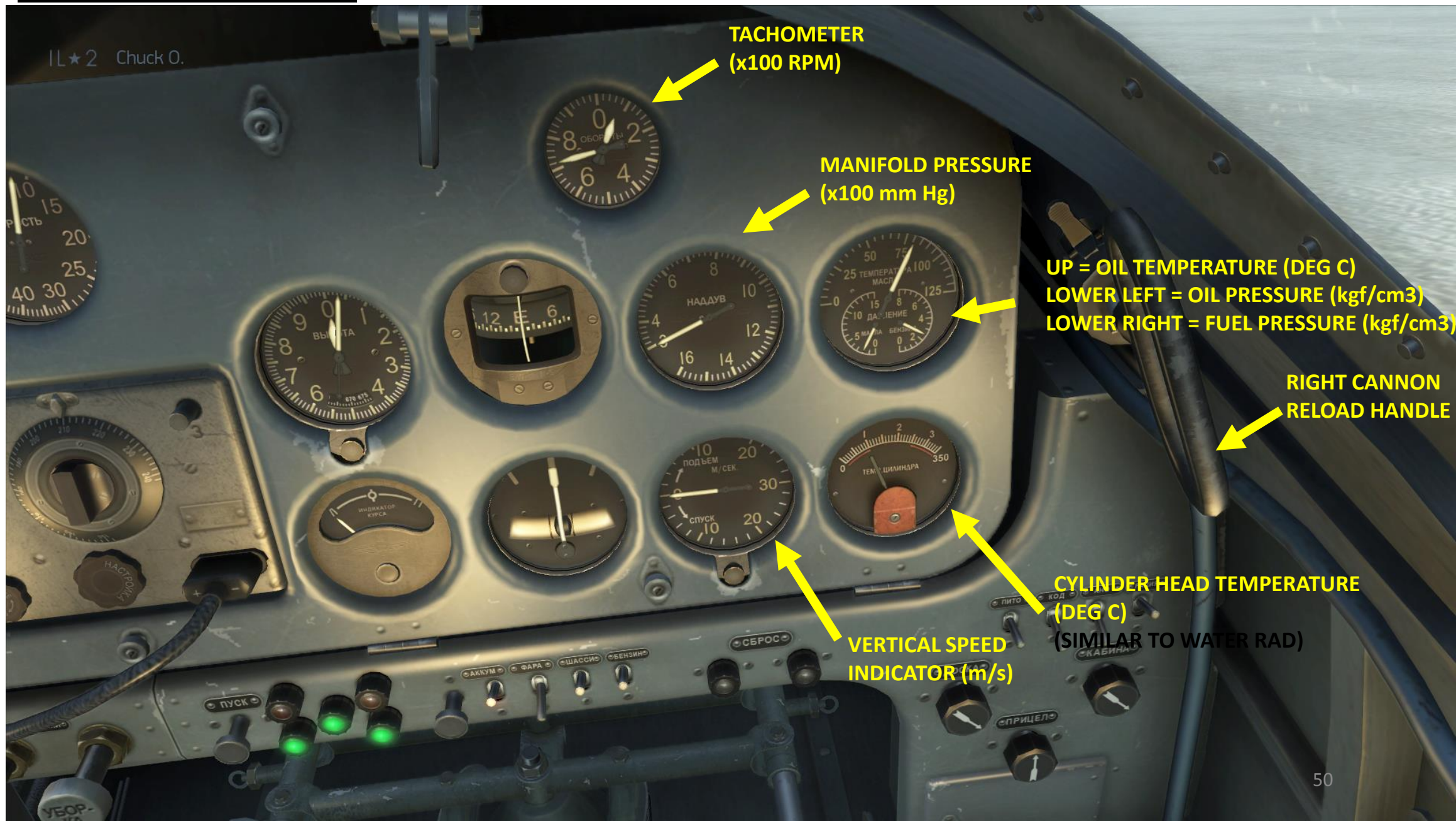
COWL SHUTTERS
Open: FWD
Close: AFT

PART I: THE AIRCRAFT

Front Left



Front Right



Important key bindings

- The La-5 has a radial engine, which doesn't have a water radiator. What you have instead to cool your engine are engine cowlings. Don't forget to set your controls accordingly.
- However, the La-5 still has an oil radiator.



COWLING FLAPS
OPEN



COWLING FLAPS
CLOSED



Important key bindings

- The La-5, like most Russian planes, has a brake system similar to what you would find in your car.
- In order to brake, you need to hold your wheel brake key while you give rudder input to steer your aircraft. Make sure you have adequate mixture, RPM and Manifold Pressure settings or your turn radius will suffer. These factors matter in heavier planes like the Il-2 Sturmovik.

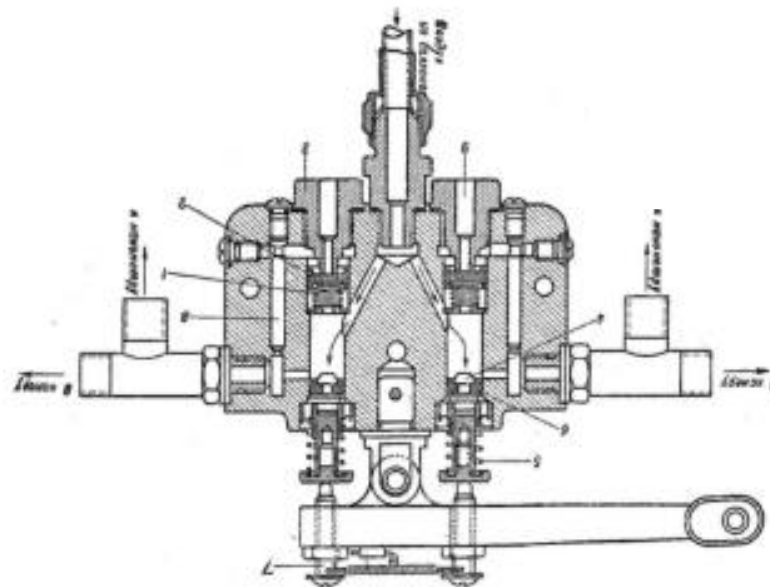
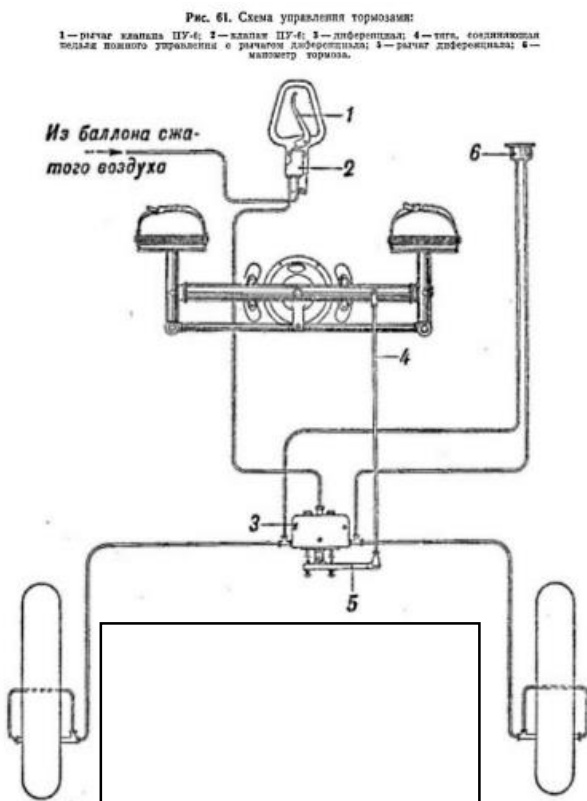
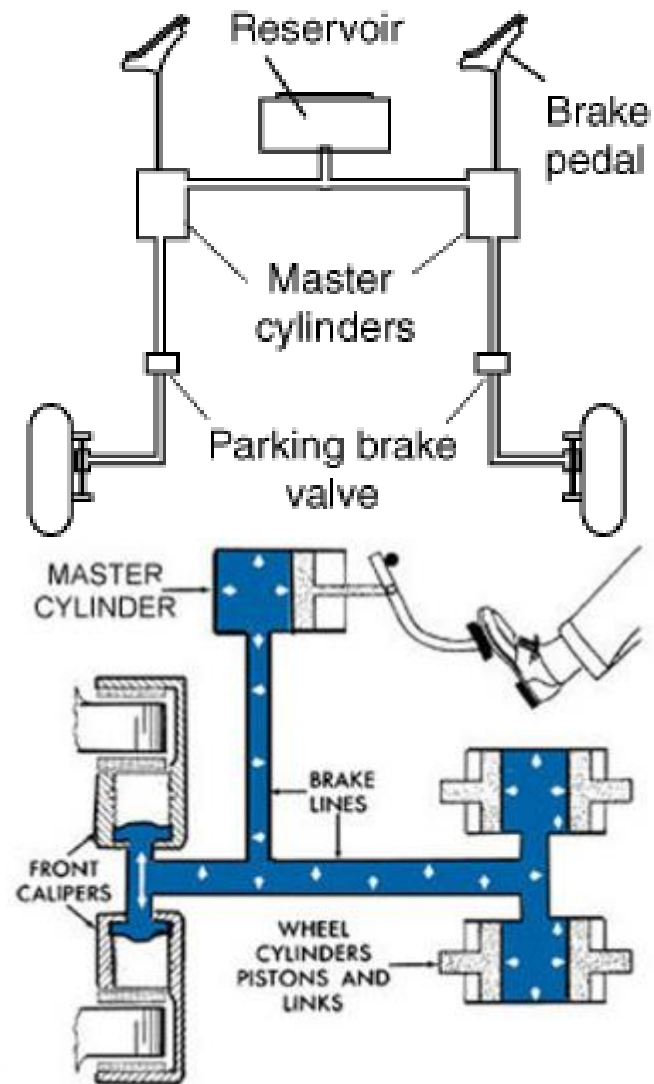


Рис. 62. Дифференциал пневматического управления тормозами:

— пружина предохранительного клапана; 2 — манжета предохранительного клапана; — штифты; 4 — шток поршня управляющего клапана; 5 — пружина управляющего клапана; 6 — манжета поршня; 7 — толкатель; 8 — канал, сообщаящий тормоз с предохранительным клапаном; 9 — отверстие штуцера предохранительного клапана.



PART III: TAKEOFF

- Taking off in the La-5 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your mixture to full rich
 - 3) Close your cowlings and your oil radiator flaps
 - 4) Set minimum RPM
 - 5) Ignite (“E” key by default)!
 - 6) Set your flaps to 20 degrees.

PART III: TAKEOFF

7) Wait for your oil radiator temperatures to reach 55-60 degrees C and your cylinder head temperatures to reach between 120 and 205 degrees C.

8) Line yourself up on the runway and lock your tailwheel by pulling your stick back to keep your tailwheel down.

9) Fully open your cowlings and oil radiator flaps.

10) Throttle up full power, max RPM. Correct heading with small rudder input.

Note: You can use engine boost, but it is completely optional.

11) As soon as you reach 120 kph, center the stick and level out to pick some speed.

12) When you reach 180 kph, rotate gently.

13) Once you are up in the air, retract flaps, pull your gear up and start climbing. Adjust RPM and manifold pressure accordingly (see engine management in part V).

PART IV: LANDING

- 1) Deploy landing gear when going slower than 300 kph.
- 2) Deploy flaps 30 degrees when going slower than 250 kph.
- 3) Max RPM, throttle as required to maintain approach speed at 200 kph.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and let yourself glide until you touch the ground naturally.
- 6) Touchdown at 170 kph with a 3-point attitude.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



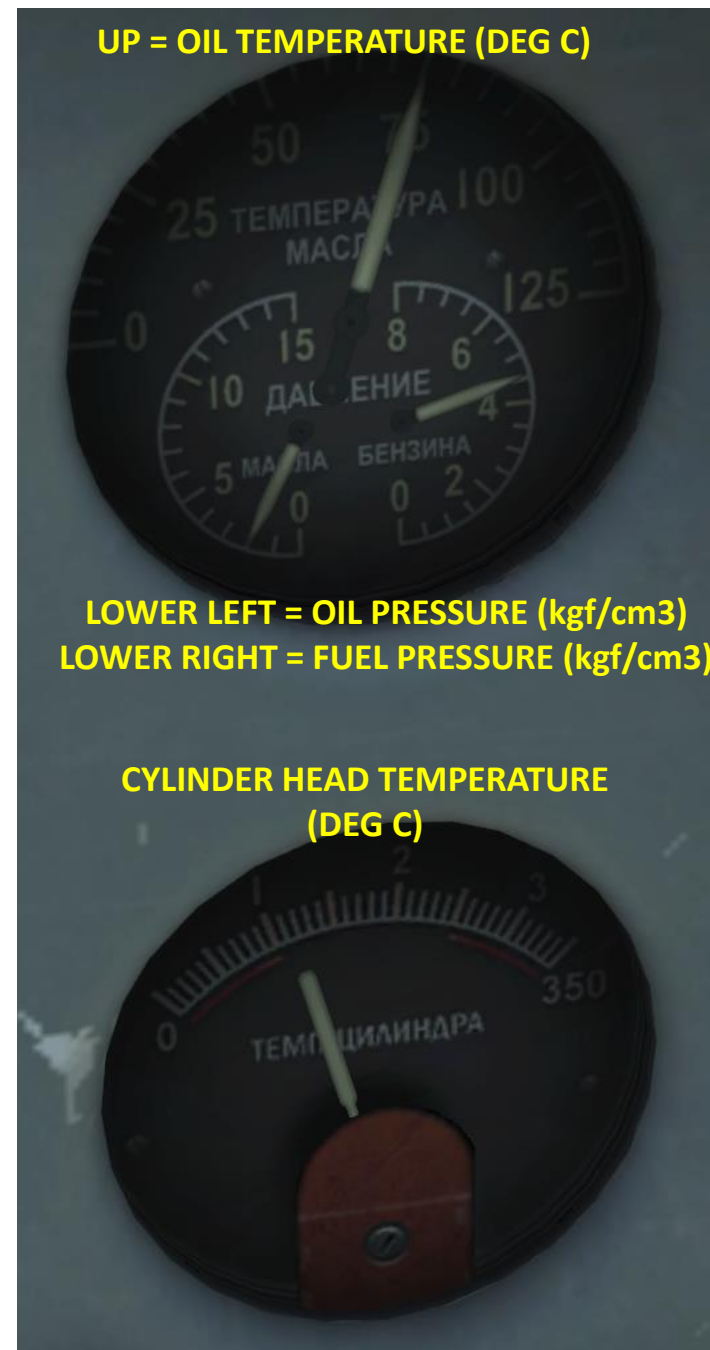
Powerplant

- The La-5 is powered by the **Shvetsov ASh-82 (M-82)**. It is a 14-cylinder, two-row, air-cooled radial engine developed from the Shvetsov M-62. The M-62 was the result of development of the M-25, which was a licensed version of the Wright R-1820 Cyclone.



Operating Limits

- Cylinder head temperatures will exceed operating limits before oil temperature overheats, which makes monitoring the oil temp a low priority (in-game... not in real life... d'uh!). Check the cylinder head temps instead.
- **Min oil temperature: 55-60 deg C.**
- **Max oil temperature: 75 deg C.**
- **Min cylinder head temperature: 120 deg C.**
- **Max cylinder head temperature: 190-200 deg C.**
- When using “Forsaz” (boost), do not use it for more than 10 minutes. Unlike the La-5, later La-5 F and La-5 FN variants allowed almost unlimited use of boost. “F” was for “forced” (for improved aircraft performance) and “N” was for a new fuel injection system.
- Do not use Forsaz/Boost above 2000 m.
- If your RPM starts to oscillate, lean your mixture progressively until RPM stabilizes.



Recommended Settings

- When using forsz/boost, make sure that you have your cowl flaps open. Boost is disengaged automatically when supercharger stage 2 is engaged.
- Oil radiator should be open at all times, as it was designed to have minimal impact on aircraft performance, open or not.
- Normal Operation (maximal performance & speed)
 - 2300 RPM, 900 Manifold Pressure
 - Cowl flaps fully closed
 - Mixture at 80 %
- Supercharger (increases Manifold Pressure @ higher altitudes)
 - Lshift+S to toggle supercharger stages
 - Stage 1 below 2000 m, Stage 2 above 2000 m
 - Note: La-5 manual recommends using Stage 1 at altitudes under 3500 m and Stage 2 above 3500 m in to save fuel.



PART VI: AIRCRAFT PERFORMANCE

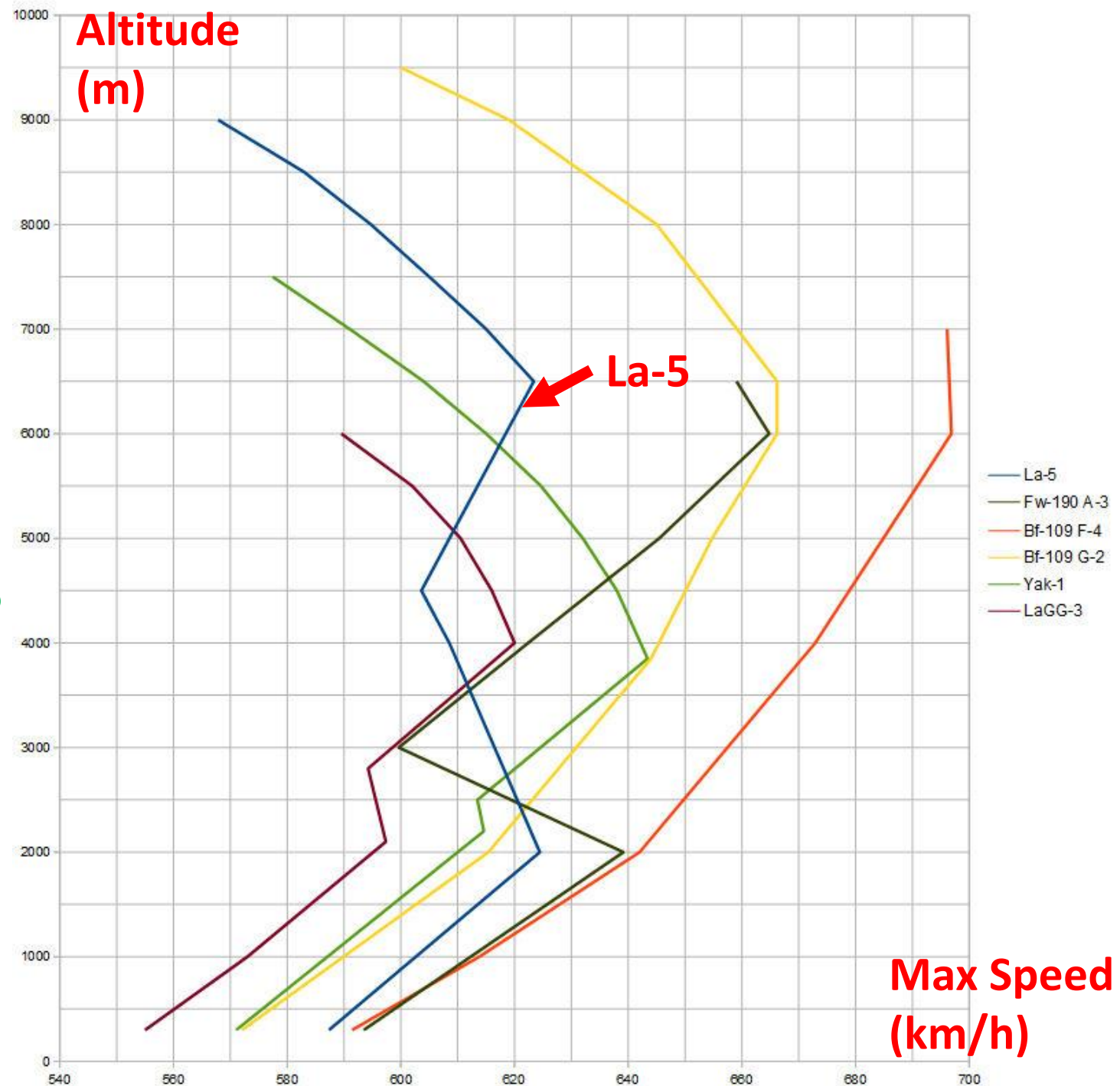
- Range: 750 km
- Fuel Max Capacity: ~440 L
- Endurance: 108 min (1h48)
- Operational ceiling: 9600 m
- Optimal Climb Speed: 250 kph
- Best Climb Rate: 840 m/min
- Turn time: 22 s
- Note: Your fuel loadout will impact your aircraft's performance, but also your cowl flaps, your trim, the air temperature and many other factors. Keeping your speed up without blowing your engine will require a heavy workload that will diminish with practice and experience. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



- Cold weather conditions modeled in Battle of Stalingrad allow superior engine power in comparison to values obtained for standard atmosphere.
- Even if the La-5 is a direct improvement over the LaGG-3's design, you should not expect all of its inherent problems to be magically fixed.
- Addition of slats helps slow speed handling, but will not help you turn better at higher speeds.
- The wing of the La-5 is still the same as the LaGG-3, which has a nasty accelerated stall. An accelerated stall is induced by the pilot when the aircraft is flying at high speeds and he pulls too hard on the stick.
- Turn performance is pretty much the same as the LaGG, even if stall can be slightly delayed due to higher power and higher airspeed.
- Be smooth when pulling the stick: you will maintain airspeed.
- The La-5 bleeds airspeed very easily. You should fly it like a high-speed energy fighter and use boom and zoom tactics.
- You should use minimal elevator input and focus on using the La-5's excellent roll rate, which is comparable to the FW190's.
- Use your flaps to forestall wing buffet at slow speeds. It will save your life.

PART VI: AIRCRAFT PERFORMANCE

MAXIMUM SPEED QMB CONDITIONS (Graph by Matt)



Ilyushin
Ил-2 Sturmovik



Ильюшин
Ил-2 Штурмовик



By Chuck

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- PART II: THE CONTROLS
- PART III: TAKEOFF
- PART IV: LANDING
- PART V: ENGINE MANAGEMENT
- PART VI: AIRCRAFT PERFORMANCE

History

IL★2 Chuck O.

The idea for a Soviet armored ground-attack aircraft dates to the early 1930s, when Dmitry Pavlovich Grigorovich designed TSh-1 and TSh-2 armored biplanes. However, Soviet engines at the time lacked the power needed to provide the heavy aircraft with good performance. In 1938, the Il-2 was designed by Sergey Ilyushin and his team at the Central Design Bureau.



The Il-2 is a single-engine, propeller-driven, low-wing monoplane of mixed construction with a crew of two (one in early versions), specially designed for assault operations. Its most notable feature was the inclusion of armor in an airframe load-bearing scheme. Armor plates replaced the frame and paneling throughout the nacelle and middle part of the fuselage, and an armored hull made of riveted homogeneous armor steel AB-1 secured the aircraft's engine, cockpit, water and oil radiators, and fuel tanks.

Thanks to the heavy armor protection, the Il-2 could take a great deal of punishment and proved difficult for both ground and aircraft fire to shoot down. One Il-2 in particular was reported to have returned safely to base despite receiving more than 600 direct hits and having all its control surfaces completely shredded as well as numerous holes in its main armor and other structural damage. Some enemy pilots favored aiming down into the cockpit and wing roots in diving attacks on the slow, low-flying Il-2 formations.

With 36,183 examples of the Il-2 produced during the war, and in combination with its successor, the Ilyushin Il-10, a total of 42,330 were built, making it the single most produced military aircraft design in all of aviation history.

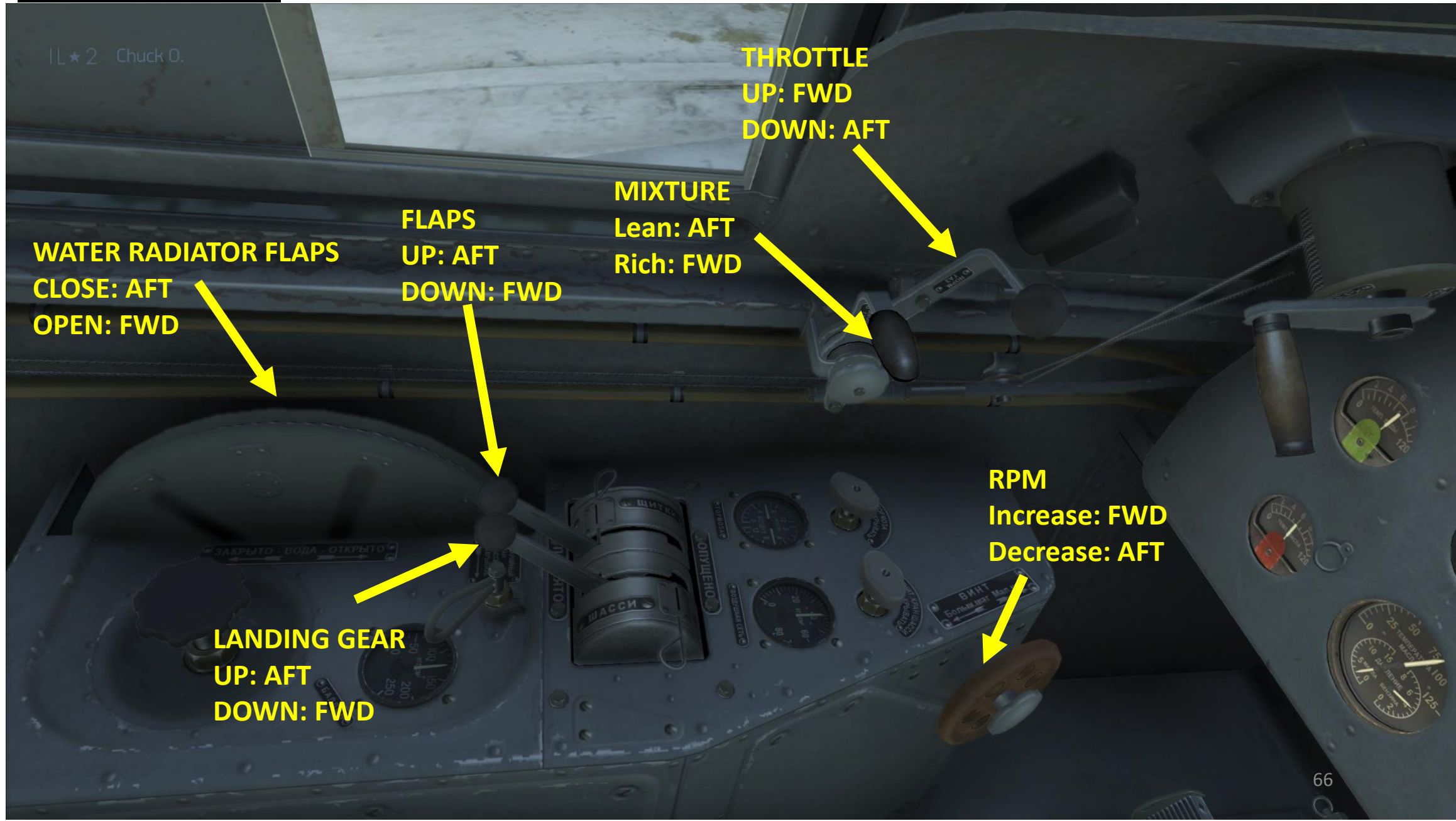
PART I: THE AIRCRAFT

The Cockpit



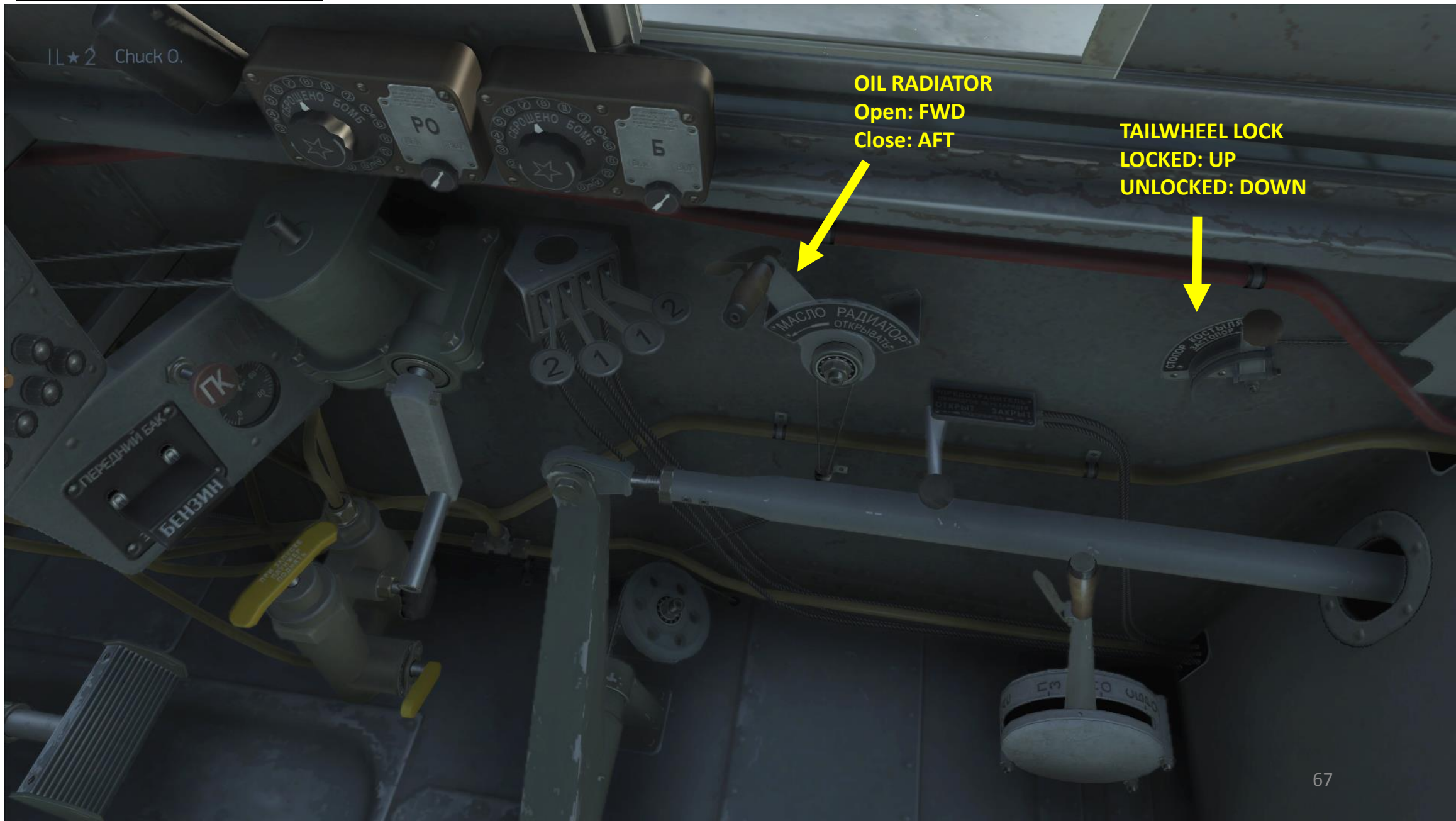
PART I: THE AIRCRAFT

Left Side



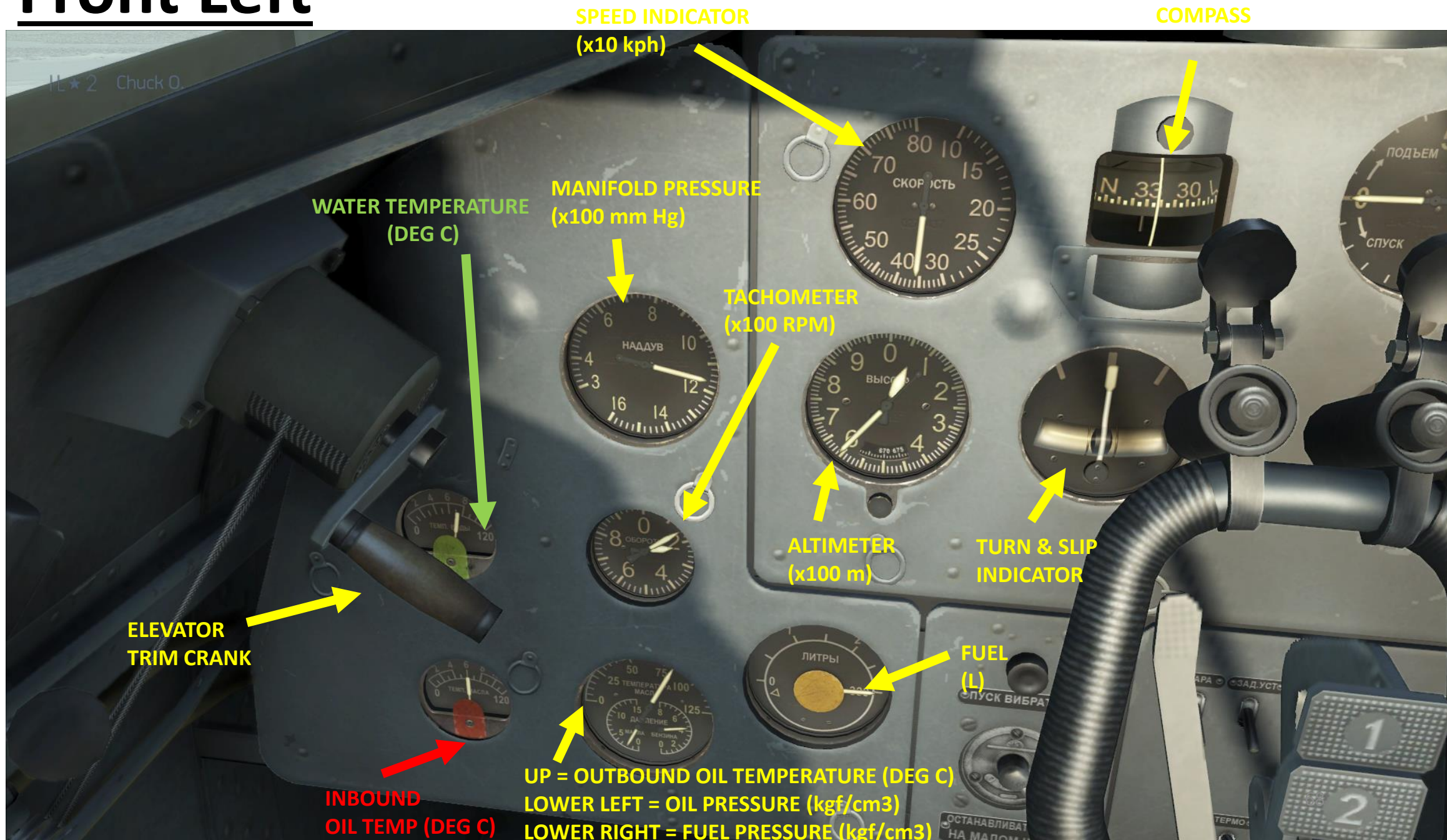
PART I: THE AIRCRAFT

Right Side

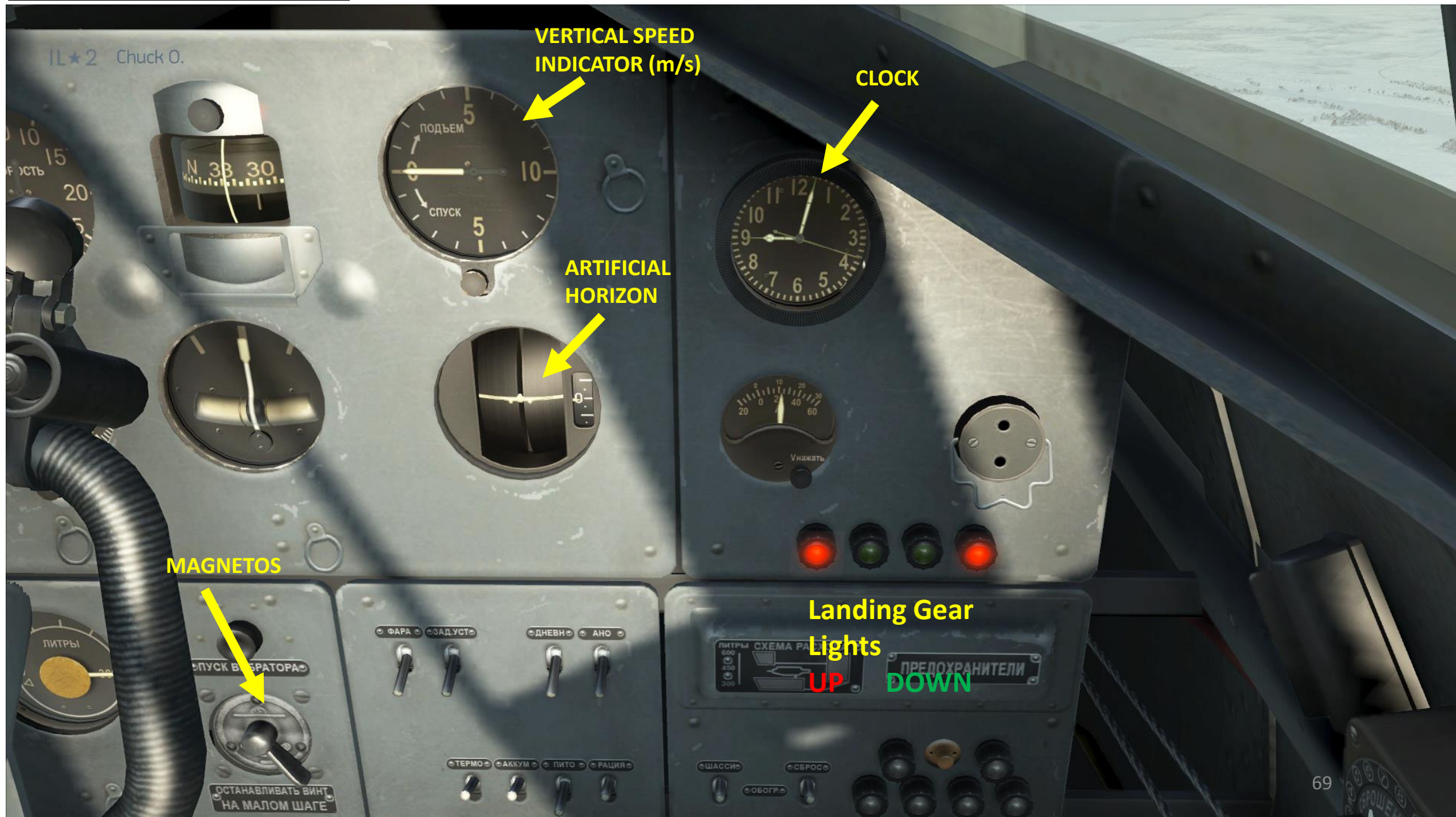


PART I: THE AIRCRAFT

Front Left



Front Right



Wings

MECHANICAL LANDING GEAR INDICATOR
VISIBLE = GEAR DOWN
RETRACTED = GEAR UP



TO SEE THE INDICATORS, YOU NEED TO
OPEN YOUR CANOPY (RALT+C)

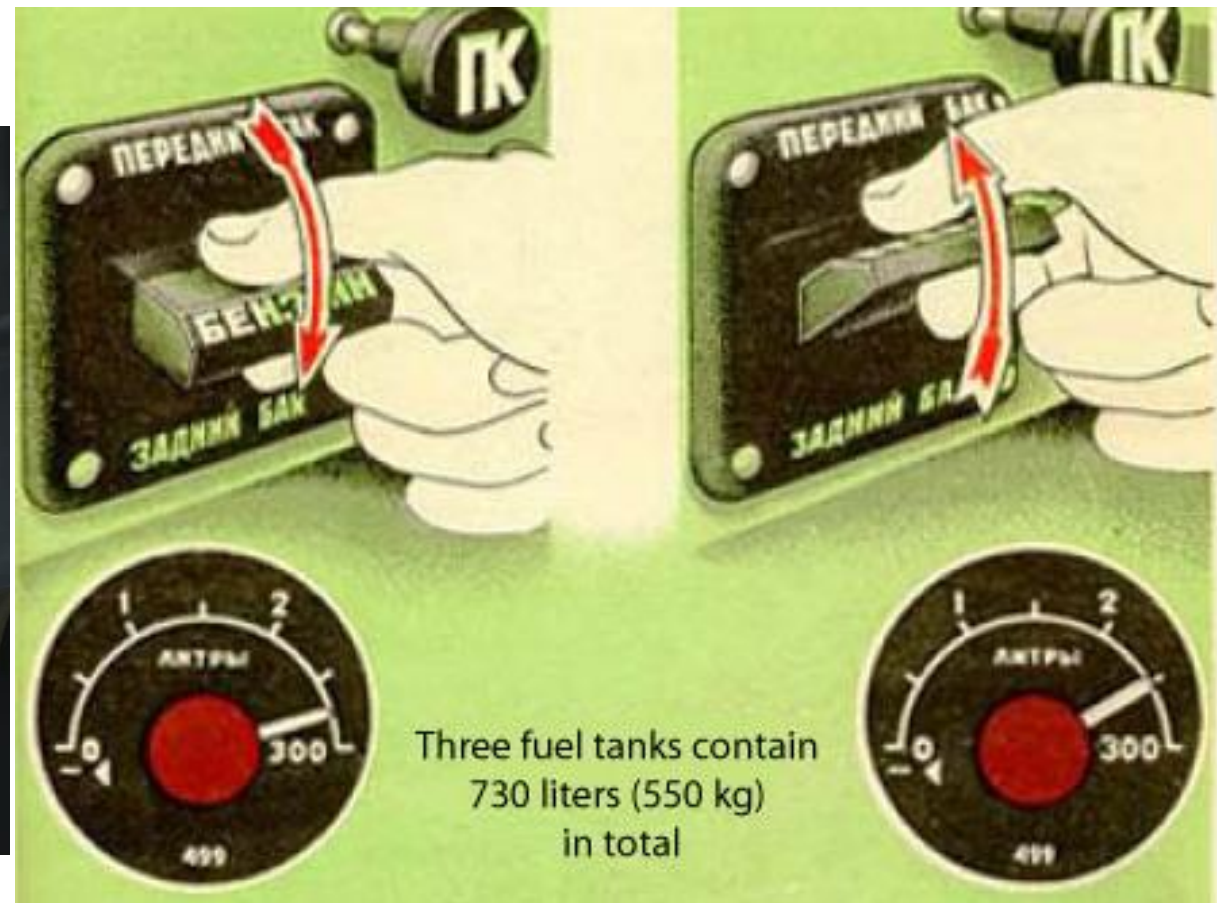
Fuel Tanks



Fuel Selector Handle



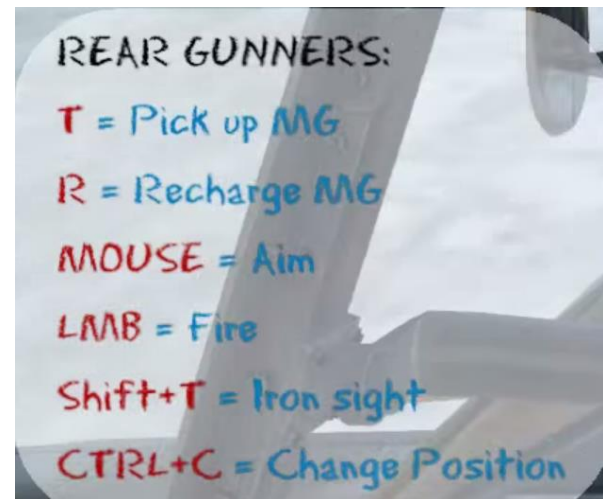
Fuel Gauge (L)



There is a total of three fuel tanks in the Il-2, with quantities which are indicated by a single fuel gauge. This gauge indicates the content of each tank based on the position of the tank selector switch. Unfortunately, this cool functionality is not modelled in the game and the fuel gauge is simply reset to another fuel tank once the previous one is empty.

Turret Operation

- For the turret gunner, make sure that you give him the command to fire at will (Ralt + 1)
- Also, give him the command to fire at long range (Ralt + 9)
- Flying in close formation with other bombers maximizes your firepower.



Important key bindings

- Make sure that you control your water and oil radiator flaps to keep your engine cool, while maintaining your airspeed. The Il-2 is a heavy plane and you can easily cook your engine if you are not careful.



**WATER RADIATOR
CLOSED**



**WATER RADIATOR
OPEN**



Important key bindings

- The Il-2, like most Russian planes, has a brake system similar to what you would find in your car.
- In order to brake, you need to hold your wheel brake key while you give rudder input to steer your aircraft. Make sure you have adequate mixture, RPM and Manifold Pressure settings or your turn radius will suffer. These factors matter in a heavy plane like the Il-2 Sturmovik.

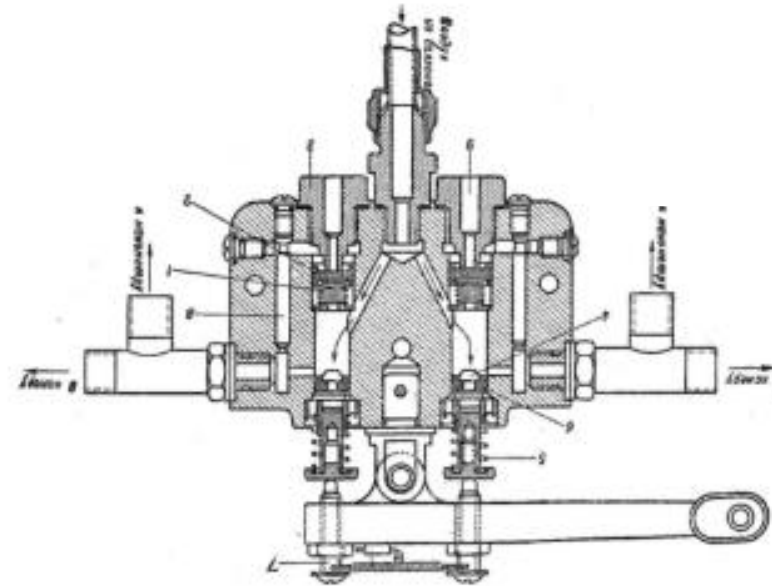
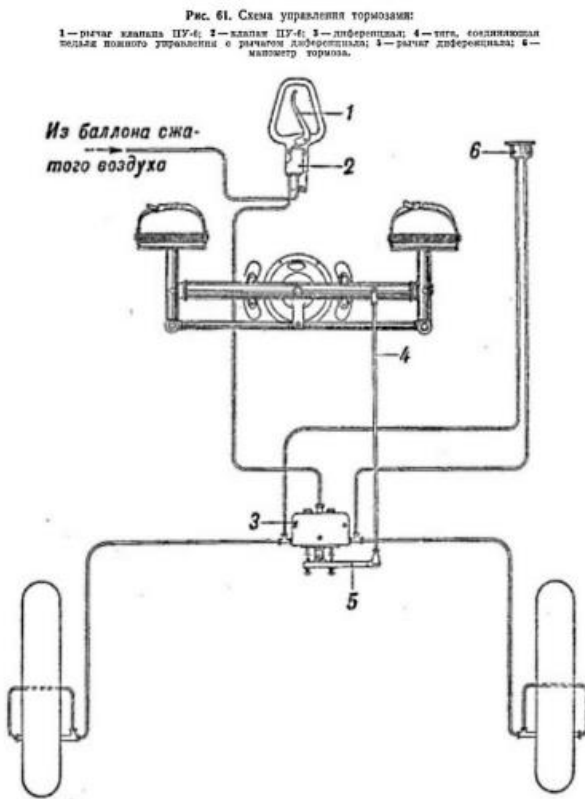
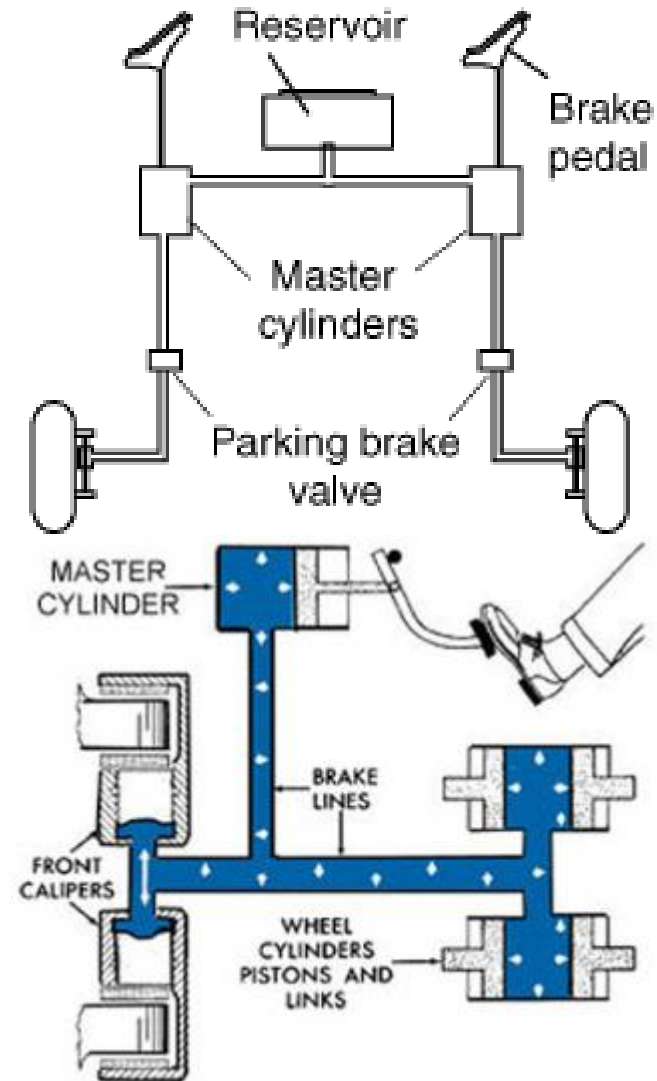


Рис. 62. Дифференциал пневматического управления тормозами:

— пружина предохранительного клапана; 2 — манжета предохранительного клапана; — штуцер; 4 — шток поршня управляющего клапана; 5 — пружина управляющего клапана; 6 — манжета поршня; 7 — толкатель; 8 — канал, сообщаящий тормоз с предохранительным клапаном; 9 — отверстие штуцера предохранительного клапана.



PART III: TAKEOFF

- Taking off in the Il-2 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your mixture to full rich
 - 3) Close your water and oil radiator flaps
 - 4) Set minimum RPM
 - 5) Ignite (“E” key by default)!
 - 6) Set your flaps in the UP position.

PART III: TAKEOFF

- 7) Wait for your oil radiator temperatures to reach (40 INBOUND, 70 OUTBOUND) degrees C and your water radiator temperature to reach 80 degrees C.
- 8) Line yourself up on the runway and lock your tailwheel by pressing “LCtrl+G” and by pulling your stick back to keep your tailwheel down.
- 9) Fully open your water and oil radiator flaps.
- 10) Throttle up full power, max RPM. Correct heading with small rudder input.
- 11) As soon as you reach 130 kph, center the stick and level out to pick some speed.
- 12) When you reach 190 kph, rotate gently.
- 13) Once you are up in the air, pull your gear up and start climbing. Adjust RPM and manifold pressure accordingly (see engine management in part V).

PART IV: LANDING

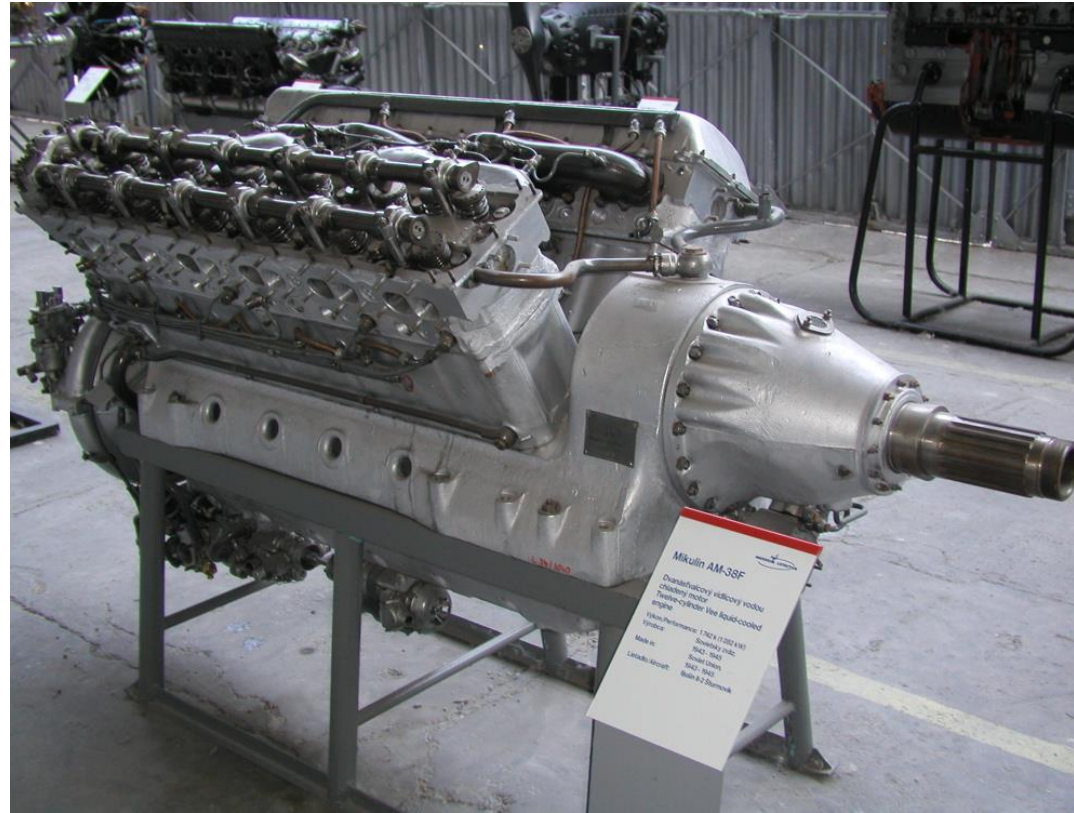
- 1) Deploy landing gear when going slower than 350 kph.
- 2) Deploy flaps when going slower than 210 kph.
- 3) Setting your RPM to 1800 and your manifold pressure to 600 mm Hg on approach is recommended. Adjust throttle as required to maintain approach speed at 200 kph.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and let yourself glide until you touch the ground naturally.
- 6) Touchdown at 150 kph.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



Powerplant

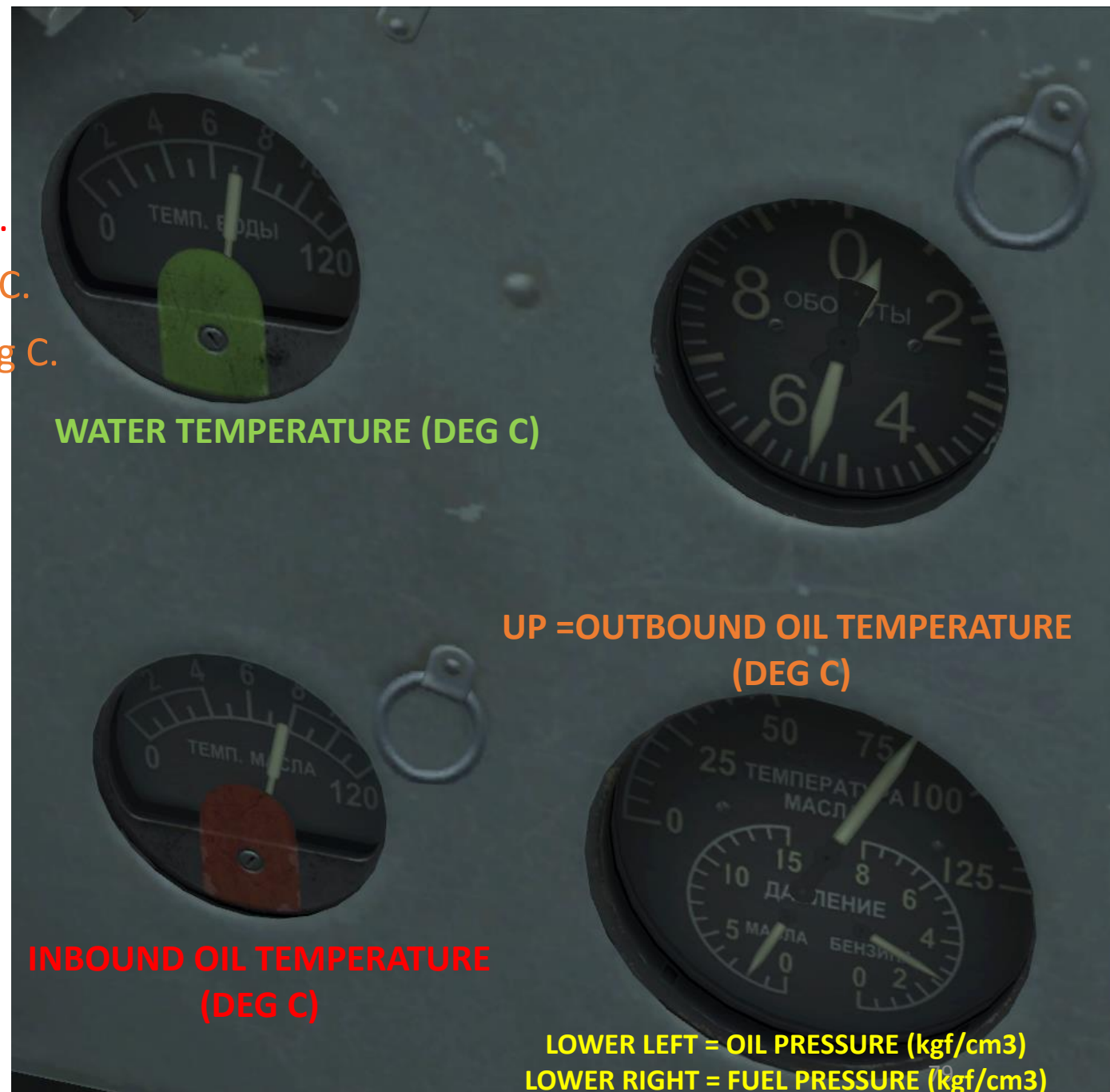
The Il-2 is powered by the **Mikulin AM-38**. It is a V-12 liquid-cooled piston engine designed by Aleksandr Aleksandrovich Mikulin and was equipped with a floatless carburettor and a booster. The AM-35 1,370 hp (1,022 kW) engine, which was originally planned for the Il-2, proved too weak and was replaced by the 1,680 hp (1,254 kW) AM-38 before the aircraft entered production.

Mikulin introduced variable-blade control for superchargers, two-speed superchargers, high-pressure supercharging, and air cooling ahead of the carburetors. Later on, he also developed the first Soviet turbocompressor and a variable-pitch propeller.



Operating Limits

- Min INBOUND oil temperature: 40 deg C.
- Max INBOUND oil temperature: 80 deg C.
- Min OUTBOUND oil temperature: 70 deg C.
- Max OUTBOUND oil temperature: 115 deg C.
- Min water temperature: 80 deg C.
- Max water temperature: 110 deg C.



Recommended Settings

- **Pro Tip:** Progressively lean your mixture as you gain altitude in order to gain maximal power.
- **Takeoff**
 - Water and Oil rads fully open
 - Max RPM, Max Manifold Pressure (MP)
- **Climb**
 - Optimal climb speed: 250 kph
 - 2050 RPM
 - 1050 mm Hg Manifold Pressure
- **Normal Operation (Cruise)**
 - 1850 RPM
 - 850 mm Hg
- **Combat**
 - 2050 RPM
 - 1050 mm Hg
 - Oil radiator closed



PART VI: AIRCRAFT PERFORMANCE

- Range: 800 km (max fuel)
600 km (max payload)
- Fuel Max Capacity: 730L
- Endurance: ~90 min (1h30)
- Operational ceiling: 5500 m
- Optimal Climb Speed: 260 kph
- Best Climb Rate: 625 m/min
(unloaded)
- Note: Your fuel loadout will impact your aircraft's performance, but also your water and oil radiator flaps, your trim, the air temperature and many other factors. Keeping your speed up without blowing your engine will require a heavy workload that will diminish with practice and experience. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



Petlyakov
Pe-2 Peshka



Петляков
Пе-2 Пешка



By Chuck

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- PART I: THE AIRCRAFT
- PART II: THE MISSION PLAN
- PART III: TAKEOFF
- PART IV: NAVIGATION
- PART V: THE BOMB RUN
- PART VI: LANDING

Exterior

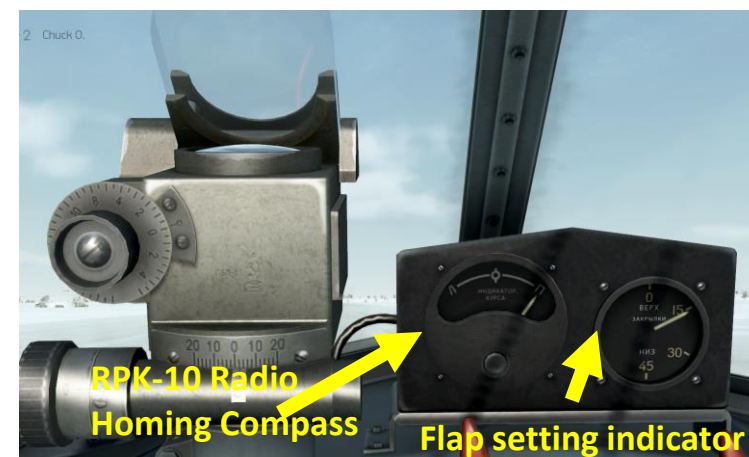


The Pe-2 “Peshka” is available in two different versions in the game: the 87 Series and the 100 Series. The differences between these 2 marks are the addition of the “Blister Turret” for the 100 Series and small variations of gauge emplacements in the cockpit.

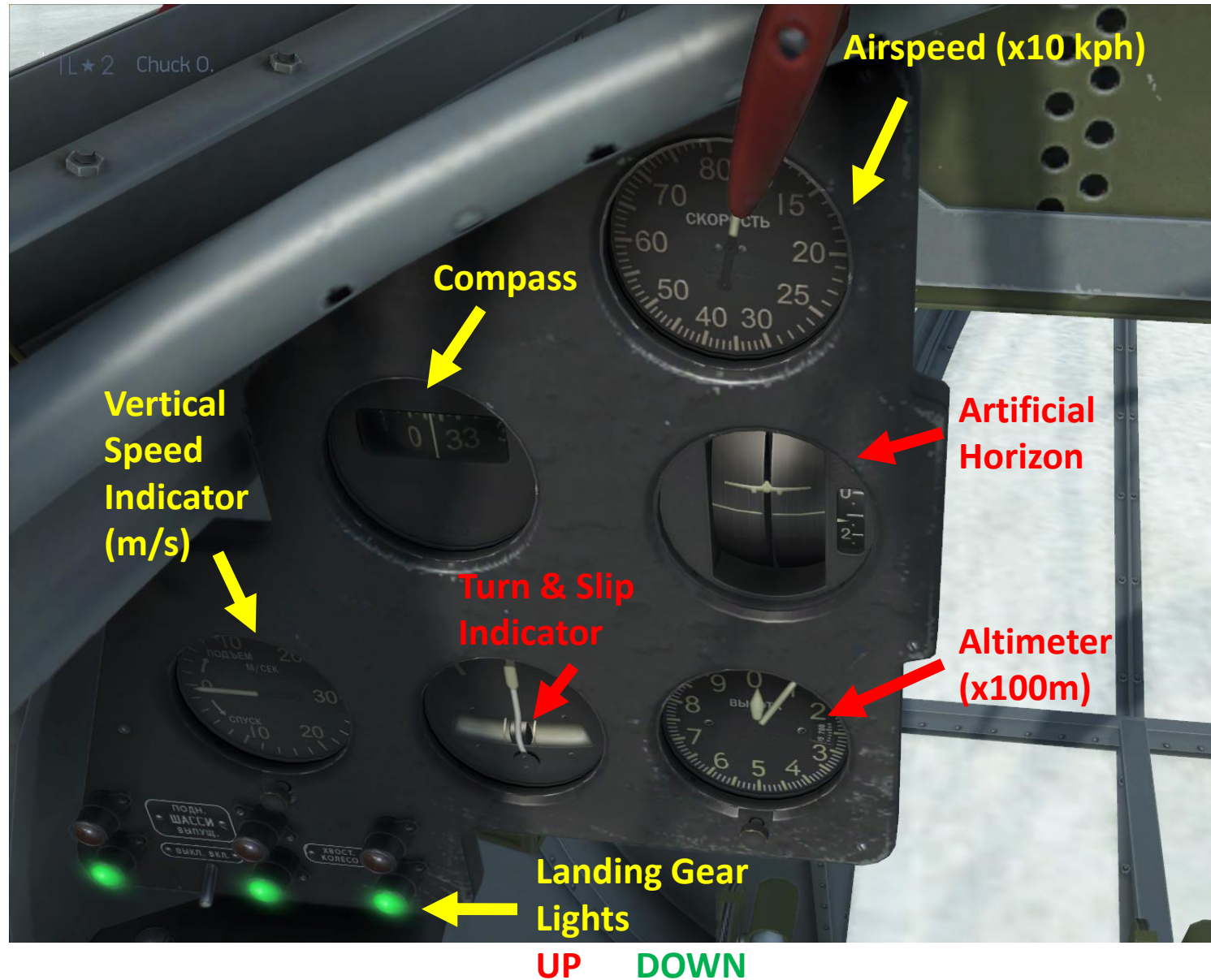
87 Series

VS

100 Series

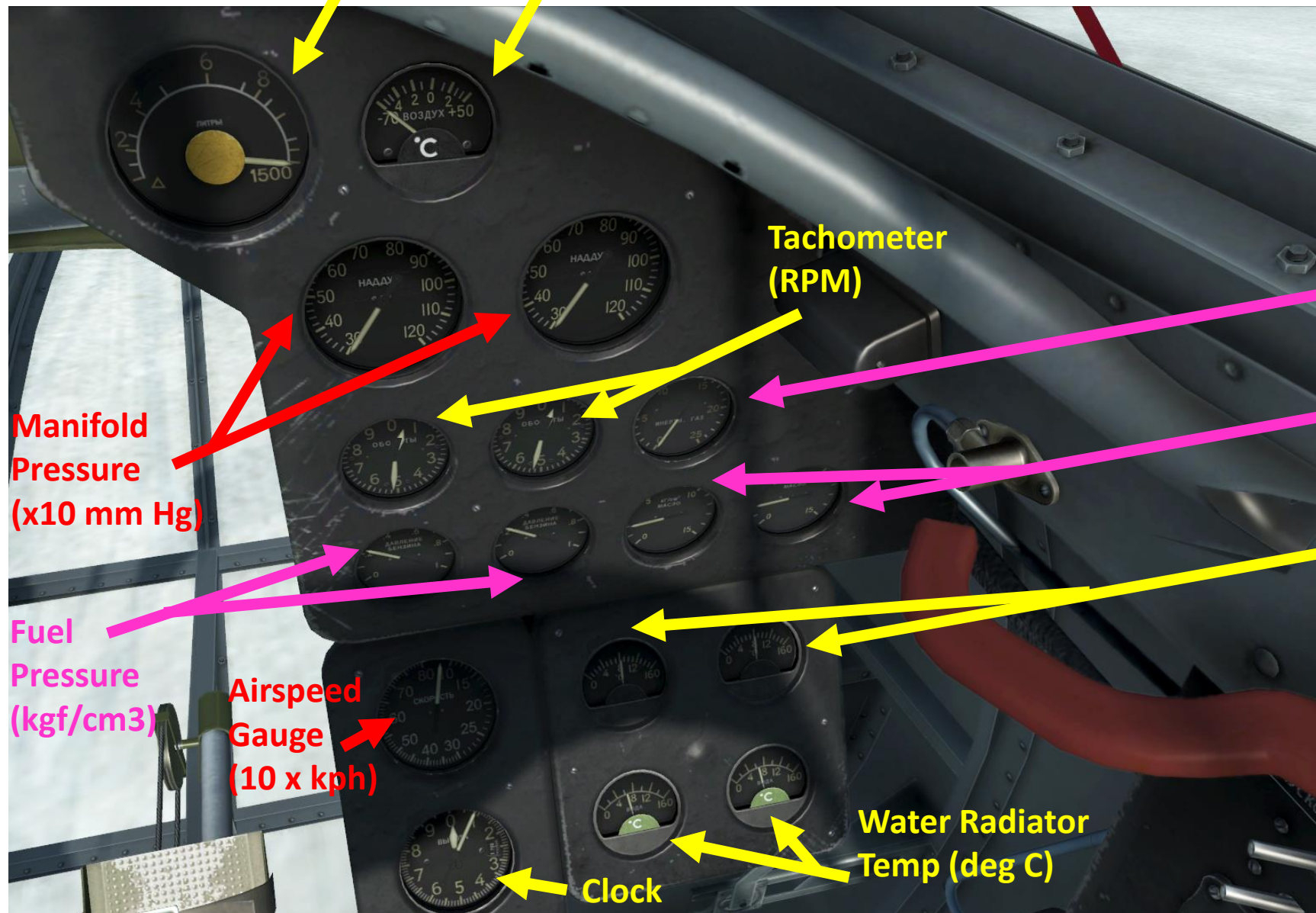


Cockpit



PART I: THE AIRCRAFT

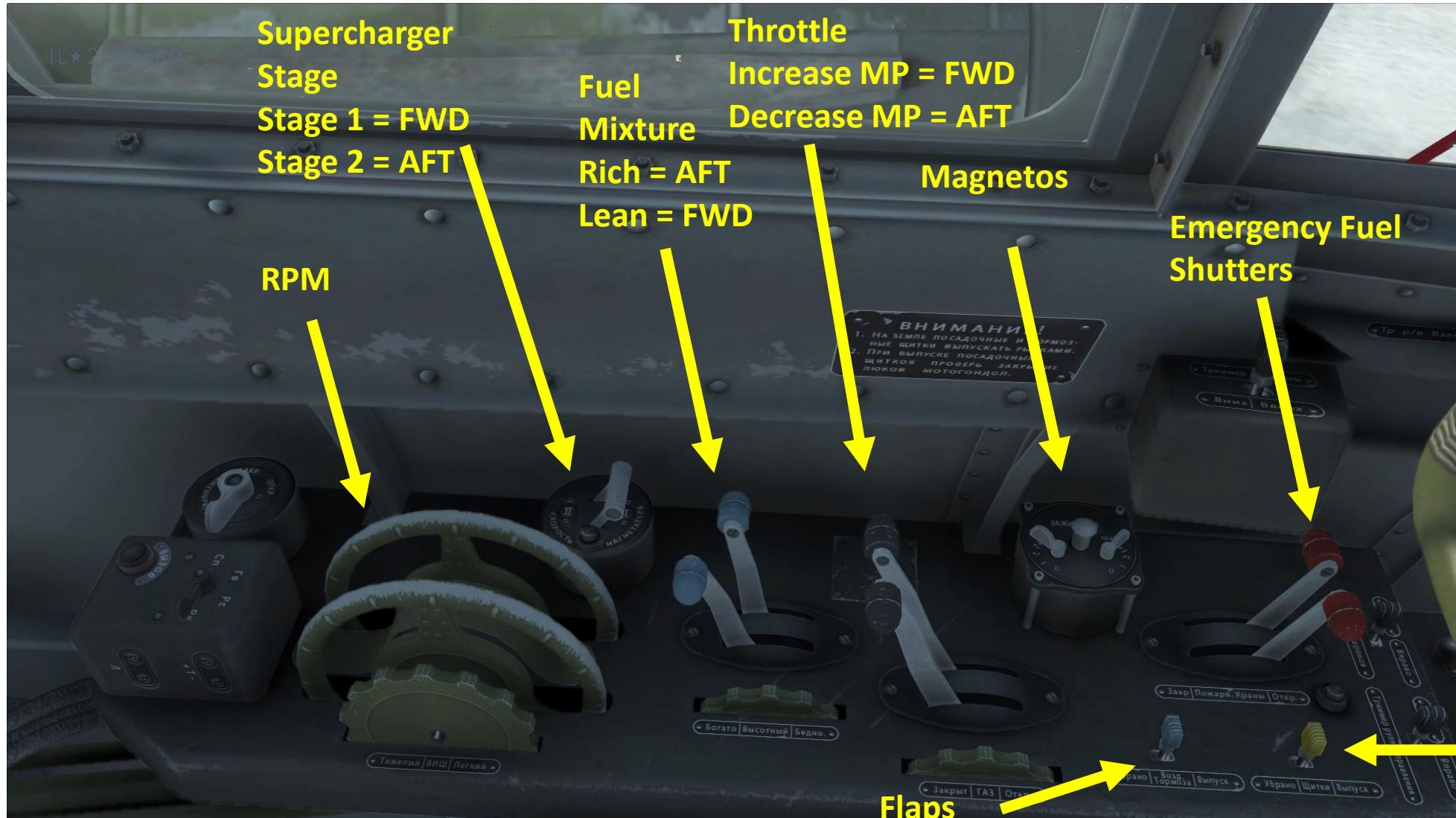
Cockpit



*no need to monitor

Note: There is no oil rad control on the Pe-2.

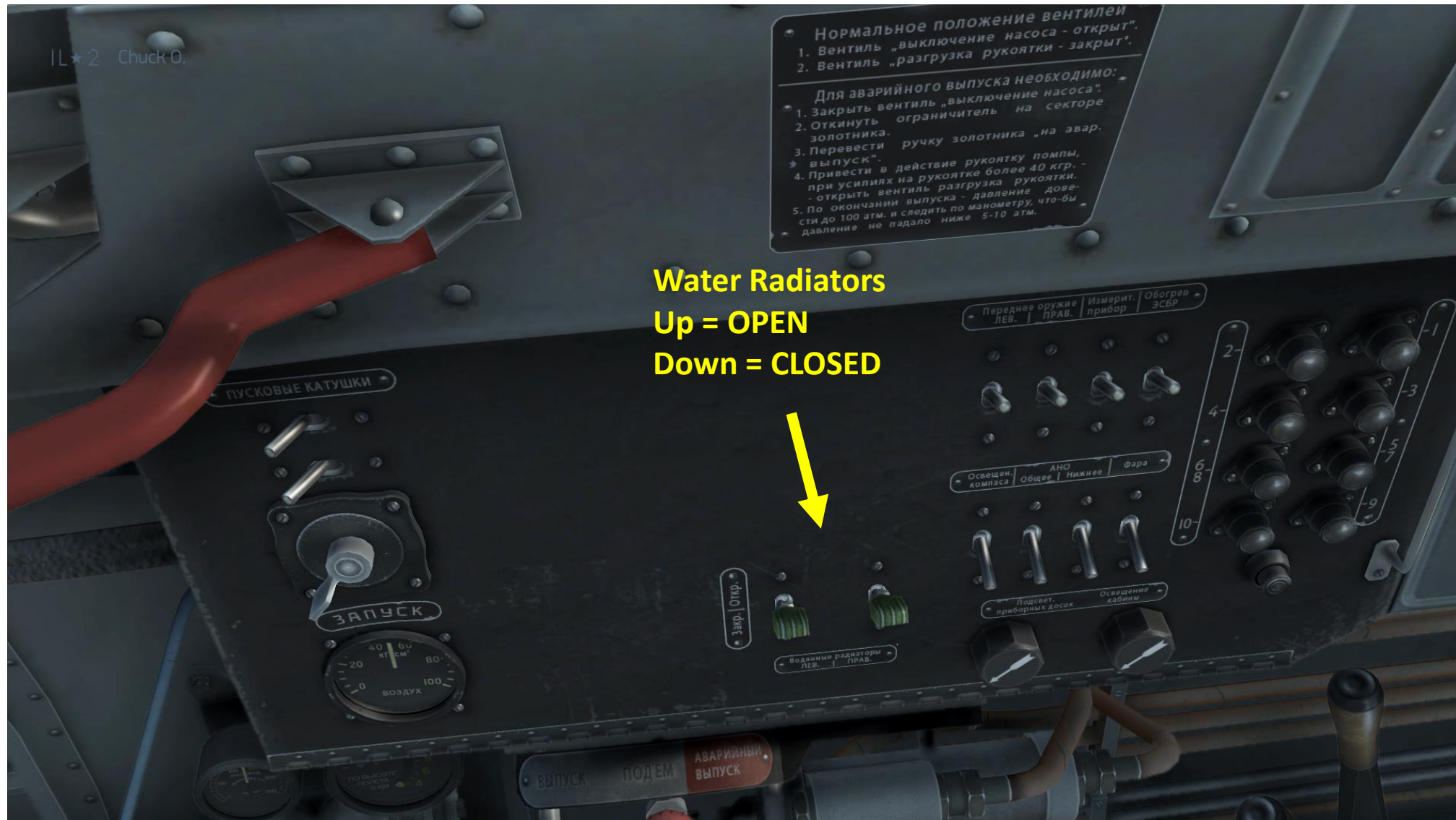
Cockpit



Dive Brake
Down = FWD
Up = AFT

Flaps
Down = FWD
Up = AFT

Cockpit



Note: There is no oil rad control on the Pe-2.

Important key bindings

- Make sure that you have the following keys mapped somewhere. *

Category	Actions	Commands
Service	*Bomb sight	V
Camera controls	*Drop bombs	B joy0_b2
Pilot head control	Throw bombs mode toggle	Lctl+B
Plane controls	Launch rockets	joy0_b3
Engine controls	Launch rockets mode toggle	LWin+R
Weapons controls	*Bomb bay doors toggle	N
Flight leader commands	Bombs safety switch	LWin+S
Pilot gestures		

Category	Actions	Commands
Service		
Camera controls	Propellers feathering: on/off	Lctl+F
Pilot head control	Oil radiators: open to next notch	Cursor Up
Plane controls	Oil radiators: close to previous notch	Cursor Down
Engine controls	*Water radiators shutters control	joy0_b12 / joy0_b10
Weapons controls	Oil radiators shutters control	Cursor Left / Cursor Right
Flight leader commands	Engines cowl shutters control	joy0_b13 / joy0_b11
Pilot gestures		

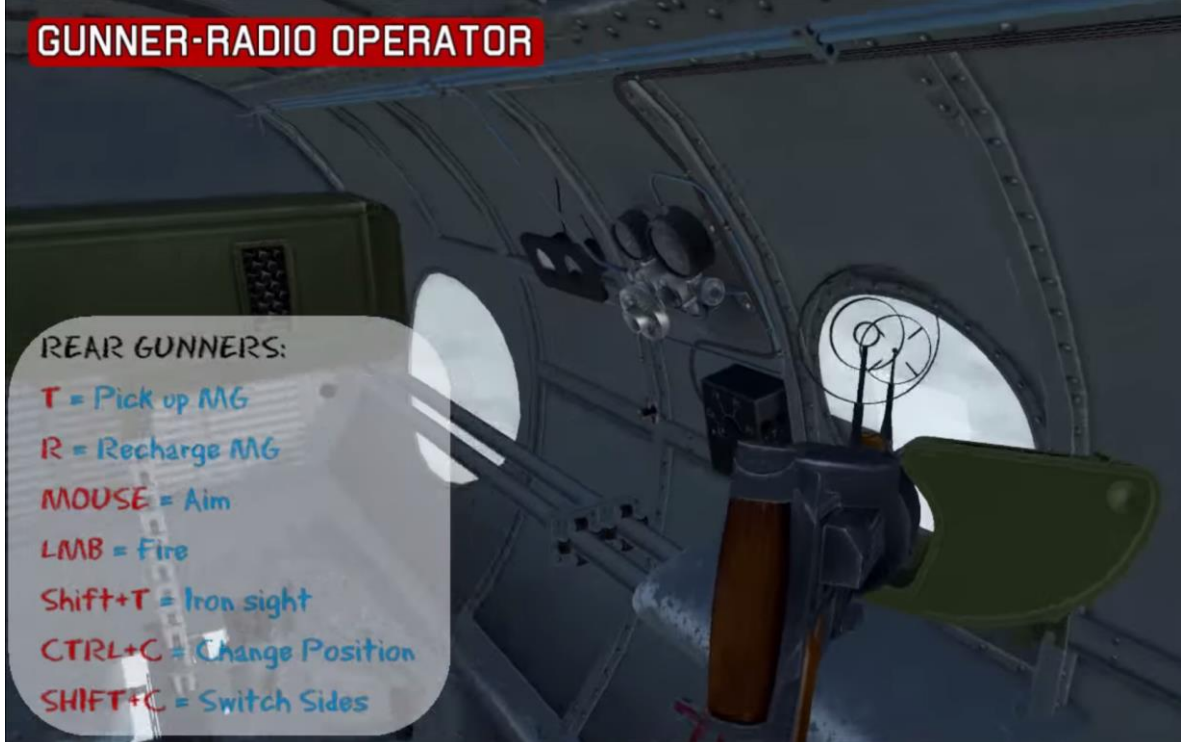
Service	Engage engines start procedure / Stop engine	E	joy1_b19
Camera controls	*Engines throttle control		joy1_axis_z
Pilot head control	*Propellers pitch control		joy1_axis_t
Plane controls	*Engines mixture control		Minus / Equals
Engine controls	*Switch engines superchargers: 1st gear speed/2nd gear speed	LSht+S	
Weapons controls			
Flight leader commands			
Pilot gestures			

Category	Actions	Commands
Service	AI-autopilot on/off	A
Camera controls	*AI-autopilot for level flight: on/off	LSht+A
Pilot head control	*Level flight AI-autopilot: left turn	LSht+Z
Plane controls	*Level flight AI-autopilot: right turn	LSht+X
Engine controls		

PART I: THE AIRCRAFT

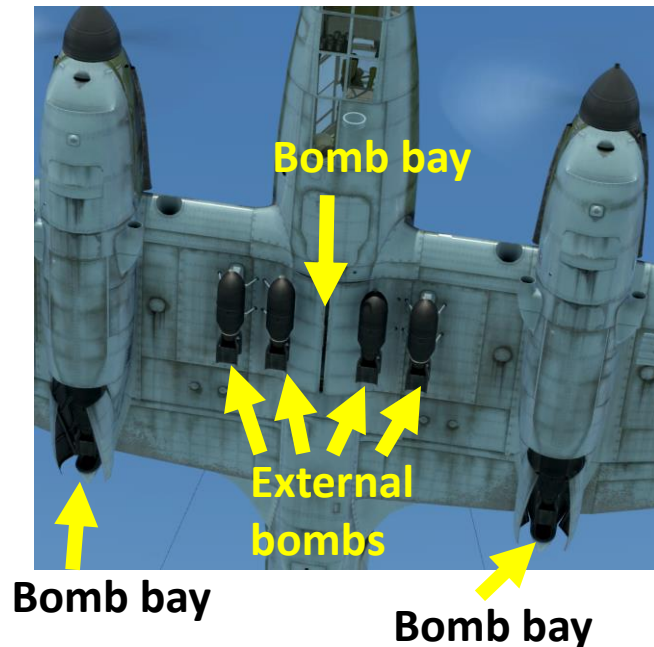
Turret Operation

- For the turret gunners, make sure that you give them the command to fire at will (Ralt + 1)
- Also, give them the command to fire at long range (Ralt + 9)
- Flying in close formation with other bombers maximizes your firepower.



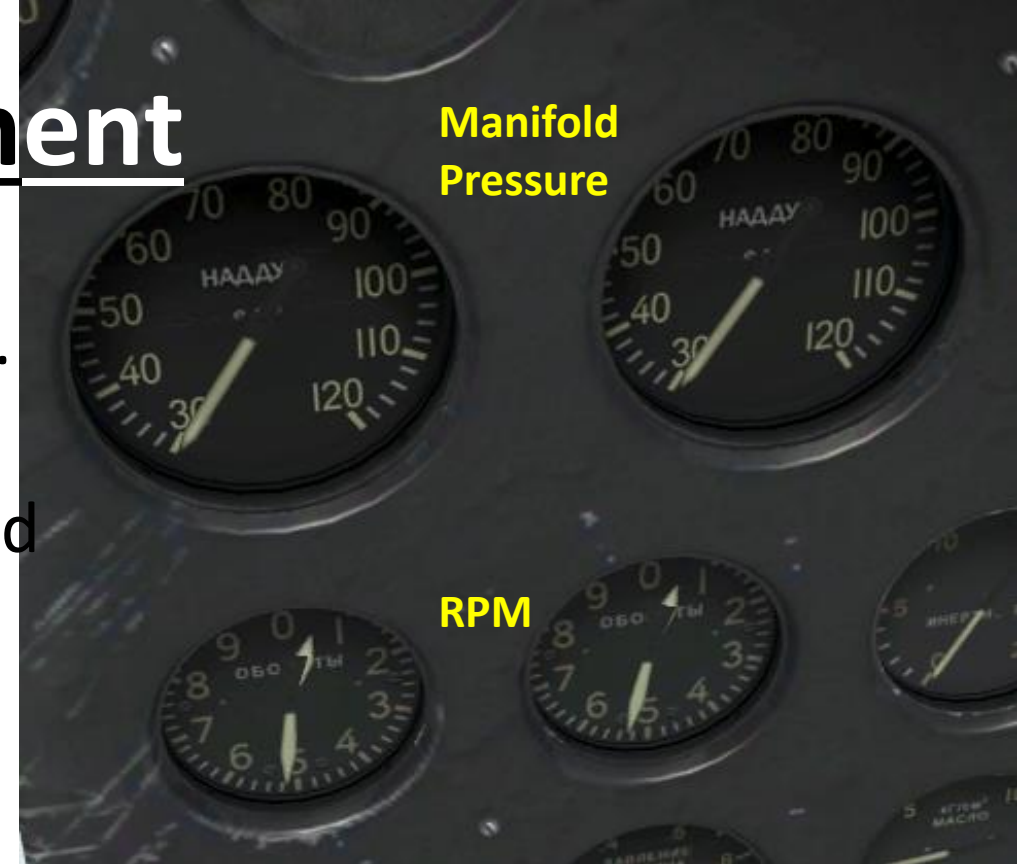
Bomb Bay Door Operation

- When you have a payload of more than 4 bombs (fixed under the fuselage), the remaining bombs are stocked in your inner bomb bay doors.
- If you try to open your bomb bay doors before the external bombs are dropped, your door will get stuck. The shutter doors will only open once the external bombs have been dropped.



Complex Engine Management

- Powered by two Klimov M-105 engines, which are also used on LaGG-3.
- Documentation is very sparse on Pe-2 operation. Operation values are deducted from LaGG-3 pilot's manual.
- Engine Temperature Limits
 - Min 40 deg C required for takeoff
 - Max 100 deg C for normal operation



Manifold
Pressure

RPM



Water Rad
Temp

Complex Engine Management

- **Takeoff:**
 - Rads fully open
 - Max RPM, Max Manifold Pressure (MP)
- **Climb:**
 - Optimal climb speed: 240 kph
 - 2600 RPM
 - 1050 mm Hg Manifold Pressure
- **Cruise:**
 - 2200 RPM
 - 1020 mm Hg
- **Combat:**
 - 2600 RPM
 - 1050 mm Hg
- **Supercharger** (increases Manifold Pressure @ higher altitudes)
 - Stage 1 below 2000 m altitude. Stage 2 over 2000 m.
 - Lshift + S to toggle supercharger stages



WHY A MISSION PLAN?

- Bombing missions require careful planning in order to be successful.
- If you fail to plan your mission properly, you most likely plan to fail.
- There is an infinity of variables, things that can go wrong during a bombing mission. However, some mistakes are avoidable and you can have control on some of these parameters.
- The best plan is not necessarily the shortest route to target. The best plan is often the most adaptable and flexible one.
- Sometimes, a bomber pilot will be forced to improvise. Always make sure that you have a plan B in case plan A goes wrong. Flexibility is the key.
- Getting shot down happens, and it is part of the game. Don't take it personal and think of how (or if) you could have avoided your untimely death. Just think of how you can do better next time!

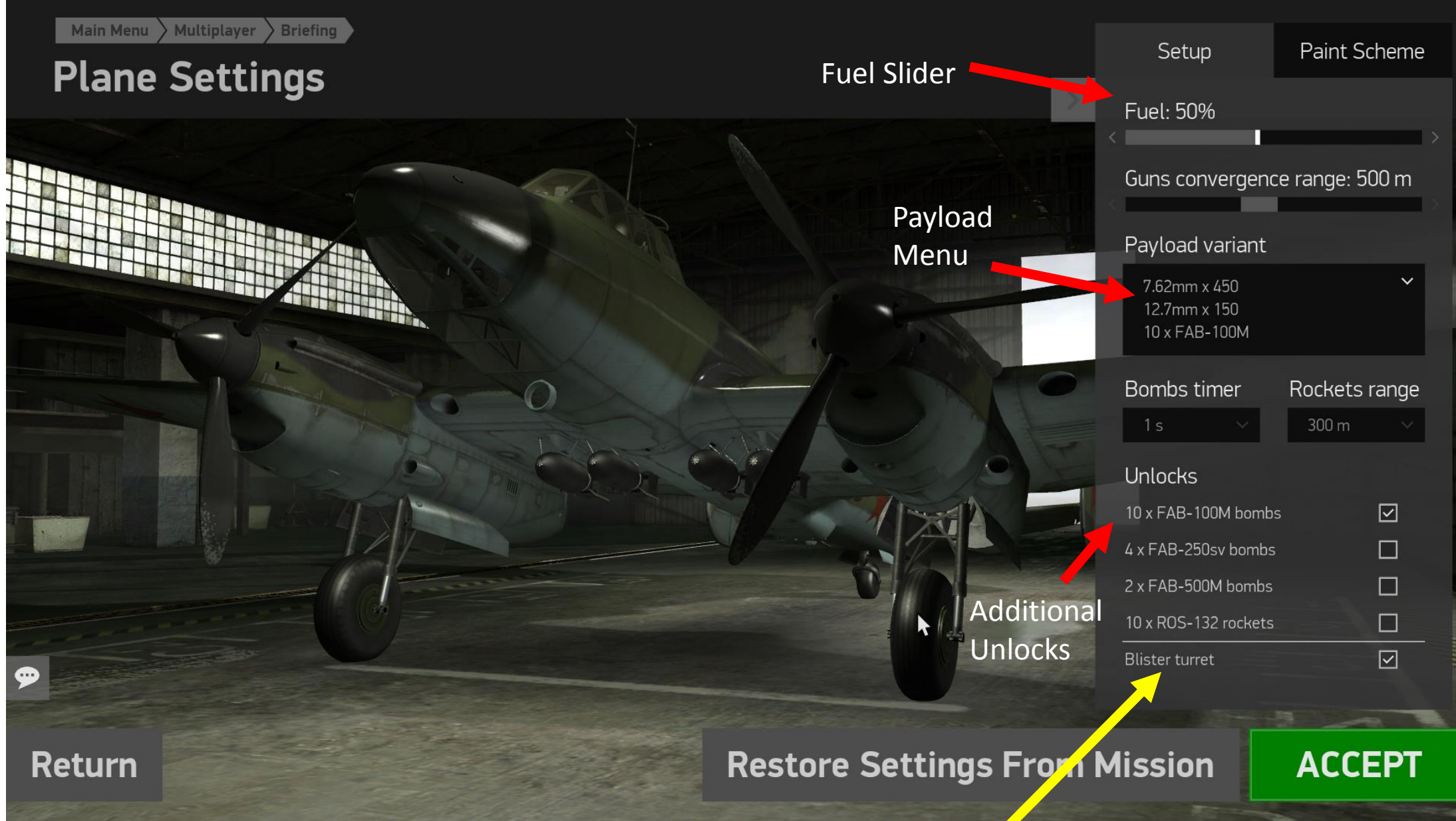
HOW TO PLAN A MISSION

- When planning a mission, you don't have to do it alone. Consult your fellow wingmen and even fighter escorts to give you intel that will help you shape your flight route accordingly to avoid patrolling enemy fighters and potential danger zones.
- Before you even takeoff, you need to know what you are going to do and how you are going to do it. Typical high-altitude bombing missions are used to knock out enemy airfields, factories or targets clumped up in a relatively small area. For smaller individual targets, you are better off dive bombing as high-altitude bombing is not as precise.
- Make sure you communicate your position, status and intentions to your teammates. You might be surprised how many people are craving to wing up with you or even escort you to your targets. Fighter jocks can also be team players, believe it or not.

WHAT TO PLAN FOR

- Your aircraft performance will be altered by mainly 2 factors: your bomb loadout and your fuel quantity (in %). Typical bomb runs are achieved with 50 % fuel. Why? Because they influence your aircraft's weight. (And people are just too lazy to calculate what they really need.) The heavier you are, the slower you will climb and the more vulnerable you will be.
- Russian bombs are designated by their weight in kg. For instance, each FAB-100M weighs 100 kg, FAB-250sv weighs 250 kg and FAB-500M weighs 500 kg.
- Different bomb loadouts all have the same weight (for the Pe-2), as each loadout has a total weight of 1000 kg. Your choice of bombs will depend on how spread out you want your blast area to be.
- In my experience, choosing 10 x FAB-100M allows for more flexibility.

PART II: MISSION PLAN



Pe-2 87 Series has the standard turret
Pe-2 100 Series has the Blister Turret

HOW TO CALCULATE YOUR REQUIRED FUEL

- You can calculate how fuel you will need pretty easily if you want to optimize your aircraft's capabilities during the missions. The less fuel you bring, the faster and more manoeuvrable you will be.
- The Pe-2's fuel tanks have a maximal capacity of approx. 1500 litres.
- The Pe-2's maximal range is 1770 km.
- Hence, we can deduce that you will need approx. 0.9 litre per km, or inversely that you will travel approx. 1.2 km per litre of fuel.
- If you know what your trajectory will be, you can easily know how much fuel you need to get there and come back.
- To judge your total distance, you can use the in-game map and plot your course at the same time.

PART II: MISSION PLAN

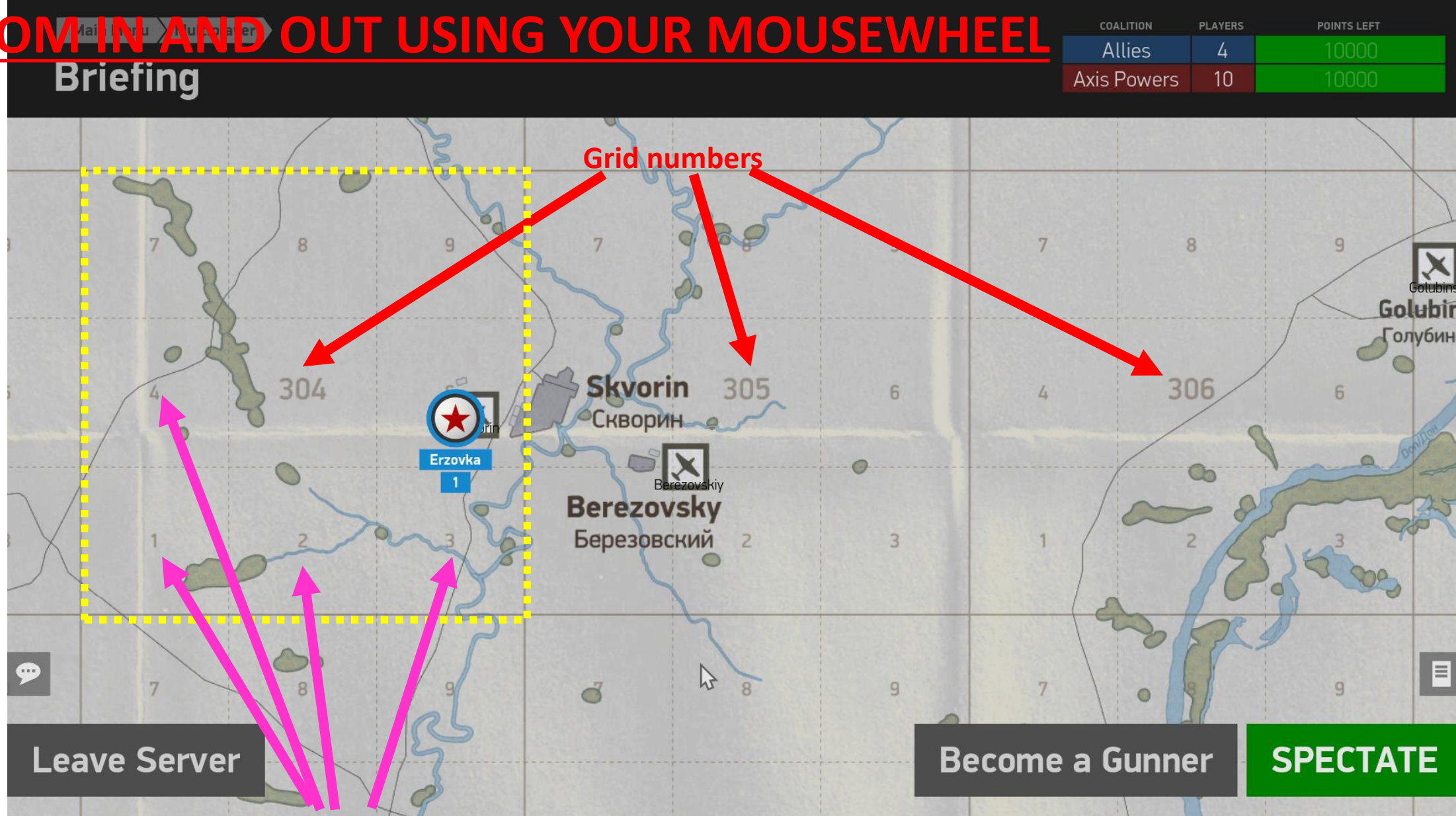
CHECK THE MAP BY PRESSING "O"

360 km
(36 squares)



PART II: MISSION PLAN

ZOOM IN AND OUT USING YOUR MOUSEWHEEL



PLOT AND PLAN YOUR COURSE

Main MenuMultiplayer

Briefing

COALITION	PLAYERS	POINTS LEFT
Allies	4	10000
Axis Powers	10	10000

You spawn here (Grid 304)

You have to travel through 10 squares, which makes 100 km.

Your target is here (Grid 314)

Since you (hopefully) want to make it back to base after your bomb run, you can add another 100 km. It is wise to add another 50 km as buffer, loitering time and extra fuel in case you need to change course or lose an engine.

Total distance = 100 + 100 + 50 = 250 km

Leave Server

Become a Gunner

SPECTATE

HOW TO CALCULATE YOUR REQUIRED FUEL

- Now that we have a rough estimate of our flight path, we know that we need fuel to travel 250 km.
- Knowing that our plane consumes approx. 0.9L/km:
- Required fuel = $250 \text{ km} \times 0.9 \text{ L/km} = 225 \text{ L}$
- Out of a capacity of 1500 L, we need roughly 15 % fuel.
- You can also consider it in a matter of time. The Pe-2 will travel approx. 5 km/min if it maintains 300 km/h in a climb.
- To fly 250 km (not counting loiter time), you can simply calculate:
 $250 \text{ km} / 5 \text{ km/min} = 50 \text{ min}$ of flight time for the whole mission.
- Using the same thought process, we can evaluate the maximal fuel % we'd need to make the longest bombing run ever. Let's calculate it, just for fun.
- Knowing that the maximal distance you would have to travel is the whole diagonal of the map (425 km, so 850 km for a full flight), the longest flight you could make from point A to point B back and forth would require 720 L of fuel, which is slightly less than 50 % of your tank capacity (1500 L).

HOW TO CALCULATE YOUR REQUIRED FUEL

- As you can see, we now know that we do not really need 50 % fuel. Just by making a quick estimate, we saved 35 % fuel, and our aircraft is now 350 kg lighter, which is about the weight of this adorable manatee.



- The lighter your aircraft is, the easier time you will have climbing. And the higher you are, the less likely you are to get bounced. Also, altitude allows you to have a better view of the landscape and navigate visually.

PART III: TAKEOFF

- Taking off in the Pe-2 is straightforward if you follow these steps for a cold engine start.

- 1) Crack your throttle about 15 %
- 2) Set your mixture to full rich
- 3) Close your water radiators
- 4) Set minimum RPM
- 5) Ignite (“E” key by default)!

6) Set your flaps to 15 degrees. Keep in mind that your flaps switch is continuous and will keep moving your flaps as long as you hold it. If your flaps are deployed too much (over 30 degrees), you will simply stall, crash and burn on takeoff. Consult your flap indicator to make sure that you are set up correctly.



Flap setting indicator

PART III: TAKEOFF

7) Wait for your oil radiator temperatures to reach 40 degrees C.

8) Line yourself up on the runway and lock your tailwheel by pulling your stick back to keep your tailwheel down.

9) Fully open your water radiators.

9) Throttle up full power, max RPM. Correct heading with small rudder input.

10) As soon as you reach 100 kph, center the stick and level out to pick some speed.

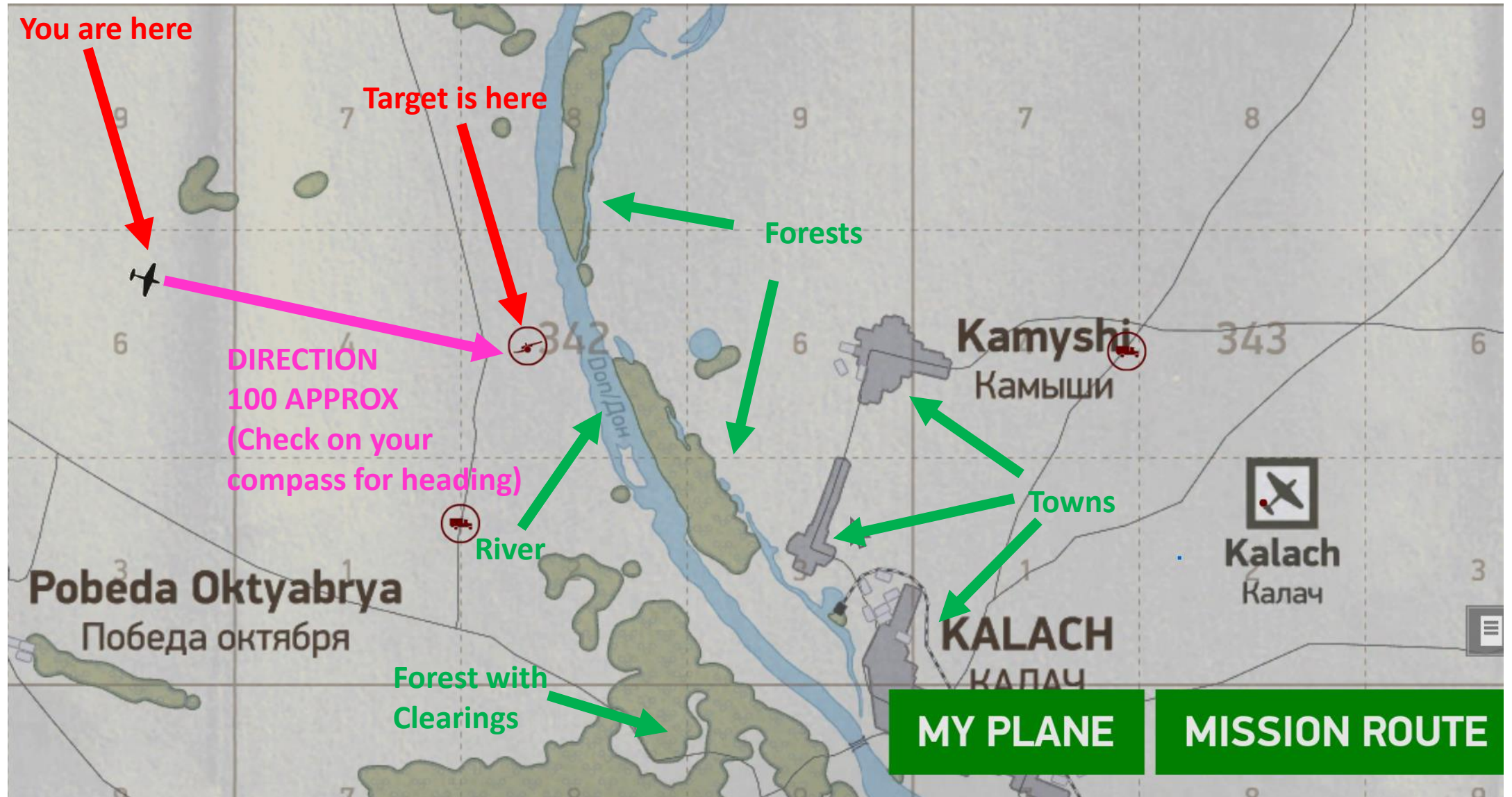
11) When you reach 150 kph, rotate gently.

12) Once you are up in the air, retract flaps, pull your gear up and start climbing. Adjust RPM and manifold pressure accordingly (see engine management in part I).

- Now that we are up in the air and that we know what our mission will be, let's do an example. We cannot bomb our target if we cannot find it, right?
- First, let's make a brief summary of the mission.
 1. We are going to bomb artillery positions
 2. We will bomb our targets at an altitude of approx. 3500 metres with 10 X FAB-100M bombs. The altitude is not set in stone, but more of a general idea.
 3. We will approach the target from the East.
 4. In this case, we will go in alone. But if you lead a bomber wing, it is important for the leader to give his speed and engine settings to his wingmen in order to allow them to form up easily on you.
Generally, bomber formations will drop on the bomber lead's go while wingmen will maintain formation. By managing the workload in this way, precision is maximized and coordination maintained throughout the bombing run.

PART IV: NAVIGATION

- Here is an overview of where the map is located and where we currently are. Spot **landmarks that you could recognize**.



PART IV: NAVIGATION

- Here is an overview what you see in your cockpit. Recognize anything familiar?



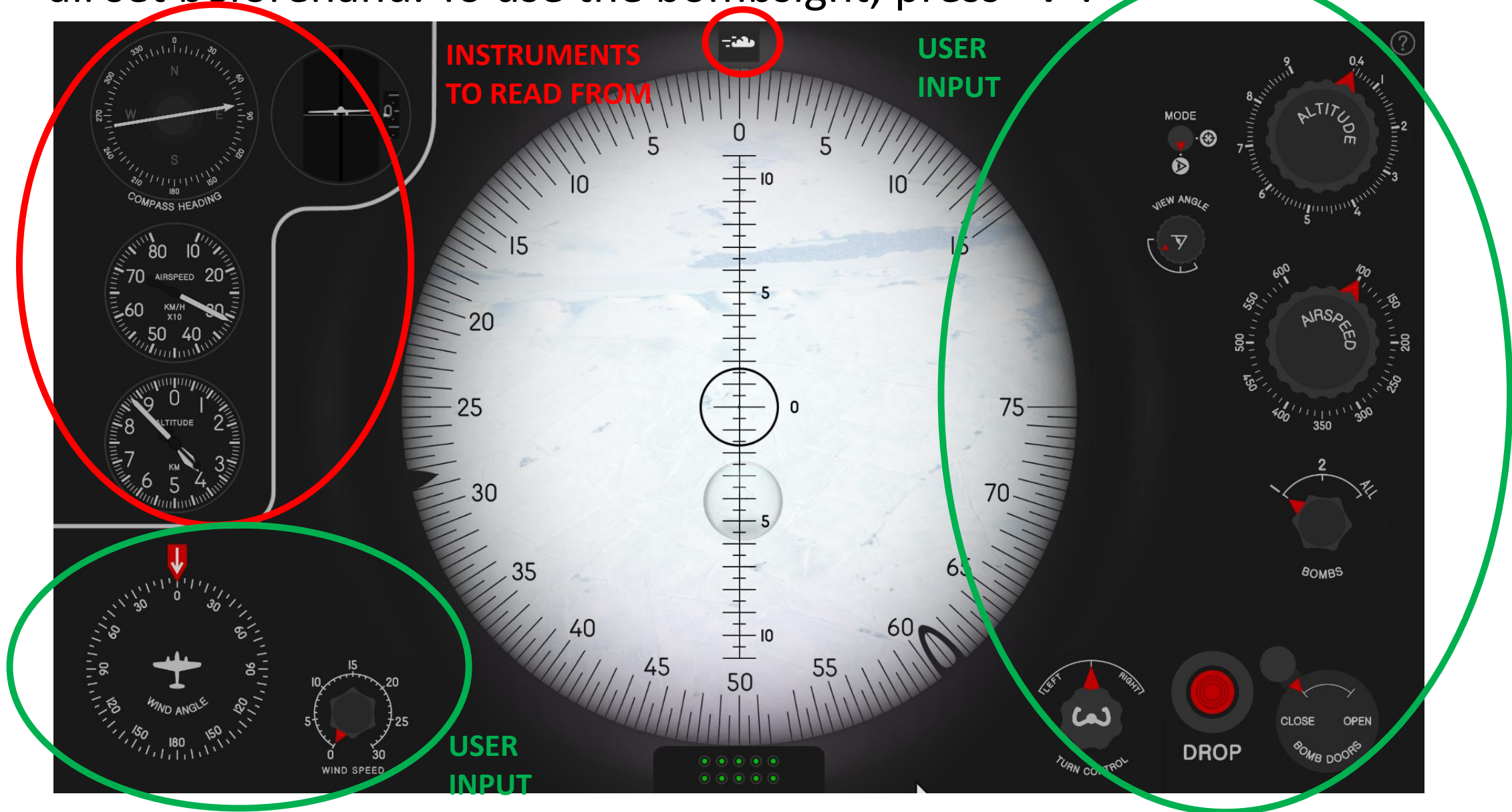
PART IV: NAVIGATION

- Here is an external view. So? Aaaah, yes, it all comes together now, does it? Let's turn a bit and try to find our target using the bombsight.



PART IV: BOMB RUN

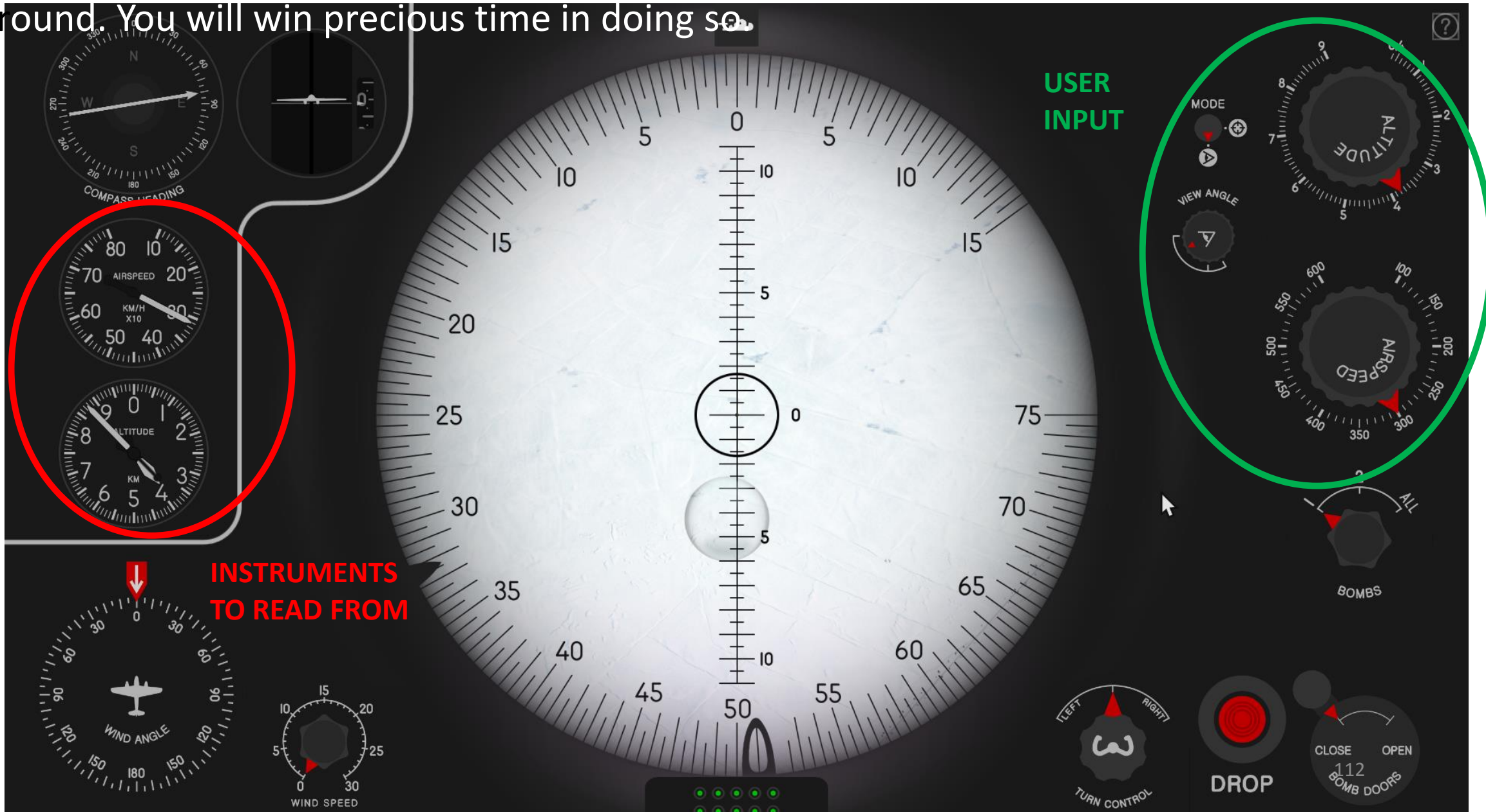
- Now comes the toughest part: understanding the bombsight and using it properly. It requires a lot of preparation, so make sure you are all set beforehand. To use the bombsight, press “V”.



PART IV: BOMB RUN

Engage the level-auto-pilot (LAlt + A) and enter speed and altitude.

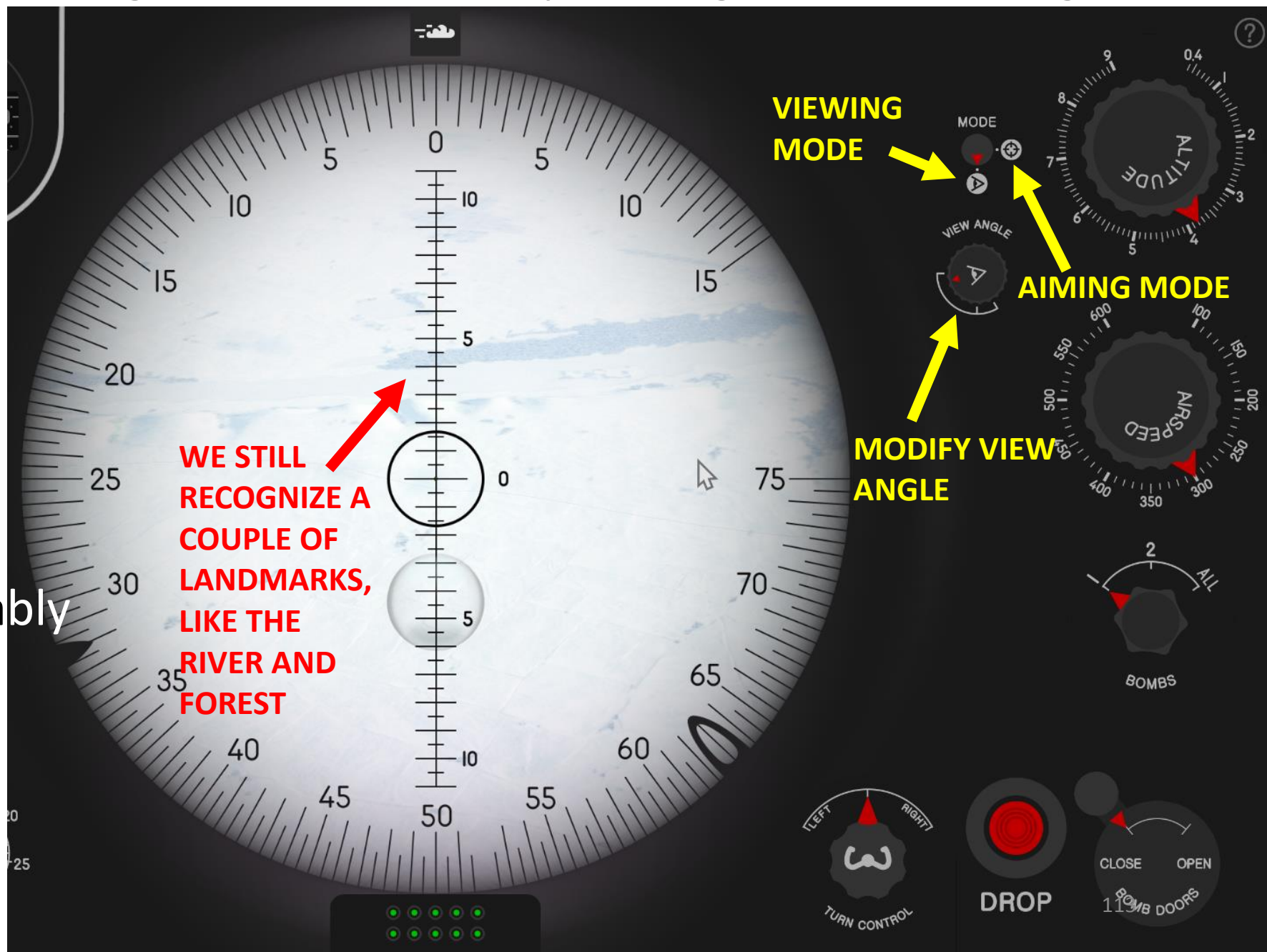
Tip: decide your speed and bombing altitude beforehand and set your bombsight on the ground. You will win precious time in doing so.



PART IV: BOMB RUN

- 2) Choose the bombsight “View Mode” by clicking on it and change your view angle to where you can see farther in front of you. You can hold left mouse btn to change angle smoothly.

We see that the target will probably be a bit more to our left.



PART IV: BOMB RUN

3) Steer your aircraft using the turn control (Lshift Z = LEFT, Lshift X = RIGHT)

In our case, we'll have to steer left.

Your aircraft will swing left and right, This is normal. Just make sure your sight is aiming straight for your target.



PART IV: BOMB RUN

- Find your target



PART IV: BOMB RUN

- About 1 minute before bomb run, check for wind correction by consulting meteo conditions... Once again, you can do this on the ground beforehand and win precious time.

HEADING

CLICK METEO!

THIS WINDOW SHOULD POP

WIND ANGLE

WEATHER REPORT

height	speed	from
GROUND	5 m/s	74°
500 m	10 m/s	67°
1000 m	15 m/s	64°
2000 m	17 m/s	63°
5000 m	19 m/s	56°

TURN CONTROL

DROP

BOMB DOORS

BOMBS

WIND SPEED

PART IV: BOMB RUN

- Here is how you get your wind angle.



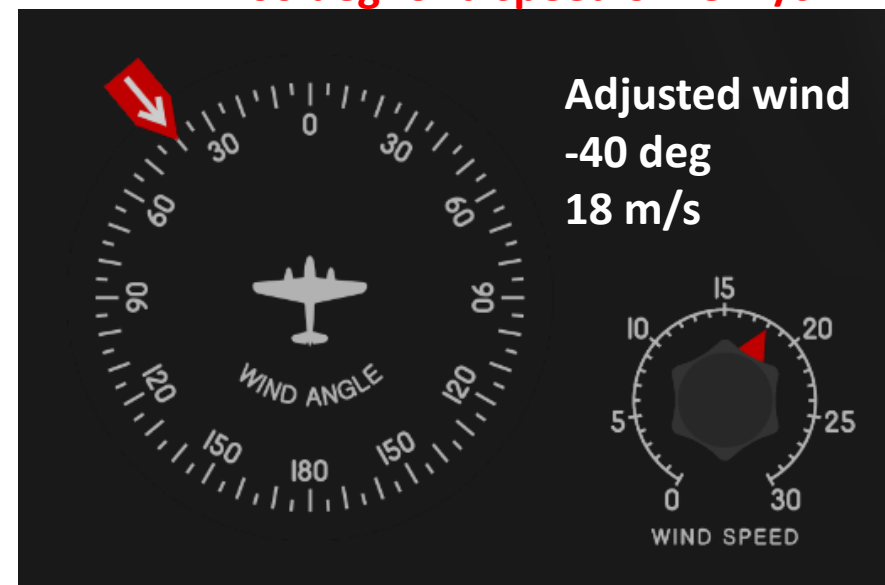
**WIND FROM 60
TO 60+ 180 = 240 DEG**

**DIRECTION OF
AIRCRAFT (GREY
ARROW): 100
DEG**

**Angle between aircraft and wind:
100 - 60 = 40 deg
We choose - 40 because the wind
is pushing you from your left.**

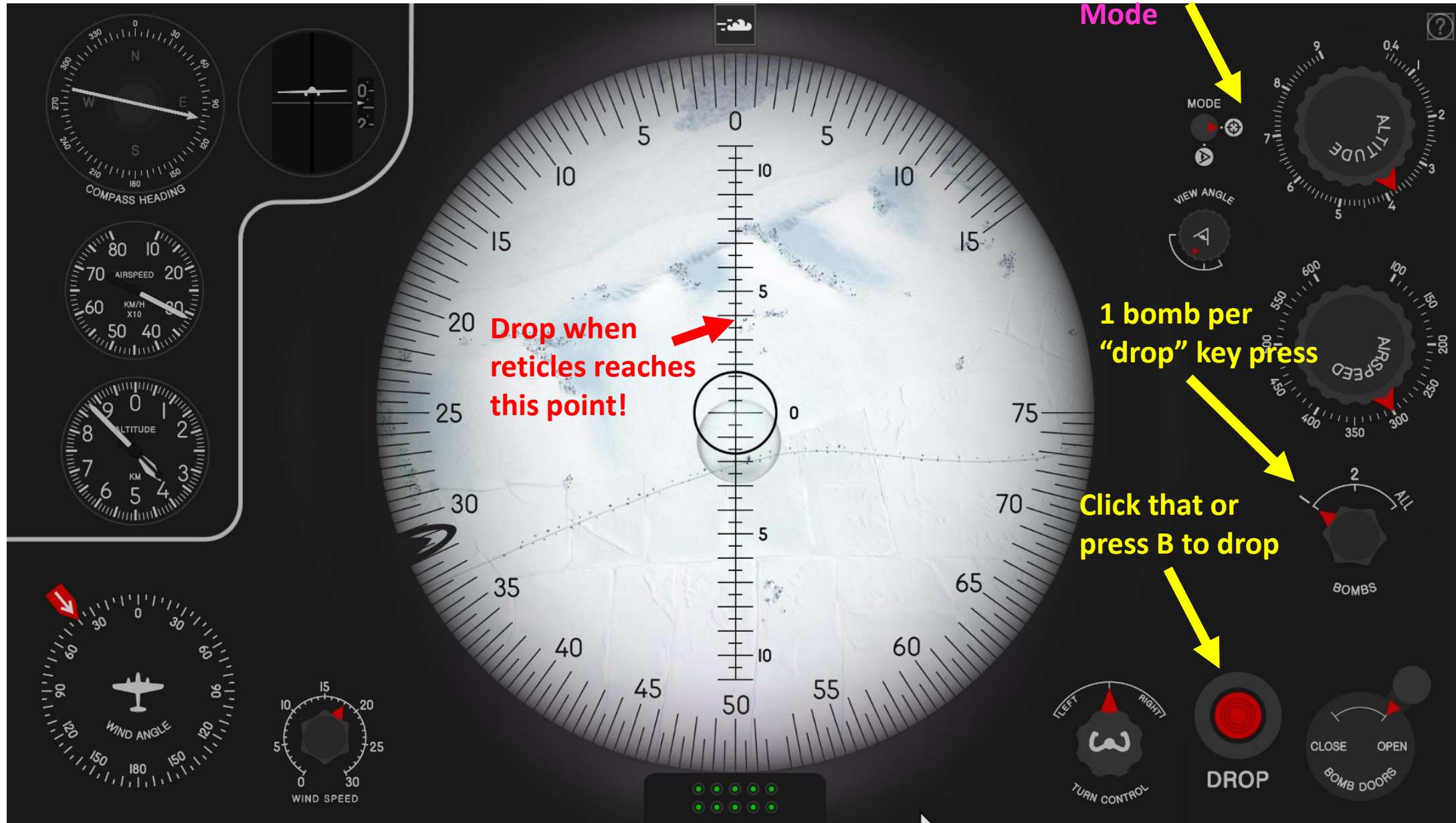
WEATHER REPORT		
height	speed	from
GROUND	5 m/s	74°
500 m	10 m/s	67°
1000 m	15 m/s	64°
2000 m	17 m/s	63°
5000 m	19 m/s	56°

**At 4000 m, it is reasonable to
predict a wind from approx.
60 deg for a speed of 18 m/s.**



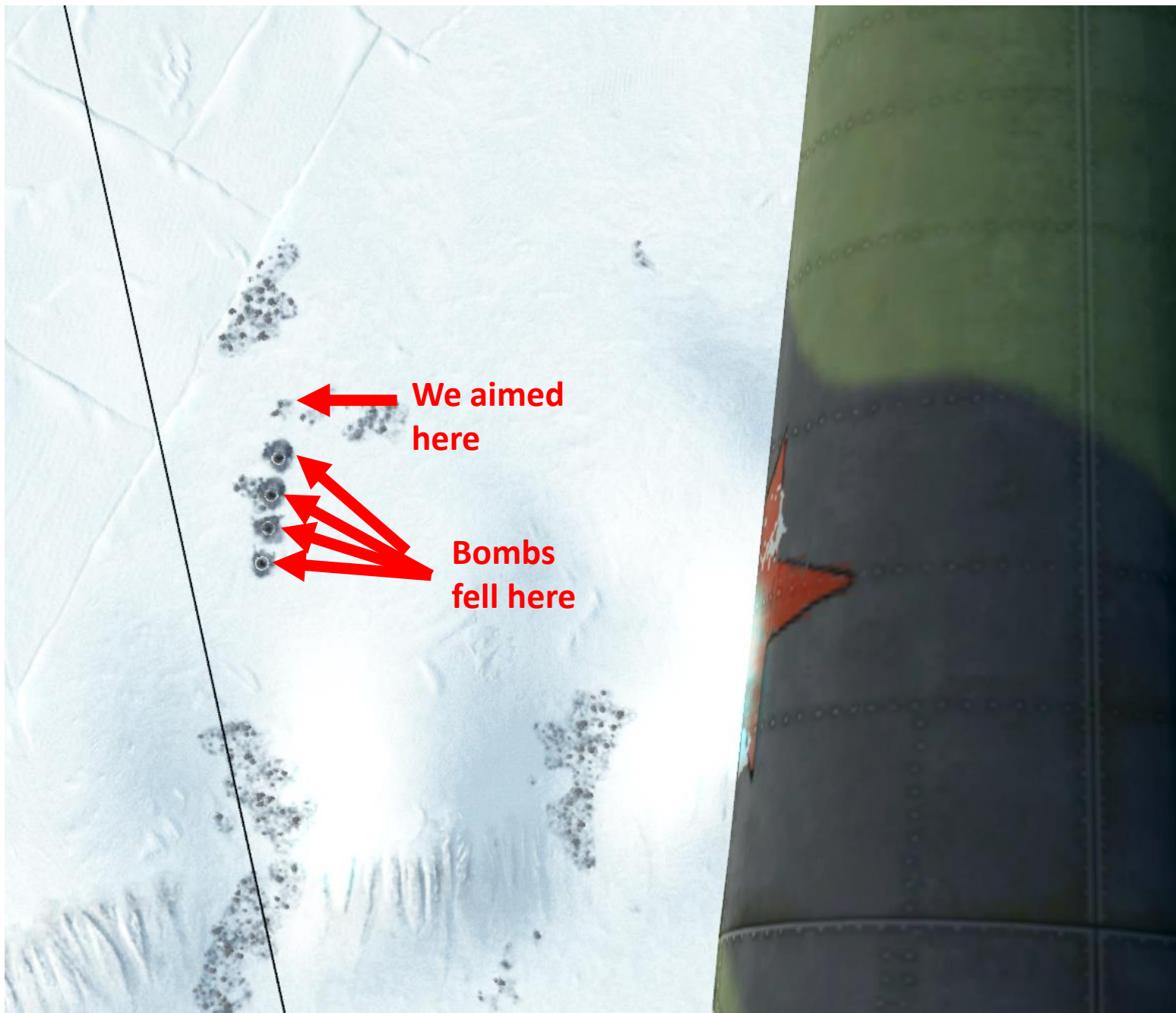
PART IV: BOMB RUN

- Now that we have all our parameters, let us drop the first 4 bombs strapped to the fuselage one by one. Bomb bay doors do not need to be open for the fuselage bombs. For the remaining bombs, press N or click the Open Bomb Doors button. **Click on AIMING Mode**



PART IV: BOMB RUN

- Not bad for a 18 m/s crosswind at 4000 m, eh?



PART V: LANDING

- 1) Deploy landing gear when going slower than 300 kph.
- 2) Max RPM, throttle as required to maintain approach speed at 200 kph.
- 3) Deploy flaps 15 degrees.
- 4) Trim nose down as flaps generate extra lift.
- 5) Touchdown at 160 kph.



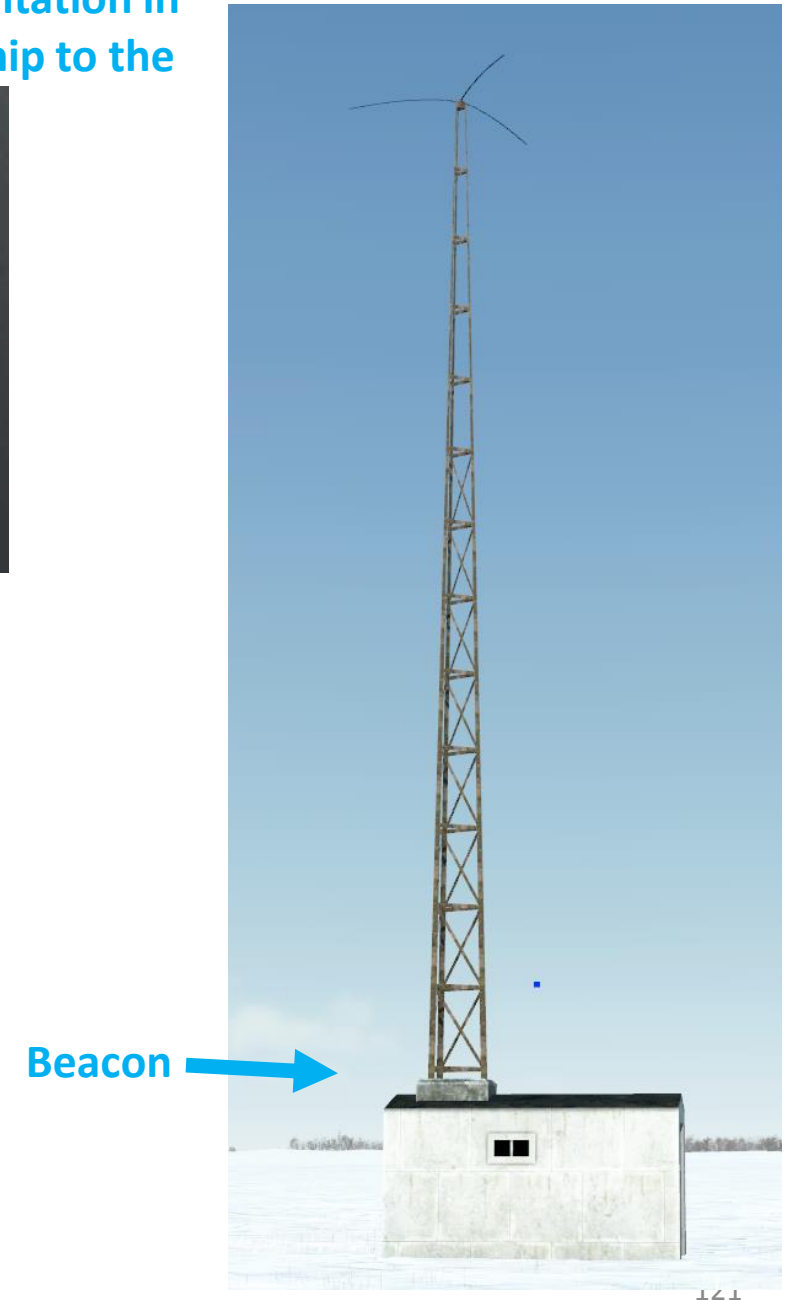
PART V: LANDING

Blind Approach Tutorial (Radio Homing)

Note: Make sure you have the RPK-10 Radio Homing Compass installed in your aircraft.



This needle displays
your orientation in
relationship to the
beacon



PART V: LANDING

Blind Approach Tutorial



Messerschmitt Bf.109 F-4

"FRIEDRICH"



By Chuck

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- PART I: THE AIRCRAFT
- PART II: THE CONTROLS
- PART III: TAKEOFF
- PART IV: LANDING
- PART V: ENGINE MANAGEMENT
- PART VI: AIRCRAFT PERFORMANCE

History



The Messerschmitt 109 was a German fighter aircraft designed by Willy Messerschmitt and Robert Lusser during the early to mid-1930s. It was one of the first truly modern fighters of the era, including such features as all-metal monocoque construction, a closed canopy, a retractable landing gear, and was powered by a liquid-cooled, inverted-V12 aero engine

The Bf 109 was the most produced fighter aircraft in history, with a total of 33,984 airframes produced from 1936 up to April 1945. Originally conceived as an interceptor, later models were developed to fulfill multiple tasks, serving as bomber escort, fighter-bomber, day-, night-, all-weather fighter, ground-attack aircraft, and as reconnaissance aircraft. Through constant development, the Bf 109 remained competitive with the latest Allied fighter aircraft until the end of the war.

The second major redesign during 1939–40 gave birth to the F series. The "Friedrich" saw a complete redesign of the wings, the cooling system and fuselage aerodynamics, and was powered by the 1,350 PS (1,332 HP) DB 601E (F-3 and F-4). Considered by many as the high-water mark of Bf 109 development, the F series abandoned the wing cannon and concentrated all armament in the forward fuselage with a pair of synchronized machine guns above and a single 15 or 20mm Motorkanone-mounted cannon behind the engine, the latter firing between the cylinder banks and through the propeller hub. This configuration was used by all subsequent variants.

PART I: THE AIRCRAFT

The Cockpit

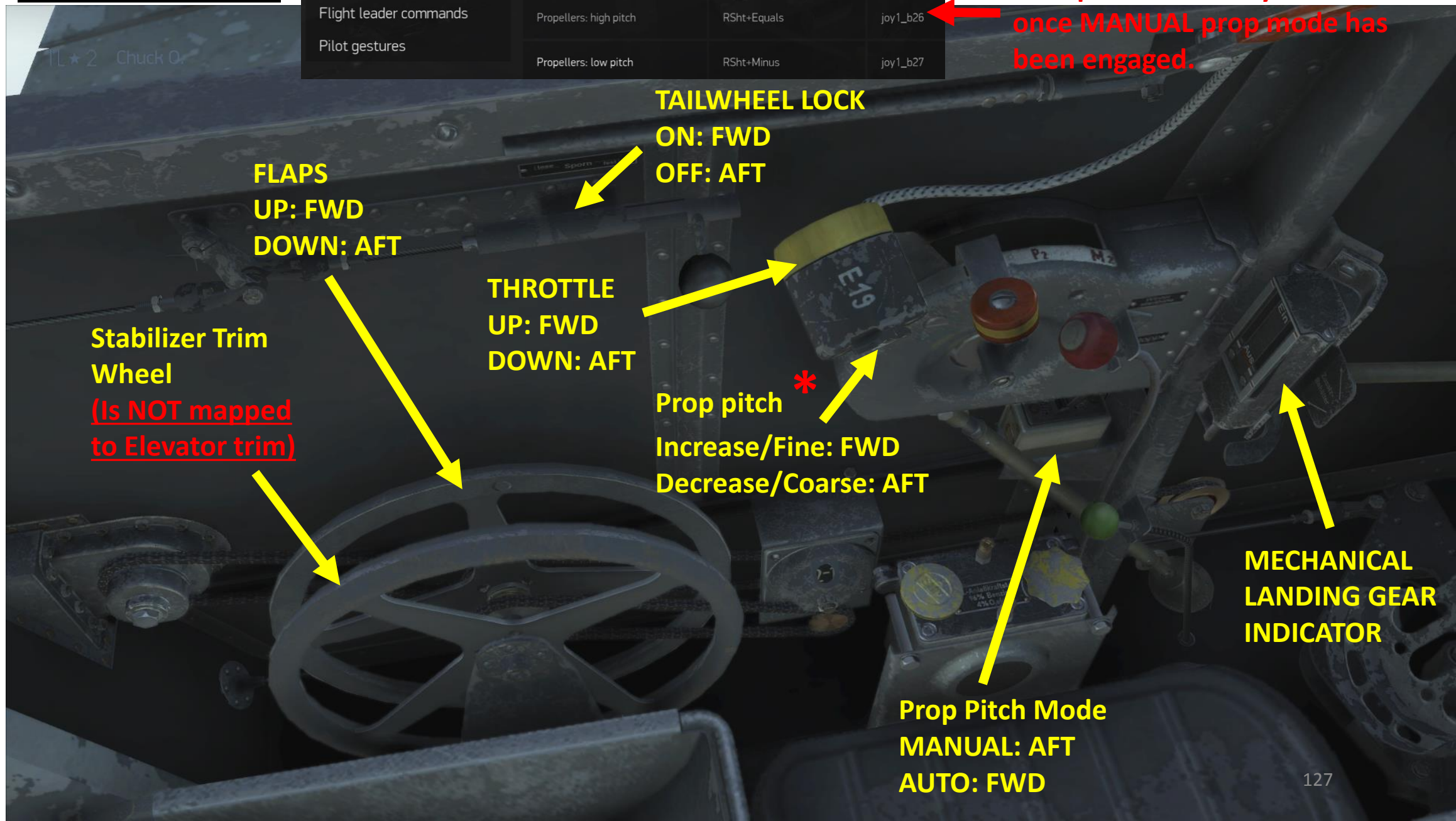


PART I: THE AIRCRAFT

Left Side

Engine controls	Switch propellers pitch control mode: manual/auto	RSht+P	joy1_b25
Weapons controls			
Flight leader commands	Propellers: high pitch	RSht+Equals	joy1_b26
Pilot gestures	Propellers: low pitch	RSht+Minus	joy1_b27

*** Prop Pitch can only be modified once MANUAL prop mode has been engaged.**



**FLAPS
UP: FWD
DOWN: AFT**

**TAILWHEEL LOCK
ON: FWD
OFF: AFT**

**THROTTLE
UP: FWD
DOWN: AFT**

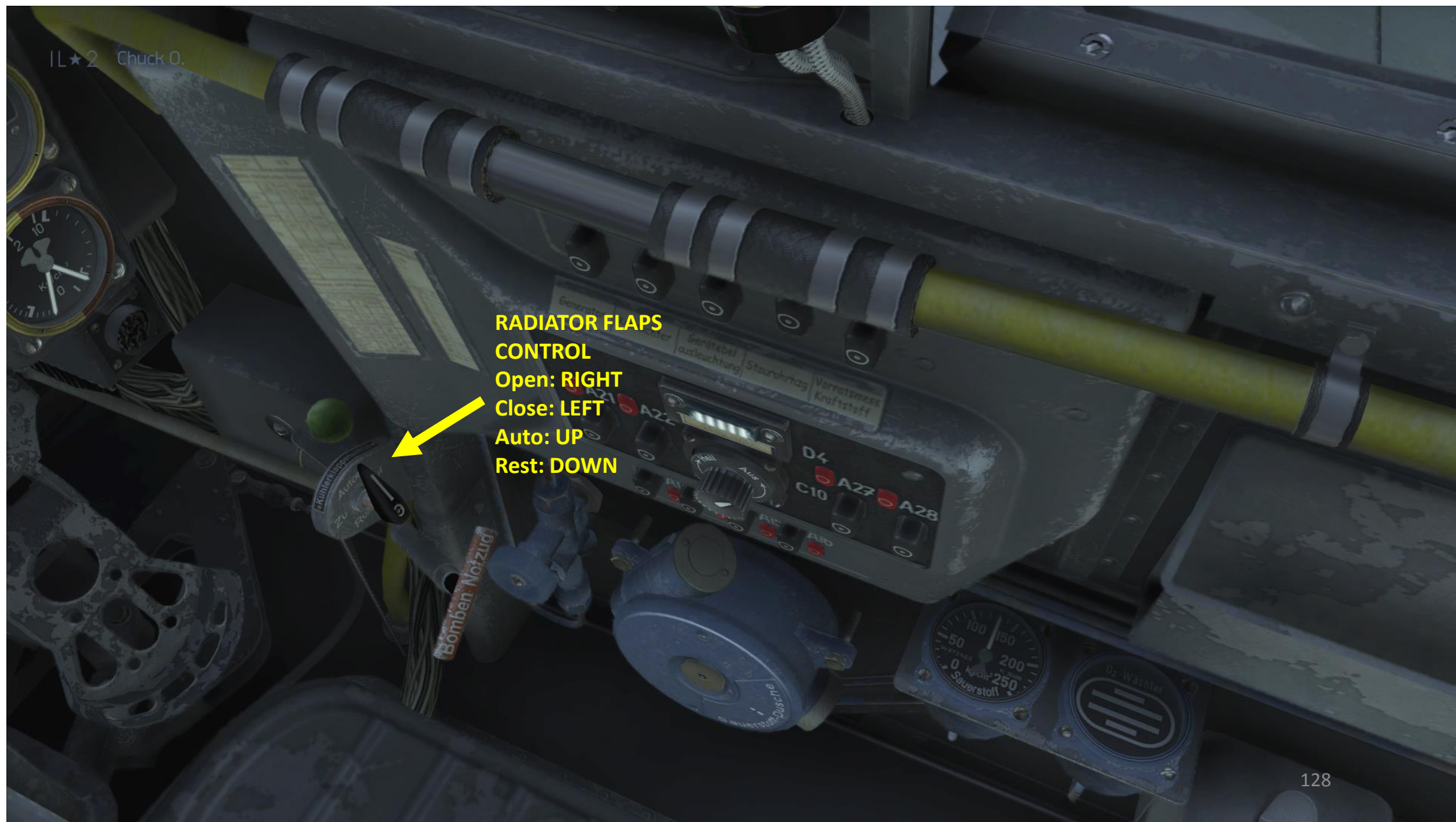
**Stabilizer Trim
Wheel
(Is NOT mapped
to Elevator trim)**

**Prop pitch *
Increase/Fine: FWD
Decrease/Coarse: AFT**

**MECHANICAL
LANDING GEAR
INDICATOR**

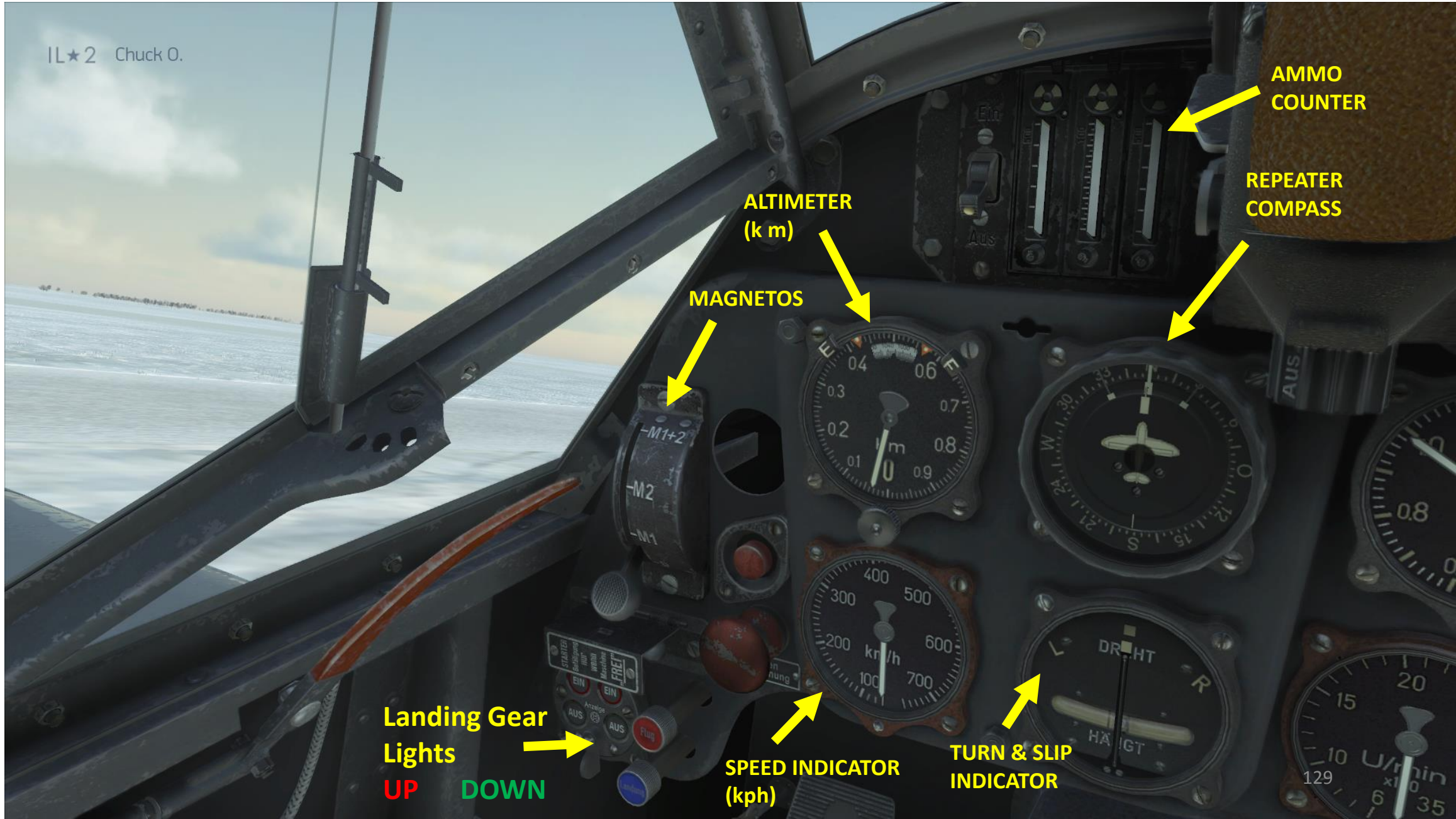
**Prop Pitch Mode
MANUAL: AFT
AUTO: FWD**

Right Side



PART I: THE AIRCRAFT

Front Left



Front Right



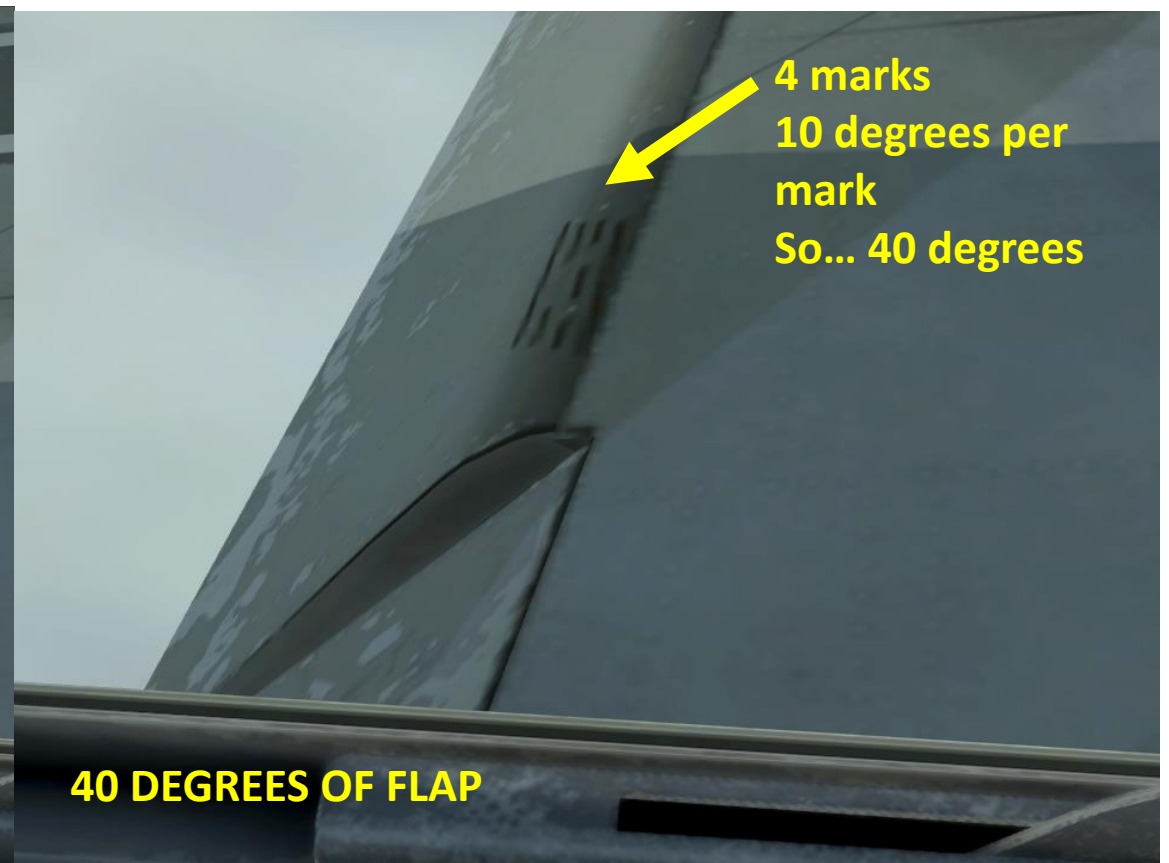
Important key bindings

- The Bf 109 has automated radiator controls, so you do not need to think about them.
- You can control your prop pitch (which will affect your RPM), but only if you have engaged the MANUAL PROP PITCH mode. Make sure you have a key to it. Changing prop pitch manually is by no means necessary, but it can allow you to fine-tune your RPM setting and gain a marginal gain in performance as the AUTO mode already does that for you.
- Unlike in Russian aircraft, you do not control your mixture setting in the 109.
- In AUTO PROP PITCH mode, your RPM will be automatically adjusted in function of your ATA (Manifold Pressure) input.

Engine controls	Switch propellers pitch control mode: manual/auto	RSht+P	joy1_b25
Weapons controls			
Flight leader commands	Propellers: high pitch	RSht+Equals	joy1_b26
Pilot gestures	Propellers: low pitch	RSht+Minus	joy1_b27

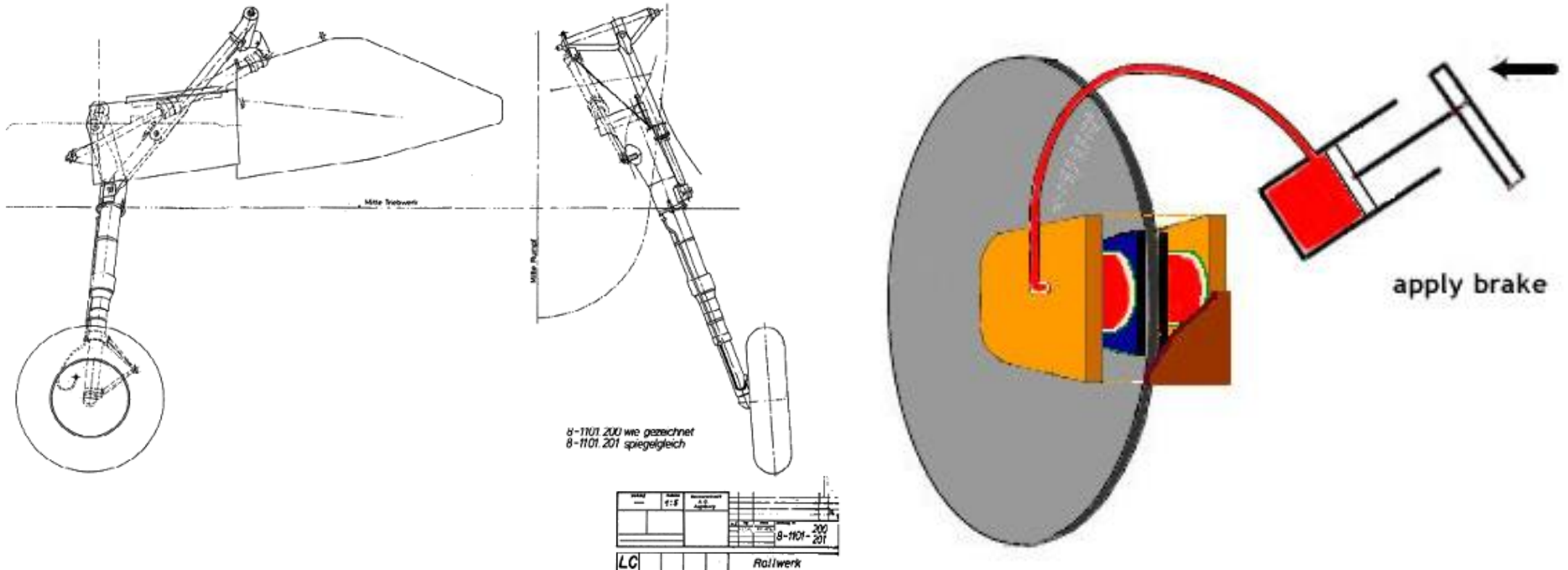
Important key bindings

- You can judge know approximately how much degrees of flaps are deployed by looking at “black marks” on the wings next to the junction between the trailing edge of the wing and the flap itself. One “notch” equals 10 degrees.



Important key bindings

- The Bf.109, unlike most 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.
- 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.



PART III: TAKEOFF

- Taking off in the Bf.109 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your prop pitch mode to “AUTO”
 - 3) Ignite (“E” key by default)!
 - 4) Wait for your oil temperature to reach 40 degrees C
 - 5) Taxi to the runway (unlock tailwheel, LShift+G by default)
 - 6) Set your flaps to 20 degrees (2 notches on the wing).

PART III: TAKEOFF

7) Set your prop pitch mode to AUTO. If you set it to MANUAL, put the prop pitch needle in the 12:00 position.

8) Lock your tailwheel once lined up on the runway (LShift+G by default)

9) Throttle up to 2500 RPM @ 1.3 ATA. Correct heading with small rudder input.

CAUTION: DO NOT EXCEED 1 MINUTE AT FULL POWER (2700 RPM/1.42 ATA)

10) As soon as you reach 120 kph, center the stick and level out to pick some speed.

11) When you reach 180 kph, rotate gently.

12) Once you are up in the air, retract flaps, pull your gear up and start climbing. Adjust manifold pressure accordingly (see engine management in part V).

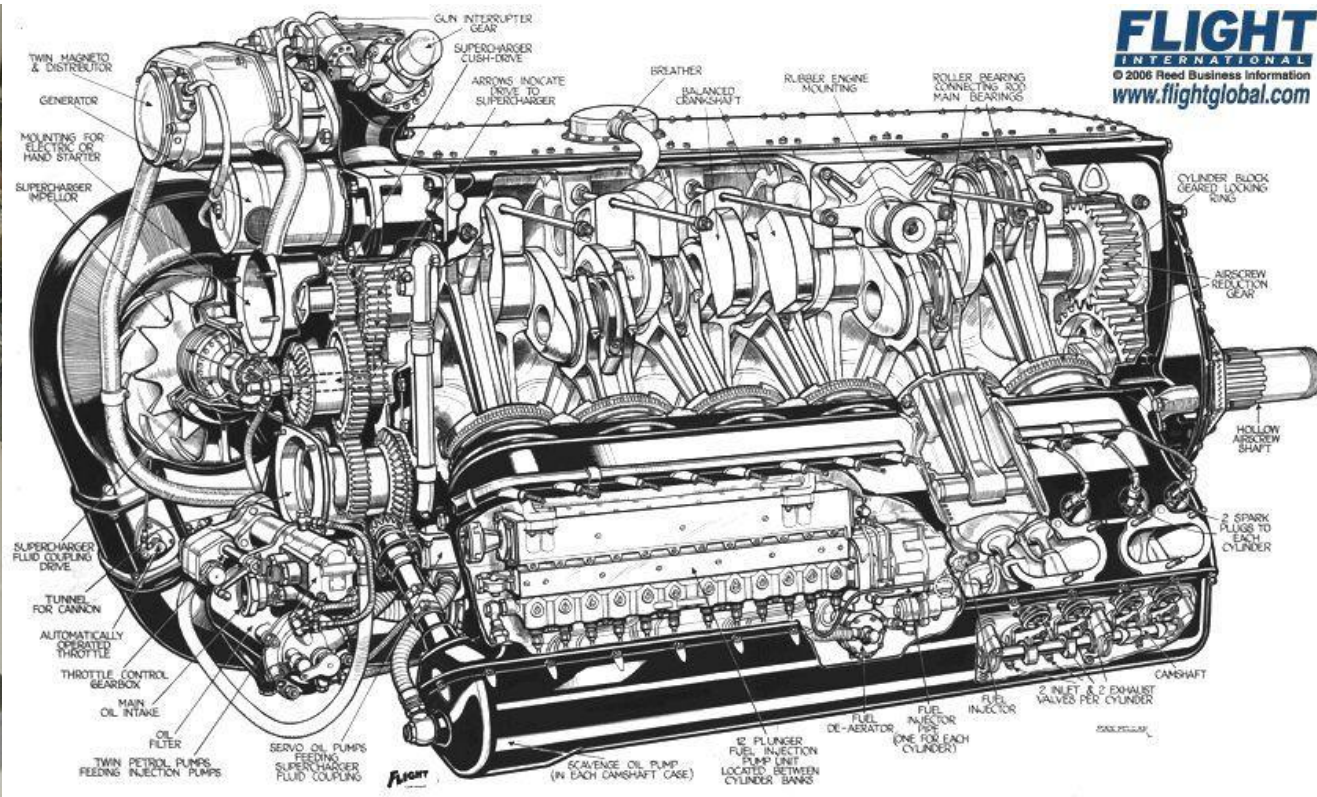
PART IV: LANDING

- 1) Deploy landing gear when going slower than 350 kph.
- 2) Deploy flaps 20 degrees when going slower than 250 kph.
- 3) Set your prop pitch to AUTO or set the needle at 11:30 in MANUAL mode. Throttle as required to maintain approach speed at 180 kph. Recommended engine setting is 1500 RPM @ 0.6 ATA.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and start a gentle, but firm flare.
- 6) Touchdown at 160 kph.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



Powerplant

- The Bf.109 F-4 is powered by the **Daimler-Benz DB 601**, a liquid-cooled inverted V-12 engine. The DB 601A-1 was a development of the DB 600 with direct fuel injection. The DB 601Aa was licence-built in Japan by Aichi as the Atsuta, by Kawasaki as the Ha-40, and in Italy by Alfa Romeo as the R.A.1000 R.C.41-I *Monson*.



Operating Limits

- Min coolant temperature: 40 deg C.
- Max coolant temperature: 100 deg
- Min oil temperature: 40 deg C.
- Max oil temperature: 80 deg C.

COOLANT EXIT TEMPERATURE (DEG C)



OIL INTAKE TEMPERATURE (DEG C)

Recommended Settings

- Do not exceed 1 minute at full power (2700 RPM & 1.42 ATA). Ever.
- Takeoff
 - 2600 RPM, 1.3 ATA
- Climb
 - 2600 RPM, 1.3 ATA, speed 250-350 kph (30 min max)
- Normal Operation (Cruise)
 - 2200 RPM, 1.0 ATA
- Combat
 - 2600 RPM, 1.3 ATA
- Landing
 - 1500 RPM, 0.6 ATA



PART VI: AIRCRAFT PERFORMANCE

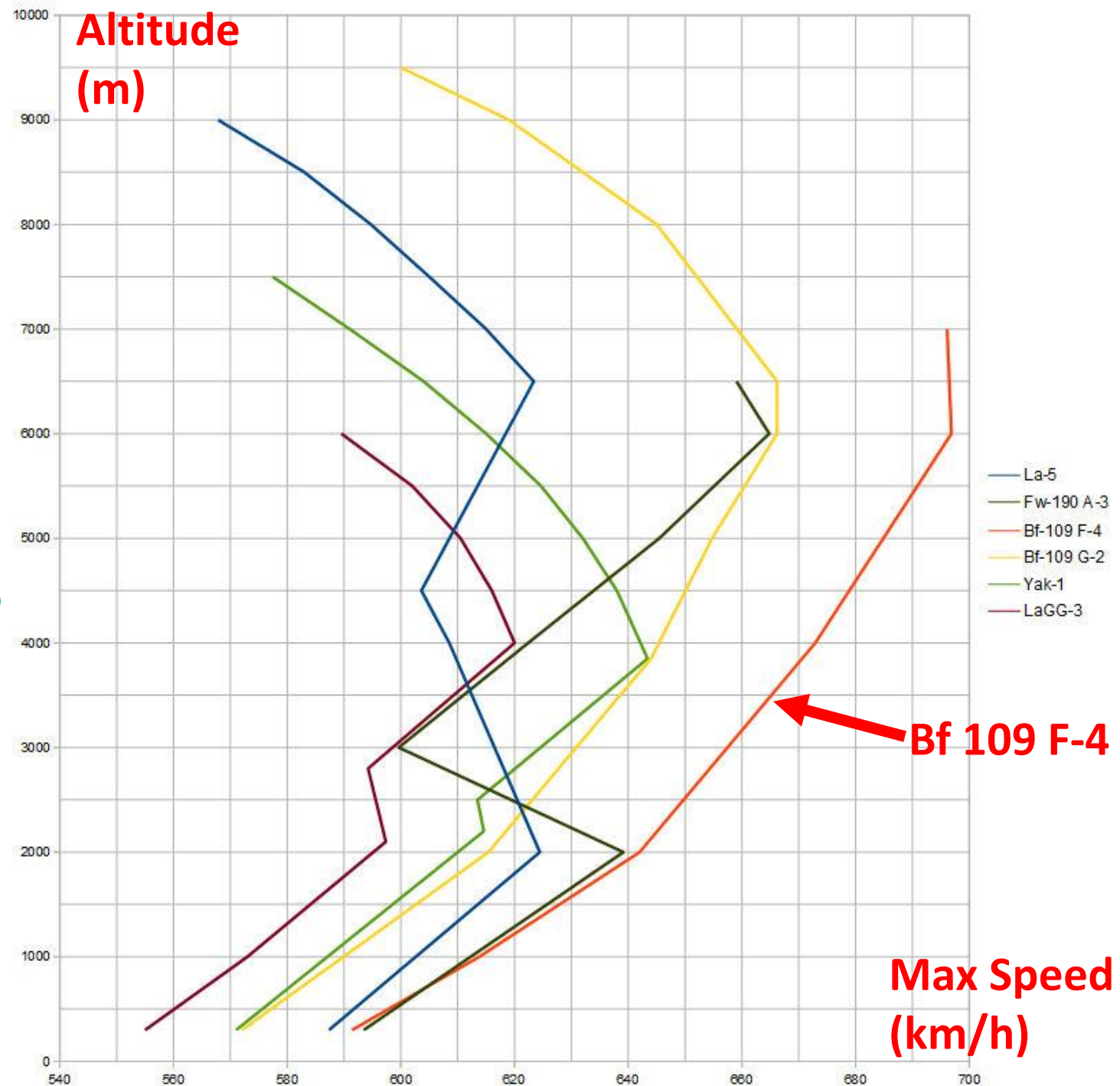
- Range: 880 km
- Fuel Max Capacity: ~400L
- Endurance: 105 min (1h45)
- Operational ceiling: 12000 m
- Optimal Climb Speed: 280 kph
- Best Climb Rate: 1000 m/min
- Turn time: 19-20 s
- Note: Your fuel loadout will impact your aircraft's performance, but also your weapon loadout. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



- Addition of slats helps slow speed handling, but will not help you turn better at higher speeds.
- Given enough speed, the Bf 109 will outclimb anything the Russians send at you. Use it to your advantage.
- Turn performance is decent, but very risky. Competent Yak-1 pilots WILL out-turn you if you fight in the horizontal plane. Stay vertical and use the sun as cover.
- Be smooth when pulling the stick: you will maintain airspeed.
- Bf.109 is an aerodynamic marvel of engineering, but it can bleed airspeed if you try to play the Yaks' "turn n' burn" game. Stay high, stay fast. You should fly it like a high-speed energy fighter and use boom and zoom tactics.
- The 109 is very fragile: take that into consideration when you think about going head-on with an Il-2 Sturmovik and its Hun-hungry 37 mm cannons.

PART VI: AIRCRAFT PERFORMANCE

MAXIMUM SPEED QMB CONDITIONS (Graph by Matt)



Messerschmitt Bf.109 G-2

"GUSTAV"



By Chuck

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History



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The Bf 109 G-series was developed from the largely identical F-series airframe, although there were detail differences. Modifications included a reinforced wing structure, an internal bullet-proof windscreen, the use of heavier, welded framing for the cockpit transparencies, and additional light-alloy armour for the fuel tank.. The G-2, which started production in May 1942, lacked the cabin pressurization and GM-1 installation. Performance-wise it was identical to the G-1. The canopy reverted to one layer of glazing and incorporated the angled head armour used on the F-4, although several G-2 had the vertical type as fitted to the G-1.

PART I: THE AIRCRAFT

The Cockpit

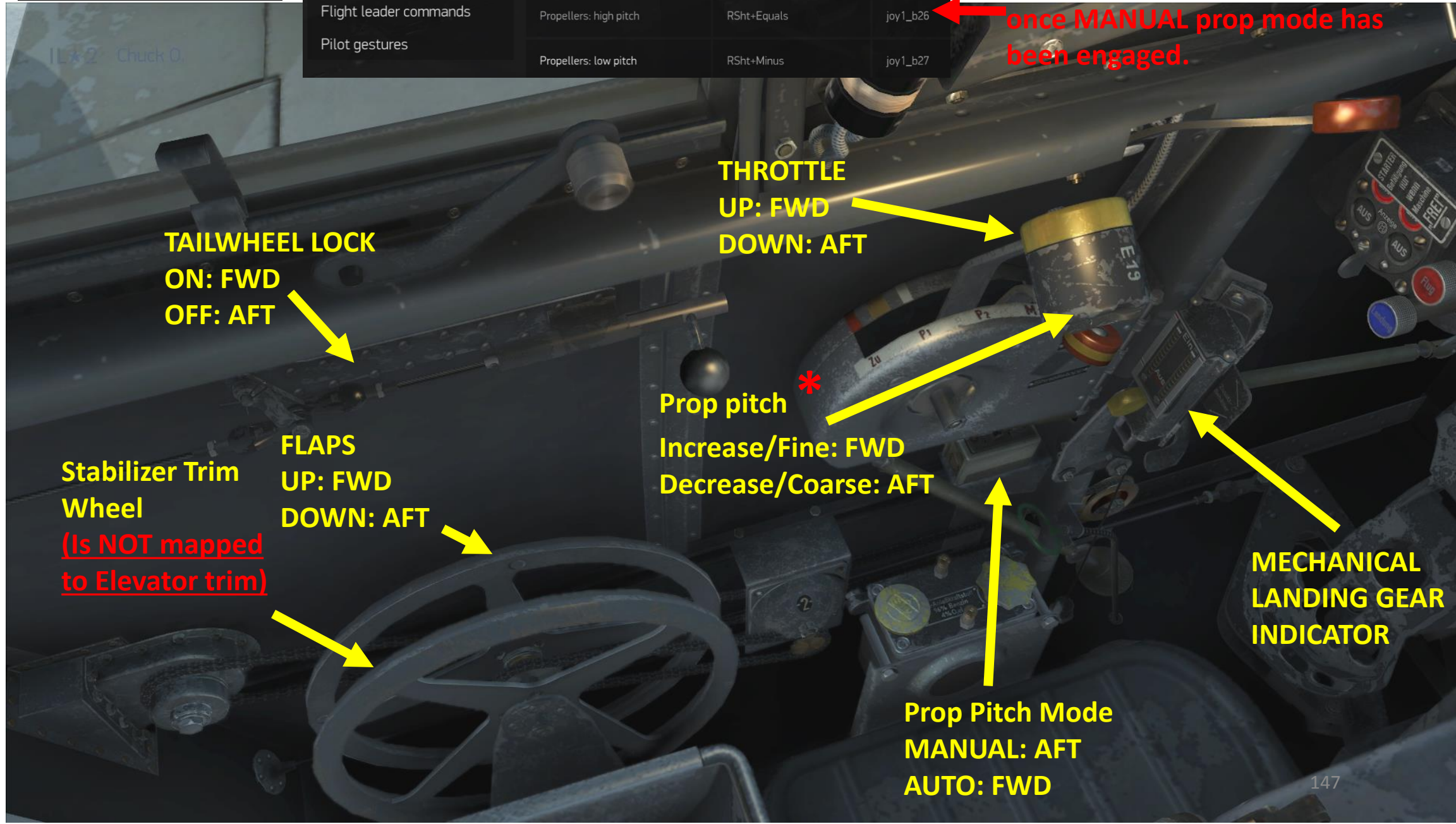


PART I: THE AIRCRAFT

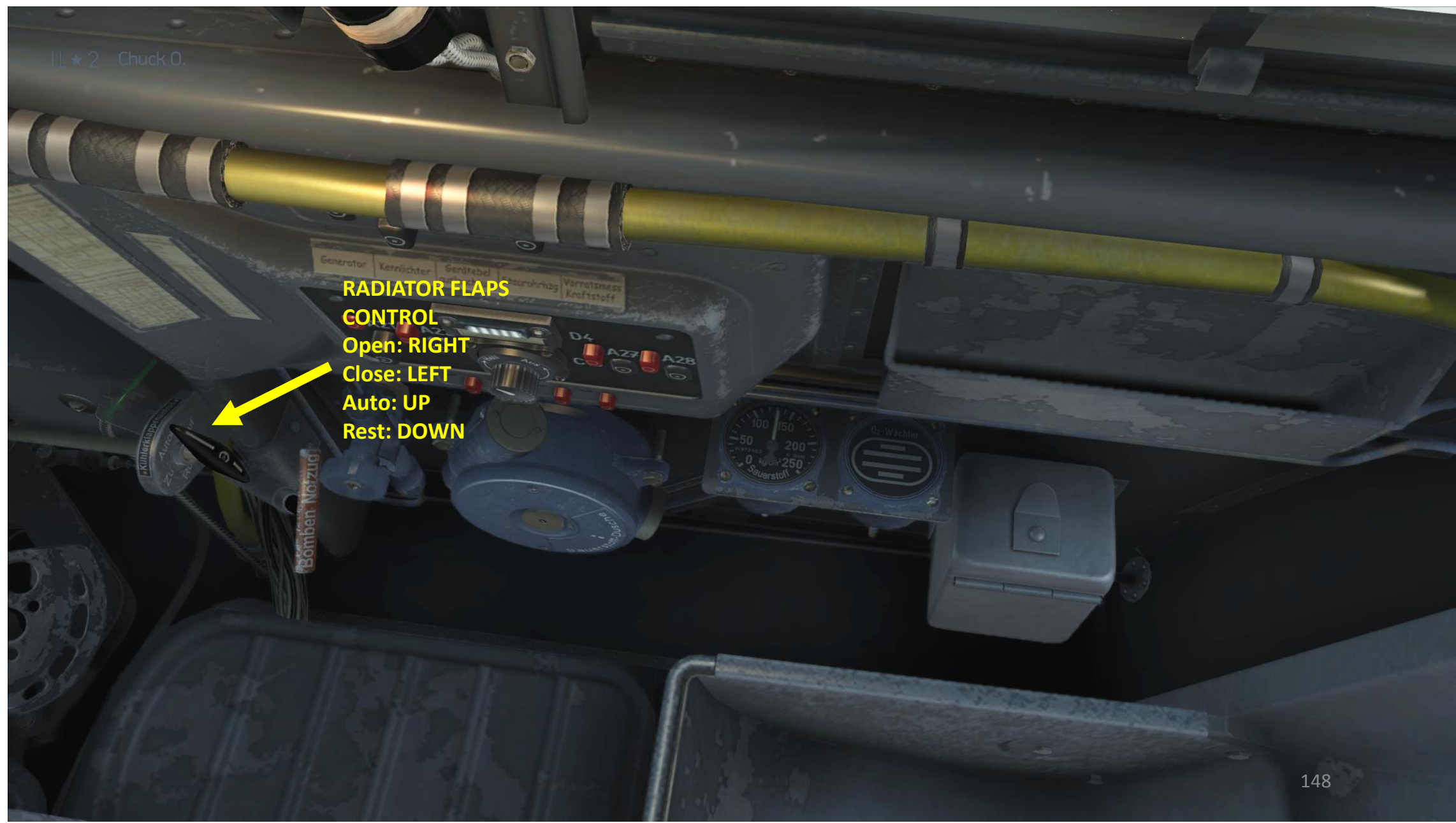
Left Side

Engine controls	Switch propellers pitch control mode: manual/auto	RSht+P	joy1_b25
Weapons controls			
Flight leader commands	Propellers: high pitch	RSht+Equals	joy1_b26
Pilot gestures	Propellers: low pitch	RSht+Minus	joy1_b27

*** Prop Pitch can only be modified once MANUAL prop mode has been engaged.**



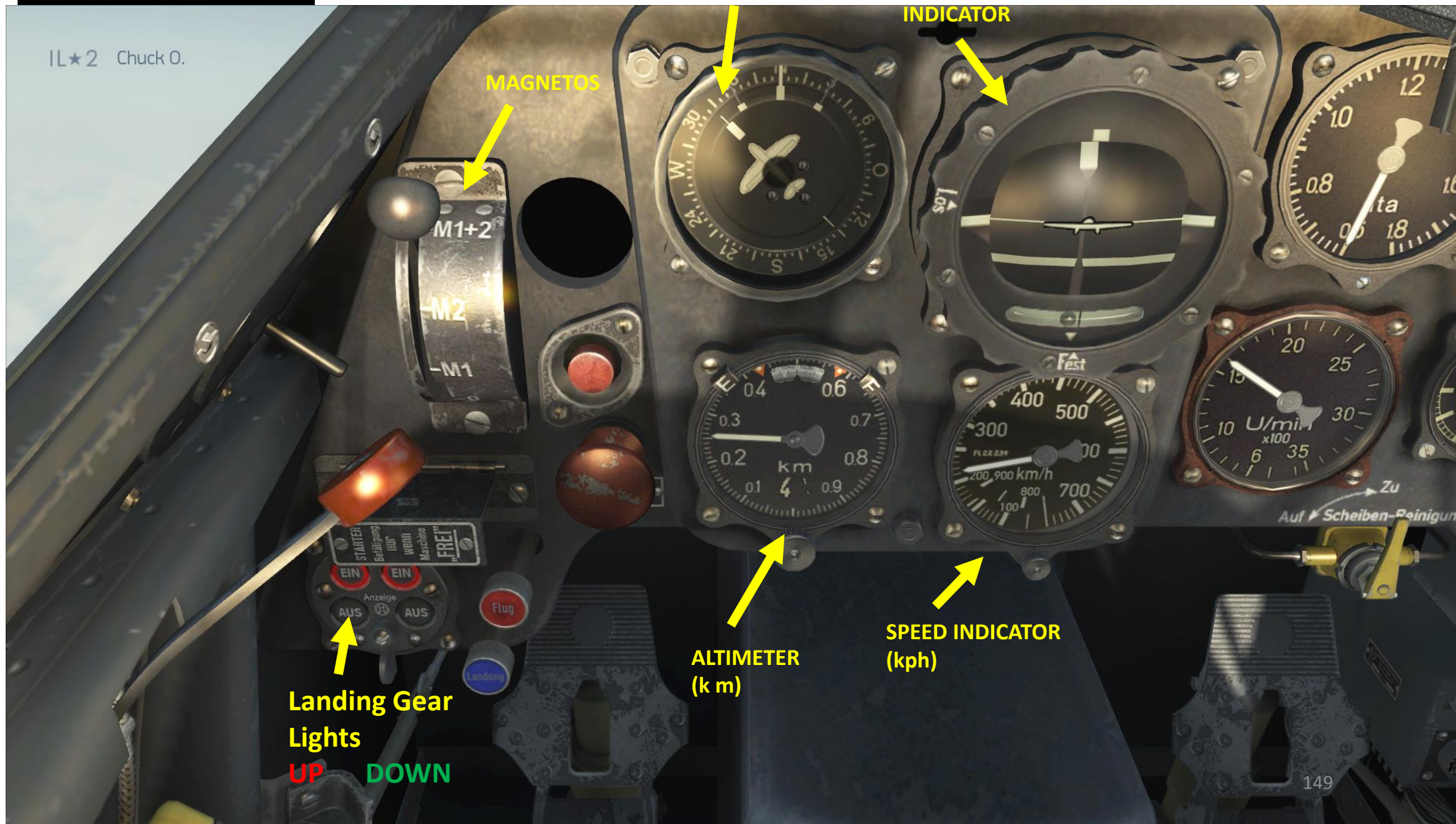
Right Side



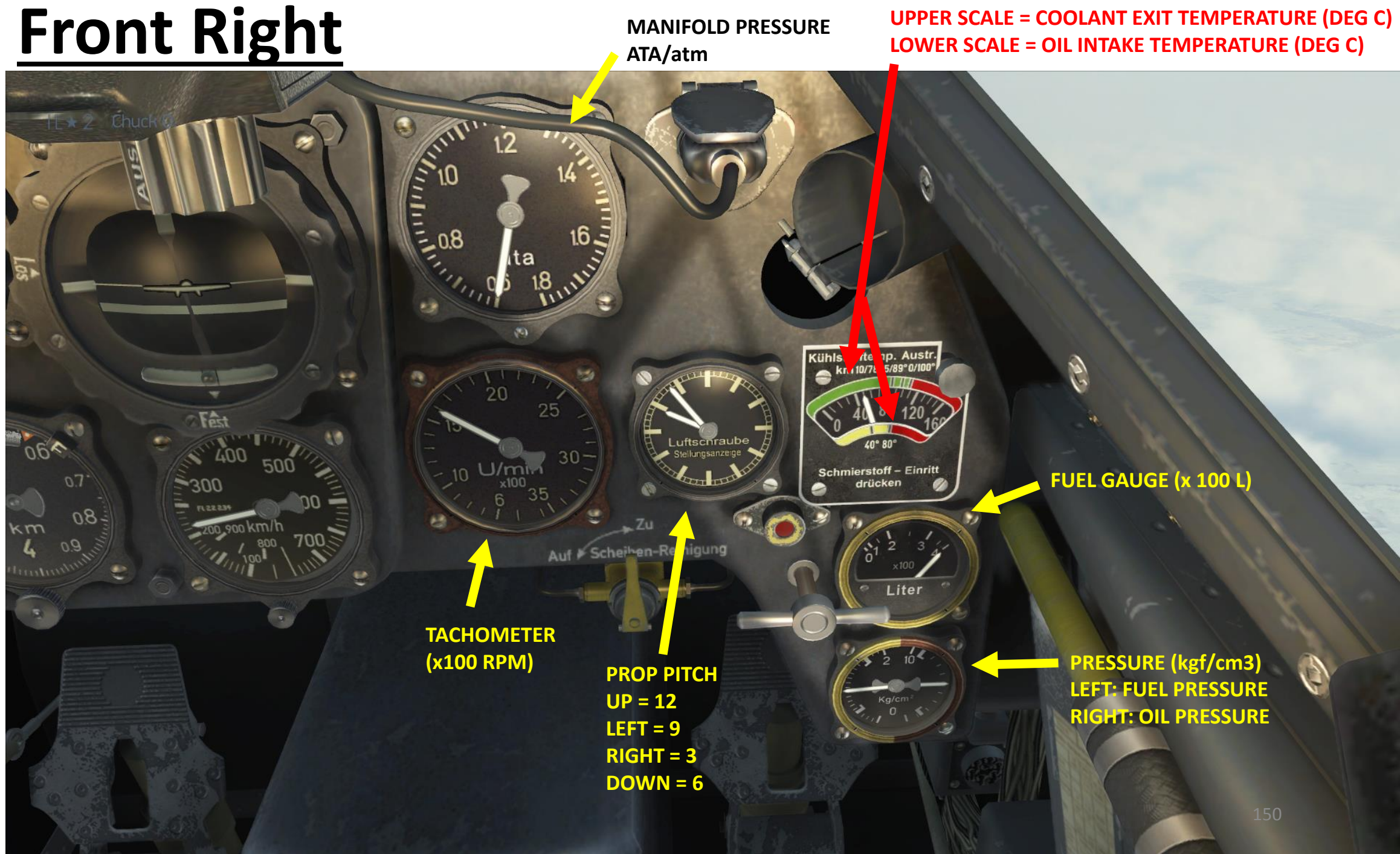
**RADIATOR FLAPS
CONTROL**
Open: RIGHT
Close: LEFT
Auto: UP
Rest: DOWN

PART I: THE AIRCRAFT

Front Left



Front Right



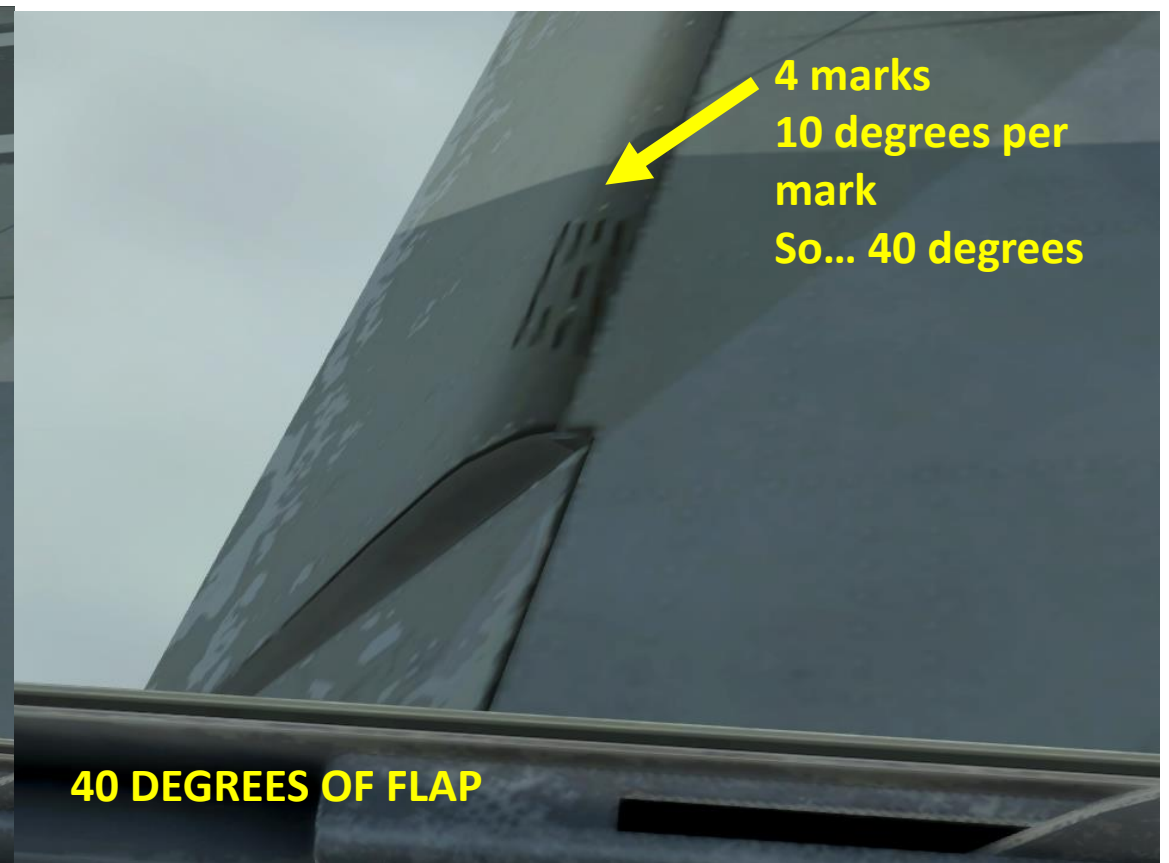
Important key bindings

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- Unlike in Russian aircraft, you do not control your mixture setting in the 109.
- In AUTO PROP PITCH mode, your RPM will be automatically adjusted in function of your ATA (Manifold Pressure) input.

Engine controls	Switch propellers pitch control mode: manual/auto	RShT+P	joy1_b25
Weapons controls			
Flight leader commands	Propellers: high pitch	RShT+Equals	joy1_b26
Pilot gestures	Propellers: low pitch	RShT+Minus	joy1_b27

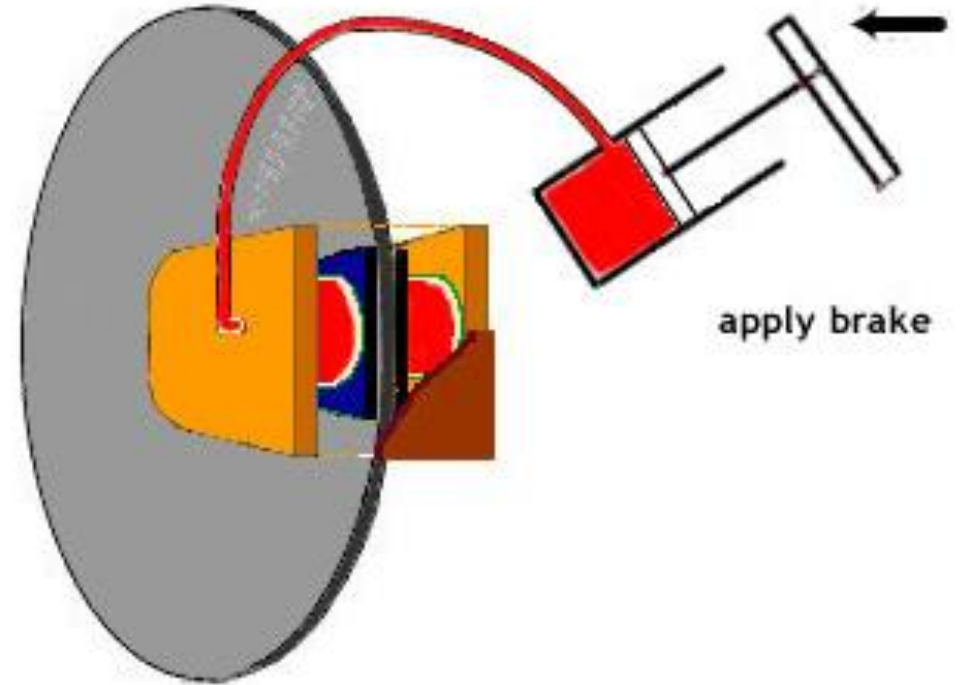
Important key bindings

- You can judge know approximately how much degrees of flaps are deployed by looking at “black marks” on the wings next to the junction between the trailing edge of the wing and the flap itself. One “notch” equals 10 degrees.



Important key bindings

-
- The image contains three technical drawings of a crane hook. On the left is a side view of the hook, showing its curved shape and the attachment point for the cable. In the center is a front view of the hook, showing its internal structure and the attachment point. On the right is a 3D model of the hook, showing its internal structure and the attachment point. The 3D model is colored in red, yellow, and blue. Below the 3D model is a red cable with a hook at the end. The cable is labeled '8-1101-200' and '8-1101-201'. The hook is labeled 'apply brake'.



PART III: TAKEOFF

- Taking off in the Bf.109 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your prop pitch mode to “AUTO”
 - 3) Ignite (“E” key by default)!
 - 4) Wait for your oil temperature to reach 40 degrees C
 - 5) Taxi to the runway (unlock tailwheel, LShift+G by default)
 - 6) Set your flaps to 20 degrees (2 notches on the wing).

PART III: TAKEOFF

- 7) Set your prop pitch mode to AUTO. If you set it to MANUAL, put the prop pitch needle in the 12:00 position.
- 8) Lock your tailwheel once lined up on the runway (LShift+G by default)
- 9) Throttle up to full power. Correct heading with small rudder input.
- 10) As soon as you reach 120 kph, center the stick and level out to pick some speed.
- 11) When you reach 180 kph, rotate gently.
- 12) Once you are up in the air, retract flaps, pull your gear up and start climbing. Adjust manifold pressure accordingly (see engine management in part V).

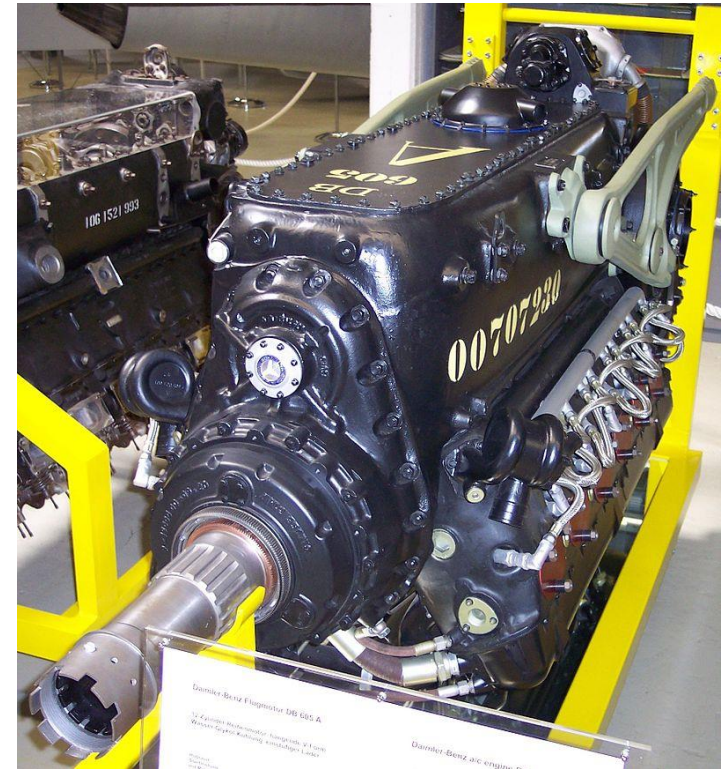
PART IV: LANDING

- 1) Deploy landing gear when going slower than 350 kph.
- 2) Deploy flaps 20 degrees when going slower than 250 kph.
- 3) Set your prop pitch to AUTO or set the needle at 11:30 in MANUAL mode. Throttle as required to maintain approach speed at 180 kph. Recommended engine setting is 1500 RPM @ 0.6 ATA.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and start a gentle, but firm flare.
- 6) Touchdown at 160 kph.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



Powerplant

- The Bf.109 G-2 is powered by the **Daimler-Benz DB 605 A1**, a liquid-cooled inverted V-12 engine. The DB 601A-1 engine was a development of the DB 601E engine utilised by the preceding Bf 109 F-4; displacement and compression ratio were increased as well as other detail improvements to ease large-scale mass production.
- The DB 605 suffered from reliability problems during the first year of operation, and this output was initially banned by VT-Anw.Nr.2206, forcing *Luftwaffe* units to limit maximum power output to 1,310 PS (1,292 hp, 964 kW) at 2,600 rpm and 1.3 atm manifold pressure (38.9 inches/4.4 lbs). The full output was not reinstated until 8 June 1943 when Daimler-Benz issued a technical directive.



Operating Limits

- Min coolant temperature: 40 deg C.
- Max coolant temperature: 100 deg
- Min oil temperature: 40 deg C.
- Max oil temperature: 80 deg C.

COOLANT EXIT TEMPERATURE (DEG C)



OIL INTAKE TEMPERATURE (DEG C)

Recommended Settings

- Takeoff
 - 2500 RPM, 1.3 ATA
- Climb
 - 2500 RPM, 1.3 ATA, speed 250-350 kph
- Normal Operation (Cruise)
 - 1900 RPM, 1.0 ATA
- Combat
 - 2500 RPM, 1.3 ATA
- Landing
 - 1500 RPM, 0.6 ATA



PART VI: AIRCRAFT PERFORMANCE

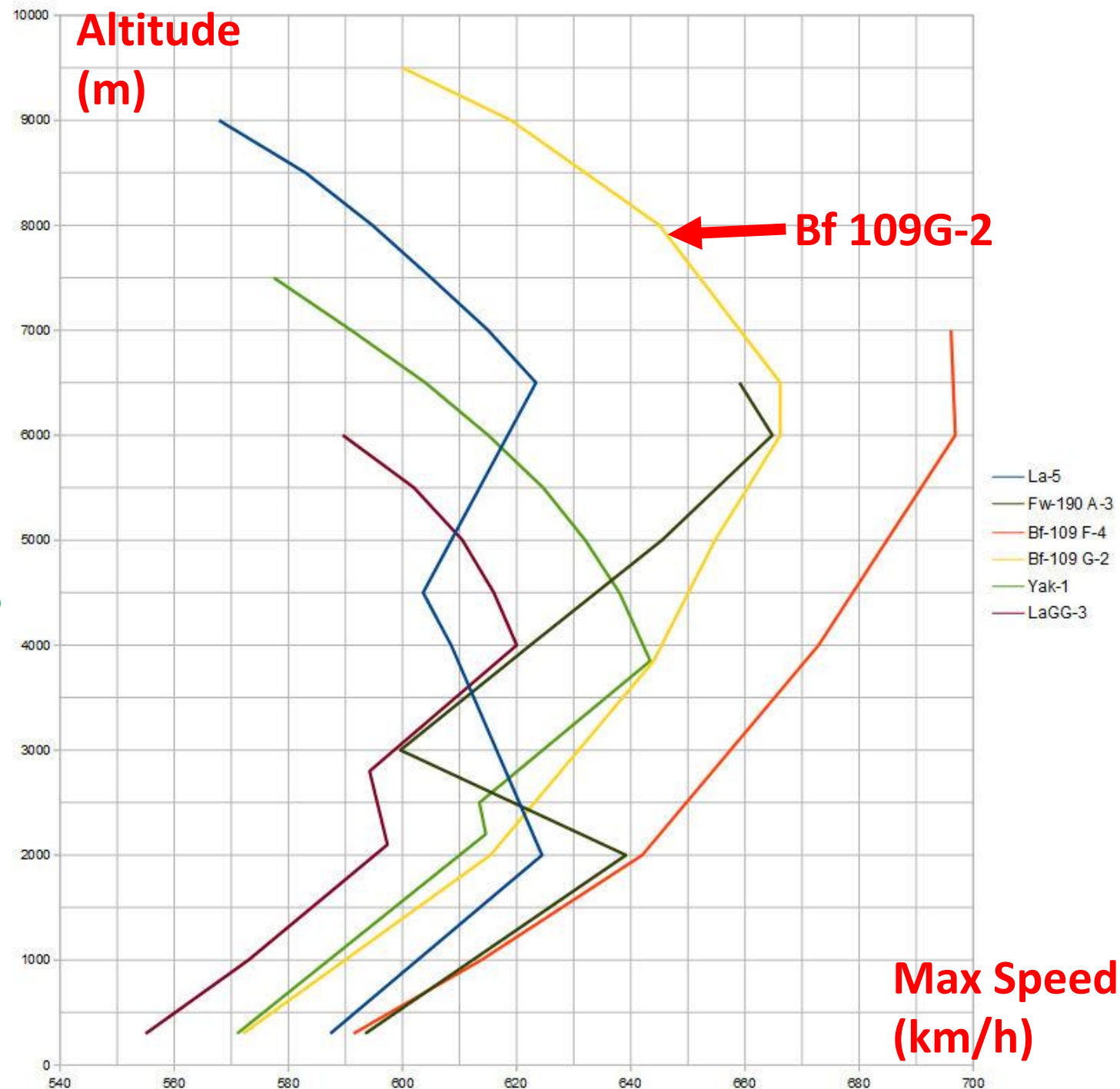
- Range: 880 km
- Fuel Max Capacity: ~400L
- Endurance: 105 min (1h45)
- Operational ceiling: 12000 m
- Optimal Climb Speed: 280 kph
- Best Climb Rate: 1140 m/min
- Turn time: 20-21 s
- Note: Your fuel loadout will impact your aircraft's performance, but also your weapon loadout. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



- Addition of slats helps slow speed handling, but will not help you turn better at higher speeds.
- Given enough speed, the Bf 109 will outclimb anything the Russians send at you. Use it to your advantage.
- Turn performance is decent, but very risky. Competent Yak-1 pilots WILL out-turn you if you fight in the horizontal plane. Stay vertical and use the sun as cover.
- Be smooth when pulling the stick: you will maintain airspeed.
- Bf.109 is an aerodynamic marvel of engineering, but it can bleed airspeed if you try to play the Yaks' "turn n' burn" game. Stay high, stay fast. You should fly it like a high-speed energy fighter and use boom and zoom tactics.
- The 109 is very fragile: take that into consideration when you think about going head-on with an Il-2 Sturmovik and its Hun-hungry 37 mm cannons.
- Bf.109 G-2 has more power than the F-4, but in 1942 it still has the 1.3 ATA boost limitation (which the F-4 doesn't have). G-2 is heavier, but better suited for pure boom and zoom. The F-4 is slightly more agile in that regard, which allows a pilot a bit more versatility.
- The G-2 is more of a high-altitude fighter than the F-4. Try to lure VVS fighters at higher altitudes (6000/7000 meters or more) and you will have the advantage.

PART VI: AIRCRAFT PERFORMANCE

MAXIMUM SPEED QMB CONDITIONS (Graph by Matt)



Focke-Wulf FW 190 A-3

"ANTON"



FOCKE-WULF



By Chuck

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- PART I: THE AIRCRAFT
- PART II: THE CONTROLS
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- PART V: ENGINE MANAGEMENT
- PART VI: AIRCRAFT PERFORMANCE

History

IL★2 Chuck O.

The Focke-Wulf Fw 190 Würger was a German single-seat, single-engine fighter aircraft designed by Kurt Tank in the late 1930s and widely used during World War II. Powered by a radial engine in most versions, the Fw 190 had ample power and was able to lift larger loads than its well-known counterpart, the Messerschmitt Bf 109. The Fw 190 was used by the Luftwaffe in a wide variety of roles, including day fighter, fighter-bomber, ground-attack aircraft and, to a lesser degree, night fighter.

In autumn 1937, the German Ministry of Aviation asked various designers for a new fighter to fight alongside the Messerschmitt Bf 109, Germany's front line fighter. Although the Bf 109 was an extremely competitive fighter, the Ministry of Aviation was worried that future foreign designs might outclass it, and wanted to have new aircraft under development to meet these possible challenges.

At the time, the use of radial engines in land-based fighters was relatively rare in Europe, as it was believed that their large frontal area would cause too much drag on something as small as a fighter. Tank was not convinced of this, having witnessed the successful use of radial engines by the U.S. Navy, and felt a properly streamlined installation would eliminate this problem.

Kurt Tank felt sure that a quite different breed of fighter would also have a place in any future conflict: one that could operate from ill-prepared front-line airfields; one that could be flown and maintained by men who had received only short training; and one that could absorb a reasonable amount of battle damage and still get back. This was the background thinking behind the Focke-Wulf 190; it was not to be a racehorse but a *Dienstpferd*, a cavalry horse.



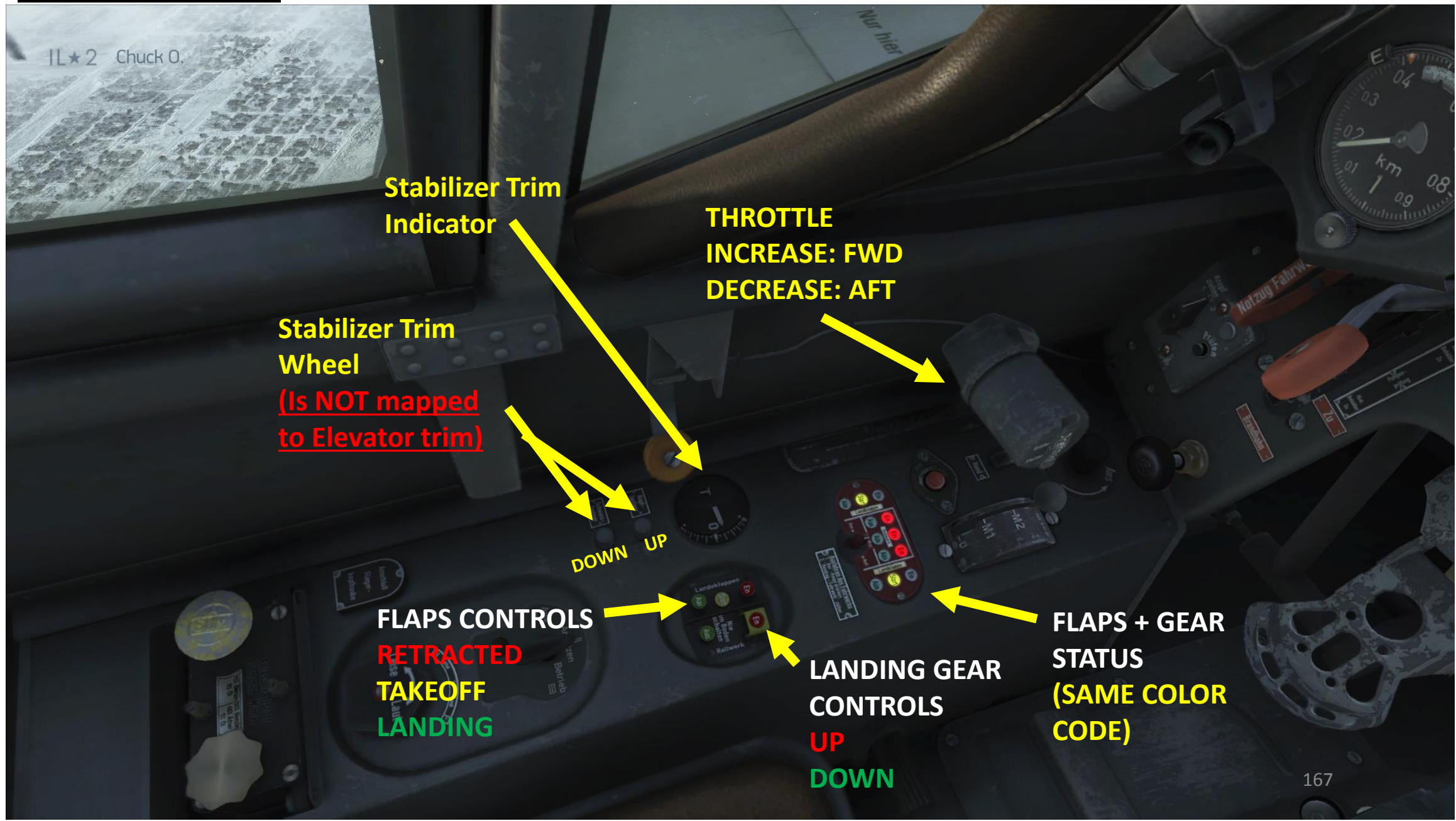
PART I: THE AIRCRAFT

The Cockpit



PART I: THE AIRCRAFT

Left Side



Stabilizer Trim Indicator

Stabilizer Trim Wheel
(Is NOT mapped to Elevator trim)

**THROTTLE INCREASE: FWD
DECREASE: AFT**

DOWN UP

FLAPS CONTROLS
RETRACTED
TAKEOFF
LANDING

LANDING GEAR CONTROLS
UP
DOWN

FLAPS + GEAR STATUS (SAME COLOR CODE)

Left Side

*** Prop Pitch can only be modified once MANUAL prop mode has been engaged.**

Engine controls	Switch propellers pitch control mode: manual/auto	RSht+P	joy1_b25
Weapons controls			
Flight leader commands	Propellers: high pitch	RSht+Equals	joy1_b26
Pilot gestures	Propellers: low pitch	RSht+Minus	joy1_b27

Prop Pitch Mode

MANUAL: AFT

AUTO: FWD



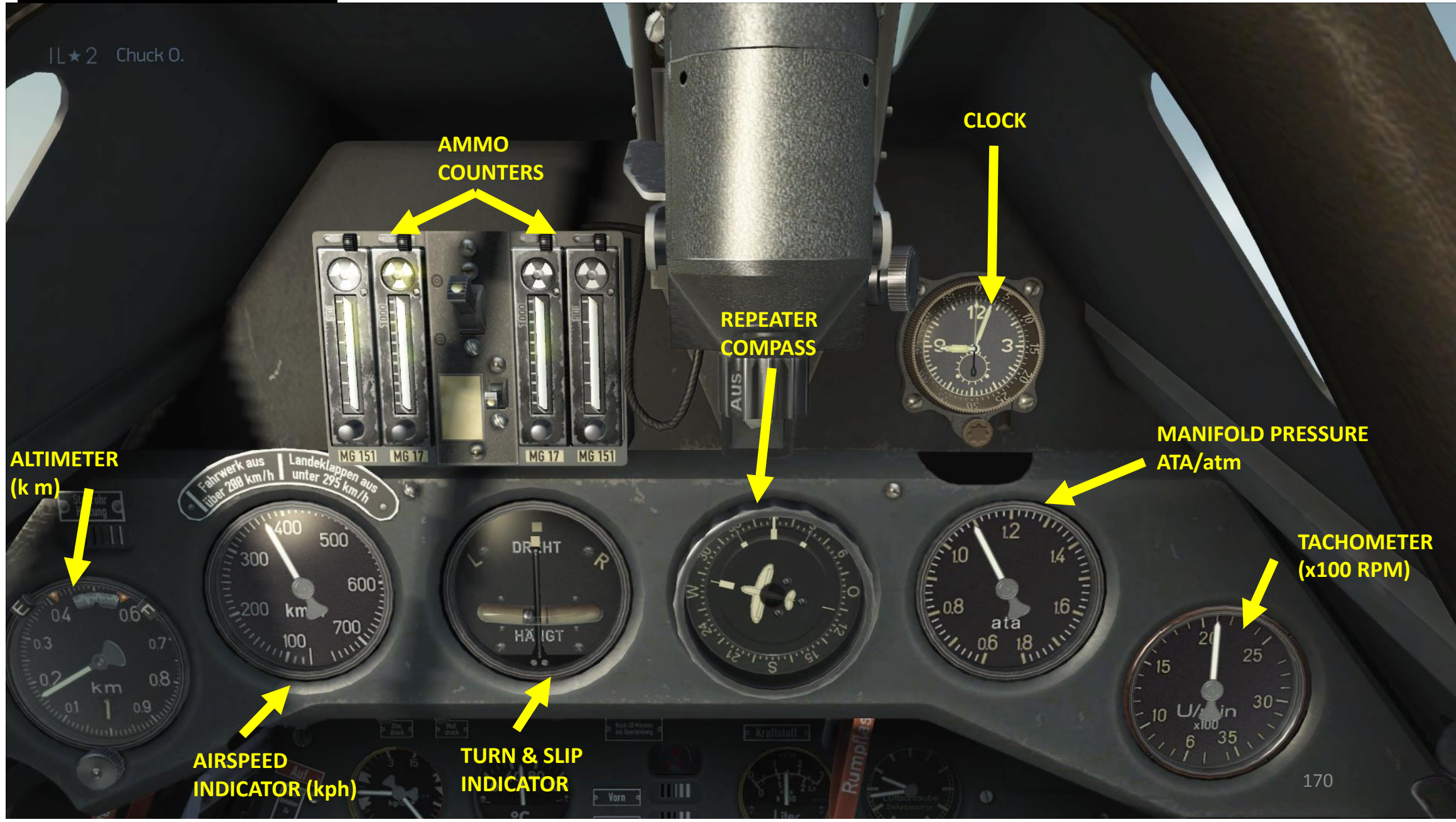
PART I: THE AIRCRAFT

Right Side

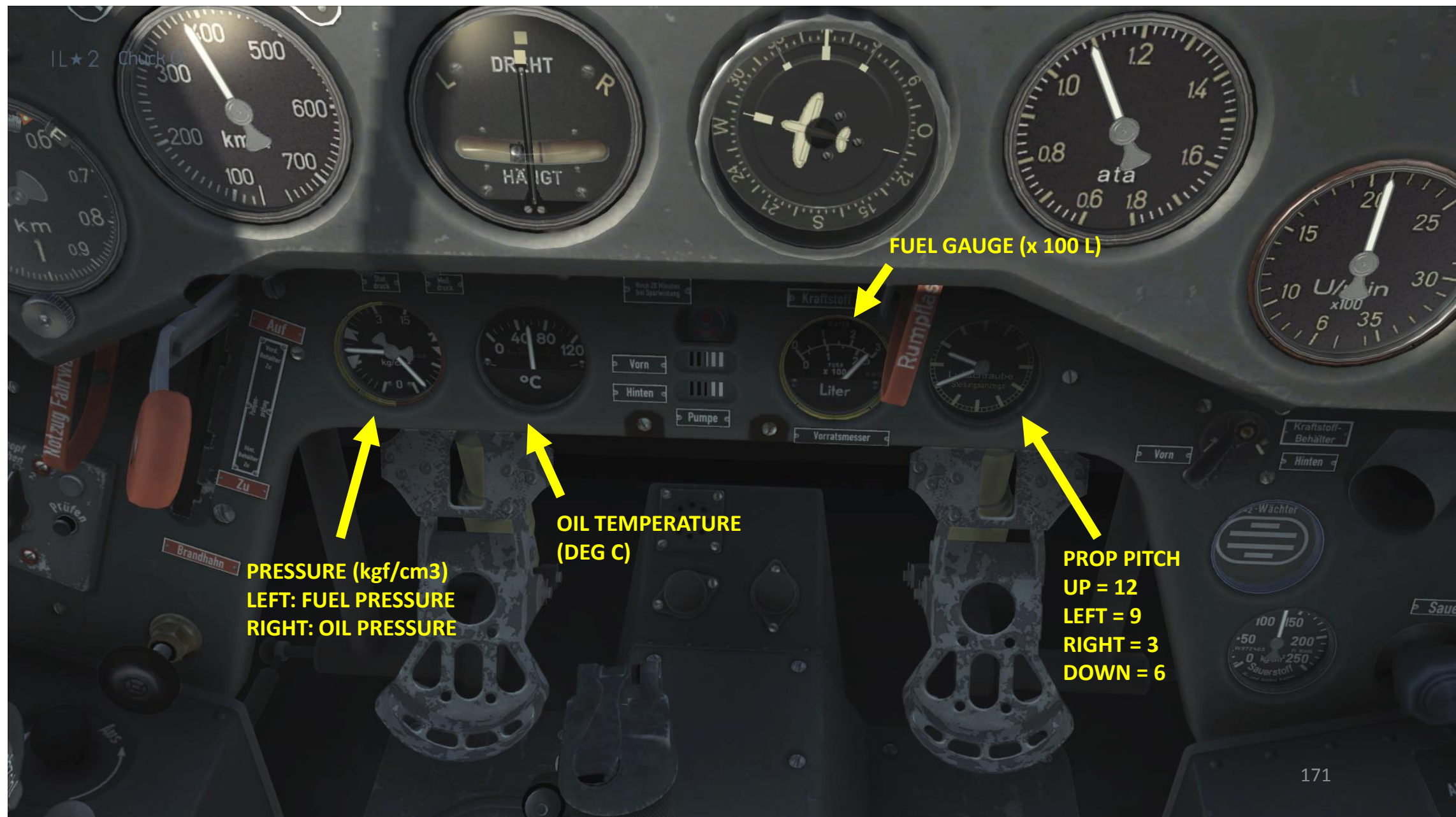


PART I: THE AIRCRAFT

Front High



Front Low



Wings

NOTE: IT IS EASIER TO OPEN YOUR CANOPY IF YOU WANT TO LOOK FOR THE MECHANICAL LANDING GEAR INDICATOR. OR... YOU CAN SIMPLY CHECK YOUR LANDING GEAR INDICATOR LIGHTS ON THE LEFT CONSOLE.



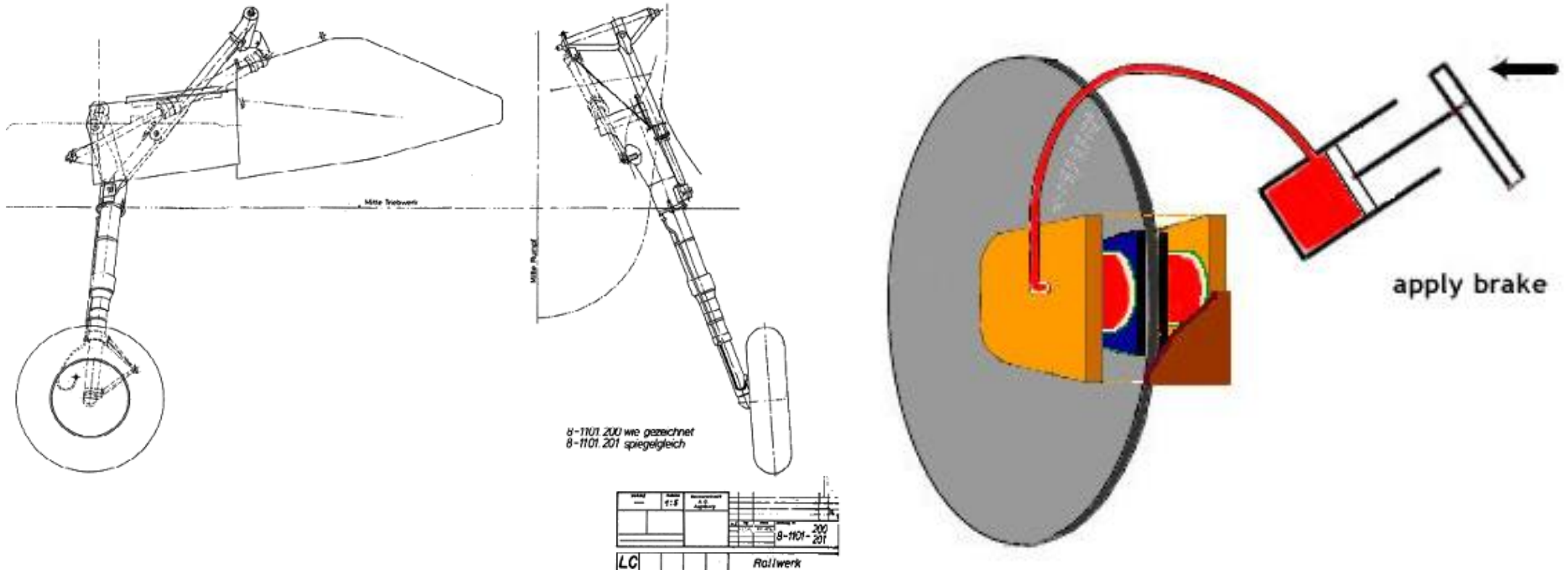
Important key bindings

- The Fw 190 has a radial engine, so you do not need to think about radiators.
- You can control your prop pitch (which will affect your RPM), but only if you have engaged the MANUAL PROP PITCH mode. Make sure you have a key to it. Changing prop pitch manually is by no means necessary, but it can allow you to fine-tune your RPM setting and gain a marginal gain in performance as the AUTO mode already does that for you.
- Unlike in Russian aircraft, you do not control your mixture setting in the 190.
- In AUTO PROP PITCH mode, your RPM will be automatically adjusted in function of your ATA (Manifold Pressure) input.

Engine controls	Switch propellers pitch control mode: manual/auto	RSht+P	joy1_b25
Weapons controls			
Flight leader commands	Propellers: high pitch	RSht+Equals	joy1_b26
Pilot gestures	Propellers: low pitch	RSht+Minus	joy1_b27

Important key bindings

- The Fw 190, unlike most 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.
- 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.



PART III: TAKEOFF

- Taking off in the Fw 190 is straightforward if you follow these steps for a cold engine start.

- 1) Crack your throttle about 15 %
- 2) Set your prop pitch mode to “AUTO” (or set 11:30 prop pitch for MANUAL)
- 3) Ignite (“E” key by default)!
- 4) Wait for your oil temperature to reach 40 degrees C
- 5) Taxi to the runway (lock tailwheel by pulling on your stick)

NOTE: Engine torque will pull you to the left, so make sure that you compensate accordingly with rudder. A good trick is to hold right toe brake when powering up and progressively release the brake once you are able to counter initial torque with rudder.

- 6) Set your flaps to “takeoff” position

PART III: TAKEOFF

7) Set your prop pitch mode to AUTO. If you set it to MANUAL, put the prop pitch needle in between the 11:30 to 12:00 position.

8) Lock your tailwheel once lined up on the runway by pulling your stick towards you. VERY IMPORTANT!!!

9) Throttle up to max power. In order to preserve your engine, I recommend going for 2500 RPM and 1.3 ATA. Correct heading with small rudder input.

CAUTION: DO NOT EXCEED 1 MINUTE AT FULL POWER (2700 RPM/1.42 ATA)

10) As soon as you reach 170 kph, center the stick and level out to pick some speed.

11) When you reach 200 kph, rotate gently.

12) Once you are up in the air, retract flaps, pull your gear up and start climbing. Adjust manifold pressure accordingly (see engine management in part V).

PART IV: LANDING

- 1) Deploy landing gear when going slower than 350 kph.
- 2) Deploy flaps 20 degrees when going slower than 250 kph.
- 3) Set your prop pitch to AUTO or set the needle at 11:30 in MANUAL mode. Throttle as required to maintain approach speed at 190 kph
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and start a gentle, but firm flare.
- 6) Touchdown at 150 kph in a 3-point attitude.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



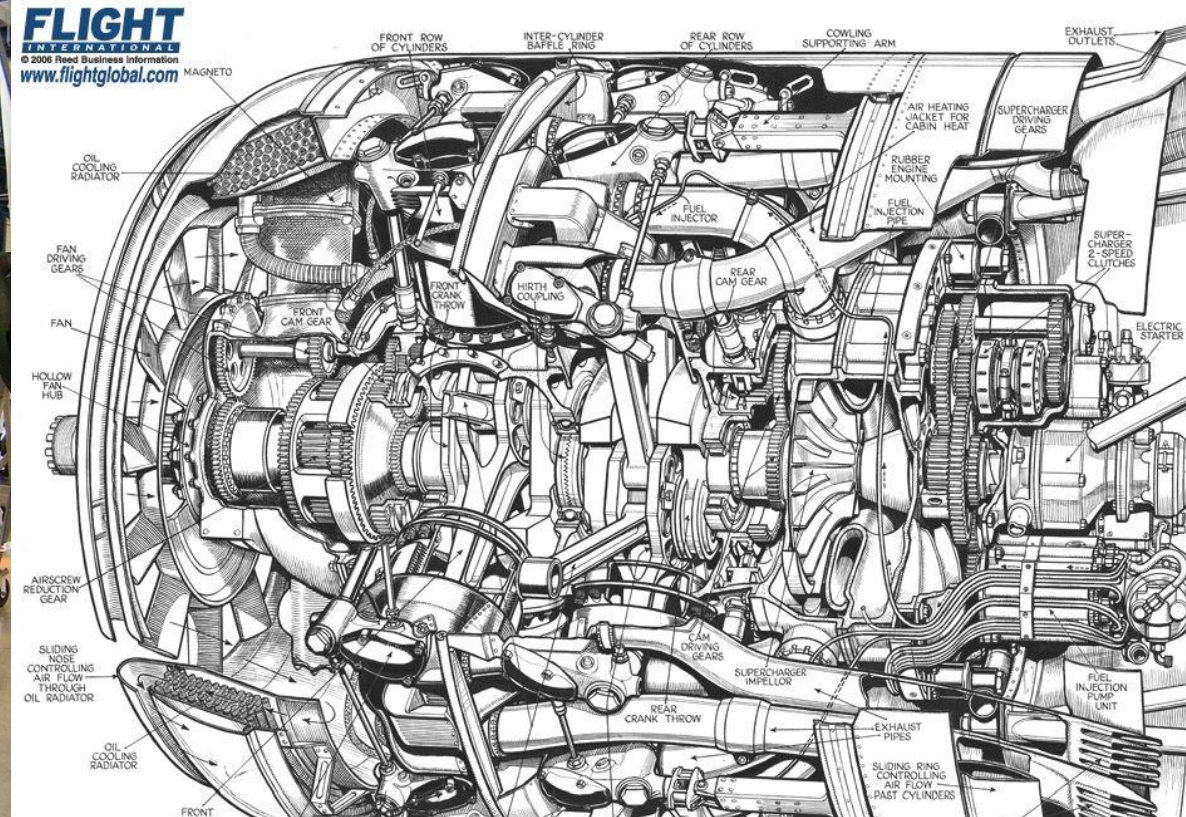
Powerplant

The FW 190 A-3 is powered by the **BMW 801 D-2**, an air-cooled 14-cylinder radial aircraft engine. In the 1930s, BMW took out a license to build the Pratt & Whitney Hornet engines. By the mid-30s they had introduced an improved version, the BMW 132. The BMW 132 was widely used, most notably on the Junkers Ju 52, which it powered for much of that design's lifetime.

In 1935 the RLM funded prototypes of two much larger radial designs, one from Bramo, the Bramo 329, and another from BMW, the BMW 139. BMW's design used many components from the BMW 132 to create a two-row engine with 14 cylinders, supplying 1,550 PS (1,529 hp, 1,140 kW). After BMW bought Bramo in 1939 both projects were merged into the BMW 801, learning from the problems encountered in both projects.

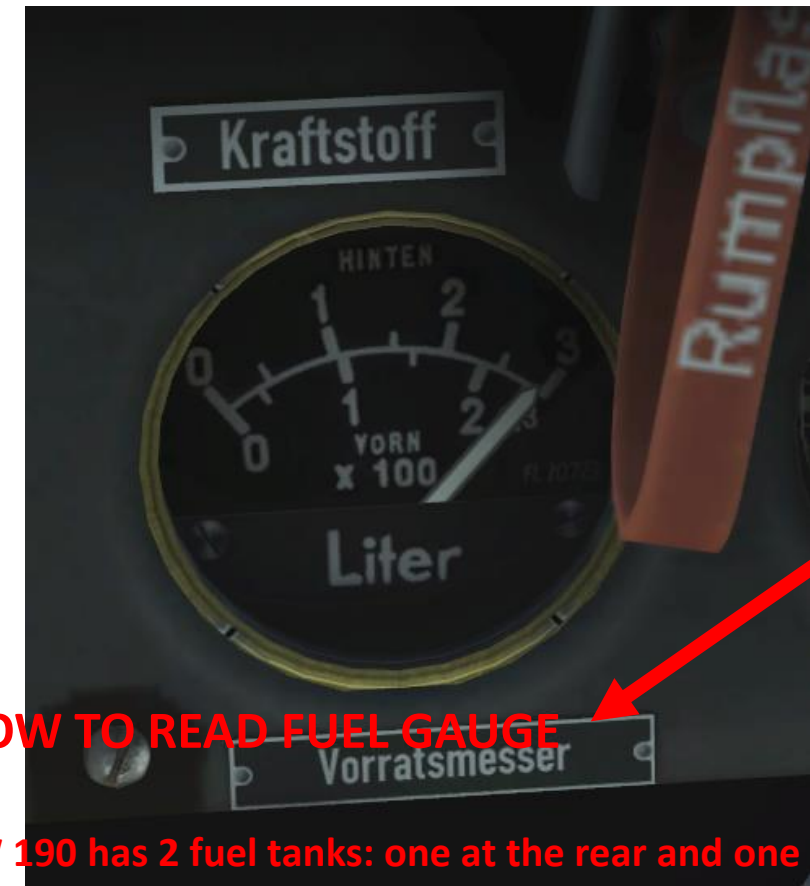
The 801 retained the 139's older-style single-valve intake and exhaust, while most in-line engines of the era had moved to four valves per cylinder, or in British use for their own radials, sleeve valves. Several minor advances were worked into the design, including the use of sodium-cooled valves and a direct fuel injection system, manufactured by Friedrich Deckel AG of Munich.

One key advancement was the Kommandogerät (command-device), a mechanical-hydraulic unit that automatically adjusted engine fuel flow, propeller pitch, supercharger setting, mixture and ignition timing in response to a single throttle lever, dramatically simplifying engine control. The Kommandogerät could be considered to be a precursor to the engine control units used for many vehicles' internal combustion engines of the late 20th and early 21st centuries.



Operating Limits

- Min oil temperature: 40 deg C.
- Max oil temperature: 110 deg C.



ALSO
APPLICABLE
FOR HE-111
GAUGES!!!

FW 190 has 2 fuel tanks: one at the rear and one at the front.

The upper dial from 0 to 3 stands for 0 to 300 litres.
(rear tank)

The lower dial from 0 to 2.3 stands for 0 to 230 litres.
(front tank)

Normally, you could switch between the 2 tanks with a toggle, but this functionality is not implemented in BoS. Instead, the fuel gauge will cycle automatically and periodically between the FWD (Vorn) and AFT (Hinten) tanks.

Recommended Settings

- Takeoff
 - 2500 RPM, 1.3 ATA
- Climb
 - 2400 RPM, 1.3 ATA, speed 250-350 kph (30 min max)
- Normal Operation (Cruise)
 - 2200 RPM, 1.1 ATA
- Combat (Max Continuous Power)
 - 2400 RPM, 1.32 ATA (30 minutes max)
 - **2600 RPM @ 1.42 ATA (MAX 7-8 MINUTES)**



About Going Full Throttle

- Keep in mind that going “full throttle” will actually go in emergency power. You cannot sustain this for very long, so watch your ATA rather than “feel” your throttle position.



PART VI: AIRCRAFT PERFORMANCE

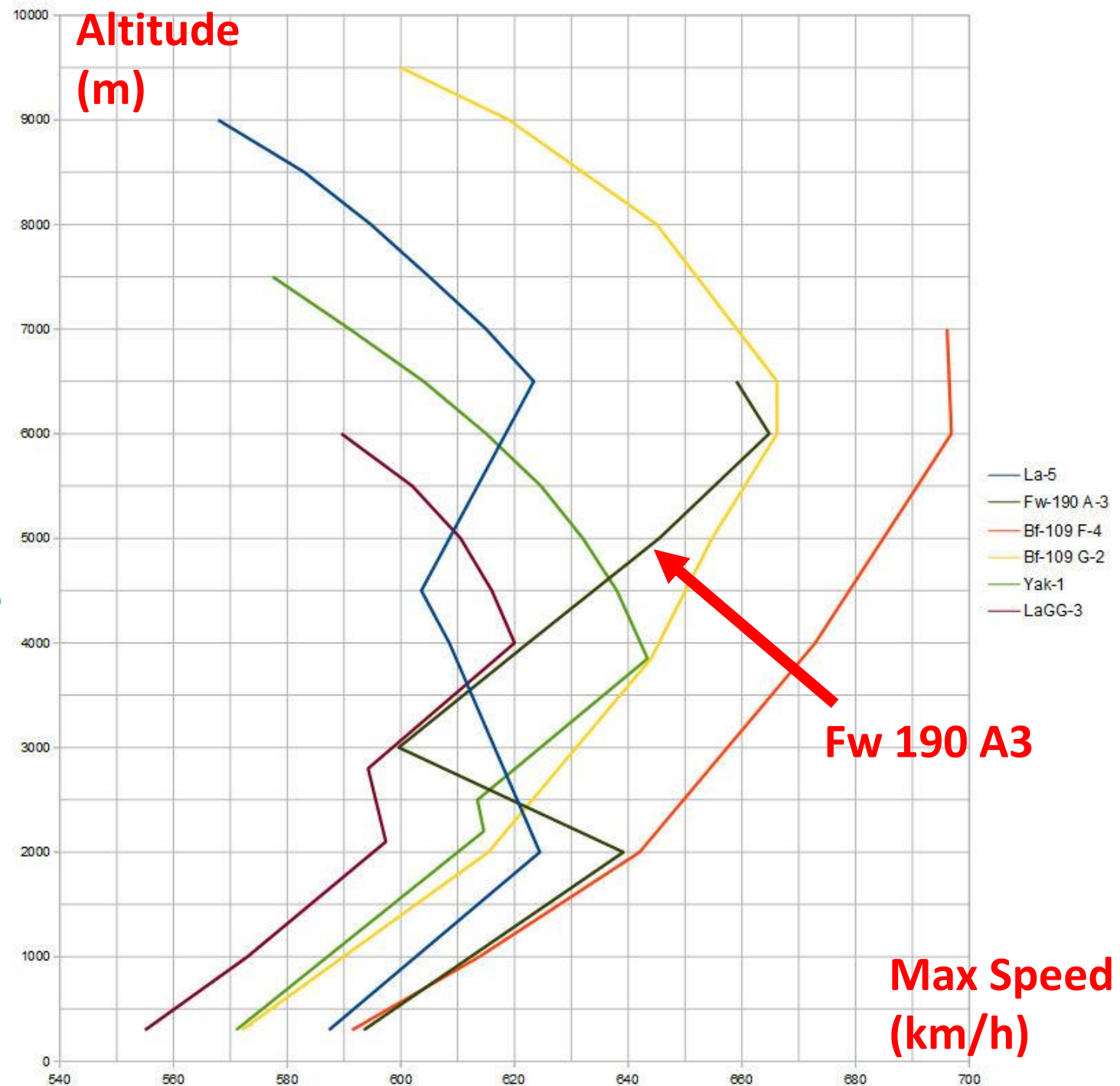
- Range: 800 km
- Fuel Max Capacity: ~525 L
- Endurance: 75 min (1h15)
- Operational ceiling: 9600 m
- Optimal Climb Speed: 270 kph
- Best Climb Rate: 900 m/min
- Turn time: 22 s
- Note: Your fuel loadout will impact your aircraft's performance, but also your weapon loadout. Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



- The 190 is not a good turner. Do not play the Yak's game if you want to live.
- A good 190 pilot should prefer boom and zoom tactics over turning in the horizontal plane. The 190 has great dive speed and good controllability at high speeds.
- The 190 requires a steady hand as it has vicious stall characteristics below 200 kph. In a tight turn, your port wing will drop to the left and flick you over into a controlled spin without warning. You can use this to your advantage if you want to escape a fighter on your six as nobody will be able to recover or turn fast enough to follow you.
- The Focke-Wulf's biggest advantage is its tremendous speed, its ability to retain energy and its great roll rate.
- You have some of the deadliest guns and cannons in the sim: head-on passes are generally risky, but the 190 has a serious advantage in terms of firepower.
- Using your advantageous roll rate can help you make rapid direction changes.
- Fly at high speeds: this is where the FW shines. Like the La-5, you should use minimal elevator input in order to maintain high speed/energy.

PART VI: AIRCRAFT PERFORMANCE

MAXIMUM SPEED QMB CONDITIONS (Graph by Matt)



Junkers Ju-87 D-3

"STUKA"



By Chuck

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History

IL★2 Chuck O.

The Junkers Ju-87 or Stuka (from Sturzkampfflugzeug, “dive bomber”), was a two-man 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 main gear 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 acceleration.

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.

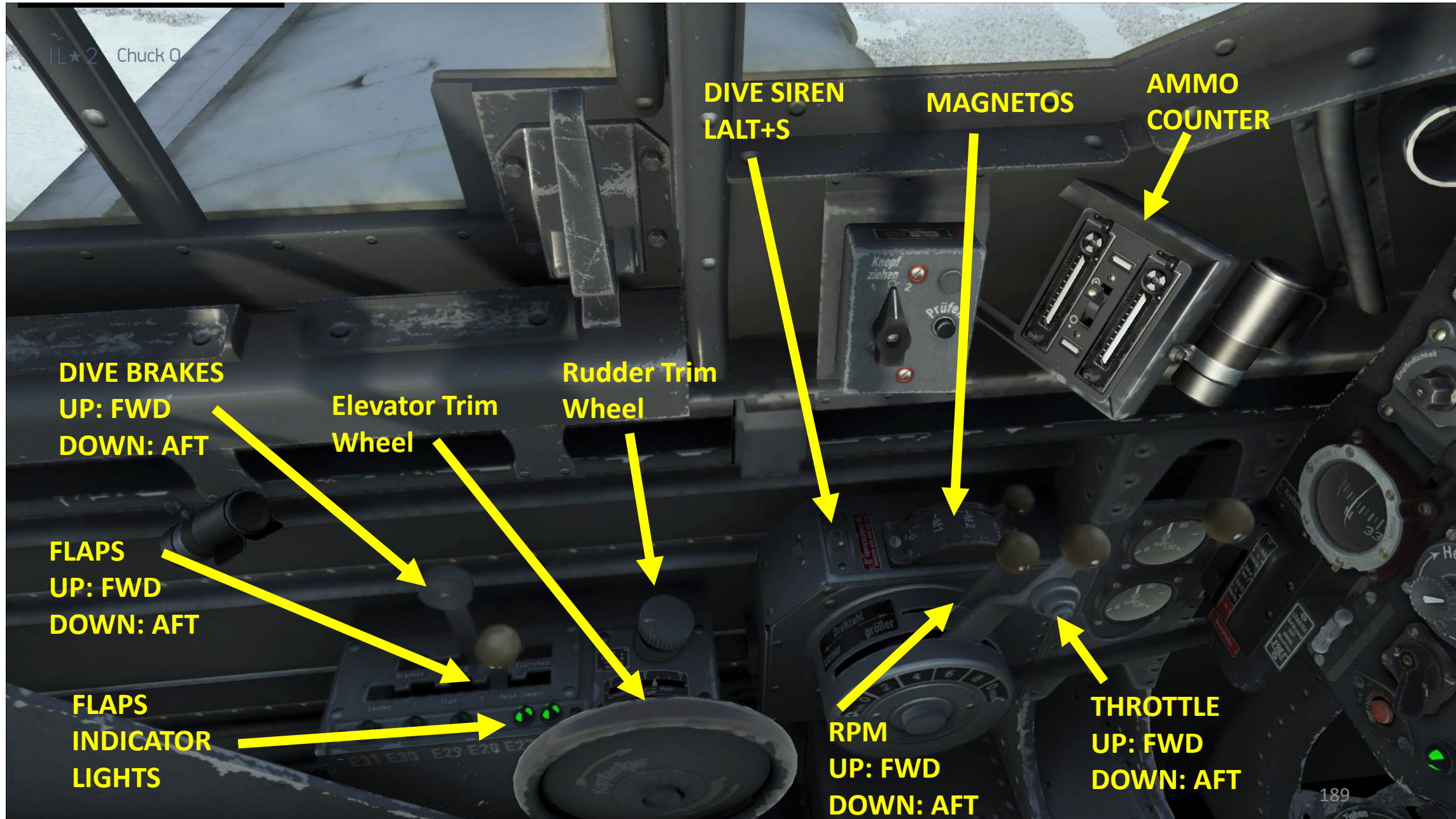
Despite the Stuka's vulnerability to enemy fighters having been exposed during the Battle of Britain, the Luftwaffe had no choice but to continue its development, as there was no replacement aircraft in sight. The result was the D-series. The Ju 87 D-series featured two coolant radiators underneath the inboard sections of the wings, while the oil cooler was relocated to the position formerly occupied by the coolant radiator. The D-series also introduced an aerodynamically refined cockpit with better visibility and space. Towards the end of the war, as the Allies gained air supremacy, the Stuka was being replaced by ground-attack versions of the Fw 190. By early 1944, the number of Ju 87 units and operational aircraft terminally declined.

The Cockpit

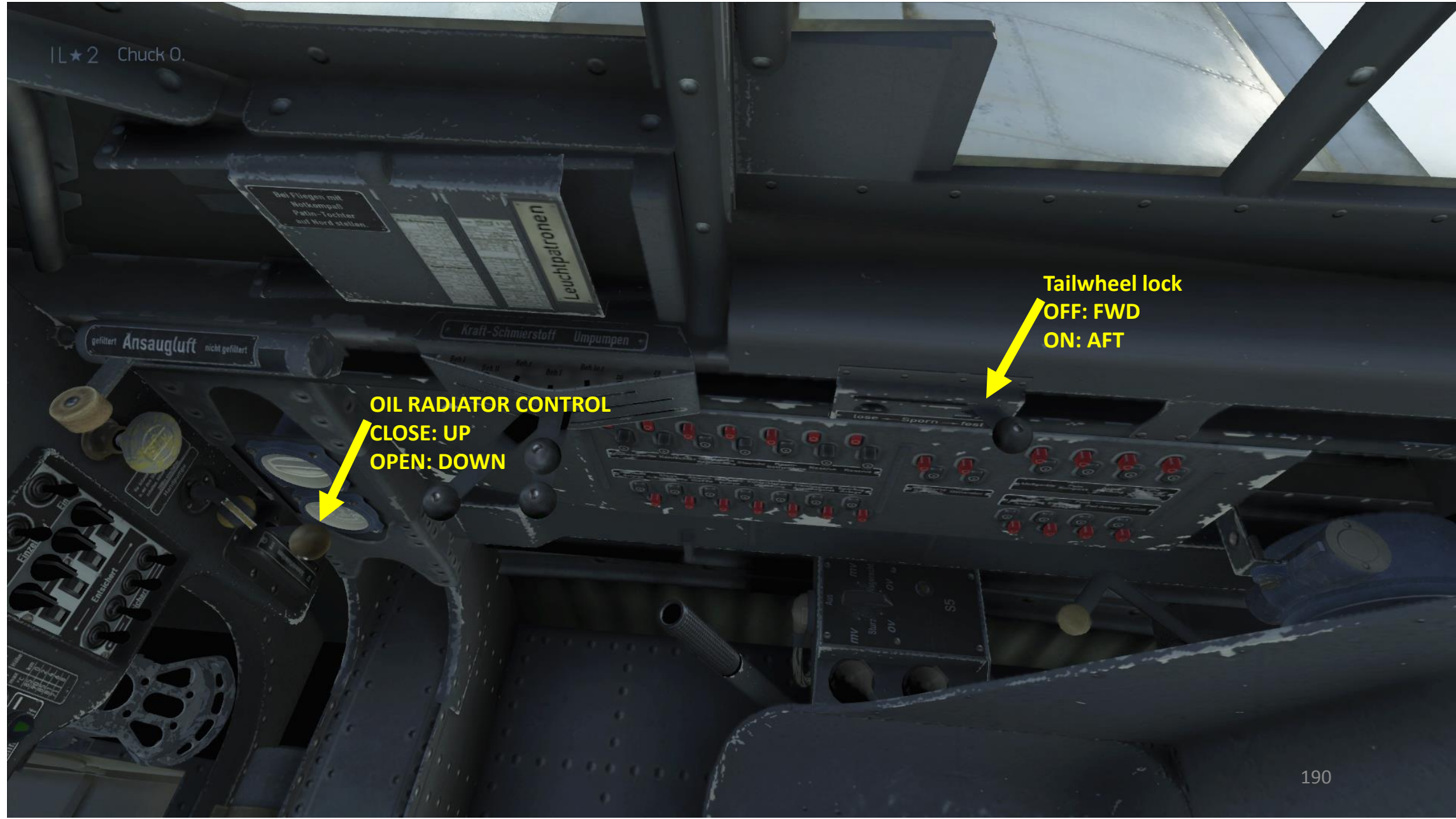


PART I: THE AIRCRAFT

Left Side

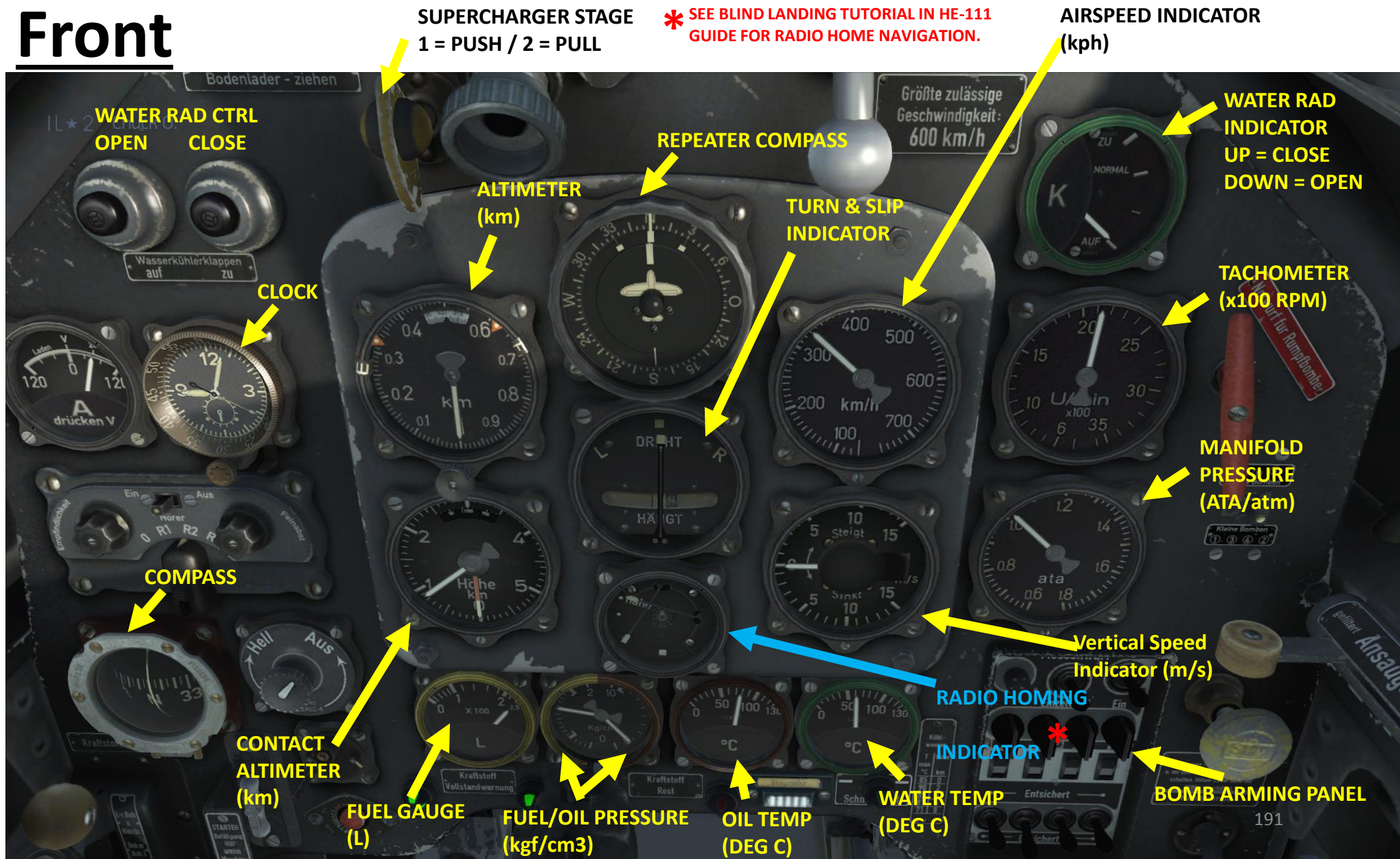


Right Side



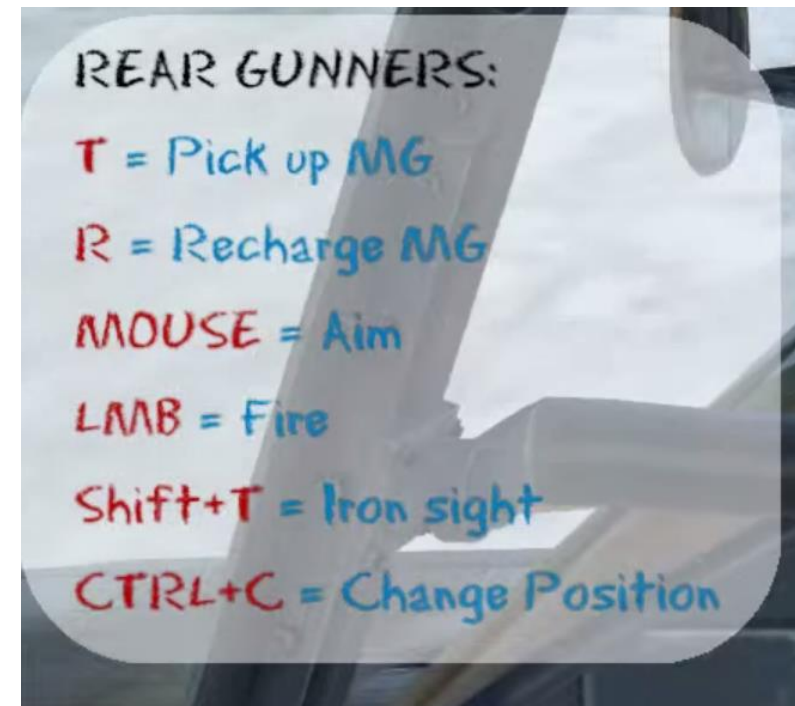
PART I: THE AIRCRAFT

Front



Turret Operation

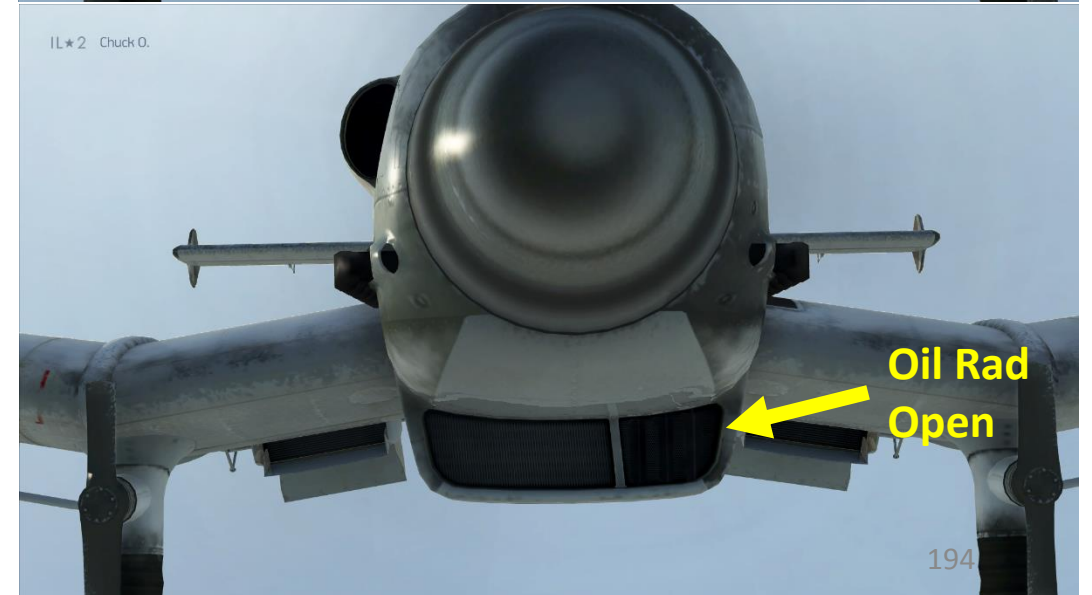
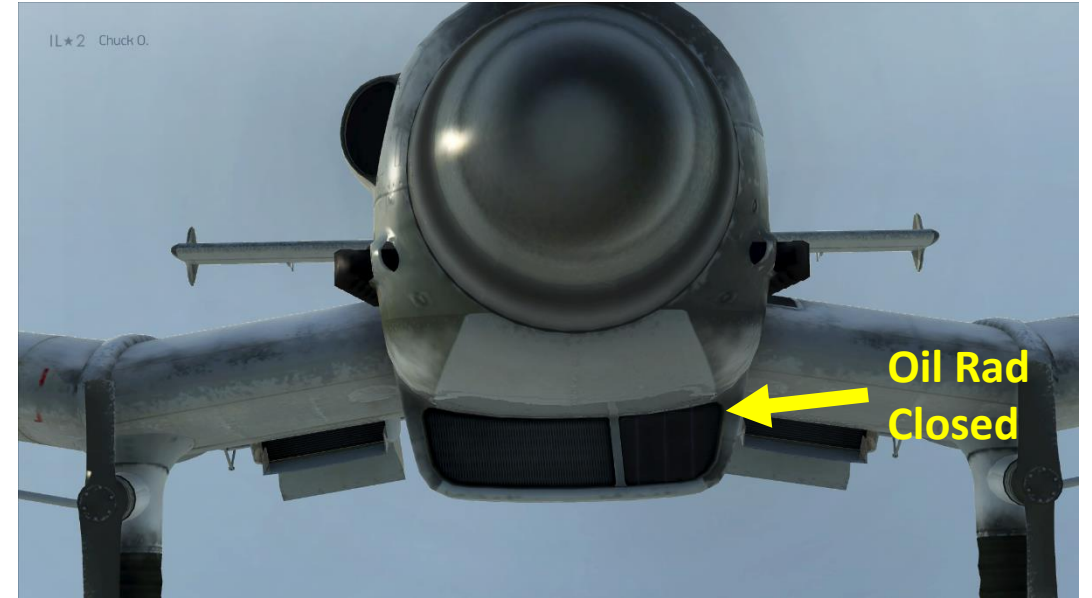
- For the turret gunner, make sure that you give him the command to fire at will (Ralt + 1)
- Also, give him the command to fire at long range (Ralt + 9)
- Flying in close formation with other bombers maximizes your firepower.



Important key bindings

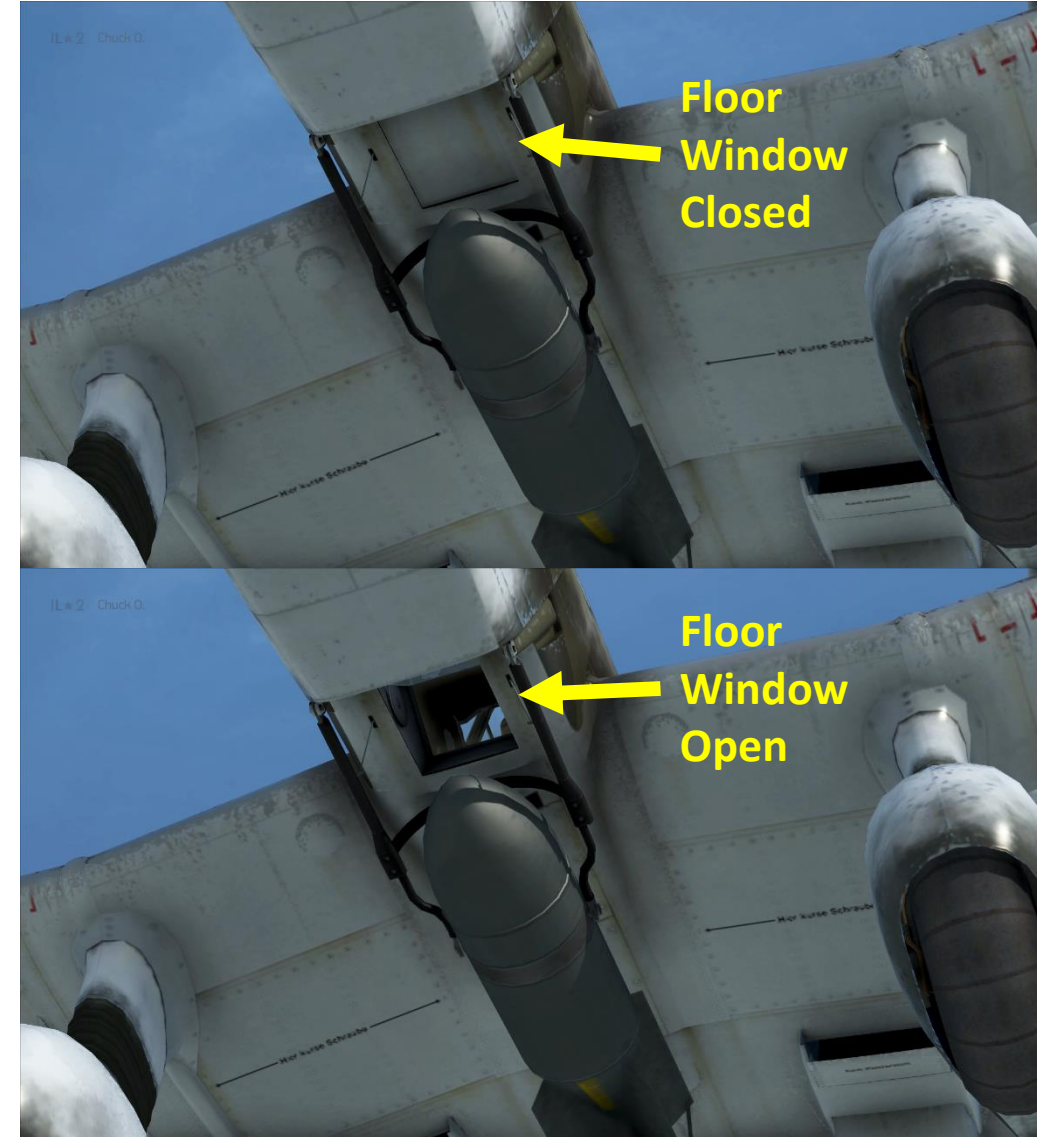
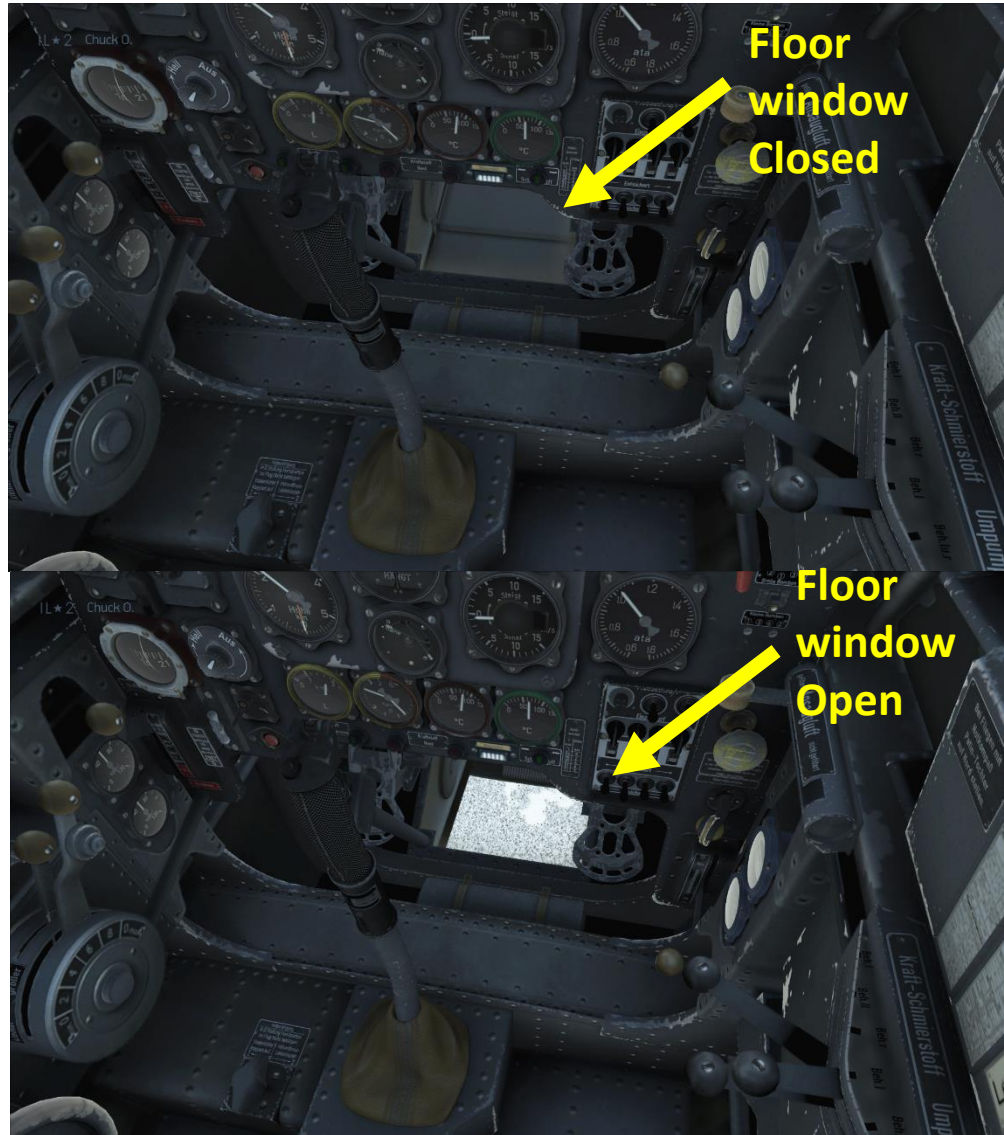
- The Ju-87 has manual water and oil radiator controls unlike the 109 and 190. Also, its RPM is controlled manually. Keep that in mind when assigning your keys.
- Unlike in Russian aircraft, you do not control your mixture setting in the Ju-87.
- When going on dive bomb run, make sure that you deploy your dive brakes beforehand or your wings will simply fly away from you (literally).

Important key bindings



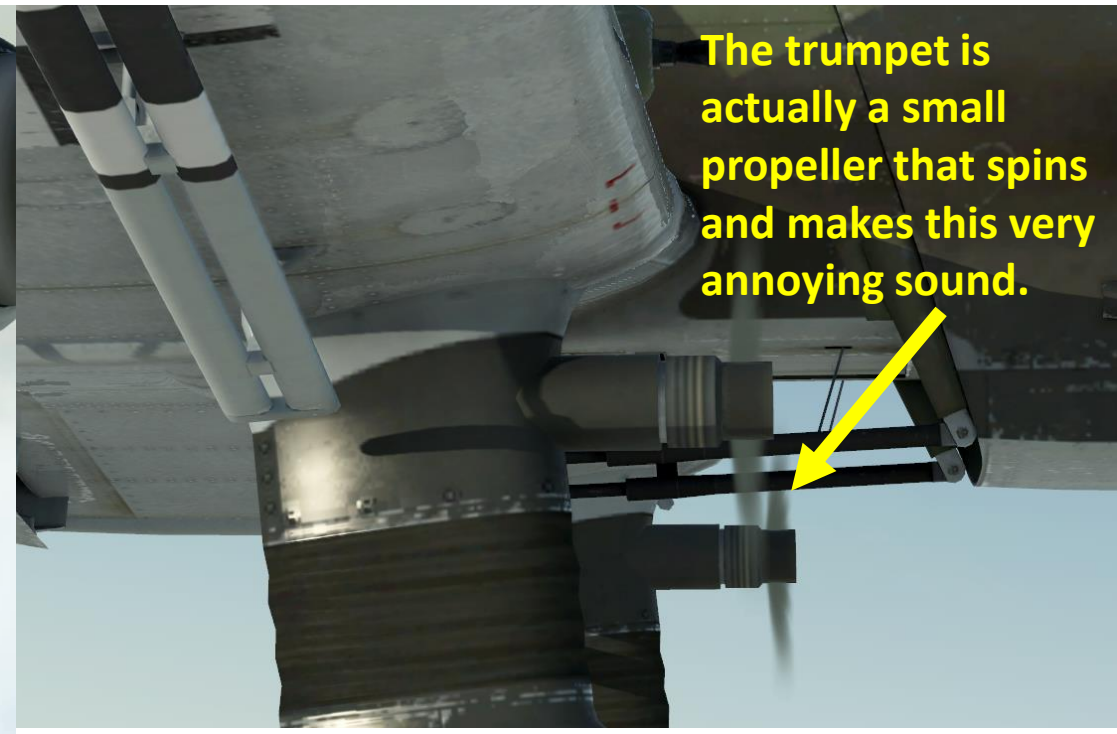
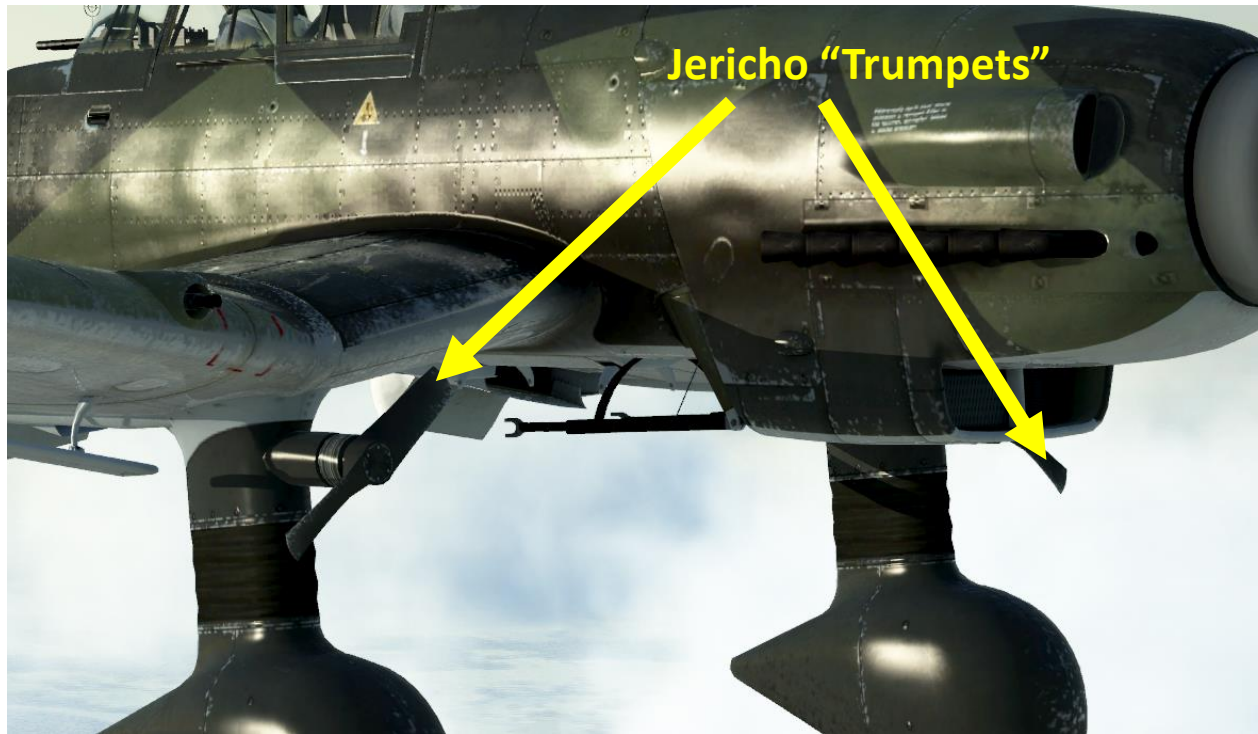
Important key bindings

**OPEN/CLOSE FLOOR WINDOW FOR DIVE
BOMBING USING THE "OPEN BOMB BAY
DOOR" KEY ("N" BY DEFAULT)**



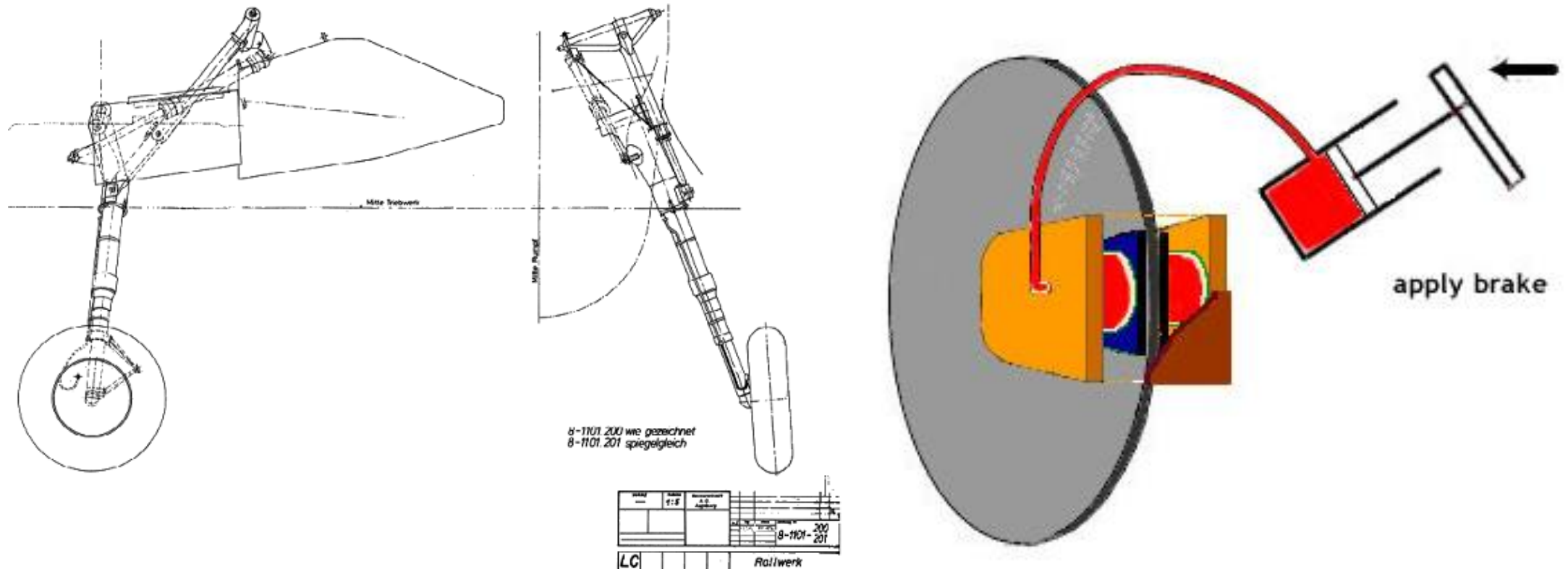
Some not so important key bindings

- Use of Jericho trumpet is recommended if you want to act all badass and stuff. Default key is LAlt+S.



Important key bindings

- The Ju-87, unlike most 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.
- 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.



PART III: TAKEOFF

- Taking off in the Ju-87 is straightforward if you follow these steps for a cold engine start.
- 1) Crack your throttle about 15 %
 - 2) Set your RPM to min (fully back)
 - 3) Ignite (“E” key by default)!
 - 4) Close your water and oil radiators.
 - 5) Wait for your oil temperature to reach 30 degrees C and your coolant (water) temperature to reach 80 deg C.
 - 6) Taxi to the runway (unlock tailwheel, LShift+G by default)

PART III: TAKEOFF

7) Set your flaps to takeoff position (1 notch) and open your coolant (water) and oil radiator flaps.

8) Lock your tailwheel once lined up on the runway (LShift+G by default)

9) Throttle up to 2500 RPM @ 1.3 ATA. Use full throttle and max RPM in case of scramble takeoff. Correct heading with small rudder input.

CAUTION: DO NOT EXCEED 1 MINUTE AT FULL POWER (2600 RPM/1.40 ATA)

CAUTION: INCREASE THROTTLE VERY GRADUALLY: ENGINE IS SENSITIVE TO ABRUPT CHANGES IN MANIFOLD PRESSURE AND RPM.

10) As soon as you reach 120 kph, center the stick and level out to pick some speed.

11) When you reach 170 kph, rotate gently.

12) Once you are up in the air, retract flaps, do not try to pull your landing gear up (because it's fixed... d'uh) and start climbing. Adjust manifold pressure accordingly (see engine management in part V).

PART IV: LANDING

- 1) Do not try to deploy landing gear: it's fixed! ☺
- 2) Deploy flaps to stage 1 (1 notch) when going slower than 250 kph.
- 3) Set your RPM to 2000 and adjust throttle input as required to maintain approach speed at 190 kph. Recommended engine setting is 2000 RPM @ 0.6 ATA.
- 4) Trim nose down as flaps generate extra lift.
- 5) Cut throttle when reaching runway and start a gentle, but firm flare.
- 6) Touchdown at 150 kph.
- 7) Once on the ground, pull back on the stick to lock your tailwheel and tap your brakes.



Powerplant

The Ju-87D is powered by the Junkers **Jumo 211**, a liquid-cooled inverted V-12 engine. 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.

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. It was the most-produced German aviation engine of the World War II years.

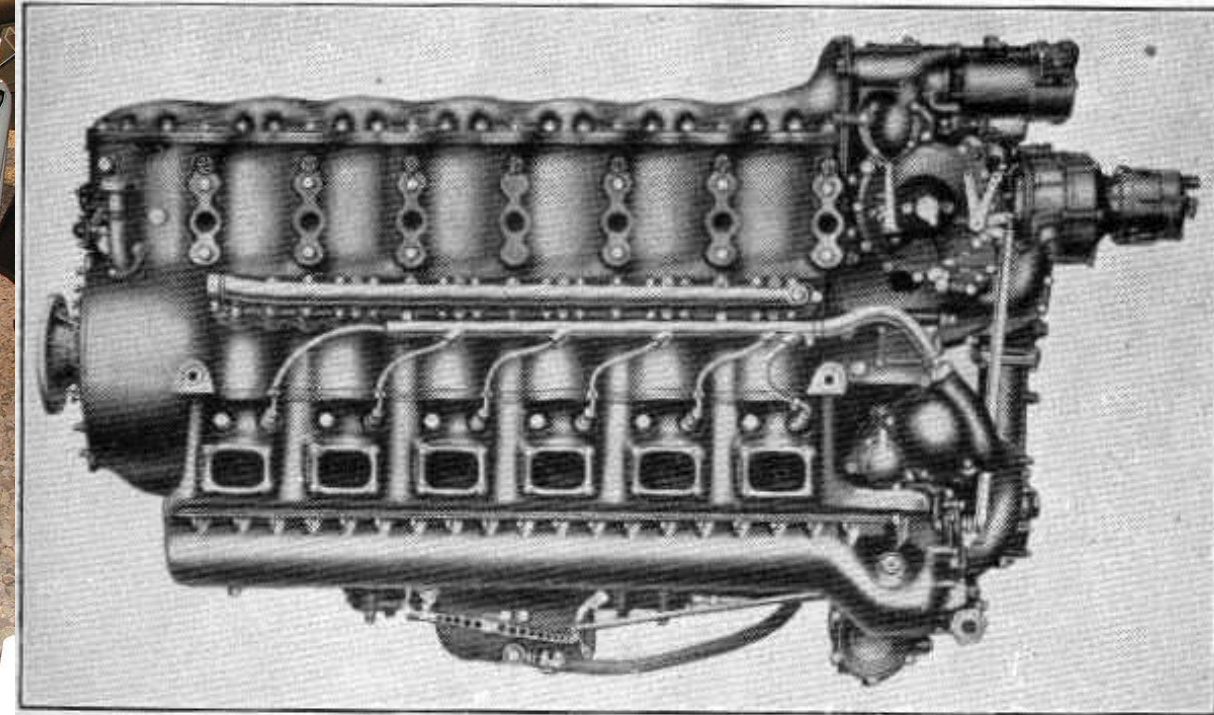
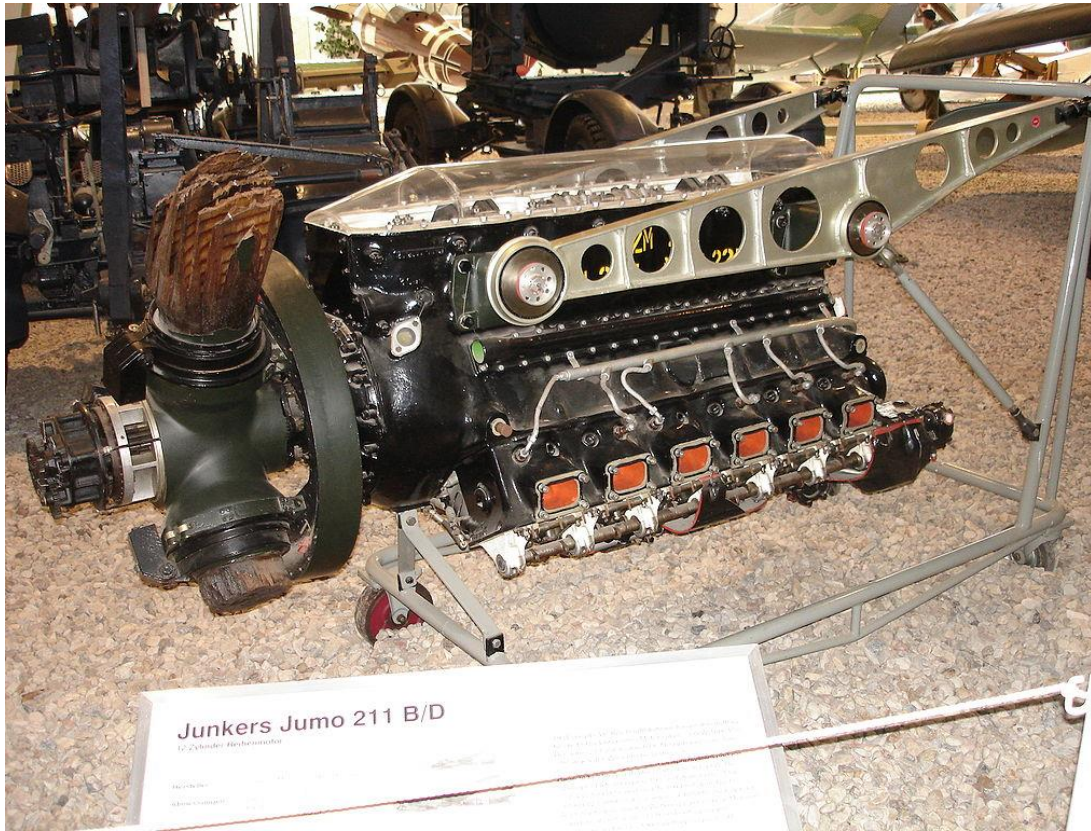
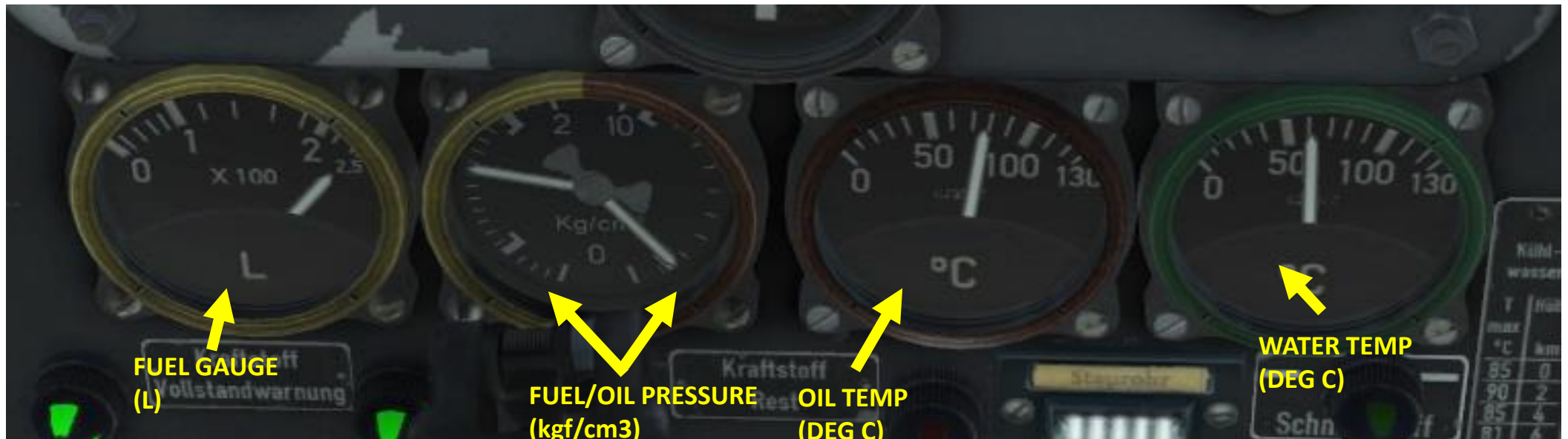


Abb. 16. Junkers-Motor Jumo 211 (Seitenansicht) (Werkphoto)

Operating Limits

- Min coolant temperature: 60 deg C.
- Max coolant temperature: 110 deg @ 1000 m, 100 deg @ 4000 m
- Min oil temperature: 30 deg C.
- Max oil temperature: 105 deg C.



Recommended Settings

- **CAUTION: AVOID RAPID INCREASE OF THROTTLE.**
- **CAUTION: AVOID PROLONGED RPM OVER 2250.**
- Takeoff
 - 2500 RPM, 1.3 ATA
- Climb
 - 2450 RPM, 1.25 ATA, speed 240 kph
(30 min max)
- Normal Operation (Cruise)
 - 2100 RPM, 1.2 ATA
- Max Continuous Power
 - 2250 RPM, 1.15 ATA
- Combat
 - 2250 RPM, 1.2 ATA
 - 2600 RPM, 1.40 ATA (1 minute max... or BOOM!)
- Landing
 - 2000 RPM, 0.6 ATA
- **Supercharger** (increases Manifold Pressure @ higher altitudes)
 - Unlike other superchargers models in the game, the Stuka supercharger has an “automatic” mode and a “manual” mode.
 - Lshift + S to toggle supercharger modes



PART VI: AIRCRAFT PERFORMANCE

- Range: 500 km
 - With 500 kg bomb load
- Fuel Max Capacity: ~780 L
- Endurance: 135 min (2h15)
 - No bomb load
- Operational ceiling: 8500 m
- Optimal Climb Speed: 230 kph
- Best climb Speed: 415 m/min
 - With 4 * 50 kg + 500 kg bomb
- Note: Your fuel and bomb loadout will impact your aircraft's performance, but also your weapon loadout (i.e. 37 mm guns). Performance data often being subject to many factors (test conditions, state of aircraft (captured vs factory fresh), etc.), these numbers are to be taken with a grain of salt. Just like today, aircraft performance can and will vary between the real values and the values that you get on paper.



Heinkel He-111 H6

HEINKEL



By Chuck

TABLE OF CONTENTS

- PART I: THE AIRCRAFT
- PART II: THE MISSION PLAN
- PART III: TAKEOFF
- PART IV: NAVIGATION
- PART V: THE BOMB RUN
- PART VI: LANDING

PART I: THE AIRCRAFT

Exterior



PART I: THE AIRCRAFT

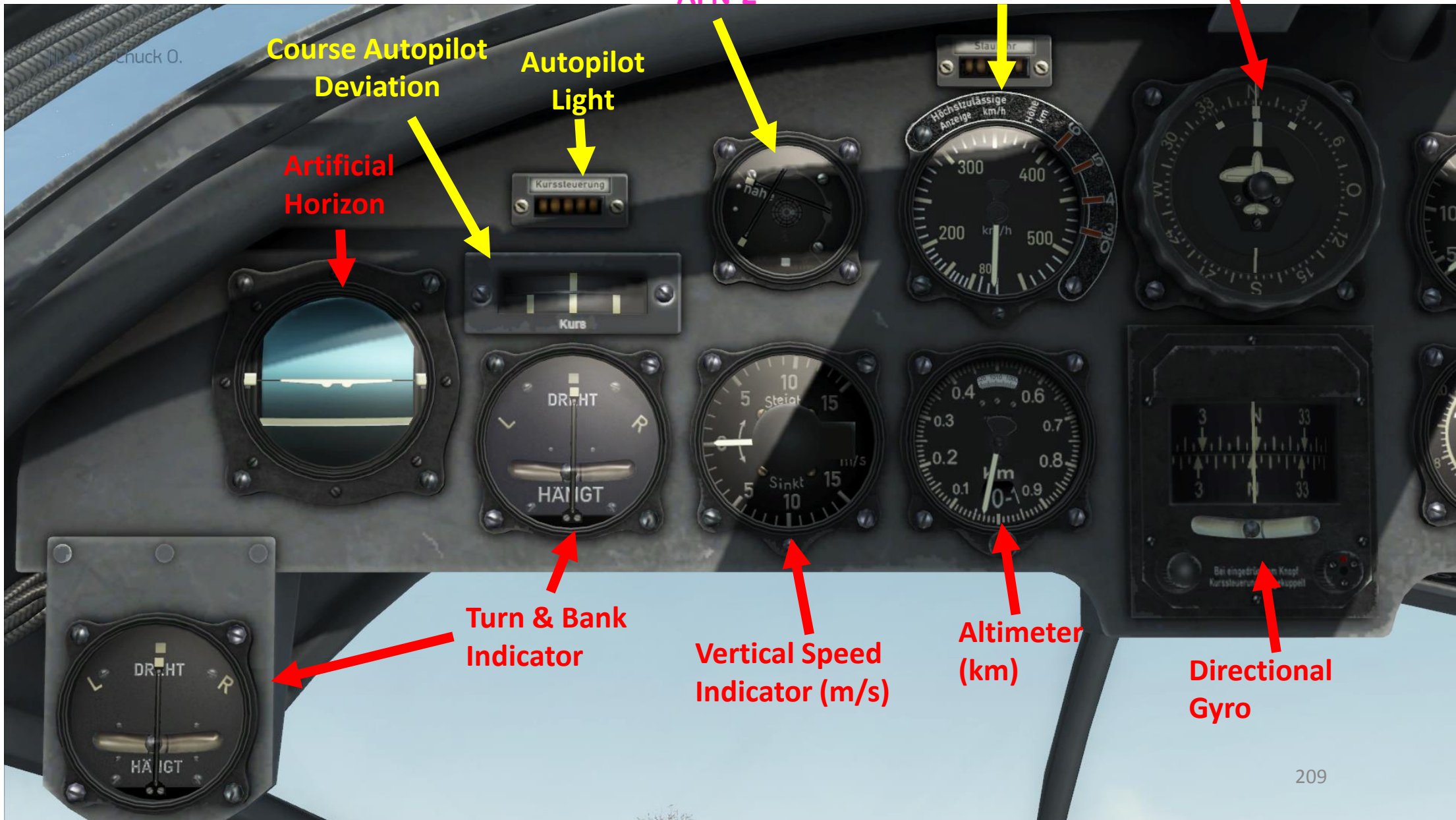
Exterior

Oil radiators are opened incrementally, so you need to push the oil rad lever more than once to open it all the way.



PART I: THE AIRCRAFT

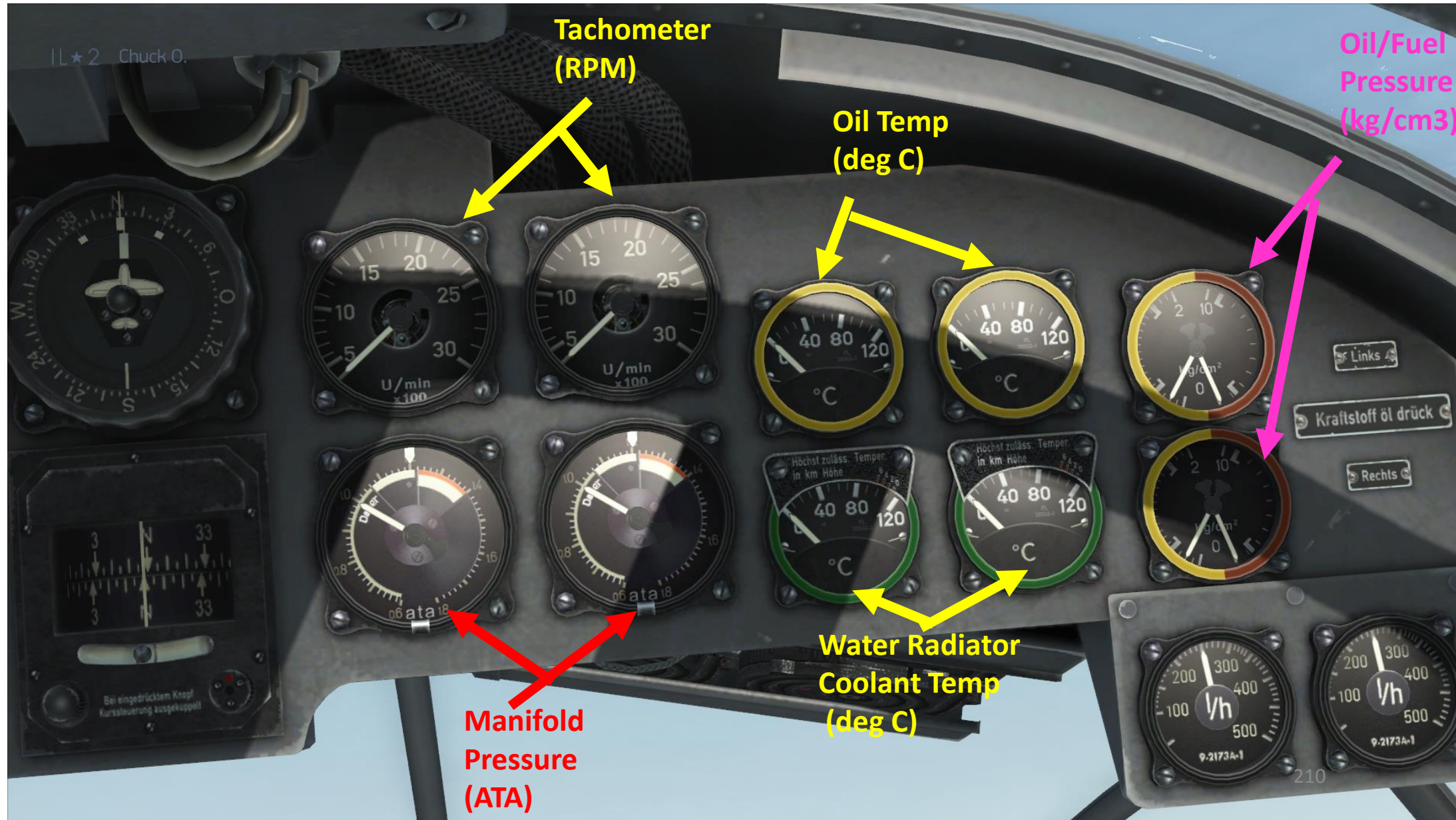
Cockpit



PART I: THE AIRCRAFT

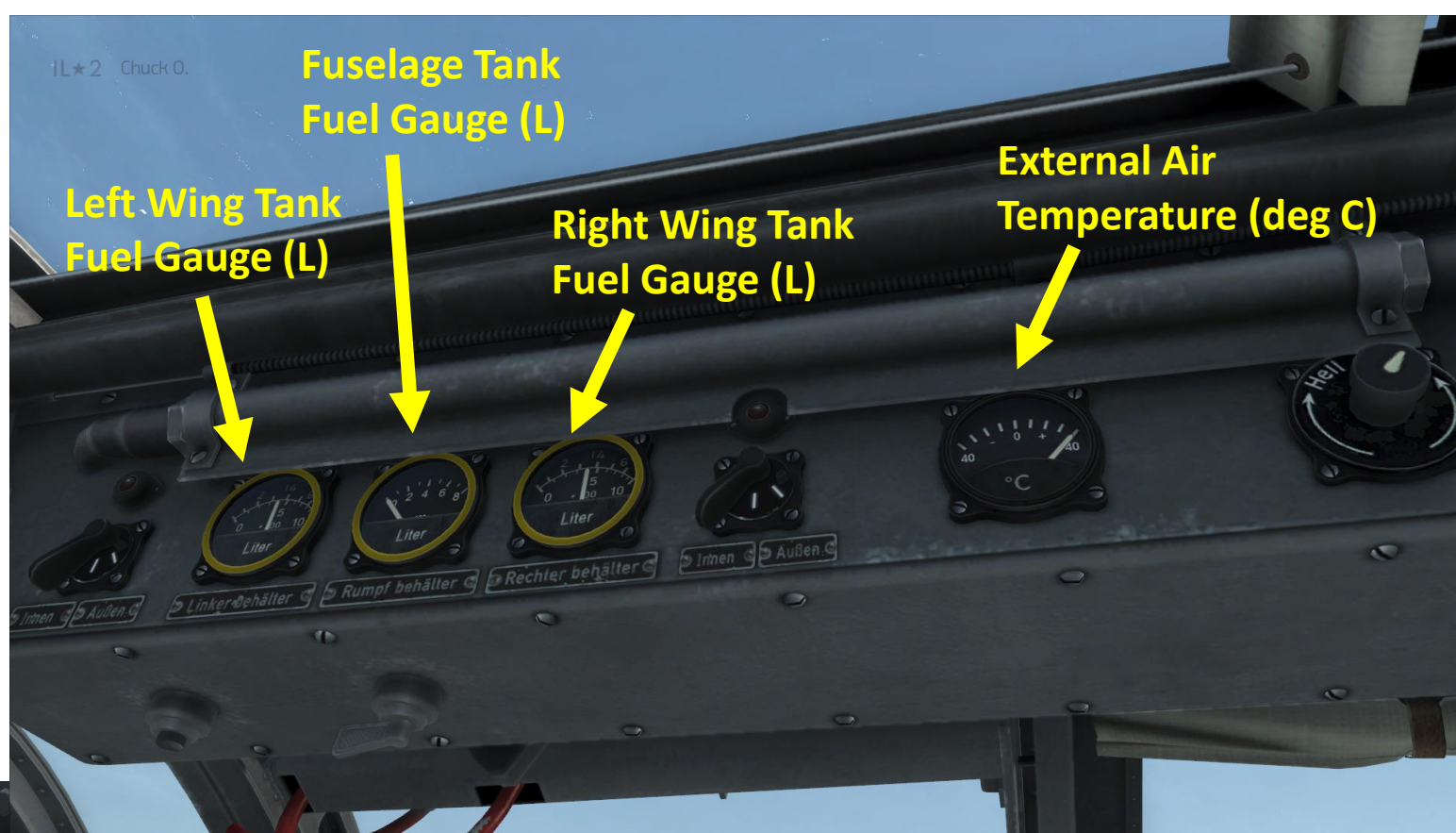
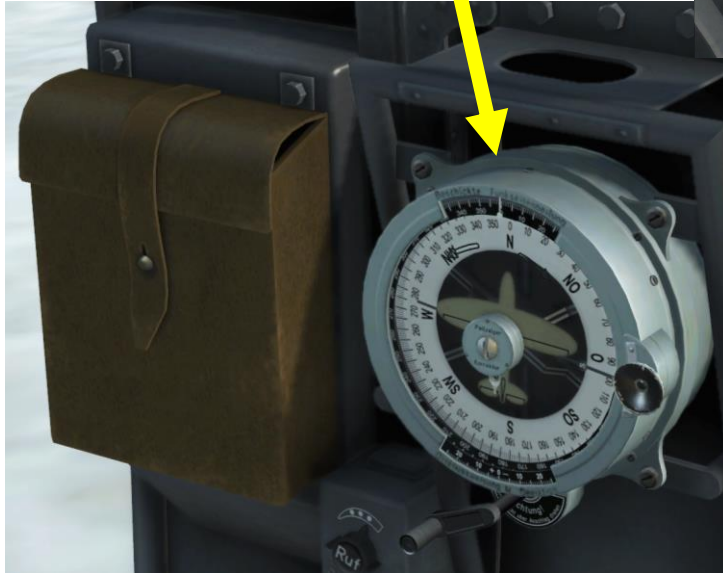
Cockpit

*no need to monitor



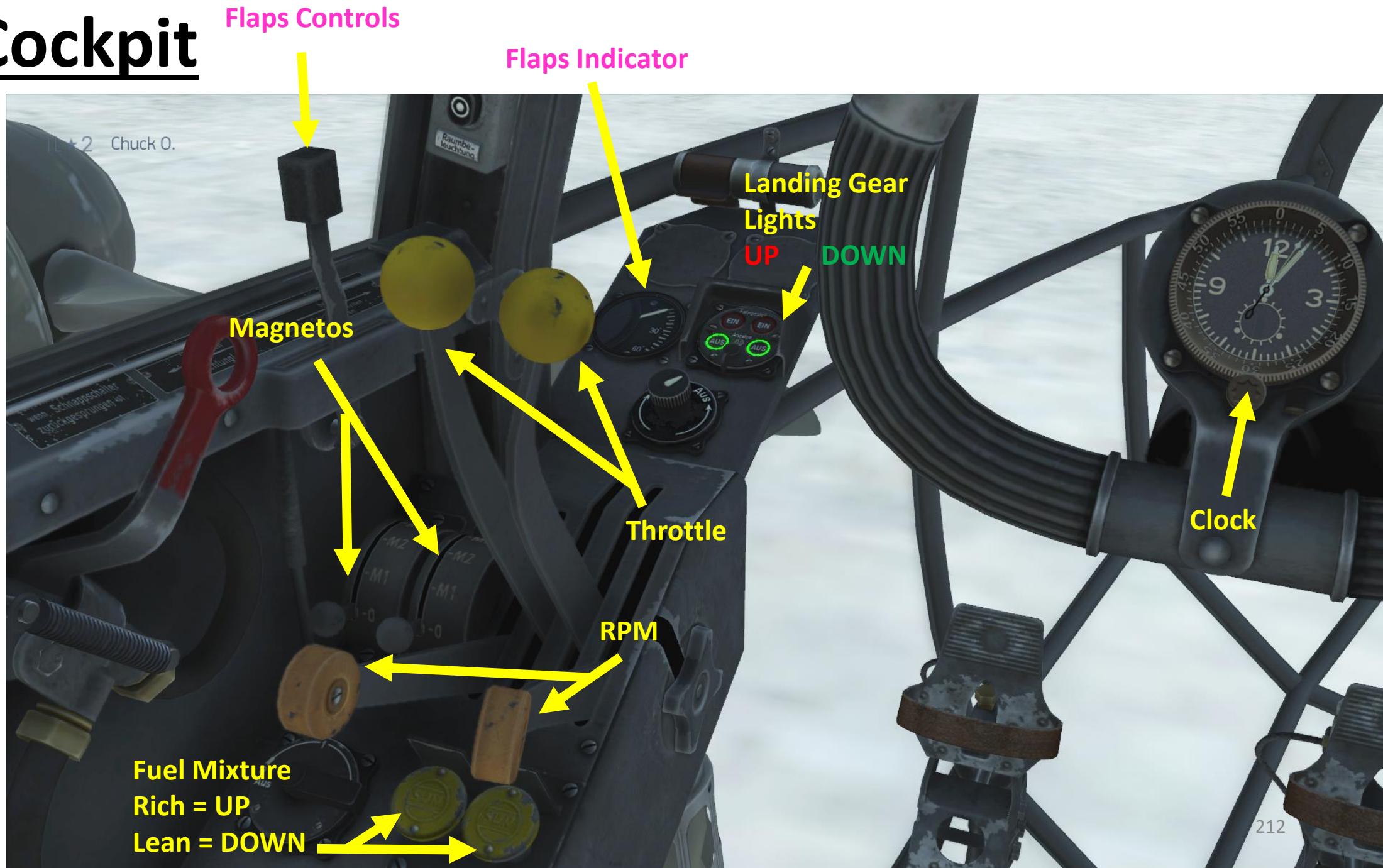
Cockpit

Radio bearing
indicator



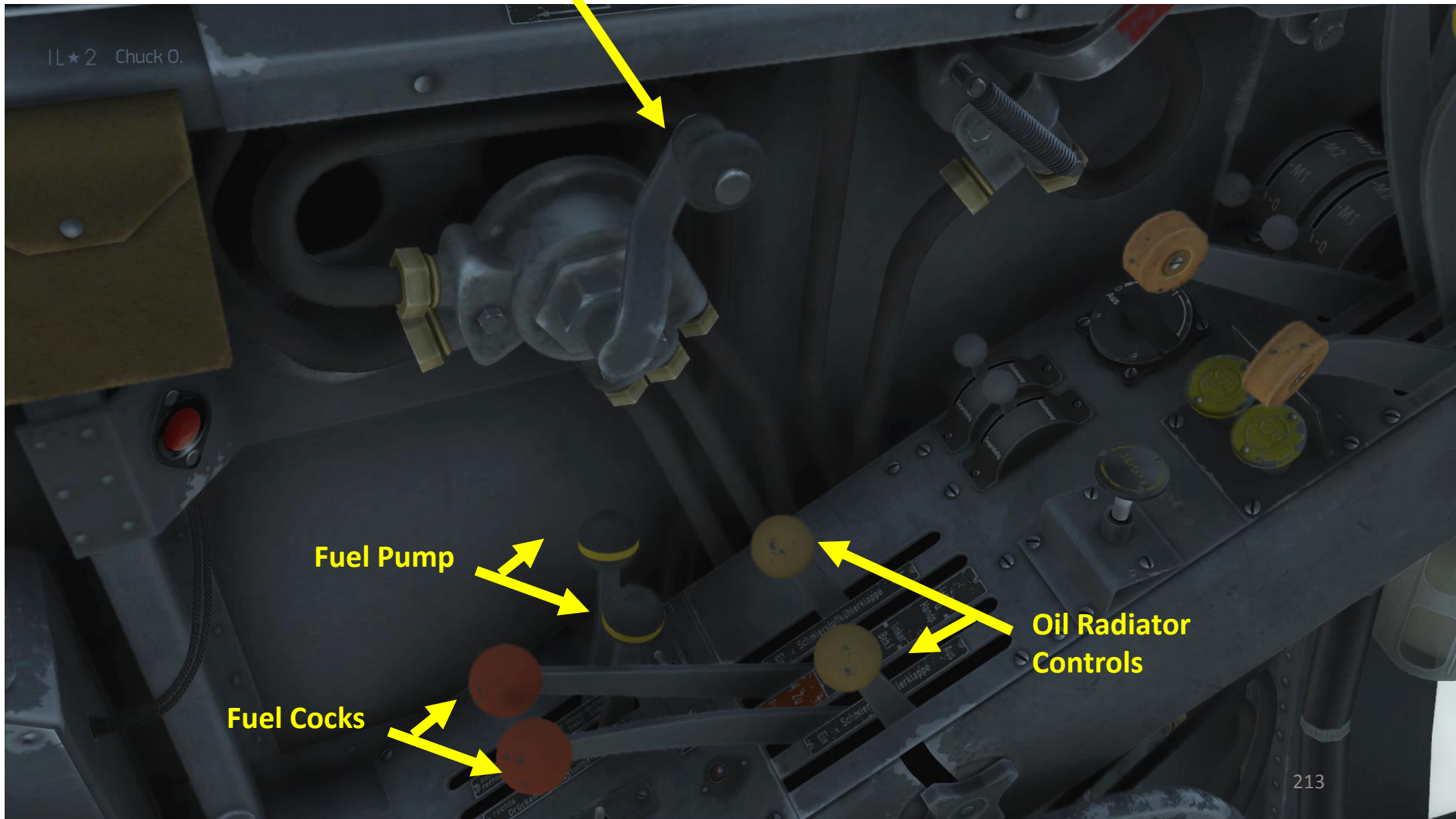
PART I: THE AIRCRAFT

Cockpit

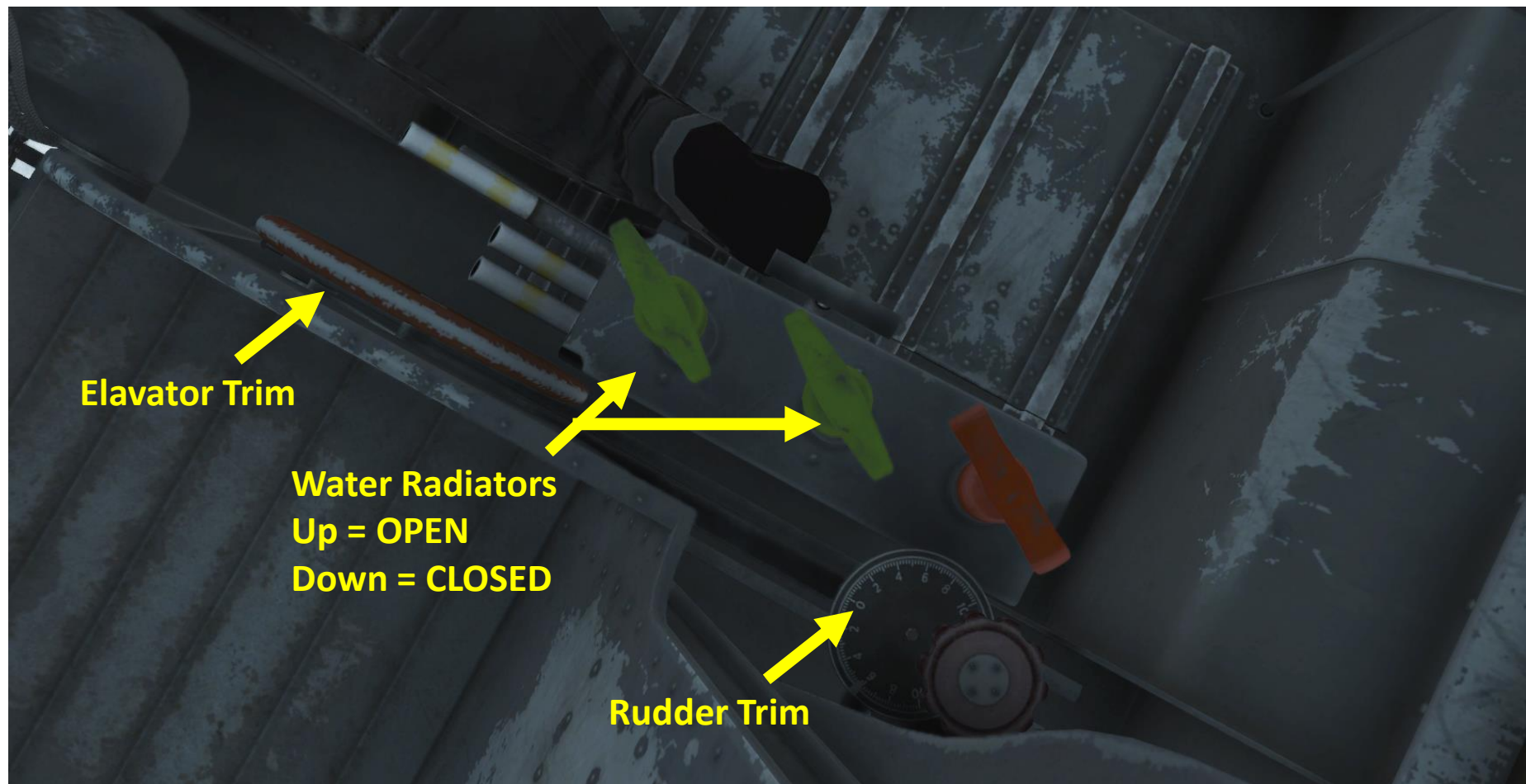


PART I: THE AIRCRAFT

Cockpit



Cockpit



Important key bindings

- Make sure that you have the following keys mapped somewhere. *

Category	Actions	Commands
Service	*Bomb sight	V
Camera controls	*Drop bombs	B joy0_b2
Pilot head control	Throw bombs mode toggle	LCtl+B
Plane controls	Launch rockets	joy0_b3
Engine controls	Launch rockets mode toggle	LWin+R
Weapons controls	*Bomb bay doors toggle	N
Flight leader commands	Bombs safety switch	LWin+S
Pilot gestures		

Category	Actions	Commands
Service	Propellers feathering: on/off	LCtl+F
Camera controls		
Pilot head control	* Oil radiators: open to next notch	Cursor Up
Plane controls	* Oil radiators: close to previous notch	Cursor Down
Engine controls	* Water radiators shutters control	joy0_b12 / joy0_b10
Weapons controls	Oil radiators shutters control	Cursor Left / Cursor Right
Flight leader commands	Engines cowl shutters control	joy0_b13 / joy0_b11
Pilot gestures		

Service	Engage engines start procedure / Stop engine	E	joy1_b19
Camera controls			
Pilot head control	* Engines throttle control		joy1_axis_z
Plane controls	* Propellers pitch control		joy1_axis_t
Engine controls	* Engines mixture control		Minus / Equals
Weapons controls	* Switch engines superchargers: 1st gear speed/2nd gear speed	LSht+S	
Flight leader commands			
Pilot gestures			

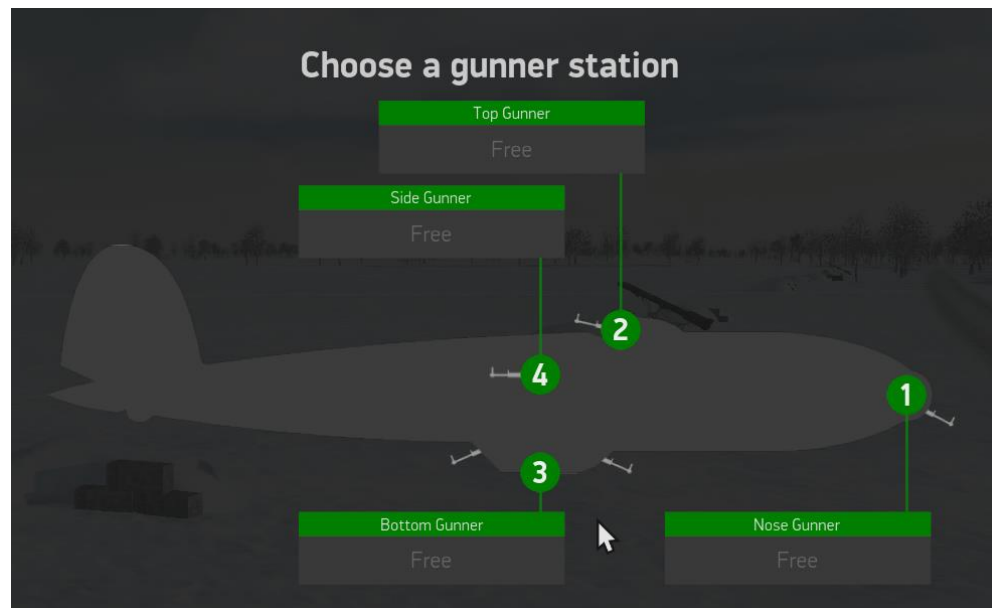
Category	Actions	Commands
Service	AI-autopilot on/off	A
Camera controls		
Pilot head control	* AI-autopilot for level flight: on/off	LSht+A
Plane controls	* Level flight AI-autopilot: left turn	LSht+Z
Engine controls	* Level flight AI-autopilot: right turn	LSht+X

Note: Don't forget that the He-111 has toe brakes.

PART I: THE AIRCRAFT

Turret Operation

- For the turret gunners, make sure that you give them the command to fire at will (Ralt + 1)
- Also, give them the command to fire at long range (Ralt + 9)
- Flying in close formation with other bombers maximizes your firepower.



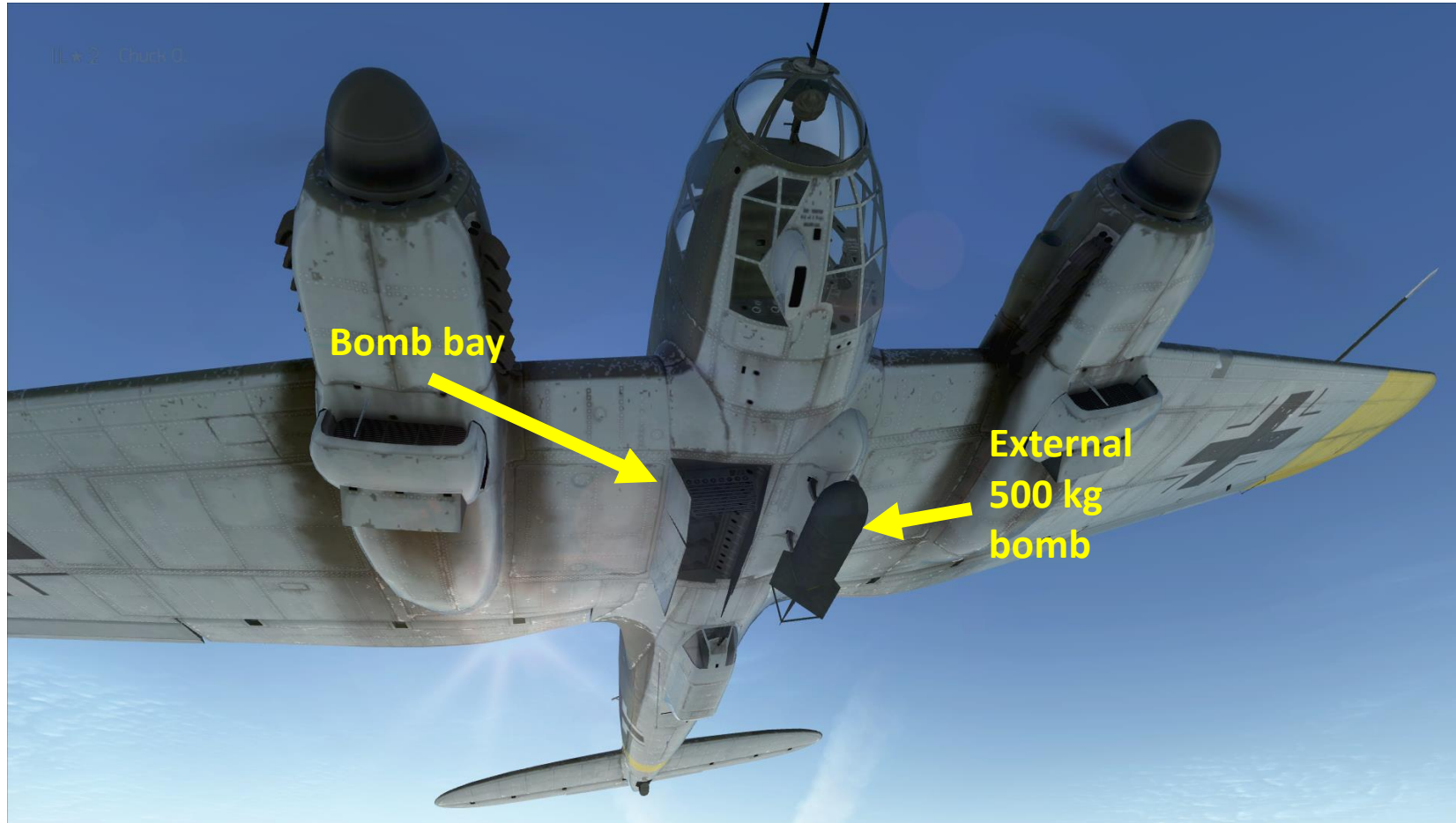
T = Pick up MG
R = Recharge MG
MOUSE = Aim
LMB = Fire
Shift+T = Iron sight
CTRL+C = Change Position

T = Pick up MG
R = Recharge MG
MOUSE = Aim
LMB = Fire
Shift+T = Iron sight
CTRL+C = Change Position
SHIFT+C = Switch Sides



Bomb Bay Door Operation

- You can have an additional 500 kg bomb attached to a pylon right next to your bomb bay doors.



Complex Engine Management

- Powered by Jumo 211 engines.
- Documentation is very sparse on He-111 H-6 operation. Operational values are deducted from He-111 H-2 pilot's manual.
- Engine Temperature Limits
 - Min 35 deg C for oil required for takeoff
 - Max 95 deg C for oil for normal operation
 - Min 40 deg C for water coolant required for takeoff
 - Max 95 deg C for water coolant for normal operation



Oil Temp
(deg C)

Water Radiator
Coolant Temp
(deg C)

Complex Engine Management

- **Takeoff:**
 - Rads fully open
 - Max RPM, 1.35 ATA (1 minute max)
- **Climb:**
 - 1.15 ATA
 - 2300 RPM
 - 30 min rating
- **Operation limits**
 - 1.35 ATA / 2400 RPM (1 min max)
 - 1.15 ATA / 2300 RPM (30 min max)
 - 1.10 ATA / 2200 RPM: Max Continuous Power
- **Supercharger** (increases Manifold Pressure @ higher altitudes)
 - Unlike other superchargers models in the game, the He-111's supercharger has an "automatic" mode and a "manual" mode.
 - Lshift + S to toggle supercharger stages
 - Make sure not to overrev the engines and monitor your ATA (must not exceed 1.15 (30 min max)) once second stage has been engaged.



How to Read a Fuel Gauge



HOW TO READ FUEL GAUGES

He-11 has 5 fuel tanks: two in each wing and one in the fuselage. Here is an example of how to read a gauge. Fuel quantities are purely for illustrative purposes... Yawn.

For each wing tank:

The upper dial from 0 to 6 stands for 0 to 600 litres. (wing tank # 1)

The lower dial from 0 to 10 stands for 0 to 1000 litres (wing tank # 2)

For the Fuselage tank:

The dial from 0 to 8 stands for 0 to 800 litres (fuselage tank)

Normally, you could switch between the 2 different fuel tanks on a single gauge with a toggle, but this functionality is not implemented in BoS.

Instead, the fuel gauge will cycle automatically and periodically between tanks.

WHY A MISSION PLAN?

- Bombing missions require careful planning in order to be successful.
- If you fail to plan your mission properly, you most likely plan to fail.
- There is an infinity of variables, things that can go wrong during a bombing mission. However, some mistakes are avoidable and you can have control on some of these parameters.
- The best plan is not necessarily the shortest route to target. The best plan is often the most adaptable and flexible one.
- Sometimes, a bomber pilot will be forced to improvise. Always make sure that you have a plan B in case plan A goes wrong. Flexibility is the key.
- Getting shot down happens, and it is part of the game. Don't take it personal and think of how (or if) you could have avoided your untimely death. Just think of how you can do better next time!

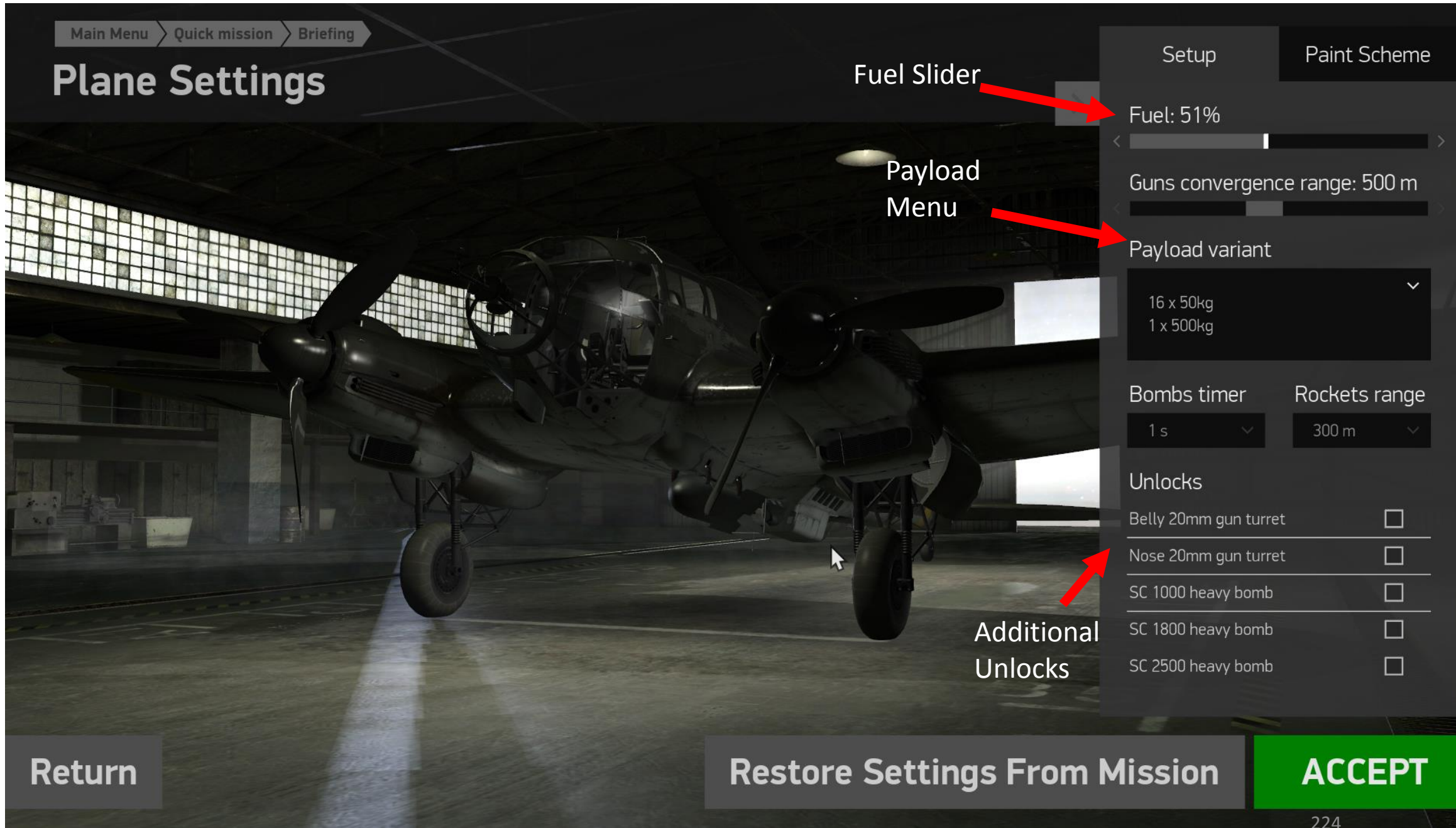
HOW TO PLAN A MISSION

- When planning a mission, you don't have to do it alone. Consult your fellow wingmen and even fighter escorts to give you intel that will help you shape your flight route accordingly to avoid patrolling enemy fighters and potential danger zones.
- Before you even takeoff, you need to know what you are going to do and how you are going to do it. Typical high-altitude bombing missions are used to knock out enemy airfields, factories or targets clumped up in a relatively small area. For smaller individual targets, you are better off dive bombing as high-altitude bombing is not as precise.
- Make sure you communicate your position, status and intentions to your teammates. You might be surprised how many people are craving to wing up with you or even escort you to your targets. Fighter jocks can also be team players, believe it or not.

WHAT TO PLAN FOR

- Your aircraft performance will be altered by mainly 2 factors: your bomb loadout and your fuel quantity (in %). Typical bomb runs are achieved with 30-40 % fuel. Why? Because they influence your aircraft's weight. (And people are just too lazy to calculate what they really need.) The heavier you are, the slower you will climb and the more vulnerable you will be.
- German bombs are designated simply by their weight in kg. For instance, the SC-1800 bomb stands for "Sprengbombe Cylindrisch" (explosive cylindrical bomb) for a weight of 1800 kg.
- Different bomb loadouts do not all have the same weight (unlike for the Pe-2). Your choice of bombs will directly impact your weight. Your maximal bomb loadout weight is 3600 kg (2 x SC-1800).
- With a fuel capacity of approx. 3500 litres (~2500 kg), we can make the (very veeery conservative) assumption that its max range fully loaded is 4000 km. In reality, with a heavy load, the range would be much less than that. Let us take these numbers for the simple reason that I don't have all day and that the Battle of Britain Historical Society probably didn't get these numbers out of thin air. I just wished I found the sodding manual... but I hear life's not perfect. Whatever. I ain't even mad. Seriously.
- Moving on.

PART II: MISSION PLAN



HOW TO CALCULATE YOUR REQUIRED FUEL

- You can calculate how fuel you will need pretty easily if you want to optimize your aircraft's capabilities during the missions. The less fuel you bring, the faster you'll go, the easier you will climb and the more fuel-efficient your aircraft will be.
- The He-111's fuel tanks have a maximal capacity of approx. 3500 litres.
- The He-111's maximal range is 4000 km.
- Hence, we can deduce that you will need approx. 0.9 litre per km (which is strangely comparable to the Pe-2's approximated value), or inversely that you will travel approx. 1.2 km per litre of fuel.
- If you know what your trajectory will be, you can easily know how much fuel you need to get there and come back.
- To judge your total distance, you can use the in-game map and plot your course at the same time.

PART II: MISSION PLAN

CHECK THE MAP BY PRESSING "O"

360 km
(36 squares)



The map is divided in grids. Each grid has a number. Knowing that each grid square is 10 km x 10 km, you can deduce the total distance you will have to travel to reach your target. Once you know your distance, you can then choose the adequate fuel quantity.

PART II: MISSION PLAN

ZOOM IN AND OUT USING YOUR MOUSEWHEEL

Briefing

COALITION	PLAYERS	POINTS LEFT
Allies	4	10000
Axis Powers	10	10000

Grid numbers

Sub-quadrants
(structured like a numpad)

Leave Server

Become a Gunner

SPECTATE

PART II: MISSION PLAN

PLOT AND PLAN YOUR COURSE

Main Menu Multiplayer

Briefing

Note: I know that you obviously won't spawn from a Russian airfield... but I got lazy and just copy-pasted the example in the Pe-2 guide. Sue me.

COALITION	PLAYERS	POINTS LEFT
Allies	4	10000
Axis Powers	10	10000

You spawn here (Grid 304)

You have to travel through 10 squares, which makes 100 km.

Your target is here (Grid 314)

Since you (hopefully) want to make it back to base after your bomb run, you can add another 100 km. It is wise to add another 50 km as buffer, loitering time and extra fuel in case you need to change course or lose an engine.
Total distance = 100 + 100 + 50 = 250 km

Leave Server

Become a Gunner

SPECTATE

HOW TO CALCULATE YOUR REQUIRED FUEL

- Now that we have a rough estimate of our flight path, we know that we need fuel to travel 250 km.
- Knowing that our plane consumes approx. 0.9L/km:
- Required fuel = $250 \text{ km} \times 0.9 \text{ L/km} = 225 \text{ L}$
- Out of a capacity of 3500 freaking Litres, we need roughly 7 % fuel.
- You can also consider it in a matter of time. The He-111 will travel approx. 4 km/min if it maintains 240 km/h in a climb.
- To fly 250 km (not counting loiter time), you can simply calculate:
 $250 \text{ km} / 4 \text{ km/min} = 62.5 \text{ min}$ of flight time for the whole mission.
- Using the same thought process, we can evaluate the maximal fuel % we'd need to make the longest bombing run ever. Let's calculate it, just for fun.
- Knowing that the maximal distance you would have to travel is the whole diagonal of the map (425 km, so 850 km for a full flight), the longest flight you could make from point A to point B back and forth would require 720 L of fuel, which is slightly less than 20 % of your tank capacity (3500 L).

HOW TO CALCULATE YOUR REQUIRED FUEL

- As you can see, we now know that we do not really need 50 %, 40 % nor 30 % of that fuel we wanted to bring earlier. Just by making a quick estimate, we saved up to 40 % fuel, and our aircraft is now 1000 kg lighter, which is about the weight of this bloodthirsty Russian bear.



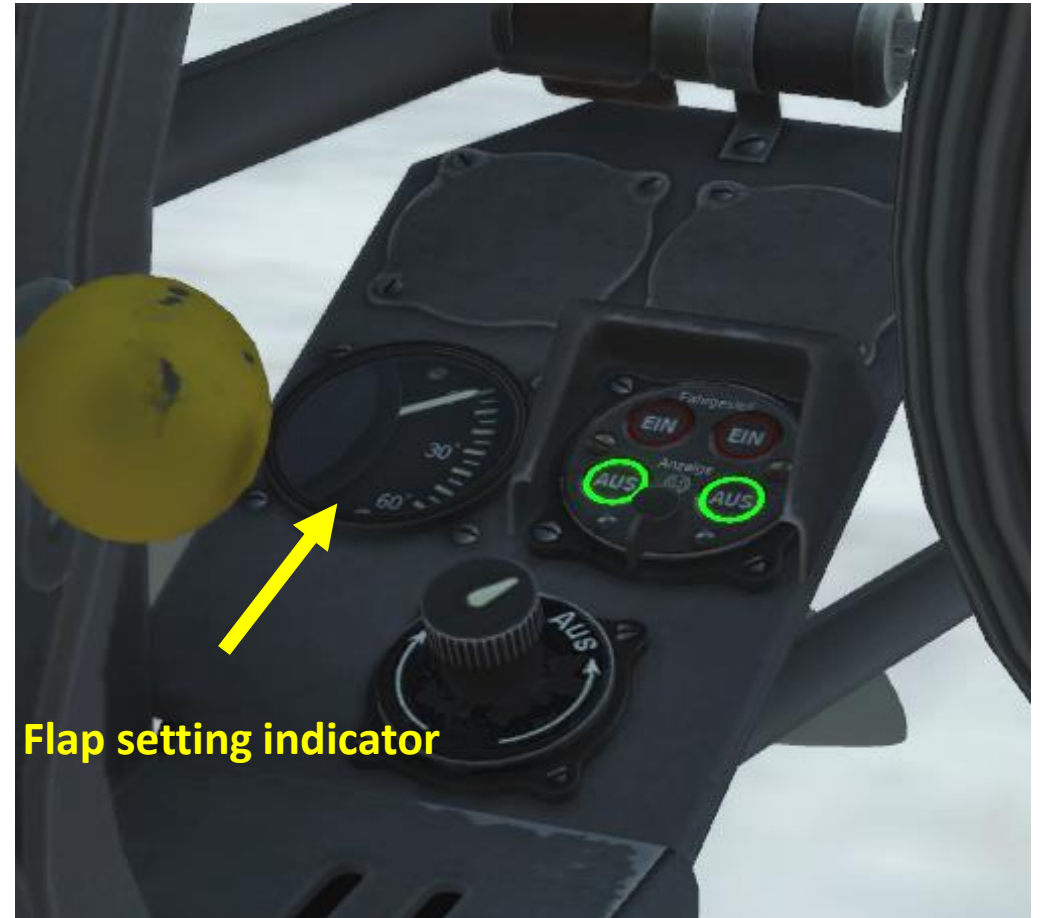
- The lighter your aircraft is, the easier time you will have climbing. And the higher you are, the less likely you are to get bounced. Also, altitude allows you to have a better view of the landscape and navigate visually.

PART III: TAKEOFF

- Taking off in the He-111 is straightforward if you follow these steps for a cold engine start.

- 1) Crack your throttle about 10 %
- 2) Set your mixture to full rich
- 3) Close your water and oil radiators
- 4) Set maximum RPM
- 5) Ignite (“E” key by default)!

6) Set your flaps to 15-20 degrees. Keep in mind that your flaps switch is continuous and will keep moving your flaps as long as you hold it. If your flaps are deployed too much (over 30 degrees), you will simply stall, crash and burn on takeoff. Consult your flap indicator to make sure that you are set up correctly.



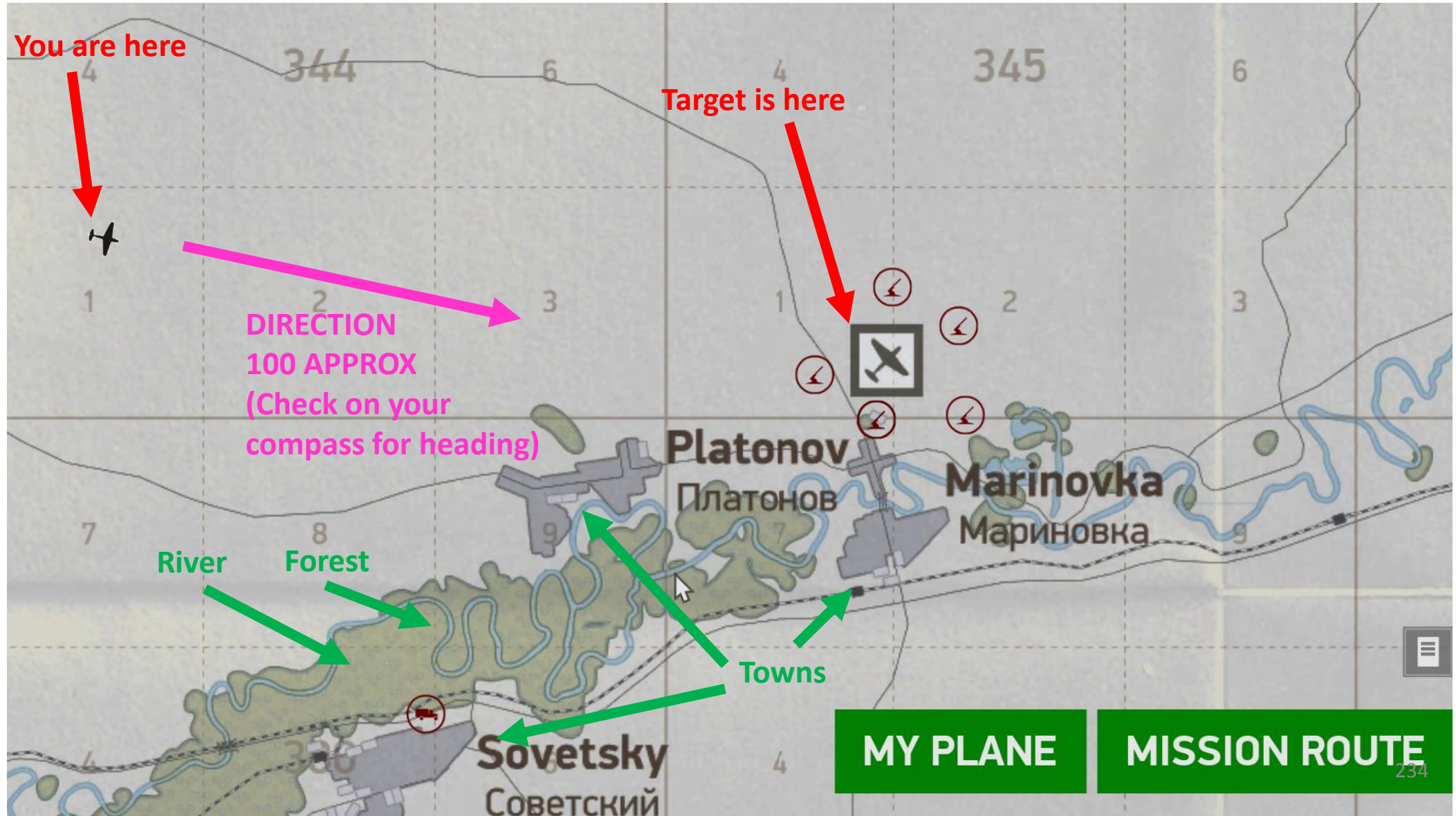
PART III: TAKEOFF

- 7) Wait for your oil radiator temperatures to reach 35 degrees C and your water radiator temperatures to reach 40 degrees C.
- 8) Line yourself up on the runway using your toe brakes and lock your tailwheel by pulling your stick back to keep your tailwheel down.
- 9) Fully open your water coolant and oil radiators.
- 9) Throttle up full power (1.35 ATA), max RPM. Correct heading with small rudder input.
- 10) As soon as you reach 100 kph, center the stick and level out to pick some speed.
- 11) When you reach 150 kph, rotate gently.
- 12) Once you are up in the air, retract flaps, pull your gear up and start climbing. Adjust RPM and manifold pressure accordingly (see engine management in part I).

- Now that we are up in the air and that we know what our mission will be, let's do an example. We cannot bomb our target if we cannot find it, right?
- First, let's make a brief summary of the mission.
 1. We are going to bomb an airfield.
 2. We will bomb our target at an altitude of approx. 3000 metres with 1 X 2500 kg and 1 X 1000 kg bombs. The altitude is not set in stone, but more of a general idea.
 3. We will approach the target from the East.
 4. In this case, we will go in alone. But if you lead a bomber wing, it is important for the leader to give his speed and engine settings to his wingmen in order to allow them to form up easily on you.
Generally, bomber formations will drop on the bomber lead's go while wingmen will maintain formation. By managing the workload in this way, precision is maximized and coordination maintained throughout the bombing run.

PART IV: NAVIGATION

- Here is an overview of where the map is located and where we currently are. Spot **landmarks that you could recognize**.



PART IV: NAVIGATION

- Here is an overview what you see in your nose gunner's position (LCtrl+C). Recognize anything familiar?



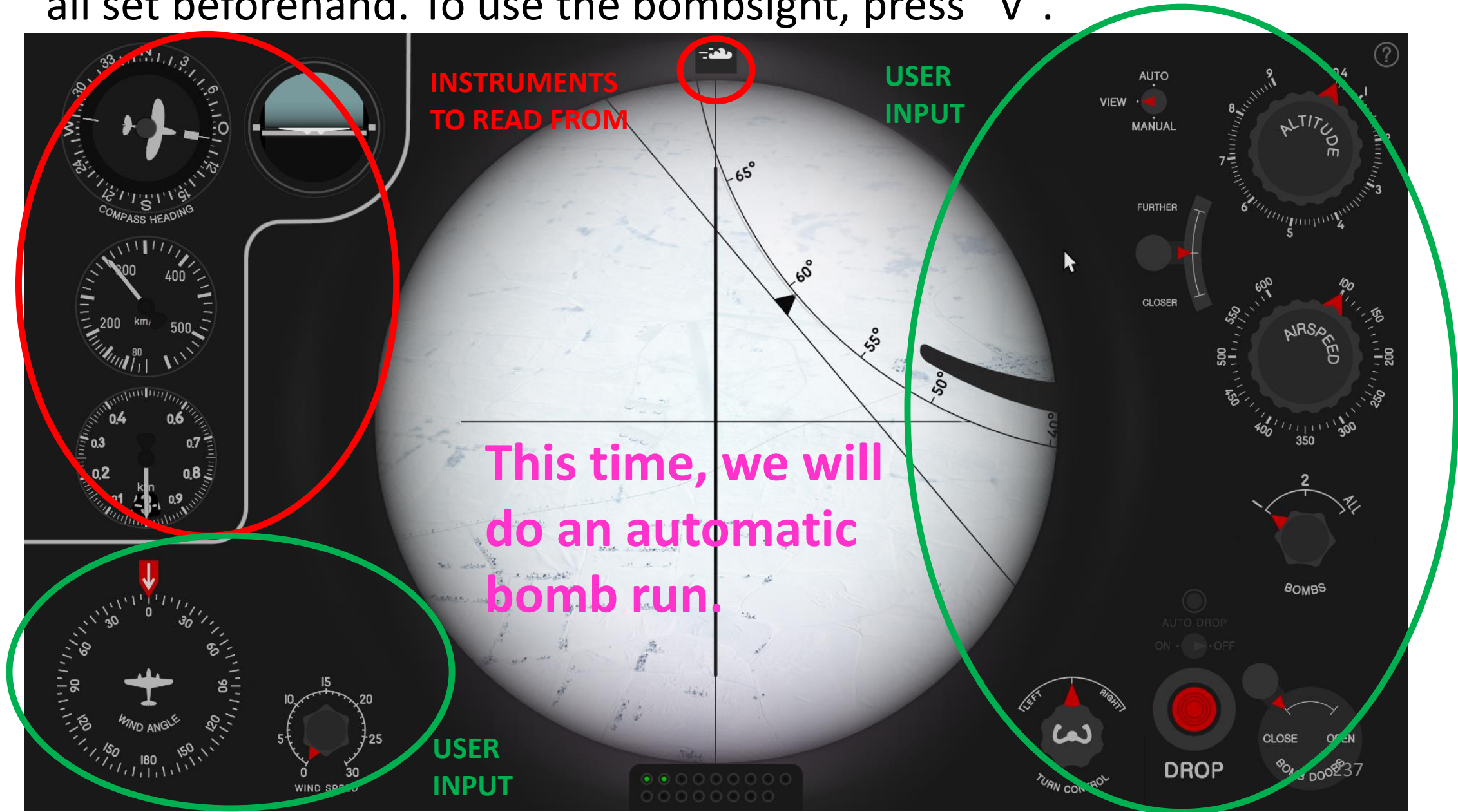
PART IV: NAVIGATION

- Here is an external view. So? Aaaah, yes, it all comes together now, does it? Let's turn a bit and try to find our target using the bombsight.



PART IV: BOMB RUN

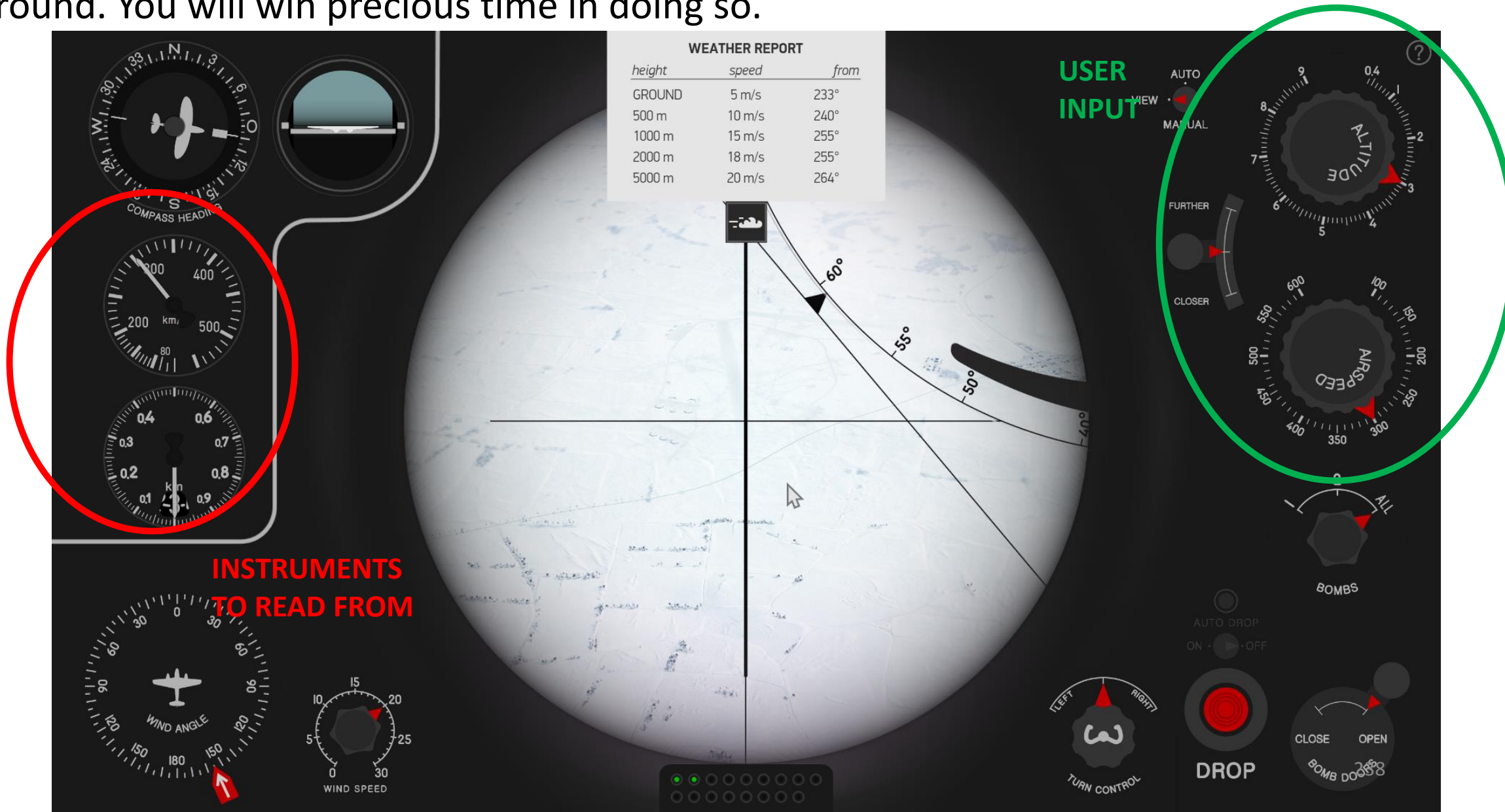
- Now comes the toughest part: understanding the bombsight and using it properly. It requires a lot of preparation, so make sure you are all set beforehand. To use the bombsight, press “V”.



PART IV: BOMB RUN

Engage the level-auto-pilot (LAlt + A) and enter speed and altitude.

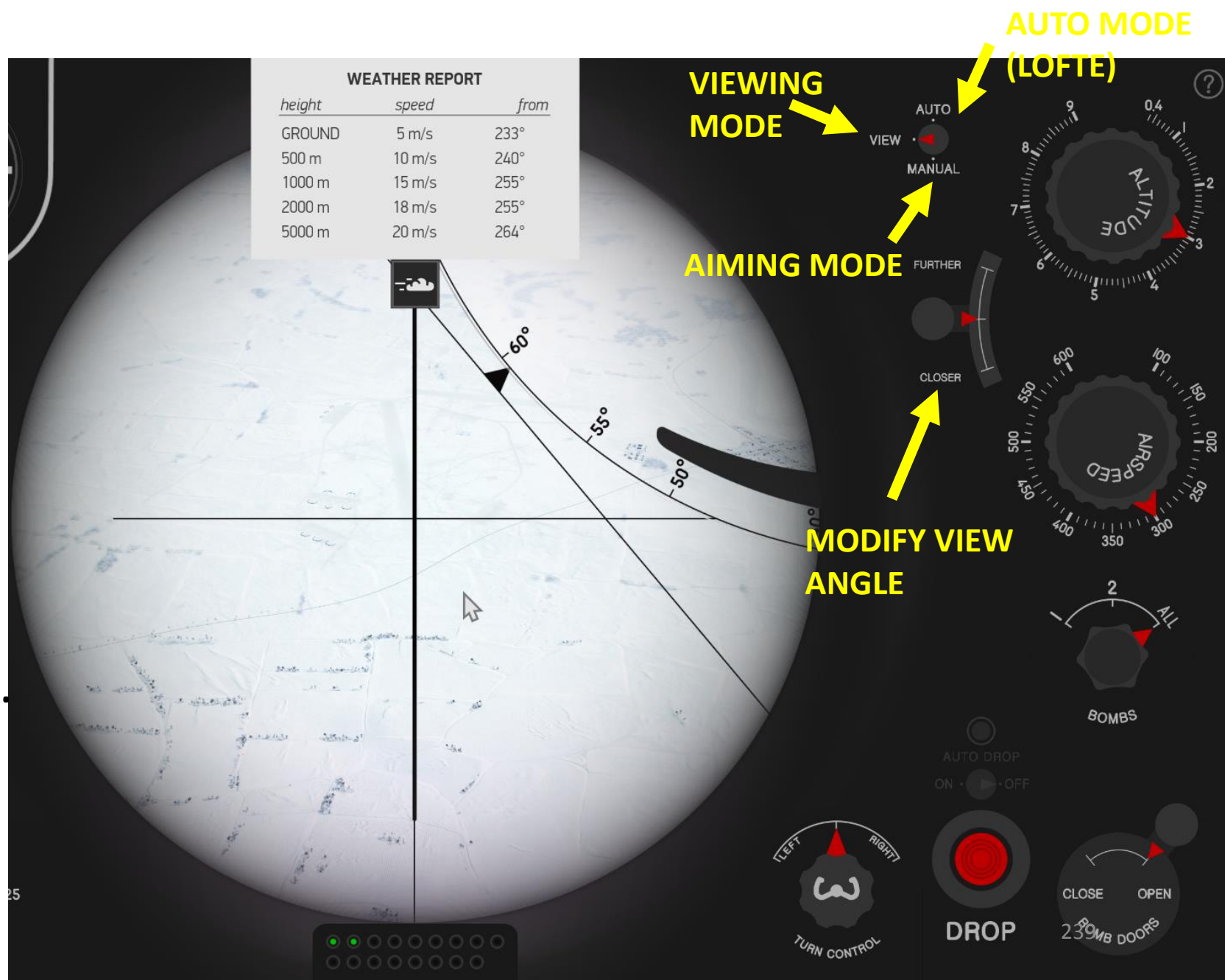
Tip: decide your speed and bombing altitude beforehand and set your bombsight on the ground. You will win precious time in doing so.



PART IV: BOMB RUN

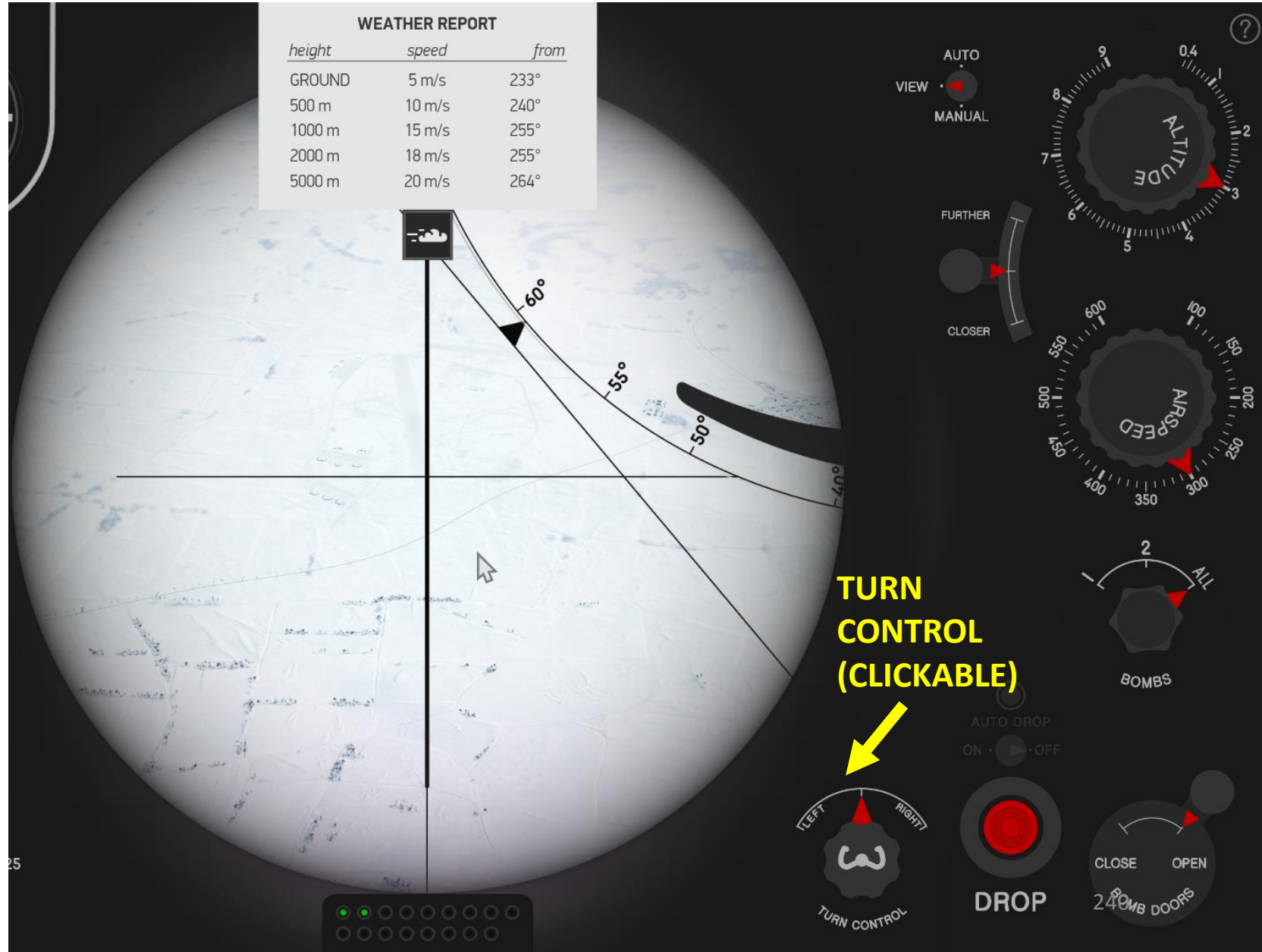
- 2) Choose the bombsight “View Mode” by clicking on it and change your view angle to where you can see farther in front of you. You can hold left mouse btn to change angle smoothly.

We see the runway and we are pretty much lined up on it.



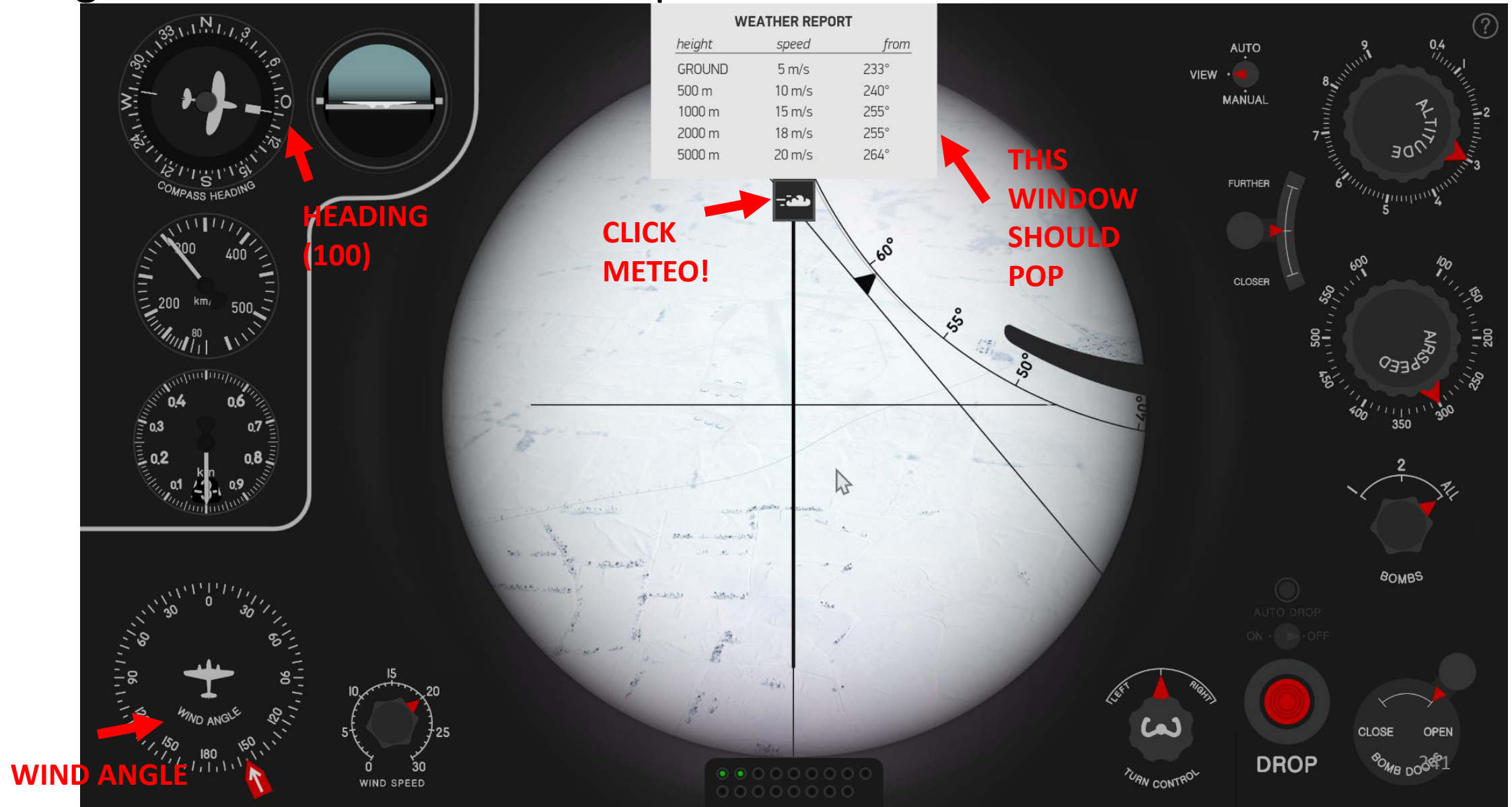
PART IV: BOMB RUN

3) Steer your aircraft using the turn control (Lshift Z = LEFT, Lshift X = RIGHT) to make corrections. Your aircraft will swing left and right, This is normal. Just make sure your sight is aiming straight for your target.



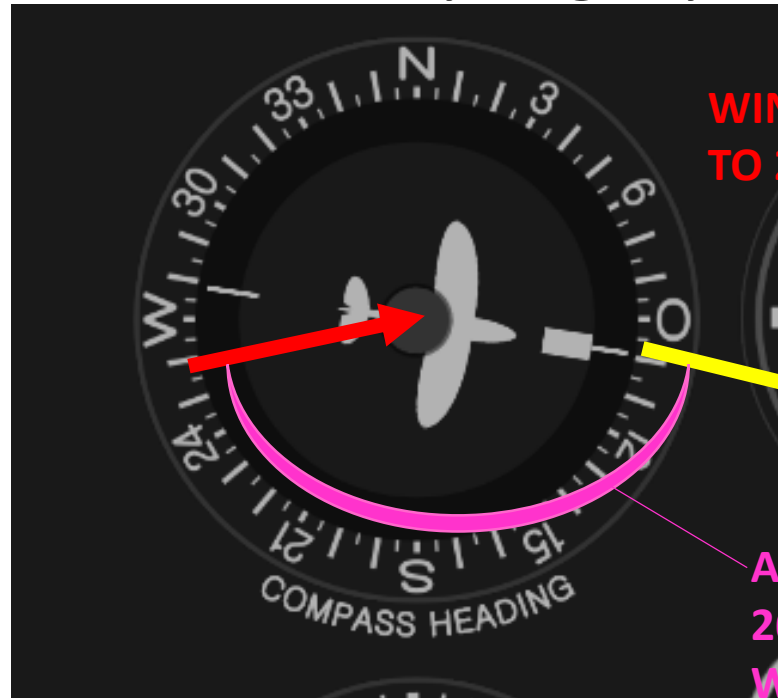
PART IV: BOMB RUN

- About 1 minute before bomb run, check for wind correction by consulting meteo conditions... Once again, you can do this on the ground beforehand and win precious time.



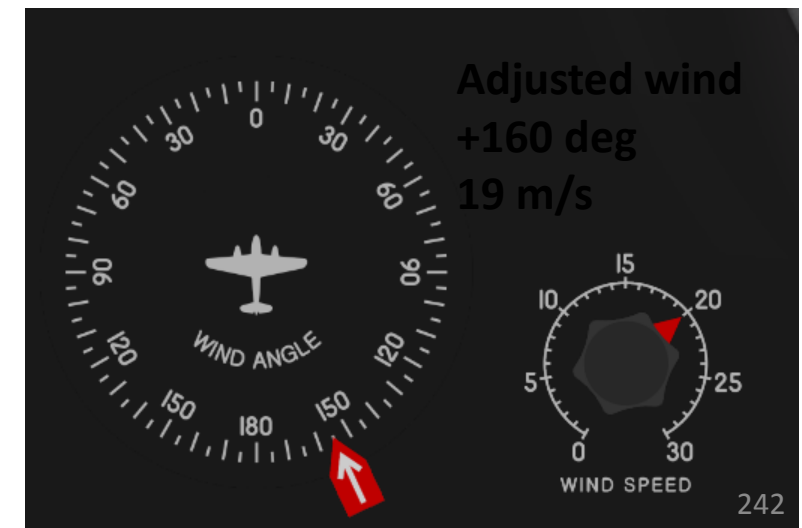
PART IV: BOMB RUN

- Here is how you get your wind angle.



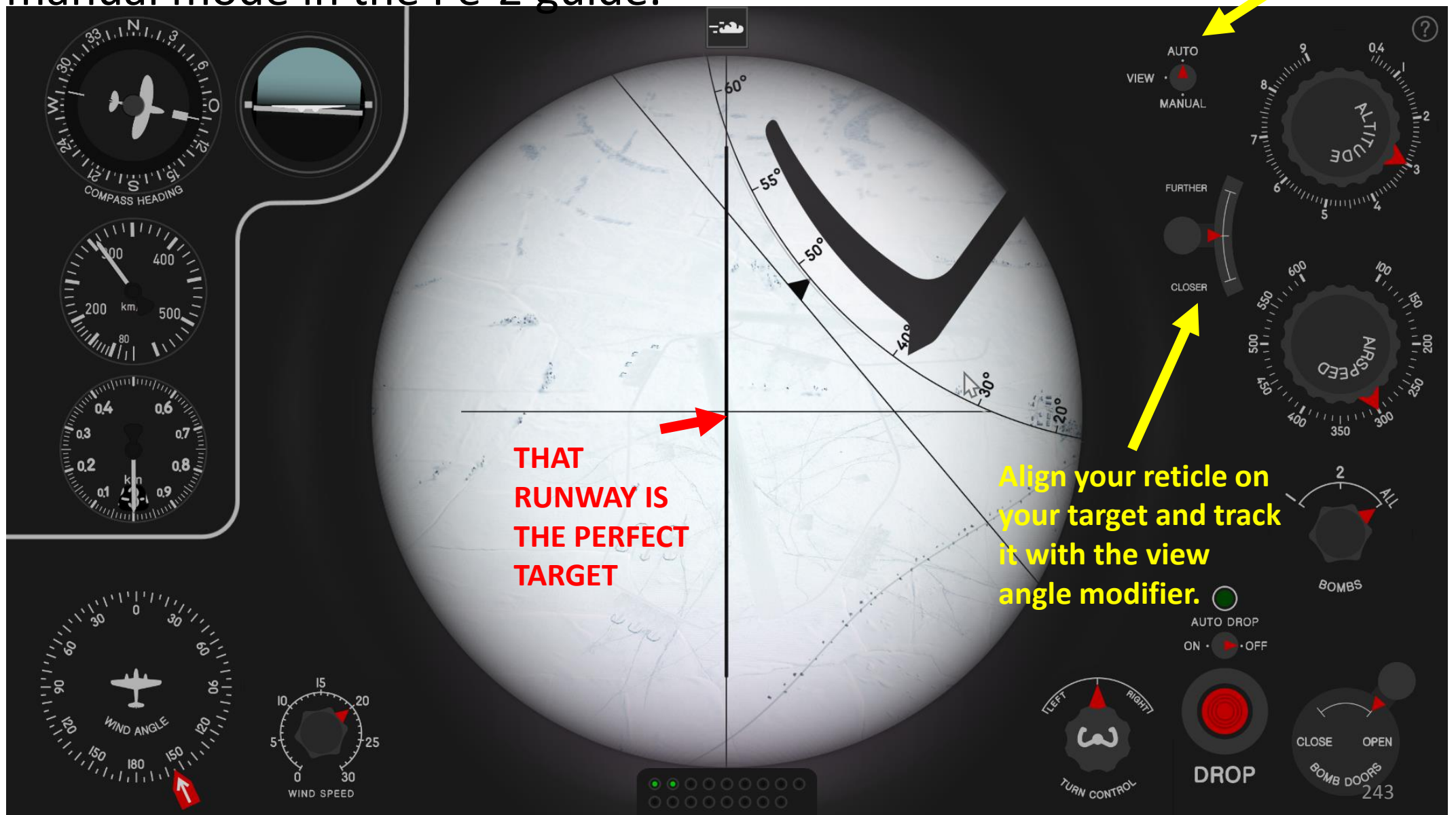
height	speed	from
GROUND	5 m/s	233°
500 m	10 m/s	240°
1000 m	15 m/s	255°
2000 m	18 m/s	255°
5000 m	20 m/s	264°

At 3000 m, it is reasonable to
predict a wind from approx. 260
deg for a speed of 19 m/s.



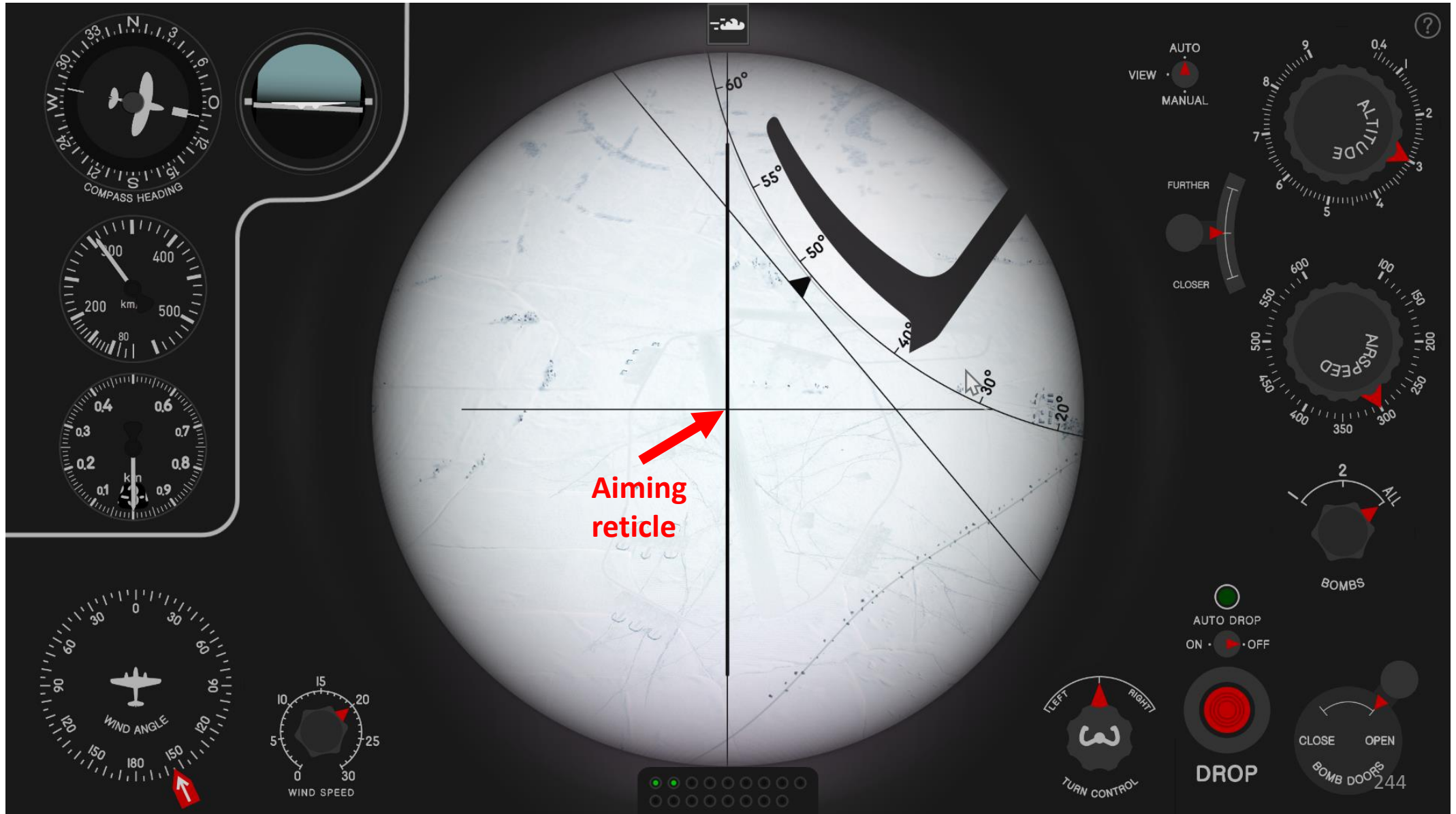
PART IV: BOMB RUN

- Find your target using your view mode. Once it's done, we will engage the LOFTE Auto mode as we did the manual mode in the Pe-2 guide.

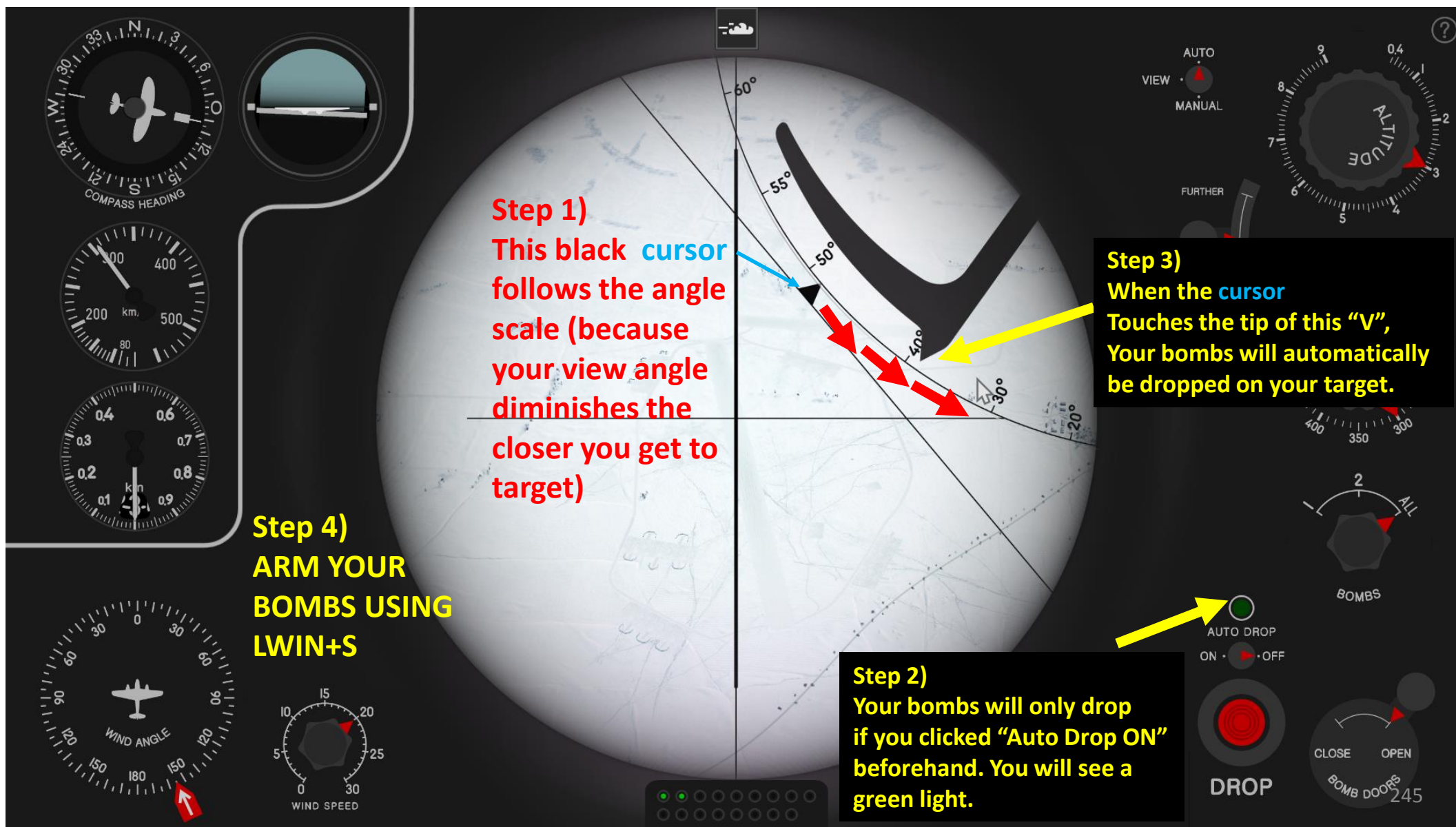


PART IV: BOMB RUN

- Now, here is the tricky part. Auto mode basically tracks a point that you set with your auto-pilot (steering left and right) AND with your view angle modifier. Your sight will not move ONLY if your altitude and speed are the same as you have entered in the bombsight. If your sight drifts in auto mode, check your inputs and steer your aircraft with the auto-pilot. Now, you need to know how to tell the bombsight to drop your ordnance on the point you set while being in Auto Mode.

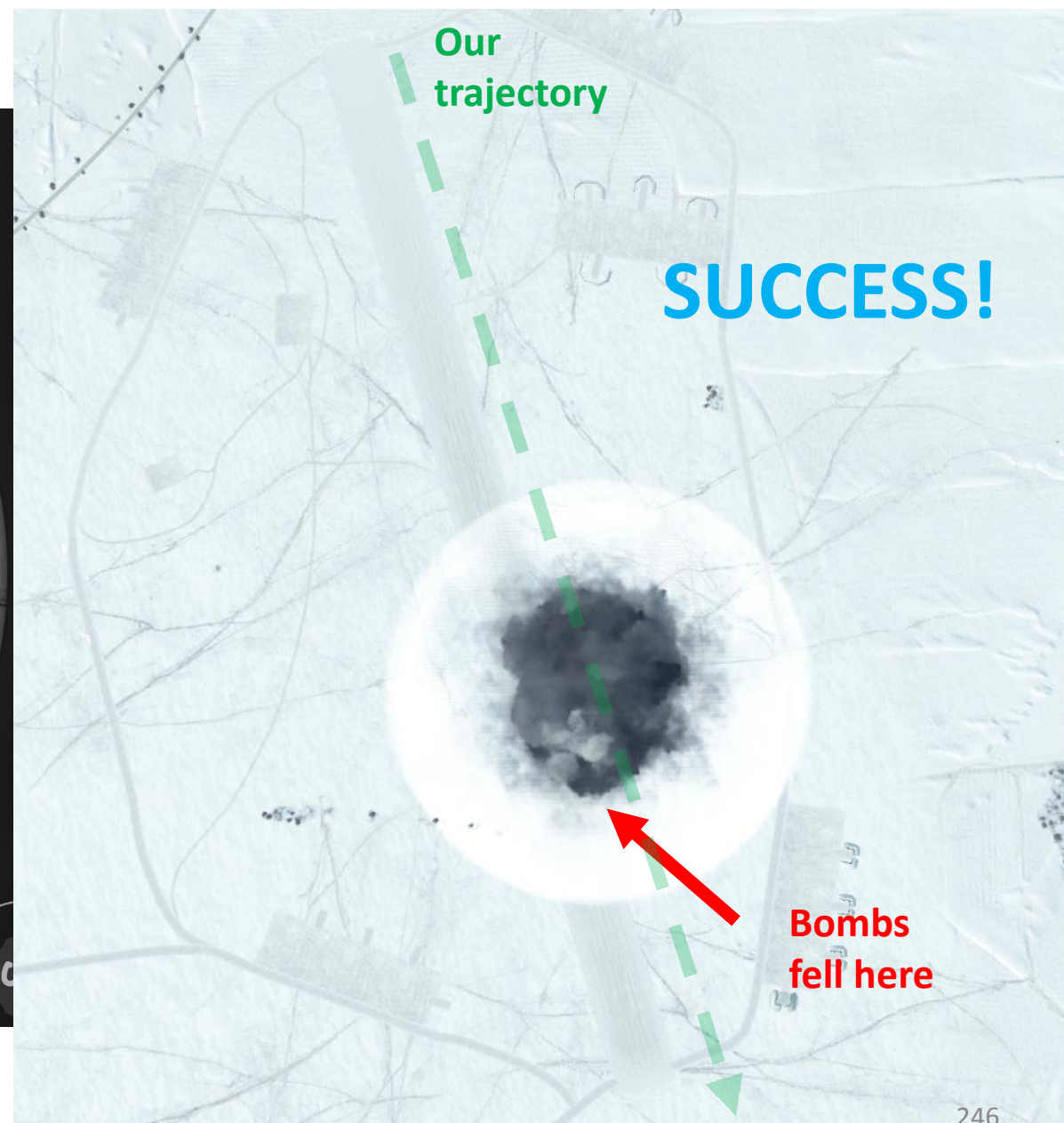
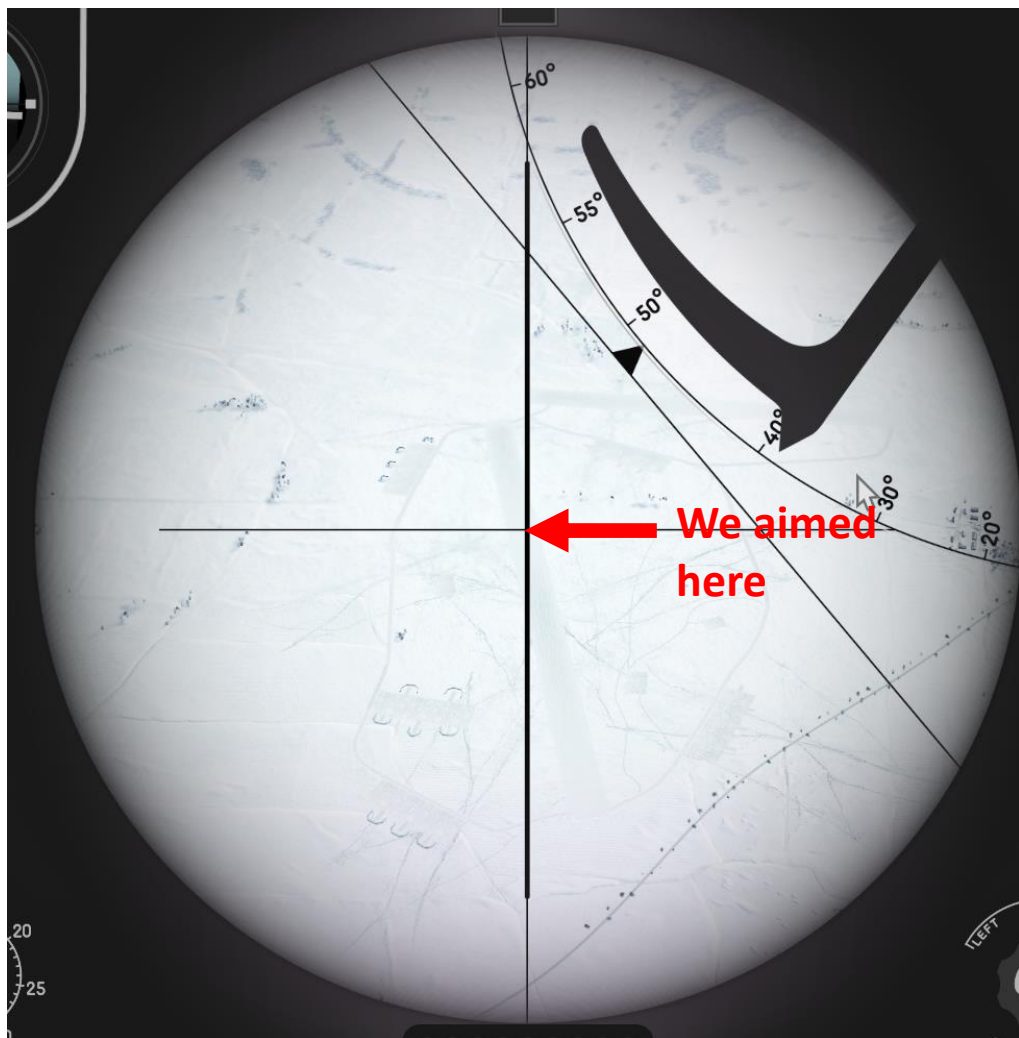


PART IV: BOMB RUN



PART IV: BOMB RUN

- Not bad for a 19 m/s crosswind at 3000 m, eh?



PART IV: BOMB RUN

- I'm afraid the guys below didn't quite appreciate all the effort we put into it. That was to be expected.



PART V: LANDING

- 1) Deploy landing gear when going slower than 300 kph.
- 2) Max RPM, throttle as required to maintain approach speed at 200 kph.
- 3) Deploy full flaps.
- 4) Touchdown at 140-150 kph.



PART V: LANDING

- 5) Pull your stick back to keep the tailwheel down.
- 6) Tap your toe brakes until you come to a full stop.
- 7) Home sweet home.



PART V: LANDING

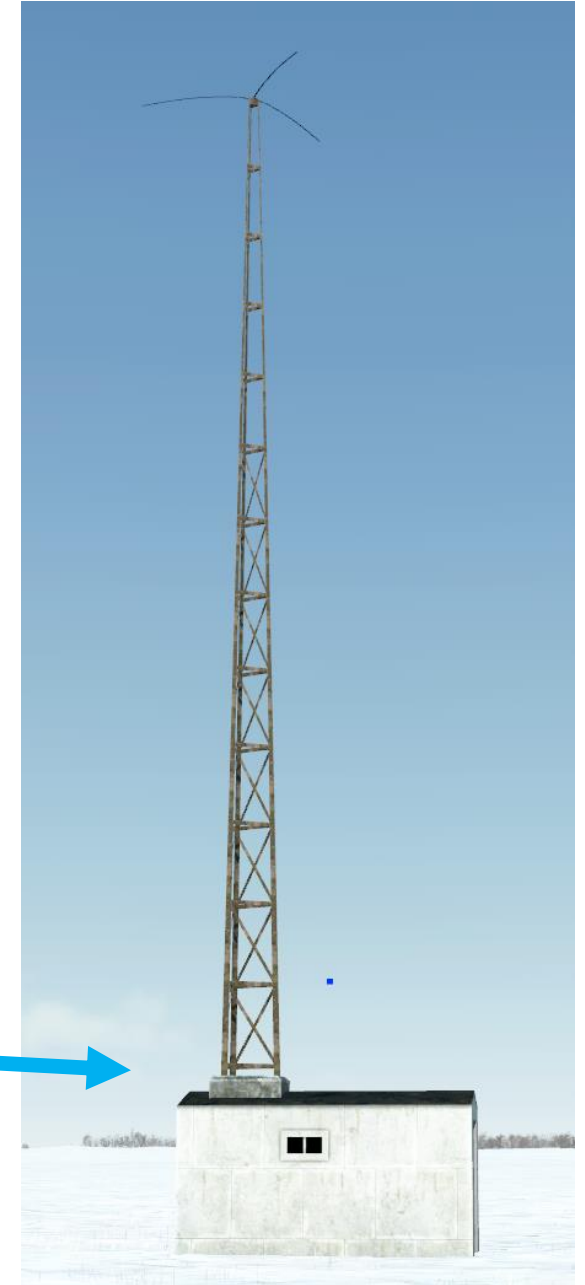
Blind Approach Tutorial

This needle displays intensity of beacon signal (currently fixed position)
In reality, it is the distance to the beacon, or in other words the intensity of the signal.

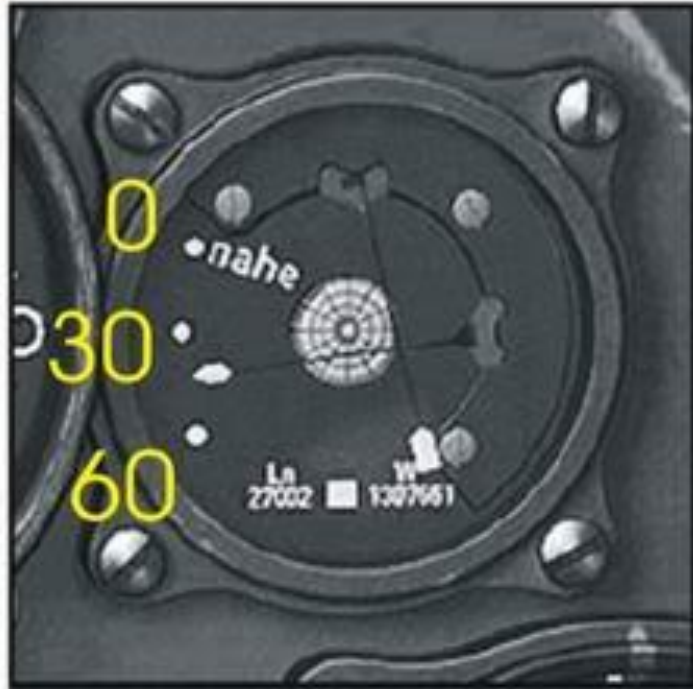


This needle displays your orientation in relationship to the beacon

Beacon



Blind Approach Tutorial



AFN-2 Radio Beacon Indicator

Ln.27002

Vertical needle indicates course deflection

Horizontal needle indicates distance to selected VOR station.

Indicated range: 60 – 0 nautical miles

PART V: LANDING

Blind Approach Tutorial

