DCS GUIDE

P-47D THUNDERBOLT

BY CHUCK

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

The **Republic P-47 Thunderbolt** was a World War II-era fighter aircraft produced by the American aerospace company Republic Aviation from 1941 through 1945. Its primary armament was eight .50-caliber machine guns, and in the fighter-bomber ground-attack role it could carry five-inch rockets or a bomb load of 2,500 pounds. When fully loaded, the P-47 weighed up to eight tons, making it one of the heaviest fighters of the war. The P-47 was designed around the powerful Pratt & Whitney R-2800 Double Wasp engine, which was also used by two U.S. Navy/U.S. Marine Corps fighters, the Grumman F6F Hellcat and the Vought F4U Corsair. The Thunderbolt was effective as a short-to medium-range escort fighter in high-altitude air-to-air combat and ground attack in both the European and Pacific theaters.

Originally known as the Seversky Aircraft Company, the Republic Aviation Corporation was an American aircraft manufacturer based in Farmingdale, New York, on Long Island. By April 1939, the Seversky Aircraft Corporation had lost $550,000, and Seversky was forced out of the company he had founded back in 1931. The board, led by financier Paul Moore, voted W. Wallace Kellett to replace him as president, and in September 1939, the company was reorganized as the Republic Aviation Corporation.

The P-47 Thunderbolt itself was designed by Alexander Kartveli, a man of Georgian descent. It was to replace the Seversky P-35 developed earlier by a Russian immigrant named Alexander P. de Seversky. Both had fled from their homeland, Tbilisi, in Georgia to escape the Bolsheviks. The stories of Kartveli and Seversky are very interesting and deserve much more than a mere paragraph.

Seversky P-35

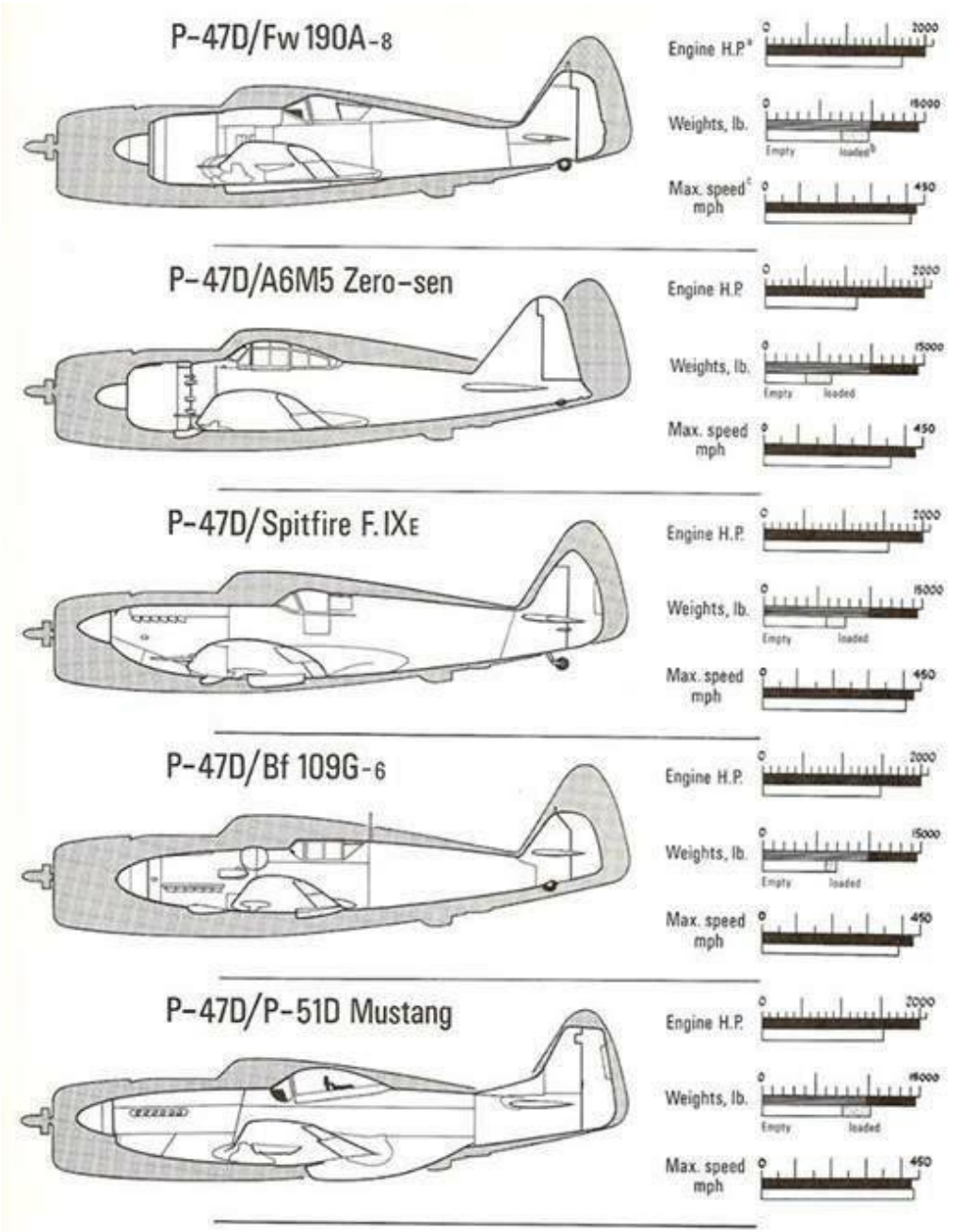
Alexander Kartveli
(1896-1974)

Alexander P. de Seversky
(1894-1974)

In 1939, Republic Aviation designed the AP-4 demonstrator powered by a Pratt & Whitney R-1830 radial engine with a belly-mounted turbocharger. A small number of Republic P-43 Lancers were built but Republic had been working on an improved P-44 Rocket with a more powerful engine, as well as on the AP-10 fighter design. The latter was a lightweight aircraft powered by the Allison V-1710 liquid-cooled V-12 engine and armed with two .50 in M2 Browning machine guns mounted in the nose and four .30 in M1919 Browning machine guns mounted in the wings The United States Army Air Corps (USAAC) backed the project and gave it the designation XP-47. One thing that is absolutely incredible is the fact that it only took 9 months between the beginning of the design phase until the prototype's first flight... with slide rules and tracing paper. By today's standards, this design cycle can last 10 to 15 years.

In the spring of 1940, Republic and the USAAC concluded that the XP-44 and the XP-47 prototypes were inferior to Luftwaffe fighters. Republic tried to improve the design, proposing the XP-47A but this failed. Kartveli then designed a much larger fighter, which was offered to the USAAC in June 1940. The Air Corps ordered a prototype in September as the XP-47B. The XP-47A, which had little in common with the new design, was abandoned. The XP-47B was of all-metal construction (except for the fabric-covered tail control surfaces) with elliptical wings, with a straight leading edge that was slightly swept back. The air-conditioned cockpit was roomy and the pilot's seat was comfortable—"like a lounge chair", as one pilot later put it. Though the XP-47B had its share of teething troubles, the newly reorganized United States Army Air Forces placed an order for 171 production aircraft, the first being delivered in December 1941.

By the end of 1942, P-47Cs were sent to England for combat operations. The initial Thunderbolt flyers, 56th Fighter Group, was sent overseas to join the 8th Air Force. As the P-47 Thunderbolt worked up to operational status, it gained a nickname: the "Jug" (because its profile was similar to that of a common milk jug of the time). The P-47, when compared to other fighters of the time, was massive and fitted with a very powerful engine. While heavy, it was a superb firing platform and could attain very high speeds when diving. Within capable hands, this aircraft was deadly.



Notes
(a) The figure used in each case is horse-power available for take-off.
(b) External stores not included in loaded weight
(c) Max. speed quoted at the following altitudes: P-47, 30,000 ft.; Fw190A-8, 20,800 ft.; A6M5, 22,000 ft.; Spitfire IX, 27,500 ft.; Bf109G-6, 22,600 ft.; P-51D, 25,000 ft.
In each diagram the bar adjoining the scale indicates figure for P-47.

The first P-47 combat mission took place 10 March 1943 when the 4th FG took their aircraft on a fighter sweep over France. The mission was a failure due to radio malfunctions. All P-47s were refitted with British radios, and missions resumed 8 April. The first P-47 air combat took place 15 April 1943.

By mid-1943, the Jug was also in service with the 12th Air Force in Italy and against the Japanese in the Pacific, with the 348th Fighter Group flying missions out of Port Moresby, New Guinea. By 1944, the Thunderbolt was in combat with the USAAF in all its operational theaters except Alaska.

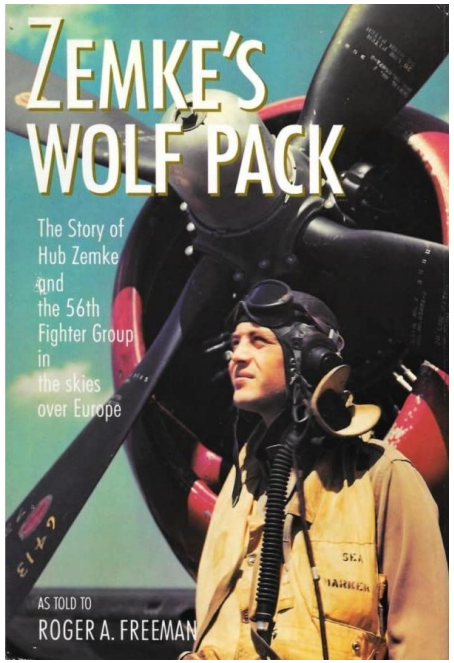
Luftwaffe ace Heinz Bär said that the P-47 "could absorb an astounding amount of lead [from shooting at it] and had to be handled very carefully". Although the North American P-51 Mustang replaced the P-47 in the long-range escort role in Europe, the Thunderbolt still ended the war with 3,752 air-to-air kills claimed in over 746,000 sorties of all types, at the cost of 3,499 P-47s to all causes in combat. By the end of the war, the 56th FG was the only 8th Air Force unit still flying the P-47, by preference, instead of the P-51.

With increases in fuel capacity as the type was refined, the range of escort missions over Europe steadily increased until the P-47 was able to accompany bombers in raids all the way into Germany. On the way back from the raids, pilots shot up ground targets of opportunity, and also used belly shackles to carry bombs on short-range missions, which led to the realization that the P-47 could perform a dual-function on escort missions as a fighter-bomber. Even with its complicated turbosupercharger system, its sturdy airframe and tough radial engine could absorb a lot of damage and still return home.

The P-47 gradually became the USAAF's primary fighter-bomber, by late 1943, early versions of the P-47D carrying 500 lbs bombs underneath their bellies, mid production versions of the P-47D could carry 1000 lbs bombs and M8 4.5 in (115 mm) rockets under their wings or from the last version of the P-47D in 1944, 5 in (127 mm) High velocity aircraft rockets (HVARs, also known as "Holy Moses"). From D-Day until VE day, Thunderbolt pilots claimed to have destroyed 86,000 railroad cars, 9,000 locomotives, 6,000 armored fighting vehicles, and 68,000 trucks. During Operation Cobra, in the vicinity of Roncey, P-47 Thunderbolts of the 405th Fighter group destroyed a German column of 122 tanks, 259 other vehicles, and 11 artillery pieces.

Famous Thunderbolt aces include Lieutenant Colonel Francis S. “Gabby” Gabreski (28 victories), Captain Robert S. Johnson (27 victories) and 56th FG Commanding Officer Colonel Hubert “Hub” Zemke (17.75 victories). All of them have fascinating stories. Despite being the sole remaining P-47 group in the 8th Air Force, the 56th FG remained its top-scoring group in aerial victories throughout the war.

Francis S. Gabreski
(1919-2002)



Hubert Zemke
(1914-1994)

Robert S. Johnson
(1920-1998)

After World War II, Republic continued creating aircraft such as the F-84 family (F-84F Thunderstreak, RF-84F Thunderflash) and the F-105 Thunderchief. Eventually, Republic Aviation was acquired by Fairchild in 1965. Interestingly, the Fairchild Republic A-10 Warthog (designated “Thunderbolt II”) is the direct descendant of the P-47. Both aircraft are large, sturdy and pack a real punch… “Flying Tanks” as one would call them.

During the fall of 1987, Fairchild Corporation (then Republic's parent company) destroyed Republic's corporate archives. Joshua Stoff, the curator of the Cradle of Aviation Museum on Long Island, wrote in Air & Space Magazine that, upon being invited to have a last look at the archives, he surreptitiously took one document with him. That lone surviving document was a contract for 225 P-47Bs from Republic for the US Army Air Corps at a cost of $16,275,657.50 (War Department Contract #15850, dated September 13, 1940) is now housed at the museum.

This ~~unbelievably stupid~~ decision to destroy Republic’s archives makes the DCS P-47 very special for me since it’s a plane that has been literally brought back from the dead. In my humble opinion, Eagle Dynamics hasn’t only created a mere piece of software… they have created an almost living and breathing virtual museum about one of the most precious parts of aviation history: the mighty Thunderbolt.

I hope you enjoy reading this guide as much as I enjoyed writing it. The “Jug” is an aircraft that will send shivers down your spine whenever you strafe trains or ground targets. Whether you want to fly up there with the bombers or down low with the flak and tracers, the P-47 is a very versatile aircraft that just screams American Muscle in every aspect of its design. The whirl of the turbosupercharger, the roar of the radial engine, the clanking of the machineguns… all of these sounds still inexplicably bring a silly, satisfied grin on my face… Every. Single. Time. Happy flying!

WHAT YOU NEED MAPPED

Note: Bindings in blue are for the P-47D-30 Early Variant Only.

+ TOE BRAKES (MAPPED ON PEDALS)

WHAT YOU NEED MAPPED

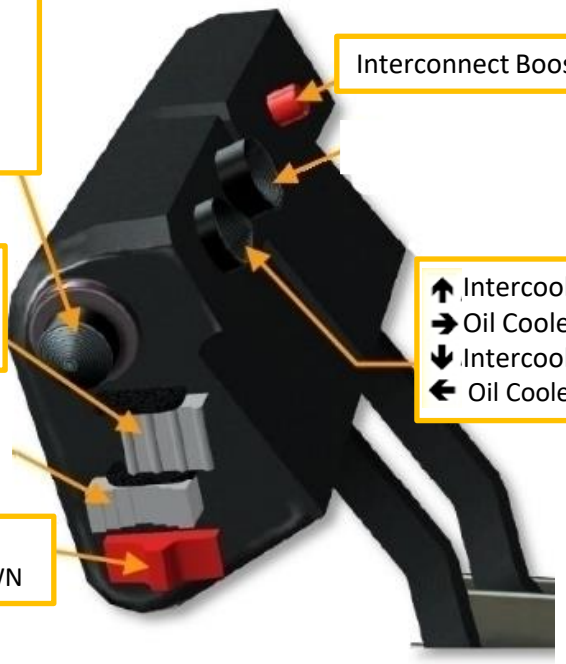
Boost (B) - Analog Turbosupercharger Lever

Throttle Lever

Landing Flaps EXTEND (Hold) / NEUTRAL (Release)
Landing Flaps RETRACT (Hold) / NEUTRAL (Release)

↑
→ COMM – Push-to-Talk (RALT+ \)
↓
←
P

Interconnect Boost Lever to Throttle (Toggle)

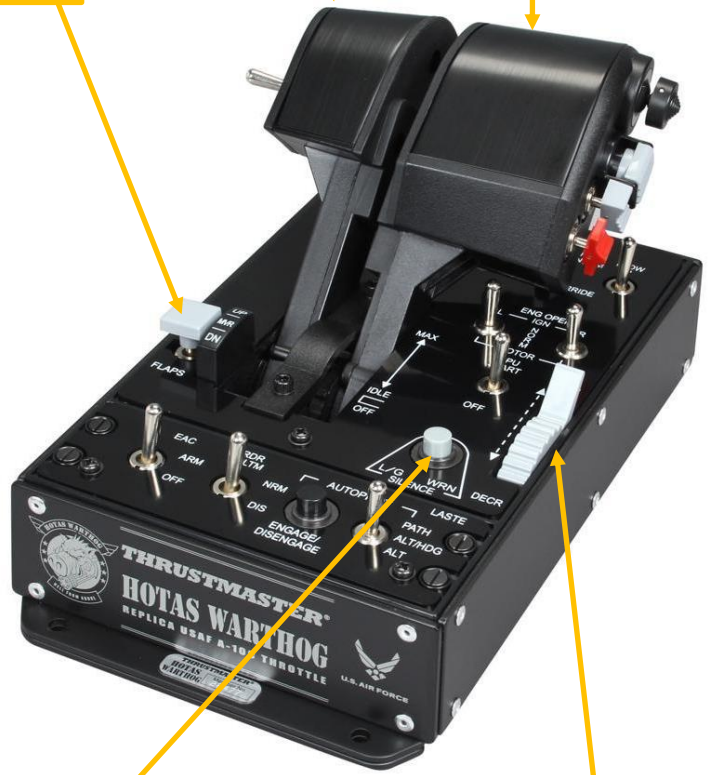


← Mixture IDLE CUTOFF

→ Mixture AUTO RICH

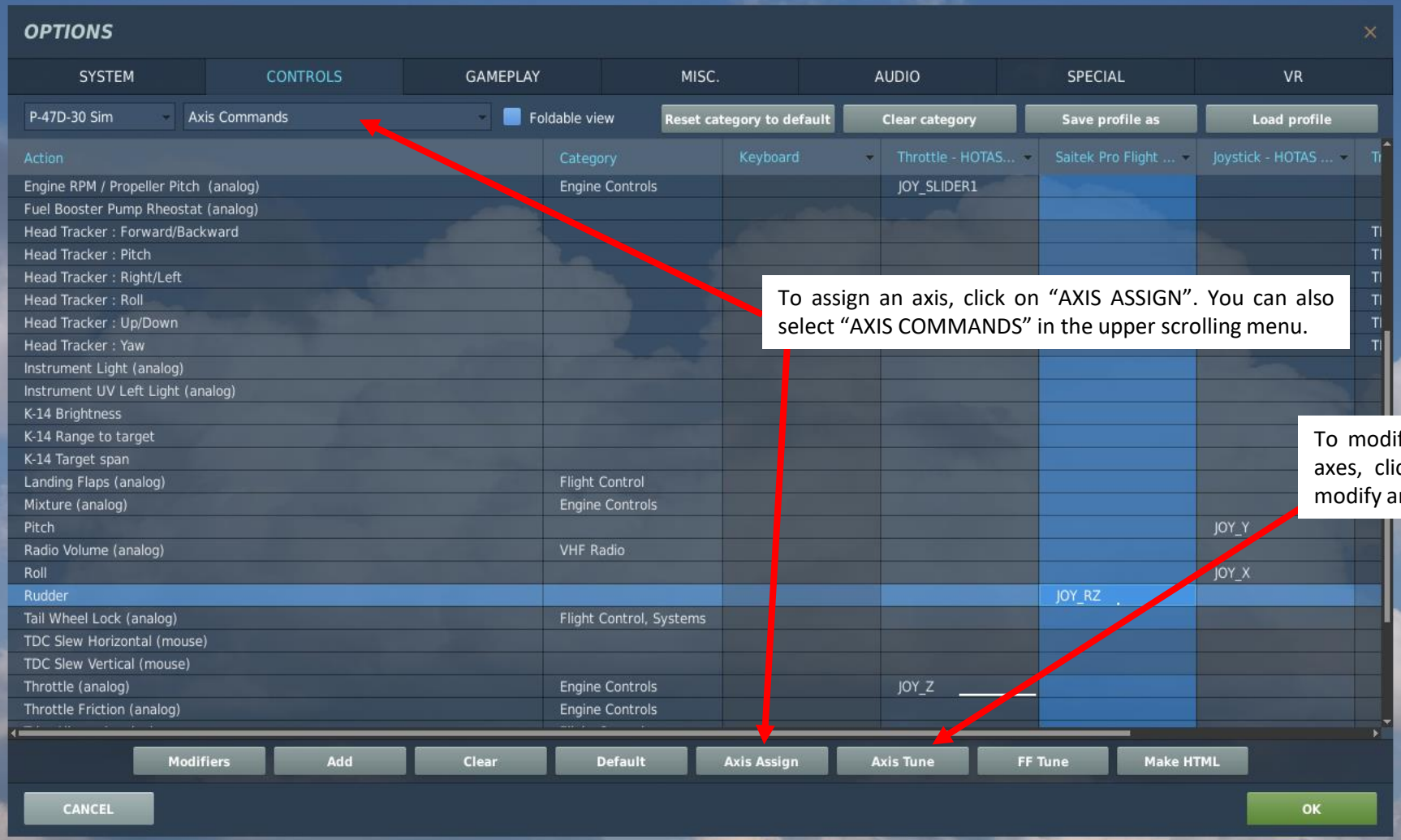
↑ Intercooler Shutter OPEN
→ Oil Cooler Shutter OPEN
↓ Intercooler Shutter CLOSE
← Oil Cooler Shutter CLOSE

← Compressibility Recovery Flaps - UP
→ Compressibility Recovery Flaps - DOWN



Undercarriage (Landing Gear) - Toggle

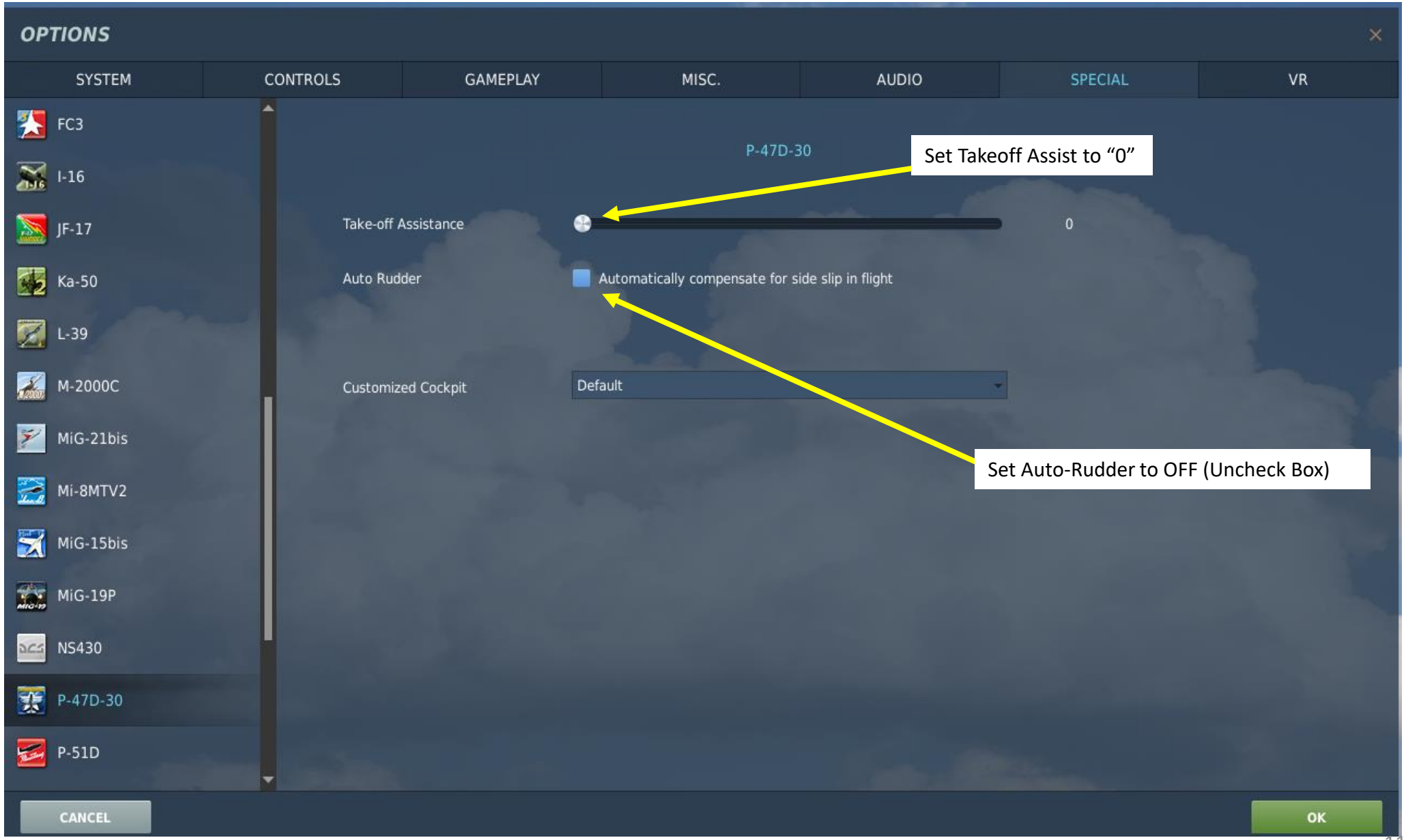
Engine RPM (P) / Propeller Pitch Lever



To assign an axis, click on “AXIS ASSIGN”. You can also select “AXIS COMMANDS” in the upper scrolling menu.

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

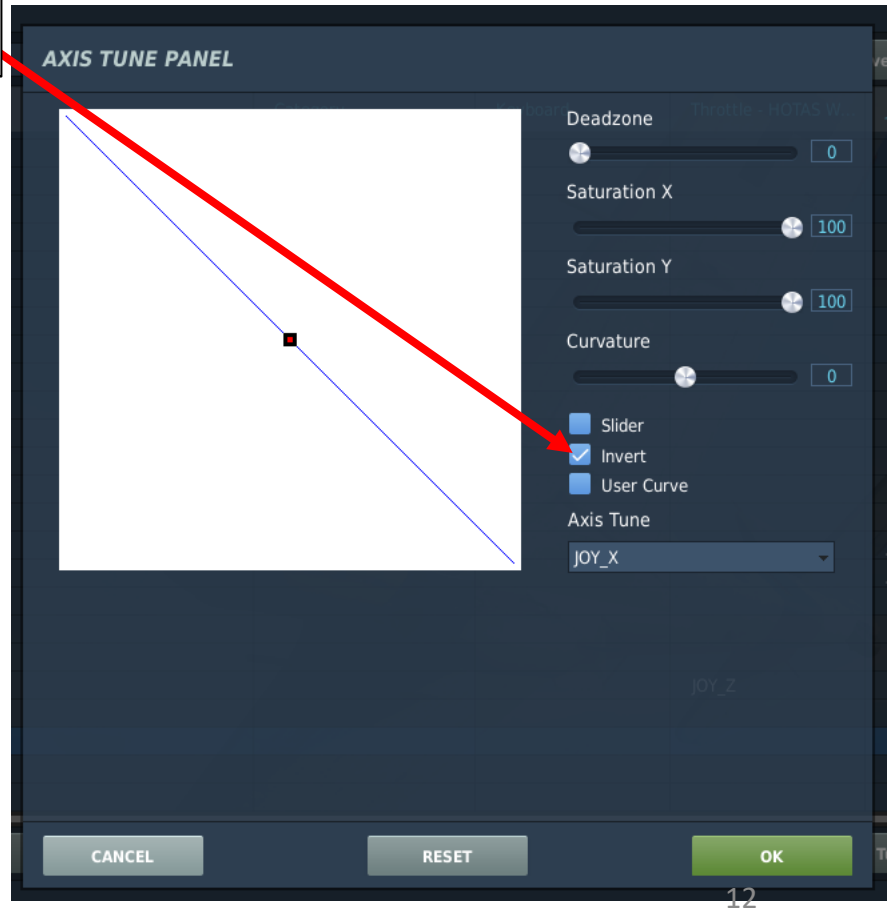
In the “Special” menu in Options, select the P-47D-30 menu. Make sure to have Takeoff Assist set to “0” (turned off). By default it is set to 100 (ON). This will cause you to crash and burn inexplicably during takeoff. Also uncheck the Auto-Rudder box.



Bind the following axes:

- Pitch, Roll, Rudder (Deadzone at 0, Saturation X at 100, Saturation Y at 100, Curvature at 0)
- Throttle – Controls Manifold Pressure
- Engine RPM / Propeller Pitch (P)
- Boost (B) – Controls Turbosupercharger
- Wheel Brake Left
- Wheel Brake Right

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

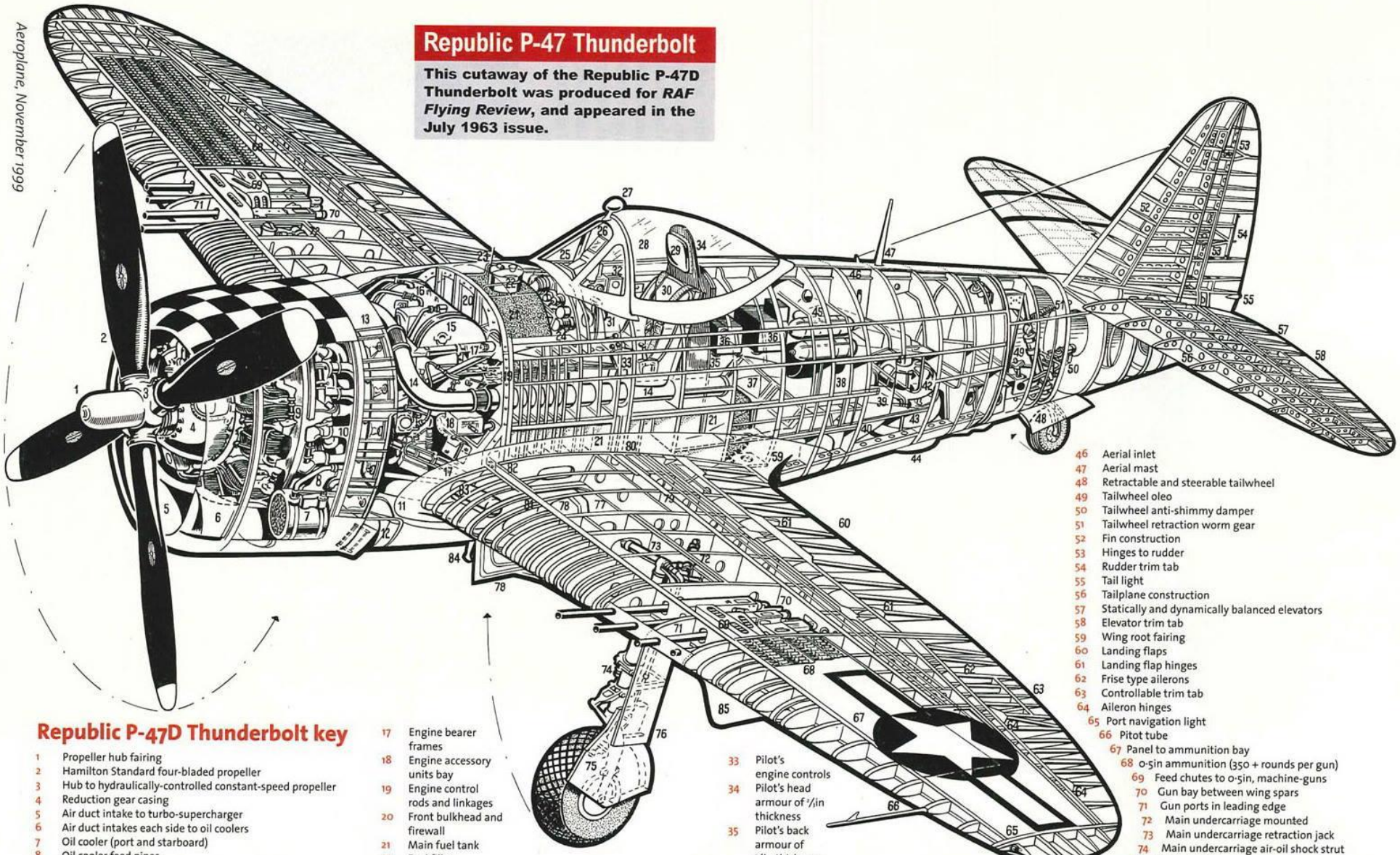



NO
HAND HOLD
LDG WARNING
LIGHT
FLAP WARNING
WARNING: DO NOT
OPEN COWL FLAPS
ABOVE 225 I.A.S
FUEL
LEVEL
WARN
LIGHT
BOMB OR TANK RELEASE
PARK BRAKE
OXYGEN
BLINKER
COWL
FLAPS
PUSH TO OPEN
PULL TO CLOSE

Aeroplane, November 1999

Republic P-47 Thunderbolt

This cutaway of the Republic P-47D Thunderbolt was produced for *RAF Flying Review*, and appeared in the July 1963 issue.



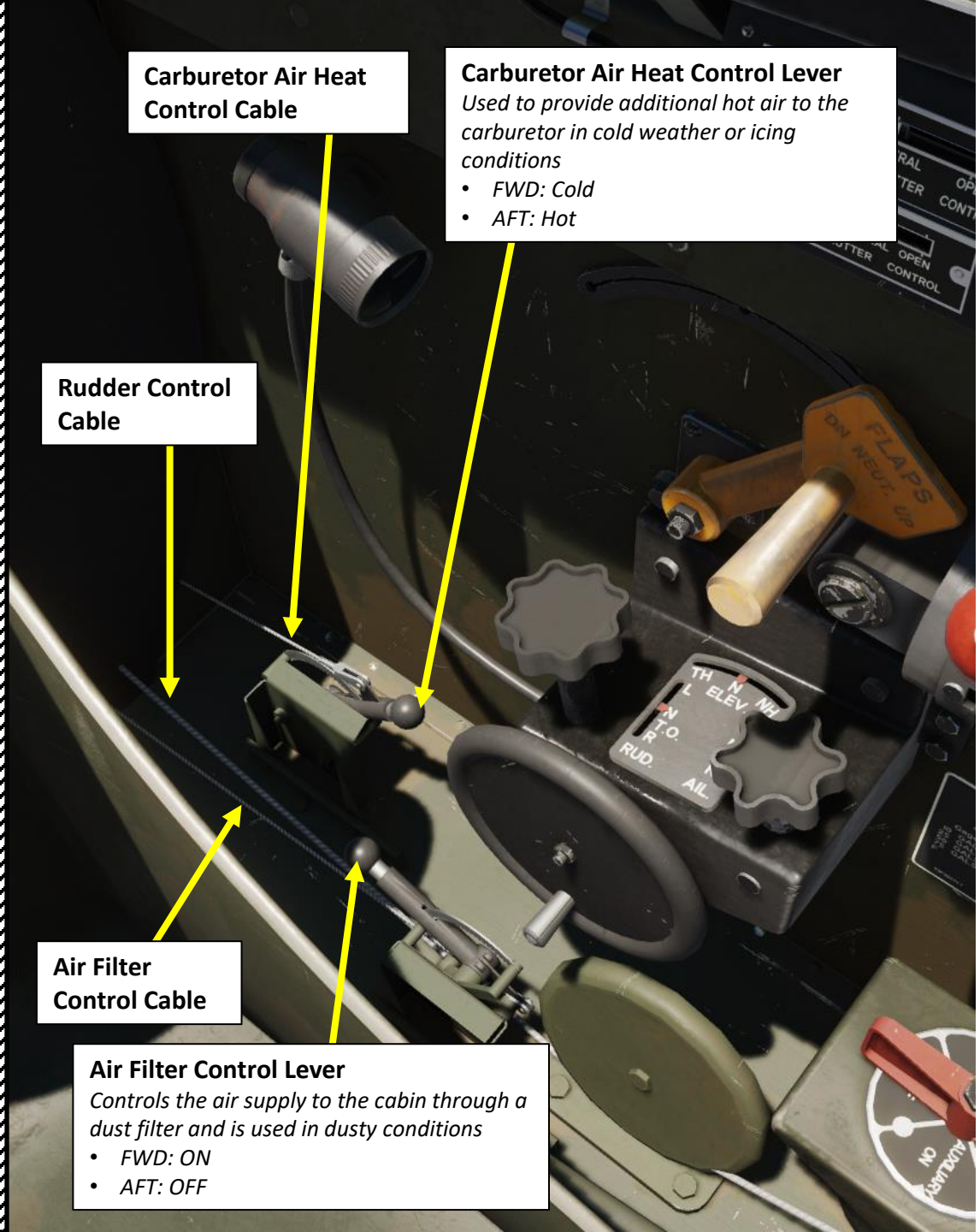
Republic P-47D Thunderbolt key

1 Propeller hub fairing
2 Hamilton Standard four-bladed propeller
3 Hub to hydraulically-controlled constant-speed propeller
4 Reduction gear casing
5 Air duct intake to turbo-supercharger
6 Air duct intakes each side to oil coolers
7 Oil cooler (port and starboard)
8 Oil cooler feed pipes
9 18-cylinder twin-row Pratt and Whitney R-2000 air-cooled radial engine
10 Exhaust outlets to collector ring
11 Exhaust gas pipe from collector ring to supercharger
12 Exhaust waste gate
13 Cooling air control flaps
14 Supercharged and cooling air feed pipe from supercharger to carburettor
15 30 US gallon water tank for water injection system
16 Feed pipes from oil tank
17 Engine bearer frames
18 Engine accessory units bay
19 Engine control rods and linkages
20 Front bulkhead and firewall
21 Main fuel tank
22 Fuel filler
23 Bead sight
24 Instrument panel
25 Windshield of 12in bullet-resistant glass
26 Gunsight
27 Rear-view mirror
28 Rearward-sliding full-vision bubble canopy
29 Pilot's headrest cushion
30 Pilot's seat and harness
31 Pilot's control column
32 Pilot's starboard control and switch panels
33 Pilot's engine controls
34 Pilot's head armour of ⅛in thickness
35 Pilot's back armour of ⅛in thickness
36 Radio transmitter and receiver packs
37 Ducting to intercooler unit
38 Intercooler
39 Intercooler cooling air exit from fuselage sides
40 Exhaust gas feed pipe to supercharger turbine
41 Air filter
42 Turbo-supercharger unit
43 Turbine
44 Flight hood
45 Oxygen bottle
46 Aerial inlet
47 Aerial mast
48 Retractable and steerable tailwheel
49 Tailwheel oleo
50 Tailwheel anti-shimmy damper
51 Tailwheel retraction worm gear
52 Fin construction
53 Hinges to rudder
54 Rudder trim tab
55 Tail light
56 Tailplane construction
57 Statically and dynamically balanced elevators
58 Elevator trim tab
59 Wing root fairing
60 Landing flaps
61 Landing flap hinges
62 Frise type ailerons
63 Controllable trim tab
64 Aileron hinges
65 Port navigation light
66 Pitot tube
67 Panel to ammunition bay
68 0·5in ammunition (350 + rounds per gun)
69 Feed chutes to 0·5in, machine-guns
70 Gun bay between wing spars
71 Gun ports in leading edge
72 Main undercarriage mounted
73 Main undercarriage retraction jack
74 Main undercarriage air-oil shock strut
75 Fork to wheel
76 Shock strut cover plate
77 Wheel well
78 Wheel cover plate
79 Rear spar
80 Rear spar/fuselage attachment
81 Front spar
82 Front spar/fuselage attachment
83 Hydraulic fluid reservoir
84 Fuel tank or war load shackles
85 Underwing pylons

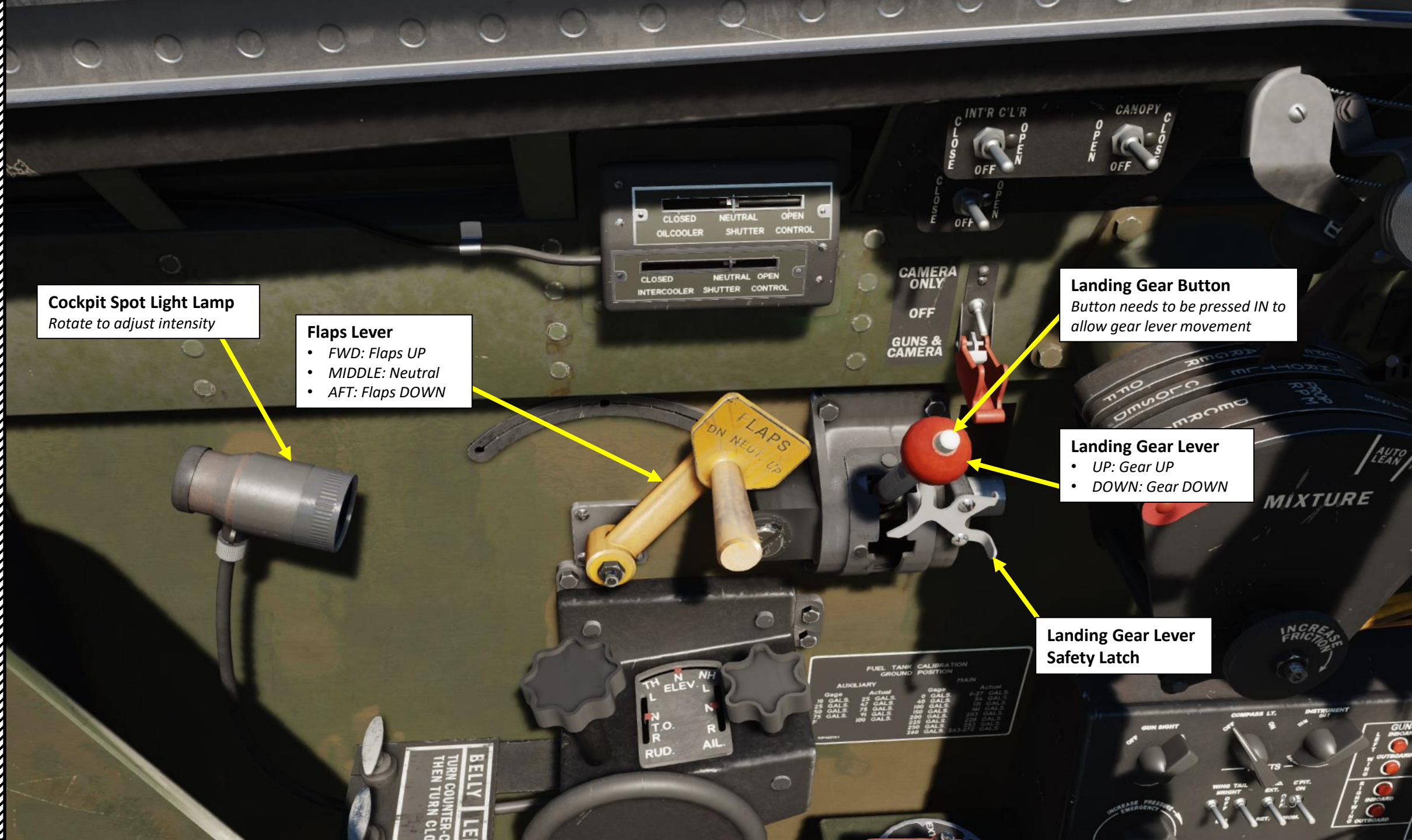
Tip: Pilot body can be toggled ON/OFF with “RSHIFT+P”

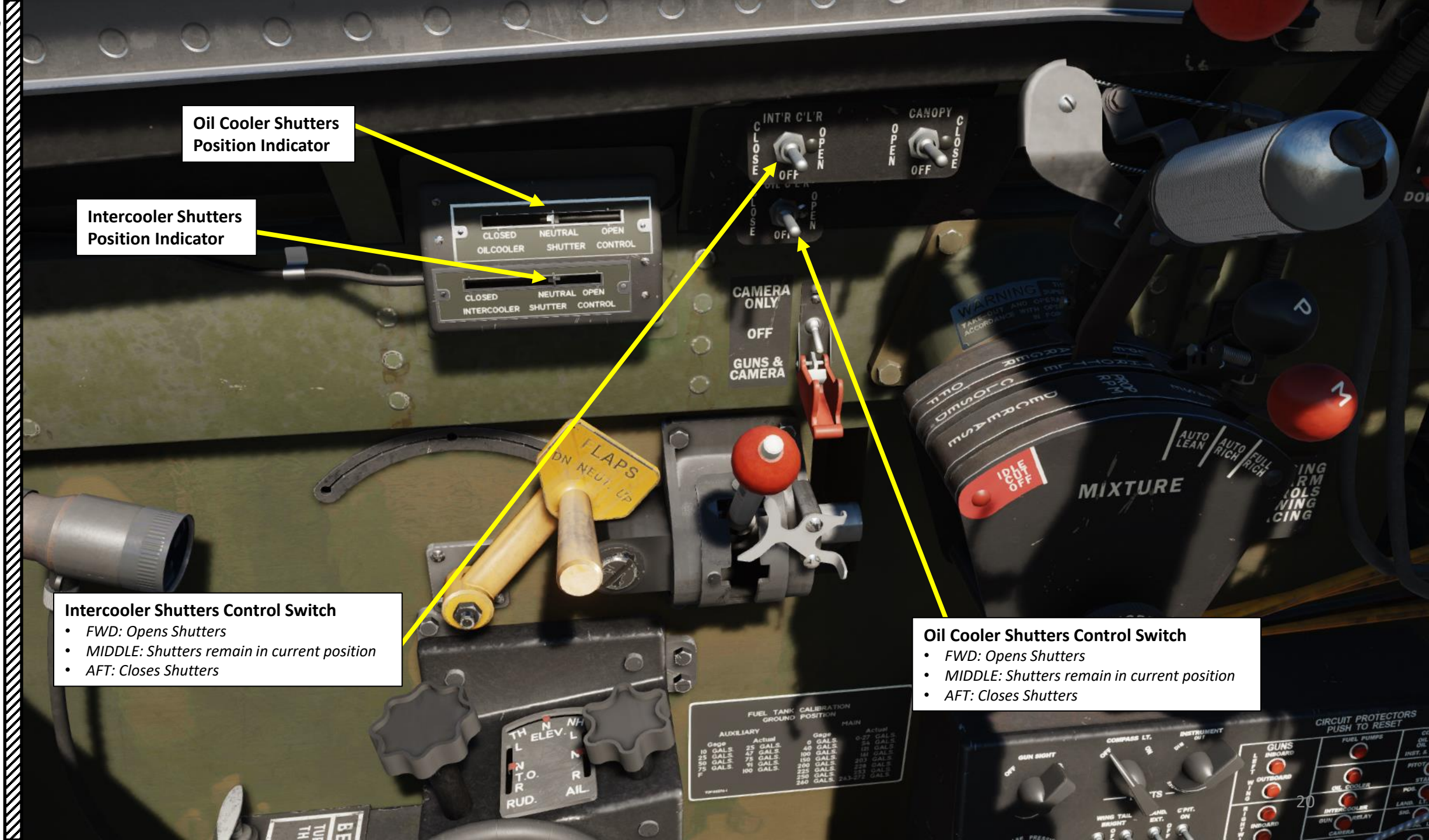

DANGER
NO PUSH

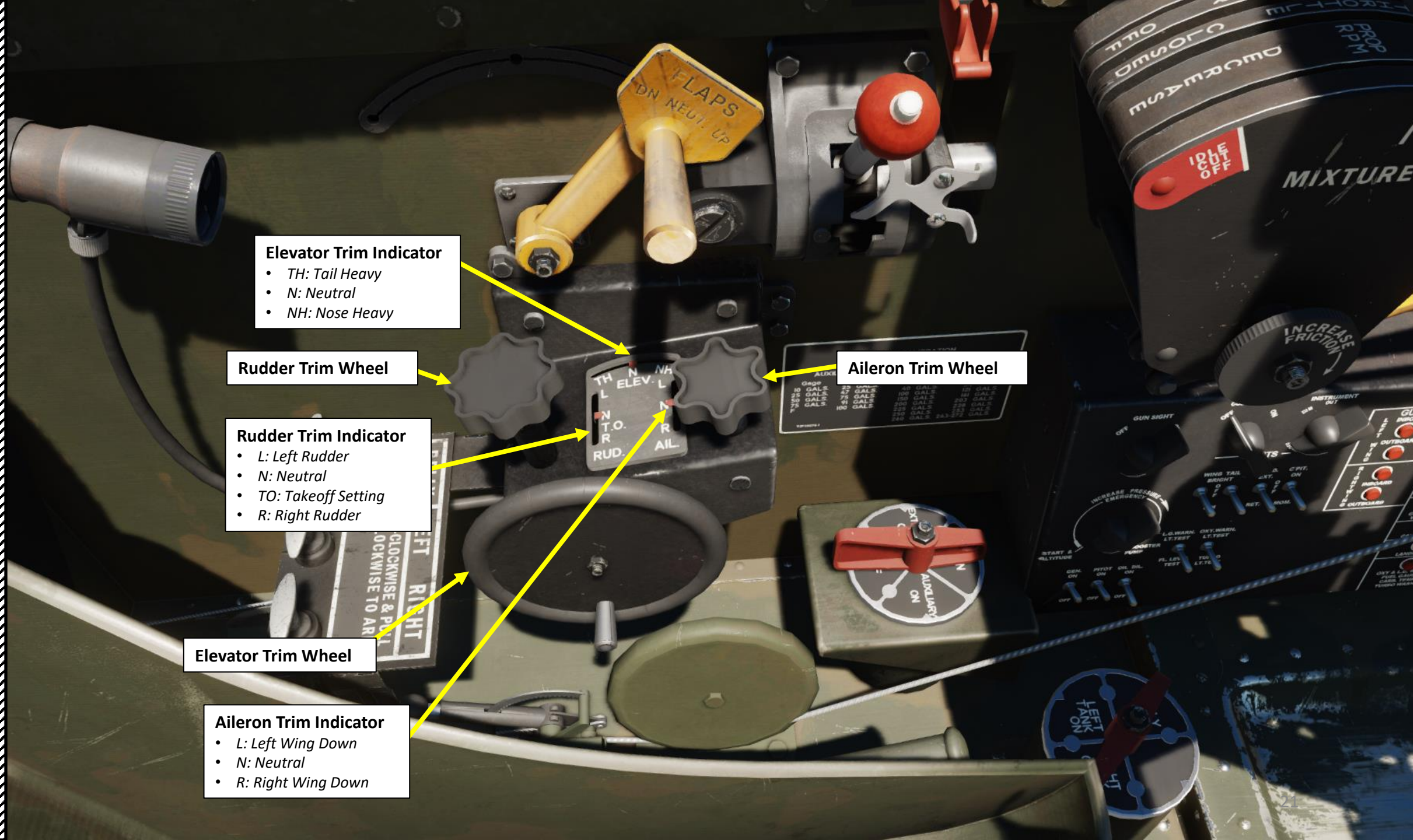
PART 3 – COCKPIT & EQUIPMENT

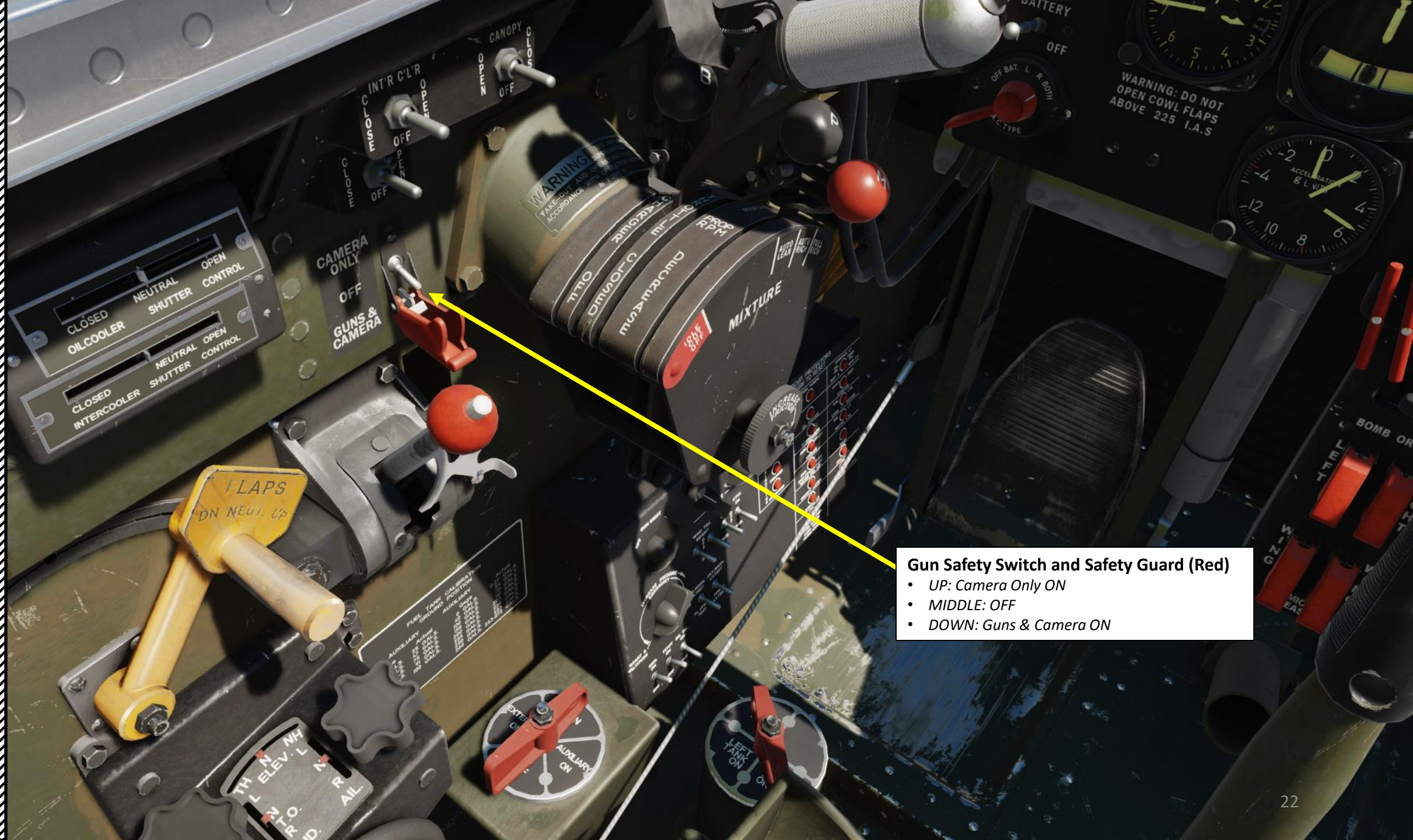

Carburetor Air Heat Control Cable
Carburetor Air Heat Control Lever
Used to provide additional hot air to the carburetor in cold weather or icing conditions
• FWD: Cold
• AFT: Hot
Rudder Control Cable
Air Filter Control Cable
Air Filter Control Lever
Controls the air supply to the cabin through a dust filter and is used in dusty conditions
• FWD: ON
• AFT: OFF


Bomb Arming Levers
Turn Counter-clockwise and pull, then turn clockwise to arm.
• BELLY / LEFT / RIGHT Bomb Rack
BELLY
LEFT
RIGHT
TURN COUNTER-CLOCKWISE & PULL
THEN TURN CLOCKWISE TO ARM


Cockpit Spot Light Lamp
Rotate to adjust intensity
Flaps Lever
• FWD: Flaps UP
• MIDDLE: Neutral
• AFT: Flaps DOWN
Landing Gear Button
Button needs to be pressed IN to allow gear lever movement
Landing Gear Lever
• UP: Gear UP
• DOWN: Gear DOWN
Landing Gear Lever Safety Latch
INT'R C'L'R
CANOPY
CAMERA ONLY
OFF
GUNS & CAMERA
MIXTURE
FLAPS
DN NEUT UP

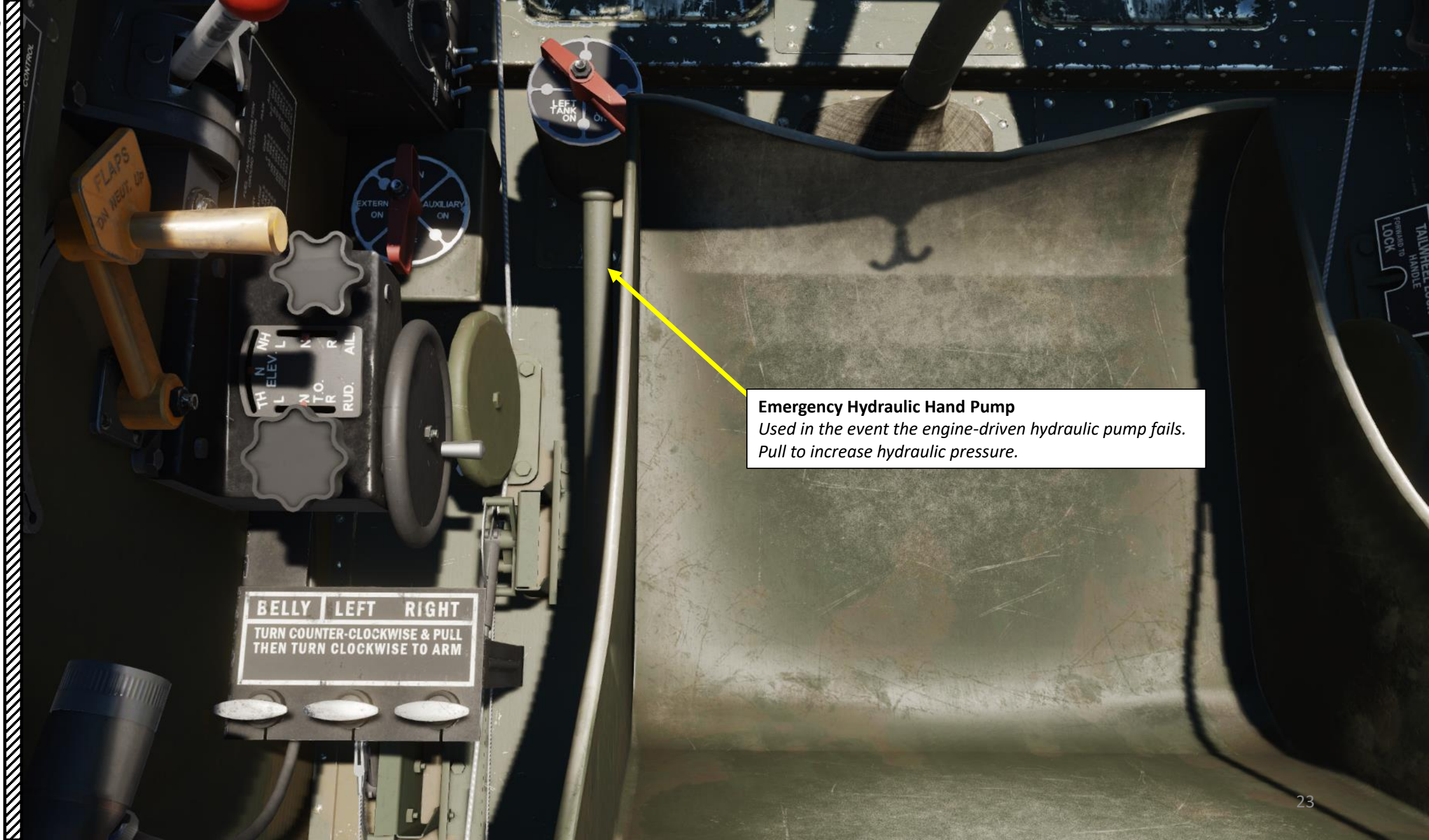

Oil Cooler Shutters Position Indicator
Intercooler Shutters Position Indicator
CLOSED NEUTRAL OPEN
OILCOOLER SHUTTER CONTROL
CLOSED NEUTRAL OPEN
INTERCOOLER SHUTTER CONTROL
INT'R C'L'R
CLOSE OPEN
OFF
CANOPY
OPEN CLOSE
OFF
CAMERA ONLY
OFF
GUNS & CAMERA
FLAPS
DN NEUT UP
MIXTURE
AUTO LEAN
AUTO RICH
FULL RICH
IDLE CUT OFF
Intercooler Shutters Control Switch
• FWD: Opens Shutters
• MIDDLE: Shutters remain in current position
• AFT: Closes Shutters
Oil Cooler Shutters Control Switch
• FWD: Opens Shutters
• MIDDLE: Shutters remain in current position
• AFT: Closes Shutters


Elevator Trim Indicator
• TH: Tail Heavy
• N: Neutral
• NH: Nose Heavy
Rudder Trim Wheel
Aileron Trim Wheel
Rudder Trim Indicator
• L: Left Rudder
• N: Neutral
• TO: Takeoff Setting
• R: Right Rudder
Elevator Trim Wheel
Aileron Trim Indicator
• L: Left Wing Down
• N: Neutral
• R: Right Wing Down
FLAPS
DN NEUT UP
TH N NH
ELEV.
L L
N N
T.O.
R R
RUD. AIL.
IDLE CUT OFF
MIXTURE
PROP RPM
INCREASE FRICTION
GUN SIGHT
AUXILIARY ON
LEFT TANK ON

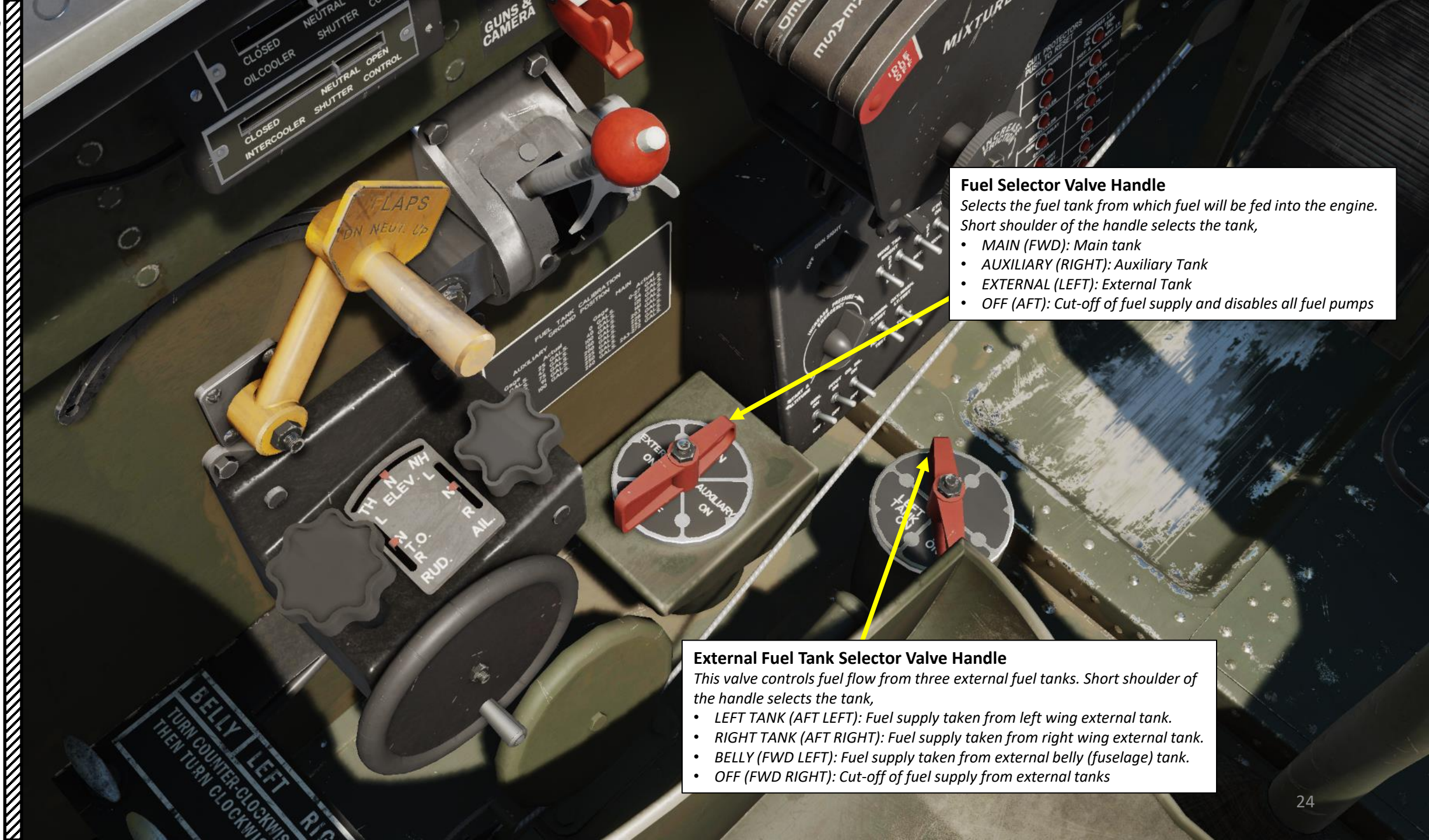


Gun Safety Switch and Safety Guard (Red)

- *UP: Camera Only ON*
- *MIDDLE: OFF*
- *DOWN: Guns & Camera ON*



Emergency Hydraulic Hand Pump
Used in the event the engine-driven hydraulic pump fails.
Pull to increase hydraulic pressure.



Fuel Selector Valve Handle

Selects the fuel tank from which fuel will be fed into the engine. Short shoulder of the handle selects the tank,

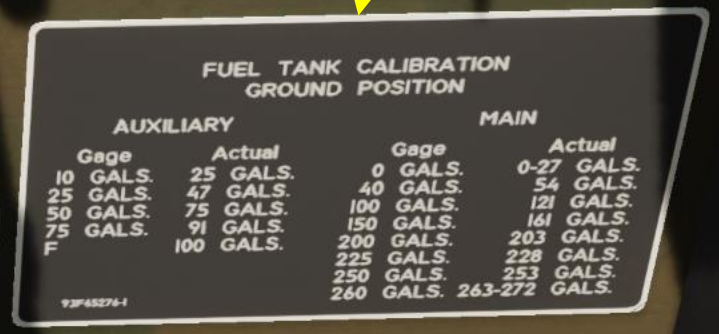
- *MAIN (FWD): Main tank*
- *AUXILIARY (RIGHT): Auxiliary Tank*
- *EXTERNAL (LEFT): External Tank*
- *OFF (AFT): Cut-off of fuel supply and disables all fuel pumps*

External Fuel Tank Selector Valve Handle

This valve controls fuel flow from three external fuel tanks. Short shoulder of the handle selects the tank,

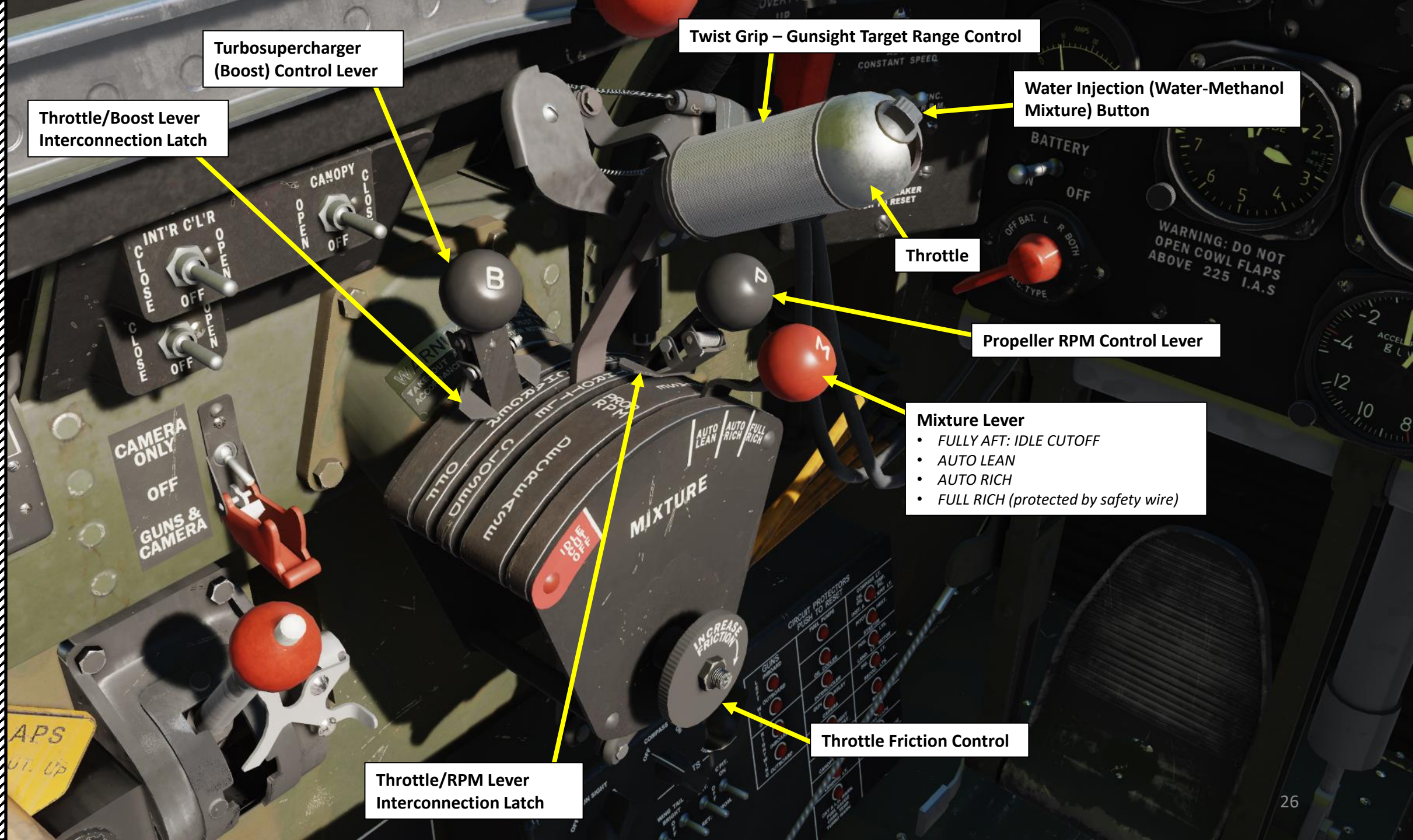
- *LEFT TANK (AFT LEFT): Fuel supply taken from left wing external tank.*
- *RIGHT TANK (AFT RIGHT): Fuel supply taken from right wing external tank.*
- *BELLY (FWD LEFT): Fuel supply taken from external belly (fuselage) tank.*
- *OFF (FWD RIGHT): Cut-off of fuel supply from external tanks*

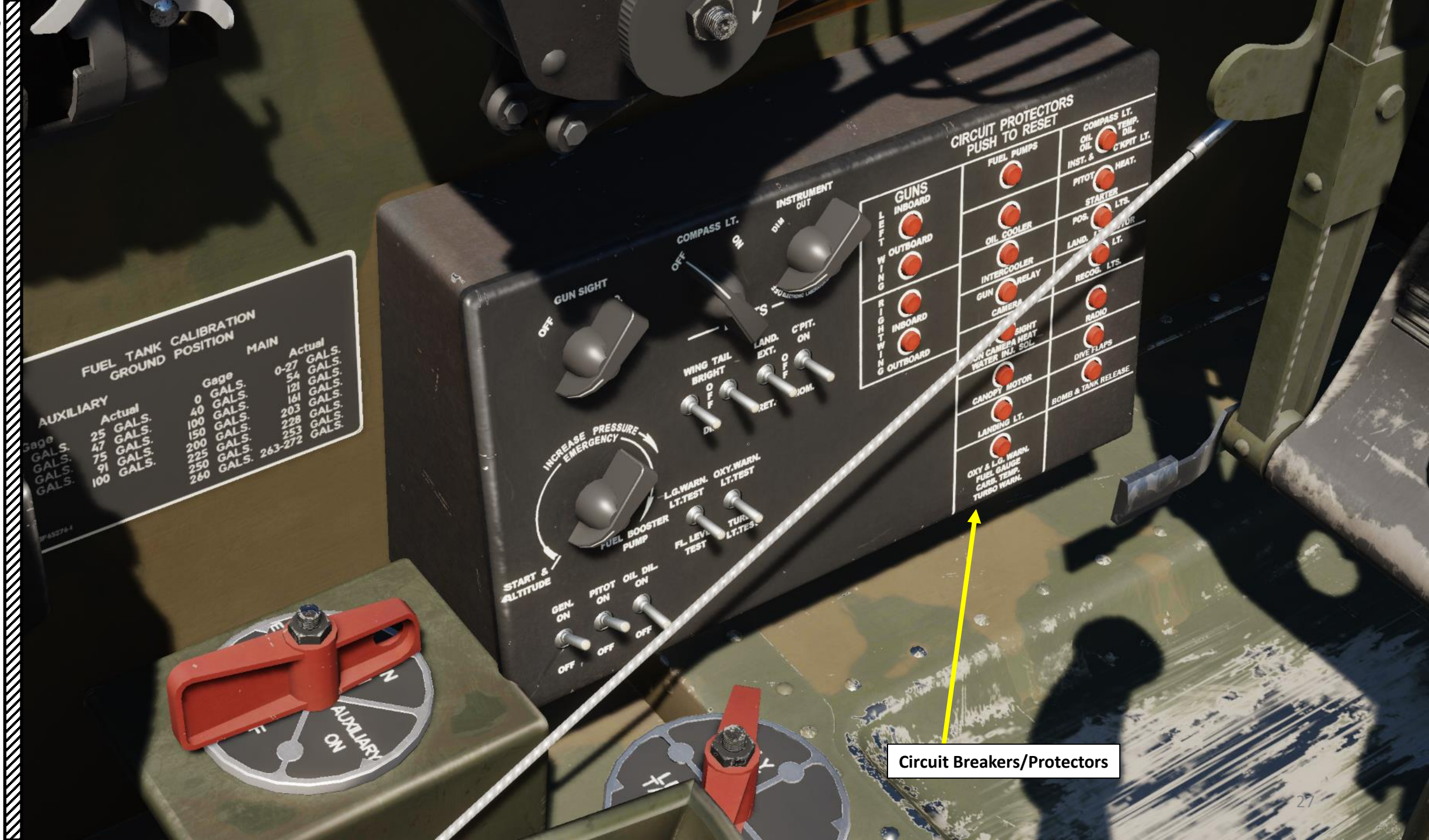
Fuel Tank Calibration Ground Position Table



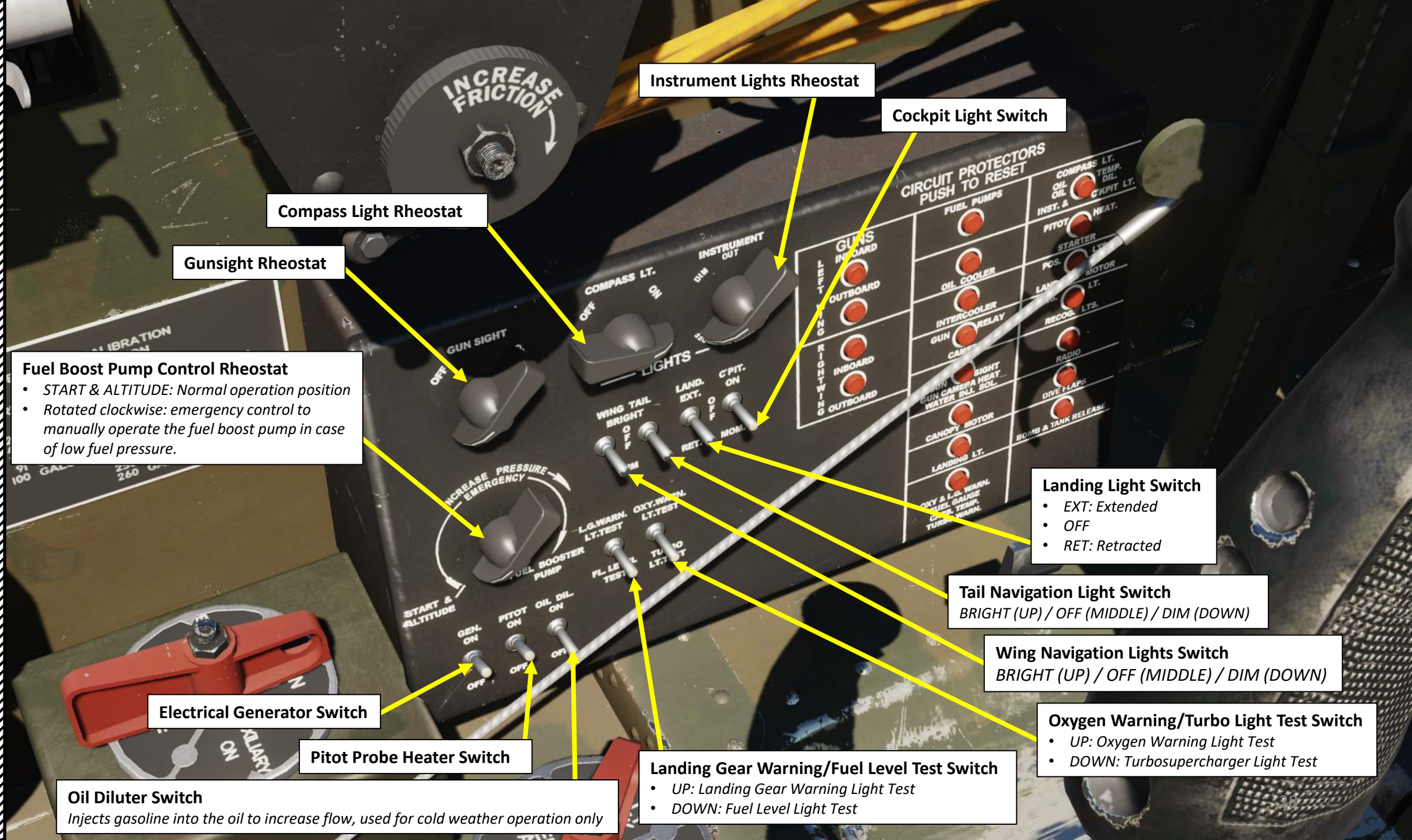
FUEL TANK CALIBRATION
GROUND POSITION

AUXILIARY		MAIN	
GAGE	ACTUAL	GAGE	ACTUAL
10 gals	25 gals	0 gals	0-27 gals
25 gals	47 gals	40 gals	54 gals
50 gals	75 gals	100 gals	121 gals
75 gals	91 gals	150 gals	161 gals
F (Full)	100 gals	200 gals	203 gals
		225 gals	228 gals
		250 gals	253 gals
		260 gals	263-272 gals


Turbosupercharger (Boost) Control Lever
Twist Grip – Gunsight Target Range Control
Water Injection (Water-Methanol Mixture) Button
Throttle/Boost Lever Interconnection Latch
Throttle
Propeller RPM Control Lever
Mixture Lever
• FULLY AFT: IDLE CUTOFF
• AUTO LEAN
• AUTO RICH
• FULL RICH (protected by safety wire)
Throttle Friction Control
Throttle/RPM Lever Interconnection Latch
INT'R C'L'R
CANOPY
CAMERA ONLY
OFF
GUNS & CAMERA
MIXTURE
AUTO LEAN
AUTO RICH
FULL RICH
IDLE CUT OFF
INCREASE FRICTION
BATTERY
WARNING: DO NOT OPEN COWL FLAPS ABOVE 225 I.A.S



Circuit Breakers/Protectors



Instrument Lights Rheostat

Cockpit Light Switch

Compass Light Rheostat

Gunsight Rheostat

Fuel Boost Pump Control Rheostat

- *START & ALTITUDE: Normal operation position*
- *Rotated clockwise: emergency control to manually operate the fuel boost pump in case of low fuel pressure.*

Landing Light Switch

- *EXT: Extended*
- *OFF*
- *RET: Retracted*

Tail Navigation Light Switch

BRIGHT (UP) / OFF (MIDDLE) / DIM (DOWN)

Wing Navigation Lights Switch

BRIGHT (UP) / OFF (MIDDLE) / DIM (DOWN)

Oxygen Warning/Turbo Light Test Switch

- *UP: Oxygen Warning Light Test*
- *DOWN: Turbosupercharger Light Test*

Electrical Generator Switch

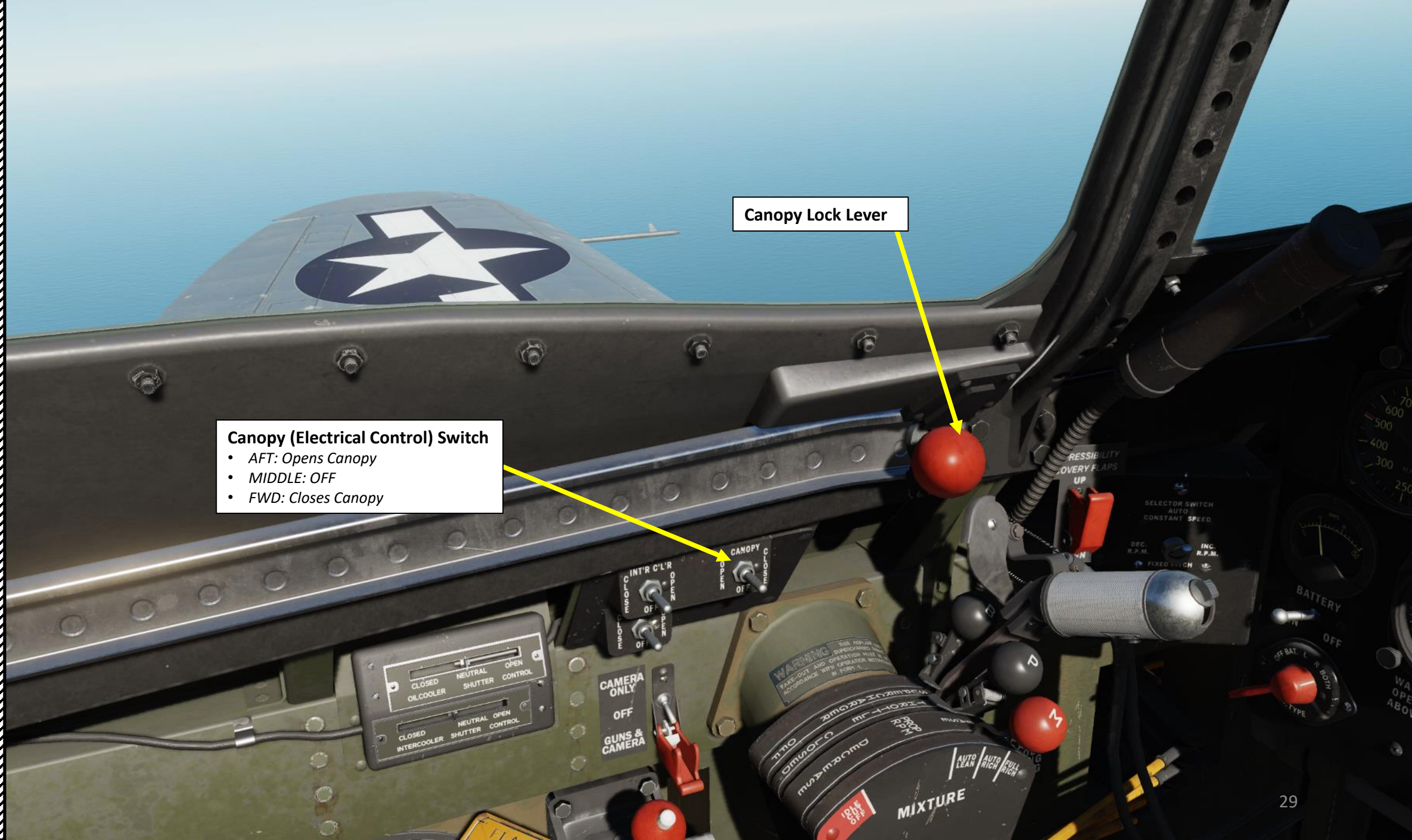
Pitot Probe Heater Switch

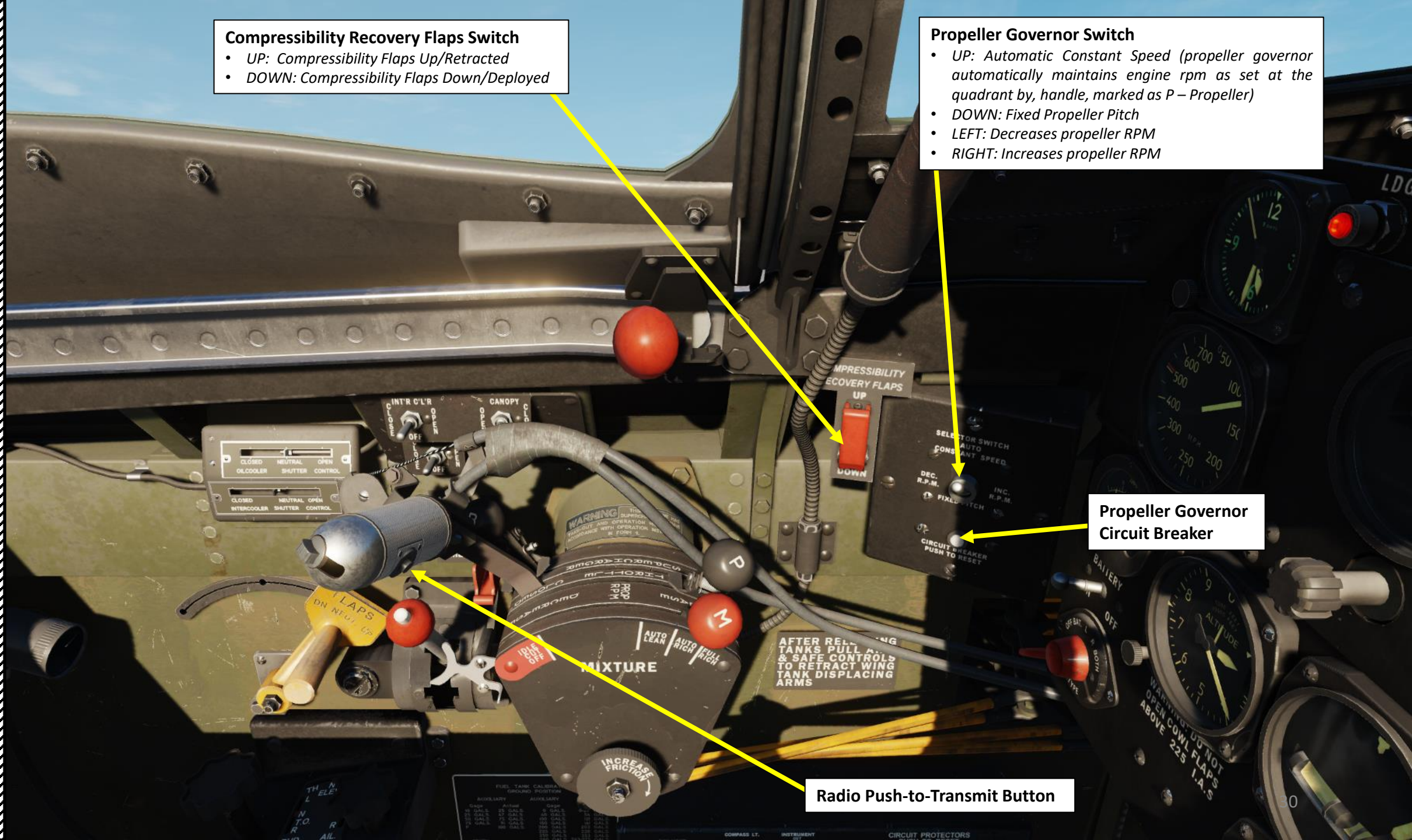
Oil Diluter Switch

Injects gasoline into the oil to increase flow, used for cold weather operation only

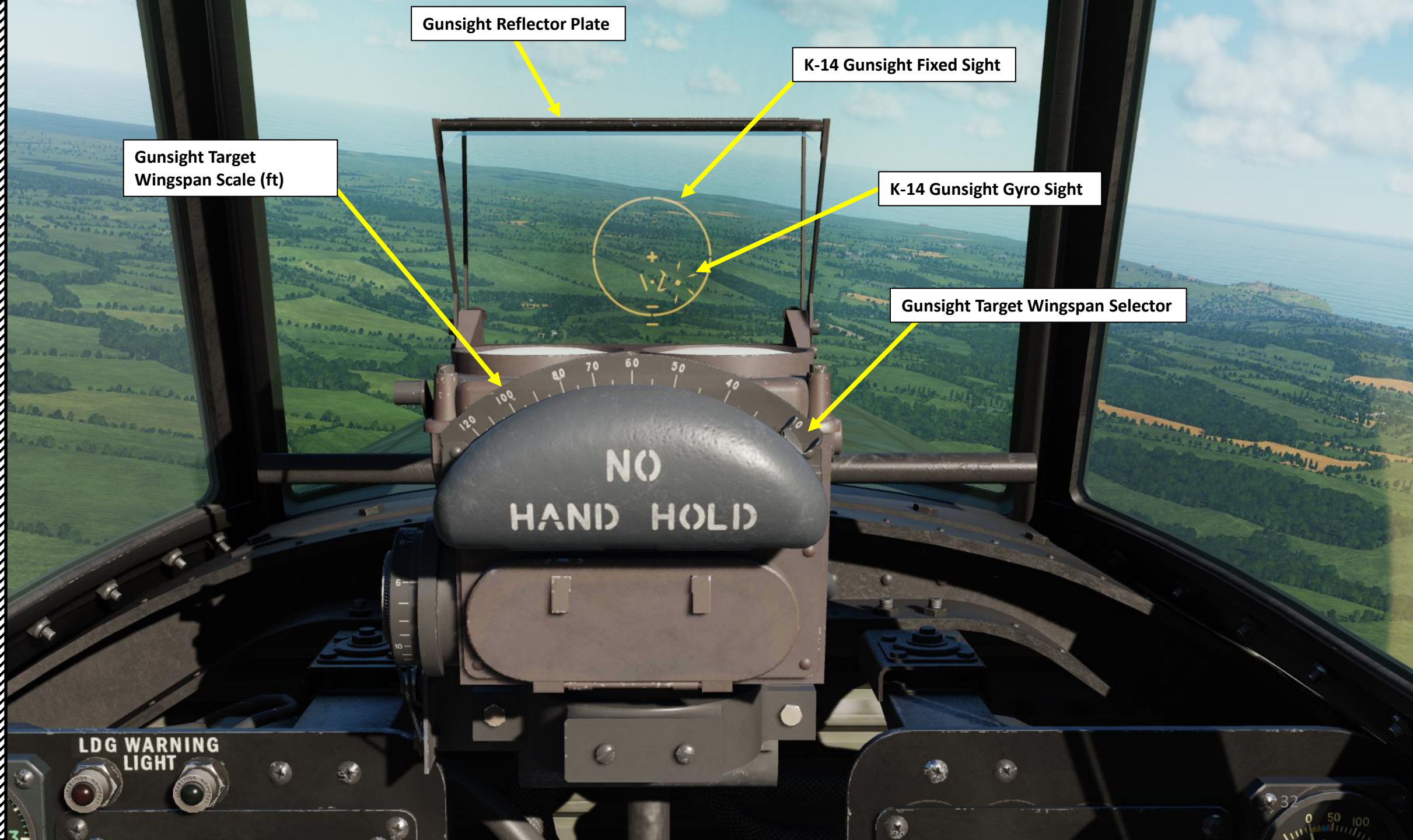
Landing Gear Warning/Fuel Level Test Switch

- *UP: Landing Gear Warning Light Test*
- *DOWN: Fuel Level Light Test*


Canopy Lock Lever
Canopy (Electrical Control) Switch
• AFT: Opens Canopy
• MIDDLE: OFF
• FWD: Closes Canopy
INT'R C'L'R
CANOPY
CAMERA ONLY
OFF
GUNS & CAMERA
MIXTURE
BATTERY

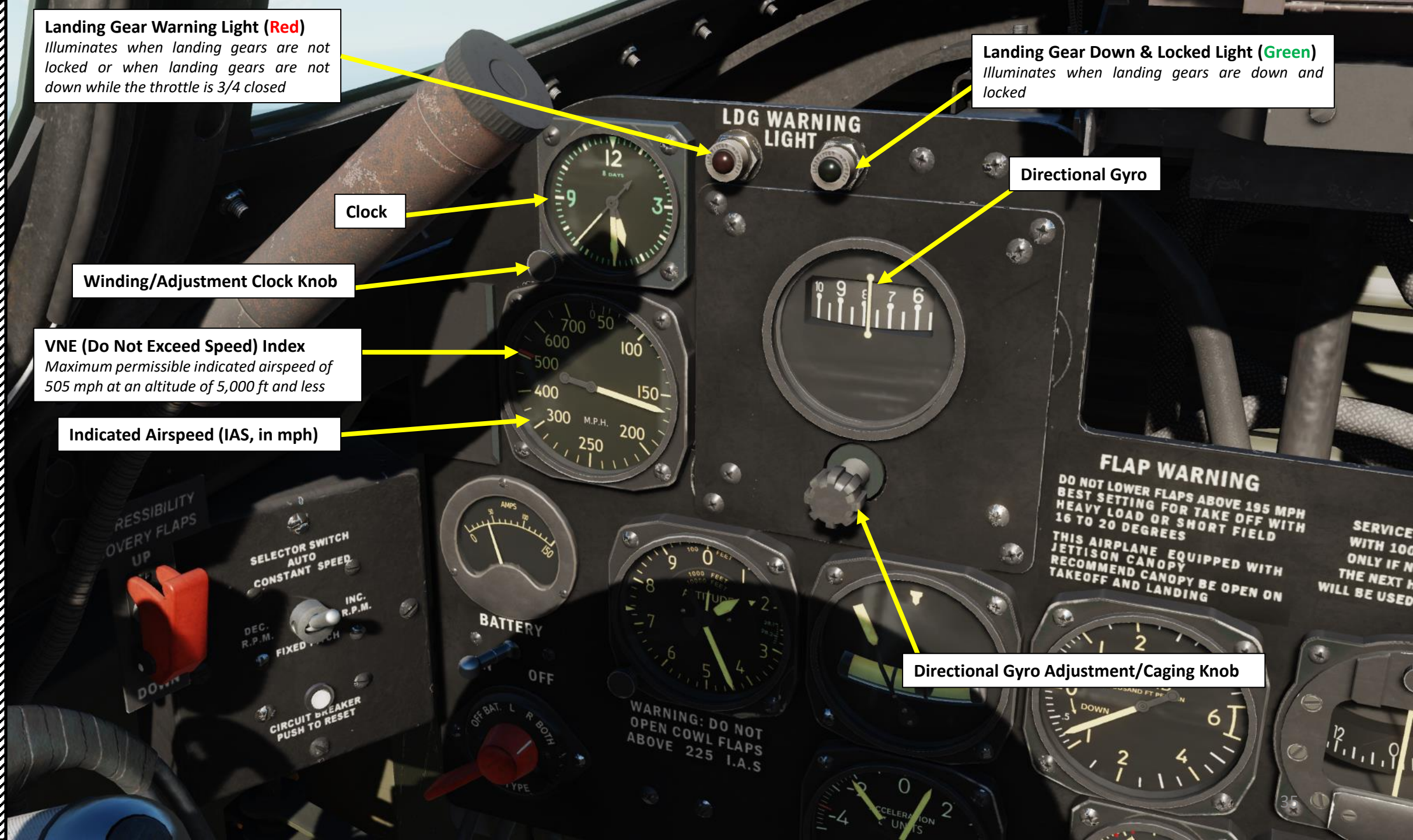

Compressibility Recovery Flaps Switch
• UP: Compressibility Flaps Up/Retracted
• DOWN: Compressibility Flaps Down/Deployed
Propeller Governor Switch
• UP: Automatic Constant Speed (propeller governor automatically maintains engine rpm as set at the quadrant by, handle, marked as P – Propeller)
• DOWN: Fixed Propeller Pitch
• LEFT: Decreases propeller RPM
• RIGHT: Increases propeller RPM
Propeller Governor Circuit Breaker
Radio Push-to-Transmit Button
MIXTURE
PROP RPM
INCREASE FRICTION
CIRCUIT BREAKER PUSH TO RESET
DO NOT OPEN COWL FLAPS ABOVE 225 I.A.S.


Fluorescent Cockpit Light
Fluorescent Cockpit Light
NO HAND HOLD
LDG WARNING LIGHT
FLAP WARNING
DO NOT LOWER FLAPS ABOVE 185 MPH
BEST SETTING FOR TAKE OFF WITH HEAVY LOAD OR SHORT FIELD 16 TO 20 DEGREES
THIS AIRPLANE EQUIPPED WITH JETTISON CANOPY RECOMMEND CANOPY BE OPEN ON TAKEOFF AND LANDING
SERVICE THE AIRPLANE WITH 100 OCTANE FUEL ONLY IF NOT AVAILABLE THE NEXT HIGHER GRADE WILL BE USED IN EMERGENCY
BATTERY
WARNING: DO NOT OPEN COWL FLAPS ABOVE 225 I.A.S
FUEL LEVEL WARN LIGHT
BOMB OR TANK RELEAS
COWL FLAPS PULL TO OPEN PUSH TO CLOSE


Gunsight Reflector Plate
K-14 Gunsight Fixed Sight
Gunsight Target Wingspan Scale (ft)
K-14 Gunsight Gyro Sight
Gunsight Target Wingspan Selector
NO
HAND HOLD
LDG WARNING LIGHT


Gunsight Fixed Reticle Mask Lever
• UP: ON
• DOWN: OFF
NO
HAND HOLD
Gunsight Target Range Dial (x100 ft)
G WARNING
LIGHT


Canopy Jettison Emergency Handle
JETTISON
RELEASE
NO
HAND HOLD
LDG WARNING
LIGHT


Landing Gear Warning Light (Red)
Illuminates when landing gears are not locked or when landing gears are not down while the throttle is 3/4 closed
Landing Gear Down & Locked Light (Green)
Illuminates when landing gears are down and locked
LDG WARNING LIGHT
Directional Gyro
Clock
Winding/Adjustment Clock Knob
VNE (Do Not Exceed Speed) Index
Maximum permissible indicated airspeed of 505 mph at an altitude of 5,000 ft and less
Indicated Airspeed (IAS, in mph)
M.P.H.
FLAP WARNING
DO NOT LOWER FLAPS ABOVE 195 MPH
BEST SETTING FOR TAKE OFF WITH HEAVY LOAD OR SHORT FIELD 16 TO 20 DEGREES
THIS AIRPLANE EQUIPPED WITH JETTISON CANOPY
RECOMMEND CANOPY BE OPEN ON TAKEOFF AND LANDING
SELECTOR SWITCH AUTO CONSTANT SPEED
CIRCUIT BREAKER PUSH TO RESET
BATTERY
OFF
WARNING: DO NOT OPEN COWL FLAPS ABOVE 225 I.A.S
Directional Gyro Adjustment/Caging Knob


Ammeter Indicator (Amps)
Battery Switch
• LEFT: ON
• RIGHT: OFF
Magneto (Ignition) Selector Switch
• OFF: Magnetos Off
• L: Left Magneto ON Only
• R: Right Magneto ON Only
• BOTH: Both Magnetos ON
FLAP WARNING
DO NOT LOWER FLAPS ABOVE 195 MPH
BEST SETTING FOR TAKE OFF WITH HEAVY LOAD OR SHORT FIELD 16 TO 20 DEGREES
THIS AIRPLANE EQUIPPED WITH JETTISON CANOPY
RECOMMEND CANOPY BE OPEN ON TAKEOFF AND LANDING
SERVICE THE AIRPLANE WITH 100 OCTANE FUEL ONLY IF NOT AVAILABLE THE NEXT HIGHER GRADE WILL BE USED IN EMERGENCY
BATTERY
OFF
WARNING: DO NOT OPEN COWL FLAPS ABOVE 225 I.A.S
FUEL LEVEL WARN LIGHT
BOMB OR TANK RELEASE

Altimeter (ft)
- *Long Thin Needle (Outer Scale): x100 ft*
- *Medium Thick Needle (Middle Scale): x1,000 ft*
- *Short Thin Needle (Inner Scale): x10,000 ft*

Barometric Pressure Setting (inches Hg)

Bank Indicator

Turn & Slip Indicator

Vertical Speed Indicator/Variometer (x1000 ft per minute)

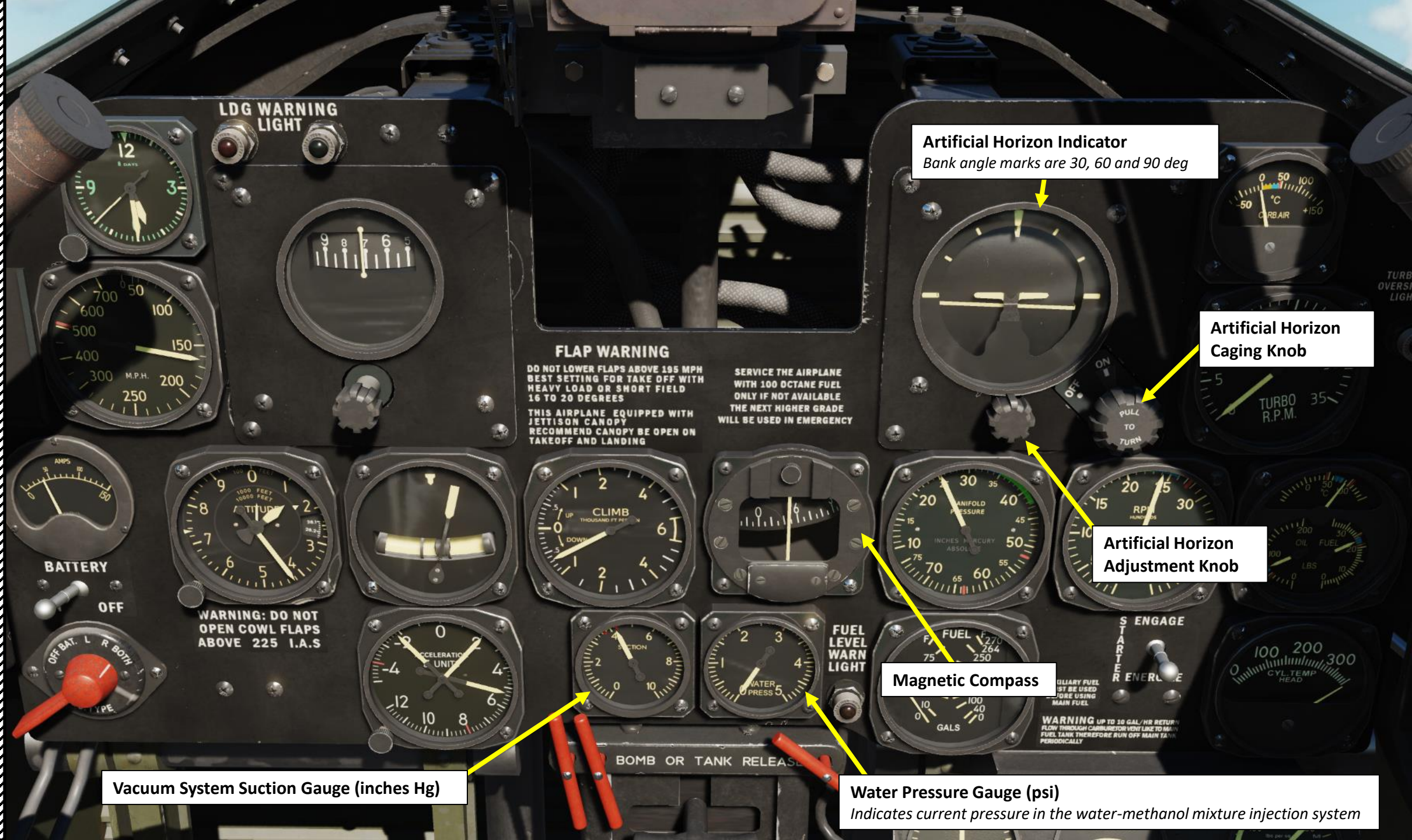
Accelerometer
(Current Acceleration in Gs)

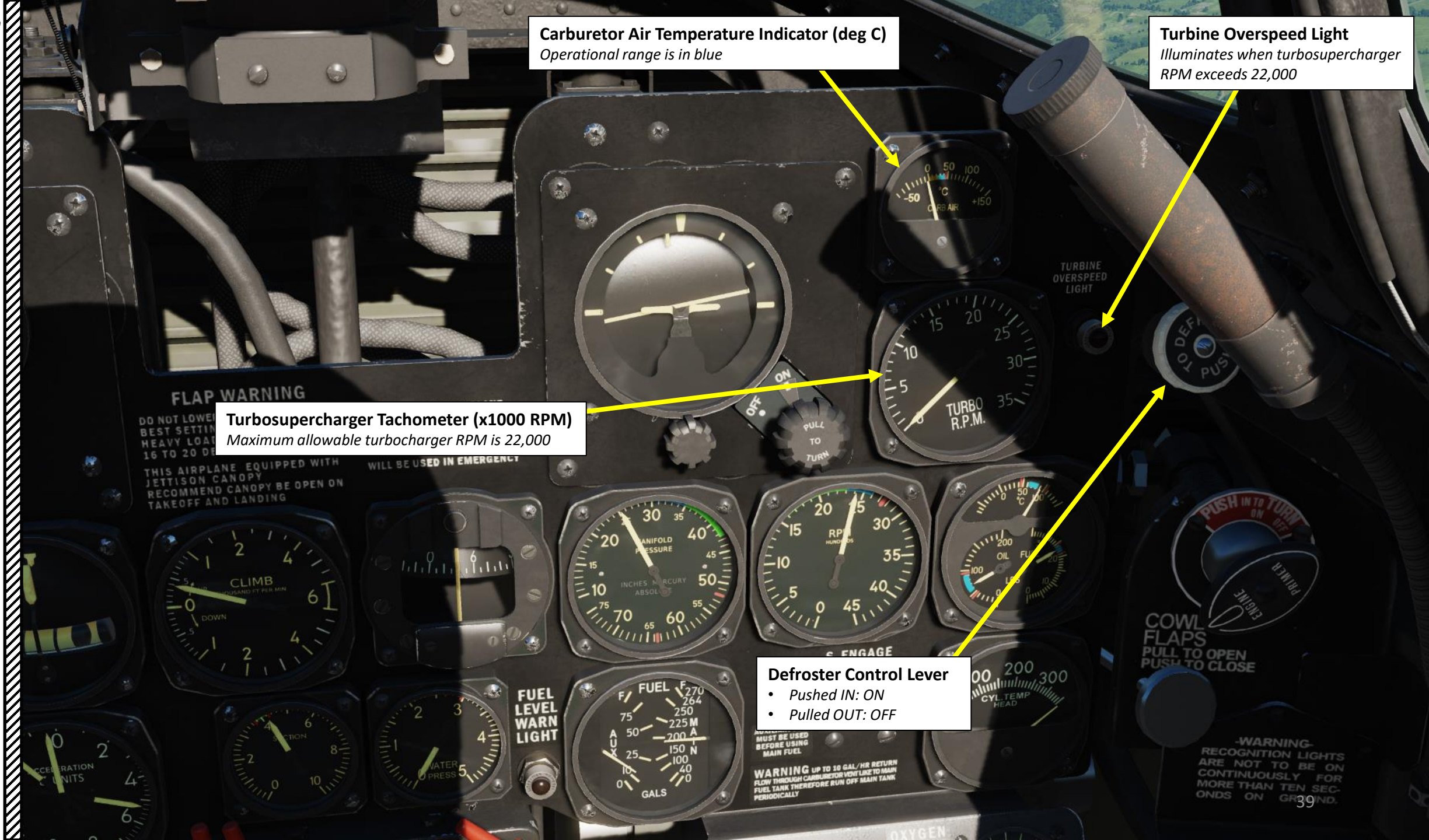
Minimum Detected G

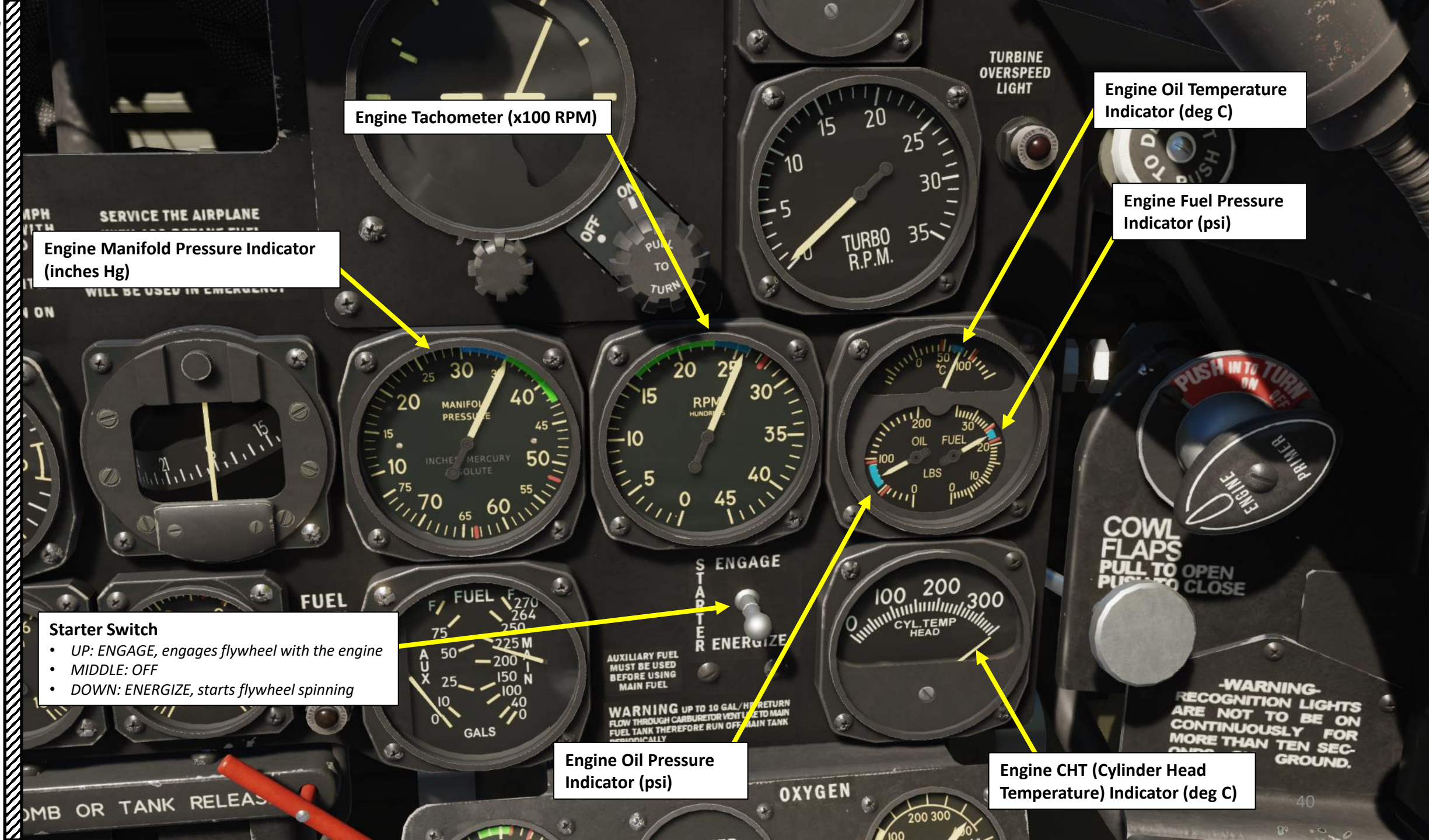
Barometric Pressure Setting Adjustment Knob

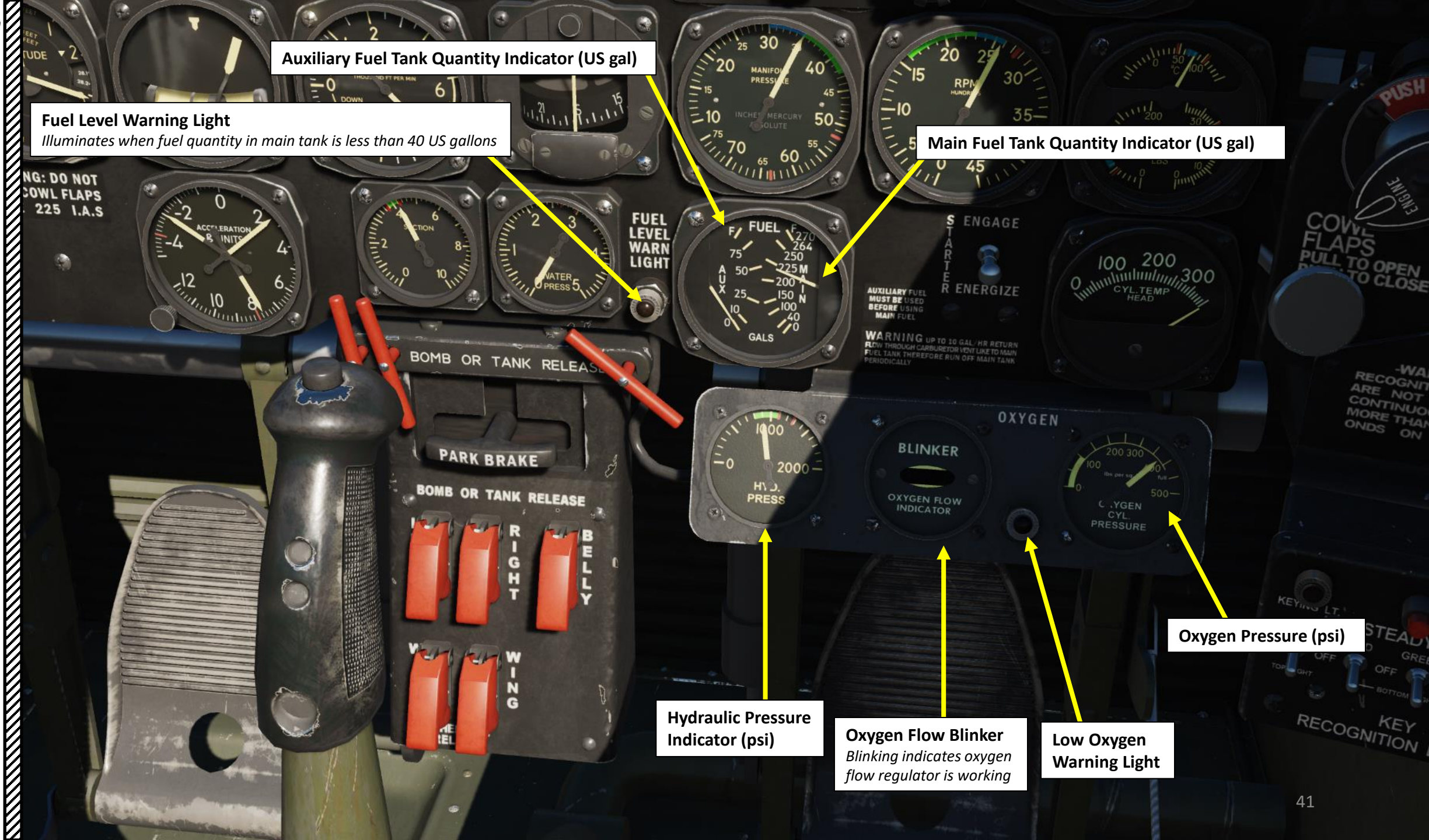
Accelerometer Reset Button

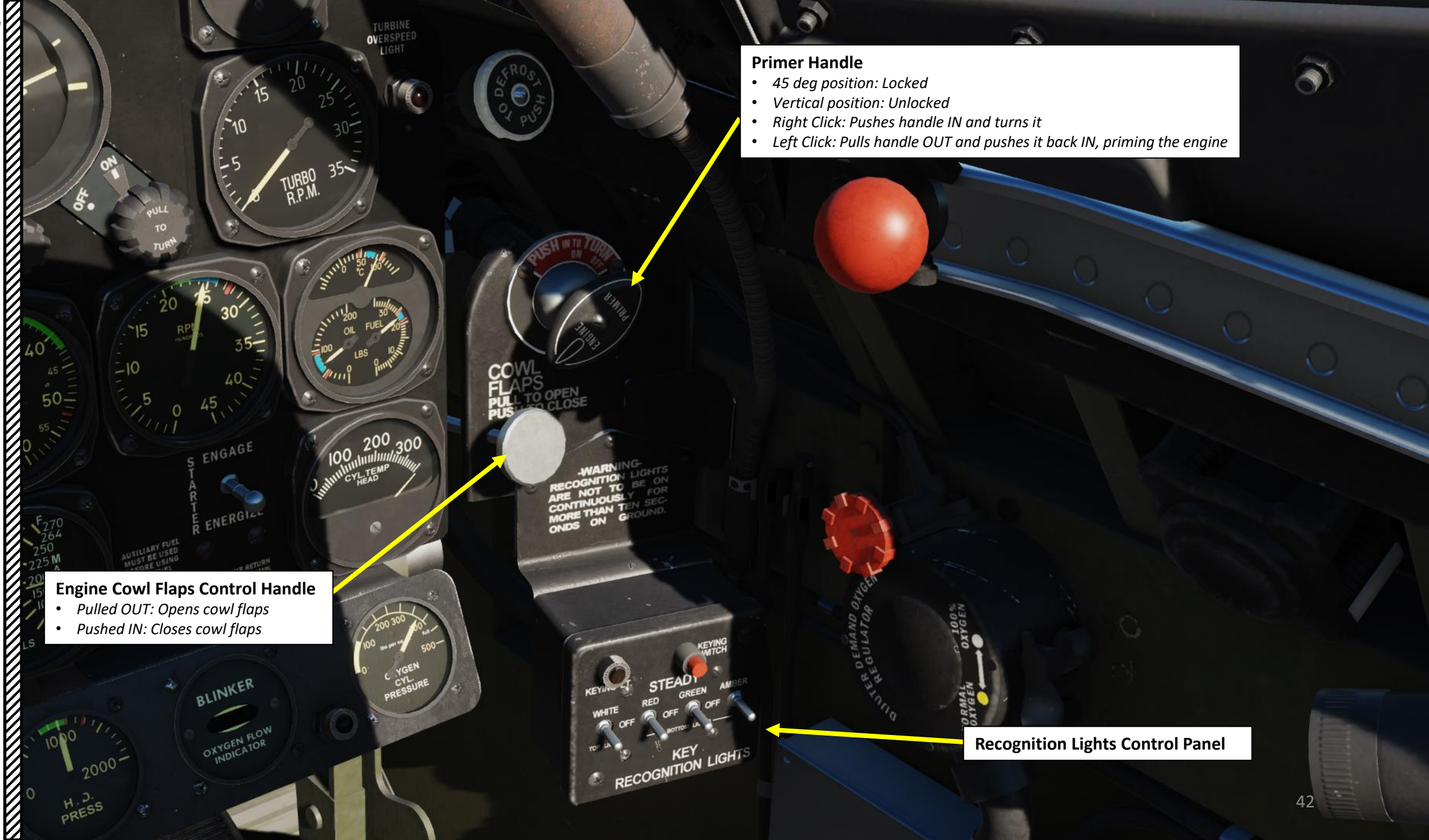
Maximum Detected G


LDG WARNING LIGHT
FLAP WARNING
DO NOT LOWER FLAPS ABOVE 195 MPH
BEST SETTING FOR TAKE OFF WITH HEAVY LOAD OR SHORT FIELD 16 TO 20 DEGREES
THIS AIRPLANE EQUIPPED WITH JETTISON CANOPY
RECOMMEND CANOPY BE OPEN ON TAKEOFF AND LANDING
SERVICE THE AIRPLANE WITH 100 OCTANE FUEL ONLY IF NOT AVAILABLE THE NEXT HIGHER GRADE WILL BE USED IN EMERGENCY
BATTERY
OFF
WARNING: DO NOT OPEN COWL FLAPS ABOVE 225 I.A.S
CLIMB
FUEL LEVEL WARN LIGHT
BOMB OR TANK RELEASE
TURBO R.P.M.
ENGAGE
STARTER
Artificial Horizon Indicator
Bank angle marks are 30, 60 and 90 deg
Artificial Horizon Caging Knob
Artificial Horizon Adjustment Knob
Magnetic Compass
Vacuum System Suction Gauge (inches Hg)
Water Pressure Gauge (psi)
Indicates current pressure in the water-methanol mixture injection system


Carburetor Air Temperature Indicator (deg C)
Operational range is in blue
Turbine Overspeed Light
Illuminates when turbosupercharger RPM exceeds 22,000
Turbosupercharger Tachometer (x1000 RPM)
Maximum allowable turbocharger RPM is 22,000
Defroster Control Lever
Pushed IN: ON
Pulled OUT: OFF
TURBINE OVERSPEED LIGHT
TURBO R.P.M.
FLAP WARNING
FUEL LEVEL WARN LIGHT
COWL FLAPS
PULL TO OPEN
PUSH TO CLOSE
-WARNING-
RECOGNITION LIGHTS ARE NOT TO BE ON CONTINUOUSLY FOR MORE THAN TEN SECONDS ON GROUND.


Engine Tachometer (x100 RPM)
Engine Oil Temperature Indicator (deg C)
Engine Fuel Pressure Indicator (psi)
Engine Manifold Pressure Indicator (inches Hg)
Starter Switch
• UP: ENGAGE, engages flywheel with the engine
• MIDDLE: OFF
• DOWN: ENERGIZE, starts flywheel spinning
Engine Oil Pressure Indicator (psi)
Engine CHT (Cylinder Head Temperature) Indicator (deg C)
TURBINE OVERSPEED LIGHT
TURBO R.P.M.
MANIFOLD PRESSURE
INCHES MERCURY ABSOLUTE
RPM
OIL
FUEL
LBS
CYL.TEMP HEAD
STARTER
ENGAGE
ENERGIZE
FUEL
GALS
AUX
MAIN
AUXILIARY FUEL MUST BE USED BEFORE USING MAIN FUEL
OXYGEN
COWL FLAPS
PULL TO OPEN
PUSH TO CLOSE
PUSH IN TO TURN
ENGINE PRIMER
-WARNING-
RECOGNITION LIGHTS ARE NOT TO BE ON CONTINUOUSLY FOR MORE THAN TEN SEC-
GROUND.
SERVICE THE AIRPLANE


Auxiliary Fuel Tank Quantity Indicator (US gal)
Fuel Level Warning Light
Illuminates when fuel quantity in main tank is less than 40 US gallons
Main Fuel Tank Quantity Indicator (US gal)
FUEL LEVEL WARN LIGHT
FUEL
GALS
AUX
BOMB OR TANK RELEASE
PARK BRAKE
RIGHT
BELLY
WING
OXYGEN
BLINKER
OXYGEN FLOW INDICATOR
Hydraulic Pressure Indicator (psi)
Oxygen Flow Blinker
Blinking indicates oxygen flow regulator is working
Low Oxygen Warning Light
Oxygen Pressure (psi)



Primer Handle

- *45 deg position: Locked*
- *Vertical position: Unlocked*
- *Right Click: Pushes handle IN and turns it*
- *Left Click: Pulls handle OUT and pushes it back IN, priming the engine*

Engine Cowl Flaps Control Handle

- *Pulled OUT: Opens cowl flaps*
- *Pushed IN: Closes cowl flaps*

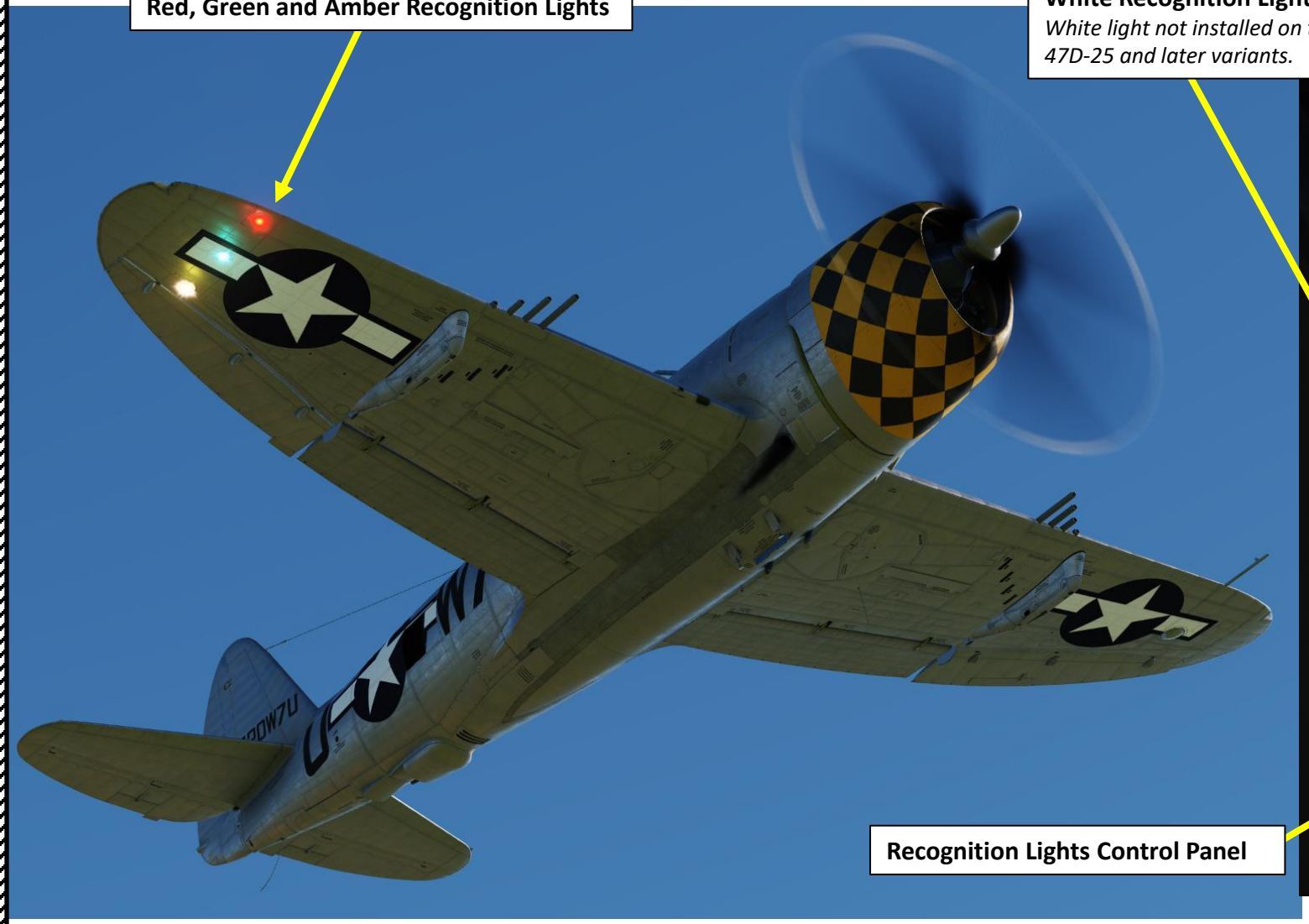
Recognition Lights Control Panel

Red, Green and Amber Recognition Lights

White Recognition Light Switch
White light not installed on the P-47D-25 and later variants.

Keying Switch
When Recognition Lights switches are DOWN (Keying position), pressing the Keying Switch allows you to turn them on and off as you press the Keying Switch. This can be used to send visual morse code signals.

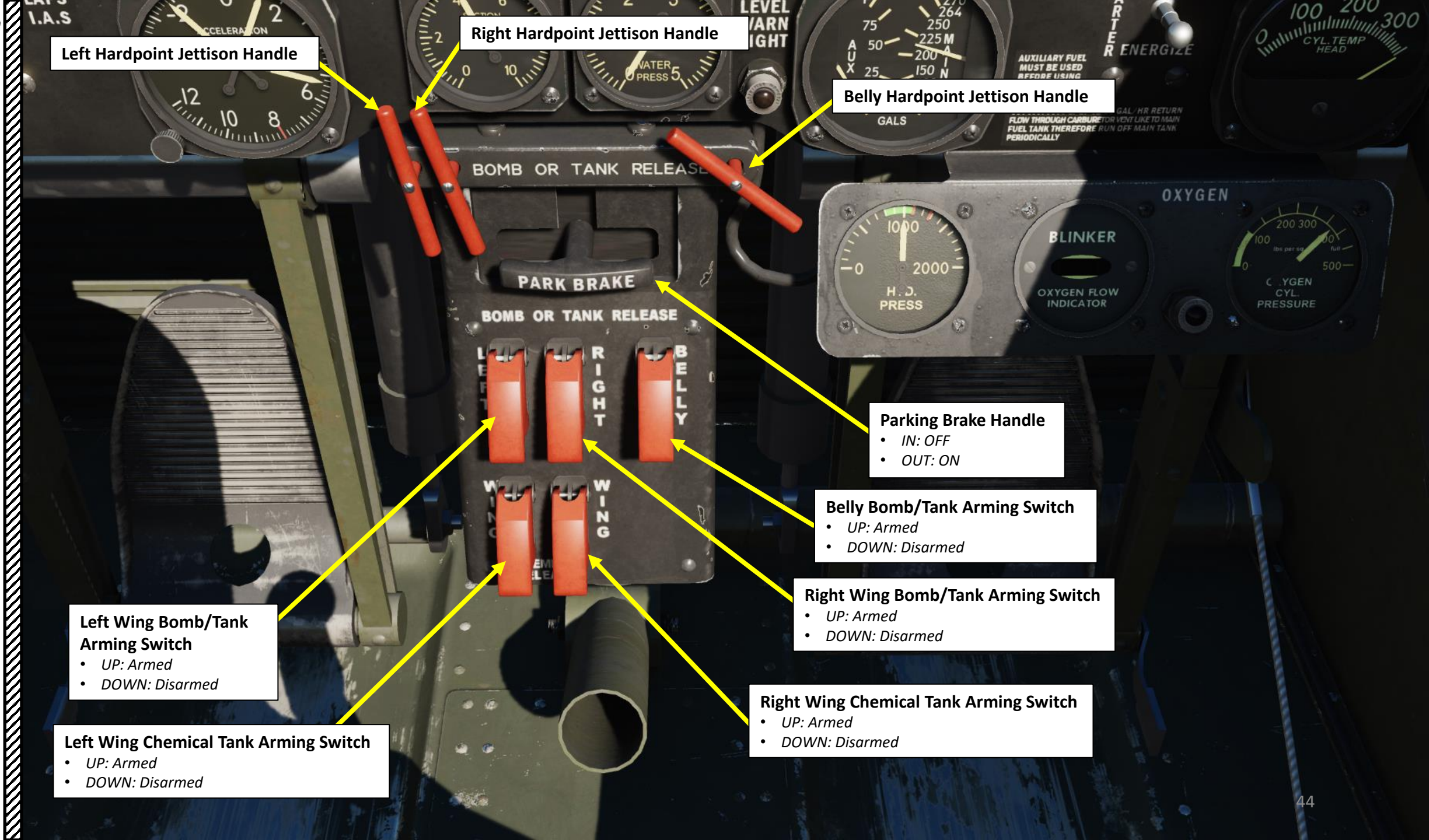
Keying Light
Illuminates when keying switch is being pressed



Recognition Lights Control Panel

Red, Green & Amber Recognition Lights Switches
- *UP: Steady glow (ON)*
- *MIDDLE: OFF*
- *DOWN: Key position (ON when the keying switch is being pressed)*

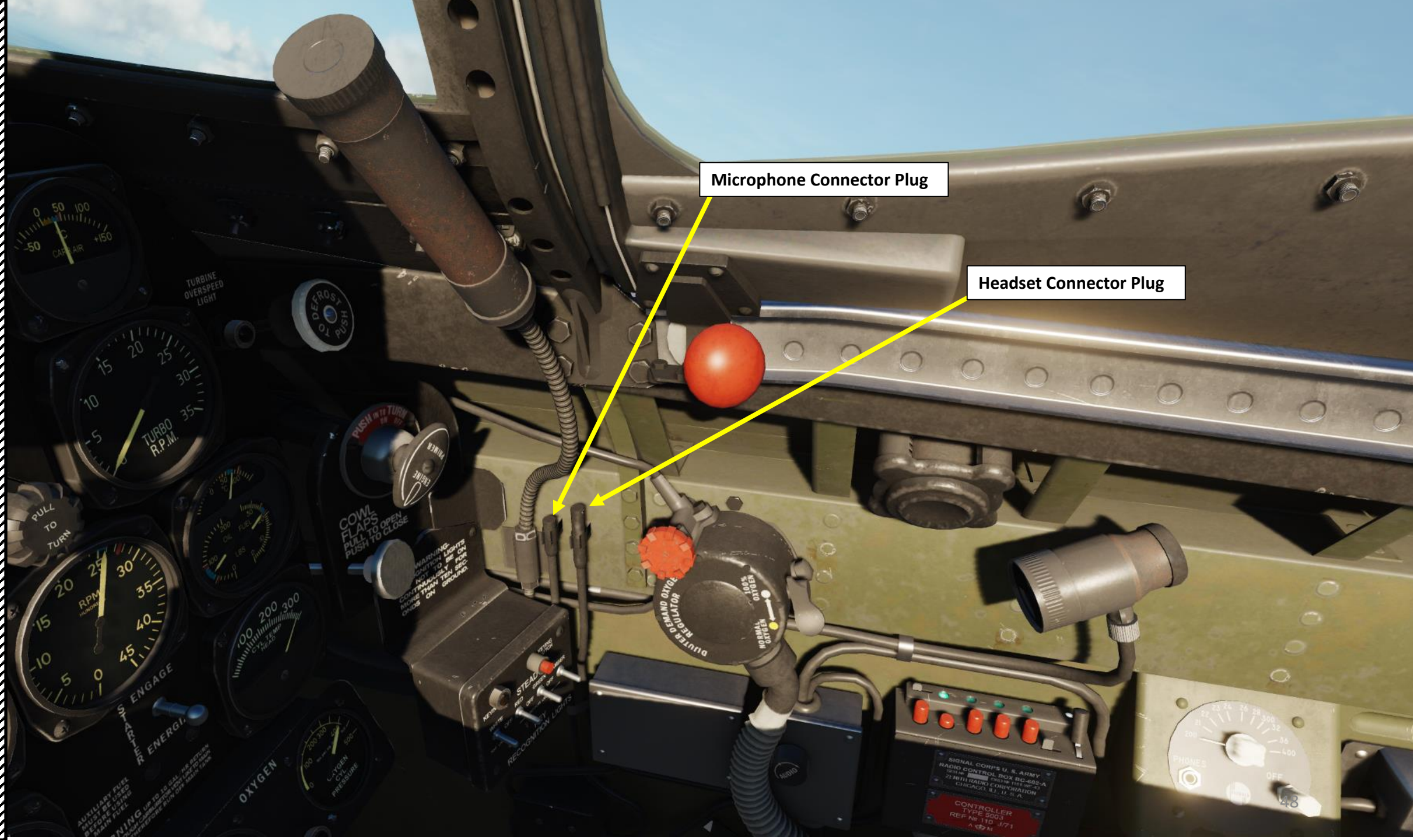
NOTE:
Do not operate the recognition lights for over 10 seconds continuously on the ground. This may result in melting the plastic lens due to heat.

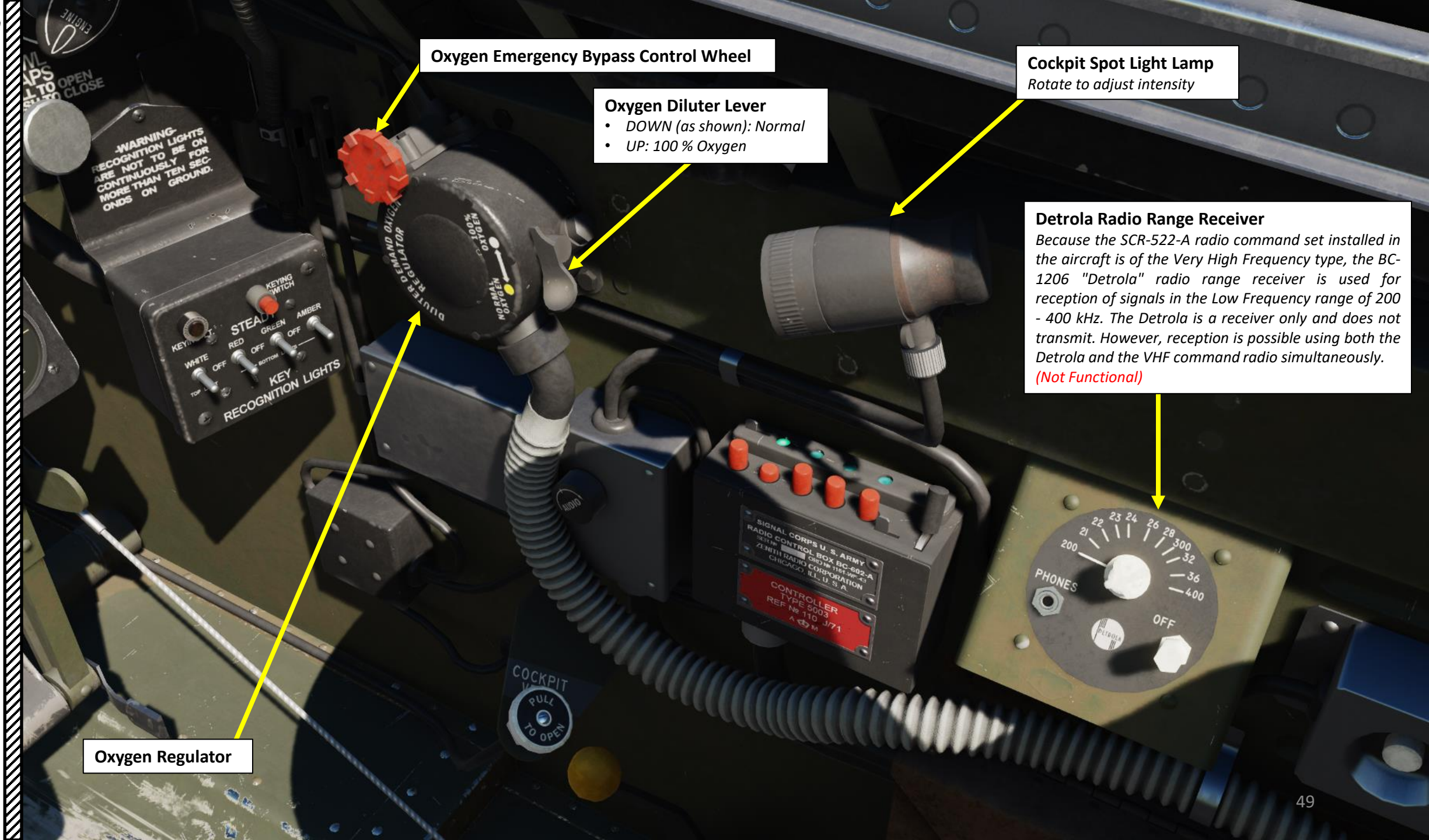

Left Hardpoint Jettison Handle
Right Hardpoint Jettison Handle
Belly Hardpoint Jettison Handle
BOMB OR TANK RELEASE
PARK BRAKE
BOMB OR TANK RELEASE
RIGHT
BELLY
WING
OXYGEN
BLINKER
OXYGEN FLOW INDICATOR
H.P. PRESS
Parking Brake Handle
• IN: OFF
• OUT: ON
Belly Bomb/Tank Arming Switch
• UP: Armed
• DOWN: Disarmed
Right Wing Bomb/Tank Arming Switch
• UP: Armed
• DOWN: Disarmed
Left Wing Bomb/Tank Arming Switch
• UP: Armed
• DOWN: Disarmed
Left Wing Chemical Tank Arming Switch
• UP: Armed
• DOWN: Disarmed
Right Wing Chemical Tank Arming Switch
• UP: Armed
• DOWN: Disarmed

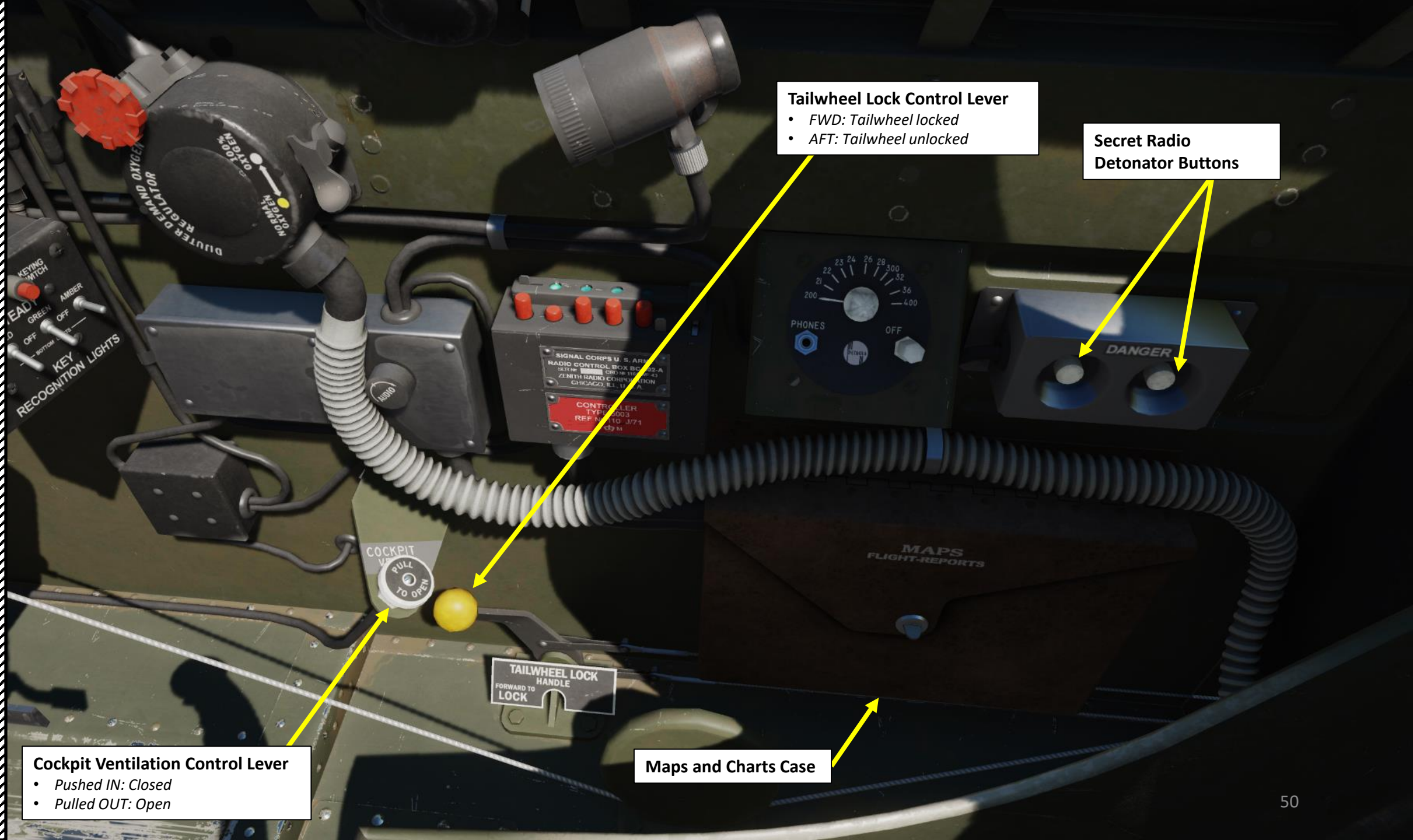

Weapons (Bomb) Release Button
Gun Trigger
BOMB OR TANK RELEASE
PARK BRAKE
BOMB OR TANK RELEASE
RIGHT
BELLY
WING
OXYGEN
BLINKER
OXYGEN FLOW INDICATOR
H.D. PRESS
OXYGEN CYL. PRESSURE
GALS
WARNING UP TO 10 GAL/HR RETURN FLOW THROUGH CARBURETOR VENT LIKE TO MAIN FUEL TANK THEREFORE RUN OFF MAIN TANK PERIODICALLY
BEFORE USING MAIN FUEL
HEAD
CIRCUIT PROTECTORS PUSH TO RESET
GUNS
WHITE
RED
OFF
RECOGNITION

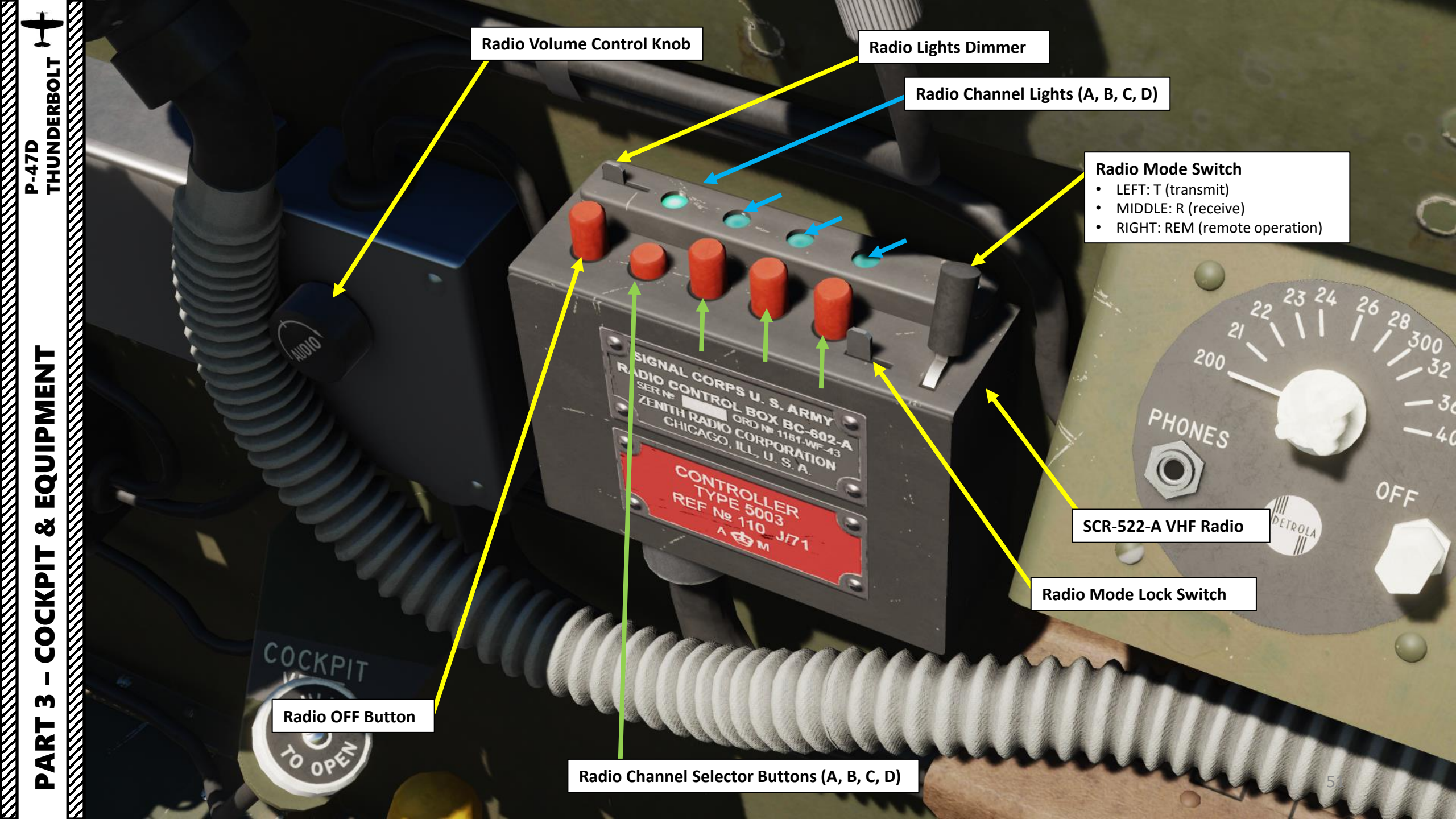

Bomb
(Right Hardpoint)
Bomb
(Belly Hardpoint)
Bomb
(Left Hardpoint)

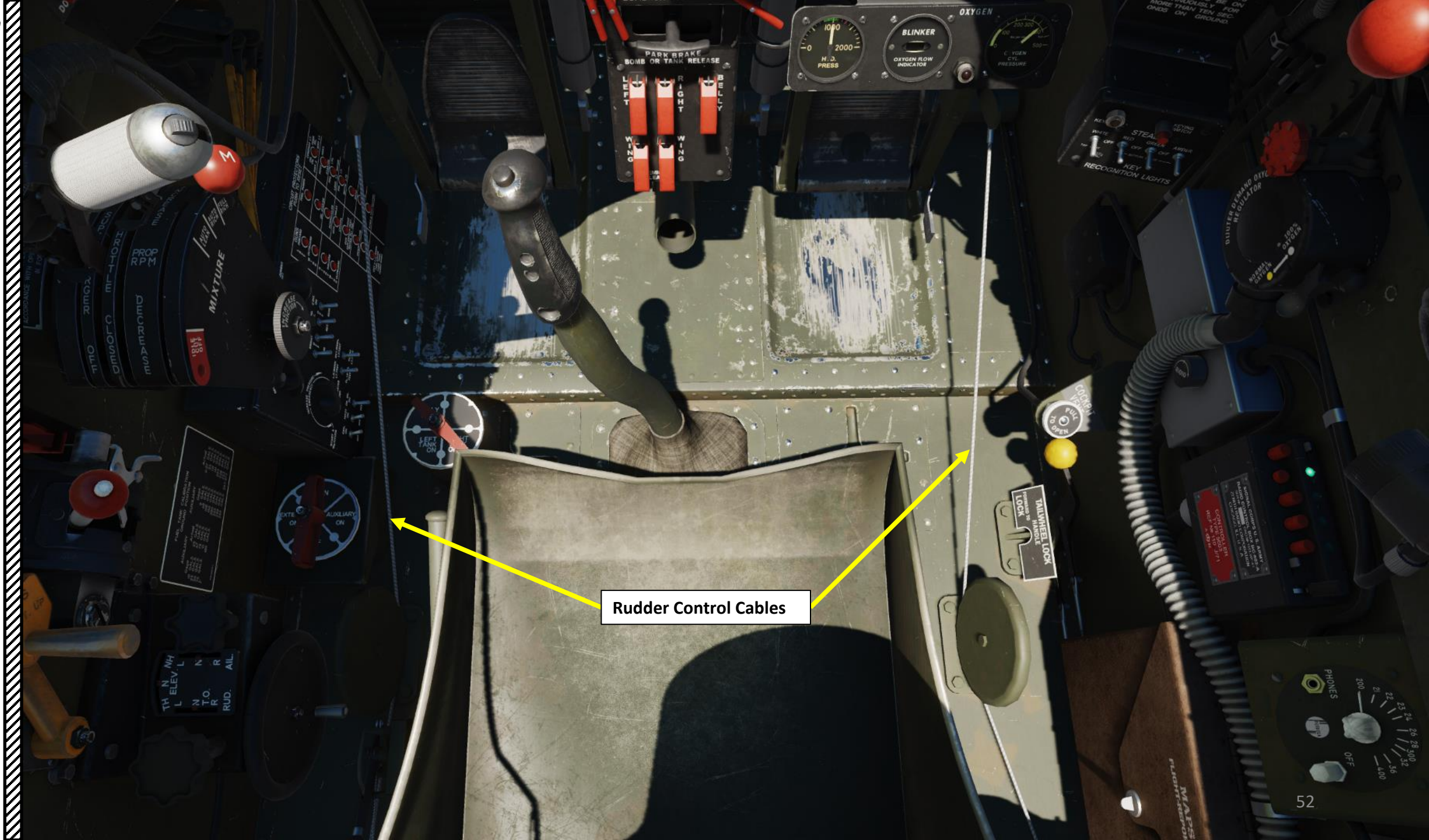

Canopy Lock Lever


Microphone Connector Plug
Headset Connector Plug


Oxygen Emergency Bypass Control Wheel
Oxygen Diluter Lever
• DOWN (as shown): Normal
• UP: 100 % Oxygen
Cockpit Spot Light Lamp
Rotate to adjust intensity
Detrola Radio Range Receiver
Because the SCR-522-A radio command set installed in the aircraft is of the Very High Frequency type, the BC-1206 "Detrola" radio range receiver is used for reception of signals in the Low Frequency range of 200 - 400 kHz. The Detrola is a receiver only and does not transmit. However, reception is possible using both the Detrola and the VHF command radio simultaneously.
(Not Functional)
Oxygen Regulator
KEY RECOGNITION LIGHTS
PHONES
OFF


Tailwheel Lock Control Lever
• FWD: Tailwheel locked
• AFT: Tailwheel unlocked
Secret Radio Detonator Buttons
DANGER
PHONES
OFF
TAILWHEEL LOCK HANDLE
FORWARD TO LOCK
COCKPIT
PULL TO OPEN
MAPS
FLIGHT-REPORTS
Cockpit Ventilation Control Lever
• Pushed IN: Closed
• Pulled OUT: Open
Maps and Charts Case

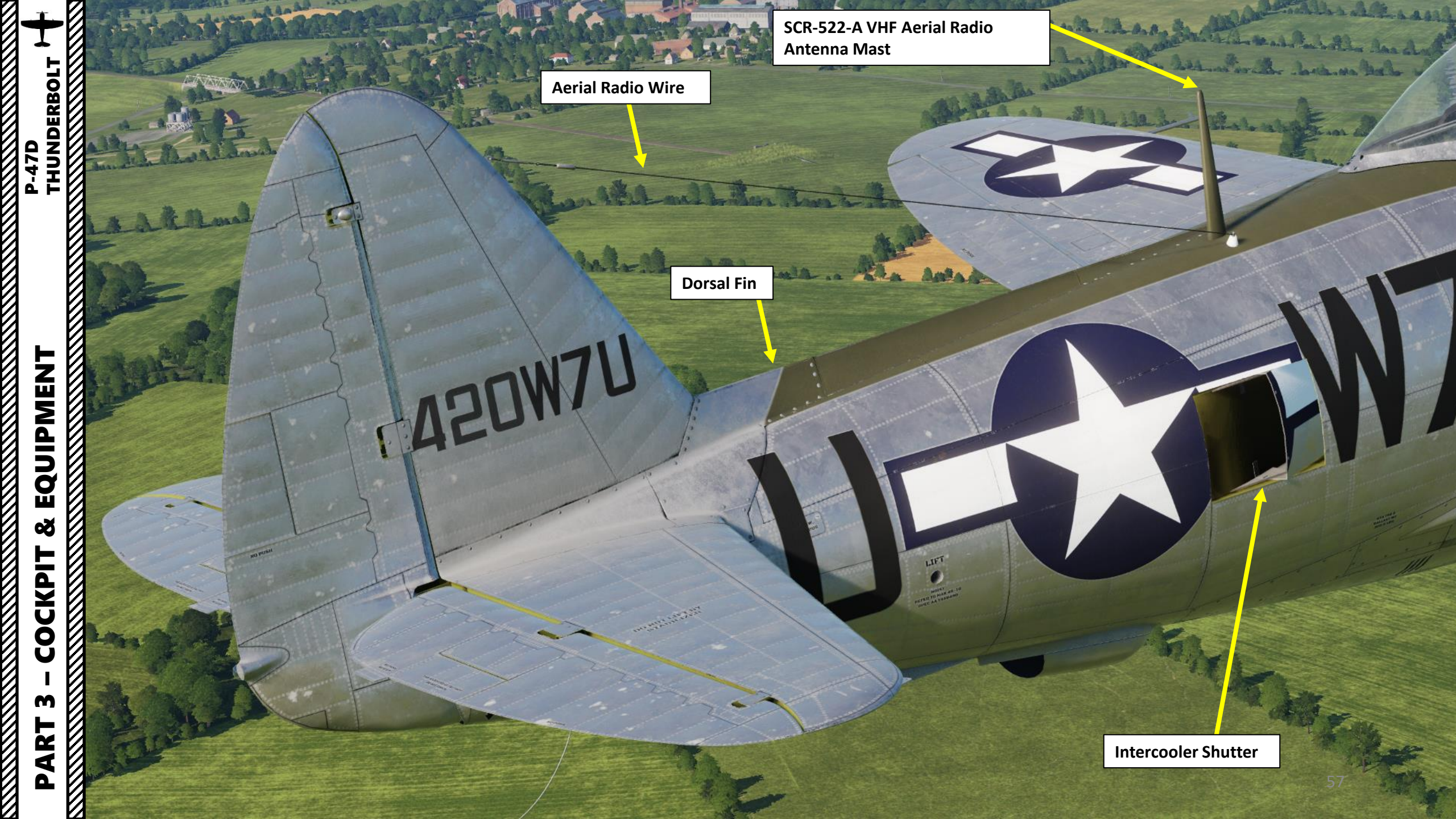

Radio Volume Control Knob
Radio Lights Dimmer
Radio Channel Lights (A, B, C, D)
Radio Mode Switch
• LEFT: T (transmit)
• MIDDLE: R (receive)
• RIGHT: REM (remote operation)
SCR-522-A VHF Radio
Radio Mode Lock Switch
Radio OFF Button
Radio Channel Selector Buttons (A, B, C, D)
SIGNAL CORPS U. S. ARMY
RADIO CONTROL BOX BC-602-A
ORD № 1161-WF-43
ZENITH RADIO CORPORATION
CHICAGO, ILL, U. S. A.
CONTROLLER
TYPE 5003
REF № 110 J71
AUDIO
PHONES
OFF
PETROLA
COCKPIT
TO OPEN

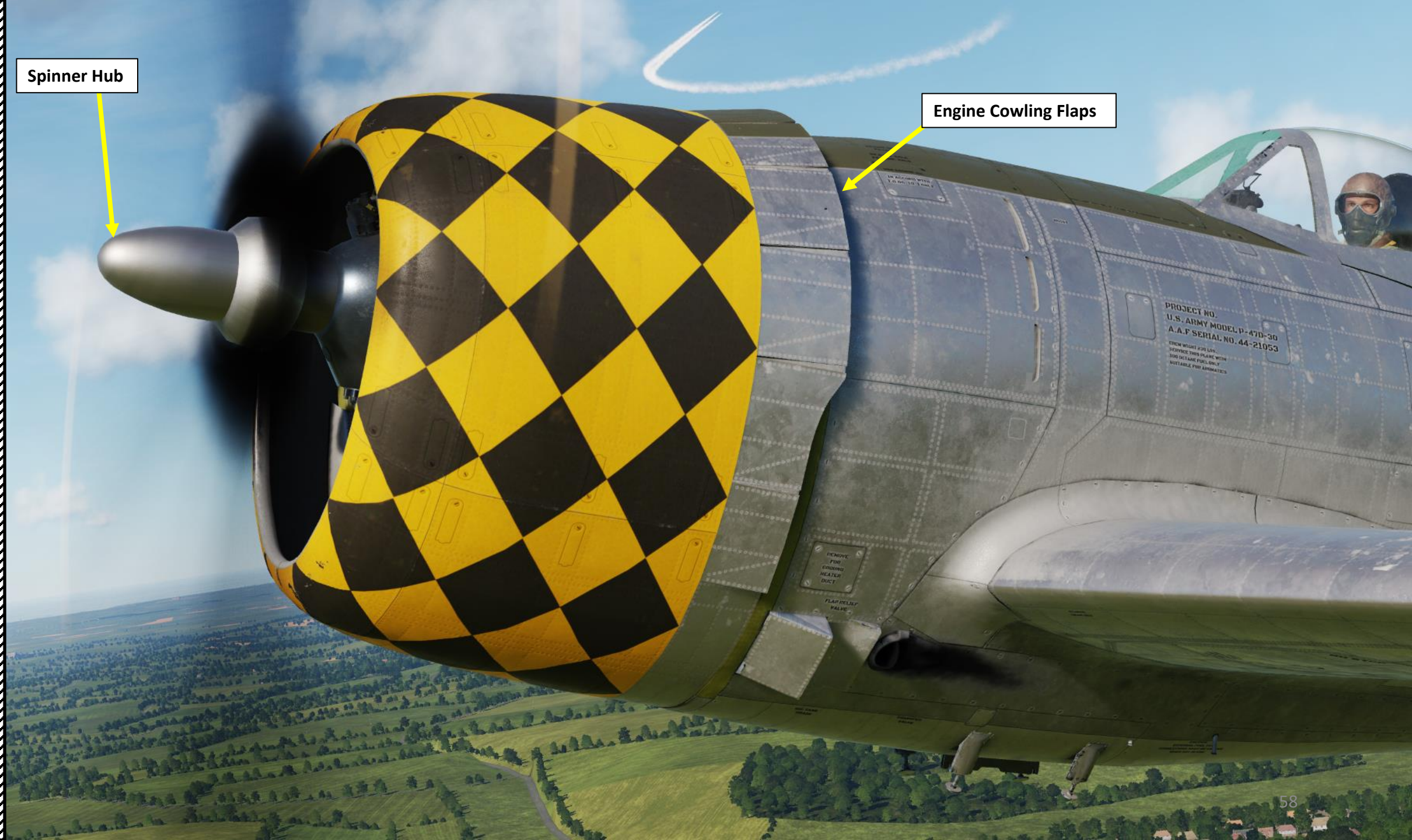

Rudder Control Cables


DANGER
TURBO R.P.M.
OXYGEN
TAILWHEEL LOCK
HANDLE
LOCK

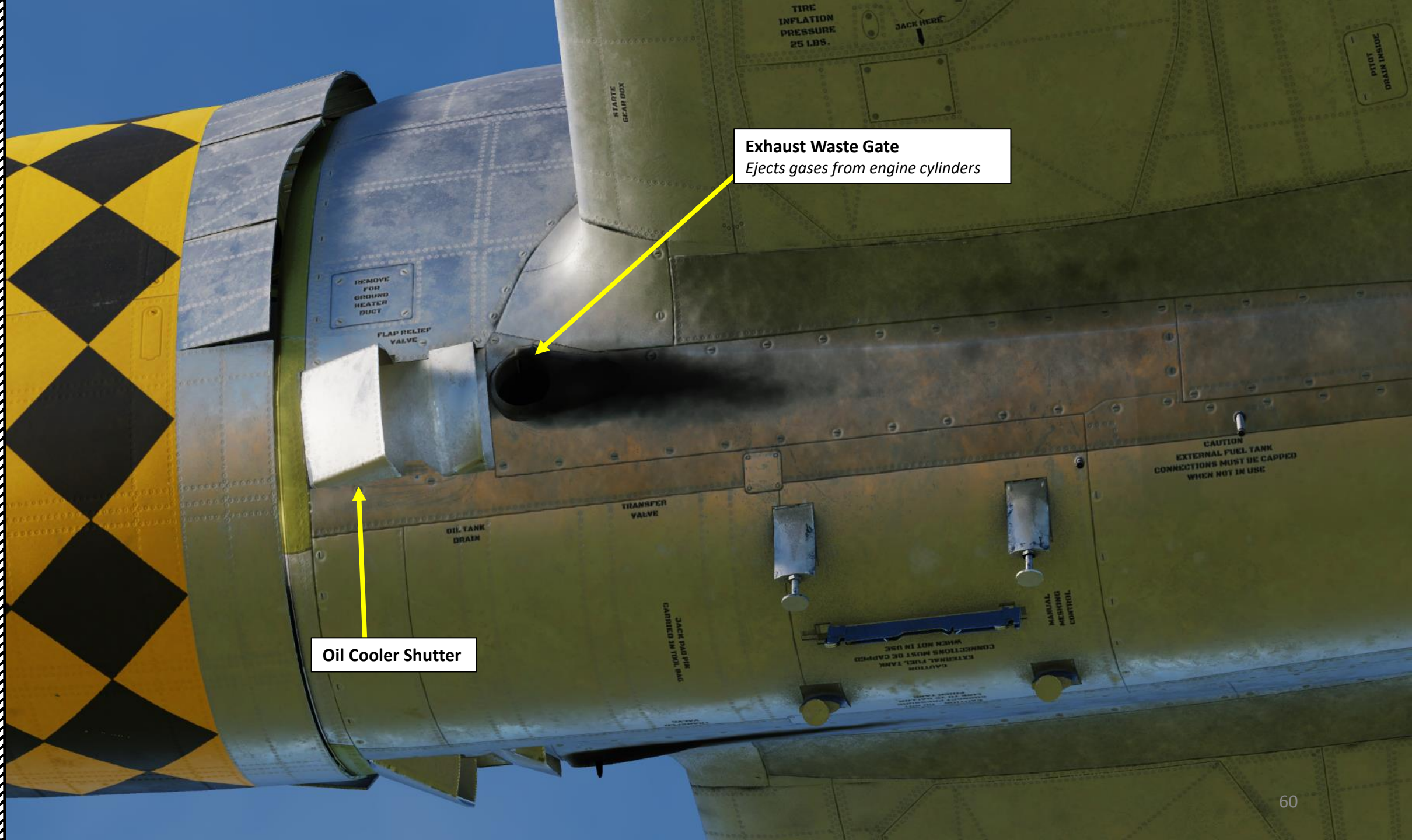

TAILWHEEL LOCK


Bubble Canopy
CANOPY RELEASE
HAND HOLD
HAND HOLD
STEP
FLAP RELIEF VALVE
BATTERY LOCATION ENGINE COMPT. RIGHT SIDE
W7
STEP

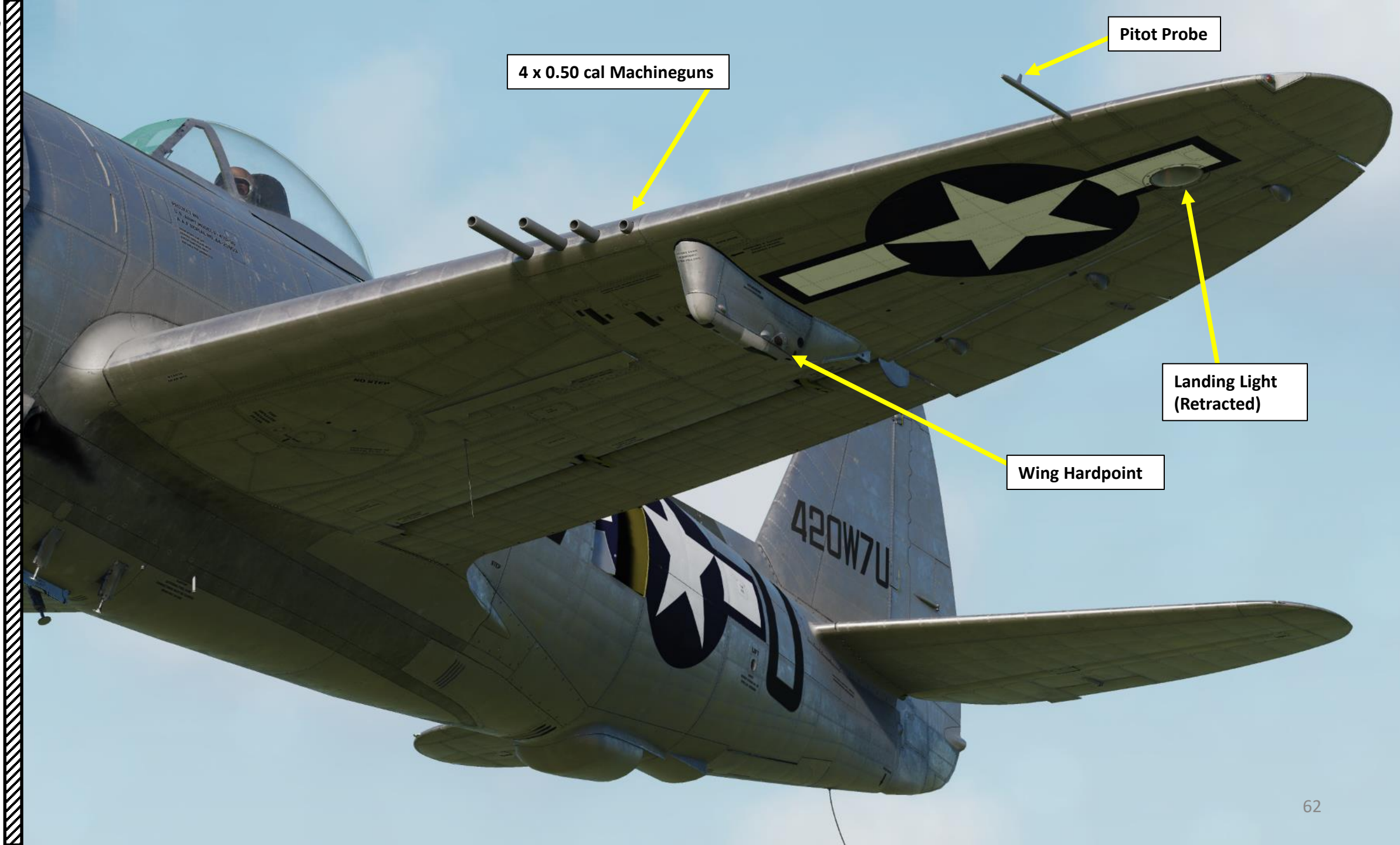

SCR-522-A VHF Aerial Radio Antenna Mast
Aerial Radio Wire
Dorsal Fin
Intercooler Shutter
420W7U


Spinner Hub
Engine Cowling Flaps
PROJECT NO.
U.S. ARMY MODEL P-47D-30
A.A.F SERIAL NO. 44-21053


Engine Air Duct Intake


Exhaust Waste Gate
Ejects gases from engine cylinders
Oil Cooler Shutter
REMOVE FOR GROUND HEATER DUCT
FLAP RELIEF VALVE
OIL TANK DRAIN
TRANSFER VALVE
TIRE INFLATION PRESSURE 25 LBS.
JACK HERE
PITOT DRAIN INSIDE
CAUTION EXTERNAL FUEL TANK CONNECTIONS MUST BE CAPPED WHEN NOT IN USE
MANUAL MESHING CONTROL


Belly Hardpoint
TRANSFER VALVE
CAUTION - DO NOT CONNECT PRESSURE LINE TO 75 GALLON FIDER TANK
CAUTION EXTERNAL FUEL TANK CONNECTIONS MUST BE CAPPED WHEN NOT IN USE
MANUAL MESHING CONTROL
JACK PAD PIN CARRIED IN TOOL BAG


Pitot Probe
4 x 0.50 cal Machineguns
Landing Light (Retracted)
Wing Hardpoint
420W7U


FUEL FILLER SUITABLE FOR AROMATIC FUELS
270 U.S. GALLS
225 IMP. GALLS
BATTERY LOCATION HERE
HOIST
WATER INJECTION TAMIC FILTER
SUPER CHARGER OIL
HAND HOLD
GROUND HERE
30.0 U.S. GALLS
25.0 IMP GALLS
ENTER COCKPIT FROM LEFT SIDE ONLY
FUEL FILLER
SUITABLE FOR AROMATIC FUEL
EXTERNAL ELECTRICAL POWER CART PLUG - 24V
MANUAL MESHING CONTROL
REMOVE FOR GROUND HEATER DUCT


Retractable Main Landing Gear
(Hydraulically actuated)
Retractable Main Landing Gear
(Hydraulically actuated)

Static Ground Wire
Designed to control static electrical accumulations on aircraft while aircraft is stored or is undergoing servicing in a hangar.

Retractable Tailwheel
(Hydraulically actuated)

Flight Hood
Located under turbosupercharger's turbine

Landing Light (Extended)

Wing Navigation Light (Green)

Wing Navigation Light (Red)

Tail Navigation Light


Rudder
Rudder Trim Tab
T-Bolt Empennage
Elevator Trim Tab
Elevator
420691


Aileron
Aileron Trim Tab
NO PUSH
NO STEP
NO STEP
NO PUSH


W7
420W7U
Flaps
(Hydraulically Actuated)


Flap Position Indicator (deg)

Compressibility Recovery Flaps


Flashlight (LALT + L)
CIRCUIT PROTECTORS PUSH TO RESET
GUNS
LEFT WING INBOARD
LEFT WING OUTBOARD
RIGHT WING INBOARD
RIGHT WING OUTBOARD
FUEL PUMPS
OIL COOLER
INTERCOOLER
GUN CAMERA RELAY
GUN SIGHT
CANOPY MOTOR
LANDING LT.
OXY & L.G. WARN. FUEL GAUGE CARB. TEMP. TURBO WARN.
COMPASS LT.
OIL TEMP.
INST. & C'KPIT LT.
PITOT HEAT.
STARTER
POS. LTS.
LAND. LT.
RECOG. LTS.
RADIO
DIVE FLAPS
BOMB & TANK RELEASE
GUN SIGHT
COMPASS LT.
INSTRUMENT LIGHTS
WING TAIL BRIGHT DIM
LAND. EXT. RET. MOM.
C'PIT. ON
INCREASE PRESSURE EMERGENCY
FUEL BOOSTER PUMP
L.G.WARN. LT.TEST
OXY.WARN. LT.TEST
START & ALTITUDE
GEN. ON
PITOT ON
OIL DIL. ON
CONTROL OPTIONS
P-47D-30 Sim
All
Foldable view
Reset category to default
Action
Category
Keyboard
Flashlight
View Cockpit
LAlt + L

Cockpit Spot Light Lamp
*Rotate to adjust intensity **(blue light)***

Set to START

Set to START

Cockpit (White) Light Switch

E: Aircraft Identification Letter

420691: Aircraft Serial Number

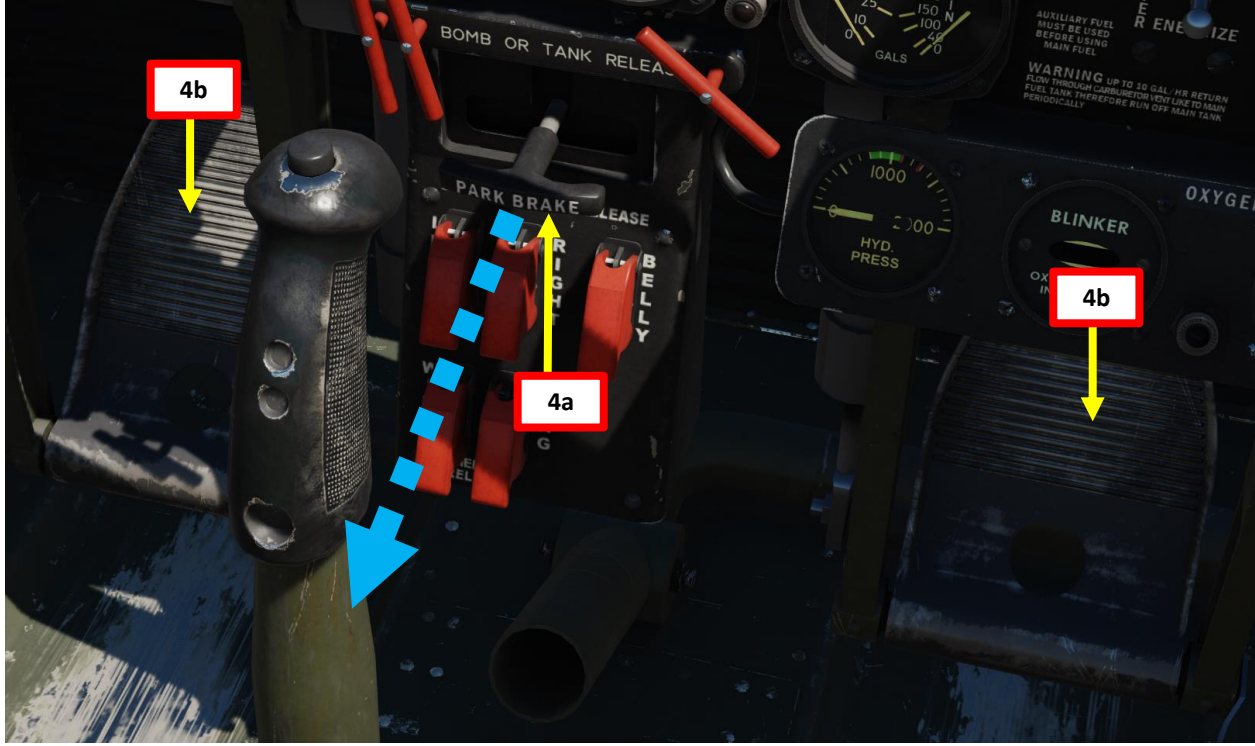
LH: USAAF Squadron Code. “LH” belongs to 350th Fighter Squadron.

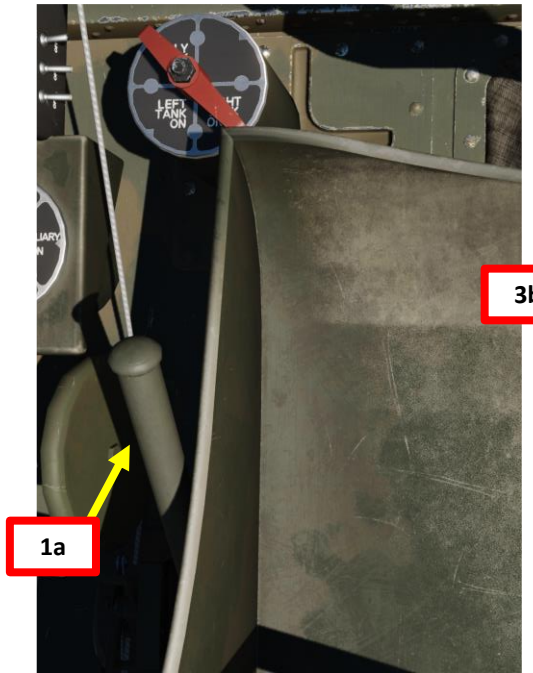
In World War 2, the United States Army Air Forces used aircraft markings as identification codes. For instance, “LH-E” means that the Aircraft E belongs to the 350th Fighter Squadron (LH). You can set up your aircraft markings in the Mission Editor.

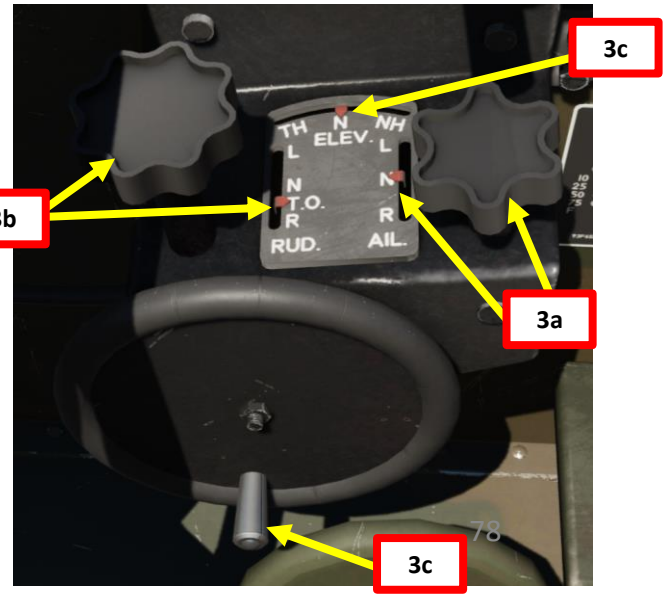
PRE-START

*Within the scope of DCS, we can assume that the aircraft is in good condition. The majority of verifications/checks should pass and are therefore **optional**. These checks are preceded by **(O)**.*

1. **(O)** We will perform a hydraulic hand pump test first. Give the hand pump two or three pumps and verify the hydraulic pressure increases. This verifies that hydraulic pressure can be built up manually to extend the gear and flaps in case of an engine-driven hydraulic pump failure.
2. **(O)** Move the stick and rudder through their full range of travel to check flight controls. Confirm freedom of movement and correct response from the flight control surfaces.
3. Check and set Trim Tab controls
   a) Set Aileron Trim to Neutral (N)
   b) Set Rudder Trim to Takeoff (TO)
   c) Set Elevator Trim:
      - If auxiliary fuel tank is empty, set elevator trim to Neutral (N).
      - If fuel is present in the auxiliary fuel tank, the center of gravity of the aircraft is shifted aft, which requires Nose Heavy (NH) trim. Set elevator trim to approximately 0.75 inch NH (Nose Heavy) forward of Neutral (N).
4. Engage Parking Brake
   a) Pull and hold the parking brake handle
   b) Depress and release toe brake pedals
   c) As you raise your feet from the toe brake pedals, the pedals should remain depressed in the “braking” position.
   d) Release the parking brake handle. It should remain in the ENGAGED position.





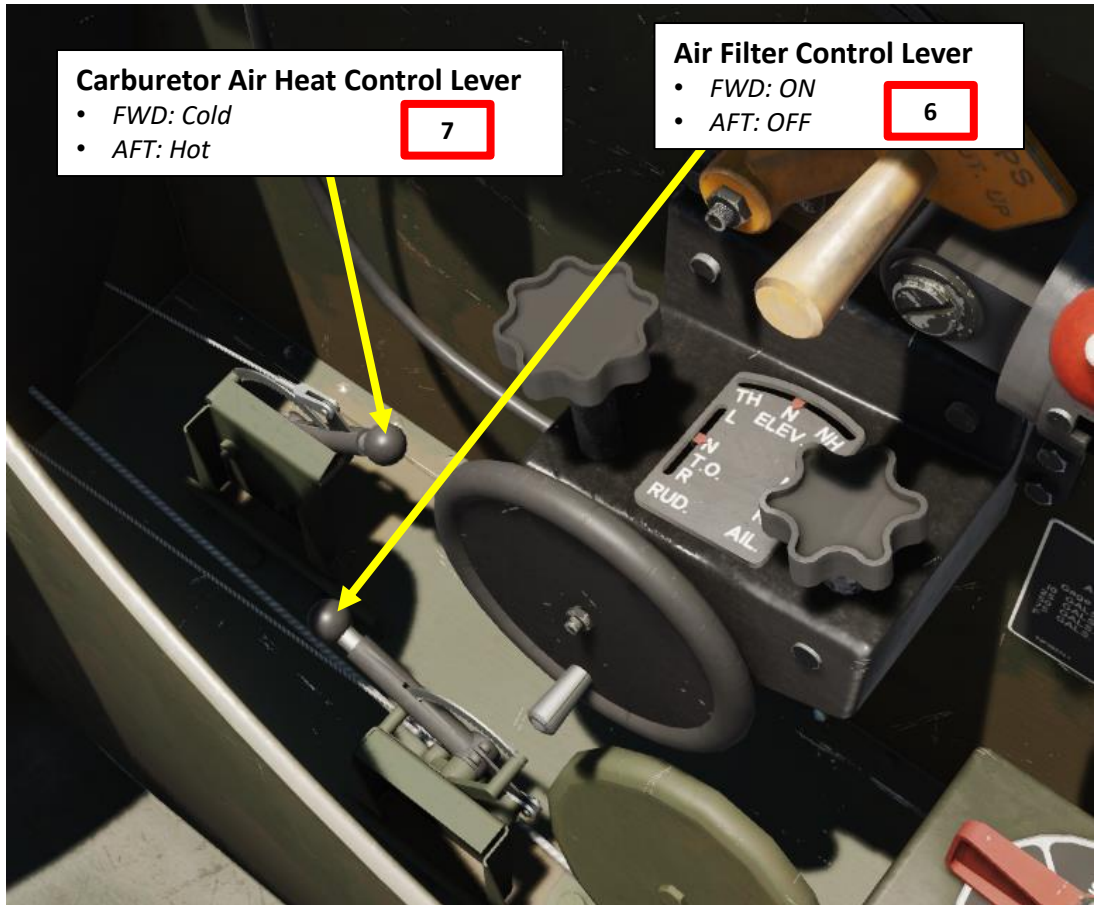


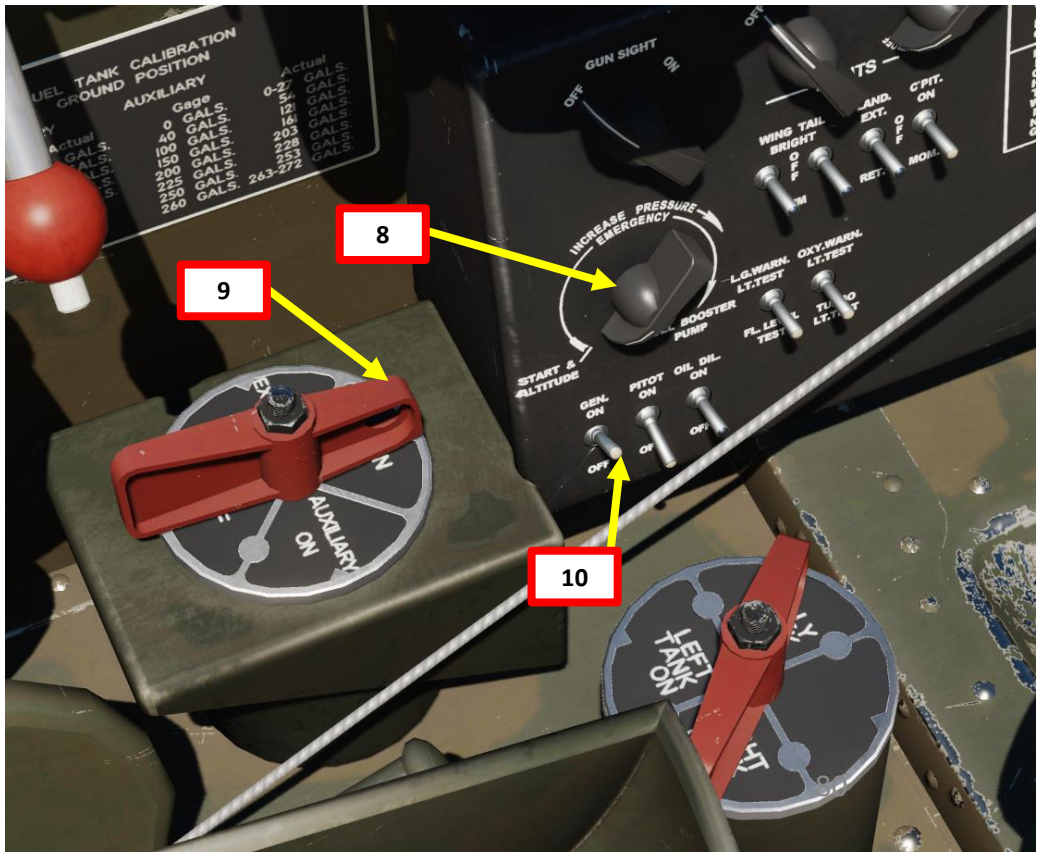
PRE-START

5. Set Altimeter to the airport's elevation by rotating the barometric pressure setting knob.

ENGINE START PROCEDURE

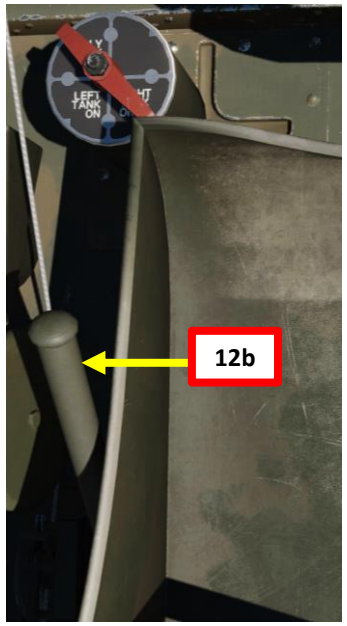
6. Set Air Filter Control Lever FWD (ON) if aircraft is operating in dusty conditions. Otherwise, leave Air Filter Control Lever AFT (OFF).
7. Set Carburetor Air Heat Control Lever – FWD (COLD).
8. Rotate Fuel Boost Pump Rheostat counter-clockwise to START/ALTITUDE position.
9. Set Fuel Selector Valve Handle to MAIN (short shoulder FWD).
10. Set Generator Switch – UP (ON). This will provide electrical power once engine is up and running.
11. Set Propeller Governor Switch – UP (Automatic Constant Speed). This ensures the propeller RPM is controlled through the propeller (P) lever on the throttle quadrant.

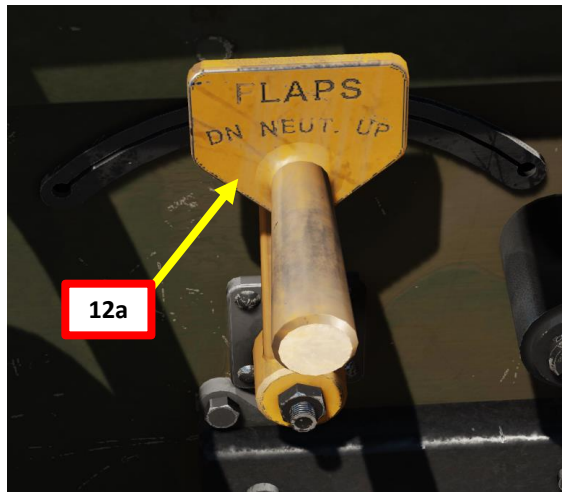


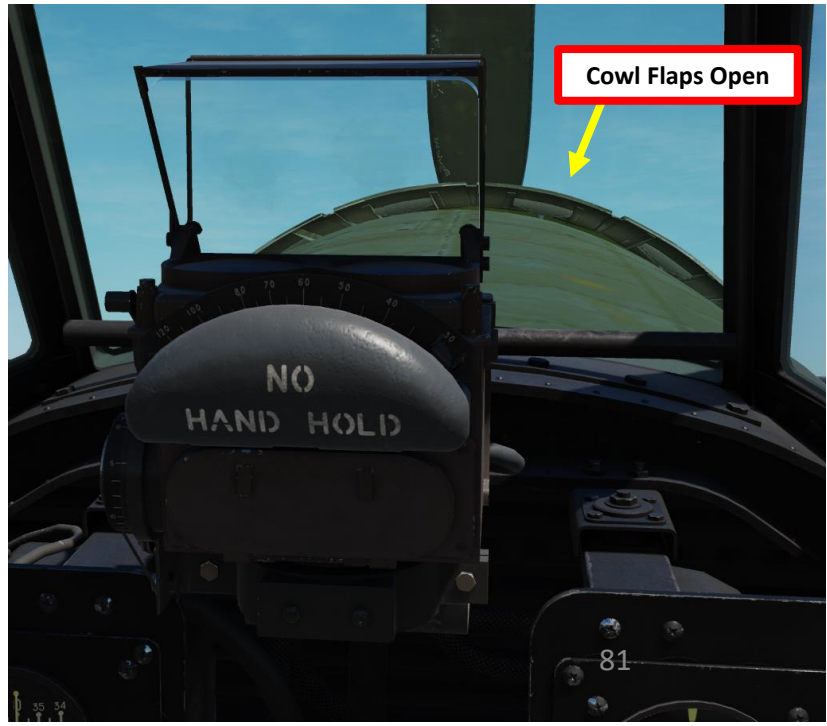


ENGINE START PROCEDURE

12. Open engine cowl flaps. When the engine is not running, the only way to open them is to generate hydraulic pressure with the hand pump.
    a) Set Flaps Lever to NEUTRAL (Middle) so that the flaps do not soak up all the hydraulic pressure.
    b) Pull the Hydraulic Hand Pump 5 to 10 times to build up sufficient hydraulic pressure.
    c) Pull the Engine Cowl Flaps Handle until the cowl flaps open fully.
    d) Set Flaps Lever to UP (FWD).

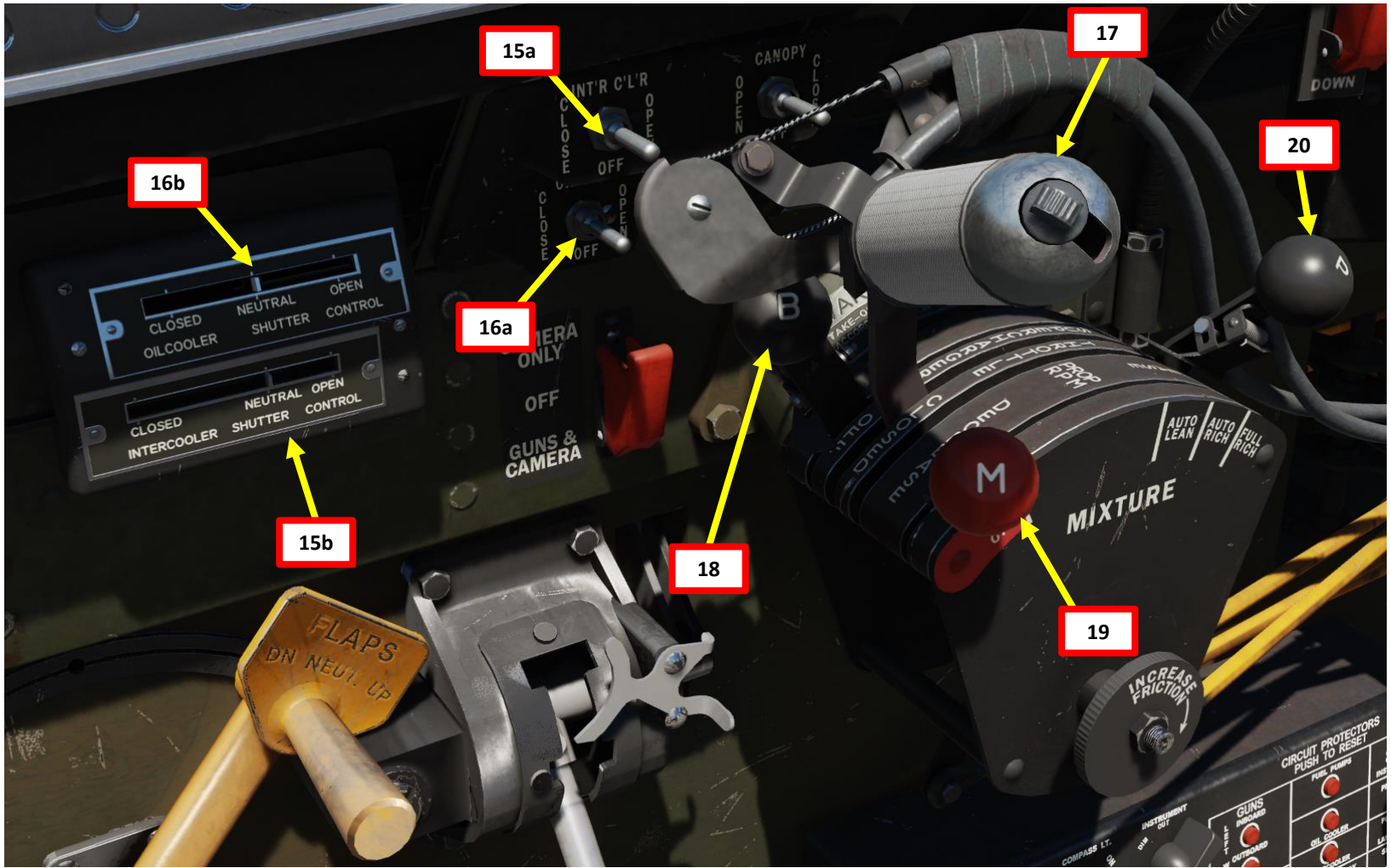


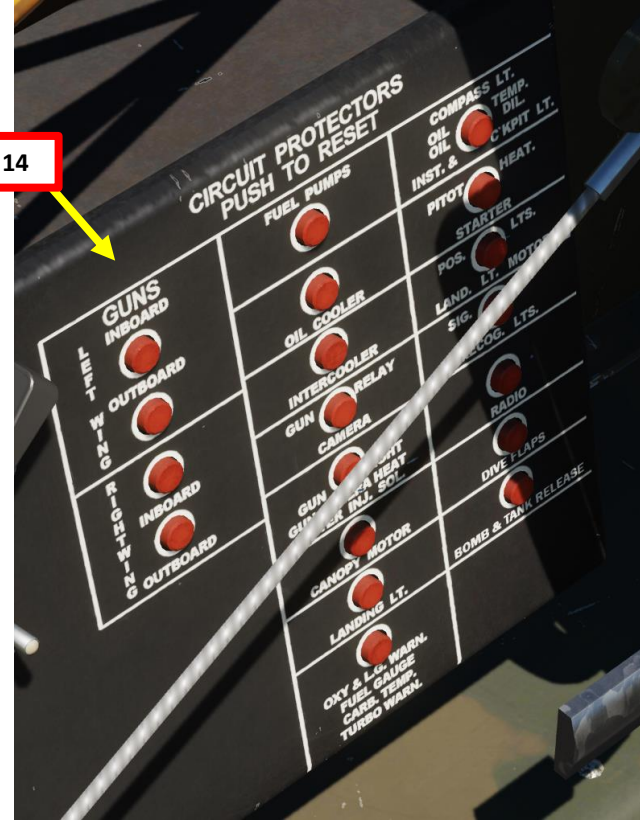


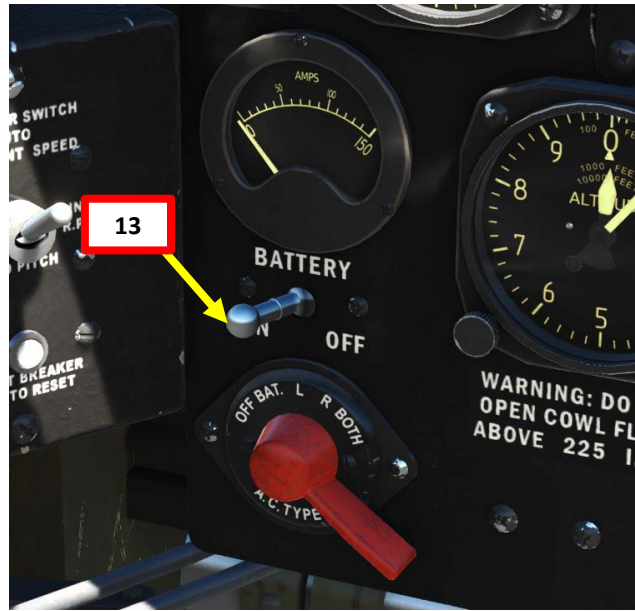


ENGINE START PROCEDURE

13. Set Battery Switch – ON (LEFT)
14. Verify that no circuit breakers pop out on the electrical panel and the propeller governor panel.
15. Use Intercooler Shutters Control (INTRCLR) Switch to set the intercooler shutters to the NEUTRAL position.
16. Use Oil Cooler Shutters Control (OIL CLR) Switch to set the oil cooler shutters to the NEUTRAL position.
    - Note: If operating in cold weather, oil cooler shutters should be set to CLOSED position instead.
17. Move throttle one inch forward.
18. Set Turbosupercharger (B) lever to OFF position (AFT).
19. Set Mixture Control (M) lever to IDLE CUT-OFF (AFT).
20. Set Propeller RPM Control (P) lever to INCREASE RPM (FULL FWD)





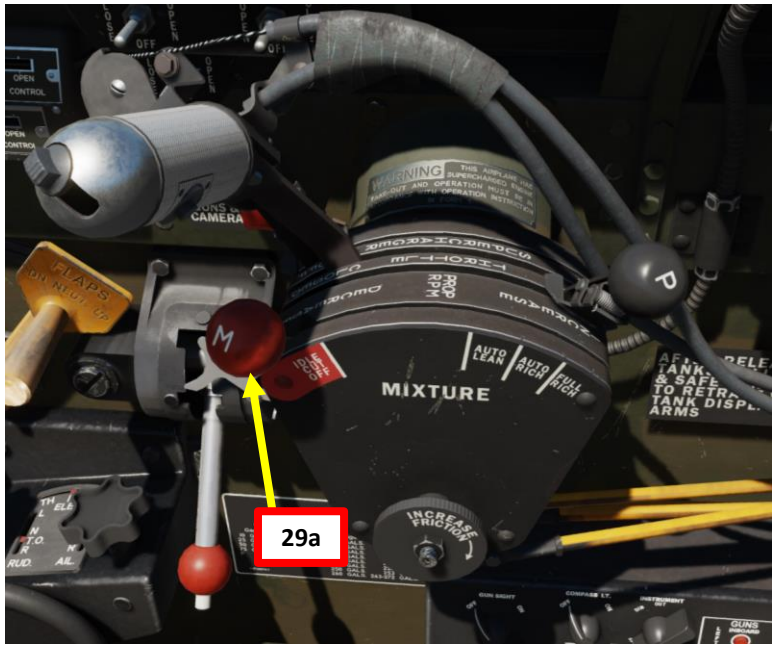


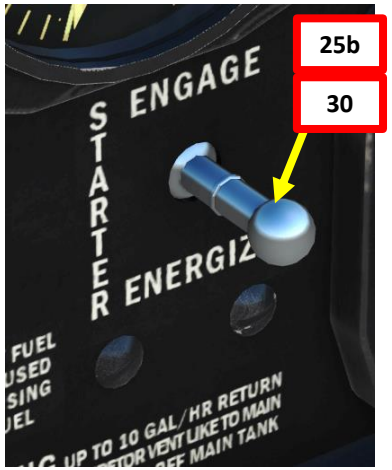
ENGINE START PROCEDURE

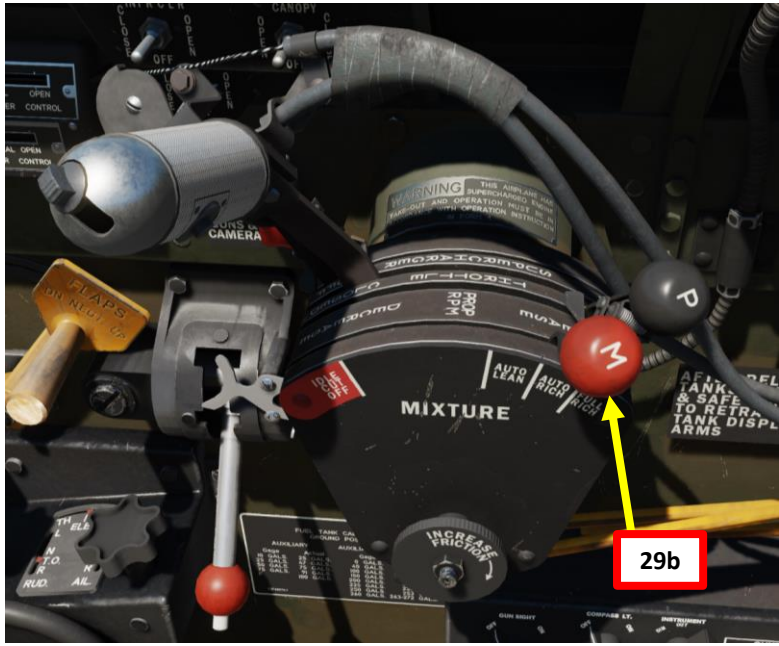
21. The crew chief will have already rotated the propeller several turns by hand.
22. Prime the engine
    a) Unlock primer handle by turning it counterclockwise (right click).
    b) Prime engine four to six times in order to pump fuel into combustion chamber. This is performed by pulling the primer handle and pushing it back in (hold left click to pull, release click to push).
        - 2 to 4 strokes are required for hot weather
        - 4 to 6 strokes are required for cold weather
    c) Lock primer handle back in locked position (right click).

ENGINE START PROCEDURE

23. Verify that the propeller is clear and command « Clear prop! » to warn people around you that you are about to start the engine.
24. Set Magneto (Ignition) Selector Switch to BOTH to select both magnetos.
25. Flick the starter switch up to ENGAGE, then back to OFF. This seats the starter brushes on the commutator.
26. Set STARTER switch to ENERGIZE (DOWN) position for 15 seconds by left clicking and holding the switch DOWN. This will energize (crank up) the starter's inertial flywheel.
27. After 15 seconds, set STARTER switch to ENGAGE (UP) and keep it held up by right clicking and holding the switch UP. This transfers the flywheel's energy to the engine to turn it over.
28. Keep the STARTER switch to ENGAGE (UP) until the engine fires.
29. Once engine fires (you will hear a distinct « cough »), set Mixture Control (M) lever to AUTO RICH position (FWD). The STARTER switch can be left in ENGAGE for five or six revolutions of the propeller to provide a hotter spark and help the engine to « catch ».
    - *Note: I suggest mapping the « Mixture AUTO RICH» binding to a switch on your throttle to let your right hand hold the starter switch with the mouse while the left hand moves the mixture lever.*
30. Return STARTER switch to OFF when the engine is running on its own. The engine-driven hydraulic pump will start running and raise the flaps.
31. If the engine does not catch on the first attempt, release the STARTER switch and return the mixture lever to IDLE CUTOFF (AFT). Something like engine priming, fuel supply or electrical power could have been missed along the way. You will want to wait one minute to allow the starter to cool down and double check the cockpit setup before trying again.



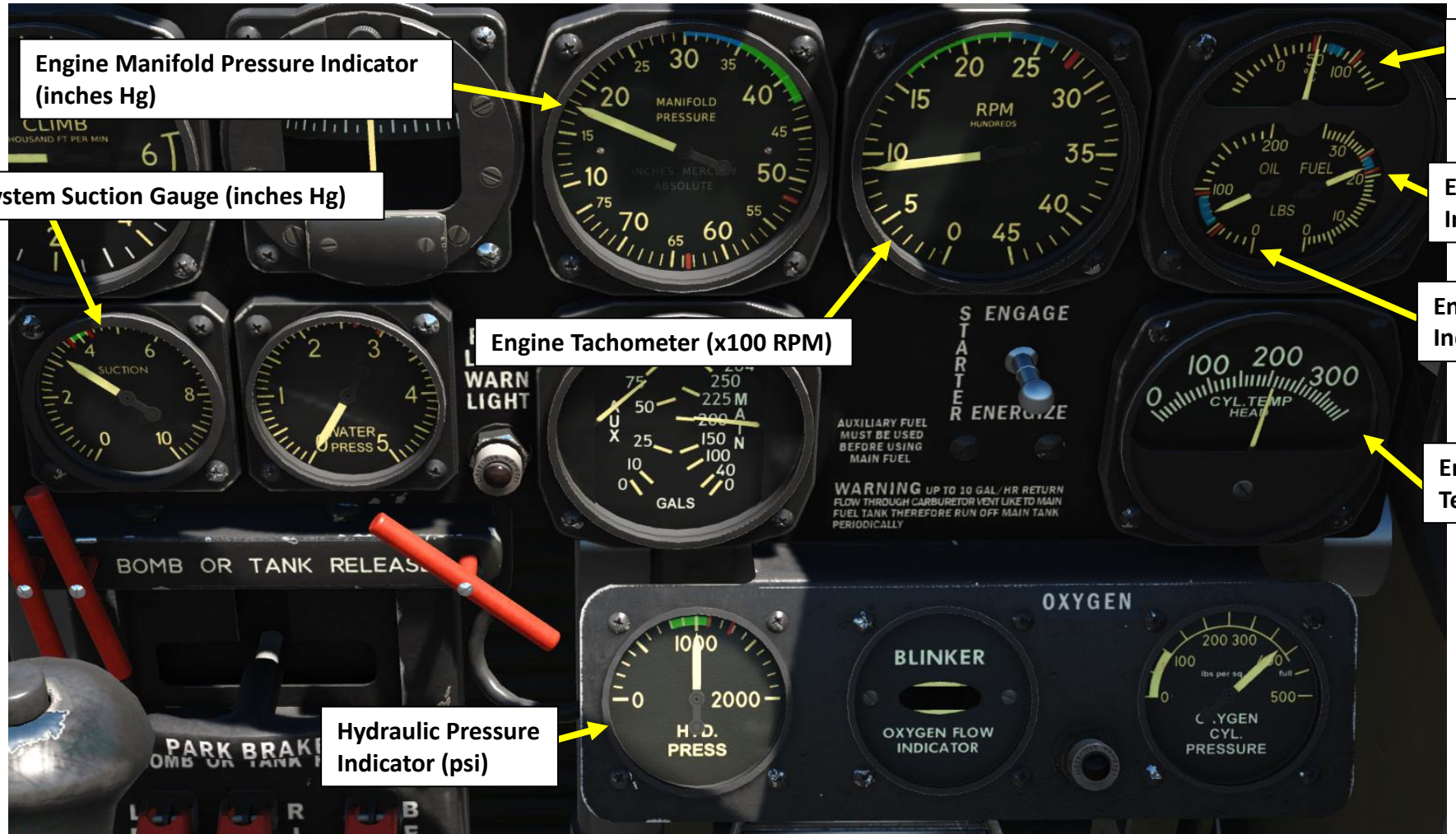




ENGINE START PROCEDURE

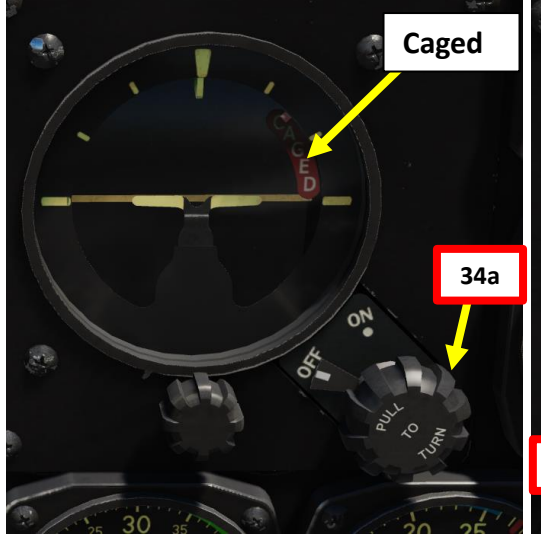
ENGINE WARM UP

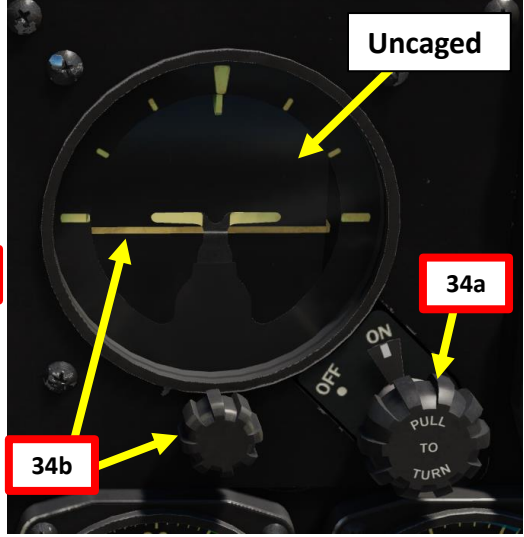
32. Adjust throttle so the engine RPM is about 900 and wait for the engine to warm up (this process can take about 3 minutes)
    a) Verify that oil pressure increases. If oil pressure is not above 25 psi within 30 seconds, shut down the engine.
    b) In cold weather, you can expect an oil pressure increase to 150-200 psi before it settles down to its normal range of 75-85 psi.
    c) Oil temperature gauge should settle down at about 50 deg C.
    d) Fuel pressure should be 22-24 psi.
    e) Cylinder Head Temperature (CHT) should settle in at about 100-260 deg C.
    f) Check for proper Hydraulic Pressure (should be between 800 and 1100 psi).
    g) Vacuum Suction gauge's pointer should be within the values of 3,85 – 4,15 in Hg
33. Once oil pressure, oil temperature, fuel pressure, cylinder head temperature and fuel pressure are stabilized at the normal operating values listed above, increase throttle above 1000 RPM.

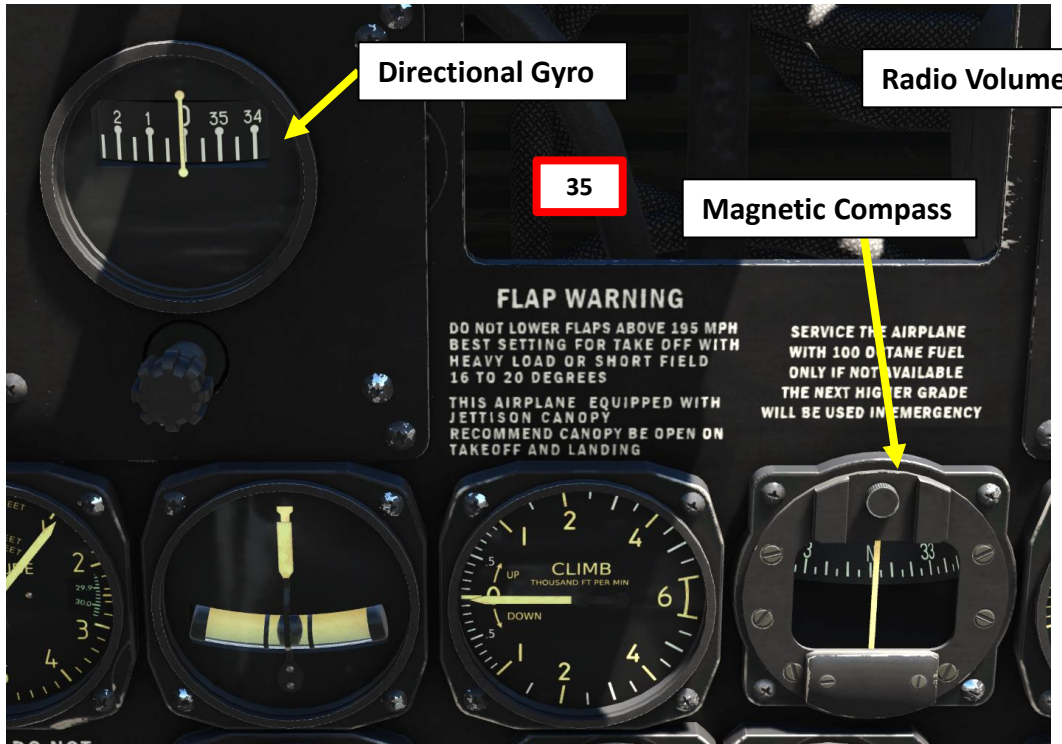


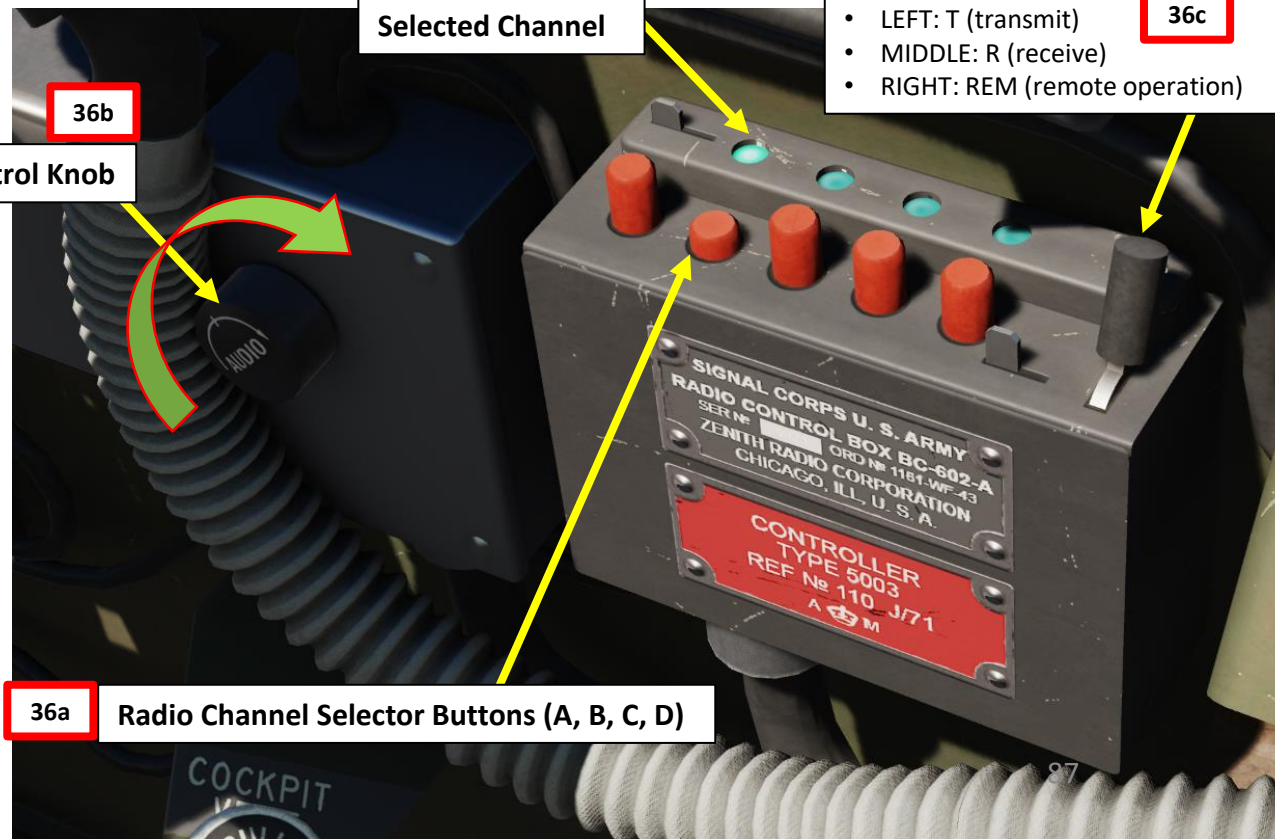
POST-START

34. Uncage and set the Horizon Gyro
    a) Left click on the Caging knob to uncage the gyro
    b) Scroll mousewheel to rotate the Horizon Alignment Knob to align the horizon line slightly below the wings. Since we are sitting nose high on the ground.
35. Check that directional gyro has had enough time to calibrate by comparing its heading with the magnetic compass' heading.
36. Turn on radio (this is typically delayed as long as possible to preserve the battery but can be done at any time if communications are required earlier in the mission)
    a) Select Channel A, B, C or D (as per mission briefing).
        - "A" channel is usually used for all normal plane-to-plane communications with a Controller.
        - "B" channel is common to all VHF-equipped control towers. It is normally use to contact the control tower for takeoff and landing instructions.
        - "C" channel is frequently use in contacting homing stations.
        - "D" channel is normally used for plane-to-ground contact with Radio Direction Finding (D/F) stations.
    b) Rotate AUDIO knob to adjust volume as desired.
    c) Set Radio Mode switch RIGHT to REM (Remote Operation)









POST-START

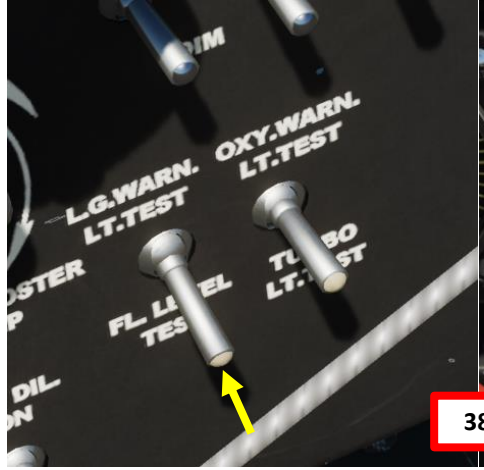
*Within the scope of DCS, we can assume that most of warning light checks will pass and are therefore **optional**. These checks are preceded by **(O)**.*

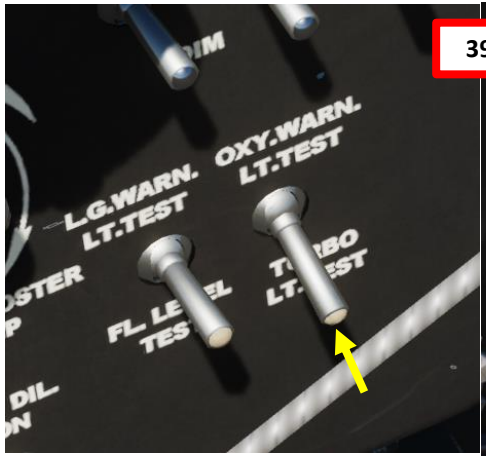
37. **(O)** Set LG WARN LT TEST / FL LEVEL TEST switch UP to test the Landing Gear Warning Light. Confirm that the **Red LDG WARNING LIGHT** illuminates when switch is held UP.

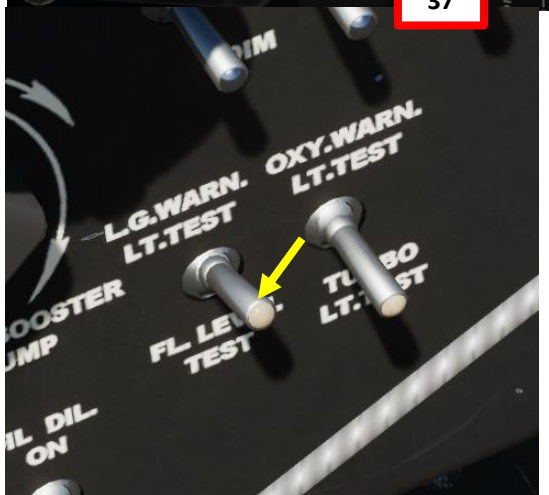
38. **(O)** Set LG WARN LT TEST / FL LEVEL TEST switch DOWN to test the Fuel Level Light. Confirm that the **FUEL LEVEL WARN LIGHT** illuminates when switch is held DOWN.

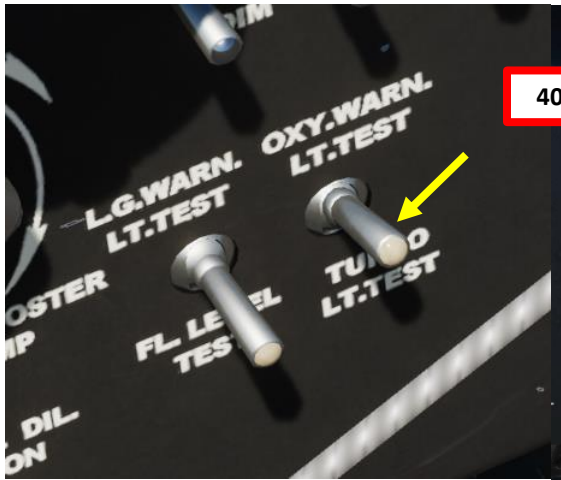
39. **(O)** Set OXY WARN LT TEST / TURBO LT TEST switch DOWN to test the Turbosupercharger Light. Confirm that the **TURBINE OVERSPEED LIGHT** illuminates when switch is held DOWN.

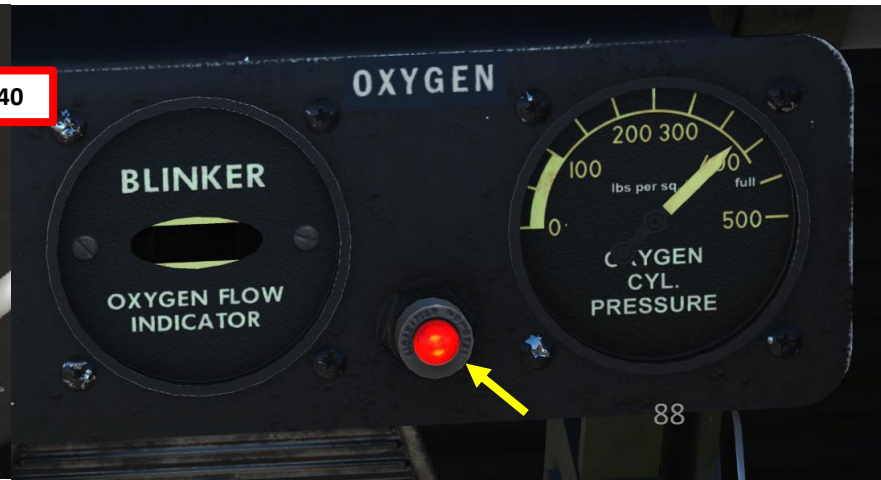
40. **(O)** Set OXY WARN LT TEST / TURBO LT TEST switch UP to test the Oxygen Warning Light. Confirm that the **LOW OXYGEN PRESSURE** warning light illuminates when switch is held UP.











ENGINE RUN-UP

The engine run-up is basically a series of checks to make sure that every engine component is behaving as expected in relevant engine regimes. *Within the scope of DCS, we can assume that most of engine run-up checks will pass and are therefore **optional**. These checks are preceded by **(O)**.*

41. **(O)** When engine is warmed up, advance throttle to set 30 in Hg of manifold pressure and adjust Propeller RPM Control (P) lever to 2000 RPM.

Magneto Check

42. **(O)** Make sure engine RPM is at 2000 RPM, then set Magneto (Ignition) switch to R for the right magneto, then L for the left magneto while watching the engine RPM gauge. You should expect a drop of about 60 RPM while running on either magneto, but never more than 100 RPM.

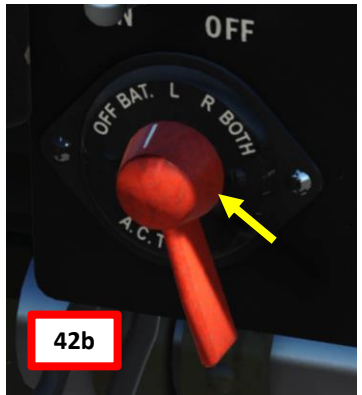
43. **(O)** If all is well, set Magneto (Ignition) switch back to BOTH.

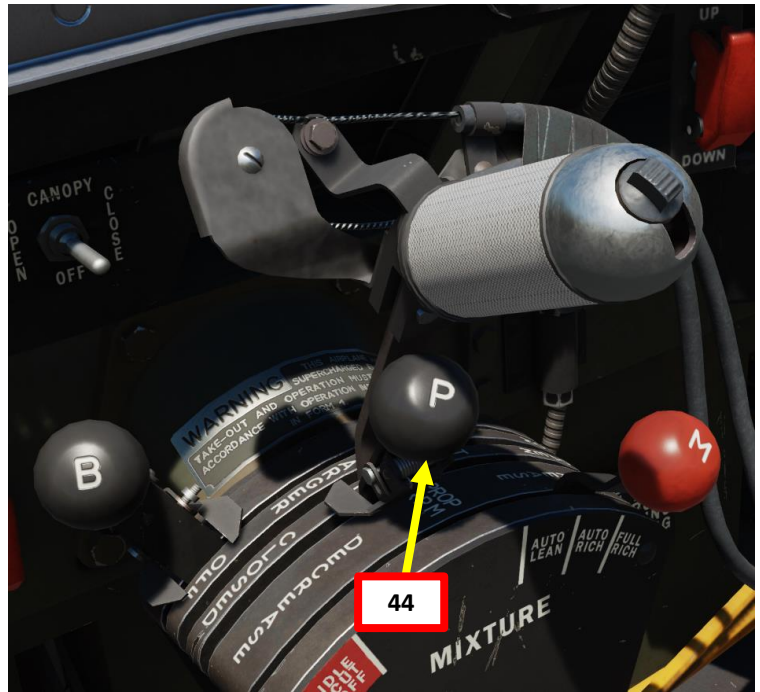
Propeller Governor Operation Check

44. **(O)** Pull the Propeller RPM Control (P) lever back until you get a drop of about 200 RPM on the gauge (1800 RPM).

45. **(O)** Leave the Propeller RPM Control lever in place for a moment to ensure there is no oscillation that could indicate a faulty governor.

46. **(O)** Return RPM to 2000 using the Propeller RPM Control lever.





ENGINE RUN-UP

Propeller Backup Operation Check

47. **(O)** Set Propeller Governor Switch to FIXED PITCH (DOWN) position.
48. **(O)** Toggle Propeller Governor Switch FWD to INCREASE and confirm that RPM increases.
49. **(O)** Toggle Propeller Governor Switch AFT to DECREASE and confirm that RPM decreases.
50. **(O)** Set Propeller Governor Switch to CONSTANT SPEED AUTO (UP) and confirm that RPM goes back to governed propeller speed 2000 RPM.

ENGINE RUN-UP

Fuel Tank Feed Check

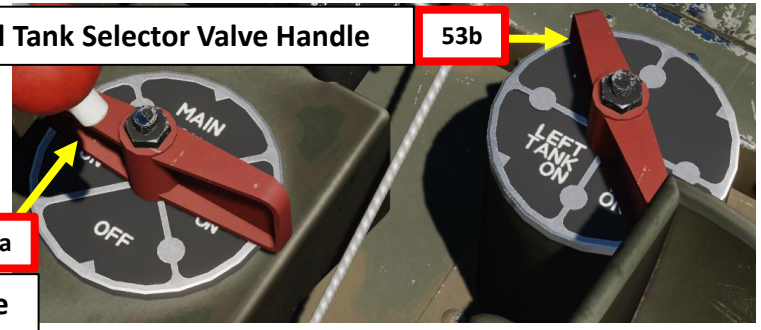
51. **(O)** While on ground, the fuel tanks quantity readings are inaccurate from the gauge and must be translated through the Fuel Tank Calibration Ground Position Table.

52. **(O)** If fuel is available in auxiliary tank, set Engine Fuel Selector Valve Handle from MAIN to AUXILIARY. Verify that engine does not stutter or hesitate for more than a second or two and fuel pressure remains between 22 and 24 psi.

53. **(O)** If fuel is available in external tanks, perform similar checks with the Fuel Selector Valve Handle being set to EXTERNAL and with the External Fuel Tank Selector Valve Handle being set to the installed tanks.

54. **(O)** When fuel checks are performed, set Engine Fuel Selector Valve Handle back to MAIN.

External Fuel Tank Selector Valve Handle



Fuel Selector Valve Handle

Generator Check

55. **(O)** Check for a charge on the Ammeter. This indicates the generator is operating.

- If no charge is indicated, verify the RPM is set above 1100 or so required to operate the generator. If there is still no charge indicated, there is a problem and you should short he aircraft.
- If the charge is low, it means the battery is fully charged and helping pick up the electrical load.

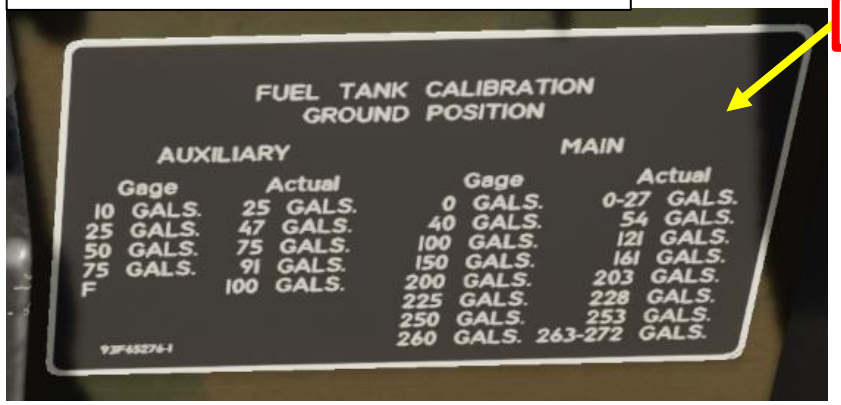
Engine Instrument Check

56. Check engine instruments readings at 2000 RPM.
    a) Oil Pressure: 75-85 psi
    b) Oil temperature: approx. 50 deg C
    c) Fuel pressure: 22-24 psi
    d) Cylinder Head Temperature (CHT): 100-260 deg C
    e) Hydraulic Pressure: 800 and 1100 psi

Important Note about Battery Power

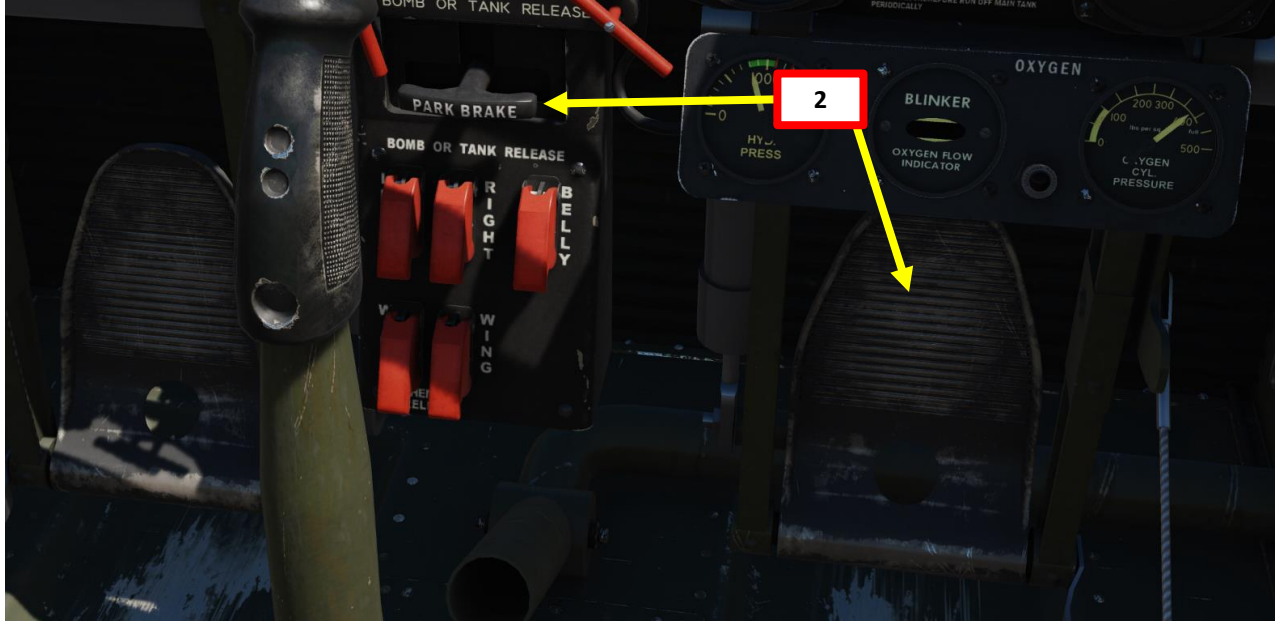
57. Engine RPM on the ground and during taxi will usually be below the 1100 RPM required to run the generator, so you will be using up the battery power below this RPM. You will want to minimize the time on the ground or run the engine up periodically to run the generator and refresh the charge. Keep an eye on your ammeter!

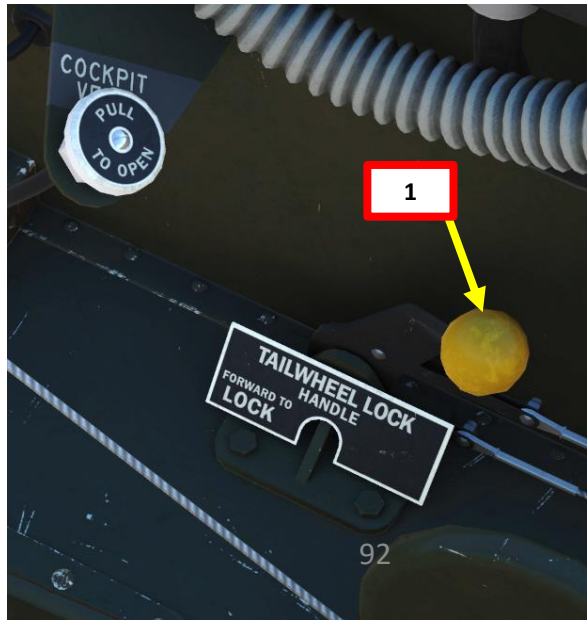
Fuel Tank Calibration Ground Position Table



TAXI PROCEDURE

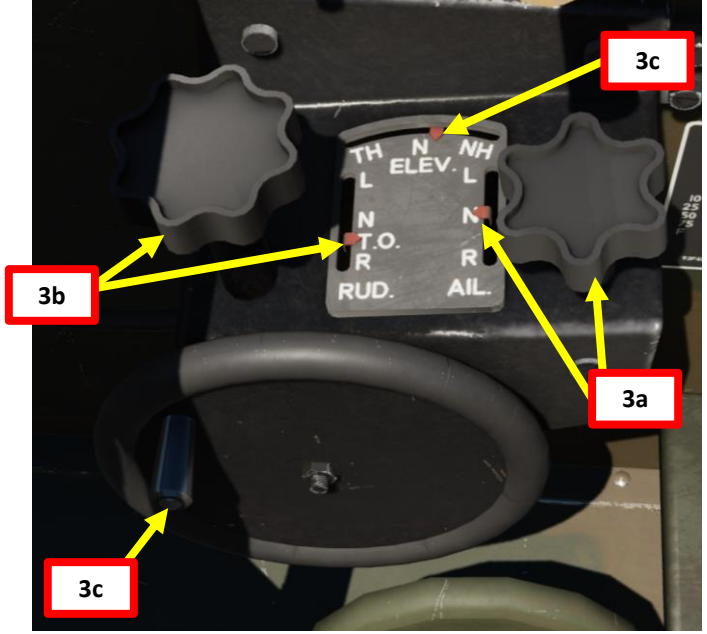
1. Unlock tailwheel by setting the Tailwheel Lock Control Lever AFT.
2. Tap toe brakes to release the parking brake
3. Throttle up to gain forward motion. Taxiing should be done at 10-15 mph maximum (recommended RPM is 900).
4. The nose restricts forward visibility. This means that in taxiing, you must zig-zag (or "S-turn") continually.
5. To perform a turn, use differential braking by gently tapping the wheel brake pedal on the side you wish to turn.

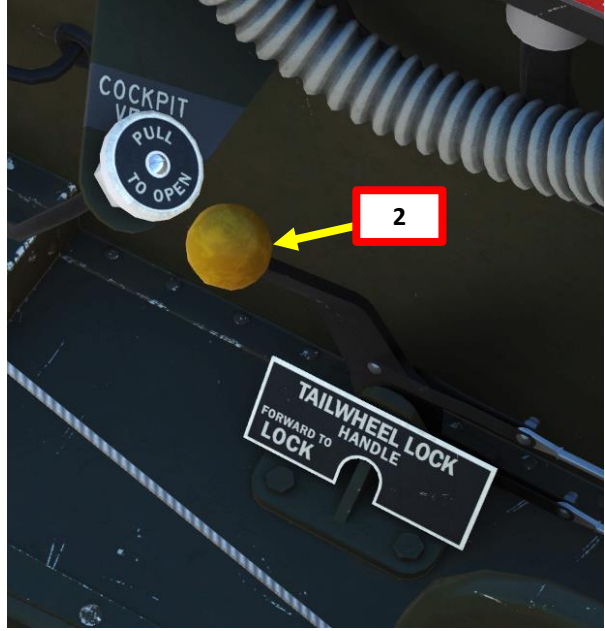




TAKEOFF PROCEDURE

1. Once you are lined up on the runway, move forward to straighten the tailwheel.
2. Lock tailwheel by setting the Tailwheel Lock Control Lever FWD.
3. Check and set Trim Tab controls
   a) Set Aileron Trim to Neutral (N)
   b) Set Rudder Trim to Takeoff (TO)
   c) Set Elevator Trim:
      - If auxiliary fuel tank is empty, set elevator trim to Neutral (N).
      - If fuel is present in the auxiliary fuel tank, the center of gravity of the aircraft is shifted aft, which requires Nose Heavy (NH) trim. Set elevator trim to approximately 0.75 inch NH (Nose Heavy) forward of Neutral (N).



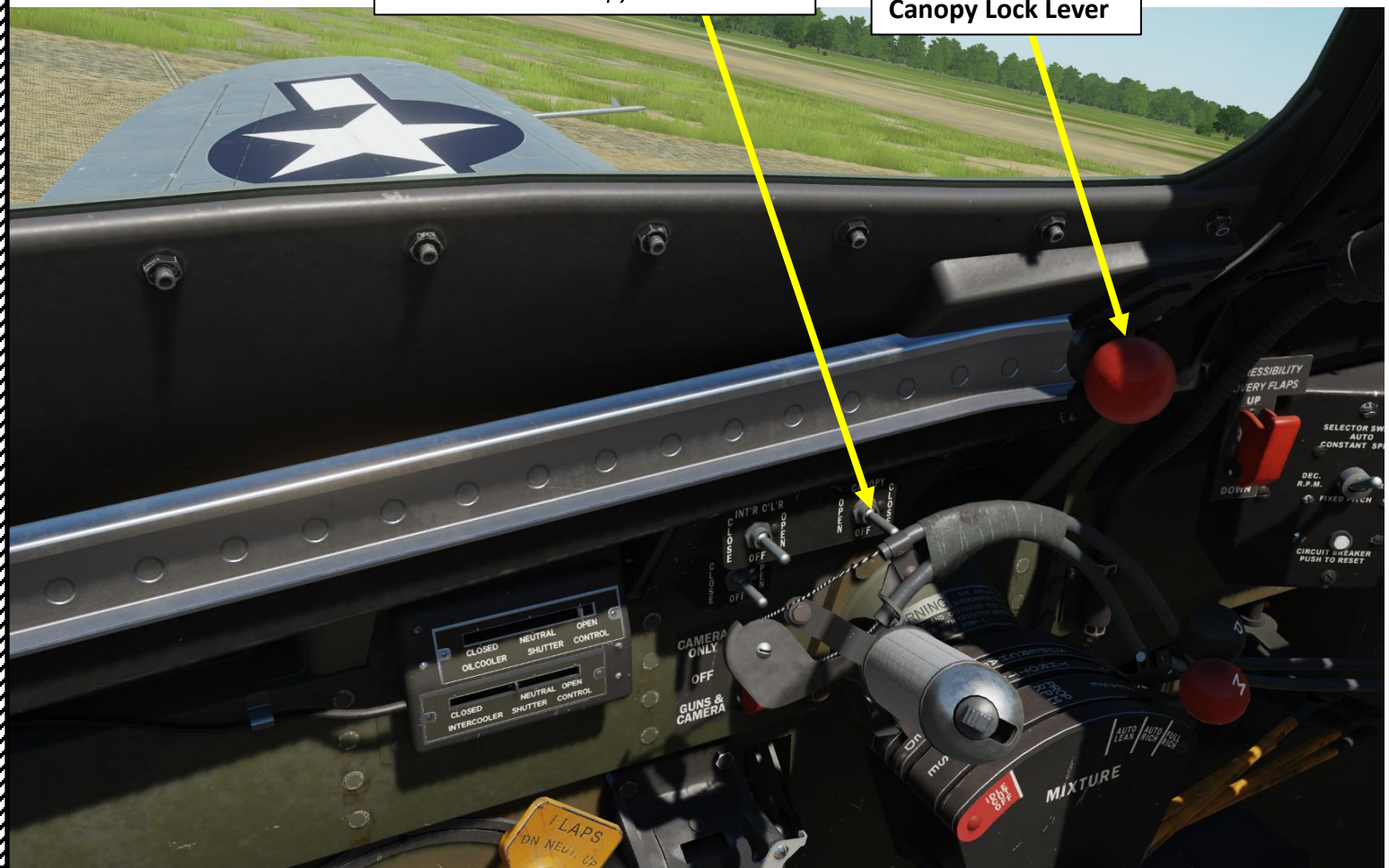


TAKEOFF PROCEDURE

4. Close Canopy using either the Canopy Lock Lever or the Canopy (Electrical Control) Switch.

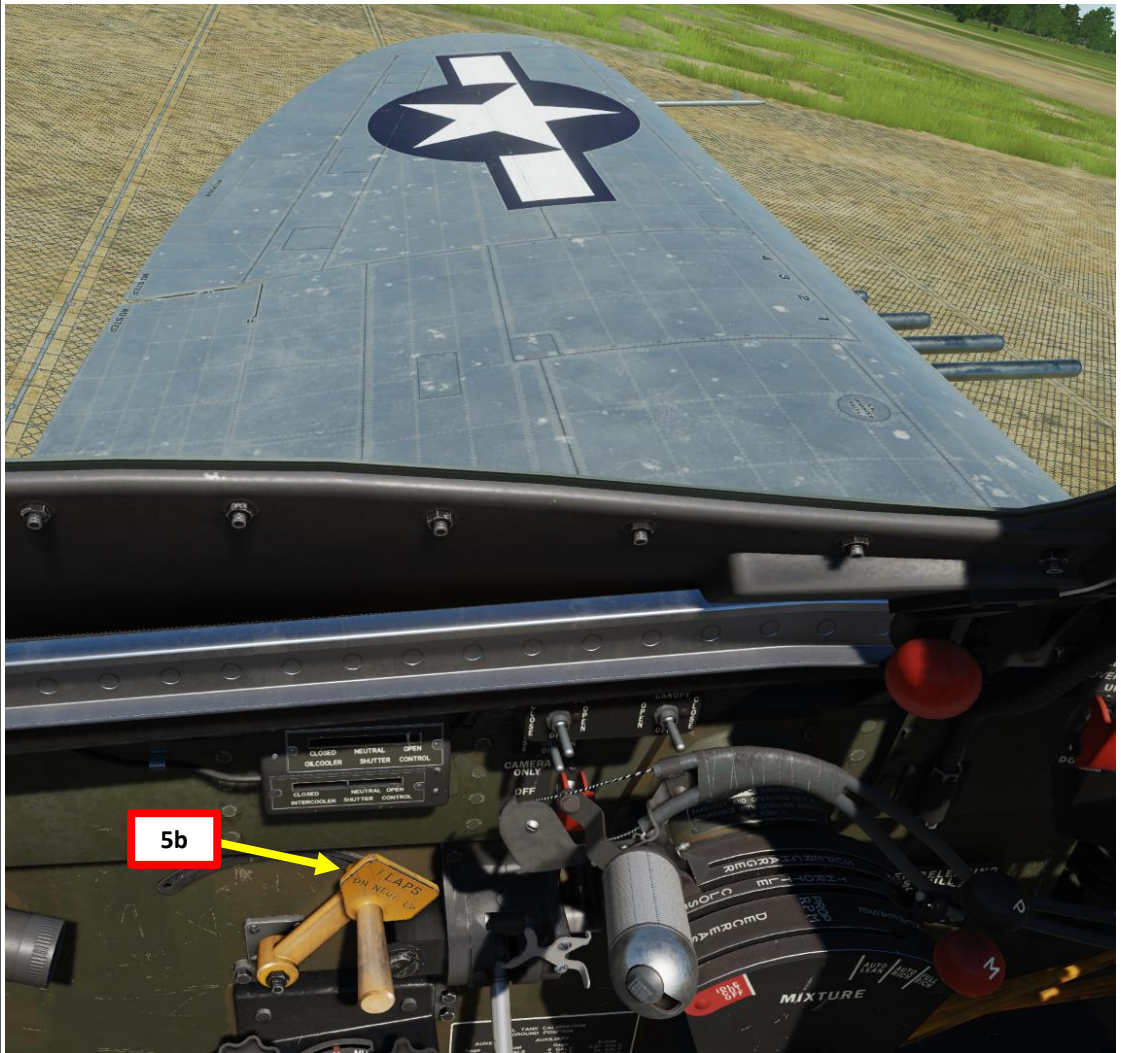
Canopy (Electrical Control) Switch
- *AFT: Opens Canopy*
- *MIDDLE: OFF*
- *FWD: Closes Canopy*

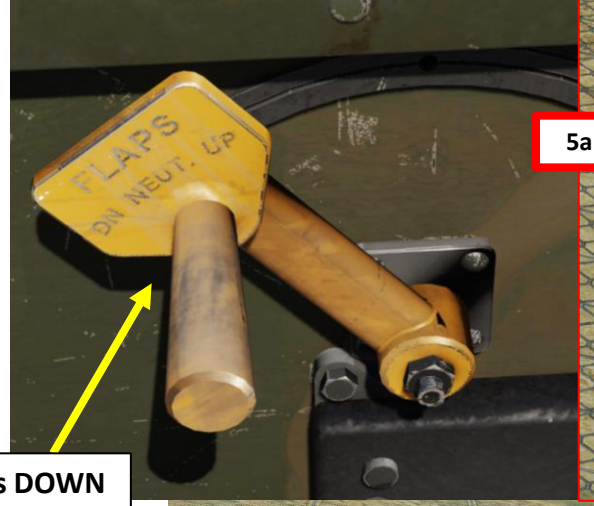
Canopy Lock Lever

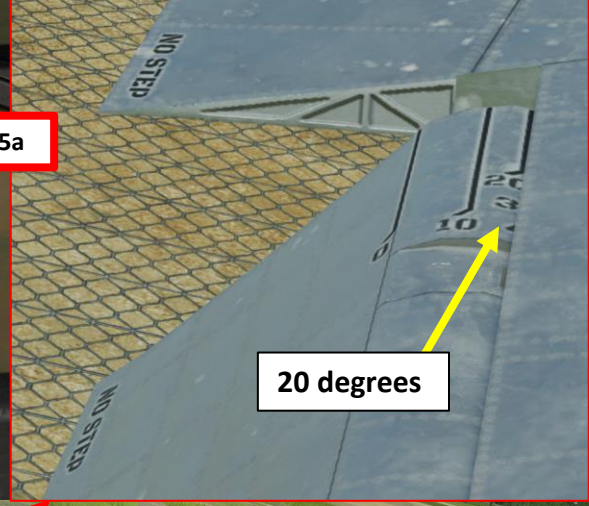


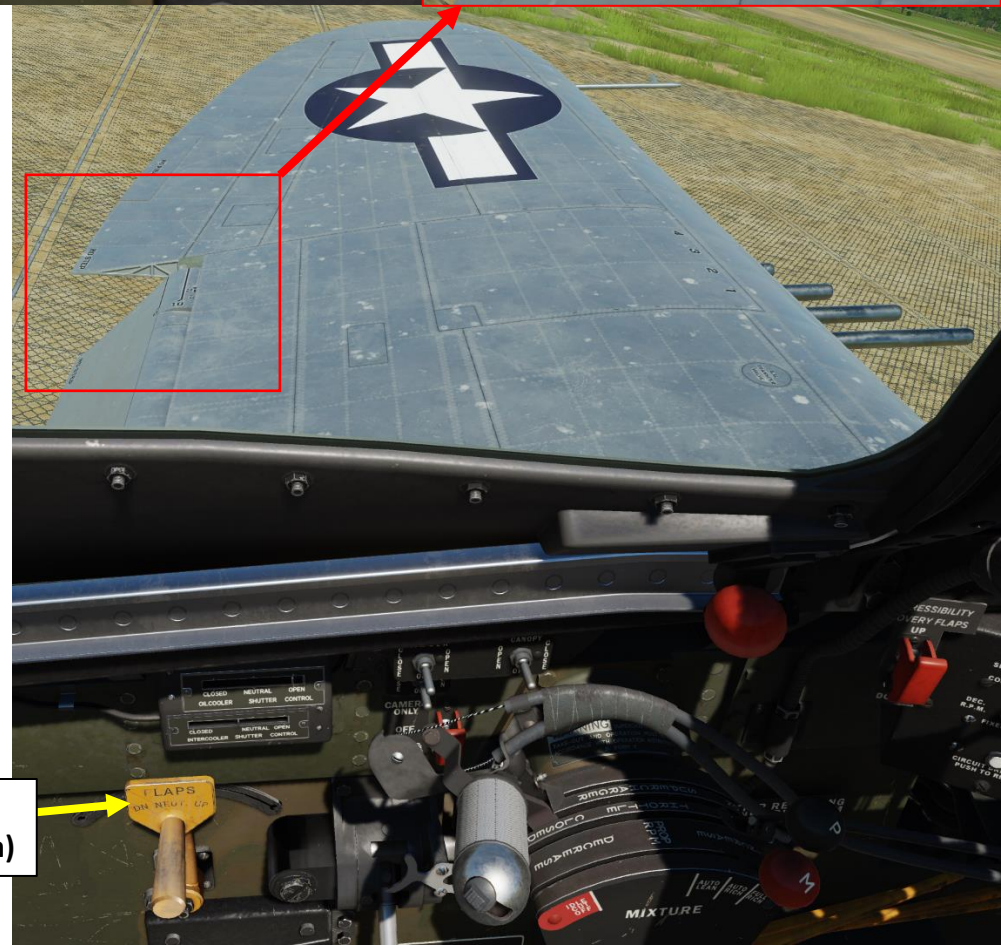
TAKEOFF PROCEDURE

5. Set flaps for takeoff using the Flaps Control Lever
   a) For heavy configurations (bombs equipped) or abnormally short runways, set flaps to 20 deg by setting the flaps lever AFT to DN (Down) until the flaps position indicator on the wing indicates 20. Then, set flaps lever to MIDDLE (Neutral) position to lock flaps into position.
   b) For normal configurations (no bombs equipped), set flaps UP by setting the flaps lever FWD (UP).



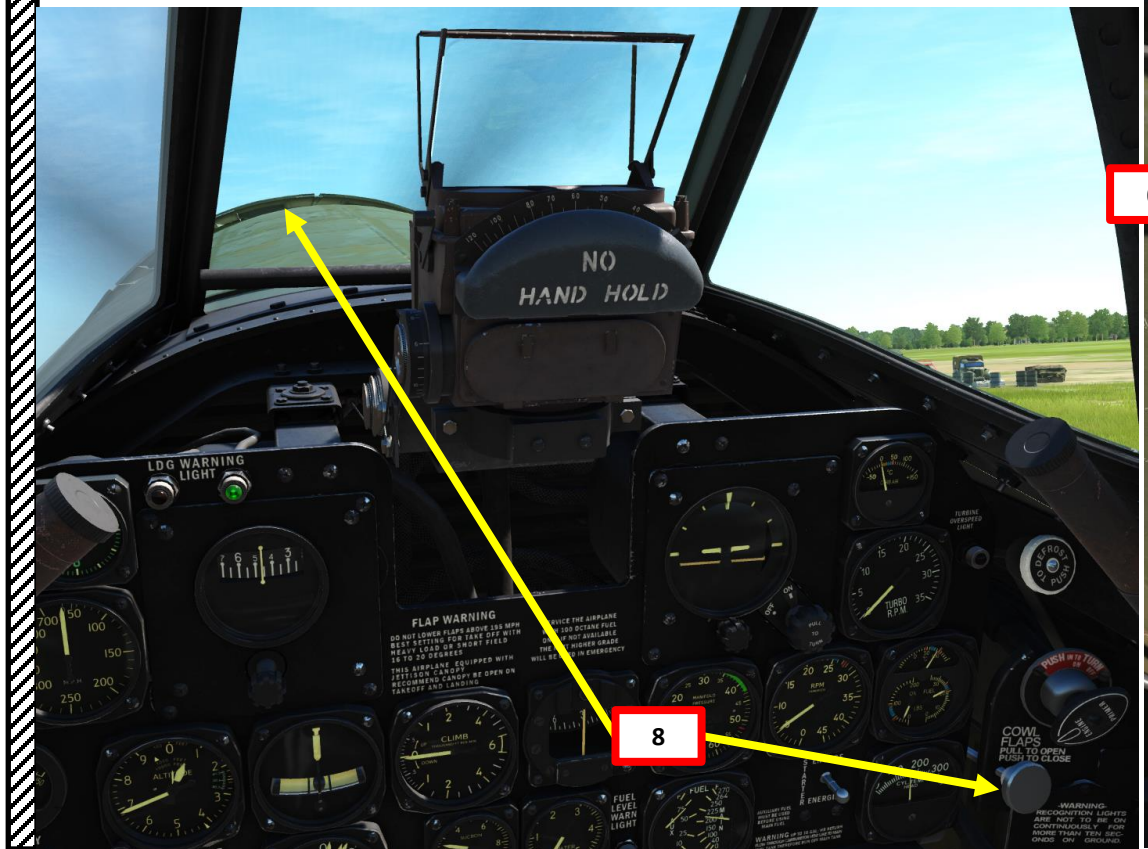


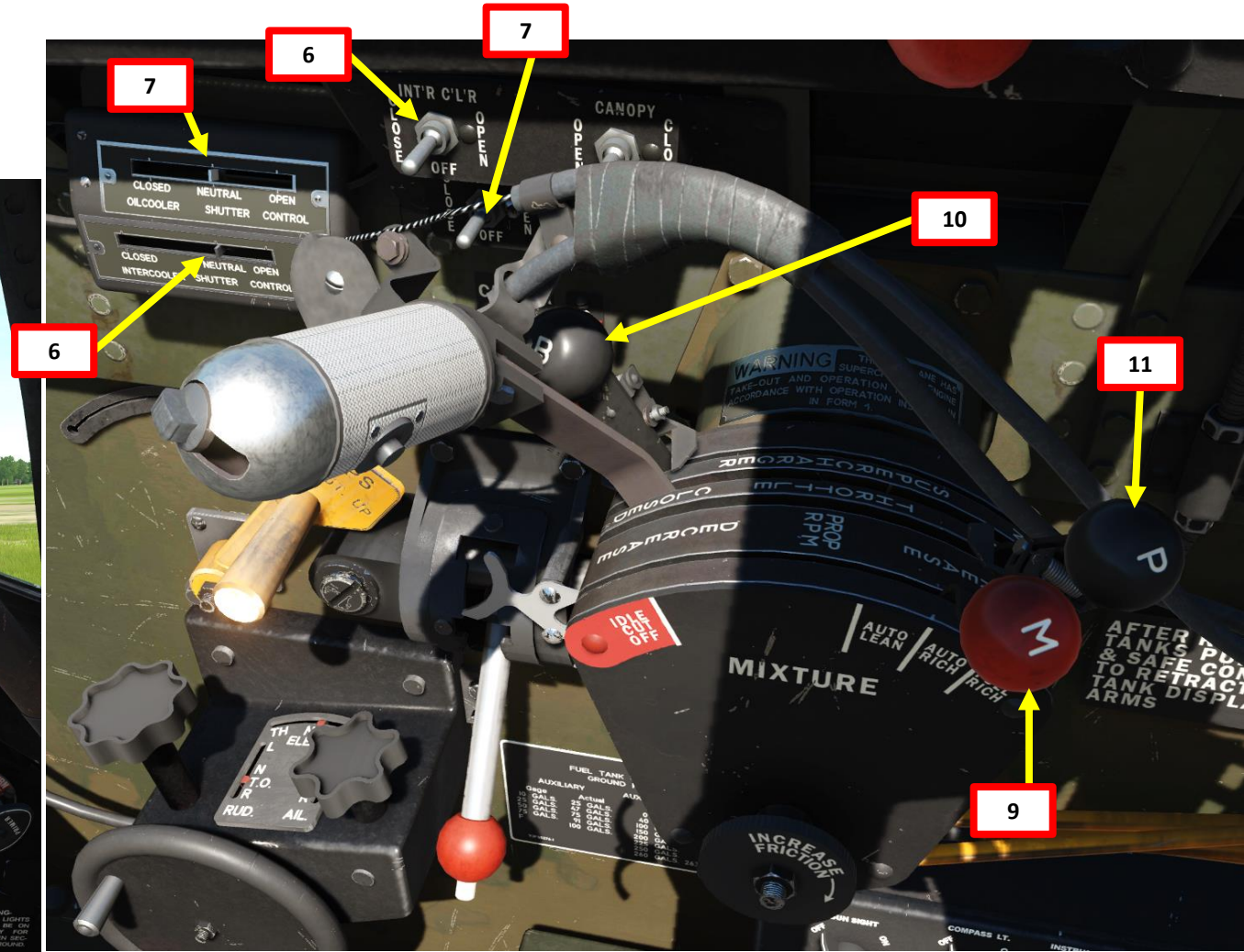




TAKEOFF PROCEDURE

6. Verify Intercooler Shutters are in the NEUTRAL position.
7. Verify Oil Cooler Shutters are in the NEUTRAL position.
8. Close Cowl Flaps Half-way by pushing IN the Engine Cowl Flaps Handle and releasing it when cowl flaps are in the desired position.
9. Verify Mixture Control (M) Lever is set to AUTO RICH.
10. Set Turbosupercharger (B) Lever – FULLY AFT (OFF). This is done to avoid power loss during takeoff (see the ENGINE & FUEL MANAGEMENT section) and to avoid carburetor overheat during hot weather takeoff (temperature greater than 35 deg C).
11. Set Propeller RPM Control (P) lever – FULLY FWD (INCREASE).

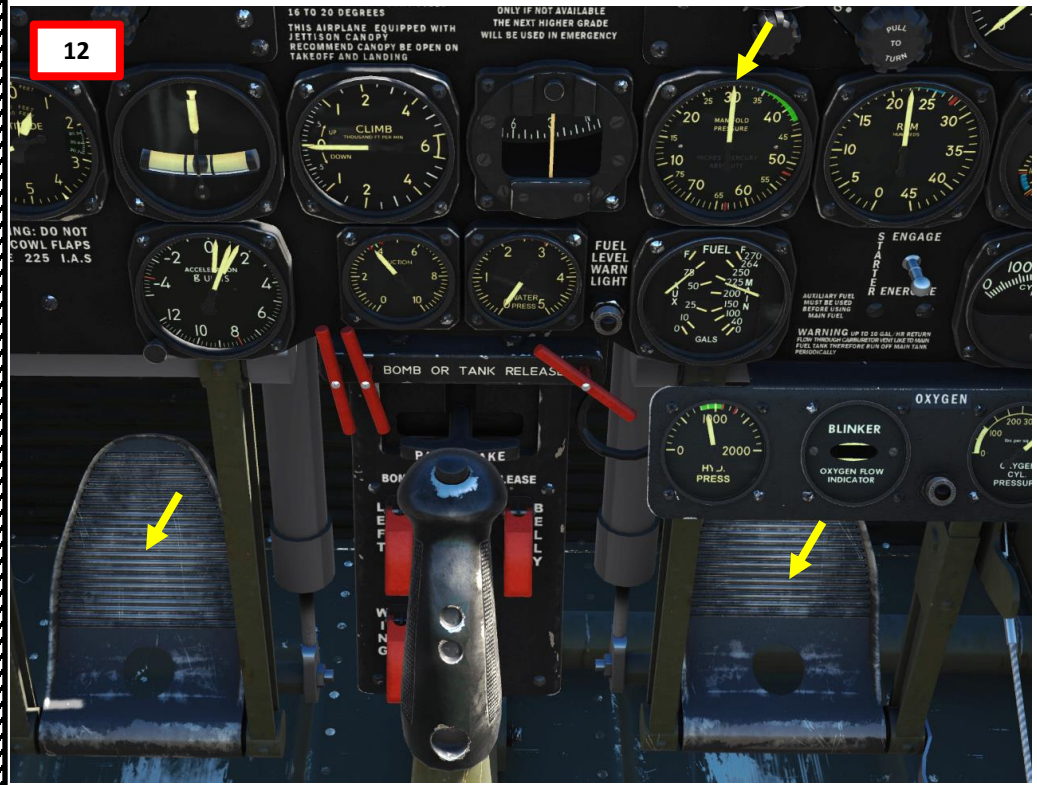




TAKEOFF PROCEDURE

12. Hold Wheel Brakes and throttle up to 30 in Hg manifold pressure.
13. Once engine parameters are stabilized, release wheel brakes and throttle up smoothly. Controlled RPM should be 2700 RPM.
    - You can takeoff either without or with using the Turbosupercharger (B) Lever Boost depending on your takeoff weight and the required attainable manifold pressure. If using (B) Lever, always advance throttle first.
    - Not using the Turbosupercharger on takeoff will generate a manifold pressure of up to 45 in Hg, which is generally sufficient for normal takeoff. Using maximal Turbosupercharger on takeoff will generate more than 52 in Hg (takeoff redline).
    - **Do not exceed 52 in Hg of manifold pressure on takeoff**.
14. Apply right rudder to counter the engine torque. Do **NOT** use toe brakes to counter the torque.
15. The heavy weight of the P-47 means that it requires a longer takeoff run than most other WWII fighters; you may be tempted to exceed the takeoff redline (52 in Hg) in order to build up speed: **don't do it!** Your plane will get off the ground just fine using prescribed power limits.
16. The P-47 flies off the ground from a 3-point position at about 100 mph. When you feel the tail rising, adjust the stick to raise the tail about 6 inches from the ground.
17. Stay on the ground until reaching a speed of around 110 mph, then smoothly pull back on the stick to lift the plane off the runway. The raised tail and added speed give you much better rudder control in case of trouble.

Takeoff power redline (do not exceed!)

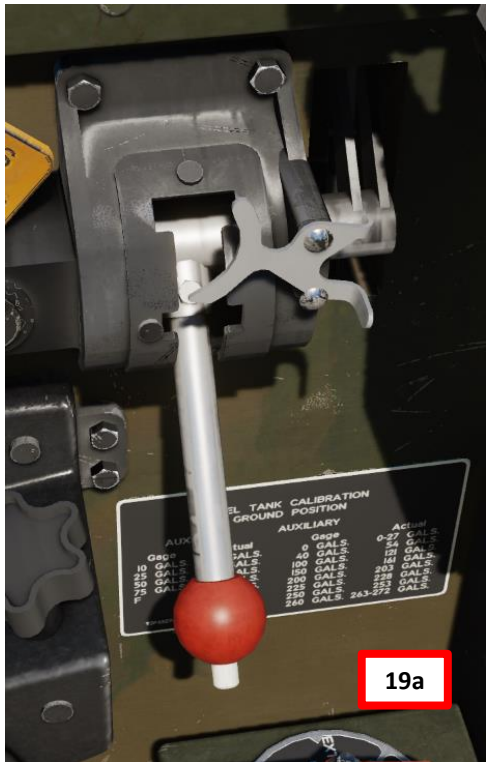


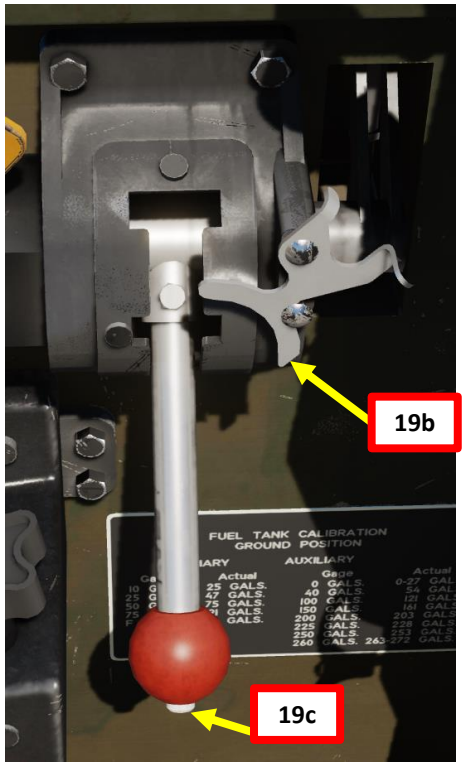
TAKEOFF PROCEDURE

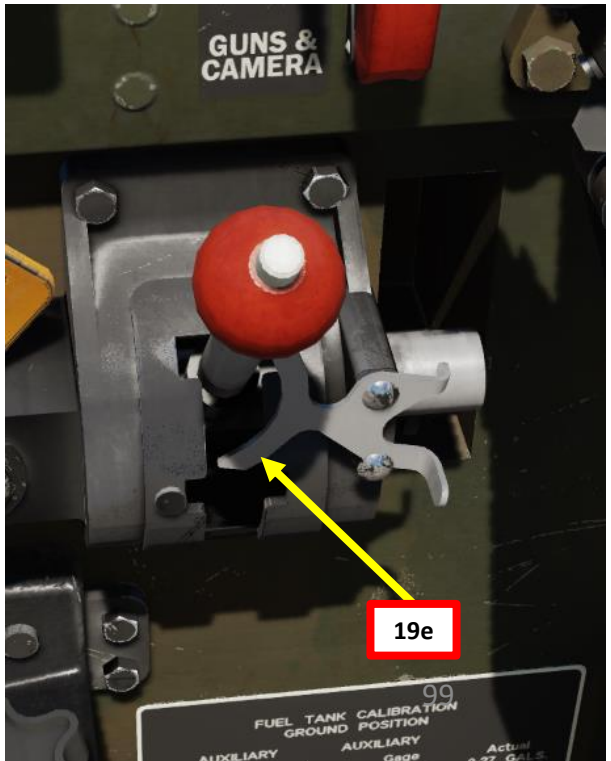
18. Aircraft rotation should occur at approx. 120 mph. Do **NOT** apply brakes to stop rotation of the wheels while in the air; doing so may seize brake disks and leave you a nasty surprise on landing.

TAKEOFF PROCEDURE

19. Raise the landing gear as quickly as possible.
    - The Green LDG WARNING LIGHT indicates the gear is down and locked
    - The Red LDG WARNING LIGHT indicates the gear is in transition
    - When both the Green and Red LDG WARNING LIGHTS are extinguished, the gear is retracted and locked.
20. If using flaps during takeoff, develop at least 145 mph before rising flaps. Flaps should be extended until you reach 500 ft altitude. Then, carefully raise flaps by moving the yellow handle to the UP position.



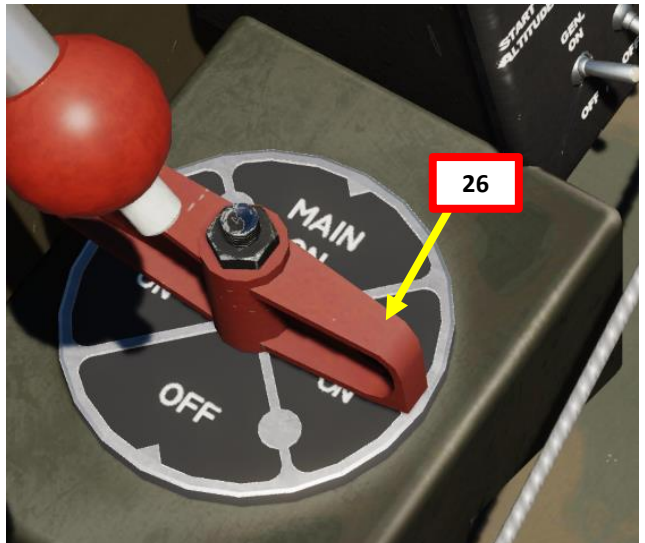




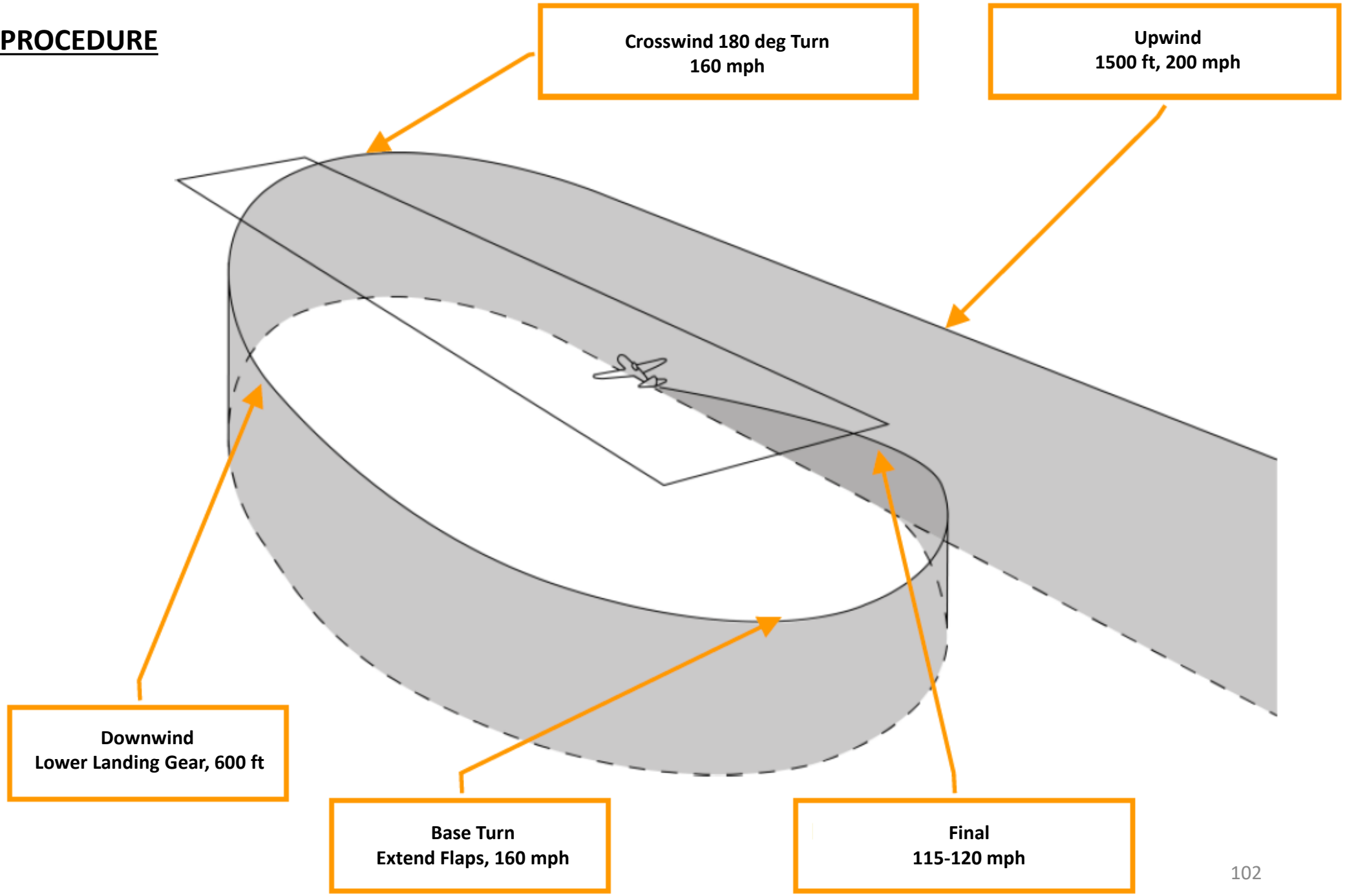
TAKEOFF PROCEDURE

CLIMB

21. Adjust cowl flaps as needed to cool the cylinders; about 1/3 open is about right for climbing. CHT (Cylinder Head Temperature) should be maintained at or below 260 deg C. Check CHT frequently; if CHT goes over 260 deg C, increase airspeed to provide more airflow to cool the engine cylinders.
22. Throttle down to 42 in Hg manifold pressure.
23. Adjust Propeller RPM Control (P) lever to 2550 RPM.
24. Set climb speed between 150 and 165 mph, 160 mph being the optimal climb speed.
25. Trim the aircraft as required for climbing; you
26. If fuel is available in the auxiliary tank, set Fuel Selector Valve Handle from MAIN to AUXILIARY after reaching a safe altitude (after roughly 10 min of flight). This is the fuel tank you will want to use first since the aux tank fuel offsets your aircraft's center of gravity and reduces your aircraft's longitudinal stability.
27. If aircraft airspeed is above 225 mph, fully close cowl flaps as they will cause turbulence..

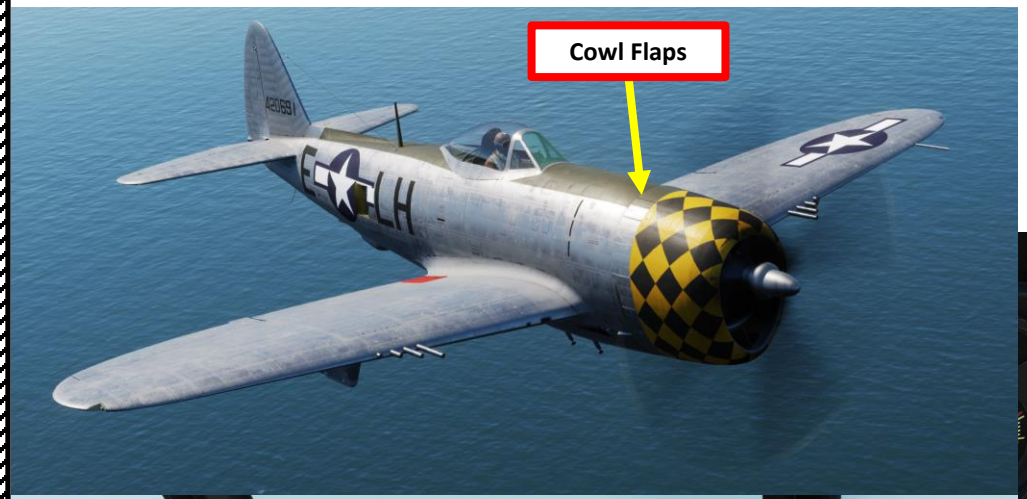


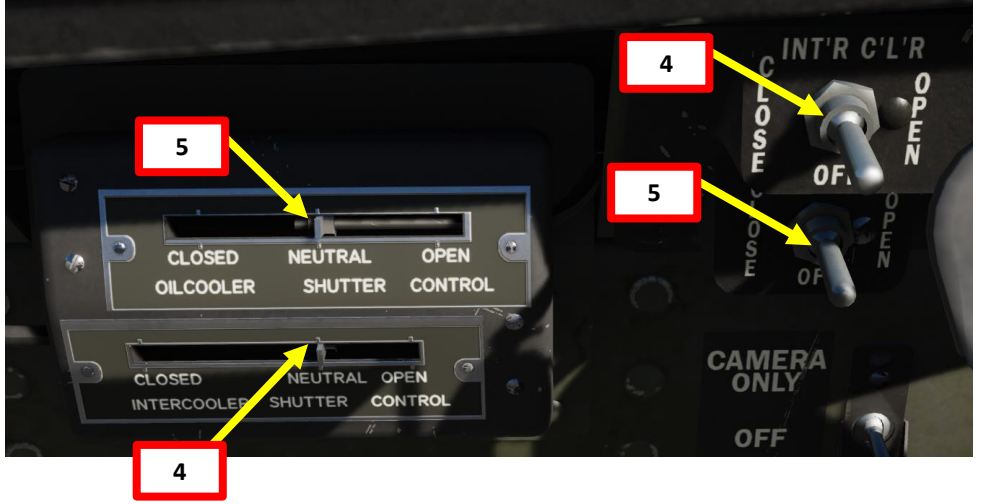
LANDING PROCEDURE

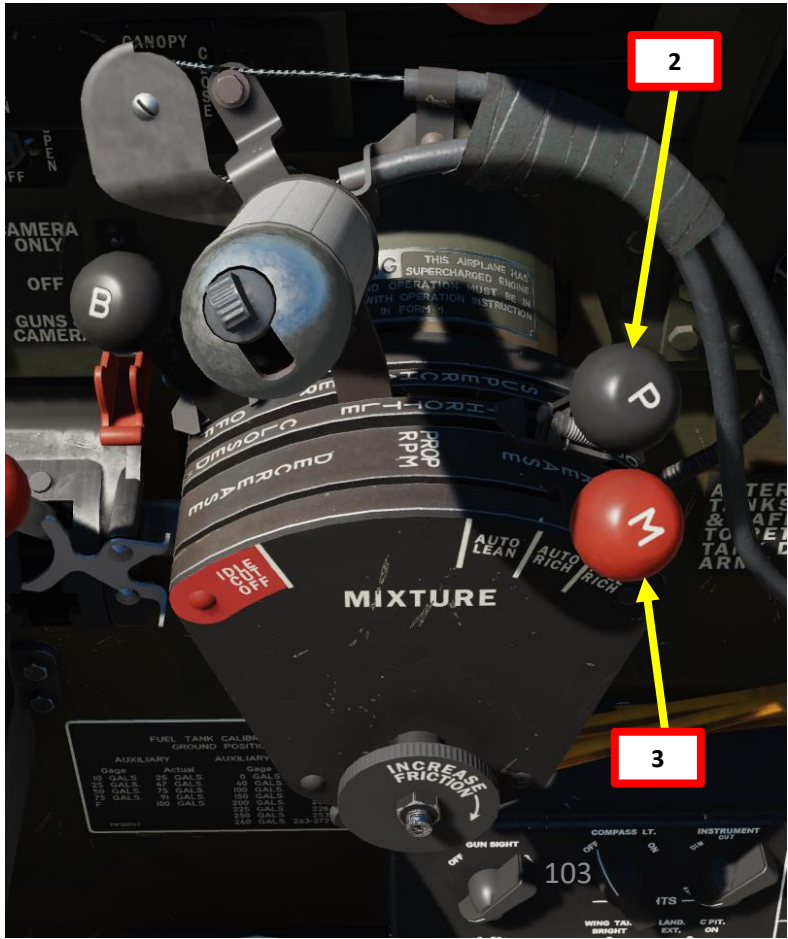


LANDING PROCEDURE

1. Verify Propeller Governor Switch is set to CONSTANT SPEED AUTO (UP)
2. Adjust Propeller RPM Control (P) lever to set a RPM of 2550.
3. Verify Mixture Control (M) Lever is set to AUTO RICH
4. Verify Intercooler Shutters are in the NEUTRAL position.
5. Verify Oil Cooler Shutters are in the NEUTRAL position.
6. Close Cowl Flaps completely by pushing IN the Engine Cowl Flaps Handle and releasing it when cowl flaps are in the desired position. This will prevent engine overcooling at low throttle settings.

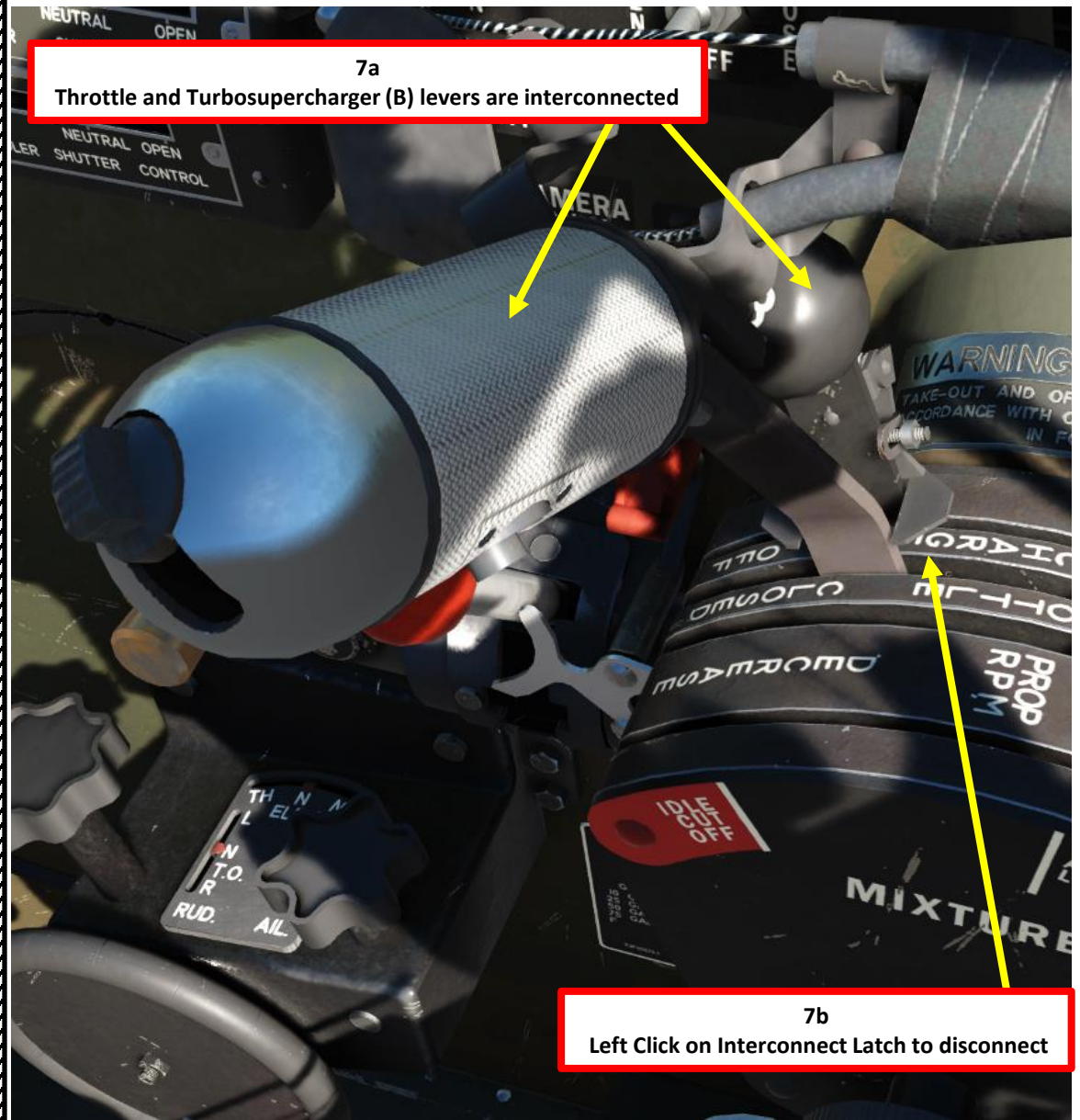






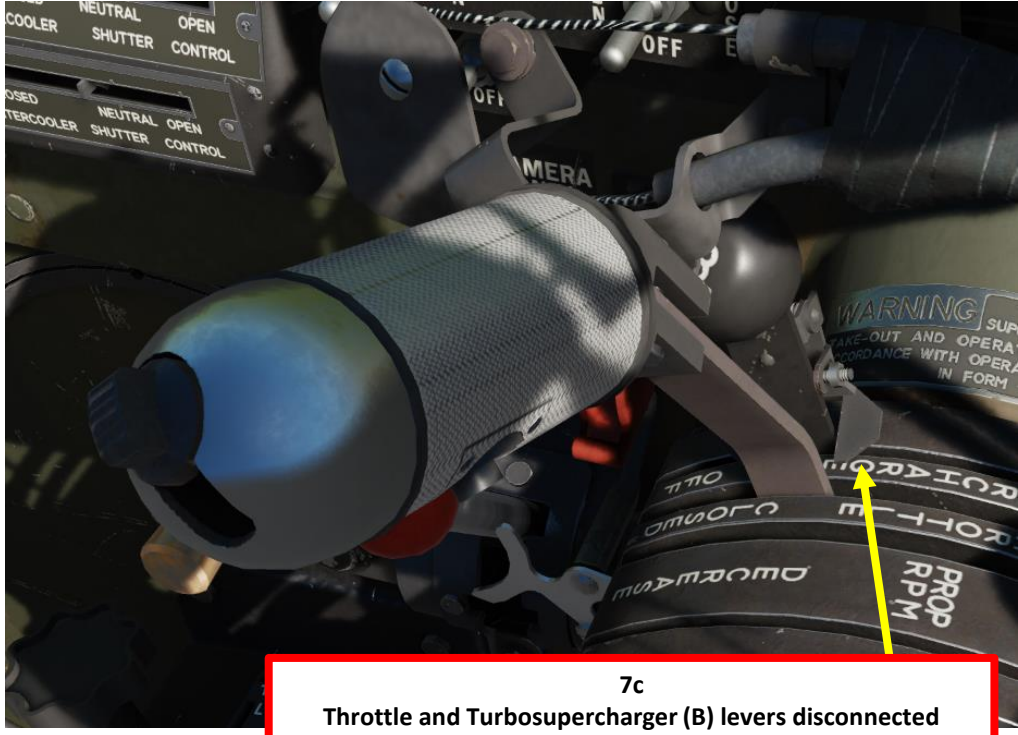
LANDING PROCEDURE

7. Verify that throttle and Turbosupercharger (B) levers are not interconnected, then set Turbosupercharger (B) lever to OFF position (AFT).

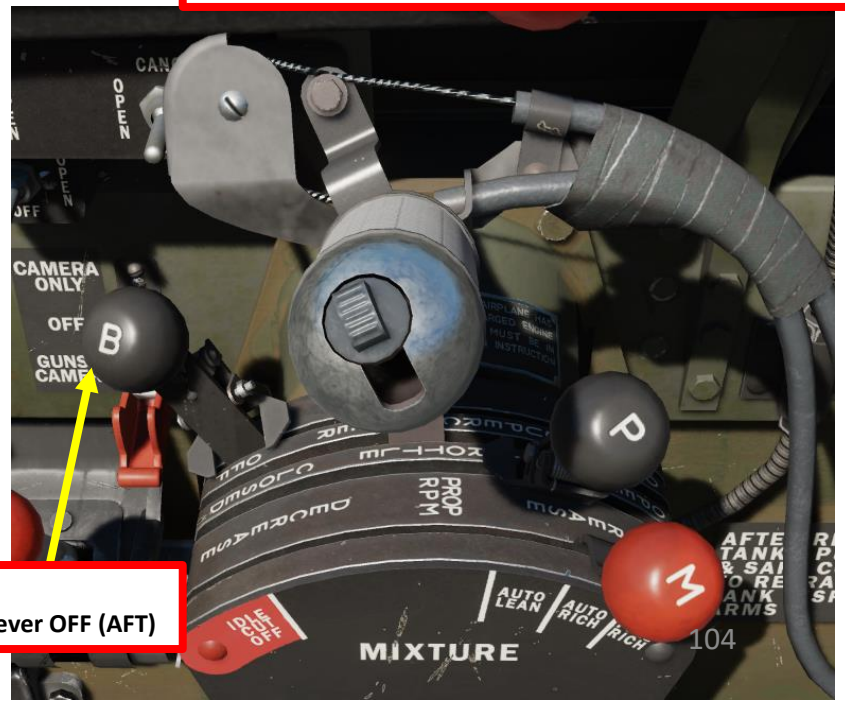


7a
Throttle and Turbosupercharger (B) levers are interconnected

7b
Left Click on Interconnect Latch to disconnect



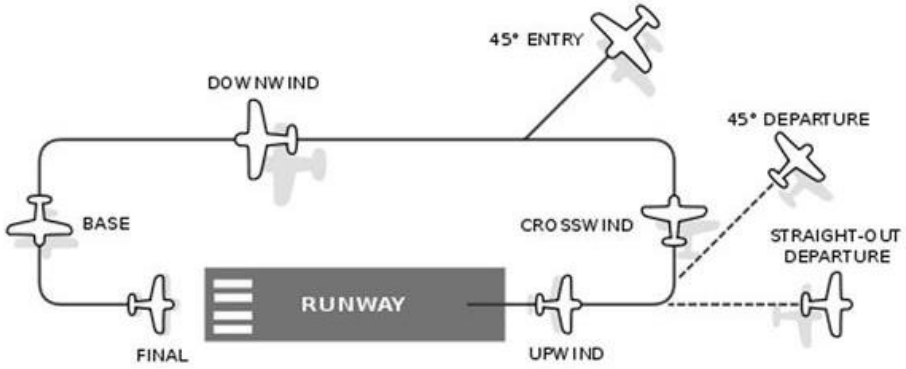
7c
Throttle and Turbosupercharger (B) levers disconnected

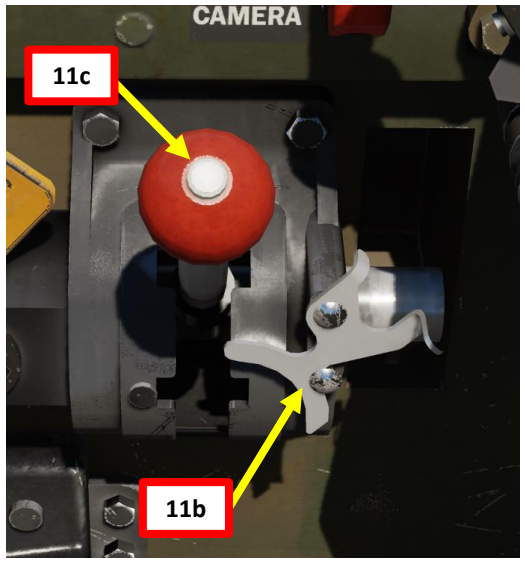


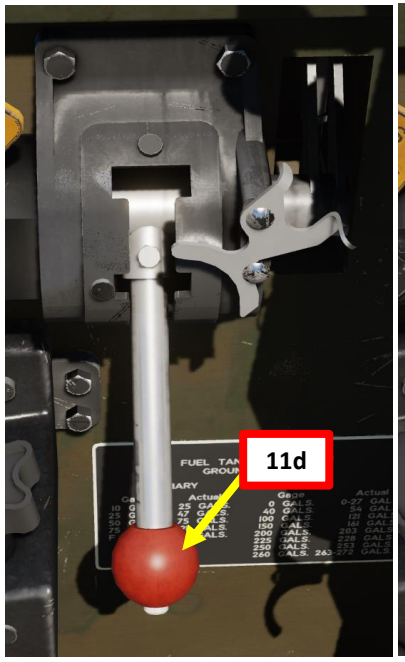
7d
Turbosupercharger (B) lever OFF (AFT)

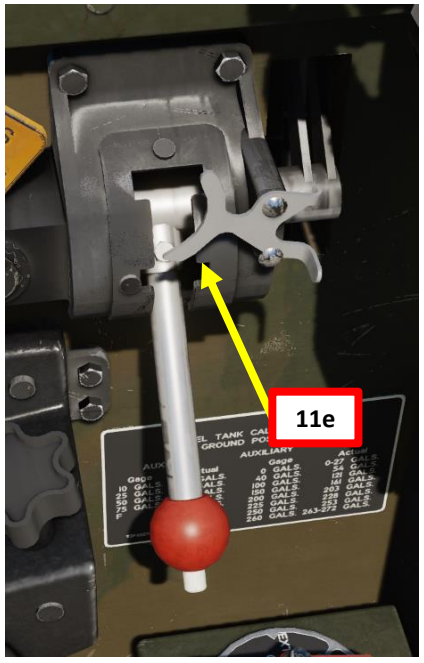
LANDING PROCEDURE

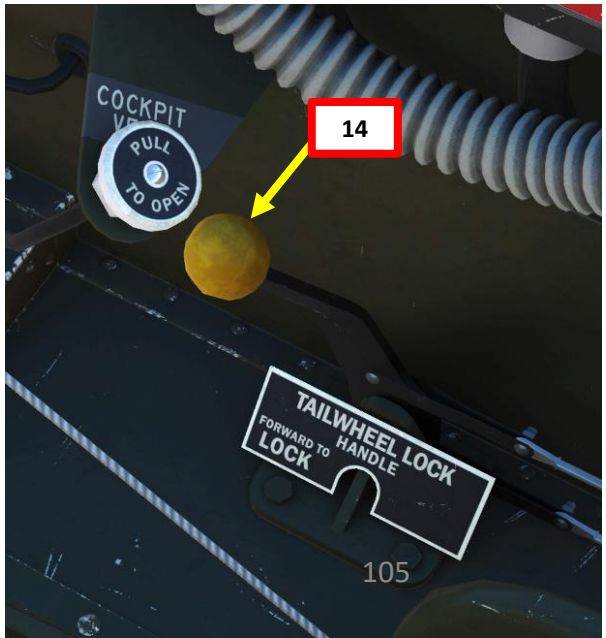
8. Approach airfield at 1500 ft and 200 mph
9. After passing the reverse end of the runway, make a 180-degree turn (crosswind).
10. Reduce speed to 160 mph
11. Lower landing gear and check the gear warning lights.
    - Never lower landing gear above 200 mph, and never exceed 250 mph with the landing gear down.
12. Trim plane by using elevator trim.
13. Reduce altitude to 600-800 ft.
14. Lock tailwheel by setting the Tailwheel Lock Control Lever FWD.





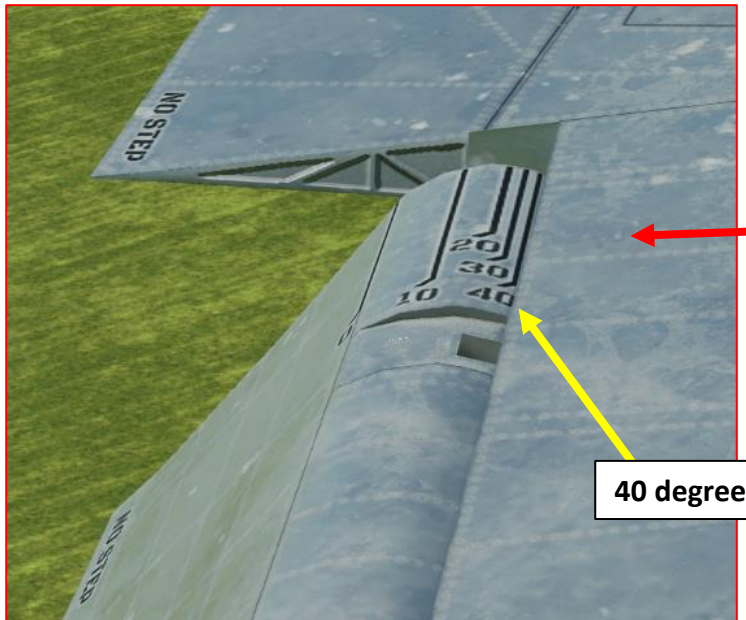


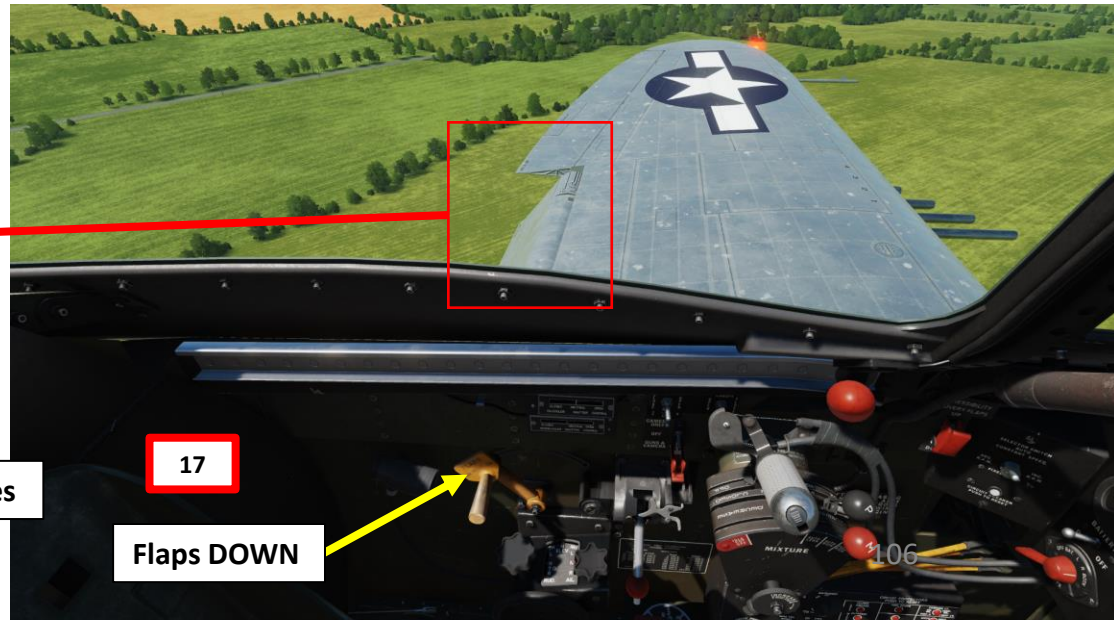




LANDING PROCEDURE

15. Turn on Wing and Tail Navigation Lights and extend Landing Light.
16. When turning on final approach (base leg) and airspeed is below 160 mph, reduce altitude to 500 ft.
17. Extend flaps fully by setting the flaps lever AFT to DN (Down) until the flaps position indicator on the wing indicates 40 deg.
    - Never lower flaps above 195 mph
18. Maintain approximately 150 mph in the traffic pattern.
19. Once lined up on final with flaps lowered, maintain approx. 115-120 mph. Always make sure to keep a little bit of excess power during the approach or you will start sinking; the Thunderbolt is a very heavy plane.
20. Just before you are about to cross the runway threshold, cut the throttle.
21. Just before touchdown, break the glide with a controlled flare and approach so as to land within the first third of the runway in a 3-point attitude.
22. Hold the aircraft in the 3-point attitude just above the runway until flying speed is lost and the plane sets down at approx. 90 mph.

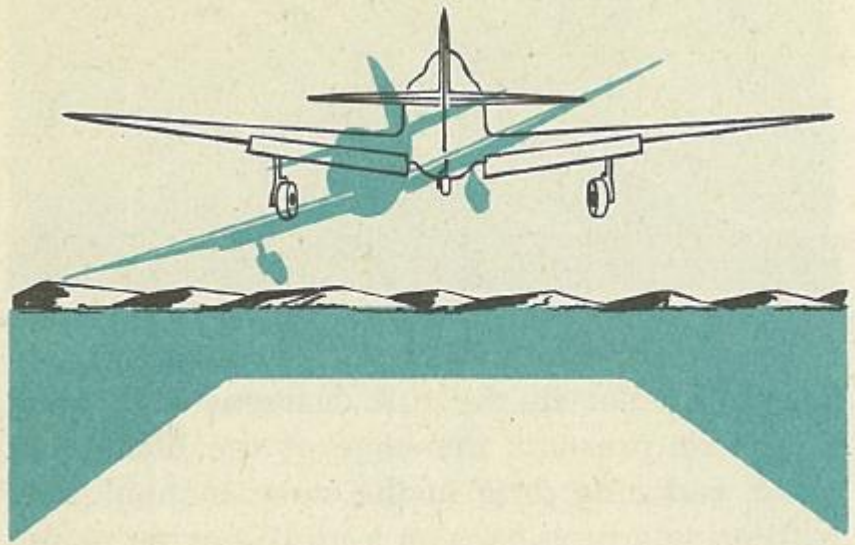




LANDING PROCEDURE

LANDING PROCEDURE

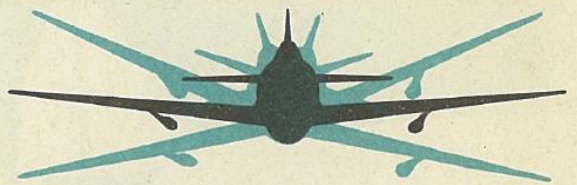
LANDING PROCEDURE



WHEN GOING AROUND—APPLY POWER SMOOTHLY TO AVOID EXCESSIVE TORQUE

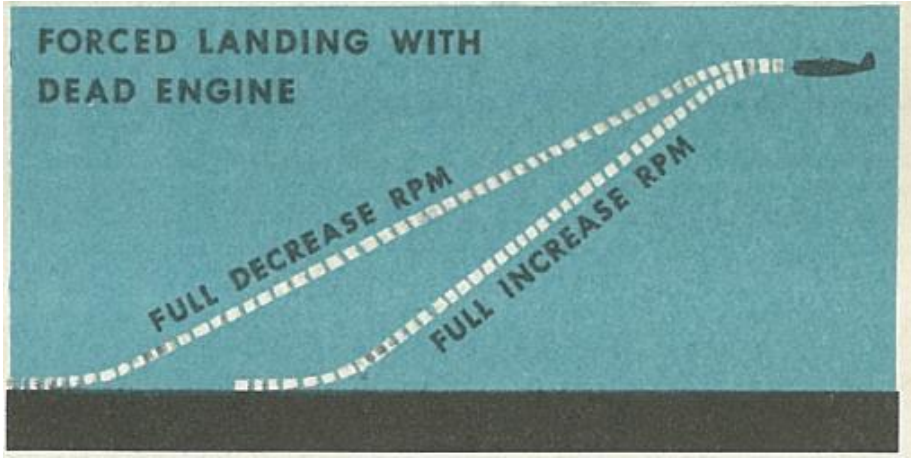
Hydraulic Failure

If your wheels won't come down, don't try to pump them down with the hydraulic hand pump. It isn't necessary, and you need the remaining hydraulic pressure for your flaps.



ROCK GEAR DOWN

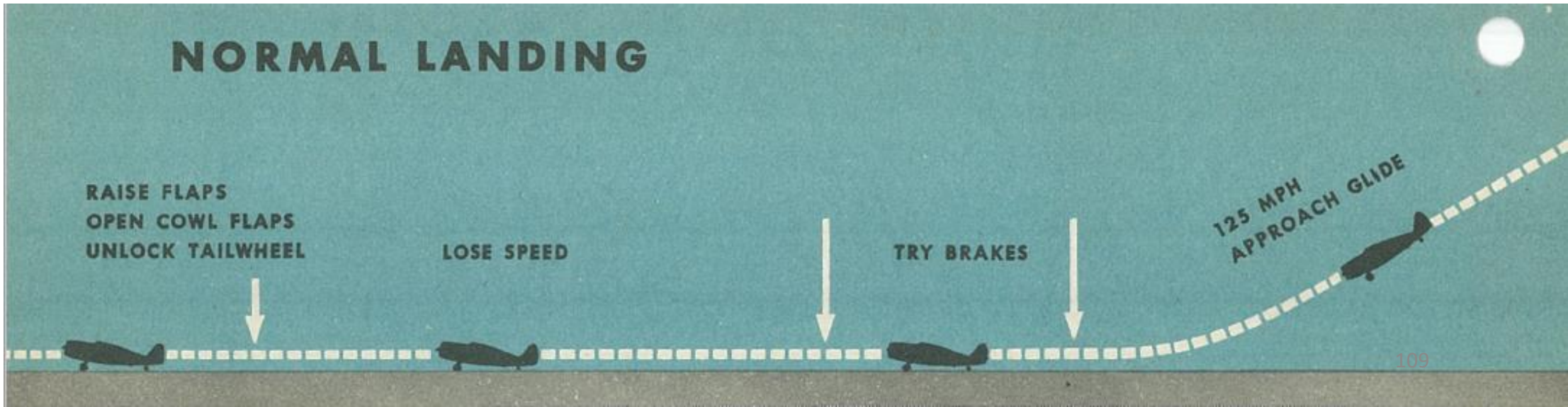
Place the landing gear lever in the DOWN position, rock your plane and execute turns, dives, and pull-outs until your wheels are down. Fly over the field and ask the tower for a check.



3 RULES FOR ANY FORCED LANDING

1. DON'T STALL
2. DON'T EVER STALL
3. DON'T NEVER EVER STALL*

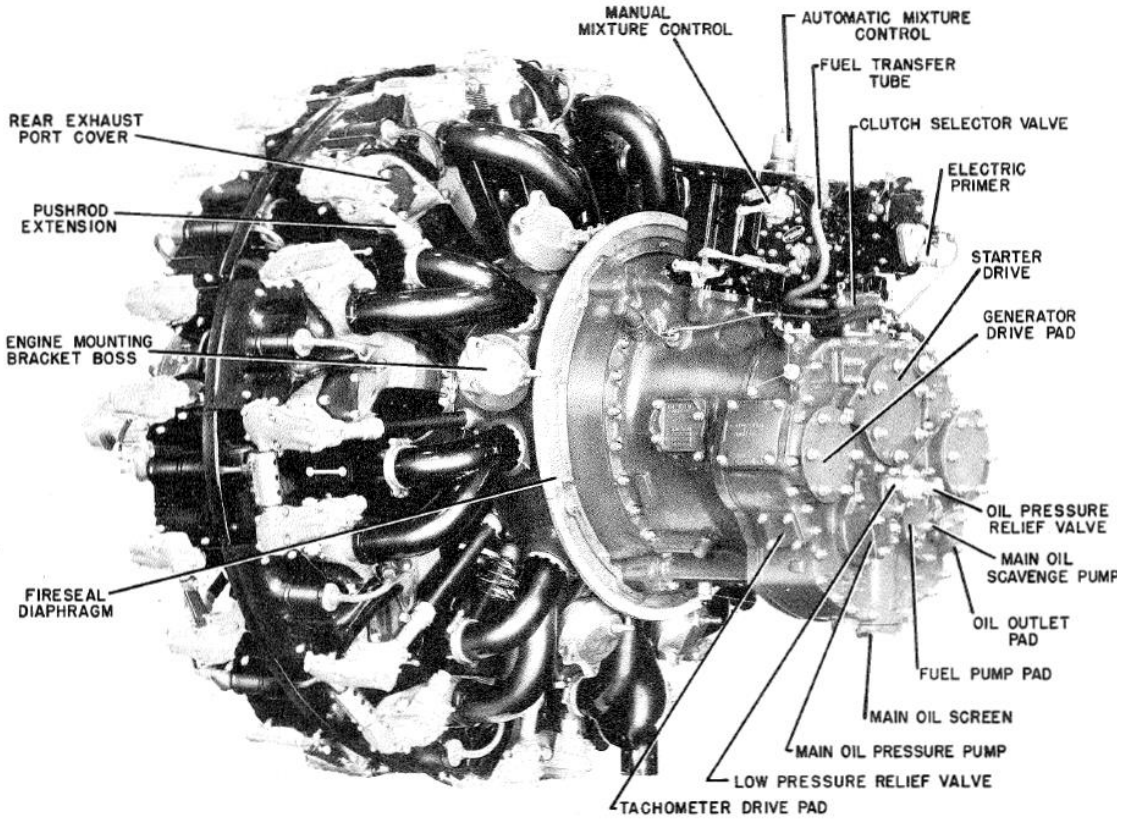
* Ungrammatical, but still true.



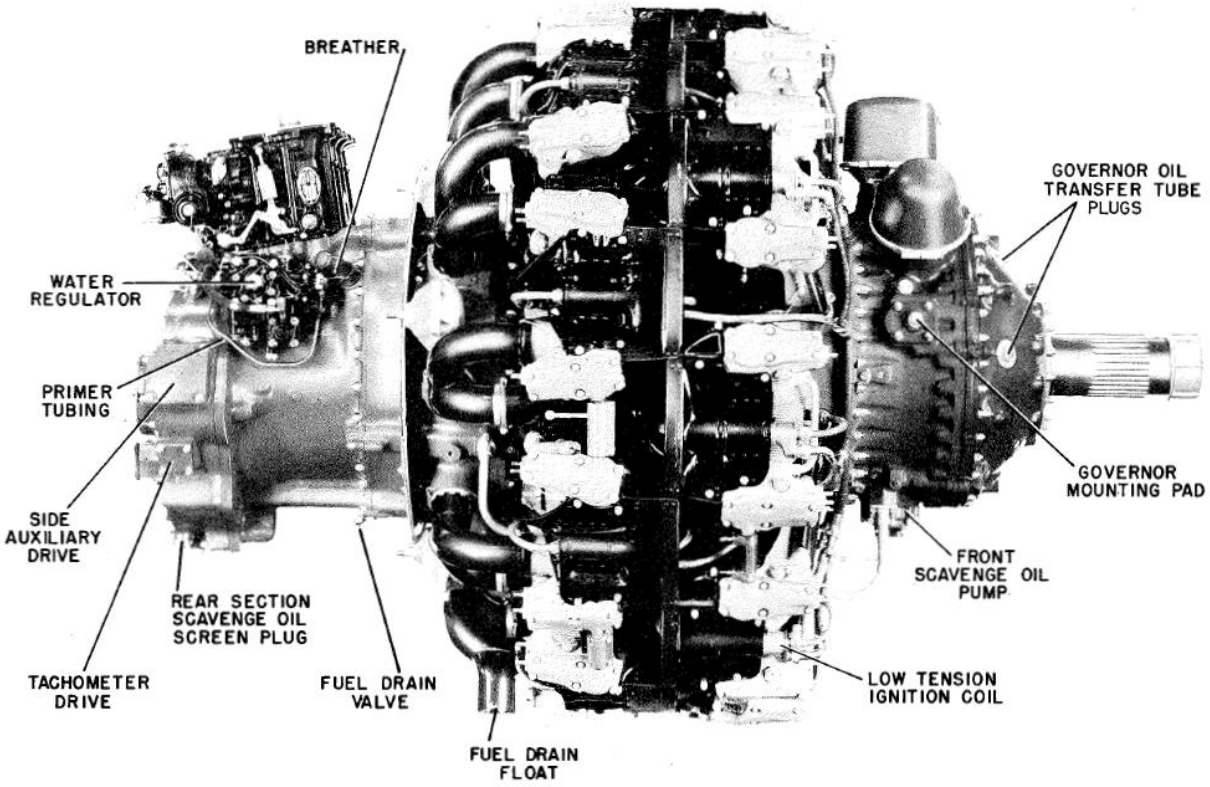
PRATT & WHITNEY R-2800 DOUBLE WASP

The P-47 is powered by the Pratt & Whitney R-2800-59W Double Wasp; a twin-row, 18-cylinder, air-cooled radial aircraft engine with a displacement of 2,800 in³ (46 L). The Double Wasp is part of the long-lived Wasp family of engines, and the R-2800 designation means “Radial engine with total capacity of 2800 cubic inches”. This 2,000 hp engine is equipped with a single-speed mechanical compressor, a General Electric turbosupercharger and a Curtiss Electrics four-bladed propeller.

PRATT & WHITNEY R-2800 DOUBLE WASP

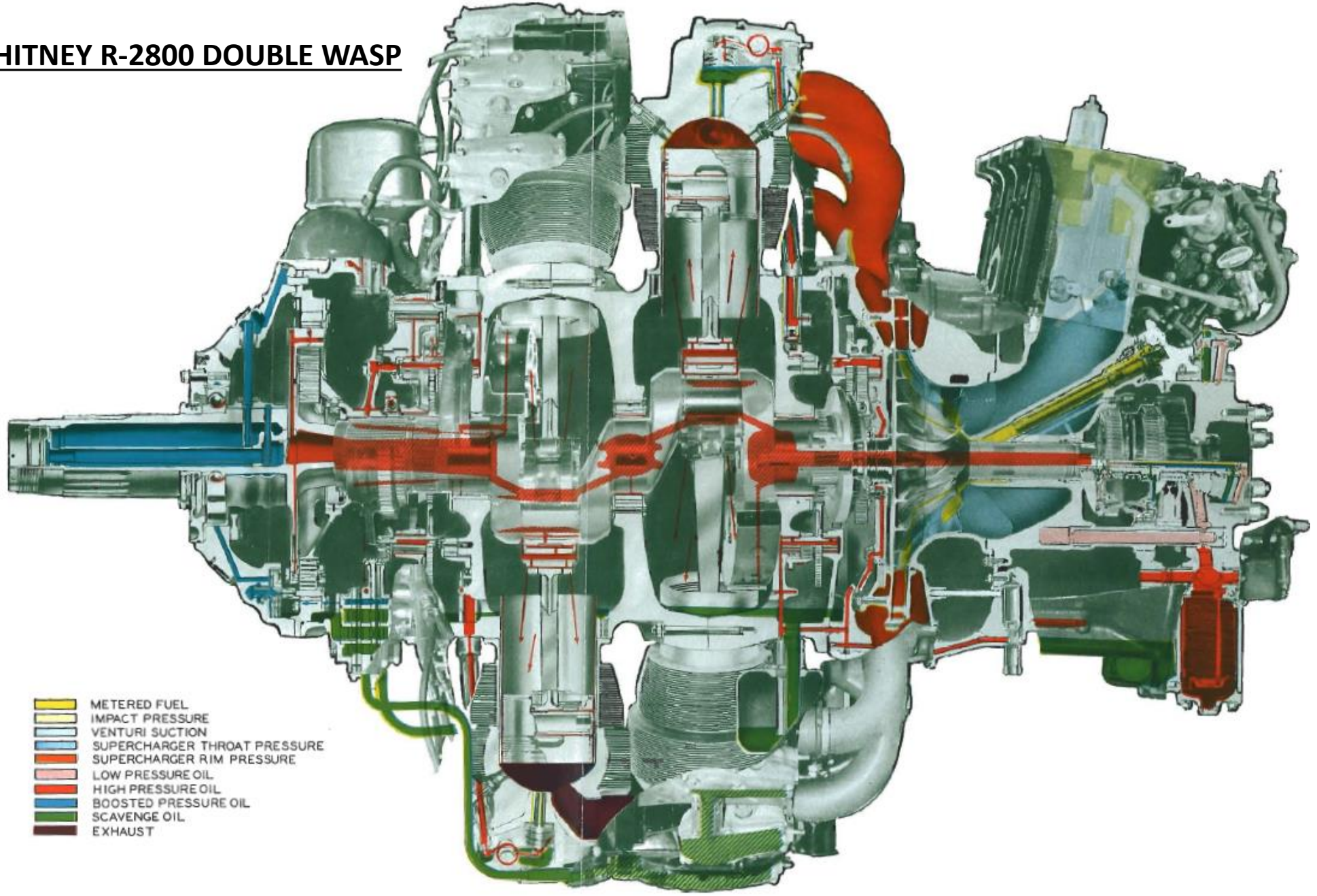


Left Rear View of Engine



Right Side View of Engine

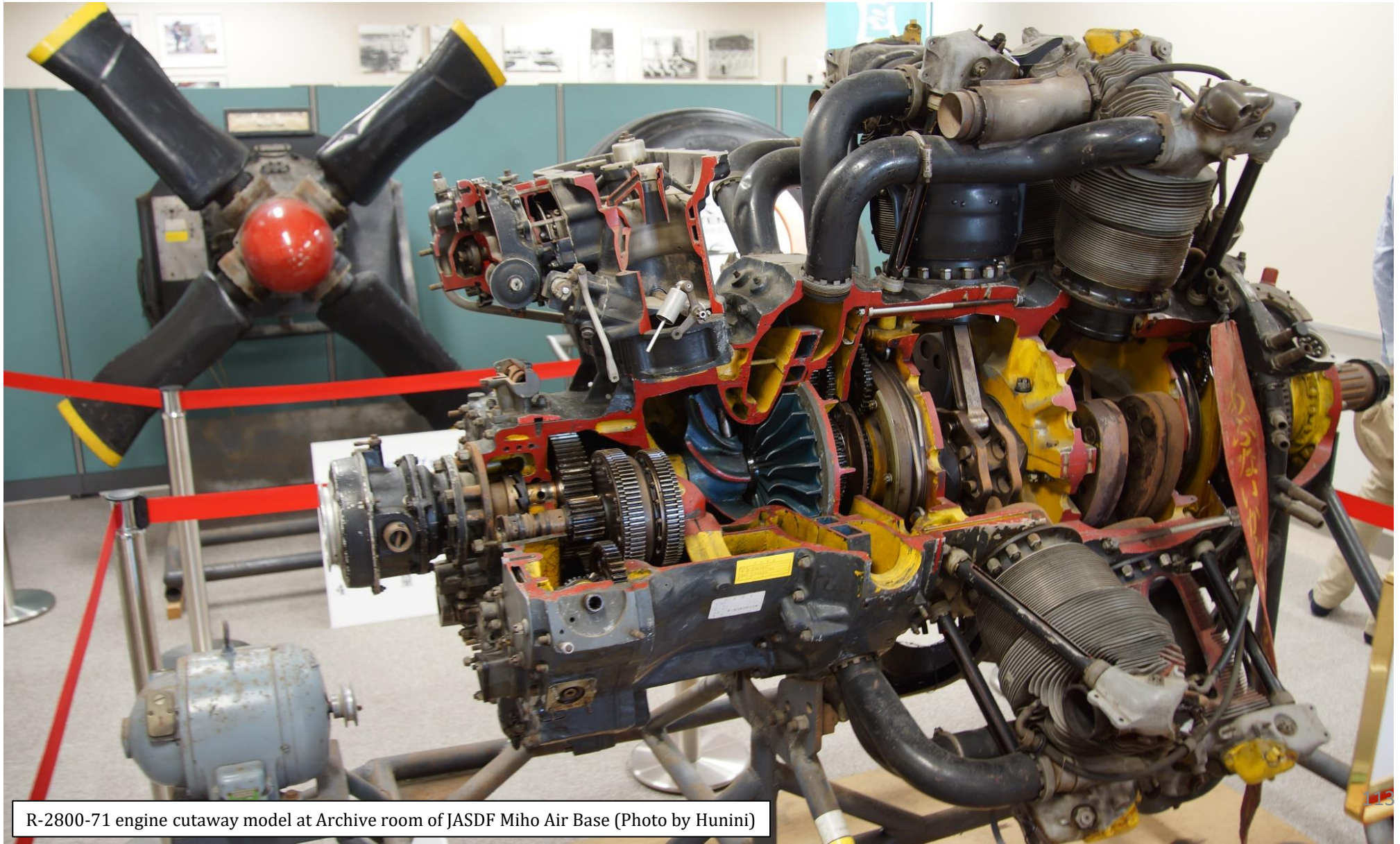
PRATT & WHITNEY R-2800 DOUBLE WASP



Sectional View of Fuel/Air, and Oil System

PRATT & WHITNEY R-2800 DOUBLE WASP

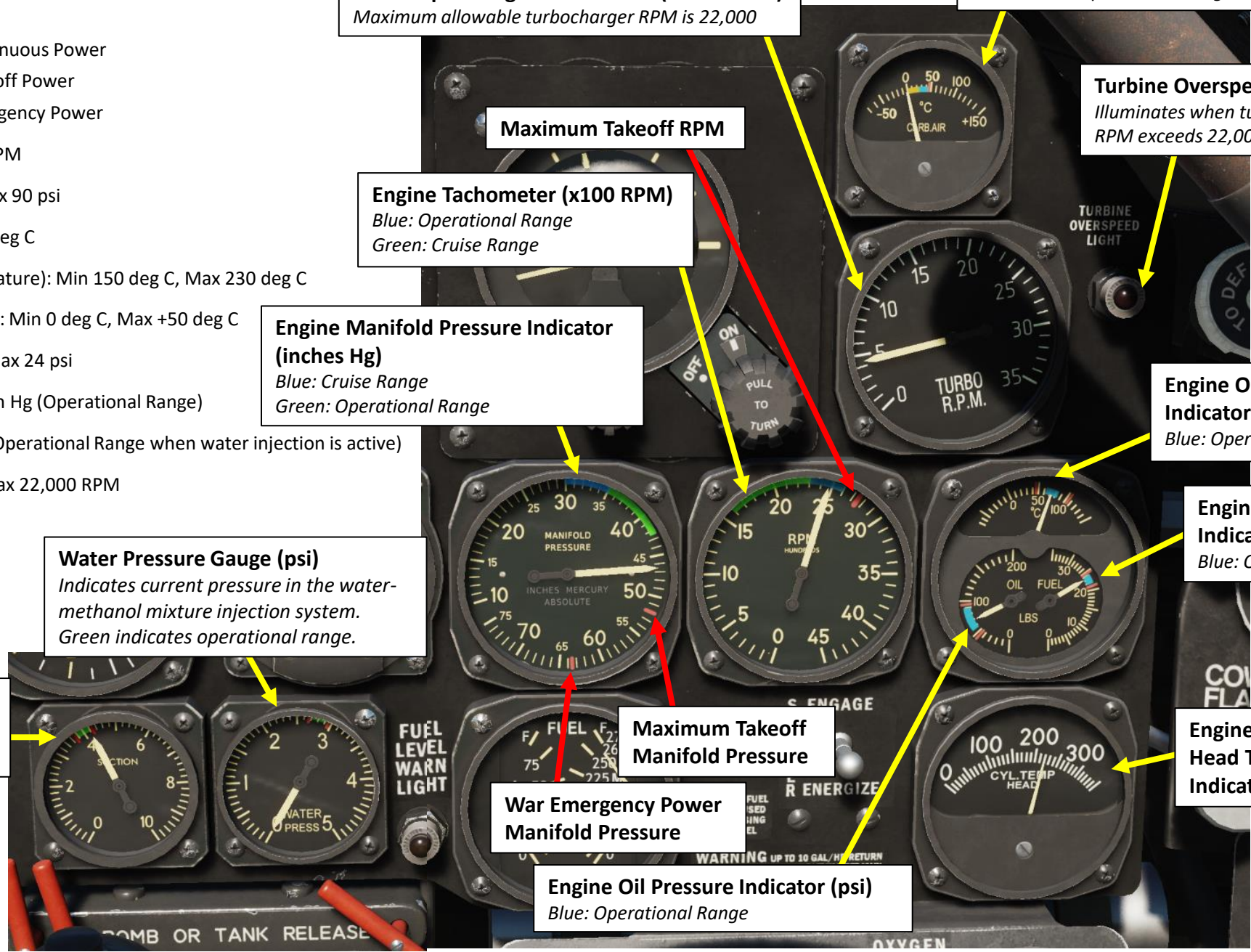
Here is a nice video of what the engine looked like internally:
https://youtu.be/EyPvpdy4dgg



R-2800-71 engine cutaway model at Archive room of JASDF Miho Air Base (Photo by Hunini)

ENGINE LIMITS & PARAMETERS

- Manifold Pressure:
  - 42 in Hg: Max Continuous Power
  - 52 in Hg: Max Takeoff Power
  - 64 in Hg: War Emergency Power
- Propeller RPM: Max 2800 RPM
- Oil Pressure: Min 50 psi, Max 90 psi
- Oil Temperature: Max 105 deg C
- CHT (Cylinder Head Temperature): Min 150 deg C, Max 230 deg C
- Carburetor Air Temperature: Min 0 deg C, Max +50 deg C
- Fuel Pressure: Min 22 psi, Max 24 psi
- Vacuum System Suction: 4 in Hg (Operational Range)
- Water Pressure: 25-27 psi (Operational Range when water injection is active)
- Turbosupercharger RPM: Max 22,000 RPM



Turbosupercharger Tachometer (x1000 RPM)
Maximum allowable turbocharger RPM is 22,000

Carburetor Air Temperature Indicator (deg C)
Blue/Yellow: Operational Range

Turbine Overspeed Light
Illuminates when turbosupercharger RPM exceeds 22,000

Maximum Takeoff RPM

Engine Tachometer (x100 RPM)
Blue: Operational Range
Green: Cruise Range

Engine Manifold Pressure Indicator (inches Hg)
Blue: Cruise Range
Green: Operational Range

Engine Oil Temperature Indicator (deg C)
Blue: Operational Range

Engine Fuel Pressure Indicator (psi)
Blue: Operational Range

Water Pressure Gauge (psi)
Indicates current pressure in the water-methanol mixture injection system. Green indicates operational range.

Vacuum System Suction Gauge (inches Hg)
Green: Operational Range

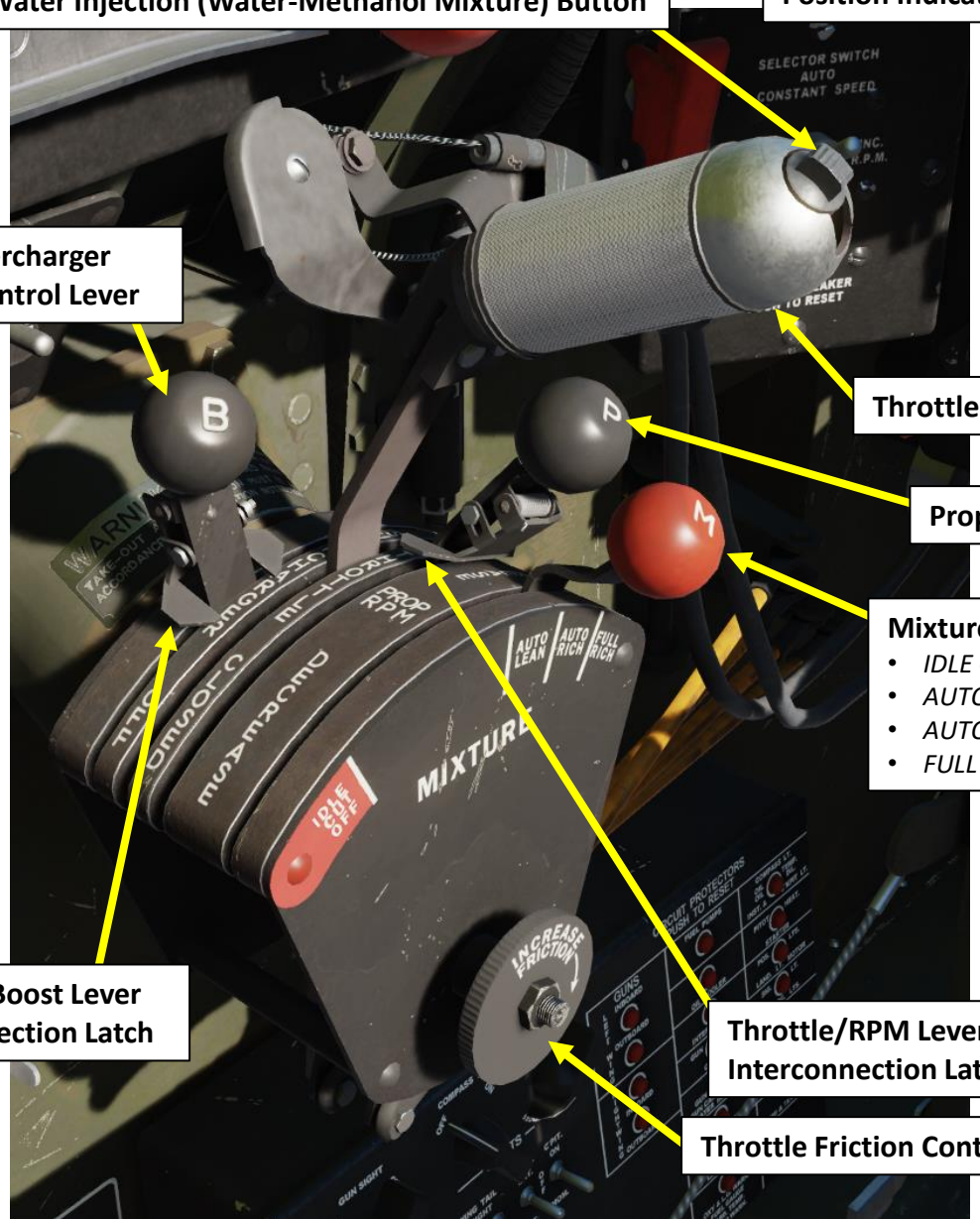
Maximum Takeoff Manifold Pressure

War Emergency Power Manifold Pressure

Engine CHT (Cylinder Head Temperature) Indicator (deg C)

Engine Oil Pressure Indicator (psi)
Blue: Operational Range

ENGINE CONTROLS



Water Injection (Water-Methanol Mixture) Button

Turbosupercharger (Boost) Control Lever

Throttle

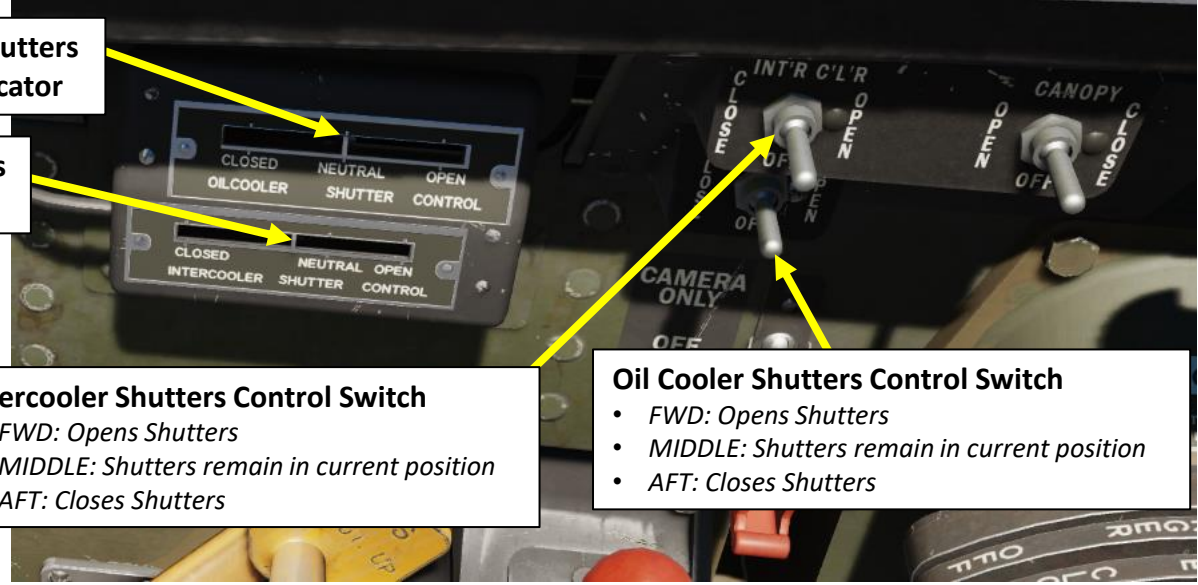
Propeller RPM Control Lever

Mixture Lever
- *IDLE CUTOFF*
- *AUTO LEAN*
- *AUTO RICH*
- *FULL RICH (protected by safety wire)*

Throttle/Boost Lever Interconnection Latch

Throttle/RPM Lever Interconnection Latch

Throttle Friction Control

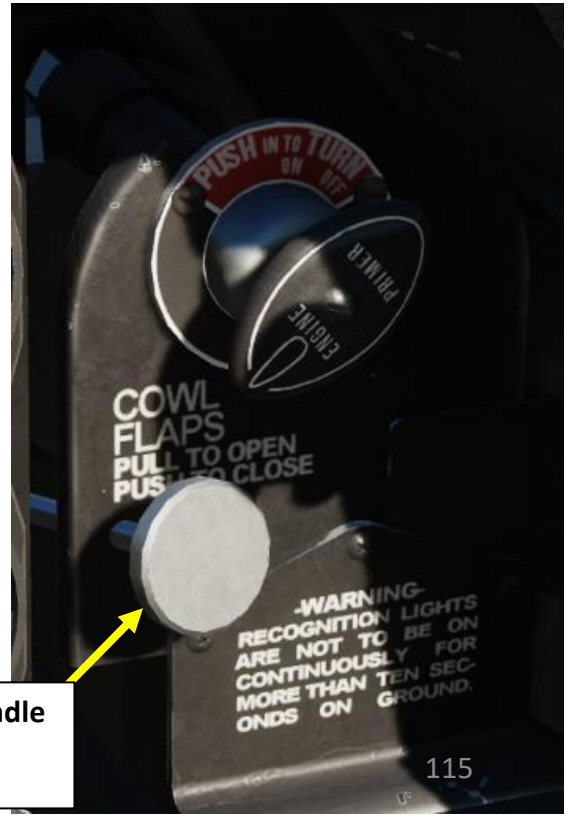


Oil Cooler Shutters Position Indicator

Intercooler Shutters Position Indicator

Intercooler Shutters Control Switch
- *FWD: Opens Shutters*
- *MIDDLE: Shutters remain in current position*
- *AFT: Closes Shutters*

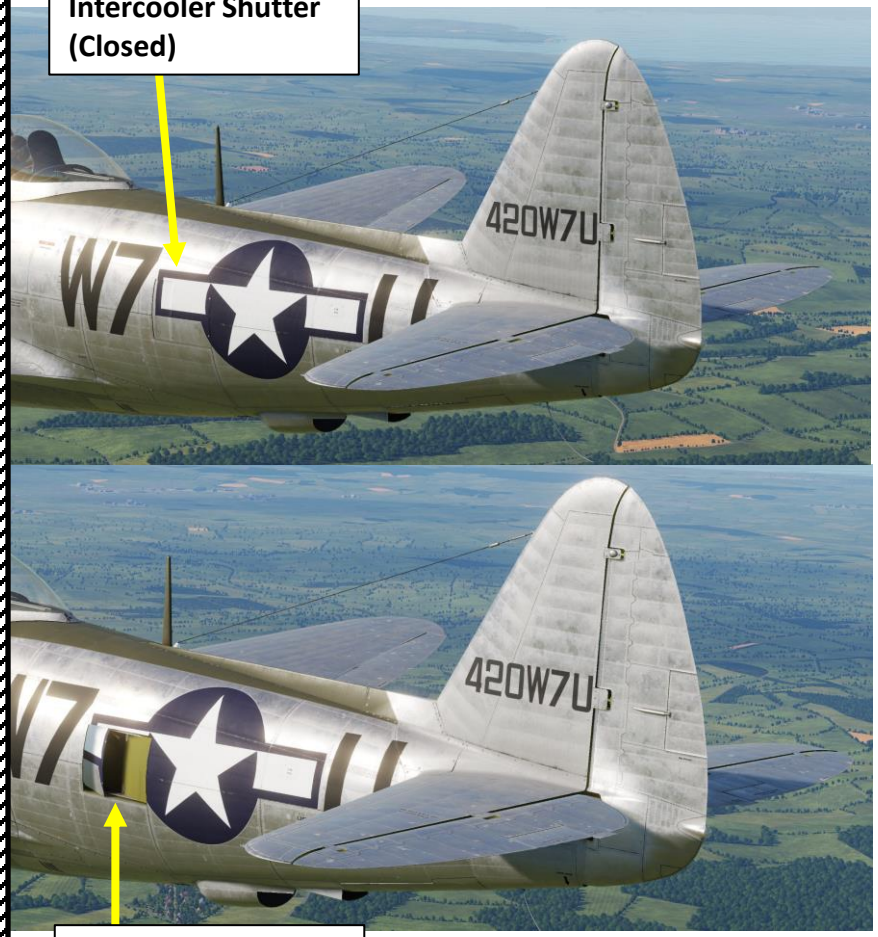
Oil Cooler Shutters Control Switch
- *FWD: Opens Shutters*
- *MIDDLE: Shutters remain in current position*
- *AFT: Closes Shutters*

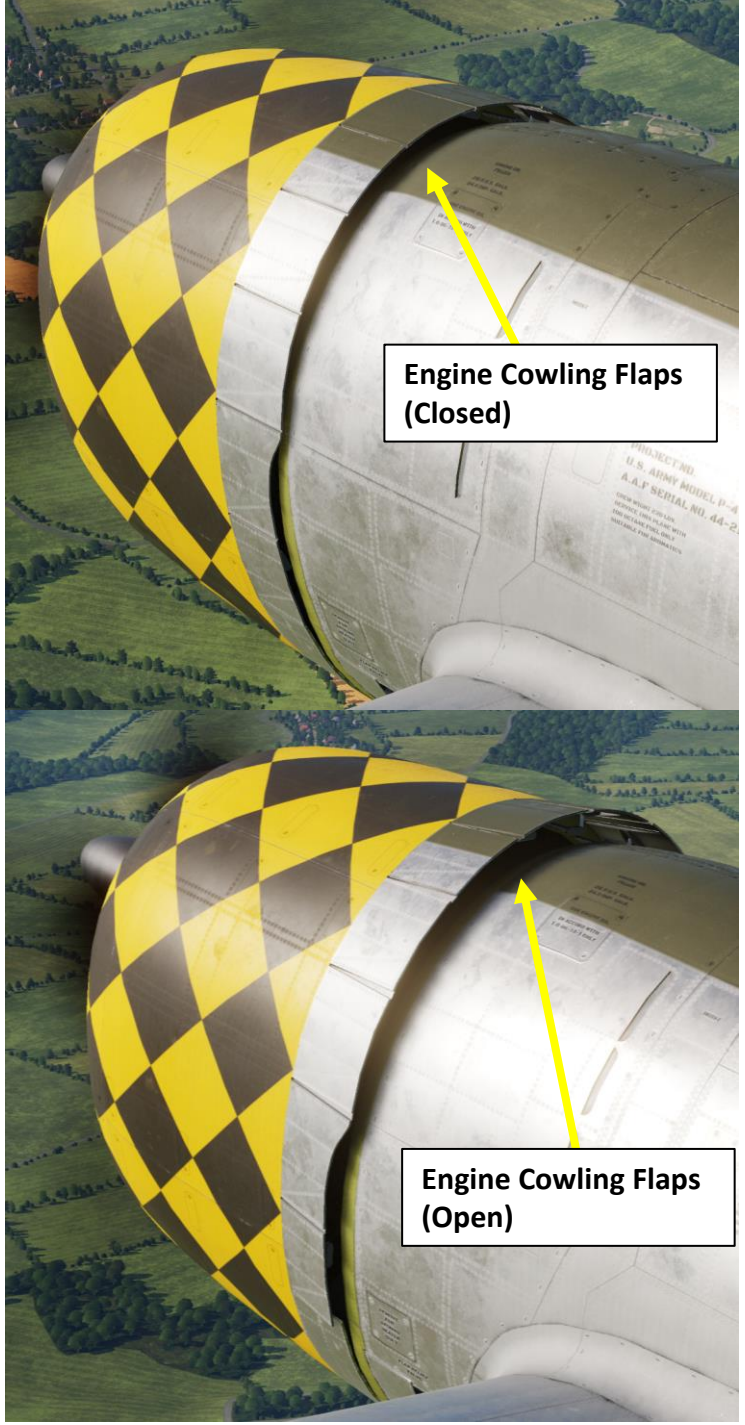


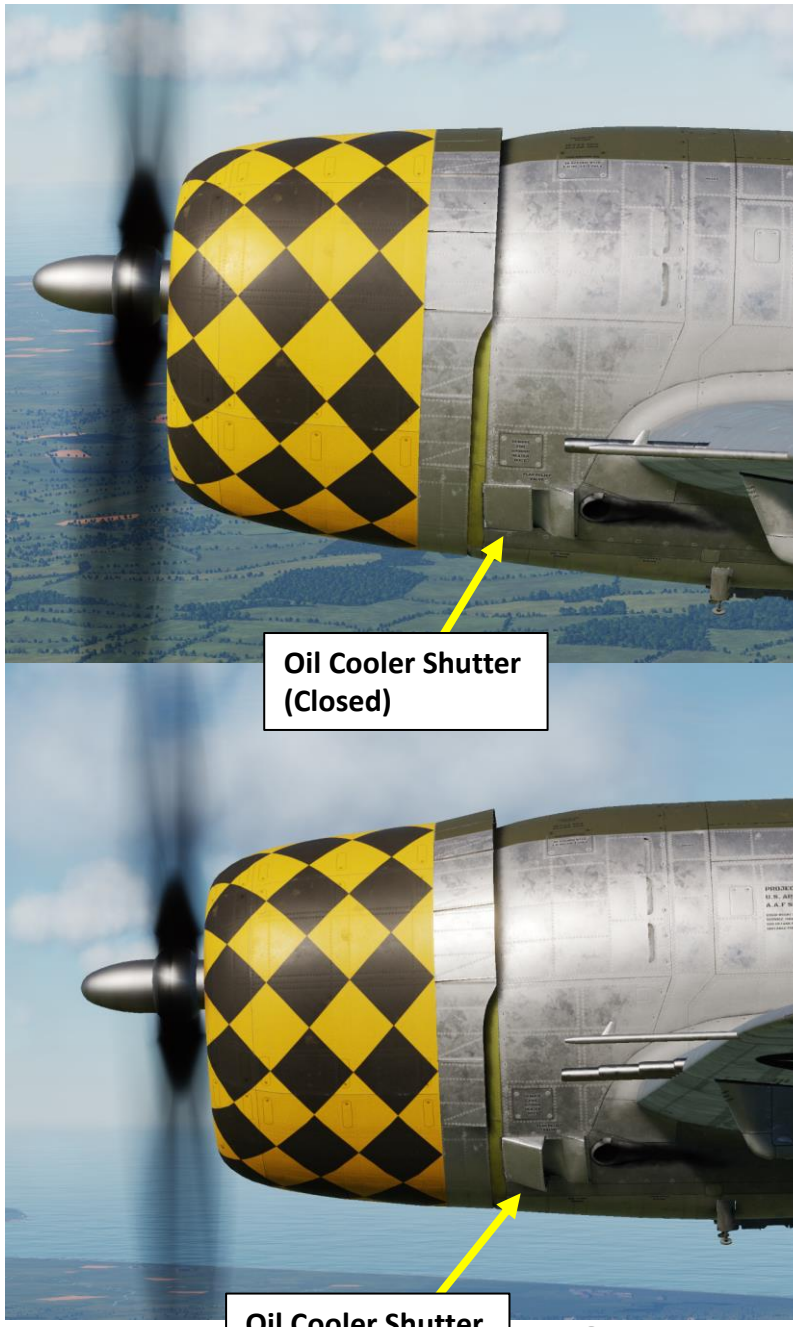
Engine Cowl Flaps Control Handle
- *Pulled OUT: Opens cowl flaps*
- *Pushed IN: Closes cowl flaps*

ENGINE CONTROLS

Take note that the Engine Cowling Flaps have no indication in the cockpit; you have to check the cowls themselves and estimate how open or closed they are.

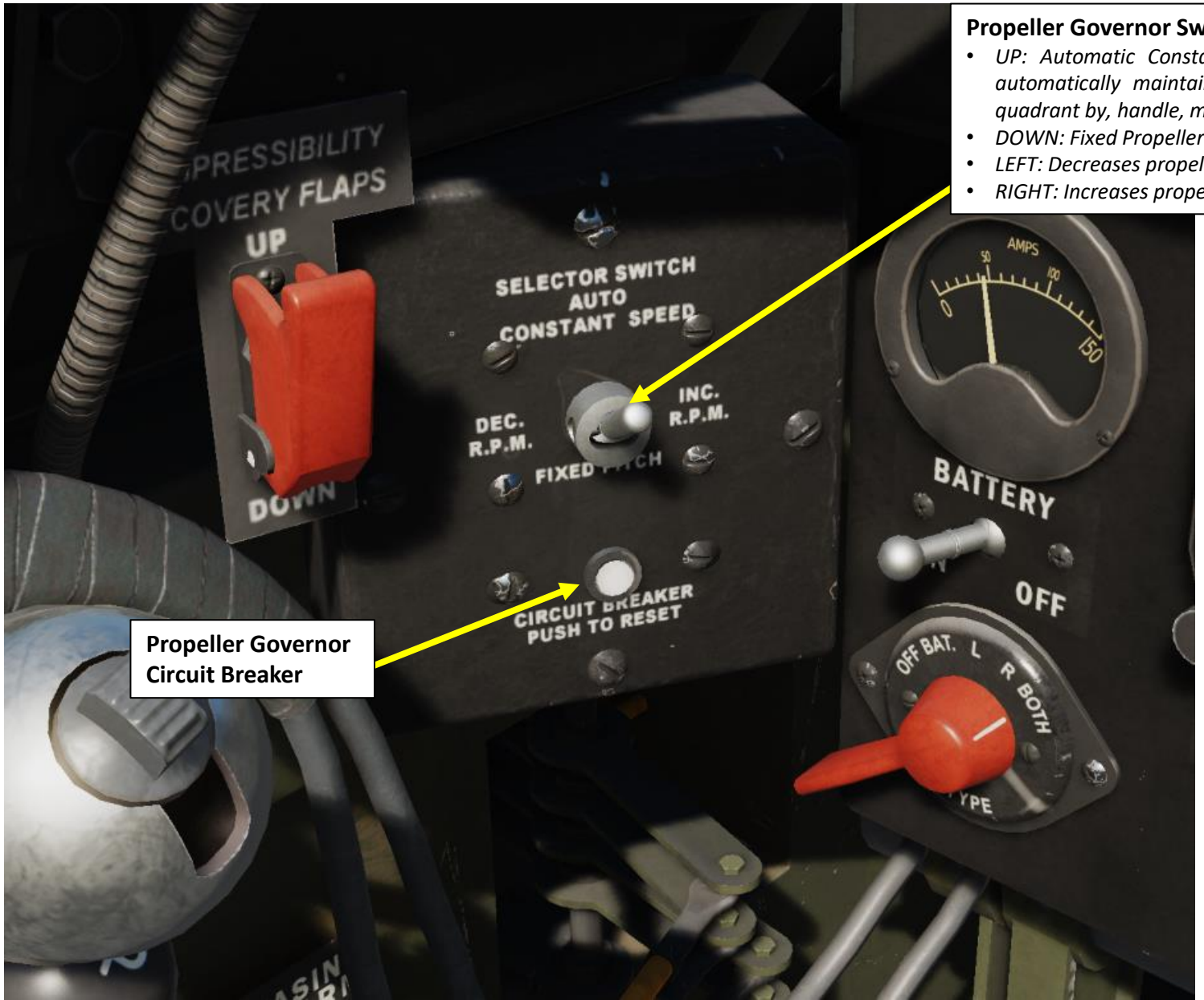






ENGINE CONTROLS

The propeller governor switch is usually left in the UP (Automatic Constant Speed) position unless the governor is running into some issues.



Propeller Governor Switch

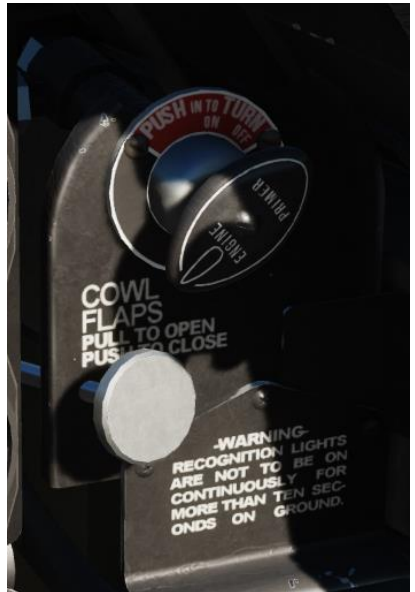
- *UP: Automatic Constant Speed (propeller governor automatically maintains engine rpm as set at the quadrant by, handle, marked as P – Propeller)*
- *DOWN: Fixed Propeller Pitch*
- *LEFT: Decreases propeller RPM*
- *RIGHT: Increases propeller RPM*

Propeller Governor Circuit Breaker

ENGINE CONTROLS

The P-47 has many different engine controls… but what do all these levers do exactly? Here is a table that sums up what engine parameter you can affect with specific engine controls.

ENGINE CONTROL VS ENGINE PARAMETER EFFECT	
Throttle	Controls manifold pressure / engine power.
Propeller RPM (P) Control Lever	Controls propeller RPM
Mixture Lever	Controls fuel/air mixture ratio, which allows diluted mixture with AUTO LEAN (used for long-range flights during cruise to save fuel) or rich mixture with AUTO RICH (used for better performance but increases fuel consumption). FULL RICH is only used for cases where the automatic control is defective.
Turbosupercharger (Boost) Control Lever	Controls turbosupercharger, which allows you to increase manifold pressure further when flying at high altitudes (above 12000 ft when air density drops significantly).
Water Injection Button	Water injection system (water-methanol mixture) cools down the mixture and does not increase engine power by itself, but it allows the engine to be run at a higher pressure setting without risking overheat.
Intercooler Shutter Switch	Affects carburetor air temperature.
Oil Cooler Shutter Switch	Affects oil temperature and pressure.
Engine Cowl Flaps Control Handle	Affects CHT (Cylinder Head Temperature).



ENGINE POWER SETTINGS

POWER SETTINGS TABLE (GRADE 100 FUEL)

Setting	Sea Level	25,000 ft	29,000 ft	33,000 ft	35,000 ft	Description
Takeoff	52'' Hg 2700 RPM	-	-	-	-	• **Limited to 15 minutes** • **Cowl** Flaps FULLY OPEN • **Intercooler** shutters NEUTRAL • **Oil cooler** shutters NEUTRAL • **Mixture** AUTO RICH
Climb	42'' Hg 2550 RPM	42'' Hg 2550 RPM	42'' Hg 2550 RPM	36'' Hg 2550 RPM	33'' Hg 2550 RPM	• Max Continuous Power (use for high-speed cruise) • Best climb speed: 150-165 mph • **Cowl Flaps** FULLY OPEN (increase airspeed if cylinder head temperature is above 230 deg C) • **Intercooler** shutters OPEN during standard flight, NEUTRAL during cold weather (or flying at speeds above 350 mph), CLOSED if carburetor temperature drops below 25 deg C. • **Oil cooler** shutters OPEN (unless operating in cold weather) • Mixture AUTO RICH
Cruise	32'' Hg 2250 RPM	32'' Hg 2250 RPM	30'' Hg 2250 RPM	28'' Hg 2250 RPM	-	• Used for normal operation • **Cowl** Flaps FULLY CLOSED when flying above 225 kts, 1/3 OPEN when flying below 225 kts • **Intercooler** shutters OPEN during standard flight, NEUTRAL during cold weather (or flying at speeds above 350 mph), CLOSED if carburetor temperature drops below 25 deg C. • **Oil cooler** shutters OPEN (unless operating in cold weather) • **Mixture** AUTO LEAN
Minimum Cruise	31'' Hg 2150 RPM	31'' Hg 2150 RPM	-	-	-	• Used below 25,000 ft for fuel conservation. • **Cowl** Flaps FULLY CLOSED when flying above 225 kts, 1/3 OPEN when flying below 225 kts • **Intercooler** shutters OPEN during standard flight, NEUTRAL during cold weather (or flying at speeds above 350 mph), CLOSED if carburetor temperature drops below 25 deg C. • **Oil cooler** shutters OPEN (unless operating in cold weather) • **Mixture** AUTO LEAN

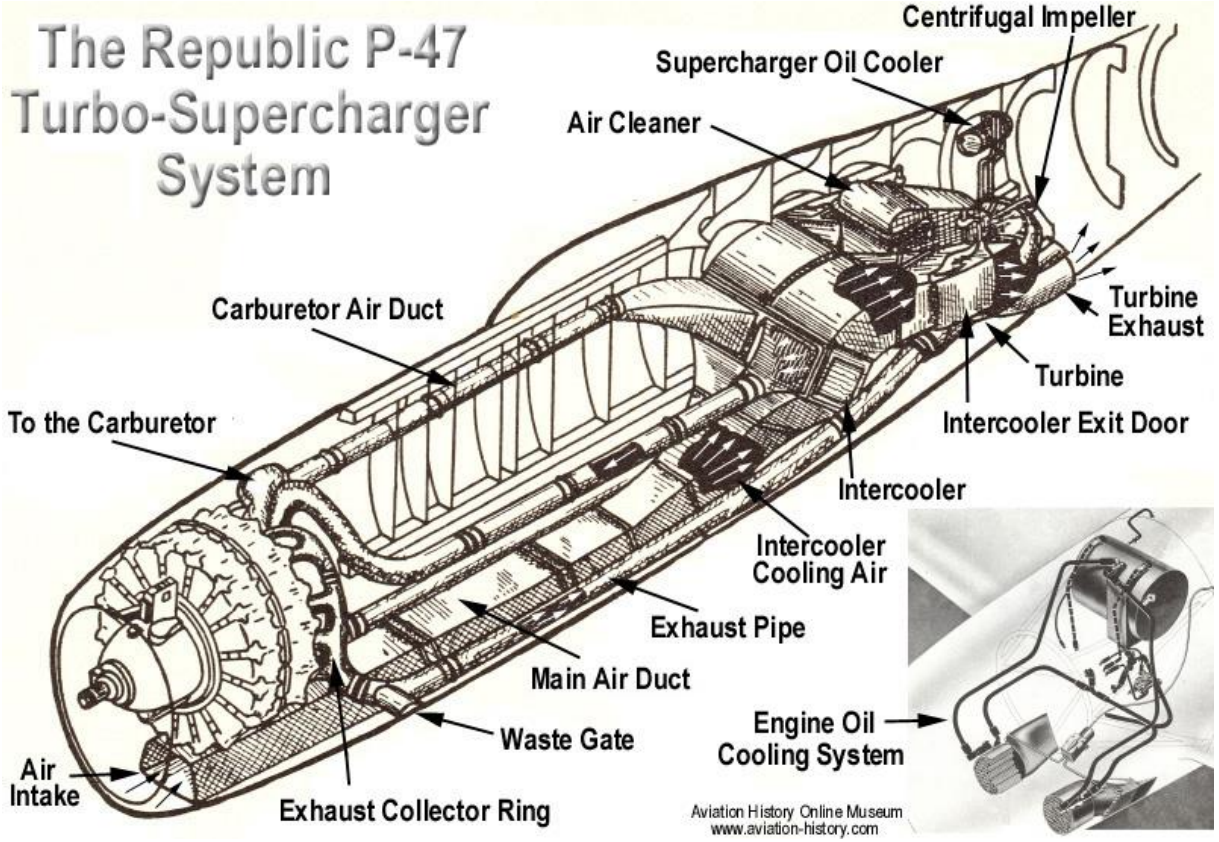
- **Note 1**: During a dive, make sure to close your cowling flaps or you may overcool the engine.
- **Note 2**: Cowl flaps are usually left 1/4 OPEN (or fully closed) when flying above 225 kts since they generate a lot of turbulence and drag at high speeds. If you run into a cylinder head temperature (CHT) overheat, you have to reduce throttle, slow down and only then open cowl flaps once you are below 225 kts (or the flaps could very well jam or be damaged).
- **Note 3**: Carburetor icing can occur at any time when the temperature and dew point are within 12 deg C of each other. The P-47 does not have a carburetor heater, but when icing is detected (noticeable by a sudden loss of power, airspeed and a decrease in the carburetor air temperature), close intercooler shutters. If carburetor air temperature doesn't rise to above 12 deg C, push the Turbosupercharger (Boost) Control lever forward.
- **Note 4:** In case of an engine oil overheat, reduce throttle and increase airspeed.

POWER BOOSTING

The Thunderbolt, despite its heavy weight, is a fighter that was meant to be flown at high altitudes. Why? Because of its engine. The P-47's great performance at high altitudes is explained by the fact that the plane has two types of "power boosting devices":

a) A geared supercharger which is an integral part of the engine, and;

b) A turbosupercharger (also called "turbo" or "turbocharger"), installed just forward of the tail section.



What's the difference between a turbo and a supercharger? Good question! Simply put:

- A **turbocharger** uses the **velocity and heat energy of the searingly hot (and expanding) exhaust gases** rushing out of an engine's cylinders to spin a turbine that drives a small compressor, or impeller, that in turn stuffs more air back into the engine.

- A **supercharger** also pumps additional air into the engine, but it is instead **driven mechanically by the engine** via a belt that runs off the crankshaft or by an electric motor.

Each of these power-boosting technologies has advantages and disadvantages, but the most obvious difference is a **slight delay in response to throttle input**. That's because the turbocharger requires a moment to "spool up" before delivering its burst of additional power—it takes a second for exhaust heat and pressure to increase enough to spin the turbo after you throttle up the Boost (B) lever. It's called "boost lag" or "turbo lag" for obvious reasons. By contrast, a supercharger has no lag; because its air pump is linked directly to the engine's crankshaft, it's always spinning and instantly responsive. The power boost it provides, and therefore the engine response you feel through the seat of your pants, increases immediately in direct proportion to how far you throttle up.

While the turbo's primary drawback is boost lag, the supercharger's is efficiency. Because a supercharger uses the engine's own power to spin itself, it siphons power—more and more of it as engine revs climb. Supercharged engines tend to be less fuel efficient for this reason. For developing mega power with instant kick-you-in-the-back throttle response, however, supercharging rules.

SUPERCHARGER BASICS

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

With a normally aspirated engine, it is not possible to have manifold pressure higher than the existing atmospheric pressure. A supercharger is capable of boosting manifold pressure above 30 "Hg. For example, at 8,000 feet a typical engine may be able to produce 75 percent of the power it could produce at mean sea level (MSL) because **the air is less dense at the higher altitude**. The supercharger compresses the air to a higher density allowing a supercharged engine to produce the same manifold pressure at higher altitudes as it could produce at sea level.

Thus, an engine at 8,000 feet MSL could still produce 25" Hg of manifold pressure whereas without a supercharger it could produce only 22 "Hg. Superchargers are especially valuable at high altitudes (such as 18,000 feet) where the air density is 50 percent that of sea level. The use of a supercharger in many cases will supply air to the engine at the same density it did at sea level. With a normally aspirated engine, it is not possible to have manifold pressure higher than the existing atmospheric pressure.

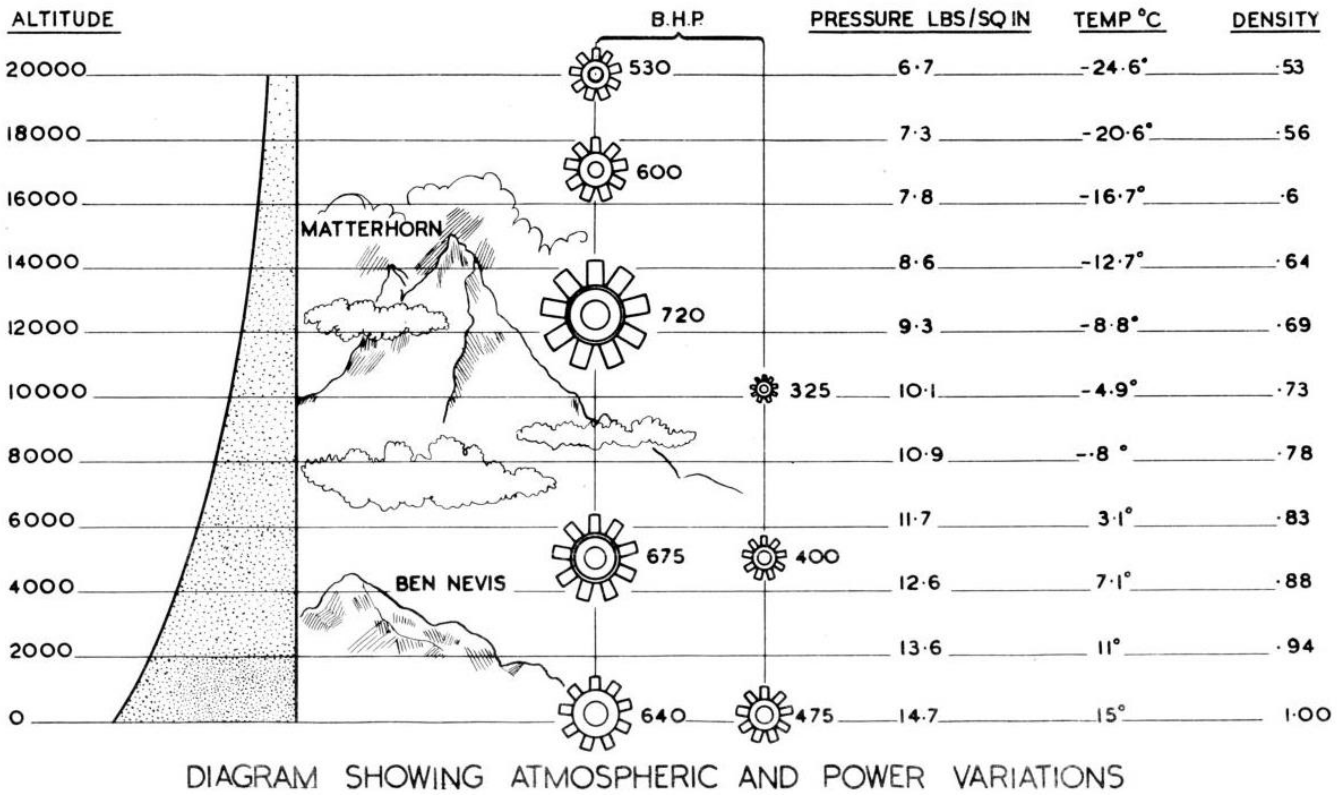
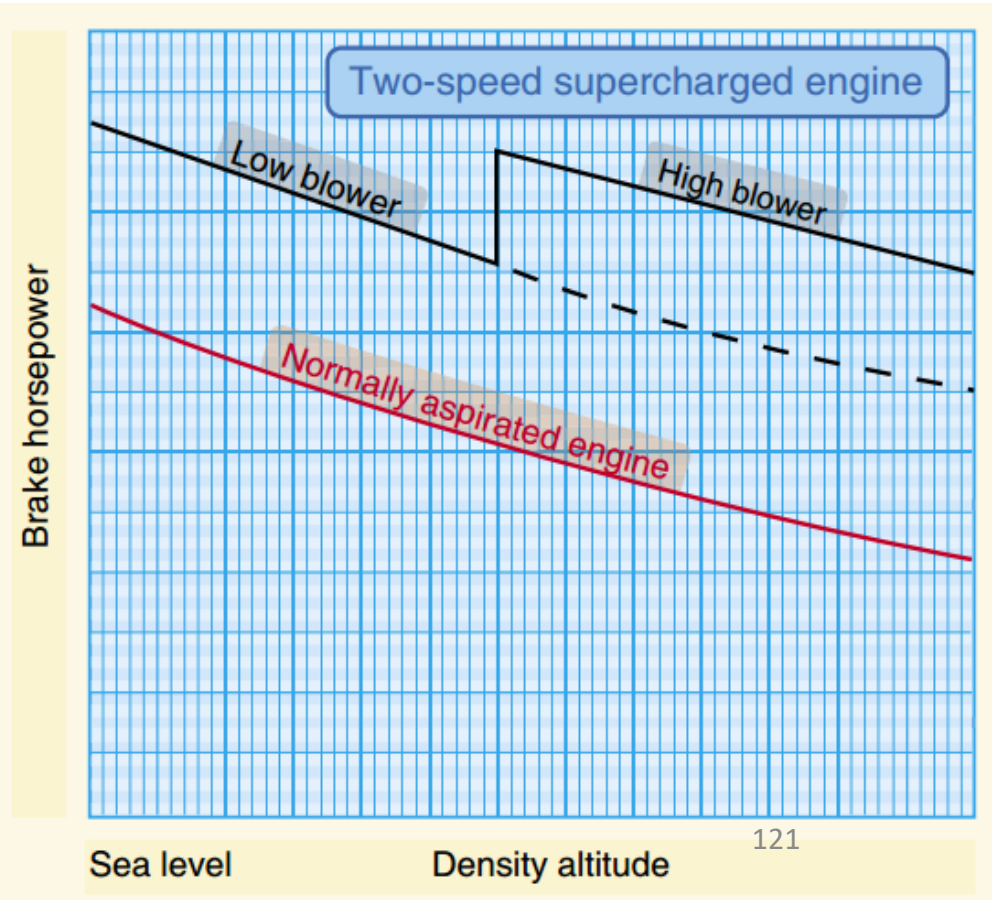


DIAGRAM SHOWING ATMOSPHERIC AND POWER VARIATIONS



TURBOSUPERCHARGER BASICS

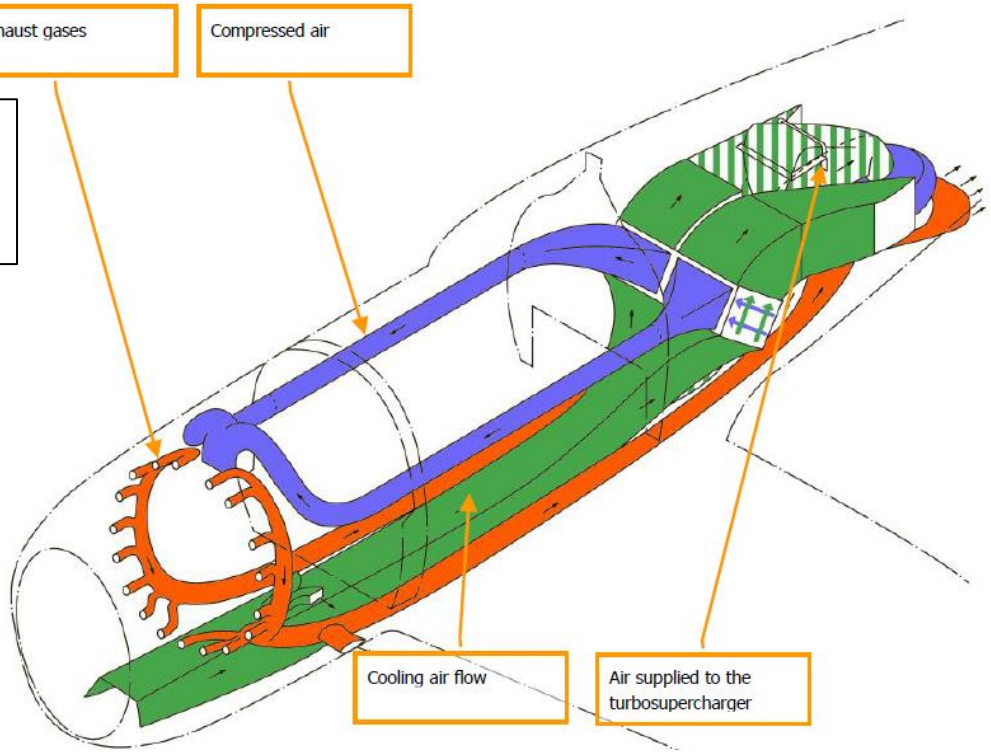
The principle of operation of the turbocharger is as follows: the exhaust gases coming from the engine are directed to the gas turbine which drives the compressor, which in turn compresses the air. A side effect of such compression is the strong heating of the air. Therefore, the air is cooled down by an intercooler, which is installed in the tail section, before it enters the engine cylinders.

Cold air for blowing the intercooler is drawn from the air intake, which is placed under the engine. Then it passes through a long duct, and is supplied to the outer surfaces of the intercooler tubes to cool the compressed air, coming from the turbocharger to the carburetor, and then, it is released through two adjustable nozzles on the sides of the fuselage tail section.

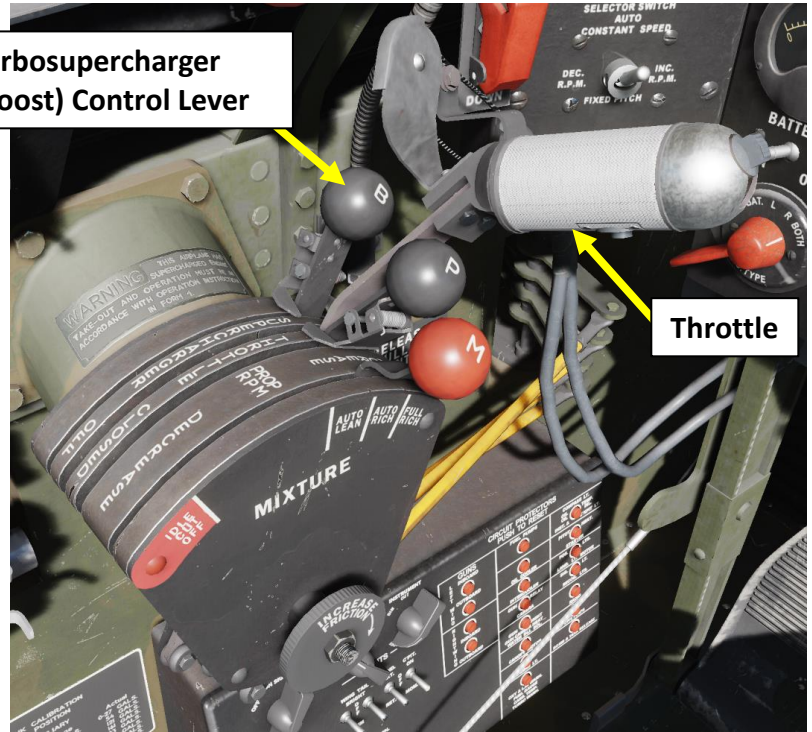
Typically, a turbocharger is used at altitudes more than 12,000 feet, as well as for takeoff at very heavy weight configurations and emergency boost at any altitude.

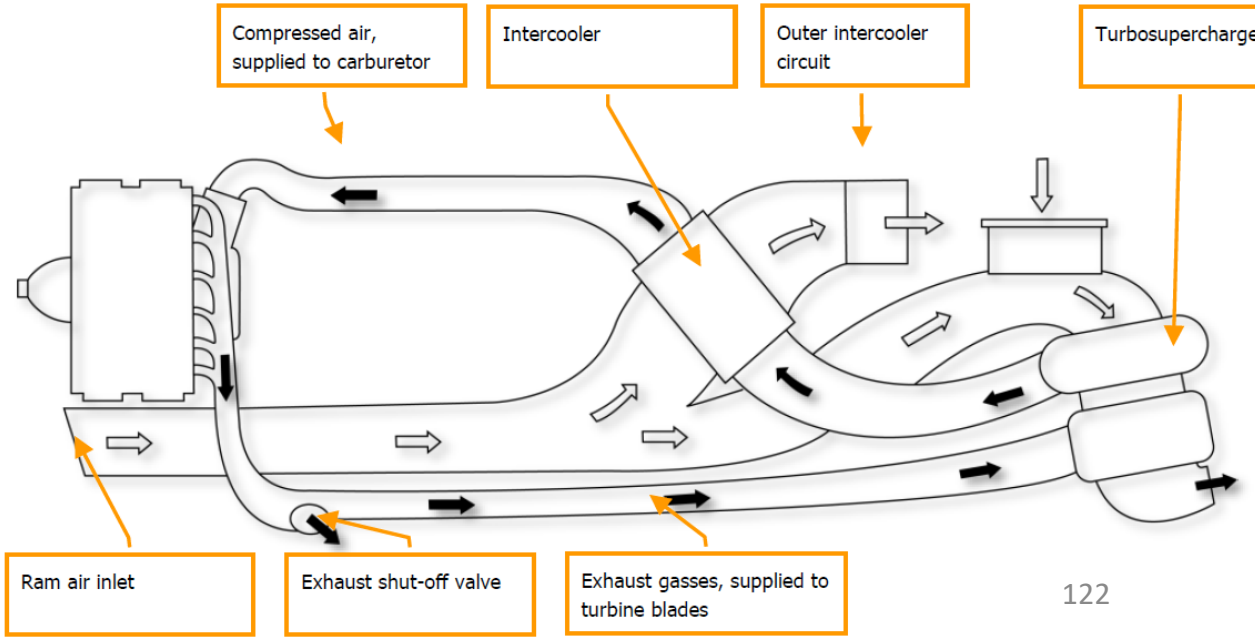
Turbosupercharger Tachometer (x1000 RPM)
Maximum allowable turbocharger RPM is 22,000

Turbine Overspeed Light
Illuminates when turbosupercharger RPM exceeds 22,000



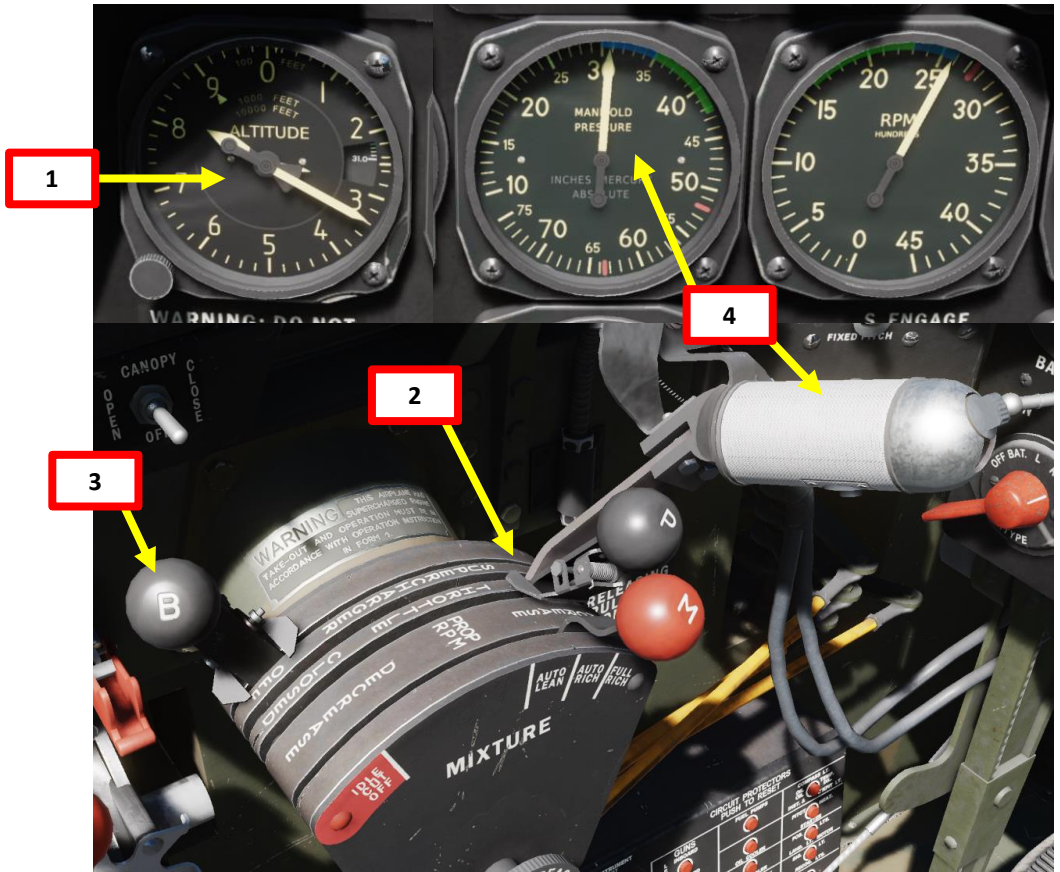
Turbosupercharger (Boost) Control Lever



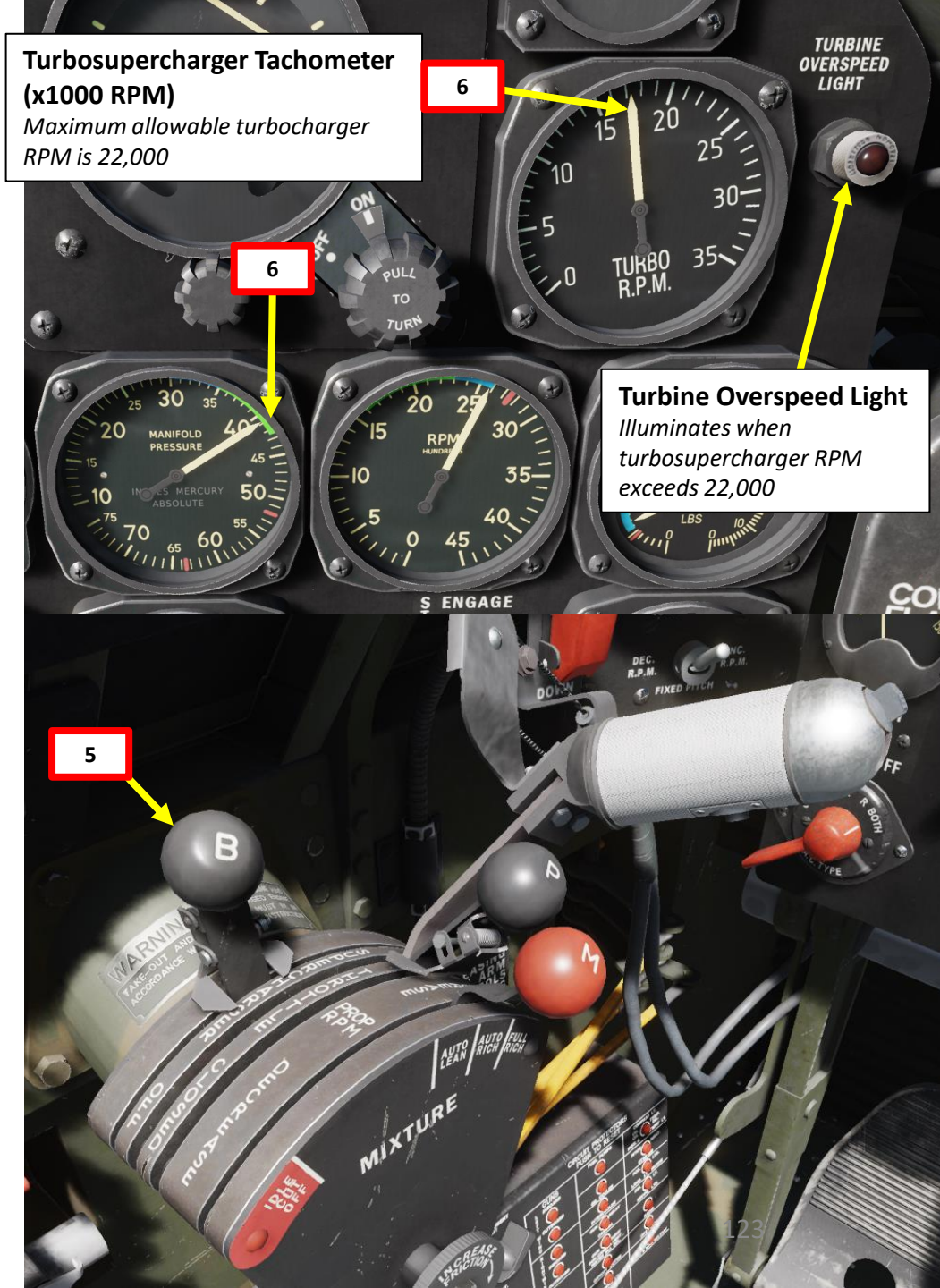


TURBOSUPERCHARGER OPERATION

1. To use the turbosupercharger, you should be at an altitude of 7000 ft or above. Recommended altitude to use a turbosupercharger is above 12,000 ft.
2. Verify that Throttle and Turbosupercharger Control Lever (B) are not interconnected.
3. Set Turbosupercharger Control Lever (B) fully AFT (OFF).
    - Note: the Turbosupercharger lever must **NEVER** be advanced in front of the Throttle or you risk damaging the turbosupercharger.
4. Push throttle forward to gain the maximum manifold pressure.
5. Once throttle is fully forward, advance Turbosupercharger Control Lever (B) to engage turbo as desired.
6. Turbo Tachometer RPM will increase, increasing Manifold pressure and engine power in the process.
7. At high altitudes, you should not need to touch the throttle; engine power should be controlled with the (B) lever.
8. The turbo RPM can be pushed to 22,000 RPM for 15 minutes maximum.
9. If you want to disengage turbosupercharger or throttle down, set Turbosupercharger Control Lever (B) AFT first, then throttle back.



Turbosupercharger Tachometer (x1000 RPM)
Maximum allowable turbocharger RPM is 22,000



Turbine Overspeed Light
Illuminates when turbosupercharger RPM exceeds 22,000

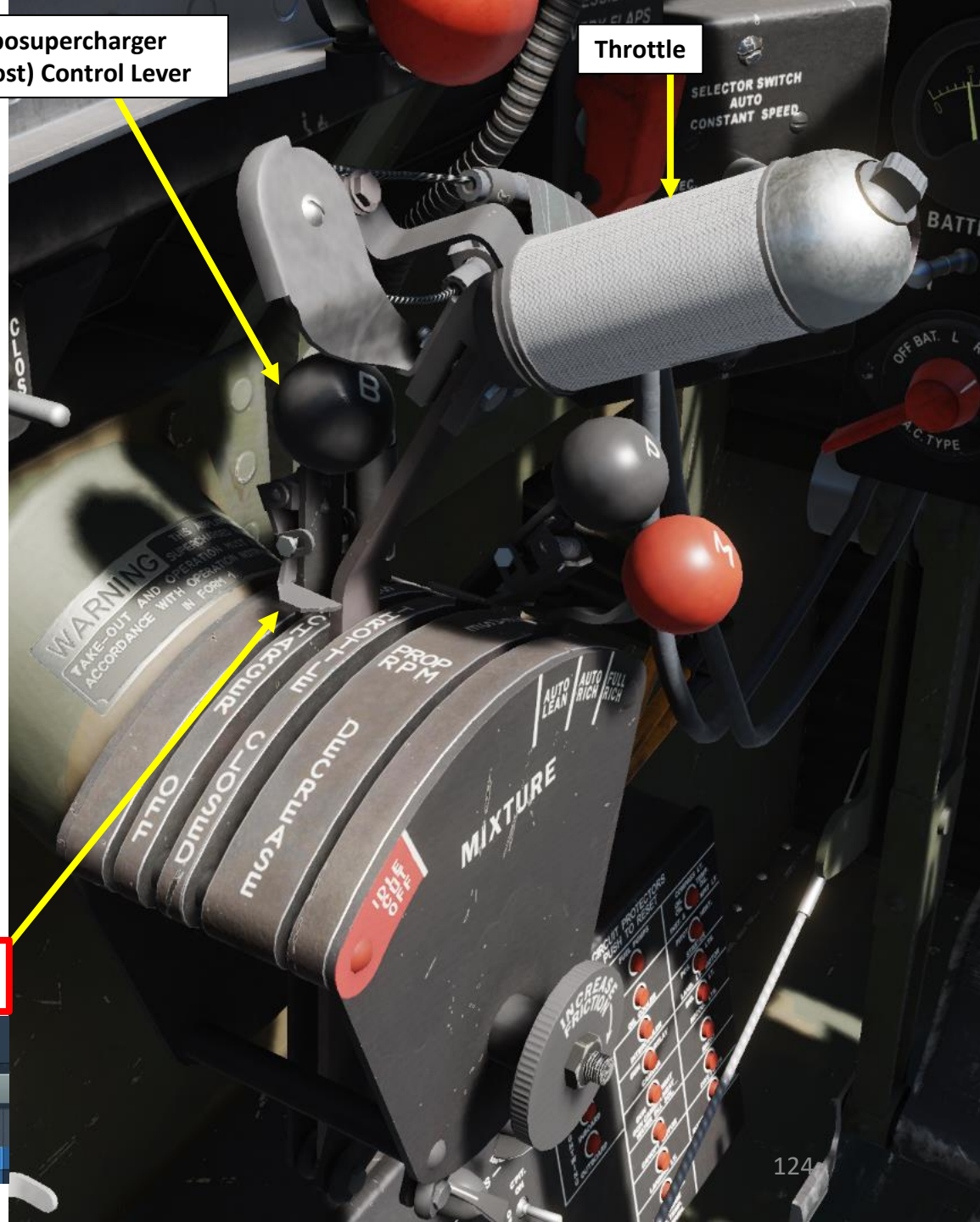
TURBOSUPERCHARGER RULES AND TIPS

Here are a number of general rules to consider when operating the turbosupercharger.

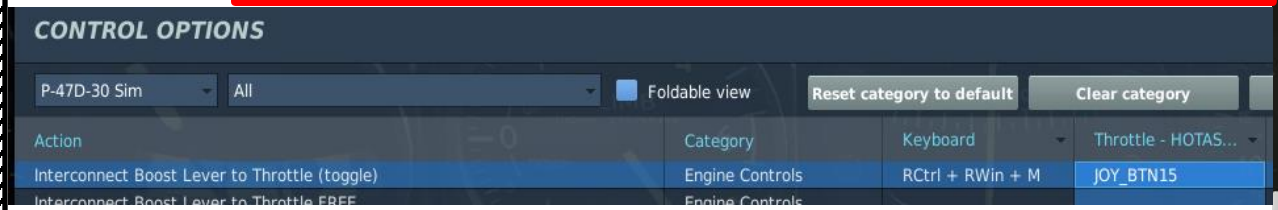
- Turbo should be used above 7000 ft.
- Turbosupercharger (Boost) Control lever should **NEVER** be advanced past the throttle. Doing so can create a pressure build-up and blow the seals in the air ducting. If that happens, you will not be able to build up pressure and will likely have to descend.
- Interconnecting the Boost lever and the throttle can be done to facilitate power management during dogfights; this is useful in cases when you need a quick response of power or if you are making a takeoff with water injection. However, interconnecting these levers has some drawbacks.
- Interconnecting the Boost lever is generally not recommended since the operation of the turbosupercharger's impeller costs the engine about 300 horsepower (due to mechanical energy being "lost" in the gear-driven shaft), which otherwise could be delivered to the propeller. This loss of horsepower is minimized at higher altitudes.
- My personal recommendation would be to interconnect Boost/Throttle in cases where you know you will be playing with power at medium altitude (10000-20000 ft). Otherwise, keep Boost/Throttle disconnected. The rationale behind this is that if you are at high altitude, there shouldn't be any reason for you to cut the throttle (you will simply fall out of the sky) since you can control power reasonably well with the Boost lever. If you are at low altitude, the induced loss in horsepower (as explained above) isn't worth using the turbosupercharger.

Here are a few interesting videos on the P-47's turbosupercharger:

- P-47 Thunderbolt Pt. 1A Throttle and Boost Lever Use: https://youtu.be/HHtypRJuNKY
- Turbo vs Supercharging in WW2 Airplanes: https://youtu.be/ULLsIo1VzTw
- The Turbosupercharger: Master Of The Skies: https://youtu.be/KFwwgbj9Bi8



Right Click on Interconnect Latch to connect Throttle and Turbosupercharger (B) levers
Left Click on Interconnect Latch to disconnect Throttle and Turbosupercharger (B) levers



WAR EMERGENCY POWER (WEP) AND WATER INJECTION

The P-47 has a tank holding a solution of water and methanol to prevent detonation while drawing War Emergency Power (WEP).

The mixture is injected finely into the inlet manifold and then entrained into the cylinders. The presence of the water reduces the temperature of the mixture, which makes it possible to increase the supercharging and increase the efficiency of the engine and get more power without causing detonations.

Water injection system consists of a 30-gallon consumable water tank, an engine driven pump, water pressure regulator, a relief valve and automatic boost-reset.

Water injection is controlled by a switch, which is located on the throttle. The switch opens a solenoid valve that transmits a mixture of water and methanol to the regulator. At the same time, the automatic boost mechanism is triggered under water pressure in the supply line and the mixture is impoverished to reduce fuel consumption. The water injection system is heated in flight by the engine heat, which prevents the system from freezing in flight.

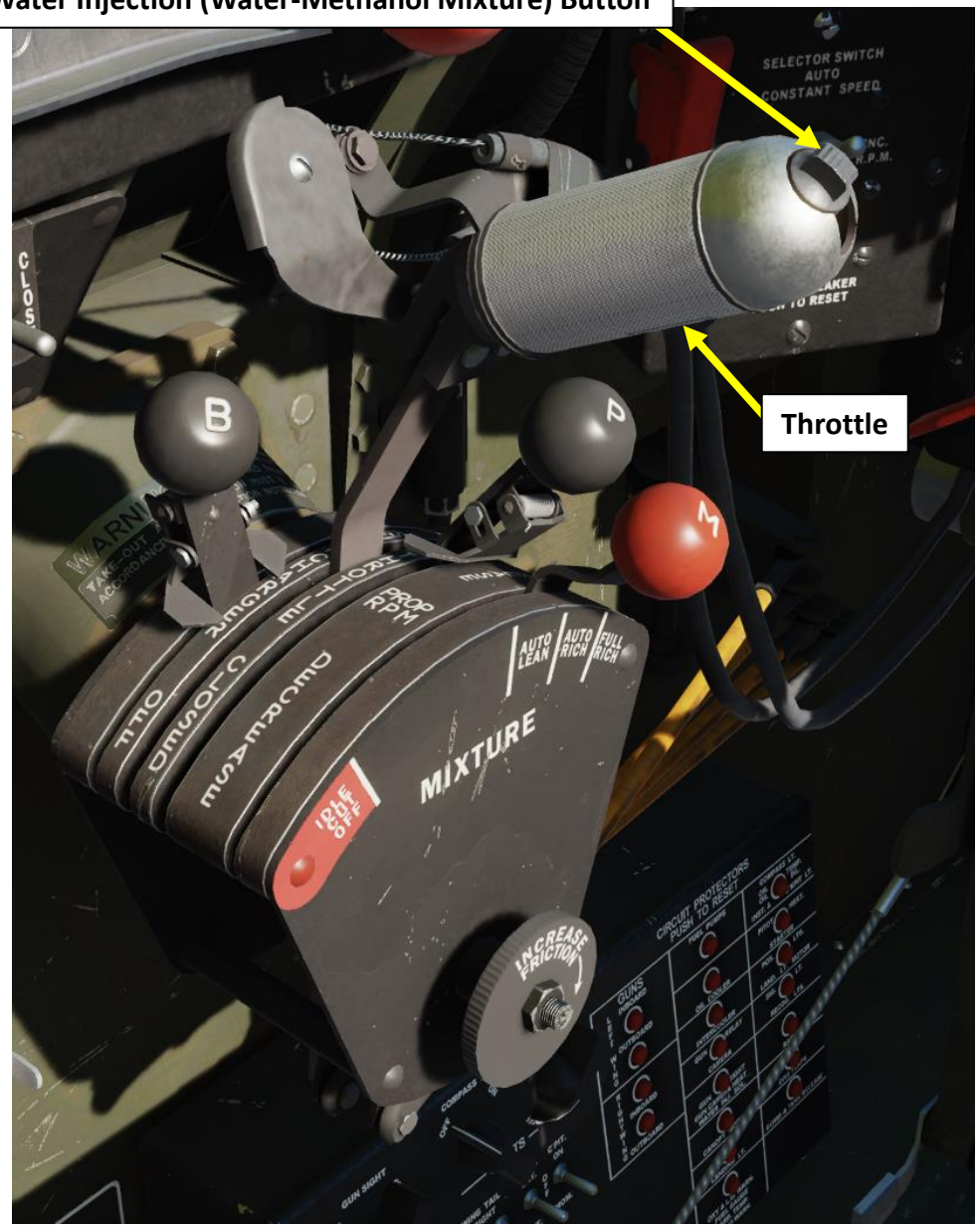
Water injection occurs when the engine is running in War Emergency Power (WEP) mode, which is activated by **pressing the Water Injection button on the throttle** and then **throttling up to approximately 1/8 inch from the full forward throttle position (95 %)**. The pressure in the collector reaches then up to 64 inches of Hg, increasing power by 30%. The water supply is **sufficient for about 15 minutes of operation**.

Water Pressure Gauge (psi)
Indicates current pressure in the water-methanol mixture injection system.
Green indicates operational range.

Engine Manifold Pressure Indicator (inches Hg)
Blue: Cruise Range
Green: Operational Range

War Emergency Power Manifold Pressure

Water Injection (Water-Methanol Mixture) Button

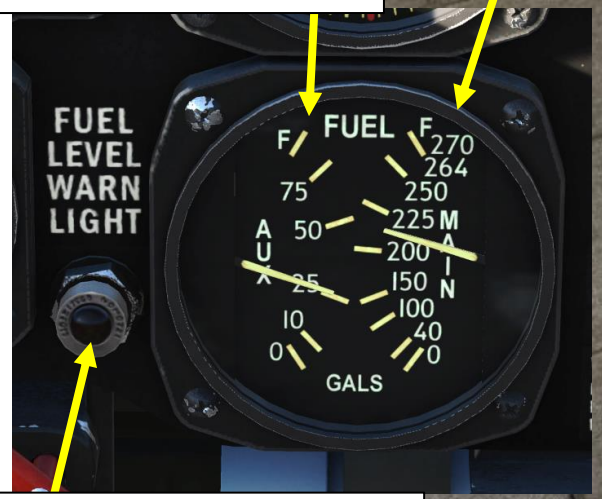


FUEL TANKS

Fuel Capacity
Main Tank Capacity: 270 gal
Auxiliary Tank Capacity: 100 gal
Total Capacity: 370 gal

Main Fuel Tank Quantity Indicator (US gal)

Auxiliary Fuel Tank Quantity Indicator (US gal)

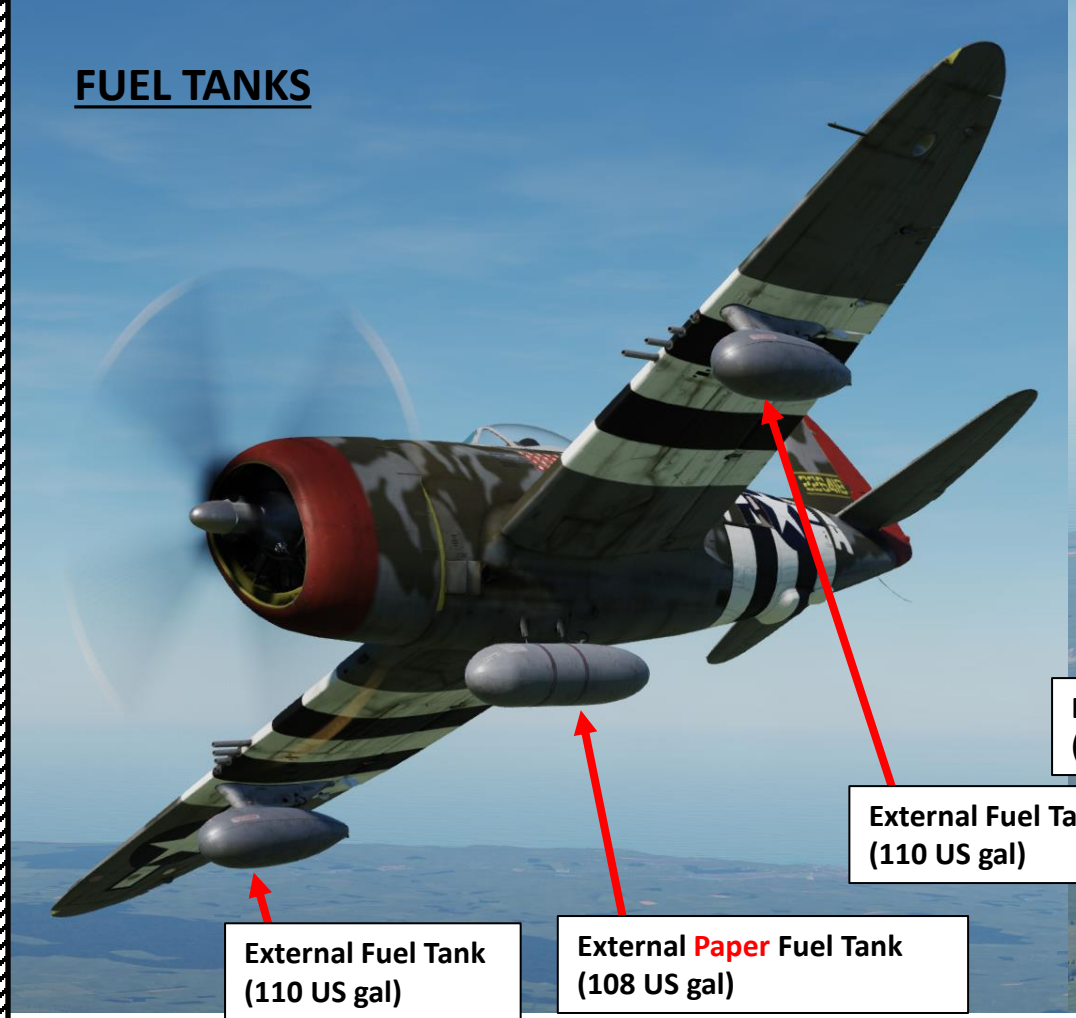


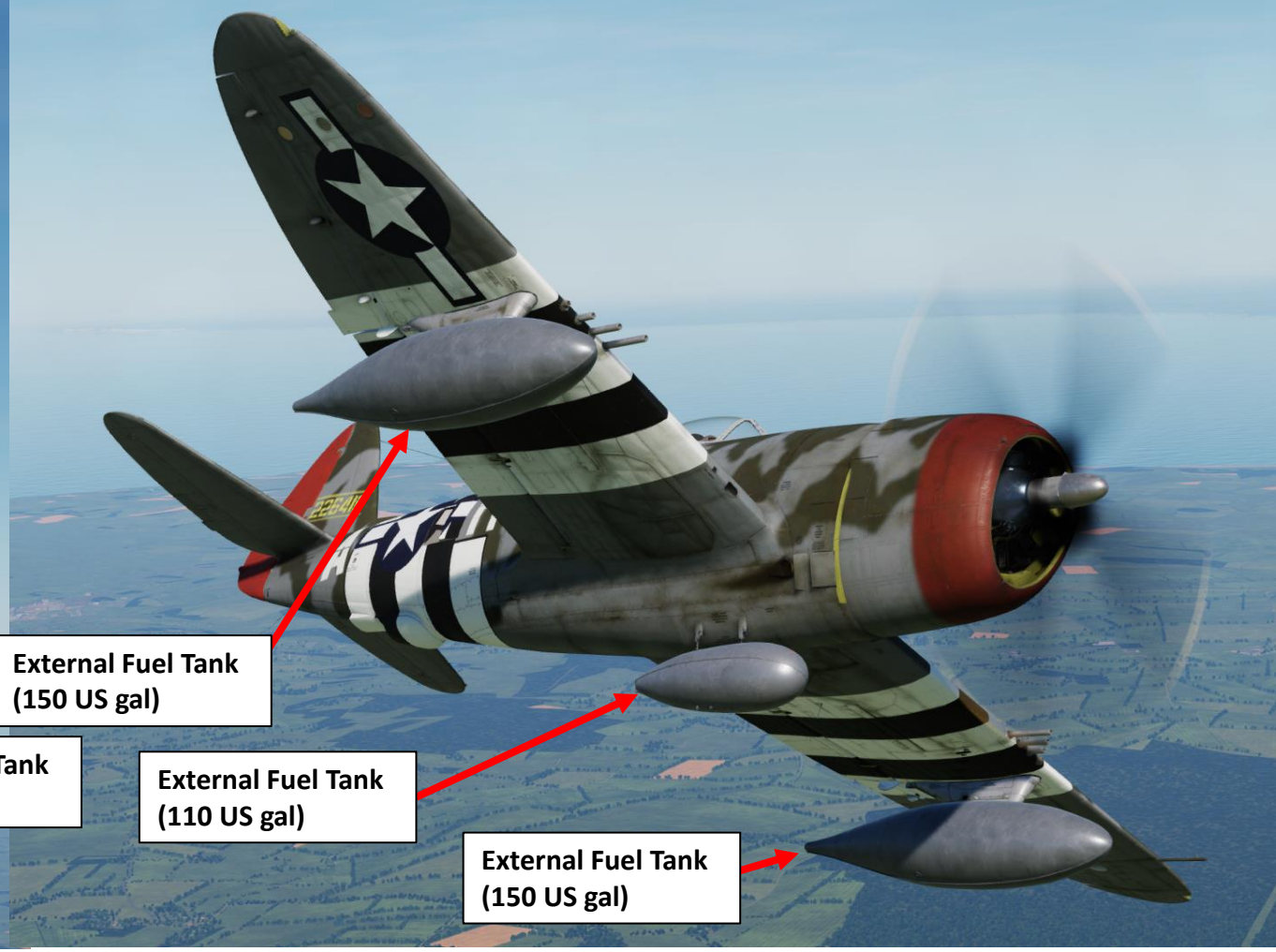
Fuel Level Warning Light
Illuminates when fuel quantity in main tank is less than 40 US gallons

Auxiliary Fuel Tank

Main Fuel Tank

FUEL TANKS





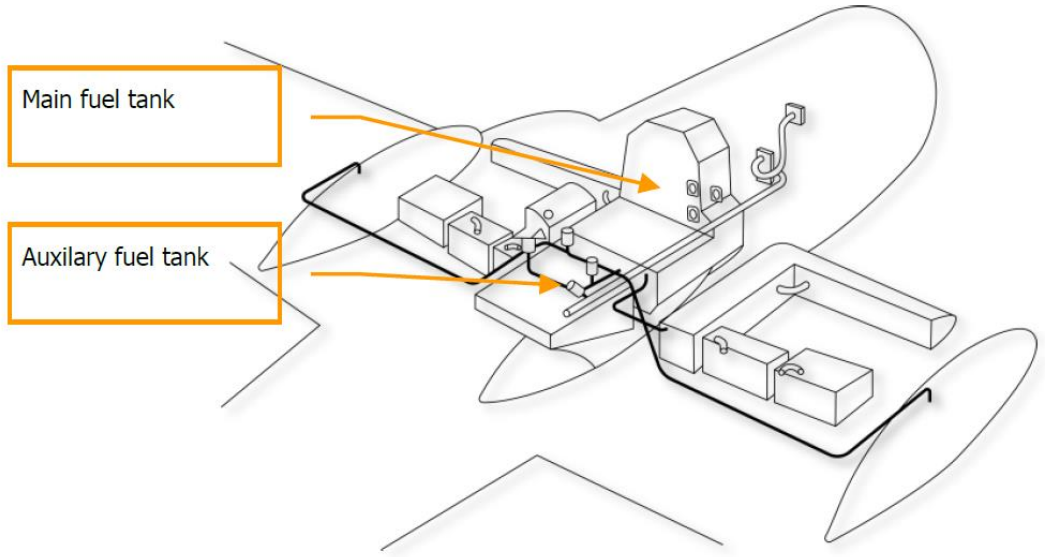
Fun Fact:

Faced by wartime metal shortages and a need to extend the range of fighter craft, the British came up with drop tanks made of glue-impregnated kraft paper, which had excellent tolerance characteristics for extreme heat and cold necessary for operation on an aircraft as well as being waterproof. Since the glue would slowly dissolve from the solvent effects of the fuel (sometimes developing leaks within a few hours of being loaded with fuel) these were strictly a single-use item, used in typically chilly Northern European conditions, filled immediately before take off, jettisoned in the event of an aborted mission and only being required for the outbound portion of any flight. Such papier-mâché tanks were assembled from three main components, the nose cone, tail cone and the body, each shaped over wooden forms, the centre section created by wrapping layers of the impregnated paper around a cylinder, the end caps hand-laminated with petal-shaped pieces sometimes named gores. Some 13,000 papier-mâché tanks were made and used by the RAF, the vast majority used in the course of the war, conserving a considerable amount of metal. Very few examples survive due to their expendable nature and low intrinsic value at the time of their creation, and the fact that they are not inherently robust.

FUEL MANAGEMENT

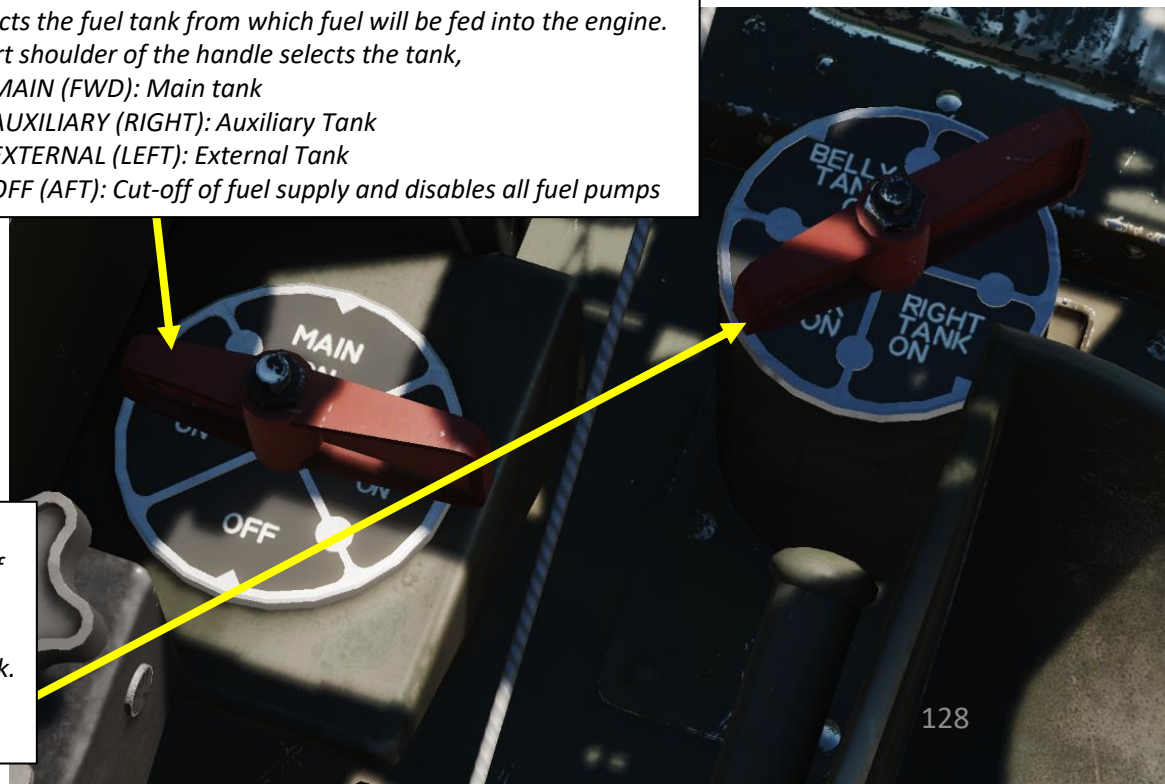
The P-47 fuel gauge only displays fuel quantity for the main and auxiliary fuel tank. The external fuel tanks have no fuel quantity indication. Here are a few pointers on how to manage your fuel during flight.

- During takeoff and landing, set Fuel Selector Valve Handle to MAIN (FWD)
- After takeoff, if fuel is available in the Auxiliary Tank, set Fuel Selector Valve Handle to AUXILIARY (RIGHT). **You need to empty the auxiliary tank first** since it shifts your center of gravity aft and gives the aircraft undesirable aerodynamic characteristics. If auxiliary tank is empty, use Main Fuel Tank.
- When the fuel pressure drops or the engine runs exceedingly rough, coughs or emits black smoke, this means that your selected fuel tank is empty.
- To use external fuel drop tanks, set the External Fuel Tank Selector Valve Handle to your desired tank first, then set Fuel Selector Valve Handle to EXTERNAL (LEFT).



Engine Fuel Pressure Indicator (psi)
Blue: Operational Range

Fuel Selector Valve Handle
Selects the fuel tank from which fuel will be fed into the engine. Short shoulder of the handle selects the tank,
- *MAIN (FWD): Main tank*
- *AUXILIARY (RIGHT): Auxiliary Tank*
- *EXTERNAL (LEFT): External Tank*
- *OFF (AFT): Cut-off of fuel supply and disables all fuel pumps*



External Fuel Tank Selector Valve Handle
This valve controls fuel flow from three external fuel tanks. Short shoulder of the handle selects the tank,
- *LEFT TANK (AFT LEFT): Fuel supply taken from left wing external tank.*
- *RIGHT TANK (AFT RIGHT): Fuel supply taken from right wing external tank.*
- *BELLY (FWD LEFT): Fuel supply taken from external belly (fuselage) tank.*
- *OFF (FWD RIGHT): Cut-off of fuel supply from external tanks*

EXTERNAL FUEL DROP TANK OPERATION

To use fuel from external tanks:

1. Set External Fuel Tank Selector Valve Handle to desired tank (BELLY, RIGHT or LEFT EXTERNAL TANK)
2. Set Fuel Selector Valve Handle to EXTERNAL (LEFT) to use fuel from selected external tank.

Note: There is no fuel quantity indication for external tanks. You will know the tank is empty once the engine starts running rough.

Fuel Selector Valve Handle

Selects the fuel tank from which fuel will be fed into the engine. Short shoulder of the handle selects the tank,

- *MAIN (FWD): Main tank*
- *AUXILIARY (RIGHT): Auxiliary Tank*
- *EXTERNAL (LEFT): External Tank*
- *OFF (AFT): Cut-off of fuel supply and disables all fuel pumps*

2

1

External Fuel Tank Selector Valve Handle

This valve controls fuel flow from three external fuel tanks. Short shoulder of the handle selects the tank,

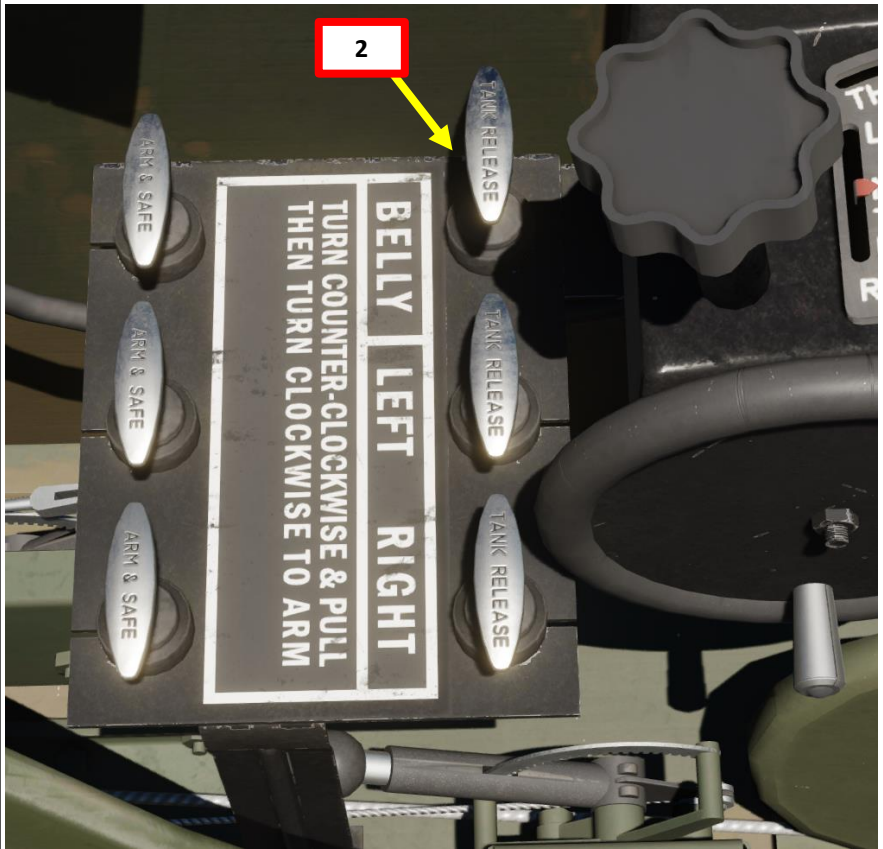
- *LEFT TANK (AFT LEFT): Fuel supply taken from left wing external tank.*
- *RIGHT TANK (AFT RIGHT): Fuel supply taken from right wing external tank.*
- *BELLY (FWD LEFT): Fuel supply taken from external belly (fuselage) tank.*
- *OFF (FWD RIGHT): Cut-off of fuel supply from external tanks*

EXTERNAL FUEL DROP TANK JETTISON

(P-47D-30 EARLY SERIES)

To jettison external tanks:

1. Set the Fuel Selector Valve Handle to MAIN
2. Pull the required Jettison Handle.

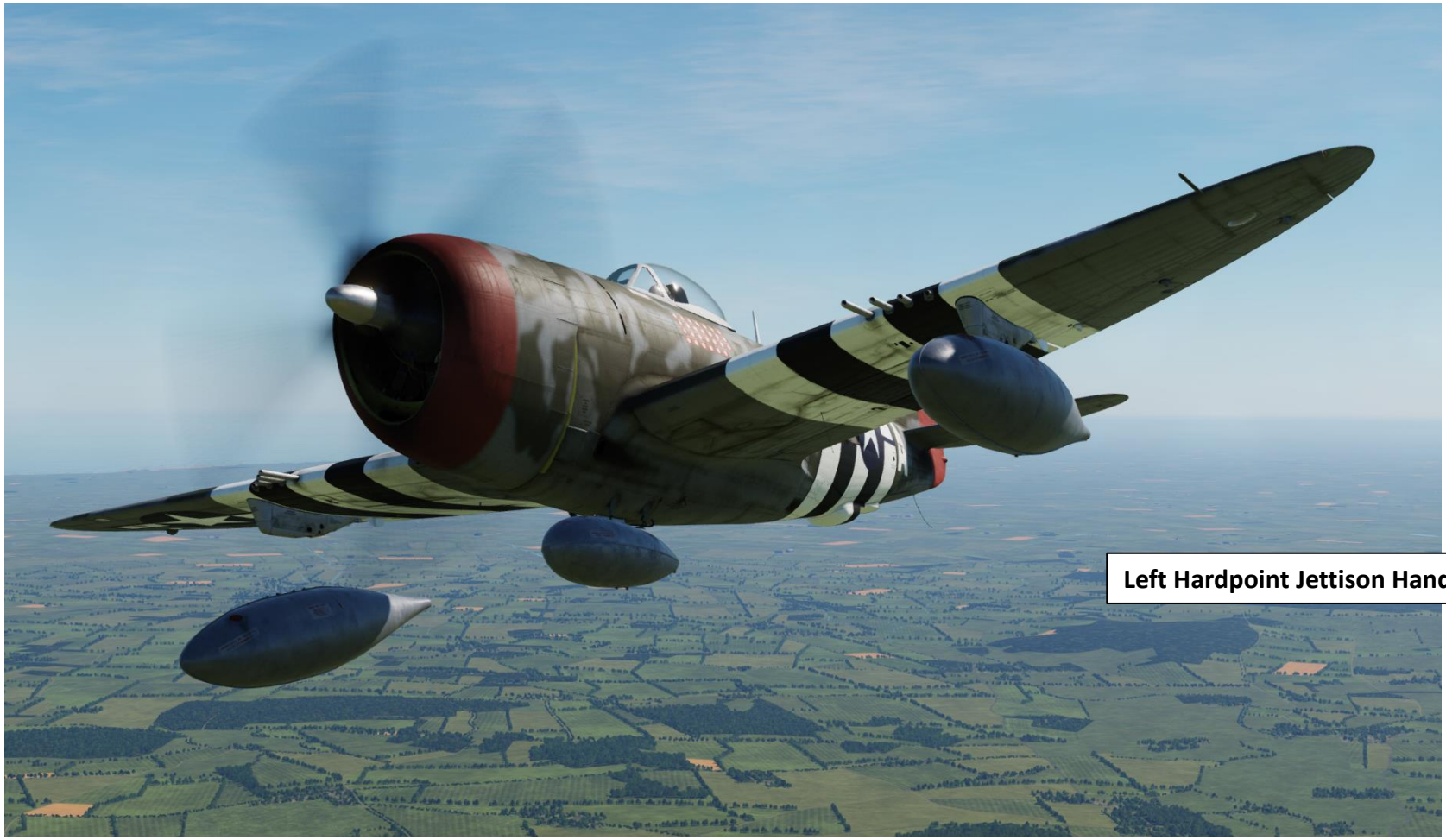


EXTERNAL FUEL DROP TANK JETTISON

(P-47D-30 LATE SERIES)

To jettison external tanks:

1. Set the Fuel Selector Valve Handle to MAIN
2. Pull the required Hardpoint Jettison Handle.



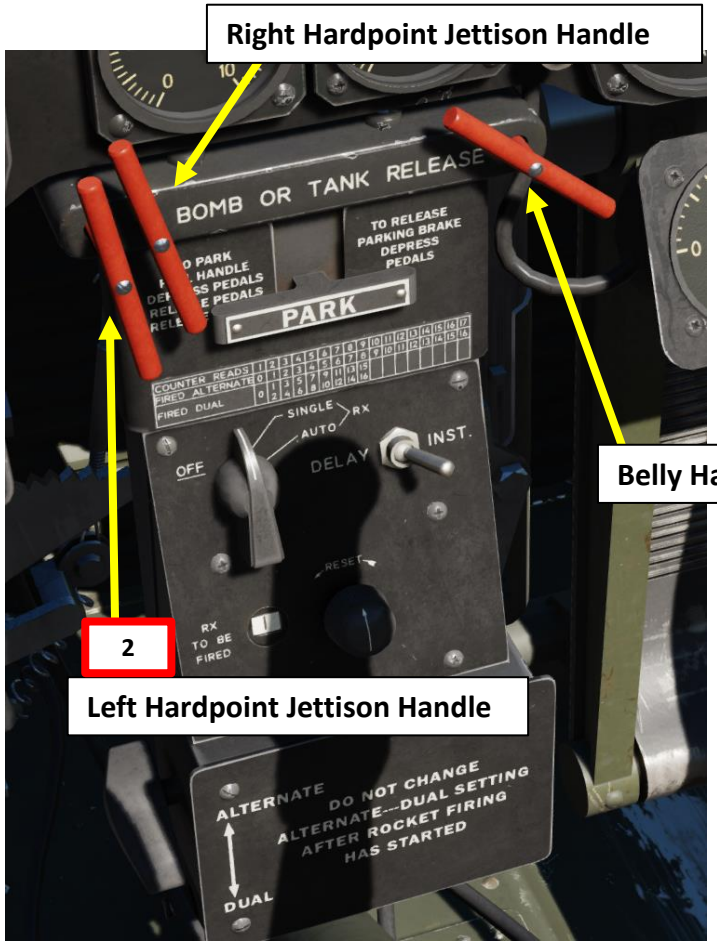
EXTERNAL FUEL DROP TANK JETTISON

(P-47D-40 SERIES)

To jettison external tanks:

METHOD 1:

1. Set the Fuel Selector Valve Handle to MAIN
2. Pull the required Hardpoint Jettison Handle.



EXTERNAL FUEL DROP TANK JETTISON

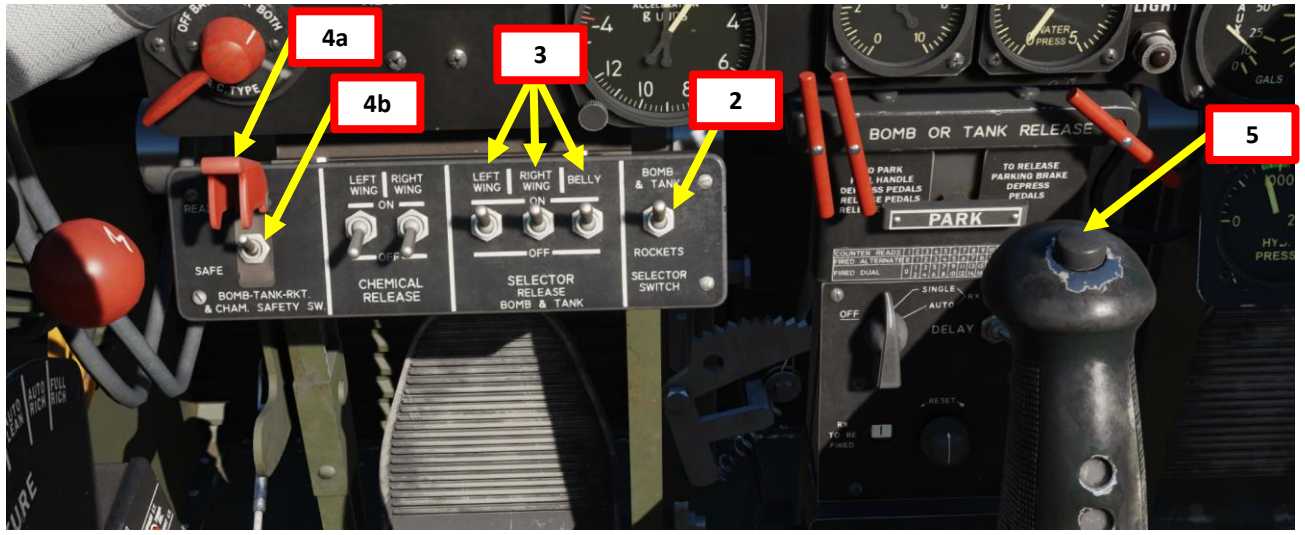
(P-47D-40 SERIES)

To jettison external tanks:

METHOD 2:

This method might be useful in situations where you need to jettison multiple tanks at once.

1. Set the Fuel Selector Valve Handle to MAIN
2. Set Rockets / Bomb & Tank Selector Switch to BOMB & TANK (UP)
3. Set Arming Selector Switches to ARMED (UP) for the fuel tanks you want to jettison (Left Wing, Right Wing or Belly Tank)
4. Flip red safety guard, then set Bomb/Tank/Rocket Safety Switch to ARMED (UP)
5. Press the Weapons (Bomb) Release Button (RSHIFT+SPACE) to jettison the selected external tanks



AIRCRAFT SPECIFICATIONS

Modification	P-47D-30-RE
Wing span, m.	12.42
Length, m.	10.99
Height, m.	4.44
Wing area, m^2	27.87
Weight, kg.	
Empty plane	4853
Normal Takeoff	6622
Maximum Takeoff	7938
Engine type	Pratt & Whitney R-2800-59W Double Wasp
Power, h.p.	
Takeoff	1 x 2000
Short-term maximum	1 x 2430
Maximum speed, km. /h.	690
Cruising speed, km. /h.	563
Maximum range, km	
Without external tanks	1529
With external tanks	2898
Maximum climbing speed, m./min.	847
Maximum ceiling, m.	12192
Crew memb.	1
Weapons	Eight 0.50-inch Colt Browning M2 guns. 1135 kg of bombs, napalm tanks or unguided rockets

SPEED LIMITATIONS

- Do not extend landing gear and landing light at speeds above 200 mph
- Do not extend flaps at speeds above 190 mph
- Do not make turns below 130 mph (very important when flying in the pattern)
- Max permissible airspeed (indicated): 505 mph
- When external tanks are installed:
  - If using 75 US gal belly tank, do not exceed 350 mph
  - If using 110 US gal belly tank, do not exceed 325 mph
  - If using 165 US gal wing tank, do not exceed 300 mph

PROHIBITED MANEUVERS

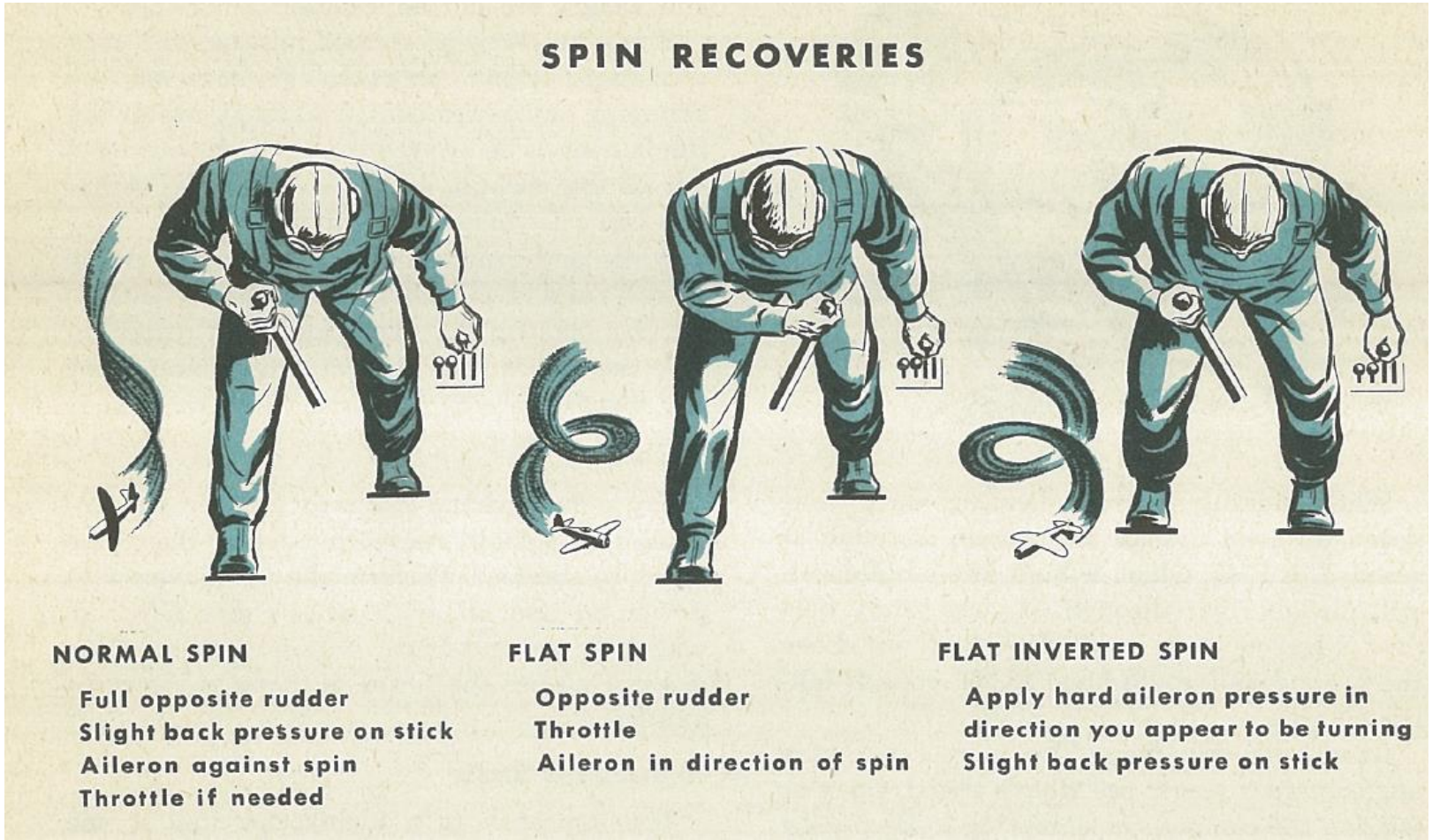
- Intentional spins of more than one-half turn
- Outside loops
- Whip stalls
- Prolonged inverted flight (engine may cut out due to fuel starvation)
- Snap rolls
- Slow rolls above 313 mph
- Slow speed turns
- When external tanks are installed:
  - Dynamic Maneuvers
  - Training Landings
  - High-speed Dives
- Tight turns or dives exceeding 225 mph with cowl flaps open (tail buffeting may result)

STALLS

- Stall speed with flaps and landing gear UP: 115 mph IAS
- Stall speed with flaps and landing gear down: 100 mph IAS
- There is a pronounced tendency for the airplane to snap to the left when stalled in a turn. There is ample warning of the impending stall (sloppiness of the controls and buffetting).

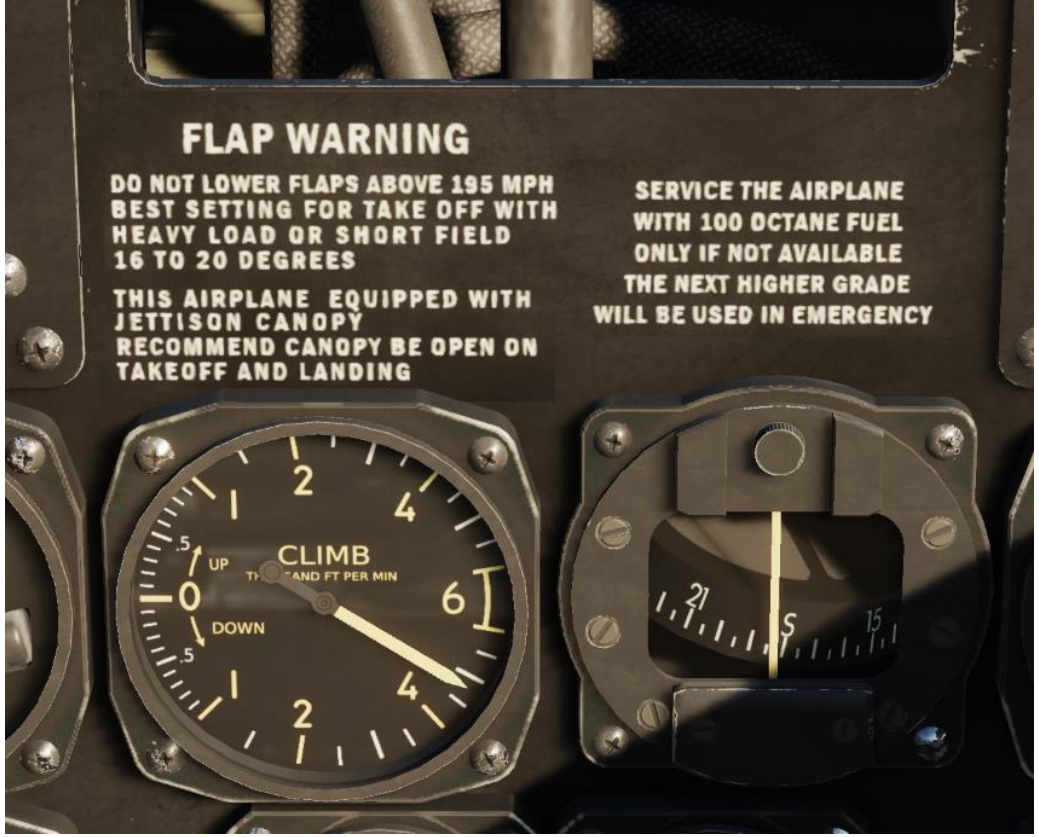
SPINS

- During all types of maneuvers and spin demonstrations, it has been foud that the airplane will never spin of its own accord, but must be forced into the spin by use of elevator and rudder. To induce a spin, you must use full rudder and full elevator.
- To recover from a spin:
  - Set full rudder in the opposite direction to the spin
  - Set elevator to neutral position
  - Set full ailerons against the spin direction
  - Note: do not try different control position until at least three turns have been made with no change in the spinning attitude. Approximately 1000 ft of altitude will be lost in the entry into the spin, 1000 ft in the recovery and 1000 ft per turn.

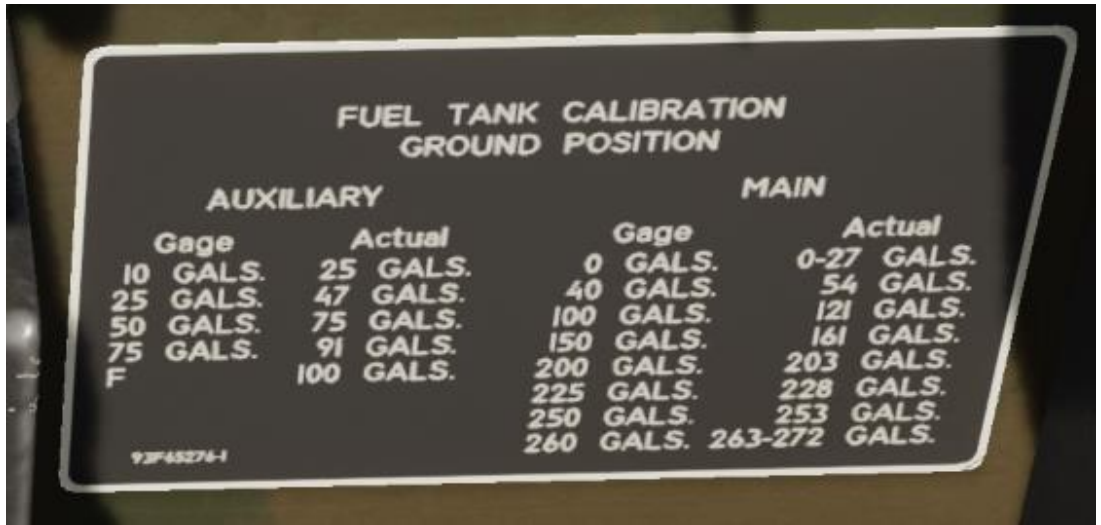


PLACARDS


WARNING: DO NOT
OPEN COWL FLAPS
ABOVE 225 I.A.S


FLAP WARNING
DO NOT LOWER FLAPS ABOVE 195 MPH
BEST SETTING FOR TAKE OFF WITH
HEAVY LOAD OR SHORT FIELD
16 TO 20 DEGREES
THIS AIRPLANE EQUIPPED WITH
JETTISON CANOPY
RECOMMEND CANOPY BE OPEN ON
TAKEOFF AND LANDING
SERVICE THE AIRPLANE
WITH 100 OCTANE FUEL
ONLY IF NOT AVAILABLE
THE NEXT HIGHER GRADE
WILL BE USED IN EMERGENCY
CLIMB
UP
DOWN


PUSH IN TO TURN
PRIMER
ENGINE
COWL
FLAPS
PULL TO OPEN
CLOSE
-WARNING-
RECOGNITION LIGHTS
ARE NOT TO BE ON
CONTINUOUSLY FOR
MORE THAN TEN SEC-
ONDS ON GROUND.


FUEL TANK CALIBRATION
GROUND POSITION
AUXILIARY
Gage
Actual
10 GALS.
25 GALS.
25 GALS.
47 GALS.
50 GALS.
75 GALS.
75 GALS.
91 GALS.
F
100 GALS.
MAIN
Gage
Actual
0 GALS.
0-27 GALS.
40 GALS.
54 GALS.
100 GALS.
121 GALS.
150 GALS.
161 GALS.
200 GALS.
203 GALS.
225 GALS.
228 GALS.
250 GALS.
253 GALS.
260 GALS.
263-272 GALS.


ENGAGE
STARTER
ENERGIZE
AUXILIARY FUEL
MUST BE USED
BEFORE USING
MAIN FUEL
WARNING UP TO 10 GAL/HR RETURN
FLOW THROUGH CARBURETOR VENT LIKE TO MAIN
FUEL TANK THEREFORE RUN OFF MAIN TANK
PERIODICALLY


CIRCUIT BREAKER
PUSH TO RESET
AFTER RELEASING
TANKS PULL ARM
& SAFE CONTROLS
TO RETRACT WING
TANK DISPLACING
ARMS

TAKEOFF, CLIMB & LANDING PERFORMANCE

AIRPLANE MODELS: P-47 SERIES

TAKE-OFF, CLIMB & LANDING CHART

ENGINE MODELS: R-2800-21

TAKE-OFF DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	HEAD WIND (MPH)	HARD SURFACE RUNWAY						SOD-TURF RUNWAY						SOFT SURFACE RUNWAY					
		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
		GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.	GROUND RUN	TO CLEAR 50' OBJ.
15,000	0	2400	3500	2600	3800	2900	4200	2500	3600	2800	4000	3000	4300	2800	3900	3000	4200	3300	4600
	20	1800	2600	2000	3000	2200	3300	1900	2700	2100	3100	2300	3400	2100	2900	2300	3300	2500	3600
	40	1200	1800	1400	2000	1600	2300	1300	1900	1500	1700	1700	2400	1400	2000	1600	2200	1800	2500
14,000	0	2100	3100	2300	3400	2500	3800	2200	3200	2400	3500	2600	3900	2400	3400	2600	3700	2900	4200
	20	1500	2200	1700	2600	1900	2900	1600	2300	1800	2700	2000	3000	1800	2500	2000	2900	2200	3200
	40	1000	1500	1200	1800	1400	2100	1100	1600	1300	1900	1500	2200	1200	1700	1400	2000	1600	2300
12,500	0	1800	2800	2000	3100	2200	3400	1900	2900	2100	3200	2300	3500	2100	3100	2300	3400	2500	3700
	20	1300	2000	1500	2300	1600	2500	1400	2100	1600	2400	1700	2600	1600	2300	1700	2500	1900	2800
	40	900	1400	1000	1500	1200	1800	1000	1500	1100	1600	1300	1900	1100	1600	1200	1700	1400	2000

NOTE: INCREASE DISTANCE 10 % FOR EACH 10°C ABOVE 0°C

ENGINE LIMITS FOR TAKE-OFF 2700 RPM & 52 IN. HG

CLIMB DATA

COMBAT MISSIONS USE * 2700 RPM & 52 IN. HG

FERRY MISSIONS USE 2350 RPM & 35 IN. HG

GROSS WEIGHT (IN LBS.)	TYPE OF CLIMB	S.L. TO 5000 FT. ALT.			AT 10,000 FT. ALT.				AT 15,000 FT. ALT.				AT 20,000 FT. ALT.				AT 25,000 FT. ALT.				BLOWER CHANGE
		BEST I.A.S.	FT./MIN.	TIME FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	BEST I.A.S.	FT./MIN.	TIME FROM S.L.	FUEL FROM S.L.	
15,000	COMBAT	165	1850	3	165	1350	6	60	155	1200	10	75	155	1000	14	90	155	900	19	110	
	FERRY	165	750	7	165	750	14	70	155	700	21	90	155	600	28	110	155	500	37	135	
14,000	COMBAT	165	2050	2.4	165	2050	4.9	57	155	1400	8.3	70	155	1250	12.1	83	155	1050	16.4	98	
	FERRY	165	850	6	165	850	12	65	155	800	18	85	155	750	25	100	155	600	32	120	
12,600	COMBAT	165	2300	2.2	165	2300	4.4	55	155	1550	7.2	66	155	1400	10.6	78	155	1250	14.5	91	
	FERRY	165	1000	5	165	1000	10	60	155	950	15	75	155	900	21	90	155	800	27	105	

NOTE: INCREASED ELAPSED CLIMBING TIME 10% FOR EACH 10°C ABOVE 0°C FREE AIR TEMPERATURE

FUEL INCLUDES WARM-UP AND TAKE-OFF ALLOWANCE

LANDING DISTANCE (IN FEET)

GROSS WEIGHT (IN LBS.)	BEST I. A. S. Approach	HARD DRY SURFACE						FIRM DRY SOD						WET OR SLIPPERY					
		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.		AT SEA LEVEL		AT 3,000 FT.		AT 6,000 FT.	
		TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL	TO CLEAR 50' OBJ.	GROUND ROLL
13,500	130	2400	1550	2600	1700	2800	1850	2600	1750	2800	1900	3000	2050	4500	3650	4900	4000	5300	4350
10,600	115	2000	1200	2200	1400	2300	1500	2100	1300	2300	1500	2500	1700	3600	2800	3900	3100	4200	3400

NOTE: FOR GROUND TEMPERATURES ABOVE 35°C (95°F) INCREASE APPROACH I.A.S. 10% AND ALLOW 20% INCREASE IN GROUND ROLL.

REMARKS * FOR COMBAT CLIMB, REDUCE TO 2550 RPM AND 42 "HG WITHIN 5 MINUTES FROM START OF TAKE-OFF. IF 100 OCTANE (AMEND. #4) FUEL IS BEING USED, DO NOT EXCEED 47" HG. FOR TAKE-OFF OR CLIMB.

LEGEND

I. A. S.: Indicated Air Speed

NOTE: All distances are average, and subject to considerable variations because of differences in pilot technique, load, C.G., etc.

RED FIGURES HAVE NOT BEEN FLIGHT CHECKED.

DIVES AND COMPRESSIBILITY

As the second world war progressed, powerful fighters such as the P-47 and P-38 were encountering something relatively new to aviation at that time. While dive bombing, pilots would sometimes not be able to pull out from the dive in time and crashed into the ground. This new generation of high-speed aircraft was capable of incredible speeds in a dive, which brings us to compressibility.

Compressibility is a term used to describe what happens when localized airflow across a wing approaches trans-sonic velocity. Extreme speed disrupts the normal airflow around a plane's wings and control surfaces. The greater the altitude, the lower the speed at which it occurs. In a dive, if your plane becomes nose heavy and your elevators do not respond to control input (as if they were « frozen »), compressibility is generally the answer.

Here are a few pointers that are important to remember when performing a dive.

1. Before diving, trim the plane slightly tail heavy so that you need a little stick pressure to hold the plane in the dive.

2. Start dives from level flight by pushing the nose down. Do NOT start a dive from a Split S.

3. In a high-speed dive, decrease manifold pressure to keep it from over boosting the engine and do not retard the throttle suddenly; the nose becomes heavy and the dive steepens.

4. Recover gradually from a high-speed dive; sharp pullouts place unnecessary loads on the wings and control surfaces.

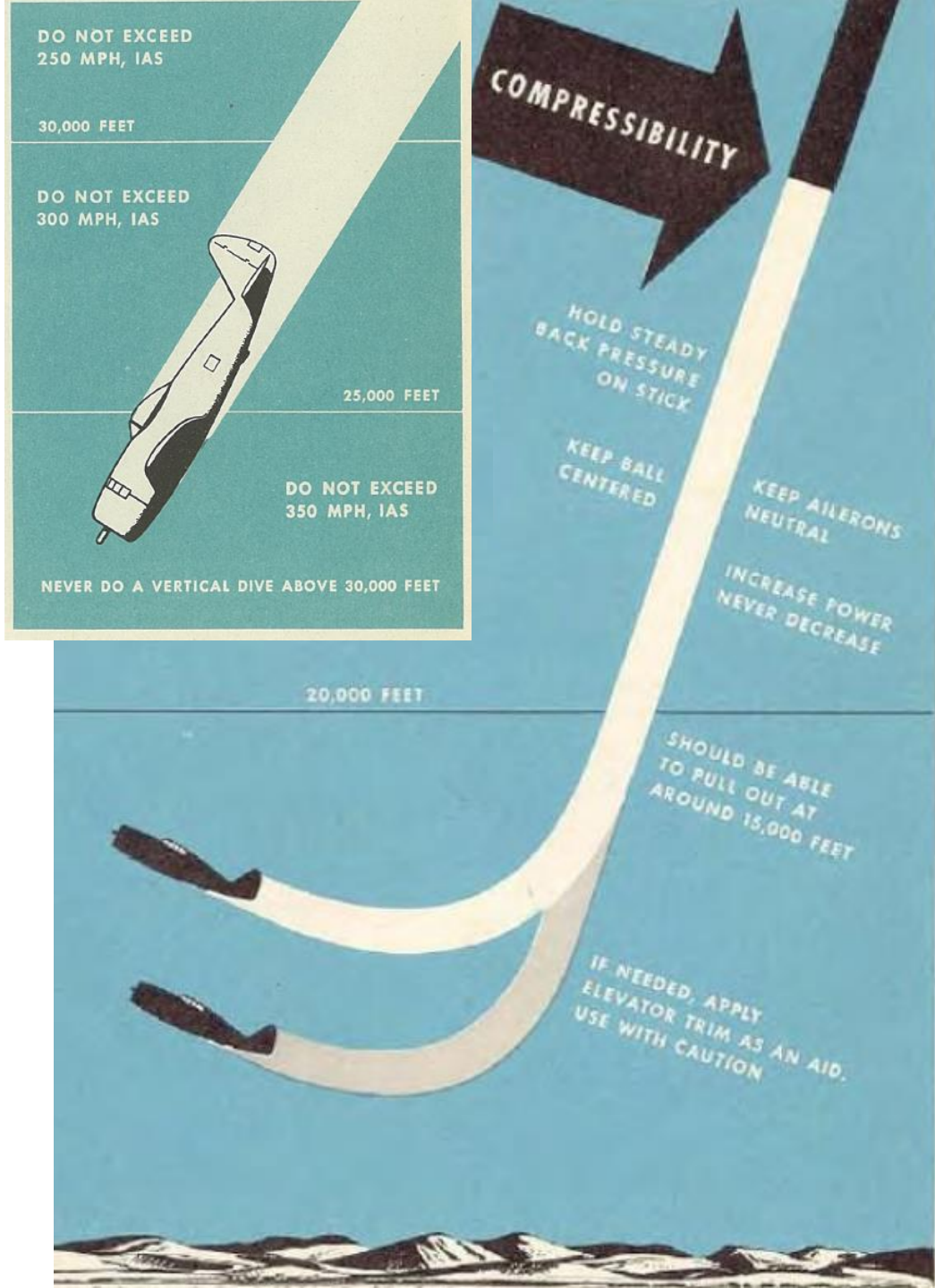
5. Aileron forces become high at speeds above 350 mph IAS. At least 12000 ft should be allowed for recovery from dives at limiting speed (500 mph IAS).

6. NEVER dive with cowl flaps open. This is due to many reasons, mainly the fact that you risk overcooling your engine and that the cowl flaps create turbulence that make the aircraft unstable above 250 kts.

7. Due to compressibility effect, diving at high altitude will produce a tendence for the airplane to nose down. If extremely high indicated speeds are reached, the elevator tab will have to be used for recovery.

8. Except in extreme emergencies, an indicated air speed of 400 mph should not be exceeded above 25,000 ft.

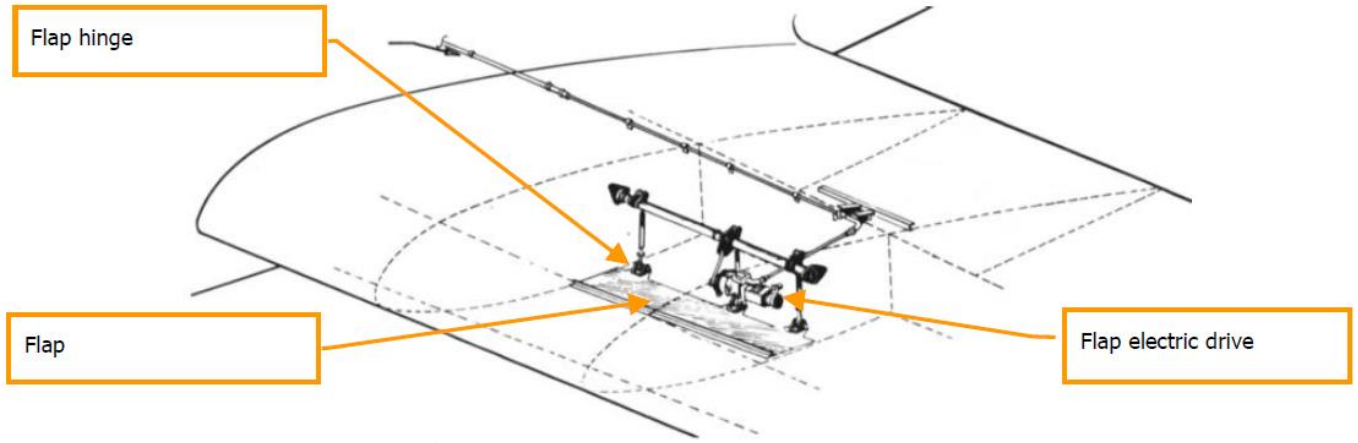
9. The P-47 is equipped with compressibility recovery flaps that can be used to pull out form a high-speed dive.



COMPRESSIBILITY RECOVERY FLAPS

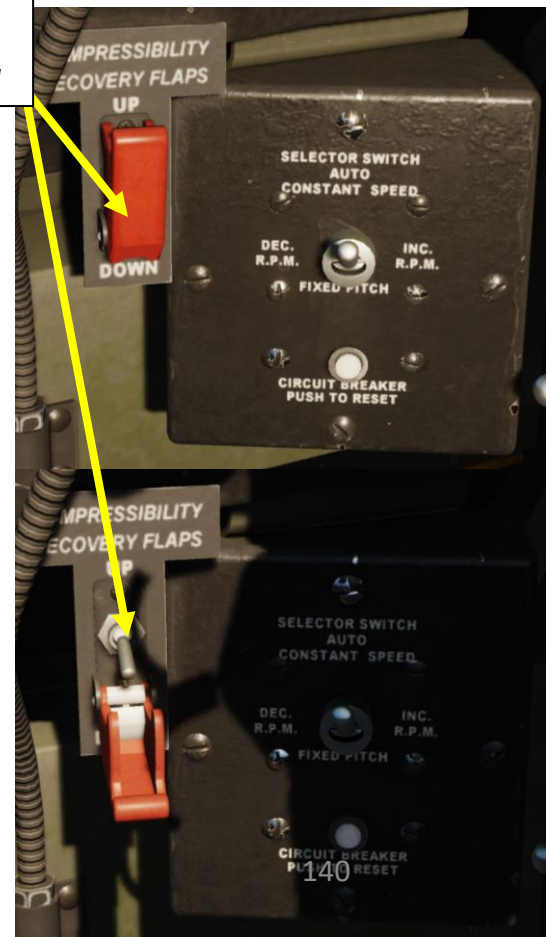
Compressibility recovery flaps can be used to aid recovery from dives within compressibility speeds. These surfaces are operated by two electric, reversible, intermittent motors synchronized by flexible shafting. Electromagnetic brakes and couplings are integrated into the flaps control system to prevent overstepping of the limit position.

The 21 deg deviation angle of the flaps ensures that the safe optimum G-force is maintained when pulling away from a dive.

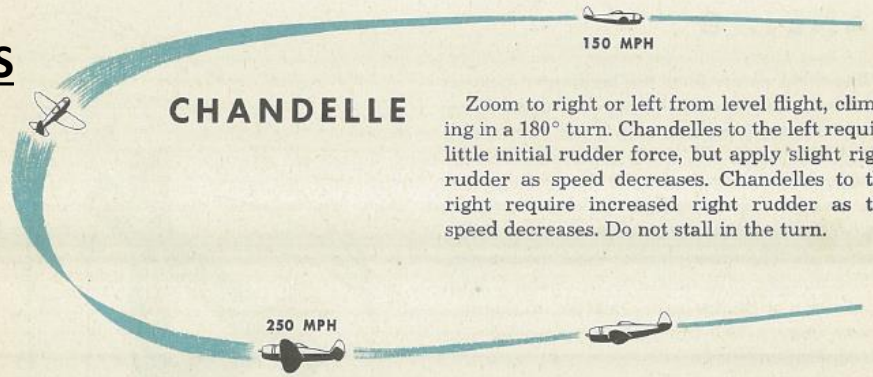


Compressibility Recovery Flaps Switch

- *UP: Compressibility Flaps Up/Retracted*
- *DOWN: Compressibility Flaps Down/Deployed*

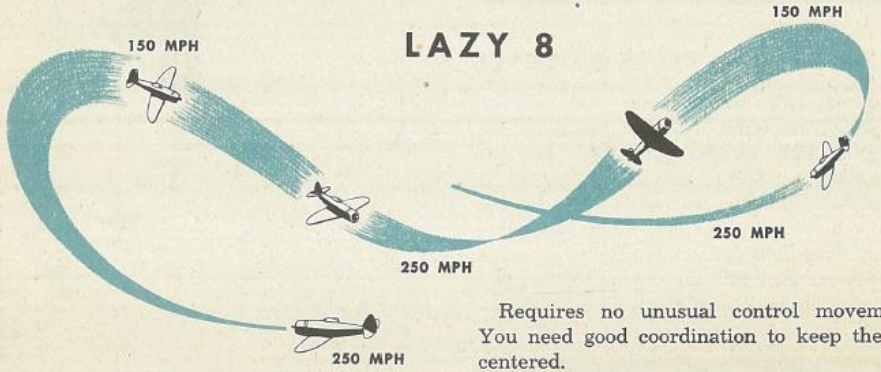


AEROBATICS



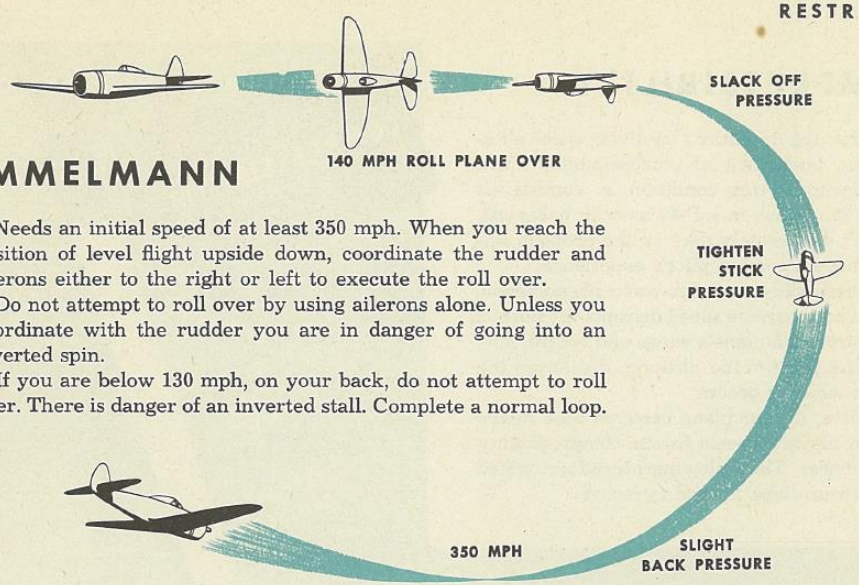
CHANDELLE

Zoom to right or left from level flight, climbing in a 180° turn. Chandelles to the left require little initial rudder force, but apply slight right rudder as speed decreases. Chandelles to the right require increased right rudder as the speed decreases. Do not stall in the turn.



Requires no unusual control movements. You need good coordination to keep the ball centered.

RESTRICTED

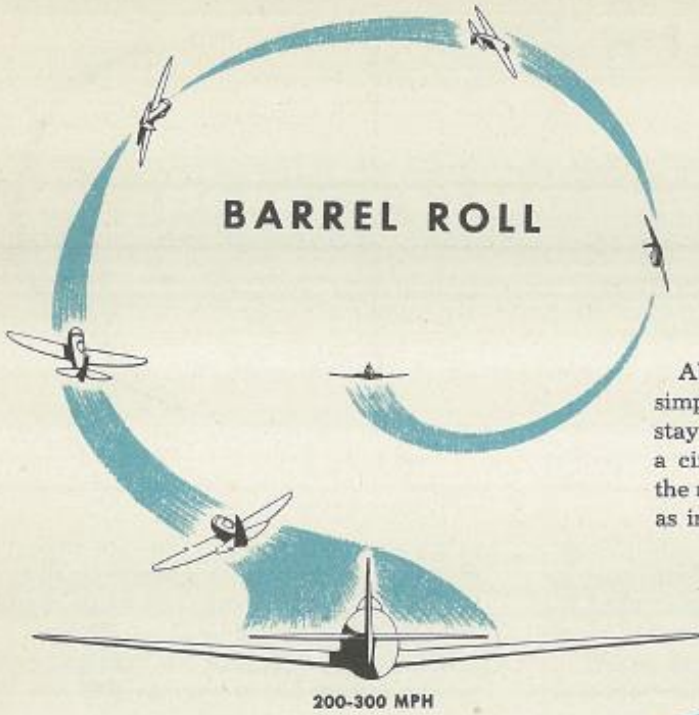


IMMELMANN

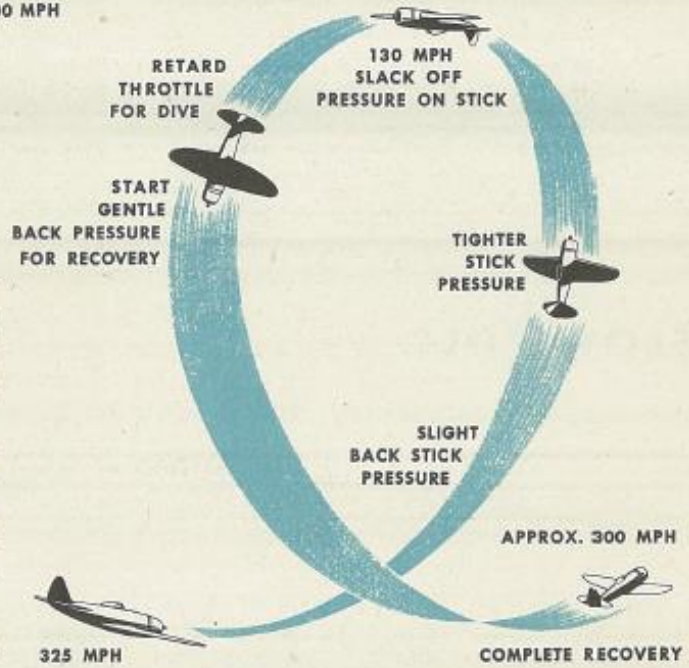
Needs an initial speed of at least 350 mph. When you reach the position of level flight upside down, coordinate the rudder and ailerons either to the right or left to execute the roll over.

Do not attempt to roll over by using ailerons alone. Unless you coordinate with the rudder you are in danger of going into an inverted spin.

If you are below 130 mph, on your back, do not attempt to roll over. There is danger of an inverted stall. Complete a normal loop.



About the same as a slow roll, but simpler to execute. The nose does not stay on a point, but revolves around a circle. You fly the plane through the maneuver instead of holding it in, as in a slow roll.



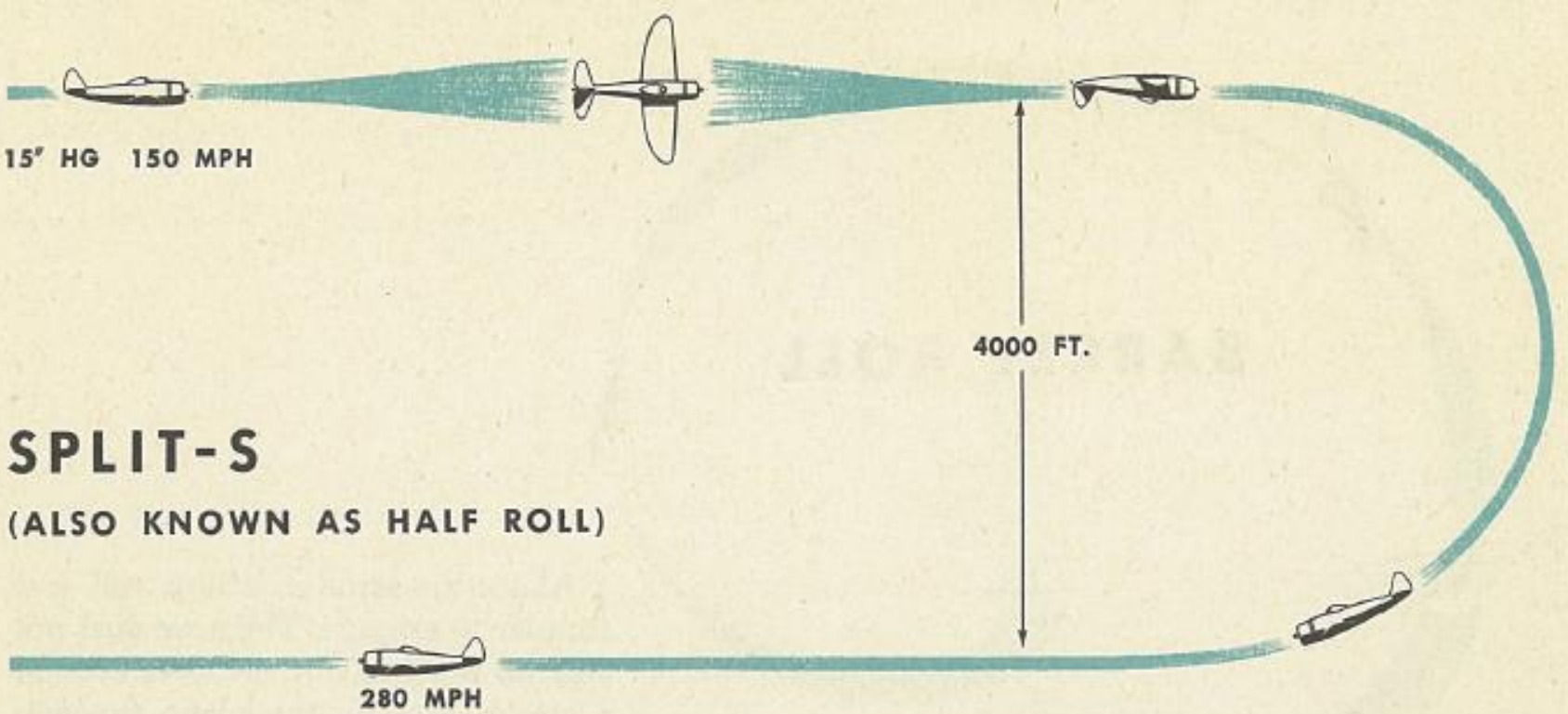
LOOP

Pull in slightly at the start of the climb to avoid killing your speed, then pull in tighter to hurry the plane on its back. Slack off on stick pressure to avoid stalling when the speed drops below 200 mph.

Do not use any aileron, and only enough rudder to keep the nose straight. If your speed is less than 130 mph at the top of the loop, allow the nose to fall through slowly before applying back pressure to recover.

Recover in the same direction as the start. If the initial speed is above 300 mph, there should be a slight gain in altitude.

AEROBATICS



SPLIT-S

(ALSO KNOWN AS HALF ROLL)

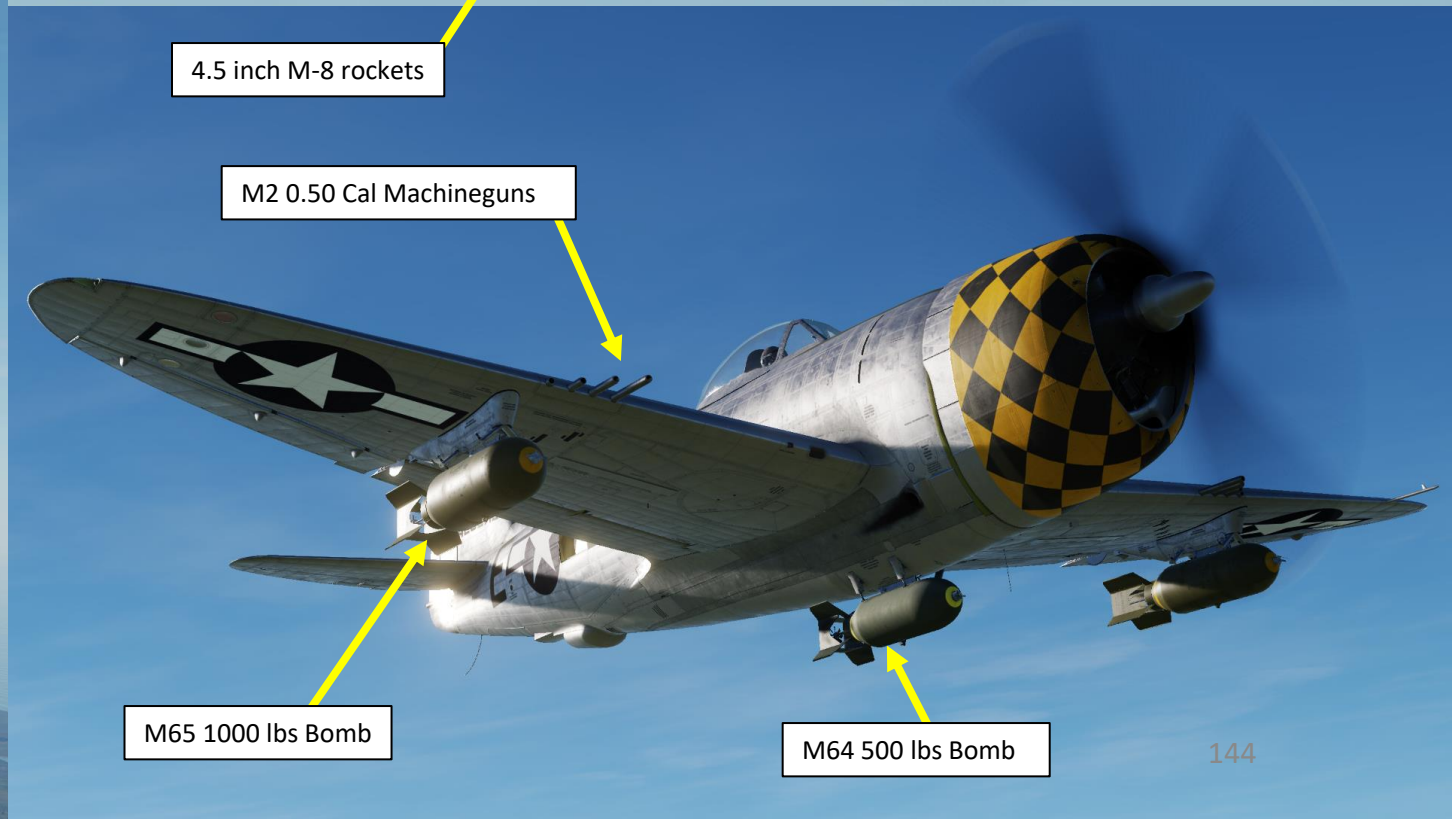
SLOW ROLL

Enter the roll with the nose about 10° above the horizon. Move the stick to right or left, using the necessary rudder to keep the nose on a point. As the plane rolls on its back, use forward stick to keep the nose up.

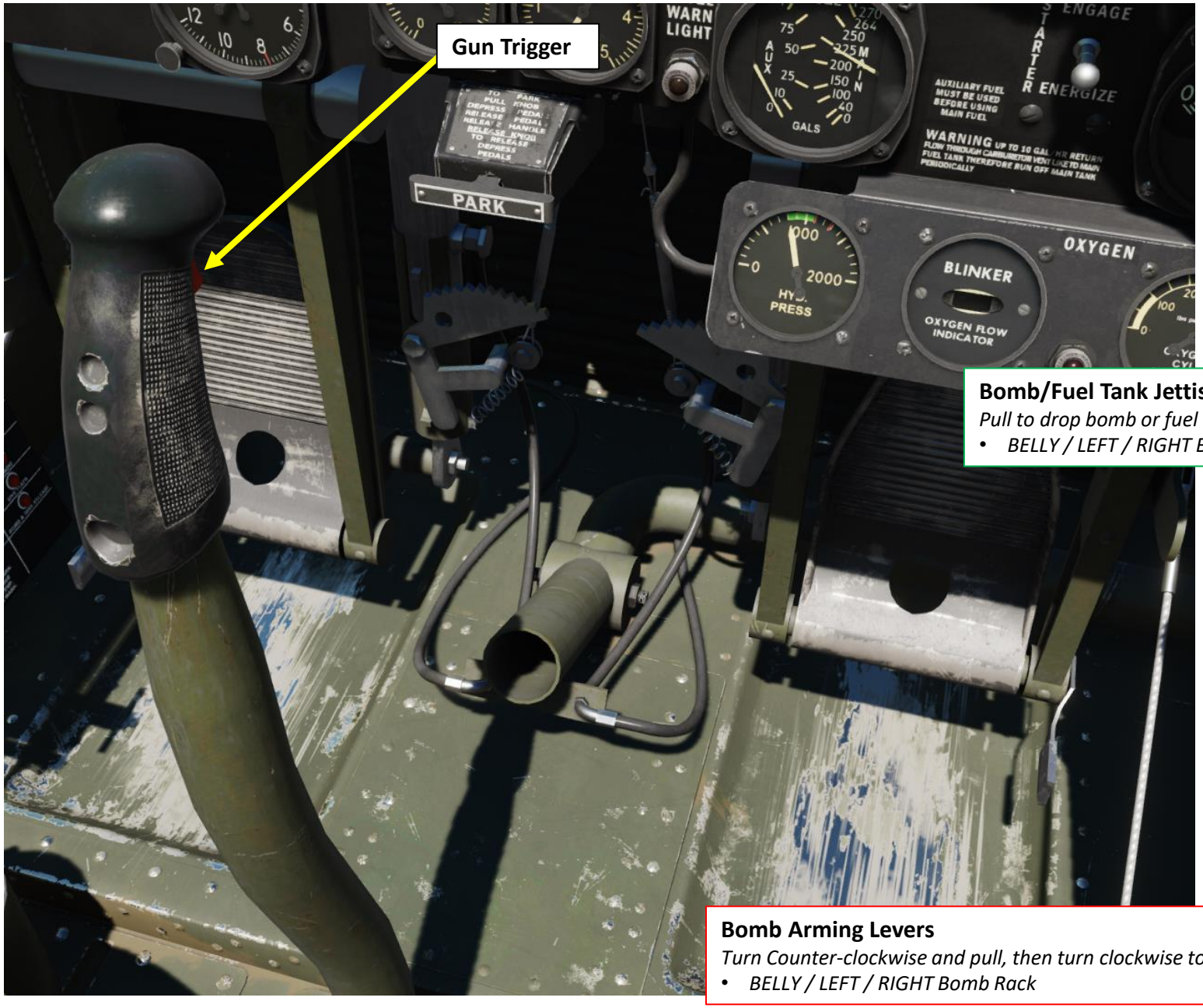
You require little rudder control while executing the maneuver at about 200 mph. Perform climbing slow rolls with an initial speed of around 300 mph. Little rudder control is required for a climbing roll.

ARMAMENT OVERVIEW

- 8 x 0.50 cal M2 machineguns (3400 rounds total)
  - 425 rounds per gun
  - Machine gun rate of fire is 800-890 shots per minute.
  - Machine gun barrels overheat when firing long salvos (recommended firing time is 3 seconds per burst).
- M30A1 100 lbs Bombs (wing-mounted or belly-mounted)
- M57 250 lbs Bombs (wing-mounted or belly-mounted)
- M64 500 lbs Bombs (wing-mounted or belly-mounted)
- M65 1000 lbs Bombs (wing-mounted only)
- 10 x 5-inch HVAR Rockets – P-47D-40 only
- 6 x 4.5-inch M-8 rockets (with M10 tubular launchers) – P-47D-40 only



WEAPON CONTROLS (P-47D-30 EARLY SERIES)

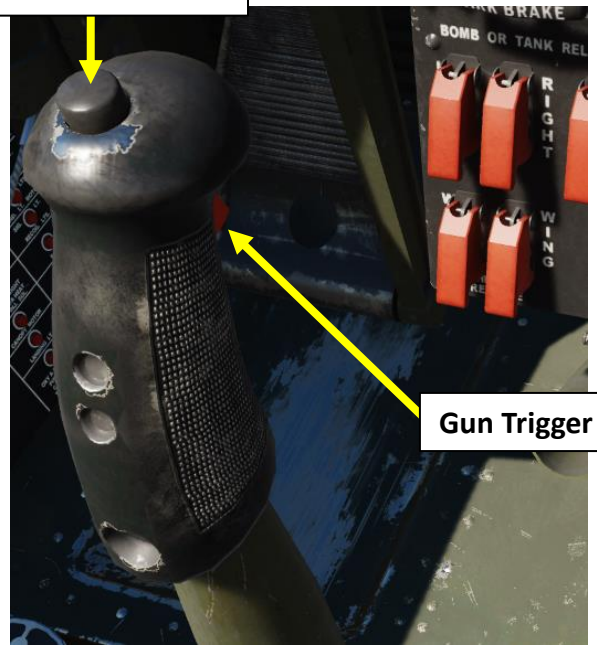


Bomb/Fuel Tank Jettison (Drop) Levers
Pull to drop bomb or fuel tank.
- *BELLY / LEFT / RIGHT Bomb Rack*

Bomb Arming Levers
Turn Counter-clockwise and pull, then turn clockwise to arm.
- *BELLY / LEFT / RIGHT Bomb Rack*

WEAPON CONTROLS (P-47D-30 LATE SERIES)

Weapons (Bomb) Release Button



Gun Trigger

Bomb Arming Levers

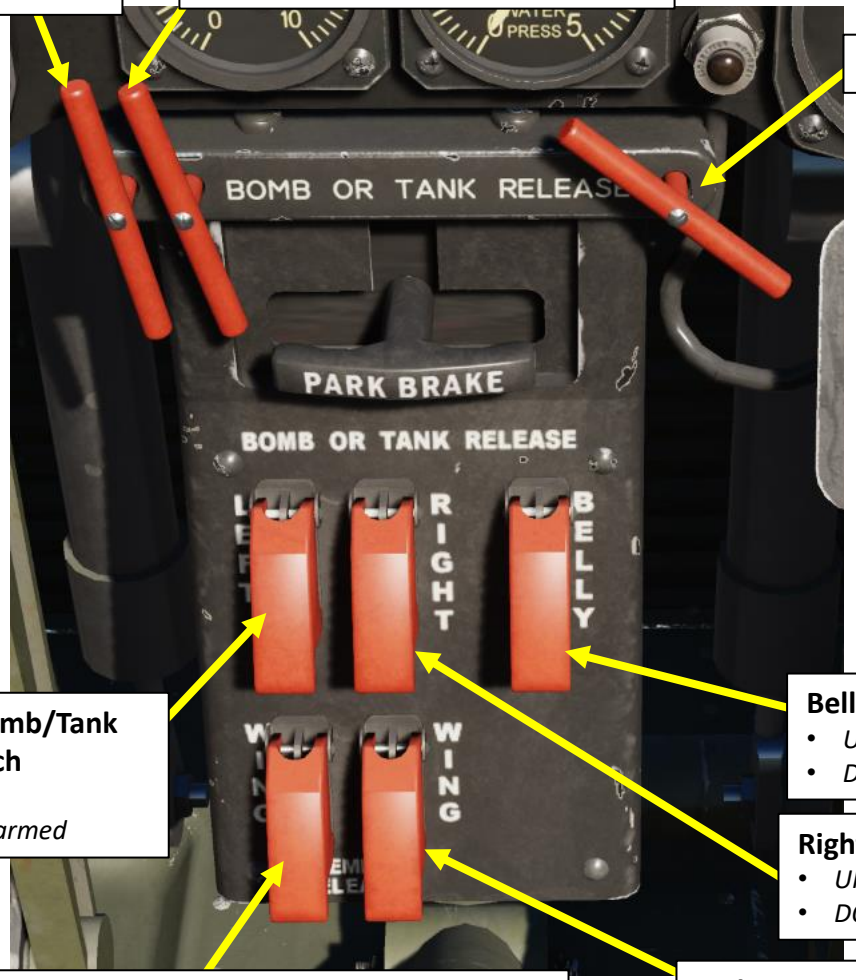
Turn Counter-clockwise and pull, then turn clockwise to arm.

- *BELLY / LEFT / RIGHT Bomb Rack*

Left Hardpoint Jettison Handle

Right Hardpoint Jettison Handle

Belly Hardpoint Jettison Handle



Left Wing Bomb/Tank Arming Switch

- *UP: Armed*
- *DOWN: Disarmed*

Belly Bomb/Tank Arming Switch

- *UP: Armed*
- *DOWN: Disarmed*

Right Wing Bomb/Tank Arming Switch

- *UP: Armed*
- *DOWN: Disarmed*

Left Wing Chemical Tank Arming Switch

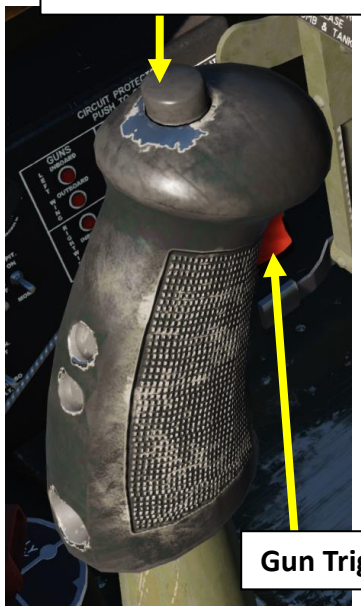
- *UP: Armed*
- *DOWN: Disarmed*

Right Wing Chemical Tank Arming Switch

- *UP: Armed*
- *DOWN: Disarmed*

WEAPON CONTROLS (P-47D-40 SERIES)

Weapons (Bomb/Rocket) Release Button



Gun Trigger

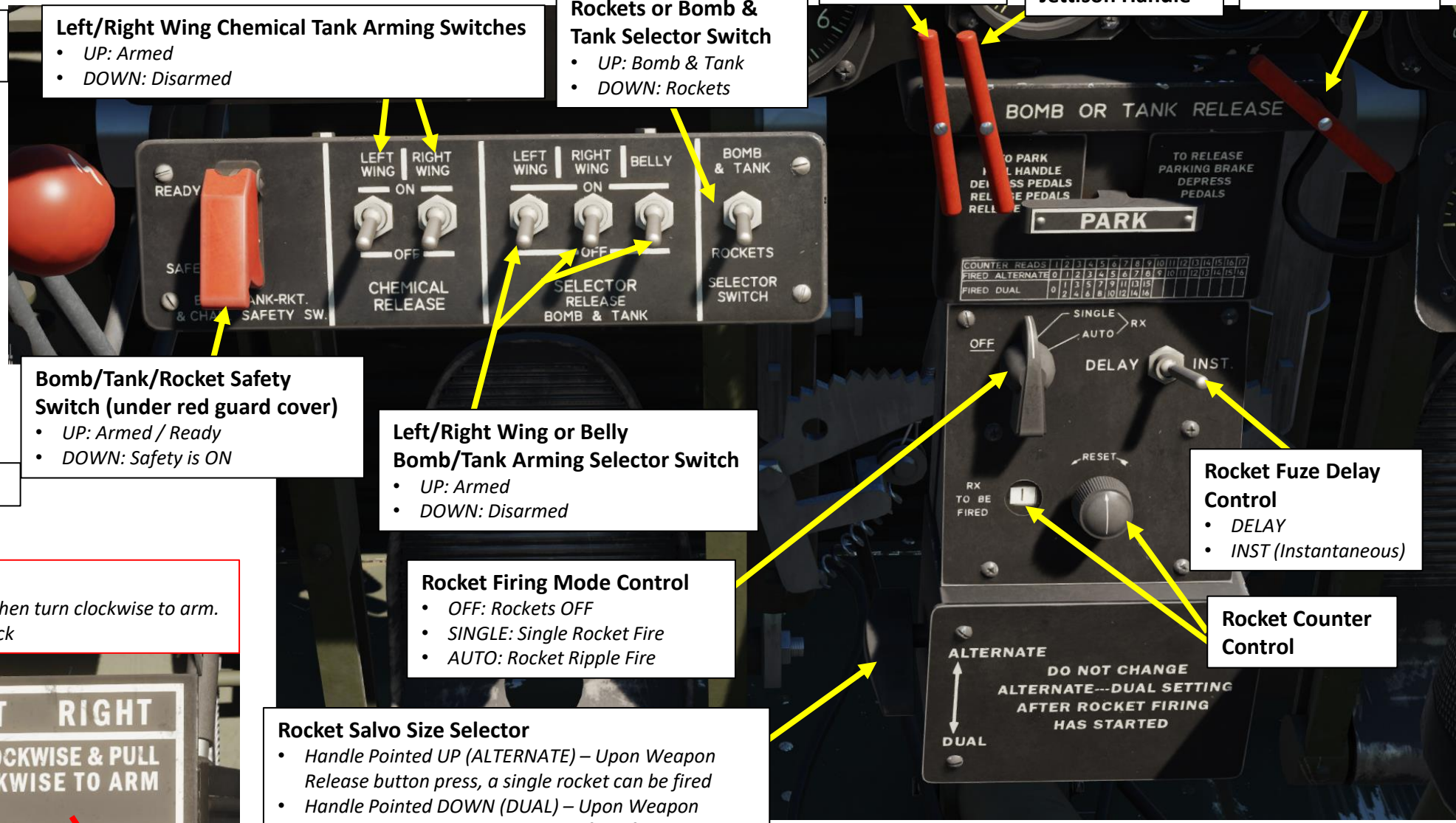
Left/Right Wing Chemical Tank Arming Switches
- *UP: Armed*
- *DOWN: Disarmed*

Rockets or Bomb & Tank Selector Switch
- *UP: Bomb & Tank*
- *DOWN: Rockets*

Left Hardpoint Jettison Handle

Right Hardpoint Jettison Handle

Belly Hardpoint Jettison Handle



Bomb/Tank/Rocket Safety Switch (under red guard cover)
- *UP: Armed / Ready*
- *DOWN: Safety is ON*

Left/Right Wing or Belly Bomb/Tank Arming Selector Switch
- *UP: Armed*
- *DOWN: Disarmed*

Rocket Fuze Delay Control
- *DELAY*
- *INST (Instantaneous)*

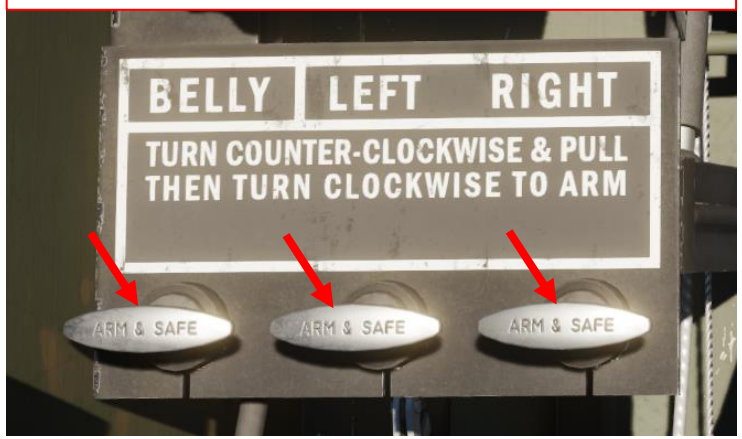
Rocket Firing Mode Control
- *OFF: Rockets OFF*
- *SINGLE: Single Rocket Fire*
- *AUTO: Rocket Ripple Fire*

Rocket Counter Control

Rocket Salvo Size Selector
- *Handle Pointed UP (ALTERNATE) – Upon Weapon Release button press, a single rocket can be fired*
- *Handle Pointed DOWN (DUAL) – Upon Weapon Release button press, rockets are fired from both wings in order to maintain aircraft roll stability*

Bomb Arming Levers

Turn Counter-clockwise and pull, then turn clockwise to arm.
- *BELLY / LEFT / RIGHT Bomb Rack*



MARK VIII GUNSIGHT (P-47D-30 EARLY SERIES)

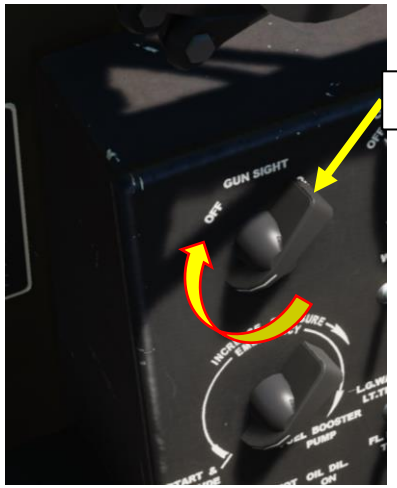
Your gunsight will show you where to shoot and when to shoot a target. The Mark VIII is an older fixed gunsight when compared to the K-14 gyro gunsight.

Interestingly, the Mark VIII is termed the "100 mph sight" since a 90 deg deflection shot requires one radius lead for each 100 mph speed of the target.

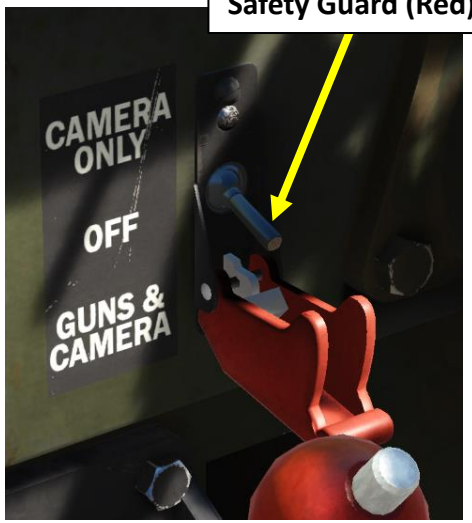
- When you are looking through the ring, at 1000 yards distance, the ring covers an area 100 yards in diameter
- When you are looking through the ring, at 1000 ft distance, the ring covers an area 100 ft in diameter

All you need to do to turn on the gunsight is to:

1. Rotate Gunsight Rheostat to ON
2. Set the Gun Safety Switch to GUNS & CAMERA (DOWN)



Gunsight Rheostat



Gun Safety Switch and Safety Guard (Red)

Mark VIII Gunsight

MARK VIII GUNSIGHT (P-47D-30 EARLY SERIES)

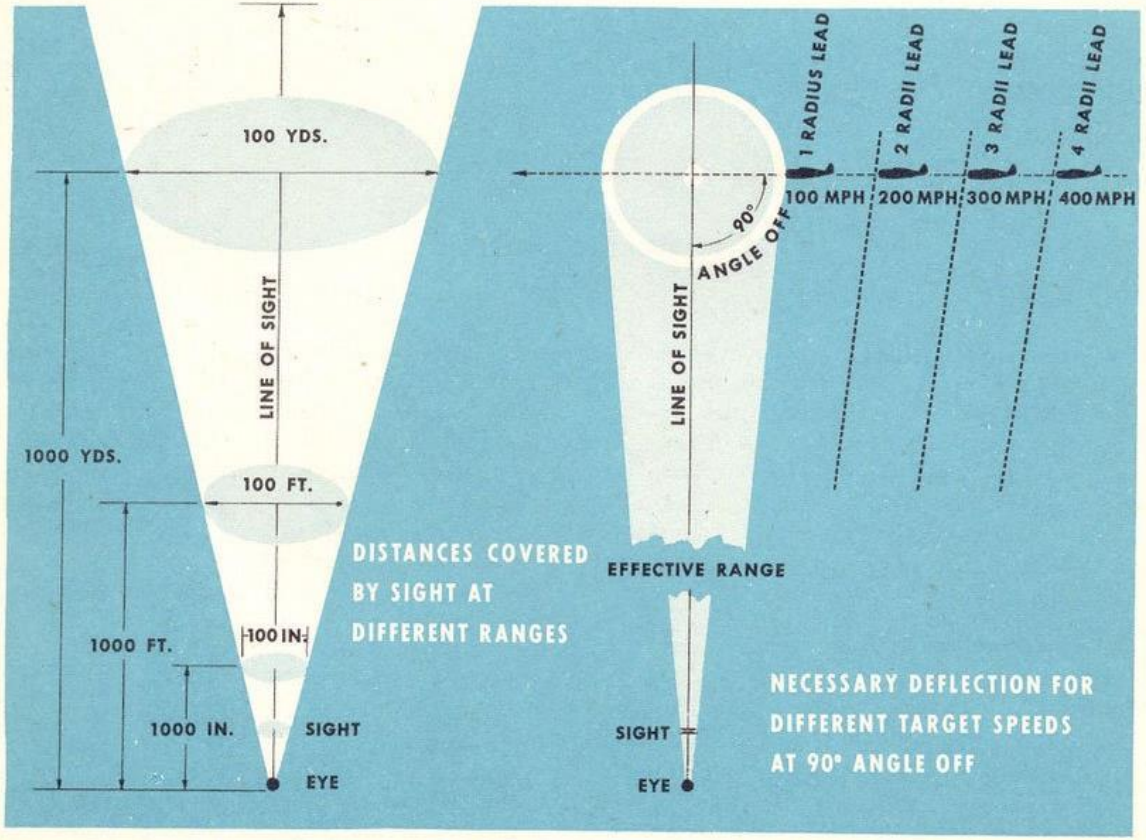
CAMERA GUNNERY

Camera gunnery teaches you to estimate:

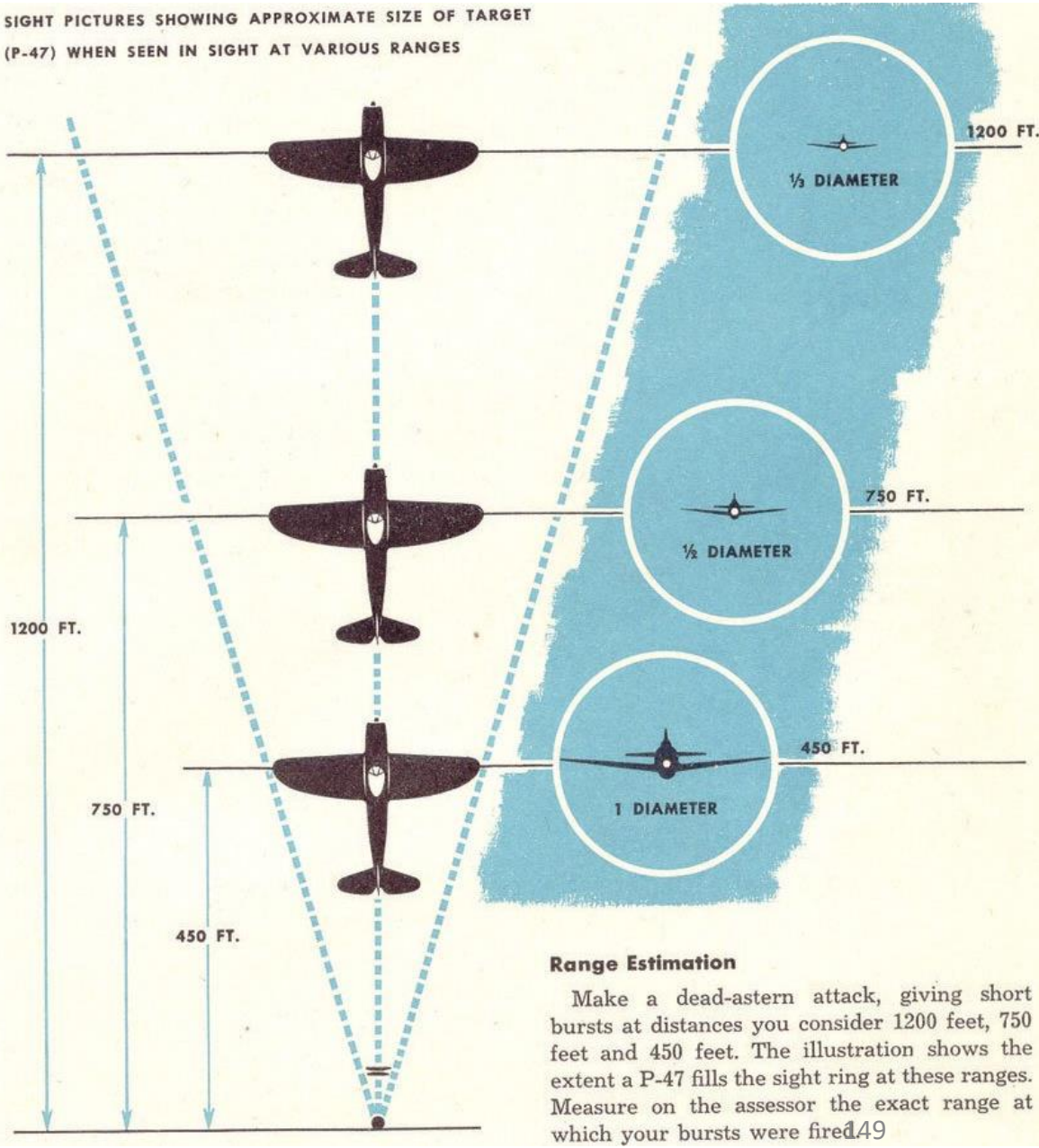
1. RANGE
2. CORRECT LINE OF FLIGHT OF TARGET
3. DEFLECTION

Master the three fundamentals, learn to fly smoothly, and you can bring down an enemy airplane every time. Be weak in one of the fundamentals and you miss the target.

The P-47's Mark VIII gunsight is termed a 100 mph sight. That is, a 90° deflection shot requires one radius lead for each 100 mph speed of the target. When you are looking through the ring, at 1000 yards distance, the ring covers an area 100 yards in diameter; at 1000 feet the ring covers 100 feet, etc.



SIGHT PICTURES SHOWING APPROXIMATE SIZE OF TARGET (P-47) WHEN SEEN IN SIGHT AT VARIOUS RANGES

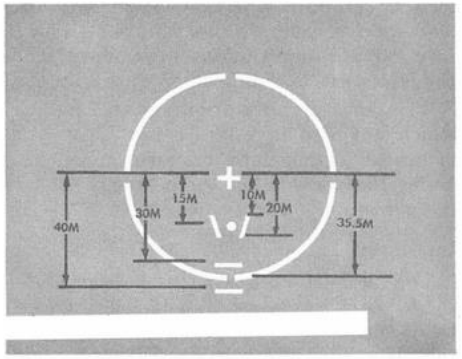


Range Estimation

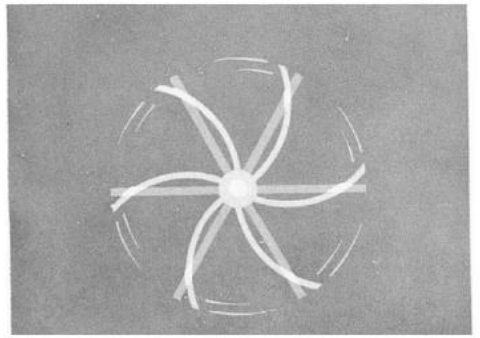
Make a dead-astern attack, giving short bursts at distances you consider 1200 feet, 750 feet and 450 feet. The illustration shows the extent a P-47 fills the sight ring at these ranges. Measure on the assessor the exact range at which your bursts were fired.

K-14 GYRO GUNSIGHT (P-47D-30 LATE & -40 SERIES)

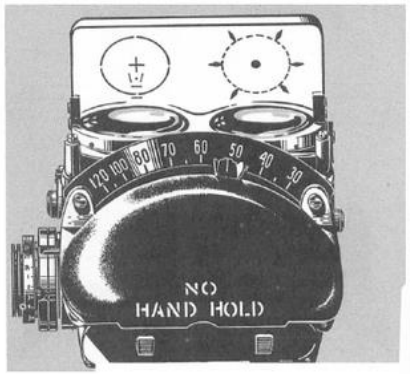
Your gunsight will show you where to shoot and when to shoot a target.

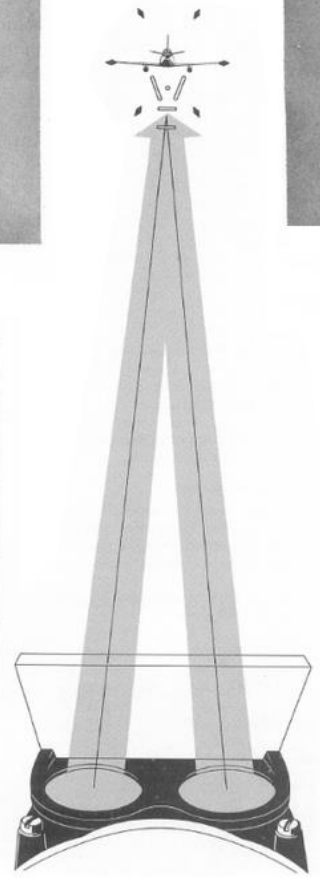


Fixed Reticle Pattern, K-14 Sight, Diameter 71.12 Mils



Movable Reticles





Gyro sight | Fixed sight | Fixed sight with ring mask

K-14 GYRO GUNSIGHT (P-47D-30 LATE & -40 SERIES)

To use the gunsight properly:

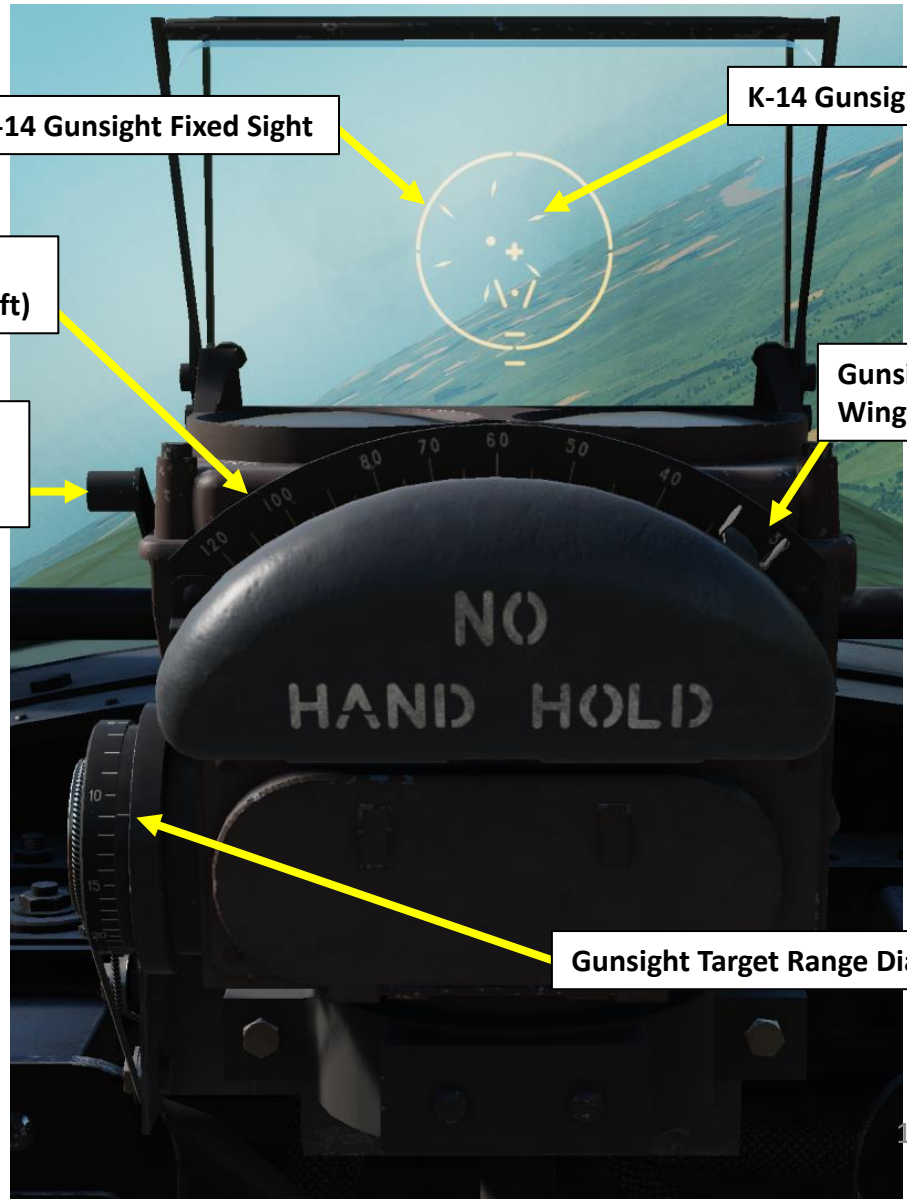
1. Flip Gun Safety Guard (Red) and set Gun Safety Switch DOWN (GUNS & CAMERA)
2. Rotate Gunsight Rheostat to ON
3. Set Gunsight Fixed Reticle Mask Lever as desired (DOWN if you want to hid the fixed sight, UP if you want to display the fixed sight)
4. Set gunsight range scale (recommended: 1100 ft) by using your twist-grip throttle ("Gunsight Range to Target Decrease/Increase" controls)
5. Set gunsight wingspan scale (recommended: 32 ft for a Bf.109 or a FW190) by using the gunsight wingspan selector
6. Fire guns when the wings of the target fit within your gunsight gyro reticle

Gunsight Rheostat

Gun Safety Switch and Safety Guard (Red)

Twist Grip – Gunsight Target Range Control

Gunsight Fixed Reticle Mask Lever
- *UP: ON*
- *DOWN: OFF*



K-14 Gunsight Fixed Sight

K-14 Gunsight Gyro Sight

Gunsight Target Wingspan Scale (ft)

Gunsight Target Wingspan Selector

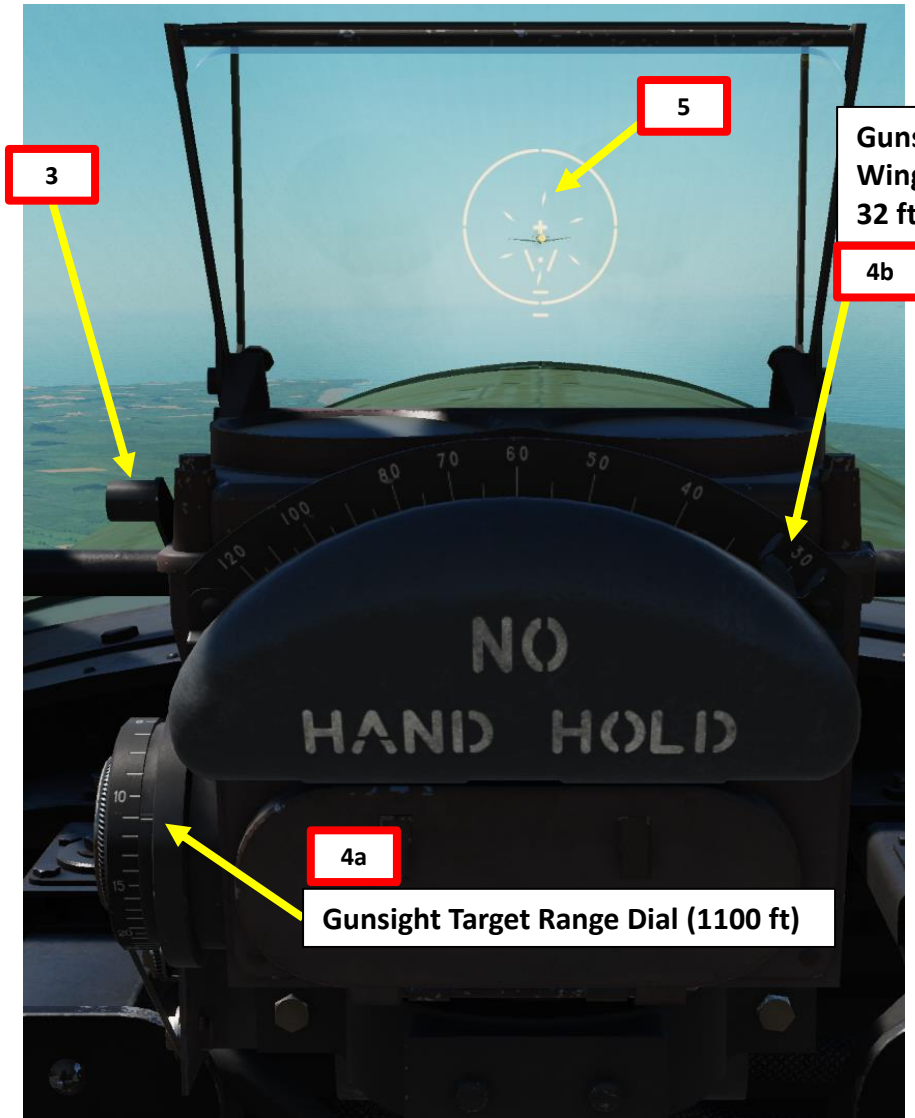
Gunsight Target Range Dial (x100 ft)

M2 BROWNING 0.50 CALIBER MACHINE GUNS (P-47D-30 LATE & -40 SERIES)

1. Flip Gun Safety Guard (Red) and set Gun Safety Switch DOWN (GUNS & CAMERA)
2. Rotate Gunsight Rheostat to ON
3. Set Gunsight Fixed Reticle Mask Lever as desired (DOWN if you want to hide the fixed sight, UP if you want to display the fixed sight)
4. Set gunsight range (a) and wingspan scale (b) as required (see K-14 Gyro Gunsight tutorial)
5. Place the wings of the target fit within your gunsight gyro reticle
6. Squeeze the machinegun trigger (Spacebar) to fire machineguns.

Gunsight Rheostat
2

Gun Safety Switch and Safety Guard (Red)
1

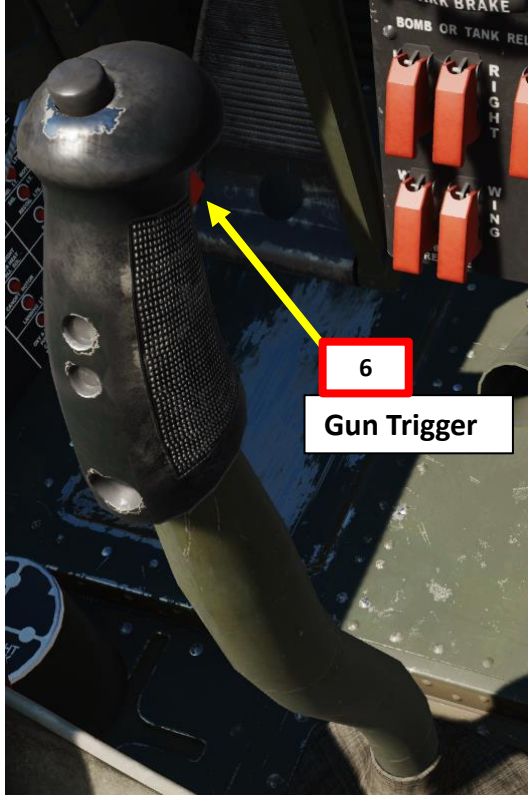


3

5

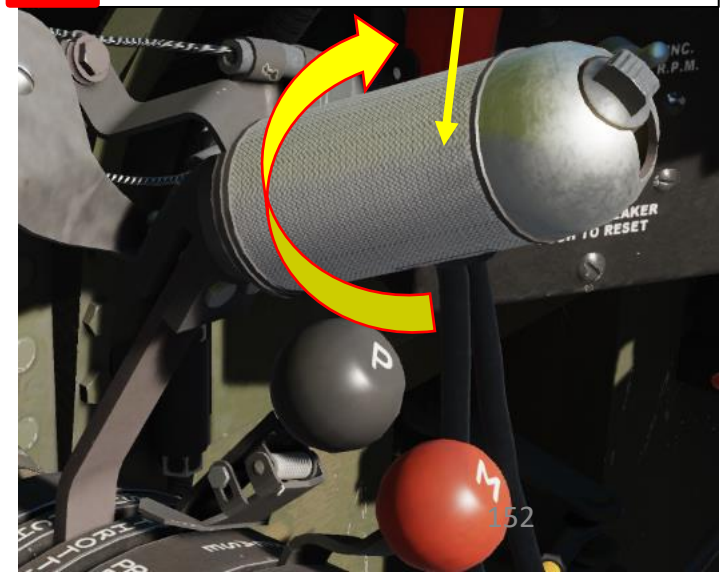
Gunsight Target Wingspan Selector 32 ft
4b

4a
Gunsight Target Range Dial (1100 ft)

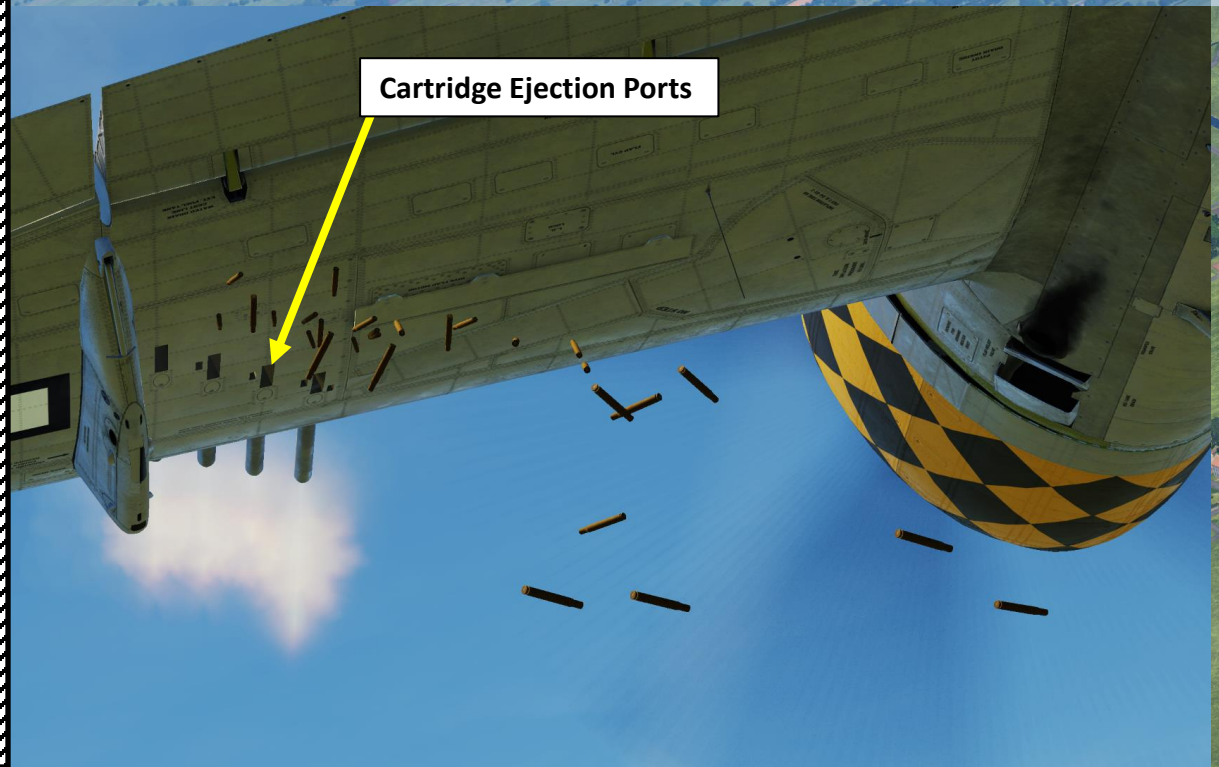


6
Gun Trigger

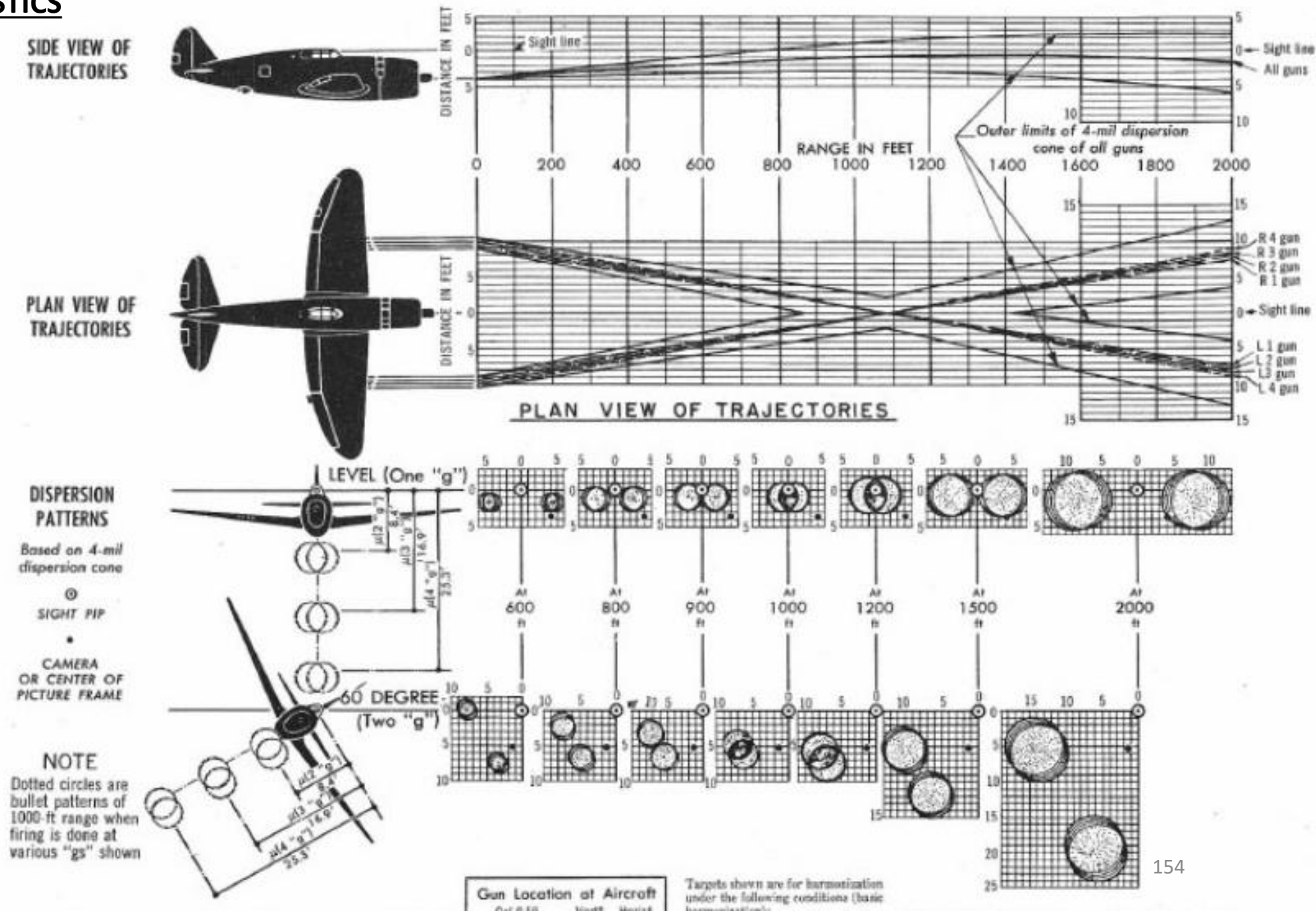
4a
Twist Grip – Gunsight Target Range Control



Note:
The P-47 has enough rounds for about 30 seconds of continuous fire. In order to avoid gun jamming or gun overheat, pilots typically used 2-second bursts.

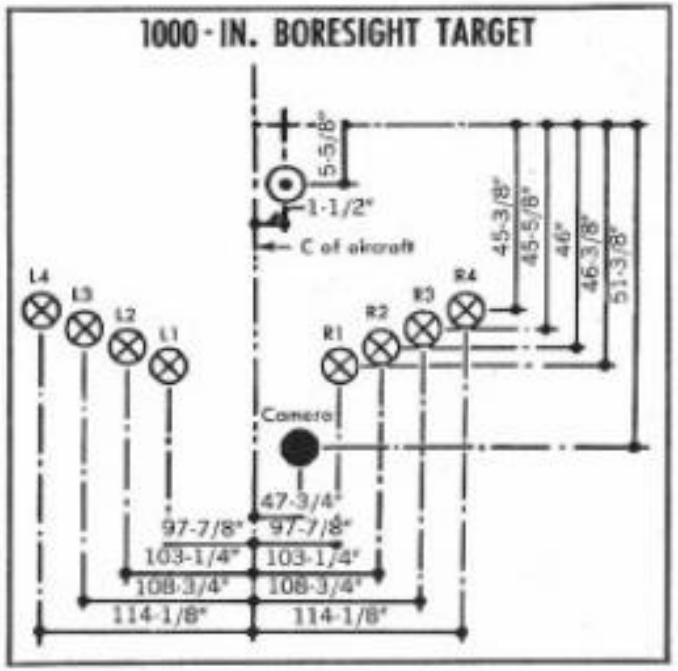


ARMAMENT BALLISTICS



ARMAMENT BALLISTICS

1000-IN. BORESIGHT TARGET



Gun Location at Aircraft

Cal 0.50	Vert*	Horizt†
L&R No. 1 guns	47.344"	107.875"
L&R No. 2 guns	46.969	113.844
L&R No. 3 guns	46.594	119.813
L&R No. 4 guns	46.219	125.78
Camera	45.750	47.813

*From sight †From plane center line.

Targets shown are for harmonization under the following conditions (basic harmonization):

Cal IAS: 300 mph Alt: 15,000 ft
TAS: ±373 mph Wt: 14,000± 250 lb
Angle of attack (cep): 11 mils nose up
Level flight: (1 "g")

- Mark where line from sight is parallel to fuselage leveling lugs.
- Mark where sight pip is aimed for harmonization with bullet patterns (sight setting for harmonization).
- Mark where bore is aimed for 1000-in. and 900-ft. targets.
- Mark for center of impact of 10 rounds at 900-ft. target.
- Mark where camera is aimed making camera parallel to sight line. This point represents the center of the picture frame.

Applied Ballistics & Design Sec., Proof Div., A.A.F.P.G.C., Eglin Field, Fla. Date: 6-8-44.

TRAJECTORY DATA
Forward Fire

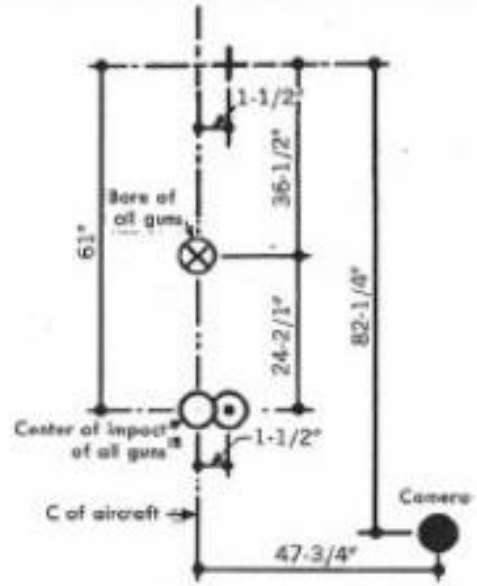
Gun: Cal .50
Ammunition: APM-2
Muz vel, ft/sec: 2700

Authority: Aberdeen data FT. 50 AC-M-1; and 1st ind. to letter from Ord. Dept., Eglin Field, Fla., April 15, 1944 to Chief of Ordnance, Washington, D.C.

BASIC HARMONIZATION
300 mph Cal IAS

At 310 mph, Cal IAS, FSL is parallel to FP

900-FT. FIRE-IN AND BORESIGHT TARGET



Flight Angle: LEVEL FLIGHT						
Alt.	Cal IAS	± TAS	Mil Angle "μ" 1 "g"	2 "g"	3 "g"	4 "g"
0'	250	250	+2.1	+10.7	+19.2	+27.8
	300	300	−0.3	+6.7	+13.7	+20.7
	350	350	−2.2	+3.8	+9.5	+15.4
	400	400	−4.0	+0.9	+6.2	+11.2
	450	450	−4.9	−0.6	+3.7	+8.0
7000'	200	222	+6.1	+18.0	—	—
	250	276	+2.4	+11.8	+21.1	+30.5
	300	331	−0.2	+7.4	+15.1	+22.7
	350	386	−2.2	+4.2	+10.5	+16.9
	400	440	−4.0	+1.1	+6.9	+12.3
15000'	200	251	+7.0	+20.3	—	—
	250	313	+2.9	+13.4	+23.7	+34.2
	300	373	0	+8.4	+16.9	+25.3
	350	434	−2.2	+4.9	+11.7	+18.8
	400	493	−4.0	+1.4	+7.7	+13.6
30000'	150	242	+16.8	—	—	—
	200	320	+9.1	+25.5	—	—
	250	398	+4.0	+16.8	+29.5	+42.3
	300	471	+0.4	+10.6	+20.8	+31.0
	350	543	−2.2	+6.2	+14.4	+22.8

Flight Angle: LEVEL FLIGHT				
Cal IAS	cep (Wt.=14000 Lbs.) 1 "g"	2 "g"	3 "g"	4 "g"
150	+161	—	—	—
200	+74	+185	—	—
250	+33	+105	+176	+248
300	+11	+61	+111	+161
350	−2	+35	+71	+108
440	−11	+15	+45	+73
450	−16	+6	+28	+50

Flight Angle: 30° DIVE OR CLIMB				
Cal IAS	cep (Wt.=14000 Lbs.) 1 "g"	2 "g"	3 "g"	4 "g"
150	+131	—	—	—
200	+59	+155	+251	—
250	+23	+86	+148	+207
300	+5	+48	+92	+134
350	−7	+25	+56	+89
400	−14	+10	+34	+59
450	−15	0	+19	+38

Flight Angle: 30° DIVE OR CLIMB						
Alt.	Cal IAS	± TAS	Mil Angle "μ" 1 "g"	2 "g"	3 "g"	4 "g"
0'	250	250	+0.9	+8.4	+15.8	+22.9
	300	300	−1.2	+4.5	+11.0	+16.9
	350	350	−3.0	+2.2	+7.3	+17.4
	400	400	−4.3	0	+4.2	+8.7
	450	450	−5.5	−1.8	+1.9	+5.7
7000'	200	222	+4.5	+14.8	+25.1	—
	250	276	+1.1	+9.3	+17.4	+25.1
	300	331	−1.1	+5.5	+12.2	+18.6
	350	386	−3.0	+2.5	+8.1	+13.6
	400	440	−4.5	−0.1	+4.8	+9.6
15000'	200	251	+5.2	+16.7	+28.2	—
	250	313	+1.5	+10.6	+19.7	+28.2
	300	373	−1.0	+6.3	+13.7	+20.7
	350	434	−3.1	+3.0	+9.1	+15.2
	400	493	−4.7	+0.3	+5.4	+10.7
30000'	150	242	+13.3	—	—	—
	200	320	+6.9	+21.1	+35.3	—
	250	398	+2.3	+13.5	+24.5	+35.0
	300	471	−0.8	+8.0	+16.9	+25.5
	350	543	−3.4	+3.9	+11.2	+18.5

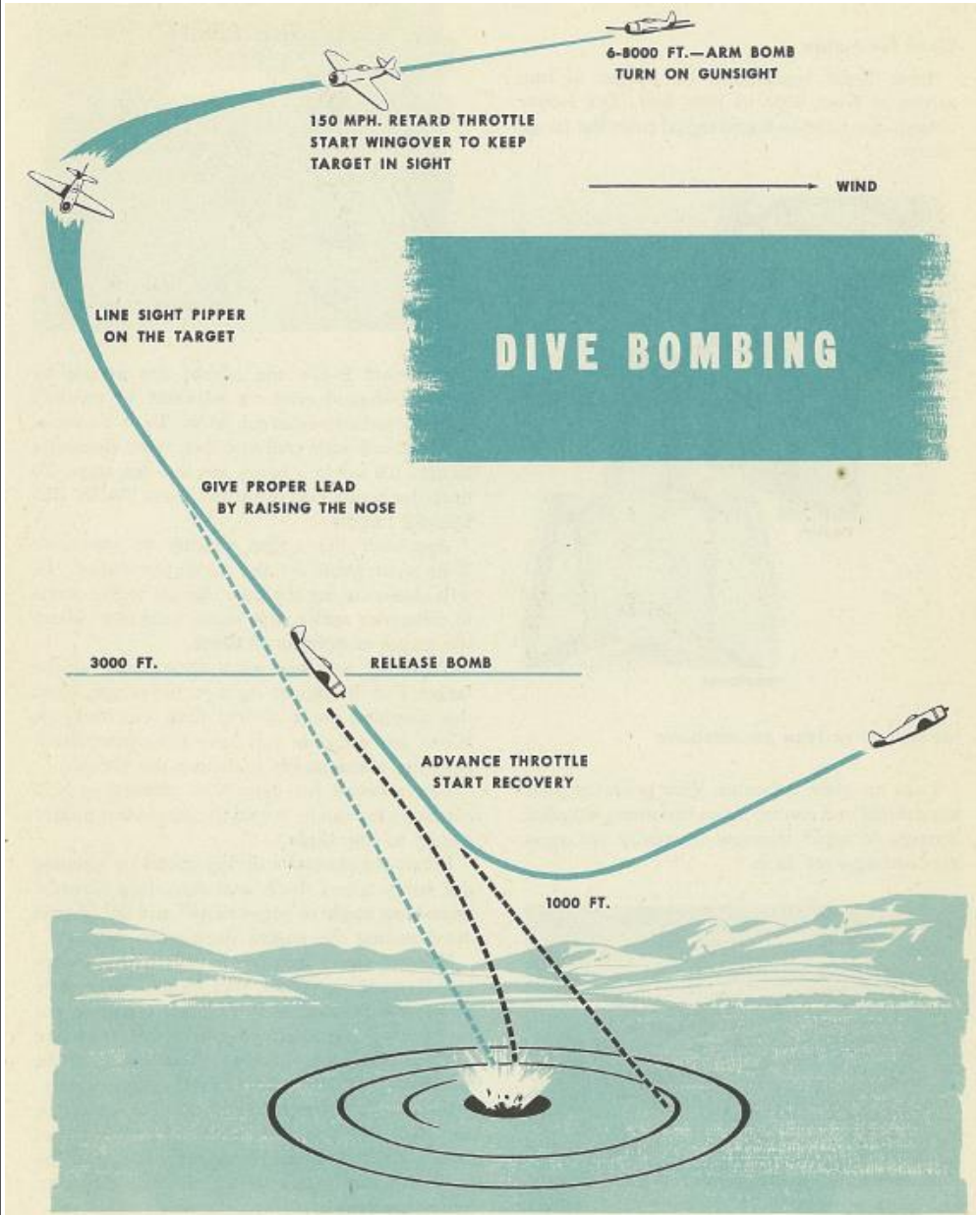
α_{cep} = Mil angle between the fuselage leveling lugs and the flight path. This data is derived from the best available angle of attack charts, but is not guaranteed. The boresight targets and μ angles are based on this angle of the attack chart.

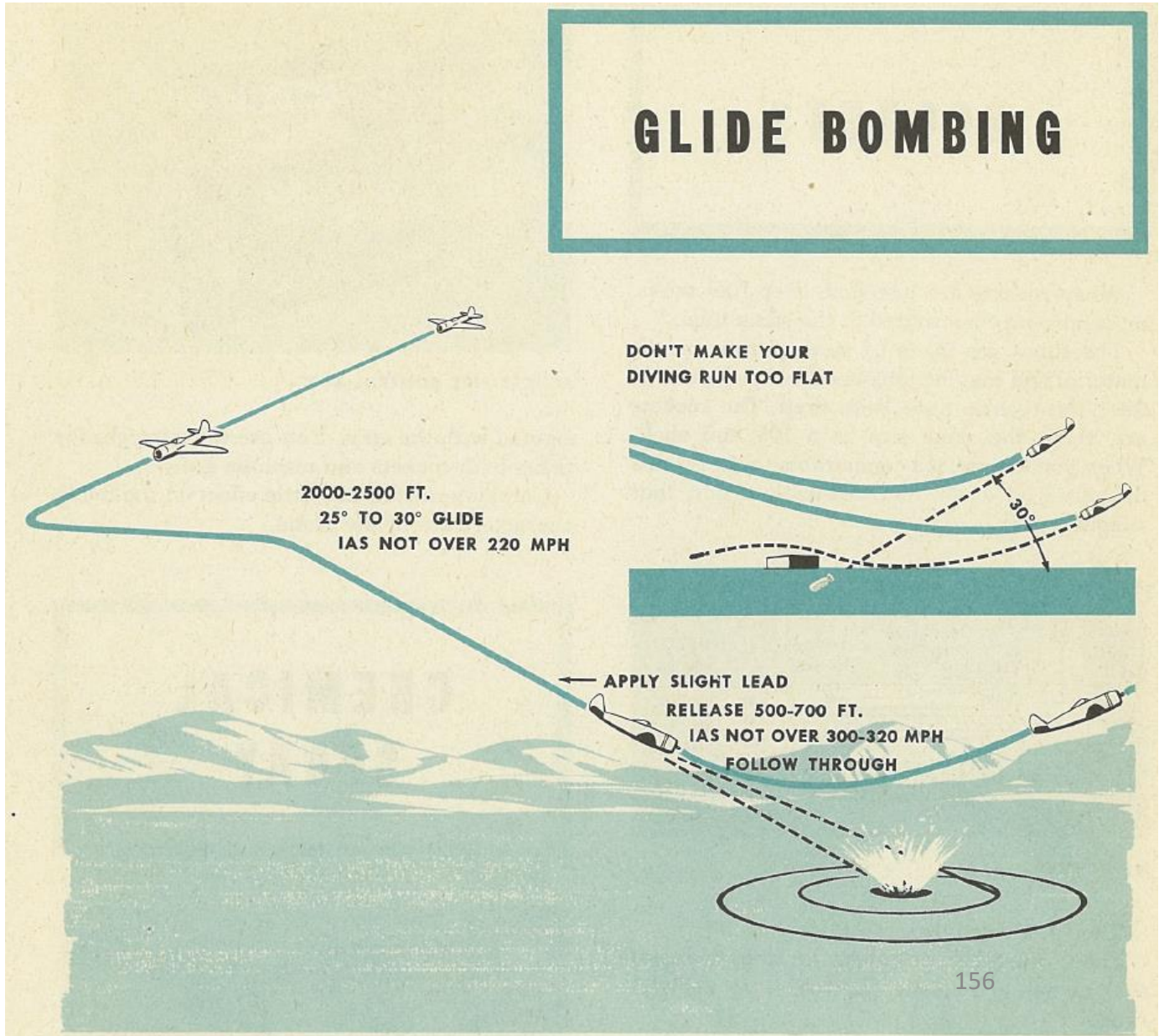
μ = Mil angle between the sight line and the projectiles at any range out to 2000 feet. When the mil angle is minus the projectiles are above the sight line; when plus they are below. This mil angle acts along the vertical axis of the sight. The mil angle μ is only applicable when the aircraft is harmonized as shown in the above boresight and fire-in targets.

Harmonization Chart: P-47 Airplane

BOMBING TECHNIQUES

Here are examples of two bombing techniques.

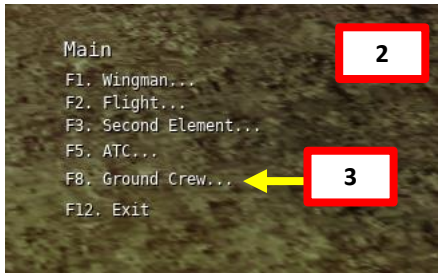


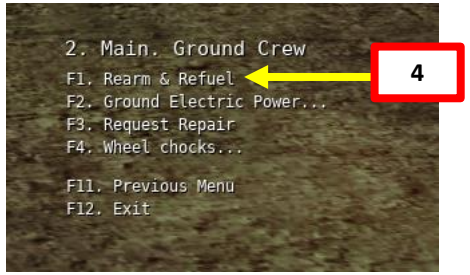


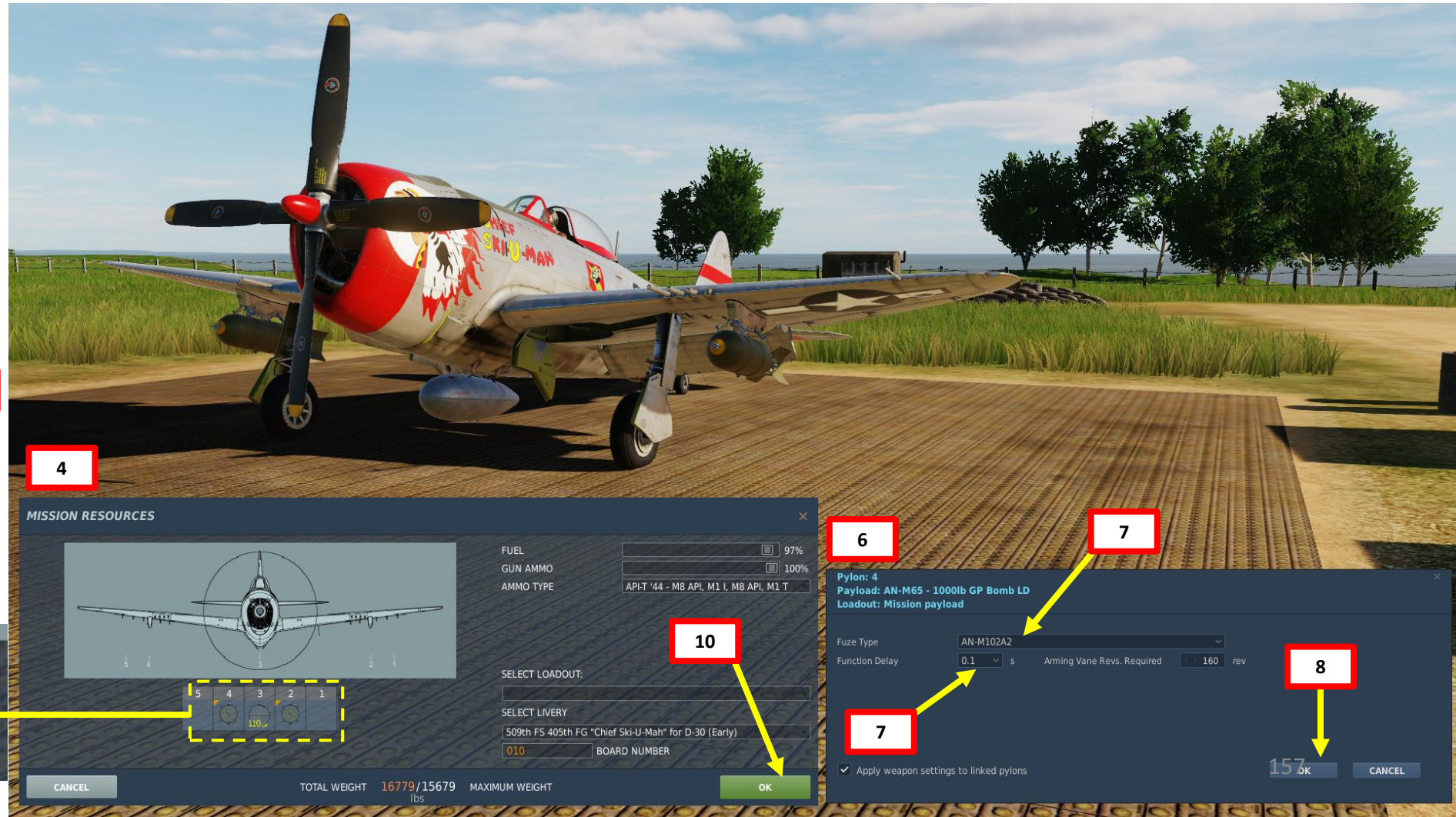
BOMB FUZES

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

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

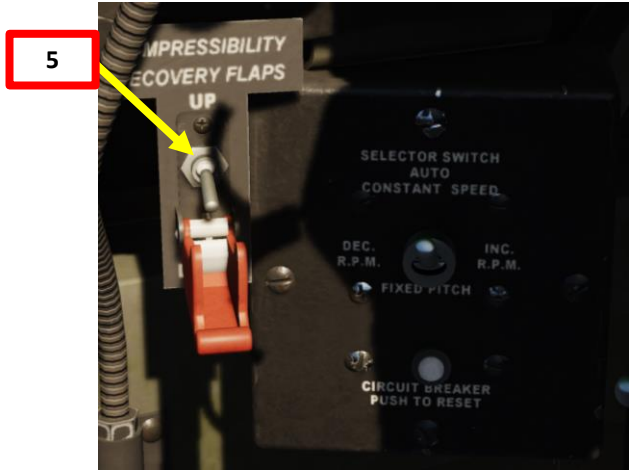






BOMBS (P-47D-30 EARLY SERIES)

1. Flip Gun Safety Guard (Red) and set Gun Safety Switch DOWN (GUNS & CAMERA)
2. Rotate Gunsight Rheostat to ON
3. Close cowl flaps before diving
4. Arm desired bomb by turning Counter-clockwise and pulling the arming lever, then turning it clockwise to arm.
5. This step is not mandatory, but I strongly recommend that you deploy the compressibility flaps to avoid overspeeding.



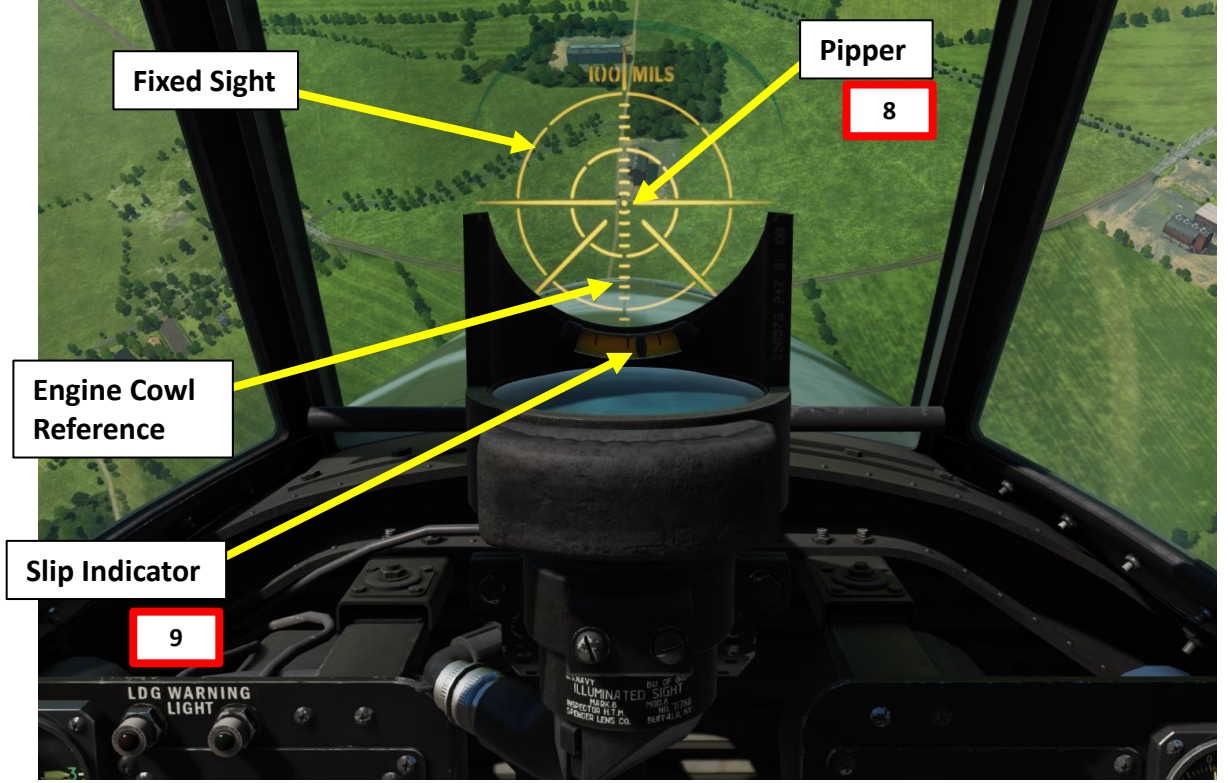
Gunsight Rheostat
2

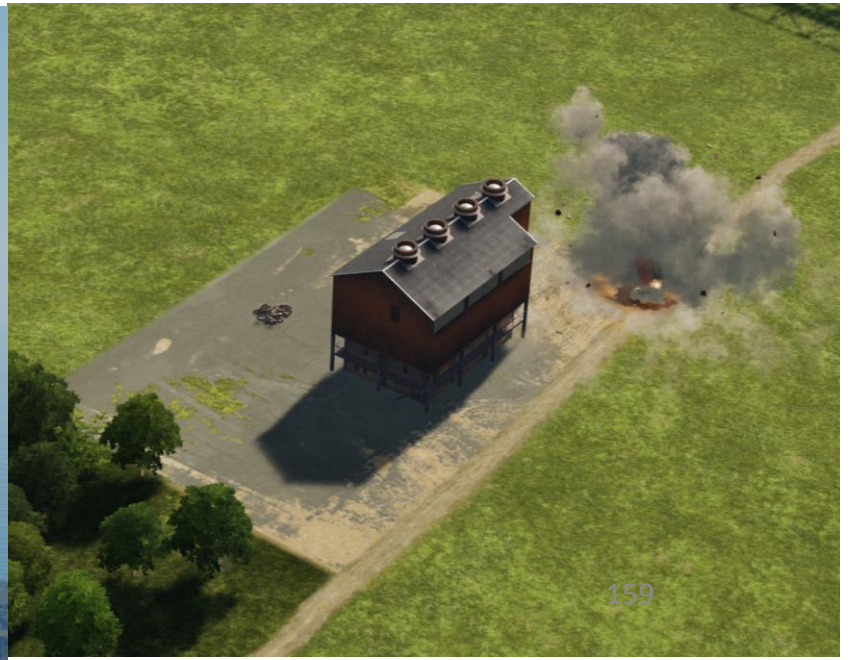
Gun Safety Switch and Safety Guard (Red)
1

BOMBS (P-47D-30 EARLY SERIES)

6. There are many different bombing profiles, but typically I would recommend starting from 9000 ft above ground level with an airspeed of 250 mph IAS.
7. When you have the target in sight, roll in and reduce throttle to maintain a 45 to 60-degree dive with an airspeed between 350 and 420 mph. Do not arc over with low or negative G during the dive or the bomb could stick in the shackle or even hit the aircraft). The steeper the dive, the better your aiming will be.
8. Line up the target with the pipper of the fixed sight.
    - *Note: Keep in mind that there are other available reference points/techniques to pull lead before dropping the bomb.*
9. You can use your slip ball below the gunsight to see if you are drifting left or right. Make sure you are not slipping when aiming for the target.
10. Using the sight pipper generally means the bomb will fall short of the target; this means you need to add a little lead before releasing the bomb. Before releasing bombs, pull the nose slightly up. The target should be below the engine cowl flaps.
11. When you are 3000 ft above the target, pull the desired Bomb/Fuel Tank Jettison (Drop) Lever to release the bomb.
12. Apply full power and pull away from the blast.

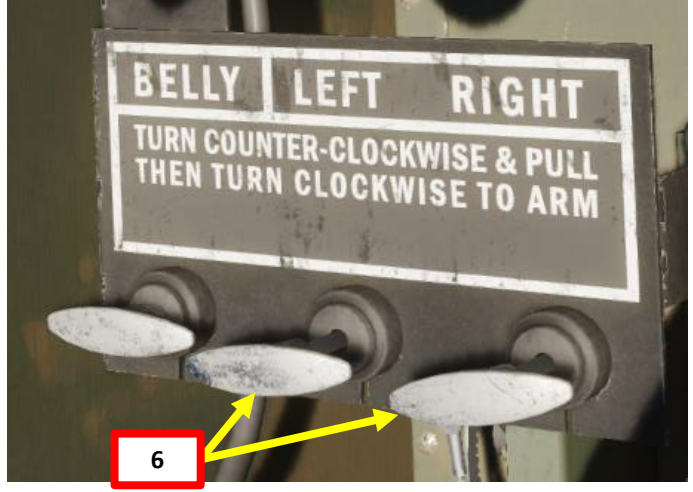
The **Air Combat Tutorial Library** has a nice bombing video: https://youtu.be/HUs_BaX7Oa8

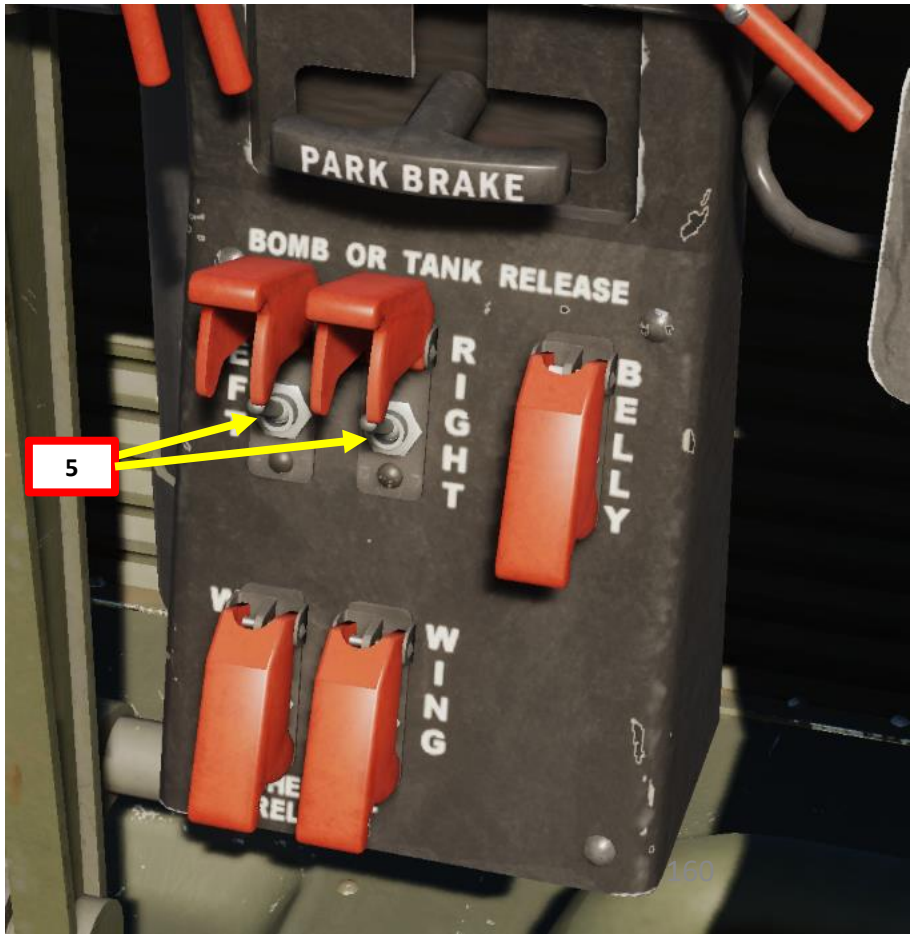




BOMBS (P-47D-30 LATE SERIES)

1. Flip Gun Safety Guard (Red) and set Gun Safety Switch DOWN (GUNS & CAMERA)
2. Rotate Gunsight Rheostat to ON
3. Set Gunsight Fixed Reticle Mask Lever UP (we want to display the fixed sight).
4. Close cowl flaps before diving
5. Select desired bomb by flipping the safety guard UP, then setting the arming switch UP.
6. Arm desired bomb by turning Counter-clockwise and pulling the arming lever, then turning it clockwise to arm.
7. This step is not mandatory, but I strongly recommend that you deploy the compressibility flaps to avoid overspeeding.

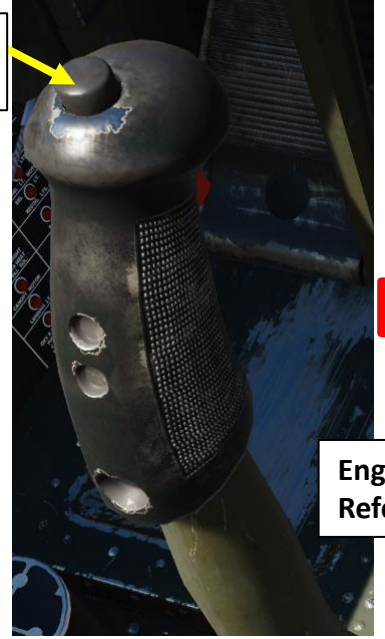


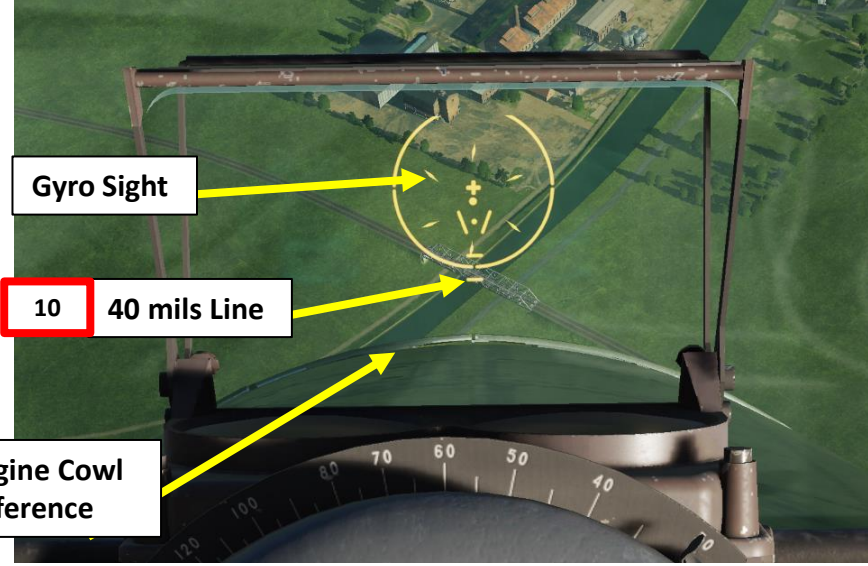


BOMBS (P-47D-30 LATE SERIES)

8. There are many different bombing profiles, but typically I would recommend starting from 9000 ft above ground level with an airspeed of 250 mph IAS.
9. When you have the target in sight, roll in and reduce throttle to maintain a 45 to 60-degree dive with an airspeed between 350 and 420 mph. Do not arc over with low or negative G during the dive or the bomb could stick in the shackle or even hit the aircraft). The steeper the dive, the better your aiming will be.
10. Line up the target with the "40 mils" line of the fixed sight.
    - *Note: Keep in mind that there are other available reference points/techniques to pull lead before dropping the bomb.*
11. You can use your gyro gunsight to see if you are drifting left or right. Make sure you are not slipping when aiming for the target.
12. Using the 40 mils line generally means the bomb will fall short of the target; this means you need to add a little lead before releasing the bomb. Before releasing bombs, pull the nose slightly up. The target should be below the engine cowl flaps.
13. When you are 3000 ft above the target, press the Weapons (Bomb) Release Button (RSHIFT+SPACE) to release the bomb.
14. Apply full power and pull away from the blast.

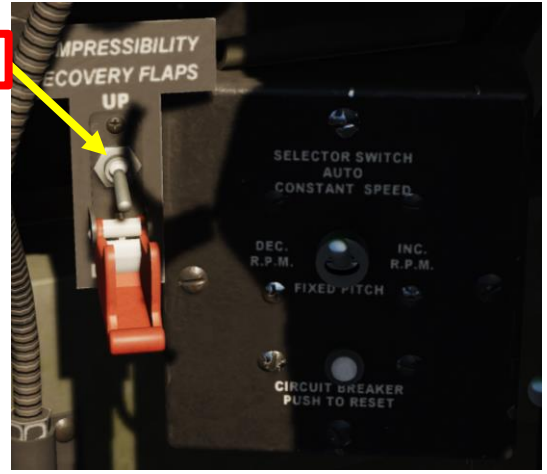
The **Air Combat Tutorial Library** has a nice bombing video: https://youtu.be/HUs_BaX7Oa8

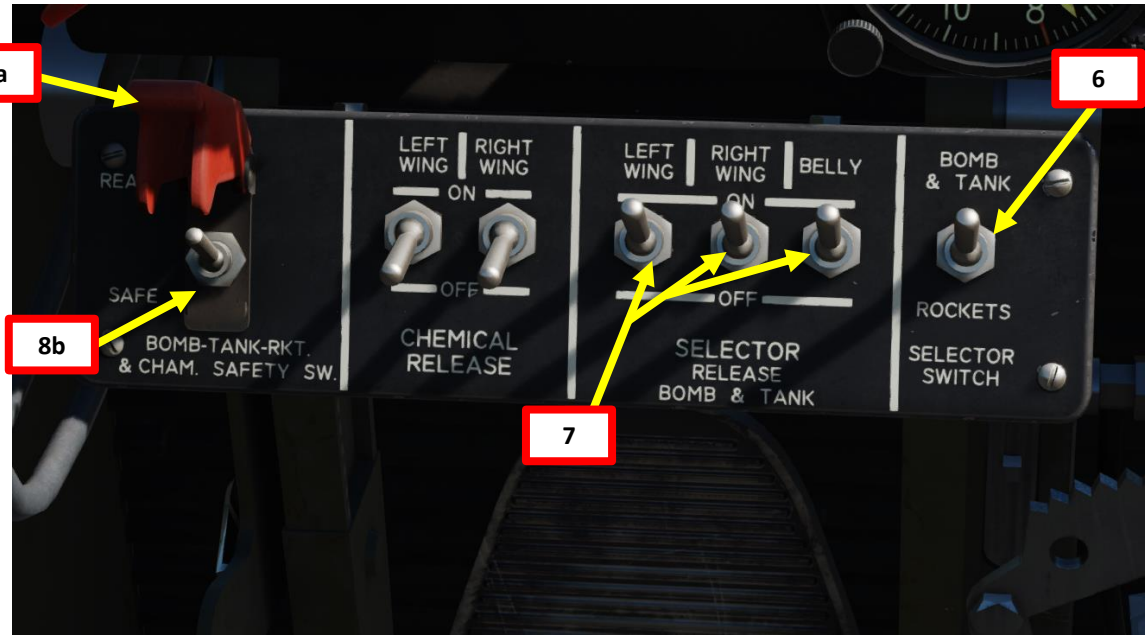




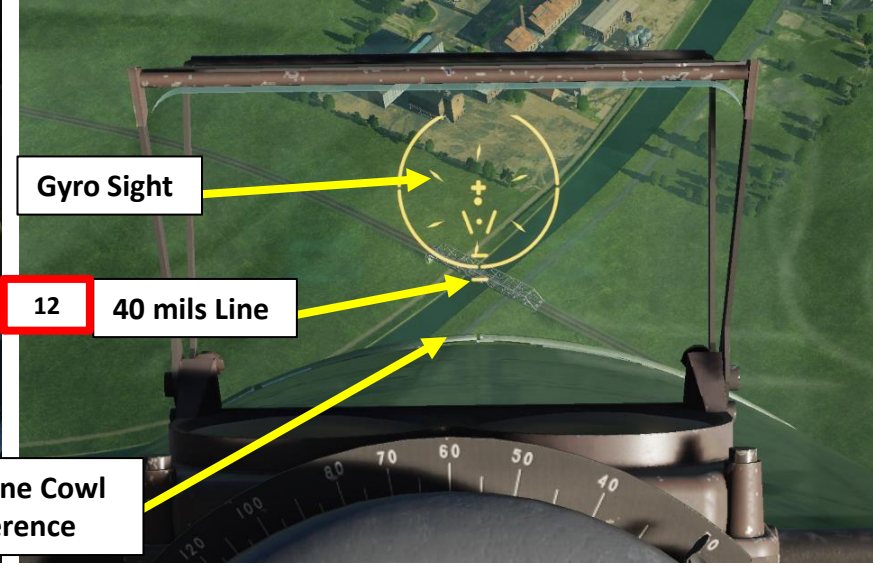
BOMBS (P-47D-40 SERIES)

1. Flip Gun Safety Guard (Red) and set Gun Safety Switch DOWN (GUNS & CAMERA)
2. Rotate Gunsight Rheostat to ON
3. Set Gunsight Fixed Reticle Mask Lever UP (we want to display the fixed sight).
4. Close cowl flaps before diving
5. Arm desired bomb by turning Counter-clockwise and pulling the arming lever, then turning it clockwise to arm.
6. Set Rockets / Bomb & Tank Selector Switch to BOMB & TANK (UP)
7. Set Arming Selector Switches to ARMED (UP) for the bombs you want to drop (Left Wing, Right Wing or Belly pylons)
8. Flip red safety guard, then set Bomb/Tank/Rocket Safety Switch to ARMED (UP)
9. This step is not mandatory, but I strongly recommend that you deploy the compressibility flaps to avoid overspeeding.





BOMBS (P-47D-40 SERIES)

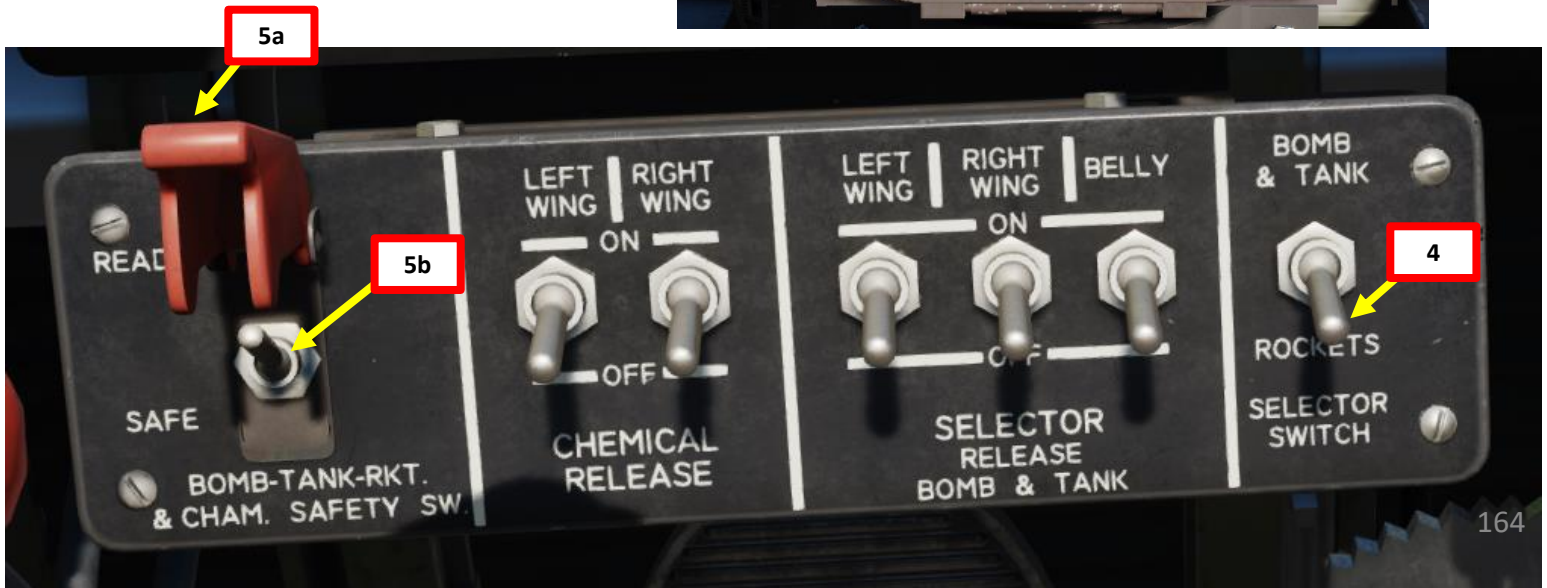


10. There are many different bombing profiles, but typically I would recommend starting from 9000 ft above ground level with an airspeed of 250 mph IAS.
11. When you have the target in sight, roll in and reduce throttle to maintain a 45 to 60-degree dive with an airspeed between 350 and 420 mph. Do not arc over with low or negative G during the dive or the bomb could stick in the shackle or even hit the aircraft). The steeper the dive, the better your aiming will be.
12. Line up the target with the "40 mils" line of the fixed sight.
    - *Note: Keep in mind that there are other available reference points/techniques to pull lead before dropping the bomb.*
13. You can use your gyro gunsight to see if you are drifting left or right. Make sure you are not slipping when aiming for the target.
14. Using the 40 mils line generally means the bomb will fall short of the target; this means you need to add a little lead before releasing the bomb. Before releasing bombs, pull the nose slightly up. The target should be below the engine cowl flaps.
15. When you are 3000 ft above the target, press the Weapons (Bomb) Release Button (RSHIFT+SPACE) to release the bomb.
16. Apply full power and pull away from the blast.

The **Air Combat Tutorial Library** has a nice bombing video: https://youtu.be/HUs_BaX7Oa8

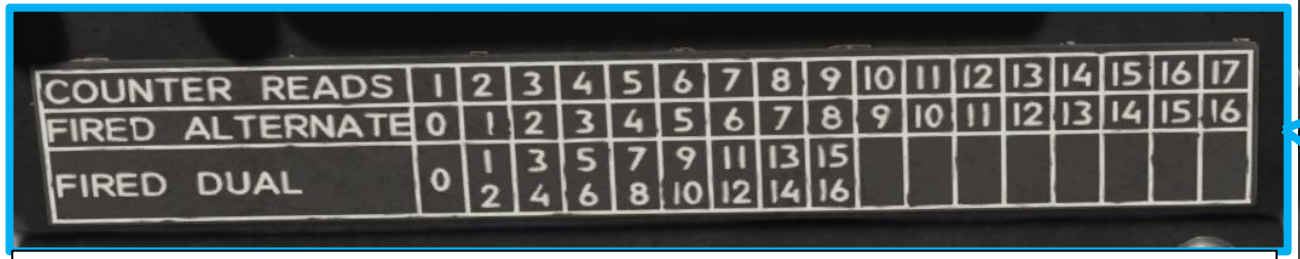
ROCKETS (P-47D-40 SERIES)

1. Flip Gun Safety Guard (Red) and set Gun Safety Switch DOWN (GUNS & CAMERA)
2. Rotate Gunsight Rheostat to ON
3. Set Gunsight Fixed Reticle Mask Lever UP (we want to display the fixed sight).
4. Set Rockets / Bomb & Tank Selector Switch to ROCKETS (DOWN)
5. Flip red safety guard, then set Bomb/Tank/Rocket Safety Switch to ARMED (UP)



ROCKETS (P-47D-40 SERIES)

6. Select desired rocket firing mode
   a) Single = Fires 1 Rocket
   b) Auto = Fires Multiple Rockets as long as Weapon Release button is pressed.
7. Set rocket counter if Auto Firing Mode is selected (should be set to 1 at start of a mission)
8. Select desired Rocket Salvo Size
   a) Handle DOWN sets DUAL Salvo: rockets are fired from each wing
   b) Handle UP sets ALTERNATE Salvo: rockets are fired from one wing only
9. Select rocket fuze delay (Delay or Instantaneous)

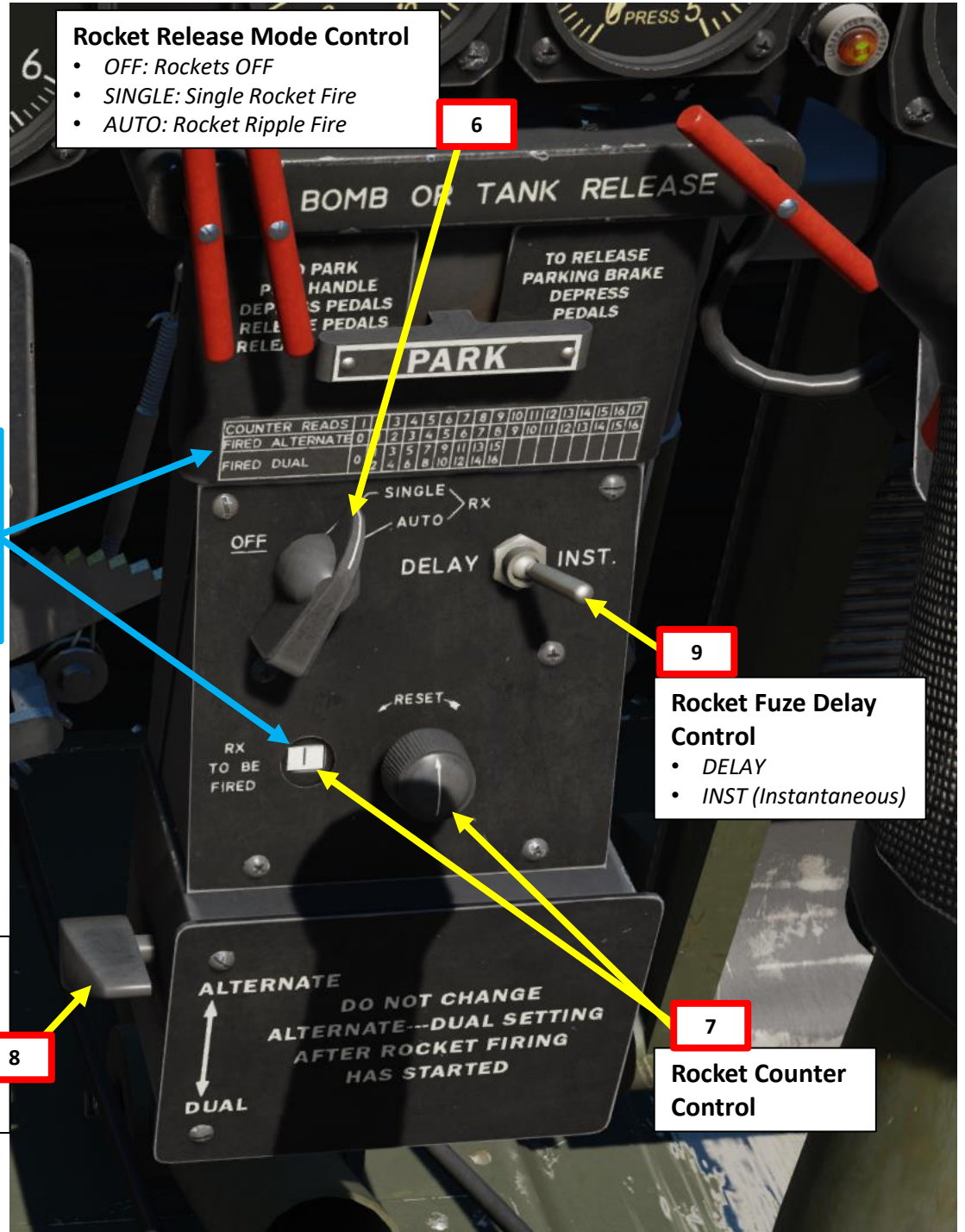


How to read the Rocket Counter

The Rocket Counter window indicates the next rocket to be fired according to station number. The knob of the Rocket Control Counter panel is used to set the desired rocket station for fire. This should be set to 1 at the start of a mission.

Rocket Salvo Size Selector

- *Handle Pointed UP (ALTERNATE) – Upon Weapon Release button press, a single rocket can be fired*
- *Handle Pointed DOWN (DUAL) – Upon Weapon Release button press, rockets are fired from both wings in order to maintain aircraft roll stability*



Rocket Release Mode Control

- *OFF: Rocket OFF*
- *SINGLE: Single Rocket Fire*
- *AUTO: Rocket Ripple Fire*

6

9

Rocket Fuze Delay Control

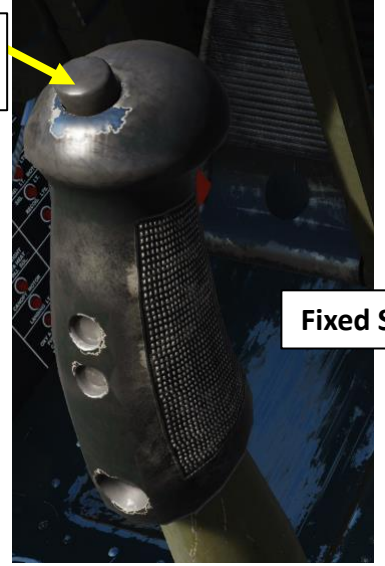
- *DELAY*
- *INST (Instantaneous)*

8

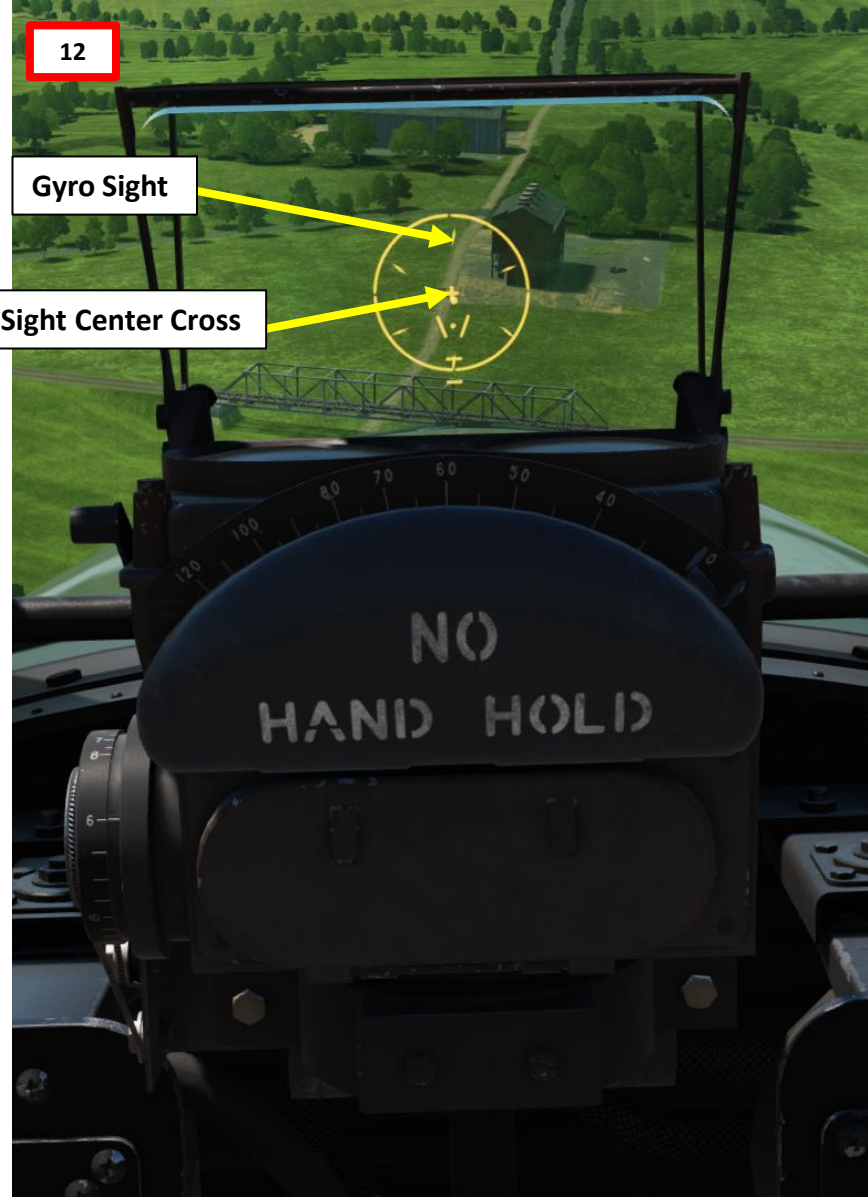
7

Rocket Counter Control

ROCKETS (P-47D-40 SERIES)



10. There are many different attack profiles, but typically I would recommend starting from 1500-2000 ft above ground level.
11. When you have the target in sight, roll in and reduce throttle to maintain a 15 to 20-degree dive with an airspeed between 350 and 420 mph.
12. Line up the target with center cross of the fixed sight.
    - *Note: Keep in mind that there are other available reference points/techniques to pull lead before launching the rocket.*
13. You can use your gyro gunsight to see if you are drifting left or right. Make sure you are not slipping when aiming for the target.
14. When you are 1000 ft away from the target, press the Weapons (Bomb/Rocket) Release Button (RSHIFT+SPACE) to fire rocket(s).
15. Apply full power and pull away from the blast. Recovery altitude should be about 75 ft above ground level.



The **Air Combat Tutorial Library** has a nice rocket video: https://youtu.be/dhEsT59b1Fo

ROCKETS (P-47D-40 SERIES)

SCR-522-A VHF RADIO

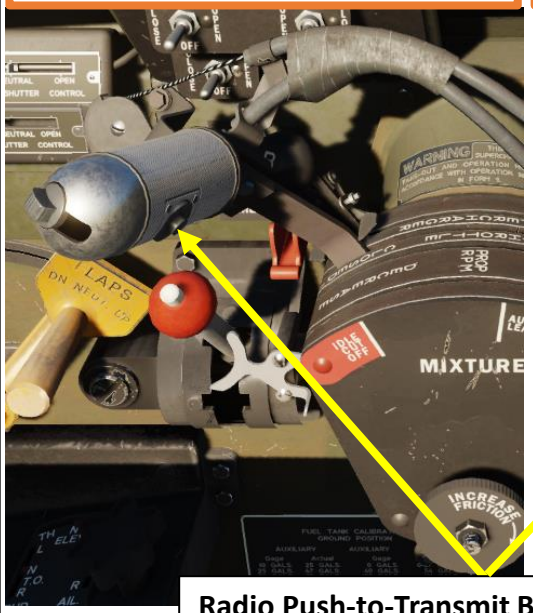
RADIO FREQUENCY RANGE: 100 - 156 MHz

The P-47D is equipped with a SCR-522 VHF (Very High Frequency) radio system. Radio frequencies are preset in the mission editor for 4 different channels and cannot be changed manually during flight.

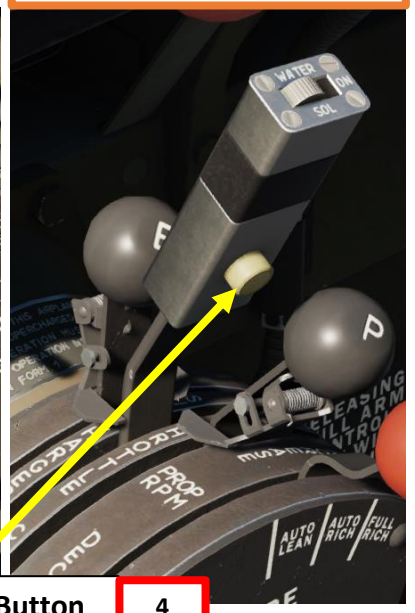
1. Set the radio Transmit-Receive switch to “REM” (Remote Operation, RIGHT position)
2. Set Radio Volume by turning the Volume Control Knob
3. Select desired channel (A, B, C or D)
4. Press the Push-to-Talk switch on your throttle to transmit (“COMM PUSH TO TALK” control, or “RALT+\”)

Radio Mode Switch 1
- LEFT: T (transmit)
- MIDDLE: R (receive)
- RIGHT: REM (remote operation)

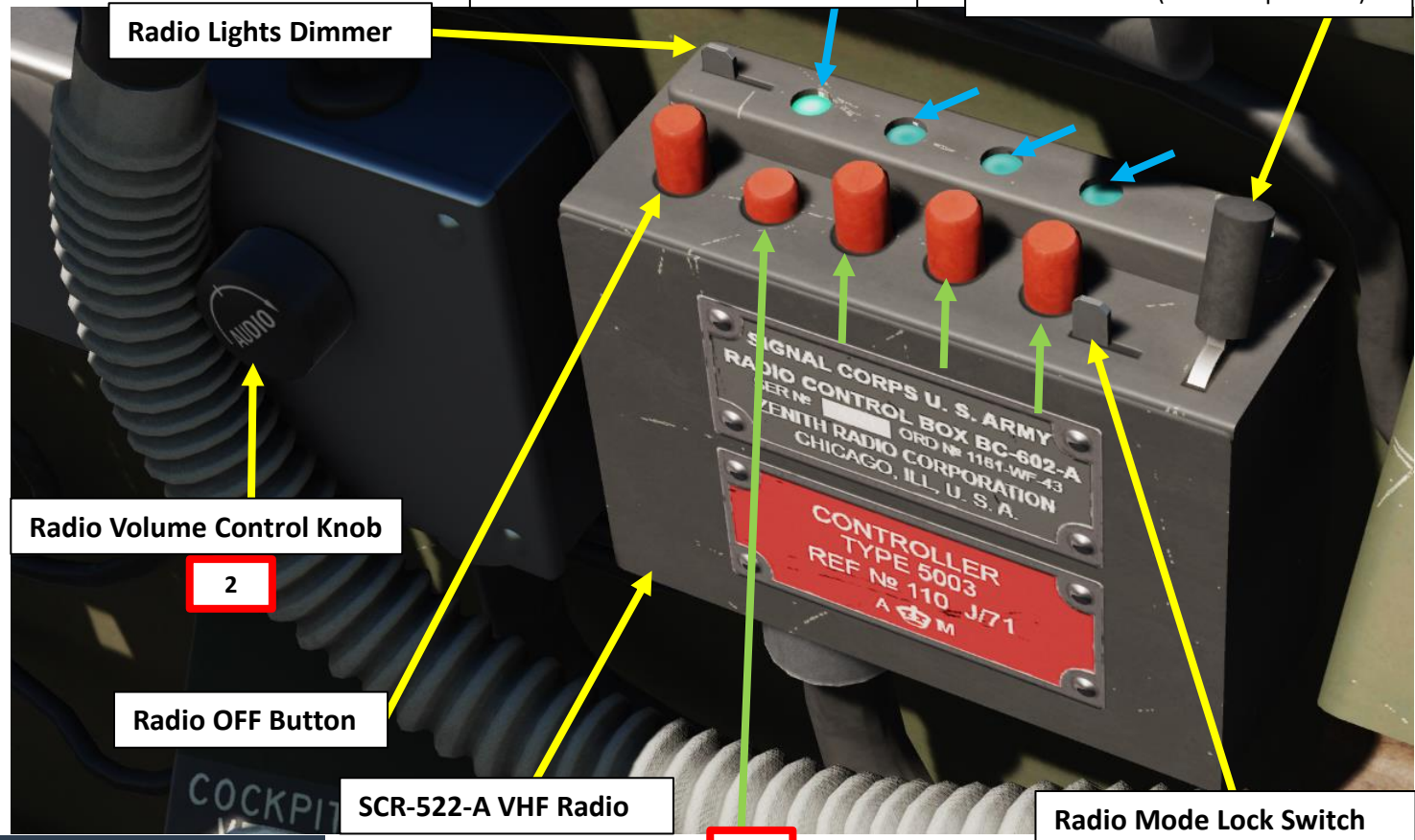
P-47D-30 Late & D-40 Variants

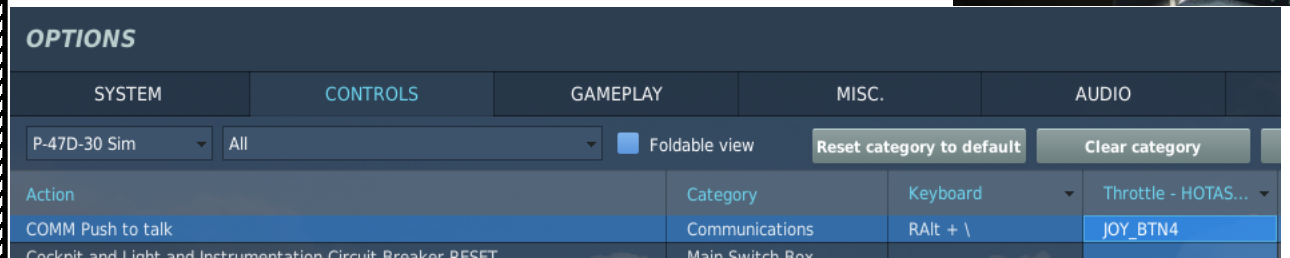


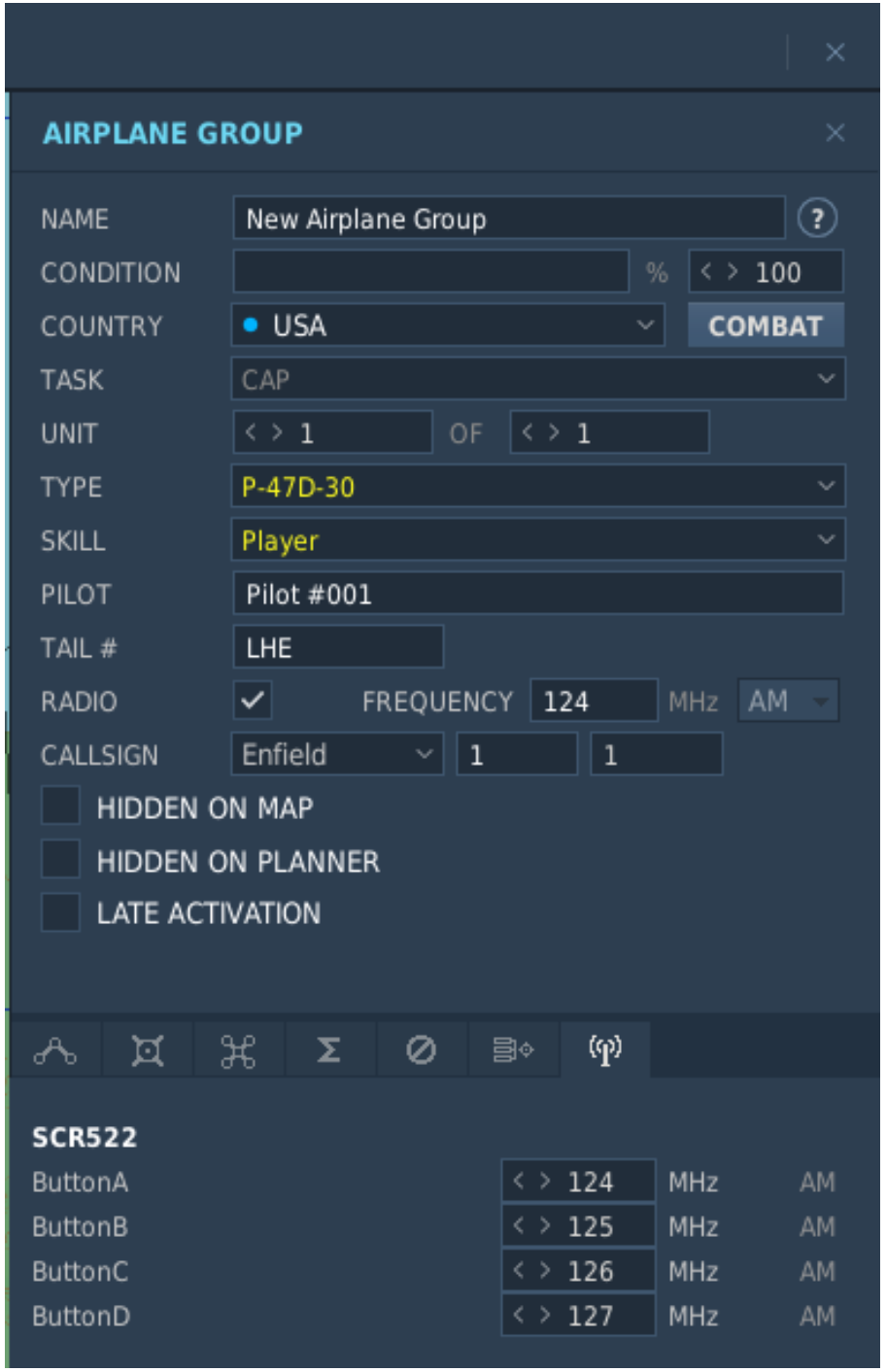
P-47D-30 Early Variant



Radio Push-to-Transmit Button 4







RADIO FREQUENCIES – AIRFIELDS

LOCATION	FREQUENCY (MHz)
Anapa	121.0
Batumi	131.0
Beslan	141.0
Gelendzhik	126.0
Gudauta	130.0
Kobuleti	133.0
Kutaisi	134.0
Krasnodar Center	122.0
Krasnodar Pashkovsky	128.0
Krymsk	124.0
Maykop	125.0
Mineral'nye Vody	135.0
Mozdok	137.0
Nalchik	136.0
Novorossiysk	123.0
Senaki	132.0
Sochi	127.0
Soganlug	139.0
Sukhumi	129.0
Tblisi	138.0
Vaziani	140.0

Channel A:
- Plane-to-plane communication on local flights
- Communication with controller in your own region.

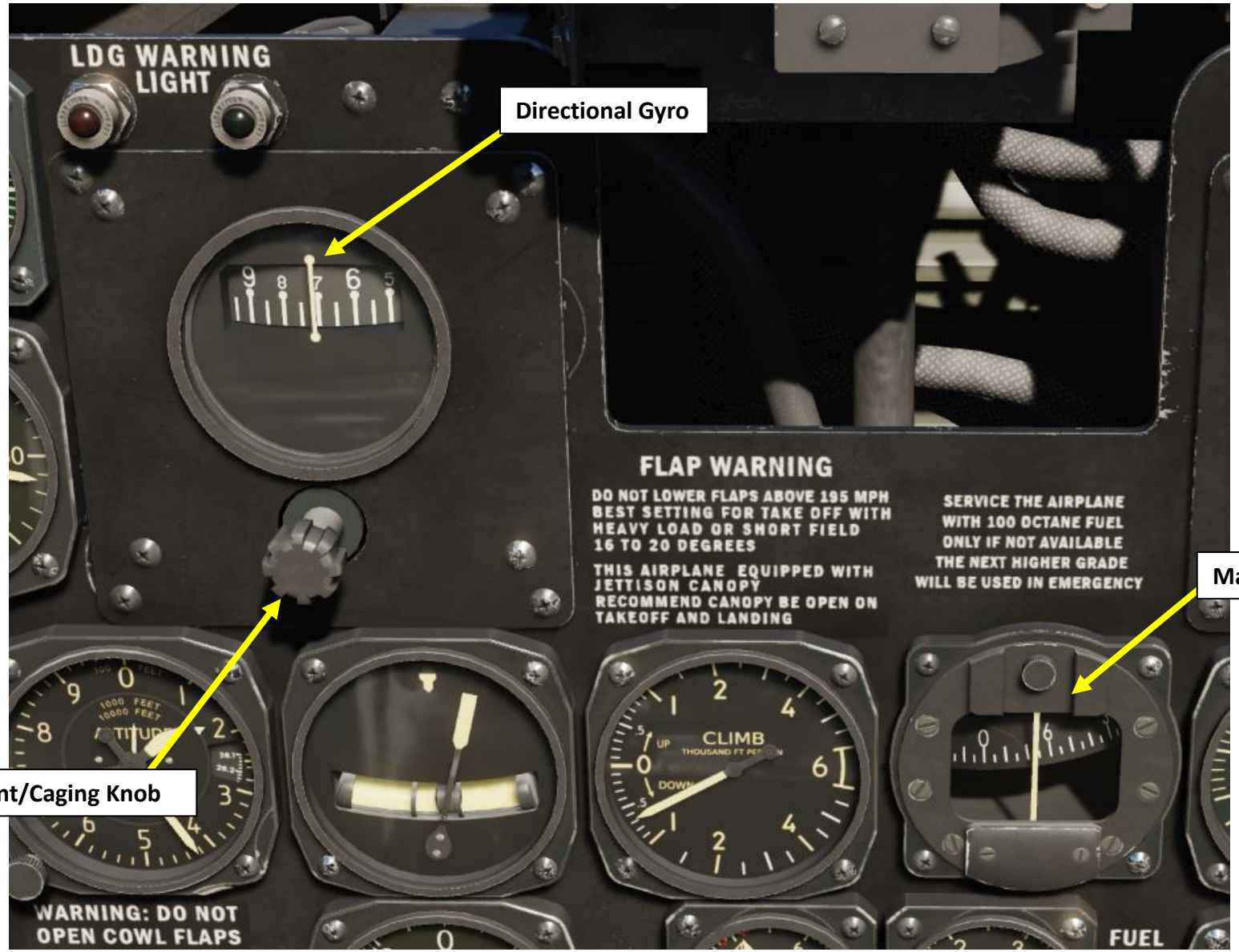
Channel B:
- Common to all VHF-equipped control towers. It is normally used to contact the control tower for takeoff and landing instructions

Channel C:
- Frequently used in contacting homing stations

Channel D:
- Plane-to-plane contact between a pilot practicing fighter instrument flying and his safety pilot.
- Normally used for plane-to-ground contact with D/F (Directional Finding) stations. The pip-squeak (contactor), used in conjunction with the D/F fixing provides controllers and intercepts officers with an accurate minute-by-minute position report of your plane. The contactor clock consists of a dial and two switches.

NAVIGATION INSTRUMENTS

Most of the navigation must be done visually in the Thunderbolt. Consult the Gyro and Magnetic Compass to determine your current magnetic heading.



MAGNETIC VARIATION

The direction in which a compass needle points is known as magnetic north. In general, this is not exactly the direction of the North Magnetic Pole (or of any other consistent location). Instead, the compass aligns itself to the local geomagnetic field, which varies in a complex manner over the Earth's surface, as well as over time. The local angular difference between magnetic north and true north is called the magnetic variation. Most **map coordinate** systems are based on **true north**, and magnetic variation is often shown on map legends so that the direction of true north can be determined from north as indicated by a compass. This is the reason why in DCS the course to a runway needs to be "adjusted" to take into account this magnetic variation of the magnetic North pole (actually modelled in the sim, which is pretty neat).

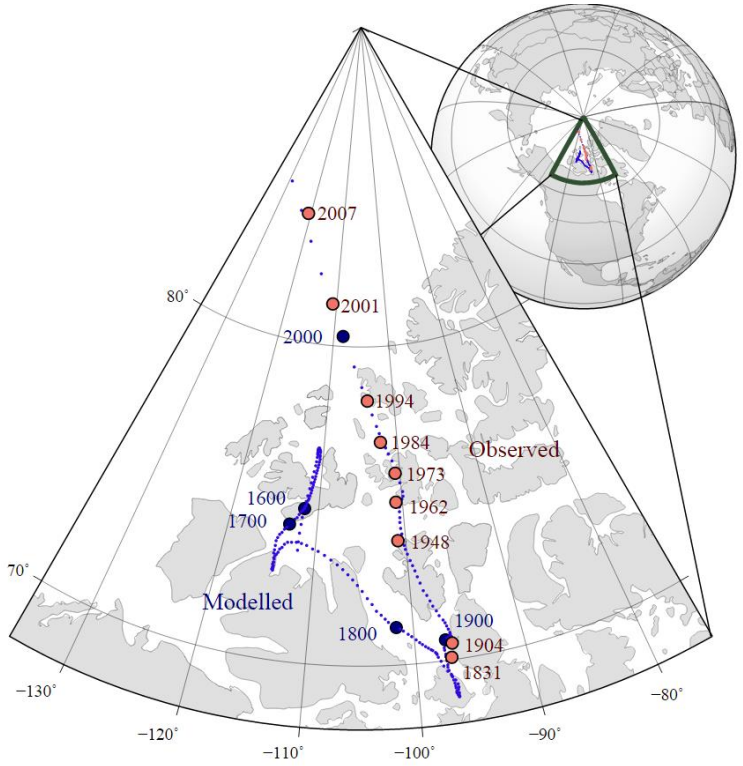
True Heading = Magnetic Heading + Magnetic Variation

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

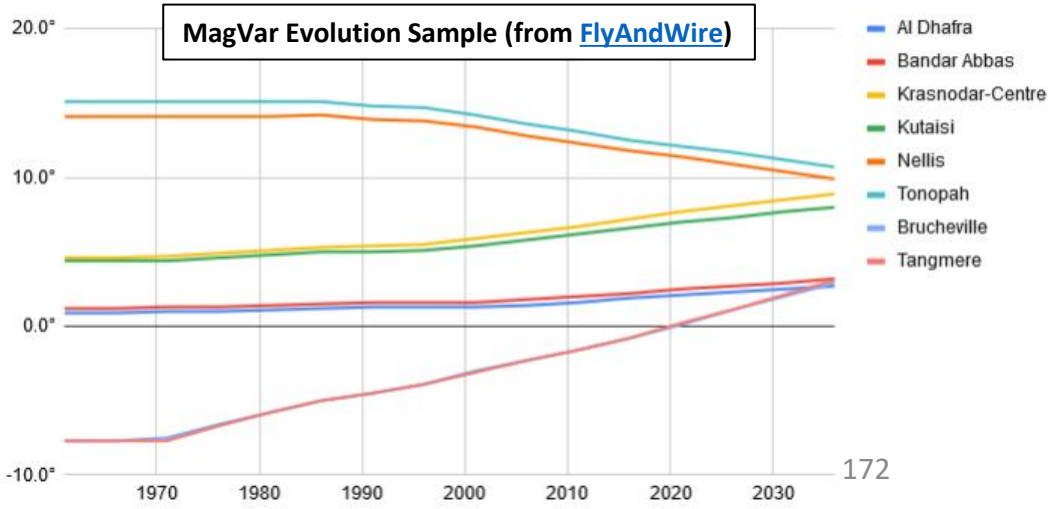
Magnetic variation varies from place to place, but it also changes with time. This means this value will be highly dependent on the mission time and map.

Magnetic Variation:

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

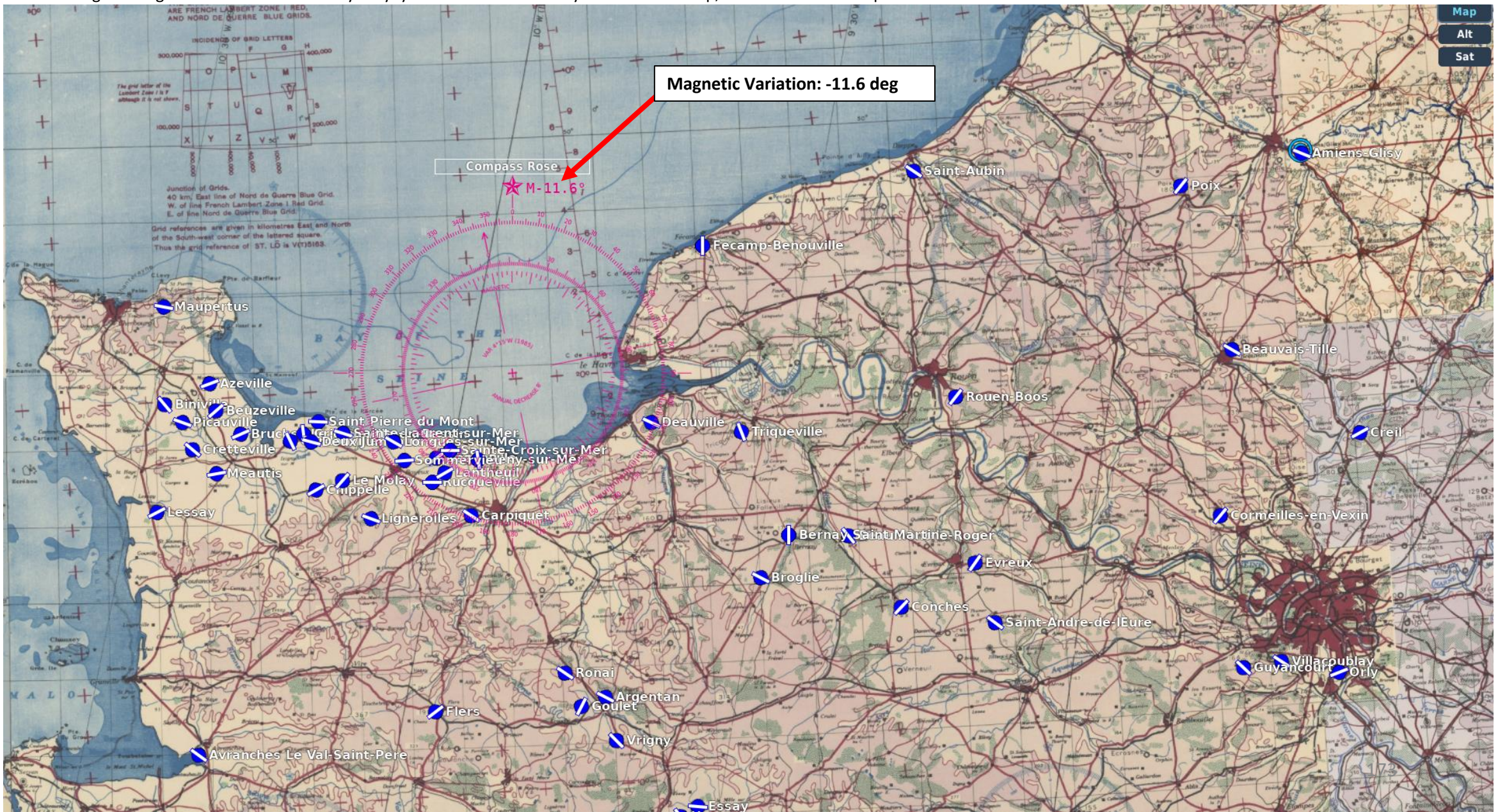


The movement of Earth's north magnetic pole across the Canadian arctic, 1831–2007.



MAGNETIC VARIATION

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



AIRPORT DATA NORMANDY 1944

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

AD Normandy 2.0, Part 1

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

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

DEG°MIN'SEC/.DCML — IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

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

AD Normandy 2.0, Part 2

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

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

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

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

AIRPORT DATA NORMANDY 1944

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

AD Normandy 2.0, Part 3

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

France — Deux–R

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

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

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

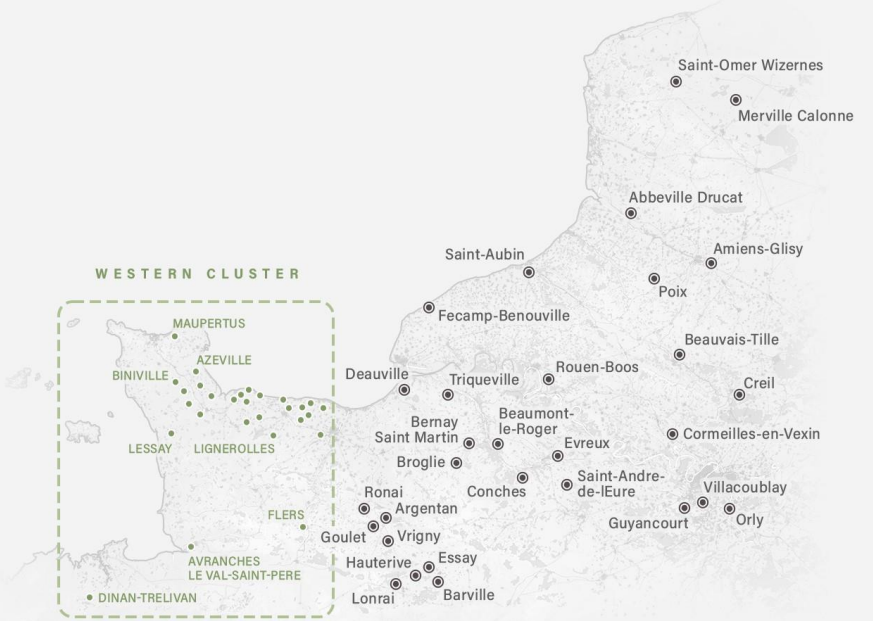
AD Normandy 2.0, Part 4

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

France — S–V

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

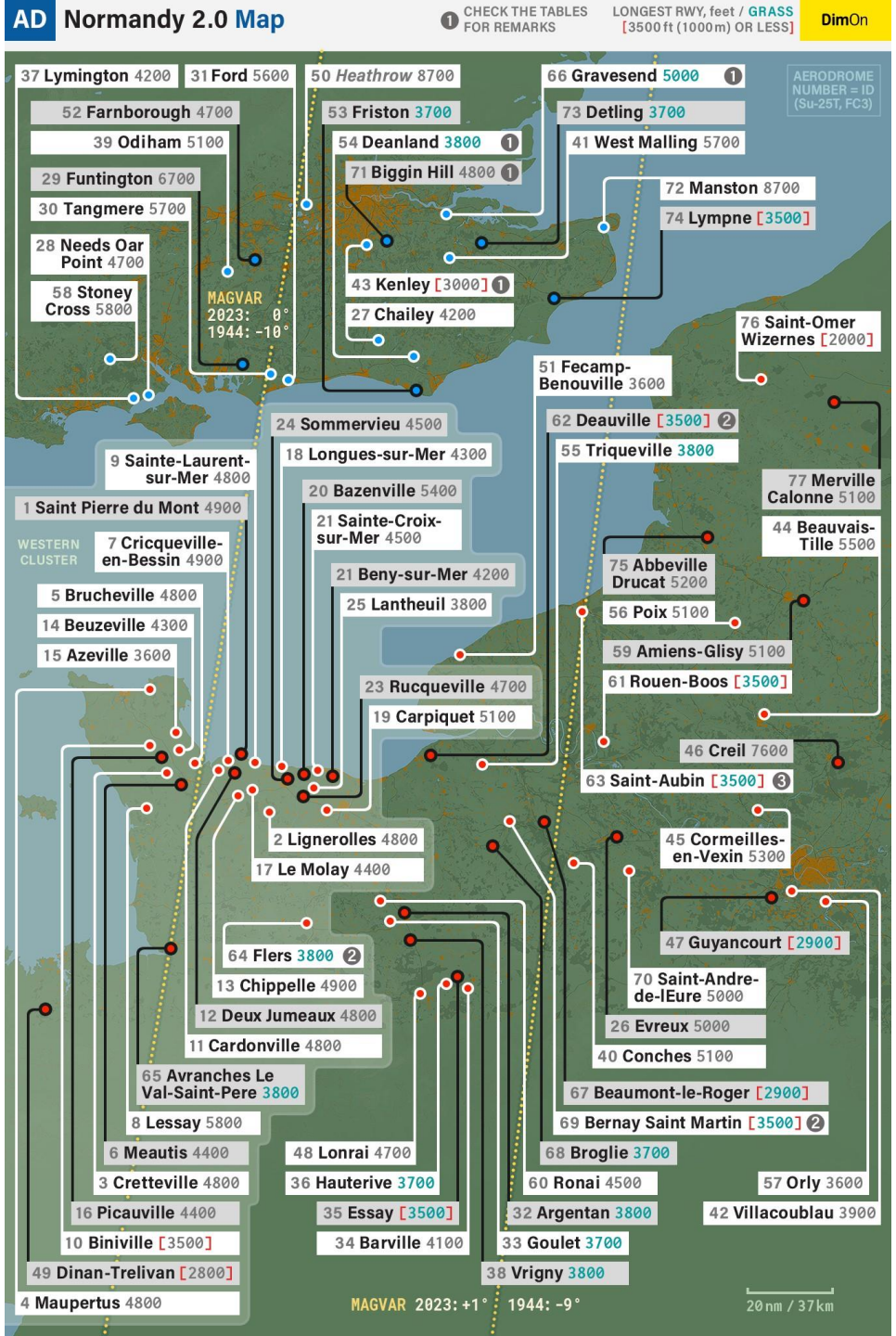
IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH



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

AIRPORT DATA NORMANDY 1944

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



AIRPORT DATA ENGLISH CHANNEL 1944

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

AD The Channel

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

DimOn

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

IMPROPERLY NAMED RUNWAYS ARE IN STRIKETHROUGH

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

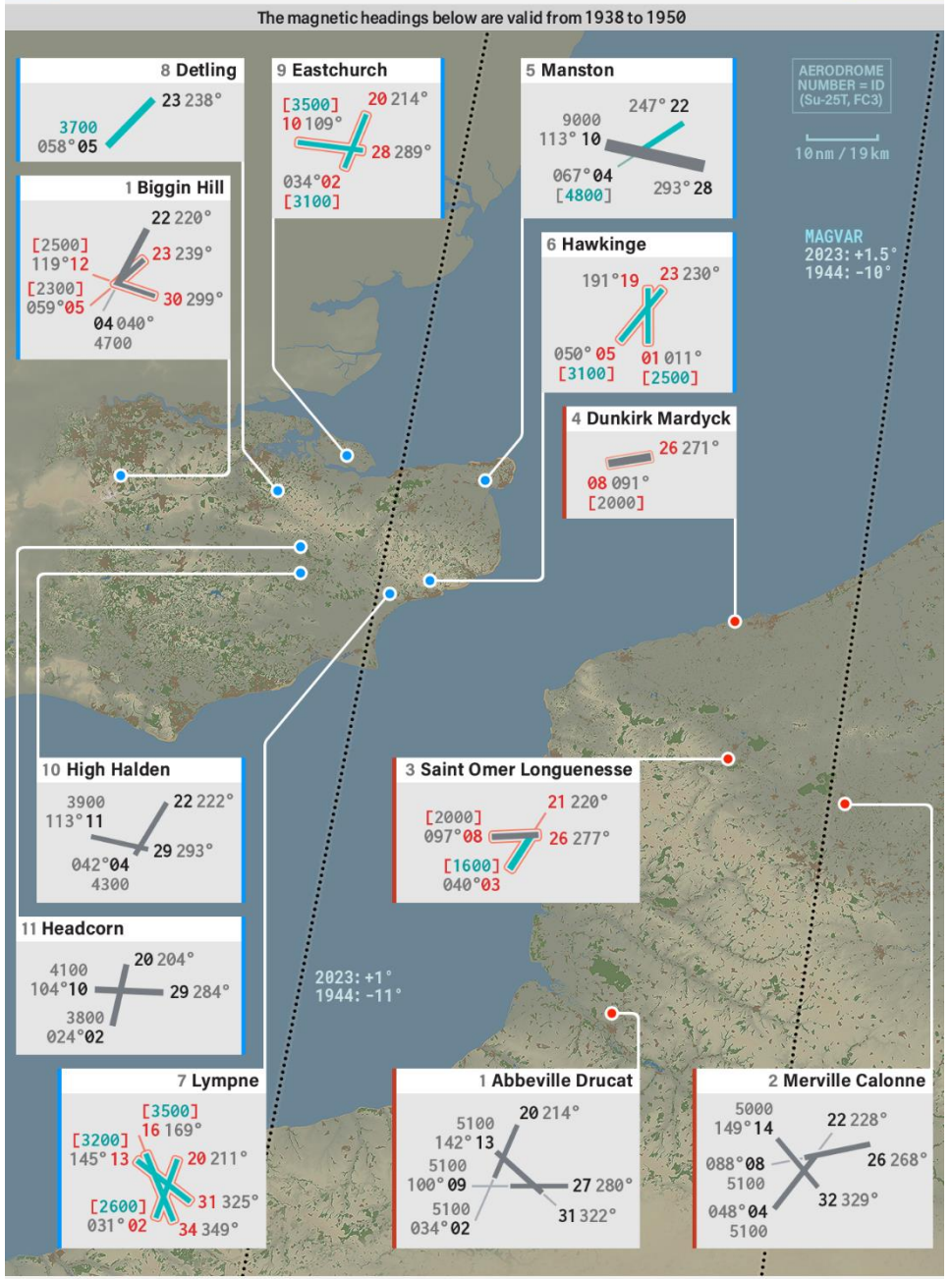
1951–1954 −1° 1955–1961 −2° 1962–1967 −3° 1968–1972 −4° 1973–1979 −5° 1980–1987 −6°
1988–1995 −7° 1996–2001 −8° 2002–2009 −9° 2010–2015 −10° 2016–2021 −11° 2022–2026 −12°

AD The Channel Map

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

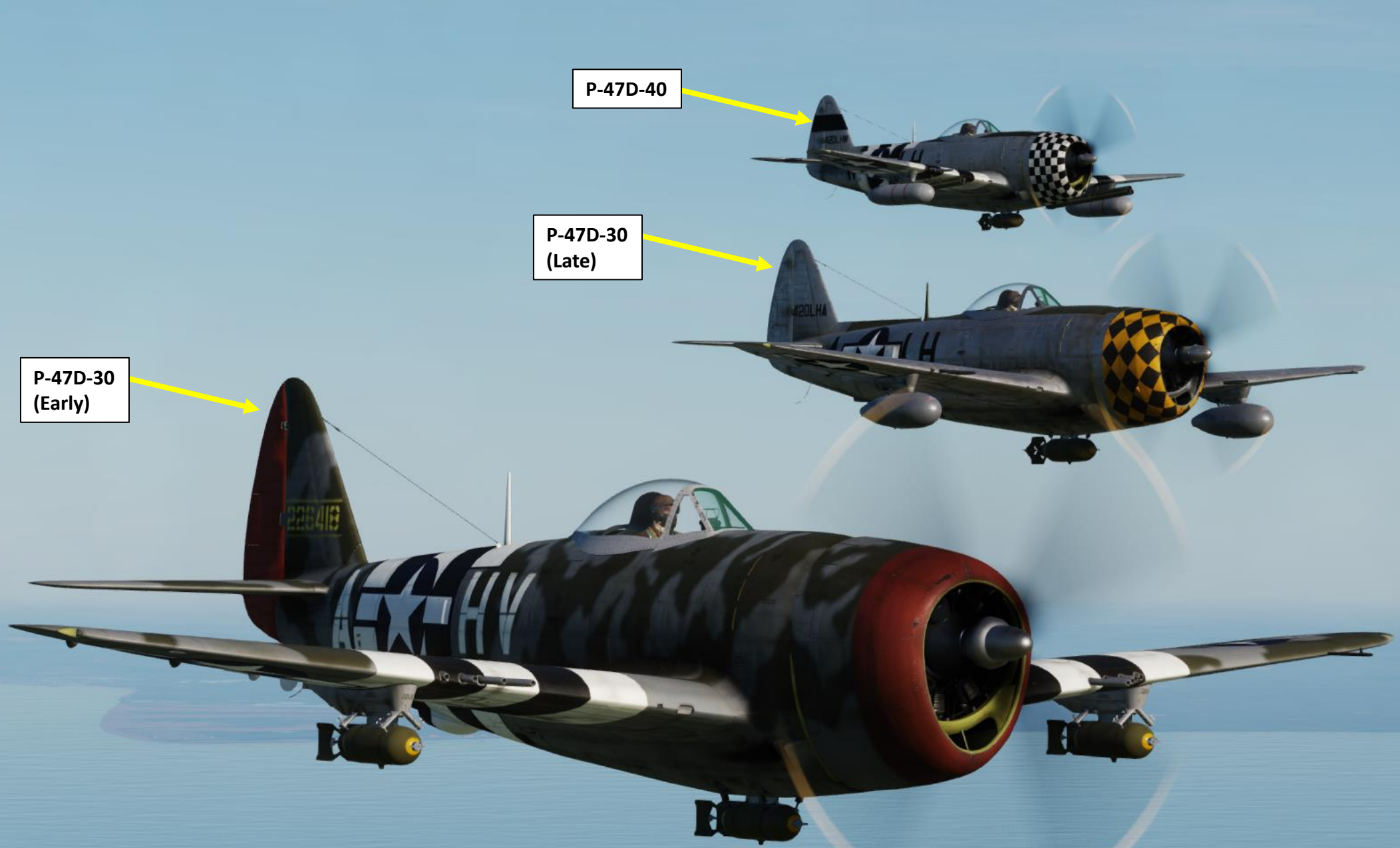
DimOn

The magnetic headings below are valid from 1938 to 1950



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

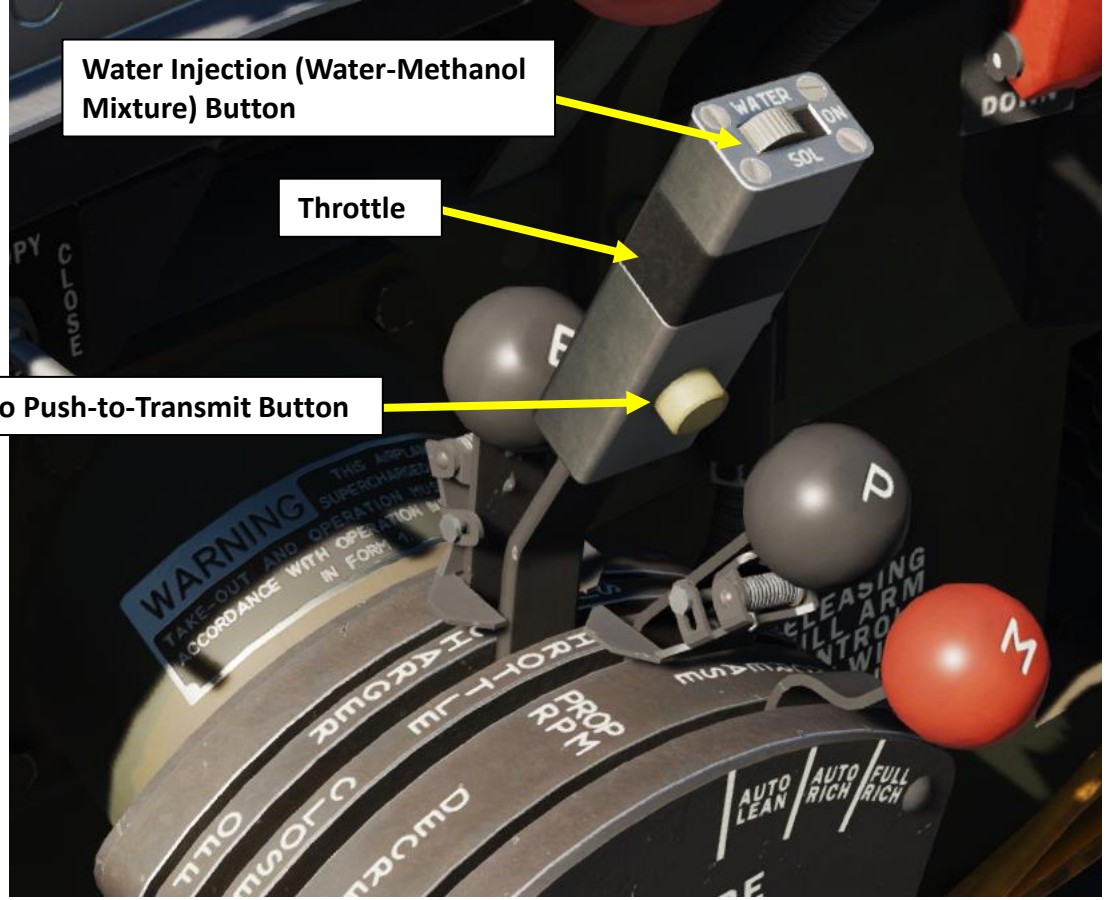
1951–1954 −1° 1955–1961 −2° 1962–1967 −3° 1968–1972 −4° 1973–1979 −5° 1980–1987 −6°
1988–1995 −7° 1996–2001 −8° 2002–2009 −9° 2010–2015 −10° 2016–2021 −11° 2022–2026 −12°

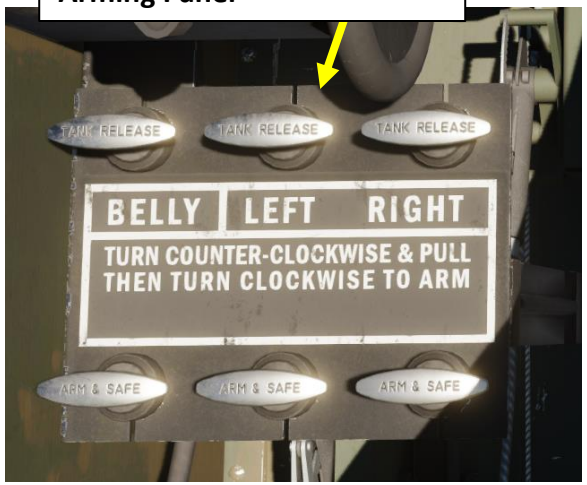

P-47D-40
P-47D-30 (Late)
P-47D-30 (Early)

P-47D-30 EARLY SERIES

The P-47D-30 Early Series has some specific modifications, such as:

- Square-shaped throttle
- Mark VIII Gunsight
- Old Bomb Releasing mechanism
- No dorsal fin
- No Weapon Release Button on the stick

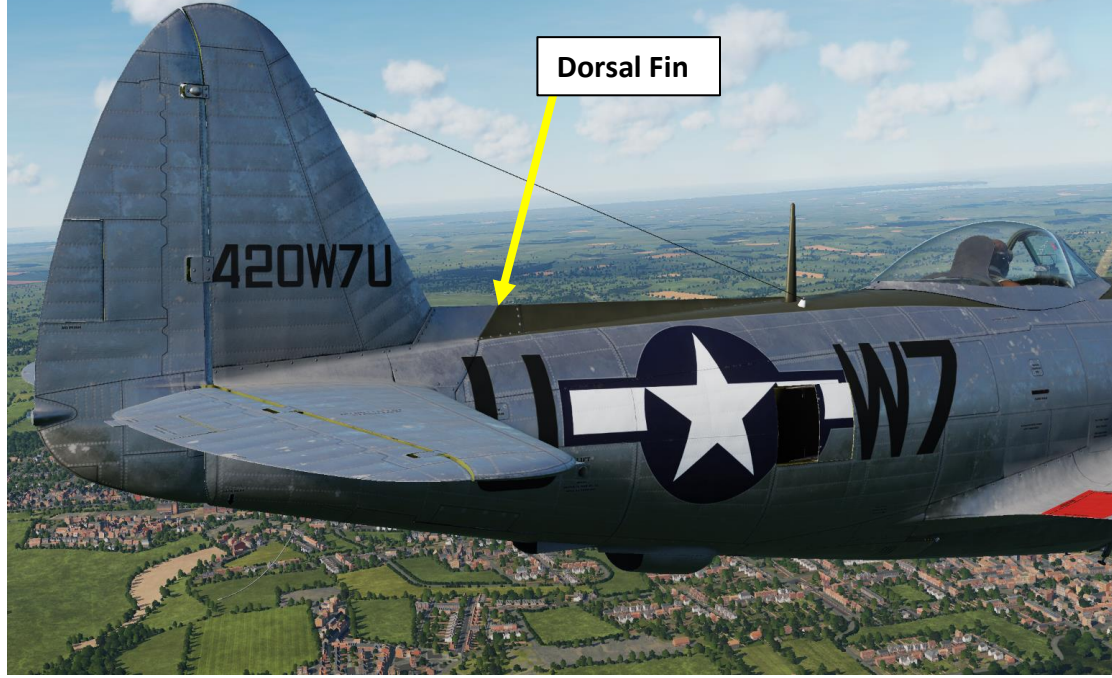


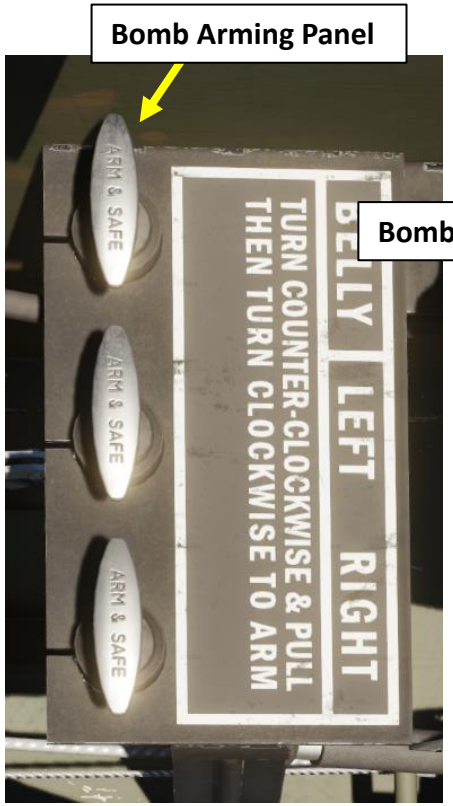


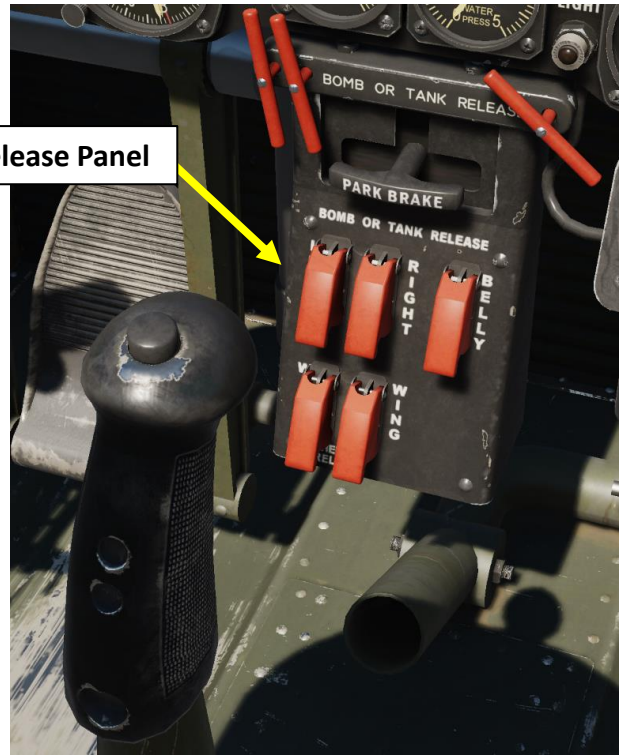
P-47D-30 LATE SERIES

The P-47D-30 Late Series has some specific modifications, such as:

- Modern rounded throttle
- K-14 Gyro Gunsight
- Modern Bomb release panel
- Dorsal Fin: provides an improvement to directional stability since the turbulence behind the bubble canopy caused directional control problems at certain speeds



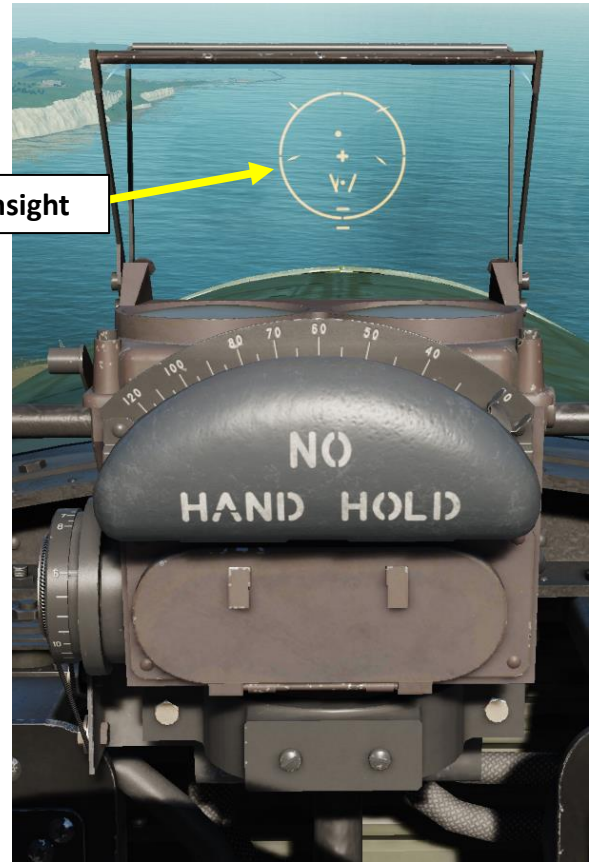


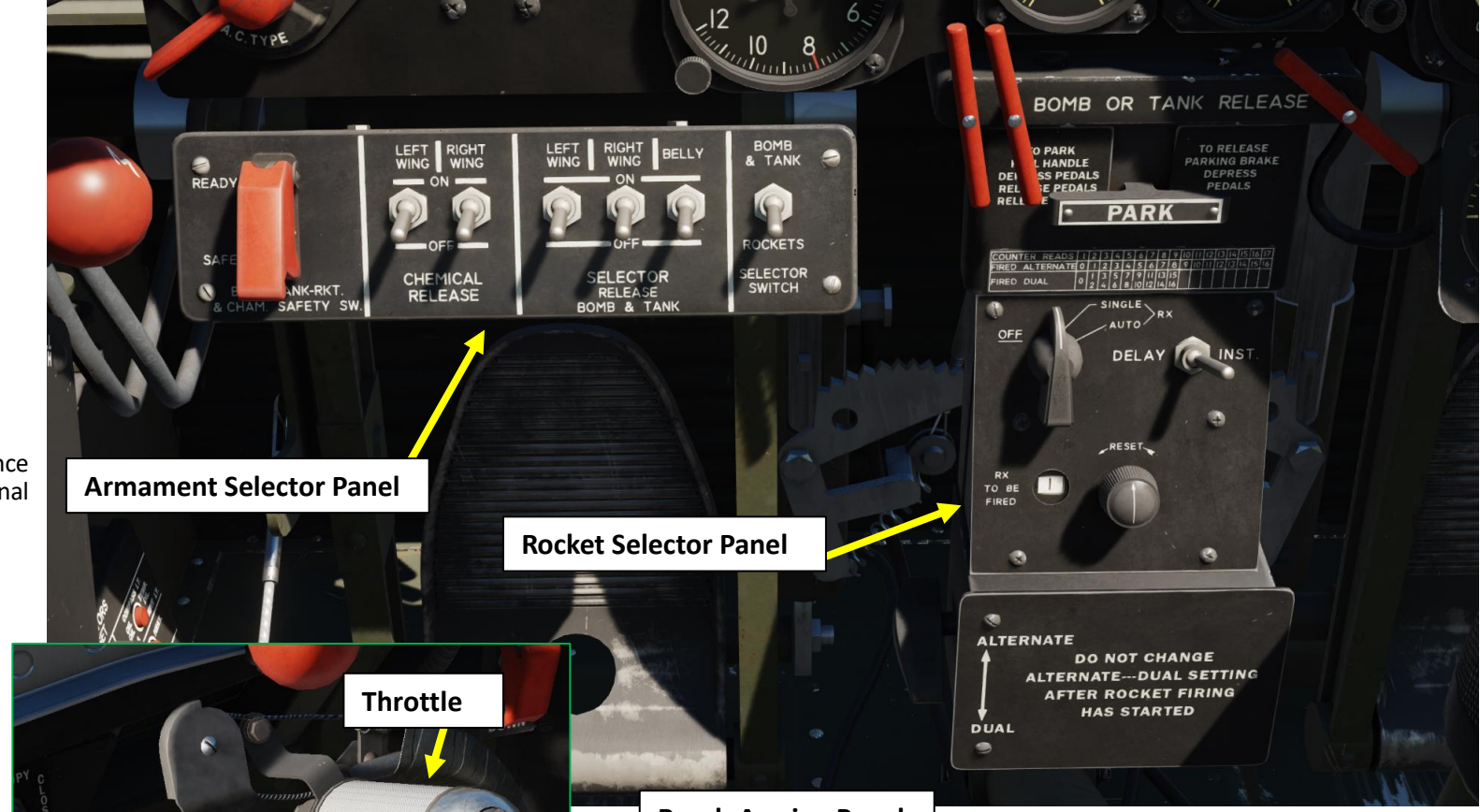


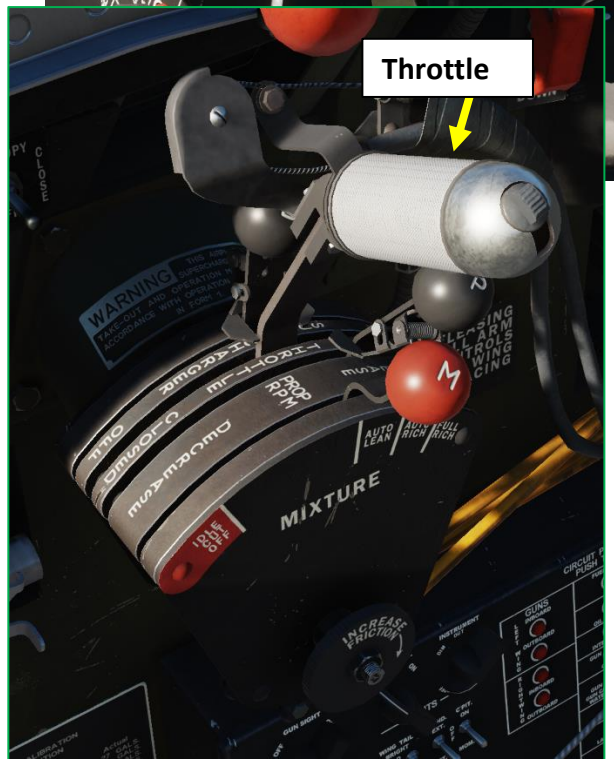
P-47D-40 SERIES

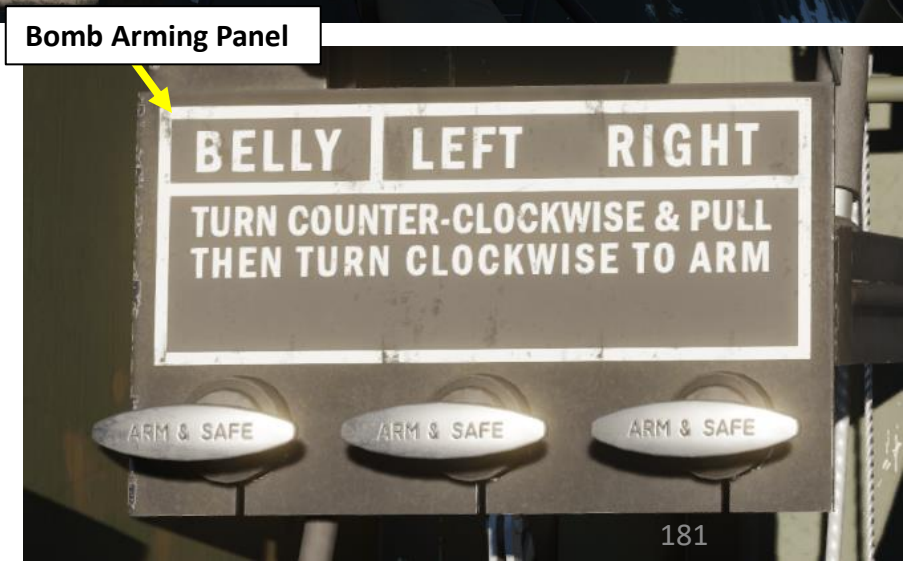
The P-47D-40 Series has some specific modifications, such as:

- Modern rounded throttle
- K-14 Gyro Gunsight
- Rockets (M-8 “Bazooka” and HVAR types)
- Armament Selector panel
- Rocket Selector panel
- Dorsal Fin: provides an improvement to directional stability since the turbulence behind the bubble canopy caused directional control problems at certain speeds









As with all warbirds, dogfighting in P-47 Thunderbolt is an art that is easy to learn, but very difficult to master.

The Thunderbolt was built to be a long-range escort fighter, which meant it had to be able to operate at high altitudes. It may sound counter-intuitive when you look at how heavy the plane is, but the turbosupercharger of the Double Wasp made the P-47 very effective above 20,000 ft. The mantra of a good P-47 pilot should be to gain as much altitude as possible as quickly as he can using the "best climb speed" (V_y), which is roughly 160 mph. Every thousand feet you gain is potential energy that you can later convert into speed when diving, which is the way Thunderbolt aces flew the plane.

Therefore, the Thunderbolt is best used at altitudes of 20,000 ft and higher. This is where it will have the greatest performance advantage over the Bf.109 and the FW190. However, most dogfights occurring in multiplayer servers happen at lower altitudes between 5,000 and 15,000 ft, which is where the Messerschmitts and Focke-Wulfs will dominate in terms of climb rate and diving speed. This partially explains why the P-47 can sometimes seem "worse" in most aspects than other fighters at low altitude: it was meant to be a high-altitude fighter. If you happen to be forced to fight on the 109's terms down low, you are at a serious disadvantage from the very beginning. When you are forced to fight at medium to low altitudes, it is better to stay high and perform controlled dives and avoid getting tangled up in prolonged turning fights. I cannot put enough emphasis on the "**fly-with-a-wingman**" advice listed below; the best way to operate is like a pack of wolves.

During dogfights, I would advise you to keep your energy state (airspeed and altitude) high at all times. These principles apply to every single aircraft, but particularly to the P-47 since it has such trouble climbing due to its weight. Do keep in mind that the P-47 can turn very well at high speeds. Just make sure you don't over-G in the process.

The P-47D must be used in the following way if you want to survive against experienced Bf.109 or FW.190 pilots.

- Always fly with a wingman
- Always fly with a high energy state (high airspeed and altitude)
- Do not attempt to outclimb a 109 or 190
- Bring the fight to high altitudes if you can to fly your plane in the combat environment it was designed for
- Master your aircraft: know your engine limits and airspeed limits by heart and practice manoeuvers to avoid stalls and spins.

Here is an insightful P-47 dogfight debrief that expands on do's and do-not-do's:
https://youtu.be/pTv5VsH5TvU

PART 13 – AIR COMBAT

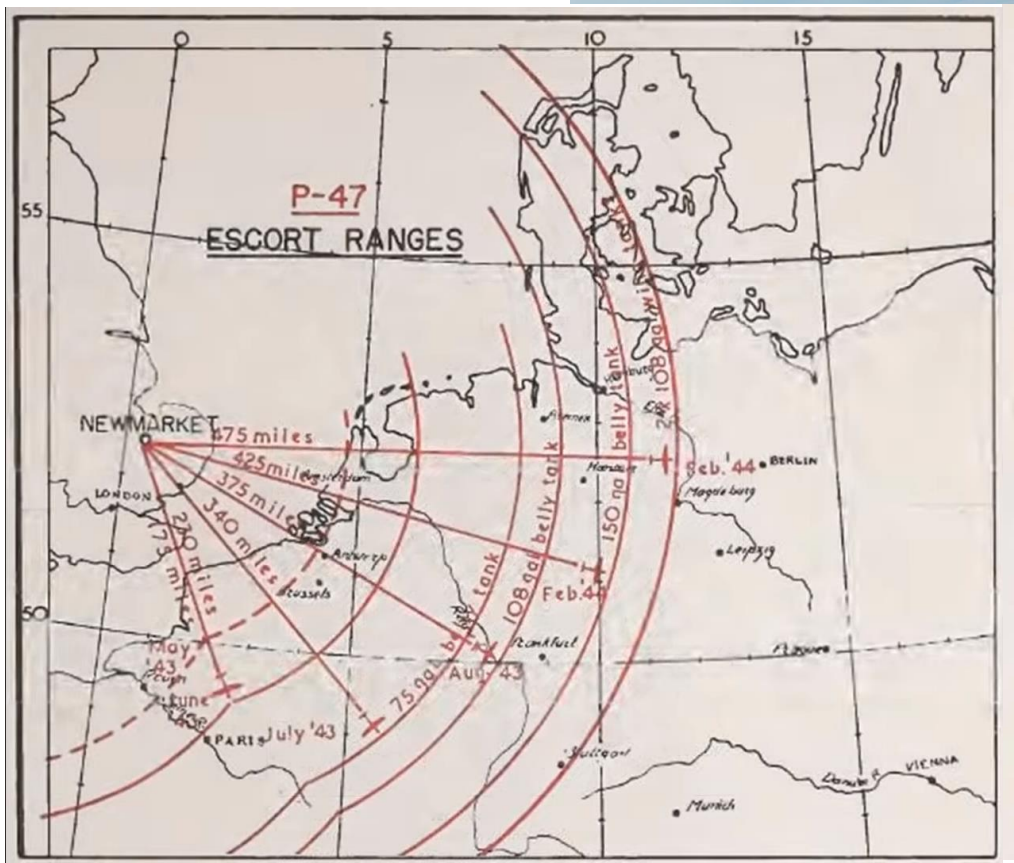
The P-47 has a number of advantages that make it an aircraft that is very capable. Its bubble canopy provides exceptional visibility and the eight 0.50 cal machineguns offers a superb gunnery platform. The aircraft's sturdy airframe and engine can also take more punishment than other planes like the Mustang or Spitfire. Read up on Robert Johnson's account of the 100+ bullet holes he counted on his P-47 after a sortie… it's a riveting tale.

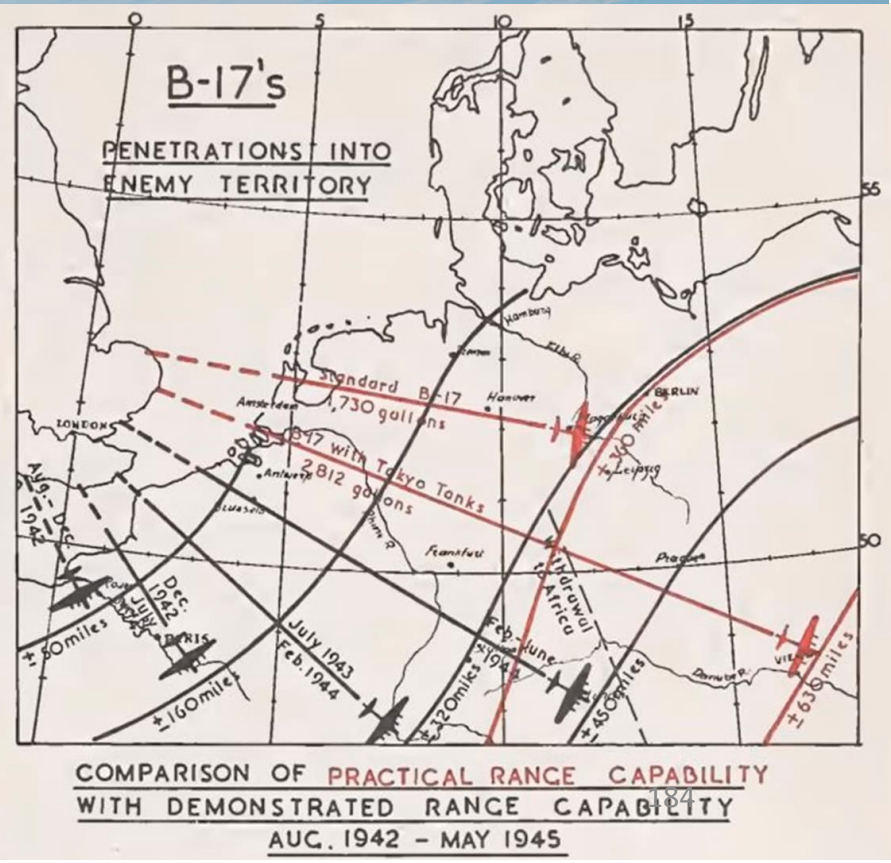
I also suggest you check out Greg's Airplanes and Automobiles P-47 Thunderbolt Series:

- *Part 1 – Design & Speed*
  https://youtu.be/mzQuq2FHdeE?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh
- *Part 1A – Throttle & Boost Lever Use*
  https://youtu.be/HHtypRJuNKY?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh
- *Part 2 – Dive Speeds & Mach Number*
  https://youtu.be/wwP6qv8jOhI?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh
- *Part 3 – Armor & Protection*
  https://youtu.be/aCNt3J65UqE?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh
- *Part 4 – Climb Rate*
  https://youtu.be/UHUmWTnBuhU?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh
- *Part 5 – Maneuverability*
  https://youtu.be/KahHLtYlveQ?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh
- *Part 6 – Range, Deceit & Treachery*
  https://youtu.be/aCLa078v69k?list=PLD2EcpzcvT-tvemNaIYUfZfV3s8K8Gbgh

While the popular image of the P-47 was that it was relegated to a air-to-ground support role, it was very much capable of doing proper bomber escort. The 56th fighter group, together with the squadrons of the 4th group, formed the core of the VIII Fighter Command of the 8th Air Army based in the United Kingdom. The main task that the Thunderbolt pilots were to undertake was to escort heavy bombers groups on their raids on Germany. The Jug's "short legs" or insufficient operational range limited tactical use of the P-47s. Thunderbolts in the field underwent significant field modification in order to accommodate additional external fuel tanks.

The situation changed only in 1944, when the P-47D-25 modification was released; on this variant it was made possible to mount 760-liter external fuel tanks for increased range. Initially, these huge tanks were intended solely for use in ferry flights, but the military's situation forced the pilots to fly with these "fuel barrels" into the enemy's rear lines to escort day bombers. The problem was that these tanks did not have a boost system, which limited their use at high altitudes, and so, effectively, only half of the fuel in these tanks were consumed in flight.





COMPARISON OF PRACTICAL RANGE CAPABILITY WITH DEMONSTRATED RANGE CAPABILITY AUG. 1942 – MAY 1945

Following the end of the Battle of Britain, RAF Fighter Command moved from defensive to offensive operations where they would engage German fighters on the other side of the Channel; the operational instructions were ready by December 1940.

There would be two types of offensive operation:

- "**Rhubarb**" (initially called Mosquito) in which small patrols would cross under cover of cloudy conditions and engage any aircraft they found and on clear weather days
- "**Circus**" which would send several squadrons - possibly with a few bombers - in sweeps of northern France. Circus came to mean an operation with bombers.

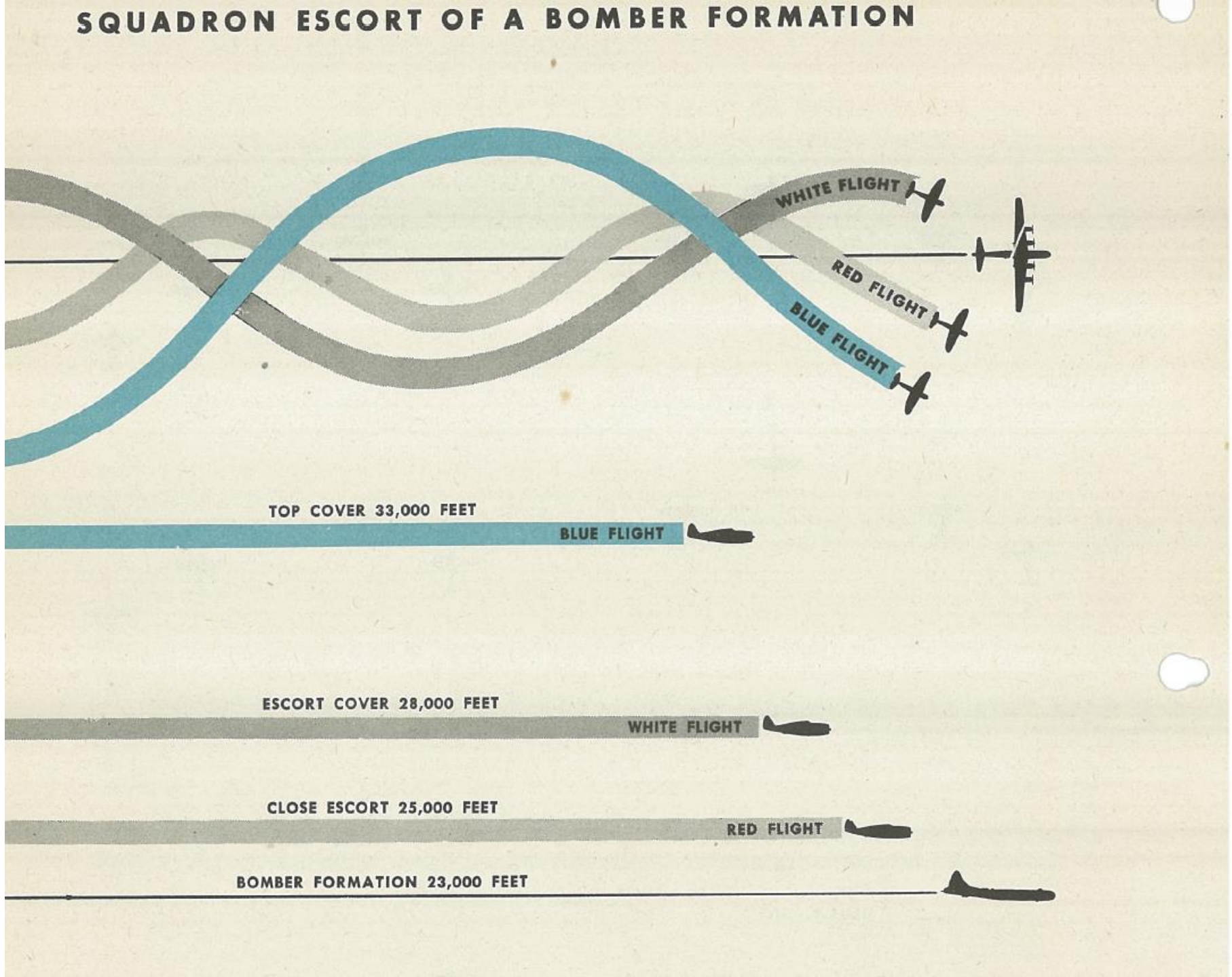
Rhubarb patrols began in December 1940; while the pilots were allowed to attack ground targets if any presented itself their primary objective was to bring down German aircraft. By mid-June 1941, Fighter Command had flown 149 Rhubarb patrols (336 sorties) claiming seven enemy aircraft brought down for loss of eight pilots on the British side. Circus operations with bombers began in January and eleven had been carried out by June, the targets including docks on the French coast and airfields. More than forty sweeps without bombers had been made in the same period.

While Fighter Command's priority was the German fighters, Bomber Command concentrated on destroying the ground targets. At higher level in the RAF it was felt that the effects on the war by damage that could be inflicted by the bombers would be minimal; the commanders of Bomber and Fighter Commands held a conference that agreed that the **purpose of a Circus was to force German fighters into combat in circumstances that favoured the British and to that end the bombers had to do enough damage that the Luftwaffe could not ignore the attacks**.

The P-47 participated in a significant number of "**Ramrod**" operations, which were similar to Circus but with destroying a target being the principal aim. I suggest you try out some escort missions if you want to experience a very different way to fly in the P-47.

Here is an interesting clip of a Ramrod operation to Emden in 1943:
https://youtu.be/WiU8EbpYd2o

SQUADRON ESCORT OF A BOMBER FORMATION



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

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

TAMING TAILDRAGGERS

Essay by Chief Instructor (CFI)

PART 1

Why taildraggers are tricky and how to overcome it

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

As a significant number of pilots here are expressing difficulties with tailwheel handling,

THANK YOU TO ALL MY PATRONS

Creating these guides is no easy task, and I would like to take the time to properly thank every single one of my Patreon supporters. The following people have donated a very generous amount to help me keep supporting existing guides and work on new projects as well:

- ChazFlyz

P-47D THUNDERBOLT

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F/A-18C: EA
Fw 190 A-8: EA
I-16: beta
JF-17: EA

Version: 2.5.6.50979