



DCS GUIDE **P-51D MUSTANG**

By Chuck

LAST UPDATED: 3/02/2021

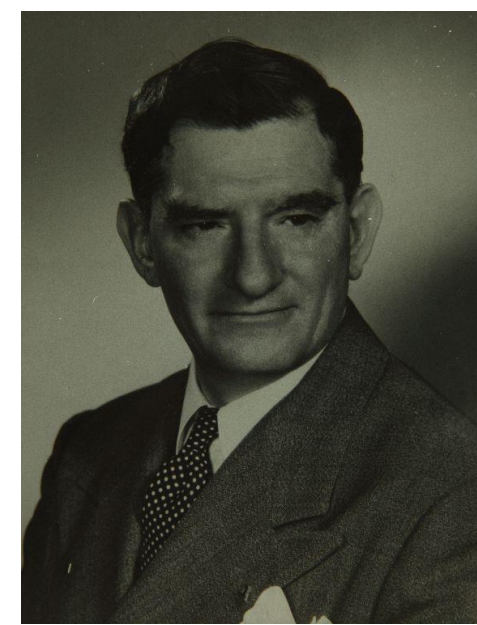
TABLE OF CONTENTS

- PART 1 – INTRODUCTION
- PART 2 – CONTROLS SETUP
- PART 3 – COCKPIT & GAUGES
- PART 4 – START-UP PROCEDURE
- PART 5 – TAKEOFF
- PART 6 – LANDING
- PART 7 – ENGINE & FUEL MANAGEMENT
- PART 8 – AIRCRAFT LIMITATIONS
- PART 9 – WEAPONS
- PART 10 – RADIO
- PART 11 – NAVIGATION
- PART 12 – AIRCRAFT VARIANTS
- PART 13 – TACTICS & AIR COMBAT
- PART 14 – TAMING TAILDRAGGERS



The **North American Mustang** is an American long-range, single-seat fighter and fighter-bomber used during World War II, the Korean War and other conflicts. The P-51 was the first aircraft of the war to be built entirely on the basis of combat experience. The Mustang was designed in 1940 by North American Aviation (NAA) in response to a requirement of the British Purchasing Commission. The Purchasing Commission approached North American Aviation to build Curtiss P-40 fighters under license for the Royal Air Force (RAF). Rather than build an old design from another company, North American Aviation proposed the design and production of a more modern fighter. The P-51 Mustang was a solution to the need for an effective bomber escort. It used a common, reliable engine and had internal space for a huge fuel load. With external fuel tanks, it could accompany the bombers from England to Germany and back.

The Mustang, which was designed by a team led by lead engineer Edgar Schmued, followed the best conventional practice of the era, but included several new features. One was a wing designed using laminar flow airfoils which were developed co-operatively by North American Aviation and the National Advisory Committee for Aeronautics (NACA). These airfoils generated very low drag at high speeds. During the development of the NA-73X, a wind tunnel test of two wings, one using NACA 5-digit airfoils and the other using the new NAA/NACA 45–100 airfoils, was performed in the University of Washington Kirsten Wind Tunnel. The results of this test showed the superiority of the wing designed with the NAA/NACA 45–100 airfoils.



Edgar O. Schmued
(1899-1985)

The Mustang was originally designed to use the Allison V-1710 engine, which, in its earlier variants, had limited high-altitude performance. The first operational Mustangs were delivered to the Royal Air Force (RAF) in October of 1941 as Mustang Mark-I's. These aircraft saw their initial action in the summer of 1942. Armed with two .50 caliber and four .30 caliber machine guns and limited in high altitude performance, they were used primarily for reconnaissance and 'rhubarb' missions – for zooming in at low altitudes and strafing trains, troops, and enemy installations. The addition of the Rolls-Royce Merlin to the P-51B/C model transformed the Mustang's performance at altitudes above 15,000 ft, allowing the aircraft to compete with Luftwaffe's fighters.

The definitive version, the P-51D, was powered by the Packard V-1650-7, a license-built version of the Rolls-Royce Merlin 66 two-stage two-speed supercharged engine, and was armed with six .50 caliber (12.7 mm) M2 Browning machine guns. The Packard engine delivers approximately 1490 horsepower at sea level. It has a critical altitude of approximately 14,000 feet in low blower supercharger mode and a critical altitude of approximately 27,000 feet in high blower mode. The maximum altitude is approximately 40,000 feet. The supercharger ratios are approximately 6 to 1 in low blower mode and 8 to 1 in high blower mode.

The P-51D version of the Mustang retained all of the great features of its predecessor, with important added improvements. Chief among these are the increased visibility for the pilot in a new "bubble" canopy, more convenient cockpit arrangement, and heavier firepower. The 'D' also featured a new dorsal fin to improve directional stability problems encountered when the rear fuselage area of the previous models was reduced to increase rear visibility from the cockpit. The fuselage is a semi-monocoque, all-metal structure. The all-metal wings are built in two halves which are joined at the aircraft center line and are of full cantilever structure. The airfoil is of laminar-flow design, which provides low drag even at high speed. The tail section is metal with fabric-covered elevator and rudder control surfaces. The aircraft is flush-riveted throughout – another factor contributing to its great speed. Two fuel tanks with a total capacity of 184 U.S. gallons are located inside the wing and an additional 85 gallon fuselage fuel tank is located aft of the cockpit.



From late 1943, P-51Bs and P-51Cs (supplemented by P-51Ds from mid-1944) were used by the USAAF's Eighth Air Force to escort bombers in raids over Germany, while the RAF's Second Tactical Air Force and the USAAF's Ninth Air Force used the Merlin-powered Mustangs as fighter-bombers, roles in which the Mustang helped ensure Allied air superiority in 1944. The P-51 was also used by Allied air forces in the North African, Mediterranean, Italian and Pacific theaters.

Becoming the definitive model of the Mustang during World War II, over 8,000 P-51D airframes were produced. As the war drew to a close, P-51s were active not only in the European theatre, but also in the Mediterranean and in the Far East, where, like in Europe, the aircraft's long range and superior performance made it the ideal escort for bombers running missions into the heart of Japan.



The Mustang has been flown by many renowned squadrons throughout the war. One of the most famous ones became known as the "Red Tails" of the 332nd Fighter Group. These "Tuskegee Airmen" were not only the first African-American military aviators in the United States, but were also considered to be some of the best pilots in the U.S. Army Air Forces due to a combination of pre-war experience and the personal drive of those accepted for training. During World War II, black Americans in many U.S. states were still subject to the Jim Crow laws and the American military was racially segregated, as was much of the federal government, which made the candidates for the Tuskegee Experiment subject to discrimination, both within and outside the army... despite their stellar track record at escorting bombers over Europe.

In air combat, the top-scoring P-51 units (both of which exclusively flew Mustangs) were the 357th Fighter Group of the 8th Air Force with 565 air-to-air combat victories and the 9th Air Force's 354th Fighter Group with 664, which made it one of the top-scoring fighter groups. The top Mustang ace was the USAAF's George E. "Ratsy" Preddy Jr, whose final tally stood at 26.83 victories (a number that includes shared one half- and one third victory credits), 23 of which were scored with the P-51. Preddy was shot down and killed by friendly fire on Christmas Day 1944 during the Battle of the Bulge.



Top P-51 Mustang Ace
Major George E. Preddy Jr.



Tuskegee Airmen

For me, flying the DCS Mustang was love at first sight. I crashed it so many times, seized countless engines, entered too many nasty spins... yet the Mustang truly is the Cadillac of the skies. Its cockpit is well laid out, and proper training will make it a real joy to fly. I learned so much about taildraggers with the Mustang, I cannot recommend this aircraft enough if you are interested in the second world war in the slightest.

The versatility of the P-51 will bring you hundreds of hours of different kinds of missions. Hopefully, you will enjoy it as much as I did since 2012.



WHAT YOU NEED MAPPED

War Emergency Power
(hidden grey button on right hand side)

Weapon Release Button

Gun Fire Trigger
(Machineguns)

- ↑ Radiator Coolant Open
- Radiator Coolant Close
- ↶ Radiator Coolant Auto

- ↑ Trim Elevator DOWN
- Trim Rudder RIGHT
- ↓ Trim Elevator UP
- ← Trim Rudder LEFT

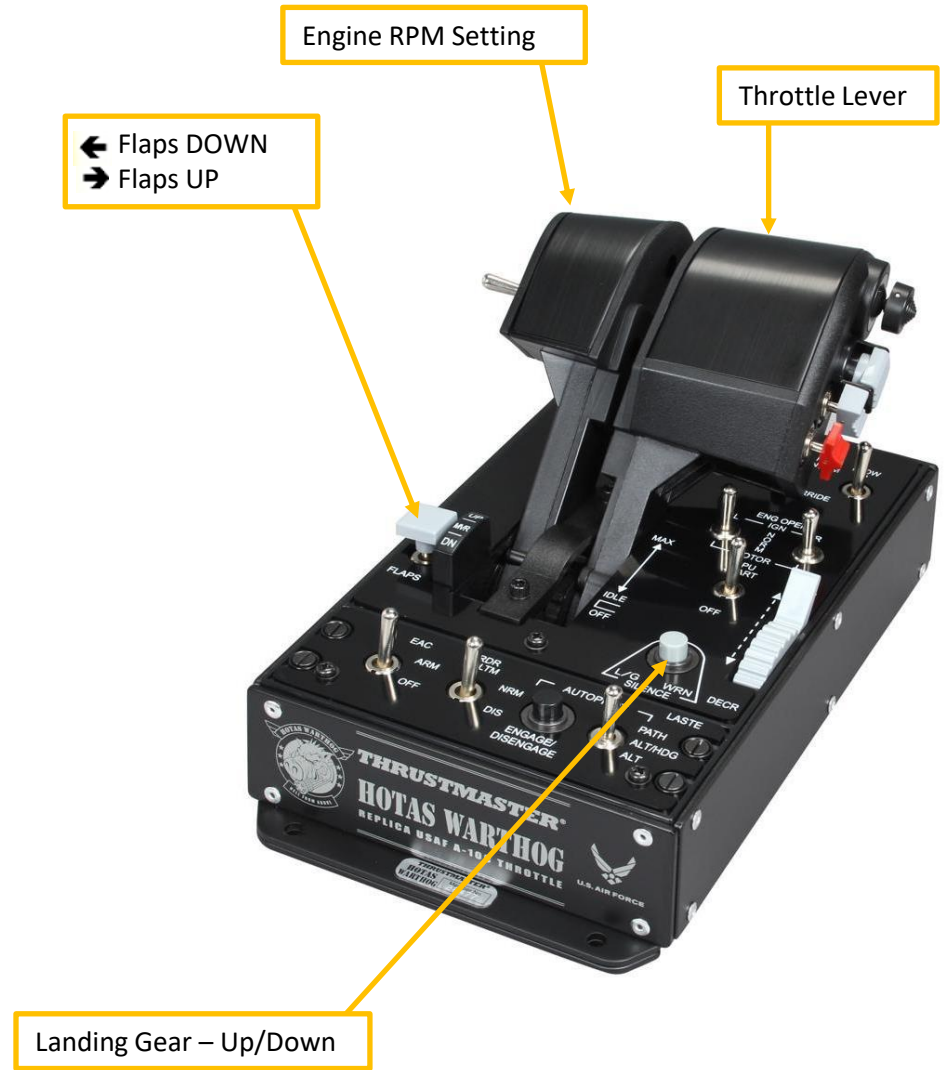
- ↑ Zoom In Slow
- Zoom Out Slow
- ↓
- ←

- ↑ Gunsight Range to Target Decrease
- Gunsight Target Span Decrease
- ↓ Gunsight Range to Target Increase
- ← Gunsight Target Span Increase



+ TOE BRAKES (MAPPED ON PEDALS)

WHAT YOU NEED MAPPED



OPTIONS

SYSTEM **CONTROLS** GAMEPLAY AUDIO MISC. SPECIAL VR

P-51D Sim Axis Commands Reset category to default Clear category Save profile as Load profile

Action	Category	Keyboard	Saitek Pro Flight Co...	Joystick - HOTAS Wa...	Throttle - HOTAS W...	M
Cold Air Control						
Engine RPM Setting					JOY_RZ	
Flaps						
K-14 Brightness						
K-14 Range to target						
K-14 Target span						
Left Fluorescent Light						
Pitch						
Propeller & Mixture Lock						
Right Fluorescent Light						
Roll						
Rudder					JOY_RZ	
Tail Warning Radar Light Brightness						
TDC Slew Horizontal (mouse)						
TDC Slew Vertical (mouse)						
Throttle						
Throttle Control Lock						
Trim Aileron						
Trim Elevator						
Trim Rudder						
VHF Radio Volume						
Warm Air Control						
Wheel Brake						
Wheel Brake Left					JOY_X	
Wheel Brake Right					JOY_Y	

Modifiers Add Clear Default **Axis Assign** Axis Tune FF Tune Make HTML

CANCEL OK

Annotations:

- To assign axis, click on "Axis Assign". You can also select "Axis Commands" in the upper scrolling menu.
- To modify curves and sensitivities of axes, click on the axis you want to modify and then click "Axis Tune".

Bind the following axes:

- Pitch, Roll, Rudder (Deadzone at 0, Saturation X at 100, Saturation Y at 100, Curvature at 0)
- Engine RPM Setting – Controls RPM
- Throttle – Controls Manifold Pressure
- Wheel Brake Left
- Wheel Brake Right

AXIS TUNE PANEL

Deadzone: 0

Saturation X: 100

Saturation Y: 100

Curvature: 0

Slider
 Invert
 User Curve

Axis Tune: JOY_X

CANCEL RESET OK

OPTIONS

SYSTEM CONTROLS GAMEPLAY AUDIO MISC. SPECIAL VR

P-51D Sim Axis Commands Reset category to default Clear category Save profile as Load profile

Action	Category	Keyboard	Saitek Pro Flight Co...	Joystick - HOTAS Wa...	Throttle - HOTAS W...	M
Cold Air Control						
Engine RPM Setting					JOY_RZ	
Flaps						
K-14 Brightness						
K-14 Range to target						
K-14 Target span						
Left Fluorescent Light						
Pitch					JOY_Y	
Propeller & Mixture Lock						
Right Fluorescent Light						
Roll					JOY_X	
Rudder				JOY_RZ		
Tail Warning Radar Light Brightness						
TDC Slew Horizontal (mouse)						
TDC Slew Vertical (mouse)						
Throttle						JOY_Z
Throttle Control Lock						
Trim Aileron						
Trim Elevator						
Trim Rudder						
VHF Radio Volume						
Warm Air Control						
Wheel Brake						
Wheel Brake Left				JOY_X		
Wheel Brake Right				JOY_Y		

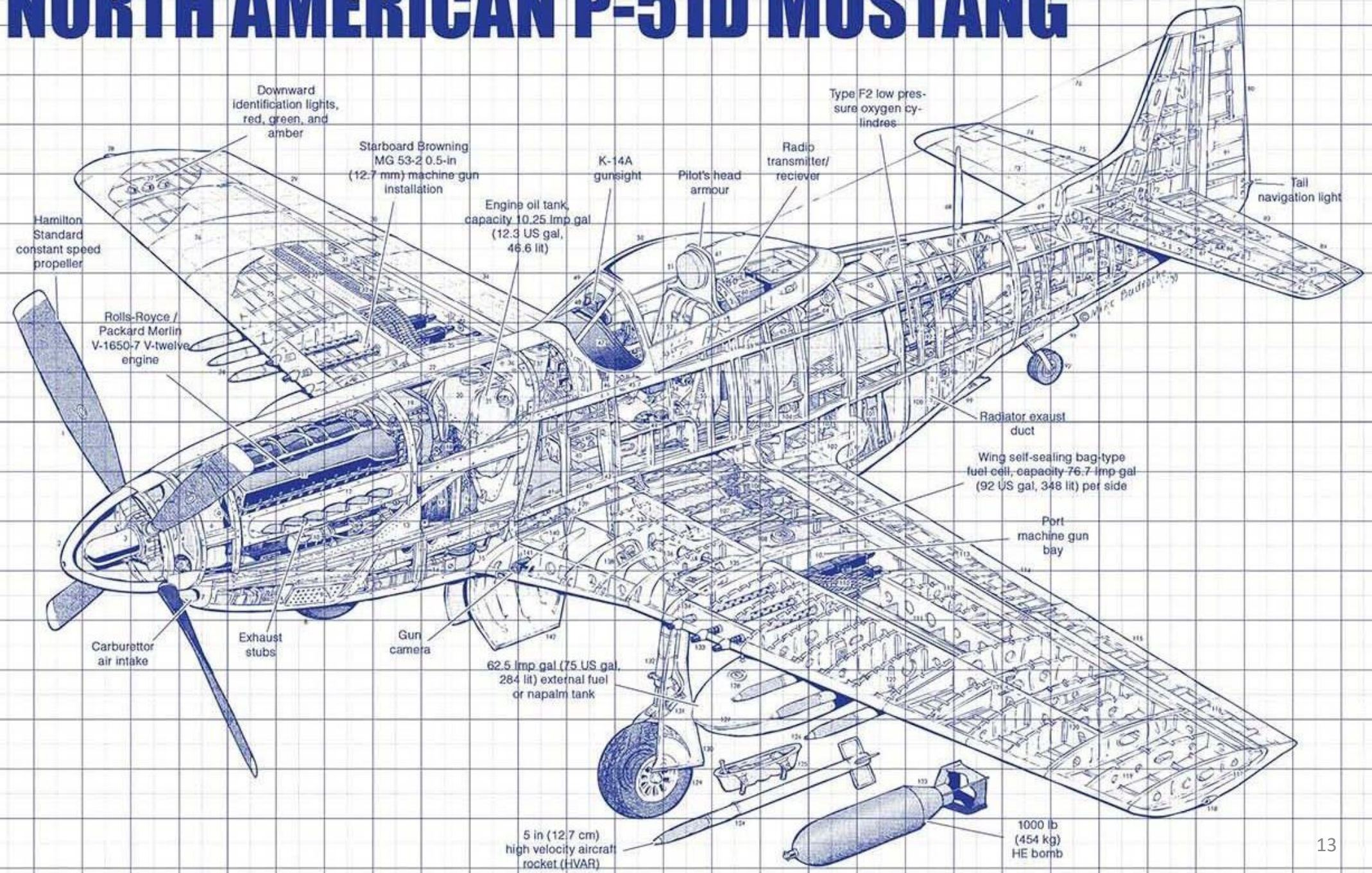
Modifiers Add Clear Default Axis Assign Axis Tune FF Tune Make HTML

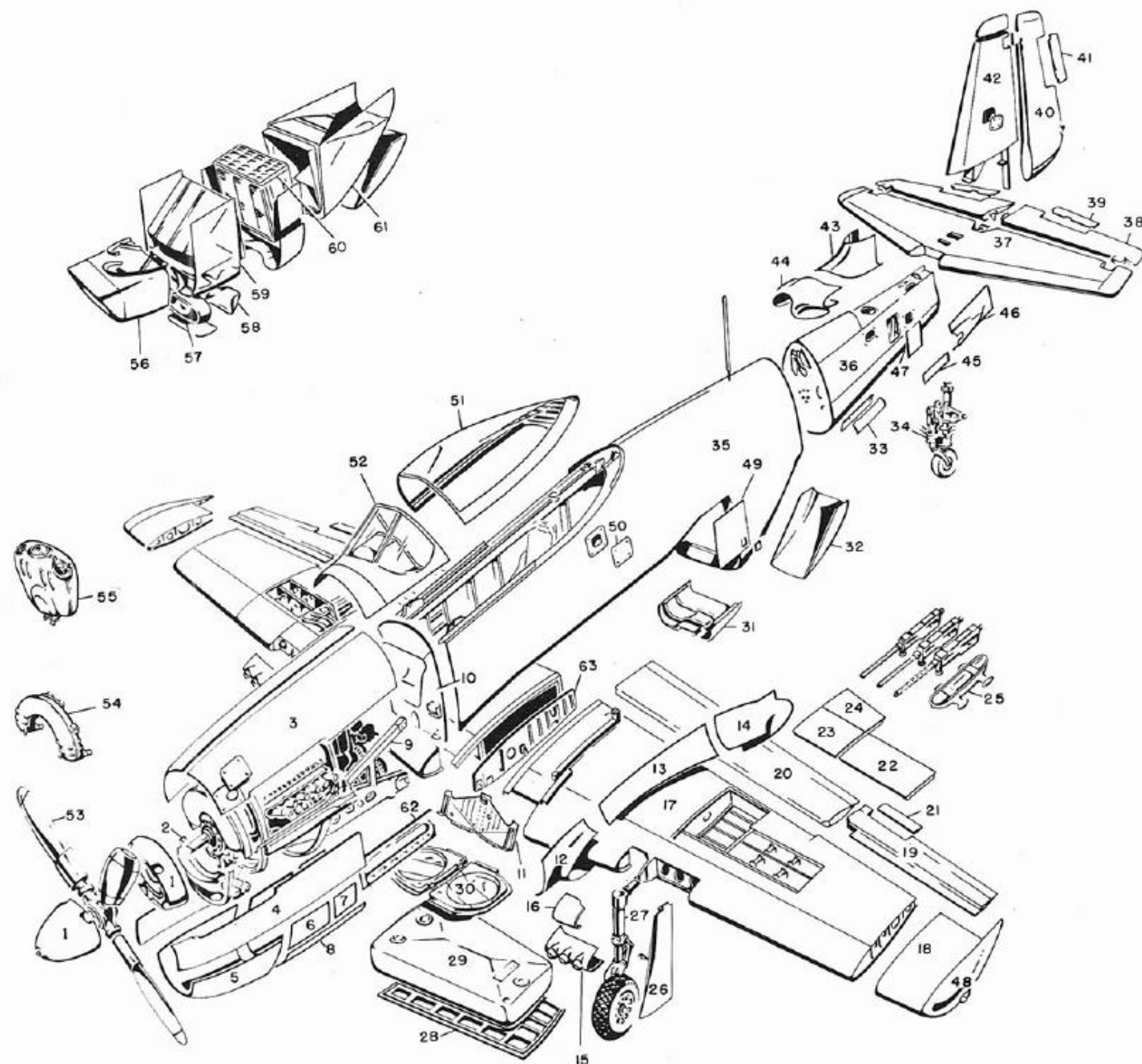
CANCEL OK

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



NORTH AMERICAN P-51D MUSTANG





- | | |
|-------------------------------------|--------------------------------|
| 1. Propeller Spinner | 6. Engine Bottom Cowl Center |
| 2. Engine Mount Front Flame | 7. Engine Bottom Cowl Rear |
| 3. Engine Top Cowling | 8. Engine Bottom Cowl Aft |
| 4. Engine Intermediate Cowling | 9. Engine Mount Assembly |
| 5. Engine Bottom Cowl Forward | 10. Firewall Assembly |
| 11. Wing Center Bulkhead | 38. Elevator |
| 12. Wing Fillet Forward | 39. Elevator Trim Tab |
| 13. Wing Fillet Intermediate | 40. Rudder |
| 14. Wing Fillet Rear | 41. Rudder Trim Tab |
| 15. Gun Nose Assembly | 42. Fin |
| 16. Landing Gear Access Door | 43. Fin Fillet Forward |
| 17. Outer Wing Panel | 44. Empennage Fillet, Forward |
| 18. Wing Tip Assembly Inner | 45. Empennage Fillet, Lower |
| 19. Aileron Assembly | 46. Stabilizer Fillet Rear |
| 20. Flap Assembly | 47. Cover Assembly |
| 21. Aileron Trim Tab Assembly | 48. Wing Tip Assembly Outer |
| 22. Ammunition Bay Door | 49. Cover Assembly |
| 23. Gun Bay Door Forward | 50. Cover Assembly |
| 24. Gun Bay Door Rear | 51. Canopy |
| 25. Wing Bomb Rack | 52. Windshield Assembly |
| 26. Strut Fairing | 53. Propeller Blade |
| 27. Landing Gear Strut | 54. Cool. Header Tank Complete |
| 28. Fuel Tank Door | 55. Oil Tank |
| 29. Fuel Cell | 56. Radiator Air Scoop Forward |
| 30. Wheel Fairing Door | 57. Oil Cooler |
| 31. Coolant Radiator Access Cover | 58. Oil Cooler Outlet Door |
| 32. Radiator Air Scoop Rear | 59. Radiator Air Duct Forward |
| 33. Tail Wheel Doors | 60. Radiator Assembly |
| 34. Tail Wheel Assembly | 61. Air Duct Aft |
| 35. Fuselage Assembly Front Covered | 62. Stack Fairing |
| 36. Fuselage Assembly Rear Covered | 63. Rib, Wing Center |
| 37. Horizontal Stabilizer | |



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





EMERG.
UNLOCKED
INDICATOR SHOWS.

THIS IS A MILITARY TYPE AIRCRAFT AND
UNDER THE CIVIL AIR REGULATIONS SHALL NOT
BE USED FOR THE CARRIAGE OF PASSENGERS
OR CARGO FOR COMPENSATION OR HIRE

PACKARD V 1650-7		ENGINE LIMITATIONS		FUEL: 100 OCT.	
TAKE OFF ONLY	RPM MP	COOLANT	OIL TEMP.	MAX	DESIRED
WAR EMERG. 5 MIN	3000 61	OIL PRESSURE	50	121	100-110
MILITARY 15 MIN	3000 61	OIL PRES. MIN. CR.	19	70-80	70-80
MAX. CONTINUOUS	2700 46	FUEL PRESSURE		90	70-80
CRUISE - MAX.	2400 36	TAKE OFF CONDITIONS			
		OIL TEMP. 15° C. MIN.	OIL PRES. 60# MIN.	COOLANT 60° C. MIN.	

U.S. ARMY
AIR
CORPS
TYPE
P-51D
SERIAL NO.
ORDER NO.
DATE ACCEPTED

Medical Pack



NIAPS-13
POWER SWITCH
TEST SWITCH
ON

OFF A B C D T REM

HOMING ADAPTER
AN/ARA-8

HOMING
COMM.
TRANS.

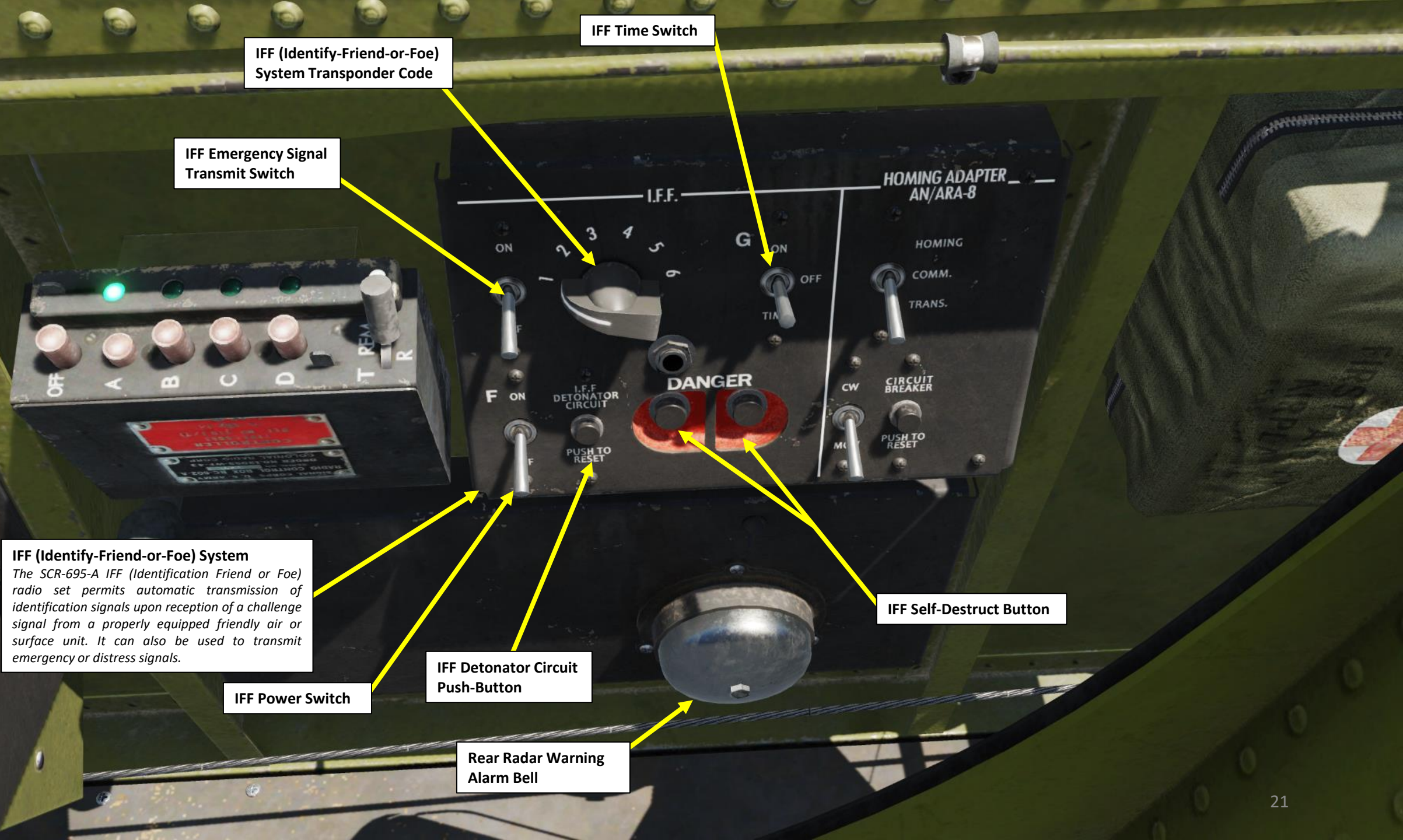
CW
MIC
CIRCUIT
BREAKER
PUSH TO
RESET

I.F.F.
ON 1 2 3 4 5
G ON
TIME OFF

DANGER

F ON
I.F.F.
DETECTOR
CIRCUIT
PUSH TO
RESET





IFF (Identify-Friend-or-Foe)
System Transponder Code

IFF Time Switch

IFF Emergency Signal
Transmit Switch

HOMING ADAPTER
AN/ARA-8

OFF
A
B
C
D
T
R

1 2 3 4 5 6 7 8 9
ON
OFF
G
TIA

HOMING
COMM.
TRANS.

F
ON
OFF
PUSH TO
RESET

IFF
DETONATOR
CIRCUIT

DANGER

CW
CIRCUIT
BREAKER
PUSH TO
RESET

IFF (Identify-Friend-or-Foe) System
The SCR-695-A IFF (Identification Friend or Foe) radio set permits automatic transmission of identification signals upon reception of a challenge signal from a properly equipped friendly air or surface unit. It can also be used to transmit emergency or distress signals.

IFF Power Switch

IFF Detonator Circuit
Push-Button

IFF Self-Destruct Button

Rear Radar Warning
Alarm Bell

AN/ARA-8 Homing Adapter System

The AN/ARA-8 Homing Adapter unit is used in conjunction with the SCR-522-A command radio to permit homing on any transmitting carrier within the frequency range of 120 - 140 MHz. In addition, this equipment may be used for air-to-air homing for the purposes of rendezvous. Homing can be performed on continuous wave (CW) and modulated continuous wave (MCW) signals. Homing signals are provided to the pilot in the form of an audible signal in the headset, Morse code character D (- . .) when the transmitting station is to the left and Morse code character U (. . -) when the transmitting station is to the right.



Homing Mode Switch

- *Homing*: homing audio signals are provided to the pilot through the headset
- *Comm*: the adapter is not homing and voice communication from the VHF radio is provided to the pilot's headset
- *Trans*: the adapter transmits a signal using the radio to act as a beacon for other aircraft

Homing Adapter
Circuit Breaker

Homing Signal Type Switch

- *CW*: Continuous Wave
- *MCW*: Modulated Continuous Wave

Alarm/Signal Light
Brightness Control

AN/APS-13 Rear Radar
Warning Power Switch

Detrola Radio Tuning Knob
(kHz)

Detrola Radio Headphone Jack

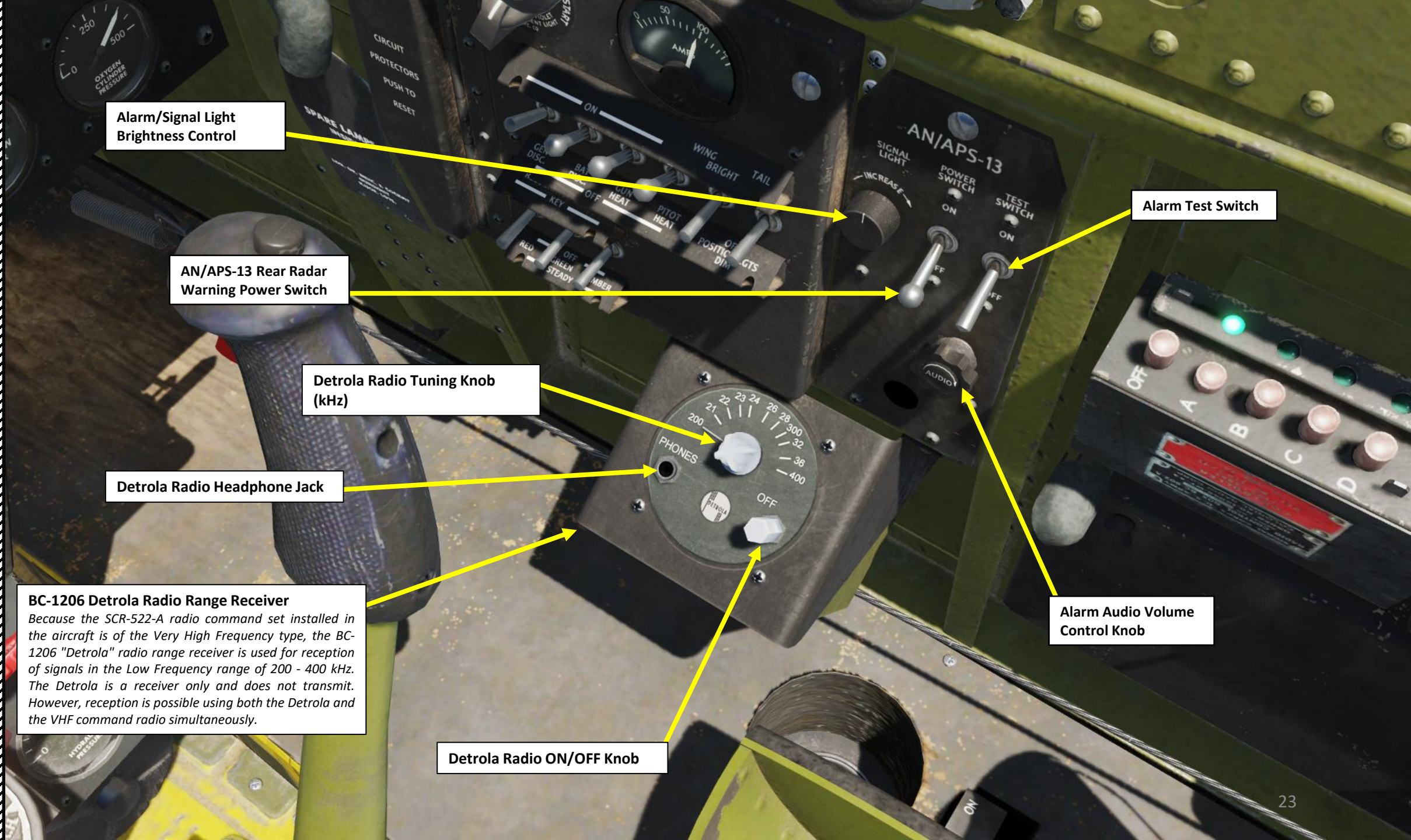
BC-1206 Detrola Radio Range Receiver

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.

Detrola Radio ON/OFF Knob

Alarm Test Switch

Alarm Audio Volume
Control Knob



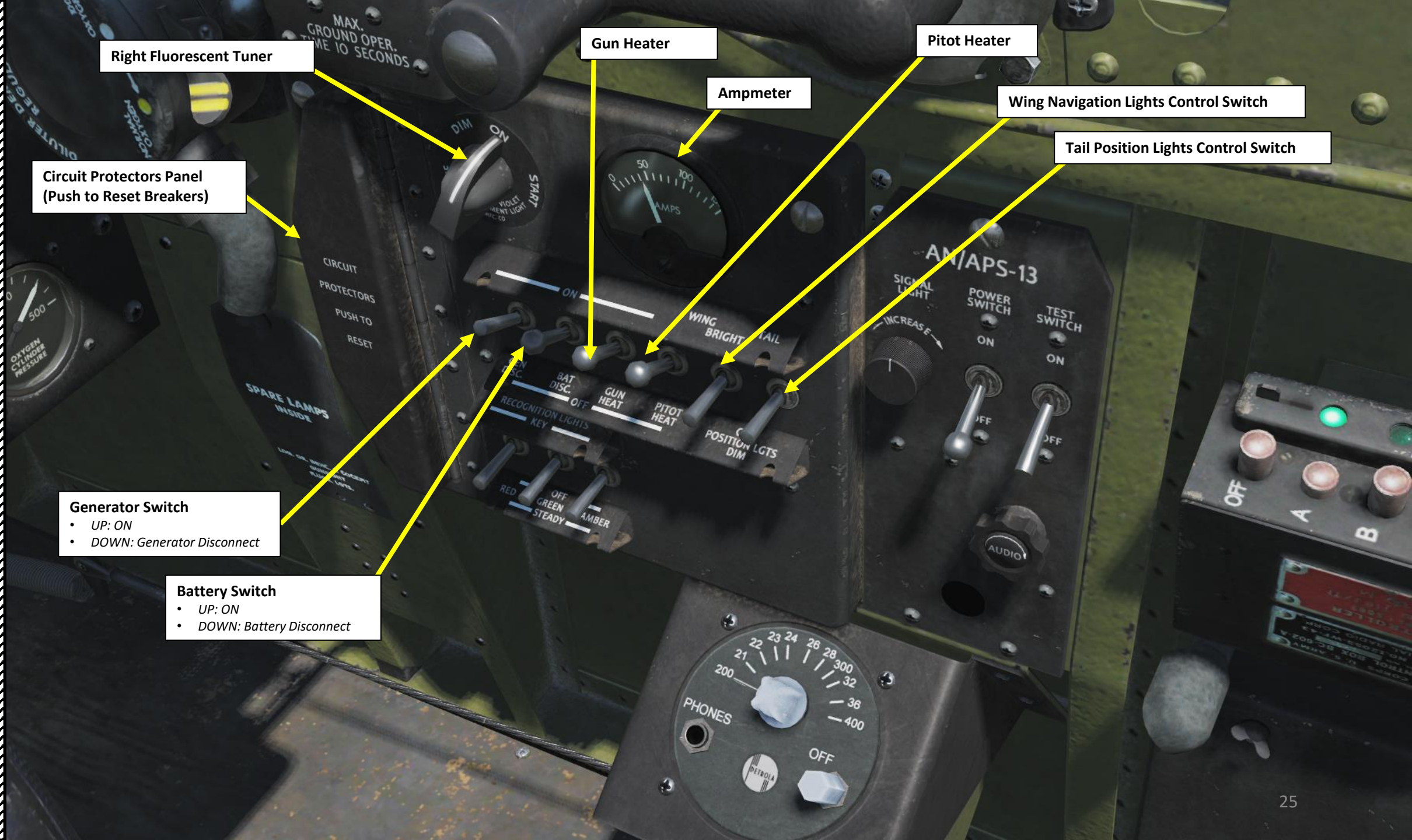
RELEASE UNLOCKED
IF RED INDICATOR SHOWS

Canopy Handle

THIS IS A MILITARY TYPE AIRCRAFT AND UNDER THE CIVIL AIR REGULATIONS SHALL NOT BE USED FOR THE CARRIAGE OF PASSENGERS OR CARGO FOR COMPENSATION OR HIRE

PACKARD V 1650-7		ENGINE LIMITATIONS	
TAKE OFF ONLY	RPM MP	FUEL: 100 OCT.	
WAREMERG. 5 MIN	3000 61	COOLANT	MAX DESIRED
MILITARY 15 MIN	3000 67	OIL TEMP.	121 100-110
MAX. CONTINUOUS	3000 61	OIL PRESSURE	90 70-80
CRUISE - MAX.	2700 48	OIL PRES. MIN. CR.	70-80
	2400 36	FUEL PRESSURE	50 70-80
OIL TEMP. 15° C. MIN.		FUEL PRES. 60# MIN.	19 16-18
TAKE OFF CONDITIONS		COOLANT 60° C. MIN.	





Right Fluorescent Tuner

Gun Heater

Pitot Heater

Ampmeter

Wing Navigation Lights Control Switch

Tail Position Lights Control Switch

Circuit Protectors Panel
(Push to Reset Breakers)

Generator Switch
• UP: ON
• DOWN: Generator Disconnect

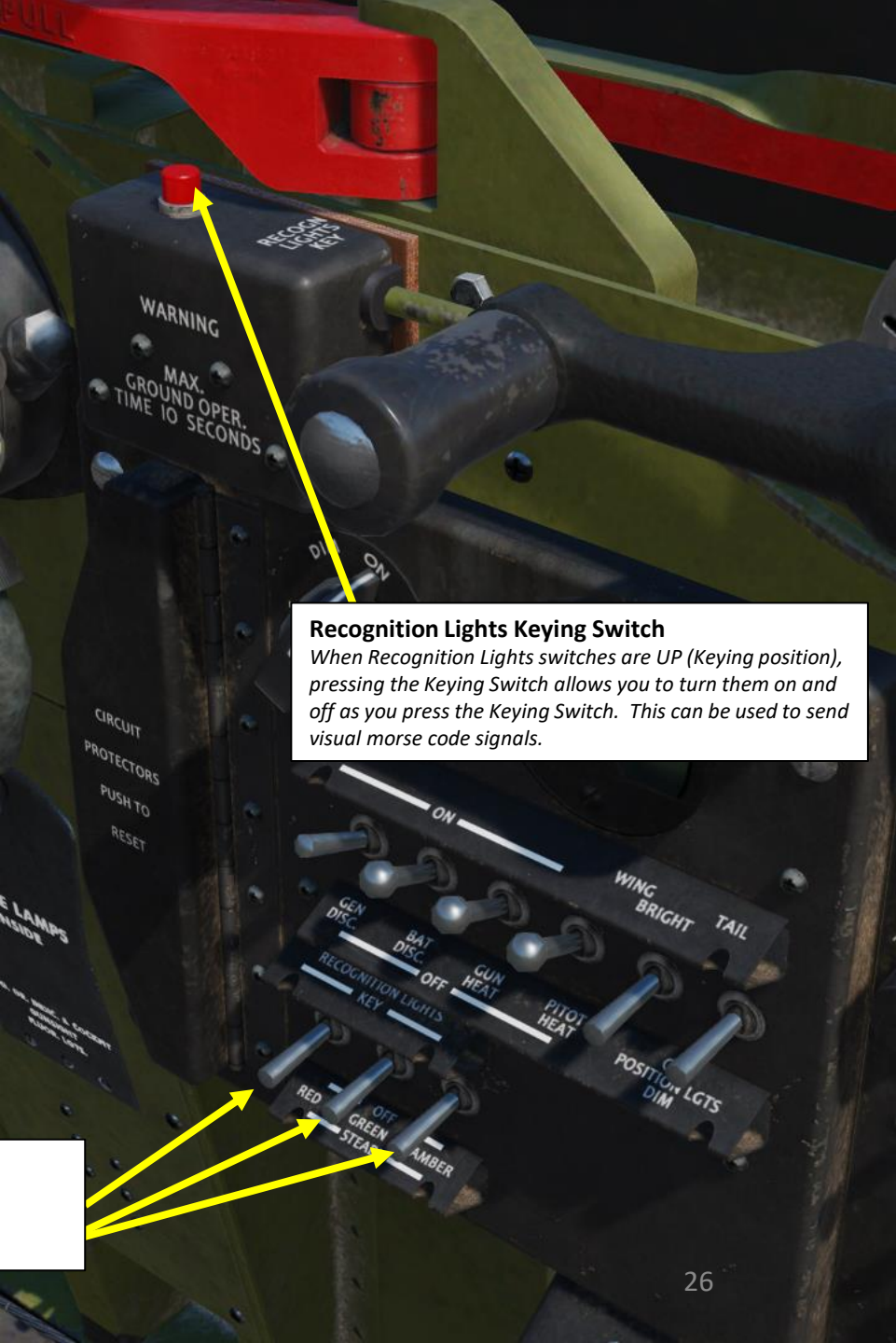
Battery Switch
• UP: ON
• DOWN: Battery Disconnect



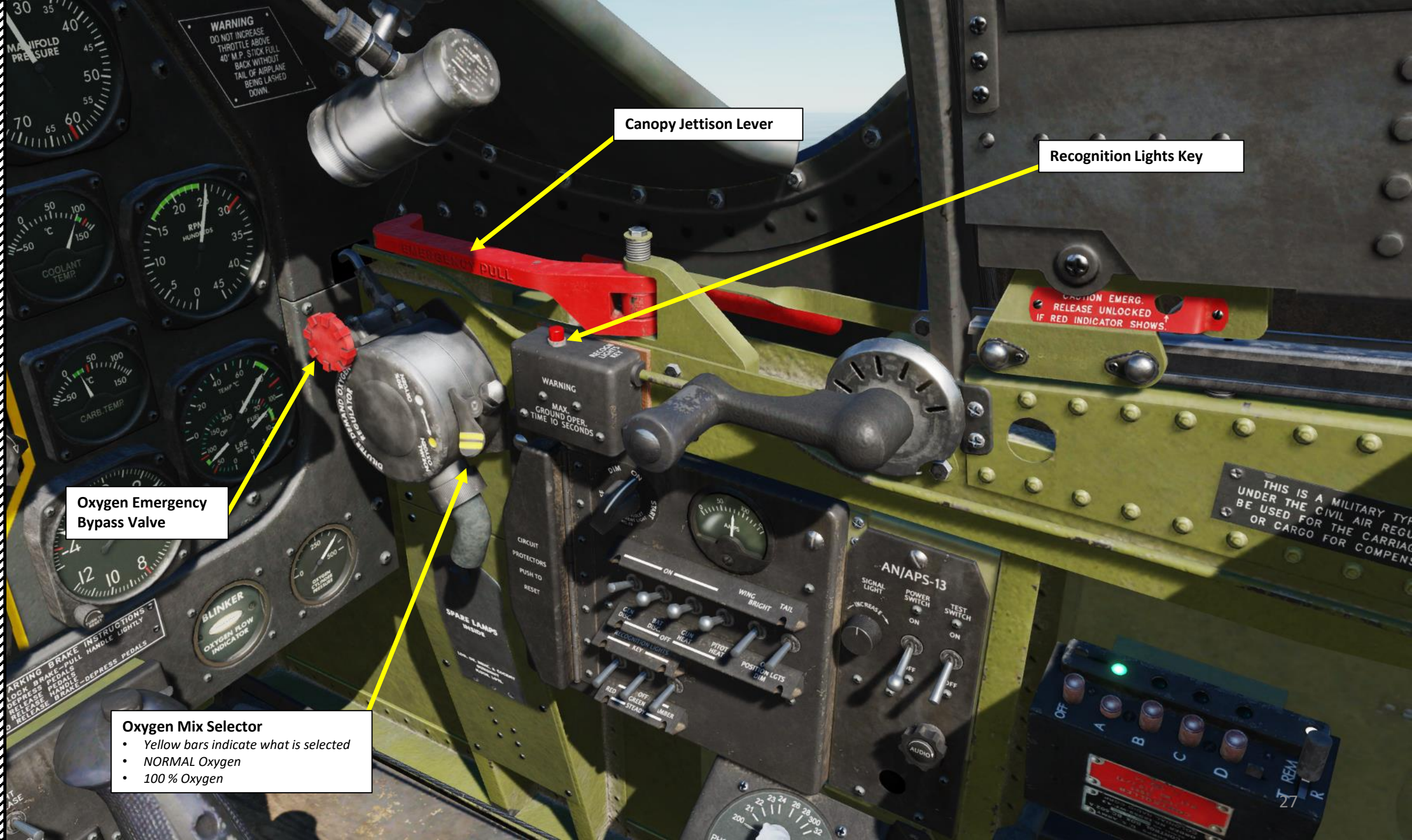
Red, Green & Amber Recognition Lights

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.

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



Recognition Lights Keying Switch
When Recognition Lights switches are UP (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.



Canopy Jettison Lever

Recognition Lights Key

Oxygen Emergency Bypass Valve

Oxygen Mix Selector

- Yellow bars indicate what is selected
- NORMAL Oxygen
- 100 % Oxygen

WARNING
DO NOT INCREASE
THROTTLE ABOVE
40" M.P. STICK FULL
BACK WITHOUT
TAIL OF AIRPLANE
BEING LASHED
DOWN.

CAUTION EMERG.
RELEASE UNLOCKED
IF RED INDICATOR SHOWS.

THIS IS A MILITARY TYPE AIRCRAFT
UNDER THE CIVIL AIR REGULATIONS
BE USED FOR THE CARRIAGE OF PASSENGERS
OR CARGO FOR COMPENSATION OR HIRE

WARNING
BRAKE INSTRUCTIONS -
PULL HANDLE LIGHTLY
DEPRESS PEDALS
RELEASE HANDS
RELEASE BRAKE-DEPRESS PEDALS

BLINKER
OXYGEN FLOW
INDICATOR

CIRCUIT
PROTECTORS
PUSH TO
RESET

AN/APS-13
SIGNAL LIGHT
POWER SWITCH
TEST SWITCH
WING BRIGHT TAIL
RECOGNITION LIGHTS
KEY

OFF
A
B
C
D
T REM
R



Gyro Gunsight

Fixed Gunsight

NO
HAND HOLD

MANIFOLD
PRESSURE

WARNING
DO NOT INCREASE
THE [unclear] ABOVE
BACK WITH
TAIL OF AIRPLANE
BEING LASHED
DOWN



Gunsight Wingspan Scale (ft)

Gunsight Wingspan Selector

Gunsight Range (x100 ft)

- FLAPS
 - TRIMS
 - RADIATORS
 - MIXTURE
 - PROPELLER
 - FRICTION LOCK
 - BOOST PUMP
 - FUEL
 - ENGINE GAGES
 - HYDRAULIC PRESS
- MIX.
 - PROPL.
 - BOOST.
 - FUEL
 - RADIATORS
 - LAND GEAR
 - FLAPS

WARNING
DO NOT INCREASE
THROTTLE ABOVE
40" M.P. STICK FULL
BACK WITHOUT
TAIL OF AIRPLANE
BEING LASHED
DOWN.

Tail Warning
Radar Light



Gunsight Mode Selector

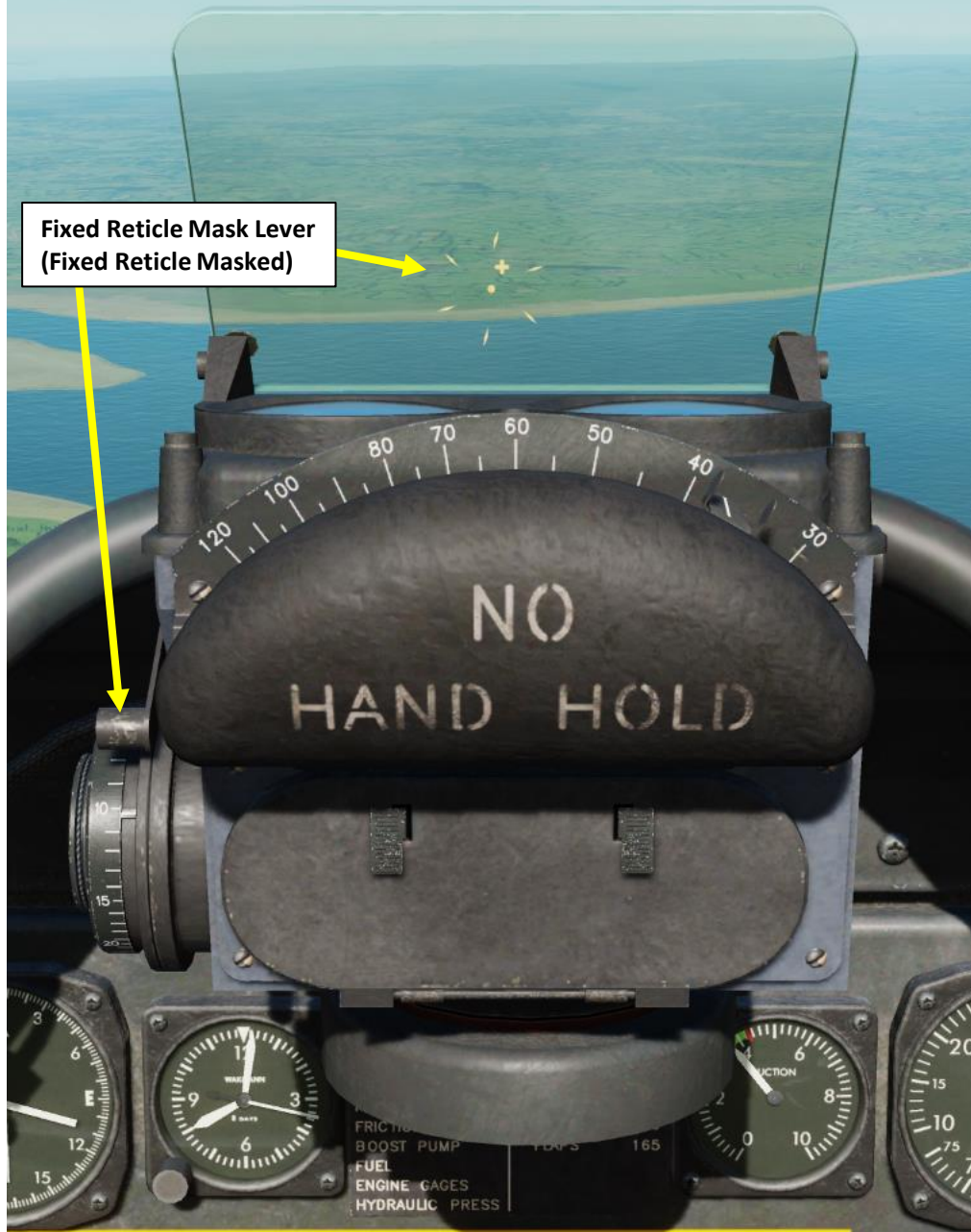
- *FIXED*
- *GYRO*
- *FIXED+GYRO*

Gyro Power Switch

- *UP = OFF*
- *DOWN = ON*

Gunsight Brightness Control

TAKE OFF	LANDING
FLAPS	MIXTURE
TRIMS	PROPELER 2700
RADIATORS	BOOSTER PUMP
MIXTURE	FUEL
PROPELER	RADIATORS
ACTION LOCK	LAND GEAR 170
BOOST PUMP	FLAPS 165
EL	
ENGINE GAGES	
HYDRAULIC PRESS	





PARKING BRAKE INSTRUCTIONS
TO LOCK BRAKE - PULL HANDLE LIGHTLY
TO DEPRESS PEDALS
TO RELEASE HANDLE
TO RELEASE BRAKE - DEPRESS PEDALS

BLINKER
OXYGEN FLOW
INDICATOR

Oxygen Flow Indicator
(Blinker)

Oxygen Pressure (psi)

WARNING
MAX. GROUND OPER.
TIME 10 SECONDS

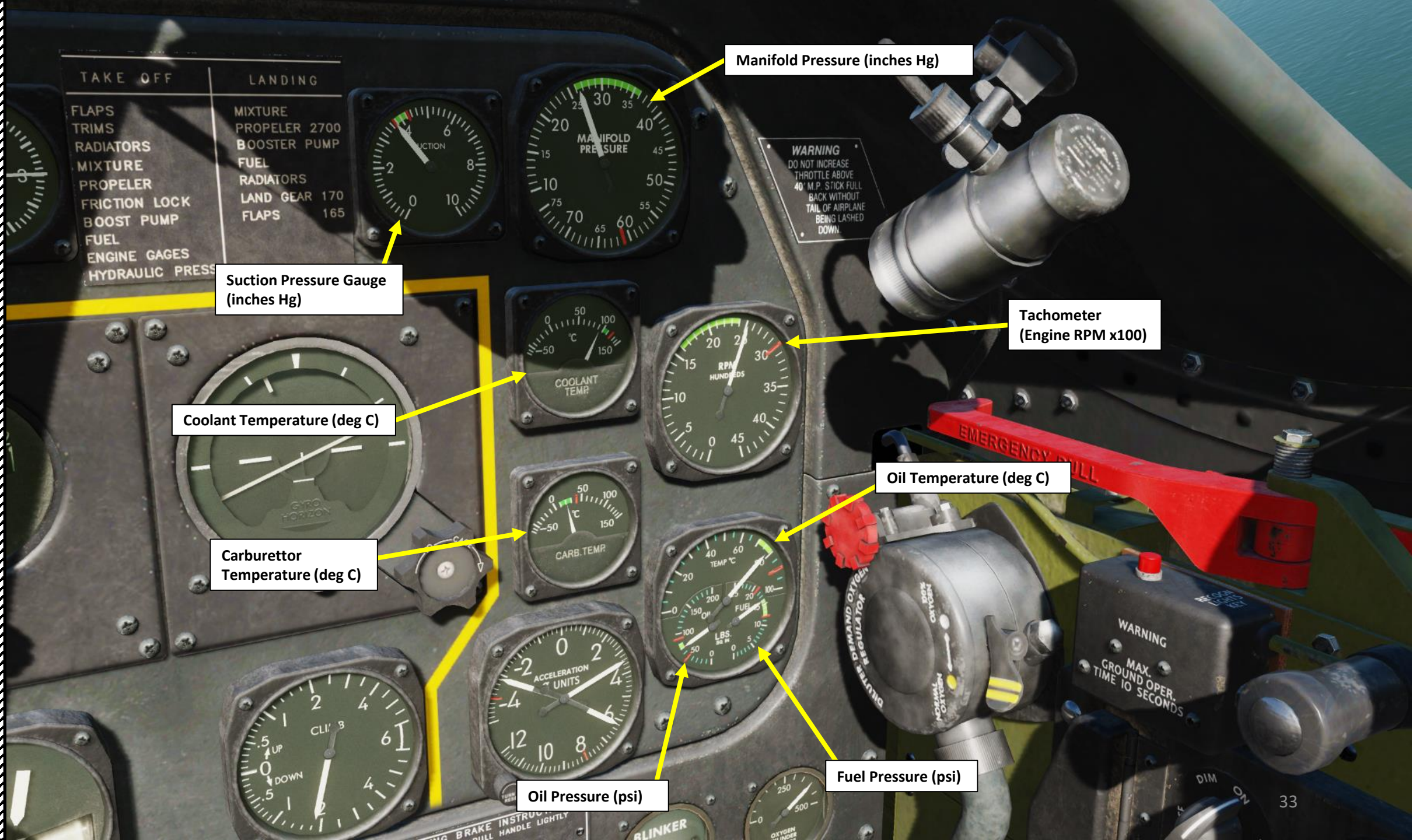
SPARE LAMPS
INSIDE

CIRCUIT
PROTECTORS
PUSH TO
RESET

DIM
ON
OFF

GEN DISC
BAT DISC
KEY

EMERGENCY PULL



TAKE OFF	LANDING
FLAPS	MIXTURE
TRIMS	PROPELER 2700
RADIATORS	BOOSTER PUMP
MIXTURE	FUEL
PROPELER	RADIATORS
FRICITION LOCK	LAND GEAR 170
BOOST PUMP	FLAPS 165
FUEL	
ENGINE GAGES	
HYDRAULIC PRESS	

Manifold Pressure (inches Hg)

Suction Pressure Gauge (inches Hg)

Tachometer (Engine RPM x100)

Coolant Temperature (deg C)

Carburettor Temperature (deg C)

Oil Temperature (deg C)

Oil Pressure (psi)

Fuel Pressure (psi)

WARNING
DO NOT INCREASE
THROTTLE ABOVE
40" M.P. STICK FULL
BACK WITHOUT
TAIL OF AIRPLANE
BEING LASHED
DOWN.

WARNING
MAX. GROUND OPER.
TIME 10 SECONDS

Magnetic Compass

Clock

Takeoff & Landing Checks Placard

TAKE OFF	LANDING
FLAPS	MIXTURE
TRIMS	PROPELER 2700
RADIATORS	BOOSTER PUMP
MIXTURE	FUEL
PROPELER	RADIATORS
FRICTION LOCK	LAND GEAR 170
BOOST PUMP	FLAPS 165
FUEL	
ENGINE GAGES	
HYDRAULIC PRESS	

Directional Gyro

Artificial Horizon

Airspeed Indicator (mph)

Directional Gyro Heading Select

Artificial Horizon Caging Knob

WARNING
GROUND RUN UP
TICK FULL BACK
DO NOT OPERATE ABOVE
WITH TAIL
CURVED.

SUPERCARGER HIGH
FUEL BOOSTER ON
OIL DILUTE ON
STARTER ON
PRIMER ON

LANDING GEAR WARNING LIGHTS PUSH TO

PARK BRAKE

PARKING BRAKE INSTRUCTIONS
TO LOCK BRAKE - PULL
TO RELEASE PEDALS
TO RELEASE HANDLE LIGHTLY

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 (in Hg)

Turn & Slip Indicator

Bank Indicator

Accelerometer (Current Acceleration in Gs)

Minimum Detected G

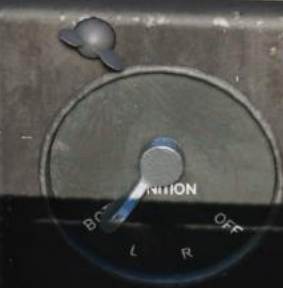
Barometric Pressure Setting Knob



Maximum Detected G

Vertical Speed Indicator (x1000 ft/min)

Accelerometer Reset Button



Supercharger Mode Selector Switch

Supercharger High Blower Indicator

Landing Gear Warning Light Indicators

- Green: Down & Locked
- Red: In Transition

Parking Brake Lever

Fuel Booster Pump

Oil Dilution Switch

Starter Switch

Primer Switch

LANDING GEAR WARNING LIGHTS PUSH TO

PARK BRAKE BOMBS

PARKING BRAKE INSTRUCTIONS
TO LOCK BRAKE—PULL HANDLE LIGHTLY
TO DEPRESS PEDALS
TO RELEASE PEDALS
TO RELEASE HANDLE
TO RELEASE BRAKE—DEPRESS PEDALS

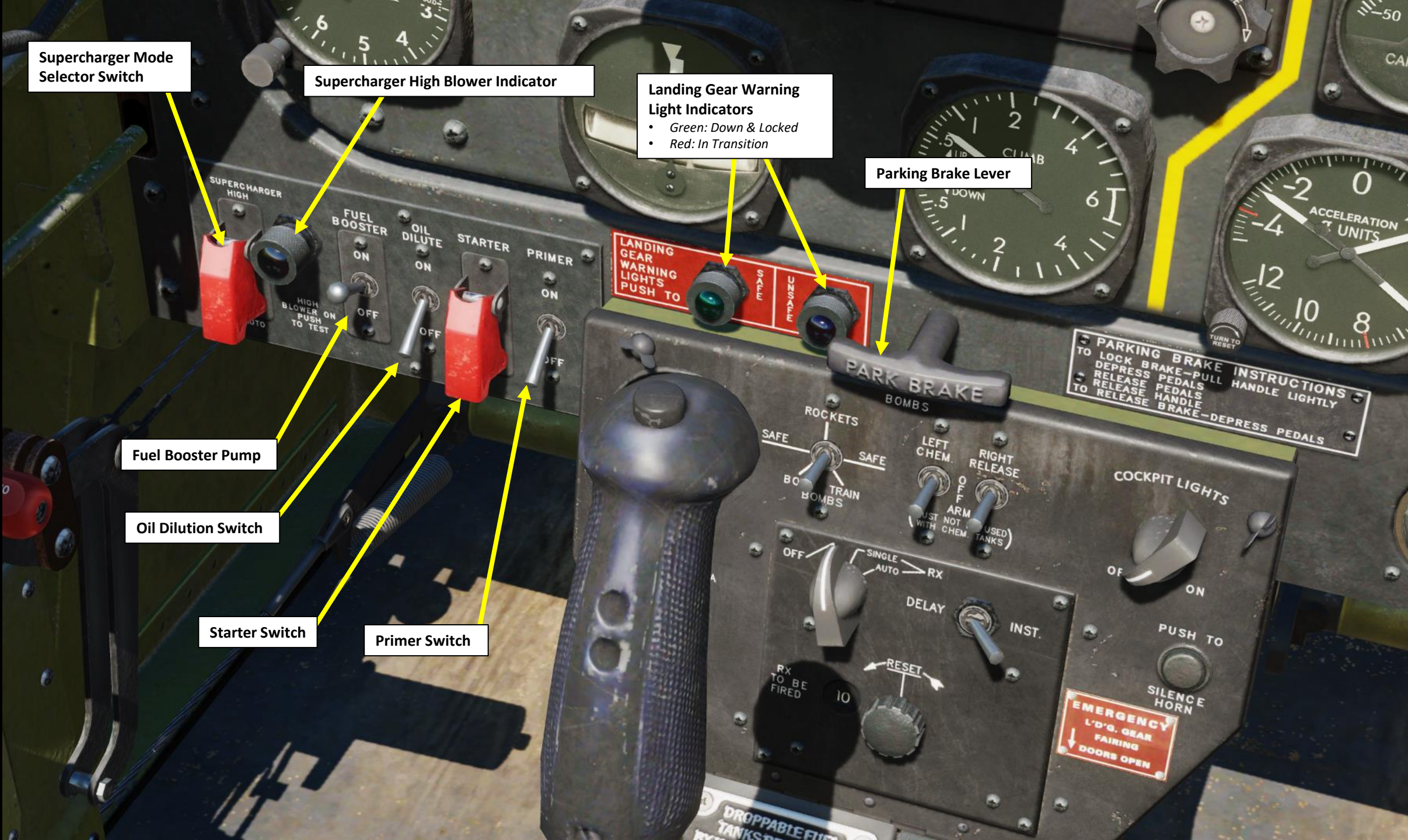
ROCKETS
SAFE TRAIN BOMBS
LEFT CHEM. BOMBS
RIGHT RELEASE
OFF ARM (JUST NOT USED WITH CHEM. TANKS)

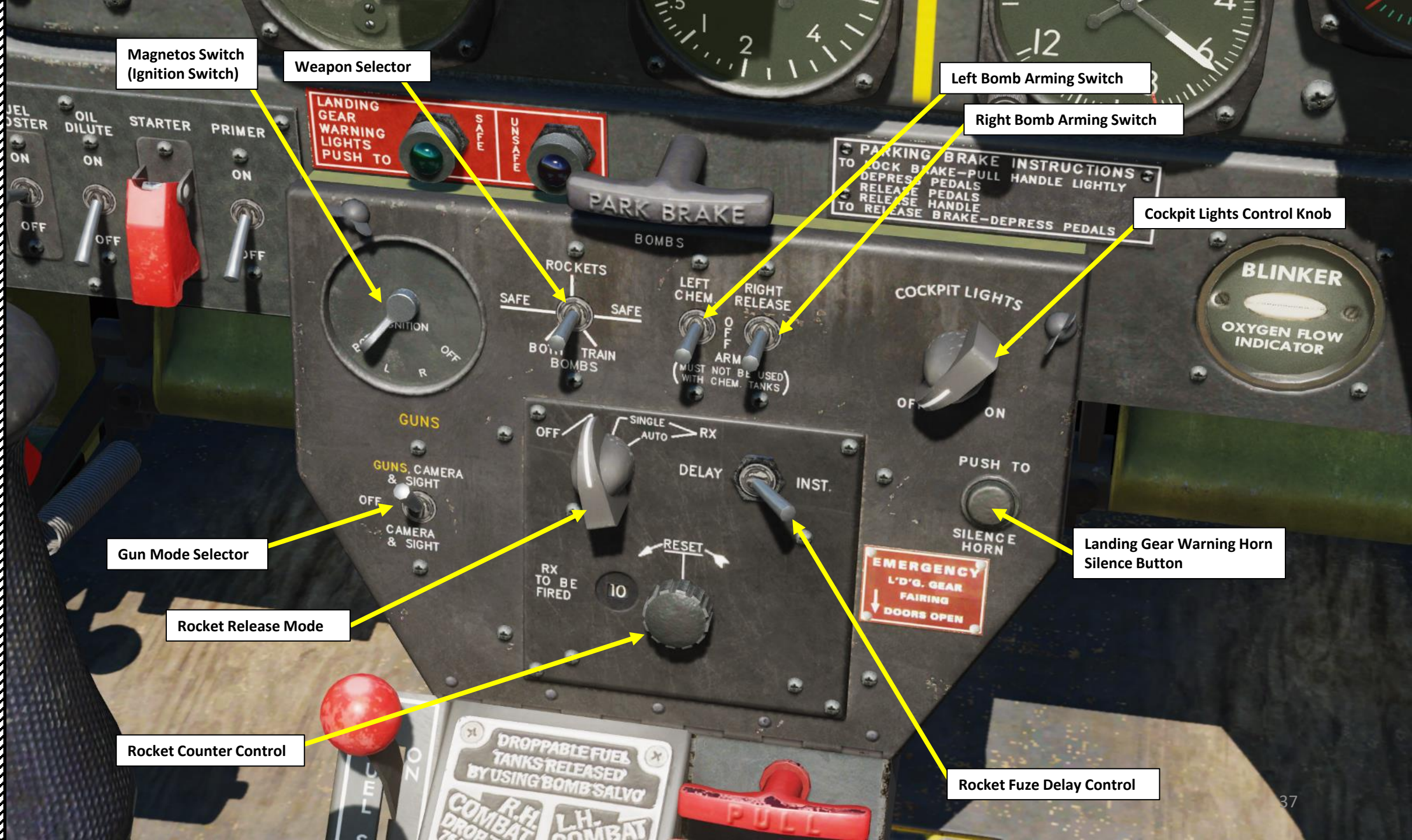
COCKPIT LIGHTS

OFF SINGLE AUTO RX
DELAY INST.

EMERGENCY L'D.G. GEAR FAIRING DOORS OPEN

DROPPABLE FUEL TANKS





Magnetos Switch (Ignition Switch)

Weapon Selector

Left Bomb Arming Switch

Right Bomb Arming Switch

Cockpit Lights Control Knob

Gun Mode Selector

Rocket Release Mode

Rocket Counter Control

Landing Gear Warning Horn Silence Button

Rocket Fuze Delay Control

LANDING GEAR WARNING LIGHTS PUSH TO

PARKING BRAKE INSTRUCTIONS
TO LOCK BRAKE - PULL HANDLE LIGHTLY
TO RELEASE BRAKE - DEPRESS PEDALS

BLINKER
OXYGEN FLOW INDICATOR

EMERGENCY
L'D'G. GEAR FAIRING
DOORS OPEN

DROPPABLE FUEL TANKS RELEASED BY USING BOMB SALVO
R.H. COMBAT
L.H. COMBAT

PULL

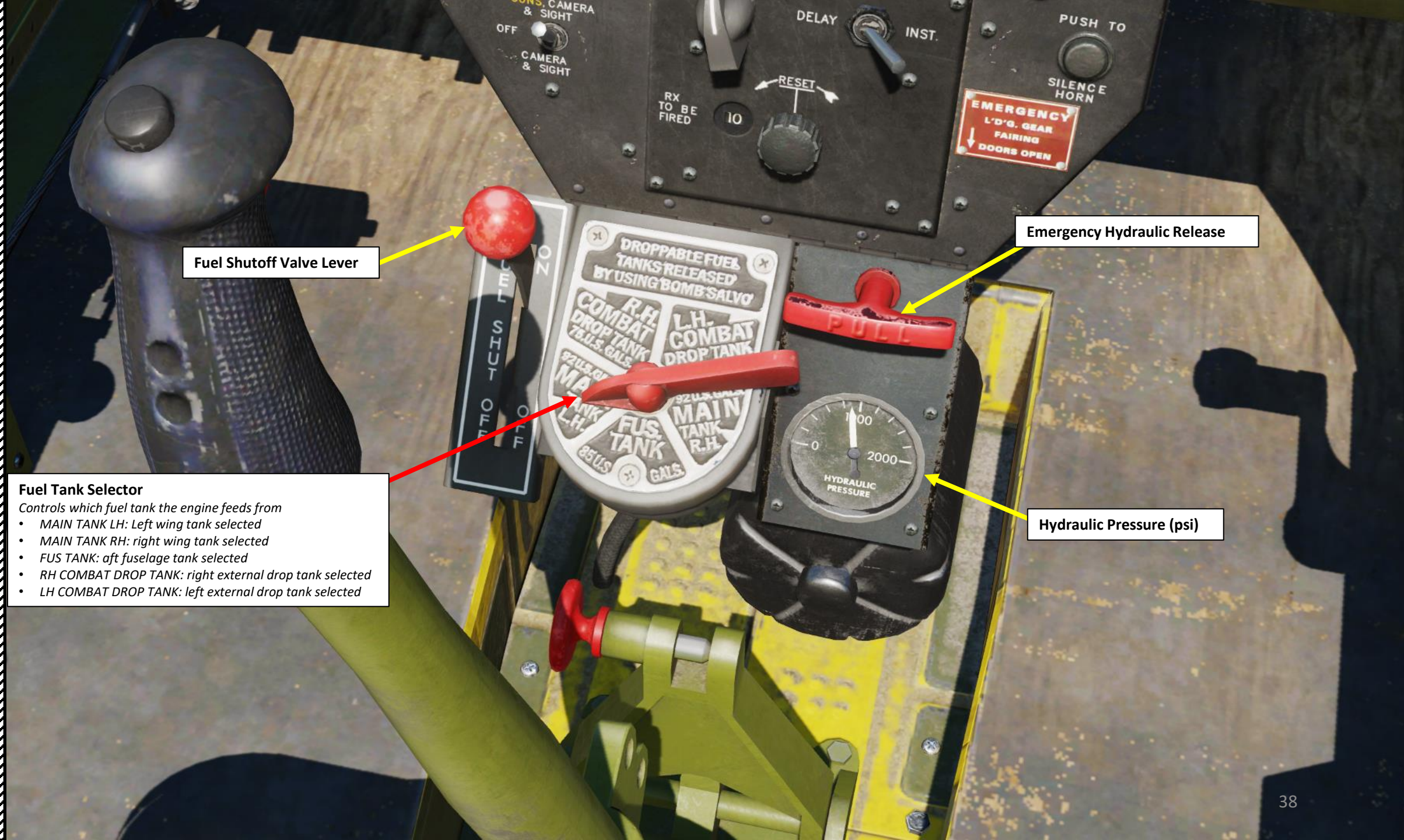
Fuel Shutoff Valve Lever

Emergency Hydraulic Release

Fuel Tank Selector
Controls which fuel tank the engine feeds from

- MAIN TANK LH: Left wing tank selected
- MAIN TANK RH: right wing tank selected
- FUS TANK: aft fuselage tank selected
- RH COMBAT DROP TANK: right external drop tank selected
- LH COMBAT DROP TANK: left external drop tank selected

Hydraulic Pressure (psi)



Propeller and Mixture Lever Lock

Throttle Lever

Microphone Switch

Twist Grip – Gunsight Target Range Control

Propeller RPM Control Lever

Left Fluorescent Tuner

Left/Right Bomb Jettison

RADIATOR AIR COOLANT CONTROL SWITCH

Throttle Lock

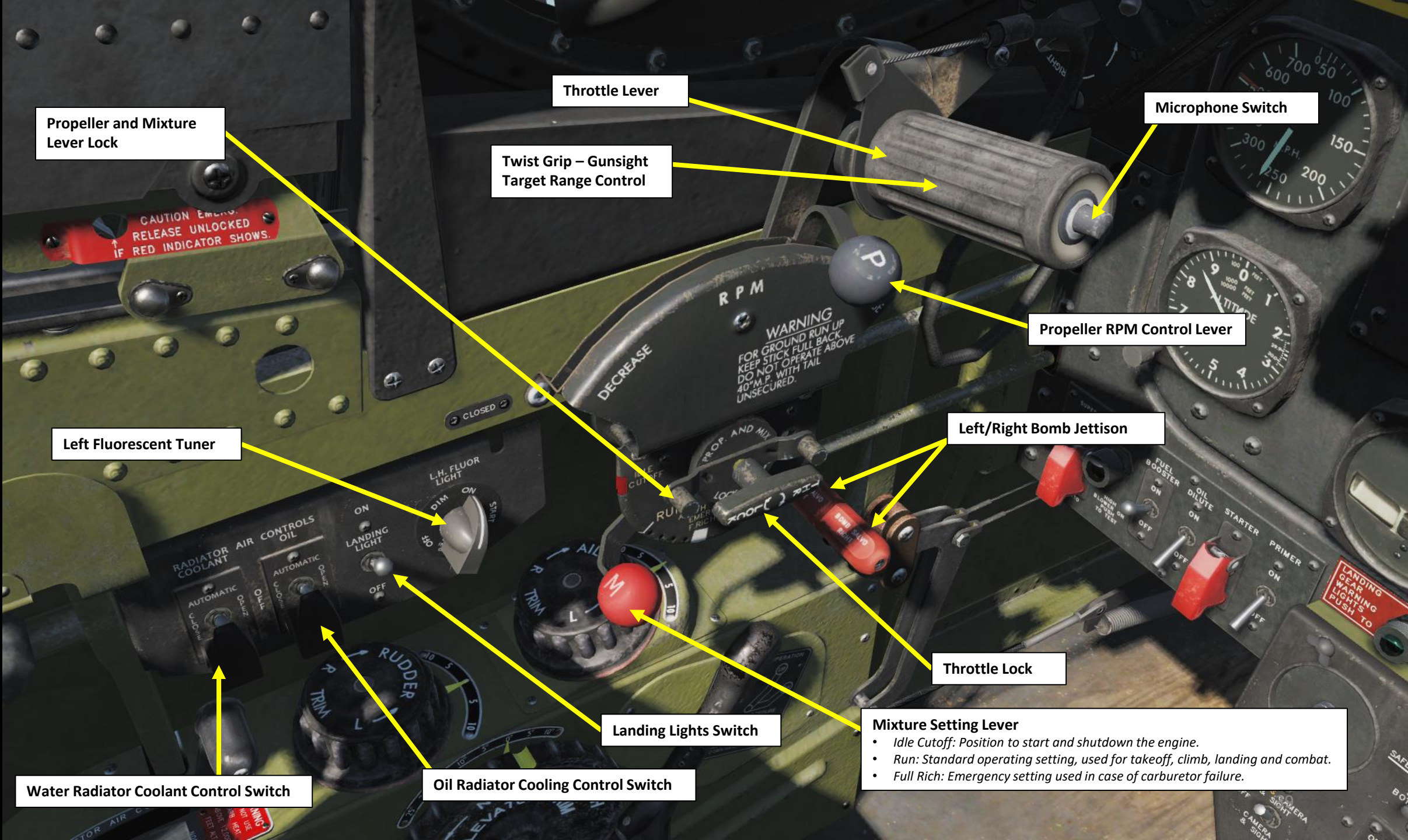
Landing Lights Switch

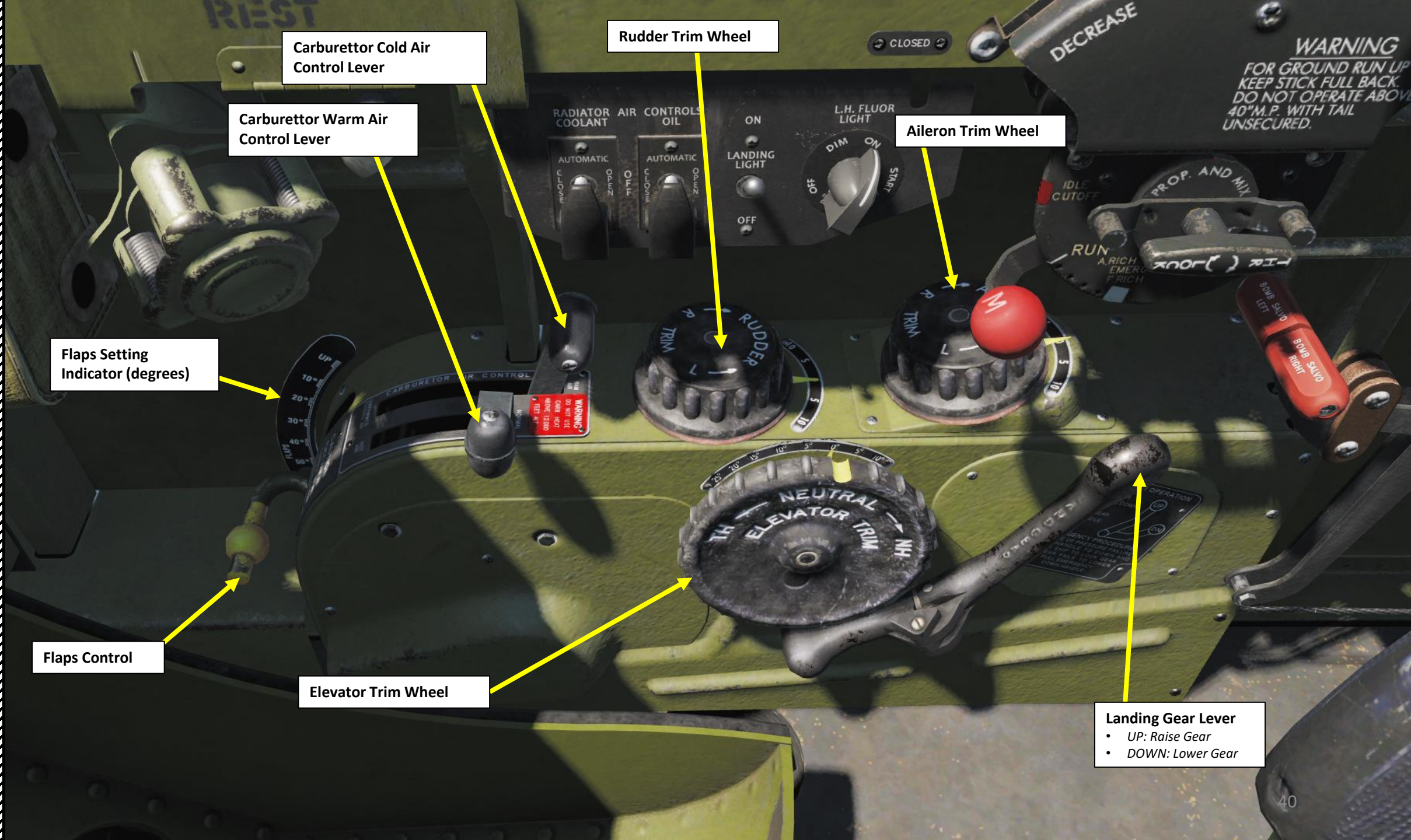
Mixture Setting Lever

Water Radiator Coolant Control Switch

Oil Radiator Cooling Control Switch

- Idle Cutoff: Position to start and shutdown the engine.
- Run: Standard operating setting, used for takeoff, climb, landing and combat.
- Full Rich: Emergency setting used in case of carburetor failure.





Carburettor Cold Air Control Lever

Carburettor Warm Air Control Lever

Rudder Trim Wheel

Aileron Trim Wheel

Flaps Setting Indicator (degrees)

Flaps Control

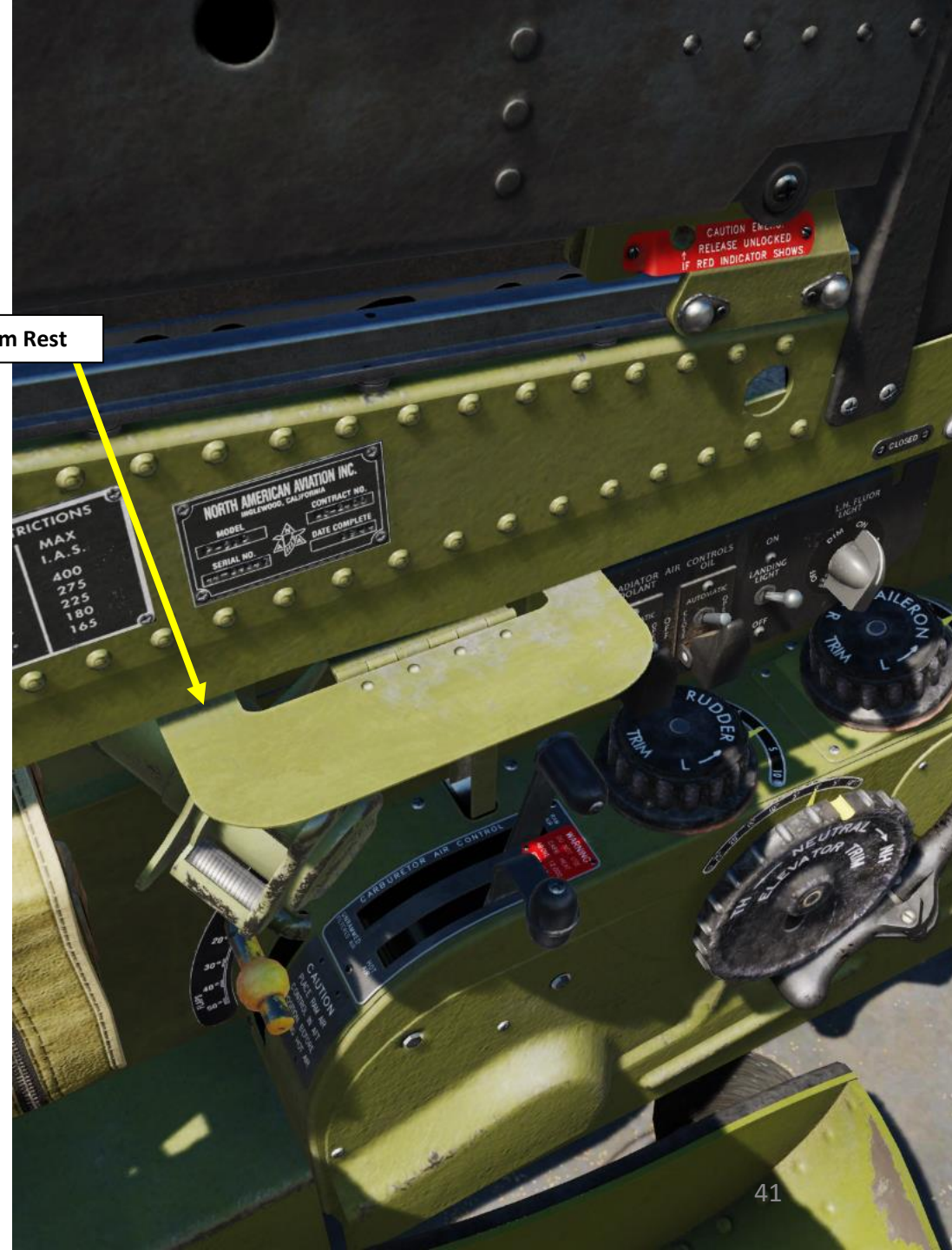
Elevator Trim Wheel

Landing Gear Lever
• UP: Raise Gear
• DOWN: Lower Gear

WARNING
FOR GROUND RUN UP
KEEP STICK FULL BACK.
DO NOT OPERATE ABOVE
40" M.P. WITH TAIL
UNSECURED.



Foldable Arm Rest



PART 3 - COCKPIT & GAUGES

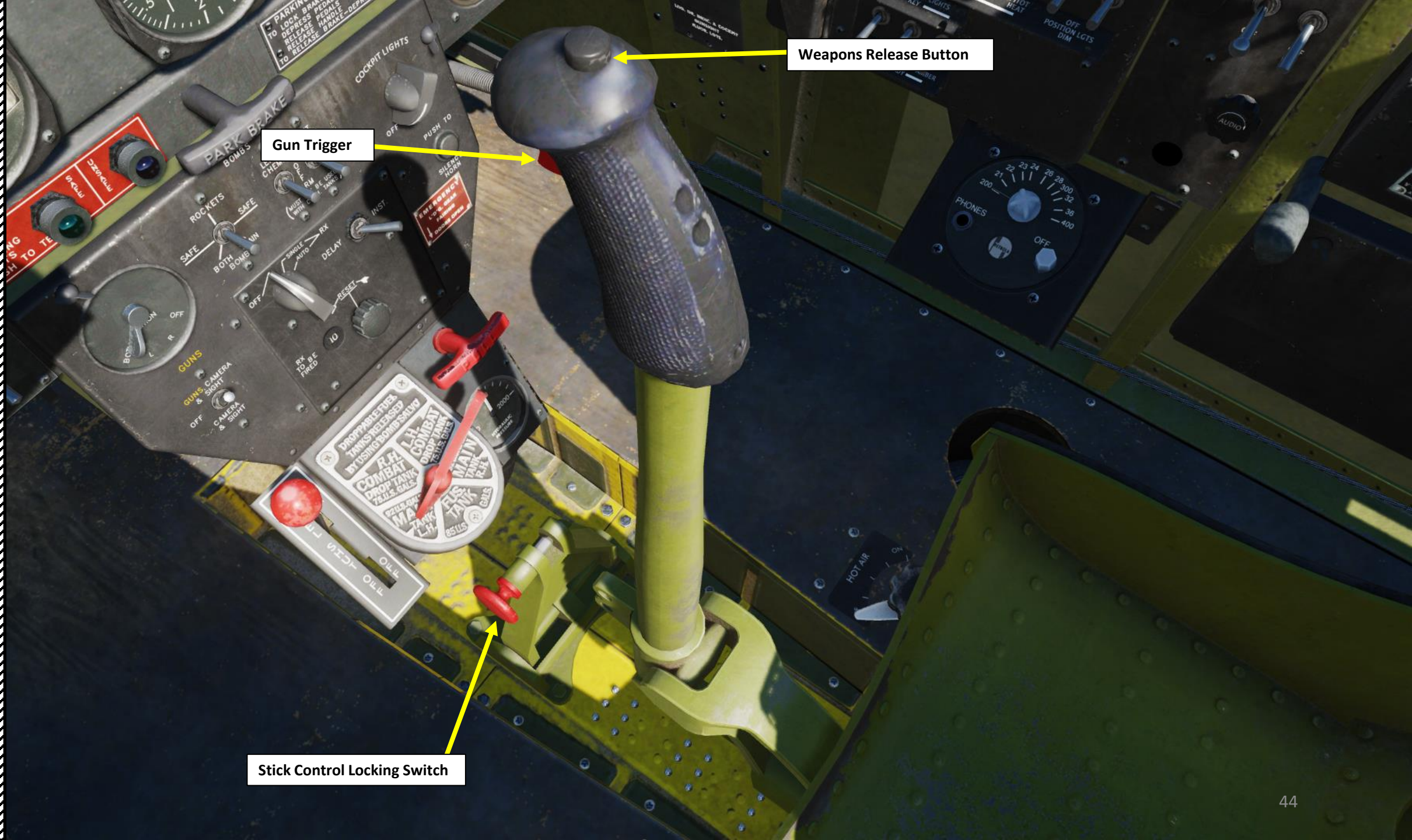
P-51D
MUSTANG



Defroster Control

Hot Air Control

Cold Air Control



Gun Trigger

Weapons Release Button

Stick Control Locking Switch

PART 3 – COCKPIT & GAUGES

**P-51D
MUSTANG**





Left Wing Tank Fuel Gauge
(92 US GAL)



Right Wing Tank Fuel Gauge
(92 US GAL)

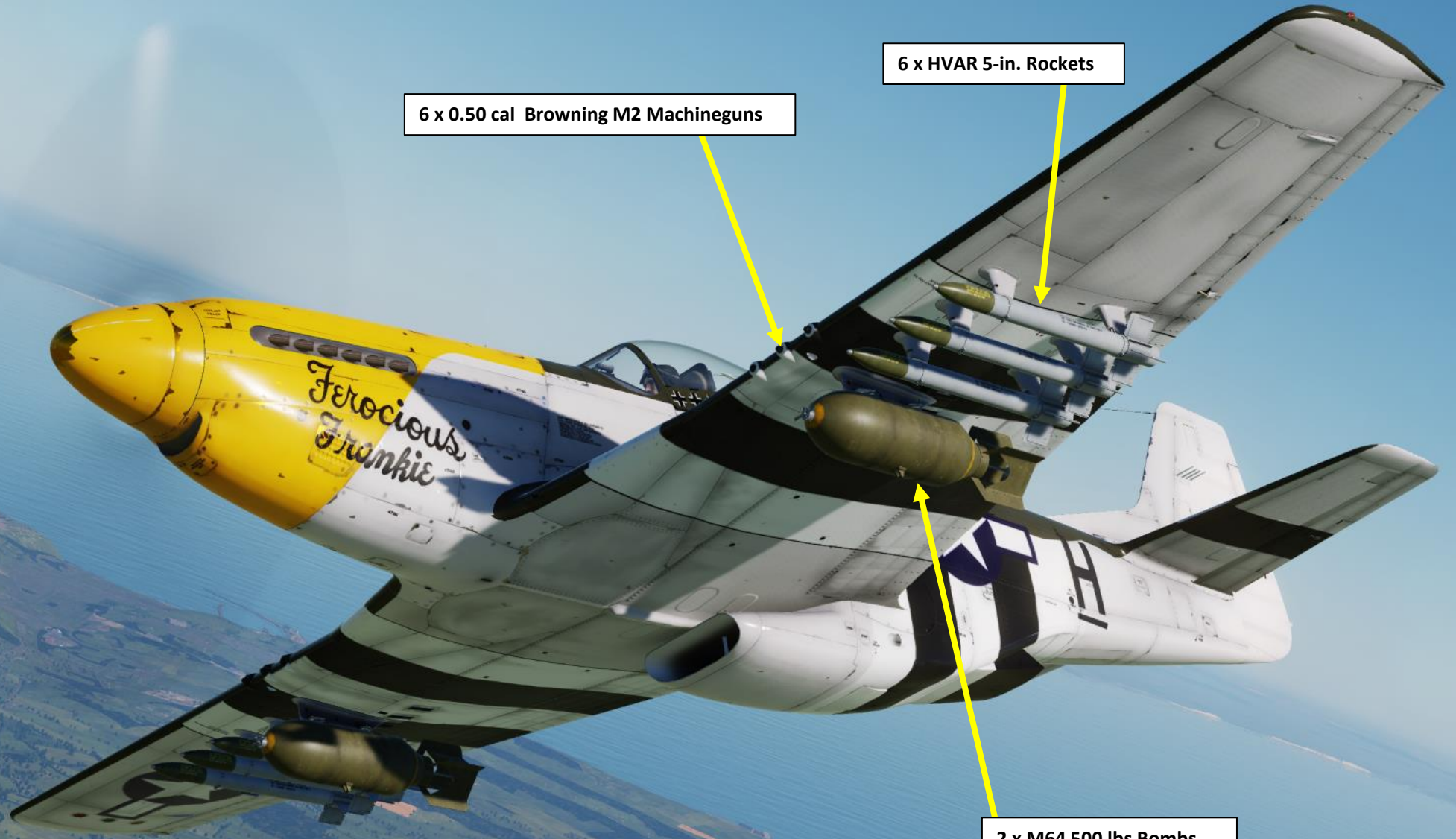


TOTAL FUEL QUANTITY: 489 US GAL
(with 2 x 110 gal drop tanks installed)

Rear Fuselage Tank Fuel Gauge
(85 US GAL)



Mirror



6 x 0.50 cal Browning M2 Machineguns

6 x HVAR 5-in. Rockets

2 x M64 500 lbs Bombs

PART 3 – COCKPIT & GAUGES

**P-51D
MUSTANG**



Machinegun Cartridge Ejection Ports



External Fuel Drop Tank

External Fuel Drop Tank



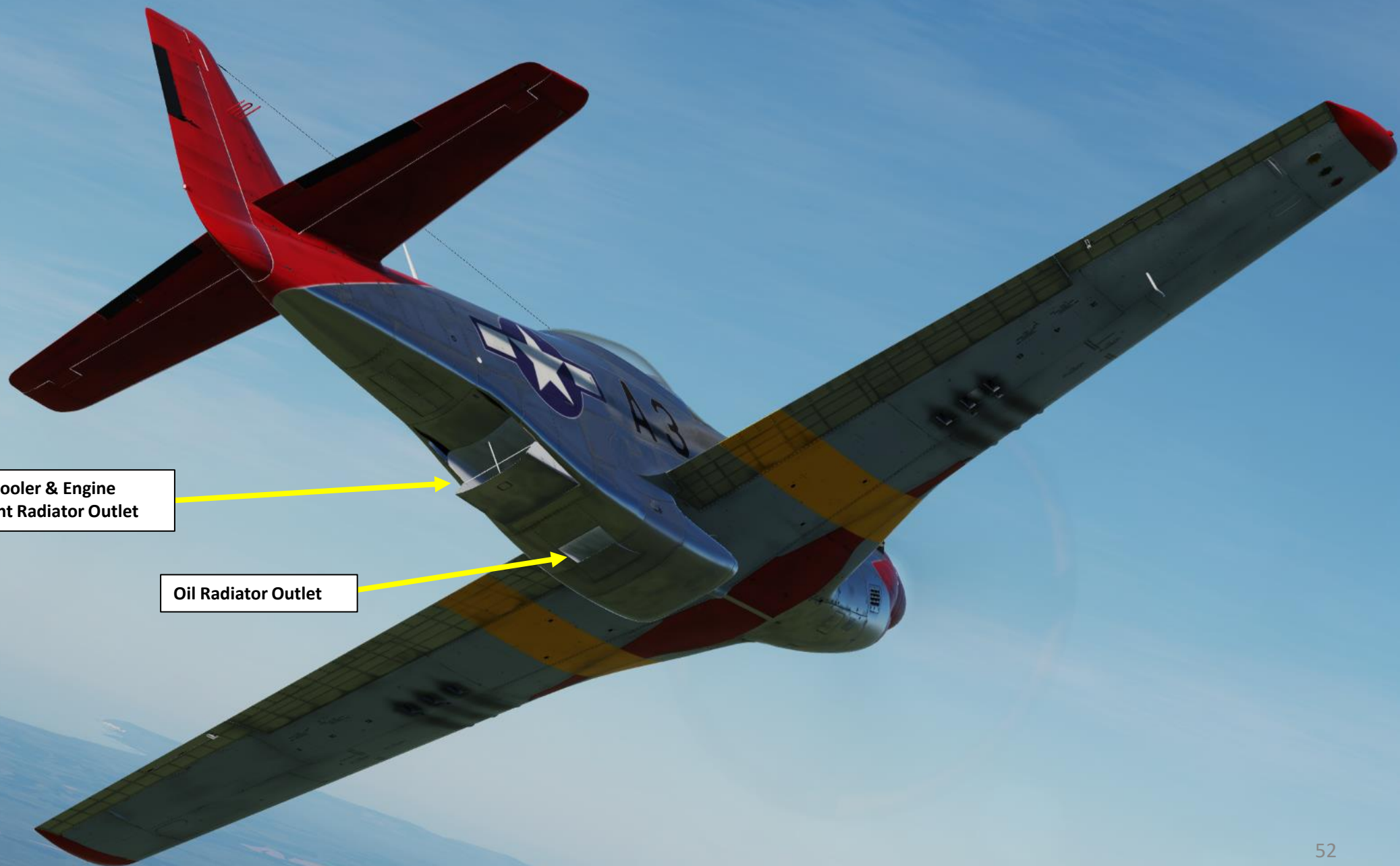
Pitot Tube

Radiator Coolant and Oil
Radiator Air Intake

Carburetor Air Scoop
(Ram Air)

Aftercooler & Engine
Coolant Radiator Outlet

Oil Radiator Outlet





Landing Gear (shown deployed)
Hydraulically actuated

Flaps (shown deployed)
Hydraulically actuated

P-51D-30-NA

Detrola LF (Low Frequency) Radio Wire Antenna

SCR-522-A VHF Radio Masts

AN/ARC-3 Radio Mast



P-51D-25-NA

Detrola LF (Low Frequency) Radio Wire Antenna

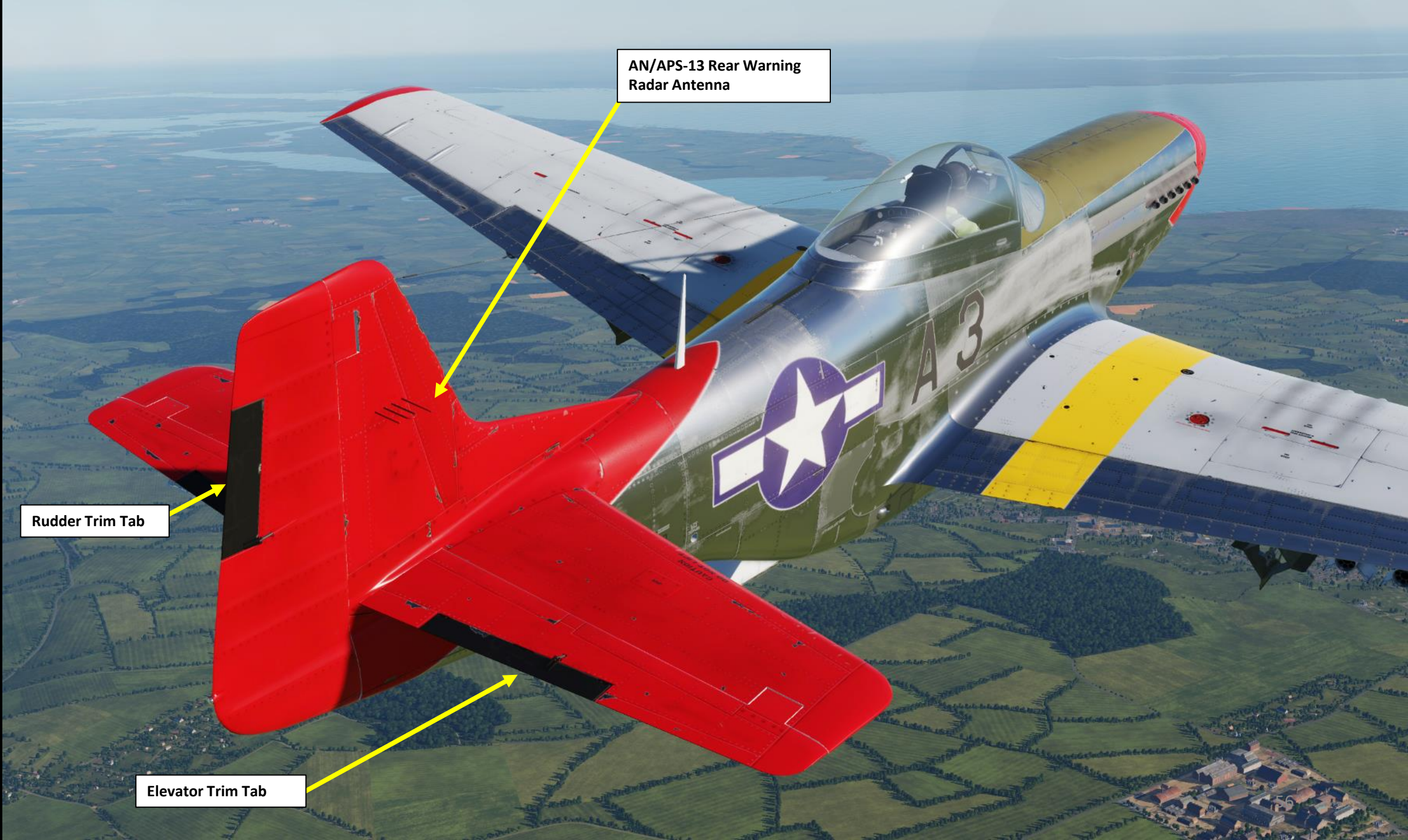
SCR-522-A VHF Radio Mast



AN/APS-13 Rear Warning
Radar Antenna

Rudder Trim Tab

Elevator Trim Tab



Wing Navigation Light (Green)



Tail Navigation Light



Wing Navigation Lights Control Switch



Tail Position Lights Control Switch



Wing Navigation Light (Red)

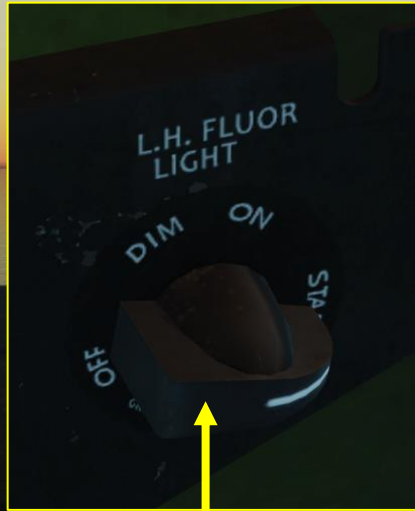




Landing Light



Landing Light Control Switch



Left Fluorescent Tuner



Right Fluorescent Tuner

CAUTION: LEAVE
RELEASE UNLOCKED
INDICATOR SWOPS

PROHIBITED
THROW RELEASE
RELEASE INDICATOR

Cockpit Utility Light

Cockpit Utility Light

Cockpit Lights
Control Knob



PERFORMANCE
MAX
I.A.S.
400
275
225
180
165

NORTH AMERICAN AVIATION INC.
INGLEWOOD, CALIFORNIA
MODEL: _____ CONTRACT NO.: _____
SERIAL NO.: _____ DATE COMPLETE: _____

Cockpit Utility Light



Cockpit Lights
Control Knob

RADIATOR COOLANT AUTOMATIC
AIR CONTROLS OIL AUTOMATIC
LANDING LIGHT ON OFF
L.H. FLUOR LIGHT DIM ON SW

RPM
DECREASE INCREASE
WARNING
FOR GROUND RUN UP
KEEP STICK FULL BACK.
DO NOT OPERATE ABOVE
40 M.P.H. WITH TAIL
UNSECURED.

RUDDER TRIM

AILERON TRIM

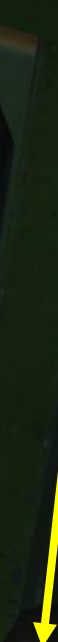
NEUTRAL
ELEVATOR TRIM

BOMB SAUTO LEFT
BOMB SAUTO RIGHT



Cockpit Lights Control Knob

Cockpit Utility Light



THIS IS A MILITARY
UNDER THE CIVIL AIR RE
BE USED FOR THE CARR
OR CARGO FOR COMPE

AIRPLANE GROUP

NAME: New Airplane Group

CONDITION: % < > 100

COUNTRY: USA

TASK: CAS

UNIT: < > 1 OF < > 1

TYPE: P-51D

SKILL: Player

PILOT: Pilot #001

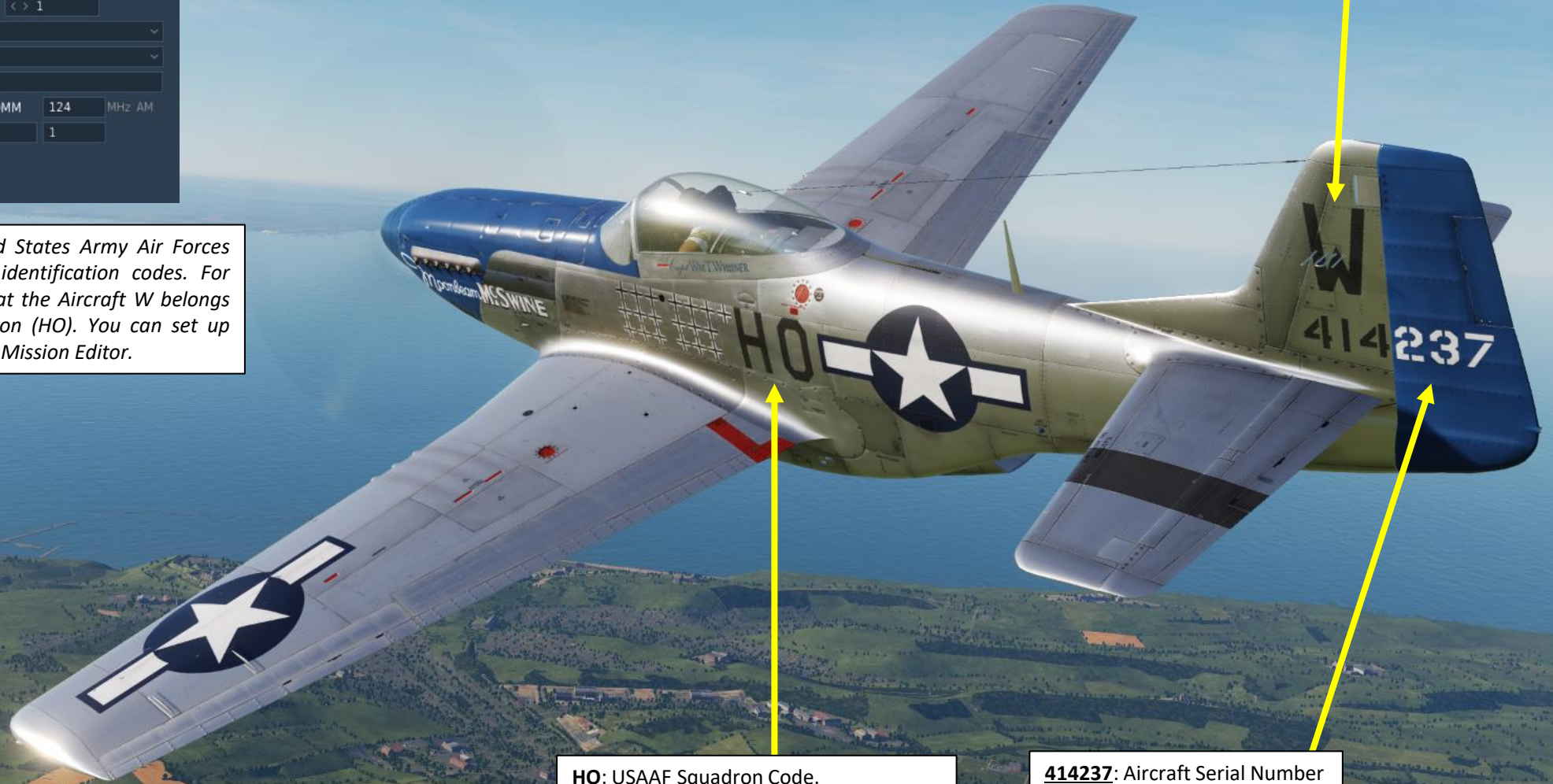
TAIL #: HOW COMM 124 MHz AM

CALLSIGN: Enfield 1 1

HIDDEN ON MAP

LATE ACTIVATION

In World War 2, the United States Army Air Forces used aircraft markings as identification codes. For instance, "HO-W" means that the Aircraft W belongs to the 485th Fighter Squadron (HO). You can set up your aircraft markings in the Mission Editor.



W: Aircraft Identification Letter

HO: USAAF Squadron Code.
"HO" belongs to 485th Fighter Squadron.

414237: Aircraft Serial Number

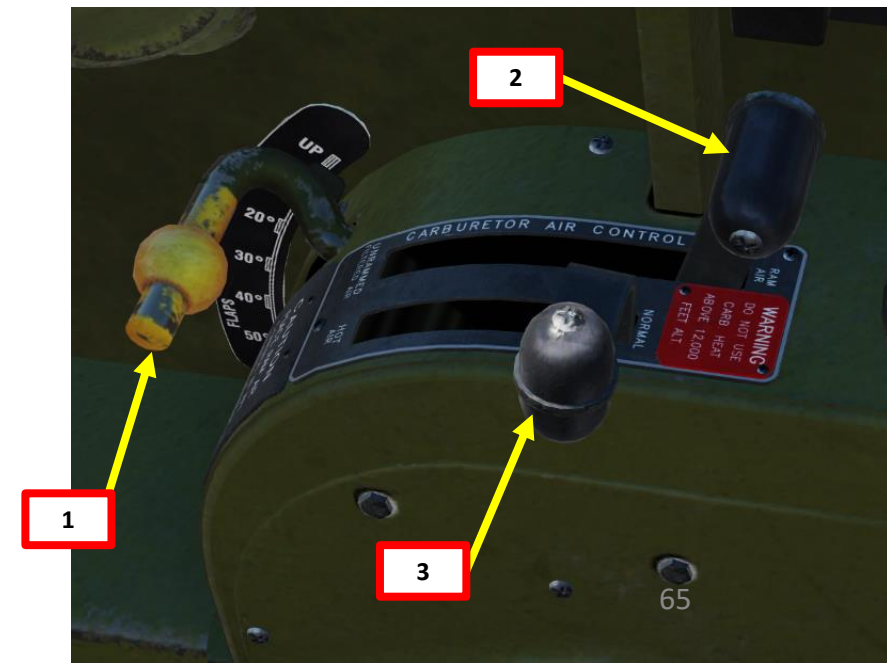
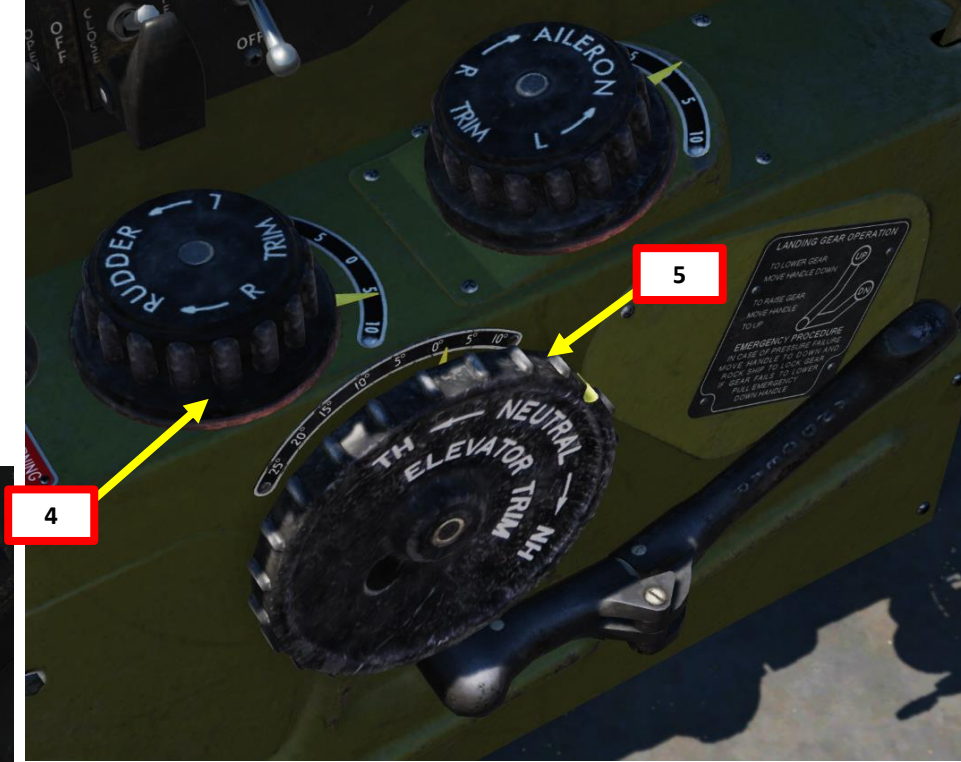
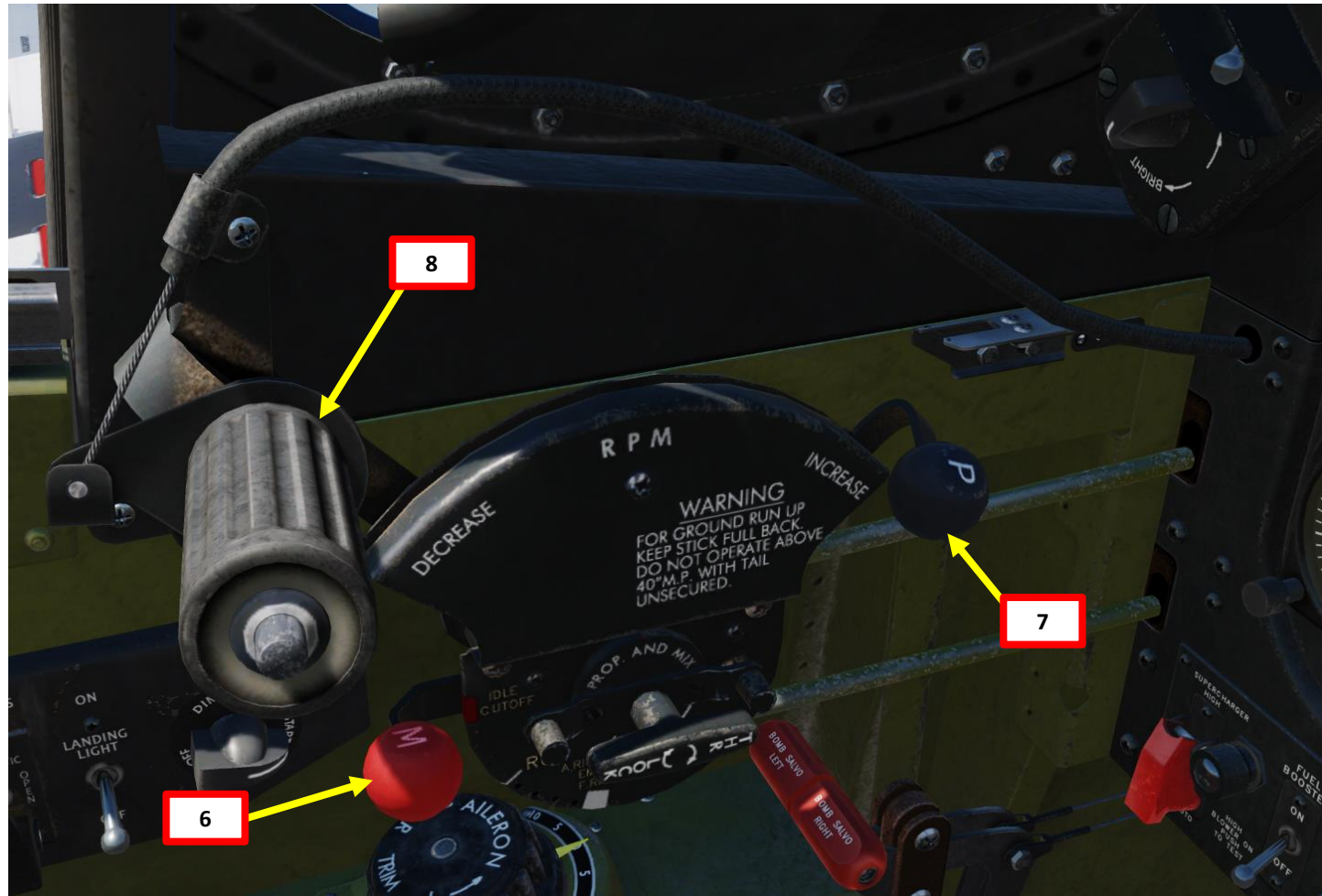
P-51D
MUSTANG



PART 4 - START-UP

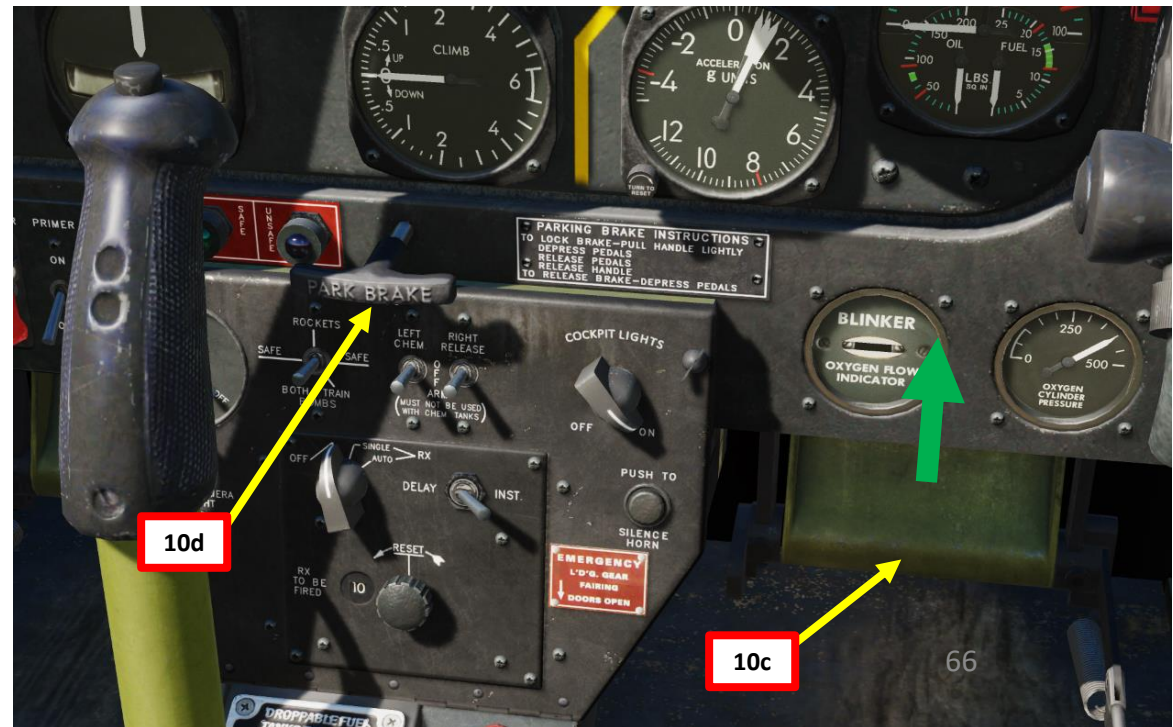
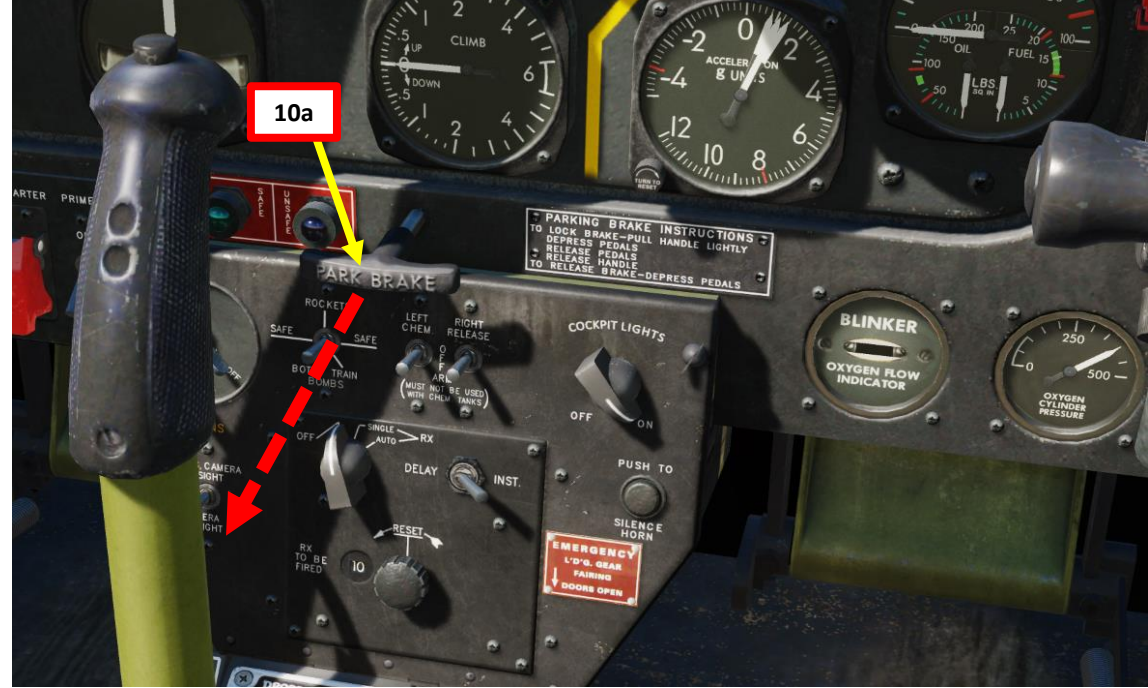
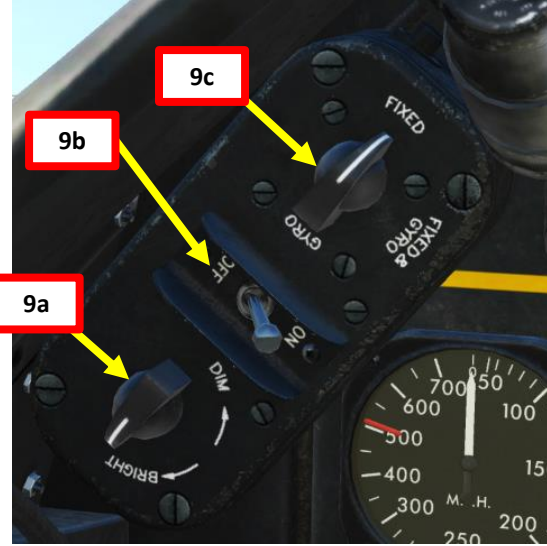
PRE-FLIGHT

1. Flaps – UP
2. Carburettor Ram Air Control Lever – FORWARD (RAM AIR POSITION)
3. Carburettor Hot Air Control Lever – FORWARD (NORMAL POSITION)
4. Rudder Trim: 6 deg right
5. Elevator Trim: 2 deg nose heavy with no drop tanks, 4 deg nose heavy with drop tanks
6. Mixture Control Lever – IDLE CUT-OFF
7. Propeller Control Lever – FULLY FORWARD
8. Crack Throttle Open (advance throttle 1 inch forward)



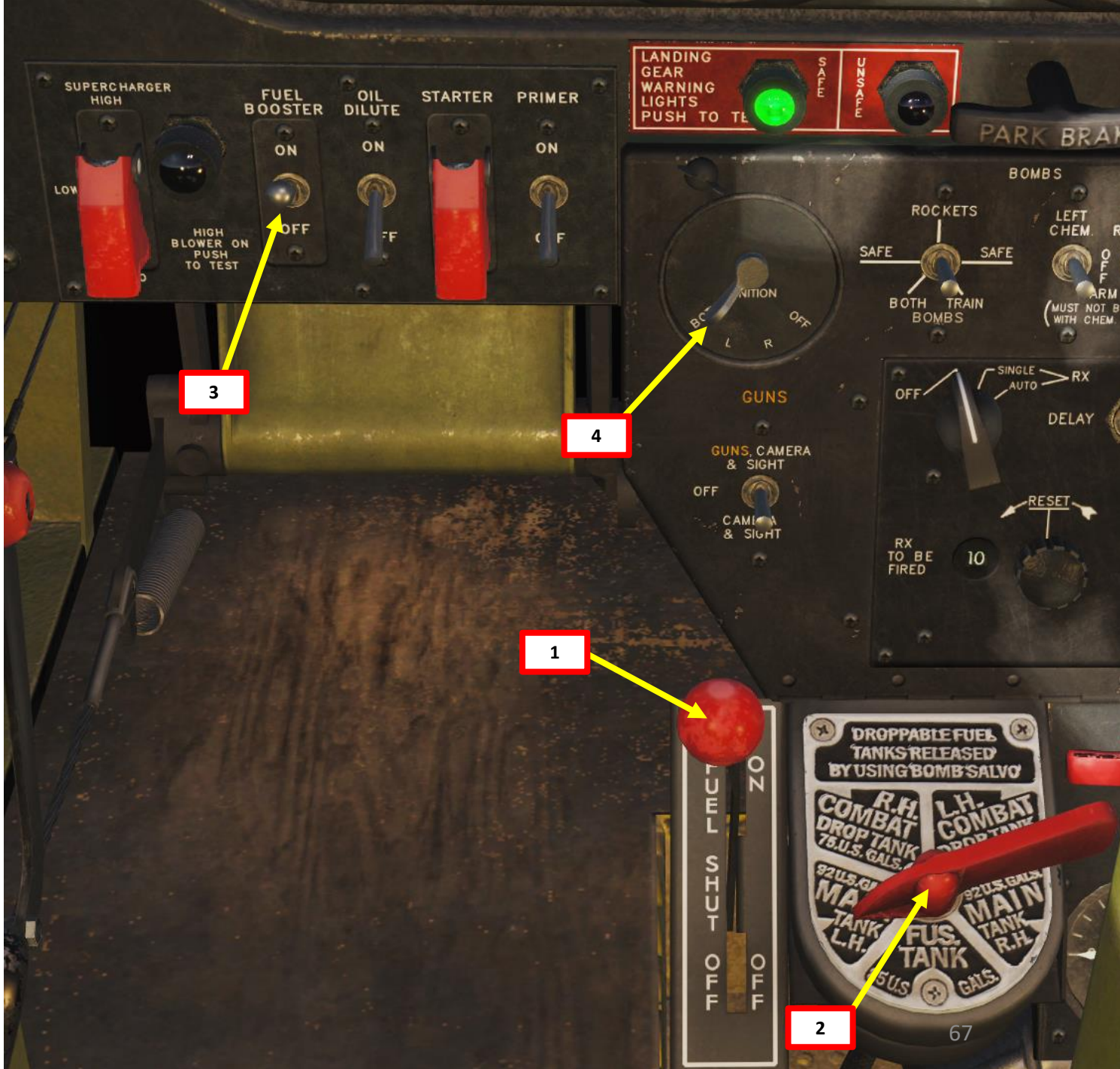
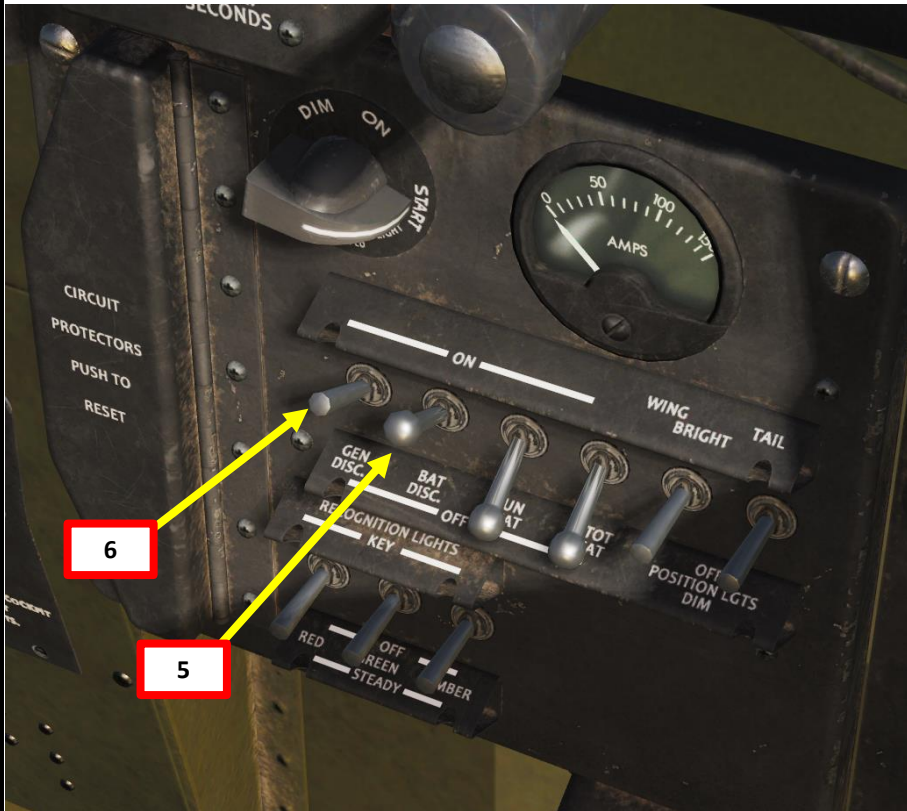
PRE-FLIGHT

9. Set Gunsight Selector-Dimmer Panel
 - a) Brightness – BRIGHT
 - b) Gyro Power – ON
 - c) Gunsight Mode - FIXED
10. Set Parking Brake
 - a) Click and Hold Parking Brake Handle (hold left mouse button)
 - b) Press wheel brake pedals
 - c) Release Wheel brake pedals
 - d) Release Parking Brake Handle (release left mouse button)
 - e) To release parking brake, tap your wheel brake pedals



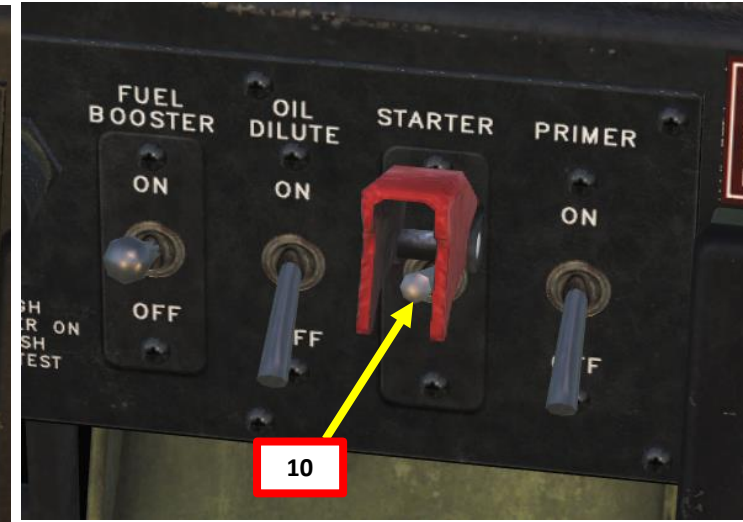
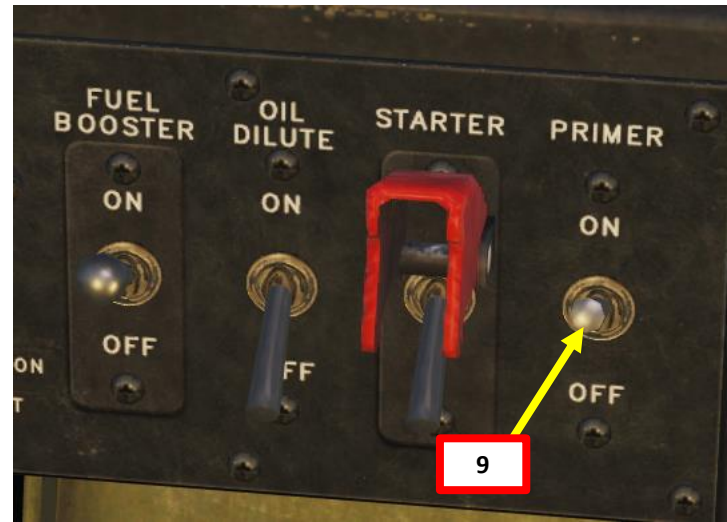
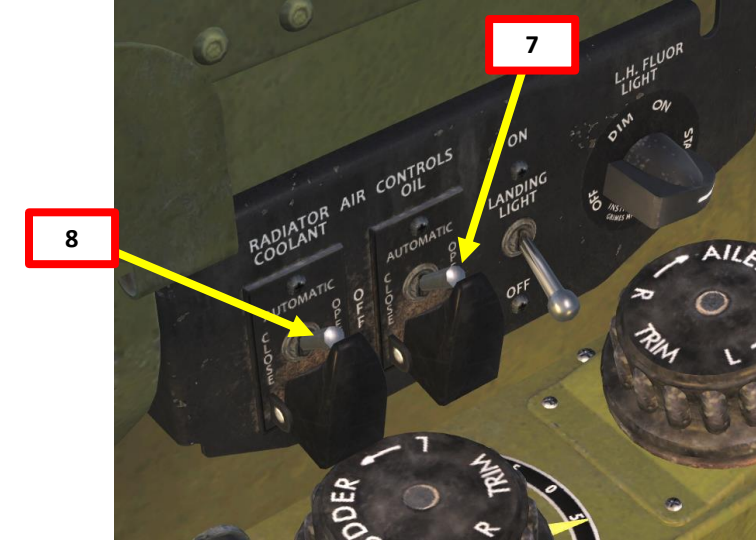
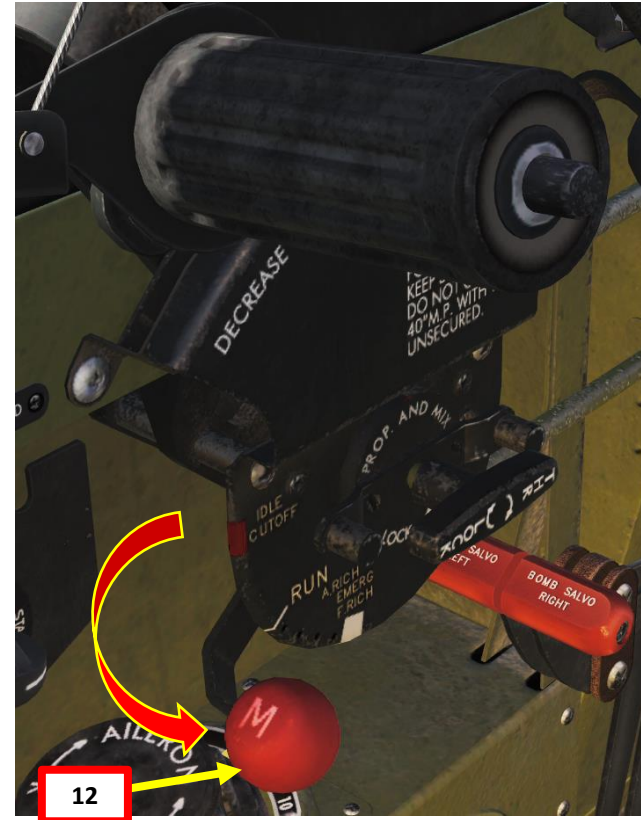
ENGINE START

1. Fuel Shut-Off Valve – ON
2. Fuel Selector Valve – Set to MAIN TANK LEFT HAND SIDE
3. Fuel Booster – ON
4. Ignition (Magnetos) Switch – BOTH
5. Battery Switch – ON (UP)
6. Generator Switch – ON (UP)



ENGINE START

7. Oil Radiator Flap Control Switch – AUTO (UP)
8. Coolant Radiator Flap Control Switch – AUTO (UP)
9. Hold Primer Switch for 3-4 seconds
10. Verify that the propeller is clear and command « Clear prop! » to warn people around you that you are about to start the engine. When ready, flip the Starter Switch cover and hold the Starter Switch.
11. Wait for the propeller to start spooling up (keep holding the starter switch) and hold the primer switch for 2-3 seconds again to prime the engine again to trigger the engine ignition.
 - **Note: do not engage starter switch for more than 15 seconds.**
12. When propeller spins and engine “coughs”, set mixture to RUN by right-clicking on the red Mixture Lever.
 - **Do not open the mixture control until the engine is firing to prevent excess fuel in the induction system. If the engine has not started after 2 minutes of cranking, disengage the starter and allow it to cool for one minute before making another attempt.**
13. After Engine Start, release starter switch and throttle back to IDLE. As engine power increases, the hydraulics will kick in automatically, raising your flaps up gradually as hydraulic pressure increases.

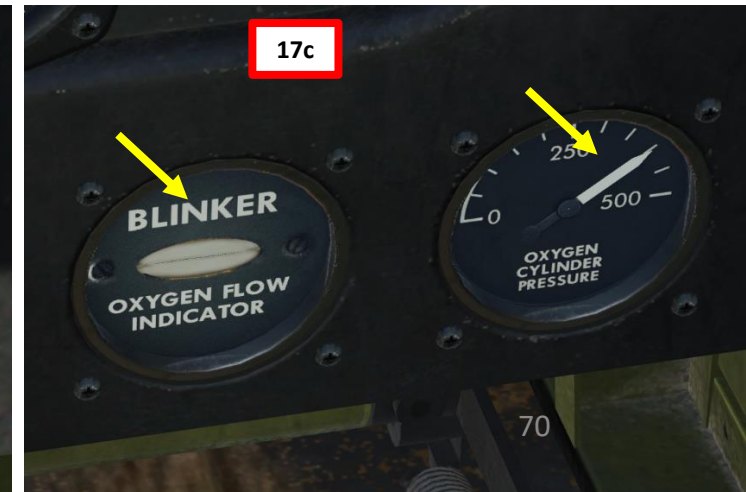
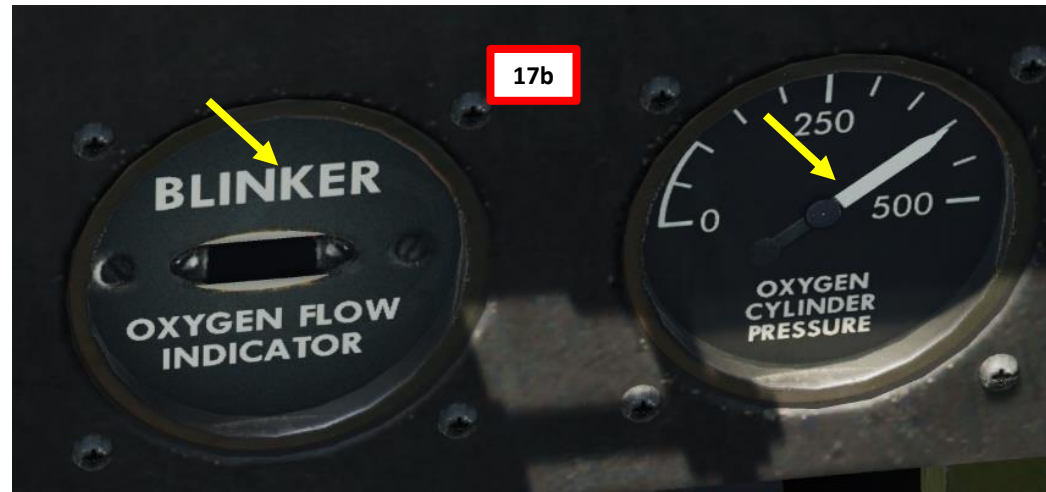
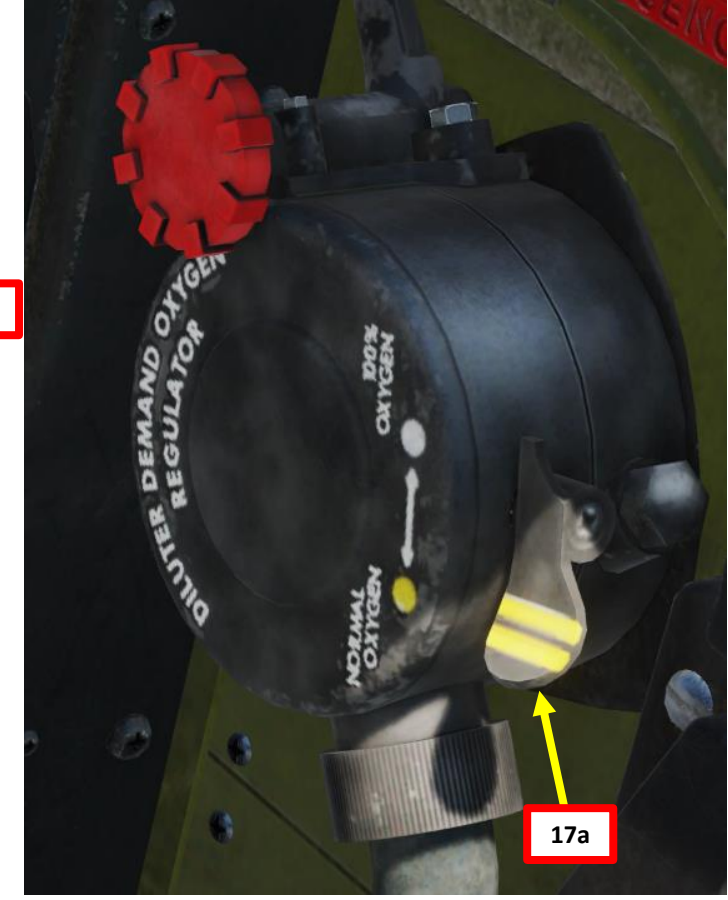
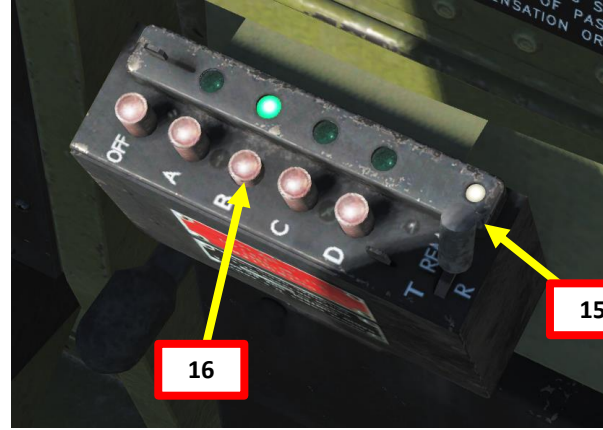


ENGINE START



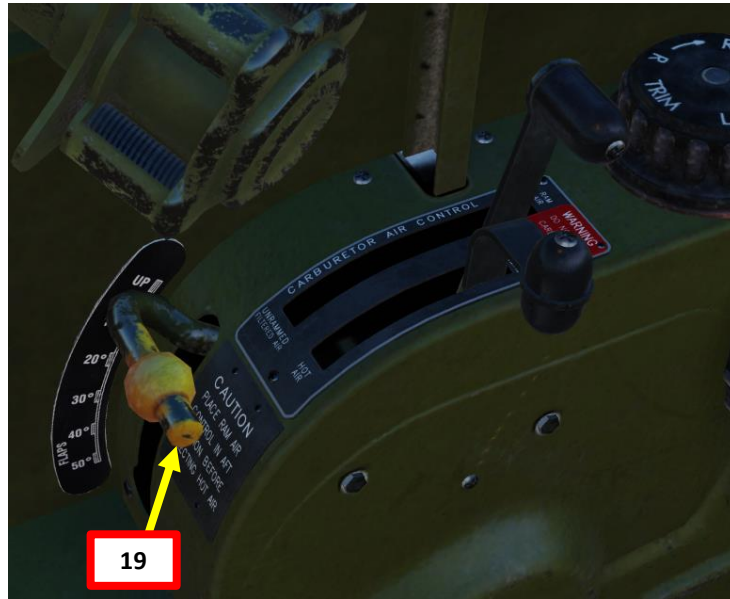
POST-START

- Uncage Attitude Indicator by scrolling mousewheel on caging knob
- Set the radio Transmit-Receive switch to “REM” (Remote Operation)
- Select desired channel (A, B, C or D)
- Select Oxygen Mix switch to NORMAL (DOWN)
- Verify that Oxygen Cylinder pressure is sufficient and that Oxygen Flow Indicator (Blinker) indicates oxygen flow (.



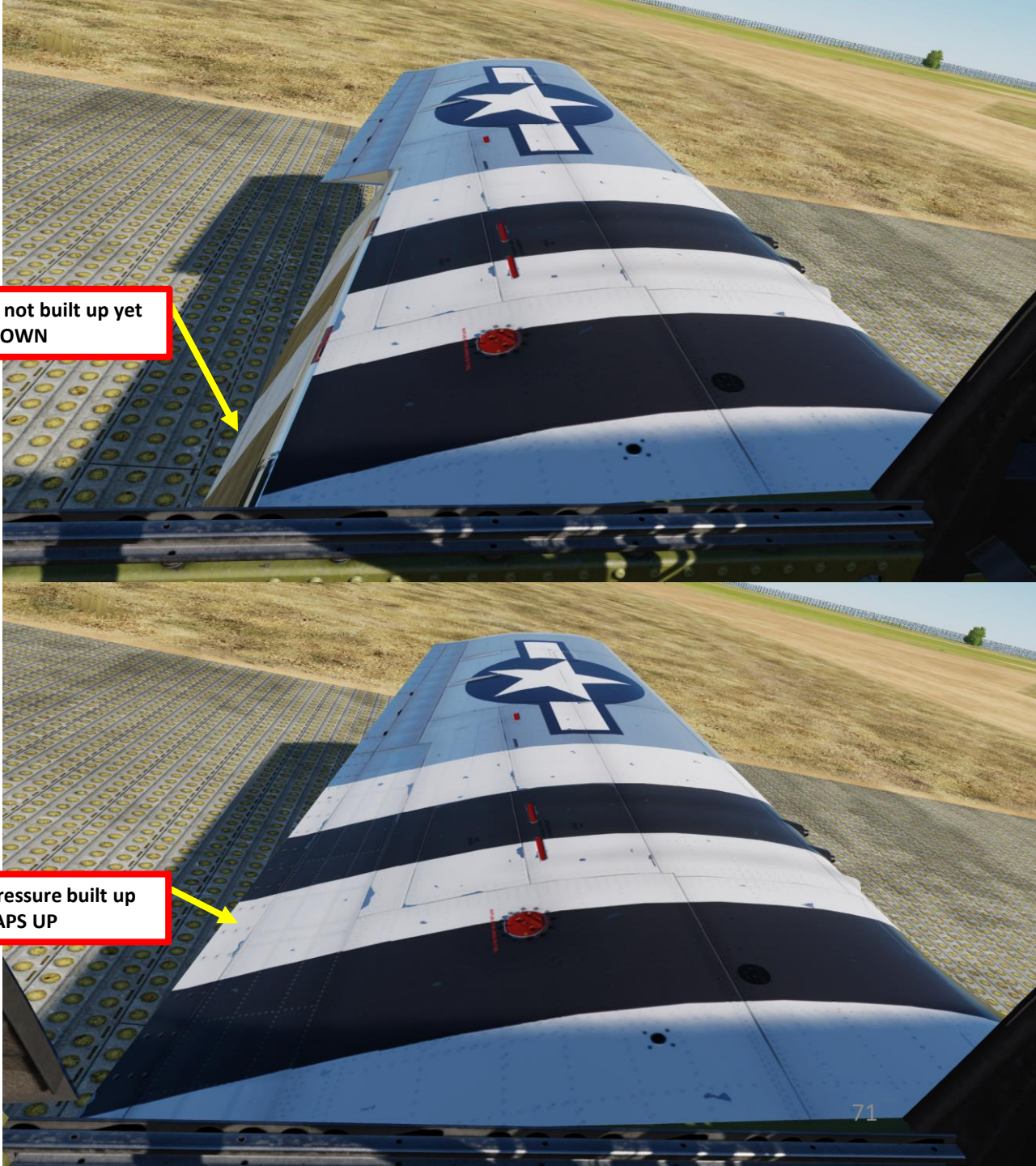
POST-START

- 19. As engine power increases, the hydraulics will kick in automatically, raising your flaps up gradually as hydraulic pressure increases.



Hydraulic pressure not built up yet
FLAPS DOWN

Hydraulic pressure built up
FLAPS UP



ENGINE WARM-UP

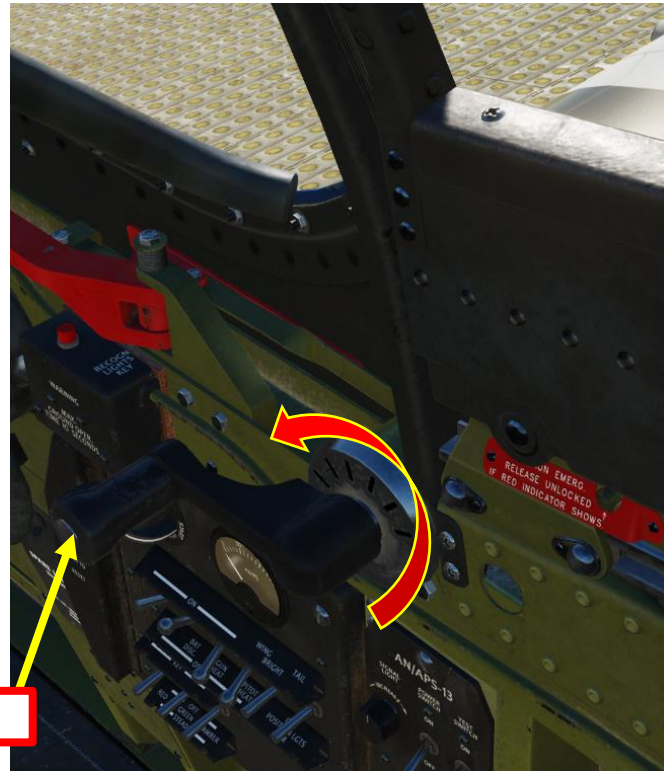
1. Ensure oil pressure is at least 60 psi.
 - If there is no oil pressure after 30 seconds running or if the pressure drops to 0 after a few minutes of ground operation, stop the engine immediately and investigate to prevent excess wear and damage.
2. Adjust throttle to reach a RPM between 1000 and 1200 (IDLE range).
3. Wait until engine oil warms up to at least 15 deg C and coolant temperature is at least 60 deg C.
4. Start taxiing when engine is warmed up by releasing the Parking Brake (tap wheel brakes).

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



TAXI PROCEDURE

1. Close canopy by turning the Canopy crank.
2. Taxi to the runway when ready. Be careful not to overheat your engine on the ground.



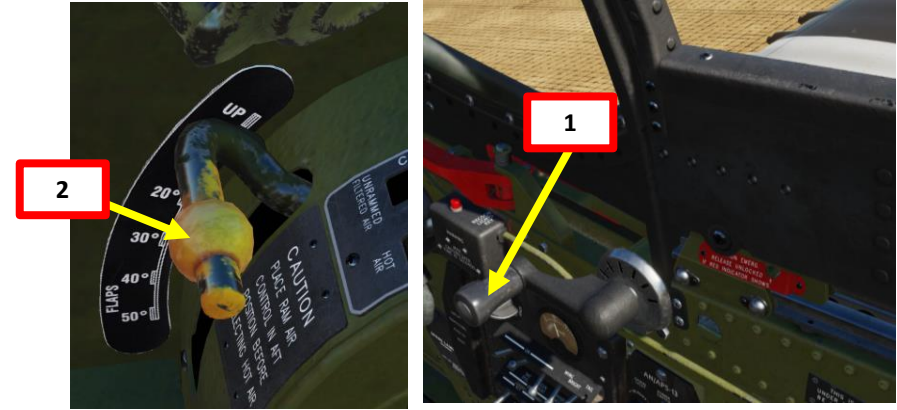
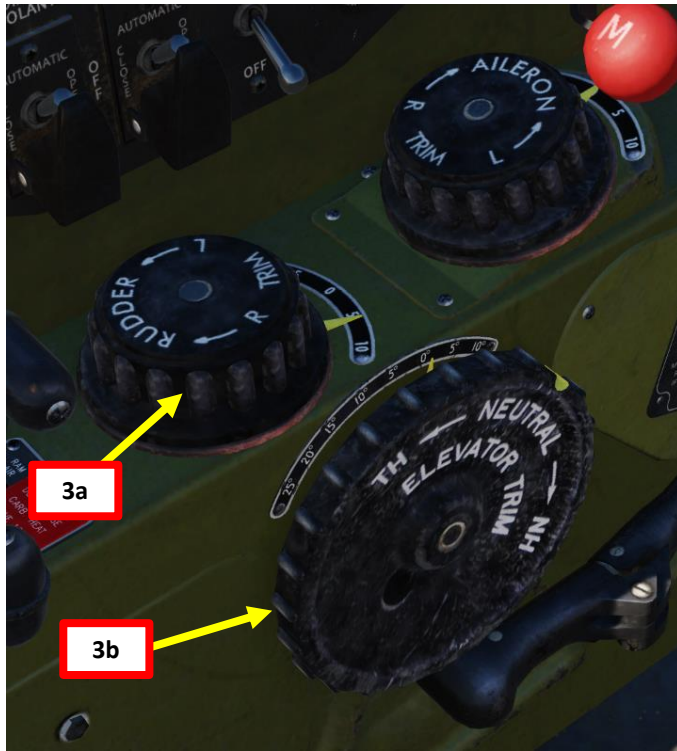
TAXI PROCEDURE

3. Tap toe brakes to release the parking brake. The disc-type wheel brakes are hydraulically-actuated.
4. Throttle up to gain forward motion. Taxiing should be done at 10-15 mph maximum.
5. The nose restricts forward visibility. This means that in taxiing, you must zig-zag (or "S-turn") continually. If you want to go straight, pull the stick fully back to lock the tailwheel in position.
6. To perform a turn, use differential braking by gently tapping the wheel brake pedal on the side you wish to turn.



TAKEOFF PROCEDURE

1. Line up on the runway and verify the canopy is closed.
2. Set Flaps Lever – UP for normal weight configurations, or 10-20 deg for heavy configurations (bombs/rockets).
3. Verify takeoff trim configuration:
 - a) Rudder Trim: 6 deg right
 - b) Elevator Trim: 2 deg nose heavy with no drop tanks, or 4 deg nose heavy with drop tanks
4. Set Propeller Pitch/RPM Control Lever Fully FWD to increase controlled RPM to 3000
5. Throttle up to move forward and ensure the tailwheel is straightened out. Then, pull your stick back to lock your tailwheel
6. Press and hold the Wheel Brakes Pedals
7. Smoothly increase throttle to 35 in Hg of Manifold Pressure (never jam the throttle forward).
8. When you reach 35 in Hg of Manifold Pressure, release brakes and gradually throttle up to 61 in Hg (Takeoff Power). A lower power setting of 55 in Hg may be used for formation takeoffs.



TAKEOFF PROCEDURE

9. Do not use your brakes to steer your aircraft. Keep the stick pulled aft to keep the tailwheel straight.
10. Use your rudder to make small adjustments and counter engine torque.

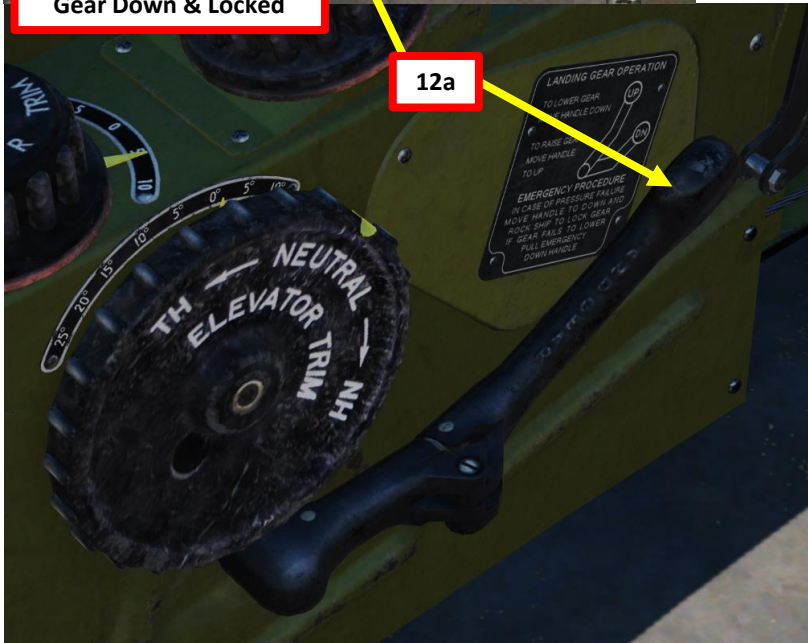


TAKEOFF PROCEDURE

11. At 100 mph, center your control stick to allow you to pick up airspeed
12. At 120 mph, rotate and retract your landing gear by pulling up the Landing Gear lever.
 - a) Landing Gear SAFE Warning light (green) illuminates when gear is down and locked
 - b) Landing Gear UNSAFE Warning light (red) illuminates when gear is in transition
 - c) Both Landing Gear SAFE and UNSAFE Warning lights extinguish when gear is up and locked



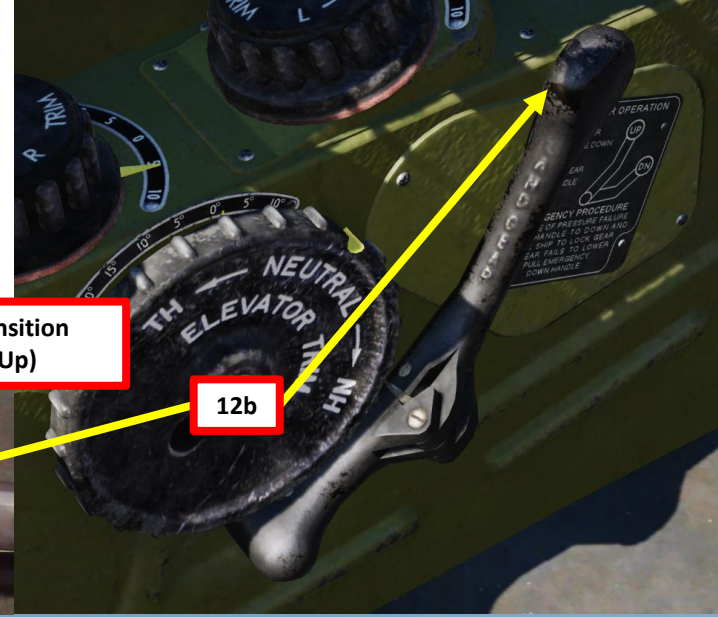
Gear Down & Locked



12a



Gear In Transition (Raising Up)



12b



TAKEOFF PROCEDURE

12. At 120 mph, rotate and retract your landing gear by pulling up the Landing Gear lever.
 - a) Landing Gear SAFE Warning light (green) illuminates when gear is down and locked
 - b) Landing Gear UNSAFE Warning light (red) illuminates when gear is in transition
 - c) Both Landing Gear SAFE and UNSAFE Warning lights extinguish when gear is up and locked
13. After takeoff, it's important to **avoid braking the wheels to stop them from turning**. If the brakes are hot from excessive ground use, they are likely to freeze/lock. The design of the gear and the wheel wells is such that under normal conditions the turning of the wheels has no harmful effect even after they have been retracted into the wheel wells.
14. When landing gear is up and locked, adjust manifold pressure to 46 in Hg with the throttle and reduce RPM to 2700 using the Propeller Pitch/RPM Control Lever (Maximum Continuous Power).
15. Start climbing.



VIDEO DEMO:

<https://www.youtube.com/watch?v=xdx8kVWL70M>



LANDING PROCEDURE

This picture sums up the landing procedure. The key to a successful landing in the P-51 is **airspeed**. If you touchdown at the proper speed, you will avoid nasty surprises like bouncing or veering off the runway.

VIDEO DEMO:
<https://www.youtube.com/watch?v=JzQacZcwvdM>

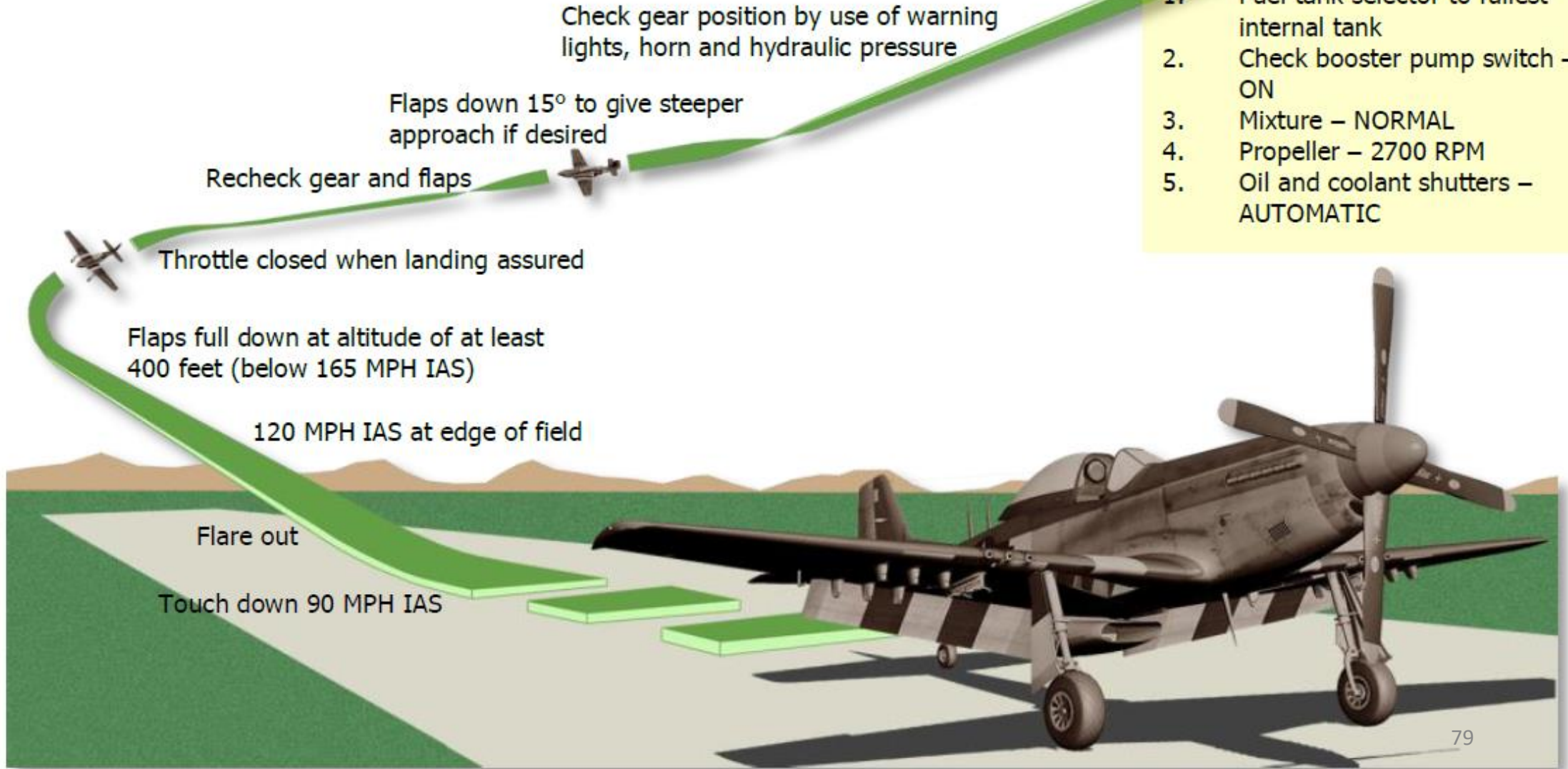
Landing gear handle down below 170 MPH IAS

WARNING
Do not change gear position until cycle is completed as gear may get out of proper sequence

Before entering pattern, accomplish the following:

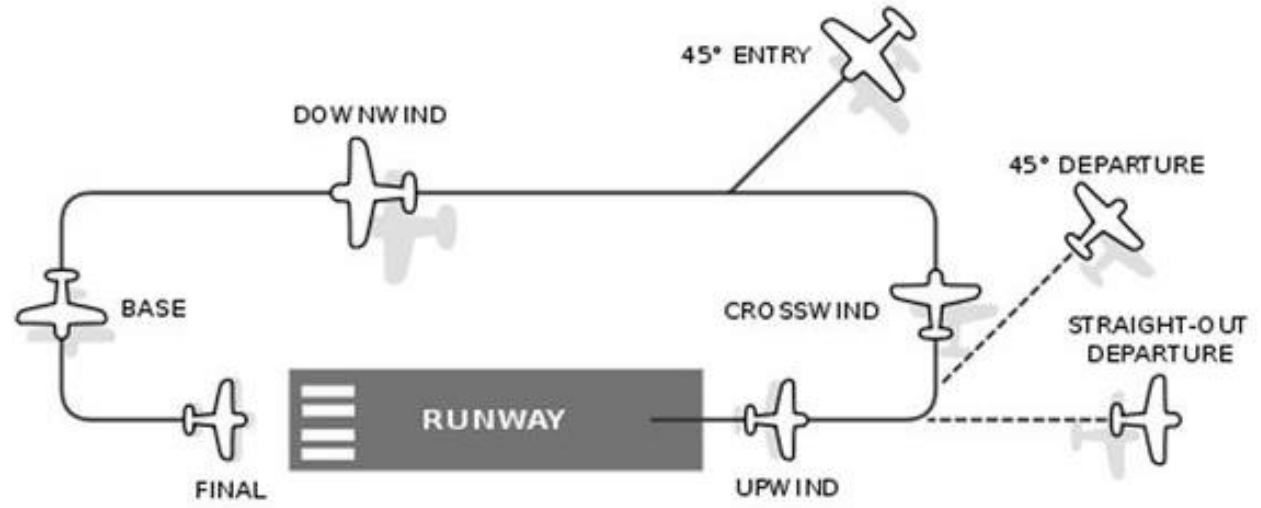


1. Fuel tank selector to fullest internal tank
2. Check booster pump switch – ON
3. Mixture – NORMAL
4. Propeller – 2700 RPM
5. Oil and coolant shutters – AUTOMATIC



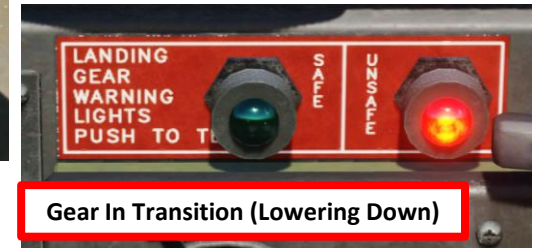
LANDING PROCEDURE

1. Fuel – select fullest internal tank for landing.
2. Set Propeller RPM control lever – 2700 RPM.
3. Enter downwind leg at 1000 ft altitude.



LANDING PROCEDURE

4. Landing gear – move lever to DOWN. Check indicator to see that the gear is down and locked. Note, the gear should be lowered below 170 mph.
5. Flaps – full down. Note, flaps are usually lowered for the turn to final approach. Only lower flaps below 165 mph.
6. Maintain approximately 150 mph IAS in the traffic pattern
7. When sure of a correct landing approach in final, close/cut the throttle.
8. Just before getting to the runway, 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.
9. Hold the aircraft in the 3-point attitude just above the runway until flying speed is lost and the plane sets down at approximately 90 mph.
10. The tail wheel is locked when the stick is neutral or aft, so steering is limited after touchdown. Keep the stick held back until enough speed is lost and you are ready to turn off the runway and taxi.
 - *Note: The **red Unsafe light** will turn on and a horn alert will sound in the cockpit when the throttle is retarded below the minimum cruise condition while the landing gear doors are closed and the gear is up and locked, or at any throttle position if the landing gear doors are open and the gear is down and unlocked or up and locked.*



LANDING PROCEDURE



LANDING PROCEDURE



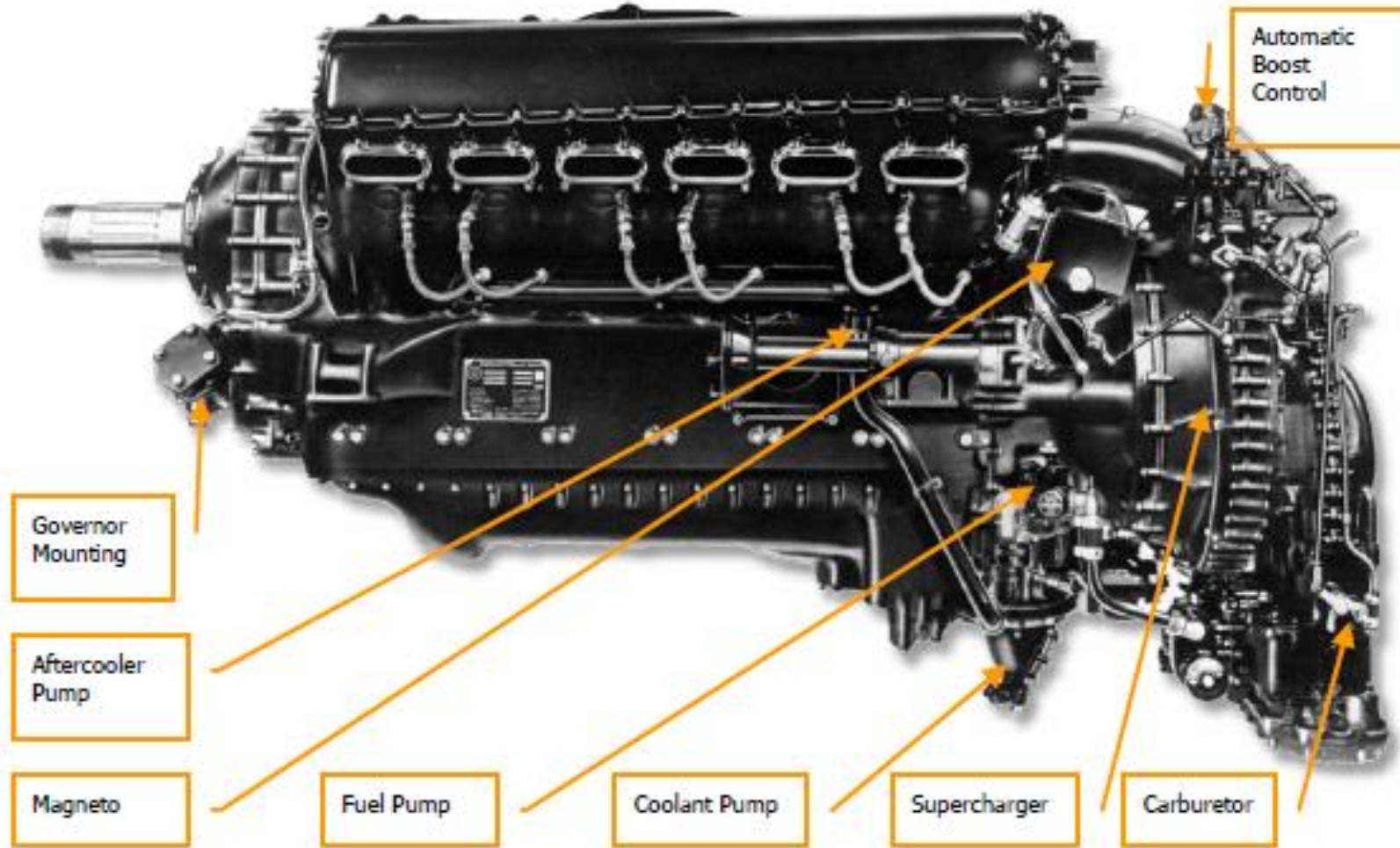
LANDING PROCEDURE



PACKARD V-1650 MERLIN ENGINE

The powerplant of the P-51D is a liquid-cooled, 12-cylinder Rolls-Royce Merlin V-1650-7, built in the U.S. by the Packard Motor Car Company. It is equipped with an injection-type carburetor, a two-speed, two-stage supercharger, and develops over 1400 hp on takeoff.

The P-51D has automatic radiator coolant and oil radiator controls, which can be overridden manually. The pilot can monitor engine RPM, manifold pressure, oil pressure, oil temperature, fuel pressure, carburetor temperature and coolant temperature. Each parameter has specific limitations that you should be aware of AT ALL TIMES. The engine limitations are listed in this section.



ENGINE INDICATIONS

Here is an overview of the various engine indications you have to monitor:

- **Engine Tachometer (x100 RPM):** Controlled by the engine RPM lever. Indicates engine speed turning the constant speed propeller. The green range indicates normal operating RPM of 1600 - 2400. The red line indicates maximum normal RPM of 3000.
- **Manifold Pressure (in Hg):** Manifold Pressure indicates the air pressure after the supercharger in inches of mercury. The green range indicates the normal operating range of 26-36 in Hg. The red line indicates full military power of 61 in Hg.
- **Coolant Temperature (deg C):** indicates the water-glycol coolant temperature. High coolant temperatures may indicate an engine setting that is too high or a perforated radiator leaking coolant.
- **Oil Temperature (deg C):** indicates the oil temperature in the engine lubrication system.
- **Oil Pressure Indicator (psi):** indicates the oil pressure of the engine lubrication system.
- **Fuel Pressure Indicator (psi):** indicates engine fuel pressure.
- **Suction Pressure Indicator (psi):** indicates engine suction pressure.
- **Carburettor Temperature Indicator (deg C):** indicates the temperature of the air running through the carburettor air scoop.
- **Supercharger High Blower Indicator Light:** indicates the supercharger is in second gear (high blower).

Redlines on the gauges show the value not to exceed of the engine parameter.

Supercharger High Blower Indicator



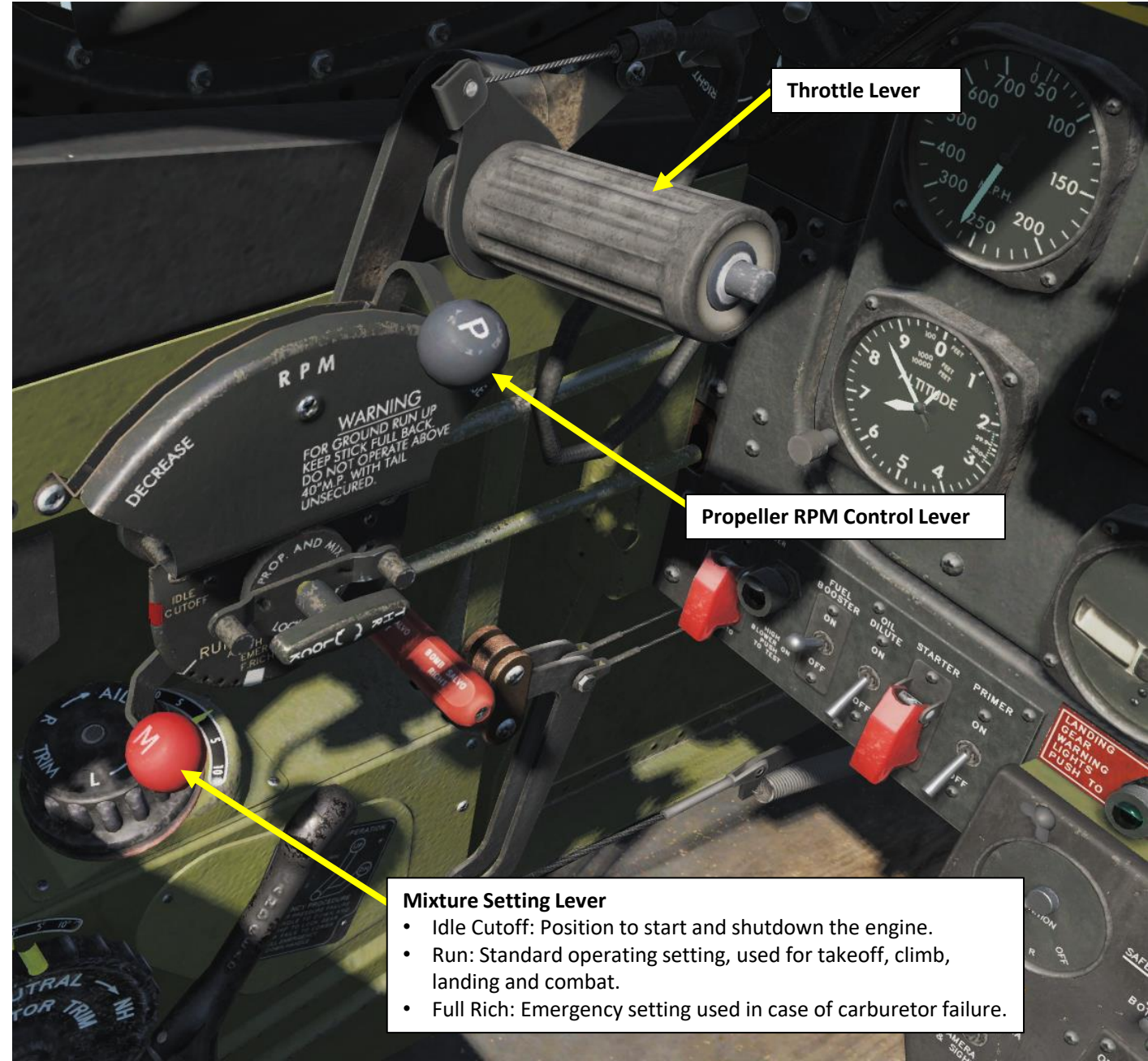
ENGINE CONTROLS

The main engine controls of the Mustang are:

- **Throttle:** Controls manifold pressure.
- **RPM Control Lever:** Controls engine speed turning the constant speed propeller.
- **Mixture Setting Lever:** Controls mixture setting automatically if set to RUN, otherwise an emergency setting is available in case of carburetor failure (FULL RICH).
- **Supercharger Mode Selector:** Controls manual or automatic gear shifting of the supercharger at high altitudes.

Supercharger Mode Selector

- Manual – High Gear
- Manual – Low Gear
- Automatic



Throttle Lever

Propeller RPM Control Lever

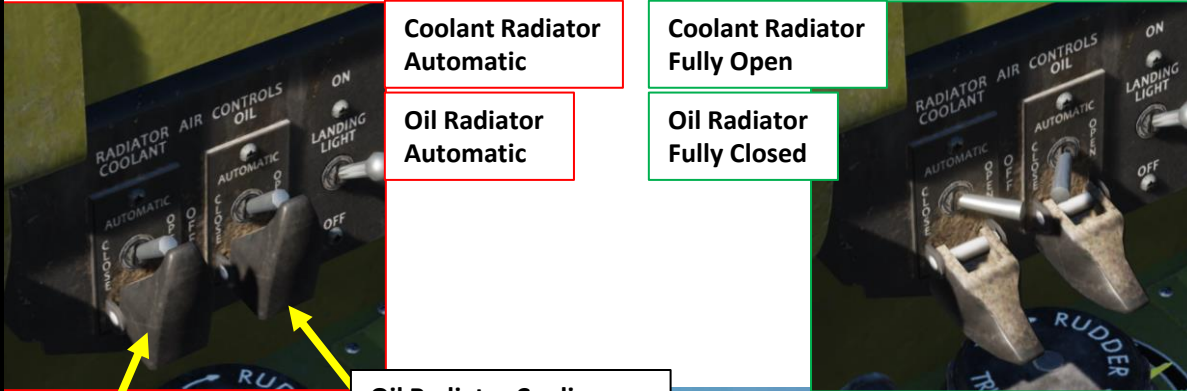
Mixture Setting Lever

- Idle Cutoff: Position to start and shutdown the engine.
- Run: Standard operating setting, used for takeoff, climb, landing and combat.
- Full Rich: Emergency setting used in case of carburetor failure.

ENGINE CONTROLS

The main engine controls of the Mustang are:

- **Radiator Coolant Control Switch:** Controls coolant radiator outlet door. Switch has 3 positions: automatic (UP), manually close (AFT), and manually open (FWD).
- **Oil Radiator Control Switch:** Controls oil cooler radiator outlet door. Switch has 3 positions: automatic (UP), manually close (AFT), and manually open (FWD).



Coolant Radiator Automatic

Oil Radiator Automatic

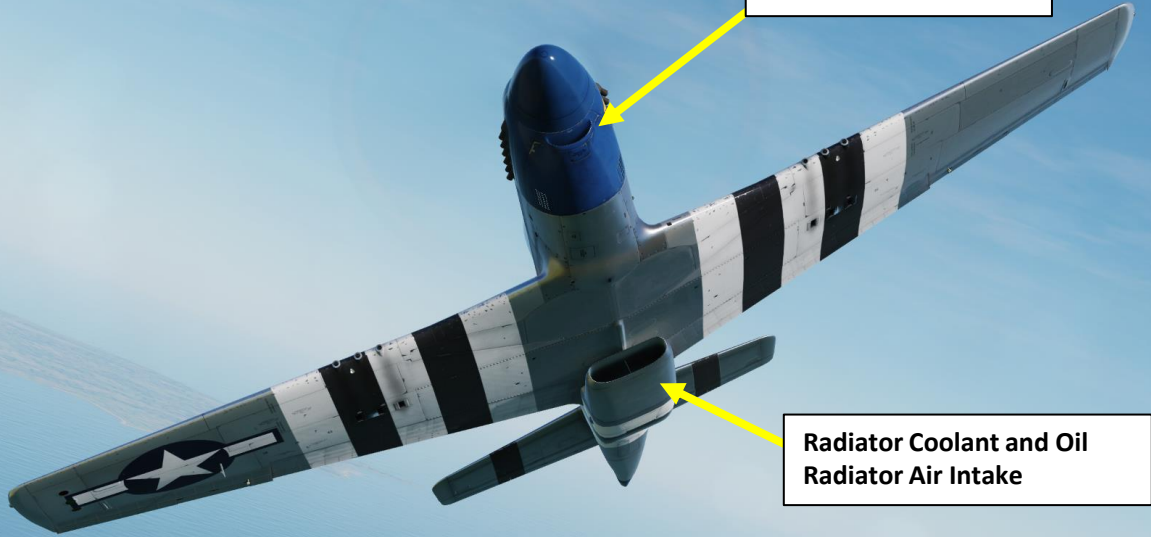
Coolant Radiator Fully Open

Oil Radiator Fully Closed

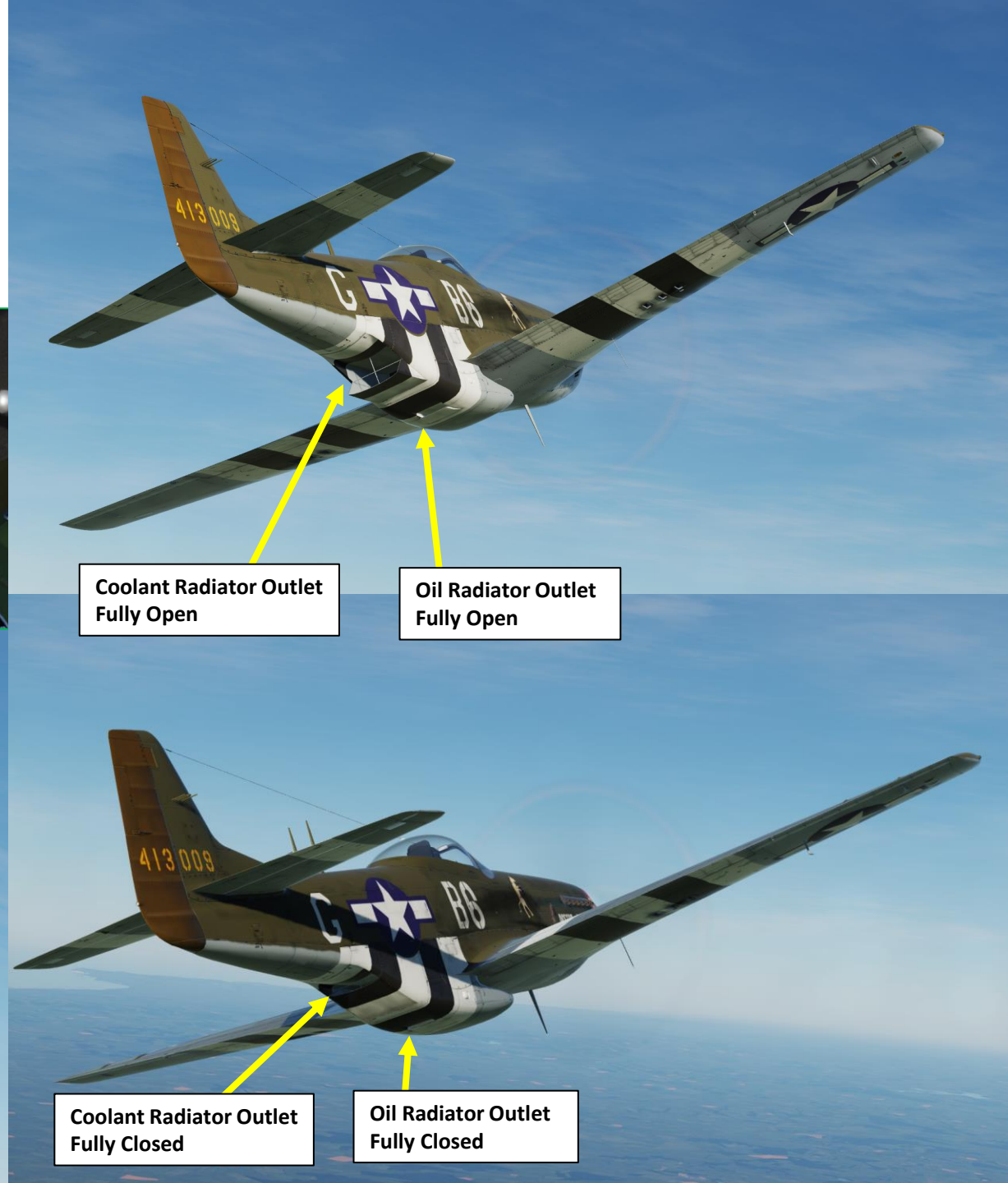
Water Radiator Coolant Control Switch (+ Cover)

Oil Radiator Cooling Control Switch (+ Cover)

Carburetor Air Scoop (Ram Air)



Radiator Coolant and Oil Radiator Air Intake



Coolant Radiator Outlet Fully Open

Oil Radiator Outlet Fully Open

Coolant Radiator Outlet Fully Closed

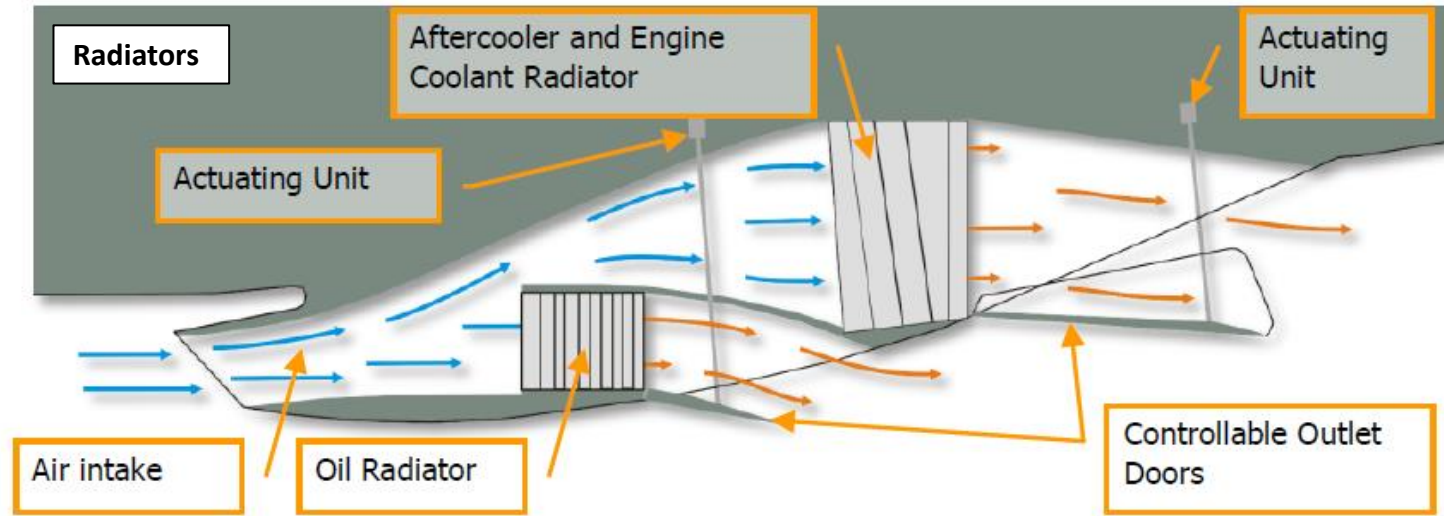
Oil Radiator Outlet Fully Closed

ENGINE CONTROLS

Note on Radiator Operation:

An outlet door on the bottom of the air scoop controls the oil temperature. Under ordinary conditions this door is operated automatically. However, it can be operated manually when running the engine on the ground or in case the automatic regulator fails in the air. This can be done by means of the Oil Radiator Air Control switch, located on the Radiator Air Control panel on the left side of the cockpit. The switch has three positions: AUTOMATIC, OPEN, and CLOSE.

The door can be set in any position by holding the toggle switch in the OPEN or CLOSE position for the necessary length of time (approximately 20 seconds), then returning the switch to neutral.



Water Radiator Coolant Control Switch

Oil Radiator Cooling Control Switch

ENGINE CONTROLS

The main engine controls of the Mustang are:

- **Carburettor Cold Air Control Lever:** Controls cold air outlet.
- **Carburettor Warm Air Control Lever:** Controls hot air outlet.

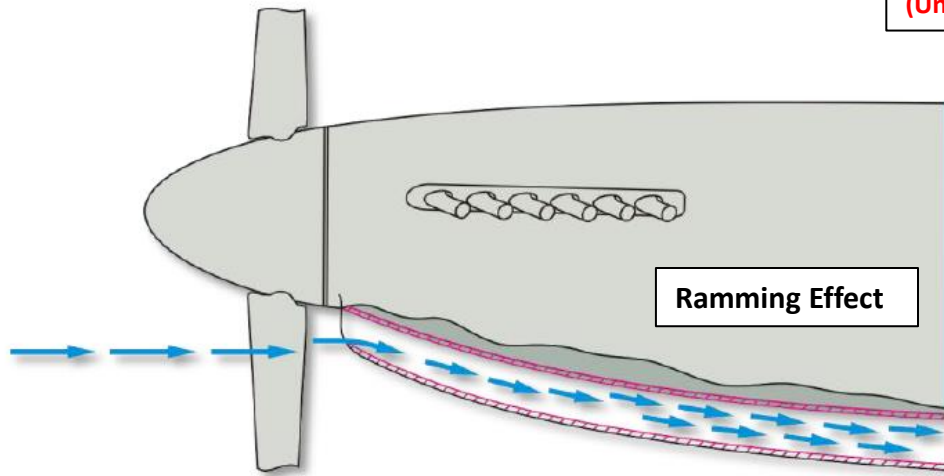
Carburetor air comes through a long carburetor air scoop directly under the engine. The aircraft's motion forces air at high speed (or rams it) directly into the carburetor. This is termed ram air.

If the scoop becomes obstructed by ice or other foreign matter, a door in the air duct opens automatically to admit hot air from the engine compartment to the carburetor.

During normal operations, ram air is always used, but in the event of extreme icing or dust conditions, the carburettor air controls allow the pilot to select either unrammed filtered or, in later model aircraft, unrammed hot air for operation.

- In order to obtain hot air:
 - Hot Air control handle must be set to HOT
 - Cold Air control handle set to UNRAMMED FILTERED AIR.
- If the Cold Air control handle is set to RAM AIR, the hot air control will be ineffective.

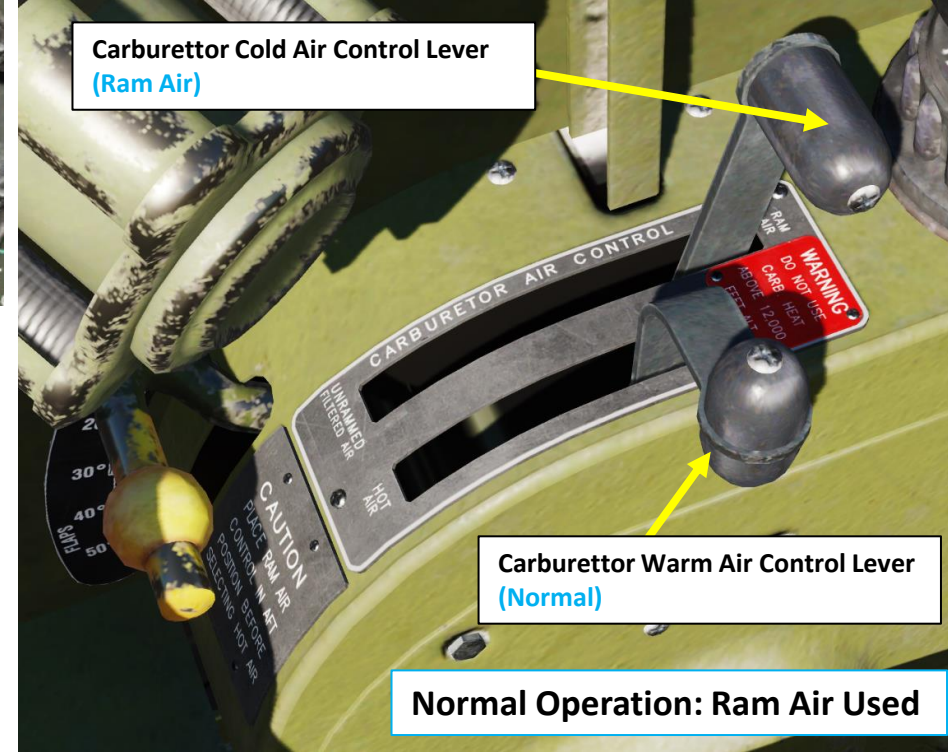
Note: Hot air should not be used above 12,000 feet. At high altitudes its use affects the carburettor's altitude compensation and may result in an overly lean fuel mixture.



Carburettor Temperature (deg C)



Carburettor Cold Air Control Lever (Ram Air)



Carburettor Warm Air Control Lever (Normal)

Normal Operation: Ram Air Used

Carburettor Cold Air Control Lever (Unrammed Filtered Air)



Carburettor Warm Air Control Lever (Hot Air)

Icing Condition: Hot Air Used

ENGINE CONTROLS

The oil system uses standard Air Force oil dilution equipment. This allows the oil to be thinned with gasoline to make the engine easier to start in ambient temperatures below 40°F or 4°C.

Thinning the oil requires allowing the engine to idle with the coolant flap open until the oil temperature drops to 50°C or less. Then, before stopping the engine, oil is diluted using the Dilution switch on the Engine Control panel of the front dash. This will dilute the oil until the engine is ready to be started again. Once the engine warms up, the gasoline in the oil is quickly evaporated.



Oil Dilution Switch



ENGINE OPERATION & LIMITS

If engine overheats, you can:

1. Enter a dive to increase airspeed and airflow to the engine intake.
2. Reduce throttle and RPM
3. Decrease rate of climb
4. Set oil and coolant radiator switches to “MANUAL” mode and set them to the Maximal Open position



CHECK YOUR ENGINE TEMPERATURES EVERY 30 SECONDS OR SO. IT WILL SAVE YOUR LIFE.

Table of Manifold Pressure & RPM Limits for Flight

	Maximum Cruise	Maximum Continuous	Takeoff Maximum	Military Power	War Emergency
Manifold Pressure [in.]	42	46	61	61	67
RPM	2400	2700	3000	3000	3000

Table of Engine Instrument Limits

	Coolant Temperature	Oil Temperature	Oil Pressure	Fuel Pressure
Minimum	-	-	50 PSI	14 PSI
Desired	100°-110°C	70°-80°C	70-80 PSI	16-18 PSI
Maximum	121°C	105°C	-	19 PSI

Manifold Pressure (inches Hg)

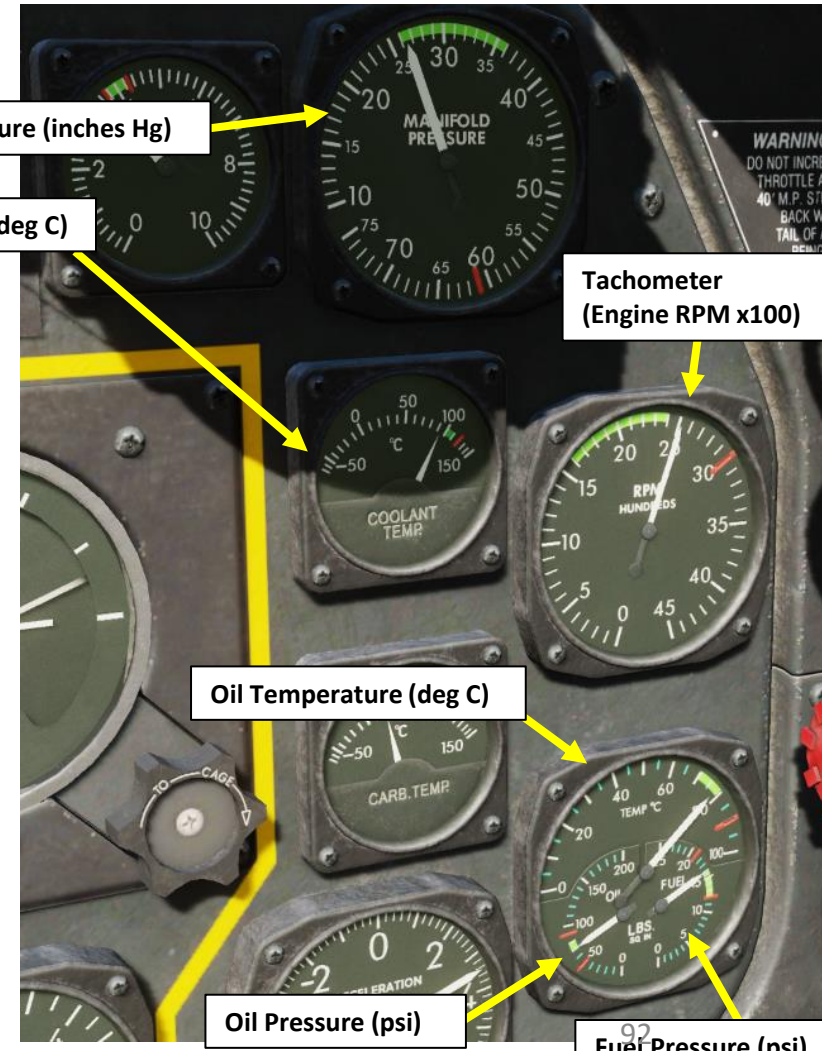
Coolant Temperature (deg C)

Tachometer (Engine RPM x100)

Oil Temperature (deg C)

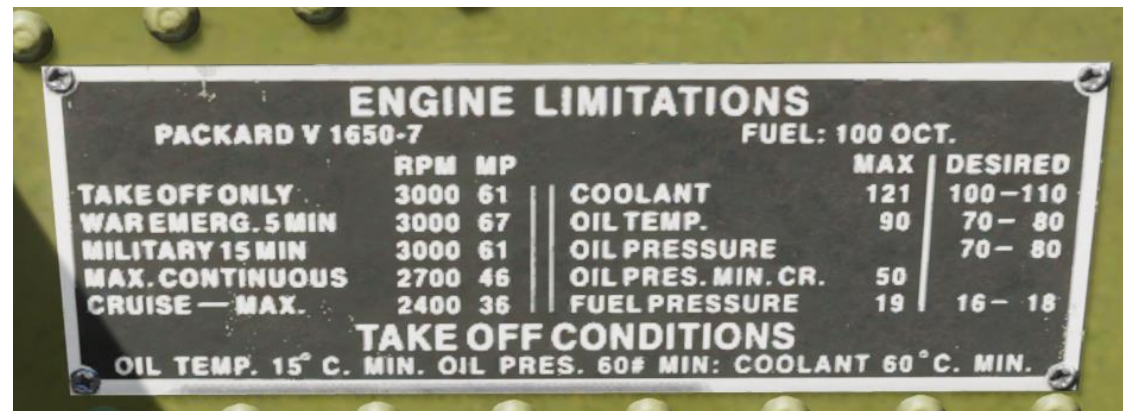
Oil Pressure (psi)

Fuel Pressure (psi)



ENGINE OPERATION & LIMITS

Engine Ratings Table									
Engine Ratings:									
Operating Condition	RPM	MP	HP	Critical Altitude With Ram	Critical Altitude No Ram	Blower	Mixture Control Position	Fuel Flow (Gal/Hr/Eng.) U.S.	Maximum Duration (Minutes)
Take-Off	3000	61	1400	S.L.	S.L.	Low	Run/AR	150	5
War Emergency	3000	67	1595 1295	17,000 28,800	11,700 23,200	Low High	Run/AR Run/AR	166 160	5
Military	3000	61	1450 1190	19,800 31,200	13,700 25,600	Low High	Run/AR Run/AR	158 144	15
Maximum Continuous	2700	46	1120 940	20,500 34,400	17,500 29,500	Low High	Run/AR Run/AR	111 106	Cont.
Maximum Cruise	2400 2400	36 35	790 640	19,500 30,200	17,000 28,200	Low High	Run/AL Run/AL	70 70	Cont.

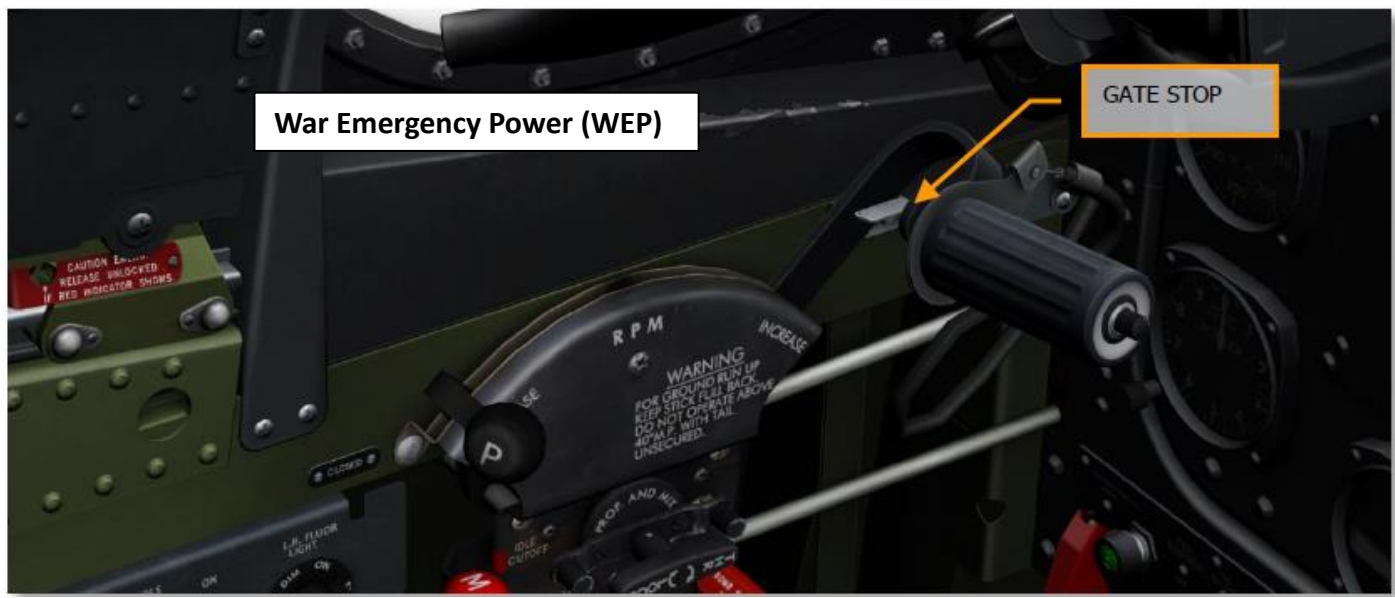
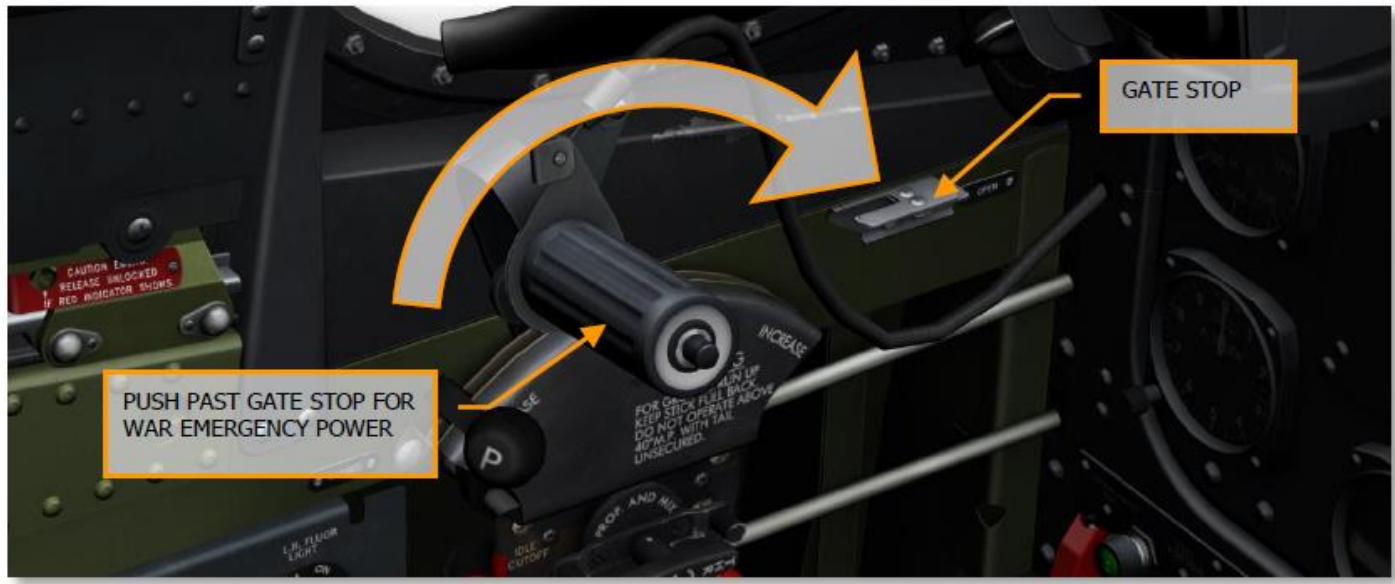


WAR EMERGENCY POWER (WEP)

In order to provide an extra boost to the engine in extreme situations, the throttle can be moved past the gate stop by the quadrant to break the safety wire. The engine will then be opened up to its absolute limit and will give approximately 6 in. of additional manifold pressure in excess of the normal full throttle setting of 61 in. (with mixture control set to RUN or AUTO RICH and prop set for 3000 RPM.) This throttle reserve is called War Emergency Power (WEP) and should be used only in extreme situations. If used for more than 5 minutes at a time, vital parts of the engine may be damaged.

WEP provides no benefit at altitudes below 5,000 feet. The throttle alone provides more than enough power to exceed the operating limits of the engine at these altitudes.

When running in War Emergency Power, the manifold pressure can be increased to a maximum of 67 inHg.



SUPERCHARGER BASICS

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

With a normally aspirated engine, it is not possible to have manifold pressure higher than the existing atmospheric pressure. A supercharger is capable of boosting manifold pressure above 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.

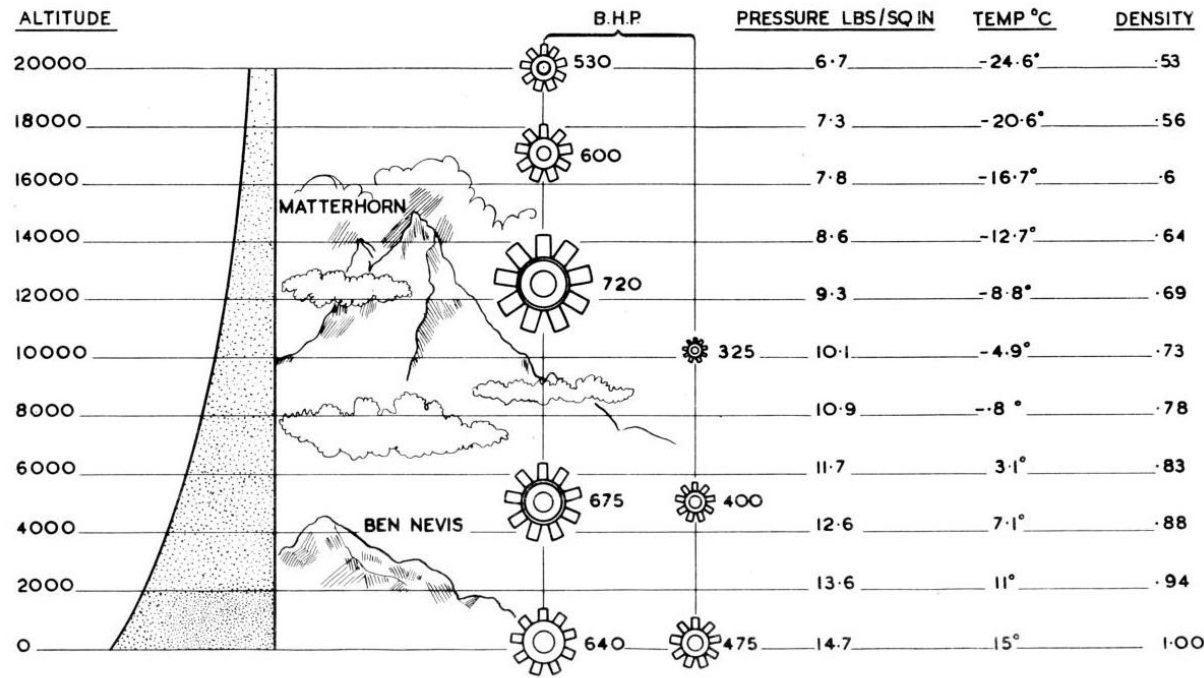
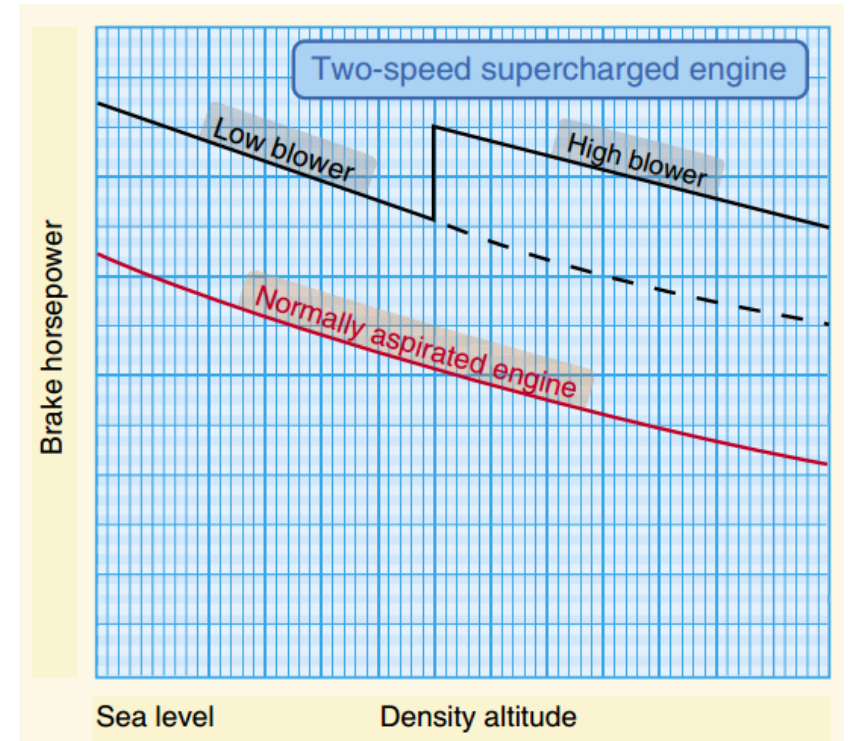


DIAGRAM SHOWING ATMOSPHERIC AND POWER VARIATIONS



First Gear = Low Blower = Low Manifold Pressure = used between 0 and 14500 ft
Second Gear = High Blower = High Manifold Pressure = used at 14500 ft or higher

SUPERCHARGER OPERATION

The supercharger installed on the Packard Merlin engine includes two compressor stages that deliver air from the carburetor intake to the pistons under much greater pressure than would be possible through direct aspiration, allowing a greater fuel-air mixture to be burned and increasing power output.

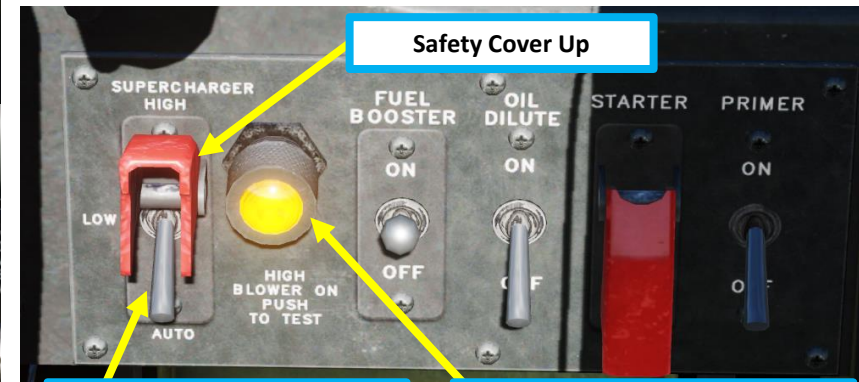
The supercharger works in either low or high blower mode, selection of which can be automatic or manually set by the pilot. In normal operations, high blower mode starts automatically from 14,500 to 19,500 feet, depending on the amount of ram air being delivered through the carburetor. The supercharger increases the blower-to-engine compression ratio from a low of 5.8 to 1 to a high of 7.35 to 1.

The supercharger can be controlled manually by a switch on the instrument panel. The switch has three positions – AUTOMATIC (DOWN), LOW (MIDDLE), and HIGH (UP). Usually, I would recommend that you set it to AUTO to avoid having to manage the supercharger.

SUPERCHARGER IN AUTOMATIC MODE



Safety Cover Down

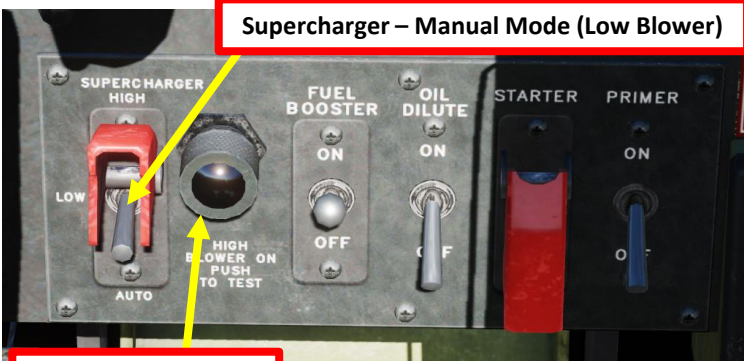


Safety Cover Up

Supercharger Mode Switch AUTO Mode (Down)

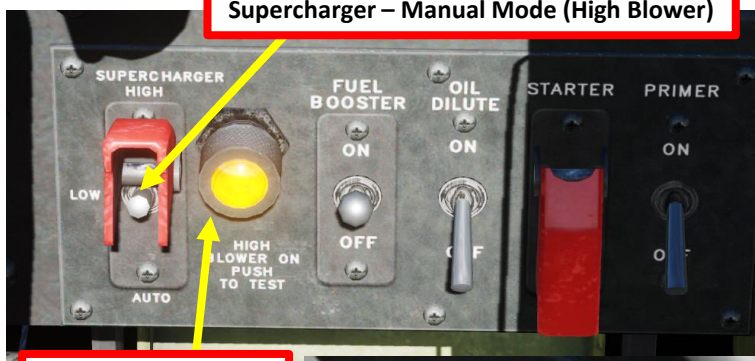
Supercharger High Blower Light

Supercharger – Manual Mode (Low Blower)



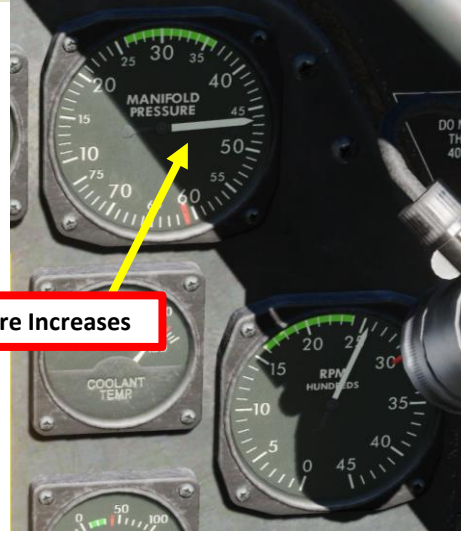
**Low/First Gear
Altitude: 18000 ft**

Supercharger – Manual Mode (High Blower)



**High/Second Gear
Altitude: 18000 ft**

Manifold Pressure Increases



FUEL TANKS

Fuel Capacity

Left Wing Tank Capacity: 92 US Gal

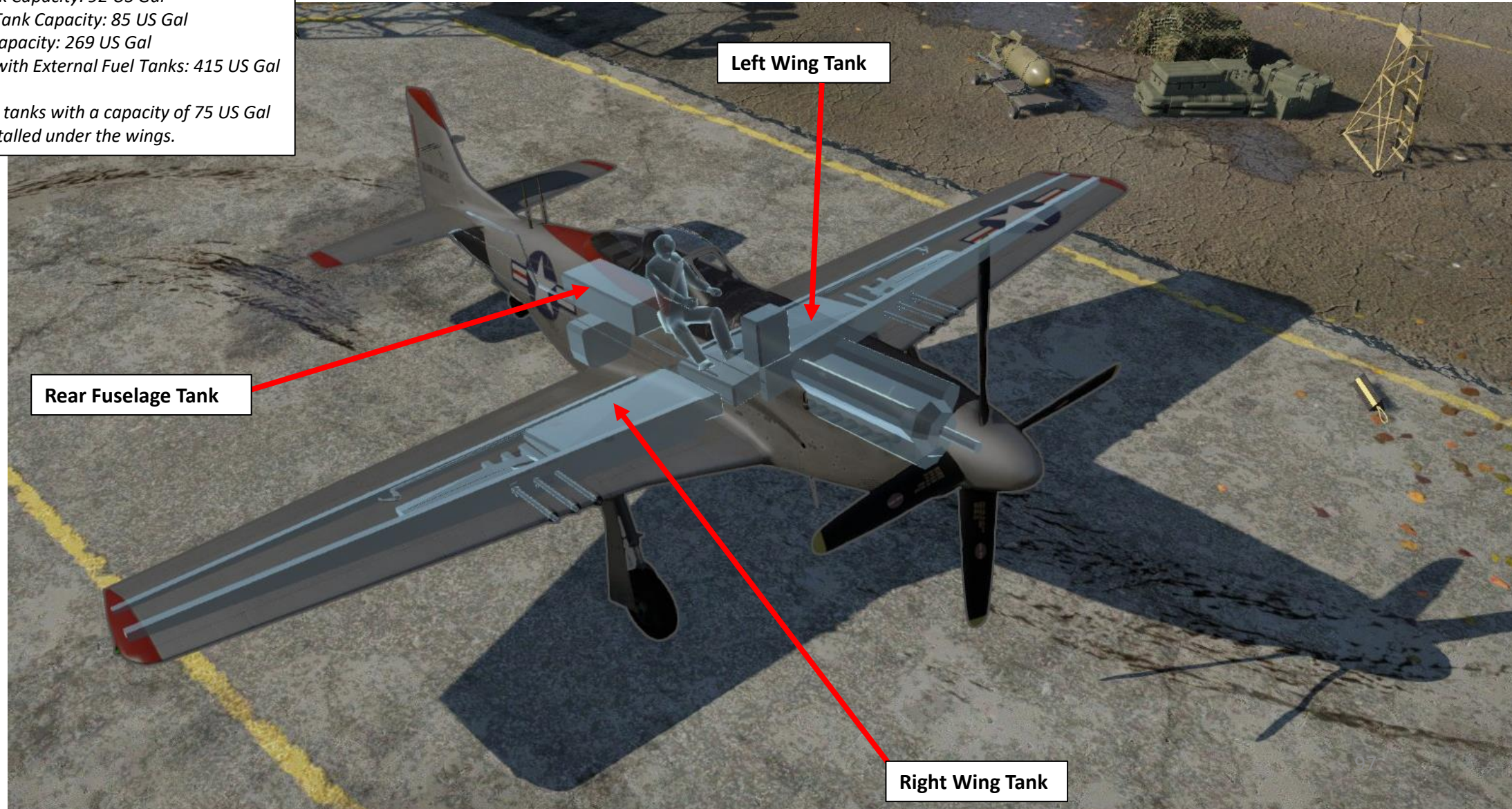
Right Wing Tank Capacity: 92 US Gal

Rear Fuselage Tank Capacity: 85 US Gal

Total Internal Capacity: 269 US Gal

Total Capacity with External Fuel Tanks: 415 US Gal

Note: Two drop tanks with a capacity of 75 US Gal each can be installed under the wings.



Left Wing Tank

Rear Fuselage Tank

Right Wing Tank

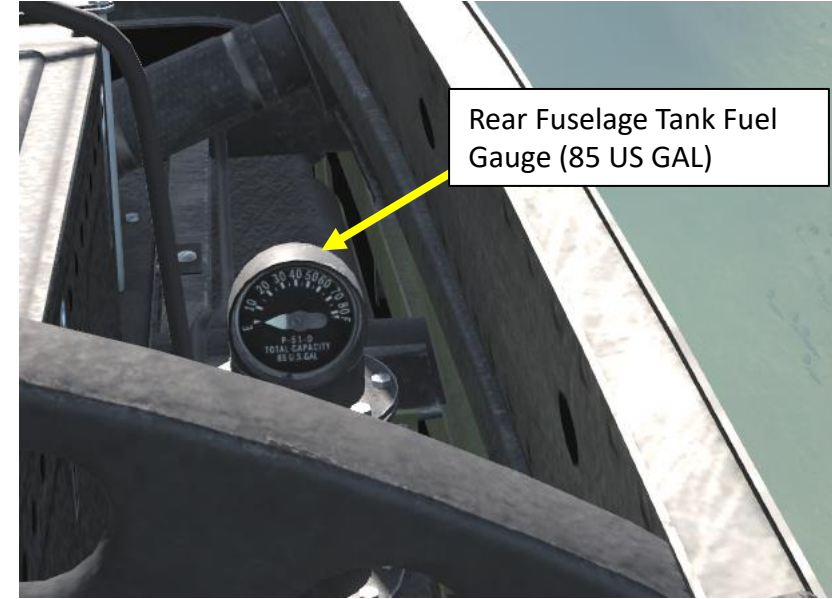
FUEL MANAGEMENT

The tanks are not interconnected and it is necessary to switch from one tank to the other to maintain balance. The three booster pumps are controlled by a single switch on the front switch panel. Selection between the tanks is performed by turning the booster pump switch to ON, then turning the fuel selector valve to the desired tank.

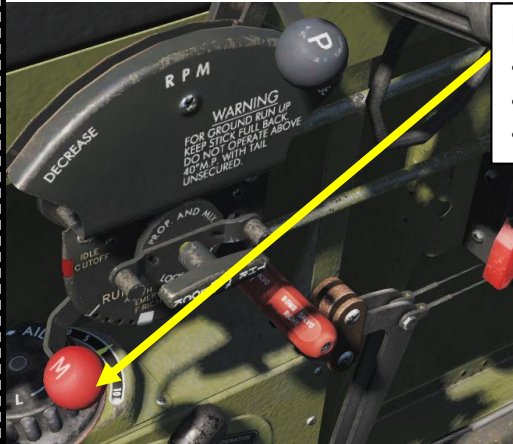
Fuel capacity is monitored using the Fuel Gauges for the main and fuselage tanks. No gauges for drop tanks are available.

When changing tanks, don't stop the selector valve at an empty tank position, or at a droppable tank position if no droppable tanks are equipped. Starving the engine of fuel will result in engine failure. In such a case, perform the following steps immediately:

1. Turn the fuel selector to a loaded tank
2. Make sure that the booster pump switch is ON
3. As the engine takes hold, adjust the throttle setting as required.



Rear Fuselage Tank Fuel Gauge (85 US GAL)

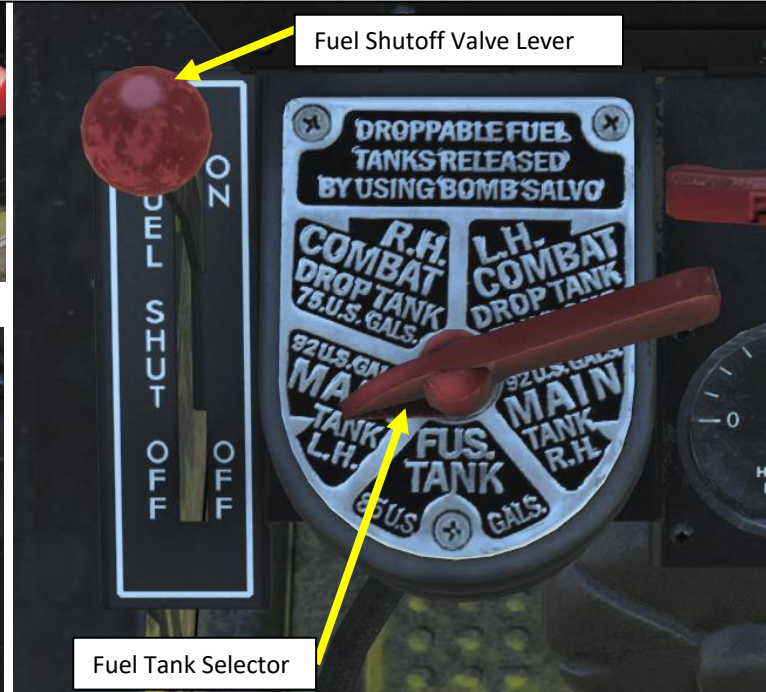


Mixture Setting Lever

- Idle Cutoff: Position to start and shutdown the engine.
- Run: Standard operating setting, used for takeoff, climb, landing and combat.
- Full Rich: Emergency setting used in case of carburetor failure.

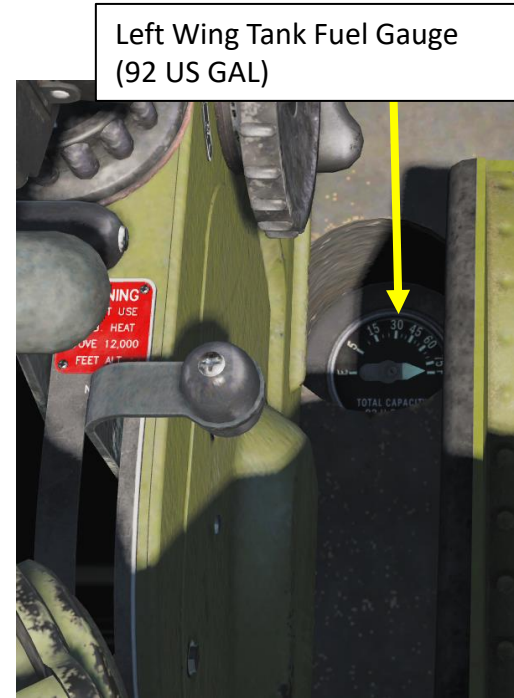


Fuel Booster Pump



Fuel Shutoff Valve Lever

Fuel Tank Selector



Left Wing Tank Fuel Gauge (92 US GAL)



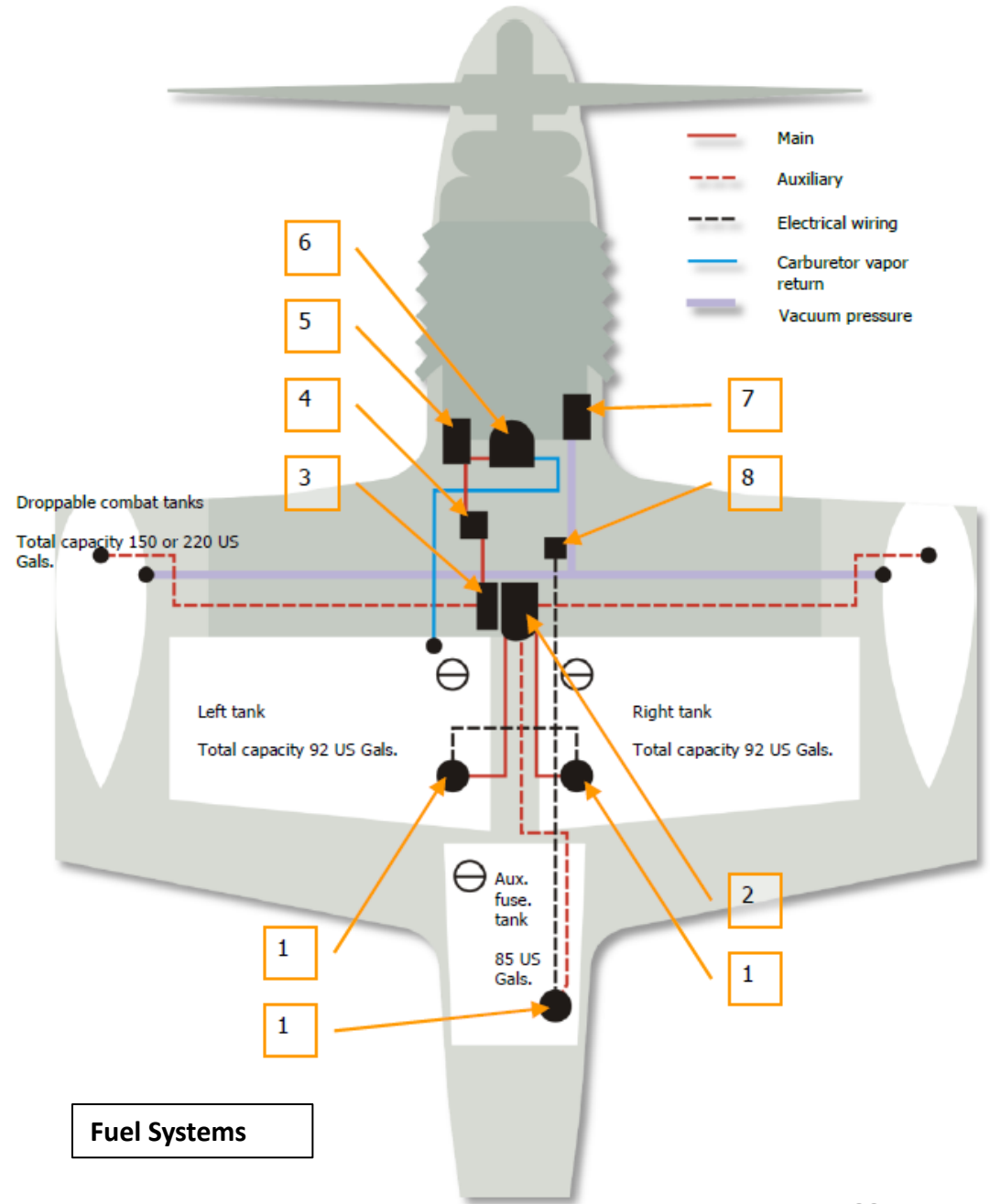
Right Wing Tank Fuel Gauge (92 US GAL)

FUEL MANAGEMENT

The fuel tanks are self-sealing and so are the fuel lines. The auxiliary drop tanks are not self-sealing. Fuel is forced to the carburetor by an engine-driven pump. In addition, there is an electrically powered booster pump in each internal tank.

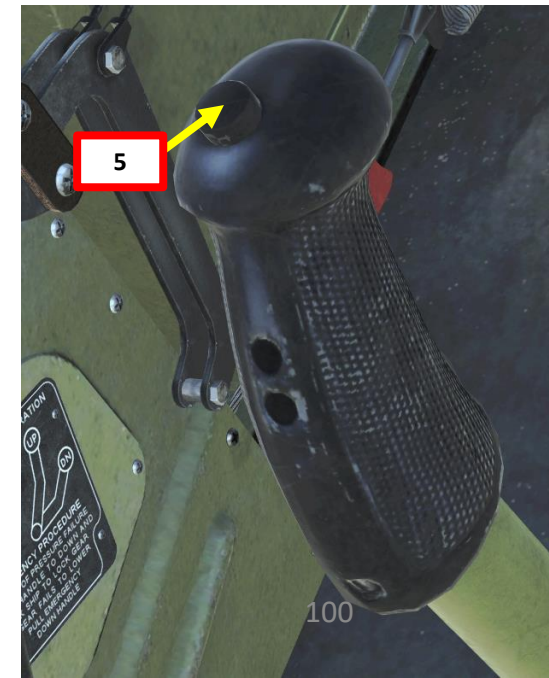
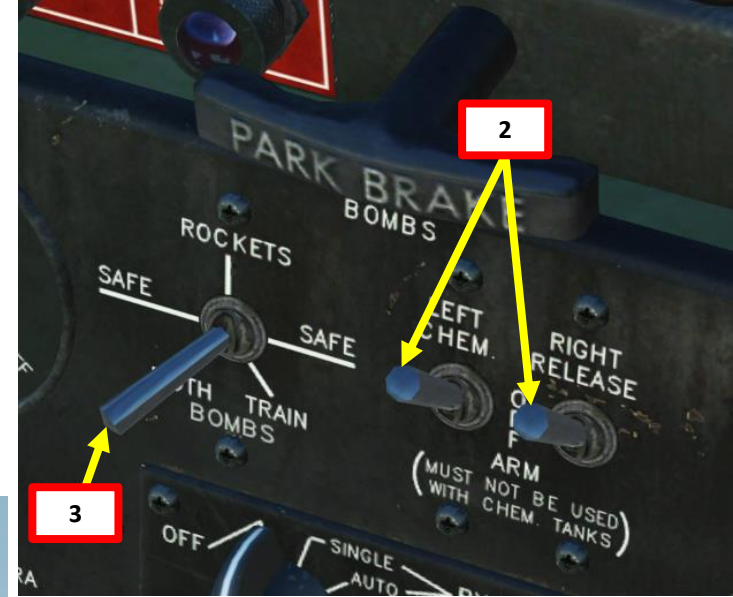
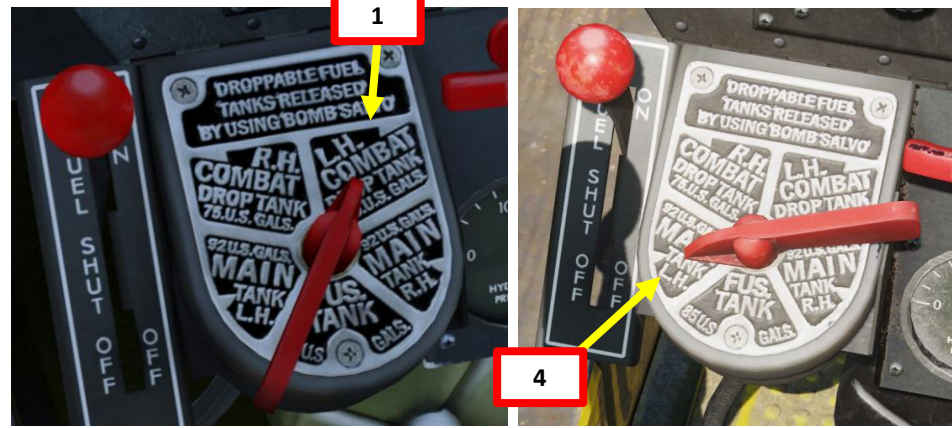
The booster pumps prevent vapor lock at high altitudes, assure sufficient fuel supply under all flight conditions and, in case of engine-driven pump failure, provide enough fuel to the carburetor for normal engine operation. The droppable tanks do not have a booster pump. However, a constant and controlled pressure is maintained within the combat tanks by pressure obtained from a vacuum pump. This is in addition to the pressure obtained from the main engine fuel pump.

The carburetor is of the fuel injection type with a separate idle cut-off device and is equipped with a vapor return line that extends to the left fuel tank. The vapor vent line may become a fuel return line if the needle valve in the vapor eliminator sticks in the open position. The left fuel tank should always be used first to ensure availability of space for any returning fuel.



FUEL DROP TANK OPERATION

1. To consume fuel from your drop tanks, set Fuel Selector to either LH or RH COMBAT DROP TANKS
2. To jettison drop tanks, set arming switch in CHEM RELEASE position (UP)
3. Select drop tank release mode
 - a) BOTH = 2 tank at the same time
 - b) TRAIN = 1 tank at a time
4. Set Fuel Tank Selector to either MAIN TANK LH or MAIN TANK RH.
5. Release drop tanks by pressing “Weapons Release” button (RALT+SPACE).



P-51D LIMIT DIVING SPEEDS	
PRESSURE ALTITUDE (FEET)	PILOTS INDICATED AIR SPEED (MPH)
40,000	260
35,000	290
30,000	325
25,000	365
20,000	400
15,000	440
10,000	480
5,000	505
0	505

SEE T.O. 01-60J-25

MAX. DIVING SPEED		FLAP RESTRICTIONS	
505 I.A.S.		ANGLE DOWN	MAX I.A.S.
MAX. DIVING R.P.M. 3240.		10°	400
DO NOT LOWER LANDING GEAR ABOVE 170 I.A.S.		20°	275
		30°	225
		40°	180
		50°	165

NORTH AMERICAN AVIATION INC.
INGLEWOOD, CALIFORNIA

MODEL P-51D	CONTRACT NO. AC-2400
SERIAL NO. 44-24447	DATE COMPLETE 12-2-44

ARM
REST

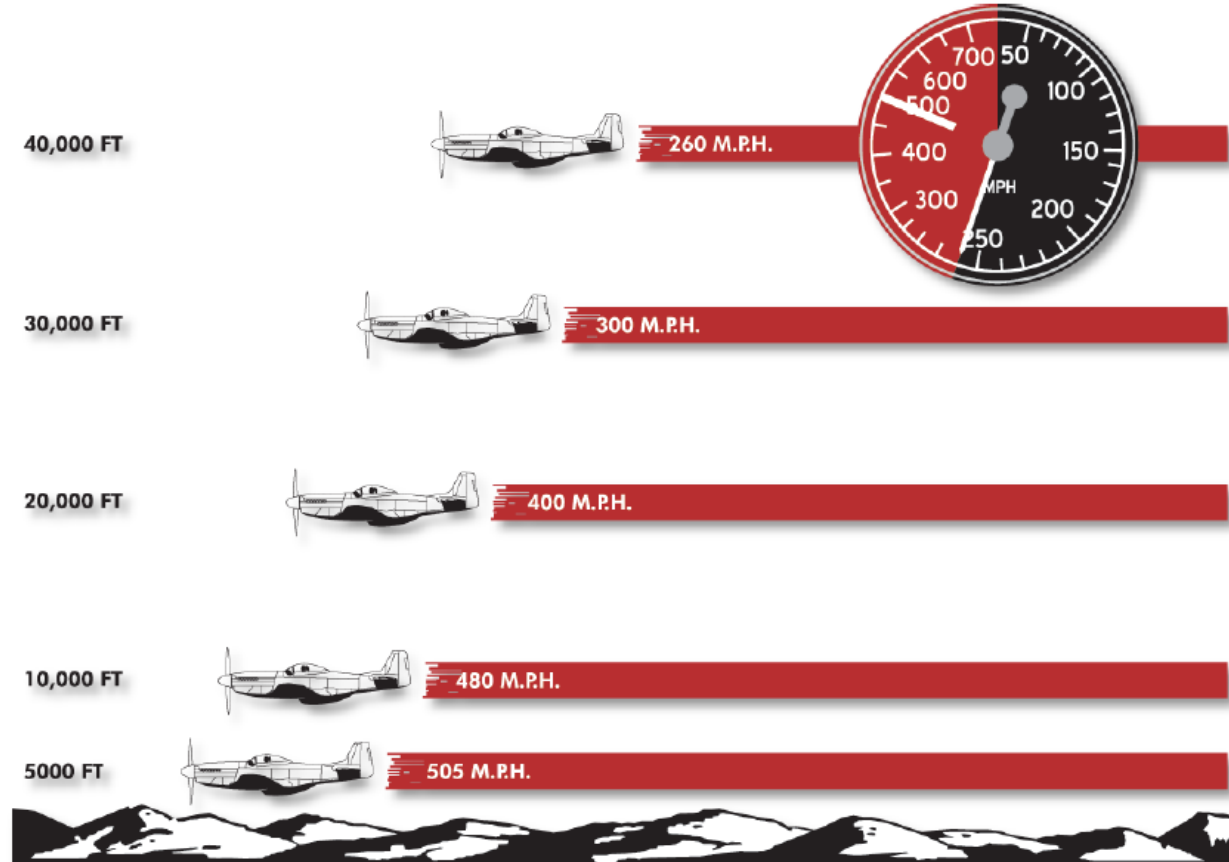
Stall Speeds Table (in mph)

	Gross weight (lbs)	Gear up Flaps up			Gear down Flaps 45° down		
		Level	30° bank	45° bank	Level	30° bank	45° bank
With Wing Racks Only	10,000	106	115	128	101	110	123
	9,000	101	109	121	94	103	116
	8,000	94	102	114	87	98	108
With Bombs, Drop Tanks, or Rockets	12,000	119	128	143	113	123	136
	11,000	113	122	137	107	117	131
	10,000	108	116	130	102	111	124
	9,000	102	110	123	95	105	117

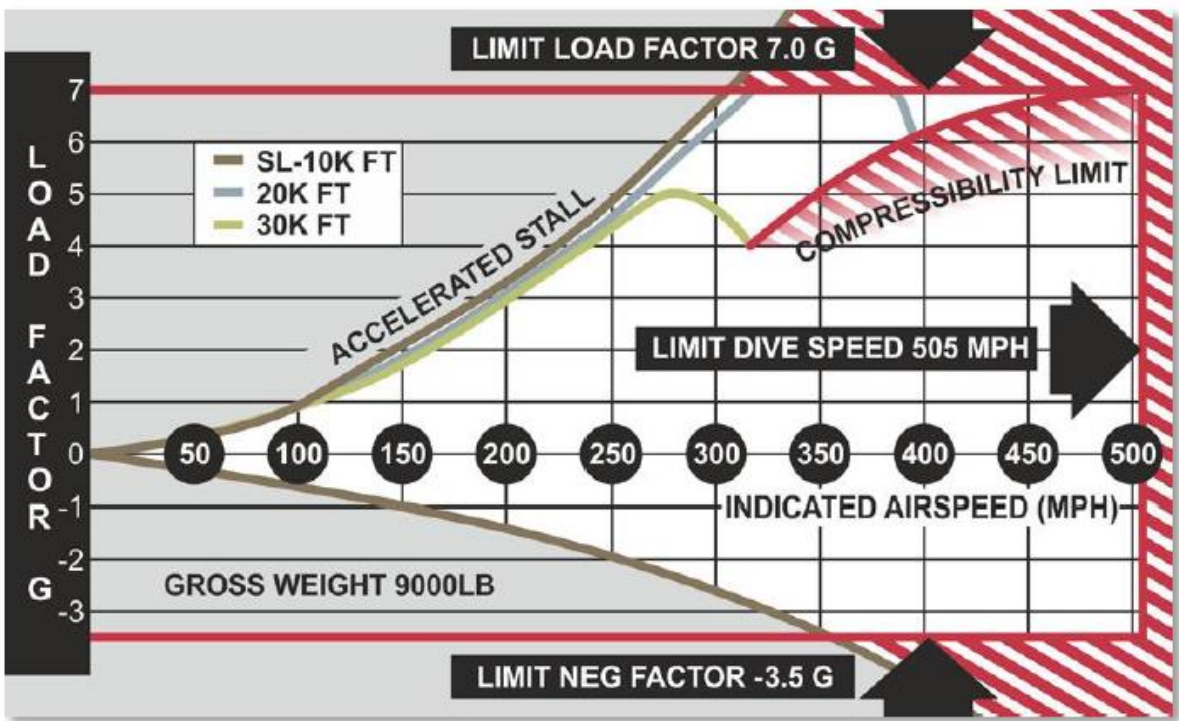
Maximum Allowable Speed for Flap Deployment

Flaps Down Angle [degrees]	Maximum IAS [mph]
10	400
20	275
30	225
40	180
50	165

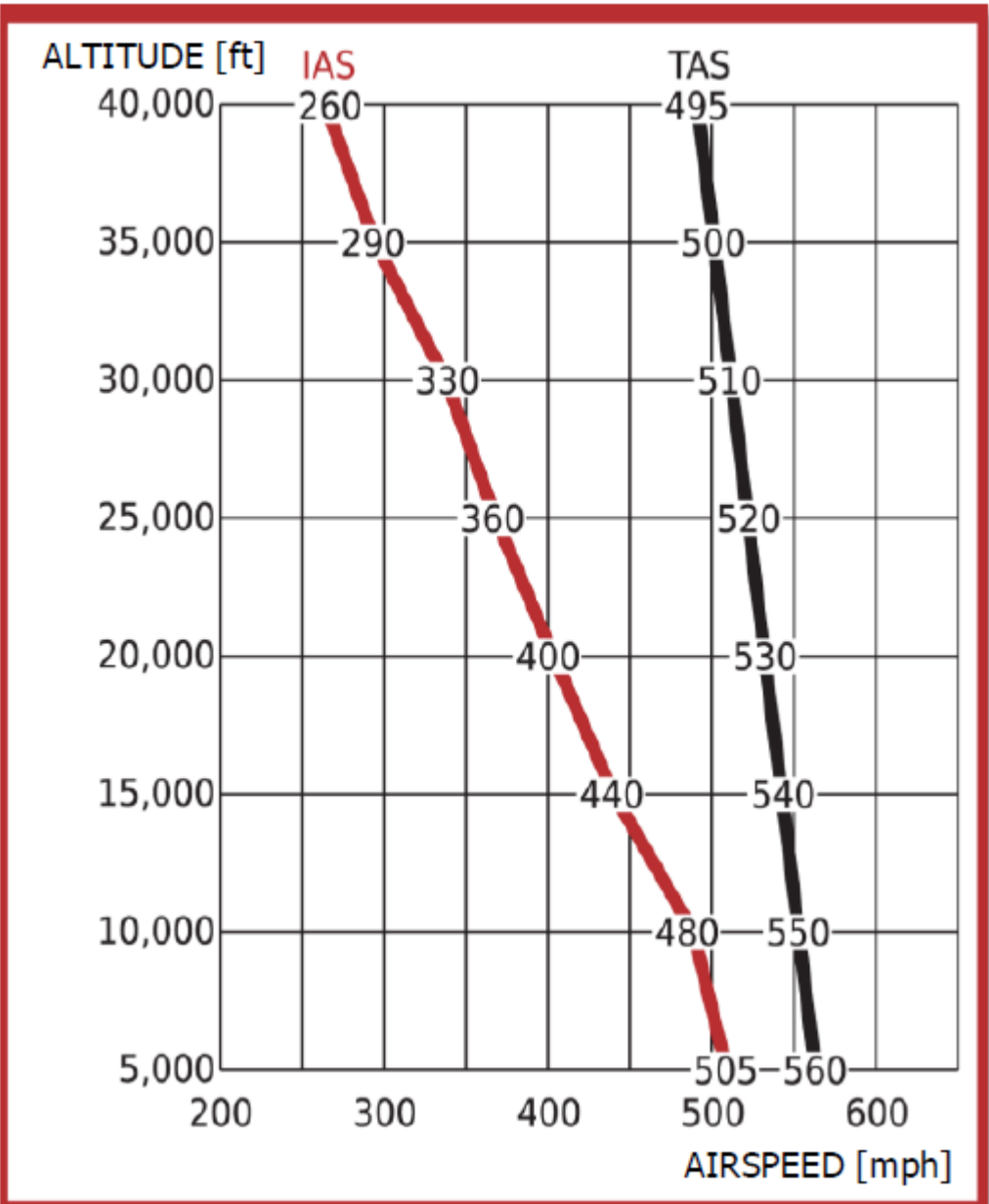
Maximum Indicated Airspeed



Load Factor Limitations



Maximum Allowable Dive Speeds



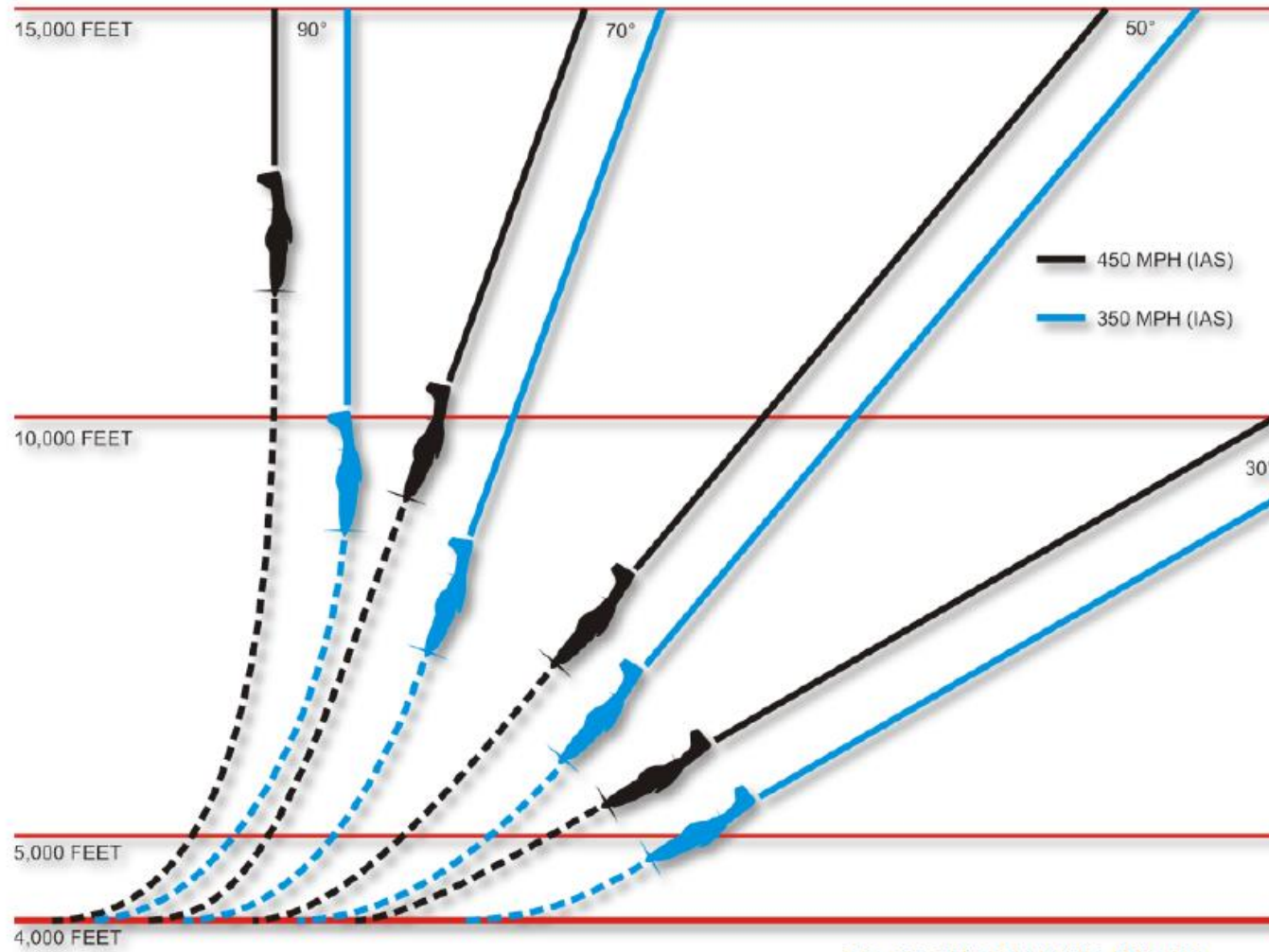
Oxygen Supply Duration

Altitude [ft]	Normal Oxygen	100% Oxygen	Emergency
40,000	11.4 Hrs.	11.4 Hrs.	12.6 Min.
35,000	8.1	8.1	12.6
30,000	6.0	6.0	12.6
25,000	6.0	4.9	12.6
20,000	7.1	3.3	9.0
15,000	8.1	2.7	9.0
10,000	10.2	2.1	9.0

TUC (Time of Useful Consciousness) once Oxygen Flow is Stopped

Altitude [ft]	TUC
15,000	30 min or more
18,000	20-30 minutes
22,000	5-10 minutes
25,000	3-5 minutes
28,000	2.5-3 minutes
30,000	1-3 minutes
35,000	30-60 seconds
40,000	15-20 seconds
45,000	9-15 seconds
50,000	6-9 seconds

Minimum Safe Altitude



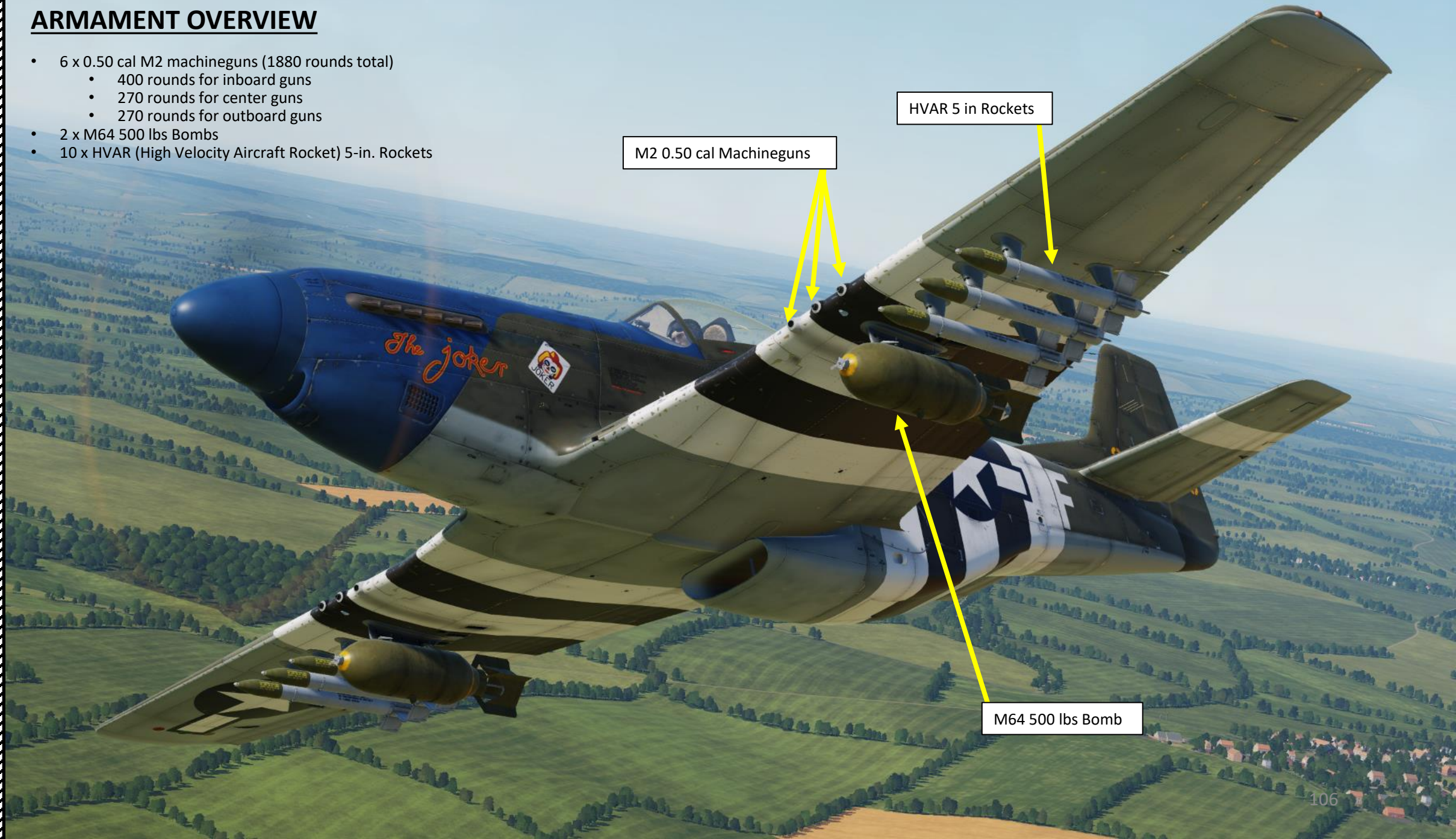
— 450 MPH (IAS)
— 350 MPH (IAS)

TO BE OUT OF DIVE AND IN
LEVEL FLIGHT AT 4,000 FEET,
START PULL OUT AT ALTITUDE
INDICATED



ARMAMENT OVERVIEW

- 6 x 0.50 cal M2 machineguns (1880 rounds total)
 - 400 rounds for inboard guns
 - 270 rounds for center guns
 - 270 rounds for outboard guns
- 2 x M64 500 lbs Bombs
- 10 x HVAR (High Velocity Aircraft Rocket) 5-in. Rockets



M2 0.50 cal Machineguns

HVAR 5 in Rockets

M64 500 lbs Bomb

ARMAMENT OVERVIEW

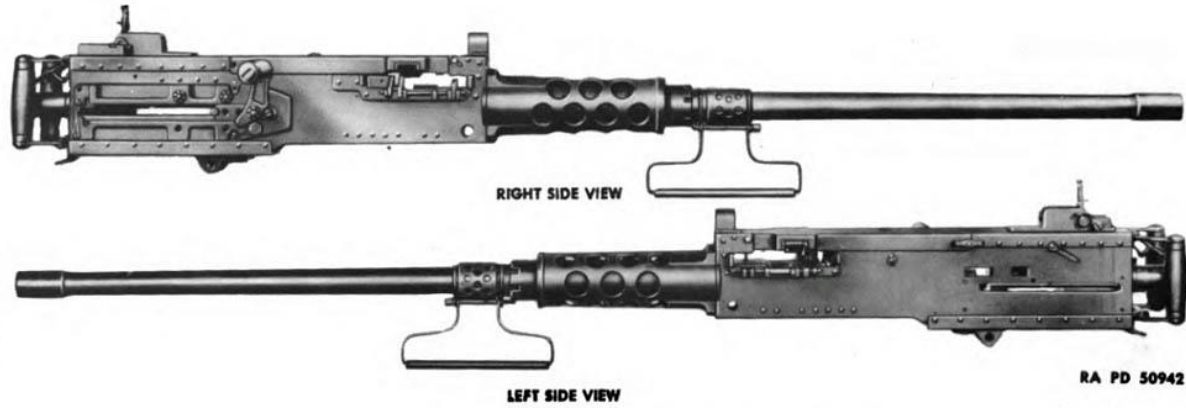
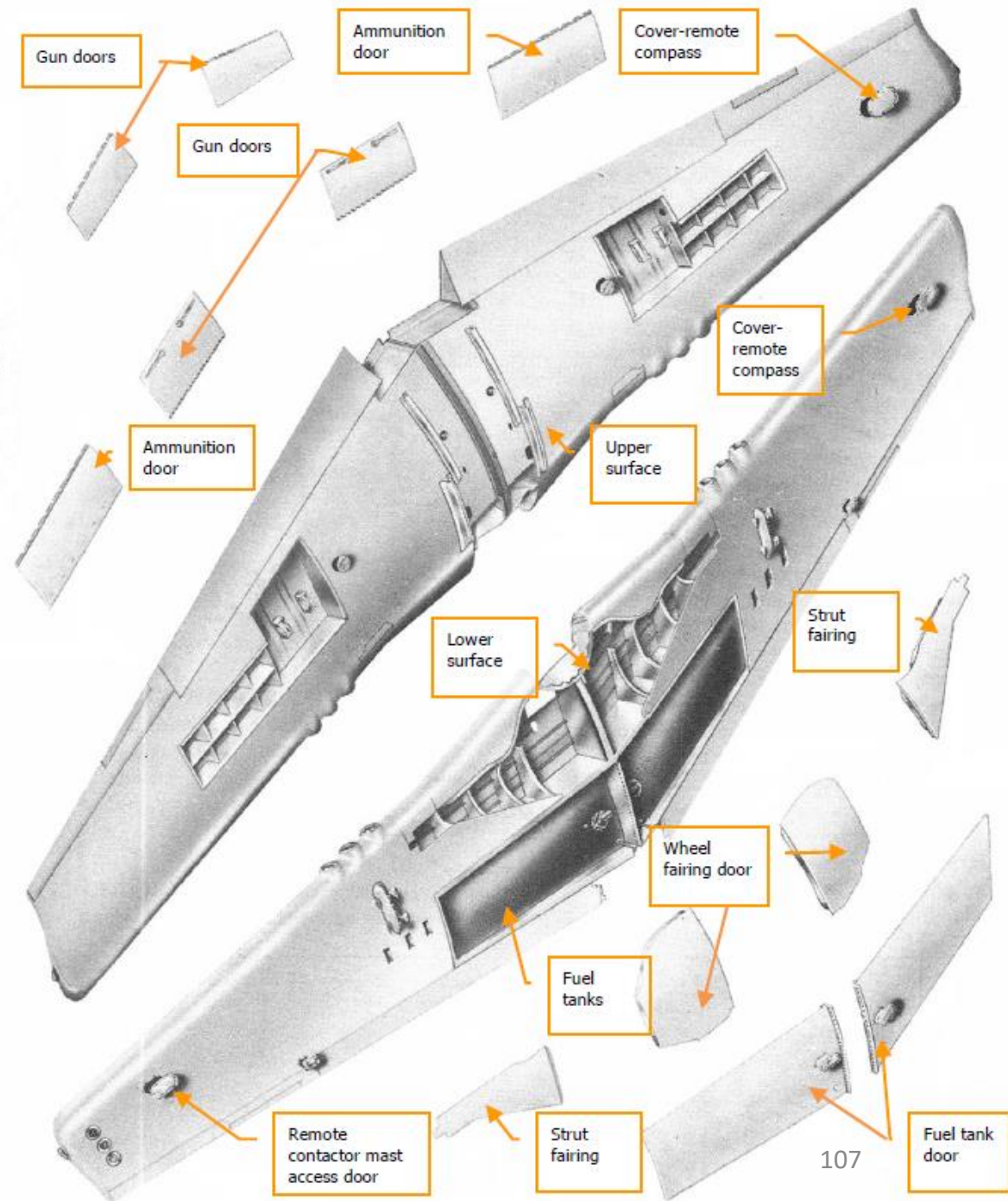
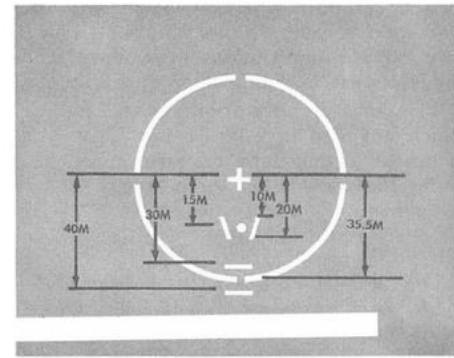


Figure 7—Browning Machine Gun, Cal. .50, M2, Heavy Barrel, Flexible

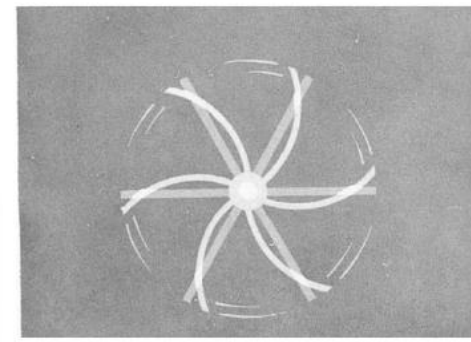


K-14 GYRO GUNSIGHT

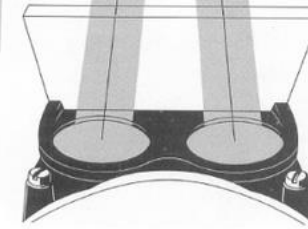
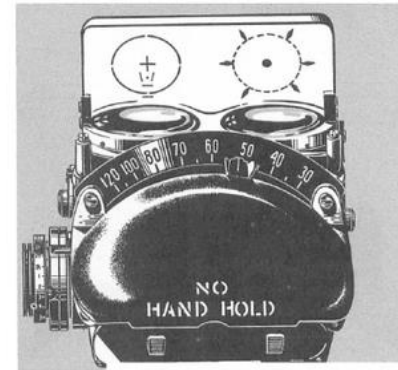
Your gunsight will show you where to shoot and when to shoot a target.



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

To use the gunsight properly:

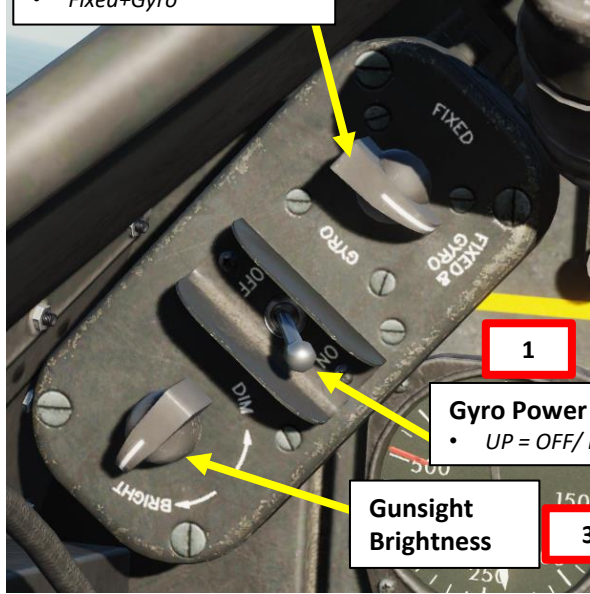
1. Set Gyro Power switch – ON (DOWN)
2. Select Gunsight Mode as required (I recommend Fixed + Gyro)
3. Adjust gunsight brightness
4. Set gunsight range scale (recommended: 1100 ft) by using your twist-grip throttle (“Gunsight Range to Target Decrease/Increase” controls)
5. Set gunsight wingspan scale (recommended: 32 ft for a Bf.109 or a FW190) by using the wingspan setter
6. Fire guns when the wings of the target fit within your gunsight reticle

Consult this tutorial about using the gunsight:
<https://www.youtube.com/watch?v=vCCuwzKV5wo>

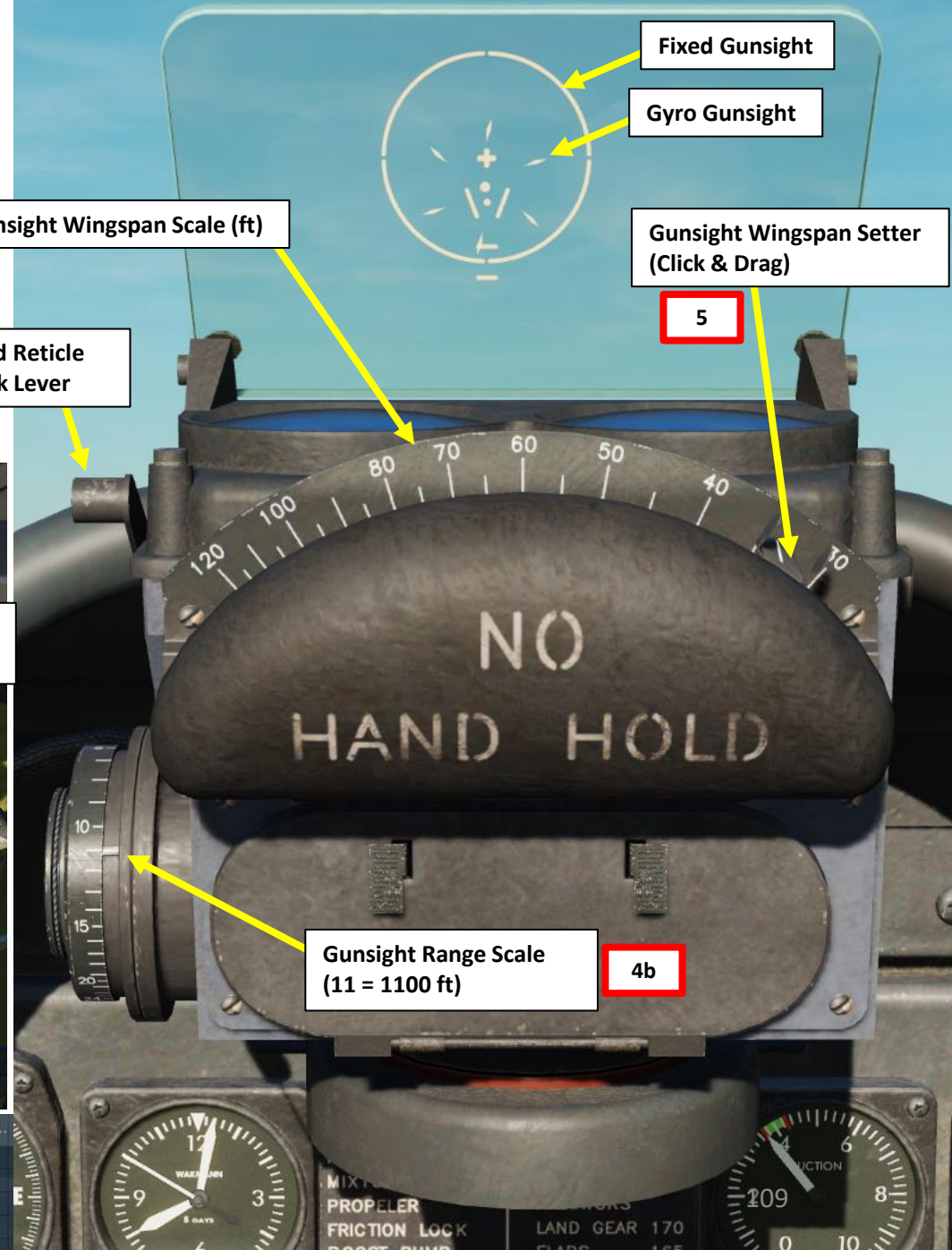
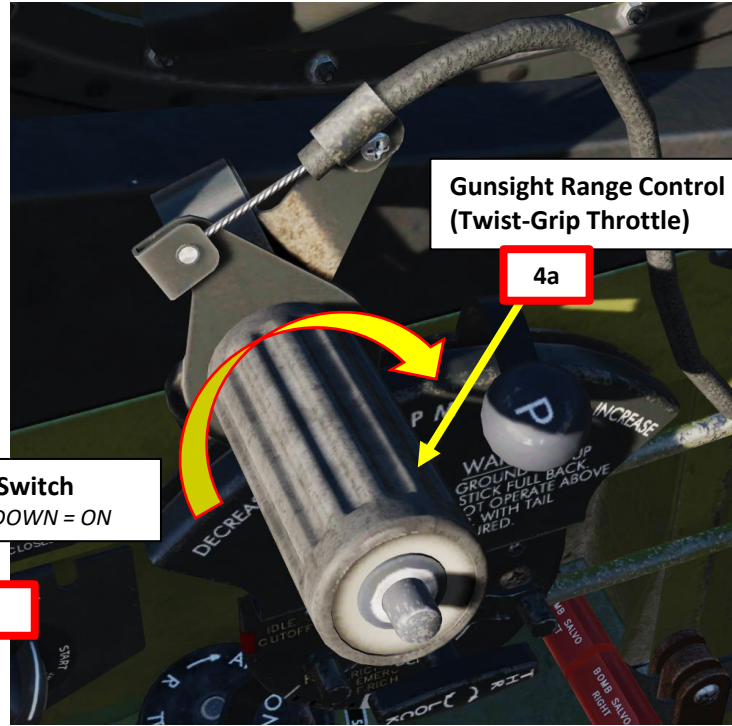
Gunsight Mode Selector

- Fixed
- Gyro
- Fixed+Gyro

2



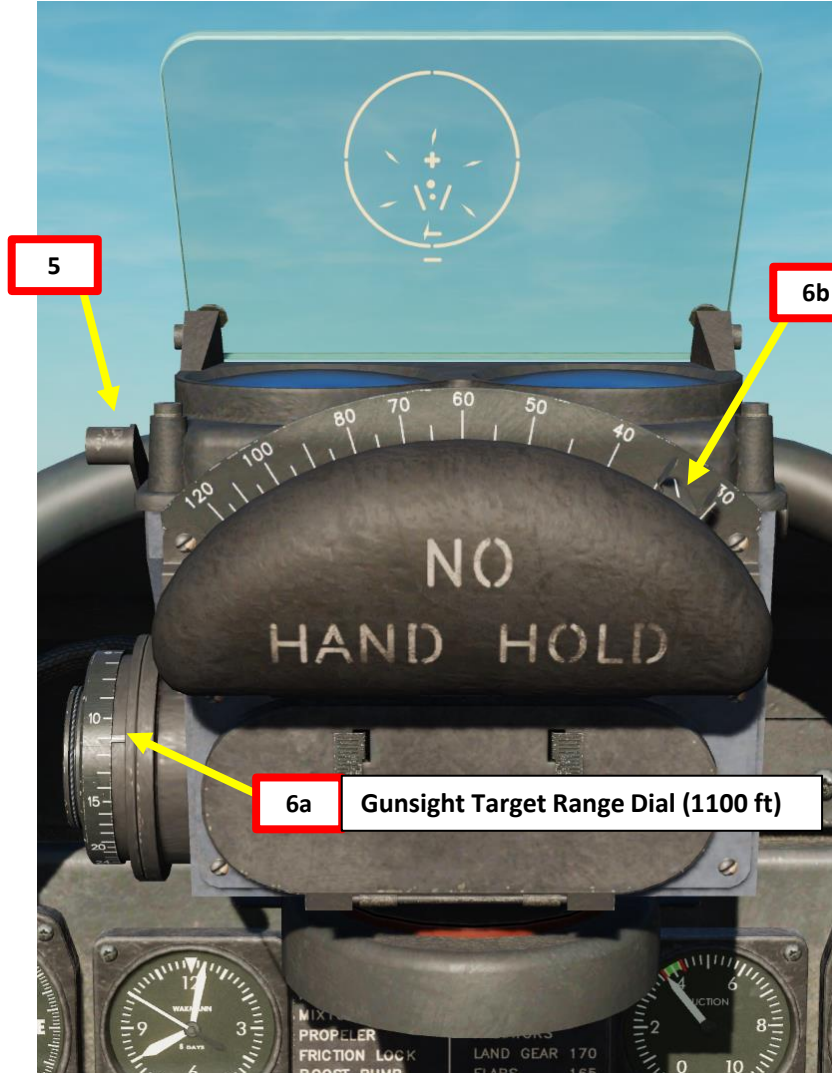
Gunsight Controls



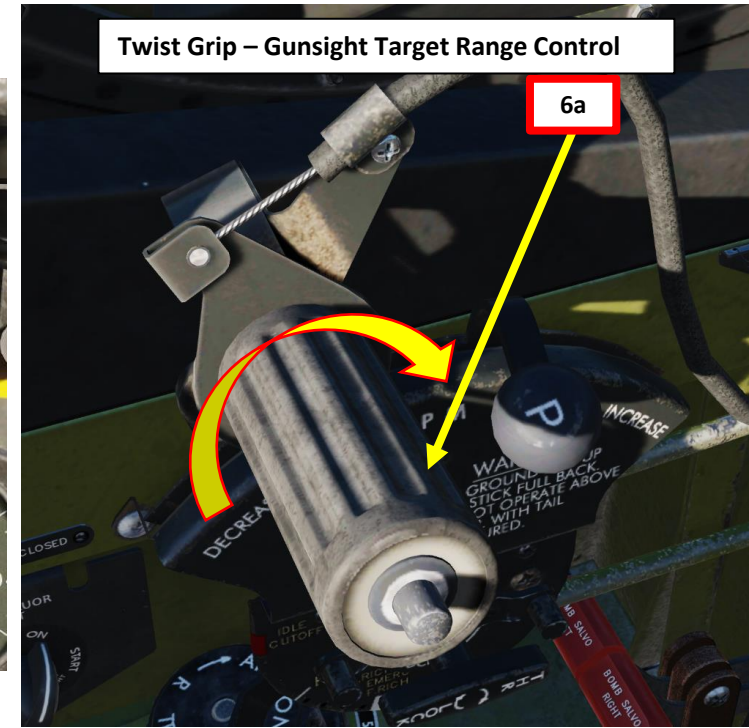
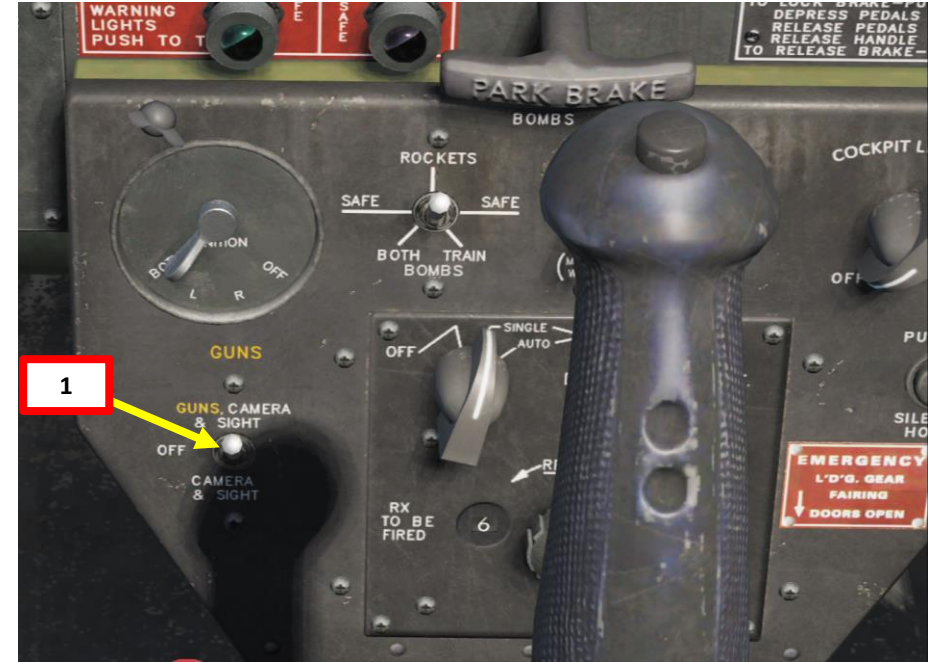
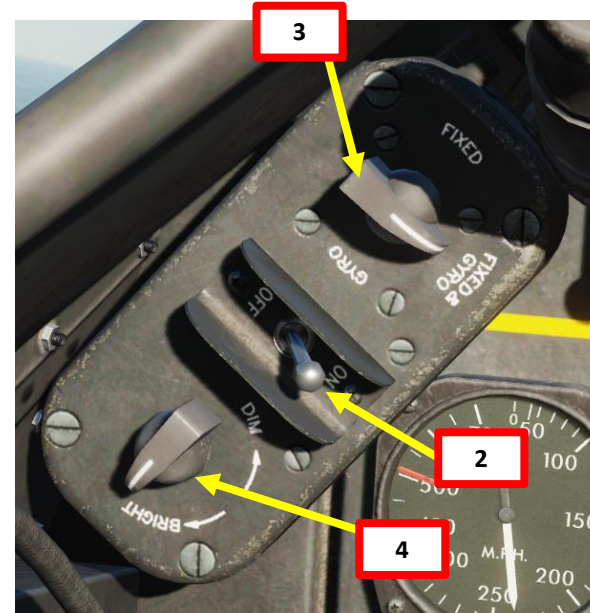
Action	Category	Keyboard	Throttle - HOTAS W...	Joystick - HOTAS Wa...
Gunsight range to target Decrease	K-14 gunsight	.		JOY_BTN11
Gunsight range to target Increase	K-14 gunsight	;		JOY_BTN13
Gunsight target span Decrease	K-14 gunsight	/		JOY_BTN12
Gunsight target span Increase	K-14 gunsight	\		JOY_BTN14
High Power Lamp Test	Engine Control Panel	[Shift + L]		

M2 BROWNING 0.50 CAL MACHINEGUNS

1. Set your guns safety OFF by setting safety switch to GUNS (UP)
2. Set Gyro Power switch – ON (DOWN)
3. Select Gunsight Mode as required (I recommend Fixed + Gyro)
4. Adjust gunsight brightness
5. 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)
6. Set gunsight range (a) and wingspan scale (b) as required (see K-14 Gyro Gunsight tutorial)

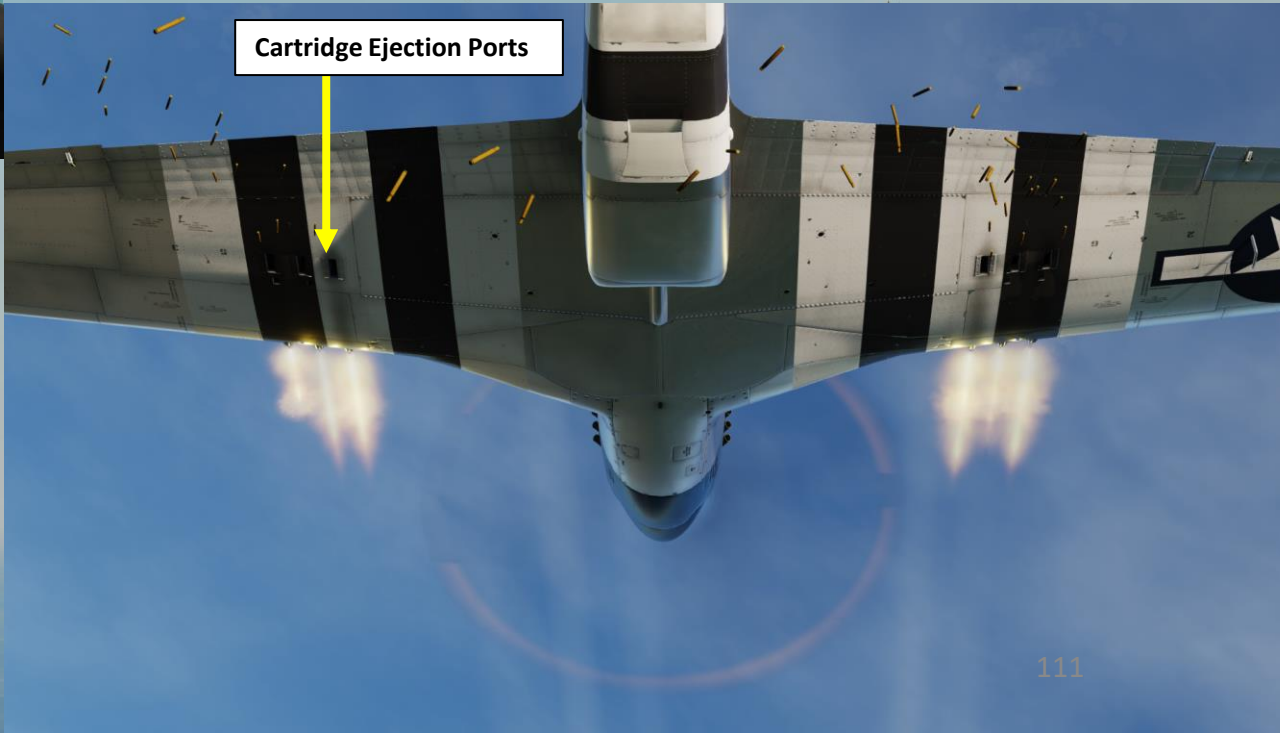
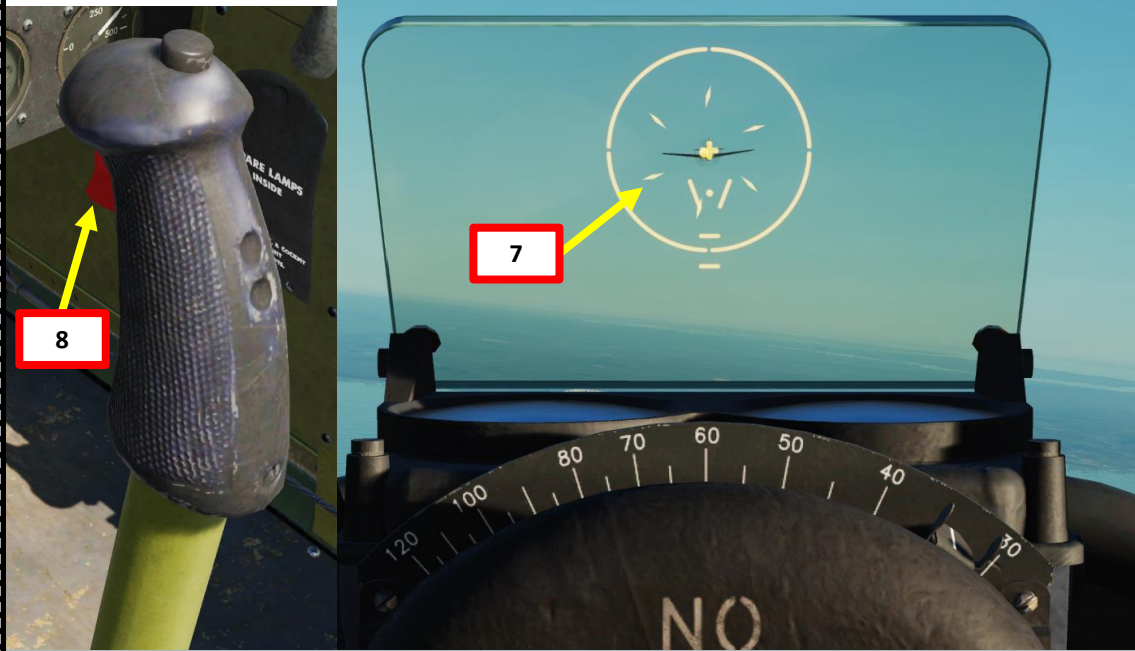


Gunsight Target Wingspan Selector 32 ft



M2 BROWNING 0.50 CAL MACHINEGUNS

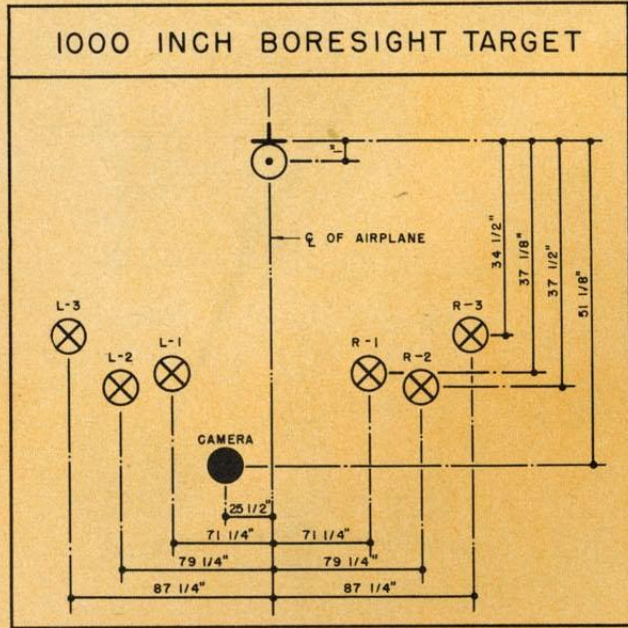
- 7. Place the wings of the target fit within your gunsight gyro reticle
- 8. Squeeze the machinegun trigger (Spacebar) to fire machineguns.



M2 BROWNING 0.50 CAL MACHINEGUNS



ARMAMENT BALLISTICS

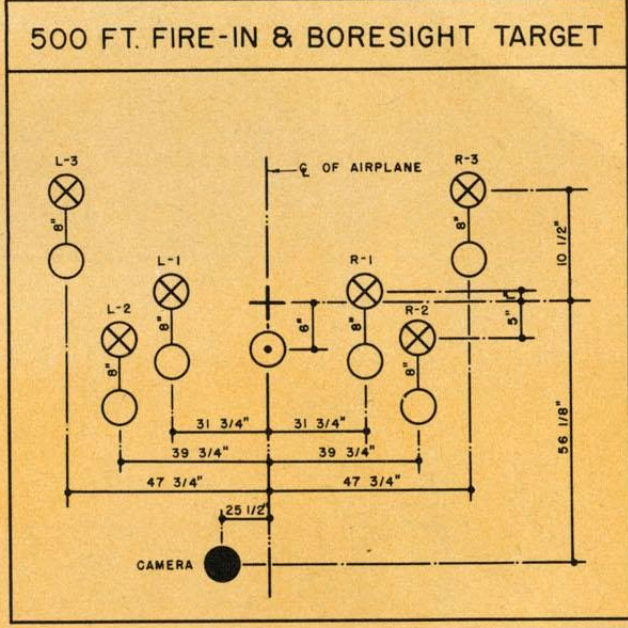


TARGETS SHOWN ARE FOR HARMONIZATION UNDER THE FOLLOWING CONDITIONS: (BASIC HARMONIZATION)
 CAL. I.A.S. = 300 M.P.H.
 ALTITUDE = 15,000 FT.
 T.A.S. = ±373 M.P.H.
 WEIGHT = 9,500 LBS. ± 200 LBS.
 ANGLE OF ATTACK (α) = 13 MILS NOSE UP
 LEVEL FLIGHT (1° g)

- ⊕ = 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 THIS HARMONIZATION.)
- ⊗ = MARK WHERE BORE IS AIMED FOR 1000 INCH AND 500 FOOT TARGETS.
- = MARK FOR CENTER OF IMPACT OF 10 ROUNDS AT 500 FT. TARGET.
- = MARK WHERE CAMERA IS AIMED MAKING CAMERA PARALLEL TO SIGHT LINE. THIS POINT REPRESENTS THE CENTER OF THE PICTURE FRAME.

GUN LOCATION AT AIRCRAFT

	CALIBER 0.50	VERT.(FROM SIGHT)	HORIZ.(FROM PLANE)
L & R NO. 1 GUNS		44.732"	79.123"
L & R NO. 2 GUNS		44.002"	87.091"
L & R NO. 3 GUNS		43.493"	95.076"
CAMERA		50.140"	25.561"



FLIGHT ANGLE	ALT.	CAL. IAS	± TAS	MIL ANGLE μ "			
				1 "g"	2 "g"	3 "g"	4 "g"
LEVEL FLIGHT	0'	250	250	+1.0	+8.1	+15.0	+22.1
		300	300	-0.6	+5.0	+10.8	+16.4
		350	350	-1.9	+2.9	+7.5	+12.3
		400	400	-3.1	+1.1	+5.1	+9.2
		450	450	-3.9	-0.4	+3.2	+6.7
LEVEL FLIGHT	7000'	200	222	+4.1	+14.0	+23.8	—
		250	276	+1.5	+9.1	+16.7	+24.4
		300	331	-0.3	+5.8	+12.0	+18.1
		350	386	-1.8	+3.4	+8.5	+13.7
		400	440	-3.1	+1.5	+5.8	+10.2
LEVEL FLIGHT	15000'	200	251	+5.0	+16.1	+27.0	—
		250	313	+2.0	+10.6	+19.0	+27.6
		300	373	0	+6.8	+13.7	+20.4
		350	434	-1.6	+4.1	+9.5	+15.4
		400	493	-3.1	+2.0	+6.6	+11.5
LEVEL FLIGHT	30000'	150	242	+13.0	+31.8	—	—
		200	320	+7.0	+20.6	+34.1	—
		250	398	+3.3	+13.7	+24.1	+34.5
		300	471	+0.8	+8.9	+17.3	+25.4
		350	543	-1.3	+5.6	+12.2	+19.0

FLIGHT ANGLE	CAL. IAS	α cp. (WT. = 9500 LBS.)			
		1 "g"	2 "g"	3 "g"	4 "g"
LEVEL FLIGHT	150	+134	+296	—	—
	200	+63	+155	+246	—
	250	+30	+89	+147	+206
	300	+13	+53	+94	+134
	350	+2	+32	+61	+91
	400	-6	+18	+40	+63
450	-10	+8	+26	+44	

α = 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 BORE-SIGHT TARGETS AND " μ " ANGLES ARE BASED ON THIS ANGLE OF ATTACK CHART.

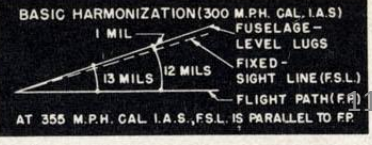
μ = MIL ANGLE BETWEEN THE SIGHT LINE AND THE PROJECTILES AT ANY RANGE OUT TO 2000 FEET. WHEN THE MIL ANGLE IS MINUS THE PROJECTILES ARE ABOVE THE SIGHT LINE; WHEN PLUS THEY ARE BELOW. THIS MIL ANGLE ACTS ALONG THE VERTICAL AXIS OF THE SIGHT. THE MIL ANGLE " μ " IS ONLY APPLICABLE WHEN THE AIRCRAFT IS HARMONIZED AS SHOWN IN THE ABOVE BORESIGHT AND FIRE-IN TARGETS.

TRAJECTORY DATA - FORWARD FIRE

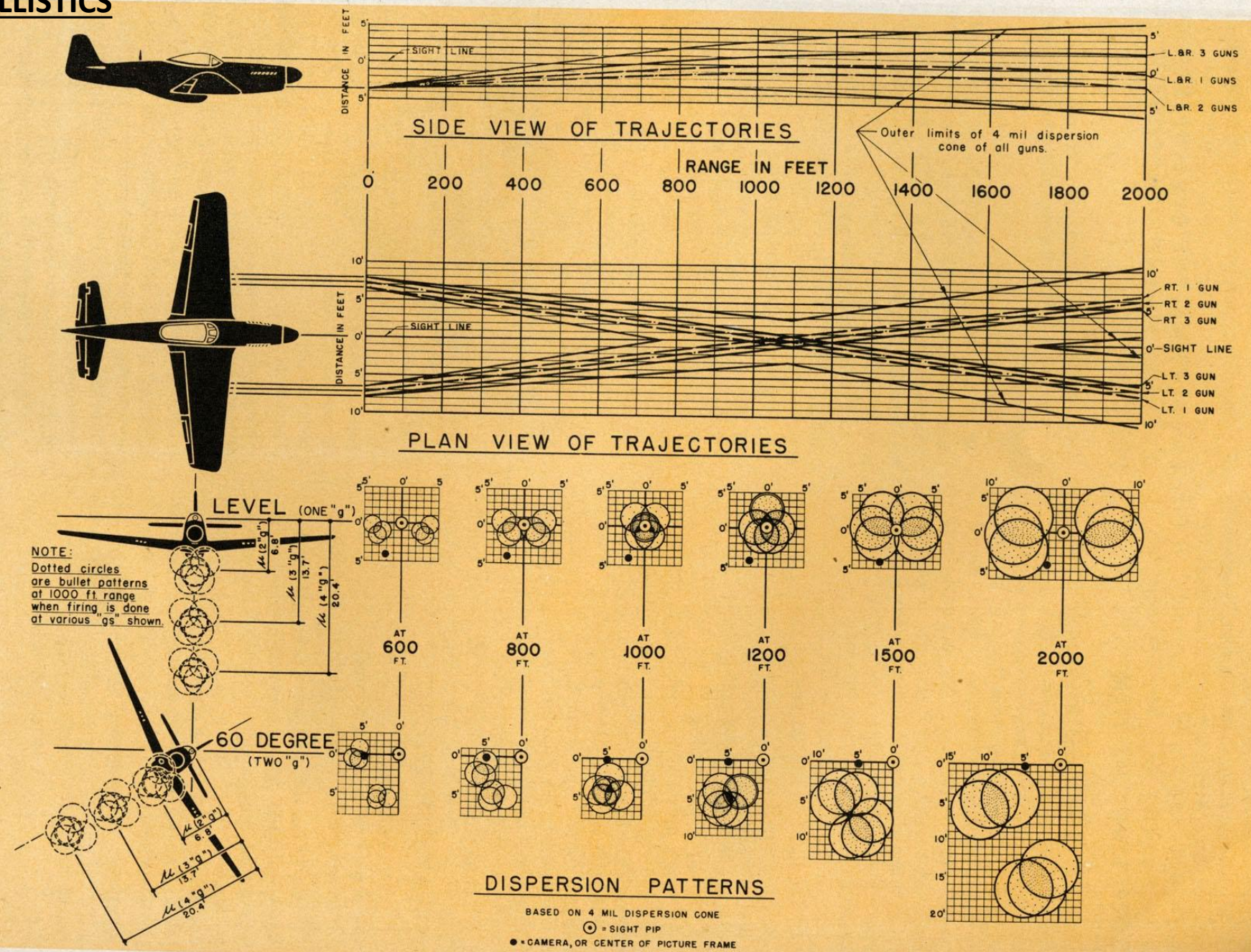
GUN	CAL. 0.50
AMMUNITION	A.P.M.-2
MUZZLE VELOCITY - FT./SEC.	2700

AUTHORITY: ABERDEEN DATA FT. 50 AC-M-1 & 1ST ED. TO LETTER FROM ORD. DEPT. EGLIN FIELD, FLA. 15 APRIL, 1944 TO CHIEF OF ORD. NANCE, WASHINGTON, D.C.

HARMONIZATION CHART P-51D



ARMAMENT BALLISTICS

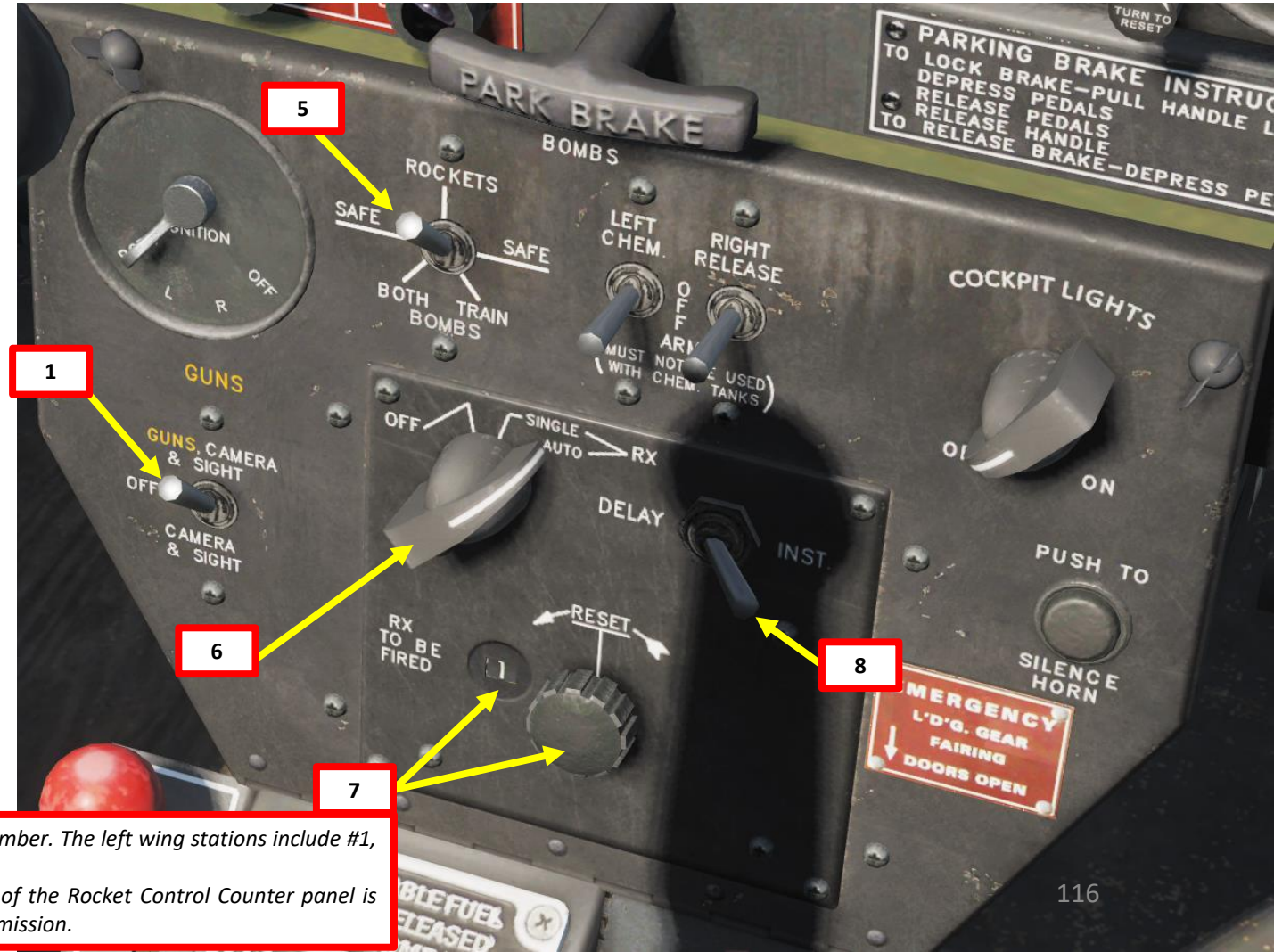
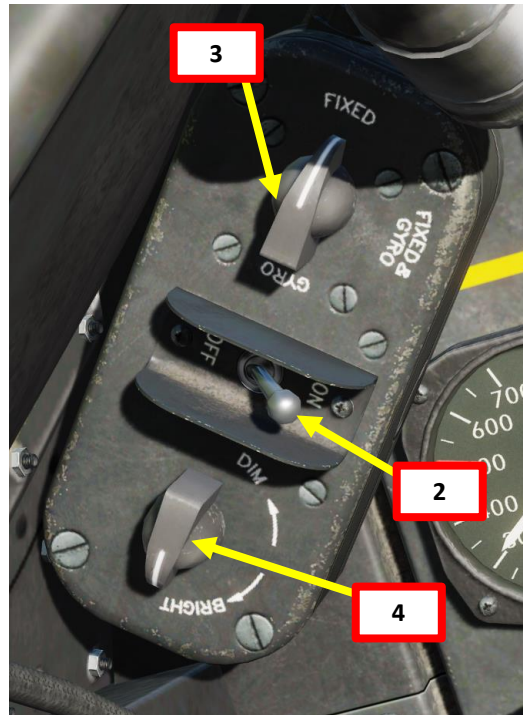


HVAR 5-INCH ROCKETS



HVAR 5-INCH ROCKETS

1. Set your gun/camera/sight safety OFF by setting safety switch to GUNS (UP)
2. Set Gyro Power switch – ON (DOWN)
3. Select Gunsight Mode as required (I recommend Fixed)
4. Adjust gunsight brightness
5. Select “ROCKETS” weapon mode (UP)
6. Select desired rocket firing mode
 - a) Single = Fires 1 Rocket
 - b) Auto = Fires Multiple Rockets as long as Weapons Release button is pressed.
7. Select rocket counter if Auto Firing Mode is selected
8. Select rocket fuze delay (Delay or Instantaneous)



The Rocket Counter window indicates the next rocket to be fired according to station number. The left wing stations include #1, 3, 5, 7, and 9. The right wing stations include #2, 4, 6, 8, and 10.

- Note, stations 7, 8, 9, and 10 are not installed when bombs are carried. 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.

HVAR 5-INCH ROCKETS

- There are many different attack profiles, but typically I would recommend starting from 1500-2000 ft above ground level.
- 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.
- 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.*
- Make sure you are not slipping when aiming for the target.
- When you are 1000 ft away from the target, Fire rockets by pressing “Weapons Release” button (RALT+SPACE).
- Apply full power and pull away from the blast. Recovery altitude should be about 75 ft above ground level.



13

11
Target

HVAR 5-INCH ROCKETS

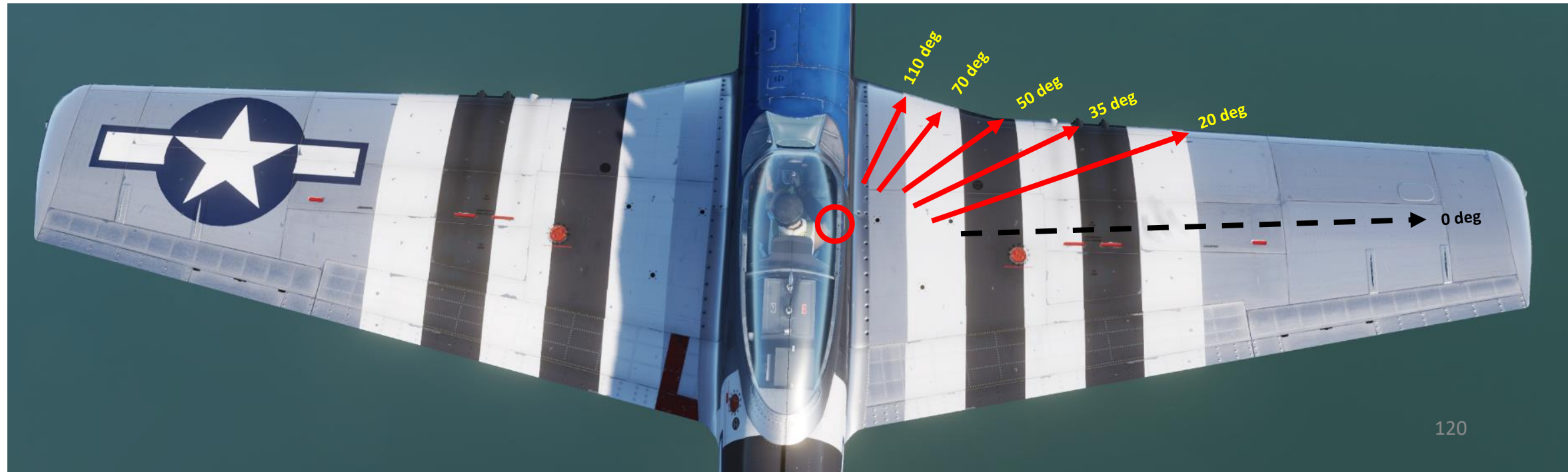
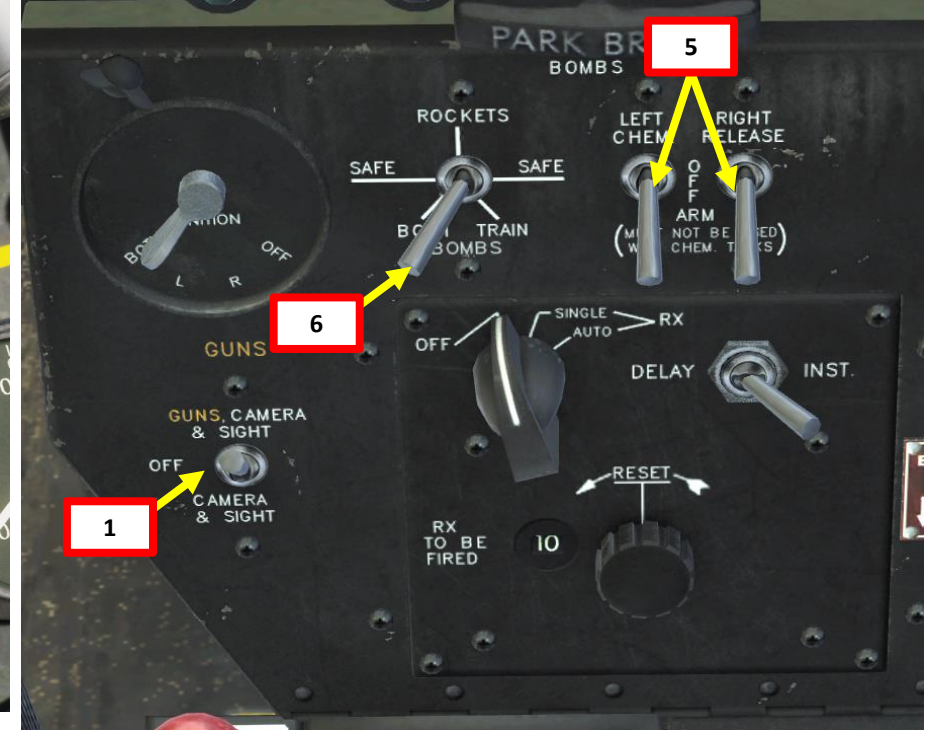
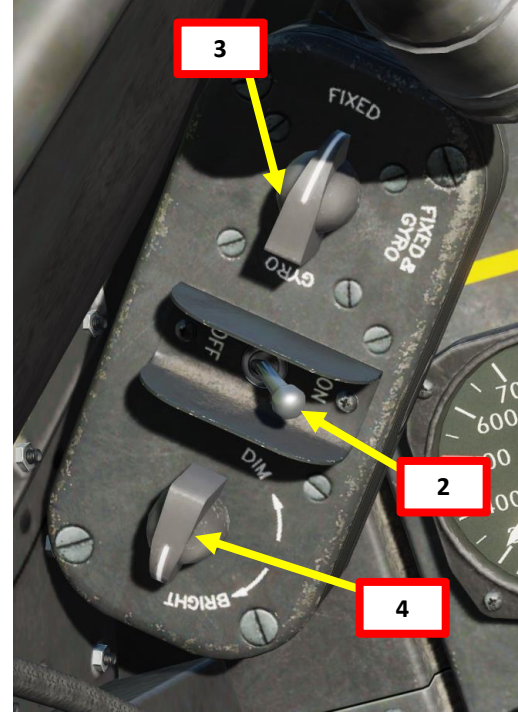


BOMBS (M64 – 500 LBS)



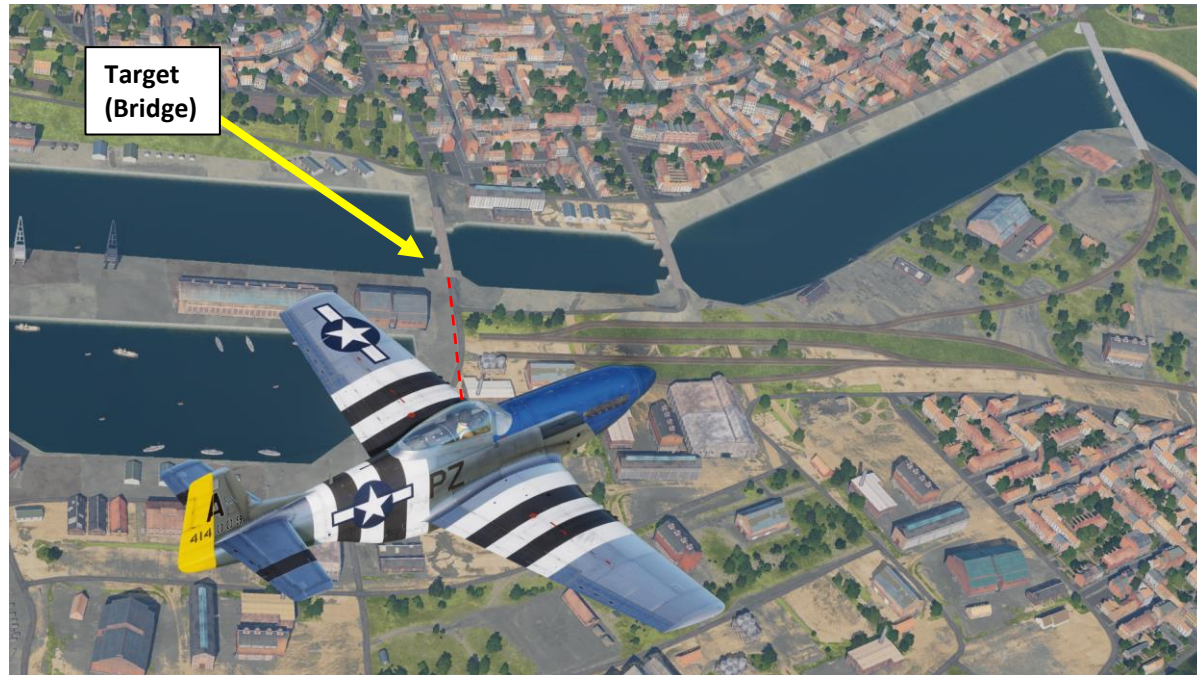
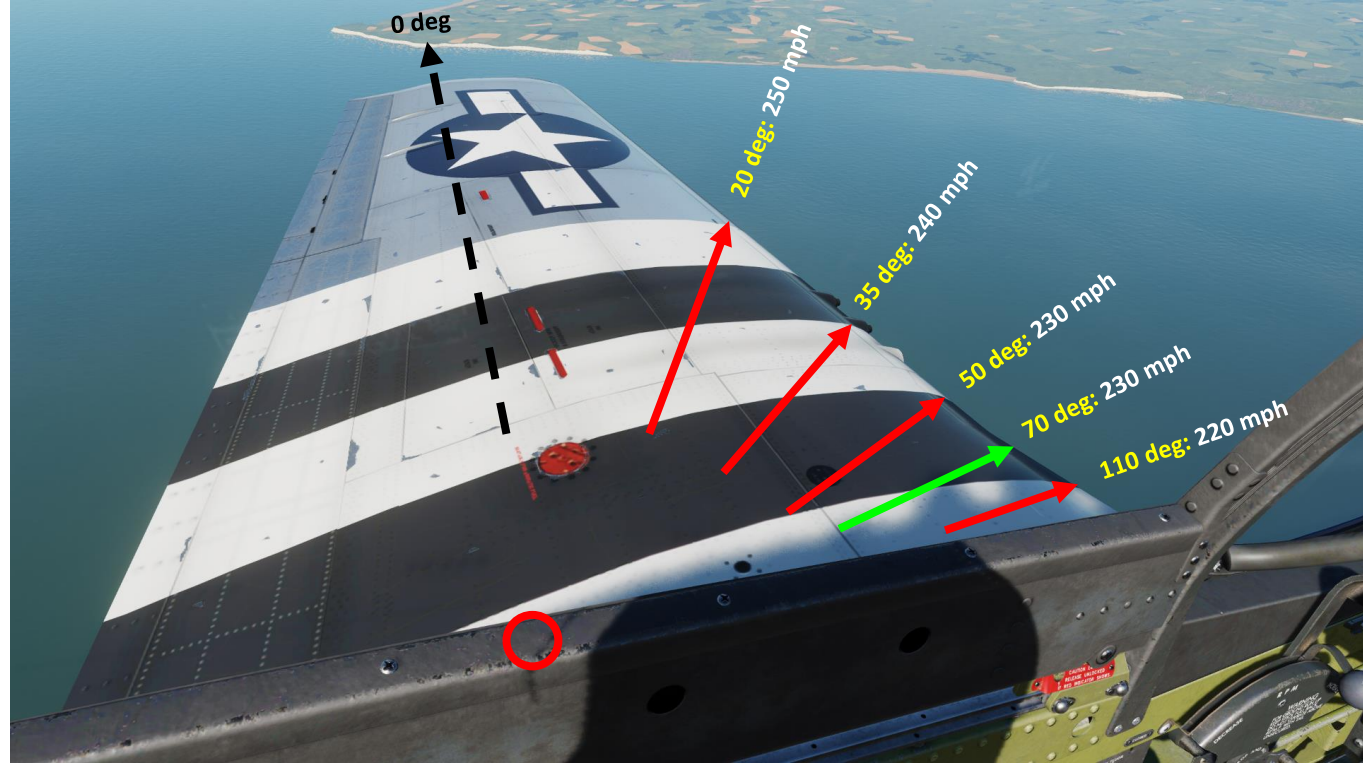
BOMBS (M64 – 500 LBS)

1. Set your gun/camera/sight safety OFF by setting safety switch to GUNS (UP)
2. Set Gyro Power switch – ON (DOWN)
3. Select Gunsight Mode as required (I recommend Fixed)
4. Adjust gunsight brightness
5. Arm bombs by setting bomb arming switch to the ARM position (DOWN)
6. Select bomb release mode
 - a) BOTH = 2 bombs at the same time
 - b) TRAIN = 1 bomb at a time
7. We will use the “Wing Line” bombing technique. Simply put, you use reference points on the wing (angle lines) to determine when to turn on the target and drop your bombs.



BOMBS (M64 – 500 LBS)

8. Plan your bombing profile
 - a) Choose a reference point (wing line) on your wing. In our case, we will choose the 70 deg line.
 - Alternatively, you could use other reference points that are easier to remember like the 35 deg line, which crosses the center machinegun of the wing.
 - b) Using the Bombing Attack Profile table, we determine that the Entry Altitude is 7000 ft and the Entry Speed is 230 mph.
 - c) Additionally, the Approach Time is 16 seconds, the amount of lead required is 107 mils. The expected firing range is 3600 ft.
9. Approach the target by flying level at the required Entry Altitude (7000 ft) and Entry Speed (230 mph).

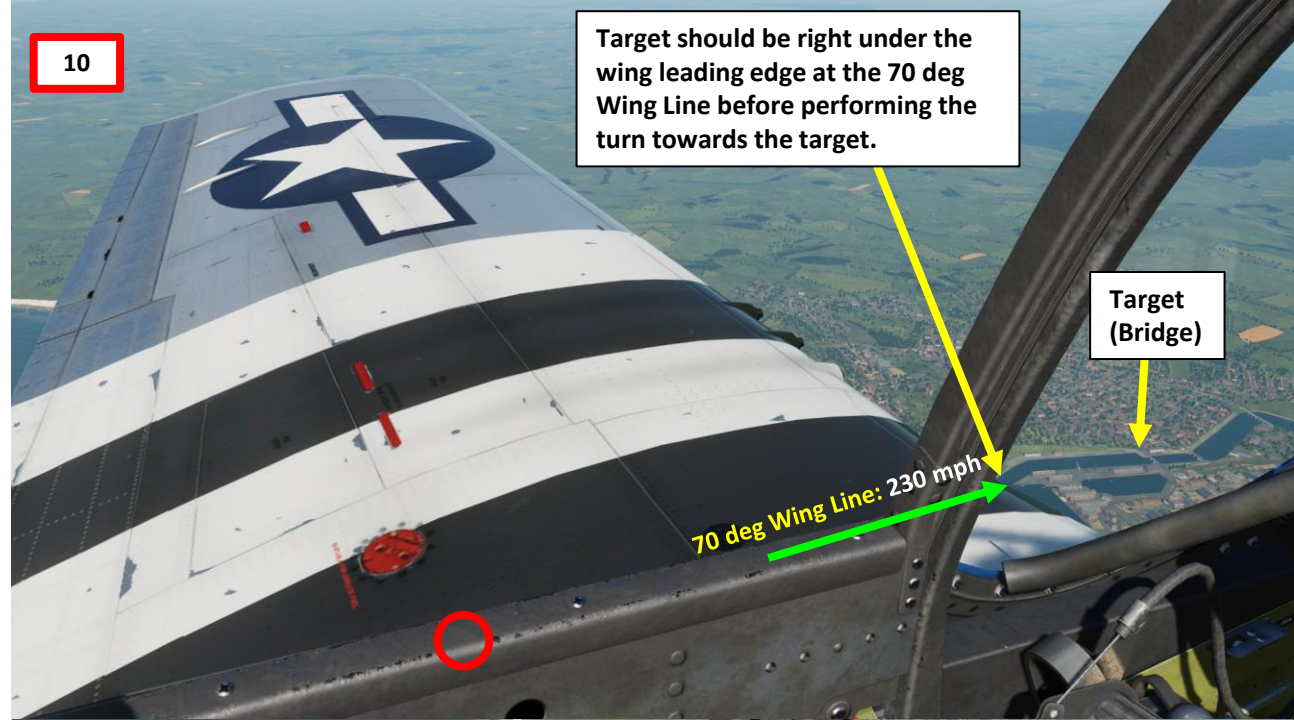


P-51 Bombing Attack Profile					
Wing Line (deg)	Entry Altitude (ft)	Entry Speed (mph)	Approach Time (sec)	Lead (mils)	Firing Range (ft)
20	2000	250	16	106	1300
35	3500	240	16	106	1800
50	5000	230	16	106	2400
70	7000	230	16	106	3600
110	11000	220	16	106	4900

BOMBS (M64 – 500 LBS)

10. When the target disappears under the wing leading edge at the 70 deg wing line, perform a gentle turn under the horizon in the direction of the target.
11. As you start your turn, start counting to 16 seconds in your head. This will allow you to do a countdown when to drop your bombs.
12. While turning, regulate speed so that the target remains visible. This turn has to be very steady and made without excessive use of the rudder.
13. Throttle back at idle power and perform a dive between 30 and 90 deg. The steeper the dive angle the better precision you will have.

10

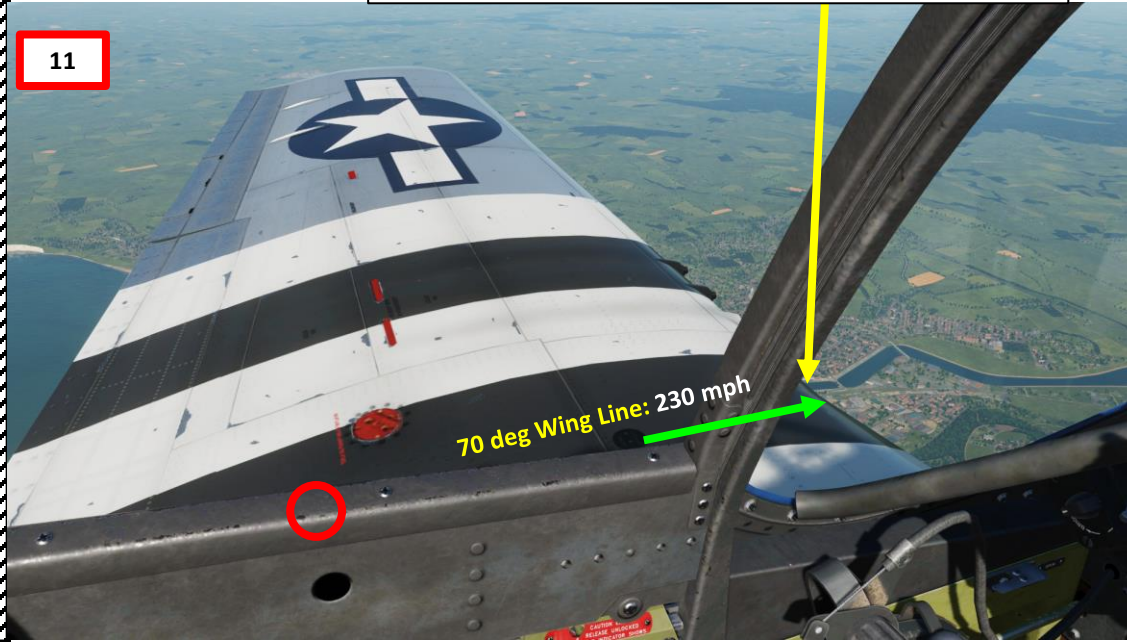


Target is right under the wing leading edge at the 70 deg Wing Line; start performing the turn towards the target.

12



11



BOMBS (M64 – 500 LBS)

14. Line up the target with the center of the gunsight reticle.
15. Pull lead to bring the target slightly under the nose (107 mils).
16. When target is lined up under your nose and you finish counting to 16 (this should bring you at an altitude of about 3000 ft over the target) release bombs by pressing the Bomb Drop button on the throttle (“RSHIFT+SPACEBAR” binding). All bombs equipped will drop simultaneously.



Target
(Under the nose, at 107 mils)

Gunsight Diameter = 70 mils

16

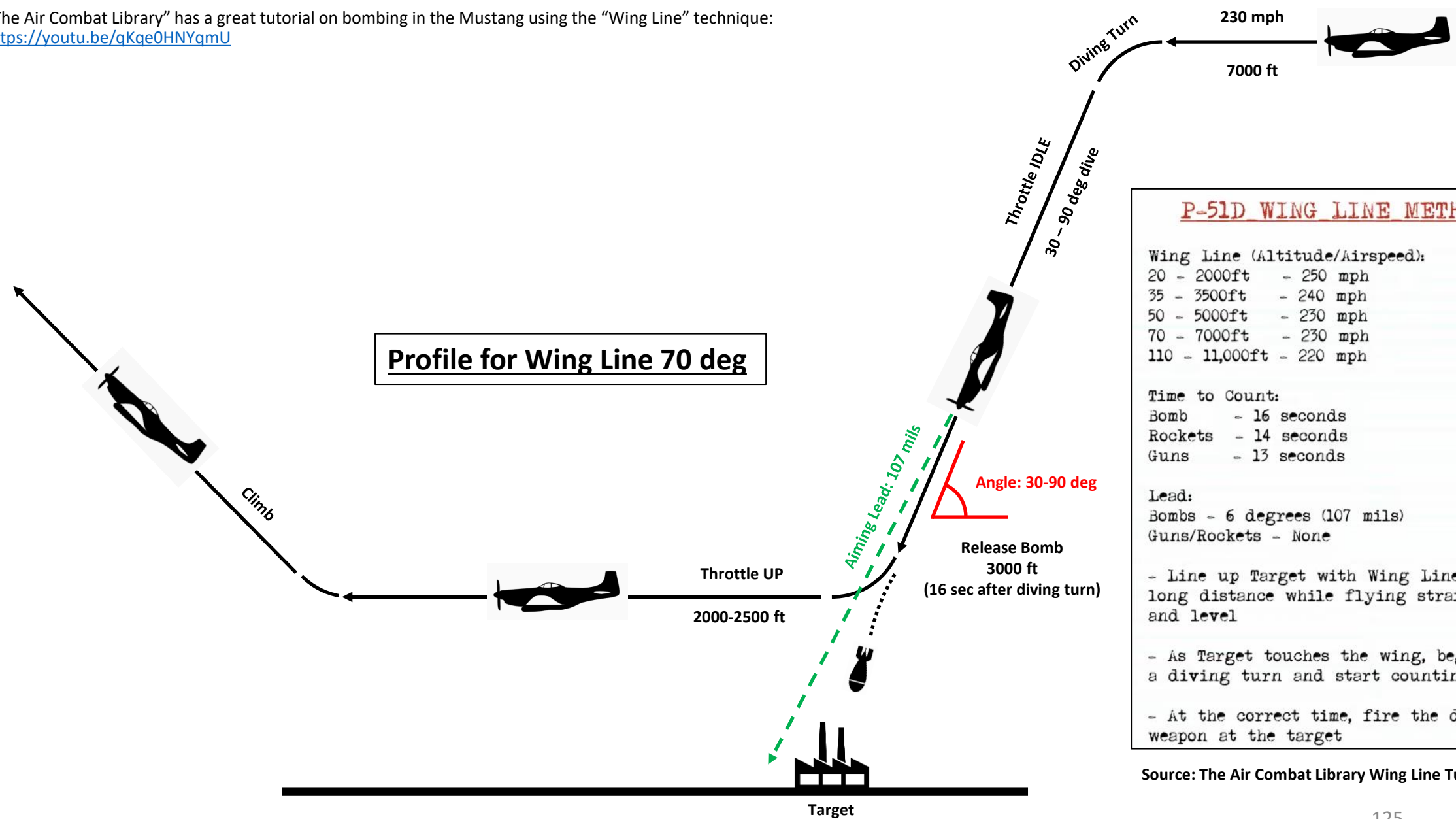
BOMBS (M64 – 500 LBS)

17. Apply full power and pull away from the blast while maintaining level flight. This will allow you to get out as quickly as possible from the orbit of enemy flak.
18. After having travelled enough distance, start climbing. Climbing immediately after the release of bombs was one of the most common mistakes and resulted in:
 - Unnecessary danger to the pilot from the enemy flak
 - Black-out
 - Wing wrinkling



BOMBS (M64 - 500 LBS)

"The Air Combat Library" has a great tutorial on bombing in the Mustang using the "Wing Line" technique:
<https://youtu.be/qKqe0HNYqmU>



Profile for Wing Line 70 deg

P-51D WING LINE METHOD

Wing Line (Altitude/Airspeed):

20 - 2000ft	- 250 mph
35 - 3500ft	- 240 mph
50 - 5000ft	- 230 mph
70 - 7000ft	- 230 mph
110 - 11,000ft	- 220 mph

Time to Count:

Bomb	- 16 seconds
Rockets	- 14 seconds
Guns	- 13 seconds

Lead:

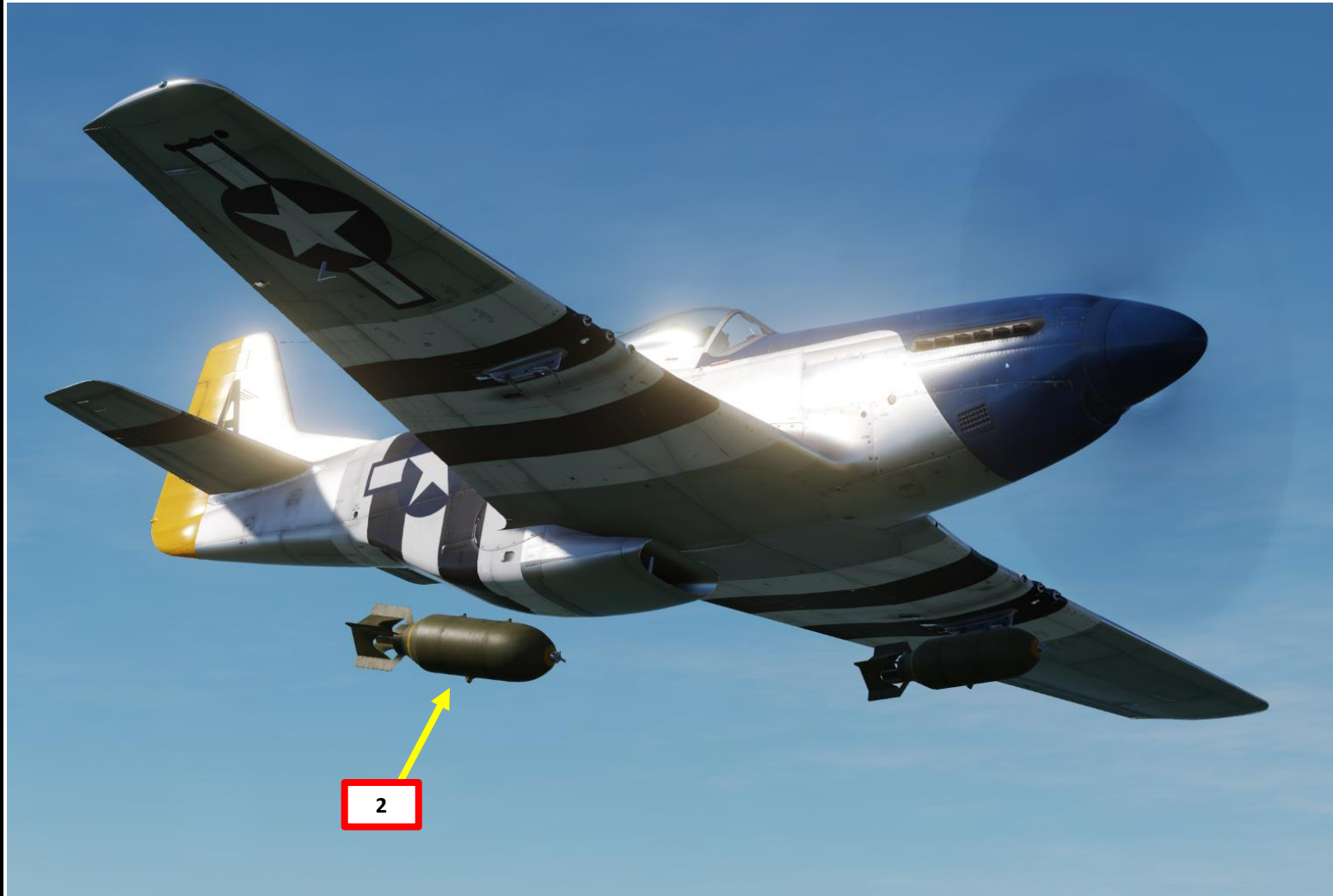
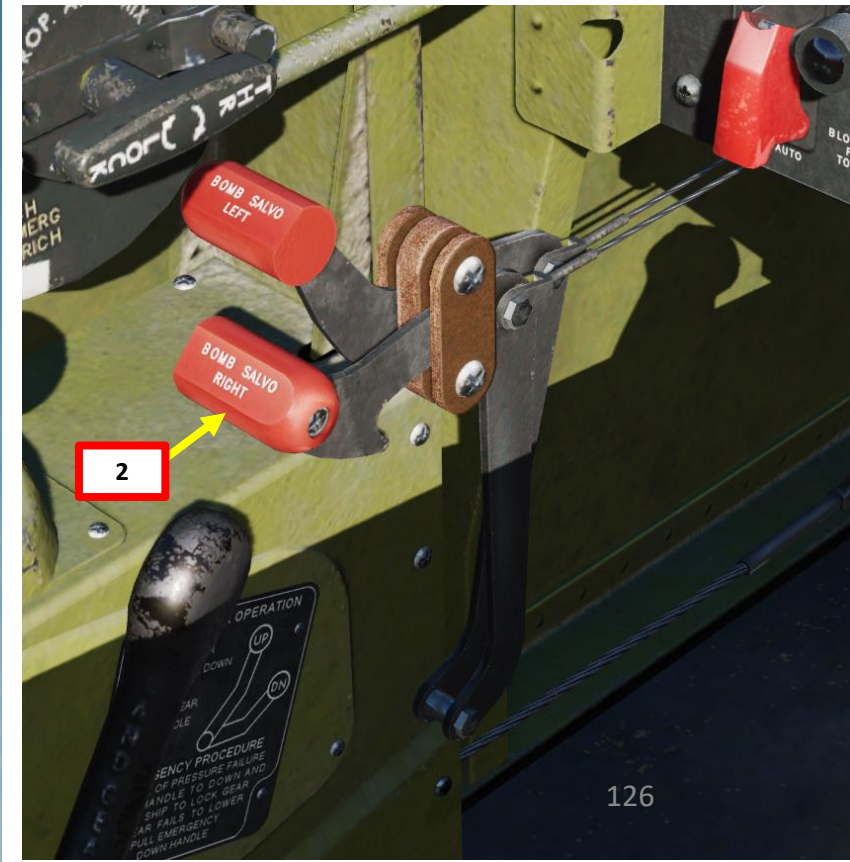
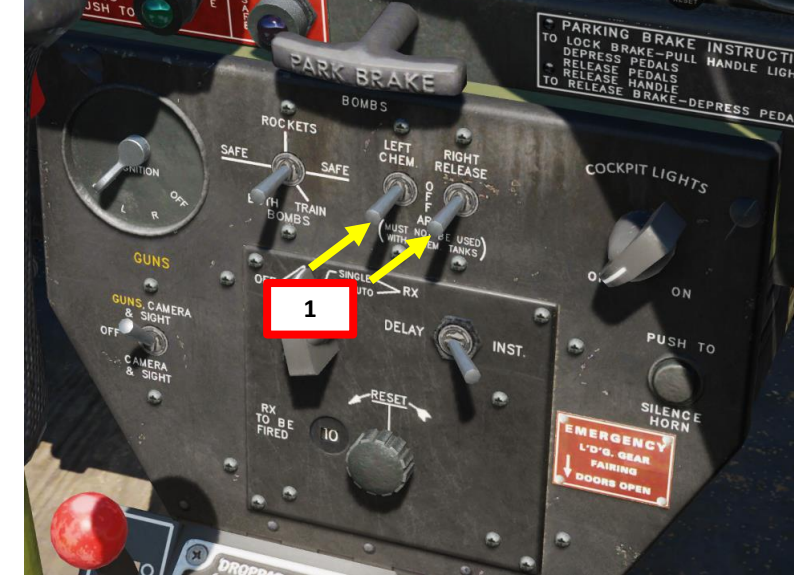
Bombs	- 6 degrees (107 mils)
Guns/Rockets	- None

- Line up Target with Wing Line at long distance while flying straight and level
- As Target touches the wing, begin a diving turn and start counting
- At the correct time, fire the desired weapon at the target

Source: The Air Combat Library Wing Line Tutorial

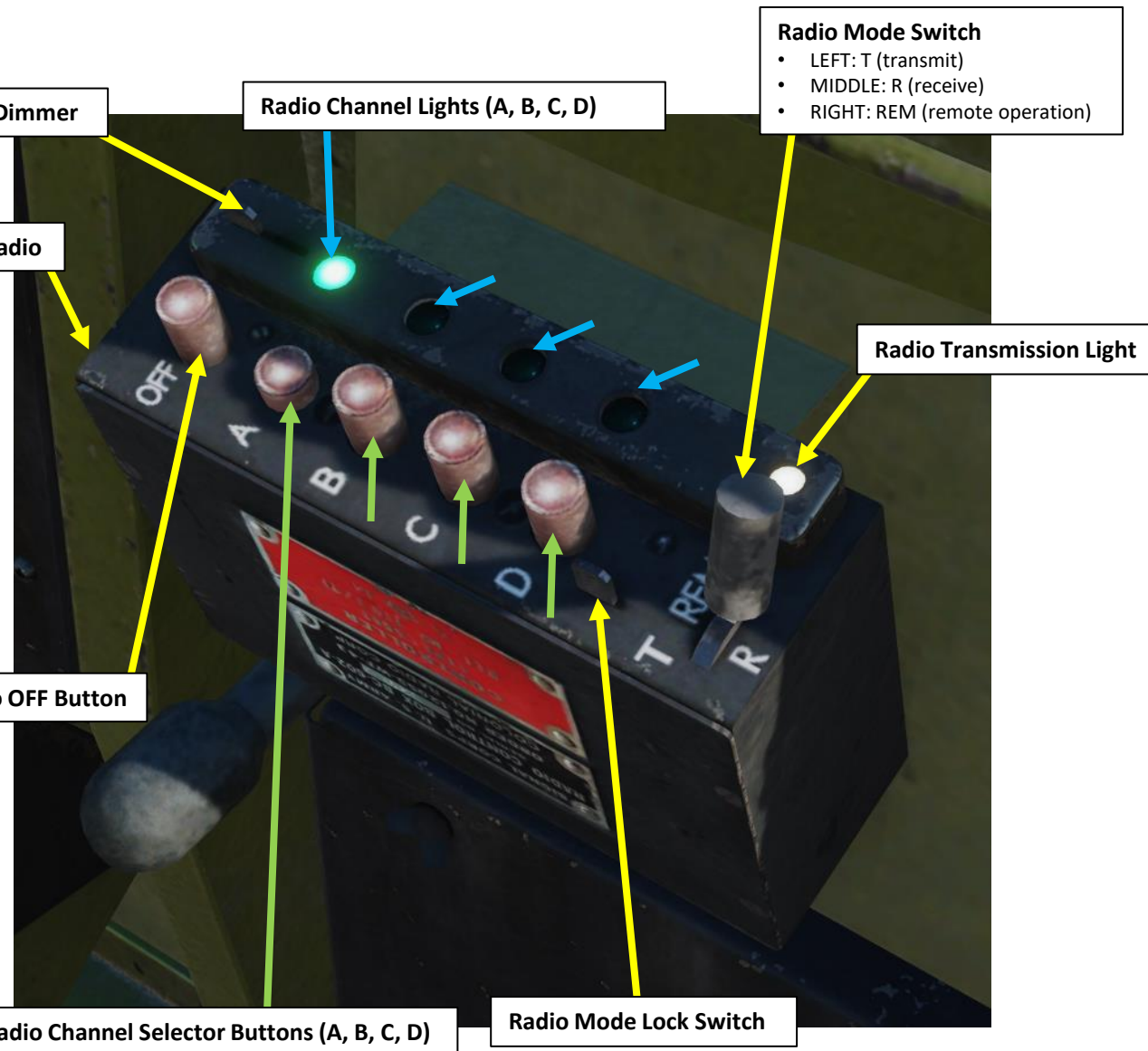
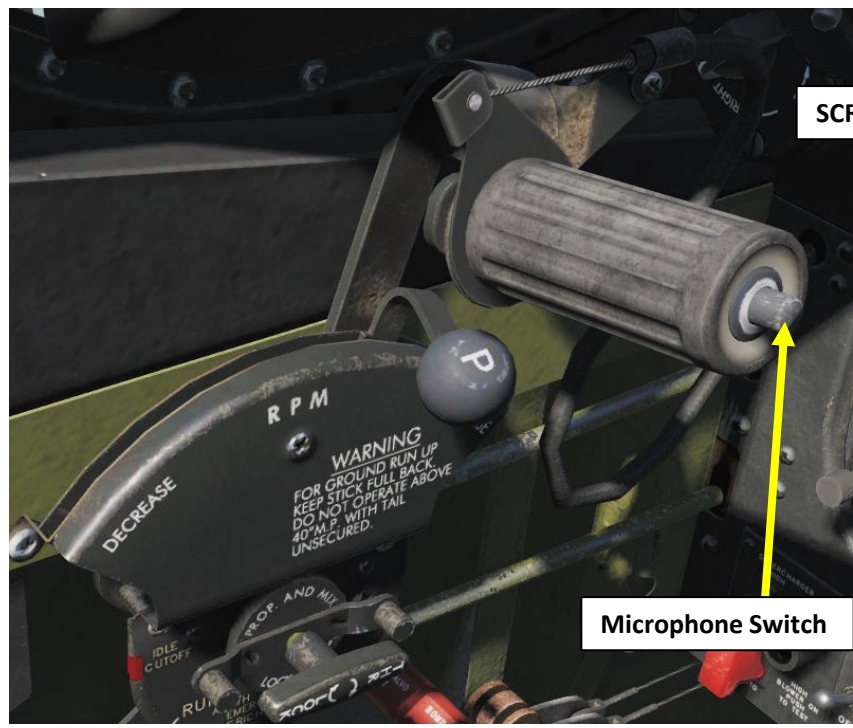
BOMB JETTISON

1. Disarm bombs by setting bomb arming switch to the OFF position (MIDDLE).
2. Jettison desired bomb by pulling the appropriate BOMB SALVO LEFT/RIGHT lever AFT. This will jettison the bomb without the fuze being armed.



SCR-522-A VHF RADIO

The P-51D 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.

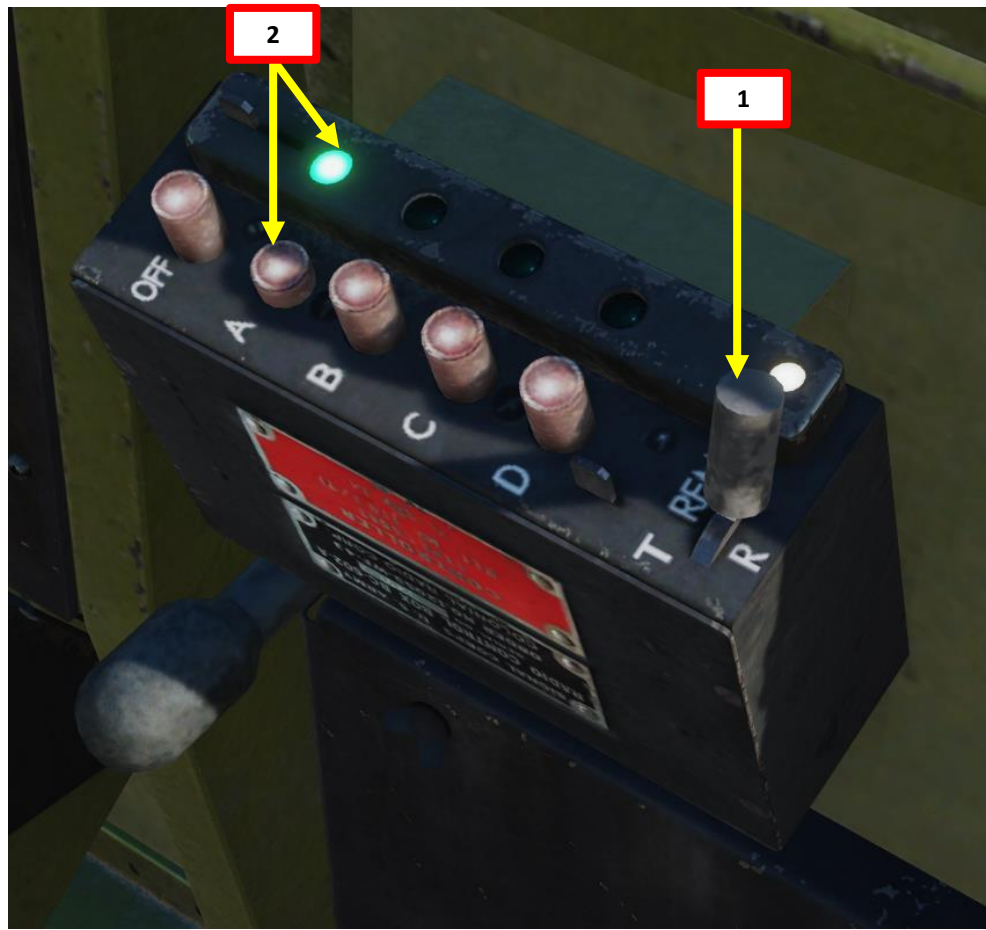
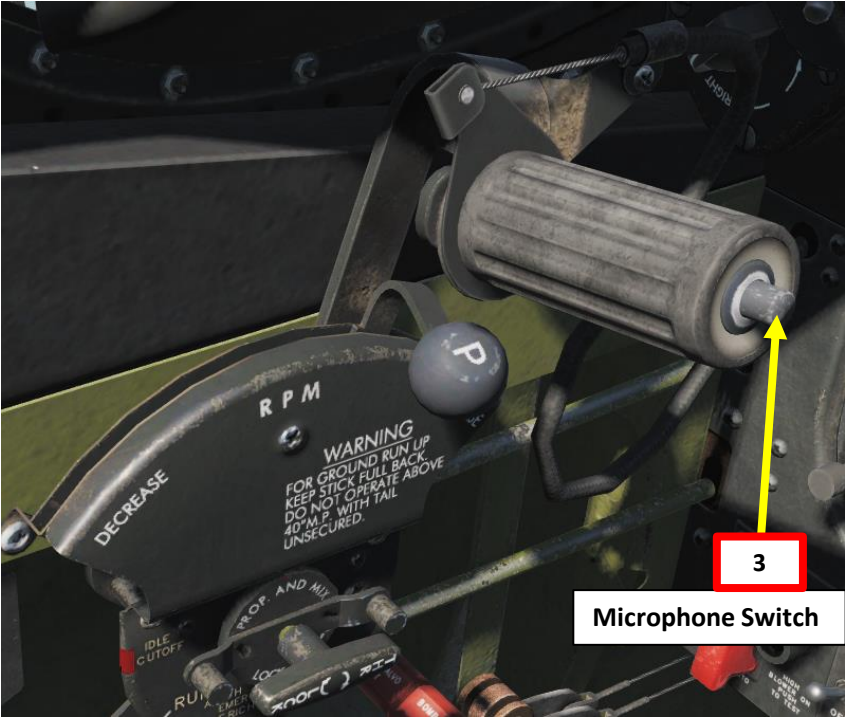


**RADIO FREQUENCY
RANGE: 100 - 156 MHz**

SCR-522-A VHF RADIO

To use the radio:

1. Set the radio Transmit-Receive switch to "REM" (Remote Operation)
2. Select desired channel (A, B, C or D)
3. Press the Push-to-Talk switch on your throttle to transmit ("COMM PUSH TO TALK" control, or "RALT+\")



CONTROL OPTIONS					
P-51D Real	All	Reset category to default	Clear category	Save profile as	Load profile
Action	Category	Keyboard	Throttle - HOTAS W...	Joystick - HOTAS Wa...	Saitek Pro Flight Co...
COMM Push to talk	Communications	RAlt + \	JOY_BTN6		
COMM Switch dialog	Communications	RShift + \			128
COMM Switch to main menu	Communications	RCtrl + \			

AIRPLANE GROUP
✕

NAME ?

CONDITION %

COUNTRY

TASK

UNIT OF

TYPE

SKILL

PILOT

TAIL # COMM MHz AM

CALLSIGN

HIDDEN ON MAP

HIDDEN ON PLANNER

LATE ACTIVATION

SCR522
📶

ButtonA	<input type="text" value="124"/>	MHz	AM
ButtonB	<input type="text" value="124"/>	MHz	AM
ButtonC	<input type="text" value="131"/>	MHz	AM
ButtonD	<input type="text" value="139"/>	MHz	AM

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:

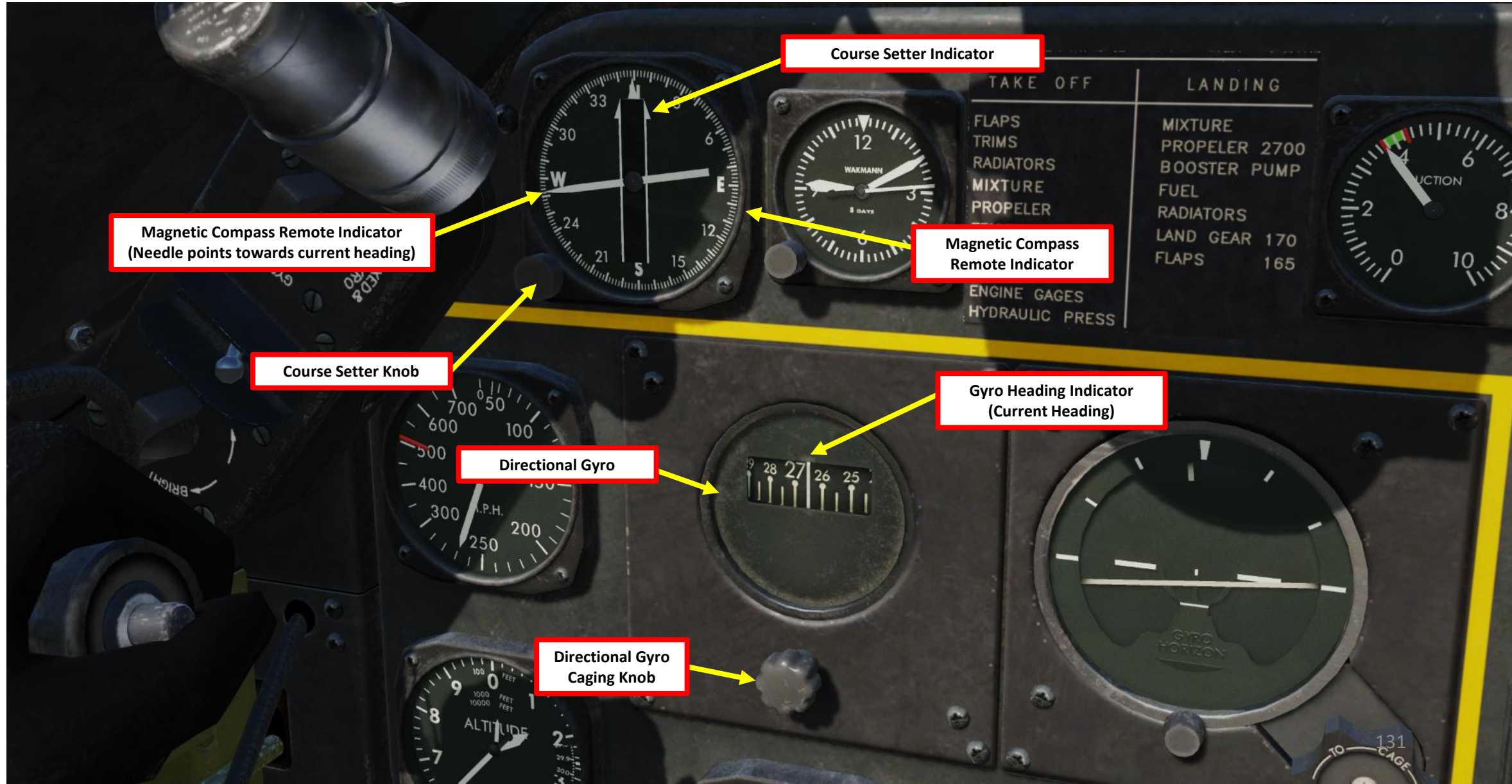
- Frequently used in contacting homing stations

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 Mustang. Consult the Gyro and Remote Indicator Compass (Magnetic Compass) to determine your current magnetic heading.



AIRCRAFT VARIANTS

There are two variants of the Mustang modelled in DCS: the P-51D-25-NA and the P-51D-30-NA variants. There are no difference between the two variants in terms of performance; they use the same engine and have the same wing profile. The D-25 was used in the ETO (European Theater of Operations) while the D-30 was used in the PTO (Pacific Theater of Operations). The difference lies mainly in terms of on-board equipment (antennas).



AIRCRAFT VARIANTS

P-51D-25-NA Variant

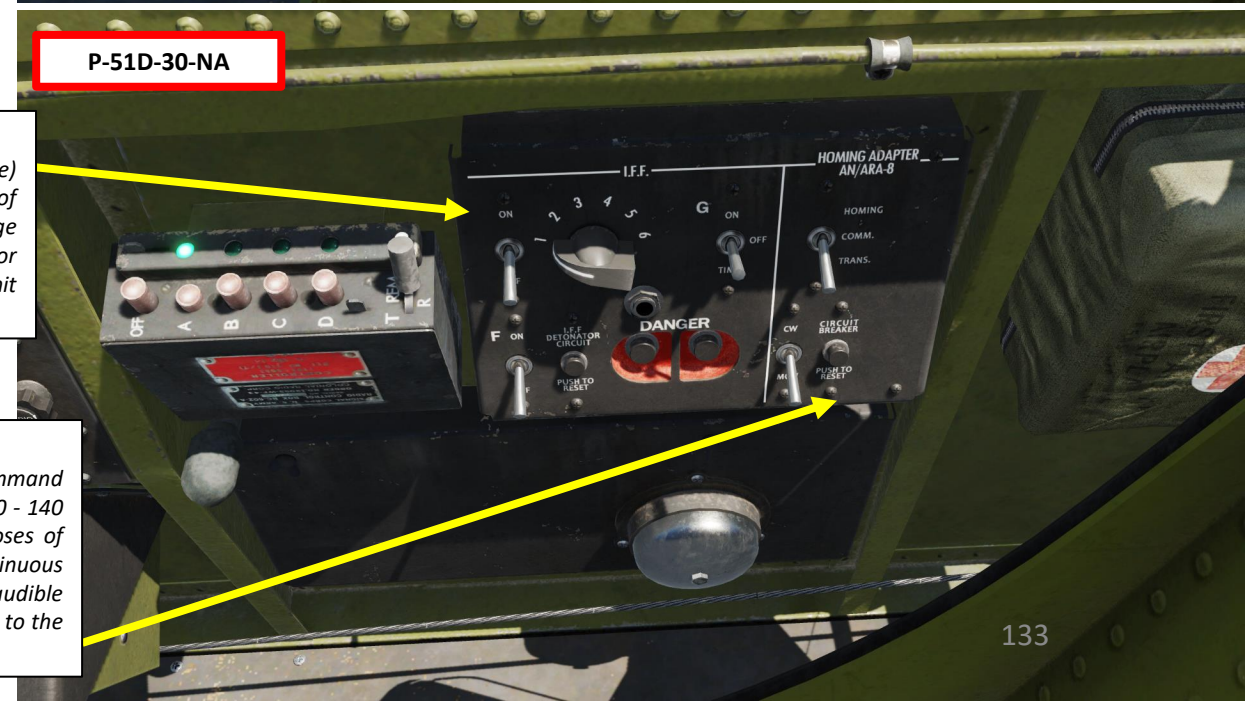
The D-25 was mainly used in Europe. The version we have is stripped of the IFF panel and the Homing Adapter system.

P-51D-30-NA Variant

The D-30 was used in the Pacific. The D-30 had to navigate over long distances and navigation was very challenging in the middle of the ocean. The AN/ARA-8 Homing Adapter system panel is installed (but not functional in DCS) and was used to home on radio emitters. The IFF (Identify-Friend-or-Foe) Panel is not functional in DCS either, but it was used as a method of responding to radar interrogators. This system would tell the ground radar operator whether your aircraft was friendly or enemy based on your response code/frequency.



P-51D-25-NA



P-51D-30-NA

IFF (Identify-Friend-or-Foe) System
The SCR-695-A IFF (Identification Friend or Foe) radio set permits automatic transmission of identification signals upon reception of a challenge signal from a properly equipped friendly air or surface unit. It can also be used to transmit emergency or distress signals.

AN/ARA-8 Homing Adapter System
The AN/ARA-8 Homing Adapter unit is used in conjunction with the SCR-522-A command radio to permit homing on any transmitting carrier within the frequency range of 120 - 140 MHz. In addition, this equipment may be used for air-to-air homing for the purposes of rendezvous. Homing can be performed on continuous wave (CW) and modulated continuous wave (MCW) signals. Homing signals are provided to the pilot in the form of an audible signal in the headset, Morse code character D (- . .) when the transmitting station is to the left and Morse code character U (. - -) when the transmitting station is to the right.

PART 13 – TACTICS & AIR COMBAT

**P-51D
MUSTANG**



Dogfighting in the P-51D Mustang is an art that is easy to learn, but very difficult to master. On various forums, you will read a thousand different theories about “how to dogfight” or “why it sucks monkey balls” or “why it’s the most overpowered aircraft ever”. Everyone has an opinion on the Mustang, but few people have a truly “informed” opinion about it. I will try to give you some tips that are intended to be as unbiased and factual as possible.

First, the P-51D Mustang was built to be a high-speed, long-range escort fighter. While the majority of allied fighters like the Spitfire had a range of about 430 miles, a P-51 equipped with external fuel tanks had a range of about 1,650 miles. The distance between London and Berlin being approximately 600 miles, the Mustang became the aircraft of choice to escort the bombers during the bombing campaign over Germany.

Therefore, the Mustang is best used at altitudes of 25,000 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 Mustang 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.

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 Mustang too. If you have to make a quick turn, you will notice that the Mustang’s wing configuration has an airfoil of a laminar-flow design, which provides low drag at high speeds but has the inconvenient of inducing violent accelerated stalls and spins if you pull too hard on the stick when turning and banking. A good trick is to deploy 10 to 20 degrees (1 to 2 notches) of flaps before beginning a turn and to retract your flaps immediately afterwards to gain back airspeed. The Mustang can have a surprisingly good turn rate when your flaps are deployed; this can be used to your advantage when you need to evade an enemy that is bouncing you.



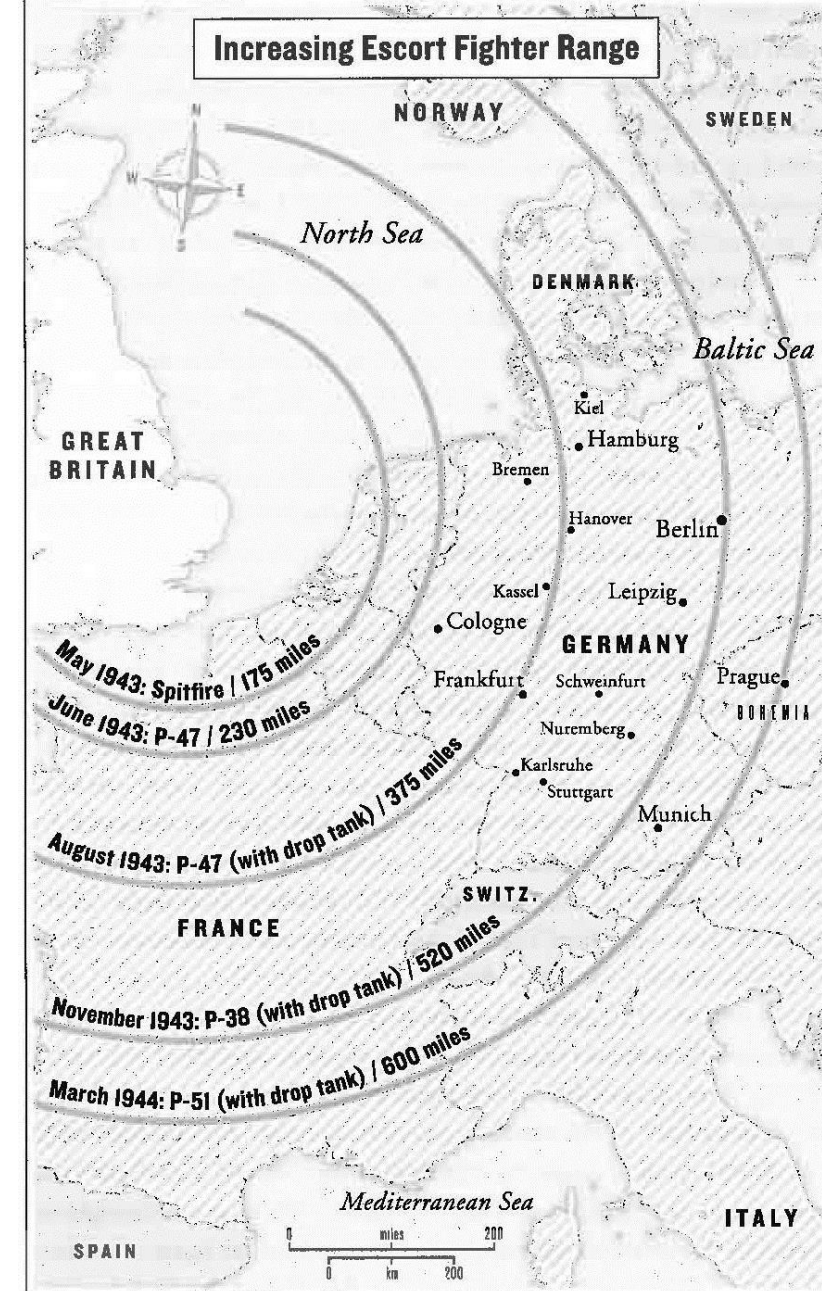
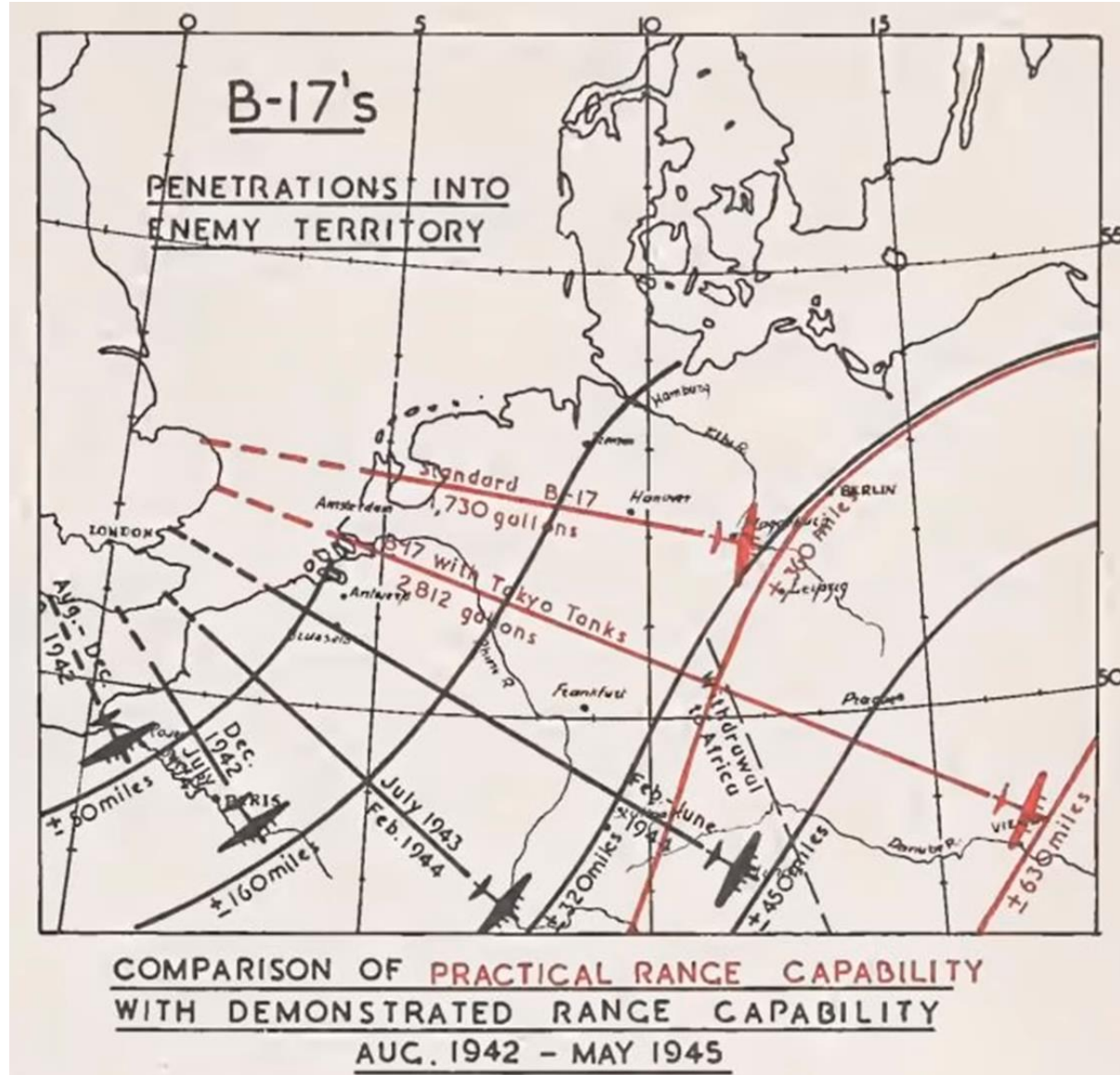
It is also important for you to realize that the P-51D modelled in DCS is an early 1944 variant, while the Bf.109K-4 and FW.190D-9 entered service in late 1944. Therefore, the P-51D of early will underperform in comparison to the P-51D of late 1944 since the maximum allowable manifold pressure went from 67 inches of Hg to 75 inches of Hg, partly due to a change of fuel grade. There have been extensive and heated debates on “what fuel grade should be used” on the Eagle Dynamics forums.

While we could argue day and night about what the P-51D should or should not be, the conclusion remains the same. The P-51D must be used in the following way if you want to survive against experienced Bf.109 or FW.190 pilot:

- Always fly with a wingman
- Always fly with a high energy state (high airspeed and altitude)
- Do not attempt to outclimb or outdive 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 manoeuvres to avoid stalls and spins.



The laminar flow wings of the Mustang made it the perfect fighter for long flights since it generated minimal drag and allowed for high altitude flights over long distances. The Mustang, alongside the P-47, was one of the few aircraft that had sufficient endurance (with external fuel tanks) to follow the B-17 Flying Fortress bombers from bases in England to the heart of Germany. Mustang squadrons like the Tuskegee Airmen of the 332nd Fighter Group (nicknamed the "Red Tails") became famous for their escort missions and their dedication to protect the bomber crews through long flights that could last for hours.



INCREASING ESCORT FIGHTER RANGE
Providing long-range fighter escorts in daytime for the American heavy bombers was the critical component in gaining air supremacy between 1943 and 1944.

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.

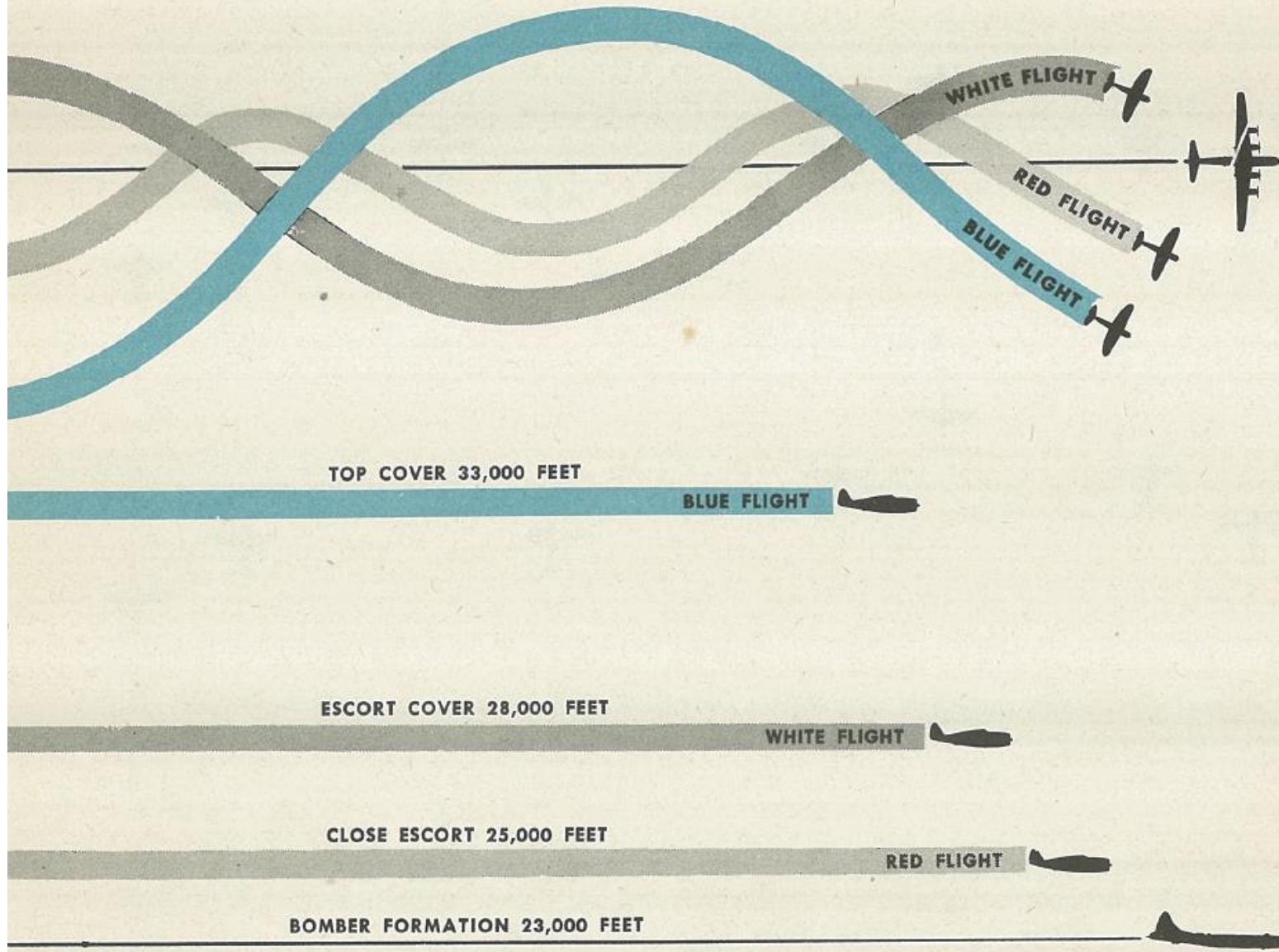
While Fighter Command's priority was the German fighters, Bomber Command concentrated on destroying the ground targets. At higher level in the RAF it was felt that the effects on the war by damage that could be inflicted by the bombers would be minimal; the commanders of Bomber and Fighter Commands held 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-51 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-51.



SQUADRON ESCORT OF A BOMBER FORMATION

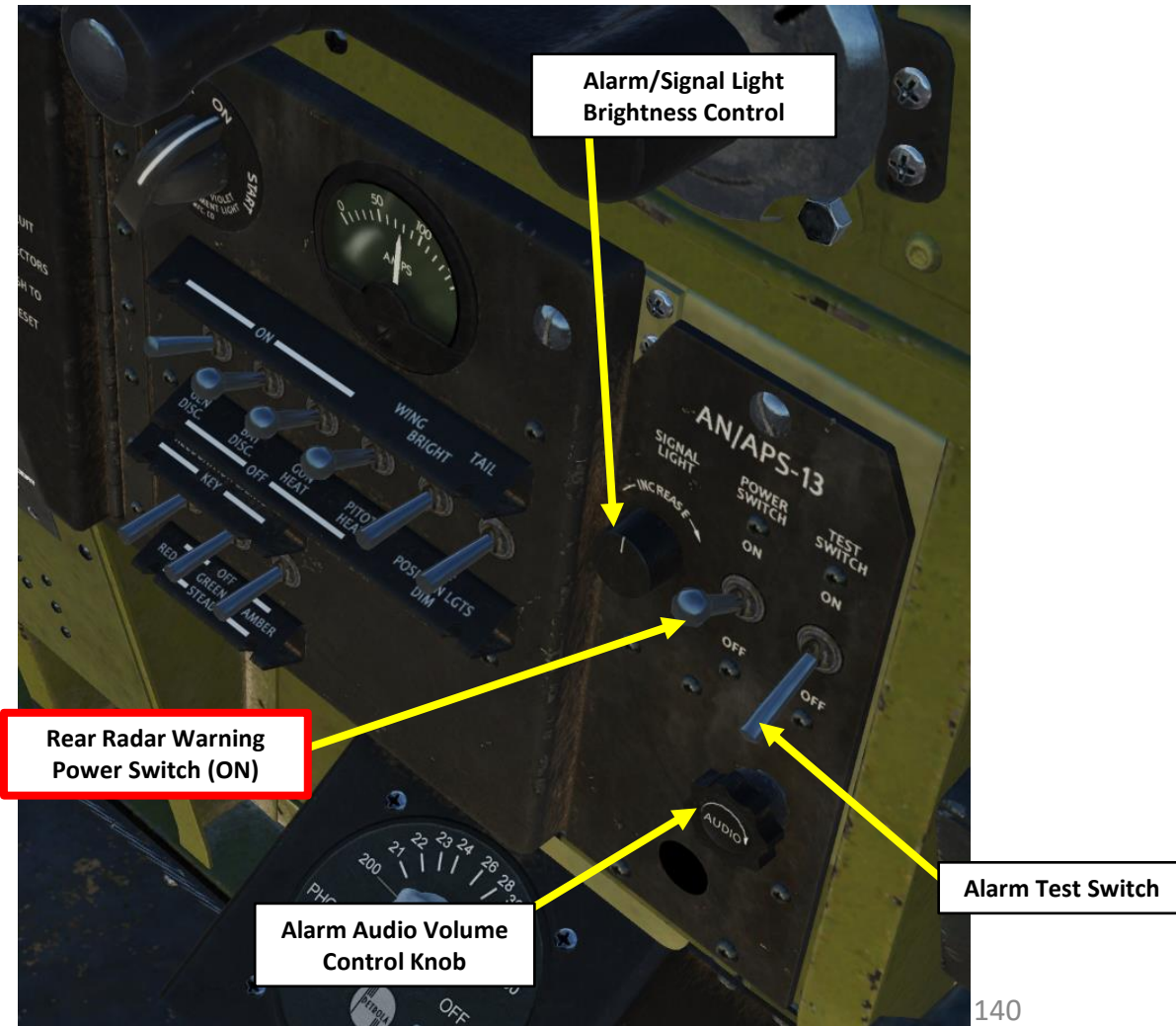
(Taken from P-47 documentation)



AN/APS-13 REAR WARNING RADAR SYSTEM

The P-51D is equipped with the AN/APS-13 Rear Warning Radar System, which will trigger an alarm sound and light when a contact is behind you. This is very useful for situational awareness. Keep in mind that this radar is somewhat primitive and will not distinguish friend from foe.

To turn on the Rear Radar Warning switch, simply turn the Rear Radar Warning Power Switch ON (UP). An audible alarm sound and light will be triggered when an aircraft is behind you.



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,

P-51D MUSTANG



- INSTANT ACTION
- CREATE FAST MISSION
- MISSION
- CAMPAIGN
- MULTIPLAYER

- LOGBOOK
- ENCYCLOPEDIA
- TRAINING
- REPLAY

- MISSION EDITOR
- CAMPAIGN BUILDER

EXIT



Bf 109 K-4
1.5.3 beta



C-101
1.5.3 Beta



CA
1.5.3



F-86F
1.5.3



FC3
1.5.3



Fw 190 D-9
1.5.3



Hawk
1.5.3 Beta EFM



Ka-50
1.5.3



L-39
1.5.3



M-2000C
1.5.3 Beta



Mi-8MTV2
1.5.3 beta



MIG-15bis
1.5.3



MIG-21bis
1.5.3



P-51D
1.5.3



SA342
1.5.3 beta



Su-25T
1.5.3



TF-51
1.5.3