20201011

TFS FLASHCARDS

CS	ZH	IT	EN	FR	DE	RU	ES

Aircraft

This collection contains aircraft from IL-2 Sturmovik 'Cliffs of Dover Blitz' and 'Desert Wings Tobruk'

Allies

Bristol Beaufighter Mk IF
Bristol Beaufighter Mk IF Late & Mk IC
Bristol Blenheim Mk IV
De Havilland DH.82 Tiger Moth
Dewoitine D.520
Gloster Gladiator Mk II
Hawker Hurricane Mk I DH5-20
Hawker Hurricane Mk I Rotol
Hawker Hurricane Mk II
Kittyhawk Mk Ia
Martlet Mk III
Supermarine Spitfire Mk I
Supermarine Spitfire Mk Ia
Supermarine Spitfire Mk II
Supermarine Spitfire Mk V
Supermarine Spitfire Mk V HF
Tomahawk Mk II
Vickers Wellington Mk I

Axis

Fiat BR.20M Cicogna
Fiat CR.42 Falco
Fiat G.50 Freccia
Heinkel He 111 (P-2, H-2, H-6)
Junkers Ju 87 B-2 "Stuka"
Junkers Ju 88 (A-1, A-5, C-1, C-2, C-4)
Macchi C.202 Folgore
Messerschmitt Bf 108 Taifun
Messerschmitt Bf 109 E-1 & E-3
Messerschmitt Bf 109 E-1/B, E-3/B, E-4/B
Messerschmitt Bf 109 E-4 & E-7
Messerschmitt Bf 109 E-4/N & E-7/N
Messerschmitt Bf 109 F-1 & F-2
Messerschmitt Bf 109 F-4
Messerschmitt Bf 109 E-7/Z & F-4/Z
Messerschmitt Bf 110 C-2 & C-4
Messerschmitt Bf 110 C-4/B
Messerschmitt Bf 110 C-4/N, C-6, C-7

Airfield Locations And Elevation Tables

Channel Map (England)
Channel Map (France)
Tobruk Map

Using the Flashcards

These Manuals and Flashcards will be constantly reviewed and amended as required.

When reading the manuals and flashcards it is important to remember that they are written with the novice pilot in mind.

They are designed to enable a pilot, new to the sim, to start up his aircraft, take off and land again successfully. Therefore, the engine settings suggested in these manuals and flashcards are **conservative, '**safe settings designed to give the new pilot time to get used to any aircraft, without the danger of engine damage and the discouragement that might follow. Early success is the aim!

As experience grows, the pilot can later experiment with engine settings and learn to boost aircraft performance but he will also be encouraged to use these documents to try a whole variety of aircraft new to him.

Key Bindings

It is necessary to bind certain keys to cockpit controls to fly some aircraft. Single engine aircraft require fewer bindings than multi engine. Some pilots prefer to use the clickable cockpit to retain immersion, whilst others use their own wide choice of keys. Some of the most frequently used bindings include:

Prop Pitch

Many aircraft have an automated prop pitch system which can be controlled with the following key bindings:

Propeller Pitch Mode – Toggle *Decrease Propeller Pitch* *Increase Propeller Pitch*

Multi engine: would also require further bindings:

Select 1 Engine *Select 2 Engine* *Select All Engines* *Close Radiator* *Open Radiator*

Bombing:

Open bomb bay doors *Arm bombs* *Drop Ordnance (bombs)*

For more information on key bindings please refer to the Desert Wings – Tobruk Installation Guide, under:

Weapons Systems > Suggested Key Assignments

Experienced pilots will understand that an aircraft can be 'pushed' to higher performance by closing the radiator, engaging boost, etc. but this involves a higher risk of engine damage, particularly to the novice pilot, who is unused to monitoring instruments closely

Allied Aircraft

CS	ZH	IT	EN	FR	DE	RU	ES

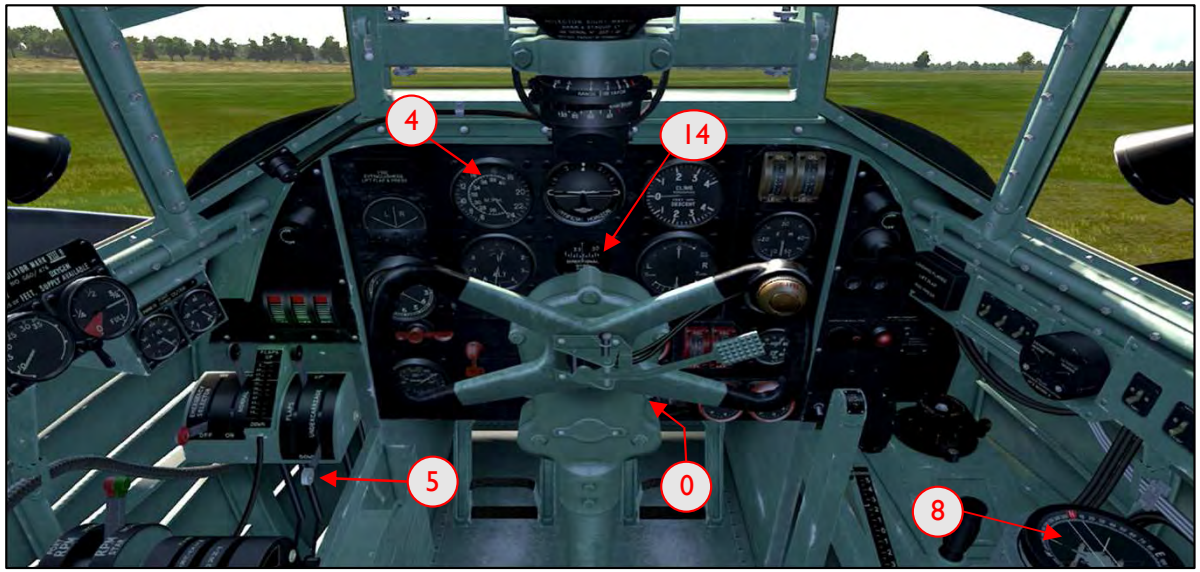
Bristol Beaufighter Mk IF

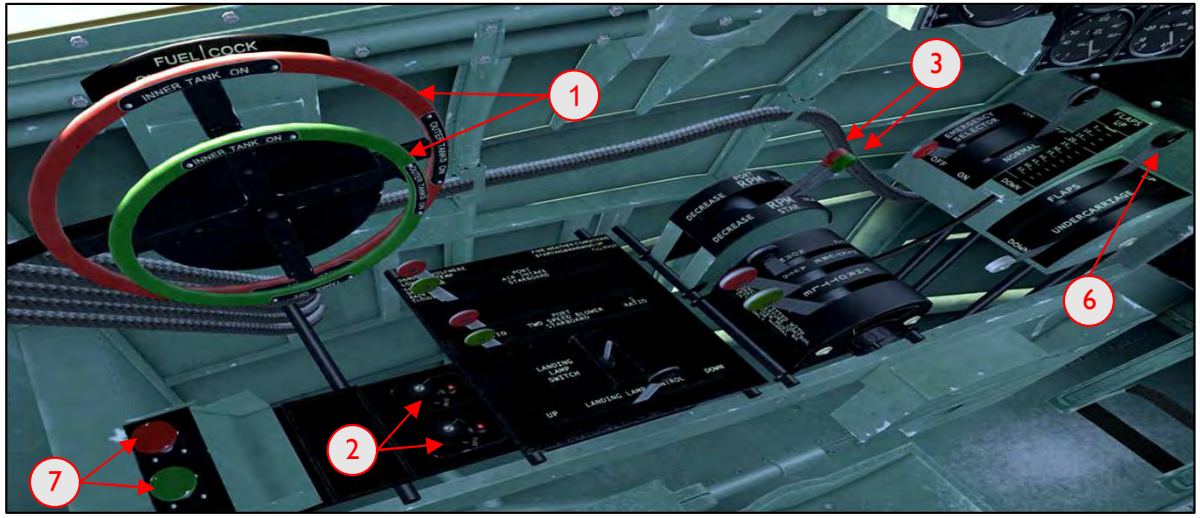
Starting, taxi, and take-off procedures

1. Apply chocks. Magnetos 'On' for both engines (0)
2. Turn the green and red rotary fuel cocks to 'Inner' tank position (**1**)
3. Open radiators (2)
4. Turn on boost cut out (bound key)
5. Select propeller pitch to fine (100%) (3)
6. Apply 10% throttle
7. Select engine 1. Start engine (default key is 'i')
8. Select engine 2. Start engine (default key is 'i')
9. Select both engines
10. Wait approx. 5 minutes. Then push throttle forward to 110%
11. After some coughing the engines should catch and start to run smoothly
12. If an engine stops, select that engine
13. Reduce throttle to 10%, start again and wait one minute longer before opening throttle
14. Re-select both engines
15. Remove chocks
16. Release brakes
17. Slowly increase throttle until the aircraft starts to move
18. Steer by using rudder and brakes
19. On runway accelerate with full throttle and fine prop pitch to approx. 105 mph (4) then pull stick smoothly to take off
20. Raise undercarriage (5)

Landing procedure

21. Open radiators to 100% (2)
22. Prop pitch to full fine (100%) (3)
23. Lower undercarriage (5) at approx. 160 mph (4)
24. Lower flaps on approach (6) at approx. 140 mph (4)
25. Approach speed and touch down at approx. 95 mph
26. After touchdown maintain slight back pressure on joystick until low speed to avoid nosing over
27. Apply brakes carefully
28. Steer with rudder and brakes
29. Select 'Slow running cut-outs' (7) to stop engines





Engine Management

Recommended settings for:	Radiators	Boost	RPM
Cruise	55%	+1.0	2400
Climb	75%	+2.5	2400
Highest speed	As necessary	+4.0	2800

Never exceed engine temperature of 260°C, Oil max. 90°C
Toggle charger at 6500 ft (climb) or 3500 ft (combat)

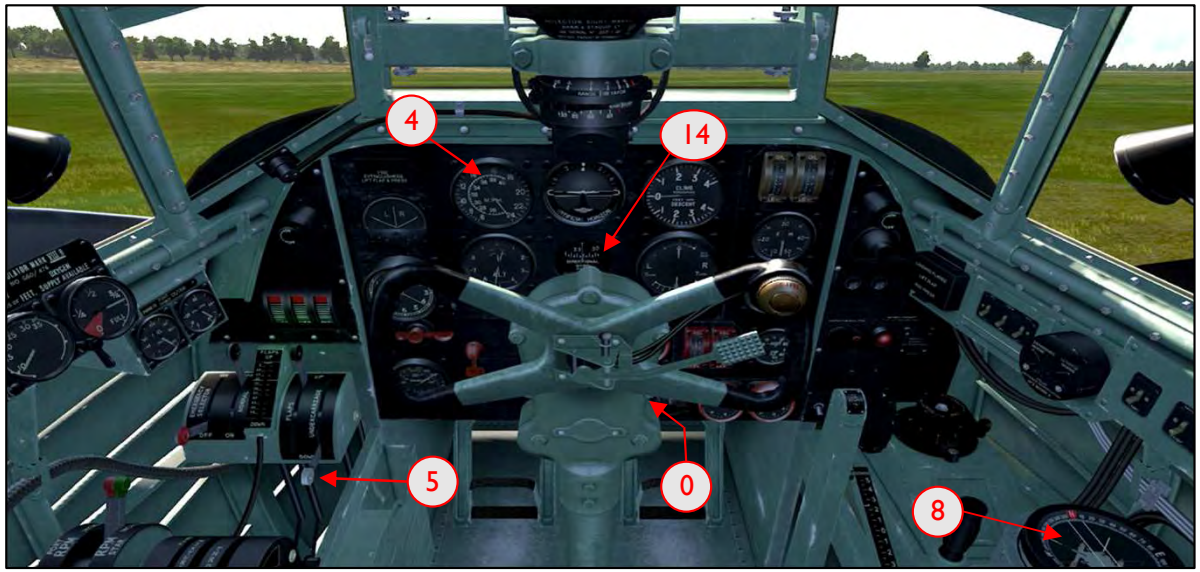
Bristol Beaufighter Mk IF Late and Mk IC

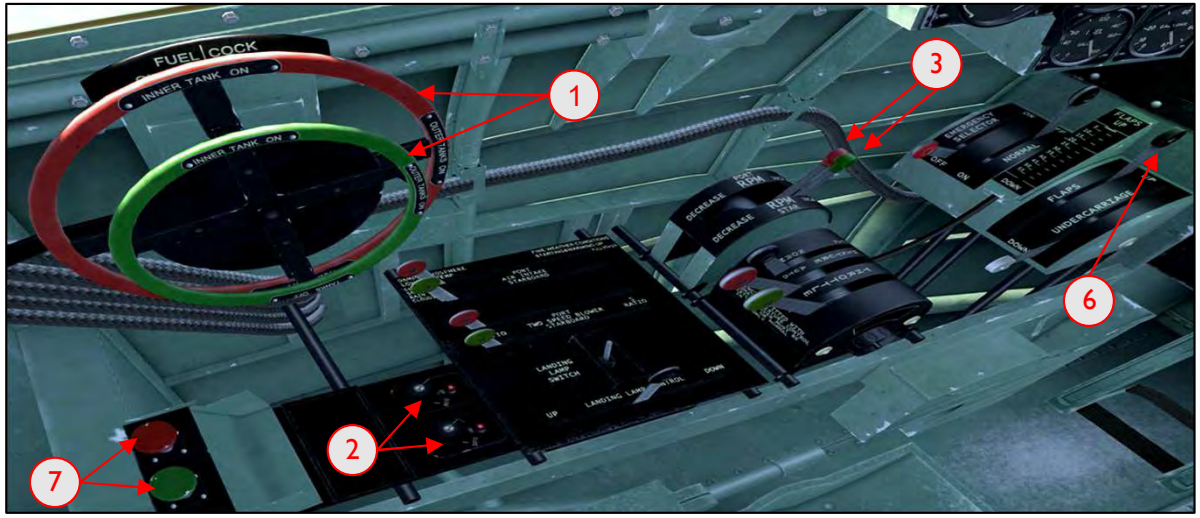
Starting, taxi, and take-off procedures

1. Apply chocks. Magnetos 'On' for both engines (0)
2. Turn the green and red rotary fuel cocks to 'Inner' tank position (1)
3. Open radiators (2)
4. Turn on boost cut out (bound key)
5. Select propeller pitch to fine (100%) (3)
6. Apply 10% throttle
7. Select engine 1. Start engine (default key is 'i')
8. Select engine 2. Start engine (default key is 'i')
9. Select both engines
10. Wait approx. 5 minutes. Then push throttle forward to 110%
11. After some coughing the engines should catch and start to run smoothly
12. If an engine stops, select that engine
13. Reduce throttle to 10%, start again and wait one minute longer before opening throttle
14. Re-select both engines
15. Remove chocks
16. Release brakes
17. Slowly increase throttle until the aircraft starts to move
18. Steer by using rudder and brakes
19. On runway accelerate with full throttle and fine prop pitch to approx. 105 mph (4) then pull stick smoothly to take off
20. Raise undercarriage (5)

Landing procedure

21. Open radiators to 100% (2)
22. Prop pitch to full fine (100%) (3)
23. Lower undercarriage (5) at approx. 160 mph (4)
24. Lower flaps on approach (6) at approx. 140 mph (4)
25. Approach speed and touch down at approx. 95 mph
26. After touchdown maintain slight back pressure on joystick until low speed to avoid nosing over
27. Apply brakes carefully
28. Steer with rudder and brakes
29. Select 'Slow running cut-outs' (7) to stop engines





Engine Management

Recommended settings for:	Radiators	Boost	RPM
Cruise	55%	+2.5	2500
Climb	75%	+3.5	2500
Highest speed	As necessary	+6.75	2800

Never exceed engine temperature of 280°C, Oil max. 90°C
Toggle charger at 5000 ft (climb) or 3500 ft (combat)

Bristol Beaufighter - All Variants

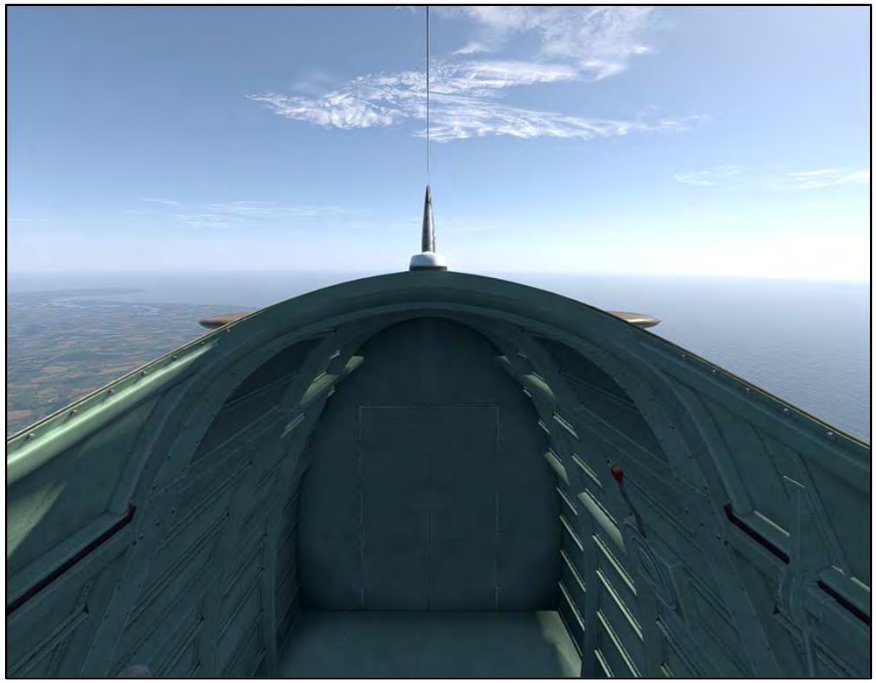
Navigation basics and bomb dropping

Navigation is an important aspect of Beaufighter operations, especially long-range intruder missions deep into enemy territory.

30. Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees)
31. To set the compass (8) rotate the 2 parallel white lines (9) by placing cursor on compass rim (10) and pressing when 'Course Setter – Increase' label is seen
32. Rotate until the 'T' line parallels the double white line (9) and red 'N' (11) aligns with 'T' (12)
33. The number at the 12 o'clock position on the dial (13) – and indicated by blue text on your screen – is the aircraft's current magnetic heading
34. Set directional gyro (14) to this heading. After aggressive manoeuvres you will need to reset the directional gyro using the above steps
35. During aircraft selection prior to spawn-in ensure correct fuze and bombs selected. Over the target drop bombs using bound key

Observer position

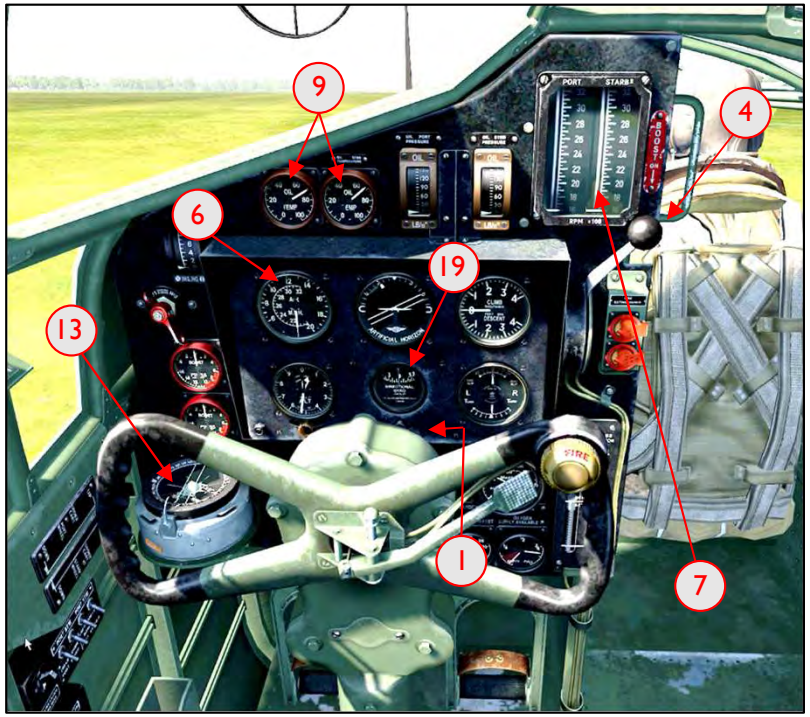
36. Although the in-game Beaufighter does not have a rear gun, player use of the observer position is recommended to compensate for the Beaufighter's poor rearward visibility from the front cockpit. With practice, flying from the observer position is possible which greatly improves situational awareness and helps defensive manoeuvring
37. Enter observer position using bound key (default 'C') and enable mouse control of view ('F10') or use your head tracker to move the view
38. Return the observer back to AI (so that it will call out enemy aircraft, and to allow you to drop bombs from the pilot seat) by pressing 'Alt F2', then return to pilot position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash



Bristol Blenheim Variants: Pilotage

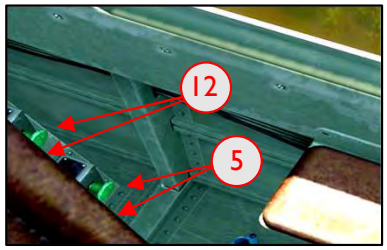
Starting, taxi, and take-off procedures

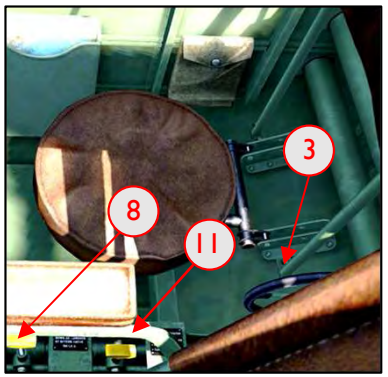
1. Apply chocks. Magnetos 'On' for both engines (1)
2. Turn green/red rotary fuel cocks to 'Inner' tank position (2). Set fuel cross feed valve to 'On' (2a)
3. Open radiators to 100% (3)
4. Turn on boost cut-out (4)
5. Select fine prop pitch (100%) (5) (recommend bound key) and apply 10% throttle
6. Select engine 1 and start it by pressing bound key ('I'). Repeat with engine 2
7. Select both engines using bound key
8. Wait three minutes, then push throttle to 100%
9. If engine(s) stop, set throttle 10% and start again. Wait a little longer before applying 100%
10. Remove chocks, release breaks and slowly apply throttle and taxi using rudder and brakes to steer
11. Once aligned on the runway apply chocks
12. Set throttle to 110%, ensure fine propeller pitch and release chocks. Steer with rudder
13. Take off at about 100 mph (6), while not exceeding 2630 RPM (7) during the take-off run
14. Apply gentle back stick to take-off. Keep speed above 110 mph when airborne
15. After take-off raise undercarriage (8) and reduce pitch to coarse setting (0%) (5) (recommend bound key) position once aircraft has reached about 140 mph. Monitor oil (9) and engine temps (10)

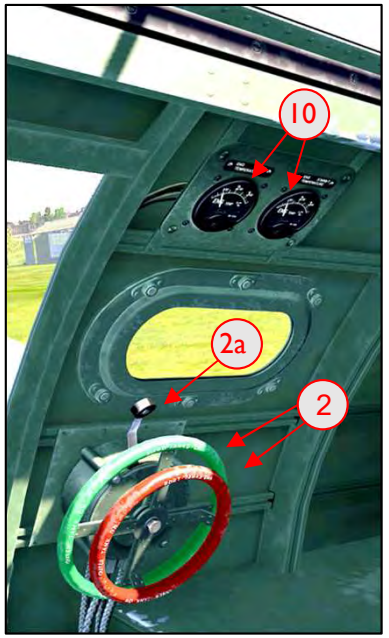


Landing procedure

16. Fully open radiators to 100% (3) and reduce speed to about 140 mph (6)
17. Lower flaps (11) at approx. 120 mph and lower undercarriage (8)
18. Set prop pitch to fine position (5) (recommend bound key)
19. Maintain approx. 110-120 mph by adjusting throttle and trim
20. Touch down at approx. 110 mph, maintaining back stick pressure to avoid nosing over
21. Steer using rudder and apply brakes carefully to stop
22. Apply chocks and turn off fuel cocks (2) or slow running cut outs (12) to finish sortie







Engine Management

Recommended settings for:	Radiators (Cylinder Head Temp)	Boost	Prop Pitch	RPM
Cruise	50%	+3.5	0% (Coarse)	2390-2400
Climb	50%	+5	0% (Coarse)	2100-2400
Highest speed	35% (watch temp.)	+9 (*)	0% (Coarse)	2750

Never exceed temperature of 235°C for cylinder head temperature (10), 85°C for oil (9)

(*) With Boost cut-out 'on'

Bristol Blenheim Variants: compass and auto-pilot use

Navigation basics and auto-pilot use

Navigation is an important aspect of bomber operations, especially long-range missions deep into enemy territory.

23. Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees)

24. After take-off set the compass (13) rotate the 2 parallel white lines (14) by placing cursor on compass rim (15) and pressing when 'Course Setter – Increase' label is seen

25. Rotate until the red 'N' (16) aligns with 'T' (17)

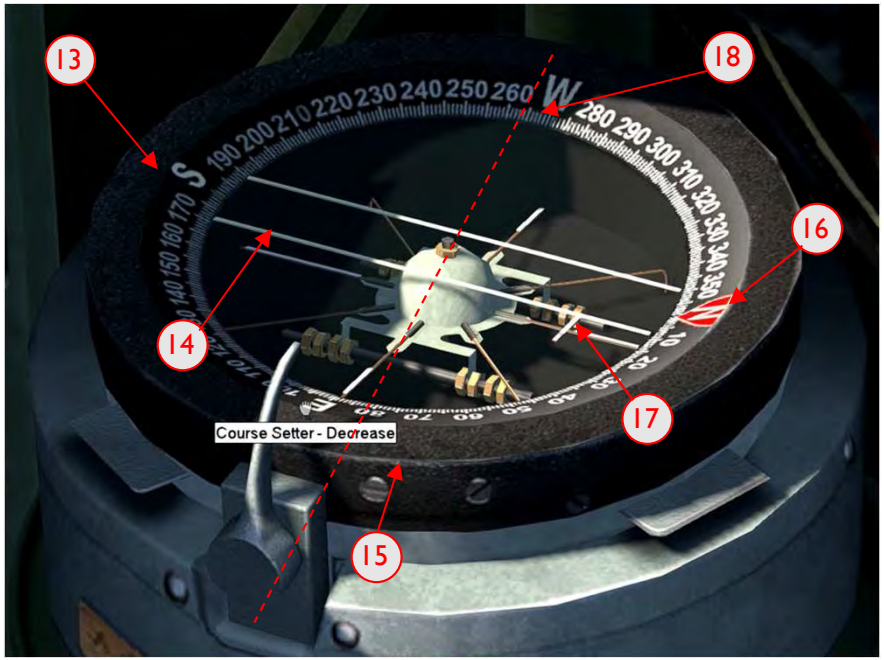
26. The number at the 12 o'clock position on the dial (18) – and indicated by blue text on your screen – is the aircraft's current magnetic heading

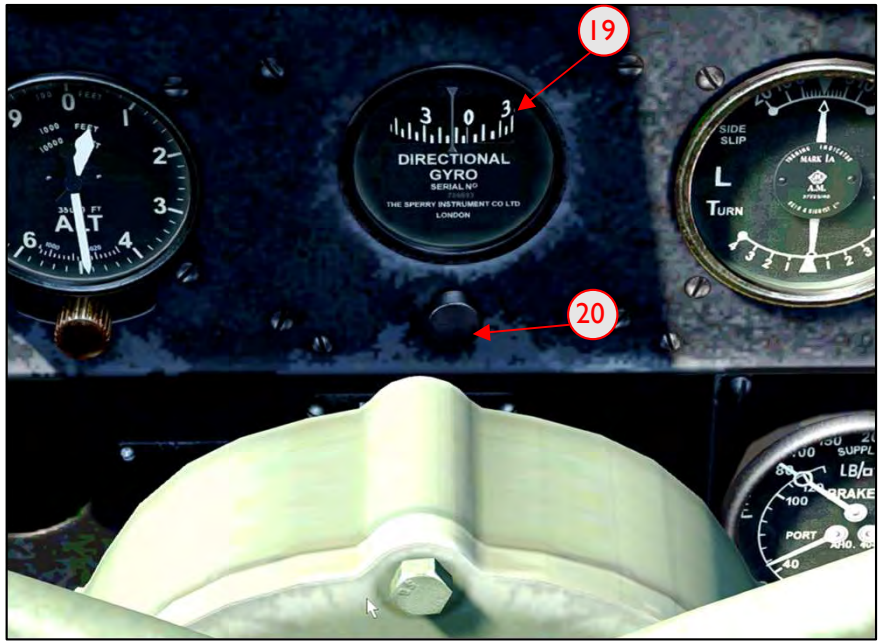
27. Set directional gyro (19) to this heading using control knob (20). After aggressive manoeuvres you will need to reset the directional gyro using the above steps

28. Once aircraft is flying wings level on desired heading set directional gyro (19) to 0 using the bound keys (recommend using bound keys: 'Alt left' or 'Alt right' arrow keys) or control knob to increase or decrease

29. '**Course mode'**. Once the directional gyro is at 0 activate autopilot (recommend bound key: 'Ctrl A' for toggle autopilot) to maintain heading only

30. '**Mode 22'**. Once the directional gyro is at 0 activate 'Mode 22' autopilot (altitude, heading) by stepping through 'course mode' ('Ctrl A'). 'Mode 22' is recommended for high-altitude bombing

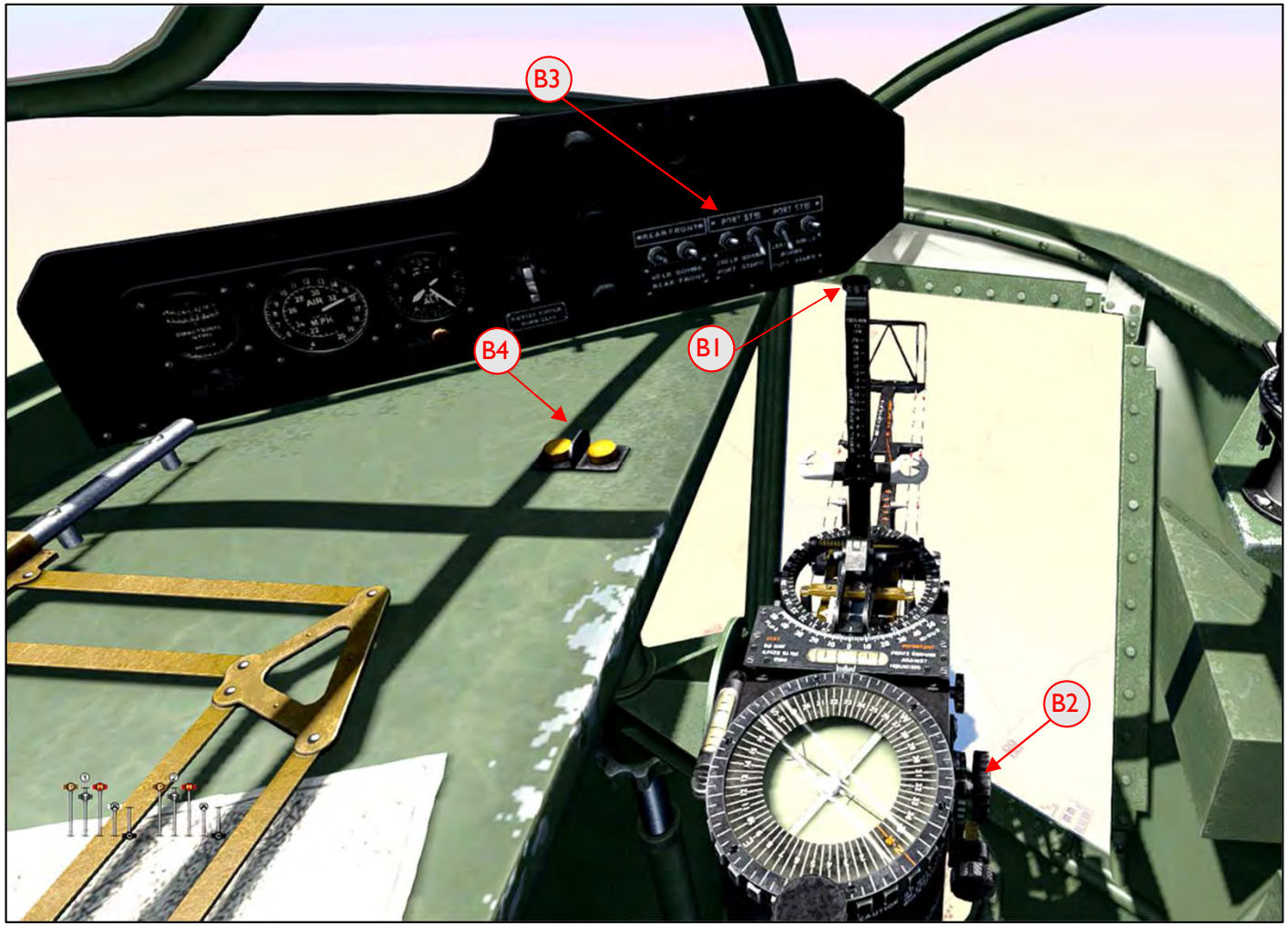




Bristol Blenheim Variants: Bombing (Part 1)

High altitude bombing

31. During aircraft selection prior to spawn-in ensure correct fuze and bombs are selected and fuel load adjusted accordingly in loadout
32. Before reaching the initial point (IP) (recommend doing this prior to take off) move to bomb aimer's position (recommend bound key: 'Alt 2')
33. Adjust intended bombing altitude using bound key (recommended: 'Ctrl Numpad 9' to increase, 'Ctrl Numpad 3' to decrease) or control knob on bomb sight (B1)
34. Adjust intended bombing velocity (noting it is true air speed (TAS) and not indicated air speed (IAS)) using bound key (recommended: 'Ctrl Numpad 7' to increase, 'Ctrl Numpad 1' to decrease) or control knob on bomb sight (B2). At 15000 ft 150 mph IAS = approx. 187 mph TAS
35. Set bomb mode (single or salvo) using control on bomb aimer's panel (B3). In single mode 1 bomb will drop per press of bomb drop bound key or control (B4). In salvo mode all bombs will be dropped when bomb drop button is pressed once
36. Once IP is reached and aircraft turned to bombing heading, set directional gyro to 0 (19) and engage 'Mode 22'
37. Once aircraft stabilised readjust bombing altitude and velocity to reflect current altitude and true airspeed using information from bomb aimer's flight instruments (B5)



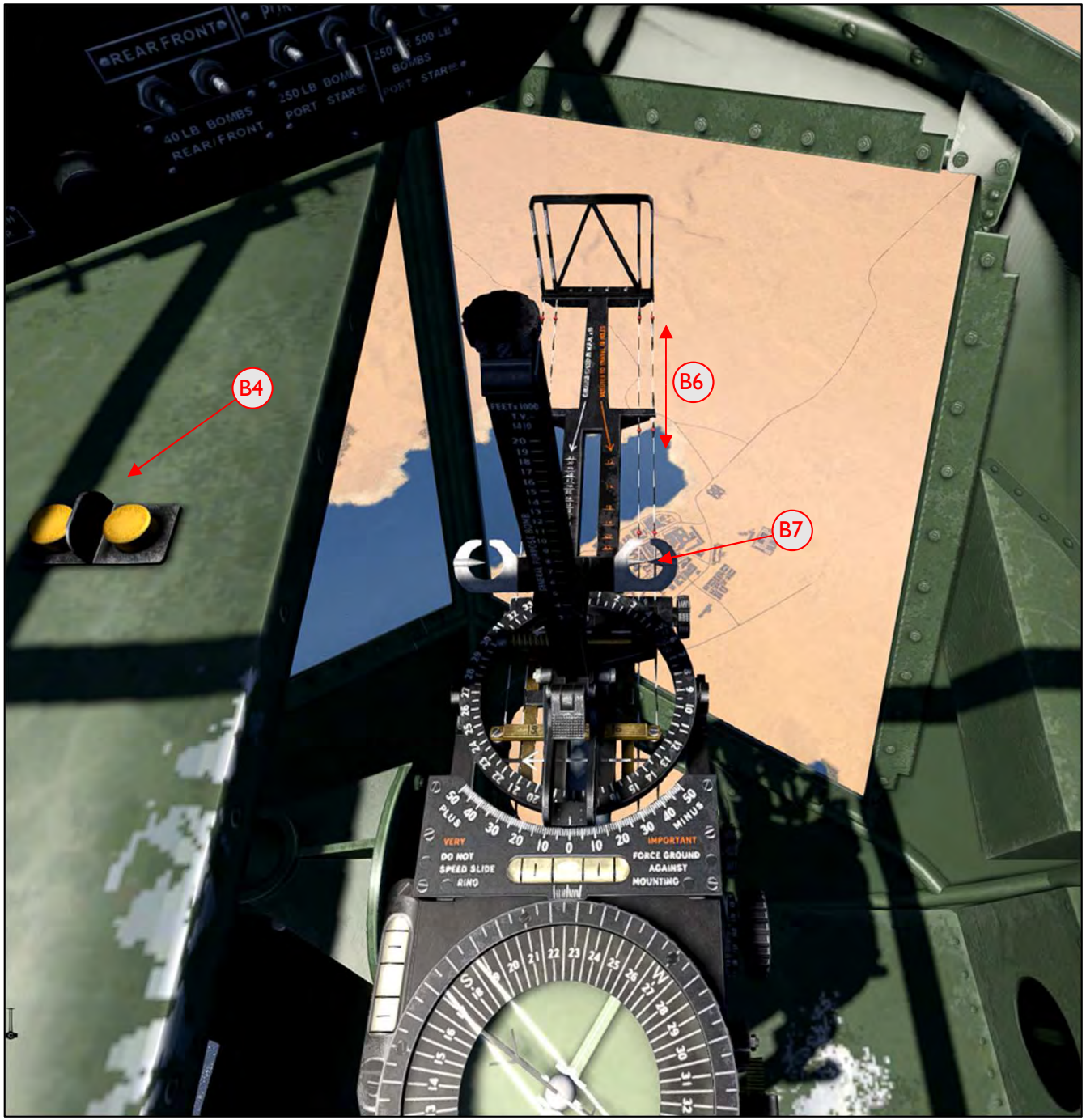
Bristol Blenheim Variants: Bombing (Part 2)

High altitude bombing

38. Locate target or target area. There is no ‘arm bomb’ or ‘bomb bay doors open/close’ functions in the Blenheim
39. Move aircraft heading left or right using changes to directional gyro (‘Alt’ + left/right arrow) until target is aligned with vertical lines of bomb sight (B6)
40. Enter bombsight view by using bound key (‘Shift F1’)
41. Pick a point on the ground near the top of the bomb sight vertical line (B6). Watch to see if the vertical line moves left or right of this point as it traverses towards the bottom of the display. If it does drift then slightly change directional gyro heading left or right to compensate using bound keys
42. When target enters bombsight’s reticule (B7) drop bombs using bound key or button on panel (B4)

Low altitude manual bombing (no use of sight)

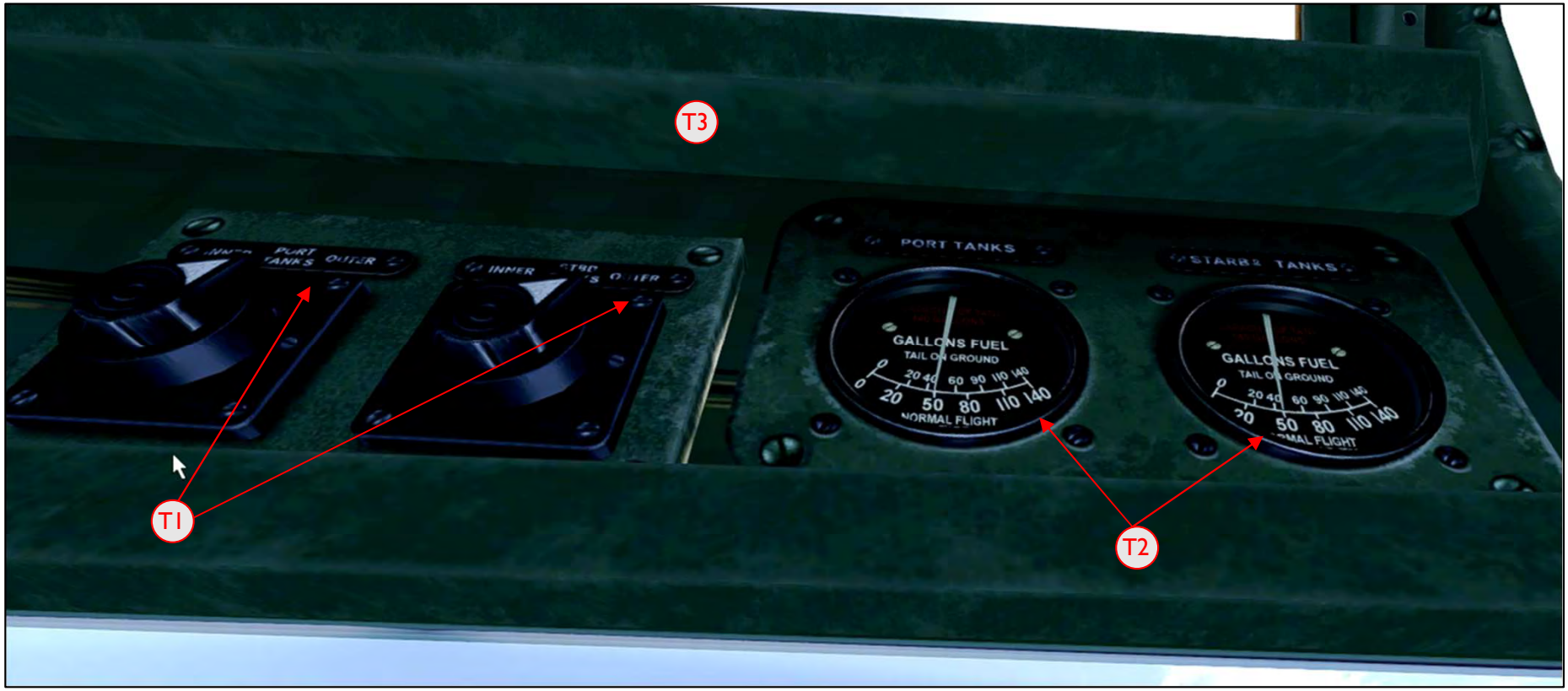
43. During aircraft selection prior to spawn-in ensure correct fuze and bombs are selected and fuel load adjusted accordingly in loadout
44. Set bomb mode (single or salvo) (B3)
45. Over the target drop bombs using bound key or button on panel (B4)
46. Head home or to next target



Bristol Blenheim Variants: Fuel transfer

Fuel basics

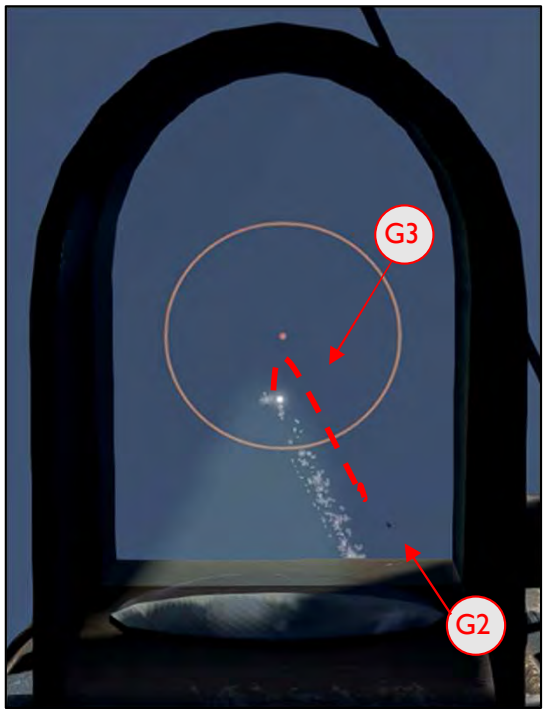
47. The Blenheim has 4 fuel tanks; port inner, port outer, starboard inner and starboard outer. Prior to spawn-in the fuel load should be selected so that the combined weight of the fuel and bombload does not exceed the aircraft maximum allowable all-up weight. For some bombload configurations there may be little or no fuel in the outer tanks, on the Channel map about 30% of fuel will be enough for most purposes (no change of tanks required)
48. Once airborne the outer tanks should be used to feed the engines until they are almost empty. To select the outer tanks cycle the green/red rotary fuel cocks (2) to the 'Outer' position
49. Monitor outer fuel tank quantity by turning the fuel indicator selector (T1) to the 'Outer' setting and then reading the quantity on the applicable dial (T2) on the fuel monitoring panel (T3) located above the pilot's left ear on the canopy framing
50. Just prior to the outer tanks becoming empty, cycle the green/red rotary fuel cocks (2) to the 'Inner' position
51. Monitor inner fuel tank quantity by turning the fuel indicator selector (T1) to the 'Inner' setting and then reading the quantity on the dial (T2)
52. In the event a fuel tank leak configure the fuel system so that the engines draws fuel from the leaking tank if not already doing so
53. If the fuel cross feed valve is set to 'On' (2a) both engines will draw from both the port and starboard tanks at the same time. If the fuel cross feed valve is set to 'Off' the engines will only draw fuel from their respective wing tanks

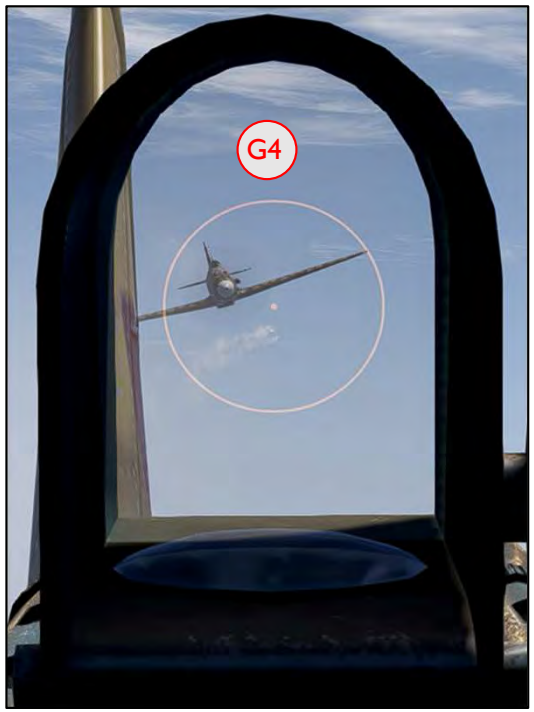


Bristol Blenheim Variants: Gunnery

Gunnery

54. Before launching game adjust mouse /gun traverse speed (if required) by altering 'conf' file (located in Documents\1Csoftclub\IL2-Sturmovik cliffs of dover) in 'rts_mouse' section by changing X and Y sensitivity to 1.5 or 2 depending on personal preference. Consider inverting mouse direction by changing to 'Invert=1'
55. During aircraft selection prior to spawn-in ensure ammunition load-out includes tracer (recommend at least 1 in 5) and that a convergence range of 500 metres is selected
56. In Options-Controls-General assign key to 'fire current weapon'. Recommend using an unassigned button on joystick and not the mouse button as use of the mouse button will prevent concurrent moving and shooting of the gun
57. Once in area where enemy fighters could be encountered engage 'Course Mode', 'Mode 22' or continue to hand fly the aircraft. With practice, concurrent flying and gunnery is possible and improves gunnery effectiveness as gunnery can be coordinated with aircraft manoeuvre
58. Enter gunner position using bound key (recommend 'Alt 3' for upper rear gunner), activate gunner position (recommend 'Ctrl O') and enable mouse control of turret ('F10'). A significant increase in gunner's elevation and azimuth can be achieved by moving gunner's rack (G1). Recommend using bound keys ('Shift' + left/right/up/down arrows)
59. When an enemy fighter has been observed heading towards your bomber move to gunsight view ('Shift F1'). Zoom in the view noting the more zoomed in the view, the more gun vibration will be observed. Fire a short burst noting the position of the tracer stream with respect to the sight and enemy fighter
60. Move gunsight so that enemy fighter (G2) is now at a point along where the tracer stream would go if a second burst was fired
61. Open fire, firing in short bursts while adjusting aim to place tracer stream (G3) through the enemy fighter (G2). Reduce view zoom as required as enemy aircraft comes closer
62. When target is directly behind at less than 400 metres increase burst size (G4)
63. Once enemy has broken off attack commence search for other nearby enemy aircraft. If clear return gunner back to AI by pressing 'Alt F2' and then return to pilot position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash





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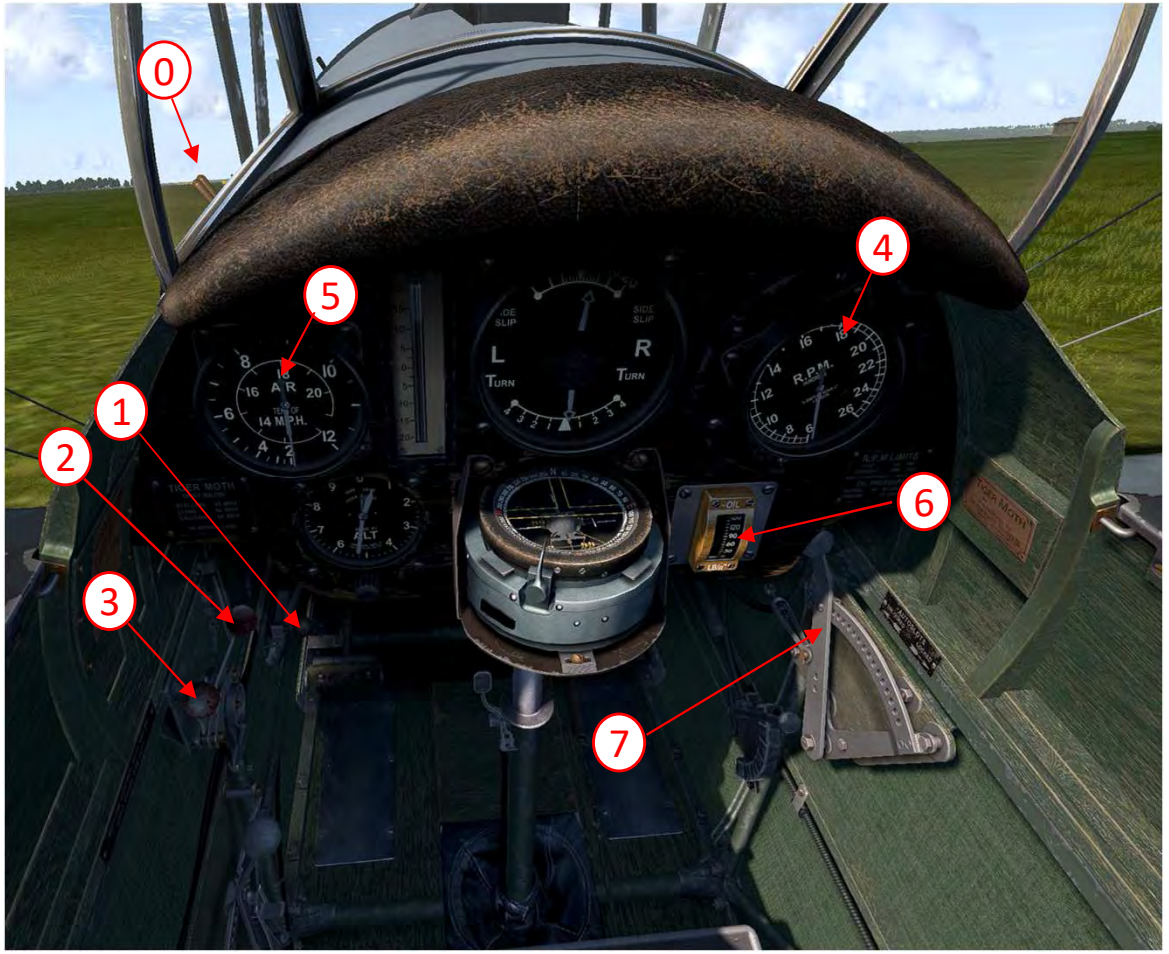
De Havilland DH.82 Tiger Moth Variants

Starting, taxi, and take-off procedures

1. Apply chocks, magnetos on (0)
2. Open fuel cock (1)
3. Mixture lever (2) fully forward to 100% (default)
4. Open throttle (3) to 10%
5. Start engine
6. Leave engine to idle on 10% throttle for at least one minute
7. Open throttle (3) firmly and quickly to 100%. Wait for engine to rev up. Adjust throttle to prevent engine stall
8. Keep engine at 1600 RPM (4) for up to one minute
9. Close throttle (3) to 10%
10. To taxi, remove chocks
11. Slowly increase power (3) until aircraft starts to move
12. Steer by using left/right rudder inputs and throttle
    No brakes on this aircraft
    Use ailerons in **opposite** direction for tighter turns
13. To take off, smoothly increase throttle (3) to 100%
14. Use light rudder inputs to steer
15. Do not attempt to take off early, allow aircraft to fly off the ground naturally
16. At approx. 55-60 mph (5) take-off and avoid climbing too steeply

Landing procedure

17. Use throttle (3) to adjust speed
18. On final approach reduce speed to approx. 55-60 mph (5) for touchdown
19. Open leading edge slats (7) to 100% to slow the aircraft down
20. After touchdown use light rudder inputs to steer until aircraft comes to a stop
    Remember **no brakes on this aircraft**
    use ailerons in **opposite** direction for tighter turns
21. Apply chocks, turn off fuel cock (1) and magnetos to finish sortie



Engine Management

Recommended settings for:	RPM	Speed
Cruise	1900-2050	80-90 mph
Climb	2100 (max. 30 minutes)	60 mph
Highest speed	2350 (max. 5 minutes)	107 mph
Never exceed 60 lb per square inch oil pressure (6)		

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DESERT WINGS TOBRUK

Dewoitine D.520

Start up, taxi and take-off procedure

1. Apply chocks
2. Open fuel cocks 1 and 2 (1)
3. Set propeller pitch to 'Manual' (2)
4. Fully open water-radiator (3)
5. Open throttle to 10%
6. Start engine
7. Oil temperature must be 30ºC, water temperature 40ºC before moving
8. Set propeller pitch to 'Auto'
9. To taxi remove chocks, release breaks and slowly increase power until aircraft moves
10. Steer by using rudder and brakes; the aircraft turns very slowly
11. Ensure canopy is closed before take off
12. Open throttle to 100%
13. Use rudder inputs left/right to steer
14. As speed increases lift the tail as soon as possible but do not nose over
15. At approx. 130-135 km/h take off (4), raise landing gear (5), avoid climbing too steeply

Landing procedure

16. Fully open water-radiator (3)
17. Lower airspeed to below 220 km/h
18. Lower flaps on approach at 180 km/h (6)
19. Lower landing gear at 180 km/h (5)
20. Touchdown speed approx. 130 km/h
21. Use light rudder inputs to steer
22. After touchdown maintain slight back pressure on joystick until low speed to avoid nosing over
23. Steer by applying rudder and brakes carefully until full stop

Engine Management

Recommended settings for:	Radiator	Throttle	RPM
Cruise	60%	1.0 ata	2200
Climb	as required	1.17 ata	2400
Highest speed	as required	1.28 ata	2520 (**max.**)

Never exceed 125ºC water temperature, 100ºC Oil
For combat manoeuvers never load more than 62% fuel!

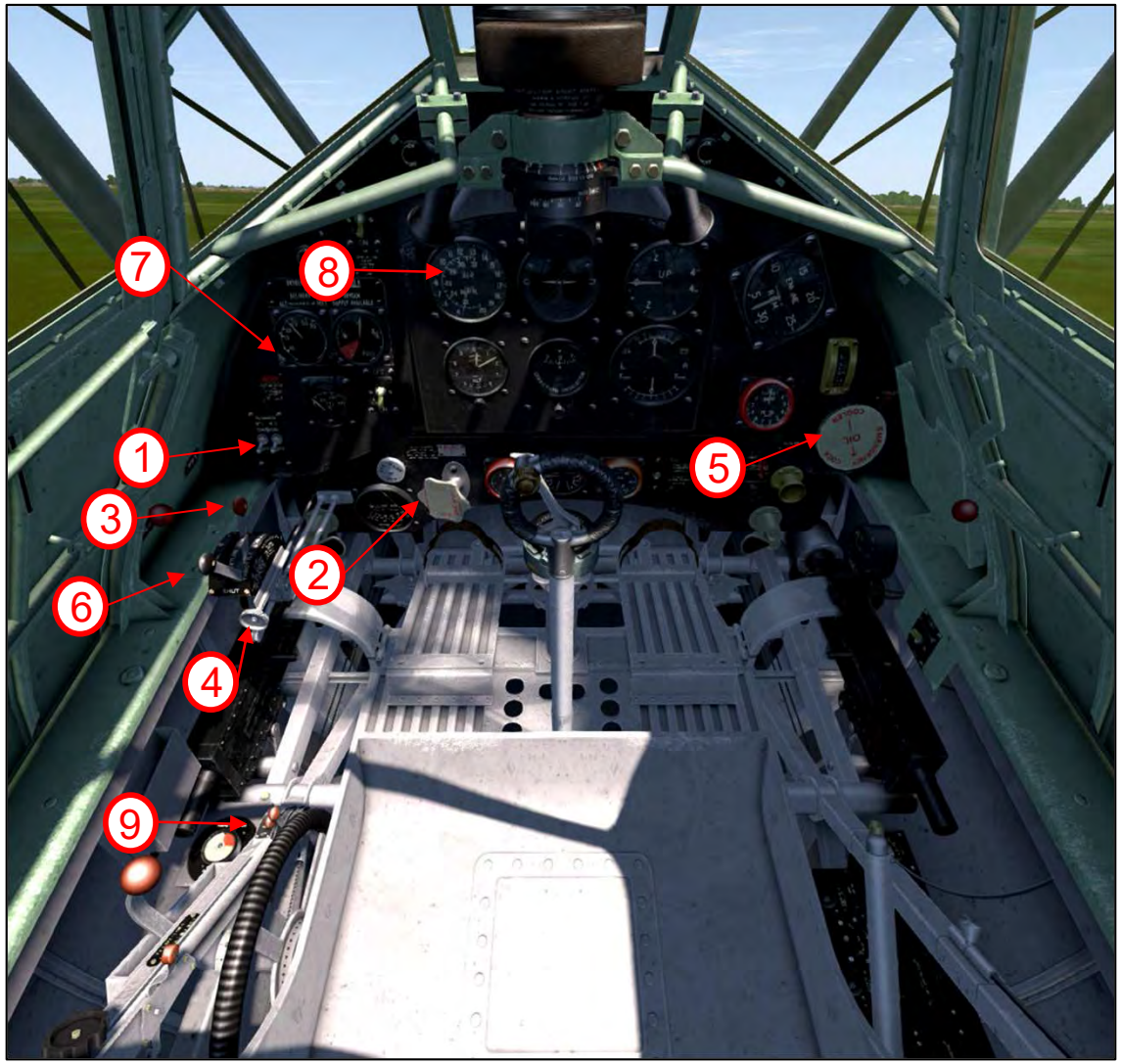
Gloster Gladiator Mk II and Mk II Trop

Start-Up, Taxi and Take-Off Procedures

1. Apply chocks
2. Set magnetos 1&2 to 'On' (1)
3. Set fuel cock 1 to auxiliary ('Gravity') (2)
4. Set mixture to 100% (3)
5. Pull air intake shutter (carburettor heat 1) to 'Open' (100%) (4)
6. Set oil radiator dial to 'Cooler on' (5)
7. Apply 10-12% throttle (6)
8. Start engine (default key is 'i')
9. Wait until engine temperature reaches 26-27°C (7) then push throttle forward to 100%
10. After some coughing, engine should catch and start to run smoothly
11. Throttle back to idle
12. Set fuel cock 1 to 'Main' (2)
13. Push air intake shutter (carburettor heat 1) to 'Close' (0%) (4)
14. Remove chocks and release breaks
15. Slowly increase throttle until the aircraft starts to move
16. Steer by using rudder and brakes
17. On runway accelerate to approx. 70-80 mph (8) then pull stick smoothly to take off

Landing Procedure

18. Push air intake shutter (carburettor heat 1) to 'Close' (0%) (4)
19. Set fuel cock 1 to auxiliary ('Gravity') (2)
20. Lower flaps (9) on approach at approx. 90 mph (8) maintaining approx. 75 mph on finals. Touchdown speed approx. 65 mph.
21. Steer by applying rudder and brakes carefully
22. Apply chocks and set fuel cock 1 to 'Close' to stop engine (2)



Engine Management

Recommended settings for:	Oil radiator	Boost
Cruise (170 mph, 2200 rpm)	Open	+3
Climb (110 mph, 2400 rpm)	Open	+5
Max speed (243mph, 2750 rpm)	As neccessary	+5.75
Never exceed engine temperature of 240°C and oil temperature of 85°C		

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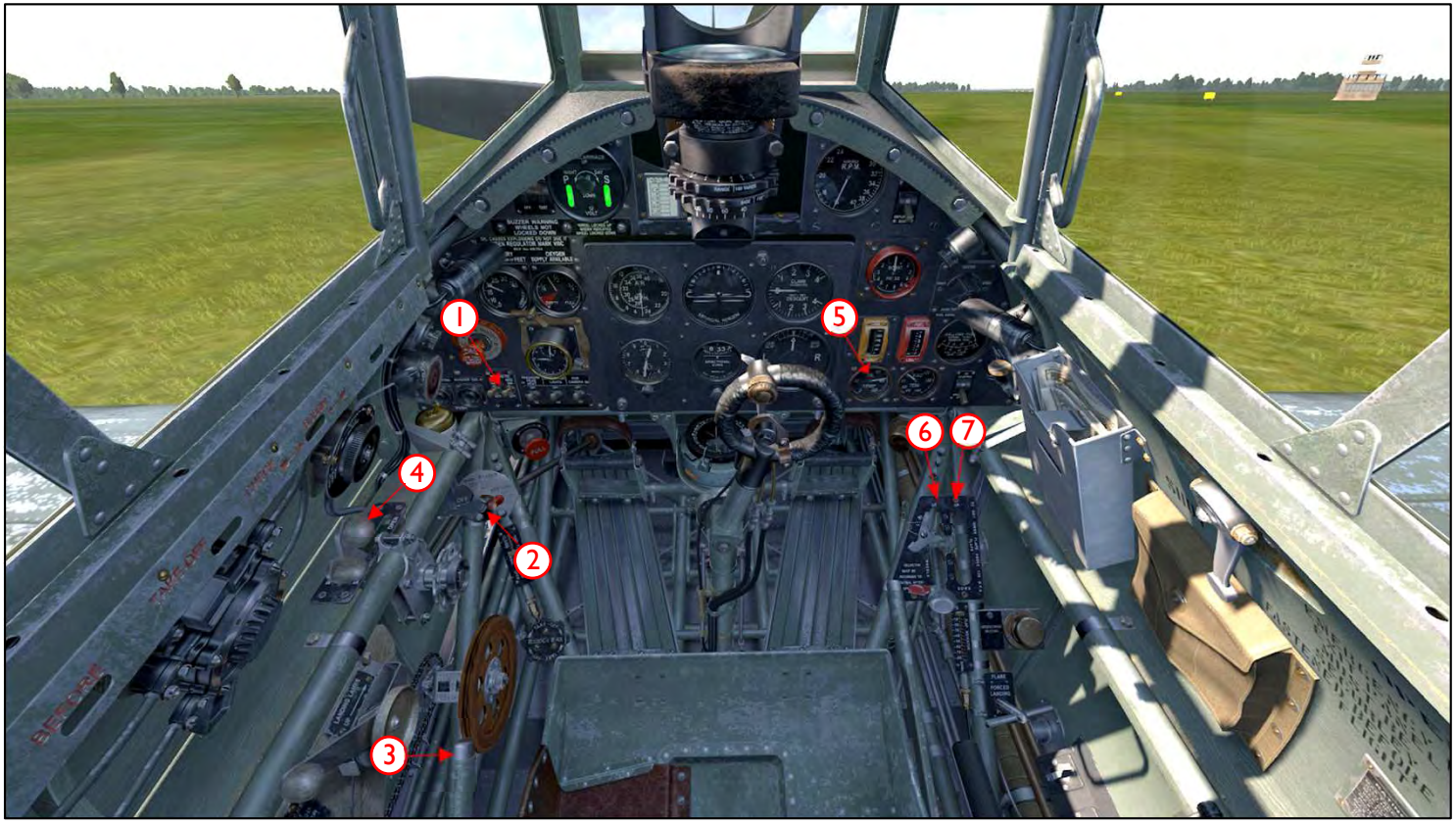
Hawker Hurricane Mk I DH5-20 (100 Octane)

Start-up, taxi and take-off procedures

1. Apply chocks
2. Switch on both magnetos (1)
3. Switch on fuel cock to 'Main on' (2)
4. Open radiator full (down) (3)
5. Set prop pitch to fine (100%)
6. Apply 10% throttle (4)
7. Start engine
8. When engine is running open throttle to 20%
9. Wait until engine oil temperature (5) reaches 18°C
10. Remove chocks and release brakes
11. Slowly increase throttle until aircraft starts to move, steer with rudder and brakes
12. On runway accelerate to approx. 100 mph then pull stick smoothly back
13. Raise undercarriage (6) and set prop pitch to coarse (0%)

Landing Procedure

14. Lower flaps (7) (two stage) on approach at approx. 140 mph
15. Lower landing gear (two stage)
16. Set prop pitch to fine (100%)
17. Open radiator full to 100%
18. Touchdown speed approx. 80 mph
19. After touchdown, keep slight back pressure on joystick until low speed to avoid nose over
20. Steer by applying rudder and brakes carefully
21. Apply chocks and close fuel cock to finish sortie

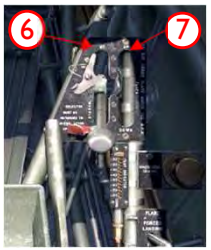


Engine Management

Recommended settings for:	Radiators	Boost	RPM
Cruise	50%	+4	Prop Pitch **Coarse**
Climb	100%	+6	Prop Pitch **Coarse**
Highest speed	50%	+12 (*)	3000 (5 min.)
Never exceed 110°C water temperature, 90 °C Oil			

(* with boost cut out on)

Note: this aircraft is fitted with a two-way selector lever for operating both undercarriage (6) and flaps. (7) To select, move lever to centre (neutral) and then up-left to select undercarriage up, or up-right to select flaps up. Lever down, through neutral, will select undercarriage or flaps down.



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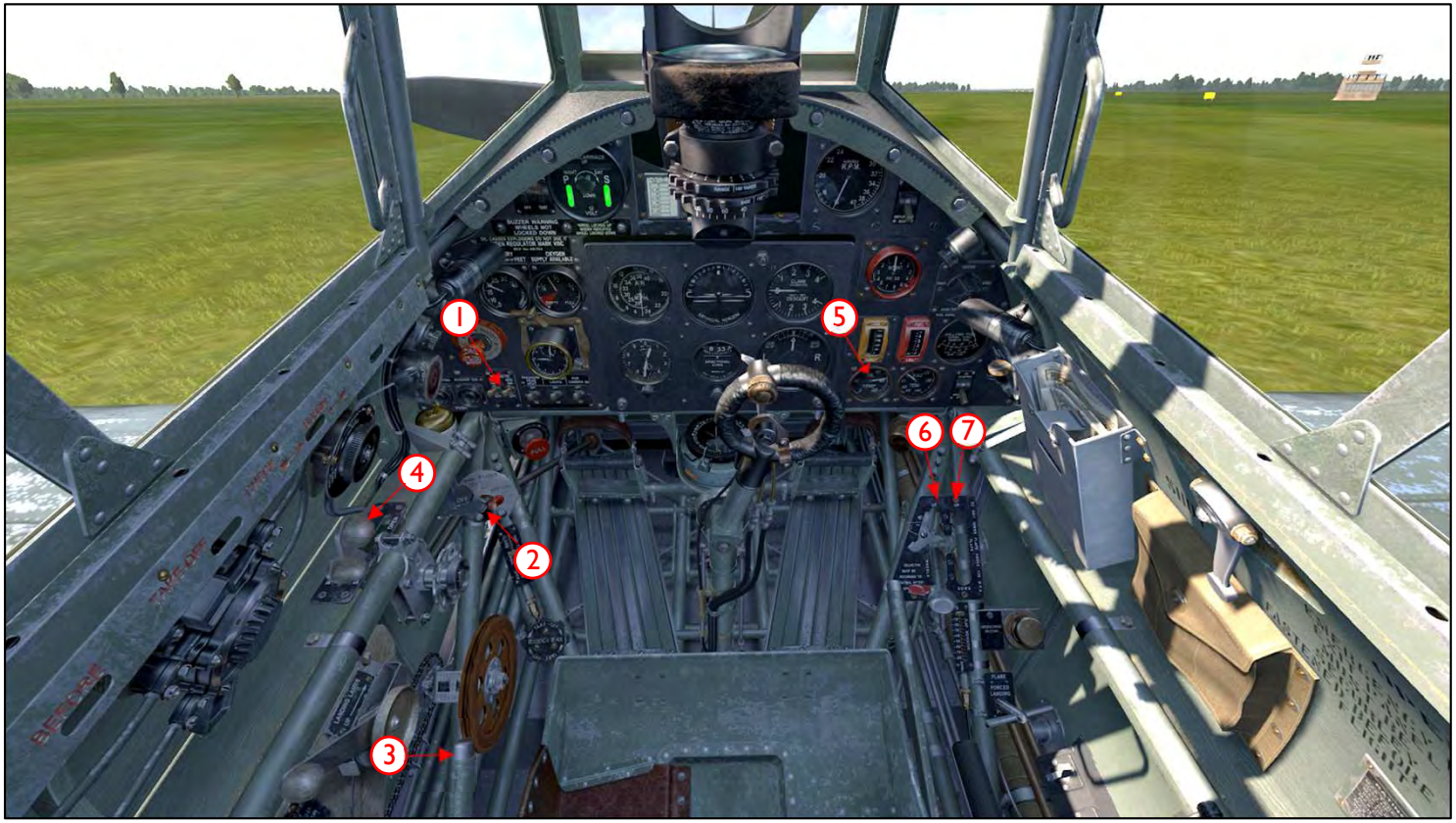
Hawker Hurricane Mk I Rotol (100 Octane)

Start-up, taxi and take-off procedures

1. Apply chocks
2. Switch on both magnetos (1)
3. Switch on fuel cock to 'Main on' (2)
4. Open radiator full (down) (3)
5. Set prop pitch to fine, fully forward
6. Apply 10% throttle (4)
7. Start engine
8. When engine is running open throttle to 20%
9. Wait until engine oil temperature (5) reaches 18°C
10. Remove chocks and release brakes
11. Slowly increase throttle until aircraft starts to move, steer with rudder and brakes
12. On runway accelerate to approx. 100 mph then pull stick smoothly back
13. Raise undercarriage (6)

Landing Procedure

14. Lower flaps (7) (two stage) on approach at approx. 140 mph
15. Lower landing gear (two stage)
16. Increase prop pitch to 100%
17. Open radiator full to 100%
18. Touchdown speed approx. 80 mph
19. After touchdown, keep slight back pressure on joystick until low speed to avoid nose over
20. Steer by applying rudder and brakes carefully
21. Apply chocks and close fuel cock to finish sortie

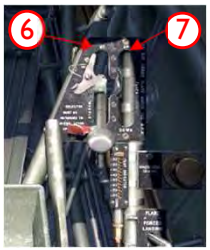


Engine Management

Recommended settings for:	Radiators	Boost	RPM
Cruise	50%	+3	2600
Climb	100%	+6	2600 (30 min.)
Highest speed	50%	+12 (*)	3000 (5 min.)
Never exceed 115 ºC water temperature, 95 ºC Oil			

(* with boost cut out on)

Note: this aircraft is fitted with a two-way selector lever for operating both undercarriage (6) and flaps. (7) To select, move lever to centre (neutral) and then up-left to select undercarriage up, or up-right to select flaps up. Lever down, through neutral, will select undercarriage or flaps down.



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Hawker Hurricane Mk II Variants

Start-Up, Taxi and Take-Off Procedures

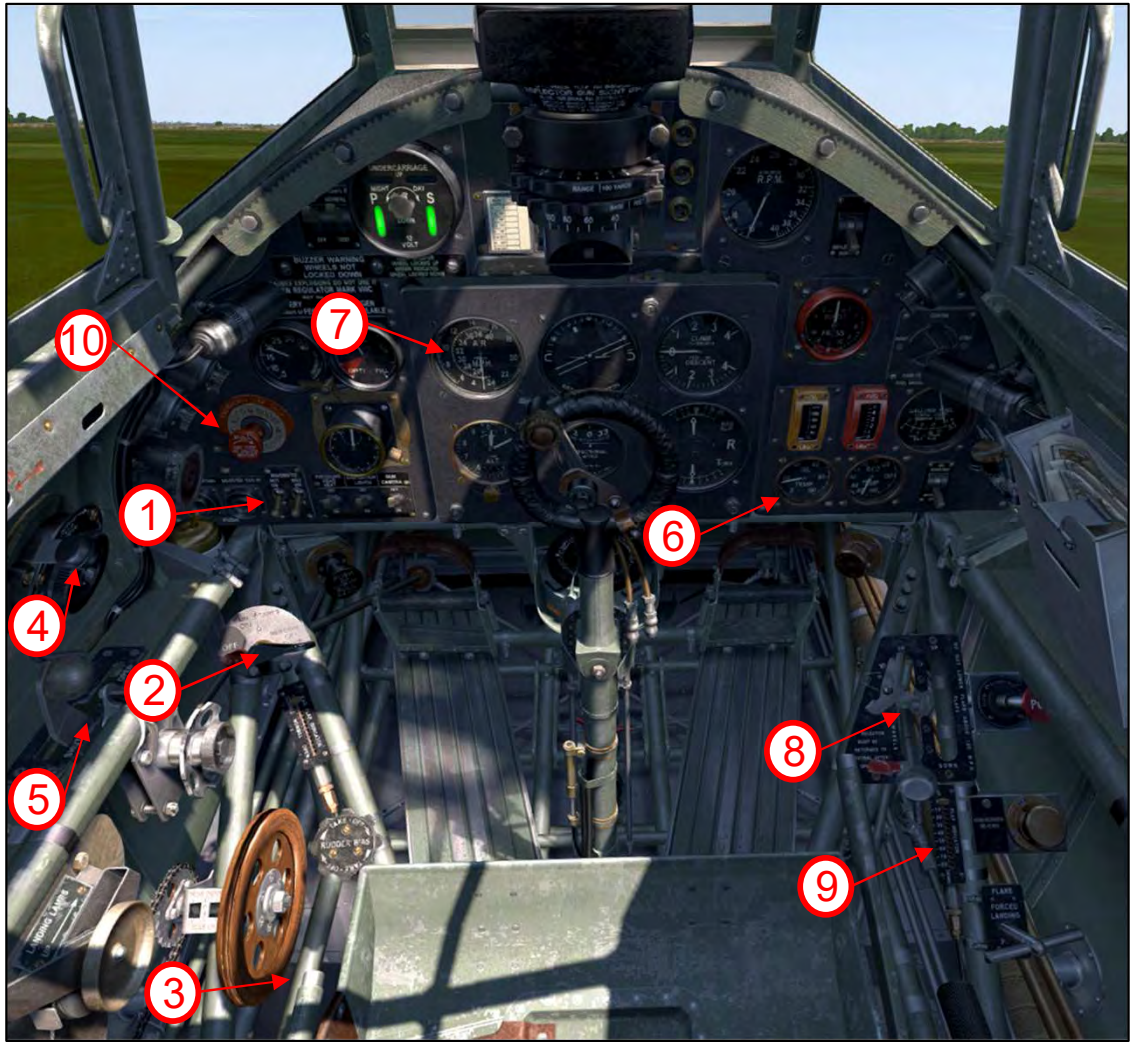
1. Apply chocks
2. Switch on magnetos (1)
3. Switch on fuel cock to 'Main On' (2)
4. Open radiator fully (3)
5. Set prop pitch to full fine (100%) (4)
6. Apply 10% throttle (5)
7. Start engine
8. When the engine is running open throttle to 20%
9. Wait for engine oil temperature to reach 18°C (6)
10. Remove chocks
11. Release brakes
12. Slowly increase throttle until the aircraft starts to move
13. Steer by using rudder and brakes
14. On runway accelerate to approx. 100 mph (7) then pull stick smoothly to take off
15. Raise undercarriage (8)

Landing Procedure

16. Lower flaps (two stage) at approx. 140 mph (9)
17. Lower landing gear (two stage) (8)
18. Increase Prop Pitch to full fine (100%) (4)
19. Open radiator fully (3)
20. Touchdown speed approx. 80 mph (7)
21. Steer by applying rudder and brakes carefully
22. Apply chocks and close fuel cock to finish sortie (2)

Hurricane Mk II variants overview

Hurricane Mk IIa and tropical variant (Merlin 20, eight .303, +12 boost)
Hurricane Mk IIb and tropical variant (twelve .303, option for bombs, +12 boost)
Hurricane Mk IIb-Late and tropical variant (twelve .303, option for bombs, +14 boost)
Hurricane Mk IIc and tropical variant (four 20mm, option for bombs, +12 boost)
Hurricane Mk IIc-Late and tropical variant (four 20mm, option for bombs, +14 boost)
Hurricane Mk IId Tank buster (two 40mm cannon, two .303, +14 boost)



Engine Management

Recommended settings for:	Radiator	Boost	RPM
Cruise	50%	+6	2700
Climb	100%	+9	2850
Highest speed	50%	+12 (*)	3000

Never exceed 135°C water temperature, 95°C Oil
Toggle charger at 13000 ft (climb) or 11000 ft (combat)

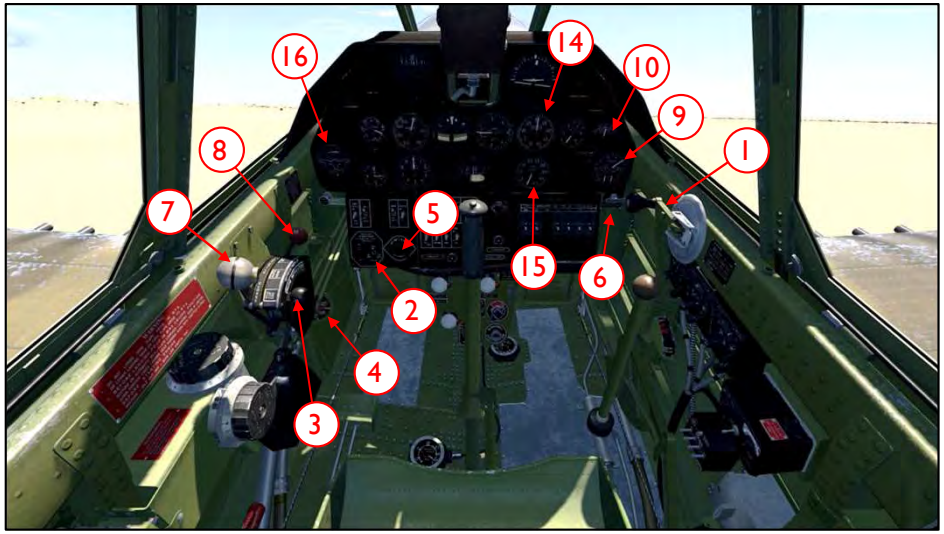
(* with boost cut-out) (10)

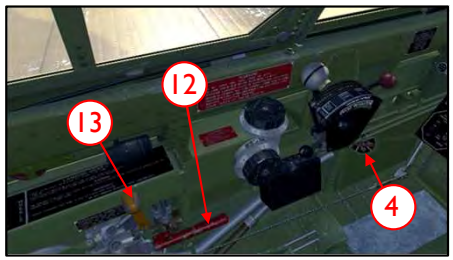
DESERT WINGS TOBRUK

Kittyhawk Mk Ia

Start-Up, Taxi and Take-Off Procedures

1. Apply chocks and open canopy (1)
2. Set constant speed toggle (prop pitch mode - toggle) switch to 'Auto' (constant speed) (2)
3. Set propeller pitch lever fully forward (100%) (3)
4. Set fuel selector switch to 'Fuse' (Centre) if aircraft has 100% fuel load. Set to 'Wing' (Auxiliary) if less than 60% fuel load (4)
5. Set magnetos to 'Both' (M1+2) (5)
6. Turn carburettor air (6) to 'Cold' (fully out) and radiator shutters to 'Shut' (0%) (11)
7. Set throttle to approx. 10% (7)
8. Set mixture control fully forward to 'Full rich' (100%) (8)
9. Start engine (default key is 'i')
10. Warm up engine at approx. 1000 RPM until a minimum oil temperature (9) of 40°C and a minimum radiator temperature (10) of 80°C have been reached
11. Set radiator shutters to 'Open' (11) and deploy flaps (13) to about ¼
12. Remove chocks, release breaks and slowly increase throttle until the aircraft moves
13. Steer by using rudder and brakes
14. At approx. 100 mph pull stick smoothly to take off
15. Raise undercarriage (12) and flaps (13), set boost to 42 in (14) and alter prop pitch lever to achieve 2800 RPM (15)





Undercarriage lever and flaps – cockpit wall (left)

Radiator lever – cockpit wall (right)

Landing Procedure

16. On approach lower flaps (13) and undercarriage (12) once speed is below 140 mph
17. Ensure constant speed toggle switch (2) is set to 'Auto' and propeller pitch lever (3) is fully forward on 100%
18. Approach with approx. 100-110 mph, aiming to be crossing boundary at approx. 100mph
19. Steer with rudder and brakes, to keep straight during landing roll

Pilots please note:
Position of flaps and undercarriage is indicated by the aircraft shaped cockpit dial at lower left of dash (16)

Engine Management

Recommended settings for:	Oil and coolant	Boost	RPM
Cruise	Adjust oil and coolant radiators settings to keep Oil/Coolant below 95°C/125°C	42 in	2600
Climb (150 mph, radiator 100% open)		42 in	2800
Highest level speed (5 min. limit, 470 mph in dive)		56 in	3000, 3120 max in dive

DESERT WINGS TOBRUK

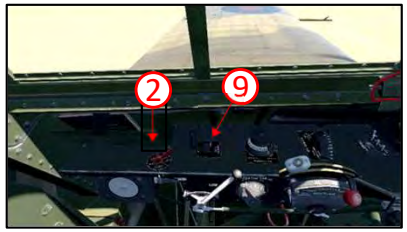
Martlet Mk III

Start-Up, Taxi and Take-Off Procedures

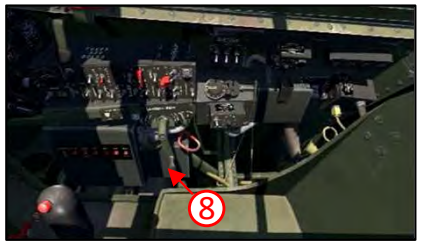
1. Apply chocks and open canopy
2. Rotate Magnetos switch to 'Both' (1)
3. Switch fuel cock to 'Main' (2)
4. Open cowl flaps full (3)
5. Prop pitch to 'Manual' mode, set to 100% (4)
6. Apply 20% throttle (to give approx. 1000 RPM) (5)
7. Start engine (default key is 'i')
8. Run engine at 1000 RPM until oil temperature reaches 40°C
9. Prop pitch to 'Auto' mode (constant speed) for taxi and take off
10. Unlock tail-wheel to taxi (6)
11. Remove chocks and release brakes
12. Slowly increase throttle until the aircraft begins to move
13. Steer by using rudder and toe brakes (7)
14. Lock tail wheel when lined up for take off
15. On runway accelerate to 85 knots (kn) I.A.S then pull stick smoothly to take off
16. Raise undercarriage (8)

Landing Procedure

17. Lower flaps on approach at approx. 120 kn (9)
18. Lower landing gear at approx. 120 kn and open canopy
19. Lock tail-wheel
20. Prop pitch to 'Auto' (constant speed) (100%)
21. Approach speed and touch down at approx. 85 kn
22. After touchdown maintain back pressure on joystick until low speed to avoid nose over
23. Apply brakes carefully
24. Steer with rudder and brakes



Fuel cocks - cockpit wall (left)



Landing gear – cockpit wall (right)

Engine Management

Recommended settings for:	Cowl Flaps	Boost	RPM
Cruise	35%	32.5 in	2470
Climb	As required	41 in	2550
Highest speed	As required	48 in	2700 (5 min max.)

Never exceed cyl. head temperature of 260°C & oil temperature of 100°C
Toggle charger at 7800 ft (climb) or 5200 ft (combat)

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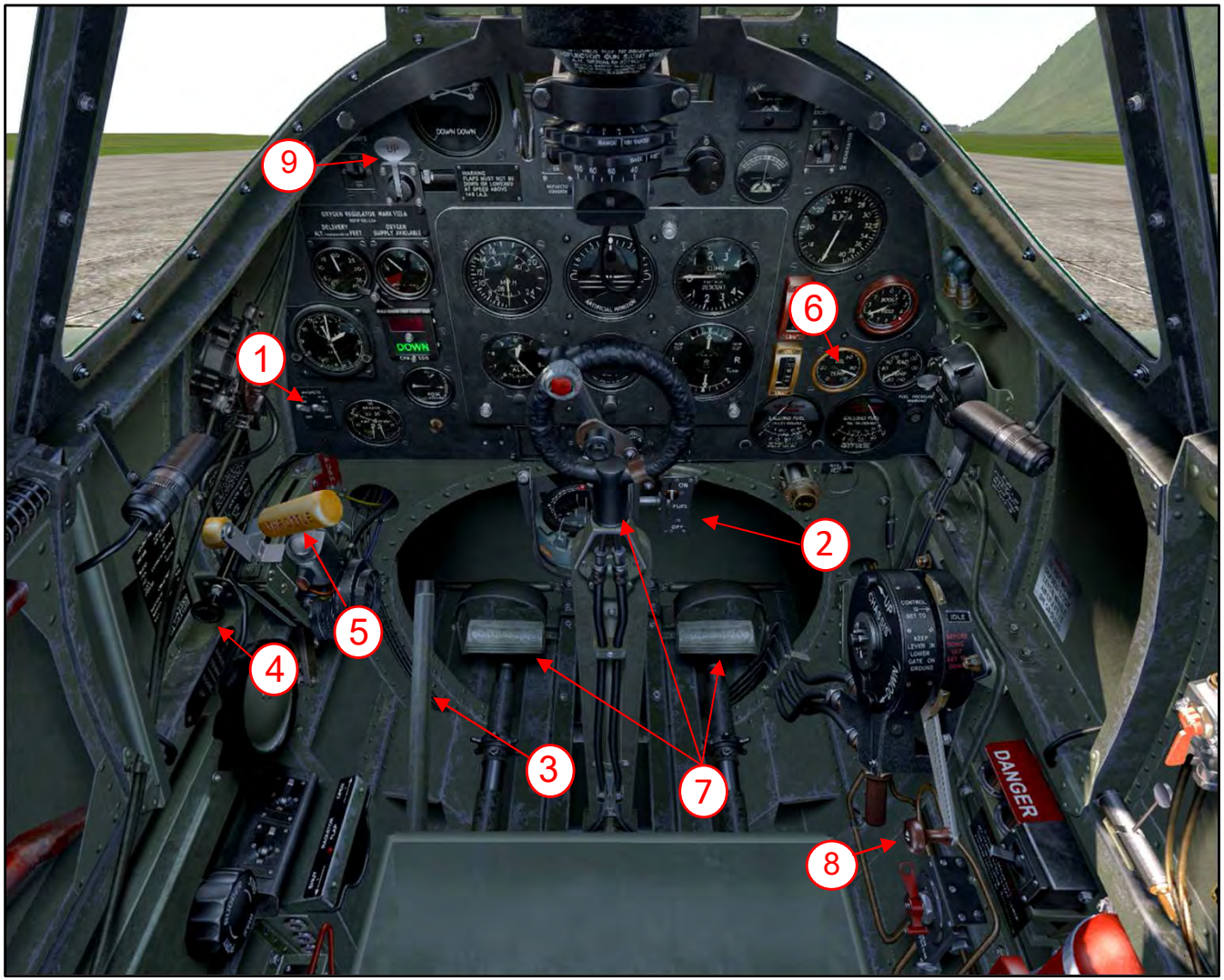
Supermarine Spitfire Mk I (100 Octane)

Starting, taxi, and take-off procedures

1. Apply chocks
2. Switch on magnetos (1)
3. Switch on fuel cock (2)
4. Open radiator full (3)
5. Prop pitch to fine (100%) (4)
6. Apply 10% throttle (5)
7. Start engine
8. When the engine is running open throttle to 20%
9. Wait until engine oil temperature reaches 18 °C (6)
10. Remove chocks and release brakes
11. Slowly increase throttle until the aircraft starts to move
12. Steer by using rudder and brakes (7)
13. Tighter turns, apply brakes, use rudder, increase throttle
14. On runway accelerate to approx. 100 mph then pull stick smoothly back to take off
15. Raise undercarriage (8), prop pitch to coarse (0%) (4)

Landing procedure

16. Lower flaps (9) on approach at approx. 140 mph
    Lower landing gear at approx. 140 mph
17. Prop pitch to fine (100%) (4)
18. Touch down speed approx. 80-85 mph
19. After touchdown maintain slight back pressure on joystick until low speed to avoid nose over, steer by applying rudder and brakes carefully
20. When stopped, apply chocks, switch off fuel cock (2) and magnetos (1)



Engine Management

Recommended settings for:	Radiator	Boost	RPM
Cruise	55%	+3	**Coarse** Prop Pitch
Climb	100%	+6	**Coarse** Prop Pitch (30 min.)
Highest speed	50%	+12 (*)	3000 (5 min.)
Never exceed 115 °C water temperature			

(* with boost cut out on)

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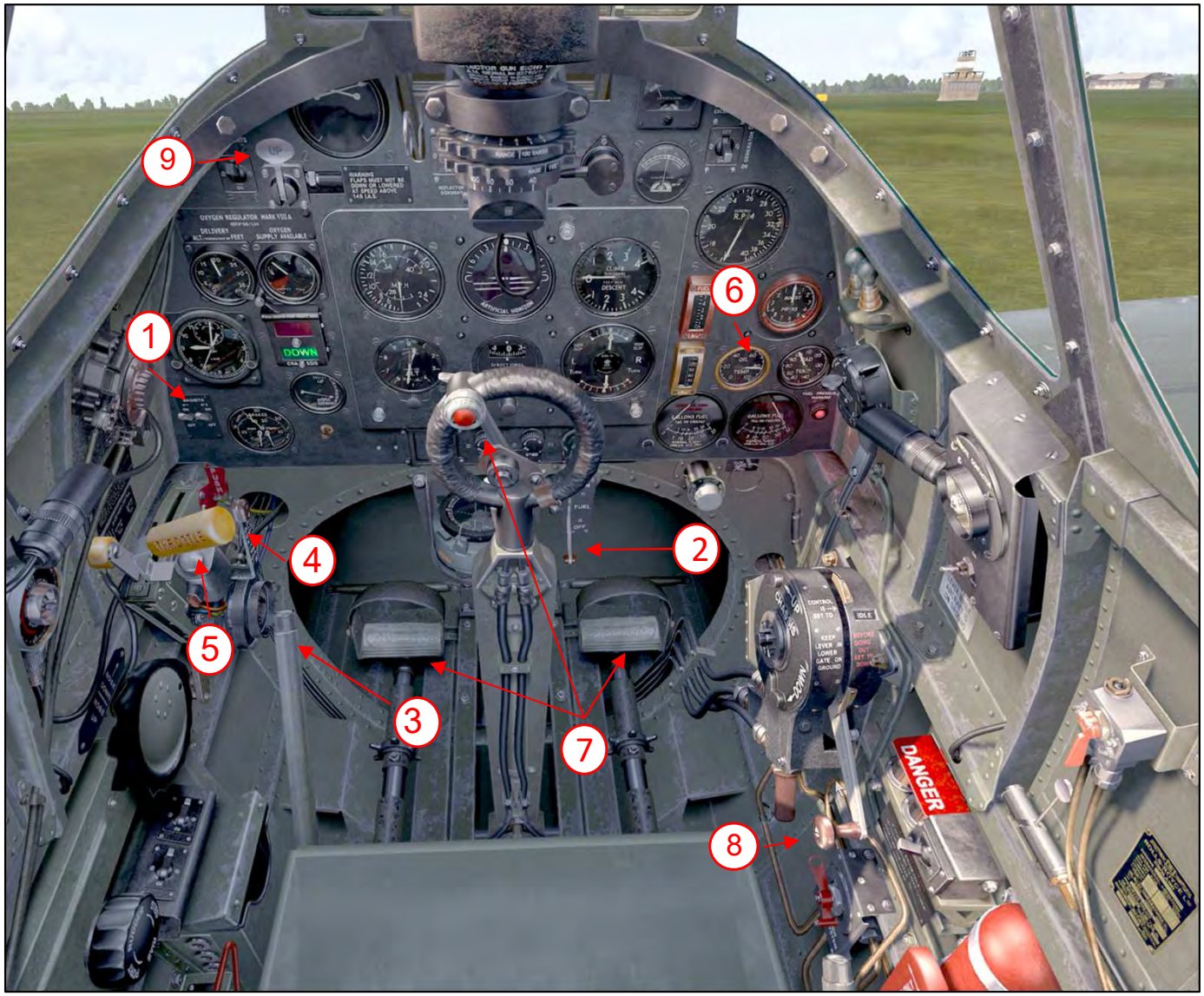
Supermarine Spitfire Mk Ia (100 Octane)

Starting, taxi, and take-off procedures

1. Apply chocks
2. Switch on magnetos (1)
3. Switch on fuel cock (2)
4. Open radiator full (3)
5. Prop pitch fully forward (100%) (4)
6. Apply 10% throttle (5)
7. Start engine
8. When the engine is running open throttle to 20%
9. Wait until engine oil temperature reaches 18 °C (6)
10. Remove chocks and release brakes
11. Slowly increase throttle until the aircraft starts to move
12. Steer by using rudder and brakes (7)
13. Tighter turns, apply brakes, use rudder, increase throttle
14. On runway accelerate to approx. 100 mph then pull stick smoothly back to take off
15. Raise undercarriage (8)

Landing procedure

16. Lower flaps on approach at approx. 140 mph (9)
17. Lower landing gear at approx. 140 mph
18. Prop pitch fully forward (100%)
19. Touch down speed approx. 80-85 mph
20. After touchdown maintain slight back pressure on joystick until low speed to avoid nose over, steer by applying rudder and brakes carefully
21. When stopped, apply chocks, switch off fuel cock and magnetos



Engine Management

Recommended settings for:	Radiator	Boost	RPM
Cruise	55%	+3	2700
Climb	100%	+6	2750
Highest speed	50%	+12 (*)	3000
Never exceed 120°C water temperature			

(* with boost cut out on)

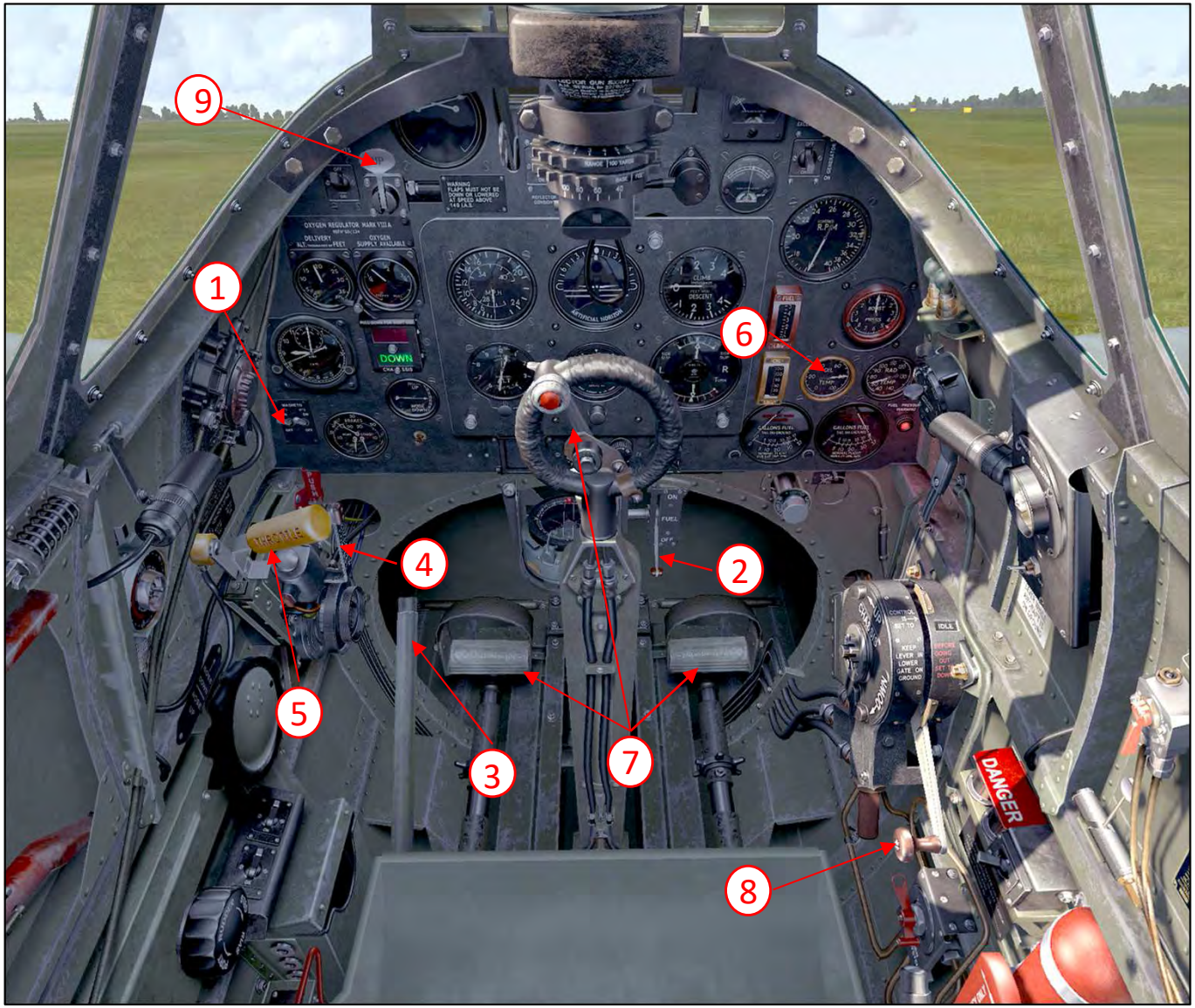
Supermarine Spitfire Mk II Variants

Starting, taxi, and take-off procedures

1. Apply chocks
2. Switch on magnetos (1)
3. Switch on fuel cock (2)
4. Open radiator full (3)
5. Prop pitch fully forward (100%) (4)
6. Apply 10% throttle (5)
7. Start engine (default key is 'i')
8. When the engine is running open throttle to 20 %
9. Wait until engine oil temperature reaches 18°C (6)
10. Remove chocks and release brakes
11. Slowly increase throttle until the aircraft starts to move
12. Steer by using rudder and brakes (7)
13. For tighter turns, apply brakes, use rudder, and increase throttle
14. On runway, accelerate to approx. 100 mph then pull stick smoothly to take off
15. Raise undercarriage (8)

Landing procedure

16. Lower flaps on approach at approx. 140 mph (9)
17. Lower landing gear at approx. 140 mph
18. Prop pitch fully forward (100%)
19. Touch down speed approx. 80-85 mph
20. After touchdown apply brakes carefully maintain slight back pressure on joystick until low speed to avoid nosing over
21. Steer by applying rudder and brakes carefully
22. When stopped, apply chocks



Engine Management

Recommended settings for:	Radiator	Boost	RPM
Cruise	55%	+6	2700
Climb	100%	+9	2850
Highest speed	50%	+12 (*)	3000
Never exceed 135°C water temperature			

(* with boost cut-out)

DESERT WINGS TOBRUK

Supermarine Spitfire Mk V (Non HF) Variants

Start-Up, Taxi and Take-Off Procedures

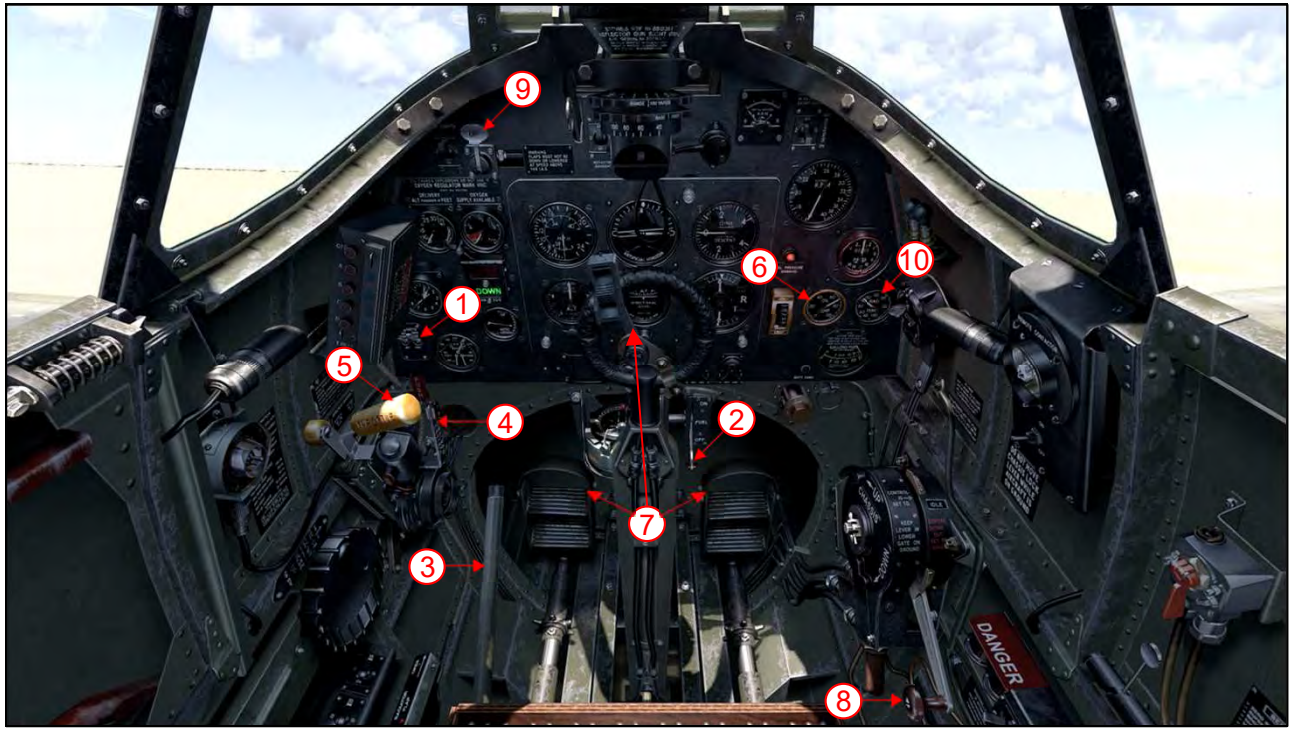
1. Apply chocks and open canopy
2. Switch on magnetos (1)
3. Switch on fuel cock (2)
4. Open radiator full (3)
5. Prop pitch fully forward (4)
6. Apply 10% throttle (5)
7. Start engine (default key is 'i')
8. When the engine is running open throttle to 20%
9. Wait until engine temperature reaches 18°C (6)
10. Remove chocks and release brakes
11. Slowly increase throttle until the aircraft starts to move
12. Steer by using rudder and brakes (7)
13. For tighter turns, apply brakes, use rudder, and increase throttle
14. On runway accelerate to approx.100 mph then pull stick smoothly to take off
15. Raise undercarriage (8)

Landing Procedure

16. Lower flaps on approach at approx. 140 mph (9)
17. Lower landing gear at approx. 140 mph and open canopy
18. Prop pitch fully forward (100%)
19. Touch down speed approx. 80-85 mph
20. After touchdown apply brakes carefully, maintain slight back pressure on stick to avoid nose over. Steer by using rudder and brakes carefully. Apply chocks, switch off fuel cock and magnetos

Spitfire V Variants Overview

- Spitfire Mk Va (Merlin 45, eight .303, +12 boost)
- Spitfire Mk Vb (Merlin 45, two 20mm, four .303, +12 boost). Includes tropical version
- Spitfire Mk Vb Late (Merlin 45, two 20mm, four .303, +16 boost), includes tropical version



Engine Management

Recommended settings for:	Radiator	Boost	RPM
Cruise	55%	+6	2760
Climb	100%	+9	2850
Highest speed	50%	+12 (*)	3000
Never exceed 135°C water temperature			

(* with boost cut-out)

WARNING!

If based in N. Africa pilots are reminded that temperatures **rise quickly.** Monitor your water temperature! (10)

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DESERT WINGS TOBRUK

Supermarine Spitfire Mk V HF variants

Start-Up, Taxi and Take-Off Procedures

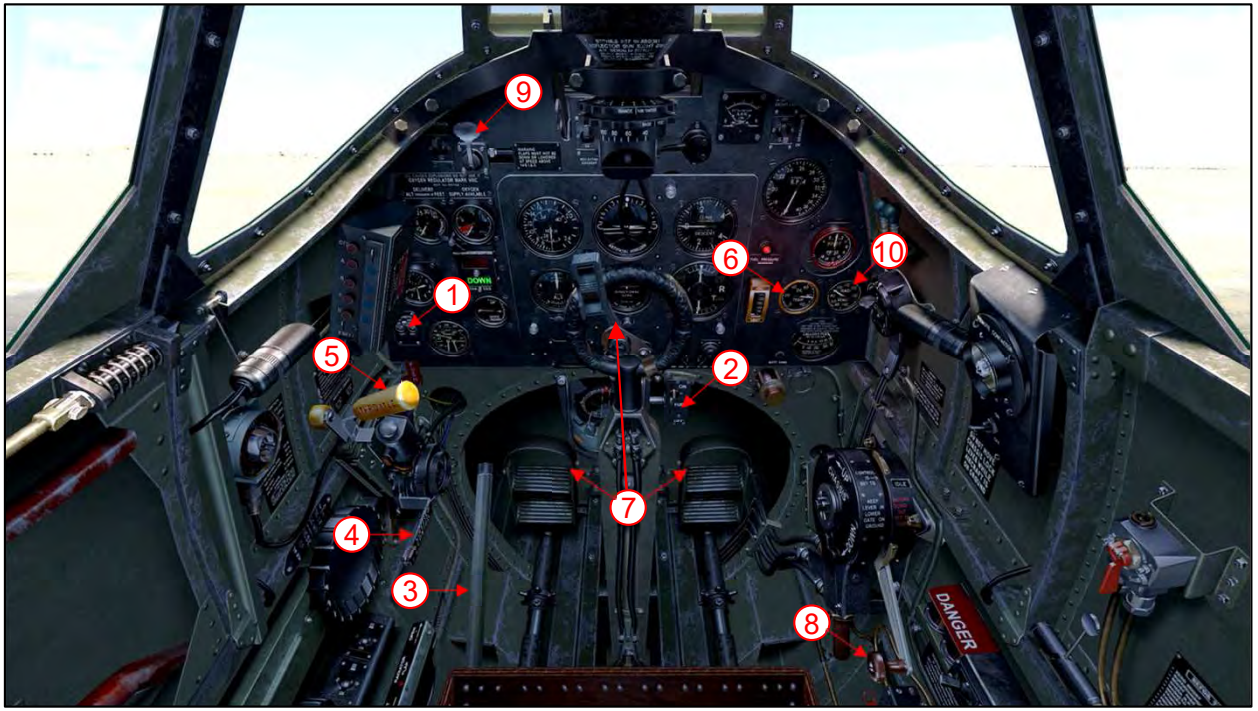
1. Apply chocks and open canopy
2. Switch on magnetos (1)
3. Switch on fuel cock (2)
4. Open radiator full (3)
5. Prop pitch fully forward (4)
6. Apply 10% throttle (5)
7. Start engine (default key is 'i')
8. When the engine is running open throttle to 20%
9. Wait until engine temperature reaches 18°C (6)
10. Remove chocks and release brakes
11. Slowly increase throttle until the aircraft starts to move
12. Steer by using rudder and brakes (7)
13. Tighter turns, apply brakes, use rudder, increase throttle
14. On runway accelerate to approx.100 mph then pull stick smoothly to take off
15. Raise undercarriage (8)

Landing Procedure

16. Lower flaps on approach at approx. 140 mph (9)
17. Lower landing gear at approx. 140 mph and open canopy
18. Prop pitch fully forward (100%)
19. Touch down speed approx. 80-85 mph
20. After touchdown apply brakes carefully, maintain slight back pressure on stick to avoid nose over. Steer by using rudder and brakes carefully. On stopping apply chocks

Spitfire V HF Variants Overview

- Spitfire Mk Vb-HF (Merlin 46 High Altitude, two 20mm Hispano II cannon, four .303 Browning machine guns, +12 boost). Includes tropical version
- Spitfire Mk Vb-HF-Late (Merlin 46 High Altitude, two 20mm Hispano II cannon, four .303 Browning machine guns, +16 boost). Includes tropical version



Engine Management

Recommended settings for:	Radiator	Boost	RPM
Cruise	55%	+6	2760
Climb	100%	+9	2850
Highest speed	50%	+12 (*)	3000
Never exceed 135°C water temperature			

(* with boost cut-out)

WARNING!

If based in N. Africa pilots are reminded that temperatures **rise quickly.** Monitor your water temperature! (10)

DESERT WINGS TOBRUK

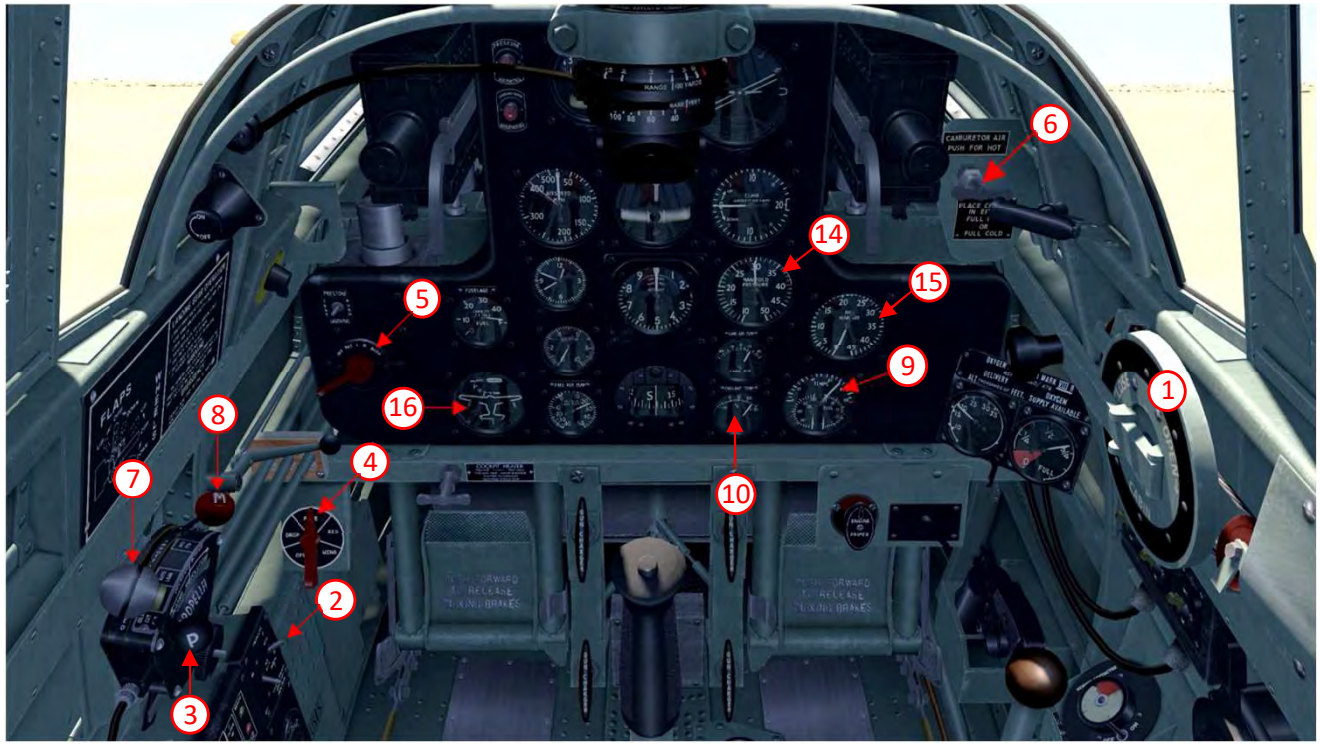
Tomahawk Mk II Variants

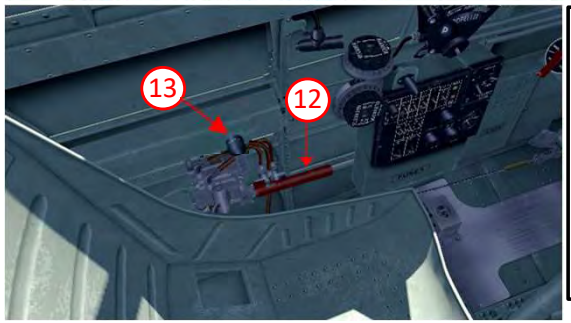
Start-Up, Taxi and Take-Off Procedures

1. Apply chocks and open canopy (1)
2. Set constant speed toggle (Propeller pitch mode - toggle) switch to 'Auto' (constant speed) (2)
3. Set propeller pitch lever fully forward (100%) (3)
4. Set fuel selector switch to 'Fuse' (centre) if aircraft has 100% fuel load. Set to 'Wing' (auxiliary) if less than 60% fuel load (4)
5. Set magnetos to 'Both' (M 1+2) (5)
6. Turn carburettor air (6) to 'Cold' (fully pulled out) and radiator shutters to 'Shut' (0%) (11)
7. Set throttle to approx. 10% (7)
8. Set mixture control fully forward to 'Full Rich' (100%) (8)
9. Start engine by pressing 'i' (default)
10. Warm up engine at approx. 1000 RPM until a minimum oil temperature (9) of 40°C and a minimum radiator temperature (10) of 80°C have been reached
11. Set radiator shutters to 'Open' (11)
12. Remove chocks, release breaks and slowly increase throttle until the aircraft starts to move. Steer by using rudder and brakes if required
13. Apply rudder as required to keep straight and at approx. 90 mph pull stick smoothly to take off
14. Raise undercarriage (12), set boost to 42 in (14) and alter prop pitch lever to achieve 2800 RPM (15)

Landing Procedure

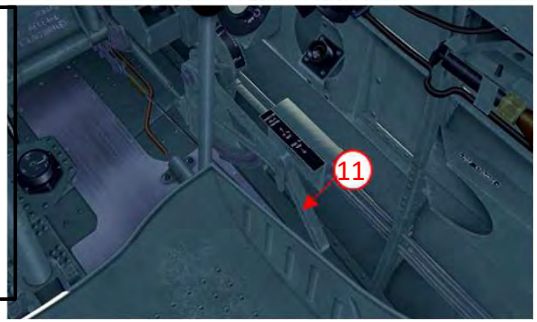
15. On approach lower flaps (13) and undercarriage (12) once speed is below 140 mph
16. Ensure constant speed toggle switch (2) is set to 'Auto' and propeller pitch lever (3) is fully forward 100%
17. Fly approach speed of approx. 95-100 mph
18. Carefully steer with brakes and rudder, to keep straight during landing roll





Undercarriage lever and flaps – cockpit wall (left)

Note: Position of flaps and undercarriage is indicated by the aircraft shaped cockpit dial at lower left of dash (16)



Radiator lever – cockpit wall (right)

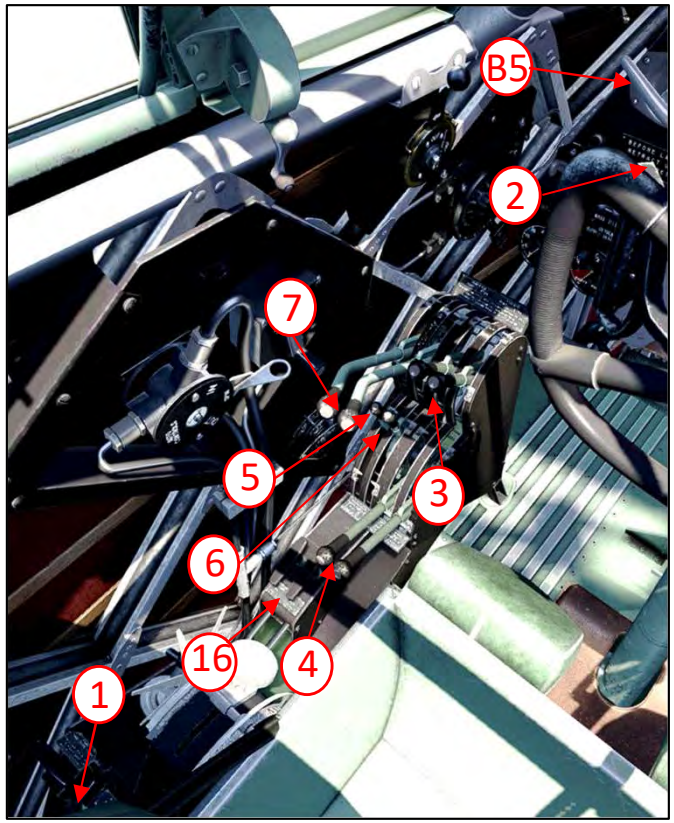
Engine Management

Recommended settings for:	Oil and coolant	Boost	RPM
Cruise	Adjust oil and coolant radiators settings to keep below 90°C/125°C	37 in	2600
Climb (150 mph, radiator 100% open)		42 in	2800
Highest level speed (5 min max.), do not exceed 470 mph in dive		48 in 54 in	3000 3120 in dive

Vickers Wellington Mk I Variants: Pilotage

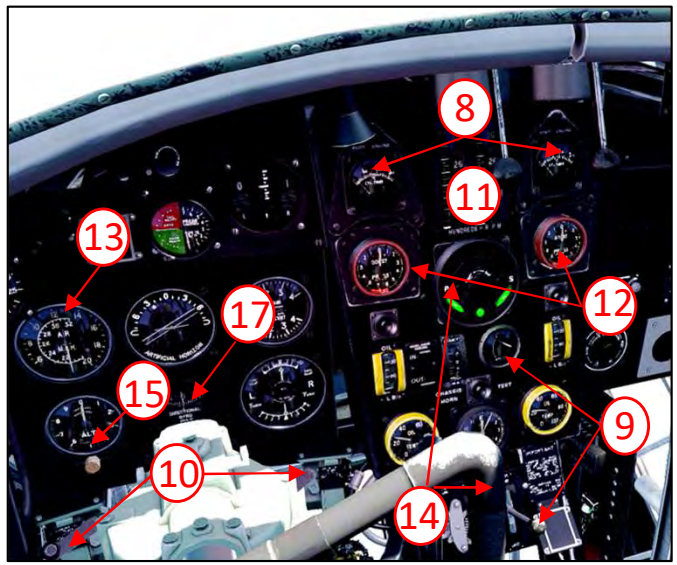
Starting, taxi, and take-off procedures

1. Apply chocks
2. Set fuel tank selector 1 and 2 to 'On' (1)
3. Select both engines (default)
4. Set magnetos to 'On' (2), mixture to 'Full' (100%) (3) and prop pitch to 'Fine' (100%) (4)
5. Set supercharger to 'Medium' (0%) (5) and set carburettor heat (6) to 'Cold'. Set throttle to approx. 10% open (7)
6. Select engine 1 and start it. Repeat with engine 2 ('i' by default)
7. Once engine temperature reaches approx. 30°C (8) select both engines
8. Throttle up and observe RPMs to ensure both engines are in sync. Throttle back to 0% (7)
9. Select 15° (0.2 on indicator) of flaps (9) and open cowling flaps to approx. 1/3 open position (10)
10. Remove chocks, release breaks, slowly apply throttle and carefully use differential brakes and then rudder. Will easily tip on nose due to excessive braking
11. When ready for take-off increase throttle to 100% (7) using rudder to keep aircraft straight. See table below for maximum take-off RPM (11) and boost settings (12)
12. Once 80 mph (13) is reached ease back on control column and raise undercarriage (14). Don't let speed get to 120 mph with gear still down
13. Open cowling flaps to 100% (10). Once 125 mph (13) is reached adjust pitch (4) and throttle (7) to achieve climbing RPM and boost settings – see table
14. At 600-800 ft (15) fully raise flaps (9) and adjust cowling flaps (10) to maintain desired engine temperatures
15. Maintain 125 mph and climb to 12000 ft, set superchargers to 'Full' (highest setting) (5) at 8000 ft (15)



Landing procedure

16. Ensure superchargers are set to 'Medium' setting (5)
17. Fully close cowling flaps (10) and set pitch to 'Fine' (4)
18. Fly a very flat approach and ensure speed is at or below 120 mph early in approach
19. Lower undercarriage (14) and flaps (9) once speed is below 120 mph
20. Touch down at approx. 75-85 mph and use rudder to keep straight until brakes can be used
21. Once in parking position apply chocks and engage slow running cut off switch (16) to turn off engines



Engine Management

Recommended settings for:	Cowl flaps	RPM	Boost	Mixture
Take-off	Approx. 1/3 open	2600	6 ¾	100%
Climb (125 mph)	100%	2250	2 ½	100%
Cruise (130 mph)	Closed	2250	2 ½	0%
Highest Speed	As desired	2600	6 ¾	100%

Never exceed temperature of 240°C for engine / 85°C for oil
Toggle charger at 8000 ft (climb) or 6000 ft (combat)

Vickers Wellington Mk I variants: Compass and autopilot

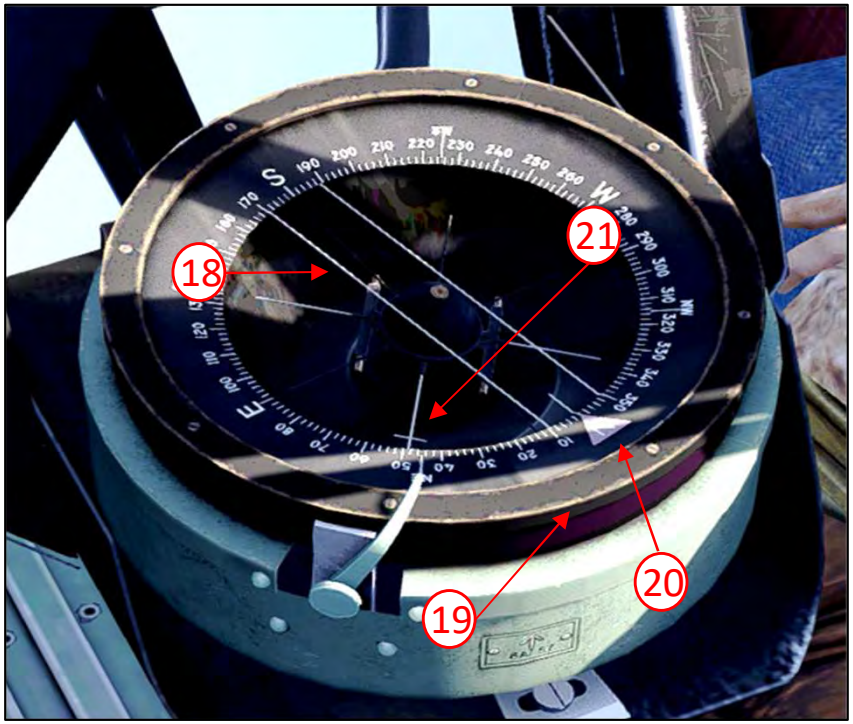
Setting the compass

22. Rotate the two parallel white lines (18) by placing cursor on compass rim (19) and pressing when 'Course Setter – Increase' label is seen

23. Rotate until the red 'N' (20) aligns with 'T' (21)

24. The number at the 12 o'clock position on the dial (22) is the aircraft's current magnetic heading

25. Set directional gyro (17) to this heading



Engaging autopilot

26. Once aircraft is flying wings level on desired heading set directional gyro (17) to 0 using the bound keys (recommend using bound keys: 'Alt left' or 'Alt right' arrow keys) or control knob to increase or decrease

27. '**Course mode'**. Once the directional gyro is at 0 activate autopilot (recommend bound key: 'Ctrl A' for toggle autopilot) to maintain heading only

28. '**Mode 22'**. Once the directional gyro is at 0 activate 'Mode 22' autopilot by stepping through 'course mode' autopilot ('Ctrl A'). 'Mode 22' is required for high-altitude bombing

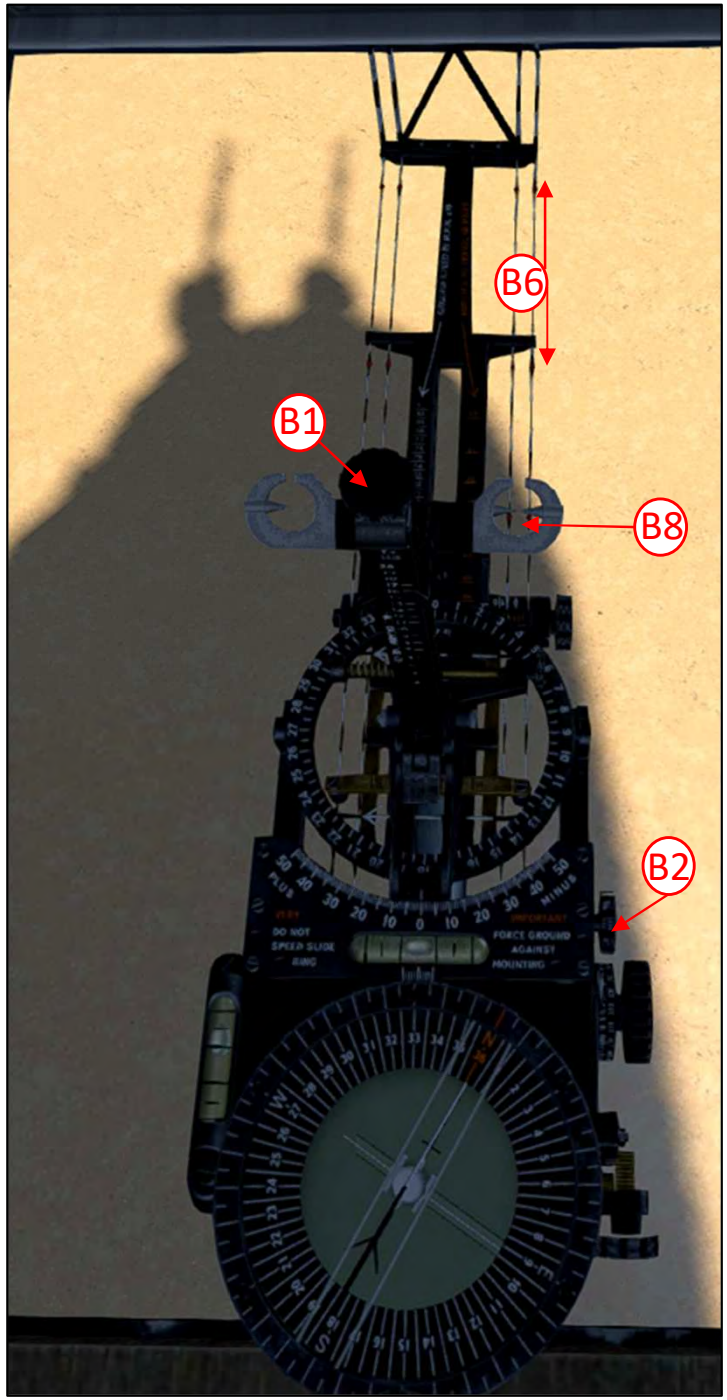
29. After a minute or two of adjustments 'Mode 22' will maintain the aircraft's altitude and heading and fly the aircraft straight and level

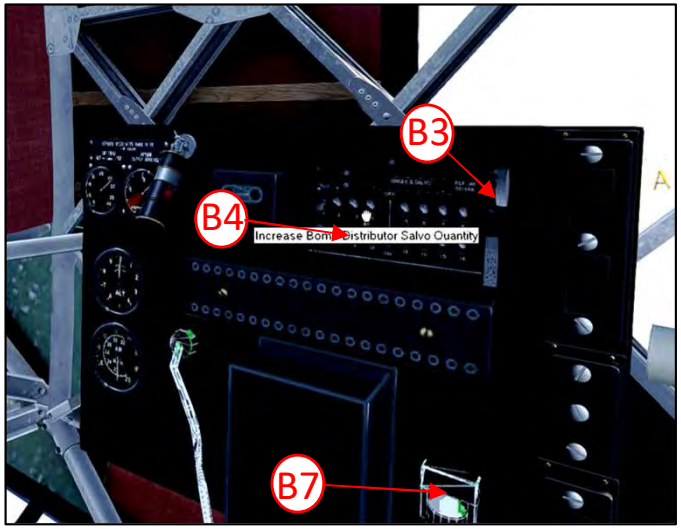
30. Heading adjustments can be made by changing the directional gyro heading using bound keys (recommend using bound keys: 'Alt left' or 'Alt right' arrow key)

Vickers Wellington Mk 1A, 1C Variants: Bombing (Part 1)

High altitude bombing

31. During aircraft selection prior to spawn-in ensure correct fuze and bombs selected and fuel load adjusted accordingly in loadout
32. Before reaching the initial point (IP) (recommend doing this prior to take off) move to bomb aimer's position (recommend bound key: 'Alt 2')
33. Adjust intended bombing altitude using bound key (recommended: 'Ctrl Numpad 9' to increase, 'Ctrl Numpad 3' to decrease) or control knob on bombsight (B1)
34. Adjust intended bombing velocity (noting it is true air speed (TAS) and not indicated air speed (IAS)) using bound key (recommended: 'Ctrl Numpad 7' to increase, 'Ctrl Numpad 1' to decrease) or control knob on bomb sight (B2). At 15000 ft 150 mph IAS = approx. 187 mph TAS
35. Set bomb mode (single, series or salvo) using control on bombsight panel (B3). In single mode 1 bomb will drop per press of bomb drop bound key or control (B7). Select the number of bombs to be dropped in series mode using control on bombsight panel (B4). Switches in the down position indicate the respective bombs have been selected to drop. In salvo mode all bombs will be dropped when bomb drop button is pressed once
36. Once IP is reached and aircraft turned to bombing heading set directional gyro to 0 and engage 'Mode 22'
37. While waiting for aircraft to stabilise in heading and altitude open bomb bay using bound key (recommend: 'Alt B') or cockpit switch (B5 – see page 1)
38. Once aircraft stabilised readjust bombing altitude and velocity to reflect current altitude and true airspeed



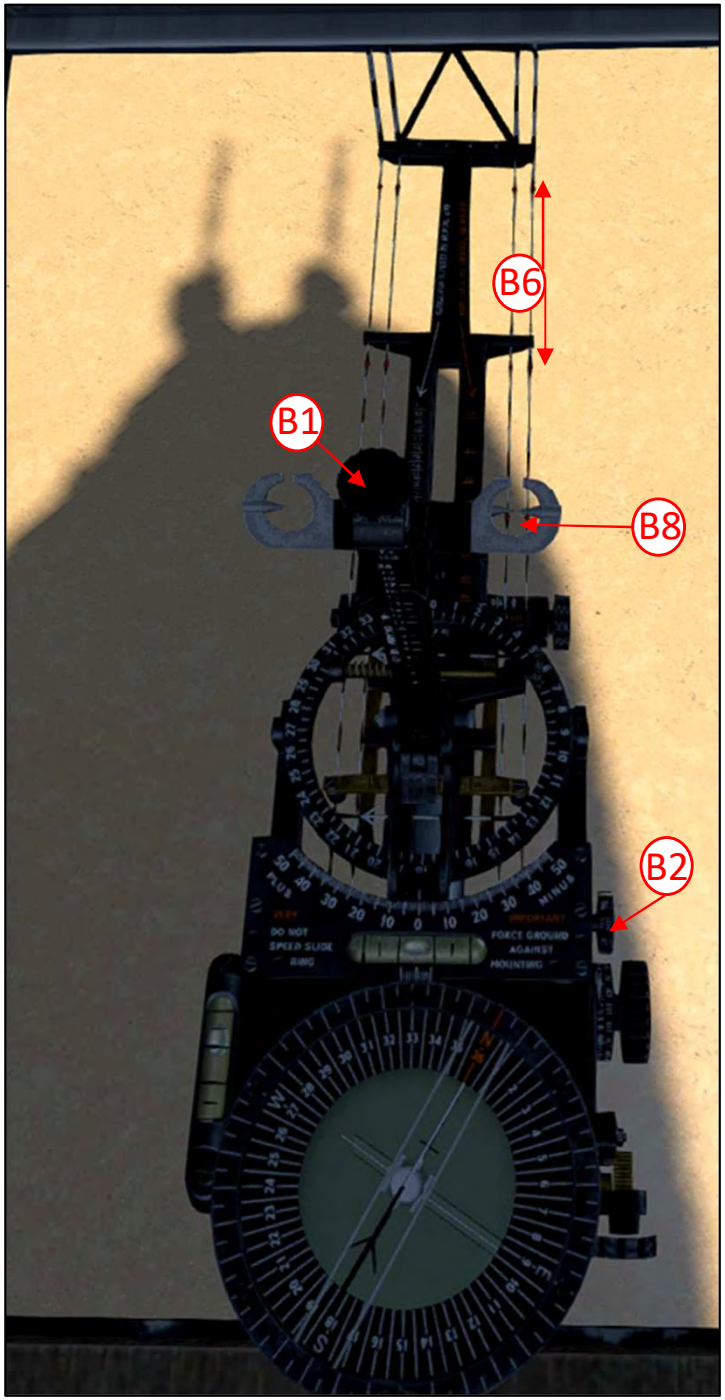


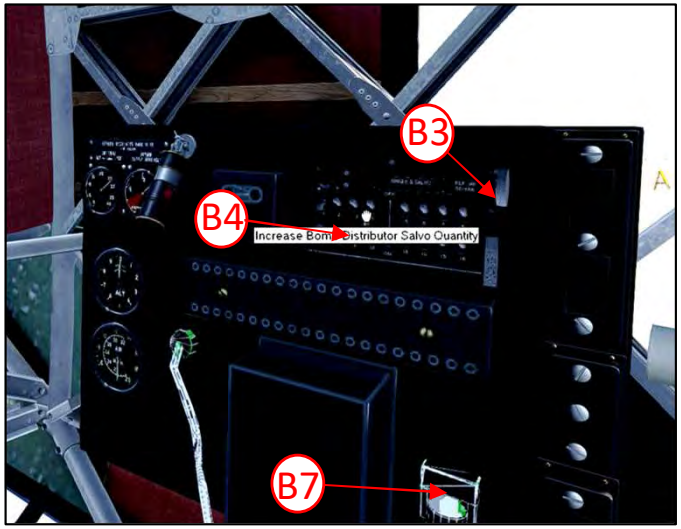
39. Locate target or target area from pilot seat and front gunner position if required
40. Move aircraft heading left or right using changes to directional gyro ('Alt-left/right' arrow) until target is aligned with centred front gun gunsight and then the vertical lines of the bombsight (B6)
41. Enter bombsight view by using bound key ('Shift F1')
42. Pick a point on the ground near the top of the bomb sight vertical line (B6). Watch to see if the vertical line moves left or right of this point as it traverses towards the bottom of the display. If it does drift then slightly change directional gyro heading left or right to compensate using bound keys
43. When target enters bombsight reticule (B8) drop bombs using bound key or button on panel (B7)
44. Close bomb bay door (B5)

Vickers Wellington Mk 1A, 1C Variants: Bombing (Part 2) and basic navigation

Low altitude manual bombing (no use of sight)

45. During aircraft selection prior to spawn-in ensure correct fuze and bombs selected and fuel load adjusted accordingly in loadout
46. Set bomb mode (single, series or salvo) and bomb series size as for high altitude bombing
47. Once IP is reached and aircraft turned to bombing heading open bomb bay using bound key ('Alt B') or cockpit switch (B5 – see page 1)
48. Over the target drop bombs using bound key or button on panel (B7) noting different modes Bombs do not have delayed fuzing so ensure you are high enough to avoid being damaged by your own bombs
49. Head home or to next target





Navigation basics

Navigation is an important aspect of bomber operations. The following provides a basic approach to reasonably accurate navigation in clear weather. More detailed navigation information is beyond the scope of this flashcard but is available elsewhere

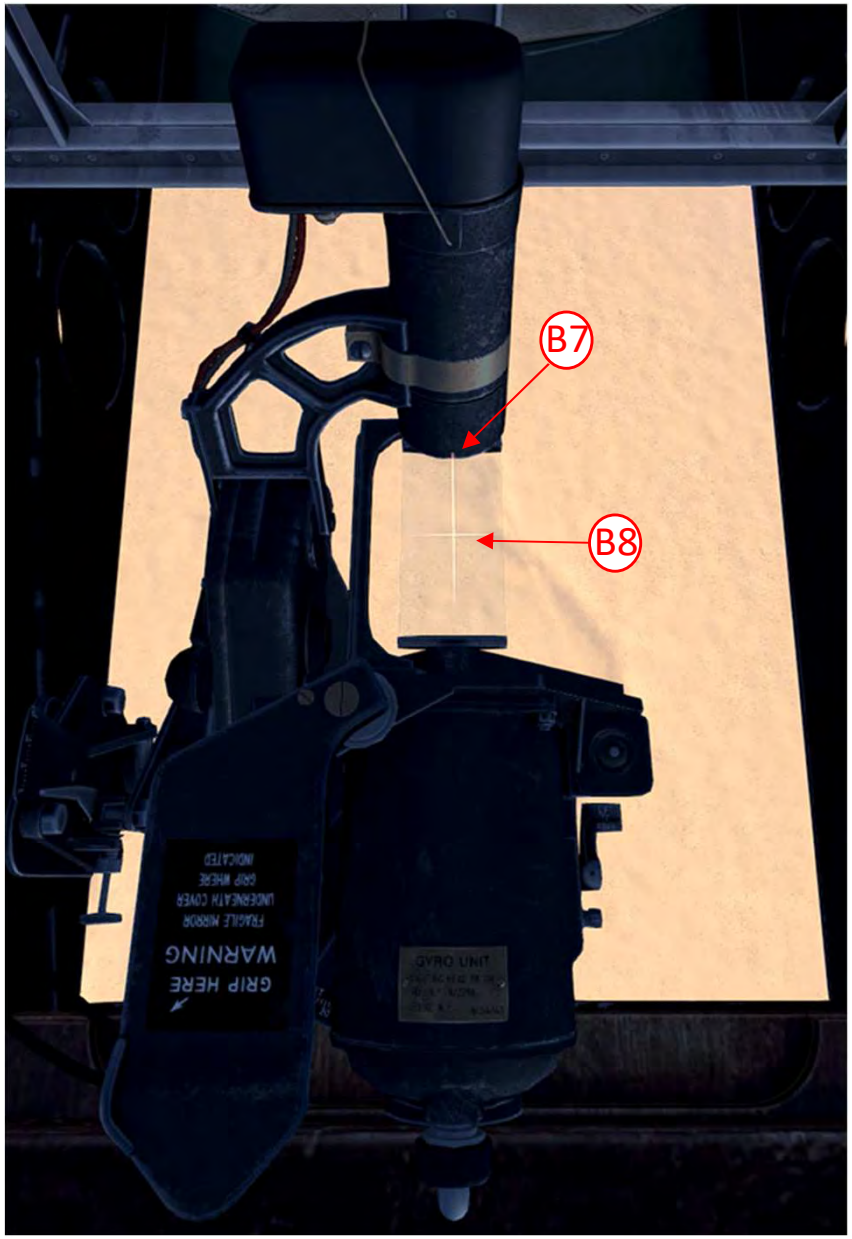
N1 Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: +1.5 degrees)

N2 During flight ensure gyro compass and magnetic compass are aligned – especially when using autopilot – and correct your aircraft's track based on map-to-ground analysis to overfly waypoints

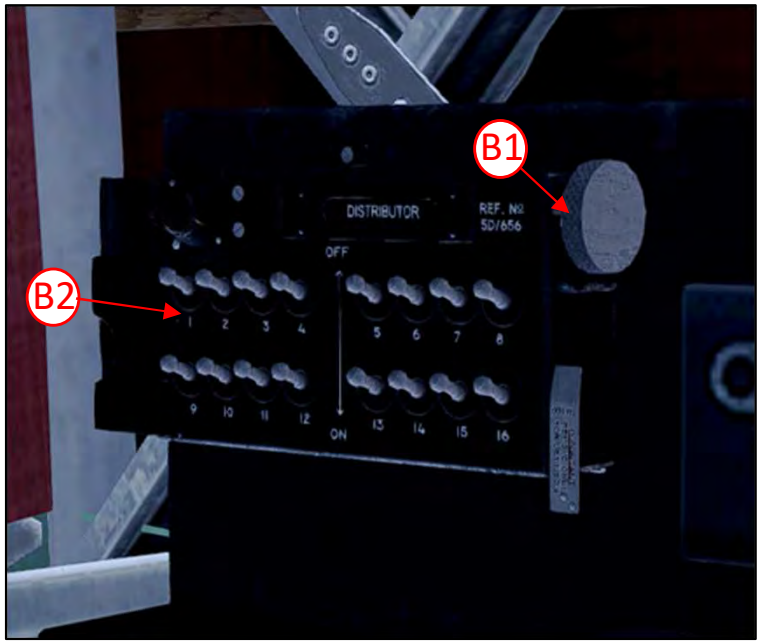
Vickers Wellington Mk 1C Late Variant: Bombing (Part 1)

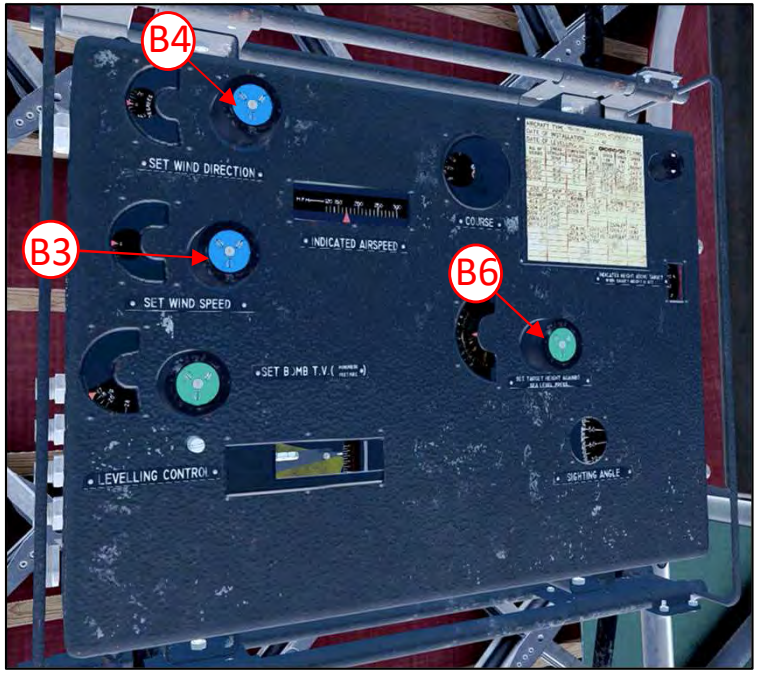
High altitude bombing

50. During aircraft selection prior to spawn-in ensure correct fuze and bombs selected
51. Before reaching the initial point (IP) (recommend doing this prior to take off) move to bomb aimer's position (recommend bound key: 'Alt 2') and enter wind speed (B3), wind direction (B4) and the target's altitude above sea level (B6) if known
52. Set bomb mode (single, series or salvo) using control on bombsight panel (B1). In single mode 1 bomb will drop per press of bomb drop bound key. Select the number of bombs to be dropped in series mode using control on bombsight panel (B2). Switches in the down position indicate the respective bombs have been selected to drop. In salvo mode all bombs will be dropped when bomb drop button is pressed once
53. Once IP is reached and aircraft turned to bombing heading set directional gyro to 0 and engage 'Mode 22'
54. While waiting for aircraft to stabilise in heading and altitude open bomb bay using bound key (recommend: 'Alt B') or cockpit switch (B5 – see page 1). Remove bombsight cover using the 'toggle gunsight dimmer' command (bind a key)



Low altitude manual bombing (no use of sight)
Refer low altitude procedure on page 4





Vickers Wellington Mk 1C Late Variant: Bombing (Part 2)

High altitude bombing

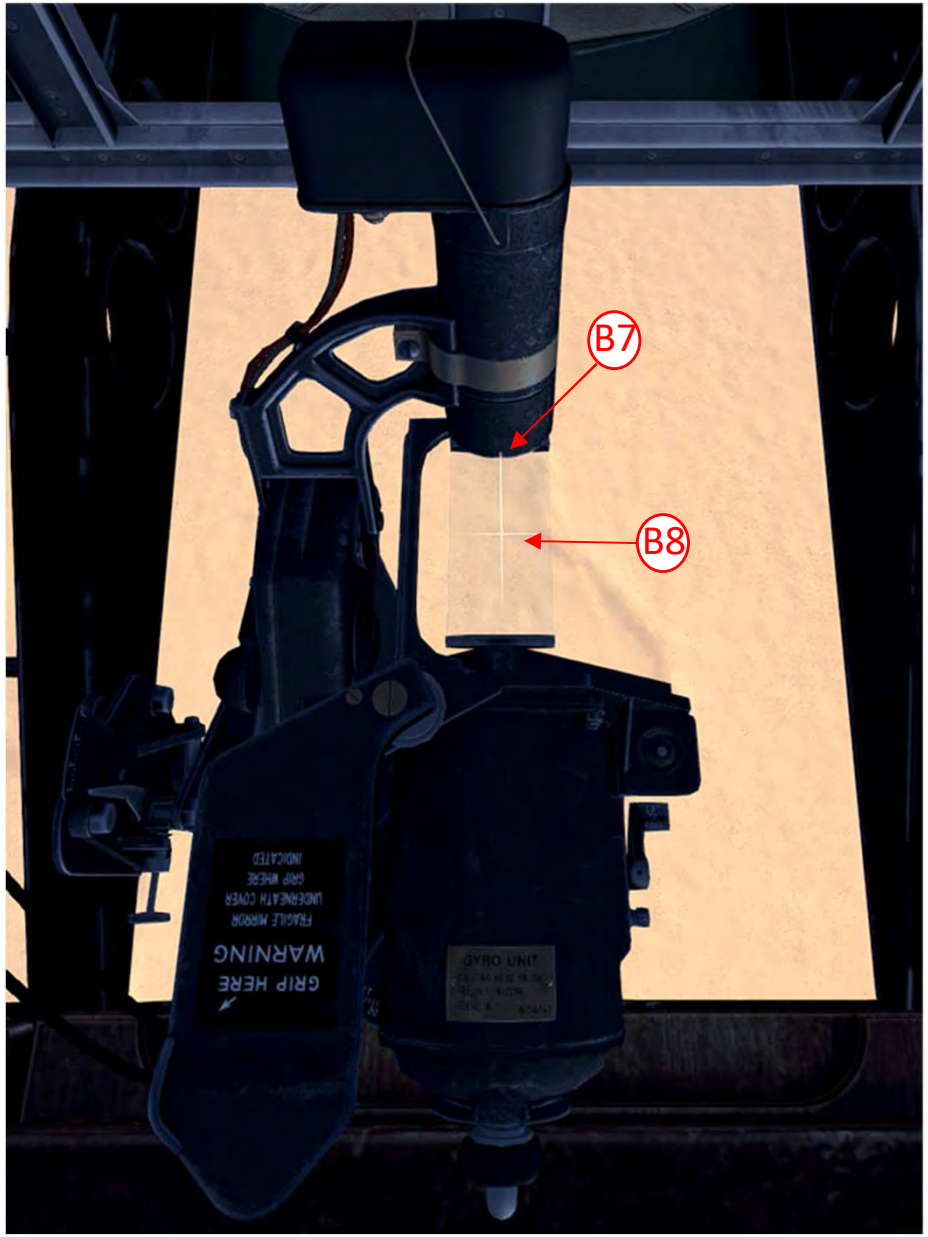
55. Locate target or target area from pilot seat and front gunner position if required.

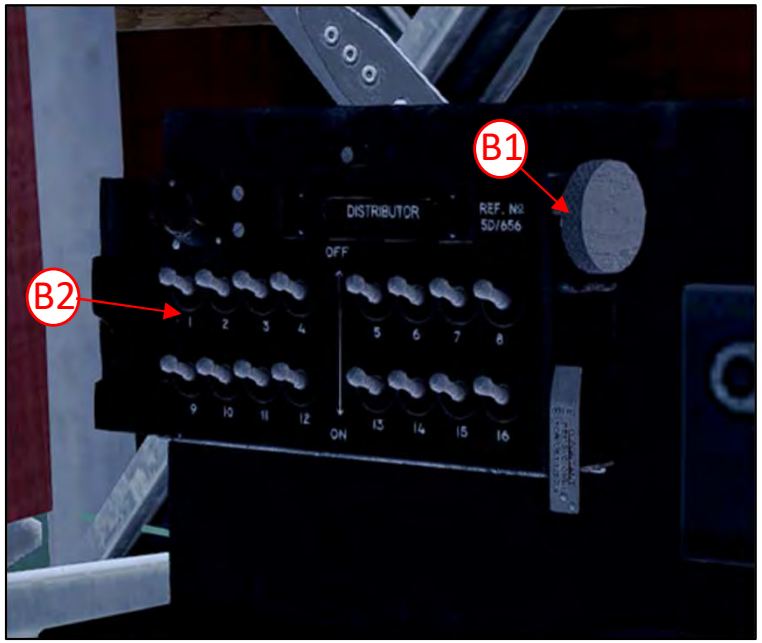
56. Turn on sight using bound key ('Alt L') and move aircraft heading left or right using changes to directional gyro ('Alt-left/right' arrow) until target is aligned with centred front gun gunsight and the vertical line of bombsight points to target (B7)

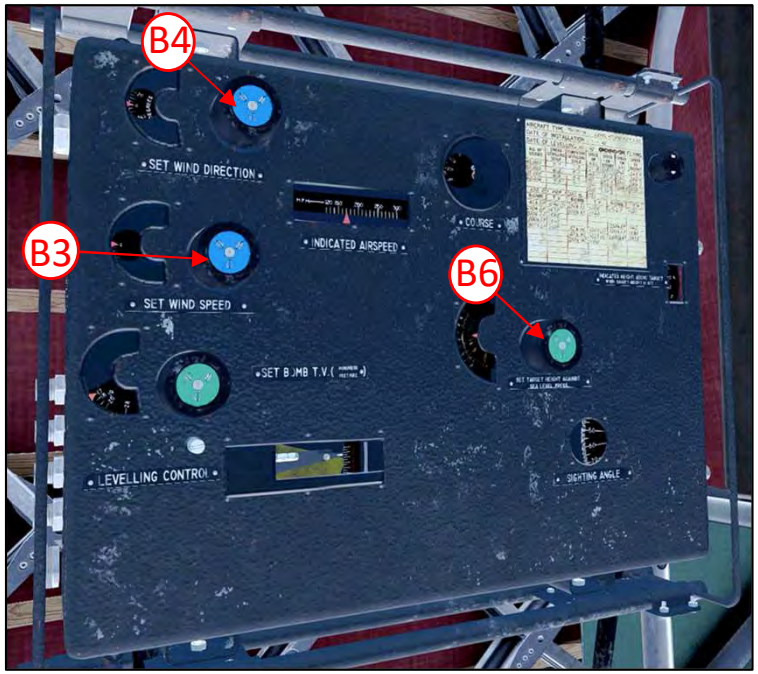
57. Enter bombsight view by using bound key ('Shift F1')

58. When target reaches cross hairs (B8) on bombsight drop bombs using bound key

59. Close bomb bay using bound key (recommend: 'Shift B') or cockpit switch (B5)







Low altitude manual bombing (no use of sight)
Refer low altitude procedure on page 4

Vickers Wellington Mk I Variants: Gunnery

Gunnery

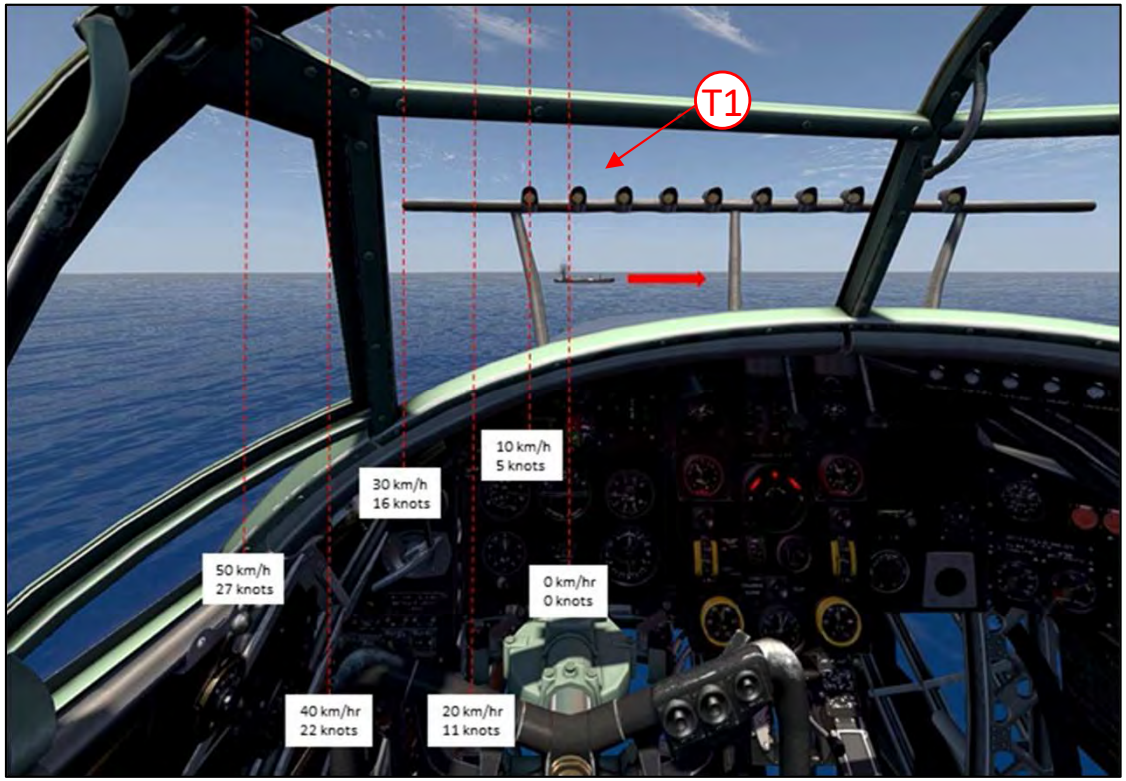
60. During aircraft selection prior to spawn-in ensure ammunition load-out includes some tracer in both guns (recommend at least 1 in 5) and that a convergence range of 400 m is selected. Recommend using tracer with a burn out range of at least 500 yards. Ensure joystick control has been assigned in 'Options-Controls-Axes-Turret'
61. Once in area where enemy fighters could be encountered set directional gyro to 0 and engage 'Course Mode' or 'Mode 22'
62. Enter front or rear gunner position using bound key (recommend 'Alt 3' and 'Alt 4') and turn on gunsight ('Alt L') (G1) and move to gunsight view ('Shift F1')
63. Enable mouse control of turret ('F10')
64. When an enemy fighter is seen heading towards your bomber ensure view is fully zoomed in and place gunsight pipper on enemy fighter. Fire a short burst noting the position of the tracer stream with respect to the pipper and enemy fighter
65. Move gunsight so that enemy fighter (G2) is now at a point along the tracer stream
66. Open fire, firing in short bursts while adjusting aim to place tracer stream (G3) through the enemy fighter (G2)
67. When target is directly behind at less than 400 metres increase burst size (G4)
68. Once enemy has broken off attack commence search for other nearby enemy aircraft using large movements of turret to compensate for the turret's limited view

Vickers Wellington Mk 1C Torpedo Variant: Torpedo employment

Torpedo employment

69. During aircraft selection prior to spawn-in ensure torpedos are selected and fuel load adjusted accordingly in loadout. Obtain ship speed information from mission briefing if available
70. Search for target shipping at 500 ft, 150 mph
71. When ship 'dots' are spotted fly towards dot remaining at 500 ft altitude
72. At about 10-12 km range to go the targets should be discernible with view fully zoomed in
73. Adjust flight path to ensure a beam attack is conducted with the ship sailing from your port to starboard (ie. from left to right across your nose)
74. Refine your flight path and confirm ship identity at about 6 km range to go
75. Descend to 100-150 ft altitude, open bomb bay and continue to fly towards target at speed of around 150-160 mph
76. Determine attack profile as follows:
    76a: For attacks on warships or escorted merchant ships you should plan to drop a single torpedo at about 1000 m range to go
    76b: For attacks on unescorted merchant ships you should plan to drop your torpedo at <500 m
77. For attacks on warships: Using the ship speed aiming guide (T1) and the estimated ship speed from your mission brief fly your aircraft to place the target ship on the applicable speed line when you reach approx. 1000 m range to go. This range can be estimated by using your thumb (T2)
78. Drop a single torpedo and then conduct a full throttle max rate turn away from the ship
79. Once established in your egress close bomb bays and consider entering the rear turret to see if your torpedo hit. Repeat attack if torpedo missed
80. For attacks on merchant ships: Either conduct your drop at 1000 m using the same procedure as for warships or approach until very close and conduct the drop 'by eye' using your own estimated offset

Place target ship on relevant aiming line based on estimated ship speed



When view fully zoomed in at approx. 1000 m range to go this distance is approx. the thickness of 6 ft tall (180 cm) adult male thumb.

Historical note

Accurate torpedo employment was difficult. Aircrew who flew these missions often conducted extensive training. At the end of 1942 Wellington-dropped torpedoes in the Mediterranean had a hit rate of 28%. In other words just under 3 in 10 torpedoes hit their target.

Axis Aircraft

CS	ZH	IT	EN	FR	DE	RU	ES

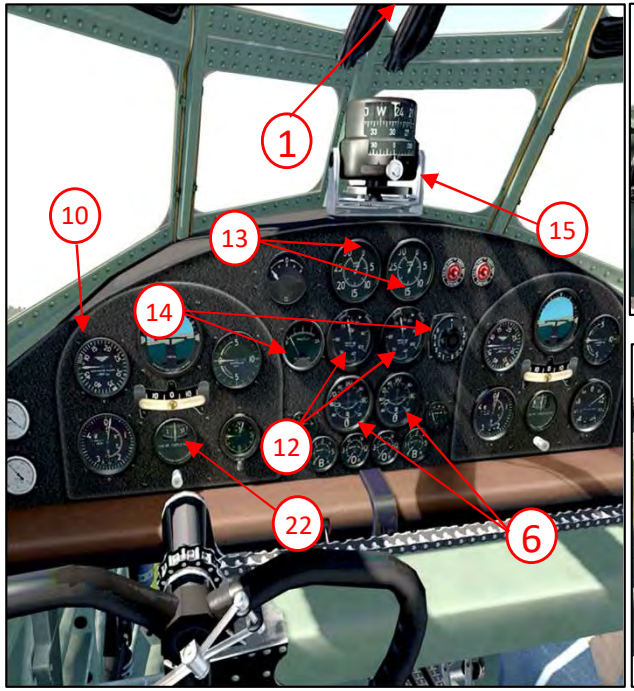
Fiat BR.20M Cicogna: Pilotage

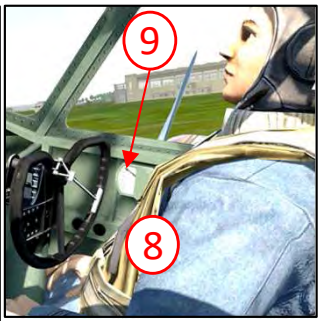
Starting, taxi, and take-off procedures

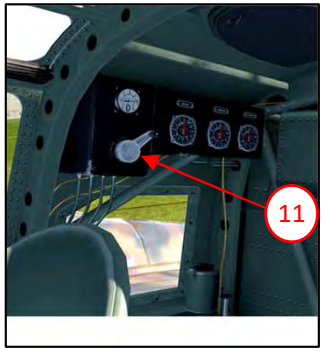
1. Apply chocks and set magnetos to 'M1+2' (1)
2. Set prop pitch to 'Full fine' (100%) (default) (2)
3. Ensure oil-(3) and air-radiators (4) are closed (default)
4. Select 'All Engines' and open throttle to 10%. Select engine 1 and start. Repeat with engine 2
5. Select 'All Engines', keep 10% throttle for four minutes & set boost cut out to 'On' (5)
6. Open throttle quickly to 100% until engines run smoothly then throttle back to 0%
7. If engines stop, repeat starting procedure
8. When oil temperature reaches 18°C (6) open oil-radiator to 50% (3) and cowling flaps to 100% (4)
9. Release chocks and press once on brakes to release them (7)
10. Slowly increase power and steer by using rudder and brakes
11. On runway, lower flaps (8) to 1st position (partially obscured by co-pilot) (9)
12. Apply chocks, throttle to 110%, release chocks and use light rudder inputs to steer
13. As speed increases pull control stick back slightly to prevent nose over
14. At approx. 150-160 km/h (10) increase back stick pressure to take-off
15. Raise undercarriage (11) and flaps and adjust throttle and prop pitch (2) to 85%

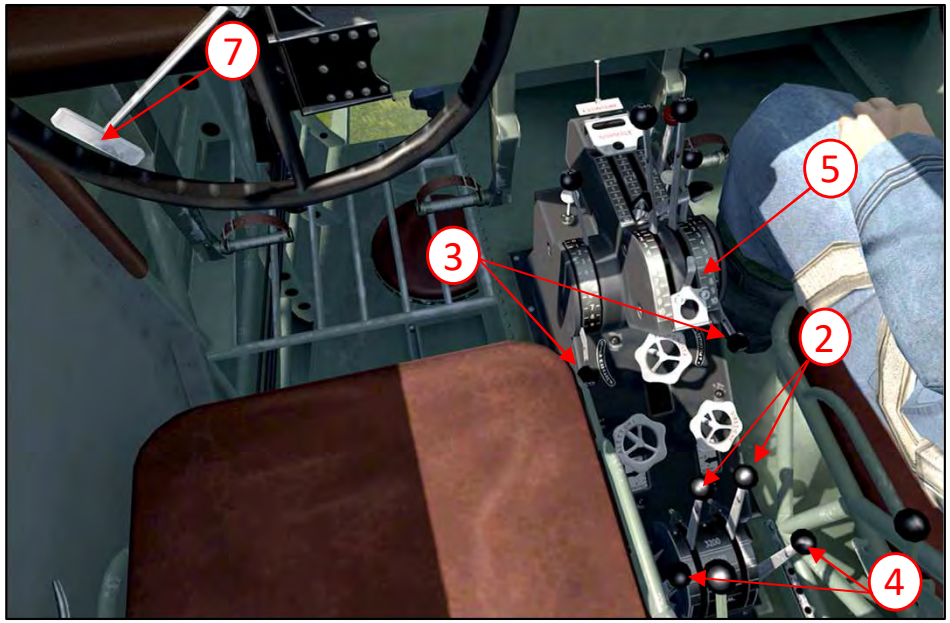
Landing procedure

16. Ensure ventral gunner position is stowed for landing
17. Slow aircraft speed to approx. 230 km/h (10)
18. Set flaps (8) to full down (9) and lower undercarriage (11)
19. Approach airfield at approx. 175 km/h, aiming for 165 km/h on short final
20. Do not go below 155 km/h and fly aircraft onto the runway
21. After touchdown steer with rudder, using brake once under 100 km/h
22. Apply chocks, mixture to 0%, magnetos on M0 (1) to finish sortie









Engine Management

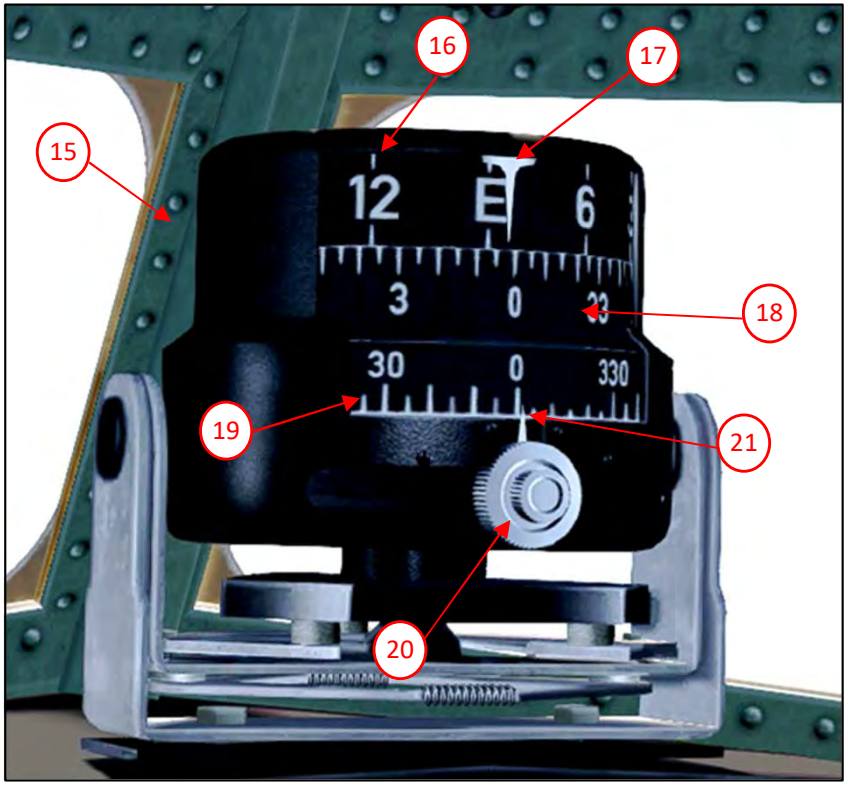
Recommended settings for:	Radiators (cowling flaps/oil)	Prop Pitch	ATA (12) mmHG	RPM (13)
Cruise	50%/50%	85%	670	2100
Climb	100%/50%	85%	740 (max. 30 min)	2100
Highest speed	as required (check temp.)	100%	820 (max. 3 min)	2200
Never exceed temperatures of 260°C Cylinder Head (14) /100°C Oil (6)				

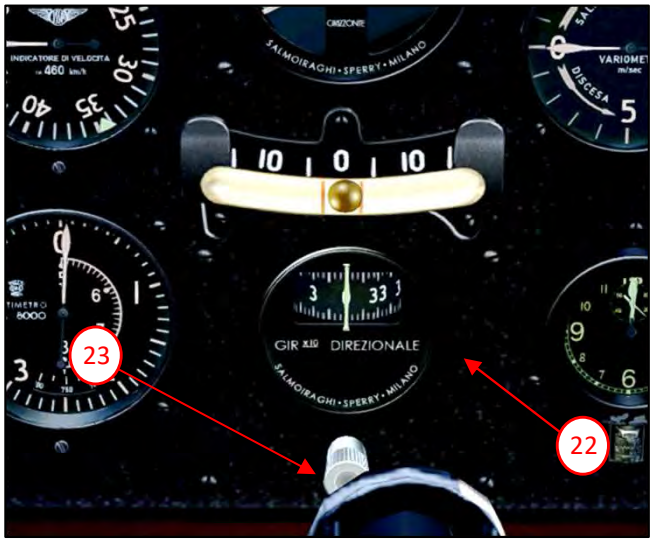
Fiat BR.20M Cicogna: compass and auto-pilot use

Navigation basics and auto-pilot use

Navigation is an important aspect of bomber operations, especially long-range missions deep into enemy territory.

23. Prior to, or during, engine start-up, plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees)
24. On the compass (15) the top band (16) is the aircraft's magnetic compass and the white T (17) is the aircraft's magnetic heading (85° in the image). The middle band (18) is a gyroscopically stabilized compass that is slaved to the magnetic compass once engine #1 is running. It should be more stable and accurate than the magnetic compass during aircraft maneuvering
25. Set the desired course to be flown by rotating the lower band (19) using the control knob (20) until the marker (21) points to the desired course
26. Turn the aircraft so that the aircraft's magnetic heading (17) aligns with the lower band marker (21)
27. Once the aircraft is flying wings level on desired heading set directional gyro (22) to 0 using the bound keys (recommend using bound keys: 'Alt left' or 'Alt right' arrow keys) or control knob (23) to increase or decrease
28. **'Course mode'**. Once the directional gyro is at 0 activate autopilot (recommend bound key: 'Ctrl A' for toggle autopilot) to maintain heading only
29. **'Mode 22'**. Once the directional gyro is at 0 activate 'Mode 22' autopilot (altitude, heading) by stepping through 'course mode' ('Ctrl A'). 'Mode 22' is recommended for high-altitude bombing

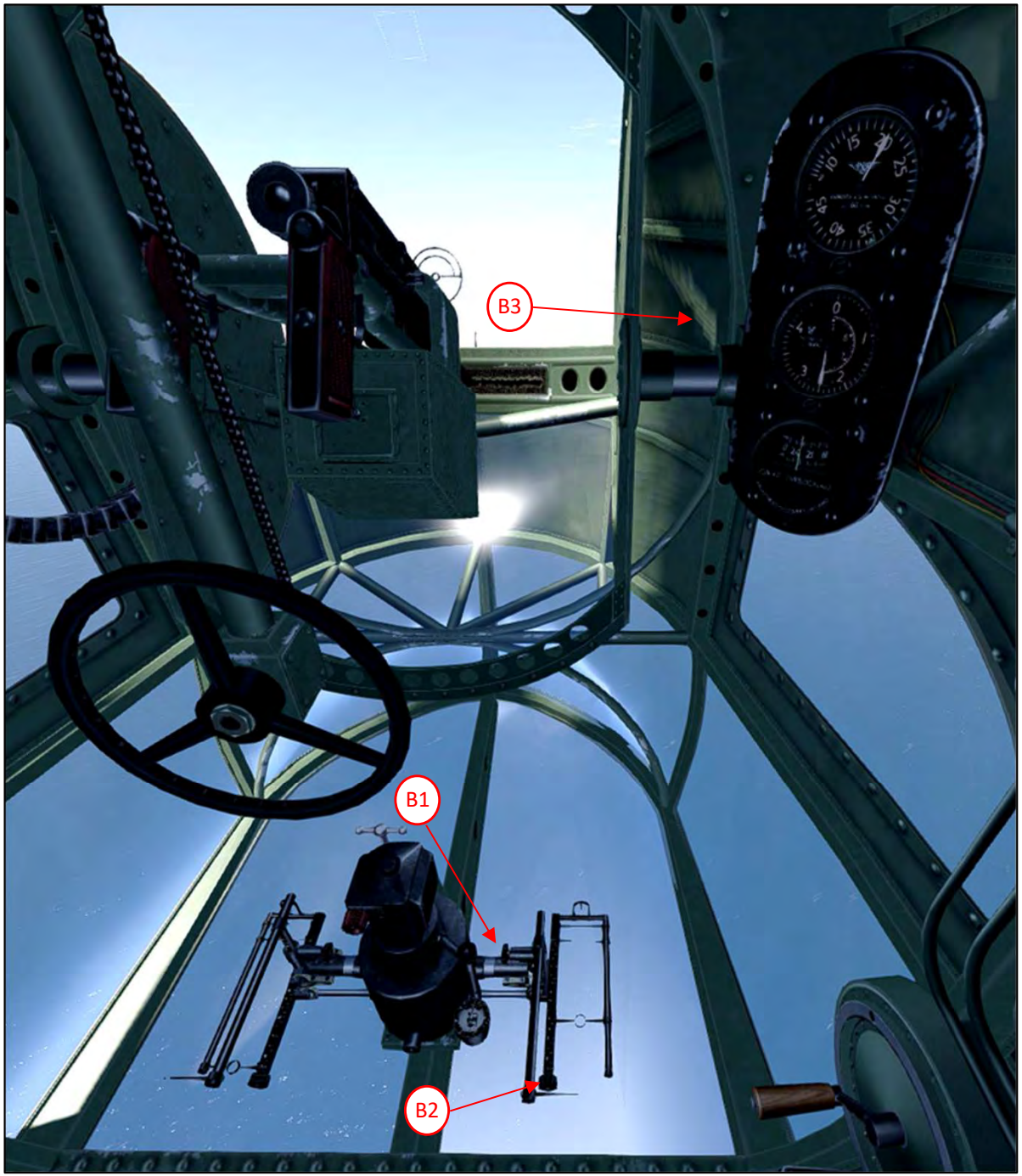




Fiat BR.20M Cicogna: Bombing (Part 1)

High altitude bombing

30. During aircraft selection prior to spawn-in ensure, correct fuse and bombs are selected and fuel load adjusted accordingly in loadout
31. Before reaching the initial point (IP) (recommend doing this prior to take off) move to bomb aimer's position (recommend bound key: 'Alt 2')
32. Adjust intended bombing altitude using bound key (recommended: 'Ctrl Numpad 9' to increase, 'Ctrl Numpad 3' to decrease) or control knob on bomb sight (B1)
33. Adjust intended bombing velocity, noting it is true air speed (TAS) and not indicated air speed (IAS), using bound key (recommended: 'Ctrl Numpad 7' to increase, 'Ctrl Numpad 1' to decrease) or control knob on bomb sight (B2). At 4500 metres 240 km/h IAS are approx. 300 km/h TAS
34. Set bomb mode (single, series or salvo) using bound keys. In single mode 1 bomb will drop per press of bomb drop bound key. In series mode all bombs will be dropped when bomb drop bound key is pressed with a distribution delay between each bomb that can be set. In salvo mode all bombs will be dropped simultaneously when bomb drop button is pressed once. If using series mode set bomb drop distribution delay using bound keys
35. Once IP is reached and aircraft turned to bombing heading, set directional gyro to 0 (22) and engage 'Mode 22'
36. Once aircraft stabilised readjust bombing altitude and velocity to reflect current altitude and true airspeed using information from bomb aimer's flight instruments (B3)



Fiat BR.20M Cicogna: Bombing (Part 2)

High altitude bombing

37. Locate target or target area using view from front gunner's position if required

38. Arm bombs using bound key ('Ctrl W') and open bomb bay using bound key ('Alt B')

39. Move aircraft heading left or right using changes to directional gyro ('Alt' + left/right arrow) until target is aligned with vertical lines of bomb sight (B4)

40. Enter bomb sight view by using bound key (Shift F1)

41. Pick a point on the ground near the top of the bomb sight vertical line (B4). Watch to see if the vertical line moves left or right of this point as it traverses towards the bottom of the display. If it does drift then slightly change directional gyro heading left or right to compensate using bound keys or using the adjust sight control (B5)

42. When target enters bombs sight reticule (B6) drop bombs using bound key

43. Close bomb bay door

Low altitude manual bombing (no use of sight)

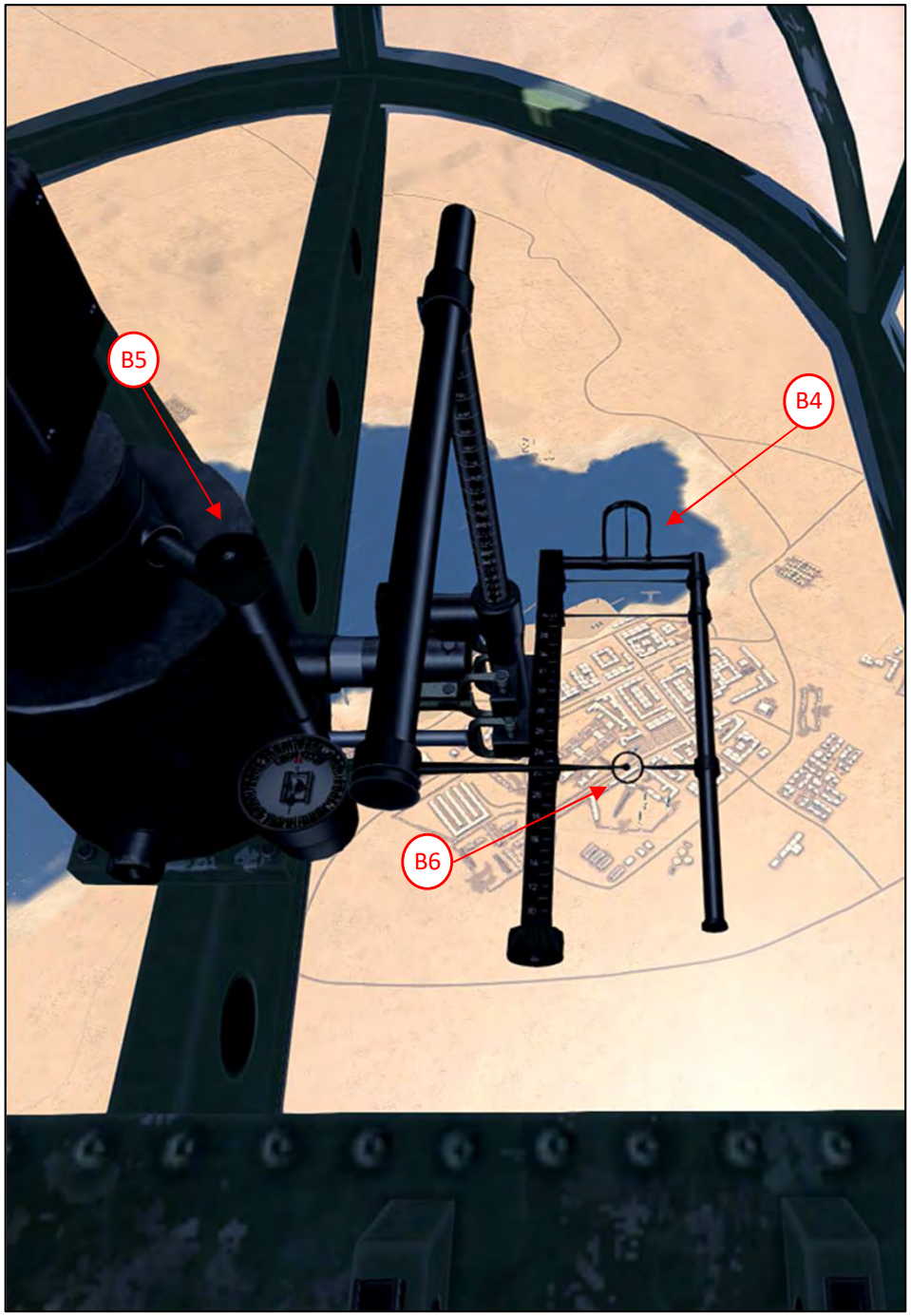
44. During aircraft selection prior to spawn-in ensure correct fuse and bombs are selected and fuel load adjusted accordingly in loadout

45. Set bomb mode (single, series or salvo) using bound key. If using series mode set bomb drop distribution delay using bound keys

46. Prior to reaching target arm bombs using bound key ('Ctrl W') and open bomb bay using bound key ('Alt B')

47. Over the target drop bombs using bound key

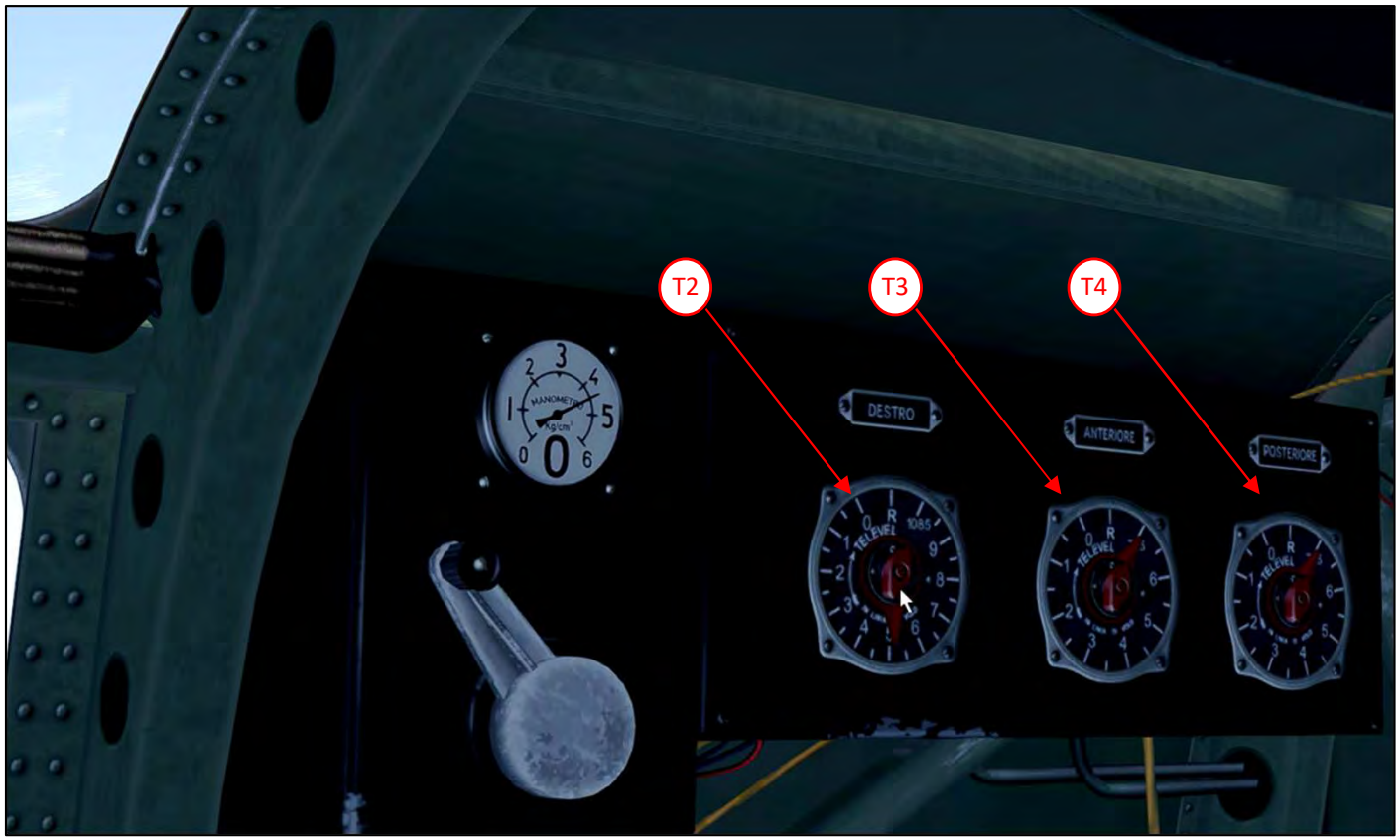
48. Head home or to next target



Fiat BR.20M Cicogna: Fuel system

Fuel basics

49. The Br.20M has 6 fuel tanks; forward centre fuselage, aft centre fuselage and 2 tanks in each wing. The gauge (T1) for the port wing tanks is located behind the pilot's left shoulder. The gauges for the fuselage (T2, T3) and starboard wing tanks (T4) are located behind the co-pilot's right shoulder
50. The engines take fuel from all tanks simultaneously and there's no ability to transfer fuel between tanks



Fiat BR.20M Cicogna: Gunnery

Gunnery

51. Before launching game adjust mouse /gun traverse speed (if required) by altering 'conf' file (located in Documents\1Csoftclub\il-2 sturmovik cliffs of dover) in 'rts_mouse' section by changing X and Y sensitivity to 1.5 or 2 depending on personal preference. Consider inverting mouse direction by changing to 'Invert=1'

52. During aircraft selection prior to spawn-in ensure ammunition load-out includes tracer (recommend at least 1 in 5) and that a convergence range of 500 metres is selected

53. In Options-Controls-General assign key to 'fire current weapon'. Recommend using an unassigned button on joystick and not the mouse button as use of the mouse button will prevent concurrent moving and shooting of the gun

54. Once in area where enemy fighters could be encountered engage 'Course Mode', 'Mode 22' or continue to hand fly the aircraft. With practice, concurrent flying and gunnery is possible and improves gunnery effectiveness as gunnery can be coordinated with aircraft manoeuvre

55. Enter gunner position using bound key (recommend 'Alt 4' for upper rear gunner), activate gunner position (recommend 'Ctrl O') and enable mouse control of turret ('F10')

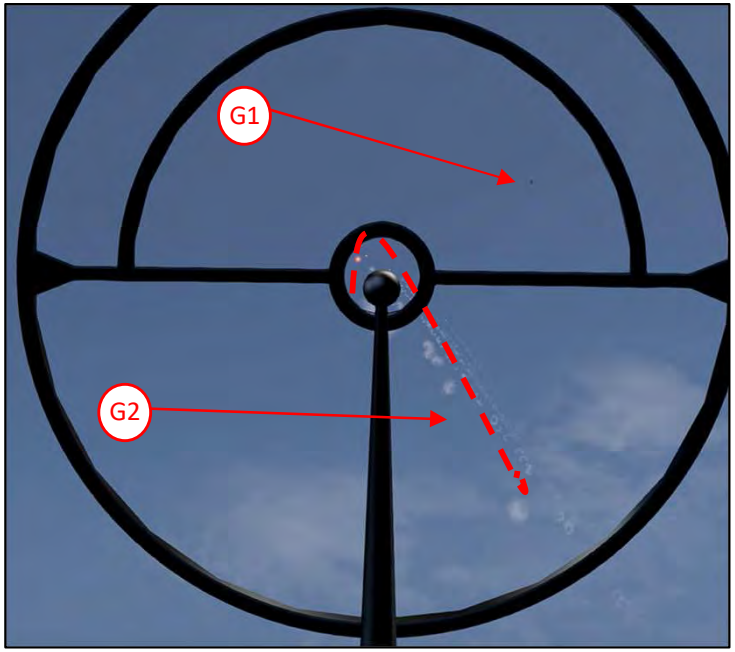
56. When an enemy fighter has been observed heading towards your bomber move to gunsight view ('Shift F1'). Zoom in the view and fire a short burst noting the position of the tracer stream with respect to the sight and enemy fighter

57. Move gunsight so that enemy fighter (G1) is now at a point along where the tracer stream (G2) would go if a second burst was fired

58. Open fire, firing in short bursts while adjusting aim to place tracer stream (G2) through the enemy fighter (G1). Reduce view zoom as required as enemy aircraft comes closer

59. When target is directly behind at less than approx. 400 metres increase burst size (G3)

60. Once enemy has broken off attack commence search for other nearby enemy aircraft. If clear return gunner back to AI by pressing 'Alt F2', only then return to pilot position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash



DESERT WINGS TOBRUK

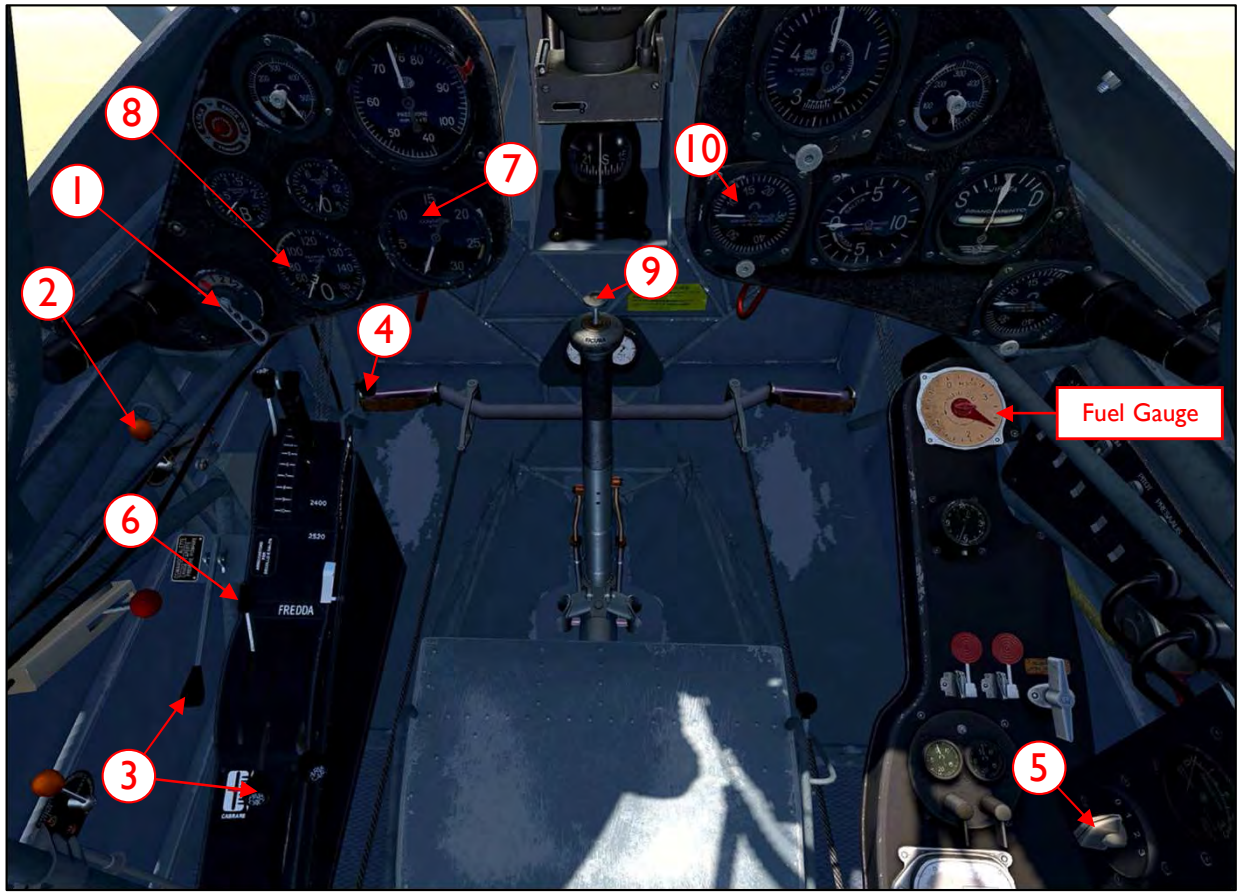
Fiat CR.42 Falco

Starting, taxi, and take-off procedures

1. Apply chocks, magnetos on M 1+2 (1)
2. Open fuel cock by lowering lever (2)
3. Open oil and water radiators (3) to 100%
4. Pull prop pitch (4) to '2520' (100%)
5. Turn temperature selector to position 2 (5)
6. Turn on boost cut-out (6)
7. Apply 15% throttle
8. Start engine (default key 'i')
9. After engine starts adjust throttle to 1200 RPM (7)
10. Wait until oil temperature reaches 30°C (8)
11. Remove chocks
12. Press brakes (9) once to ensure they are disengaged
13. Slowly increase throttle until the aircraft starts to move
14. Steer by using rudder and brakes
15. On runway accelerate with 110% throttle to approx. 150 km/h (10) then pull stick smoothly to take-off
16. Reduce prop pitch (4) to 85-90% to reach 2400 RPM
17. Trim aircraft as required

Landing procedure

18. Reduce speed to 200 km/h
19. Increase prop pitch to '2520' (100%)
20. Open oil and water radiators (3) to 100%
21. Touchdown speed 150 km/h (10)
22. Maintain slight back pressure on joystick until low speed to avoid nose over
23. Keep throttle at 1000 RPM (7)
24. Steer by using rudder and brakes
25. Apply chocks, close fuel cock (2), magnetos to M 0 (1) to finish sortie



Engine Management

Recommended settings for:	Radiators (water/oil)	Throttle	Prop Pitch	RPM
Cruise	75%/75%	100%	80%	2200
Climb	100%/100%	100%	85-90%	2400
Highest speed	50%/50%	110% (*)	100%	2520 (watch temp.)
Never exceed 260°C engine temperature in position 2 (5) /100°C Oil				

(*) with boost cut-out

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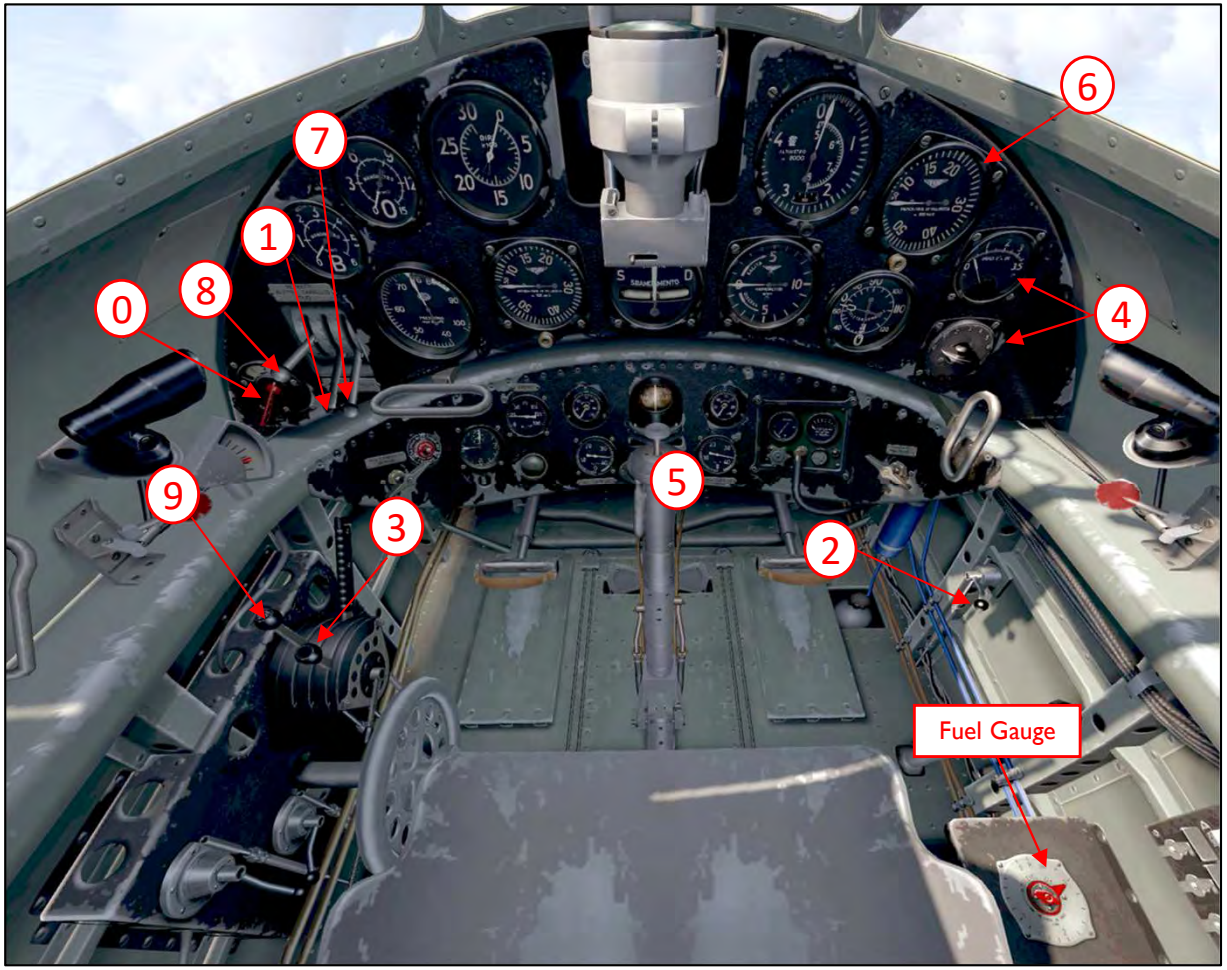
Fiat G.50 Freccia

Starting, taxi, and take-off procedures

1. Apply chocks, magnetos on M 1+2 (0)
2. Open oil- (1) and water-radiators (2) to 100%
3. Set prop pitch (3) to 'Fine' (100%)
4. Turn temperature selector to position 5 (4)
5. Turn on boost cut-out (bind a key)
6. Apply 8% throttle
7. Start engine
8. Wait one minute for the engine to warm up
9. Push to full throttle (110%), after coughing the engine will begin to run smoothly
10. Immediately reduce throttle to 0%
11. Remove chocks
12. Press brakes (5) once to ensure they are disengaged
13. Slowly increase throttle until the aircraft starts to move
14. Steer by using rudder and brakes
15. On runway accelerate with 110% throttle to approx. 160 km/h (6) then pull stick smoothly to take-off
16. Raise undercarriage (7)
17. Trim elevator, rudder, and ailerons as required

Landing procedure

18. Reduce speed to below 300 km/h
19. Lower flaps (8)
20. Maintain approx. 200 km/h
21. Lower landing gear (two stage) on approach (7)
22. Increase prop pitch to 'Fine' 100%
23. Open both radiators full
24. Touchdown speed 150-160 km/h
25. Maintain slight back pressure on joystick until low speed to avoid nose over
26. Steer by using rudder and brakes
27. Apply chocks, mixture 0% (9), magnetos M 0 (0) to finish sortie



Engine Management

Recommended settings for:	Radiators (water/oil)	Throttle	Prop Pitch	RPM
Cruise	65%/55%	100%	85%	2400
Climb	100%/100%	100%	85%	2400
Highest speed	50%/50%	110% (*)	100%	2520 (watch temp.)
Never exceed 260°C engine temperature in position 5 / 100°C Oil (4)				

(*) with boost cut-out

Heinkel He 111 P-2: Pilotage

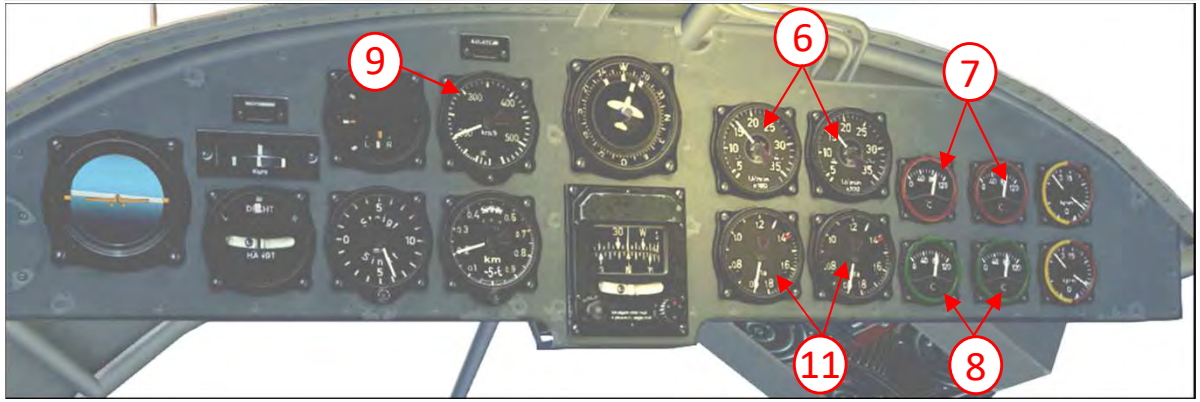
Starting, taxi, and take-off procedures

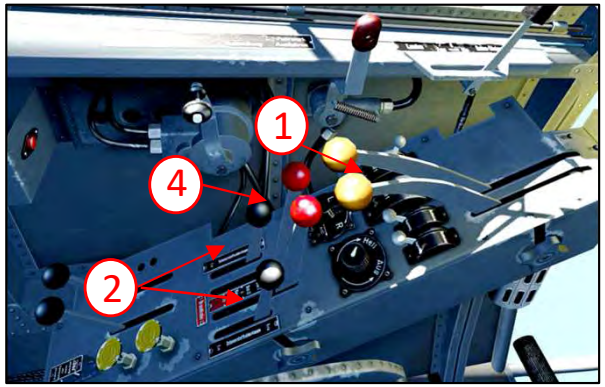
1. Apply chocks
2. Select both engines (default setting). Set magnetos to M1+2 (1)
3. Open oil (2) and water radiators (3) to 100%. Set fuel cocks to 'both tanks' (4)
4. Ensure prop pitch for both engines is at 12:00 o'clock (default position) (5)
5. Select engine 1 and start it ('1' by default). Repeat with 2
6. Select both engines
7. Throttle up and observe RPM (6) to ensure both engines are in sync. Throttle back to 0%
8. Remove chocks
9. Slowly apply throttle and taxi using rudder and toe-brakes to steer
10. Once aligned on the runway, apply chocks
11. Ensure oil (7) and water temperatures (8) are at least 40°C before taking off
12. Throttle to 100% and release chocks. Steer with rudder and gentle toe brakes
13. Take off at approx. 150 km/h (9). Don't let speed get to 200 km/h
14. Raise undercarriage immediately after lift-off using bound key (10)
15. Reduce to 1.23 ATA (11) and remain at or below 2300 RPM (6) during climb

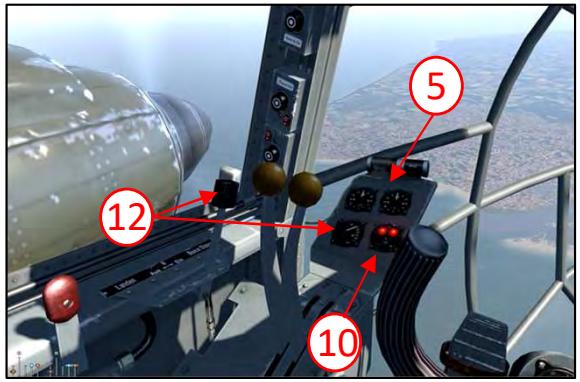
Landing procedure

Note: This aircraft bleeds speed slowly and floats, much more than other aircraft

16. Fully open oil (2) and water radiators (3) to 100%
17. Fly a very flat approach and ensure speed is at or below 200 km/h (9) early in approach
18. Lower flaps (12) and undercarriage (2 green lights (10)) once speed is below approx. 200 km/h (9)
19. Come over runway threshold at approx. 150 km/h (9)
20. Touch down at approx. 140-150 km/h (9)
21. Use rudder to keep straight until under approx. 100 km/h then cautiously apply toe-brakes. Apply chocks and turn off fuel cocks (4)

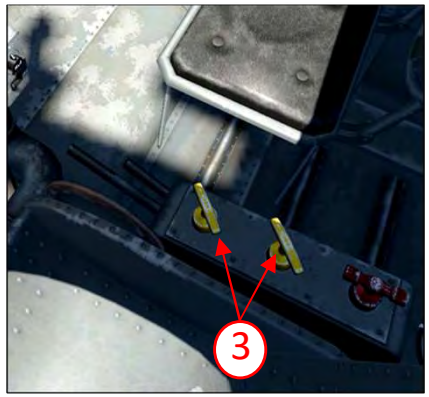






Engine Management

Settings for:	Radiators (water/oil)	Time	ATA	RPM
Cruise	50%/50%	No limit	1.15	2200
Climb	100%/100%	30 min	1.23	2300
Highest speed	As required	5 min	1.3	2400
Never exceed temperature of 100°C for water and 105°C for oil				



Heinkel He 111 H-2: Pilotage

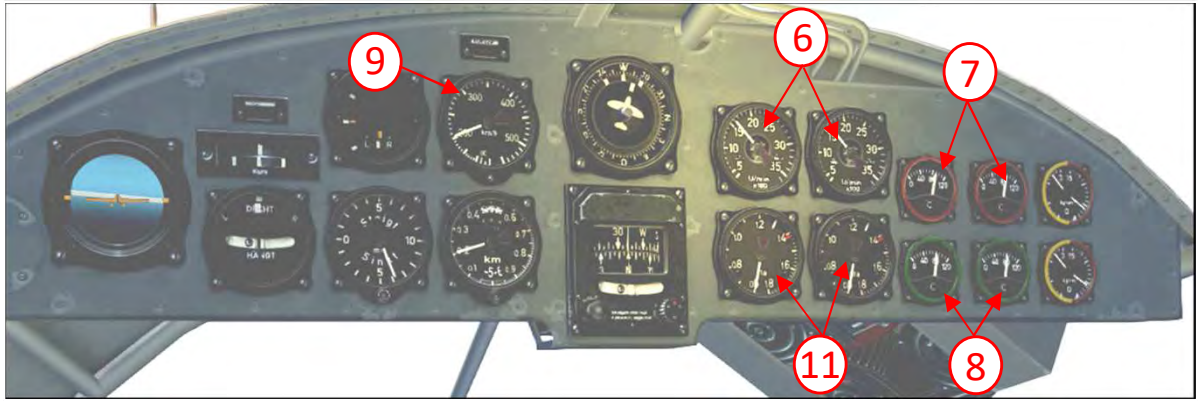
Starting, taxi, and take-off procedures

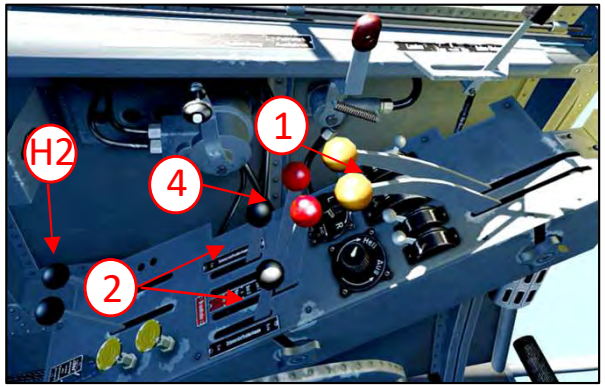
1. Apply chocks
2. Select both engines (default setting). Set magnetos to M1+2 (1)
3. Open oil (2) and water radiators (3) to 100%. Set fuel cocks to 'both tanks' (4)
4. Ensure prop pitch for both engines is at 12:00 o'clock (default position) (5)
5. Select engine 1 and start it ('1' by default). Repeat with 2
6. Select both engines
7. Throttle up and observe RPM (6) to ensure both engines are in sync. Throttle back to 0%
8. Remove chocks
9. Slowly apply throttle and taxi using rudder and toe-brakes to steer
10. Once aligned on the runway, apply chocks
11. Ensure oil (7) and water temperatures (8) are at least 40°C before taking off
12. Throttle to 100% and release chocks. Steer with rudder and gentle toe brakes
13. Take off at approx. 150 km/h (9). Don't let speed get to 200 km/h
14. Raise undercarriage immediately after lift-off using bound key (10)
15. Reduce to 1.15 ATA (11) and remain at or below 2300 RPM (6) during climb. Engage supercharger (H2) @ 1500m

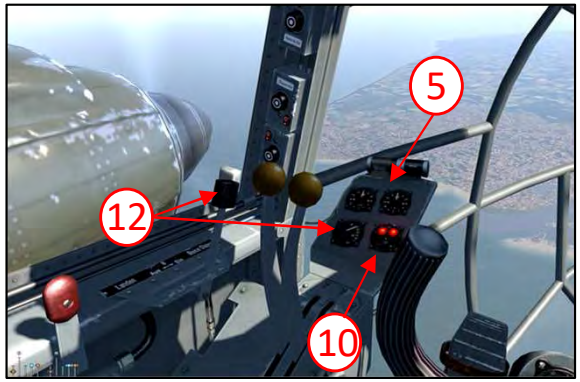
Landing procedure

Note: This aircraft bleeds speed slowly and floats, much more than other aircraft

16. Fully open oil (2) and water radiators (3) to 100%
17. Fly a very flat approach and ensure speed is at or below 200 km/h (9) early in approach
18. Lower flaps (12) and undercarriage (2 green lights (10)) once speed is below approx. 200 km/h (9)
19. Come over runway threshold at approx. 150 km/h (9)
20. Touch down at approx. 140-150 km/h (9)
21. Use rudder to keep straight until under approx. 100 km/h then cautiously apply toe-brakes. Apply chocks and turn off fuel cocks (4)

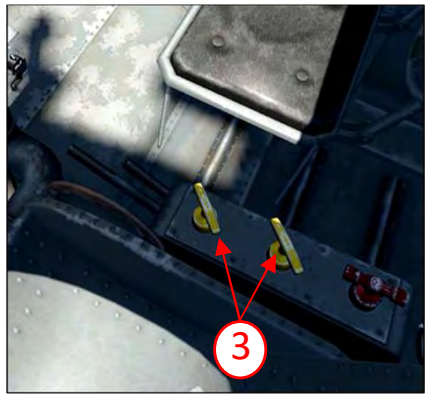






Engine Management

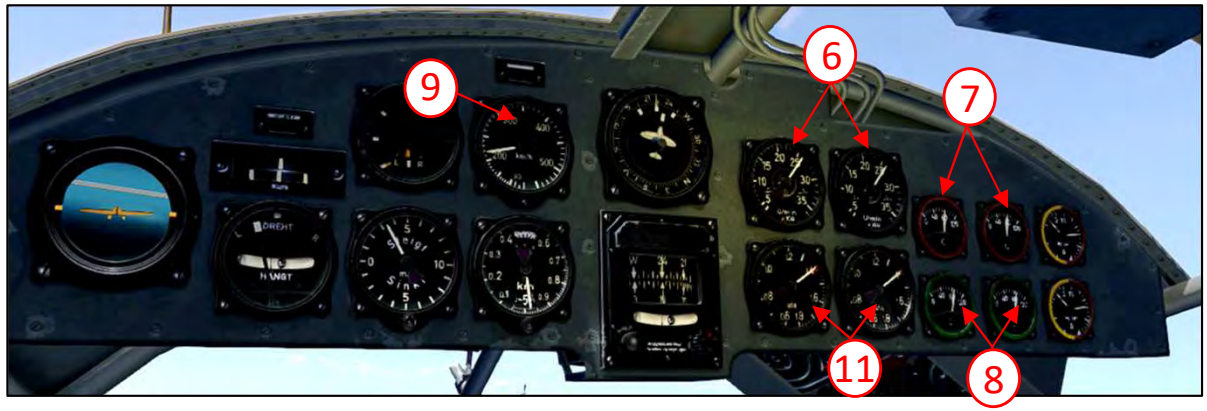
Settings for:	Radiators (water/oil)	Time	ATA	RPM
Cruise	50%/50%	No limit	1.1	2200
Climb	100%/100%	30 minutes	1.15	2300
Highest speed	As required	1 minute	1.35	2400
Never exceed temperature of 95°C for water and 90°C for oil				

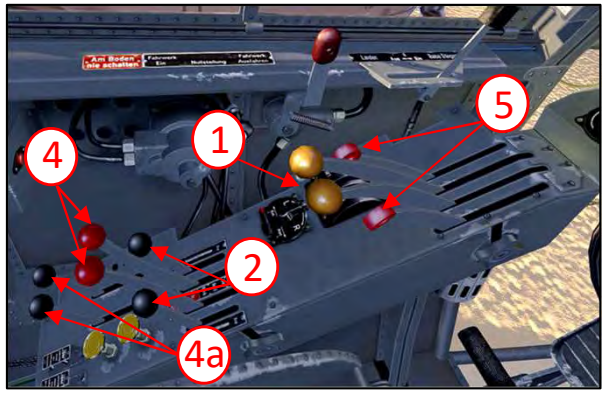


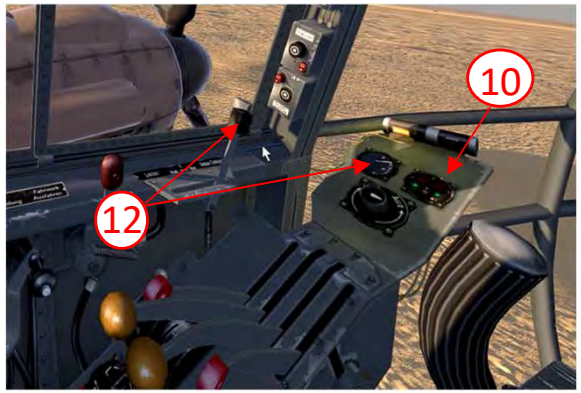
Heinkel He 111 H-6 variant: Pilotage

Starting, taxi, and take-off procedures

1. Apply chocks
2. Select both engines (default setting). Set magnetos to M1+2 (1)
3. Open oil (2) and water radiators (3) to 100%. Set fuel cocks to 'both tanks' (4) and both superchargers (4a) fully fwd to 'automatic' (100%)
4. Ensure prop pitch (5) for both engines is at 100% (fully forward), noting the H-6 uses a constant speed propeller. Recommend use of bound key or joystick button for coarse prop pitch control; precise RPM settings can then be achieved using the in-cockpit pitch levers
5. Select engine 1 and start it ('i' by default). Repeat with engine 2
6. Select both engines
7. Throttle up and observe rpms (6) to ensure both engines are in sync. Throttle back to 0%
8. Remove chocks and slowly apply throttle and taxi using rudder and toe-brakes to steer
9. Once aligned on the runway, apply chocks
10. Ensure oil (7) and water temperatures (8) are at least 40°C before taking off
11. Throttle to 100% and release chocks. Steer with rudder and gentle toe brakes
12. Take off at approx. 150 km/h (9). Don't let speed get to 200 km/h
13. Raise undercarriage immediately after lift-off using bound key (10)
14. Reduce to 1.25 ATA (11) and set prop pitch to achieve 2400 RPM (6) during climb. Propeller pitch will automatically change to keep RPM at this setting







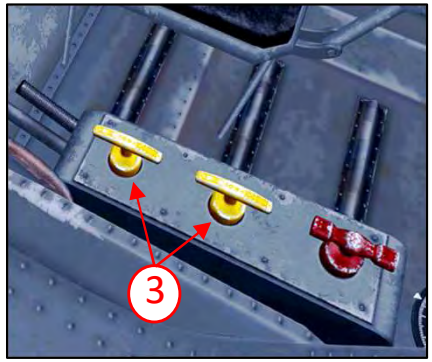
Landing procedure

Note: This aircraft loses speed slowly and floats more than other aircraft

15. Fully open oil (2) and water radiators (3) to 100%
16. Fly a very flat approach and ensure speed is at or below 200 km/h (9)
17. Lower flaps (12) and undercarriage (2 green lights (10))
18. Come over runway threshold at approx. 150 km/h (9)
19. Touch down at approx. 140-150 km/h (9)
20. Use rudder to keep straight until under approx. 100 km/h then cautiously apply toe-brakes. Apply chocks and turn off fuel cocks (4)

Engine Management

Settings for:	Radiators (water/oil)	Time	ATA	RPM
Cruise	50%/50%	No limit	1.15	2200
Climb	100%/100%	30 minutes	1.25	2400
Highest speed	As required	1 minute	1.4	2600
Never exceed temperature of 95°C for water and 90°C for oil				



Heinkel He 111 variants: Auto-pilot, single-engine flight and navigation

Engaging auto-pilot ('Course' and 'Mode 22')

1. Ensure directional gyro heading (12) is the same as stable magnetic compass heading (13) using control knob (14)
2. Align upper (15) and lower bands (16) on directional gyro (recommend using bound keys 'Alt left arrow' or 'Alt right arrow' key)
3. '**Course mode**'. Once aligned activate autopilot (recommend bound key: 'Ctrl A' for toggle autopilot) to maintain heading only
4. '**Mode 22**'. Once aligned activate 'Mode 22' autopilot by stepping through course mode auto-pilot ('Ctrl A'). 'Mode 22' is recommended for high-altitude bombing but its use is not essential
5. After a minute or 2 of altitude and heading adjustments 'Mode 22' will maintain the aircraft's altitude and heading and fly the aircraft straight and level
6. Heading adjustments can be made by changing the directional gyro heading
7. To deactivate 'Mode 22' toggle autopilot

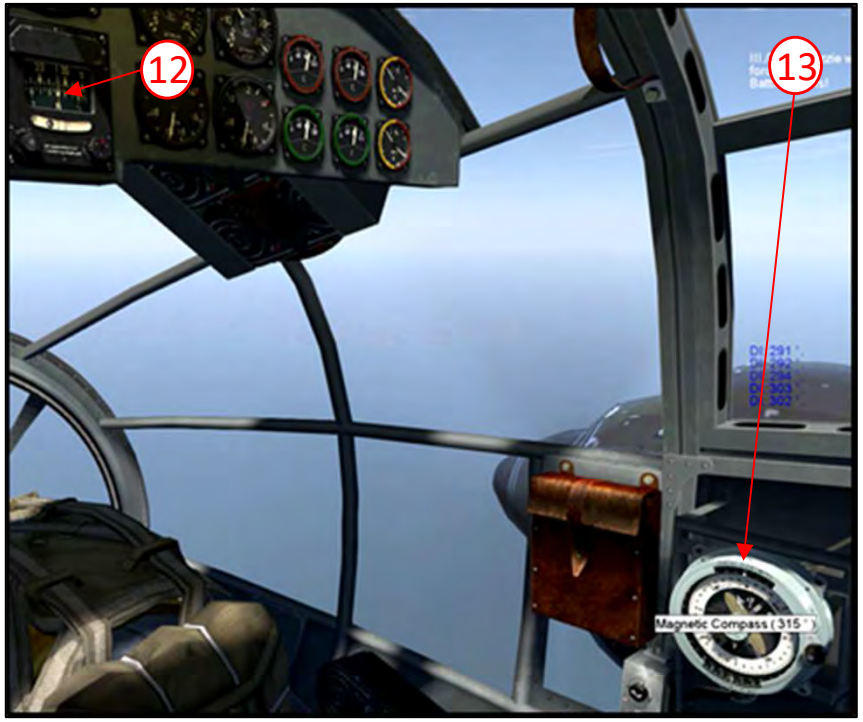
Single engine flight

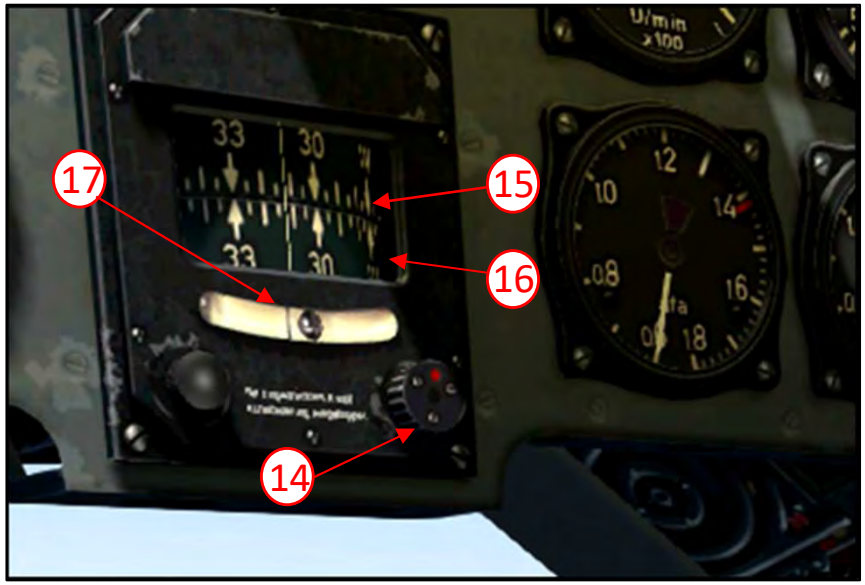
8. Before damaged engine stops or engine control functions start failing select damaged engine
9. Reduce pitch down to approx. 0130 on the dial (5) to feather the propeller which should stop rotating. Fully close radiators (2) and (3)
10. Reselect good engine
11. Ensure RPM (6) and ATA (11) are at safe levels and fully open radiators (2) and (3)
12. Trim aircraft to centre the ball (17) and maintain zero or slightly positive rate of climb if possible

Navigation basics

Navigation is an important aspect of bomber operations. The following provides a basic approach to reasonably accurate navigation in clear weather. More detailed navigation information, including operation of the radio navigation aids and navigation in poor visibility, is beyond the scope of this flashcard but is available elsewhere

13. Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees)
14. During flight ensure gyro compass and magnetic compass are aligned – especially if using autopilot – and manually correct your aircraft's track based on map-to-ground analysis to overfly waypoints

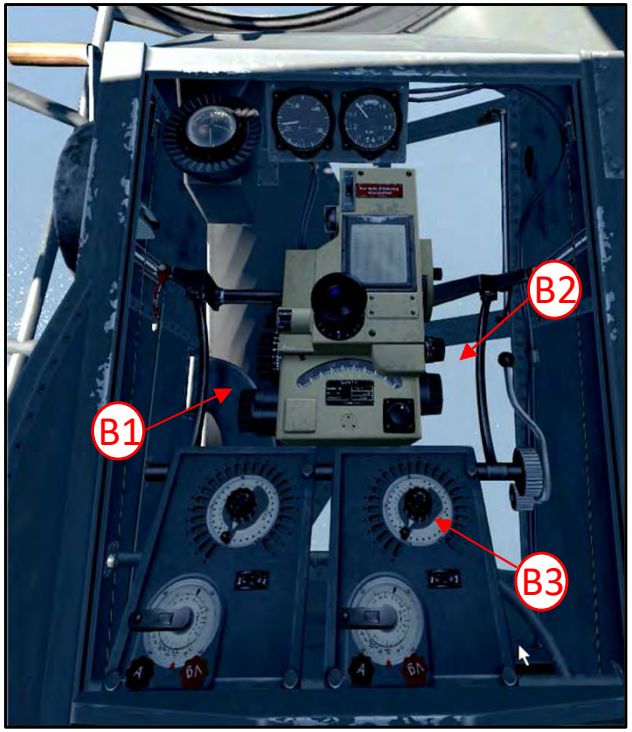




Heinkel He 111 variants: High altitude bombing

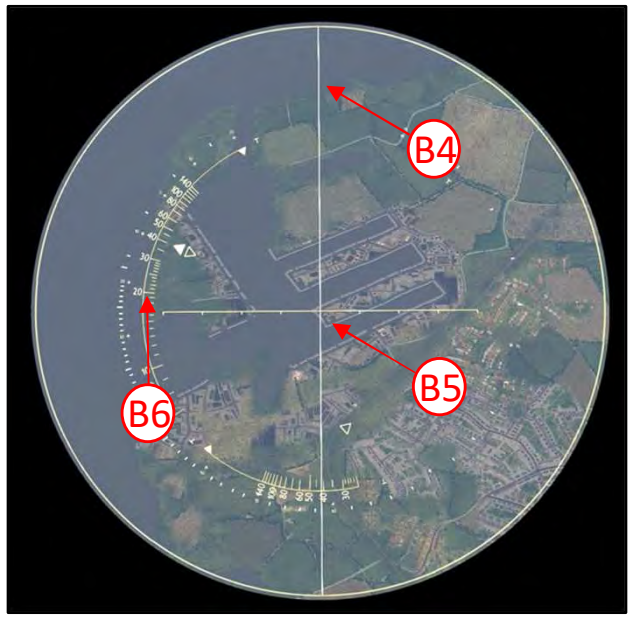
High altitude bombing: Preparation

1. During aircraft selection prior to spawn ensure correct fuze and bombs selected and fuel load adjusted accordingly in loadout
2. Before reaching the initial point (IP) (recommend doing this prior to take off while waiting for engines to warm up) move to bombardier's position ('Alt 2')
3. Adjust intended bombing altitude using bound key (recommend 'Ctrl Numpad 9' to increase, 'Ctrl Numpad 3' to decrease) or control dial (B1) on bombsight. Factor in target altitude when setting bombing height (refer to airport slides at the end of this document)
4. Adjust intended bombing velocity (noting it is true air speed and not indicated) using bound key (recommend 'Ctrl Numpad 7' to increase, 'Ctrl Numpad 1' to decrease) or control dial (B2) on bombsight
5. Set salvo quantity using control (B3) on bombsight
6. Set salvo distance using bound key (recommend 'Shift D' to increase and 'Ctrl D' to decrease)
7. Once IP is reached and aircraft turned to bombing heading engage 'Mode 22'
8. While waiting for aircraft to stabilise in heading and altitude arm bombs using bound key ('Ctrl W') and open bomb bay using bound key ('Alt B')
9. Once aircraft stabilised and engine RPM and ATA in correct zone readjust bombing altitude to reflect current altitude and re-adjust bombing velocity to current true airspeed



High altitude bombing: Target location and lock-on (airfield type target)

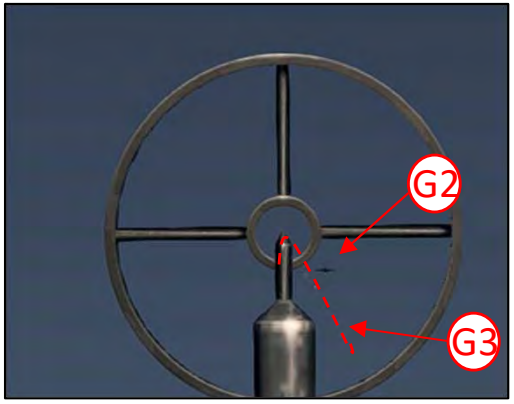
10. Using map-to-ground analysis locate target or target area if target not yet visible
11. Enter bombsight view by using bound key ('Shift F1')
12. Move aircraft heading left or right using changes to directional gyro ('Alt left/right' arrows) until vertical axis of bomb sight runs thru target area (B4)
13. Decrease sight distance of sight using bound key (recommend 'Ctrl Numpad 2' to decrease and 'Ctrl Numpad 8' to increase) until sight is looking down at about 40 degrees (on left hand side of bomb sight display)
14. Pick a point on the ground near the top of the bombsight display that the vertical line runs through. Watch to see if the vertical line moves left and right of this point as it traverses towards the bottom of the display. If it does drift then move bombsight left or right to compensate using bound keys (recommend 'Ctrl Numpad 4' and 'Ctrl Numpad 6')
15. Adjust aircraft heading as required to continue to place target under vertical line. Move horizontal line of bombsight up/down ('Ctrl Numpad 2 and 8') until cross hairs are on target (B5)
16. Once on target activate bomb sight autopilot using bound key (recommend 'Ctrl Numpad 5')
17. Monitor, making small adjustments as required until automatic bomb release at around 20 degrees angle (B6), noting there are no visual or aural indications of bomb release

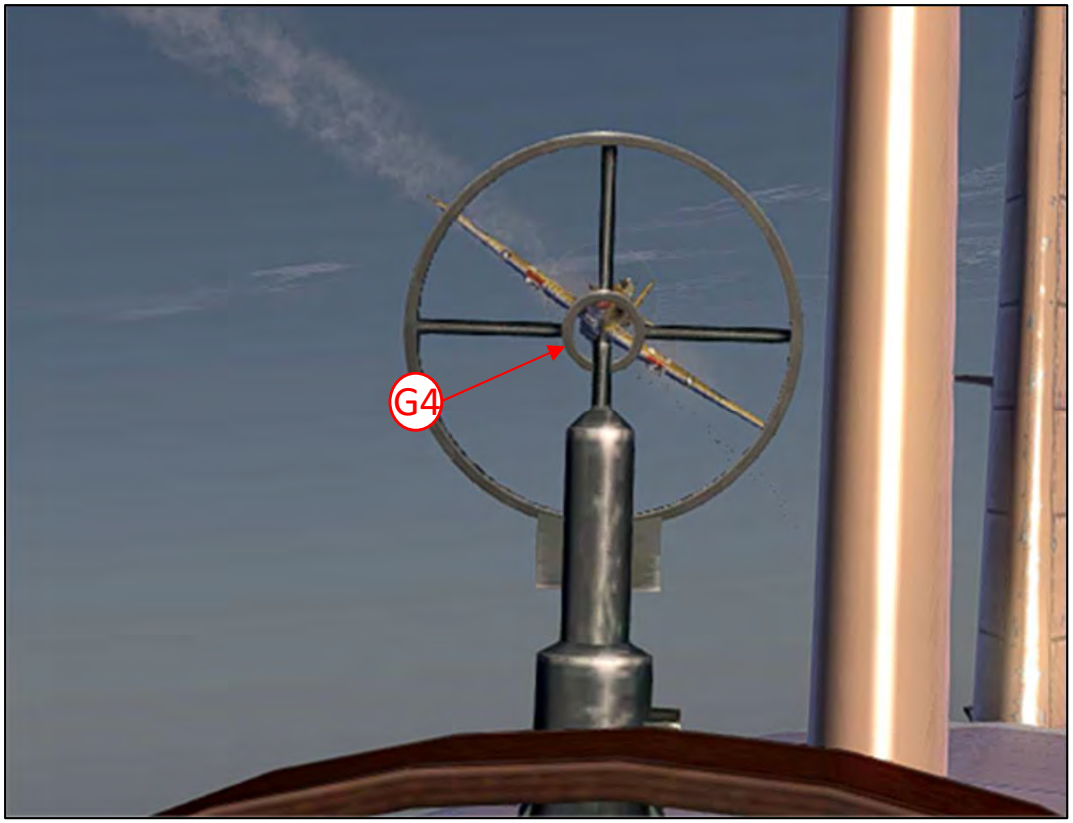


Heinkel He 111 variants: Gunnery

Gunnery

1. Before launching game adjust mouse /gun traverse speed (if required) by altering 'conf' file (located in Documents\1C SoftClub\il-2 sturmovik cliffs of dover) in 'rts_mouse' section by changing X and Y sensitivity to 1.5 or 2 depending on personal preference. Consider inverting mouse direction by changing to 'Invert=1'
2. During aircraft selection prior to spawn-in ensure ammunition load-out includes tracer (recommend at least 1 in 5) and that a convergence range of 500 metres is selected
3. In Options-Controls-General assign key to 'fire current weapon'. Recommend using an unassigned button on joystick and not the mouse button as use of the mouse button will prevent concurrent moving and shooting of the gun
4. Once in area where enemy fighters could be encountered engage 'Course Mode', 'Mode 22' or continue to hand fly the aircraft. With practice, concurrent flying and gunnery is possible and improves gunnery effectiveness as gunnery can be coordinated with aircraft manoeuvre
5. Enter gunner position using bound key (recommend 'Alt 4' for upper dorsal gunner), open rear cockpit hood (recommend 'Ctrl O') and enable mouse control of turret ('F10'). A significant increase in gunner's elevation and azimuth can be achieved by moving gunner's rack (G1). Recommend using bound keys ('Shift left/right/up/down' arrows)
6. When an enemy fighter has been observed heading towards your bomber move to gunsight view ('Shift F1'). Zoom in the view noting the more zoomed in the view, the more gun vibration will be observed. Fire a short burst noting the position of the tracer stream with respect to the sight and enemy fighter
7. Move gunsight so that enemy fighter (G2) is now at a point along where the tracer stream would go if a second burst was fired
8. Open fire, firing in short bursts while adjusting aim to place tracer stream (G3) through the enemy fighter (G2). Reduce view zoom as required as enemy aircraft comes closer
9. When target is directly behind at less than 400 metres increase burst size (G4)
10. Once enemy has broken off attack commence search for other nearby enemy aircraft. If clear return gunner back to AI by pressing 'Alt F2', only then return to pilot position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash





Heinkel He 111 variants: Fuel system management

Fuel system management

1. The He 111 has a total of up to 3450 litres in 4 fuel tanks; inner left (700 l), inner right (700 l), outer left (1025 l) and outer right (1025 l). The H-6 has an additional ventral auxiliary tank (835 l). Fuel for the engines is obtained from the inner tanks, with the outer tanks replenishing the inner tanks manually. Note that the outer tanks start to be filled above 40% load (35% for the H-6)

2. To read contents of the inner left tank (fuel tank 1) select the left inner tank (F1) and then read the upper scale (x 100 l) on the fuel gauge (F2)

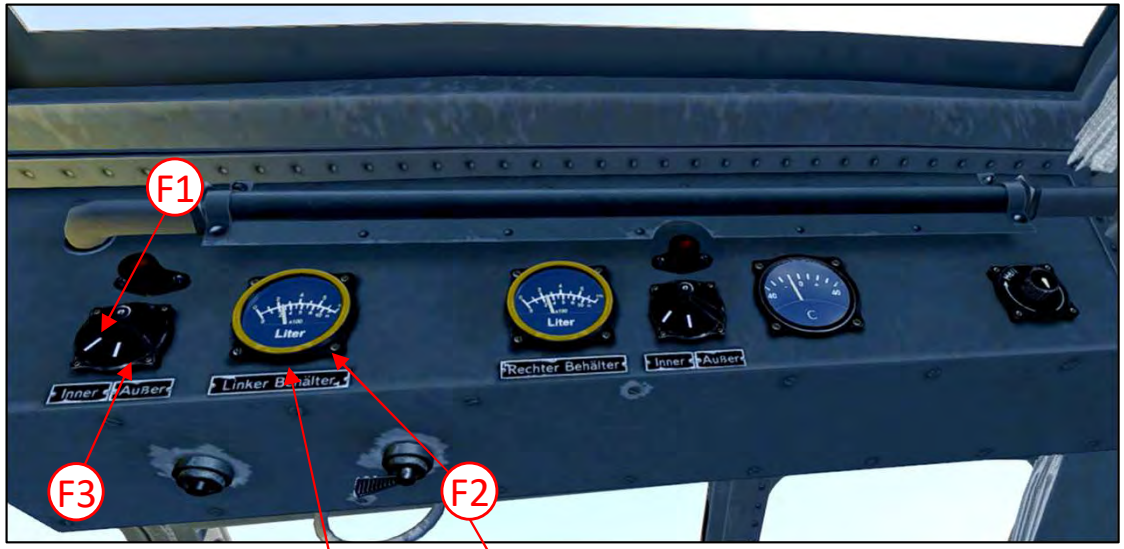
3. To read the contents of the outer left tank (fuel tank 3) select the left outer tank (F3) and then read the lower scale (x 100 l) on the fuel gauge (F4)

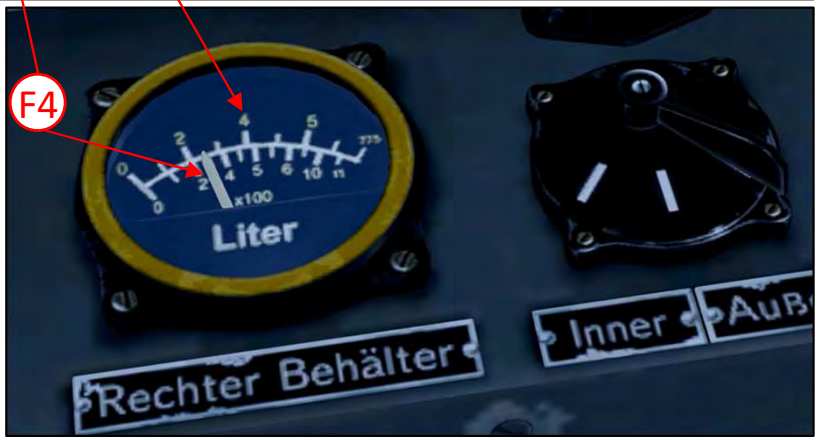
4. Repeat the above to read the contents of the right inner (fuel tank 2) and outer (fuel tank 4) tanks

5. Fuel cock # 3 (F5) is used to select the tank ***FROM*** where the fuel will be taken when transferring fuel. Fuel cock #4 (F6) is used to select the tank the fuel will be sent ***TO***

6. For example; to transfer fuel from the left outer to left inner fuel tanks click and hold your mouse key on fuel cock #3 (F5) and move up or down until the text shows fuel tank 3 (left outer tank). Then click and hold your mouse key on fuel cock #4 (F6) and move up or down until the text shows fuel tank 1 (left inner tank). Drag fuel cock # 3 to OFF when you wish to conclude the fuel transfer

7. Ensure both outer fuel tank contents remain reasonably similar to keep the aircraft's fuel weight evenly distributed and avoid an unbalanced aircraft



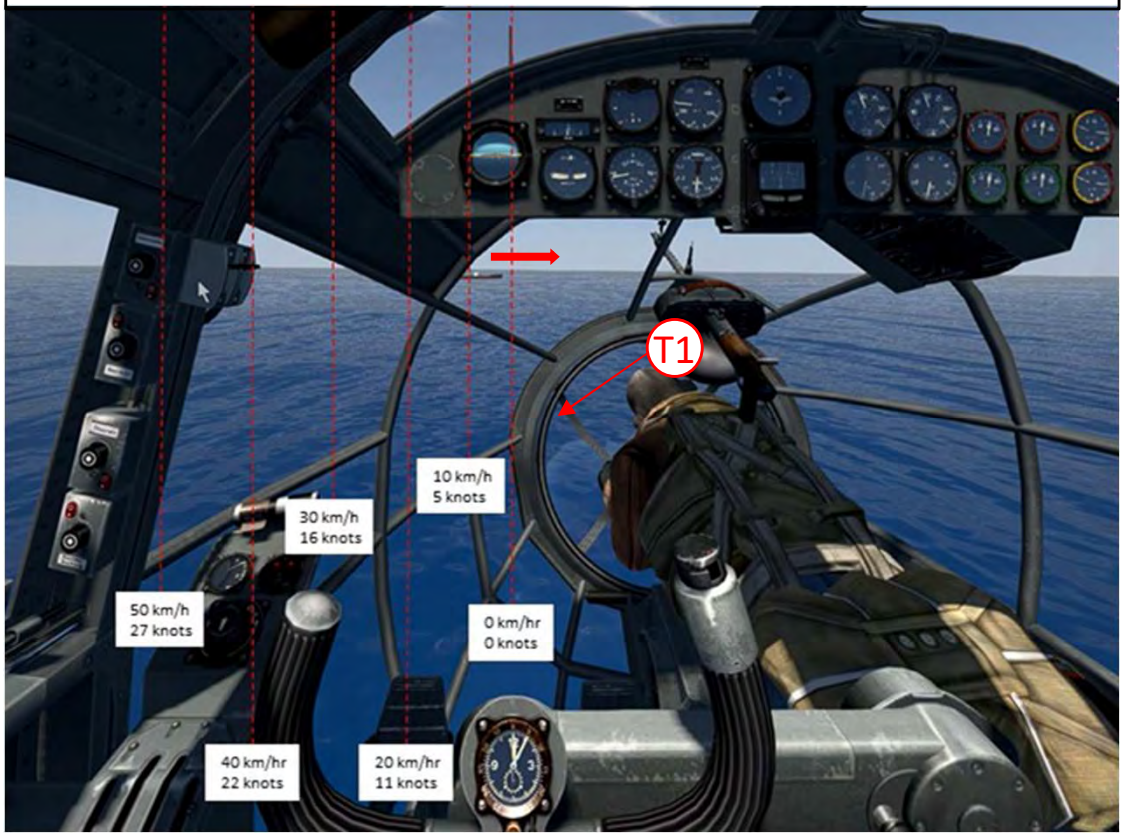


Heinkel He 111 H-6 variant: Torpedo employment

Torpedo employment

1. During aircraft selection prior to spawn-in ensure torpedos are selected and fuel load adjusted accordingly in loadout. Obtain ship speed information from mission brief if available
2. Search for target shipping at 200 m, 220 km/h
3. When ship 'dots' are spotted fly towards dot remaining at 200 m altitude
4. At about 10-12 km range to go the targets should be discernible with view fully zoomed in
5. Adjust flight path to ensure a beam attack is conducted with the ship sailing from your port to starboard (ie from left to right across your nose)
6. Refine your flight path and confirm ship identity at about 6 km range to go
7. Descend to 30-50 m altitude and continue to fly towards target at speed of around 220 km/h
8. Determine attack profile as follows:
   - 8a: For attacks on warships or escorted merchant ships you should plan to drop a single torpedo at about 1000 m range to go
   - 8b: For attacks on unescorted merchant ships you should plan to drop your torpedo at <500 m
9. For attacks on warships: Using the ship speed aiming guide (T1) and the estimated ship speed from your mission brief fly your aircraft to place the target ship on the applicable speed line when you reach approx. 1000 m range to go. This range can be estimated by using your thumb (T2)
10. Drop a single torpedo and then conduct a full throttle max rate turn away
11. Once established in your egress consider entering the rear turret to see if your torpedo hit. Repeat attack if torpedo missed
12. For attacks on merchant ships: Either conduct your drop at 1000 m using the same procedure as for warships or approach until very close and conduct the drop 'by eye' using your own estimated offset

Place target ship on relevant aiming line based on estimated ship speed



When view fully zoomed in at approx. 1000 m range to go this distance is approx. the thickness of 180 cm tall adult male thumb

Historical note

Accurate torpedo employment was difficult due to a range of factors including imprecise distance and ship speed information, torpedo performance variables and enemy action. Aircrew who flew these missions often conducted extensive training. By way of comparison, at the end of 1942 Wellington-dropped torpedoes in the Mediterranean had a hit rate of 28%.

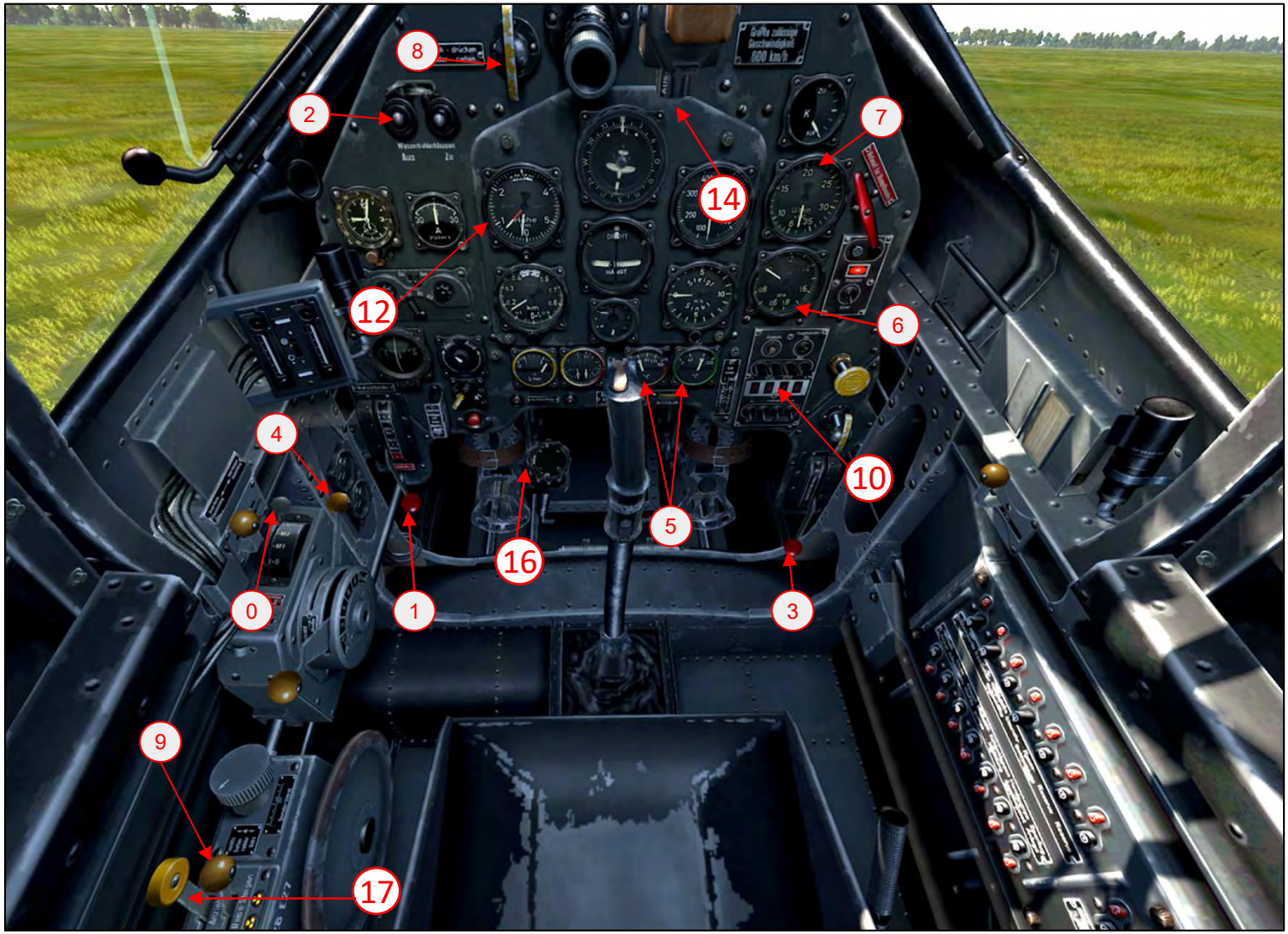
Junkers Ju 87 B-2: Pilotage

Start up, taxi and take-off procedure

1. Apply chocks, set magnetos on M 1+2 (0)
2. Open fuel cock (fuel tank selector to 'Both') (1) and set supercharger fully forward to automatic mode (0%) (8)
3. Open water- (2) and oil-radiators (3)
4. Set propeller pitch (4) to 'Full fine' (100%)
5. Start engine
6. When oil is at 15ºC and water at 30ºC (5) remove chocks and release breaks
7. Slowly apply throttle and taxi using rudder and toe brakes to steer
8. Open throttle to 100% (1.35 ata for a maximum of one minute) (6)
9. Use rudder to steer and as speed increases pull control stick back slightly to prevent nose over
10. At approx. 155-160 km/h take off (7)
11. Set 1.15 ata and 2300 RPM for climb out

Landing procedure

12. Open water (2) and oil radiators (3) and set supercharger to auto mode once <1500m
13. Lower flaps and set propeller pitch to 'Full fine' on approach (9)
14. Touchdown speed 150 km/h
15. Use light rudder inputs to steer
16. After touchdown maintain slight back pressure on joystick to avoid nosing over
17. Steer by applying rudder and brakes carefully
18. Apply chocks, close fuel cock to finish sortie



Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	80%	100%	1.0	2200 (up to 6000m)
Climb	100%	100%	1.15	2300
Highest speed	40%	100%	1.35	2400 (1 min max.)
Never exceed 95ºC water and 90ºC oil temperature				

Junkers Ju 87 B-2: Dive bombing

Dive bombing

19. During aircraft selection prior to spawn-in ensure correct fuze and bombs selected
20. After spawn-in check the presence of red lights on the bomb selection panels (10) to confirm bombs are loaded
21. Before reaching target area select which bombs you will drop (wing, fuselage or both) using the bomb selection panel (10). Cycle through the options using the selection knobs (11) as follows:

All (wing and fuselage bombs dropped)
Flat section of knobs are all horizontal (– – – –)
All 5 lights are red

Slot #1 (fuselage bomb only)
Two left knobs horizontal, two right knobs vertical (– – | |)
Only 1 light is red

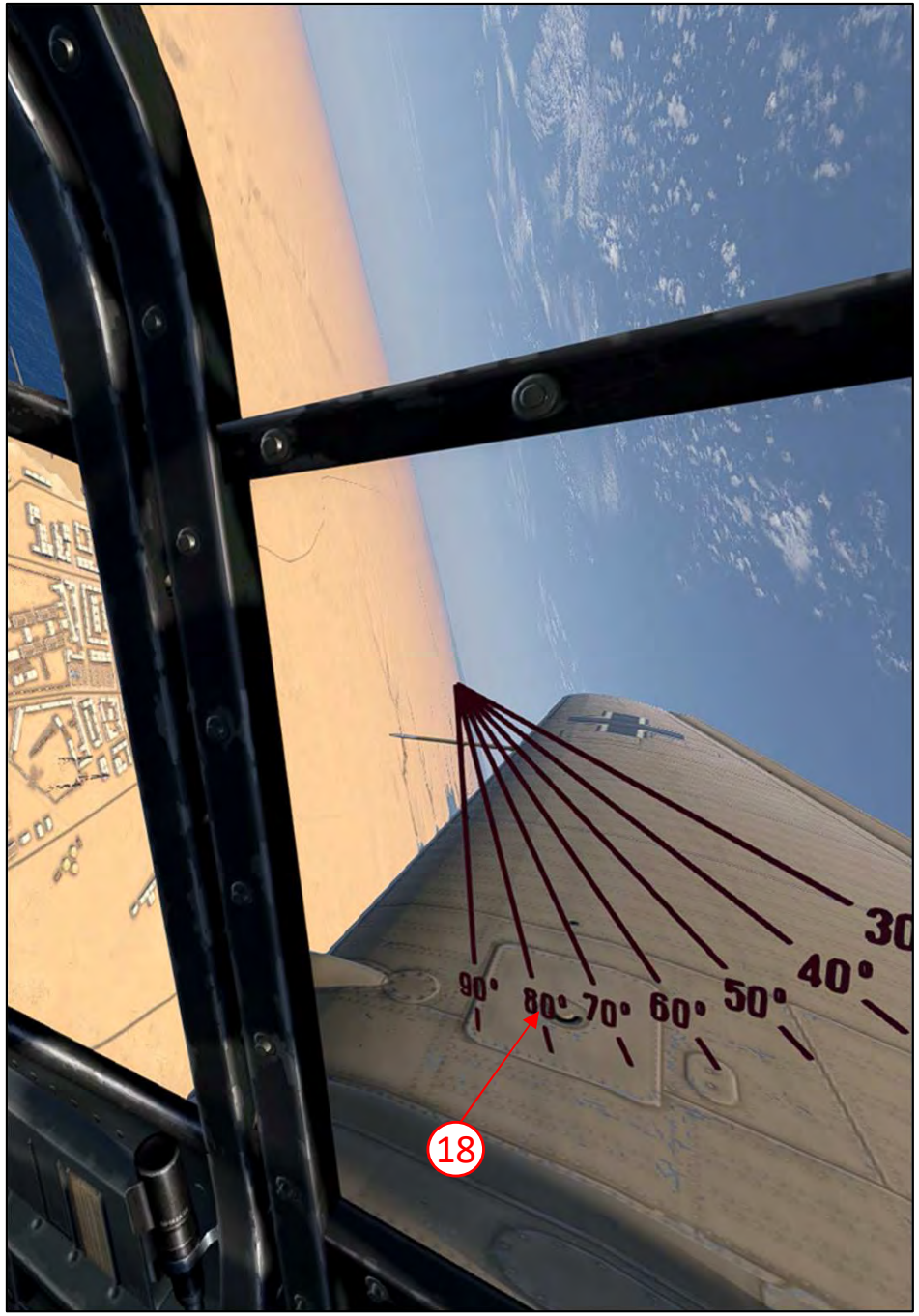
Slot #2 (wing bombs only)
Two left knobs vertical, two right knobs horizontal (| | – –)
Only 4 lights are red

22. Before reaching target area set automatic dive pull-out altitude on bomb altimeter (12) using control knob (13) to adjust red/white clock dial hands to desired altitude. Recommend a minimum pull-out altitude of at least 650 m above target altitude be used. Do not set automatic dive pull-out altitude to be higher than current altitude as the automatic function will not work

Junkers Ju 87 B-2: Dive bombing (continued)

Dive bombing (continued)

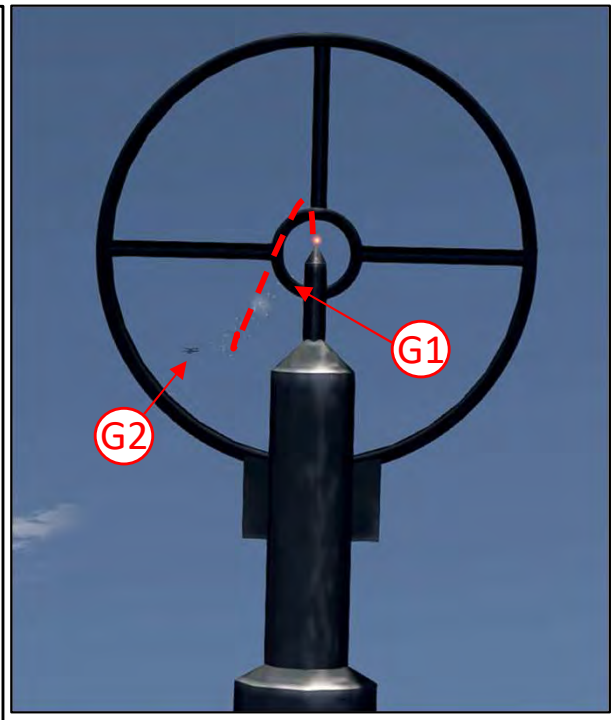
23. Approaching target area ensure gunsight is on (14)
24. Arm bombs by clicking buttons (15) on bomb selection panel (10) – see previous slide. Bombs are armed when switches are pointing up
25. Open floor window by clicking on floor window dial (16) and manoeuvre aircraft so that target will be visible through this window
26. Set supercharger (8) to auto. As target moves to the aft of the floor window set throttle to idle, engage airbrakes (17) and push nose over until target becomes visible in gunsight
27. Manoeuvre aircraft to achieve a vertical dive angle of at least 80 degrees (18) and enter gunsight view ('Shift F1') for final adjustments to line up on target
28. Monitor altimeter and be prepared to manually pull out of dive if automatic pull out doesn't activate at set height. After pull out retract airbrakes, throttle up and egress the target area

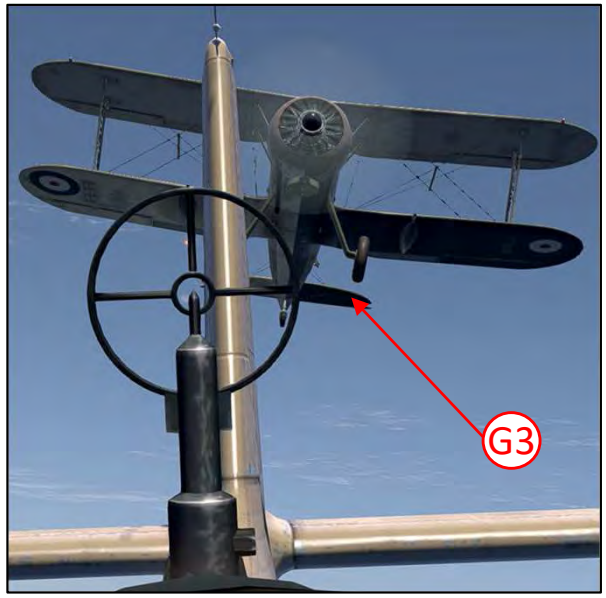


Junkers Ju 87 B-2: Rear gunnery and basic navigation

Gunnery

29. Before launching game adjust mouse/gun traverse speed (if required) by altering 'conf.ini' file (located in Documents\1C SoftClub\il-2 sturmovik cliffs of dover) in 'rts_mouse' section by changing X and Y sensitivity to 1.5 or 2 depending on personal preference. Consider inverting mouse direction by changing to 'Invert=1'
30. During aircraft selection prior to spawn-in ensure ammunition load-out includes tracer (recommend at least 1 in 5) and that a convergence range of 500 metres is selected
31. In Options>Controls>General assign key to 'fire current weapon'. Recommend using an unassigned button on joystick and not the mouse button as use of the mouse button will prevent concurrent moving and shooting of the gun
32. Once in area where enemy fighters could be encountered engage autopilot or continue to hand fly the aircraft. With practice, concurrent flying and gunnery is possible and improves gunnery effectiveness as gunnery can be coordinated with aircraft manoeuvre
33. Enter gunner position using bound key (default 'C'). Open rear cockpit hood (recommend 'Ctrl O') and enable mouse control of turret ('F10')
34. When an enemy fighter has been observed heading towards your aircraft enter gunsight view ('Shift F1') and zoom in the view. Fire a short burst noting the position of the tracer stream (G1) with respect to the sight and enemy fighter (G2)
35. Move gunsight so that enemy fighter is now at a point along where the tracer stream would go if a second burst was fired
36. Open fire, firing in short bursts while adjusting aim to place tracer stream through the enemy fighter. Reduce view zoom as required as enemy aircraft comes closer
37. When target is directly behind at less than 400 metres increase burst size (G3)
38. Once enemy has broken off attack commence search for other nearby enemy aircraft. If clear return gunner back to AI by pressing 'Alt F2', only then return to pilot position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash





Navigation basics

Navigation is an important aspect of Stuka operations, especially long-range missions deep into enemy territory. The following provides a basic approach to reasonably accurate navigation in clear weather conditions

39. Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees)
40. During flight correct your aircraft's track based on map-to-ground analysis to overfly waypoints

Ju 88 Variants - Comparisons

The main differences in the various Ju 88 Types in the game are summarized in these two tables. They can be divided into two main categories.

Bombers: A-Series: designed as bombers, with massive bomb load capacity (up to 2400 kg), equipped with the Lotfe 7 automatic bombsight, and dive brakes for accurate dive bombing

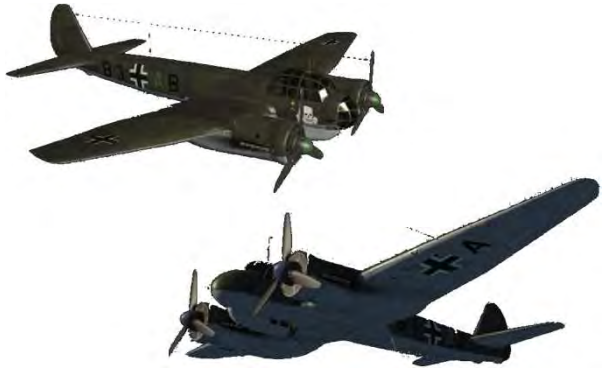
Fighters: C-Series: designed as heavy fighters, mainly to destroy ground targets. Bombing capability limited to 10 x 50 kg bombs mostly for tactical and support purposes

The Ju 88 can be further split into two sub categories, by type of engine and pitch mode used.

Jumo 211B-1: With manual propeller pitch control (A-1 and A-5, C-1 and C-2)

Jumo 211F: With automatic constant speed pitch control (A-5 Late, C-4, C-4 Late)

Trop versions: Each type also has its Trop version whereby a sand filter was fitted to avoid damage due to the desert dust, but at the cost of some engine performance



	Prop Pitch Control	
	Manual	**Constant Speed**
Bomber	A-1, A-5 A-5/Trop	A-5 Late, A-5 Late/Trop
Fighter	C-1, C-2, C-2/Trop	C-4, C-4/Trop, C-4 Late, C-4 Late/Trop

	Ju 88 Type	Jumo Engine	Prop Pitch	Forward Nose Gun	Rear Top Gun	Rear Ventral Gun	Forward Cannons	Front Bomb Bay	Rear Bomb Bay	Wing Bomb rack	Lotfe 7 Bombsight	Dive Brakes	Wings
Bomber	A-1	211B-1	manual	7.92 mm	1 x 7.92 mm	1 x 7.92 mm	no	8 x 50 kg or 18 x 50 kg	10 x 50 kg	4 x 250 kg or 2 x 500 kg	yes	yes	short
	A-5				2 x 7.92 mm								long
	A-5 /Trop												
	A-5 Late	211F	constant speed										
	A-5 Late/Trop												
Fighter/Bomber	C-1	211B-1	manual		1 x 7.92 mm		3 x 7.92 mm 1 x 20 mm	no		no	no	no	short
	C-2												long
	C-2/Trop												
	C-4	211F	constant speed										
	C-4/Trop												
	C-4 Late			no	2 x 7.92 mm	no	3 x 7.92 mm 3 x 20 mm						
	C-4 Late/Trop												

Junkers Ju 88 - Manual Prop Pitch variants - Pilotage

(A-1, A-5, A-5/Trop, C-1, C-2, C-2/Trop)

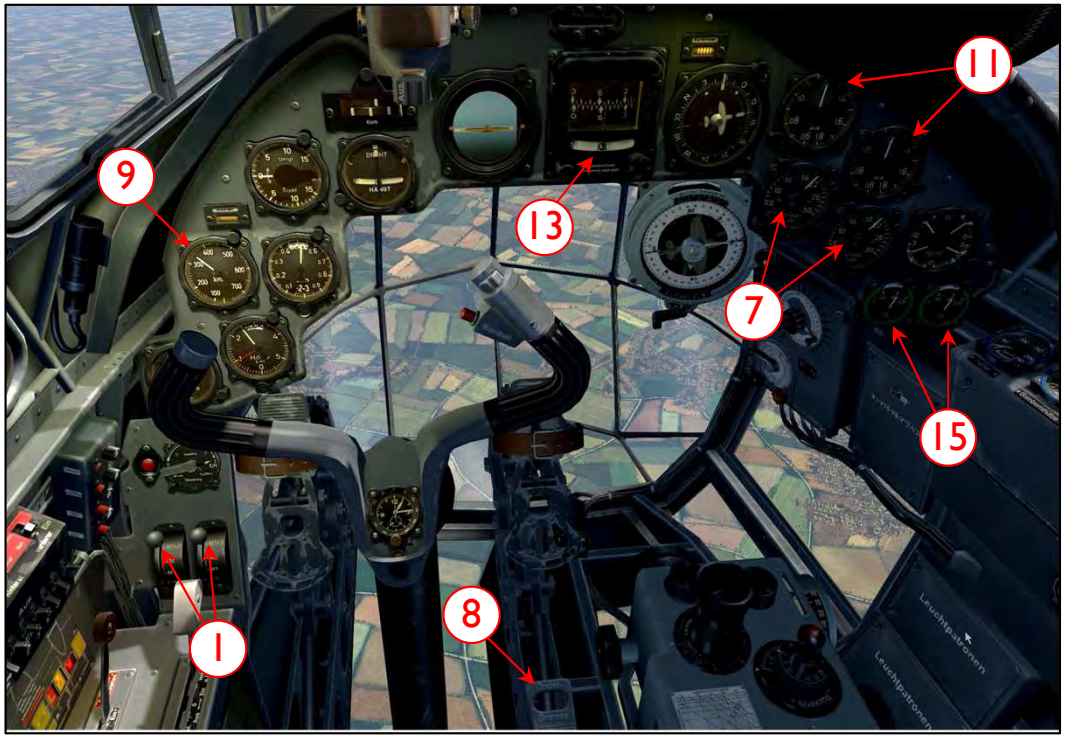
Starting, taxi, and take-off procedures

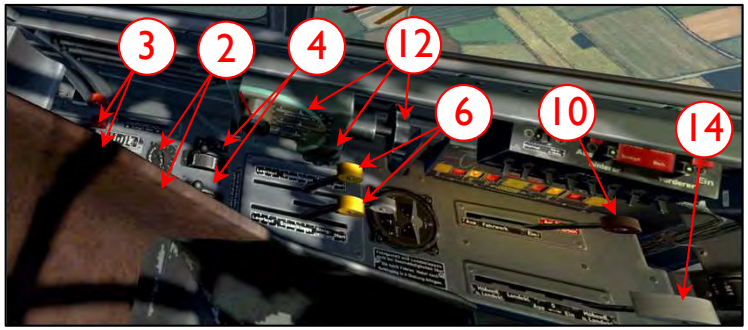
1. Apply chocks. Magnetos on M1+2 (1)
2. Select both engines (by default)
3. Open oil (bind keys) and water (2) radiators, set fuel cocks to 'BOTH' (3)
4. Ensure prop pitch (4) for both engines are on 12:00 o'clock (5) (default)
5. Select engine 1 and start it, repeat with engine 2
6. Select both engines
7. Throttle up (6), observe RPM (7) are in synch for both engines, then throttle back to 0%
8. Remove chocks and release breaks
9. Slowly apply throttle and taxi using rudder and toe-brakes to steer
10. Once aligned on the runway, apply chocks, lock tailwheel (8) (optional)
11. Throttle to 100% and release chocks. Steer with rudder and gentle toe brakes
12. Take off above 160 km/h (9), do not let speed exceed 180 km/h on the ground
13. Apply gentle back stick to take-off, keep speed above 200 km/h when airborne
14. After lift-off raise undercarriage (10) and **immediately** reduce pitch (4) to 11:30 position (5), reduce throttle to approx. 90% to not exceed 1.3 ata (11)
15. Trim the plane on 3 axes (12) to stabilize climb speed at 250 km/h and keep ball (13) centered, while constantly adjusting prop pitch and throttle to maintain RPM and ata within engine limits

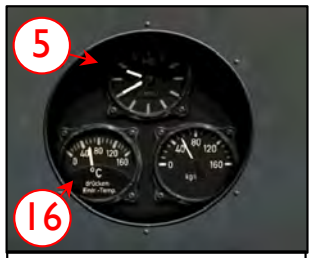
Pilot tips: The Ju 88 with manual pitch control is very sensitive to RPM variations pitch when accelerating. Constantly monitor RPM (7) and ata (11) not to exceed maximum limits, especially when levelling or diving

Landing procedure

16. Fully open oil (bind key) and water (2) radiators to 100%
17. Reduce speed to below 250 km/h (9)
18. Lower two-stage flaps (14)
19. Lower undercarriage (10)
20. Set prop pitch (4) to 12:00 o'clock position (5)
21. Maintain approx. 200 km/h by adjusting throttle - trim aircraft (12)
22. Touch down at 180 km/h - maintain back stick pressure to avoid nose down
23. Under 100 km/h steer with rudder and toe-brakes
24. Apply chocks, fuel cocks to 'OFF' (3), magnetos (1) on M0, to finish sortie







Dials are located on the engine nacelles, outside

Engine Management

Recommended settings for:	Radiators (water / oil)	Throttle	ATA	RPM
Cruise	40% / 40% (on deck) 75% / 75% (altitude)	90%	1.1	2200 (no limit)
Climb	100% / 100%	100%	1.15	2300 (30' max.)
Highest speed	As required	100%	1.35	2400 (1' max.)
Never exceed temperature of 95°C for water (15) and 90°C for oil (16)				

Junkers Ju 88 - Auto Prop Pitch variants - Pilotage

(A-5 Late, A-5 Late/Trop, C-4, C-4/Trop, C-4 Late, C-4 Late/Trop)

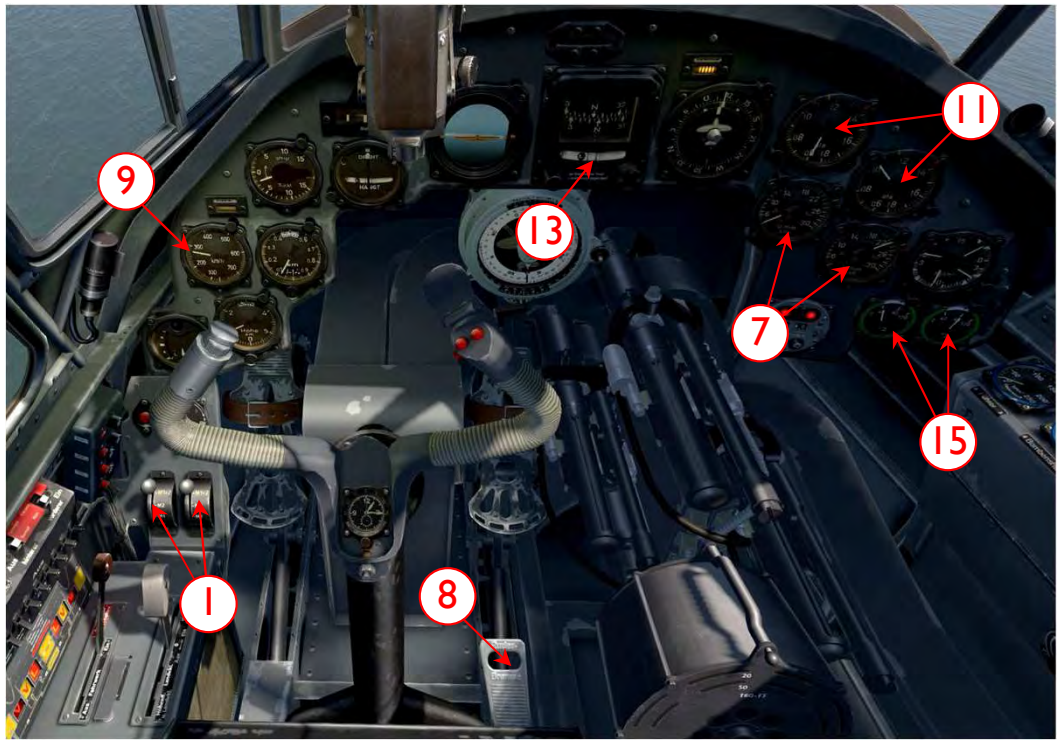
Starting, taxi, and take-off procedures

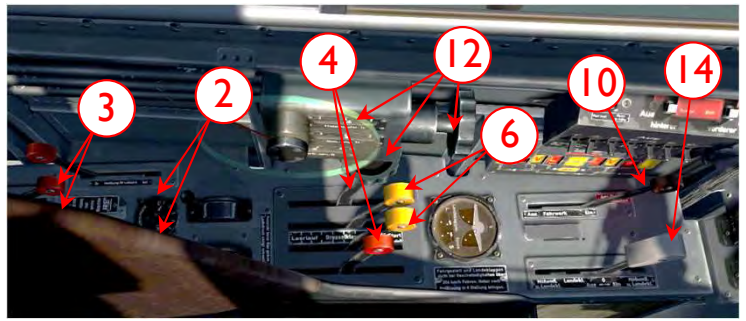
1. Apply chocks. Magnetos on M1+2 (1)
2. Select both engines (by default)
3. Open radiator cowls (2), set fuel cocks to 'BOTH' (3)
4. Select prop pitch (bind keys) to 'Constant Speed' and set to 100% (4)
5. Select engine 1 and start it, repeat with engine 2
6. Select both engines
7. Throttle up (6), observe RPM (7) are in synch for both engines, then throttle back to 0%
8. Remove chocks and release breaks
9. Slowly apply throttle and taxi using rudder and toe-brakes to steer
10. Once aligned on the runway, apply chocks, lock tailwheel (8) (optional)
11. Throttle to 100% and release chocks. Steer with rudder and gentle toe brakes
12. Take off above 160 km/h (9), do not let speed exceed 180 km/h on the ground
13. Apply gentle back stick to take-off, keep speed above 200 km/h when airborne
14. After lift-off raise undercarriage (10), **immediately** reduce pitch to 85% (4) and reduce throttle to maintain 2400 RPM (7) and 1.25 ata (11)
15. Trim the plane on 3 axes (12) to stabilize climb speed at 250 km/h and keep ball (13) centered

Pilot tips: The manual pitch mode is only needed when the governor is damaged. You can otherwise remain in automatic mode at all times with prop pitch set between 85% (in climb) and 75% (in cruise) to keep RPM (7) as per engine management table. Monitor ATA (11) and adjust throttle to keep it at recommended values, especially when changing altitudes.

Landing procedure

16. Fully open radiator cowls (2) to 100%
17. Reduce speed to below 250 km/h (9)
18. Lower two-stage flaps (14)
19. Lower undercarriage (10)
20. Maintain approx. 200 km/h by adjusting throttle - trim aircraft (12)
21. Touch down at 180 km/h - maintain back stick pressure to avoid nose down
22. Under 100 km/h steer with rudder and toe-brakes
23. Apply chocks, fuel cocks to 'OFF' (3), magnetos (1) on M0, to finish sortie





Dials are located on the engine nacelles, outside

Engine Management

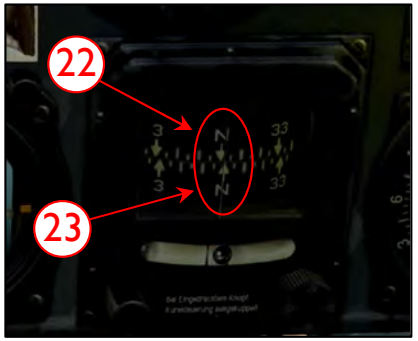
Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	40% (on deck) 75% (altitude)	90%	1.15	2250 (no limit)
Climb	100%	100%	1.25	2400 (30' max.)
Highest speed	As required	100%	1.4	2600 (1' max.)
Never exceed temperature of 95°C for water (15) and 90°C for oil (16)				

Junkers Ju 88 - Auto-pilot
(All variants)

Auto-pilot instruments

There are two autopilot modes: 'Course Mode' which controls direction only (to use when climbing or descending), and 'Mode 22', which controls both direction and altitude (to use for level flight and bombing). First let us familiarize with the instruments:

(17) Autopilot ON/OFF switch
(18) Autopilot ON/OFF indicator
(19) Course setter (rotates both the magnetic and repeater compasses so that desired course points to the 12:00 o'clock position)
(20) Magnetic compass
(21) Repeater compass
(22) Directional gyroscope
(23) Course autopilot preset
(24) Course Autopilot Deviation (indicates if you deviate from preset course - turn towards where the needle moves to get back on course)

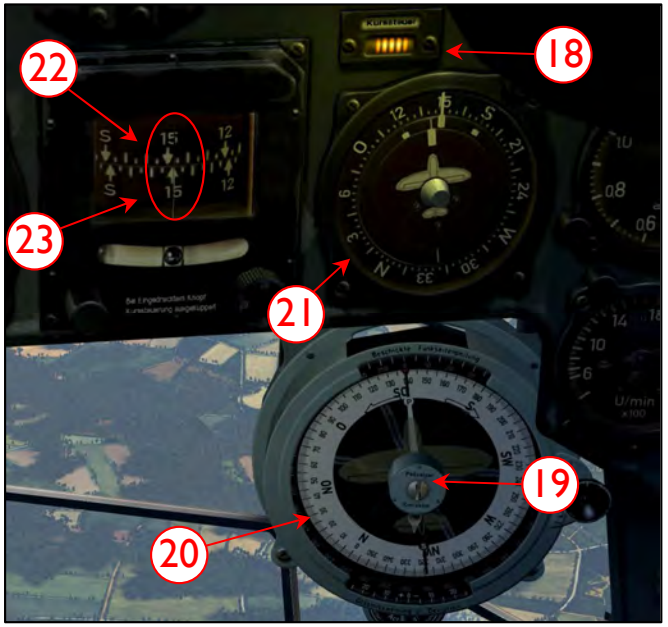


Tip: when dials (22) and (23) are aligned the plane will fly straight, regardless of what the numbers are

Tip: Depending on your heading, there may be a mismatch between the magnetic compass (20), the repeater compass (21) and the directional gyro (22). This is normal and is caused by magnetic interferences in the plane. In doubt, prefer the reading of the magnetic compass (20).

The simple way to use the autopilot:

Keep the course autopilot preset (23) always on 'N'. Turn the plane manually until you are on your desired course, then turn the directional gyroscope (22) until it also point to 'N'. Engage 'Course Mode' (17). The plane will lock on its current heading. You can finetune by rotating the directional gyro (22) by a few degrees left or right. The plane will turn until the dials align again. Always read your heading on the repeater compass (21). This is the same technique as used in British planes.



The proper way to use the autopilot:

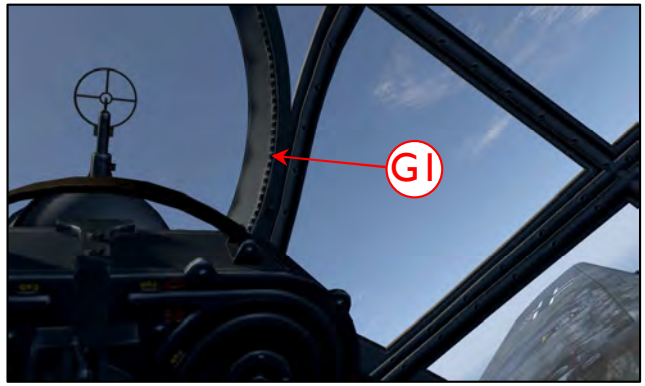
In the following example we wish to fly a course of 150° magnetic

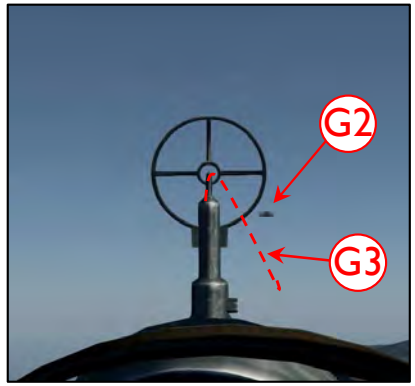
1. Increase/decrease the directional gyro (22) to read your current heading as indicated on the magnetic compass (20)
2. Increase/decrease the course setter (19) to bring 150° to 12:00 o'clock on the repeater (21)
3. Increase/decrease the autopilot pre-set (23) to read 150°
4. Manually turn the aircraft to +/- 10° of the intended course (the white plane symbol on the repeater compass (21) should point up), then engage 'Course Mode' (17). The directional gyro (22) will align with the autopilot pre-set (23) and you will be flying on the intended course of 150°
5. Adjust course left/righ by increasing/decreasing the autopilot pre-set (23) or the directional gyro (22)
6. When you have reached your intended altitude, engage 'Mode 22'. The aircraft will lose 600-800 m to increase speed before stabilising, so always allow for this gap before engaging 'Mode 22'. Be prepared to adjust prop pitch as RPM will increase rapidly with speed

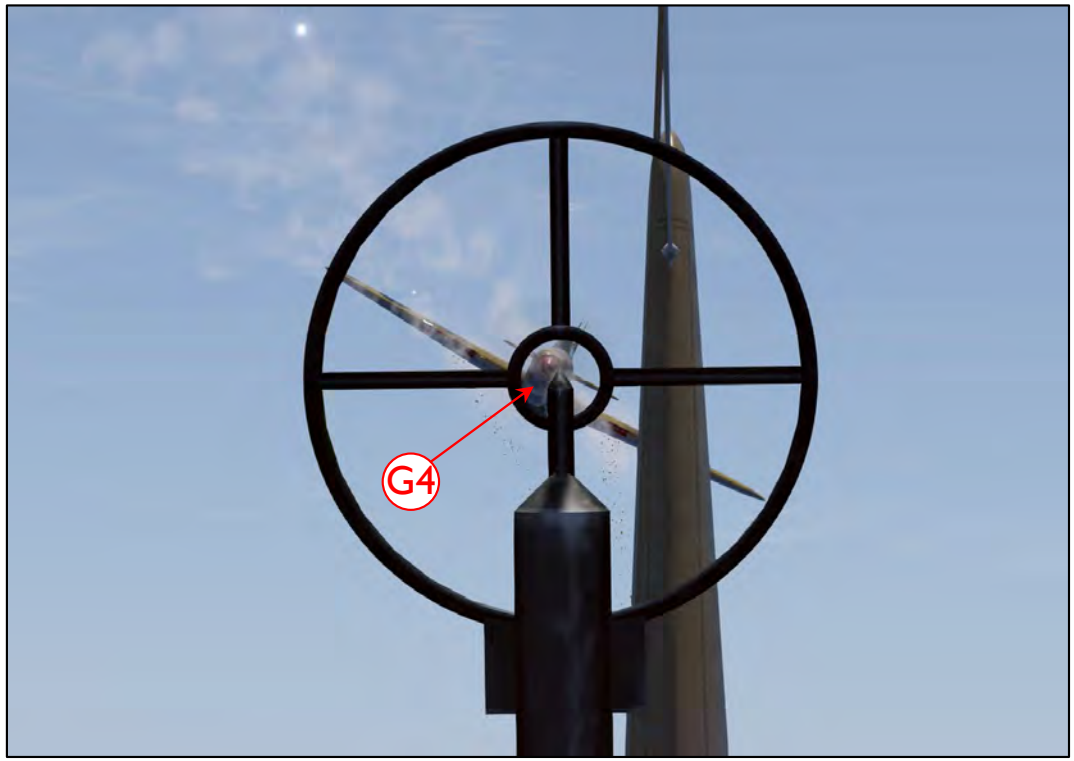
Junkers Ju 88 - Gunnery
(All variants)

Gunnery

1. The Ju 88 has three gunner positions: front, top, and ventral (not all are available depending on the Ju 88 type - refer to the comparison table). You can cycle sequentially through the various positions (bind keys), or you can move directly to any position by hitting 'Alt' + the desired position number (may vary by type) : 1=pilot, 2=bomber, 3=front gun, 4=top gun, 5=ventral gun, etc.
2. Current and last occupied positions will be reserved for you, so in order to give gunner control back to AI, move back to pilot position by hitting 'Alt F2' from any gunner position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash
3. Before flight, cycle through all gunner positions and toggle park position to off (bind key)
4. To operate gun, lean to gunsight, toggle mouse control, and fire (bind keys)
5. Mouse movement can be reversed by changing Invert=0 to Invert=1 in [rts_mouse] section of the file "Documents\1C SoftClub\il-2 sturmovik cliffs of dover\conf.ini". In the same section you can also increase or decrease mouse X and Y sensitivity as suits you best
6. A significant increase in gunner's elevation and azimuth can be achieved by moving gunner's rack (G1) (bind keys)
7. With some practice you can fly the aircraft 'backwards', but for beginners it is recommended to be under auto-pilot while in gunner position
8. When an enemy fighter has been observed heading towards your bomber lean to gunsight view ('Shift F1'). Zoom in the view noting the more zoomed in the view, the more gun vibration will be observed. Fire a short burst noting the position of the tracer stream with respect to the sight and enemy fighter
9. Move gunsight so that enemy fighter (G2) is now at a point along where the tracer stream would go if a second burst was fired
10. Open fire, firing in short bursts while adjusting aim to place tracer stream (G3) through the enemy fighter (G2). Reduce view zoom as required as enemy aircraft comes closer
11. When target is directly behind at less than 400 metres increase burst size (G4)
12. Once enemy has broken off attack commence search for other nearby enemy aircraft. If clear, press 'Alt F2' to return to pilot position and give gunner control back to AI







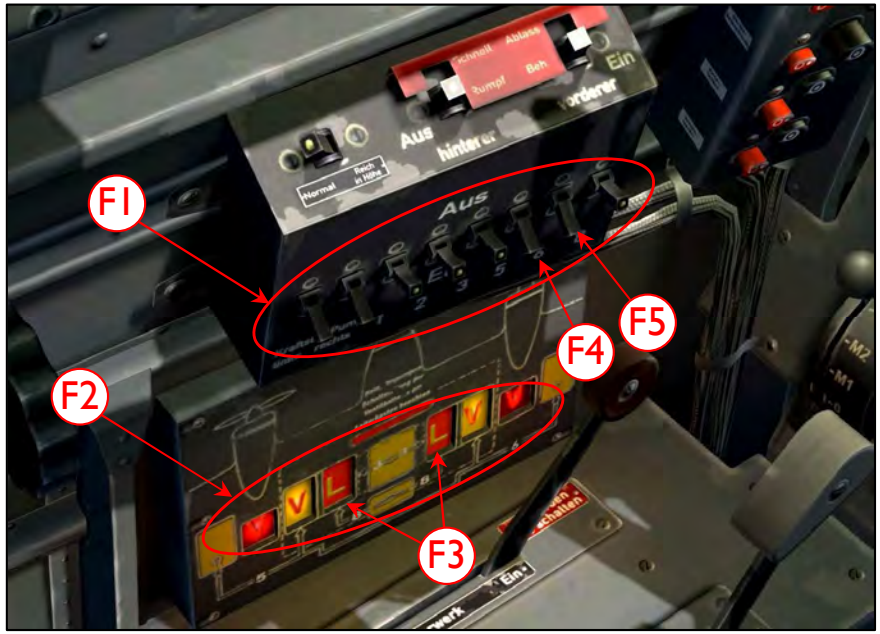
Tip: the front gunner position is rarely needed. For beginners it is recommended to remove the front gun before flight as this greatly improves the visibility forward and to the instrument panel

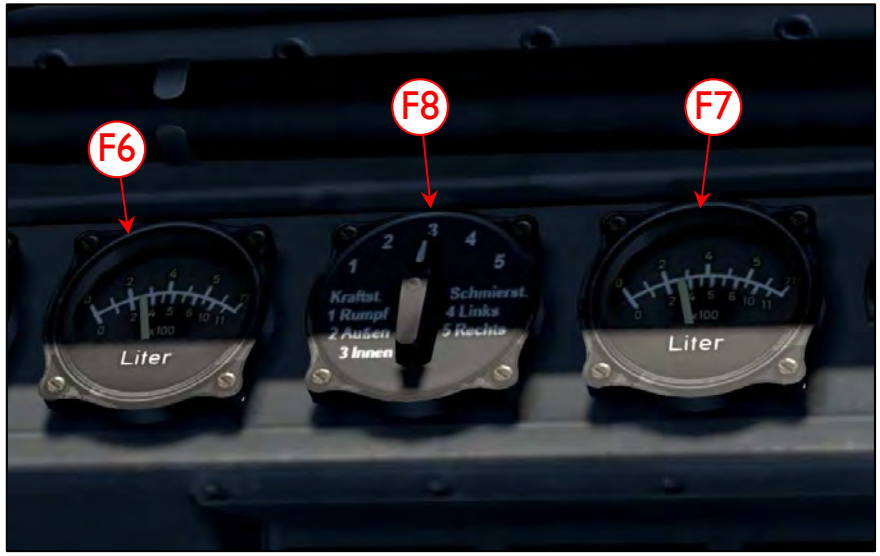
Junkers Ju 88 - Fuel System Management
(All variants)

Fuel System Management

1. The Ju 88 has four tanks in the wings: left outer, left inner, right inner, right outer. The engines are only fed from the two inner tanks. The two outer tanks are for reserve fuel and are to be used for long distance flights only
2. The fuel control panel is to the left side of the cockpit next to the gear and flap levers. It consists of a row of 8 switches (F1) and 6 red/yellow lights (F2)
3. The middle red '**L**' lamps (F3) will lit when the inner tanks are below 50% capacity, indicating it is time to start transferring fuel from the outer tanks to the inner tanks
4. You only need to remember switches 6 (F4) and 7 (F5). The others switches are not functional in the game
5. Switch 6 transfers fuel from the left outer tank to **both** inner tanks. Switch 7 transfers fuel from the right outer tank to **both** inner tanks. It is therefore recommended to operate both switches together to maintain left/right weight balance
6. The gauges control panel is to the right side of the cockpit. It consists of two gauges (F6 & F7) and one 5-position selector (F8)
7. The selector controls what tanks you read as follows:
   - #1: not implemented
   - #2: Outer **fuel** tanks - read outer left on gauge (F6) and outer right on gauge (F7)
   - #3: Inner **fuel** tanks - read inner left on gauge (F6) and inner right on gauge (F7)
   - #4: Left **oil** tank - read on gauge (F7)
   - #5: Right **oil** tank - read on gauge (F7)

It is recommended to keep the selector on #3 which corresponds to the main tanks feeding the engines. The fuel in the main inner tanks is largely sufficient for most missions. The reserve outer tanks start filling as of 50% fuel load, so you will not need to transfer any fuel if you have loaded the plane with less than 50% fuel.





Fuel capacity	Tank 1 (auxiliary) outer left	Tank 2 (main) inner left	Tank 3 (main) inner right	Tank 4 (auxiliary) outer right
Litres	400	410	410	400
Kg	305	312	312	305

Junkers Ju 88 - Single Engine Flight / Navigation
(All variants)

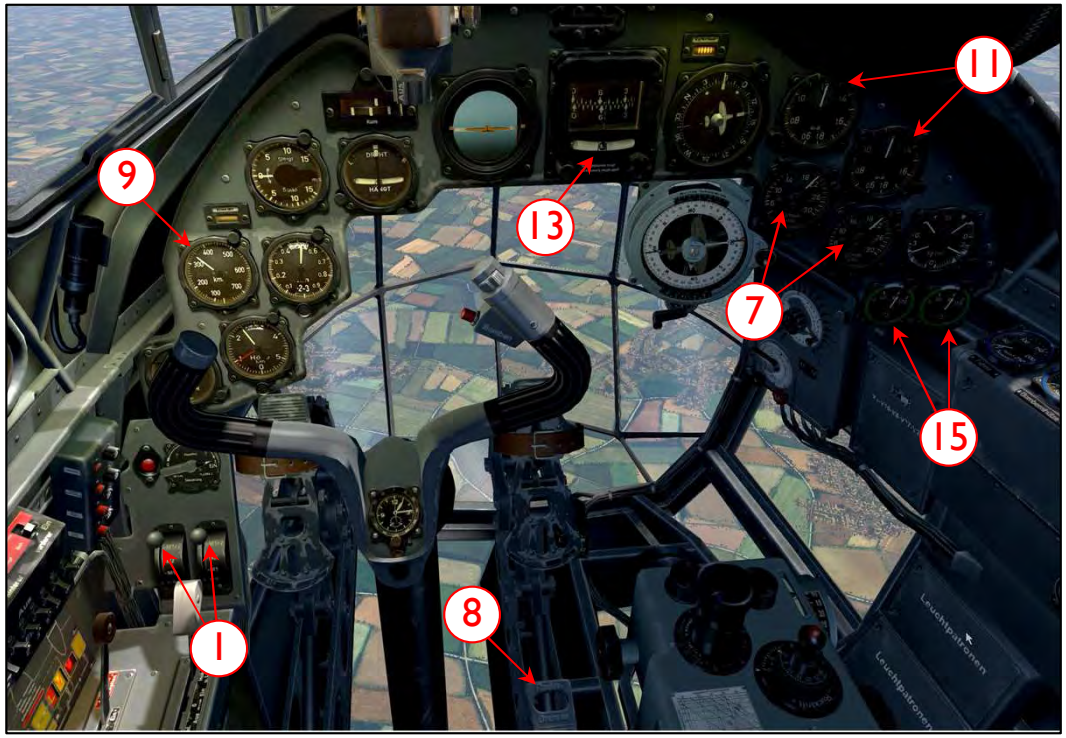
Single engine flight (when you have a damaged engine)

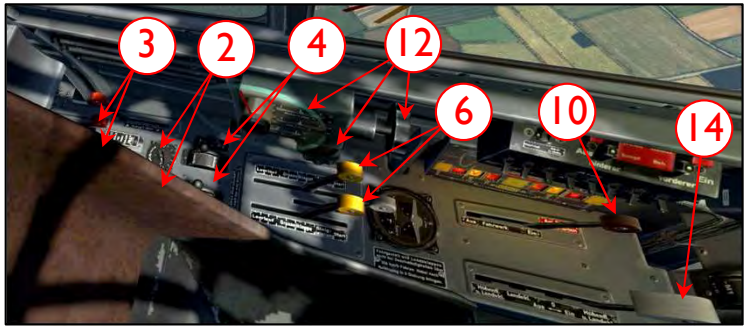
1. Before the damaged engine stops or engine functions start failing, select the damaged engine (bind keys)
2. Reduce prop pitch (4) down to 0% of the damaged engine to feather the propeller which should stop rotating (manual prop pitch planes must read 01:30 on the dial (5)). Fully close oil (bind keys) and water (2) radiators. Close fuel cock (3) of damaged engine to prevent fire
3. Reselect good engine
4. Ensure RPM (7) and ATA (11) are at safe levels and fully open oil (bind keys) and water (2) radiators
5. Trim aircraft (12) to centre the ball (13) and maintain zero or slightly positive rate of climb if possible
6. Head to nearest friendly airfield

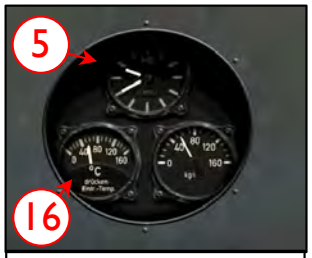
Navigation basics

Navigation is an important aspect of bomber operations. The following provides a basic approach to reasonably accurate navigation in clear weather. More detailed navigation information, including operation of the radio navigation aids and navigation in poor visibility, is beyond the scope of this flashcard but is available elsewhere

7. Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees). For more precision you will also need to correct for compass errors and wind drift
8. During flight ensure gyro compass and magnetic compass are aligned – especially if using autopilot – and manually correct your aircraft's track based on map-to-ground analysis to overfly waypoints
9. As much as finding recognizable groundmarks is easy on the coast, it gets more complicated when flying inland, or low on the deck. In that case you should look for significant towns, forests, rivers, compare their position and orientation with what you were expecting from reading the map, etc. It gets even more complicated when flying over the desert or water... that's when dead reckoning and/or radio navigation intervenes (out of scope)







Dials are located on the engine nacelles, outside

Junkers Ju 88 - Bombing techniques
(A-1, A-5, A-5/Trop, A-5 Late, A-5 Late/Trop)

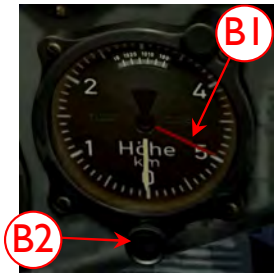
High altitude bombing: Preparation (also refer to autopilot section)

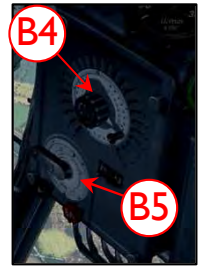
1. During aircraft selection prior to spawn ensure correct fuze and bombs selected and fuel load adjusted accordingly in loadout
2. Before reaching the dropping zone (DZ) (recommend doing this prior to take off while waiting for engines to warm up) move to bombardier's position ('Alt 2')
3. Adjust intended bombing altitude (B1) using (B2) on bombing altimeter or (B3) on bombsight. Factor in target altitude when setting bombing height (refer to airport slides at the end of this document)
4. Select from which bomb bay you wish to drop (front, rear, wing, or all), and the desired bombing mode (single, series, or salvo) (bind keys). For series bombing, you also have to select the series length (B4) (quantity of bombs to be dropped at a time), and the salvo distribution delay (B5) (distance between each bomb)
5. Adjust intended bombing velocity using knob (B6) on bombsight, noting that you need true air speed (TAS) and not indicated air speed (IAS). At this stage put your best estimation, you will finetune at the final stage
6. Once DZ is reached and aircraft turned to bombing heading engage 'Mode 22'. Remember to allow for an altitude drop of 600-800 m during autopilot stabilization. Arm bombs and open bomb bay doors (bind keys)
7. Once aircraft has stabilised in Mode 22, readjust bombing altitude to reflect current altitude by turning the knob (B2) to align red needle on white needle. Re-adjust bombing velocity (B6) to current true air speed

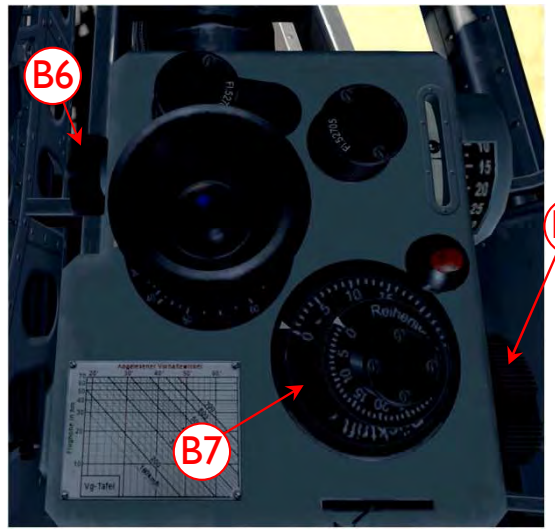
Pilot tip: TAS can be approximated by adding 3% to IAS for every 500 m of altitude. For example, at 5000 m with an IAS of 340 km/h, the TAS is 340 + 30% ≈ 440 km/h. This is the figure you should enter in the bombsight

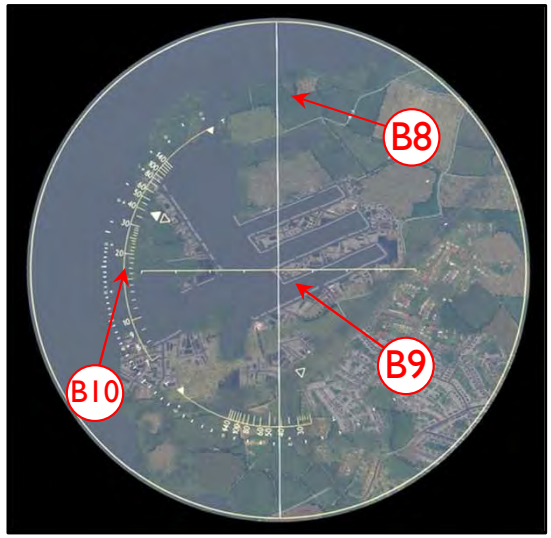
High altitude bombing: Target location and lock-on

8. Using map-to-ground analysis locate target or target area if target not yet visible
9. Enter bombsight view by leaning to gunsight (bind key)
10. Adjust heading left or right using changes to directional gyro until vertical axis of bomb sight (B8) runs thru target
11. Decrease sight distance of sight (bind keys) until sight is looking down at about 40 degrees (B10)
12. Pick a point on the ground near the top of the bombsight display (B8) and watch it move along the vertical sight line. Correct any drift by turning the bombsight towards the drift (B7, or assign keys)
13. Adjust directional gyro as required to continue to place target under vertical line. Move horizontal line of bombsight up/down (bind keys) until cross hairs are on target (B9)
14. Once on target activate bomb sight automation (bind key)
15. The target should remain centered. If it drifts up or down, the altitude or speed settings are incorrect. If the target drifts up on bombsight, increase bombing velocity (B6), if it drifts down decrease it, until target stops moving
16. Check bombs armed and bays open. Finetune as required until automatic bomb release at around 20 degrees angle (B10), noting there are no indications of bomb release. Enjoy the view from the ventral gunner position





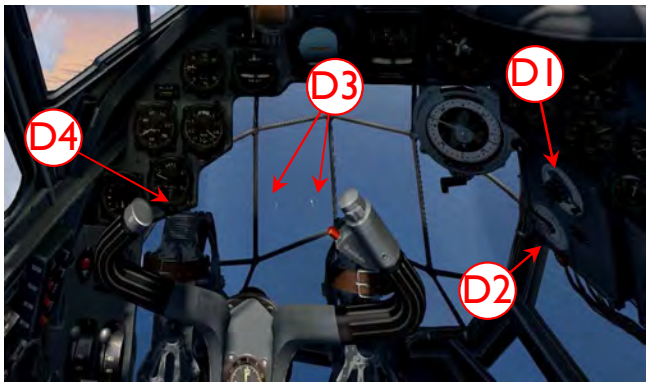


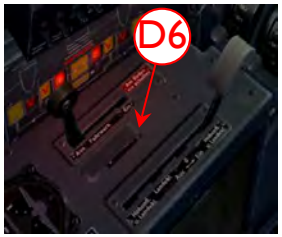


Junkers Ju 88 - Bombing techniques
(A-1, A-5, A-5/Trop, A-5 Late, A-5 Late/Trop)

Dive Bombing

17. The Ju 88 is capable of very precise dive-bombing, like the Ju 87 Stuka
18. During aircraft selection prior to spawn-in select correct fuze and bombs
19. Before take-off, select from which bomb bay you will drop (front, rear, wing, or all) (bind key), and the desired bombing mode (single, salvo, or series). For series bombing, you also have to select the quantity (D1) of bombs to be dropped at a time, and salvo delay (D2) (distance between bombs). For dive bombing set 0 m delay
20. Before reaching target area (D3) set the red needle to desired automatic dive pull-out altitude on bomb altimeter using control knob (D4). Recommend a minimum pull-out altitude of at least 650 m above target altitude be used to allow sufficient margin to pull-out of dive
21. Arm bombs and open bomb bay doors (bind keys)
22. Manoeuvre aircraft so that target will be visible through the window between your legs (D5)
23. Before the target disappears, fully close throttle and toggle dive airbrakes (D6) to 'OPEN'
24. Dive at an angle between 50° and 70°. The dive angle is given by the line parallel to the horizon on your left window (D7)
25. Lean to gunsight and keep it centered on target (D8) using rudder
26. Monitor the bombing altimeter (D4). Upon reaching the preset altitude the plane will automatically drop the bombs and pull out of the dive. If nothing happens when you pass the red needle the system may have a failure, so pull the stick firmly back to avoid crashing on the ground
27. Toggle airbrakes (D6) to 'CLOSE', and throttle up. Monitor RPM and ATA
28. When out of reach of enemy AAA, turn back and enjoy the sight of your burning target (D9)





DESERT WINGS TOBRUK

Macchi C.202 Folgore III / VII

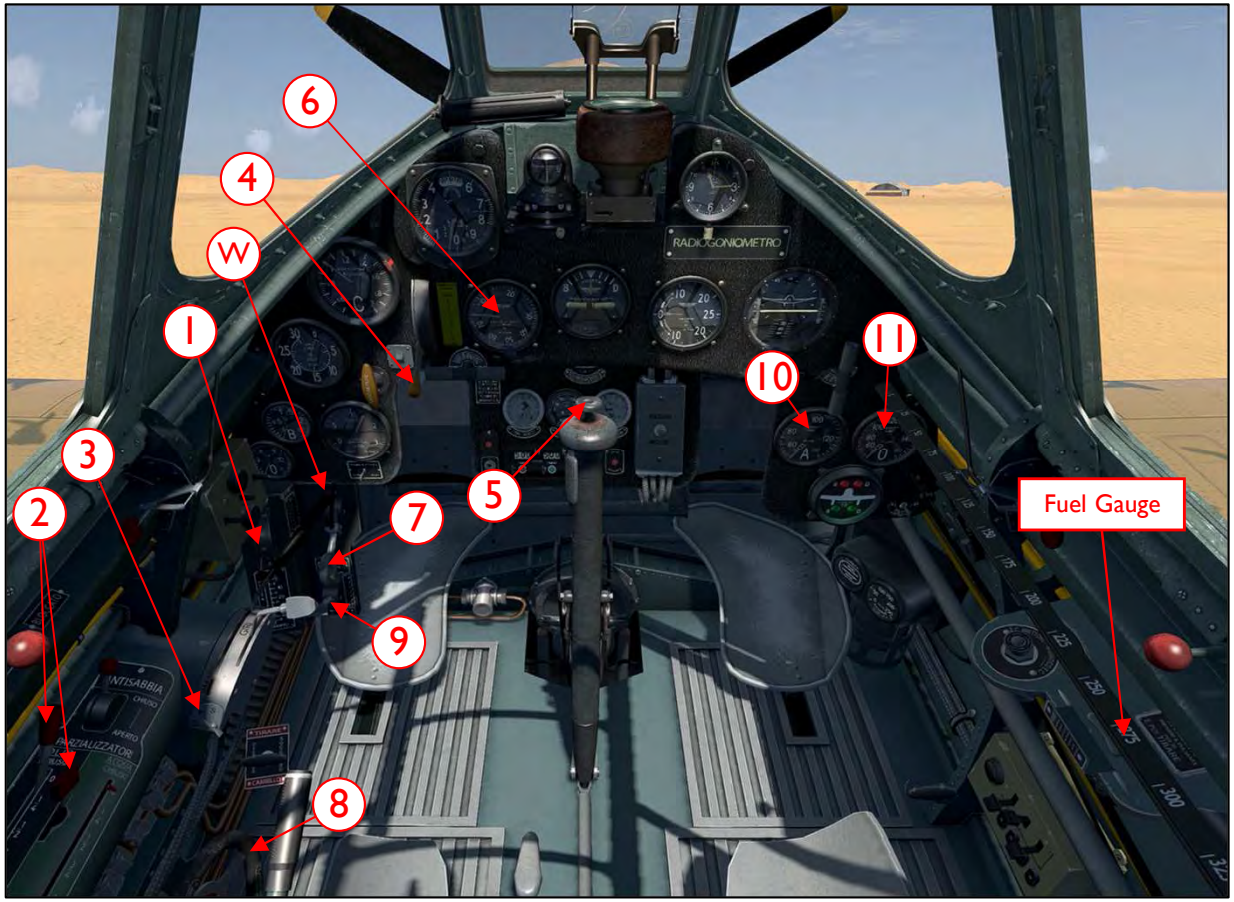
Starting, taxi, and take-off procedures

1. Apply chocks, magnetos on M 1+2 (1)
2. Open both radiators (2) to 100%
3. Set MAS (3) to 'A' (automatic)
4. Open fuel cock by raising lever (4) to 'Aperto'
5. Start engine (default key 'i')
6. Remove chocks
7. Press brakes (5) once to ensure they are disengaged
8. Slowly increase throttle until the aircraft starts to move
9. Steer by using rudder and brakes
10. On runway engage WEP (W)
11. Accelerate with full throttle to approx. 170 km/h (6) then pull stick smoothly to take-off
12. Raise undercarriage (7)
13. Trim aircraft as required (8)

Hint:
You can eyeball the ideal take-off and landing speeds when the needle on gauge (6) points up to 12:00

Landing procedure

14. Reduce speed to below 250 km/h (6)
15. Lower flaps (9)
16. Maintain approx. 200 km/h
17. Lower landing gear (two stage) on approach (7)
18. Open both radiators (2) to 100%
19. Touchdown speed 150-160 km/h (6)
20. Maintain slight back pressure on joystick until low speed to avoid nose over
21. Steer by using rudder and brakes
22. Apply chocks, lower fuel cock (4) to 'Chiuso', magnetos M0 (1) to finish sortie



Engine Management

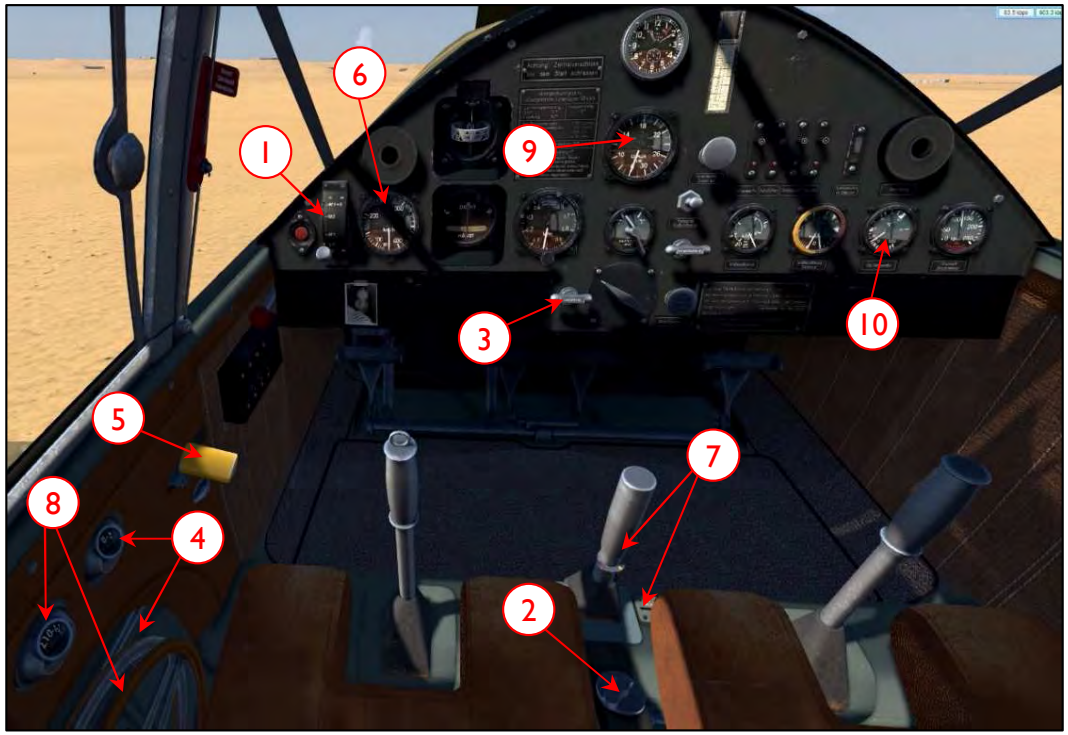
Recommended settings for:	Radiators (water/oil)	Throttle (III / VII)	Prop Pitch	RPM
Cruise	75%/75%	1.23/1.23 ata	A	2200
Climb	100%/100%	1.3/1.35 ata	S	2400 (watch temp.)
Highest speed	50%/50%	WEP 1.4/1.45 ata	S	2400 (watch temp.)
Never exceed a temperature of 100°C for water (10) and 105°C for oil (11)				

DESERT WINGS TOBRUK

Messerschmitt Bf 108 Taifun

Starting, taxi, and take-off procedures

1. Apply chocks
2. Set magnetos on M 1+2 (1)
3. Switch fuel cock to 'Center' (2)
4. Start engine (3)
5. To taxi remove chocks (bind key)
6. Open flaps to 15 degrees (4)
7. Slowly increase power (5) until aircraft starts to move
8. Steer by using rudder and toe-brakes
9. Ensure canopy is closed before attempting take off
10. To take off smoothly increase throttle to 100%
11. Use light rudder inputs to steer
12. As speed increases pull control stick back slightly to prevent nose over
13. At approx. 110 – 120 km/h (6) take off, raise undercarriage (7) and flaps (4) and avoid climbing too steeply
14. Trim the aircraft (8)
15. Do not exceed 2000 RPM (9)



Tip: Keep an eye on the RPM gauge (9) at all times. As long as the needle points up to 12:00 o'clock you are OK.

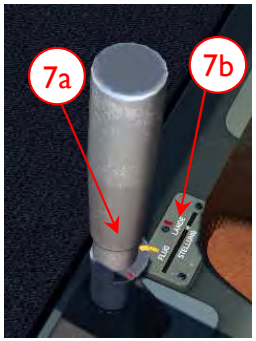
Landing gear : Operate gear by pulling and pushing the lever (7) (not above 180 km/h!); to raise turn handle (7a) clockwise, to lower turn it anti-clockwise. Monitor gear position on the mechanical display (7b). To fully raise or lower the gear, you need to pump about 40 to 45 times (takes about 20 seconds). When reducing throttle to 0% there is an alarm sound, if the gear is not completely lowered (bind keys to the commands 'manually raise/lower gear')

Landing procedure

16. Reduce speed to 190 km/h (6) and lower flaps (4) fully
17. Lower landing gear (7) below 180 km/h (6)
18. Trim nose up (8)
19. Final approach approx. 130 km/h (6)
20. Maintain slight back pressure on joystick to avoid nose over
21. Use light rudder inputs to steer and toe-brakes carefully until full stop
22. Apply chocks and turn off fuel cocks (2) to finish sortie

Engine management

Recommended settings for:	Throttle	RPM	Speed
Cruise	75%	1800	220 km/h
Climb	100%	1850	170 km/h
Highest speed	100%	2200	307 km/h
Never exceed 350 kmh/2300rpm 85°C oil temp (10)			



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Messerschmitt Bf 109 E-1 and E-3

Start up, taxi and take-off procedure

1. Apply chocks, set magnetos on M 1+2 (0)
2. Open fuel cock (1)
3. Set propeller pitch clock to 12:00 o'clock (2)
4. Fully open both oil (3) and water radiators (4)
5. Open throttle to 10%
6. Start engine
7. To taxi remove chocks and release breaks
8. Slowly increase power until aircraft starts to move
9. Steer by using rudder and brakes
10. Ensure canopy is closed before take off
11. Open throttle to 100%
12. Use rudder inputs left/right to steer
13. As speed increases pull control stick back slightly to prevent nose over
14. At approx. 180-185 km/h take off (5), raise landing gear (6) and avoid climbing too steeply. Once 2 reds are shown toggle landing gear to neutral position
15. Once 200 km/h is reached set propeller pitch to cruise setting

Landing procedure

16. Fully open both oil and water radiators
17. Lower flaps on approach at 250 km/h (8)
18. Lower landing gear at 250 km/h (6)
19. Set propeller pitch clock to 12:00 o'clock (2) and do not exceed 1.30 ata and 2400 RPM
20. Touchdown speed 180 km/h
21. Use light rudder inputs to steer
22. After touchdown maintain slight back pressure on joystick until low speed to avoid nosing over
23. Steer by applying rudder and brakes carefully until full stop

Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	50%/50%	90%	1.15	2200
Climb	100%/100%	100%	1.23	2300
Highest speed	As required check temp.	100%	1.40 1.30	2400 (**1 min**) 2400 (**5 min**)
Never exceed 100ºC water and 105ºC oil temperature				

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Messerschmitt Bf 109 E-1/B, E-3/B, E-4/B

Start up, taxi and take-off procedure

1. Apply chocks, set magnetos on M 1+2 (0)
2. Open fuel cock (1)
3. Set propeller pitch clock to 12:00 o'clock (2) (set to manual for the E-4/B)
4. Fully open both oil (3) and water radiators (4)
5. Open throttle to 10%
6. Start engine
7. To taxi remove chocks and release breaks
8. Slowly increase power until aircraft starts to move
9. Steer by using rudder and brakes
10. Ensure canopy is closed before take off
11. Open throttle to 100%
12. Use rudder inputs left/right to steer
13. As speed increases pull control stick back slightly to prevent nose over
14. At approx. 180-185 km/h take off (5), raise landing gear (6), avoid climbing too steeply. Once 2 reds are shown toggle landing gear to neutral position
15. Once 200 km/h is reached set propeller pitch to cruise setting (set to automatic for the E-4/B)

Landing procedure

16. Fully open both oil (3) and water (4) radiators
17. Lower flaps on approach at 250 km/h (7)
18. Lower landing gear at 250 km/h (6)
19. Set propeller pitch clock to 12:00 o'clock (2), use throttle, do not exceed 1.30 ata and 2400 RPM (not needed for the E-4/B)
20. Touchdown speed 180 km/h
21. Use light rudder inputs to steer
22. After touchdown maintain slight back pressure on joystick until low speed to avoid nose over
23. Steer by applying rudder and brakes carefully until stopped

Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	50%/50%	90%	1.15	2200
Climb	100%/100%	100%	1.23	2300
Highest speed	As required check temp.	100%	1.45 1.35	2500 (**1 min**) 2400 (**5 min**)
Never exceed 100°C water and 105°C oil temperature				

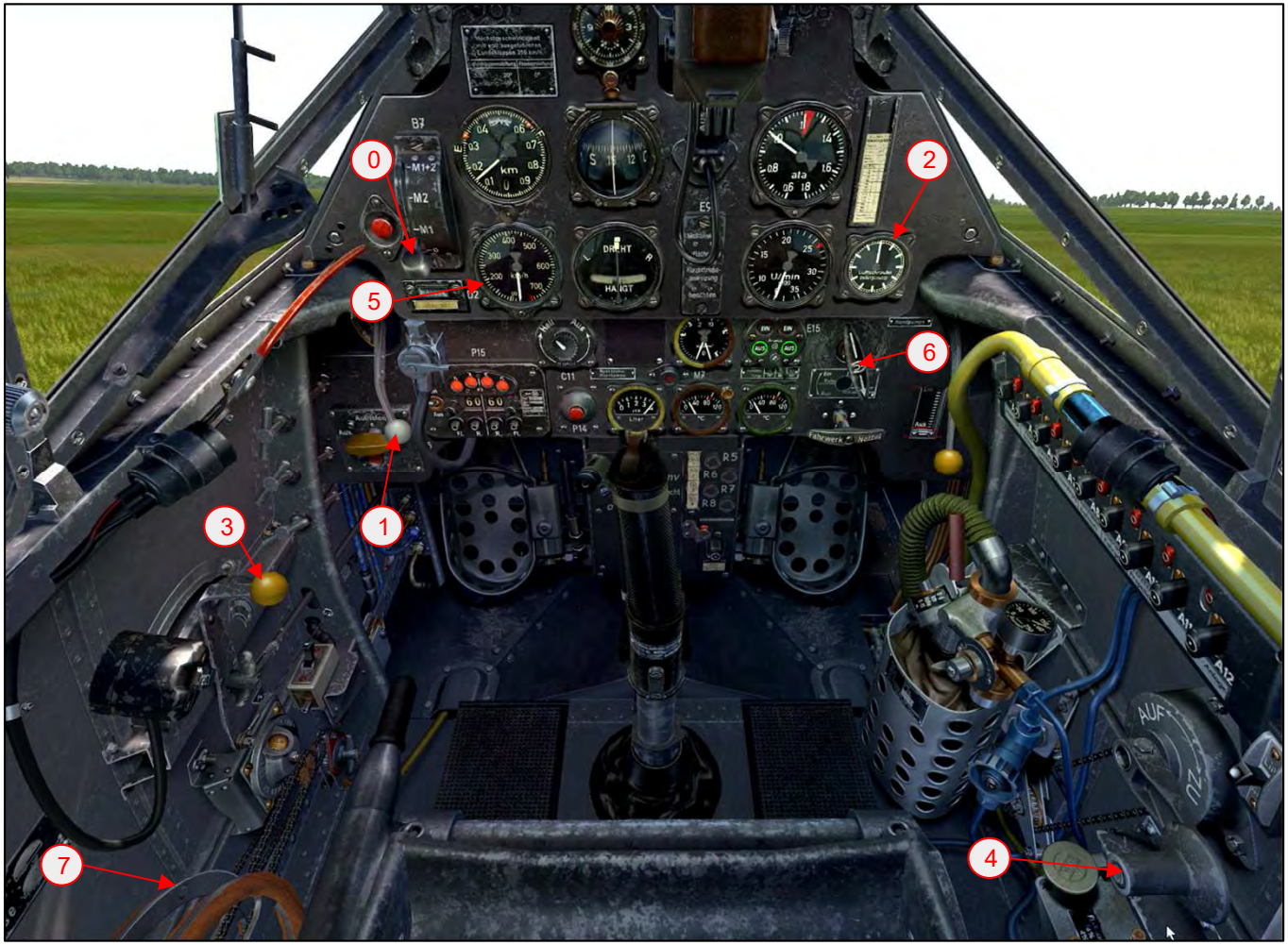
Messerschmitt Bf 109 E-4 and E-7

Start up, taxi and take-off procedure

1. Apply chocks, set magnetos on M 1+2 (0)
2. Open fuel cock (1)
3. Set propeller pitch mode to 'Manual'
4. Set propeller pitch clock to 12:00 o'clock (2)
5. Fully open both oil (3) and water radiators (4)
6. Open throttle to 10%
7. Start engine
8. To taxi remove chocks and release breaks
9. Slowly increase power until aircraft starts to move
10. Steer by using rudder and brakes
11. Ensure canopy is closed before take off
12. Open throttle to 100%
13. Use rudder inputs left/right to steer
14. As speed increases pull control stick back slightly to prevent nose over
15. At approx. 180-185 km/h take off (5), raise landing gear (6), avoid climbing too steeply. Once 2 reds are shown toggle landing gear to neutral position
16. Once 200 km/h is reached set propeller pitch to 'Auto'

Landing procedure

17. Fully open both oil (3) and water radiators (4)
18. Lower flaps at approx. 250 km/h (7)
19. Lower landing gear at approx. 250 km/h (6)
20. Set propeller pitch mode to 'Manual'
21. Set propeller pitch clock to 12:00 o'clock (2)
22. Use throttle not to exceed 1.30 ata and 2400 RPM
23. Touchdown speed 180 km/h
24. Use light rudder inputs to steer
25. After touchdown maintain slight back pressure on joystick until low speed to avoid nosing over
26. Steer by applying rudder and brakes carefully until stopped



Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	50%/50%	approx. 90%	1.15	2200
Climb	100%/100%	100%	1.23	2300
Highest speed	As required check temp.	100%	1.40 1.30	2500 (1 min) 2400 (5 min)
Never exceed 100°C water and 105°C oil temperature				

DESERT WINGS TOBRUK (E-7/N)

Messerschmitt Bf 109 E-4/N and E-7/N variants

Start up, taxi and take-off procedure

1. Apply chocks, set magnetos on M 1+2 (0)
2. Open fuel cock (1)
3. Set propeller pitch mode to 'Manual'
4. Set propeller pitch clock to 12:00 o'clock (2)
5. Fully open both oil (3) and water radiators (4)
6. Open throttle to 10%
7. Start engine
8. To taxi remove chocks and release breaks
9. Slowly increase power until aircraft starts to move
10. Steer by using rudder and brakes
11. Ensure canopy is closed before take off
12. Open throttle to 100%
13. Use rudder inputs left/right to steer
14. As speed increases pull control stick back slightly to prevent nose over
15. At approx. 180-185 km/h take off (5), raise landing gear (6), avoid climbing too steeply. Once 2 reds are shown toggle landing gear to neutral position
16. Once 200 km/h is reached set propeller pitch to 'Auto'

Landing procedure

17. Fully open both oil and water radiators
18. Lower flaps on approach at 250 km/h (7)
19. Lower landing gear at 250 km/h (6)
20. Set propeller pitch mode to 'Manual'
21. Set propeller pitch clock to 12:00 o'clock (2)
22. Use throttle, do not exceed 1.35 ata and 2600 RPM
23. Touchdown speed 180 km/h
24. Use light rudder inputs to steer
25. After touchdown maintain slight back pressure on joystick until low speed to avoid nose over
26. Steer by applying rudder and brakes carefully until stopped

Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	50%/50%	90%	1.15	2200
Climb	100%/100%	100%	1.25	2400
Highest speed	As required check temp.	100%	1.35	2600 (**5 min**)
Never exceed 100ºC water and 105ºC oil temperature				

DESERT WINGS TOBRUK

Messerschmitt Bf 109 F-1 and F-2 Variants

Start up, taxi and take-off procedure

1. Apply chocks. Magnetos on M 1+2 (1)
2. Set fuel cock to 'On' (down position) (2)
3. Ensure that the propeller pitch (3) is at 12:00 o'clock (4)
4. Make sure the radiator switch is on automatic (5)
5. Open throttle to 10% (7)
6. Close air filter door (8) (trop version only)
7. Start engine
8. Remove chocks and release breaks
9. Slowly increase power until aircraft starts to move
10. Steer by using rudder and toe-brakes
11. Ensure canopy is closed before attempting take off (9)
12. To take off smoothly increase throttle to 100%
13. Use light rudder inputs to steer
14. As speed increases pull control stick back to prevent nose over
15. At approx. 180-185 km/h (10) take off, raise undercarriage (2 stage) (11), avoid climbing too steeply

Landing procedure

16. Close air filter door (8) (trop version only)
17. Lower flaps on approach at 250 km/h (12)
18. Lower landing gear (two stage) at 250 km/h (13)
19. Touchdown speed 180 km/h
20. Use light rudder inputs to steer
21. After touchdown maintain back pressure on joystick until low speed to avoid nose over
22. Steer by applying rudder and brakes carefully until stopped
23. Set fuel cock to 'Off' (up position) (2)

Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	Auto.	90%	1.15	2300
Climb	Auto.	100%	1.25	2400
Highest speed	Auto.	100%	1.35	2600 (**1 min**)
Never exceed 110ºC water and 80ºC oil temperature				

DESERT WINGS TOBRUK

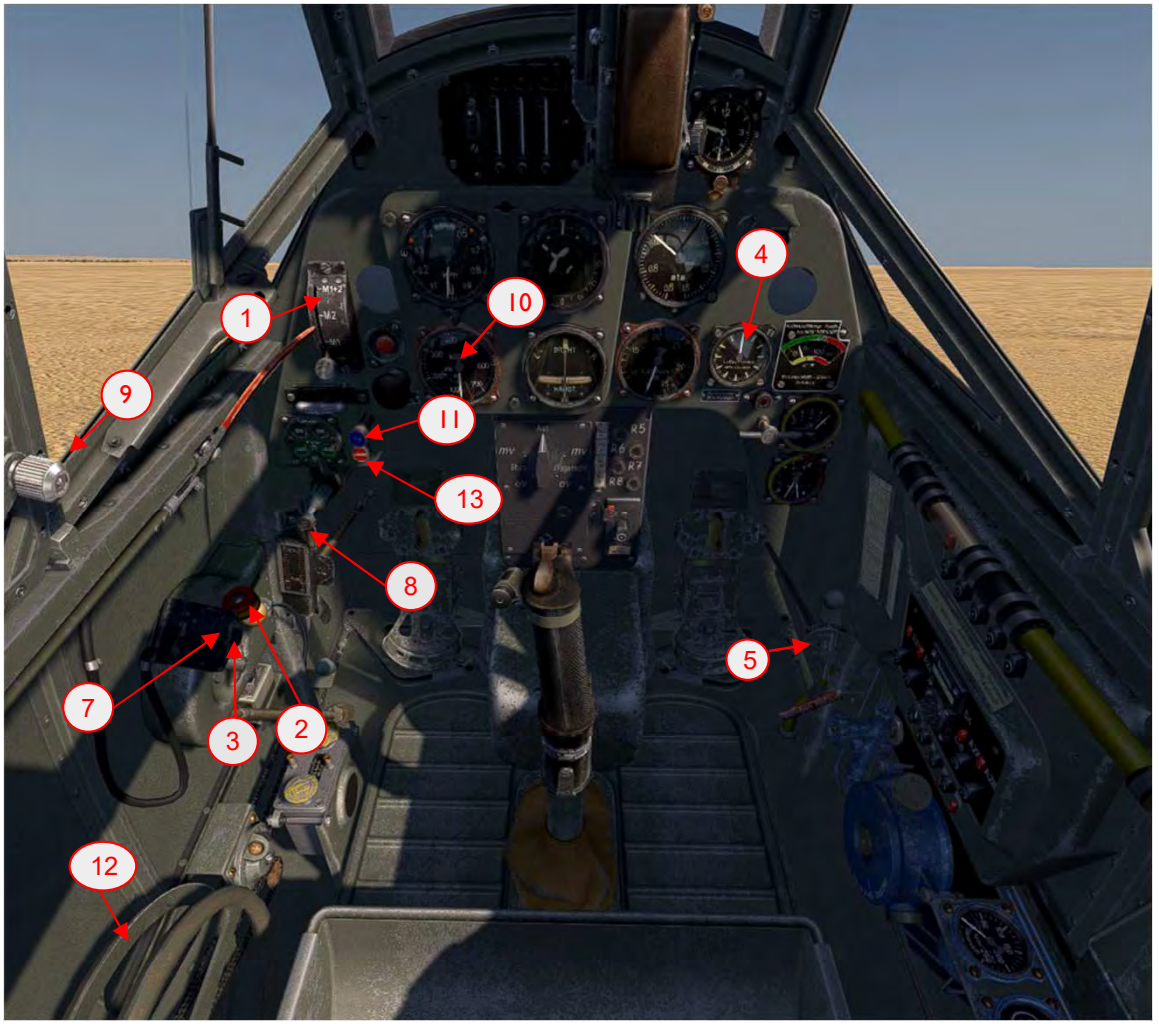
Messerschmitt Bf 109 F-4 variants

Start up, taxi and take-off procedure

1. Apply chocks, set magnetos on M 1+2 (1)
2. Set fuel cock to 'On' (down position) (2)
3. Ensure that the propeller pitch (3) is at 12:00 o'clock (4)
4. Make sure the radiator switch is on automatic (5)
5. Open throttle to 10% (7)
6. Close air filter door (8) (trop version only)
7. Start engine by pressing 'i' (default)
8. Remove chocks and release breaks
9. Slowly increase power until aircraft starts to move
10. Steer by using rudder and toe-brakes
11. Ensure canopy is closed before attempting take off (9)
12. To take off smoothly increase throttle to 100%
13. Use light rudder inputs to steer
14. As speed increases pull control stick back slightly to prevent nose over
15. At approx. 180-185 km/h (10) take off, raise undercarriage (two stage) (11) and avoid climbing too steeply

Landing procedure

16. Close air filter door (8) (trop version only)
17. Lower flaps on approach at 250 km/h (12)
18. Lower landing gear (two stage) at 250 km/h (13)
19. Touchdown speed 180 km/h
20. Use light rudder inputs to steer
21. After touchdown maintain slight back pressure on joystick until low speed to avoid nosing over
22. Steer by applying rudder and brakes carefully until stopped
23. Set fuel cock to 'Off' (up position) (2)



Engine Management

Recommended settings for:	Radiators	Throttle	ATA	RPM
Cruise	Auto.	90%	1.15	2300
Climb	Auto.	100%	1.30	2500
Highest speed	Auto.	100%	1.42	2700 (**1 min**)
Never exceed 115ºC water and 85ºC oil temperature				

DESERT WINGS TOBRUK

Messerschmitt Bf 109 F-4/Z and E-7/Z - Using the GM-1

Information about the GM-1

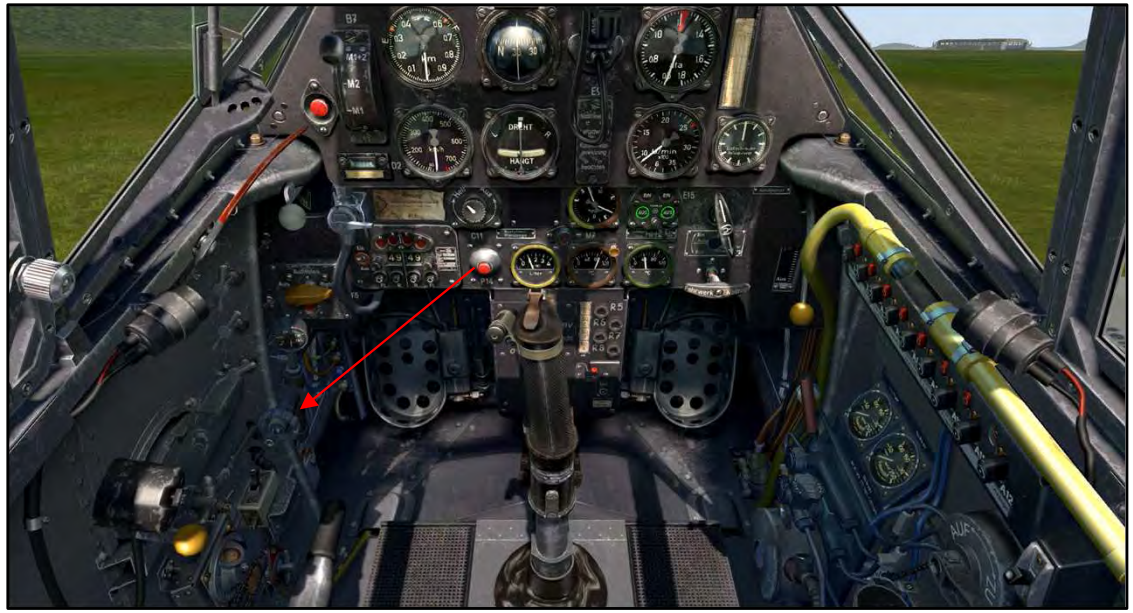
The GM-1 was normally applied in liquid form, directly to the supercharger inlet from two different diameter pumps while at the same time increasing the fuel flow to take advantage of the additional oxygen from the nitrous oxide.

Pumps could be operated individually or in combination, allowing for a three-stage power increase, namely 120/240/360 hp at different flow rates (60, 100 and 150 grams/sec).

The minimum recommended altitude for using the GM-1 with the DB 601 engine is 8000 meters.

The operation of the GM-1 only works with the propeller pitch in automatic.

The increase in power obtained by the GM-1 causes an increase in fuel consumption, an additional consumption of 40 l/h can be assumed.



Messerschmitt Bf 109 E-7/Z

Using the GM-1

1. The reason for the minimum altitude of 8000 meters is to avoid damage to the engine, because if it exceeds 1.42 ata it would cause excessive pressure
2. As explained above, there are 3 different flow rates which are 60, 100 and 150 grams/sec.
3. Once above 8000 meters, turn the knob which you can see in the images on the right

Messerschmitt Bf 109 F-4/Z

Engine Managment

Recommended settings for:	Radiators	ATA (E-7/Z)	ATA (F-4/Z)
Cruise	Automatic	1.15	1.15
Climb	Automatic	1.25	1.30
Highest speed	Automatic	1.35	1.42

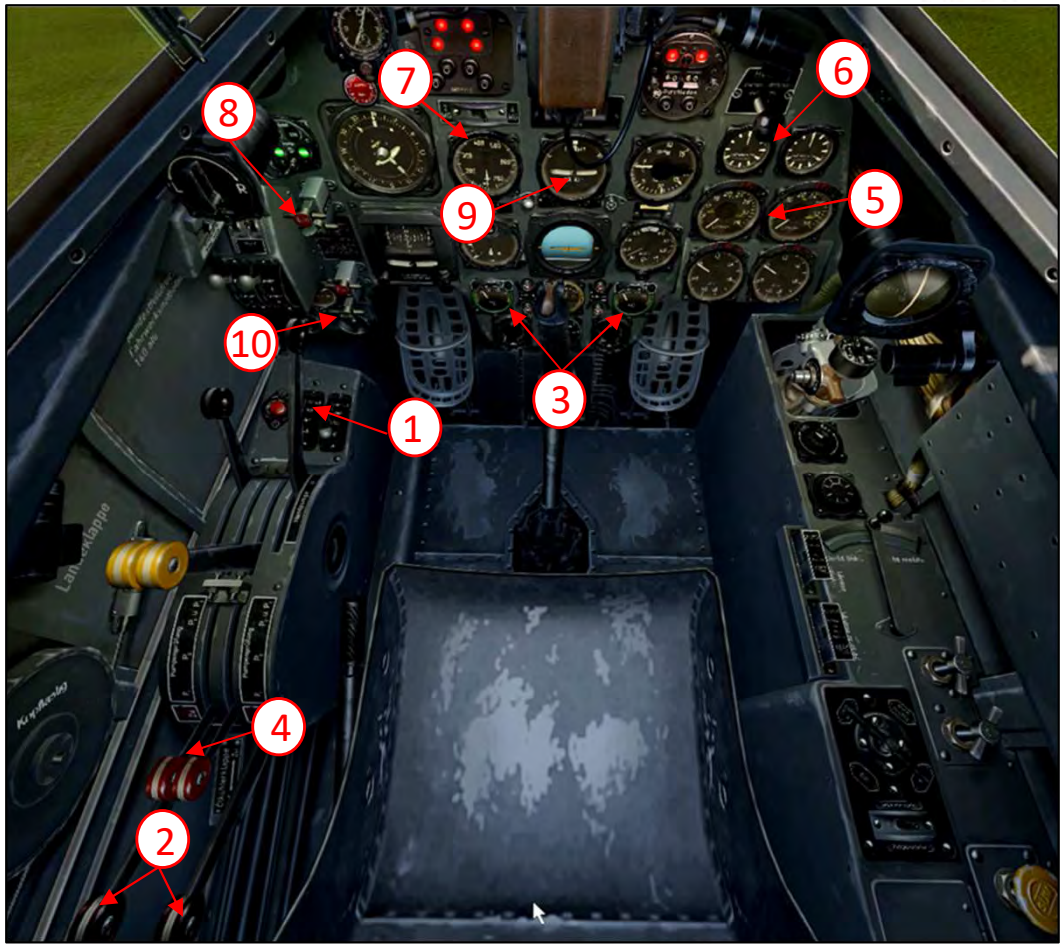
Messerschmitt Bf 110 C-2 & C-4: Pilotage

Starting, taxi, and take-off procedures

1. Apply chocks and set magnetos to M 1+2 (1)
2. Open both oil- (2) and water-radiators (3) to 100%
3. Engine 1 and 2 fuel cocks fully forward (4)
4. Select engine 1 and start (default key 'i'), repeat for engine 2
5. Select both engines and throttle up, observe RPM (5) to ensure both engines are in synch
6. The propeller pitch is manual (6), which means that it has to be constantly adjusted so that it never exceeds the limits of the engine
7. Remove chocks and release breaks
8. Slowly apply throttle and taxi using rudder and toe-brakes to control direction of travel
9. Turn aircraft towards take-off direction and use toe-brakes to stop aircraft
10. Apply chocks
11. Increase throttle to 100%
12. Remove chocks, use rudder to keep aircraft straight
13. Take-off at approx. 150-180 km/h (7), do not let speed get to 200 km/h on the ground
14. Raise undercarriage (8) immediately after take-off
15. As speed increases above 300 km/h (7) trim to centre the ball (9) and keep the nose from rising (via key binding or in cockpit controls: recommend key binding for trims as it's the most used control in the constant trimming is the key to Bf 110's speed, climb rate and gun accuracy

Engine Management

Settings for	Radiators (water/oil)	Throttle ATA	RPM
Cruise	50%/50%	1.15	2200
Climb	100%/100%	1.23	2300
Max. speed	As required (check temp.)	1.30	2400 **(5 min. max.)**
Never exceed temperature of 100°C for water and 105°C for oil (keep both below 95°C recommended)			



Landing procedure

16. Fully open oil (2) and water radiators (3)
17. Once airspeed is below 240 km/h (7) lower flaps (two stage) (10)
18. Lower two stage undercarriage (8)
19. Slow down to approx. 200 km/h (7)
20. Touch down at approx. 150-180 km/h (7), maintain back pressure on joystick to prevent nose over
21. Gently apply toe-brakes once below approx. 130 km/h
22. Apply chocks and turn off fuel cocks (4) to finish sortie

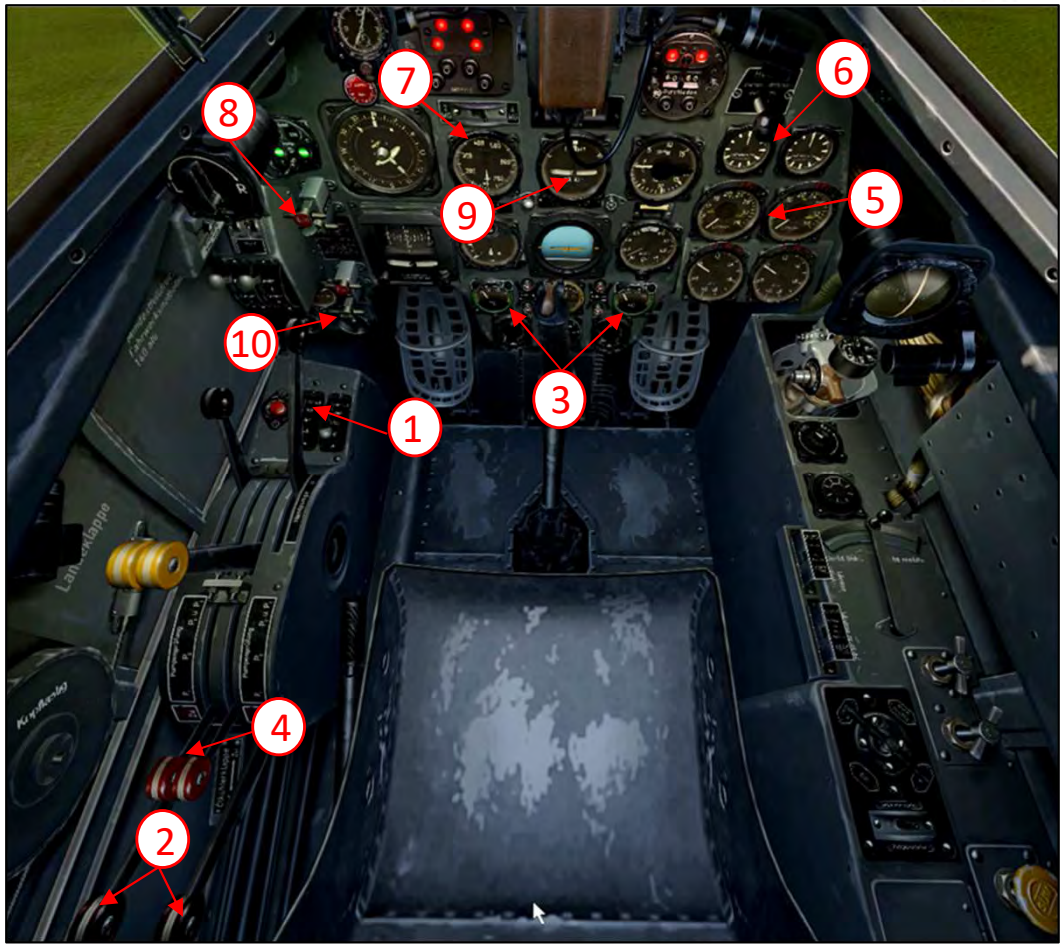
Messerschmitt Bf 110 C-4/B (auto prop pitch): Pilotage

Starting, taxi, and take-off procedures

1. Apply chocks and set magnetos to M 1+2 (1)
2. Open both oil- (2) and water-radiators (3) to 100%
3. Engine 1 and 2 fuel cocks fully forward (4)
4. Select engine 1 and start (default key 'i'), repeat for engine 2
5. Select both engines and throttle up, observe RPM (5) to ensure both engines are in synch
6. Toggle manual prop pitch on and reduce pitch to 11:25 o'clock position (6) and then toggle auto prop pitch on
7. Remove chocks and release breaks
8. Slowly apply throttle and taxi using rudder and toe-brakes to control direction of travel
9. Turn aircraft towards take-off direction and use toe-brakes to stop aircraft
10. Apply chocks
11. Increase throttle to 100%
12. Remove chocks, use rudder to keep aircraft straight
13. Take-off at approx. 150-180 km/h (7), do not let speed get to 200 km/h on the ground
14. Raise undercarriage (8) immediately after take-off
15. As speed increases above 300 km/h (7) trim to centre the ball (9) and keep the nose from rising (via key binding or in cockpit controls: recommend key binding for trims as it's the most used control in the Bf 110). Accurate, constant trimming is the key to Bf 110's speed, climb rate and gun accuracy

Engine Management

Settings for	Radiators (water/oil)	Throttle ATA	RPM
Cruise	50%/50%	90% / 1.15	2200 (auto pitch)
Climb	100%/100%	100% / 1.23	2300 (auto pitch)
Max. speed	Adjust while watching temps	1.35 1.45	2400 (**5 min max.**) 2500 (**1 min max.**)
Never exceed temperature of 100°C for water and 105°C for oil (keep both below 95°C recommended)			



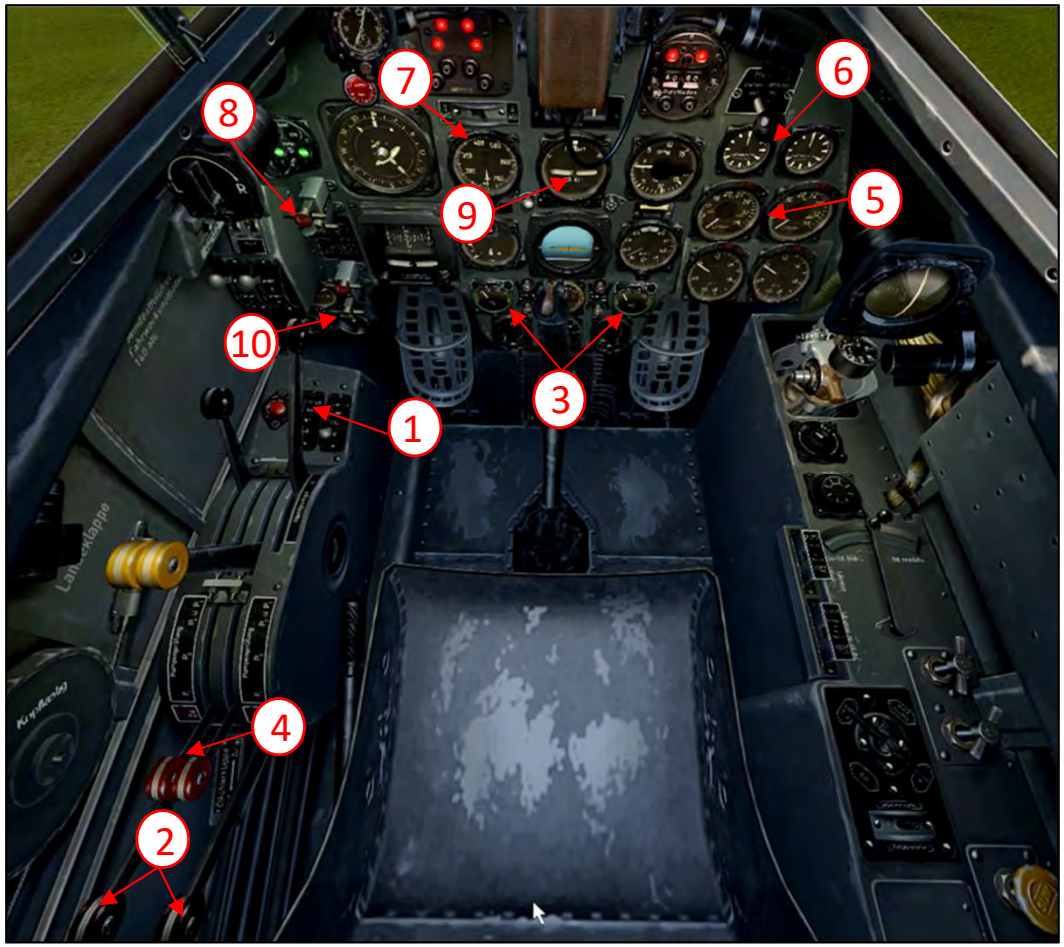
Landing procedure

16. Fully open oil (2) and water radiators (3)
17. Once airspeed is below 250 km/h (7) lower flaps (two stage) (10)
18. Lower two stage undercarriage (8)
19. Slow down to approx. 200 km/h (7)
20. Touch down at approx. 150-180 km/h (7), maintain back pressure on joystick to prevent nose over
21. Gently apply toe-brakes once below approx. 130 km/h
22. Apply chocks and turn off fuel cocks (4) to finish sortie

Messerschmitt Bf 110 C-4/N, C-6, C-7 (auto prop pitch): Pilotage

Starting, taxi, and take-off procedures

1. Apply chocks and set magnetos to M 1+2 (1)
2. Open both oil- (2) and water-radiators (3) to 100%
3. Engine 1 and 2 fuel cocks fully forward (4)
4. Select engine 1 and start (default key 'i'), repeat for engine 2
5. Select both engines and throttle up, observe RPM (5) to ensure both engines are in synch
6. Toggle manual prop pitch on and reduce pitch to 11:25 o'clock position (6) and then toggle auto prop pitch on
7. Remove chocks and release breaks
8. Slowly apply throttle and taxi using rudder and toe-brakes to control direction of travel
9. Turn aircraft towards take-off direction and use toe-brakes to stop aircraft
10. Apply chocks
11. Increase throttle to 100%
12. Remove chocks, use rudder to keep aircraft straight
13. Take-off at approx. 150-180 km/h (7), do not let speed get to 200 km/h on the ground
14. Raise undercarriage (8) immediately after take-off
15. As speed increases above 300 km/h (7) trim to centre the ball (9) and keep the nose from rising (via key binding or in cockpit controls: recommend key binding for trims as it's the most used control in the Bf 110). Accurate, constant trimming is the key to Bf 110's speed, climb rate and gun accuracy



Engine Management

Settings for	Radiators (water/oil)	Throttle ATA	RPM
Cruise	50%/50%	90% / 1.15	2200 (auto pitch)
Climb	100%/100%	100% / 1.25	2400 (auto pitch)
Max. speed	Adjust while watching temps	~1.35	2600 (**5 min max.**)
Never exceed temperature of 100°C for water and 105°C for oil (keep both below 95°C recommended)			

Landing procedure

16. Fully open oil (2) and water radiators (3)
17. Once airspeed is below 250 km/h (7) lower flaps (two stage) (10)
18. Lower two stage undercarriage (8)
19. Slow down to approx. 200 km/h (7)
20. Touch down at approx. 150-180 km/h (7), maintain back pressure on joystick to prevent nose over
21. Gently apply toe-brakes once below approx. 130 km/h
22. Apply chocks and turn off fuel cocks (4) to finish sortie

Messerschmitt Bf 110: Auto-pilot, single-engine flight, and basic navigation

Engaging Auto-Pilot (heading only)

1. Ensure directional gyro heading (11) is the same as stable magnetic compass heading (12) using control knob (13)
2. Align upper and lower bands on directional gyro (using bound key: recommend 'Alt left' or 'Alt right' arrow key or cockpit control) (14)
3. Once aligned activate autopilot (bound key: 'Ctrl A' for toggle autopilot or cockpit control (15)) to maintain heading only
4. To deactivate toggle bound key or cockpit control (15)

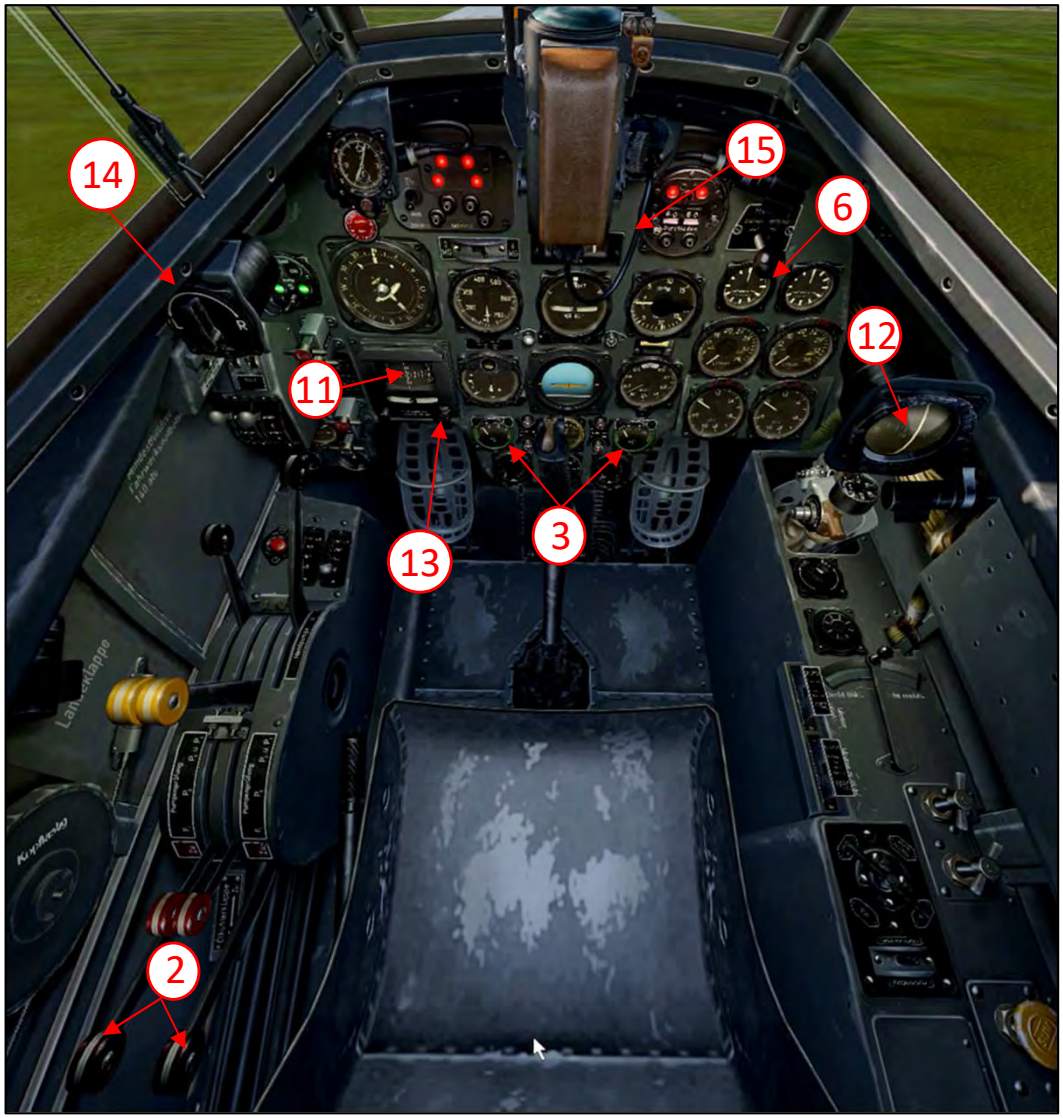
Single engine flight

5. Before damaged engine stops or starts failing select damaged engine
6. Reduce pitch down to 01:30 o'clock (6) on the dial to feather the prop and fully close radiators (2, 3) on damaged engine
7. Reselect good engine and ensure RPM and ata are at safe levels and fully open radiators on good engine
8. Trim aircraft to centre the ball. Recommended airspeed for single-engine flight is 250-300 km/h

Navigation basics

Navigation is an important aspect of Zerstörer operations, especially long-range intruder missions deep into enemy territory. The following provides a basic approach to reasonably accurate navigation in clear weather conditions

10. Prior to, or during, engine start-up plan your route using the in-game map and navigation tools. Choose prominent geographic features for your waypoints and determine the headings required to fly to each waypoint, taking into account the magnetic variation of the map (Channel Map: +10 degrees, Tobruk Map: approx. +1.5 degrees)
11. During flight ensure directional gyro compass and magnetic compass are aligned and correct your aircraft's track based on map-to-ground analysis to overfly waypoints. Use autopilot as required



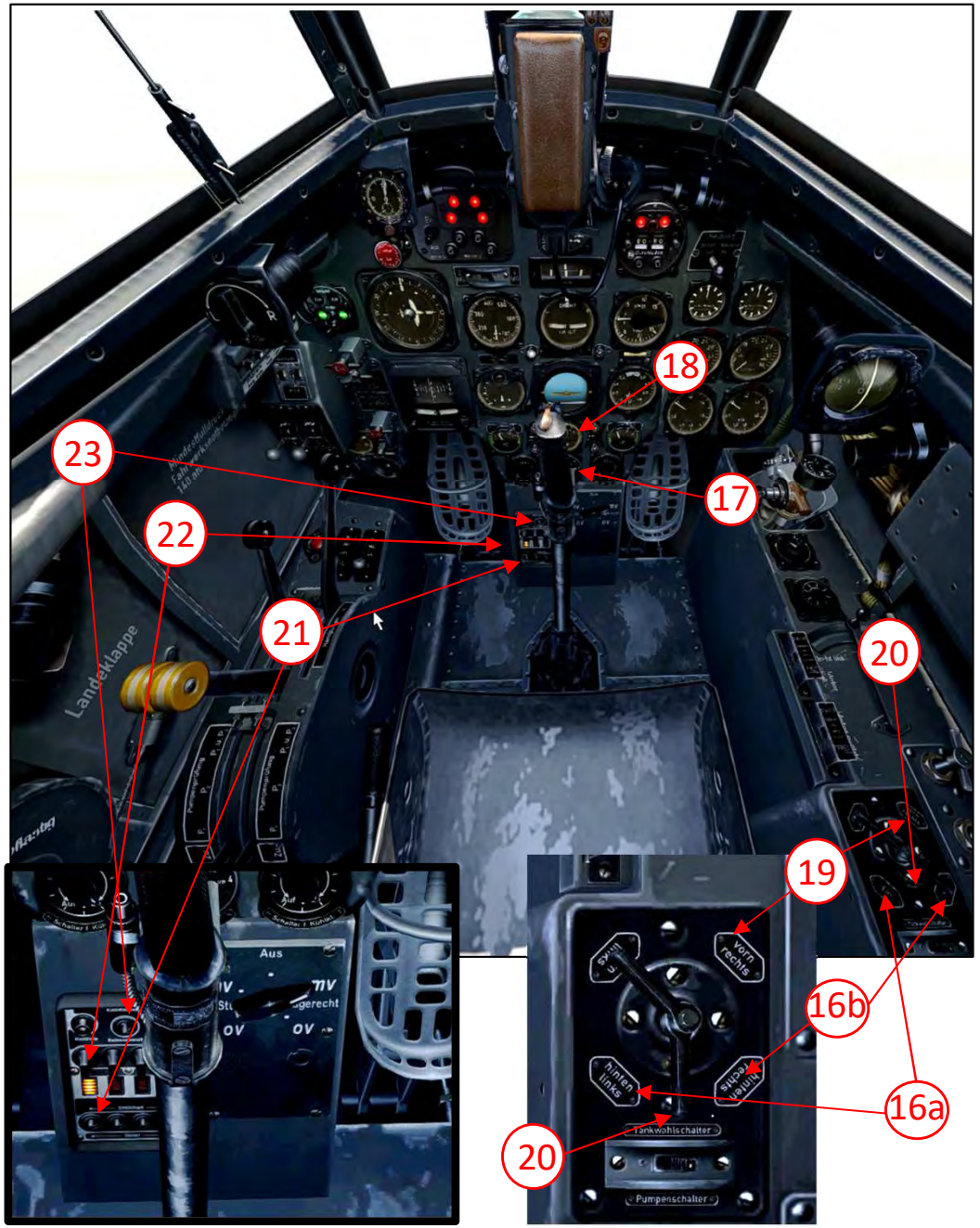
Messerschmitt Bf 110: Fuel transfer and bomb dropping procedures

Fuel transfer procedure (from rear to front tanks)

1. Engines take fuel from tanks 1 and 2 (front left and right). Any fuel in tanks 3 and 4 (rear left and right) must be transferred to the front tanks to be used. Tanks 1 and 2, as well as 3 and 4 can be individually selected. The red warning lights near the gauge (18) are lit when the corresponding tank is below 100 liters
2. To transfer from tank 3 move the rear lever to the 8 o'clock position (16a) on fuel transfer panel. To transfer from tank 4 move the rear lever to the 4 o'clock position (16b). Keep lever in 6 o'clock position to stop transfer
3. Likewise, select the tank to receive the fuel by moving the front lever (19) to the left for tank 1 or to the right for tank 2
4. Maintain even fuel tank weight distribution by transferring small quantities of fuel (approx. 100 liters) at a time, from tank 3 to tank 1, then from tank 4 to tank 2. Continue alternating until done. Monitor the filling of the front tanks by selecting tank 1 or 2 with switch (17) and reading fuel levels on gauge (18)
5. Once the front tanks are full, return the rear lever to the 6 o'clock position (20) to terminate fuel transfer

Basic bombing procedure

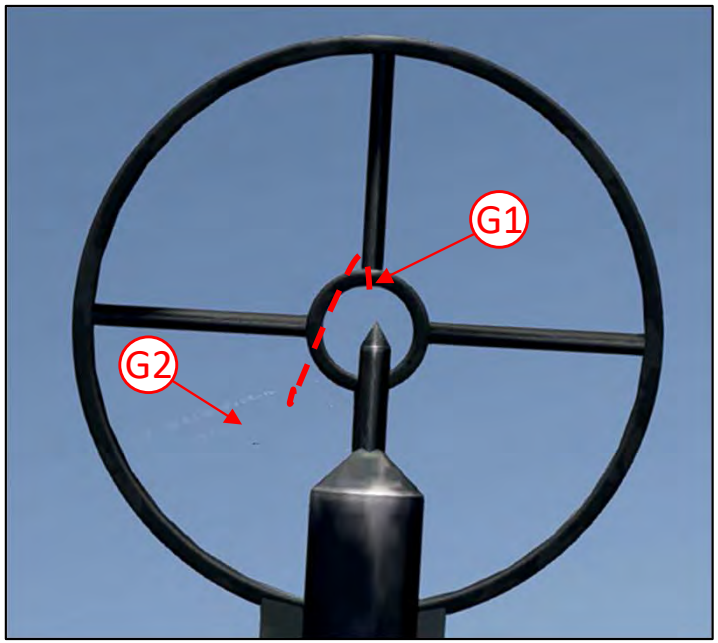
6. Ensure bombs and appropriate fuze are selected before spawn-in
7. Before engine start confirm bombs are loaded by toggling master arm switch (21). Light will illuminate if bombs loaded (22). Turn master arm off
8. Select bomb mode (salvo or single) using switch (23). In salvo mode all bombs will be released after one press of bomb release button (recommend bound key). In single mode 1 bomb will be released per press of the bomb release button
9. Prior to starting bomb run toggle master arm on (21) and confirm mode selection is correct. Judge when to drop and press the bomb release button to drop the bomb. Once all bombs gone master arm light will no longer be illuminated (22)

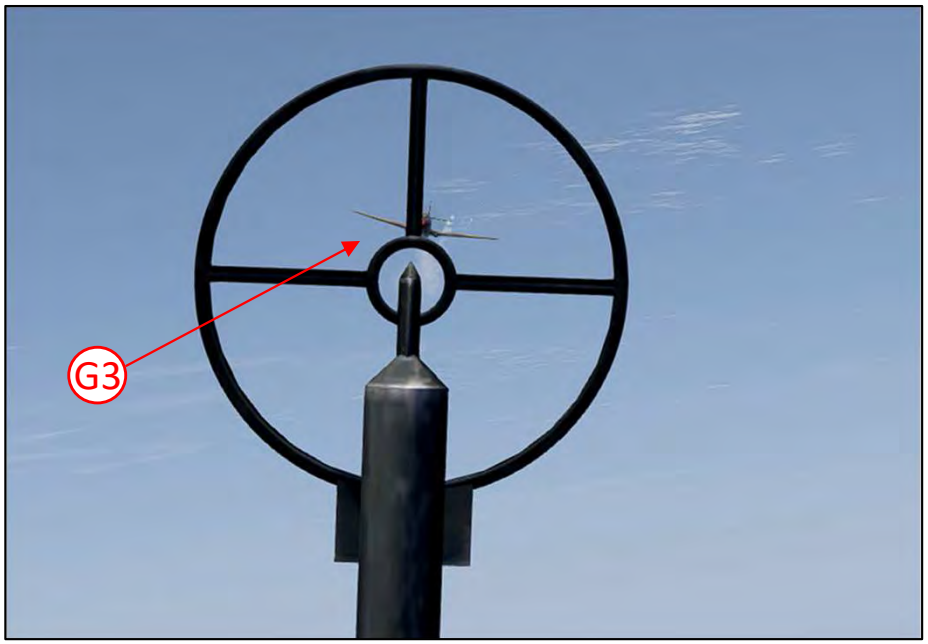


Messerschmitt Bf 110: Rear gunnery

Gunnery

1. Before launching game adjust mouse /gun traverse speed (if required) by altering 'conf' file (located in Documents\1C SoftClub\il-2 sturmovik cliffs of dover) in 'rts_mouse' section by changing X and Y sensitivity to 1.5 or 2 depending on personal preference. Consider inverting mouse direction by changing to 'Invert=1'
2. During aircraft selection prior to spawn-in ensure ammunition load-out includes tracer (recommend at least 1 in 5) and that a convergence range of 500 metres is selected
3. In Options-Controls-General assign key to 'fire current weapon'. Recommend using an unassigned button on joystick and not the mouse button as use of the mouse button will prevent concurrent moving and shooting of the gun
4. Once in area where enemy fighters could be encountered engage autopilot or continue to hand fly the aircraft. With practice, concurrent flying and gunnery is possible and improves gunnery effectiveness as gunnery can be coordinated with aircraft manoeuvre
5. Enter gunner position using bound key (default 'C'). Open rear cockpit hood (recommend 'Ctrl O') and enable mouse control of turret ('F10')
6. When an enemy fighter has been observed heading towards your aircraft zoom in the view. Fire a short burst noting the position of the tracer stream (G1) with respect to the sight and enemy fighter (G2)
7. Move gunsight so that enemy fighter is now at a point along where the tracer stream would go if a second burst was fired
8. Open fire, firing in short bursts while adjusting aim to place tracer stream through the enemy fighter. Reduce view zoom as required as enemy aircraft comes closer
9. When target is directly behind at less than 400 metres increase burst size (G3)
10. Once enemy has broken off attack commence search for other nearby enemy aircraft. If clear return gunner back to AI by pressing 'Alt F2', only then return to pilot position. Be careful as if you accidentally press 'Alt F2' from the pilot seat you will find yourself outside your aircraft which will then crash





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Airfield Elevation: Channel Map (England)

(For airfield locations on the map, please refer to the maps provided with the Flashcards)

Airfield	Elevation (m)	Elevation (ft)	Position on map
Andover	90	295	AD.23.8
Bekesbourne	51	167	AW24.8
Bembridge	13	43	AG.18.3
Biggin Hill	179	587	AO.25.5
Boscombe Down	127	417	AC.23.4
Brooklands	20	66	AL.25.4
Croydon	101	331	AN.25.5
Eastchurch	7	23	AU.26.1
Farnborough	77	253	AJ.24.7
Feltham	17	56	AL.26.5
Ford	1	3	AK.19.5
Gatwick	60	197	AN.23.4
Gosport	1	3	AG.19,4
Gravesend	63	207	AR.26.4
Hamble	20	66	AF.20.1
Harwell	120	394	AF.28.1
Hawkinge	158	518	AW.23.2
Heathrow	23	75	AL.26.7
Hendon	50	163	AM.28.5
Heston	30	98	AL27.2
Hornchurch	10	33	AP.27.9
Kenley	174	571	AN.25.2
Larkhill	114	374	AB.23.7
Lee-On-Solent	10	33	AF.19.6
Littlestone	22	72	AV.22.1
Lympne	100	328	AV.22.8
Maidstone	84	275	AR.24.7

Airfield	Elevation (m)	Elevation (ft)	Position on map
Manston	44	144	AX.25.9
Netheravon	119	390	AB.24.3
North Weald	80	262	AP.29.7
Northolt	37	121	AL.27.7
Odiham	112	367	AH.24.3
Old Sarum	79	259	AB.22.6
Portsmouth	1	3	AH.19.4
Ramsgate	47	154	AY.26.1
Reading	46	151	AI.26.4
Redhill	24	79	AN.24.2
Rochester	130	426	AR.25.9
Rochford	10	33	AT.28.4
Ryde	52	171	AG.18.5
Salisbury	131	430	AB.23.3
Sandown	21	69	AG.17.7
Shoreham	1	3	AM.19.8
Southampton	9	30	AE.21.3
Tangmere	12	40	AJ.19.8
Thomey Island	1	3	AH.19.6
Upavon	147	482	AB.24.9
Watch field	100	328	AC.28.6
Westhampnett	21	69	AJ.19.7
White Waltham	36	118	AI.27.3
Wilmington	22	72	AP.19.9
Worthy Down	100	328	AF.22.7
Yatesbury	170	558	AA.26.6

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Airfield Elevation: Channel Map (France)

(For airfield locations on the map, please refer to the maps provided with the Flashcards)

Airfield	Elevation (m)	Elevation (ft)	Position on map
Abbeville	61	200	BB.12.5
Achiet Grévillers	127	417	BH.12.3
Amiens Allonville	89	292	BF.10.1
Amiens Glisy	59	194	BF.9.4
Arras St-Léger	109	358	BI.12.8
Arras	89	321	BI.14.4
Audembert	42	138	BA.20.4
Barly	122	400	BE.13.2
Beaumont Le Roger	139	456	AT.1.3
Beauvais Nivillers	120	394	BD.5.3
Beauvais Tille	99	325	BD.4.7
Berck	1	3	AZ.15.5
Bernay St Martin	161	528	AS.1.1
Boisjean Ecuires	57	187	BA.15.9
Brias	150	492	BF.15.4
Brombos	191	627	BB.7.2
Boulogne Alprech	69	226	AZ.18.5
Caen Carpiquet	61	200	AK.1.9
Caffiers	112	367	BB.20.1
Calais Marck	2	7	BC.21.4
Carquebut	20	197	AE.3.7
Campagne Les Guînes	75	246	BB.20.3
Colembert	198	649	BB.19.2

Airfield	Elevation (m)	Elevation (ft)	Position on map
Coquelles	13	43	BB.21.4
Cramont/Yvrench	121	397	BC.12.9
Crécy	141	462	BD.3.8
Creil	101	331	BG.2.7
Crépon	59	194	AK.3.4
Deauville St-Gatien	140	459	AP.3.7
Desvres	200	656	BB.18.2
Dieppe Saint-Aubin	101	331	AV.9.6
Estrée	80	262	BB.16.4
Grandvilliers	180	590	BC.7.4
Guînes	46	151	BB.20.5
Haute Fontaine	180	590	BC.6.4
Hermelinghen	161	528	BB.19.8
Hydrequent	78	256	BA.20.2
Le Havre Octeville	96	314	AO.5.9
Le Touquet	1	3	AZ.16.9
Ligescourt	70	230	BB.13.8
Marquise West	24	79	BA.20.1
Merville Calonne	9	30	BH.17.7
Monchy Breton	150	492	BF.15.2
Montdidier	108	354	BG.7.2
Oye-Plage	2	7	BC.21.8
Persan Beaumont	42	138	BE.1.9

Airfield	Elevation (m)	Elevation (ft)	Position on map
Peuplingues	101	331	BA.20.8
Pihen	96	315	BA.20.9
Plumetot	40	131	AL.2.8
Poix Nord	171	561	BC.8.7
Querqueville	1	3	AB.7.3
Rely Norrent-Fontes	94	308	BF.17.1
Rosières en Santerre	82	269	BH.8.8
Rouen Boos	140	459	AW.4.2
Roye Amy	83	272	BI.7.1
Samer	61	200	BA.18.3
Sempy	120	394	BB.16.6
Saint-Inglevert	129	423	BA.20.8
Saint-Omer Arques	29	95	BE.19.3
Saint-Omer Clairmarais	9	29	BE.19.6
Saint-Omer Wizernes	78	256	BE.19.1
Théville	135	443	AD.7.2
Tramecourt	126	413	BD.16.2
Wailly-Beaucamp	51	167	BA.15.5
Wissant	21	69	AZ.20.9
Yvrench	110	361	BC.13.2
Zutkerque	36	118	BC.20.3

DESERT WINGS TOBRUK

Airfield Elevation: Tobruk Map

(For airfield locations on the map, please refer to the maps provided with the Flashcards)

Airfield	Elevation		Position on Map
	(m)	(ft)	
Abiar_Zaid	112	367	AT.16.9
Ain el Gazala Seaplane Base	0	0	AI.20.3
Akramah	165	541	AL.16.5
Alam Barghut	2	7	BC.12.1
Almiyah Alkhafiah (LG15)	114	374	AK.6.9
Alsmar Almafqud	174	571	AE.14.9
Althaeban (LG80)	23	75	BC.10.8
al'ukht alddayiea	108	354	AI.6.3
Amseat No1	186	610	AZ.13.2
Amseat No2	176	577	BA.13.1
Awdyat ash Ahiyah	176	577	AW.3.3
Baltat al Atash	171	561	AI.11.8
Bardia	147	482	AZ.14.9
Beltat el Qaz'ah	158	518	AG.10.4
Bir al Hakim	177	581	AJ.14.5
Bir Basur (LG69)	214	702	BI.2.6
Bir el Baheira	208	682	AW.15.9
Bir el Baheira No1 (LG140)	215	705	AX.15.8
Bir el Gaer (LG141)	121	397	AW.16.4
Bir el Malla North (LG76)	61	200	BJ.12.1
Bir el Malla South (LG76)	152	499	BJ.9.7
Bomba North	27	89	AG.23.3
Buq Buq (LG01)	1	3	BD.12.1
Buq Buq Central (LG81)	25	82	BC.11.3
Burj Aleaqarab (LG72)	214	702	BJ.2.6
Derna (al'ftalah)	250	820	AC.25.9
Derna (Siret el Chreiba)	251	823	AC.25.3
Derna Seaplane Base	0	0	AC.26.8
Derna West	253	830	AC.25.8
el Adem No1 (LG144)	149	489	AO.15.6
el Adem No2 (LG157)	133	436	AO.16.2

Airfield	Elevation		Position on Map
	(m)	(ft)	
Gambut No1 (LG139)	151	495	AU.16.4
Gambut No2 (LG142 Bir el Hanascia)	154	505	AU.16.3
Gambut No3 (LG143 Bir el Arca)	166	545	AV.16.1
Gambut No5 West	150	492	AT.16.6
Gasr el Abid	191	627	AX.10.2
Gasr el Abid South	189	620	AX.9.6
Gasr el Arid (LG147)	197	646	AU.15.5
Gazzala No1 (LG149)	16	52	AJ.20.1
Gazzala No2 (LG150)	47	154	AJ.19.6
Gazzala No3 (LG152)	51	167	AK.19.4
Habata (LG79)	210	689	BE.8.1
Halfaya	192	630	BA.11.9
Haqfat Sha'ban	166	545	AN.15.5
Martuba No1	367	1204	AC.23.9
Martuba No2	269	883	AD.23.6
Martuba No3	353	1158	AD.23.7
Martuba No4	365	1198	AC.24.2
Martuba No5	325	1066	AC.23.7
Menastir No1	175	574	AZ.14.7
Menastir No2	131	430	AZ.15.4
Menelao Bay	2	7	AG.22.9
Menelao Bay Seaplane Base	0	0	AG.22.9
Sawani el Qasn	48	157	BE.10.8
Scegga No1	191	627	AY.6.6
Scegga No2	187	614	AY.6.5
Scegga No3	189	620	AY.6.4
Sidi Barrani (LG02)	36	118	BI.13.1
Sidi Barrani Ost (LG05)	35	115	BI.13.2
Sidi Barrani Seaplane Base	0	0	BH.13.9
Sidi Barrani West1 (LG04)	52	171	BH.13.2
Sidi Barrani West2 (LG03)	44	144	BH.13.3

Airfield	Elevation		Position on Map
	(m)	(ft)	
Sidi Rezegh (LG153)	188	617	AR.15.3
Sidi_Azeiz	204	669	AX.13.7
Siwi North (LG66)	218	715	BG.2.4
Siwi Town (LG67)	214	702	BH.2.1
Sollum Seaplane Base	0	0	BA.12.8
Tariq al Ghubay	168	551	AV.4.6
Tmimi No1	38	125	AF.21.3
Tmimi No2	38	125	AF.21.3
Tobruk No1	20	66	AP.18.7
Tobruk No2 (LG145 el Gubbi)	96	315	AP.18.4
Tobruk No3 (LG146)	95	312	AO.18.6
Tobruk No5	72	236	AO.18.7
Tobruk Seaplane Base	0	0	AP.18.7
West Port Seaplane Base	0	0	AB.27.1
LG109	209	686	BG.7.6
LG110	213	699	BH.7.4
LG111	211	692	BH.7.7
LG113	217	712	BH.5.8
LG121	202	663	BB.9.7
LG122	199	653	BA.7.6
LG128	221	725	BG.6.6
LG133	202	663	BC.7.5
LG134	181	594	AT.9.9
LG135	177	581	AW.6.1
LG136	189	620	AW.7.7
LG137	177	581	AV.5.9
LG138	203	666	BC.6.1
unnamed	149	489	AE.11.4
unnamed	170	558	AI.11.8
unnamed	149	489	BA.14.1
unnamed	209	686	BJ.8.3