Virtavia

Short Stirling

for X-Plane 11

USER MANUAL

Introduction

The Short Stirling was the RAF's first operational four-engined bomber of the second World War and in its day it was reputed as an advanced and formidable aircraft.

The Short Stirling was initially conceived in 1936 in reply to advances made by the Americans and Russians in the area of quadri-motor bomber technology. The first Stirling prototype was designed in 1938 and it eventually flew for the first time on 14th May 1939 but suffered a hard landing due to collapsed undercarriage, writing off the airframe and forcing a redesign in that area. Despite being hampered by a poor choice of wing design (too-short span) which limited the aircraft to medium altitude only, the Stirling went onto to play a major part in RAF Bomber Command's strategic air offensive until 1943, when it was switched to transport duties. Even then Stirling crews valiantly played a major role in the Arnhem landing after towing gliders to Normandy, and again during the Rhine crossing. Sadly, no Stirlings have survived to the present day.

The Stirling Project : https://stirlingproject.co.uk/

An organization based in Cambridgeshire, England, called the "The Stirling Project" was created in 1997 with the intention of preserving components and documentary evidence of the aircraft's history. The organization has set up a long-term project for the reconstruction of a forward section of fuselage as well as the re-creation of the necessary blueprint drawings, none of which exist today. Virtavia is extremely grateful for the images of their amazing work on their website which were invaluable for creating the cockpit model of the X-Plane Stirling. Anyone who appreciates the Stirling should visit the Stirling Project site and maybe make a small donation to their fund.

Support

Should you experience difficulties or require extra information about the Virtavia Short Stirling, please e-mail our technical support on
tech.support@virtavia.com

Copyright Information

A Mk.3 Stirling, 1942.

Exterior Model

This model is unique to X-Plane 11. As soon as X-Plane 12 is available, the model will be tested and if necessary, updated and new files issued to all validated users.

The package contains the three main wartime variants of the Stirling :

> **Stirling Mk.1** : W7451. 7 Squadron, RAF Oakington, Cambridgeshire, England, early 1941. Manufactured by Austin Motors, Longbridge, Birmingham, England.

Main features : *FN.5 front turret, FN.7 mid-upper turret, FN.4 tail turret.*

Engines have smaller type intakes, no lower oil cooler intakes. No cowl exhaust ring covers, shorter-type exhausts on outer engines.

High number of fuselage portholes. This was due to the original design brief requirement for use as a troop transport, which was not realised in the production variants until the later post-war Mk.5.

Stirling Mk.3 : EF411. 149 Squadron, RAF Mildenhall, Suffolk, England, late 1942. Manufactured by Short Bros., Rochester, Kent.

Main features : *FN.5 front turret, FN.50 mid-upper turret, FN.20 tail turret.*

Engines have larger type intakes above, with circular oil cooler intakes underneath the cowl. Cowl exhaust ring covers commonly fitted, longer-type exhausts on all engines. Reduced number of fuselage portholes.

The Mk.3 was the main variant of the Stirling, many earlier Mk.1 airframes were later converted to Mk.3 and Mk.4 variants. The rear windows of the main canopy and the fuselage portholes were partially painted over to reduce interior light visibilty to enemy aircraft. The porthole vertical stripe is often misinterpreted as a physical divider, whereas it was actually a stripe of black paint.

The Mk.3 also had more powerful Bristol Hercules XI 14-cyl. radial engines, these being the 1,650 hp improved version over the original Hercules II units which produced 1,375 hp. Most Mk.1 Stirlings were eventually upgraded with the XI engine and this simulation assumes this engine in all variants.

***Stirling Mk.4** : LK117 (as flown by Flight Officer David Campbell during the Arnhem operation) 570 Squadron, RAF Harwell, Oxfordshire, England, 17 September 1944. Manufactured by Short & Harland, Queen's Island, Belfast, Northern Ireland.*

Main features : *Plexiglass fairing in place of front turret, no mid-upper turret, FN.20 tail turret.*

Engines/cowls/intakes same as Mk.3. Front set of fuselage windows faired over, 'bubble' type window employed each side. 'Rebecca' aerials mounted on front fuselage.

Number of fuselage portholes depended on whether the airframe was a conversion from a Mk.1 or Mk.3, or a new-build Mk.4. Fitted with glider towing bridle and hinged stop guard frame aft of the ventral supply drop hatch, used to prevent the attached parachute lanyards of dropped canisters from whipping and damaging the aircraft.

Animations

The Stirling exterior model has all the usual animations such as ailerons, elevators, landing gear and flaps. Additional animations on the exterior model are:

Crew Visibility Toggle

Pressing shift-F1 will toggle the crew on and off.
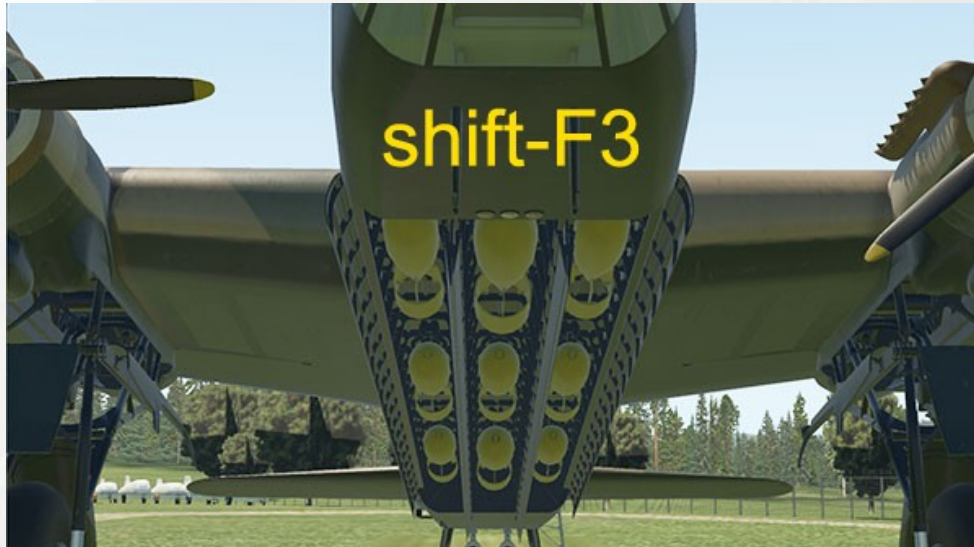

Crew Door

Pressing shift-F2 operates the crew door at the rear port side of the fuselage. The small step ladder will also appear.
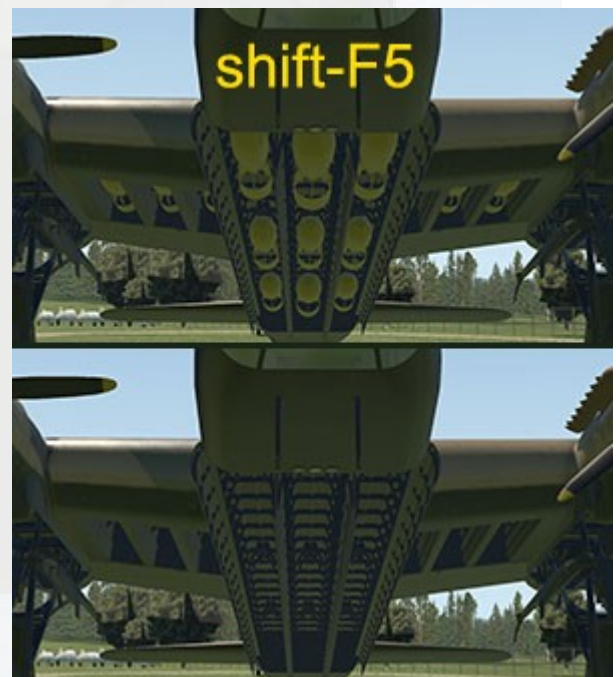
Bomb bays

Pressing shift-F3 will open or close the fuselage bomb bay doors. Alternatively there is a switch on the cockpit panel which will perform the same function when clicked with the mouse.
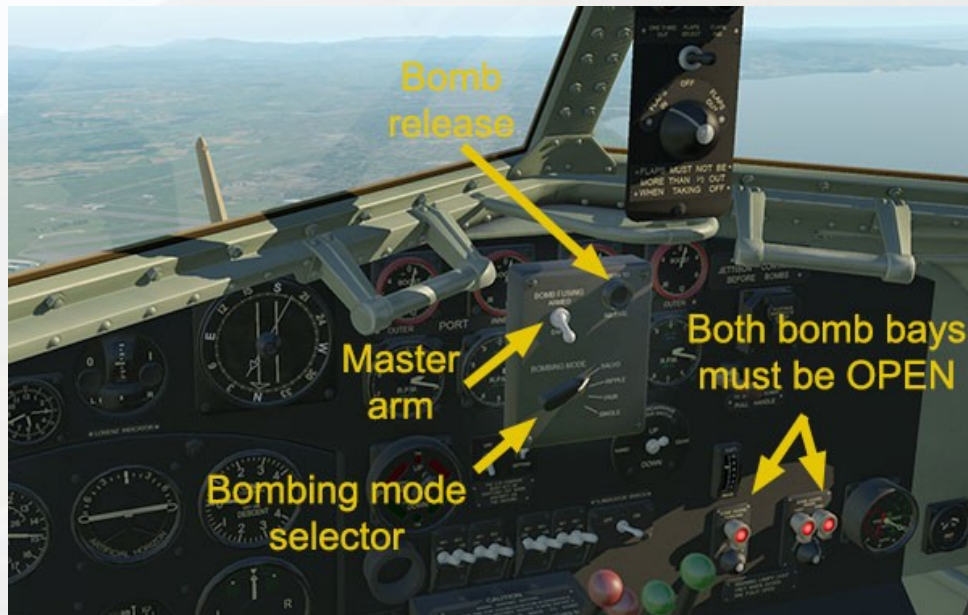

Pressing shift-F4 will open/close the wing bomb bay doors. Alternatively there is a switch on the cockpit panel which will perform the same function when clicked with the mouse. Also, pressing shift-F5 will toggle all the bombs on and off.

Droppable Bombs

When both bomb bay door switches are ON, a bomb control panel will appear in front of the main instrument panel.


Procedure for dropping bombs :

1) Open both bomb bays using the 2 bomb bay switches.

2) Set Bombing Mode switch to 1 of 4 settings. Single is 1 bomb per press, Pair will drop singles and pairs (where there are bombs in left/right pairs), Ripple (press and hold) drops all bombs one-by-one, Salvo drops the full bomb load all at once.

3) Set Bomb Fusing switch (Master Arm) to 'Armed'.

4) Press Bomb Release button to drop bomb(s).

Keys for Using Bomb Drop Feature

X-Planes allows key presses to be set for various weapons-related functions. In order to watch the bombs from outside the aircraft, make sure it is ready to drop the bombs (see procedure above), then using a key such as [Backspace], the bombs can be released. X-Plane also allows instant re-arming of the aircraft, the [Home] key is ideal for this as it is normally unused in the sim.
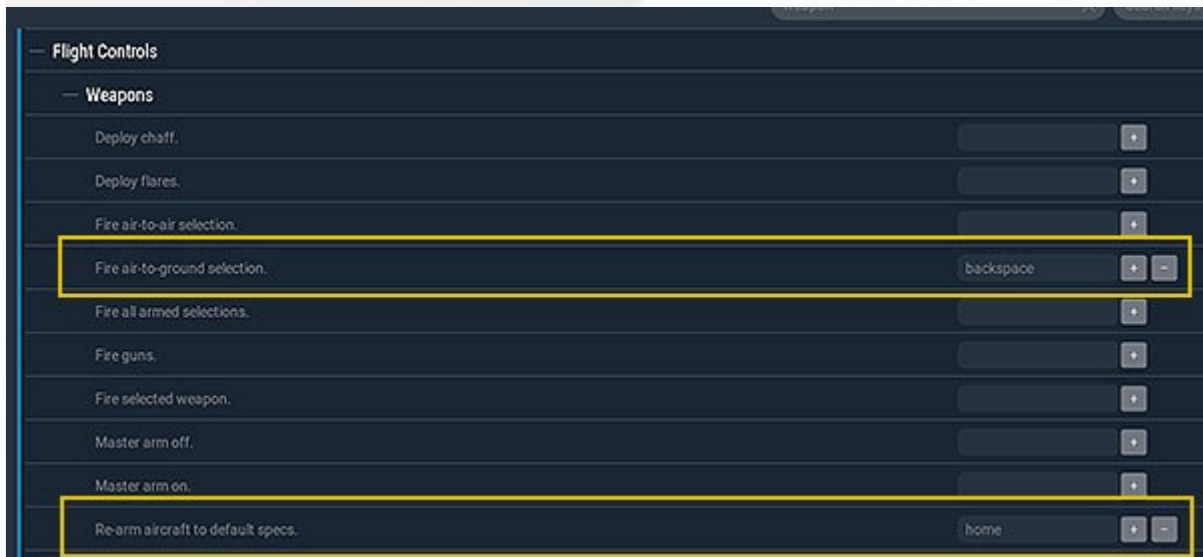
Lighting

The exterior lights are turned on and off using the usual X-Plane key presses (L for landing lights, N for nav lights) or the appropriate switches in the cockpit.

Please refer to the cockpit section of this manual for information regarding light switch location.

Quick Tips

Starting from cold – Assuming the aircraft was left in the fully shut down state and all switches and levers are in their usual OFF position, then follow the procedure below or alternatively follow the in-game checklist, which is reproduced at the end of this manual.

Check bomb doors are closed, flaps up, park brake is on (the yellow lever on the pilot's right). Set the red-handled fuel cock for engine 1 on the overhead console to ON (forward position). It is not necessary to set the mixture levers in this model as the Stirling's unusual 2-engines-per-lever format is not supported by X-Plane, the fuel cock levers are in fact the mixture levers, as X-Plane also does not have a specific per-engine fuel cock facility.There is no battery switch (controlled by Flight Engineer in the real Stirling). Turn the Booster Coil switches to ON (right side lower panel) - these are actually the master battery switches (4 batteries) as far as the simulation is concerned and so at least one is needed to run the starters. Now set the engine 1 magneto switches to ON, then flip up the switchcover on the top of the throttles console to expose the starter buttons. Press and hold the button for 2 seconds and the engine will start. Repeat the fuel cock/magneto switches/starter button sequence for the remaining engines. The pitch of the constant speed propellers is controlled automatically and needs no input from the user, the pitch levers will be seen to move according to throttle input. Close the starter switchcover.

Take-Off - set one notch of flaps (15 deg.), release the yellow parking brake lever (mounted on the throttles console) and advance throttles to

full. The tail will lift at around 80 kts, pull back on the yoke and the aircraft will start to lift off. Retract the gear immediately to reduce drag, then retract the flaps.

Autopilot

The Virtavia Stirling's 'Auto Controls' presently only allow for vertical speed control. So with the climb rate left set to the default zero position, this can also function as an Altitude Hold. The 'speed' control on the Mk.4 Auto Controls was not a modern Speed Hold function, rather it was related to the left/right bank control, the speed was entered so the bank control could work more accurately. This device was not enabled on the real Stirling anyway.

Refer to the cockpit section of this manual for the locations of the autopilot parts.

To set the Auto Controls for altitude hold, level off the aircraft first. Once the speed and climb rate are stable, click on the Auto Controls Clutch lever (with the yellow knob) and the aircraft will maintain level flight, as long as the rotary lever is set to the neutral (zero) position, this is the default position of the lever. The vertical velocity, climb or descent, can then be adjusted using this rotary lever. The lever can be dragged with mouse but this is unpredictable, it is best to click once on it for 100ft/min increments. However, due to the awkward perspective of the lever, manipulation can be difficult, so it is advisable to program some keys or joystick buttons to adjust autopilot VV rate, especially when using VR as there is no other way to affect the rotary lever. The aircraft will slowly adjust its rate of climb/descent to suit the setting of the rotary lever.

The auto controls can be disengaged by pressing the trim control (normally a button on your controller), or by clicking the yellow-knob control lever again. Lower down to the rear on the A.C. panel, the Auto Controls Servo lever has the same function as the small Auto Controls Master Switch (and the joystick trim buttons) - it just toggles the whole system on/off. But really only the control lever (yellow knob) needs to be used to drop in and out of automatic climb/descent control. If it is in the OFF state, the system comes on automatically when the yellow-knob control lever is activated, so separate system activation is not needed.
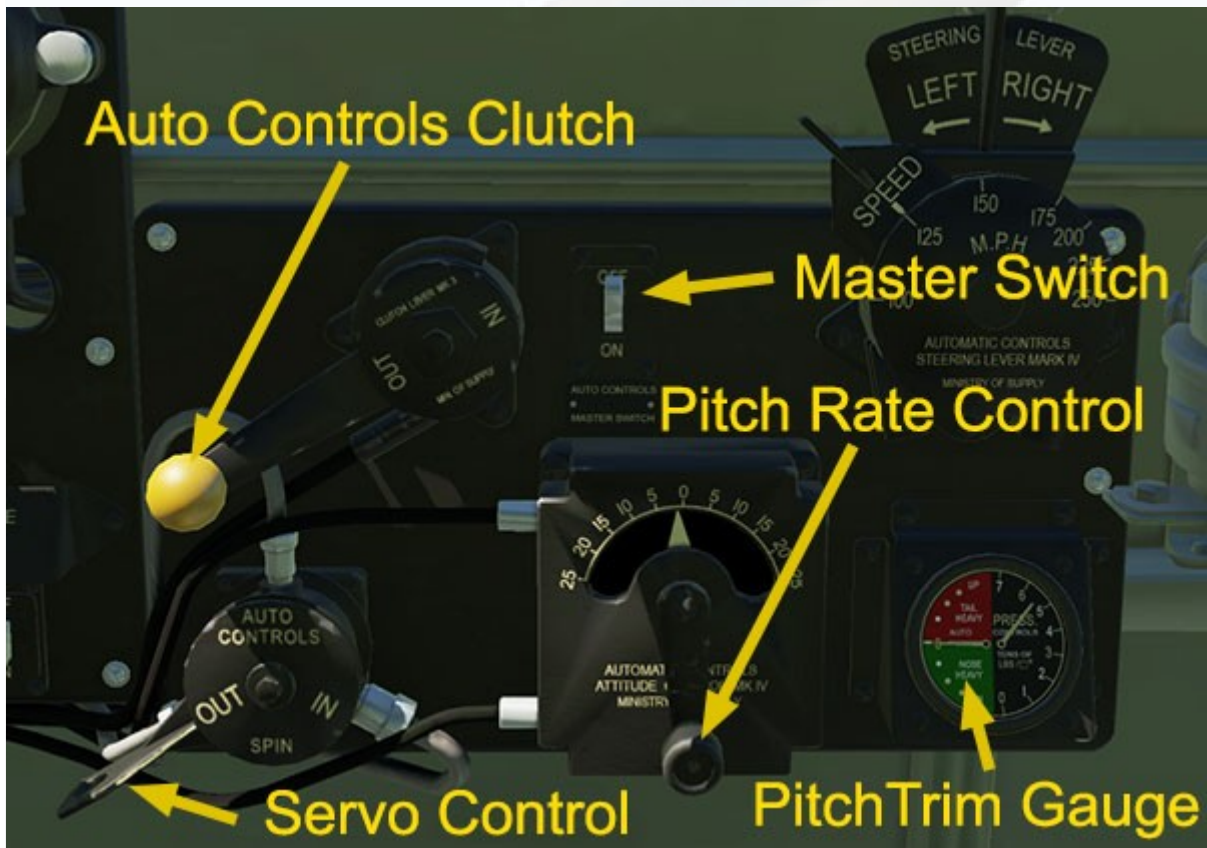
Approach & Landing –

Approach : The aircraft has no speedbrakes so merely throttling back will allow the considerable frontal drag to slow the aircraft down. Reduce speed until 130 kts is reached and you can enter the pattern.

Final : Lower the undercarriage and set flaps to position 2 of 3. At 110 kts extend the flaps fully. Reduce throttle until a steady rate of descent of around 300 ft/min is achieved and speed is 80 kts.

Landing : When the runway threshold is visible, hold speed at 80 kts. Once over the runway at 10-20 ft, cut throttles and pull the control yoke back to bleed off speed to 70 kts. Attempt to alight on all three wheels.

Cockpit

Selecting 'View/Show Instrument Click Regions' in X-Plane will highlight all the clickable objects in the cockpit. If View/Show Instrument Descriptions' is enabled, then mousing over the operable levers and switches will reveal a description. Some of the more important manipulatable parts are shown below.

Navigation Instruments

The 'Blind Landing Indicator', also know as the Lorentz Indicator is set up in this simulation as a LOC/DME indicator.
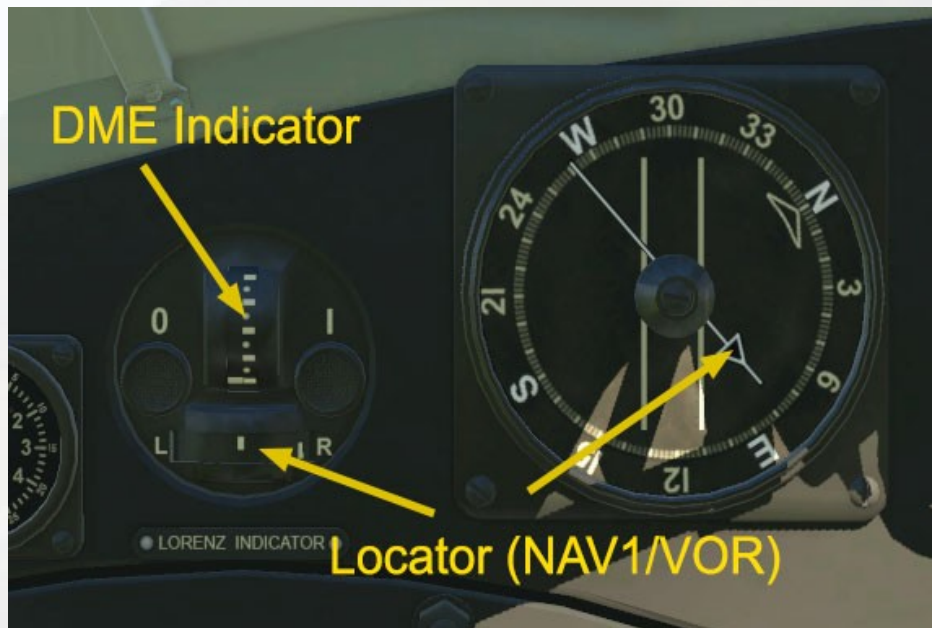
The upper instrument measures distance in nautical miles to the presently tuned NAV1 or TACAN station. The increments are 5 nm each, the needle will move downwards the closer the aircraft is to the station.

The lower instrument acts as locator needle which shows the left and right deviation from the presently tuned station. NOTE - the locator needle does not respond to TACAN, only NAV1.

The gauge on the right is the Compass Repeater. It is a normal compass with a single needle (not authentic) which points to the currently tuned NAV1 station. On the lower left of the panel is the Beam Approach Indicator , this fulfils the same Locator function as the lower part of the Lorenz Indicator, showing the direction of the NAV1 station where the needles cross.

Virtavia Short Stirling XP
Manual Version 3

Lights Switches

The Compass Lamp is just for the P4 Compass, the two overhead Cabin Lamps have a switch unit each but operate as a single lamp. There is a lamp over the navigator's desk, this is not switchable.
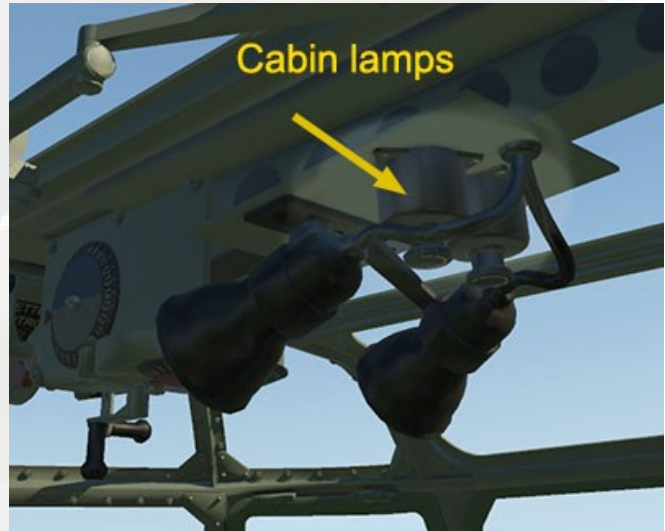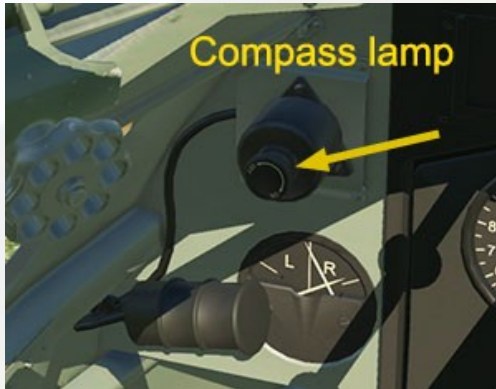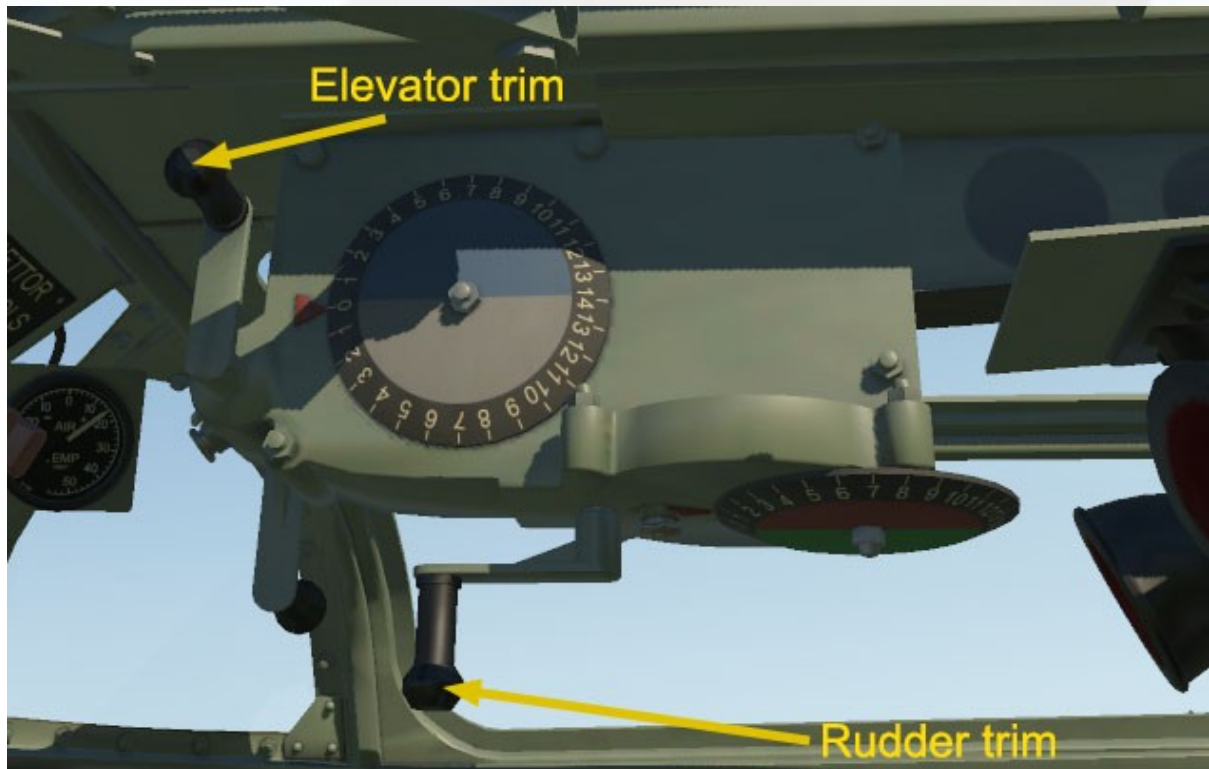

The landing lights are mounted in a retractable pod in the port wing leading edge. The pod can be extended/retracted using a lever on the throttles console left side :

Trim Controls

The next image shows the trim controls and their indicators :

The trim handles can be moved with the mouse pointer but it is easier to use a button on your controller. There is no aileron trim on the Stirling, the aircraft uses an aileron spring tab. This is pre-set to a value gained by experimentation to counter the slight roll to the left caused by the propeller torque. This value can be edited in the Stirling.acf file, Control Geometry/Trim & Speed/aileron trim tab adjust. A change of 0.02 would be sufficient to see a change. It is presently optmised for low altitude flying (under 5,000ft). If you do a lot of higher altitude flying, it might be necessary to adjust the value slightly.

Throttles Console
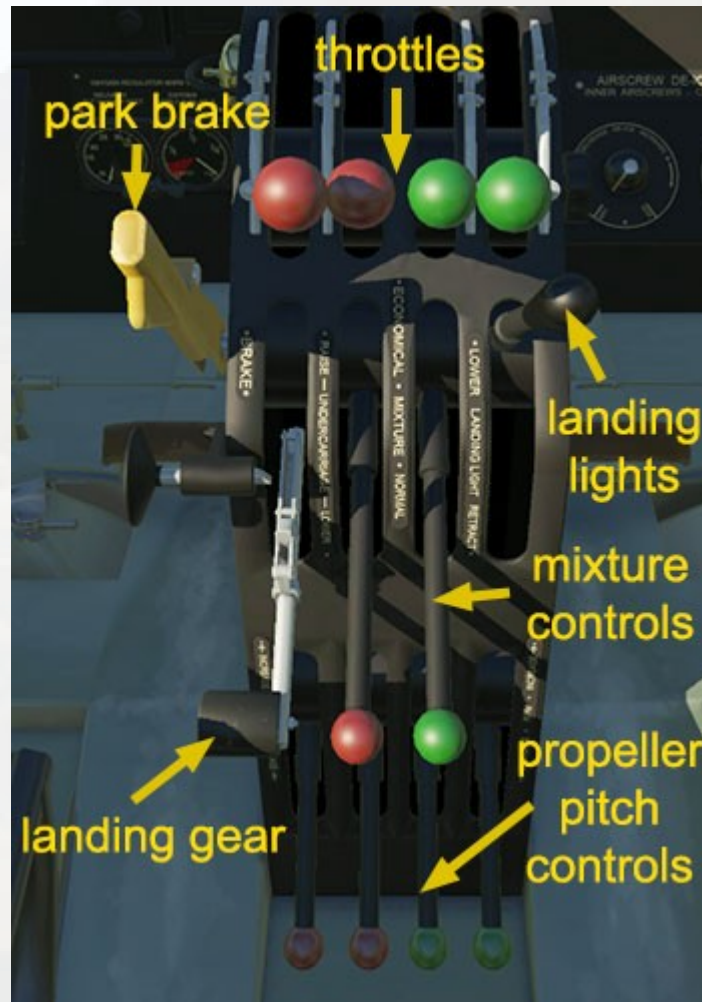
Self-explanatory, however the small plunger object on the left side is a safety device for the landing gear lever, preventing retraction when the plunger is pushed across. Although this part can be moved with the mouse, it does not actually prevent the lever moving and was included for the purpose of authenticity.

The propeller pitch controls are controlled automatically by X-Plane. The Stirling.acf file can be edited if desired to change the setting in the Prop section from 'Constant Speed' to 'Manual', then the levers will require manual input.

Engine Cooling Gills - these are animated, although there is not any lever or switch which can control them (the Flight Engineer operated them). If desired, key presses can be set to move the gills (cowl flaps).

Other Cockpit Functions

There are three animated windows each side :
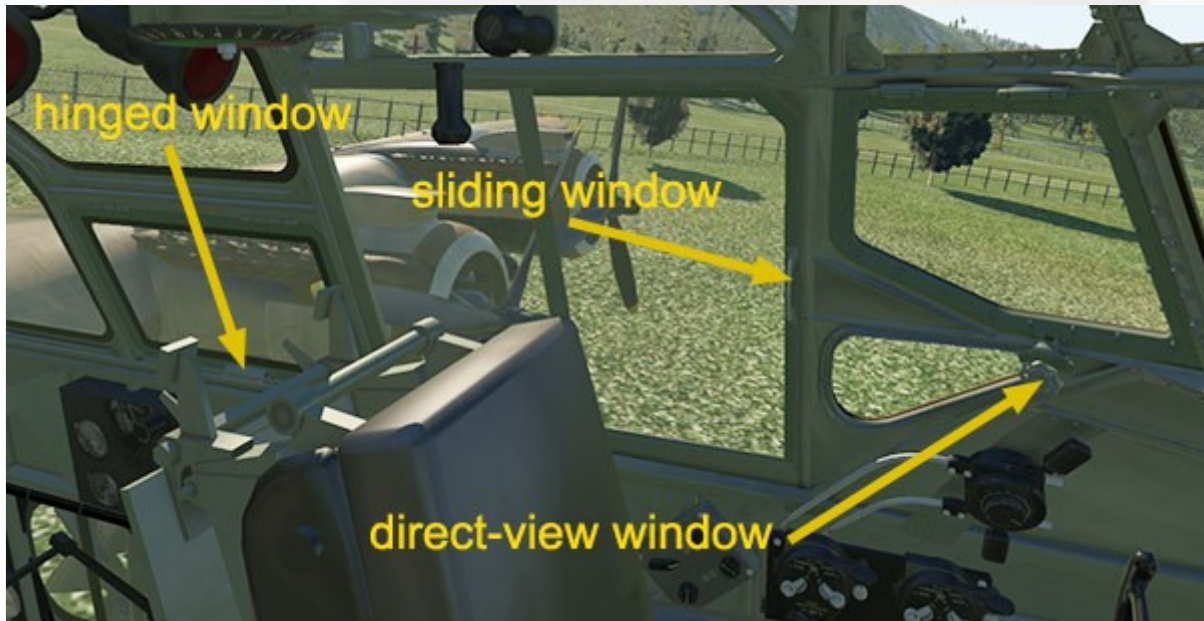
The arrows in the image point to the handles which are the hotspots for the mouse pointer. The mouse operability is rather unpredictable, however on the side windows, it is best to click on the rivets which fix the handle to the frame. Sometimes several attempts may be required until the 'sweet spot' for the pointer is located.

The armrests on both pilots' seats can be raised and lowered :

The yokes can be removed if desired :
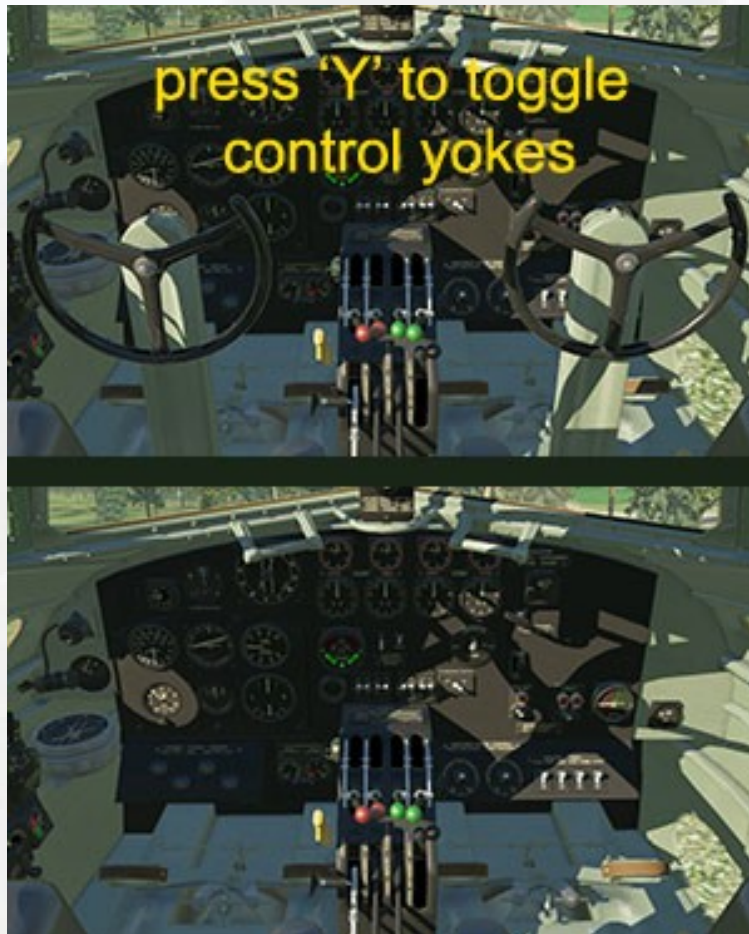
The booster coil switches are animated but presently have no function.

Fuel System

The real Stirling has 7 tanks each side (4 wing tanks + 2 smaller ones on wing trailing edge), plus a smaller auxiliary tank in the leading edge of the wing. In addition, the wing bomb bays can also carry 6 small auxiliary tanks (3 each side). The auxiliary tanks were only used for maximum ferry range, normal use would have been the 6 wing tanks each side. X-Plane only supports 9 tanks, so 4 each side are used in the sim, ie. the 4 main wing tanks, the trailing edge tanks are omitted. This 8-tank total equates to a total capacity of 1,660 gallons, but is only 288 gallons short of the actual 12-tank total, due to the small size of the trailing edge tanks.

left wing -

tank#1: 81 gal

tank#2: 164 gal

tank#3: 254 gal

tank#4: 331 gal

right wing -

tank#5: 331 gal

tank#6: 254 gal

tank#7: 164 gal

tank#8: 81 gal

Stirling Specifications

Specifications

- Manufacturers: Short Brothers at Rochester, Swindon and Brockworth; Short & Harland at Queen's Island, Belfast; Austin Motors at Longbridge, Birmingham.
- Type: Mid-wing four-engined all-metal stressed-skin cantilever monoplane.
- Crew: seven: Pilot, Navigator, Bomb Aimer, Wireless Operator, Flight Engineer and two Gunners
- Engines: Four Bristol Hercules XI 14-cylinder supercharged dual-row air-cooled radials
- Power: 1,650 h.p. each.
- Maximum speed: 270 mph / 235 knots at 14,000 feet (189 kts IAS)
- Cruise speed: 165 mph / 143 knots at 10,000 feet
- Service ceiling: 17,000 feet
- Combat radius: 2,010 miles
- Wingspan: 99 feet 1 inch
- Length: 87 feet 3 inches
- Height: 22 feet 9 inches
- Wing area: 1,460 square feet.
- Empty Weight: 46,900 pounds
- Maximum Weight: 70,000 pounds
- Armament: Three power-operated Fraser Nash type gun turrets. Two guns in FN5 front turret; two in FN7 (Mk.1) or FN50 (Mk.3) mid-upper gun turret; four guns in FN4 (Mk.1) or FN20 (Mk.3) rear gun turret.
- Maximum bombload: 17,000 pounds of general-purpose bombs.

Speed Limitations

- Full Flaps: 126 knots
- Landing Gear: 135 knots
- Landing Lamp extended: 135 knots
- Maximum indicated speed (diving): 282 knots

Stirling Procedures

Engine Start / Preliminaries

1. Set Parking Brake ON.
2. Set Nav lights ON.
3. Set Throttle Levers to IDLE.
4. Set Cooling Gills to fully OPEN. (Flight Engineer)
5. Set Engine 1 Fuel Cock Lever to ON.
6. Set Engine 1 Booster Coil switch to ON.
7. Set Engine 1 Magneto Switches to ON.
8. Starter Button Engine 1 PRESS.
9. Repeat steps 6-7 for remaining engines.
10. Brake Air Pressure 120 lbs CHECK.
11. Altimeter set to ZERO.
12. Fuel Quantity Status CHECK. (Flight Engineer)
13. Landing Lights Lever ON (as required).
14. Set Pitot Heat Switch to ON (as required).

Taking Off

1. Set Parking Brake OFF.
2. Set Cooling Gills fully CLOSED. (Flight Engineer)
3. Landing Flaps to one notch down (15 deg.) SET.
4. Brakes SET.
5. 100% power smoothly APPLY.
6. Brakes RELEASE.
7. Accelerate to full power.
8. At 70 kts tail will lift, 80 kts aircraft lifts off.

After Take- Off

1. Landing Gear RAISE.
2. Landing Flaps RAISE.
3. Landing Lights Lever OFF (as required).

Approach and Landing

1. Airfield can be approached at high speed.
2. Retard throttles to idle, raise nose to lose speed to under 150 kts.
3. Landing Lights Lever ON (as required).
4. Extend Landing Gear at 130 kts.
5. Extend Landing Flaps 2 notches at 120 kts.
6. Apply power to maintain 100 kts.
7. Extend Landing Flaps fully.
8. Limit descent rate to 100 fpm.
9. Apply back stick to lose speed at 10 ft.
10. Make 3-point Touchdown at 70 kts.

After Landing

1. Landing Flaps RAISE.
2. Set Cooling Gills fully OPEN. (Flight Engineer)
3. Taxy to parking area.
4. Set Parking Brake ON.
5. Set Landing Lights to OFF (as required).
6. Set Pitot Heat Switch to OFF (as required).

Shutdown

1. Set all Engines' Magneto Switches to OFF.
2. Set all Fuel Cock Levers to OFF.
3. Set Nav Lights to OFF.
4. Set all Booster Coil switches to OFF.
5. Exit aircraft.