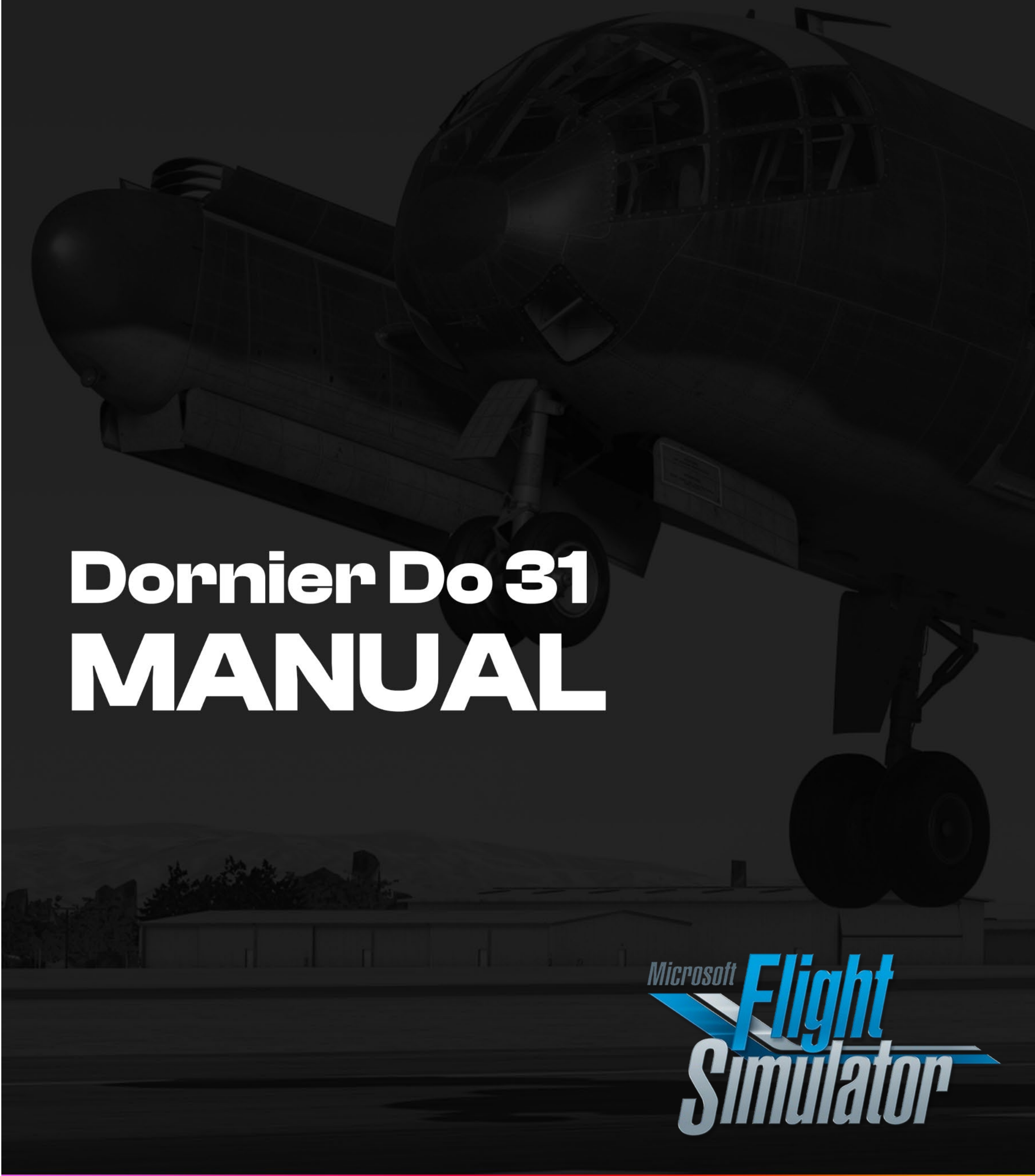
iniBuilds

Dornier Do 31
MANUAL



Microsoft Flight Simulator

Preface

FOR SIMULATION USE ONLY - DESIGNED FOR SINGLE-PILOT OPERATIONS

This guide is designed to help provide a straightforward set of instructions to aid in operating the Dornier Do 31 aircraft.

PHOTOSENSITIVE SEIZURE WARNING

A very small percentage of people may experience a seizure when exposed to certain visual images, including flashing lights or patterns that may appear in video games. Even people who have no history of seizures or epilepsy may have an undiagnosed condition that can cause these "photosensitive epileptic seizures" while playing video games.

Immediately stop playing and consult a doctor if you experience any symptoms.

These seizures may have a variety of symptoms, including light-headedness, altered vision, eye or face twitching, jerking, or shaking of arms or legs, disorientation, confusion, or momentary loss of awareness. Seizures may also cause loss of consciousness or convulsions that can lead to injury from falling down or striking nearby objects.

Parents should watch for or ask their children about the above symptoms. Children and teenagers are more likely than adults to experience these seizures.

You may reduce risk of photosensitive epileptic seizures by taking the following precautions:

- Play in a well-lit room.
- Do not play if you are drowsy or fatigued.

If you or any of your relatives have a history of seizures or epilepsy, consult a doctor before playing video games.

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About the Dornier Do 31

The Do 31 is a jet-powered, vertical take-off and landing (VTOL), experimental military aircraft developed by West German aviation manufacturer Dornier.

The Do 31, of which Dornier only produced three (two of which were airworthy), holds the distinction of being aviation history's only jet-powered VTOL utility / transport aircraft ever created. It took its maiden flight on February 10, 1967 and performed a number of experimental and public demonstration flights. The program was cancelled in April of 1970.

The Do 31 program traces its lineage to the Cold War and the desire of NATO and West Germany to develop resilient air force capabilities in the event of armed conflict. The West German military, the Bundeswehr, sought air power systems in the early 1960s that could launch and land even if Soviet Bloc forces destroyed their airfields. This meant developing experimental vertical take-off and landing systems that could be evolved into production aircraft able to operate out of traditional air facilities, small expeditionary airfields, or even roads and highways, including Autobahns. The Bundeswehr's overall plan included three VTOL aircraft: a fighter / interceptor that was designated the EWR VJ 101, a surface attack platform called the VFW VAK-191B, and a large utility aircraft that could transport troops and cargo, the Dornier Do 31.

Dornier had gained experience with short take-off and landing (STOL) aircraft prior to embarking on the Do 31 project. The Dornier Do 29, which took its maiden flight in late 1958, was an experimental twin-engine, piston-powered aircraft that used tilting motors to boost lift for take-off. The jet-powered Do 31 would prove far more complex, requiring developing some of the most advanced aviation technology to that point in history.

Dornier crafted a design, formally called the Do 31E (E for Experimental), using a high main wing, a cruciform empennage, a capacious fuselage with a rear-loading cargo ramp system, and retractable tricycle landing gear. Two Rolls-Royce Pegasus BE.53/2 turbofan engines, each producing up to 15,500 pounds of thrust directed through four thrust vectoring nozzles, provide primary power. Each Pegasus is housed in a nacelle, one under each side of the wing. For complementary thrust and redundancy purposes—should one of the Pegasus engines fail mid-flight—Dornier crafted wingtip nacelles which house four vertically-oriented Rolls-Royce RB-162-4D turbojet engines, each producing up to 4,400 pounds of thrust. In total, the Do 31 is powered by ten engines that produce an aggregate 66,200 pounds of thrust. Only a handful of other aircraft in history have comprises ten or more engines, notably Dornier's massive flying boat, the Do X, which used 12 engines.

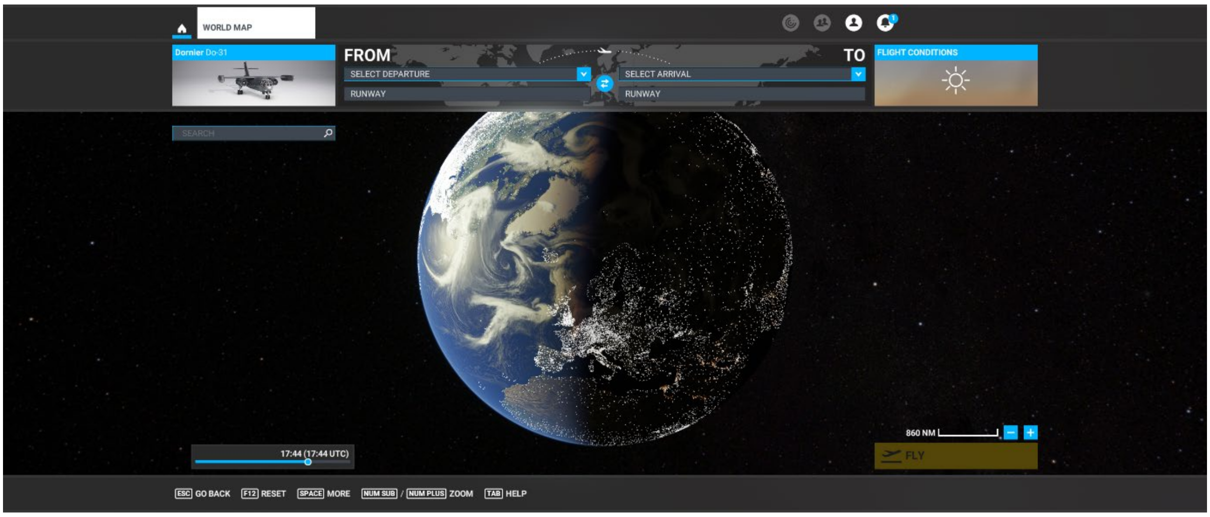
To provide control of the Do 31 throughout all its flight regimes, Dornier crafted a hybrid analog-digital computer, the DO-960. The computer enables stable and precise control in horizontal flight mode, transitional flight, and aircraft mode. The Do 31 lifts off with thrust from the Pegasus engines vectored downward through its rotating nozzles combined with thrust from the wingtip turbojets. Stability is provided by the DO-960 computer by varying the thrust of each engine as well as bleed air from the Pegasus engines ducted to nozzles in the tail of the aircraft. The aircraft transitions to forward flight mode by the rotation of the nozzles of the Pegasus engines rearward.

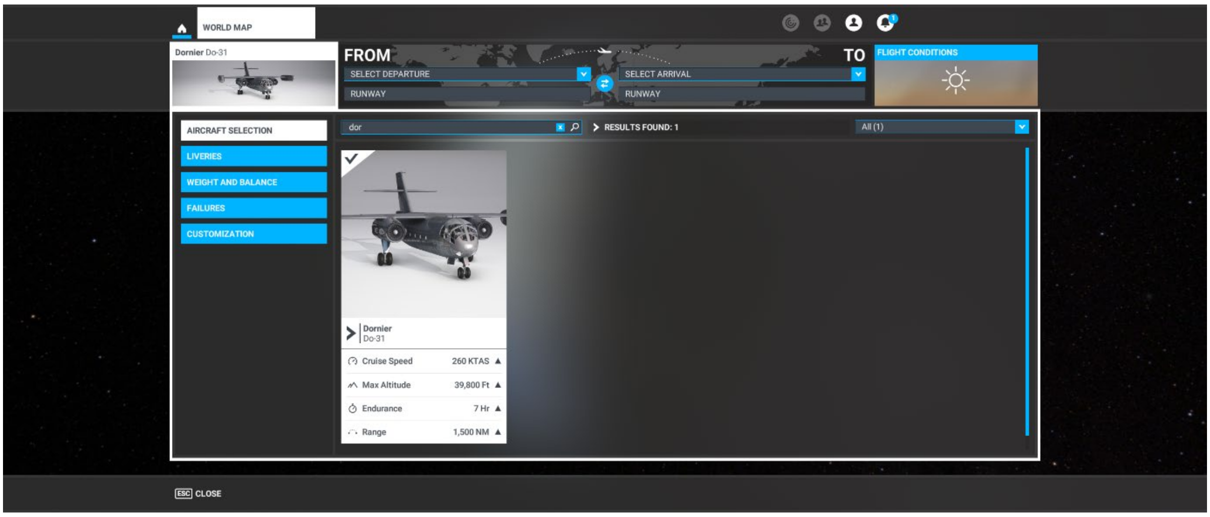
Flight tests proved the Do 31 to be remarkably manoeuvrable and versatile. It could hover, fly backwards, and rotate with precision, and then transition into forward flight for high speed transit. The aircraft set a series of flight records for its class—of which it was the only member. The Do 31 and the entire concept of a jet-powered VTOL air force was abandoned in the early 1970s due to cost, complexity, and strategic outlook.

Aircraft Selection and Liveries

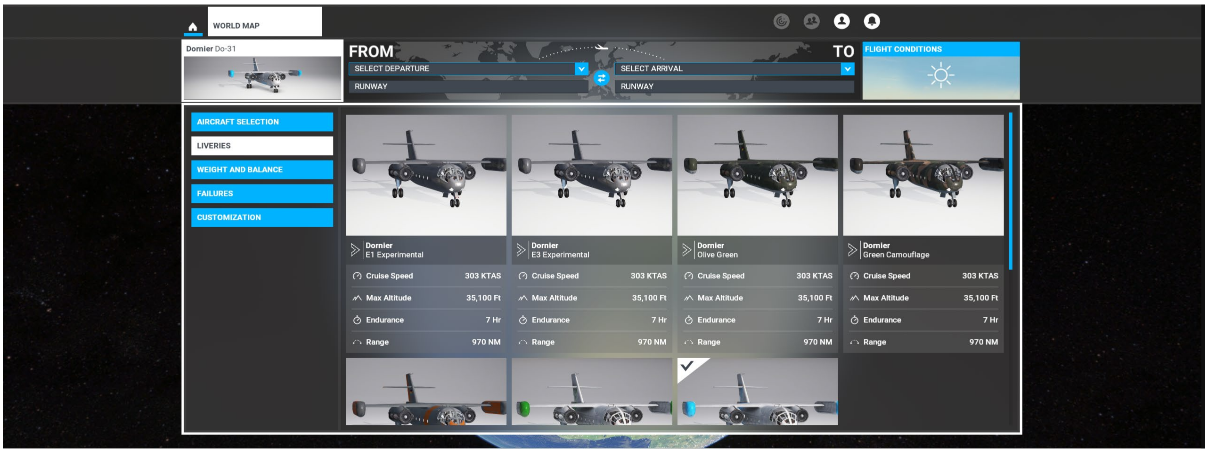
To fly the Dornier Do 31, you will need to select it from the Aircraft Selection menu.
Click on WORLD MAP in the Main Menu and click the AIRCRAFT SELECTION icon on the top left.

Scroll until you see the Dornier Do 31 or type "Do 31" in the search bar, and it will appear.





Click on Liveries to select any of the various designs available for the Do 31.


WORLD MAP
Dornier Do-31
FROM
SELECT DEPARTURE
RUNWAY
SELECT ARRIVAL
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TO
FLIGHT CONDITIONS
AIRCRAFT SELECTION
LIVERIES
WEIGHT AND BALANCE
FAILURES
CUSTOMIZATION
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E1 Experimental
Dornier
E3 Experimental
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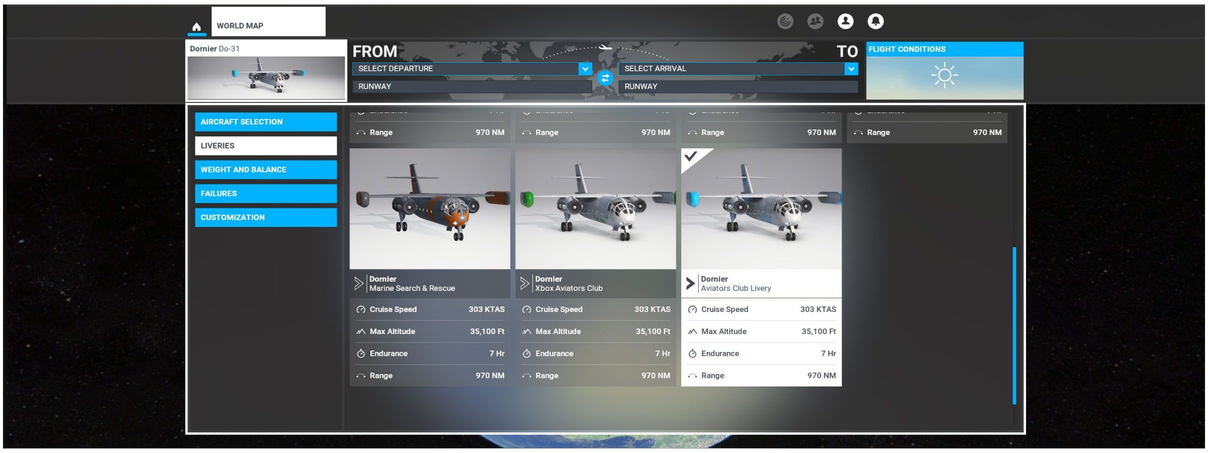
Dornier
Green Camouflage
Cruise Speed 303 KTAS
Max Altitude 35,100 Ft
Endurance 7 Hr
Range 970 NM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Dornier
Marine Search & Rescue
Dornier
Xbox Aviators Club
Dornier
Aviators Club Livery
Cruise Speed 303 KTAS
Max Altitude 35,100 Ft
Endurance 7 Hr
Range 970 NM

Cockpit Interaction

Some knobs within the cockpit have interaction where you can push, pull, or scroll them for their functionality.

This functionality will vary depending on your simulator's specific settings under GENERAL OPTIONS > ACCESSIBILITY.

If a control is set to "Lock," left click (and hold the left mouse button) the knob and push the mouse for "push" interaction and pull the mouse for "pull" interaction. Some functions also may have middle-mouse button "scroll" or "push" and right-mouse click "set" functions.

If it set to "Legacy," you will see an icon appear to the left, right, above, or below, which you use the middle-mouse wheel to scroll as if a circular arrow, and left click to "set" as if an up or down arrow icon.

On the Xbox, press **A** to interact with the knob and use **A** to "push," **X** to "pull," Right Stick to "scroll," and **B** to finish the control input.

Checklists

While this guide offers comprehensive operational instructions that are functionally complemented by the Quick Reference Card (QRC), iniBuilds has incorporated expedient procedural checklists within the simulator. These can be accessed via the top-of-screen drop-down menu by selecting the Checklist option.

Clicking the blue eye icon to the right of the checklist item will switch your view to the requisite panel where the button/switch/dial/gauge is located. You can use the AUTO COMPLETE option to expediently tick off the item from the checklist.

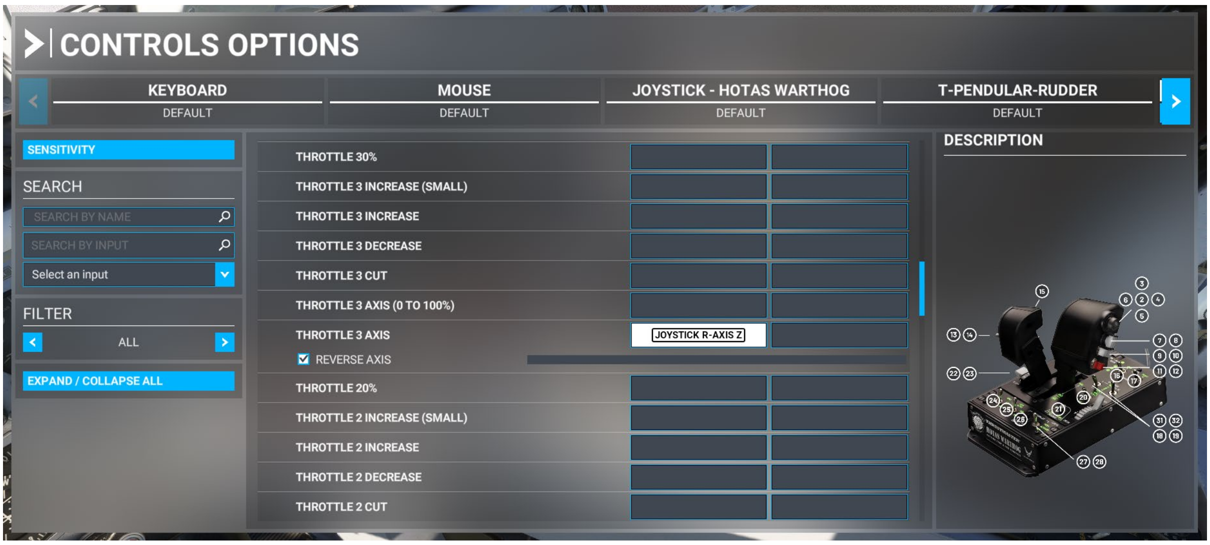
Important Notes and Substitutions

The aircraft uses the new Computational Fluid Dynamics (CFD) flight model along with new fuel system and engine physics. Care should be taken while flying the aircraft not to stress the airframe and engines beyond their intended limitations as the aircraft, including all of its internal structural elements, reacts realistically in the system under these new simulation mechanisms.

The aircraft used a number Stability Augmentation Systems (SAS) for hover flight. These have been simulated by iniBuilds to assist with varying levels of automation. Please see the Stability Augmentation System (SAS) section later in the manual.

Recommended Control Bindings

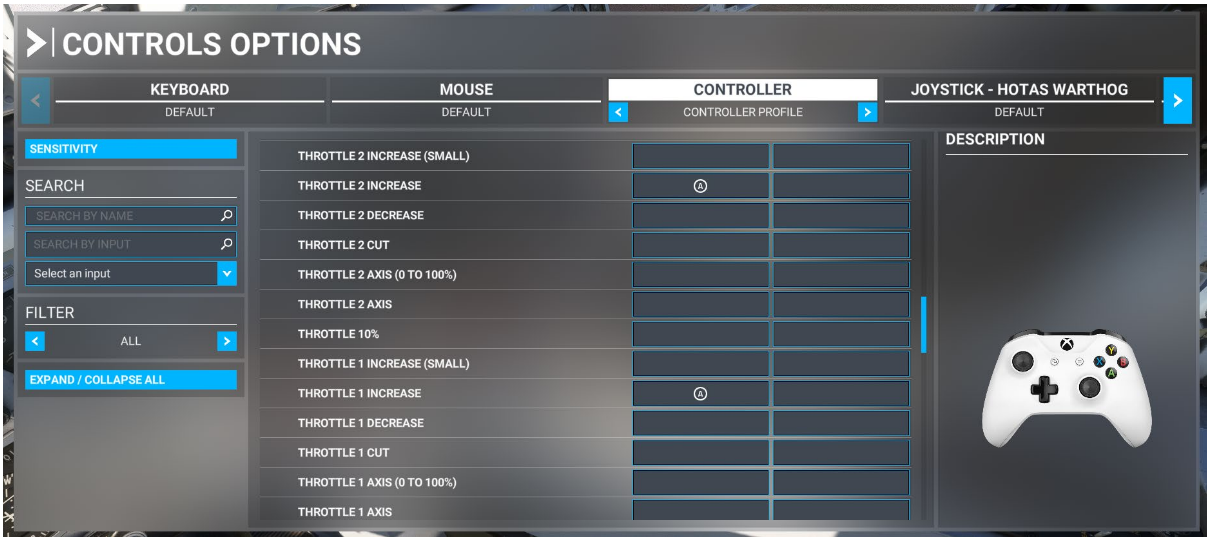
To control the transition from hover to conventional flight we recommend setting up Throttles 1 & 2 to the same axis and Throttle 3 to a different axis so you can control your throttles independently on a HOTAS unit or Xbox controller.



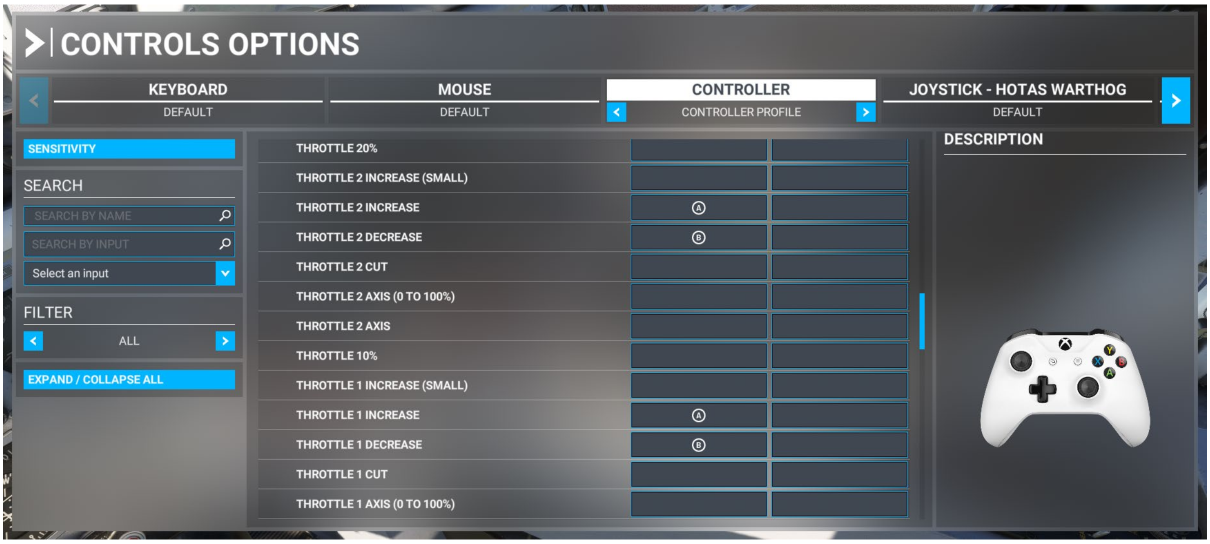
It is recommended to assign Throttle Axis3 to control the vertical engines on your throttle/joystick unit or Xbox controller.

For the Xbox, we recommend the following settings:

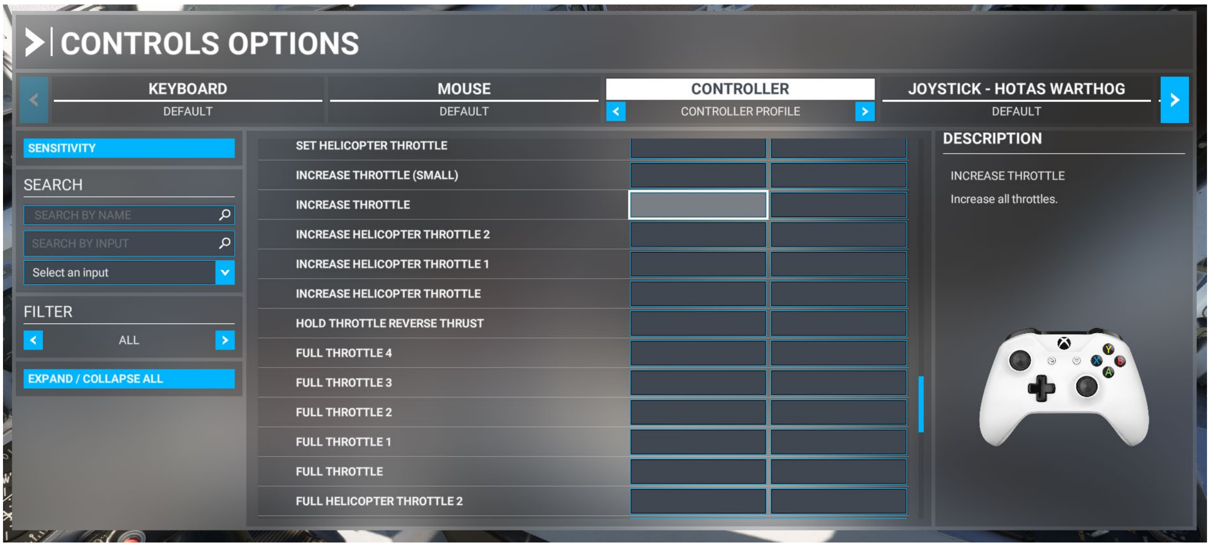
Set Throttles 1 and 2 Increase to **A**

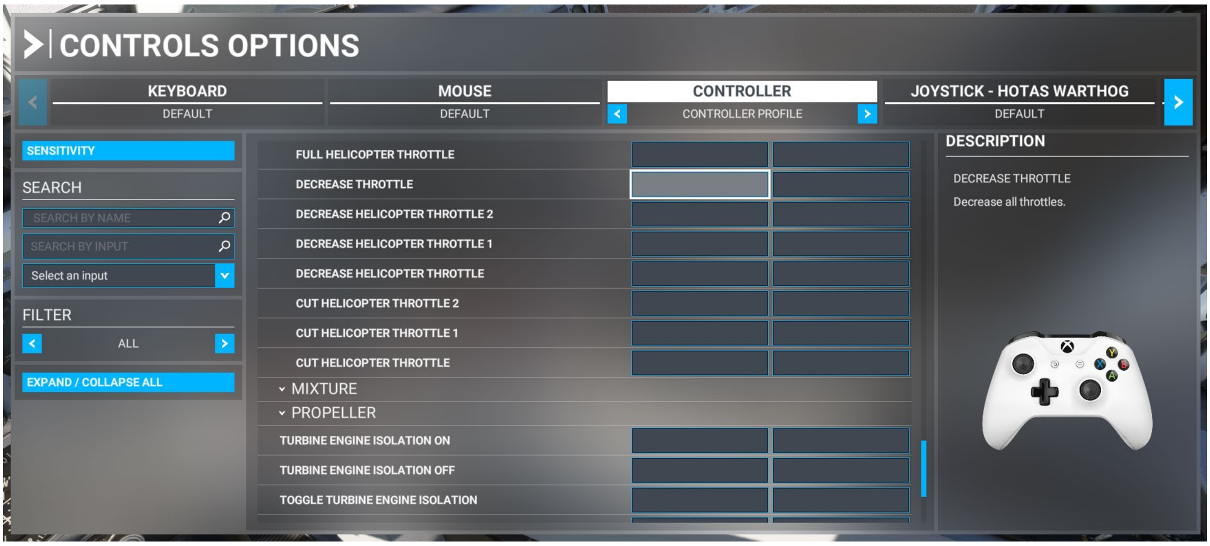


Set Throttles 1 and 2 Decrease to **B**



Clear out Throttle Increase and Throttle Decrease commands so as not to conflict with the vertical engines.





Set Throttle 3 increase to Right Bumper + Up on the d-pad.
Set Throttle 3 decrease to Right Bumper + Down on the d-pad.

Copilot Vertical Engine Control

To assist with vertical lift there is a Copilot AI system that will manage elements of the vertical flight and assist you. In addition to this there are three mode switches for varying levels of assistance.

The Copilot can be toggled on and off from the front dash panel, within certain parameters (defined below).

Vertical flight can be achieved without the use of the assistance switches; however, the Copilot function MUST be switched on for the vertical engines to start and to achieve vertical lift.

The procedure for starting the vertical engines and achieving vertical lift are as follows, ensuring you have bound your Throttle 3 controls as above:

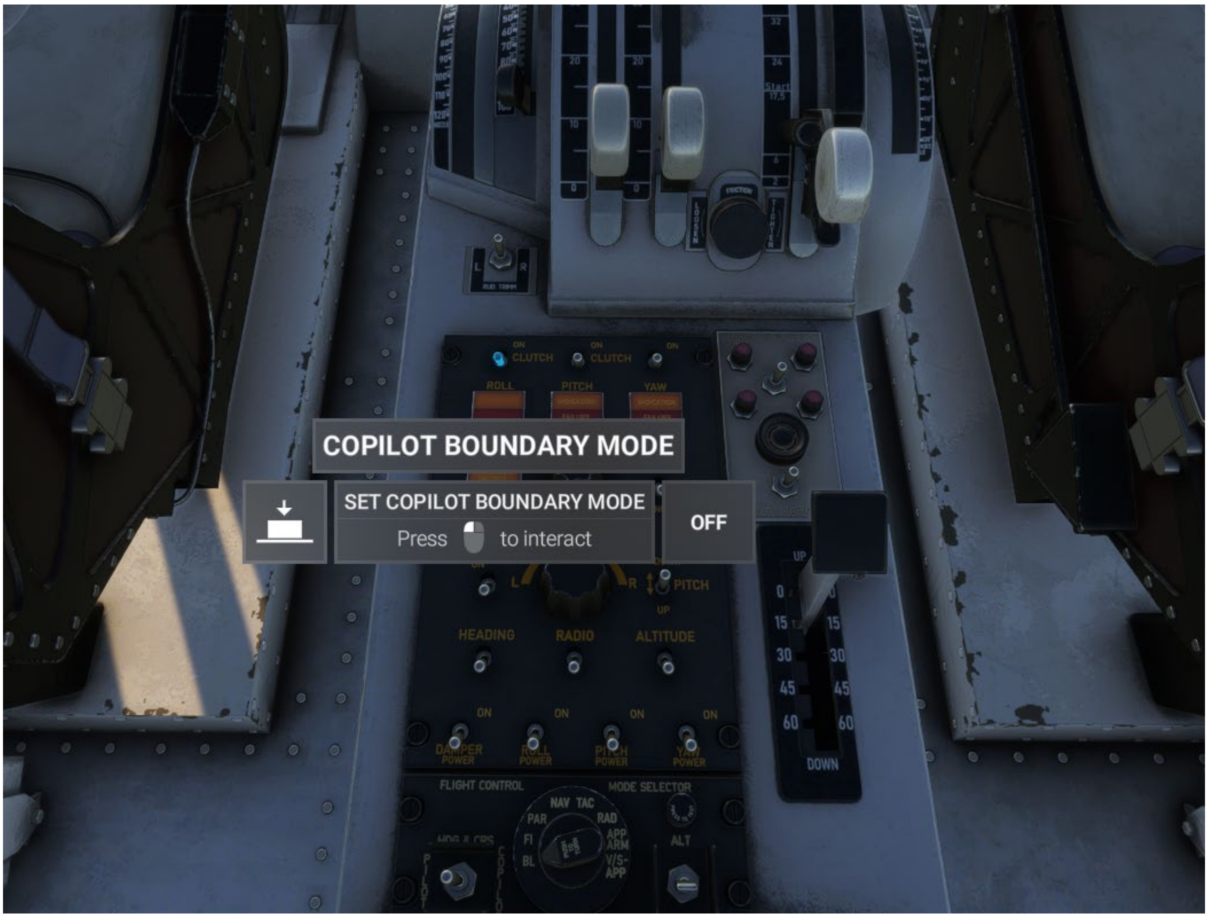
Vertical Engine Start	
Conventional Engines	RUNNING
Copilot Vertical Engine Control	ON
Copilot Green Indicator Light	CHECK ON
Vertical Lift Command Throttle	TO START
Vertical Engines Fuel Pumps	CHECK ON
Engine Spool Up	MONITOR ENGINES 3-10 RPM GAUGES WITHIN GREEN ARC
Conventional Engine Throttles	IDLE
Enable Required Copilot Assist Mode	AS REQD

To give additional protection during hover mode there are three Copilot assist mode switches located on the rear section of the centre console, each switch giving varying levels of assisted control. These do not need to be enabled to hover the aircraft.
The switches should be used independent of each other (only one switch at a time).

Copilot Boundary Mode

This is the most basic level of Copilot control and acts by way of a boundary guardian. The player should attempt to fly the aircraft as they would manually, and if you go too far outside flight envelope limits, the Copilot will give you a nudge back into the correct attitude.

With the conventional engines idle, throttle up the vertical thrust engines slowly to manage your pitch, with the aircraft achieving 7 degrees +/- (monitor on the pitch gauge) depending on weight and barometric conditions.



Copilot STOVL Assist

The STOVL Assist mode allows for a seamless Short Take Off and Vertical Landing.
Set the parking brake to on, throttle up the conventional engines to 80% N1, and when stabilized release the parking brake.
Once above 50 knots, gradually increase the vertical thrust engines throttle until you achieve between 300-600ft/min positive rate of climb, then increase the conventional engine throttles to 100% (within EGT constraints).
Once your airspeed has increased to over 100 knots, start to reduce the throttles on the vertical thrust engines with the target of closing them once above 170 knots.

Copilot Hover Assist

This mode is recommended for use with Xbox controllers and first-time players of the aircraft and will give the greatest amount of automated control during hover manoeuvring.

There is no need for any stick input to achieve hovering, however the pilot can fine tune the hover as needed with small movements on the flight stick.

Simply throttle up the vertical thrust engines slowly until you have taken off from the ground, then slowly introduce the conventional thrust engines to achieve greater transitional forward flight. As your air speed increases, slowly throttle back the vertical thrust engines until closed.

Copilot Conditions

The Copilot will switch off vertical thrust assistance automatically with **all** of the following parameters being met:

Airspeed - above 160 Knots

AGL - above 250ft

Conventional throttles – set above 50%

Gear - UP

At this point the aircraft should be within conventional flight parameters.

Below are the procedures for STOVL and Hover Take Off.

STOVL Takeoff	
Conventional Engines	RUNNING
Vertical Engines	RUNNING
Copilot Vertical Engine Control	CHECK ON
Copilot Green Indicator Light	CHECK ON
Copilot Assist Mode	OFF, BOUNDARY OR STOVL ASSIST MODE ON
Parking Brake	SET
Conventional Engine Throttles	INCREASE TO 80%
Parking Brake	RELEASE
Above 50 Knots	
Vertical Lift Command Throttle	INCREASE
Stick and Rudder	AS REQD
Positive Climb Rate	GEAR UP
Conventional Engine Throttles	INCREASE to 100% WITHIN EGT LIMITS
Copilot Assistance	AUTO-DISCONNECT WITHIN CONDITIONS

Hover Takeoff	
Conventional Engines	RUNNING
Vertical Engines	RUNNING
Copilot Vertical Engine Control	CHECK ON
Copilot Green Indicator Light	CHECK ON
Copilot Assist Mode	HOVER ASSIST MODE ON AS REQD
Conventional Engine Throttles	IDLE (Copilot will control)
Vertical Lift Command Throttle	INCREASE
Stick and Rudder	AS REQD
Positive Climb Rate	GEAR UP
Conventional Engine Throttles	INCREASE
Copilot Assistance	AUTO-DISCONNECT WITHIN CONDITIONS

Copilot Vertical Landing Assist

This mode allows for an easier transition from conventional flight to hover landing.
The Copilot will assist in the transition from conventional flight to hover flight when coming into land, it will also fully manage the brake flaps deployment at stages of transition to help slow the aircraft down.
It is essential that you monitor your Angle of Attack (AOA) and Vertical Speed (VS) descent rate during the slowing down and vertical landing part of the flight. Small inputs on your rudder and stick back pressure will allow for course correction and forward speed momentum slowing down the aircraft.
During parts of the landing procedure, you will be controlling your descent rate with vertical thrust only, and forward speed control with some back stick pressure, whilst maintaining a good AOA and VS descent rate.
Slowing down the Dornier to a vertical hover is similar in relation to slowing a helicopter down, maintaining a good AOA with back stick pressure whilst aiming for a VSI of zero to achieve a hover.
It should not be flown in a conventional aircraft sense, maintaining speed and VS for touch down.

For a good vertical landing having the aircraft set up at approach phase is equally as important to the landing phase, using the procedure below.
It is essential to monitor the gauges during the approach, hovering and landing phases of the vertical landing procedure, with glances of looking out of the window for reference datum and attitude corrections.
Instrument flying is key to a good hover landing!

Note: the Copilot vertical landing assist will automatically switch off below 25 knots and cannot be enabled below that speed.

Vertical Landing Procedure	
Conventional Engines	RUNNING
Before 5 mile final	
Copilot Vertical Landing Assist	ON
At 5 Mile Marker	
Speed	BELOW 215 KNOTS / ABOVE 180KNOTS
Gear	DOWN

Flaps	CONTROLLED BY COPILOT
Copilot Vertical Engine Control	ON
Copilot Green Indicator Light	CHECK ON
Descent Rate	MANAGE TO 3 MILE MARKER
At 3 Mile Marker	
SPEED	ACHIEVE 150-160 KNOTS AT 3 MILES
Conventional Engine Throttles	IDLE
Vertical Lift Command Throttle	USE TO MAINTAIN DESCENT RATE
VSI	MONITOR DESCENT RATE
At 1 Mile Marker	
Altitude	ACHIEVE 400FT AGL
Vertical Lift Command Throttle	USE TO MAINTAIN DESCENT RATE
Back Stick	USE TO SLOW DOWN FORWARD SPEED
Rudder	USE FOR YAW TURNS
Stick Roll (Small Amounts)	USE FOR ROLL TURNS
At Touchdown	
Vertical Lift Command Throttle	IDLE
Copilot Vertical Engine Control	OFF
Copilot Vertical Landing Assist	CHECK OFF

Use of Auto-trim

Due to the design of the aircraft, there are large amounts of trim changes required to maintain an optimal profile for flight. This is especially prevalent in the transition from conventional flight into a hovering profile.

We recommend pilots new to the aircraft utilize the Piloting auto trim function. This will greatly assist with the workload required during the critical phase of flight when the aircraft is below conventional handling speeds and being assisted by the vertical engines, but before the vertical thrust engines have taken over primary lift generation.

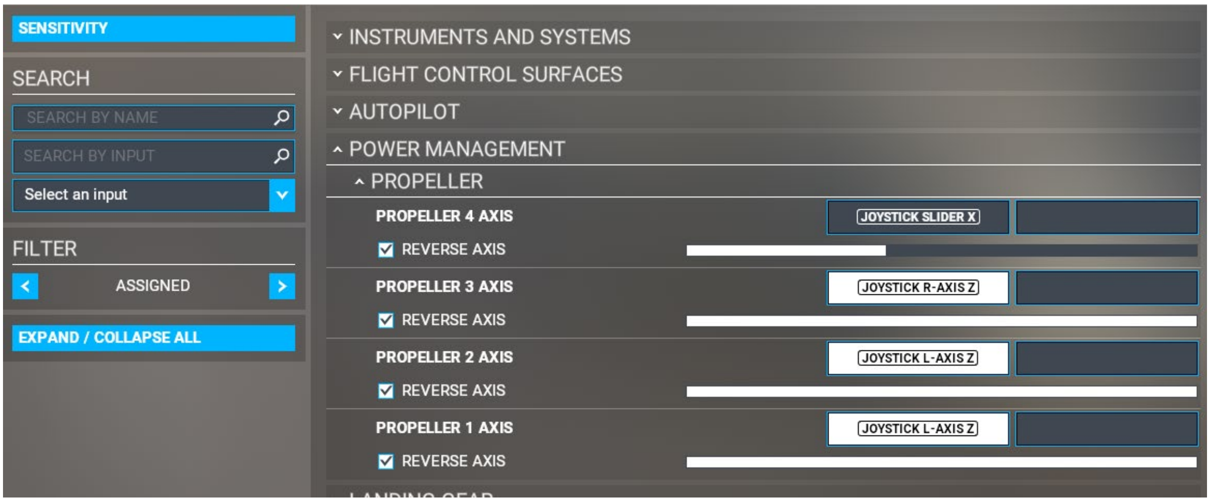
This can be found in Options > Assistance Options under the Piloting section.

Advanced Control Mode

This mode allows greater control over the engines and nozzles of the Do-31 and requires some remapping of controls. With this mode you will be able to control the nozzle angle on the Pegasus engines independently of the AI co-pilot input as well as the throttle controls for Pegasus engines and the RB162 vertical engines.

In this mode *ALL* assist controls are disabled.
For this mode to function correctly it is mandatory that you unassign all controls bound to throttles from the default menu and bindings for all engines and re-bind the following controls:

- Propeller 1 Axis – This controls Engine 1.
- Propeller 2 Axis – This controls Engine 2.
- Propeller 3 Axis – This controls the vertical lift engines.
- Propeller 4 Axis – This controls the nozzle angle on the main engines.



With the above configuration set up, the approach required to fly the Dornier is very different. Key points to remember, the natural hovering angle of the Dornier is dependent on weight and balance, around the 6-7 degrees nose up attitude. The Pegasus and RB162 engines do not produce enough thrust independently to provide vertical lift for the aircraft and must be used in a joint and smooth manner to enable control in the hover or for short field operations. We have listed below a few tips to consider for field operations in advanced mode.

Take-Off

For a vertical take-off ensure that the Vertical Engine control is advanced out of the shutdown position to enable the engines to spool up. Once >8000rpm has been observed on the vertical lift engines and the EGT has stabilised, increase power to maximum within EGT constraints. Once the RB162's have stabilised, rotate the Pegasus nozzles to the maximum rearward position and throttle up until you achieve enough power to become airborne. As you generate enough lift to become airborne pull back on the stick gently to encourage the correct hovering attitude of 6-7 degrees, this can be monitored on the pitch degree gauge.

For a rolling / Short field take off the procedure is very similar, once the RB162's are stabilised at full power, while the Pegasus nozzles are pointing forwards at the 0-degree position start to increase the throttle controls for the Pegasus engines. Once above 60 knots rotate the nozzles to the required angle and monitor the VSI for indication of an increase in climb rate.

Transitions From Hover / Rolling Take Off to Conventional Flight
Care should be taken when transitioning from a flight regime where lift is being provided by the RB162's into a conventional flight profile. The transition is a 2-stage process, during the first phase the Pegasus nozzles should be transitioned to the 0-degree mark slowly, whilst monitoring the VSI and ASI to ensure that at no point the aircraft enters a descent.
Phase 2 begins when the nozzles are 0 degrees with the Pegasus engines at or near full throttle, slowly begin to reduce thrust from the RB162 vertical thrust engines with the aim being that once you have exceeded 150 knots the RB162's have been shut down allowing normal conventional flight.

Transition To the Hover from Conventional Flight
When on approach and a minimum of 3 miles from the runway the Vertical engine control must be brought out of the shutdown position to the start position. Monitor the RPM and EGT gauges for the vertical lift engines to ensure good spool up until they are above 8000RPM.

Once this has been achieved the correct procedure to transition is a blend of the control inputs to control both engine output for all engines, nozzle angle and the attitude of the aircraft relative to the pitch angle and IAS.

The transition is a 3-phase procedure as follows:
Phase one:
Once under 150 knots with the vertical lift engines above 8000rpm and with a minimum of flaps 2 setting, bring the main engines to idle and monitor the VSI to ensure controlled descent rate. The objective of phase one is to control the aircraft descent while using the pitch of the aircraft to manage airspeed. By the end of phase one the aircraft should be no higher than 500AGL and between 95-110 knots IAS.

To slow the aircraft down gradually increase the pitch of the aircraft relative to the direction of travel, this can be dual monitored by the AOA gauge and the Pitch indicator on the control panel. Descent of the aircraft should be controlled by the throttle on the vertical lift engines. If you find that the aircraft is climbing, decrease your pitch input and then monitor the airspeed and as this decreases continue to increase pitch angle in a relative manner.

Phase 2:
With the vertical lift engines at full power and the aircraft in a controlled descent or level flight with the airspeed between 95-110 knots IAS phase 2 can begin. Move the Pegasus nozzle lever to the required angle (50-60 degrees for a STOVL landing and 90 for a vertical landing – for the purposes of this instruction we will do a vertical landing). And while managing airspeed with pitch increase the throttle position of the Pegasus engines to counter any sink rate displayed on the VSI. To slow the aircraft down effectively you will need to be achieving a pitch angle of around 10 degrees. Note: The aircraft is very sensitive to trim inputs and you are advised to make use of this during this phase. Once you are under 50 knots and in control of the climb/sink rate Phase 3 begins

Phase 3:
This phase deals with the transition between lift generation being primarily driven between the geometry of the aircraft and the engines. As the airspeed drops below 40 knots you will notice a decided increase in sink rate. Careful attention needs to be paid during this stage to increase power to the Pegasus engines to counter this, at no point during this transition should the sink rate be allowed to exceed 500fpm. As you slow down (by maintaining the pitch angle as described in phase 2) through 20 knots IAS the controls will shift priority to the hover attitude requirements, this will mean that you “step” onto the air column being created by the 10 engines of the Dornier.
The aircraft should now be flown akin to a helicopter where the flight control stick controls speed and attitude and the throttles control altitude. Remember, the neutral pitch attitude of the Dornier in the hover is around 6 degrees nose high.

Vertical Landing
With the aircraft in or near a hover the Pegasus engines should be used to control altitude with gentle control movements on the flight control stick to control speed and attitude of the airframe. When you are located at your desired landing point reduce throttle and monitor the vertical speed on the VSI to touch down below 200fpm.
Once on the ground engage brakes and idle all the engines immediately.

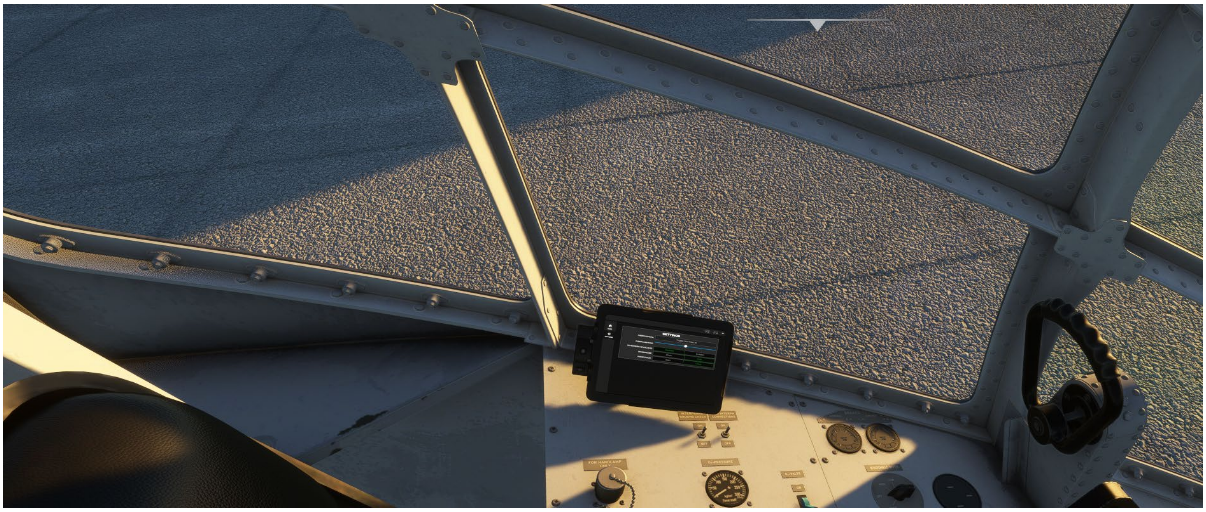
Rolling Landing / Short Field Operations.
Follow Phases 1 and 2 from the vertical landing operations however only reduce the nozzle angle to the required position to enable some conventional thrust generation. When on final approach and stabilised with the vertical engines at full power utilise the thrust from the Pegasus engines in combination with the nozzle angle control to arrest any unwanted descent rate during the touch down phase.

Dornier Do 31 Specifications

Max Speed: 350 KIAS
Cruise Speed: 303 KTAS
Max Altitude: 35,100 Ft
Max Weight: 49,604 Lb
Range: 970 NM
Fuel Capacity: 1,922 Gal
Length: 68.00 Ft
Wingspan: 59.20 Ft
Engines: 10 Jet

Electronic Flight Bag (EFB)

Within the left-hand side of the cockpit is an EFB which allows for some key functions of the aircraft to be accessed.
There is a moving VFR Map, which will show your route if set within the World Map.
The options page lets you control the rear cabin lighting, having the nosecone shown or hidden, opening of the ramp door and displaying the flight manual reminder to set up your throttle control bindings.



Home Page (incorporating moving map)

Settings page

Within the settings page you can open and close the rear cargo ramp.

You can also show or hide the nose cone in the setting page.

Autopilot Control

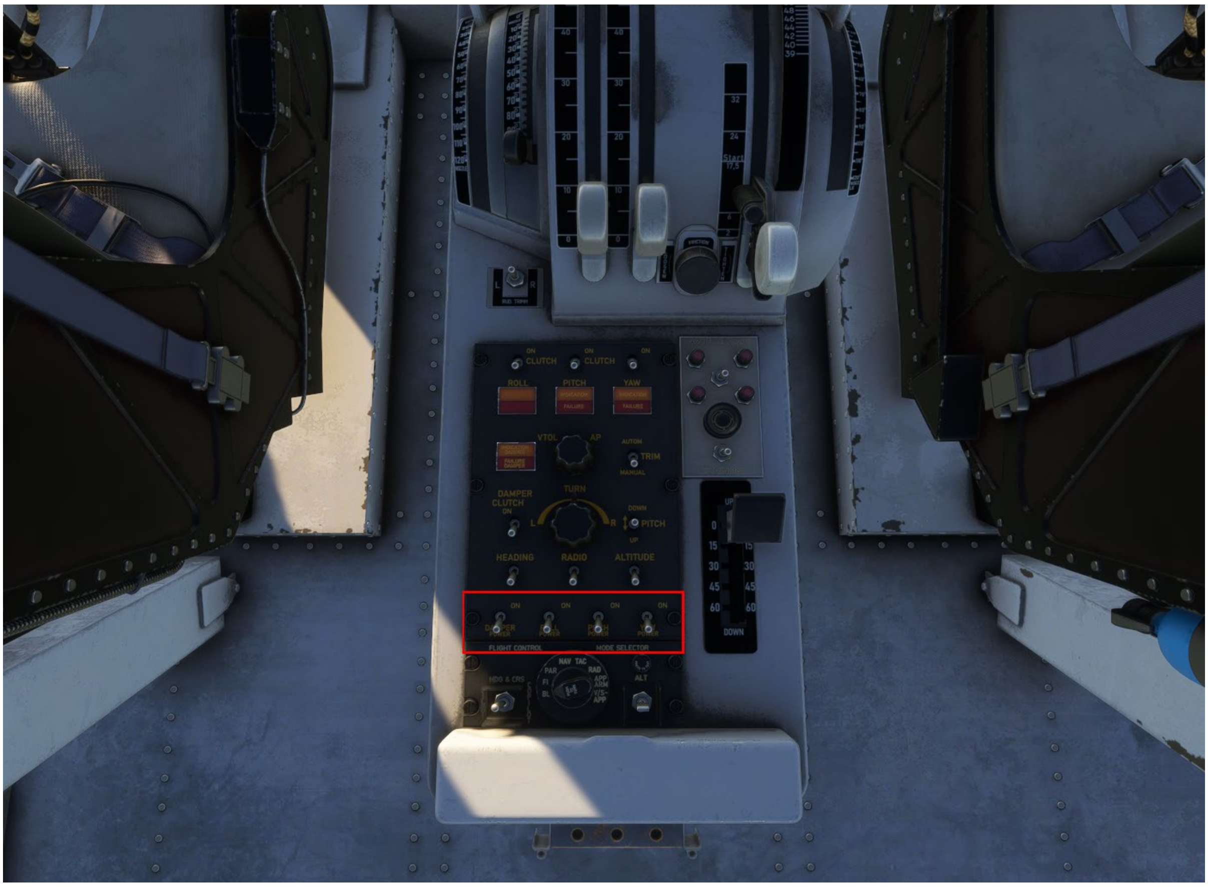
The Dornier comes with an in-built autopilot system, the switches for it are located on the centre console rear panel.
The autopilot adds controls for damper, roll, pitch and yaw and all four of the switches need to be set to ON for the autopilot to function.
Pressing Z or any autopilot master keybind on hardware will toggle the autopilot master and the power to the four switches.
The Flight Director on the front panel should be switched ON.

The autopilot can only be switched on when the following conditions are met:

- Copilot assistance modes deactivated
- Pitch between -10 and +10 degrees
- Roll between -35 and +35 degrees
- Airspeed above 170 knots
- Altitude above ground greater than 1000 ft

Once these conditions are met, the player should turn on the following switches:

- Damper power
- Roll power
- Pitch power
- Yaw power

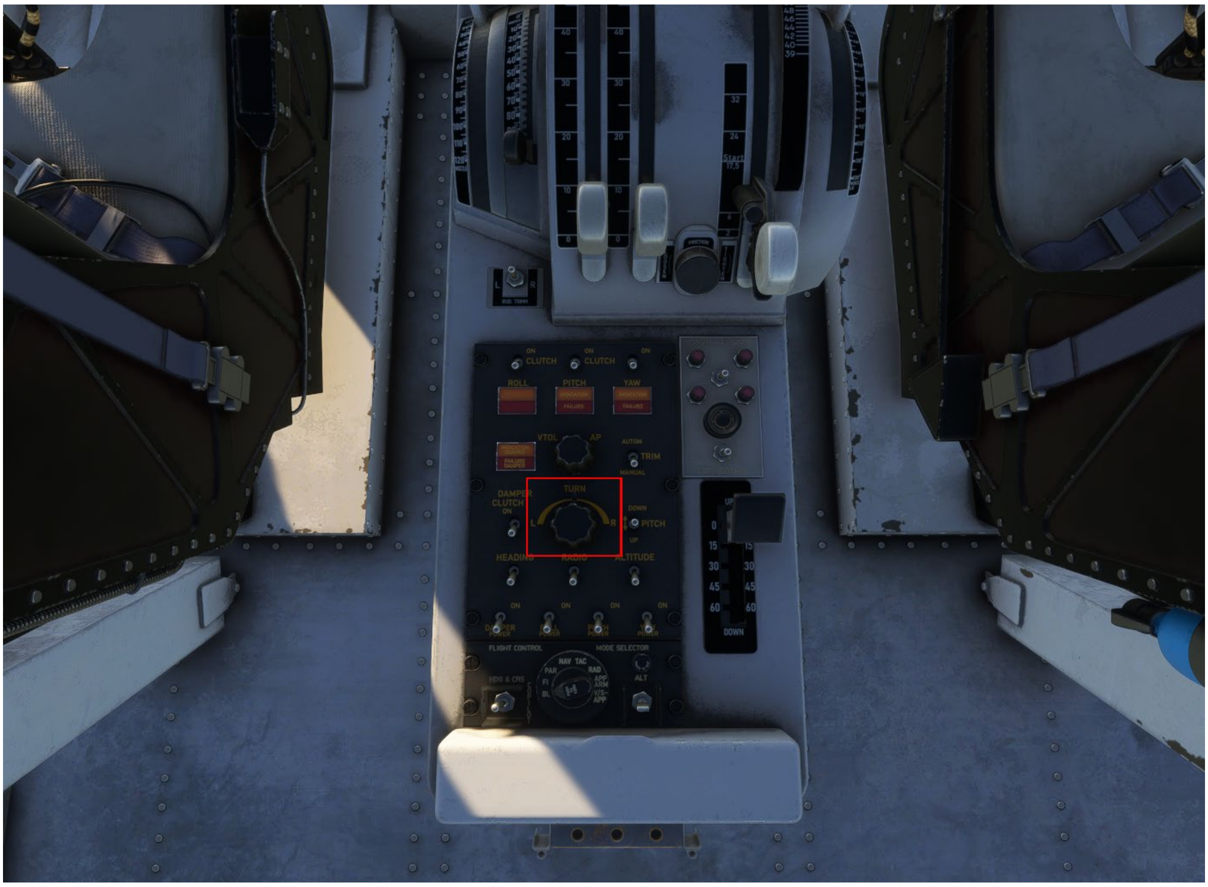


If the autopilot is switched on using hardware or by pressing Z, the aircraft will be at bank hold and pitch hold until another mode on the switches is turned on.

The autopilot has the following modes:

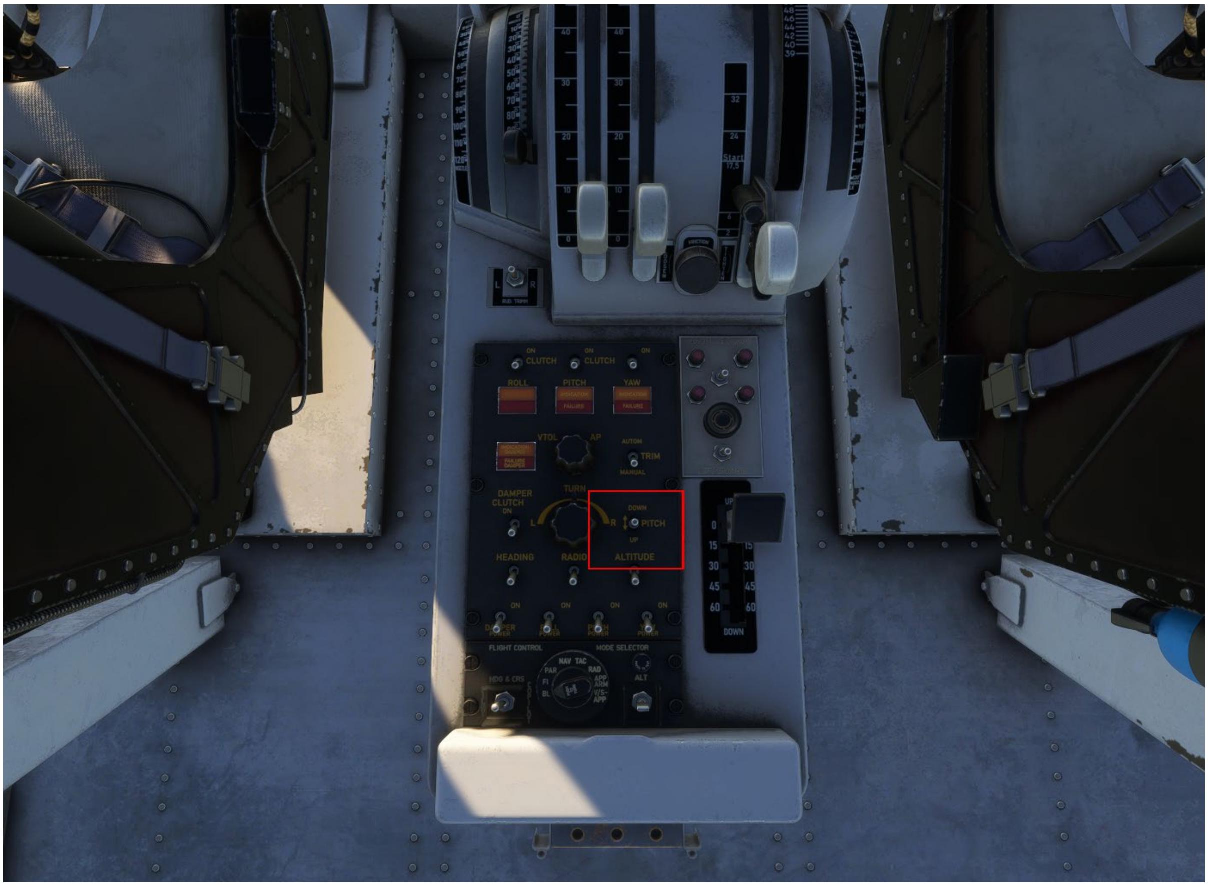
Turn hold

To change the bank angle of the aircraft by 30 degrees, use the switch in the middle of the panel to the right or left. To make the aircraft wings level turn the switch in the opposite direction.



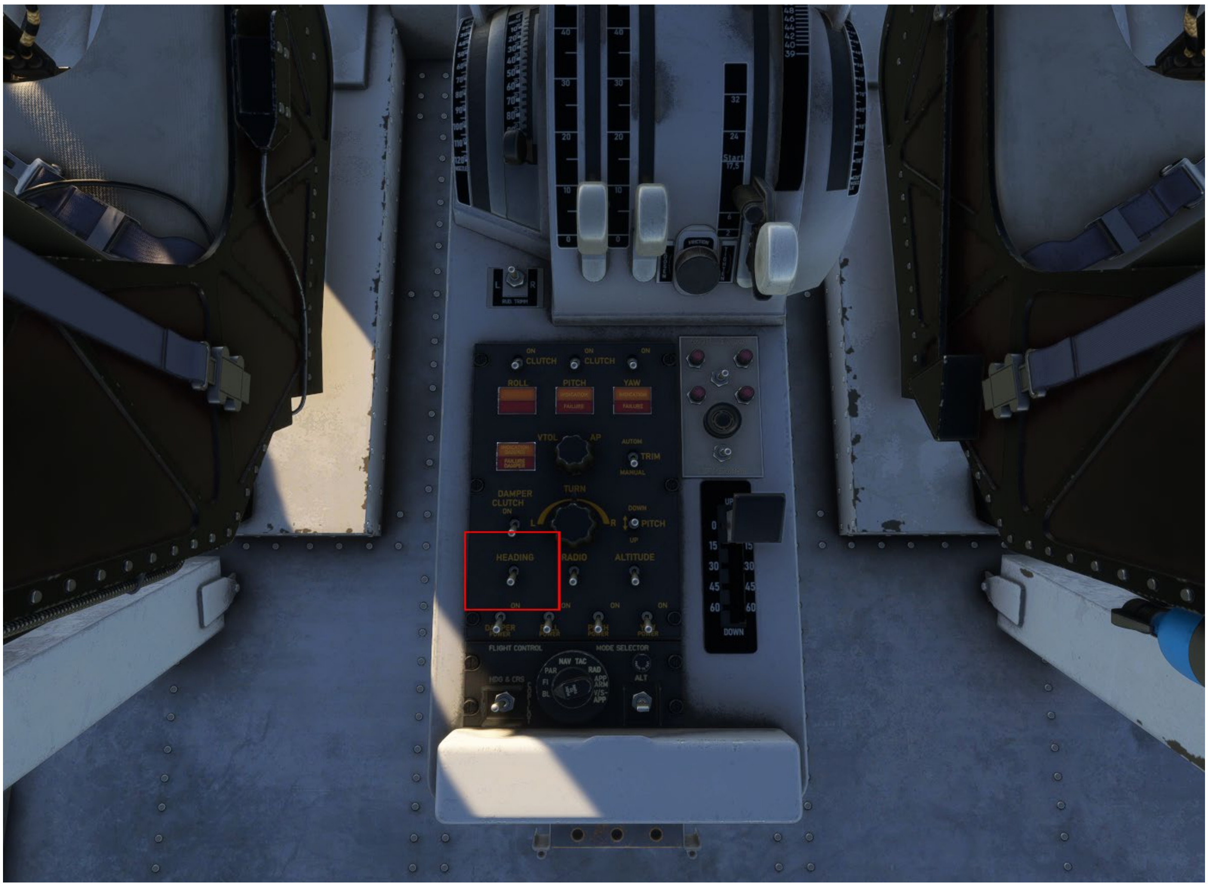
Pitch Hold

With the altitude hold switch off, moving the Pitch switch up or down will increase or decrease the vertical speed by 500fpm increments. Set the pitch angle to follow the desired vertical speed between -1000fpm and +1000fpm. Moving the switch in the opposite direction will bring the v/s to zero.



Heading Change

Switch on the heading hold mode to follow the desired heading selected on the HSI using the heading selector knob.

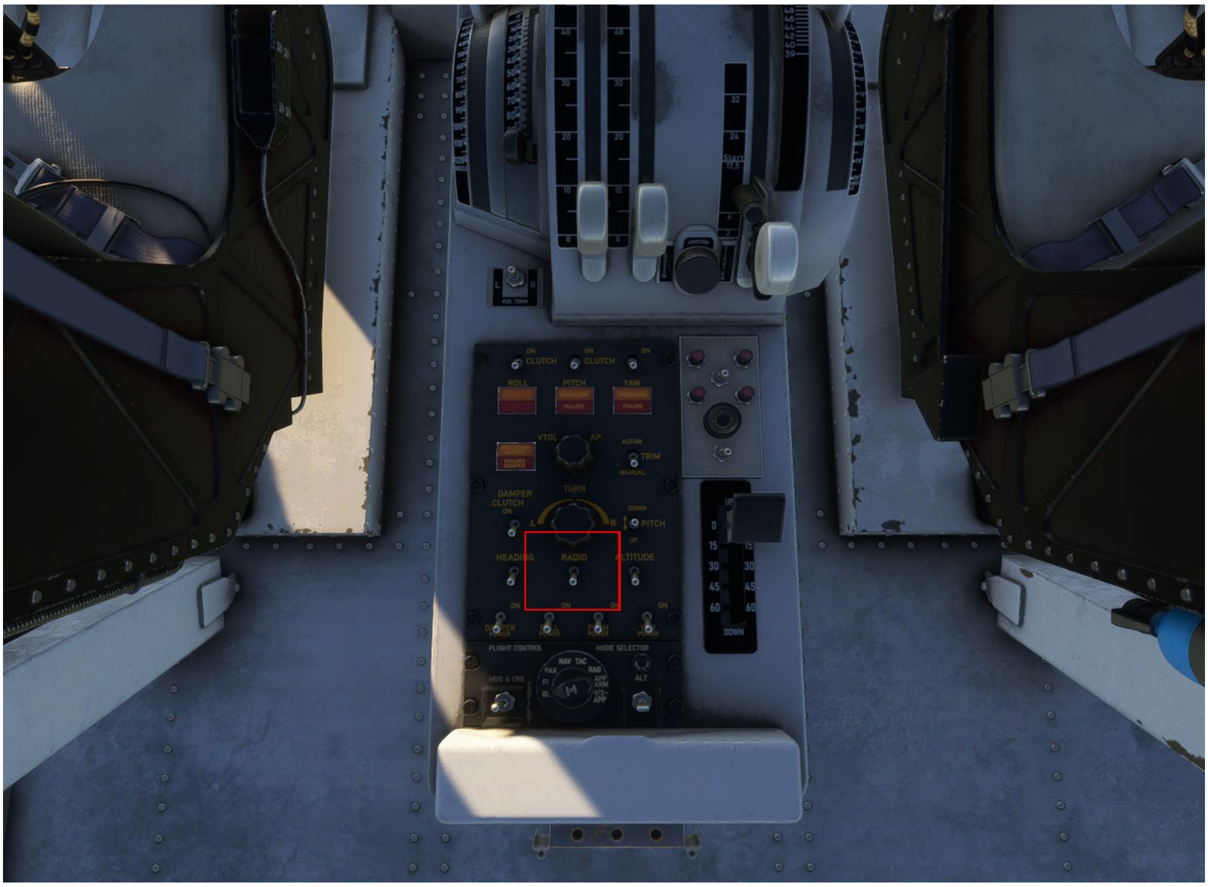


1. Heading Bug 2. Heading Selector

Radio Mode

This mode is equivalent to NAV mode to follow the selected course using the HSI course knob and VOR indicator.

Switch the RADIO switch to ON and tune your desired VOR frequency on the overhead VHF panel with the switch set to NAV/COMM.

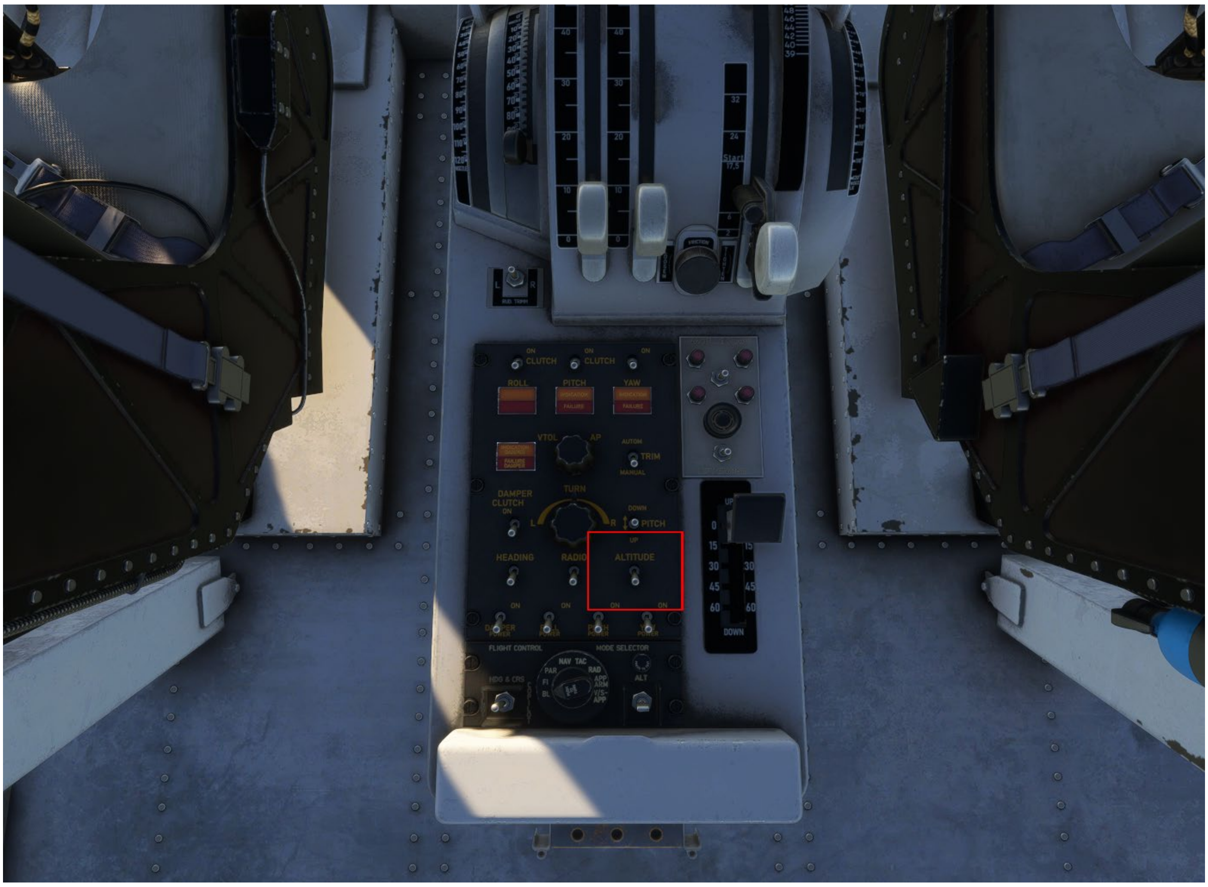


1. Heading
2. Distance to DME
3. Deviation and Glideslope Bars
4. Course selector
5. Heading selector

Note that this works the same way if using TACAN navigation and setting the frequency on the TACAN panel.

Altitude Hold

To set the altitude hold mode with the current aircraft altitude, turn on the ALTITUDE switch.



ILS – Glide Slope Indicator and Deviation Indicator

With the ILS frequency of an airport tuned into the NAV1 radio panel and set to ON, the GSI and DI bars on the HSI will automatically direct you on course to land, as long as the aircraft is within the airport ILS beam and the heading has been set on the HSI.

The white bars will move in the opposite direction of the aligned course. For example, if you are off course to the left, the DI bar will show to the right. Similarly if you are above glideslope path the GSI bar will show below the horizon line.

The DME counter on the top right hand side will show the distance to the airport.

With the autopilot in APP mode and the Flight Director switch ON

This can be turned on for the Captain and First Officer HSI.

Steps for an ILS Approach

1. Tune the frequency on the VHF Radio, NAV mode (switch down) to the desired plate frequency, in this example KLAX RNWT 24L - 111.70

2. Set the Heading and Course on the HSI

This will rotate the HSI inner card to the desired course setting and will adjust the deviation needle. The heading bug will also show the set heading and distance to the DME will be shown and count down.

3. Establish yourself toward the ILS beam from the STAR or as directed by ATC.

a. The glideslope indicator will move down or up depending on your altitude in relation to the ILS transmitter. If the bar is high, you are too low. If the bar is low, you are too high. Adjust your height until the GSI is centered.

b. The deviation bar will move left or right in relation to the course set. With the bar centered, you are on course. Adjust your aircraft heading until the bar is centered.

Fly the bars down the beam, controlling your airspeed, height and heading to land at the desired runway.

Autopilot ILS Approach

Follow steps 1 to 3 above and when established on the glide path, enable the autopilot using all 4 switches along with the radio switch and set the NAV mode to APP ARM.

If the aircraft is established within the ILS beam the autopilot will automatically follow the heading and glideslope down to 500ft AGL, where the Autopilot will disconnect for manual landing.

With the Flight Director switch set to ON the deviation and glideslope bars on the ADI will automatically follow the heading and glideslope altitude.

Cockpit Layout

Front Main Panel

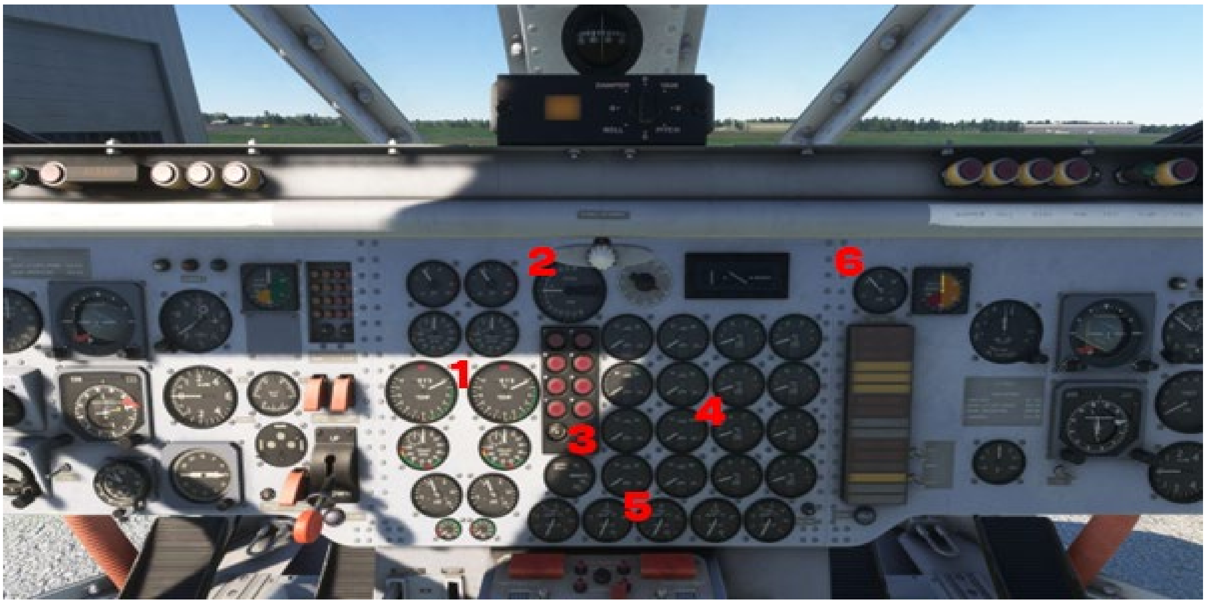
1. Attitude Indicator and Alpha Angle Indicator	7. Attitude Indicator and Alpha Angle Indicator
2. Autopilot Control Indicators	8. Captain Instrument Gauges
3. Copilot Control Button and Indicator	9. Landing Gear Panel
4. Warning Indicator Lights	10. Engines Instrument Gauges
5. Magnetic Compass	11. Copilot Instrument Gauges
6. Warning Indicator Lights	12. Main Warning Panel

Captain's Instrument Panel

1. Pitch Indicator	9. Turn and Slip Indicator
2. Alpha Angle Indicator (AOA)	10. Horizontal Situation Indicator (HSI)
3. Vertical Speed Indicator (VSI)	11. Vertical Speed Indicator (VSI)
4. Air Speed Indicator (ASI)	12. Brake Pressure Indicator
5. Attitude Direction Indicator (ADI)	13. Mach Number
6. Altimeter	14. Standby Attitude Indicator (SAI)
7. Nozzle Angle Indicator	15. Clock
8. Radio Altimeter (RADALT)	16. Radio Magnetic Indicator (RMI)

Captain's Left-Hand Panel

1. Electronic Flight Bag (EFB)	4. Windscreen Wiper Control
2. Oxygen Supply and Pressure Indicator	5. Nose Wheel Steering Tiller
3. Brake Pressure Indicator	



Engine Instrument Panel

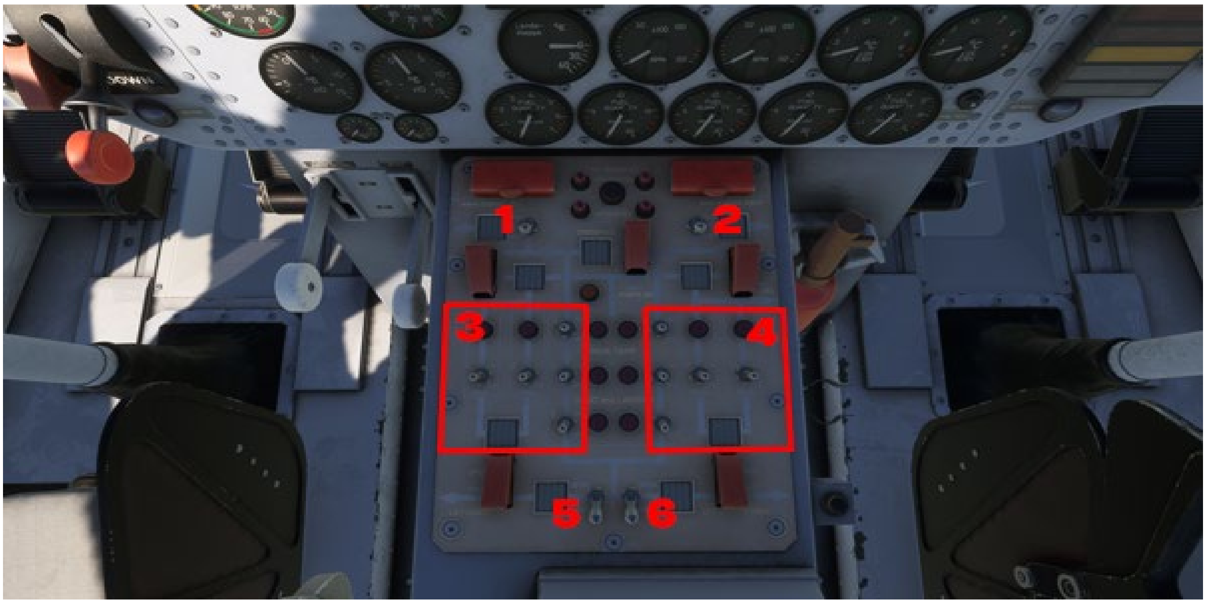
1. Conventional Engines Gauges	4. Vertical Engines Gauges
2. Pitch Trim Indicator	5. Fuel Gauges
3. Vertical Engine Warning Lights	6. Outside Air Temperature (OAT)

Copilot's Instrument Panel

1. Alpha Angle Indicator (AOA)	8. Horizontal Situation Indicator (HSI)
2. Pitch Indicator	9. True Air Speed (TAS)
3. Nozzle Angle Indicator	10. Radio Altimeter (RADALT)
4. Mach Number	11. Beta Gauge
5. Attitude Direction Indicator (ADI)	12. Vertical Speed Indicator (VSI)
6. Altimeter	13. Radio Magnetic Indicator (RMI)
7. Vertical Speed Indicator (VSI)	

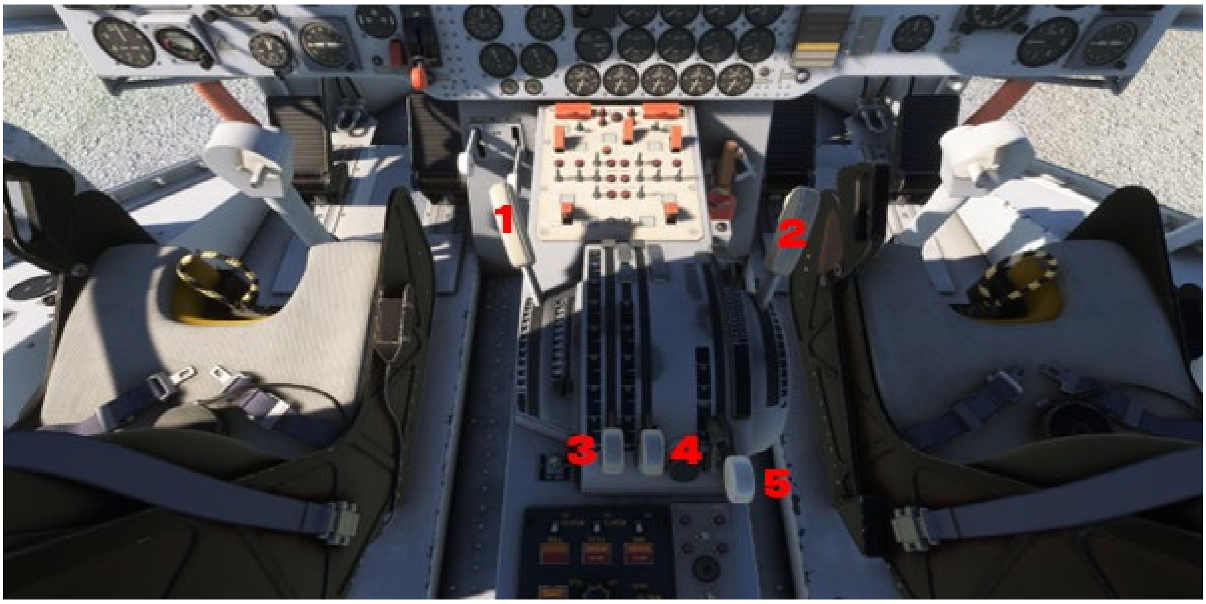
Copilot’s Side Panel

1. Windscreen Wiper Control	2. Oxygen Pressure Indicator



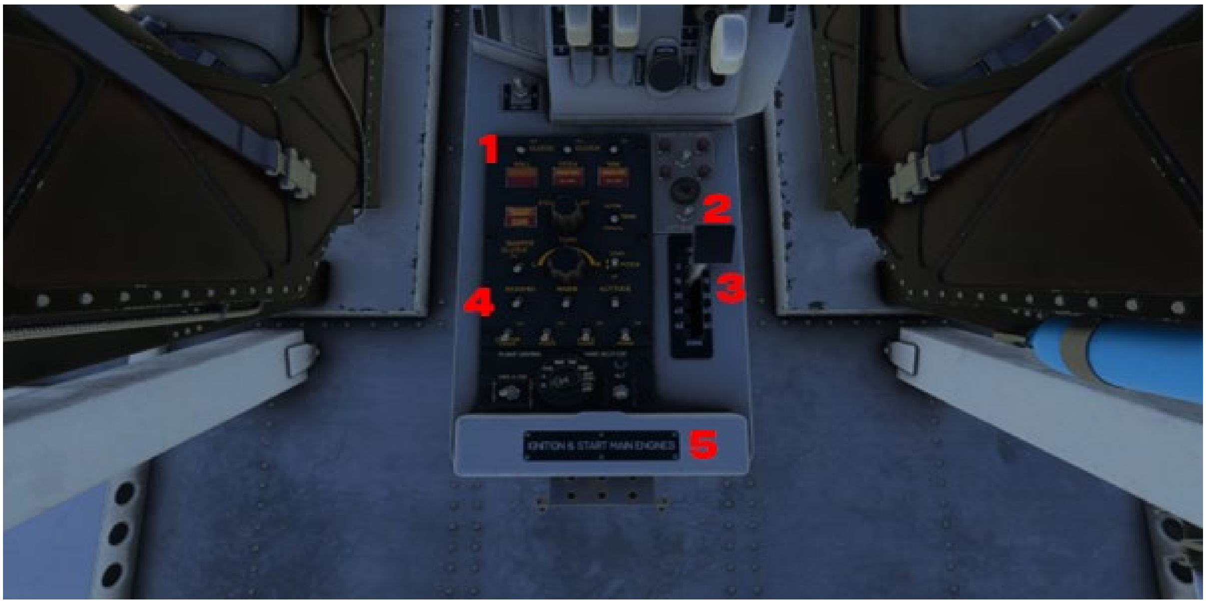
Center Console Fuel Panel

1. Conventional Engine 1 Fuel Master	4. Starboard Fuel Pumps
2. Conventional Engine 2 Fuel Master	5. Port Vertical Engines Fuel Master
3. Port Fuel Pumps	6. Starboard Vertical Engines Fuel Master



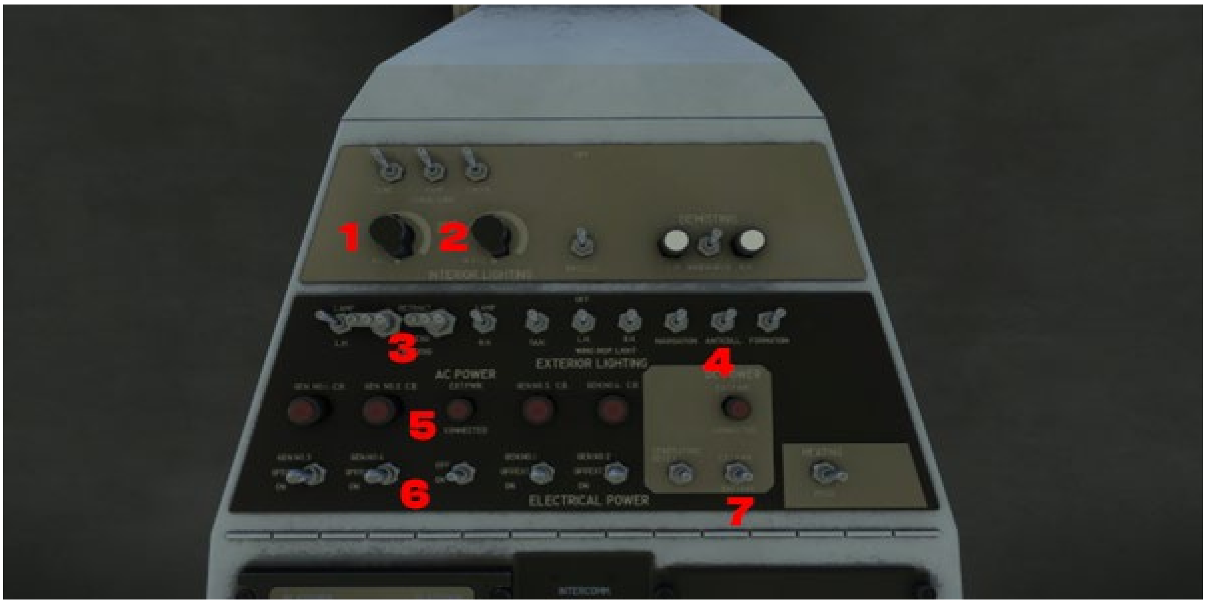
Center Console Throttle Quadrant

1. Nozzle Angle Handle (Controlled by Copilot)	4. Right Conventional Engine Throttle
2. Nozzle Angle Handle (Controlled by Copilot)	5. Vertical Thrust Engines Throttle
3. Left Conventional Engine Throttle	



Center Console Copilot and Autopilot Panel

1. Copilot Assist Mode Switches	4. Autopilot Switches and Controls
2. Copilot Hover Landing Assist Switch	5. Engine Starter Switch Cover & Switches
3. Flaps Lever	



Overhead Lighting and Electrical Panel

1. Interior Cabin Lighting	5. Generator Lights
2. Interior panel Lighting	6. Generator Switches
3. Landing Lights	7. Battery Switch
4. External Lights	

Radio and Transponder Functions

The aircraft has conventional radio units that are linked into the in-sim Air Traffic Control (ATC). When using the in-sim ATC menu, selecting the frequencies will automatically adjust the radio panel frequencies.
You can however still tune these manually to match the required ATC frequencies.

The overhead panel consists of multiple radio and transponder units as detailed below.

Master Switch and Radio Panel lighting

In the centre of the radio panel is the Master kill switch to turn the radio panel on or off.
There is also a radio and nav panel lighting knob which will light up the decals within the panel.


CHANGE-OVER
INTERCOMM
MAG
HDG
MASTER
NAV
DF
RMI
ADF
VOR
TACAN
2 MARKER
TAC/IFF
SENS
UHF
VHF
HF
SPKR
AMPLIS
CALL
FREQUENCY KC
TUNE
RADIO &NAV
PANEL LIGHTING
LOOP
CHAN
FREQ MC
NAV/COMM
SQ

Volume Control Panels:

COM1/NAV1 Panel:

COM2 Panel:

Nav1 Panel:

ADF Panel

TACAN Panel

Transponder Panels

Simplified Procedures

Preliminary Cockpit Preparation	
Battery	OFF
Generators 1,2,3,4	OFF
Lights	OFF
Conventional Engine Throttle	IDLE
Vertical Engine Throttle	IDLE
Engine start cover	OPEN
Engine Start Switches	OFF
Engine start cover	CLOSED
Fuel Switches	OFF
Parking Brake	ON

Conventional Engine Start	
Battery	ON
Beacon	ON
Engine Starter Switch Cover	OPEN
ENG 1 Master switch	ON
ENG 1 ignition switch	ON
ENG 1 Starter Switch	ON
Monitor N2	ABOVE 18%
ENG 1 Master Fuel Switch	ON
Once achieved combustion and EGT > 300 degrees	
ENG 1 Starter Switch	OFF
Pressures and Temperatures	MONITOR
ENG 2 Master switch	ON
ENG 2 ignition switch	ON
ENG 2 Starter Switch	ON
Monitor N2	ABOVE 18%
ENG 2 Master Fuel Switch	ON
Once achieved combustion and EGT > 300 degrees	
ENG 2 Starter Switch	OFF
Pressures and Temperatures	MONITOR
Engine Starter Switch Cover	CLOSED

After Start Flow	
Generators 1,2,3, 4	ON
Engine Starter Switch Cover	OPEN
ENG 1 & ENG 2 Starter Switches	OFF
Engine Starter Switch Cover	CLOSED
Beacon	ON
Fuel Pumps 1 to 10	ON

Vertical Engine Start	
Ensure conventional engines are running	
Conventional Engines	RUNNING
Copilot Vertical Engine Control	ON
Copilot Green Indicator Light	CHECK ON
Vertical Lift Command Throttle	TO START
Left And Right Vertical Engine Fuel Pumps	ON
Engine Spool Up	MONITOR ENGINES 3-10 RPM GAUGES WITHIN GREEN ARC
Conventional Engine Throttles	IDLE
Enable Required Copilot Assist Mode	AS REQD

Taxi-Out	
Taxi Clearance	OBTAIN
Brake Pedals	PRESS AND CHECK PRESSURES
Parking Brake	OFF
Conventional Thrust Levers	AS REQD
Brakes	PRESS AND CHECK STOPPING
Tiller or Rudder Pedals	AS REQD
Flight Controls	CHECK

ATC Clearance	CONFIRM

Line-Up Actions	
Takeoff Clearance	OBTAIN
Line-up or Takeoff Clearance	Obtain
Formation Lights	AS REQD
Navigation Lights	ON
Transponder Mode	TA/RA
Landing Lights	ON

Conventional Takeoff	
Takeoff Clearance	OBTAIN
Flaps	AS REQD
Throttle	FULL FORWARD
Rotate	160-165 KNTS
Landing Gear	UP
Flaps	UP

STOVL Takeoff	
Conventional Engines	RUNNING
Vertical Engines	RUNNING
Copilot Vertical Engine Control	CHECK ON
Copilot Green Indicator Light	CHECK ON
Copilot Assist Mode	OFF, BOUNDARY OR STOVL ASSIST MODE ON
Parking Brake	SET
Conventional Engine Throttles	INCREASE TO 80%
Parking Brake	RELEASE

Above 50 Knots	
Vertical Lift Command Throttle	INCREASE
Stick and Rudder	AS REQD
Positive Climb Rate	GEAR UP
Conventional Engine Throttles	INCREASE to 100% WITHIN EGT LIMITS
Copilot Assistance	AUTO-DISCONNECT WITHIN CONDITIONS

Hover Takeoff

Conventional Engines	RUNNING
Vertical Engines	RUNNING
Copilot Vertical Engine Control	CHECK ON
Copilot Green Indicator Light	CHECK ON
Copilot Assist Mode	HOVER ASSIST MODE ON AS REQD
Conventional Engine Throttles	IDLE (Copilot will control)
Vertical Lift Command Throttle	INCREASE
Stick and Rudder	AS REQD
Positive Climb Rate	GEAR UP
Conventional Engine Throttles	INCREASE
Copilot Assistance	AUTO-DISCONNECT WITHIN CONDITIONS

Climb

Landing Lights	OFF

Descent Preparation

Landing Lights	ON
Copilot Vertical Landing Assist	AS REQD

Approach	
Conventional Engines	RUNNING
Before 5 mile final	
Copilot Vertical Landing Assist	AS REQD
At 5 Mile Marker	
Speed	BELOW 215 KNTS / ABOVE 180KNTS
Gear	DOWN
Copilot Vertical Engine Control	AS REQD

Conventional Landing	
Flaps	AS REQD
Landing Gear	DOWN
Landing Speed	160 KNTS MINIMUM
Throttle	IDLE
Brakes	PUSH GENTLY
Steering	USE RUDDER

Vertical Landing	
Conventional Engines	RUNNING
Before 5 mile final	
Copilot Vertical Landing Assist	ON
At 5 Mile Marker	
Speed	BELOW 215 KNTS / ABOVE 180KNTS
Gear	DOWN
Copilot Vertical Engine Control	ON
Copilot Green Indicator Light	CHECK ON
Flaps	CONTROLLED BY COPILOT

Descent Rate	MANAGE TO 3 MILE MARKER
At 3 Mile Marker	
SPEED	ACHIEVE 150-160 KNOTS AT 3 MILES
Conventional Engine Throttles	IDLE
Vertical Lift Command Throttle	USE TO MAINTAIN DESCENT RATE
VSI	MONITOR DESCENT RATE
At 1 Mile Marker	
Altitude	ACHIEVE 400FT AGL
Vertical Lift Command Throttle	USE TO MAINTAIN DESCENT RATE
Back Stick	USE TO SLOW DOWN FORWARD SPEED
Rudder	USE FOR YAW TURNS
Stick Roll (Small Amounts)	USE FOR ROLL TURNS
At Touchdown	
Vertical Lift Command Throttle	IDLE
Copilot Vertical Engine Control	OFF
Copilot Vertical Landing Assist	CHECK OFF

After Landing

Landing Lights	OFF
Navigation Lights	OFF
Formation Lights	OFF
Throttles	IDLE

STOVL Engine Shutdown	
VTOL Throttle	IDLE
VTOL Master Fuel Switches	OFF
Once Engines Shut Down	
Monitor Pressures and Temperatures	VTOL ENGINE GAUGE PANEL

Conventional Engine Shutdown	
ENG 2 Master Fuel Switch	OFF
Once Engine Shut Down	
Engine Starter Switch Cover	OPEN
ENG 2 Ignition Switch	OFF
ENG 2 Master Switch	OFF
Monitor Pressures and Temperatures	ENGINE GAUGE PANEL
ENG 1 Master Fuel Switch	OFF
Once Engine Shut Down	
ENG 1 Ignition Switch	OFF
ENG 2 Master Switch	OFF
Monitor Pressures and Temperatures	ENGINE GAUGE PANEL
Beacon	OFF

Parking	
Parking Brake	ON
Fuel Switches	OFF
Engine Start Switches	OFF
Engine Start Cover	CLOSED
Vertical Engine Throttle	IDLE
Conventional Engine Throttle	IDLE
Lights	OFF
Generators 1,2,3,4	OFF
Battery	OFF

Preliminary Cockpit Preparation

Battery .... OFF
Generator Switches .... OFF
Lights .... OFF
Conventional Engine Throttles .... IDLE
Vertical Engine Throttles .... IDLE
Engine Start Switches .... OFF
Engine Start Cover .... CLOSED
Fuel Switches .... OFF
Parking Brake .... SET

Conventional Engine Start

Battery .... ON
Parking Brake .... SET
Beacon Light .... ON
Engine Start Cover .... OPEN
ENG1 Master Switch .... ON
ENG1 Ignition Switch .... ON
ENG1 Starter Switch .... ON
Monitor N2 .... ABOVE 18%
ENG1 Master Fuel Switch .... ON
Once Combustion Achieved and EGT > 300 Degrees .... MONITOR
ENG1 Starter Switch .... OFF
Pressures and Temperatures .... MONITOR
ENG2 Master Switch .... ON
ENG2 Ignition Switch .... ON
ENG3 Starter Switch .... ON
Monitor N2 .... ABOVE 18%
ENG2 Master Fuel Switch .... ON
Once Combustion Achieved and EGT > 300 Degrees .... MONITOR
ENG2 Starter Switch .... OFF
Pressures and Temperatures .... MONITOR
Engine Start Cover .... CLOSED

Vertical Engine Start

Ensure Conventional Engines Are Running .... CHECK
Copilot Vertical Engine Control .... ON
Copilot Green Indicator Light .... ON
Vertical Engine Throttle Lever .... START POSITION
Wait Until Engines Start Spooling Up .... MONITOR ENGINES 3-10 RPM GAUGES
Left and Right Vertical Engine Fuel Pumps .... ON
Allow Engines To Spool Up .... MONITOR ENGINES 3-10 RPM GAUGES
Pressures and Temperatures .... MONITOR
Conventional Engine Throttles .... IDLE
Enable Required Copilot Assist Mode .... AS REQD

After Engine Start

Generators 1,2,3 and 4 .... ON
ENG1 and ENG2 Starter Switches .... OFF
Engine Start Cover .... CLOSED
Beacons .... ON

Taxi and Line Up

Lights .... AS REQUIRED
Parking Brake .... RELEASE
Conventional Thrust Levers .... AS REQD
Toe Brakes .... PRESS
Brakes .... CHECK
Tiller or Rudder Pedals .... AS REQD
Taxi .... SLOWLY
Use Rudder to Steer .... SLOWLY
Flight Controls .... CHECK
ATC Clearance .... CONFIRM
TCAS .... TA/RA
Nav Lights .... ON
Landing Lights .... ON

Conventional Take Off

ATC Clearance .... CONFIRM
Flaps .... AS REQD
Conventional Throttle Levers .... FULL FORWARD
Rotate .... 160-165 KNTS
Landing Gear .... ABOVE 165 KNTS AND POSITIVE CLIMB, UP
Flaps .... UP

STOVL Take Off

ATC Clearance .... CONFIRM
Conventional Engines .... RUNNING
Vertical Engines .... RUNNING
Copilot Vertical Engine Control .... CHECK ON
Copilot Green Indicator Light .... CHECK ON
Copilot Assist Mode .... OFF / BOUNDARY or STOVL ASSIST ON
Parking Brake .... SET
Conventional Engine Throttles .... INCREASE TO 80%
Parking Brake .... RELEASE
Above 50 Knts Vertical Engine Throttles .... INCREASE SLOWLY
Achieve Vertical Thrust .... MONITOR
Control Attitude .... WITH STICK AND RUDDER
Landing Gear .... ABOVE 165 KNTS, UP
Conventional Engine Throttles .... INCREASE TO 100% WITHIN EGT LIMITS
Copilot Assistance .... AUTO-DISCONNECT WITHIN CONDITIONS

Hover Take Off

ATC Clearance .... CONFIRM
Conventional Engines .... RUNNING
Vertical Engines .... RUNNING
Copilot Vertical Engine Control .... CHECK ON
Copilot Green Indicator Light .... CHECK ON
Copilot Assist Mode .... HOVER ASSIST ON AS REQD
Parking Brake .... SET
Conventional Engine Throttles .... IDLE (CO-PILOT WILL CONTROL)
Vertical Lift Engine Throttles .... INCREASE
Achieve Vertical Thrust .... MONITOR
Control Attitude .... WITH STICK AND RUDDER
Landing Gear .... POSITIVE CLIMB, UP
Conventional Engine Throttles .... INCREASE
Copilot Assistance .... AUTO-DISCONNECT WITHIN CONDITIONS

Climb

Gear Lever .... UP
Flaps Lever .... UP
Landing Lights .... OFF
Trim .... AS REQUIRED

Cruise

Throttle Levers .... AS REQD
Maintain Cruise Speed .... 240 KNTS

Conventional Landing

Landing Lights .... ON
Landing Gear .... DOWN
Flaps .... AS REQD
Maintain Speed .... 160 KNTS
Throttle .... IDLE
Touchdown .... MONITOR
Brakes .... PUSH GENTLY
Steering .... USE RUDDER

Vertical Landing

Landing Lights .... ON
Conventional Engines .... RUNNING
Before 5 Mile Final .... CHECK
Copilot Vertical Landing Assist .... ON
At 5 Mile Marker .... CHECK
Speed .... BELOW 215 KNTS / ABOVE 180 KNTS

Landing Gear .... DOWN
Flaps .... CONTROLLED BY COPILOT
Copilot Vertical Engine Control .... ON
Copilot Green Indicator Light .... CHECK ON
Descent Rate .... MANAGE TO 3 MILE MARKER
At 3 Mile Marker .... CHECK
Speed .... ACHIEVE 150-160 KNTS
Conventional Engine Throttle .... IDLE
Vertical Lift Command Throttle .... USE TO MAINTAIN DESCENT RATE
VSI .... MONITOR DESCENT RATE
At 1 Mile Marker .... CHECK
Altitude .... ACHIEVE 400FT AGL
Vertical Lift Command Throttle .... USE TO MAINTAIN DESCENT RATE
Back Stick .... USE TO SLOW DOWN FORWARD SPEED
Rudder .... USE FOR YAW TURNS
Stick Roll (Small Amounts) .... USE FOR ROLL TURNS
At Touchdown .... CHECK
Vertical Lift Command Throttle .... IDLE
Copilot Vertical Engine Control .... OFF
Copilot Vertical Landing Assist .... OFF

After Landing and Taxi In

Landing Lights .... OFF
Nav Lights .... OFF
Strobe Light .... OFF
Flaps .... 0 DEGREES
Throttles .... IDLE

SVOTL Engine Shutdown

Vertical Engine Throttles .... IDLE
Left and Right vertical engine fuel pumps .... OFF
Monitor Pressures and Temperatures .... CHECK

Conventional Engine Shutdown

ENG2 Master Fuel Switch .... OFF
Engine Start Cover .... OPEN
ENG2 Ignition Switch .... OFF
ENG2 Master Switch .... OFF
Monitor Pressures and Temperatures .... CHECK
ENG1 Master Fuel Switch .... OFF
ENG1 Ignition Switch .... OFF
ENG1 Master Switch .... OFF
Monitor Pressures and Temperatures .... CHECK
Engine Start Cover .... CLOSED
Beacon .... OFF

Parking

Parking Brake .... SET
Fuel Switches .... OFF
Engine Start Switches .... OFF
Engine Start Cover .... CLOSED
Throttle Levers .... ALL IDLE
Lights .... ALL OFF
Generator Switches .... OFF
Battery .... OFF