DHC-3T Turbo Otter

X-PLANE USER GUIDE

MILVIZ

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Introduction to the Turbo Otter

What happens when you combine one of the hardest-working single engine aircraft ever built with proven turbine designs well known for their reliability?

To begin with, you end up with an airplane that defies absolutely any attempt to put a limit on it's lifespan.

The Turbo Otter definitely stands unique amongst commercially operated aircraft. Instead of a factory manufactured aircraft type with full documentation, the Turbo Otter represents the combined efforts of an entire industry to keep a valuable and unique resource in the air, all the while implementing modern performance, durability and safety standards.

Throughout this guide, we use the designation DHC-3T. In truth, the addition of the 'T' is completely informal. The fact is that nary a single 'Turbo' Otter ever left the de Havilland Canada production line at Downsview. (Well, except for that time they installed not one but ***two*** PT-6 turboprops on an Otter, RCAF #3682, for testing STOL capabilities. The outcome of that testing is rather well known - the DHC-6 Twin Otter!)

The tale of the Turbo Otter is but a single chapter of a larger story detailing the efforts at de Havilland Canada to manufacture a utility aircraft designed to satisfy the requirements of even the most demanding operators. That story, of the Beaver, of the Otter, of the Twin Otter, has been the subject of some fascinating books. We don't need to go into it in-depth, since as mentioned, the subject of this user guide was never a factory design.

Originally powered by a nine cylinder, 600 horsepower, P&W R-1340 Wasp reciprocating radial engine, the Otter was never considered a weakling. But as the years, no, ***decades***, keep marching on, the advantages of a modern turbine engine start to outweigh the simplicity of a radial engine.

It's hard to believe, but the R-1340 Wasp was introduced in 1925! Although nearly 35,000 engines were produced overall, it was already an older engine (albeit exceedingly well-proven) by the time it was selected to power the new DHC Otter in the early 1950's. In fact, the ready availability as surplus was ultimately one of the major factors in its selection.

Engines, however, are simply not designed to be operated indefinitely. Limits arise, driven by age, operating hours, and even the ever increasing cost of aviation gasoline (avgas). From a commercial operators point of view, these have all had a detrimental effect on the long serving R-1340 Wasp.

When repair & overhaul facilities began thinking about alternative means of powering the Otter, they looked to the range of small turbine engines that had begun to dominate commercial aviation in the years since the Otter was built. Once you reach a certain horsepower requirement, turbine engines start to display clear advantages over reciprocating engines in areas such as power to weight ratio, efficiency, reliability and maintenance.

Today, there are a number of distinguished overhaul & rebuild facilities that offer turbine conversions for DHC-3 Otters, installing variants of the PT6A, the Walter 601, or the Garrett TPE331. For our Turbo Otter, we've selected the PT6A-34 as the powerplant. (Other variants of the PT6A used in turbine conversions include the PT6A-135, the PT6A-135A, and the PT6A-34AG. All are capable of developing 750 shaft horsepower at sea level.)

From the introduction of the DHC-3 Otter in 1953 to the end of production in 1967, a total of **466** aircraft rolled off the assembly line. Of that total, approximately **161** Otters are known to be currently or recently registered. And of those, over **133** Otters, approximately **80%**, have been fitted with a turbine engine.

Considering that some of the facilities that offer conversions and rebuilds hold non-registered airframes in stock for parts or future rebuilds, its very possible that in years to come, the rate of replacement will equal or outstrip the rate of attrition. Not too bad for an aircraft that last rolled of the production line more than 50 years ago!

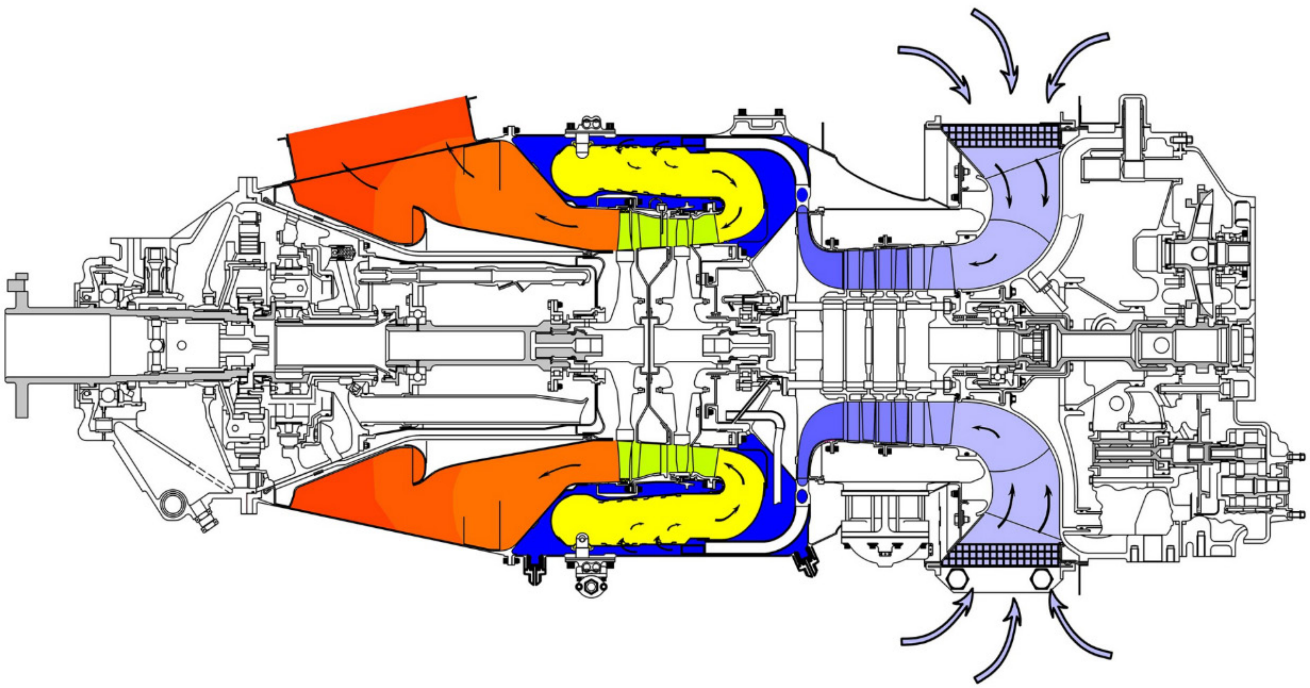
The Basics of a PT6A-34

The PT6A family of engines includes three series of models with increasing power levels, referred to as PT6A 'Small', 'Medium' and 'Large.' The increased power levels are achieved through the increase of compressor air flow and an increased number of power turbine stages.

The PT6A-34 is within the 'Small' series, and as previously noted, develops a maximum permissible takeoff power of 750 SHP (shaft horsepower) at sea level up to 87 °F (30.6 °C) ambient temperature.

The PT6A-34 engine has a three-stage axial, single stage centrifugal compressor driven by a single-stage reaction turbine. Another single-stage reaction turbine, counter-rotating with the first, drives the output shaft. Fuel is sprayed into the annular combustion chamber by fourteen individually removable fuel nozzles mounted around the gas generator case.

An ignition unit and two igniter plugs are used to start combustion. A hydro-pneumatic fuel control schedules fuel flow to maintain the power set by the power control lever.



(above) Diagram of a PT6A engine, depicting air movement through the engine. Note the intake of air to the rear and the exhaust at the front.

The accessory drive at the aft end of the engine provides power to drive the fuel pumps, fuel control, the oil pumps, the starter-generator, and the tachometer transmitter.

The reduction gearbox forward of the power turbine provides gearing for the propeller and drives the propeller tachometer transmitter, the propeller overspeed governor, and the propeller governor.

Propeller speed remains constant at any selected propeller control lever position through the action of the propeller governor, except in Beta range where the maximum propeller speed is controlled by the pneumatic section of the propeller governor.

Immediately following touchdown, partial or full reverse power may be obtained by retarding the power control lever below IDLE. Varying amounts of reverse power are available, depending upon how much the power control lever is retarded. Reverse power is also available for ground handling.

An important characteristic of the PT6A-34 engine is the physical disconnect between the gas generator and power generator turbines. The power turbine (and by extension the propeller) can spin freely from the gas generator section. This is why the PT6A-34 is referred to as a ***free turbine***.

Turbine Conversions

The installation of the PT6A into the DHC-3 Otter results in a variety of changes both external and internal.

The most apparent change is the distinctive engine shroud that surrounds the turbine. However, it's speaks to the design and styling of the aircraft that even though it represents a radical departure from the 9 cylinder radial that formerly graced the business end of the Otter, the long tapered nose looks completely at home.

The longer nose changes the overall length of the aircraft by four feet: formerly 41 feet 10 inches, the Turbo Otter stretches out to 45 feet 10 inches. The width of the aircraft does not change. The gross weight of the landplane version of the Turbo Otter does not change at all, and remains at 8000 pounds.

Internally, the Power, Propeller and Mixture levers now read Power, Propeller and Condition, with the power lever having it's range extended downwards to allow for a beta range. An additional lever is added to the left of the Power lever, this is the Emergency Power Lever. It allows for the bypass of the fuel control unit to provide fuel to the engine in the event that the Power Lever fails to provide a response in the engine. It's normally wired shut.

The oil tank under the floor of the cockpit has been removed, along with the fill spout and cap previously located below the pedestal. The oil tank is now an integral part of the engine.

The fuel controls and their operation are changed significantly. Although the fuel tanks and tank capacities are unchanged from the original DHC-3 configuration, the routing of fuel lines and the flow of fuel to the engine has been changed. Fuel to the engine is supplied from the aft center fuel tank only. Fuel in the forward center tank flows through a check valve to the aft center tank via an interconnect line. Fuel in the forward or aft tanks is available only by means of transfer from either of these tanks to the center fuel tank. The function of the Fuel Selector Handle on the instrument panel is changed from selecting which fuel tank feeds the engine to which fuel tank will transfer to the center tank. It is in the OFF position for normal operation - until one desires to transfer fuel.

In addition, the engine instrumentation is also updated to meet the increased requirements of monitoring a turboprop engine.

Product Features

- Professionally created & tuned, high fidelity flight model including accurate characteristics specific to the DHC-3T.
- Richly detailed cabin with beautiful high resolution textures and smoothly animated gauges.
- Professionally created liveries based on or inspired by real world aircraft.
- Three body configurations: Standard Wheels, Floats, Amphibious Floats, each with carefully tuned flight models.
- Multiple loadout configurations, including passengers and cargo.
- Carefully replicated engine controls, response, and instrumentation readouts.
- Functional and realistic emergency power lever, power lever beta gate, safety guard on condition lever.
- Realistic flap operation portraying the unique hydraulic hand pump and pump selector.
- Realistic tailwheel operation, including locked, powered, and free-castoring.
- Carefully replicated fuel management simulation, with only the center tank supplying the engine and transfer controls required to access fuel in front and rear tanks.
- Three different avionics arrangements, with provision made for RealityXP GPS units (not included), default X-Plane GPS units, and no-GPS radio stack. Two of the three arrangements are located on a kick-out panel for better pilot access.
- Highly detailed KAP 140 autopilot simulation, closely replicating the real-life unit in operation and usage.
- Extremely detailed sound environment by Sim Acoustics, leveraging the powerful FMOD system with rich engine sounds and a full sound environment that includes prop wash, brakes, stall buffeting, cockpit switches, weather effects, and more.
- Ability to completely hide yoke and column for ease of access to important switches and controls.
- Produced in partnership with VFlyteAir Simulations
- Integrated AviTab plugin support

System Requirements

These requirements apply as a minimum to successfully install, configure and operate the MilViz DHC-3T Turbo Otter for X-Plane

Supported Platforms:	**X-Plane 11** The current release version of X-Plane 11 is always supported. Beta releases are un-supported; ongoing development of the X-Plane platform during the beta cycle may require our product to be updated for proper functionality.
Supported Operating Systems:	Operating system compatibility matches the X-Plane 11 simulation platform.
Processor (CPU):	Intel Core i3, i5, or i7 CPU with 2 or more cores, or AMD equivalent. (Recommended: Intel Core i5 6600K at 3.5 ghz or faster.)
Video Card (GPU):	DirectX 11-capable video card from NVIDIA, AMD or Intel with at least 1 GB VRAM. (Recommended: DirectX 12-capable video card from NVIDIA, AMD or Intel with at least 4 GB VRAM, GeForce GTX 1070 or better or similar from AMD.)
System Memory (RAM):	8 GB RAM (Recommended: 16-24 GB RAM or more.)
Hard Drive Space:	1.5 GB or greater free hard drive space.
Gaming Controller:	Joystick, yoke, or other gaming controller (a means of controlling the aircraft rudder, either with twist joystick function or dedicated pedals, is additionally recommended).
Internet Connection:	Please note that an active internet connection is required for successful activation of this product.

Product Installation

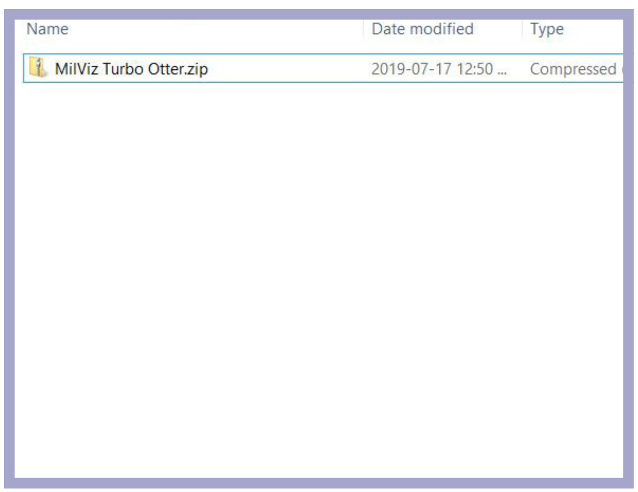
1

Beginning Installation

(Note: File names and folder contents may differ slightly from what is shown in these instructions.)

After purchase, you will have been given a link or an option to download a compressed file. This compressed file contains all of the folders and files for the MilViz DHC-3T Turbo Otter for X-Plane.

Using a file compression utility of your choice, decompress this file to a location or folder of your choosing.



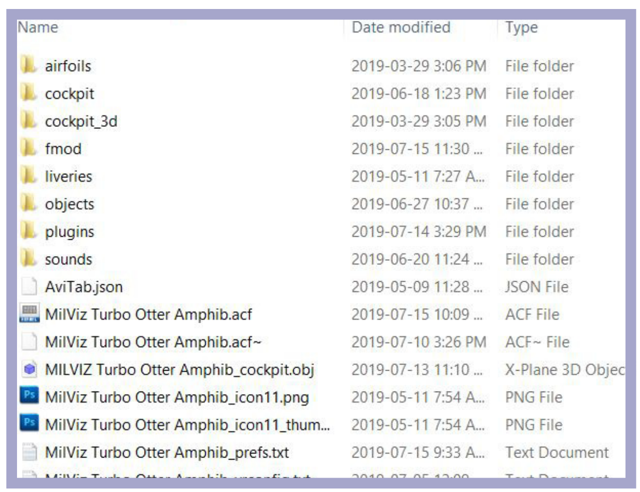
2

Identifying Files to Copy

Within this newly decompressed folder, you will find a sub-folder containing both files and folders.

You'll know that you have identified the correct folder when the contents resemble the below image.

This folder **containing** the below files is the aircraft folder that needs to be placed within the X-Plane file structure.

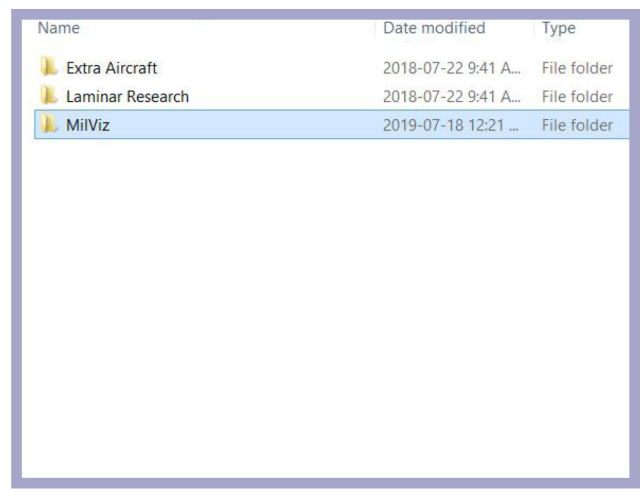


3

Creating a Destination Folder

In the X-Plane 11 file structure, all aircraft are placed within the 'X-Plane 11\Aircraft' folder, generally in developer specific folders. This structure helps to organize your aircraft collection.

While it is largely left up to the end user on how they wish to organize their aircraft, we recommend creating a sub-folder within the 'X-Plane 11\Aircraft' folder titled 'MilViz'.



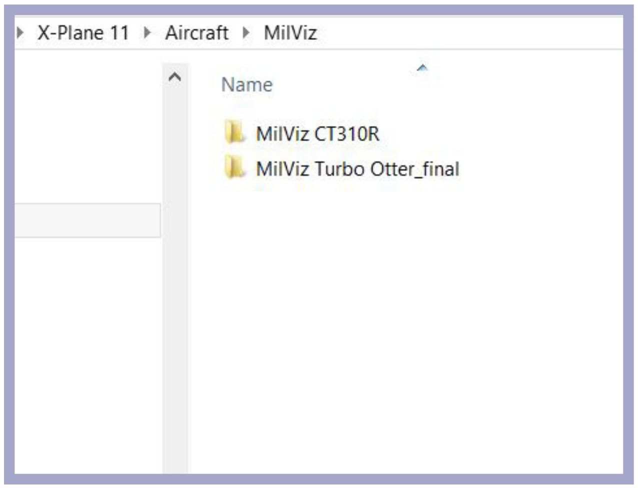
4

Copying the Aircraft

You should now have a folder structure that resembles the following:

'X-Plane 11\Aircraft\MilViz'

Copy the aircraft folder you identified in Step 2 into this newly created MilViz folder. Done correctly, it should resemble the following image.



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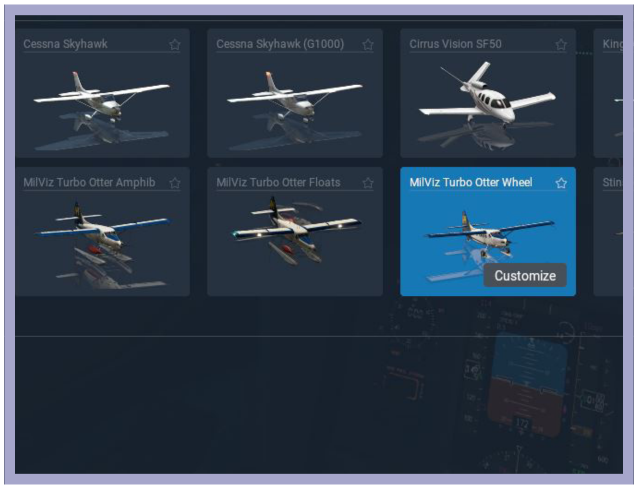
Verify Installation

Once the aircraft folder is installed correctly, launch X-Plane 11.

On the left side of the Flight Configuration UI screen, you should be able to find your new Turbo Otter in three configurations: Wheel, Floats, Amphib.

You may now select your aircraft and start a flight (making any other desired adjustments to starting location & weather, of course).



6

Go Fly!

That's it! Now go and enjoy some great flying!

Uninstalling

The MilViz DHC-3T Turbo Otter for X-Plane may be un-installed by deleting the aircraft folder that you manually copied into the X-Plane 11 file structure.

Note: *Prior to uninstalling the aircraft, please be sure to back up any customized files or custom liveries you have installed if you wish to keep them.*

Updating

In the event that you are notified of an update to the MilViz DHC-3T Turbo Otter for X-Plane, it is highly recommended that you completely un-install the previous version before you install the newly updated version. This will ensure that the correct versions of any changed files are present.

Product Support

We are deeply committed to the satisfaction of our customers. If you encounter any issues with your product or require assistance, or just have a general question, we encourage you to visit our forums at http://milviz.com/forum/.

Support forums for our individual products are restricted to owners of that product. To register for a specific support forum, please contact oisin@milviz.com for registration information and details. Please note that proof of purchase will be required.

Rain Effects for Windows

The MilViz Turbo Otter includes a plugin which adds rain effects to all windows.

Rain will accumulate when the aircraft is parked, will be affected by wind while moving or flying, and will realistically affect the appearance of anything viewed through the windows.

These effects add an improved sense of realism and immersion while flying through inclement weather; instead of seeing rain falling around you, rain is now something directly affecting the aircraft itself.

The plugin which adds these effects is compatible with Windows and Mac. If using Linux, the aircraft will still work, but the rain effects will be missing.

This plugin requires the latest VCC distributable from Microsoft. If it is not installed on your system, it can be found at: https://support.microsoft.com/en-us/help/2977003/the-latest-supported-visual-c-downloads

Using the Aircraft Menu

The MilViz Turbo Otter includes a custom aircraft menu panel which is accessible once the aircraft is loaded. From this menu, it's possible to perform the following actions:

- Remove / Attach external features
- Show / Hide tablet plugin (requires AviTab plugin installed)
- Change aircraft liveries
- Switch between GPS options
- Adjust aircraft loadout

The menu panel may be opened by clicking the popup icon which appears on the left hand side of the screen when the mouse is moved to the left hand screen edge.

The panel may be closed by clicking the red 'X' in the top right hand corner of the panel.

To move the panel around the screen, both the top and bottom of the panel are enabled to allow a mouse to click and drag the window as desired.

The Reality XP GNS units are automatically used in place of the default X-Plane GNS units if present and activated within the simulator.

NOTE: Reality XP GNS units are third party software and not included with the MilViz DHC-3T Turbo Otter. The installation and use of these units is optional; if not installed, warnings related to their absence may appear in the X-Plane log file when the DHC-3T is loaded. These warnings are safe to ignore.

Cabin & Controls Familiarization

Absolutely no doubt is left as to the overall purpose of the Otter: It embodies the very essence of an honest day's work.

Many of the Turbo Otters in service today show their age in the cockpit, albeit with pride. Functionality replaces form, the fine lines envisioned by the designers at de Havilland 60 years ago dented, bent, and re-purposed. However, to a Turbo Otter, this is not a matter of shame. Rather, this is a badge of honor, the reflection of decades of labour, of sweat and grease, of muttered curses at inclement weather, of a 'make-it-work' sensibility that gets the job done.

From the pilot's seat everything is well thought out and easy to reach. The controls and instrumentation common to every aircraft are where you'd expect, with no real differences from the original Otter: The instrument panel in front of the pilot, a study control column reaching out from the center of the cabin floor, electrical switches under the flight instrument panel, a prominent pedestal in the center prominently displaying the power, propeller and fuel levers. (An emergency power lever, normally wired shut, has been added to the left side of the pedestal beside the power lever.)

The engine instrumentation panel, adapted to monitor the PT6A dominating the front, is located above the pedestal. The rudder trim wheel and indicator is located on the cabin roof, while the trim wheel for the variable incidence tailplane is located on the right side of the pilot's seat. Also to the left of the pilots seat, just slightly forward and lower than the previously mentioned trim wheel, is the wing flap hand pump lever and selector; the indicator for the wing flaps is located on the center windshield post, just above the glareshield. Above the flap indicator is the compass.

The fuel selector is located in it's original spot to the left of the pedestal, re-purposed to allow transfer of fuel from the front and rear tanks to the center. Ample space for avionics is provided on the panel to right of the engine instrument gauges.

Engine Instrumentation Overview

Torquemeter

The torquemeter measures torque applied to the propeller shaft which is turned indirectly by the gas generator. This is operated by engine oil pressure metered through a valve that is controlled by a helical ring gear that moves in response to the applied torque. This gear moves against a piston that controls the opening of a valve, which controls the oil pressure flow. This action makes the oil pressure proportional to torque being applied at the propeller shaft. A transducer is used to transfer the oil pressure into an electrical signal to be read by the engine instrument.

Indication is in PSI, with a normal operating range of 0 - 58.7 PSI.

ITT Gauge

The Interstage Turbine Temperature (ITT) gauge monitors the relative temperature of the exhaust gases entering the first stage turbine inlet guide vanes. Temperature is an absolute engine operating limit and must be monitored to ensure the mechanical integrity of the turbines as well as to check engine operating conditions.

The ITT gauge on the Turbo Otter indicates a normal operating range of 400 to 790 °C. A momentary starting temperature of 1090 °C is indicated on the gauge as a red dot.

Propeller (Np)

The propeller tachometer indicates the revolutions per minute (RPM) of the propeller shaft.

Because of the free turbine design of the PT6A-34, this section of the engine is not mechanically connected to the gas generator shaft and so is monitored independently.

The propeller tachometer on the Turbo Otter indicates a normal governed operating range of 1800 to 2000 RPM, with an indicated maximum limit of 2200 RPM.

Gas Generator (Ng)

Similar to the propeller tachometer, the gas generator tachometer displays the revolutions per minute of the gas generator shaft. Actual power generation on the PT6A is coming from the gas generator and determined by positioning of the power lever.

Because of the free turbine design of the PT6A-34, this section of the engine is not mechanically connected to the propeller shaft and so is monitored independently.

The normal operating range of the gas generator tachometer is 52.6 to 101.6%.

Lower Switch Panel Overview

Note: *In order to easily access the lower switch panel, it is possible to hide the yoke and steering column through the use of the built-in X-Plane menu commands, or by clicking the left mouse button anywhere on the lower vertical portion of the column or on the column base.*

The switches located on the starter panel and lower switch panel, although located in roughly the same positions as their counterparts on the original DHC-3 Otter, have had their functions altered to meet the different requirements of a turbine engine.

On the left-most panel, the **MASTER SWITCH** controls all electrical power in the airplane, while the **NAV MASTER** switch controls power to the avionics.

The three guarded switches are used for starting the engine. These are operated from right to left during the start process: The **HEATER** switch (P3 Heater) heats the compressor air inlet line to the fuel control unit, the **IGNITION** switch operates the engine ignition system, and the **STARTER** switch activates the engine starting system.

The **ENG DEICE** switch operates the engine inlet deicing boot.

The **PROP GOV TEST** switch is used for testing the overspeed governor as part of the ground warm-up procedure.

The fire extinguisher system consists of a fire warning light, a guarded **EXTINGUISHER SWITCH**, and a switch marked **EXTINGR**. The extinguisher system may be operated by opening the guard and flipping the extinguisher switch upwards, then pressing the extinguisher button, all performed with the left mouse button.

The remaining toggle switches on the left side of the lower panel control the landing lights (**LAND LITE**), pitot heat (**PITOT HEAT**), navigation and strobe lights, (three position switch, **NAV/STROBE**, **OFF**, **NAV LIGHTS**), the rotating beacon (**BEACON**), further navigation lights (**NAV LTS**), instrument lighting (**INST. LIGHTS**), the ground blower fan (**GROUND BLOWER FAN**), the cabin fan, (**CABIN FAN**), the defrost fan (**DEFROST FAN**), and the emergency locator transmitter (**ELT**).

Also present on the left side of the lower panel is the rotary dial that operates the heater control.

All toggle switches may be operated with the left mouse button by clicking either the upper or lower portion of the switch (the mouse pointer will change to an up or down arrow respectively), or by using the mousewheel while hovering the mouse pointer over a switch.

Throttle Quadrant Overview & Operation

The throttle quadrant on the DHC-3T Turbo Otter consists of a power control lever, a propeller control lever, a condition lever, as well as an emergency power lever that is normally wired shut.

Power Lever

Located on the top left of the pedestal, the power control lever modulates engine power from full REVERSE to MAXIMUM. The position for IDLE represents the lowest recommended level of power for flight operation. This lever may be moved below IDLE in order to obtain partial to full reverse power. As soon as the propeller blade angle decreases below the low pitch stop the BETA LIGHT will illuminate telling the pilot that the propeller is operating in the REVERSE range.

If controlled with the mouse, the lever may be moved from IDLE to MAXIMUM and back to IDLE by clicking and holding the lever with the left mouse button while dragging the mouse forward or back. To enter the reverse range, move the mouse backwards until the animation shows the lever being lifted, at which point it can continue being moved backwards through the REVERSE range.

Propeller Lever

The propeller control lever is located immediately to the right of the power control lever. It signals the amount of blade angle commanded to the propeller governor, which accordingly sets that blade angle to achieve a fixed RPM setting. The governor then makes automatic corrections to blade angle to maintain a constant RPM setting during flight. By moving the propeller control lever to the FEATHER position, it will cause the propeller blades to feather, that is, adjusting the angle of the blades so that the outer section is aligned with the airflow in order to create minimal resistance.

The propeller control lever may be freely moved with the mouse by clicking and holding the lever with the left mouse button while dragging the mouse forward or back.

Condition Lever

The condition lever, located on the top right of the pedestal, regulates a valve in the starting unit which controls fuel flow at the fuel control outlet from no flow at CUT OFF to normal idle at the RUN position.

Inadvertent movement of the condition lever to the CUT OFF is normally achieved by the safety catch. On the DHC-3T Turbo Otter, this safety catch animates out of the way automatically as the lever is moved past it.

The condition lever may be freely moved with the mouse by clicking and holding the lever with the left mouse button while dragging the mouse forward or back.

Emergency Power Lever

The emergency power lever is located to the left of the power lever. This lever provides an emergency by-pass of the fuel control unit to provide fuel to the engine in the event of a failure in the fuel control unit. This lever is safety-wired in the closed position.

To operate the emergency power lever with the mouse, it's required to click the left mouse button on the safety wire to simulate it's removal / breakage. Once done, the emergency power lever may be freely moved with the mouse by clicking and holding the lever with the left mouse button while dragging the mouse forward or back.

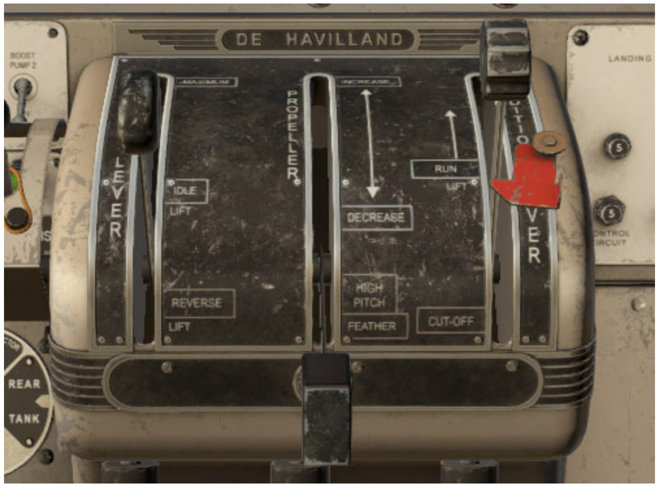
Since the emergency power lever bypasses the fuel control unit, all normal engine safety limits are inoperative. The emergency power lever should be moved slowly and smoothly, while ITT, Ng, and torque are monitored and kept within operating limits.

The safety wire can be restored through clicking the left mouse button on its location.

Friction Control Knobs

The friction control knobs, located immediately underneath the power, propeller and condition levers, are normally used during flight to keep the levers from inadvertently moving while engine vibration is present.

On the DHC-3T Turbo Otter for X-Plane, the friction control knobs are inoperative and may not be controlled by the user.



Lower Pedestal Overview

Note: *In order to easily access the controls located on the pedestal, it is possible to hide the yoke and steering column through the use of the built-in X-Plane menu commands, or by clicking the left mouse button anywhere on the lower vertical portion of the column or on the column base.*

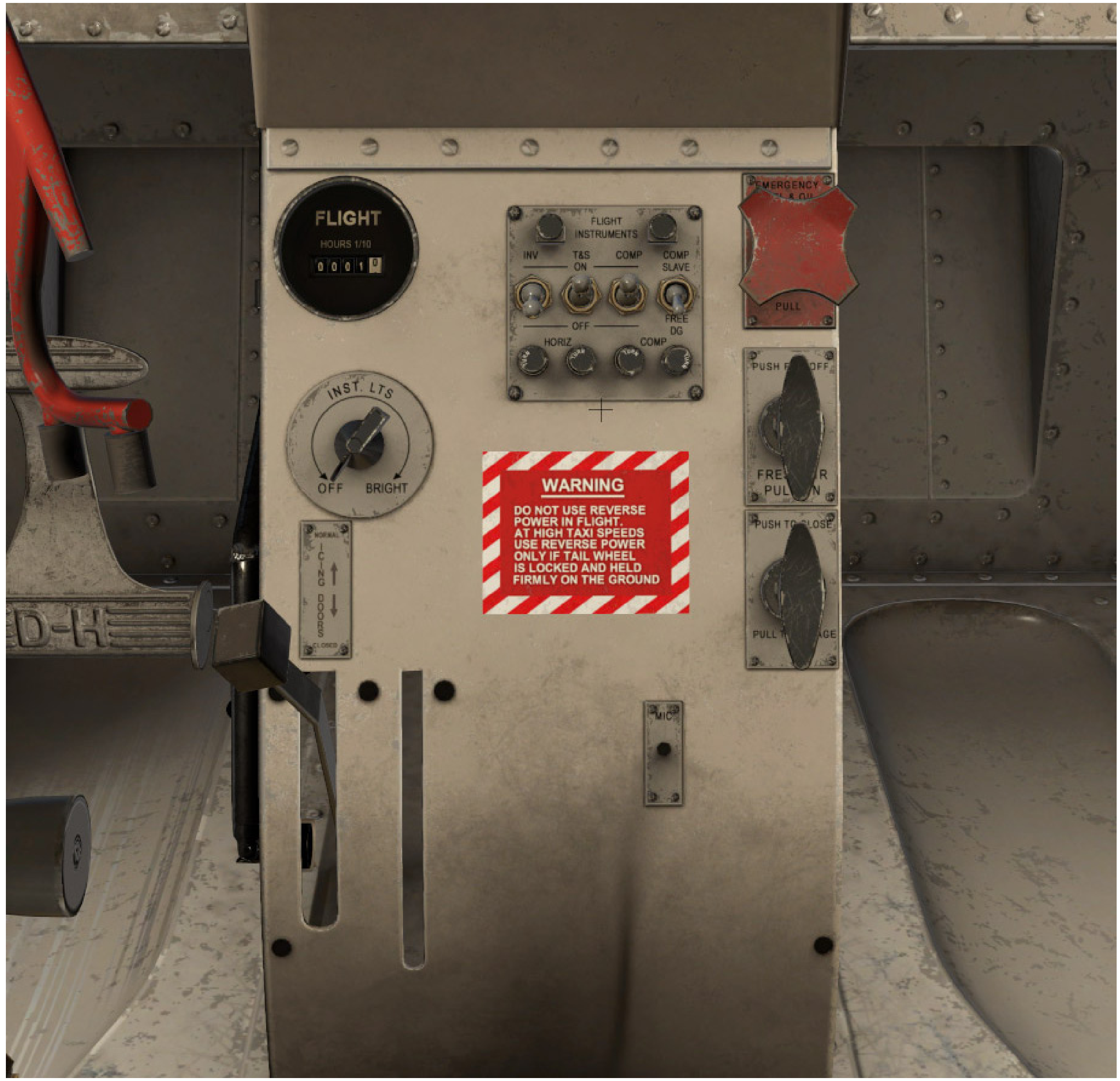
The lower section of the pedestal, below the throttle quadrant, contains a variety of important controls.

In the upper right corner is the emergency fuel cut-off. When pulled in the event of an emergency, the flow of fuel to the engine is stopped. The placard is a hold-over from the original DHC-3, as this control now only cuts fuel flow and not oil. This lever may be moved by clicking and holding the left mouse button while dragging the mouse forward or backwards.

In the lower left corner is the lever that operates the engine icing doors. During cruise, if the OAT is below 41°F or less with visible moisture, the icing doors lever should be moved to the CLOSED position, in addition to the ENG DEICE switch on the lower switch panel being moved to ON.

Fresh air controls, instrument light brightness controls, and a Hobbs meter are located on the pedestal, as well as various switches for the flight instruments.

The ON/OFF toggle switches for the flight instruments are to be placed in the ON position during aircraft operation. The toggle switch for the directional gyro may be set to SLAVE or FREE as desired.



Fuel System Overview & Operation

Although the fuel tanks and tank capacities are unchanged from the original DHC-3 configuration, the flow of fuel to the engine has been changed.

Fuel to the engine is supplied from the center tank cells only (the aft center cell, to be precise, with fuel in the forward center cell flowing through a check valve to the aft center cell). Fuel in the forward or aft tanks is available only by means of transfer from either of these tanks to the center fuel tank.

In a master stroke of reusability, what used to be the fuel tank switching control on the original Otter is now the control for selecting the tank to transfer fuel from. Once the fuel lever on the center tank is below 60 gallons, the selector handle can be rotated to the fore or aft tank, and the BOOST PUMP 2 switch turned on to effect the transfer of fuel from that tank to the center. When the transfer is complete, the BOOST PUMP 2 switch and the selector handle are moved to OFF.
Pilots should take care to ensure that enough space exists in the center tank for the fuel to be transferred; it is possible to overflow the center tank.

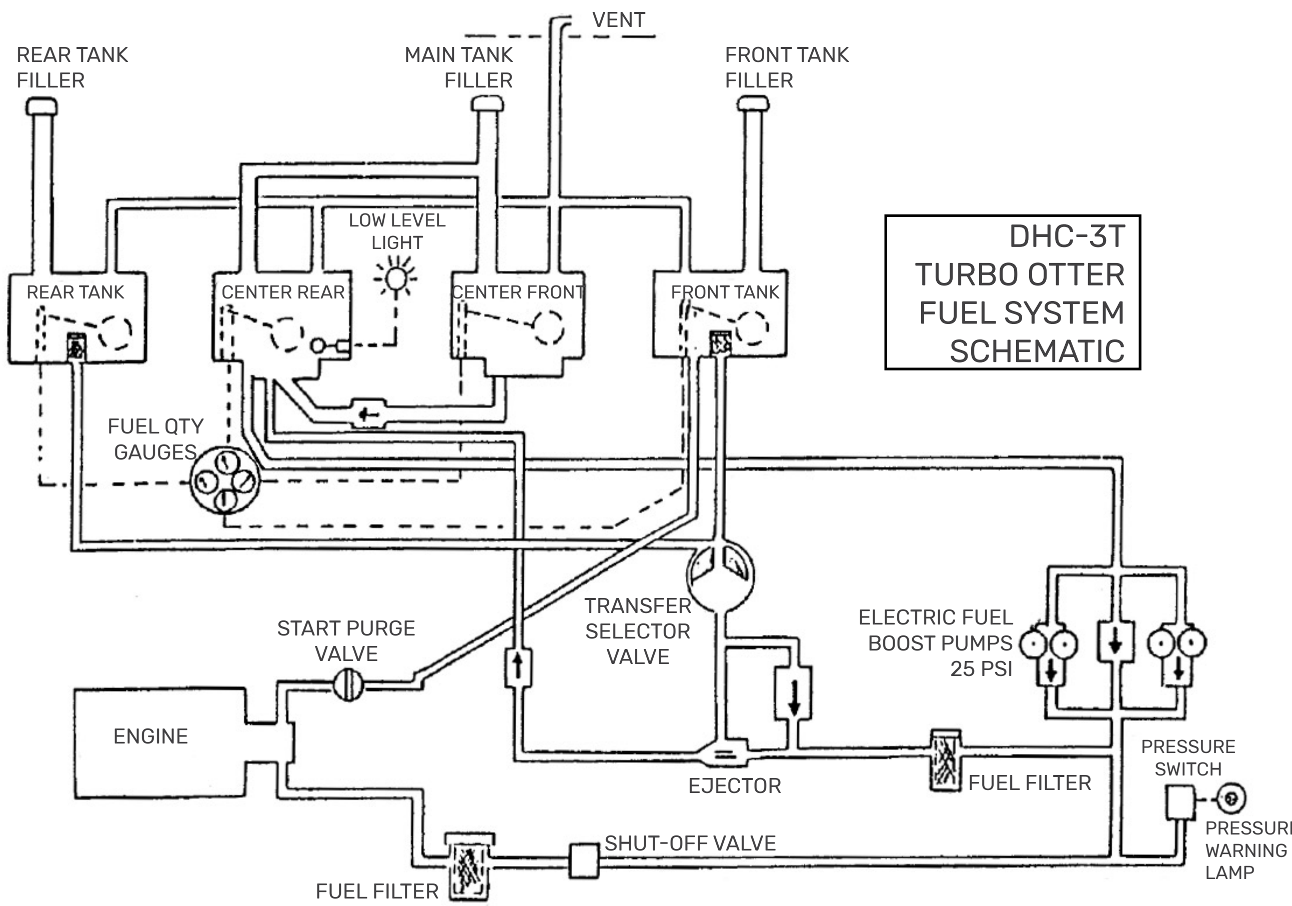
The Turbo Otter is equipped with two electrical boost pumps, with toggle switches being located immediately to the upper left of the throttle quadrant. Standard procedure is to use boost pump #1 to provide fuel pressure to the engine, while the additional pressure required by the transferring fuel is accomplished by using boost pump #2.

Fuel gauges exist in two locations: The original triple gauge, graduated in pounds, is located on the engine instrument panel above the throttle quadrant, while a second gauge for the center tank only, graduated in U.S. gallons, is located on the lower switch panel.

Three warning lamps associated with the fuel system exist in the Turbo Otter. The first, marked LOW FUEL LEVEL, is located on the lower switch panel, to the upper left of the ignition and starter switches. This lamp will illuminate when less than 40 gallons of fuel remains in the center tank.

The second, marked FWD & AFT EMPTY, is located on the left hand side of the engine instrument panel. This lamp illuminates when the tank currently selected by the fuel transfer selector handle is empty. The third, marked LOW FUEL PRESS, is located on the lower right hand side of the engine instrument panel. This lamp illuminates when fuel pressure is low. All three lamps are of the push-to-test type.

An emergency fuel cut-off handle is located on the upper right of the lower pedestal. Normally wired open (pushed inwards), it is used in the case of an emergency requiring the fuel flow to the engine to be halted.



Flight Controls Overview

Primary control surfaces on the Turbo Otter are mass-balanced and conventionally operated by a control column and rudder pedals.

Wing Flaps

The wing flaps are of the full-span, double-slotted type. The outboard trailing edge portions of the flaps are operated independently as ailerons. Differential control of the ailerons is maintained at all flap positions, and lowering the ailerons with the flaps does not prevent lateral control of the airplane.

The wing flaps are operated hydraulically by a flap actuating jack assembly, located in the fuselage roof between the front and rear wing attachment lugs. Hydraulic fluid, contained in a separate reservoir located aft of the firewall on the left hand side, is pumped into the flap actuating jack assembly by means of a handpump located beneath the pilot's seat.

Wing flaps are selected UP or DOWN with the flap selector lever and after they are pumped to the desired position with the handpump, they are automatically locked by a hydraulic ratchet valve which is part of the flap actuating jack assembly.

The wing flaps are mechanically connected to the trim tab on the left elevator so that actuation of the wing flaps automatically deflects the trim tab to maintain the longitudinal trim.

The handpump lever is in line with the right-hand side of the pilot's seat and is operated in a fore-and aft movement.

The wing flaps selector lever is mounted on the tailplane trim pedestal, to the right of the pilot's seat. CRUISE, LAND, or intermediate positions of the wing flaps are obtained by moving the wing flaps selector lever to up or down position and then pumping the flaps to the desired position, as shown on the wing flaps position indicator.

The wing flaps position indicator is located on the vertical frame member of the windshield and is marked UP, CRUISE, CLIMB. TAKEOFF AND LANDING and DOWN. The wing flaps position indicator is mechanically connected to the right hand flap bellcrank in the fuselage roof, and moves vertically in a slot in the FLAPS label.

Overall, the flight controls remain unchanged from the original DHC-3 except that the flap "full down" angle has been decreased and the same flap position is used for both takeoff and landing.

Variable Incidence Tailplane

The incidence of the tailplane may be adjusted in flight by rotating the TAILPLANE TRIM handwheel at the right side of the pilot's seat.

The tailplane trim position indicator operates mechanically and its pointer moves over a label marked NOSE DOWN, TAKE OFF SETTING and NOSE UP.

It is essential for the tailplane to be trimmed to the correct incidence before take-off is attempted. The action of the tailplane trim wheel is too slow to allow correction for wrong trimming at the last moment, and a badly trimmed tailplane cannot be overcome with elevator control.

Rudder & Aileron Trim

The rudder trim tab is actuated by a handwheel in the cockpit roof, incorporating a position indicator which moves over a scale marked L and R indicating the direction and amount of trim applied.

Aileron trim is actuated by a small handwheel located on the lower center of the yoke column.

Tailwheel Steering Overview

The tailwheel power steering system in the DHC-3T Turbo Otter facilitates taxiing in strong winds and can be used to advantage when operating on wheels.

The tailwheel system consists of an electric steering unit which steers the tailwheel fork, a magnetic clutch for the steering unit, and a power steering control panel located to the left of the throttle quadrant. The system is protected by a push-to-reset circuit-breaker located on the circuit-breaker panel behind the co-pilot's seat.

The control panel includes a three position toggle switch in addition to two indicator lamps of the press-to-test variety.

With the toggle switch in the OFF (bottom) position, the tailwheel will castor freely. This is used when a

fully castoring tailwheel is required, such as during ground handling or taxiing in light winds. Neither indicator lamp will be lit while the toggle switch is in the OFF position.

With the toggle switch in the middle position, the steering unit is immediately centered and the tailwheel fork is locked in the fore-and-aft position, regardless of the position of the rudder pedals. This is used during takeoff and landing procedures. While the tailwheel is in the locked position, the green indicator lamp marked TAIL WHEEL LOCK will be lit.

With the toggle switch in the upmost position, the steering unit is engaged through its magnetic clutch, and the tailwheel will immediately respond to the movements of the rudder pedals. While in this mode, the amber indicator lamp marked GROUND STEERING will be lit.

Floatplane & Amphibious Operations

*(**Note:** It may be noted by the user that the effects of wave height and speed within X-Plane 11 are greatly magnified by the simulator. This can result in an undesirable level of aircraft rolling and pitching while on the water.*

Our recommendation is to use the weather customization panel within the simulator to set the Wave Height to an extremely minimal amount. This setting is only available when manually configuring the weather, not with real world weather.)

Water operations, whether on straight floats or with the amphibious version of the Turbo Otter, requires familiarization with a few additional controls.

The first, included on both versions, is the retractable water rudders. The water rudders are steerable by use of the aircraft rudder pedals to which they are connected through a cable and pulley system. They are raised or lowered by means of a handle, located at the rear of the right side of the pilot's seat. To raise or lower the water rudders, drag the handle forward (raised) or back (lowered) with the left mouse button.

For taxi, take-off, and landing operations on land, the water rudders should be in the raised position. For taxi operations on water, the water rudders should be extended. They should then be retracted before, or during, take-off, and remain retracted until a water landing has been completed.

The next control requiring familiarization is particular to the Turbo Otter equipped with amphibious floats, which feature retractable main and nose wheels. On this version of the aircraft, the hydraulic hand pump assembly located to the left of the co-pilot's seat is used to retract or extend the nose and main wheels,

The hand pump assembly consists of three primary components that require the pilot to be familiar with prior to operation. The large lever on the top of the assembly is the hydraulic pump handle, the small handle to the left of the pump is the selector handle which determines the effect of operating the hand pump (extending or retracting), and the indicator gauge on the top of the pump assembly is used to show the current position of the nose and main wheels.

Raising or lowering the nose and main wheels is effected by first identifying the current position of the wheels as shown on the indicator gauge, dragging the pump selector handle forward (to raise) or back (to lower) with the left mouse button, and finally clicking on the pump handle with the left mouse button. The pump handle will animate during the movement of the landing gear, and the indicator gauge will move to show the new position of the wheels.

Avionics Overview

The MilViz DHC-3T Turbo Otter supports three different avionics layouts which differ in the presence of GPS units and the layout of the avionics on the right side of the front panel. Switching between the available options is done from the Turbo Otter in-game menu.

The first two options that utilize GPS units utilize the native X-Plane GNS units. However, they can also support the Reality XP GNS and GTN plugins (not included with the Turbo Otter):

Option 1 - Dual GPS:
- GTN750 configured as GPS #1 – OR- GNS530 configured as GPS #1
- GTN650 configured as GPS #2 -OR- GNS430 configured as GPS #2

Option 2 - Single GPS:
- GTN750 configured as GPS #1 – OR- GNS530 configured as GPS #1

Important: No other Reality XP plugin configurations are supported by these two options.

The Reality XP units will automatically appear and replace the default X-Plane units if the Reality XP plugins are installed and activated. In the case of the GTN 750, it automatically also replaces the KMA 30 audio panel, since the GTN 750 includes that functionality.

Options 2 & 3 place the avionics stack on a 'kick-out' panel to make them easier to view from the pilot's seat.

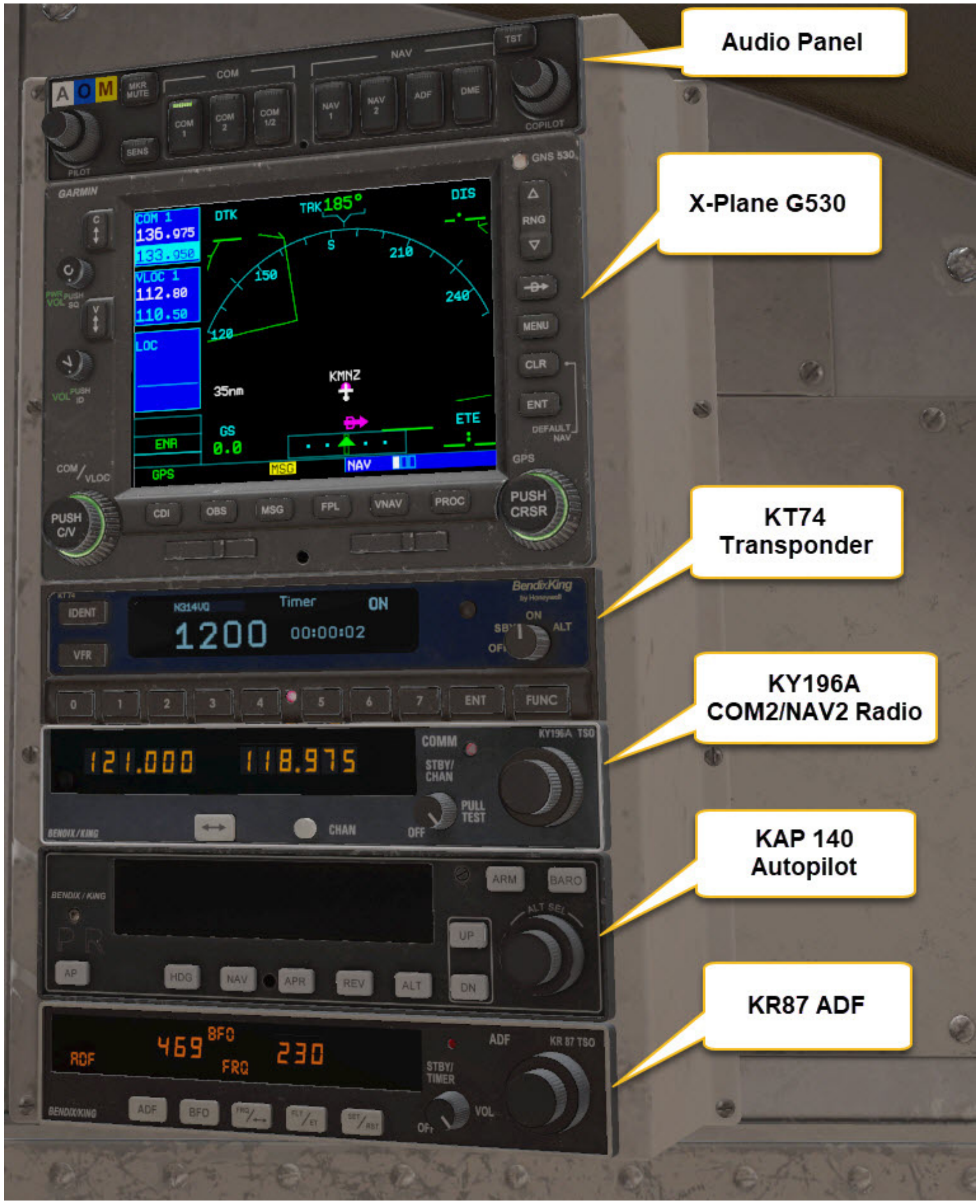
For operation instructions on the default X-Plane GNS units, or the Reality XP units, please refer to their respective product manuals.

Option 1: Dual GPS

Important Note

When the Reality XP gauges are NOT installed, errors relating to their abscence are present in the X-Plane log file when loading the DHC-3T Turbo Otter. This is not a cause for concern and will have no negative impact on the simulator nor the operation of the Turbo Otter.

Option 2: Single GPS



Option 3: No GPS

KX165A COM1/NAV1 Radio Overview

The KX165A is a COM1/NAV1 radio with Omni-Bearing Selector and Active Adjust modes. The KX165A supports both 25Khz and 8.33 Khz channel spacing for COM1.

KX165A Omni-Bearing Selector Mode

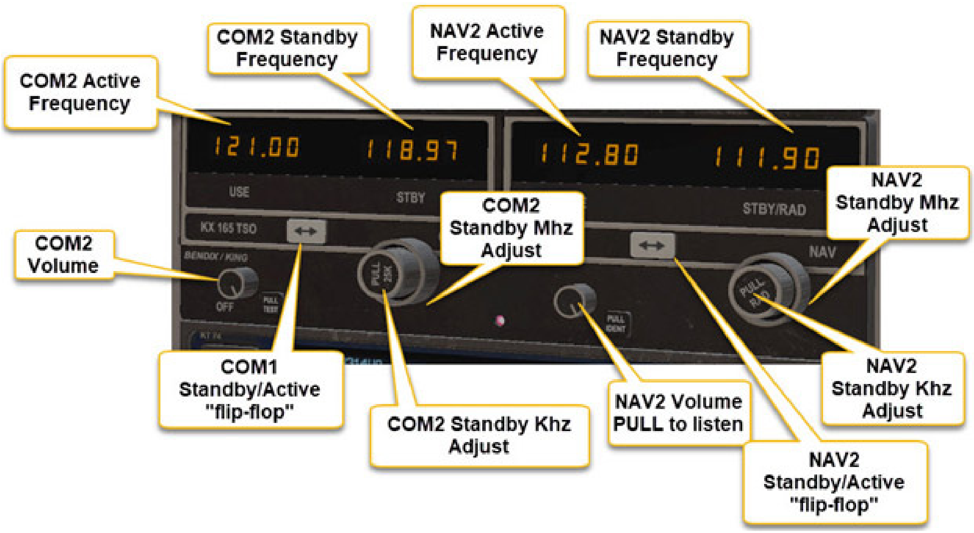
The KX165A is capable of displaying a digital OBS for tracking a VOR radial on the NAV1 Active Frequency. To show the OBS display, press the MODE button. Press again to dismiss the display. To adjust the selected radial for the VOR, click the small right-hand knob to pull it out, then turn the knob to adjust the selected radial. "TO" or "FR" will be shown to the right of the selected radial, and the Course Deviation Indicator will move left/right (up to +/- 2.5 degrees of deviation) as you adjust the radial.

KX165A Active Adjust Mode

Press and Hold the COM1 or NAV1 flip-flop buttons to enter Active Adjust mode. In this mode, the Standby frequencies will not be displayed, and the frequency adjust knobs will change the Active frequencies directly. Press the flip-flop buttons to dismiss Active Adjust mode and return to normal.

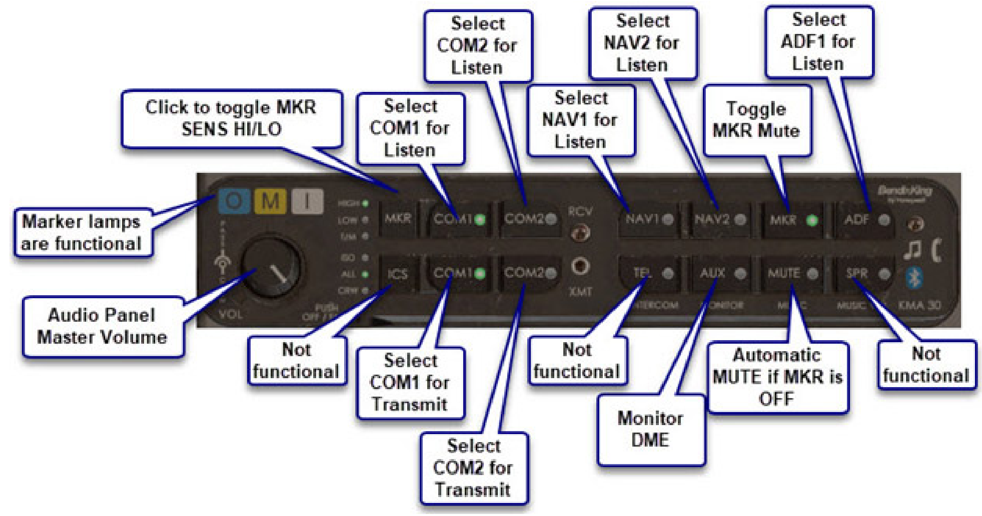
KX165 COM2/NAV2 Radio Overview

The KX165 is a COM2/NAV2 radio with conventional operation.



KMA 30 Audio Panel Overview

The KMA 30 is an audio control panel with conventional operation.



Notes:

a. With X-Plane 11.3x and newer, the MKR SENS HI/LO function is operational (does not work in older versions).

b. Bluetooth functionality is not implemented.

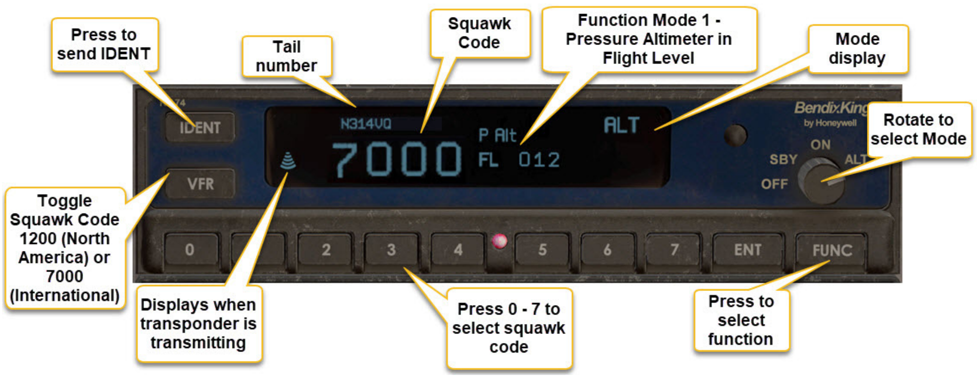
KT 74 Transponder Overview

The KT 74 is a ADS-B compliant Mode S transponder with Pressure Altimeter, Flight Timer, Count-Up Timer, Altitude Monitor, and ADS-B OUT Position functions.

To cycle the function modes, press the FUNC key repeatedly.

For the convenience of European and other international pilots, the VFR button toggles between 1200 and 7000.

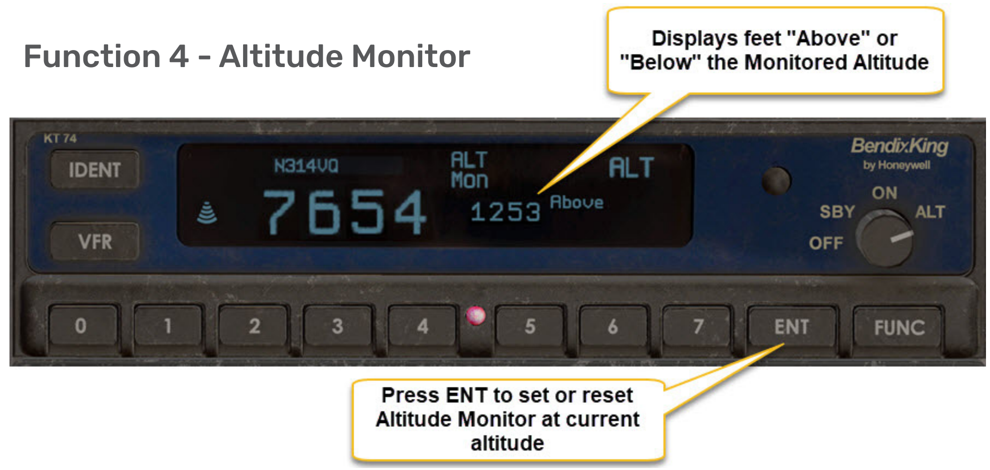
Function 1 - Pressure Altimeter



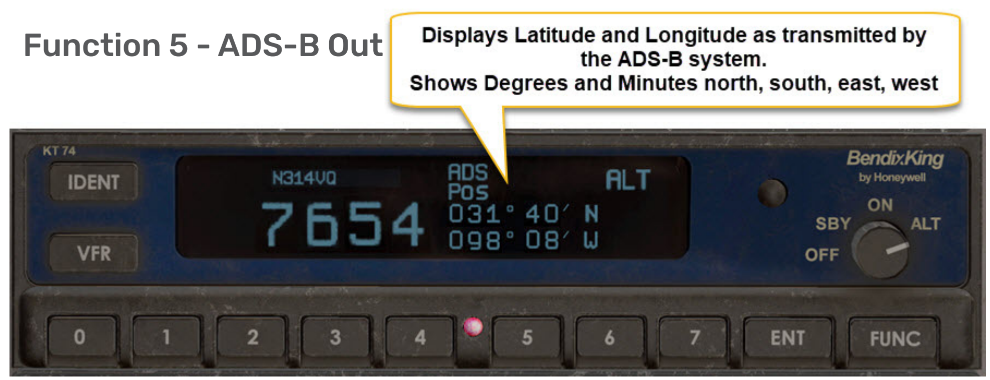
Function 2 - Flight Timer

Function 3 - Count-Up Timer

Function 4 - Altitude Monitor



Function 5 - ADS-B Out

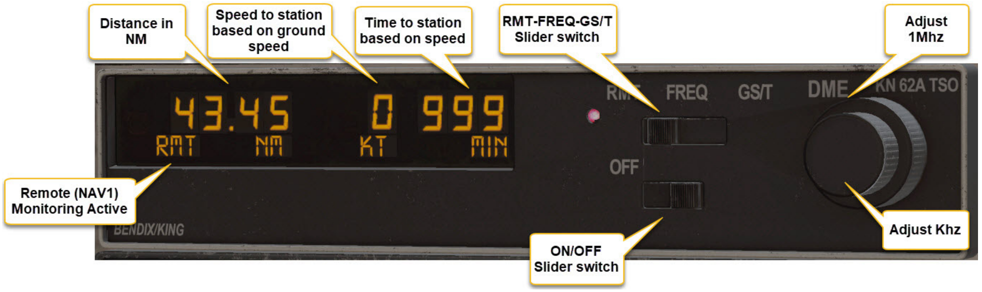


KN 62A DME Overview

The KN62A is a conventional DME (Distance Measuring Equipment) instrument that provides monitoring of the Active NAV1 frequency in “RMT” mode, and allows monitoring of a separate ground station in the FREQ and GS/T modes.

RMT Mode

In “RMT” mode, the KN62A is monitoring the current Active NAV1 station, and provides Distance, Speed (based on ground speed to the selected station) and Time-to-Station in minutes (based on ground speed). Place the mode selector slider switch in the RMT position to monitor NAV1.

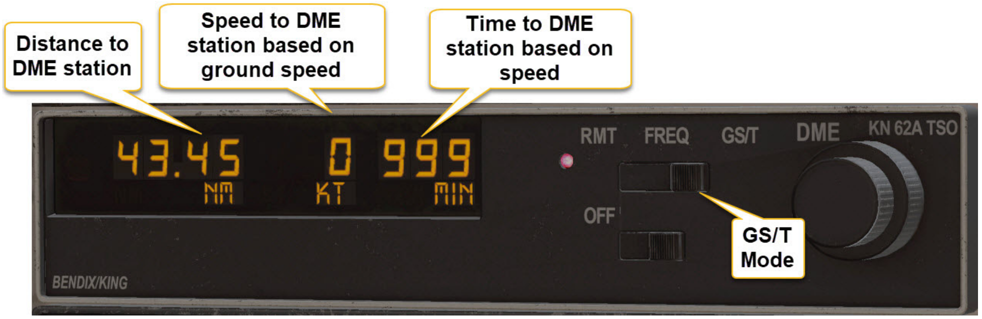


FREQ Mode

In “FREQ” mode, the KN62A is monitoring the currently selected DME station, and provides Distance and Frequency displays. To change the DME frequency, use the knobs to adjust the frequency. NOTE: In this mode, the DME is not monitoring NAV1, but is monitoring the station selected by the DME frequency.

GS/T Mode

In “GS/T” mode, the KN62A is monitoring the currently selected DME station, and provides Distance, Speed and Time-to-Station displays. NOTE: In this mode, the DME is not monitoring NAV1, but is monitoring the station selected by the DME frequency.

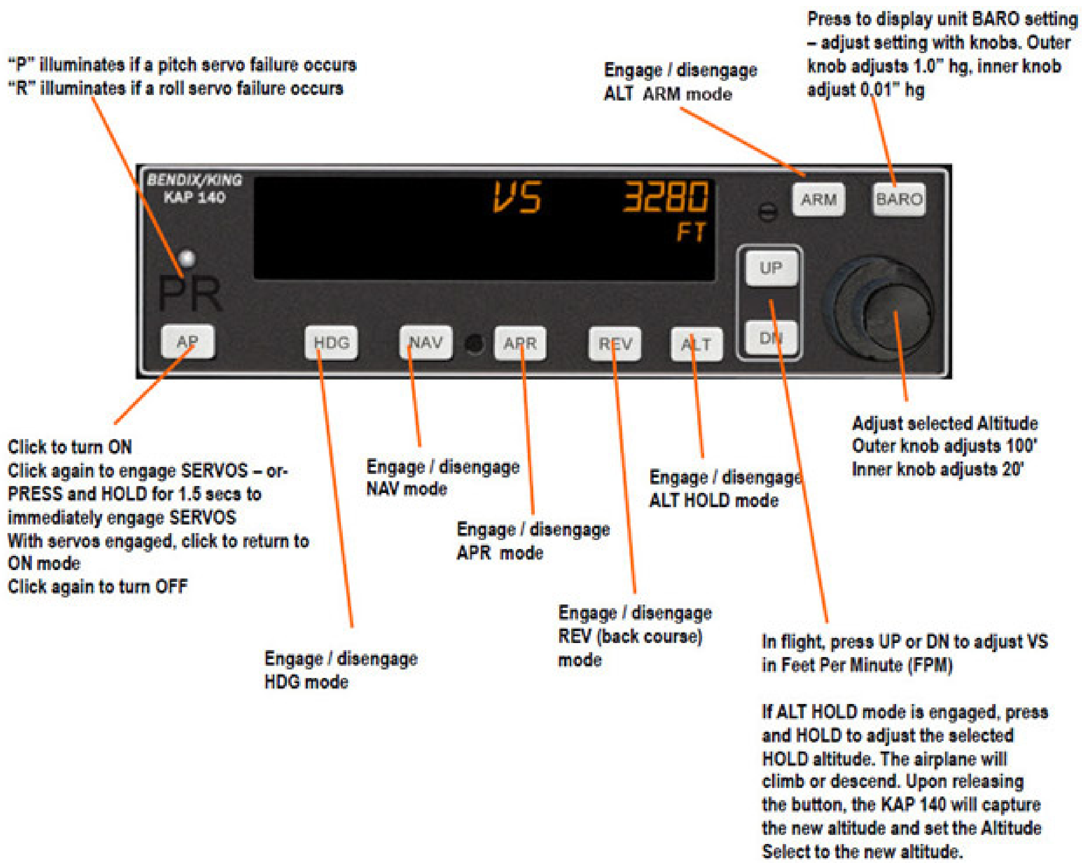


KAP 140 Autopilot Overview

The KAP 140 is a two-axis (pitch and roll) autopilot that has an Altitude Pre-select operation, allowing you to set a pre-selected altitude for altitude HOLD mode in cruise flight.

The KAP 140, when first engaged, defaults to ROL mode for lateral control of the airplane. In ROL mode, the wings are leveled when the autopilot servos are engaged. The KAP 140 defaults to Vertical Speed (VS) mode when engaged. The autopilot will capture and hold the current rate of climb or descent when the servos are first engaged.

IMPORTANT: The KAP 140 uses the HDG bug for tracking intercepts to VORs and ILS Localizers. Be sure to adjust the HDG bug to the desired intercept course when attempting to intercept a VOR radial or an ILS localizer. When you engage NAV or APR or REV modes, the "HDG" label will flash on screen three times as a reminder to adjust your HDG course.



Turning on the KAP 140 and adjusting settings

The KAP 140 unit initializes and presents a ready (power-on) state whenever the avionics switch is ON and there is power on the electrical bus. In this power-on mode, the autopilot servos are not engaged. The unit will display “VS” on the screen, and the pre-selected altitude in feet will display on the right side of the screen. At this time, the pilot may adjust the BARO mode to agree with the aircraft altimeter, set the altitude alerter reference altitude to the desired altitude, and set the vertical speed to the desired climb/descend rate.

Important: The KAP 140 has an internal barometric pressure control that is NOT slaved to the pilot’s altimeter. You MUST set the BARO on the KAP 140 anytime you set or reset the baro pressure on the altimeter. Otherwise, the ALT HOLD function may occur at surprising altitudes.

Press the BARO button to adjust the internal barometric pressure for the KAP 140. Upon pressing the BARO button, the unit will display “BARO”, and the current setting will be shown in in. hg. Use the inner and outer knobs to set the BARO (outer knob changes 1.0” hg, inner knob changes 0.01” hg) to agree with baro setting on the airplane’s altimeter. “BARO” is displayed for 3 seconds after pressing the BARO button or adjusting the BARO with the knobs. (Note: The BARO setting is inHG only, switching to HPA is not available.)

When “BARO” is not displayed, you may turn the knobs to adjust the pre-selected altitude. If you adjust the altitude, the unit will automatically engage Altitude ARM.

Pressing the AP button will engage the servos, and the KAP 140 will be in command of the control surfaces. “ROL” and “VS” will be engaged and the AP symbol will appear, indicating that the servos are engaged. To disengage the servos, press the AP button again. The autopilot will revert to power-on mode, with the servos disengaged.

To test the unit on the ground, engage the servos and select HDG mode. Change the HDG bug on the directional gyro or HSI and observe the yokes responding to the servos. Disengage HDG mode and select ALT HOLD. Press and hold the UP or DOWN button and observe the yokes responding to the servos. Be sure to disengage the servos before taxi.

VS Mode

The KAP 140 engages VS mode automatically by default when first turned on. When the servos are first engaged (“AP” symbol displayed), an alert tone will sound, and the unit will operate in the ROL and VS modes. Climb or descent rate will be captured when servos are engaged.

Important: When climbing or descending, be cautious to adjust the power setting for the aircraft accordingly. Is is possible for the autopilot to cause the aircraft to stall if the power setting is not sufficient for the commanded climb rate.

Press the UP or DN to adjust the climb or descent rate. Each press will increment / decrement by 100 ft/min, or more rapidly (300 ft/min) if pressed and held. Maximum selectable FPM is +/- 1500.

To enter VS mode from ALT mode (ALT HOLD), press the ALT button to disengage ALT HOLD. “VS” will display on the screen, and the current vertical speed is displayed. Select the desired climb or descent rate with the UP or DOWN button.

Altitude Hold Mode (ALT)

Press the ALT button to immediately engage ALT HOLD mode, “ALT” is displayed on screen, and the KAP 140 will capture and hold the current pressure altitude.

To adjust the reference altitude, single presses on the UP or DOWN buttons will adjust the altitude by +/- 20 ft per press.

To climb or descend in ALT HOLD mode, press and hold the UP or DN buttons. The aircraft will climb or descend while the button is being held at +/- 500 ft/min. Adjust throttle as needed. Release the button when the desired altitude has been reached. The new reference altitude will be captured and held.

Altitude Alerter

The altitude alerter is a visual cue to alert the pilot that the selected altitude is approaching or has been attained. “ALERT” will appear on the display when the aircraft is within 1000 feet of the pre-selected altitude, and the “ALERT” cue will extinguish 200 feet prior to reaching the selected altitude. (Note: Within X-Plane, the Altitude Alerter Reference Altitude is known as the ‘altitude_preselect’.)

Altitude Pre-Select

Rotate the knobs (outer knob is 100' increments, inner knob is 20' increments) until the desired altitude is displayed. "ALT ARM" automatically displays when the pre-selected altitude is adjusted, and the autopilot will level the aircraft and engage ALT HOLD automatically upon reaching the selected altitude. The ALT ARM mode can be disengaged by pressing the ARM button.

Altitude Hold Mode

Altitude Hold mode will be automatically engaged upon reaching the pre-selected altitude if ALT ARM is engaged. Otherwise, you may press the ALT button at any time you wish to capture and hold the current pressure altitude.

When ALT is pressed, the current pressure altitude is captured and held, and the pre-selected altitude will be changed to the current altitude (within +/- 20' increments).

Heading Mode (HDG)

Press the HDG button with the autopilot servos engaged to command the aircraft to turn to and maintain the heading selected by the heading bug on the directional gyro or HSI. Press the HDG button again to disengage HDG mode and return to ROL mode.

Navigation Mode (NAV)

Press the NAV button to ARM the navigation mode. In NAV mode, the autopilot will capture and track VOR or LOC courses as selected on the CDI (course deviation indicator).

When the NAV button is first pressed, "HDG" will flash for 3 seconds to remind the pilot to put the aircraft on an intercept course with the VOR or LOC course. "NAV ARM" will be annunciated on the screen until the VOR or LOC signal is captured, at which point the "ARM" annunciation will extinguish.

Approach Mode (APR)

Press the APR button to engage approach mode. Approach mode provides precision tracking of VOR, LOC and GPS courses, and will also provide tracking of glideslope signals if present. "HDG" will flash for 3 seconds to remind the pilot to put the aircraft on an intercept course with the VOR or LOC course.

"NAV ARM" and "GS ARM" will be displayed until the LOC and GS signals are captured and tracked, at which point the "ARM" annunciations will be extinguished.

Backcourse Mode (REV)

Press the REV button to engage backcourse mode. This mode functions similarly to APR mode except that the autopilot response to LOC signals is reversed.

Note: When engaging NAV, APR, or REV modes, it may take up to 15 seconds for the autopilot to capture the VOR or LOC signal and begin a turn to the source signal.

Notes:

- A solid PT annunciation that would normally indicate as fault in the pitch trim system is not implemented.
- AP annunciation does not flash for 5 seconds on autopilot disconnect.
- VS annunciation being displayed during CWS is not implemented.
- Voice annunciations are not implemented.
- Autopilot behavior is consistent with pre 03/01 software revision.

Important:

- When engaging NAV or APR modes for VOR and localizer tracking, the pilot **MUST** adjust the OBS to the correct front course or desired radial. The autopilot will then turn to the selected course and intercept and capture the VOR or localizer signal.

- Use the HDG mode to have the autopilot follow a GPS flight plan. When the X-Plane HSI source is "GPS," the autopilot will automatically switch to GPSS tracking if HDG mode is engaged. If the GPS source is changed back to "VLOC," normal HDG mode will re-engage and the autopilot will track the HDG bug on the directional gyro as normal.

KR 87 ADF Overview

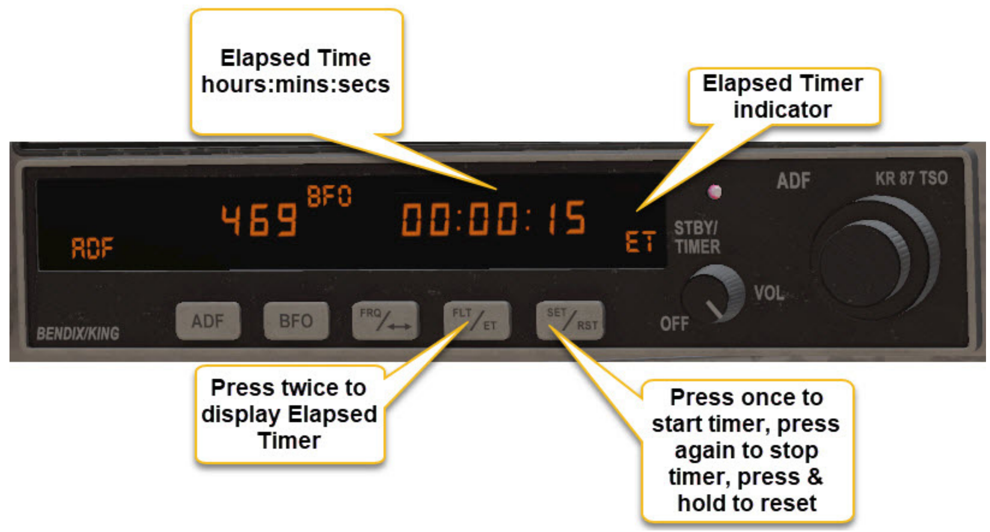
The KR 87 ADF is a conventional ADF radio providing ADF, ANT and BFO modes of operation. In addition, the KR 87 has an automated Flight Timer and an Elapsed Timer function. The KR 87 allows the pilot to adjust a Standby frequency for the desired ground station and then "flip-flop" the Standby and Active frequencies.

Frequency Change Operation

Flight Timer Operation

Press the FT / ET button once to display the automated Flight Timer. The Flight Timer starts when the airplane is airborne, and stops when the airplane is on the ground.

Elapsed Timer Operation



Normal Operating Procedures

BEFORE ENTERING AIRCRAFT

Carry out an exterior inspection of the airplane as detailed below. Check the stowage of cargo and baggage, and determine the load distribution and C.G. position. Check fuel quantities, and that fuel is the proper jet fuel.

Starting at the cockpit door, port side, make the following checks. The numbers correspond to the checkpoints shown in the included illustration.

1. COCKPIT AND SERVICING POINTS.

All switches off. Fuel filler caps and hydraulic reservoir caps secure. Drain fuel sumps.

2. LANDING GEAR.

Landing gear and fairings for damage. Grounding chain for security and contact. Tires for cuts, bruises, slippage and proper inflation. Brake lines and hose for fluid leaks.

3. POWERPLANT SECTION.

Check security and condition of engine cowling, panels, and exhaust stubs. Check engine air inlet, screen and exit are secure and unobstructed. Check ice vane retracted. Check engine oil quantity and secure oil cap. Check propeller for condition and oil leaks. Check security of spinner.

4. STARBOARD WING.

All hinges clear. Aileron trim tab neutral. Wing tip and navigation light assembly for dents or damage.

5. STARBOARD FUSELAGE SIDE.

Fuselage side for dents or wrinkles. Underside for fuel leaks Cabin access ladder stowed and secure. Cabin entrance door closed. Wing and fuselage antennas, lead-ins, and loop housing for damage.

6. EMPENNAGE.

All hinges clear. Access panels secure. Tailplane incidence and rudder trim tab neutral. Control surfaces for wrinkles, dents, and damage. Lower rudder hinge assembly (bracket, bolt, and control rod) for condition. Servo-tabs for operation. Inspect navigation light assembly for damage.

7. TAILWHEEL ASSEMBLY.

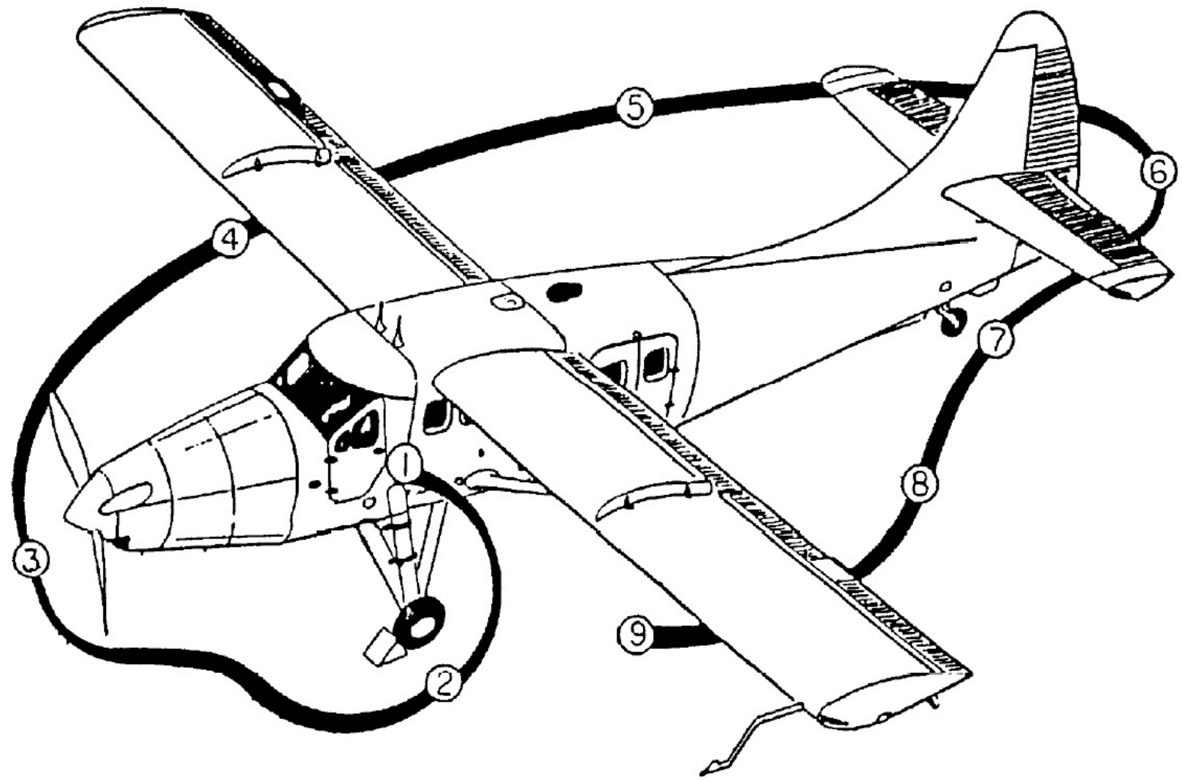
Tailwheel tire for proper inflation, cuts, bruises, and slippage. Check shock strut for inflation and leaks.

8. PORT FUSELAGE SIDE.

Fuselage side for damage or wrinkles. Underside for fuel leaks. Hand fire extinguisher in rear cargo door secure. Cargo doors closed. Wing and fuselage antennas and lead-ins for damage.

9. PORT WING.

All hinges clear. Aileron trim tab neutral. Wing tip and navigation light assembly for dents or damage. Pitot head cover removed.



Engine Start & Run-up

UPON ENTERING AIRCRAFT

a. Parking Brake - Set.
b. Flight Controls - Unlocked. Check for correct, free, and full movement.
c. Trim tabs - As required.
d. All switches - OFF (except generator switch on Junction Box which is to be left ON at all times.).
e. Condition lever - IDLE CUT OFF.
f. Fuel emergency shutoff - IN.
g. All circuit breakers - Set on, including flight and engine instrument circuit breaker switches.
h. Inverter Switch - ON.
i. Fuel transfer selector - OFF.
j. Flight instruments - Check. Set altimeter.
k. Master Switch - ON.
l. Push-to-test lights - TEST.
m. Fuel quantities - Check gage indications.
n. Communications equipment - Test.

BEFORE START

a. Master switch - OFF.
b. All doors - Closed and secure.
c. Propeller area - clear.
d. Brakes - Checked Set.
e. Power lever - IDLE.
f. Standby emergency power lever - Wired to OFF.
g. Prop control - INCREASE position.
h. Condition lever - IDLE CUT OFF.

ENGINE START

a. Master switch - ON.
b. Cabin heat control lever - COLD.
c. No. 2 fuel boost pump switch - ON. Check fuel low pressure warning light goes out. Then turn switch OFF.
d. No. 1 fuel boost pump switch - ON. Check fuel low pressure warning light goes out.
e. P3 heater - ON.
f. Engine ignition - ON.
g. Starter switch - Hold ON and check for oil pressure rise.
h. Condition Lever -RUN after stabilized Ng at or above 12% (18% is OPTIMAL).
i. ITT and Ng - MONITOR (1090 °C maximum - not to exceed 2 seconds) and engine accelerates to normal idle (52.6% Ng).
j. Oil pressure - CHECK.
k. Engine starter and ignition switches - OFF (when engine attains idle RPM).

Taxiing & Takeoff

TAXIING - LANDPLANE

a. Wing flaps - CRUISE to improve directional control.
b. Engine temperatures - Monitor for normal ranges.
c. Parking brake - OFF, Test wheel brakes as soon as airplane starts moving.
d. Rudder pedals - Operate to control steerable tailwheel. Operate Power Steering System as applicable.
e. Power Lever - Momentarily advance beyond IDLE to initiate taxiing speed. When momentum is obtained, retard to IDLE. If taxi speed becomes too high at IDLE, reduce speed by moving the Power Lever into REVERSE range as necessary to control speed.

BEFORE TAKEOFF

a. All doors properly closed and LOCKED.
b. Tailplane trim - TAKEOFF SETTING.
c. Rudder and aileron trim - SET
d. Wing flaps - TAKEOFF AND LANDING position.
e. Directional gyro and artificial horizon - SET and uncaged.
f. Radios/NAV aids - Check as required.
g. All instruments in correct ranges.
h. Pitot head heater - ON when required.
i. If OAT is 41 °F or less with visible moisture - ice doors to ICING CONDITION, and inlet deice boot switch to ON.
j. Stall Warning Light - Push to check lighting.
k. Propeller - Full INCREASE.
l. Ignition switch - ON.
m. Oil temperature - Above + 10 °C.

TAKEOFF

a. When aligned on runway - Tailwheel locked.
b. Power Lever - Advance smoothly to takeoff power according to either the torque limit (58.7 psi), ITT limit (790°C), or Ng limit (101.5%), whichever governs.
c. Direction - Maintain through rudder control.
d. Allow airplane to fly itself off in a tail-down attitude at approximately 60 MPH IAS and then permit airspeed to build up to 80 MPH IAS by 50 feet above runway. If obstacles are present maintain 66 MPH IAS or more after liftoff until obstacles are cleared and then permit airspeed to build up to 80 MPH IAS.

Climb & Cruise

CLIMB

a. Flaps - UP.
b. Ignition - OFF.
c. Tailwheel lock - OFF (if installed)
d. Climb speed - 91 MPH IAS.
e. Power - Reduce Power Lever smoothly to maximum recommended normal climb power according to either the torque limit (64.5 psi @ 2000 RPM); ITT limit (765 °C); or Ng limit (101.5%), whichever governs. This is recommended maximum cruise power for maximum engine life.
f. If OAT is 41 °F or less with visible moisture - Ice doors to ICING CONDITION, and inlet deice boot switch to ON.

CRUISE

a. Flaps - UP.
b. Power - The following are recommended maximum cruise power limits: torque limit (60.2 psi @ 2000 RPM, 54.8 psi @ 2200 RPM); ITT limit (740 °C); or Ng limit (101.5%), whichever governs.
c. If OAT Is 41 °F or less with visible moisture - Ice doors to ICING CONDITION, and inlet deice boot switch to ON.
d. Fuel Transfer (only after center tank has less than 60 gallons remaining):
   (1) Both fuel boost pumps must be ON for the fuel to transfer.
   (2) When at FWD CG - Fuel Transfer Selector to FWD tank first then AFT tank after FWD tank is empty.
   (3) When at AFT CG - Fuel Transfer Selector to AFT tank first then FWD tank after AFT tank is empty.
   (4) After fuel transfer - Fuel Transfer Selector OFF and No. 2 boost pump OFF.

CAUTION:

The pilot should ensure that the fuel transfer system operates before the aircraft is flown farther from an airport than the range capability of the remaining fuel in the center tank.

NOTE:

Anytime the aircraft is operated in the proximity of heavy moisture the pilot should turn the Ignition Switch ON as a precaution. Also when the fuel in the center tank is below 40 gallons, turn the Ignition Switch ON as a precaution.

Descent, Approach & Landing

DESCENT

a. Power Lever - Reduce as desired.
b. Airspeed - As desired (do not exceed VMO = 143 MPH IAS, landplane; 133 MPH IAS, seaplane/skiplane).
c. If OAT is 41 °F or less with visible moisture - Ice doors to ICING CONDITION, and inlet deice boot switch to ON.

APPROACH

a. Propeller Lever - Full INCREASE.
b. Tailwheel - Locked.
c. Flaps - As required (below 91 MPH IAS, landplane; 91 MPH IAS, seaplane/skiplane).
d. Brakes - Check.
e. If OAT is 41 °F or less with visible moisture - Ice doors to ICING CONDITION, and inlet deice boot switch to ON.
f. If Heater is operating - BLOWER switch ON above 90 MPH IAS.

LANDING

a. Flaps - TAKEOFF AND LANDING position.
b. Ignition - ON.
c. Airspeed on final - 80 MPH IAS.
d. Propeller - Reverse range as required after tail wheel is firmly on ground.
e. Brakes - As required.

GO-AROUND AND BALKED LANDING

a. Power Lever - Advance smoothly to takeoff power according to either the torque limit (64.5 psi); ITT limit (790 °C); or Ng limit (101.6%), whichever governs.
b. Airspeed - 66 MPH IAS until obstacles are cleared. Then 80 MPH IAS.
c. Tailplane trim - As necessary to maintain a safe airspeed.
d. Flaps - As required.

AFTER LANDING

a. Tailwheel - Ground steering.
b. Flaps - CRUISE setting for taxi.
c. Landing light - OFF.
d. Ignition - OFF.
e. Tailplane trim – NEUTRAL

ENGINE SHUTDOWN

a. Parking brake - Set.
b. Power Lever - IDLE. Allow engine to stabilize for one minute at IDLE.
c. Tailwheel control - OFF.
d. Propeller Lever - FEATHER.
e. Condition Lever - IDLE CUT OFF.
f. Fuel boost pumps - OFF (after Ng is below 5%).
g. P3 Heater - OFF.
h. Deice boot switch to OFF.
i. Radios - OFF.
j. Anticollision light - OFF.
k. Master Switch - OFF.

Emergency Procedures

ENGINE FAILURE DURING TAKEOFF RUN

a. Apply brakes - control column fully back all the time.
b. Condition Lever - IDLE CUT OFF.
c. Maintain directional control.
d. Ignition - OFF.
e. Fuel boost pumps - OFF.
f. Master Switch - OFF.
g. Fuel emergency shutoff - If necessary - PULL SHARPLY

ENGINE FAILURE AFTER TAKEOFF

a. Lower nose immediately to attain airspeed of 85 MPH IAS.
b. Maintain directional control.
c. Propeller Lever - FEATHER
d. Condition Lever - IDLE CUT OFF.
e. Ignition - OFF.
f. Fuel boost pumps - OFF.
g. Fuel emergency shutoff - PULL SHARPLY (to break wire lock and close).
h. Master Switch - OFF.
i. LAND STRAIGHT AHEAD. CHANGE DIRECTION ONLY ENOUGH TO AVOID OBSTACLES.

ENGINE FAILURE IN FLIGHT

a. Propeller Lever - FEATHER.
b. Condition Lever - IDLE CUT OFF.
c. Both fuel boost pump switches - OFF.
d. P3 heater switch - OFF.
e. Power Lever - IDLE.

NORMAL AIR-START - STARTER ASSIST.

Note: The normal starter assist airstart envelope is from sea level to 16,000 feet and from minimum flying airspeed to VMO (143 MPH IAS, landplane; 137 MPH IAS, seaplane).

a. Propeller Lever - Anywhere in the operating range.

Note: Propeller feathering is dependent on circumstances and is at the pilot's discretion. Fine pitch (INCREASE position) will provide increased gas generator windmilling speed for emergency starts in the remote event of starter failure.

b. Power Lever - IDLE.
c. Fuel emergency shutoff valve - Push in to open.
d. Condition Lever - IDLE CUT OFF.
e. Both fuel boost pump switches - ON.
f. Fuel inlet pressure - 5 psig minimum.
g. P3 heater switch - ON.
h. Ignition - ON.
i. Starter switch - Hold ON and check for oil pressure.
j. Condition Lever - RUN after stabilized Ng at or above 12% (18% is OPTIMAL).
k. ITT and Ng - MONITOR (1090 °C maximum not to exceed 2 seconds) and engine accelerates to normal idle (52.6% Ng).

Note: A re-light normally should be obtained within 10 seconds, and will be evidenced by a rise in ITT and gas generator (Ng) RPM.

l. Oil pressure - CHECK.
m. Engine starter and ignition switches - OFF (when engine attains idle RPM).
n. Propeller Lever - Desired operating range.
o. Power Lever - As required.

EMERGENCY POWER LEVER

Use the following procedure if the engine fails to respond to the normal Power Lever.

a. Power Lever - IDLE.
b. Emergency Power Lever Safety Wire - Break.
c. Push down on the Emergency Power Lever round knob and advance lever SLOWLY. Monitor ITT while advancing Emergency Power Lever to desired power.

Caution: The Emergency Power Lever bypasses the fuel control unit therefore all the normal engine safety limits are inoperative. The Emergency Power Lever should be moved SLOWLY while all engine readings are kept within limits.

d. Land as soon as possible.

GENERATOR FAILURE.

Generator failure will be indicated by illumination of the red Generator Failure Warning Light. If the Generator Failure Warning light comes on turn off all non-essential electrical equipment and land as soon as possible.

FUEL BOOST PUMP FAILURE.

If fuel pressure drops below 5 psi turn on remaining boost pump. If fuel pressure remains below 5 psi engine will continue to run in cruise but not for climb or go-around power. With a fuel boost pump failure the pilot should land as soon as possible.

Engine Operating Limits

Note: The operating limits presented do not necessarily occur simultaneously.

POWER SETTING	SHP	TORQUE (psi) (1)	ITT (°C)	Ng (%) (2)	Np (RPM) (1)	OIL PRESSURE (psig) (7)	OIL TEMP (°C)
Takeoff and Max. Continuous (12)	750	64.5 (1)	790	101.6	2200 (1)	85 to 105	10 to 99
Idle			685 (5)	52.6		40 (min)	-40 to 99
Starting (9)			1090 (4 & 6)				-40 (min)
Momentary		68.4	850 (4)	102.6 (4)	2420		0 to 99
Max. Reverse (8)	720	64.5	790	101.6	2120	85 to 105	0 to 99

NOTES:

1. Maximum sustained torque limit is 1970 ft-lb (64.5 psi). Np must be set so as not to exceed power limitations (maximum torque is 58.7 psi @ 2200 RPM and 64.5 psi @ 2000 RPM, with a straight line variation between these settings).
2. For every 10 °C (18 °F) below -30 °C (-22 °F) ambient temperature, reduce maximum allowable Ng by 2.2%.
3. Overspeed, overtemp, and overtorque action is not listed within this chart.
4. These values are time limited to two (2) seconds.
5. Increase Ng to keep within this limit.
6. Starting temperatures above 850 °C should be investigated for cause.
7. Normal oil pressure is 85 to 105 psig at gas generator speeds above 72% Ng with oil temperature between 60° to 70 °C (140° to 158 °F). Oil pressure below 85 psig is undesirable and should be tolerated only for the completion of flight, preferably at reduced power setting. Oil pressure below 40 psig is unsafe and requires that a landing be made as soon as possible, using minimum power to sustain flight.
8. Reverse power operation is limited to one (1) minute.
9. Use of starter is limited to 30 seconds ON, one minute OFF, 30 seconds ON, one minute OFF, 30 seconds ON, then one hour OFF to cool.
10. In event of failure of the propeller governor toward overspeed, it is permissible to complete a flight with the propeller control via the overspeed governor, providing the overspeed limit is not exceeded.
11. Accessory drive seal leakage should not exceed 3 c.c. per hour.
12. Maximum Continuous Power, MCP, 2000 RPM @ 64.5 psi; Takeoff Power, 2200 RPM @ 58.7 (limited to 3 minutes).

Engine Instrumentation Markings

INSTRUMENT	Red Line Minimum Limit	Yellow Arc Caution	Green Arc Normal Operating	Red Line Maximum Limit
Torquemeter	---	---	0 to 58.7 psi	58.7 psi
Interstage Turbine Temperature	---	---	400 to 790 °C	790 °C
Propeller Tachometer (Np)	---	---	1800 to 2000 RPM	2200 RPM
Gas Generator Tachometer (Ng)	---	---	52.6 to 101.6%	101.6%
Oil Temperature	-40 °C	-40 °C to 10 °C	10 °C to 99 °C	99 °C
Oil Pressure	40 psi	40 to 85 psi	85 to 105 psi	105 psi
Fuel Pressure	5 psi	---	5 to 35 psi	35 psi
Vacuum Gage	3.5 inHg	---	3.5 to 5.1 InHg	5.1 inHg

Aircraft Operating Limits

	Indicated Air Speed- IAS (MPH)	Corrected Air Speed - CAS (MPH)
Maximum Operating Limit Speed, V_{MO}	143	147
Maneuvering Speed, V_A	125	129
Maximum Flap Extended Speed, V_{FE}	91	95

Kinds of Operations Limits

The airplane is approved for the following types for operations when the required equipment is installed and operational:

1. VFR Day
2. VFR Night
3. IFR Day
4. IFR Night
5. Flight into known icing conditions is prohibited.

Maximum Operating Altitude

The maximum operating altitude is 16,000 feet for all operations when sufficient units of Sky-OX, SK-10, portable oxygen equipment are on board and operable for each crew member and passenger.

If no operable oxygen equipment is on board, then the maximum operating altitude is 12,500 feet.

Outside Air Temperature Limits

Maximum outside air temperature operating limit: ISA + 33 °C (ISA + 60 °F)
Minimum outside air temperature operating limit: -40 °C (-40 °F)

Stall Speeds (8000 lb Weight)

Flap Setting	Bank Angle (°)	Stall Speed (MPH)	
		CAS	IAS
UP	0	78	76
	30	84	82
	45	93	90
	60	110	107
DOWN	0	63	61
	30	68	65
	45	75	72
	60	89	85

Credits

Development Team	**Walker Guthrie - vFlyteAir** **Alan Shafto** **Cooper LeComp - AFM Simulations**
Modeling & Textures	**Dmi Usatyi - 3DReach**
Sound Environment	**Mike Maarse - SimAcoustics**
Documentation	**Jim Stewart**
Team Management	**Colin Pearson** **Oisin Little**
Product Testers	**OzWookiee** **John Wharton** **Sergio Sanchez** **Mike Cameron** **Tony “Bagobonez” Peaker** **Ryan Butterworth** **Steve Mcnitt** **BeeJay Bristow-Stagg** **Matthew Simmons**