De Havilland Canada DHC-6 Twin Otter

Aircraft Operating Manual

Introduction

This manual introduces you to the de Havilland Canada DHC-6 Twin Otter in Microsoft flight simulator 2024. Please review the available introductory flight as well to familiarize yourself with this highly versatile aircraft.

Table of contents

Overview

This package brings you the de Havilland Canada DHC-6 Twin Otter Series 300 for Microsoft flight simulator 2024. You'll find three variants of the aircraft to fly with:

- Wheel landing gear version
- Ski version
- Amphibian version with floats and extendable gear

All explanations in this manual are based on the wheel landing gear version with further explanations for the ski and amphibian version in a separate section.

Manuals and further support

Two manuals and a set of checklists are available for the Twin Otter:

- The Aircraft Operating Manual (AOM).
- An introductory flight, introducing you to flying the Twin Otter. All stages of the flight from planning, preparing the simulator and aircraft, and conducting the flight are covered.
- Short and expanded checklists.

In case you still encounter a problem which can't be solved with either manual, try the following resources:

Microsoft Flight Simulator Support (zendesk.com)
Official Microsoft support page

Microsoft Flight Simulator Forums
A user-user support forum

The Aircraft

Design, Development, and History

The Twin Otter's design started in 1964 and it took its maiden flight in 1965. De Havilland Canada aimed for a successor to the single-engine DHC-3 Otter that had similar flight performance but more reliability and safety margin, hence the twin engine configuration. The Series 100 was the first model that used a PTA6A-20 engine, followed by an improved series 200 and the series 300 with a new engine (the PT6A-27 engine).

De Havilland Canada ceased production in 1988 but Viking Air resumed manufacturing of the model in July 2010. The 'new' aircraft was called the series 400, which is essentially identical to the series 300; the key difference being that it is manufactured by Viking Air.

Specification

- Manufacturer — Viking (initially De Havilland)
- Modell — DHC-6 Twin Otter Series 300
- Maximum take-off weight (MTOW) — 12.500 lbs / 5.670 kg
- Maximum landing weight (MLW) — 12.300 lbs / 5.579 kg
- Capacity — 1 or 2 crew, up to 20 passengers
- Wingspan — 65 ft / 19.8m
- Length — 51 ft, 9 in / 15.8m
- Tail Height — 19 ft, 6 in / 5.94m
- Temperature operating range — -40°F (-40°C) to +125°F (+51.7°C)
- Engines — 2 Pratt & Whitney PT6A-27
- Propeller — 3-blade constant speed propeller (fully feathering and fully reversing)
- Fuel tanks & capacity — 2 fuel tanks with 99% of useable fuel

Tank location	**Gallons**	**Liters**	**Pounds / kg (Jet A or A1)**
Forward tank	181	685	1.086 lbs 493 kg
Rear tank	197	746	1.182 lbs 536 kg
Left wing tank	37	140	222 lbs 101 kg
Right wing tank	37	140	222 lbs 101 kg

Find your way through the cockpit

The following sections explain available view presets, available click-spots and help identifying and finding the instruments on the different panels.

View presets

Presets are pre-defined views which can be selected by hot keys. The following table shows the available presets and their respective hot keys:

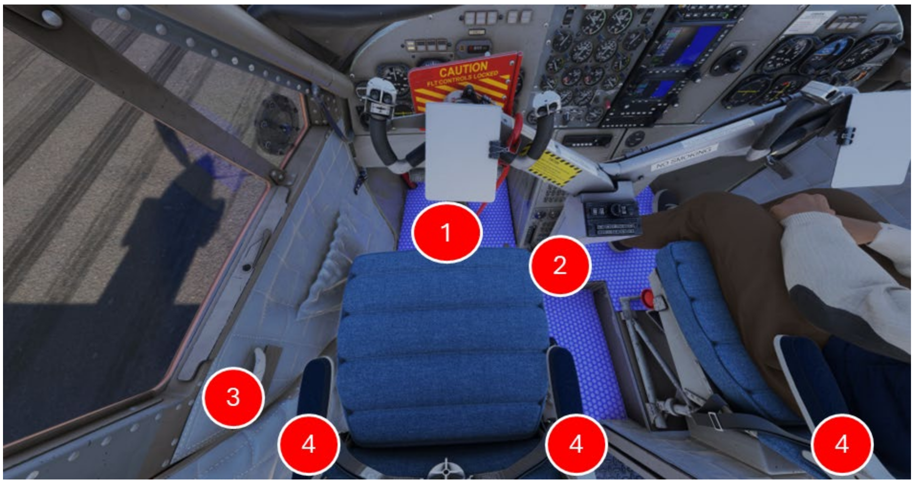
Hot key	Title	Preview
Shift + space	Resets view to cockpit view	
Shift + 1	Main Instrument panel	
Shift + 2	Pedestal	
Shift + 3	Overhead Panel	

Shift + 4	Flaps and throttle controls	
Shift + 5	Start panel	
Shift + 6	Windshield control panel	
Shift + 7	Pedestal & wing fuel tank controls	
Shift + 8	Arm rest – autopilot controls	

Shift + 9	Cabin – main door	

Click spots

Several click spots allow you to open and close doors as well as latches or toggle the visibility of certain components. There are four click spots in the cockpit:



No.	Description	Remark
1	Control lock	Hides and shows the control lock, which locks flight controls and needs to be removed in order to move the steering column
2	Yoke	Hides and shows the captain's and copilot's yoke
3	Cockpit door	Clicking on the door handle opens and closes the cockpit door. The same applies for the door on the copilot's side.
4	Armrests	Toggles either armrest of the pilot's and copilot's seat

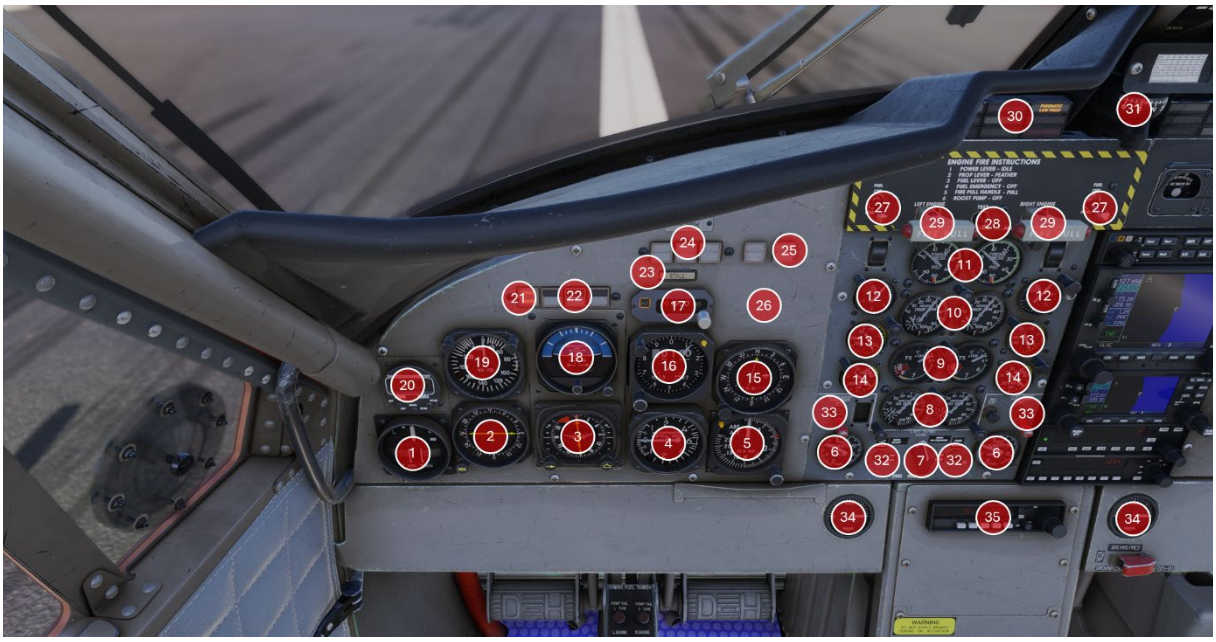
The cabin offers two click spots to open and close the doors.

No.	Description	Remark
5	Service door	Clicking on the handle opens and closes the service door
6	Passenger door	Clicking on the handle opens and closes the passenger door

Cockpit instrumentation

This section introduces where to find which panel and instrument in the Twin Otter's cockpit.

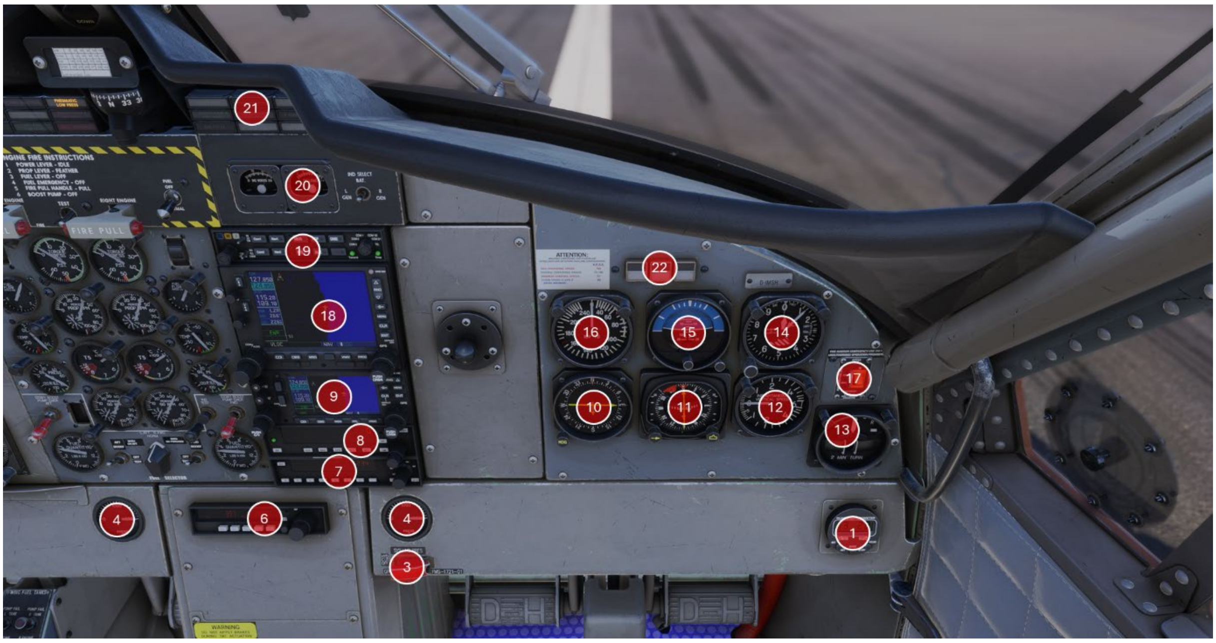
Pilots panel



No.	Instrument	Abb.	Description
1	Turn and slip indicator		
2	Automatic Direction Finder	ADF	Indicator for ADF / NDB stations
3	Horizontal Situation Indicator	HSI	
4	Vertical Speed Indicator (VSI)	VSI	
5	Radar altimeter	RA	Shows altitude above ground, measured by radar in ft (0-2.500 ft)
6	Fuel quantity indicator		Indicates fuel quantity in main tanks Check indicators on pedestal for wing tanks
7	Fuel selector		Allows selection from which tank fuel is supplied to the engines
8	Gas generator tachometer	N_G	
9	Propeller tachometer	N_P	
10	Turbine temperature indicator	T_5	
11	Torque pressure indicator		Indicates torque pressure in PSI
12	Fuel flow indicator		
13	Oil pressure indicator		
14	Oil temperature indicator		
15	Course deviation indicator for VOR 2	CDI	Indicates the deviation of a selected course to / from the station tuned on VOR 2. Use the OBS knob to tune the selected course
16	Altimeter	ALT	
17	Altitude selector		
18	Attitude Director Indicator	ADI	
19	Airspeed Indicator	ASI	
20	Chronometer		

21	GPWS warning light and inhibit pushbutton		
22	MDA, GO-AROUND and ALT ALERT warning lights		
23	STALL warning light		
24	G/S arm, NAV arm, G/S capt and NAV Capt indicator lights		
25	Autofeather select pushbutton and indicator light		
26	Autopilot mode selector panel		
27	Fuel cutoff switch		
28	Fire detection test switch		
29	Fire handles		
30	Caution and warning panel		
31	Standby compass		
32	Boost pump selector switches		
33	Standby boost pump emergency aft and forward		
34	Hydraulic pressure indicator		
35	Automatic Direction Finder	ADF	Panel to tune ADF / NDB stations

Copilots panel

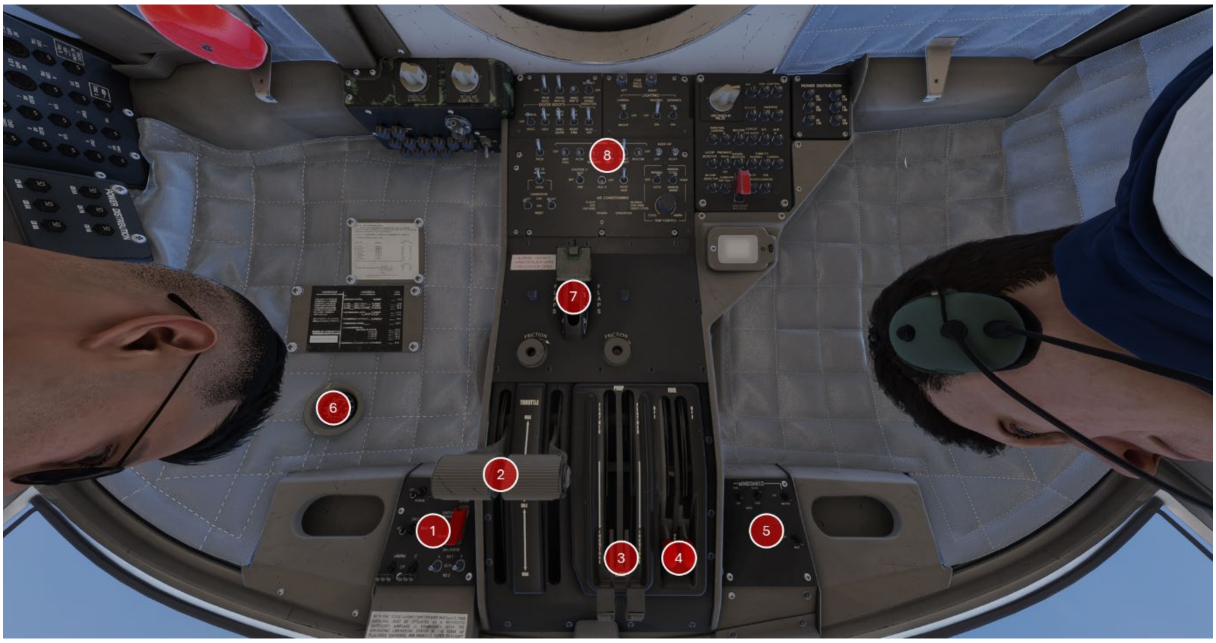


No.	Instrument	Abb.	Description
1	Chronometer		
2			*Currently not assigned*
3	Hydraulic shutoff switch		
4	Hydraulic pressure indicators		
5			*Currently not assigned*
6	Automatic Direction Finder	ADF	Panel to tune ADF / NDB stations
7	Transponder		
8	Autopilot		
9	GPS unit #2		
10	Radio Magnetic Indicator		
11	Horizontal Situation Indicator	HSI	
12	Vertical speed indicator	VSI	
13	Turn and slip indicator		
14	Altimeter		
15	Attitude Director indicator	ADI	
16	Airspeed indicator	ASI	
17	Emergency Locator Transmitter	ELT	Not simulated
18	GPS unit #1		
19	Audio selector panel		
20	Voltmeters and selector		Shows electric load and current on selected source: either left or right generator or battery
21	Caution and warning panel		

Center pedestal

No.	Instrument	Abb.	Description
1	Ram air switch		
2	Parking brake		
3	Hydraulic pressure indicator		
4	Automatic Direction Finder	ADF	
5			*Currently not assigned*
6	Fuel crossfeed		
7	Ventilation fan switch		
8	Static air source selector		
9	Wing fuel tank pump switches		

Overhead panel



No.	Instrument	Abb.	Description
1	Start panel		
2	Throttle levers		
3	Propeller levers		
4	Engine fuel levers		
5	Windshield control panel		
6	Outside air temperature gauge	OAT	
7	Flap selector lever		
8	Overhead panel		Exterior and interior lighting and anti-ice controls

Start Panel

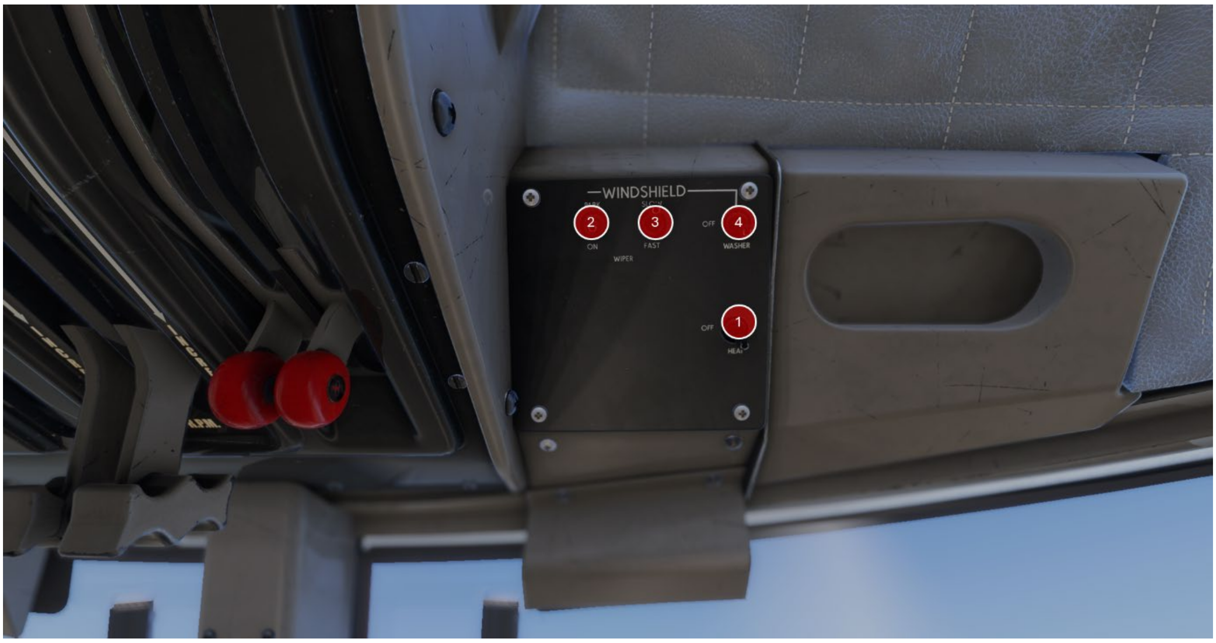
No.	Instrument	Abb.	Description
1	Battery switch		
2	DC Master switch		
3	Engine start switch		
4	Ignition switch		
5	Landing light switches		
6	Engine ignition switches		

Overhead Panel

No.	Instrument	Abb.	Description
1	Generator switches		
2	Bus tie		
3	Caution lights test		
4	Taxi lights		
5	Pitot heat		
6	Temperature control mode selector		Three-position switch to control heating: AUTO – temperature is regulated according temperature selector knob below the switch OFF – heating / cooling is switched off MANUAL – heating / cooling is selected according the manual control switch
7	Manual control switch		Manually controls heating or cooling of aircraft by controlling the position of the hot air valve and controlling the temperature of air streaming into the cabin MANUAL COOL – hot air valve is moved to closed position as long as switch is held HOLD – hot air valve remains in position MANUAL WARM - hot air valve is moved to open position as long as switch is held
8			*Currently not assigned*
9			*Currently not assigned*
10	Bleed air switches		
11	Beacon light		
12	Flight compartment light		Not simulated
13	Fasten seat belt sign		
14	No smoking sign		

15	Position light switch		
16	Anti-collision light switch		Strobe lights
17	Deicer boots mode selector		See section on ice and rain protection
18	Deicer boots speed selector		See section on ice and rain protection
19	Wing deicer boots selector		See section on ice and rain protection
20	Stabilizer deicer boots selector		See section on ice and rain protection
21	Stabilizer anti ice		See section on ice and rain protection
22	Propeller anti-ice selector		See section on ice and rain protection
23	Intake anti-ice selector		See section on ice and rain protection
24	Wing inspection light		See section on ice and rain protection
25	Intake deflector controls		See section on ice and rain protection
26	Stabilizer deicing boots pressure indicator		
27	Brightness selector		Toggles between normal or dimmed mode of operation
28	Reading lights		
29	Entrance lights		

Windshield control panel



No.	Instrument	Abb.	Description
1	Windshield heating		Toggles windshield heating - see section on ice and rain protection
2	Wipers speed selector		See section on ice and rain protection
3	Wipers switch		Switches wipers on and off - see section on ice and rain protection
4	Window washer		Not simulated

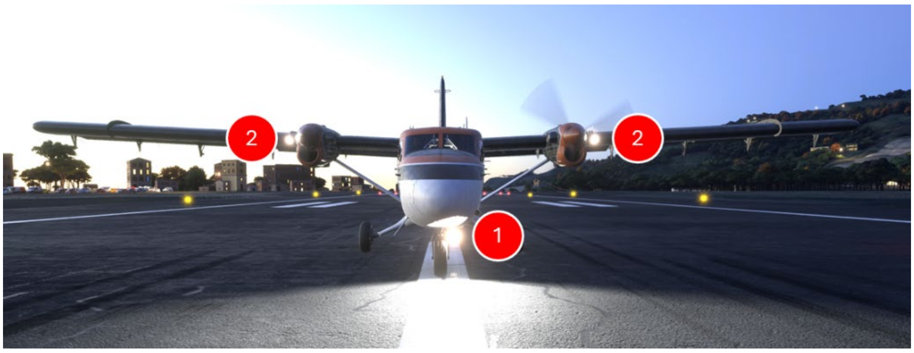
Twin Otter-specific systems

As most of the Twin Otters systems work like other turboprop or piston prop multi-engine aircraft, only the Twin Otter specific features are described in this manual.

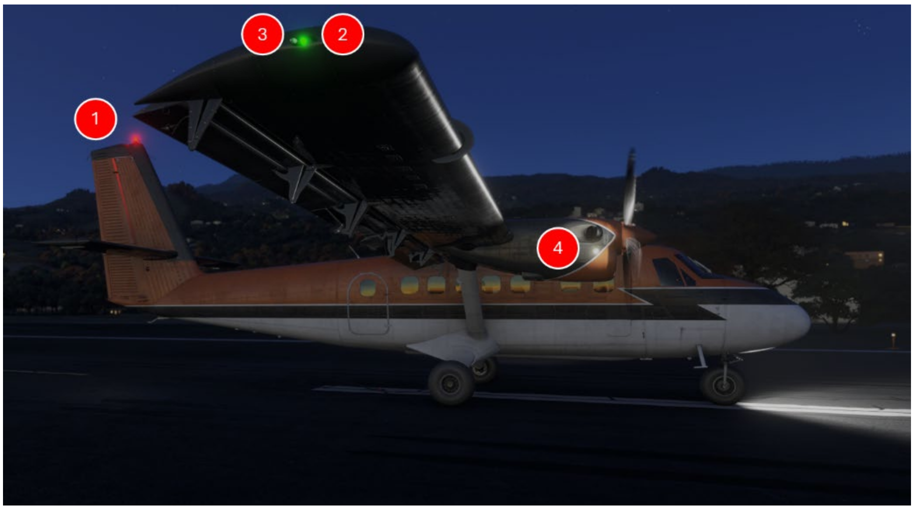
Lighting

Exterior lighting

The Twin Otter is equipped with several external and interior lights.



No.	Instrument	Abb.	Description
1	Taxi light		Used during taxi – switch is on overhead panel
2	Left & right landing light		Used during take-off and landing – switch is located on overhead panel left of throttle levers



No.	Instrument	Abb.	Description
1	Beacon light		Indicates that at least one engine is running, or the engines are about to be started. The switch is located on the overhead panel
2	Position light		Located on either wing tip – left light is red and right light is green. They help other crew to identify in which direction the aircraft is going. The switch is located on the overhead panel
3	Anticollision / Strobe light		Used during flight, takeoff, landing and crossing runways to enhance visibility of aircraft and other crew. Switched off on ground to prevent blinding other crews. The switch is located on the overhead panel
4	Wing inspection light		Located on either engine nacelle and used to inspect the wing's leading edges for ice accumulation and proper function of deicing boots. The switch is located on the overhead panel

Interior lighting

No.	Instrument	Abb.	Description
1	CO PLT RADIO & V/A PNL LTS		Dimmable light control for the instrument lights on the copilot's side and main center panel.
2	PLT ENG LTS		Dimmable light control for the instrument lights on the pilot's side and center overhead panel.
3	CONSOLE FLAP & TROM PNL LTS		Dimmable light control for the instrument lights overhead panel (flaps and trims)

Fuel system

The Twin Otter is equipped with two tanks located in the forward and aft fuselage below the cabin floor. The forward tank feeds the left engine, while the right engine is supplied from the aft tank. Two boost pumps are installed in either tank. They need to be switched on to provide fuel for the engines. The forward tank holds 181 US gallons, whereas the aft tank holds 197 US gallons. This equals 2.268 lbs (1.029 kg) of usable fuel. Furthermore, the Twin Otter is equipped with 2 wing tanks, each with a capacity of 37 US gallons, which equals 222 lbs (101 kg).

Each main tank has a low-level warning, when fuel level falls below 75 lbs in the forward tank and below 110 lbs of usable fuel in the aft tank. In case the warning is triggered, the FWD FUEL LOW LEVEL or AFT FUEL LOW LEVEL warning light on the caution panel illuminates.

Pushbuttons next to the fuel tank selector provide a test function for the fuel indicators, labelled IND TEST. When pressed the fuel indicator needles should fall to zero and reset to the previous indication as soon as the pushbutton is released.

The fuel tank selector controls from which tank fuel is supplied to the engines and which boost pumps are energized.

	Fuel supplied from	**Crossfeed valve position**	**Forward tank**		**Aft tank**	
			No. 1 boost pump	**No. 2 boost pump**	**No. 1 boost pump**	**No. 2 boost pump**
BOTH ON FWD	Fwd tank	open	energized	energized	Inoperative	Inoperative
NORM	Fwd & aft tank	closed	energized	Inoperative	energized	Inoperative
BOTH ON AFT	Aft tank	open	Inoperative	Inoperative	energized	energized

The forward and aft no. 1 boost pumps can be controlled by two boost pump switches (labelled AFT BOOST and FWD BOOST pump) though. Each switch for either engine offers three positions

(not labelled) The upper position is not labelled and marks the ON position. Standard position through all phases of flight

OFF Deactivates the respective no. 1 boost pump switch

TEST spring-loaded – actives test mode (not simulated)

The no. 2 boost pump is automatically activated in case a failure of the no. 1 pump is detected.

The no. 2 boost pump of the forward and aft tank can be manually activated by moving the STBY BOOST PUMP EMER switch to the ON position. The STBY BOOST PUMP EMER switches controlling the forward and aft no. 2 boost pumps are located left and right next to the fuel tank selector.

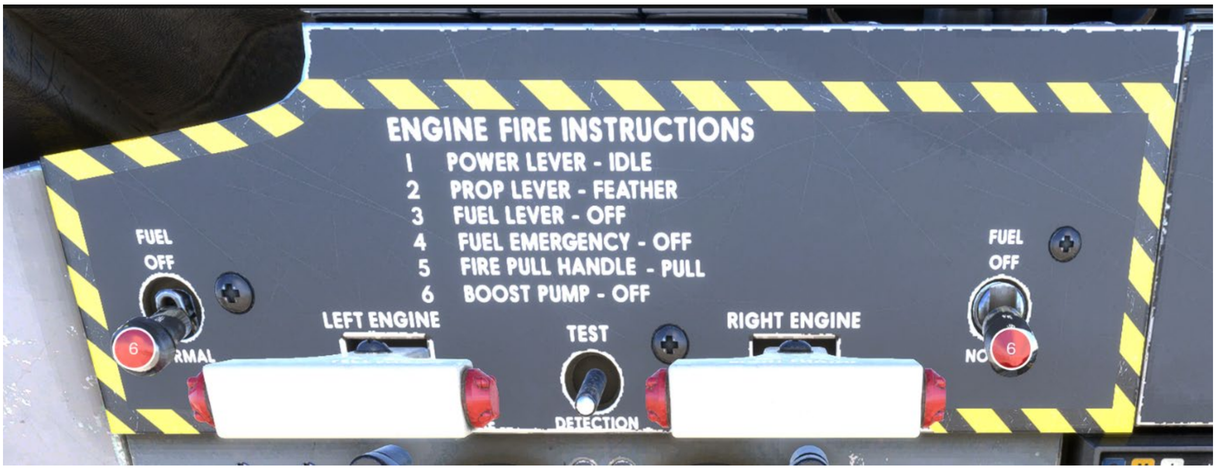
In case of emergency two fuel shut-off switches, located on the fire emergency panel, can be used to cut fuel supply to the respective engine. Each cut-off switch has two positions:

OFF fuel supply is cut off

NORMAL regular fuel supply

Main fuel tank controls

No.	Instrument
1	Fuel tank selector
2	Forward and aft boost pump switches
3	Forward and aft standby boost pump switches
4	Indicator test switch
5	Fuel quantity indicators



No.	Instrument
6	Left and right fuel shut-off switches

Wing fuel tanks

This version of the Twin Otter is equipped with two wing tanks located in the forward portion of each wing, just inboard of each wing tip. Either tank holds 222 lbs (101 kg) of fuel.

The fuel tanks can either be filled during fueling on ground, or by refueling from the main tanks. This requires either power supply by a ground power unit, or a running engine. Refueling from the main tanks is possible during taxi, but only allowed during taxi after landing and prohibited during taxi to takeoff.

Of course fuel can be supplied to either engine from the respective wing tank as well.

Each tank is equipped with a fuel pump which either pumps fuel from the main tank into the wing tank, or pumps fuel to the engine, depending on the switch position:

REFUEL	The tank is refueled from the main tank. With the fuel selector in NORM position the left wing tank is supplied by the rear main tank. The right wing tank is supplied by the forward main tank. The main (fuselage) boost pump switches need to be turned on to refuel the wing tanks from the main tanks.
L/R ENGINE	The left engine is supplied from the left wing tank. The right engine is supplied from the right wing tank
OFF (middle position)	The wing tank fuel system is de-energized and not active.

The quantity indicators for each wing tank are located on the center pedestal. They offer a graduated scale marked E, ¼, ½, ¾, and F.

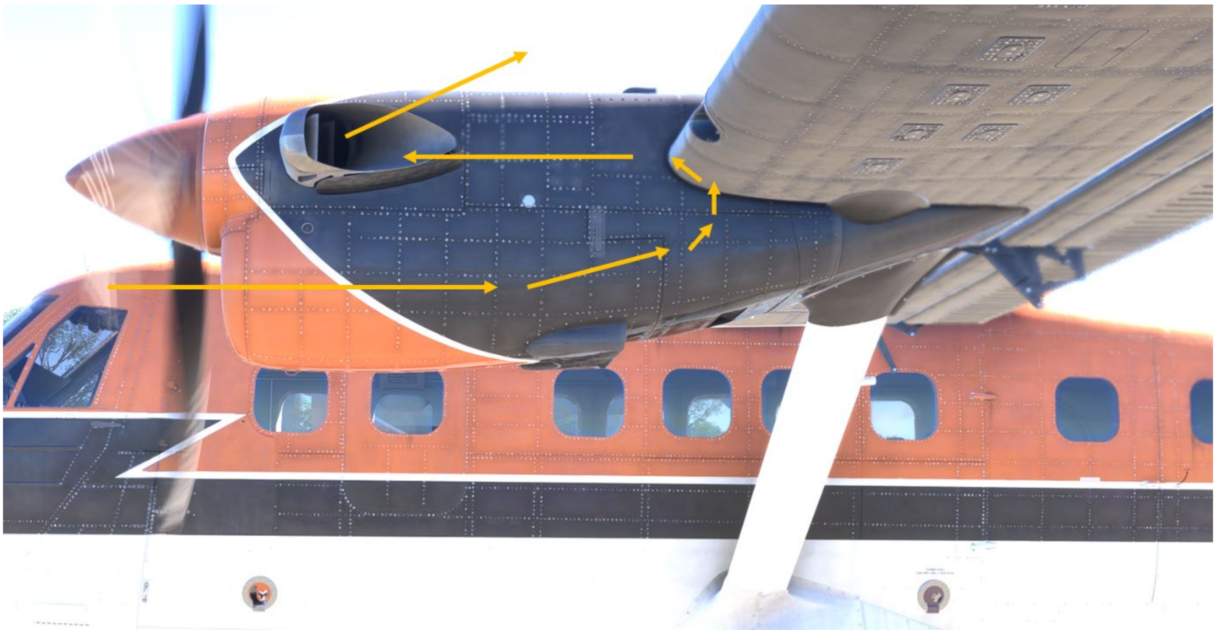
When flying with the ski version of the Twin Otter and you plan landing on snow / ice the wing tanks must be less than half full before landing.

Because there is only one fuel pump, fuel from the wing tanks needs to be consumed prior to the point of no return if completion of the flight is dependent on using the fuel in the wing tanks.

Engines & autofeather system

The PT6A-27-engine is a turboprop engine. A turboprop engine / propulsion system comprises a propeller, compressor, combustion chamber, turbine and exhaust. In comparison to a turbofan or turbojet engine, propulsion is provided by the propeller and not thrust from the engine.
Basically the engine has two stages – the first stage is the core engine. The compressor and parts of the turbine are mounted on one shaft. The other part of the turbine is mounted on a second shaft, on which the propeller is mounted.
Air enters the core engine through the compressor. It then proceeds through the combustion chamber where fuel is injected and ignited. The subsequent expansion drives the turbine and propeller.
The two primary shafts are not mechanically interconnected; hence this type of engine is called a free-flow turboprop.
Another special feature of the Twin Otter is that the engine is mounted 'backwards', meaning that the airflow intake is at the rear end of the engine nacelle. This makes the construction of the engine easier as the propeller and turbine are located closer to each other.

Inertial separators in the intake section prevent dust, dirt, debris or ice from being sucked into the engine. The inertial separator is controlled by a switch in the cockpit. Nevertheless, only movement of the deflector is modelled in this version of the Twin Otter. Further effects are not simulated.



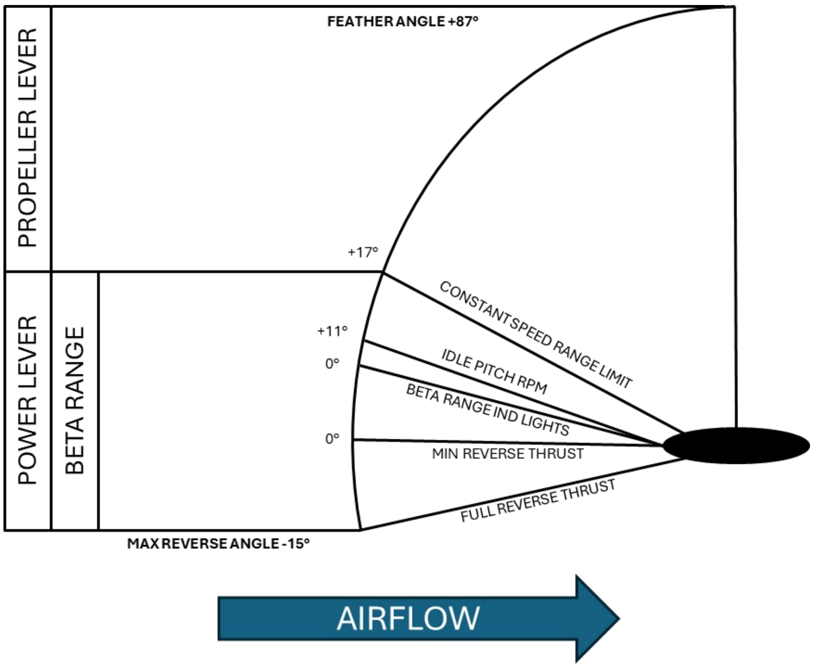
Three controls are available to control the engine:

- ***Throttle lever***
  Adjusts the torque setting, including beta and reverse thrust
- ***Propeller lever***
  Adjusts the pitch of the propeller blades
- ***Fuel control***
  Activates / shuts off fuel flow to the engine

A turboprop engine's thrust is basically controlled by two parameters: the propeller blade's pitch and the selected torque setting. The throttle lever controls fuel flow and the selected torque accordingly. Full forward is maximum thrust but with turboprop engines you need to be careful and watch not to exceed maximum torque or maximum turbine temperature (Called T_5 in the Twin Otter). Operating the engine beyond limitations may lead to failure.

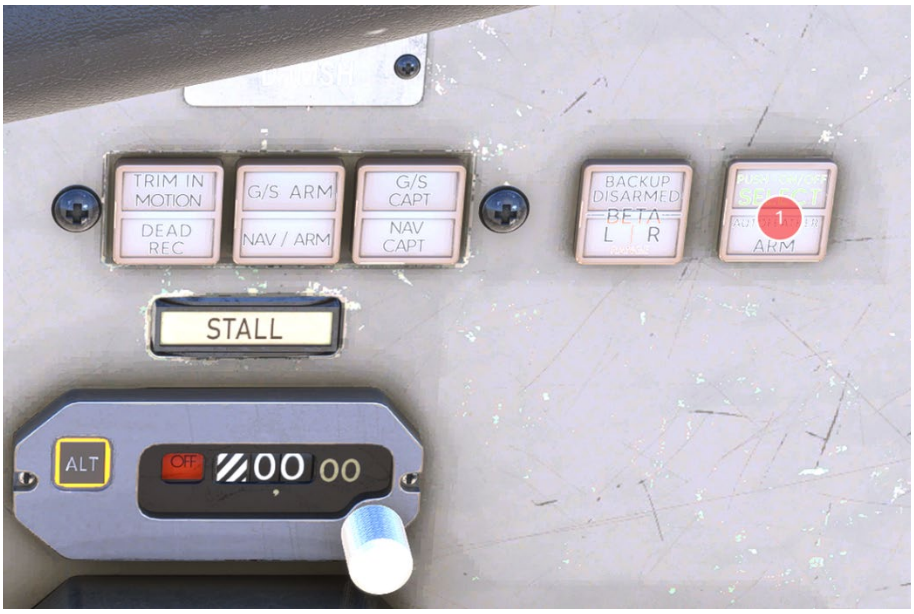
Propeller pitch is mainly controlled by propeller levers. The full forward position equals the lowest propeller blade pitch angle. This setting is used during takeoff and landing. By pulling the lever back, the propeller blade pitch angle increases, and the propeller takes a larger 'slice' of air. Simultaneously the torque, and T_5 temperature are going to rise and to keep the engine you maybe need to reduce thrust when reducing propeller pitch. That is why you always adjust propeller pitch first and thrust afterwards.

Be careful not to reduce thrust (throttle levers) below idle in flight. Below idle beta range starts, where the engine starts to create backward thrust. By pulling the power levers full back, reverse thrust increases until it reaches the maximum at full reverse thrust, which is only used on very short runways.



Condition	Thrust lever	Prop lever	Remark
Reverse	Full reverse	Full forward	Engine generating maximum reverse thrust
Beta range	Below idle and full reverse	Full forward	
Flight idle	Idle	Full forward	Least possible forward thrust
Cruise	See performance tables		Optimized setting for cruise
Full power	Full forward	Full forward	
Feather	Doesn't matter	Full reverse	None – only used for emergencies to reduce drag produced by 'dead' engine

Feathering the engine is important for engine failures. In case the engine has a malfunction and does not produce thrust anymore, the propeller would start to create drag. To minimize drag, the propellers are 'feathered' and aligned as much as possible with the airflow. Hence, they are set to the maximum pitch angle possible. To reduce load on the pilot during an engine failure, the autofeather system assists during takeoff and climb out (and when activated) by automatically setting the propeller of the affected engine to 'feather' as soon as a failure is detected.



No.	Instrument
1	Autofeather selector pushbutton

Pneumatic and bleed system

The Twin Otter is equipped with a bleed air and pneumatic system. Bleed air is drawn directly from each engine and is used for heating the cabin but also to supply the anti-ice-systems. The air supplied in the cockpit and cabin runs through a heat exchanger and mixes with outside air to achieve the selected temperature.

The bleed air shut-off valve is operated by two switches on the overhead panel which open and shut off the bleed air on the left and right side.
The PNEUMATIC LOW PRESSURE light comes on, as soon as the bleed system does not provide sufficient pressure to run the heating and de-icing-systems.

No.	Instrument
1	Left and right bleed switch
2	PNEUMATIC LOW PRESSURE warning light

Ice and rain protection

Icing conditions are to be expected as soon as the air temperature is 5°C or lower and visible moisture like clouds, fog, rain, or snow are present.

The Twin Otter is operated in nearly every corner of the world, including some of the coldest parts of the globe like Antarctica. The Twin Otter needs to be able to provide reliable service in icing conditions as well and is equipped with the respective anti-icing equipment accordingly.

These comprise:

- Wipers
- Windshield heating
- Propeller heating
- Intake anti-ice
- Intake deflectors
- De-icing boots
  - Wing
  - Stabilizer

Wipers

On either cockpit side a wiper is installed. Both are controlled by two wiper switches located on the windshield switch panel and the right of the overhead panel. The left switch offers three positions:

PARK returns the wipers to the 'parking position'

OFF switches the wipers

ON activates the wipers

The right switch controls wiper speed and offers a FAST and SLOW mode.
SLOW mode must not be used longer than 2 minutes to prevent damage to the wiper motor.
The wipers are not supposed to be used at speeds over 100 KIAS as the motor then has difficulty to return the wipers to the center position due to airflow.

Windshield heating

The Twin Otter offers glass windshields with integrated heating elements and temperature sensors to prevent overheating. It is controlled by a two-position switch on the right windshield panel next to the overhead panel. Windshield heat can only be switched on (HEAT position), or off (OFF position).

Propeller anti-ice

Each propeller blade is equipped with a de-icing boot at its root. Either propeller's oil pressure switch ensures that propeller de-icing is only activated for a running engine. It is operated by a two-position switch PROP DE-ICE on the overhead panel.

Intake anti-ice

Engine intake anti-ice is required for flight in known icing conditions in the United Kingdom. It contains electric heater elements in the engine nacelle air intake and is controlled by the INTAKE ANTI ICE switch on the overhead panel.

Intake deflectors

The intake deflectors prevent ice and snow from being sucked into the engine. The intake deflectors need to be extended manually by moving the intake deflector switches to the EXT position. Position indicators next to the respective torque gauges indicate if the deflector is extended by an EXT inscription. To return the intake deflectors to their original position, they need to be retracted by moving the switch to the RETRACT position.

In flight simulator the deflector panels as well as the position indicators are modelled and visible but have no effect on icing.

De-icing boots

De-icing boots are installed on the wings and stabilizers leading edges. When activated they are fed with hot air from the bleed system and inflate and deflate according to the selected interval.

The interval can be set automatically or manually. In AUTOMATIC mode the pilot can choose between fast and slow mode depending on the icing conditions:

FAST	**1 minute** ***Inflation time***: 5 seconds for outer and inner wings, 3 seconds for stabilizer ***Dwell time***: 44 seconds
SLOW	**3 minutes** ***Inflation time***: 5 seconds for outer and inner wings, 3 seconds for stabilizer ***Dwell time***: 164 seconds

In manual mode the pilot needs to control the interval themselves by selecting the respective boots between WING INNER and WING OUTER and LEFT STAB and RIGHT STAB.

The tailplane de-icing boot indicator lights (STAB DEICE) indicate pressure distribution to each tailplane de-icer boot. Furthermore, they offer a test-mode by pressing the respective light.

Radios, Transponder, GPS and Autopilot

The Twin Otter is equipped with several communication and navigation systems:

- 2 VHF radios for communication
- 2 VOR radios for radio navigation
- 1 ADF / NDB for radio navigation
- 2 GPS for GPS / RNAV navigation
- 1 Transponder for identification by ATC
- 1 Autopilot to reduce workload during the flight

The Twin Otter is equipped with 2 GPS units – a GNS 530 and a GNS 430. Among other functions, the GPS units are used to control the tuned frequencies for VOR 1 and 2 as well as COM 1 and 2 radio. VOR 1 and COM 1 are tuned by the GNS 530, while VOR 2 and COM 2 are tuned by the GNS 430.

No.	Instrument
1	Swaps the active and standby COM 1 radio frequency
2	Indication of active (upper) and standby (lower) COM 1 radio frequency
3	Swaps the active and standby NAV 1 radio frequency
4	Indication of active (upper) and standby (lower) NAV 1 radio frequency
5	Selector knob – the outer ring tunes the selected frequency, while the inner ring tunes the decimals of the frequency. Click with the right mouse button to switch between COM 1 and NAV 1.

No.	Instrument
1	Swaps the active and standby COM 2 radio frequency
2	Indication of active (upper) and standby (lower) COM 2 radio frequency
3	Swaps the active and standby NAV 2 radio frequency
4	Indication of active (upper) and standby (lower) NAV 2 radio frequency

5	Selector knob – the outer ring tunes the selected frequency, while the inner ring tunes the decimals of the frequency. Click with the right mouse button to switch between COM 2 and NAV 2.

The Twin Otter can receive signals sent by Non-directional Beacons (NDBs). The aircraft uses the Automatic Direction Finder (ADF) to indicate the NDB's position relative to the aircraft by pointing a needle into the direction of the NDB. There is no distance information and the closer you get to the station, the more sensitive the pointer is going to be.

No.	Instrument
1	Activates ADF mode
2	Activates BFQ mode (not simulated)
3	Swaps the active and the standby frequency
4	Displays the flight timer or the elapsed timer (second press)
5	Sets and resets the elapsed timer
6	Tuning knob – outer ring tunes the first two digits, the inner knob tunes the third or the fourth digit (right mouse button click swaps between third and fourth digit)
7	Indication of active NDB frequency
8	Indication of standby NDB frequency or flight timer and elapsed timer: 

When a NDB station is tuned, and a signal is received the stations position is indicated by a pointer on the ADF unit. The pointer indicated the position of the station relative to the aircraft.

In the shown picture the tuned NDB is positioned at the three o'clock position of the aircraft. Remember that NDB's don't offer information on the distance to the station.

The transponder is needed so that ATC can identify your aircraft amongst all the other radar signals. Accordingly, a transponder code (squawk) is issued by ATC which needs to be tuned into the transponder. Depending on the selected mode, the transponder can be switched off or send the squawk signal with or without altitude information (ON and ALT mode). On ground after leaving the runway the transponder is set to standby.

No.	Instrument
1	Mode selector
2	Pushing the VFR button automatically tunes the transponder to squawk 1200 (used for VFR flying when no specific squawk is assigned)
3	Pushing CLR resets the transponder code to 0000
4	Numbers for tuning the transponder code
5	Pressing the button sends a ident signal (not needed in flightsimulator)
6	Indication of transmitted altitude
7	Indication of tuned transponder code / squawk

The autopilot helps to reduce the crew's workload. It offers several lateral and vertical modes:

HDG in heading mode the autopilot follows the heading selected on the horizontal situation indicator (HSI)

NAV in NAV mode the autopilot follows the selected CDI signal of the GNS 530. This may either be a VOR station tuned on NAV 1 or the GPS flight plan

APR approach mode follows an ILS signal and follows the glideslope as well as the localizer. Bear in mind that this is not Autoland mode, and the Twin Otter offers no throttle / speed control by the autopilot

REV used when flying a backcourse approach

ALT holds altitude – press a second time to activate vertical speed (V/S) mode.

V/S (ARM) the aircraft follows the vertical speed selected by the DN and UP button. When an altitude is preselected and vertical speed mode is activated, the autopilot automatically levels off, when the altitude is reached.
Bear in mind to monitor the speed and throttle setting during climb.

No.	Instrument
1	Autopilot master switch – activates and deactivates the autopilot
2	Mode selector switches
3	UP / DN buttons – used to select vertical speed, when in vertical speed (V/S) mode
4	Altitude selector knob – allows to preselect an altitude which is captured by the autopilot, when vertical speed mode is selected
5	Indication of the selected altitude and the vertical speed, when DN or UP button is pressed and V/S mode is active
6	Used to active the vertical speed mode – when in ALT mode and a new altitude is selected, V/S mode is activated, when ARM is pressed
7	Allows to select the barometric setting

Amphibian version differences

The amphibian version of the Twin Otter is equipped with floats and wheels, so it can land on terrestrial surfaces or water. There is no maximum ramp weight for the amphibian version, so weight is limited to 12.500 lbs maximum under all circumstances. Due to the floats, the center of gravity is limited to a range of 25 to 32% MAC (mean aerodynamic chord).

To lower and raise the wheels, a gear lever needs to be installed obviously. It is located between the copilots panel and GPS units on the right-hand side of the center panel.
It offers a gear lever to raise and lower the gear and 4 green as well as 4 blue lights to indicate the position of each wheel (blue lights = wheel raised, green lights = wheel lowered).

	Lever position	**Outside view of gear position**
Extended gear		
Retracted gear		

Even though the amphibian version flies substantially similarly to the wheeled landing gear version, certain aspects need to be considered during the different phases of flight.

Phase of flight	**Items**
Preflight inspection	• Check general condition of floats, rubber float bumpers, float spreader bars, struts, bracing wires, wing fences and finlets • If on water: Check that the plane is moored to the dock
Taxiing	• If on water: use beta thrust for taxiing
Starting Engines	• Caution: the floatplane must be securely moored to the dock before starting the engines
After Start (Pre taxi)	• While the aircraft is still moored to the dock and before releasing the mooring ropes: check engines are working properly, and the propellers operate correctly in forward and reverse thrust ranges
Taxi checks	• If on water: cast off and proceed to take-off position at a appropriate speed for water conditions. Steer by using differential thrust. The aircraft has a weathercocking characteristic, when headed downwind. Especially when maneuvering close to the dock counteract immediately by applying large amounts of reverse thrust on the appropriate engine. Watch the oil temperature as beta range operation causes a lack of airflow to the oil cooler. • Watch for floating and partially submerged objects • Flap settings of up to 20° may be used during taxiing • At take-off position, turn the aircraft into wind
Take-off	• Floatplane take-off elevator trim tab setting is approximately one indicator pointer width forward compared to the landplane • Flaps - set for take-off (20°) • During initial take-off run the nose of the airplane will rise without any pilot action. Prior to becoming airborne, the nose tends to drop. Now the control wheel should be held aft until the airplane is airborne. Allow aircraft to become airborne, not below V_{MC} 65 KIAS • for crosswind take-offs use differential power settings during initial take-off run. As soon as rudder becomes more effective, use rudder and re-adjust thrust to take-off power
After take-off	• -
Before landing	• Before landing the landing, area should be carefully observed for surface craft, floating or partially submerged objects and the surface state of the water • Approach speed is 100 KIAS • Select approach flap (20°) and allow air speed to decrease to 80 KIAS • Advance prop levers to full increase immediately after flap extension
Landing	• Select landing flap (37.5°) when landing is assured. Adjust speed according to V_{REF}

	• Touch down with a nose-up attitude and power levers in idle. During rough water conditions, contact should be made with very low rates of descent (as low as possible) • Maintain direction using the rudder. As soon as the rudder becomes more ineffective use differential thrust
After landing	• The same applies for taxiing as during taxi for take-off • The airplane should be positioned against the dock with the appropriate thrust selected to hold the airplane stationary

Ski version differences

For specific limitations on the ski version see chapter limitations and section on ski version.

The skis are mounted to the gear and prevent the Twin Otter from sinking into the snow. The skis can be extended and retracted, to enable the ski version to be operated on usual runway surfaces as well as snow.

	Lever position	Outside view of ski position
Extended skis		
Retracted skis		

Please see the following table for specific items which need to be considered when working through the different checklists.

Phase of flight	Items
Preflight inspection	• Check that neither wheels nor skis are frozen to the ground. • With skis retracted, check that running surfaces of skis are free from ice
Taxiing	• Extending or retracting skis is only possible when the aircraft is stopped. Extension of skis must not take place on concrete, tarmac or any harsh surface likely to damage the skis • The airplane should be steered by nose-wheel-steering and asymmetric thrust
Take-off	• Take-off roll with skis may be longer compared to the wheels-version. Heavier than normal snow can create more friction, more backward pressure may be necessary to attain take-off attitude
After take-off	• The position of the skis has no influence on flight characteristics. Leave skis extended or retract skis depending on the expected conditions at arrival site
Before landing	• Prior to the approach, the pilot should decide whether to extend or retract the skis in accordance with landing conditions. Check desired position through confirmation by position indicators. • When landing on snow / ice the wing tanks must be less than half full before landing
Landing	• A normal landing approach should be made. In deep snow the wheel should be held back after touchdown to relieve nose ski load
After landing	• When the airplane is to be parked on snow or ice, it is advisable to stand the aircraft on boards to prevent skis from freezing to the ground. If possible, allow a cool-down-period to reduce icing from melted snow after landing and before taxiing and parking at final parking position

Aircraft Limitations

Airspeed limitations

Speed		**Comment**	**Knots**	
			CAS	**IAS**
Minimum control speed	V_{MC}	Flaps 10°	66	64
Best angle climb speed	V_X	Flaps 0°	89	87
Best rate climb speed	V_Y	Flaps 0°	103	100
Flaps extend speed	V_{FE}	Flaps 10°	105	103
		Flaps 10° to 37.5°	95	93
Maximum operating speed	V_{MO}	Sea level to 6.700 ft	170 floatplane: 160	166
		10.000ft	160	156
		15.000ft	145	141
		20.000ft	130	126
		25.000ft	115	112
Maneuvering speed	V_P	Sea Level to 18.000 ft	136	132
		Above 18.000 ft	Limited by V_{MO}	
Gust penetration speed	V_B	Sea Level to 18.000 ft	136	132
		Above 18.000 ft	Limited by V_{MO}	

Engine limitations

Power Setting	**Operating Limits**						
	SHP	**Torque [PSI]**	**T_5 [°C]**	**N_G [%]**	**N_P [%]**	**OIL PRESS [PSI]**	**OIL TEMP [°C]**
TAKEOFF AND MAXIMUM CONTINUOUS	620 to ISA +18°C	50	725	101.6	96	80 to 100	10 to 999
MAX CLIMB / MAX CRUISE	620 to ISA +6°C	50	695		96	80 to 100	0 to 999
IDLE			660			40 Min	-40 to 99
STARTING			1090 (2 sec)				-40 Min
ACCELERATION		68.7	825 (2 sec)	102.6	110		0 t 99
MAX REVERSE	620	50 (1 Min)	725	101.5	91 ± 1	80 to 100	0 to 99

Propeller limitations

Take-off setting	Max RPM	96% N_P
Maximum Continuous Power	Max RPM	96% N_P
Normal Climb Setting		between 75 and 96% N_P, as desired
Landing Setting	MAX RPM	96% N_P Propeller levers must be set to MAX RPM (96% N_P) position no later then 500 feet above ground level (visual approaches), or 500 feet above decision height / minimum descent altitude (instrument approaches).
Reverse		Maximum RPM 91% ± 1 N_P The limitation of 91% N_P in reverse prevents the propeller from entering the constant speed range, when reverse is selected. This is mechanically accomplished by the governor.

Electrical limitations

Each generator has the following limitations:

Loadmeter reading	Condition of flight	Minimum N_G	OAT	Reason for limitation
> 0.5	On ground	Idle N_G + 15%	Any	To keep T_5 below idle limit of 660°
Max 0.8	On ground		> 7°C	Generator cooling
Max 1.0	On ground		≤ 7°C	Generator capacity
Max 1.0	In flight		Any	Generator capacity

In case of single generator operation switch off, unnecessary electrical services in the following sequence, if possible:

Seq.	System	Examples
1	Anti-Ice	Windshield heat, propeller de-ice
2	External & cabin lighting	Entry lights
3	Air conditioning	Check mode switch is in FLIGHT position – this automatically provides load shedding of the air conditionier if one generator is offline

Starter limitations

Cross generator starting (starting one engine while the generator of the other, running, engine is on line and produces power) is prohibited except in an emergency.

Starter duty cycle limitations

25 seconds ON   1 minute OFF then
25 seconds ON   1 minute OFF then
25 seconds ON   followed by a 30-minute cooling period

Air operable door limitations

This limitation is valid for aircraft with an installed air operable door only, such as an aircraft for dropping parachutists.

- Cabin occupancy is limited to crew numbers essential for operation, and, if applicable, parachutists dropped during the flight.
- Maximum operating speed is 140 KIAS with air operable door open
- The air operable door must be closed for take-off and landing and single engine operation
- Size and bulk of packages to be dropped need to be ensured that jamming in the door frame or striking the aircraft structure is not possible,

Packages of up to 300 lbs (136 kg) or parachutists can be safely dropped in the following configuration:

Flaps 20°

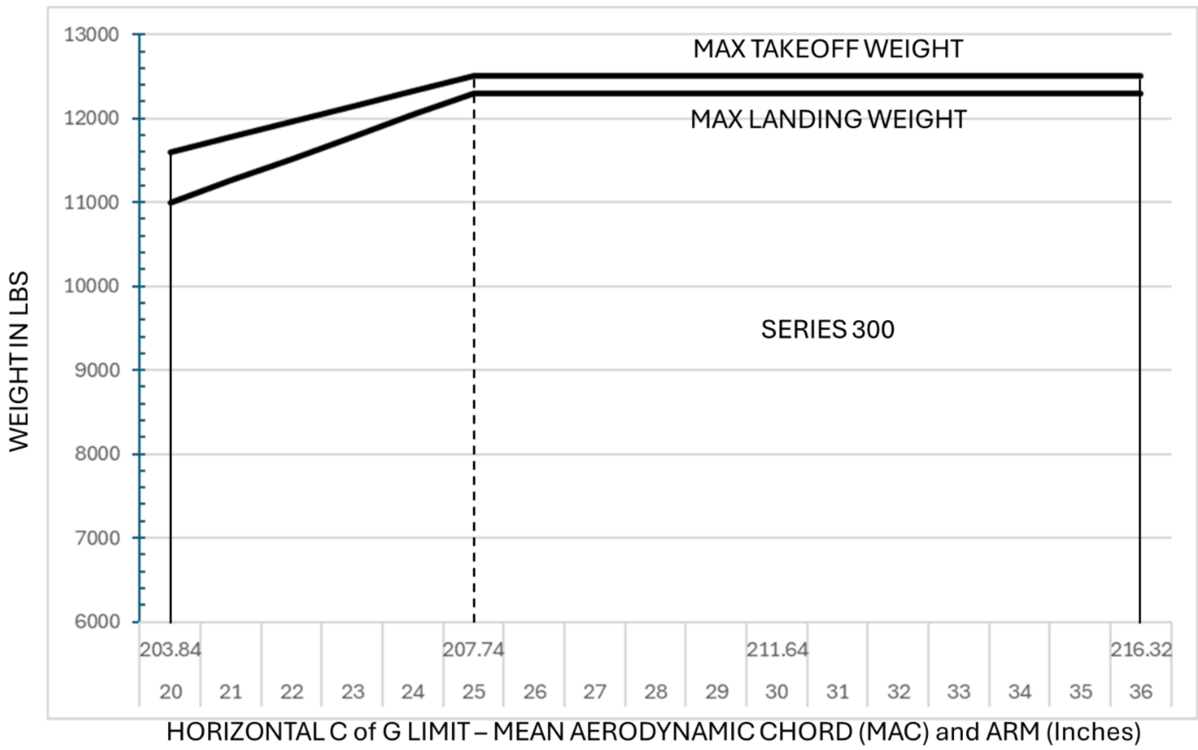
Speed 70 KIAS

Altitude limitations

Maximum operating altitude 25.000 ft

Service ceiling 24.380 ft
(both engines at max. climb power, weight 12.500 lbs, ISA conditions +15°C)

Weight and Center of gravity limitations



Flap system limitations

Approved take-off setting	Flaps 10°	
Approved landing settings	For normal operations: During flight in icing conditions:	flaps 20° to 37.5° flaps 10°
Enroute climb – both engines	Flaps 0°	
Enroute climb – single engine	Flaps 10°	

Flaps 20° is regarded as the normal landing setting. Flaps 37.5° is only selected if runway length and aircraft performance doesn't allow a flaps 20° landing.

All landing distances provided are based on flaps 37.5°. To obtain flaps 20° values, multiply the flaps 37.5% values by 1.3.

All landing distances provided are based on flaps 37.5°. To obtain flaps 10° values, multiply the flaps 37.5% values by 1.8.

Ice related limitations

While flying in icing conditions, flap extension must not exceed 10°.

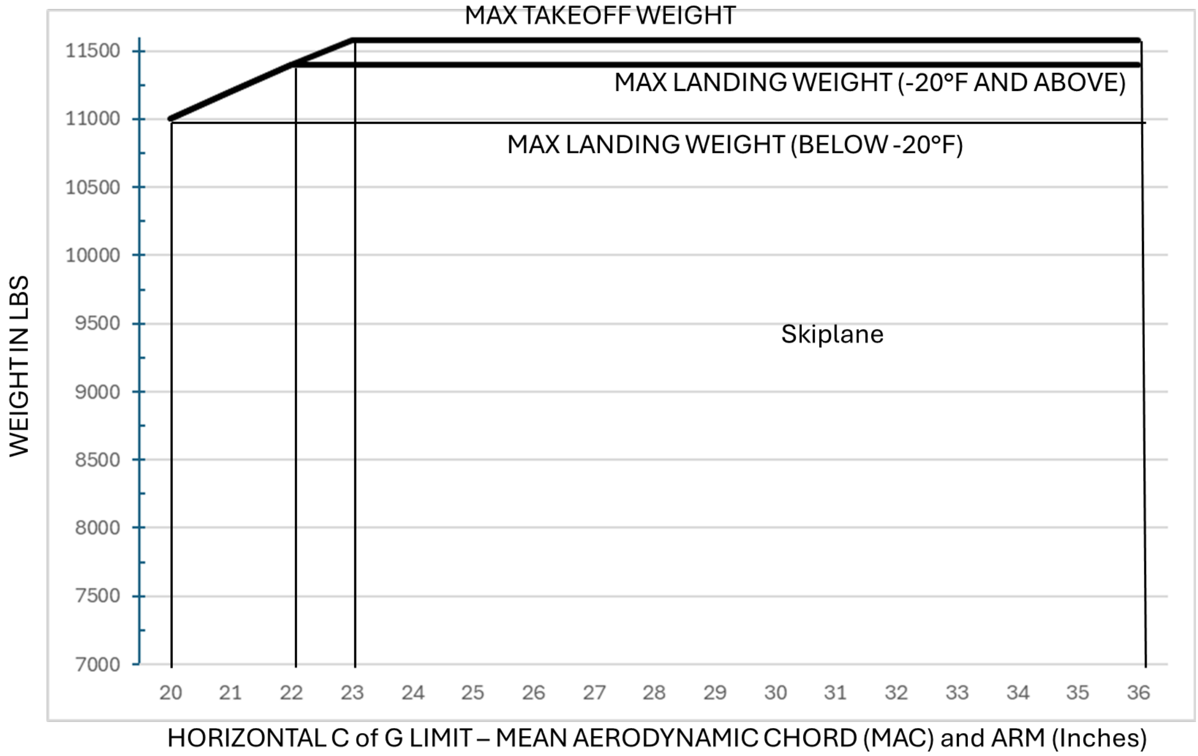
Engine intake deflectors must be extended during flight in icing conditions.

Ski-version limitations

In general, the same limitations apply for the ski-version as for the wheel-version. Nevertheless there are some differences regarding limitations for ski-versions which are listed here.

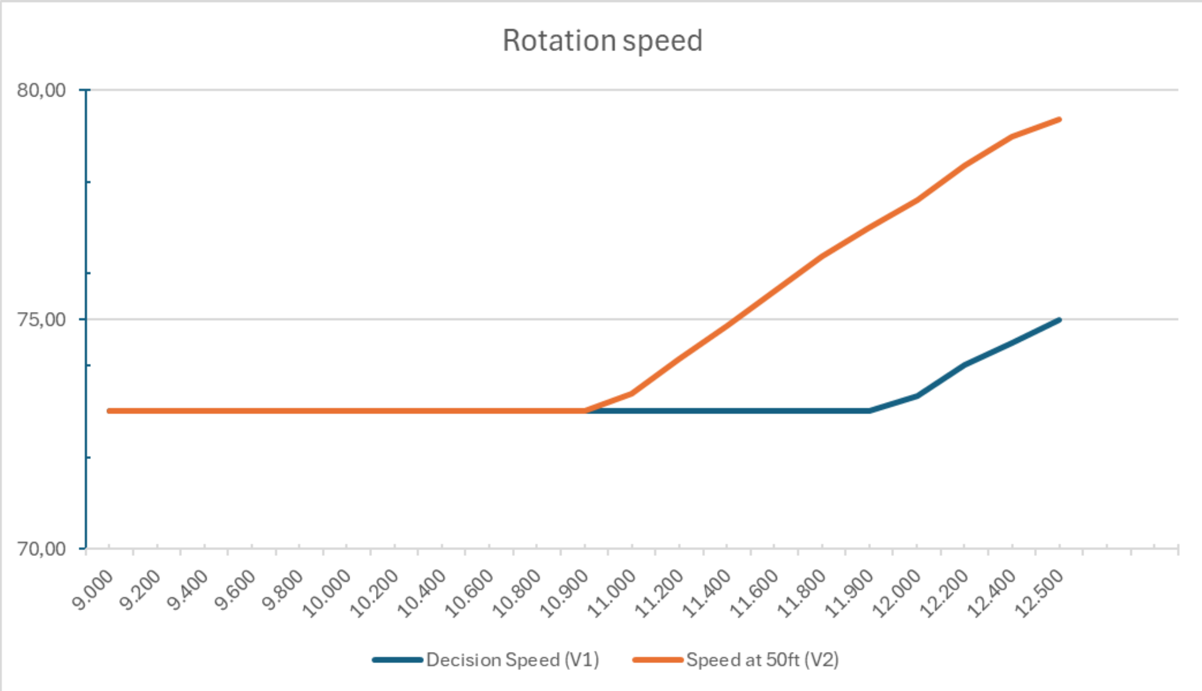
Never Exceed Speed	V_{NE}	**KNOTS**	
		CAS	**IAS**
	Sea level to 10.000 ft	183	178
	Above 10.000ft	Reduce V_{NE} by 4 knots per 1.000 ft increase in altitude	

The Skiplane has the following, different center of gravity limits



Aircraft performance tables

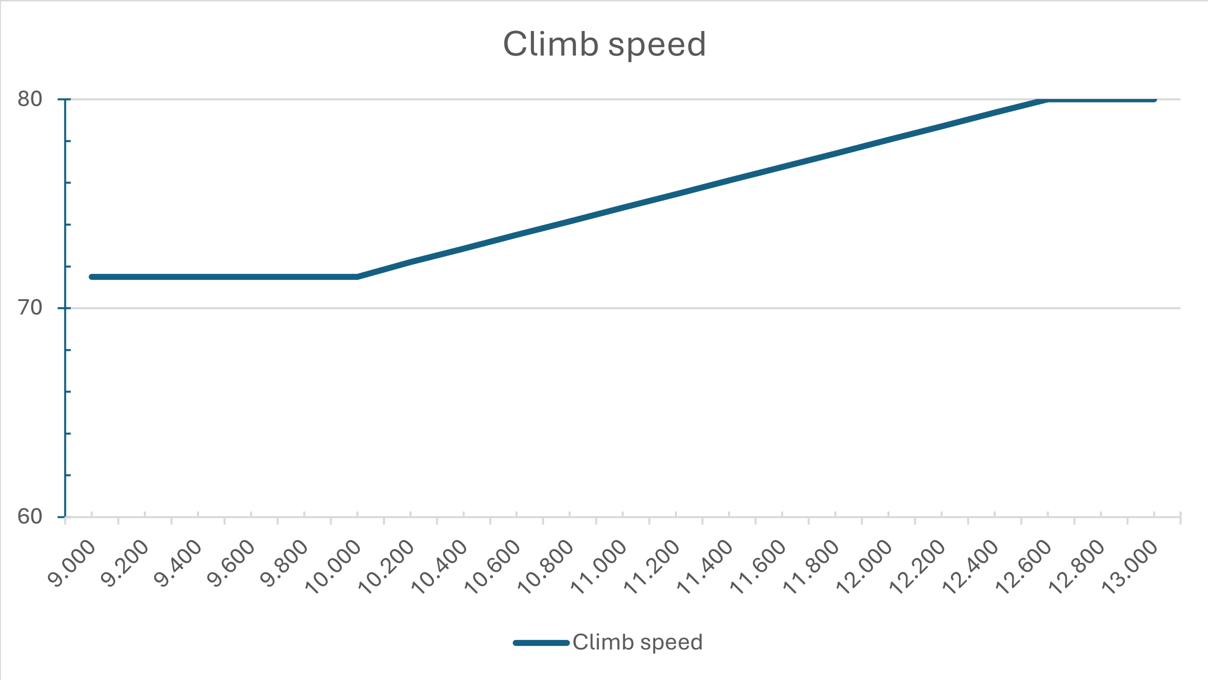
Rotation Speed



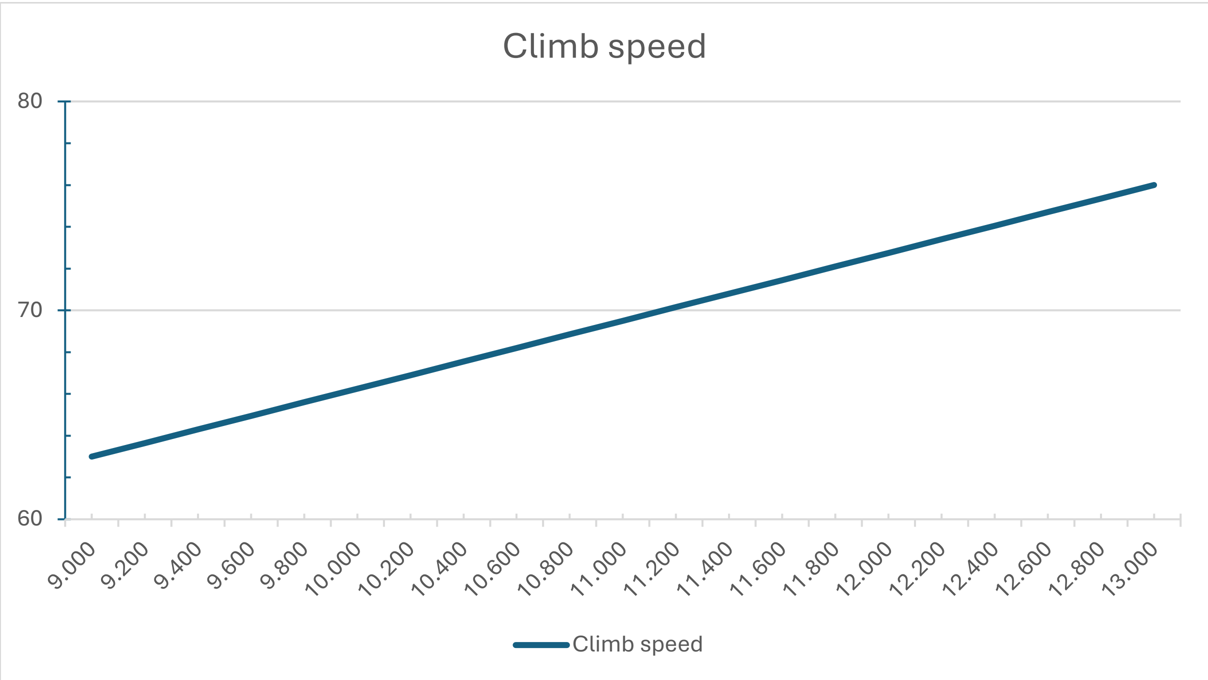
Climb speeds

Climb Speed both engines

Climb Speed single engine



Climb Speed balked landing



Cruise performance all-wheels variant

Max. Cruise power (91% N_P @ 2,000 RPM)

Press. Alt. [ft]	Torque per engine [PSI]	Fuel flow per engine [lbs/hr]	Total fuel flow [lbs/hr]	Airspeed [kts]
8.200 lbs / 3.720kg				
0	50	380	760	166
2.000	50	380	760	164
4.000	50	380	760	163
6.000	50	380	760	161
8.000	50	370	740	160
10.000	49	360	720	158
12.000	46	330	660	153
14.000	43	300	600	149
16.000	40	300	600	144
12.500 lbs / 5.670kg				
0	50	380	760	165
2.000	50	380	760	164
4.000	50	380	760	163
6.000	50	380	760	161
8.000	50	370	740	160
10.000	49	360	720	158
12.000	46	330	660	153
14.000	43	300	600	148
16.000	40	300	600	144

Normal Cruise power (75% NP @ 1.650 RPM)

Press. Alt. [ft]	Torque per engine [PSI]	Fuel flow per engine [lbs/hr]	Total fuel flow [lbs/hr]	Airspeed [kts]
8.200 lbs / 3.720kg				
0	50	350	700	157
2.000	50	340	680	155
4.000	50	330	660	153
6.000	50	320	640	151
8.000	50	320	640	150
10.000	50	320	640	149
12.000	50	320	640	147
14.000	50	320	640	145
16.000	48	320	640	140
12.500 lbs / 5.670kg				
0	50	340	680	156
2.000	50	340	680	155
4.000	50	330	660	153
6.000	50	330	660	151
8.000	50	330	660	150
10.000	50	320	640	148
12.000	50	320	640	147
14.000	50	320	640	145
16.000	47	320	640	140

Economy cruise power (75% NP @ 1.650 RPM)

Press. Alt. [ft]	Torque per engine [PSI]	Fuel flow per engine [lbs/hr]	Total fuel flow [lbs/hr]	Airspeed [kts]
		8.200 lbs / 3.720kg		
0	40	300	600	145
2.000	40	290	580	144
4.000	40	280	560	142
6.000	40	270	540	141
8.000	40	260	520	140
10.000	40	260	520	139
12.000	40	240	480	137
14.000	40	240	480	135
16.000	40	260	520	134
		12.500 lbs / 5.670kg		
0	40	300	600	145
2.000	40	290	580	144
4.000	40	280	560	142
6.000	40	270	540	141
8.000	40	260	520	140
10.000	40	260	520	139
12.000	40	250	500	137
14.000	40	240	480	135
16.000	40	260	520	134

Fuel Planning

The following sections contain data to optimize the enroute sector performance. Three categories of optimum performance are considered:

- Minimum block time
- Minimum block fuel
- Minimum cost

The tables show the optimum cruise altitude, time and amount of fuel needed to travel a certain distance depending on different temperatures and aircraft weights.

Accordingly different profiles are used during climb, cruise and descent:

	Min. block time	**Min. block fuel**	**Min. cost**
Climb	High speed	High speed	High speed
Cruise	Max. cruise rating	Long range cruise	Max. Cruise rating
Descent	High speed	*Cruise alt 10,000 ft and below:* intermediate speed *Cruise alt greater than 10.000 ft:* low speed	High speed

Minimum Block time technique

Takeoff weight 12.500 lbs

Sector distance	ISA			ISA +10°C			ISA + 20°C		
	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]
50	2.000	24.7	250	2.000	24.6	246	2.000	24.8	241
75	4.000	33.3	347	3.000	33.3	346	3.000	33.6	338
100	5.000	41.7	445	5.000	41.9	433	5.000	42.4	424
125	5.000	49.9	549	5.000	50.3	533	5.000	51.0	520
150	5.000	58.2	653	5.000	58.7	633	5.000	59.7	616
175	6.000	66.6	738	5.000	67.1	733	5.000	68.3	712
200	6.000	74.9	839	5.000	75.5	833	5.000	76.9	809
250	7.000	91.5	1.015	6.000	92.5	1.006	5.000	94.1	1.001
300	7.000	107.9	1.211	6.000	109.3	1.200	5.000	111.3	1.192
400	8.000	140.9	1.563	6.000	142.8	1.586	5.000	145.6	1.575
500	9.000	173.7	1.893	7.000	176.4	1.921	5.000	179.8	1.956
600	10.000	206.3	2.207	7.000	209.7	2.295	5.000	213.9	2.336

Takeoff weight 9.000 lbs

Sector distance	ISA			ISA +10°C			ISA + 20°C		
	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]
50	2.000	24.5	243	2000	24.3	241	2.000	24.4	236
75	4.000	32.9	338	3000	32.8	338	3.000	33.0	330
100	5.000	41.1	433	5000	41.1	423	5.000	41.5	413
125	5.000	49.3	534	5000	49.4	521	5.000	49.9	507
150	6.000	57.6	619	5000	57.7	618	5.000	58.3	601
175	7.000	65.8	700	6000	66.0	698	5.000	66.7	695
200	7.000	73.9	795	6000	74.3	792	5.000	75.2	789
250	7.000	90.2	985	6000	90.8	981	5.000	92.0	976
300	8.000	106.4	1.147	6000	107.2	1.169	5.000	108.8	1.164
400	9.000	138.7	1.476	7000	140.1	1.506	5.000	142.3	1.537
500	10.000	170.8	1.787	8000	172.8	1.883	5.000	175.7	1.910
600	10.000	203.0	2.132	8000	206.5	2.176	5.000	209.0	2.282

Minimum Block fuel technique

Takeoff weight 12.500 lbs

Sector distance	ISA			ISA +10°C			ISA + 20°C		
	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]
50	5.000	28.5	221	5.000	28.1	221	4.000	28.0	223
75	7.000	38.7	304	7.000	38.2	304	6.000	38.0	305
100	11.000	52.5	379	9.000	48.0	382	8.000	47.8	386
125	13.000	62.9	451	12.000	62.0	454	11.000	61.1	457
150	15.000	73.2	519	14.000	72.1	521	13.000	71.1	527
175	17.000	83.3	584	16.000	82.1	588	14.000	80.8	596
200	19.000	93.2	646	18.000	91.9	651	16.000	90.7	661
250	22.000	112.7	769	21.000	111.5	773	18.000	110.0	789
300	24.000	132.0	888	23.000	131.5	893	21.000	129.3	906
400	25.000	169.4	1.126	25.000	170.2	1.128	24.000	168.8	1.144
500	25.000	206.6	1.360	25.000	207.7	1.362	25.000	207.3	1.377
600	25.000	246.4	1.591	25.000	244.9	1.594	25.000	245.1	1.610

Takeoff weight 9.000 lbs

Sector distance	ISA			ISA +10°C			ISA + 20°C		
	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]
50	5.000	28.9	207	5.000	28.6	207	5.000	28.3	207
75	9.000	38.9	280	8.000	38.8	282	7.000	38.6	283
100	12.000	53.7	341	12.000	53.0	341	11.000	52.3	344
125	15.000	64.5	399	14.000	63.6	402	13.000	62.9	406
150	18.000	74.8	454	17.000	73.8	457	16.000	73.0	462
175	20.000	84.9	507	19.000	83.8	510	18.000	82.8	516
200	22.000	94.5	556	21.000	93.5	560	20.000	92.4	567
250	25.000	113.8	649	25.000	112.1	652	24.000	110.9	660
300	25.000	133.6	748	25.000	131.5	751	25.000	129.7	756
400	25.000	173.4	944	25.000	170.6	947	25.000	167.9	952
500	25.000	213.5	1.139	25.000	209.9	1.141	25.000	206.4	1.146
600	25.000	253.7	1.331	25.000	249.4	1.333	25.000	245.2	1.338

Minimum cost technique

Takeoff weight 12.500 lbs

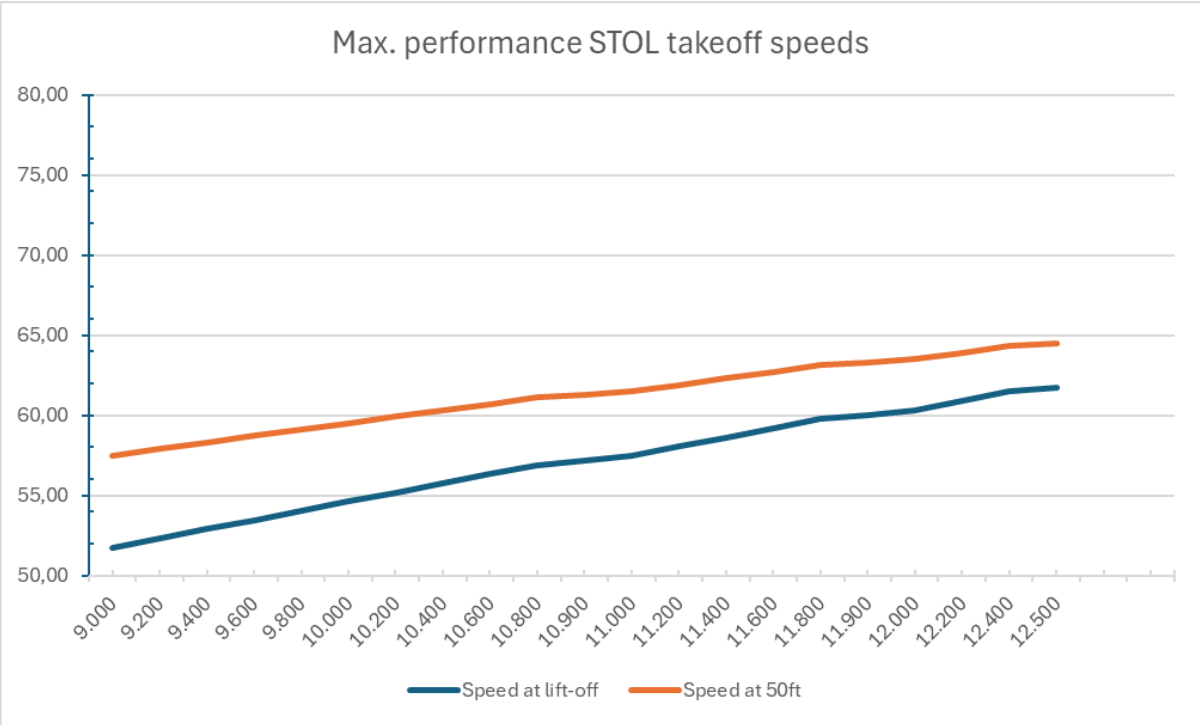
Sector distance	ISA			ISA +10°C			ISA + 20°C		
	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]
50	4.000	25.0	241	4.000	24.9	238	4.000	25.0	234
75	6.000	33.6	333	6.000	33.6	328	5.000	33.7	327
100	8.000	42.4	421	8.000	42.4	414	7.000	42.5	412
125	10.000	51.1	500	10.000	51.2	492	9.000	51.4	492
150	12.000	59.9	578	11.000	59.9	573	10.000	60.2	572
175	14.000	69.0	644	13.000	69.0	643	12.000	69.2	644
200	16.000	78.1	710	15.000	78.1	709	13.000	78.2	715
250	19.000	96.7	835	18.000	96.5	836	16.000	96.6	845
300	21.000	115.4	968	20.000	115.1	958	19.000	115.7	963
400	25.000	155.1	1.182	24.000	155.4	1.188	22.000	154.5	1.201
500	25.000	190.7	1.424	25.000	193.5	1.421	25.000	195.5	1.429
600	25.000	226.0	1.663	25.000	130.1	1.656	25.000	234.0	1.682

Takeoff weight 9.000 lbs

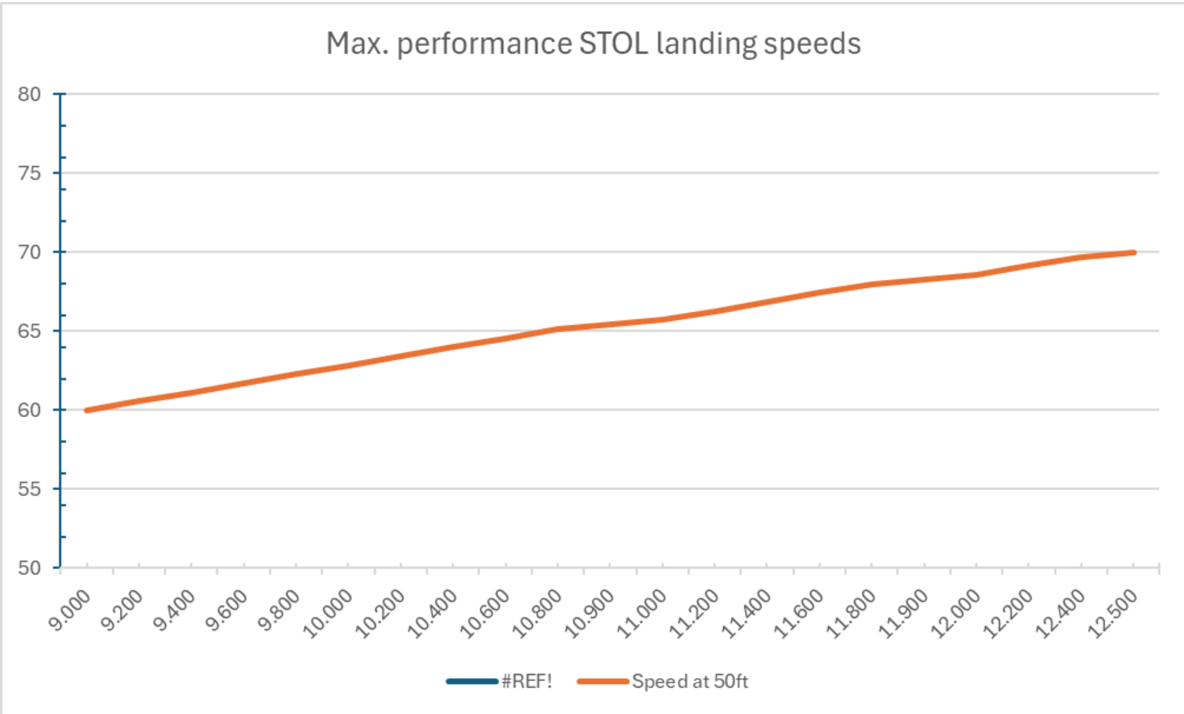
Sector distance	ISA			ISA +10°C			ISA + 20°C		
	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]	Opt. alt. [ft]	Time [Min]	Fuel [lbs]
50	4.000	24.6	235	4.000	24.5	232	4.000	24.5	228
75	7.000	33.2	318	7.000	33.1	314	6.000	33.1	313
100	9.000	41.7	400	9.000	41.6	395	8.000	41.6	395
125	12.000	50.5	469	11.000	50.1	468	10.000	50.1	468
150	14.000	59.2	535	13.000	58.7	536	12.000	58.7	537
175	16.000	68.0	597	15.000	67.5	598	14.000	67.4	599
200	18.000	77.1	652	17.000	76.3	655	16.000	76.1	658
250	22.000	95.8	749	21.000	94.6	755	20.000	94.1	761
300	25.000	114.8	840	24.000	113.1	849	23.000	112.5	855
400	25.000	149.7	1.056	25.000	148.1	1.057	25.000	148.0	1.053
500	25.000	184.6	1.271	25.000	182.4	1.270	25.000	182.5	1.263
600	25.000	219.4	1.483	25.000	216.7	1.483	25.000	216.8	1.471

Max. performance STOL takeoff and landing speeds

Max. performance STOL takeoff speed



Max. performance STOL landing speed



Appendix

Credits

This Twin Otter is brought to you by by Asobo Studio. Hans Hartmann undertook the programming. Jeroen Doorman undertook audio, and documentation is by Ingo Voigt.