De Havilland Canada DHC-6 Twin Otter

Introductory flight

Introduction

This introductory flight explains how to operate the Twin Otter in Microsoft flight simulator 2024. It resembles a real flight, which was carried out by Leeward Islands Air Transport (LIAT) in 1998 and takes us from Dominica to St. Lucia (LIA flight 333). We are going to leave Dominica Roseau airport (TDPD / DOM) at 09:15 and are scheduled to arrive at St. Lucia at George F. L. Charles airport (TLPC / SLU) at 10:00.

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Planning

The journey begins with flight planning, which includes determining route and payload.

Payload

We expect 12 passengers and 284 kg (626 lbs) of cargo for this flight. This totals 1,461 kg (3,221 lbs) of payload.

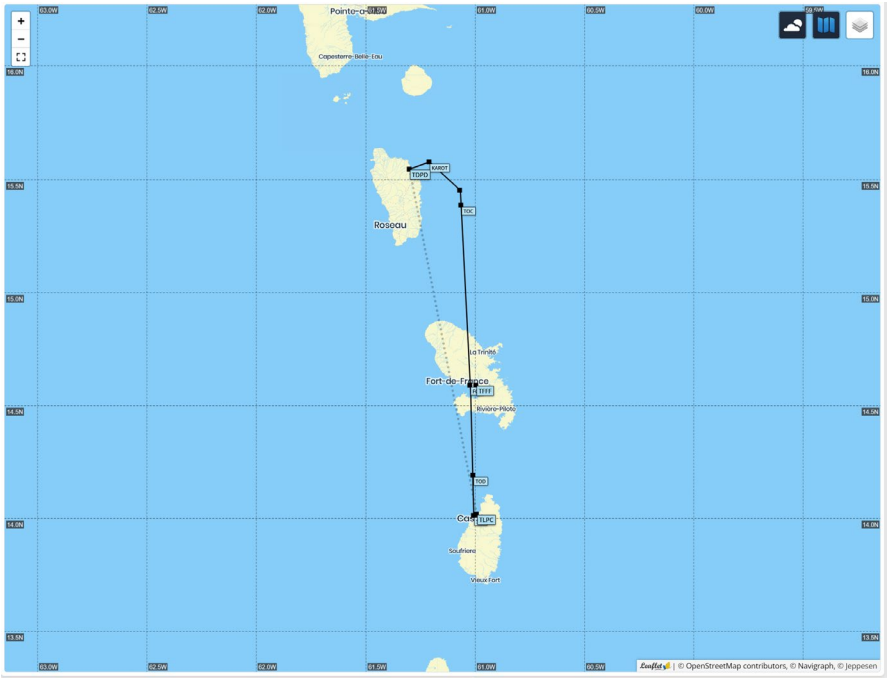
Weather forecast

The weather is rather good: during the climb we are going to encounter a thin, shattered layer of clouds between 6,000 ft and 7,600 ft. The further cloud layers are above 30,000ft and way too high to bother us on this flight. For takeoff and landing we expect the winds from 080 degrees at 8 kts (no gusts). Our cruise segment is going to be supported by a slight tail wind with 15 kts from 359 degrees. Temperature and pressure are to be expected at 20°C and 1013 mbar, which nearly equals standard atmosphere.

Route planning

We suggest supporting route planning by using SimBrief. SimBrief provides a rather simple routing: TDPD/09 KAROT1 FOF DCT SLU DCT TLPC/09

What might appear as a somewhat cryptic phrase means that we leave Melville Hall (TDPD), taking off from runway 09. Then we climb out following KAROT1 Standard Instrument Departure (SID), which ends at Fort-de-France (FOF) VOR. Passing Fort-de-France we are supposed to proceed directly to St. Lucia (SLU) NDB which is located very close to the threshold of runway 09 at George F. L. Charles Airport (TLPC).
Nevertheless, expect a slightly different routing for approach as we intend to follow the RNAV approach for runway 09. Further explanations follow during the setup of the GPS system during flight preparation.



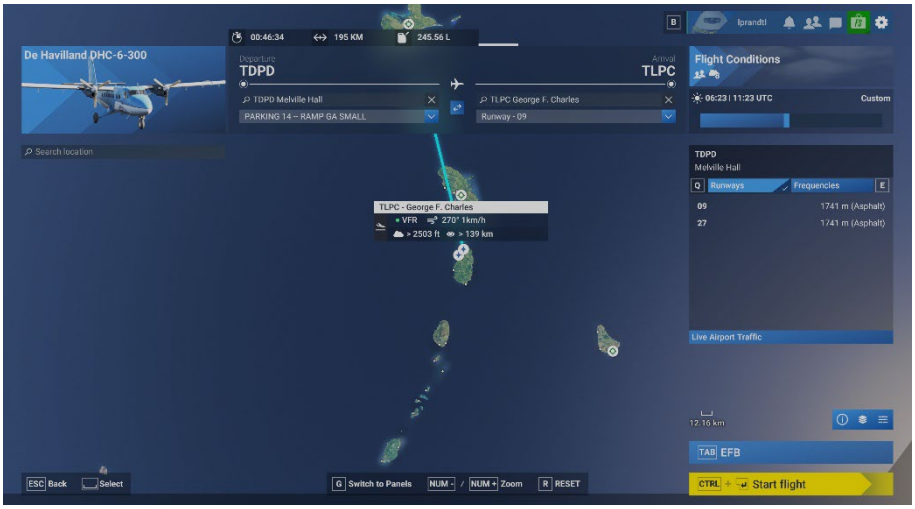
Our cruising altitude is 10,000 ft, and the flight is supposed to take 42 minutes airtime. Including time for taxiing SimBrief calculates 70 minutes block time. Considering preparation of the aircraft, time to read and use the pause function, estimate 90 to 120 minutes time to complete the entire flight.

According SimBrief's calculation, the DHC-6 will burn 220kg of fuel, including reserves, fuel for taxiing and idling. We'll load 709 kg (1,563 lbs) of fuel.

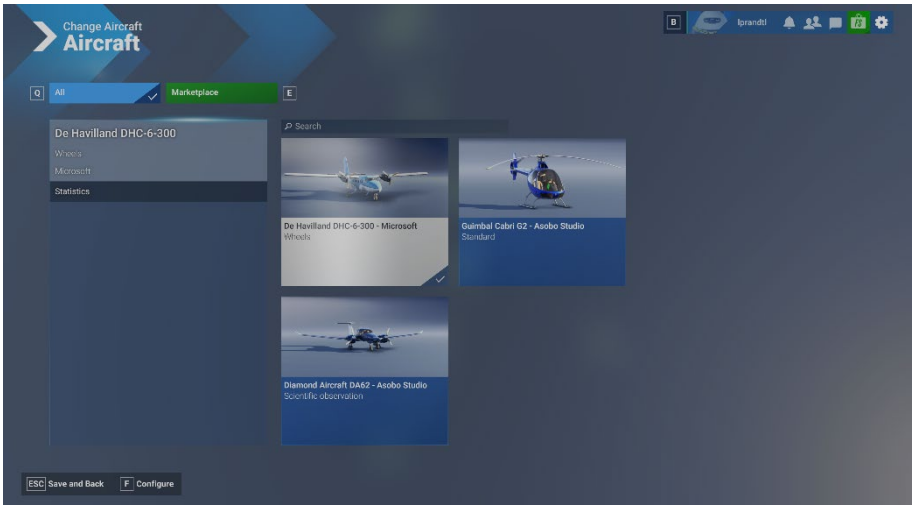
Next – configure Microsoft Flight Simulator 2024.

Configuring the simulator

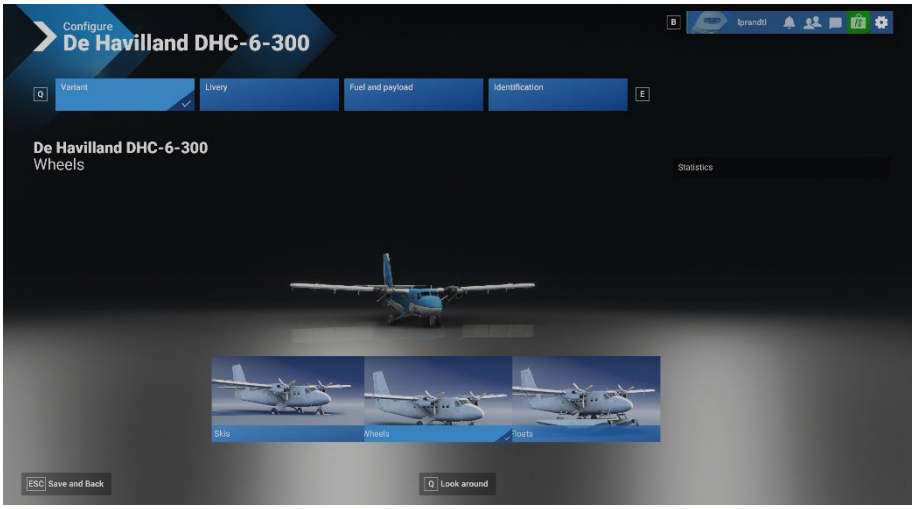
Select 'free flight' from the main menu and then select TDPD, Parking 14 as departure and TLPC, runway 09 as arrival. This should look roughly like this:



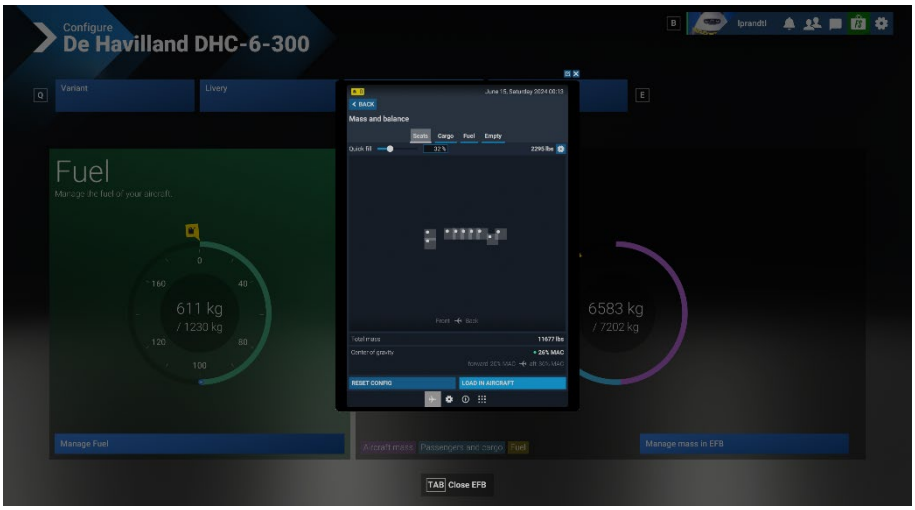
Now click on the aircraft box in the top left corner. The aircraft selection menu opens, select the De Havilland DHC-6-300 by Microsoft, and press 'f' or the configure button.



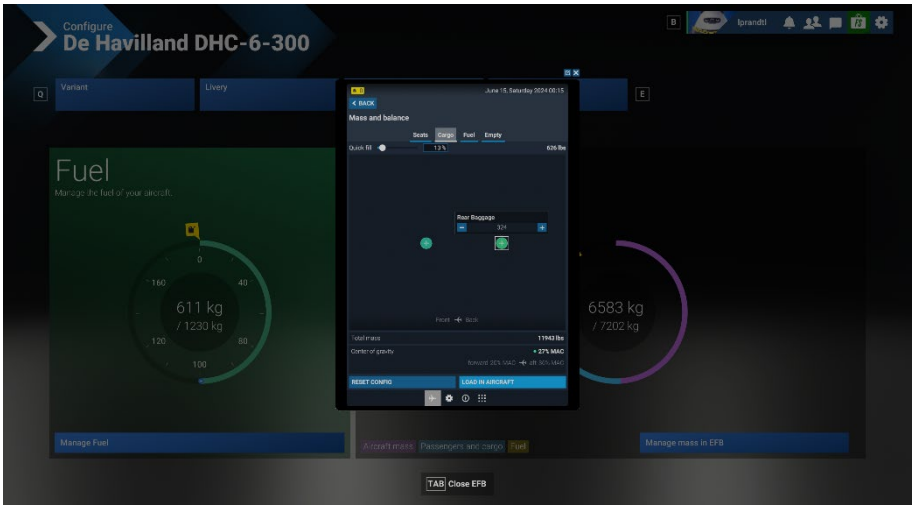
As the first step make sure the ‘Wheels’ variant is selected. Then select a livery of your choice.



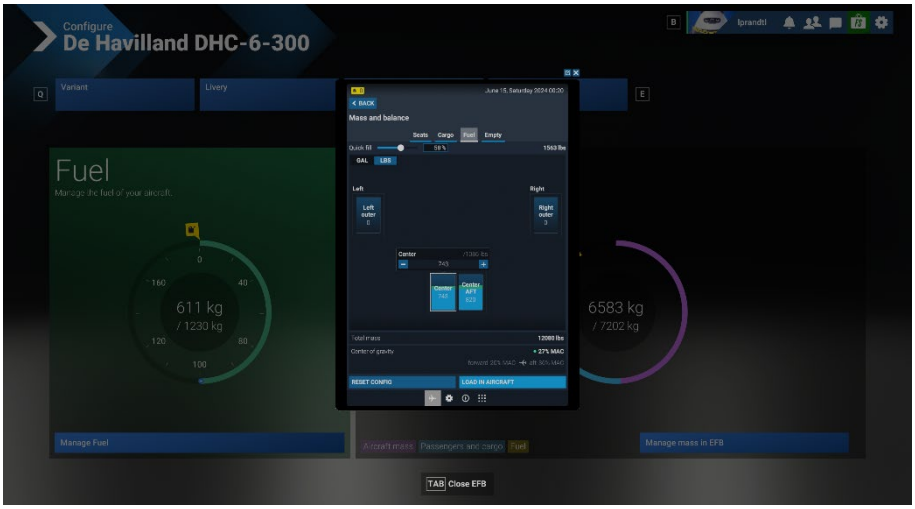
Now switch to fuel and payload and open the EFB by clicking the ‘Manage mass in EFB’ button in the lower right corner. We intend to transport 12 passengers, weighing 1,177 kg (2,595 lbs). Use the ‘quick fill’ slider to get the next value to 1,177 kg (2,595 lbs), then click on the single rows to adjust loading in detail until the total reads 1.177 kg (2.595 lbs). Then press ‘Load in aircraft’.



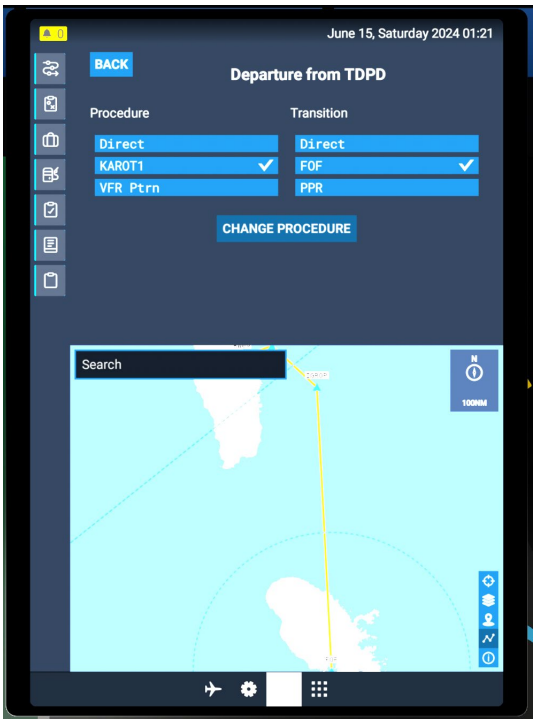
Switch to the ‘Cargo tab and proceed in the same way until the total cargo reads 284 kg (626 lbs). Press the ‘Load in aircraft’ button again.

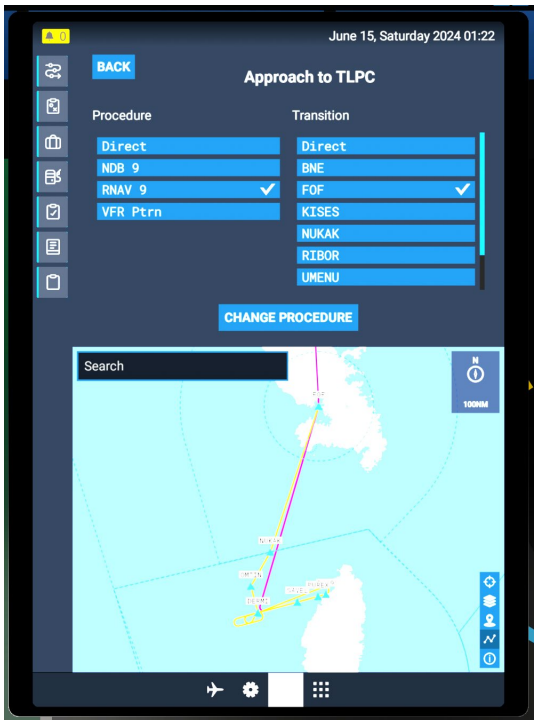


The last step to adjust the payload is to setup fuel – we intend to take 709 kg (1.563 lbs) of fuel with us, so adjust the slider or values in both center tanks accordingly. Make sure that the indicated unit is 'lbs' and not 'gal' (gallons) and that the 'Load in aircraft' button is clicked when adjustment is completed.



With the payload and fuel configured, proceed to determining the specifics of the route. Switch to the 'Atlas' tab by clicking on the compass needle icon at the bottom edge of the EFB. Then press the 'route' icon on the left edge of the EFB. Select runway 09 as departure runway for Melville Hall and KAROT1 procedure and FOF transition. Add FOF VOR (Fort-de-France, Martinique) as a waypoint and RNAV 9 approach with FOF transition. As a last step, check that the cruise altitude in the top right corner is set to FL-100 (10,000 ft).





The complete route should look like this:

Select the second tab from the top to enter the flight details like IFR flight rules, the airline ('Other' as Leeward is not available), the flight number (333), the flight date (Nov 19th 2024), the flight date (NOV 19th 2024), the time the flight is scheduled to leave the parking position (09:00 local time), the transponder type (C as it transmits the squawk and altitude), and the pilot's name, if you wish.

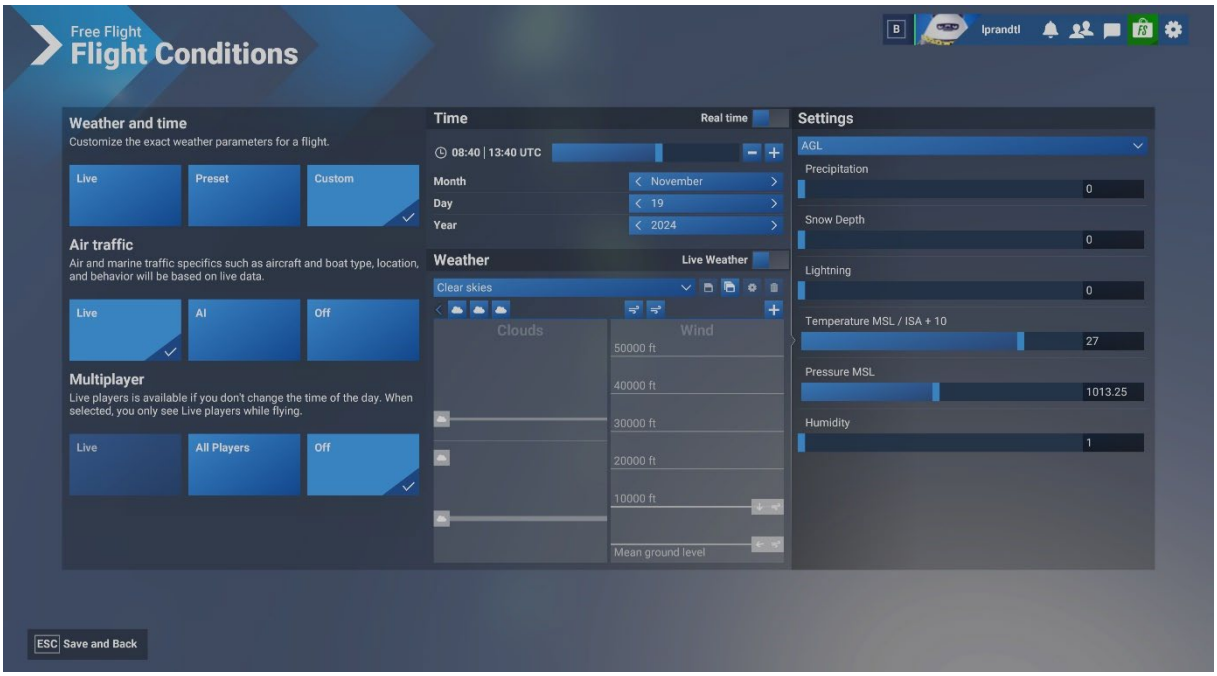
Close the EFB, then return to the flight setup screen to set up the time and weather.

Make sure that Nov. 19th 2024 and 08:40 local time is selected as the time and date of flight. Select custom weather and make sure that 0 precipitation, 0 snow depth, 0 lightning is selected. Set the temperature to 27°C, pressure to 1013.25 mbar, and humidity to 1.

Now add a first layer of clouds between approximately 32,500 and 35,000 ft with a coverage of 30, a density of 0.9, and scatter of 70.
The second layer is left at 23,000 ft, with 0 coverage, 1 density and 0 scatter.
The third layer ranges from 6,000 to 7,600 ft, with 85 coverage, 2.5 density and 60 scatter.

Next, configure the wind – at ground level the wind direction is 080° with a speed of 3 meter per second, which equals 6 knots. Gusts are set to 080°, with 3 meters per second speed as well and 1 gust per minute.

Then we add another wind layer at 10,000 ft with a direction of 359° and a speed of 8 meters per second, which equals 16 knots. Set gusts to 359° and 8 meters per second and 1 gust per minute.



Next press 'Fly' to start the flight.

Before embarking, the following section provides some information on speeds which should be considered during the flight.

Speeds for normal operations

Normal Take-off (flaps 10°)	Rotate at 75 KIAS, climb (initial) to 400 feet AGL with 80 KIAS
Normal climb speed	100 KIAS with flaps up
Best rate of climb	100 KIAS with flaps up
Best angle of climb	87 KIAS with flaps up
Enroute descent	Flaps up, speed limited by V_{MO}
Initial approach	> 94 KIAS (flaps up) > 85 KIAS (flaps 10°)
Final approach	80 KIAS (flaps 20°) 74 KIAS (flaps 37.5°)

Conducting the flight

The following checklists separate the flight into different phases. You'll start with inspections and aircraft preparation, followed by boarding, engine startup, and checks. The aircraft is prepared for takeoff and a climb to an appropriate cruise altitude. Descend from cruise merges into approaching the destination airport, landing, taxiing, and shutdown to finalize the flight.

Preparation and Inspection

Each flight starts with the exterior check of the aircraft. Different systems are checked and inspected to ensure proper function during the flight. The exterior check starts outside the aircraft in front of the cockpit door on the left-hand side. You will then proceed clockwise around the aircraft and check the different systems according to the following picture and checklists.

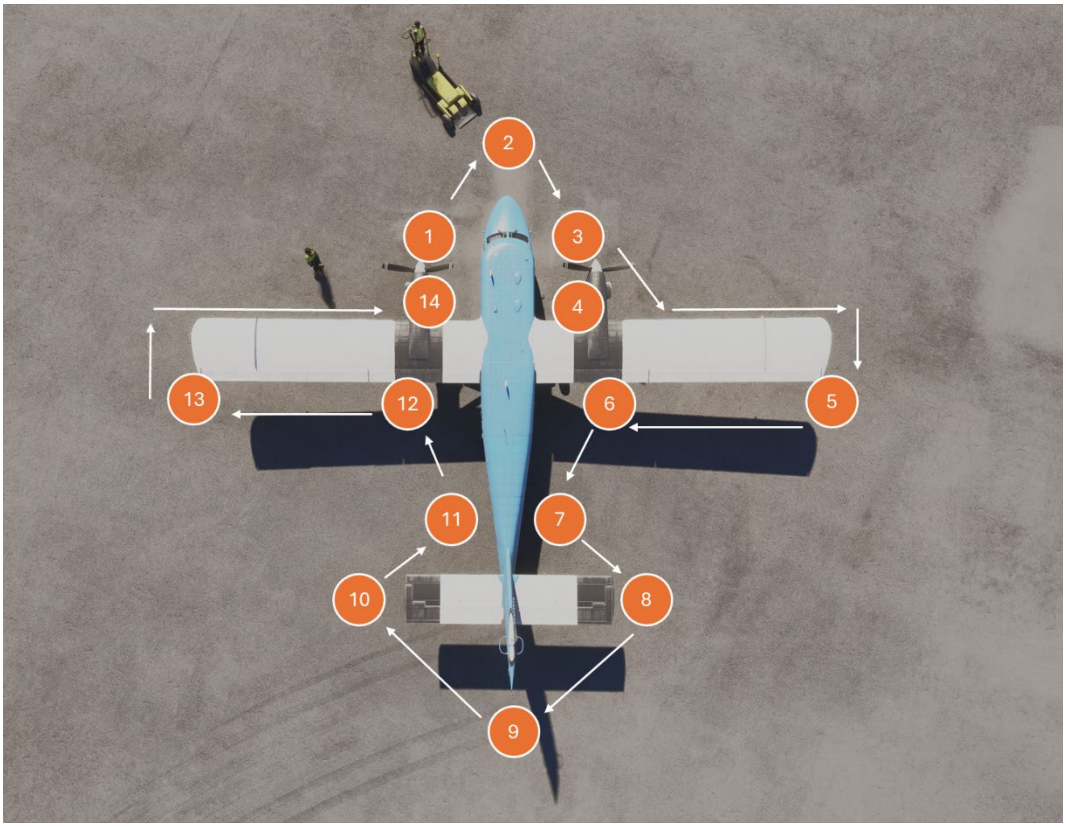
Microsoft flight simulator 2024 is the first simulator to offer the required features to perform the exterior check and starts with the aircraft sitting on the ramp and the pilot standing in front of the plane.

Use the A, D, W, and S key to move / walk around and the mouse to adjust your view or interact with aircraft parts, like removing the covers, examining a tire, or opening the door. By opening the cockpit door on the pilot's side, you automatically enter the aircraft.

Before switching into the cockpit, feel free to perform the outside check, which adds to the immersive Microsoft Flight Simulator 2024 experience, but is not required to perform the flight. Please make sure to have the cockpit covers, engine covers, and pitot covers removed.

Exterior check

The exterior check follows a specific pattern to ensure that specific components of the aircraft are modelled. The following section describes the exterior pre-flight of a physical aircraft. Please note, not all aspects of the virtual aircraft may be modelled identically to the physical aircraft.



Left forward fuselage

1	Left cockpit door	Unlocked (do not open the door in MSFS yet, as this automatically puts you in the pilot's seat)
2	Pitot heats and static vents	Vent covers removed
3	Ram air intake	Check unobstructed
4	Hydraulic compartment door	Secured
5	Crew oxygen pressure	Check
6	Nose baggage compartment door	Secured

Nose wheel

1	Tire	Pressure and condition checked
2	Shock strut	Extension, no leaks
3	Torque link and connecting pin	In place and secure
4	Taxi light	Check the condition of bulb and wiring

Right forward fuselage

1	Radome	Check condition
2	Pitot heads and static vents	Vent covers removed
3	Right cockpit door	Unlocked
4	Hydraulic compartment door	Secured

Right main gear

1	Tire	Pressure and condition checked
2	Brake lines	Check for leakage
3	Fairings	Check

Right fuselage

1	Wing strut	Check undamaged
2	Right emergency exit	Secure
3	Cabin windows	Check
4	Antennas below fuselage	Check for damage
5	Fuel drains	Drain, check for water and visible contaminants

NOTE

Do not turn boost pumps on prior to draining fuel from fuselage tanks

Right inner wing

1	Leading edge access panel	Check
2	Wing and flap undersurface	Check

Right engine

1	Propeller blades, spinner	Check for damage, secure mounting
2	Air inlet, air exit ducts	Check unobstructed
3	Exhaust stubs	Check
4	Cowling and all access panels	Check security
5	Fire extinguisher discs	Check for discharge
6	Fuel drains	Drain, check for water and visible contaminants

NOTE

Boost pumps must be selected ON prior to draining fuel from fuselage tanks. Fuel drains located at the rear of each engine nacelle

Right outer wing

1	Wing and flap undersurface	Check clean and undamaged
2	Wing leading edge	Check clean, undamaged
3	Landing light	Check clean and lens secure
4	Stall strip and fence	Check
5	Fuel vent and lightning protection tunnel	check
6	Navigation light	Check for damage
7	Static wicks and bonding straps	Check all are present, secure, good condition

Right aft fuselage

1	Right rear cabin door	Unlocked

Empennage

1	Right vortex generators	Check
2	Vertical stabilizer leading edge	Check
3	Right horizontal stabilizer	Check clean and undamaged
4	Elevator flap interconnect tab	Check
5	Static wicks and bonding straps	Check all are present, secure, good condition
6	Tail bumper	Check
7	Antennas	Check for damage
8	Rotating beacon	Check
9	Elevator trim tab	Check
10	Left horizontal stabilizer	Check, clean and undamaged
11	Left vortex generators	Check

Left aft fuselage

1	Jury strut	Installed or stowed, as required (not simulated)
2	Baggage compartment door	Secure, unlocked
3	Baggage compartment	Contents secure, tied down as required
4	Passenger oxygen pressure (if installed)	check
5	External power receptacle	Secure or ground power connected
6	Aft fuel cap	Cap secure

Left main gear

1	Tire	Pressure and condition
2	Brake Links	Check for leakage
3	Fairings	Check

Left outer wing

1	Wing and flap undersurface	Check clean and undamaged
2	Wing leading edge	Check clean, undamaged
3	Landing light	Check clean and lens secure
4	Stall strip and fence	Check (stall strip is installed on right wing on floatplanes)
5	Stall warning vanes	Check clean, no deformation
6	Fuel vent and lightning protection tunnel	Check
7	Navigation light	Check for damage
8	Static wicks and bonding straps	Check all are present, secure, good condition
9	Aileron and trim tab	Check

Left engine

1	Propeller blades, spinner	Check for damage, secure mounting
2	Air inlet, air exit ducts	Check unobstructed
3	Exhaust stubs	Check
4	Cowling and all access panels	Check security
5	Fire extinguisher discs	Check for discharge
6	Fuel drains	Drain, check for water and visible contaminants

Left inner wing

1	Leading edge access panel	Check
2	Wing and flap undersurface	Check clean and undamaged

Left fuselage

1	Wing strut	Check undamaged
2	Left emergency exit	Secure
3	Cabin windows	Check
4	Forward fuel cap	Cap secure

Warning

All accumulations of frost, ice, or snow need to be removed from all wings, tail, control surfaces, propellers, spinners, and the engine air inlets in cold weather.

This concludes the exterior check. Now you enter the aircraft either by opening the pilot's door, or by pressing Shift + C, and work through the cockpit preparation and startup checklists.

Cockpit preparation

Once inside the cockpit, we are ready to prepare the aircraft for the flight. Most checklist items are self-explanatory, especially as nearly everything is checked to be switched off to ensure a clean startup state.
The ram air lever operates the ram air valve and controls how much external air is introduced into the heating and ventilation system. An activated ventilation fan forces external air into the heating and ventilation system.

1	Pilot operating handbook and other required documents	Available in aircraft
2	Parking brake	On
3	Control locks	Remove & stow
4	Yoke visibility	Optional: hide yoke
5	RAM AIR lever	As required (OPEN for this flight)
6	PILOT STATIC selector	NORM
7	Electrical loads (lighting, de-ice, unnecessary avionics)	OFF
8	Circuit breakers	In

Warning

Ensure that the HYD PUMP circuit breaker is in before turning on aircraft power. It only needs to be pulled in the event of hydraulic abnormalities.

The following steps comprise powering up the aircraft and performing the caution light test. These tests ensure that the respective caution lights are working for the following system tests. These include the fire detection test and test of the fuel boost pumps.

8	EXTERNAL / BATTERY switch	As required (BATTERY in this case)
9	DC MASTER switch	MASTER (lower 'ON' position)
10	LIGHTING EMER switch	Currently not simulated
11	IGNITION switch	NORMAL & GUARDED
12	ENG IGNITER switches	BOTH
13	GENERATOR switches	OFF – check that L and R GENERATOR caution lights are illuminated
14	BUS TIE	NORMAL
15	CAUTION LT TEST switch	TEST Check that all caution lights illuminate: * 18 lights on either side of the magnetic compass * the three beta systems * the stall warning light * red battery temperature light * green beta back-up power lever microswitch * autofeather SEL and ARM lights * the stall warning horn sounds
16	NO SMOKING / FASTEN BELT switches	ON
17	Bleed air switches	OFF
18	Power levers	IDLE
19	PROP levers	FEATHER
20	FUEL levers	OFF
21	FIRE DETECTION switch	TEST Check that each end of the two FIRE PULL handles illuminates and the fire bell rings. Ensure that the FIRE BELL MUTE switch is in the down position with the guard lowered
22	FUEL CUT OFF emergency shut-off switches #1 & #2	NORMAL
23	PROP AUTOFEATHER switch	OFF
24	FUEL SELECTOR knob	NORMAL (center position)
25	INVERTER switch	No. 1 or No. 2 (not simulated)
26	System tests (every 24 hours)	1. Lift STDBY BOOST PUMP EMER AFT and STDBY BOOST PUMP EMER FWD switches to unmarked position. Check BOOST PUMP 2 AFT PRESS and BOOST PUMP 2 FWD PRESS caution lights go out 2. Move STDBY BOOST PUMP EMER AFT and STDBY BOOST PUMP EMER FWD switches to unmarked off position. Check BOOST PUMP 2 AFT PRESS and BOOST PUMP 2 FWD PRESS caution lights illuminate. 3. Move AFT BOOST pump and FWD BOOST pump switches to TEST. Check BOOST PUMP 2 AFT PRESS and BOOST PUMP 2 FWD PRESS caution lights go out.

	4. Move AFT BOOST pump and FWD BOOST pump switches to ON. Check BOOST PUMP 1 AFT PRESS and BOOST PUMP 2 AFT PRESS and BOOST PUMP 1 FWD PRESS and BOOST PUMP 2 FWD PRESS caution lights go out. 5. Check, if correct (not in checklist): Move AFT BOOST pump and FWD BOOST pump switches to OFF. Check BOOST PUMP 1 AFT PRESS and BOOST PUMP 2 AFT PRESS and BOOST PUMP 1 FWD PRESS and BOOST PUMP 2 FWD PRESS caution lights illuminate.

Now the cockpit is ready, and the next step is to prepare the cabin for boarding and the following flight

Cabin preparation

The following steps can only be performed to a limited extent. This is a good opportunity to take a closer look at the cabin of the aircraft.

1	Fire extinguishers	Charged and secure
2	First Aid kit	Sealed and secure
3	All 6 exit doors	Unobstructed and secure
4	Left rear cabin door	Locking pins secure
5	Cabin furnishings	Checked
6	Passenger safety briefing cards	Present
7	All interior lights	Check for proper function (if required)
8	Cabin emergency lights	Check for proper function (see item 14 of cockpit preparation)

Now the aircraft is ready for boarding.
As boarding is not yet simulated within Microsoft flight simulator 2024, we skip this step.
All passengers are on board now, and we are now ready to start the engines.

Before starting engines

By working through the next steps, we'll prepare the aircraft to start the engines. The exterior, cockpit, and cabin preparation need to be finished, as well as comparing actual and scheduled weight and balance of the aircraft and performing the passenger briefing (usually we can skip those two steps in flight simulator).
Make sure that the hydraulic pumps are functional, the circuit breakers are not pulled, and pressure is established above 1,300 PSI (currently flight simulator needs at least one engine running to supply hydraulic pressure, so you may skip this item).
Check that sufficient fuel is on board (710 kg / approx. 1,540 lbs) and the aft and forward boost pump switches are ON.
Switching on the beacon light finalizes the checklist and indicates to other crew and ground personnel that the engines are running, or as in this case, we are about to start the engines.

1	Exterior check checklist	Completed
2	Cockpit preparation checklist	Completed
3	Cabin preparation checklist	Completed
4	Preflight weight and balance checks	Completed
5	Passenger briefing	Completed
6	HYD OIL PUMP circuit breaker (CB)	Visually confirm, that CB is not pulled / tripped
7	Hydraulic pressures	Check that both are above 1.300 PSI (1.500 is a typical value)
8	Fuel quantity	Sufficient for planned flight
9	AFT BOOST and FWD BOOST switches	ON – check that all four BOOST PUMP caution lights are out
10	Beacon light switch	ON

Starting the engines

There are two ways to start the Twin Otter's engines. Either power is supplied from an external source, or from the battery. For this introductory flight, power is supplied by the battery (see cockpit preparation checklist). Check the appendix or the aircraft operating manual for the checklist to start the engines with power supplied from an external source.

Battery power start

Check that power is supplied by the battery by confirming that the EXTERNAL/BATTERY switch is set to BATTERY. Check the voltmeter and confirm that 24 V power are available.

Before starting the engines read through the checklist items and make sure that you feel safe performing each step as the engine start sequence is rather quick. Moving the start switch to the right activates the right engine starter and same for the left. Check the engine instruments and make sure you are ready to move the fuel lever after spooling up and stabilizing at 12% N_G or more. The engine is going to accelerate to idle RPM (typically 52% N_G at standard temperature). Check T_5 temperature during the entire start that no limitations are exceeded.

When both engines are started, the prop levers are moved to the full forward position and generators are activated.

By moving the START switch to RIGHT we initiate the start sequence for the right engine.

1	EXTERNAL / BATTERY switch	BATTERY
2	VOLTMETER	Confirm 24 Volt power
3	START switch	First RIGHT to start right engine and minimize wind blast direct to the ground crew. After the right engine, the left engine is started and LEFT selected accordingly

CAUTION

Do not move the engine fuel lever to on before turbine RPM N_G is stabilized. The minimum stabilized N_G to start fuel flow is 12%. Do not select fuel ON if 12% N_G cannot be archived.

4		Allow the gas generator to stabilize (usually between 16 and 18%). Confirm rising oil pressure and as soon as the gas generator is stabilized, N_G exceeds 12%, move fuel lever to ON without delay. The gas generator of the second engine being started will normally stabilize 1% lower than the first engine due to depletion of the battery.
5	Light-up	Check that engine accelerates to idle RPM (typically 52% N_G at ISA, standard atmosphere). Make sure that T_5 temperature stays within limitations.
6	START switch	Release, when N_G has reached idle speed. Check, that respective L GENERATOR or R GENERATOR caution light illuminates when start switch is released. Check oil pressure is within limits.
7		Repeat steps 1-6 for opposite engine. Check sufficient battery voltage or perform procedure to recharge battery between starts
8	EXTERNAL / BATTERY switch	BATTERY
9	PROP levers	MAX RPM
10	Power levers	If a significant electrical load is anticipated, when generators are brought online, advance throttle to idle N_G +15%
11	GENERATOR switches	RESET, then ON Check that L GENERATOR and R GENERATOR lights extinguish. Monitor T_5 temperature (idle limit = 600°C)
12	Generator IND SELECT switch	L GEN and R GEN. Check generator load is below 0.5 on each side
13	Power levers	Idle

After start (pre-taxi)

With the engines up and running, a little preparation and some more tests need to be completed before we can taxi to the runway.

First, we need to check that the doors are closed and secured, the battery is (still) selected as the power source, and external power is disconnected, and chocks are removed.
Re-check that hydraulic pressure is available and established. Switch on the bleed switches, so air conditioning and anti-ice systems are supplied with hot air from the engines.
Check that the prop levers are set fully forward, and all seats, seat belts, and harnesses are secured. Now switch off the brakes, check operation of the nose wheel steering and brakes by turning the tiller, or rudder (depending on your flight simulator setup) to either fully deflected position while pressing the brakes and checking brake pressure.

1	Doors	Secure. Check that the DOORS UNLOCKED caution light is out
2	EXTERNAL / BATTERY switch	BATTERY
3	External power	Disconnected
4	Hydraulic pressure	Between 1,300 and 1,600 PSI
5	Chocks	Removed
6	BLEED AIR switches	ON If cabin heat or surface de-ice is required
7	PROP levers	Full INCREASE
8	Crew seats, Seat Belts, Shoulder Harnesses	Check secure
9	Brakes	Off. Check operation of nose wheel steering and brakes, and correct function of electrically operated hydraulic pump motor

As we still need to complete some more preparations and functional tests, before we can head for the runway, please set the parking brakes again.

Setting up the GPS and navaids

With the generators providing electrical power, we now can configure the GPS.
Ensure that the GPS units are switched on and check that the flight plan is already loaded (courtesy of setting up the flight in the flight loading window).

In case the procedures (instrument departure and arrival) are already sent to the avionics by flight simulator, check the routing and the entered procedures.

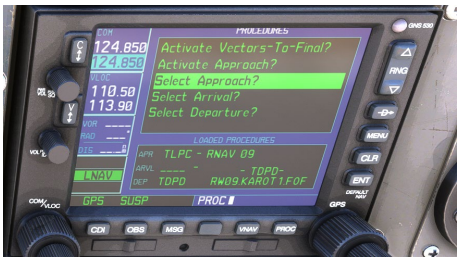
1. Load flight plan page by pressing the FLT button and check that the flight plan is displayed. It should at least show that the flight leaves TDPD and arrives at TLPC. Possibly, part of the departure or arrival route is already included. Furthermore, check which segment is pre-selected for navigation (the one with the purple arrow on the left side). In case the KAROT1 departure is missing, it needs to be updated.

2. As the KAROT1 departure is missing, press the PROC button to open the procedures menu and navigate to line ‘Select Departure’ and press ENT button

3. Select ‘KAROT1’ departure, runway 09 and FOF (Fort-de-France VOR) transition and confirm loading the procedure by pressing the ENT button.




4. In case we need to add the approach as well, press the PROC button again, navigate to ‘Select Approach’ and press the ENT button.



5. Select RNAV 09 approach, select FOF transition (Fort-de-France VOR) and press LOAD, but do not activate yet. In case the approach was already loaded, skip activating the approach by pressing the CLR button.



6. The FLT PLN page should look like this now – this might vary a bit as it depends on the position where you scrolled in the list.

7. Make sure that CDI is set to GPS by clicking on the CDI button and the first leg / waypoint is selected correct (the purple arrow should point to KAROT waypoint)

Check that 10,000ft is already selected as the cruise altitude and that the autopilot automatically levels off during climb. As the last step check that the radios are tuned to the correct stations as shown in the picture below:

VOR 1 active: FOF, Fort-de-France VOR, 113.30 MHz **VOR 1 standby**: DD, Domenica DME, 116.40 MHz **VOR 2 active**: DD, Domenica DME, 116.40 MHz **VOR 2 standby**: not tuned **ADF / NDB**: SLU, George Charles NDB, 415 kHz	

System functional checks

With the engines up and running, several systems are checked before takeoff. The provided checklists for this aircraft only contain system checks, which are simulated in flight simulator. In case you look at a real aircraft operating manual and the respective checklists, you'll find several more tests, which we skipped as they are not simulated.

Bleed / pneumatic test

The following test ensures that the PNEUMATIC LOW PRESS light works as expected.

1		Select de-icing system mode switch to OFF
2		Ensure bot BLEED AIR switches are OFF
3		Confirm PNEUMATIC LOW PRESS caution light is illuminated
4	Power levers	Advance to idle N_G + 15%
5	BLEED AIR	LEFT - ON Check that PNEUMATIC LOW PRESS caution light goes out
6	BLEED AIR	LEFT – OFF Check that PNEUMATIC LOW PRESS caution light illuminates
7	BLEED AIR	RIGHT - ON Check that PNEUMATIC LOW PRESS caution light goes out
8	BLEED AIR	RIGHT – OFF Check that PNEUMATIC LOW PRESS caution light illuminates
9	Power levers	Idle

Battery temperature monitor test (currently not simulated)

The battery temperature indicator has a push-button test function. Pressing it simulates an overheated battery. The pointer, as well as the warning lamp, should be activated while pressing the test button. This system is normally installed on nickel-cadmium batteries. If lead-acid batteries are used, the system is inactive.

The battery warning lamp has a trigger of 150° degrees Celsius. The graduation of the scale ranges from 120° to 180° degrees and is highlighted with the colors green (normal), yellow (caution), red (danger).

1	BATTERY TEMPERTURE monitor test switch	Press and hold Check that the 150° warning light comes on when the indicator pointer reaches 150°

The test switch should be released either as soon as the warning light illuminates or before the indicators reaches 170°

NOTE

The temperatures are degrees Fahrenheit

Power lever microswitch test

The power lever microswitch test ensures that the microswitches in the throttle unit are functional. The test works in flight simulator, even though the microswitches themselves are not simulated.

1	Power levers	Idle
2	PWR LEV TEST switch	Press until light illuminates, then release
3	PWR LEV TEST light	Check On, then off

Ant-ice systems test

The anti-ice systems test ensures that the respective anti-ice-systems work. Not all systems are simulated in flight simulator.

1	Power levers	Idle + 15%
2	BLEED AIR switches left & right	On
3	PNEU LOW PRESS light	Out
4	De-ice boots	Man
5	Inner / outer wing	Toggle
6	Left / right stab	Toggle
7	STAB DE-ICE PRESS light left & right	On (not simulated)
8	De-ice boots	As required
9	Power levers	Advance to 80% N_G
10	Intake deflectors	Extend (not simulated)
11	De-Ice Dollseyes	EXT (not simulated)
12	Intake deflectors	Retract (not simulated)
13	Power levers	Idle
14	BLEED AIR switches left & right	As required
15	Generator left & right	Off
16	Propeller de-ice	On – check battery load increase
17	Propeller de-ice	Off
18	Windshield heat	On – check battery load increase
19	Windshield heat	Off
20	Generator left & right	On

Now we are ready to taxi to our runway, which is shown in the following picture:

Before entering the runway, make sure that the ‘before takeoff checks’ are completed.

Before-takeoff checks

The before-takeoff checks are the last preparations prior to takeoff. Trim and flaps settings are re-checked (rudder and elevator trim are set according marking on trim indication), and the radios checked that they are tuned correctly. The propeller levers are set fully forward and autofeather is activated (check that the respective SEL indicator light illuminates). Take another look at the engine instruments to ensure that all parameters are within limits and as expected. For this introductory flight, make sure that the bleed system is activated.

Even though the strobe (anti-collision) and landing lights are not mentioned yet, please switch them on before taxiing on the runway and when crossing runways as well (not relevant for Melville Hall though but for further flights with the Twin Otter most likely).

1	Trim tabs	Set
2	Flaps	10°
3	Flight instruments	Check
4	Radios	Set
5	Propeller levers	Full forward
6	Autofeather	ON
7	SELECT light	ON
8	Engine instruments	Check
9	Bleed air left & right	As required
10	De-ice	As required

Taxi on the runway and backtrack runway 27 followed by a 180° turn at the end of the runway. Then line up on runway 09 and work through the line-up checks.

Line-up checks:

These are the final checks before takeoff.
Make sure that flight controls are free and travel in all axes is unrestricted (aileron, elevator, rudder). Check that the landing and strobe lights are switched on and only the expected caution lights (like PNEUMATIC PRESS due to idle thrust) are illuminated.

1	Flight controls	Free
2	Transponder	On
3	Landing lights	On
4	Strobe lights	On (use anti-collision light switch)
5	Caution lights	As appropriate
6	Runway & heading	Check

Press the brakes and advance the thrust levers until torque reaches 85% N_G. Wait a few seconds for the engines to stabilize, then advance the power levers further until torque or T_5 reaches the limit, then release the brakes.
The Twin Otter now accelerates rather quickly and when reaching 75 KIAS pull the yoke to raise the aircraft's nose. You should aim for a pitch up attitude of approx. 12,5° so that speed for the initial climb establishes at 79 KIAS (aim a tad below the 80 kts marking on the air speed indicator).

After takeoff 400 ft AGL:

At 400' AGL retract flaps and adjust pitch to maintain 100 KIAS during climb. Then work through the after-takeoff checklist.

The flaps are retracted, autofeather switched off and climb power is set (torque 50 lbs and N_P at 85%) and the yaw damper activated.
Feel free to adjust the passenger signs and landing lights later during climb.

1	Flaps	Up
2	Autofeather	OFF
3	Climb Power	Set
4	Nosewheel steering	Centered
5	Yaw damper	On
6	Passenger signs	As required
7	Landing lights	Off

Reduce workload by activating the autopilot:

1. Check that 10,000ft is preselected as cruise altitude
2. Switching the master autopilot switch on
3. Selecting NAV mode for lateral guidance
4. Selecting ALT hold mode and directly deactivating it to select V/S mode (vertical speed mode)
5. Adjust vertical speed to approx. 1800 feet per minute by pressing the UP key several times
6. Press ARM button to ensure the aircraft recognizes the preselected altitude

Remember to check and adjust torque during climb, when passing the next 1,000 ft.

Before passing the cloud layer during climb check the outside temperature. If the outside temperature is below +4°C and visible moisture is present (cloud, fog, rain, snow, ...), icing is to be expected and anti-ice-systems active respectively.
So active propeller and intake anti-ice and switch the boots to AUTO while climbing through the clouds. Make sure to switch off all anti-ice equipment, when clear of the clouds.

Cruise (no checklist):

When the aircraft reaches 10,000 ft the autopilot will level off and hold altitude automatically. According to the cruise speed tables, our cruise speed is going to be 139 KIAS. As soon as the aircraft reaches 140 KIAS, please adjust throttle and propeller levers to 1,650 RPM / 75% N_P and 40 PSI torque N_G. Fuel flow per engine should remain at 260 lbs per hour.

The GPS system can determine the top of descent (TOD) point. The following steps show how to calculate the TOD based on a target altitude and a waypoint. Make sure that a STAR or approach procedure is entered into the GPS before using the VNAV calculation.

1. Select VNAV page by pressing VNAV the button

2. Enter a target altitude of 2,000 ft
   2 nm before DERMI waypoint
   a 600 ft/min vertical speed profile
   The VNAV page calculates when the descend needs to be initiated

Continue the cruise and when approaching the top of descend prepare to descend. Select an altitude of 2,000 ft and change the autopilot mode to V/S (vertical speed) by pressing the ALT button to deselect altitude hold mode. When passing TOD, move the throttle levers to flight idle and leave the prop levers at the cruise setting. Adjust VS to -700fpm or according to the value displayed in the GPS VNAV mode.

After levelling off we work through the Descend checklist.

Descend checks:

Check fuel quantity and fuel levels in both thanks are the same and the fuel selectors are set. Make sure that sufficient hydraulic pressure is available (1,600 PSI) and check that the caution lights are off. Like climbing to cruise altitude, remember to activate anti-ice when passing the cloud layer. Check that sufficient power is set, and the PNEUMATIC LOW PRESS light is off before activating anti-ice. During other flights you need to check the correct altimeter setting now.

1	Fuel quantity & selector	Check / Set
2	Hydraulic pressure	Check
3	Caution lights	Check
4	De-ice	As required
5	Altimeters	Set

When approaching DERMI waypoint work through the approach checklist

Approach checks:

The approach checklist is rather short – switch on the passenger signs and landing lights and you are done.

1	Passenger signs	On
2	Landing lights	On

Make sure that before passing SAVEL waypoint the aircraft is slowed down to 100 KIAS, the propeller levers are set to full forward and flaps can be extended to 10°. When passing SAVEL waypoint start the final approach for runway 09. Adjust thrust and pitch and keep the airspeed around 80 KIAS and glideslope is maintained (check the PAPI lights left of the runway threshold). Extend flaps to 20°, our landing configuration for today. After descending through 1,000 ft, work through the before landing checklist.

Before landing checks:

As already mentioned, we are landing with flaps 20°, which is the usually recommended flap setting for landing. Flaps 37.5° is only chosen due to runway length limitations. Flaps 20° landing distance can be determined by multiplying the landing distance for flaps 37.5° by 1.3.
Check that the nosewheel steering is centered, (autopilot) and yaw damper are switched off, flaps are set to 20° and the propeller levers are set full forward.
When crossing the runway threshold (50 ft above the runway), pull the power levers slowly back to idle and let the aircraft settle on the runway.
Apply brakes as needed after touchdown, reverse thrust won't be needed in this case.

1	Nosewheel steering	Centered
2	Yaw damper	Off
3	Flaps	Set (20° or 37.5°)
4	Propeller levers	Full forward
5	Power levers	Idle - When crossing runway threshold at 50 ft AGL
6		Touchdown on main wheels
7	Brakes	Apply as required after nose wheel contact
8	Zero thrust / reverse power	As required

Warning

Reverse power cannot be applied unless the prop levers are at full increase (max RPM).

Flap angle	Min. V_{REF} = 1.3 * V_S (Stall Speed)					
	12.300 lbs 5.600kg	11.500 lbs 5.200kg	10.500 lbs 4.800kg	9.500 lbs 4.300kg	8.500 lbs 3.900kg	7.500 lbs 3.400kg
20°	80	77	73	70	66	62
37.5°	74	70	67	64	60	57

When the aircraft is stopped, execute a 180° turn on the runway and taxi back to the apron. After leaving the runway, stop again and perform the after landing checks.

After landing checks:

Retract the flaps, switch off bleed air and anti-ice, the landing and strobe lights as well as the transponder. Reset the trim tabs for takeoff. Now you are ready to taxi to the parking position.

1	Flaps	Up
2	Bleed air left & right	Off
3	De-Ice	Off
4	Landing lights	Off
5	Strobe lights	Off (use anti collision lights switch)
6	Transponder	Off
7	Trim tabs	Reset for takeoff

Shutdown checks:

After arriving at the final parking position, shut down the aircraft by working through the shutdown checklist.

1	Parking brake	Set
2	Radios	Off
3	Power levers	Idle
4	Propeller levers	Feather
5	Generators	Off
6	Fuel levers	Off
7	Boost pumps	Off
8	Lights	Off (all)
9	External / Battery switch	Off
10	D.C. Master switch	Off
11	Control locks	Attached

Welcome to Saint Lucia and congratulation on finishing your first flight with the Twin Otter!

Appendix

External power start

The external power source needs to provide a minimum of 28 volt (negative) with at least 800 and max. 1700 ampere capacity.

1	EXTERNAL / BATTERY switch	EXTERNAL
2	VOLTMETER	Confirm 28 Volt external power
3	START switch	First RIGHT to start right engine and minimize wind blast direct to the ground crew. After the right engine, the left engine is started and LEFT selected accordingly

CAUTION

Do not move the engine fuel lever to on, before the turbine RPM N_G is stabilized. The minimum stabilized N_G to start fuel flow is 12%. Do not select fuel ON, if 12% N_G cannot be archived.

4		Allow the gas generator to stabilize. Confirm rising oil pressure and as soon as the gas generator is stabilized, N_G exceeds 12%, move fuel lever to ON without delay.
5	Light-up	Check that engine accelerates to idle RPM (typically 52% N_G at ISA, standard atmosphere). Make sure, that T_5 temperature stays within limitations.
6	START switch	Release, when N_G has reached idle speed. Check, that respective L GENERATOR or R GENERATOR caution light illuminates when start switch is released. Check oil pressure is within limits.
7		Repeat steps 1-6 for opposite engine
8	EXTERNAL / BATTERY switch	BATTERY
9		Disconnect external power source
10	PROP levers	MAX RPM
11	Power levers	If a significant electrical load is anticipated, when generators are brought online, advance throttle to idle N_G +15%
12	GENERATOR switches	RESET, then ON Check that L GENERATOR and R GENERATOR lights extinguish. Monitor T_5 temperature (idle limit = 600°C)
13	Generator IND SELECT switch	L GEN and R GEN. Check generator load is below 0.5 on each side
14	Power levers	idle

Procedure for recharging battery between starts

1	PROP lever (operating engine)	Full INCREASE
2	Power lever (operating engine)	Advance to idle N_G + 15%

3	GENERATOR switch (operating engine)	RESET, then ON Check that L GENERATOR or R GENERATOR lights extinguish. Monitor T_5 temperature (idle limit = 600°C)
4		Observe battery charge current (load meter reading with switch in center position) until battery charge current load is .4 or less
5	GENERATOR switch (operating engine)	OFF. Check L GENERATOR or R GENERATOR caution light illuminates.
6	Power lever (operating engine)	As desired
7		Repeat the starting procedure for second engine

Battery start of cold soaked engines

This procedure applies when the engine / or the battery has been cold-soaked to temperatures below -30°C or -20°F.

1	START switch	LEFT or RIGHT Engine starter for 5 seconds, do NOT introduce fuel. Release switch after 5 seconds.
2		Wait approximately one minute, then start the engine using the normal battery start procedure
3		Allow the engine to idle until oil temperature reaches 0°C. Do not increase engine speed above idle, before oil temperature reached 0°C.
4		Once 0°C oil temperature is reached, advance throttle lever to idle N_G + 15%.
5	GENERATOR switch	RESET, then ON Check that L GENERATOR and R GENERATOR lights extinguish.
6		Observe battery charge current (load meter reading with switch in center position) until battery charge current load is .4 or less
7	GENERATOR switch (operating engine)	OFF. Check L GENERATOR or R GENERATOR caution light illuminates.
8	Power lever (operating engine)	As desired
9		Repeat steps 1 through 4 for the second engine, including the 5 second dry motoring and one minute wait.
10	Power levers	Advance to idle N_G +15%
11	GENERATOR switches	RESET, then ON Check that L GENERATOR and R GENERATOR lights extinguish.
12	Generator IND SELECT switch	L GEN and R GEN. Check generator load is below 0.5 on each side
13	Power levers	idle

Go-Around

1	Power levers	Advance to take-off power setting
2	PROP levers	Ensure at full INCREASE position
3	Flaps	10°
4	Minimum Airspeed	1.3 times stall speed with flap 10° - see table below
5	Flaps	0° when clear of obstacles and positive rate of climb

Warning
With flap fully extended at 37.5° any pitch attitude in the go-around maneuver greater than 0° (level flight attitude) may cause a rapid decrease in airspeed and possible stall

Flap angle	1.3 * V_S (Stall Speed)					
	12,300 lbs 5,600kg	11,500 lbs 5,200kg	10,500 lbs 4,800kg	9,500 lbs 4,300kg	8,500 lbs 3,900kg	7,500 lbs 3,400kg
10°	88	83	79	75	71	67

Flight in icing conditions

Ice may form in conditions of visible moisture (i.e. clouds, or fog) at temperatures below +5°C OAT.

WARNING
Following exposure to any icing conditions in flight, flap extension to the final setting must be accomplished prior to descending below 500 feet AGL. The speeds in the following table must be maintained. They may be increased by a maximum of 5 knots to offset turbulence. Higher speeds increase the risk of ice contaminated tailplane stall (ICTS).

Accumulation of ice on the airplane may change the stall characteristics, stall speed, or warning margin provided by the stall warning device.
In case a significant amount of ice has accumulated, an airspeed margin of 1.3 times the normal stall speed appropriate to weight should be maintained accordingly,

The aircraft may only be flown into known or forecast icing conditions as long as it is equipped with properly working de-icing equipment. This comprises:

- Pitot heat
- Intake deflectors
- Windshield heat
- Valve heat
- Bleed air switches
- Surface de-ice boots
- Propeller anti-ice
- Engine ignition system

Operation of intake deflectors

The intake deflectors are only extended for flight in icing conditions as they reduce engine power but are needed to ensure engine operation in icing conditions.

To extend the intake deflectors, the INTAKE DEFLECTOR switch should be held in the EXTEND position for 3 to 5 seconds, after EXT is indicated.
To retract the switch does not need to be held in the Retract position.

In the event of a malfunction, the deflectors will remain in their last selected position. In case the malfunction prevents extension of either deflector, icing conditions must be avoided.

A minimum of 80% N_G is required to extend the intake deflectors. They will normally retract at idle N_G.