

The Complete Novices Guide to Turboprop Aircrafts Propeller and Power plant.

This Free Guide is aimed at giving a little, but essential, knowledge about the handling of turboprops as they are becoming more and more popular with recent Twin-Otter and Dash-8 panel designs.

Most of the text refers to the DASH-8 but since the author is an real life SAAB 340 pilot there might be some differences in the naming conventions.

I apologize for any errors.

The PSS Dash-8 manual comes with relatively sparse information and my DASH-8 Fuel.pdf on our website might be nice to have for fuel planning purposes.

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Powerplants

The most widespread modern type is the Pratt & Whitney PT-6 free-turbine engine found on several popular short haul commuter aircraft like the SAAB 340 and DeHavilland DHC-6 Twin-Otter.

The Bombardier DASH-8 series have a P&W engine with similar construction.

The free-turbine engine consists of two parts – the **Gas Generator** and the **Power Generator**.

The Gas Generator

is a jet engine that produces a high speed gas stream aimed to the Power Turbine which will then rotate and transfer this power to the Power Generator.

The two parts are not physically connected which makes it possible to start the engine with still standing propellers – actually you can hold the propeller still with bare hands for a while at start-up if you like too.

The Power Generator

is connected to the Propellers via a Propeller Gearbox – necessary as the Gas Turbine spins with a whopping 44.000 RPM and it would be a bit unhealthy to put out the generated power directly to the propeller to say the least.

The outgoing axis from the Prop Gearbox is connected to a **Constant Speed Propeller**. This means that you set a certain propeller speed on the flight deck with your “**Condition Levers**” and the constant speed system will keep the set value at all times regardless of power input.

To be able to do that the propeller angle will vary, depending on the engine power output. (E.g. **TRQ** – engine *torque*).

On Flight Deck, you are in the case of a P&W Dash-8 engine, faced with two sets of levers on the “Power Lever Quadrant”:

- **Power Levers**
- **Condition Levers**

Power Levers:

(Never ever use the word “Throttles” – this is reserved for combustion engines found on e.g. a vintage Douglas. DC-3)

With the Power Levers you set:

- Engine *Torque* (= engine power output) referred to as TRQ
- Reverse Thrust

The actual PL quadrant has a safeguard lock at **Flight Idle** which is the minimum position during all flight phases (to use anything lower in flight than Flight Idle usually means sudden death).

Unfortunately there are no such safeguard in your FS2002 so beware!

Condition Levers (CL):

Just another word for “Propeller Levers”, renamed in turboprops, as they perform a more complex task than an ordinary “Propeller Lever”.

With the Propeller Levers you set:

- Propeller Angle between Start & Feather position and Max Propeller RPM
- Fuel OFF and Fuel ON at engine shutdown respective start-up.

How do they interact?

At engine start:

When you set the **CL** to Start & Feather position fuel will be introduced into the Gas Generator and Propellers will be in **Feathered** position.

Feathered means the propeller blades are angled 90 degrees from the aircraft's fore and aft direction and thus will not give any forward thrust.

There is however some forward thrust from the engine exhaust pipes but it is too little to make the plane move forward. In flight it contributes to approximately 5% of the total thrust.

You should remain with propellers feathered until ready for taxi.

It is less noisy and also you will not blow away any late boarding passengers.

When ready for pushback:

If you have parked too close to the gate it is possible to reverse the aircraft out!

To do this with the PSS Dash-8:

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- With Condition Levers in full forward position move the Power Levers back into the REVERSE range. (Use F2 repeatedly in FS2002)

The aircraft will then like in real life reverse slowly!

But be careful – there will be a severe wind thrust in front of you that will blow away any light object in its way!

- When you have enough distance to taxi forward free of obstacles, stop the motion by setting the **PL** back to Ground Idle.
- Do NOT use the brakes as this will/can result in “tail-tipping”, that is the rear part will hit the ground and you will lose your job.

The above procedure is sometimes prohibited by your company's FOM (Flight Operation Manual) - but what the heck – you have to get out and no towing equipment available.

Taxi:

This is accomplished with Condition Levers fully forward. (Minimum prop pitch position)
Keep the speed with the Power Levers – only small adjustments are necessary.

Take-Off:

This is accomplished with Condition Levers fully forward. (Minimum prop pitch position)
The power in takeoff is set by the Power Levers to match the “bug” in the TRQ gauges.
To do that the knob on the **ENGINE ECU** panel must be set to **TOP** (Take-off Power)

Why?

It assures you maximum power available if one engine quits on you.

A bit noisier, but safe, and the ONLY procedure for take-off.

In the real aircraft there is a CONFIG WARNING system that will almost scare you to death if you ever consider a takeoff without props in full fine.

This system is automatically “armed” and triggered by the Power Levers.

The CONFIG warning comes on as well if the Parking Brake is set or if the flaps or trims are not in the takeoff range. Not implemented (yet) in the PSS Dash-8.

Climb:

At the proper altitude, 1000 feet AGL, you must reduce to Climb Power.

This is how you do (in PSS Dash-300):

- Set the **Engine ECU selector knob** towards **MCL** (Max Climb Power)
- Reduce slowly your **Condition Levers** to get **1150 RPM** on the Prop gauges.
- Follow up with **Power Levers** to adjust TRQ according to the bug.

Watch out so your Engine TRQ does not exceed the redline (106%) when adjusting power.

Reduce **Power Levers** throughout the whole climb to meet the “bug” value in the TRQ gauges. The ECU computer will continuously recalculate and reposition the bug in the climb so the power needs close attention.

The propeller system *constant speed feature* will interact and vary the propeller blade angle a bit to maintain the set 1050 RPM at all times until you desire to change it with the prop levers again.

When you reduce power with the Power Levers the propellers needs to reduce blade angle (*cut thinner slices of air*) to maintain the 1050 RPM and your speed will thus decrease.

If you give more power by advancing the Power Levers, the propeller system is able to *cut thicker slices of air* and will push the propellers to a coarser angle thus increasing your speed.

Note:

Some operators use 900 RPM for climb and cruise when possible due to passenger comfort (quieter).

There are no big performance differences between the two methods in real life.

The ECU works only in TOP mode in some operator’s aircraft among these is e.g. SAS Commuter.

Cruise:

At level flight, switch the Engine ECU to **MCR** (Max Cruise) and adjust the Power Levers according to the “bug” in the TRQ gauges.

Descent:

Is performed with Prop Cruise setting, 1050 RPM, but you need to reduce power in order not to exceed **MMO** – which is shown by the red and white “barber pole” in your speed indicator.
MMO = Maximum Operating Speed

The “barber pole” will move during climb and descent since the **MMO** speed varies with aircraft altitude.

A violation will activate the OVERSPEED warning horn in the real aircraft.
(Not yet in the PSS Dash-8)

When descending from high altitude it is important to plan the Rate of Descent so the cabin rate of descend will not be more than 500 feet/min.

The Dash-8 Max Cabin Differential is only 5.5 psi so with a continuous 3-4000 fpm RoD from FL250 you might get into trouble. Always monitor the Cabin RoD on the pressurisation panel (overhead) when descending from high altitude.

Failure to adhere will result in broken eardrums and possibly also result in a new job further away from flightdeck.

Approach:

On Final Approach, latest when you select Flaps 35 at 500 feet, you have to set **Condition Levers** in the **fully forward position** again.

If you don't do that, you will not be able to use reverse after landing.
Equally important is that you would have extra workload if you have to make a go-around.

Landing:

After landing you pull back the Power Levers into Reverse as needed.
(Remember the repeated presses on the F2 button on your PC keyboard)

You should move out of reverse range latest at 50 knots to avoid sucking in loose objects or ice and snow into the propeller and engine intakes.

(To move out of reverse in FS2002 just push your throttle a tiny bit forward and back again.)

Finally

I hope this little explanation have been useful for you, if not just use the “Waste Bin”.

If you need some nice FS2002 scenery for testing it all out – take a look at our website

www.swedflight.com

I strongly suggest both **SwedFlight Pro Pack 1 and Pack 2** since together they will give two stunningly beautiful “short 10 minutes hops”.

Takeoff VMC from ESSA **Stockholm-Arlanda** to ESSB **Stockholm-Bromma** City Airport overflying our beautiful capital and enjoy full photo real, hires scenery over the City.

Another short and beautiful “10 min hop” is available with Pack 1 together with our free customer bonus, The Copenhagen Intl. Airport scenery.

Takeoff at ESMS **Malmoe-Sturup** for a scenic sea crossing and land at EKCH **Copenhagen-Kastrup**, both replicated down to the tiniest detail.

Happy Flying,
Bjorn

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