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DEPARTMENT OF AEROSPACE ENGINEERING

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Course	:	**23ASB201 - Aerospace Propulsion**			

UNIT III - FUNDAMENTALS OF GAS TURBINE ENGINES

Comparative Study of Turboprop Vs. Turbojet Engines

Turboprop Advantages

1. More efficient & more cost-effective for short distances

A turboprop engine is more lightweight than a jet, giving it better performance during takeoff. It runs more efficiently while providing a higher power output per unit of weight than a jet. Expect optimum fuel efficiency when flying at low altitudes (ideally below 25,000 feet).

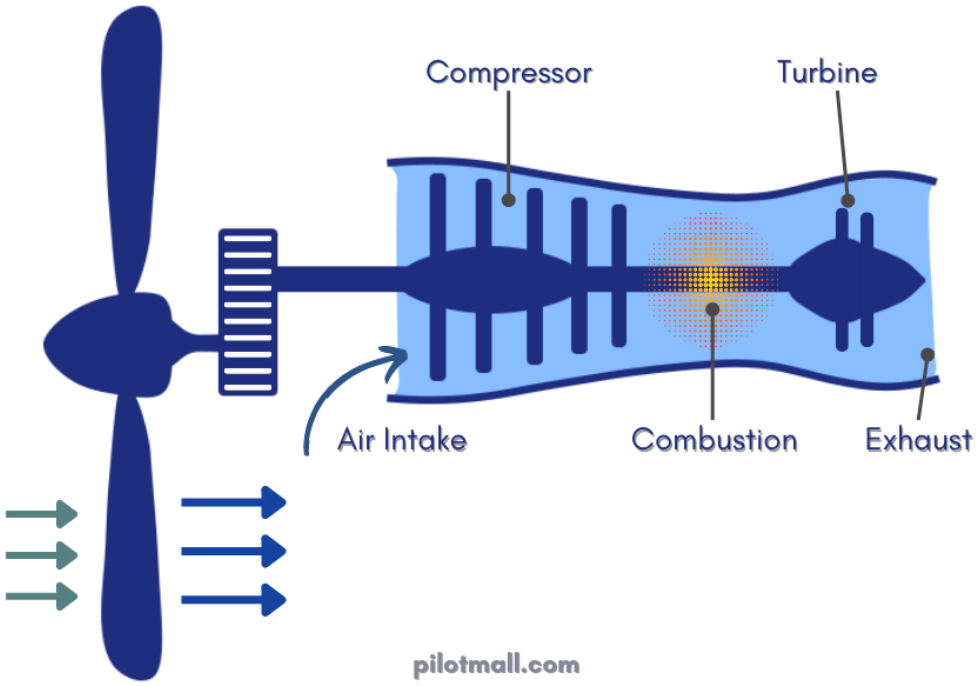
2. Able to take off and land on shorter and non-concrete runways

A turboprop has a clear advantage over a jet if your travel plans include destinations with shorter, less highly improved runways. Turboprops can land on runways as short as 3,200 feet compared to an average jet minimum of 5,000 feet. Turboprops can also handle the grass airfields that jets must avoid. This means that with a turboprop, you can get into some of the most hard-to-reach airports.

3. Lower charter, insurance, operation and maintenance costs

The overall cost of a turboprop is lower than a jet both for chartering and for owning. Fewer moving parts in a turboprop engine make it more reliable and less likely to require extensive maintenance. Since turboprops burn less fuel per hour than jets, their hourly operation cost is lower.

Turboprop Engine



Turboprop Disadvantages

1. Slower cruising speed

Since turboprops have a slower maximum efficient cruising speed—up to an average of 300 knots indicated airspeed (KIAS) depending on the aircraft—expect your overall flight time to be longer than it would be with a jet. Although the hourly cost of a turboprop is lower, since the slower speed makes the flight time longer, at some point with a longer-distance flight, the cost savings will be offset.

2. Lower cruising altitude

Turboprops typically have an altitude ceiling of 25,000-30,000 feet. If you run into turbulence or inclement weather conditions at this altitude, a turboprop won't be able to avoid them by climbing to a higher altitude like a jet can. This may make for a bumpy and uncomfortable ride.

3. Shorter range

Turboprops' slower cruising speed and lower cruising altitude equates to shorter range even factoring in improved efficiency. This means that while turboprops are great for short and mid-range flights, they are not designed for long-distance travel. Expect an average range of around 1,000-1,300 miles.

Jet Advantages

1. Capable of cruising at higher altitudes

The average light jet will cruise at an altitude of 41,000 feet and is capable of a maximum altitude of 45,000 feet. This is substantially higher than the turboprop's 30,000-foot ceiling and can mean the difference between a smooth, comfortable flight and a flight marred by repeated patches of turbulence.

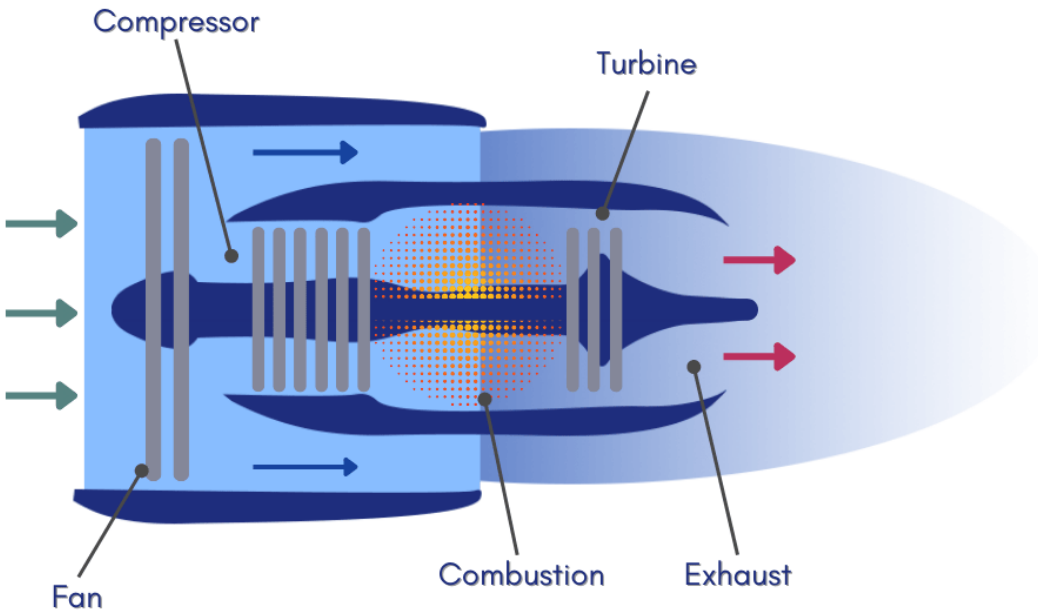
2. Faster and quieter

Expect to arrive at your destination faster in a jet than you would in a turboprop. Light jets have average cruising speeds of between 370 and 450 knots. The jet engine design also provides a quieter cabin than a turboprop.

3. Longer range

Thanks to their faster cruising speeds and ability to fly at higher altitudes where their efficiency is improved, light jets are capable of an extended range from 1,600 to over 2,000 miles. This makes them the aircraft of choice for mid-to-long-range flights.

Jet Engine



Jet Disadvantages

1. Less efficient & less cost-effective for short distances

Jets are at their most efficient when operating at faster speeds and higher altitudes. During takeoff, at slower speeds, and lower altitudes, turboprops are more efficient. This means that for short flights with less time spent at cruising altitude, a jet will be less efficient and will cost more per hour than a turboprop.

2. Require longer, concrete runways

Jets may do well with flying into standard airports, but if you want to explore a more remote area with a short runway or unimproved grass airstrip, you will be out of luck with a jet. On average, jets need a paved runway at least 5,000 feet long. By contrast, many turboprops can land on a 3,200-foot grass strip.

3. More expensive to charter, insure, and maintain

In 2016, the Aircraft Owners and Pilots Association (AOPA) published a detailed breakdown of hourly operating costs for both jets and turboprops. Across the board, jet aircraft were consistently more costly than turboprops. The additional moving parts and relative complexity of a jet engine vs a turboprop make maintenance costs higher as well.

Turboprop vs. Turbofan Engine

- Medium Speed
- High Efficiency
- Geared Transmission

- High Speed
- Low Efficiency
- High Temp

Speed and Fuel Burn

The differences between a jet engine and a turboprop engine in terms of speed and fuel consumption can depend on various factors, such as the particular aircraft make and model, its design, and the environmental conditions.

Speed

Typically, jets are faster than turboprops: jet engines produce thrust by expelling a powerful stream of exhaust gases that makes it possible to attain higher speeds; commercial jetliners may reach velocities between 500-600 knots (575-690 mph) or even beyond Mach 1. On the other hand, turboprop engines are generally created to achieve lower speeds–commonly seen in regional airliners and smaller aircraft–which usually range from 200-400 knots (230-460 mph).

Fuel Burn

In terms of fuel burn rate, jets tend to be more inefficient than turboprops. Jet engines are designed for high performance and velocity, causing them to consume more fuel; although the exact amount will depend on several factors like the model, weight, size of the plane, and its path through the sky. Comparatively, turboprops are usually more economical at lower altitudes and speeds; thus, they're often employed for shorter regional trips due to their fuel efficiency.

That said, these are general trends; certain models, technologies, or configurations can influence both jet and turboprop engines' speed and fuel consumption features.

Feature	Turboprop Engine	Turbojet Engine
Thrust Generation	Primarily through a propeller driven by a gas turbine	Primarily through high-velocity exhaust gases
Speed & Altitude	Optimized for lower speeds and altitudes	Optimized for high-speed flight and high altitudes
Fuel Efficiency	More fuel-efficient at lower speeds and altitudes	Less fuel-efficient at subsonic speeds compared to turboprops
Applications	Regional airlines, commuter aircraft, and short-distance flights	Military aircraft, high-speed civilian aircraft
Takeoff/Landing	Requires less runway length	Requires longer runway length
Cost	Lower operating and maintenance costs	Higher operating and maintenance costs