SNS COLLEGE OF TECHNOLOGY

Turboprop Engine

Lecture – 4

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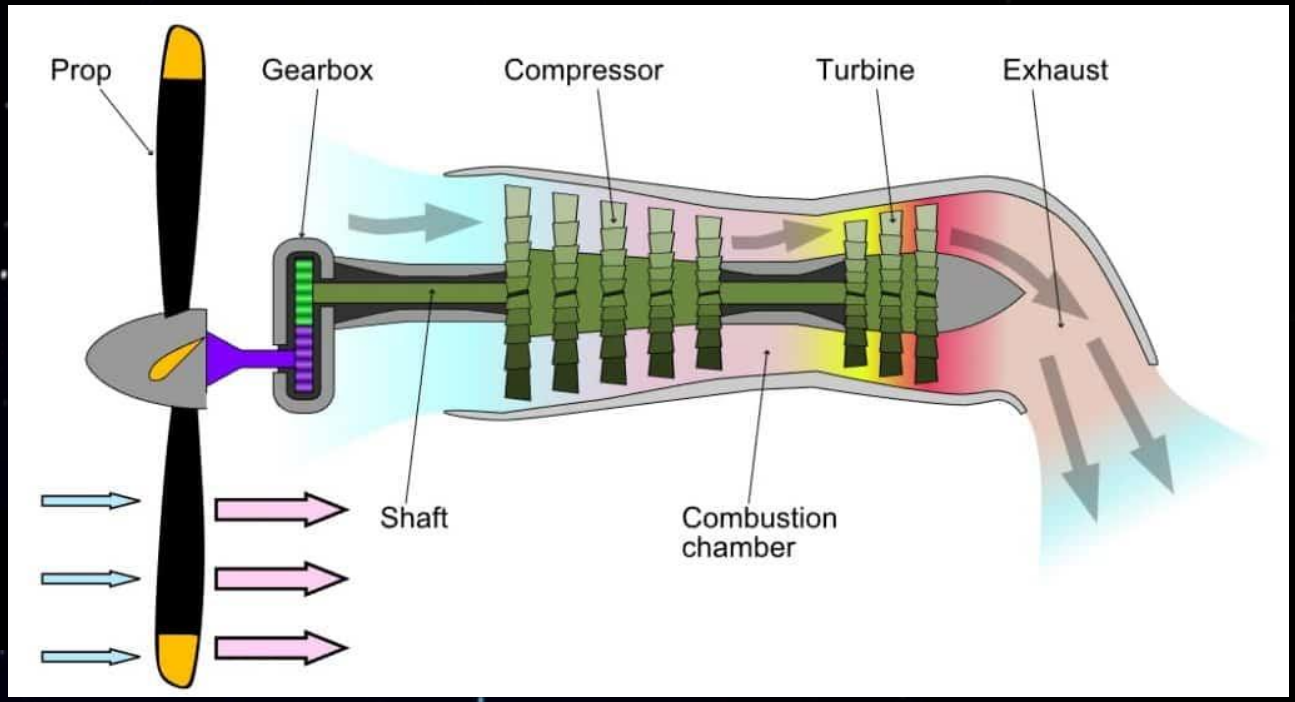
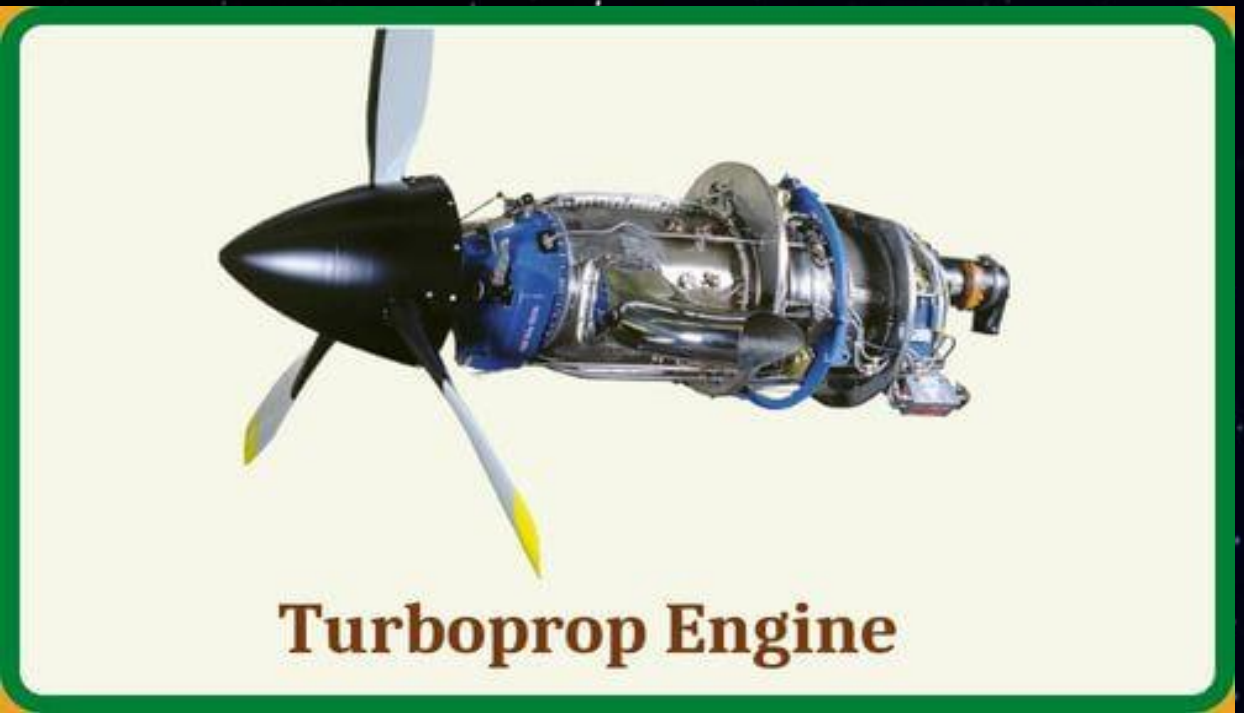
Introduction

- A turboprop engine is a turbine engine that drives a propeller through a reduction gear. The exhaust gases drive a power turbine connected by a shaft that drives the reduction gear assembly.
- Many low speed transport aircraft and small commuter aircraft use **turboprop** propulsion.
- The turboprop uses a gas turbine core to turn a propeller. As mentioned on a previous page, propeller engines develop thrust by moving a large mass of air through a small change in velocity. Propellers are very efficient and can use nearly any kind of engine to turn the prop (including humans!). In the turboprop, a gas turbine core is used.

Process





Model Turboprop Engine

Working principle

- There are two main parts to a turboprop propulsion system, the core engine and the propeller. The core is very similar to a basic turbojet except that instead of expanding all the hot exhaust through the nozzle to produce thrust, most of the energy of the exhaust is used to turn the turbine.
- There may be an additional turbine stage present, as shown in green on the diagram, which is connected to a drive shaft. The drive shaft, also shown in green, is connected to a **gear box**.
- The gear box is then connected to a propeller that produces most of the thrust. The exhaust velocity of a turboprop is low and contributes little thrust because most of the energy of the core exhaust has gone into turning the drive shaft.

Compression process

- The exhaust gases also contribute to engine power output through thrust production, although the amount of energy available for thrust is considerably reduced.
- Two basic types of turboprop engine are in use:

1. fixed turbine 2. free turbine.

- The fixed turbine has a mechanical connection from the gas generator (gas-turbine engine) to the reduction gear box and propeller.
- The free turbine has only an air link from gas generator to the power turbines. There is no mechanical link from the propeller to the gas turbine engine (gas generator).

Structural assembly

The typical turboprop engine can be broken down into assemblies as follows:

1. The power section assembly—contains the usual major components of a gas turbine engine (i.e., compressor, combustion chamber, turbine, and exhaust sections).
2. The reduction gear or gearbox assembly—contains those sections unique to turboprop configurations.
3. The torquemeter assembly—transmits the torque from the engine to the gearbox of the reduction section.
4. The accessory drive housing assembly—mounted on the bottom of the compressor air inlet housing. It includes the necessary gear trains for driving all power section driven accessories at their proper rpm in relation to engine rpm.

Applications

- Because propellers become less efficient as the speed of the aircraft increases, turboprops are used only for low speed aircraft like cargo planes.
- High speed transports usually use high bypass turbofans because of the high fuel efficiency and high speed capability of turbofans. A variation of the turboprop engine is the turboshaft engine.
- In a **turboshaft engine**, the gear box is not connected to a propeller but to some other drive device. Turboshaft engines are used in many helicopters, as well as tanks, boats, and even race cars in the late 1960's