SNS COLLEGE OF TECHNOLOGY

Turbofan Engine

Lecture – 3

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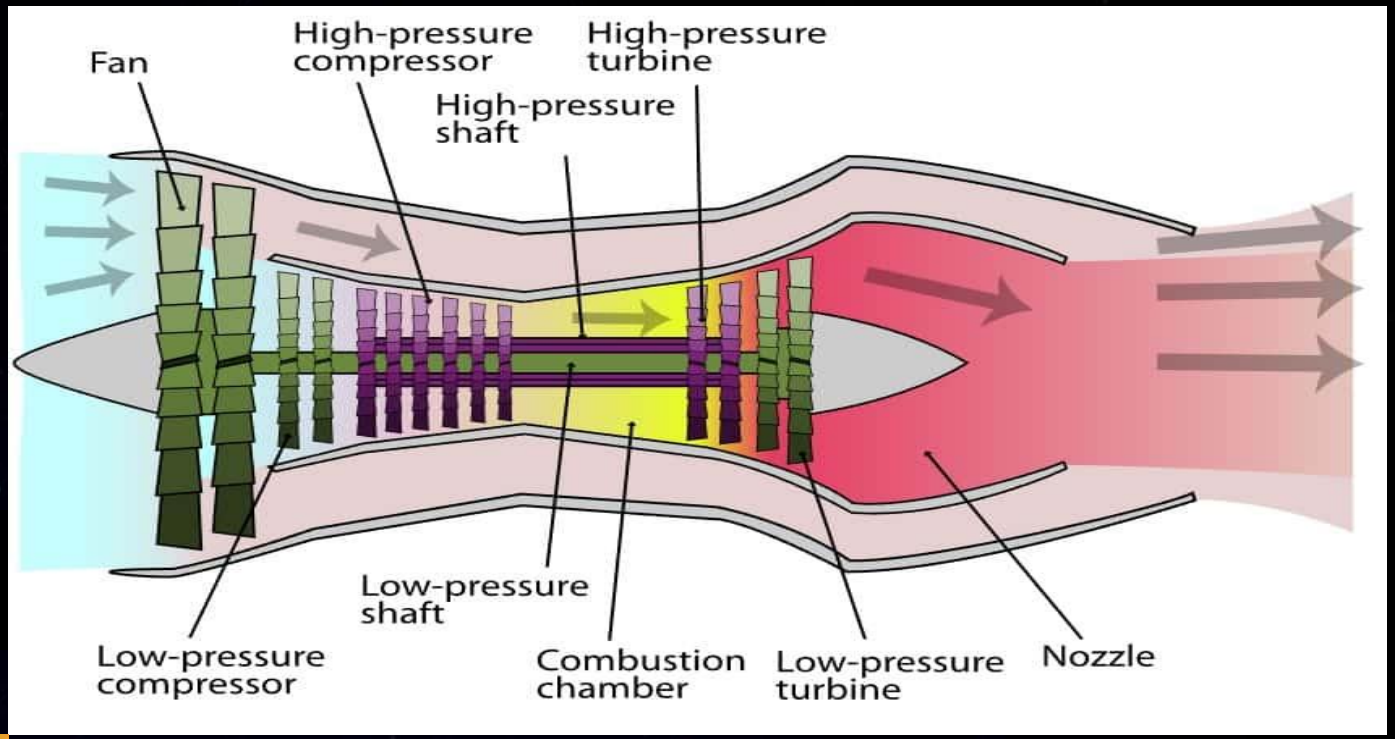
Introduction

- A turbofan engine is designed in such a way that it combines features and technology of.turboprop and turbojet engines.
- Turbofan engines are designed to create additional thrust by diverting a secondary airflow around the combustion chamber.
- It was developed to turn a large fan or set of fans at the front of the engine and produces about 80 percent of the thrust from the engine. This engine was quieter and has better fuel consumption in this speed range

Process



Model Turbofan Engine

Working principle

- The incoming air is captured by the engine inlet. Some of the incoming air passes through the fan and continues on into the core compressor and then the burner, where it is mixed with fuel and combustion occurs.
- The hot exhaust passes through the core and fan turbines and then out the nozzle, as in a basic turbojet. The rest of the incoming air passes through the fan and **bypasses**, or goes around the engine, just like the air through a propeller.
- The air that goes through the fan has a velocity that is slightly increased from free stream. So a turbofan gets some of its thrust from the core and some of its thrust from the fan. The ratio of the air that goes around the engine to the air that goes through the core is called the **bypass ratio**.

Compression process

- In the turbofan engine, the core engine is surrounded by a fan in the front and an additional turbine at the rear.
- The fan and fan turbine are composed of many blades, like the core compressor and core turbine, and are connected to an additional shafts. All of this additional blades called **turbomachinery**.
- As with the core compressor and turbine, some of the fan blades turn with the shaft and some blades remain stationary.

Combustion

- The fan shaft passes through the core shaft for mechanical reasons. This type of arrangement is called a **two spool** engine (one "spool" for the fan, one "spool" for the core.) Some advanced engines have additional spools for even higher efficiency.
- Because the fuel flow rate for the core is changed only a small amount by the addition of the fan, a turbofan generates more thrust for nearly the same amount of fuel used by the core.
- This means that a turbofan is very fuel efficient. In fact, high bypass ratio turbofans are nearly as fuel efficient as turboprops. Because the fan is enclosed by the inlet and is composed of many blades, it can operate efficiently at higher speeds than a simple propeller.

Applications

- Turbofans are found on high speed transports and propellers are used on low speed transports. Low bypass ratio turbofans are still more fuel efficient than basic turbojets.
- Many modern fighter planes actually use low bypass ratio turbofans equipped with afterburners.
- They can then cruise efficiently but still have high thrust when dogfighting. Even though the fighter plane can fly much faster than the speed of sound, the air going into the engine must travel less than the speed of sound for high efficiency. Therefore, the airplane inlet slows the air down from supersonic speeds.