



SNS COLLEGE OF TECHNOLOGY
(Autonomous)
DEPARTMENT OF AERONAUTICAL ENGINEERING



UNIT-3

PISTON AND JET ENGINES



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JET ENGINES

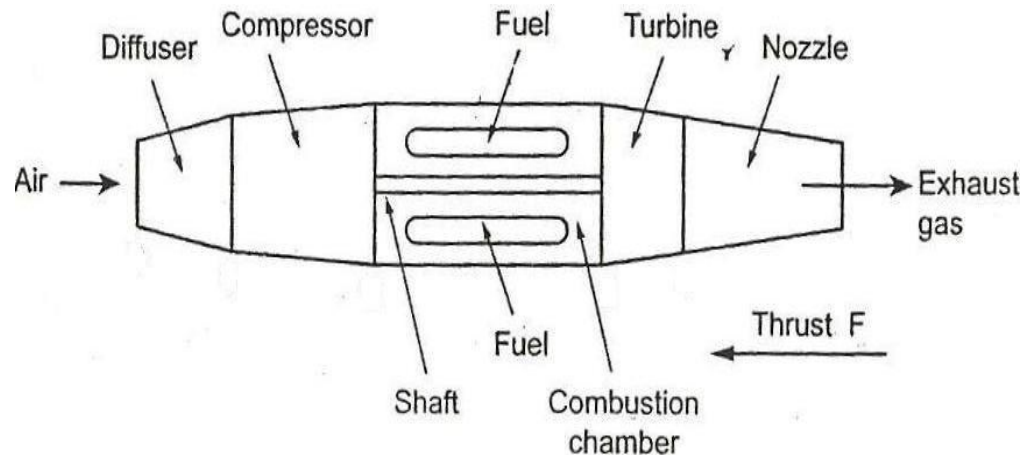


TURBOJET ENGINE

- The most common type of air-breathing engine is the Turbojet engine.

Construction

- The construction of turbojet engine is shown in Fig.



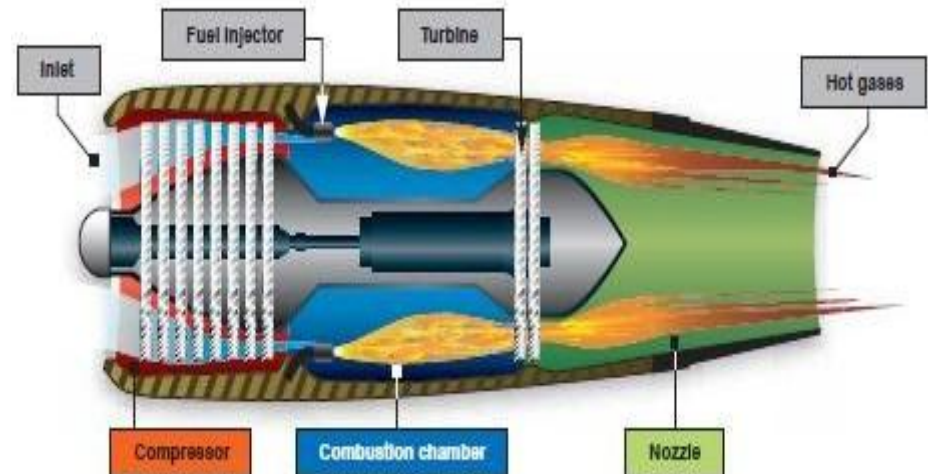


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It consists of:

- Diffuser.
- Rotary compressor,
- Combustion chamber,
- Turbine
- Exhaust nozzle





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- The function of the diffuser is to convert the kinetic energy of the entering air into pressure energy.
- The function of the nozzle is to convert the pressure energy of the combustion gases into kinetic energy.



Working

- Air from the atmosphere enters into turbojet engine. The air velocity gets reduced and its static pressure is increased by diffuser.
- Then the air passes through the rotary compressor in which the air is further compressed.
- Then the high pressure air flows into the combustion chamber. In the combustion chamber, the fuel is injected by suitable injectors and the air fuel mixture is burnt. Heat is supplied at constant pressure.
- The highly heated products of combustion gases are then enter the turbine and partially expanded.



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- The power produced by the turbine is just sufficient to drive the compressor, fuel pump and other auxiliaries.
- The hot gases from the turbine are then allowed to expand in the exhaust nozzle section.
- In the nozzle, pressure energy of the gas is converted into kinetic energy. So the gases coming out from the unit with very high velocity.
- Due to high velocity of gases coming out from the unit, a reaction or thrust is produced in the opposite direction. This thrust propels the air craft.
- Like ramjet engine, the turbojet engine is a continuous flow engine.
- Because of turbine material limitations, only a limited amount of fuel can be burnt in the combustion chamber.



Advantages, Disadvantages, Applications

Advantages

- Construction is simple.
- Less wear and tear.
- Less maintenance cost.
- It runs smoothly because continuous thrust is produced by continuous combustion of fuel.

Disadvantages

- Fuel consumption is high.
- Costly materials are used.
- Sudden decrease of speed is difficult.
- Propulsive efficiency and thrust are lower at lower speeds.

Applications

- It is best suited for Piloted air-crafts, Military aircrafts, etc.

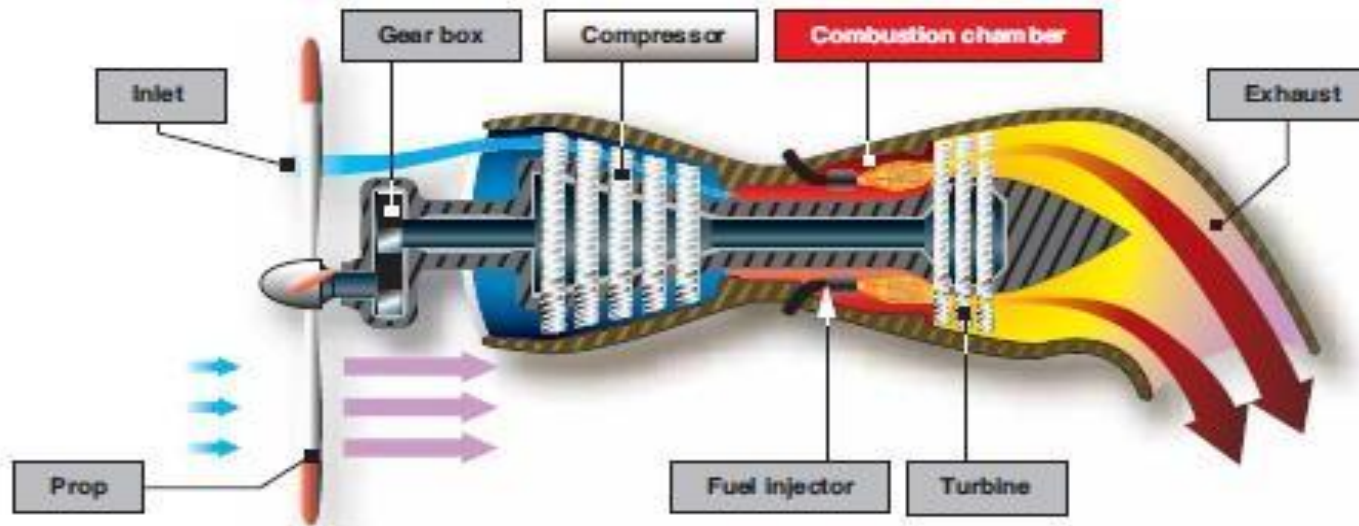
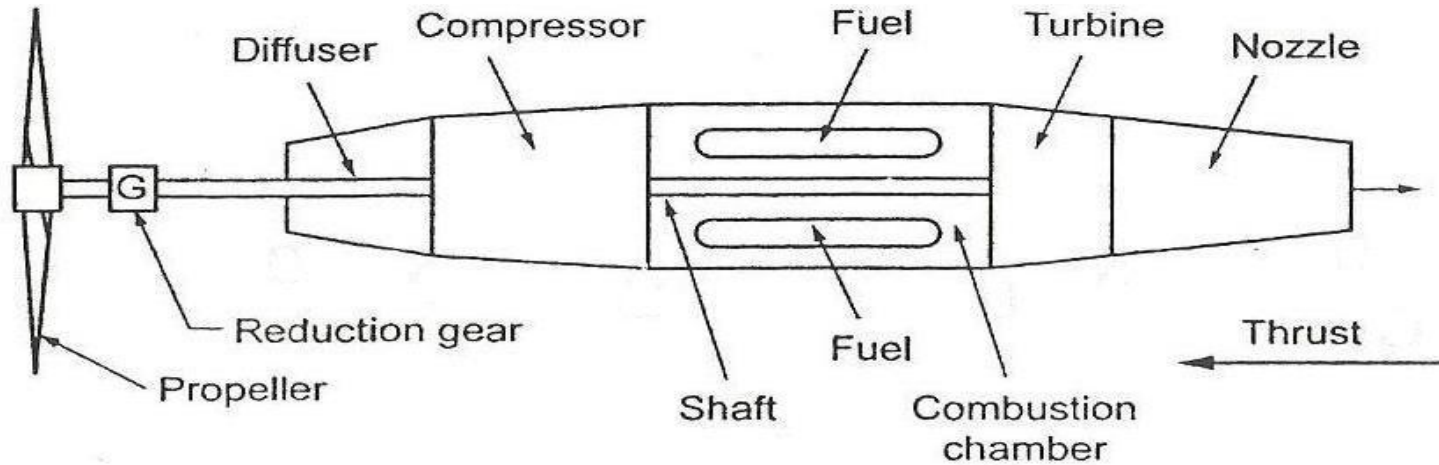


TURBO-PROP ENGINE (OR) TURBO-PROPELLER ENGINE

- The turboprop engine is an effort to combine the best features of **turbojet and propeller aircraft**. It is very similar to turbojet engine.
- Approximately 90% of thrust comes from propeller and about only 10% comes from exhaust gas.



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Construction

The construction of Turbo-Prop Engine is shown in Fig.

- It consists of:
- Diffuser
- Compressor
- Combustion chamber
- Turbine
- Exhaust nozzle
- Propeller
- The function of diffuser is to convert the kinetic energy of the entering air into pressure energy.
- The function of nozzle is to convert the pressure energy of the combustion gases into kinetic energy.
- The angular velocity of the shaft is very high. But the propeller cannot run at higher angular velocity. So a reduction gear box is provided before the power is transmitted to the propeller.



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Working

- Air from the atmosphere enters into turbo prop engine. The air velocity gets reduced and its static pressure is increased by diffuser.
- Then the air passes through the rotary compressor in which the air is further compressed. So, the static pressure of the air is further increased.
- Then the high pressure air flows into the combustion chamber. In the combustion chamber, the fuel is injected by suitable injectors and the air-fuel mixture is burnt. Heat is supplied at constant pressure.
- The highly heated products of combustion gases are then enters the turbine and partially (about 80 to 90%) expanded.



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Working

- The power produced by the turbine is used to drive the compressor and propeller.
- Propeller is used to increase the flow rate of air which results in better fuel economy.
- The hot gases from the turbine are then allowed to expand in the exhaust nozzle section.
- In the nozzle, pressure energy of the gas is converted into kinetic energy. So the gases coming out from the unit with very high velocity.
- Due to high velocity of gases coming out from the unit, a reaction (or) thrust is produced in the opposite direction.
- The total thrust produced in this engine is the sum of the thrust produced by the propeller and the thrust produced by the nozzle. This total thrust propels the air craft.



Advantages, Disadvantages, Applications

Advantages

- High take-off thrust.
- Good propeller efficiency at a speed below 800 km / hr.
- Reduced vibration and noise.
- Better fuel economy.
- Easy maintenance.
- Sudden decrease of speed is possible by thrust reversal.

Disadvantages

- The main disadvantage is, the propeller efficiency is rapidly decreases at high speeds due to shocks and flow separation.
- It requires a reduction gear which increases the cost of the engine.
- More space needed than turbojet engine.
- Engine construction is more complicated.

Applications

- The turbo prop engine is best suited for commercial and military aircraft operation due to its high flexibility of operation and good fuel economy.