SNS COLLEGE OF TECHNOLOGY

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Coimbatore – 35

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DEPARTMENT OF AEROSPACE ENGINEERING

19ASO301 BASICS OF AERONAUTICAL ENGINEERING

UNIT 4 – AIRCRAFT POWER PLANTS

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UNIT 4 – AIRCRAFT POWERPLANTS

- *Power Plant*
- *Reciprocating Engine*
- *Gas Turbine Engine*
- *Ramjet Engine*
- *Propeller*
- *Comparison - Helicopter & Airplane*
- *Rocket – Principle & Operation*

TEXT BOOK

- ***Anderson. J D, "Introduction to Flight", McGraw-Hill, 1995***

- ***Richard S. Shevel, "Fundamentals of Flight", Prentice Hall, 2010***

Gas Turbine Engine-Turbojet

TURBOJET ENGINES

- *The thrust of a turbojet engine is developed by compressing the free stream air in the compressor.*
- *After compressions, high pressure air enters the combustion chamber, where fuel is mixed at high pressure.*
- *The combusted gases pass through set of nozzles before impinging the turbine and then exit through nozzle*
- *Turbojet engines are most suitable for speeds above 800 km/hr and up to 3.0 mach numbers*

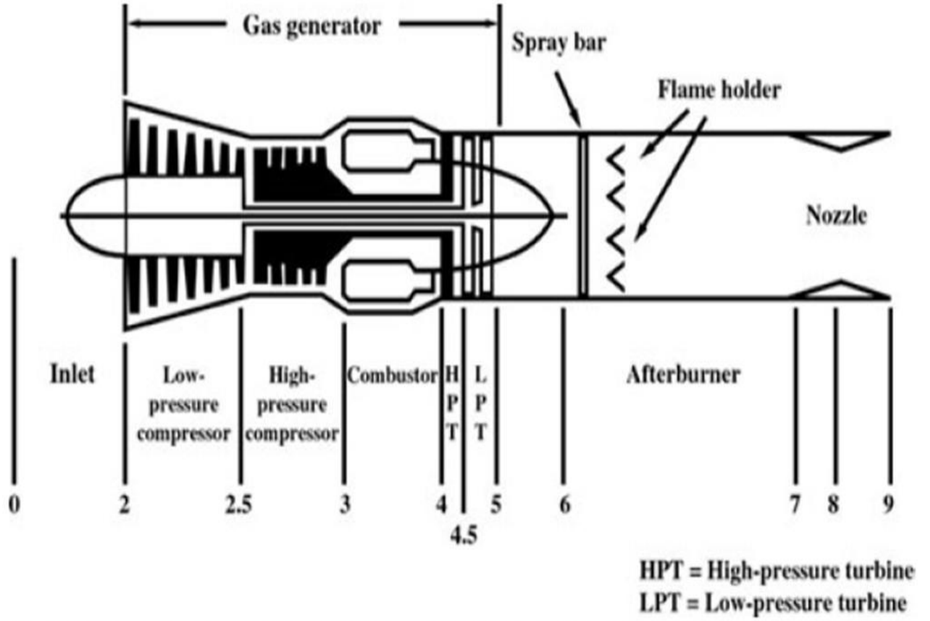
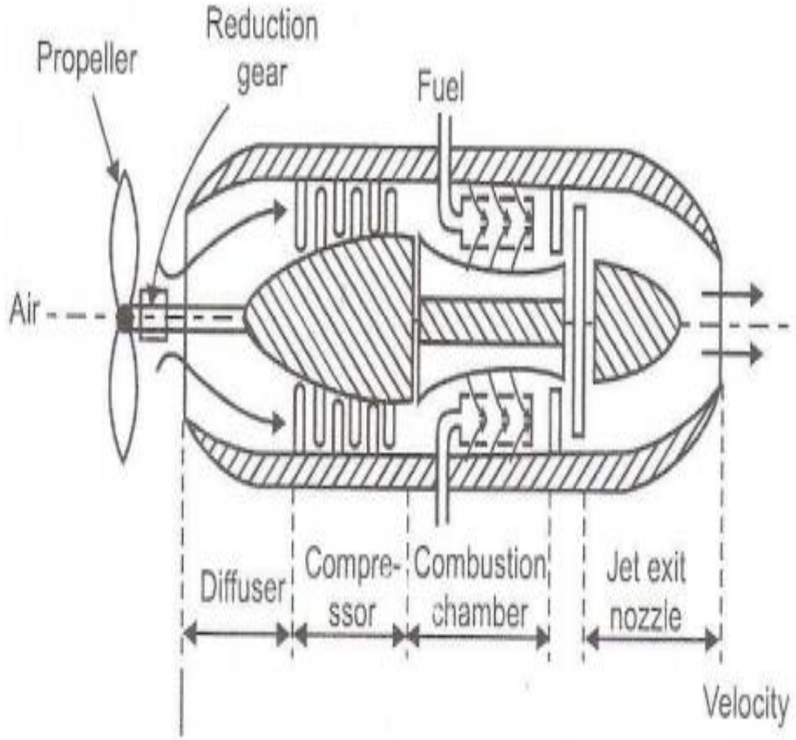


Figure 1. Conventional Gas Turbine Engine Station Numbers

Gas Turbine Engine-Turboprop

TURBOPROP ENGINE:

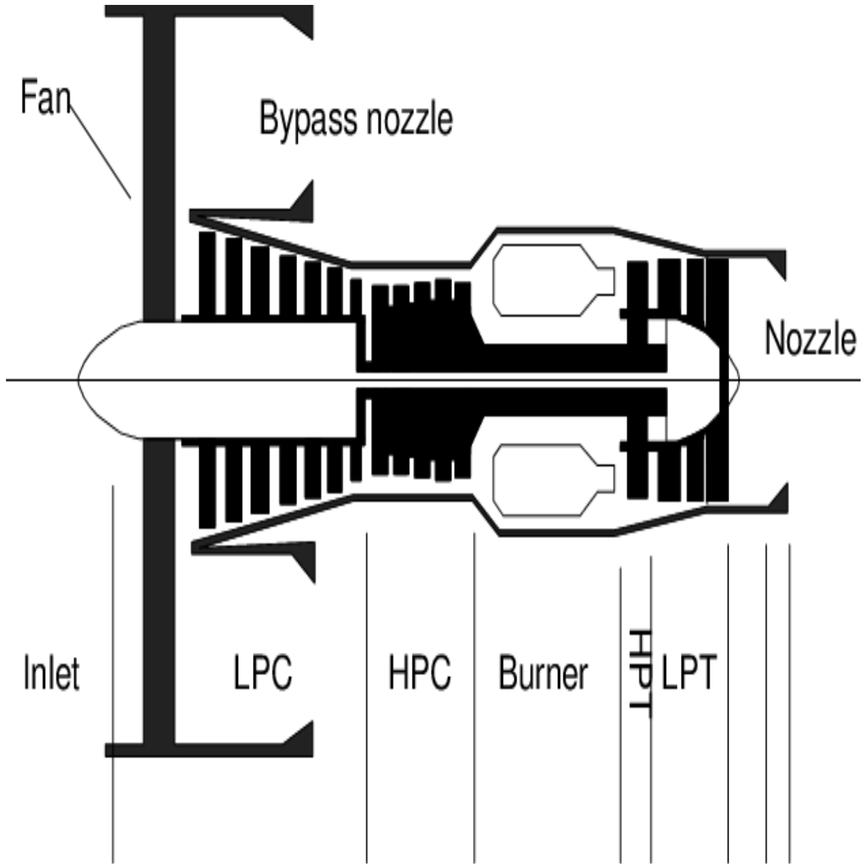
- *Turboprop engine – Propeller driven by a Gas Turbine.*
- *Turboprop engine provides high thrust per unit mass of fuel burnt. It offers better fuel economy.*
- *The propeller displaces a large mass of air rearwards, thereby generating thrust.*
- *In general, Turboprop is used in low speed & small aircrafts.*



Gas Turbine Engine-Turbofan

TURBOFAN ENGINE

- *Turbofan engine is designed as a compromise between Turbojet and Turboprop engines. The turbofan engine consists of a fan larger in diameter than the compressor driven by the turbine.*
- *The fan bypasses free stream air around the primary engine. Two streams of air flow through the engine, primary airstream pass through the compressor and is delivered to the combustion chamber at high pressure to mix with fuel.*
- *The hot and cold streams may be expanded through separate nozzles or combined together through a single nozzle.*



Gas Turbine Engine-Components

Compressor: *Compressor is a mechanical device that increases the pressure by reducing its volume.*

Combustion Chamber: *Fuel is mixed with the compressed air inside the combustion chamber, which increases the internal energy of the gas, which translates into an increase in temperature, pressure or volume.*

Nozzle: *A nozzle is a device designed to control the direction and increase the velocity of a fluid.*

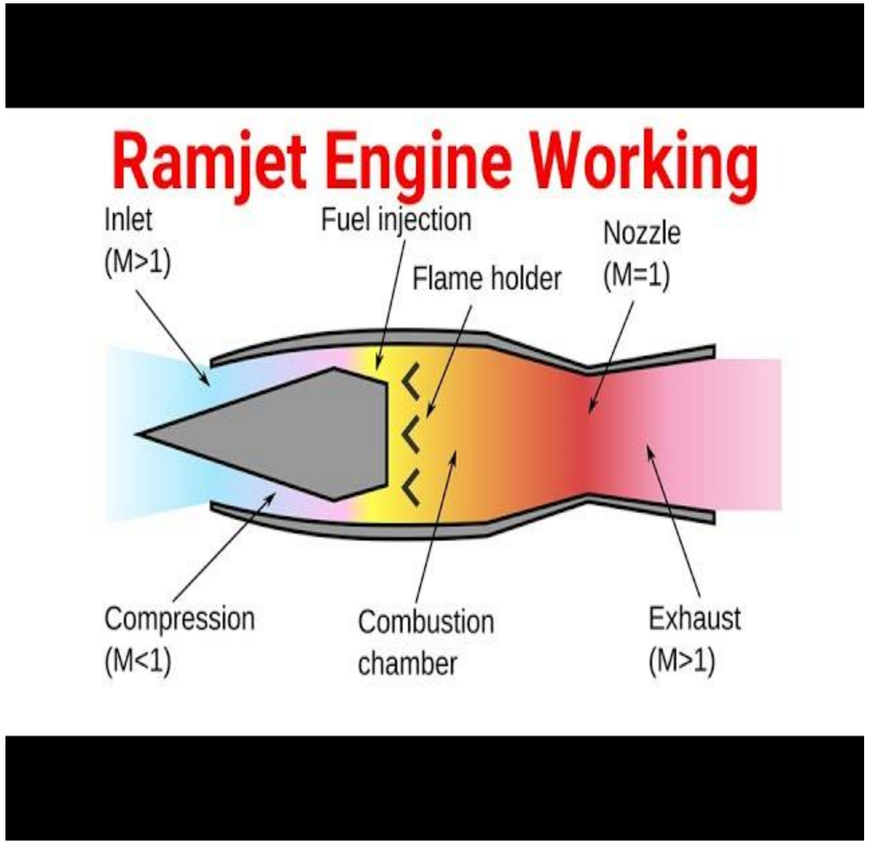
Gas Turbine Engine-Components

Turbine: *Turbine is a mechanical device made up of three major components viz. rotor, nozzle and blade. Blades are fixed on to the rotor. Hot gases from the combustion chamber pass through the nozzle and impinge on the turbine blades at a very high velocity, which in turn rotates the turbine rotor at a very high RPM*

Gear Box: *Gear box is a mechanical device through which, power developed by the engine is transmitted to the propeller.*

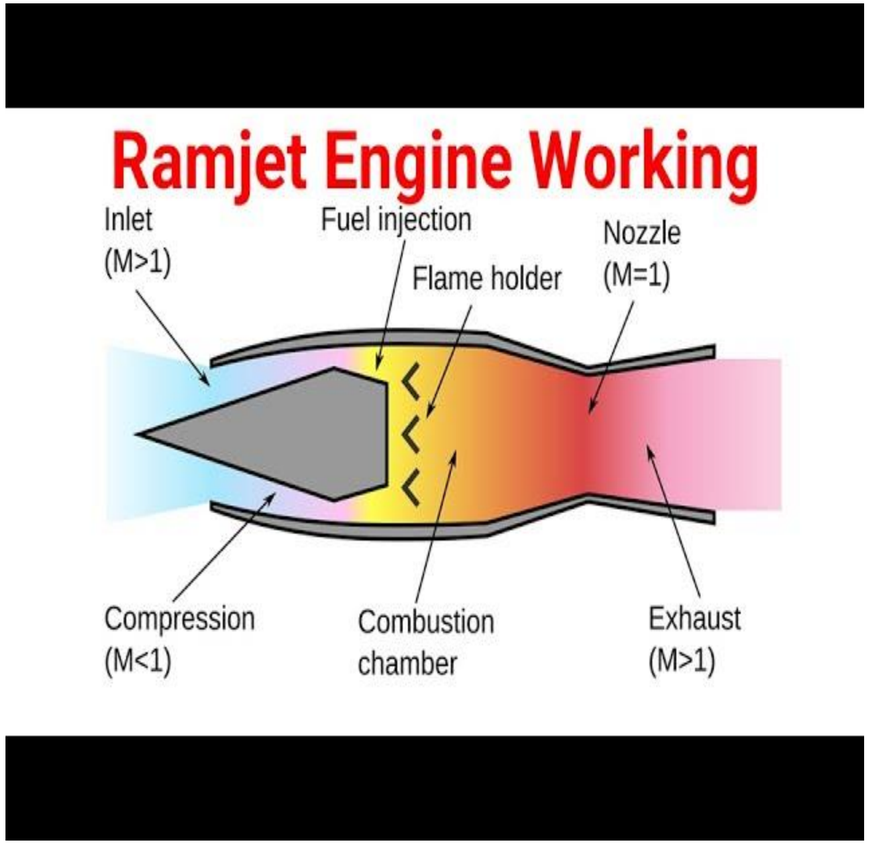
Ramjet Engine

- *Ramjet Engine consists of a Inlet Diffuser, Combustion Chamber and nozzle section.*
- *Does not have rotating components and hence the losses are minimal.*
- *At the inlet diffuser, inlet velocity of the incoming air is reduced.*
- *Air is subsequently combusted in the combustion chamber.*



Ramjet Engine

- *Combusted gases are discharged through exhaust nozzle at a very high velocity.*
- *Because of the simplicity in design and high thrust, Ramjets have fascinated Aerospace Engineers.*
- *They are not used in aircrafts view safety issues.*
- *Used predominantly in guided Missiles*
- *May be used in Hypersonic aircrafts in future*



Propeller

- *Propeller converts the power generated by the engine into thrust.*
- *An aircraft propeller is a rotating wing that generates thrust to move an aircraft forward.*
- *Propellers can have fixed or variable pitch.*
- *Pitch is the distance moved by the propeller in one complete rotation*
- *High-pitched propellers produce more thrust than low-pitched propellers.*

Propeller

***Thrust**: Propellers create thrust, which is the force that moves an aircraft forward.*

***Aerodynamic device**: Propellers are aerodynamic devices that convert rotational energy from an engine into thrust.*

***Rotating wings**: Propellers are essentially rotating wings that produce lift and thrust.*