



# SNS COLLEGE OF TECHNOLOGY

Coimbatore-35  
An Autonomous Institution



Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade  
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

## DEPARTMENT OF AEROSPACE ENGINEERING

### 19AST101 – INTRODUCTION TO AEROSPACE ENGINEERING

#### I YEAR II SEM

#### UNIT-III GAS DYNAMICS

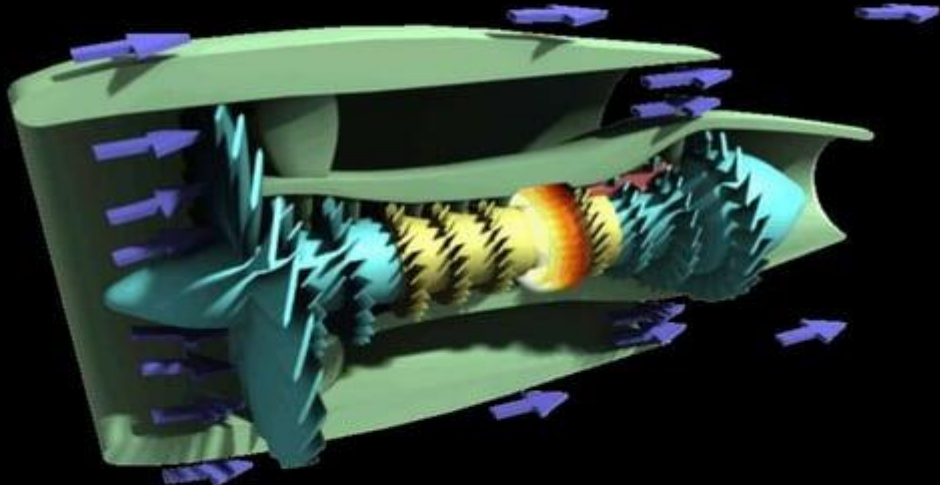
#### TOPIC: Illustration working of gas turbine engine

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# AIRCRAFT PROPULSION SYSTEM





# EXTRACT

- **Aircraft** is any craft that flies through the air, whether it be an airplane, helicopter, missile, glider, balloon, or any other vehicle that uses the air to generate lift for flight.
- **Propulsion** means the action of driving or pushing forward. [Jet propulsion](#) is used in the most of the Aircrafts.



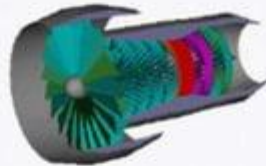


# EXTRACT

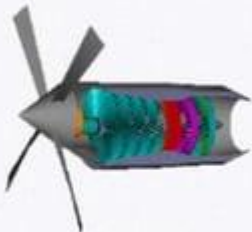
- Gas turbines are used for aircraft propulsion system because they are light and compact and have a very high power to weight ratio.



Turbojet



Turbofan



Turboprop

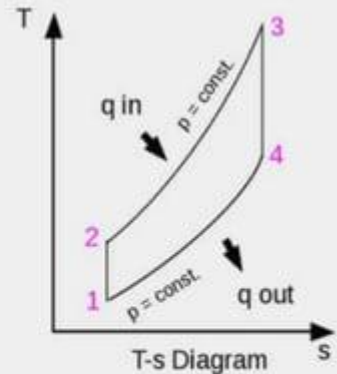
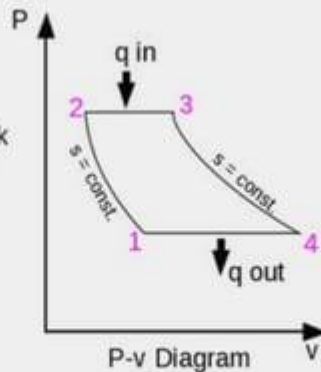
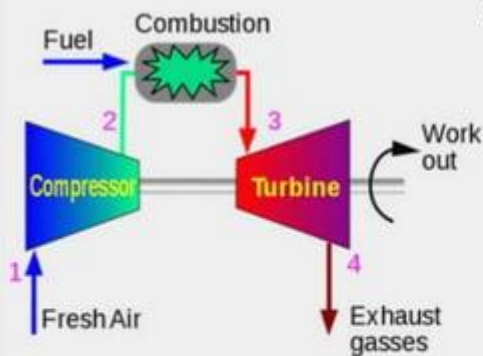


Afterburning Turbojet



# EXTRACT

- Aircraft gas turbines operates on an open cycle called “jet propulsion cycle”, which can be of turbojet engine, ramjet engine, turbofan engine or turboprop engine.

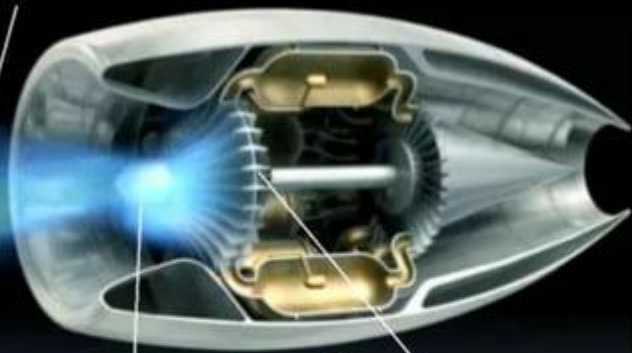




# EXTRACT

- High velocity air first flow through diffuser where it is decelerated increasing its pressure air is then compressed in the compressor.

High Speed Air



Diffuser

Compressor

Compressor

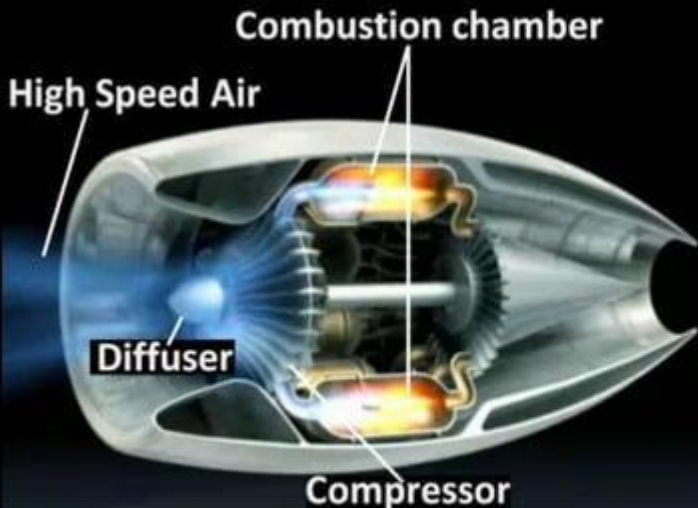
Diffuser





# EXTRACT

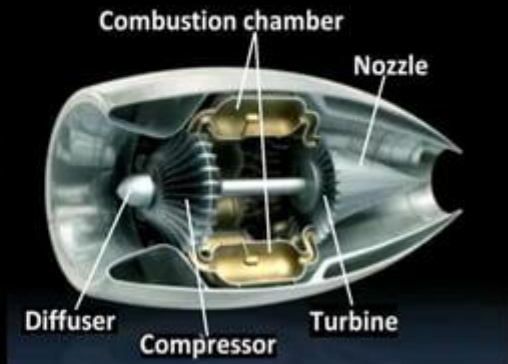
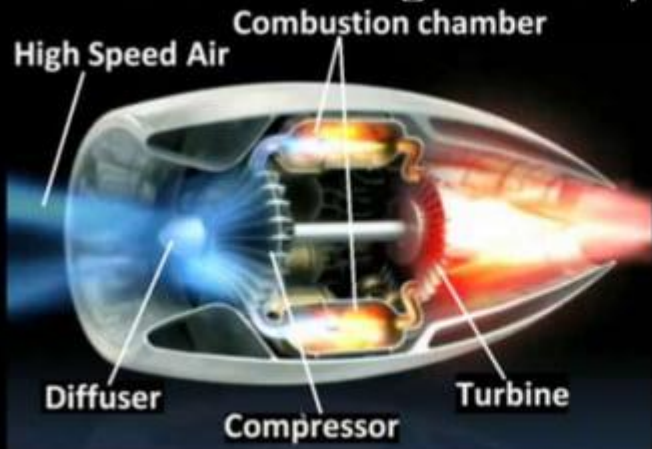
The air is mixed with fuel in the combustion chamber, where the mixture is burned at constant pressure .





# EXTRACT

- The high pressure high temperature combustion gases partially expand in the turbine producing enough power to drive the compressor and auxiliary equipment. Finally the gases expand in the nozzle to the ambient pressure and leave the aircraft at high velocity.







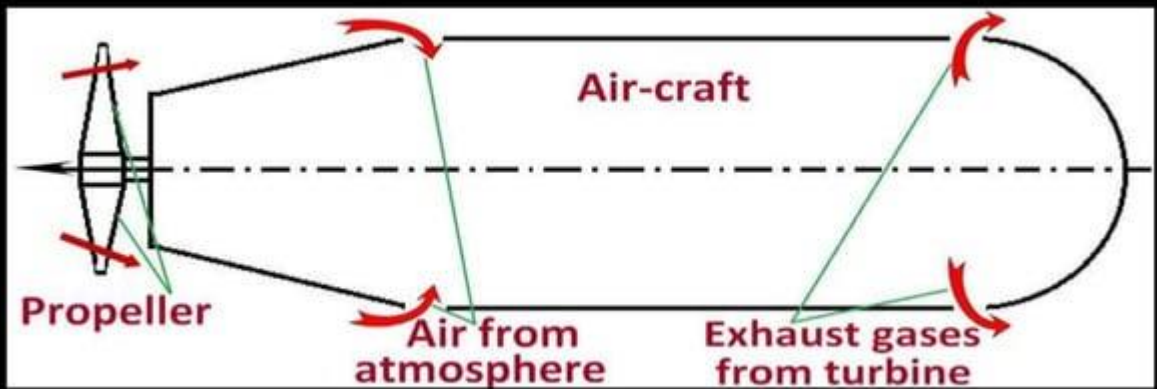
# Discussion

## -:JETPROPULSION SYSTEM:-

When the work output of the gas turbine plant is used to produce high velocity jet of hot gasses and this jet is used to propel (to push or move something with a lot of force) the vehicles in which the systems are mounted, such systems are known as **jet propulsion system** .



**Screw propeller** :- In this system, full expansion takes place in the turbine, and total power developed by turbine is used to drive the compressor and the propeller, power supplied to propeller is controlled by controlling the supply of fuel in the combustion chamber. The rate of efficiency of screw propeller is higher at lower speed but the efficiency falls rapidly at higher speed above the sonic velocity.

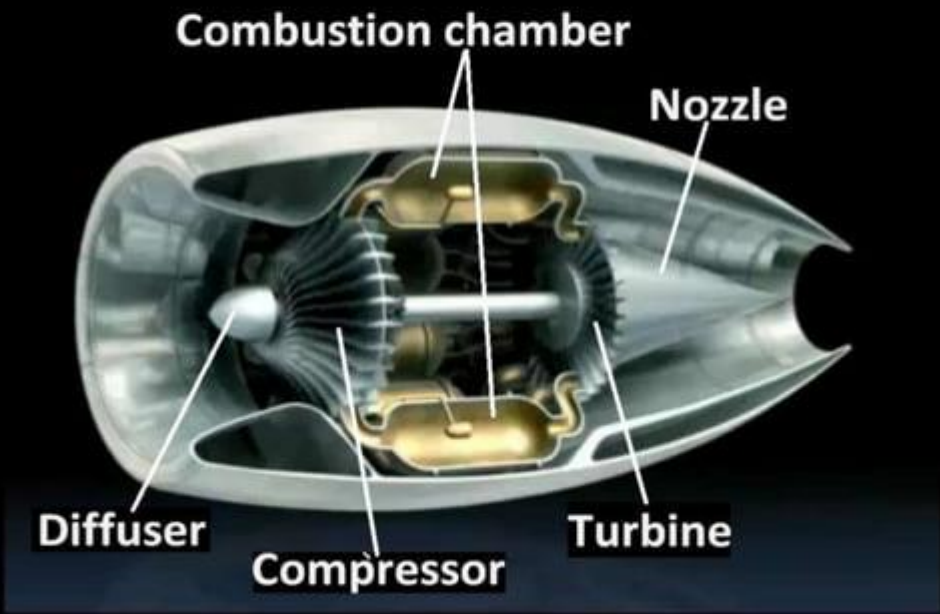




5. **Turbo-jet** :- In turbo-jet unit, the turbine of the gas turbine power plant produces just sufficient power to drive the compressor by partial expansion in the turbine. The gases coming out from turbine, which are at higher pressure than atmosphere are expanded in a nozzle and produce very high velocity jet which gives a forward motion to the air craft by the jet reaction. The turbo jet gives higher efficiency at higher speed and are the best suited to the aircraft travelling above 800 km/hr.

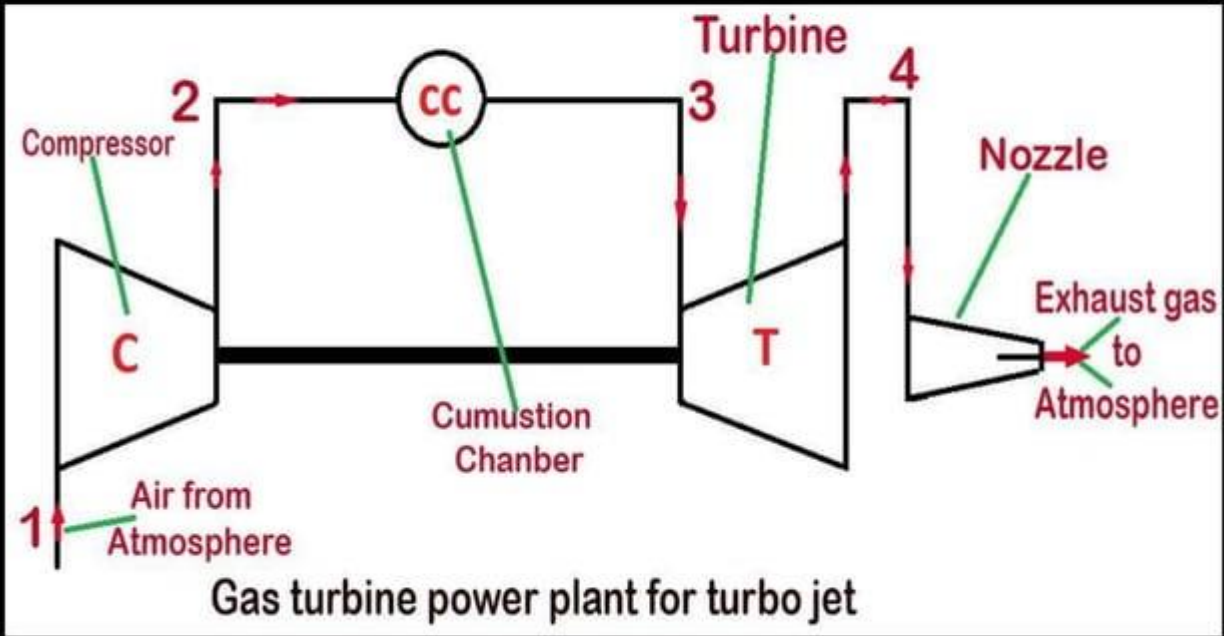


# TURBO-JET



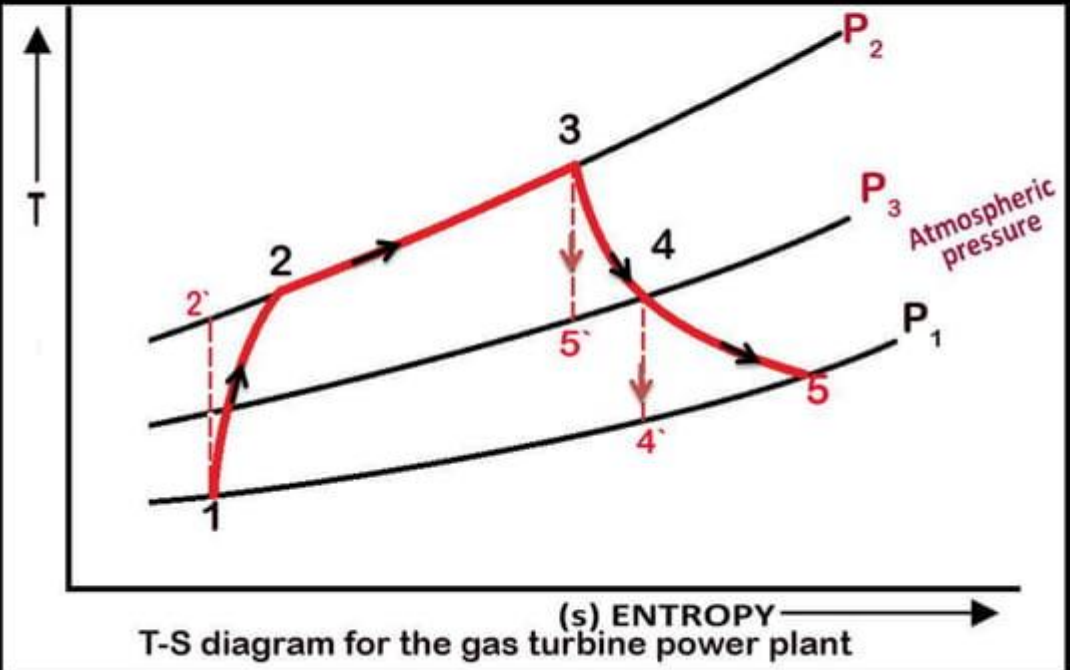


# Turbo-jet





# Turbo-jet



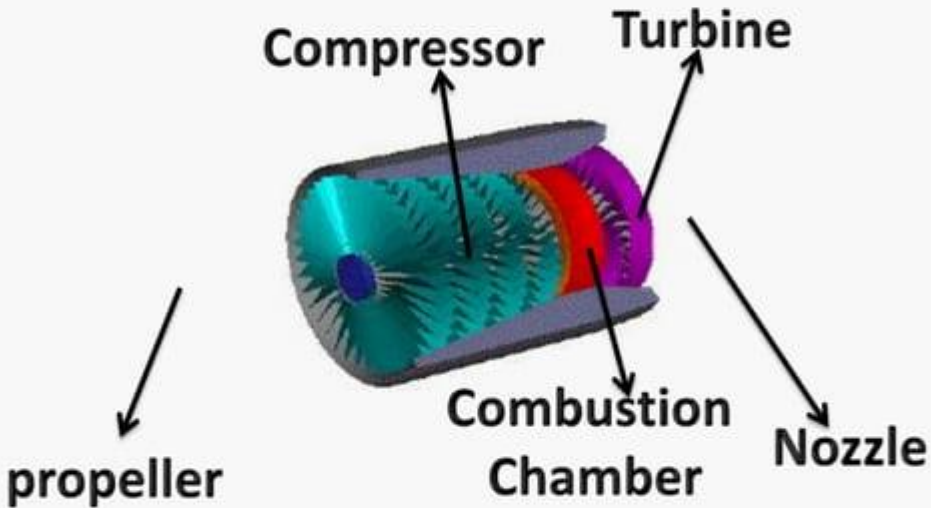


**Turbo-prop** :- In this system the gases are partly expanded in the turbine and partly in the nozzle. Nearly 80% expansion takes place in the turbine and the remaining 20% in the nozzle.

- The total power developed by the turbine is used to run the compressor as well as the propeller. The forward motion to the aircraft is given partly by the jet produced by the nozzle.
- The turbo-prop combines the merits of turbo-jet, i.e. low specific weight and simplicity in design and merits of propeller, i.e., high power for take-off and high propulsion efficiency at speed below 600km/hr.



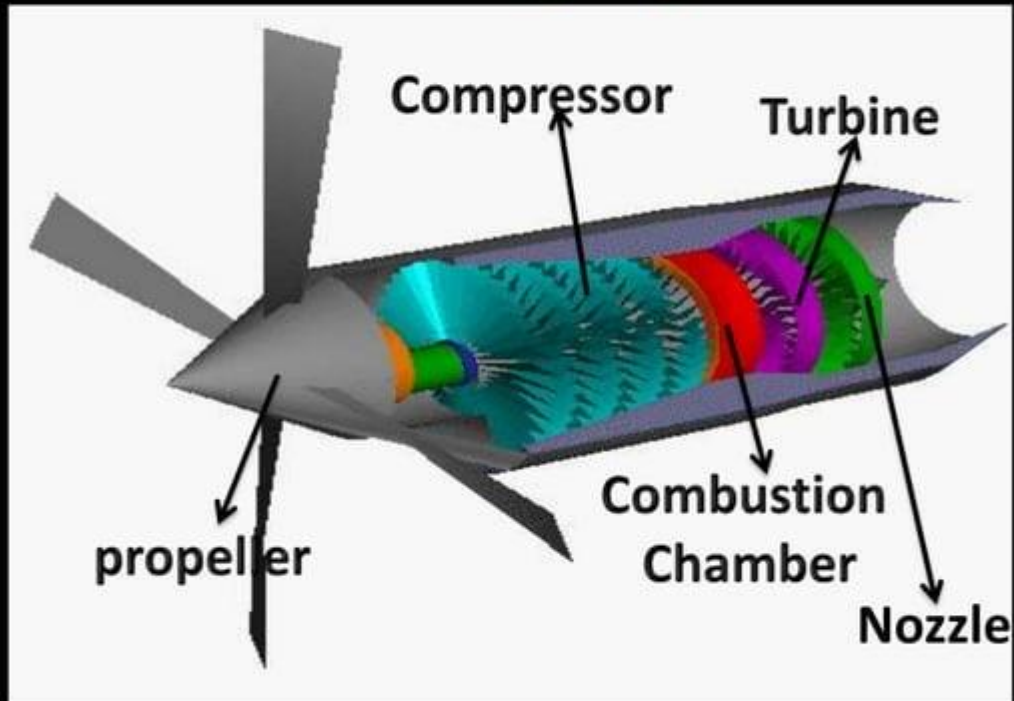
# Turbo-prop





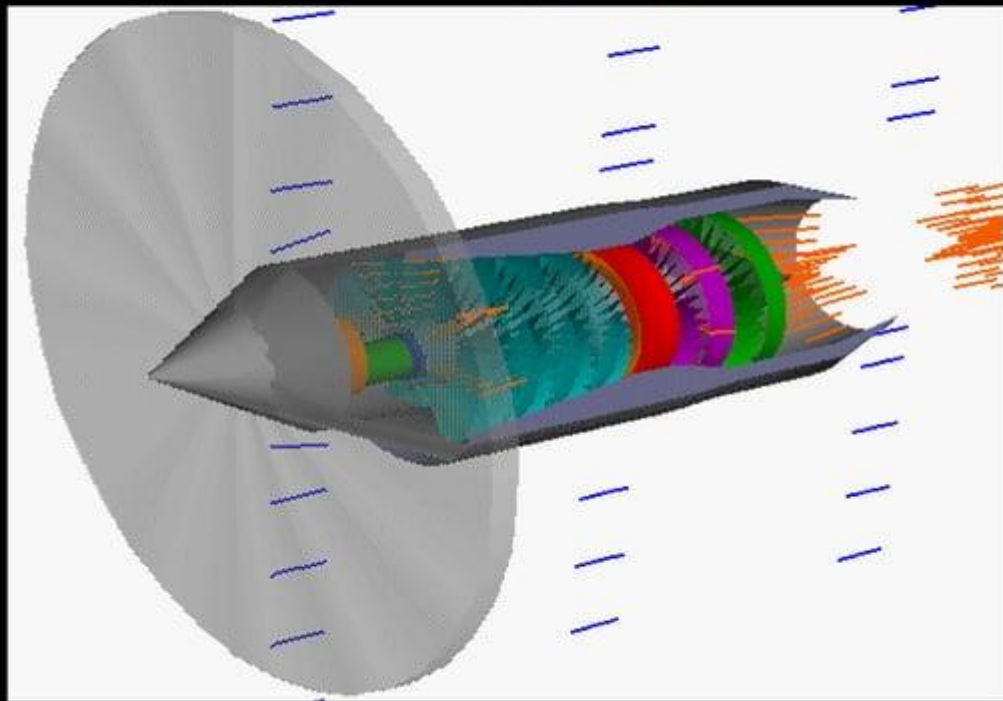


# Turbo-prop



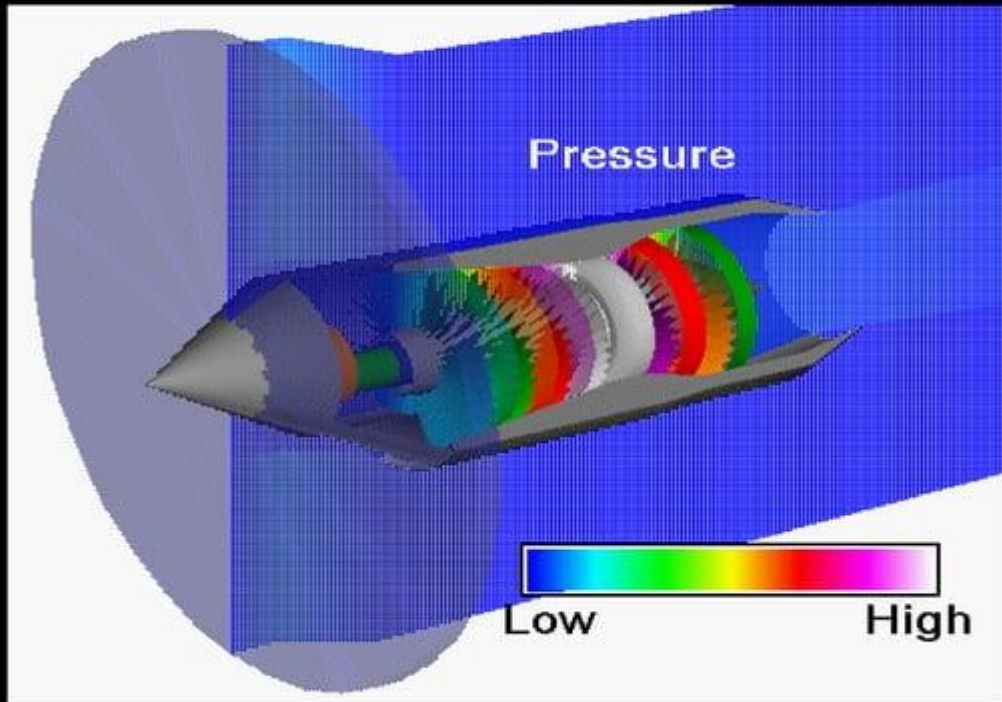


# Turbo-prop



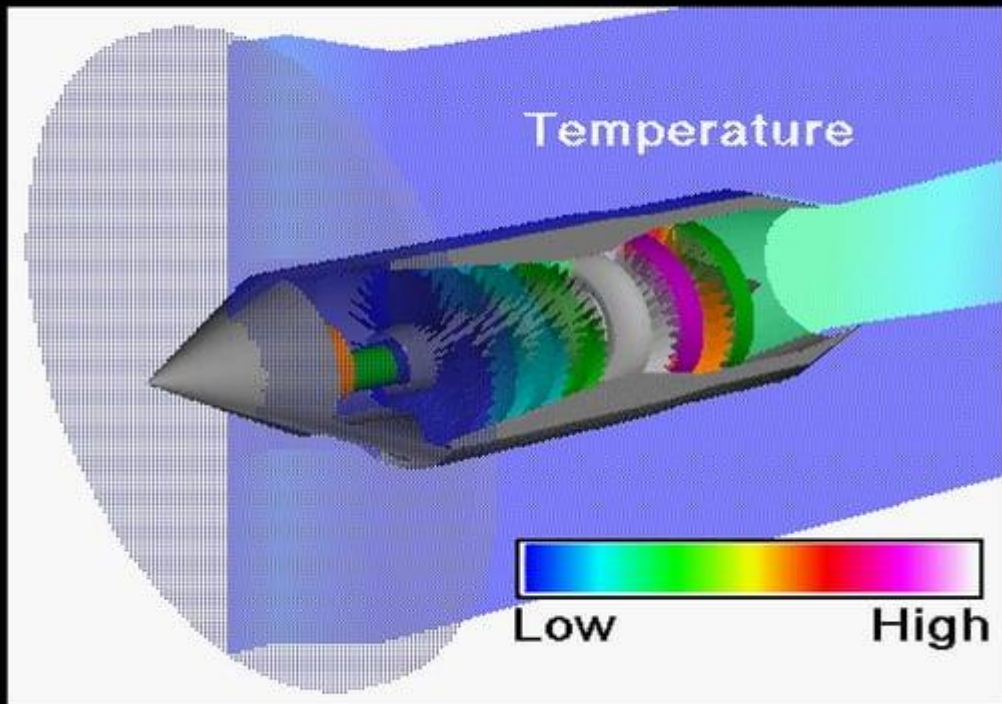


# Turbo-prop



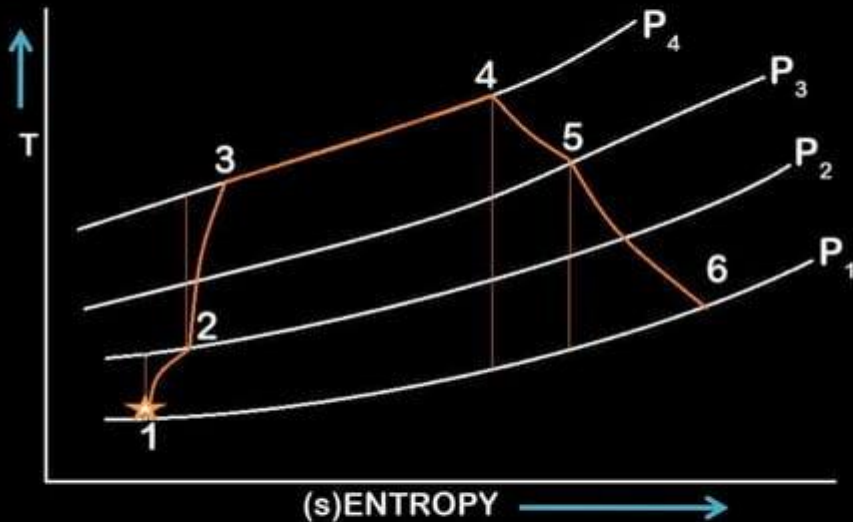


# Turbo-prop





# T-S DIAGRAM FOR TURBOPROP



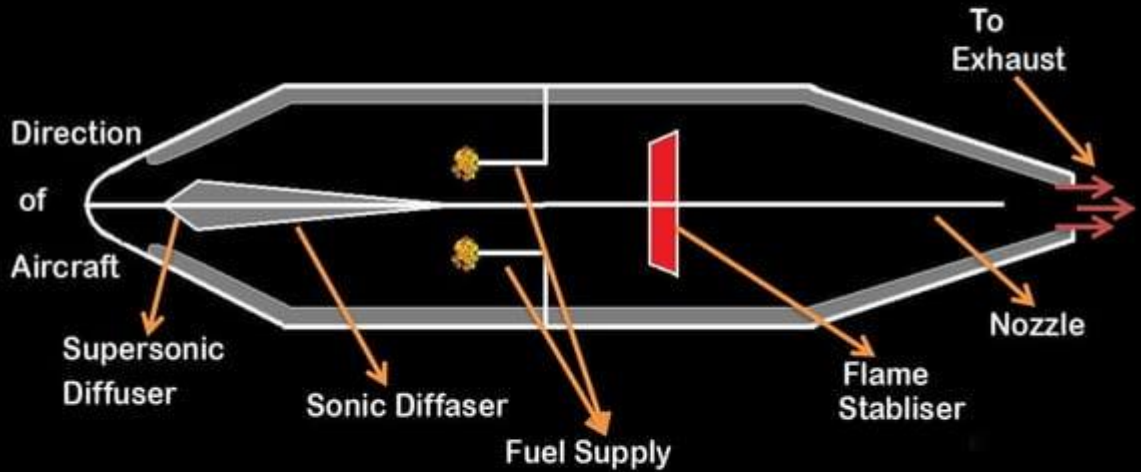


**D. Ramjet** :- Ramjet engines are used to fly at super sonic speed.

- :- The pressure of the incoming air is increased sufficiently high with the help of diffuser action ,which is sufficient of self-ignite the fuel as the temperature is high.
- :- The temperature of the rammed air in ramjet engine is always above the self ignition temperature.
- :- Ramjet engine consist of a diffuser (used for compression), combustion chamber and nozzle.

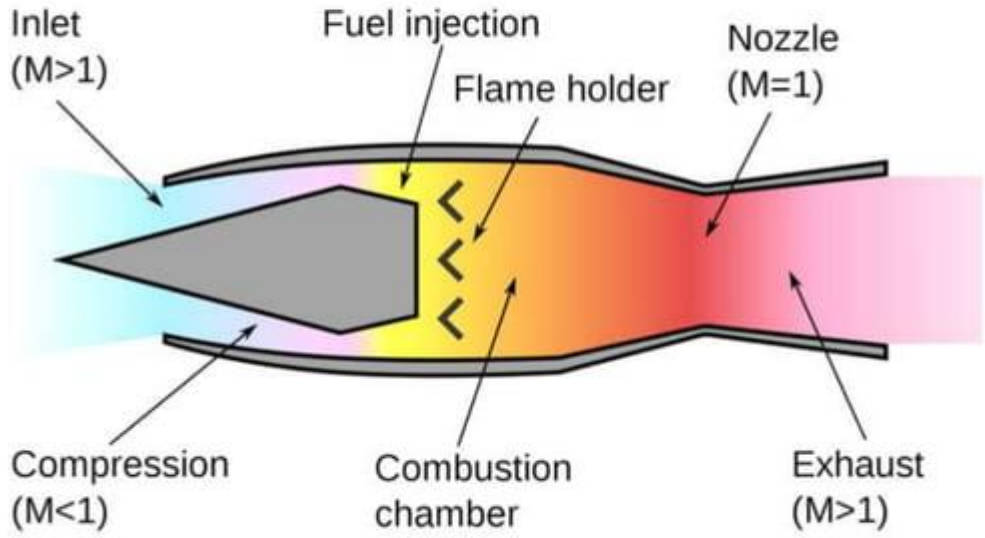


# BLOK DIAGRAM OF RAMJET ENGINE





# RAMJET



( $M < 1$ )

combustion

( $M > 1$ )





# RAMJET





# ADVANTAGES OF RAMJET

1. Light in weight.
2. No moving parts.
3. Use of wide variety of fuel is possible.

# DISADVANTAGES OF RAMJET

1. It cannot be started to its own from rest.
2. It has to be accelerated to a certain flight velocity by some launching device.
3. It is always equipped with a small turbojet, which helps in starting the ramjet.



## REFERENCES

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- ii. Engineering Thermodynamics 3<sup>rd</sup> edition in S.I. Units by R.K. Rajput
- iii. Thermodynamics - An Engineering Approach, 5Th Cengal Boles
- iv. Thermal engineering by Domkundwar
- v. <http://www.grc.nasa.gov>



# THE END

