



SNS COLLEGE OF TECHNOLOGY
(Autonomous)
DEPARTMENT OF AERONAUTICAL ENGINEERING



UNIT-3

PISTON AND JET ENGINES



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JET ENGINES



JET PROPULSION

- The principle of Jet Propulsion is obtained from the application Newton's third law. i.e., for every action there is an equal and opposite reaction.
- We know that when a **fluid is to be accelerated**, a force is required to produce this acceleration in the fluid. At the same time, there is an **equal and opposite reaction force acting on this fluid**.
- This **opposite reaction force of the fluid** on the engine is known as **thrust**.
- Hence it may state that the principle of jet propulsion is based on the reaction principle. Any fluid can be used to achieve the jet propulsion principle. Thus water, steam, and combustion gases are used to propel a body in a fluid.
- But there are limitations imposed upon the choice of the suitable fluid when it is applied to the propulsion bodies.



CLASSIFICATION OF JET PROPULSION

Jet propulsion engines may be classified broadly into two groups.

- **Air breathing engines** - combustion takes place by using atmospheric air
- **Rocket engines** - Combustion takes place by using its own oxygen supply



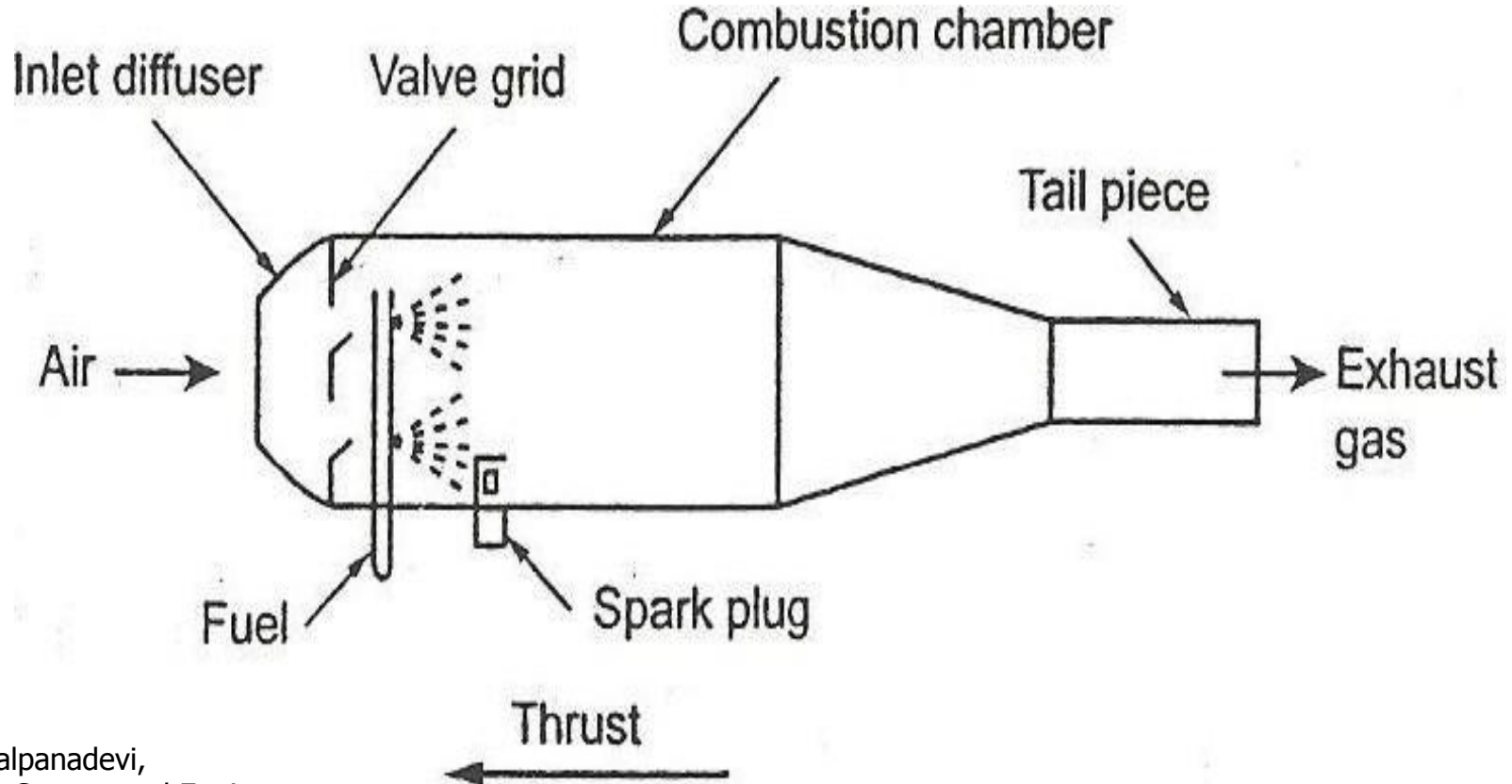
CLASSIFICATION OF AIR BREATHING ENGINES

Air breathing engines can be further classified as follows:

- Pulse Jet Engine
- Turbojet Engine
- Turbo Prop Engine
- Turbo Fan Engine
- Ramjet Engine
- Scramjet engine



PULSE JET ENGINE (OR) FLYING BOMB





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The construction of pulse jet engine is shown in Fig. which is similar to ramjet engine. It consists of:

- A diffuser
- A valve grid which springs that close on their own spring pressure.
- Combustion chamber.
- Spark plug
- A tail pipe (or discharge nozzle).

The function of diffuser is to convert the kinetic energy of the entering air into pressure energy.

The function of nozzle is to convert pressure energy of gas into kinetic energy.



Working

- Air from the atmosphere enters into pulse jet engine. The air velocity gets reduced and its static pressure is increased by diffuser.
- When a certain pressure difference exists across the valve grid, the valve will open and allow the, air to enter into the combustion chamber.
- In the combustion chamber, fuel is mixed with air and combustion starts by the use of spark plug.
- Once the combustion starts it proceeds at constant volume. So there is a rapid increase in pressure, which causes the valve to close rapidly.



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- The highly heated products of combustion gases are then allowed to expand in the exhaust nozzle (Tail pipe) 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.
- Since the combustion process causes the pressure to increase, the engine can operate even at static condition once it gets started.
- When the combustion products accelerate from the chamber, they leave a slight-vacuum in the combustion chamber. This, in turn, produces sufficient pressure drop across the valve grid, allowing the valves to open again and new charge of air enters the combustion chamber.



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Advantages

- Pulse jet engine is very simple device next to ramjet engine.
- Less maintenance.
- Cost is low.
- Light weight when compared with turbojet engine.

Disadvantages

- High rates of fuel consumption.
- The maximum flight speed of the pulse jet engine is limited to 750 km/h.
- Low propulsive efficiency than turbojet engines.
- High degree of vibration leads to noise pollution.

Applications

- It is used in subsonic flights. German V-I missiles, Target aircraft missiles, etc.