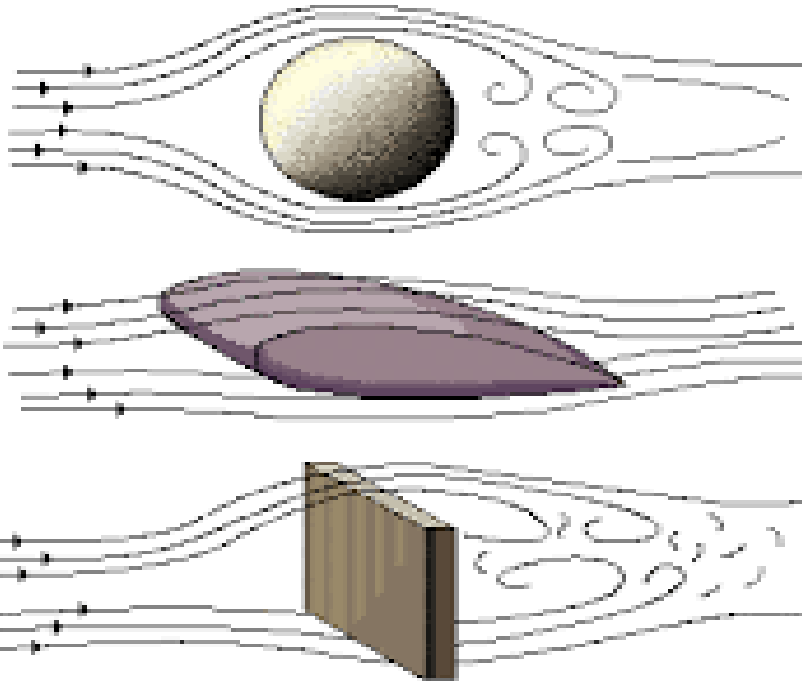
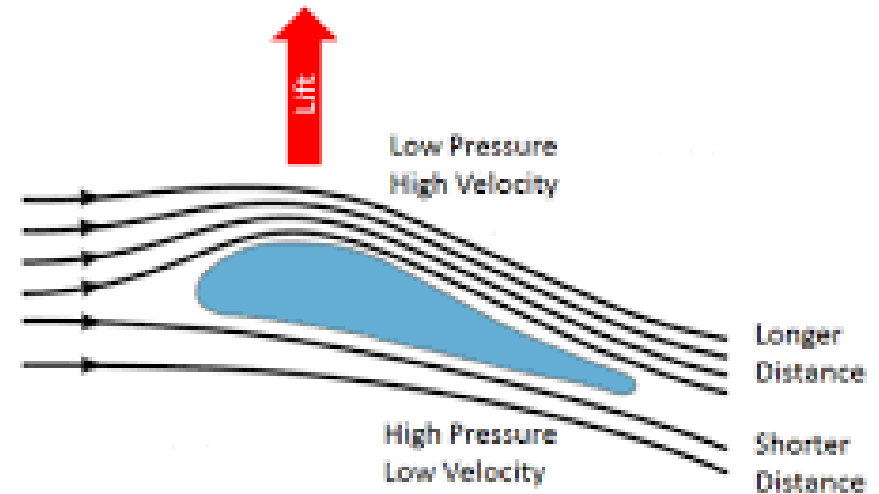


AERODYNAMICS

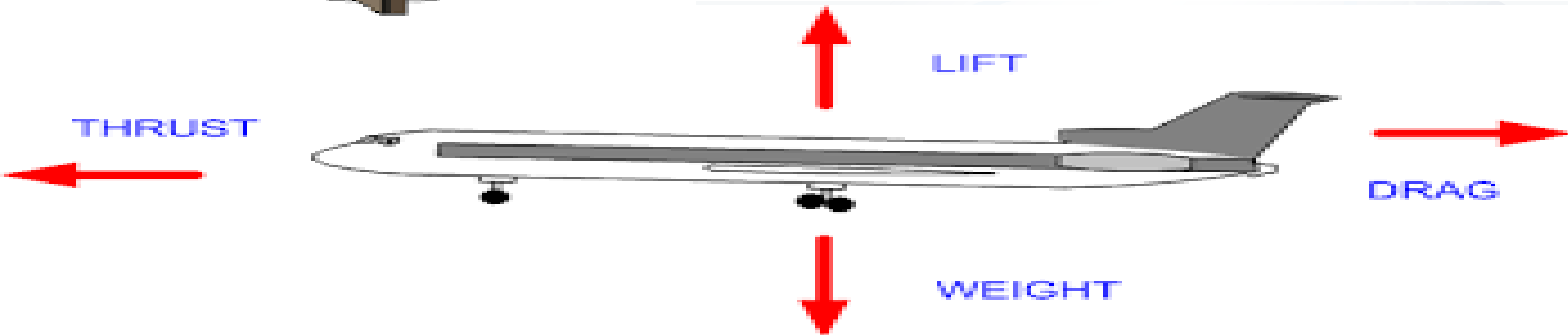
Study of forces and the resulting motion of objects through air



Aerodynamic Lift – Explained by Bernoulli's Conservation of Energy Law



Also known as the "Longer Path" or "Equal Transit" Theory



AERODYNAMIC FORCES

When an object is in the flow field of a fluid or if object is moving through a stationary flow field, fluid exerts force on the surface of the object.

Resultant force is the equivalent of forces exerted on the entire surface of the object by the fluid.

The vertical component of this force is called lift & horizontal component of this force is called drag

Thrust is required to overcome the drag force and to maintain air flow past the airfoil

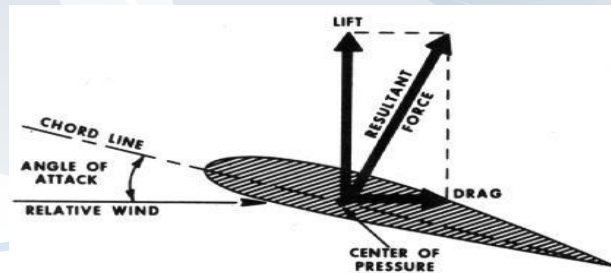


Figure 17-8 Force Vectors on an Airfoil

When air flows past a asymmetrical airfoil/ symmetrical airfoil with a certain angle of attack (less than 13 degree), the flow above airfoil faces a curved path. The fluid gets accelerated (centripetal accel.) to continue flow over the curved path. Hence velocity increases and pressure reduces (Bernoulli's principle). But the lower part of airfoil, the flow is obstructed, because of which the velocity reduces and pressure increases (again Bernoulli's). Thus a pressure difference is developed which results in lift force on the surface of airfoil.

TYPES OF JET ENGINE

They are basically gas turbine engines:

Advantages of gas turbine engines :

Simpler construction

High speed operation

Able to handle high flow rate of air and fuel

Different types of jet engines are:

- 1) Turbo prop engine**
- 2) Turbojet engine**
- 3) Turbo fan engine**
- 4) Ramjet engine**

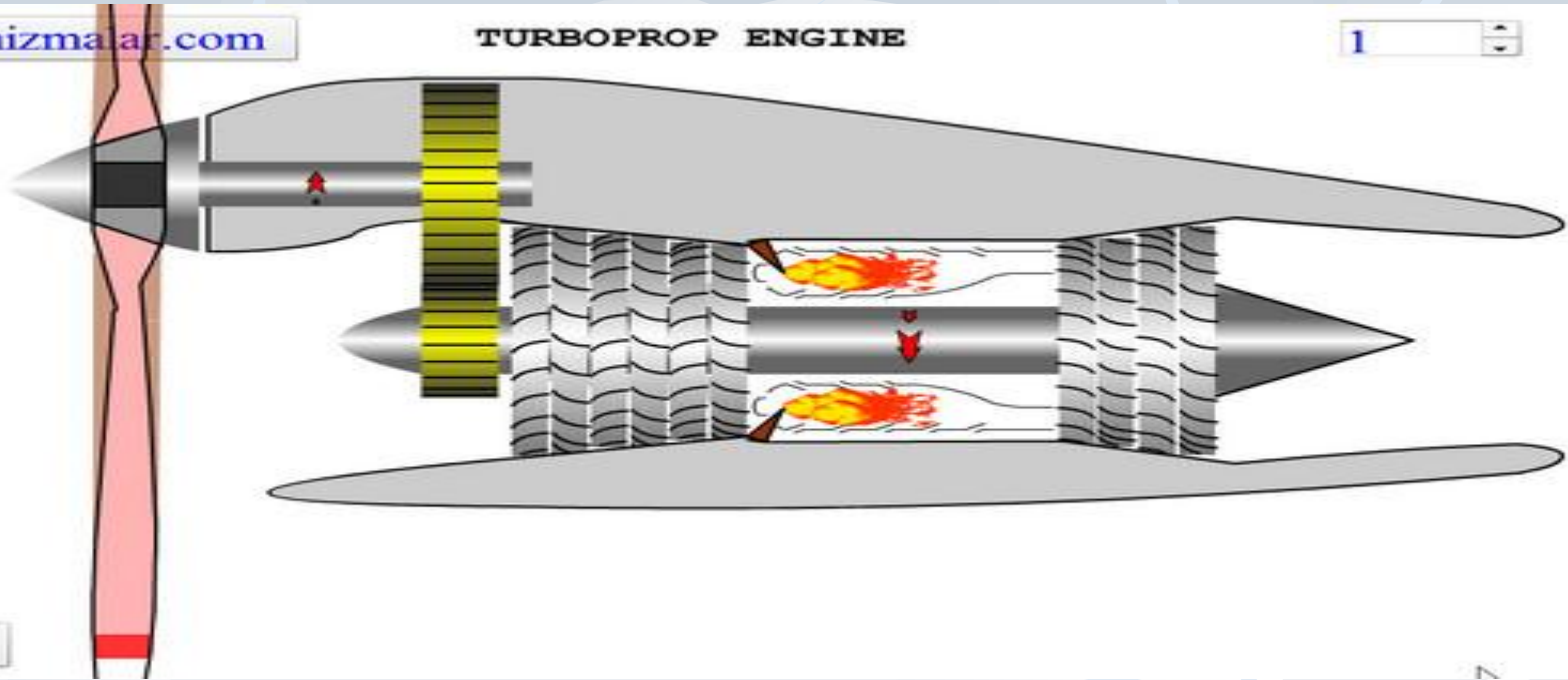
TURBO PROP ENGINE

www.mekanizmalar.com

TURBOPROP ENGINE

1

- Temperature
- Arrows ON



[For
slides/Turboprop
Engine.mp4](#)



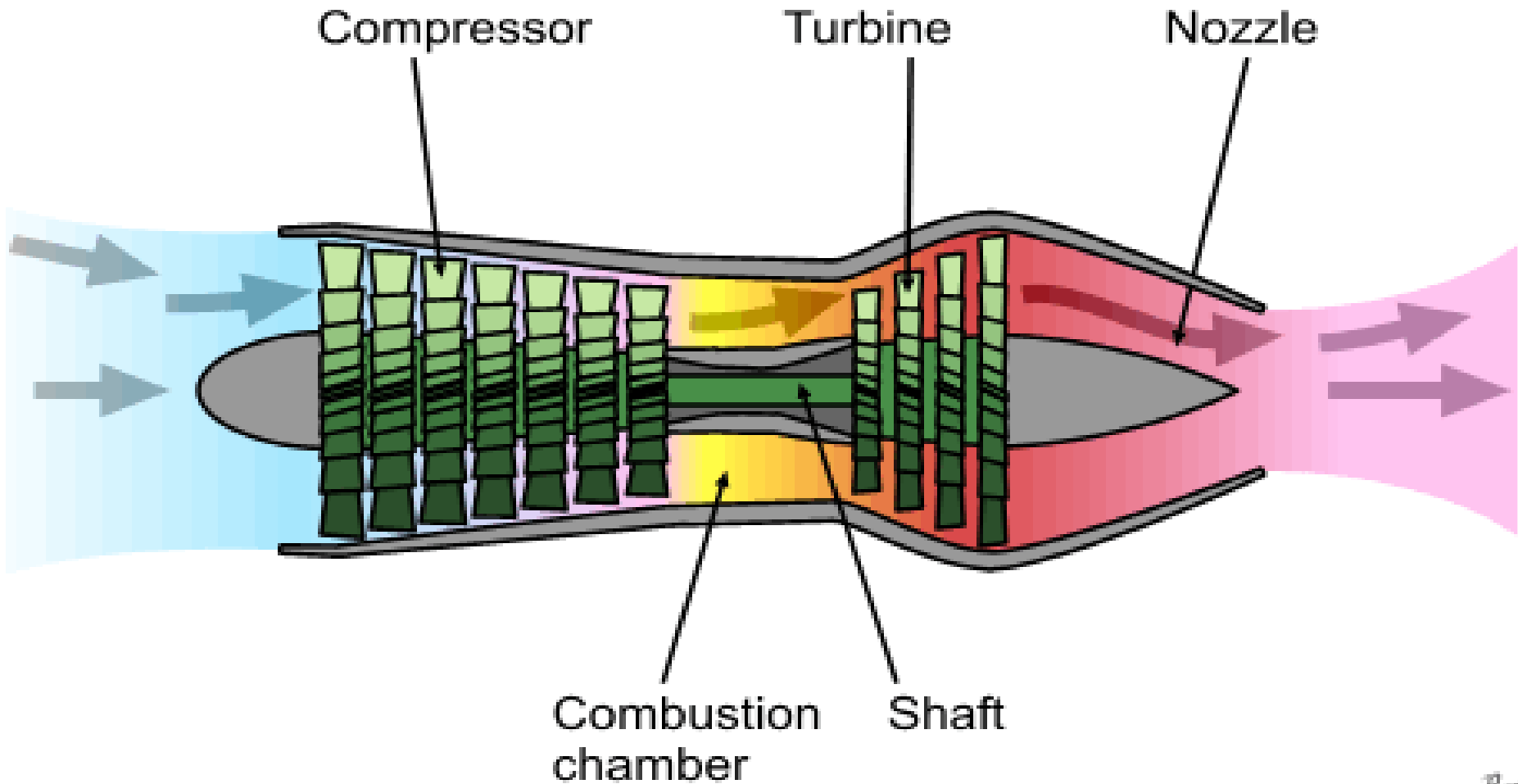
ADVANTAGES OF TURBO PROP

- 1. Produces high thrust at low speeds**
- 2. Short take off roll**
- 3. Fuel consumption per unit thrust is low**

DIS DVANTAGES OF TURBO PROP

- 1. Low speeds**
- 2. Landing gears are longer due to propeller blade length**
- 3. Engine is more heavier**

TURBO JET ENGINE



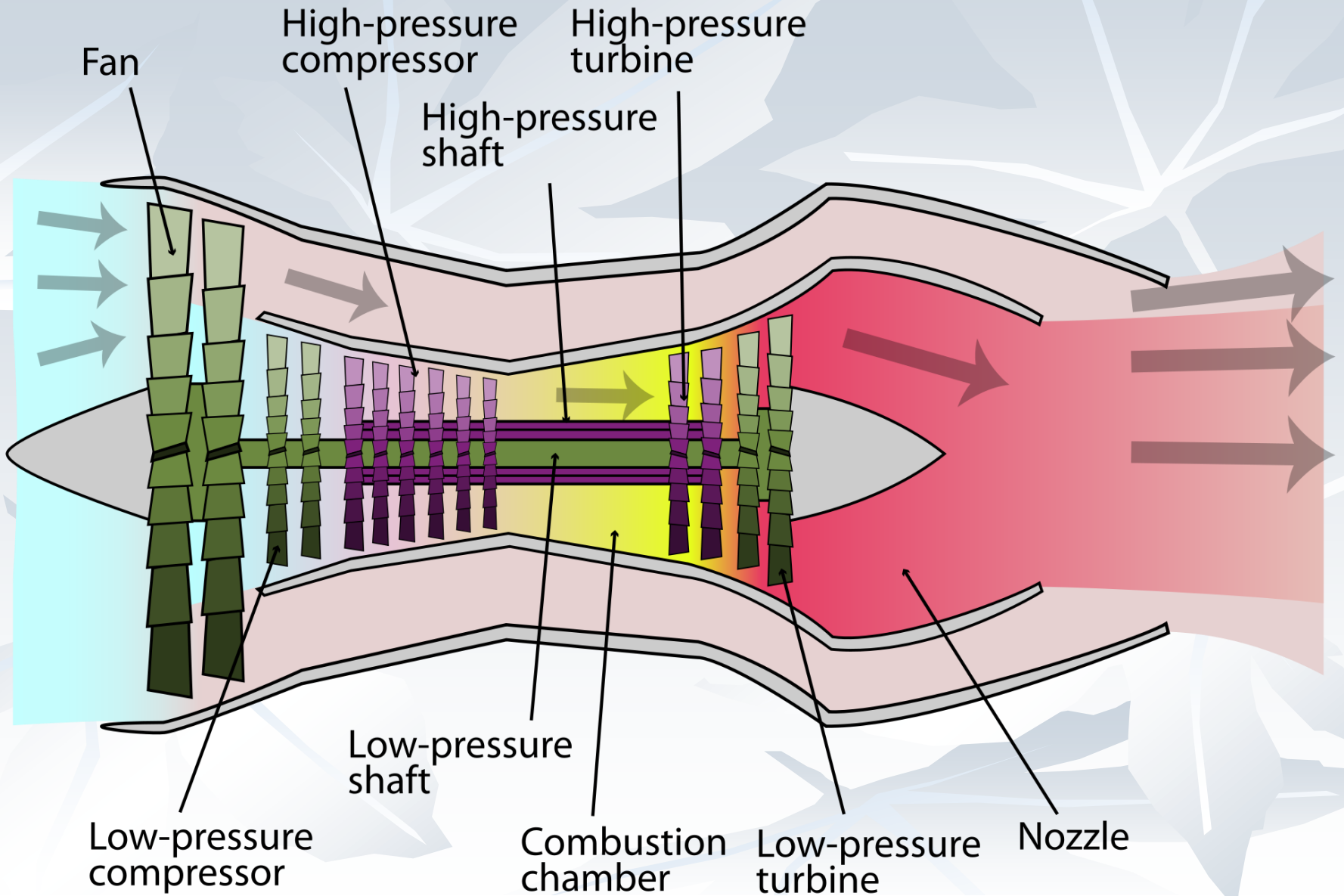
ADVANTAGES OF TURBOJET

- 1. Suitable for long distance flights**
- 2. Higher altitudes and high speed**
- 3. Low frontal area**
- 4. Short landing gears**
- 5. Lower weight per unit thrust compared to turbo prop**

DISADVANTAGES OF TURBOJET

- 1. Low thrust at low speeds**
- 2. take off roll is longer**
- 3. Fuel consumption per unit thrust produced is high**
- 4. Uneconomical for short distance**

TURBO FAN ENGINE



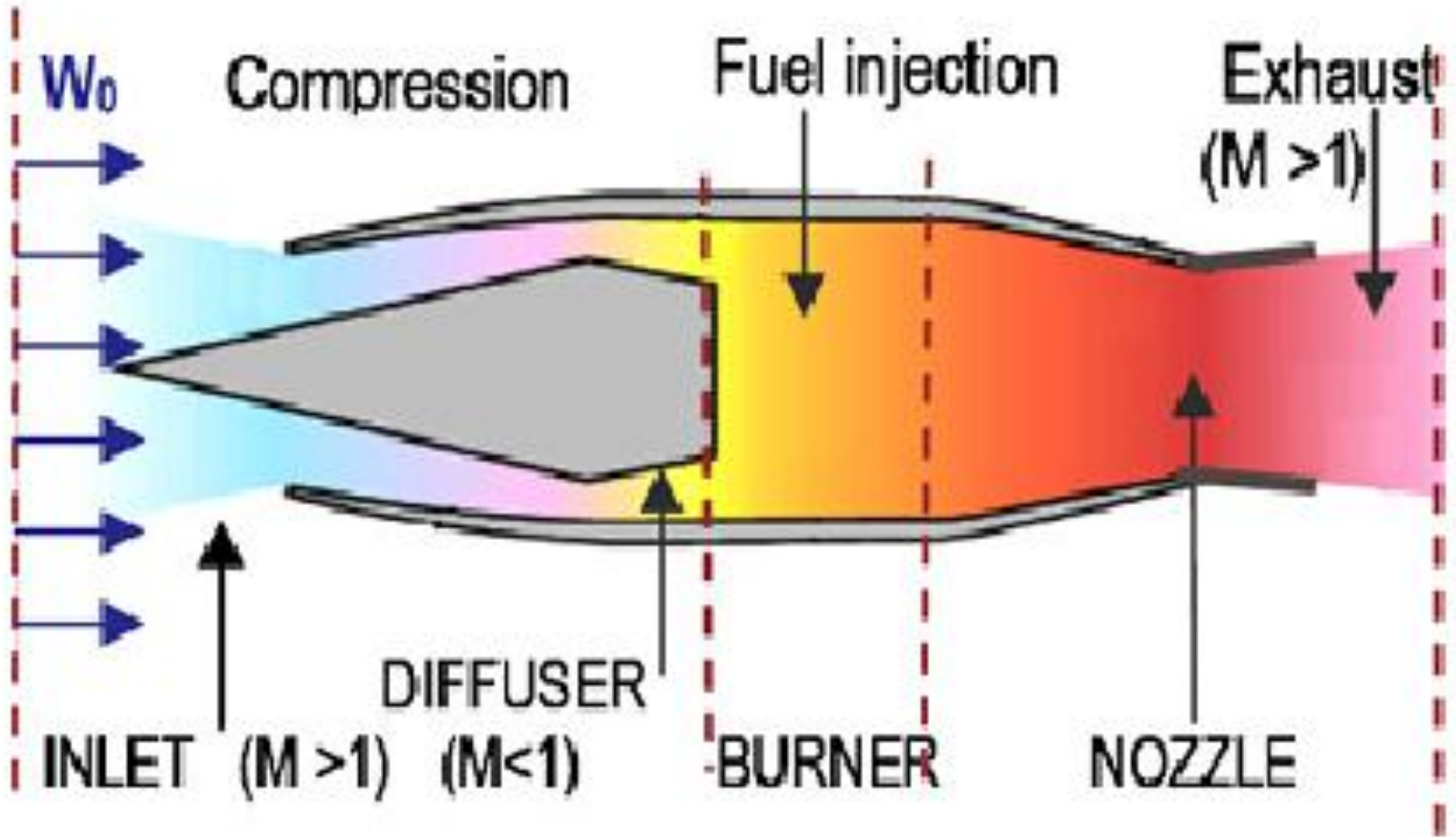
ADVANTAGES OF TURBOFAN

- 1. Increased thrust at low speeds**
- 2. Shorter take off roll**
- 3. Weight per unit thrust is lower than turboprop**
- 4. High thrust than turbojet**

DISADVANTAGES OF TURBOFAN

- 1. Increased frontal area , therefore drag increases**
- 2. Lower speed limits**
- 3. Heavier and complicate engine**

RAMJET ENGINE



ADVANTAGES

- 1. High temperature operation(no blades to get damaged)**
- 2. Simple and cheap construction**
- 3. Efficient operation at supersonic speeds**
- 4. Not sensitive to quality of fuel, low weight, low frontal area**

DISADVANTAGES OF RAMJET ENGINE

- 1. Requires to be launched at supersonic speed**
- 2. Low thermal efficiency**
- 3. High fuel consumption**
- 4. Unsuitable for low speeds**

APPLICATION OF DIFFERENT ENGINES

Turbo prop: Generally used in small subsonic aircrafts used for transportation in small islands & short runway airports, Large aircrafts used for military and civil purposes, Air Bus 400M

Turbojet: Used in fighter aircrafts coz of its ability to create high thrust at larger speed

Turbofan : used in passenger air crafts which require medium speed, low noise and better fuel efficiency. (Boeing 787)

Ramjet : Its simple mechanism for high speed use. Used in missiles artillery shells, mortars, tip jets in helicopter rotors

SCRam jet: Future high speed transportation vehicle, use as tether vehicle to carry payload in outer orbits