SNS COLLEGE OF TECHNOLOGY

An Autonomous Institution
Coimbatore – 35

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DEPARTMENT OF AEROSPACE ENGINEERING

19ASO301 BASICS OF AERONAUTICAL ENGINEERING

UNIT 4 – AIRCRAFT POWER PLANTS

Dr. D K KARTHIK , Professor &Head-CCE/SNSCT

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***

Comparison – Helicopter & Airplane

Helicopter

Lift: *Helicopters generate lift through the rotation of their main rotor blades, which act like wings, creating an upward force as they move through the air.*

Thrust: *Unlike airplanes, helicopters don't rely on forward movement to generate lift; instead, they tilt the rotor to create thrust, allowing for vertical takeoff, hovering, and manoeuvrability in any direction.*

Control: *Helicopters use adjust the angle of the rotor blades to control the direction of lift and thrust.*

Comparison – Helicopter & Airplane

***Engine**: A helicopter's engine powers the rotor, providing the necessary energy to spin the blades and generate lift and thrust.*

***Airflow & Lift**: The shape of the rotor blades, similar to airplane wings, is designed to create an area of low pressure above the blade and high pressure below, generating lift.*

***Manoeuvrability**: Helicopters are known for their manoeuvrability, allowing them to take off and land vertically, hover, and fly in any direction, unlike airplanes which require runways and primarily move forward.*

***Torque**: The rotation of the main rotor can cause the helicopter's fuselage to rotate in the opposite direction. This is counteracted by a tail rotor or counter-rotating rotors.*

Comparison – Helicopter & Airplane

Airplane

***Lift**: Aircraft generate lift using fixed wings, which are designed to create an upward force as they move through the air at speed.*

***Thrust**: Aircraft use engines to generate thrust, propelling them forward through the air.*

***Control**: Aircraft use control surfaces (ailerons, elevators, rudder) to steer and control their flight path.*

***Engine**: Aircraft engines provide the power to propel the aircraft and generate lift.*

Comparison – Helicopter & Airplane

***Airflow & Lift**: The shape of the wings, known as an airfoil, is designed to create an area of low pressure above the wing and high pressure below, generating lift.*

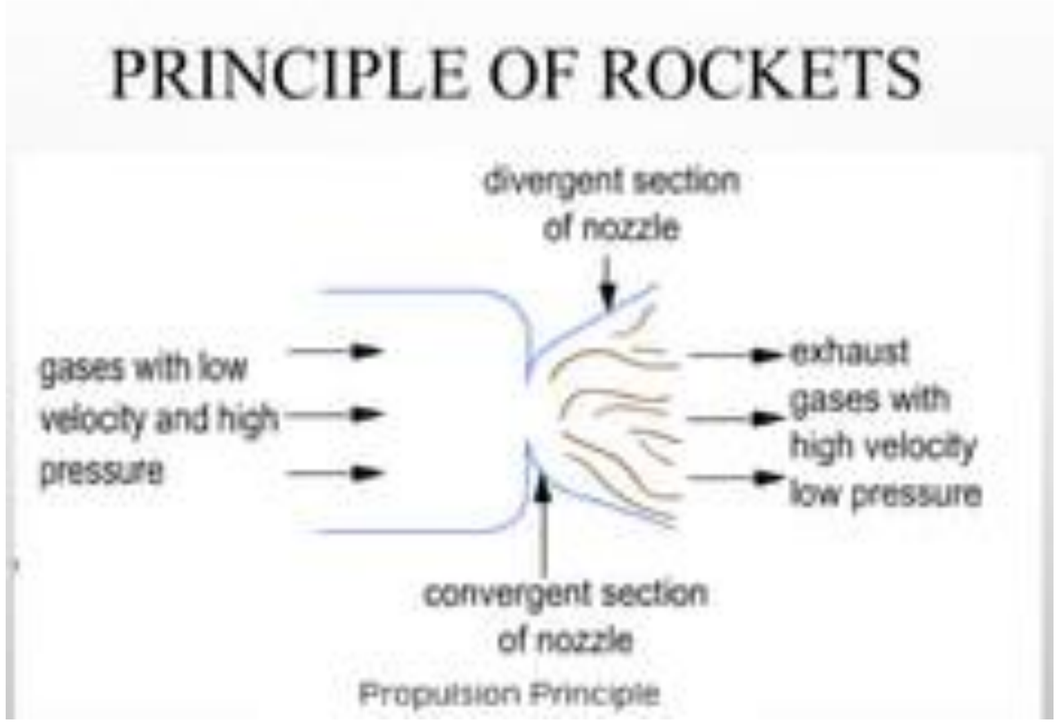
***Manoeuvrability**: Aircraft can only fly horizontally, requiring runways for takeoff and landing, and typically move in a straight line.*

***Forces**: The principles of flight for both helicopters and aircraft are based on the four fundamental forces: lift, weight, thrust, and drag.*

Rocket - Principle

Laws governing the Principle of Rocket:-

- *Newton's Third law of motion*
- *Law of Conservation of Momentum*



Newton's Third Law of Motion

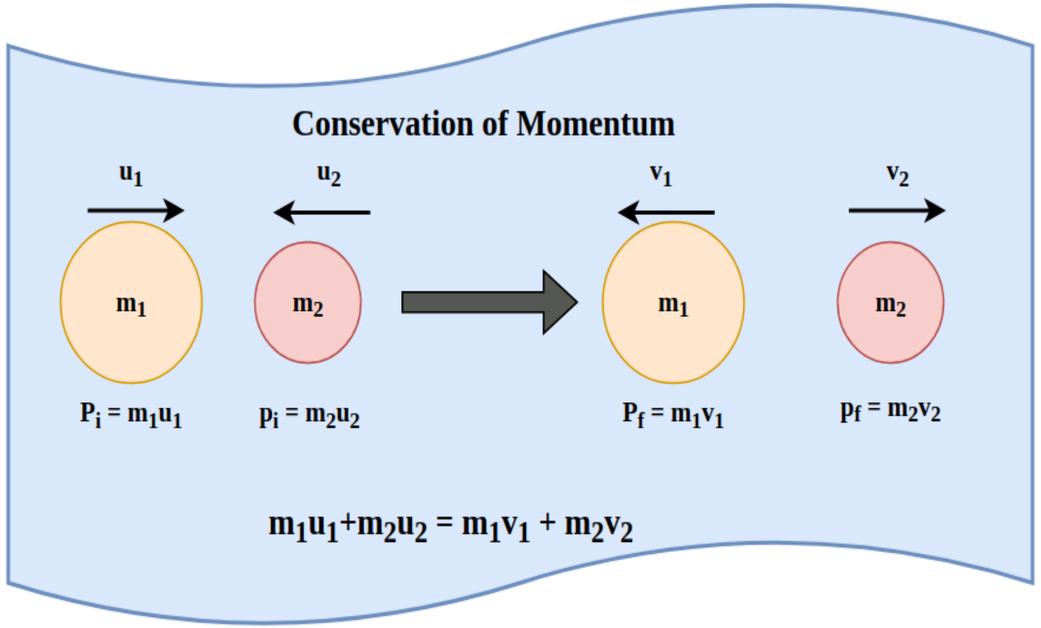
- *Third law of motion states that, for every action there is an equal and opposite reaction. The magnitude of the action is the same however, direction of reaction is opposite.*
- ***In other words:*** *When an object 1 exerts a force on object 2, object 2 exerts a force on object 1, which is equal in magnitude however, opposite in direction.*

Newton's Third law of motion

- *When you jump off a small rowing boat into water, force exerted by you to push yourself forward to jump into the water will be exerted on the boat, which will move the boat backwards.*
- *When air is discharged from a balloon, balloon moves in the opposite direction.*

Law of Conservation of Momentum

The law of conservation of momentum states that the total momentum of a closed system remains constant. This means that momentum is neither created or destroyed, but only changed through the action of forces.



Rocket - Operation

Action & Reaction

Thrust & Efficiency

Stages