# 1

CHAPTER

# Rocket and its Major Components

## 1.1 INTRODUCTION

Rocket is basically a vehicle, which carries a given payload from one place to another. It is a single shot device. It works on the principle of Newton's third law of motion.

Payload of a rocket may contain explosive materials, sophisticated equipment or propaganda materials.

## 1.2 ROCKET CAN BE CLASSIFIED AS FOLLOWS

A. Based on rocket motor
   (*a*) Solid propellent rocket
   (*b*) Liquid propellent rocket
B. Based on stability
   (*a*) Finned rocket
   (*b*) Spin stabilized rocket
C. Based on controllability
   (*a*) Uncontrolled rocket
   (*b*) Controlled rocket

## 1.3 MAJOR COMPONENTS OF A ROCKET

There are seven working parts of a rocket:

(*a*) Payload
(*b*) Instrumentation
(*c*) Tanks
(*d*) Pumps
(*e*) Valves
(*f*) Injectors and
(*g*) Combustion chamber (See Fig. 1.1)

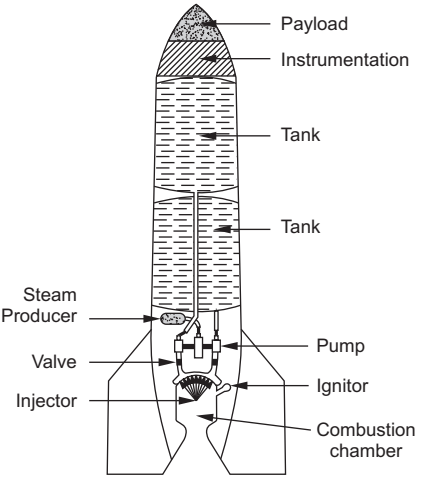


**Fig. 1.1**

## Payload

Starting from nose of the rocket payload is the first component. It may contain explosive materials, instruments/equipment, astronauts, weather monitoring equipment, high altitude research vehicle or spacecraft. Payload has great importance for the structure of the rocket. According to an application size of the payload governs the structure of the rocket. Weight of the payload is 5% of the total weight of the rocket.

## Instrumentation

Instrumentation may contain equipment for stability control, directional control, recording and telemetry. It is observed that impact and vibration are the main problems of electronic equipment.

Recording instrument is kept separate in safe place because it provides the details of solar and cosmic radiation.

## Tank

Much space in the rocket is taken by tank. It is observed that at-least two tanks are needed for the fuel and mount to 70% of weight. Tanks may be of different types.

After fabricating outside, it may be kept into the rocket or it may be a part of the rocket. Third possibility would be that it should be separated from the rocket after exhaust of the fuel to prevent the rocket for carrying unnecessary weight. Further, the walls of the tank should be able to bear the pressure.

### Pump

Pumps are just below the tanks and they are operated with the help of turbine. The consumption of fuel by the rocket motor is very fast. Thus it becomes necessary to keep high pressure in the combustion chamber with the help of the pump.

The materials of turbine and pump should be such that there should not be any effect of fuel on them. The capacity of pump impellers should be very high so that it can operate corrosive liquid or low temperature liquid. Furthermore, turbine blade should also work at temperature 400°C or even more high temperature.

### Valve

Many literatures are available about carrying fuel from tank to combustion chamber but very few literatures are available about its control. Valve is used for control purpose. Valve is not fitted at one place of rocket but they are fitted throughout the rocket. Their requirements are for the flow of gas in the tank, flow of fuel from tank to combustion chamber and pump. Further, valves are used for the generation of vapour and also for the control of flow of vapour from pump to turbine.

### Injectors

If a line is drawn from pump to combustion chamber or in other words the sixth section is injector by which fuel and oxygen are converted from liquid to vapour. They produce thrust gases before burning. Thus accuracy in fabrication of injector is very important for producing more vapour particles which can mix with the fuel properly.

### Combustion Chamber

This component is the most important part of the rocket as thrust by fuel is produced here.

### Igniters

This is small but an important part which is connected with the combustion chamber of the rocket. It helps in the burning of the mixture of fuel and oxygen. Igniters are of three types: spark plug, pyrotechnic and pyrogen.

Main components of the rocket giving the purpose of the component and the means of implementation:

| ***Main component*** | ***Purpose*** | ***Implementation*** |
|---|---|---|
| 1.Warhead or payload | Destruction or Investigation | Explosives or miniaturized Instruments |
| 2.Propulsion System | To maintain speed and control | Rocket, Motor |
| 3.Booster system | Attain high speed | Rocket, Motor |
| 4. System for receiving Intelligence | Guidance and Discrimination | Radar and other Electronic devices |
| 5. Power systems | Implementation and intelligence Control | Chemical Batteries Solar Batteries and Atomic Batteries |
| 6. Aerodynamic control | Stability and Steering | Fins, Rudder and other control surfaces |
| 7. Airframe | Integrating the Whole assembly | Structure to weigh least and yet have high strength |