

# ROCKET SCIENCE

## THE BASICS OF A ROCKET ENGINE

There are four main components in a simplified *liquid-fuel* rocket engine: the **Pumps**, the **Turbine**, the **Combustion Chamber**, and the **Nozzle**. Each of these play a critical role in creating enough thrust to propel humans and payloads into Earth orbit... and beyond.

"With no air in space, liquid-fueled rockets need to carry both oxidizer (usually oxygen) and fuel (usually hydrogen or kerosene) in specialized tanks. Liquid Hydrogen is the most powerful rocket fuel. The objective of rocket design is to keep the hardware weight as low as possible. Using Liquid Hydrogen allows for a smaller (and lighter) engine."



### 1 PUMP IT UP

To reduce the total weight of the tanks the fuel and oxygen propellants are liquified through extreme cooling. The **Pumps** increase the pressure of these low propellants before sending them on down the line.

### 2 COOL FUEL

Because of the high temperatures created from burning propellants within the engine, the **cooler-cooled** fuel is pumped through special passages to keep the **Combustion Chamber** and **Nozzle** from melting. The nozzle is designed to act as a heat exchanger, keeping the metal components cool while expelling the liquid fuel to drive the turbine.

### 3 MINI ENGINE

After the fuel passes through the coolant passages, it is cooled into the turbo-pumps. The pressurized fuel passes over the **Turbine**, causing it to rotate. This provides the power to operate the pumps.

### 4 LIGHT THE FIRE

Once the oxidizer and fuel enter the **Combustion Chamber**, they are ignited and burned to form a super heated, high-pressure gas. This pressure created by the pumps forces the gas through the narrow throat and out the **Nozzle**.

### 5 ACTION REACTION

As the gas accelerates through the throat and out the **Nozzle**, it generates thrust that pushes up toward the **Combustion Chamber**, much like the air escaping from an inflated balloon, thus propelling the rocket upwards.

# Introduction To Rocket Science And Engineering

**Travis S. Taylor**



## **Introduction To Rocket Science And Engineering:**

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**Progress in Combustion Science and Technology** J. Ducarme, Melvin Gerstein, A. H. Lefebvre, 2014-05-12 International Series of Monographs in Aeronautics and Astronautics Division III Progress in Combustion Science and Technology Volume I focuses primarily on the aeronautical aspects of combustion This book discusses the flow visualization techniques chemical analysis in combustion chamber development and aerodynamic influences on flame stability The geometric optical techniques in combustion research flame quenching and ignition in liquid propellant rocket engines are also elaborated This text likewise covers the flow studies under combustion conditions geometric optics of flames and empirical studies of hypergolic rocket propellant ignition delays This volume is a good reference for research students scientists and engineers conducting work in the field of combustion science and technology

**Rocket Propulsion Elements** George P. Sutton, 1992-05-07 Concentrates on the subject of rocket propulsion its basic technology performance and design rationale Provides an introduction to the subject an understanding of basic principles a description of their physical mechanisms and designs and an understanding of the application of rocket propulsion to flying vehicles

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