TYPES OF THRUSTERS

A. Classification 1: Based on acceleration mechanism

I. Electrothermal thrusters

The propellant in a gaseous state is heated using electricity, and thrust is produced by the thermodynamic expansion of the propellant aided by a nozzle. Thrusters of this kind have a straightforward design; nonetheless, they do not achieve high exhaust velocities of the propellant. Traditional electrothermal thrusters include the Resistojet and the Arcjet.

II. Electrostatic thrusters

Electrostatic thrusters use electric fields to accelerate ionized propellant (e.g., Xenon) to generate thrust. Ions are created in a chamber, accelerated by grids, and neutralized by emitted electrons to maintain spacecraft charge balance. GEI, HET and HMPT are examples of electrostatic thrusters.

III. Electromagnetic thrusters

Electromagnetic thrusters generate thrust by using electric and magnetic fields to accelerate ionized propellant. The Lorentz force, produced by the interaction of a current-carrying plasma and a magnetic field, propels the ions at high speeds. Common types include Hall Effect Thrusters and Magneto plasma dynamic Thrusters.

B. Classification 2: Based on propellant state

I. Ion thrusters

Ion thrusters use electric fields to accelerate ionized gas (e.g., Xenon) for propulsion. They provide high specific impulse but low thrust. Examples are gridded ion thrusters, kaufman thrusters

II. Plasma thrusters

Plasma thrusters accelerate fully ionized plasma using electromagnetic fields, leveraging the Lorentz force. Magneto plasma dynamic (MPD) thrusters, Helicon thrusters are examples of plasma thrusters.

III. Neutral gas thrusters

Neutral gas thrusters heat non-ionized gas electrically, which expands through a nozzle to generate thrust. Examples are Resistojet thrusters, Arcjet thrusters.

C. Other distinct subcategories of thrusters

I. Resistojet

Heats neutral gas using electric resistance, expanding it through a nozzle for simple, low-cost propulsion.

II. Arcjet

Arcjet generates thrust by heating propellant with an electric arc for higher thermal efficiency.

III. GIE (Gridded Ion Engine)

GIE accelerates ions electrostatically using grids for high efficiency and low thrust.

IV. HET (Hall Effect Thruster)

Hall effect thrusters uses magnetic and electric fields to accelerate ions for efficient, reliable propulsion.

V. HEMPT (High Efficiency Multistage Plasma Thruster)

High Efficiency Multistage Plasma Thruster employs magnetic insulation for improved performance and longevity.

VI. PPT (Pulsed Plasma Thruster)

PPT Generates thrust by ablating solid propellant using pulsed electric discharges.

VII. MPDT (Magneto Plasma Dynamic Thrusters)

Magneto plasma dynamic Thruster accelerates plasma via the Lorentz force for high thrust potential.

VIII. ECR (Electron Cyclotron Resonance Thruster)

ECR uses resonant microwaves to ionize and accelerate the plasma for efficient propulsion.