Launchers – Propellant Types

Chemical Launcher Propellants

They differ in that they are a power source and a propellant at the same time.

Old, well understood technology that remains simple and offers a high energy density, second to nuclear systems.

As discussed before, 3 types:

- Solids
- Liquids
- Hybrids

Solids

Big fireworks called motors.

Double base exothermic decomposition composite (oxidiser and fuel in one substance).

High mass flows, high thrusts but low specific impulse (2300m/s-2800m/s).

Grains are shaped too control burn rate.

Used in apogee boost motors or the Space Shuttle solid rocket motors.

Liquids

- Called engines rather than motors.
- Allow to control thrust, can be restarted and have greater thrust.
- However, they are less reliable and more prone to problems linked to temperature.
- Needs to be very reactive, have low molecular weight, be easy to handle and cheap.

Liquids - Monopropellants

- React through exothermic decomposition through a catalyst.
- Eg. Hydrazine
- Mainly used in satellite control.

Liquids - Bipropellants

- Two chemicals violently react together.
- Most common
- Examples:
  - Liquid Oxygen and Kerosene used in the Atlas 1st stage.
  - Nitrogen Tetroxide and Hydrazine used in the Ariane V 2nd stage.
  - Liquid Oxygen and Liquid Hydrogen used in the Space Shuttle's main engine

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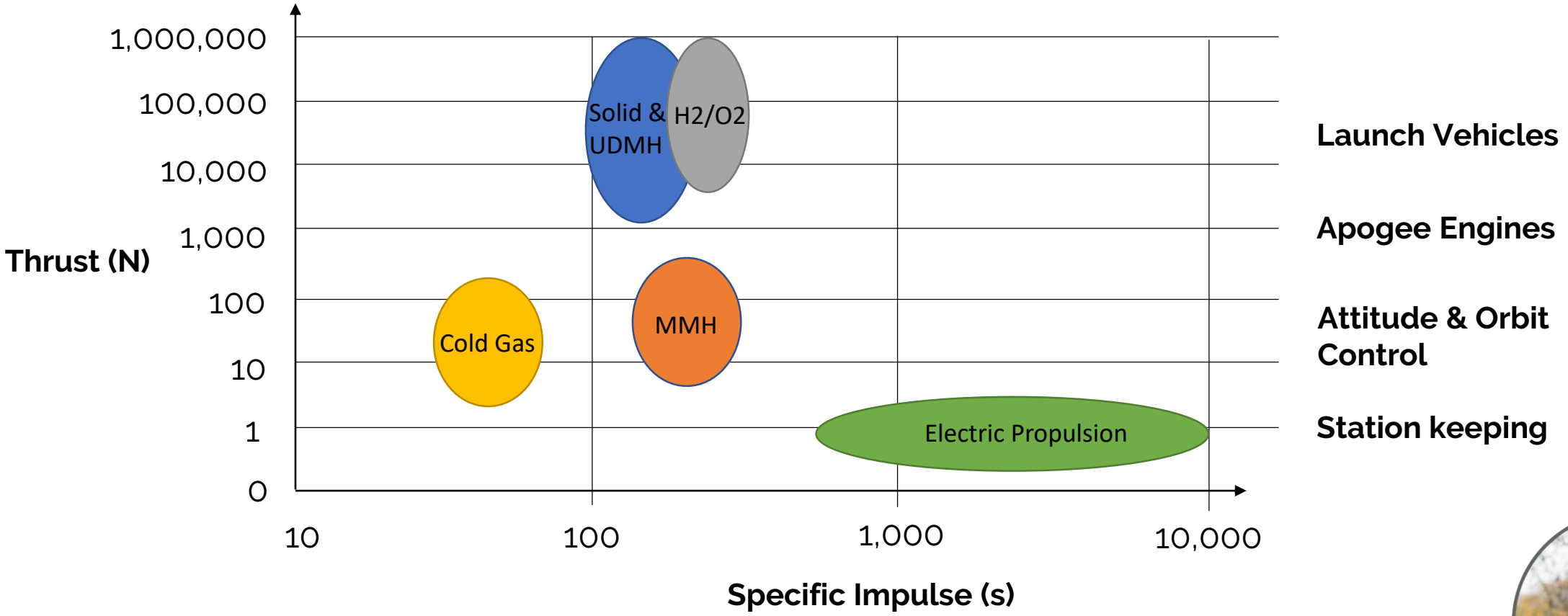
Hybrids

- Usually a solid fuel with a liquid oxidiser.
- Can be restarted, throttled and are relatively safe.
- They offer a similar performance to solids.
- They are more reliable than liquid engines.
- Example:
  - Plastic fuel (Polyethylene or PVC) + Oxidiser (N_2O or H_2O_2).

Thrust against Specific Impulse for Various Propellants.



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