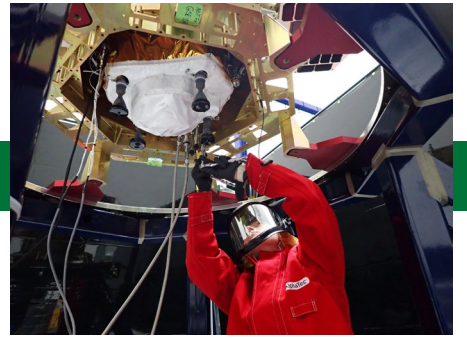
Propellant Comparison

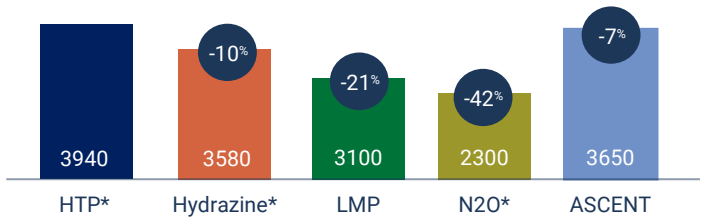
BENCHMARK space systems



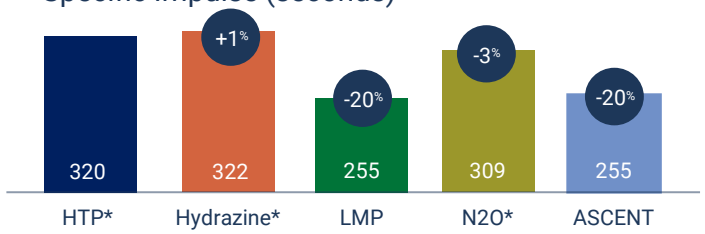
Each propellant has pros and cons in performance, safety, and handling - even those considered "green,"

PERFORMANCE

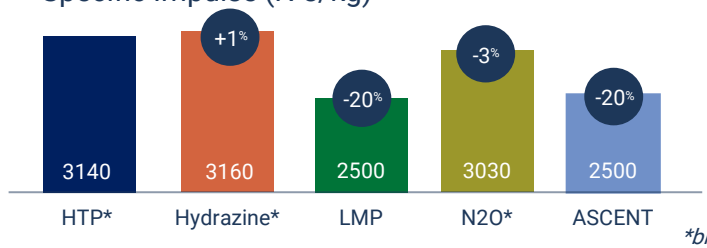
Density Impulse (N·s/L)



Specific Impulse (seconds)



Specific Impulse (N·s/kg)



**bipropellant*

	HTP (High-Test Peroxide Bipropellant)	Hydrazine Bipropellant	LMP-103	N2O (Nitrous Oxide Bipropellant)	ASCENT
INTEGRATION & FUELING	Low-Cost No Vapor Pressure Hazard	High-Cost Toxic Vapor Hazard	Moderate-Cost No Vapor Pressure Hazard	Low-Cost High Vapor Pressure Hazard	Moderate-Cost No Vapor Pressure Hazard
DETONABILITY	Non-Detonable Liquid	Non-Detonable Liquid	Non-Detonable Liquid	Detonable Liquid	Non-Detonable Liquid
SUPPLY CHAIN	Easily Sourced	Limited Availability	Limited Availability	Easily Sourced	Limited Availability
STORABILITY	~10 Year On-Orbit Mission Life	Indefinite Mission Life	Indefinite Mission Life	Indefinite Mission Life	Indefinite Mission Life

HTP can be handled with minimal safety equipment

What is High-Test Peroxide and Why Does Benchmark Use It?

- HTP stands for High Test Peroxide, which is a highly concentrated solution (85-100%) of hydrogen peroxide
- Utilized in satellite propulsion systems since the 1960s
- High specific impulse and density impulse for optimal performance
- Low flame temperatures enable long duration burns
- Low-toxicity - simple, cost-effective handling, no harmful byproducts, breaks down into water and oxygen in the environment
- Low vapor pressure - no hazard of propellant vapor inhalation or ignitable propellant vapor clouds
- Non-detonable liquid - will not mass-detonate due to water hammer, adiabatic compression, friction heating or any other ignition mechanism
- ISRU-friendly - can be generated from lunar or Martian water
- Moderate on-orbit storability - performance degrades at ~1% per year, with path to 0.1% in active development

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