

United Launch Alliance Overview

2016 ITEA Symposium

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America's Ride to Space

United Launch Alliance Overview

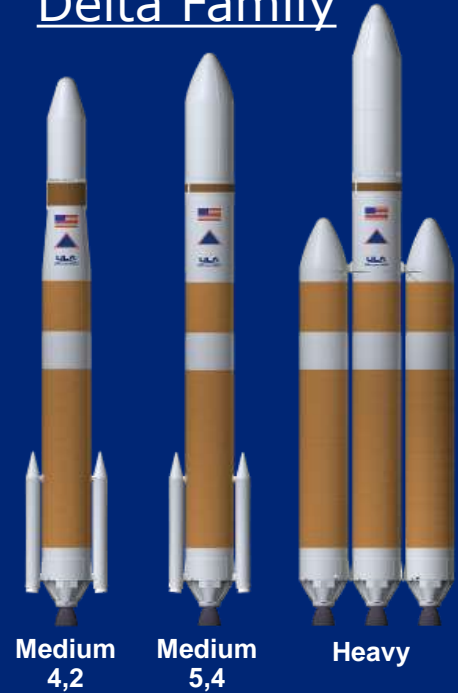
Atlas V Family



- ❑ EELV Provides Assured Access for National Security Space Missions
- ❑ Two World Class Launch Systems
 - Atlas V, Delta IV
- ❑ More Than a Century of Combined Experience in Expendable Launch Systems
 - Pooled Experience of > 1300 Launches
 - Legacy Reaching Back to the 1950s
- ❑ Commercial Sales Through Lockheed Commercial Launch Services or Boeing Launch Services

GTO	LEO
4,750 kg – 8,900 kg	8,080 kg – 15,760 kg
10,470 lb – 19,620 lb	17,820 lb – 34,750 lb

Delta Family



GTO	LEO
4,210 kg – 13,810 kg	7,690 kg – 23,560 kg
9,280 lb – 30,440 lb	16,960 lb – 51,950 lb

One Team, One Infrastructure , 100% Mission Success



America's Ride to Space

A Sampling of Notable Launches...

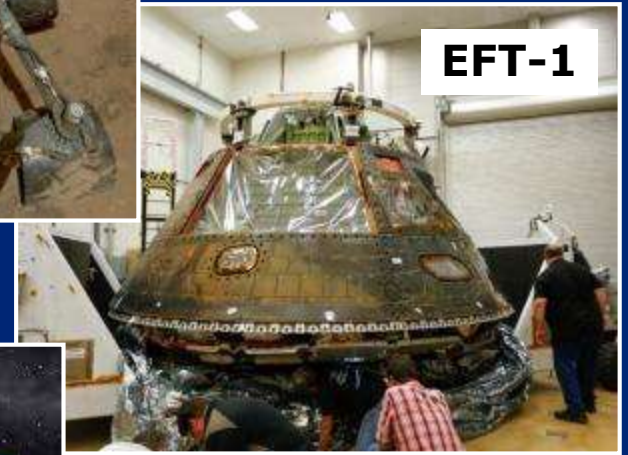
New Horizons



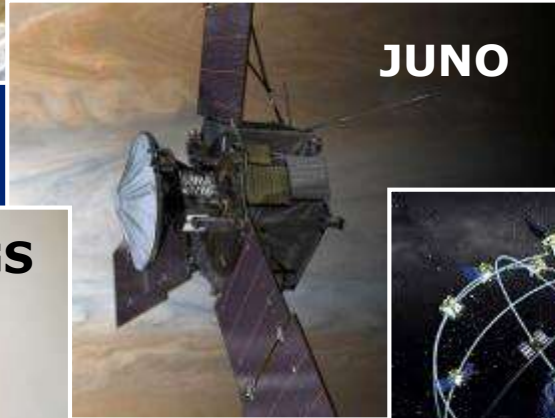
MSL



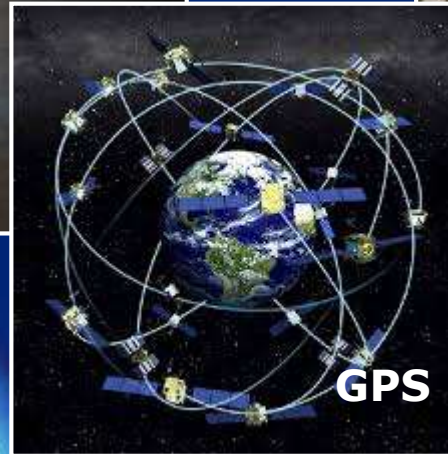
EFT-1



JUNO



WGS



GPS

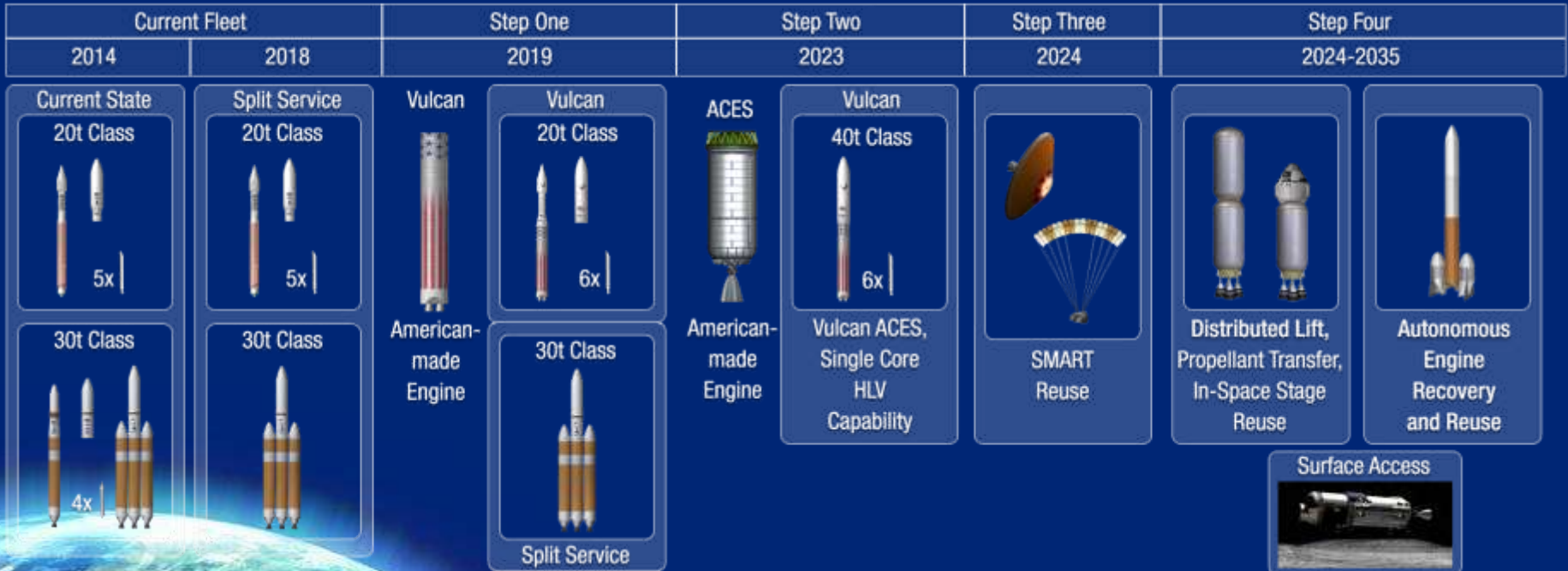
OTV





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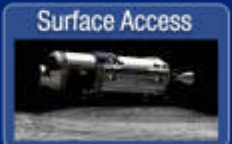
30 Year Product Road Map



Delta-M Retired

RD180 Retired

Delta-Hvy Retired



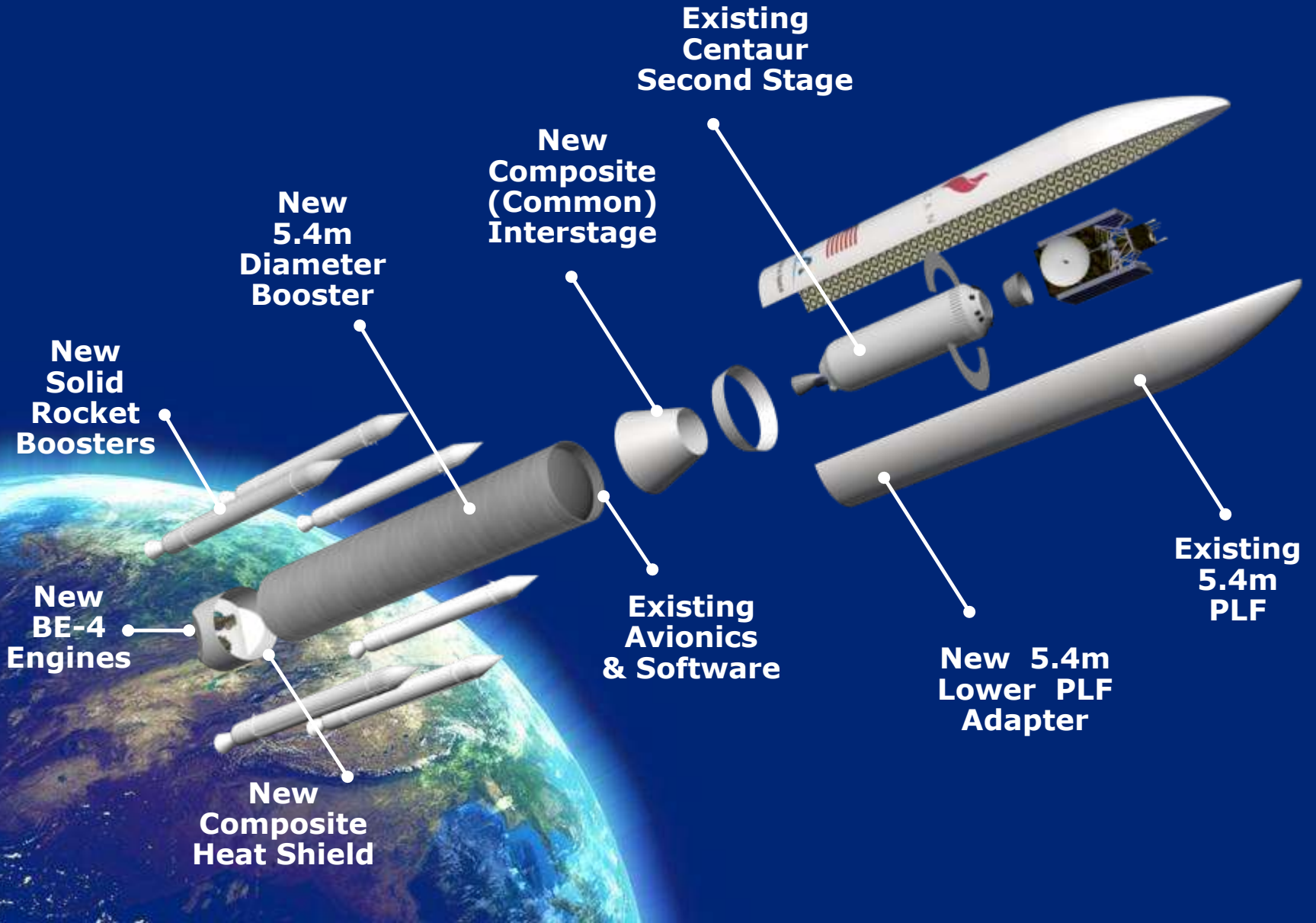
BE4 Replaces the RD180

Later Upgrade to ACES **Retires Delta-Heavy** for **1/4** the Lift **Cost**



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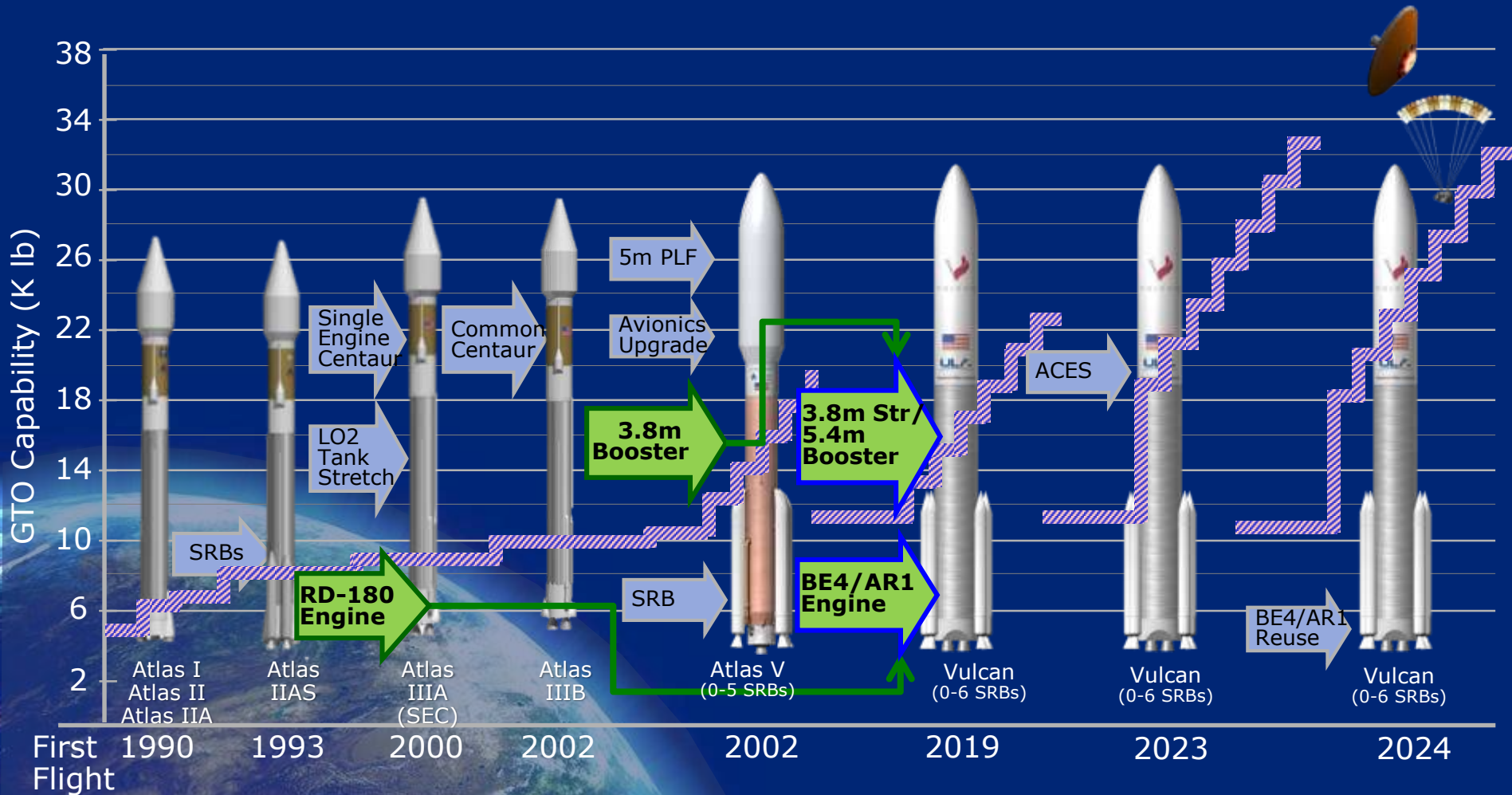
500 Series Configuration Expanded





America's Ride to Space

Atlas - Vulcan Evolution



Continuing Atlas Evolution with CCB & Engine Refresh

Advanced Cryogenic Evolved Stage (ACES)

- ❑ Large 150 klb capacity, in same length
- ❑ Best of Atlas and Delta
 - Centaur type construction
 - Anticipate >0.92 Mass Fraction
 - Aft avionics similar to Delta
- ❑ Designed specifically for Vulcan Booster
- ❑ Competitive engine downselect
 - RL10, XCOR, BE-3 derivative options publicly acknowledged
- ❑ New capabilities with Integrated Vehicle Fluids
 - Long Duration



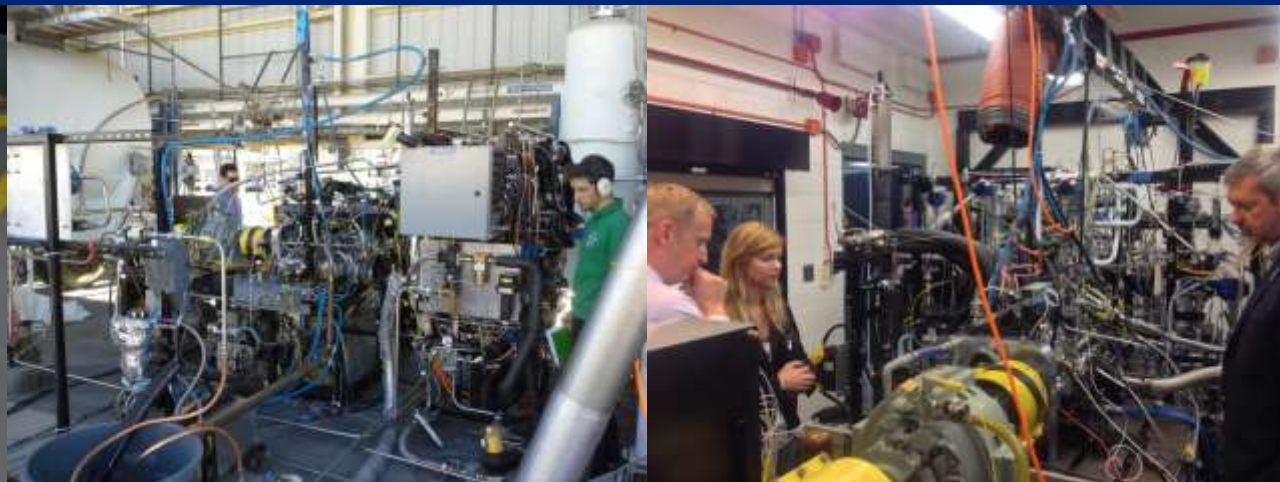
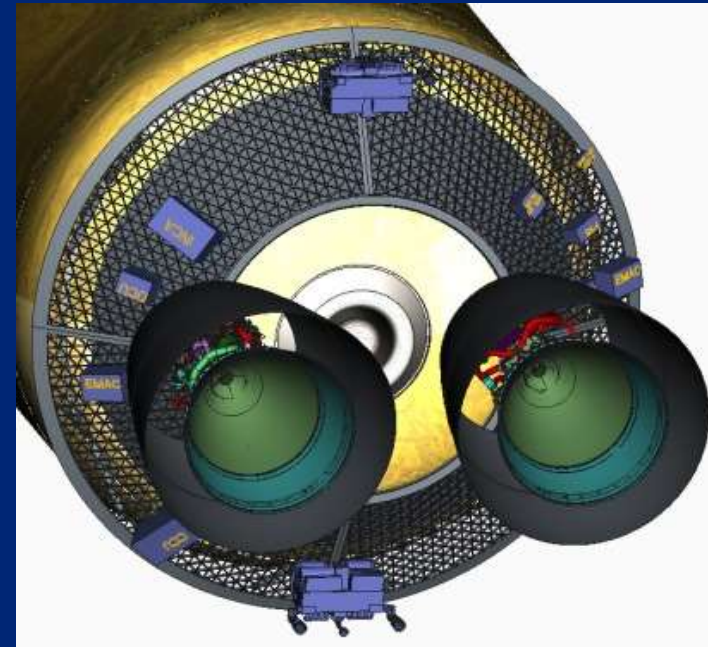
Technology Development Integrated Vehicle Fluids

An APU which burns boil-off H₂ and O₂

Generates electricity (replacing main batteries)

Provides autogenous pressurization (replacing He bottles)

Supplies H₂/O₂ ACS Thrusters (eliminating Hydrazine and hydrazine Operations)





America's Ride to Space

Launch Vehicle Recovery & Reuse

- Value and cost of recovery
 - Booster engine most valuable
 - Inertial velocity
 - Booster 3-6 km/sec
 - Upper stage at LEO 7-8 km/sec
 - GTO at perigee 10 km/sec
 - Substantial cost for RTLS

