United Launch Alliance Overview

- **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**

### Atlas V Family

<table>
<thead>
<tr>
<th>GTO</th>
<th>LEO</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,750 kg – 8,900 kg</td>
<td>8,080 kg – 15,760 kg</td>
</tr>
<tr>
<td>10,470 lb – 19,620 lb</td>
<td>17,820 lb – 34,750 lb</td>
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### Delta Family

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<thead>
<tr>
<th>GTO</th>
<th>LEO</th>
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<tbody>
<tr>
<td>4,210 kg – 13,810 kg</td>
<td>7,690 kg – 23,560 kg</td>
</tr>
<tr>
<td>9,280 lb – 30,440 lb</td>
<td>16,960 lb – 51,950 lb</td>
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</tbody>
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One Team, One Infrastructure, 100% Mission Success
A Sampling of Notable Launches...

New Horizons

JUNO

MSL

EFT-1

WGS

JUNO

GPS

OTV
30 Year Product Road Map

<table>
<thead>
<tr>
<th>Current Fleet</th>
<th>Step One</th>
<th>Step Two</th>
<th>Step Three</th>
<th>Step Four</th>
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<tbody>
<tr>
<td>2014</td>
<td>2018</td>
<td>2019</td>
<td>2023</td>
<td>2024</td>
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<tr>
<td>Current State</td>
<td>20t Class</td>
<td>Vulcan</td>
<td>ACES</td>
<td>Vulcan</td>
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<tr>
<td></td>
<td>30t Class</td>
<td>30t Class</td>
<td>30t Class</td>
<td>40t Class</td>
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<td>5x</td>
<td>American-</td>
<td>American-</td>
<td>Vulcan</td>
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<tr>
<td></td>
<td>4x</td>
<td>Engine</td>
<td>Engine</td>
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<td>Single Core,</td>
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<tr>
<td>Split Service</td>
<td>20t Class</td>
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<td></td>
<td>40t Class</td>
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<td>5x</td>
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**BE4** Replaces the RD180
Later Upgrade to ACES **Retires Delta-Heavy** for \(1/4\) the Lift **Cost**
500 Series Configuration Expanded

- **New 5.4m Diameter Booster**
- **New Solid Rocket Boosters**
- **New BE-4 Engines**
- **New Composite Heat Shield**
- **Existing Centaur Second Stage**
- **New Composite (Common) Interstage**
- **New 5.4m Diameter Booster**
- **Existing Avionics & Software**
- **New 5.4m Lower PLF Adapter**
- **Existing 5.4m PLF**
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 H2/02 ACS Thrusters (eliminating Hydrazine and hydrazine Operations)
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