Abstract #1754

English

Resources in the cislunar marketplace

To follow

French

No abstract title in French

No French resume

Author(s) and Co-Author(s)

Mr. GEorge Sowers
(UnknownTitle)
United Launch Alliance

Dr. Melissa Samson
(UnknownTitle)
ULA
Melissa Sampson  
**XEUS Program Manager, Advanced Programs**  
**United Launch Alliance**

Melissa Sampson is a program manager in the Advanced Programs group, developing ULA’s next generation technology. Advanced Programs enables the design of products, processes and infrastructure to meet ULA’s customers’ future requirements. She currently leads the XEUS (eXperimental Enhanced Upper Stage) program, a lunar lander.

Prior to joining Advanced Programs, she was the Building Leadership and Sustaining Talent (BLAST) program facilitator, coach and mentor, Operations Excellence Manager, and a category manager in Supply Chain. Dr. Sampson began her aerospace career as a systems engineer at Lockheed Martin, responsible for integrating Atlas launch vehicles and creating system solutions based on customer and product requirements. She was then selected as Executive Liaison for ULA’s Chief Operating Officer. In this capacity, she interfaced daily with the executive team, participated in all aspects of the company, and implemented executive projects. She continued her career in Washington, D.C. to lay the foundation for the ULA WDC offices and build relationships with elected officials. Previous to her aerospace career, Dr. Sampson worked in the Governor’s Office of Maryland, program management, space station payloads, sales, and lobbying.

Dr. Sampson earned her M.S. and Ph.D. degrees in Aerospace Engineering from the University of Colorado and her B.S. in Chemistry from the College of William and Mary. She is a certified ULA Lean & Six Sigma Black Belt and is an International Coaching Federation (ICF) certified coach.
Transportation & Resources in the Cislunar Marketplace

Dr. Melissa Sampson
XEUS Program Manager
Advanced Programs

CIM Convention 2017
Montreal, Canada
2 May 2017
Agenda

- Cislunar Space Economy
- Advanced Evolved Upper Stage (ACES) Update
- Progress on Cislunar Enabling Technologies
- eXperimental Enhanced Upper Stage (XEUS) Overview
- Transportation to Lunar Surface and Cislunar Space
Cislunar video
Cislunar Econosphere

**LEO**
- ISS
- Remote Sensing
- Commercial Station
- Communication
- Space Control
- Debris Mitigation
- Science
- R&D
- Tourism
- Manufacturing
- Propellant Transfer
- Data Servers

**GEO**
- Observation
- Communication
- Space Control
- Debris Mitigation
- Space Solar Power
- Repair Station
- Satellite Life extension
- Harvesting

**High Earth Orbit**
- Science / Astronomy
- Communication Link
- Way Station
- Propellant Depots
- Repair Station
- Lunar Solar Power Sat
- Manufacturing
- Planetary Defense

**Lunar Surface**
- Science / Astronomy
  - Lunar
  - Observatory
  - Human Outpost
  - Tourism
  - Mining
  - Oxygen / Water
  - Regolith
  - Rare Earth Elements
  - HE3
- Manufacturing
- Fuel Depots
- Solar Power to Earth

Existing market / Emerging market / Future market

Cislunar Vision: 1,000 People working in Space

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ACES – Advanced Cryogenic Evolved Stage

- **New Mission Capability**
  - Weeks Duration
  - Many Engine Burns
  - Service Module Type Flexibility
  - Increased Mission Flexibility

- **Affordable**
  - **Atlas 541** performance for less than $100M
  - GSO Heavy Performance for $140M
  - >20% more Performance than DIV Heavy

ACES is Key to Opening Cislunar Highway
IVF and Cryo Storage Key Enabling Technologies
Enabling Technologies In Development

- **Integrated Vehicle Fluids & Cryogenics**
  - Power  → No Main batteries
  - Reaction control  → No Hydrazine
  - Pressurization  → No Helium

- **Enables**
  - Weeks to Years
  - Service Module Flexibility
  - On Orbit Refueling

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**CRYOTE 3 at MSFC**

**IVF Prototype**

**H2/O2 Thruster**
ACES Capabilities Go Beyond Performance

<table>
<thead>
<tr>
<th></th>
<th>Centaur</th>
<th>ACES</th>
</tr>
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<tbody>
<tr>
<td>Max Engine Burns</td>
<td>3</td>
<td>Unlimited</td>
</tr>
<tr>
<td>Max Mission Duration</td>
<td>0.33 Days (8 hrs)</td>
<td>days - extendable to months</td>
</tr>
<tr>
<td>Peak power to P/L</td>
<td>Watts</td>
<td>Kilo Watts</td>
</tr>
<tr>
<td>Avionics</td>
<td>Static (Common Avionics)</td>
<td>GPS update, star tracker, uplink, etc</td>
</tr>
<tr>
<td>RCS Delta V</td>
<td>Limited to upper stage settling and thermal control</td>
<td>Virtually unlimited maneuvering</td>
</tr>
<tr>
<td>Reusable (w/ refueling)</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Secondary Payloads (aft bulkhead)</td>
<td>80 kg</td>
<td>400 kg</td>
</tr>
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</table>

Revolutionary New Capabilities
ULA’s technology can lead to large scale lunar surface access, enabling cislunar economy.

ACES + Mission Kit
- LH2/LO2 Thruster
- Landing GN&C
- Landing struts
Distributed Launch

<table>
<thead>
<tr>
<th>Vulcan</th>
<th>Earth Escape</th>
<th>GSO or Lunar Orbit</th>
<th>Lunar Surface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Launch</td>
<td>14 mT</td>
<td>10 mT</td>
<td>3.8 mT</td>
</tr>
<tr>
<td>Distributed Launch</td>
<td>30 mT</td>
<td>24 mT</td>
<td>12 mT</td>
</tr>
</tbody>
</table>

Initial Step to Upper Stage Reuse for ACES and XEUS
Potential Lunar Surface Cargo Mission

1) Launch
2) Refuel ACES
3) Trans-Lunar Injection
4) Lunar Orbit Insertion And Descent
5) XEUS Terminal Descent

Potential to Enable Large Scale Lunar Infrastructure
- Mining
- Science
- Manufacturing
- Habitation
Lunar Water

- Prospecting
  - ~10B mT of ice per pole
- Power Tower on Crater Rim
  - Beam power to crater floor

Standing on Threshold of Robust Cislunar Economy

Early Base

Lunar Water Mining: A Potential Oasis Supporting Lunar Settlement

Insitu Settlements

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