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

America's Ride to Space

Agenda

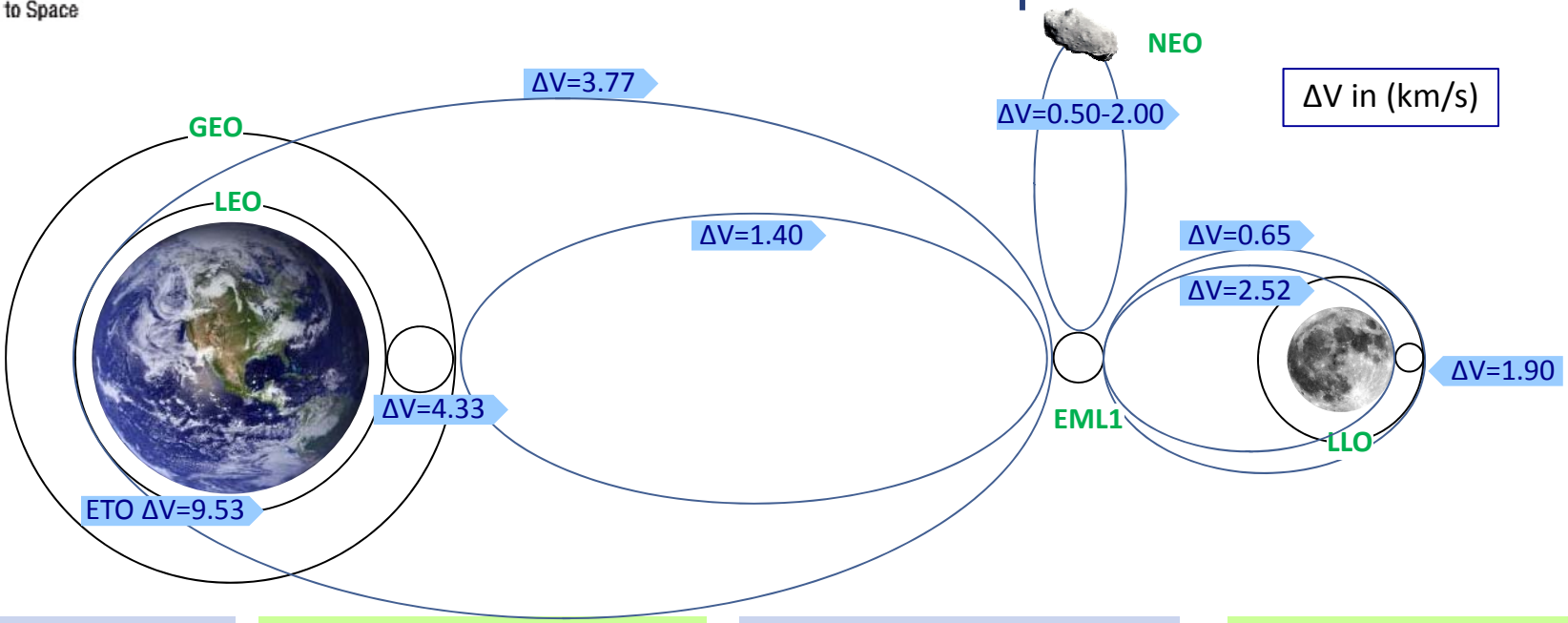
- Cislunar Space Economy
- Advanced Evolved Upper Stage (ACES) Update
- Progress on Cislunar Enabling Technologies
- eXperimental Enhanced Upper Stage (XEUS) Overview
- Transportation to Lunar Surface and Cislunar Space

America's Ride to Space

Cislunar video

America's Ride to Space

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

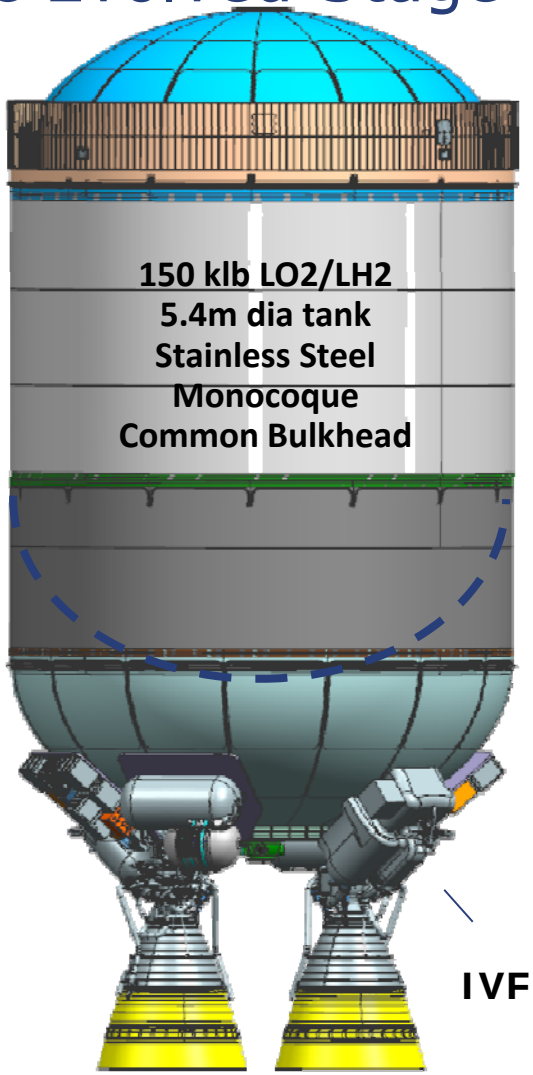
Lunar Surface
Science/ Astronomy
•Lunar
•Observatory
Human Outpost
Tourism
Mining
•Oxygen/Water
•Regolith
•Rare Earth Elements
•HE3
Manufacturing
Fuel Depots
Solar Power to Earth

Existing market / Emerging market / Future market

Cislunar Vision: 1,000 People working in Space

ACES – Advanced Cryogenic Evolved Stage

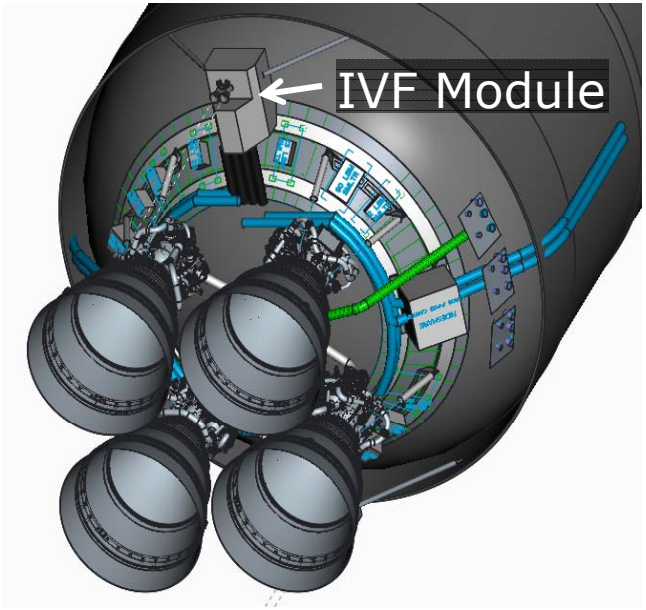
- **New Mission Capability**
  - **Weeks Duration**
  - Many Engine Burns
  - Service Module Type Flexibility
  - Increased Mission Flexibility
- Affordable
  - **Atlas 541** performance for less than $100M
  - GSO Heavy Performance for $140M
  - **>20% more** Performance than **DIV Heavy**

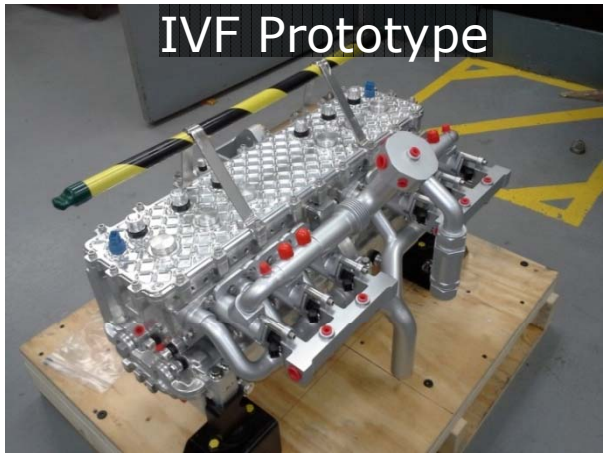


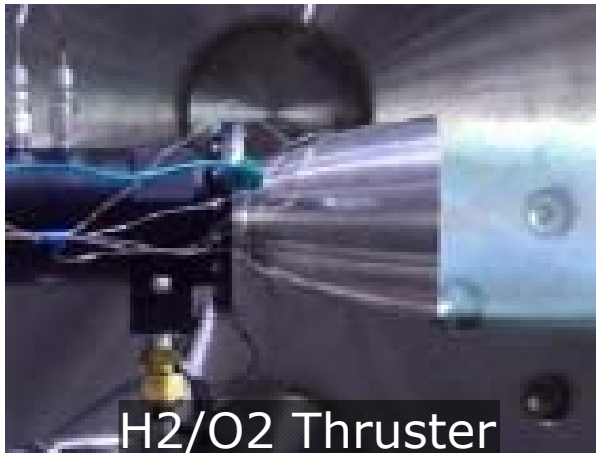
ACES is Key to Opening Cislunar Highway
IVF and Cryo Storage Key Enabling Technologies

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







ACES Capabilities Go Beyond Performance

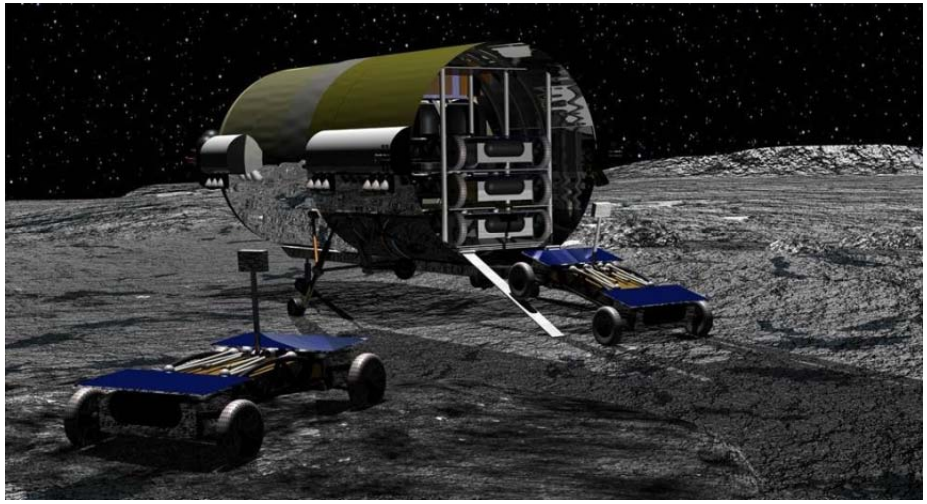
	Centaur	ACES
Max Engine Burns	3	Unlimited ∞
Max Mission Duration	0.33 Days (8 hrs)	days - extendable to **months**
Peak power to P/L	Watts	**Kilo Watts**
Avionics	Static (Common Avionics)	GPS update, star tracker, uplink, etc
RCS Delta V	Limited to upper stage settling and thermal control	Virtually unlimited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

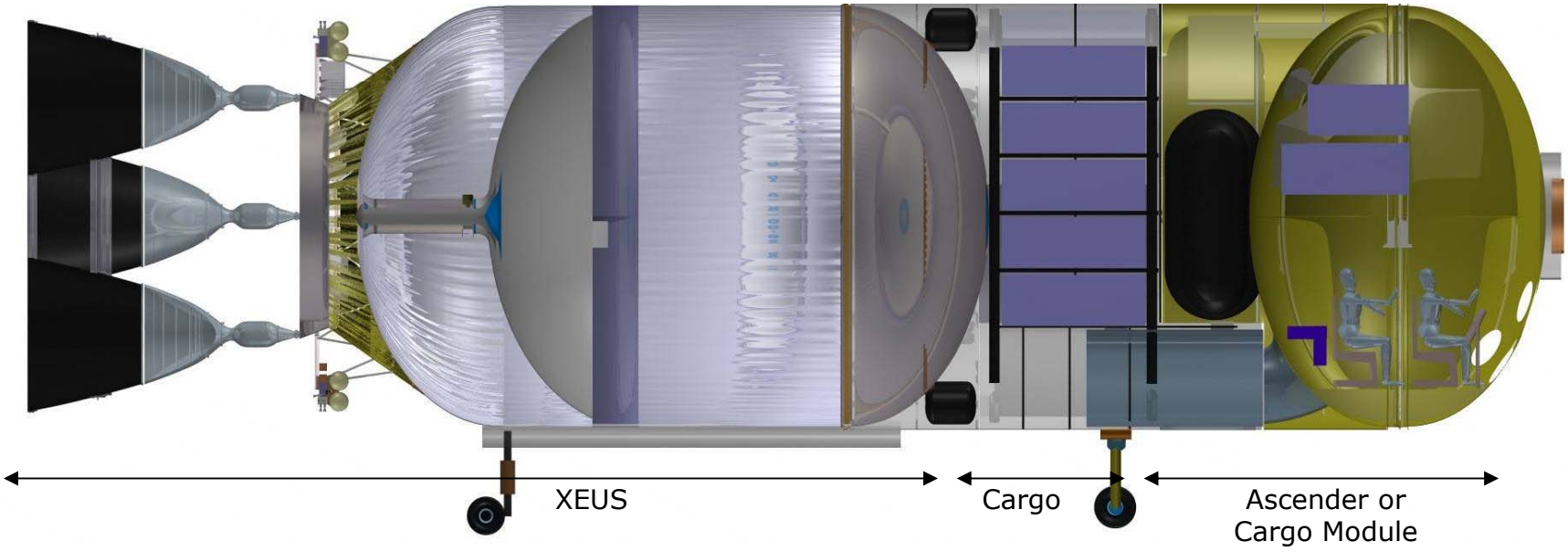
Revolutionary New Capabilities

XEUS Lunar Lander

- 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

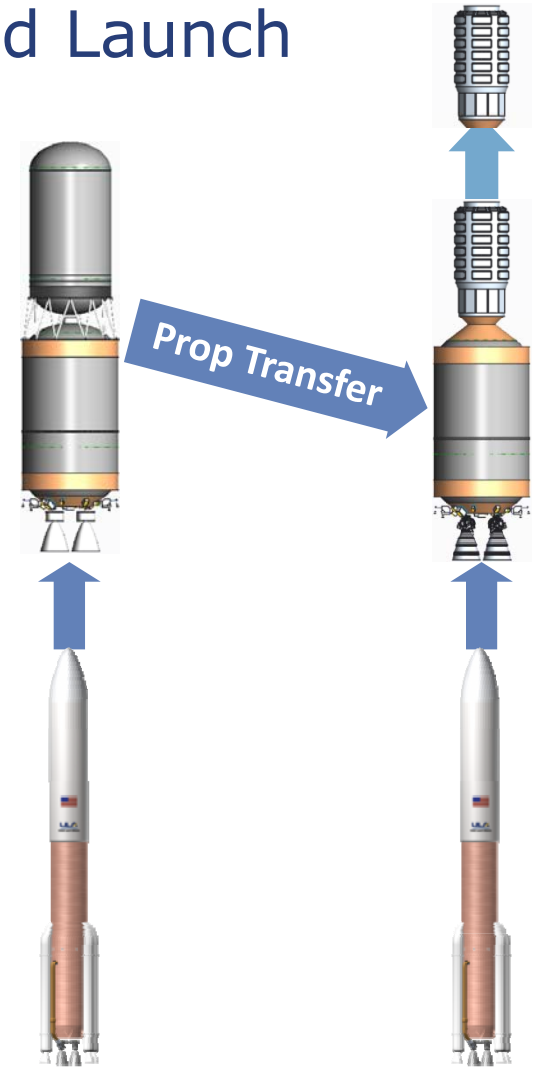




America's Ride to Space

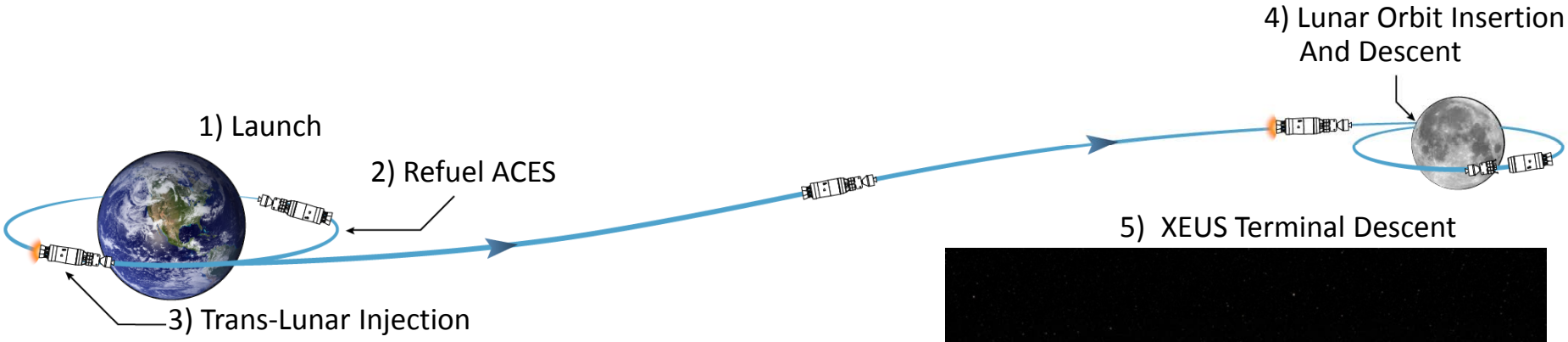
Distributed Launch

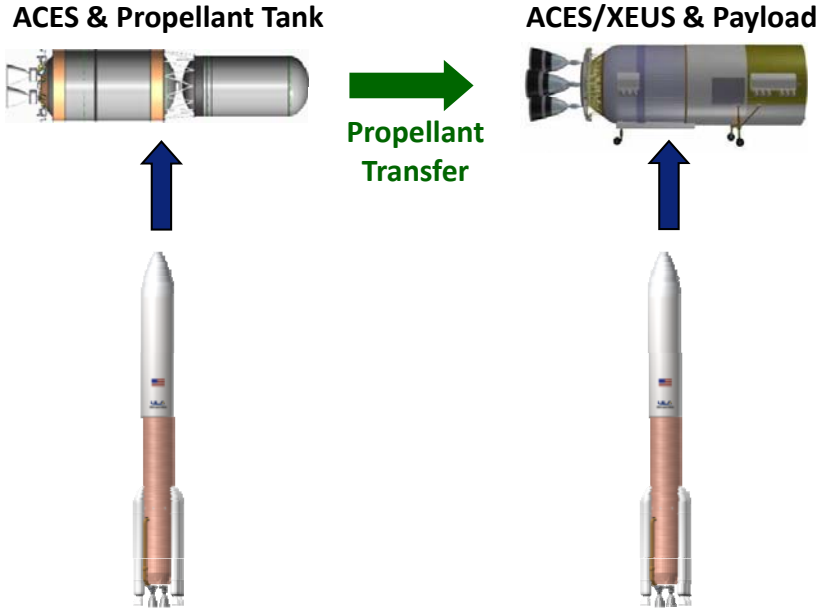
Vulcan	Earth Escape	GSO or Lunar Orbit	Lunar Surface
Single Launch	14 mT	10 mT	3.8 mT
Distributed Launch	30 mT	24 mT	12 mT



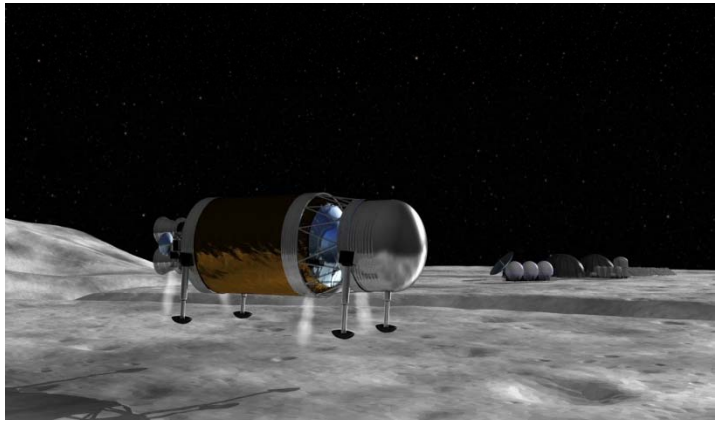
Initial Step to Upper Stage Reuse for ACES and XEUS

Potential Lunar Surface Cargo Mission





5) XEUS Terminal Descent

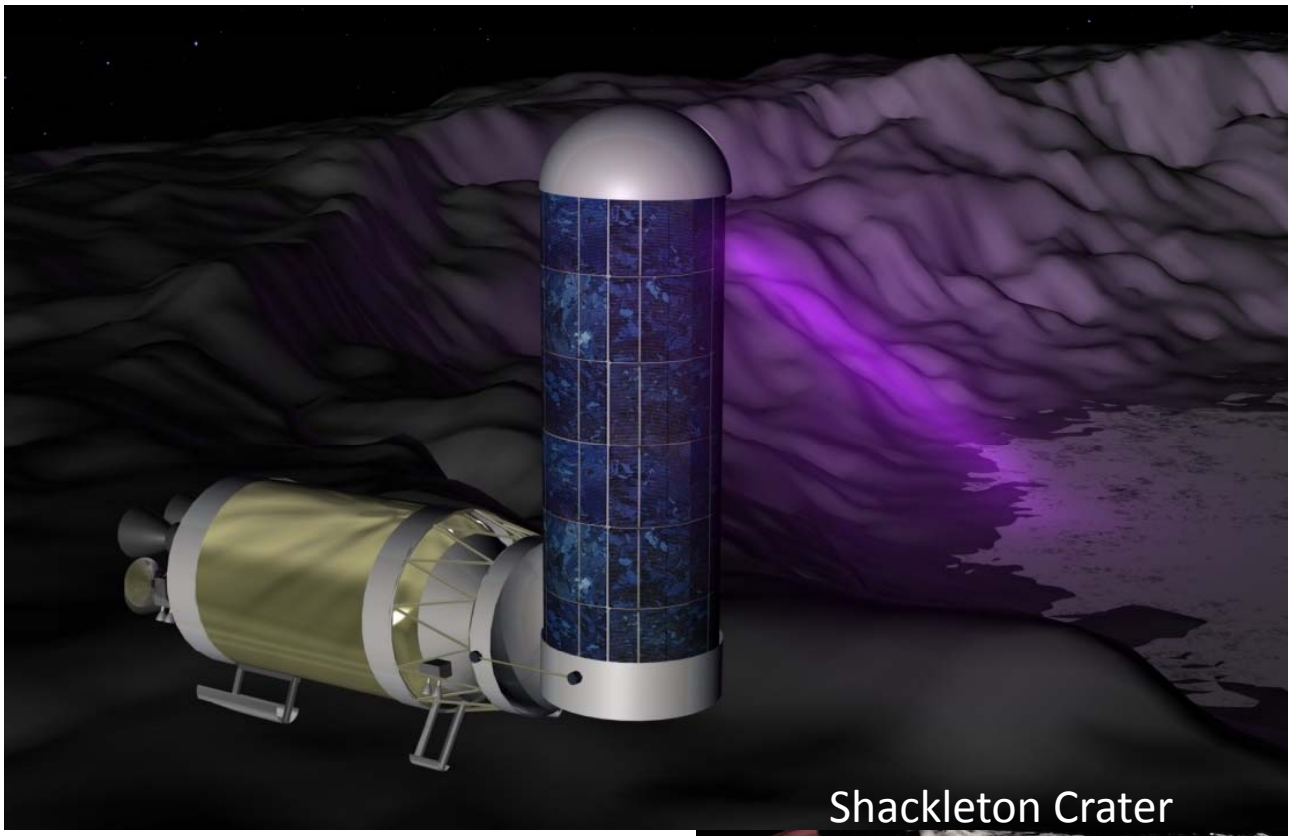


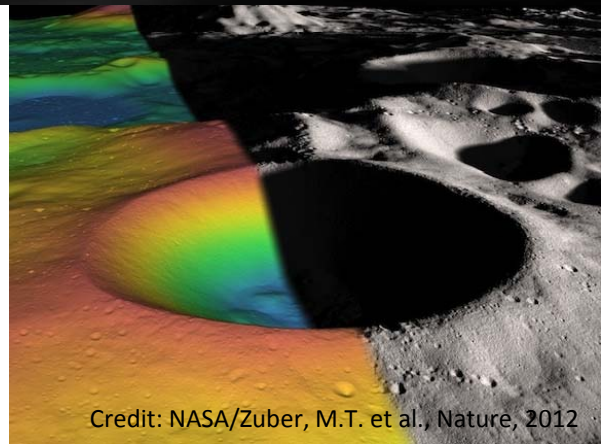
- Potential to Enable Large Scale Lunar Infrastructure
  - Mining
  - Science
  - Manufacturing
  - Habitation

America's Ride to Space

Lunar Water

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

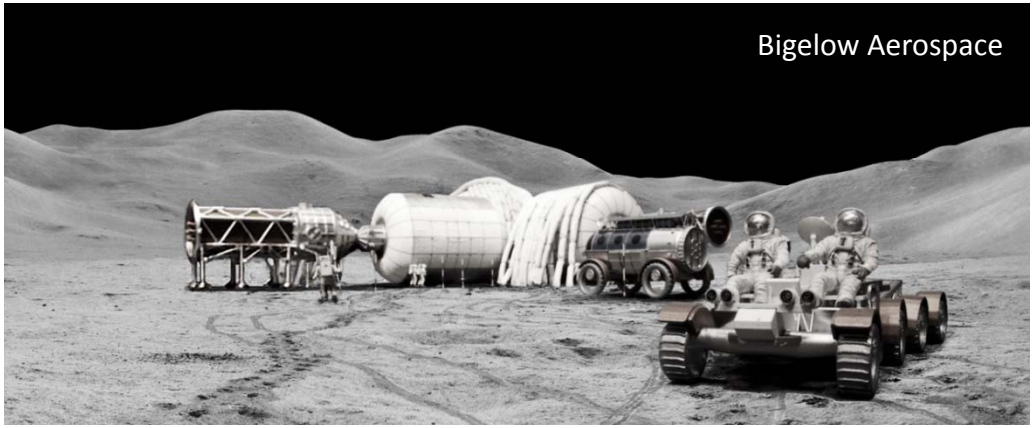




Standing on Threshold of Robust Cislunar Economy

America's Ride to Space

Early Base



Insitu Settlements

Lunar Water Mining: A Potential Oasis Supporting Lunar Settlement