

Lunar Farside (L2)

A Stepping Stone in a
series of Exploration
Missions ...

...with Ultimate Goal of
Mars in mind

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Lockheed Martin

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6 GER Principles and L2



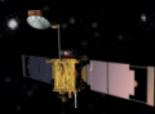
Principle	L2 Mission Solution
Capability Driven	SLS and Orion by 2018
Exploration Value	Science and HSF Risk Reduction
International Partnership	ICM, roles for Habitat and Rover
Robustness	Multiple Levels of Mission Options
Affordability	Within Current Budget Plans
Human-Robotic Partnership	Tele-robotic Operations

Deep Space Exploration

Stepping Stones is a series of exploration missions building incrementally towards America's long-term goal of exploring Mars.



Red Rocks: explore Mars from Deimos



Deimos Scout



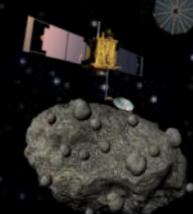
Plymouth Rock: Humans explore asteroid 2008 EA9 and others



Explore the Moon's far side from Earth-Moon L2 point



Lunar flyby



Asteroid scout



Asteroid survey



SLS test flight

A human mission to the moons of Mars will require capabilities such as heavy-lift launch ,

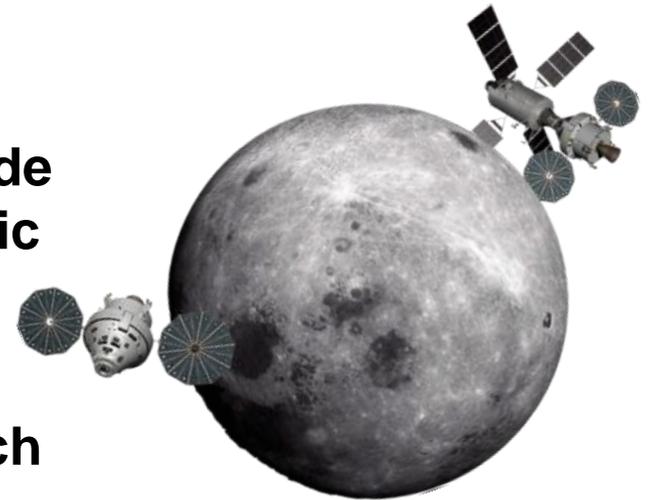
Notional mission concepts: Lockheed Martin

Deimos photo courtesy of NASA-JPL, University of Arizona

Why the Farside?



- **Placing Humans on the moon is cost prohibitive in the next decade**
- **Tele-operated rovers on the lunar farside are affordable and support key scientific objectives**
- **Orion at Earth Moon L2 can enable such exploration missions affordably and provide valuable risk reduction for future missions**



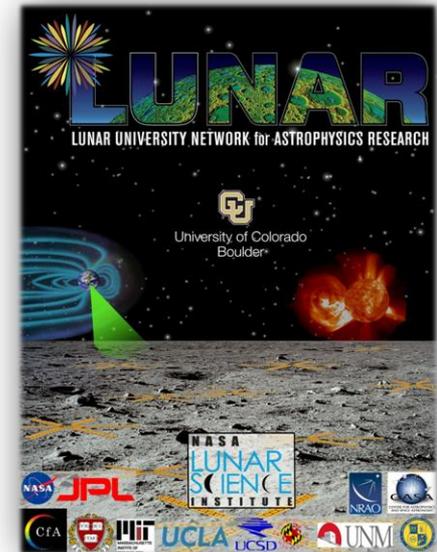
What Science?

“The exploration and sample return from the Moon’s South Pole Aitken (SPA) basin is among the highest priority activities for solar system science”

- 2011 Planetary Sciences Decadal Survey
- When did the big, ‘late’ impacts occur on the Moon, and by extension, in the rest of the inner solar system
- What is the Moon’s lower crust and mantle made of?
- What are big impact basins like?

Deploying a Low Frequency Radio Antenna on the "radio quiet" Farside

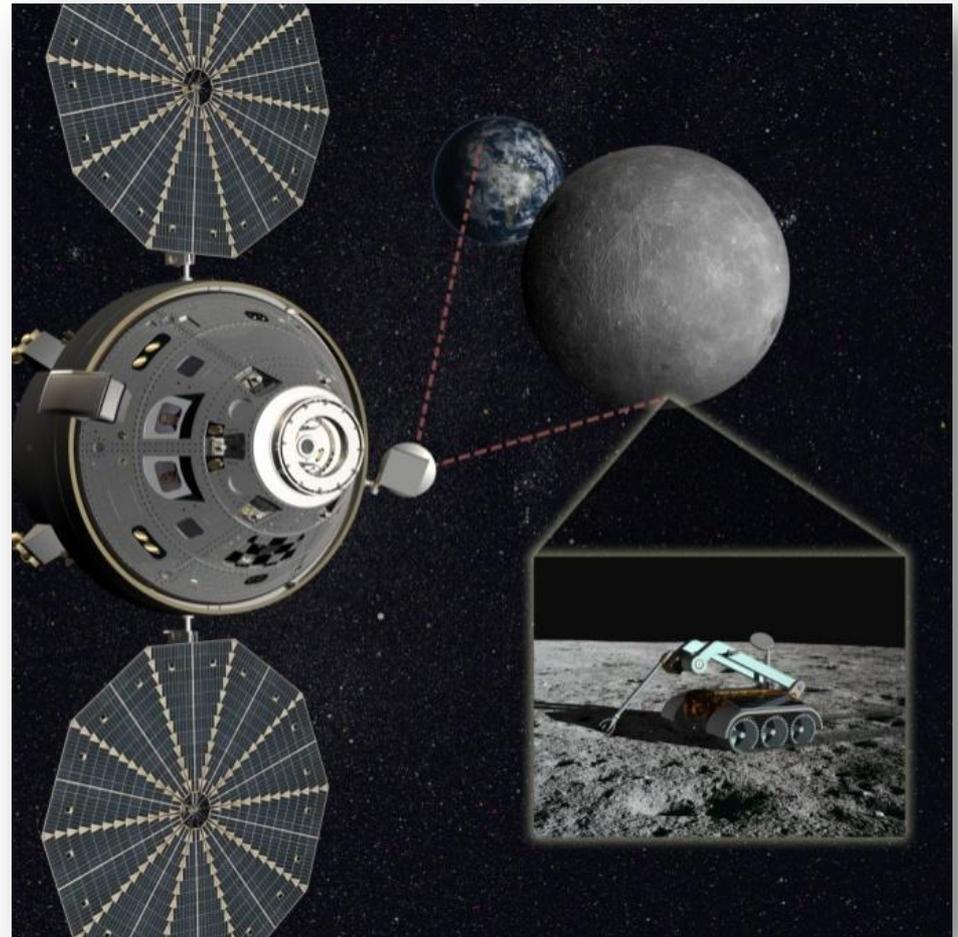
- What were the first objects to light up the Universe?
- When did they do it?



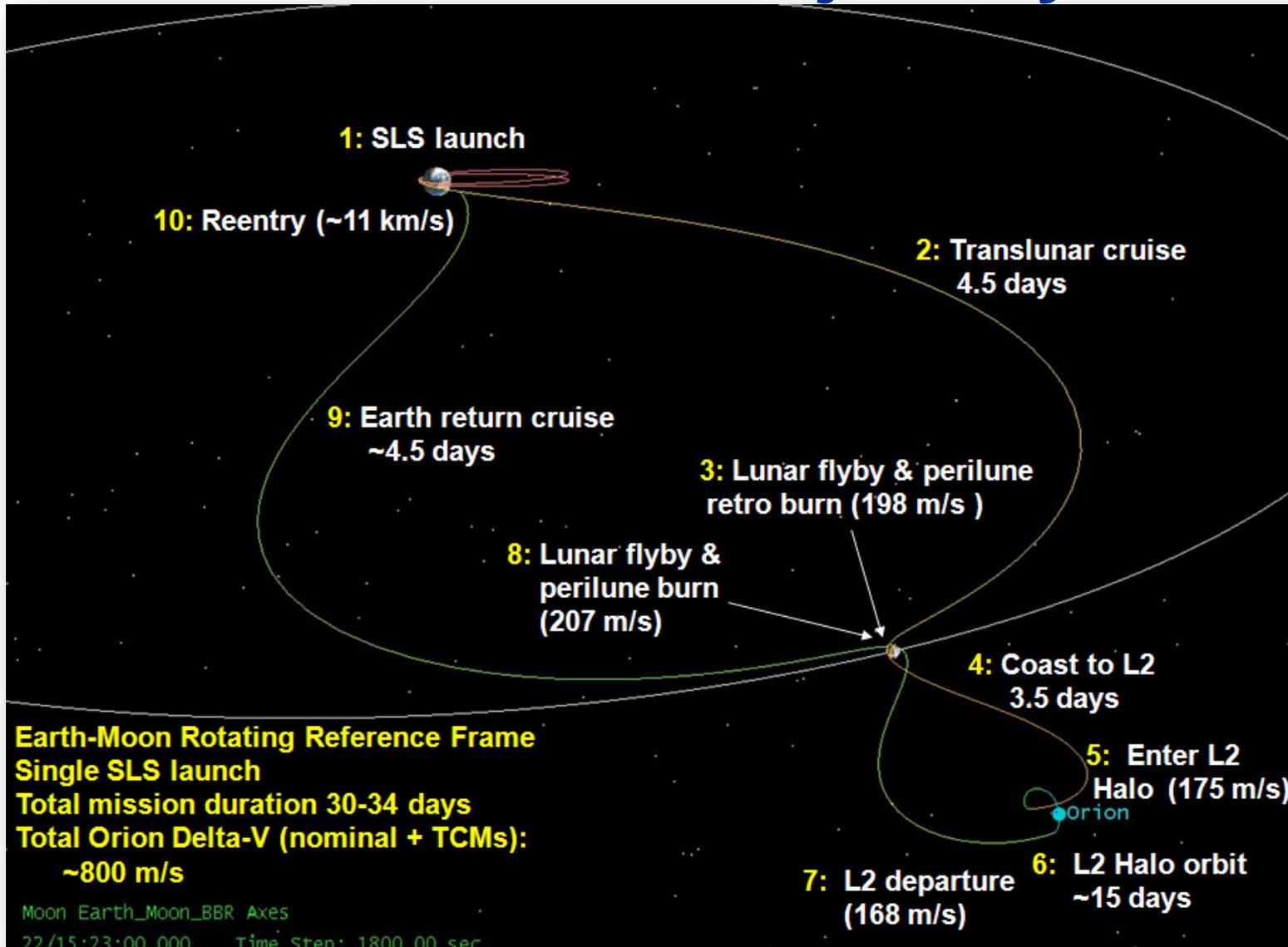
What Risk Reduction?



- Demonstrate Orion in deep space and high speed Earth Re-reentry
- 30 to 35 day mission into trans-lunar space as early as 2018
- Crew will travel 15% farther than Apollo and spend 3 times longer in deep space
- Practice tele-operation of rovers before a Mars mission



L2-Farside Mission Trajectory



Enabling Systems



Credit: NASA

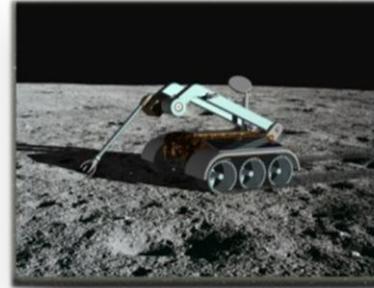
SLS

- Orion Launch
- Trans-Lunar Injection w/ Upper Stage



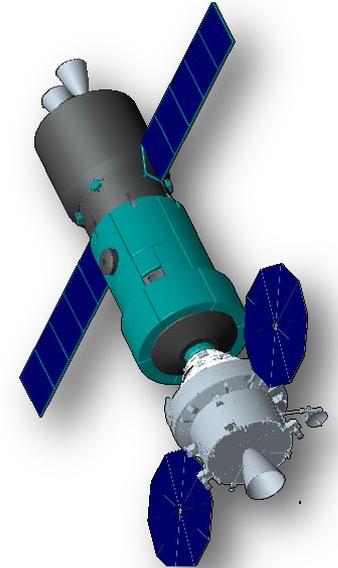
Orion

- Crew transport
- Life Support
- Tele-Robotic Operation



Robotics

- Sample Return
- Radio Antenna



Habitat (optional)

- Life Support
- International Collaboration

International Collaboration



- Cooperative partnership formed in 2009 to jointly investigate international space endeavors
- Objectives:
 - ✓ Develop a joint industry vision for a cooperative space exploration scenario
 - ✓ Foster a working international approach promoting an integrated global space architecture
 - Merge the industrial capabilities with an acceptable space agencies strategy



L2 Aligns with GER Objectives



GER Objectives	L2 Alignment
Search for Life	Radio Telescope Platform
Extend Human Presence	Furthest Humans have gone
Develop Exploration Technologies and Capabilities	Tele-robotic Operation
Perform Science	Explore South Pole-Aitken basin
Stimulate Economic Expansion	Synergistic use of Technology
Perform Space, Earth, and Applied Science	Radio Telescope Platform
Engage the Public	Exciting New Mission
Enhance Earth Safety	Understand Earth's future based on past