

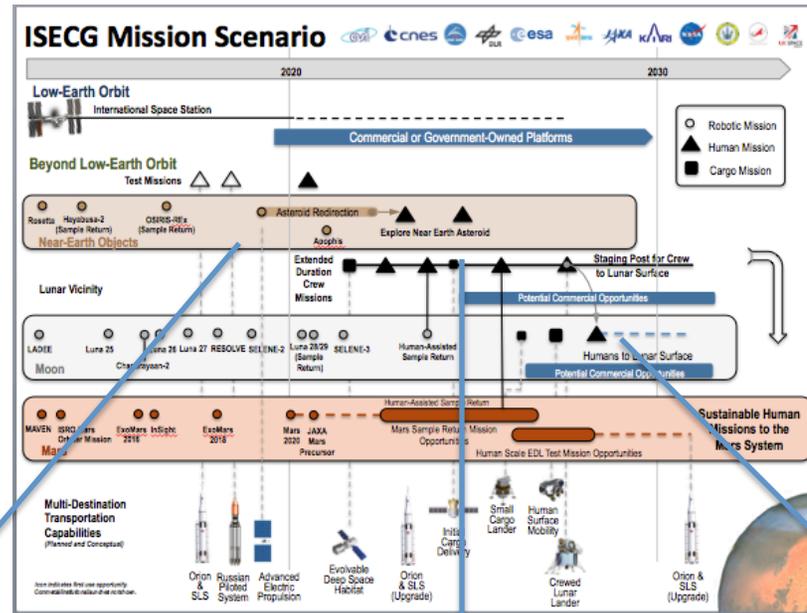


Global Exploration Roadmap Mission Scenario

NASA/R. Martinez
Chair, International Architecture Working Group

July 2014

ISECG Mission Scenario Mission Themes



Exploration of a Near Earth Asteroid

Human exploration of an asteroid which has been captured and redirected to lunar vicinity

Enabling Capabilities

- NASA's SLS and Orion
- Advanced Electric Propulsion
- Extra Vehicular Activity

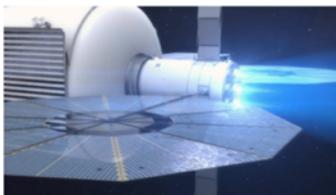
Contributions to Mars Mission Readiness

Demonstration of the following core capabilities:

- Space Launch System and Orion
- 30-50kW Solar Electric Propulsion System
- Spacewalks, rendezvous, proximity operations, docking or grapple, deep space navigation and communications.

Mission Activities

- Characterize the composition of the asteroid
- Identify any resources and assess their potential for extraction
- Apply human evaluation capabilities to select samples for return to Earth laboratories
- Demonstrating sample acquisition, cycling, storage operations, and crew transfer operations for future human-assisted sample return mission.



Extended Duration Crew Missions

Visits to an evolvable Deep Space Habitat in the lunar vicinity

Enabling Capabilities

- NASA's SLS and Orion
- Russian Piloted System
- Evolvable Deep Space Habitat
- Cargo Delivery

Contributions to Mars Mission Readiness

- Demonstrate deep space exploration capabilities such as SLS, Orion, advanced Russian crew transportation capabilities and life support systems, achieving an acceptable level of risk prior to travel to destinations away from the relative safety of Earth's orbit
- Demonstrate autonomous crew operation capability
- Demonstrate operations with reduced supply chain
- Increase experience with complex deep space staging operations
- Advance core technologies and radiation protection strategies for long duration missions
- Demonstrate interactive human and robotic operations analogous to Mars operational concepts
- Gain experience with solar electric propulsion used on a crewed spacecraft

Mission Activities

- Advancing deep space human space flight operations and techniques, including staging operations
- Conducting high priority science benefiting from human presence, including human-assisted lunar sample return.
- Testing technologies and subsystems benefitting from the deep space environment
- Characterizing human health and performance in a deep space environment



Humans to the Lunar Surface

Using evolvable Deep Space Habitat as staging post

Enabling Capabilities

- NASA's SLS and Orion
- Russian Piloted System
- Evolvable Deep Space Habitat
- Lunar Lander
- Cargo Delivery

Contributions to Mars Mission Readiness

- Demonstrate staging operations with an Earth-return vehicle
- Demonstrate extended crew mobility and habitation systems
- Demonstrate advanced power systems
- Characterize human health and performance, combining deep space and partial gravity environment exposure
- Demonstrate operations concepts and enhanced crew autonomy for surface exploration
- Potentially provide the opportunity for advancing concepts related to the use of local resources

Mission Activities

- Test advanced surface power technologies
- Address high priority objectives of the science community which benefit from human surface presence
- Characterize human health and performance in a partial gravity environment
- Demonstrate long distance mobility concepts
- Explore concepts for human-robotic partnership in planetary surface exploration
- Utilize precision landing technologies demonstrated on robotic missions
- Explore landing sites of interest for extended durations



Exploration of a Near Earth Asteroid

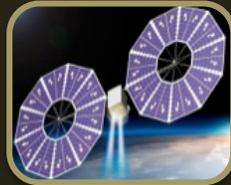
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Enabling Capabilities



NASA's SLS
and Orion



Advanced Electric
Propulsion



Extra Vehicular
Activity

Contributions to Mars Mission Readiness

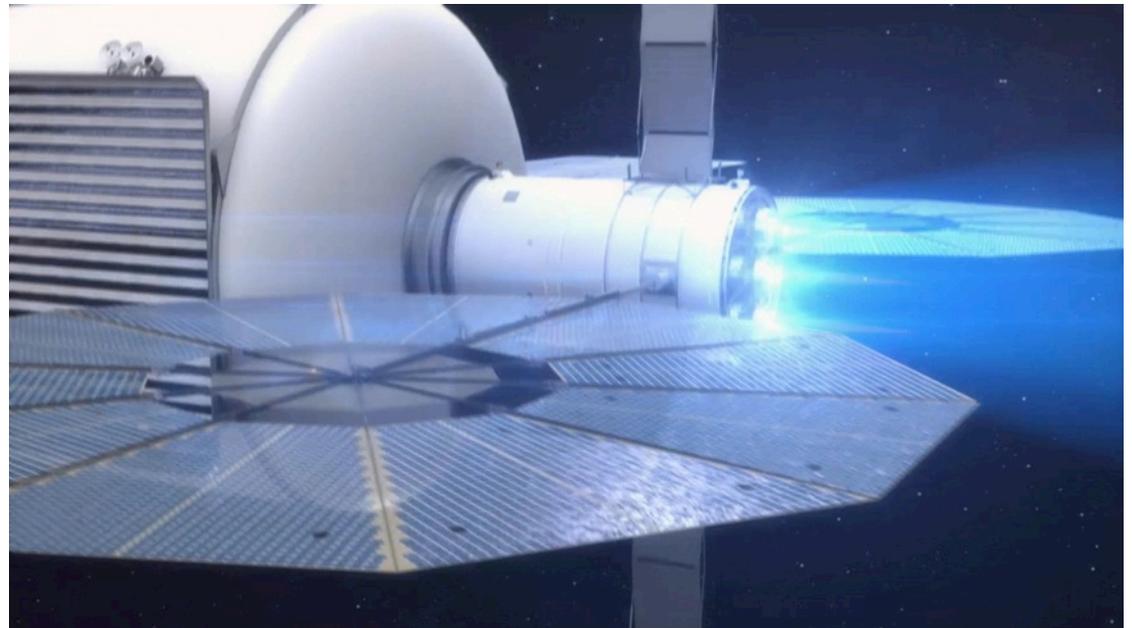
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Extended Duration Crew Missions

Visits to an evolvable Deep Space Habitat in the lunar vicinity



Enabling Capabilities



NASA's SLS and Orion



Russian Piloted System



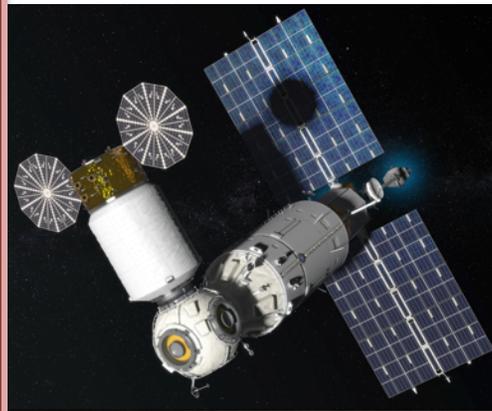
Evolvable Deep Space Habitat



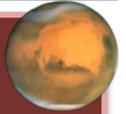
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Enabling Capabilities



NASA's SLS
and Orion



Russian Piloted
System



Evolvable Deep
Space Habitat



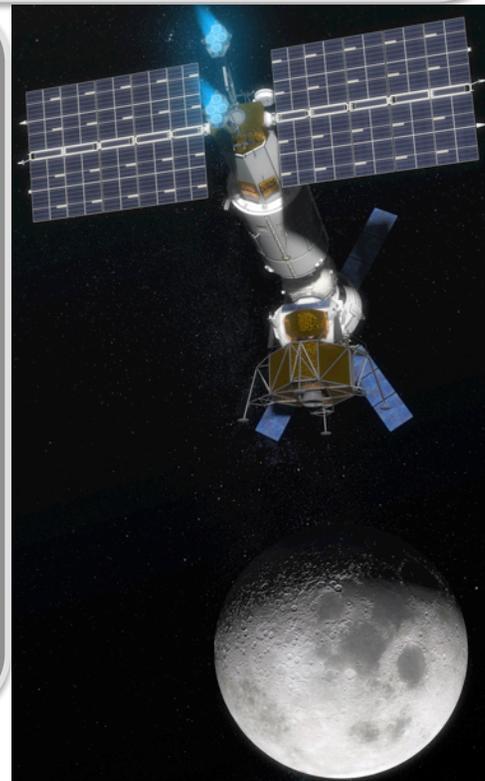
Lunar Lander



Cargo
Delivery

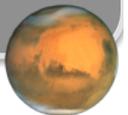
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Identifying Mars Mission Risk Reduction



<ul style="list-style-type: none"> ● Full utilization in relevant environment ● Sufficient risk reduction in relevant environment ⊙ Initial feasibility validation/partial validation 	Earth	ISS/Low-Earth Orbit	Lunar Vicinity (Earth-Moon Lagrange Point (EML), Moon Orbit)	Moon Surface	Mars Vicinity	Mars Surface (Robotic Mission)
Beyond Low-Earth Orbit Crew Transportation			●	●	●	
Heavy Lift Launch			⊙	●	●	
Reduced Supply Chain		⊙	●	●	●	
Autonomous Crew Operations	⊙	⊙	●	●	●	
Deep Space Staging Operations			●		●	
Mars Ascent	⊙			⊙		⊙
Space Radiation Protection/Shielding		⊙	●	●	●	
Life Support & Habitation Systems		●	●	●	●	
Entry, Descent, & Landing Systems	⊙			⊙		●
Surface Power and Energy Management	⊙			●		●
Surface Mobility	⊙			●		●
Human Robotic Integration	⊙	●	●	●	●	●
Mars In-Situ Resource Utilization	⊙			⊙		●
Long Duration Human Health	⊙	●	●	●	●	
Deep Space Operation Techniques	⊙	⊙	●		●	

Note: This table assumes critical capabilities will be provided by multiple agencies.