ISECG GER Mission Scenario Details: Asteroid Next

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Agenda & Contents

Outline:

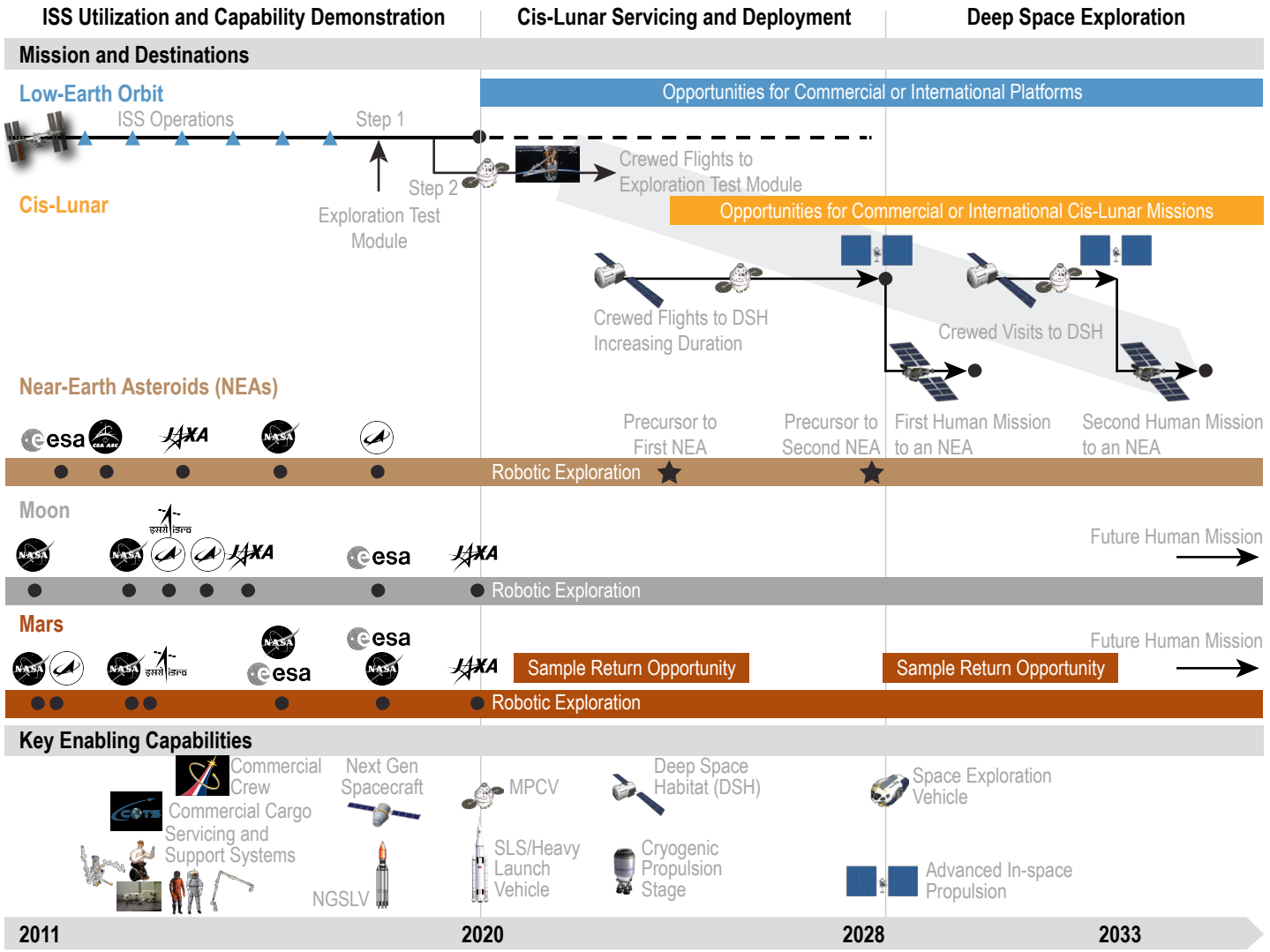
- **Asteroid Next - Key Features**
- **Mission Scenario: Asteroid Next**
- **Asteroid Next Capabilities and Missions**

Asteroid Next - Key Features

- Targeted utilization of the ISS to advance capabilities needed for human exploration
- Continued availability of access to LEO through commercial or government provided capabilities
- Opportunities to demonstrate human operations in cis-lunar space, enabling missions like satellite servicing
- Early deployment of the deep space habitat to Lagrange point, allowing demonstration of habitation and other key capabilities in a deep space environment
- Progressively longer demonstrations of the ability to live without the supply chain from earth
- Technology Pull for in-space propulsion, advanced life support and power generation
- Two asteroid missions, each with crew of 4, and a robotic precursor

Mission Scenario: Asteroid Next

Evolutionary Strategy Demonstrating Technologies Needed for Mars



Mission Scenario: Asteroid Next

Phase: ISS Utilization and Capability Demonstration

Crewed Missions
Robotic Precursor Mission
Initial Capability Mission
Robotic Mission
Technology Demonstration

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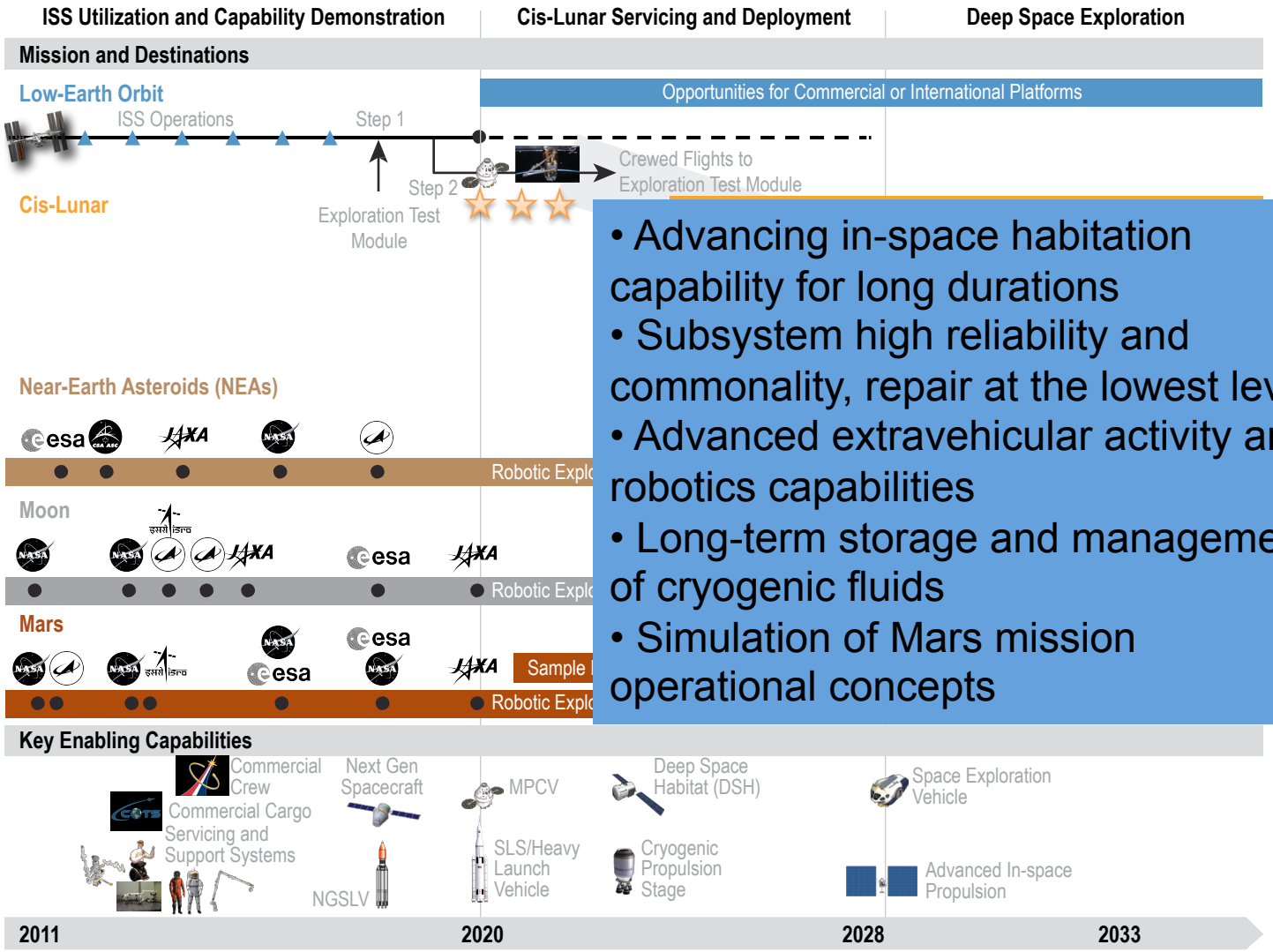

- Advancing in-space habitation capability for long durations
- Subsystem high reliability and commonality, repair at the lowest level
- Advanced extravehicular activity and robotics capabilities
- Long-term storage and management of cryogenic fluids
- Simulation of Mars mission operational concepts

Mission Scenario: Asteroid Next

Phase: Cis-Lunar Servicing and Deployment

Crewed Missions
Robotic Precursor Mission
Initial Capability Mission
Robotic Mission
Technology Demonstration

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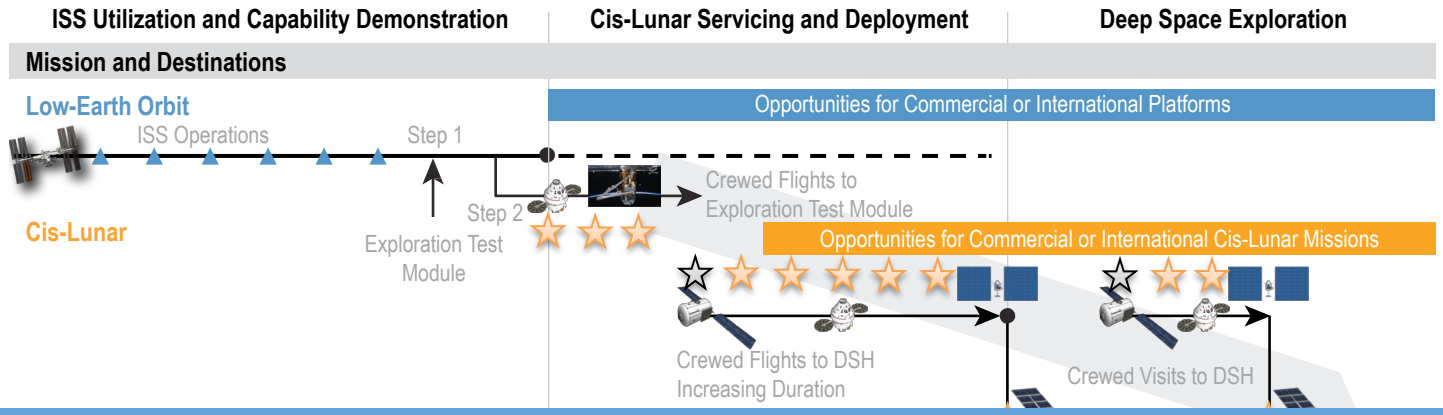
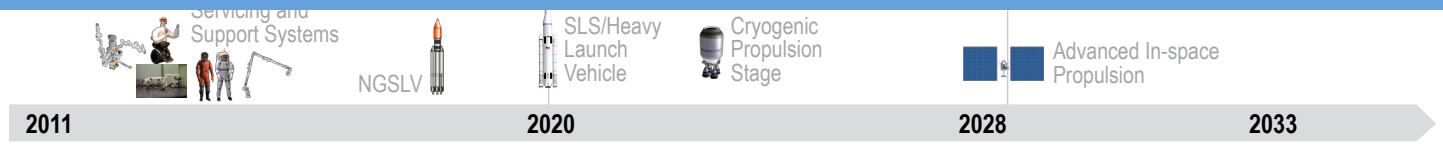
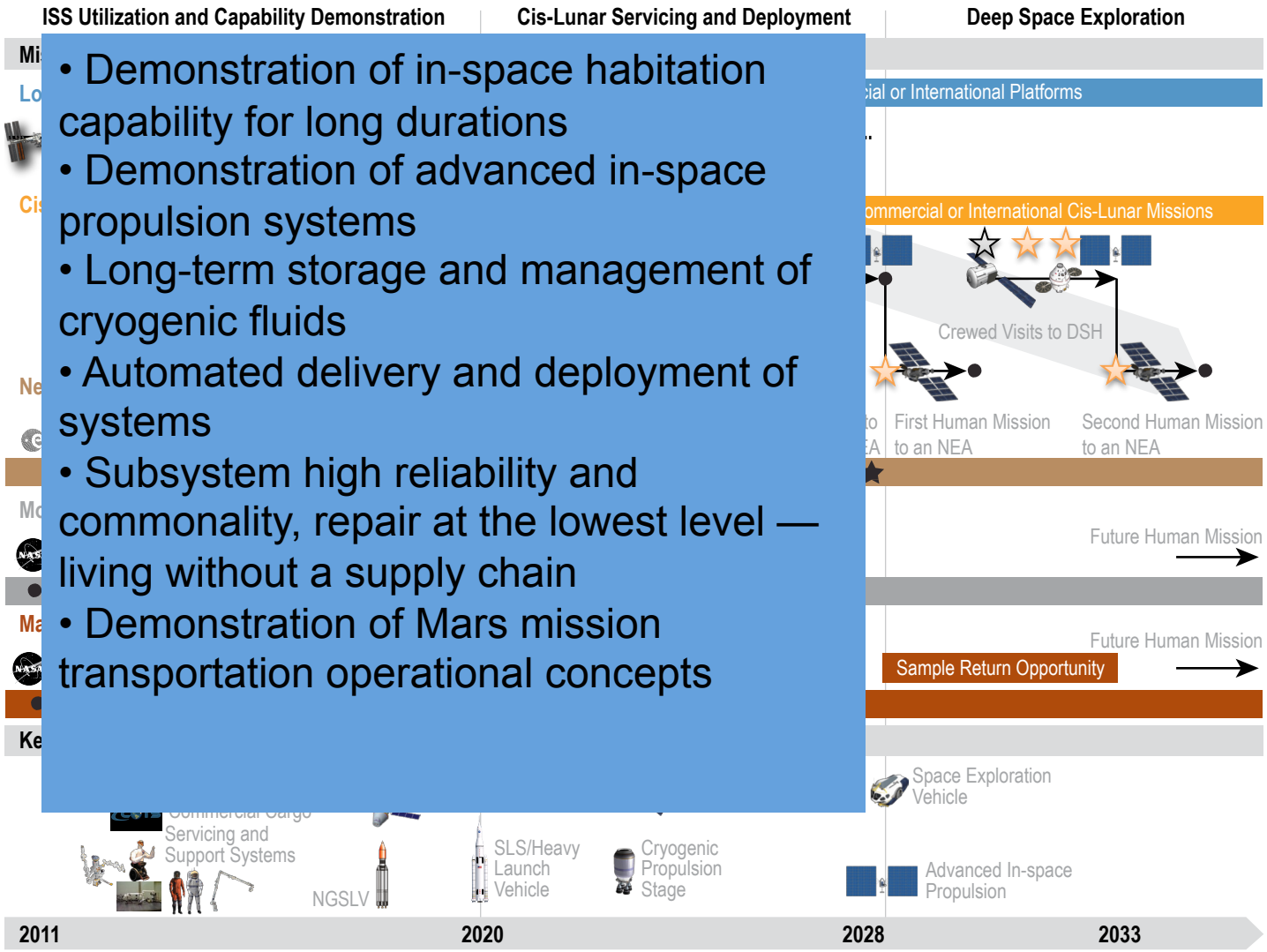


- In-space habitation for long durations in the appropriate radiation environment
- Radiation protection and measurement techniques
- Demonstration of beyond low-Earth orbit re-entry speeds
- Automated delivery and deployment of systems
- Subsystem high reliability and commonality, repair at the lowest level - living without a supply chain
- Long-term storage and management of cryogenic fluids
- Simulations of near-Earth asteroid mission operational concepts



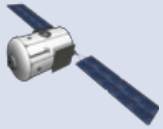
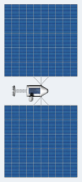
Mission Scenario: Asteroid Next

Phase: Deep Space Exploration



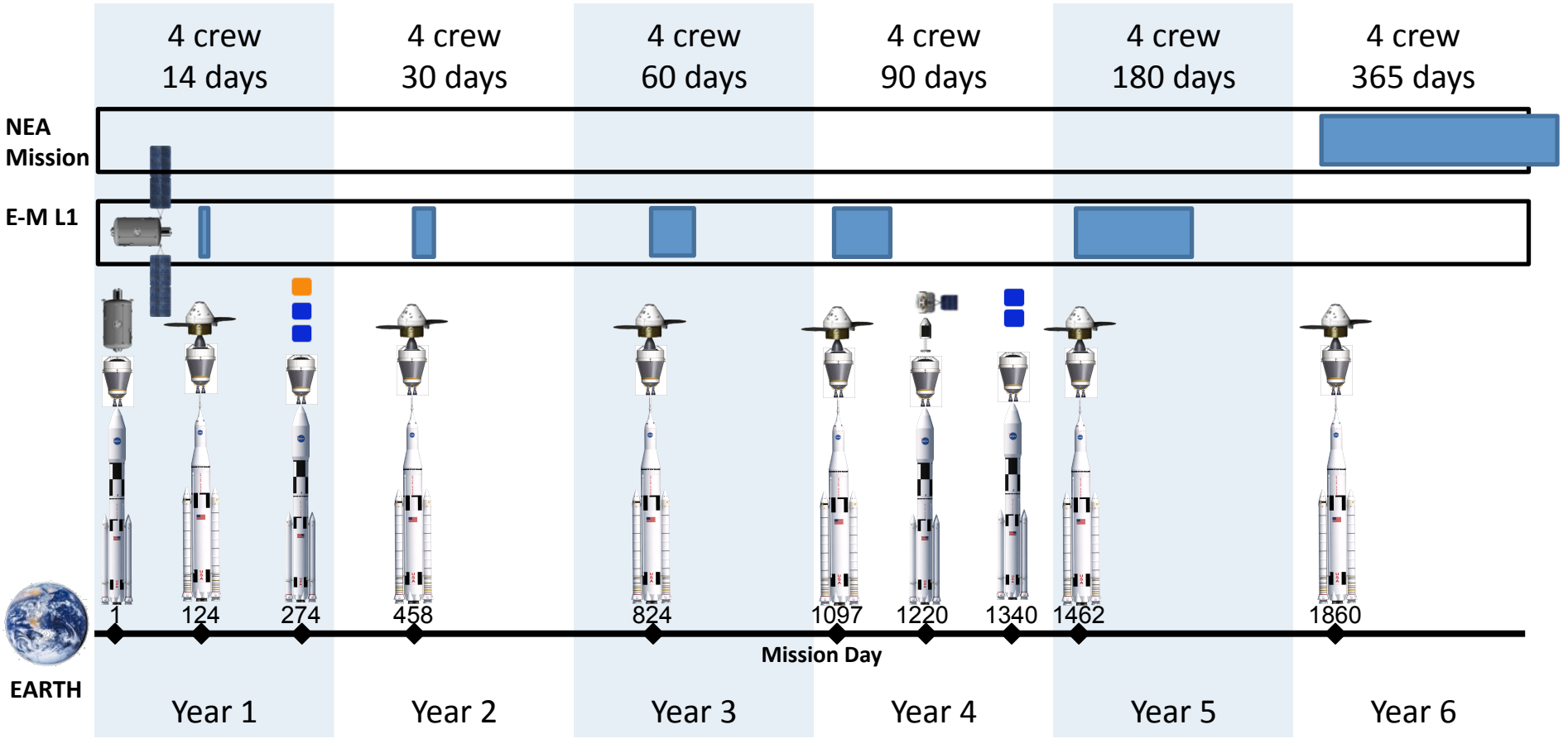
Asteroid Next Capabilities & Missions

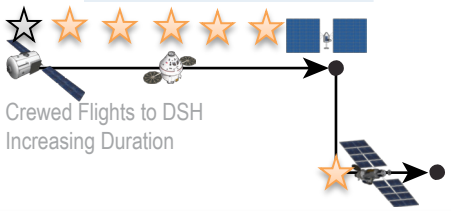
Common Capabilities		
	NASA Space Launch System (SLS)	Launch vehicle that has the capability to deliver cargo or crew from Earth to orbit.
	NASA Multi-purpose Crew Vehicle (MPCV)	Crew vehicle capable of delivering a crew to exploration destination and back to Earth.
	Roscosmos Next Generation Space Launch Vehicle (NGSLV)	Launch vehicle that has the capability to deliver cargo or crew from Earth to orbit.
	Roscosmos Next Generation Spacecraft	Crew vehicle capable of delivering a crew to exploration destination and back to Earth.
	Cryogenic Propulsion Stage (CPS)	In-space stage that provides delta V to architecture elements using traditional chemical rocket engines, cryogens, and storables and may include the capability for propellant transfer.
	Servicing Support Systems	Systems and tools to enable crew and robots to service in-space systems and assemble larger capabilities, including extravehicular activity suits.
	Commercial Crew	Commercial system capable of taking crew to low-Earth orbit.
	Commercial Cargo	Commercial system capable of taking cargo to low-Earth orbit.

Unique Capabilities		
	Deep Space Habitat	An in-space habitat with relevant subsystems for the purpose of advancing capabilities and systems requiring access to a deep space environment.
	Advanced In-Space Propulsion Stage	In-space stage using nontraditional propulsion technologies, such as high-power electric and nuclear propulsion.
	In-Space Destinations Systems	These systems have the capabilities that enable humans to effectively complete in-space destination objectives by enabling access.

"Asteroid Next" Design Reference Missions
Deep Space Habitat Deployment
Robotic Precursor Mission
Crew-to-Deep Space Habitat in E-M L1 – Short Stay
Crew-to-Deep Space Habitat in E-M L1 – Long Stay
Crewed Near-Earth Asteroid Mission using Advanced Propulsion

Example DSH at E-M L1 Campaign Leading to Asteroid Mission





Total Crewed Duration	No. of HLLVs			Logistics Sections	
	Crewed	Cargo	Resupply	Pressurized	Unpressurized
739	6	2	2	4	1

Logistics Legend Pressurized Unpressurized

Example DSH at E-M L1 Campaign Options

Mission Durations	Total Crewed Duration	Resupply Launches			Total HLLV Launches
		Total Resupply Launches	No. of Pressurized Sections	No. of Unpressurized Sections	
14, 30, 60, 90, 180, 365	739	2	4	1	10
5 x 30-day, 365	515	2	3	1	10
30, 90, 180, 365, 365, 365	1395	3	6	2	11
6 x 365-day	2190	4	9	2	12

- **Multiple options available for crew durations depending on the type and number of cargo launches committed to support resupply for increasing mission duration**
- **Should be driven by the science and exploration objectives**

Robotic Precursors Prior to Crewed Mission

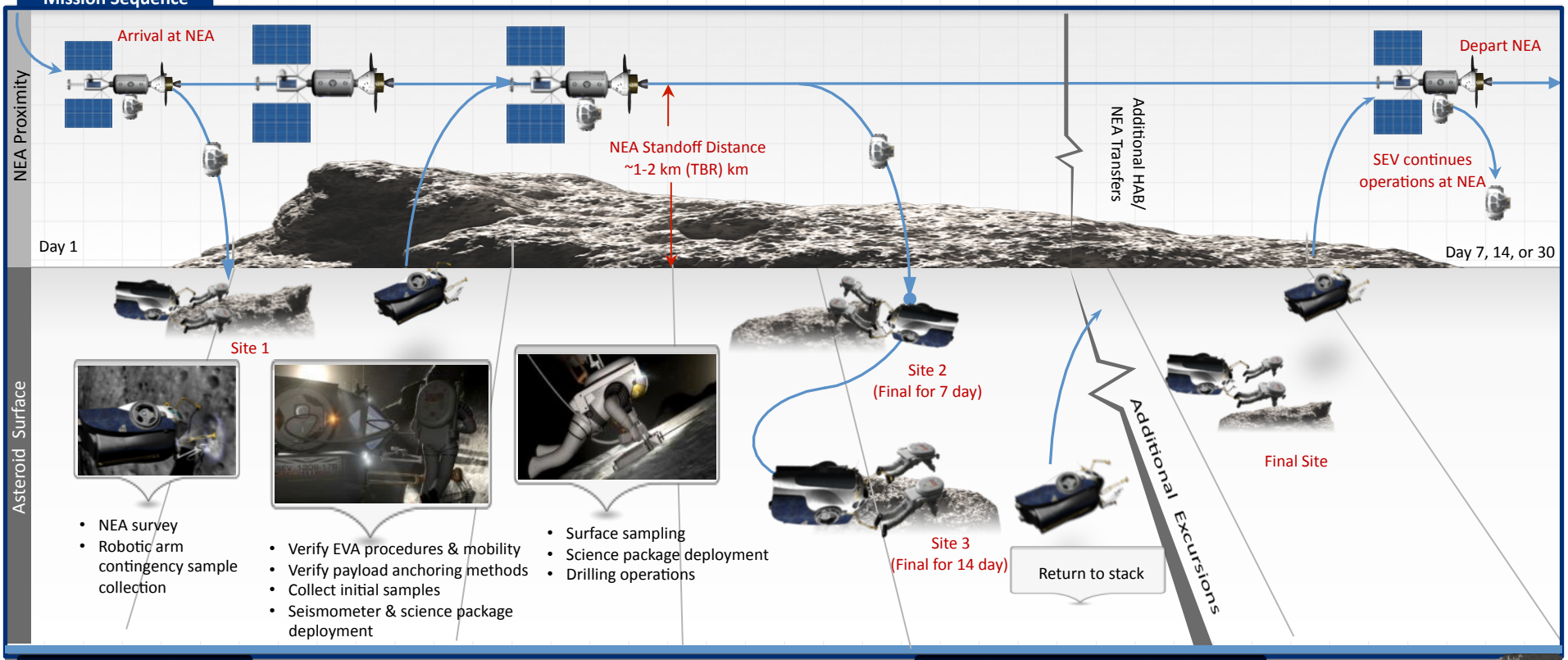
- **Some NEAs are solid, some are an aggregation of particles, and all rotate at various rates. Precursor robotic missions to the eventual human mission targets will allow us to refine destination systems performance that will be required to explore the chosen NEA.**

- **Ideally this precursor spacecraft should arrive several years (~3 to 5) in advance of the human mission in order to give missions planners, spacecraft engineers, and planetary scientists adequate time prepare suitable operations plans, system designs, and science experiments.**

- **Potential Properties to be characterized:**
  - Orbital Position, System Type (e.g. Binary or Ternary), Spin Rate/Mode, Activity/ Debris Field, Internal Structure, Near-Surface Structure and Regolith, Geotechnical/Mechanical Properties, Gravitational Field, Mineralogical/Chemical Composition, Electrostatics/Plasma Environment, Thermal Properties, Radiation Environment at the NEA

NEA Exploration - Single SEV Option; 7, 14 or 30 days at NEA

Mission Sequence



Mission Summary

SEV robotic arms anchor to the NEA surface and provide astronaut platforms during EVA. The mothership stack, including the SEP, DSH, and MPCV, stationkeeps at a safe standoff distance. Surface activities include sample collection and deployment of probes (radar, acoustic, seismometer, etc.), experiments and planetary defense devices.

Mission Site: Near Earth Asteroid