



ESMD Overview: Imagining a Vibrant Future for Human Exploration of Space

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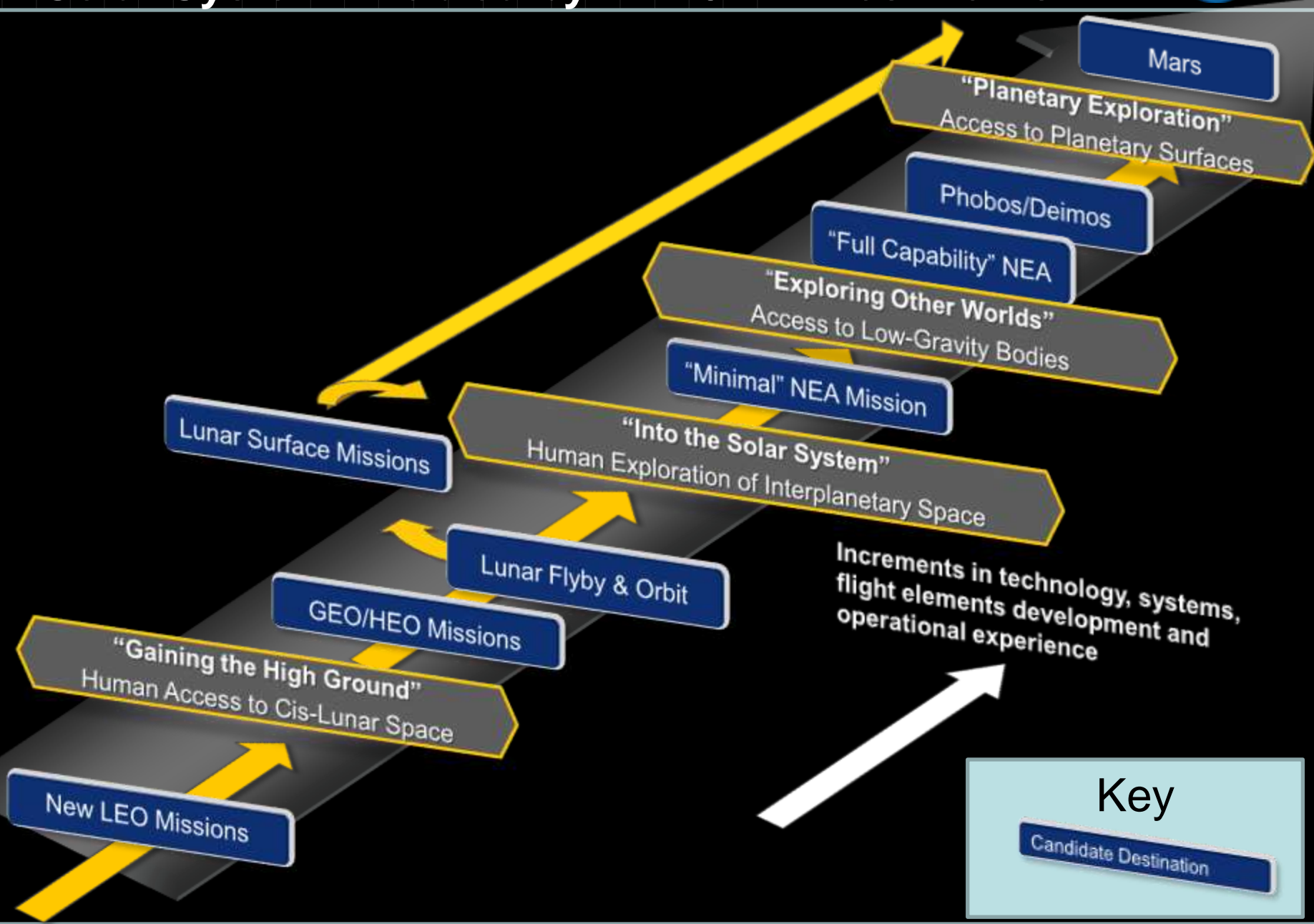
A New Path: The NASA Authorization Act of 2010



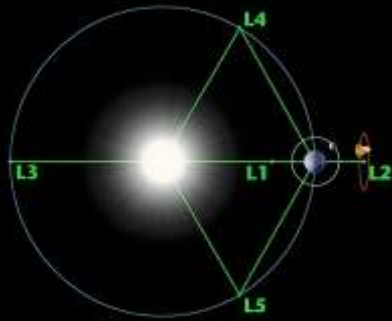
- **The Congress approved and the President signed the National Aeronautics and Space Administration Authorization Act of 2010**
 - Bipartisan support for human exploration beyond Low Earth Orbit
- **The law authorizes:**
 - Extension of the International Space Station until at least 2020
 - Strong support for a commercial space transportation industry
 - Development of a multi-purpose Crew Vehicle and heavy lift launch capabilities
 - A “capabilities-driven” approach to space exploration opening up vast opportunities including near-Earth asteroids (NEA), the Moon, and Mars
 - New space technology investments to increase the capabilities beyond low Earth orbit



Destinations for Expansion of Humans Into the Solar System Enabled by FY 2012 Investments



A Bounty of Opportunity for Human Explorers



HEO/GEO/Lagrange Points:

- Microgravity destinations beyond LEO
- Opportunities for construction, fueling and repair of complex in-space systems
- Excellent locations for advanced space telescopes and Earth observers

Earth's Moon:

- Witness to the birth of the Earth and inner planets
- Has critical resources to sustain humans
- Significant opportunities for commercial and international collaboration



Mars and its Moons:

- A premier destination for discovery: Is there life beyond Earth? How did Mars evolve?
- True possibility for extended, even permanent, stays
- Significant opportunities for international collaboration
- Technological driver for space systems



Near Earth Asteroids:

- Compelling science questions: How did the Solar System form? Where did Earth's water and organics come from?
- Planetary defense: Understanding and mitigating the threat of impact
- Potential for valuable space resources
- Excellent stepping stone for Mars



ESMD FY 2012 President's Budget Overview



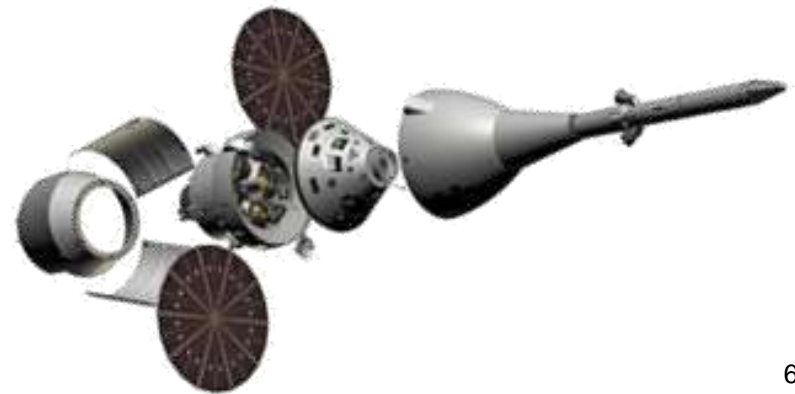
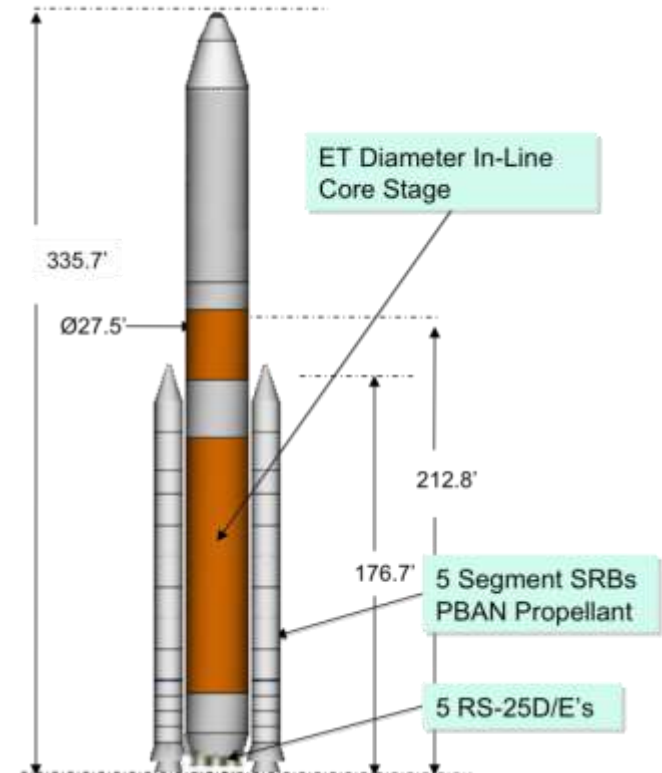
- **Funds Exploration Programs at \$3,949M** - \$243M above FY 2011 Authorized Level
- The President's FY 2012 Budget Request supports a diversified portfolio of activities in human exploration:
 - Enables substantial **partnership with the commercial space industry** to provide safe and cost effective human access to LEO
 - Funds key systems development for exploration through the **Space Launch System (SLS) and Multi-Purpose Crew Vehicle (MPCV)** capable of traveling to multiple destinations beyond LEO
 - Provides for **key human research and critical capability development** required for future human exploration beyond LEO

The FY 2012 Budget Request supports all major components of the NASA Authorization Act of 2010

Human Exploration Capabilities Theme: Reimagining Exploration for the Future



- Funded at \$1.8B in FY 2012, the **Space Launch System (SLS)** program will develop the heavy lift vehicle that will launch the crew vehicle, other modules, and cargo for these missions
- Funded at \$1.0B in FY 2012, the **Multi-Purpose Crew Vehicle (MPCV)** program develops the vehicle that will carry the crew to orbit, provide emergency abort capability, sustain the crew while in space, and provide safe re-entry from deep space return velocities
- Required **Ground Operations and Mission Operations** will largely be funded from these budget lines



SLS/MPCV Significant Recent Progress



- Planning Teams for **MPCV at Johnson Space Center** and **SLS at Marshall Space Flight Center** are in place and active
 - ESMD is in the process of standing up SLS & MPCV Program Offices
- SLS team is developing the Program requirements working towards System Requirements Review in FY 2012
 - Developing full vehicle concept that can be delivered within the available budget
 - Using internal study teams and external Broad Agency Announcements (BAAs) for input
 - Evaluating existing contract scope against SLS requirements
 - Considering early test flight timing and content
- MPCV team continues to implement the current Orion Project plan
 - Documenting that MPCV requirements same as current Orion/Lockheed Martin scope
 - Technical progress continues – Orion Ground Test Article recently shipped from Michoud to Lockheed Martin Denver for testing
 - Considering early test flight timing and content



SLS and MPCV are moving out aggressively and deliberately

Orion & Area Progress Applicable to SLS/MPCV



Ground Test Article



DM-2 Static Motor Firing in Utah



AR&D testing



Pad Abort-1



Pioneering Commercial Spaceflight for Humans



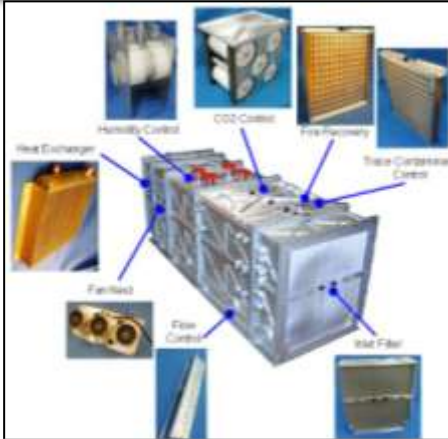
- Objectives of Commercial Crew (\$850M in FY2012):
 - Facilitate the development of a U.S. commercial crew space transportation capability with the **goal of achieving safe, reliable and cost effective access to and from LEO and the ISS**
 - Once the capability is matured and expected to be available to the Government and other customers, NASA could purchase commercial services to meet its ISS crew transportation needs



Commercial Crew Development Accomplishments: More H/W Than You'd Imagine



Boeing Air Bag Test Article



Paragon Life Support System



SNC Motor Firing



ULA Emergency Detection System Prototype and Test Bed



Blue Origin Composite Crew Pressure Vessel

Exploration Research and Development: Enabling the Future



- The Exploration Research and Development theme includes the **Human Research Program (HRP)** funded at \$164M in FY 2012, and the **Advanced Exploration Systems Program (AES)** funded at \$124M in FY 2012
 - HRP provides countermeasures, diagnostics, technologies and design tools **to keep crews safe and productive on long-duration space missions**, and makes extensive use of the ISS
 - AES will focus on continuing current development **of key required capabilities** for future human exploration beyond the SLS and MPCV including advanced life support, EVA, and prototyping of other beyond LEO exploration systems
 - In future years, AES will support **robotic missions of opportunity** to obtain required precursor measurements of human spaceflight destinations



NASA Exploration: Going Beyond



- NASA's human spaceflight program dares to imagine extending human presence throughout the solar system
- The FY 2012 **Budget Request supports all critical aspects of a vibrant human spaceflight program**, and all components of the NASA Authorization Act of 2010:
 - Safe, affordable LEO access with Commercial Crew and leveraging ISS for future exploration
 - Significant progress on NASA's beyond-LEO vehicles – the SLS and MPCV
 - Investment in required research and capabilities development for beyond LEO human missions
- **Affordability** measures are key to a successful future
- NASA Exploration accepts the challenge to execute our programs within available budgets – we will leverage prior investments creatively to enable a sustained, exciting future for human exploration

