Exploration Partnership Strategy

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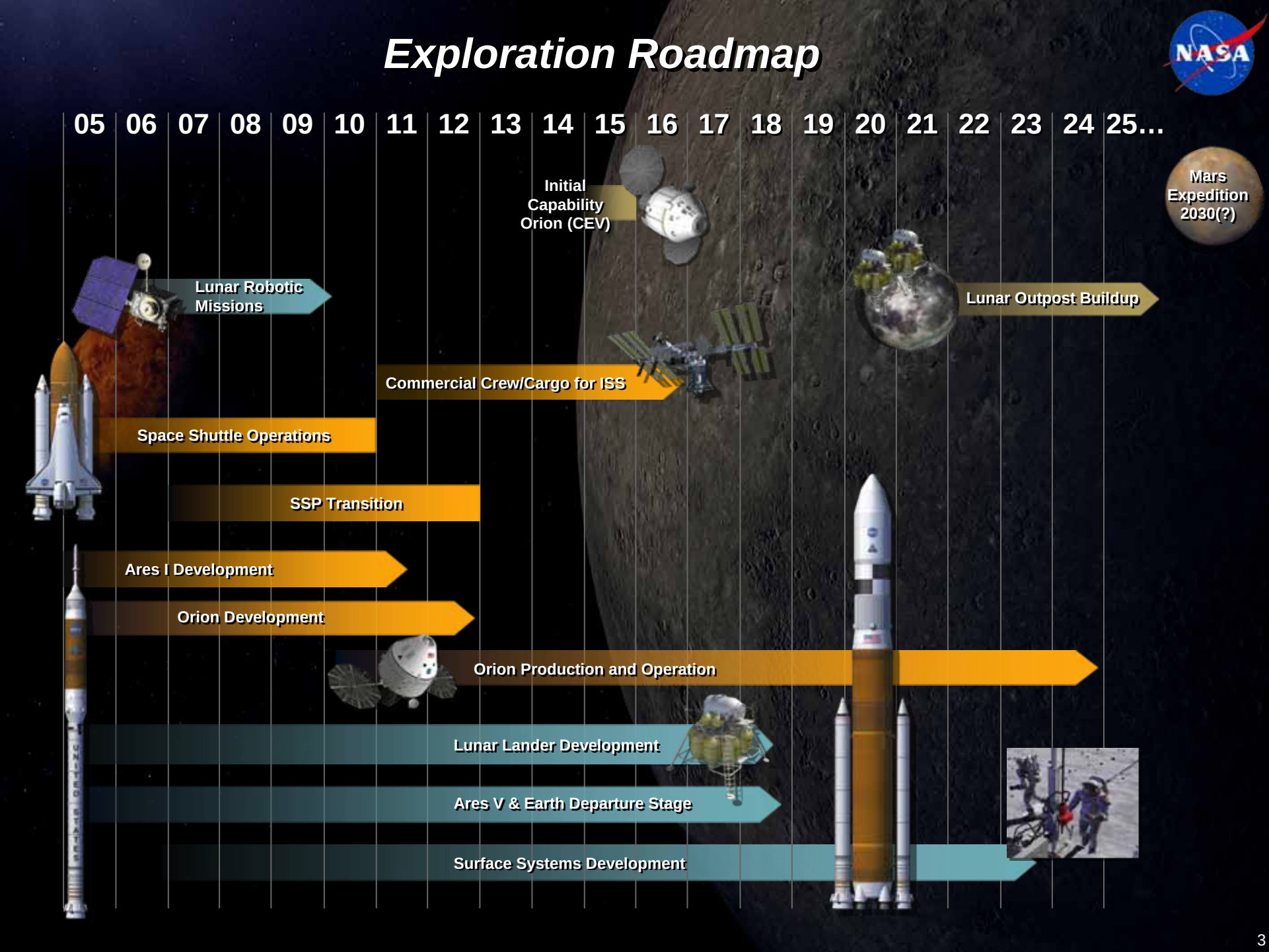
Vision for Space Exploration

- Complete the International Space Station
- Safely fly the Space Shuttle until 2010
- Develop and fly the Crew Exploration Vehicle no later than 2014
- Return to the Moon no later than 2020
- Extend human presence across the solar system and beyond
- Implement a sustained and affordable human and robotic program
- Develop supporting innovative technologies, knowledge, and infrastructures
- **Promote international and commercial participation in exploration**

Exploration Roadmap



What is a 'Global Exploration Strategy'?

- **The compelling answer to the following questions:**
  - "Why" we are going back to the moon? - ***Themes***
  - "What" do we hope to accomplish when we get there? - ***Objectives***

- **Not a definition of 'how' we will explore (operations & architecture)**

- **Global - refers to the inclusion of all stakeholders in the strategy development process - to ensure that as NASA moves forward in planning for future exploration missions - we understand the interests of:**
  - International Space Agencies
  - Academia
  - Private Sector
  - Private Citizens

- **Includes the Moon, Mars, and beyond as potential destination for exploration:**
  - Initially focused on human and robotic exploration of the Moon
  - An evolving plan that will expand to include Mars and other destinations

NASA Exploration Lunar Activities addressing Themes

Human Civilization

Global Partnerships

Scientific Knowledge

Economic Expansion

Exploration Preparation

Public Engagement

Architecture Desired Attributes

- Enable lunar sustained presence early
- Develop infrastructure while actively engaged in science and exploration
- Ensure architecture is flexible to redirection
- Ensure architecture supports Objectives
- Support the establishment of Mars analog
- Allow the earliest partnership opportunities for commerce and International Partners
- Continuous and measurable progress
- Continuous and focused public engagement

Architecture Driven By A Strategy

Global Exploration Strategy Development

Themes & Objectives

National Priorities Defined

LAT-1

Architecture Assessment

Reference Architecture & Design Reference Mission

Outpost First at one of the Poles

Elements critical to US

Detailed Requirements Defined

LAT-2

Detailed Design

Operations Concept, Technology Needs, Element Requirements Maintain flexibility

Open Architecture: Infrastructure Open for Potential External Cooperation

- **Lander and ascent vehicle**
- **EVA system**
  - CEV and Initial Surface capability
  - Long duration surface suit
- Power
  - Basic power
  - Augmented
- Habitation
- Mobility
  - Basic rover
  - Pressurized rover
  - Other; mules, regolith moving, module unloading
- Navigation and Communication
  - Basic mission support
  - Augmented
  - High bandwidth
- ISRU
  - Characterization
  - Demos
  - Production

- **Robotic Missions**
  - LRO- Remote sensing and map development
  - Basic environmental data
  - Flight system validation (Descent and landing)
  - Lander
  - Small sats
  - Rovers
  - Instrumentation
  - Materials identification and characterization for ISRU
  - ISRU demonstration
  - ISRU Production
  - Parallel missions
- Logistics Resupply
- Specific Capabilities
  - Drills, scoops, sample handling, arms
  - Logistics rover
  - Instrumentation
  - Components
  - Sample return

**** US/NASA Developed hardware**

Exploration – Domestic Progress

- **In December 2006, we released the exploration themes and objectives developed with input and participation from U.S. industry, academia, and science communities, NASA and 13 other space agencies.**
- **In 2007, our collective and individual communities have continued to make progress in determining how we will achieve our exploration objectives.**

- **U.S.**
  - A new space industry is developing and achieving new milestones in flight.
  - Both domestically and internationally, the science communities' enthusiasm and support for lunar science has grown and many research objectives have been identified.
  - We continue to have executive and legislative branch support for exploration.
  - We all must continue to meet our performance commitments and communicate the importance of this nation's space program to our stakeholders.

Exploration – Domestic Progress

- **NASA and Industry:**
  - NASA applauds the creativity and commitment by private industry to make investments to build our nation's capabilities.

- **NASA Interest and Approach:**
  - We continue to provide assistance and opportunities to U.S. industry to augment their investment in building new capabilities that will also benefit NASA.
    - Innovative Partnership Program
      - SBIR/STTR being one of the larger sources of technology development funding in the Agency; supports mission directorate technology portfolios.
    - Centennial Challenges
      - Prize contests to stimulate innovation in NASA mission areas.
    - Commercial Orbital Transportation System
    - Space Act Agreements

  - ESMD Commercial Development Policy
    - To encourage the development of commercial space capabilities and markets and accomplish NASA's exploration missions at a lower cost and risk.

- **Next Steps:** Dialogue with industry through US Chamber of Commerce, conferences, workshops to identify specific needs and opportunities for collaboration.

Exploration – Domestic Progress

- **Mission Directorates:**
  - NASA's mission directorates are working very closely and collaboratively as we focus on the Moon and beyond.
    - Discussing needs, exploring synergies, developing strategies and identifying partnership opportunities.
  - ESMD & SMD working collectively on lunar missions and jointly utilizing the Science Mission Directorate's competitive selection process of 'notice of intent' (NOI) and "Mission of Opportunity' (MOO).
  - ESMD & SOMD are working closely on designing efficient operational systems and communication and navigation; identifying opportunities for utilizing the Shuttle and ISS for risk reduction for Constellation; performing technology demonstrations; and transitioning of personnel and infrastructure to support Constellation.




Exploration – Global Progress

- **International:**
  - US and representatives from 13 other international space agencies produced GES Framework Document, released May 31, 2007.
  - Many countries developing national space exploration plans that include lunar exploration.
  - Space agencies of China, Japan and India implementing lunar robotic programs.
  - ESA and space agencies of France, Germany, Italy, and the UK are each studying lunar robotic missions for the 2012-2017 time frame.

- **NASA Interest and Approach:**
  - NASA is committed to providing the transportation system beyond LEO.
  - We seek to engage the "GES 13" as well as other international space agencies in human and robotic exploration activities on the Moon.
  - We will not be prescriptive in our approach – we seek to coordinate plans in a manner that will advance our mutual goals for space exploration.

- **Next Steps:**
  - Forming the Exploration Coordination Group
  - Developing an international space exploration coordination tool
  - Advancing potential partnerships through bilateral and multilateral discussions

A Look Ahead 2008

- **Identify opportunities for collaboration with the international community as both NASA and other countries identify their interests and priorities for lunar space exploration.**
- **Demonstrate On-Going Progress through NASA's LRO/LCROSS missions, participation in international missions to the Moon, and development of NASA's Constellation systems.**
- **Leverage resources and interests across other U.S. federal agencies to maximize synergies and capabilities.**
- **Engage industry for creative, cost-effective, innovative approaches to achieve our nation's exploration goals and objectives – as suppliers, partners and stakeholders.**

Working Together