



**SPACE SCIENCE**  
ENTERPRISE

# Where the **Moon** Fits in Exploration 2004

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*NASA Lead Scientist for Mars and Moon*

- The **Moon** is a key step in the President's Vision
- **Science** must connect what the **Moon** can tell us to what we should do on **Mars** (with people)
- ***Key Early Questions:***
  - ***Role of 2008 LRO orbiter and follow-on lander***



# 2004: A Renewed Spirit of Discovery

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The fundamental goal of this vision is to **advance U.S. scientific, security, and economic interests through a robust space exploration program.** In support of this goal, the United States will:

- **Implement a sustained and affordable human and robotic program to explore the solar system and beyond**
- Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations
- **Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration; and,**
- **Promote international and commercial participation in exploration to further U.S. scientific, security, and economic interests.**



# Solar System Exploration Theme

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Our science objectives tell a story written in the language of the planets, of how our solar system formed and evolved, and how life arose within it.



Stardust flyby of Comet Wild-2

- Learn how the Sun's family of planets and minor bodies originated (Moon)
- Determine how the solar system evolved to its diverse state (Moon)
- Determine the characteristics of the solar system that led to the origin of life (Moon → Mars...)
- Understand how life begins and evolves
- Explore the space environment to discover hazards to Earth (Moon)





# Robotic Lunar Exploration

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“Starting no later than 2008, initiate a series of robotic missions to the Moon to prepare for and support future human exploration activities”

- *President George W. Bush, January 2004*



- Rationale

- Global reconnaissance to provide global access to compelling sites
- Technology “proving ground”
- Allows realistic assessment of In-Situ Resource Utilization (ISRU) possibilities
- Allows for optimization of the human and robotic “skill mix” in achieving exploration-enabled **science** goals

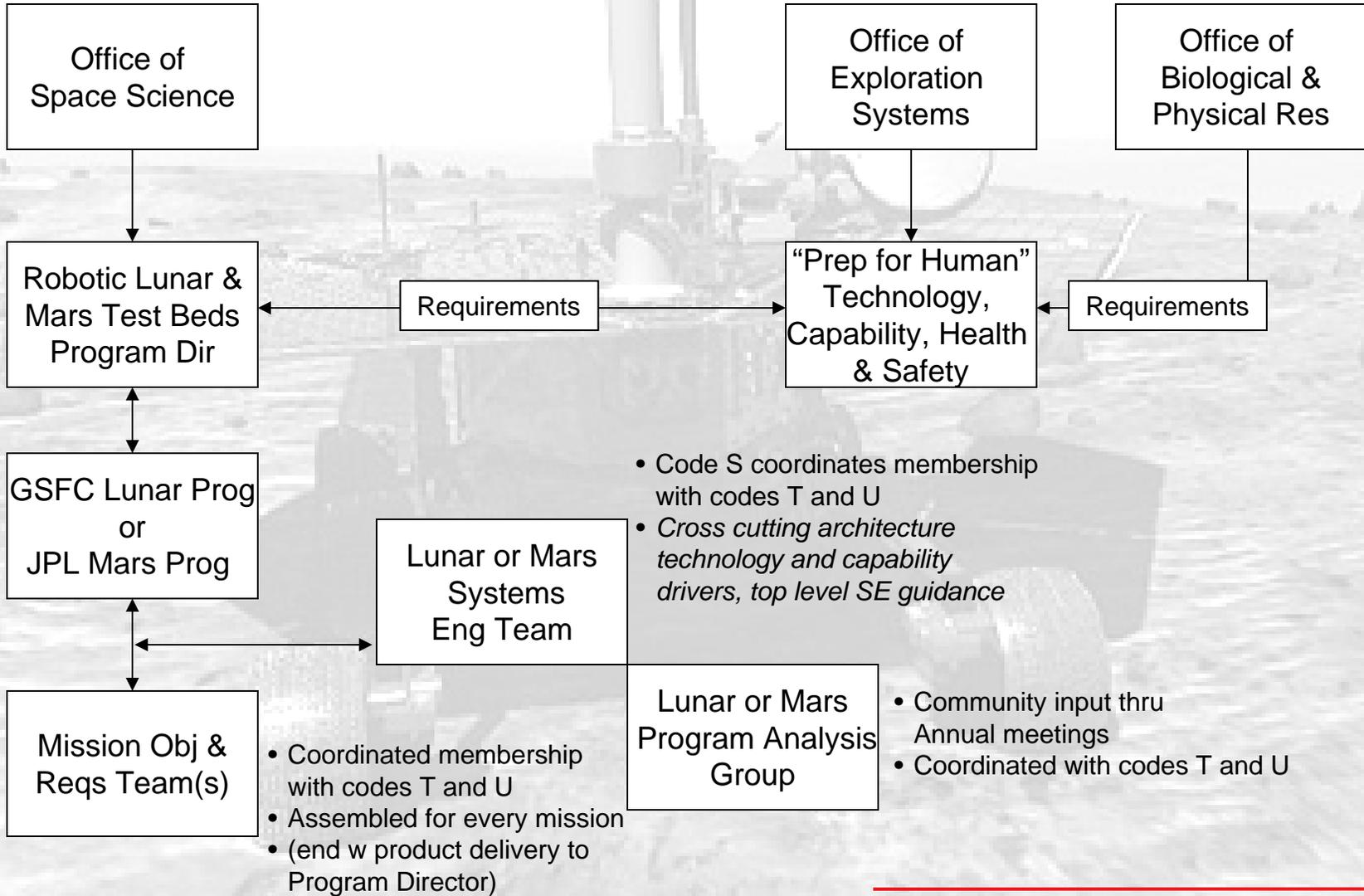
- Program

- Series of orbiting and/or landed missions designed to satisfy requirements defined by Exploration Systems Enterprise ([applied science research etc.](#))
- Program implementation modeled after highly successful Mars Program
- Classical OSS Science investigations to be competed in *Discovery/New Frontiers*



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# Robotic Lunar Exploration Organization



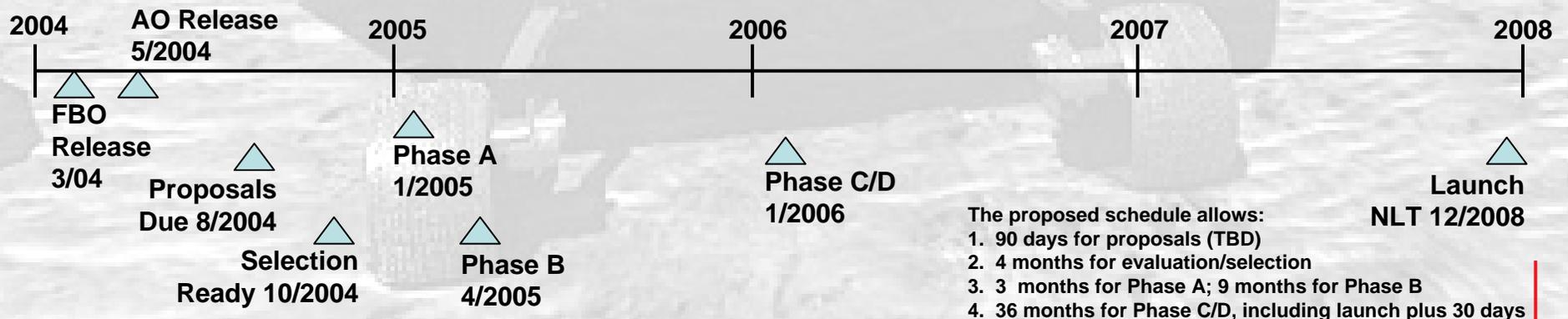


# ORDT Charter and LRO Schedule

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### Charter

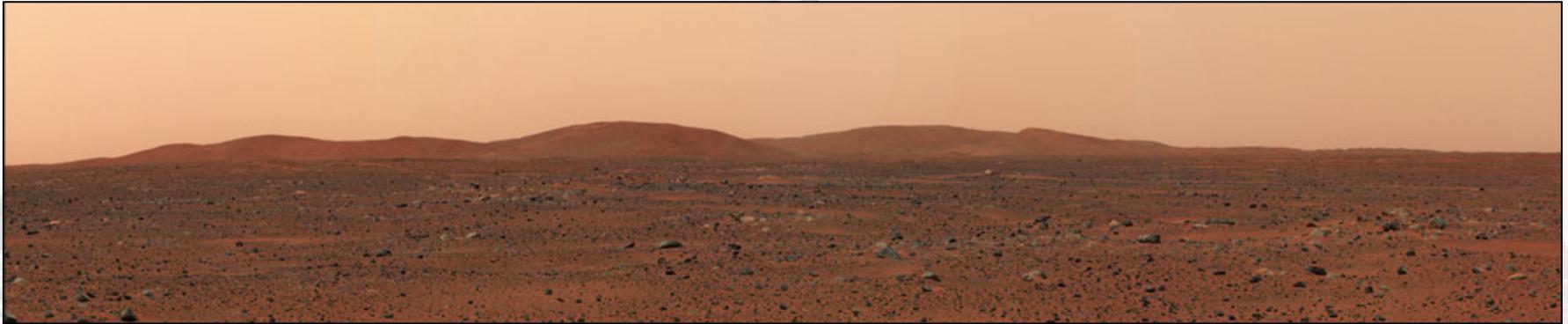
- Provide NASA with a **prioritized set of measurements** that can be attained with a resource- and schedule-constrained **Lunar Reconnaissance Orbiter (LRO)** mission to be launched before the end of the 2008 calendar year.
- Unlike traditional *Science Definition Teams*, the Objectives and Requirements Definition Team (ORDT) activity will be guided by the needs associated with future human-based exploration of the Moon as a "proving ground" and "test bed" for eventually sending humans to the surface of Mars (*for science*) and beyond.
- NASA will release an Announcement of Opportunity (AO) in April/May 2004 for the acquisition of the payload to respond to priority measurement requirements





# Augmentation to Mars Program Trailblazer Missions

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Introduction of new robotic missions, and targeted technologies designed to focus on program goal of **“Prepare for Future Human Exploration”**

### Rationale

- Address issues identified in jointly funded (Codes S/M) “Safe on Mars” report by Space Studies Board (e.g. local radiation environ, weather, toxic, physical and electrostatic properties of dust and soil)
- Validate technologies and capabilities relevant to human exploration (e.g. *In-Situ Resource Utilization, hypersonic parachutes, entry shapes, pin point landing sensors and systems, search/rendezvous/capture*)
- Selection of potential sites on the basis of resource availability and safety
- Address planetary protection concerns

### Program

- Series of landed missions (may include orbiting platforms) designed to satisfy requirements defined by Exploration Enterprise
- Program integrated with Mars Exploration Program infrastructure, but with its own identity (measurement/experiment goals)





NASA

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# SUMMARY

- President's Exploration Vision provides unique opportunity to use science to enable human exploration of the Moon, Mars, ...
- 2008 LRO is first step in this new program
  - *"New style" of competition, with derived (levels 2/3) measurement sets the goal*
  - *Fast-track ORDT will define first-order measurement priorities in March 2004 which will be competed via OSS AO in Spring/Summer of 2004*
- First landed robotic precursor mission in 2009 or 2010 must logically follow what LRO tells us
- Traditional science investigations featuring the Moon must still be competed within Discovery and New Frontiers programs
- We (Science Community) must get together and develop measurement and applied research priorities that support the President's Goals