

# ***Global Exploration Strategy***

A composite image of three celestial bodies: Earth on the left, the Moon in the center, and Mars on the right, all set against a black background. The Earth shows blue oceans and white clouds, the Moon is grey and cratered, and Mars is reddish-orange with some darker spots.

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# What Is a 'Global Exploration Strategy' Used For?



- A high-level compelling story of the value of lunar exploration that can be used to explain this effort to policy makers and the general public
- A blueprint that will serve as a starting point for:
  - Coordination: coordination among participants to maximize what can be accomplished
  - Collaboration: discussions between participants regarding areas of potential collaboration
  - Mission Design: detailed technical analyses that address,
    - **Time Phasing** of activities and identification of dependencies among them
    - **Prioritization** based on individual stakeholder goals
    - **Operational and Architecture Impacts** of implementation of the strategy

# Development of Lunar Objectives Initial Data Collection



What can be accomplished through lunar exploration?



Ideas

Initial list of lunar objectives developed

- What would be accomplished?
- What is the value of this accomplishment?

800 Initial Objectives

- Similar objectives merged
- Duplicates removed

Merge

85 Merged objectives

RFI & April Workshop

# Development of Lunar Objectives – Thoroughness and Completeness Check



Meetings in :

- Montreal
- Rome
- Valencia
- Houston

Objective ID	Objective Description	Priority	Category	Source
1	Establish a lunar base by 2025	High	Infrastructure	ESA
2	Conduct scientific research on the Moon	Medium	Science	NASA
3	Develop lunar rovers for exploration	High	Technology	JAXA
4	Map the lunar surface for resource extraction	Medium	Resource	ESA
5	Establish a lunar communication network	High	Infrastructure	NASA

85 Merged objectives

14  
International  
Space  
Agencies  
identify gaps  
in initial  
data set

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188 Refined objectives

Note:

Space agencies consulted with subject matter experts to identify gaps, for example NASA queried:

- All 10 NASA centers
- NASA Advisory Council, Science Subcommittee
- Lunar Exploration Analysis Group
- Mars Exploration Planning & Analysis Group
- Lunar Commerce Roundtable
- Space Enterprise Council, US Chamber of Commerce
- Next Generation Space Explorers Conference
- Newspace 2006 Conference
- NASA Lunar Architecture Team

# Development of Lunar Objectives – Objectives linked to high level themes



Lunar Exploration Themes					
Exploration Preparation	Scientific Knowledge	Human Civilization	Global Partnerships	Economic Expansion	Public Engagement
	X				X
X	X	X	X		
			X		
	X				X
				X	
	X	X			
					x
			X		

Objectives linked to all themes that they support

188 Refined objectives

Addresses how to “implement” a theme area... for example  
 – What work could be done on the Moon to prepared for future Missions to Mars & Beyond?

# Development of Lunar Objectives – Time Phasing



Meetings in

- Rome
- Houston

International Space Agencies evaluate phasing

188 Refined objectives

Continuous



Robotic Precursor



Early Human



Early Outpost



Significant Permanence

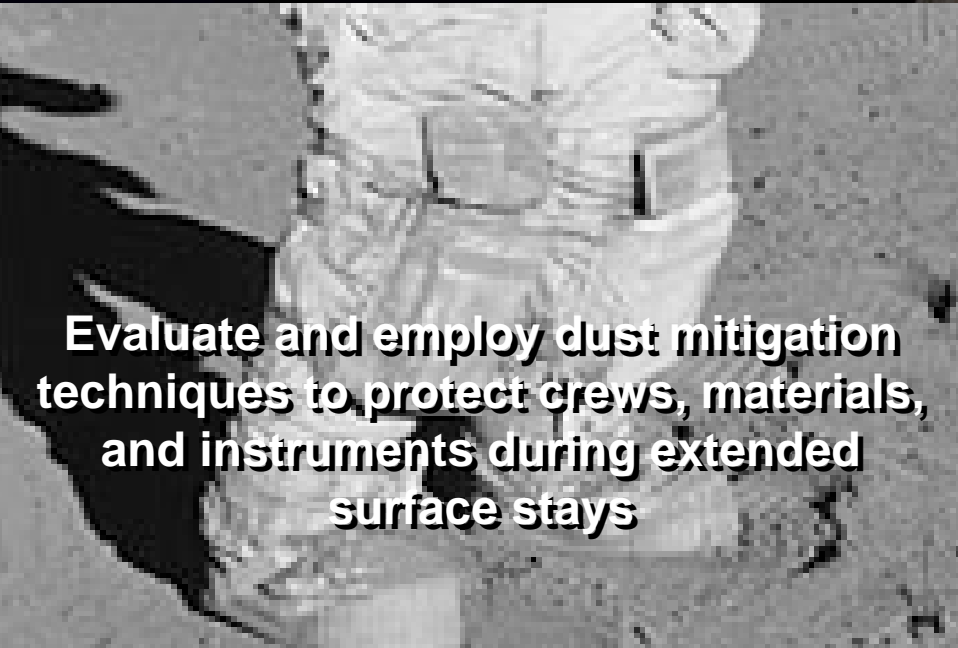


Objective ID	Mission	Category	Value	Single Item	Area Knowledge	Threat Reduction	Resource Extraction	Regulation	Participation per 4th	Input Score
0001	...	...	...	...	...	...	...	...	...	...
0002	...	...	...	...	...	...	...	...	...	...
0003	...	...	...	...	...	...	...	...	...	...
0004	...	...	...	...	...	...	...	...	...	...



Time phase filtered objectives

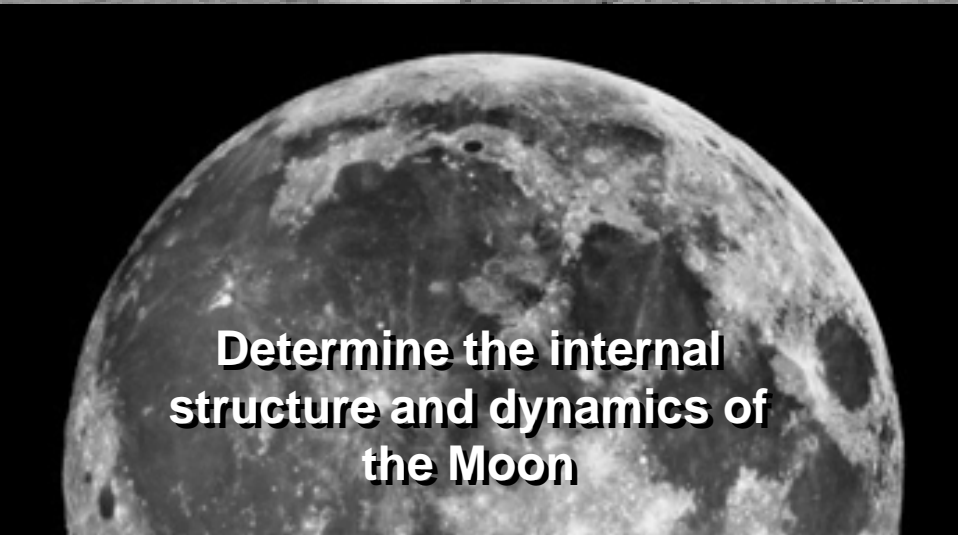
# ***Lunar Exploration Objectives Exploration Preparation***



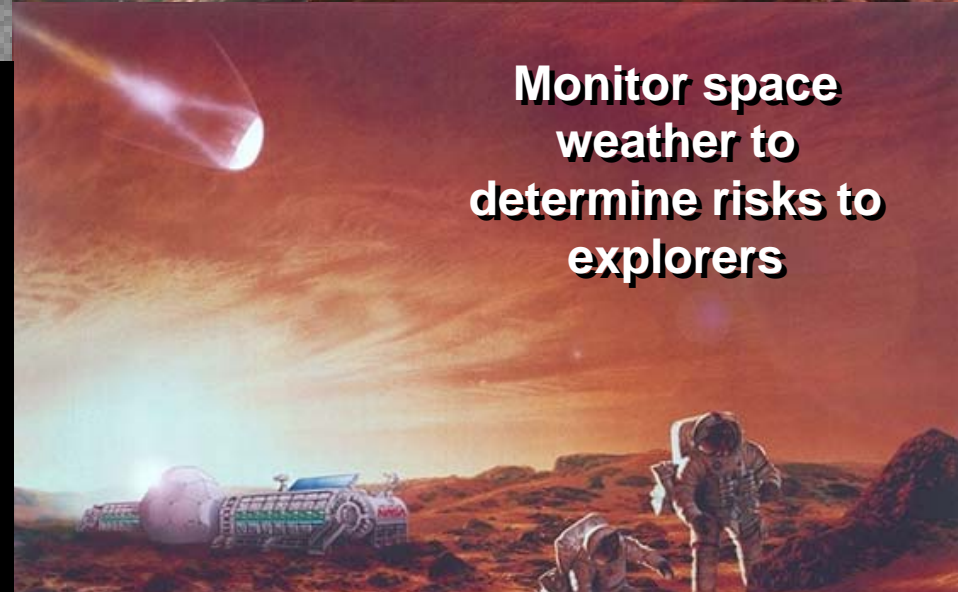
**Evaluate and employ dust mitigation techniques to protect crews, materials, and instruments during extended surface stays**



**Demonstrate Robust EVA Capability**

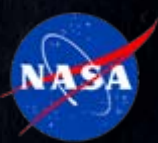


**Determine the internal structure and dynamics of the Moon**



**Monitor space weather to determine risks to explorers**

# Lunar Exploration Objectives Scientific Knowledge



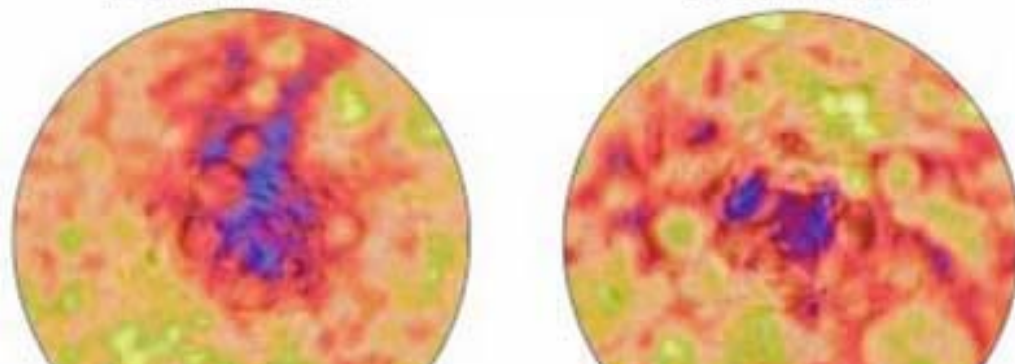
**Characterize impact cratering over the Moon's geologic history, to understand early solar system history**



**Characterize the Moon's atmosphere to better understand surface boundary exospheres**

**NORTH POLE**

**SOUTH POLE**



**Determine the origin and distribution of lunar volatiles to support studies of the origin, composition, and structure of the Moon and other planetary bodies**

**Study the lunar regolith to understand the nature and history of solar emissions, galactic cosmic rays, and the local interstellar medium**



# *Lunar Exploration Objectives*

## *Human Civilization*



**Develop and validate tools, technologies, and systems that excavate lunar material**



**Understand the affects of the integrated lunar environment on human performance**

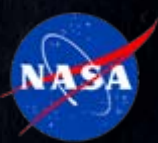
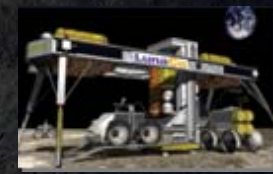


**Provide position, navigation, and timing capabilities to support lunar operations and evolve to support Mars operations**



**Characterize radiation bombardment on the lunar surface and subsurface**

# Lunar Exploration Objectives Economic Expansion



Utilize innovative commercial entertainment and media outlets to broadcast to the public high-bandwidth video, imagery, and other information



Use the private sector to deliver payloads to the Moon



Deploy effective in-site and remote health care systems to ensure crew health on the Moon



Utilize the commercial sector appropriately to perform lunar resource extraction

# *Lunar Exploration Objectives Global Partnership*



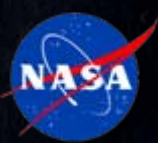
**Establish an appropriate global framework, able to encompass both commercial and governmental involvement, to coordinate the lunar activities of all interested parties**

**Establish standards to enable interoperability of systems developed by a global community**



**Establish common interface designs to enable interoperability of systems developed by a global community**

# Lunar Exploration Objectives Public Engagement



Provide opportunities for the public  
to watch surface operations via  
video broadcast

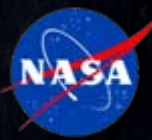


Allocate space on lunar missions  
for university-built payloads



Allocate time for  
crews to teach  
about lunar  
activities

# *2007 Exploration Strategy Plans*



- **Extend discussion of destination objectives to include Mars**
- **Complete Framework Document which defines a common vision for exploration**
- **Discuss Coordination Mechanism for long-term multi-lateral engagement**
- **Discuss International Reference Architecture as a tool for coordination**