



NASA Strategic Planning

The Mars Exploration Roadmap: Status Report

Douglas Stetson

Advanced Planning and Integration Office

AIAA Space Exploration Conference

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NASA Objectives: *Mars Exploration*

Conduct robotic exploration of Mars to search for evidence of life, to understand the history of the solar system, and to prepare for future human exploration.

Conduct human expeditions to Mars after acquiring adequate knowledge about the planet using robotic missions, and after successfully demonstrating sustained human exploration missions to the Moon.



Committee Members

Al Diaz	NASA Science Mission Directorate	co-chair
Charles Elachi	Jet Propulsion Laboratory	co-chair
A. Thomas Young	Lockheed Martin (retired)	co-chair
Ray Arvidson	Washington University	
Robert Braun	Georgia Institute of Technology	
James Cameron	producer/writer/director	
Aaron Cohen	Texas A & M University	
Steven Dorfman	Hughes Electronics (retired)	
Linda Godwin	Johnson Space Center	
Noel Hinners	Lockheed Martin (retired)	
Kent Kresa	Northrop Grumman	
Gentry Lee	Jet Propulsion Laboratory	
Laurie Leshin	Arizona State University	
Shannon Lucid	Johnson Space Center	
Paul Mahaffy	Goddard Space Flight Center	
Christopher McKay	Ames Research Center	
Sally Ride	University of California, San Diego	
Lawrence Soderblom	U.S. Geological Survey	
Steve Squyres	Cornell University	
Margaret (Peggy) Whitson	Johnson Space Center	



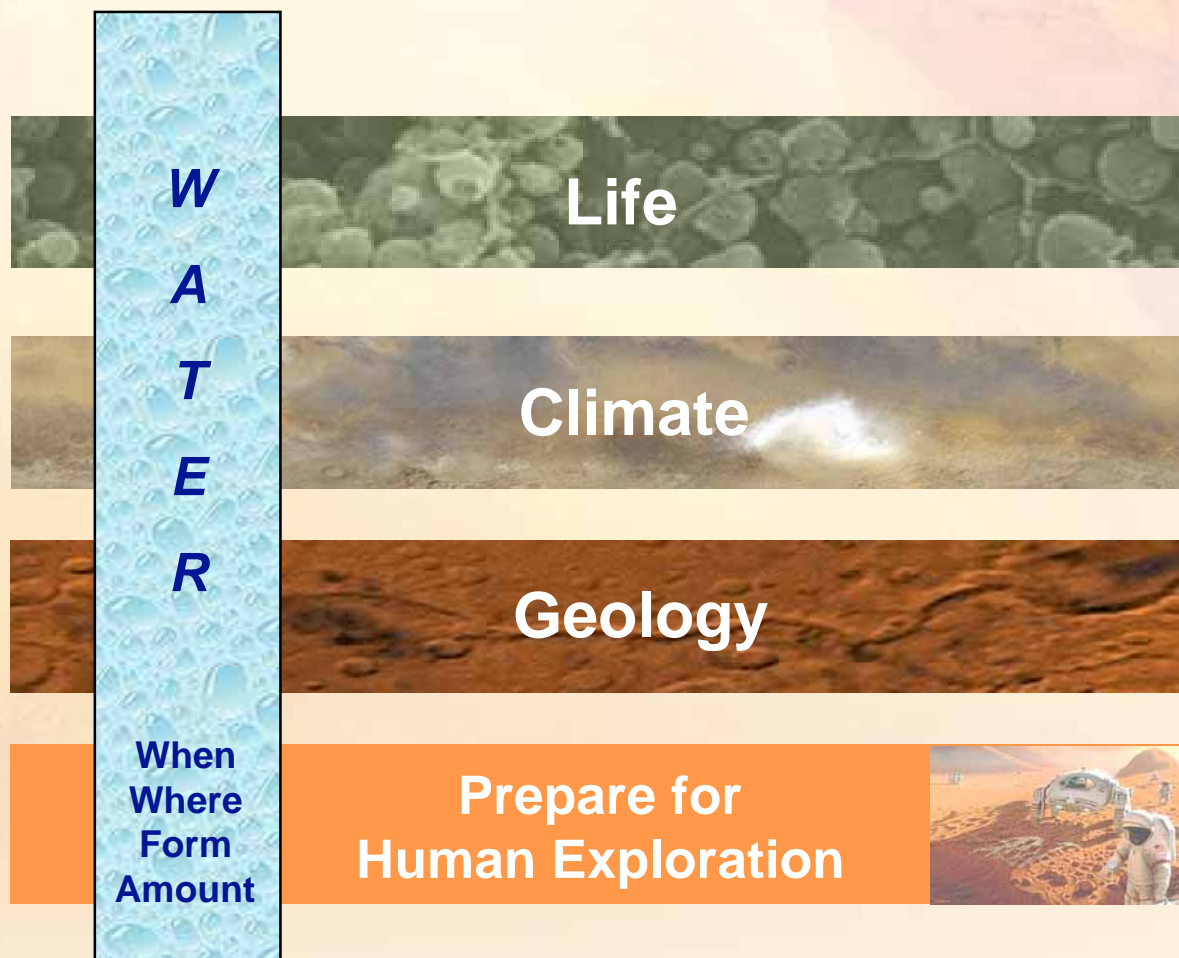
Major Discussion Topics at Meeting #1

- *Goals of the Mars exploration program in view of the Vision for Space Exploration*
 - *Science objectives and the role of human explorers*
 - *Near-term activities that can enable critical decisions - what and when?*
- *Coupling the science-driven robotic program with the emerging human program*
 - *Identify high-leverage assets, program elements, and investigations*
 - *Feed-forward strategy for science/technology/engineering*
 - *Required new capabilities or paradigm shifts*
 - *Human precursor missions and human mission trade space*
- *Implementation issues and program robustness*
 - *Common designs and architectures - multi-mission approach*



Mars Science Strategy


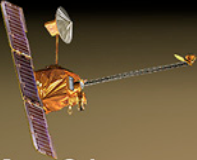







“Follow the Water”



HOW SHOULD WE ADAPT THIS GIVEN A NEW CONTEXT?



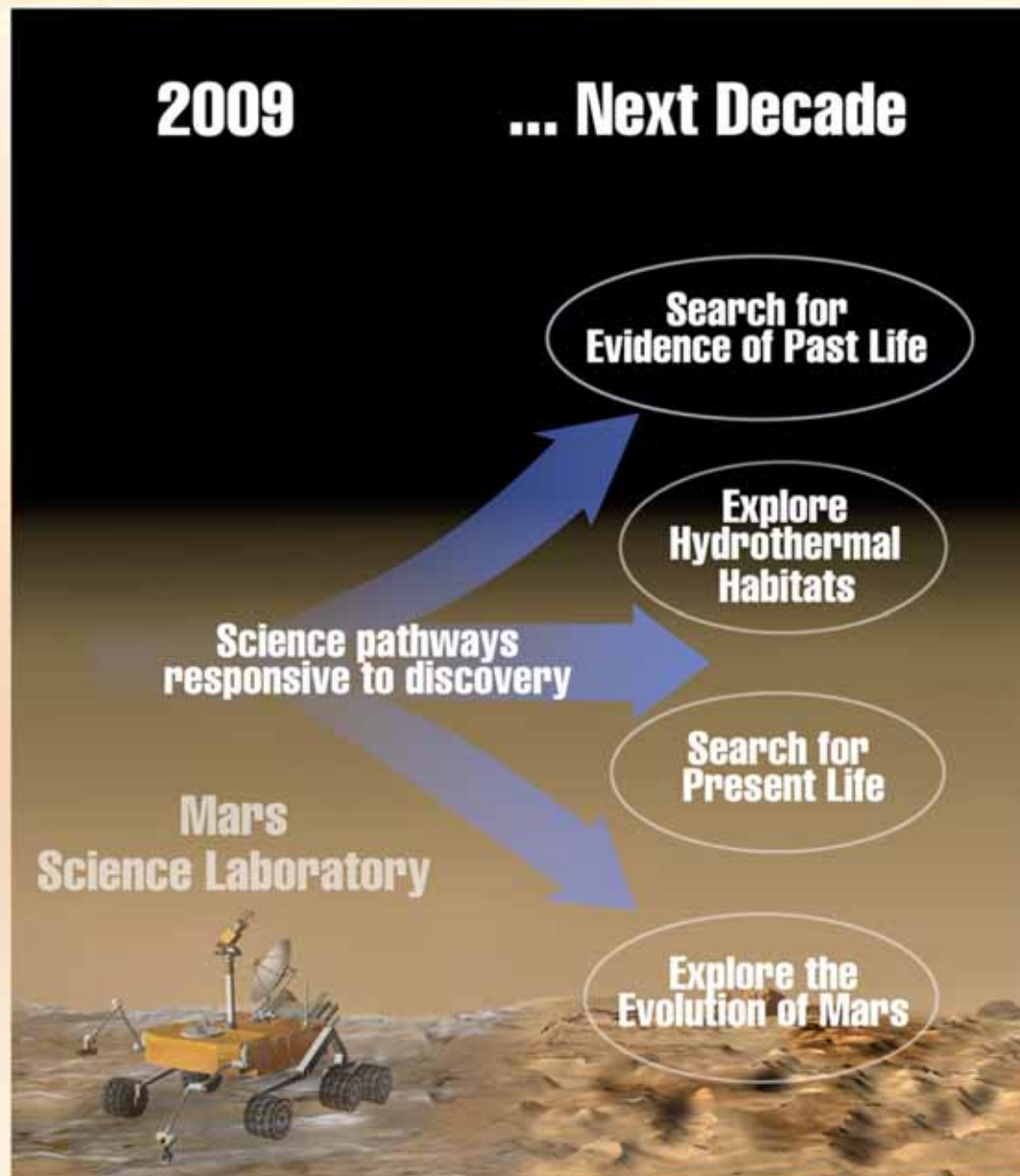
Mars Exploration Missions

Currently at Mars	Coming soon <i>(proposed)</i>				
 Mars Global Surveyor  Mars Odyssey  Opportunity  Spirit	2005  Mars Reconnaissance Orbiter	2007  Phoenix Scout	2009  Mars Telecom Orbiter  Mars Science Laboratory	2011 <div style="border: 1px solid white; padding: 5px; text-align: center;">Competed Scout Missions</div>  Technology Testbed Lander	2013  Mars Sample Return

- *Current robotic Mars exploration program*
 - *Life: Where to look, how to look*
 - *Mars as a planet: Geology, climate, resources*
 - *Environmental conditions for human explorers*
 - *Key capabilities and testbeds*



Mars Exploration: Investigation Pathways



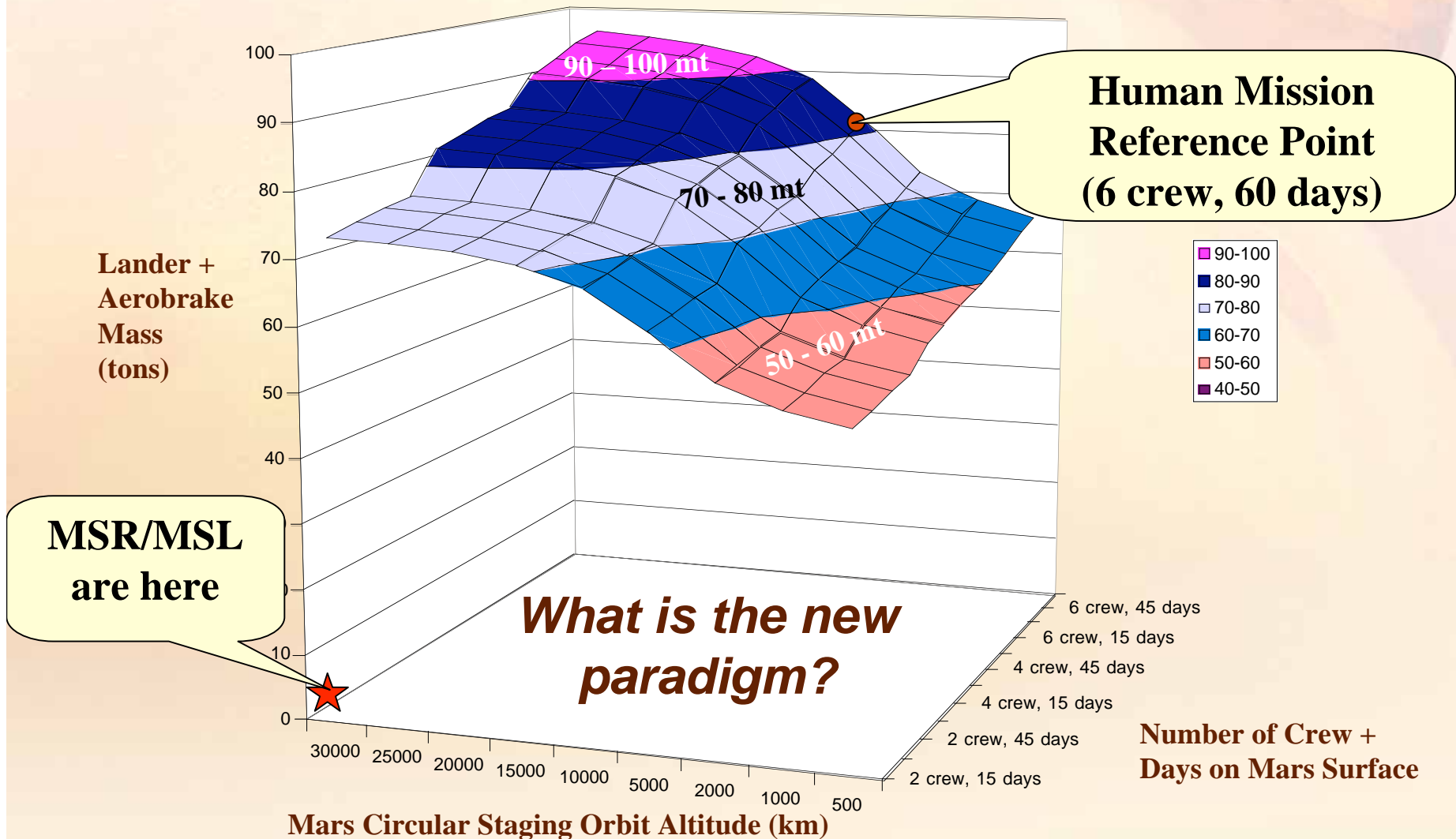
- *Components of future Mars program*
 - *Discovery-driven “investigation pathways”*
 - *Human precursor test bed program for mitigation of human hazards*
 - *Enable key decisions regarding human exploration*
 - *Preparation for in situ resource utilization*
 - *Emplacement of infrastructure for humans*



One Challenge: Technology Scalability

Lander Mass at Mars Atmospheric Entry

- Human missions will require landed masses in the tens of tons

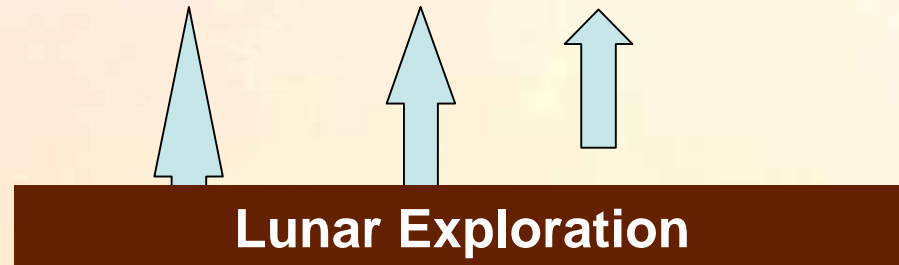


Courtesy: J. Geffre/JSC



Integration: Major System Relationships (example)

Mars Science and Exploration



Lunar Exploration

Sun-Solar System Connection

Space Station

Exploration Transportation

Nuclear Systems

- Testbeds and system validation
- Operations concepts

- Human health and safety
- Human performance
- Space environment
- Testbeds

- Power and propulsion
- Mission duration, safety, human factors

Goal: Identify developments or achievements which enable Mars exploration objectives



Integration: Major Scientific Relationships (example)

Mars Science and Exploration

Solar System Exploration

- Terrestrial planet evolution

Lunar Exploration

- Inner solar system impact history

Extrasolar Planets

- Atmospheric biosignatures

Earth System Science

- Climate change
- Habitability of analog environments

Goal: Identify investigations or discoveries which may help inform the Mars science strategy



Public Input to the Mars Roadmap

- *Request for Information (RFI) responses received Dec. 10*
 - *53 submissions to the Mars Strategic Roadmap*
 - *Reviewed by subgroups and discussed at Mtg. #1*
 - *Subset reviewed by full committee; others forwarded to relevant roadmap teams*
- *Invited expert testimony at Mtg. #2*
 - *Recent study reports by national/international organizations*
- *Email input to NASA roadmap coordinators*
 - *Michael Meyer (michael.a.meyer@nasa.gov)*
 - *Judee Robey (judith.l.robey@nasa.gov)*
- *Follow progress on NASA web page*
 - *http://www.nasa.gov/about/strategic_roadmaps.html*