National Aeronautics and Space Administration

MEPAG
September 30, 2010

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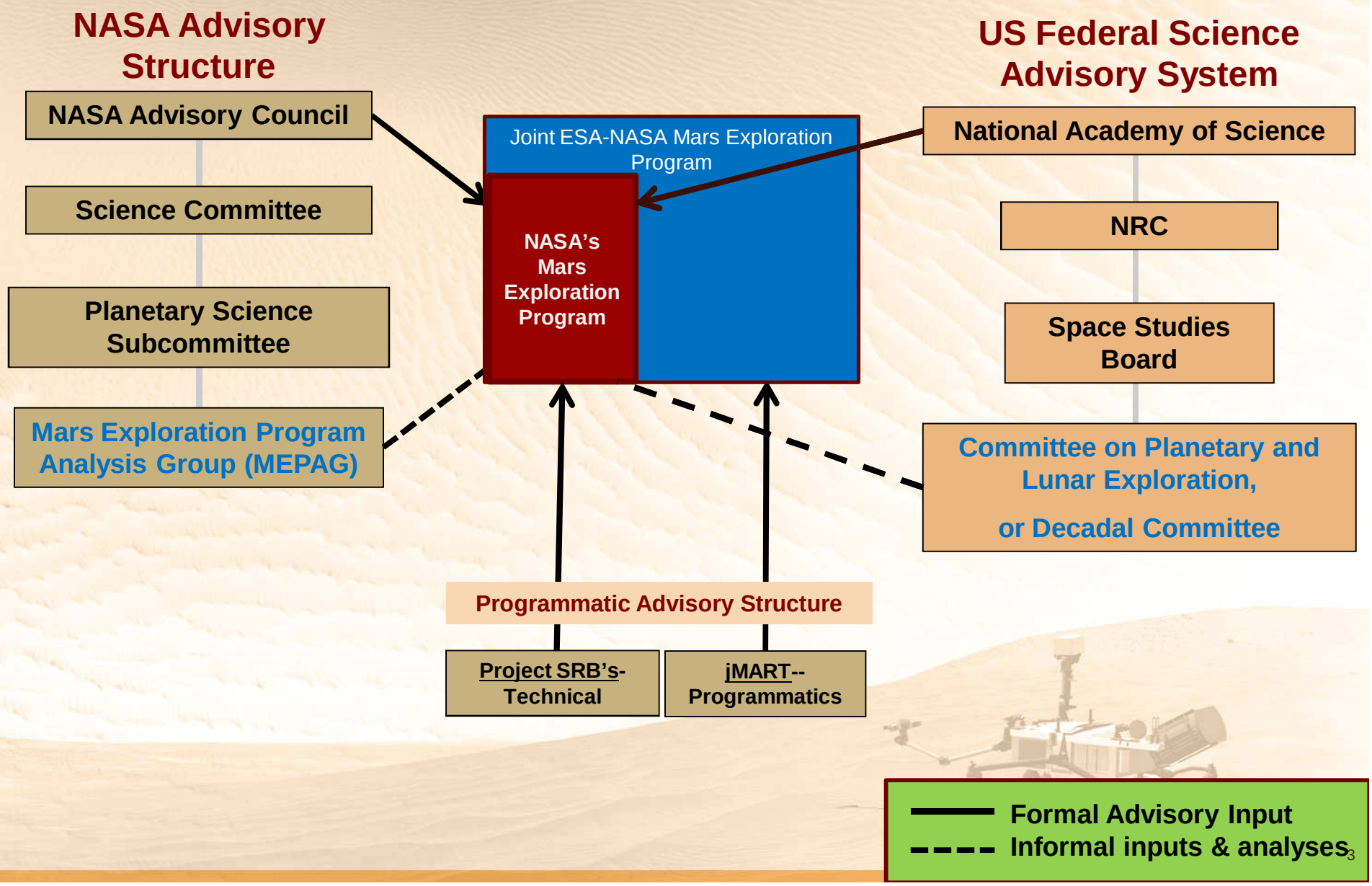
Mars Exploration Program

Mars Exploration Program Analysis Group

- MEPAG is responsible for providing science input for planning and prioritizing Mars exploration activities.
  - Community-based, interdisciplinary forum for analysis in support of Mars exploration objectives
  - Biannual meetings have >100 participants and are WEBEX'ed
- MEPAG organizes ad-hoc sub-groups, Science Analysis Groups (SAG), to analyze specific planning questions and report their findings to the full group
  - SAG tasks are fairly specific and clearly defined
  - SAG membership is small but representative of the viewpoints that should be heard
  - Topics are important and timely, with sufficient time to do a good job and produce a report
  - There is programmatic follow-through, such as an Science Definition Team to define the next mission

Advisory Structure for MEP



Top Ten Reasons for MEPAG

- MEPAG is an open science community group providing a formal mechanism for establishing and certifying consensus positions for goals and objectives, important in guiding NASA's competitive processes.
- MEPAG is the primary avenue for direct interactions between the community and program leadership, and is a means of regularly exchanging information leading to widespread buy-in by the community
- MEPAG fosters a strong working relationship between the scientists and engineers
- MEPAG assures community input, through the chair, to the Planetary Science Subcommittee
- MEPAG's processes are open and committee assignments are rotated
- Through Science Analysis Groups, MEP is able to receive in-depth analyses of topical questions of relevance to mission and program planning
- MEPAG's processes, Chair and executive committee structure allow for rapid responses to short-fuse planning questions
- Well defined linkage between MEPAG and JPL-NASA HQ leads to the MEP actively listening to what MEPAG has to say
- MEPAG is a valuable forum for maintaining interactions and communications with international colleagues
- MEPAG makes extensive use of volunteers . . . relatively cheap

Planned Joint NASA-ESA Mars Program

NASA-ESA Joint Mars Initiative

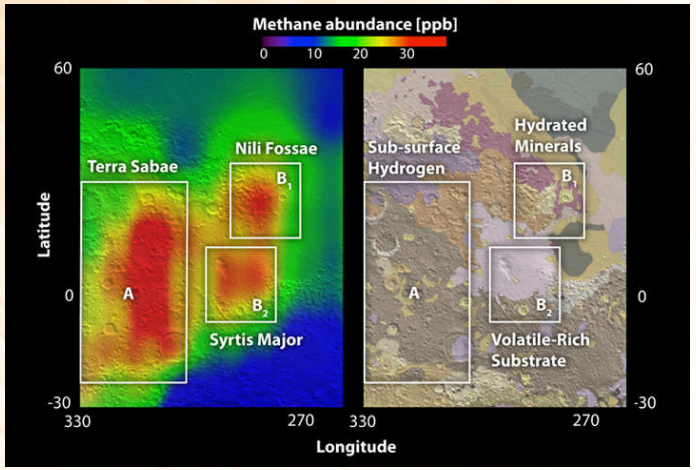
Operational 2001-2007	2009	2011	2013	2016	2018	2020 & Beyond
Odyssey, MRO, Mars Express Collaboration			MAVEN Aeronomy Orbiter	ESA—NASA ExoMars Trace Gas Orbiter; ESA—EDL Demonstrator	The Era of Mars Sample Return begins; NASA—ESA Rovers (Astrobiology/ Sample Return Cache)	
MER; Phoenix (completed)		Mars Science Laboratory				

"For Planning and Discussion Purposes Only"

2016 ExoMars/Trace Gas Orbiter (TGO)

- **Science Objectives**
  - **Detect** and survey trace gases and their isotopologues in the Mars atmosphere
  - **Characterize** the processes by which methane, other trace gases, and aerosols interact
  - **Locate** atmospheric source regions to further characterize the surface/subsurface sources
  - **Operate** in ~400 km near-circular inclined orbit; 1 Mars year
- **Programmatic Support to Future Missions**
  - **Telecommunications Relay** for landed assets
  - **Site Characterization** and **Environmental Monitoring**
- **All Science Teams have international Co-I membership**

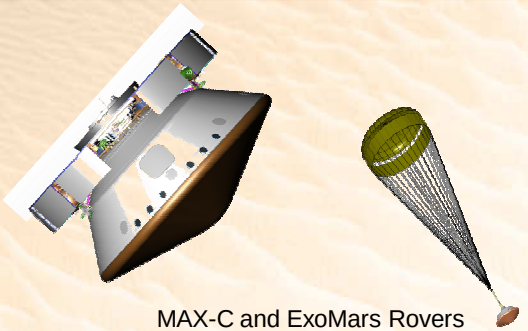
Methane:
Evidence of an active subsurface?
Abiotic or biotic?



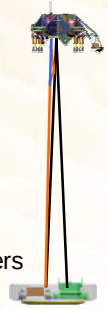
Instrument	PI	Foreign Partner	Observing Mode
MATMOS: Mars Atmospheric Trace Molecule Occultation Spectrometer	Paul Wennberg *California Institute of Techology*	Canadian Space Agency	Solar Occultation VIS-IR
SOIR-NOMAD: Nadir and Occultation Spectrometer for Mars Discovery	Ann C. Vandaele *Belgium Institute for Space Aeronomy*	Spain, Italy, UK	Solar Occultation/ Limb-nadir UV-VI-NIR
EMCS: ExoMars Climate Sounder	J. Tim Schofield *Jet Propulsion Laboratory*	Oxford U.	Limb-nadir Thermal IR
HiSCI: High-resolution Stereo Color Imager	Alfred McEwen *University of Arizona*	University of Bern (Switzerland)	Imager ~2 m/pixel 2 vis + 2 NIR colors
MAGIE: Mars Atmospheric Global Imaging Experiment	Bruce Cantor *Malin Space Science Systems*	n.a.	Daily Global Imager 2 UV + 2 VIS bands

2018 Dual Rover Mission

- Mission Overview—NASA Mission Lead
  - Deliver two rovers (one NASA, one ESA) to the surface of Mars
  - Extended surface exploration with concurrent operations
    - NASA: in-situ science with sample caching
    - ESA rover: ExoMars exobiology payload

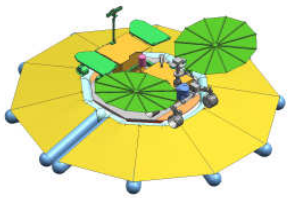


MAX-C and ExoMars Rovers delivered by a derivative of the MSL Cruise/EDL system



Skycrane lands rovers on landing pallet

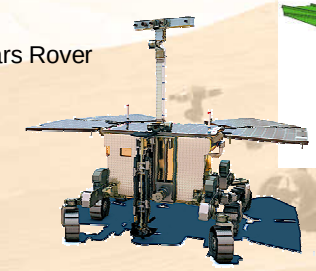
- NASA roles/deliverables
  - Rover—science payload selected via AO
  - Launch vehicle – Atlas V 531-class
  - SkyCrane-based entry, descent and landing system
  - Launch, cruise and EDL operations, operations for U.S. rover
  - Project Categorization: Category 1 (>$1B; High Priority; nuclear—RHUs)

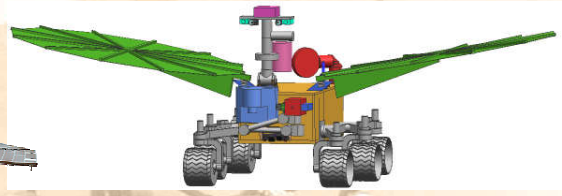


Rovers post-landing w/ egress aids

- NASA Implementation Approach:
  - Reuse MSL architecture/components
  - Cruise/EDL Evolution: aeroshell growth (4.5m to 4.7m diameter) and descent stage load path change to accommodate both rovers, potential hazard avoidance.
  - Rover components are mostly clones of MSL with smaller rover structure/thermal/mobility system.

ExoMars Rover





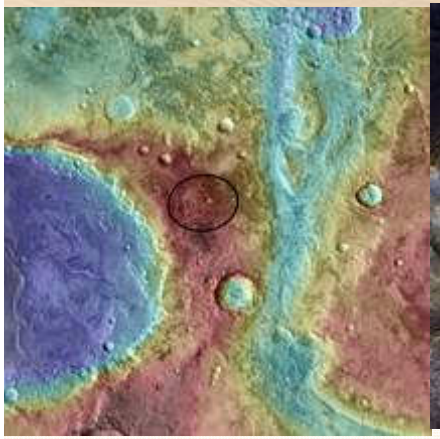
Mars 2018 Rover

- Key Near-term Milestones
  - Dec ‘10: Mission architecture review
  - Apr ‘11: NASA/ESA Interface Requirements Doc., Version 1
  - Nov ’11: Mission Concept Review (leads to KDP-A Jan ‘12)
  - KDP-A: Jan’12; KDP-B: April’13; KDP-C: Sept’14

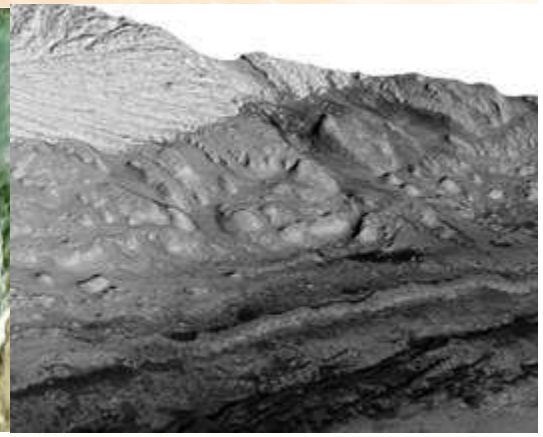
Near-term Mars Activities

- Mars Exploration Program
  - MAVEN Key Decision Point C, Oct. 4
  - Signing the Joint Program Executive Plan ~ November
    - Signature cycle for the MOU
  - President's budget released Feb. 7
  - Decadal Survey announced at LPSC on Mar. 7
  - Program Implementation Review ~ March
    - agency review of the entire Mars Program
  - June MEPAG meeting in Portugal
- Building excitement for Curiosity
  - Year of the Solar System (also Juno & Grail)
  - Nov. 25, 1-year before Curiosity launch
- Landing Site Selection
  - Community and Curiosity science team have done a tremendous job in analyzing potential landing sites
  - Work to be done - projection of exploration timelines for reaching scientific milestones
- Call for Participating Scientist this fall

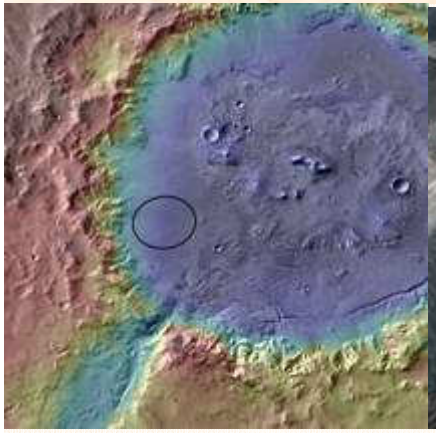
Potential MSL Field Sites: Wow!



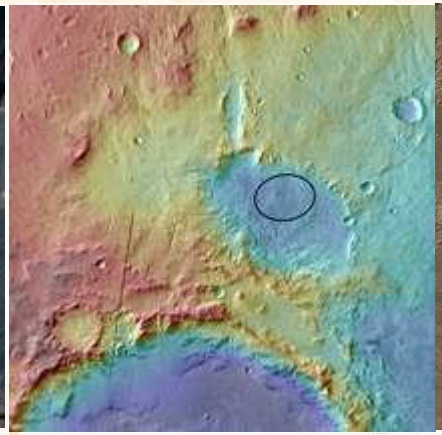
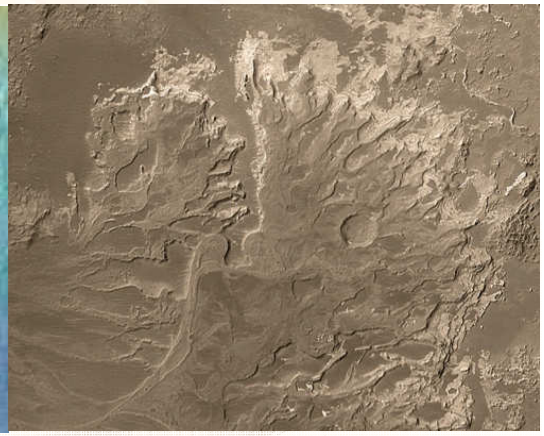

Mawrth Vallis: The oldest stratigraphic record on Mars?

Gale Crater The thickest stratigraphic section on Mars?




Holden Crater: The most diverse alluvial system on Mars?

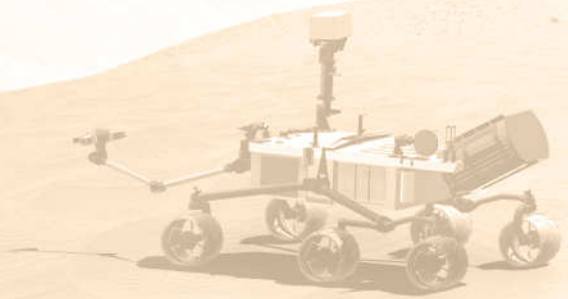



Eberswalde Crater: The best delta on Mars?

Year of the Solar System

- Starting October 2010
  - Spanning a Martian Year—23 months
  - Missions to Jupiter, Mars, and Earth's Moon
  - encounter comets and asteroids
  - continue exploration of the Sun, Mercury, Saturn, and our home planet, Earth
- Each month from October 2010 to August 2012 will highlight different aspects of our Solar System

http://solarsystem.nasa.gov/yss



Upcoming Planetary Science Mission Events

2010

November 4 - EPOXI encounters Comet Hartley 2

November 19 - Launch of O/OREOS

December 7- Venus Climate Orbiter (JAXA) arrives at Venus

2011

February 14 - Stardust NExT encounters comet Tempel 1

March 7– Planetary Decadal Survey Released

March 18 - MESSENGER orbit insertion at Mercury

July - Dawn orbit insertion at asteroid Vesta

August - Juno launch to Jupiter

September - GRAIL launch to the Moon

November - Curiosity launch to Mars

2012

Mid 2012 -- Mars Opportunity Rover gets to Endeavour Crater

Mid-year -- Dawn leaves Vesta starts on its journey to Ceres

August - Curiosity lands on Mars