

MEPAG Perspective on Mars Architecture

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From discussion at MEPAG Virtual Meeting July 10, 2017

Mars Exploration Program Analysis Group (MEPAG)

chartered by NASA HQ to assist in planning the scientific exploration of Mars

*Presented to first meeting of mid-term
DS Review committee on May 4, 2017*

Summary

- New and ongoing discoveries have challenged many previous views of Mars—this will continue, given new and long-lived assets at Mars, supported by data analysis
- Progress is being made toward Mars Sample Return
 - 2020 Mars caching rover is on schedule and budget, with a capable payload for selecting samples and providing their geological context
 - Key technical studies are in progress to help lower the cost and cost risk of the future missions that are needed to complete sample return, but at low levels that need to be accelerated
- Major concerns for both sample return and Mars science are:
 - An aging infrastructure and a lack of a confirmed post-2020 architecture, including no identified opportunities for competed flight investigations that often make the key discoveries
 - The missing element seems to be the will to proceed on the part of the agency and administration
- There remains much exciting science to do at Mars, and community momentum is strong to address fundamental questions about planetary evolution and origin of life
 - MEPAG remains ready to respond to calls for assistance to help implement the plans

Mars Exploration: Where are we today?

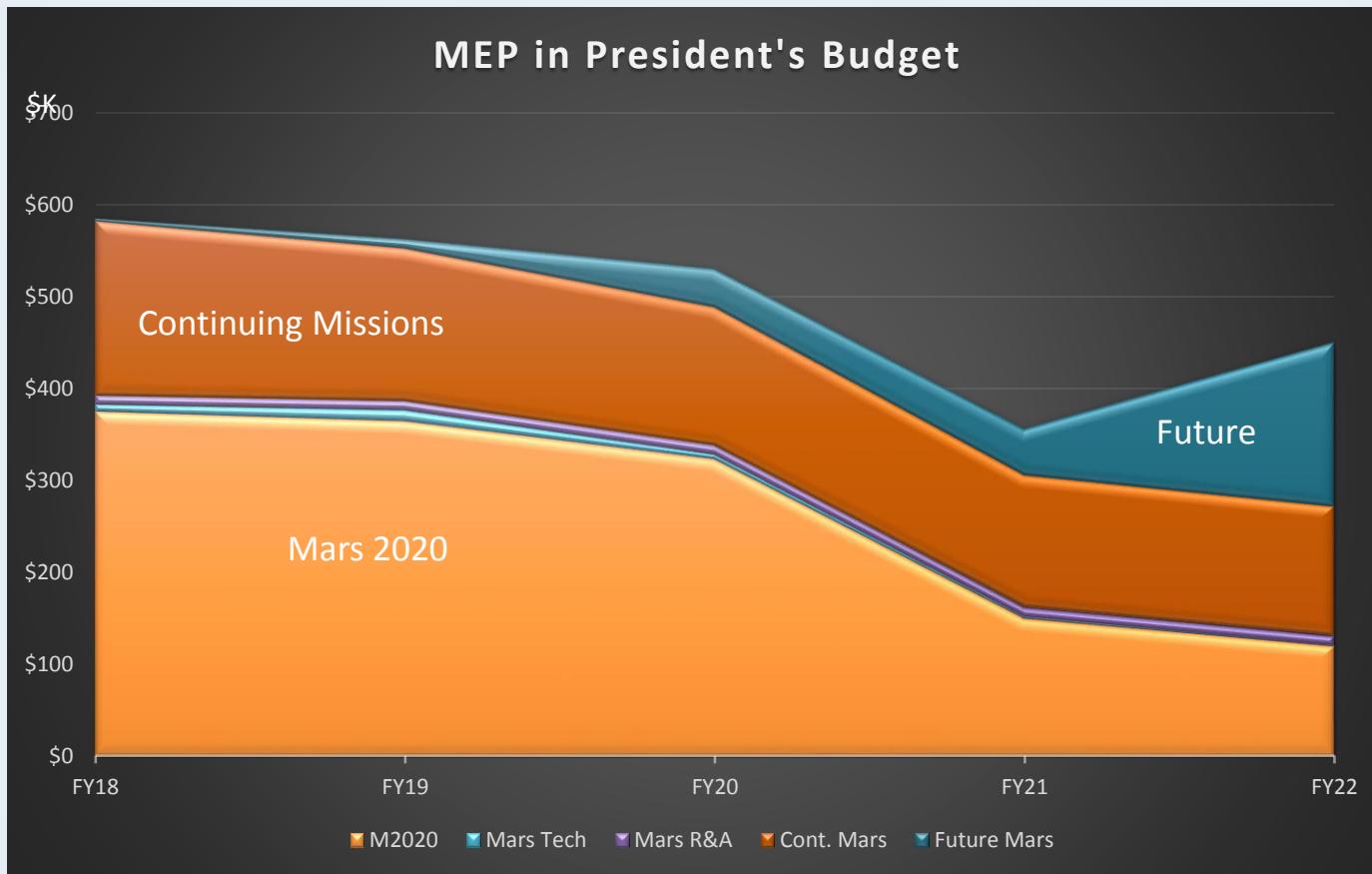
- On behalf of the MEPAG Executive Committee, the MEPAG Chair presented to the Decadal Mid-Term Review Committee on May 4 regarding recent discoveries, the status of the current Mars Exploration Program and concerns about the lack of commitment to future planning beyond the 2020 mission.
- A major development after the May 4 meeting was the release of the President's FY18 budget proposal.
- This budget development was incorporated into a discussion of MEPAG concerns at a MEPAG virtual meeting on July 10, 2017.
 - ~110 WebEx attendees
 - Draft charts were posted prior to the meeting and comments were also collected via email before and after the meeting
- The following charts are a result of the July 10 MEPAG virtual meeting and are presented to this committee in response to its earlier request and its charter to consider the Mars architecture.

Mars Exploration: Where are we today?

Mars Exploration Program

- ❖ The 2020 Mars Rover mission is on schedule and on budget to prepare the carefully selected and documented sample cache advocated in *Vision & Voyages (V&V)* as the highest priority for flagship missions
 - This mission has been well-supported by the Agency and Congress
 - Some technology work on rendezvous & capture and on Mars Ascent Vehicles is ongoing, but not discussed extensively with the community
- ❖ Extended missions are supported, albeit at ever decreasing levels, but still able to advance our understanding of current and ancient Mars
 - Such missions are also providing necessary support to future Mars missions (InSight, M2020, ExoMars 2020, Red Dragon) through landing site characterization and preparation for critical event coverage and relay
 - However, these assets are aging
- **However (after May 4): FY18 President's budget showed only a small wedge in the FY20-22 Mars future missions line**
 - The additions to the Planetary Science budget were devoted elsewhere
 - Without substantial augmentation to the Mars mission line by Congress, there is little chance of launching a Mars spacecraft in 2022

FY2018 President's Budget Request Summary



Based on numbers available at
https://www.nasa.gov/sites/default/files/atoms/files/fy_2018_budget_estimates.pdf

MEPAG Concerns (1 of 2)

The lack of commitment—or even engagement—by NASA concerning planning for the future of what has been a highly successful Mars Exploration Program (MEP) is frustrating to the Mars community.

- ***There are no approved Mars flight projects after the Mars 2020 rover.***
 - No definition teams (ORDTs or SDTs) have been formed
 - Even the small wedge in the President's FY18 budget was undefined
- ***The Agency has declined to openly discuss with the Mars community the lack of progress on possible MEP next steps, such as:***
 - The follow-on missions to Mars 2020 needed to accomplish Mars Sample Return, a *Vision and Voyages* next decadal priority
 - Orbital or landed missions and payloads that could address high-priority science questions, including those arising from recent observations and analysis
 - Payload opportunities on strategic missions could be very limited for U. S. investigator contributions
 - Even current New Frontiers candidates do not address Mars

MEPAG Concerns (2 of 2)

- **Possible advances through commercial/private partnerships with NASA are not being shared across the Mars community.**
 - The success of such partnerships is best assured by open communications and a common understanding amongst all parties of goals and objectives
 - How science could be leveraged through such partnerships is not clear; e.g., there is not yet a path for getting NASA-funded payloads delivered to Mars by commercial spacecraft
 - Can programmatic goals be accomplished via this path?
 - A caution: Pursuit of faster development with cheaper overall costs should incorporate the lessons from the “faster/better/cheaper” era

What Does MEPAG Advocate (1 of 3)?

Mars Sample Return

- MEPAG fully supports the Decadal Survey's conclusion that "*the highest-priority missions for Mars in the coming decade are the elements of the Mars Sample Return campaign*" [V&V, Ch. 6, pg. 164]
 - There should be a next orbiter mission and a lander mission that advance MSR in a meaningful way
 - Replenishment of the telecommunications and reconnaissance capabilities needed for the 2020's should be pursued immediately
- NASA PSD/MEP should be authorized and funded to proceed with planning for the possible return of the samples to be cached by the Mars 2020 mission, with a goal of return by 2031
 - A fast path would proceed with mission definition activities soon
 - At a minimum, progress on the technological challenges should be made: "*Mars Ascent Vehicle...and the end-to-end Planetary Protection and sample containment system*" [V&V, Ch. 9, pg. 309]

What Does MEPAG Advocate (2 of 3)?

Non-MSR Science

- **New/Continuing observational discoveries and analyses point the way to address additional (i.e., other than by sample return) high-priority science objectives.**
- **The measurements required to advance these scientific objectives are largely synergistic with those needed to address key strategic knowledge gaps, thereby reducing risk and potentially cost of future exploration by humans on Mars.¹**

¹*Next Mars Orbiter SAG: NEX-SAG, Report 12/2015*

<https://mepag.jpl.nasa.gov/reports.cfm>

What Does MEPAG Advocate (3 of 3)?

Non-MSR Science (cont.)

- **With respect to the possible next step, MEPAG advocates going beyond an orbiter mission that supports only telecom and basic reconnaissance.**
 - Use the mass-into-orbit capability provided by Solar Electric Propulsion to follow up on recent discoveries while making progress on sample return.¹
 - Open competition for providing investigations is the best approach for obtaining the highest-quality science results.²
 - While international collaboration should be pursued, care should be taken to preserve the US national capability to build and fly instruments. This should:
 - Include (funded) U. S. participation in internationally provided investigations in all phases of development and flight.²
 - Preserve competed opportunities for flight instruments, including from the U. S.²

¹*Next Mars Orbiter SAG: NEX-SAG, Report 12/2015*

²*Mars International Collaboration Analysis Group: MIC-SAG, Report February 2017*

<https://mepag.jpl.nasa.gov/reports.cfm>

Back-up

FY2018 President's Budget Request Summary* (pg. PS-50)

https://www.nasa.gov/sites/default/files/atoms/files/fy_2018_budget_estimates.pdf

*Mars 2020 rover budget is listed elsewhere as a separate line item

Budget Authority (in \$ millions)	Actual	Enacted	Request	Notional			
	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020	FY 2021	FY 2022
Mars Organic Molecule Analyzer (MOMA)	12.5	--	15.0	8.0	5.0	6.0	3.0
Aeroscience Ground Test Capabilities	0.0	--	15.5	21.5	22.2	22.2	22.2
ExoMars	1.3	--	1.4	1.5	1.5	1.5	1.5
Mars Program Management	13.3	--	19.7	19.8	19.8	20.0	20.0
Mars Future Missions	3.5	--	2.9	10.5	42.0	50.9	178.9
Mars Mission Operations	1.5	--	1.9	1.9	1.9	1.9	1.9
Mars Research and Analysis	10.0	--	10.0	10.0	10.0	10.0	10.0
Mars Technology	23.0	--	7.5	12.0	4.8	1.9	0.7
2011 Mars Science Lab	50.3	--	57.0	54.0	49.9	43.0	43.0
Mars Reconnaissance Orbiter 2005 (MRO)	27.7	--	28.0	27.0	27.0	26.0	26.0
Mars Exploration Rover 2003	14.2	--	12.5	0.0	0.0	0.0	0.0
Mars Odyssey 2001	9.7	--	12.5	6.0	0.0	0.0	0.0
Mars Express	2.9	--	3.0	3.0	0.0	0.0	0.0
Mars Atmosphere & Volatile EvolutioN	21.3	--	23.5	23.5	23.5	23.5	23.5
Total Budget	191.2	--	210.4	198.7	207.6	206.9	330.7

FY 2016 reflects funding amounts specified in Public Law 114-113, Consolidated Appropriations Act, 2016, as executed under the Agency's current FY 2016 Operating Plan.

FY 2017 Enacted reflects the funding amounts specified in Division B of the Consolidated Appropriations Act, 2017, P.L. 115-31. Table does not reflect emergency supplemental funds also appropriated in FY 2017, totaling \$184 million.