Report of the
2018 Joint Mars Rover Mission
Joint Science Working Group (JSWG)

Feb. 28, 2012

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Borg, L.E., Farmer, J. D., Goesmann, F., Grant, J. A., Hauber,
E., Murchie, S.L., Ori, G.G., Ruff, S. W., Rull, F., Sephton, M.
A., Sherwood Lollar, B., Smith, C. L., Westall, F., Pacros,
A.E., Wilson, M.G., Meyer, M.A., Vago, J.L., Bass, D.S.,
Joudrier, L., Laubach, S., Feldman, S., Trautner, R.,
Milkovich, S.M.
Joint Science Working Group (JSWG) was chartered by the Joint Mars Exploration Executive Board to serve as the science definition team for a 2018 mission concept.

Assumptions:
- The joint rover is tightly cost-constrained.
- The joint rover needs to incorporate the scientific objectives and requirements from the ESA ExoMars rover.
- The joint rover needs to incorporate scientific objectives and priorities related to preparing for the eventual return of samples from Mars from the NRC’s Decadal Survey and from the MEPAG End-to-End international Science Analysis Group.
Report of the MEPAG E2E-iSAG
Lisbon, Portugal; June 16, 2011

Scott McLennan and Mark Sephton, E2E-iSAG co-chairs, and the E2E-iSAG team
# The E2E Team

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*Pre-decisional: for discussion purposes only*
Overview

Prioritized MSR science objectives

Derived implications

Samples required/desired to meet objectives

Measurements on Earth

Critical Science Planning Questions for 2018

Variations of interest?

# of samples?

Types of landing sites that best support the objectives?

Sample size?

Measurements needed to interpret & document geology and select samples?

On-Mars strategies?

Engineering implications

Sampling hardware

Instruments on sampling rover

EDL & mobility parameters, lifetime, ops scenario

Sample preservation

Pre-decisional: for discussion purposes only
How did this information flow forward to JSWG/JEWG?
Proposed Objective 1:
Analyze the local geology over kilometer to sub-millimeter scales and to a depth of ~2 meters, with emphasis on supporting the objectives 2–4.
Proposed Objective 2:
Investigate geological settings indicative of past habitability & favorable for preserving physical or chemical signs of life and organic matter.

Key Strategy: Seek the signs of life in paleoenvironments with high habitability and preservation potential.
Proposed Objective 3:
Search for evidence of abiotic carbon chemistry,
and for physical and chemical signs of life

Detectable with proposed \textit{in situ} instruments
Requires returned samples
Proposed Objective 4:
Select, establish context for, collect, and cache samples that could be returned to Earth for definitive analysis

Reasons for returning samples for analysis on Earth...

- Instrumentation not amenable for flight to Mars.
- Use of techniques requiring complex sample preparation.
- Application of a virtually unlimited array of different instruments, and investigation pathways that are discovery-responsive.
Five Primary Proposed Science Strategies

1. Land and operate a rover safely at a landing site of compelling scientific interest.

2. Equip the rover with a set of instruments capable of investigating the surface outcrops, rocks and soils at multiple scales.

3. Have subsurface exploration capabilities, including a deep drill to support the characterization of the local geology and the search for martian organic chemistry and life.

4. Achieve a scientifically compelling cache of samples using several linked strategies, including careful establishment of geologic context, high selectivity from a wide range of possibilities, and sample encapsulation to preserve scientific value.

5. Pursue the search for martian life using three complementary investigation strategies: observation of field relationships, in-situ analysis on Mars, and analysis of returned samples.
WISDOM
Ground penetrating radar

Ma_MISS
Drill hole VIS and IR spectrometer; operates during drilling, app. 5mm above end of drill bit

Instruments in the Analytical Laboratory Drawer (ALD)
- MicrOmega: Combined VIS imager and NIR spectrometer
- Raman: Raman Laser Spectrometer
- Mars-XRD: XRD and XRF
- MOMA: GC-MS + LD-MS
- LMC: Life Marker Chip: antibody-based detection system

PanCam
Panoramic stereo camera with geological filters, and high resolution camera

Reconnaissance mineralogy
Spectrometer for outcrop-scale mineralogy survey

Close-up Rock/Soil Instrument suite
Elemental chemistry
Fine-scale mineralogy
Microscopic colour imager

CLUPI
Microscopic colour imager

Instrument Summary

Subject to future Approval Processes from both NASA and ESA