iMARS History and Phase II Overview

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iMARS History: 2007–2008

iMARS* Charter

Original iMARS activity in 2007–2008

Produce a plan for an international

From the iMARS Terms of Reference (source: IMEWG)

"The overarching goal of this activity is to identify how international cooperation might enable sample return from Mars, document the existing state-of-knowledge on return of samples from Mars, develop international mission architecture options, identify technology development milestones to accomplish a multi-national mission, and determine potential collaboration opportunities within the architecture and technology options and requirements, and current Mars sample return mission schedule estimates of interested nations. The activity will also identify specific national interests and opportunities for cooperation in the planning, design, and implementation of mission-elements that contribute to sample return. The Working Group's final product(s) is expected to be a potential plan for an internationally sponsored and executed Mars sample return mission."

*International Mars Architecture for the Return of Samples

Summary of Primary Conclusions
(1 of 2)

1. The first MSR mission would make a significant contribution to many fundamental scientific questions.
   - Scientific return would depend on the character, diversity, and quality of the samples returned.
2. Critical technologies would need new development
   - Require substantial effort in the short/medium terms to reach a correct maturity level in the early phases of the project.
3. Planetary protection challenges for an MSR mission would be beyond those encountered for one-way Mars missions. There would be some significant technological planetary protection challenges, including aseptic sample transfer, redundant containment of the flight system, and biohazard assessment after the samples return to Earth.
4. Implementation of planetary protection and contamination control requirements for the end-to-end mission system is critical

Summary of Primary Conclusions
(2 of 2)

5. Existing launch capabilities in NASA and ESA would be sufficient
   - Two launch vehicles would be mandatory
   - Other systems in development, especially for ExoMars and MSL, could be used for MSR

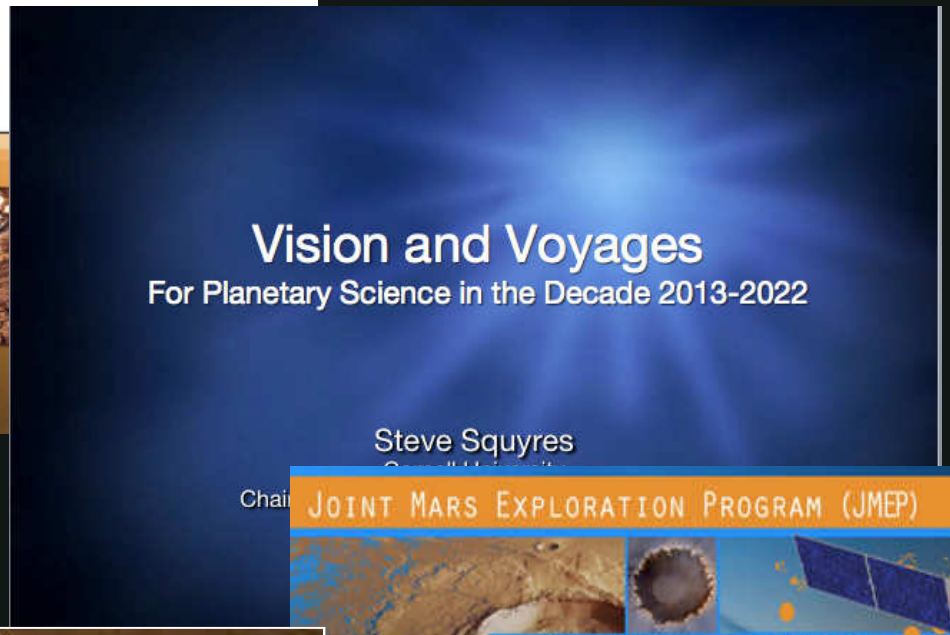
6. MSR could be divided into separate elements to be considered for funding by different international entities
   - "Who does what?" is not something iMARS could resolve on its own

7. With adequate resources and responsive decision making, the first MSR mission could be started in ~ 2013 (phase B start)
   - Would launch around 2020
   - Receiving a sample back on Earth ~3 years later

IMSI and Virtual Labs

- iMARS conclusion: selection of samples and allocation of them when returned should be the job of an international group of scientists
  - iMARS called it the International MSR Science Institute
- Further, handling samples under containment and preventing contamination would require specially trained scientist/technicians
  - Not everyone with an excellent science investigation would be able to handle the samples
  - Science back rooms at the SRF(s)
  - Virtual presence from remote back rooms would enable broader science access
- **Also need to develop secure sample transport to qualifed containment facilities**
  - **“Stuck in the SRF”**
- **Further definition of this concept was to be part of Phase II**

Since iMARS Phase I…



Current International Environment

- Successful Curiosity landing and science operations
- Three orbiters and two rovers operating on the surface of Mars
  - MAVEN and MOM to follow this fall
- ESA/Roscosmos making progress towards EXMTGO, EDM and ExoMars rover
  - NASA contribution of Electra UHF radios and MOMA-MS
- NASA's 2020 rover in formulation
  - Payload proposals being evaluated
- Budgets even more constrained, but…

Still a strong desire and intent to retain MSR as the primary goal of multinational Mars efforts

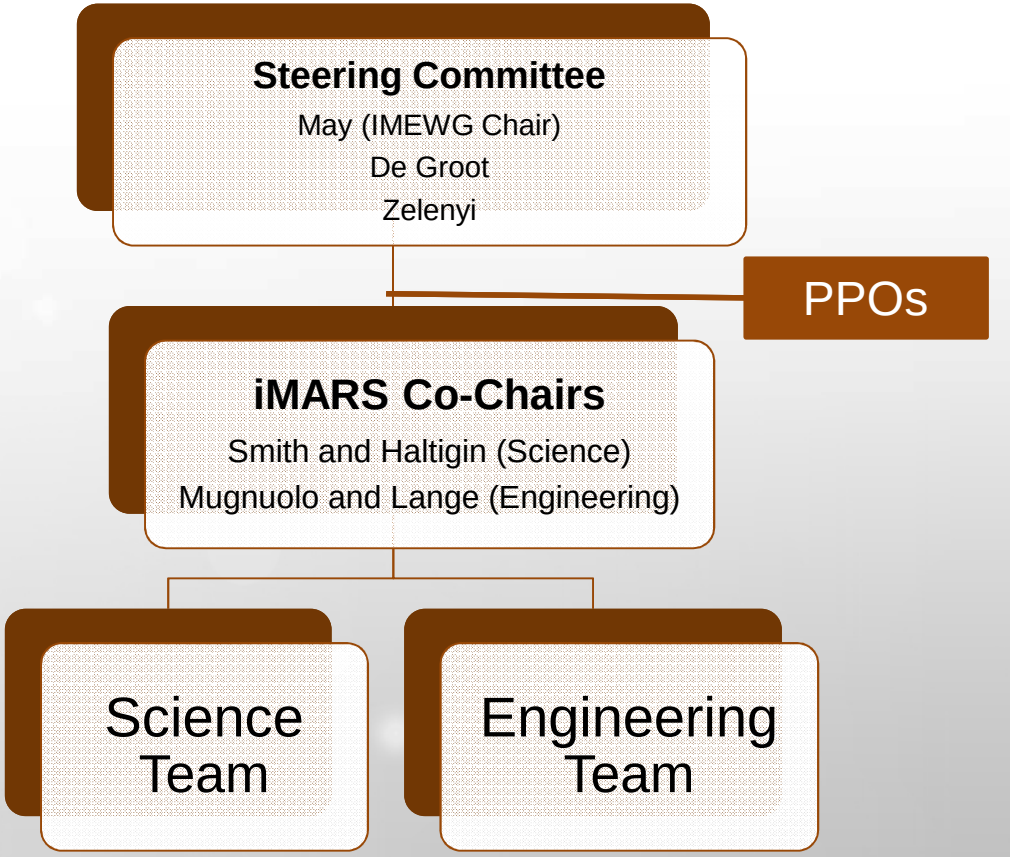
iMARS Phase II

Objectives
for iMARS Phase II

- Address outstanding science collaboration and management issues identified in Phase I
  - Revisit the concept of IMSI
  - Assuming science under containment, how would sample science be managed?
- Update the potential plan for a fully international Mars Sample Return
  - Assuming M2020 may or may not be the first element of MSR
  - Identify technology advances and update interests

iMARS Phase II Organization

- Steering Committee
  - IMEWG Chair (NASA) + ESA and Russia
- Two subteams
  - Science: On-Earth Science and Facilities
  - Engineering
- Planetary Protection Officers *as ex officio* members



iMARS Phase II Science Team Objectives

- Develop the framework of a future sample science management plan
- Ensure the international science management structure(s) proposed for future sample return would facilitate participation by a varied research community
  - Participation and access to samples must be based on a fair and transparent set of principles
  - Issue of containment and release from containment comes up frequently—“stuck in containment”
- Define an International Mars Science Institute (IMSI)
  - Would this be a physical or virtual institute or a combination?
  - What would be its role(s) and what would the management/administrative structure(s) be like?
  - What if/any interaction with other aspects of science and sample management should there be, i.e. sample receiving facility(ies) and curatorial facility(ies).

An important role of the iMARS is to ensure positive engagement with our colleagues in the engineering and scientific communities. We welcome comments and discussion!

Engineering Team Objectives

Architectural Update of Mission Descriptions

- The engineering team will:
  - Document the existing state-of-knowledge
  - Update previously developed international mission architecture options
  - Update iMARS potential plan for international cooperation enabling sample return from Mars
  - Identify technology-development milestones to accomplish a multinational mission or series of missions
  - Update descriptions of previously determined potential collaboration opportunities within the architecture and technology options and requirements.

- The activity will also update previously identified specific national/agency interests and opportunities for cooperation in the planning, design, and implementation of mission elements that contribute to sample return.

Schedule

- Kick off March 2014
- Interim briefing to IMEWG Sept 2014
- Final report and briefing to IMEWG March 2015