



# **Mars Science Laboratory Science Team Rules of the Road Revision B Release DRAFT**

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# Mars Science Laboratory Project

## Science Team Rules of the Road

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### CHANGE LOG

DATE	SECTIONS CHANGED	REASON FOR CHANGE	REVISION

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# 1 Introduction

## 1.1 Overview

The Mars Science Laboratory (MSL) scientific investigations will involve more than one hundred scientific participants: For example, there are 10 primary instruments, each with its own principal investigator (PI) and associated co-investigators (co-Is) and collaborators; participating scientists (PSs) and their associates; and scientists and engineers at JPL with significant involvement in the project. Meeting the scientific goals of the project will require coordinated interaction among all these participants (e.g., data sharing, interactive and interdisciplinary data analysis and interpretation, joint publications). Moreover, if this coordination is well conceived from the start, it can significantly influence the success of the project by encouraging opportunities for interdisciplinary results and discoveries and by maximizing the impact of the results of the project. While encouraging these interactions, the project must also encourage individual creativity and initiative and find ways to allow all members of the project to benefit appropriately from the scientific successes of the MSL.

The experiences of previous missions demonstrate that thinking through in advance how to manage the interactions and expectations of such a large and diverse group and getting “buy-in” from the leadership of the project to the approach to be followed is critically important. Although it is unlikely that all eventualities can be fully anticipated, the purpose of this document is to help ensure the orderly conduct of the MSL science investigation by specifying the principles and ground rules that will underpin the project’s approach to managing the integrated scientific investigations of the MSL. A key aspect of this approach is to encourage and maximize the openness and transparency of interactions within the Project Science Group (PSG)<sup>1</sup> and the project as a whole.

## 1.2 Scope

This plan is an agreement among MSL science team members and collaborators (i.e., those listed in sections 6.1 and 6.2) starting from now and extending until six months after the end of surface operations of the MSL science investigation (note that this includes the possibility of an extended mission).

## 1.3 Revisions

This plan will be revised as needed to accommodate changes in the MSL science investigation. Revisions to sections 6.1 (MSL science team members) and 6.2 (MSL science team collaborators) will require the approval of the co-chairs of the PSG (the project scientist and the MSL program scientist from NASA Headquarters) and will typically be proposed by a PSG

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<sup>1</sup> The PSG is co-chaired by the MSL project scientist and the MSL program scientist from NASA Headquarters and comprises the PIs as members. Additional scientists may be added to the PSG with the concurrence of the MSL project scientist and program scientist. The primary function of the PSG is to advise the project on optimization of mission science return and on resolution of issues involving science activities. For any particular PSG meeting or discussion, a PSG member can send an alternate in their place.

member or a PS. All other revisions require the same approvals as the plan itself.

## 1.4 Related documents

Related documents include:

- MSL Science Office Management Plan (JPL D-27221, MSL-214-0203);
- MSL Archive Generation, Validation and Transfer Plan (JPL D-35281, MSL-214-1333); and the
- Mars Exploration Program Data Management Plan.

## 1.5 Relationship to Phase E Experiment Operations Plans (EOPs)

The Project recognizes that several components of these Rules of the Road including – but not limited to – the generation of higher level data products, release and archiving of data to public, etc., are dependent on funding resources provided through yet-to-be negotiated contracts. Signing this document implies an intent by the instrument teams to support and abide by the Rules of the Road, and an intent by the Project to provide adequate resources. If adequate resources are not made available in the Phase E or later contracts, allowable exceptions to the Rules will be noted in those contracts.

## 2 Scientific participants

### 2.1 MSL science team members

Each PI-led investigation comprises the PI, the co-Is, and the collaborators, and these groups are responsible for organizing themselves so as to optimize their activities. In this document, however, the science “team” embraces a larger group than an individual PI-led group. This is a key point in that it recognizes that achievement of the overall goals of the MSL will require integration of a wide range of geological, chemical, and physical observations and that the best chance of achieving these objectives will come from a “lumping” of the group into a single, interacting team rather than a “splitting” of it into isolated entities. Consequently, in this document we define the members of the MSL science team to include the PIs and co-Is of each PI-led investigation; the as-yet unchosen PSs; the project scientist and deputy project scientists; and the investigation scientists. A complete list of MSL science team members is provided in section 6.1 of this document.

### 2.2 MSL science team collaborators

Collaborators will in many cases be deeply involved in the scientific work of the project, but they have lower levels of responsibility to the project than science team members and consequently lower privileges. Most MSL science team collaborators will be specifically associated by name with a PI or PS; exceptions might include selected members of the MSL project staff at JPL as appropriate. Collaborators may either be specifically named on selected proposals or as-yet unnamed students, postdocs, and technical staff collocated with and working with team members. In all cases, the team member with whom the collaborator is associated is responsible for the collaborator understanding and accepting these Rules of the Road. A complete list of MSL science team collaborators is provided in section 6.2 of this document.

### 2.3 Additions and deletions of team members and collaborators

Addition of new team members and collaborators will be possible provided they have the approval of the co-chairs of the PSG (see section 1.3) and satisfy relevant NASA requirements (e.g., for foreign participants). New team members and collaborators will typically be proposed by a PSG member or a PS. Note that if team members or collaborators disassociate from the MSL project (e.g., by resigning), they are no longer bound by the MSL Rules of the Road provided the PSG agrees to release them from these rules, with the exception that they may not submit papers based on MSL data or otherwise release data to which they have had privileged access until the MSL project releases those data to the public. All additions and deletions of team members and collaborators will be reflected in timely updates to sections 6.1 and 6.2 of this document.

### 2.4 The science community

For the purposes of this document, the “science community” is defined to be all scientists who are not MSL science team members or collaborators.

## 3 Data privileges policies

Data privileges for all Mars Exploration Program missions, including MSL, are governed by the Mars Exploration Program Data Management Plan. We highlight here four types of data sharing and how they will be managed by the MSL project:

- *Data sharing within the MSL project:* Each investigation should have the capability to produce processed data products at their home institution and while at JPL (for example when collocated at JPL right after landing) and will provide them fully as soon as they are ready to the Ground Data System (GDS) for distribution project-wide to the entire science team and to the engineering operations teams. This is expected to be important for several reasons, including (1) guiding tactical operations (i.e., next-sol decision making); (2) strategic planning, which will require constant iteration based on knowledge of the full range of results across all investigations, and (3) maximizing the scientific benefit of the integrated MSL mission (i.e., immediate data-sharing across the entire science team will help with full interpretation of the data from all instruments). It will be the responsibility of individual PIs or PSs to distribute data and data products in a timely fashion to their collaborators. Note that it is expected that data processing and interpretation will evolve (e.g., from provisionally analyzed to fully validated and archivable data), and improved data products and interpretations will also be distributed within the project as they become available. As a general rule, any MSL data products (including calibration data) will be made available to any MSL team member or collaborator.
- *Data release to the general public:* In order to engage the public, the MSL science team will release subsets of recent particularly interesting data or data products from each of the science instruments in a timely fashion. In addition, NASA, through the MSL project office, reserves the option to release or to direct the release of data or data products in support of public engagement.

Data not previously released to the public by NASA or MSL and/or inferences or interpretations based on such data may only be released by science team members based on specific approval by the PSG or through a PSG-approved-process for release approval; the PIs will have the primary responsibility for representing and coordinating their teams regarding such data releases. Note that these required approvals also apply to web sites maintained by team members, collaborators, and their institutions, as well as any release of information to the internet (e.g. blogs).

At the discretion of NASA Headquarters or the PSG, short-term embargoes on particular releases might occasionally be put in place (for example, in order to maximize the impact of a specific press conference or to comply with a particular journal publisher's request), but such embargoes are expected to be exceptions rather than the rule.

All images generated from the engineering cameras (i.e., the Navcams and Hazcams) will be made viewable by the general public as rapidly as possible on a World Wide Web site hosted by JPL. Release of these images to the web will not be delayed intentionally for any reason and will not require review or approval by anyone. However, given their rapid release, these images will typically be unvalidated and without complete ancillary information. It is not expected that other rover engineering sensor data will be released outside the science team until archived in the PDS or until included as outreach products by the project.

- *Release of data and discussion of interpretations through the media (print/radio/TV/film):* Interviews of MSL science team members by the news media should be coordinated with the JPL Media Relations office. Each PI (and each science team member) may release data from their own instrument (or their own scientific investigations) to the press and discuss their interpretations through their home institution's media relations office, provided the releases and discussions are approved by the PSG and coordinated with the JPL Media Relations Office. Requests for such approval from team members are expected to be coordinated by the PIs, leaving at least several days advance notice for the approval. An important issue in interaction with the press will be to share credit appropriately within and across PI-led teams, and in giving its approval the PSG will take particular care to ensure such sharing.

The PSG will work with JPL Media Relations to develop more detailed guidelines for science team members being interviewed in special situations, for members being interviewed at different levels of public exposure, and for members who have had different levels of media training. Public release of information about the mission's status will be coordinated with JPL Media Relations.

- *Data sharing with the science community:* It is NASA policy that investigators do not have exclusive use of data taken during the course of their investigation for any proprietary period. However, it is recognized that some time is required (no more than six months for the MSL project, as specified in the AO) for data products to be generated and validated. Consistent with this, PIs will be responsible for delivery of assembled



and validated MSL data product volumes (Level 0 and 1 data, associated ancillary information, calibration data and information, and higher-level calibrated data products) to the PDS no more than six months after receipt on earth. Archive volumes should be PDS-standards compliant. The documentation delivered to PDS that describes the higher-level products must include a complete description (techniques, algorithms, calibration measurements, and/or software when practical) such that a reasonably skilled end user has enough information to fully understand and reproduce any scientific results derived from the data products.

Before delivery to the PDS, no data products shall be released to the science community other than results contained in scientific publications (or supplemental data associated with such publications) or products released to the general public as described in the MSL Archive Generation, Validation, and Transfer Plan and this Rules of the Road document. The importance of this cannot be overemphasized, and all team members and collaborators must be especially vigilant on this point; i.e., since we want everyone to be comfortable with complete openness within the project with respect to unpublished or incompletely processed or interpreted results, we must be especially careful not to violate the confidentiality of the group by broadcasting (even inadvertently) these hard-won data. An exception (see also section 4.2) is that selected results may be released to specifically chosen members of the community on an as-needed basis in order to enable their participation in the project when no team members or collaborators with adequate expertise are available (e.g., unanticipated results are encountered and no pre-selected team members or collaborators are experts in the area or have the time to devote to the new task); all such releases must be approved by the MSL project scientist, after consultation with the PIs responsible for the data and/or the PSG.

## **4 Publications**

### **4.1 Overview – the role of the PSG**

Peer-reviewed publication of the results of the MSL science investigation will be the primary means of reporting these results and their interpretations to the scientific community. Such publications will also likely be the primary basis for the professional recognition that scientists associated with the project will earn from their participation with MSL. Thus, clear guidelines for the preparation of journal articles and other professional communications are necessary, both to ensure effective communication of the results of the project and to ensure fair distribution of credit for these results and their interpretation. Given the large number of scientific participants, the integrated nature of most of the anticipated results (i.e., most publications will involve team members and collaborators associated with multiple PI-led investigations), and the importance that most scientists attach to obtaining recognition for their work, it is anticipated that the twin goals of effective communication and achieving equity may require delicate balance and coordination of the team and collaborators.

In view of the importance of the publication policy, its coordination and implementation will be the responsibility of the PSG. It is envisioned that decisions on what papers will be written, on

authorship, on which results will be put in which of the papers, and so forth will be worked out within the PSG. This will give the PSG responsibility for coordinating the dissemination of the results of the project and the responsibility for balancing issues of equity and quality among the many participants in the project, especially as they relate to allocation of credit for obtaining and processing data, for creativity and the development of interpretations and hypotheses, and for scientific leadership within the project. In this context, the PSG will also have to respect divergent interpretations and, in particular, to encourage the publication of minority viewpoints (i.e., there will not likely be a monolithic project-wide interpretation of all the results) and the orderly publication of multiple interpretations of the same observations.

All team members and collaborators will be required to accept the decisions of the PSG on matters regarding publication, and, most critically, no science team member or collaborator shall knowingly participate in any publication of results or interpretations of MSL science data for the time period covered by these rules (i.e., until six months after the close of surface operations; see section 1.2) unless they have received specific authorization from the PSG to do so.

It is anticipated that the PSG will confer regularly to monitor the progress of manuscripts in preparation, to discuss plans for future publications and their authorships (including suggestions from any team member or collaborator for possible publications), and to coordinate the flow of publications. It is also important to emphasize that these decisions will not simply be reached by a majority vote; for reasons of academic freedom and the encouragement of maximum creativity, minority viewpoints shall be respected and protected. Thus, although the expectation is that most decisions will be achieved by consensus, it is likely that this will not always be possible. In these cases, it will be the responsibility of the project scientist to attempt to craft compromises that the PSG will accept. In those rare cases where no compromise that the entire PSG can agree to can be brokered, it will be the responsibility of the co-chairs of the PSG to make a decision. If one of the co-chairs has a personal stake in the outcome of such a decision, the decision will be made by the other co-chair.

## **4.2 Authorship guidelines**

Authorship for all publications is open to all team members and collaborators, according to the following conditions:

- any team member who asks to be an author of any paper and who makes a substantive contribution to that paper (i.e., to the writing and/or to the research reported in the paper) shall be an author; and
- any collaborator who is invited by a team member to be an author on a paper and who makes a substantive contribution to that paper (i.e., to the writing and/or to the research reported in the paper) shall be an author.

Final decisions on authorship, both the inclusion or exclusion of people from the author list and the order of authors, will be made by the PSG as part of its coordination of the entire publication process, taking care to balance the issues discussed in section 4.1. Note that it is anticipated that many of the papers will involve team members and collaborators from several of the PI-led investigations. The appropriate authorship of papers will likely evolve during their preparation; the PSG-approved lead author of each paper will have access to the PSG to discuss issues of concern and will be responsible for keeping the PSG informed as to appropriate changes in

authorship. The PSG will likewise be responsible for keeping the full project membership informed of all ongoing and anticipated publications.

As described in section 3, members of the science community may be authors (including lead authors, where appropriate) of a project-sanctioned paper only if:

- their participation on the paper (including the research leading up to the paper) has been pre-approved by the PSG based on a request from a team member; as described in section 3, approval by the PSG will be based on the judgment that the outside scientist brings to the investigation some unique and necessary capability not possessed by any team member or collaborator (or appropriate team members or collaborators are unwilling or unable to perform the work);
- they make major substantive contributions to the investigation and/or to the writing of the paper.

### 4.3 Anticipated publications

Although the actual schedule and nature of publications resulting from the MSL project will necessarily depend on events that cannot be fully predicted, we nevertheless anticipate that publication will take place in four phases: instrument descriptions, preliminary reports, detailed reports, and follow-on science.

- *Publications prior to landing*: Prior to landing, the project will publish an overview of its plans and capabilities. In addition, a series of papers in which each PI-led investigation will provide detailed investigation and instrument descriptions (including design and testing) will be published before landing; each instrument-specific publication in this series shall include an extensive description of calibration (unless a separate publication on calibration is prepared for that instrument). Note that it is expected that the author lists for these early publications describing instruments associated with a particular PI-led investigation will generally not include coauthors from other PI-led teams. It is also expected that papers with descriptions of other MSL investigations, hardware (e.g. SA/SPaH and its capabilities), and activities (such as field tests and landing site selection) will also be included in this set of publications.
- *“Preliminary” reports*: The MSL project will oversee the publication of a set of papers roughly analogous to the “30-day reports” of past missions, although they will not necessarily be written on a 30-day timescale (the actual time scale will be established by the PSG). They will be submitted to a peer-reviewed scientific journal that will provide timely publication. This set of papers will consist of one or more overview papers of key early findings, accompanied by a number of topical papers presenting these findings at a greater level of detail.
- *Detailed reports and other peer-reviewed publications*: After the publication of preliminary reports, the findings of the MSL science investigation will be published (generally in peer-reviewed journals) as appropriate. It is likely (but not required) that in addition to stand-alone papers, one or more sets of papers will be submitted as parts of special issues of journals. Planning and scheduling of these publications will be worked out by the PSG, but it is expected that there will be several coordinated waves of publications plus a steady stream of individual papers over the course of the project. As with all other publications during the course of the mission, the PSG will coordinate and oversee them. Note that with the passage of time (and especially if the mission has an

extended lifetime and for publications that deal exclusively with data already released to the PDS), the coordination role of the PSG may in some cases outweigh the oversight role, but the roles of the PSG in keeping the team working together effectively; in keeping the full group aware of results, interpretations, and intended publications; and in ensuring fairness will continue throughout the lifetime of the project.

#### **4.4 Presentations at scientific conferences**

It is anticipated that results of the MSL investigation will be presented in forums such as scientific conferences. The PSG will have the responsibility to oversee and coordinate these presentations, and team members and collaborators wishing to make such presentations should request authorization from the PSG, leaving at least several days for advance approval. Authorship rules for such professional scientific presentations that take place within the time period covered by this document will be identical to those for peer-reviewed papers as stated in section 4.3, including those which are prepared and submitted prior to landing. For abstracts where it is appropriate for all team members to be coauthors but length limits prevent all from being listed, the phrase “the MSL science team” should be used.

#### **4.5 Informal talks**

Giving informal talks where abstracts are not required (e.g., departmental colloquia) is permissible by all team members and collaborators, and advance project-level approval is not generally required. However, notification of such talks should be provided to the project scientist, and for co-Is and collaborators, permission should be sought from their associated PI or PS. However, these presentations should not include data or results that have not previously been published (or distributed as part of a public release), archived in the PDS, or discussed at a scientific conference or workshop that included attendees not associated with the MSL science team.

#### **4.6 Follow-on science**

Follow-on science is any scientific research or publication after the time period covered by this document. The MSL science team will be considered to be disbanded after this time period, and there are no restrictions on any subsequent work by any team member or collaborator.

## **5 Operations policies**

### **5.1 Integrated operations environment description**

We anticipate that the mechanism for generating and prioritizing rover and instrument science activities for landed operations on Mars will be through initiation by the science theme groups or rover engineering team and deliberation in Science Operations Working Group (SOWG) meetings. Any MSL science team member can belong to one or more theme groups of their choosing. Each theme group will be composed of team members representing multiple instruments, working together to analyze scientific results and to prepare science activity plans that address their group's science objectives. In the SOWG Meeting, science theme group leads will present and advocate their group's activity plan. In support of tactical operations, all science results and data (preliminary and updates) will be shared with the full science team, as soon as

they become available (see Section 3).

Tactically, the science investigations of PI-led instrument teams will be advocated through instrument team members' participation in theme groups. Instrument-related concerns and advice will also be provided in SOWG meetings by the payload downlink and uplink leads. On a tactical basis, the PSG will delegate SOWG meeting decisions to the SOWG chair, although the mission manager can overrule the SOWG chair. In such cases, the SOWG chair can appeal to the project manager (PM) and project scientist (PS), but if the PM and PS are not available, the mission manager has the final say. On rare occasions, the PSG co-chairs or their designee may redirect the SOWG chair when the tactical plan compromises the PSG's strategic plan.

The PSG will develop the strategic (i.e., long-term) plan for surface science and will give strategic direction to the long term planners and SOWG chairs. For strategic issues involving engineering and spacecraft health, the project manager must be involved and can overrule the PSG. The PSG has the right to appeal such decisions to the Mars Program Office and Mars Exploration Program Director.

## **5.2 Inputs to activity planning**

The PIs shall provide all project-requested input to the activity planning process for their instruments, including activity dictionary inputs, resource models, and parameters for expansion into sequences.

## **5.3 Participation in test and training**

Instrument teams will make every effort to participate in appropriate prelanding development to support operations phase capabilities, including project-level test and training exercises.

## **5.4 Instrument uplink preparation**

The instruments will be operated (command sequence generation and assignment of data downlink priority) in response to recommendations of the Science Operations Working Group to the MSL project, subject to approval by the MSL tactical uplink lead and mission manager.

## **5.5 Instrument use for engineering needs**

Instrument activities advocated for engineering use will be given high priority when necessary (e.g., inspection of the rover or other instruments, traverse planning, sun finding, environment characterization, or other uses) as needed, on a limited basis, on any sol requested. Such requests will be transmitted through the Science Operations Working Group operations processes.

## 6 Personnel lists

### 6.1 Science team members

The following individuals are the members of the MSL science team<sup>2</sup>:

#### **MSL Project Science Office + NASA Headquarters**

Anderson, Robert C. JPL (SA/SPaH Investigation Scientist)  
 Behar, Alberto JPL (DAN Investigation Scientist)  
 Blaney, Diana JPL (ChemCam Investigation Scientist)  
 Brinza, David JPL (RAD Investigation Scientist)  
 Crisp, Joy JPL (MSL Deputy Project Scientist)  
 de la Torre Juarez, Manuel JPL (REMS Investigation Scientist)  
**Grotzinger, John Caltech (MSL Project Scientist)**  
 Maki, Justin JPL (MastCam, MAHLI, MARDI Investigation Scientist)  
**Meyer, Michael NASA Headquarters (Program Scientist)**  
 Vasavada, Ashwin JPL (MSL Deputy Project Scientist)  
 Voytek, Mary NASA Headquarters (Deputy Program Scientist)  
 Yen, Albert JPL (CheMin and APXS Investigation Scientist)

#### **APXS**

Campbell, Iain University of Guelph (Co-I)  
**Gellert, Ralf University of Guelph (PI)**  
 King, Penny Australia National University (Co-I)  
 Leshin, Laurie Rensselaer Polytechnic Institute (RPI) (Co-I)  
 Lugmair, Guenter University California San Diego (Co-I)  
 Spray, John University New Brunswick (Co-I)  
 Squyres, Steven Cornell University (Co-I)  
 Yen, Albert JPL (Co-I)

#### **ChemCam**

Blaney, Diana JPL (Co-I)  
 Bridges, Nathan Applied Physics Laboratory (APL) (Co-I)  
 Clark, Benton Space Science Inst. (SSI) (Co-I)  
 Clegg, Sam Los Alamos National Lab (LANL) (Co-I)  
 Cremers, David Applied Research Associates, Inc. (Co-I)  
 Dromart, Gilles Laboratoire de Géologie de Lyon: Terre, Planètes et Environnement (LGLTPE), Lyon (Co-I)  
 d'Uston, Claude Institut de Recherche en Astrophysique et Planetologie (IRAP) (Co-I)  
 Fabre, Cécile Géologie et Gestion des Ressources Minérales et Énergétiques (G2R) (Co-I)  
 Gasnault, Olivier Institut de Recherche en Astrophysique et Planetologie (IRAP) (Co-I)  
 Herkenhoff, Ken U.S. Geological Survey (USGS) Flagstaff (Co-I)  
 Kirkland, Laurel LPI (Co-I)  
 Langevin, Yves Institut d'Astrophysique Spatiale (IAS) (Co-I)  
 Mangold, Nicolas Laboratoire de Planétologie et Géodynamique de Nantes (LPGN) (Co-I)  
 Mauchien, Patrick Commissariat à l'Énergie Atomique et aux Énergies Alternatives (CEA) (Co-I)  
 Maurice, Sylvestre Institut de Recherche en Astrophysique et Planetologie (IRAP) (Co-I and Deputy PI)  
 McKay, Christopher Ames Research Center (Co-I)  
 Newsom, Horton University New Mexico (Co-I)  
 Sautter, Violaine Laboratoire de Minéralogie et Cosmochimie du Muséum (LMCM) (Co-I)  
 Vaniman, David Planetary Science Institute (PSI) (Co-I)  
**Wiens, Roger Craig Los Alamos National Lab (LANL) (PI)**

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<sup>2</sup> Names in bold indicate Project Science Group (PSG) members.

**CheMin**

Anderson, Robert JPL (Co-I)  
Bish, David Indiana University Bloomington (Co-I)  
**Blake, David F. Ames Research Center (PI)**  
Chipera, Steve Chesapeake Energy (Co-I)  
Crisp, Joy JPL (Co-I)  
DesMarais, David Ames Research Center (Co-I)  
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Farmer, Jack Arizona State University (ASU) (Co-I)  
Feldman, Sabrina JPL (Co-I)  
Gailhanou, Marc Centre National de la Recherche Scientifique (CNRS) (Co-I)  
Ming, Douglas JSC (Co-I)  
Morris, Richard JSC (Co-I)  
Sarrazin, Philippe inXitu (Co-I)  
Stolper, Ed Caltech (Co-I)  
Treiman, Allan Lunar and Planetary Institute (LPI) (Co-I)  
Vaniman, David Planetary Science Institute (PSI) (Co-I and Deputy PI)  
Yen, Albert JPL (Co-I)

**DAN**

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Boynton, Bill University Arizona (Co-I)  
Kozyrev, Alexandre S. Space Research Inst. (IKI) (Co-I)  
Litvak, Maxim Space Research Inst. (IKI) (Co-I and Deputy PI)  
**Mitrofanov, Igor G. Space Research Inst. (IKI) (PI)**  
Sanin, Anton B. Space Research Inst. (IKI) (Co-I)

**MAHLI, MARDI, and MastCam**

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