



National Aeronautics and
Space Administration

Mars Sample Return Independent Review Response Planning and Updates



NASA/ESA
**MARS
SAMPLE
RETURN**

Planetary Advisory Committee (PAC)

Sandra Connelly, Science Mission Directorate Deputy AA

Jeff Gramling, MSR Program Director

Steve Thibault, MSR Chief Engineer

Dr. Michael Meyer, Mars Lead Scientist



MSR Summary (1 of 2)

Why Now?

- Science is important for the success of the US and NASA is a vital part of the global science enterprise: we do science that is only enabled by going to space.
- MSR is **complex** and **challenging** and has been one of the highest science priorities for over twenty years.
- We have been developing the science and engineering capabilities for over two decades and are now capable of succeeding.
- Never before has humankind been able to return material from another planet.
- MSR will teach us about how Mars went from being Earth-like to being inhospitable to life.
- MSR will provide valuable information that will better prepare us for human exploration of Mars.
- Doing hard things on Mars inspires everybody around the world. MSR will top them all.
- MSR is the next step in maintaining leadership at Mars.

MSR Summary (2 of 2)

- Science is a global endeavor and MSR requires strong international partnerships. The knowledge gained will benefit the whole world.
- MSR remains a NASA priority over the next decade, and difficult choices will need to be made in the near-term.
- We are all operating in a constrained budget environment, and we can't do everything as planned.
- We need to enable MSR's success within a balanced, executable science portfolio.
- Perseverance has already collected more than 20 compelling samples and continues.

This is the time for the planetary science community to stand up for their decadal prioritization. MSR needs their support.

NASA's Proactive Approach to MSR

- MSR has a complex mission and partnership structure that has evolved over time.
- NASA has conducted two independent reviews boards to ensure program maturity at confirmation.
- Multiple options were evaluated, and the program was replanned to address evolving technical and geopolitical considerations.
- In 2023, NASA SMD chartered IRB-2 in preparation for Preliminary Design Review (PDR) and confirmation, to address a variety of risks with the evolving architecture including technical, schedule, and cost.
- IRB-2 report was publicly released September 22, 2023.

Response to IRB



SMD IRB Response

- Some findings and recommendations are broader than the MSR Program; as a result, the SMD Deputy AA will lead the response effort.
- NASA will respond fully to the IRB report by March 2024.
 - Currently we are assembling internal teams and developing a schedule. Team composition, charter, and detailed plans are being refined.
 - Team kickoff meeting conducted Oct 19, 2023.
- Progress will be updated at future public community meetings.

SMD IRB Response Summary Team Structure

- Overarching guiderails – Core Team is independent of existing program personnel; sub teams require engagement of knowledgeable program/project personnel.
- MSR IRB Response Team (MIRT) will be comprised of a core team and 5 sub teams:
 - Core Team
 1. Programmatic/Governance Team
 2. Technical/Architecture Team
 3. Science Team
 4. Business Team
 5. Program Director Team
 - Plus ex officio members and consultants

In conclusion

- The entire team, who have been working tirelessly for decades, are to be commended for the progress made and preparations for the future.
- The IRB report was extremely thorough, thoughtful, and will help MSR move forward.
- NASA SMD and the MSR team thank the IRB for their comprehensive and dedicated engagement in developing the findings and recommendations.
- In FY 2024, NASA will determine budget alignment for a sustainable MSR program with an executable cost, schedule, and technical plan approved by ESA and NASA.

**NASA is the Agency that Makes the Impossible Possible.
Flagship missions are always complex and difficult, and therefore costly.
The rewards are high and so we do not shy away.**

Re-Architecture





Approach for Re-Architecture/Reformulation

- Preliminary Architectural Trades: Fall 2023
- Down-Select/Focused Concepts: Fall/Winter 2023
 - Develop “building blocks” and pre-work high-likelihood candidate concepts
 - Technical Interchange Meeting to select 2-3 candidate architectures for further analysis
- Independent Costing/Technical Reviews: Winter 2023/2024
 - Further develop candidate architectures
 - Rough order magnitude costing/schedule
 - Recommend go-forward architecture options
 - Non-advocate review
- Agency architectural decision based on MIRT guidance: March 2024
- Target for Confirmation: Fall/Winter 2024

Progress to Date on Re-Architecture/Reformulation

- Evaluated preliminary architectural variants in light of overall programmatic challenges; reviewed previous studies with updated knowledge of technical drivers and work from MSR Phase A/B
- Defined first set of "building blocks" and candidate concepts; engineering definitions are underway across the partner organizations: JPL, GSFC, MSFC, and ESA
- Defined Figures of Merit to guide architecture evaluation
 - Annual funding cap
 - Lifecycle cost
 - Architecture robustness, including launch/return dates
 - Organizational complexity and work balance across partner organizations
 - Sample diversity and number of samples returned
 - Technical risk and robustness

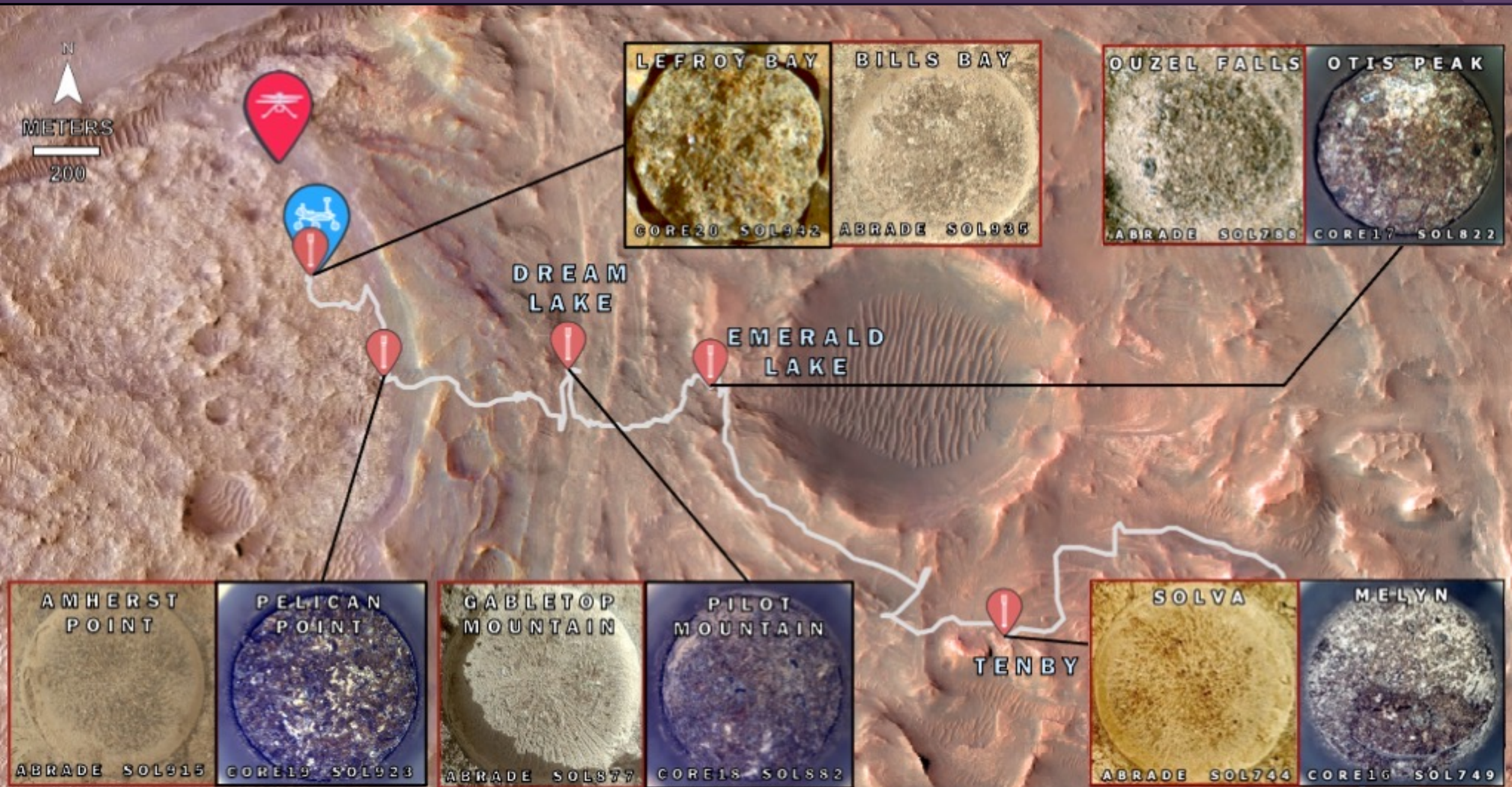


Required MSR Functions

- Get off Earth
- Get to Mars Surface
- Survive Mars Surface
- Gather/Retrieve Samples
- Get Samples off Surface
- On-orbit Rendezvous with Samples
- Sterilize/Break The Chain
- Return to Earth
- Earth Arrival/Landing

Science Update







Campaign Science Update

- The NASA /ESA MSR Campaign Science Group (MCSG)
 - Published in May, “Report of the Science Community Workshop on the proposed First Sample Depot for the Mars Sample Return Campaign”, *Meteoritics & Planetary Science* <https://doi.org/10.1111/maps.13981>
 - Rock and gas teams have assessed procedures to open the returned sample tubes to maximize the head gas extraction and minimize rock/regolith disruption. Work is done and report under review by MCSG.
 - Three Forks Analog Sample Library being established (4/5 sites already sampled) and University of Norway to conduct sample characterization
 - The Sample Receiving Facility (SRF) Contamination Panel report to be completed soon
- Sample Receiving Project (SRP) Measurement Definition Team (MDT) established - will develop a strawman set of instruments that would be needed within the high-containment facility to accomplish sample safety assessment, curation, and science.
 - Of 147 applicants 23 selected, plus 6 ex-officio members added
 - Kick-off meeting September 14, 2023
 - Report expected in April 2024

Sample Receiving Facility – Measurement Definition Team

CO-CHAIRS	
GRAHAM, Heather	NASA/GSFC (US)
HERD, Chris	University of Alberta (CA)

MEMBERS	
BRIDGES, John	University of Leicester (UK)
DEBAILLE, Vinciane	Université Libre de Bruxelles (BE)
DUPRAT, Jean	Centre National de la Recherche Scientifique (FR)
FERRARI, Marco	Istituto di Astrofisica e Planetologia Spaziali (IT)
FRENCH, Katherine	United States Geological Survey (US)
GLAMOCLIIJA, Mihaela	Rutgers University (US)
FOX, Allison	NASA/JSC (US)
HAUSRATH, Libby	University of Nevada, Las Vegas (US)
KRZESINKSKA, Agata	University of Oslo (NO)
LIU, Yang	NASA/JPL (US)
MAGNABOSCO, Cara	ETH Zurich (CH)
MARLOW, Jeffrey	Boston University (US)
MAUREL, Clara	CEREGE (FR)

MEMBERS (cont'd)	
OGLIORE, Ryan	Washington University, St. Louis (US)
PACK, Andreas	Universität Göttingen (DE)
RAMPE, Elizabeth	NASA/JSC (US)
SCHROEDER, Christian	University of Stirling (UK)
SCHWENZER, Susanne	Open University (UK)
SESSIONS, Alex	California Institute of Technology (US)
SILJESTRÖM, Sandra	Research Institutes of Sweden (SE)
WANG, Kun	Washington University, St. Louis (US)
Ex Officio	
HARRINGTON, Andrea	NASA/JSC
HUTZLER, Aurore	ESA
MCLAURIN, Hannah	NASA/JSC
PILLAI, Segaran	US Food and Drug Administration
STEELE, Andrew	Carnegie Institution
TU, Valerie	NASA/JSC

Internationally diverse team representing 10 countries

Summary

- Priority of two decadal surveys - MSR remains a NASA priority over the next decade
- Perseverance continues to collect compelling samples
- MSR program is developing viable architectures in collaboration with our ESA partners, based on IRB recommendations as well as budget and schedule constraints

THANK YOU!

