

MSL Lessons Learned Study

Presentation to NAC
Planetary Protection Subcommittee
April 29, 2013
Mark Saunders, Study Lead

Purpose

- Identify and document proximate and root causes of significant challenges experienced by MSL
- Take lessons from MSL and develop steps to strengthen processes and performance at all levels of Agency [including the Jet Propulsion Laboratory (JPL), Goddard Space Flight Center (GSFC), and NASA Headquarters] in future, large-scale complex projects
- This includes issues with planetary protection

Scope

The findings will be documented and where possible, options to improve performance will be developed addressing (as applicable):

- Adequacy of current Agency, Center, Mission Directorate, Center, and Program/ Project processes
- Day-to-day internal processes
- Design, KDP, and milestone review processes
- Decision processes at all levels from Headquarters to project
- Competitive selection and cost commitment processes
- Policy changes to improve performance insight, and to help avoid similar situations of this magnitude in the future

Team Members

- Mark Saunders, Team Lead
- Noel Hanners
- Dolly Perkins
- Scott Hubbard
- Jeff Leising
- David Tisdale
- Sarah Gavit
- Bill Luck
- Charlie Fletcher

Bios in backup

Background

- During June 2009 Agency Program Management Council (APMC), an action was assigned to the Office of the Chief Engineer (OCE) and to the Science Mission Directorate (SMD) to “conduct an in-depth lessons learned study on MSL to better understand the technical and programmatic issues, decision processes, and problem mitigations, and their impact on not being able to launch within the original window.”
- Planetary Protection Subcommittee of NASA Advisory Council also requested a lessons learned study on MSL to better understand the conditions leading to the planetary protection deviation, the decision process, and communication of the deviation decision.

Team's Scope for Addressing Planetary Protection

- Are Agency's policies and requirements (NPD/NPR) clear and concise on what is required, when it is required, and who is responsible for doing it? Are responsibilities appropriate for roles assigned, e.g. no inherent conflicts of interest?
- Is relationship between science and PP understood and documented clearly? Are policies, procedures and processes clear about this?
- Are mission directorate processes effective in defining PP requirements for missions and more specifically for MSL such that PP categorization and issuance of requirements is done in sufficient time to allow successful implementation? If so, did this happen for MSL? If not, why not?
- Are project management processes adequate to implement PP requirements? If so, did this happen for MSL? If not, why not?
- Are project processes adequate and appropriate to ensure verification that requirements have been met? If so, did this happen for MSL? If not, why not?
- Are project to program to MD to PPO communication processes adequate to ensure proper understanding, implementation and verification of PP requirements? If so, did this happen for MSL? If not, why not?

Approach

- Interview participants at HQ, JPL and others as necessary
- Review HQ and MSL documentation
- Analyze and draw conclusions
- Draft recommendations
- Prepare report and present results

6 month Schedule

- Kicked study off on March 5
- Interviewed HQ, GSFC and JPL personnel
 - Finishing initial interviews in next few weeks
 - Follow-on interviews will be conducted as new questions arise
- Collecting and analyzing lessons learned reports, HQ policies, JPL policies, Independent review documents and MSF documents
- Beginning to synthesize initial data from interviews and documents
 - Analysis scheduled for May and June
- Finalize study conclusions in August and write report
- Study to be completed by end of September

BACKUP

Team Member Bios

- **Mark Saunders (Lead)** - has extensive NASA and military program and project management, as well as system engineering experience. Most recently, he served as Director of NASA's independent program assessment, evaluating programs and projects, including the James Webb Space Telescope. He served as Director of NASA Langley's exploration and space access programs, where he oversaw research and development of new technologies for spacecraft and launch vehicles; program manager of NASA's Discovery Program; and managed four planetary missions: Mars Pathfinder, NEAR, Lunar Prospector and Stardust. He also served as the manager of the Space Station Freedom's Logistics Program and project manager of two Navy strategic weapon centers, responsible for assembly, integration, test and delivery of nuclear missiles.
- **Noel W. Hinnners** - Noel retired in 2002 from Lockheed Martin Astronautics where he was vice president of Flight Systems, responsible for planetary missions. He joined Martin Marietta Corporate as vice president of strategic planning in 1989. Dr. Hinnners was NASA associate deputy administrator and chief scientist (1987 to 1989), director of the NASA Goddard Space Flight Center (1982 to 1987), director of the Smithsonian's National Air and Space Museum (1979 to 1982), NASA's associate administrator for Space Science (1974 to 1979) and director/deputy director of Lunar Programs (1972 to 1974). Before joining NASA Noel was department head of Lunar Exploration with Bellcomm, Inc., (1963 to 1972) where he assisted NASA in science planning and site selection for Apollo.
- **Dorothy C. (Dolly) Perkins** – Ms. Perkins currently serves as a consultant to NASA and NOAA, providing independent review of programs and projects. She retired from NASA/GSFC in December 2007 from the position of Deputy Center Director – Technical. She also led the review board that investigated the loss of the Mars Global Surveyor spacecraft. Previously she was Director of Flight Programs and Projects, where she oversaw implementation of all GSFC flight projects. Prior to that she served as Deputy Associate Director of Flight Projects for Earth Observing System Operations where she led the recovery and successful implementation of the largest civilian information system in the world (the EOS Data and Information System) responsible for multi-satellite operations, and processing and distribution of scientific data for Earth science researchers and policy makers. Previous positions included Deputy Director of Applied Engineering and Technology, Mission Systems Manager for the Space Operations Management Office (GSFC position reporting to JSC), and Chief, Mission Operations and Data Systems Development Division.

Team Member Bios

- **G. Scott Hubbard, Stanford University** – Professor of Aeronautics and Astronautics - has been engaged in space-related research as well as program, project and executive management for >35 years including 20 years with NASA, culminating as director of NASA's Ames Research Center. He served as the sole NASA representative on the Columbia Accident Investigation Board; was NASA's first Mars program director and successfully restructured the entire Mars program in the wake of mission failures. He is the founder of NASA's Astrobiology Institute; conceived the Mars Pathfinder mission with its airbag landing and was the manager for NASA's highly successful Lunar Prospector Mission. Prior to joining NASA, Hubbard led a small start-up high technology company in the San Francisco Bay Area and was a staff scientist at the Lawrence Berkeley National Laboratory. Hubbard has received many honors including NASA's highest award, the Distinguished Service Medal.
- **Jeff Leising** has forty- five years of experience at JPL in various engineering, line, project and program management positions supporting a number of different government sponsors. His NASA experience includes working on Surveyor missions to the Moon, Voyager and Cassini missions to the outer planets and Mariner missions to Mars, Venus and Mercury. He also worked on R&D projects for the DOE in solar photovoltaic and solar thermal energy, for the DOT in advanced engine design and electric and hybrid vehicles and for the DOD and FAA in the design of tactical and operational information systems. Prior to retiring in 2011 he managed the JPL Project Formulation Office that supported proposal teams and new projects establish organizational structures, meet institutional requirements, identify development risks, estimate costs, generate implementation plans and establish integrated baselines. His technical background is in propulsion, system engineering, line and program management. He graduated from Cornell University with a Bachelors and Masters in Mechanical Engineering.
- **Sarah Gavit** is currently a private consultant to NASA for spacecraft system engineering and project management, and frequently serves on Technical, Management and Cost panels for space mission evaluations. Early in her career at Martin Marietta, Sarah was a mission and system engineer for the Magellan mission to Venus. During her seventeen years in planetary exploration at the Jet Propulsion Laboratory, Sarah served as the Project Manager for the Dawn mission and the Deep Space 2 Mars Microprobe Project, the Project System Engineer for the Prometheus and Kepler missions, the Fault Protection System Engineer for the Cassini mission, and as the Mars System Sterilization Study Lead

Team Member Bios

- **Dave Tisdale** - is an accomplished aerospace test engineer with over 30 years' experience in assembly ,test and launch operations. Dave was the lead engineer for the Mars Polar Lander and multiple satellite programs. He is currently key to development of the growing body of knowledge for planetary protection education system. His over 30 years of commercial space engineering provide an ability to provide unfiltered analysis of engineering change effects.
- **Charlie Fletcher** – provides a unique blend Civilian Engineering, Program management and Military operational experience to the Team. As Technical and Product development vice president for L-3's GS&ES Division he was responsible for the development, world-wide deployment, and support of 3d immersive video surveillance and command and control system, as well as the Accolade underground mine communication system, generating over 250 Million dollars in profit. While in the military he led the Air Defense Artillery portion of the digitized division study and the Army space systems study effort. A veteran of Gulf War 1 and 2, and was the Army component commander of the Defense Courier Service.

Subcommittee's Lessons Learned Recommendation

The Council recommends the preparation of an extensive "lessons-learned" report be completed while the MSL Planetary Protection team remains intact and available for preparation of the report. The report should include:

1. Issues with spacecraft materials and contamination control that may affect measurements made either *in situ* or after return.
2. Key elements of a bioburden accounting software package that can be developed jointly for use in the Mars Sample Return (MSR) campaign.
3. Publication of the Adenosine Triphosphate (ATP) assay as related to the NASA Standard Assay, to facilitate adoption of this assay for bioburden accounting on MSR elements.
4. Research needed to improve the assessment of proposed landing sites in the context of concerns for liberation of fluids from hydrated or frozen ground in the presence of a Radioisotope Power System.