Dear Colleague:

October 28, 1998

NASA has been studying the possibility of sending a human expedition to Mars. Although there currently are no programs in place to do so, within the next decade it is possible that development of human missions will begin. In recent studies, a concept has been favored in which a crew of several people (~6) would be on the surface of Mars for about 500 days. Their primary function would be to conduct field investigations to address the questions of martian geological and biological evolution. The Reference Mission description (NASA SP-6107) is available on the World Wide Web at


No coherent concept for the geological/biological exploration of Mars by humans has been developed, beyond general considerations. We would like to request your help in furthering our understanding of the opportunities and issues that NASA will have to address in preparing to send humans to Mars for these purposes. To start the process, we are convening a 2-day workshop at the Lunar and Planetary Institute on November 18-19, 1998. Dr. David McKay of the Johnson Space Center and I will be the co-convenors. A preliminary list of topics is attached. The list of invitees is small and has been selected to represent people with diverse field experience on Earth, rather than experience in space exploration. We hope that this will give us a good start, but we anticipate that much additional work will be needed.

If you are able to participate in this meeting, the Lunar and Planetary Institute will provide your travel and subsistence expenses. Ms. Sharon Steahle (281-486-2166) will be the point of contact, and will provide the necessary information.

I hope that you will be able to join us on November 18-19. Please let us know by email to Nancy Ann Budden at the Lunar and Planetary Institute (budden@lpi.jsc.nasa.gov, or by phone at 281-244-2051). If you have questions, please call me at 281-244-2036 or Dave McKay at 281-483-5048.

Sincerely,

Michael B. Duke

Attachment (1)
Mars Field Geology, Biology and Paleontology Workshop
November 18-19
Lunar and Planetary Institute
Houston, Texas

The purpose of this workshop will be to explore the objectives, desired capabilities, and operational requirements for the first field exploration of Mars. Current NASA planning envisions sending a crew of six people to Mars, as early as 2013, to conduct detailed exploration of a site on Mars. The crew will spend a year and a half on Mars and will have considerable mobility, sampling, and analysis capability, in an area of high scientific interest. The major objectives of this exploration will be to continue investigations of Mars' biological history, through geological and paleontological investigations and analysis of potential pre-biotic chemistry. The search for extant martian organisms in isolated environments, requiring deep drilling, is a likely objective.

The preliminary agenda includes:

An overview of NASA mission planning for human exploration of Mars will be provided.
  a. Science objectives
  b. Mission planning

Discussions on several major topics:

a. What are appropriate approaches to field geological/biological investigations?
   1. What prior information should be gained/assumed?
   2. What should the strategy be in the field?
   3. Are there significant differences between geological, paleontological or biological fieldwork?
   4. How can astronauts best work in the field on Mars?
   5. What tools are needed?
   6. What is the appropriate allocation of time between tasks?
b. How much analytical capability should be provided on Mars?
   1. In the field
   2. In a laboratory
   3. How should the field/laboratory work be coordinated?
c. What are the implications for crew skills and training?
   1. Primary scientific crew members
   2. Backup and associate scientific members
d. How should communications be structured between the crew on Mars and scientists on Earth?
   1. Science planning
   2. Support of crew observations
e. How should discussions on this topic be continued?
   1. Workshops
   2. Analog studies
   3. ?

(2)
Dear Mars Field Geology, Biology, and Paleontology Workshop Participant:

Thank you for agreeing to attend and support the Mars Field Geology, Biology and Paleontology Workshop scheduled for November 18 and 19, 1998 at Space Center Houston, in Houston Texas. The meeting promises to be both intriguing and challenging as we address the timely subject of how human crews could most effectively explore, study, and return samples from the surface of Mars.

We have had an overwhelming response to the meeting, and participants from many different science disciplines will be co-mingling their ideas and experiences. In our two days together we will journey from the past, to the present, to the future. We will embark on our adventure with Jack Schmitt, the geologist who walked on and explored the moon during Apollo 17, the last human mission on the lunar surface. Next Bret Drake and Steve Hoffman from NASA/JSC’s Exploration Office will review the Mars Reference Mission, and a work-in-progress, the Mars Surface Reference Mission. Steve Saunders, JPL program scientist for Mars Global Surveyor, will present the latest findings on Mars geology from Mars orbit. The final invited presentation is from Dean Eppler of the NASA/JSC EVA office, who will take us into the future with the new Mars Space suit, and discuss the challenges and limitations of conducting geologic field work in a pressurized suit.

The remaining portion of the meeting will be spent discussing specific topics and issues, first with all the workshop participants, and later in small teams. The anticipated product of the workshop is a publication (possibly EOS), documenting our discussions and conclusions. It is our hope that most of the writing will be accomplished on the second day of the workshop. A brief outline of each discussion topic along with its discussion leader is included in the agenda.

This will be the final mailing before the meeting. Enclosed please find the preliminary agenda, and some background articles and excerpts to provide everyone a common base of knowledge. Be reminded that the entire Mars Reference Mission document (NASA SP-6107) can be found at: http://www-sn.jsc.nasa.gov/marsref

Meeting attire is casual, as is our dinner on Wednesday November 18 at Villa Capri. Our fall evenings can be cool, so bring a sweater. If you have a laptop, particularly one equipped with Office 97, please bring it. For first-time visitors to Houston, be advised that Space Center Houston is a not-for-profit organization distinct from NASA Johnson Space Center. It is located adjacent to, and just before NASA/JSC, on NASA Road One.

Travel and logistics queries should be made to Ms. Sharon Steale at (281) 486-2166. Questions dealing with the content of the meeting should be addressed to Nancy Ann Budden at 281-244-2051 or budden@lpi.jsc.nasa.gov.

Best regards,

Michael B. Duke            David S. McKay            Nancy Ann Budden
Lunar and Planetary Institute     NASA/JSC               Lunar and Planetary Institute
Final Agenda

Mars Field Geology, Biology and Paleontology Workshop
Space Center Houston, Saturn Club, Houston, Texas
November 18 and 19, 1998

Mike B. Duke, David S. McKay, William R. Muehlberger, Nancy Ann Budden, conveners

Wednesday, November 18, 1998: Space Center Houston, Club Room

8:00   Continental Breakfast

8:30   Welcome and Introduction        David McKay, NASA/JSC
8:45   Meeting Objectives and Schedule  Nancy Ann Budden, LPI
9:00   From Apollo to Mars: History and Vision  Bill Muehlberger, UT Austin
9:15   Apollo 17: Field Geology on the Moon  Jack Schmitt, Interlune
9:45   Mars Reference Mission           Bret Drake, NASA/JSC

10:15  Coffee Break

10:30  Mars Surface Mission            Steve Hoffman, SAIC
11:00  Mars Geology: The Newest Data   Tim Parker, NASA/JPL
11:30  EVAs on Mars: Challenges        Dean Eppler, SAIC
       of the Next-Generation Space Suit

12:00  Lunch, Space Center Houston Cafeteria

1:00   Discussion: Approaches to Field Strategies  Bill Muehlberger, lead
3:00   Discussion: Analytical Capabilities        Frances Westall, lead

6:00   No-host dinner, Villa Capri, NASA Road One

Thursday, November 19, 1998: Space Center Houston, Club Room

8:00   Continental Breakfast

8:30   Plan for the Day                  Nancy Ann Budden
8:45   Discussion: Crew skills and training  Tom Jones, discussion leader
10:30  Discussion: Communications between Mars-Earth  Pat Dickerson, discussion lead

12:00  Lunch, Space Center Houston Cafeteria

1:00   Team Discussions and Team Writing    All
3:30   Team Responses: Top 3 Recommendations  Discussion Leaders
4:30   Final Discussion and Assignments    Budden
5:00   Adjourn
Outlines for Discussions and Sections for Final Mars Field Geology, Biology, and Paleontology Article

I. Discussion One: Bill Muehlberger, discussion leader

1. What are appropriate approaches to field geological/biological investigations?
2. What prior information should be gained/assumed?
3. What should the strategy be in the field?
4. Are there significant differences between geological, paleontological and biological field work?
5. How can astronauts best work in the field on Mars?
6. What tools are needed? (See Discussion Two)
7. What is the appropriate allocation of time between tasks?
8. How should discussions of this topic be continued?
   • Are workshops an effective mechanism?
   • Can analog experiments provide a useful focus for discussions?
   • Should a formal working group be convened for defining requirements for NASA?
   • Are specific projects or studies indicated?

II. Discussion Two: Frances Westall, discussion leader

How much analytical capability should be provided on Mars?

1. In the field
   • Strategic considerations
     • distance from base camp
     • likelihood of returning to sample site
   • Level of analytical capability
     • none
     • rock discrimination
     • in-situ analysis
     • high grading and return to Mars base

2. In a Mars-based laboratory
   • Types of analysis
   • Allocation of time to analysis
   • Miniaturization, new technologies

3. How should the field/laboratory work be coordinated?
   • Specialization
   • Feedback into field expedition planning

4. Selection of materials for return to Earth
   • Types of preliminary analyses
   • Sample curation on Mars
5. How should discussions of this topic be continued?

- Are workshops an effective mechanism?
- Can analog experiments provide a useful focus for discussions?
- Should a formal working group be convened for defining requirements for NASA?
- Are specific projects or studies indicated?

III. Discussion Three: Tom Jones, discussion leader

What are the implications for crew skills and training?

1. What scientific skills area needed?
   - Field Geology
   - Biology
   - Paleontology
   - Analytical
   - Computing
   - Communications

2. Can priorities be established?

3. What training environments are most important?
   - Terrestrial analogs
   - Virtual environments
   - On-site training

4. What techniques for maintaining science skills seem most important?
   - Videotraining
   - Lectures/Discussions
   - Field camps

5. What constraints will be placed on operations by skill mix?

6. How should discussions of this topic be continued?
   - Are workshops an effective mechanism?
   - Can analog experiments provide a useful focus for discussions?
   - Should a formal working group be convened for defining requirements for NASA?
   - Are specific projects or studies indicated?
IV. Discussion Four: Pat Dickerson, discussion leader

How should communications be structured between the crew on Mars and scientists on Earth?

1. What should be the principal objectives for communications between astronauts on Mars and scientists on Earth?

2. What is the desired level of autonomy of crew members on Mars?

3. How much time typically should be allocated by the crew for science planning?

A. Pre-Mission Science Planning
   a. Briefings by NASA staff, visiting researchers/PIs, crew scientists
   b. Field Training
      i. Exploration methods (biological/geological/geophysical methods, considering portability, crew dexterity, EVA limitations)
      ii. Use of robotic field assistants
      iii. Field documentation (photographic methods, systematic oral description/transcription, sampling)

B. Science Planning and Changes During the Mission
   a. What strategies can be used to optimize support by scientists on Earth?
   b. Utilization of rotating teams of ground-based research specialists responsible for following mission segments, conducting regular crew debriefings/discussions via radio, e-mail exchanges of “batched” data

4. The Forty-Minute Lag — How can real-time changes in strategies and plans best be implemented?

   A. Eureka!! experiences
   B. Research scientists on-call

5. What equipment should be considered for optimizing communications between astronauts in the field and at base camp and collaborators on Earth?

6. How should discussions of this topic be continued?
   A. Are workshops an effective mechanism?
   B. Can analog experiments provide a useful focus for discussions?
   C. Should a formal working group be convened for defining requirements for NASA?
   D. Are specific projects or studies indicated?