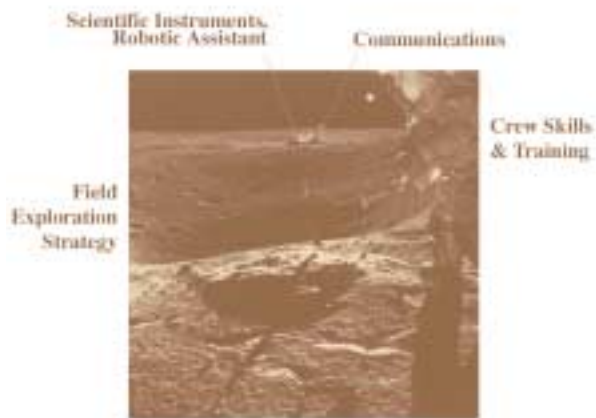
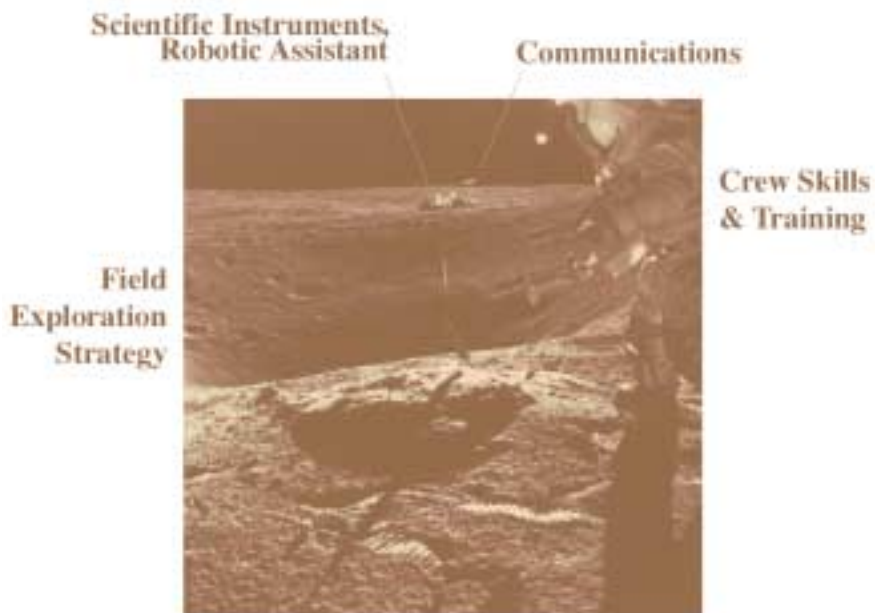


Mars Field Geology, Biology & Paleontology Workshop (November, 1999)



Consensus, Recommendations & Progress

Patricia Wood Dickerson



Field Exploration Strategy

RECOMMENDATIONS

- Robotic reconnaissance of biohazards, terrain, local geology, potential resources
- Safety protocols/contingency plans in place, and drills conducted, prior to any EVA
- Only 2 or 3 astronauts on EVA at any time
- Design traverses for flexibility in time and tasks, with greater complexity as skill and confidence increase
- Initial traverses should be to sites of highest priority

Field Exploration Strategy

RECOMMENDATIONS, continued

- When walking traverses are complete, Earth and Mars science teams should synthesize results, plan extended traverses
- Begin geophysical surveys early, for indications of water and other resources
- Significantly improve EVA suit and glove functionality
- Develop a new reach-and-grasp tool for 10- to 30-cm samples

Field Exploration Strategy

PROGRESS

- Astronaut candidate field training — increased emphasis on sampling techniques, implications of rock types re planetary origins/processes
- Astronaut candidate field training — geophysical data acquisition and planning next survey line based upon results
- Workshop on Apollo exploration strategies and experience, and their relevance for Mars exploration, will soon be convened.

Analytical Capabilities and Instruments

RECOMMENDATIONS

- The need for specific observations/analyses should drive development of compact, integrated instruments.
- Begin miniaturizing existing field/laboratory instruments:
 - Helmet-mounted fiber-optic camera, magnifying camera/hand lens
 - Voice-operated data-recording system with real-time data display within visor
 - In-visor map for locating (x,y,z) samples and outcrops
- Biologists, field geologists, geochemists, engineers should collaborate throughout mission planning.

Analytical Capabilities and Instruments

PROGRESS

- Advances in glovebox design for noncontaminating sample handling (Oceaneering Corp.)
- Probable test of voice-activated data-recording system at Devon Island this season

Crew Skills & Training

RECOMMENDATIONS

- Crew should have twice as many members with surface science skills as with spacecraft and operations systems skills — a possible combination:

Prime Role

Commander/Research & Operations Manager
Geologist
Systems Engineer
Physician or Medical Technician
Geologist
Paleobiologist

Backup Role

Geologist
Paleobiologist
Electronics Engineer/Technician
Microbiologist
Mechanical Engineer/Technician
Systems Engineer

Crew Skills & Training

RECOMMENDATIONS, continued

- Extensive field training — crew, operations and support teams should participate in at least six realistic field exploration sims before launch.
- Field training should begin in 1999 for astronauts, mission operations personnel, and scientific support teams.
- Workshops should be convened on crew selection, on site selection for scientific exercises, and for recording experience/insight of Apollo and Skylab teams.
- An expert workshop should be held to investigate the gender and nationality mix best suited for Mars mission success.

Crew Skills & Training

PROGRESS

- Geophysical exploration training began for astronaut candidates in 1999
<http://geoinfo.nmt.edu/penguins/home.html>
- Field mapping exercise for astronaut corps and ISS field science training plans
- Shuttle and ISS crew briefings on Earth/Mars analogues
- Astronaut participant in Antarctic meteorite expedition



Earth-Mars Communications

RECOMMENDATIONS

- Communications network including:
 - Satellites in Mars orbit for navigation, communication
 - Dependable communications with Earth, orbiting outposts
 - Capability for compressing/transmitting large volumes of data, as from geophysical surveys
- More structured communications with Earth during reconnaissance, less as exploration program matures
- Teleoperation of field/laboratory equipment, robotic rovers from Mars base or orbiting outposts

Earth-Mars Communications

RECOMMENDATIONS, continued

- Communications between science teams on the two planets at well-defined levels:
 - Astronaut scientists and “science back room” on Earth in regular contact throughout mission
 - Science team members on Earth would change depending upon the nature of discoveries, exploration progress, data returned
- Briefings/debriefings between departing and arriving crews, as permitted by spacecraft in transit
- Keep the public engaged:
 - Report mission news (crew selection, training, science questions, discoveries) promptly and accurately
 - Translate scientific discoveries directly into teaching materials

Earth-Mars Communications

PROGRESS

- Communications console in JSC Mission Control dedicated to field exploration and training
- Data compression/transfer capability developing on ISS
- Private-sector plans for communications/navigation satellites orbiting Mars
- Press/public engagement in astronaut field geophysical training