Extravehicular Activity and Desert Research and Technology Study

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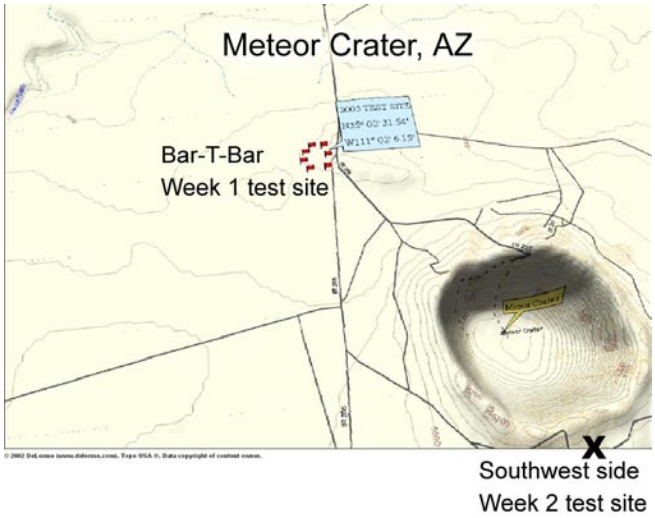
The Desert Research and Techology Study (RATS) is an integrated remote field site test with team members from several NASA Centers—Johnson Space Center (JSC) and Glenn and Ames Research Centers—and Bowling Green State University, University of Cincinnati, and Massachusetts Institute of Technology. Each week of the two-week field test had a primary focus. The primary test hardware for the first week was the Apollo 1-Gravity Lunar Rover Training Vehicle, or Grover, which was on loan to NASA from the United States Geological Survey Astrogeology Research Program. The Grover driving tests served as a baseline for the Science Crew Operations Utility Testbed Project Team. The team will be designing and fabricating a next-generation roving vehicle prototype. The second week of testing focused on human-robotic interaction between the suited subjects and the Extravehicular Activity (EVA) Robotic Assistant and also focused on EVA geologic traverses using a geologic sample field analysis science trailer.



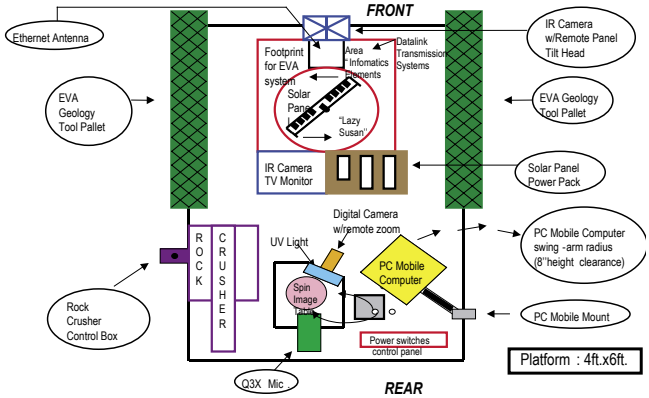
The Advanced EVA Team provided Mark III Space Suit Technology Demonstrator, which represents a hybrid space suit configuration in that it is composed of hard elements such as a hard upper torso and brief, and of soft components such as fabric elbows and knees that enable walking. The planetary mobility of the suit is primarily achieved by its use of bearings in multi-axis mobility joint systems.

The science trailer is the second-generation science trailer. The first science trailer was used during the 2002 field test, and the 2003 trailer was built on lessons learned from the 2002 test activities. The purpose of the science trailer is to provide an in-field geological sample analysis capability. This allows the planetary surface exploration crewmembers to be more discerning in their selection of samples for return to the habitat for further analysis.

The Advanced EVA Team's communication system is used to provide full-duplex, wireless voice communication between the test subject and the test team.

Overall, the subjects were impressed with the science trailer. The primary suggestion was to improve subject autonomy in performing science trailer tasks by including increasing subject familiarity through additional science trailer operations training and provision of task procedure cue cards.

Overall, the subjects were satisfied with the fit and performance of both advanced space suit configurations. The primary negative comment regarded footwear. The I-Suit inflatable boot bladder system for anchoring feet within the boots was not working well, especially the left boot heel bladder. For planetary EVAs, space suit boot fit and function are as important as glove performance for low Earth orbit applications. Boot design is an area in which continued designed improvements are essential. Performing dry runs at the JSC EVA Remote Field Demonstration Test Site is of paramount importance for a successful field test. The need for dry runs cannot be overemphasized. In particular, suit subject familiarity with test objectives and runs prior to reaching the field improves suit

subject efficiency and endurance. Dry runs should be performed early and often prior to a field test. Test systems that do not demonstrate readiness during the dry runs should not travel to the field test.

The preparation for and the actual conduct of RATS field tests have taught, and will no doubt continue to teach, valuable lessons for planetary surface exploration EVA systems design and operation. This testing lays the groundwork for the development of informed and realistic design requirements for the exploration of the Moon and Mars.