

## RED ROVER GOES TO MARS: AN EXPLORATION EDUCATION EXPERIMENT FOR THE MARS SURVEYOR. L. D. Friedman<sup>1</sup>, L. A. Hyder<sup>1</sup>, S. L. Klug<sup>3</sup>, J. S. Oslick<sup>1</sup>, G. E. Powell<sup>2</sup>, E. L. Thomas<sup>1</sup>, J. L. Vaughn<sup>1</sup>

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### Red Rover Goes To Mars: An Exploration Education Experiment for the Mars Surveyor

*Red Rover Goes to Mars* will be an exploration education experiment on the **Mars Surveyor 2001** lander mission, providing students opportunities to participate in the process of operating the lander robotic arm and *Marie Curie* rover, as well as collecting data using the science instruments.

The experiment is an outgrowth of the Planetary Society's *Red Rover*, *Red Rover™* program, a joint venture with the LEGO™ company. In this project, students at schools and science centers build LEGO model rovers equipped with digital imaging cameras, and operate them on simulated Mars terrains using software and control box interfaces. The students can connect their sites to other sites over the internet to teleoperate remote vehicles, simulating teleoperation used in planetary exploration. A network of more than 300 schools and science centers now participate in *Red Rover*, *Red Rover*. With the advent of a microprocessor in a brick developed by LEGO, called the RCX, students (and adults) can now purchase a robotics kit with the tools needed to build and program rovers in a home environment, enabling individuals to operate their rovers from their own home computers.

*Red Rover Goes to Mars* will extend the *Red Rover*, *Red Rover* network to another world. The project will have two phases designed to stimulate public interest in space exploration through hands-on activities simulating real mission experiments. One phase will be the selection of student astronauts and student scientists who will work in a simulated Mars base, interfacing with the NASA teams controlling the vehicles and experiments on Mars. This phase combines current methods of Earth-based control of robotic vehicles on other worlds, and the future goal of astronauts actually on Mars teleoperating robotic elements. The second phase will open worldwide participation in the mission using the internet. An educational program being developed by The Planetary Society, LEGO, Arizona State University K-12 Education Program and Visionary Products, Inc., will allow anyone with internet access to conduct his or her own activities, using real mission data to simulate mission experiments being conducted on Mars.

Students will be selected in a two-tiered process. Student scientists will be selected based on a worldwide essay contest, while student astronauts will be chosen based on journal reports describing simulated rover

activities. Finalists in the student scientist category will work with mission science teams to suggest experiments in such areas as imaging, geology, magnetism, chemistry and engineering operations. Student astronaut finalists will work in the simulated Mars base and will interface with the Mars Surveyor Project, developing rover and arm activity requests. Classrooms around the world and individuals at home will be able to recreate the operations and experiments using model vehicles and simulated terrains.

The specific experiments and level of student participation are in the process of being defined, in cooperation with the project management, Project Science Group, Science Operations Working Group, and engineering teams involved in operating the rover and robotic arm. All protocols and safety precautions will be observed, and the educational activities will be included so as to not interfere with the science objectives. In fact, educational activities will be designed in cooperation with Mars Surveyor Project science teams to support science objectives. It is recognized that the project has many constraints limiting the time period available for command and control sessions and the number of operations that can be performed each week of the mission. These constraints, and the care required in teleoperation on another world, make participation on the mission a team activity—very little, if any, direct individual action is permitted. Rather than this being a limit to the student activity (as it would be on a video game) we will make it part of the educational program—teaching students about how planetary exploration is conducted and data is obtained for scientific study.

*Red Rover Goes to Mars* is an experiment—the first time citizens will be permitted to be part of a planetary exploration project. It may presage a new type of participatory exploration in the next century—even the beginning of an *interplanetary internet* as suggested by Vinton Cerf, co-inventor of the TCP/IP protocol. It also begins to simulate the role that humans will play in future Mars exploration—when astronauts will be our emissaries on another world, operating robotic vehicles such as rovers, arms, and maybe airplanes, rockets and balloons to explore the world outside their protective Mars base. But most of all, it will educate and involve millions worldwide in the adventure of going to, exploring and getting information from another world, helping us understand our own world and (in the words of T.S. Eliot) "to know the place for the first time."