Field experiments with the Rocky 7 rover were performed from May 22-30, 1997 at Lavic Lake in the Mojave Desert near Barstow, CA. During the test, the rover traveled over basalt flows, cratered playa surfaces, and an alluvial fan (Figure 1). The tests were conducted in an effort to understand how to best conduct rover operations and scientific analyses that will be part of the Mars Surveyor Program’s 2001 Mars rover mission. The rover was equipped with stereo imaging systems for remote sensing science and hazard avoidance and $^{57}$Fe Mössbauer and nuclear magnetic resonance spectrometers for in-situ determination of mineralogy of unprepared rock and soil surfaces (Ref 1) (Figure 2). The experiments focused on testing traverse capabilities, measurement systems, and sampling procedures. In addition, emphasis was placed on realistic mission planning and operations that were achievable in the data-limited rover environment. For this field test, simulated orbital and descent images were acquired at various altitudes from a helicopter with a 70 mm Hasselblad camera (e.g., Figure 1).

The descent images were found to be critical for mission planning and operations. Specific hypotheses could be formulated from the descent data and these hypotheses could be tested with rover observations. The simulated descent images were also instrumental in traverse planning and in locating the rover in a regional context. Analyses of data acquired from the rover confirmed hypotheses made from orbital and simulated descent images, specifically that the Sunshine Field is composed of basalt, Lavic Lake is a recharge playa, and an alluvial fan with felsic source rocks has prograded onto the playa. Rover observations also provided new discoveries not possible from orbital or descent data, including the observation that the basalt flows are mantled with aeolian sediment and covered with a dense pavement of varnished basalt cobbles. Results demonstrate that geological field work, including testing hypotheses and making new discoveries, is an achievable objective using Rocky 7-type rovers. Appropriate preceding data are crucial and the rover must be equipped with instrumentation for both remote sensing and in-situ observations.

A new paradigm for rover operations and explorations can be created from the lessons learned in the field test (Figure 3). This paradigm can be used to help focus rover activities using orbital and descent images to formulate hypotheses and select areas of interest around the landing site for testing these hypotheses.

Field tests using a larger, more advanced rover prototype, FIDO (Field Integration Design and Operations), are planned for fall 1998 at Silver Lake near Baker, CA. This is the site of a major playa with abundant morphologic, stratigraphic, depositional, and mineralogic evidence for ancient lacustrine environments.

Figure 1. Simulated descent image of Rocky 7 May 1997 test site. Rover traverses are shown.

Figure 2. Rocky 7 rover with mast deployed onto a rock surface for an NMR measurement.

Figure 3 - Flow diagram for implementation of Mars rover mission.

Address overarching questions:
* Warm and wet?
* Prebiotic compounds?
* Life?

Site Selection

Orbital and other data

Traverse Planning

Descent Data

Reconnaissance Science

Imaging and point spectra

Intensive Science, Sampling, and Caching

In-situ observations and sampling functions

Respond to new discoveries

Sample Return