NASA Desert RATS 2010: Preliminary Results for Science Operations Conducted in the San Francisco Volcanic Field, Arizona. J. E. Gruener[1] , G. E. Lofgren[1], W. J. Bluethmann[1], and E. R. Bell[1], [1]NASA Johnson Space Center, 2101 NASA Parkway, Houston, Texas, 77058, john.e.gruener@nasa.gov

Introduction: There is now a strong consensus in the United States that the next step in human spaceflight is to travel beyond low-earth orbit [1]. The particular destinations, and the order in which they are explored are not as important as the overall goals of the human spaceflight program. The Moon and Mars have long been considered as important stepping-stones or waypoints for the expansion of human civilization beyond the Earth [2]. The Moon is the closest planetary body and possesses numerous natural resources to enable sustainable human spaceflight activities in cis-lunar space and at Mars, our ultimate destination in the inner Solar System.

The National Aeronautics and Space Administration (NASA) is working with international partners to develop the space architectures and mission plans necessary for human spaceflight beyond earth orbit. These mission plans include the exploration of planetary surfaces with significant gravity fields. The Apollo missions to the Moon demonstrated conclusively that surface mobility is a key asset that improves the efficiency of human explorers on a planetary surface [3].

NASA Desert RATS: NASA's Desert Research and Technology Studies (Desert RATS) is a multi-year series tests of hardware and operations carried out annually in the high desert of Arizona. Conducted since 1998, these activities are designed to exercise planetary surface hardware and operations in relatively harsh climatic conditions where long-distance, multi-day roving is achievable [4]. Desert RATS 2010 tested two crewed rover concepts, designed as first generation prototypes of small pressurized vehicles. Each rover provided the internal volume necessary for two crew members to live and work for periods ≥14 days, as well as allowing for extravehicular EVAs through the use of rear-mounted suit ports. The 2010 test was designed to simulate geologic science traverses over a 14-day period through a terrain of cinder cones, lava flows and underlying sedimentary units in the San Francisco Volcanic Field [5]. Desert RATS provides and operational concept to better develop the science requirements for the design of space exploration systems [6].

Preliminary Results: The science operations conducted during Desert RATS 2010 consisted of four 2-person rover crews, with each crew conducting 6 days of field exploration using a pressurized rover concept vehicle. Each crew also conducted 1 day of laboratory analyses on collected samples in a surface habitat demonstration concept [7]. Each rover crew traveled over 60 km during their field explorations (Rover A, week 1: 63.0 km; Rover A, week 2: 61.5 km; Rover B, week 1: 66.1 km; Rover B, week 2: 65.0 km). For comparison, the Apollo lunar roving vehicles (LRVs) traveled 27.9 km (A15), 26.7 km (A16), and ~ 35 km (A17) [8].

Desert RATS Rover A, week 1. During the first week of exploration analog activities and field work, the crew of Rover A collected 164 samples on 21 simulated extravehicular activities (EVAs). Each EVA was conducted at a different science station. Several different lava flows, cinder cones and volcanic structures were sampled [9], as well as basement layer rocks lying beneath the volcanics, and surficial deposits created by weathering and erosion. The total mass of the samples collected during 6 days of field work was 49.79 kg. For comparison, the Apollo J missions (3-day surface missions) collected 77 kg (A15), 94 kg (A16), and 110 kg (A17) [8].

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