

NASA Desert RATS 2011 Education Pilot Project and Classroom Activities J. E. Gruener¹, M. McGlone², J. Allen³, K. Tobola³, and P. Graff³, ¹NASA-Johnson Space Center, Houston, Texas, ²AESP-Penn State, University Park, Pennsylvania, ³ESCG-Johnson Space Center, Houston, Texas, john.e.gruener@nasa.gov

Introduction: The National Aeronautics and Space Administration's (NASA's) Desert Research and Technology Studies (Desert RATS) is a multi-year series of tests of hardware and operations carried out annually in the high desert of Arizona, as an analog to future exploration activities beyond low Earth orbit [1]. For the past several years, these tests have occurred in the San Francisco Volcanic Field, north of Flagstaff. For the 2011 Desert RATS season, the Exploration Systems Mission Directorate (ESMD) at NASA headquarters provided support to develop an education pilot project that would include student activities to parallel the Desert RATS mission planning and exploration activities in the classroom, and educator training sessions. The development of the pilot project was a joint effort between the NASA Johnson Space Center (JSC) Astromaterials Research and Exploration Science (ARES) Directorate and the Aerospace Education Services Project (AESP), managed at Penn State University.

Classroom Activities: A set of three classroom activities were developed to parallel the science and mission planning activities of NASA's Desert RATS. The activities were designed so that they could be done sequentially, using what was learned or made from the previous activities. The first activity is an extension of a previously developed activity called "Lava Layering", that is part of an education curriculum titled Destination Mars. This activity involves students making and understanding the formation of volcanoes using baking soda, vinegar, and modeling clay [2]. For Desert RATS, the activity was extended to creating a volcanic field with multiple vents and sloping topography (similar to the San Francisco Volcanic Field). The second activity, called "Satellite Imagery and Mapping", was developed to introduce students to creating maps based on images made by an orbiting satellite. This activity culminates with the students making a geologic map of the SP Mountain-Colton Crater area of the San Francisco Volcanic Field. The third activity, called "Mission Planning and Site Selection", was developed to demonstrate how science objectives determine sampling locations, and how surface terrain features affect exploration traverses and mission timelines. This activity culminates with students designing traverses on their geologic map from the previous activity, based on Desert RATS science objectives and mission constraints.

Educator Trainings: Educator trainings were conducted to familiarize teachers and others with NASA's

Desert RATS analog activities, and to introduce them to the Desert RATS classroom activities. The trainings were also used to 'dry run' the activities with educators, to provide information on how well the activities worked in a classroom setting, and where modifications were needed. Approximately 200 teachers were introduced to Desert RATS and the classroom activities, and about 100 of these participated in the activities 'dry runs'. The trainings consisted of: a one-day dedicated Desert RATS workshop at JSC's Gilruth Facility, two half-day seminars associated with JSC's Middle School Aerospace Scholars Program, one half-day seminar associated with an American Geological Institute workshop held at Gilruth, two short briefings to participants in a Pre-service Teacher Institute at JSC, and three short webinar briefings conducted on the Internet.

"What's Up at Hot Dog Hill?": The classroom activities developed for the education pilot project were based on the Desert RATS operations of 2009 and 2010, which involved traverses up to 60 km, roving speeds up to 10 km/hr, and exploration of a wide array of surface features. These surface operations are analogous to how future astronaut crews could explore the Moon or Mars. For 2011, NASA's analog activities focused on the exploration of near Earth asteroids. Consequently, the Desert RATS operations were concentrated on single surface features with correspondingly smaller surface areas, and their exploration vehicles moved at slower speeds, to mimic the velocities associated with proximity operations near an asteroid's surface [3]. To mirror these asteroid-like exploration operations, an extension to the classroom activities was created called "What's up at Hot Dog Hill?". In this extension, the same processes learned in the previous activities could be used to plan the exploration of a small volcanic vent (informally named "Hot Dog Hill" by the Desert RAT personnel). This activity is enhanced with video footage and in-field commentary from actual Desert RATS sampling locations.

Availability: Information about NASA's Desert RATS operations and the classroom activities developed for the Desert RATS education pilot project can be found and downloaded from the Internet at <http://ares.jsc.nasa.gov/ares/drats/index.cfm>.

References: [1] Romig, B. A. and J. J. Kosmo (2011), *LPSC XLII*, abstract # 2572. [2] <http://ares.jsc.nasa.gov/ares/education/program/destinationmars.cfm>. [3] Eppler, D. B. et al. (2011), *LPSC XLIII*, this meeting.