

**GEOLOGIC PREPARATION FOR EXPLORING THE MOON AND PLANETS: USING THE PAST AS A KEY TO THE PRESENT.** D.B. Eppler, SAIC-Constellation Lunar Surface Systems Office, Mail Code ZS, NASA-Johnson Space Center, 2101 NASA Parkway, Houston, TX 77058, dean.b.eppler@nasa.gov.

**Introduction:** Preparation for Apollo included extensive astronaut geologic training, including classroom training and multiple field excursions to locations throughout the US. The scientific payoff of Apollo was, in part, the result of this training – despite the fact that only one lunar crewmember considered geology his profession, each crew returned critical geologic observations and a carefully collected suite of samples upon which our understanding of lunar geology is based.

For the Constellation Program, preparing to geologically explore the Moon is taking several paths: (1) reviewing the history of Apollo geologic training as model of successful field training; (2) familiarizing the engineers and managers with geologic exploration and its impact on our approach to lunar exploration; and, (3) updating the astronaut training curriculum to reflect lunar exploration mission.

**Apollo Training History:** The success of crewmember's efforts on the Moon was based on careful field observations. These observations formed the basis for subsequent sample collection, and were founded on a combination of classroom training and geologic field trips. Field training was considered paramount, particularly for the crews that flew on Apollo 15, 16 and 17 – in the  $\approx 2$  years between crew assignment and flight, each surface crew completed  $>15$  field trips which continued up to 1 month prior to launch. These trips involved instruction by a cadre of geologists, field exercises by the crewmembers ("playing the Moon game"), and full-up, joint integrated simulations where a CAPCOM and a science backroom worked with crewmembers wearing simulated life support systems and using field cameras and geologic field tools identical to those used on the Moon.

In April 2008, 8 Apollo geologic trainers, 2 Apollo surface crewmembers and 1 lead flight director participated in a workshop to pass on lessons learned. The most important lesson was that success in geologic training and in a crew's performance on the lunar surface was directly related to mission commanders' and flight directors' enthusiasm for the task – mission commanders, in particular, could carry the whole enterprise with their excitement for the surface science mission. Second, the quality of the instructors is absolutely critical – enthusiastic, gifted instructors create competent lunar field geologists, regardless of crews' initial backgrounds. Third, the logistics associated with field training is extensive and critical to success.

**Geology Familiarization Training:** Recognizing that the best way to understand what geologists do is to take people in the field, Constellation has begun a series of 2-3 day field trips to familiarize non-geologists with the activities associated with field work. In each case, 2 students are paired with an experienced geologist in a field location mimics the lunar geology to conduct a program of geologic mapping and field observations. A brief classroom familiarization is conducted prior to going into the field, after which each team spends 2-3 full days of mapping. After each day, teams individually review their activities, and make plans for the following day. Initially, the geologist is in "teaching mode", but quickly transitions the students to making the observations and drawing contacts themselves. This program has been enthusiastically received by all students; the most common response from the students has been, "Now I see what you've been trying to tell us."

**Rewriting the Geologic Training Curriculum:** Since 1978, Shuttle and ISS astronauts have been receiving limited geologic training in their first year as astronauts. This training consisted of  $\approx 2$  hours of classroom activity in recognizing geologic processes from orbit, followed by a 1-week field trip to look at field relations first hand. This curriculum was appropriate for observations from LEO, but will be inadequate for lunar operations. To meet the requirements of Constellation, the first step is institute a program of paired field and classroom exercises. Observations in the field will prompt detailed classroom study and self-directed activities to expand on knowledge gained in the field. The initial plan is to conduct 2 field activities the first year of training, with an increase in classroom activities that include exercises with returned lunar samples. Subsequent year plans include additional field one-on-one field mapping exercises with geologist instructors. This activity will continue on a regular basis until crew assignment to a lunar crew. At that point, it is expected the crew will participate in dedicated field exercise similar to those conducted during Apollo. The transition to this curriculum will, of necessity, be gradual, but it is expected by the first human lunar landing in 2020, Constellation crewmembers will be as competent as their Apollo brethren in exploring geology of the Moon.