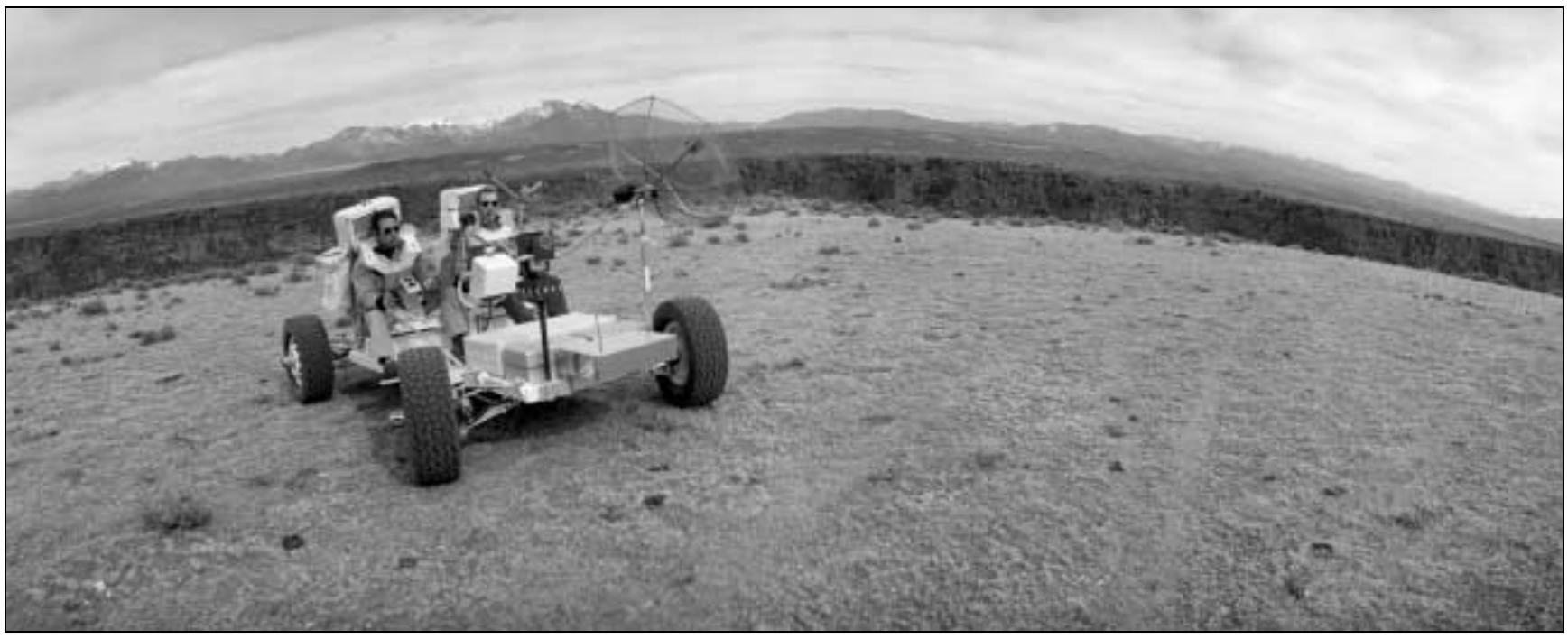
Space Rats test technology in the desert

By Joanne Hale



In this March 11, 1971, photo, Apollo 15 Commander David R. Scott (left) and Lunar Module Pilot James B. Irwin ride in the Lunar Roving Vehicle trainer called 'Grover' during a simulation of lunar surface extravehicular activity in the Taos, N.M., area. This rover was obtained from the U.S. Geological Survey Organization in Flagstaff, Ariz., for use in the recent field testing at Meteor Crater.

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RATS *took over the barren terrain of Flagstaff, Ariz., recently as Johnson Space Center engineers embarked on one of their latest missions – Desert Research and Technology Studies (RATS) 2003.*

Under the guidance of Senior Project Engineer Joe Kosmo of the Crew and Thermal Systems Division, team members from JSC and Glenn Research Center coordinated and conducted a series of robotic, rover and advanced spacesuit interactive tests in remote locations in Arizona. These field tests enabled the teams to try out surface exploration tasks that could be performed on another planet someday.

The technologies involved in the two-week test were the Extravehicular activity Robotic Assistant (ERA), the Science, Crew and Operations Utility Testbed (SCOUT), the Science Trailer and two advanced spacesuit configurations. Below, the engineering teams describe their role in Desert RATS 2003.

Boudreaux: the Extravehicular activity Robotic Assistant

The ERA project team has developed a fully autonomous mobile robotic testbed for exploring astronaut-robot interaction. During an excursion on a planetary surface, the six-foot-tall, 400-pound robot named Boudreaux could hold a conversation with an astronaut using natural language and speech synthesis technology.

Boudreaux travels at one meter per second and is fully equipped with dual differential Global Positioning System (GPS) units, a laser range finder, an inertial measurement unit with compass, two pan-tilt platforms with color cameras and a robotic arm with three-fingered hand.

The astronaut can command the robot into several autonomous modes. Boudreaux can perform tasks such as tracking, following an astronaut or other mobile agent, performing a solo scouting mission, mapping terrain and collecting science data over a search pattern. It can also deploy payloads such as science instruments, solar panels and power lines.

During the Desert RATS 2003 field tests at Meteor Crater, Ariz., Boudreaux successfully performed an autonomous science collection task by pulling a spectroradiometer instrument along a specified search pattern. Boudreaux also pulled a geology trailer for the astronaut, facilitating the on-site analysis and curation of rock samples, and provided camera pan-tilt control and video feedback from Meteor Crater to JSC via satellite.

Submitted by the ERA team: Kimberly Tyree, Nathan Howard, Robert Hirsh and technical lead Jeffrey Graham of Titan.

Science trailer, a roving geological field lab, is able to crawl over football-sized rocks with ease. The trailer is being pulled by Boudreaux, a six-foot tall, 400-pound robot.

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SCOUT: the Science, Crew and Operations Utility Testbed

SCOUT is a technology- and power-rich crewed utility vehicle testbed that draws several existing Engineering Directorate activities into one common program. It is a multipurpose rover that will support the development and demonstration of various technologies, operations and mission concepts.

The three-year SCOUT program recently completed its first field test at Meteor Crater. To serve as the vehicle for SCOUT, the team used a modified 1-G Apollo Lunar Rover Trainer. The rover was obtained by JSC from the U.S. Geological Survey Organization in Flagstaff, Ariz., and was modified to include a hybrid battery/fuel cell power system and advanced technologies including GPS and laser obstacle detection. Numerous test drives were completed, including a night illumination study, and two space-suited drivers took turns evaluating rover handling and ergonomics during analog science missions.

SCOUT provides young engineers with hands-on experience in systems and operations, while fulfilling JSC's role as Lead for Human Exploration and Robotic/Human Interaction. It also fosters cooperative development and Space Act agreements with other government agencies, industry and academia.

Submitted by the SCOUT team: Bill Studak, Tom Simon, Kerri McCurdy, Kris Romig, Rafael Jimenez, Keith Blizzard, Jen Rochlis, Dave Fletcher, Warren Tyree, Chip Kroll, Steve Hoffman, Richard Pedersen, Mike Ruiz and Dave Saley.

Members of the SCOUT team with the 1-G Apollo Lunar Rover Trainer, Mike Ruiz, Kerri McCurdy, Tom Simon and Keith Blizzard. Sitting are Kris Romig, Bill Studak and Rafael Jimenez.

jsc2003e57324

Science Trailer

The Science Trailer is a one-stop field geology station that has been in use for Advanced Suit Lab field exercises for a couple of years, both at JSC and in Arizona. The general concept is to provide a roving geological field lab for the suited astronaut. It has always had the familiar geology "pick and shovel" instruments, as well as a power rock crusher to open samples and get to the "good stuff" inside. This second-generation roving lab has four-wheel independent suspension able to crawl over football-sized rocks with ease while keeping the lab platform and equipment relatively stable.

Equipment now onboard includes:

- front and rear video and infrared video for viewing and documenting the site being explored
- battery power with solar panel charging
- self-contained rock analysis chamber with halogen and ultraviolet lighting that projects onto the chosen sample
- QX3 computer microscope for inspection of rock samples

The sample is placed on a motorized turntable and viewed via an internal camcorder or the video microscope on a laptop display. This imagery can be stored and then transmitted to a base station along with verbal commentary by the astronaut.

The development and construction process intermittently involved the whole Advanced Suit Lab staff over a few months. Nathan Smith was primarily responsible for designing and building the trailer and the rock sample chamber. Various hardware and equipment mounting was accomplished by the rest of the lab staff. Shawn Davis, a cooperative education student in the lab, was instrumental in putting all of the wiring together and getting it to behave with the computer.

Submitted by the Science Trailer team: Joe Kosmo, Bill Welch, Edward Ehlers, Amy Ross and Barbara Janoiko.

Advanced Spacesuits

Two different advanced spacesuits were tested in Arizona:

- The MK III hybrid spacesuit, which combines a variety of lightweight composite torso elements with fabric and rotary bearing mobility joint systems. This suit represents the latest version of various advanced technology spacesuit mobility and structural elements that NASA has been extensively testing and evaluating over the past six years.
- The I-1 suit, developed for NASA by ILC Dover, Inc. This particular configuration incorporates an all-fabric torso and uses a limited number of rotary bearing elements in the shoulder, arm and hip joints.

Submitted by Joe Kosmo.

Kevin Groneman, wearing the I-1 spacesuit, is pictured here with the EC-5 Science Trailer near the edge of Meteor Crater in Arizona.

jsc2003e57480

JSC engineers perform interactive testing at remote site near Flagstaff, Ariz.

jsc2003e57482

Pictured above is a close-up view of the EC-5 Science Trailer.

jsc2003e57474

All Desert RATS 2003 photos in this story by Mark Sowa

Eileen Collins honored with Society of Women Engineers' Resnik Challenger Medal

By Joanne Hale

Astronaut Eileen Collins recently received the 2003 Society of Women Engineers' (SWE) Resnik Challenger Medal in recognition of her visionary contributions to space exploration and her extraordinary leadership and flight skills.

Collins said that receiving the award was "a real honor" and that SWE and the space program share similar goals when it comes to education.

"I believe one of the goals of the SWE is to inspire and recruit young women into engineering fields," Collins said, adding that "the space program is a great way to inspire young people to get into engineering as well as science and math."

SWE, founded in 1950, is a nonprofit educational and service organization that focuses on establishing engineering as a highly desirable career field for women. SWE also recognizes women's contributions and achievements as engineers and leaders.

The Resnik Medal, named after Astronaut Judy Resnik who died in the 1986 *Challenger* accident, was formally presented to Collins Oct. 10 at the SWE National Achievement Awards banquet in Birmingham, Ala. Collins could not attend in person but accepted the award in a videotaped speech.

Collins became the first woman to pilot a Shuttle mission in 1995 aboard STS-63 and also the first woman Shuttle commander in 1999 aboard STS-93. As a real-life space explorer, she inspires young people around the world. However, she credits more down-to-earth leaders with keeping kids – especially girls – interested in science, math and engineering.

"Young women shy away from those fields – whether or not it is due to peer pressure or society expectations," she said. "I would like to get a message out to parents and teachers: You are the ones that need to tell young people 'yes, you can do it.'"

Collins said that her own parents and teachers were her role models as she grew up, along with the Women Airforce Service Pilots of World War II and the first group of women Mission Specialists selected by NASA in 1978.

Collins herself was selected by NASA in 1990 after graduation as class leader from the Air Force Test Pilot Training School at Edwards Air Force Base.

"Thousands of today's young women have been inspired by Colonel Collins," SWE president Alma Martinez Fallon said. "Colonel Collins' influence and encouragement in getting students, especially girls, involved in math and science is vital to addressing our country's essential need for a growing and diverse technical workforce."

PHOTOS, CLOCKWISE

Collins observes training activities of her STS-114 crewmates from the simulation control area in the Neutral Buoyancy Laboratory (NBL).
jsc2002-e-23144 Photo by James Blair

Collins, STS-93 Commander, checks on an experiment on *Columbia's* middeck on July 23, 1999. This Shuttle mission was the first to be commanded by a woman.
s93-e-5016

Collins dons a training version of the Shuttle launch and entry suit prior to the start of an STS-114 training session in the NBL. She will serve as Commander of STS-114, the first post-*Columbia* Shuttle flight.
jsc2002-00842 Photo by James Blair

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