Kids Help NASA Find Water on the Moon

by Ann Burdette

Student intern Chase Baines works at mission control, part of the Goldstone-Apple Valley Radio Telescope program (GAVRT).

Scientists at Ames Reasearch Center (ARC) in Mountain View, California, and others who helped design the Lunar CRater Observation and Sensing Satellite (LCROSS) for finding water on the Moon had everything they needed for the mission — except one important tool. They needed a telescope to track their satellite's journey. Unfortunately, NASA had limited telescope time to share. The LCROSS team decided that they could get by with monitoring the satellite for only two out of every 72 hours that it would be in orbit. They would feel better, though, if they could keep a closer watch over their satellite. So they turned to kids for help, but not just any kids: kids with a high-powered telescope.

Students in the Goldstone-Apple Valley Radio Telescope program (GAVRT) just happened to have what LCROSS needed — a 1-million-pound radio telescope controlled by the click of a mouse. GAVRT was created when NASA was decommissioning one of its telescopes (DSS–12). Thinking it would be useful to students, Rick Piercy, president of the Lewis Center for Educational Research, a small charter school in California's Mojave Desert, asked NASA for it. NASA granted GAVRT students exclusive use of DSS–12. GAVRT later added a second telescope, DSS–13, which it shares with NASA.

Since then, GAVRT has trained almost 500 teachers in 13 countries to teach nearly 40,000 students to use the state-of-the-art science equipment via the Internet. GAVRT students have helped NASA scan the Mars Rover landing sites, as well as earning NASA's Group Achievement Award for calibrating a device on *Cassini* — the unmanned spacecraft that explored Saturn and its moons — as it passed Jupiter. Those successes convinced LCROSS scientists that they could trust the kids with their project. Rick Piercy knew the kids could do it. "America is returning to the Moon, and this time we're taking the kids along," he says.

Both students and scientists were enthusiastic about working together.

"One of the things that brought a smile to the mission team was when, after the first burn [to correct the spacecraft's course], the students were actu-

Telescopes That Listen

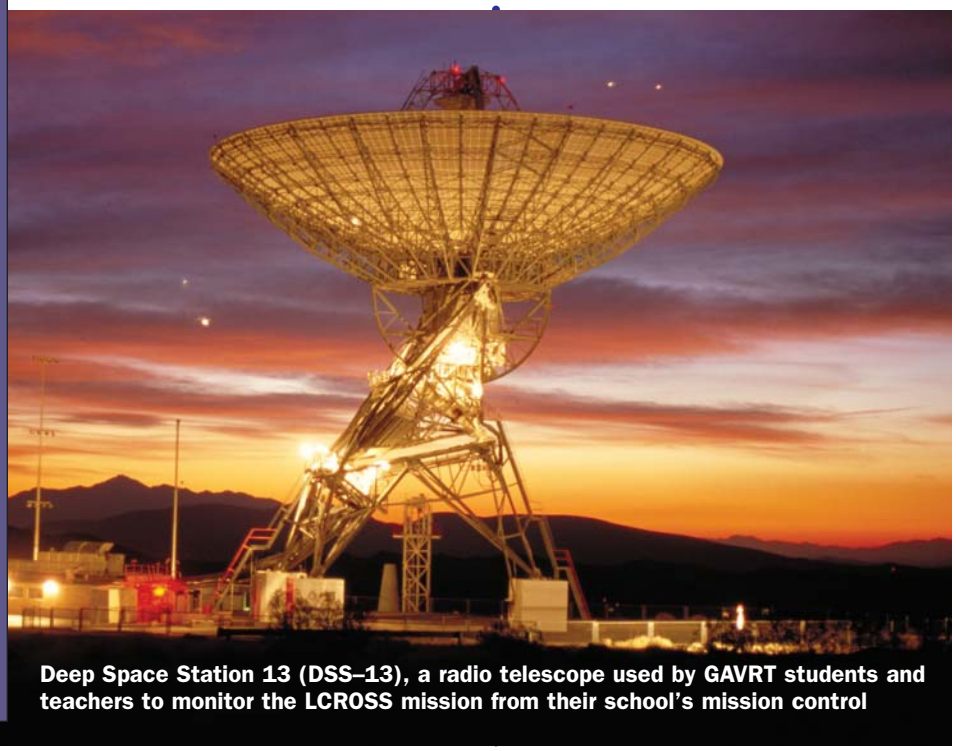
Unlike the optical telescopes that scientists look into, radio telescopes are used to sense radio waves. Scientists use them like giant ears to gather information. These "ears" listen to radio energy, called *emissions,* from natural space objects like quasars and galaxies, and from human-made satellites. Radio telescopes work like your car's radio in three ways:

- Just as your radio "listens" to a signal emitted by a radio station, the radio telescope listens to natural and human-made emissions from space. Instead of music or speech, it picks up data, such as instrument readings and pictures.
- Satellites like LCROSS can also emit a distress signal, similar to your radio's Emergency Broadcast Service alarm signal.
- A third way the telescope "hears" trouble is by picking up *anomalies* (unexpected changes) in a signal's strength or frequency. This can alert scientists to unexpected changes in the satellite's motion, in much the same way that you can tell you are getting farther from a radio station when you hear more static.

ally able to measure the change in velocity [speed and direction of LCROSS]," says Brian Day, LCROSS Mission Education and Public Outreach Lead. "The team was very, very impressed."

The students' primary job was to use their ears. "We were using the students to 'listen' for a cry for help," explained Dr. Mark Hofstadter, Jet Propulsion Laboratory's advisor to GAVRT. "The spacecraft was programmed to be silent for long periods of time, and to transmit only when something malfunctioned." It was disappointing to some, says Ryan Dorcey of GAVRT, who had the students do an experiment to prove that the silence wasn't caused by trouble with GAVRT's equipment. "We would listen to a spacecraft nearby that was transmitting, so that we could verify [prove] that our equipment was working. At the end of the day, we would send an email to Ames [Research Center] that everything was *nominal* [as expected]. That makes scientists very happy."

But not all students did the same job for NASA. "The GAVRT teachers have worked really hard on the curriculum to make it suitable for all ages," says Chase Bains, former GAVRT intern. "Elementary-aged kids can learn how to use the telescope with guidance. Watching the telescope move on the live video-feed is definitely the part they like the most." Middle and high school students actually operated the massive telescope, plotted the position and velocity of the spacecraft, and calculated how that compared to LCROSS's predicted position. "You don't have to be amazing at math. . . some of the numbers are sent to NASA for the top scientists to work on. You just have to work hard and be curious," says Kenji Toshima, a ninth grader. Students got lots of practice



Deep Space Station 13 (DSS–13), a radio telescope used by GAVRT students and teachers to monitor the LCROSS mission from their school's mission control

Watch a fun video about LCROSS and see students in mission control at www.lewislearning.org. You can also invite your teacher to discover how to bring GAVRT to your classroom at www.lewiscenter.org/gavrt.

GAVRT students from Florida and California attend LCROSS's launch with Mission Education and Public Outreach Lead, Brian Day.

before the launch. "We got to read temperatures, track quasars and pulsars. . .all for practice," says classmate Allen Miranda. "Learning how to control the radio telescope is a little harder than learning how to play a computer game," admits Allen's brother, Kenneth. "But once you learn it, you don't forget it," he adds.

So how did the GAVRT kids do, once the LCROSS mission was accomplished?

"I would give the students an 'A'," says Dr. Hofstadter. "The students did something very important and provided a safety net for our spacecraft. NASA wants projects to involve kids. . .Juno, a mission to Jupiter, is being readied for launch in 2011, and GAVRT will be a part of it."

Ann Burdette is a Lewis Center for Educational Research parent volunteer.

"MOM! I'm Gonna Work in Space!"

BEING INVOLVED with GAVRT has inspired many kids to be more interested in science and astronomy. Alicia Scarberry, a recent graduate, attended the LCROSS launch in Florida. She says, "Sports used to be the most important thing, until I got into GAVRT. I never dreamed of being a part of such an important part of history. Most kids think it's impossible to work for NASA. It seems too hard. But through the GAVRT program, they actually are working for NASA."

Chase Bains believes his unique GAVRT experience helped him to get accepted into six universities. "Schools were pretty amazed by my (GAVRT) activities. As GAVRT interns, we were able to work with different students from around the United States and the world via the Internet."

High school senior Ariel Bluy had always been interested in science, but being involved in GAVRT has sparked her interest in space science. She's changed her college plans from majoring in mechanical engineering to aerospace engineering or astrophysics.

Allen Miranda, a ninth grader, says, "Without this class, I never would have realized that there was something out there like a future space station on the Moon, something far greater than we could imagine. I sure hope that I'll be a part of it."