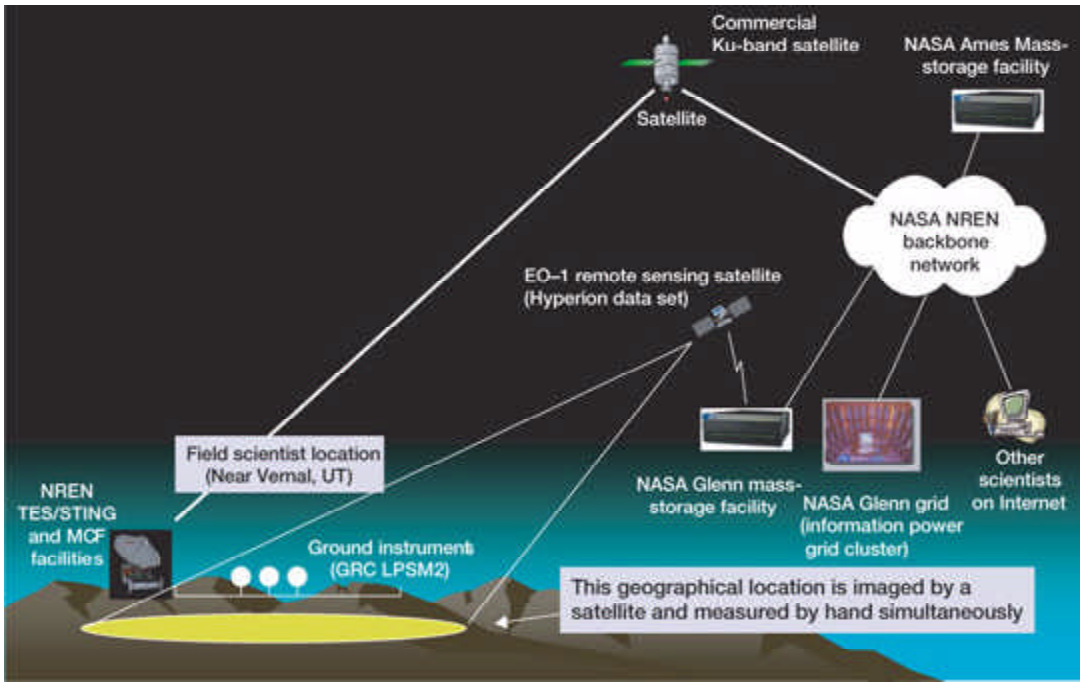
NASA Ground-Truthing Capabilities Demonstrated

NASA Research and Education Network (NREN) ground truthing is a method of verifying the scientific validity of satellite images and clarifying irregularities in the imagery. Ground-truthed imagery can be used to locate geological compositions of interest for a given area. On Mars, astronaut scientists could ground truth satellite imagery from the planet surface and then pinpoint optimum areas to explore. These astronauts would be able to ground truth imagery, get results back, and use the results during extravehicular activity without returning to Earth to process the data from the mission.

NASA's first ground-truthing experiment, performed on June 25 in the Utah desert, demonstrated the ability to extend powerful computing resources to remote locations. Designed by Dr. Richard Beck of the Department of Geography at the University of Cincinnati, who is serving as the lead field scientist, and assisted by Dr. Robert Vincent of Bowling Green State University, the demonstration also involved researchers from the NASA Glenn Research Center and the NASA Ames Research Center, who worked with the university field scientists to design, perform, and analyze results of the experiment.

As shown in the following figure, real-time Hyperion satellite imagery (data) is sent to a mass storage facility, while scientists at a remote (Utah) site upload ground spectra (data) to a second mass storage facility. The grid pulls data from both mass storage facilities and performs up to 64 simultaneous band ratio conversions on the data. Moments later, the results from the grid are accessed by local scientists and sent directly to the remote science team. The results are used by the remote science team to locate and explore new critical compositions of interest. The process can be repeated as required to continue to validate the data set or to converge on alternate geophysical areas of interest.



Experiment resource architecture of NREN ground-truthing experiment. TES, Transportable Earth Station; STING, Satellite Terminal for Internet Next Generation; MCF, Mobile Communication Facility; LPSM2, Lunar Planetary Science Module-2.

Diagram showing links in the NREN experiment architecture as well as the geographical location imaged simultaneously by the EO-1 satellite and by ground instruments (GRC LPSM2) at the field scientist location near Vernal, Utah. The NREN TES/STING and MCF facilities are linked by commercial Ku-band satellite to the NASA NREN backbone network. The EO-1 remote sensing satellite (Hyperion data set) is linked to the NASA Glenn mass-storage facility, which is linked to the NASA NREN backbone networks. The NASA NREN backbone is also linked to the NASA Ames mass-storage facility, the NASA Glenn grid (information power grid cluster), and other scientists on the Internet.

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The experiment, which was the first attempt by a field team to ground truth satellite instrument data in real time, included simulated astronauts, a field geographer, and a geologist taking spectrum measurements on the ground while being imaged by a satellite (EO-1) from above. The scientists used a combination of field computing resources along with the NASA information power grid supercomputers and mass storage devices at Ames and Glenn to complete the ground-truthing experiment. The team connected to these NASA resources over the NREN hybrid networks, which include a wideband satellite link and wide-band terrestrial networks.

The technology also can be applied to emergency settings or to scientists working just about anywhere in the field, including human missions to the Moon or Mars, where space will be limited but computational requirements will be high. This work is being funded by

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