

ENABLING SCIENCE AT THE MOON: THE LUNAR SPACE INTERNET. J. Lazio¹, W. S. Tai¹, S. A. Townes¹, B. J. Giovannoni¹, and Jared Call¹,¹Jet Propulsion Laboratory, California Institute of Technology

The exciting and compelling science to be done on the Moon, on both the near and far sides, could easily be overwhelmed by an inability to transmit the data to the science users. Only a partial list of instruments or experiments that could generate considerable volumes of data include seismometers, high-resolution imaging of lunar pits, radar sounding of the sub-surface, and mass spectrometers. On the Earth, the science community is accustomed to a robust Internet—the Moon is close enough that nearly the same access to data should be feasible. Further, lunar exploration is likely to be an increasingly international endeavor, requiring coordination and inter-operability between NASA, other space agencies, and commercial firms.

As NASA and a few other space agencies are undertaking an international endeavor to pursue the various robotic and crewed missions for the exploration to the Moon, a new Lunar space communications architecture (“Lunar Space Internet”) is emerging. Similar to the terrestrial internet that interconnects multiple networks, the Lunar Space Internet embodies three types of networks, i.e., the Lunar relay network, the Lunar surface network, and the Earth network. The Lunar relay network is manifested by one or more spacecraft operating as relay orbiters each of which provides communication and navigation services to its user space vehicles, in orbit or on surface. The deployment of multiple landers, rovers, human habitat, and other surface elements, in South Pole or elsewhere for conducting exploration and science activities, will gradually lead to the establishment of Lunar surface network(s). This type of network will facilitate wireless communications, likely using commercial components and standards, between the various landed elements. It is also expected that an Earth network comprised of those Earth stations of the cooperating space agencies and commercial entities will be in place to provide necessary global coverages to the Lunar missions. The Lunar Space Internet in essence is formed out of the necessity for achieving reliable, robust, and efficient end-to-end communications path.

In this paper, we describe the architecture and how a likely roadmap for the Lunar Ppace Internet, that would not only ensure that the next-generation instruments are deployed to the lunar surface, but that access to the data that they generate is also ensured.

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