Evolving the Deep Space Network: Implications for Planetary Probes

by

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NASA's Deep Space Network (DSN) is currently working to evolve its end-to-end link capability to better meet the communication and navigation needs of future robotic and human exploration missions. This end-to-end capability improvement encompasses the DSN ground system, flight instrumentation, evolution to Ka-band frequencies, and advances in data coding and compression. DSN ground system improvement efforts include increasing the effective receiving area, effective isotropic radiated power, and number of simultaneously supportable links. DSN flight-side technology improvement efforts include developing higher-power transmitters, larger deployable antennas, electronic beam steering antennas for in situ exploration, and lower mass, power, volume software-defined radios for relay-dependent in situ exploration elements. Together, these improvements can provide orders of magnitude increases in link capability. They can also enable lower cost planetary probe missions by eliminating the need for a spacecraft relay at the probe destination or helping reduce the telecommunications-related mass, power, and volume of both the relay and probe. The ability to use direct links from the probe to Earth can allow longer communication periods with probes, simultaneous tracking of multiple probes in one hemisphere, and improved probe position and velocity measurements (e.g., for winds). Hence, efforts to evolve the DSN's end-to-end link capability may translate into new mission concepts, lower costs, and more scientific capability for planetary probes or other in situ exploration craft (e.g., rovers, aircraft, and balloons).