

Telemetry, Tracking, and Command of Deep Space Probes

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The Deep Space Network (DSN) is at once the highest power and the most sensitive communication system on Earth. Antennas up to 70 meters diameter located at Goldstone, California, near Canberra, Australia and outside Madrid, Spain provide 24-hour coverage for spacecraft from Earth orbit to beyond Pluto.

Ground to deep space communication uses primarily S and X-band transmitters from 2kW to 400kW. The Deep Space Network's last L-band uplink will be retired with the end of the Galileo mission this fall; the first Ka-band uplink has been successfully tested in Cassini's search for evidence of gravity waves. Uplink communication delivers new programming to spacecraft, along with transmission of ultrastable frequency references that are essential to accurate navigation.

Future drivers for increased performance will include ultra-long range transmission to robot probes exploring the outer planets and Kuiper Belt. Also, uplinks to Human Exploration and Development of Space (HEDS) missions at Mars and the lunar Lagrangian points will require multiple video-bandwidth channels.

The current DSN Roadmap forecasts transition to Ka-band as the new standard for wide-band deep space communications.