Press Release

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CCSDS Proximity-1 Links Mars Mission Communications Success, Disney Film and Interplanetary Internet

WASHINGTON, March 1 (CCSDS) – The Consultative Committee for Space Data Systems (CCSDS) today reported that NASA's Mars Exploration Rovers are using the CCSDS Proximity-1 data communications protocol to send back significantly more scientific data to Earth than originally planned, with many of the most spectacular images now being showcased in Disney's IMAX film, *Roving Mars*. CCSDS hopes the dramatic tale of the rover's separate journeys to the red planet will not only inspire a whole new generation of space explorers, but also encourage the ongoing development of the "Interplanetary Internet" and other innovations for space communications in the future.

Vint Cerf, one of the most influential innovators of our time, continues to be inspired by the success of the Mars mission and Mars mission communications. Co-developer of the Internet's key "TCP/IP" protocol and chief Internet evangelist for Google, Dr. Cerf was awarded the U.S. Presidential Medal of Freedom last fall for his role in developing the terrestrial Internet. In addition to his current work for Google, he is shaping the vision of an Interplanetary Internet with an international team of space communications engineers, many of whom are responsible for the development of CCSDS Proximity-1, the protocol so successful at Mars.

Recently, Dr. Cerf attended the world premier of *Roving Mars* in Washington, D.C. A self-professed fan of science fiction and space exploration since childhood, he found the enthusiasm of the movie's narrator and the mission's principal investigator, Steven Squyres, infectious.

"*Roving Mars* is a wonderful showcase of ingenuity and Steve Squyres gets well-deserved attention for his determination and remarkable ability to communicate his passion for the Mars mission," said Dr. Cerf following the *Roving Mars* premier. "It was gratifying to see the stunning benefits of networking among the Deep Space Network ground stations, the Mars orbiters and the two Mars rovers. Imagine what we will be able to do with the richer networking infrastructure of an Interplanetary Internet."

Developing an Internet for use in deep space is necessary because while some elements of the Internet on Earth are useful in low-delay space environments, factors like speed-of-light delay and intermittent connectivity make the standard Internet protocol suite inappropriate for interplanetary communication. Cerf and the interplanetary Internet team are defining the architecture and protocols required to permit the Internet on Earth to interoperate with internet technologies located on other planets or on spacecraft in transit. The potential usefulness of their work could extend beyond the interplanetary domain back to Earth in situations where the dependence on real-time interactive communication is not possible, such as on the battlefield or in civil emergency operations where communication resources on satellites, helicopters, fixed-wing aircraft and surface vehicles are highly mobile and intermittently available. Thus far, the team has defined a general-purpose disruption-tolerant networking (DTN) architecture that can operate reliably through all of the constraints posed on deep space communications and even other constrained environments.

At Mars, CCSDS Proximity-1 demonstrated that it could provide formidable support to a future DTN-based architecture. Designed as a highly specialized short haul delivery protocol, Proximity-1 establishes a two-way communications link between a rover (or lander) and an orbiter, negotiates data rate and communications mode, and reliably delivers data during short

orbiter-to-surface contacts. Since becoming the primary communications path at Mars, rover to orbiter relay operations enabled by Proximity-1 have been used to transmit roughly 95 per cent of all rover data at much higher rates than could be accomplished using the previous Direct To Earth (DTE) approach. The path also has used substantially less energy, reducing impact on spacecraft data storage and power resources and further improving the overall science return. Despite shorter orbiter fly-over contact times, the use of Proximity-1 has resulted in a significantly higher end to end delivery of science data.

During demonstrations of in-orbit communication between NASA's Rover Spirit and the European Space Agency (ESA) Mars Express (MEX) orbiter in 2004, CCSDS Proximity-1 enabled the first ever in-space communication between NASA and ESA spacecraft and in doing so, also established the first working international communications network around a planet other than Earth, an important milestone for the Interplanetary Internet. Similar results were achieved during demonstrations in late 2005. As part of a series of interplanetary networking demonstrations, ESA's Mars Express flew over NASA's MER Opportunity and successfully received data that had been previously collected and stored by the rover.

Referred to as the "story behind the story" of successful communications at Mars, CCSDS Proximity-1 has hit important milestones towards a viable interplanetary Internet and ensured that the rovers delivered incredible, never-seen-before images of the Martian surface to filmmakers and the public. Perhaps most important, though, Proximity-1 gives researchers a more reliable, efficient and proven communications path that, like the rovers themselves, has outperformed original estimates and continues to return more scientific data than ever anticipated by mission planners.

Along with more than 300 other missions to space, all Mars spacecraft have also implemented CCSDS standard space data communications protocols on their long-haul communications links back to Earth. Supported by NASA, CCSDS is an international committee founded by the world's major space agencies to further interoperability in space through the development of standardized techniques for handling space data. NASA's Jet Propulsion Laboratory (JPL), collaborating with its international partners in the CCSDS, led the development of Proximity-1. The international team was honored with NASA's Software of the Year Award in 2005 for its work on the protocol.

About the Consultative Committee for Space Data Systems

Established in 1982 by the world's most influential space agencies, the Consultative Committee for Space Data Systems (CCSDS) provides well-engineered international space data handling standards that enhance government and commercial interoperability and cross-support, while also reducing risk, project cost and development time.

A pioneer in international cooperation in space, the CCSDS is made up of leading space communications experts representing 28 countries, its founding member space agencies, 22 observer space agencies and over 100 private companies. CCSDS national member space agencies include Japan, the United Kingdom, France, Germany, Italy, Brazil, Russia, Canada and the United States, as well as the multi-national European Space Agency.

To date, more than 300 missions to space have chosen to fly with CCSDS protocols and the number continues to grow. For more information on participation or to access CCSDS standards and protocols free of charge, please visit http://www.CCSDS.org.

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