Press Release
For immediate release

Special Delivery: NASA's MESSENGER Enters Orbit about Mercury and Sends Data to Earth Using CCSDS File Delivery Protocol Developed for Deep Space by International Team

WASHINGTON, 31 March 2011 (CCSDS) – NASA's MESSENGER spacecraft successfully entered into orbit about Mercury 18 March UTC – the first probe to do so. In order to get to Mercury, MESSENGER used six planetary flybys (one of Earth, two of Venus, and three of Mercury itself) to control its speed and trajectory as it approached the Sun and its strong gravitational pull. MESSENGER will gather data with its seven instruments and return that information to Earth. The MESSENGER team is using the CCSDS File Delivery Protocol (CFDP), a highly specialized protocol designed to overcome space operations communications challenges, to download those data.

A team of international space data communications experts, collaborating through the Consultative Committee for Space Data Systems (CCSDS), developed CFDP to reliably and efficiently downlink files from a spacecraft even in the strenuous environment of deep space and a blistering environment like that near Mercury. Since the MESSENGER spacecraft's launch seven years ago, it has successfully used CFDP to enable mission communications as it traveled 7.9 billion kilometers to Mercury, and it will continue to do so, as the spacecraft is scheduled to operate in orbit for a year, during which it circle around the planet over 730 times.

In using CFDP, MESSENGER communications represents a change in the standard method of storing science and housekeeping data on a spacecraft built by the Johns Hopkins University Applied Physics Laboratory (APL). MESSENGER is also the first U.S. space flight mission to use CFDP in mission operations.

Prior to MESSENGER, APL missions used a raw storage model of storing data, but new mission and operational requirements meant that MESSENGER would have to incorporate a file system of data storage into its spacecraft software architecture. A reliable method of downlinking files to the ground had to be found and CFDP was chosen by mission planners to do the job.

Overall support for CFDP development within NASA has been provided by the Space Communications and Navigation (SCaN) office at NASA Headquarters. CFDP is included in the MESSENGER software architecture initially through a reuse of a NASA Jet Propulsion Lab (NASA JPL) implementation on the ground and an APL "CFDP-lite" implementation on the flight side. The NASA JPL implementation is also used on NASA's highly successful Deep Impact mission. The NASA Goddard Space Flight Center is also using CFDP on its Lunar Reconnaissance Orbiter mission.

CFDP is designed to function reliably despite the long data propagation delays and frequent, lengthy interruptions in connectivity found in deep space. It uses powerful forward error correction coding that minimizes data loss in communication across deep space, and also supports optional "acknowledged" modes of operation in which data loss is automatically detected and a retransmission of the lost data is automatically requested. "With CFDP, our flight controllers can spend most of their time monitoring subsystem and instrument health and safety in the extreme environment of Mercury, and focusing on our weekly command sequence and ephemeris loads, rather than on file management," says MESSENGER Mission Operations Manager Andy Calloway, of APL

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Some of the world's leading space communications experts working within CCSDS collaborated at biannual working group sessions (similar to those scheduled to take place in May in Berlin, Germany) to first standardize CFDP. They defined the protocol according to space file transfer requirements articulated by CCSDS participating space agencies, including NASA, the European Space Agency (ESA), the UK Space Agency, the French Centre National d'Études Spatiales (CNES) and the Japan Aerospace Exploration Agency (JAXA). The protocol's ability to maintain a high level of data transfer reliability even across interplanetary distances makes it critical to successful communications on deep space missions like the MESSENGER mission to Mercury and has a high level of applicability to current lunar exploration missions.

CFDP also benefits space flight missions in another important way: cost savings.

CFDP allows an instrument to record an observation in a file and transmit the file to Earth without having to consider whether or not physical transmission is possible at that time. Sequestering outbound data management and transmission planning functions within CFDP can simplify flight and ground software, which reduces mission costs – an important benefit to lower-cost missions like MESSENGER.

CCSDS will continue to foster global scale technical cooperation to develop recommendations for space communication like CFDP that increase interoperability, as well as reduce risk and mission operation costs. Currently, the organization is investigating extending the use of CFDP in delay-tolerant networking technology to Interplanetary Internet operations, and specifically to the use of CFDP in complex mission configurations, which should further enhance the usefulness and value of CFDP to space exploration missions in the future.

Scott Burleigh, CCSDS working group chair and lead CFDP system engineer at NASA JPL in Pasadena, Calif. commented, "The successes of CFDP on MESSENGER and the Deep Impact mission bring us closer to having an automatic interplanetary communication fabric that can support deep space science and exploration the way the Internet supports science on Earth."

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About CCSDS

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, CCSDS is made up of leading space communications experts representing 30 countries, its founding member space agencies, 28 observer space agencies, and over 140 private companies. CCSDS members include national space agencies from Japan, the United Kingdom, France, Germany, Italy, Brazil, Russia, Canada, China, and the United States, as well as the multinational European Space Agency.

To date, more than 500 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 www.CCSDS.org.

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