Press Release
For immediate release

CCSDS Gives SMART-1's Data Transmissions a Turbo Boost at the Moon

TOULOUSE, France (CCSDS) – November 24, 2004 – The European Space Agency (ESA) launched SMART-1 late last year making it the first satellite to have data transmissions powered by Turbo Codes, specifically designed for use in space by the Consultative Committee for Space Data Systems (CCSDS). CCSDS Turbo Codes recently passed a series of deep space communications tests performed by SMART-1 and could be used in the future to enable the reliable transfer of large amounts of scientific data that researchers hope will shed light on the origins of the Moon. As SMART-1 was making its first orbit around the Moon last week, the CCSDS, of which ESA is a founding member, was holding its bi-annual working group sessions in Toulouse, France. The CCSDS meeting series continues this week.

Turbo Codes are a class of high performance error correction codes that achieve maximum information transfer over a limited-bandwidth communication link in the presence of data-corrupting noise.   Initially developed over a decade ago by two French electrical engineers, Turbo Codes were revolutionary because they allowed the design of systems able to get extremely close to the Shannon Limit, or in information theory, the maximum amount of information transmitted over a communication link with a specified bandwidth in the presence of noise.

Turbo Codes overcome noise and increase transmission reliability by using long, random codes arbitrarily spaced from each other. Currently being investigated for use in 3G mobile technologies, they have a potential use in many near-Earth and on-Earth applications, although the decoding delay that results might prove unacceptable for some.   Since deep space communication systems can tolerate decoding delays that other systems might not, Turbo Codes have remained a viable option for space applications.

International partners within the CCSDS developed Turbo Codes for space at working group sessions similar to those being hosted in Toulouse by le Centre National d'Etudes Spatiales (CNES), the national space agency of France and another founding member of the CCSDS. Although sometimes referred to as the frontlines of the organization, the CCSDS working groups are where cultural and political differences are set aside, so that the work of the organization, developing space communications standards, can be accomplished. The collaborative environments that emerge during these sessions allow participants to exchange information regarding space communications standards on a global scale.

"I think people assume that the CCSDS purposely operates under a shroud of mystery because so many are familiar with our work, yet few really know who we are," said Andy Dowen of NASA's Jet Propulsion Laboratory (JPL), Pasadena, Calif. and NASA's representative to CCSDS' Management Council (CMC). NASA sponsors the CCSDS and is one of ten founding member agencies of the organization along with ESA and CNES. "Instead, we're producing space communications standards that we hope the world will adopt, thus we encourage open, international collaboration from as many qualified participants as possible."

Prior to its first successful orbit of the Moon, ESA's SMART-1 began testing new space technologies, including miniaturized instrumentation and a highly efficient jet propulsion system. CCSDS Turbo Codes were tested during deep-space communication tests called the KaTE experiments that involved sending turbo coded radio transmissions at very high frequencies and comparing them to radio transmissions sent at traditional frequencies. The Turbo Codes were a

success, transmitting data with increased reliability at even the highest frequencies. It is expected that this advance will allow SMART-1 and future spacecraft to transfer the ever-increasing volumes of scientific data from deep space more reliably than ever before.

"The fact that CCSDS-developed space communication Turbo Codes were able to successfully optimize data transmission reliability for SMART-1 is great news for CCSDS," said Gian Paolo Calzolari of ESA's European Space Operation Center in Darmstadt, Germany and one of the leaders in the development of CCSDS Turbo Codes for space. "We anticipate further validation of other code rates and for more missions in the near future to take advantage of standardized CCSDS coding schemes."

Indeed, other missions are already using CCSDS turbo codes successfully in space. NASA / JPL's Messenger Mercury orbiter, launched in August 2004, advanced the use of turbo codes to flight proven technology. ESA's Rosetta mission, launched in March 2004 and to date the agency's most demanding mission in terms of ground station requirements, will test CCSDS Turbo Codes to see if they improve return-link margins. Currently, SMART-1, Messenger and Rosetta all use traditional coding developed by the CCSDS.

The recent success of Turbo Codes in space has also turned attention to the possibility of reviving other capacity approaching codes for use in space communications. For example, the Low-density Parity Check code (LDPC), first invented in the 1960's at the Massachusetts Institute of Technology, is now being considered for space application by the CCSDS. Using an iterative decoding process, LDPC's may allow engineers to actually design systems that get even closer to the Shannon Limit than Turbo Codes and with lower implementation cost. Similarly, Serial Concatenated Convolutional Codes (SCCC) are also currently under investigation by the CCSDS.

The series of CCSDS meetings that began earlier this month with working group sessions will culminate in December with a meeting of the CCSDS Management Council (CMC), attended by representatives from each of the ten founding member space agencies. This week, the CCSDS Engineering Steering Group is meeting at CNES to summarize and formalize the work done at the working group level for presentation to the CMC.

About the CCSDS

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

An international cooperative, the CCSDS is made up of leading space communications experts representing 28 countries, the organization's ten founding member space agencies, 22 observer space agencies and over 100 private companies.

To date, more than 300 missions 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.

Contact for Members of the Press:
Penelope Wrenn Walz
CCSDS - Public Affairs
Greenbelt, Maryland USA
T - +1 301 474 5424
E - penelope.walz@btas.com

# # #