

Using the ISS to Prepare for Exploration (01)  
Exploration Technology Demonstrations Using ISS (2)

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UTILIZING THE ISS TO DEMONSTRATE INTERNATIONAL OPERATIONAL UTILIZATION OF  
DISRUPTION TOLERANT NETWORKING (DTN) FOR EXPLORATION SPACE  
COMMUNICATIONS

**Abstract**

The NASA Disruption Tolerant Networking (DTN) Project was started in 2009 with the goal of demonstrating operational advantages of DTN for space communications. DTN is currently deployed on the CUBoulder CGBA4 and CGBA5 payloads in the U.S. Destiny Lab onboard the International Space Station (ISS). The DTN protocol is utilized for communications between the CGBA payloads onboard ISS and the Boulder, Colorado payload operations control center (POCC).

In this paper, we described two international collaborative activities that utilize the ISS and CGBA payloads as a relevant operational environment to mature the DTN technology in support of future, partnered, space exploration communications. The first international, ongoing, DTN collaboration is between NASA and JAXA to extend the ground and ISS DTN network topology and operations to include the Japanese Aerospace Agency (JAXA) Kibo module on the ISS and the JAXA mission control facilities at Tsukuba, Japan. The second international, ongoing, collaboration is between NASA and ESA to extend the international DTN network to include the ESA Columbus module on ISS and the ESA ground control facilities at the ESOC in Darmstadt, Germany. ESA, JAXA, and NASA are all interested in utilizing DTN for networked space communications and for supporting robotic and tele-operated robotic activities deemed crucial for planetary surface exploration activities.

Operational challenges, lessons learned and benefits associated with DTN networking for Exploration communications will be presented. Operational results will be given with suggestions for improvement. Practical operational issues are emphasized and the specific logistics associated with utilizing the ISS as an international testbed to vet new communication protocols and operational paradigms in support of collaborative space exploration communications are discussed in detail. Planned activities to augment the ISS international DTN network are summarized.