Space station's data rate increase supports future exploration

August 20 2019, by Matthew D. Peters

Many components of the Space Network were upgraded to support the increased data rate, including at ground stations such as this one in White Sands, New Mexico. Credit: NASA

NASA recently doubled the rate at which data from the International Space Station returns to Earth, paving the way for similar future upgrades on Gateway, NASA's upcoming outpost in lunar orbit, and other exploration missions. This new data rate will enable the space

station to send back more science data faster than ever before.

NASA's missions, both near and far, rely on quick and effective communications to relay critical mission data to control centers and scientists here on Earth. The station now supports a 600 megabit-per-second (Mbps) connection, doubling the amount of data that the station can transmit and receive at a time.

"NASA's communications networks play a pivotal role in every NASA mission, enabling data from human spaceflight, space and Earth science research missions and technological demonstrations to reach Earth for the benefit of humanity," said George Morrow, the acting center director of NASA's Goddard Space Flight Center in Greenbelt, Maryland. "This increase in data rate capability for the International Space Station underlines our commitment to provide high-quality operational services for NASA exploration missions today and in the future."

The space station's unique environment allows astronauts to conduct research that would not otherwise be possible on Earth. These experiments and technology demonstrations are increasingly reliant on high data rates between the station and researchers on Earth. The work on the orbiting laboratory provides knowledge in human research, experience in long-duration spaceflight, and capabilities for technology demonstrations that may enable future missions. With the data rate increase, the station can now accommodate new experiments and technology demonstrations that require higher resolution or more detailed data than was previously possible.

The space station communicates with Earth through radio frequency signals using a system of Tracking and Data Relay Satellites (TDRS) and ground-based antennas called the Space Network. The TDRS are placed in a high orbit above the Earth, over various strategic locations so that they can relay data to the ground from anywhere in orbit. Landlines then

send the signal to various NASA centers, and their computer systems turn the radio signal back into readable data. To send data back, the process repeats in the other direction. This happens with less than a one-second delay in communication.

"This project demonstrated that advanced radio frequency waveforms can be used efficiently to increase data rates and improve performance for high-rate communication services," said Risha George, the upgrade project lead for the Space Network. "Operational use of these advanced waveforms proves that they can also be used for future missions, such as on the Gateway, a small spaceship that will orbit the Moon and provide a stepping stone to human exploration on Mars."

Several components in this global communications system were upgraded to support the increased data rate, including a new digital ground architecture for the Space Network. Technicians updated the space station's software-based modem, improved data processors at various NASA centers, and enhanced routers, interfaces and other equipment and software at the ground stations. The circuits and bandwidth of the terrestrial data lines between the various Earth-based components were also upgraded. The team then performed extensive testing to ensure the upgrades worked correctly. All of this was done while still providing real-time support to the more than 40 missions the network regularly supports.

"Partnerships like this are crucial to our continued success as an agency," said Penny Roberts, the upgrade project lead for the space station. "Our continued partnership will transition us to 600 Mbps, and who knows where else we will go together."

Provided by NASA's Goddard Space Flight Center