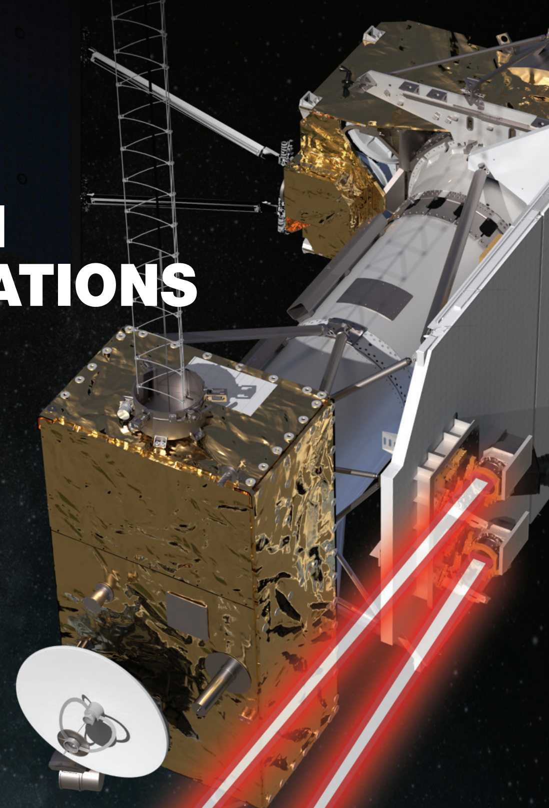
LCRD

LASER COMMUNICATIONS RELAY DEMONSTRATION

National Aeronautics and Space Administration



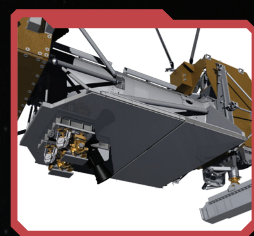
NASA'S NEXT STEP IN OPTICAL COMMUNICATIONS

THE TECHNOLOGY

LCRD is poised to revolutionize the way NASA communicates with spacecraft by showcasing the unique capabilities of laser communications.

Currently, NASA missions use radio frequency communications to send data to and from spacecraft. Radio waves have been used in space communications since the beginning of space exploration and have a proven track record of success. However, as space missions generate and collect more data, the need for enhanced communications capabilities becomes paramount.

Laser communications is one of these enhancements. Using lasers to encode and transmit data can provide missions with data rates 10 to 100 times better than current radio systems. This advanced data transfer capability will allow the aerospace community to communicate more high-definition videos and photos from space than ever before.



The LCRD payload is hosted onboard the U.S. Department of Defense's Space Test Program Satellite 6 (STPSat-6).

INFRARED VS. RADIO

Laser communications uses a different wavelength of light than radio waves, which is how the benefits of laser technology are realized. Laser, which uses invisible infrared light, has a shorter wavelength than radio waves. This allows it to transmit more data at a time, enabling scientists to get their data back from space more quickly. It would take roughly nine weeks to transmit a completed map of Mars back to Earth with current radio frequency systems. With lasers, we can accelerate that to about nine days.

LCRD is hosted onboard the U.S. Department of Defense's Space Test Program Satellite 6 (STPSat-6) and will reside in geosynchronous orbit, about 22,000 miles from Earth's surface, to support missions in low-Earth orbit. Prior to mission support, LCRD will test its capabilities with experiments developed by NASA, other government agencies, industry, and academia. These experiments will test laser communications functionality, demonstrating how it can meet the aerospace industry's growing need for higher data rates.

LCRD will communicate with optical ground stations at Table Mountain, California, and Haleakala, Hawaii. The Table Mountain station, seen above, is managed and operated by NASA's Jet Propulsion Laboratory in Pasadena, California. ***Credit: NASA/JPL-Caltech***

Missions in space will send their data to LCRD, which will then relay the information down to designated ground stations on Earth. LCRD's ground stations are located high in the mountains of California and Hawaii, which were chosen for their minimal cloud coverage. Unlike radio waves, laser signals cannot penetrate cloud coverage so NASA must build a system flexible enough to avoid weather interruptions. LCRD will test different cloud coverage scenarios, gathering valuable information about the flexibility of laser communications.

LCRD will pave the way for future laser communications missions. The relay's first user will be the Integrated LCRD Low-Earth Orbit User Modem and Amplifier Terminal (ILLUMA-T) on the International Space Station. ILLUMA-T will send data to LCRD at rates of 1.2 gigabits per second over laser links, allowing for more high-resolution experiment data to be transmitted back to Earth.

Laser communications systems are ideal for missions like the space station not only because of their increased data capabilities, but also because laser systems provide decreased size, weight, and power requirements. A smaller size means more room for science instruments. Less weight means a less expensive launch. Less power means less drain on the spacecraft's batteries.

LCRD will demonstrate the vast advantages of laser communications near-Earth. This will prove that laser systems are an option for our future expeditions back to the Moon and then on to Mars!

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