National Aeronautics and
Space Administration

TECHNOLOGY SOLUTION

Communications

The Teletenna - A Hybrid Telescope Antenna System

Enables deep space missions by combining radio frequency and optical communications

Innovators at NASA's Glenn Research Center have developed a hybrid telescope antenna system - Teletenna - to deliver high data-rate communication over great distances. Teletenna has the potential to benefit deep space missions and communications on Earth. By combining two very different communications systems - optics and radio frequency (RF) - Teletenna capitalizes on the benefits of each system while overcoming conflicting engineering requirements. Teletenna is a breakthrough innovation, particularly in the field of Deep Space Optical Communications (DSOC), in which it could deliver high-definition imagery, live video feed, and real time data-transmission 10 to 100 times faster than current state-of-the-art technology. Teletenna supports beaconless pointing, remains nearly transparent to RF, and achieves an unprecedented level of data richness and bandwidth. This exceptionally lightweight and precise instrument stands ready to revolutionize deep space exploration, satellite communications, telecommunications, and more.

BENEFITS

- Reliable: Combines the benefits of high data-rate optics with the reliability of a RF system
- Low Mass: Achieves the functionality of both a telescope and an antenna with minimal system mass
- High Data Rates: Can return data at rates approaching 300 Mbps optically and 100 Mbps RF at Mars' closest approach
- Robust: Provides optical alignment and stabilization in high vibration environments and is tolerant to radiation
- Precise: Combines Ka-band RF with 1550 nanometer optical capability

THE TECHNOLOGY

Initially developed for missions to Mars, Teletenna integrates RF and optical communication technologies to transmit data from deep space to Earth at extremely high speeds. The system combines a co-boresighted telescope and a Ka-band RF antenna to minimize system mass and enhance performance. Designed with an optimal focal length-to-diameter ratio, the apparatus features a classical Cassegrain geometry, including a sub-reflector in front of the RF feed which acts as a mirror for the optical signal while being transparent to the RF signal. The apparatus also mechanically and thermally isolates the RF reflector system from the optics to offer maximum stability.

Teletenna was created to overcome two significant challenges to DSOC: 1) laser inefficiency due to poor alignment during spacecraft disturbances and 2) performance degradation due to lack of rigidity in vibrational environments (such as space). The first challenge is addressed by the telescope portion of this technology, which facilitates the acquisition and maintenance of the link with ease - even in less than ideal conditions. The second challenge is addressed by rigidly fixing the RF reflector to the spacecraft body and attaching the optical section to a vibration isolation platform. The result is a device that can point to within 0.5 degrees of the sun (traditional optical systems are limited to 3 degrees), allowing for approximately 20 extra days of contact time between Earth and Mars. By combining RF and optical communications, this breakthrough innovation has the power to transform communications as we know it.

Glenn welcomes co-development opportunities.

To limit RF interference from the telescope tube, Teletenna could use the innovative structure shown, or a novel silicon carbide material

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APPLICATIONS

The technology has several potential applications:

- Aerospace
- Secure communications for aircraft
- Satellites

PUBLICATIONS

Patent No: 10,862,189; 10,673,146; 11,121,518

technology.nasa.gov

More Information

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Agency Licensing Concierge

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