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Advancing the Arizona State University Knowledge Enterprise

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Case ID:M15-123P
Published: 6/27/2016

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Low-Cost, Long-Distance, High-Bandwidth Laser Communication System for Small Mobile Devices and Spacecraft

Ground stations used for communication have low bandwidth and high maintenance costs, prompting scientists to focus on laser communication. Laser communication is an alternate method of communication that uses laser light to transmit information from a ground source to a photovoltaic or photodiode cell that reflects the light back to the ground source. The laser focuses the light and enables coherency (same frequency and phase) of the photon beams over long distances, providing higher bandwidth while using relatively low mass, volume, and power. However, laser communication systems placed on nano-spacecraft are inefficient due to a high consumption-production ratio of power and thus, has driven scientists to find an efficient, high-speed means of low-power, low-mass laser communication.

Researchers at ASU have developed a fully bi-directional, free-space optical interconnect for communication with satellites and unmanned aerial systems. The framework comprises a ground station that contains various components to aim, transmit, and receive signals to and from a spacecraft. At the spacecraft, a solar photovoltaic element functions as an optical detector for detection and receipt of a modulated signal, effectively reducing the cost and optimizing area usage. A second element on the spacecraft is an actuated reflector that uses the incoming laser beam as a source of transmission of information back to the ground source. In essence, ASU researchers have created a solution for the lack of efficiency of communication systems on nano-spacecraft by implementing a detection-actuated reflector system that works with a ground source to produce low-cost, long-distance, high-bandwidth laser communication.

Potential Applications

- Communication Systems
- Nano and Picosatellites
- Robotic and Spacecraft Telemetry
- Small Electronic Devices

Benefits and Advantages

- Lower Cost – The detection-actuated reflector system¬ on the satellite eliminates the need for a laser on the satellite, reducing cost, complexity, and power usage
- Effective – The proportionately large satellite makes it so that the laser is easy to aim and transmit/obtain information at high speed
- Efficient – The interconnect can reach the same communication speed as radio frequency systems while using less power

- Retrofittable – A simplified version can be applied to existing satellites as an added source of unidirectional communication without modifying existing hardware

For more information about the inventor(s) and their research, please see:

Dr. Jekan Thanga's directory webpage