Air Force SBIR STTR

CONCEPT ON THE HORIZON

BETTER USE OF LIMITED VOLUME AND POWER

TOPIC NUMBER:
AF103-096

TOPIC TITLE:
High-Efficiency Optical Transmitter Module

CONTRACT NUMBER:
FA9453-12-C-0115

SBIR COMPANY NAME:
Physical Sciences Inc.
Andover, MA

TECHNICAL PROJECT OFFICE:
AFRL Space Vehicles Directorate,
Kirtland AFB, NM

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A new optical receiver platform for use in satellite-based, high-speed communications systems may someday benefit service members in the field (U.S. Air Force photo).

PAVING THE WAY

FOR BETTER SPACE-BASED COMMUNICATION SYSTEMS

A Massachusetts-based small business may help pave the way for futuristic high-speed communication between satellites and service members in the field.

With the backing of an Air Force Small Business Innovation Research (SBIR) award, Physical Sciences Inc. developed an optical receiver platform for use in satellite-based, high-speed communications systems. Its compact size, low weight and low-power consumption are key features that may eventually simplify deployment of space-based communications systems.

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This advancement is directly applicable to military space communications systems in the planning stages and could also enable cost-effective commercial space-based communications links envisioned as a supplement to long-haul fiber optic communication links.

BEHIND THE TECHNOLOGY

Existing space communications systems use radio frequency antennas - both for transmission and reception - offering limited bandwidth and power.

Optical communication systems, by comparison, can provide higher speed, better security, and greater efficiency. However, the technology requires efficient, scalable receivers for use in space as long distances necessitate efficient detection systems.

Physical Sciences' project addressed the integration of multiple optical receiver functions on a single chip, allowing better use of limited volume and power in space applications. The receiver developed by the company takes light transmitted through space and couples it to waveguides, where it is combined with light from another laser to extract the signal amplitude and clock.

"These functions take advantage of the unique properties of lithium niobate waveguides, which can efficiently change the wavelength or color of light to extract information from optical beams with data encoded on them," said Joel Hensley, of Physical Sciences.

SBIR SUPPORT A KEY

SBIR funding allowed Physical Sciences to optimize the critical optical frequency mixer device and collaborate with the Bell Laboratories group of LGS Innovations to demonstrate hybrid integration of lithium niobate with silica waveguides and optoelectronic components, including lasers and detectors.

Physical Sciences had previously developed optical frequency mixers and investigated the possibility of integrating them with other optoelectronic components to create a versatile receiver. The Bell Labs group is known to have experience in hybrid integration of devices used in optical communications. Physical Sciences approached Bell Labs to develop a system concept leveraging skills and capabilities of both teams.

The prototype combined the optical frequency mixer with a laser, detectors, and electronics on a single substrate to prove the system concept.

With the completion of this SBIR contract, the Air Force and Department of Defense have a new technology in their arsenal that may one day be used to improve surveillance, reconnaissance and communications, thereby boosting the success of missions.