Topic: N171-031

Freedom Photonics LLC

1 Micron Fiber Optic Receiver for Mil-Aero Environment

Freedom Photonics, a growing small business which focuses on the development of unique photonic components for high-performance systems, is developing a ruggedized, high-power photodiode module optimized to work at 1-micron wavelengths. These modules are a component of 1-micron wavelength links, which can perform with high efficiency at elevated temperatures with low cooling requirements. These detector modules are the highest linearity devices available at this wavelength. Freedom Photonics successfully designed, fabricated, packaged, and tested the modules during the SBIR Phase I, significantly reducing the risk of this second round of production, aimed toward achieving improved device specifications. The ultimate goal is to integrate and transition this component technology into government and prime contractor analog photonic link systems onboard avionics, sensor, and electronic warfare platforms.

Technology Category Alignment:

Air Platforms
Electronic Warfare (EW)
Advanced Electronics

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SYSCOM: NAVAIR
Contract: N68335-19-C-0100

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0100

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2020-841

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WHO

SYSCOM: NAVAIR

Sponsoring Program:

Transition Target: TBD

TPOC:
(301)342-4122

Other transition opportunities: The ultimate goal is to integrate and transition this component technology into government and prime contractor analog photonic link systems, especially for avionic environments.

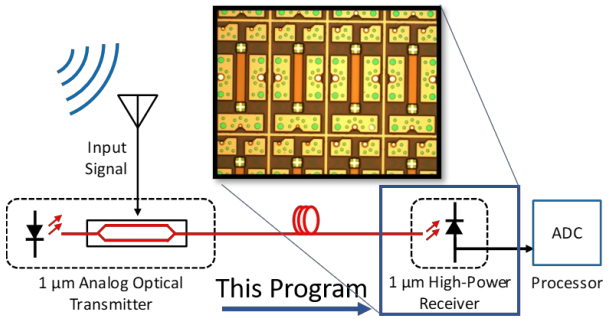


Image Courtesy of Freedom Photonics, LLC

WHAT

Operational Need and Improvement: Modern military avionic systems employ a vast network of sophisticated sensors and communication equipment, requiring high-bandwidth digital and analog links. Fiber-optic communications have been proven as the superior means to transmit digital information over electronic transmission via heavy and lossy coaxial cable, where wideband operation and low-susceptibility to electromagnetic interference (EMI) is critical. Traditionally, the DOD has used photonic devices operating in the 1550-nm wavelength range to leverage commercial fiber-optic component technology. However, deployment in harsh military environments requires components to meet extended temperature range requirements, which commercial telecom components cannot do without temperature stabilization and cooling. Photonic devices built to operate at wavelengths around 1 micron can operate over an extended temperature range without the need for thermoelectric cooling. Furthermore, a 1-µm link has improved power efficiency compared to links at 1.55-µm.

Specifications Required: The receiver must operate from DC to 45 gigahertz (GHz) threshold at photocurrents of 50mA threshold / 70 mA objective. The targeted responsivity is 0.6 A/W threshold and 0.7 A/W objective. The packaged receiver must operate over a temperature range of -40 to 100 degrees Celsius, and maintain hermeticity and optical alignment upon exposure to air platform vibration, thermal shock, mechanical shock, and temperature cycling environments.

Technology Developed: The overall program objective is to develop a multi-octave, high-power and linearity photodetector receiver operating at 1-µm, in a ruggedized package for harsh military environment avionics. The 1-micron analog photonic link will operate with high efficiency at high temperature, without the need for thermoelectric cooling. To our knowledge, these detector modules are the highest linearity devices available at the 1-micron wavelength.

Warfighter Value: These 1-micron wavelength detectors will be used in RF photonic links, which support a lower cost, size, weight, and power than a standard RF link. 1 Micron wavelength photonic links offer the advantage of high power efficiency even at high-temperature operation, reducing cooling requirements for the link. It is anticipated that this technology will be integrated into optical data links onboard avionics, sensor, and electronic warfare platforms.

WHEN

Contract Number: N68335-19-C-0100 **Ending on:** December 2, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Phase II Design Completed	Med	Simulations of detector structure suggests that devices will meet the specifications defined with the TPOC	3	January 2020
Initial Device Testing	Med	Fabricated balanced devices are validated to meet key metrics at wafer level.	3	August 2020
Module Testing	Med	Packaged devices are characterized and validated to meet parameter specifications in module.	4	December 2020
Production Run Complete	Med	Pilot production run complete (* contingent on option award)	4	September 2021

HOW

Projected Business Model: The business model for the multicore fiber photodiode module technology is to create a product line of detector modules which can be sold directly to the Department of Defense or DoD primes.

Company Objectives: We anticipate that the Navy SBIR/STTR Transition Program (STP) Forum will facilitate the development of a Technology Transition plan to define a clear path to the integration of this technology into analog photonic links onboard avionics, sensor, and electronic warfare platforms.

Potential Commercial Applications: This technology would be applicable to other analog photonic links, which are low-loss, lightweight alternatives to coaxial cable links. Analog photonic link applications include CATV distribution networks, radio over fiber for wireless systems, antenna remoting, and radio astronomy applications.

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