Department of the Navy SBIR/STTR Transition Program

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NAVAIR JSF18-947

Topic # N152-085
Rugged, Uncooled Monolithic Analog Optical Transmitter at 1 um
Freedom Photonics LLC

WHO

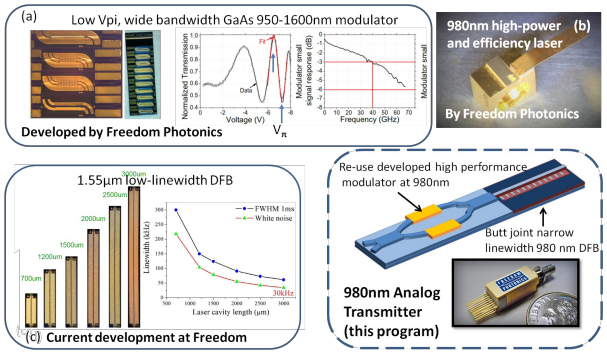
SYSCOM: NAVAIR

Sponsoring Program: JSF

Transition Target: JSF

TPOC:
(301)342-9115

Other transition opportunities: DOD Branches:
Microwave photonic links for radars
Antenna remoting and sensing,
Electronic warfare (airplanes, helicopters, ships, submarines)
Commercial Markets:
Telecommunications (5G standard)
Fiber-wireless Infrastructure
Sensing markets



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WHAT

Operational Need and Improvement: Avionic RF coaxial cable systems are bulky, heavy, have high RF loss over longer path lengths, and require heavy shielding for electro-magnetic interference (EMI). Optical fibers provide a nearly loss-less transmission medium for RF signals, are very lightweight, EMI immune with no shielding requirement. Replacing coaxial cables by RF photonic links promises drastic weight reduction and low-loss ultra-broadband RF signal transport. A ruggedized, wideband, highpower, optical laser transmitter with high linearity is a key component required for the realization of these links.

Specifications Required: One (1) micrometer GaAs optical sources can operate over an extended temperature range (>100 degrees C) at high efficiency (up to ~60%). This is currently not possible at 1550nm. The desired optical component is a GaAs-based integrated analog transmitter (laser and high-efficiency modulator), with an integrated optical source with low relative intensity noise (RIN) (<-160dBc/Hz), 100 milliwatt (mW) output power, uncooled operation over a minimum temperature range of -40 to +100 degrees C, and an integrated optical intensity modulator with low V-pi (<2V), packaged in a ruggedized package that has a height less than or equal to 5 mm, and a volume of <2.5 cubic centimeters.

Technology Developed: Fiber optic links using 1060nm lasers and photodiodes are ideal for Navy's deployment, since they provide for maximum link performance and relaxed cooling requirements. Freedom Photonics is using GaAs based laser and modulator technology, successfully demonstrated in Phase I, and a ruggedized, hermetic package design. This is a wafer-scale, low production cost, low size, weight and power solution.

Warfighter Value: Coaxial cable replacement by lightweight optical fiber RF photonic links, weight reduction, EMI immunity, broadband transmission of electronic signals for data acquisition, sensing and surveillance, very efficient links, ability to carry more payload and process more information.

WHEN

Contract Number: N68335-17-C-0259 **Ending on:** September 20, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Laser Demonstration	Med	Key specifications met on chip	4	February 2019
Transmitter Demonstration	Med	Key specifications met on chip	4	July 2019
Packaged Module Demonstration	Med	Key specifications met in package	4	September 2019

HOW

Projected Business Model: Freedom Photonics will search in Year 2 of this SBIR Phase II program for government and private investment to bring these products to market in Phase III.

Company Objectives: Freedom Photonics will design and manufacture integrated transmitters for specific and demanding requirements in terms of size, weight, performance, reliability, ruggedness, and cost. These transmitters will provide many advantages in terms of performance over existing transmitter technologies. During this technology development phase, we will maintain close relationships with the NAVAIR customer and potential prime DoD system integration companies. We will establish a transition plan to reach the highest technical and manufacturing readiness levels required to incorporate these receivers into deliverable systems.

Potential Commercial Applications: Commercial RF photonic systems and links (5G wireless phone, television, etc), sensing and surveillance systems; fiber-optic telecommunications and data communications networks; and high speed communications within a vehicle, such as airplanes, ships, or trains.

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