

Topic: N171-032

## Freedom Photonics LLC

Built-In Test Capability for WDM Avionic Systems

Freedom Photonics is developing a Built-In-Test (BIT) methodology and hardware for fiber-optic plant on F-35, which provides a cost-effective in-situ network health monitoring and installed network port position identification without degrading the ongoing communications on the same fiber link. Freedom Photonics is a manufacturer of unique and innovative photonic components, modules and subsystems. Our approach leverages our existing tunable swept laser technology, and provides a scalable solution for many network ports, while allowing for both BIT and network intelligence. To date, Freedom Photonics has developed and demonstrated the feasibility and the merit of a novel approach of incorporating O-Band gratings and O-Band interrogators into the existing planned architecture. Besides working with LMCO, we are looking for other customers for this technology and transition partners.

### Technology Category Alignment:

EO/IR Components for sensing, transmission and communication

Microelectronics and Nanoelectronics

Networks and Communications

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**SYSCOM:** NAVAIR

**Contract:** N68335-19-C-0159

**Booth:** 1113

**Room:** FST at WEST 2020

# Department of the Navy SBIR/STTR Transition Program

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NAVAIR JSF19-1007

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Built-In Test Capability for WDM Avionic Systems

Freedom Photonics LLC

## WHO

**SYSCOM:** NAVAIR

**Sponsoring Program:** F-35

**Transition Target:** F-35

**TPOC:**

(301)342-4122

**Other transition opportunities:** On-board of Navy aircraft (JSF, P-8), Unmanned Air Vehicles (UAVs) (X-47B, MQ-4C, MQ-8B and MQ-8C) and ships

Potential defense markets under consideration are:

- Fiber-optic communications systems on naval, air, space and ground defense platforms
- Electronic warfare systems

Government markets, other than Defense, to be addressed:

- NASA intra-satellite fiber-optic communications
- DHS data communications networks
- Intelligence community data communications networks

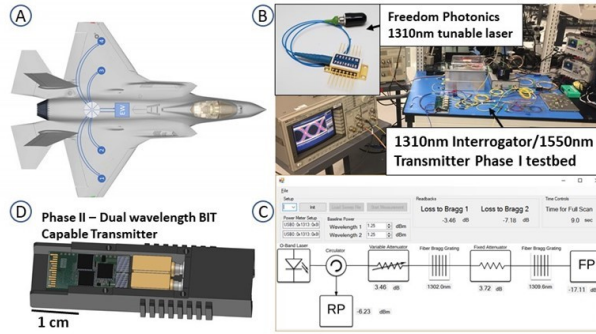


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## WHAT

**Operational Need and Improvement:** Wavelength division multiplexing (WDM) in optical fiber allows for tremendous increase in data transmission capacity using a fixed physical communication channel, and thus offers a path for upgradeability and future-proofing of avionic platforms. A WDM enabled fiber-optic payload integration network has been proposed for integration into the F-35 in future tech refresher opportunities. For this deployment, a cost effective and easy to incorporate solution for in situ network health monitoring is needed.

**Specifications Required:** Transmitter supporting 10 Gbps digital, and 20 GHz analog data transmission in C-band. Integrated with miniature 1310nm interrogator, capable of detecting a minimum of 30 different interfaces.

Package footprint shall be less than 100 cm<sup>2</sup> Threshold / 50 cm<sup>2</sup> Objective.

Mass: Package shall be less than 1,000 grams Threshold / 500 grams Objective. Power: Package shall require less than 12 W of electrical power.

**Technology Developed:** In this program, Freedom Photonics, in collaboration with Lockheed Martin (LMCO) as the final user and Prime Supplier responsible for JSF production and tech upgrades, is developing a Built-In-Test (BIT) methodology and corresponding hardware that can be used in conjunction with the WDM transceivers envisioned to be contained within the Weapons Interface Adapters (WIAs) residing on the payload side of the 1760 connector. Our approach allows for continuous link performance monitoring as well as installed position identification, without degrading the ongoing communications on the same link. The proposed compact solution for this program utilizes Freedom Photonics 1310nm widely tunable laser commercially available technology, in a ruggedized, compact BIT capable dual wavelength transmitter module.

**Warfighter Value:** Current military avionic platforms support point-to-point optical links. Physical changes to the cabling are required to add new equipment, leading to down-time of the platforms, and major upgrade costs.

Optical WDM deployment will enable future-proofing of the military aircraft, with high-bandwidth links available for current and future weapons systems. New systems will be easily added, efficiently and with minimal cost. Additionally, built-in-test will reduce maintenance complexity and down time.

## WHEN

**Contract Number:** N68335-19-C-0159

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Interrogator Laser Control Design	Med	Demonstrated control	TRL4	October 2019
BIT transmitter demonstration	Med	Confirmed operation	TRL 4	April 2020
Alpha module demonstration	High	Confirmed operation	TRL 4	March 2022

## HOW

**Projected Business Model:** Freedom Photonics intends to manufacture and supply these subsystems to the JSF program via a selected prime which will manufacture the WDM systems. We will search in Year 2 of this SBIR Phase II program for government and private investment to bring this product to market in Phase III.

**Company Objectives:** Freedom Photonics has previously developed a swept tunable laser source at 1550nm, for fiber sensing applications. This new derivative technology will add to our product portfolio, allowing us to expand our presence in this market. Our goal is to grow our business coming from swept tunable laser sources.

**Potential Commercial Applications:** This technology is directly applicable to the optical sensing market. FBG technology has made large advances in the past few years. There is now a requirement for the interrogator photonics technology to make equally large advances to reduce SWaP and improve ruggedness, while maintaining or enhancing performance. Achieving these interrogator advances and implementing it in this novel avionic BIT system is the goal of this program. By the time that Phase II is completed, in 2020, the addressable market for this new product will be a significant portion of the \$4.0bn indicated earlier; this is a very significant potential market of several hundred million dollars.

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