Topic: N171-032

Intelligent Fiber Optic Systems Corporation

Intelligent Fiber-Optic Network with Real Time Built-in Test Performance Monitoring for Prognostics and Diagnostics
IFOS' tagging technology leverages growth-provision fiber links based on the emerging MIL-1760 connector standard. Powered by an optical interrogator based on miniature and robust photonic integrated circuits that enables small form-factor, it easily integrates with military aviation platforms. Scalable network configurability ensures passive, continuous monitoring does not interfere with network communications. IFOS, a leading developer of photonic sensing solutions, is targeting advanced fighter aircraft and has engaged the Prime Contractors. To date IFOS has demonstrated concept feasibility in the laboratory and is now fabricating the flight-worthy photonic integrated circuit (PIC)-based optical interrogator to power the network built-in-test solution. The IFOS technology is seen as a near-term upgrade that will enable expanded mission operability, enhanced prognostics and monitoring of deployed aircraft, and greater warfighter confidence in this aircraft and other platforms.

Technology Category Alignment:

Electronics Integration
Air Platforms
Networks and Communications
Sensors

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SYSCOM: NAVAIR
Contract: N68335-19-C-0115
Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0115
Tech Talk: https://atsi.adobeconnect.com/p3snieref2nz/

Department of the Navy SBIR/STTR Transition Program

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NAVAIR

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WHO

SYSCOM: NAVAIR

Sponsoring Program: F-35, Joint Strike Fighter (JSF)

Transition Target: Future generation analog/RF-over-Fiber (radio frequency) and digital multiplexed communication and electronic warfare systems

TPOC:
(301)342-4122

Other transition opportunities: Improved and/or dedicated processing for supporting advanced mission capabilities could be feasibly incorporated into AF's store-station-mounted devices (weapons, sensors, or pods). This will enable taking timely advantage of emerging weapon and sensor technology advancements over the platform lifespan, by alleviating the need for highly expensive and operationally disruptive platform modifications. All military air platforms will benefit from the results of this project.



https://news.usni.org/2019/02/28/navy-declares-initial-operational-capability-for-f-35c-joint-strike-fighter

Notes: IFOS will leverage their leading capabilities in Si and InP fabrication to enhance network node size, weight, power and cost (SWaP-C) through integration of Si and InP chipsets. IFOS teams with leading Silicon Valley contract manufacturers and has their own 10,000 sq ft. facilities in Silicon Valley near Stanford University. Established product lines include: I*Sense®, R*Sense®, D*Sense™, G*Sense™, H*Sense™, E*Sense™, FyberSpace™.

WHAT

Operational Need and Improvement: Wavelength division multiplexing photonics technology has been demonstrated for transmitting multiple digital data and analog/RF optical signals through military-grade single mode fiber optic cable and connectors. However, the disparate digital and analog/RF signal types and power levels preclude transmitting more than a few digital and analog/RF signals through the same 16 AWG fiber optic connector terminus. The MIL-DTL-38999/31 connector is designed for stores breakaway fail safe applications. Exposure of 16 AWG fiber optic termini to ambient conditions can result in link failure. Fiber optic built-in test technology can be applied to detect and isolate fiber optic connector failure at the terminus-to-terminus interface.

Specifications Required: The interface design must fit into a 16 AWG military aircraft connector cavity and be qualifiable for 25-year use in an operational environment using MIL-PRF-64266. The interface must be capable of simultaneously transmitting no less than four 0 dBm 10 Gb/s digital optical signals with crosstalk, return loss, insertion loss and optical modulation amplitude/extinction ratio at bit error rates commensurate with Ethernet and FibreChannel protocol standards. The interface must also be capable of simultaneously transmitting no less than four 23 dBm DC to 45 GHz RF-over-Fiber optical signals with crosstalk, return loss, insertion loss and linearity commensurate with single and balanced RF-over-Fiber receiver performance requirements. The aircraft sensor and stores fiber optic connector interface must operate over a temperature range of -65 to 165 degrees Celsius, and maintain optical alignment upon exposure to air platform environments.

Technology Developed: Innovative, miniaturized, multifunctional optical network node chipsets that include all-optical spectral tagging (AOST), based on fiber Bragg gratings (FBGs), for network built-in-test (BIT). Aerospace optical networks will be enhanced by implementation of IFOS' innovations incorporated in two ASPICs called Tag*Sense™ and OptiNode™. Tag*Sense™ includes AOST for real-time network-wide BIT capability using FBGs. OptiNode™ includes key network functionalities like arrayed waveguide grating (AWG).

Warfighter Value: IFOS' distributed BIT-integrated optical networking approach will enable greater reliability and implementation of highly advanced processing capabilities using integrated photonics.

WHEN

Contract Number: N68335-19-C-0115 **Ending on:** December 13, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Photonic integrated circuit (PIC) chipsets fabricated and packaged	Med	PIC chipsets meet performance requirements specified for application	3	March 2020
Aviation optical network cable/links fabricated with embedded sensors	Med	Optical sensor-embedded cable/links qualified with reliability est partner	4	August 2020
System integrated with prime collaborator testbed	Med	System demonstrated in prime technology integrator testbed	5	August 2020
Transition plan finalized with prime collaborator(s)	Med	Detailed technology insertion plan agreed, including timelines and business arrangement	5	May 2021

HOW

Projected Business Model: Intelligent Fiber Optic Systems Corporation (IFOS) is a silicon valley based pioneer of advanced sensing system solutions and products using fiber optics for the measurement of physical, chemical and biological parameters derived from the interaction of light with matter. Pressures to 1 kBar, temperatures to 1000°C, angular rates, strains as small as sub micro strain and as large as 10,000 micro-strain and a number of other parameters can be measured accurately at MHz sampling rates simultaneously across large numbers of sensors in the extreme environments of space, energy and the human body. IFOS fiber optic interrogators and fiber optic gyroscopes are made to withstand the harsh environment of space and are used for structural health monitoring, prognostics, NDT and other applications requiring access to difficult areas, electromagnetic interference immunity, low size, weight and power packaging.

Company Objectives: IFOS seeks to meet with prime systems integrators to better understand customer requirements for synergistic applications across Navy and DoD platforms. The IFOS technology developed in this program is applicable to aviation, naval, and land-based mission systems.

Potential Commercial Applications: Applicable to wavelength division multiplexing (WDM) digital and RF-over-Fiber links offering real-time embedded systems such as space vehicles; transport vehicles such as automobiles and commercial ships; and other harsh environment applications.

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