

Topic: N171-031

## Phase Sensitive Innovations, Inc.

1 Micron Fiber Optic Receiver for Mil-Aero Environment

RF photonic links operating at the near-IR offer improved signal fidelity at shorter ranges compared to telecom wavelengths. The enabling technology is the photodetector at the link's back-end, which is capable of high-power handling at mmW frequencies despite its small size, light weight, and environmental robustness. Vehicular systems that are SWaP-restricted, but demand bandwidth for applications such as imaging, radar, and sensing, are ideally suited to replace bulky cables with flexible optical fibers. PSI has successfully prototyped this photodetector technology at both the component and system level, and has spent the past decade streamlining our core competency of high-speed modulator and photodetector production. Our goal is to transition this technology to a manufacturable state to provide integration into government and prime contractor short-range photonic links.

### Technology Category Alignment:

EO/IR Components for sensing, transmission and communication

Fixed Wing Vehicles (includes UAS)

Electro-Optical/Infrared (EO/IR)

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**SYSCOM:** NAVAIR

**Contract:** N68335-19-C-0099

Department of the Navy SBIR/STTR Transition Program

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NAVAIR JSF19-1008

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WHO

SYSCOM: NAVAIR

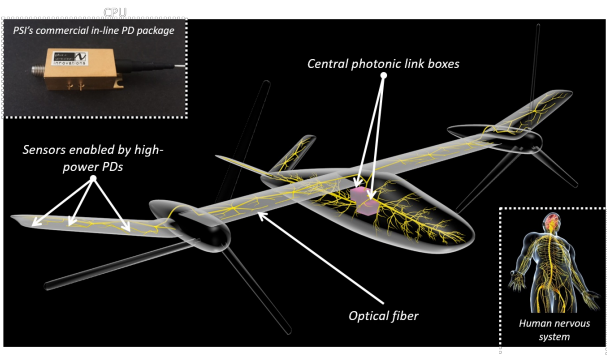
Sponsoring Program:

Transition Target: JSF

TPOC:

(301)342-4122

Other transition opportunities: MQ-25, EA-18G, V-22



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WHAT

**Operational Need and Improvement:** Modern trends toward increasing RF/analog bandwidth and frequency requirements are often complicated by significant increases in system cost and size, weight, and power (C-SWaP). Replacing conventional coaxial cables with fiber-optic links can improve these metrics, but requires the development of a high-power photodetectors (PDs) to maintain signal fidelity.

**Specifications Required:** For low-noise figure analog photonic links, the power handling of the photodetector is of prime importance. PSI's high-power near-IR photodetectors are capability of outputting over 15 dBm of RF output power at 45 GHz, 0.6 A/W responsivity, and third-order intercept point (OIP3) greater than 30 dBm. Additionally, for mil-aero environments, the package is hermetically sealed into a form-factor less than 2.5 cm^3. The photo-receiver module is capable of withstanding temperature cycling from -40 °C to 100 °C, and the expected mechanical shock from aircraft vibration.

**Technology Developed:** PSI has developed a new type of uni-traveling carrier (UTC) photodetector for operation at an optical wavelength of 1 μm, in addition to our current commercial line of C-band (1530 nm - 1565 nm) PDs. Both singular and balanced configuration photo-receiver modules are being developed for high-power operation in mil-aero environments. This allows the end-user to determine the best photo-receiver choice for their desired RF photonic link configuration.

**Warfighter Value:** RF photonic links with gain and low-noise figure have the potential to replace vast swathes of traditional RF cabling in new craft. This will allow for not only the integration of more on-board systems, but access to new bands of frequency for next generation radar, imaging, and communications.

WHEN

Contract Number: N68335-19-C-0099    Ending on: December 11, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Meeting required photodiode chip specifications	Low	Performance metrics outlined in solicitation	3	September 2019
Packaging of singular and balanced photodetectors	Med	RF photonic link demonstration	4	December 2019
Reliability testing and yield improvements	Med	Manufacturing analysis	5	December 2020

HOW

**Projected Business Model:** PSI has already begun low rate initial production of the photodetector modules. Within the next 2 years we intend to scale production to full scale after transitioning our fabrication and packaging processes to a new, larger manufacturing facility.

**Company Objectives:** PSI wishes to improve reliability and expand production of our photodetector products, with the goal of becoming a leading commercial provider of high-power photodetectors for analog photonic link applications.

**Potential Commercial Applications:** Potential commercial applications include avionics, on-board autonomous vehicle sensors, medical imaging, and tomography.