

# Department of the Navy SBIR/STTR Transition Program

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NAVSEA #18-551

Topic # N161-034

Radio Frequency over Fiber (RFoF) for the Next Generation Submarine Electronic Warfare (EW) System

Photonic Systems, Inc.

## WHO

**SYSCOM:** NAVSEA

**Sponsoring Program:** PMS 435, Sub Electromagnetic Systems

**Transition Target:** AN/BLQ-10 Electronic Support Measures (ESM) and AN/BVS-1 Photonics Mast

**TPOC:**

(401)832-5610

**Other transition opportunities:** Any DoD system using an antenna for RF/microwave signal reception could improve system performance and capability using this high performance linearized RF over fiber (RFoF) link technology. Potential transition programs include the AN/SLQ-32 Electronic Warfare (EW) System Upgrade and the Integrated Topside (InTop) Innovative Naval Prototype program.



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## WHAT

**Operational Need and Improvement:** Due to limitations of copper interconnect technology, the DoN is looking for improved RF over fiber (RFoF) technologies for many applications including the next generation of non-penetrating modular mast concepts for future submarine masts. The improved RFoF link performance developed in the SBIR will also open up new opportunities for tethered RF antenna sets that will greatly improve the overall situational awareness of a submarine.

**Specifications Required:** The improved performance linearized RFoF link will provide a noise figures of less than 10 dB across extremely broad band instantaneous bandwidths (goal is > 20 GHz), with multi-tone spur free dynamic ranges in excess of 80 dB in 4 GHz instantaneous bandwidths.

**Technology Developed:** A linearization circuit integrated into a high-performance RFoF link to provide radically improved RF performance over current electrical-to-optical conversion capabilities. The linearized RFoF link will be used in place of high RF signal loss, heavy, and bulky copper cables traditionally used in Electronic Warfare (EW), Intelligence Surveillance Reconnaissance (ISR), Signal Intelligence (SIGINT), sensor, and communication systems.

**Warfighter Value:** Fiber optic cable is much lighter, extremely flexible, and immune to electromagnetic interference (EMI) and electromagnetic pulse (EMP) damage. Additionally, Navy and other DoD system developers desire to use RFoF links as they are extremely wideband, provide exceptionally low RF/microwave signal loss, and have the capability of carrying multiple RF signals over a single fiber. The linearized RFoF link will greatly simplify the RF front ends of current and future DoD systems, enable new capabilities, reduce overall cost, and improve system reliability.

## WHEN

**Contract Number:** N00178-17-C-8007

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Demonstrate feasibility through modeling and analysis	N/A	Model validates the analytical predictions	2	July 2017
Critical components identified	Med	Selected components used in prototype design	3	April 2018
Prototype linearizing circuit	High	Lab testing demonstrating components will work together	4	June 2018
Integrated linearizing circuit	High	Lab testing verifies projected circuit performance	5	August 2018
Linearized RFoF link	Med	RFoF link test verifying improved RF performance	6	September 2018

## HOW

**Projected Business Model:** Photonic Systems Inc. (PSI) provides innovative RF, microwave, and photonic products for defense, aerospace, and telecommunications markets. For almost 20 years, PSI has developed and manufactured high-performance RFoF component, modules, and subsystem products marketed and sold to both defense and commercial customers. PSI intends to integrate the high-performance linearized RFoF link into its existing portfolio of products.

**Company Objectives:** PSI is seeking Government and DoD equipment manufacturers to support the transition of this technology into systems.

**Potential Commercial Applications:** High-performance remote antenna links for wireless infrastructure as well as satellite and radio astronomy ground stations.

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