

WHO

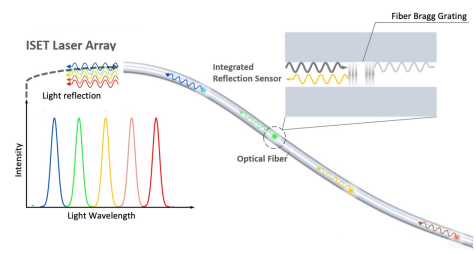
SYSCOM: ONR
Sponsoring Program: None
Transition Target: TBD

TPOC: Blake Simpkins
blake.s.simpkins.civ@us.navy.mil

Other Transition Opportunities: All Naval and DoD platforms including ships, aircraft and land vehicles.

Notes: New Capability. A "Low Noise Tunable Laser System", which is just one part of a larger "Intelligent, Fiber Optic Sensor System for System Health Management (SHM)" of Naval Platforms. With a few AI-controlled tunable lasers and hundreds of sensors and actuators, a health management system on a fiber provides for total platform coverage, with no ship electrical power requirements, and minimal man-in-the-loop requirements.

Axalume was established in 2017 with a mission to Develop Semiconductor Lasers & Electronic-Photonic Integrated Circuits. Background:
 - Spinout from Oracle/Sun Microsystems
 - SBIR contracts with US Navy, DARPA, and NSF
 - Co-operative development grant with ARPA-E (DoE)
 - 6 US patents granted (2 additional pending)
 - Exclusive license to 200+ patents on photonics from Oracle



Axalume SBIR proposal

WHAT

- Operational Need and Improvement:**
1. To monitor loads and temperature continuously from DC to MHz frequencies cycle-by-cycle.
 2. To locate impact events and hot spots, to track damage initiation and progression, to help pre-position parts and optimize time and place of maintenance actions.
 3. To triangulate high-fatigue areas, impact damage events, cracking, delamination, fretting.
 4. To monitor the performance of repairs, composite patches, welded joints.
 5. To lower the cost of ownership and accelerate the insertion of new materials, structures, and parts.

Specifications Required: Multiple low-cost, low-Space Weight and Power (SWaP) tunable lasers and controllers monitoring 100's of sensors in a distributed fiber optic sensor system. This laser system will be a tunable, high sensitivity and low noise (Signal/Noise > 100 femto-strain/sqrt (Hz) in the frequency range from 10 kHz – 1 MHz). The system will provide small SWaP, unobtrusive technology with active-passive monitoring and will advance the state of the art in Fiber Optic (FO) sensors.

Technology Developed: Intelligent laser system for powering, sensing, and communicating between a centralized health management unit and acoustic emissions sensors on a platform-wide distributed fiber optic network for Condition Based Maintenance Plus (CBM) of Naval platforms.

Warfighter Value: The Intelligent Laser System will be a crucial part of a fiber optic based CBM approach and will reduce or eliminate the need for the complex, wired, and electrically powered health monitoring systems currently in use. A laser FO sensor CBM will provide a reliable, durable and cost-effective technology that can monitor the degradation of weapon systems at all length scales and in real-time for the entire operational life of the platform. It will enable cost effective, reliable, predictive en-route maintenance and lower the Navy's overall operating and maintenance costs.

WHEN

Contract Number: N68335-22-C-0834 **Ending on:** Feb 02, 2024

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Intelligent low-SWaP multiple laser system	Low	Capability demonstration with sensitivity measurements	4	1st QTR FY24
Intelligent low-SWaP multiple laser system Tunable lasers interrogating multiple distributed fiber sensors on a single fiber	Medium	Capability demonstration with sensitivity measurements	4	2nd QTR FY24

HOW

Projected Business Model: Axalume will consider a variety of business opportunities including direct sales and/or working with a Navy-designated prime.

Company Objectives: To accelerate photonic sensing and interconnect adoption with differentiated lasers and optical sub-systems.

Potential Commercial Applications: Widely-tunable lasers for communications, structural health monitoring, and medical sensing applications.