

Department of the Navy SBIR/STTR Transition Program

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NAVAIR 2016-850

Topic # N141-005

Ruggedized Narrow-Linewidth 1550nm Laser

Orbits Lightwave, Inc.

WHO

SYSCOM: NAVAIR

Sponsoring Program: F-35

Transition Target: Coherent laser applications

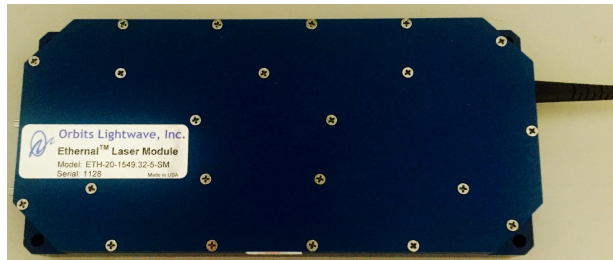
TPOC:

(301)342-9101

Other transition opportunities:

High power and low noise Laser oscillator for: Microwave Photonics Links, Acoustic Sensors, Coherent LIDAR and seed laser for high power 1-micron lasers.

Notes: By the end of Phase II, the laser prototype for the F-35 program will be TRL 3. However, other photonics applications may accept somewhat less stringent size requirements. For such systems, the Orbits laser technology is already at TRL 5.



Current commercial Orbits laser package (16.8 x 8.2 x 2.4 cm) Copyright 2016, Orbits Lightwave Inc.

WHAT

Operational Need and Improvement: Microwave photonics links require high dynamic range and low noise floor. The current Distributed Feedback (DFB) laser technology has large Relative Intensity Noise (RIN) at microwave frequencies. This fundamentally limits the performance of sensor systems. Our Virtual Ring laser oscillators provide a clean shot noise limited microwave spectrum and hence longer range for warfighters.

Specifications Required: The laser source is required to have an ultra-narrow linewidth of <1 kHz, wavelength in the range of 1545 to 1560 nm, and output powers greater than 100 mW. The RIN spectrum must be -175 dBc/Hz from 500 MHz to 40 GHz, -155 dBc/Hz from 100 – 500 MHz, and -110 dBc/Hz at frequencies below 100 MHz. The laser will be housed in a compact and ruggedized package with a volume <100 cc.

Technology Developed: Orbits' offers ultra-stable, low noise, high power fiber lasers in the 1060nm and 1550nm wavelength ranges; however, upgrades of some components are needed to fully achieve NAVAIR's requirements and maintain full domestic sourcing. Orbits' introduced "slow light" and its proprietary Virtual Ring™ laser cavity in its Eternal™ laser, a novel architecture that allows travelling wave operation in a compact all-fiber laser cavity. The Virtual Ring™ design enables "slowing" the intra-cavity light. The "slower" light has extended the laser cavity lifetime by a factor of 30 and quenched the laser AM and FM noise to unprecedented levels. Another important effect of the "slow light" is reduction of the low frequency RIN, by close to 6 orders of magnitude, down to the shot noise level.

Warfighter Value: Our laser shot noise limited RIN can increase dynamic range by at least 1-2 order of magnitude and hence increases warfighters effective range. Orbits lasers also have the highest power and lowest phase noise that allows better detection sensitivity for acoustic sensing and have 2-3 orders of magnitude better signal-to-noise ratio which is important in amplified laser systems as well as narrow linewidth and low noise that increases the range and the target velocity resolution for LIDAR systems.

WHEN

Contract Number: N68335-16-C-0052 **Ending on:** October 30, 2017

Milestone	Risk Level	Measure of Success	Ending TRL	Date
compact fiber laser oscillator	Low	High stability under adverse environmental conditions	4	December 2016
complete first integrated package 12.5 mm high	Med	Prototype conforming to power and noise spec	5	May 2017
<5 mm tall pump laser	High	High coupling efficiency	3	July 2017
Complete 5 mm tall package	High	Conforming to specs	3	September 2016

HOW

Projected Business Model: Orbits is planning to manufacture the fiber laser oscillator and associated electronics in house. Orbits may produce the low profile pump laser in house or in collaboration with other US 976 nm pump laser manufacturers.

Company Objectives: Communicate with prime contractors and program managers to solicit interest in our laser unique capabilities and transitioning your laser in existing or future next generation programs.

Potential Commercial Applications: Acoustic sensing for security and oil exploration, coherent LIDAR and pump lasers for quantum sources.

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