Department of the Navy SBIR/STTR Transition Program

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Topic # N181-016

Two-Dimensional Surface Emitting Mid-Wave Infrared (MWIR) Quantum Cascade Laser Arrays for High-Power Applications

Pendar Technologies, LLC

WHO

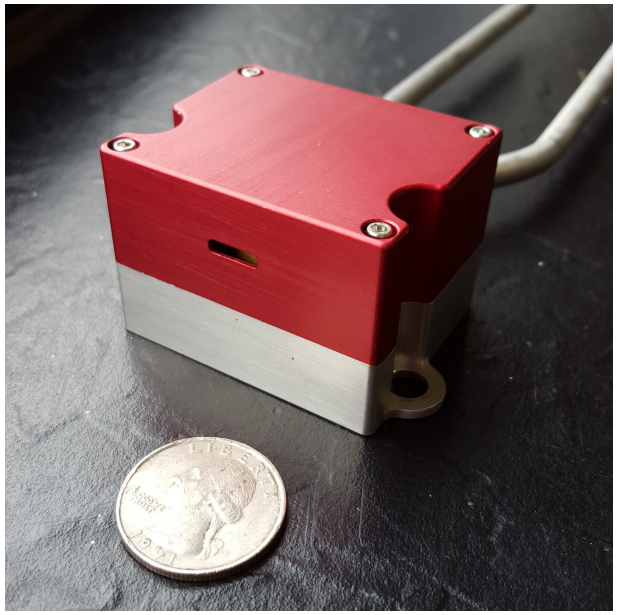
SYSCOM: NAVAIR

Sponsoring Program: PMA 272 Tactical Aircraft Protection Systems

Transition Target: Infrared Countermeasures (IRCM)

TPOC:
(760)939-0239

Other transition opportunities: Mid-wave and long-wave infrared (MWIR, LWIR) lasers coupled to imaging systems for military, law enforcement, and civilian applications including; target acquisition, situational awareness (infrared scene illumination), industrial process control, remote sensing, obstacle avoidance, and selective etching, cutting, and marking of materials.



High Power mid-wave infrared (MWIR) laser modules developed by Pendar Technologies.

WHAT

Operational Need and Improvement: This advance is aimed at the the realization of a monolithic, high power laser source based on a beam-combined surface-emitting Quantum Cascade Laser (QCL) array. The benefits of this program include lower production costs, higher power on target, improved reliability, and simple integration.

Specifications Required: The main goal of this SBIR topic is to develop a MWIR QCL source based on a cost-effective architecture similar to that of high-power, two-dimensional VCSEL arrays.
- Single, monolithic chip architecture.
- Power levels exceeding 200 Watts during CW operation.
- Implement innovative thermal management solutions to eliminate the need for active water cooling.
- Develop beam combining scheme maximizing the brightness of the source.

Technology Developed: - Surface emission (SE) with near-diffraction limited beam-profile has been experimentally demonstrated.
- Narrow-ridge, high-yield buried heterostructure process compatible with surface emission has been developed.
- Multi-Watt output power of Fabry-Perot arrays demonstrated.

Warfighter Value: - High-power MWIR QCL emitter enable effective infrared countermeasure systems in a low SWaP package.
- Narrow BH QCLs have inherently stable and excellent beam quality without beamsteering, enabling long distance propagation.
- Surface emission capability results in improved reliability and enables low-cost testing and burn-in, resulting in significant cost reduction.
- Affordable, high power MIWR QCL source are a game changer for many military applications.

WHEN

Contract Number: N68936-19-C-0052

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Monolithic High Power QCL Arrays	Low	Output Power	6	December 2022
Beam-combined High Power Arrays	Med	Brightness	5	December 2022
Surface-Emitting Arrays	High	Brightness, Reliability	4	December 2022

HOW

Projected Business Model: There are aspects of the countermeasures technology chain that drive Pendar toward collaborative supply relationship with one or more Primes. Pendar alone cannot furnish a fully integrated IRCM system, including all steering and electronics. Pendar is actively pursuing opportunities to transition laser prototypes emerging from this and other SBIR/STTRs into next generation systems. Additionally, advances made in this program will more broadly benefit the commercialization of Pendar's IR platform, including spectroscopic instrumentation.

Company Objectives: To address the different markets in need for affordable, compact mid-infrared sources, Pendar has developed several infrared platforms which all share and leverage our proprietary QCL designs, beam-combining solutions, and system innovations:
1. Broadly tunable single-mode laser array as general spectroscopy tool.
2. Compact, high performance IR spectrometers and sensors..
3. Reliable high-power lasers and laser bars for IRCM, and other DoD applications.

Potential Commercial Applications: Pendar has developed several proprietary mid-infrared QCL platforms, which have unique features such as broadband spectral coverage, arrays with high optical power through power scaling, excellent beam-quality through rugged wavelength beam-combining, low laser noise , fast tuning speed, and low SWaP due to monolithic nature of laser source. These advantages enable a host of applications in IRCM, spectroscopy, medical device, pharma, laser processing, and scientific applications.

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