DoD SBIR / STTR
DETAILS - Topics Search Results

Proposals Accepted: February 23, 2010 - March 24, 2010
Program: STTR
Topic Number: A10a-T007 (Army)
Title: Coherent Beam Combining of Mid-IR Lasers
Research & Technical Areas: Sensors

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Acquisition Program:

Objective: To develop robust, high-efficiency mid-infrared lasers based laser beam combining of quantum cascade or other mid-IR laser diodes. Power outputs for room temperature continuous wave operation of several to a hundred watts are sought in the 3-5 micron and 8-12 micron bands for IRCM (Infrared Countermeasures) and stand-off sensing needs for the military.

Description: DARPA MTO has a high power quantum cascade laser program (QCLs) in the 4-5 micron band for IR Countermeasures (also called, IRCM). The Army supplemented this by starting work on improved QCLs in the 3-4 and 8-12 micron regimes also. Another aspect of this work is beam combining whereby several (or even hundreds) of QCLs are phase locked to create an extraordinarily high power beam with a single tranverse mode. Such high power beams could be used in multiple military applications which include IRCM systems, free-space optical communications, tracking and surveillance including imaging laser radar, and laser based chemical sensing. In such systems of the future cost and power scaling are important as well as size of the system. Thus, solutions based on integrated chip-level and even passive approaches are desired. Cost is definitely related to simplicity, and active phase locking approaches (with feedback) tend to be complex and have seen little success to date; however, active phase locking is potentially advantageous for tracking and scanning scenarios through electronic beam steering.

PHASE I: Demonstrate design of beam combined high performance mid-IR lasers arrays based on QCLs or other semiconductor lasers with power output of 3W or more (i.e. greater than state-of-the-art output power over single lasers with comparable wall-plug efficiencies). The wavelengths of interest include both the MWIR (3-5 microns) and LWIR

(8-12 microns). Prototype designs should be made at one wavelength with potential application to another regime, i.e. start at one wavelength and discuss applicability to other wavelengths.

PHASE II: Develop room temperature high efficiency beam combined laser arrays in the MW/LWIR (wall-plug efficiency > 15% for beam combined lasers) with powers greater than 3W for usable single facet output. Scaling of the power for 10 – 100W should be studied and initial attempts made for achieving > 10W on a single integrated platform within the laser chip. MOCVD (Metal Organic Chemical Vapor Deposition) or other manufacturable growth and fabrication process should be used in order to produce low-cost units at high volume for multiple applications.

PHASE III: Commercialize beam combined arrays and develop full manufacturing process working with system integrators for various wavelengths and packages to meet military needs. Thermal management and power scalability should be considered here as well as wall-plug efficiency for single lasers. Dual use (civilian) applications include free-space optical communications and biohazard monitoring.

References: 1. S. Li and D. Botez, "Analysis of 2-D Surface-Emitting ROW-DFB Semiconductor Lasers for High-Power Single-Mode Operation," IEEE Journal of Quantum Electronics, Vol. 43, No. 8, August 2007.

Keywords: mid-infrared, lasers, phase-locking

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Questions and Answers:

No questions posed on this topic at this time

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New Question: