Department of the Navy SBIR/STTR Transition Program
DISTRIBUTION STATEMENT A. Approved for public release. Distribution is unlimited.
ONR Approval #43-3252-17

Topic # N142-115

High-Performance Deformable Mirror Technology Test and Evaluation Platform
Advanced Systems & Technologies, Inc.

WHO

SYSCOM: ONR

Sponsoring Program: PMS405

Transition Target: NAVY Tactical Laser Weapon System (T-LaWS) with its derivative Ground-Based Air Defense Directed Energy on-The-Move for U.S. Marine Corps

TPOC:
Mr. Peter Morrison
peter.a.morrison@navy.mil

Other transition opportunities: Hel-MD - US Army High Energy Laser Mobile Demonstrator;
Shield - US Air Force; Long range
imaging - US Custom and Border Protection

Notes: MIEDAS's primary role is in characterizing and validating the performance of the Deformable Mirror DM) - a key element of the Laser Beam Control (LBC) module of T-LaWS, to enhance power density and beam pointing on the target. Typically this is achieved by using the Adaptive Optics system for LBC module. One of the key elements of Adaptive Optics system is the DM - the optical element with adjustable/controllable topography of the front surface.

MIEDAS – a multi-gadget system for real-time evaluation of the performance of Deformable Mirrors (Copyright AS&T, 2015).
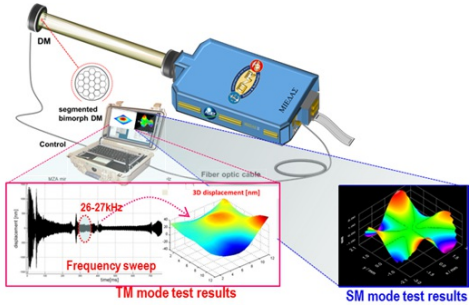
WHAT

Operational Need and Improvement: System for Deformable Mirror performance characterization and evaluation is required to enhance and optimize operation of the Adaptive Optics module that is one of the key elements of the Laser Beam Control sub-system of the Tactical Laser Weapon System of various configurations and implementations

Specifications Required: As required by the SBIR topic the test system should allow to measure the following parameters of the deformable mirror with the diameter in excess of 3": strokes > 10 micron with 0.01 micron precision, at operating speeds up to 100 kHz at displacement rates higher than 20 nm/μs (20 mm/s), measure in-plane and out-of-plane surface displacement, with spatial resolution < 500 micron, detect full aperture sag up to 25 micron with a pixel stroke precision < 0.01 micron and to do this on diffuse or mirror like surfaces with reflectivity from 0.5% to 100% including glass/fused silica, metal or dielectric coated mirrors.

Technology Developed: At the core of MIEDAS is the AS&T's proprietary sensor technology for rapid full-field imaging vibrometry merged with a high-speed Shack Hartman wavefront sensor. Fusion of the orthogonal data taken by these two essentially different types of sensors enables the distinctive capabilities in validating the temporal and spatial variations and response to actuation of the DM's topography with the Specification above outlined.

Warfighter Value: Ability to perform quantitative and qualitative analysis of the performance of Deformable Mirror serves to identify an optical element most suitable for the Beam Control module of the T-LaWS. High-quality deformable mirror allows to enhance T-LAWS operational efficiency, maximize power density, aiming accuracy and position stability of the laser beam on a remote image-resolved target

WHEN

Contract Number: N00014-16-C-1049 **Ending on:** December 31, 1969

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Complete MIEDAS design	N/A	MIEDAS design is established	2	January 2018
Demonstrate MIEDAS feasibility	N/A	MIEDAS feasibility study completed	4	December 2018
MIEDAS pre-prototype validation	Low	Integration of MIEDAS	5	December 2019
ML4 MIEDAS in house tests	Low	Proof of performance	6	June 2020
ML5 Full-scale MIEDAS validation	Low	System delivered to ONR	7	December 2021

HOW

Projected Business Model: AS&T is a high-tech company with a mission to develop and commercialize laser and opto-electronic-based technologies. Within this mission AS&T strategy includes all phases of system development from its start to completion. Developed and validated commercial version of the system will be distributed directly or through the partnership with relevant venders associated with the specific field. Current AS&T's portfolio includes:
* Wireless Identification and Tracking system. Area of applications: tracking items in industrial and commercial areas
* Conformal imaging vibrometer (patented). Examples of applications include, but not limited to: structural vibration measurements and analysis, non-destructive testing, characterization of MEMS-like devices, detection and validation of aero-elastic effects, others.
* Laser Imaging Amplifiers (patented)

Company Objectives: The AS&T objective is to perform a comprehensive simulation of the MIEDAS design and performance, prototype its working module and perform extensive laboratory validation of its operation with various types of mirrors, including MEMS-based arrays, bimorph and thin-plate membrane that are most commonly used in Adaptive Optics systems. Once the lab operation is proven to work AS&T and its will establish and present to ONR and other interested parties the detailed plan for MIEDAS upgrade to the field-evaluation level, concluding the program with the field test and demonstration

Potential Commercial Applications: As a key elements of the Adaptive Optics Systems, Deformable Mirrors are used in: (i) laser scanning ophthalmology and eye surgery; (ii) biomedical applications, (iii) astronomy, (iv) military/security surveillance, including border patrol; (v) communications and sensing, and (vi) manufacturing system

Contact: Vladimir Markov, President
vmarkov@asatechinc.com   949-310-1789, ext. 226