

# Transition

An example of Air Force supported SBIR/STTR technology that has been transitioned into an Air Force or other DoD system or subsystem or used by Air Force test ranges and facilities or maintenance depots.

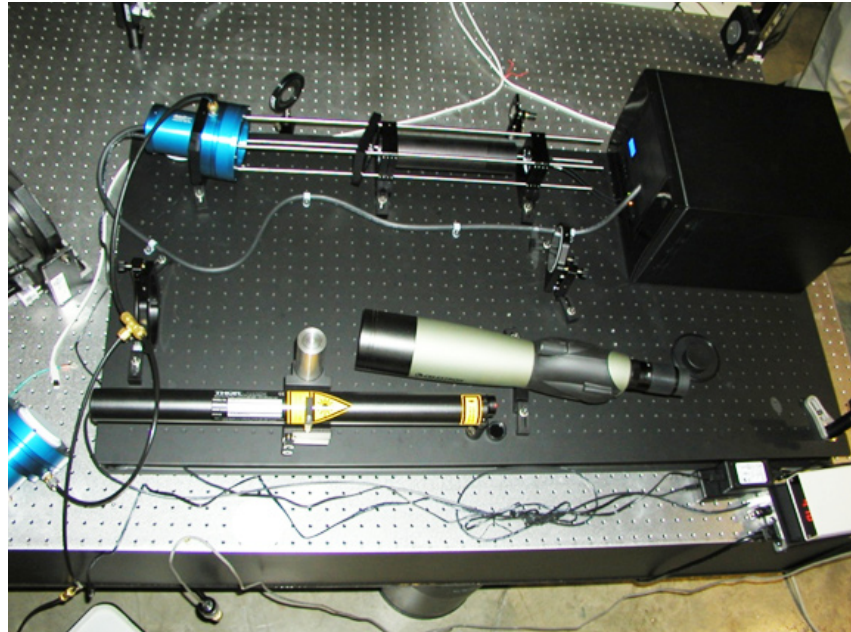
**SBIR Topic Number:**  
AF05-003

**SBIR Title:**  
High-Resolution  
Wide-Dynamic-Range  
MEMS-Based  
Closed-Loop  
Adaptive Optics System

**Contract Number:**  
FA9451-06-C-0027

**SBIR Company Name:**  
AgilOptics Inc.  
Albuquerque, NM

**Technical Project Office:**  
AFRL Directed Energy  
Directorate, Kirtland  
AFB, NM



**The Analog Beam Control System (ABCS) in a U.S. Navy Laboratory**

## Closed-Loop Adaptive Optics System

- The Air Force needs a closed-loop adaptive optics system for wide-dynamic range aberration control with high-resolution Micromachined Electro-Mechanical Systems (MEMS) mirrors
- The ABCS system is a first-of-a-kind adaptive optics system which employs analog (as opposed to digital) controls, permitting very fast operation
- AgilOptics developed the Analog Beam Control System (ABCS) which is now used in a military facility
- The ABCS could be further developed into a very lightweight, rugged, compact, low cost and low power-consuming Adaptive Optic system for additional military applications

Commercialization Pilot  
Program Series

RD08-0325

**A**

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## Air Force Requirement

There is an emerging generation of deformable mirror (DM) technologies based on Micromachined Electro-Mechanical Systems (MEMS) manufacturing techniques resulting in DM components with capabilities exceeding those of conventional DMs while, at the same time, reducing cost, weight, and electrical power requirements. Large throw, high-pixel-number MEMS DMs are an enabling technology that may facilitate the development of optical systems with inherently large time-dependent aberrations or high-spatial-frequency aberrations. These include systems based on large lightweight primary mirrors.

The Air Force needs a closed-loop adaptive optics system for wide-dynamic range aberration control with high-resolution MEMS mirrors.

## SBIR Technology

In this SBIR project, AgilOptics built and demonstrated a moiré Wave-Front Sensor (MWFS) test-bed to evaluate the MWFS design and to extend the design for use in a novel all-analog closed-loop Adaptive Optic (AO) system coupled with a MEMS Membrane Deformable Mirror (MDM) corrector. Subsequently, under SBIR enhancement funding and based on the lessons learned under the early Phase II work, a Distorted Grating Curvature Sensor (DGCS) was substituted for the moiré wavefront sensor, and a new test-bed was built and tested to evaluate the advanced Analog Beam Control System (ABCS) with greatly improved performance.

The ABCS prototype was extremely successful and demonstrated 2 kHz correction of wavefront distortions from a variety of disturbances simulating realistic atmospheric wavefront errors.

## Transition Impact

As a result of its success on the Phase II enhancement, AgilOptics won a Phase III effort that lasted approximately 2 1/2 months with the additional funding. AgilOptics manufactured an ABCS component and subsequently delivered the unit. The system was set up and became operational almost immediately upon delivery. This hardware was the first system to be incorporated into a new military facility.

The ABCS unit is a first-of-a-kind adaptive optics system which employs analog (as opposed to digital) controls, permitting very

fast operation. This system could be further developed into a very lightweight, rugged, compact, low cost and low power-consuming AO system for future military applications.

## Company Impact

This SBIR project provided AgilOptics an opportunity to work on developing a new technology with potential military and civilian applications.

AgilOptics is a New Mexico-based R&D company providing deformable optic systems to a global customer base. AgilOptics provides a cost-effective way to correct aberrations in laser beam quality and is dedicated to providing a complete system solution to its customers to improve the quality of their optical equipment.



# SBIR/STTR

Air Force SBIR Program  
AFRL/XP  
1864 4th Street  
Wright-Patterson AFB OH 45433

AF SBIR/STTR Program Manager: Augustine Vu  
AF CPP Program Manager: Richard Flake  
Website: [www.sbirsttrmall.com](http://www.sbirsttrmall.com)  
Comm: (800) 222-0336  
Fax: (937) 255-2219  
e-mail: [afrl.xppn.dl.sbir.hq@wpafb.af.mil](mailto:afrl.xppn.dl.sbir.hq@wpafb.af.mil)

