

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.

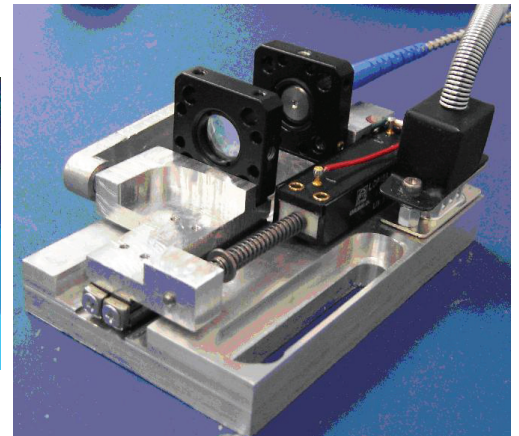
**SBIR Topic Number:**  
AF04-156

**SBIR Title:**  
Vertical Cavity Surface  
Emitting Lasers

**Contract Number:**  
FA8651-05-C-0099

**SBIR Company Name:**  
Photodigm, Inc.,  
Richardson, TX

**Technical Project Office:**  
AFRL Munitions  
Directorate,  
Eglin AFB, FL



Left: Photodigm Laser Target Simulator. Right: Divergence variability module.

## Versatile Laser Target Simulator

- The Air Force needs a versatile laser target simulator (LTS) to be integrated into the test loop to make sure that seeker systems, used in laser guided weapons, perform according to specifications.
- Photodigm Inc. developed a LTS system which was built around the firm's proprietary high-power, single-frequency Distributed Bragg Reflector (DBR) lasers
- This improved LTS system has several advantages over the neodymium yttrium aluminum garnet (Nd:YAG) Q-switch lasers currently used in the field
- The development of the LTS system under this SBIR program led to the successful transition of similar systems being sold to several manufacturers of seeker systems

Commercialization Pilot  
Program Series

96ABW-2010-0078

**A**

DISTRIBUTION A:  
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## Air Force Requirement

The seeker systems used in laser guided weapons, those currently in production and those to be used in future weapons, must endure rigorous testing to ensure proper functionality. This testing requires a versatile laser target simulator (LTS) or semi-active laser (SAL) to be integrated into the test loop to make sure these seeker systems perform according to specifications.

The Air Force requires a LTS capable of emitting in the visible for alignment. The Air Force also requires these sources to be emitted from a single fiber to reduce alignment difficulty, and requires electronic controls of the laser output intensity and beam divergence in order to simulate seeker fly in.

## SBIR Technology

Under this SBIR project, Photodigm Inc. developed a LTS system which was built around the firm's proprietary high-power, single-frequency Distributed Bragg Reflector (DBR) lasers. This LTS system integrates three separate fiber-coupled laser diodes. These sources are spectrally combined using wavelength division multiplexers to provide the laser light emission from one single-mode fiber.

The electronic laser diode drivers for each of these lasers are directly integrated into the system. These drivers were designed such that each laser could be enabled individually, both locally and remotely; further, these drivers were designed such that the laser diodes could be pulsed at any necessary pulse repetition frequency with any desired pulse width. The LTS also contains remotely controlled variable optical attenuators, such that the optical intensity can be varied by more than seven orders of magnitude. Lastly, the output fiber is coupled to an analog voltage controlled variable divergence module that allows the beam divergence angle to be controlled with the system able to cover the fully dynamic range.

This LTS system used in a testing environment has several advantages over the neodymium yttrium aluminum garnet (Nd:YAG) Q-switch lasers currently used in the field. First, the cost of the LTS system with all features needed to simulate a missile fly in is less than just a single Nd:YAG without any features that allow a fly in simulation. Second, the combination of separate wavelengths into a single output reduces overall alignment difficulty.

## Transition Impact

The development of the LTS system under this SBIR program led to the successful transition of similar systems being sold to several manufacturers of seeker systems.

Three LTS systems were sold to separate Air Force prime contractors. Two of these LTS systems are identical to the Air Force LTS and are to be used in a closed loop projection system for advanced seeker testing. A similar, more customized LTS system was purchased for use in production testing of a current seeker design.

## Company Impact

This SBIR supported the development of a family of high-power precision laser diodes to support multiple DoD programs. The LTS, demonstrated to the AFRL Munitions Directorate as a deliverable under this program, showcased the unique high speed performance characteristic of these devices and provided the company with valuable applications experience.

As a result, the company was able to generate substantial revenue while meeting the needs of several Air Force prime contractors. The company is now designing derivative systems using these lasers, including laser beacons for Identification Friend or Foe and illumination.

Photodigm is an innovator in semiconductor diode lasers for precision applications. The company develops products for spectroscopy, non-linear optics, precision instruments, and high speed pulsed operation where single frequency operation is critical.



U.S. AIR FORCE

# 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)

