Air Force SBIR/STTR

Innovation

Air Force SBIR/STTR Innovation Story

SBIR Topic Number:
AF05-010

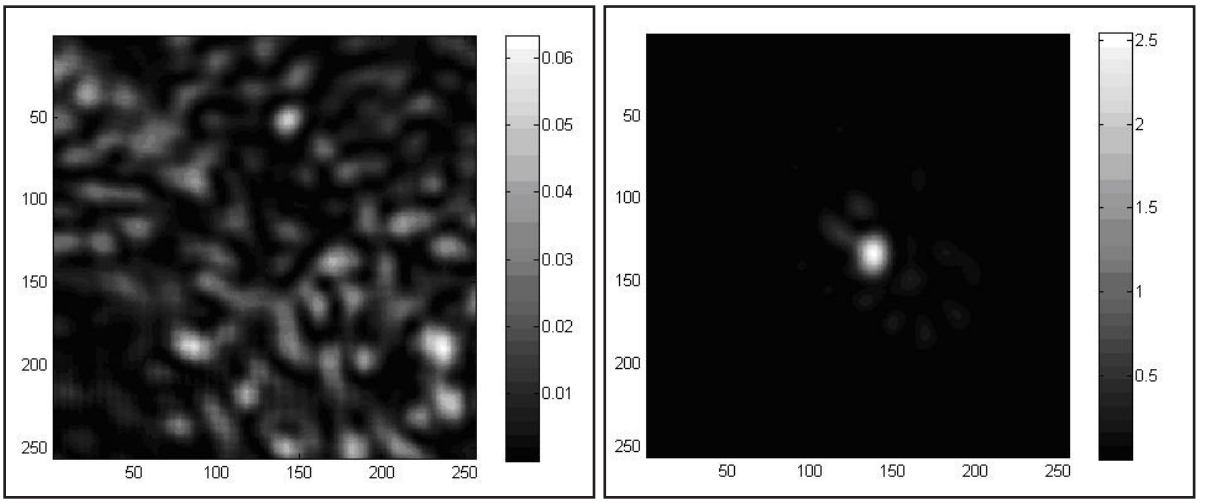
SBIR Title:
Aero-Optics Research & Development

Contract Number:
FA9451-06-C-0034

SBIR Company Name:
Kestrel Corporation
Albuquerque, NM

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

This Air Force SBIR/STTR Innovation Story is an example of Air Force supported SBIR/STTR technology that met topic requirements and has outstanding potential for Air Force and DoD.



Typical Improvement in Energy Density on Target Using Kestrel's Ultra High Speed Aero-Optic Adaptive Optics System

Ultra High Speed Aero-Optics Compensation

- The Air Force requires the capability to minimize aero-optical degradation through the introduction of improved ultra high speed adaptive optics
- Kestrel Corporation developed an ultra high-speed adaptive optics system for the compensation of aero-optic aberrations
- The design is capable of over 30,000 frames per second operation (and thus over 3kHz closed loop correction bandwidth)
- Potential military applications exist in all forms of atmospheric propagation, including high energy laser systems, laser communications, and target tracking, identification and designation systems

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Air Force Requirement

The Air Force arsenal includes a wide range of systems that project and/or receive laser beams from airborne platforms. The performance of these devices is adversely affected by aero-optical degradation of the optical wavefront caused by boundary turbulence as the platform moves through the air.

In order to improve beam quality (and, therefore, increase energy on the target or improve bandwidth), the Air Force requires the capability to minimize these effects through the introduction of improved ultra high speed adaptive optics (AO).

SBIR Technology

Leveraging Kestrel Corporation's highly successful proprietary wavefront sensing technology (the Distorted Grating Wavefront Sensor or DGWFS), the goal of this SBIR program was to develop an ultra high speed adaptive optics system for the compensation of aero-optic aberrations. A design was successfully developed capable of over 30,000 frames per second operation (and thus over 3kHz closed loop correction bandwidth).

This design delivers the ultra high speed adaptive optics performance required to correct aero-optic aberrations for aircraft flying at Mach 0.3 and higher and for the first time allows comprehensive adaptive optic correction for fast moving platforms, which prior to this work was an unrealizable prospect.

Potential Air Force Application

This high-speed AO design is based on Kestrel's proven wavefront sensor technology (previously supported by SBIR funding), which has been used to provide the first 2D wavefront maps of aero-optic turbulence with frame rates of up to 130,000 frames per second. This same basic technology platform is currently being used to develop solutions for other AO needs of interest to the Air Force.

The work done on this SBIR project has continued to advance the commercialization progress of the technology, as various components have progressed from laboratory tools to commercial-ready technologies.

Potential Air Force applications exist in all forms of atmospheric propagation, including high energy laser systems, laser communications, and target tracking, identification and designation systems. Commercial applications include laser communications, laser imaging, astronomy and surveillance systems.

Company Impact

The technology developed under this SBIR contract will find a wide range of applications in compensation for flow fields and aero-optics effects in directed energy systems of all kinds. This technology represents a significant segment of Kestrel's business and will enable the company to remain on the leading edge of flow compensation technology and will improve its competitive position in this area.

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