

Air Force Requirement

Airborne reconnaissance sensors for electro-optical (EO) imaging, particularly those developed for high altitude aircraft, have historically been high cost, low rate production systems designed to achieve exceptional performance in terms of sensitivity, spatial resolution, and area coverage. The Air Force needs to develop more affordable and more advanced EO sensor systems, including those with hyperspectral imaging capabilities. In addition, there is a critical need for practical improvements in the performance and timeliness of hyperspectral target detection processing.

SBIR Technology

Under this SBIR project, Space Computer Corporation (SCC) developed algorithm and data processing innovations that provide high-performance target detection in real-time for airborne hyperspectral imaging (HSI) sensors. Prior to this effort, HSI false-alarm rates had been one to three orders of magnitude too high for wide-area reconnaissance applications. It was also impossible to obtain timely targeting information from airborne HSI sensors because the massive amounts of data they acquired could not be readily transmitted to the ground for exploitation using available low-bandwidth data links.

SCC addressed these problems by developing fully-automated signature-based HSI detection algorithms that could be executed in real-time hardware on board the sensor platform, and by demonstrating the capability to automatically produce target cues and image chips for immediate interpretation. Off-line analysis of recorded HSI data, as well as real-time processing experiments on actual HSI systems, demonstrated that the new algorithms and processing techniques could significantly improve the discrimination of high-value military targets from natural and man-made anomalies and deliver the resulting targeting information with very low time latencies. This real-time exploitation concept of operation also provides very significant savings in analyst time and effort required to exploit HSI for tactical missions.

Transition Impact

The research and development performed under the original Phase I and Phase II SBIR contracts led to successful transition of the SBIR-developed algorithms, processor, and related tools to multiple fielded and research-grade systems.

One such system is used by the Civil Air Patrol (CAP), the civilian auxiliary of the U.S. Air Force. The Airborne Real-time Cueing Hyperspectral Enhanced Reconnaissance (ARCHER) is

an operationally deployed system for CAP. ARCHER is a very intuitive graphical user interface (GUI) wrapped around a suite of SCC's HSI data analysis and visualization tools, each customized for the particular demands of CAP missions. Although primarily intended for enhanced search and rescue capabilities, CAP has found many additional uses for ARCHER, including missions for homeland security, disaster assessment, and drug interdiction.

During a June 2008 search and rescue mission in the eastern United States, ARCHER proved its worth. CAP used ARCHER to search for a person who was missing in a large forested area. The imagery and analysis capabilities provided by ARCHER pinpointed the location of the missing individual, thus averting what could otherwise have been a human tragedy.

In addition to ARCHER, the success of this SBIR project is further highlighted by transitions to the following programs:

- AFRL Spectral Infrared Remote Imaging Transition Testbed (SPIRITT) Advanced Technology Demonstration (ATD) which has transitioned to the 659th Aeronautical Systems Squadron (AESS)
- AFRL Advanced Responsive Tactically Effective Military Imaging Spectrometer (ARTEMIS) program, the primary payload for TacSat-3 (Operationally Responsive Space program)
- National Air and Space Intelligence Center (NASIC) Hyperspectral Collection and Analysis System (HyCAS) Advanced Concept Technology Demonstration (ACTD)
- 659th Aeronautical Systems Squadron (AESS) Airborne Cueing and Exploitation System Hyperspectral (ACES HY) system

Company Impact

This SBIR program enabled SCC to become the national leader in on-board, real-time data processing systems for airborne hyperspectral imaging sensors. As a result, SCC was selected to provide processing systems and software for multiple military sensor programs as well as the civilian CAP ARCHER program, as noted above. Since the award of the Phase II contract in 2001, SCC has increased its sales by 140% and doubled the number of people it employs.



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