Department of the Navy SBIR/STTR Transition Program
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NAVSEA #2023-0746

Topic # N17A-T016
Improved Infrared Imaging with Variable Resolution Achieved via Post-Processing
Opto-Knowledge Systems, Inc. (OKSI)

WHO

SYSCOM: NAVSEA

Sponsoring Program: NAVSEA

Transition Target: SPEIR

TPOC: (812) 854-3440

Other Transition Opportunities: Other DoD programs needing an electro-optical and infrared capabilities for long-range identification including Automatic Target Recognition, targeting, and passive ranging using low-cost sensors. The target transition program is Shipboard Passive Electro-optic Infrared (SPEIR). SPEIR began development in FY22. Other programs could be ISTALKER and Periscope Programs.

Notes: OKSI has a 3-decade plus long success story of developing sensors and applications for the DoD and NASA. VariAp® technology developed by OKSI is used in all 3rd Generation FLIRs. Sensors and software designed by OKSI are being used to obtain airborne flight data observations for hypersonic and rocket flight testing including the ARTEMIS program.
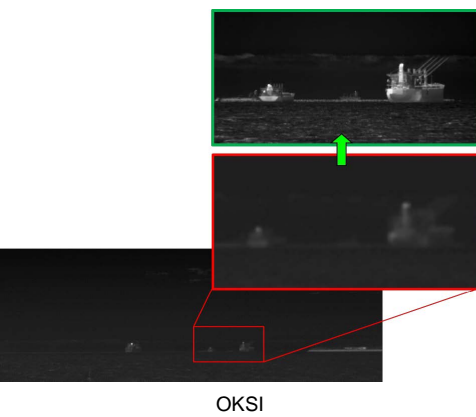
OKSI

WHAT

Operational Need and Improvement: The USN currently deploys MWIR imagers primarily as part of weapon systems for target recognition, identification, and aim point selection, which require high spatial resolution. Increasingly, MWIR imagers are also used for situational awareness (SA), which requires a wide field of view. For a fixed focal plane array (FPA) size, high spatial resolution and wide field of view drive the optical design in opposite directions, making a single conventional system impractical for both tasks unless a very large and therefore expensive FPA is used. Likewise, employing two separate MWIR systems is expensive due to the need for multiple FPAs and associated cryogenic coolers. It would be desirable to accomplish both tasks with a single system that exploits image processing to avoid requiring a large FPA.

Specifications Required: The overall project objective is to develop a variable resolution MWIR imaging system to support both SA and weapon system functions possibly from a single imaging system, including the optics and sensor to acquire optimal imagery and the super-resolution (SR) processing software and hardware.

Technology Developed: OKSI and Northwestern University have teamed to develop the Super Resolution MWIR Imagery Enhancement (SUPREME) algorithm that provides real-time variable resolution to support both situational awareness and weapons system functions. The MWIR SR method has successfully demonstrated image reconstruction. The SR approach is specifically targeted to the characteristics of MWIR imagery, for which commercial SR solutions are not effective.

Warfighter Value: The Navy and other customers will be provided with a dramatic improvement in the resolution that can be achieved using MWIR imagers without requiring larger and more expensive optics and FPAs. This will enable the Navy to increase deployed capability while reducing or maintaining SWaPC for MWIR imagers. In addition, existing deployed systems can be upgraded without replacing imaging hardware.

WHEN

Contract Number: N68335-22-C-0369   **Ending on:** Jul 01, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Laboratory Demonstration	N/A	Use pipelined software to successfully reconstruct high resolution images from prerecorded surrogate SPECCS imagery	4	1st QTR FY20
Near real-time demonstration	N/A	Near real-time reconstruction of high resolution images from pre-recorded demo system imagery	5	1st QTR FY21
Live Video Demonstration	N/A	Near real-time reconstruction of high resolution images from live demo system imagery	6	4th QTR FY21
CRP Completion	Low	Integration of SUPREME pipeline into representative MWIR hardware	7	2nd QTR FY25

HOW

Projected Business Model: OKSI specializes in the development of turn-key electro-optical sensor systems covering the UV, VNIR, SWIR, MWIR and LWIR. Primarily, OKSI develops systems that combine imaging and spectroscopy, including the mechanical assembly (high vacuum dewars for cryogenic operations), electronics, optics, computer interface and signal acquisition, algorithms for signal and data processing. OKSI excels in R&D projects where off-the-shelf solutions are unavailable. OKSI will license the technology to manufacturers of sensors used for situational awareness and targeting. OKSI will work with the prime contractors to integrate, customize, and refine the technology for specific applications.

Company Objectives: OKSI has over 30 years of successfully developing sensor hardware and software. All third-generation FLIR use technology developed by OKSI. OKSI wants to team with a prime contractor to provide the underlying technology to insert SUPREME into passive sensors used by all branches of the DoD. Near term, this program will result in a TRL 7 capability ready for the transition into Navy programs. In Phase-I and early in Phase-II, OKSI has focused on developing, testing, and demonstrating the SR technique, without precluding transition into other programs or sensors.

Potential Commercial Applications: SUPREME could be used for other applications to provide increased resolution where low-cost MWIR imagers are used such as security cameras, environmental monitoring, border security, and precision agriculture.

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