Topic: N17A-T016

Opto-Knowledge Systems, Inc. (OKSI)

Improved Infrared Imaging with Variable Resolution Achieved via Post-Processing

Targeting the Shipboard Passive Electro-Optical Infrared (SPEIR) program of record, OptoKnowledge 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. SUPREME successfully demonstrated image reconstruction, including recovery of small features useful for target recognition that are not observable in low-resolution images, at a >6x resolution enhancement factor. For 30 years, OptoKnowledge has been protecting America's interests through intelligent sensors and machine learning and is working with L3Harris to integrate SUPREME into their FarSight product, which does not preclude integration into any other system. Opto-Knowledge would be a supplier or subcontractor to the prime, providing a SUPREME module that would be integrated into the larger software architecture/system such as SPEIR.

Technology Category Alignment:

Sensors

Command, Control, Communications, Computers, & Intelligence (C4I)

None

Contact:
Marco Romani
marco.romani@optoknowledge.com
(415) 412-9203
https://optoknowledge.com/

SYSCOM: NAVSEA

Contract: N68335-19-C-0027

Corporate Brochure: https://navystp.com/vtm/open_file?type=brochure&id=N68335-19-C-0027

Tech Talk: https://www.youtube.com/watch?v=STpjgBcf6Ns

Department of the Navy SBIR/STTR Transition Program

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NAVSEA #2020-0403

Topic # N17A-T016

Integrated learning-based and regularization-based super resolution for extreme MWIR image enhancement

Opto-Knowledge Systems, Inc. (OKSI)

WHO

SYSCOM: NAVSEA

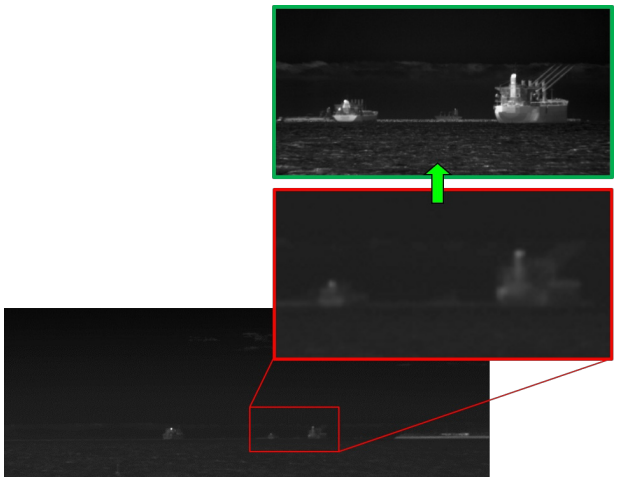
Sponsoring Program: SPEIR

Transition Target: Shipboard Passive Electro-Optical Infrared (SPEIR)

TPOC:
(202)767-9466

Other transition opportunities: Other DoD programs needing an electro-optical and infrared capabilities for long-range identification and targeting using low cost sensors. The target transition program is Shipboard Passive Electro-Optical Infrared (SPEIR). It is anticipated that SPEIR will begin development in FY21 and the be fielded in FY25.

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



OptoKnowledge

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: OptoKnowledge 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, including the recovery of small features useful for target recognition that are not observable in low-resolution images, at a >6x resolution enhancement factor. 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 SWaP-C for MWIR imagers. In addition, existing deployed systems can be upgraded without replacing imaging hardware.

WHEN

Contract Number: N68335-19-C-0027 **Ending on:** November 7, 2020

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Laboratory Demonstration	N/A	Use pipelined software to successfully reconstruct high resolution images from pre-recorded surrogate SPECCS imagery	4	October 2019
Near real-time demonstration	Low	Near real-time reconstruction of high resolution images from pre-recorded demo system imagery	5	October 2020
Live Video Demonstration	Low	Near real-time reconstruction of high resolution images from live demo system imagery	6	August 2021

HOW

Projected Business Model: OptoKnowledge specializes in the development of turn-key electro-optical sensor systems covering the UV, VNIR, SWIR, MWIR and LWIR. Primarily, OptoKnowledge 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. OptoKnowledge excels in R&D projects where off-the-shelf solutions are unavailable. OptoKnowledge will license the technology to manufacturers of sensors used for situational awareness and targeting. OptoKnowledge will work with the prime contractors to integrate, customize, and refine the technology for specific applications.

Company Objectives: OptoKnowledge has a nearly 30 year record of successfully developing sensor hardware and software. All third-generation FLIR use technology developed by OptoKnowledge. OptoKnowledge 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 6 capability ready for the transition into Navy programs. In Phase-I and early in Phase-II, OptoKnowledge has focused on integration into SPECSS, a part of the CESARS program developing technology for transition to SPEIR, when 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, and precision agriculture.

Contact: Marco Romani, VP Strategic Growth
marco.romani@optoknowledge.com 415.412.9203