

# Department of the Navy SBIR/STTR Transition Program

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ONR Approval #43-4388-18

Topic # N161-057

Short-Wave Polarimetric Imager

Polaris Sensor Technologies, Inc.

## WHO

**SYSCOM:** ONR

**Sponsoring Program:** Expeditionary Maneuver Warfare and Combating Terrorism S&T

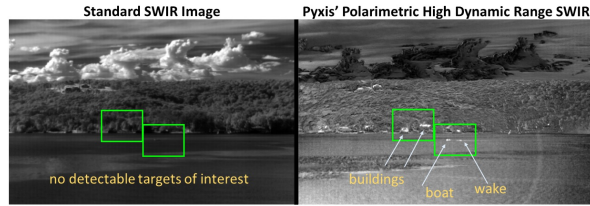
**Transition Target:** Ground Vehicles and Unmanned Aircraft

**TPOC:**

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**Other transition opportunities:** Polaris' Pyxis SWIR (Short-Wave InfraRed) sensor will provide force protection and route clearance for the Marine Corps' ground vehicles. It will also help naval search-and-rescue teams find objects and people in the water. The technology developed for this program can also perform facial recognition for surveillance, border security and checkpoint control applications, which can benefit the military, the Department of Homeland Security, the Transportation Security Administration and any private company requiring security or restricted-access controls.

**Notes:** The figures above illustrate the power of polarization in the Pyxis SWIR camera. A standard SWIR image is shown on the left, and there are no clearly identifiable objects of interest. The image on the right is a Pyxis polarimetric SWIR image, and several objects are clearly differentiated from the background. The Pyxis is particularly advantageous for detecting man-made objects against natural, cluttered environments; and sensing in the short-wave infrared band is particularly well-suited for imaging through aerosols such as mist, haze, light fog and smoke. Pyxis is therefore ideally suited to maritime environments to detect objects and people in the water and against the shorelines. It is equally powerful to detect small unmanned aircraft against a bright or a cloud-filled sky and man-made objects amidst shadowy foliage.



Performance Advantage of the Pyxis SWIR Copyright, 2018, [Polaris]

## WHAT

**Operational Need and Improvement:** The Navy needs a compact, rugged camera that has an "on the move" polarimetric imaging capability in the short-wave infrared (SWIR) spectrum. Conventional SWIR polarimetric sensors are designed for stationary operation and often have variable image registration issues that lead to changing polarization artifacts if used on a moving platform. Pyxis SWIR is a snapshot polarimeter where all data needed to compute a complete linear polarization image set is gathered in one frame.

**Specifications Required:** To achieve "on the move" operation, the sensor must have a sufficiently high frame rate. The sensor also must have state-of-the-art features, including its focal plane array, noise reduction technology and dynamic range.

**Technology Developed:** Polaris' Pyxis SWIR sensor offers superior acquisition, tracking and classification of objects that are traditionally difficult to detect. Pyxis is a 1920 x 1200 pixel pitch matched infrared polarimeter with a 10 micron pixel pitch and a high dynamic range for both day and night operation. Pyxis incorporates a powerful feature called polarization sensing and provides a high-quality SWIR image and 4 additional polarization data products in a single frame. Pyxis includes field programmable gate array (FPGA) processing electronics to compute all data products at video rates. Because Pyxis is a snapshot polarization imager, it mitigates the motion artifacts that can be present in conventional SWIR sensors.

**Warfighter Value:** The Pyxis SWIR outperforms conventional SWIR cameras by providing an "on the move" polarimetric sensing capability. Pyxis offers the warfighter greater operational flexibility for increased situation awareness and safety. Its extremely high dynamic range allows Pyxis to image very dim objects adjacent to very bright objects in the same scene. Its low SWAP (less than 4 cubic inches in volume; weight less than one pound) simplifies its integration into ground, air and sea platforms.

## WHEN

**Contract Number:** N68335-18-C-0049 **Ending on:** October 3, 2019

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Sensor Design	Med	specifications defined	3	1st QTR FY17
Development of pixelated polarizer filter	Med	verification of performance	4	3rd QTR FY18
Prototype Sensor Run Completed	High	manufacturing process demonstrated	6	1st QTR FY19
Sensor Lab Demonstration	Med	sensor meets specifications	6	2nd QTR FY19
Sensor Field Demonstration	Med	sensor flown on a drone for route clearance	7	3rd QTR FY20

## HOW

**Projected Business Model:** Polaris seeks to penetrate the SWIR camera market by offering unique polarization-sensing capabilities. The Pyxis will offer a distinct advantage over all other SWIR cameras by offering an extremely high dynamic range and four additional polarization-sensing modes unavailable in standard thermal imagers. Polaris has identified a well-established camera manufacturing partner who has a proven track record of building quality cameras. Polaris has formed a manufacturing partnership agreement with this company for this project. This partnership reduces system risk by utilizing established expertise for both the R&D and the manufacturing phases of the program. Polaris will license its technology to the camera firm, who will integrate the new technology into its manufacturing line, taking advantage of their established quality manufacturing processes. By partnering with the camera manufacturer, Pyxis will offer improved performance at a streamlined cost without having to overcome the barriers or challenges of a manufacturing startup.

**Company Objectives:** Polaris will present the Pyxis at symposia and technical trade shows to demonstrate the sensor performance to new customers. Polaris will work with the camera manufacturer to integrate its capabilities into their camera system and will develop training and marketing materials.

**Potential Commercial Applications:** Commercially, the Pyxis SWIR can be used to improve navigation by detecting obstacles in the roadways; to aid rescue workers by detecting swimmers and objects in water; and the detection of man-made objects partially hidden in shaded areas or foliage. Its facial recognition capabilities can assist private companies with security and be integrated into systems to grant access to restricted areas.

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