

WHO

SYSCOM: NAVAIR

Sponsoring Program: PMA-266

Transition Target: MQ-8C Fire Scout

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Other Transition Opportunities: Alternative programs: PMA-263. Alternative platforms: RQ-21 Blackjack, Unmanned Logistic AV, MQ-9 Reaper, or Far Target Locators such as MDUSA, JETS II, or ASURES.

Notes: Polaris is currently developing and implementing algorithms to determine position using SkyPASS Gen3 hardware with two optical channels for sun/moon and sky polarization tracking. SkyPASS Gen3 hardware has been used to test SkyPASS heading capability on both dynamic and static platforms as well as in high-latitude environments. External testing using ground-vehicles has been completed by testing partners in Huntsville, Alabama and at Auburn University. A Gen3-N sensor with three optical channels for sun/moon, sky polarization, and star tracking has been previously designed and tested for heading. Accuracies less than 2 mil were observed. Lessons learned from that effort are being used to optimize the sensor design for dynamic operation and position capability during the day and at night. Algorithms developed for position are compatible with both Gen3 and Gen3-N hardware.



Images Courtesy of U.S. Navy (DVIDS: 7145823, 3240985, 6356575, 285206, 5858852, 6565838)

WHAT

Operational Need and Improvement: Failure of the Global Positioning System (GPS) is becoming a reality and a critical risk for navigation, localization, and targeting applications due to GPS jammers and other forms of signal denial becoming increasingly cheap and effective. Without GPS, the position estimate derived solely from an inertial navigation system (INS) will drift and accumulate errors quickly, degrading the position estimate until the system is rendered unusable.

Specifications Required: Low-SWaP for Unmanned and Manned Applications

Technology Developed: Celestial-based sensor that provides highly accurate heading with course position that bounds inertial drift during the day and at night for aircraft navigation.

Warfighter Value: Navigation, localization, and targeting confidence in GPS-denied environments.

The SkyPASS position and heading sensor is a passive, celestial-based sensor that will allow the US military to develop and maintain awareness of its location on the Earth's surface without using GPS. It is a complementary solution to use when GPS and visual-aided solutions fail. SkyPASS offers the following benefits: it is low-cost, it has a small enough SWaP (Gen3: 3.5 x 1.9 x 2.4 in; 8oz; 4.1W; Gen3-N: 4.1 x 3.9 x 3.2in; 20oz; 4.1W) to fit almost any military platform, it can operate in various cloud conditions, it cannot be spoofed or jammed in day-to-night operation; and since it is passive, it does not increase the probability of detection. This position and heading technology utilized by SkyPASS is not affected by magnetic disturbances, it provides a drift-less position solution, it can operate anywhere on Earth (including at high altitudes and near the North and South poles), and it has 24-hour functionality making it valuable navigation solution when GPS is lost or is entirely denied.

WHEN

Contract Number: N68335-21-C-0003

Ending on: Mar 08, 2023

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Simulated landing an aircraft on a ship in a GPS-denied region with 1 nmi accuracy for different mission profiles.	Low	Provided proof of concept that SkyPASS' celestial-based position algorithm bounds inertial errors.	3	1st QTR FY20
Implemented and tested celestial position algorithms developed by Polaris using SkyPASS Gen3 hardware.	Low	Test data	5	4th QTR FY22
Improve SkyPASS' dynamic mode operation by restructuring SkyPASS' embedded software architecture.	Medium	Test data; System design	5	1st QTR FY23
Build, calibrate, and test two SkyPASS Gen3-N sensors with sun/moon, sky polarization, and star tracking.	Medium	Test data; System design	6	1st QTR FY23
Demonstrate SkyPASS Gen3-N on a fixed-wing aircraft.	Low	Test data	7	2nd QTR FY23

HOW

Projected Business Model: Polaris would like to remain an integrator, application developer, and a creator of new sensors and technologies. We would like to manufacture SkyPASS through a contract manufacturing license to lower the price of the system, ensure consistent quality, and leverage sales and distribution channels that are established in the market. Our hope is to license SkyPASS' technology to a Prime Contractor with a presence in the market to speed the adoption and integration of SkyPASS. Polaris can meet low-rate initial production and is open to supporting a spin out of the sensor as an investment; however, a manufacturing partner is needed for full-rate production. Two commercial vendors have been vetted for large scale manufacturing; however, we found that the optical system skillset was less than required.

Company Objectives: Commercialization of leading-edge technologies is a major business objective for Polaris who has dedicated years to developing polarization-based imaging systems for military, commercialization, and scientific entities. These systems provide daylight detail in the dark and visibility in low contrast conditions with real-time image processing. Our passion in meeting customer needs with unique sensing solutions has successfully led to a variety of technologies that are ready for and are currently transitioning to full production. Polaris is committed to commercializing our unique products and technologies developed under federally funded programs.

Potential Commercial Applications: Shipping, Aviation, Autonomous Vehicles and Robots, First Responders, and Law Enforcement