Department of the Navy SBIR/STTR Transition Program

Statement A: Approved for Release. Distribution is unlimited.

Topic # N121-069
Single Camera Passive Optical Ranging
Prioria Robotics, Inc.

WHO

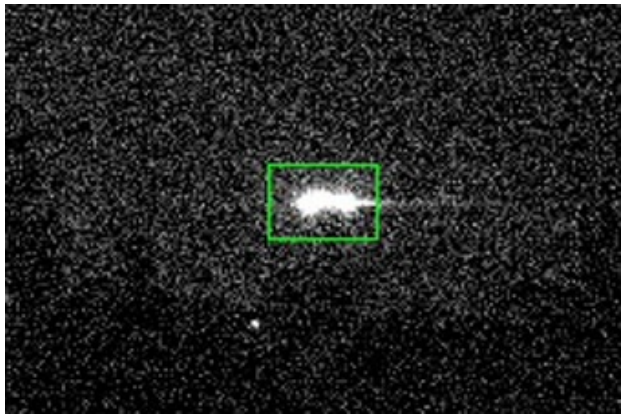
SYSCOM: NAVSEA

Sponsoring Program: Photonics Mast Program / PMS 435

Transition Target: Advanced Processor Build 17 (APB-17), with an estimated start in Q3 FY16

TPOC:
(401)832-7847

Other transition opportunities: Supports vision-based navigation in Global Positioning System (GPS) denied environments by a small unmanned aerial vehicle (UAV) or other mobile robot. Prioria has received a Phase 2 STTR award from NASA to leverage passive ranging to support GPS-denied navigation for small Vertical Takeoff Unmanned Aerial Vehicles (VTUAV).



Notes: Image: A point light source is observed at night with a nighttime visual Electron-Multiplier Charge Coupled Device (EMCCD) camera by a stand-alone data collection rig to help establish an experimental proof-of-concept for nighttime passive ranging with limited object visibility. The scene is optically equivalent to an object at 9700 m viewed at maximum magnification.

WHAT

Operational Need and Improvement: Submarines have a need to automate and improve their passive optical ranging process, currently accomplished with a stadimeter. The process is labor intensive for the mast operator and can have inaccuracies. A capability is needed to rapidly and accurately estimate the distance to a visually observed target without compromising operational security without adding additional hardware. Ideally this will be a software process for passive optical ranging by any individual camera in the submarine against ships and aircraft.

Specifications Required: A software solution, compatible with existing photonics masts, is sought by the Navy for a passive ranging capability in day and night operations. The estimation should function with typical mast observing conditions and should be compatible with the existing target observation processes. If target visibility does not support an accurate estimate, then the solution should gracefully degrade without reporting inaccurate range estimates.

Technology Developed: Prioria's technology is a software algorithm compatible with existing Navy hardware. The software consumes mast video, telemetry metadata, and target queueing information and produces a passive visual estimate of the distance to the target. Optional estimates for target speed and bearing can be used if available. The technology can function day and night against visually observed surface vessels or aircraft. Any visually resolvable portion of the vessel is sufficient to enable range estimation; the technology can estimate range against a mast tip (day) or a single running light (night) where the remaining portion of the vessel is obscured by the horizon.

Warfighter Value: The technology will enable the warfighter to acquire a passive visual estimate of the range to a target vessel or aircraft which is visually observable in the mast. The target does not need to be identified by the operator. No knowledge of the target's motion is required, but estimates can be exploited if available. Visibility does not need to be continuous; observations may be interrupted by waves, sea spray, or other environmental effects. Range estimates are three to ten times more accurate than current methods. The technology will gracefully degrade when a suitable range estimate cannot be made.

WHEN

Contract Number: N00024-14-C-4077 **Ending on:** July 6, 2016

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Passive Ranging Simulation Proof-of-Concept	N/A	Simulated accuracy better than 20% for any photonics mast camera at ranges out to 10 kyd.	TRL 3	November 2013
Visual Tracking on Tactically Relevant Data	N/A	Graceful degradation of visual track during loss-of-precision and auto-resume upon visual recovery	TRL 4	May 2015
Passive Ranging for Land Targets	N/A	Passive ranging accuracy better than 20% for land targets at tactically relevant distances	TRL 5	September 2015
Passive Ranging for Unclassified and Classified Sea Targets	Med	Passive ranging accuracy better than 20% for ships out to 10,000 yd	TRL 6	February 2016

HOW

Projected Business Model: Prioria plans to sell the technology as a C/C++ software library for integration by a prime contractor into APB-17 and other commercialization opportunities. Prioria will also support customization of the technology and integration into other applications, such as visual navigation by robots.

Company Objectives: Prioria desires to transition the technology to the US Navy submarine fleet to the photonics mast through the Navy's Advanced Processor Build (APB) process. Prioria is targeting the APB-17 cycle for transition. This requires visibility of the new capability to requirements writers and decision makers at Submarine Sensor Systems Program Office (PMS 435) of PEO Submarines (PEO SUBS) and for personnel at PEO Integrated Warfare Systems (PEO IWS) responsible for transitioning software to the fleet through the Advanced Processor Build (APB) process. Prioria would also like to introduce the technology to Lockheed Martin, who is the prime contractor for inboard integration. Additional objectives are to gain exposure for the technology in support of other related applications such as the SEAL Delivery Vehicle (SDV) or small aircraft with visual navigation or passive targeting requirements.

Potential Commercial Applications: Autonomous visual navigation for aircraft and other robots; situational awareness for robots; obstacle avoidance; GPS-Denied Navigation; GPS-Spoofing Detection

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