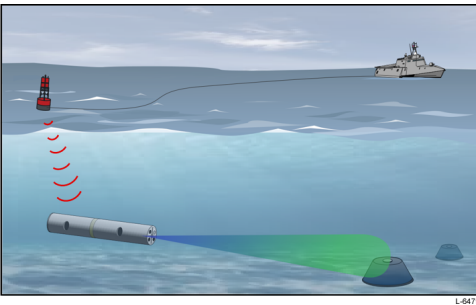


WHO

**SYSCOM:** NAVSEA  
**Sponsoring Program:** PMS 495  
**Transition Target:** Barracuda

**Other Transition Opportunities:** Potential applicability to PMS406 and PMS 408 UUV fleets (Swordfish, Sandshark, Kingfish, Knifefish, Razorback, Snakehead and Orca). Also seeking to explore application of this sensor architecture for operation in degraded visual environments (DVE).

**Notes:** The developed flash lidar system was initially designed to produce sharp, range-resolved images in the underwater environment. However, this technology is equally applicable to a wide range of remote autonomous vehicles (e.g. ground or air) operating in DVE (e.g. brown outs). The system has key attributes that improve performance in all these scenarios: rejection of background and near-field scatter, as well as inherent compression and encryption of the data for easier transmission from the remote platform to key decision makers.



Copyright 2022 [Physical Sciences Inc]

WHAT

**Operational Need and Improvement:** Unmanned underwater vehicles (UUV) require an imaging capability for operation in degraded visual environments (DVE) to detect potential targets and/or obstacles. These platforms further require a ranging capability to determine whether the detected objects are actionable (avoid, engage, or close). Such a capability would address a wide range of applications, including mine neutralization, autonomous docking, pipeline survey, search & rescue and obstacle avoidance.

**Specifications Required:** In order to address these applications, the sensor needs a wide FOV to retain situational awareness, while providing centimeter scale lateral and range resolution over a range of several meters. This data needs to be updated at video frame rates to support platform motion. The sensor further needs to achieve this capability in a package that is size, weight, power and cost compatible with platform payload requirements.

**Technology Developed:** The flash LIDAR system flood illuminates the field with a low-cost, pulsed laser diode. The reflected/scattered returns are modulated using a high speed, dynamic spatial filter which encodes the lateral and range information from the scene. The system leverages balanced detection to reject common mode solar background and backscatter while preserving hard target returns; the result is maximized range image contrast and minimized bit-depth requirements. The system records the data in a way that is inherently compressed and encrypted, supporting streamlined data transmission from the remote UUV platform to key decision makers.

**Warfighter Value:** The sensor platform effectively suppresses scattered and background light to achieve higher image quality in degraded visual environments than conventional flash LIDAR systems. This capability is provided in a package compatible with widespread deployment from small, low-cost autonomous platforms. Using this approach, risky and low visibility missions can be accomplished while allowing the warfighter to maintain a safe distance.

WHEN

**Contract Number:** N68335-21-C-0078      **Ending on:** Nov 15, 2022

Milestone	Risk Level	Measure of Success	Ending TRL	Date
Prototype Build and Integration Complete	Low	In-Air Range cube reconstructions generated at expected update rates	4	4th QTR FY22
In-Water Testing	Medium	Successful integration into pressure housing and successful reconstruction of engineered targets and natural scenes in local waters of varying turbidity	5	1st QTR FY23
Spiral Design Upgrade Complete	Low	All issues identified in prior in-water testing addressed and demonstrated	5	3rd QTR FY23
System Demonstration at Government Sponsored Test Event	Medium	System performance demonstrated on government test range and ID algorithms used to identify target of interest	6	TBD

HOW

**Projected Business Model:** After successful demonstration of the flash lidar capability, PSI plans to pursue a program to integrate the sensor into a specific platform. Release to manufacturing and low-rate initial production will be performed in PSI's flexible manufacturing area, where PSI will support the platform vendor through integration activities.

**Company Objectives:** PSI has identified Barracuda as the initial target platform. We are currently looking to identify other platforms and applications for which this technology would be useful, with specific emphasis on DVE.

**Potential Commercial Applications:** The developed technology has applicability to a wide range of underwater applications including: mine detection, obstacle avoidance, automated UUV docking and pipeline survey. The sensor further has applicability to autonomous ground and air vehicles operating in dusty, foggy, or otherwise degraded visual environments.