DEPARTMENT OF THE NAVY
SBIR/STTR TRANSITION PROGRAM

SUCCESS STORY

TOPIC NUMBER: N143-129 | **SBIR INVESTMENT:** $1,687,396 | **PHASE III FUNDING:** $3,256,266

TARGET-LESS RELATIVE REFERENCE SENSOR SYSTEM (R2S2)

Advanced Scientific Concepts (ASC) improved upon the dynamic positioning system used by SSBN blocking vessels that accompany Navy submarines, increasing the safety of operations and resulting in better overall performance.

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THE CHALLENGE

Navy submarines are escorted by a surface security boat called an SSBN blocking vessel. This vessel uses a Relative Reference Sensor System (R2S2), containing a dynamic positioning system (DPS) that essentially drives the ship near the sub and keeps track of relative/absolute bearing, heading, and speed. However, they present a safety risk because they require Sailors to go topside while underway to install or uninstall large targets poles on the submarine. As such, the Navy sought to upgrade this sensor in order to increase safety of operations and also to gain better performance in weather conditions, including rain and fog.

THE TECHNOLOGY

Advanced Scientific Concepts won the Phase I SBIR award and got right to work developing a target-less system for use on Navy SSBN blocking vessels by utilizing its 3D global shutter flash LiDAR (GSFL) technology. Similar to technology used in self-driving cars, it's a laser-based system that uses an emitter to shoot 16,000 points of light. Based on what is received from those points, a digital pixel-based image is created of the world around it. During Phase I, ASC acquired 3D GSFL images of sea going vessels and demonstrated that an SSBN relative bearing can be derived from these images. The GSFL is designed to be deployed on a blocking vessel and interface with the existing shipboard DPS to track and maintain the bearing, heading, and speed of a surfaced submarine without the need to physically modify the submarine deck or hull. Redundancy is achieved by mounting two sensors on the blocking vessel. The system uses off-the-shelf hardware technology combined with previously demonstrated machine vision object recognition and tracking algorithms.

THE TRANSITION

During the subsequent Phase II portion of the SBIR, ASC developed two prototype R2S2 GSFL systems. The new sensor was named the T-R2S2. The company was awarded a Phase III contract from Strategic Systems Programs (SSP) worth $3.2 million (N00030-21-C-1004). The Phase III project will continue the design development and critical design review and also move the project into engineering test units and integration. The goal is to integrate on four of the Navy's SSBN blocking vessels, replacing the existing sensors with ASC's T-R2S2 sensor and transition to operation.

THE NAVAL BENEFIT

The biggest benefit realized by the Navy is the increased safety of the crew. Many times, bad weather would result in the original sensors failing and needing to be switched out. This meant a crewmember would need to do this manually in weather that was less than ideal. This technology was developed so that the hardware is contained in a small box that sits on a pan and tilt unit on the surface vessel. The crew then uses the software portion of the system to get a range on the submarine but also has the option of initiating an automatic mode so the ship can drive itself.

THE FUTURE

The current Phase III project includes a fleet retrofit for the SSBN blocking vessels stationed at Bangor, Washington and Kings Bay, Georgia. Redundant systems will be provided for each blocking vessel along with a spare unit. This equates to a production delivery of approximately 15 units. Other applications for this development include autonomous docking support for military applications and the oil and gas industry. Marine reconnaissance, surveillance, target detection, identification, location, and tracking are also applications that this development can support. By simple changes to the laser power and optics, the GSFL can locate and track targets over 1 km away. This can apply to marine based and aerial applications for detecting, locating, and tracking surface based targets.

"This was a technology that was unavailable from any other vendor. We had to develop it through SBIR. We solicited what we needed and created it. We went from 43 proposals down to one; through that competition process we found this great company and exactly what we were looking for."

Scott Bernhard, Program Manager, SP302, Nuclear Weapons Surety Technical Planning

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