DEPARTMENT OF THE NAVY
SBIR/STTR TRANSITION PROGRAM

SUCCESS STORY

TOPIC NUMBER: N02-025 | **SBIR INVESTMENT:** $825,511 | **PHASE III FUNDING:** $69,458,580

NON-COLLINEAR WAVE-FRONT CURVATURE RANGE MEASUREMENT

Mikel's technology gives Navy submarines GPS-like geodetic position accuracy while remaining covertly submerged, allowing for short data rate acoustic communications, resulting in greater situational awareness and improved communications.

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THE CHALLENGE

The U.S. submarine force desires improved situational awareness and tracking capability based on detection and intercept of active emissions. To do this, noncollinear sensors needed to be developed for improved target localization coverage and accuracy. The Navy sought a small business through SBIR that could accomplish this, as well as time difference of arrival (TDOA) estimation algorithms using generalized cross correlators, matched filters and leading-edge detectors. Target localization algorithms to estimate the target's range, bearing and depression elevation angle based on the TDOAs measured from sets of non-collinear sensor pairs were also desired.

THE TECHNOLOGY

Mikel met all the requirements in Phase I, leading to a Phase II contract with the goal to provide U.S. submarines with increased acoustic superiority over increasingly quiet adversaries. The Phase II focused on the development and at-sea testing of a real time non-collinear wavefront curvature and active intercept ranging systems. The real time systems use commercial off-the-shelf (COTS) hardware, novel TDOA estimation techniques and localization/tracking algorithms as the basis for the SBIR Phase II prototype system. Interfaces and TDOA processing channels were included in this system to accommodate existing and new sensors in a non-collinear arrangement on 688I class submarines.

THE TRANSITION

Mikel was awarded a $6,425,300 modification under a previously awarded contract (N00024-05-C-6236) to exercise an option for non-collinear wavefront curvature ranging engineering services for the Navy's development of tactical combat and surveillance system algorithms and software to include sonar, combat control, weapons, communications, command and control, and navigation functionality as well as non-tactical software for undersea fixed and portable tracking ranges. Mikel was also awarded a $41 million Phase III contract (N66604-20-D-H001) from PEO SUBS, of which just over $13 million has been obligated. This Phase III award combines the efforts of this SBIR topic (N02-025) and N05-149—Combat Systems of the Future to deliver never-before-realized submerged platform self and external sensor tracking capabilities to the Navy's fleet of submarines.

THE NAVAL BENEFIT

Mikel's SBIR technology provides increased anti-submarine warfare (ASW) capability in test and evaluation and tactical operations scenarios. Used as a portable undersea tracking range, it determines the submerged platform geodetic position in either passive or active mode using underwater beacons. This “ground truth” information is crucial to support the developmental and operational test and evaluation of all U.S. submarines. Used as an underwater position fix system, it provides precision undersea positioning in GPS-denied environments, allowing submerged waypoint and chokepoint navigation. It provides cross domain messaging and improved navigation capabilities for submerged platforms including submarines, SEAL Delivery Vehicles (SDVs), unmanned underwater vehicles (UUVs) and weapons.

THE FUTURE

This project is focused on identifying the systems, environments and conditions that support collecting and analyzing the data needed to meet critical test requirements, such as developmental test and evaluation (DT&E) and operational test and evaluation (OT&E) and to equip the Navy's subs with global positioning satellite (GPS)-like geodetic position accuracy, while remaining covertly submerged and acoustically passive. To support these test and training requirements, Mikel developed a cost-effective combined multilateration and self-track underwater tracking solution. This hardware and software consist of an oceanfloor anchored acoustic beacon and application software hosted on the submarine’s AN/BQQ-10 A-RCI system. The bottom-anchored acoustic beacon and the submarine-hosted application software communicate via acoustic signals. The software consists of innovative positioning algorithms called Range Only Motion Analysis (ROMA), a critical component of the overall system, the Submerged Acoustic Navigation System (SANS), which was tested extensively at sea. The target platforms for Mikel's SANS technology include all classes of current and in-development U.S. submarines, UUVs, weapons and mobile targets.

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