Swimmer Detection Sonar Network (SDSN)

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LONG-TERM GOALS

Develop a high-performance cost-effective underwater threat detection system for port and harbor security.

OBJECTIVES

Develop the hardware, software, and signal processing to enable a distributed sonar system that detects, tracks, and classifies underwater threats in the harbor environment. The short term objectives are to complete a full 4-node system based on the successful Swimmer Detection Sonar Network prototype work conducted in 2005.

APPROACH

A first production design of the SDSN system now exists (see Figure 1).   The approach is to build a four-node system using this design and deploy it in a semi-permanent installation at the Portsmouth Navy Shipyard (Figure 2). Using this installation we will improve the system through a continued build-test-build cycle. Initially we will be concentrating on improvements to the signal processing. However, improvements to the system hardware and operating software are also envisioned.
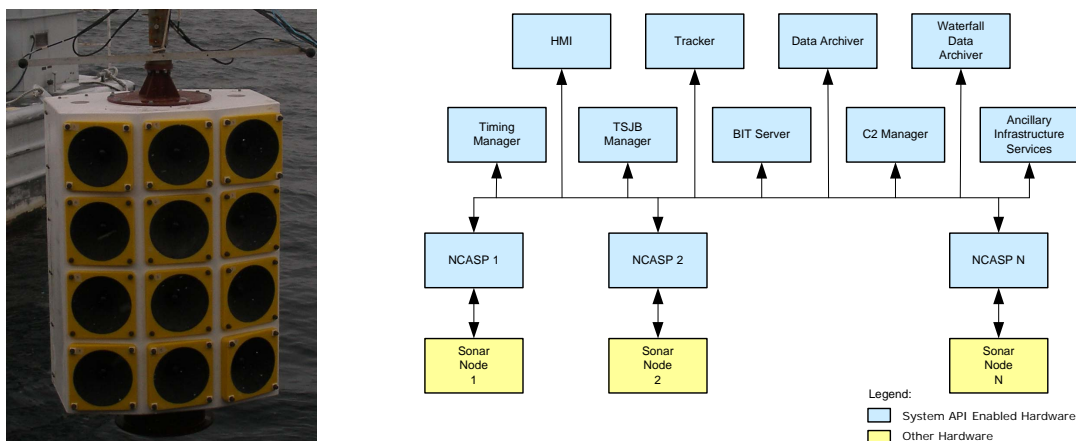

Figure 1. Production version of the SDSN node (left) and the software architecture (right).   Each node covers roughly 54 degrees. The majority of the signal processing is done in the NCASP's (Node Control and Signal Processing Computer) connected via fiber-optics to each node.

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Figure 2. Planned installation for the Portsmouth Navy Shipyard. The first two nodes (1,2) will be placed side-by-side on the southern point of the island covering the channel to the west, while the other 2 nodes (3,4) will be placed so as to cover the same area from the northwest. In this fashion a there will be a large region of coverage for developing bi-statics.

WORK COMPLETED

In FY08 the following work was completed:
- Four nodes were built and tested.
- An MOU was developed and signed with the Portsmouth Navy Shipyard (PNS).
- An Environmental Assessment (EA) for the PNS installation was initiated.
- A preliminary installation plan was developed.
- The system software was advanced in the areas of node control, including the addition of built-in-test functionality.
- Extensive reliability testing was conducted.
- The signal processing was signficantly advanced using data from other locations.

RESULTS

The signal processing improvements were the most significant new results in FY08.   There is a multi-tiered detection algorithm that looks for targets of different sizes followed by tracking "filters". These filters now effectively eliminate false alarms. The classification has now been broken into a two tiered system were a target is identified as threat or non-threat. Following that the returns are further analyzed for classifications clues to determine if the target type can be identified. We are very successful at determining if the target is an open-circuit diver (versus a diver with re-breather or closed-circuit apparatus).   Except for classification due to speed, we are not able to tell if the diver is aided by the swimmer delivery vehicles we have tested with.

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IMPACT/APPLICATIONS/TRANSITIONS

This project has already transitioned into a acquistion program and the work conduted under this R&D effort will be used to imporve the operational system. Further, the work will lead to a cost-effective system for protecting ports and harbors around the world.

RELATED PROJECTS

None.

PATENTS

A U.S. patent on the Swimmer Detection Sonar Network was granted during the last year.