CEROS Project Description

Project: ***Safety of Ship Systems (SOSS)*** [1]

Contractor: **Lockheed Martin Orincon Defense, Kailua HI**

Summary: Lockheed Martin ORINCON Defense (LMOD) developed the SOSS II program for submarines to minimize the risk of collision at sea. Currently, submarine acoustic sensors and their associated signal processing systems are designed and optimized for long range, open ocean anti-submarine warfare (ASW). As a result, these systems have a very limited capability for tracking multiple targets and are easily overwhelmed with the dense surface clutter found in the littoral environments. Operators are frequently overwhelmed with surface clutter, often spending 90-100 percent of their time on managing the surface picture. This directly affects the ability to safely operate while performing ASW and other critical mission related tasks. SOSS algorithms associate targets from both sonar arrays with targets identified through the periscope. SOSS provides a passive sonar processing and data fusion system that focuses on automatic detection and tracking of surface ships that pose a credible threat to safe submarine operations. LMOD plans to transition the SOSS algorithms into submarine combat systems through the Advanced Rapid COTS Insertion (A-RCI) program.

Description: Operations in the littoral regions provide a great challenge to the United States submarine fleet. Near-shore operations are routinely stressful and frequently dangerous as submarines operate closer to the coast. Ambient noise levels dramatically increase in the littorals due to biological, geological, and man-made acoustic sources. For example, ferries, pleasure craft, and trawling fishermen typically radiate high levels of broadband acoustic energy. These noise sources, combined with complex propagation effects in the littorals, create a difficult sonar contact management situation. As a result, submarines are constrained in their maneuvering options and may become vulnerable to detection or collisions, forcing them from periscope depth.

To minimize the risk of collision, the submarine crew must associate all targets on both sonar arrays (hull and towed) and periscopes. They must then detect, track, classify, geo-locate and parameterize course, speed, and range data for each target on multiple sonar sensors. These sensors and their associated systems are designed and optimized for long range, open ocean anti-submarine warfare (ASW). As a result, these systems have a very limited capability for tracking multiple targets and are easily overwhelmed with the dense surface clutter found in the littoral environments. Current automation algorithms have not significantly reduced the operator's workload. Operators are frequently overwhelmed with surface clutter, often spending

[1] CEROS FY03 contract 50987, completed 30 June 04.

90-100 percent of their time on managing the surface picture. This directly affects the ability to safely operate while performing ASW and other critical mission related tasks.

The SOSS solution provides a passive sonar processing and data fusion system that focuses on automatic detection and tracking of surface ships that pose a credible threat to safe submarine operations. Contact information is displayed on intuitive and intelligent operator interface displays to allow for management and evaluation of the complex littoral surface ship picture for complete situational awareness.

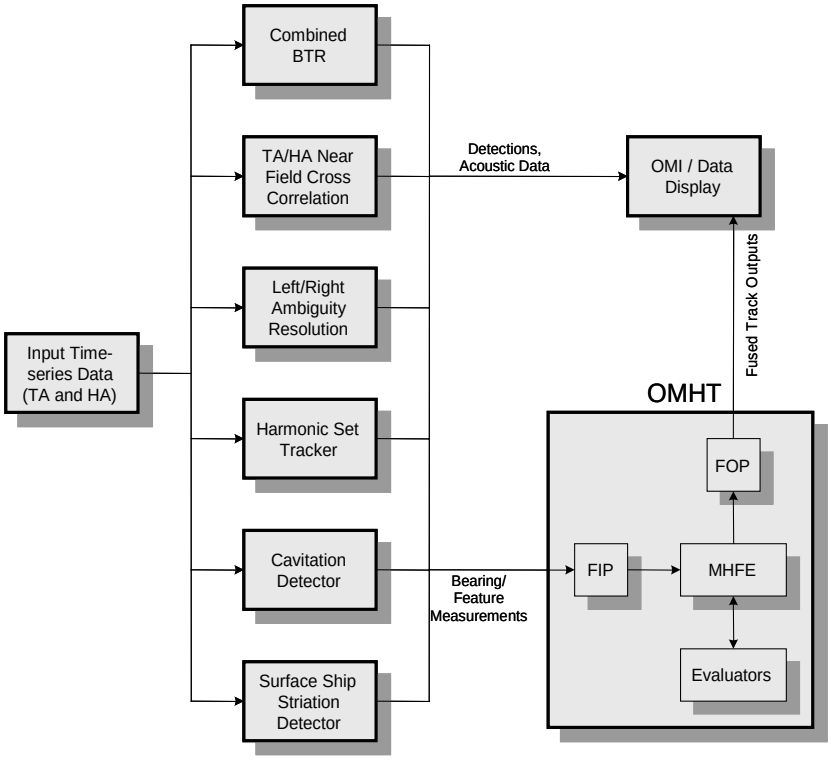

Figure 1. SOSS Phase II System Diagram

LMOD developed algorithms on both arrays to automate the process of enhancing and detecting certain characteristics of signals from other vessels. The characteristics exploited are the primary signals of interest operators currently use to detect, track, and classify. Combining and associating detections from these two arrays will provide the operator with a better ability to maintain contacts and provide an intuitive situation assessment of the contact scene. Figure 1 shows where these system functions fit in the overall SOSS system.

The hull array and towed arrays each have their own strengths and weaknesses, but together they have capabilities that complement one another. For example, the towed array beams have a left/right bearing ambiguity, but the hull array has both port and starboard beams. The hull array suffers from poor sensitivity due to mechanical noise and flow noise. The towed array has higher sensitivity due the more quiet and reduced flow noise environment away from the submarine. In general, these differences are issues of signal-to-noise, beam size and coverage, and array element positional stability.

With the demonstration system SOSS installed in laboratory at NSTCPAC and testing with in-house data, LMOD will get a good estimate of performance. LMOD plans to transition the SOSS algorithms into submarine combat systems through the Advanced Rapid COTS Insertion (A-RCI) program.

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