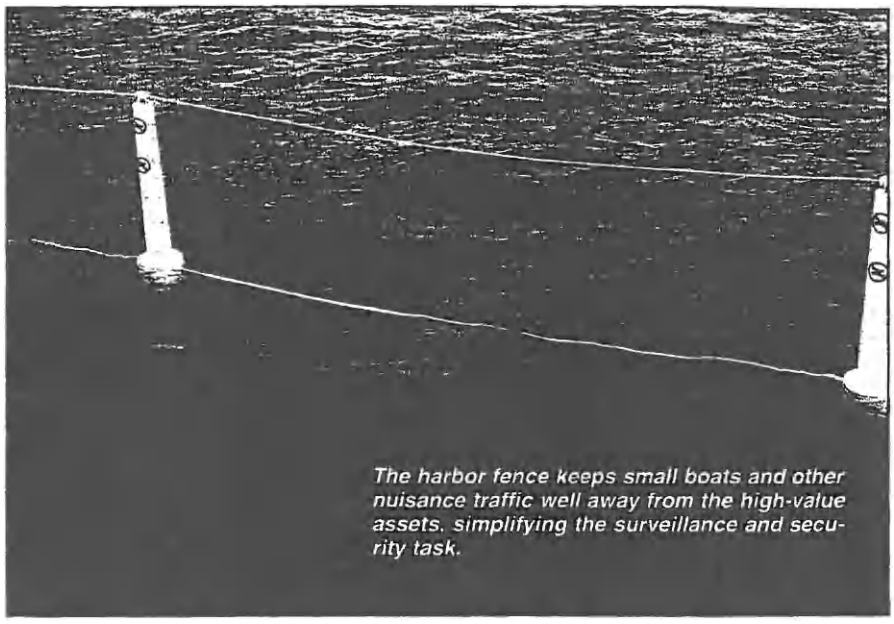
Integrated Harbor Security System Enhances Port Protection

Layered Security Systems Provide Situational Awareness and Threat Detection

By Larry McDonald
Senior Scientist
and
Rachel O'Sullivan
Marketing Coordinator
Maritime Surveillance and Security Systems Operation
Science Applications International Corp.
San Diego, California



The harbor fence keeps small boats and other nuisance traffic well away from the high-value assets, simplifying the surveillance and security task.

We in America generally take the free movement of goods into and out of ports as routine, until a strike or security event limits port operation. A one-day delay at busy ports like Los Angeles, Long Beach and Seattle may represent millions of dollars of lost revenue. Even worse is the threat of importing a dirty bomb or a weapon of mass destruction (WMD). Security systems must be implemented in order to counter highly sophisticated threats. Currently, our commercial and military ports are increasing security levels. But are the systems up to the task? Threats range from low-tech suicide bombers to sophisticated terrorists, and include the introduction of a WMD in a shipping container into a port area. A wide variety of integrated, disparate sensors are necessary to generate a high level of situational awareness in and around the port, while facilitating, rather than hampering, the flow of commerce.

Science Applications International Corp. (SAIC) has developed several layered security systems aimed at providing broad-based situational awareness, early threat detection and event management. Using both SAIC-developed technology and commercially available hardware as appropriate, the systems produce cost-effective solutions that enhance port operations.

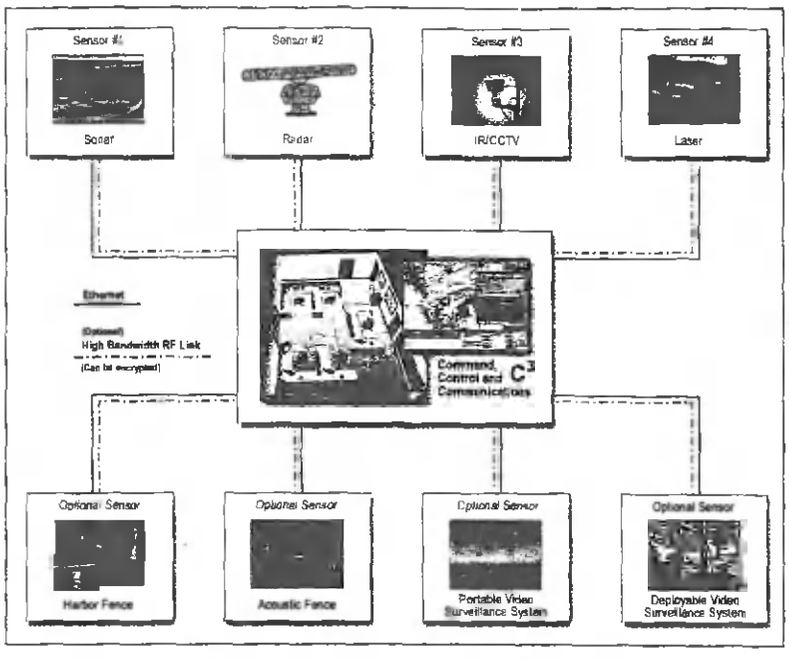
One important element of port security is often the last to be enhanced. Waterfront security has traditionally been largely ignored, except at military ports. With the level of threats that exist today, ignoring this aspect is now done at our peril.

Successful waterfront security requires the intensification of surveillance and security measures, the provision of command situation awareness on and around the water, the dependability of rapid and effective threat response and the provision of overall security for high-value assets and critical infrastructure. The purpose of an integrated harbor security system (IHSS) is to provide broad-based surface and underwater surveillance. To do this, a variety of sensors and subsystems are integrated to allow in-depth coverage and notice-of-intrusion from any quarter.

Sonar Detects Divers, Submersibles

Undersea threats, such as divers, have exacted a heavy toll on moored ships and facilities in several areas in the world. Undersea mines or limpets strategically placed can create substantial damage. To counter this threat, a diver detection sonar is one of the primary components of a harbor security system.

Sonar provides the initial detection and tracking of divers, swimmers and mini submersibles at sufficient ranges to allow response forces time to act. SAIC's IHSS employs a state-of-the-art diver detection sonar with many adjustable elements that provide optimal long-range performance in shallow water. Upon the initial detection of intrusion, effective signal processing allows the system to automatically track and display divers present in high-clutter environments, such as noisy harbors.



The integrated harbor security system consists of standard and optional sensors integrated to allow in-depth coverage and notice-of-intrusion from any quarter. The system consists of standard and optional sensors, as well as command control and display functions.

Radar Tracks Air and Sea Craft

Radar is the second primary component of the IHSS. In this instance, radar is used for the detection and tracking of approaching surface craft and other threats, such as low-flying aircraft. The radar requirements are matched to target range and type, and most harbors require a detection range of less than one nautical mile. A major advantage of radar is that it is operational in conditions of near-zero visibility, with auto-detect and track features. The radar can provide unattended alarms in selected areas, and automatically feed target information to pan and tilt motors, which point infrared and visible cameras for further identification.

Cameras Provide Identification

Infrared cameras and sensitive low-light closed-circuit television systems are the third major sensor subsystem of the integrated harbor security system. These are also sometimes referred to as thermal and visual imaging systems (TIS/VIS). The cameras are used for positive visual identification of threats during the day, night and in most weather conditions. Camera and lens selection is configured for each application, depending upon the environment, range and threat. To provide good coverage and maximum effectiveness in radar and sonar zones, both infrared cameras and standard video cameras are recommended. Options and upgrades to camera systems include wireless data links, radar/video data fusion, enhanced radar and automated target detection and tracking with all video or infrared cameras

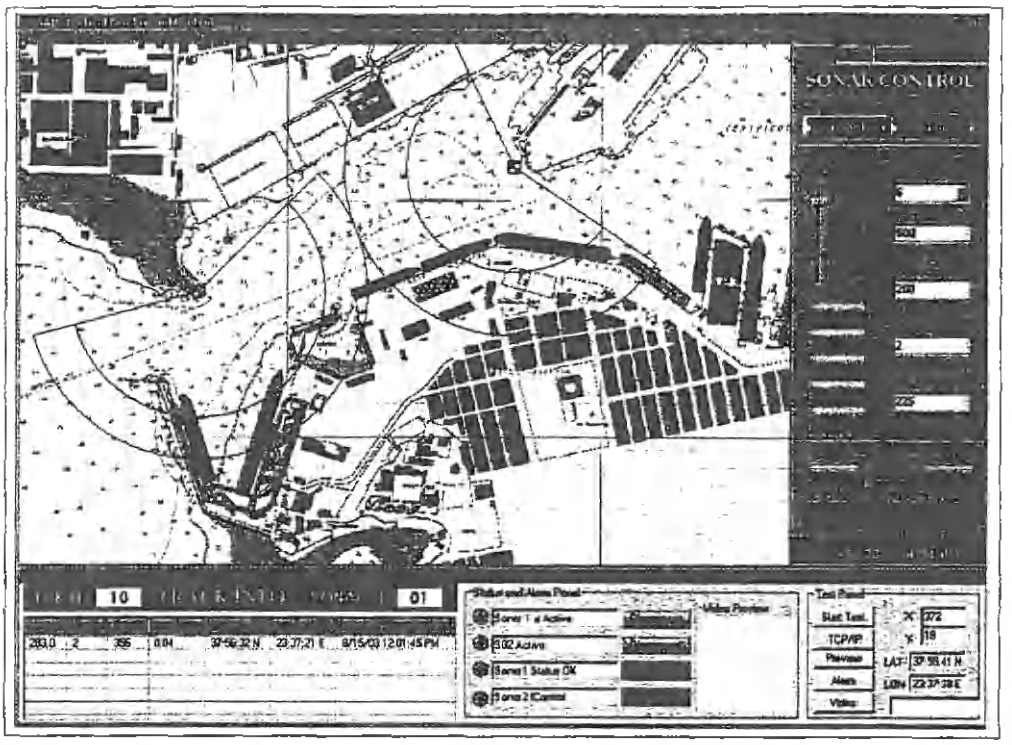
A relatively new, but highly effective, sensor for the IHSS is laser-illuminated imaging. These subsystems can provide imaging at longer ranges, under more adverse conditions than can a standard infrared camera or visual camera. This imaging can be a cost-effective and readily adaptable solution to long-range targeting and identification requirements, regardless of whether it is day or night. Ideally, a laser system should be portable and versatile, and in support of both mounted and dismounted operations. It is also important that the laser imaging system be safe for the human eye. Previous systems operated in infrared wavelengths carried a severe risk of optical damage or blinding to both observed and friendly forces, but current technology allows systems that avoid these risks.

Command Communication

The central element in any integrated security system is the command, control and communications (C3) display. This element is a desktop or laptop computer system that provides system control and communications with the various sensors, and combines the data and processing results on a common situation display. The software will provide automatic, unattended alarms from the station upon any intrusion detected by the sensors. A watchstander can then use the cameras or other sensor outputs to further identify the threat, and to quickly evaluate the situation to provide the most appropriate response. The SAIC IHSS employs variations of the C3 displays developed for military systems, and adapts them to the requirements of each application.

Floating Harbor Fence

SAIC offers several other new options to the basic IHSS. The harbor fence is a portable, reusable and environmentally friendly floating device designed to provide a visible line



The tactical display uses effective signal processing to automatically track and display divers in high-clutter environments when an intrusion is detected.

of demarcation around a ship moored pier-side, across choke points or entrances or around other high-value waterfront assets. The fence is a string of lightweight "smart" fenceposts, or buoys incorporating multiple embedded sensors in each post. A major feature of the fence is that it keeps small boats and other nuisance traffic well away from high-value assets, thus simplifying the surveillance and security task.

If the harbor fence is breached in any way by surface craft, the embedded sensors transmit data to a laptop control console and alarms are automatically generated. The system also provides a map display showing the location of the intrusion. The neon yellow color of the posts and lines provide high day-time visibility, and lights on each post (with selectable flashpatterns) allow excellent visibility in darkness, fog, rain or snow conditions.

The section intruded upon changes its flashpattern to allow in-stant recognition of the breach location for response forces. Options include remote alarms, system operation over the Internet, automatic camera pointing and audible warnings on the fenceposts themselves.

Acoustic Fence Provides Tripwire

A good partner system for the harbor fence is the SAIC acoustic fence, which is also referred to as the underwater sentry system. The acoustic fence is a series of small, very low-power, active sonar transducers on a line that provides an acoustic tripwire barrier around a ship or other high-value waterside asset. It is designed to be integrated with the harbor fence, or it can be alternatively attached to most other floating security or containment booms. The acoustic fence sensors and the associated signal processing algorithms provide automated, unattended detection, alert and localization of an underwater intruder, upon any penetration of the sound curtain. The algorithms provide tracking in the vicinity of the tripwire, prediction of future track and classification features to help minimize false alarms from marine mammals or other non-threatening targets. The booms are moored at a sufficient distance from the vessel to provide a significant amount of time for a response. Both systems have been de-

veloped to be easily deployed and retrieved in about an hour by two to three people in a small boat, or to be used as a fixed asset. The combination of the harbor fence and the acoustic fence provides a high degree of both above-water and underwater perimeter security for either military or commercial applications.

Other Security Options

Other options to the IHSS camera systems include the portable security system (PSS) and the deployable video surveillance system (DVSS). The PSS is a low-cost camera system that functions as a highly portable surveillance system, consisting of a man-portable tripod-like mast that supports a thermal imaging camera with an integral color camera, plus radar.

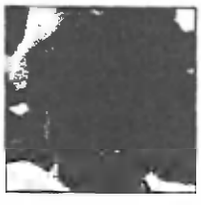
The uncooled thermal camera, which requires no light to operate, creates a clear picture of surrounding objects. Images are read into a TIS/VIS monitor at the C3 display. It has an incorporated chart, plotter and global positioning system receiver. The PSS is currently being used successfully in many areas, including the provision of surveillance for remote oil rigs.

The DVSS is a deployable, advanced technology motion-detection system that consists of four color-fixed, low-light cameras and one pan tilt zoom camera installed at each corner of the protected staging area. This system provides automatic, unattended alarms when motion is detected in selected areas of the field of view, functioning as a remote watchstander. Two wireless video units transmit real-time video to a control unit housed in a rugged PC to evaluate the threat and call for an appropriate response. Utilizing commercial off-the-shelf hardware and SAIC systems, the DVSS is ideal for detecting hostile and threatening intrusions at remote or unattended facilities, from both the water or on land.

The need to exclude or intercept hostile personnel and dangerous material in our seaports is the first line of domestic defense. Integrated harbor security systems are the recognized tools necessary to keeping our harbors safe. By incorporating multiple layers of sensors and surveillance, the ability to respond rapidly and effectively to threats will keep the trade and supply chain open with a minimum of risk and personal safety. /st/

For more information, e-mail oceanbiz@sea-technology.com.

Larry McDonald is a senior scientist at SAIC, working on port security projects for the Maritime Surveillance and Security Operation. With a 1967 B.S. in electrical engineering from the University of Illinois, his specialties are system design, development and test-signal processing, and software solutions. The majority of his experience has been in underwater acoustics, and designing and building sonar systems for the U.S. Navy. In the last 15 years at SAIC, McDonald has worked on a wide range of both water and land-based systems related to surveillance and security.



Rachel O'Sullivan is currently the marketing coordinator for the Maritime Surveillance and Security Operation of SAIC. She has been affiliated with the U.S. Navy and U.S. Naval Reserve for 18 years. Her specialties are print and broadcast journalism, business development and marketing.