Enhancing Port and Harbour Security with Unmanned Surface Vehicles

As readers of *Hydro International* know, the world's ports and harbours are crucial to global trade. From Singapore to Antwerp, and from Shanghai to Rotterdam, Los Angeles, other megaports and hundreds of other smaller ports, these crucial nodes are critical to world trade. A disaster like a fire, explosion or major oil spill could close one of these ports for an indefinite time. The secondary effects of such a catastrophe could include releasing a huge amount of pollution into rivers and oceans.

The magnitude of providing comprehensive security for an average size port – let alone some of the world's megaports – can sometimes lure port authorities into wishing away the challenge. But in an increasingly dangerous world where not just terrorists, but others too, may wish to make a statement or lash out at a particular nation, ports that can be attacked via land or sea present an all too-inviting target.

Port authorities must ensure port security 24 hours a day, 365 days a year. This task includes threat detection and security response, continuous inspection of port assets and on-demand inspections after storms or other disasters, ongoing surveys to ensure navigable waterways, hull inspections, and a wide range of other missions. Port authorities must accomplish these myriad tasks while monitoring port activities' impacts on the environment and maintaining a positive image with the local community.

Today's State of the Art for Port Security

Today's state of the art for port security in most ports involves monitoring the video provided by cameras throughout the port, as well as patrolling the ports' expanse of water with a fleet of manned vessels. These measures are decades old and have seen few technological improvements over that time. Dealing with old and less-than-effective technology stretches the ability of port authorities to provide around-the-clock security and can lead to unacceptable gaps in coverage.

Most large ports – and many smaller ones – use cameras as a means to monitor all or most of the port. However, the video sent by cameras must be monitored or the cameras themselves are useless. Since some ports maintain scores of cameras, this requires having a command centre and enough watchstanders to monitor all of the cameras in real time, 24 hours a day. This often means that multiple crews must be paid to provide round-the-clock monitoring of these cameras.

Almost all ports have the capability to patrol the harbour with a manned surface craft. However, manned vessel operations are increasingly expensive, are often limited by weather and water conditions, and physically requires someone to operate the craft. For most ports, multiple manned vessels are needed to guarantee sufficient revisit time to ensure that a threat has not slipped through the port's security net.

Mantas at work

Additionally, there is a physical toll that accompanies riding in a small vessel. Unlike watchstanders on land who might be able to work shifts as long as 8, 10 or even 12 hours, pounding through an often-choppy harbour in a RHIB or small vessel means that those operating the craft can typically only endure a much shorter watch rotation. This sometimes leads port authorities to purchase larger craft, but this drives up the vessel costs and sometimes demands more operators.

It is easy to see how the need to provide round-the-clock security with manned surface craft can quickly multiply costs, even in the most optimistic scenarios. Add rain, wind, waves, fog and other natural phenomena that often reduce visibility and slow patrol speeds, and the need for more craft and more people can multiply significantly.

Clearly, there are substantial challenges in trying to provide round-the-clock security for ports using old technology such as cameras and manned craft. For this reason, visionary port officials have looked to new technology that will enable them to provide better security at a

lower cost for their ports and harbours.

The Port of Los Angeles: A Megaport with a Challenge

The Port of Los Angeles (POLA) is the busiest port in the United States. This megaport comprises 3,200 acres (42 square miles) of water, 43 miles of waterfront, 26 passenger and cargo terminals and 86 ship-to-shore container cranes. In the last year for which statistics are available, the port handled almost ten million twenty-foot equivalent units (TEUs) of cargo.

Current capabilities to secure the POLA's 42 square miles of water involve monitoring the video provided by 500 cameras throughout the port, as well as patrolling the port's expanse of water with manned vessels. This current state-of-the-art solution stretches the ability of the port authorities to provide the necessary around-the-clock security for the ships berthed there, as well as for those port facilities on the water's edge.

The challenges faced by the POLA are not unique and are likely to be similar to those faced by other ports such as Singapore, Antwerp, Shanghai, Rotterdam and many others. And while, like POLA, most of these ports have probably made incremental technology upgrades to their port security capabilities, a better approach might be to leverage what the POLA is doing by proactively exploring a cutting-edge technology solution to their security challenges.

A Best-practices Demonstration for the Port of Los Angeles

Due to the fact that it is not only the busiest port in the United States but also one that sits astride the nation's second-largest city and the country's third-largest airport, a large number of government agencies and other organizations are stakeholders in maintaining the security of the POLA. While officials in these entities recognize the desire of POLA officials to contain security costs by seeking a technology solution, they also insist on a 'try-before-buy' approach before replacing current systems with new technology. Therefore, a technology demonstration was required as a first step before making any wholesale changes in the port's security capabilities.

POLA officials did their due diligence and searched for another port or harbour that had experimented with emerging technology to provide enhanced security. POLA's search led them to a port security demonstration conducted by the US Army. In September 2017, the US Army evaluated three unmanned surface vessels as part of a Mobile Ocean Terminal Concept Demonstration (MOT-CD) in Concord, CA. The primary objective of this demonstration was to assess the ability of a small USV to patrol and protect the harbour and ammunition-loading container ships berthed there.

In order to perform a comprehensive evaluation, the Army used three different sizes of small USVs (6-foot, 8-foot and 12-foot) for varying missions. While the details of this MOT-CD demonstration are well beyond the scope of this article, what *is* important is that the family of small USVs provided superior coverage of the expanse of the terminal as well as quicker threat detection and identification than the manned vessels currently in use.

After consulting with the US Army regarding the success of MOT-CD, POLA officials invited Maritime Tactical Systems Inc. (MARTAC) to visit and demonstrate the capabilities of their MANTAS USV that Army officials used for their demonstration and evaluation. MANTAS is a high-performance USV built on a catamaran-style hull and comes in a number of variants ranging in size from 6-foot to 50-foot. A demo was conducted with a 12-foot MANTAS as it had already proven its viability for the wide variety of POLA missions described above.

Twin-screw Battery-powered Electric Propulsion

The 12-foot MANTAS (otherwise known as the T12) has a length of 12 feet and a width of 3 feet. It is 14 inches high and draws only 7 inches of water. The vessel weighs 260 pounds and has a carrying capacity of 140 pounds. Its twin-screw battery-powered electric propulsion prime mover enables the T12 to cruise at a comfortable 20 knots in sea state four. It has a cruising range of up to 60 nautical miles.

While the demonstration was performed with the T12, the family of MANTAS vessels ranges up to 50-foot in size and, as the size increases, so too does the speed, on-station endurance/loitering time and payload/sensor carrying capability. All craft can be controlled via a remote operator or manoeuvred autonomously in a preset mission scenario, providing port officials with numerous options for patrolling the port.

The MANTAS can be equipped with a wide variety of above-surface sensors (EO/IR/thermal video) and below-surface sensors (sonars and echo sounders), as well as other devices such as chem/bio/nuclear sensors, water quality monitors and above/below-surface environmental sensors. Real-time monitoring is provided by a MANTAS communications package that can support redundant high-bandwidth networked radios, 4GLTE or satellite communications.

During the visit to the POLA, MARTAC representatives gave a comprehensive briefing on MANTAS capabilities, took a three-hour boat tour to observe the entirety of the POLA authorities' span of operations, and provided a remote demonstration in which port officials controlled and observed MANTAS operating off the eastern coast of Florida near MARTAC headquarters. The demonstration validated the going-in assumption that employing a thoroughly tested and proven USV is a solution POLA is keen to pursue.

Open Architecture and Modular Design

After observing the MANTAS remote demonstration, it was determined that the capabilities of this USV meet the requirements for a variety of missions for the POLA. The MANTAS has an open architecture and modular design, which facilities the rapid changing of payload and sensor components, thereby providing day-to-day port security as well as on-demand inspections.

It was pointed out that an active port-security unmanned profile may require a longer endurance, a higher interdiction speed, and an increased mission payload sensor profile than what the T12 could provide. The modularity and open architecture design of the MANTAS USV system easily allows for increasing the size of the craft from the battery-powered electric motor 12-foot T12 to a marine diesel-fuelled 24-foot T24 or 38-foot T38 that further provides for an intercept burst speed of up to 80 knots.

This demonstration certified that commercial off-the-shelf USVs can conduct a comprehensive harbour security inspection of a megaport such as the POLA. As a facility with a longstanding need to augment its camera and manned vessel patrol activities with emergent technology in the form of USVs, the POLA demonstration provided a best-practices example of the art-of-the-possible for enhancing port security.

Providing Enhanced Port and Harbour Security

There is a clear reason why this kind of enhanced security methodology has not yet been evaluated. The technology to provide reliable, adaptable and affordable USV support to augment manned capabilities and expand the reach of port officials at facilities such as the POLA – as well as other megaports such as those in Europe or Asia – simply did not exist a few years ago.

This technology is available today with commercial off-the-shelf USVs, and these can be employed to increase the effectiveness of port protection. Given the enormous personnel costs associated with monitoring cameras and patrolling with manned vehicles, this new solution will drive down costs. This is not to suggest that ports completely abandon current means of patrol and inspection, but rather that they supplement these means with COTS USVs.

Given the way that commercial off-the-shelf USVs have performed in an increasing number of military and civilian exercises, experiments and demonstrations, one has to ask why they are not being leveraged more fully – and more quickly – for a variety of missions. Like any new technology, COTS USVs take a while to gain traction.

However, there is a danger to waiting too long to put them to use. Our megaports support globalization and the worldwide security and prosperity it delivers. World leaders should remain cognizant of the obligation, as well as the challenge, of protecting these vital nodes that support the burgeoning world trade that has lifted hundreds of millions out of poverty. Protecting these vital ports must be a first-order priority for all nations.
