# BORDER CONTROL

**Karen Kingham** *reveals the latest innovations in port security systems*

**If money is what makes the world go round, it's the goods on ships sailing round the world that makes the money! And a staggering 80 percent of all global trade travels the world on the planet's oceans and seas.**

Many of the cars we drive and the fuel to drive them, fuel to heat our homes and power our industries. The TVs we watch, our phones and laptops, food and the clothes we wear. The raw materials that we need for our own industries and the fertilisers we need to make our crops grow. In fact, almost everything we take for granted.

In Europe, it is estimated that 53 percent of all goods arrive by sea. All those goods and materials ultimately have to make landfall somewhere, so whether you are in the Netherlands or landlocked Hungary, those goods are likely to have been offloaded at one of a relatively small number of major ports and transhipped to you by road or rail. And unless Xi Jinping's 'belt and road initiative' becomes a reality, that situation is not likely to change.

Given that we are so dependent on ports, particularly the major ones, it's not surprising that they are considered critical infrastructure. But more than that, they are also borders. This means port authorities and stakeholder agencies manage what is probably one of the most complex security domains possible.

Ports are often spread over a very large area, Rotterdam for instance is 40km long and 10km wide over 12,464 hectares giving us an estimated perimeter fence of around 90km+. Sometimes in a semi-rural environment, but very often set in the middle of a busy urban environment and sometimes both. There are usually multiple entrances in and out of the port for people, vehicles and trains, and waterside for vessels of all sorts. Not only do they have to secure the landside domain, but surface and sub-surface water domain and now increasingly the air domain because of the proliferation of drones. And all this has to be done while ensuring the free flow of goods and people.

The threat landscape is equally complex. You have organised and petty criminals trying to get in, to take advantage of the rich pickings in goods just waiting for some enterprising thief to get their hands on. Often with the aid of insiders.

Then there are smugglers and traffickers, trying to get contraband, people and sometimes weapons through the port and into the wider country, all hidden among the regular flow of legitimate goods and passengers.

Then of course there is the threat of terrorism. Given that ports are relatively vulnerable and offer such a target-rich environment, it is really surprising that there hasn't been a major terrorist attack in the west. There is a number of terrorist threat scenarios that keep the authorities up at night, the most obvious being an attack on a fuel storage facility within a port. The proliferation of highly capable drones makes this a real danger. Then there is the much-hyped possibility of a 'dirty bomb', which whilst unlikely, is an ongoing concern.

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So complex are the security issues facing ports that I decided to focus on just four technologies for this article. Some may be new to readers and others more familiar, but as part of an integrated security system they all could and should significantly enhance port security.

Effective perimeter security at ports can be significantly enhanced by deploying fiber-optic Distributed Acoustic Sensing (DAS) technology. These systems can be installed on the perimeter fence or, for covert operations, buried in the ground near the fence. According to David Hill from Sintela, DAS transforms a standard fiber-optic cable into a virtual dense array of highly sensitive motion sensors.

DAS Sensing Units acquire and process data in real-time, allowing for the detection, location and classification of activities adjacent to the fence. Unlike older fiber-based Perimeter Intrusion Detection Systems (PIDS), DAS achieves a high probability of detection with a low nuisance alarm rate, even in noisy environmental conditions. This is made possible through the acquisition of broadband high dynamic range acoustic data, which is then processed using machine learning and advanced heuristic algorithms to accurately classify each signal.

The real-time geolocation, detection and classification capabilities of DAS enable these systems to direct slew-to-cue cameras and other sensors to provide further confirmation. Security personnel are immediately informed of the exact location of any suspicious activity, ensuring a prompt response and more effective use of valuable (and expensive) manpower assets.

An additional benefit of using DAS is its versatility. The fiber-optic sensing cable can be laid on the seabed beside the port to detect and locate motorised craft, extending the security perimeter beyond the land to the water.

## HUMAN PRESENCE DETECTION IS VITAL FOR SEARCHING FOR PEOPLE HIDDEN IN VEHICLES

In summary, deploying DAS technology at ports provides a robust and versatile solution for enhancing perimeter security, leveraging advanced acoustic sensing and real-time data processing to maintain high-security standards.

Bad actors involved in illegal activities such as smuggling, surveillance drones and dark ship cargo transfers depend on wireless communication to enable their activities. Port authorities that monitor their wireless spectrum can better understand their own RF emissions and consequently detect signals that may indicate illegality.

Wireless technologies, such as Wi-Fi, Bluetooth and push-to-talk radios, use the RF part of the spectrum to send and receive radio waves carrying data from a transmitter to a receiver. RF spectrum monitoring using sensors and software provides operators with a picture of what signals are present and helps identify illegal, unlicenced, or interfering signals. Continuous spectrum monitoring allows operators to identify problem signals in real-time and to detect patterns of signals over time. These signals can then be geolocated using the Time Difference of Arrival or Angle of Arrival techniques and personnel can be dispatched for closer investigation.

To safeguard port infrastructure against unmanned aerial vehicles (UAVs), RF sensors detect any RF emission made by drones (including telemetry data, video transmission or payload communication) or wireless devices being used to operate the drone. RF technology monitors the spectrum and actively hunts for specific signals in known frequency bands. Upon detection, the signals are immediately geolocated using 3D TDoA – providing port authorities with accurate, real-time intelligence.

This type of technology has its origins in the military domain, but companies like the UK's CRFS are now bringing this sort of know-how and technology to the wider security market and have already successfully deployed their system at the Port of Antwerp.

Something new in the world of drug detection is Muon Tomography, a technology which has been around for a while, but is relatively new to the security market and this author, for one, had not heard of it at all until only last year. So, what is it? Cosmic rays are constantly bombarding the earth, interacting with atmospheric

atoms and giving rise to subatomic charged particles known as muons and electrons. These naturally occurring particles permeate our entire environment passing through us and everything around us, including steel, lead and the densest rock, penetrating the earth's surface up to 1 kilometre below ground. In fact, there is no substance known to man that they don't penetrate. It is estimated that approximately 10,000 of these particles pass through the human body every minute, without any adverse effects at all.

## RF SENSORS DETECT ANY RF EMISSION MADE BY DRONES TO SAFEGUARD PORTS AGAINST ATTACKS

US company, Decision Sciences developed a unique and groundbreaking technology capable of producing imagery by mapping the interactions of muons and electrons based on the atomic number and bulk density of materials and analysing the trajectories of these charged particles as they pass through the materials.

Based on this science they have developed a non-intrusive scanning technology system called Discovery, capable of detecting contraband and anomalies such as drugs, weapons, chemicals, even inside bulk truck cargoes and containers, penetrating cover loads such as ice and water, salts, gravel and aggregate, steel and lead. It can also detect unshielded and shielded radiological and nuclear materials,

In addition, the system is also uniquely able to detect and identify anomalies in organic cargoes, such as bulk fruit consignments like bananas, frozen goods in freezer containers, wheat, coffee, etc. that are used as shielding cargoes to defeat X-ray scanning. But unlike artificially generated X-rays, which can be extremely harmful, it is completely safe for the drivers, operators and any type of cargo.

Taking full advantage of the benign nature of this scanning technology, Decision Sciences has recently announced that it has developed an algorithm that can even safely detect human beings hidden inside containers and cargoes. Discovery systems are already in ports such as Singapore and Abu Dhabi.

For the last couple of decades, one of the most important technologies used by border officials in the search for people hidden in vehicles, has been Human Presence Detection (HPD) systems, or so-called heartbeat detectors.

The way they work is that the driver and legitimate passengers are asked to vacate the vehicle, and then operators attach at least two magnetic geophone sensors to it.

These ultra-sensitive sensors measure the tiniest movements or vibrations, both voluntary (body movement) and in-voluntary (heartbeat) transmitted through the vehicle's body and suspension system to detect person/s hidden inside.

This works well in a protected inspection shed, but in the busy open-air environment of a working port, the systems are liable to generate an unacceptable level of false positives. What's needed is an HPD system that operates outdoors in wind and rain and can cope with the constant movement of heavy goods vehicles in very close proximity.

UK company ClanTect, which came out of the Institute of Sound & Vibration Research, was founded with the specific brief of eliminating the problem of false positives generated by environmental noise and vibration. ClanTect HDS uses advanced proprietary algorithms, signal processing and systems logic to eradicate any background interference. In addition, it uses a ground sensor and a unique proprietary wind-frame, which can effectively 'block' out the vibration resulting from wind excitation, thereby enabling accurate searches to continue, even in very busy locations. This system is already in use with border agencies worldwide ●

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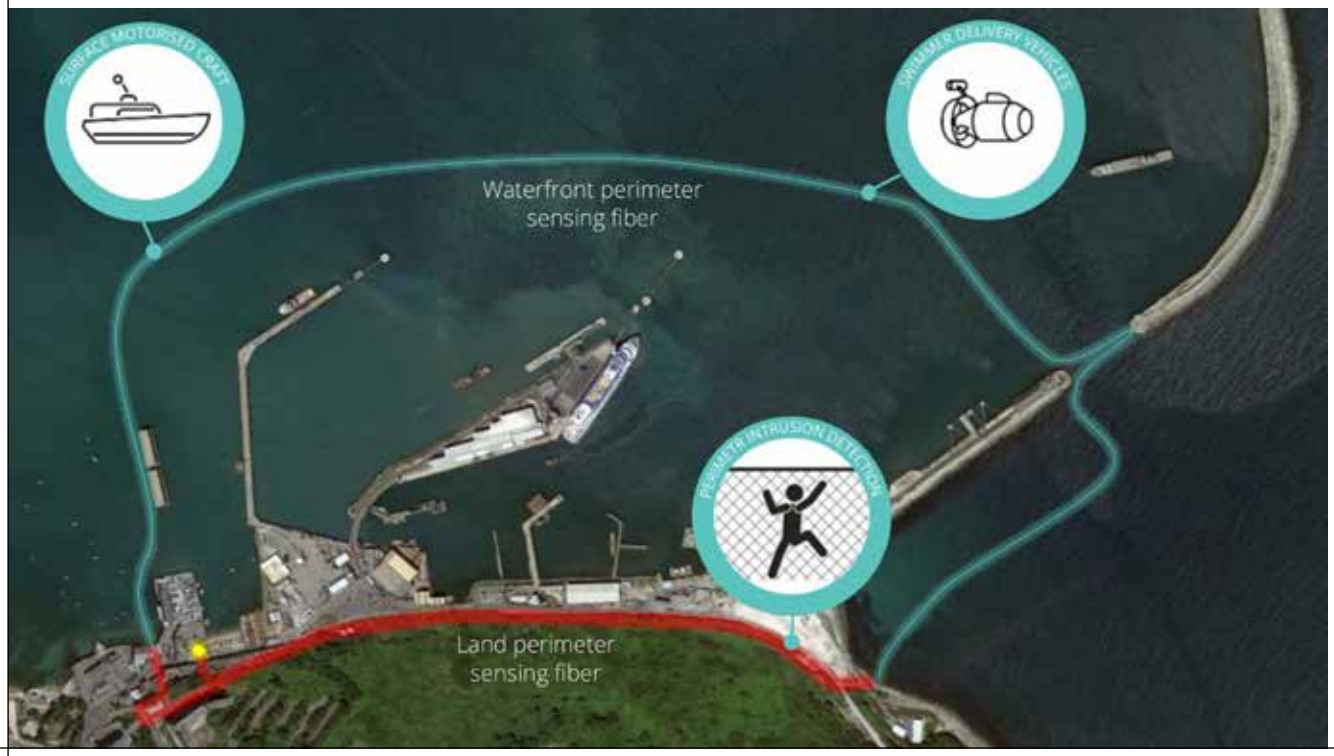


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Picture credit: Sintela, DAS