Case studies help in upgrading port security

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The Houston Ship Channel is a major seaport with unique and complex vulnerability issues that can be analyzed to design general models of integrated safety solutions.

Seaport security has become a critical element of supply chain economics and a vital concern for world shipping. Since 2002, the International Maritime Organization has recommended comprehensive safety measures within the framework of its International Ship and Port Facility Security (ISPS) code. In the United States, port security is regulated by Homeland Security directives. The market for related technology and services has grown significantly in recent years with the elaboration of several attractive options for marine facilities. Large seaports, however, are not conducive to a ‘one-size-fits-all’ solution. This is because every port has different security features and challenges, and the vulnerability issue usually requires consideration of large-scale, multitiered complex systems. In this context, seaport case studies offer cross-fertilizing insights and alternatives that can be generalized.

The Houston Ship Channel (HSC), one of the busiest waterways in the United States, provides a unique example. It is the second largest American port (2005) and the world’s tenth largest in cargo volume (2004). Its important economic role has long been recognized. Strategically more critical, however, is that it also represents globally one of the largest petrochemical complexes, with 40% of US refinery capacity located along its waterways. Since 2002, its security issues have been the object of extensive scrutiny and were also featured in popular articles with vivid descriptions of hypothetical disaster scenarios. The HSC has periodically been widened and deepened to accommodate larger ships and is currently 530 feet wide by 45 feet deep by 50 miles long. It extends from the Gulf of Mexico to the fourth largest city of the United States: see Figure 1(a).

The safeguarding of the HSC is a shared responsibility of federal, state, and local authorities, including 151 privately owned facility operators. These various entities together form a de facto macroscopic security system that represents an interesting case of complex multilayered systems consisting of a throughput screening and access control system, a command, control, communication, and information (C3I) system for total situational awareness, and a support infrastructure that includes telecom network, power and material supply, and service.

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Figure 2. Basic concept of the macroscopic physical security system, which includes access control and surveillance of important aspects of the port and its operation. 5

Figure 3. General concept for a channel-wide surveillance network. GIS apps: Geography information service applications. AIS: Automated identification system. VTS: Vessel tracking system. SAN: Storage area network.

The challenge of upgrading such a system is to achieve integrated effectiveness. One proposed strategy would bootstrap the upgrade in different phases. At each step, components of various layers are selected for improvement to provide an immediate and high-impact return on the whole operation.

A focus of the HSC study is the issue of access control, specifically, intrusion protection, surveillance, and situational awareness. The basic working concept is illustrated in Figure 2. 5 It consists of a top-level application layer that requires support from lower layers. A key front end is the proposed surveillance network illustrated in Figure 3. Undergirding this layer and the C3I system is a back end that includes a planned high-capacity backbone optical network that will enable the

net-centric information integration system outlined in Figure 4. The data sharing will promote unified situational awareness for effective coordination among the different HSC administrative and jurisdictional authorities.

Surveillance is particularly crucial. A theoretical feasibility study was conducted with the technologies illustrated in Figure 3 (visible/IR camera, radar, and sonar). The study included parameterized modeling of threat detection in the HSC environment. Results showed that the unusual riverlike geography of the HSC Buffalo bayou segment—see Figure 1(a)—presents both advantages and challenges. The narrow channel allows easy waterside surveillance, but landside security is significantly complicated by its location in the middle of urban and industrial zones. Attacks could conceivably occur using vehicles in public access locations. In addition, current technologies have significant limitations, since most are designed to prevent stealth intrusions but not those based on deception, that is, using camouflage or false representation.

In summary, the HSC poses an interesting case study of port security with a degree of complexity beyond any stereotypical perception. Defense against intrusion involves not only waterside but also landside issues, and requires a balanced and systematic reduction of vulnerability that considers all potential threats. Although several technologically advanced surveillance products have recently emerged, important challenges must be addressed in developing sophisticated countermeasures. Increasingly, port security will not be a one-time implementation, but a continuous process of building layers of defense that will integrate and build on several subsystems.

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References