Risks Analysis and Efficient Logistics for Maritime Ports and Waterways

The overall goal of this research project is to develop advanced probabilistic risk assessment algorithms for maritime port and waterway infrastructure security/safety and efficient operational logistics. A comprehensive effort will be undertaken developing a combined simulation and mathematical risk analysis approach and collecting streaming data and expert opinion on key parameters. The proposed research will lead to a new port/waterway risk monitoring approach that will help generating scientifically sound and practical risk mitigation policies. Thus, enhanced maritime domain awareness will be achieved via detection and monitoring for anomalies or potential dangerous incidents that can occur in the course and flow of trade. The proposed research will also lead to efficient operational logistics with direct applications to the Ports of Qatar, traffic around the port and the choke points in the region such as the Strait of Hormuz.

In the world of international trade, nearly every business opportunity places a demand on maritime transportation, since it is the most economical and in many situations the only means of transportation. Today, more than 90% of the world's exports are moved via maritime transportation (UNCTAD-2009). Thus, marine ports (all of which have channels for navigating vessels) and waterways are critical for the safe and secure movement of goods in the global supply chain. In view of this, we propose to develop computationally efficient mathematical risk analysis algorithms for maritime-born security and safety risks for port and waterway infrastructure. These algorithms will use data on vessel movements obtained via the AIS (Automatic Identification System) that are constantly streaming from vessels navigating in coastal areas, ports and waterways. The analysis will be based on probabilistic models of risk and use historical data, expert opinion and streaming data.

Development of a real-time risk monitoring tool for ports and waterways is very important to be able to constantly monitor maritime-born risks to commerce, infrastructure and population in the surrounding areas. Such a tool will have the potential to serve as an operational tool by the port partners (Coast Guard, private and public facilities) and to maintain continuity of operations and resiliency via better planning and preparedness. This is utmost important for the Ports of Qatar and the Strait of Hormuz which is a major choke point for the global energy supply chain.

Efficient operational port and waterway logistics will be achieved through the study of the analysis of the vessel movements in the port. An important measure of efficiency in ports is the expected port time per vessel and is highly affected by vessel scheduling. Using the combined mathematical and simulation models we propose to design various cargo-vessel scheduling policies and principles that will achieve lower risk and port time targets. The same principles also apply to handling truck congestion at the gates of the Ports of Qatar.

More importantly, taking into account the latest advances in maritime traffic monitoring, the project will result in developing human resources in Qatar through technology transfer and

advanced training programs. These will include professional and educational programs not only for graduate students and academic researchers but also for professional personnel involved in maritime operations such as port operations and management and the VTS system in the Ports of Qatar.

The long-term vision of this proposal is to establish a center for research on maritime port and waterway risk analysis and operational logistics for the Ports of Qatar and the surrounding coastal infrastructure.

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