A System for Improved Situation Awareness at Sea around the Ship

M. Andersson, R. Forsgren, R. Johansson and K.G. Stenborg
Swedish Defence Research Agency (FOI), Sweden

***Abstract*— Maritime situation awareness is the understanding of activities carried out at sea that may impact on security, safety, economy or environment. The EU FP7 project IPATCH[1,2] has developed a system that is able to extract critical information among heterogeneous data for improved situation awareness.**

I. Introduction And Background

To obtain effective situation awareness in a maritime environment is a complicated task. The reason is that many different factors are at play in the diverse and highly dynamic environment around the coast and at sea. There are numerous ships with different appearance and kinematic behavior. There are multiple decision makers from diverse agencies focused on different perspectives, such as trade, regulation, safety, security, customs, border control and maritime environment. In addition, available information of maritime activities can be expected to be distributed, uncertain and unreliable and therefore needs to be used with some caution.

This poster will present a maritime surveillance system that can automatically sort among a large amount of heterogeneous data. The system extracts critical information to the ship's crew to obtain situation awareness and detect possible risks and threats.

II. The Maritime Surveillance System

The maritime surveillance system, which was developed in the EU FP7-project IPATCH [1], is based on statistical models that use sensor data from heterogeneous sensors, historical data of events and threats and environmental information. Environmental information includes weather data, time of day and geographical data.

The sensor data are the basis for object detection and tracking as well as behavioral and threat analyses. Data and information processing for behavioral and threat analyses combines processed information from on-board sensors with intelligence from external sources about the current situation in the region with associated historical events, in order to give early warnings about specific risks and threats.

The focus in the IPATCH project was early warnings of pirate attacks on merchant ships. In the pirate application, the system does not only estimate the likelihood of threats but also suggests non-lethal countermeasures in order to minimize the risk of effective attacks. The system use output data from the threat analysis for the suggestion of suitable countermeasures.

The system is based on the concepts of *intent, capability* and *opportunity*. All three factors should be present (with high probability) in order for a threat to be realized. For example, if there is an intent and an opportunity, but no capability, the threat cannot be realized.

III. Results

The system has been evaluated against real data from sensors, historical events and environment. Sensor data were collected during the IPATCH demonstration at the end of the project. The demonstration took place outside the coast of Greece. Different pirate attacks were simulated by small boats towards the own ship, which was a tanker. Sensors that were positioned on the tanker were visual and thermal infrared sensors. Also the tanker's radar and AIS information were used. In the scenarios one or two boats approached the tanker in different ways concerning behavior, speed and direction.

Figure 1 presents results from the threat analysis from one of the scenarios. In this scenario small boats are loitering near the tanker. Since they are relatively close to the tanker there is a relatively high threat level already at the beginning. Then the system detects that the boats are loitering, which is not often the case at sea, which leads to a further increase in threat level. Finally, one of the boats starts approaching the tanker and the threat level is increased again.

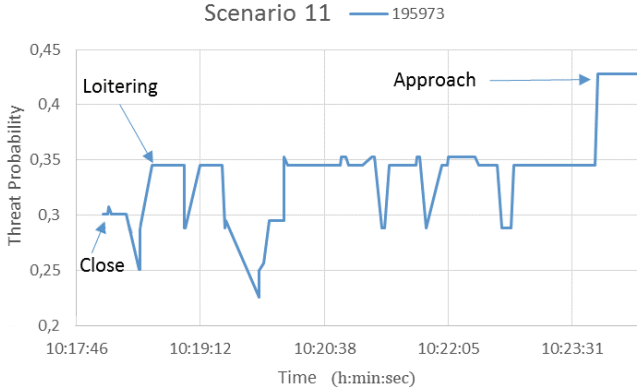

Figure 1: Estimation of threat level for a pirate attack scenario.

In summary, the IPATCH system gives an automatic threat analysis and local situation awareness around a ship. The information is presented in a decision support system on the ship's bridge.

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[2] The coordinator of the project was BMT (UK). Partners were FOI (SE), Sagem (FR), University of Reading (UK), ITTI (PL), Termisk Systemteknik (SE), Università Cattolica del Sacro Cuore /Transcrime (IT), University of Namur (BE) and Foinkas Shipping Company (GR).

References

[1] EU FP7 project IPATCH (2014-2017), http://www.ipatchproject.eu/.