

# Simulation of Illegal Maritime Activities

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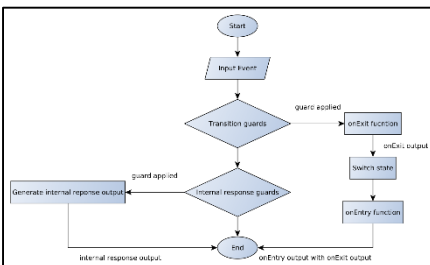
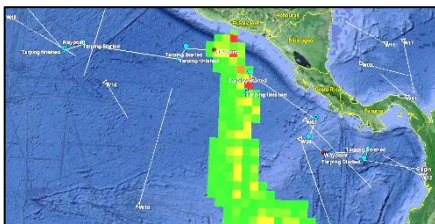
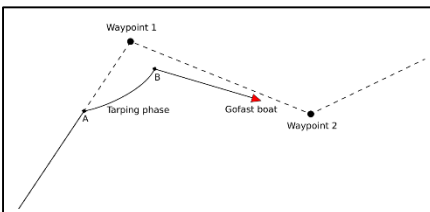
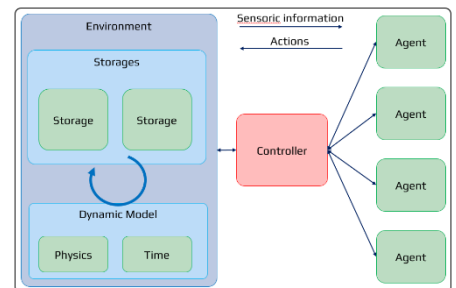
## Problem Overview

Today's high seas are filled with a number of illegal activities including illegal fishing, waste dumping, maritime piracy, drug smuggling, human trafficking and others. A number of naval assets is deployed in both national and international waters to detect, interdict and prevent these activities. The positioning and allocation of naval assets is typically planned and scheduled by subject matter experts and naval authorities. A crucial link in the mission planning chain is validation of the asset allocation schedule which is typically performed by conducting various what-if analyses, both mentally and computationally.

We provide a state-of-the-art agent-based simulation of the illegal maritime activities to enhance the validation step by executing thousands of scenario realisation to assess the performance of the planned mission. The simulation can be directly connected to an existing decision support system through a web service call or the user can access the framework through a graphical user interface directly defining scenarios to be validated.

## Simulation Framework

We provide the operator with the access to the agent-based simulation, which is either event-based for domains with low interaction requiring high scalability (such as illegal fishing and waste dumping problems) or step-based for quick implementation and high interaction (maritime piracy, drug smuggling and others). The simulation contains a high-fidelity model of meteorological condition with integrated forecast as well as high-resolution geographical area representation.



## BSS Behavior Models

The agents' behavior models capture incentives, constraints, level of rationality and level of knowledge. We have developed unique hierarchical behavior state machines to be able to capture an unlimited behavior complexity. We capture reactive behavior, such as collision or obstacle avoidance or goal attraction incentives to react on weather changes, sight of an opponent or reacting on a new piece of information. We capture proactive behavior such as route planning, decision-making as well, integrating advanced multi-objective route planning and intelligent reasoning about the opponent, where we utilize game theory to capture the cat and mouse relationship of the opposing sides.

The agents control their embodiment (such as vessels) which are directly influenced by the state of the environment (currents, wind, waves etc.). We model different sensors through which the agents perceive the environment and detection of other agents. Of course, the interaction between the agents is fully supported, standing at the heart of every agent-based simulation.

Blindspot Solutions is able to customize the developed simulation core for any maritime activity and extend the environment model to account for Automated Identification Systems, Unmanned Aerial Vehicles etc. We are able to develop customized behavior models as described by subject-matter experts and we are able to deploy the simulation on site or provide access remotely, execution scenarios on our servers.