Optimal planning of dispersed operations in urban coastal environments

Consider a coastal mega-city with millions of inhabitants in the midst of a threat such as a climate disaster (hurricane, earthquake or flooding) or conflict (organized paramilitary troops, terrorist threats, conventional threats). The army needs to organize a sea-to-land operation to protect such a territory, where marines are landed on the shore of such contested or degraded environment to provide stability and/or humanitarian aid, see Figure 1 below.

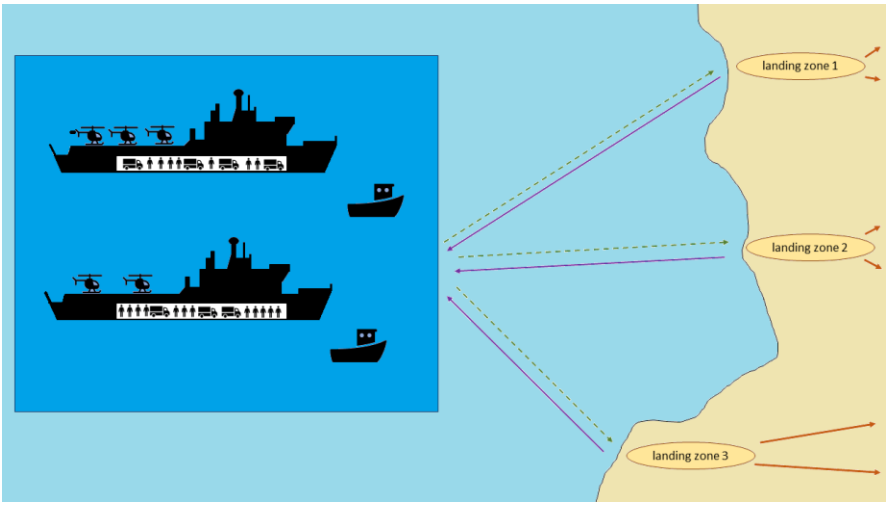

Figure 1. Scheme of a sea-to-shore operation.

Such problems, consisting of complex logistic operations and facing time-changing uncertainty, are solved by the Royal Netherlands Armed Forces. The aim of this project is to construct an operations research methodology for solving and studying the optimal solutions to them.

There are three main parts of such an operation which constitute optimization problems on their own. First, there is the movement phase on a base consisting of several ships located off the coast. For this base, one needs to determine how different units and equipment are placed on the base so that it is easy to put them onto the transporters that will take them to the shore. Optimal solutions might differ based on available transporters (ships or aircraft), the location and layout of the sea base, and location and number of landing zones.

Next, there is the tactical ship-to-shore maneuver phase, where the land units and resources have to be transported to several locations on the coast. This transport is done by helicopters and sea-based landing vehicles. From the coast, the units will disperse to multiple locations on land. The landing has to be conducted in a short period of time, taking into account the always-changing risk posed by the enemy reactions and environmental conditions.

In the last, sustainment phase, the dispersed units ashore are moving towards their objectives. At the same time, units need to be continuously re-supplied from the sea base. The dispersion of the troops on land will have an influence on the feasibility of the re-supply. Adaptive and dispersed operations require frequent and fast replanning of activities when unexpected (real-time) opportunities and threats occur. Planning should provide insight in the consequences of such events and the potential response.

The three problems together constitute the ship to objective maneuver problem for future sea-to-land operations. Problems on land and sea are interrelated, meaning that solutions for one problem affect

feasibility and effectiveness of solutions for other problems. Due to the changing nature of the environment, good solutions need to be found at real-time speed. In this PhD project, the candidate will develop new optimization techniques to solve this problem together with experts from the Netherlands Defense Academy, TNO, and the Erasmus University Rotterdam.

Supervisors
This project is a joint project of the Erasmus University Rotterdam, TNO in The Hague, and the Netherlands Defence Academy (NLDA) in Den Helder. There will be a supervisor from each of these parties, and the candidate is expected to regularly visit each of these institutions. Specifically, the candidate will spend 40% of his/her time at both Erasmus and TNO, and 20% of his/her time at the NLDA.

Requirements
Due to the project's defense-related character, only Dutch candidates are considered. Moreover, a security screening is part of the hiring process.

Contact
If you are interested in working on this project, please contact the following people:
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Deadline
Please send your application (consisting of your CV, grade list, and a motivation letter) to Krzysztof Postek: postek@ese.eur.nl before December 30, 2019. Applications shall be considered on a running basis until the position is filled.