HOWLOG — Heuristic solver for offshore wind O&M logistic resource optimization

HOWLOG is a software program that offers decision support for maritime logistic optimization for O&M at offshore wind farms. HOWLOG utilizes advanced analytical techniques from operations research to help decision makers selecting the best combination of logistical resources and their deployment for O&M tasks at offshore wind farms.

It is challenging to select and deploy the most efficient resources for operation and maintenance (O&M) tasks at offshore wind farm for several reasons:

- Many options for resources, e.g. different vessel types and helicopters, and corresponding infrastructure, e.g. ports and offshore bases

- Several options for maintenance strategies, e.g. when to repair failures, how much and when to execute preventive tasks, should there be some sort of condition-based and/or opportunistic maintenance strategy?

- The maritime aspect and weather conditions challenges the access to offshore wind farms and possibility of executing maintenance tasks

For larger offshore wind farms further offshore these challenges becomes more evident and it becomes impossible for the human mind to capture all relevant aspects and hence, analytical decision support tools are necessary to ensure cost-efficient and risk-reducing options.

MARINTEK has developed decision support tools for logistic resource optimization for the O&M phase at offshore wind farms through a number of research projects: NOWITECH (Norwegian Research Centre for Offshore Wind Technology, 2009-2017), FAROFF (Far offshore operation and maintenance vessel concept development and

optimization, 2012-2013) and LEANWIND (Logistic Efficiencies and Naval architecture for Wind Installations with Novel Developments, 2013-2017). HOWLOG is the result from work in LEANWIND that builds on mathematical optimization models developed in the other projects.

The use of HOWLOG by stakeholders in the offshore wind industry can significantly reduce the cost of energy by providing decision support aiding the use, and development of cost-optimal logistic resources and organization.

APPLICATION AREAS

HOWLOG can provide valuable decision support to several stakeholders in the offshore wind industry:

- Offshore wind farm developers and operators

    - Which are the optimal maintenance vessel resources?

    - Which are the optimal maintenance bases and what type of characteristics should they have?

    - When to schedule maintenance tasks?

- Maintenance vessel providers and innovators

    - Cost/benefit analysis for evaluating/ choosing among existing vessel designs

- Early phase feedback for new vessel design
- Maintenance concept developers and innovators
  - Cost/benefit analysis of new concepts and the potential effects on the logistic system

SOFTWARE OVERVIEW

HOWLOG is built with an Excel-based input/output user interface. Weather data are read from a number of generated text-files. The model itself is implemented as a Java-application. From the Java-application the user selects input excel file and runs the solver. Upon completion, the optimal solution can be exported to an Excel file.
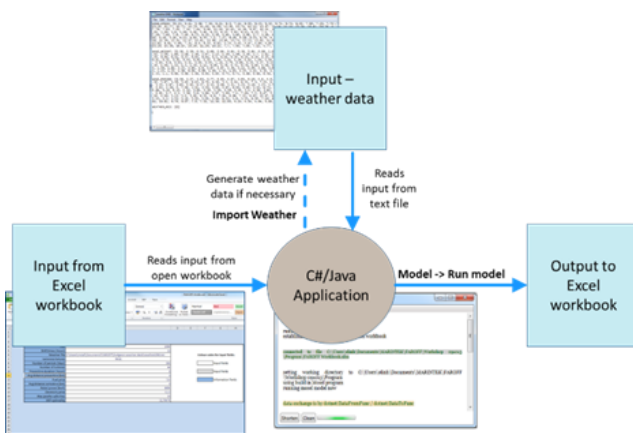
KEY FEATURES

- Advanced analysis of logistics operations for O&M at offshore wind farms
- Propose cost-optimal options to the planning problems
  - Logistics resources and deployment
- Weather conditions and corrective maintenance tasks are stochastic parameters

MODELLING OVERVIEW

In the discipline of operations research (OR), the aim is to develop and apply advanced analytical methods for decision-making process. The modelling of HOWLOG is from a research area within OR where mathematical models are used to describe the planning problems and solution methods for these are used to find optimal or near-optimal solutions to the problems.

In HOWLOG, a heuristic solution method is implemented, with the following building blocks:

The implemented solution method can efficiently find
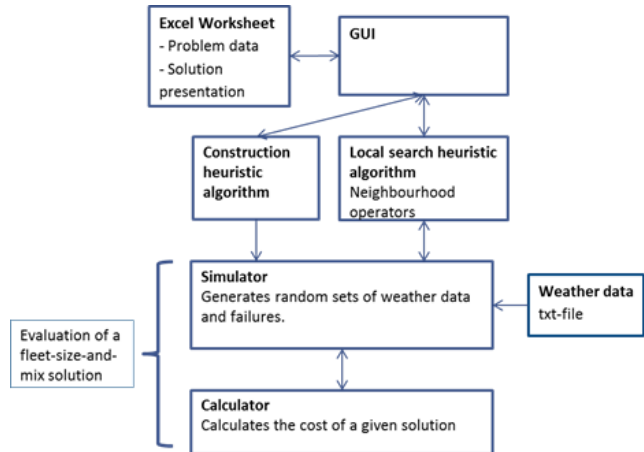
close-to-optimal solutions to the O&M maritime logistic resource planning problem.

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