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# Emergency Lightering in Open Seas

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## ABSTRACT.

Even though the frequency of incidents involving large oil tankers has been reduced during recent decades, the consequences of such incidents can be very serious. At the Ship Manoeuvring Simulator in Trondheim a number of shipping companies are training senior officers in ship-to-ship lightering operations. On the basis of experience from real-life situations it was decided to develop specific training scenarios for emergency transfers of oil between two large tankers under harsh weather conditions in open seas. This work formed part of a research and development project supported by the Research Council of Norway.

KEY WORDS: Tankers; Simulation; Lightering; Training; Emergency operations.

## INTRODUCTION

The purpose of this paper is to describe the development of simulator-based training exercises for open-sea transfer of oil between two large oil tankers. The situation behind the training exercises is a loaded tanker in distress due to hull strength problems. Before the distressed tanker can be taken under emergency towing to a safe haven it has been found necessary to transfer a significant amount of its oil cargo. Transfer is to be made to a ballasted tanker by means of a side-by-side lightering operation. It is assumed that such an operation may have to be done under harsh weather conditions in order to prevent a major oil spill from the damaged vessel.

Increased oil exports from Russian Barents Sea ports will increase the number of oil tankers that take a northern route passing between the Faroe Islands and Iceland. South-west of Iceland, the tankers will pass through very rough waters, possibly resulting in hull damage due to repeated high and/or extreme wave loading. In order to prevent further hull damage the tanker may need to offload part of its cargo to lower global and local stress levels. Controlled offloading in the form of emergency lightering to another tanker is a high-risk operation. Personnel involved in planning and performing such operations will need dedicated simulator-based training inorder to learn about critical aspects of the various phases of an emergency lightering operation. They will also need support from shore-based personnel who have access to advanced strength and stability calculation programs as well as a simulator for studying the potential outcomes of different strategies for assisting the disabled tanker.

For many years, shipping companies involved in normal lightering operations have used ship-handling simulators to train and qualify mooring masters and senior officers on vessels performing lightering operations. The Ship Manoeuvring Simulator Centre in Trondheim, Norway, offers several lightering courses at several levels for shipping companies and pilots. On the basis of these courses and the real-life experience of some of the simulator instructors, a special training concept for emergency lightering in harsh weather has been developed. This paper describes work done to update simulator models to handle two vessels in close proximity under harsh weather conditions. Various stakeholders have been invited to provide input regarding the functional requirements of a simulator to be used for training of emergency lightering operations. Necessary extensions to the existing simulator have been identified. MARINTEK will be assisting the simulator operator in the development and testing of improved models for interaction forces during the individual phases of an emergency lightering operation.

The paper opens with a description of existing training courses for lightering operations. The second part highlights work on mathematical models of interaction forces in ship-to-ship lightering operations. The final part discusses how to upgrade visualisation models in order to provide a better graphic representation of the relative motions between the vessels during the final approach and mooring phase.

## EXISTING COURSES FOR LIGHTERING OPERATIONS

The Ship Manoeuvring Simulator Centre (SMS) has developed a set of lightering courses for various customers, see Table 1. Courses range from Introduction to lightering, to Advanced operations and Handling of abnormal situations. Customers come from all over the world and include groups