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DEPARTMENT OF INDUSTRIAL ENGINEERING

TITLE OF THESIS: MULTI-CRITERIA APPROACH TO MARITIME SEARCH AND RESCUE LOCATION ANALYSIS

TIME/DATE: 9:00am, Friday, April 21, 2017

PLACE: Room 3107, The Mona Campbell Building, 1459 Lemarchant Street

EXAMINING COMMITTEE:

Dr. Michel Gendreau, Department of Mechanical and Industrial Engineering, Polytechnique Montréal (External Examiner)

Dr. Pemberton Cyrus, Department of Industrial Engineering, Dalhousie University (Reader)

Dr. Peter VanBGerkel, Department of Industrial Engineering, Dalhousie University (Reader)

Dr. Gordon Fenton, Department of Engineering Mathematics and Internetworking, Dalhousie University (Reader)

Dr. Ronald Pelot, Department of Industrial Engineering, Dalhousie University (Co-Supervisor)

Dr. H.A. Eiselt, Department of Business Administration, University of New Brunswick (Co-Supervisor)

DEPARTMENTAL REPRESENTATIVE: Dr. Connie MacDonald, Department of Industrial Engineering, Dalhousie University

CHAIR: Dr. Josef W. Zwanziger, PhD Defence Panel, Faculty of Graduate Studies

ABSTRACT

Operating on the ocean can be risky, particularly in harsh weather, or under economic drivers as with the offshore industry or fishing activities. In addition to advances in safety technology and practices, a robust Search and Rescue (*SAR*) capability is a key factor for mitigating risks and improving the safety of Canadians. The Canadian Coast Guard strives to provide an acceptable maritime *SAR* service. Optimizing the efficiency of limited resources helps to ensure that the Coast Guard's maritime *SAR* services are used to best advantage. For strategic and tactical planning, this involves Location-Allocation modelling to ensure that the right assets are in the best place to respond effectively. This problem becomes more complicated when we are faced with several criteria for assessing decision outcomes, some of which are conflicting as well.

The contribution of this study is a framework of mathematical models to support efficient management of maritime *SAR* resources with regard to several criteria such as primary and backup coverage, mean access time, service equality, and cost. A scenario planning approach is adopted along with spatial density estimation to deal with uncertainty of future incidents at sea. Several models are developed in multiple phases of the study with different purposes and complexity to determine the optimal location and response allocation of *SAR* resources, aiming to achieve greater responsiveness and resource utilization.

The multi-criteria analyses, developed in different stages of this study, provide a range of good trade-off solutions. Comparing the performance of solutions obtained by the developed models with the current arrangement of the *SAR* fleet, indicates an appreciable potential improvement in terms of coverage, accessibility and efficiency of service. Such improvements can be achieved through several changes in fleet composition and/or location. Results of this study can guide decision makers with regards to *SAR* vessel acquisitions and placement in order to improve the efficiency of resources and increase the service level. More specifically, the outcome of this study provides the Canadian Coast Guard with some beneficial insights for future resource planning including fleet renewal planning, station locations for new vessels, and the arrangement of the current fleet.