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PLAN 2006-2007

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The Canadian Coast Guard Research and Development Plan lists those research projects planned for fiscal year 2006-2007 by the various branches and regions.

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FY 2006-2007
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FOREWORD

Research and Development (R&D) is an essential element in helping the Canadian Coast Guard to achieve its operational mandate. The Coast Guard is dedicated to ensuring the safe and environmentally responsible use of Canada's waters. Research and Development is one way in which the Coast Guard seeks to become more efficient in its day-to-day operations as well as improving the effectiveness and appropriateness of its levels of service.

The Coast Guard R&D Program has been traditionally funded at \$3.5 million dollars. Due to serious financial pressures in the CCG, the 2005-06 budget has been reduced to \$567.5M for the R&D Program. No new projects were started. Only ongoing commitments were honoured.

The ongoing R&D projects support the Coast Guard's strategic plan. R&D performed today provides marine expertise in order to influence international standards and to support Canadian industry for the future. Coast Guard research is dedicated to resolving those technology challenges brought-on by the changing nature of commerce worldwide and the evolution of the marine community.

As part of its commitment to the economy and the achievement of Canada's goals, the Canadian Coast Guard continues to offer a broad-based planning process involving not only its own staff but also its clients. As CCG management resolves its current financial challenges, the CG R&D Program will be revitalized. The Coast Guard will continue to work and consult closely with other government departments, Canadian industry, universities and colleges seeking partnerships in knowledge wherever practical.

Any questions or suggestions regarding this publication should be directed to the Manager, Research and Development, (613) 990-3087.

LOOKING TO THE FUTURE

CCG (Canadian Coast Guard) official status as a Special Operating Agency (SOA) allows CCG to focus on providing essential and valuable services to Canada's marine community. It also requires the application of rigorous management procedures and accountability for all program expenditures.

The ultimate goal of SOA status is improved results for Canadians. The role of the CCG R&D program within CCG's new status is the investment in applications that will allow CCG to fulfil its mandate more effectively and affordably in the delivery of critical services to all clients.

CCG research addresses those specific issues brought-on by changing trends in the marine world and international transportation markets; changes in demand for marine services; and to new strategic directions defined by the government. R&D is also directed to a strategic understanding of the broader marine environment, the footprint left by marine activities on our oceans and freshwater resources, and to sustainable transportation objectives. The R&D program assists in meeting new management strategies relating to changes in levels of service and client advice on the marine program. Finally, the CCG research activity also complements the departmental ocean strategies by supporting a shared knowledge base in theme areas of mutual or overlapping interest.

The Coast Guard R&D Program is coordinated through one focal point to assist in the establishment of a master plan, support to the CG business plan and to facilitate the establishment of priorities, project selection criteria, performance measures, reporting and accounting.

At this time, Coast Guard priorities relate to implementing a new management structure and achieving operational efficiencies. Substantively, priorities include safety of life, operational efficiency, and support to the domestic marine industry. The evolution of the CCG's navigation services and the development of a new maritime security role requires for new ways of gathering and analyzing information.

In summary, R&D sponsored work will focus on the following:

Marine Information/Safety/Security Highway:

- development of advanced navigational and ship-related information systems (often satellite-based);
- automatic processing, analysis and automated transmittal of remotely-sensed ice information;
- interactive nature of displays on the bridge of the vessel;
- integration of ship's information with shore-side management functions;
- electronic devices which automatically monitor vessel position and/or services to home-in on persons in the water.

Sustainable Transportation, Environmental Protection and Safety:

- continued efforts at marine aids (system) modernization;
- development of improved standards, training and certification procedures for CCG vessels;
- research into new engine maintenance management systems, novel power systems/components, and emission control technologies which offer greater efficiency, reduced emissions and reduced maintenance;
- development of “biological” sewage treatment facilities for ships, to handle black and gray water, with zero tolerance regimes as a target;
- development of new technologies which will reduce clean-up costs and demonstrate due diligence in environmental matters.

Annually, CG will plan and prioritize R&D projects based on the above key thrust areas to give CG the information it needs to make prudent and strategic investments to provide effective and efficient public services.

PROGRAM DELIVERY

Traditionally, the R&D program has been coordinated at Headquarters (HQ) Ottawa and delivered at HQ branches or in the regions.

At the end of fiscal year 2005/06 new budgeting procedures were implemented with a view to resolving long-standing fiscal pressures. Regrettably, this solution has had unintended implications for the funding of CG R&D projects. The CG R&D is currently reviewing new procedures for the implementation and funding of new projects and is also reviewing the role of the CG R&D management structure.

Dispersion of Oil Spills In Ice – Developing an Effective Procedure

In ice-infested waters such as the Canadian Arctic, the Saguenay and St. Lawrence Rivers, the St. Lawrence estuary and the Gulf of St. Lawrence, there are no known "recipes" to bring about the natural dispersion of accidentally spilled petroleum products. The oil-mineral aggregation (OMA) process is a simple and easy approach the Quebec CCG's Environmental Response (ER) Division uses to disperse petroleum products that are trapped in ice and non-recoverable by other means. The approach has the added advantage of using only non-toxic and environmentally safe products. To help develop an oil spill response procedure for the winter season, this R&D project will study the applicability and efficiency of the oil-mineral aggregation (OMA) process in the ice-infested waters of the St. Lawrence.

The scientific community has hailed this new process as one of the more promising solutions. It is also one of the only international research initiatives in this field, since other countries are simply "making do" with processes from the 1970s and 1980s (i.e. burning, mechanical recovery, etc.), which are not suitable for the unique environment of the St. Lawrence.

The first phase of the project (2003-2004) identified the hydraulic and chemical parameters determining the effectiveness of the oil-mineral aggregate process (OMA) in cold water, and characterized its applicability conditions in the presence of ice. In light of the findings, which confirmed the potential of the process, we drafted an experimental protocol outlining the laboratory tests required to validate OMA efficiency conditions.

We conducted these tests in 2004-2005, in typical ice-infested water conditions, with the two types of oil most commonly encountered in the St. Lawrence. Our findings helped validate the effectiveness of the OMA process, determine the best minerals, and assess how much hydraulic energy is needed to form and disperse fine oil-mineral aggregates.

We considered using Coast Guard icebreakers to generate this type of energy, and conducted field work to assess the icebreakers' hydraulic energy potential. A study (2005-2006) is underway to optimize the parameters governing hydraulic energy generation by the passage of icebreakers when cleaning spills via the OMA process. Its findings will help establish a link between the requirements of the process and the hydraulic conditions present during the passage of an icebreaker.

The findings of the 2003-2004 studies are quite promising, and have attracted a great deal of interest. We presented them at an Arctic and Marine Oilspill (AMOP) international conference in 2005. We are conducting the project's current phase jointly with the Bedford Institute of Oceanography's Centre for Offshore Oil and Gas Environmental Research (COOGER).

The findings, which will be used to develop guidelines for cleaning oil spills in ice-infested waters via the OMA process, will be the cornerstone of a response procedure that takes operating conditions and field stresses into account. Simulating an oil spill will not only help validate the effectiveness of the OMA process. It will supplement our information and help develop a response procedure borne out by academic studies and practical results. Though not an initial part of the project, these activities constitute new phases and will require an extension of the project until March 2008.

The new phases will be conducted with interested partners in 2005-2006, 2006-2007 and 2007-2008, and will involve testing the process in the natural environment (i.e. first in our Quebec facilities, and then in the marine estuary in winter), developing an experiment and data analysis methodology, using outside agencies, getting the necessary approval, designing a fine mineral spreader, simulating an oil spill, analyzing data, drafting a report that includes a recommended oil spill response procedure, and publishing our findings nationally and internationally.

The benefits of this process for CCG include low operating costs, readily available products throughout Quebec, non-toxicity in comparison with chemical dispersants, and ease of deployment.

Contact:	Pierre Rouleau, Eng. Québec Region (418) 648-7493		
CG Branch:	Navigation Services		
Funding:	CCG R&D Program	TEC	\$783,300
		06/07	\$270,000
	Thales Navigation		\$400,000
Schedule:	Fiscal Year 2001/2002 – Fiscal Year 2006/2007		
Project Number:	GMJF3		

Squat Study for the Purpose of Re-Evaluating Underkeel Clearance Specifications

The loading capacity and safety of ships travelling the St. Lawrence are directly related to three factors: (1) the maintained (dredged) depth of the channel with respect to the chart datum; (2) the water level with respect to the chart datum; and (3) the various dynamic factors and phenomena that are included in the underkeel clearance calculation (squat, roll, pitch, etc). Squat, which is defined as the measurement of the sinking of the ship when in movement, is one of the components of underkeel clearance (UKC). This squat, which varies mainly according to the speed, width, and static draft of the ship and the depth of the water, is estimated by means of a theoretical formula that has never been validated under real operational conditions and whose accuracy can vary from one ship to another. This formula constitutes the basis for the UKC specifications that have been in force on the St. Lawrence waterways between Montreal and Quebec City since 1992. These UKC specifications, which were implemented for reasons of safety and environmental protection, are managed and enforced by Marine Communications and Traffic Services (MCTS) of the Canadian Coast Guard (CCG).

Climate changes predicted for the short and medium terms suggest that in future, the water level of the river could dip below the average more often than it has in the past 40 years. At a time when dredging is the subject of many environmental concerns, a better knowledge of the phenomenon of ship squat, with a view to optimizing the water column available for navigation, could offer a promising alternative to dredging, should the maintained depth of the waterway need to be increased to ensure the competitiveness of ports along the St. Lawrence.

The purpose of this project is to study the squat phenomenon of ships, using GPS-OTF (Global Positioning System – On-the-Fly) technology for the purpose of re-evaluating the underkeel clearance standard in force on the St. Lawrence.

Phase I (2001-2002; 2002-2003) consisted of a feasibility study that reviewed literature and recent squat studies conducted around the world, analyzed available technologies, and identified the resources required to conduct the study as well as the development of a work plan. An initial squat measurement survey was made in December 2002. Analyses of the data gathered revealed some problems associated with the quality of data measured by the GPS-OTF technology.

Phase 2 (2003-2004) comprised of a study to improve the reliability and performance of the GPS-OTF technology in response of the results and technical problems encountered in phase 1.

During 2004-2005 (phase 3), the new approach was used to process and validate the quality of the data obtained during the measurement survey conducted in December 2002.

Phase 4 (2005-2006) was devoted to conducting the measurement exercise, processing the data and determining the squat of ships based on the various parameters that influence these phenomena.

Phase 5 (2006-2007) will analyse the results obtained in phase 4 and propose a new formula to calculate squat.

Optimizing the UKC offers several benefits. It will help CCG ensure safe shipping, preserve the coastal regions and oceans and produce potential fuel savings for the marine industry. The findings of the study could also lead the CCG to revise downward the squat factor in the application of the UKC standard, the marine industry could increase load capacity of its ships without further deepening the navigation channel. This would help maintain or improve the competitiveness of Canadian ports along the St. Lawrence.

Contact:	Pierre Rouleau, Eng. Québec Region (418) 648-7493		
CG Branch :	Navigation Services		
Funding:	CCG R&D Program	TEC	\$774,700
		06/07	\$ 90,000
	Thales Navigation		\$400,000
Schedule:	Fiscal Year 2001/2002 – Fiscal Year 2006/2007		
Project Number:	GMJF3		

Erosion-Sedimentation Model of the St. Lawrence River

The purpose of this project is to develop a modelling package comprising a numerical erosion/sedimentation model and a graphic interface. This model could be used to gain a better understanding of erosion, transport and sedimentation processes in the St. Lawrence under various hydrological and hydraulic conditions; and

- evaluate the potential impacts of navigation and of waterway maintenance on the environment (shore erosion and deposition of dredged sediments).

The potential impact of maritime navigation and the maintenance of the St. Lawrence Waterway have been the subject of numerous comments and concerns, following Environment Canada's publication of a background paper on the condition of the St. Lawrence in 1996, and the submission of an impact study during the course of a project to deepen the waterway. These events lead to the creation of a navigation co-operation committee which brings together representatives of government, the maritime industry and the community who have a mandate to find means of limiting the impact of navigation on the environment. The main concerns raised by the committee are bank erosion, the destruction of fauna habitats and dredging-related impacts. In conjunction with the committee's work, the purpose of this project is to develop a software which is capable of modeling the influence of navigation and maintenance of the waterway on bank erosion of the St. Lawrence between Cornwall and Cap Gribane at the end of the North Traverse. The knowledge gained from these projects will enable various departments to be better informed to respond to concerns expressed by interest groups and the general public.

In addition, the numerical model will be used in the International Joint Commission (IJC) study to review the criteria for Lake Ontario-St. Lawrence River water-level regulation. It will be used to simulate erosional processes in the fluvial portion of the St. Lawrence.

The numerical erosion/sedimentation model, in development over the last several years in partnership with National Research Council's Canadian Hydraulics Centre (CHC), Environment Canada and the Science Directorate of Fisheries and Oceans Canada, is designed to provide CCG with a tool for the analysis and understanding of the phenomena of erosion, sedimentation and lapping (ship-generated waves) in the St. Lawrence.

In 2005-2006, the research team used the model to analyse erosion and sediment transport processes based on various hydrological and hydraulic scenarios and evaluate the potential environmental impacts of navigation and waterway maintenance in terms of erosion and sedimentation.

For 2006-2007, the research team will complete the model validation task and make required modifications to the working model.

The numerical model will be of benefit to the CCG in that CCG will be better informed to manage dredged sediments, assess environmental impacts of navigation and maintenance of the waterway and respond to concerns raised by interest groups and the general public regarding certain CCG activities or development projects.

Contact : Pierre Rouleau, P. Eng., Québec Region (418) 648-7493
CG Branch : Navigation Services
Funding: CCG R&D Program TEC \$541,100
06/07 \$50,000
Schedule : Fiscal Year 2001/2002 – Fiscal Year 2006/2007
Project Number : FMCC3

Lighted Spar Buoy

Every year, the Quebec Region faces pressure from the marine industry to leave the lighted buoys in place as long as possible in the fall and to put them back as soon as possible in the spring. Furthermore, the requirement to go to the same place twice a year to change the spar buoy for the lighted one (and the reverse) involves considerable CCG resources.

During the first four years of this project, ten CCG spar buoys (0.7m & 1.0m) were converted into lighted buoys and have been moored in various sectors to cover the whole range of existing river conditions. To date, the field trials have provided excellent information on the spar buoys' performance, level of service, and structural resistance as well as user feedback about this type of navigational aid.

A concurrent study is investigating why spar buoys become unstable when currents reach a certain speed and on the modifications they require to achieve satisfactory performance in terms of stability, angle of heel, and trim. The findings from this study will be available shortly.

Based on the current findings, the project objectives were modified and the project is now focused on providing the necessary technical information to install 0.7m and 1m luminous spar buoys that can provide reliable and efficient service 9 months of the year, remain in the water year round, and stay in place up to two years without replacement or maintenance.

For 2006/07, field trials continue with two lighted spar buoy prototypes (one of 0.7 m, the other of 1 m). Other tasks will include the development of a heeling model for the buoys and conduct a hydrodynamic characterization of the St. Lawrence River between Montreal and Beauharnois, including Lac Saint-Louis. L'objectif est de fournir l'information technique nécessaire pour mouiller et laisser en place un espar au plus deux ans sans son remplacement et son entretien.

Ce projet vise à réduire les coûts d'exploitation de la GCC propre à ce service en développant une bouée quatre saisons qui pourra augmenter le niveau de service à la navigation commerciale au début et à la fin de la période hivernale.

Contact: Sylvie Pelletier, Québec Region (418) 648-7450
CG Branch: Navigation Services
Funding: CCG R&D Program TEC \$872,000
06/07 \$115,000
Schedule: Fiscal Year 2000/2001 – Fiscal Year 2005/2006
Project Number: FJNF3

NEW SEARCH AND RESCUE INITIATIVES FUND (NIF)

The New Search and Rescue Initiatives Fund (NIF) is a unique undertaking by federal and participating provincial, municipal and private Search and Rescue (SAR) organizations. The objective is the saving of lives by enhancing SAR prevention and the provision of SAR services. NIF is not specifically oriented to R&D projects but, rather, was established by the federal government to provide funding to new initiatives which enhance the effectiveness of SAR by all participants, especially those outside government.

NIF is managed by the National Search and Rescue Secretariat (NSS) reporting to the Lead Minister for Search and Rescue (the Minister of National Defence).

Within CCG, it is managed as a separate program within the Safety and Environmental Response Directorate (SERS). For the CCG R&D Program, NIF funded research projects are reported when a research project is sponsored by CCG.

Below lists the ongoing projects to be funded by NIF for FY 2006/2007. New proposals were not yet approved at the time of this publication and will therefore, be included in the year-end annual report.

To obtain more information about these projects, please contact Janice Brasier at (613) 991-6123, CCG NIF Coordinator.

Project List Summary

PROJECT NUMBER	PROJECT TITLE	2006/07 Approved ('\$'s)
2003023	Personal Emergency Location Device	7,200
203025	Remote Sensing Shoreline for Northern Labrador	236,567
2004033	Investigating Leeway and Drift in Ovatek Life Rafts	15,000
2004041	CCGA-P Marine Simulator Program	52,448
2004036	Life Raft Performance During Evacuation, Rescue/Recovery	408,233
2005021	Man Overboard Recovery Equipment on a T-1200	22,000
2005019	Marine Marker for Common SAR Objects	211,838
	NIF – Total Approved	3,766,097

Personal Emergency Location Device

Now in its final year of a three-year plan, current activities include putting together a test package to evaluate methods of improving signal detect ability and investigating alternatives in antenna design. A final report will be delivered by the end of FY 2005/06.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$515,684
 06/07 \$ 7,200
Schedule : Fiscal Year 2003/2004 – Fiscal Year 2006/2007
Project Number : 2003023

Remote Sensing Shoreline for Northern Labrador

CHS to provide information to improve SAR capability and reduce the risk to mariners and the environment by updating coastal information on Canadian charts along the Labrador coast, especially from Nain, North to the Button Island. CHS is responsible for charting Canadian waters but, priorities dictate that this area will receive little attention in the foreseeable future.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$885,969
 CY \$236,567
Schedule : Fiscal Year 2003/2004 – Fiscal Year 2006/2007
Project Number : 2003025

Investigating Leeway and Drift in Ovatek Life Rafts

Ocean's Ltd. to carry out a leeway investigation for Ovatek 4- and 7-person rigid life rafts for which leeway speed and angle information is currently not available in the National SAR Manual (DFO, 1998) and the CANSARP program.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$537,966
 06/07 \$ 15,000

Schedule : Fiscal Year 2004/2005 – Fiscal Year 2006/2007
Project Number : 2004033

CCGA-P Marine Simulator Program

CCGA-P to develop and implement a new volunteer SAR training program employing emerging technology to improve the safety, efficiency, and cost-effectiveness of the existing SAR training program and the effectiveness of current marine SAR operations throughout Canada.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$346,879
 06/07 \$ 52,448
Schedule : Fiscal Year 2004/2005 – Fiscal Year 2006/2007
Project Number : 2004041

Life Raft Performance During Evacuation, Rescue/Recovery

NRC to assess life raft operational performance in terms of technical capabilities in a range of weather conditions. The influence of external factors and mitigating measures on performance will also be evaluated including the role of human factors and training. The outcome of the project will be practical knowledge that can promote survival and support operational decision-making, with the ultimate goal being to improve the safety.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$989,098
 06/07 \$408,233
Schedule : Fiscal Year 2004/2005 – Fiscal Year 2006/2007
Project Number : 2004036

Man Overboard Recovery Equipment on a T-1200

CCG-Quebec to experiment with specialized equipment on a T-1200 CG Ship with heavy-tonnage and a very high freeboard to improve safety during recovery operations. At present, there is no equipment capable of hoisting a man overboard back on board a T-1200. Since we cannot change the structural variables of the T-1200, we have to experiment with equipment that will make it possible to mount recovery operations of this kind safely and efficiently.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$22,000
 06/07 \$22,000
Schedule : Fiscal Year 2006/2007
Project Number : 2005021

Marine Marker for Common SAR Objects

C-Core to find a multi-application marine marker for CCG, SAR resources that is easily deployable, reliable, cost effective, and have the ability to survive in the harshest marine environments. To improve search operations, saving valuable search time.

Contact : Janice Brasier, (613) 991-6123
CG Branch : Search and Rescue
Funding: NIF Fund TEC \$468,501
 06/07 \$211,838
Schedule : Fiscal Year 2006/2007 – Fiscal Year 2008/2009
Project Number : 2005019