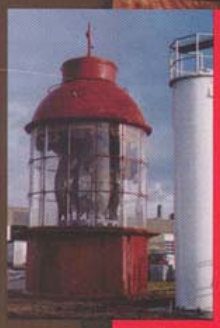
Research and Development

ANNUAL REPORT

2003-2004



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17. Abstract

The Canadian Coast Guard (CCG) annual report on its R&D activities, describing the research projects undertaken by the various branches and regions of the CCG during the fiscal year 2003-2004.

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Research and Development Annual Report 2003-2004 Table of Contents

Research and Development
Annual Report 2003-2004
Table of Figures

INTRODUCTION

The Program

The Canadian Coast Guard's (CCG) Research and Development (R&D) program is designed to meeting the challenges of increased expectations regarding marine safety, protection of the marine and freshwater environment, and support to ocean development. The priority of the R&D program is to support the CCG's operational, regulatory and procurement objectives. Its mission is to develop knowledge essential to the achievement of those objectives.

The R&D program is co-ordinated at Headquarters and delivered at the branch and regional levels. Senior management determines the overall direction of the program in accordance with the CCG's Strategic Plan and individual business lines deliver the program in the form of individual R&D projects. The business lines provide project management as well as securing external funding and creating partnerships. The R&D Office provides policy advice, strategic direction and co-ordination.

CCG branches involved in R&D often draw upon the resources and expertise of other federal agencies such as the Transportation Development Centre (TDC) and the National Research Council (NRC) as well as seeking co-operative funding from the New Search and Rescue Initiatives Fund (NIF), and the Program for Energy, Research and Development (PERD) and other special funds.

CCG is also involved in Joint Research Project Agreements (JRPAs) with other countries. Canada has a long history of successful JRPAs with the United States, Japan and Finland, confirming its reputation as a leader in marine technologies.

Program Highlights for 2003-04

The R&D program operated at a reduced budget level due to financial cutbacks. This limited the number of new projects to be initiated.

The ongoing projects have delivered comprehensive data and information required to achieve mission goals. Some key highlighted are noted below.

The Cross-polarized radar trials have demonstrated that this technology is an effective detection tool for multi-year ice in a first-year sea ice environment.

The Frame Relay technology, project now complete, is a promising option for CG towards lowering operating costs for MCTS communications.

The evaluation and testing of arctic diesel fuel and marine diesel oil blends with and without lubricity additives are yielding a solid technical base of information to assist CCG in the use of lubricity additives in the CG fleet of diesel engines that also takes into account Canada's broad range of climatic temperature conditions.

The research project for increased wearing of personal flotation devices (PFDs) is now complete. The study finds "perceived risk" to be a key factory in wearing PFDs.

In the area of environmental response, three years of planning led to a successful international workshop to test new pumping/lightering technologies for heavy viscous oil products.

Program Delivery

This Research and Development report reflects the delivery of the CCG's R&D Program that supports CCG's business lines: Navigation Services, Safety and Environmental Response Systems, and Fleet

Management. Services from the Integrated Technical Services branch are used for the delivery of "technical" solutions within CCG.

A brief overview of the groups involved in the delivery of the R&D program follows.

Navigation Services provides, operates and maintains a system of aids to navigation, provides waterways development and maintenance, and ensures protection of the public right to navigation and protection of the environment. Also part of Navigation Services is Icebreaking operations which include activities such as icebreaking escort, channel maintenance, flood control, harbour breakouts, ice routing and information services for marine traffic navigating through or around ice-covered waters, and for the general public. It also co-ordinates the movement of cargo for the annual re-supply of Northern settlements and military sites using contracted commercial carriers.

Safety and Environmental Response Systems conducts R&D in the following major program areas: marine search and rescue, environmental response, the promotion of boating safety to the marine public and marine communication and traffic services. The R&D activities provide knowledge, technologies and tools to improve efficiencies and reduce expenditures. On April 1, 2004, the Office of Boating Safety was transferred to Transport Canada.

Fleet Management provides leadership in the development, implementation and execution of a national Fleet management framework, aimed at delivering optional sea and air support to CCG Marine programs, Science and Fisheries Management and to other government and international organizations.

Integrated Technical Support provides project planning and management services for the delivery of technical solutions and/or service delivery needs identified by Marine program managers.

R&D office has the responsibility to establish goals, objectives, priorities, and accountability measures for the program that support CCG's Business Plan. It is also the program's focal point for resource/business management services, special projects and planning and co-ordination of the program.

Risk Management is responsible for the development of marine services Risk Management Program. Its R&D focus pertains to the development of a comprehensive marine activity and risk model to address CG planning issues as well as to serve as an important component of coastal mapping.

A description of each R&D project undertaken by CCG during the 2003-2004 fiscal years may be found under their appropriate section heading. More details on these initiatives can be obtained by contacting the responsible project officers. A contact name and telephone number is given at the end of each project report.

Additional information on the R&D program, and/or a copy of the R&D Strategic Plan is available from:

Manager, Research and Development
Marine Programs, Canadian Coast Guard
200 Kent Street
Ottawa, Ontario
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Fax: (613) 996-8902

Navigation Systems

Located at headquarters in Ottawa, this directorate conducts R&D to support a safe, efficient and accessible waterway by improving operational performance and modernization of aids to navigation; reducing maintenance costs and ship-time usage in the servicing of short- and long-range aids to navigation; and improving water flow models and water level prediction capability. This directorate also supports Icebreaking activities through improved technologies and effectiveness in delivering icebreaking and ice-routing services, thereby enhancing the safety of ice navigation and providing support to marine transportation and to the economy in general.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
	Aids to Navigation			
New	Development of Laser Range Light-Phase II	CCG	cancelled	
New	Automatic Identification System (AIS) for Aids to Navigation	CCG	cancelled	
FKAE6	Evaluation of Large Electric Double-layer Capacitors for Powering Aids to Navigation	CCG	See ITS Section	
FKAD6	Long Life Synthetic Mooring	CCG	See ITS Section	
FKAB6	Lighted Plastic Buoy Development	CCG	See ITS Section	
FKAG6	Visual and Radar Ranges for Steel and Plastic Buoys	CCG	See ITS Section	
	Icebreaking			
FTPA6	Cross-Polarized Radar Trials	CCG	50	60
	Navigation Systems - **TOTAL**		**50**	60

Aids to Navigation

The R&D program funded six projects submitted by the Aids to Navigation directorate in 2003-2004. The aim of the projects is to explore new technologies that will generate efficiencies and reduce costs of the aids to navigation operations and services without compromising marine safety or service to the public. The projects were subsequently tasked to the Integrated Technical Support (ITS) branch. The project titles are listed in the preceding table while the project descriptions can be found in the ITS section of this report.

Two projects, *Development of Laser Range Light-Phase II and Automatic Identification System (AIS) for Aids to Navigation*, were cancelled due to financial cutbacks.

Contact: Reiner Silberhorn, (613) 998-1441

Icebreaking

The R&D efforts of this branch support the enhancement of an ice operations data information system to enable more effective analysis of icebreaking services in order to increase effectiveness and deployment of resources.

Cross-polarized Radar Trials

The availability of the X-Polarized radar technology will provide precise ice information regarding ice conditions. Better route planning and improved operational efficiency will result for CCG Icebreaking and commercial operators.

A trial was executed during March 2003 en route to Deception Bay in the Canadian Arctic. The object of the trial was to use the X-Polarized radar in an operational situation and assess its usefulness as a multiyear ice detection tool, and instrumentally assess the overall radar interface technology in support of ice navigation. Unfortunately, a technical failure of the tape unit prevented the collection of digital recordings of radar images; however, video and digital cameras were used to capture events during the trial.

During the trial, both the X-Polarized radar and the Advanced Radar "Sea Scan" displays were actively used for navigation. The X-Polarized radar, as in the full scale implementation in the 1980's, proved to be an effective detection tool for multi-year ice in a first year sea ice environment. The X-Polarized radar edge detection ability provided an efficient way of localizing the far edge of ice floes that can otherwise be confused with the edge of lead.

The Modular Radar Interface (MRI) developed by Rutter Technology of St. John's Newfoundland was used to display the radar images. The MRI simultaneously interfaces to the main shipboard radar and the slaved X-Polarized radar signals which can be displayed alternately or as a single source. The 256 gray level display resolution offered by the MRI is far superior to that of the 2 level display of conventional commercial radar displays. This feature makes it a very efficient ice navigation tool for detecting multiyear ice and for tactical navigation.

The low cost X-Polarized radar technology has demonstrated to be feasible and beneficial. Follow-on developments should focus on increasing the reliability of the system and improving the user interface for operating the unit. A specific X-Polarized radar processor should be

developed to combine the returns of the main radar with those of the X-Polarized radar to improve the detection performance of the system.

Figures 1 and 2 below respectively show the main radar display (HH, Horizontal transmit and Horizontal receive), and the X-Polarized radar display (HV, Horizontal transmit and Vertical receive). An iceberg is clearly visible in Figure 1 due to the shadow cast behind it on the radar image. The iceberg itself is barely brighter than the surroundings, indicating that if it was any smaller and without a shadow, it might well have not been detected. By contrast, the same iceberg is brightly illuminated in Figure 2 and would have been visible even without a shadow.

Figure 1: Main Radar Display (HH)

Figure 2: **X-Pol Radar Display (HV)**

Contact: Fiona Robertson, (613) 998-1581 *Project Number: FTPA6*

Fleet

Located at headquarters in Ottawa, this directorate conducts R&D to improve cost-effectiveness and performance of the Fisheries and Oceans fleet and the management of policies and standards for improved safety and development of seagoing personnel.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
FQBK6	Hearing Standard for Seagoing Personnel	CCG	50	
FQAG6	Vision Standards for Seagoing Personnel	CCG	100	
	Fleet - **TOTAL**		**150**	

Hearing Standards for Seagoing Personnel

The collection and analyzes of environment noise data in the work place of seagoing personnel is being used to develop a BFOR (Bona Fide Occupation Requirement) standard for hearing. The standard will ensure that the minimum medical standard for hearing is appropriate for the hearing-critical jobs in marine operations and that this standard is based on empirical evidence defendable in court.

The project is 95% completed. The final stage of the project, "Incumbent Testing" was completed in early March. This stage was an important step in the process in order to ascertain if CCG seagoing incumbents with different number of years of experience, different patterns of hearing status and no history of incidents or accidents are able to meet the newly established norms.

Presentation of the findings to Coast Guard senior management will take place in early summer, 2004. Upon acceptance of the research and its findings, implementation of the results will be instituted within Health Canada medical requirements for seagoing personnel. The research team is confident that the findings will stand up before a Tribunal and that the hearing standard will be established as a Bona *Fide Occupational Requirements (BFOR)*.

Contact: Sharon Robertson, (613) 990-2573 *Project Number: FQBK6*

Vision Standards for Seagoing Personnel

This project will establish a Bona Fide Occupation Requirement (BFOR) standard for vision for seagoing personnel. CG is gathering and analyzing data to identify the importance of and risk(s) of decreased visual functioning in all relevant visual parameters for the tasks that make up the requirements of the seagoing jobs in DFO (Department of Fisheries and Oceans).

Phase I identified 16 visually demanding critical tasks of seagoing jobs which will be used in Phase II work to develop task simulations and methods to assess the minimum levels of vision required to perform the tasks safely and effectively.

The first stage of Phase II, Simulation Design, is now complete. This involved the design of task simulations, and identifying locations for testing. The second stage of Phase II will implement the simulations at three sites, analyze the results and make recommendations to senior Coast Guard management by the end of fiscal year 2004/05.

Contact: Sharon Robertson, (613) 990-2573 *Project Number: FQAG6*

Integrated Technical Support

Located at headquarters in Ottawa, this directorate conducts research and development on behalf of other Coast Guard Branches to deliver high quality technical support and solutions in response to operational requirements for the delivery of the most efficient services possible.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)		CLIENT GROUP
			CCG	PARTNER	
FRBQ6	U.S. Ship Structures Committee	CCG	cancelled		
FQAX6	Frame Relay Trial	CCG	45		MCTS*
FQAM6	Evaluation of Large Electric Double-layer Capacitors for Powering Aids to Navigation	CCG	cancelled		Aids to Navigation
FQAP6	Long Life Synthetic Mooring	CCG	25		Aids to Navigation
FQAS6	Lighted Plastic Buoy Development	CCG	25		Aids to Navigation
A62AA	Visual and Radar Ranges for Steel and Plastic Buoys	CCG	1		Aids to Navigation
HCAA6	Evaluation of Arctic Diesel Fuel and Marine Diesel Oil Blends with and without Lubricity	CCG	360	75 and in kind (130)	Fleet
	INTEGRATED TECHNICAL SUPPORT - **TOTAL**		**456**		

*MCTS=Marine Communication and Traffic Services

International Ship Structure Committee

Due to departmental financial pressures this project has been terminated.

Contact: Daniel Gauvin, (613) 998-1666 *Project Number: FRBQ6*

Frame Relay Trial

This project, now complete, investigated a new telecommunication technology, Frame Relay, that can potentially provide improved flexibility and scalability at a lower cost of ownership. The investigation has provided significant technical and operational data that will allow the CCG to make the best decision for the future telecommunication network upgrade.

The existing CCG operational network runs under the dedicated Megastream service and links the majority of our remote radio sites with the Marine Communication Traffic centers. It has very limited flexibility and scalability and is costly because each leg is charge on the inter-exchange mileage between the MCTS Centers and the remote peripheral sites. The Frame Relay network could potentially provide a more cost-effective approach in connecting our sites because the charges are applied on the connectivity and on the bandwidth regardless of the distance.

In 2003-2004 the Frame Relay technology was tested in an operational environment. The Frame Relay circuits were deployed at 3 St. John's VHF remote sites linked to the St. John's MCTS centre. The results showed that no deterioration in the quality or reliability of the service was detected by the operational staff during the execution of routine, safety and distress services with up to five voice channels active simultaneously.

This technology is very promising from a technical and operational point of view for CCG MCTS communications. Further testing of the technology is required with MF transmitters, receivers and Navtex as well as proving that frame relay technology can work with different digital carrier systems that the telecommunication provider provides to many of the remote sites.

A technical report is available.

Contact: Gilles Parent, (613) 993-2710 *Project Number: FQAX6*

Evaluation of Large Electric Double Layer Capacitors for Powering Aids to Navigation

Due to departmental financial pressures this project has been terminated.

Contact: Sunny Leung, (613) 998-1390 *Project Number: FQAM6*

Long Life Synthetic Mooring

Under the umbrella of the five-year buoy project is the study of synthetic mooring. There are a significant number of locations where the mooring chain does not stay on location for more than two years due to extreme bottom or sea conditions and many other buoys are being risk managed in years 4 and 5.

Previous studies have looked at the reliability, safety and cost effectiveness of synthetic moorings. Although the results have raised several questions, there is a lot of potential in synthetic moorings and it is recommended that comprehensive performance specifications be developed before any further testing is undertaken.

In FY2002/2003 the project developed a comprehensive performance standard/specification detailing all CCG requirements in a synthetic mooring system. The requirements included design, handling and safety concerns.

During this fiscal year, 2003/2004, CCG developed a set of operational and technical requirements for plastic buoys and synthetic moorings. These requirements resulted from the analysis of questionnaires completed by stakeholders (industry, Regions and HQ CCG Staff). The requirements should be validated in the next phase, as they are not ready to go to contract.

The consolidated requirements are available in a report entitled “Development of Operational and Design Requirements for Plastic Buoys and Synthetic Moorings”. Once reviewed by the project manager and translated, the report will be sent to stakeholders.

The questionnaire addressed a number of issues relating to the buoy mooring system, and in particular with the use of synthetic material for the mooring cable. As might be expected, for such a specialist subject, results from the survey were fairly superficial however the following general observations and requirements are apparent form the analysis of the results:

- The selection process used for determining the type and weight of anchors required for different types of buoys relies a great deal on historical data as well as environmental conditions such as wind speed, current, wave type and height, and factors in seabed structure and tidal conditions. As a general rule the weight of the anchor in water, together with the weight of the mooring cable and fittings, must be at least equal to the reserve of buoyancy of the buoy that it is holding in place multiplied by some factor of safety which is typically in the region of 2.5. In this way the buoy mooring and anchoring system will submerge the buoy before there is any tendency for the buoy anchor to be lifted or dragged out of position

- Once the anchor is selected using the above methodology the mooring cable that attaches the anchor to the buoy must be strong enough to lift its own weight plus the weight of the anchor. In certain bottom conditions the mooring cable must also have a reserve of strength to allow for the additional tension that must be applied in order to extract the anchor that has sunken into the sea, river or lake bed.

- The weight of the mooring cable in water must be light enough, under normal operational conditions, not to submerge the buoy below its design waterline.

- The scope of the mooring cable (ratio of mooring cable length to water depth) has a significant impact on the loading that is induced in various parts of the mooring system.

In general the shorter the scope of the mooring cable the higher the loading. In the extreme, for a taught mooring, the cable, and all associated fittings, are always in tension and this tension is increased by any motion of the buoy about its static waterline caused by wind, wave, current or tidal variation.

- Mooring lugs on buoys obviously exhibit wear after being in service, and this wear increases as the loading increases. It has been found that the use of Stainless Steel or Delrin bushings, or bushings made of a material of equal properties helps to mitigate this wear

- Twisting of mooring lines is apparent in some operational conditions but is not an overall concern; the use of swivel fittings has been proved successful in overcoming this marginal problem.

- Synthetic mooring cables present an issue with mooring recovery as most Coast Guard vessels are equipped to handle steel cables and chains and do not have the specialist equipment necessary to handle synthetic materials. As a result in some conditions synthetic moorings tend to slip and this can be a safety hazard.

- Coast Guard have operational experience with Nylon, Samson Braided Nylon, Polyethylene, Polyester, Polypropylene and Kevlar for synthetic moorings.

- Kevlar with a Dacron Jacket is preferred for wear resistance, better UV protection and longer life.

- Types of mooring construction used are braid, double braid, Samson braid, twisted and plaited. Twisted construction has been found to "unravel" under load. Braided cable has been found to provide the best operational characteristics.

- Both pre-manufactured and custom end fittings are utilised across regions for mooring lines, generally ends of lines are thimble spliced and shackles used.

- Synthetic mooring cables are much more susceptible to damage than steel cable or chain. To prevent chafing on the sea bed chain "thrashing sections are often incorporated into the mooring system or polyethylene floats or glass balls are used to lift the mooring of the bottom.

- Steel chain and cable moorings show obvious signs of wear and/or deterioration. Synthetic cable, unless chafed or cut, shows no obvious external signs of degradation and there is a need to develop guidelines or tests to ensure that synthetic mooring cables are not used beyond their safe working life.

Future work is subject to the availability of funding.

Synthetic moorings can save money and ship time for the CCG. They are also environmentally friendly as they cause less sea bottom disturbance compared to chain moorings.

Contact: Doug Jones, (613) 998-1387
Reiner Silberhorn, (613) 998-1411
Project Number: FQAP6

Lighted Plastic Buoy Development

This project is part of the Marine Aids Modernization Project to develop a buoy system that operates without servicing or maintenance, for a period up to five years.

This project has three phases: Phase 1 to develop a set of performance specifications specifying CCG's operational requirements; Phase 2 is the development of testing specifications and procedures to help determine whether the buoys are in full compliance with the CCG performance specifications; and Phase 3 will test and evaluate commercially available large lighted plastic buoys. A final report of the findings and recommendations is expected in March 2005.

During fiscal year 2003/2004, CCG developed a set of operational and technical requirements for plastic buoys and synthetic moorings. These requirements resulted from the analysis of questionnaires completed by stakeholders (industry, Regions and HQ CCG Staff). The requirements should be validated in the next phase, as they are not ready to go to contract.

The consolidated requirements are available in a report entitled "Development of Operational and Design Requirements for Plastic Buoys and Synthetic Moorings". Once reviewed by the project manager and translated, the report will be sent to stakeholders. Buoys were defined as small, medium or large. Requirements were broken down as operational, physical, environmental, and structural. Stability and buoyancy requirements may need to be better addressed in the next phase. Examples of operational requirements for small, medium and large plastic buoys are presented below.

It should be noted that there were responses outside of these ranges and the reader is invited to review the full results from the questionnaire to get an appreciation for this variation.

Operational Requirement	**Operational Requirement – Small Plastic Buoys**	**Operational Requirement – Medium Plastic Buoys**	**Operational Requirement – Large Plastic Buoys**
Daylight visual range	0.5 – 1 mile	2 – 3 miles	2 – 5 miles
Light range at night	n/a	1 – 3 miles	1 – 3 miles
Radar range	0.25 – 1 mile	1 – 3 miles	1 – 4 miles
Audible Range	n/a	n/a	¼ - ½ mile
Minimum Mooring Depth	1 metre	2 metres	3 metres
Maximum Mooring Depth	20 metres	60 metres	150 metres
Watch Circle	Site specific dependant on channel width, depth of water and current.	Site specific dependant on channel width, depth of water and current.	Site specific dependant on channel width, depth of water and current.
Minimum Cable Scope	1:1	1:1	1.5:1
Maximum Cable Scope	1.5:1	2:1	3:1
Time on Station	There is currently no definitive time span for the deployment and recovery of small plastic buoys, and length of deployment varies from region to region. Small plastic buoys that are	There is currently no definitive time span for the deployment and recovery of medium plastic buoys, and length of deployment varies from region to region. Small plastic buoys that	There is currently no definitive time span for the deployment and recovery of medium plastic buoys, and length of deployment varies from region to region. Small plastic buoys that

Operational Requirement	Operational Requirement – Small Plastic Buoys	Operational Requirement – Medium Plastic Buoys	Operational Requirement – Large Plastic Buoys
	left on station for greater lengths of time are generally those which experience lighter ice conditions or ice free waters. These small plastic buoys may be on station for periods of up to 12 months.	are left on station for greater lengths of time are generally those which experience lighter ice conditions or ice free waters. These medium plastic buoys may be on station for periods of up to 12 months.	are left on station for greater lengths of time are generally those which experience lighter ice conditions or ice free waters. These medium plastic buoys may be on station for periods of up to 12 months.
Lay up periods	Generally from 4 – 7 months before redeployment, and the majority of buoys are stored externally.	Generally from 4 – 7 months before redeployment, and the majority of buoys are stored externally	Generally from 4 – 7 months before redeployment, and the majority of buoys are stored externally

Phase 1 is complete. Phase 2 and 3 are subject to the availability of funding.

Large lighted plastic buoys could bring significant savings to the CCG by eliminating the need for sandblasting and painting and servicing by large buoy tenders.

Contact: Douglas MacLeod, (613) 993-6142 *Project Number FQAS6*
Reiner Silberhorn, (613) 998-1411

Visual and Radar Ranges for Steel and Plastic Buoys

Due to departmental financial pressures this project has been terminated.

Contact: John Barron, (613) 998-1537 *Project Number: A62AA*

Evaluation of Arctic Diesel Fuel and Marine Diesel Oil Blends with and without Lubricity

For operational cost reduction purposes and preparedness objectives for reduced sulphur content of marine diesel fuel in 2006, the CCG has been in the process of investigating the potential use of Arctic Diesel Fuel (DFA) as a blending fuel in icebreakers deployed in the Arctic. Currently, CCG icebreakers are fuelled with Marine Diesel Oil (MDO) which cannot be stored in the Arctic due to high pour and cloud point temperatures of the fuel. This project has addressed concerns raised regarding the lubricating qualities (or lubricity) of the proposed diesel fuel blends and sufficient viscosity to avoid increased wear of fuel injections system wear components. While this multi-year project is in its final stages of completion, a number of significant accomplishments have been achieved.

These major accomplishments and conclusions are:

1. A comprehensive understanding and knowledge base for low sulphur marine diesel fuel and its lubricity characteristics has been developed and reported on.
2. In conjunction with the instrument's two manufacturers (one Canadian and one US based) an apparatus the Ball On Three Disk (BOTD) test instrument (Figure 3) and

associated draft ASTM/EI Standard Test Method has been developed to more precisely/accurately determine the lubricity of diesel fuel with and without lubricity additives. This lubricity test apparatus has been shown to be the only instrument that can determine lubricity in field applications independent of ambient humidity. The apparatus and test method has been shown to correlate well with light to heavy duty – high speed and medium speed diesel engines. Preparations are now being formulated to conduct a mini round robin test with four BOTD units (one at ChevronTexaco, one at Falex Corporation and two at AET).

3. The CCG medium speed diesel fuel injection system component wear mechanisms have been investigated and understood. The ability of lubricity additives to substantially reduce this wear has been shown.
4. It was found that most lubricity additives provided by the six major additive companies that participated in this study may be satisfactorily employed to improve the lubricity of a poor lubricity fuel and provide improved wear resistance.
5. Several companies have been found to provide considerably superior additive products. However, a number of smaller, less well known additive companies have been found to provide products which do not improve lubricity at a reasonable additive concentration level.
6. The improvement in diesel fuel lubricity can be obtained by using relatively low concentrations of lubricity additives (as low as 70 ppm).
7. During the initial study phases a number of lubricity additives were shown to precipitate out of solution at low ambient temperatures representative of Canadian winters. However, through collaboration with these additive companies that participated in the study it was shown, in later study phases, that the precipitation problem was resolved. In general, the six major lubricity additive companies have lubricity additives that effectively improve the lubricity of Canadian oil sands derived diesel fuels and conventionally derived diesel fuels over the broad range of Canadian climatic conditions

Based on the Wärtsilä VASA 9R32 engine test results, it is anticipated that the diesel/electric propulsion systems in CCG Arctic class icebreakers could be operated on blends of MDO (of present quality levels) and DFA (using high concentrations of DFA) without experiencing markedly increased FIE wear rates or seizure. This would be possible since the lubricity of an MDO/DFA blend would be higher than neat DFA. The final blend ratio used would depend upon the lubricity and viscosity characteristics of each of the two fuels. Since, it has been shown that the BOTD can be used in the field without the need for an environmentally controlled chamber, the BOTD should be able to be used on-board CCG vessels before bunkering fuel.

It is recommended that a follow on Fuel Quality Management (FQM) study be undertaken. There is a need to continue to investigate and develop an improved understanding of the effects of ultra low sulphur diesel (ULSD) fuel with and without additives on ignition quality, lubricity, and the flash point.

Figure 3: Falex Ball on Three Disk (BOTD) Test Rig

Visible in the picture are the fuel sample transfer syringe and AET's new fulcrum mount, fulcrum bearings, fuel sample reservoir and fuel sample reservoir cover.

Contact: Al Dacosta, (613) 998-1776 *Project Number: HCAA6*

Safety and Environmental Response Systems

Located at headquarters in Ottawa, this directorate conducts R&D projects related to safety and environmental response systems. The specific areas are identified below.

1. ***Search and Rescue*** *projects focus on the technological support and innovative techniques necessary for the saving of lives and the protection of the marine environment.*

2. ***Environmental Response*** *projects investigate and apply techniques and technologies that directly assist the response community to prevent, respond to and remediate oil and chemical spills in Canadian waters.*

3. ***Boating Safety*** *projects address the safety aspects of recreational boating and associated environmental concerns.*

4. ***Marine Communications and Traffic Services*** *projects are aimed to improve cost-effectiveness and performance in communication and information processing systems for the marine community and for the benefit of the public at large, in support of a safe and environmentally sound transportation system. Technological solutions in support of the overall effectiveness of the MCTS program can be made in areas relating to communications and transmission networks, automatic identification system (AIS), and integrated information management systems.*

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS	
			CCG	PARTNER
	Search & Rescue			
FKDH2	Search Planning and Validation	CCG	0	
	Environmental Response			
FKCA6	Development of Response Strategies for Orimulsion	CCG	See Maritimes Section	
	Office of Boating Safety			
FKCT6	Research Project for Increased Wearing of Personal Flotation Devices (PFD)	CCG	See Newfoundland Section	
	Marine Communications & Traffic Services			
FKAH6	Frame Relay Trial	CCG	See ITS Section	
	Safety & Environmental Response **- TOTAL**			

Safety and Environmental Response Systems

The branches within the Safety and Environmental Response Systems (SERS) directorate tasked their R&D projects to other headquarters or regional branches of the CCG in 2003-2004. Project titles are noted in the preceding table while the project description can be found in the section noted on the table.

Contacts for the respective divisions of SERS are provided below.

Search and Rescue:	Ron Miller	(613) 990-6518
Environmental Response:	David Yard	(613) 990-3382
Office of Boating Safety*:	Daniel Haché	(613) 990-3105
Marine Communications and Traffic Services:	Michel Desparois	(613) 990-3031

*As announced in the February 2004 Speech from the Throne, the Office of Boating Safety was transferred to Transport Canada on April 1, 2004.

Research and Development Office

Located at headquarters in Ottawa, this office is the focal point for planning, co-ordinating and reporting of CCG R&D activities. Projects are initiated when required to improve CCG management practices or to promote multi-disciplinary issues with other government departments, the marine community and international agencies.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
	In-house activities.	CCG		
	R&D Office - **TOTAL**			

R&D Office

No R&D contracts were let in 2003-2004. The activities focused on management of the program.

The outputs included quarterly budget reports, an annual report, an annual plan, and posting program information to the web.

Risk Management

Located at headquarters in Ottawa, this office is the focal point for developing a comprehensive marine activity and risk model to address CG planning issues.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
FKDE6	Maritime Activity Geomatics and Risk Analysis in the Coastal Zone	CCG	40	
	Risk Management- **TOTAL**		**40**	

Maritime Activity Geomatics and Risk Analysis in the Coastal Zone

The Canadian Coast Guard (CCG) Search and Rescue (SAR) Branch often needs to make strategic decisions that impact the well-being of distressed mariners. Historically, these decisions were made based on incident statistics and expert opinion. The Maritime Activity and Risk Investigation Network (MARIN) is developing a decision-support tool that utilizes a custom geographical information system (GIS) application based on a risk model specifically designed for the CCG.

The Maritime Activity and Risk Investigation System (MARIS) enables the CCG to quantify levels of activity and incident rates in temporal and spatial contexts. Geographical areas that have high levels of incident occurrence are easily identified on color-coded maps. These areas are of particular interest in planning the placement of SAR vessels.

In the past year, the following traffic layers for the East Coast have been completed: shipping, fishing, ferries, cruise ships, aquaculture, and commercial recreational. Limited West Coast data sets have also been acquired and are being formatted for inclusion in MARIS, in preparation for more comprehensive traffic data collection in that region. Multiple surveys on private recreational boating frequencies and patterns have been collected to complete the spatial traffic modelling.

Several statistical and risk analyses have been completed. Cluster analyses show where the highest incident concentrations are, seasonal variations, which areas a fixed number of SAR vessels should be tasked to, and where the highest incident rates are. Predictive models have been completed, yielding a set of factors which are related to incident frequency and/or severity levels. Work is ongoing to investigate the effects of weather factors in incident occurrences.

Previously, the Lifeboat Station Placement Program (LSPP) relied on MARIS results to maximize vessel coverage, while minimizing response times. Each candidate station was ranked based on its area of coverage, the amount of time responding to historical SAR incidents, and the potential reduction in response time to future incidents. This enabled SAR planners to quantitatively compare potential SAR stations in terms of resource effectiveness. Quicker response times result in higher chances of success; saving time, money, and lives. More recently, the MARIS model has been used to investigate the impact of multi-tasking vessels on expected response times and distributions.

Specific studies on cruise ships have examined traffic patterns, local and worldwide incident types and rates, and risk factors such as distance from shore and POB. A separate study on recreational boating is considering the location and duration of outings, the breakdown of boat types, and operator attitudes towards various risk factors including weather conditions. Over the next year, this will result in a more comprehensive model of recreational boating.

Contact: Ian Gillis, (613) 998-1394 *Project Number: FKDE6*

Newfoundland Region

With regional headquarters located in St. John's, Newfoundland, this Region selects R&D projects to assist in their challenge to adapt to trends in operational demands, strategic changes in levels of service, and evolving expectations from clients. The priority technological opportunities in support of their overall effectiveness of service delivery operations relate to: boating safety, communications and transmission network technologies, and aids to navigation.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
FKCT6	Research Project for Increased Wearing of Personal Flotation Devices (PFD)	CCG	225	7
	Newfoundland Region- **TOTAL**		**225**	7

Research Project for Increased Wearing of Personal Flotation Devices (PFDs)

Five- year study finds "perceived risk" to be a key factor in wearing Personal Flotation Devices (PFDs)

The year 2004 marked the end of the most comprehensive research program on Personal Flotation Device (PFD) wear ever undertaken in Canada. With a view to learning how to influence Canadian recreational boaters to wear PFDs on a regular basis, the five-year research program investigated boaters' current attitudes and behaviour towards PFD wear.

The research began in 1999 with the formation of a Steering Committee, a review of existing literature and the conducting of focus groups all aiming to establish baseline wear rates across the country, and to understand factors that motivate boaters to wear, or not to wear, PFDs. Much of the existing data was statistical rather than attitudinal and behavioral and regional in scope; however, by understanding the issues, a questionnaire could be designed that would glean significant and quantifiable data.

During the 2000 boating season, there was a national observational study conducted of boaters actively participating in boating activities. The survey concluded, and the baseline established that 20 per cent of Canadian recreational boaters wear PFDs on boats six meters or less in length. It also concluded that operator behaviour affects passenger wear-rates. Two areas showed higher-than-average wear-rates – the Far North with 44 per cent and Newfoundland and Labrador with 60 per cent.

Patterns emerge

In 2001, a national telephone survey questioned approximately 4000 respondents on their attitudes and beliefs towards PFDs and lifejackets. Results of that survey indicated:

- the decision to wear a PFD was often based on the amount of perceived risk present;
- most people would wear a PFD if asked to do so by the operator of the boat;
- affluent and highly-educated individuals claim greater control over the environment reducing their perceived need to wear a PFD; and
- women tend to be more safety-conscious than men.

The following year, focus groups conducted in the two areas with the highest PFD wear-rates gave further insight into the influencing factors. Boaters, who reported that they always or almost always wear a PFD, stated that certain factors influenced their decision, such as:

- environmental risks, such as larger lakes, oceans, colder air and water temperatures;
- the ability to be prepared to handle the unpredictable;
- a near-drowning experience or having known a drowning victim; and
- parental instruction to wear a PFD.

Overall, respondents felt that the operator of the boat is always responsible for ensuring the safety of all occupants on board, and the decision to wear a PFD should be based on individual assessment of risk involved with mandatory wear being untenable.

The national attitudinal survey process was completed in the fall of 2002 with a survey of over 600 respondents in the North. As in the rest of Canada, the majority was not aware of differences

between lifejackets and PFDs.[1] However; northern boaters expressed more positive attitudes than boaters in the rest of Canada toward PFD wear – 80 per cent versus 70 per cent respectively. They also displayed strong beliefs that PFDs are necessary despite strong individual boating skills.

Decision based on degree of risk

The two-part attitudinal survey provided detailed comparisons of boater attitudes. One commonly shared attitude was that the key reason to wear a PFD is perceived risk. If a boater feels that the risk is manageable, a PFD will not be worn. Also, each time a boater safely undertakes a boating activity it lowers the perceived risk and, this in turn, lowers the wear rate.

The majority of Canadians are somewhere in the middle of a continuum ranging from those who never think about wearing a PFD to those who always wear one. While most boaters believe that boating activities would be safer if they wore a PFD, and more than 90 per cent carry the appropriate number on board, wear-rates are low. Reasons for not wearing PFDs included discomfort, lack of mobility to hunt and fish, or stained and smelly material.

In the fall of 2003, six focus groups were conducted in St. John's, Toronto and Montreal to confirm key findings and to generate concepts to be used to develop promotional communication tools to encourage PFD wear. The groups confirmed that many boaters recognize the risks associated with boating and claim to be able to handle them without regularly wearing a PFD.

Changing perceived risk is a difficult and long-term process, and the current perception that boating is usually low risk, which is reinforced by the frequency of incident-free boating, represents a major barrier to increased PFD wear. Possible approaches to increasing risk perception include reminding boaters that the unexpected can happen and demonstrating that the belief that there is enough time to react and put on a PFD when a dangerous boating situation occurs is a fallacy.

Another important barrier is the reported lack-of-comfort, poor mobility and fabric issues associated with PFD wear. However, when shown an example of the newer types of approved PFDs, boaters were much more receptive. This represents a major opportunity to increase PFD wear-rates, especially since more than two thirds of respondents are not aware of the new and improved PFD designs, introduced in 1997. Successful education of the improvements in design and materials of PFDs could lead to significant increase in wear-rates in a shorter time frame.

Based on the results of the extensive research, a series of communication tools were developed highlighting the new PFDs available, increasing raising awareness of the risks associated with boating activities and encouraging operators to request their passengers to wear PFDs. The tools were designed to support the community-based education approach of the Office of Boating Safety (OBS) in Newfoundland and Labrador. They will be tested throughout the province, fine-tuned where necessary, and made available to the rest of the country in both official languages.

Although the research is complete, there is still a lot of work to be done on focus testing and finalizing the communication tools. Risks associated with recreational boating vary across the country and any marketing campaign will need to be regionally tailored. Marketing and

[1] A lifejacket is designed to turn an unconscious person into a face upwards position within a few seconds. A personal flotation device (PFD) keeps a conscious person's head out of the water in calm conditions and assists them in rough water. A PFD is not designed to turn an unconscious person from a face down position to a face upward position.

communication professionals estimate that changes in beliefs, attitudes and, consequently, behaviour will not begin to be significantly noticeable for at least five to ten years after an effective communication strategy (e.g.: a social marketing program implemented at a consistent level of intensity and duration, has been in place).

Contact: Sharon Sellars, (709) 772-2079 *Project Number: FKCT6*

Maritimes Region

With regional headquarters located in Dartmouth, Nova Scotia, this region selects R&D projects to assist in their challenge to adapt to trends in operational demands, strategic changes in levels of service, and evolving expectations from clients. The priority technological opportunities in support of their overall effectiveness of service delivery operations relate to: spill response technologies, and search planning strategies.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
FMDG2	Enhanced Sweeping Methods	CCG	25	
FKCA6	Orimulsion Project (Year 3)	CCG	285	
FMDH2	Viscous Oil Pumping Systems (VOPS) for Orimulsion and Heavy Oils	CCG	100	
FMDJ2	Ocean Buster – Development of Various Integrated Skimming Systems Installation Methods	CCG	60	
FMDK2	OTTERboom – High Speed Sweep Guide Booms	CCG	75	
	Maritimes Region- **TOTAL**		**545**	

Enhanced Sweeping Methods

See project Ocean Buster – Development of Various Integrated Skimming Systems Installation Methods.

Development of Response Strategies for Orimulsion and Heavy Oils (Year 3)

Since 2001-2002, the International Orimulsion Working Group have been evaluating new and existing oil spill recovery methods and techniques to assist in the advancement of recovering Orimulsion. The five-year research plan consists of five subject areas: shoreline recovery, mechanical recovery, biological studies, chemical/physical studies and detection/tracking.

Below highlights the work carried out in FY 2003-2004 within each of the subject areas.

Shoreline Recovery

This year involved the analyses of the data gathered from a series of tests conducted on the removal of Orimulsion® bitumen coatings from rock surfaces and orimulsion® penetration and retention in coarse sediments.

The results of the analyses are under review and will be used to determine the best direction for further study on the fate and effects of bitumen from Orimulsion® and heavy fuel oils.

Mechanical Recovery (GT-260 Platewheel)

This study area is focussed on methods of pumping bitumen and the feasibility of burning bitumen from Orimulsion during response/recovery operations. The results are described below.

This year several joint project agreements involving many partners within government and industry alike took place to follow up on previous year's results and to support other related R&D projects. The project agreements are as follows:

- Improvement of the structural integrity of the GT-260 platewheel and sealing capabilities (JPA partners CCG, Breco Innovations, Fleming Co.)
- Extended Testing of the Modified GT-260 Pump using Extremely Viscous Oil (Bitumen) (JPA partners CCG, EC, Breco Innovations, SAIC Canada)
- In-Situ Burning of Orimulsion® and Heavy Oils Mid-Scale Test (part of the HOBO Study) (JPA partners CCG, EC)

The test results on the GT-260 platewheel were impressive. The modifications made to the GT-260 demonstrated that they would withstand conditions of elevated operational temperatures with minimal impact on performance.

An inspection by the developer revealed that excess material was binding during the operation of the pump and ended up being extruded by the motion of the platewheel within the pump (Figure 4). A redesign has been undertaken and the centre hub has been slightly reduced in size.

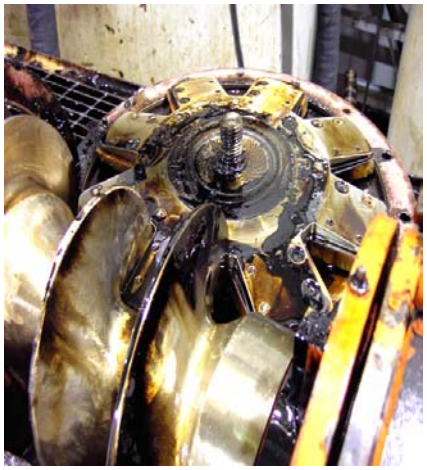

Figure 4: Pump open for inspection

Figure 5: DOP 250 Pump

The robust nature of the materials of construction, including their ability to seal and withstand temperatures upwards of 80^{O}C, have proved that the upgrade has improved the operational windows for these pumps (Figure 5). The upgrades included an inlet hot water/steam injection along with annular water injection to improve the capacity of the pumps permitting the pumps to continue operating under harsh conditions.

In-Situ Burning of Heavy Fuel Oils & Bitumen

In-situ burning is recognized as a viable alternative to mechanical methods for cleaning up oil spills on water. Orimulsion®, once separated into bitumen and water, can be ignited at mid-scale situations and will burn with useful efficiency, although re-ignition may be necessary.

A series of mid-scale tests of in-situ burning of orimulsions® and heavy oils were conducted in the winter months in specially designed square burn pans. A total of four types of heavy fuel oils (HFO's), two types of Bunker C, Orimulsion®, and weathered Butumen were burned in-situ on salt water.

A typical burn pan is shown below (Figure 6).

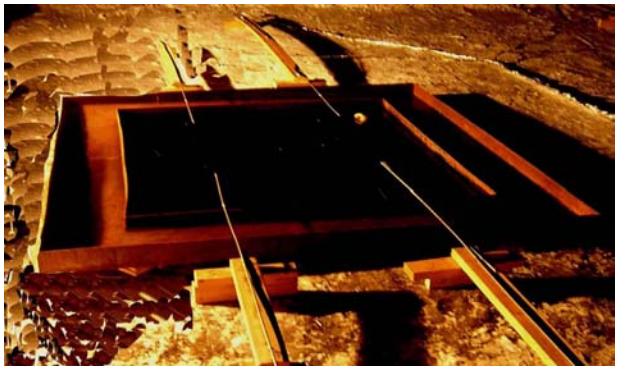

Figure 6: Typical Oil Pan Set-up with Probes in Place

The results show that the efficiency for the burning of Orimulsion® was about 60 to 70% for the burns re-ignited when they extinguished prematurely. The weathered bitumen could only be burned an additional 13%.

The residue was very viscous and adhesive if fresh. If the burn was efficient and the residue was let cool for a period of time, the residue solidified and was very easy to remove.

These small scale results show that there is potential for burning heavy oils of several types in-situ.

Biological Studies

Work was deferred to April 2004. A technical approach strategy is under development to collect data on the effects of orimulsion on marine organisms.

Chemical and Physical Characteristics

Previous studies have shown that Orimulsion® is driven by buoyancy to rise in salt water and sinks in fresh water and there is a complex interaction among salinity, time, energy and temperature. The current study extended experimentation down to lower temperatures, and salinity values in the range from fresh to salt water with three levels of input energy.

The experiment involved adding Orimulsion® to a 300 L tank of water and mixing it well then taking a time series of samples to quantify oil on the surface and determine the concentration of bitumen and the particle size distribution as a function of time. Using these data, simple equations were developed to describe and predict the concentration of bitumen in the water column as a function of time.

The experiment also revealed that salinity appears to affect the coalescence rate significantly and that the energy used to simulate sea conditions was an important factor for prediction of the amount of bitumen particle droplets remaining on the surface as compared to particle size and even oil remaining in the water column.

Remote Detection & Tracking

Since Orimulsion disperses in the water column and does not float, it makes the detection and tracking of Orimulsion difficult during a response.

This study confirmed that laser-induced fluorescence can be employed to detect and classify emulsified oils resulting from real-life spills can be performed routinely with a laser fluorosensor.

Next year, the project enters its fourth year of research work.

Contact: Ron MacKay (902) 368-0204 *Project Number: FKCA6*

Viscous Oil Pumping Systems (VOPS) for Orimulsion and Heavy Oils

Orimulsion is a new petroleum product that presents new challenges for recovery in the event of a spill. Finding ways to modify and enhance current inventory holdings are significant since improved response capabilities will enable responders to cleanup Orimulsion spills more effectively and efficiently.

This multi-phased project investigated viscous oil pumping technology for Orimulsion and heavy oils. CCG in partnership with the US Coast Guard and industry from North America and Europe have developed a Technical Approach Strategy (TAS) entailing the timelines and details for the test protocols to be carried out by the respective partners.

Three years of planning have lead to a successful workshop to test new pumping/lightering technologies for heavy viscous oil products. The Joint Viscous Oil Pumping System (JVOPS) Workshop was held at the CENAC Towing Inc. facility in Houma (LA) from December 8-15-2003. The goal was to advance the distance this highly viscous oil can be pumped.

A technique tested was “Annular Water Injection”. This technique of lubricating heavy oil products is accomplished by heating the oil and injecting water into the product. The water acts as a seal and lubricant around the oil allowing it to move easier within the hose while being pumped the desired distance.

CCG successfully met the goal of pumping a bitumen product at 500,000 cST 500 feet. While the USCG also successfully met their goal of pumping heavy fuel oil at 200,000 cST up to 1,500 feet.

The total project cost was over $1M (US). Over half (56%) of the funding was provided equally by the Canadian and US Coast Guards. Support and in-kind services from multiple entities covered the rest of the workshop costs.

The collected data is under review. Initial conclusions indicate that the water lubrication techniques and equipment used may decrease pump system pressures by as much as 25 times when pumping product upwards of 200,000 – 500,000 cST up to 1,500 feet. Additional system enhancements were also identified. These included inlet lubrication and local bulk steam heating at the pump inlet. Also, a unique diesel flush-pigging technique could be used to completely decontaminate the hose following use with heavy viscous oil.

The future of VOPS is very promising. The challenge will be to implement mechanical improvements while keeping the overall system manageable by the operating personnel and keeping the costs of equipment modification at an affordable level.

Contact: Ron Mackay, (902) 368-0204 *Project Number: FMDH2*

Ocean Buster – Development of Various Integrated Skimming Systems Installation Methods

Under a joint project agreement among CCG (Canadian Coast Guard), NOFO (Norwegian Clean Seas Association for Operating Companies, Stavanger), Norske Agip, NOFI Tromso AS, and NOREN wished to further develop the Ocean/Current Buster High Speed Sweep technology forming an oil collection system to a fully integrated containment and oil recovery system known as NOBIS.

The System (Figure 7) will consist of the Ocean Buster (OB) with an Integrated Skimmer (IS) adapted to the separator part, hose system for supply of hydraulic power to the skimmer unit, hose system for transfer of recovered oil from the separator to the vessels tank system, a control unit and a hydraulically operated boom reel capable of storing, deploying and recovering the System. The skimmer unit's pump capacity shall be min. 150 m3/h up to 400 m3/h.

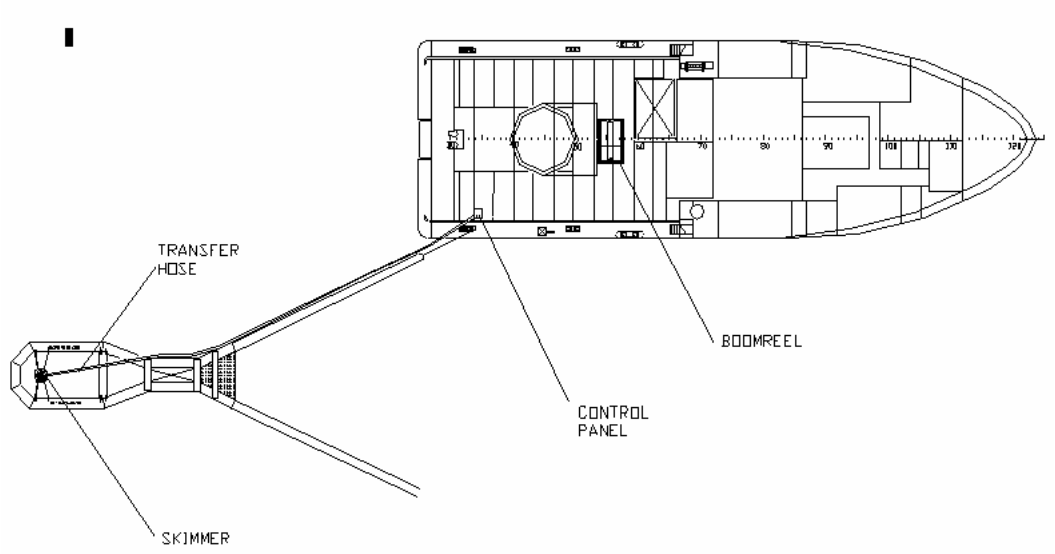

Figure 7: Overall Layout of NOBIS System

The project was carried out in multi phases with the final phase being a field test of the complete Ocean Buster system as part of NOFO's at sea oil in water exercise with other open water oil sweep systems.

Due to unforeseen delays, scheduling and unsafe poor weather conditions, the NOBIS was not fully tested during the oil in water exercise. AllMaritim made arrangements with the Belgium Coast Guard to conduct a second oil in water exercise in the English Channel off the coast of Holland in September, 2003.

A series of unfortunate circumstances such as debris at sea, skimmer construction and pump selection, understanding of system requiring sufficient forward movement, if oil supplied was sufficiently emulsified, and accurate measurements by data collection contractor led to the test results being inconclusive.

Many lessons have been learned through this exercise including skimmer construction and anchoring mechanism, guide boom diameters, alternated guide boom project (OTTERboom) to eliminate excessive apexes and subsequent oil loss, and deployment strategies. Further information on the *OTTERboom High Speed Sweep Guide Booms* R&D project can be found in CCG's R&D 2004-2005 Annual Plan available at CCG's website www.ccg-gcc.gc.ca.

The NOBIS project is seen as a viable option for the Current/Ocean Buster Technology and will continue primarily through support of NOFO, NOREN, and NOFI Tromso.

Now that we know the very positive results of a concurrent R&D project, Joint Viscous Pumping System (JVOPS) with the USCG, the continuing support the NOBIS project would be in CCG's interest for off shore collection and pumping of very viscous oils such as in the Prestige incident off the coast of Spain.

The figures 8, 9, and 10 below capture the set-up arrangements of the test trials.

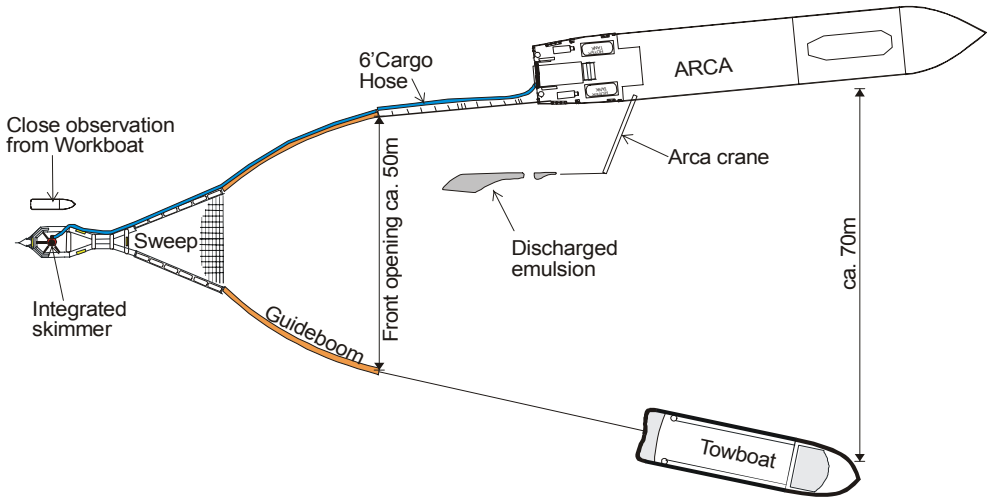

Figure 8: Overall Test Setup

Figure 9: OB with Integrated Skimmer Inset

Figure 10: NOBIS in Collected Oil Emulsion

Contact: Ron Mackay, (902) 368-0204 *Project Number: FMDJ2*

OTTERboom – High Speed Sweep Guide Booms

CCG in partnership with AllMaritim AS/NOFI Tromsoe AS have developed new high speed oil sweep technologies - the Current Buster and Ocean Buster in a previous R&D project. There is now a need to develop guide booms to match this technology.

The purpose of this project is to examine the possibilities and limitation in using sloping or different skirt depths in oilbooms in order to optimise oilboom configurations. The objective is to develop, produce, test and verify different scaled booms for different applications typically for:

- low speed guidebooms (in front of sweeps, apex booms or inline skimmers etc.);
- high speed guidebooms (in front of Ocean or Current Buster etc.);
- low speed deflection booms (open ocean use in front of normal U or J booms); and
- high speed deflection booms (use in rivers etc.).

The results of Phase I prototype test trials conclude that the OTTERboom technology utilizing construction techniques to alter the hydrodynamic forces on the skirt of the boom has promising effects to achieve the desired V-shape for various on-sea sweep systems. The prototype design, as tested in controlled pool conditions, indicates that it is possible to increase the front opening of a sweeping boom up to 39%. It was also shown that the desired V-shaped configuration of sweeping systems is achievable while still increasing the front opening 23% over conventional on-water sweeping systems.

The photographs below (Figure 11) show the shape of various booms during testing.

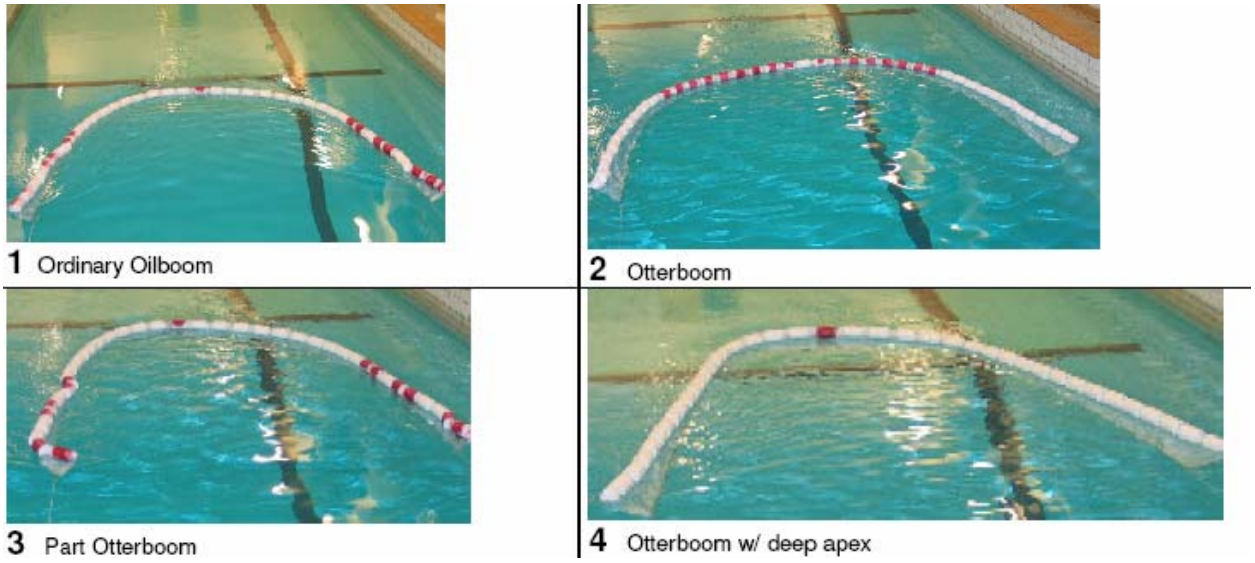

Figure 11: Shape of Various Booms during Testing

The second phase will get underway in 2004/05 and conduct test trials of the hydrodynamic skirt forces on a full size OTTERboom at the OHMSETT facility. Time permitting, attempts will be made to test other applications noted above. Sea trials in Canadian waters are also planned.

Success in obtaining such guidebooms or subsequent high speed/current performing booms would significantly increase the area covered and encounter rate of on water sweeping responses. Also, development of the subsequent high current boom would reduce the need of multiple deployments of boom resources and allow placement of these resources at other areas for protection and deflection applications. These two applications would significantly reduce both the asset requirements and response costs associated with an incident cleanup.

Contact: Ron Mackay, (902) 368-0204 *Project Number: FMDK2*

Québec Region

With regional headquarters located in Quebec City, Québec, this region selects R&D projects to assist in their challenge to adapt to trends in operational demands, strategic changes in levels of service, and evolving expectations from clients. The priority technological opportunities in support of their overall effectiveness of service delivery operations relate to: ice information management, marine traffic management, aids to navigation, erosion/sedimentation mechanisms, and SAR and environmental response.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
GMJH3	Wireless Communication Protocol Application for Georeferenced Marine Data Internet Access	CCG	70	
FJMP3	Dispersion of Oil Spills Stranded in Ice and Its Environmental Fate	CCG	65	
FJNF3	Lighted Spar Buoy	CCG	337.5	
FMCC3	Erosion-Sedimentation Model of the St. Lawrence River	CCG	150	
GMJF3	Squat Study for the Purpose of Re-evaluating Underkeel Clearance Specifications	CCG	292.3	
GMJG3	Computer-Assisted Ice Observation System in Helicopters	CCG	35	
GMJJ3	User-Friendly Software Forecasting the Trajectory of Oil Spills in Cases of Environmental Intervention	CCG	101.6	
GPJN3	Revision of non-commercial buoy types	CCG	20	
FQAT3	Sewage Treatment System : Central Wastewater Treatment Plant for Ships	CCG	200	
	Québec Region- **TOTAL**		**1,271.4**	

Wireless Communication Protocol Application for Georeferenced Marine Data Internet Access

The first phase on the use of a wireless communication protocol for accessing georeferenced marine data concluded that the shipborne Automatic Identification System (AIS) is the best option for transmitting such data aboard vessels. In the near future new regulations will be introduced that will require all ships to be outfitted with an AIS transponder.

Phase II of this project, carried out this fiscal year, conducted a feasibility study using AIS as a communication medium for transmitting georeferenced marine data critical to navigators directly to the bridge. The good results justified the development of a transmission prototype. The architecture of the prototype, shown below, is of the client/server type.

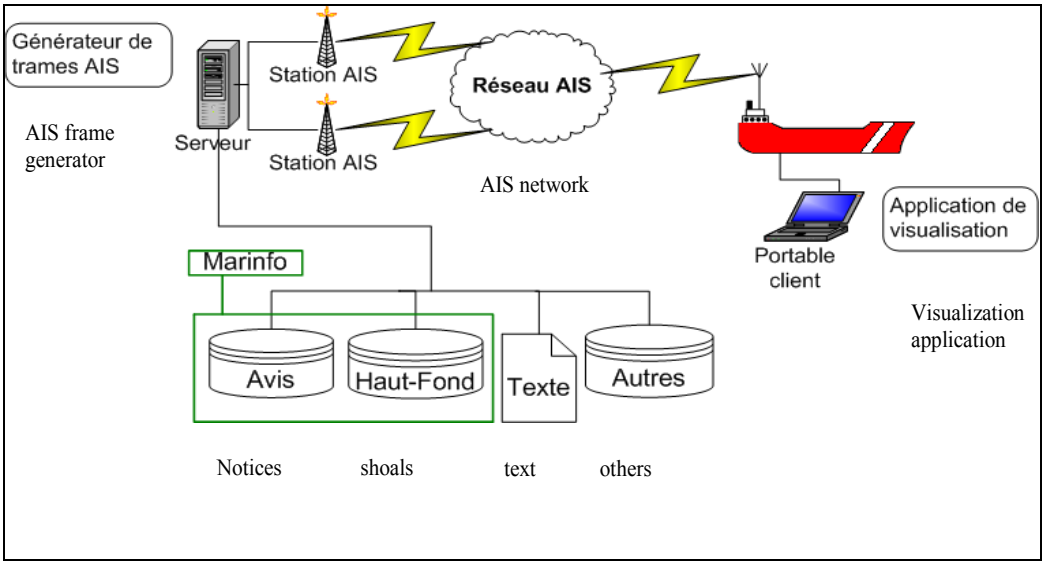

Figure 12: Prototype Architecture

The prototype will be installed at Quebec stations for field trials. The data collected will be used to determine future development and enhancements of data transmission via AIS.

This technology provides instaneous generation and communication of detailed marine information to mariners.

Future expansion of the prototype is anticipated as funding and user requirements are identified.

Contact: Stéphane Lessard, (418) 649-6351 *Project Number: GMJH3*

Dispersion of Oil Spills Stranded in Ice and Its Environmental Fate

The aim of this project is to study and evaluate the efficiency of using an oil-mineral aggregate as a natural dispersant for oil that is trapped in an ice field. The study's findings will help provide the basic blueprint for a response procedure in the event of an oil spill in ice-infested waters.

Previous studies have shown that bioflocculation causes oil to react with fine minerals, even in cold water, to form aggregates that help promote oil biodegradation. The formation and dispersion potential of these aggregates depends on the characteristics (turbulence and sediment movements) of the hydrodynamic field, and on the fine minerals that are used. An understanding of the various mechanisms at play, and of the parameters that govern the fine mineral/oil/ice-infested water system, is essential if we are to offer a useful approach to dispersing oil that is trapped in the ice.

In 2003-2004, this project reviewed literature on different aspects of the oil-mineral aggregation process in ice-infested waters. As a result, the main parameters affecting the efficiency of this process were identified. An evaluation of the efficiency of the process, in light of the hydrodynamic conditions and chemical characteristics of the waters of the St. Lawrence in the presence of ice, has shown that the current response procedure could be effective if sediments and hydroelectric power were artificially introduced into the environment. Furthermore, the study concluded that in order to use the oil-mineral aggregation process as a response procedure for oil spills in the presence of ice, some laboratory tests are required. The purpose of these would be to establish the type and quantity of sediments required and to determine how much energy should be introduced into the environment. The tests would also help determine a practical method for introducing the sediments and energy. An experimental protocol has been developed which outlines the tests that are to be conducted and the methodology that is to be used for analyzing the results.

During the project's next phases tests will be conducted in the laboratory and on the ground in order to certify the effectiveness of the oil-mineral aggregation process and to develop a basic blueprint for a response procedure. This procedure will be evaluated during an oil spill simulation exercise in the presence of ice on the St. Lawrence River.

The results of this research have been submitted for the "International Oil Spill Conference 2005" to be held in Florida (USA) from May 15-19, 2005, entitled "*On the Oil-Mineral Aggregation Process: A Promising Response Technology in Ice-Infested Waters", by Danielle Cloutier, Samir Gharbi, and Michel Boulé.*

Contact: Martin Blouin, (418) 648-4557 *Project Number: FJMP3*

Lighted Spar Buoy

The overall goal of the project in 2003-2004 was to raise the level of service for commercial navigation during the winter season and, if possible, to lower the CCG's operating costs for this service by developing a four-seasons buoy.

The civil engineering component completed the following activities:

- A financial analysis of the costs associated with the various buoy system scenarios being considered have cast doubt on the option of developing a prototype four-seasons buoy. As a result, the project's goals have been modified and will now focus on adapting CCG spar buoys to stay lighted for three seasons, while keeping them in the water all year long.
- Observation and monitoring of seven lighted spar buoys on the St. Lawrence River continued. An additional location was chosen to observe the overall performance of the buoys in severe ice and strong current conditions. Unfortunately the Finland spar buoy was lost during the spring break-up.

- Tests on structural and coating materials to design a prototype four-seasons buoy are complete and a final report is being prepared.
- Research on the types of long-life security batteries that are available and on the consequences of their aging found that when it comes to four-seasons spar batteries only the 21-volt alkaline battery with a 135 amp/hrs work best. All the lighted spar buoys being tested are equipped with twin batteries. The lifespan of a pair, calculated according to lantern specifications and the number of hours of use, seems to meet the project's objectives.
- Spectral measurements of two new MVP3-LED lanterns were conducted by DRDC Valcartier, EO Eng & Eval Center to determine how well each lantern performed in accordance with the number of seasons of which it was in service. This knowledge will allow CCG to make recommendations about the future use of the MVP3-LED lantern.

The activities completed by the hydraulic engineering component included:

- The processing of data gathered during the winter of 2002-2003 and conducting an ice impact analysis. The results showed that the maximum force recorded exceeded the predicted theoretical value in 30-50% of cases. The methodology for calculating the force of impact has been revised based on these results. The research team has proposed a design specification for new buoys to withstand ice conditions in the St. Lawrence River.
- The development of a forecast model allowed the research team to predict the angle of heel and trim of "spar" and Finland buoys in accordance with the hydrodynamic conditions of their environment.
- The data collected from the monitoring of the angle of heel of "spar" and Finland buoys in strong current conditions revealed that the spar buoy encountered an oscillation problem that makes it unstable, especially in strong currents. This problem is under study.
- The final task involved the deployment and operation of a monitoring system for the experimental buoys deployed in the Ile Des Barques region. The observations gathered will assist in evaluating the level of service offered by the lighted "spar" buoys.

Figure 13 below illustrates the different stages in the development of a certified and calibrated model for predicting angle of heel of a Finland buoy in various current conditions.

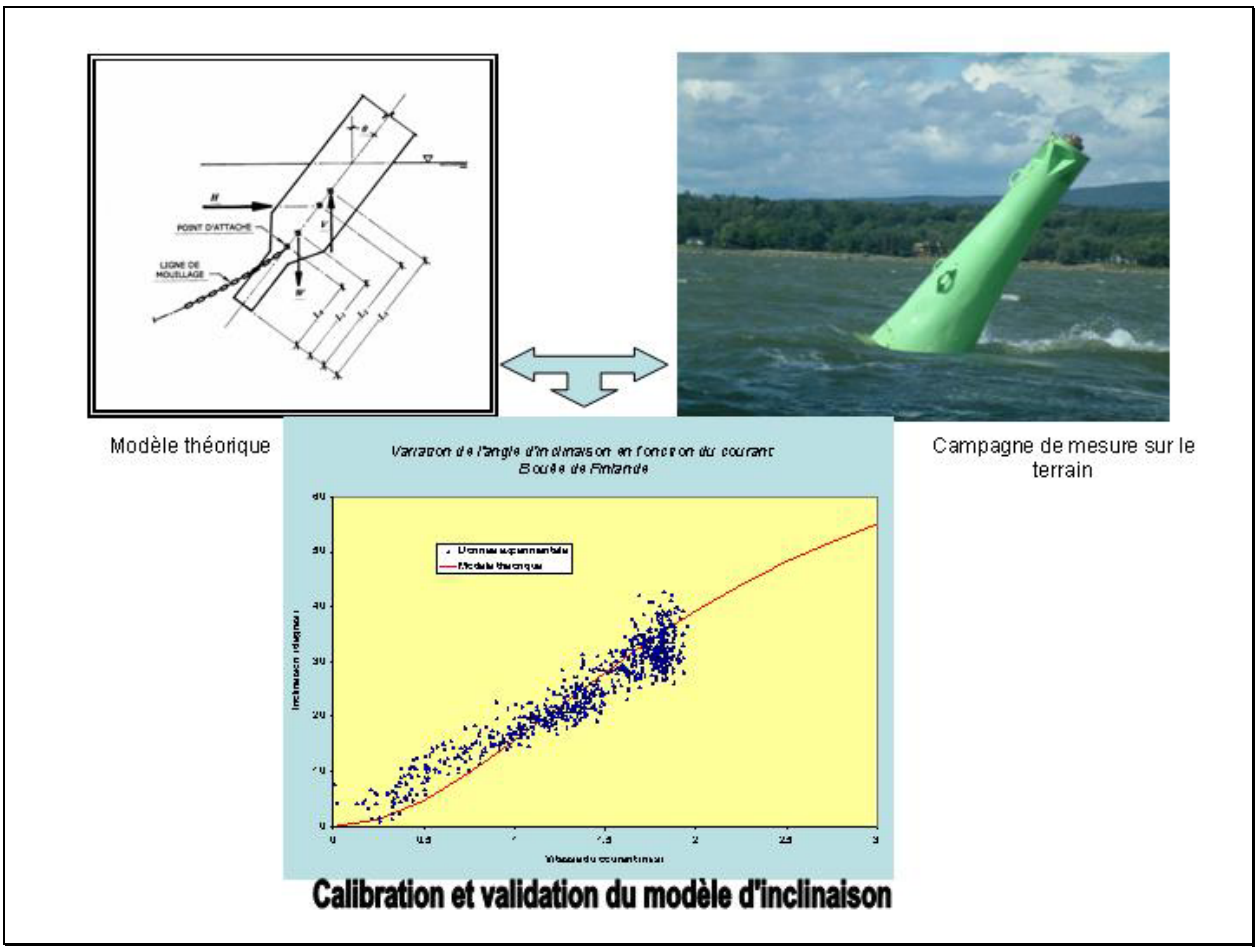

Figure 13: Calibrated model for predicting angle of heel

The results will now be used in phase 4 work to design and build a prototype year-round buoy. In situ trials will be conducted in the winter 2004-2005. Floats will be mounted to the buoy in the summer 2005 that will increase the buoy's visibility and stability in wind and currents. Data will be collected and analyzed to determine whether or not the buoy meets operational requirements.

Contact: Sylvie Pelletier, (418) 648-7493 Project Number: FJNF3

Erosion-Sedimentation Model of the St. Lawrence River

This project is developing a modeling package for the St. Lawrence River comprising a numerical erosion/sedimentation model and a graphic interface. This model could be used:

- to gain a better understanding of the erosion, transport and sedimentation processes in the St. Lawrence River based on various hydrological and hydraulic conditions;
- to evaluate the potential impact of navigation and maintenance of the waterway on the environment (bank erosion and sedimentation).

The project involves the integration into a graphic interface (SedSim) of several numerical models: sediment transport model, models for the generation and transformation of wind and boat waves, bank

erosion model. These models must be validated by field measurements. The graphic interface must be able to run and display simulations of various hydrological and hydraulic conditions.

The SedSim environment and associated utilities were submitted in 2003. The model that was submitted consists of the following modules:

- Two numerical models for sediment transport (Psed and Sed2D);
- A model to simulate waves generated by the passing of boats (SGH);
- A wave transformation model (STWaves);
- Utilities to calculate bank erosion (WCE)

The files required for calibrating, validating and evaluating the various modules were submitted and verified by the Coast Guard in 2003-2004. In addition, to conduct a monitoring campaign to validate the boat wave generation model, an experimental protocol was produced. This protocol defines the measurements to be taken, the methodology for processing data, and the different validation stages of the numerical model.

The year 2003-04 had to be devoted to a monitoring campaign to validate the wave generation model (SGH), as well as to testing with the other components of the SedSim environment. These tests involve using SedSim to study the transport of sediments from the île Madame dumping site for dredged materials, and to evaluate the impact of ship lengthening on the erosion of St. Lawrence River banks.

The wave monitoring campaign could not be conducted because a consultant was late in submitting the required experimental protocol. However, we were able to buy the necessary equipment, so the wave monitoring campaign and the validation of the SGH model can be carried out in 2004-2005. Also, due to the loss of one of the project's key human resources in January 2004, the studies of the île Madame site and the impact of ship lengthening must be postponed until 2004-2005.

The year 2004-05 will also be devoted to evaluating all of SedSim's components in case studies to determine the potential environmental impacts, in terms of erosion and sedimentation, of navigation and waterway maintenance. In 2005-2006 we will conduct an analysis of erosion and sediment transport processes in the St. Lawrence River as they relate to various hydrological and hydraulic scenarios. The project should be completed in 2005-2006.

Below are a few examples of the products derived from the models.

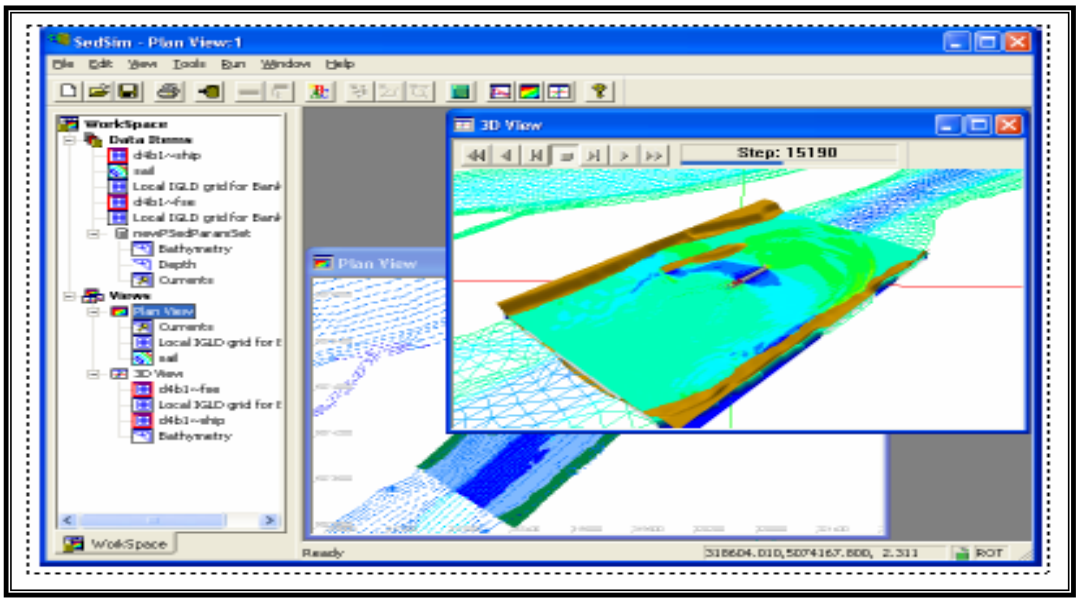

Figure 14: View of SedSim Environment

Contact: Pierre Rouleau, P. Eng. (418) 648-7493 *Project Number: FMCC3*

St. Lawrence River Ice Manager – Integrated Ice System

The Integrated Ice System (IIS) was developed as a result of PERD financing (project no. 32214) from 1997-2000. The IIS consists of a set of data gathering instruments, a telecommunications network which transmits this data in real or quasi-real time to IIS servers, specialized software which processes and analyzes this data, and an Intranet site which makes information on ice conditions available to users.

During the winter of 2000-2001, the IIS was the subject of an operational mode evaluation, without financing from the PERD or CCG R&D programs. Based on information gathered during that season, it was decided that further R&D efforts would focus on improving the remote surveillance site of curve no. 1 at lac St-Pierre.

The development of Curve 1 on lac St-Pierre was funded by the CCG R&D program since 2001. It involved testing two underwater sensors: an ADCP (Acoustic Doppler Current Profiler) and an IPS (Ice Profiling Sonar). They were installed at the bottom of the channel to measure the thickness and speed of the ice, and the speed of currents

The findings showed how useful the ADCP and the IPS are in quantifying ice and detecting ice jams. A series of manual tests were conducted in January and February 2003 that allowed the research team to validate the data from the sensors. The analysis, conducted by Laval University, confirmed that the precision of the IPS-ADCP measurements met CCG's expectations in terms of reliability and accuracy concerning the measurement of thickness concentration and speed of the ice and the diameter of the ice floes.

One of the difficulties encountered in processing the IPS-ADCP data had to do with the presence of open water. For example, the ADCP measures speed even when there is no ice. As a result, a study in 2003-04 developed ice speed validation criteria and incorporated into the software.

The Curve 1 site is now equipped with an entirely automated system for the acquisition, transfer and processing of data. The novelty of this system is that it allows those responsible for ice breaking to rapidly obtain quantitative data on ice and current conditions by consulting the IIG website. Authorized users can also consult the data in real time because access is restricted to computers that are onsite.

The CCG's Curve 1 remote monitoring site is a model site. It has been the subject of several presentations and publications, notably:

- ASL Environment Sciences Inc. presented this project at the Hydroacoustics Workshop in San Diego, March 2004;
- ASL submitted an article, co-authored by the CCG, to the Oceans 2004 Conference in Japan, November 2004; and
- Professor Brian Morse of Laval University was awarded the Thomas C. Keefer Medal 2003 for his article published in the Canadian Journal of Civil Engineering.

Figures 15, 16, and 17 below show the installation of underwater sensors at Curve 1 (the ADCP and IPS sensors) as well as a sample of data posted on the IIG website.

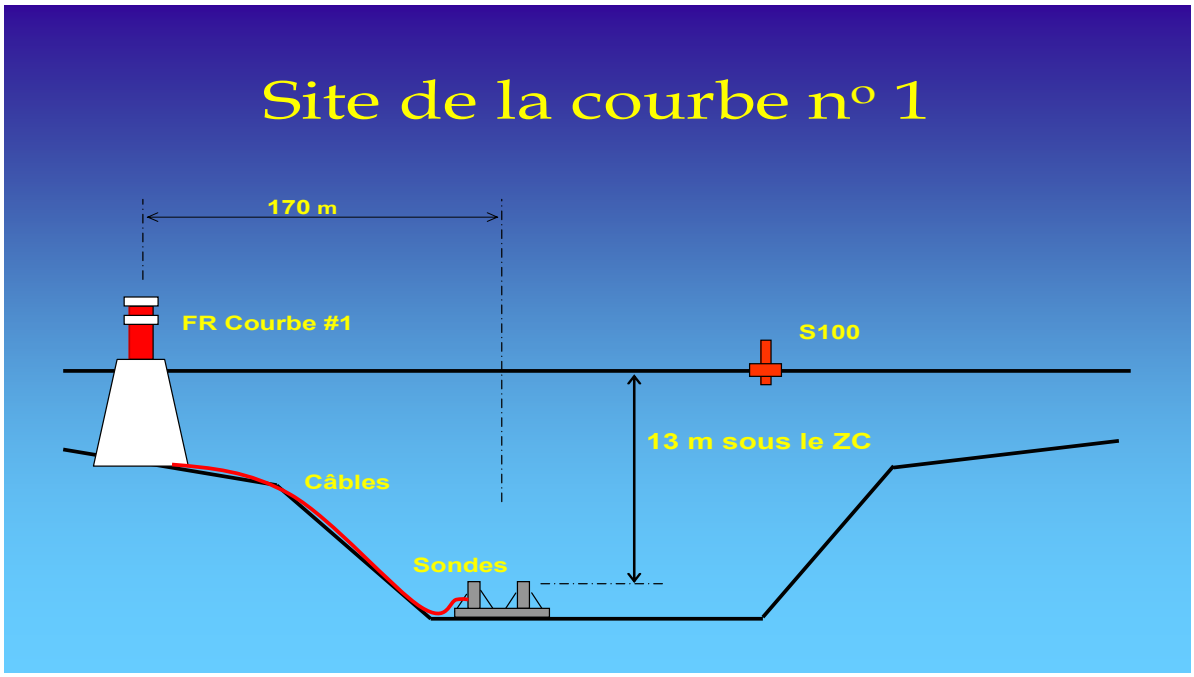

Figure 15: Curve 1 site

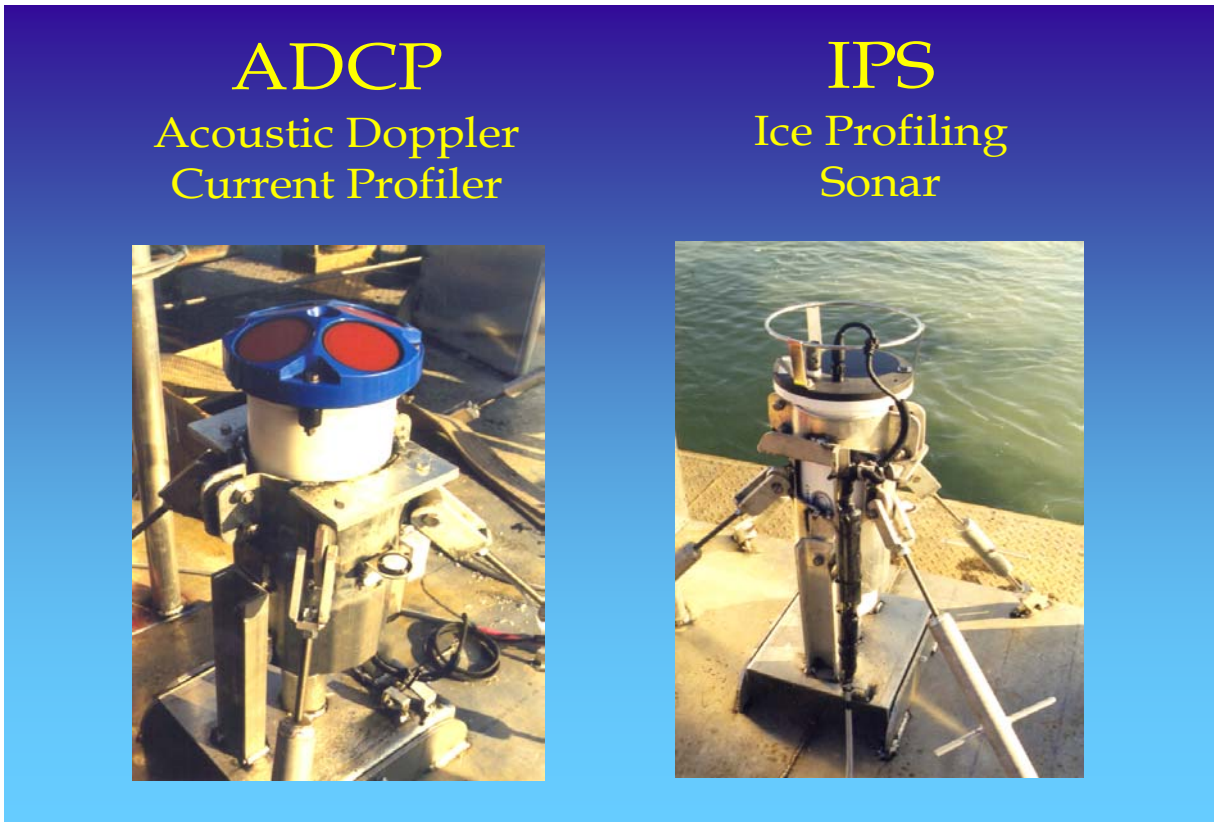

Figure 16: Measurement Senors

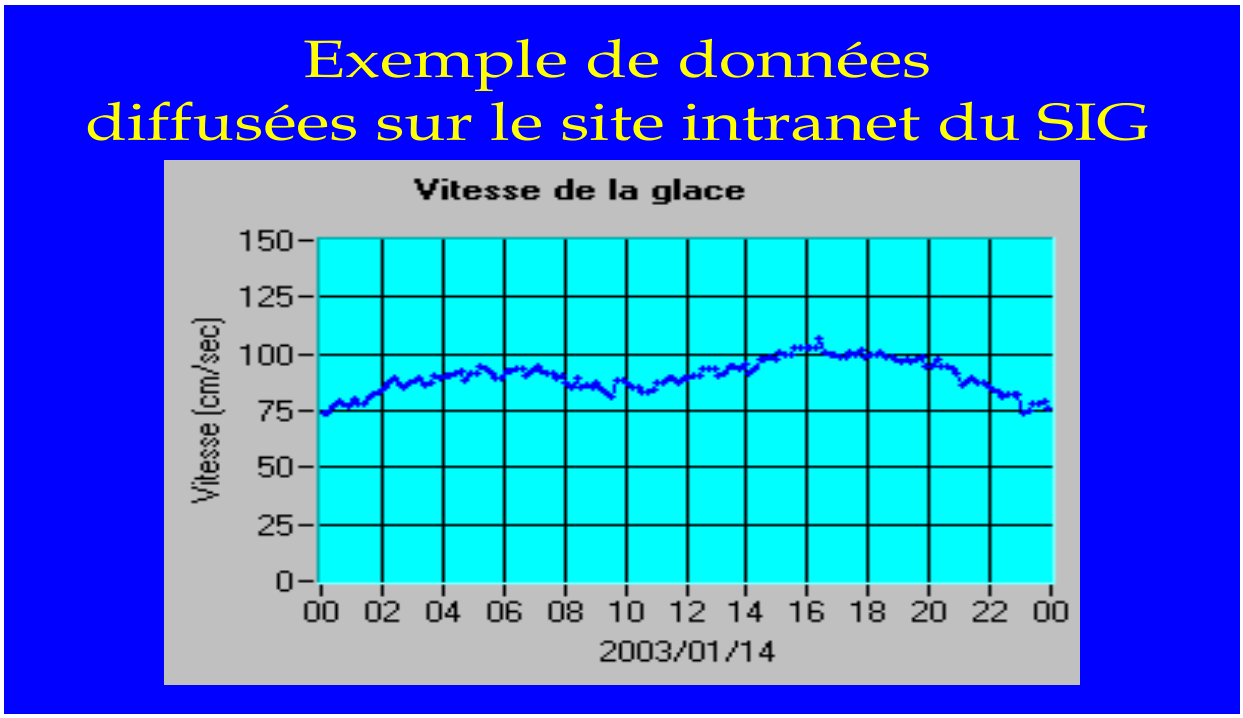

Figure 17: Example of data posted on IIG website

Contact: Réginald Corriveau, (418) 648-5620 *Project Number: GMJE3*

Squat Study for the Purpose of Re-evaluating the Underkeel Clearance Specifications for the St. Lawrence River

The purpose of this project is to study the squat phenomenon by using GPS-OTF technology. The results will allow us to re-evaluate the under keel clearance specifications for the St. Lawrence River. Where appropriate, the proposed study could lead to the development of new tools that will allow optimum management of under keel clearance on the St. Lawrence waterway.

A first phase of the project, the carrying out of a feasibility study, was completed in 2001-2002. This study comprised a literature review, recent squat studies from around the world, an analysis of available technologies, identification of the resources needed to complete the study, and the outline of a working plan.

An initial squat monitoring campaign was conducted in December 2002 for a container ship (Canmar Honour) in transit between Montreal and Quebec City. The campaign's primary objective was to validate the entire data collection system under operating conditions and to collect data that helped to validate the methodology used for data processing and analysis.

Preliminary analysis of the data we collected revealed problems with the quality of data that had been measured with GPS-OTF technology. Indeed, the results did not meet our expectations. Some improvements were made to the GPS-OTF network (re-engineering of UHF coverage, new calculation software), and additional equipment has been deployed to correct certain problems that were encountered during this initial monitoring campaign.

Given the results of the initial monitoring campaign and the technical problems we encountered, we conducted an in-depth study on the performance and reliability of GPS-OTF technology in 2004, in the context of a squat study. This study led us to conclude that the GPS-OTF technology could provide a satisfactory level of precision for squat measurement, although we still recommended modifying the data collection methodology and conducting tests to validate the deployment scenarios for the various ships profiled in the squat study. We recommended that this be done before undertaking the comprehensive and costly monitoring campaign originally planned for 2004-2005. This new phase (validation of limited staff and budget scenarios), planned for the summer of 2004, is necessary to ensure the project's chances of success and to keep costs under control. Moreover, the year 2004-2005 will be marked by the implementation of the "system for predicting and estimating water levels" (SPINE) in the Quebec region. This system could be used during the next campaign while helping to lower the project's costs. The year 2004-2005 will also be marked by the review, and definitive establishment, of the quality of data from the December 2002 campaign, as well as by the squat analysis conducted during this campaign. Furthermore, the data from previous studies, which helped to develop the formula currently used by the Coast Guard, will be analyzed in 2004-2005 in order to evaluate the formula's accuracy. The comprehensive monitoring campaign, which involves measuring the squat of three different types of ship, will be conducted during the summer of 2005. All the data will subsequently be processed and analyzed in order to re-evaluate the under keel clearance specifications for the St. Lawrence River.

The project helped enhance the reliability of the Coast Guard's GPS-OTF network which has replaced, among other things, the fixed tide staffs used in the sounding operations that the Canadian Hydrographic Service conducted on CCG's behalf as part of its follow-up operations on the state of the St. Lawrence waterway. Furthermore, the project has led to the drafting of an error and accuracy budget for the water survey, a survey conducted with the help of GPS-OTF technology. These results will help establish the

scope and limits of the GPS-OTF technology when it is used in the various activities designed to ensure security of navigation and the optimum use of the waterway's available water column.

Contact: Pierre Rouleau, P. Eng. / René Paré, (418) 648-7493 Project Number: GMJF3

Computer-Assisted Ice Observation System in Helicopters

This project is now complete. Work in this area has lead to the successful development of the ICEggs application for aerial ice reconnaissance observations and the SpillView 1.0 application for locating and monitoring oil spills and evaluating the amount of oil spilled. The ICEggs application has become the operational tool of ice observers in the Quebec region.

Fine-tuning and additional functions to these applications have now allowed users to:

- *Have greater ability to exchange observed information* via EXPORT / IMPORT with other related and/or complementary information management systems, such as:
  - **MarInfo** – Information geoportal for the CCG, Quebec region
  - **ISIS** – Environment Canada system for analyzing ice conditions
  - Modelling system for the MLI (Maurice Lamontagne Institute)
  - Technologies (Internet, Intranet or Xtranet) in general
- *Share software components*, thanks to the creation of a development environment that is common to both applications while still preserving the independence of both ICEggs and SpillView.
- *Increase the ability to manage information,* i.e. the ability to collect information not only from the St. Lawrence River and Estuary, but from the entire Gulf of St. Lawrence and/or other neighbouring regions quickly and accurately.

The direct benefits of this project include:

- Reduction of the effort and costs associated with processing and retransmitting information to external elements and other systems that require this information as input data. For example: Routing management support model (MLI), Ice Service Integrated System ISIS (Environment Canada)
- Increased speed with which information becomes available to clients, particularly to all government services and the marine industry.
- Marked reduction of the effort and costs associated with traditional means of processing and retransmitting information such as fax, regular mail, electronic mail, etc. This is due to the availability of information on the Internet and its accessibility not only to the entire local community but to the international community as well.

Consideration is being given to implement this tool in other CCG regions.

Figure 18 below illustrates an ice chart generated by the ICEggs application.

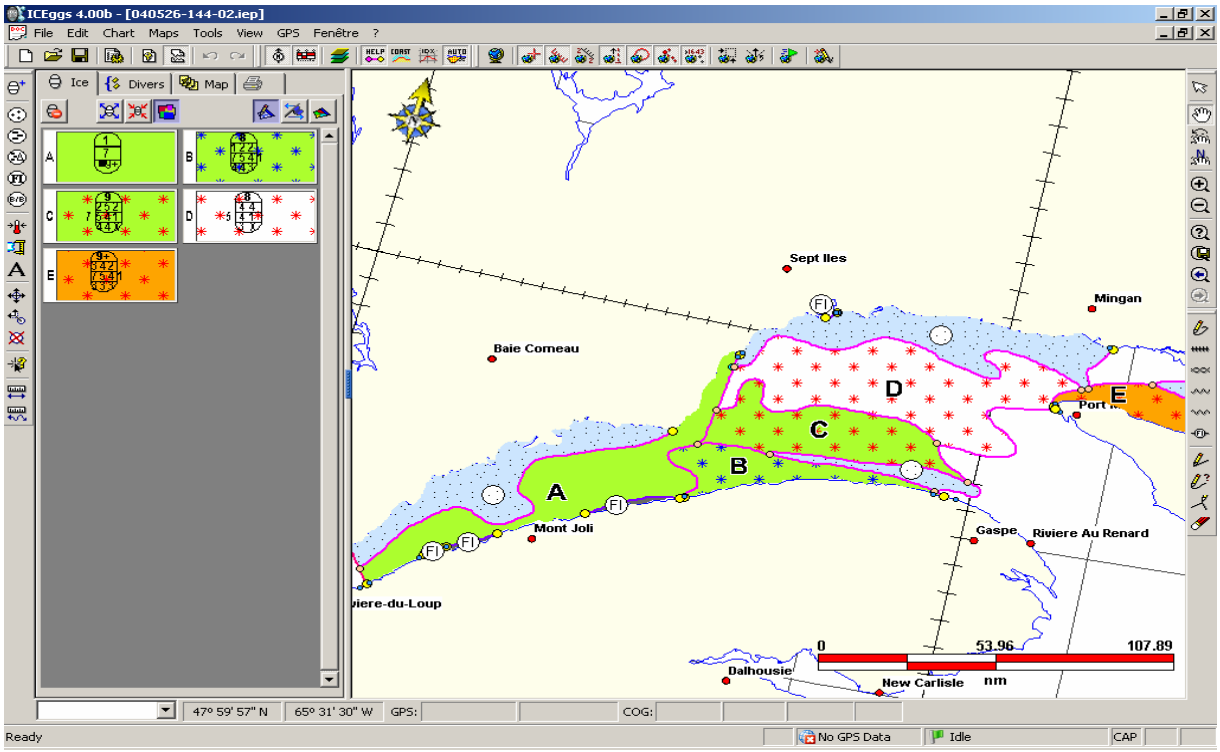

Figure 18: Ice Chart generated by ICEggs application

Figure 19 below shows the same information using MarInfo.

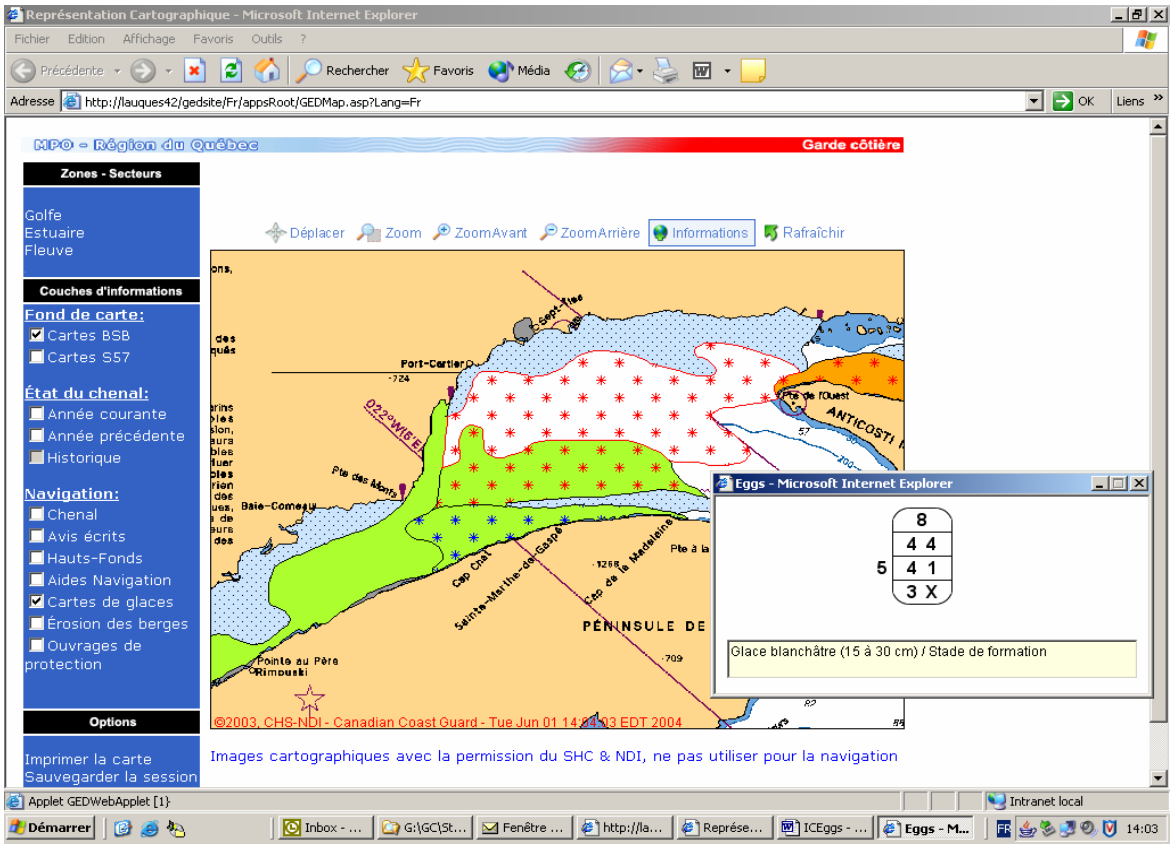

Figure 19: Ice Information using MapInfo

Contact: Réginald Corriveau, (418) 648-5620 *Project Number: GMJG3*

User-friendly Software Forecasting the Trajectory of Oil Spills in Case of Environmental Intervention

The completion of this project has resulted in the development of SpillView software to interface with the drift model developed by the Physical Modelling Section, Oceanic Sciences Division of the Institut Maurice Lamontagne. It is now possible for the model to produce and view oil slick drifts. Duty officers have access to online modelling (internet link) from real-time data, 24 hours a day, 7 days a week.

The SpillView software was developed using a majority of concepts and functions established in a parallel project, *Computer Assisted Ice Observation System (ICEggs)*. Like ICEggs, the Spillview information gathered in the field can be shared with other related and/or complementary information management systems like: MarInfo, ISIS, MLI modeling system, and the internet.

Training and implementation for members of environmental response and direct associates of the Maurice Lamontagne Institute will follow over the course of 2004-2005.

An article on SpillView software was submitted to the *International Oil Spill Conference 2005* and will also be presented at the national meeting of *Environmental Response* in Newfoundland and Labrador in September 2005 to establish a national implementation strategy.

The figure 20 below is an example of a model generated by SpillView.

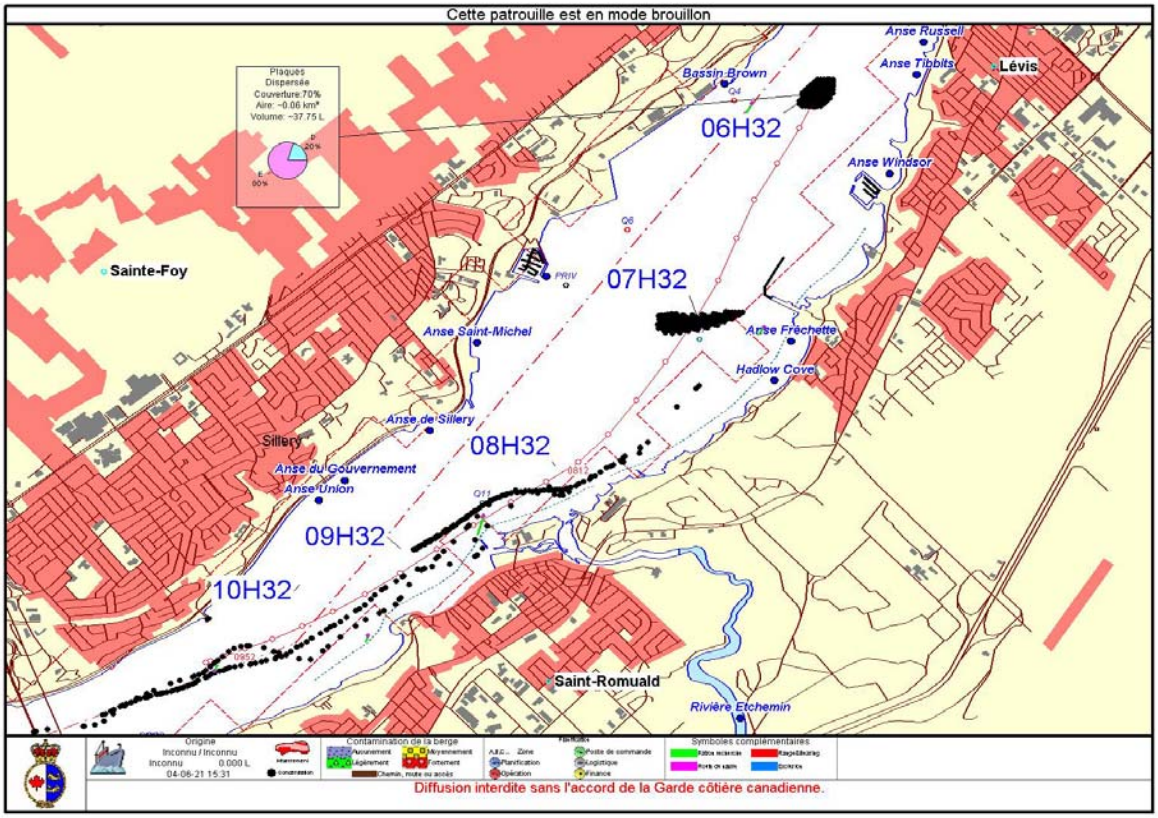

Figure 20: Model Generated by SpillView

Contact: M. Blouin, (418) 648-4557 *Project Number: GMJJ3*

Revision of non-commercial buoy types

In efforts to reduce costs of the non-commercial buoy program and improve the level of service in line with client expectations, this project is investigating four problem areas:

- Divergence stability of lamps;
- Stability, handling and maintenance of barge buoys bearing information panels;
- High number of SB-101 buoys to be deployed; and
- High number of buoys to be removed and installed annually because of winter conditions.

Phase 1 built two prototype “divergence stabilizers” for lamps (Figure 21 and Figure 22). The field trials did not achieve the desired results. A literature review was also performed to determine to what extent

products available on the international market could meet CCG requirements. The research revealed that a buoy model developed by a recognized manufacturer in 2002-03 could possibly meet some of CG's performance requirements. It is possibly that that this buoy could replace the rowboat type and the SB-101, with greater diurnal visual range and a format such that messages on nautical safety could be entered.

Figure 21: Buoy tested with a stabilizer

Figure 22 : Second stabilizer prototype

This year, phase 2 purchased and tested a new model of buoy (three in total, all identical) that had been put on the market in 2003 by a Canadian manufacturer. Performance tests in certain currents determined that the buoy had good potential to meet some of the needs identified in this project. Additional tests will be conducted during the 2004 season. A new model of lantern was also purchased and will be tested in 2004.

Due to financial cutbacks and changing priorities this project has been terminated.

Contact: Sylvie Pelletier, (418) 648-7450 *Project Number: GPJN3*

Sewage Treatment System: Central Wastewater Treatment Plant for Ships

This project is focussed on the potential for the installation of a biological waste treatment system on board a ship capable of handling any vessel's total waste water product that could be released into the environment.

Last year the proposal for a test protocol was not favourably received by Transport Canada (TC) regulators and they added a requirement that the system be tested in a land-based establishment prior to installation on board a ship. Therefore, the original manner of proceeding was changed to take these factors into account and to avoid costly failure on the certification testing grounds.

During this fiscal year, the research team began work on a new test protocol for this type of treatment system. This involved establishing a methodology equivalent to the IMO-recognized laboratory procedure for detecting hydrocarbons, producing a list of (hazardous) substances that could potentially be present in the effluent of a central biological treatment system, evaluating and monitoring methods and tools used to detect hydrocarbons. Work continues in the identification of laboratory and sampling methods for evaluating the concentrations of potentially toxic substances, evaluation and development of a strategy favouring approval of the test bed qualification protocol as well as laboratory experiments on living materials under conditions simulating arctic waters to determine toxicity thresholds (combined effects) and identify substances present in the effluent of the system. Upon completion of this work, the research team will begin drafting a test protocol for the system for submission to TC by January 2005.

Once approved by TC, the project can resume with the installation of the system on board the CCGS Amundsen in 2005-06.

The probability of success is high and will put CG in the forefront in this field. CG will also be capable of reducing the discharge of harmful substances that are not presently being treated for controlled.

Contact: Gilbert Francoeur, (418) 648-3756 *Project Number: FQAT3*

Central and Arctic Region

With regional headquarters located in Sarnia, Ontario, this region selects R&D projects to assist in their challenge to adapt to trends in operational demands and strategic changes in levels of service and evolving expectations from clients. The priority technological opportunities in support of their overall effectiveness of service delivery operations relate to: aids to navigation, vessel maintenance, SAR and environmental response, icebreaking and support to environmental standards for the protection of the fragile Arctic environment.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
FRAA4	Replacement of Lead Paint	CCG	59.2	
	Central and Arctic Region- **TOTAL**		**59.2**	

Replacement of Lead Paint

This project is now complete. It examined the paints in use in the CG, primarily those paints used for painting buoys, with a view to improving the safety of the paint systems for CG staff and to review the standards established in 1989. Both the technical aspects of the paints and their relative hazard ratings were examined.

The overall results revealed that a choice of one system over another is unlikely to lead to increased hazard. However, all systems are relatively hazardous and CG staff must continue to take all proper precaution in all their work with paints.

A final report is available that documents the evaluation criteria used on 17 paint systems, the paint system points ratings, costs per square metre, data from Health Canada rating each component according to an internationally accepted hazard rating scheme (4 points-highest hazard, 1 point-lowest hazard). Each region is encouraged to review the report as it will provide a basis for choosing a paint system to meet their operational requirements.

Contact: Doug Hayes, (613) 925-2865 *Project Number: FRAA4*

Pacific Region

With regional headquarters located in Vancouver, B.C., this region selects R&D projects to assist in adapting to local trends in operational demands, strategic changes in levels of service and evolving expectations from clients. The priority technological opportunities in support of their overall effectiveness of service delivery operations relate to: communications and transmission network technologies, aids to navigation, Search and Rescue and environmental response, and marine traffic management.

Year End Budget Summary 2003-2004

PROJECT NO.	PROJECT TITLE	FUND SOURCE	2003-2004 FUNDS (K$)	
			CCG	PARTNER
FPAN5	Web-Based Display of Commercial Fishery Openings/Traffic Information System (FOTIS) Utilizing Graphical GIS Technology	CCG	cancelled	
	Pacific Region- **TOTAL**			

Due to departmental financial pressures this project has been terminated.

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. Its 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.

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	2003/04 Budget
2002038	Ingestion of Grand Banks Surface Current Data into CANSARP	32.8
2003027	SAR Access to Vessel Monitoring Information	151.8
2003028	Self-Locating Data Marker Buoy (SLDMB) Project Phase II – Deployment Strategy	117.7
2003023	Personal Emergency Locator Device	160.8
2003022	Location-Based Risk Analysis of Recreational Boating Activity	211.0
2003026	Cruise Ship Activity and Risk Analysis for Improved SAR Response Planning	128.0
2003032	Coherent UHF Radar for Small Target (Liferaft) Detection: Phase 2	30.0
	NIF – Total Budget	**832.1**

Ingestion of Grand Banks Surface Current Data into CANSARP

Surface current models for the Grand Banks continue to be evaluated. A technical report documenting the analysis of the drifter data has been prepared. Modifications and adjustments to model are underway and are to be completed by September 2004.

The system generates 48-hour forecast of surface currents and other ocean variables for the Grand Banks everyday. This real time and near real time data is the most critical type of information required for CANSARP and the SAR system.

Project Number: 2002038

SAR Access to Vessel Monitoring Information (VMS)

This project, now complete, has been very successful in bringing together the various sources of information to help enhance SAR efforts by allowing for more timely access to location of fishing vessels. SAR coordinators now have access to information that is accessible from a single source.

Project Number: 2003027

Self-Locating Data Marker Buoy Phase II – Deployment Strategy

The sensitivity experiments suggest that the variability in the prediction depends on the flow regime, position of the drifter in respect to those used to generate the field and "tightness" of the initial deployment. Analysis of the data and guidelines will be included in the final report in March.

Project Number: 2003028

Personnel Emergency Locator Device

Current activities include putting together a test package to evaluate methods of improving signal detectability and investigating alternatives in antenna design.

Project Number: 2003028

Location-Based Risk Analysis of Recreational Boating Activity

This project made excellent progress in its first year. A detailed risk framework for recreational boating has been generated. The design of the recreational boating survey, to be conducted at boat shows, and development of a national telephone survey were completed.

Project Number: 2003022

Cruise Ship Activity and Risk Analysis for Improved SAR Response Planning

This project is progressing very well in traffic data collection, traffic modeling, traffic analysis, incident mapping, risk factor hierarchy development, and on specific risk factor evaluations. The data is being collected and organized from a wide range of sources.

Project Number: 2003026

Coherent UHF for Small Target (Liferaft) Detection: Phase 2

Upgrades to the coherent radar prototype are on-going. A field test program is anticipated for the spring 2004. A new antenna design is also being pursued to enhance the performance of the radar system through improvements in bandwidth, gain and sidelobe rejection.

Project Number: 2003032