Research and Development Plan/ 2001-2002

Table of Contents

FOREWORD

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

The variety and depth of research themes sponsored by Coast Guard are reflected in the 2001-2002 Research and Development Plan. As part of its commitment to the economy and the achievement of Canada's goals, the Canadian Coast Guard continues to offer a broad-based planning process involving not only its own staff but also its clients. Likewise the Coast Guard will continue to work and consult closely with Canadian industry, universities and colleges seeking partnerships in knowledge wherever practical. Also the R&D program is closely integrated with the work of other government departments and foreign countries.

Coast Guard will fund a $3.5 million dollar R&D program in the 2001-2002 fiscal year. Additional funds will be provided by industry and international partners.

Strategic Planning is a key element in the Coast Guard R&D program. R&D performed today provides marine expertise in order to influence international standards and to support Canadian industry for the future. Coast Guard research is dedicated to resolving those technolo*gy challenges brought-on by the changing nature of commerce worldwide and the evolution of the marine community.

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

Research and Development Plan
2001-2002

LOOKING TO THE FUTURE

The R&D program has a long and valued history in the Canadian Coast Guard (CCG). The program was initiated in 1974 in order to meet new CCG operational demands, using technology as one of the primary tools of change. The decision to put an R&D (engineering) program in place was recognized as one of the several mechanisms required to keep the organization forward looking and to respond to challenges in service delivery and efficiency. Today, the adoption of new technologies to meet the challenges of a changing environment remains one of the Coast Guard's four organizational pillars for modernization and growth.

Subsequent to the 1995 merger with the department of Fisheries and Oceans, a new series of strategic directions and operational goals were enunciated, to bring the Coast Guard into line with government wide business planning practices. As well, the new strategic directions placed emphasis on organizational evolution from a broad-based service delivery group to a more finely-tuned organization exercising leadership and and knowledge management . Today, the CCG's leadership role is more broadly understood by industry and other members of the marine community; the evolution of government services to permit a more inclusive role is seen as an effective means of involving interested parties, reducing overall costs, and meeting new challenges for services. Within this organizational context, the issues of safety, environmental protection and support to marine commerce remain as the operational pillars and play determining roles in our capital and operational planning.

CCG's mission is to ensure the safe and environmentally responsible use of Canada's waterways, to support understanding and management of ocean resources, to facilitate the use of our waters for shipping, recreation and fishing, and to provide marine expertise in support of Canada's domestic and international interests.

CCG research addresses a wide range of technological issues brought-on by changing trends in the marine world and international transportation markets; changes in demand for marine services; and to new strategic directions defined by the government. R&D is also directed to a strategic understanding of the broader marine environment, the footprint left by marine activities on our oceans and freshwater resources, and to sustainable transportation objectives. Finally, the R&D program assists in meeting new management strategies relating to changes in levels of service and client advice on the marine program.

The CCG research activity also complements the departmental ocean strategies by supporting a shared knowledge base in theme areas of mutual or overlapping interest.

A wide range of strategies are used to achieve the CCG R&D program goals, including (but not limited to) contracting-out; intellectual property (IP) management; technology transfer through partnerships with other departments, agencies, industry and/or universities; the marketing of public service expertise; and international cooperation.

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

At this time, Coast Guard has as its highest overall priority the development of a new orientation to the marine electronic highway, which is focused on using information-based services. A second major theme is the promotion of sustainable transportation, involving a focus on minimizing the marine footprint of the world's oceans. Traditional priorities, which include safety of life, operational efficiency, and support to the domestic marine industry also, remain strong.

Research and Development Plan
2001-2002

CG will explore these and other opportunities by sponsoring R&D.

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

Marine Highway:

- development of advanced navigational and ship-related telecommunications and information systems (often satellite-based);
- automatic processing, analysis and automated transmittal of remotely-sensed ice information;
- adoption of AIS and development of alternative technologies to the current physical navigational aid infrastructure;
- presentation of information to the navigator both logically, and in a compatible manner/languages;
- interactive nature of displays on the bridge of the vessel;
- integration of ship's information with shore-side traffic management and commercial shipping operations;
- electronic devices which automatically monitor vessel position and/or services to home-in on persons in the water.

- Sustainable Transportation, Environmental Protection and Safety:

- development of improved regulation, standards, training and certification procedures for small craft operators
- new remote sensing technologies which permit the detection and tracking of personnel lost at sea
- research into new engine maintentance management systems, novel power systems/components, and emission control technologies which offer greater efficiency, reduced emissions and reduced maintenance;
- development of "biological" sewage treatment facilities for ships, to handle black and gray water, with zero tolerance regimes as a target.
- development of new technologies which will lead to the mitigation of clean-up costs;

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

NAVIGATION SYSTEMS

Located at HQ in Ottawa, this directorate conducts R&D to support a safe , efficient and accessible waterway by improving operational performance 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 improve 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.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002
Navigation Systems/Systèmes à la navigation
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT CCG GCC	PARTNER PARTENAIRES	BUSINESS LINE / ACTIVITÉS PRINCIPALES
? Headquarters/Administration centrale					
FNAB1	Development of Laser Range Light Développement d'un feu d'alignement au laser	CCG GCC	70	0	
NOUV.	Determine Shipboard Multipath Levels & Their Impact on Marine Navigation Les effets des niveaux de trajets multiples sur la navigation maritime	CCG GCC	75	0	
NOUV.	Long Life Lamp Development Développement d'une lampe de longue durée	CCG GCC	100	0	
NOUV.	Long Life Synthetic Mooring Câble d'amarrage synthétique de longue durée	CCG GCC	200	0	
NOUV.	Lighted Plastic Buoy Development Développement d'une bouée légère en plastique	CCG GCC	100	0	
	Headquarters/Administration centrale - **TOTAL**		**545**		

DEVELOPMENT OF LASER RANGE LIGHT

Background:

The Canadian Coast Guard (CCG) wants to reduce its costs in providing the services offered to navigation users. Laser technology has progressed in the recent years and now offers compact efficient visible sources at reasonable costs. Currently, range lights require two land sites at a significant distance from each other. The use of a laser range light would allow the CCG to offer the same level of service from a single site with much reduced real estate requirements and even increase the level of safety offered to the public.

Project Description:

This two-color laser system is a significant step forward in laser development in CCG and should generate a product that meet the performance requirement of a lighted range system. The color seen by the users, red or green, will automatically give the port and starboard deviation from the center of the channel without any code interpretation like it was happening with the first one-color prototype. Only the degree of deviation will be given by a code which will consist of pulses of light transmitted at different repetition rates with respect to the angle of deviation. This two-color laser system is based on the good results of the first prototype which was developed, constructed and field tested from 1996 to 1998. Furthermore, it is also based on a more simplified two-color laser range that was developed and installed in Hay River in 2000. More info on the project in Hay River is given in section 1.5 .

Demonstrations of the laser range for Portneuf and the one in Hay River are available on the Intranet site of the Aids to Navigation at : http://142.130.14.20/marineaids-aidesmaritimes under the item National Projects.

The contract of 1999/2000 has been the focal point in the development of this laser range. The range has been designed and constructed and it is planned that field trials will be conducted in the late fall of 2000 around the Portneuf area in Laurentian Region.

The proposal for 2001/2002 is for the maintenance and evaluation of the laser range. Also, as this evolution should be the final step in laser range development, this project should lead toward the completion of a final and commercial product. This objective will be part of the project for 2001/2002.

Benefits:

Financial: The Canadian Coast Guard operates approximately 650 lighted ranges. It can be calculated that the elimination of one structure, through the use of a single-station laser range would result in an annual savings of 650 x $9000/2 = $ 2,950,000. Of course, it would not be every range light system that could be converted to a single laser range light but this shows that this laser range development represents a good opportunity for savings.

Environmental: The laser ranges are developped to be powered by solar energy. The development and the production of laser ranges are environmentally friendly. Since the goal of this project is to offer the same level of service to the users than the actual range systems used across the country, a wide-implementation of laser ranges would not affect the environmental risks associated with ship's traffic.

Project: FNBB6
CCG Contact: André Châteauvert
(613) 998-1405

DETERMINE SHIPBOARD MULTIPATH LEVELS & THEIR IMPACT ON MARINE NAVIGATION

Background:

The differential GPS (DGPS) corrections generated by the Canadian Coast Guard's (CCG) reference station sites provide accurate and reliable corrections to the mariner user. The corrections are checked in real time as follows:

1) The DGPS reference station checks the magnitude of each satellite's corrections;

2) The DGPS integrity monitor checks the magnitude of each satellite's residuals;

3) The DGPS integrity monitor checks the resulting horizontal position error.

If the corrections exceed a predefined threshold, the reference station does not broadcast the correction. The integrity monitor checks the magnitude of the residuals, and if any of these exceed a predefined threshold, the reference station stops sending corrections for the offending satellite. Finally, if the integrity monitor's position error is outside of tolerance, the marine users are immediately notified to stop using the corrections. With these integrity checks combined with the quality installation, and redundant equipment, one can be assured that the corrections being transmitted by the CCG reference station sites are reliable. However, this does not guarantee that the resulting marine user's position will also be reliable due to problems at the marine user's end. The two major error sources on the marine user's end are differential ionospheric errors and multipath. Differential ionospheric errors are being examined under another R&D project to determine its magnitude and stochastic behaviour. To this point in time marine multipath as been ignored. Multipath can produce range errors that exceed 100 m, thereby biasing the navigation solution. The following questions remain unanswered with respect to marine multipath:

1) What types of multipath errors can occur on typical CCG ships and what are their stochastic behaviours?

2) What is the response of typical CCG marine user receivers to the multipath found in #1 ?

3) If the CCG receivers cannot mitigate or detect the multipath found in #1, what measures can be taken to improve the reliability of the navigation solution?

If the CCG receivers cannot mitigate or detect the multipath found in #1.

Project Description:

This project will try to answer the three questions posed at the end of the last section. Phase 1 of the project will determining the magnitudes and stochastic behaviour of the shipboard multipath. This will be done from a theoretical and practical perspective. The impact of the resulting multipath signal on the ship's position will be determined.

If the multipath induced position errors determined in phase 1 are significant, the two additional questions will be addressed. Phase 2 of the project will determine the response of the CCG's marine user receivers to the multipath signals determined in phase 1.

If the CCG's GPS receivers do not mitigate the multipath signals, phase 3 of the project will analyze various methods of mitigating multipath on CCG ships.

Benefits:

Financial: Improving the reliability / integrity of DGPS positioning will increase the reliability / integrity of floating aids to navigation placed using DGPS. This will reduce the cost of re-visiting aids to navigation due to incorrect placement.

Environmental: By increasing the reliability / integrity of floating aids to navigation placement, the overall safety of navigation is increased.

Social: In improving the reliability of placing aids to navigation, CCG shiptime will be freed up for other endeavours.

Project: NEW
CCG Contact: Sam Ryan
(613) 998-1528

LONG LIFE LAMP DEVELOPMENT

Background:

Previous studies have shown that the best way of achieving a five-year performance of light-source for marine aids' applications, is through refinements to the incandescent lamps/flashers/lamp changers configurations currently being used. However, with limitations for possible improvements by this means and with breakthrough developments taking place in other light sources (such as LED's), it is important to evaluate alternatives as they become available.

LEDs are a product of the technological revolution arising from the latest advancement in semiconductor technology. LEDs for lighting application are readily solarized. They consume the equivalent amount of energy as conventional incandescent lamps but last up to 100,000 hours (100 times longer) and they are virtually maintenance free.

National support for the use of LEDs in marine aids is growing and operational performance requirements have been developed. It is now necessary to develop comprehensive testing specifications and procedures for the qualification of these lanterns in order that they can be qualified for general use throughout the CCG.

Project Description:

This project will be carried out in two phases; they are as follows:

Development of testing specifications and procedures
Develop testing specifications and procedures for both self-contained and external LED Lanterns. These specifications will help to determine whether the lanterns are in full compliance with the performance specifications already developed. The testing specifications and procedures will be available in hard copy and electronic format in both French and English.

Test and evaluate
Test and evaluate the currently available LED Lanterns according to the developed testing specifications and procedures. The results will be detailed in a report outlining the procedures followed, the results obtained and the conclusions and recommendations. The report will be available in hard copy and electronic format in both French and English.

Benefits:

Financial: Presently the CCG has approximately 12,000 floating aids of which 3,000 are lighted. The lighted aids use incadecent lamps in an automatic lampchanger in order to achieve a five year life. Lamp changers are not always reliable or sometimes the lampchanger does not have enough lamps to last the five years which will result in unscheduled visits to the buoy to either replace the lampchanger, lamps or both.

Environmental: LED Lanterns will save ship time thereby reducing fuel consumption required in the aids to navigation program.

Social: In helping to make the Five Year Buoy Project a reality, LED lanterns will help free up more CCG ship time, which can then be redirected to other endeavours such as Search & Rescue etc.

Project: NEW
CCG Contact: Reiner Silberhorn
(613) 998-1411

LONG LIFE SYNTHETIC MOORING

Background:

In 1992, the Canadian Coast Guard (CCG) began the 5-year buoy project the purpose of which was to reduce the costs and increase the efficiency of the Aids to Navigation Program. The major over-riding goal of the 5-year buoy project was to develop and implement a total buoy equipment system, which can operate on station, without servicing or maintenance, for a period of up to five years. This goal has been achieved for most buoys by using high strength mooring chain, high performance coatings, solar power systems and ruggedized lights. However in a significant number of locations, the mooring chain still cannot stay on station 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.

In order to achieve a reliable 5-year mooring for the difficult sites, work continued in the evaluation of alternative mooring systems. In 1994, CCG began a program of field testing a new mooring system in the difficult sites on the East Coast. This mooring system goes under the Trade Name of the Hurricane Mooring System, which was developed and supplied by Strait Moorings International Inc. of Shediac N.B. The moorings have evolved to the present configuration as the company was educated regarding the requirements of CCG buoy moorings and handling practices and the CCG became more aware of the potential and limitations of the Hurricane Mooring system. The original systems consisted of synthetic rope, Seaflex elastic cord and a helical anchor connected with CCG shackles and swivels. Since then, many improvements have been incorporated.

There are presently approximately 60 of these systems installed in the East Coast and Quebec. A number of performance data have been collected on these test installations over the years but the data are inconclusive and the suitability of this product to provide the necessary performance remains uncertain. The initial assessment phase for Hurricane moorings has reached a decision point where it has to be decided whether and to what extent to further assess or use this product. If it is decided to proceed with further evaluation or use, the next step is to prepare a holistic design for the system which has been lacking in the ‘try and see” approach used to date. Taking an engineering approach could save significant time and cost.

Project Description:

The work conducted on the test moorings presently in place throughout the Maritimes and Laurentian Regions demonstrates that there is a lack of knowledge in two aspects of these moorings. This lack of knowledge needs to be addressed before there is any large scale implementation of this potentially promising new mooring system.

Further research is required to develop a thorough understanding of the residual strength in synthetic ropes after they have been in service in a marine environment for periods of up to five years. In conventional chain moorings, residual strength is very easy to calculate and estimate as chain wear is readily apparent. In synthetic rope, residual strength is not so readily obvious as a rope after several year’s service does not look much different from new rope. Previous limited break tests have shown that synthetic rope which has been in service for approximately five years lost approximately 50% of its original break strength. A comprehensive series of break tests needs to carried out to determine the anticipated residual strength of synthetic rope after it has been in service for up to five years in various marine conditions. Without this information, it will be impossible to size a mooring properly to withstand mooring forces and also to safely retrieve the sinker after five years of service.

The present process of sizing synthetic moorings through trial and error is not only time consuming but also very costly, not only

in materials but also in ship time. Work is required to develop methods of calculating the maximum forces synthetic moorings will face in various locations with various buoy sizes. These calculations need to be verified through various field trials and or laboratory tests. Without these tools the mooring and sinker sizes cannot be accurately determined.

Benefits:

Financial: In the Five Year Buoy Project, the following annual savings were forecast:

Newfoundland	$210,000
Maritimes	$1,860,000
Pacific	$830,000
Total	$2,900,00

These savings will not be realized if a small percentage of bouys in most areas cannot stay on station for the full five years as originally anticipated.

Environmental: Synthetic rope moorings are taut or semi-taut moorings and therefore they do not touch the sea-bottom. Consequently, these moorings do not scour the sea bed as a conventional chain mooring does.

Social: In helping to make the Five Year Buoy Project a reality, synthetic moorings will help free up more CCG ship time, which can then be redirected to other endeavours such as Search & Rescue etc.

Project: NEW
CCG Contact: Reiner Silberhorn
(613) 998-1411

LIGHTED PLASTIC BUOY DEVELOPMENT

Background:

One of the objectives of the Marine Aids Modernization Project is to develop a buoy system that operates without servicing or maintenance, for a period of up to five years. This includes all components of the aids-to-navigation buoy system: hull materials, paints, moorings, power supplies, lanterns and sound signals. The main benefit resulting from the implementation of a year-round buoy equipment system is in the reduction of ship time required to service and transport buoys. Savings also result from a reduced requirement for servicing and refurbishing of buoys at CCG bases.

In 1990, the CCG began investigating the use of plastics as a potential replacement material for the steel predominantly used in buoy construction. The groundwork has been laid and today there are a significant number of small unlighted plastic buoys in service across the couintry representing significant savings to the CCG. This success has not yet translated into plastic buoys to replace the larger steel lighted buoys still in service. This is due to the fact that there are many structural and strategic problems to overcome before these buoys can become a reality.

Project Description:

This project will be carried out in three phases; they are as follows:

Development of performance specifications
Develop performance specifications for large lighted plastic buoys. These specifications will specify CCG's operational requirements, they will be available in hard copy and electronic format in both French and English.

Development of testing specifications and procedures
Develop testing specifications and procedures for large lighted plastic buoys. These specifications will help to determine whether the buoys are in full compliance with the performance specifications previously developed. The testing specifications and procedures will be available in hard copy and electronic format in both French and English.

Test and evaluate
Test and evaluate the currently commercially available large lighted plastic buoys according to the developed testing specifications and procedures. The results will be detailed in a report outlining the procedures followed, the results obtained and the conclusions and recommendations. The report will be available in hard copy and electronic format in both French and English.

Benefits:

Financial: Presently the CCG has approximately 12,000 floating aids of which 3,000 are large lighted steel buoys. Due to their size and weight, these buoys can only be serviced by large buoy tenders. These buoys also need to be returned to base every 5 years to be sandblasted and repainted. Any decrease in these operations represents a significant savings to the CCG.

Environmental: Large lighted plastic buoys will eliminate the need for sandblasting and painting thereby eliminating all the associated pollution. They can also be serviced with smaller vessels, decreasing the amount of fuel consumed.

Social: In helping to make the Five Year Buoy Project a reality, large lighted plastic buoys will help free up more CCG ship time, which can then be redirected to other endeavours such as Search & Rescue etc.

Project: NEW
CCG Contact: Reiner Silberhorn
(613) 998-1411

FLEET

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

R-D PLAN 2001 – 2002
PLAN DE R ET D 2001-2002
Fleet/Flotte
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT CCG GCC	PARTNER PARTENAIRES	BUSINESS LINE / ACTIVITÉS PRINCIPALES
? Headquarter's Branch/Direction d'administration centrale					
FQBK6	Hearing Standards For Seagoing Personnel Normes auditives pour le personnel navigant	CCG GCC	200	0	All Tout
FQAG6	Vision Standards for Seagoing Personnel (Physical Activity Requirements) Normes de vision pour le personnel navigant (Exigences relatives aux activités physiques)	CCG GCC	200	0	All Tout
NEW	Combustion Pressure Engine Monitoring Tool Outil pour analyser les pressions de cylindres	CCG GCC	40	0	All Tout
	Headquarters/Administration centrale - TOTAL		**440**		

HEARING STANDARDS FOR SEAGOING PERSONNEL

Background:

Coast Guard (CG) is conducting several studies on fitness and medical standards for physically demanding jobs of seagoing personnel. Coast Guard must demonstrate the bona-fide occupational requirements for hearing standards. Coast Guard ships' officers and crew must often work in harsh, noisy environments. For many of these duties, oral communication and accurate distinction of sounds is essential. For example, those working during Search and Rescue (SAR) and buoytending operations must often distinguish sounds and command in extreme winds, cold, rain and fog. They must be able to detect the variations and directions of sounds such as bells, whistles, alarms and normal and abnormal machinery sounds.

Project Description:

Phase 1 of this project has been completed and a recommended standard for hearing received from the contractor. Remaining work is to determine the appropriate clinical test/s to be used to test employees against the standard and to validate the pass/fail mark assigned for each test.

Benefits:

As continued downward pressure on CG resources results in fewer ships, personnel and operating funds, the need for the fleet's seagoing personnel to be medically fit grows stronger. This medical fitness will assist in:

1. Ensuring safety;
2. Reducing the number of injuries occurring as a result;
3. Reducing associated costs.

Project: FQBK6
CCG Contact: Joanne Jankun
(613) 998-1632

VISION STANDARDS FOR SEAGOING PERSONNEL (PHYSICAL ACTIVITY REQUIREMENTS)

Background:

It is crucial that occupational requirements be based on actual, job specific requirements, if one wants to ascertain their true validity.

The first phases of the CCG's research into vision standards addressed visual acuity and colour vision. These tests were mainly conducted in a laboratory environment using test subjects taken from the field (pictures of buoys, dials, charts, etc.). The experience learned from this first phase was that greater emphasis has to be placed on developing tests that more closely resemble the tasks performed in the field.

A further review of the first phase research was carried out to assess the research in terms of defensibility. Based on this assessment it was agreed that a complete task analysis must be carried out to determine what the actual requirements of the job are as they relate to colour vision and visual acuity, and to develop a fair and accurate standard.

This will form part of this next contract.

New research will also extend beyond the current standards for static visual acuity in seagoing occupations. Most recently research has been conducted to assess the requirements for peripheral vision and depth perception for seagoing occupations. A draft research report was provided in the summer of 1998. Future directions were identified.

Project Description:

The earlier research conducted on vision requirements demonstrated the requirement to place greater emphasis on developing standards and testing methods which more closely resemble the tasks performed in the field. This research also supported the requirement to complete a detailed task analysis of the actual requirements of the job as they relate to the various visual functions, i.e. visual acuity, colour discrimination, depth perception, field of view, visual search and useful field of view.

This project will be completed in two contracting phases.

The two phases of work are:

1. Analysis of work tasks;
2. Data collection, analysis, recommendations.

Benefits:

Fair and equitable treatment for all seagoing personnel.

Project: FQAG6
CCG Contact: Sharon Robertson
(613) 990-2573

COMBUSTION PRESSURE BASED ENGINE MONITORING TOOL

Background:

Cylinder pressure measurements and waveform data provide useful information about the condition of each cylinder of an engine. Knowledge of, not only the peak cylinder pressure, but also of the shape of the combustion pressure waveform, can help to pinpoint potential problems before they become serious. Problems with the fuel injection system or cylinder sealing (ie., rings, valves) will result in reduced peak cylinder pressure. Injection problems are often observed as a delayed start of combustion - or, possibly, no combustion. By knowing the cylinder and crankshaft dimensions, numerical analysis of the waveform can provide Mean Effective Pressure, Rate of Heat Release (ROHR), and Pressure Volume (PV) diagrams which can be used to determine combustion efficiency. Because these waveforms are stored in computer memory, they can be easily retrieved at a later date for comparison with current measurements. This feature can be used to determine if a condition is worsening, or if repairs have been successful. Additionally, the PV data can be used to balance the output of each cylinder in terms of indicated power. The PV analysis can then be used to set the injection timing and fuel injection quantity for each cylinder to minimize exhaust emissions and fuel consumption.

A contractor developed Portable Pressure Tool (PPT) uses an air-cooled probe which is manually attached to the "Keine" adapter, commonly found in the combustion pressure ports on most medium and low speed diesel engines. The PPT probe in the recent past has been used on a Wartsila Vasa 9R32.

The PPT probe measures cylinder pressure using a long durability pressure transducer. The transducer is accurate to within 3 % and is much less expensive and much more durable than the piezoelectric pressure transducers commonly used in engine test laboratories. In addition, the transducer does not require costly signal conditioning and fragile high impedance/low noise electrical connections as do piezoelectric transducers. The majority of cylinder pressure transducers must be liquid cooled to prevent heat damage, however, the proprietary contractor designed air cooled probe provides adequate cooling to keep the transducer within the correct operating temperature range.

Although the PPT is a powerful diagnostic tool, it must be used frequently to detect problems in time to prevent serious engine damage. Another limitation of the PPT is that the operator must install the PPT probe on each cylinder and manually open and close the Keine valve. During this procedure, the operator must work in close proximity to the running engine and is, therefore, exposed to high ambient temperatures and noise levels. Should the operator forget to close the Keine adaptor after making a measurment, or should an exhaust gas leak occur as a result of a faulty Keine adaptor, the operator may also be exposed to high combustion gas temperatures and pressures.

All of these concerns could be eliminated by permanently installing a probe similar to the PPT approach in each cylinder of the engine. A Data Acquisition System (DAS) could then measure the combustion pressure in each cylinder continuously. From an Engine Condition Monitoring (ECM) viewpoint, this is the best possible solution, however, transducer life is approximately 100 to 200 million pressure cycles. In other words, each transducer would survive for approximately 6 months to 1 year in continuous use in a typical low to medium speed diesel engine. The cost of replacing the transducers would be prohibitive to most end users.

It is believed that a fully automated on-line system can be developed which will overcome these limitations and some of the shortcomings of the contractor's current PPT.

Project Description:

In the proposed system each cylinder of the engine would be permanently equipped with an air cooled cylinder pressure transducer similar in approach to the PPT. Each transducer would mount in a new adapter design which replaces the Keine adapter in each cylinder (the new adaptor would use the existing cylinder access port - no additional holes or other fittings are required). The adapter would use a pneumatic actuator to open a valve exposing each transducer to cylinder pressure at a user specified frequency. The pneumatic actuator would be controlled by ECM/Control Software. The ECM/Control Software would periodically open each valve and perform combustion pressure measurements on each cylinder. This would occur automatically at timed intervals, or, the engine operator could request current measurements at any time. When cylinder pressure measurements are not being made, the pneumatic actuators would close the valves, isolating the combustion pressure from the transducer and prolonging transducer life.

Phase 1. High Speed Diesel Tests
The first phase would entail testing the unit on a high speed diesel engine and analyzing its performance. Any recommended design modifications along with recommendations for Phase 2 Activity on a large meduim speed engine would be made.

Phase 2. Medium Speed Diesel Tests
The second phase would entail testing the unit on a medium speed diesel engine and analyzing its performance. Any recommendations for future CCG/Program Participant considerations would be made.

Benefits:

Financial: Engine condition monitoring (ECM) has been shown to be very effective as a preventative maintenance tool to reduce engine maintenance costs. If a maintenance free ECM is used it is estimated that the payback period for the R&D expenditure is quite short.

Environmental: The combustion pressure measurement ECM tool has the capability to balance cylinders very accurately in terms of combustion pressure, cranking pressure, and injection timing. This provides the ability to have a well-balanced engine in terms of combustion and injection parameters. A well-balanced engine has reduced fuel consumption and reduced exhaust emissions.

Social : The outcome of this project will lead to the development of this ECM tool for many other large medium/slow speed marine, naval, and stationary diesels with combustion pressure port access. The benefit to Canada and globally will lead to lower CO_2, oxides of nitrogen and other exhaust emissions components. In addition the successful development of this ECM tool will also lead to more skilled jobs for Canadian workers.

Project: NEW
CCG Contact: Patrice St. Pierre
(519) 383-1807

INTEGRATED TECHNICAL SUPPORT

Located at HQ in Ottawa, this directorate conducts R&D on behalf of other Coast Guard Branches. The goal is to improve the efficiency and effectiveness of those central services provided in support to DFO Programs by: testing and evaluating communication and electronic technologies; exploring new environmental technologies; developing and implementing vessel maintenance programs and services; and human factors research to improve the safety and effectiveness of our sea-going personnel.

R&D PLAN 2001 – 2002
PLAN DE R ET D 2001-2002
Integrated Technical Support/Soutien technique intégré
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG / GCC	PARTNER / PARTENAIRES	
? Headquarter's Branch/Direction d'administration centrale					
FRBQ6	U.S. Ship Structures Committee Comité de structure des navires – É.-U.	CCG GCC	45		All Tout
FQAB6	VNET Line Replacement for DGPS Ligne de remplacement VNET pour DGPS	CCG GCC	20		
FQAE6	ANIK-Based Ship-to-Shore Data Communications Transmission de données Navire-au-Rivage par l'entremise d'ANIK	CCG GCC	125		
NEW NOUVEAU	Development of Ionospheric Monitoring and Prediction tools for the CCG Développement d'outils de contrôle et de prédiction de l'ionosphère pour la GCC		25		
NEW NOUVEAU	Evaluation of Large Electric Double-Layer Capacitors for Powering Aids to Navigation Évaluation de l'utilisation de condensateurs électriques à couches doubles d'aide à la navigation		80		
	Headquarters/Administration centrale - TOTAL		**295**		

UNITED STATES SHIP STRUCTURE COMMITTEE

Background:

The Ship Structure Committee (SSC) based in the United States is an international agency with the mandate to further research and development in the area of ship structures. The purpose of the Committee is to prosecute a research program to improve the hull structures of ships and other marine structures by an extension of knowledge pertaining to structural design, lifecycle risk management and production methods. Canadian membership is comprised of the Defence Research Establishment Atlantic (DREA) (Canadian Navy), Transportation Canada (TC) and Canadian Coast Guard (CCG).

Project Description:

A variety of topics related to the advancement of welding/materials/structural applications for marine structures will be researched with due regard to production, maintenance and life cycle risk management.

The topics addressed are of interest to CCG in the design, maintenance and repair of vessels.

Benefits:

The research will improve the life cycle cost-effectiveness of the ship structures and may also enable the use of high strength steels in DFO vessel structures. Improved methodology will be used by CCG during design, development and evaluation techniques used to review design proposals. SSC R&D will support projects to improve safety of life at sea and to protect the marine environment. Duplication of research efforts will be prevented.

Improvements in the regulatory regime resulting from the committee's efforts will result in benefits to CCG and industry. It is anticipated that CCG will benefit by a reduction in the frequency of weld repairs, structural material repairs and reduced long term maintenance costs.

Project: FRBQ6
CCG Contact: Justus Benckhuysen
(613) 998-1496

VNET LINE REPLACEMENT FOR DGPS

Background:

The DGPS service relies on secure and reliable communications with its remote sites. The current architecture relies on VNET. This is proving to be problematic. This R&D submission provides a feasibility study for alternate solutions, the selection of alternatives and their evaluation, as part of the Life Cycle Management of the DGPS service

Project Description:

The project will be carried out in a sequence of phases.

As the initial phase an in depth analysis of the DGPS communication needs based on the current architecture and planned improvements plus an analysis of the current communication methodologies, with a purpose to identify the scope of changes needed to address an alternate solution.

Based on the result of the study, an alternate communication method will be proposed and recommended for implementation. The final phase and objective of the R&D project will be to procure any hardware and/or software, which will be used for proof of concept by testing out in a captive environment and then by field trial within an operational region. A proposed implementation plan for the deployment to the field will also be a required deliverable.

It is possible due to the remoteness of some DGPS sites and their available communication lines, that a hybrid system may be required. If so, then this study will identify the potential risks and operational impacts, to enable Canada to meet its international (IALA/IMO) obligations for the worldwide DGPS service.

Benefits:

This project will ensure that the best and most cost effective communication methodologies are being used for the DGPS program. Part of the study will review the cost effectiveness within each of the CCG regions and adapting the software to allow for its implementation on a regional basis.

Project: FQAB6
CCG Contact: Sun Wee
(613) 998-1514

ANIK-BASED SHIP-TO-SHORE DATA COMMUNICATIONS

Background:

The Canadian Coast Guard has an expanding requirement for ship-to-shore digital communication services due to the addition of shipboard computers and networks, as well as data driven navigational equipment. The service uses a number of services such as IMARSAT, M-SAT and/or cellular telephone to provide the necessary connectivity at the present time. However, these existing ship/shore systems are generally inefficient for various reasons including inadequate bandwidth, poor geographic coverage, unreliable radio frequency channels, and/or cost.

The Coast Guard has undertaken a number of studies including the evaluation of the Fleet Location and Graphics (FLAG/DataHail) system, integrated communications and spread spectrum technologies in order to determine requirements and possible solutions. A series of specific criteria (architecture, availability, bandwidth, traffic/volume, security, accessibility, and application/service interface) have been developed which form the basis for CCG/DFO's long range plans.

The effort is aimed at ensuring short and long range capacity, scalability and compatibility in order for the CCG/DFO to meet its operational requirements across the fleet. This has become a more important consideration in the face of downsizing, increasing complexity of the operating environment and broader operating requirement resulting from the mergers of the CCG with DFO.

Project Description:

This project will investigate and develop ways to increase the efficiency and speed of transferring information between CCG/DFO vessels and land based facilities using various satellite systems as the transfer medium. The systems investigated will address the requirements to provide integrated digital communications in four main categories as follows:

1. Operational secure voice channels connecting the Regional Operations Centres directly with the ship's bridge (Secure Telephone Unit (STU)-III);
2. Administrative voice channels;
3. Low speed data channels to pass position, weather and short text messages such as email and fax; and
4. High-speed data channels connecting ship-borne computer workstations to the shore based DFO LAN.

The system will provide the required communications to support:

1. Ice Operations
2. Rescue and Environmental Response Operations,
3. Buoy Tending Operations,
4. Fleet Operations in General,
5. Administrative Functions such as office automation, maintenance, logistics, and financial management.

Issues to be addressed by this R&D Project are:

1. Coverage and reliability of the systems in various geographic areas of Canada;
2. Shorebased equipment, including hardware and software interfaces;
3. Ship-board equipment, including hardware and software interfaces, by ship class; and
4. Technical and cost feasibility.

Benefits:

Benefits accruing from an integrated digital communications infrastructure are as follows:

1. reduced long-range communication cost,
2. efficient handling of information, less time for personnel, higher reliability,

maintenance and logistics savings through commonality of equipment, and improved operational performance.

Project: FQCD6
CCG Contact: Roger Doucett
(613) 998-1523

DEVELOPMENT OF IONOSPHERIC MONITORING AND PREDICTION TOOLS FOR THE CCG

Background:

The ionosphere causes two major effects on DGPS navigation. The first is increased positional errors, caused by the spatial de-correlation of the ionosphere. The magnitude of the positional errors is proportional to the baseline length and the ionospheric activity. The second is ionospheric scintillation, which can cause GPS receivers to loose lock on the L1 and / or L2 signals. These major effects are often caused by ionospheric storms. Several analysis centres around the world provide ionospheric storm advisories on both a global and regional scale. However, it is not known how well the ionospheric storm advisories correlate with the increased DGPS positional errors and scintillation effects.

Project Description:

This project proposes to determine the correlation between the ionospheric storm advisories and the resulting DGPS positional errors and scintillation effects. Assuming that a suitably strong correlation is found between the advisories and the DGPS effects, a look-up table will be generated which would match the type and location of the ionospheric storm with the location and magnitude of the resulting DGPS positional errors and scintillation effects. The look-up table would form the basis for ionospheric warnings, which would be transmitted to the mariner via the RTCM Type 16 message of the DGPS broadcast.

The second stage of the project will only go ahead if the first stage produces a look-up table with a strong correlation between the ionospheric storm advisories and the DGPS errors. The second stage will take the look-up table and will trial its operation at one of the DGPS control monitor sites. Formal links between the Coast Guard and the external agency providing the ionospheric advisories must be made. This includes procedural and technical links. During this testing period refinements to the look-up table and warning procedure will be made. Following this trial period the ionospheric warning service will be included in the operational DGPS system.

The tasks for the first and second stage of the project are as follows:

Stage 1:

Task 1 - Capture Scintillation Events on Marine User Receivers. Data from two Coast Guard marine user GPS receivers will be collected for several months to capture ionospheric scintillation events. Assuming that scintillation events are captured, the data will be analysed to determine the sensitivity of the receivers to ionospheric scintillation.

Task 2 - Canadian baseline measurements. Several years of Natural Resources Canada's archived GPS data will be used to generate DGPS error estimates for different user latitudes and baseline distances (from 100 km to 300 km) within Canada. The contribution of the ionosphere to the overall positional errors will be determined.

Task 3 - Analysis of US predictive data. The DGPS navigation errors from Task 2 will be correlated against ionospheric storm advisories from the US Space Environment Service. This will verify if there is a correlation between the ionospheric storm advisories and the measured results.

Task 4 - Table development. Assuming that a meaningful correlation is determined, this task will provide a look-up table for the ionospheric warnings, which will eventually be transmitted to the mariner via the RTCM Type 16 message.

Stage 2:

Task 5 - Generate Formal Links for the Ionospheric Advisories. In order to include the ionospheric warnings into the DGPS service, a formal agreement between the Coast Guard and the external agency (e.g. US Space Environment Service) must be made.

The communication path for the advisories must be determined (e-mail, web based, et cetera).

Task 6 - Trial the Ionospheric Warnings Service. One of the Coast Guard Regions will trial the ionospheric warning service. The service will be validated using data from surrounding DGPS Reference Stations and Far Field Integrity Monitor Sites. The procedures and the actual correlation between the warning and the actual DGPS errors will be updated as required.

Task 7 - Test the Warning Service at all DGPS Sites. After successfully testing the ionospheric warning service in one DGPS Region, it will be tested in the other four regions. Again both procedural and technical modifications will be made as required.

Task 8 - Finalise the Ionospheric Warning Service. After successfully testing the ionospheric warning service in all of the DGPS regions, the final technical evaluation of the warning service will be performed.

Benefits:

Financial: Providing warnings when the DGPS positional errors maybe greater than normal will increase the integrity / reliability of buoy tending, since buoys will not be placed during an ionospheric warning. Efficiencies would also be increased, since buoys placed during ionospheric disturbances may have to be re-visited due to higher than average positional errors.

Environmental: Increasing the integrity / reliability of CCG Aids to Navigation (buoy positioning using DGPS and the DGPS navigation service) will improve the safety of navigation for the general marine community. This will help the environment by decreasing the probability of marine incidents.

Social: In improving the integrity / reliability of placing aids to navigation, CCG ship time will be freed up for other endeavours.

Project : NEW
CCG Contact: Sam Ryan
(613) 998-1528

EVALUATION OF LARGE ELECTRIC DOUBLE-LAYER CAPACITORS FOR POWERING AIDS TO NAVIGATION

Background:

To probe the possibility of using large electric double-layer capacitors for powering minor aids to navigation. This kind of equipment is new. Information about this new technology was first released in the 2nd World Photovoltaic Conference in Vienna, Austria in July, 1998. For the past two years, the equipment has been deployed by NTT to boost the photovoltaic power supply system for tele-communication equipment. The performance of the equipment is encouraging. The success of its applications in aids to navigation would certainly have a huge financial impact on the Coast Guard's operation.

Project Description:

The proposed R & D project is to evaluate the possibility of using large electric double-layer capacitors in the following situations:

1) For power systems with small loads, the electric double-layers will be used for replacing the existing batteries.

2) For power systems with medium loads, the electric double-layer capacitors will be tested for replacing some of the existing storage batteries and solar panels.

3) For power systems with large loads (i.e. in large navigational sites), it might become cost effective enough for the CCG to convert these sites to solar.

It is crucial that at least in the initial stage of work to evaluate the propositions stated in (1) and (2) before we could possibly venture onto (2) and (3) propositions in full scale.

Benefits:

This project supports almost all areas of operation, especially marine aids to navigation requiring independent power supply. If the equipment is proven to be as successful as we anticipate, the equipment can be expanded to the entire area of CCG and DFO where power supplies are necessary.

Of course, estimated utility and savings must be compared to costs. Currently, the initial cost for the prototype capacitor unit is about $1000 each. Its life span is 25 years. Annual costs are, therefore, equivalent to $40 a year. If a large quantity of capacitors is used, the unit cost could easily be reduced to under $300. This means the annualized cost is about $12 per unit. It is estimated that most of the small existing solar systems will need one or two capacitors per system.

The system will reduce technical maintenance requirements in the regions. For example, as the internal resistance of the capacitor is very small compared to that of the regular storage battery, its "receiving charge" capability is much larger than that of the regular battery. Hence under conditions of low solar insulation level, the capacitor will still pick up a charge from the solar panel. The more effective operation and greater flexibility will reduce failures of systems due to depleted batteries and will improve the performance of existing batteries.

One unnecessary maintenance trip by a technician with a helicopter or ship would cost hundreds of dollars. For illustration only, if there are 100 unnecessary maintenance trips every year from coast of coast (7 trips per base or sub base), with an average cost of $500 per trip, the total maintenance cost comes to $50,000 per year. However, the cost of capacitors under discussion is only $4000 per year even if we use the expensive figure. The benefit ratio is more than ten times (50000 divided by 4000). The capacitor is cost effective and significant savings could be anticipated.

Annual savings due to an increase in battery life, a reduced number of batteries and panels, in total, are estimated to be substantial. On full implementation, this could mean savings of millions of dollars, over a period of 25 years.

Improved operational efficiency of the aids will also assure a higher level of safety to the marine users.

Project: NEW
CCG Contact: Sunny Leung
(613) 998-1390

SAFETY AND ENVIRONMENTAL RESPONSE SYSTEMS

Located at HQ in Ottawa, this directorate conducts R&D projects for search and rescue, environmental response, boating safety activities and marine communications and traffic services. For *Search and Rescue*, projects provide the technological support and innovative techniques necessary for the saving of lives and the protection of the marine environment.

The *Environmental Response* projects test and evaluate technologies for waste disposal, response strategies for marine oil and chemical spills; and new countermeasure equipment.

The B*oating Safety* initiatives address the safety aspects of recreational boating and environmental concerns such as noise from recreational watercraft, attitudes to safety and training.

The Marine Communications and Traffic Services projects within the Safety and Environmental Systems Branch 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 marine transportation system. Technological solutions in support of the overall effectiveness of the MCTS program can be made in areas relating to communications and transmission network technologies, automatic identification system (AIS), and integrated information management.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002
Safety & Environmental Response Systems/
Sécurité et systèmes d'intervention
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG GCC	PARTNER PARTENAIRES	
? **HEADQUARTERS/ADMINISTRATION CENTRALE**					
FKCA6	Development of Response Strategies for Orimulsion (Chemical & Physical Properties) Élaboration de stratégies de récupération de l'origmulsion (ses propriétés chimiques et physiques)	CCG GCC	150	0	
	Headquarters/Administration centrale **- TOTAL**		**150**	0	

DEVELOPMENT OF RESPONSE STRATEGIES FOR ORIMULSION / HEAVY OILS

Background:

As new petroleum products are introduced into Canada, both the Canadian Coast Guard (CCG) and industry must strive to continously improve their ability to respond to spills of these new products. The current stock of response equipment held within CCG and industry inventories was developed to cleanup up oils spills ranging from light fuels to heavy Bunker C. New petroleum products, such as Orimulsion, present new challenges for response.

Orimulsion is currently being shipped to the Dalhousie Generating Station in New Brunswick and can be quite difficult to cleanup once spilled. It is a heavy bitumen that has a higher viscosity than Bunker C, sinks in freshwater and floats, semi-emerged in salt water. Due to the unusual behaviour of this product, response agencies are struggling to find ways of recovering Orimulsion and are just beginning to understand its impacts on the marine environment.

Any R&D work conducted on recovering Orimulsion will also benefit responders in dealing with other heavy oils, such as Bunker C. Unweathered or fresh Bunker C is relatively easy to recover. However emulsified and highly weather Bunker C can be just as difficult to recover as bitumen. Recent incidences, such as the Erika incident off the coast of France in 1999, demonstrates this point. Even with the most advanced oil spill response equipment, of the 16,000 tonnes of Bunker C that was spilled, only 1,100 tonnes was recoverd. The majority of the unrecoverable oil washed ashore or sank to the bottom. Therefore, any research and development work conducted on Orimulsion will also benefit recovery strategies and techniques for heavy fuel oils, such as weathered Bunker C.

Some R&D work has already been conducted in the field of Orimulsion and heavy fuel oils. An International Orimulsion Working Group was originally created to help direct the work effort on Orimulsion R&D, however, due to other more recent critical issues (i.e. Y2K), the Working Group has been unable to continue managing R&D Orimulsion projects in an effective and efficient manner .

The goal of this project justification is to set out a multiyear project workplan for Orimulsion and heavy fuel oil R&D and to reinstate the International Orimulsion Working Group and have it oversee the projects in this workplan on a yearly basis. Project proposals from both government and private organizations have been submitted to the CCG and have been classified under 5 subject areas. The projects in the subject areas have been prioritized. For each fiscal year, a project from each subject area will be conducted as planned. At the end of the fiscal year, the Orimulsion Working Group will convene to discuss the results of the year's projects and to discuss any changes that need to be made to the project workplan.

This project is scheduled to be conducted over the next several years and falls under 5 subject areas. Projects under each of the subject areas have been prioritized under order of importance. Each year, the project from the top of the list will be conducted and if that project could not be conducted (for whatever reason), the next one down the list will be conducted.

The following 5 subject areas are as follows:

1. Shoreline Recovery

The objective of the Orimulsion Shoreline Studies Program is to develop scientific/technical information and direction on the behaviour and cleanup of Orimulsion on different types of shorelines and conditions.

The program consists of a staged series of integrated component studies that address issues related to Orimulsion on shorelines. Simply put, the strategy will be to assemble what we know or can surmise, identify deficiencies and conduct investigations to fill those gaps. The program generally follows a framework of needs that have been identified by the International Orimulsion Working Group and more recently in an integrated global plan for cold marine shoreline studies developed Bitor America, Bitor Europe and Bitor Venezuela.

The projects that will be conducted under this section are as follows:

1. Hydraulic Cleanup Techniques – Rock Surfaces / Hydraulic Cleanup Techniques – Coarse Mixed Sediments
2. Persistence / Recovery – Hard Rock Surfaces / Persistence / Recovery – Coarse Mixed Sediments
3. Shoreline Cleanup – Field Trial
4. Salt Water Marshes
5. Shoreline Washing Agents II
6. Adhesion
7. Sediment Interactions
8. Bitumen Coating of Intertidal Substrates
9. Disposal
10. Sediment Relocation

2. Mechanical Recovery

This section of the project plan will examine various methods of recovering Orimulsion via mechanical methods. This will include testing new skimmers, developing methods and techniques for pumping bitumen, examining methods of refloating or separating bitumen from the water column and studying the potential of burning resurfaced Orimulsion in-situ.

The projects that will be conducted under this subject area are as follows:

1. Study the potential of burning resurfaced Orimulsion in-situ – (3 year study)
   - ✍ Year 1 - Preliminary burn test
   - ✍ Year 2 – Meso-Scale Tests
   - ✍ Year 3 – Test Tank Trials
2. Study methods of pumping bitumen during response/recovery operations.
3. Air injection during recovery operations to enhance bitumen/water separation.
4. Air curtain diversion during containment operations to enhance bitumen/water separation.

3. Biological Studies

Little is known about Orimulsion's effects on marine organisms. Various biological studies will be conducted to give responders a better understanding of the fate and effects of Orimulsion on marine biology.

The projects that will be conducted under this section are as follows:

1. Orimulsion Mesocosm Experiment
2. A study of the ecological effects of Cerro Negro bitumen on organisms in the Seabed
3. Bioremediation potential of Orimulsion

4. Chemical / Physical Studies

Various studies will be conducted to determine Orimulsion's physical and chemical characteristics. Since Orimulsion behaves differently from floating oils, this study will allow responders to better understand Orimulsion's physical properties in the water.

The projects that will be conducted under this section are as follows:

1. Heavy Oils, Bitumen, and Orimulsion (HOBO) Studies Program – (5 year study).
   - ✍ Year 1 – The Dynamics of Orimulsion Spills in Water of Varying Temperature and Salinty.
   - ✍ Year 2 – Properties of Heavy Oils and Bitumen.
   - ✍ Year 3 – Comparative Study of Bitumen Prepared by Various Methods.
   - ✍ Year 4 – Properties of Orimulsion X.
   - ✍ Year 5 – The Dynamics of Orimulsion X Spills.
2. Orimulsion and Heavy Oil Acute Toxicity Studies Program.

3. Chemical Characterization of the Water and Oil Phases of Orimulsion Dispersions in salt, fresh and brackish water.
4. Test to determine the rise and sinking times of Orimulsion in waters of different salinities.
5. Orimulsion Behaviour in Salinities between 0 and 17%.
6. Orimulsion Behaviour / Dilution – Constant Salinity.
7. Orimulsion Behaviour / Dilution – Changing Salinity.

5. Detection / Tracking

Since Orimulsion disperses in the water column and does not float, detecting and tracking Orimulsion can be difficult during a response. This section will examine different techniques and devices that can track Orimulsion in the water column.

The projects that will be conducted under this section are as follows:

1. Orimulsion / Heavy Oil Remote Detection Studies Program.
2. Measurement of Orimulsion in the Water Column using a Flow-through Fluorometer.
3. Trajectory Evaluation of Orimulsion.

Project Description:

This project is scheduled to be conducted over the next several years and falls under 5 subject areas. Projects under each of the subject areas have been prioritized under order of importance. The subject areas for the first year are:

1. Shoreline Recovery – Hydraulic Clean-up Techniques; Persistence / Recovery.
2. Mechanical Recovery - Preliminary Burn Test.
3. Biological Studies – Orimulsion Mesocosm Experiment.
4. Chemical / Physical Studies - The Dynamics of Orimulsion Spills in Water of Varying Temperature and Salinty.
5. Detection / Tracking - Fluorescence Detection of Submerged Orimulsion in Fresh Water.

Benefits:

Financial: Improving response strategies for Orimulsion and heavy fuel oils will reduce the amount of time and effort spent on recovering these products as newly developed equipment and response strategies will improve the efficiency and effectiveness of response operations, thus reducing response costs.

Environmental: The environmental benefit of improving orimulsion and heavy fuel oil response techniques are significant since improved response strategies will enable responders to cleanup Orimulsion spills more effectively and efficiently.

Project: FKCA6
CCG Contact: John Latour
(613) 990-3376

RESEARCH AND DEVELOPMENT OFFICE

Located at HQ in Ottawa, this office is the focal point for planning, coordinating 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.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002
CCG R&D Office/Bureau de R et D de la GCC
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG GCC	PARTNER PARTENAIRES	
FKAA6	Federal Partners in Technology Transfer Le transfert technologique entre les partenaires fédéraux	CCG GCC	10		
	R&D Office/ Bureau de R-D - TOTAL		**20**		

FEDERAL PARTNERS IN TECH TRANSFER

Background:

The FPTT was set-up in 1995 to pursue initiatives aimed at building an entrepreneurial culture in science-based departments and agencies. The FPTT enables DFO to be better informed about government-wide intellectual property (IP) management and commericalization issues. It provided an opportunity to be heard and to deal effectively with those issues.

In 1999, DFO and 14 other departments were asked to sign an MOU committing support for FPTT over three years, starting in 1999-2000. The PTT requested $20 K from DFO, with DFO and CCG being called upon equally to support the partnership. Executive commitment was provided for a three-year trial.

DFO is billed annually for costs relating to the maintenance of this partnership arrangement.

Project Description

The project comprises core support to the administrative expenses of the FPTT. Executive commitment explicitly recognized a variance from the standard R&D project format.

Benefits:

Benefits fall primarily in the policy area. The FPTT enables DFO to be better informed about government-wide intellectual property (IP) management and commercialization issues. It provided an opportunity to be heard and to deal effectively with those policy issues.

Some benefits accrue to CCG clients through improved awareness of opportunities and techniques for joint venture projects and/or projects involving the sale of federal expertise abroad.

Project : FKAA6
CCG Contact: W. Ellwood
(613) 990-3087

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: communications and transmission network technologies, and aids to navigation.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002
Newfoundland Region/Région de Terre-Neuve
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG / GCC	PARTNER / PARTENAIRES	
FKCT6	Research Project for Increased Wearing of Personal Flotation Devices (PFD) Recherches en vue d'accroître le port des vêtements de flottaison individuels (VFI)	CCG GCC	210		
FMBE1	Coast Guard Public Information System (CGPIS) Système d'information publique de la Garde côtière (SIPGC)	CCG GCC	28		
NEW	Fishing Vessel Safety Study Étude sur la sécurité des navires de pêche	CCG GCC	18.5		
	Newfoundland/Terre-Neuve - TOTAL		**228.5**		

RESEARCH PROJECT FOR INCREASED WEARING OF PERSONAL FLOTATION DEVICES (PFD)

Background:

There have been significant changes to the regulatory framework governing recreational boating safety in Canada. In addition, there are major non-regulatory initiatives underway within the Office of Boating Safety (OBS) to address concerns with Canadian recreational boating safety, a substantial effort has been directed towards making Canadian waters as safe as possible for everyone. Many of these initiatives will have significant national impact on recreational boater safety. For example the passing of the *Competency of Operators of Pleasure Craft Regulations*, *Age and Horsepower Restrictions*, the amendments to the *Small Vessel Regulations*, as well as a more highly visible *Enforcement Program* on the water will lead to an increased awareness of boating safety issues by industry, boating organizations and the boating public. These initiatives and the regulatory changes are expected, for example, to increase compliance with the safety equipment carriage requirements of the *Small Vessel Regulations.*

The Canadian recreational boating industry, consisting of manufacturing, sales, repairs, marinas, rentals or outfitters, is a significant contributor to the economy, providing thousands of jobs both directly and indirectly. Recreational boating is a fast growing and popular leisure activity in Canada. Every year, approximately 8 million boaters enjoy our waters in 2.7 million recreational vessels. Demographic and economic trends suggest that recreational boating in Canada will continue to grow. The trend towards smaller, greater powered water craft, and the simultaneous increase in the numbers of boaters on Canadian waters has created a heightened awareness of boating safety concerns and have provided more challenging demands of the Canadian Coast Guard. Unfortunately, the growing recreational boating community does not come without its price. Spectacular and tragic incidents, often involving fast, high-powered craft, and younger operators, and often the consumption of alcohol, highlight the newspapers throughout Canada each summer. Concern about these incidents and the public's desire to improve boating safety, has become a concern to the 2.7 million recreational boaters and the boating industry.

Historical data concerning boating incidents on both inland waters and the oceans coastal waters reflect that the majority of drowning victims were not wearing any flotation devices, even if the required flotation equipment was carried onboard. It is a national tragedy that every year, 200 Canadians die in boating related incidents, which might have been prevented. Sadder still, approximately 90 percent of all persons who drowned in recreational boating incidents were not wearing a personal flotation device (PFD), even if the required flotation device was carried onboard. Recreational boaters are also involved in over 50 percent of SAR incidents. Nationally, even though significant financial and human resources have been targeted at increasing PFD wear, people are still dying. The challenge for this project may be similar to the one faced by those who worked to bring about seat belt legislation, however the benefits may be equally as great.

The OBS has not made significant progress in this area of increasing PFD wear because neither the boating public, nor the Canadian Coast Guard (CCG), have the information required to identify and understand the barriers that exist within different age groups. It is at present considered to be simply an issue of individual rights. It is believed that a great deal of the required information is available through numerous sources. For example studies have been carried out in various states to demonstrate why mandatory wearing is necessary for children 12 years of age and under. Similarly, studies have accumulated data to show why PFD wearing is very important in conjunction with various activities and circumstances.

Prevention is the key to positive results. The research and data gathered, as a result of this project is crucial so that we can properly educate people and reduce the needless loss of lives.

The majority of boating fatalities should be preventable by focusing comprehensive social marketing strategies to increase the wearing of PFDs.

Project Description:

Phase IV of this project will include seeking the necessary approval to conduct major qualitative fieldwork (public opinion research) which was recommended during Phase II. Behavioural change and marketing professionals recommended that it was critical to conduct a national **PFD Attitudinal Survey** to determine boater's attitudes towards PFD wear. The survey will lead to a fuller understanding of the specific subgroups of boaters as they arise naturally in the Canadian population. The data collected from this survey is critical to improve the design and delivery of non-regulatory interventions to effect an awareness change, an attitude change and a behaviour change. As a result of these professional recommendations a survey questionnaire and methodology were designed during Phase II to continue research to meet the specific R&D project objectives. The benchmark data gathered from conducting the survey would provide the OBS the data necessary to measure future accomplishments and enable measurement of increases in awareness and attitude change. The survey would also be an opportunity to investigate some potential communication strategies to increase wearing of PFDs.

Upon completion of the attitudinal survey, preliminary safety messages and themes to target specific subgroups of boaters to increase PFD wear will be developed based upon improved research. Develop draft safety educational materials based upon the findings of both the PFD Observational Study and the Attitudinal Survey. A draft communication plan will be developed to implement an educational campaign based on the findings of research to date.

As well, a PFD safety information video will be produced in partnership with Memorial University of Newfoundland's Centre for Academic and Media Services.

Benefits:

Financial: Prevention is the key to positive results. The results from this project will have a positive impact financially on CCG as an organization by reducing the time, cost, number and severity of SAR cases.

Social: This project will enhance the profile of boating safety in Canada. As well it will help to create safer recreational boating in Canadian waters.

Project: FMBA1
CCG Contact: Sharon Sellers
(709) 772-2079

COAST GUARD PUBLIC INFORMATION SYSTEM (CGPIS)

Background:

The Marine Communications and Traffic Services Branch (MCTS) is responsible for dissemination of information to the public. This includes marine, environmental and fisheries information. Much of the information originates in digital format from the Message Data System (MDS) and Anikom Systems. It is printed, then distributed manually via facsimile.

During peak periods, this places a heavy load on resources and diverts personnel from other duties. For example, during the sealing season, the Great Northern Peninsula MCTS handles 2500-3000 faxes/month responding to mariners' requests for information.

Project Description:

This project would investigate and implement an automated "fax back" solution allowing the public to request the information in an automated fashion. The MDS file would be converted to a file that the fax would send out. This would be similar to fax back solutions used by industry to distribute product information. A 900 service would be used, where the public would request information via fax for a charge per call.

Phase I of the project was initiated in the prior fiscal year and is scheduled to be completed by March 31, 2001. It comprised a MCTS needs assessment, options analysis, and procurement of all software and hardware. MCTS required a system that converted requested information in digital format from the MDS and Anikom Systems to a file that the fax system would send out to the public in an automated fashion. We investigated several options and came up with a solution. A requisition has been placed with PWGSC for a faxback 4 fax-on-demand system to allow dissemination of the requested information.

The (proposed) final phase of the project, Phase II, involves system implementation and testing. Software testing will commence on April 1, 2001 lasting approximately 4 months. Hardware and Software integration will be completed Aug. 1, 2001 and final testing will take approximately 3 months. The final report will be completed by February 1, 2002. In order to complete Phase II, we require $28K in R&D funding for fiscal year 2001/2002.

Benefits:

Client Impacts:

- Information more accessible by users;
- Personnel resources can concentrate efforts on higher priority MCTS tasks;
- Efficient handling of information.

Project: FMBE1
CCG Contact: Tracey Sampson
(709) 772-4081

FISHING VESSEL SAFETY STUDY

Background:

Since 1987 a number of CCG studies and reports have examined the issue of safety in the fishing industry. The most current, still in draft form, was undertaken by Maritime Search & Rescue (MRSC), Newfoundland region in year 2000. As an added exercise to this review, A "Perspective and Analysis" of Newfoundland fishing incidents was completed under the direction of Dr. Ronald Pelot, of Dalhousie University in Halifax.

All studies have revealed distrubing trends in the safety of those involved in the fishing industry. Occupational health & safety and fishing vessel safety are two essential areas of concern. Data investigated in the 2000 "Fishing Vessel Safety Review" and the supplementary "Perspective and Analysis' show some of the following results;

- In 1999, over one third (38 %) of all registered fishing vessels in Newfoundland between the length of 45 to 65 feet called the MRSC St. John's for assistance;
- In 1999, nearly one quarter (23%) of all vessels registered in the 35 to 45 foot range called for assistance;
- In 1999, 75 % of all fishing vessels applying to become members of the Coast Guard Auxiliary failed their initial safety equipment inspection;
- Overall, SAR data has shown that the number of incidents involving fishing vessels 65 feet and less have grown from 194 in 1993 to 383 in 1999, and
- There is an evolving trend for more incidents to occur further offshore, therby increasing the complexity and effort to resolve situations when they occur.

In examining the cause of these incidents it was found that there was no simple or single answer. Instead, it was a combination of factors such as a poor safety culture among fishermen, the propency of fishermen to take risk, poor safety standards in such areas as equipment, seamanship, training and ship stability, and external influences from fish management and regulatory enforcement regimes.

The 2000 Fishing Vessel Safety Review also identified emerging trends that are likely to impact on fishing vessel safety in the near future. The pursuit of non-traditional species will require fishermen to harvest further offshore. Downsizing and restructuring within the CG fleet bring new challenges in meeting the SAR mandate over a wide range of sea areas in the region.

In meeting the needs of the fishing industry it will be necessary to understand all the dynamics at play. Various data bases currently exist in the SAR system and through other avenues. Nevertheless, other important aspects of safety need further study and analysis. Given the scope of the issues surrounding fishing safety, whether occupational heath & safety or accidents involving vessels themselves, a focused and enhanced effort must be advanced by qualified institutions.

Project Description:

The "Fishing Vessel Safety Review" referenced a new initative in research undertaken by Memorial University 0f Newfoundland through a vehicle known as the Community Alliance for Health Research (CAHR). Essentially, the structure is based on an alliance between the University and a broad base of community partners. Many disciplines are represented such as fishermen's organizations, plant workers, industry employees and various government agencies with vested interests. Maritime Search and Rescue, Newfoundland Region, is represented on the current committee process and has been given a terms of reference for a long term study on fishing safety. As a partner with significant interest in this special area, it seems appropriate to support this initative financially and otherwise.

An attachment has been included which addresses the criteria stipulated under (1-2) project description.

Benefits:

Financial: Improvements in fishing vessel safety will reduce the costs associated with reponding to incidents at sea in the Newfoundland Region. Direct costs to other DFO programs (notably Science and MNS) as a result of SAR taskings will reduce. Costs associated with CGA reimbursements will also reduce significantly.

Environmental: Study objectives will improve knowledge and enhance understanding of environmental factors affecting fishing safety.

Social (if any): Significant improvement can occur in the safety and well being of people involved in the fishing industry. Ultimate harmonization of the fishery and safety policies of the Federal Government will result in a better managed and sustainable fishery.

Project: FMBA1
CCG Contact: TBA

CODED ACCESS TO CONTINUOUS MARINE BROADCAST (CMB)

Background:

Mariners currently have to listen to the complete Continuous Marine Broadcast (CMB) for their region in order to get the portion of the CMB that is of interest to them. For example St. John's CMB broadcast includes synopsis and weather information for the Northeast Coast, East Coast, South Coast, all of the Grand Banks (which include North, Southeast, Southwest) and the Funk Island Banks. The CMB broadcast also includes Sea State, Weather Observations, Ice, Notice to Shipping.

It can easily be seen that a mariner who wants to listen to the Northeast Coast weather may have to listen to 30 minutes of information that he has no interest in, at the present time.

Project Description:

The project would investigate the feasibility of providing the mariner with immediate access to the information that they require.

A call-in system will be developed so that Mariners are able to call into the local Coast Guard Communications Centre in their area of operation and select the portion of the CMB that they are interested.

Benefits:

The mariner will be able to access the information that he/she specifically wants which relieves him from having to wait up to approximately an hour on times for the information he/she needs. Also most mariners will call the Coast Guard Communications Centre looking for the information which ties up the Operators from doing their other duties. The coded access CMB will allow the Operators to carry out their other task which during peak seasons (like Seal Fishery, Crab Fishery, Shrimp Fishery) could mean a lot of time saved to a single stand station.

Project: FMBD1
CCG Contact: Cyril Hewitt
(709) 772-5941

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: ice data collection and information management.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002
Maritimes Region/Région des Maritimes
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG / GCC	PARTNER / PARTENAIRES	
NEW	Enhanced Sweeping Methods Méthodes de ratissage améliorées	CCG GCC	100	0	
NEW	Magnetic Ship Joint for Sweeping Systems Joint de bâtiment magnétique pour les systèmes de ratissage	CCG GCC	40		
	Maritimes - TOTAL		**140**		

ENHANCED SWEEPING METHODS

Background:

The Canadian Coast Guard operates a number of offshore sweep systems from a variety of vessels, both CCG and vessels of opportunity. These systems must be operated at one knot or less to ensure optimum oil collection without entrainment. Most vessels have difficulty maintaining this low speed for extended periods of time that is required during an offshore cleanup operation. A Norwegian boom manufacturer has developed a system that has the potential to achieve sweeping speeds as high as four knots. This system requires testing to assess its operational capabilities / limitations and its feasibility of use in Canadian waters.

Project Description:

The Canadian Coast Guard would like to test this new system for use in Canadian waters. Appropriate arrangements would be negotiated with the designer and manufacturer to lend the prototype to Canada for testing. A test protocol would be developed using ASTM guidelines. Test facilities would be researched for the most appropriate capability to accommodate the full scale unit and match the protocol parameters.

One system was tested last year in Victoria, called the "Current Buster". This is a smaller model and is designed for the near-shore.

The Canadian distributor advises that there is a 70% probability of having the larger version, called "Ocean Buster", available for September. The larger "Ocean Buster" high speed sweep equipment is primarily for the off-shore.

If the project proceeds, there is also a good chance that the Canadian distributor will also provide the "Current Buster" so that we may conduct near-shore trials using a ship single side sweep configuration.

Benefits

Indications utilizing the "Current Buster" in Victoria have proven to enhance the on-water recovery aspect of spill response by at least 400% (conservative estimate 0.5 knot vs.2.0 knots). Should this technology be as successful in the larger "Ocean Buster" version, a combination of the two in our inventories would be most beneficial.

An increased on-water recovery rate of more than 4 times our current ability would enable us to collect more and significantly reducing costly shore-line response. Also, vessel can be more effectively manoeuvred without causing extensive and costly damage to vessel gearboxes, and resulting in a premature removal of the vessel from the response activities.

If proven successful, having both the "Ocean Buster" and "Current Buster" within our inventories would enable CCG to significantly reduce its on-water sweep recovery systems which may be deemed as old and ineffective technology. This would enable CCG to reduce its inventory holdings in terms of numbers, storage and maintenance requirements, and value without reducing our response capability.

Project: NEW
CCG Contact: Ron MacKay
(902) 368-0204

MAGNETIC SHIP JOINT FOR SWEEPING SYSTEMS

Background:

The Canadian Coast Guard operates a number of offshore sweep systems from a variety of vessels, both CCG and vessels of opportunity. During a sweeping operation, part of the boom must stay in constant contact with the ships hull, as to create a leak-proof seal and to limit the tendency of the two units to separate, resulting in a loss of part of the pollution along the ship itself. This loss can reduce the performance of a sweeping system by as much as 40%. A Canadian inventor has developed a Flexible Magnetic Sealing joint, capable of assuring a positive seal between ships hull and the boom. This system has the potential to greatly increase the performance rate of sweeping systems. This system requires further development and testing to ensure it meets expectations.

Project Description:

The Canadian Coast Guard intends to pursue this technology with field tests using a full-scale prototype in the Coast Guard's regions. Appropriate arrangements would be negotiated with the designer and manufacturer to build the prototype in Canada for testing. A test protocol would be developed using ASTM guidelines. Test locations would be researched for the most appropriate capability to accommodate the full-scale unit and match the protocol parameters. This will be a two phase project with full-scale offshore testing and comparison utilizing a variety of single side sweep systems within current inventories. As well as a prototype high-speed sweep system will form phase two of the project.

Benefits

The Canadian Coast Guard maintains and operates the vast majority of offshore cleanup equipment in Canada. The present inventory consists of " state of the art " V sweep systems that allow maximum swath width during operations, thereby collecting oil from the largest possible area. These systems can achieve a forward sweep speed of approximately one-knot, even at such a low speed the tendency of the boom to pull away from the hull lets floating oil escape in the ship/boom seal area. If a system can be developed that maintained a positive seal between the vessel and the sweep system a number of benefits could be realised.

The present method of sealing the ship/boom interface area tends to leak ever increasing quantities of product with greater forward velocity. Recently developed technology allows the sweep system itself to maintain efficiency at speeds greater than one knot. With a better interface seal vessels in a cleanup operation could sweep at a greater speeds covering a larger area in a shorter time period. In addition, the area swept would be covered more completely with less product lost during the operation. These two factors would allow operational vessels to collecting larger volumes of product that would otherwise wash ashore causing greater shoreline and environmental damage.

Currently, to keep the minimal quality seal, ships must reduce their speed so slow that it becomes difficult to keep its course and they risk either a grounding or loosing control of the spill. These exceptionally slow forward speeds can also cause additional wear and tear on ships machinery

Should this technology be successful in maintaining a seal between the ship hull and sweep interface and if you incoprorate it with an effective high speed sweep system, such as the Current Buster, the total system would be among the most effective on water recovery system in the world today. (A R&D project to test a high speed sweep system in a single side sweep configuration has been submitted for the 2001/2001year)
The tendency of the hull and boom to separate added to the manoeuvring difficulties often cause the sweep systems to

pulsate resulting in additional loss of product at each pulse cycle. The Flexible Magnetic sealing joint that is proposed to test under this project has the potential to eliminate all of the above mentioned problems. The Regions are the targetted clients.

Financial: Contineously maintaining a seal between the ship and sweep system will significantly increase the amount of product collected ultimately greatly reduce the cost of the cleanup. Should this seal be maintained and incorporated with a high speed sweep system, much more product can be recovered on water at a significantly increased encounter rate. This should greatly reduce the shore line impacts and subsequently reduce the overall costs of a clean up.

Environmental: As noted earlier, a sweep system working under its full capability allows more oil to be collected from the water surface, reducing shoreline impact and the final cost of cleanup. Furthermore, ships will be able to maintain manoeuvrability, thus enabling work in limited areas, without compromising efficiency and performance. Incorporation with a high speed sweep system, as stated above, would significantly reduce shore line impact and detremental effects on the marine, wild life, and scocio-economic environments.

Project: NEW
CCG Contact: Ron MacKay
(902) 368-0204

LAURENTIAN 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.

R&D PLAN 2001-2002

Laurentian Region
Project List

PROJECT NO. / Nº DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT CCG GCC	PARTNER PARTENAIRES	BUSINESS LINE / ACTIVITÉS PRINCIPALES
FMCD3	Helicopter Fixed-mount Detection of "Brash" Ice Thickness in Fresh Water Détection par hélicoptère de l'épaisseur du « brash » dans les étendues d'eau douce	CCG GCC	0		ICE-BREAKING DÉGLAÇAGE
FMCC3	Erosion/Sedimentation Model of the St. Lawrence River Modèle d'érosion/de sédimentation pour le fleuve Saint-Laurent	CCG GCC	150		MNS SNM
FJMQ3	Feasibility of Immersing Ice Booms in Place Evaluer la faisabilité d'immerger sur place les estacades de retenue des glaces	CCG GCC	20		
FJMP3	Dispersion of Oil Spills Stranded in Ice and its Environmental Fate Dispersion des produits pétroliers coincés dans les glaces et incidence écologique	CCG GCC	60		
NEW	St. Lawrence River Ice Manager Système intégré des glaces	CCG GCC	150		
NEW	Squat Study for the Purpose of Re-Evaluating Underkeel Clearance Specifications Étude du squat des navires en vue de réévaluer la norme de dégagement sous quille en vigueur sur le Saint-Laurent	CCG GCC	60		
NEW	Computer-Assisted Ice Observation System in Helicopters Système informatisé d'observation des glaces par hélicoptère	CCG GCC	65		
NEW	Wireless Communication Protocol Application for Geo-Referenced Marine Data Internet Access Application d'un protocole de communication sans fil pour l'accès aux données maritimes géoréférencées	CCG GCC	75		
NEW	Develop an user-friendly software forecasting the trajectory of oil spills in cases of Environmental Intervention Développer un logiciel convivial de prévision de dérive d'hydrocarbures lors d'Intervention environnementale	CCG GCC	125		
	Laurentian /Laurentienne - TOTAL		**705**		

HELICOPTER FIXED-MOUNT DETECTION OF "BRASH" ICE THICKNESS IN FRESH WATER

Background:

Ice observation is essential to ensuring adequate ice breaking and escort services and providing relevant information to reduce the risks of flooding. Quantitative assessments of ice thickness cannot be performed with current ice observation techniques. It is essential to know how thick the ice is to identify (a) the volume of ice which must be cleared away from locations vulnerable to the formation of ice jams; and (b) the resistance to navigation in ice-infested water. Some tools developed as part of the PERD project (Ice Manager System) make it possible to measure ice thickness but at fixed points only. A continuous measure of ice thickness from a helicopter would reveal the ice conditions along the entire distance covered, e.g., the entire length of the ship channel between Quebec City and Montreal. This broad knowledge of the ice cover could enable ice management officials to make more profitable use of ice breakers and consequently increase their efficiency.

In spite of several recent developments in the use of radar to measure the thickness of ice free of salt water, there currently are no known detection techniques to arrive at a quantitative evaluation of the thickness of brash ice in fresh water. A feasibility study was done in 1999 which identified technologies which would enable the helicopter fixed-mount detection of brash. The CCG is said to be a pioneer by contributing to the development of such a tool.

This project complements the PERD project. Both projects help provide information in real or near-real time on ice conditions. Moreover, both projects use the most advanced information technologies to accelerate the gathering and processing of data so that the information is available to users as soon as possible.

Project Description:

Several research projects have been conducted and are under way in the area of fixed-mount detection of ice. The work by the Bedford Institute of Oceanography (BIO), the Cold Regions Research and Engineering Laboratory (CRREL), the National Research Council of Canada (NRC), the Transport Development Centre (TDC) and the Canadian Ice Centre are related to the project which is the subject of this proposal. The purpose of this project is to make use of the work done by the aforementioned organizations to create a fixed-mount detection tool for brash which is suited to the ice conditions encountered in the fresh water of the St. Lawrence.

This tool should uncover in the most automated way possible the concentration, roughness, speed and thickness of all types of ice (including brash) encountered in the St. Lawrence River between Quebec City and Montreal. The instrument must be fixed on the helicopters which do daily ice reconnaissance missions. Digital data will be gathered, recorded and processed on the helicopter. Interpretation algorithms will be developed so that the relevant quantitative information can be taken therefrom.

The first phase of this project took place over a two-year period (1999-2001). The first year involved doing a feasibility study and preliminary testing to identify a technology which would enable one to measure the thickness of brash ice from a helicopter. The second year (2000-2001) will involve doing enough flight testing and making field measurements to determine the effectiveness of the technology used.

The second phase of the project would involve developing an operational prototype using the technology validated during the first phase. The completion of this second phase, however, is conditional on the success of the testing scheduled for the winter of 2000-

2001. Only after learning of the results of this testing will CCG managers decide whether additional resources must be invested in the development of an operational prototype. That is why this proposal does not require financing for 2001-2002. It is during that year the project will be reevaluated and a decision will be made concerning the completion of the second phase of the project.

Benefits:

Financial: There is reason to believe that broad knowledge of the thickness of the ice cover would increase the efficiency of CCG interventions in ice breaking and escort activities, which would bring down the operating costs of helicopters and ice breakers.

Environmental: By helping to reduce the number of interventions by icebreakers and helicopters, this project would reduce the energy consumed by this equipment. Emissions of pollutants into the atmosphere would therefore be cut.

Social: By making precise information on the evolution of the ice cover available to the flood control officials, this project would help reduce the risk of ice jams and consequently the risk of flooding. This, in turn, would make it safer for residents and various municipalities along the shores of the St. Lawrence River.

Project: FMCD3
CCG Contact: Réginald Corriveau
(418) 648-5620

EROSION/SEDIMENTATION MODEL FOR THE ST. LAWRENCE RIVER

Background:

The potential impact of maritime navigation and the maintenance of the St. Lawrence Waterway have been the subject of numerous comments and concerns, following Environment Canada's publication of a background paper on the condition of the St. Lawrence in 1996, and the submission of an impact study during the course of a project to deepen the waterway. These events were behind the creation of a navigation co-operation committee established during phase 3 of the St. Lawrence action plan. This committee brings together representatives of government, the maritime industry and the community who have a mandate to find means of limiting the impact of navigation on the environment. The main concerns this committee has raised are bank erosion, the destruction of fauna habitats and dredging-related impacts.

In conjunction with this committee's work, the purpose of this project is to develop software which is capable of modeling the influence of navigation and maintenance of the waterway on bank erosion of the St. Lawrence between Cornwall and cap Gribane at the end of the North Traverse. This will enable the various departments involved in the project evaluation to increase their level of knowledge of the impacts of these projects and to be better able to respond to concerns expressed by interest groups and the general public.

Project Description:

The purpose of the project is to develop a software which includes a mathematical sedimentation transportation model and a graphic interface. This model must make it possible to:

1. Gain a better understanding of the erosion, transportation and sedimentation process in the St. Lawrence based on various hydrological and hydraulic conditions; and
2. Evaluate the potential impact of navigation and maintenance of the waterway on the environment (bank erosion and sedimentation).

To plan and carry out this project, the Canadian Coast Guard has associated itself with partners which can help it achieve its objectives with the expertise they have developed in this field. They are the Science Branch of Fisheries and Oceans Canada, Environment Canada, the National Research Council (NRC) and the Quebec Environment Department.

The project involves combining in one graphic interface several mathematical models – a sedimentary transport model, wind and boat wave transformation and generation models, and a bank erosion model. These models must be validated by measurements in the field. The graphic interface must make it possible to perform and visualize the simulations corresponding to various hydrological and hydraulic conditions.

The project planning calls for five stages. During the first stage (1999-2000), two existing sedimentary transport models were used for CCG requirements – the NRC PSED model and the Dispersim model of INRS-Eau. Based on the results obtained, one of the two models will be selected to serve as a basis for the development of the erosion-sedimentation model. In 2000-2001 (stage 2), a boat-generated wave transformation and generation model and a boat wave model will be integrated into the application. The erosive action of waves will be studied and the findings will be evaluated during a three- to four-day field session to validate the theories that have been put forward.

During stage 3 of the project (2001-2002), the applications that are part of the erosion-sedimentation model will be finalized so that

the erosive effect of wind- and boat-generated waves can be modeled. That year will also be devoted to a vast field session to validate the results of the mathematical model, a campaign Environment Canada will take part in.

Stage 4 in 2002-2003 will involve extending the area covered by the erosion-sedimentation model to the entire portion of the St. Lawrence River between Cornwall and cap Gribane. This model will also be used during this stage to analyze the erosion and sedimentary transportation process based on various hydrological and hydraulic scenarios.

Finally, the erosion-sedimentation model will be used during stage 5 of the project (2003-2004) to evaluate the potential impact of navigation and maintaining the waterway on the environment in terms of erosion and sedimentation.

Benefits:

Financial: Once the Canadian Coast Guard (CCG) has this new tool, it will able to perform the studies it would otherwise have to have consultants do, e.g., studies of the erosion of dredging sediment deposits. These studies will therefore be produced more quickly, be of higher quality and cost less. The CCG will therefore make some savings.

Environmental: The CCG is concerned about the environmental consequences of activities such as navigation, maintenance and development of the waterway. However, it has few tools to evaluate potential impacts such as bank erosion, sedimentation and dredging. The development of a mathematical model such as the one proposed in this project will give it a means of better assessing these impacts. For example, the erosion-sedimentation model will give the CCG the opportunity to validate and change, if necessary, the way it currently manages dredged sediments. It will also make it possible to anticipate the potential environmental impact associated with changes in the volume and type of marine traffic in the waterway.

Project : FMCC3
CCG Contact: Pierre Rouleau
(418) 648-7493

FEASIBILITY OF IMMERSING ICE BOOMS IN PLACE

Background:

The annual installation and removal of ice booms on the St. Lawrence River in Lavaltrie, Lanoraie and Yamachiche cost $200,000 annually. Since 1999, the booms in Yamachiche, Lavaltrie and Lanoraie now completely consist of circular steel beams. Booms must be removed every year, inspected and maintained, if necessary, to avoid premature aging of the cables due to the action of the waves during the ice free season. The presence of these structures during the summer season could pose a risk to pleasure boaters. With this new concept of circular steel beams, one is lead to believe that the booms could be submerged where they are located and brought back to the surface for the winter by using a mechanism of some kind to fill or drain the beams. This would eliminate the requirement to install and remove these structures every year, which would reduce operating costs that have been substantial in recent years.

This project directly relates to the new imperatives, R&D orientations and short-term initiatives of the CCG aimed at improving the effectiveness of its operations as a result of federal government financial pressures and greater demands to achieve efficiencies in program delivery with respect to the costs of maritime services. This program also falls within the vision of sustainable maritime development.

This document constitutes the proposal for the completion of the second phase of the project, the first phase of which is currently under way.

Project Description:

The first demonstration of the boom immersion principle was successfully completed by Fleet Technology of Ottawa at its expense in May 1999. The test was done with only a few beams.

Following Fleet Technology's first initiative, the first phase of this project, which involved a second more complete test, was performed in September 2000 by this same firm for CCG. The test was done on a complete section of booms (11 beams and 2 buoys) at the wharf in Prescott, Ontario. The results of this testing showed that the approach seemed to hold some promise. A third test (which is yet another part of this first phase) with improved submerging/raising procedures and a complete section of booms (11 beams and 2 buoys) will be completed in February 2000 under actual conditions in Yamachiche. Fleet Technology will be delivering a preliminary report on the first phase of testing with analysis and recommendations in February 2001. The final report to be approved by CCG will be delivered on March 31, 2000.

The second phase of the project is further to the initial project to evaluate the feasibility of submerging and raising ice booms in Lavaltrie, Lanoraie and lac St-Pierre in the St. Lawrence River to save a portion of the costs of installing and removing these structures each year. The results of testing to date, before and during the first phase (1999 and 2000), make it possible to go forward with a pilot project which could be performed on a complete section of booms (11 beams and 2 buoys) under actual conditions. The section of booms would be submerged in May and left at the bottom of the river all summer. It would be refloated in early fall. The objective of this second phase would be to come up with a concrete validation of the project in the presence of ice, seaweed, currents and waves. The effect of the silty river bottom on the submersion/raising procedures will also be studied carefully. The structure will be monitored for the potential formation of corrosion. The Yamachiche site, where the main ice cover retention infrastructures have been installed, was selected for this fourth series of tests.

Benefits:

Economic: The main advantage of this project would be the substantial reduction of the costs of installing and removing these structures each year, some $200,000. Should this project prove conclusive, it would probably only be necessary to install and remove the structures for maintenance every three years only.

Environmental: A priori, due to a less frequent installation/removal cycle (one year out of three), and if the study confirms the project is feasible, the quantity of fuel consumed annually by tugs used to install and remove the booms will be decreased, as will the amounts of corresponding greenhouse gases released into the atmosphere.

Moreover, the new proposed method will be the subject of an environmental impact study (to be delivered in February 2001) which will look at, among other things, possible effects on currents, sedimentation, aquatic fauna that placing the boom on the bed of lac Saint-Pierre will have in the summer.

Project : FJMQ3
CCG Contact: Pierre Rouleau
(418) 648-7493

DISPERSION OF OIL SPILLS STRANDED IN ICE AND ITS ENVIRONMENTAL EFFECTS

Background:

To ensure the safety of Canada's natural resources there is a need for new techniques for the clean-up of oil spills in ice-infested waters. An environmentally sound and cost-effective countermeasure strategy may be oil dispersion into the water column facilitated by the addition of mineral fines.

Project Description:

Oil-mineral fine aggregates (OMA) that result from the natural interaction between mineral fines such as clay and oil has been identified as the means to account for the apparent mobility of beached oil in low-energy environments. Since oil droplets do not re-coalesce following stabilization by mineral fines and thus no longer adhere strongly to shoreline sediment, the oil-mineral fine interaction process is now recognized as a principal mechanism to explain how sheltered, low-energy shorelines "self-clean" in the absence of wave action and erosion. Both field and laboratory experiments have proven the effectiveness of an oil spill countermeasure strategy based on the enhancement of this natural oil dispersion process linked to the availability of mineral fines (i.e., surf-washing). In terms of environmental impacts, studies have shown that oil associated with oil-mineral fine aggregates is biodegraded at a much higher rate and extent than the residual bulk oil remaining within sediments.

During the recent Saraband oil spill incident, a significant amount of oil was released onto the ice of the Saguenay Fjord. Environmentalists were concerned that the oil trapped on or within the ice cover would become stranded on the shoreline following spring ice breakup. A recommendation was made to apply mineral fines to the oil stranded on or within the ice during a scheduled ice-breaking operation to open the shipping channel. The crew on the ice-breaker observed that the oil was rapidly dispersed into the water column along with the mineral fines. There was no report of any oil reaching the shore in the coming weeks. Unfortunately, due to logistical constraints, no scientific data was collected to validate the significance of OMA formation in success of this operation. A research study is now required to quantify the efficacy of accelerated OMA formation as an oil spill countermeasure strategy in ice infested waters and to identify the environmental impact of oil dispersed into the environment in this manner. Promising research results will lead to the publication of an operational guideline describing a new oil spill countermeasure technique.

Benefits:

Environmental : Biological impacts of accelerated oil-mineral aggregate formation as an oil spill countermeasure are presumed to be minimal as the oil is rapidly dispersed into the water column to environmentally safe concentrations. The formation of oil-mineral fine aggregates will likely accelerate the natural biodegradation rates of residual oil dispersed into the environment. This strategy is environmentally more sound that that of physical recovery and transport strategies, as the oil is effectively from the environment removed (degraded to benign components such as CO_2 and H_2O) rather than moved from one environmental compartment to another.

Financial: The results of this project will improve the effectiveness of the response and help to decrease the costs of the response. Compared to the existing oil spill response technologies for use in ice, the cost benefits of the proposed technology are substantial.

Project : FJMQ3
CCG Contact: Martin Blouin
(418) 648-4557

ST. LAWRENCE RIVER ICE MANAGER

Background:

The development of the Integrated Ice System (IIS) began in 1997-1998 thanks to PERD financing (project no. 32214). The IIS is made up of (a) a series of data gathering instruments; (b) a telecommunications network which forwards this data in real or near-real time to IIS servers; (c) specialized software that processes and analyses this data; and (d) an Intranet site which makes information on ice conditions available to users. Eventually, some of this information could be made available to users over the Internet.

The IIS covers the portion of the St. Lawrence which stretches from Montreal to Quebec City. In the winter (from December to March), this portion of the navigation channel is clogged with ice, which significantly increases energy consumption and makes shipping less reliable. The purpose of the PERD 32214 was to develop an integrated ice management system to:

- provide CCG ice breaking officials with the means to determine in real or near-real time the ice conditions in the navigation channel and ice condition forecasts which would significantly reduce the risk of ice jams in the St. Lawrence waterway;
- combine the conventional ice observation methods with new remote sensing methods to gather indicators of ice conditions (thickness, speed, concentration and flow), water conditions (level and temperature) and wind conditions (speed and direction);
- transmit data gathered to IIS servers by way of an appropriate telecommunications network;
- use applications to analyze this data, which would yield value-added information on ice conditions; and to predict ice conditions based on weather observations and forecasts, which would make the CCG better able to forecast the formation of ice jams and to intervene effectively, as the case may be.

The IIS does help ice breaking officials in their decisions and results in fewer interventions by ice breakers, which cuts fuel consumption. Moreover, by reducing the frequency and size of the ice jams, the GIS also makes it possible for shippers to reduce their energy consumption and increase their efficiency, thereby making Canadian ports more competitive.

The IIS dovetails perfectly with the directions the CCG will be taking with respect to research and development for 2001-2002 in a document entitled “The CCG Technology Drive”. The IIS is particularly consonant with the concept of the marine highway. The IIS has currently developed to the point where it can ensure greater safety of ships during the winter season and more effective deployment of the icebreaker fleet in the St. Lawrence River, a role it will perform even better in future. In the long term, the IIS will be able to fulfill a strategic role by providing an evaluation of ice conditions and obtaining punctual information on prevailing or forecast ice conditions at a given point. The IIS already enables the CCG to examine mechanisms aimed at deploying icebreakers more effectively, which improves the quality of CCG advisory services. This facet of the IIS will improve over the long term.

This winter, the IIS will be the subject of an operational assessment. This will enable IIS designers and users to take stock of the system’s effectiveness and reliability, identify the strengths and weaknesses and eventually plan the improvements required to achieve effective operation.

Project Description:

The objective of the current funding request is to make the anticipated improvements to the IIS. The proposed improvements are further to the recommendations contained in the PERD report on the advancement of the

1999-2000 work. However, these recommendations will be reviewed to take into account the additional information on the operation of the system, which will be gathered in the winter of 2000-2001. One of the proposed improvements involves completing and optimizing the deployment of a remote surveillance site (item 1), while the others deal with the improvement of applications that are already part of the IIS (items 2 and 3).

Item 1: Finalization and optimization of a remote surveillance site on curve no. 1 of lac St-Pierre

Experience has shown that curve no. 1 at the entrance to lac St-Pierre is a critical site for the formation of ice jams. Installing an instrument to measure the thickness and speed of the ice at that location would significantly improve the ability of the IIS to detect ice stoppages on lac St-Pierre. By comparing this information with that gathered at the two sites located downstream : curve no. 2 (two cameras and one radar) and island 3 (a camera and a bottom-founded echo sounder), ice breaking officials could identify and locate rapidly any possible ice stoppages.

The data gathered on curve no. 1 could also feed the ice evacuation model, which would improve the accuracy of the trend curves calculated by this model (see item 3). At present, this model uses ice data gathered at block 3 as entry data.

Item 2: Improving the Ice Image Processing Interface (IIPI) application

The IIPI application, which was developed to process images recorded by video cameras, is advantageous as it makes use of existing installations. About ten cameras installed around the navigation channel are already part of the IIS. The IIPI application calculates the speed and concentration of ice from the images it records and makes this information available to users on the IIS Intranet site.

During project development, the plan was to develop the ITIG in two phases. At present, phase I of the application development has been terminated. This phase centred on the development of an application which would operate under ideal weather conditions, which was verified in the winter of 1999-2000. The objective of the second development phase is to process more useful images under less-than-ideal weather conditions. Another aim is to alter the application so that it can process radar images, an important advantage as they are available at any time of the day. Moreover, the proposed improvements are inexpensive considering the anticipated results.

Item 3: Improvement of ice production and evacuation models

The comparison of the volumes of ice predicted by the production model and the evacuation model is a clue of the possibility of a jam. In 1999-2000, a CCG engineer developed an ice production model, and an evacuation model was the subject of a contract awarded to NRC. These models will be integrated into the everyday operations of the IIS in 2000-2001. The goal of the proposed project for 2001-2002 is to make improvements to both models to increase the reliability of their forecasts.

Benefits:

Financial: The use of the IIS has already produced major benefits and savings for operations and users. The information system is already helping managers make better use of CCG ice breaking and escort resources, now that more key information is at their fingertips. CCG productivity has already increased, and actual savings have been noted in maintenance and operating costs.

Environmental: The St. Lawrence waterway is continually clogged with ice in the winter months (December to March). The IIS will provide the tools to observe from a single work station the amounts of ice produced and evacuated from critical areas of the river, real time information on the pressure exerted by the floating booms and the integrity of the

latter; and real time information on the observed weather conditions. The system will allow for the use of expert decision aid systems which will provide information on the risk of ice stoppages or jams.

By helping to reduce the frequency and risk of ice jams, the IIS will significantly reduce the energy consumed by CCG ice breakers and commercial shippers.

Social: The IIS is now considered a tool to help reduce the frequency and risks of ice jams on the St. Lawrence River and flooding for residents and municipalities located on the shores of the St. Lawrence between Montreal and Quebec City. Given the increased reliability of the St. Lawrence Seaway in the winter, the arrival of the Integrated Ice System should also result in increased economic activity in the Quebec City, Trois-Rivieres, Sorel and Montreal areas; and in Quebec and the rest of Canada in general. As a result, existing jobs will be preserved and new jobs created.

Project : NEW
CCG Contact: Reginald Corriveau
(418) 648-5620

SQUAT STUDY FOR THE PURPOSE OF RE-EVALUATING UNDERKEEL CLEARANCE SPECIFICATIONS

Background:

The R&D project described in this proposal is an update of a similar project on the same subject, which was proposed and accepted in principle in 1998-99. In 1998-99, the project was known as the "Underkeel Clearance Pilot Project in Real Time". Project funding was postponed to a later date until such time as the OTF technology was sufficiently developed and validated to ensure the study is a success. One of the aims to take advantage of the findings of another R&D project under way in the CCG in 2001, i.e., project no. FJMR3 entitled "Eliminating the Effect of the Ionosphere on the OTF Solution". The knowledge acquired since then has resulted in a change in the title and scope of the study originally proposed. This document therefore sets out the study of squat as it could be done over the next three years (2001-2004).

CCG Requirements

The loading capacity of ships travelling the St. Lawrence is directly related to three elements: the maintained (dredged) depth of the channel with respect to the chart datums on the maps; (2) the elevation of the flat body of water with respect to the chart datums on the maps; and (3) the various dynamic factors and phenomena which are included in the underkeel clearance calculation (squat, roll and pitch, etc.). Squat, which is defined as the measurement of the squat of the ship when in movement, is one of the components in the underkeel clearance (UC). This squatting, which varies mainly due to the speed and width of the ship, the static draft and water depth, is evaluated based on a theoretical formula which has never been validated under actual conditions of use and the accuracy of which can vary from one ship to another. This formula constitutes the basis of the UC standard which has been in force since 1992 on the navigable channel between Montreal and Quebec city. The UC standard, which was implemented for reasons of safety and environmental protection, has been managed and enforced by the Maritime Communications and Traffic Services (MCTS) of the Canadian Coast Guard.

The short- and medium-term climatic changes suggest that the water level of the river could dip more frequently beneath the average than it has in the past 40 years. At a time when dredging is the subject of many environmental concerns, a better knowledge of the ship squat phenomenon with a view to optimizing the column of water available for navigation could be an interesting alternative to dredging should the maintained depth of the navigable channel be increased to ensure the competitiveness of ports along the St. Lawrence.

Links with the 1994-1998 Study

A preliminary study conducted between 1994 and 1998 concluded that the squat evaluation obtained by the formula currently in use could be too conservative for some types of ships, particularly those with high drafts. The study, however, was done when new technology such as the GPS-OTF and the ADCP were in their infancy. There is reason to believe that the recent developments of these technologies and the experience gained through their use would yield more conclusive findings were a new study to be conducted. Furthermore, the ellipsoid-geoid-zero relationship of maps was not well established when the first study was done, which could have made for less accurate results. The latter then did not establish with certainty the more or less conservative nature of the current UC for ships with large drafts. However, It did show the potential of GPS-OTF technology to measure the squat phenomenon accurately.

This document proposes that a new squat study be performed to re-evaluate the underkeel clearance standard in force on the St. Lawrence based on the lessons learned during the previous study and using the latest

developments in the GPS-OTF area. Given the CCG's obligations in the area of environmental protection and safety in the navigable channel of the St. Lawrence, this study has been made necessary, because the theoretical equation in use has never been validated under actual conditions of use. In addition, the preceding study reveals that the current standard should not necessarily be generalized and applied to all types of ships.

This project dovetails with the Canadian Coast Guard's R&D orientations. The CCG hopes to take advantage of new technology to meet the challenges pertaining to water depths in strategic navigable channels such as the one in the St. Lawrence, a key factor in international commerce. Moreover, from the perspective of promoting sustainable means of transport, this study will help the CCG ensure safe shipping to preserve the coastal regions and oceans.

Project Description:

To ensure optimal resource utilization, the first phase of the project (2001-2002) will involve a feasibility study and preliminary testing. The feasibility study will, include, among other things, (a) a detailed definition of CCG requirements; (b) an extensive literature review on squat studies recently conducted elsewhere in the world; (c) an analysis of available technology to accurately measure relevant parameters; (d) a well-defined quality control process covering data for all of the parameters measured; (e) the identification of resources required to gather and process data (equipment and personnel); and (f)) the definition of a detailed work plan. The knowledge acquired during the previous study (1994 to 1998) and the experience gained through the use of the GPS-OTF acquired in the time since will be put to use. Therefore, the types of ships to be studied and specific sections of the river will be selected to analyze the dynamic behaviour of ships (squat, roll and pitch) under different conditions. After the feasibility study, preliminary studies will be performed to confirm the methodology and instruments selected.

The second stage (2002-2003) essentially consists of planning and collecting data, based on the findings and recommendations of the feasibility study and the findings of the preliminary testing. This stage will also include the validation and processing of the data gathered.

The third stage (2003-2004) will be devoted to (a) determining squat, roll and pitch of ships based on the various parameters that influence these phenomena; (b) an assessment of both the accuracy and reliability of the data; and (c) a comparison with the current UC standard. As need be, requirements for additional measures will be defined to review the UC standard currently in force.

Benefits:

Environmental: An extensive knowledge of the squat phenomenon will confirm whether the current UC standard can ensure the safety of ships and consequently achieve environmental protection. If necessary, the acquired knowledge can be used to re-evaluate this standard and maintain the safety of ships. Depending on the findings, this project could lessen the need for a new project to deepen the navigable channel, which would also limit the potential adverse environmental effects.

Moreover, optimizing the UC will produce potential fuel savings for the marine industry, which would reduce greenhouse gases. In addition, this project could facilitate the implementation of new optimal measures to reduce the impact of commercial navigation on bank erosion (see item (b) below).

Social: Thanks to this study, the CCG will be better equipped to respond to concerns raised by non government organizations (NGO's) and the general public with respect to development projects involving the navigable channel. Consequently, the CCG

will improve its credibility and image with the public and NGOs.

Project: NEW
CCG Contact: Pierre Rouleau
(418) 648-7493

COMPUTER-ASSISTED ICE OBSERVATION SYSTEM IN HELICOPTERS

Background:

The ice breaking and escort operations are first accompanied by helicopter and plane ice reconnaissance patrols to gain a current picture of the condition of the ice and which routes navigators should follow.

Traditionally, the ice observer with Environment Canada did this work manually and drew on pieces of paper the various maps which are then forwarded to the CCG's Regional Ice Centres, the Canadian Ice Service (Environment Canada) located in Ottawa and the ice breaker commanders. These are delivered directly to the interested parties orally (brief summary) or there is a wait involved for the product to be downloaded. At present, once the ice observer returns to the point where he was assigned, he must retranscribe or scan these images to add colour or to make them more visible. This work requires a lot of paper handling and is time- and labour intensive. Unfortunately, the visual information (the map) is not forwarded to us in timely fashion and as such does not meet the requirements of the ice centres and the maritime clientele. The conventional data collecting method is obsolete and we must now take advantage of new technology offered to us in the form of a laptop computer. The objective will be to simplify the data gathering activity, make it more accurate and forward it as soon as possible to the CCG Ice Centres and Environment Canada.

Another problematic area is the exact location of routes or ice packs on the map prepared by the ice observer (Environment Canada). Under conditions of reduced visibility, this location cannot be readily determined, and a GPS device was deemed necessary to do so.

A Pen Computer was created in 1999 to facilitate the work of ice observers (Environment Canada). It is hooked up to a GPS device which produces standardized maps in Mapinfo format for the ice observer. The latter can see the movement on the Mapinfo map, and the software presents standard tools to insert objects known as "eggs", which are descriptions of the ice conditions (concentration, age, type, etc.). This has shown the feasibility of facilitating the work of ice observers and potentially increasing the effectiveness of the ice observer.

A prototype was used on a few ice patrols, and the users commented favourably on how it operated and provided a list of possible improvements.

Software development for this prototype has not been fully completed. The portion dealing with communications with the ice information centres was not developed in its original phase.

Moreover, since this prototype was developed, the environmental response group has shown interest in the possibilities of the product developed, particularly in locating and monitoring oil spills. It would also be able to evaluate the amount of oil spilled very quickly.

Project Description:

The prototype must be improved, as the Pen Computer did not perform to a high enough standard. The new device must be good enough to use in a CCG helicopter or on one of the Environment Canada ice reconnaissance planes (Canice 3) which are used in the Gulf region and the St. Lawrence estuary in the winter and in the Arctic in the summer.

The objective of this project is to forward ice maps as soon as possible to the CCG regional ice centres and to the Canadian Ice Service, Environment Canada, in Ottawa. We are planning on moving the Mapinfo

software library to the Caris Spatial Component library. However, a function will be retained to allow for the import/export of data in Arcinfo format. This is necessary to ensure that Environment Canada and other interested parties can retain the existing software which would cost too much to convert to the Caris format.

We also intend to improve person-machine interface by experimenting with voice recognition data entry. The prototype project did show that monotone repetition occurs while observations are being entered. This merits improvement, and voice recognition would be an important asset.

Finally, we plan to add several cartographic symbols specific to oil spills or other types of spills, including chemical products.

Benefits:

Effectiveness: The aim of this project is to (a) improve the quality, accuracy and production of products (ice maps and oil spills); and (b) forward data more quickly to the CCG regional ice centres, the Environmental Intervention Centre and the Canadian Ice Service Centre in Ottawa so that decisions can be made more expeditiously.

Client Impacts:

- The product developed will have an impact on navigators who use the St. Lawrence Gulf and River; and on the navigation routes in the Arctic. Navigators are defined as all persons wishing to find out about ice conditions;
- This product could be of potential interest to personnel on board the Environment Canada ice reconnaissance plane, which is used in the St. Lawrence Estuary and Gulf and in the Arctic.
- This product will increase the effectiveness of environmental response personnel by producing more detailed maps (according to the type of product, the thickness of the slick) and providing information on the quantities involved. This would make for more rapid deployment in the most affected areas.

Project: NEW
CCG Contact: Reginald Corriveau
(418) 648-5620

WIRELESS COMMUNICATION PROTOCOL APPLICATION FOR GEO-REFERENCED MARINE DATA INTERNET ACCESS

Background:

Federal agencies and departments, including the CCG, now have georeferenced systems for the processing, display and storage of various data such as the marine maps of the Canadian Hydrographic Service (CHS), data on maintenance (dredging) and on the presence of shoals in the St. Lawrence waterway that is available on the Waterway Navigation General Information System (WNGIS), river ice conditions in the Ice Information System and information on maritime traffic available on the INNAV system developed for the requirements of the Maritime Communication and Traffic Service.

The CCG is proposing the testing of a georeferenced data display system known as the Caris Spatial Fusion system, which makes it possible to display spatial information from various data servers available over the Internet.

The CCG also developed a navigation data information system (INNAV), which will soon be implemented in the MCTS and allows for the integration and display of georeferenced dynamic information on navigation (the positioning of ships, the calculation of sub-keel clearance, etc.).

The CCG is searching for ways of disseminating or making accessible this georeferenced data (both static and dynamic) to mobile stations or ships with electronic navigation systems (ECDIS or ECS) that are fixed or portable such as those used by pilots. In order to disseminate this information to ships, an optimized communication protocol and systems must be used for wireless communication and for users who are not permanently hooked up to an information network.

This initiative directly supports two (2) objectives in the DFO mandate, i.e.:

1. **To maintain maritime safety** through the use of cutting edge technologies, modernization and maintenance of navigational aids, improvements to maritime communications and traffic services; and the update of information services.

2. **Facilitate maritime commerce and ocean development** through measures to replace ship travel time by improving information management technologies and by increasing the effectiveness of commercial ship movements.

Project Description:

The objective will be to:

1. Evaluate new data communication protocols (WAP, XML, WTLS, etc.) which are currently being developed to respond to the increasing needs to access the Internet network for cellular telephones and portable palm-top computers.

2. Develop a communication system based on a communication protocol designed for wireless data communication, using an intermediary server serving as a gateway between mobile stations and data servers. This system would make it possible to optimize for mobile stations (ships) Internet/Intranet access to marine data servers. Find a protocol which would optimize transfers of information to ships. Based on the protocol chosen, a prototype could be designed to evaluate the performance of the protocol in relation to the needs of the CG and its clients.

3. Design a prototype to allow for bi-directional information transfers between georeferenced data servers and develop a user interface to facilitate the transfer and display of relevant data such that

mobile stations on ships using wireless communication links could gain access.

Benefits:

Financial: The use of an optimized communication protocol for wireless communication will make it possible to reduce communication charges required to access the data;

The proposed development will make it possible to standardize the georeferenced information query interface, which, in the medium term, will result in savings in the use of information systems use. In particular, it will help reduce the time and effort required to find and access the data sought.

Environmental: Once developed, this product will enable ships to gain more direct access to strategic information on navigation conditions available to the CCG, which will help improve navigation safety and bring about a concomitant decrease in the risks of maritime incidents that could have an impact on the environment.

Client Impacts: Once developed, the product will improve the efficiency of shipping on the St. Lawrence, as it will provide more effective access to information on navigation conditions, which will improve the competitiveness of Canadian ports.

Project: NEW CCG Contact: Reginald Corriveau (418) 648-5620

USER-FRIENDLY SOFTWARE FORECASTING THE TRAJECTORY OF OIL SPILLS IN CASE OF ENVIRONMENTAL INTERVENTION

Background:

Since 1988, the personnel of the Physical Modeling Section, Division of Ocean Sciences, Sciences Sector, has been doing operational oil spill forecasts in cases of environmental interventions. In 1995, the salvage activities of the Irving Whale barge resulted in the development of software to replace the manual portion of forecasting the spill. This reduced the team's response time. However, several sections need improvement so that it can be used by persons who have not been initiated to numerical modelization.

Project Description:

The idea is to make operational a research tool used by the Physical Modeling Section, Division of Ocean Sciences, Sciences Sector, to forecast the trajectory of oil spills in cases of environmental intervention.

This is a two-stage project:

Stage 1: involves developing a user-friendly and better performing software.
Stage 2: calls for the development of integration tools for the Coast Guard – Laurentian Region so that they can use the software.

Benefits:

Efficiency: In addition to the development of a better model, it will also be possible to entrust this work to users in the CG – Laurentian Region as part of their normal operations. This would achieve better resource utilization and decrease response time.

Environmental: Reducing the time it takes to produce oil spill models which are improvements over existing ones increases response efficiency and helps protect the environment.

Client Impacts: This procedure clarifies the roles of various sectors of Fisheries and Oceans Canada. The Coast Guard is confirmed in its operational role to respond to external requests. The Sciences Sector has been clearly identified and used as support for the development and analyses of cases requested by external clients for environmental interventions.

Project : NEW
CCG Contact: Martin Blouin
(418) 648-4557

CENTRAL & 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.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002

Central/Arctic Region/ Région du Centre et de l'Arctique

Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2002 FUNDS/ FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG GCC	PARTNER PARTENAIRES	
HCAA4	Evaluation of Arctic Diesel Fuel and Marine Diesel Oil Blends with and without Lubricity Additives in a Vasa 32 Diesel Test Engine Évaluation de carburant diesel Arctic avec ou sans additif de lubricité sur un moteur Vasa 32 de pointe	CCG GCC	225	0	
FGRS4	Small Footprint Sewage Treatment Plant (Feasibility Study) Usine modulaire de traitement des eaux usées à l'échelle réduite (Étude de faisibilité)	CCG GCC	20		
FCW4	Modular Shipboard Water Treatment System (Phase III & IV) Système modulaire de bord de traitement de l'eau (Phases III et IV)	CCG GCC	150	0	TOSD DGSTO
FRCU4	Industrial Noise Interference with Marine Mammal Interférence des bruits industriels avec les mammifères marins	CCG GCC	70	0	ICE-BREAKING DÉGLAÇAGE
	Central/Arctic/Centre et Arctique - TOTAL		**465**		

EVALUATION OF ARCTIC DIESEL FUEL AND MARINE DIESEL OIL BLENDS WITH AND WITHOUT LUBRICITY ADDITIVES IN A VASA 32 DIESEL TEST ENGINE

Background:

In prior phases of this project, the CCG has developed a new test standard and test equipment to determne the lubricity of diesel fuels and to ascertain the correct amount of additives which might be required to bring any specific fuel to within viable operating specifications. As a final precautionary step, it is proposed that the lubricity additive(s) be tested in a stationary generator set engine in the Arctic with low lubricity Arctic diesel fuels. The final round of tests will assure the viability of the test procedures and standards over a longer-term of application before CCG icebreakers can be committed to using lower lubricity fuels with lubricity additives in a CCG heavy duty ice-breaker engine over lengthy time periods. This step of testing in a full size medium speed diesel engine is proposed so that any potential longer term engine problem during testing would not jeopardize a CCG heavy icebreaker during a major mission. Discussions have been undertaken with the Northwest Territories Power Corporation (NWTPC) for potential utilization of their Vasa 32 engine for test purposes. This in-line nine cylinder engine is coupled to a stationary generator set. The engine/generator is used for electric power and heat generation in the Arctic community of Iqaluit.

Project Description:

It is proposed that the lubricity additive that has the best performance to date in the bench test rig – Ball on Three Disk (BOTD) tester be tested in the NWTPC Vasa 32 engine (12 cylinder-V configuration), (initial discussions indicate that the NWTPC will approve the proposed Vasa 32 test program). It is anticipated that DDC8V71T engine data be used to augment the BOTD data. It is unlikely that the data from the Bosch pump rig tests (being co-operatively carried out by Shell Canada) can be completed in time to be included. It is proposed that a separate fuel system be used for each of the two cylinders on the Vasa 32 engine. The remaining ten cylinders would use P50 without any lubricity additives. One of the cylinders, with its separate fuel system, would have a heated blend of P50 plus the selected lubricity additive. The second of the cylinders with its separate fuel system would have heated P50 without the selected lubricity additive. This second cylinder plus the first one would operate at the same elevated fuel temperatures. The first cylinder would receive its fuel from a separate 13,600 L fuel tank. The lubricity additive would be added to this tank. The tank would utilize a circulating pump to initially mix the fuel additive. To obtain the same elevated fuel temperature to each fuel injection pump inlet, the fuel supply line for each of these cylinders would move through the same water bath heat exchanger. In other words, the fuel to each cylinder would have its own separate paths through the water bath heat exchanger and would not be able to mix with each other. By both moving through the same water bath heat exchanger at the same mass flow rate, each fuel would receive the same amount of heating/cooling and thus have the same fuel temperature at the inlet to each high pressure fuel injection pump. This fuel injection system was fabricated in the previous year's study so it just has to be re-assembled and shakedown/calibration tested.

Benefits:

Financial: Several millions of dollars can be saved if Arctic fuel re-supply can be avoided by using Arctic diesel from supplies in the North with lubricity additives developed for Canadian climatic conditions

Environmental: This project permits environmentally friendly low sulphur diesel fuel to be consumed by CCG heavy ice breakers and other diesel engines. Fewer

re-supply voyages mean lower CO2 generated

Social: The outcome of this project will lead to lubricity additive formulation development that will in general benefit all heavy/light duty diesel engine applications for Canadian climatic conditions. This project also demonstrates CCG responsible behaviour in the North to help protect an environmentally sensitive area.

This project will benefit all of CCG's diesel engine application areas through reduced maintenance costs. This project is also being funded by and supported in-kind by a number of Canadian and US industries including all of the major additive manufacturers.

Project: FRCY4
CCG Contact: Patrice St. Pierre
(519) 383-1885

SMALL FOOTPRINT SEWAGE TREATMENT PLANT (FEASIBILITY STUDY)

Background:

It is of considerable interest to the Canadian Coast Guard (CCG) and the Department of Fisheries and Oceans (DFO) to see the development and operation of a waste water treatment system that is self-contained and is specifically designed to address those requirements of small marine vessel applications.

This technology is being applied in order to accommodate the "environmental policy" Initiatives of the DFO as well as the CCG. This document will provide a brief outline of the waste water that CCG/DFO wants treated. The ultimate goal of this system is to apply a proven technology that will provide the following discharge on a marine vessel:

Biochemical Oxygen Demand: < 20 ppm
Total Suspended Solids: < 20 ppm
E.Coli Count: < 1 cfu/100ml
Oil and Grease: < 1 ppm

The proposed system is to be designed for installation on board those smaller vessels that are used in the Coast Guard in Search and Rescue work as well as Environmental Response Operations. They are of a shallow draft configuration with an average length of sixty feet. They usually perform their tasks in inland waters.

The vessel configurations will vary from vessel to vessel and the proposed systems should be designed in such a way so as to allow for ease of entry through access hatchways averaging 33" x 58". A minimum of vessel disruption is to be considered in the design of the equipment.

Project Description:

Smaller vessels, of the type being addressed under this study, rarely have any specific waste water treatment equipment on board save for a holding tank to allow for the collection of blackwater. Graywater is usually allowed to go overboard with no treatment being applied. The bilge water is usually pumped out separately when the holding tanks are cleaned out during a maintenance cycle.

The objective of this proposal is to address the potential for the installation of a treatment system for the waste water which is generated by the staff and equipment of the vessel.

The following are the specific issues which will be addressed:

- Show that the treated waste water can be discharged with a discharge rating of 1 CFU/100ml E.Coli bacteria.
- Show that the treated waste water generated will have a biological oxygen demand reading of <20 ppm.
- Show that the treated waste water generated will have a total suspended solids reading of <20 ppm.
- Show that the treated waste water generated will have a oil and grease content of < 1 ppm.
- Show that the technology proposed is designed for use in the marine industry and specifically addresses those issues and concerns presented by vessel operators.
- That the final proposal will address all current environmental codes and engineering practices.
- It is understood that the water to be treated is human waste, shower water and bilge water. The bilge water will be contaminated with no more than 5% hydrocarbons.
- That the system will be automated thus eliminating the need for hands on operation by ships' personnel.

Consideration must be given to the fact that this is a small vessel and that the weight of the proposed system must not negatively impact the medial and lateral trim of the vessel.

Benefits :

Financial: Develop a single process to deal with discharge overboard will reduce the O&M cost throughout the life of the vessel. The capital expenditures will be reduced.

Environmental: To date the discharge level from marine sewage devices do not meet the discharge criteria, an effort to change this is being made and the results are more than satisfactorily.

Social: E-coli will not come from marine source.

Project: FGRS4
CCG Contact: Patrice St. Pierre
(519) 383-1885

MODULAR SHIPBOARD WATER TREATMENT SYSTEM

Background:

The Canadian Coast Guard, C&A has investigated the possibility of improving vessel discharge by introducing a BIO-reactor? treatment system developed by Advanced Biological Solutions Inc (ABS). The system was introduced as an hybrid on the CCGS Griffon and a as a complete design on the CCGS Dumi, CCGS Eckaloo, and CCGS Nahidik.

In 2000, an effort to improve the hybrid system was undertaken by modIfying the primary hybrid system. Also bilge water was introduced to the CCGS Dumit treatment plant to test the extent to which this process might be applied. Results were extremely satisfactory, including oil and grease discharges below detection limit and zero e-coli zero throughout the test.

Project Description:

This coming year, 2001 we are proposing to improve the monitoring of the exisiting plants to provide more data to the operator and to improve the operational procedures and manuals. As well, we plan to repeat the test on the CCGS Eckaloo for bilge water treatment. This test will also include the evaluation of an oil content meter which will not be affected by volatile compounds, at the parts per billion level. This should improve the ability to accurately measures discharges below currently detectable limits. This will aid in the certification of the process and provide "proofs" of operation.

Benefits:

Financial: Develop a single process to deal with discharge overboard will reduce the Operating & Maintenance cost throughout the life of the vessel. The capital expenditures will be reduced.

Environmental: To date the discharge level from marine sewage devices do not meet the discharge criteria, an effort to change this is being made and the results are more than satisfactorily.

Social: E-coli will not come from marine source.

Project: FRCW4
CCG Contact: Patrice St. Pierre
(519) 383-1885

INDUSTRIAL NOISE IMPACTS ON MARINE MAMMALS: DEVELOPMENT OF TOOLS FOR OBJECTIVE ENVIRONMENTAL ASSESSMENTS, AND APPLICATIONS

Background:

For the last couple of decades, two trends have become obvious and apparently inevitable: Marine biodiversity decreases while marine industrial activities increase. Every year, COSEWIC classifies more marine mammal populations as "at risk", e.g. some beluga populations are endangered, and Pacific killer whales are threatened. Heavy shipping, shore and offshore construction, geophysical exploration and other industrial activities have steadily been increasing in these animals' habitat. All of these activities emit loud underwater noise which has various short-term and long-term effects on marine mammal populations. Objective tools are required to assess the degree of impact and to develop regulations and mitigation methods. Last but not least, public awareness for marine mammals and public demand for solutions is stronger than ever and steadily growing.

Project Description:

In the framework of our R&D project, we are developing such an objective tool for acoustic environmental assessments of man-made noise. The project consists of four phases, which run concomitantly. In phase 1, we conduct acoustic experiments with trained marine mammals at the Vancouver Aquarium, to measure noise effects such as auditory masking. In an earlier R&D project for the Canadian Coast Guard, we measured how industrial noise interfered with beluga whale communication, through trained behavioural experiments in a pool. In the current project, we study hearing abilities of Steller Sea Lions. This species is considered threatened by Canadian Authorities (the very same population is considered endangered by US Authorities). Population numbers are declining, while industrial noise in their habitat is increasing. Our animal experiments are non-invasive; animals are trained for a "yes" or "no" response through positive reinforcement. Subsequent experiments are based entirely on the animals' own will to participate. With the data collected, we enter phases 2 and 3. In phase 2, we develop a software algorithm for how noise and signals important to the animals (e.g. their own communication signals) travel through their habitat. We need to model along what paths sound travels, and what received sound levels are. In phase 3, software algorithms are developed to model biological noise effects. We are working on four such algorithms to determine:

a) over what ranges from a noise source, the noise is audible to the target species;
b) over what ranges it disturbs animals;
c) over what ranges it interferes with the animals' communication; and
d) over what ranges the noise can cause physiological damage to the animals' body (e.g. the inner ear).

Phases 2 and 3 are combined into a self-contained software package that can be applied to various types of noise (low-frequency, high-frequency, broad-band), to various ocean environments (ice-covered arctic versus open ocean; various bottom sediments), and to differing marine mammal species (dolphins, whales, seals and sea lions).

Phase 4 finally comprises the application of the software package to real-life scenarios. In particular, we will apply the tool to assess the effects of Canadian Coast Guard icebreakers affecting endangered beluga whales. The severity of the impact is assessed by a comparison with 'standard' passenger ferries affecting threatened killer whales. Also, the effects of extremely large and noisy ships such as icebreakers are compared to

cumulative effects of small but very numerous (whale-watching) boats.

Benefits:

Financial: CCG will have a fast, efficient, cost-effective tool at hand to assess environmental impacts of their own and industrial activities. This tool will be much more cost-effective than the traditional way of employing animal observers in the field.

Environmental: The tool can be used for acoustic environmental assessments of CCG's own marine activities as well as any other industrial (and even naval) activities falling into CCG's mandate.

Social: Although protecting animals (as compared to humans) is likely not considered "social", this project will enable CCG to appease their own minds and the public by fostering the understanding of noise effects on marine mammals and laying the groundwork for potential mitigation methods and /or sensible regulation.

Project: FRCU4
CCG Contact: Patrice St. Pierre
(519) 383-1885

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.

R&D PLAN 2001-2002
PLAN DE R ET D 2001-2002
Pacific Region/Région du Pacifique
Project List/Liste des projets

PROJECT NO. / N° DU PROJET	PROJECT TITLE / TITRE DU PROJET	FUND SOURCE / SOURCE DE FIN.	2001/2001 FUNDS/ FINANCEMENT		BUSINESS LINE / ACTIVITÉS PRINCIPALES
			CCG / GCC	PARTNER / PARTENAIRES	
	No projects were submitted for fiscal year 2001-2002 On n'a présenté aucun projet pour l'exercice financier 2001-2002	CCG GCC	0 0	0 0	
	Pacific /Pacifique - TOTAL:		**0**		