petroleum RESEARCH newfoundland & labrador

Request for Proposals
(RFP)

Phase 1
Needs Analysis and Project Development
"Joint Industry Project for Enhanced Iceberg and Sea Ice Drift Forecasting"

April 13, 2012

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1. Definitions and Introduction

1.1 Definitions

For the purposes of this RFP, the following definitions are provided:

"**Addendum"** means the document issued by Petroleum Research to all Service Providers during the open period of the RFP, containing additional information or corrections, made by Petroleum Research, to the RFP already issued.

"Budget" shall mean the budget for the Project as set forth in the Proposal.

"Contract" means the legal written agreement between the Service Provider and Petroleum Research to provide the research and development services and deliverables as stated in the SOW under any specified negotiated conditions in exchange of a valuable consideration.

"Deliverable(s)" mean the deliverables as described in Section 4.1 of this RFP.

"JIP" means a Joint Industry Project.

"Late Participant(s)" shall mean any company or organization approved by the Participants at a later date to be a participant of the Project and who shall have all the rights and benefits of Participants including the right to appoint a representative as a member of the Project Steering Committee.

"May" shall indicate something that is not mandatory but permissible.

"Participant(s)" shall mean Hibernia Management and Development Company Ltd., Husky Oil Operations Limited in its capacity as Operator of the White Rose Project, Suncor Energy Inc. in its capacity as Operator of the Terra Nova Project, ExxonMobil Canada Properties in its capacity as Operator of the Hebron Project and any Late Participant.

"Project" means Phase 1 of the JIP for enhanced iceberg and sea ice drift forecasting, as more particularly described in the SOW hereto.

"Proposal(s)" means the document(s) submitted by the Service Providers in response to the RFP.

"Request for Proposal (RFP)" means the documents issued to the Service Providers by Petroleum Research in connection with the preparation of the Proposal, including all Addendums.

"Scope of Work (SOW)" means a formal written description that captures and defines the work activities, deliverables and timeline a Service Provider will execute against in performance of the specified work for Petroleum Research.

"Service Provider(s)" means any person(s), corporation(s), partnership(s), joint venture(s), company(s) or other organization(s) which may submit a Proposal to Petroleum Research in response to the RFP.

"Shall/Must" shall indicate a mandatory requirement. Failure to meet a mandatory requirement may result in the rejection of a Proposal.

"Should" shall indicate something that is recommended but not mandatory. If the Service Provider fails to provide recommended information, Petroleum Research may, at its sole option, ask the Service Provider to provide the information or evaluate the Proposal without the information.

"Steering Committee (SC)" means a committee composed of representatives appointed by the Participants and/or any Late Participants to address all Project scoping, governance and policy decisions.

"Successful Service Provider" means the Service Provider whose Proposal has been accepted by Petroleum Research and with whom a Contract will be negotiated.

1.2 Project Introduction

Petroleum Research Newfoundland & Labrador (Petroleum Research) is a federally-incorporated, not-for-profit corporation that identifies opportunities, develops proposals, funds, and manages the execution of research and technology development projects on behalf of the Newfoundland and Labrador offshore oil and gas industry. Research and technology development projects funded must be strategically and commercially relevant, create value for members, be compliant with C-NLOPB R&D guidelines, enhance local R&D capacity and capability in strategic research areas and enable broader application of technologies developed through Petroleum Research.

The Participants are proposing a multi-phased Joint Industry Project (JIP) to be managed by Petroleum Research with the overall objective to determine if improvements in existing iceberg and sea ice forecasting models can have a real impact on operational decision-making and resource planning in terms of reliability and cost effectiveness. Enhancements in the accuracy of iceberg and sea ice drift models for application at both existing production projects and/or new exploration areas will enable more reliable quantitative comparisons of multiple threats and/or the improvement of decision support tools to assist in assessing ice management options.

The aim of the project is to conduct the research effort in a phased approach where the continuation to subsequent phases is based on the technical justification and recommendations of the previous task(s). The first phase will address a needs analysis and an understanding of the technology gaps. The tasks comprising Phase 1 will document the strengths and limitations of current iceberg and sea ice drift forecasting models in the context of well-defined industry needs for sea ice forecasts, and then establish the sensitivity of the models to new developments and/or better real time data inputs from a "cost versus improvement in performance" perspective.

Phase 1 – Needs Analysis and Project Development:

- Define key needs for iceberg and sea ice forecasts, including the most important ice factors and the associated time and space scales of interest (in relation to clear industry operations scenarios);
- Benchmark existing capabilities, both strengths and limitations, of iceberg and sea ice drift forecasting models that are currently available (and being used);
- Determine the sensitivity/accuracy of existing or enhanced iceberg and sea ice drift models to new developments and potential benefits to current and future oil industry operations;
- Evaluate benefits of including more real-time data into these models;
- Detailed scope of work, execution plan and cost estimate for Phases 2-3; and
- High level scope-of-work, execution plan and cost estimate for Phases 4-5.

Based on the results and technical justification obtained from each phase, a decision will be made on whether or not to move forward with the next phase and related tasks, as follows.

Phase 2 – Concept Identification and Evaluation:

- Identify new technologies and/or enhancements to existing technologies; and
- Evaluate new or enhanced methodologies.

Phase 3 – Analysis and Development:

- Develop/implement any new novel iceberg and sea ice drift models;
- Integrate real-time inputs into selected drift models (i.e. iceberg profiles, measured sea ice drift trajectories, ocean currents and measured/forecasted wind data); and
- Confirm impact of real-time inputs on the accuracy and reliability of iceberg and sea ice drift forecasting.

Phase 4 – Demonstration and Evaluation:

- Test model(s) through field trials/drifter buoys, if warranted.
- Identify suitable devices to gather met-ocean data (e.g. Acoustic Doppler Current Profiler (ADCP), Upward Looking Sonar (ULS), etc.);
- Design a network of devices for collecting information in real-time, if warranted;
- Deploy such a network for real time information on iceberg and sea ice movement; and
- Integrate data with the drift models for verification within an actual or simulated operational setting.

Phase 5 – Technology Integration and Training:

- Develop training material and/or simulation tools to demonstrate incorporation of the model into an ice management system.

Successful selection for Contract award will consist of agreement by the project Steering Committee on the accepted Phase 1 project Proposal, to include project goals, project execution plan, and costs. It is expected that all work and expenditures for Phase 1 take place in Newfoundland and Labrador (subsequent phases of the JIP will also be required to be conducted in Newfoundland and Labrador). The Successful Service Provider (and any consultant(s)/sub-contractor(s)/vendor(s) where used) will be required to have a local base of operations from which the Scope-of-Work (SOW) will be executed and where the Contract will be administered.

1.3 Objective of the Request for Proposal

Petroleum Research, by means of this RFP, is seeking Proposals from qualified Service Providers to conduct Phase 1 – Needs Analysis and Project Development for the JIP on Enhanced Iceberg and Sea Ice Drift Forecasting as detailed in the SOW as specified in Section 3, herein.

1.4 Background Information

Forecasting of iceberg and sea ice movements, along with changes in their physical characteristics, is a critical input to any ice management system. For example, short range ice forecasting, on the order of hours to days, is one of the key inputs needed to assess which ice features present the highest risk to any given operation and which should be managed, and ultimately, at what point an operator should shut down and move off site. Similarly, good longer range ice forecasts, on the order of weeks to months, would allow operators to more reliably plan equipment mobilization and demobilization schedules, together with the associated costs

and contractual details. In order for an operator to make informed and well-based decisions, knowing the level of uncertainty in both short and longer range iceberg and sea ice forecasts may be as important as the forecasts themselves.

With regards to iceberg drift forecasting, the iceberg drift model developed by the National Research Council – Canadian Hydraulics Centre (NRC-CHC) and the Canadian Ice Service (CIS) has been extensively used to forecast the drift and deterioration of icebergs on the east coast of Canada, with special emphasis on the Grand Banks. The previous CIS drift model used ocean currents predictions obtained from the CIS operational Community-Ice-Ocean-Model (CIOM). The CIS/CIOM is a framework used for implementing ice forecasting models by allowing the exchange of data through interface modules between the ice model, an atmospheric model, an ocean model and an output model. Also, previous iceberg prediction models assumed a uniform forcing current independent of the iceberg keel's depth. However, the NRC-CHC/CIS iceberg forecasting model has recently undergone several major improvements. These improvements include the use of an enhanced iceberg deterioration model considering various thermal processes and calving, the use of a variable vertical profile for water currents (values at 10 meter intervals) and the ability to interact with other available met-ocean models to obtain environmental data. However, additional enhancements (e.g., incorporating more rigorous assessments of the iceberg shape, mass and keel cross-sectional areas, the use of real time environmental data and a more realistic consideration of vertical variations in the current profile acting on the keel) and validation of a modified NRC-CHC/CIS iceberg drift model could provide improved forecasting capabilities.

Any proposed enhancements to either iceberg or sea ice forecasting methods will only be useful if the improvements have a significant impact on the decision-making process relative to any mitigation activities. Thus, a sensitivity analysis is needed as a first step to see if any further ice forecasting model enhancements are justified. In this regard, the cost and practicality of acquiring input parameter data to drive the model(s) is a very important consideration. If the improvements are determined to be of benefit from both a reliability and cost effectiveness point of view, then field trials to validate the accuracy of the modified model(s) may be considered. The NRC-CHC/CIS iceberg model is compatible with several ocean current models and it is important to know which one yields the greatest accuracy over any given area of interest. It is possible that different current models will be preferred on the Grand Banks versus northern Newfoundland and Labrador Sea waters and these models should also be assessed. Also, the impact of key real-time inputs on the accuracy of the model along with the practicality and costs of obtaining the data need to be assessed.

A great deal of effort has also been expended on sea ice movement forecasts, including work at CIS, but the spatial and temporal scales of their models are typically coarse in relation to industry's short term sea ice forecast needs. Sea ice drift forecasting has typically been done on a project by project basis, by specialized contractors using readily available information, largely consisting of local ice observations and short term wind forecasts, with consideration also being given to tides and the Coriolis Effect. Other parameters are treated as an unknown "constant" current component which is calibrated based on the observed motion of the ice and updated periodically. The effects of spatial and temporal changes in ocean currents and internal ice stresses (i.e. the friction and ridging between floes) have been difficult to forecast. However, knowledge of internal stresses (or ice pressure) is a very important parameter affecting the ability of operators to physically manage ice with support icebreakers.

The accuracy of a sea ice drift model is largely limited to the duration of the wind forecasts. From a practical point of view relative to ice management operations, the ice area passing a given location over time frames of several hours to a day is important. However, forecasts over two-day or four-day time frames are also desirable since some drilling activities require more than 24 hours to safely suspend and/or to secure a well for disconnection (resulting in the need for ice drift forecasts that extend beyond a 24 hour time period).

Significant advancements have been made recently in large scale coupled ice-ocean-atmospheric models used for longer range forecasting of sea ice motions and conditions, i.e., forecasts over time frames of weeks to months and for climate change assessments. However, these models are limited with respect to practical requirements for operational sea ice forecasting, in that the projected ice conditions (thickness, velocity, etc.) are averaged values over large grid cells (many kilometers) and longer time frames (over days). Also, the accuracy of the models may be limited for near-shore conditions, particularly with respects to ice pressure events.

2. Administrative

2.1 Technical and Contractual Contact

Any questions regarding the technical content of the RFP, the contractual terms and conditions or the proposal format must be written and submitted by post or by e-mail to the contact stated below with the subject line "Questions/RFP/Enhanced Drift Forecasting JIP". All inquiries must include a return e-mail address as questions, whether received by post or by e-mail, will only be answered by return e-mail.

Petroleum Research Contact:

Name	Charles E. Smith
Address	Petroleum Research Newfoundland & Labrador Baine Johnston Centre, Suite 802 10 Fort William Place St. John's, NL A1C 1K4 Canada
Phone	(709) 738-7918
Cell	(709) 691-6984
Fax	(709) 738-7922
E-mail	charles.smith@petroleumresearch.ca

2.2 General Instruction for Preparing Proposal

Upon receipt of the RFP, the Service Provider must complete and promptly return to Petroleum Research the Form of Acknowledgement contained as Attachment 1, hereto, stating if they will or will not submit a Proposal in response to the RFP.

Service Provider shall incorporate in the Proposal all relevant and required information concerning the requirements as stated hereunder and submit the Proposal as stated in Section 2.5, herein.

Service Provider shall not be reimbursed for any costs, expenses or charges which the Service Provider incurs or is required to expend in its preparation of a Proposal, including, but not limited to, the Service Provider travel and attendance at any clarification or pre-award meetings. Neither, Petroleum Research nor any of the Participants shall not be under any liability whatsoever for or in respect of payment of any said costs, expenses or charges.

The Proposal shall remain open for acceptance by Petroleum Research and irrevocable for a period of ninety (90) days after the closing date and time of receipt as defined in Section 2.5.3, herein. Service Providers shall be notified in writing when selection of a Successful Service Provider has been made.

The lowest cost Proposal will not necessarily be accepted. Petroleum Research reserves the right to accept the Proposal which it deems most advantageous to accomplish the SOW as stated in Section 3, herein, and also reserves the right to reject any or all Proposals, in each case without notice.

Petroleum Research reserves the right, at its sole discretion, to negotiate with any Service Provider they believe has the most advantageous Proposal or with any other Service Provider or Service Providers concurrently. In no event will Petroleum Research be required to offer any modified terms to any Service Provider prior to entering into a Contract with the Successful Service Provider.

2.2.1 Mandatory Requirements

To declare the Proposal compliant, the mandatory requirements must be met by the Service Provider. Proposals which do not meet all mandatory requirements may be rejected and deemed as non-responsive.

Mandatory Requirements	**Reference** (section of this RFP that describes each of the requirements in more detail)
The Service Provider must complete and promptly return to Petroleum Research the Form of Acknowledgement contained as Attachment 1, stating they will submit a Proposal in response to the RFP.	2.2
The Proposal must be complete, signed on the Service Provider's behalf and under seal by a duly authorized signing officer of the Service Provider and submitted in a manner consistent with the requirements of this RFP on or before the closing date.	2.5
The Service Provider must carry out the work in Newfoundland and Labrador.	1.2
The Service Provider must provide information to demonstrate their ability to complete a project [e.g.: References, qualifications and experiences].	2.5.1
The Technical Proposal and the Cost Proposal must be submitted separately in clearly marked and sealed envelopes with both signed by a duly authorized officer of the Service Provider.	2.5
Seven (7) hardcopies and one (1) electronic copy of **both** the Technical Proposal and the Cost Proposal must be submitted as a single package by post, courier or in person.	2.5.3
Comply with all applicable Canadian/Newfoundland and Labrador regulations, standards and laws.	2.6
The Service Provider must provide costing information in Canadian Dollars ONLY in the Cost Proposal.	2.5.2
The Service Provider must include an Organization Chart showing the Project team along with the resumes of all key personnel. A brief description of the roles and responsibilities for each member of the Project team shall be included.	2.5.1
The Service Provider must provide a detailed description of the Project management approach that will be used to manage the overall Project.	2.5.1

The Service Provider must provide a detailed integrated Project schedule of all Project activities from the date of contract award through project completion	2.5.1
The Service Provider must disclose all companies cooperatively involved in presenting an integrated solution. Disclosure shall explain the unique capabilities and expertise relationships with which they propose to work.	2.5

2.3 Discrepancies, Omissions or Clarifications

The Service Provider is required to carefully study the RFP and to obtain all information they may require to enable submission of the Proposal. In responding to the RFP, the Service Provider shall be deemed to have satisfied itself as to the correctness and sufficiency of its Proposal as submitted. No claim whatsoever shall be entertained arising out of a Service Provider's failure to study the RFP or to submit the mandatory information required in Section 2.2.1. No Proposal shall be conditional upon the availability of labour, staff, equipment, materials, permits, authorizations or anything whatsoever which the Service Provider is required to provide.

Should Service Provider find discrepancies in or omissions from the RFP, or have any doubts as to the meaning or intent of any part thereof, Service Provider shall notify Petroleum Research by e-mail or by facsimile to the contact as specified in Section 2.1, herein. Questions and comments that are deemed to materially affect the RFP requirements, project scope, time line, etc. or that may be of interest to all prospective Service Providers will be handled as an Addendum while the RFP is open and will be made available to all Service Providers via the same means as the RFP was distributed.

2.4 Rejection of Proposal

Petroleum Research and the Participants reserve the right to reject any Proposal or part thereof which is incomplete, conditional or obscure, contain additions not called for, contain irregularities of any kind or does not fulfill the mandatory requirements listed in Section 2.2.1. Petroleum Research and the Participants further reserve the right not to award this Contract if Petroleum Research and the Participants determine that the Service Providers' Proposals do not offer sufficient information and opportunities to complete the SOW as specified herein.

2.5 Preparation and Submittal of Proposal

In order to address the needs of this RFP, Petroleum Research and the Participants encourage Service Providers to work cooperatively in presenting integrated enhancements for iceberg and sea ice drift forecasting. Service Provider team arrangements may be desirable to enable the companies involved to complement each other's unique capabilities and expertise in iceberg and sea ice drift forecasting, while offering the best combination of performance, enhancements, cost and deliverables to be provided under the RFP. Petroleum Research and the Participants will recognize the integrity and validity of Service Provider team arrangements provided that:

(a) The arrangements are identified and relationships are fully disclosed, and
(b) A prime Service Provider is designated that will be fully responsible for all Contract performance and requirements.

Service Provider Proposal shall be submitted in two (2) parts; a Technical Proposal and a Cost Proposal as set forth below. Both the Technical Proposal and the Cost Proposal must be submitted separately in clearly marked and sealed envelopes. Service Providers must also submit an electronic version (.PDF) plus hard copies of both the Technical and Cost Proposals as specified in Section 2.5.1 and Section 2.5.2, herein.

Both the Technical and Cost Proposals shall be signed by a duly authorized officer of the Service Provider. If the Service Provider is a corporation, the Proposal must be signed on the corporation's behalf and under seal by a duly authorized signing officer of the corporation to include the office held by the singing officer.

If a partnership or joint venture submits a Proposal, a "Power of Attorney" shall be submitted with the Proposal executed by all of the general partners or members of the joint venture, designating and appointing one of the general partners as the authorized signer for the Proposal on behalf of the Service Providers, to act for and bind all Service Providers in all matters relating to the Proposal and, in particular, to agree that each party or member of the partnership or joint venture shall be jointly liable for all duties and obligations assumed by the Service Providers under the Proposal and Contract, if awarded.

2.5.1 Technical Proposal

The Technical Proposal must fully demonstrate how the Service Provider will fulfill the objectives of the Project and meet all deliverables as described herein. Service Providers must provide the following information in sufficient detail to enable Petroleum Research and the Participants to properly evaluate the Proposals based on the criteria listed in Section 5, herein.

(a) The official registered name and contact information (titles, direct telephone and fax numbers and e-mail addresses) of the Service Provider(s) and other key team members who will be involved in the Project, including any university, institute, company or other affiliations;
(b) An executive summary (EC) presenting a high-level synopsis of the Service Provider's response to the RFP. The EC should be a brief overview of the proposal and should identify the main features and benefits of the proposed efforts to be undertaken;
(c) A detailed description of the Project management approach that will be used to manage the overall Project and client liaison including an organization chart of the Project team with roles and responsibilities. This shall include a description on how the Contract will proceed from beginning to end including how change shall be managed;
(d) A detailed description of the technical approach that will be taken, the tasks, sources of data and information and other resources including third party sub-contractors that will be used and the specific tasks for which they will be responsible;
(e) A detailed integrated Project schedule with a Gantt chart from Project award date to final issue of deliverables including completion of major milestones, scheduled Steering Committee meetings, and the issuance of interim progress reports at a frequency to be determined and all draft and final reports. The schedule shall provide an estimate of the time for each task, both in person hours and elapsed time and include time allowances where Petroleum Research and/or Steering Committee review is required for Deliverables, etc. (period could be of the order of 2-4 weeks depending on the document and/or level of review required); and
(f) An overview of the relevant experience and qualifications of the key management and technical staff identified in the proposal including a project organization chart along with resumes of key personnel proposed for the project. A brief description of the role and responsibilities of each proposed team members should be included.

2.5.2 Cost Proposal

The Cost Proposal shall include the Project Budget with an estimated cost for each task in Canadian dollars for the work proposed and an overall Project cost. The Budget shall provide a detailed breakdown of all costs to complete the Project. Details shall include all project management costs, administrative support costs, individual professional service and personnel costs, broken down in hours worked and cost per hour in Canadian dollars, direct and indirect expenses to include materials, anticipated travel and incidental costs as well as any contingency costs incorporated.

The Budget must include a line item for all costs associated with any contractors' visits and/or contractors' studies as well as any other subcontractor or technical expertise provider to the Project.

2.5.3 Submission Instruction and Deadline

Seven (7) hardcopies and one (1) electronic copy of both the Cost Proposal and the Technical Proposal must be submitted as a single package by post, courier or in person and must be received on or before **Friday, May 18, 2012, 5:00PM (Newfoundland Time).** E-mail submissions **will not be accepted**.

Proposals are to be addressed and marked as follows:

Address	Petroleum Research Newfoundland & Labrador Baine Johnston Centre, Suite 802 10 Fort William Place St. John's, NL A1C 1K4 Canada
Marked	Confidential Proposal – Enhanced Drift Forecasting JIP Attention: Charles E. Smith

2.6 Contract

Any Contract resulting from this RFP shall be governed by the Laws of the Province of Newfoundland and Labrador and shall be issued in the legal entity name of the Service Provider(s) exactly as that Service Provider's legal name is stated in the response document.

The Proposal of the Successful Service Provider will form part of any Contract by attachment and will be incorporated by reference. Claims made in the Proposal will constitute contractual commitments on behalf of the Successful Service Provider. Any provision in the Proposal may be included in the Contract as a direct provision thereof. Petroleum Research and the Participants have no liability unless and until a Contract is signed. Neither Petroleum Research nor the Participants will be responsible for any of the Successful Service Provider's legal costs associated with Contract development.

The Contract will provide for the following:

(a) Petroleum Research's standard payment terms which are net 30 days from receipt of the invoice. All applicable taxes must be shown separately on all invoices;
(b) The Contract shall be reimbursement based and all progress payments requested by the Successful Service Provider must be supported by sufficient detail relative to the work completed, resources

used, costs incurred, and hours worked and must be approved by Petroleum Research before payment;

(c) No fee payment will be made on the cost of work incurred to remedy errors or omissions for which the Successful Service Provider is responsible; and

(d) The Successful Service Provider will be required to execute a confidentiality agreement and accept the intellectual property rights, terms and conditions as set forth in the Contract.

In the event of a decision by Petroleum Research and/or the Participants to terminate the Project at any point, liability to the Successful Service Provider will extend only to those costs actually and properly incurred up to the time of such termination.

2.6.1 Contractual Documentation

The Successful Service Providers will be expected to sign a Petroleum Research standard Research & Development Services Agreement (RDSA), amended as required, which will govern all aspects of the services to be delivered. The RDSA will serve as the Contract between Petroleum Research and the Successful Service Provider. As specified in Section 2.6, herein, the RDSA will incorporate the content of this RFP, the successful Proposal, clarification questions and any other relevant terms and conditions.

Throughout the Project period the Successful Service Provider will be accountable to Petroleum Research and the Steering Committee (SC) for all deliverables. It will be the responsibility of the Successful Service Provider to sub-contract all consultant(s) that will be used for the duration of the project. The Successful Service Provider and consultant(s) may be expected to meet periodically with Petroleum Research and the SC to review the Project progress.

2.6.2 Additional Phases of Work

Petroleum Research reserves the right to amend or replace any Contract that may emerge from this RFP to complete subsequent phases of the JIP as outlined in Sections 3 and 6, herein. Petroleum Research also reserves the right to issue a subsequent Expression of Interest (EOI) and/or RFP to address any of these additional phases. The decision to amend or replace the existing contract and/or to issue a subsequent EOI and/or RFP is at the sole discretion of Petroleum Research.

3. Project Scope of Work

The Scope of Work for this RFP is for Phase 1 of what is envisioned to be a five-phase research and development project undertaken with discrete goals and objectives for each phase as outlined below. As part of the Phase 1 effort, the Successful Service Provider must develop the Project execution plans, scopes-of-work, and cost estimates for the other phases of the project as described below. However, selection for the Phase 1 Project does not imply that the Phase 2 Project will be undertaken or that the Phase 1 Service Provider will be selected to do Phase 2 or any other phase of the Project. The continuation of future Project phases for the Enhanced Drift Forecasting JIP will be decided solely by the Participants and Petroleum Research.

Many differences exist between iceberg and sea ice drift forecasting methodologies; therefore, the proposed research project shall be divided into two parts. One part shall address and validate current and/or proposed enhancements to the NRC-CHC/CIS iceberg drift forecasting model and the other part shall address the

development of new or enhanced sea ice drift forecasting models. A multi-phased parallel approach shall be used to progress each part (i.e. iceberg and sea ice movement forecasts) of the research project.

Thus, the following project phases shall apply to both iceberg and sea ice drift forecasting methodologies.
Also, as previously stated, the project shall be conducted using a phased approach with the initial phase consisting of the Phase 1 effort noted below.

Phase 1 (Needs Analysis and Project Development): This phase shall consist of developing a summary of key industry needs relative to iceberg and sea ice drift forecasting; developing a comprehensive understanding of the capabilities, both strengths and limitations, of existing iceberg and sea ice drift forecasting models to meet these needs; establishing performance benchmarks relative to past applications in support of various oil industry activities; and, assessing the sensitivity and expected benefits of any new technology development or enhancements and/or better real time data inputs.

With respect to iceberg forecasts, current technology, used on the Grand Banks and elsewhere, shall be reviewed and benchmarked to provide a baseline for analysis to ensure that efforts are not duplicated. The work in Phase 1 shall form the basis for delineating technology gaps identified and prioritizing research needed to address these gaps so as to provide maximum benefits and performance to an overall ice management system. Several actual iceberg drift case histories shall be studied in order to develop a sense for what the effects are on the deviation between model forecast results to actual measured tracks without the benefit of “ideal” real time data inputs.

A sensitivity analysis shall be undertaken to scope the actual utility of this work and be used to identify areas where R&D efforts will possibly yield the greatest benefits to overall ice forecasting in terms of reliability and cost effectiveness. For example, if improved ice drift forecasting can be expected to reduce drift uncertainty by 50%, the sensitivity analysis will provide a measure of input by answering questions such as ‘Will fewer icebergs need to be towed?’, ‘Will tow durations be shorter?’, ‘Will physical ice management be deferred?’ and/or others. Also, this effort shall consist of sensitivity runs to identify key parameters in the iceberg forecast model that may give rise to very large uncertainties in their results and reliability. These uncertainties shall be scoped in relation to the varying range of meaningful response time frames that are associated with different industry activities. All of the key input data and determining parameters shall be clearly identified with a perspective on how best to obtain the data or get the parameters in real or near real time. The cost and practicality of getting fundamentally important data such as high resolution current fields versus water depths, iceberg keel draft and shape, wind speeds, etc. in real or near real time shall be addressed.

The benefits of including real or near real time data into the model(s) shall also be evaluated. The potentially high cost for the acquisition of the basic met-ocean and ice data will be weighed against potential terms of improvements in model performance and reliability for actual, well defined industry needs. This applies to both iceberg and sea ice forecasting methods.

Also, as part of Phase 1, a detailed scope-of-work, execution plan and cost estimate shall be developed for Phases 2 and 3 and a high level scope-of-work, execution plan and cost estimate shall be developed for Phases 4 and 5. The general contexts of the remaining phases are noted below and should be used as guidance in determining the scope-of-work, execution plans and cost estimates for the remainder of the project.

Based on the results, recommendations and technical justifications obtained from Phase 1, a decision will be made on whether or not to move forward with the other project phases as follows.

Phase 2 (Concept Identification and Evaluation): This phase shall focus on identifying new technologies, and/or collecting information on existing technologies, that can fill the gaps identified in Phase 1. Data from candidate drift forecasting models shall be collected and evaluated. Specifications for real time current and drift measuring sensors shall be developed and evaluated in terms of practicality and cost of placement versus proposed benefits within an overall ice management program. It is also possible that new technologies, not discussed here, could be identified and pursued throughout the rest of the project.

Phase 3 (Analysis and Development): This phase shall consist of developing new or enhanced drift forecasting models, if justified. The developments may take on many forms as needed to include:

- Algorithms and software packages;
- Electronic hardware;
- Equipment; and/or
- Best practices for existing and future environments.

Phase 4 (Demonstration and Evaluation): This phase shall demonstrate the capability of any new or enhanced models and/or procedures developed and to validate their benefits within an overall ice management program. Validation activities may involve a combination of simulations and field trials. Field trials may be necessary to validate the accuracy of the ice drift models and real time sensor networks. Depending upon ice conditions on the Grand Banks some field trials may need to take place in coastal Labrador, or further north as necessary (particularly with respect to sea ice forecasting methods).

Phase 5 (Technology Integration and Training): This phase is intended to assist the integration of any improved models and/or procedures into operational use. This integration process could vary depending upon the model under consideration and may include, installing software and equipment, updating documentation and revising best practices. Accompanying these steps a comprehensive training program or workshop for personnel directly involved in ice management activities may be required. It is imperative that operating personnel are comfortable with and understand the importance of any new developments. Training should cover the operation and function of each new model(s) as well as how to use and interpret the data produced. It is recommended at the end of the project that a training course and/or workshop be conducted to provide information on how the enhanced or new drift forecasting model may affect the state-of-the-practice for sea ice management.

4. Deliverables and Reporting

4.1 Phase 1 Deliverables

Phase 1 deliverables are defined as follows (iceberg and sea ice):

Deliverables/Activity	**Status** (Note 1)
(a) A project management plan for Phase 1, to include, but not limited to, project execution approach, schedules, assumptions and dependencies, project risks and project constraints. (Note 2)	Complete
(b) A comprehensive review of the capabilities, both strengths and weaknesses, of existing drift forecasting models and performance benchmarks relative to past applications in support of various industry activities. (Note 2)	Identified
(c) Complete documentation of industry needs, sensitivity analyses, cost/benefit studies undertaken and key study gates proposed.	Identified
(d) Detail scopes-of-work, execution plans and cost estimates for Phases 2-3. (Note 2)	Defined
(e) High level scopes-of-work, execution plans and cost estimates for Phases 4-5. (Note 2)	Defined
(f) A final Phase 1 Project report detailing the scope undertaken for the Phase 1 project, actions taken, results obtained, information developed, conclusions, recommendations, execution plans proposed for other project phases and a final Project presentation. (Notes 3 & 4)	Complete

4.2 Status Notes

In developing the Deliverables as stated in Section 4.1, herein, the Successful Service Provider shall take account of the following notes:

(a) Note 1 – The status for each Deliverable at the end of the Project is defined as follows:

Status	Definition
Complete	Deliverable shall be provided as a stand-alone document submitted to Petroleum Research and the SC for review and input. This Deliverable shall be "revision" controlled based on the Successful Service Provider's document Procedures.
Identified	Deliverable shall be provided as a discrete section in the Phase 1 final Report.
Defined	Deliverable shall be provided in the final report in the form of a proposal for follow-up work.

(b) Note 2 – A stand-alone document that provides the stated Deliverable that shall be included as an appendix to the final report.

(c) Note 3 – The final Phase 1 Project report shall summarize the findings and recommendations resulting from the Project. This summary shall include discrete sections that identify and explain the recommended enhancements and provide supporting documentation. All PowerPoint presentation slides, reports, catalogues, schedules, reference materials and matrices used in the generation, screening and selecting of drift models or evaluation studies shall be included in the Final Report as Appendices.

(d) Note 4 – All software models, preliminary drawings including system schematics, arrangements and installation storyboards shall be delivered in native file format.

4.3 Progress Reports

The Successful Service Provider shall submit monthly progress reports detailing accomplishments since the last report as well as future actions to be taken and listing any problems foreseen and outstanding issues to be resolved.

4.4 Meetings

Service Providers may be asked to meet with Petroleum Research and the Participants in St. John's, Newfoundland at their own expense to give a short summary presentation on their Proposal as part of the review process.

Regular meetings will be scheduled between the Successful Service Provider and the SC to brief them on the status of the Project. These meetings will cover tasks completed or accomplishments made since the last meeting, outline of future work during the next period, current and future expenditures and any update relative to the Project schedule or Project tasks. The frequency of these meetings will be determined by Petroleum Research and the Steering Committee

5. Evaluation Criteria:

5.1 Technical Proposal

The Technical Proposal will be evaluated by Petroleum Research and the Steering Committee based on the following criteria:

(a) Experience and knowledge of the proposed investigators, consultants and/or others assigned to the project relative to the forecasting and modeling of iceberg and sea ice movements;
(b) Project experience in the management of similar large scale R&D projects;
(c) The approach that will be used to conduct the study;
(d) The ability to meet the time schedule outlined;
(e) The number of person hours required to complete the work and allocation of hours among tasks; and
(f) Contribution to the development of Newfoundland and Labrador engineering, education and training, and/or research and development capacity.

5.2 Cost Proposal

The Cost Proposal will be evaluated by Petroleum Research and the Steering Committee and will be evaluated based on the reasonableness of the full estimated cost to conduct Phase 1 and the effort applied by the Service Provider relative to the time and resources used including sub contractors and other service providers.

6. Project Tasks, Timeline and Estimated Cost:

The work covered under this RFP is expected to begin in July, 2012, with an estimated duration of 8 months. The details and duration of individual tasks and milestone dates are to be determined and/or recommended by the Successful Service Provider as part of their Phase 1 proposal(s). However, a draft project schedule is

attached as Attachment 2 for guidance as to envisioned phases and a suggested timeline to meet the proposed project objectives.

As noted, the Phase 1 effort is envisioned as part of a five-phase JIP. For planning purposes the following timelines are estimated for the additional phases of the JIP, should they be undertaken. These timelines will be modified or confirmed as part of the Phase 1 scope-of-work.

Phase 2	Quarter 1, 2013 – Quarter 4, 2013
Phase 3	Quarter 2, 2013 – Quarter 1, 2014
Phase 4	Quarter 3, 2013 – Quarter 2, 2014
Phase 5	Quarter 2, 2014 – Quarter 2, 2014

The following is the estimated timeline for the Enhanced Iceberg and Sea Ice Drift Forecasting JIP - Phase I project procurement process:

Submission deadline	5:00 p.m. NST, Friday, May 18, 2012
Proposal evaluations	1st Week of June 2012
Contract award	4th Week of June 2012
Project start	1st Week of July 2012
Project kickoff meeting	2nd Week of July 2012
Project Phase 1 completion	Estimated on or about February 2013

Attachment 1

Form of Acknowledgement

Date _____

Petroleum Research Newfoundland & Labrador
Baine Johnston Centre, Suite 802
10 Fort William Place
St. John's, NL
Canada
A1C 1K4

Attention: Charles E. Smith
Fax: 709-738-7922
E-mail: charles.smith@petroleumresearch.ca

Subject: **Request for Proposals – Phase 1 – Needs Analysis and Project Development "Joint Industry Project for Enhanced Iceberg and Sea Ice Drift Forecasting"**

We have received the subject Request for Proposals and based on our review:

_____ We will submit a Proposal on or before the stated deadline

_____ We will not submit a Proposal

Yours truly,

_____
Name

_____
Company Contact Information

Attachment 2

Phase 1 Schedule Guideline

Phase/Time	Q2-12			Q3-12			Q4-12			Q1-13			Q2-13			Q3-13			Q4-13			Q1-14			Q2-14		
Phase 1																											
Phase 2																											
Phase 3																											
Phase 4																											
Phase 5																											