

**RETURN BIDS TO:  
RETOURNER LES SOUMISSIONS À:**  
**Bid Receiving Public Works and Government  
Services Canada/Réception des soumissions  
Travaux publics et Services gouvernementaux  
Canada**  
**1713 Bedford Row  
Halifax, N.S./Halifax, (N.É.)  
B3J 1T3  
Bid Fax: (902) 496-5016**

**REQUEST FOR PROPOSAL  
DEMANDE DE PROPOSITION**

**Proposal To: Public Works and Government  
Services Canada**

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

**Proposition aux: Travaux Publics et Services  
Gouvernementaux Canada**

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).

**Comments - Commentaires**

|  |   |
|--|---|
| <b>Title - Sujet</b><br>ACOUSTIC PROPAGATION SIMULATOR   |   |
| <b>Solicitation No. - N° de l'invitation</b><br>W7707-145673/A   | <b>Date</b><br>2013-06-11   |
| <b>Client Reference No. - N° de référence du client</b><br>W7707-14-5673   |   |
| <b>GETS Reference No. - N° de référence de SEAG</b><br>PW-\$HAL-409-9014   |   |
| <b>File No. - N° de dossier</b><br>HAL-3-71023 (409)   | <b>CCC No./N° CCC - FMS No./N° VME</b>                                      |
| <b>Solicitation Closes - L'invitation prend fin<br/>at - à 02:00 PM<br/>on - le 2013-06-27</b>   | <b>Time Zone<br/>Fuseau horaire</b><br>Atlantic Daylight Saving<br>Time ADT |
| <b>F.O.B. - F.A.B.</b><br><b>Plant-Usine:</b> <input type="checkbox"/> <b>Destination:</b> <input checked="" type="checkbox"/> <b>Other-Autre:</b> <input type="checkbox"/>  |   |
| <b>Address Enquiries to: - Adresser toutes questions à:</b><br>Taylor, Kathie  | <b>Buyer Id - Id de l'acheteur</b><br>hal409                                |
| <b>Telephone No. - N° de téléphone</b><br>(902) 496-5510 ( )   | <b>FAX No. - N° de FAX</b><br>(902) 496-5016                                |
| <b>Destination - of Goods, Services, and Construction:<br/>Destination - des biens, services et construction:</b><br>DEPARTMENT OF NATIONAL DEFENCE<br>DRDC ATLANTIC<br>9 GROVE STREET<br>DARTMOUTH<br>NOVA SCOTIA<br>B3A3C5<br>Canada |   |

**Instructions: See Herein**

**Instructions: Voir aux présentes**

**Vendor/Firm Name and Address  
Raison sociale et adresse du  
fournisseur/de l'entrepreneur**

|  |  |
|--|--|
| <b>Delivery Required - Livraison exigée</b><br>See Herein  | <b>Delivery Offered - Livraison proposée</b> |
| <b>Vendor/Firm Name and Address<br/>Raison sociale et adresse du fournisseur/de l'entrepreneur</b>   |  |
| <b>Telephone No. - N° de téléphone</b><br><b>Facsimile No. - N° de télécopieur</b>   |  |
| <b>Name and title of person authorized to sign on behalf of Vendor/Firm<br/>(type or print)</b><br><b>Nom et titre de la personne autorisée à signer au nom du fournisseur/<br/>de l'entrepreneur (taper ou écrire en caractères d'imprimerie)</b> |  |
| <b>Signature</b>   | <b>Date</b>                                  |

**Issuing Office - Bureau de distribution**  
Acquisitions  
1713 Bedford Row  
Halifax, N.S./Halifax, (N.É.)  
B3J 3C9

**Title: Development of an Acoustic Propagation Simulator for Shallow Water Environments****PART 1 - GENERAL INFORMATION**

1. Security Requirement
2. Statement of Work
3. Debriefings

**PART 2 - BIDDER INSTRUCTIONS**

1. Standard Instructions, Clauses and Conditions
2. Submission of Bids
3. Former Public Servant
4. Enquiries - Bid Solicitation
5. Applicable Laws

**PART 3 - BID PREPARATION INSTRUCTIONS**

1. Bid Preparation Instructions

**PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION**

1. Evaluation Procedures
2. Basis of Selection

**PART 5 - CERTIFICATIONS**

1. Mandatory Certifications Required Precedent to Contract Award
2. Additional Certifications Precedent to Contract Award

**PART 6 - RESULTING CONTRACT CLAUSES**

1. Statement of Requirement
2. Standard Clauses and Conditions
3. Term of Contract
4. Authorities
5. Payment
6. Invoicing Instructions
7. Certifications
8. Applicable Laws
9. Priority of Documents
10. SACC Manual Clauses

**List of Annexes:**

- Annex A - Statement of Requirement  
Annex B - Basis of Payment  
Annex C - Evaluation Criteria

## PART 1 - GENERAL INFORMATION

### 1. Security Requirement

There is no security requirement associated with the requirement.

### 2. Requirement

The work will be performed as per Annex "A" - Statement of Work, attached herein.

### 3. Communications Notification

As a courtesy, the Government of Canada requests that successful bidders notify the Contracting Authority in advance of their intention to make public an announcement related to the award of a contract

### 4. Debriefings

Bidders may request a debriefing on the results of the bid solicitation process. Bidders should make the request to the Contracting Authority within 15 working days of receipt of the results of the bid solicitation process. The debriefing may be in writing, by telephone or in person.

## PART 2 - BIDDER INSTRUCTIONS

### 1. Standard Instructions, Clauses and Conditions

All instructions, clauses and conditions identified in the bid solicitation by number, date and title are set out in the *Standard Acquisition Clauses and Conditions Manual* (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

Bidders who submit a bid agree to be bound by the instructions, clauses and conditions of the bid solicitation and accept the clauses and conditions of the resulting contract.

The 2003 (2012-11-19) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

#### 1.1 Subsection 5.4 of 2003, Standard Instructions - Goods or Services - Competitive Requirements, is amended as follows:

Delete: sixty (60) days

**Insert: one hundred and twenty (120) days**

### 2. Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada (PWGSC) Bid Receiving Unit by the date, time and place indicated on page 1 of the bid solicitation.

Due to the nature of the bid solicitation, bids transmitted by "electronic mail" to PWGSC will not be accepted.

### 3. Former Public Servant

Contracts with former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of public funds. In order to comply with Treasury Board policies and directives on contracts with FPS, bidders must provide the information required below.

#### Definitions

For the purposes of this clause, "former public servant" is any former member of a department as defined in the Financial Administration Act, R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

- a. an individual;
- b. an individual who has incorporated;
- c. a partnership made of former public servants; or
- d. a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means, a pension or annual allowance paid under the Public Service Superannuation Act (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the Supplementary Retirement Benefits Act, R.S., 1985, c.S-24 as it affects the PSSA. It does not include pensions payable pursuant to the Canadian Forces Superannuation Act, R.S., 1985, c.C-17, the Defence Services Pension Continuation Act, 1970, c.D-3, the Royal Canadian Mounted Police Pension Continuation Act, 1970, c.R-10, and the Royal Canadian Mounted Police Superannuation Act, R.S., 1985, c.R-11, the Members of Parliament Retiring Allowances Act, R.S., 1985, c.M-5, and that portion of pension payable to the Canada Pension Plan Act, R.S., 1985, c.C-8.

#### Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? Yes ( ) No ( )

If so, the Bidder must provide the following information, for all FPS in receipt of a pension, as applicable:

- a. name of former public servant;
- b. date of termination of employment or retirement from the Public Service.

By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

#### Work Force Reduction Program

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of a work force reduction program? Yes ( ) No ( )

If so, the Bidder must provide the following information:

- a. name of former public servant;

b.conditions of the lump sum payment incentive;  
c.date of termination of employment;  
d.amount of lump sum payment;  
e.rate of pay on which lump sum payment is based;  
f.period of lump sum payment including start date, end date and number of weeks;  
g.number and amount (professional fees) of other contracts subject to the restrictions of a work force reduction program.

For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is \$5,000, including Applicable Taxes.

#### **4. Enquiries - Bid Solicitation**

All enquiries must be submitted in writing to the Contracting Authority no later than **five (5)** calendar days before the bid closing date. Enquiries received after that time may not be answered.

Bidders should reference as accurately as possible the numbered item of the bid solicitation to which the enquiry relates. Care should be taken by bidders to explain each question in sufficient detail in order to enable Canada to provide an accurate answer. Technical enquiries that are of a proprietary nature must be clearly marked "proprietary" at each relevant item. Items identified as "proprietary" will be treated as such except where Canada determines that the enquiry is not of a proprietary nature. Canada may edit the questions or may request that the Bidder do so, so that the proprietary nature of the question is eliminated, and the enquiry can be answered with copies to all bidders. Enquiries not submitted in a form that can be distributed to all bidders may not be answered by Canada.

#### **5. Applicable Laws**

Any resulting contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Nova Scotia.

Bidders may, at their discretion, substitute the applicable laws of a Canadian province or territory of their choice without affecting the validity of their bid, by deleting the name of the Canadian province or territory specified and inserting the name of the Canadian province or territory of their choice. If no change is made, it acknowledges that the applicable laws specified are acceptable to the bidders.

### **PART 3 - BID PREPARATION INSTRUCTIONS**

#### **1. Bid Preparation Instructions**

Canada requests that bidders provide their bid in separately bound sections as follows:

Section I: Technical Bid (two hard copies)

Section II: Financial Bid (one hard copy)

Section III: Certifications (one hard copy)

Prices must appear in the financial bid only. No prices must be indicated in any other section of the bid.

Canada requests that bidders follow the format instructions described below in the preparation of their bid:

- (a) use 8.5 x 11 inch (216 mm x 279 mm) paper;
- (b) use a numbering system that corresponds to the bid solicitation.

#### Section I: Technical Bid

In their technical bid, bidders should explain and demonstrate how they propose to meet the requirements and how they will carry out the Work.

#### Section II: Financial Bid

Bidders must submit their financial bid in accordance with the Basis of Payment. The total amount of applicable taxes must be shown separately.

#### Section III: Certifications

**Bidders must submit the certifications required under Part 5.**

## **PART 4 - EVALUATION PROCEDURES AND BASIS OF SELECTION**

### **1. Evaluation Procedures**

Bids received will be assessed in accordance with the entire requirement of the bid solicitation including the technical and financial evaluation criteria.

- (a) Bids will be assessed in accordance with the entire requirement of the bid solicitation including the technical and financial evaluation criteria.
- (b) An evaluation team composed of representatives of Canada will evaluate the bids.
- (c) The evaluation team will determine first if there are three (3) or more bids with a valid Canadian Content certification. In that event, the evaluation process will be limited to the bids with the certification; otherwise, all bids will be evaluated. If some of the bids with a valid certification are declared non-responsive, or are withdrawn, and less than three responsive bids with a valid certification remain, the evaluation will continue among those bids with a valid certification. If all bids with a valid certification are subsequently declared non-responsive, or are withdrawn, then all the other bids received will be evaluated.

#### **1.1 Technical Evaluation - Point Rated Technical Criteria**

Point Rated Technical Criteria are listed herein in Annex "C".

### **2. Basis of Selection**

#### **2.1 Highest Rated Within Budget**

1. To be declared responsive, a bid must:

- (a) comply with all the requirements of the bid solicitation; and
- (b) obtain the required minimum of **70** percent overall of the points for the technical/management evaluation criteria which are subject to point rating. The rating is performed on a scale of 170 points.  
*Refer to Annex C.*

2. Bids not meeting (a) or (b) will be declared non responsive. The responsive bid with the highest number of points will be recommended for award of a contract, provided that the total evaluated price does not exceed the budget available for this requirement. The maximum funding available for the Contract resulting from the bid solicitation is **\$95,000** (applicable taxes extra, as appropriate). Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.

## **PART 5 - CERTIFICATIONS**

*Bidders must provide the required certifications to be awarded a contract. Canada will declare a bid non-responsive if the required certifications are not completed and submitted as requested.*

Compliance with the certifications bidders provide to Canada is subject to verification by Canada during the bid evaluation period (before award of a contract) and after award of a contract. The Contracting Authority will have the right to ask for additional information to verify bidders' compliance with the certifications before award of a contract. The bid will be declared non-responsive if any certification made by the Bidder is untrue, whether made knowingly or unknowingly. Failure to comply with the certifications or to comply with the request of the Contracting Authority for additional information will also render the bid non-responsive.

### **1. Mandatory Certifications Required Precedent to Contract Award**

#### **1.1 Code of Conduct and Certifications - Related documentation**

By submitting a bid, the Bidder certifies that the Bidder and its affiliates are in compliance with the provisions as stated in Section 01 Code of Conduct and Certifications - Bid of Standard Instructions 2003. The related documentation therein required will assist Canada in confirming that the certifications are true.

### **2. Additional Certifications Precedent to Contract Award**

The certifications listed below should be completed and submitted with the bid, but may be submitted afterwards. If any of these required certifications is not completed and submitted as requested, the Contracting Authority will so inform the Bidder and provide the Bidder with a time frame within which to meet the requirement. Failure to comply with the request of the Contracting Authority and meet the requirement within that time period will render the bid non-responsive.

#### **2.1 Federal Contractors Program - Certification**

##### **Federal Contractors Program - over \$25,000 and below \$200,000**

Suppliers who are subject to the Federal Contractors Program (FCP) and have been declared ineligible contractors by Human Resources and Skills Development Canada (HRSDC) are no longer eligible to receive federal government contracts over the threshold for solicitation of bids as set out in the Government Contracts Regulations. Suppliers may be declared ineligible contractors either as a result of a finding of non-compliance by HRSDC, or following their voluntary withdrawal from the FCP for a reason

other than the reduction of their workforce to less than 100 employees. Any bids from ineligible contractors, including a bid from a joint venture that has a member who is an ineligible contractor, will be declared non-responsive.

The Bidder, or, if the Bidder is a joint venture the member of the joint venture, certifies its status with the FCP, as follows:

The Bidder or the member of the joint venture:

(a) ( ) is not subject to the FCP, having a workforce of less than 100 full-time or part-time permanent employees, and/or temporary employees having worked 12 weeks or more in Canada;

(b) ( ) is not subject to the FCP, being a regulated employer under the Employment Equity Act, S.C. 1995, c. 44;

(c) ( ) is subject to the requirements of the FCP, having a workforce of 100 or more full-time or part-time permanent employees, and/or temporary employees having worked 12 weeks or more in Canada, but has not previously obtained a certificate number from HRSDC, having not bid on requirements of \$200,000 or more;

(d) ( ) has not been declared an ineligible contractor by HRSDC, and has a valid certificate number as follows: \_\_\_\_\_.

Further information on the FCP is available on the HRSDC Web site.

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

### 3.1 Canadian Content Certification

SACC Manual clause A3050T (2010-01-11) Canadian Content Definition

### 3.2 This procurement is conditionally limited to Canadian services

Subject to the evaluation procedures contained in the bid solicitation, bidders acknowledge that only bids with a certification that the service offered is a Canadian service, as defined in clause A3050T, may be considered.

*Failure to provide this certification completed with the bid will result in the service offered being treated as a non-Canadian service.*

#### **The Bidder certifies that:**

( ) the service offered is a Canadian service as defined in paragraph 2 of clause A3050T.

## **PART 6 - RESULTING CONTRACT CLAUSES**

### **1. Statement of Requirement**

The Contractor must provide the items detailed in Annex A - Statement of Requirement, attached herein.

### **2. Standard Clauses and Conditions**

All clauses and conditions identified in the Contract by number, date and title are set out in the *Standard Acquisition Clauses and Conditions Manual* (<https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-and-conditions-manual>) issued by Public Works and Government Services Canada.

#### **2.1 General Conditions**

**2.1.1** SACC Manual clause 2040 (2013-04-25) - General Conditions - Research & Development applies to and forms part of the Contract.

### **3. Term of Contract**

#### **3.1 Period of Contract**

The work will be performed from date of Contract award and completed by \_\_\_\_\_.

### **4. Authorities**

#### **4.1 Contracting Authority**

The Contracting Authority for the Contract is:

Kathie Taylor  
Supply Officer  
Public Works and Government Services Canada  
Acquisitions Branch  
1713 Bedford Row  
Halifax, NS B3J 1T3  
Telephone: (902) 496-5510  
Facsimile: (902) 496-5016  
E-mail : kathie.taylor@pwgsc.gc.ca

The Contracting Authority is responsible for the management of the Contract and any changes to the Contract must be authorized in writing by the Contracting Authority. The Contractor must not perform work in excess of or outside the scope of the Contract based on verbal or written requests or instructions from anybody other than the Contracting Authority.

#### **4.2 Project Authority**

The Project Authority for the Contract is:

Will be identified upon contract award.

The Project Authority is the representative of the department or agency for whom the Work is being carried out under the Contract and is responsible for all matters concerning the technical content of the Work under the Contract. Technical matters may be discussed with the Project Authority, however the Project Authority has no authority to authorize changes to the scope of the Work. Changes to the scope of the Work can only be made through a contract amendment issued by the Contracting Authority.

#### 4.3 Contractor's Representative (To be completed by the supplier)

Contractor Contact Name: \_\_\_\_\_ PBN: \_\_\_\_\_  
 Business Name: \_\_\_\_\_  
 Business Address: \_\_\_\_\_  
 Telephone: \_\_\_\_\_  
 Facsimile: \_\_\_\_\_  
 E-mail Address: \_\_\_\_\_

### 5. Payment

#### 5.1 Basis of Payment

The Contractor will be reimbursed for the costs reasonably and properly incurred in the performance of the work, as determined in accordance with the prices quoted in accordance with Annex B, Basis of Payment.

#### 5.2 Limitation of Expenditure

1) Canada's total liability to the Contractor under the Contract must not exceed \$\_\_\_\_\_ and Goods and Services Tax or Harmonized Sales Tax is extra, if applicable.

2) No increase in the total liability of Canada or in the price of the work resulting from any design changes, modifications or interpretations of the Work, will be authorized or paid to the Contractor unless these design changes, modifications or interpretations have been approved, in writing, by the Contracting Authority before their incorporation into the Work. The Contractor must not perform any work or provide any service that would result in Canada's total liability being exceeded before obtaining the written approval of the Contracting Authority. The Contractor must notify the Contracting Authority in writing as to the adequacy of this sum:

- (a) when it is 75 percent committed, or
- (b) four (4) months before the contract expiry date, or
- (c) as soon as the Contractor considers that the contract funds provided are inadequate for the completion of the Work, whichever comes first.

3) If the notification is for inadequate contract funds, the Contractor must provide to the Contracting Authority a written estimate for the additional funds required. Provision of such information by the Contractor does not increase Canada's liability.

#### 5.3 Method of Payment

### 5.3 Method of Payment - Progress Payments

1. Canada will make progress payments in accordance with the payment provisions of the Contract, no more than once a month, for cost incurred in the performance of the Work, up to 90 percent of the amount claimed and approved by Canada if:

- a. an accurate and complete claim for payment using form PWGSC-TPSGC 1111, Claim for Progress Payment, and any other document required by the Contract have been submitted in accordance with the invoicing instructions provided in the Contract;
- b. the amount claimed is in accordance with the basis of payment;
- c. the total amount for all progress payments paid by Canada does not exceed the total amount to be paid under the Contract;
- d. all certificates appearing on form PWGSC-TPSGC 1111 have been signed by the respective authorized representatives.

2. The balance of the amount payable will be paid in accordance with the payment provisions of the Contract upon completion and delivery of all work required under the Contract if the Work has been accepted by Canada and a final claim for the payment is submitted.

3. Progress payments are interim payments only. Canada may conduct a government audit and interim time and cost verifications and reserves the rights to make adjustments to the Contract from time to time during the performance of the Work. Any overpayment resulting from progress payments or otherwise must be refunded promptly to Canada.

### 6. Invoicing Instructions

1. The Contractor must submit a claim for payment using form PWGSC-TPSGC 1111 (<http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/formulaires-forms-eng.html>).

Each claim must show:

- (a) all information required on form PWGSC-TPSGC 1111;
- (b) all applicable information detailed under the section entitled "Invoice Submission" of the general conditions;
- (c) a list of all expenses;
- (d) expenditures plus pro-rated profit or fee;
- (e) the description and value of the milestone claimed as detailed in the Contract.

Each claim must be supported by:

- (a) a copy of the time sheets to support the time claimed;
- (b) a copy of the invoices, receipts, vouchers for all direct expenses, travel and living expenses;
- (c) a copy of the monthly progress report, if applicable

2. Goods and Services Tax or Harmonized Sales Tax (GST/HST), as applicable, must be calculated on the total amount of the claim before the holdback is applied. At the time the holdback is claimed, there will be no GST/HST payable as it was claimed and payable under the previous claims for progress payments.

3. The Contractor must prepare and certify one original and two (2) copies of the claim on form PWGSC-TPSGC 1111, and forward it to the Project Authority identified under the section entitled "Authorities" of the Contract for appropriate certification after inspection and acceptance of the Work takes place.

The Project Authority will then forward the original and two (2) copies of the claim to the Contracting Authority for certification and onward submission to the Payment Office for the remaining certification and payment action.

4. The Contractor must not submit claims until all work identified in the claim is completed.

## **7. Certifications**

**7.1** Compliance with the certifications provided by the Contractor in its bid is a condition of the Contract and subject to verification by Canada during the term of the Contract. If the Contractor does not comply with any certification or it is determined that any certification made by the Contractor in its bid is untrue, whether made knowingly or unknowingly, Canada has the right, pursuant to the default provision of the Contract, to terminate the Contract for default.

### **7.2 SACC Manual Clauses**

SACC Manual Clause A3060C (2008-05-12) Canadian Content Certification

## **8. Applicable Laws**

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in Nova Scotia.

## **9. Priority of Documents**

If there is a discrepancy between the wording of any documents that appear on the list, the wording of the document that first appears on the list has priority over the wording of any document that subsequently appears on the list.

- (a) the Articles of Agreement;
- (b) the general conditions:  
2040 (2013-04-25) General Conditions - Research & Development;
- (c) Annex A - Statement of Requirement;
- (d) Annex B - Basis of Payment (if applicable);
- (e) the Contractor's bid dated \_\_\_\_\_ (insert date of bid).

## **10. SACC Manual Clauses**

A9006C (2012-07-16) - Defence Contract

---

**ANNEX "A"**  
**STATEMENT OF REQUIREMENT**

**Title**

Development of an Acoustic Propagation Simulator for Shallow Water Environments

**Requirement**

Unmanned systems and off-board sensors are becoming a critical part of the Canadian Forces toolbox to keep troops out of harm's way. Even though such systems have gained in autonomy, they still have limited capabilities for collaborating among themselves and with other fixed or mobile assets. One particular area where significant progress is needed is that of underwater sensor networks. The main impediment to such progress relates to the unreliable nature of underwater acoustic communications. The purpose of this contract is to perform research leading to the development of an acoustic propagation simulator specific to shallow water environments.

This contract has the following objectives:

- (a) Investigation of the impact of a layered water current profile on impulse responses, Doppler spreads and delay spreads. An assessment of the impact of a layered water current profile compared to other factors, including sea-surface roughness, shall be performed for a limited number of shallow water environments.
- (b) If a significant impact results from the presence of a layered water current profile, then a physics-based range-dependent ray-tracing simulator shall be developed and shall incorporate such a layered water current profile. The simulator shall also incorporate the effects of sea-surface roughness. The impact of a partial, complete and rough underwater-surface ice covers should also be investigated, if possible.
- (c) Generation and characterization of acoustic channel impulse responses, Doppler spreads and delay spreads in response to various shallow water environmental and communication conditions.
- (d) Development of front and back ends of the range-dependent ray-tracing simulator so that the propagation of complex broadband acoustic signals can be simulated. If possible, a hardware-in-the-loop bench system should be built and include the range-dependent simulator, the front and back ends, as well as hardware provided by the Project Authority. The hardware-in-the-loop bench should operate as an overall system and be capable of taking any user-defined message as an input.

The attached Statement of Work of Appendix A describes in detail the requirements of the contract effort.

**Security**

All work is unclassified and the Contractor will not have access to any classified information.

### **Intellectual Property**

This requirement has been reviewed in accordance with "Basis For DRDC Ownership of Intellectual Property Arising From DRDC Contracts" form and it has been determined that the Intellectual Property arising from this requirement should rest with the Contractor.

### **Time Schedule**

It is requested that the contract be awarded in three phases.

#### Phase 1

Start date: Upon award of contract  
 Draft of yearly report: March 15, 2014  
 Phase 1 completion & yearly report: March 27, 2014

#### Optional Phase 2

Phase 2 will commence upon satisfactory completion, as determined by the Project Authority, of Phase 1 and confirmation of availability of funding.

Start date: Upon satisfactory completion of Phase 1, as determined by the Project Authority; and confirmation of available funding.  
 Draft of yearly report: March 15, 2015  
 Phase 2 completion & yearly report: March 27, 2015

#### Optional Phase 3

Phase 3 will commence upon satisfactory completion, as determined by the Project Authority, of Phase 2 and confirmation of availability of funding.

Start date: Upon approval of the work plan by the Project Authority; satisfactory completion of Phase 2; and confirmation of available funding.  
 Draft of yearly report: March 15, 2016  
 Phase 3 completion & yearly report: March 27, 2016

### **Deliverables**

In addition to the return of all non-expended items (equipment, software, books, etc.) acquired by the Contractor in support of this requirement and claimed for against the contract, the common deliverables shall be as described in Appendix A - Statement of Work.

## **Reports**

Monthly short, informal, progress reports are required. These reports can take the form of an email, teleconference, or any other format chosen by the Contractor, so long as they summarize the current state of progress with respect to the research objectives. Yearly reports shall be short documents summarizing the work completed in a single phase. Yearly reports shall not exceed 10 pages, highlight the major achievements including publications, and be written in LaTeX or Microsoft Word (2007 or 2010).

## **Report Standard and Format**

Reports will be to a standard acceptable to the Project Authority. Should a report not be in accordance with the requirement of the work, the Project Authority shall have the right to reject it or require its correction. The Contractor will provide an editable soft copy of the yearly report.

The Contractor is responsible for delivering a draft copy of the yearly report to the Project Authority for review. This review may require the Contractor to make changes as directed by the Project Authority. Also, this review will help to ensure the report is in keeping with contract requirements and that DND interests, including security, are safeguarded.

## **Financial Limitations**

The funding available for each phase of this contract is (excluding applicable taxes):

|                |         |              |
|----------------|---------|--------------|
| Phase 1        | FY13/14 | \$40,000 CAD |
| Option Phase 2 | FY14/15 | \$40,000 CAD |
| Option Phase 3 | FY15/16 | \$15,000 CAD |

The above amounts include up to \$6,000 per year that can be spent by the Contractor personnel for travel and living expenses to attend project-related meetings, conferences where project-related results will be presented, and/or project-related experiments.

Funding for each phase of the project is contingent upon successful completion of the previous phase, and availability of funds as determined by the Project Authority.

## **Travel and Living**

A 1-2 day kick-off meeting will be held soon after award of contract for Phase 1 and optional phases, at a date and a place mutually agreed to by the Contractor and the Project Authority. A yearly project review meeting will occur at a date and location mutually agreed to by the Contractor and the Project Authority.

Any anticipated travel and living expenses are to be identified in the Contractor's proposal as separate items and must be included within the stated budget. The travel and living expenses are to be in accordance with Treasury Board guidelines. All travel is to be pre-approved by the Project Authority.

### Contractor Personnel

Key Contractor personnel shall be named in the contract. All proposed changes in Contractor personnel shall be addressed by the Contractor to Public Works and Government Services Canada who in turn will request DRDC Atlantic's approval.

### Government Furnished Equipment (GFE)

DRDC Atlantic and the Project Authority may loan the following GFE to support the contract:

acoustic modems, acoustic modem components, and related accessories.

### DRDC Atlantic Support, Facilities and Responsibilities

It is anticipated that the work will be conducted off of DND and DRDC properties.

### Policy for Connecting Non-DND Computers to DRDC Atlantic Networks

No connectivity to DRDC Atlantic Networks is required to support the contract.

### Control Procedures

Progress will be monitored through short, informal monthly progress reports and regular consultations between the Contractor and the Project Authority.

Face-to-face meetings (kick-off meeting and yearly meeting) will take place to further help monitor the progress made by the Contractor and facilitate the knowledge transfer.

Each phase shall be deemed 100% complete upon receipt of the phase deliverables and approval of the final version of the yearly report by the Project Authority. The Contractor must allow time for editorial review of the report by the Project Authority and agree to make changes to the report, to print the report, and to deliver it, at no additional cost. Upon receipt of the yearly

report and other deliverables, and upon receipt of a Claim for Holdback, the holdback will be released.

Upon approval of the report for each phase and the work plan for the next phase by the Project Authority, satisfactory completion of each phase, and confirmation of available funding, approval will be given to commence the next phase of the contract.

Inspection shall be by and to the satisfaction of the Project Authority, Defence R&D Canada - Atlantic.

#### Approval Prior To Publication

All manuscripts for publication in scientific journals or the like, abstracts of oral presentations and any releases that describe portions of the contract work or related information shall be submitted to the Project Authority for approval of release. If the inadvertent presence of either defence classified or proprietary material is determined, the Project Authority will consult with the Contractor to redraft the relevant sections to their joint satisfaction to produce an unclassified text or theme without sensitive information. Review of manuscripts and releases will be completed within 4 weeks after receipt. Review of abstracts and any other releases will proceed rapidly and approval of release will follow without delay.

## **Appendix A: Statement of Work**

### **Development of an Acoustic Propagation Simulator for Shallow Water Environments**

#### **1. Background**

Recently, Defence R&D Canada - Atlantic was awarded a "Technology Investment Fund" project. This funding was granted for developing robust distributed data aggregation and network connectivity techniques to enhance underwater target localization. These techniques rely on collaborative and adaptive off-board fixed and mobile sensors networked through underwater acoustic communications.

#### **2. Scope**

This contract represents a crucial step for enabling unsupervised underwater surveillance by a network of off-board fixed and mobile sensors deployed in shallow waters. In particular, this contract will assist with the development of a statistical characterization of underwater acoustic node-to-node communications.

#### **3. Objectives**

This contract has the following objectives:

- (a) Investigation of the impact of a layered water current profile on impulse responses, Doppler spreads and delay spreads. An assessment of the impact of a layered water current profile compared to other factors, including sea-surface roughness, shall be performed for a limited number of shallow water environments.
- (b) If a significant impact results from the presence of a layered water current profile, then a physics-based range-dependent ray-tracing simulator shall be developed and shall incorporate such a layered water current profile. The simulator shall also incorporate the effects of sea-surface roughness. The impact of a partial, complete and rough underwater-surface ice covers should also be investigated, if possible.
- (c) Generation and characterization of acoustic channel impulse responses, Doppler spreads and delay spreads in response to various shallow water environmental and communication conditions.
- (d) Development of front and back ends of the range-dependent ray-tracing simulator so that the propagation of complex broadband acoustic signals can be simulated. If possible, a hardware-in-the-loop bench system should be built and include the range-dependent simulator, the front and back ends, as well as hardware provided by the Project Authority. The hardware-in-the-loop bench should operate as an overall system and be capable of taking any user-defined message as an input.

#### 4. Problem Context

The "shallow water environments" represent a generic setup capturing littoral environments characterized by the following features:

1) Constant environmental features:

- Bottom composition: Mud or Sand
- Bottom slope profile: Flat, Up, or Down
- Depths: 50, 100, 150, 200, and 250 meters

2) Dynamic environmental features:

- Sound speed profile: Isothermal, upward-refracting and downward-refracting
- Wind: Low, medium, and high with an overall range of 0-40 knots
- Water current profile shall accommodate a layered structure with more than one layer.

3) Acoustic communication features:

- Frequencies: 9-14 kHz, primarily
- Source-to-receiver distance shall cover up to 20 kilometers.
- Frequency increments: Sensitivity analysis shall be performed for determining appropriate frequency increments in the specified frequency range so that interpolations result in predictions of acceptable accuracy.

#### 5. Requirements

The requirements for this contract are split into three phases. Each phase will take 12 months or less to complete. Outlined below are specific tasks for each phase, as well as the deliverables required. **It is expected that the Contractor proposal will include a work plan for Phase 1, with options for Phase 2 and 3.**

##### Phase 1

##### Task 1 Investigation of the impact of a layered water current profile

One of the most challenging situations for reliable underwater acoustic node-to-node communication is that of overspread, which is characterized by both delay and Doppler (or frequency) spreads. Delay spread usually is caused by multi-path effects and Doppler spread may originate from sea-surface roughness, source/receiver motions, and the layered water current profile. Given that the proposed sensor-network may be exploited in shallow-water straits where strong currents and winds may prevail, large delay and Doppler spreads may be at play simultaneously.

This task shall investigate and assess the impact of a layered water current profile on impulse responses, Doppler spreads and delay spreads. An assessment of the impact of a layered water current profile compared to other factors, including sea-surface roughness, shall also be performed. Part of the investigation shall include a study of how well current profiles must be known (e.g., how many depth-dependent layers) to predict current Doppler effects with sufficient accuracy for communications applications.

Through this first task, the Contractor shall develop or modify an existing physics-based range-independent ray-tracing software simulator capable of mimicking the propagation of an underwater acoustic signal. The layered water current profile shall be implemented in the said physics-based range-independent ray-tracing simulator. The simulator shall also be written so that a subset of environmental and communication conditions described in the above "Problem Context" can be readily tested and evaluated. A separate and additional statistical analysis suite shall be built and be capable of determining key environmental and communication parameters. To accelerate the development and the generation of results, the simulator and the statistical analysis suite shall be developed in MATLAB or with a MATLAB interface. The Contractor shall maintain the code and tools enabling such simulations and is responsible for purchasing and maintaining licenses for this phase and the subsequent ones provided funding is available.

#### Task 2 Development of a physics-based range-dependent ray-tracing simulator

Range-independent ray-tracing simulators are simpler to develop but less accurate than their range-dependent counterparts in real environments where the seafloor slopes.

This next phase shall focus on developing or modifying an existing physics-based range-dependent ray-tracing simulator. The simulator shall incorporate the effects of sea-surface roughness. A layered water current profile shall be incorporated into the simulator only if its impact was proven significant in prior Task 1. The simulator shall be written so that all environmental and communication conditions described in the above "Problem Context" can be readily tested and evaluated through simple input files. Up to five additional and specific environmental and communication conditions may be given for validation and investigation purposes. The impact of partial, complete, and rough ice covers should also be investigated, if possible.

The statistical analysis suite developed in Task 1 shall be adapted to the range-dependent simulator for determining key environmental and communication parameters. To accelerate the development and the generation of results, the simulator and the statistical analysis suite shall be developed in MATLAB or with a MATLAB interface. The Contractor shall maintain the code and tools enabling such simulations and is responsible for purchasing and maintaining licenses for this phase and the subsequent ones provided funding is available.

#### Task 3 Generation and characterization of acoustic responses

Typical acoustic modems modulate messages to be transmitted over a given frequency range. In order to relate the simulator developed in Task 2 to a modem-modulated signal, one requires the propagation of acoustic signals under various conditions.

For this third task, the Contractor shall simulate the propagation of various types of acoustic signals through the simulator developed in Task 2 under environmental and communication conditions defined in the "Problem Context". The Contractor shall characterize the resulting impulse responses, Doppler-spreads and delay-spreads in a structured manner. Possible approaches for structuring results include a database, parameterization, a lookup table, or any other manner judged appropriate based on the possibility of performing interpolations on a fewer number of responses.

In particular, the Contractor shall use sensitivity and statistical analysis tools and methods for determining an appropriate discretization of environmental and communication conditions, such as frequency and depth increments, so that interpolations result in predictions of acceptable accuracy.

Optionally and pending sufficient funds, the Contractor may be asked to validate some acoustic impulse responses in an underwater environment.

In the event that the Contractor completes the above tasks ahead of time and with remaining funds, tasks in the subsequent phase should be initiated upon approval from the Project Authority.

## **Optional Phase 2**

The tasks performed in this phase and the subsequent one strongly depend on the progress and obstacles resulting from the research performed in Phase 1.

The Contractor is expected to consult with the Project Authority to create an adequate work plan satisfying the requirements listed below and any new requirement that may have resulted from the research executed in Phase 1.

The general purpose of this second phase is to further generalize results obtained in Phase 1. In particular, Phase 2 shall focus on developing the front and back ends of the range-dependent ray-tracing simulator developed in Phase 1. The intended use of the range-dependent ray-tracing simulator is to propagate complex broadband acoustic signals in conditions defined in the "Problem Context". The front-end suite shall be developed so that a real acoustic signal could be directly fed to the simulator, which will then simulate its propagation. The back-end suite shall be able to convert the simulator-propagated signal in to a real acoustic signal. If needed, the simulator shall be modified so that it can propagate broadband acoustic signals.

---

To accelerate the development and the generation of results, the front and back ends shall be developed in MATLAB or with a MATLAB interface. The Contractor shall maintain the code and tools enabling such simulations and is responsible for purchasing and maintaining licenses for this phase and the subsequent ones provided funding is available.

### **Optional Phase 3**

The tasks performed in this phase and the subsequent one strongly depend on the progress and obstacles resulting from the research performed in Phase 1 and Phase 2.

The Contractor is expected to consult with the Project Authority to create an adequate work plan satisfying the objective below and any new requirement that may have resulted from the research executed in Phase 1 and Phase 2.

For this last phase, the Contractor shall generate the complete and necessary documentation for installing and operating both range-dependent and range-independent ray-tracing simulators, the statistical analysis suite, as well the front and back end suites. If possible, a hardware-in-the-loop bench system should be built and include the range-dependent simulator developed in Task 2 of Phase 1, the front and back ends developed in Phase 2, as well as acoustic modems provided by DRDC Atlantic and the Project Authority. The hardware-in-the-loop bench should operate as an overall system and be capable of taking any user-defined message as an input. The bench system will be used to simulate modem-to-modem underwater acoustic transmissions while using the simulator to mimic the propagation of an underwater acoustic signal.

## **6. Common Deliverables**

- All code; executable program/file; instructions to run modeling etc. originally developed and written in support of this work. Executable code shall be created with MATLAB or with a MATLAB interface and the use of specific toolboxes or libraries shall be limited and approved by the Project Authority. Instructions for installing necessary routines, code, and libraries shall be provided. The Contractor shall ensure that the Project Authority obtains a cohesive software package that all works together.
- All figure and text created in support of the contract. Figures shall be created in Microsoft Visio (2007 or 2010) and any text, documentation, and presentation shall be generated in LaTeX, Microsoft Word (2007 or 2010), or Microsoft Power Point (2007 or 2010). The use of any other software for generating figures, documentation and presentations shall be approved by the Project Authority.
- Results of simulations/calculations in electronic format (in a non-proprietary file format). Raw simulation outputs as well as their statistical significance shall be provided.

- Detailed procedures for physically implementing the derived solutions on an acoustic sensor network.
- Brief and informal monthly progress reports.
- Minutes of all project review meetings.
- A final and brief yearly report detailing all work carried out by the Contractor under this contract in the phase.
- Submission of co-authored scientific publications sponsored by IEEE, IFAC, or similar organizations. Journal publications are favored over conference publications and either could be initiated by the Project Authority or the Contractor.
- Detailed work and publication plans for the next phase.

Submissions of co-authored publication at events or journals sponsored by IEEE, IFAC, or similar organizations are encouraged. All publications resulting from this contract must first seek the approval of the Project Authority and are subject to the DRDC review and approval process.

## **ANNEX "B"**

### **BASIS OF PAYMENT**

Your Financial Bid will be used to determine the Basis of Payment. Negotiation of the pricing basis may be required. If the proposed hourly rates are not those negotiated with PWGSC, detailed financial data should be provided if required.

**Labour:** For each individual and/or labour category to be employed on the project, indicate the proposed hourly rate (including overhead, excluding profit) and the estimated time to be spent by each.

\$ \_\_\_\_\_

#### **Other Direct Charges:**

**Equipment:** Identify the items required to complete the work and identify the pricing basis inclusive of customs duty. These items will be delivered to Canada upon completion of the project.

**Materials, Supplies, Components:** Indicate general categories and the pricing basis. Indicate whether the items are likely to be used or consumed during the course of the Work.

**Other Charges:** Identify any other direct charges anticipated such as long distance communication and rentals and provide the estimated costs and relevance to the proposed work.

\$ \_\_\_\_\_

**Travel and Living Expenses:** Indicate the estimated number and cost of journeys together with the basis of these costs. The Contractor will be paid its authorized travel and living expenses, reasonably and properly incurred in the performance of the Work, at cost, without any allowance for overhead or profit, in accordance with the meal, private vehicle and incidental allowances specified in Appendices B, C and D of the National Joint Council Travel Directive (<http://www.njc-cnm.gc.ca/directive/travel-voyage/index-eng.php>), and with the other provisions of the directive referring to travellers, rather than those referring to employees. All payments are subject to government audit. All travel must have prior authorization of the Project Authority.

\$ \_\_\_\_\_

**Subcontracts:** Identify potential subcontractors and provide the same cost breakdown information detailed herein.

\$ \_\_\_\_\_

**Profit:** State your proposed profit, if any, and the basis on which it is computed and applied.

**Total Estimated Price (excluding applicable taxes):** \$ \_\_\_\_\_

Solicitation No. - N° de l'invitation

W7707-145673/A

Amd. No. - N° de la modif.

File No. - N° du dossier

HAL-3-71023

Buyer ID - Id de l'acheteur

ha1409

Client Ref. No. - N° de réf. du client

W7707-14-5673

CCC No./N° CCC - FMS No/ N° VME

---

**Applicable taxes must be identified separately.**

### **ANNEX "C"** **EVALUATION CRITERIA**

The Technical proposals will be evaluated and scored in accordance with the following point rated evaluation criteria. It is suggested that bidders address these criteria in sufficient detail in their Technical proposals.

#### **Point Rated Evaluation Criteria:**

##### **1. Technical Category (Maximum 20 points/Minimum 14 points)**

- |   |          |
|---|----------|
| - Demonstrated understanding of scope and objectives                          | 5 points |
| - Proposed work feasibility, approach and methodology                         | 5 points |
| - Proposed technical solution   | 5 points |
| - Recognition of direct as well as peripheral problems and solutions proposed | 5 points |

##### **2. Management Category (Maximum 150 points/Minimum 105 points)**

|   |          |
|---|----------|
| (a) proposed management of the project and the demonstrated qualifications and experience of the project manager, including: position within the organization, relevant experience, education, etc.; demonstrated ability to control costs. | 5 Points |
|---|----------|

(b) key personnel capability – demonstrated relevant experience, qualifications and competence proven by similar and/or related work in the following areas:

- |   |           |
|---|-----------|
| i) at-sea acoustic measurement                            | 20 Points |
| ii) acoustic propagation                                  | 20 Points |
| iii) acoustic wave propagation modeling                   | 25 Points |
| iv) acoustic signal processing                            | 20 Points |
| v) scientific document preparation and writing experience | 25 Points |
| vi) sensitivity and statistical analysis                  | 25 Points |

|  |          |
|--|----------|
| (c) company capability including subcontractors, if applicable – relevant experience/competence proven by similar or related work, and resource capability, risk of non-performance, commitment to this field of work. | 5 Points |
|--|----------|

(d) adequacy of planned team organization, including availability of team members and backup capability, reporting structure, management of project, subcontracts and capability to carry out the project with in the time frame allotted.

5 Points

#### **Maximum Total 170 Points Overall**

#### **Basis of Selection - Highest Rated Within Budget**

1. To be declared responsive, a bid must:

- (a) comply with all the mandatory requirements of the solicitation; and
- (b) obtain the required minimum of 14 points for the Point Rated Evaluation Criteria in the Technical Category (i.e. maximum 20 points, minimum 14 points) specified in the solicitation; and
- (c) obtain the required minimum of 105 points for the Point Rated Evaluation Criteria in the Management Category (i.e. maximum 150 points, minimum 105 points) specified in the solicitation.

2. Bids not meeting (a) or (b) or (c) above will be declared non responsive and will be given no further consideration. The responsive bid with the highest overall points will be recommended for award of a contract, provided that the price does not exceed the budget available for the Requirement. The maximum funding available for a Contract resulting from the bid solicitation is \$95,000.00 (applicable taxes extra). Bids valued in excess of this amount will be considered non-responsive. This disclosure does not commit Canada to pay the maximum funding available.

3. In the case of a tie, the bid with the higher Total Points for the Point Rated Evaluation Criteria in the Technical Category (maximum 20 points, minimum 14 points) will be recommended for award of a contract.