

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

To obtain a copy of: Area Survey Leg 1 Mission, Area
Leg 2 Mission and NRCAN AUV VCC Log:
PLEASE EMAIL
ATL.NSRequisitions@pwgsc-tpsgc.gc.ca
and Reference RFP# W7707-145707 HF
INTERFEROMETRIC SAS SOFTWARE

Title - Sujet HF INTERFEROMETRIC SAS SOFTWARE	
Solicitation No. - N° de l'invitation W7707-145707/A	Date 2013-11-25
Client Reference No. - N° de référence du client W7707-14-5707	
GETS Reference No. - N° de référence de SEAG PW-\$HAL-305-9139	
File No. - N° de dossier HAL-3-71167 (305)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2013-12-12	Time Zone Fuseau horaire Atlantic Standard Time AST
F.O.B. - F.A.B. Plant-Usine: <input type="checkbox"/> Destination: <input checked="" type="checkbox"/> Other-Autre: <input type="checkbox"/>	
Address Enquiries to: - Adresser toutes questions à: Collier, Susan	Buyer Id - Id de l'acheteur hal305
Telephone No. - N° de téléphone (902) 496-5350 ()	FAX No. - N° de FAX (902) 496-5016
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: DEPARTMENT OF NATIONAL DEFENCE DRDC ATLANTIC 9 GORVE STREET DARTMOUTH NOVA SCOTIA B3A 3C5 Canada	

Instructions: See Herein

Instructions: Voir aux présentes

Vendor/Firm Name and Address

**Raison sociale et adresse du
fournisseur/de l'entrepreneur**

Issuing Office - Bureau de distribution

Acquisitions
1713 Bedford Row
Halifax, N.S./Halifax, (N.É.)
B3J 3C9

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

Solicitation No. - N° de l'invitation

W7707-145707/A

Amd. No. - N° de la modif.

File No. - N° du dossier

HAL-3-71167

Buyer ID - Id de l'acheteur

hal305

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

W7707-14-5707

CCC No./N° CCC - FMS No/ N° VME

High-Frequency Interferometric Synthetic Aperture Sonar Acquisition, Integration and Signal Processing Software

PLEASE NOTE:

To obtain a copy of: Area Survey Leg 1 Mission, Area Leg 2 Mission and NRCAN AUV VCC Log:

PLEASE EMAIL

ATL.NSRequisitions@pwgsc-tpsgc.gc.ca

and Reference RFP# W7707-145707 HF INTERFEROMETRIC SAS SOFTWARE

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PART 1 - GENERAL INFORMATION

1. Security Requirement

There is no security requirement associated with this bid solicitation.

2. Requirement

1.1. INTRODUCTION

Defence Research and Development Canada - Atlantic intends to procure one (1) modular dual-sided Interferometric Synthetic Aperture Sonar (SAS) system. The SAS system must be integrated into DRDC's Arctic Explorer class Autonomous Underwater Vehicle (AUV), manufactured by International Submarine Engineering Ltd. The proposed contractor must perform the integration of the SAS sensor with the AUV on site at DRDC Atlantic, located at Dartmouth, Nova Scotia, Canada. The proposed contractor must supply all electronics, data storage and additional auxiliary sensors not already included in the AUV configuration (specified in Annex E) required to produce focussed SAS images and interferometric maps. The proposed contractor shall provide SAS beamforming software for post processing of acoustic data and creating geo-located SAS imagery and interferometry.

1.2. BACKGROUND

The Mine Defence project, part of the DRDC's Maritime Science and Technology Programme, is focussed on the use of unmanned systems for naval mine countermeasures activities. A key transformational technology in this area has been the development of commercial synthetic aperture sonars (SAS) which provide significant improvements to along-track resolution through the coherent summing of pings as the vehicle follows a straight line trajectory. The increased image resolution and quality can provide better input to other parts of the research programme, such as Automatic Target Recognition, Battlespace Characterization and Marine Autonomy. DRDC has a requirement to acquire a commercial off-the-shelf Interferometric SAS system to be integrated into an Arctic Explorer AUV in order to better achieve the research and development objectives within its programme of work.

3. 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 (2013-06-01) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

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

Delete: sixty (60) days

Insert: ninety (90) 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 facsimile to PWGSC will not be accepted.

3. Former Public Servant

Contracts awarded to 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 before contract award.

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 Adjustment Directive

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of the Work Force Adjustment Directive? 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 adjustment 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 (2) hard copies)

Section II: Financial Bid (One (1) hard copy)

Section III: Certifications (One (1) 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.

In April 2006, Canada issued a policy directing federal departments and agencies to take the necessary steps to incorporate environmental considerations into the procurement process [Policy on Green Procurement](http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy-eng.html) (<http://www.tpsgc-pwgsc.gc.ca/ecologisation-greening/achats-procurement/politique-policy-eng.html>). To assist Canada in reaching its objectives, bidders should:

- 1) use 8.5 x 11 inch (216 mm x 279 mm) paper containing fibre certified as originating from a sustainably-managed forest and containing minimum 30% recycled content; and
- 2) use an environmentally-preferable format including black and white printing instead of colour printing, printing double sided/duplex, using staples or clips instead of cerlox, duotangs or binders.

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. Bidders should demonstrate their capability and describe their approach in a thorough, concise and clear manner for carrying out the work.

The technical bid should address clearly and in sufficient depth the points that are subject to the evaluation criteria against which the bid will be evaluated. Simply repeating the statement contained in the bid solicitation is not sufficient. In order to facilitate the evaluation of the bid, Canada requests that bidders address and present topics in the order of the evaluation criteria under the same headings. To avoid duplication, bidders may refer to different sections of their bids by identifying the specific paragraph and page number where the subject topic has already been addressed.

Section II: Financial Bid

Bidders must submit their financial bid in accordance with the Basis of Payment, Annex B. 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

- (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.

1.1 Mandatory Technical Evaluation

Mandatory Evaluation Criteria and procedures for the technical bids are included in Annex B1 Technical Evaluation Plan..

1.2 Financial Evaluation

This solicitation specifically requires bids to be submitted in Canadian currency.

The price of the bid will be evaluated in Canadian dollars, Applicable Taxes excluded, FOB destination, Canadian customs duties and excise taxes included.

1.3 A budget of \$500,000.00 Canadian dollars plus applicable taxes has been set aside for this project. The total amount of Goods and Services Tax or Harmonized Sales Tax must be shown separately. Bidders must submit their financial bid in accordance with Annex "B", Basis of Payment. The total amount of Applicable Taxes must be shown separately.

2. Basis of Selection

2.1 A bid must comply with the requirements of the bid solicitation and meet all mandatory technical evaluation criteria to be declared responsive. Bids meeting the mandatory requirements will be point rated against the evaluation criteria detailed in Annex B2 Performance Criteria. The lowest responsive cost-per-point proposal within the stated budget of \$500,000.00 (taxes extra) will be recommended for award of a contract.

3. Security Requirement

There is no security requirement associated with this bid solicitation.

PART 5 - CERTIFICATIONS

Bidders must provide the required certifications and documentation to be awarded a contract.

The certifications provided by bidders to Canada are subject to verification by Canada at all times. Canada will declare a bid non-responsive, or will declare a contractor in default, if any certification made by the Bidder is found to be untrue whether during the bid evaluation period or during the contract period.

The Contracting Authority will have the right to ask for additional information to verify the Bidder's certifications. Failure to comply with this request will also render the bid non-responsive or will constitute a default under the Contract.

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.

1.2 Federal Contractors Program for Employment Equity - Bid Certification

By submitting a bid, the Bidder certifies that the Bidder, and any of the Bidder's members if the Bidder is a Joint Venture, is not named on the Federal Contractors Program (FCP) for employment equity "[FCP Limited Eligibility to Bid](http://www.labour.gc.ca/eng/standards_equity/eq/emp/fcp/list/inelig.shtml)" list (http://www.labour.gc.ca/eng/standards_equity/eq/emp/fcp/list/inelig.shtml) available from [Human Resources and Skills Development Canada \(HRSDC\) - Labour's website](#).

Canada will have the right to declare a bid non-responsive if the Bidder, or any member of the Bidder if the Bidder is a Joint Venture, appears on the "[FCP Limited Eligibility to Bid](#)" list at the time of contract award.

PART 6 - RESULTING CONTRACT CLAUSES

1. Security Requirement

There is no security requirement applicable to this Contract.

2. Requirement

1.1. INTRODUCTION

Defence Research and Development Canada - Atlantic intends to procure one (1) modular dual-sided Interferometric Synthetic Aperture Sonar (SAS) system. The SAS system must be integrated into DRDC's Arctic Explorer class Autonomous Underwater Vehicle (AUV), manufactured by International Submarine Engineering Ltd. The proposed contractor must perform the integration of the SAS sensor with the AUV on site at DRDC Atlantic, located at Dartmouth, Nova Scotia, Canada. The proposed contractor must supply all electronics, data storage and additional auxiliary sensors not already included in the AUV configuration (specified in Annex E) required to produce focussed SAS images and interferometric maps. The proposed contractor shall provide SAS beamforming software for post processing of acoustic data and creating geo-located SAS imagery and interferometry.

1.2. BACKGROUND

The Mine Defence project, part of the DRDC's Maritime Science and Technology Programme, is focussed on the use of unmanned systems for naval mine countermeasures activities. A key transformational technology in this area has been the development of commercial synthetic aperture sonars (SAS) which provide significant improvements to along-track resolution through the coherent summing of pings as the vehicle follows a straight line trajectory. The increased image resolution and quality can provide better input to other parts of the research programme, such as Automatic Target Recognition, Battlespace Characterization and Marine Autonomy. DRDC has a requirement to acquire a commercial off-the-shelf Interferometric SAS system to be integrated into an Arctic Explorer AUV in order to better achieve the research and development objectives within its programme of work.

3. 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.

3.1 General Conditions

2010A (2013-04-25), General Conditions - Goods (Medium Complexity), apply to and form part of the Contract.

4. Term of Contract

4.1 Delivery Date

All the deliverables must be received in accordance with the Delivery Schedule detailed in Annex B3, Basis of Payment.

5. Authorities

5.1 Contracting Authority

The Contracting Authority for the Contract is:

Susan Collier
Supply Specialist | Spécialiste en approvisionnement
Acquisitions | Approvisionnements
Public Works and Government Services Canada | Travaux publics et Services gouvernementaux Canada
1713 Bedford Row, Halifax, NS B3J 1T3 | 1713 Bedford Row Halifax, (N.É.) B3J 1T3
susan.collier@pwgsc-tpsgc.gc.ca
Telephone | Téléphone 902-496-5350
Facsimile | Télécopieur 902-496-5016
Teletypewriter | Tél'imprimeur 1-800-926-9105
Government of Canada | Gouvernement du Canada

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.

5.2 The Technical Authority for the Contract is (to be given upon contract award):

Name: _____
Title: _____
Organization: _____
Address: _____
Telephone: ____-____-____
Facsimile: ____-____-____

E-mail: _____

The Technical Authority named above 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 Technical Authority, however the Technical 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.

5.3 Contractor's Representative

Name: _____

Title: _____

Company: _____

Address: _____

Telephone: ____ - ____ - ____

Facsimile: ____ - ____ - ____

E-mail: _____

6. Proactive Disclosure of Contracts with Former Public Servants

By providing information on its status, with respect to being a former public servant in receipt of a Public Service Superannuation Act (PSSA) pension, the Contractor has agreed that this information will be reported on departmental websites as part of the published proactive disclosure reports, in accordance with Contracting Policy Notice: 2012-2 of the Treasury Board Secretariat of Canada.

7. Payment

7.1 Basis of Payment

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid a firm price, as specified in Annex B3 Basis of Payment, for a cost of \$ _____ (insert the amount at contract award). Customs duties are included, and Applicable Taxes are extra.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work, unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

7.2 Limitation of Price

SACC Manual clause C6000C (2011-05-16) Limitation of Price

7.3 SACC Clauses

Multiple Payments - H1001C (2008-05-12)

Milestone Payments - H3010C (2010-01-11)

Taxes - Foreign-based Contractor - C2000C (2007-11-30)

Canadian Customs Documentation -C2608C (2012-07-16)

Customs Duties - Department of National Defence - Importer - C2610C (2007-11-30)

8. Invoicing Instructions - Progress Payment Claim - H3022C (2013-04-25)

1. The Contractor must submit a claim for payment using form PWGSC-TPSGC 1111, Claim for Progress Payment.

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.the description and value of the milestone claimed as detailed in the Contract.

Each claim must be supported by:

a.a copy of 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.

2. Applicable Taxes 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 Applicable Taxes 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 Technical Authority identified under the section entitled "Authorities" of the Contract for appropriate certification after inspection and acceptance of the Work takes place.

The Technical 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.

Invoices must be distributed as follows:

a. The original and one (1) copy must be forwarded to the following address for certification and payment.

Department of National Defence
DRDC Atlantic
9 Grove Street
Dartmouth, Nova Scotia
B3A 3C5

9. Certifications

9.1 Compliance

Compliance with the certifications and related documentation 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, provide the related documentation or if 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.

10. Applicable Laws

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

11. 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 2010A (2013-04-25), General Conditions - Goods (Medium Complexity), apply to and form part of the Contract;
- (c) Annex A Requirement and Mandatory Technical Specifications
- (d) Annex B1 Technical Evaluation Plan
Annex B2 Performance Criteria
Annex B3 Basis of Payment
- (e) Annex C Technical Drawings for Arctic Explorer Free Flooding Hull Section
- (f) Annex D Vehicle Stability Statistics and Log File
- (g) Annex E Existing Vehicle Positioning, Attitude and Orientation Systems and Log
- (h) Annex F Criminal Code of Conduct;
- (i) the Contractor's bid dated _____

12. Defence Contract

SACC Manual clause A9006C (2012-07-16) Defence Contract

13. SACC Manual Clauses

Canadian Forces Site Regulations - A9062C (2011-05-16)

Electrical Equipment - B1501C (2006-06-16)

Excess Goods - B7500C (2006-06-16)

ANNEX "A"

REQUIREMENT

&

MANDATORY TECHNICAL SPECIFICATIONS

1. REQUIREMENT

High-Frequency Interferometric Synthetic Aperture Sonar Acquisition, Integration and Signal Processing Software

1.1. INTRODUCTION

Defence Research and Development Canada – Atlantic intends to procure one (1) modular dual-sided Interferometric Synthetic Aperture Sonar (SAS) system. The SAS system must be integrated into DRDC's Arctic Explorer class Autonomous Underwater Vehicle (AUV), manufactured by International Submarine Engineering Ltd. The proposed contractor must perform the integration of the SAS sensor with the AUV on site at DRDC Atlantic, located at Dartmouth, Nova Scotia, Canada. The proposed contractor must supply all electronics, data storage and additional auxiliary sensors not already included in the AUV configuration (specified in Annex D) required to produce focussed SAS images and interferometric maps. The proposed contractor shall provide SAS beamforming software for post processing of acoustic data and creating geo-located SAS imagery and interferometry.

1.2. BACKGROUND

The Mine Defence project, part of the DRDC's Maritime Science and Technology Programme, is focussed on the use of unmanned systems for naval mine countermeasures activities. A key transformational technology in this area has been the development of commercial synthetic aperture sonars (SAS) which provide significant improvements to along-track resolution through the coherent summing of pings as the vehicle follows a straight line trajectory. The increased image resolution and quality can provide better input to other parts of the research programme, such as Automatic Target Recognition, Battlespace Characterization and Marine Autonomy. DRDC has a requirement to acquire a commercial off-the-shelf Interferometric SAS system to be integrated into an Arctic Explorer AUV in order to better achieve the research and development objectives within its programme of work.

2. METHOD OF SELECTION

A bid must comply with the requirements of the bid solicitation and meet all mandatory technical evaluation criteria to be declared responsive. Bids meeting the mandatory requirements will be point rated against the evaluation criteria in Annex B2 - Performance Criteria . The lowest responsive cost-per-point proposal within the stated budget of \$500,000 (taxes extra) will be recommended for award of a contract.

2.1. Mandatory technical Criteria

The Synthetic Aperture Sonar system must be in compliance with the Statement of Requirements as detailed in clause 1 of PART 1 – INFORMATION AND INSTRUCTION and Annex A.

In order to show compliance with the Statement of Requirements the proposed Contractor must submit a “Performance Inspection and Acceptance Test Plan” as detailed below and conduct a “Performance Acceptance Test” at DRDC Atlantic facilities as describe below.

2.2. PERFORMANCE INSPECTION AND ACCEPTANCE TEST PLAN (PIATP)

The contractor must provide in their bid package a Performance Inspection and Acceptance Test plan. The PIATP is a detailed testing plan demonstrating how the Contractor proposes to evaluate their SAS to ensure compliance with the DRDC Statement of Requirements during the Performance Acceptance Test.

The PIATP must list all Mandatory Technical Specifications. For each Mandatory Technical Specification, the proposed contractor must:

- detail how the proposed SAS system meets the Mandatory Technical Specification, this can include but is not limited to collected experimental data, technical drawings, algorithm descriptions, and analytical or modeled results;
- describe a test to be performed during the PAT to measure, test, and prove compliance with the Mandatory Technical Specification. If a particular specification is extremely difficult or impossible to demonstrate compliance, analytical or modeled results can be proposed.

The DRDC TA will review the PIATP to determine that all Mandatory Technical Specifications have been addressed and that the applicable PAT test is sufficient to test for the technical specification.

The DRDC TA will assign a “PASS/FAIL” to all Mandatory Technical Specification descriptions and applicable test.

All Mandatory Technical Specification descriptions and tests listed in the PIATP must PASS for the bid to be found technically compliant.

The PIATP will be the baseline document which PWGSC and the DRDC TA will use during the PAT to confirm inspection and acceptance of the SAS.

2.3. PERFORMANCE ACCEPTANCE TEST (PAT)

The Performance Acceptance Test is a series of tests performed according to the PIATP. Tests with measurable results utilizing the DRDC Arctic Explorer with integrated SAS must be included in the PAT. Tests must include a combination of bench testing, in-water AUV tethered and untethered testing, and software demonstration.

The PAT will be conducted at DRDC Atlantic with in water testing locations at the Bedford Institute of Oceanography jetty located at Dartmouth and the DRDC barge located in the Bedford basin, Nova Scotia, Canada.

The PAT must be no less than two and no more than five (5) days duration and carried out no later than 17-21 of March 2014.

Other than the DRDC provided support the PAT must be conducted by the contractor at their expense and witnessed by representatives of PWGSC and DRDC TA.

A successful PAT will confirm inspection and acceptance of the SAS. An unsuccessful PAT is deemed non-compliant.

3. DRDC SUPPORT

DRDC Atlantic will provide support for one in-water Performance Acceptance Test. DRDC support includes provision of the AUV; AUV launch and recovery; safety boats; workspace and AUV operator personnel.

At the request of the proposed contractor, DRDC Atlantic will support integration and testing at DRDC Atlantic facilities located in Dartmouth Nova Scotia. This integration will take place immediately prior to the PAT and will be no longer than two weeks. The DRDC support includes access to the DRDC AUV, salt/fresh water and pressure testing tanks and/or the Acoustic Calibration Barge and AUV operators.

Other than the DRDC provided support the SAS integration will be conducted by the contractor at their expense.

The proposed contractor will notify DRDC of PAT and integration testing dates at a minimum of 30 working days in advance.

4. DELIVERABLES

1. The proposed contractor must deliver to the Crown one (1) fiberglass free-flooding hull section complete with one SAS system and syntactic foam;
2. The proposed contractor must deliver one complete integration of the SAS into the Arctic Explorer AUV;
3. The vendor must deliver one Performance Acceptance Test;
4. The proposed contractor must provide beamforming software.
5. Documentation,
 - a. a minimum of two complete operating/maintenance manuals;
 - b. two sets of wiring diagrams;
 - c. specifications for spare components and vendors;
 - d. integration technical instructions;
 - e. sonar technical information;
 - f. For the MATLAB beamforming software, all proprietary algorithms must be identified and documented interfaces to those routines must be provided.
6. Two (2) removable storage units for data transfer.
7. Training: The proposed contractor shall provide a qualified instructor to conduct an operator/maintainer course at the DRDC Atlantic facility for a minimum of three DRDC personnel at a date agreeable to both parties for no less than three (3) days;
8. Support: Phone-in technical support must be readily available for 1 year after completion of the PAT. The level of phone-in support shall not exceed 10 hours

5. Mandatory Delivery Date

	Date
PERFORMANCE ACCEPTANCE TEST	No later than 17-21 March 2014
TRAINING (Deliverables)	No later than 24-28 March 2014

ANNEX B1

TECHNICAL EVALUATION PLAN

1.0 Acronyms: The following is a list of acronyms used throughout this Technical Evaluation.

SAS	Synthetic Aperture Sonar
AUV	Autonomous Underwater Vehicle
GRP	Glass Reinforced Plastic
TVG	Time Variable Gain
TCP	Transmission Control Protocol
VCC	Vehicle Control Computer
ACSA	ACSA is a high-tech company specializing in undersea robotics & underwater positioning systems
IXBlue	Undersea Equipment manufacturer
PHINS	PHotonic Inertial Navigation System (INS)
DVL	Doppler velocity Log
RDI	Teledyne RD Instruments, Inc., located in San Diego, CA, specializes in the design and manufacture of underwater acoustic Doppler products
PSI	Pressure Per Square Inch
OS	Operating System
XTF	eXtended Triton Format (XTF) is a Triton Imaging, Inc. file format for recording various types of hydrographic survey data
TIFF	Tagged Image File Format) is a file format for storing images
MATLAB	MATLAB is a high-level technical computing language and interactive environment for algorithm development, data visualization, data analysis
XYZ	XYZ files, a format for recording points in 3D space
MEX	MATLAB Executable. A MEX-file provides an interface between MATLAB and subroutines written in C, C++ or Fortran.
DLL	Dynamic Linked Library
DC	Direct Current
OA	Obstacle Avoidance
PIATP	PERFORMANCE INSPECTION AND ACCEPTANCE TEST PLAN
PAT	PERFORMANCE ACCEPTANCE TEST
TA	Technical Authority
PWGSC	Public Works and Government Services Canada
DRDC	Defence Research and Development Canada
INS	Initial Navigation System
3D	Three Dimensional

DPCA	Displaced Phase Center Antenna
M-code	MATLAB code

1.1 General: This Technical Evaluation will be used to evaluate the Bidders suitability to satisfy the requirements of as detailed in Annex A herein.

- a. It is the sole responsibility of the Bidder to provide sufficient information to allow comprehensive evaluation of capabilities.
- b. The Proposals shall contain a description of the total goods/services to be provided in response to the Requirement and Mandatory Specifications, with similar headings and numbering.

1.2 Proposal Content:

Bidders will be required to submit the following documents with their proposals:

- a. In order to show compliance with the Requirements the proposed Contractor must submit a "Performance Inspection and Acceptance Test Plan" .
- b. Complete all Certifications requested in the RFP.

1.3 Evaluation Process:

The evaluation process is a combination of mandatory requirements and price with the contract to be awarded to the lowest compliant bidder. The evaluation will be conducted as follows:

- a. Proposals will be evaluated against the Mandatory Requirements detailed herein (Annex B). Proposals which fail to meet all of the Mandatory Requirements will not be evaluated further.
- b. Proposals that are technically compliant will then have their cost proposal evaluated by PWGSC.

1.4 Evaluation:

- a. The DRDC TA will review the PIATP to determine that all Mandatory Technical Specifications have been addressed and that the applicable PAT test is sufficient to test for the technical specification.
- b. The DRDC TA will assign a "PASS/FAIL" to all Mandatory Technical Specification descriptions and applicable test.
- c. All Mandatory Technical Specification descriptions and tests listed in the PIATP must PASS for the bid to be found technically compliant.

d. A bid must comply with the requirements of the bid solicitation and meet all mandatory technical evaluation criteria to be declared responsive.

e. Bids meeting the mandatory requirements will be point rated against the evaluation criteria in Annex B2 - Performance Criteria . The lowest responsive cost-per-point proposal within the stated budget of \$500,000 (taxes extra) will be recommended for award of a contract.

MANDATORY TECHNICAL PROPOSAL EVALUATION CRITERIA

In order for a proposals to be evaluated further, the proposal must fully demonstrate it complies with all the mandatory requirements LISTED BELOW. If full compliance is not fully demonstrated, no further evaluation of the Bidder's proposal shall be carried out.

ITEM #	CABILITY/GENERAL	YES	NO	NOTES
a	<p>The SAS system shall be contained within a fiberglass hull section. To provide for modular integration in the Arctic Explorer AUV.</p> <p>1.This new hull section must mate with the existing AUV hull sections and is flush with the existing hull. 2.The free flooding hull section must be made of polyester based resin GRP. The SAS hull section must be painted with a yellow polyurethane paint. 3.The SAS section must join to the existing AUV nose section and the pressure hull forward dome section. 4.The new hull section must not exceed a total length of 2.5 meters. A technical drawing showing interface dimensions for the free flooding hull section is provided as Annex C.</p>			
b	<p>SAS System Weight</p> <p>1.The SAS system weight in air and water shall be provided. The proposed contractor at their expense shall contact the original equipment manufacturer of the DRDC Atlantic AUV (International Submarine Engineering of Port Coquitlam, BC) to calculate the new AUV weight and balance figures and required amounts of syntactic foam to achieve effective AUV ballasting parameters 2.The SAS system must come complete with syntactic foam (rated to the same depth as the SAS system) in sufficient quantity as calculated above.</p>			
c	<p>The SAS system shall be designed to function under the stability constraints of the Arctic Explorer AUV. See Annex D.</p>			

ITEM #	CABILITY/GENERAL	YES	NO	NOTES
d	The SAS system shall be rated to no less than a 200 meter depth rating.			
e	The SAS system shall achieve a measured constant along-track resolution (unshaded) of 5 cm or less			
f	The system shall achieve a measured across-track resolution of 5 cm or less.			
g	The system must achieve effective range of no less than 200m per side: 1.in 50 meters of water depth; and 2.with a platform velocity of 1.5 meters per second or greater.			
h	The SAS system must be interferometric using vertically displaced arrays			
i	The SAS system shall achieve an Interferometry spatial resolution of 25 cm x 25 cm or less.			
j	The SAS system shall achieve an Interferometry vertical resolution of 25 cm or less.			
k	The system shall have a nadir gap less than 30% of the total swath.			
l	The system shall provide for hardware time varying gain (TVG) A hardware TVG or high dynamic range (> 20 bits) Analog to Digital converter must be provided.			
m	The SAS system must allow for the user to specify: 1.transmit pulse type; 2.pulse center frequency; 3.bandwidth; 4.length; and 5.pulse repetition rate.			
n	Integration with AUV Ethernet bus using standard TCP protocols			
o	The SAS system must allow for the AUV to control the sonar functions, specifically: 1.On 2.Off 3.Sonar mode			
p	The SAS system must be a dual-sided sonar system, complete with both Port and Starboard arrays.			
q	The system must operate at a center frequency greater than or equal to 80 kHz			

ITEM #	CABILITY/GENERAL	YES	NO	NOTES
r	<p>The SAS system shall produce geo-referenced data. Geo-referenced data shall be produced either by interfacing to the existing AUV navigation positioning, attitude and orientation system data or by means of additional self-contained navigational positioning, attitude, gyroscopic sensors integrated in the SAS electronics module. Available AUV produced navigation positioning, attitude and orientation system data is listed as Annex D and Annex E.</p>			
s	<p>Windows version SAS beamforming software SAS beamforming Windows OS based software executable shall: 1.read raw sonar and attitude data; 2.carry out all signal processing in order to produce geo-referenced SAS imagery and interferometry; 3.output at least the following file formats: 3.1.XTF and GeoTIFF; 3.2.gridded XYZ bathymetry; 3.3.Optionally produce phase and amplitude data (i.e. complex numbers) in MATLAB-readable format;</p>			
t	<p>MATLAB version SAS beamforming software A MATLAB version of the SAS beamforming software must be provided, with algorithms written in M-code The code shall be written in a modular way such that individual algorithms (e.g. DPCA micronavigation) can be replaced. Algorithms deemed proprietary shall be provided as compiled MEX or DLL files, however documented software interfaces to these methods must be provided. Data readers for raw ping data must be provided.</p>			
u	<p>System shall operate from power supplied by the AUV. Available power supply is 48V DC at 4A. Provision for DC-DC conversion is possible using the above value as primary input.</p>			
v	<p>The integrated SAS system shall provide a method to deconflict or coordinate all the acoustic sources on the AUV (SAS, DVL, altimeter and OA) in order to mitigate mutual interference.</p>			
w	<p>Removable storage</p>			

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ITEM #	CABILITY/GENERAL	YES	NO	NOTES
	The system shall supply an integrated removable storage method to transfer data to and from the vehicle. At a minimum ten (10) hours of sonar data storage per unit is required.			
x	Real-time beamforming The proposed contractor must provide real-time beamforming within the integrated SAS-AUV. While a reduced resolution imagery is acceptable, full resolution imagery is preferred.			
y	SAS System is Commercial off-the-shelf The proposed contractor must show proof of having sold the proposed SAS system to other customers.			

Evaluator Name: _____ Signature _____ Date _____

Evaluator Names: _____ Signaature _____ Date _____

ANNEX B2**PERFORMANCE CRITERIA**

Bids meeting the mandatory requirements will be point rated against the evaluation criteria listed below, Performance Criteria. The lowest responsive cost-per-point proposal within the stated budget of \$500,000.00 (taxes extra) will be recommended for award of a contract.

TEST #	PERFORMANCE CRITERIA	SCORE
0	PERFORMANCE INSPECTION AND ACCEPTANCE TEST PLAN The level of detail is minimal: 50 pts The level of detail is considerable and includes some modeled results and/or experimental data showing how the system is expected to meet the criteria. Proposed evaluation methods during the PAT are appropriate: 100 pts Highly detailed test plan with a significant amount of theoretical detail backed up by data measured by the proposed system showing how the system meets the criteria. Proposed evaluation methods during the PAT are appropriate and demonstrate a thorough understanding of the factors affecting system performance: 130 pts	____/ 130
1	Theoretical along-track resolution (unshaded) More than 5 cm = 0 pts; 5 cm = 5 pts 2.5 cm to 5 cm = 10 pts 2.5 cm or less = 20 pts	____/ 20
2	Theoretical across-track resolution More than 5 cm = 0 pts 2.5 cm to less than 5 cm = 10 pts Less than 2.5 cm = 15 pts	____/ 15
3	Effective range in deep water (> 100 meters) with a platform velocity of a minimum of 1.25 meters per second. 200 meters or less = 0 pts 200-250 meters = 10 pts 250-300 meters = 15 pts 300 meters or more = 20 pts	____/ 20
4	Interferometry spatial resolution 25 cm x 25 cm = 2.5 pts 15 cm x 15 cm = 5 pts Less than 15 cm = 10 pts	____/ 10

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TEST #	PERFORMANCE CRITERIA	SCORE
5	Interferometry vertical resolution More than 25 cm = 0 pts Between 15-25 cm = 10 pts Less than 15 cm = 20 pts	____/ 20
6	Expected Nadir Gap Less than 20% total swath: 10 pts Less than 30% total swath 5 pts Greater than 30% swath 0 pts	____/ 20
7	Depth rating Less than 200 meters = 0 pts Between 200 and 1000 = 5 pts Greater than 1000 meters = 10 pts	____/ 20
8	Data recording space Less than 10 hours = 0 pts Between 10-15 hours = 5pts Between 15-24 hours = 10 pts Equal to or more than 24 hours = 20 pts	____/ 20
	TOTAL	____/ 275
	SCORE	

ANNEX B3 BASIS OF PAYMENT

Currency:

This solicitation specifically requires bids to be submitted in Canadian currency.

The price of the bid will be evaluated in Canadian dollars, Applicable Taxes excluded, FOB destination, Canadian customs duties and excise taxes included.

Basis of Payment – Firm Price – Deliverables

Deliverable Schedule

In consideration of the Contractor satisfactorily completing all of its obligations under the Contract, the Contractor will be paid the following firm all inclusive price in accordance with the following deliverable schedule. Customs duties are included and Applicable Taxes are extra.

	Milestones	Delivery Date	Firm Price
1	a). The proposed contractor must deliver to the Crown one (1) fiberglass free-flooding hull section complete with one SAS system and syntactic foam; b). The proposed contractor must deliver one complete integration of the SAS into the Arctic Explorer AUV; c). The vendor must deliver one Performance Acceptance Test; d). The proposed contractor must provide beamforming software. e). Two (2) removable storage units for data transfer.	To be completed on or before March 17-21, 2014	\$
2	Documentation: a. minimum of two (2) complete operating/maintenance manuals; b. two sets of wiring diagrams; c. Specifications for spare components & vendors; d. two sets of wiring diagrams; e. specifications for spare components & vendors; f. integration technical instructions; g. sonar technical information; h. all proprietary algorithms must be identified and documented interfaces to those routines must be provided.	To be mutually agreed upon at contract award	\$
3	Training: The proposed contractor shall provide a qualified instructor to conduct an operator/maintainer course at the DRDC Atlantic facility for a minimum of three DRDC personnel at a date agreeable to both parties for no less than three (3) days;	To be completed on or before March	\$

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	Milestones	Delivery Date	Firm Price
		24-28, 2014	
4	Support: Phone-in technical support must be readily available for 1 year after completion of the PAT. The level of phone-in support shall not exceed 10 hours.	To be mutually agreed upon at contract award	\$

Total Pricing for Evaluation (including items 1 through 4) \$ _____

(GST/HST Extra)

The lowest responsive cost-per-point proposal within the stated budget of \$500,000.00 (taxes extra) will be recommended for award of a contract.

Canada will not pay the Contractor for any design changes, modifications or interpretations of the Work unless they have been approved, in writing, by the Contracting Authority before their incorporation into the Work.

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ANNEX C

Technical Drawings for Arctic Explorer Free Flooding Hull Section (attached)

ANNEX D**Vehicle Stability Statistics and Log File****To obtain a copy of: AUV VCC Synchronous Log Files:****PLEASE EMAIL:****ATL.NSRequisitions@pwgsc-tps.gc.ca****and Reference RFP# W7707-145707 HF INTERFEROMETRIC SAS SOFTWARE**

The AUV VCC Synchronous Log file contains examples of system produced logged data which can be used to aid in the production of Geo-referenced SAS data.

Vehicle stability parameters such as the following are also contained in the log files.

Pitch = vcc_phins_pitch_fb_deg

Pitch Rate = vcc_pos_pitch_rate_fb_dps

Roll = vcc_phins_roll_fb_deg

Roll Rate = vcc_pos_roll_rate_fb_dps

Heading = vcc_phins_heading_fb_deg

Heading Rate = vcc_pos_heading_rate_fb_dps

Yaw = Difference between Heading and 4 s averaged vehicle course made good calculated from vcc_pos_longitude_fb and vcc_pos_latitude_fb.

Example statistics of vehicle performance compiled from two previous missions are tabulated below. i.e. NRCan Basin mission (1.4 km straight run) and two consecutive opposite heading legs of Area Survey mission (750 m and 660 m runs).

	NRCan Basin		Area Survey Leg 1		Area Survey Leg 2	
	Mean	Std	Mean	Std	Mean	Std
Pitch (°)	-0.003	0.26	-0.29	0.90	0.13	0.85
Pitch Rate (°/s)	0.001	0.09	0.003	0.14	-0.003	0.14
Roll (°)	-1.78	0.18	-1.84	0.22	-1.70	0.22
Roll Rate (°/s)	0.003	0.19	0.003	0.20	-0.002	0.20
Heading (°)	325.8	0.44	334.3	0.58	158.4	0.85
Heading Rate (°/s)	-0.002	0.05	-0.003	0.04	0.001	0.06
Yaw (°)	0.23	0.41	-0.04	0.67	-0.38	1.00

ANNEX E

Existing Vehicle Positioning, Attitude and Orientation Systems and Log File

The following section details existing vehicle navigational, positioning, attitude systems currently installed aboard the AUV, and describes geo-referenced data.

Production of geo-referenced data.

For the purpose of this requirement Geo-referenced data is produced either by interfacing to the existing AUV navigation positioning, attitude and orientation system data; or by means of additional self-contained navigational positioning, attitude, gyroscopic sensors integrated in the SAS electronics module.

Currently the AUV determines navigation position, attitude and orientation data using the following onboard equipment:

Time Synchronization

Time Synchronization is available and provided over 100Mb Ethernet from an A.C.S.A Network Time Protocol server (model GIB-USC-1-A) located within the pressure hull.

The AUV vehicle control computer (VCC) time stamps operational parameters at either 10Hz or 1 Hz rate.

Example: VCC ACSA output is provided in the AUV VCC Synchronous Log files. (Annex D)

Inertial Navigation System

An IXSEA dry PHINS is mounted inside the forward end dome of the pressure hull. The PHINS provides the AUV vehicle control computer (VCC) with the following data:

- Position (DVL aided and pure inertial)
- Heading
- Roll and Pitch rates.

Example VCC PHINS output is provided in the AUV VCC Synchronous Log files. (Annex D)

DVL

A 300 kHz Teledyne RDI Workhorse Navigator DVL is mounted to the forward end of the AUV. The DVL provides velocity accuracy (0.4% +/- 0.4cm/s) at up to 200m of bottom lock.

Example VCC DVL output is provided in the AUV VCC Synchronous Log files. (Annex D)

Depth Sensor

The depth sensor is a Paroscientific (model 8CB7000-1) Digiquartz intelligent pressure transmitter with a serial output and accuracy of 0.01% over a 7000 meter depth range. This sensor is mounted to the forward dome section.

The transducer measures sea pressure in PSI and transmits that value to the VCC for conversion to a depth value.

Example VCC AUV depth data is provided in the AUV VCC Synchronous Log files. (Annex D)

Bottom Avoidance Altimeter

A 675kHz Kongsberg Simrad Mesotech 1007 digital altimeter is installed in the flooded forward nose cone. The sensor is angled at 45 deg. down inclination facing forward for collection of bottom avoidance data.

Example VCC altimeter data is provided in the AUV VCC Synchronous Log files. (Annex D)

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ANNEX F

Criminal Code of Conduct

COMPLETE LIST OF EACH INDIVIDUAL WHO ARE CURRENTLY DIRECTORS OF THE BIDDER

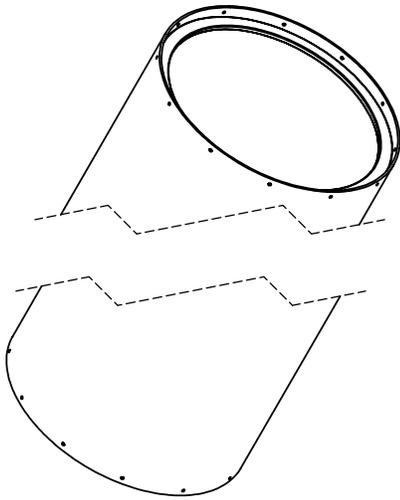
NOTE TO BIDDERS

WRITE DIRECTOR'S SURNAMES AND GIVEN NAMES IN BLOCK LETTERS

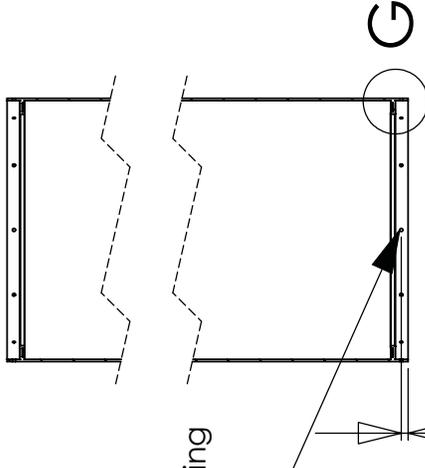
Board of Directors: (Please print clearly)

NAME	NAME	NAME	NAME

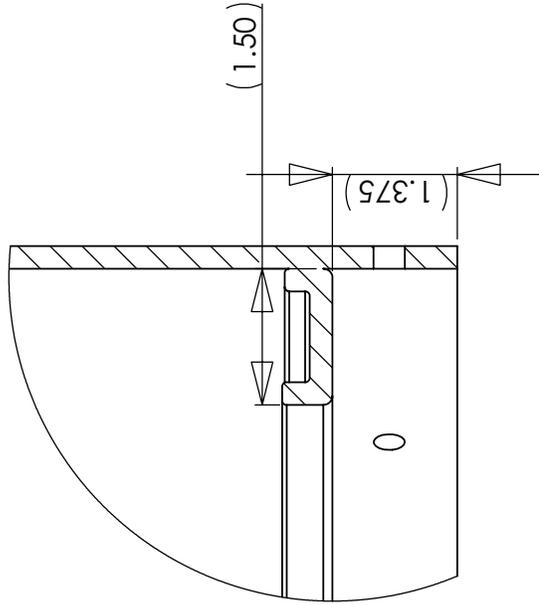
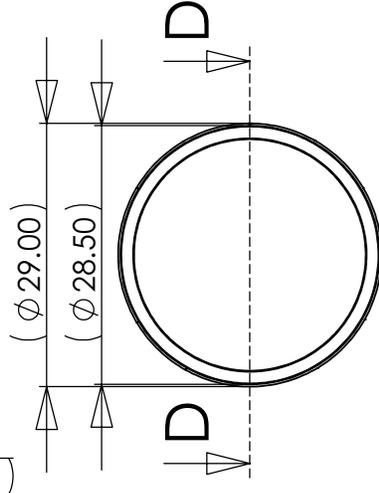
Attach additional names on a separate sheet if required.



12 equally spaced
11/32" thru-holes starting
top center

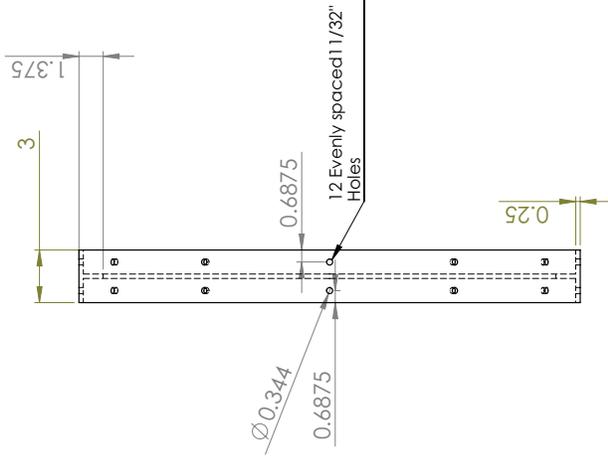
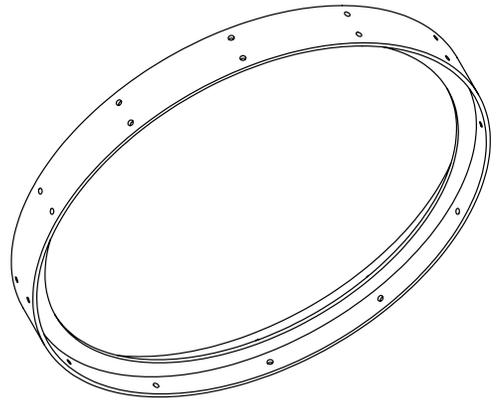
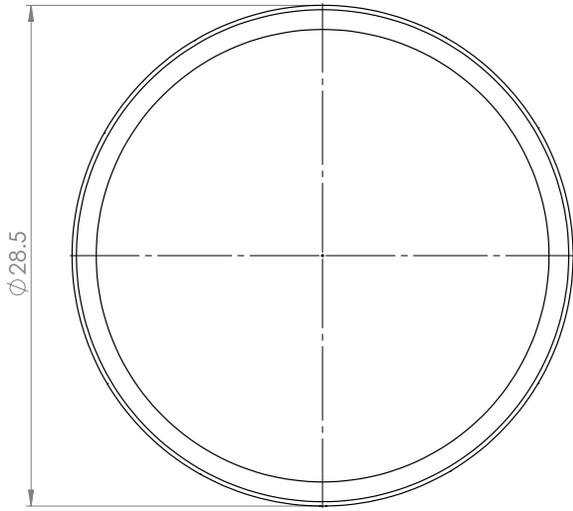


SECTION D-D



DETAIL G
SCALE 1 : 2

DIMENSIONS ARE IN INCHES		DRAWN	NAME	DATE	DRDC Atlantic
TOLERANCES:		CHECKED			Example Free Flooding Fwd Section Explorer 5000 class
FRACTIONAL: ±		ENG APPR			
ANGULAR: MACH ± BEND ±		MFG APPR			
TWO PLACE DECIMAL ±		Q.A.			
THREE PLACE DECIMAL ±		COMMENTS:			
MATERIAL: Polyester					SIZE: A
B0362 GRP					DWG. NO.
FINISH: --					REV.
DO NOT SCALE DRAWING					SCALE: 1:20
NEXT ASSY	USED ON				WEIGHT:
APPLICATION					SHEET 1 OF 1



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES		FINISH:		DEBUR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		DATE		TITLE:		Stiffener Ring			
TOLERANCES:		SIGNATURE		MATERIAL:		Explorer 5000 Class			
ANGULAR:		DATE		Polyester Based GRP		DWG NO.		A3	
DRAWN		DATE		WEIGHT:		SCALE: 1:7		SHEET 1 OF 1	
CHK'D		DATE							
APP'D		DATE							
MFG		DATE							
Q.A.		DATE							