

RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:
Bid Receiving - PWGSC / Réception des
soumissions - TPSGC
Gare Maritime Champlain
Champlain Maritime Harbour
901, Cap Diamant
901, Cap Diamant
Québec
Québec
G1K 4K1

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

Title - Sujet Self-Healing Network control Syst.	
Solicitation No. - N° de l'invitation W7701-092072/A	Date 2010-02-05
Client Reference No. - N° de référence du client W7701-9-2072	
GETS Reference No. - N° de référence de SEAG PW-\$QCL-018-12514	
File No. - N° de dossier QCL-9-30832 (018)	CCC No./N° CCC - FMS No./N° VME
Solicitation Closes - L'invitation prend fin at - à 02:00 PM on - le 2010-02-24	Time Zone Fuseau horaire Heure Normale du l'Est HNE
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: Piras, Gabriel	Buyer Id - Id de l'acheteur qcl018
Telephone No. - N° de téléphone (418) 649-2870 ()	FAX No. - N° de FAX (418) 648-2209
Destination - of Goods, Services, and Construction: Destination - des biens, services et construction: R & D POUR LA DÉFENSE CANADA - VALCARTIER BATIMENT 55 2459 BLVD PIE XI NORD QUÉBEC Québec G3J1X5 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
TPSGC/PWGSC
Gare Maritime Champlain
Champlain Maritime Harbour
901, Cap Diamant
901, Cap Diamant
Québec
Québec
G1K 4K1

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

PROJECT TITLE : SELF-HEALING NETWORKED CONTROL SYSTEMS STUDY

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PART 1 - GENERAL INFORMATION

1. Introduction

The bid solicitation and resulting contract document is divided into seven (7) parts plus annexes as follows:

- Part 1 General Information: provides a general description of the requirement;
- Part 2 Bidder Instructions: provides the instructions, clauses and conditions applicable to the bid solicitation and states that the Bidder agrees to be bound by the clauses and conditions contained in all parts of the bid solicitation;
- Part 3 Bid Preparation Instructions: provides bidders with instructions on how to prepare their bid;
- Part 4 Evaluation Procedures and Basis of Selection: indicates how the evaluation will be conducted, the evaluation criteria that must be addressed in the bid, if applicable, and the basis of selection;
- Part 5 Certifications: includes the certifications to be provided;
- Part 6 Security, Financial and Other Requirements: includes specific requirements that must be addressed by bidders; and
- Part 7 Resulting Contract Clauses: includes the clauses and conditions that will apply to any resulting contract.

The Annexes include:

Annex "A"	Statement of Work
Annex "B"	Basis of Payment
Annex "C"	Contractor Disclosure of Foreground Information
Annex "D"	Security Requirements Check List
Annex "E"	Financial Bid Presentation Sheet
Annex "F"	Mandatory and point rated technical evaluation criteria

2. Summary

The objectives of the work are :

To conduct an extensive study on the synthesis, the analysis and the validation of self-healing networked control systems for heterogeneous teams of small-scale unmanned vehicles. On the one hand, to develop concepts and theory pertaining to the following functionalities in teaming autonomous systems: cooperative health management and decision making, condition monitoring, information fusion, and robust fault-tolerant control. On the other hand, to prove the validity of the proposed concepts and systems in autonomy by means of theoretical proofs, extensive studies of modeling and simulation, and hardware-in-the-loop experiments.

The organization for which the services are to be rendered is Defence Research and Development Canada - Valcartier (DRDC - Valcartier).

The period of the Contract is from date of Contract to March 31st, 2012, inclusive.

Part of work is to be carried out on site at Defence Research and Development Canada - Valcartier, located at 2459 Pie-XI Blvd North, Quebec City, Quebec.

Defence Research and Development Canada - Valcartier has determined that any intellectual property rights arising from the performance of the Work under the resulting contract will belong to Canada.

There is a security requirement associated with this requirement. For additional information, consult Part 6 - Security, Financial and Other Requirements, and Part 7 - Resulting Contract Clauses. Bidders should consult the "[Security Requirements for PWGSC Bid Solicitations - Instructions for Bidders](#)" document on the Departmental Standard Procurement Documents Web site.

The requirement is subject to the provisions of the Agreement on Internal Trade (AIT).

The requirement is limited to Canadian goods and/or services.

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

After contract award, bidders may request a debriefing on the results of the bid solicitation. Bidders should make the request to the Contracting Authority within 15 working days of receipt of notification that their bid was unsuccessful. The debriefing may be provided 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 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 (2010-01-11) Standard Instructions - Goods or Services - Competitive Requirements, are incorporated by reference into and form part of the bid solicitation.

Subsection 4.4 of 2003, Standard Instructions - Goods or Services - Competitive Requirements, is amended as follows:

Delete: sixty (60) days

Insert: one hundred twenty (120) days

1.1 SACC Manual Clauses

A7035T (2007-05-25), List of Proposed Subcontractors

2. Submission of Bids

Bids must be submitted only to Public Works and Government Services Canada Bid (PWGSC) 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 or electronic mail to PWGSC will not be accepted.

3. Enquiries - Bid Solicitation

All enquiries must be submitted in writing to the Contracting Authority, preferably via email at Gabriel.Piras@tpsgc-pwgsc.gc.ca, no later than ten (10) 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.

4. Applicable Laws

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

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.

5. Basis for Canada's Ownership of Intellectual Property

Defence Research and Development Canada - Valcartier has determined that any intellectual property rights arising from the performance of the Work under the resulting contract will belong to Canada.

The Treasury Board, granted Defence Research and Development Canada exemption from the Treasury Board Policy on "Title to Intellectual Property Arising Under Crown Procurement Contracts"

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 (4 hard copies)
Section II:	Financial Bid (2 hard copies)
Section III:	Certifications (1 hard copies)

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.

1.1 Section I : Technical Bid

In their technical bid, bidders should demonstrate their understanding of the requirements contained in the bid solicitation and explain how they will meet these requirements. 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.

1.2 Section II: Financial Bid

1.2.1 Maximum funding

The maximum funding available for the Contract resulting from the bid solicitation is **\$275,000.00** (Goods and Services Tax or Harmonized Sales Tax 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.

1.2.2 Financial Bid

Bidders must submit their financial bid in accordance with the Financial Bid Presentation Sheet detailed in Annex "E". The total amount of Goods and Services Tax or Harmonized Sales Tax must be shown separately, if applicable.

1.3 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 Technical Evaluation

Mandatory and point rated technical evaluation criteria are included in Annex F, *Mandatory and point rated technical evaluation criteria*.

Except where expressly provided otherwise, the experience described in the bid must be the experience of the Bidder itself (which includes the experience of any companies that formed the Bidder by way of a merger, and subcontractors, but does not include any experience acquired through a purchase of assets or an assignment of contract). The experience of the Bidder's affiliates (i.e. parent, subsidiary or sister corporations) or suppliers will not be considered.

1.2 Financial Evaluation

1.2.1 Mandatory Financial Criteria

- The maximum funding available for the Contract resulting from the bid solicitation is **\$275,000.00** (Goods and Services Tax or Harmonized Sales Tax 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.
- Bidders must submit their financial bid in accordance with the Financial Bid Presentation Sheet detailed in Annex E.

1.2.2 Evaluation of Price

The price of the bid will be evaluated in Canadian dollars, the Goods and Services Tax or the Harmonized Sales Tax excluded, FOB destination, Canadian customs duties and excise taxes included.

2. Basis of Selection

2.1 Basis of Selection - Highest Rated Within Budget

1. To be declared responsive, a bid must:
 - (a) comply with all the requirements of the bid solicitation;
 - (b) meet all mandatory technical evaluation criteria; and

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- (c) obtain the minimum number of points required set out in the table in Annex F for the rated technical criteria.
2. Bids not meeting (a) or (b) or (c) 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.

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. 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.

1.1 Federal Contractors Program - \$200,000 or more

1. The Federal Contractors Program (FCP) requires that some suppliers, including a supplier who is a member of a joint venture, bidding for federal government contracts, valued at \$200,000 or more (including all applicable taxes), make a formal commitment to implement employment equity. This is a condition precedent to contract award. If the Bidder, or, if the Bidder is a joint venture and if any member of the joint venture, is subject to the FCP, evidence of its commitment must be provided before the award of the Contract.

Suppliers who have been declared ineligible contractors by Human Resources and Skills Development Canada (HRSDC) are no longer eligible to receive 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.

2. If the Bidder does not fall within the exceptions enumerated in 3.(a) or (b) below, or does not have a valid certificate number confirming its adherence to the FCP, the Bidder must fax (819-953-8768) a copy of the signed form LAB 1168, Certificate of Commitment to Implement Employment Equity, to the Labour Branch of HRSDC.
3. 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, 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, 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), in which case a duly signed certificate of commitment is attached;
- (d) () is subject to the FCP, and has a valid certificate number as follows: _____ (e.g. has not been declared an ineligible contractor by HRSDC.)

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

1.2 Former Public Servant Certification

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, in the context of the fee abatement formula, 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

Is the Bidder a FPS in receipt of a pension as defined above?

YES () NO ()

If so, the Bidder must provide the following information:

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

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 the Goods and Services Tax or Harmonized Sales Tax.

Certification

By submitting a bid, the Bidder certifies that the information submitted by the Bidder in response to the above requirements is accurate and complete.

1.3 Canadian Content Certification

This procurement is limited to Canadian services.

The Bidder certifies that:

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

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

1.4 Status and Availability of Resources

The Bidder certifies that, should it be awarded a contract as a result of the bid solicitation, every individual proposed in its bid will be available to perform the Work as required by Canada's representatives and at the time specified in the bid solicitation or agreed to with Canada's representatives. If for reasons beyond its control, the Bidder is unable to provide the services of an individual named in its bid, the Bidder may propose a substitute with similar qualifications and experience. The Bidder must advise the Contracting Authority of the reason for the substitution and provide the name, qualifications and experience of the proposed replacement. For the purposes of this clause, only the following reasons will be considered as beyond the control of the Bidder: death, sickness, maternity and parental leave, retirement, resignation, dismissal for cause or termination of an agreement for default.

If the Bidder has proposed any individual who is not an employee of the Bidder, the Bidder certifies that it has the permission from that individual to propose his/her services in relation to the Work to be performed and to submit his/her résumé to Canada. The Bidder must, upon request from the Contracting Authority, provide a written confirmation, signed by the individual, of the permission given to the Bidder and of his/her availability.

1.5 Education and Experience

The Bidder certifies that all the information provided in the résumés and supporting material submitted with its bid, particularly the information pertaining to education, achievements, experience and work history, has been verified by the Bidder to be true and accurate. Furthermore, the Bidder warrants that every individual proposed by the Bidder for the requirement is capable of performing the Work described in the resulting contract.

PART 6 - SECURITY, FINANCIAL AND OTHER REQUIREMENTS

1. Security Requirement

1. Before award of a contract, the following conditions must be met:
 - (a) the Bidder must hold a valid organization security clearance as indicated in Part 7 - Resulting Contract Clauses;
 - (b) the Bidder's proposed individuals requiring access to classified or protected information, assets or sensitive work site(s) must meet the security requirement as indicated in Part 7 - Resulting Contract Clauses;
 - (c) the Bidder must provide the name of all individuals who will require access to classified or protected information, assets or sensitive work sites.
2. Canada will not delay the award of any contract to allow bidders to obtain the required clearance.
3. For additional information on security requirements, bidders should consult the "[Security Requirements for PWGSC Bid Solicitations - Instructions for Bidders](#)" document on the Departmental Standard Procurement Documents Web site.

2. Financial Capability

SACC Manual clause A9033T (2007-11-30) Financial Capability

PART 7 - RESULTING CONTRACT CLAUSES

The following clauses and conditions apply to and form part of any contract resulting from the bid solicitation.

1. Statement of Work

The Contractor must perform the Work in accordance with the Statement of Work at Annex A and the technical portion of the Contractor's bid entitled _____, dated _____ (**to be completed at contract award**).

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 issued by Public Works and Government Services Canada.

2.1 General Conditions

2040 (2010-01-11), General Conditions - Research & Development, apply to and form part of the Contract.

2.2 SACC Manual Clauses

2.2.1 Canada to Own Intellectual Property Rights in Foreground Information

SACC Manual clause K3410C (2008-12-12) Canada to Own Intellectual Property Rights in Foreground Information

2.2.2 License to Intellectual Property Rights in Foreground Information

SACC Manual clause K3305C (2008-05-12) License to Intellectual Property Rights in Foreground Information

3. Security Requirement

SECURITY REQUIREMENT FOR CANADIAN SUPPLIER:
PWGSC FILE #W7701-92072

1. The Contractor must, at all times during the performance of the Contract, hold a valid Designated Organization Screening (DOS), issued by the Canadian Industrial Security Directorate (CISD), Public Works and Government Services Canada (PWGSC).
2. The Contractor personnel requiring access to sensitive work site(s) must EACH hold a valid RELIABILITY STATUS, granted or approved by CISD/PWGSC. Until the security screening of the Contractor personnel required by this Contract has been completed satisfactorily by the CISD, PWGSC, the Contractor personnel **MAY NOT ENTER** sites without an escort.

3. Subcontracts which contain security requirements are NOT to be awarded without the prior written permission of CISD/PWGSC.
4. The Contractor must comply with the provisions of the:
 - (a) Security Requirements Check List and security guide, attached at Annex D;
 - (b) Industrial Security Manual (Latest Edition).

4. Term of Contract

4.1 Period of the Contract

The period of the Contract is from date of Contract to March 31, 2012, inclusive

5. Authorities

5.1 Contracting Authority

The Contracting Authority for the Contract is:

Name: Gabriel Piras
 Title: Supply Specialist_
 Public Works and Government Services Canada
 Acquisitions Branch
 Quebec Region
 901, Cap-Diamant Street, room 240, Quebec, Quebec, G1K 4K1
 Telephone: 418-649-2870
 Facsimile: 418-648-2209
 E-mail address: Gabriel.Piras@tpsgc-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.

5.2 Technical Authority

The Technical Authority for the Contract is:

(The Technical Authority will be identified at contract award)

Name: _____
 Title: _____
 Defence Research and Development Canada - Valcartier
 Building 65, room 112A
 2459, boul. Pie-XI Nord
 Quebec, Quebec
 G3J 1X5

Telephone: 418-844-4000 extension _____
 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

Administrative representative :

Technical representative :

Name : _____
 Telephone : _____
 Facsimile : _____
 Email : _____

Name : _____
 Telephone : _____
 Facsimile : _____
 Email : _____

6. Payment

6.1 Basis of Payment - Limitation of Expenditure

The Contractor will be reimbursed for the costs reasonably and properly incurred in the performance of the Work, and profit, as determined in accordance with the Basis of Payment in Annex B, to a limitation of expenditure of \$_____ (**the amount will be inserted at contract award**). Customs duties are included and Goods and Services Tax or Harmonized Sales Tax is extra, if applicable.

6.2 Limitation of Expenditure

1. Canada's total liability to the Contractor under the Contract must not exceed \$ _____ (**the amount will be inserted at contract award**). Customs duties are included 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.

6.3 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 (<http://www.tpsgc-pwgsc.gc.ca/app-acq/forms/formulaires-forms-eng.html>), 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 90 percent of 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.

6.4 Funding by Fiscal Year

Despite the Total Estimated Cost (Limitation of Expenditure) specified in the Contract, and unless otherwise authorized in writing by the Contracting Authority, the maximum amount which may be paid for work completed in the period ending 31 March of the year specified is as follows:

Period from date of Contract to March 31st, 2010 : \$0.00

Period of April 1st, 2010, to March 31, 2011 :	\$145,000.00
Period of April 1st, 2011, to March 31, 2012 :	\$130,000.00

6.5 SACC Manual Clauses

6.5.1 T1204 - Direct Request by Customer Department

SACC Manual clause A9117C (2007-11-30) T1204 - Direct Request by Customer Department

6.5.2 Cost Submission

SACC Manual clause C0305C (2008-05-12) Cost Submission

6.6 Time Verification

SACC Manual clause C0711C (2008-05-12) Time Verification

7. Invoicing Instructions - Progress Payment Claim

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

Each claim must show:

- all information required on form PWGSC-TPSGC 1111;
- all applicable information detailed under the section entitled "Invoice Submission" of the general conditions;
- a list of all expenses;

Each claim must be supported by:

- a copy of time sheets to support the time claimed;
- a copy of the invoices, receipts, vouchers for all direct expenses, travel and living expenses;
- a copy of the monthly progress report.

- The 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.
- 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 following address for certification.

ATTN: Mrs Suzanne Larrivée
Public Works and Government Services Canada
Champlain Harbour Station
901, Cap Diamant, room 240

Québec, Québec
G1K 4K1

The Contracting Authority will then forward the original and two (2) copies of the claim to the Technical Authority for appropriate certification after inspection and acceptance of the Work takes place, and onward submission to the Payment Office for the remaining certification and payment.

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

8. Certifications

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.

8.1 Canadian Content Certification

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

9. Applicable Laws

The Contract must be interpreted and governed, and the relations between the parties determined, by the laws in force in _____. **(to be completed at contract award)**

10. 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 (2010-01-11) General Conditions - Research & Development;
- (c) Annex A, Statement of Work;
- (d) Annex B, Basis of Payment;
- (e) Annex C, Contractor Disclosure of Foreground Information;
- (f) Annex D, Security Requirements Check List;
- (g) the Contractor's bid dated _____ **(to be completed at contract award)**

11. Defence Contract

SACC Manual clause A9006C (2008-05-12) Defence Contract

12. Foreign Nationals (Canadian Contractor)

SACC Manual clause A2000C (2006-06-16) Foreign Nationals (Canadian Contractor)

13. Insurance

SACC Manual clause G1005C (2008-05-12) Insurance

14. List of Non-consumable Equipment and Material

SACC Manual clause B6800C (2007-11-30), List of Non-consumable Equipment and Material

15. Progress Reports

1. The Contractor must submit **monthly reports** on the progress of the Work in one copy to the Technical Authority and one copy to the Contracting Authority.
2. The progress report must contain three parts:
 - (a) PART 1 : The Contractor must answer the following three questions:
 - (i) Is the project on schedule?
 - (ii) Is the project within budget?
 - (iii) Is the project free of any areas of concern in which the assistance or guidance of Canada may be required?

Each negative response must be supported with an explanation.

- (b) PART 2 : A narrative report, brief, yet sufficiently detailed to enable the Technical Authority to evaluate the progress of the Work, containing as a minimum:
 - (i) A description of the progress of each task and of the Work as a whole during the period of the report. Sufficient sketches, diagrams, photographs, etc., must be included, if necessary, to describe the progress accomplished.
 - (ii) An explanation of any variation from the work plan.
 - (iii) A description of trips or conferences connected with the Contract during the period of the report.
 - (iv) A description of any major equipment purchased or constructed during the period of the report.

16. Canadian Forces Site Regulations

SACC Manual clause A9062C (2010-01-11), Canadian Forces Site Regulations

17. Identification Badge

Solicitation No. - N° de l'invitation

W7701-092072/A

Amd. No. - N° de la modif.

File No. - N° du dossier

QCL-9-30832

Buyer ID - Id de l'acheteur

qcl018

CCC No./N° CCC - FMS No/ N° VME

W7701-9-2072

SACC Manual clause A9065C (2006-06-16), Identification Badge

ANNEX A**STATEMENT OF WORK****Project title :****Self-Healing Networked Control Systems Study****Objectives :**

The objectives of the work are :

To conduct an extensive study on the synthesis, the analysis and the validation of self-healing networked control systems for heterogeneous teams of small-scale unmanned vehicles. On the one hand, to develop concepts and theory pertaining to the following functionalities in teaming autonomous systems: cooperative health management and decision making, condition monitoring, information fusion, and robust fault-tolerant control. On the other hand, to prove the validity of the proposed concepts and systems in autonomy by means of theoretical proofs, extensive studies of modeling and simulation, and hardware-in-the-loop experiments.

Background information :

The purpose of the present contract is to conduct an extensive study on the synthesis, the analysis and the validation of self-healing networked control systems for heterogeneous teams of unmanned vehicles. This contract provides support to DRDC Valcartier Project 12pz18 Self-Healing Networked Control Systems for Enhanced Reliability and Safety of Multi-vehicle Missions.

To date, unmanned aerial vehicles, or UAVs, have been operated in real missions with various levels of autonomy. It is envisaged that future unmanned and joint manned-unmanned missions will include cooperative sensor networks for search, rescue, and monitoring, collaborative indoor/outdoor surveillance and protection with small, miniature or micro UAVs, as well as cooperating networked unmanned combat aerial vehicles and weapons for engagements of mobile targets in adversarial environments. Furthermore, UAV applications are expected to include firefighting, heavy lifting, first-responder support in case of natural disasters, remote sensing, scientific research, and geographical survey, to name a few. It is well recognized that the development of UAVs has been partly motivated by the desire to carry out missions that are too dull, dirty, or dangerous for humans. However, there exist challenging barriers to overcome before the futuristic vision of multiple UAVs, combat vehicles and weapons operating cooperatively with other manned vehicles is realized. Among the scientific and technological challenges, lies the problem of ensuring multi-vehicle mission success, in terms of efficiency and safety, despite changing, potentially abnormal, conditions in vehicles, network and environment. Under such adverse conditions, the capabilities of the vehicles are reduced. Mission success is thus compromised and safety of nearby civilian population is at risk. Indeed, during flight, UAVs may be faced with a variety of events affecting their operation. These contingencies include faults, or malfunctions, and failures, or complete breakdowns, in UAV flight-critical components, platform damage, inter-vehicle information flow faults and failures, anomalous behaviors and environmental effects, such as bursts of wind, extreme weather, and icing forming on the airframe. Depending on context, certain events are more likely to occur than others. Obviously, several different contingencies may occur concurrently. Furthermore, it is possible that the occurrence of one contingency leads to the development of another. For example, cold weather may lead to control surfaces freezing and hence the

latter may not respond as expected. Safe and reliable multi-vehicle operations require the development of systems handling the aforementioned contingencies, as humans simply cannot accommodate, in a timely and effective manner, off-nominal conditions of various kinds occurring during the execution of the mission.

This contract intends to develop the basic principles and algorithms for the design and the analysis of health management systems for missions involving cooperating unmanned systems, with objective of addressing realistic contingencies which are unavoidable in complex, and possibly hostile environments. Concepts and theory are complemented with case studies and application examples featuring small-scale unmanned vehicles and weapons emphasizing modeling of realistic dynamics, implementation of algorithms and systems integration. Taxonomy of performances under a variety of identified anomalies, malfunctions, dynamic events, and environmental effects is obtained.

Detailed statement of work & work plan :

Acronyms:

SHNC: Self-Healing Networked Control

TA: Technical Authority

FTC: Fault-Tolerant Control

UAVs: Unmanned Aerial Vehicles (small-scale rotorcraft and airship-type vehicles of dimensions below 2 meters)

GNC: Guidance, Navigation and Control

RF: Radio Frequency

WMR: Wheeled Mobile Robot (small robot of 50cm maximum in dimensions and with onboard electronics)

Part of the work will be carried out on site at Defence Research and Development Canada - Valcartier, located at 2459 Pie-XI Blvd. North, Quebec City, Quebec. More specifically, Tasks 3.3, 4.5, 5.2, 5.3 and 6.2 will be carried out on the indoor hardware-in-the-loop multi-vehicle test-bed facility of DRDC - Valcartier (Precision Weapons Section).

The contractor will provide services across Tasks 1 to 7, as outlined below. These tasks are firm, and can be performed concurrently.

Material required to carry out Tasks 4, 5 and 6 can be any of the following: small-scale rotorcraft or airship-type unmanned aerial vehicles (UAV) (of dimensions below 1 meter), software for the control of the UAVs, viewing software, hardware electronics, cameras, or sensors. All material bought for this contract will be delivered to DRDC Valcartier by the end of the contract.

Firm Tasks 1 to 7 are described as follows.

Task 1: Mathematical Modelling

Task 1.1: To develop analytical nonlinear dynamic models for the UAVs (defined above) and a generic tail-controlled missile, using Newtonian physics principles and expressed in state-space form, including autopilots, guidance, and navigation systems. A mathematical model of onboard sensors and actuators will be developed. To characterize in mathematical form a minimum of three types of component-level faults and failures, namely those affecting sensors, actuators, and control effectors, and damage on the control effectors. To implement the models on Mathworks' Simulink software. The models must be compliant to Simulink's Real-Time Workshop.

Task 1.2: To model analytically, and within the state-space equations of Task 1.1, the wind effects affecting UAV flight. To implement the models on Mathworks' Simulink software. The models must be compliant to Simulink's Real-Time Workshop.

Task 1.3: To develop an inter-UAV RF communications analytical model which will express the salient features of current communications technology, including delays, data packet loss, and failures. To implement the RF communications model on Mathworks' Simulink software. The models must be compliant to Simulink's Real-Time Workshop.

Task 1.4: To validate the mathematical models of Tasks 1.1, 1.2 and 1.3 analytically, and by means of real-time simulations on Simulink.

The analysis and the simulations in Task 1.4 will include at least the following considerations: 1) effectiveness of trajectory tracking for the UAVs, 2) acceleration command tracking for the missile, 3) quantification of the impact of the severity of faults and failures of the components on the flight path of the missile and UAVs, 4) measure of the effect of body damage and wind on the motion of the UAVs, and 5) effect of concurrent faults and failures on the motion of the UAVs and missile.

Task 2: Definition of self-healing networked control (SHNC) system parameters, requirements, and problem

Task 2.1: To formulate mathematically, using nonlinear control theoretic and systems concepts, and implement on Simulink the scenarios of persistent surveillance and cooperative search for tight formation flying UAVs and groups of dispersed UAVs. There is a maximum of ten vehicles flying in formation or executing a mission as a group. To implement the two scenarios in Simulink in closed-loop with the models developed in Task 1. The models must be compliant to Simulink's Real-Time Workshop.

Task 2.2: To perform an exhaustive review of existing and conceptual cooperative guidance, navigation and control (GNC) systems for nominal and off-nominal operations of UAVs and missile. To review open scientific literature and government reports from the year 2000 to present. Off-nominal operations pertain to degraded performances in unmanned vehicle components (actuator and sensor faults/failures), presence of unexpected dynamic events (changes in mission planning from commander, and occurrence of pop-up targets and threats), and adverse environmental effects (wind effects).

Task 2.3: Establish theoretical requirements, performance metrics, and constraints on design.

Task 2.4: Determine SHNC system integration and implementation requirements for the UAVs, with their onboard GNC systems and current RF communications.

Task 3: Design of robust fault-tolerant control (FTC) system for the individual vehicle

Task 3.1: To develop a robust active fault-tolerant control system that is robust to system uncertainties (on aerodynamics and dynamics of the UAV platform and missile), exogenous disturbances (wind), and measurement (onboard sensor) noise. The FTC system must execute in real-time. For both UAV and missile dynamic models, to prove mathematically (via control theoretic and nonlinear systems theory concepts, and by means of proposed theorems, lemmas and proofs) the robustness, stability and performance of the FTC system in closed-loop with the UAV and missile GNC systems. To investigate analytically the performances obtained under

several sensor and actuator faults, and body damage. Cases of faults, failure and damage occurring one at a time and concurrently are studied. To implement the robust active FTC system on Simulink. The models of the robust active FTC system must be compliant to Simulink's Real-Time Workshop. To carry out real-time simulations, and determine the limitations in the performance of the robust active FTC system.

Task 3.2: For the UAV and missile dynamic models, to determine the classes of sensor and actuator faults (type of fault and severity of fault), and level of body damage, for which the robust active FTC system can provide compensation. By means of mathematical proofs and real-time simulations on Simulink, to identify the recovery levels achieved by the UAV and missile equipped with the proposed robust active FTC system in terms of trajectory tracking of various commanded three dimensional trajectories.

Task 3.3: To design a system of dynamic trajectory generation and online trajectory re-generation in case faults, failure or damage takes place. To integrate, in Simulink, this system with the robust active FTC system and the low-level GNC systems of the UAV and missile models. The models must be compliant to Simulink's Real-Time Workshop. By means of mathematical analysis (proposed theorems, lemmas and proofs) and real-time simulations, to prove the closed-loop stability and the tracking of trajectories for the UAV and the missile, and to determine the levels of performance achievable for the component faults and failures and body damage. The tasks of integration and real-time simulations will be partly done at DRDC Valcartier site, on the indoor hardware-in-the-loop multi-vehicle test-bed, with a minimum stay of 3 months.

Task 4: Design of SHNC system at the UAV team level and interaction with individual vehicle FTC

Task 4.1: To define a decentralized architecture for SHNC, integrated with individual UAV robust active FTC, trajectory generation and online trajectory re-generation, and the low-level UAV GNC system.

Task 4.2: To develop a decentralized team decision making and health management system, labelled SHNC system, for the near autonomous operation of a group of UAVs. The system will include online, dynamic mission planning, task/target assignment and path planning functions to coordinate the motion of the group and formations of UAVs for near-optimal persistent surveillance and cooperative search operations. The proposed SHNC system will exploit techniques of artificial intelligence, optimization and control under uncertainty, heuristics, discrete-event systems and information theory, and will rely on RF communication among the UAVs. To define individual and team health states, and include this definition in the formulation of the SHNC system. The SHNC system will be implemented on Simulink and must be compliant to Simulink's Real-Time Workshop. The SHNC system must execute in real-time.

Task 4.3: To design a condition monitoring function. The proposed condition monitoring function will detect abnormal conditions in the UAVs in the team, the RF communication network, and changes in the environment (wind effects), and will predict the evolution of the abnormal conditions and their impact on the UAV team performance. The condition monitoring function will rely on the characterization of signal singularities proper to fault-induced transients, hypothesis testing, and simplified-model robust observers on neighboring UAVs. The condition monitoring function will be implemented on Simulink, must execute in real-time, and must be compliant to Simulink's Real-Time Workshop.

Task 4.4: To develop an information management function. Such function will build upon concepts of information fusion for filtering and estimation in case of imperfect and partial knowledge of the condition (health status) of the team and of the surroundings. This function will collect available information and generate the relevant signals to the team decision making and health management system of Task 4.2. The information management function will be implemented on Simulink, must execute in real-time, and must be compliant to Simulink's Real-Time Workshop.

Task 4.5: To conduct analytical studies on the effectiveness of the functions developed in Tasks 4.2, 4.3 and 4.4, integrated according to the architecture proposed in Task 4.1. The analysis relies on mathematical proofs (proposed theorems, lemmas and proofs) and performance metrics defined in Task 2.3. The SHNC system and the functions of condition monitoring, and information management will be validated by means of real-time simulations using Simulink and hard real-time simulations using a real-time operating system. Simplified low-level UAV models (individual UAV GNC system, actuators, sensors and body dynamics) will be used. The scenarios of persistent surveillance and cooperative search will serve as the test cases, following a simple case scenario where a formation will be required to fly from one waypoint to another and faults, failures and body damage will occur in sequence. The tasks of integration and real-time simulations will be partly done at DRDC Valcartier site, on the indoor hardware-in-the-loop multi-vehicle test-bed, with a minimum stay of 6 months.

Task 5: Proof of SHNC system concept by means of extensive modelling and real-time simulations, and hardware-in-the-loop experiments

Task 5.1: To conduct a verification and a validation of each subsystem model (functions) and the entire, integrated system by means of real-time simulations. The simulations will use the models and systems developed in Tasks 1 to 4 in Simulink. To do so, the metrics of Task 2 will be employed, and open-literature experimental and simulation data will serve as a yardstick against which the performance of the individual UAV and the team of UAVs are measured.

Task 5.2: To set-up a real-time simulation demonstrator, in the indoor hardware-in-the-loop multi-vehicle test-bed of DRDC Valcartier, which includes the entire suite of models and systems developed in Tasks 1 to 4 in Simulink, uses one or more computers, and displays a three-dimensional rendering of the UAV flight and surroundings. One demonstration is for the persistent surveillance scenario, and the other is for the cooperative search scenario. The demonstrations will allow a single operator to control a fleet of UAVs, with possible intervention at any time during the course of the operation. The main capabilities of the SHNC system, as determined in Task 4, will be featured in the demonstrations.

Task 5.3: To integrate the functions of the SHNC and the low-level robust active FTC systems on the indoor hardware-in-the-loop multi-vehicle test-bed of DRDC Valcartier. The integration will rely on 1) the Real-time Workshop code generation capability of Simulink, and 2) a seamless rapid prototyping process from Simulink models to functions embedded onboard the UAVs, to the deployment of the team of UAVs. An electronic board with a real-time operating system will be embedded onboard each UAV and will run the functions of the SHNC, the low-level robust active FTC and the autopilot. The developed SHNC system will be integrated with UAVs and WMRs already available in the indoor hardware-in-the-loop multi-vehicle test-bed of DRDC Valcartier. To validate the effectiveness of the systems by means of flight experiments with scenarios of persistent surveillance and cooperative search.

Task 6: Learning Network of a Mixed team of UAVs-WMRs

Task 6.1: To develop a physics-based mathematical model representative of the dynamics of a small team of UAVs and WMRs (including low-level GNC system, local FTC system, vehicle dynamics, and information flow). The model will be expressed in mathematical state-space form, and will be implemented in Simulink. The model must be compliant to Simulink's Real-Time Workshop. A mathematical model of onboard UAV and WMR sensors and actuators will also be developed and will be implemented in Simulink, and compliant to the Real-Time Workshop. The team is composed of a minimum of 2 UAVs and 3 WMRs. The vehicles will communicate through currently available RF communications.

Task 6.2: To design a cooperative navigation system to move the vehicles of the mixed team over a volume with area of 7m by 7m and height of 7m, at the indoor hardware-in-the-loop test-bed of DRDC Valcartier. The operation will include a minimum of 5 static obstacles and 3 threats, and a minimum of 2 moving obstacles and 3 pop-up threats. The cooperative navigation system will compensate for intermittent losses of GPS-like signals (emulated via an indoor vehicle tracking system available at the indoor hardware-in-the-loop test-bed of DRDC Valcartier), and adapt its behavior by learning about the motion of the moving obstacles and the statistics of the pop-up threats. The system will be based on learning concepts and theory. The cooperative navigation system of a small team of UAVs and WMRs will be implemented on Simulink and must be compliant to Simulink's Real-Time Workshop. The integration on the indoor hardware-in-the-loop test-bed at DRDC Valcartier will rely on a seamless rapid prototyping process from Simulink models of cooperative navigation to functions embedded onboard the UAVs and WMRs available at the indoor hardware-in-the-loop multi-vehicle test-bed of DRDC Valcartier.

Task 6.3: To conduct analytical studies on the effectiveness of the cooperative navigation system, integrated according to the architecture proposed in Task 4.1. The analysis will rely on mathematical proofs (proposed theorems, lemmas and proofs) and performance metrics defined in Task 2.3.

The tasks of developing a real-time simulation demonstrator and the hardware-in-the-loop experiments, which are part of Tasks 5 and 6, will be done at the DRDC Valcartier site, on the indoor hardware-in-the-loop multi-vehicle test-bed, with a minimum stay of 6 months.

Task 7: Final Report

Task 7.1: To prepare the final report. The report will include a description of the components of the SHNC system, the approaches and limitations, the results, and the concluding remarks and recommendations for future work. Taxonomy of performances under a variety of identified anomalies, malfunctions, dynamic events, and environmental effects will be proposed.

Material/support to be supplied by DND to contractor :

None.

Material/support to be supplied by contractor to DRDC Valcartier :

None.

Documentation to be supplied as reference material / Document de référence :

None.

Quality assurance standards :

The contractor must meet the DRDC Valcartier SOW within the available funding and with respect to the duration of the contract.

Meetings :

The contractor, on approbation of the scientific authority and of the project manager, will be authorized to travel to attend project progress meetings and workshops with the funds provided under this contract, up to a maximum of \$5 000.

Once every four months, in-person progress meetings, workshops or demonstrations will be held at DRDC Valcartier. The frequency of the meetings may be increased if deemed necessary, upon request from the contractor or from the technical authority. Monthly teleconferences will be held to ensure satisfactory work progress.

A meeting will also be convened at the end of each task to review the progress, achievement of the objectives, and review of the work plan for the subsequent task. The minutes will be provided by the contractor.

Reports/deliverables :

All reports, other than letter reports, must be provided in at least 10 (printed and bounded) copies. A PDF version of each report must also be provided. The language of correspondence is English. Reports must be formatted in accordance with DRDC standard. The standard can be obtained through the project's technical authority. For letter reports, an electronic copy using a pre-approved format will be provided to the technical authority.

All models, scripts, and algorithms must be supplied in Matlab-Simulink format.

Note: Deliverable and/or material must be received through DRDC Valcartier supply section

The main deliverables from this contract are listed below and must be added to the Section's document management system as per the instructions to be provided by the technical authority.

Task 1.1: Report on the mathematical models of UAVs and missile, GNC systems, actuators, sensors, degraded conditions of operation, actuator and sensor faults and failures, and body damage. The report will contain the equations, theory, techniques, functionalities and specifications. Furthermore, the contractor will deliver the code, algorithms, and scripts in Matlab-Simulink format. A textual description of the functions or code will appear on the first 50 lines of the Matlab script.

- Due: start date + 6 months

Task 1.2: Report on the mathematical model of the wind effects affecting UAV flight. The report will contain the equations, theory, and techniques used in the model, as well as a textual description of weather conditions and surroundings corresponding to such wind model.

Furthermore, the contractor will deliver the code, algorithms, and scripts in Matlab-Simulink format.

- Due: start date + 6 months

Task 1.3: Report on the mathematical model of the RF communications. The report will contain the equations, theory, and techniques used in the model of the inter-vehicle RF communication; in particular, the mathematics employed to model delays, packet dropouts and communication loss will be presented. Furthermore, the contractor will deliver the code, algorithms, and scripts in Matlab-Simulink format. A textual description of the functions or code will appear on the first 50 lines of the Matlab script.

- Due: start date + 6 months

Task 1.4: Letter report describing (1) analytical validation of the models developed in Tasks 1.1 to 1.3, and (2) baseline simulations. The code, algorithms, and scripts used in the simulations will be delivered (in Matlab-Simulink format).

- Due: start date + 6 months

Task 2.1: Report on the formulation of the persistent surveillance and cooperative search operations. The report will include a description of the parameters of the operations, and the events taking place, as well as a description of existing work in the open-scientific literature for such operations. Furthermore, the contractor will deliver the code, algorithms, and scripts used in modeling the two scenarios (in Matlab-Simulink format). A textual description of the functions or code will appear on the first 50 lines of the Matlab script.

- Due: start date + 6 months

Task 2.2: Report providing a review of existing and conceptual cooperative GNC systems for nominal and off-nominal operations of UAVs and missile. The review will cover open scientific literature and government reports from the year 2000 to present. The report will contain at least the following components: main researchers carrying out research in the area of health management for the individual aerospace vehicle (missile and UAVs) and for the cooperating UAVs; principal techniques, concepts, tools, and approaches used for fault/failure/damage tolerance in aerospace GNC systems; current capabilities, challenges, issues and limitations in cooperative GNC for nominal and off-nominal conditions of operation for the UAVs.

- Due: start date + 2 months

Task 2.3: Letter report summarizing theoretical requirements on stability and performance, metrics of performance (on signals of interest), and constraints on design (on computations and communications).

- Due: start date + 2 months

Task 2.4: Letter report describing SHNC system integration and implementation requirements for the UAVs. The report will cover the real-time implementation aspect, and the computational and communication constraints imposed on the team.

- Due: start date + 2 months

Task 3.1: Report on the robust active fault-tolerant control system designed for the UAV and the missile. The report will contain the equations, theory, techniques, and approaches used to design the robust active FTC system. The analytical study of the stability (internal), robustness (to uncertainties, disturbances and measurement noise) and performance (trajectory tracking and attitude stabilization for the UAV, acceleration tracking and body stabilization for the missile) of the FTC system in closed-loop with the UAV and missile GNC systems will be described in the report. Furthermore, the robust active FTC is a system that will be delivered by the contractor in

the form of a model in Simulink format. A description of the Simulink model will be delivered as a separate Microsoft Word document. Analysis of the real-time simulations will be provided in the report. The analysis reported will focus on implementation effects (finite wordlength effects, sampling rates achievable, converter effects, and fixed-point arithmetic computing on the closed-loop stability and tracking performances), trajectory tracking, and stabilization properties.

- Due: start date + 12 months

Task 3.2: Letter report summarizing the classes of sensor and actuator faults (type of fault and severity of fault) and level of body damage that can be compensated for by the robust FTC system, for both UAV and missile. Recovery levels will be described in the report. Real-time execution and recovery levels will be demonstrated by means of the simulations, and the results will be included in the report. Fault, failure and damage tolerance will also be proven mathematically and included in the report by means of proposed theorems, lemmas and proofs. The contractor will deliver the code, algorithms, and scripts used for the real-time simulations (in Matlab-Simulink format). A textual description of the functions or code will appear on the first 50 lines of the Matlab script.

- Due: start date + 12 months

Task 3.3: Report on the dynamic trajectory generation and online trajectory re-generation system designed for the UAV and the missile. The report will contain the equations, theory, techniques, and approaches used to design the trajectory generation and re-generation system. The analytical study of vehicle stability (internal), implementation considerations (discussion of trade-off between real-time constraints and vehicle performance) and tracking performance (error magnitude, duration and size of transients, and bumps in motion) of the dynamic trajectory generation and online trajectory re-generation system in closed-loop with the UAV and missile GNC and FTC systems will be described in the report. Furthermore, the trajectory generation and re-generation system will be delivered by the contractor in the form of a model in Simulink format. A description of the Simulink model will be delivered as a separate Microsoft Word document. Mathematical proofs of stability, effectiveness of trajectory re-generation, and vehicle tracking performance (size of error, magnitude of transients, and severity of bumps in the motion due to the change in trajectory) will be included in the report. The contractor will deliver the code, algorithms, and scripts used for the integration and the real-time simulations of the dynamic trajectory generation and online trajectory re-generation system (in Matlab-Simulink format). A textual description of the functions or code will appear on the first 50 lines of the Matlab script.

- Due: start date + 12 months

Task 4.1: Letter report describing the decentralized architecture for SHNC integrated with FTC, and trajectory re-generation. Feasibility of system architecture is described in the report.

- Due: start date + 10 months

Task 4.2: Report on the decentralized decision making and health management system designed for the group of UAVs. The report will contain the equations, theory, techniques, and approaches used to design the SHNC system. The SHNC system will be delivered by the contractor in the form of a model in Simulink format. A description of the Simulink model will be delivered as a separate Microsoft Word document.

- Due: start date + 18 months

Task 4.3: Report on the condition monitoring function designed for the group of UAVs. The report will contain the equations, theory, techniques, and approaches used to design the condition monitoring function. The condition monitoring function will be delivered by the contractor in the form of a model in Simulink format. A description of the Simulink model will be delivered as a separate Microsoft Word document.

- Due: start date + 20 months

Task 4.4: Report on the information management function designed for the group of UAVs. The report will contain the equations, theory, techniques, and approaches used to design the information management function. The information management function will be delivered by the contractor in the form of a model in Simulink format. A description of the Simulink model will be delivered as a separate Microsoft Word document.

- Due: start date + 20 months

Task 4.5: Report on an analytical study of performance for the system and functions developed in Tasks 4.2, 4.3 and 4.4. The contractor will deliver the code, algorithms, and scripts used for the integration and the real-time simulations of the SHNC system (in Simulink format), for the simple case scenario and for the persistent surveillance and cooperative search operations. The report will focus on mathematical proofs (proposed theorems, lemmas and proofs) of the performance obtained with a team of simplified low-level UAV dynamic models (individual UAV GNC system, actuators, sensors and body dynamics). The performance pertains to effectiveness of the team in achieving the mission objectives despite the occurrence of actuator and sensor faults, damage, and wind effects on the UAV flight.

- Due: start date + 20 months

Task 5.1: Report describing the results of the verification and validation of each function, and the entire integrated SHNC system done by means of real-time simulations.

- Due: start date + 20 months

Tasks 5.2 and 5.3: Report on the real-time simulation demonstrator and indoor hardware-in-the-loop flight tests. The report will contain the equations, theory, techniques, and approaches used to integrate the various components of the SHNC system onboard the UAVs. The report will contain a description on how to run the demonstrations, and present experimental results that showcase the effectiveness of the adaptation capability of the SHNC system to faults, failures, damage and wind effects. The contractor will deliver the code, algorithms, and scripts used for the integration, the real-time simulations and the hardware-in-the-loop experiments (in Matlab-Simulink and other formats).

- Due: March 31st, 2012.

Task 6.1: Report on the physics-based mathematical model representative of the dynamics of a small team of UAVs and WMRs (including low-level GNC system, local FTC system, vehicle dynamics, and information flow). The report will contain the equations, theory, and techniques used in the model. Furthermore, the contractor will deliver the code, algorithms, and scripts in Real-Time Workshop compliant Matlab-Simulink format.

- Due: start date + 20 months

Task 6.2: Report on the cooperative navigation system for the mixed UAV-WMR team. The report will contain the equations, theory, techniques, and approaches used to design the cooperative navigation system. The cooperative navigation system will be delivered by the contractor in the form of a model in Real-time workshop compatible Simulink format. A description of the Simulink model will be delivered as a separate Microsoft Word document.

- Due: start date + 22 months

Task 6.3: Report on the performance of the cooperative navigation system containing the analytical study and the real-time experimental validation on the indoor hardware-in-the-loop facility of DRDC Valcartier. The contractor will deliver the code, algorithms, and scripts used for the integration, the real-time simulations and the experiments of the cooperative navigation

system. The report will focus on mathematical proofs (proposed theorems, lemmas and proofs) of the performance obtained the mixed team of UAVs and WMRs. The performance pertains to effectiveness of the team in achieving the mission objectives despite the occurrence of actuator and sensor faults, and emulated body damage.

- Due: March 31st, 2012.

Task 7.1: Comprehensive final report.

- Due: March 31st, 2012, containing
 - Objectives, mission scenarios, contingencies
 - Theoretical concepts, algorithms, and mathematical techniques, as well as practical approaches used for the design and the analysis of the proposed SHNC system, requirements, survey of methods, and taxonomy of performances;
 - Evaluation of SHNC with respect to commercial-off-the-shelf capabilities and existing systems and concepts;
 - Description of modelling and simulation, and hardware-in-the-loop tests, post-test analysis, methodology used to evaluate SHNC functions, performance metrics, and results;
 - Analysis;
 - Description of software, code, models, and user guide.

Letter reports must be submitted in electronic form.

All documents, in hard-copy and in electronic form, software, source code, products, modified and/or revised during the course of this contract, must be delivered to the technical authority by the end of the contract.

The contractor shall provide support to DRDC Valcartier scientists for the use of tools, algorithms, software and hardware developed, used or bought during the course of the contract.

Mathematical models, algorithms, tools, techniques and electronic files developed and/or modified during the course of the contract will be delivered to DRDC Valcartier prior to the end of the contract.

The contractor, on approbation by the technical authority, must purchase and deliver at DRDC Valcartier all equipment that will be necessary to complete this contract up to a maximum amount of \$60 000 (maximum amount included in the project budget). The purchase of the equipment can be done at anytime during the project. The equipment purchased under this contract will remain the property of DRDC Valcartier at the end of the project.

Duration of contract :

- Task 1: contract start date + 6 months
- Task 2: contract start date + 6 months
- Task 3: contract start date + 12 months
- Task 4: contract start date + 20 months
- Task 5: 2012-03-31
- Task 6: 2012-03-31
- Task 7: 2012-03-31

OTHER DELIVERABLES

Solicitation No. - N° de l'invitation

W7701-092072/A

Amd. No. - N° de la modif.

File No. - N° du dossier

QCL-9-30832

Buyer ID - Id de l'acheteur

qcl018

CCC No./N° CCC - FMS No/ N° VME

W7701-9-2072

In addition to the disclosure obligation under Section 22 of the general conditions 2040, any Foreground Information must be fully disclosed and documented by the Contractor in the technical reports delivered by the Contractor to the Technical Authority under this Contract. Such disclosure must be done with the form "Contractor disclosure of foreground information" supplied in Annex C.

ANNEX B - BASIS OF PAYMENT

1. LABOUR: at the following firm hourly rates:

Proposed Resources	Firm Hourly Rates	
	Date of Award to 31 March 2011	01-04-11 to 31-03-12
	\$	\$
	\$	\$
	\$	\$
	\$	\$
	\$	\$
	\$	\$
	\$	\$
	\$	\$

Est.: \$ _____

2. MATERIALS AND SUPPLIES: at laid down cost without markup **Est.: \$ _____**

3. TRAVEL AND LIVING EXPENSES: **Est.: \$ _____**

The Contractor will be reimbursed its authorized travel and living expenses reasonably and properly incurred in the performance of the Work, at cost, without any allowance for profit and/or administrative overhead, in accordance with the meal, private vehicle and incidental expenses provided in Appendices B, C and D of the Treasury Board Travel Directive (http://www.tbs-sct.gc.ca/pubs_pol/hrpubs/TBM_113/td-dv_e.asp), and with the other provisions of the directive referring to "travellers", rather than those referring to "employees".

All travel must have prior authorization of the Technical Authority. All payments are subject to government audit.

4. SUBCONTRACTS: at actual cost without markup **Est.: \$ _____**

5. OTHER DIRECT CHARGES: at actual cost without markup **Est.: \$ _____**

Estimated Cost to a Limitation of Expenditure: \$ _____
(GST/HST extra)

With the exception of the firm rate(s) and price(s), the amounts shown in the various items specified above are estimates only. Minor changes to these estimates will be accepted for billing purposes as the Work proceeds, provided that these changes have the prior approval of the Technical Authority, and provided that the estimated cost does not exceed the aforementioned Limitation of Expenditure.

ANNEX C

CONTRACTOR DISCLOSURE OF FOREGROUND INFORMATION

Please see reference applicable in your contract to look into Article 1 - Interpretation of 2040 General Conditions to obtain the complete definition of the term Foreground Information and thus to help you to determine the information which must be revealed. <http://sacc.pwgsc.gc.ca/sacc/query-e.jsp>.

The Contractor shall respond to the following questions:

1. Contract No.:
2. What is the descriptive title of the FIP (Foreground Intellectual Property)?
3. Abbreviated description of the FIP and, if applicable, of the different systems and sub-systems.
4. What is or was the objective of the project?
5. Explain how the FIP meets the objective of the project (for example: the advantage of the new solution, what problem did the FIP resolve or what benefits did the FIP deliver).
6. Under which category (ies) would you best describe the FIP and why: Patents, Inventions, Trade Secrets, Copyright, Industrial Designs, Rights in Integrated Circuit Topography, Know-how, Other?
7. Describe the features or aspects of the FIP that are novel, useful and not obvious.
8. Has the FIP been tested or demonstrated? If yes, please summarise the results.
9. Has any publication or disclosure to others been made? If so, to whom, when, where and how?
10. Provide names and addresses of the inventors.
11. Provide an explicit and detailed description of the FIP developed during the contract (Refer to pertinent section of the technical report, if necessary).

Please specify name and position of person approving / authorizing this disclosure. This person is to sign and date the disclosure.

Name:
Title:

Date

(Internal DRDC Valcartier)

Nom
Titre : (Technical authority)

Date

Solicitation No. - N° de l'invitation

W7701-092072/A

Amd. No. - N° de la modif.

File No. - N° du dossier

QCL-9-30832

Buyer ID - Id de l'acheteur

qcl018

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

W7701-9-2072

CCC No./N° CCC - FMS No/ N° VME

ANNEX D

SECURITY REQUIREMENTS CHECK LIST

The Security Requirements Check List (SRCL) appended to the bid solicitation package is to be inserted at this point and forms part of this document.

ANNEX E**FINANCIAL BID PRESENTATION SHEET**

Note to bidders: this annex applies only to the request for proposals and will therefore cease to apply on award of the contract.

1. **LABOUR** : at firm all-inclusive hourly rates (inclusive of overhead and profit), GST/HST extra, in accordance with the following:

BIDDERS ARE REQUESTED TO QUOTE ONE RATE PER PROPOSED RESSOURCE REQUIRED, PER PERIOD.

Proposed Resources	Firm Hourly Rates				Extended Total per Proposed Resource
	Proposed Contract Period				
	Date of Award to 31 March 2011	Total Est. Hours	01-04-11 to 31-03-12	Total Est. Hours	
	\$		\$		\$
	\$		\$		\$
	\$		\$		\$
	\$		\$		\$
	\$		\$		\$
	\$		\$		\$
	\$		\$		\$

TOTAL ESTIMATED LABOUR: \$ _____

2. **MATERIALS AND SUPPLIES:** at laid down cost without markup

Description

Price

The total estimated amount for materials and supplies must be smaller or equal to \$60,000.00.
--

TOTAL ESTIMATED MATERIALS AND SUPPLIES : \$ _____

3. SUBCONTRACTS: at actual cost without markup

Support for the proposed subcontractor's price is required in the same details as that required for the Bidder's price. The estimated price for subcontracts should include all direct charges and travel & living expenses which would be to the account of the subcontractor.

TOTAL ESTIMATED SUBCONTRACTS: \$ _____

4. TRAVEL & LIVING: at actual cost without markup but not to exceed the limits of the Treasury Board Travel Directive. With respect to the TB Travel Directive, only the meal, private vehicle and incidental allowances specified in Appendices B, C and D of the TB Travel Directive <http://www.tbs-sct.gc.ca/hr-rh/gtla-vgcl/> and the other provisions of the directive referring to "travellers" rather than those referring to "employees", are applicable. Details are to be provided on a separate sheet.

The total estimated amount for travel and living must be smaller or equal to \$5,000.00.

TOTAL ESTIMATED TRAVEL & LIVING: \$ _____

5. OTHER DIRECT CHARGES: at actual cost without markup

TOTAL ESTIMATED OTHER DIRECT CHARGES: \$ _____

TOTAL ESTIMATED COST TO A LIMITATION OF EXPENDITURE: \$ _____
(GST/HST extra)

ANNEX F

MANDATORY AND POINT RATED TECHNICAL EVALUATION CRITERIA

Note to bidders: this annex applies only to the request for proposals and will therefore cease to apply on award of the contract.

1) MANDATORY TECHNICAL CRITERIA

None

2) POINT RATED TECHNICAL CRITERIA

Each technical offer that meets all the mandatory requirements defined above will be evaluated and rated in terms of the following evaluation criteria. These criteria are important to determine whether the company can deliver the desired R&D to efficiently support DRDC Valcartier program, and to assess whether the company can mitigate risks associated with this high-risk research.

Description	Min. score	Max. score
1. Merit of the technical proposal	16	40
1.1 <i>Understanding of the objectives and problems</i>	2	7
1.2 <i>Demonstration of the required expertise</i>	4	9
1.3 <i>Proposed innovations and improvements</i>	9	20
1.4 <i>Clarity and accuracy of the data provided</i>	1	4
2. Merit of the management proposal	10	22
2.1 <i>Project control methods and techniques (quality assurance process)</i>	1	4
2.2 <i>Conformity and realism of the work schedule</i>	4	8
2.3 <i>Management of personal resources</i>	5	10
3. Experience of the company	22	45
3.1 <i>Experience and training of the personnel assigned to the project</i>	17	31
3.2 <i>Previous pertinent experience of the company</i>	5	14
4.0 Experience of the proposed resources with regards to Tasks 1 to 6	9	25
4.1 <i>Experience of the resource(s) who will be responsible for Tasks 1 and 5 in real-time modeling and simulation</i>	1	4
4.2 <i>Experience of the resource(s) who will be responsible for Task 3 in active fault-tolerant control system design</i>	2	5
4.3 <i>Experience of the resource(s) who will be responsible for Tasks 2, 4 and 6 in the design of the self-healing networked control system</i>	3	8

<i>4.4 Experience of the resource(s) who will be responsible for Task 5 in the hardware-in-the-loop experiments with unmanned platforms, and systems integration on the DRDC Valcartier test-bed</i>	2	6
<i>4.5 Experience of the project manager in the supervision of R&D projects involving guidance, navigation and control concepts/systems for precision weapons and/or unmanned aircraft.</i>	1	2

Total score 132 points

Note that offers must obtain the minimum score required specified in the table above.

Criteria 1.1 to 2.3 will be scored as follows :

Each "evaluated element" of criteria 1.1 to 2.3 will be scored out of 10 based on the table "Guidelines for evaluating proposals" appended **to this annex**, and weighted based on the scores specified in the last column of the following table.

Criteria 3.1 to 4.5 will be scored in terms of the indications accompanying each criterion in the following table.

Description	Min. score	Max. score	Evaluated elements
1. Merit of the technical proposal	16	40	
<i>1.1 Understanding of the objectives and problems</i>	2	7	<ul style="list-style-type: none"> a. Substantial and original problem description (0-2 pts) b. Formulation of objectives (0-2 pts) c. Bring out critical elements of the problem (0-3 pts)
<i>1.2 Demonstration of the required expertise</i>	4	9	<ul style="list-style-type: none"> a. Conformity of the activities with the technical specification (0-2 pts) b. Detailed description of each activity (0-2 pts) c. Identify challenges and risks of the different activities (0-3 pts) d. Completeness and realism of the strategy and methodology to conduct the activities (0-2 pts)
<i>1.3 Proposed innovations and improvements</i>	9	20	<ul style="list-style-type: none"> a. Originality of proposed concepts and systems of robust fault-tolerant control (0-5 pts) b. Originality of proposed concepts and systems of team decision making and cooperative health management (0-6 pts) c. Pertinence of proposed concepts and systems is placed into context with respect to other research works (0-2 pts) d. Exploitation of information fusion and condition monitoring concepts integrated with team health management (0-5 pts) e. Real-time and integration issues addressed, and feasible solutions proposed and delivered as a system (0-2 pts)
<i>1.4 Clarity and accuracy of the data provided</i>	1	4	<ul style="list-style-type: none"> a. Easiness to understand the document (0-2 pts) b. Content quality and veracity (0-2 pts)

Description	Min. score	Max. score	Evaluated elements
2. Merit of the management proposal	10	22	
<i>2.1 Project control methods and techniques (quality assurance process)</i>	1	4	<ul style="list-style-type: none"> a. Description of the quality assurance process (0-2 pts) b. Applicability and realism of the proposed methods (0-2 pts)
<i>2.2 Conformity and realism of the work schedule</i>	4	8	<ul style="list-style-type: none"> a. Elaboration of a detailed calendar for each task and conformity with the schedule (0-3 pts) b. Quantity of working days allocated within the proposed budget (0-3 pts) c. Realism of the proposed calendar and manpower loading (0-2 pts)
<i>2.3 Management of personal resources</i>	5	10	<ul style="list-style-type: none"> a. Resources availability for concept formulation (0-2 pts) b. Resources substitutions provision (0-2 pt) c. Resources availability for integration on DRDC Valcartier test-bed (0-6 pts).

Description	Min. score	Max. score	Evaluated elements
3. Experience of the company	22	45	
<i>3.1 Experience and training of the personnel assigned to the project</i>	17	31	<p>a. Academic background: (7 pts)</p> <ul style="list-style-type: none"> PhD training in any of those disciplines: control, aerospace or aeronautics, mathematics and optimization, electrical engineering, mobile robotics, mechanical engineering (3 or more PhD holders: 7 pts, 2 PhD holders: 1 pt, 1 or 0 PhD holder : 0 pt) <p>b. Years of experience in total for all personnel assigned to the project pertaining to internships in control of aircraft and/or weapons and/or robots, contract or consulting work for aerospace and defence sectors, active research in the area of control, teaching in the area of control, and graduate studies in control of aircraft (manned and/or unmanned) and/or robots and/or weapons: (0-2 pts)</p> <ul style="list-style-type: none"> over 15 years (2 pts) from 10 to 15 years (1 pt) below 10 years (0 pt) <p>c. Particular skills: (0-22 pts)</p> <ul style="list-style-type: none"> experience in R&D projects involving design and delivery of algorithms, software, real-time models and simulators, and embedded control electronics in the context of precision weapons and/or unmanned vehicles (delivery of real-time workshop compliant Simulink models of guidance and control algorithms for weapons and/or controlled unmanned aircraft/ground vehicles, and guidance and control algorithms embedded on hardware onboard small unmanned vehicles: 2 pts; delivery of real-time workshop compliant Simulink models of guidance and control algorithms for weapons and/or controlled unmanned aircraft/ground vehicles, but no guidance and control algorithms embedded on hardware onboard small unmanned vehicles: 1 pt; otherwise, 0 pt.). <p style="text-align: right;"><i>Continued on next page</i></p>

Description	Min. score	Max. score	Evaluated elements
<p>3.1 <i>Experience and training of the personnel assigned to the project</i></p>			<p><i>Continued from previous page</i></p> <ul style="list-style-type: none"> • participation in team projects involving academia, industry and government (at least one project involving academia, industry and government: 1 pt, otherwise 0 pt). • publications in recognized peer-reviewed scientific journals and books from 2002 to 2009 in the control-related areas of interest, i.e. in aircraft/weapon guidance and control, in adaptive control, in nonlinear control, in estimation, in information fusion, in cooperative control, in networked control systems, and in fault-tolerant control: <ul style="list-style-type: none"> - 15 or more peer-reviewed journal articles and/or book chapters: 6 pts, otherwise 0 pt; - 2 or more journal papers on weapons (missile, bomb, UCAV) guidance law or autopilot: 3 pts, otherwise 0 pt; - A minimum of 4 edited/co-edited or authored/co-authored books, including at least one book on the topic of fault-tolerant control: 8 pts, otherwise 0 pt; • experience with commercial-off-the-shelf rapid control prototyping environment/software for cooperative control using (1) Matlab, (2) Simulink, (3) Real-time Workshop, and (4) commercial prototyping tools (experience with all of the above: 2 pts; otherwise, 0 pt).
<p>3.2 <i>Previous pertinent experience of the company</i></p>	5	14	<p>a. Number of projects in defence R&D with value over 100K\$ in which the company has been involved (2 or more projects: 5 pts; 1 project: 2 pts; 0 project: 0 pt.)</p> <p>b. Involved in at least one multi-year project in reliable UAV cooperative control in severe, harsh or complex environment (7 pts, otherwise 0 pt)</p> <p>c. Number of projects in precision weapons guidance and control in which the company has been involved (1 or more: 2 pts; otherwise, 0 pt).</p>

Description	Min. score	Max. score	Evaluated elements
4.0 Experience of the proposed resources with regards to Tasks 1 to 6	9	25	
<p><i>The same resource can be proposed for more than one criterion and more than one resource can be proposed for a given criterion. If more than one resource is proposed for the same criterion, each one will be evaluated individually and the final score for this criterion will be obtained by means of an average.</i></p>			
4.1 Experience of the resource(s) who will be responsible for Tasks 1 and 5 in real-time modeling and simulation.	1	4	<ul style="list-style-type: none"> a. Delivery of real-time workshop compliant Simulink models to clients or as part of graduate work (evidence being at least one report or thesis containing one or more models): 3 pts; otherwise, 0 pt. b. Delivery of at least one report and/or thesis and/or article and/or book that includes real-time modeling of the dynamics of aircraft and/or UAV (fixed-wing, rotorcraft or airship) and/or weapons for control design: 1 pt; otherwise, 0 pt.
4.2 Experience of the resource(s) who will be responsible for Task 3 in active fault-tolerant control system design.	2	5	<ul style="list-style-type: none"> a. Design of integrated fault diagnosis and reconfigurable control systems (evidence being at least one peer-reviewed article, book chapter, book or thesis): 2 pts; otherwise, 0 pt. b. Development of multiple-model approaches with application to fault-tolerant control systems design (evidence being at least one peer-reviewed article, book chapter, book or thesis): 2 pts; otherwise, 0 pt. c. Delivery of Simulink models to verify the performance of fault-tolerant control systems (evidence being at least one peer-reviewed article, book chapter, book or thesis): 1 pt; otherwise, 0 pt.

Description	Min. score	Max. score	Evaluated elements
<p>4.3 <i>Experience of the resource(s) who will be responsible for Tasks 2, 4 and 6 in the design of the self-healing networked control system.</i></p>	3	8	<p>a. Experience in the development of concepts in trajectory planning/tracking systems for unmanned vehicles (evidence being at least one peer-reviewed article, book chapter, book, report or thesis): 1 pt; otherwise, 0 pt.</p> <p>b. Experience in filtering and estimation (evidence being at least one peer-reviewed article, book chapter, book, report or thesis): 2 pts; otherwise, 0 pt.</p> <p>c. Experience in the design of nonlinear control systems (evidence being at least one peer-reviewed article, book chapter, book, report or thesis): 2 pts; otherwise, 0 pt.</p> <p>d. Experience in aircraft control systems designs and concepts (evidence being at least one peer-reviewed article, book chapter, book, report or thesis): 1 pt; otherwise, 0 pt.</p> <p>e. Experience in networked control systems (evidence being at least one peer-reviewed article, book chapter, book, report or thesis): 2 pts; otherwise, 0 pt.</p>
<p>4.4 <i>Experience of the resource(s) who will be responsible for Task 5 in the hardware-in-the-loop experiments with unmanned platforms, and systems integration on the DRDC Valcartier test-bed.</i></p>	2	6	<p>a. Experience in setting up a multi-vehicle control laboratory: 2 pts.</p> <p>b. Experience with (1) Simulink, (2) Matlab, (3) Real-time workshop, (4) Quarc, (5) RT-Lab, and (6) X-Plane: 4 pts if experience with all 6 tools; 2 pts if experience with at least 4 tools; 0 pt, otherwise.</p>
<p>4.5 <i>Experience of the project manager in the supervision of R&D projects involving guidance, navigation and control concepts/systems for precision weapons and/or unmanned aircraft.</i></p>	1	2	<p>a. Experience of supervision for at least 5 years: 2 pts, between 3 and 5 years: 1 pt, otherwise: 0 pt.</p>

APPENDIX 1 OF ANNEX "F" - GUIDELINES FOR EVALUATING PROPOSALS

NON RESPONSIVE	INADEQUATE	POOR	WEAK	JUST ACCEPTABLE	ACCEPTABLE	GOOD	VERY GOOD	EXCELLENT
0 point	1 point	2 - 3 points	4 points	5 points	6 points	7 - 8 points	9 points	10 points
<ul style="list-style-type: none"> Did not submit information which could be evaluated 	<ul style="list-style-type: none"> Absolutely inadequate Weaknesses can't be corrected Proponent lacks qualifications and experience Team proposed is not likely able to meet requirements 	<ul style="list-style-type: none"> Slightly or substantially below the desirable minimum Generally doubtful that weaknesses can be corrected Proponent generally lacks qualifications and experience Team is weak - either missing components or overall experience is weak 	<ul style="list-style-type: none"> Just fails to meet the desirable minimum Weaknesses can be corrected Proponent just below minimum qualifications and experience Team not quite capable of fulfilling requirements as presented 	<ul style="list-style-type: none"> Just meets the desirable minimum Weaknesses can easily be corrected Proponent has minimum qualifications and experience Team capable of just fulfilling requirements 	<ul style="list-style-type: none"> Meets the desirable minimum No significant weaknesses Proponent is qualified and experienced Team covers all components and will likely meet requirements 	<ul style="list-style-type: none"> Slightly exceeds the desirable minimum No significant weaknesses Proponent is well qualified and experienced Team covers all components and more than likely will meet requirements 	<ul style="list-style-type: none"> More than satisfies desirable minimum No apparent weaknesses Proponent is highly qualified and experienced Strong team - some members have previously worked together 	<ul style="list-style-type: none"> Exceptionally strong proposal No apparent weaknesses Proponent is exceptionally qualified and experienced Exceptional team - has worked well together before on comparable work
	<ul style="list-style-type: none"> Sample projects not related to this project's needs Extremely poor, insufficient to meet performance requirements 	<ul style="list-style-type: none"> Sample projects generally not related to this project's needs Little capability to meet performance requirements 	<ul style="list-style-type: none"> Sample projects only marginally related to this project's needs Just below acceptable capability 	<ul style="list-style-type: none"> Sample projects somewhat related to this project's needs Minimum acceptable capability, should meet minimum performance 	<ul style="list-style-type: none"> Sample projects generally related to this project's needs Average capability, should be adequate for effective results 	<ul style="list-style-type: none"> Sample projects related to this project's needs Above average capability 	<ul style="list-style-type: none"> Sample projects directly related to this project's needs Superior capability, should ensure effective results 	<ul style="list-style-type: none"> Took the lead in projects directly related to this project's needs Exceptional capability, should ensure extremely effective results



Contr. Number / Numéro du contrat W7701-92072
Security Classification / Classification de sécurité UNCLASSIFIED

**SECURITY REQUIREMENTS CHECK LIST (SRCL)
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)**

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE		
1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine DND	2. Branch or Directorate / Direction générale ou Direction DRDC Valcartier	
3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant	
4. Brief Description of Work / Brève description du travail Self-Healing Networked Control Systems Study. To conduct an extensive study on the synthesis, the analysis and the validation of self-healing networked control systems for heterogeneous teams of small-scale unmanned vehicles.		
5. a) Will the supplier require access to Controlled Goods? / Le fournisseur aura-t-il accès à des marchandises contrôlées?	<input checked="" type="checkbox"/> No / Non <input type="checkbox"/> Yes / Oui	
5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? / Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?	<input checked="" type="checkbox"/> No / Non <input type="checkbox"/> Yes / Oui	
6. Indicate the type of access required / Indiquer le type d'accès requis		
6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? / Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) / (Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)	<input checked="" type="checkbox"/> No / Non <input type="checkbox"/> Yes / Oui	
6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. / Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.	<input type="checkbox"/> No / Non <input checked="" type="checkbox"/> Yes / Oui	
6. c) Is this a commercial courier or delivery requirement with no overnight storage? / S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit?	<input checked="" type="checkbox"/> No / Non <input type="checkbox"/> Yes / Oui	
7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès		
Canada <input type="checkbox"/>	NATO / OTAN <input type="checkbox"/>	
Foreign / Étranger <input type="checkbox"/>		
7. b) Release restrictions / Restrictions relatives à la diffusion		
No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>	All NATO countries / Tous les pays de l'OTAN <input type="checkbox"/>	
Not releasable / À ne pas diffuser <input type="checkbox"/>	No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>	
Restricted to: / Limité à: Specify country(ies); / Préciser le(s) pays: <input type="checkbox"/>	Restricted to: / Limité à: Specify country(ies); / Préciser le(s) pays: <input type="checkbox"/>	
7. c) Level of information / Niveau d'information		
PROTECTED A / PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED A / PROTÉGÉ A <input type="checkbox"/>
PROTECTED B / PROTÉGÉ B <input type="checkbox"/>	NATO RESTRICTED / NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED B / PROTÉGÉ B <input type="checkbox"/>
PROTECTED C / PROTÉGÉ C <input type="checkbox"/>	NATO CONFIDENTIAL / NATO CONFIDENTIEL <input type="checkbox"/>	PROTECTED C / PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>	NATO SECRET / NATO SECRET <input type="checkbox"/>	CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>
SECRET / SECRET <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	SECRET / SECRET <input type="checkbox"/>
TOP SECRET / TRÈS SECRET <input type="checkbox"/>		TOP SECRET / TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>



PART A (continued) / PARTIE A (suite)

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS? No / Non Yes / Oui

If Yes, indicate the level of sensitivity:

Dans l'affirmative, indiquer le niveau de sensibilité :

9. Will the supplier require access to extremely sensitive INFOSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate? No / Non Yes / Oui

Short Title(s) of material / Titre(s) abrégé(s) du matériel :

Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

- | | | | |
|---|---|---|--|
| <input checked="" type="checkbox"/> RELIABILITY STATUS
COTE DE FIABILITÉ | <input type="checkbox"/> CONFIDENTIAL
CONFIDENTIEL | <input type="checkbox"/> SECRET
SECRET | <input type="checkbox"/> TOP SECRET
TRÈS SECRET |
| <input type="checkbox"/> TOP SECRET- SIGINT
TRÈS SECRET - SIGINT | <input type="checkbox"/> NATO CONFIDENTIAL
NATO CONFIDENTIEL | <input type="checkbox"/> NATO SECRET
NATO SECRET | <input type="checkbox"/> COSMIC TOP SECRET
COSMIC TRÈS SECRET |
| <input type="checkbox"/> SITE ACCESS
ACCÈS AUX EMPLACEMENTS | | | |

Special comments:

Commentaires spéciaux : See attached Security Classification Guide/Voir guide de classification de la sécurité fourni.

Accès au site du RDDC - Valcartier

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.

REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work?
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail? No / Non Yes / Oui

If Yes, will unscreened personnel be escorted?

Dans l'affirmative, le personnel en question sera-t-il escorté? No / Non Yes / Oui

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises?
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS? No / Non Yes / Oui

11. b) Will the supplier be required to safeguard COMSEC information or assets?
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC? No / Non Yes / Oui

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises?
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ? No / Non Yes / Oui

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data?
Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS? No / Non Yes / Oui

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency?
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale? No / Non Yes / Oui



W7701-92073

se

Security Classification / Classification de sécurité
UNCLASSIFIED

PART C - (continued) / PARTIE C - (suite)

For users completing the form **manually** use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.

Les utilisateurs qui remplissent le formulaire **manuellement** doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form **online** (via the Internet), the summary chart is automatically populated by your responses to previous questions.

Dans le cas des utilisateurs qui remplissent le formulaire **en ligne** (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category Catégorie	PROTECTED PROTÉGÉ			CLASSIFIED CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL CONFIDENTIEL	SECRET	TOP SECRET TRÈS SECRET	NATO RESTRICTED	NATO CONFIDENTIAL	NATO SECRET	COSMIC TOP SECRET COSMIC TRÈS SECRET	PROTECTED PROTÉGÉ			CONFIDENTIAL	SECRET	TOP SECRET TRÈS SECRET
							NATO DIFFUSION RESTREINTE	NATO CONFIDENTIEL	A		B	C				
Information / Assets Renseignements / Biens Production	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT Media / Support TI	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT Link / Lien électronique	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?

La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

No / Non Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".

Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?

La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

No / Non Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).

Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquer qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).