RETURN BIDS TO:
RETOURNER LES SOUMISSIONS À:

Bid Receiving
PWGSC
33 City Centre Drive
Suite 480
Mississauga
Ontario
L5B 2N5
Bid Fax: (905) 615-2095

LETTER OF INTEREST
LETTRE D'INTÉRÊT

Title - Sujet RFI Centrifuge Upgrade	
Solicitation No. - N° de l'invitation W7719-145261/A	**Date** 2014-02-12
Client Reference No. - N° de référence du client W7719-145261	**GETS Ref. No. - N° de réf. de SEAG** PW-$TOR-002-6544
File No. - N° de dossier TOR-3-36266 (002)	**CCC No./N° CCC - FMS No./N° VME**
Solicitation Closes - L'invitation prend fin **at - à** 02:00 PM **on - le** 2014-03-13	**Time Zone** **Fuseau horaire** Eastern Standard Time EST
F.O.B. - F.A.B. **Plant-Usine:** ☐ **Destination:** ☑ **Other-Autre:** ☐	
Address Enquiries to: - Adresser toutes questions à: Callahan, Kaye	**Buyer Id - Id de l'acheteur** tor002
Telephone No. - N° de téléphone (905) 615-2071 ( )	**FAX No. - N° de FAX** (905) 615-2060
Destination - of Goods, Services, and Construction: **Destination - des biens, services et construction:** DEPARTMENT OF NATIONAL DEFENCE 1133 Sheppard Ave. W. Toronto Ontario M3K2C9 Canada	

Comments - Commentaires

Instructions: See Herein

Instructions: Voir aux présentes

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

Delivery Required - Livraison exigée 2014-03-31	**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**

Issuing Office - Bureau de distribution
Public Works and Government Services Canada
Ontario Region
33 City Centre Drive
Suite 480
Mississauga
Ontario
L5B 2N5

Canada

REQUEST FOR INFORMATION REGARDING

THE MOTION CONTROL SYSTEM FOR THE DEPARTMENT OF NATIONAL DEFENCE HUMAN CENTRIFUGE

FOR

DEFENCE RESEARCH AND DEVELOPMENT CANADA, TORONTO RESEARCH CENTRE

Annex A: Draft Statement of Work - attached separately
Annex B: Experience Criteria - attached separately

ANNEX A

DRAFT Statement of Work (SOW) for the
Refit of the Control System Software and Hardware
of the
DRDC Human Centrifuge

SCOPE

1.1 Introduction
DRDC's Human Centrifuge is designed to simulate the forces experienced in a steep turning manoeuvre in high performance aircraft. It is used for training Canadian Forces pilots, Air Combat Systems Operators (ACSOs), and flight surgeons in high gravitational force (G) environments to recognize and prevent symptoms of G-induced loss of consciousness (G-LOC) while flying.

1.2 Objective
The objective is to replace the existing Control System (hardware and software) of the Human Centrifuge with current technology that can be life-cycle managed for a minimum of ten years.

1.3 Background
The Centrifuge Control System uses proprietary drive control software running on Intel 286 CPU's and Microsoft DOS 3.1 operating system. The source code for this software is no longer available. Consequently, the software must also be redeveloped.

The Centrifuge Control System is coupled to the centrifuge electromechanical system via a General Electric DC-300 Motor Drive. The Centrifuge Control System provides the signal for the targeted acceleration profile and the DC-300 controls the motor that spins the gondola to create the target acceleration.

The existing electro-mechanical subsystem, consisting of a 400 HP DC motor, safety coupling, brake, gear reducer, vertical drive shaft, horizontal arm and rider gondola, will remain as is.

The Centrifuge Control System also incorporates a Pilot Mode Control. This allows the gondola rider to control Gz. The new Control System must also support Pilot Mode Control.

The Centrifuge Control System and DC-300 drive systems operate in parallel with a custom-built, electro-mechanical Safety System. The new Centrifuge Control System must work in co-ordination with the current Safety System.

Operation of the system, description of all controls, display screens, system states, sensed and controlled variables for both the Control System and the Safety System along with a technical description of the Pilot Mode Control are included in the DRDC Human Centrifuge User's Manual.

The focus of this SOW is to replace the existing Centrifuge Control System hardware and software on the DRDC Centrifuge. A complete replacement is necessary to eliminate the reliability risk associated with the old hardware and to incorporate technological advances since the last refit.

2. APPLICABLE DOCUMENTS

2.1 NATO Standardization Agreement (STANAG) 3827 (Edition 5) – available through NATO Standardization Agency (http://nsa.nato.int/nsa/)

2.2 ASCC Advisory Publication 61/103/18 - available through the Air And Space Interoperability Council (http://www.airstandards.org/index.html)

2.3 MIL-STD-882E (or most recent) https://acc.dau.mil/CommunityBrowser.aspx?id=514013

2.4 DRDC Human Centrifuge User's Manual – available from DRDC upon request to the Contracting Officer

3. REQUIREMENTS

3.1 General

The items above the dashed line in Figure A-1 in Appendix A represent the components that need replacement. Specifically, these components include:

- Operator Control Console
- Centrifuge Control Computer consisting of a
    - Master Computer including the;
        - Pilot Mode Control System, and
    - Slave Computer
- Target Tracking System (TTS) Computer
- TTS Video Switch
- Operator & Secondary Operator Display
- Subject Video Overlay
- Safety System Status Display

The new system must be compatible and integrated with those components below the dashed line in Figure A-1. Specifically, these components include:

- ASECO Safety System
- Safety Sensors
- DC300 Motor Drive
- Gondola Components

- Triaxial Accelerometer
- Control Stick Rheostat
- Foot Pressure Plate Force Transducer
- Safety Switches
- Remote TTS Display

It is desirable that the DC-300 Motor Drive be retained in the system to reduce costs; however, it may be necessary to update this major component to make it compatible with the new Control System and ensure compliance with required standards.

The Control System must permit operation of the Centrifuge such that it meets NATO Standardization Agreement (STANAG) 3827 (Edition 5) for maximum G-onset rates as defined in ASCC Advisory Publication 61/103/18.

The Control System must come pre-programmed with all existing training and verification profiles. The current profiles utilized for the Human Centrifuge are included in the DRDC Human Centrifuge User's Manual.

3.2 Hardware

The Contractor must use previously proven equipment and commercial, off-the-shelf (COTS) items where possible to meet the requirements of this SOW. Nevertheless, all hardware must be from certified sources. It is expected that hardware replacement will be necessary during the 10-year life. Consequently, it is important that the hardware platforms and configurations be specified so they can be refit.

3.3 Software

The top-level user interface of the Centrifuge Control System software must be developed in the LabVIEW® graphical programming language **or equivalent**. Third party software must be from certified sources. As it is expected that hardware will need replacement during the 10-year life, it is important that the software be written to recognized standards and so it is easily portable to new hardware platforms. The Operators are seeking functionality similar to the existing Control System (see Appendix A) to minimize training effort. Nevertheless, this needs to be balanced with the need to modernize the interface and be compatible with the newest operating systems. The Operators are seeking the following improvements:

- Optimize input through mouse control and touch screen;
- Incorporate Foot Pressure Plate Indicator Bar on Secondary Operator (Run Director) Display Screen;
- Pilot Mode control using the gondola stick - Currently, the Pilot Mode control has a set rate for each position of the gondola stick regardless of the active profile and thus caps off at the limit set by the profile even if there is more space to move the stick back. The new Control System software must have Pilot Mode control with the ability to change the rates relative to the gondola stick position where the neutral position gives no acceleration and full stick back is the maximum rate as allowed by the set profile.

- Database. All data from all runs must be stored in a database. Reports of rider performance for individual runs must be retrievable in electronic form suitable for printing to hardcopy.
- System diagnostics. The current system has limited diagnostics for fault finding despite all system signals being monitored. Shutdowns of the centrifuge usually produce a cascade of error signals, but it is difficult to identify the error that triggered the cascade. A diagnostics utility that uses the Database must be included that permits maintainers to trace the origin of faults.

3.4 System Safety

The Human Centrifuge is a life-critical system. The Control System must operate in a fail-safe reliability regime. The design process and changes must be implemented in accordance with MIL-STD-882E (or most recent) using recognized systems safety methods for software, firmware and hardware.

3.5 Contract Phases

System Assessment. The Contractor must assess the current system to ensure that the existing system components that are not planned for replacement are compatible with the refit.

User Task Analysis. The Contractor must conduct a user task analysis of the centrifuge operation. The work will also involve research into the background of the current centrifuge configuration and set-up. In this research the Contractor is expected to complete a systems analysis of the Centrifuge to determine deficiencies.

Design Review. The Contractor must review the proposed Control System design with the Operators and the Technical Authority before developing the software and hardware.

Validation and Man-rating Test Plan. The Contractor must develop and review the plan with the Technical Authority and Operators for approval.

Prototype Development. The system must be developed such that the complete Centrifuge Control System is built and tested using simulated inputs. Barring unforeseen circumstances, for example, the development of costly equipment test benches, this must allow all current profiles, profile generation, and all safety conditions to be tested. Prototypes must be cleared by the Operators through usability testing and user validation and the results and recommendations must be presented to the Operators and the Technical Authority for each phase of the project.

System Installation and Commissioning. The Contractor must provide a plan for decommissioning the existing Control System, installation and commissioning of the new system. The system must be developed to minimize downtime of the Centrifuge during the refit of the Control System. The maximum acceptable downtime for the removal of the existing system, installation, validation and man-rating, training and hand-over of the new system is three months.

3.6 Security

- Classification of work:
  - The work completed will be unclassified

- Security clearance:
  - Level 1 Enhanced Reliability is required for all workers who will be on premises and who have access to the design and the code.
  - Security cards will be issued to the contractor for facility access.

4. DELIVERABLES

Along with a fully functional Human Centrifuge Control System, the Contractor must submit the following deliverables:

4.1 Project Plan and Schedule for Control Systems Replacement

The Contractor must produce a Project Plan and Schedule using the requirements outlined in this SOW. A presentation describing the Plan to Centrifuge Operators, Technical Authority and the Project Manager is required.

4.2 User Task Analysis

This document must include a full assessment of the operation of the Centrifuge including the configuration, physical layout and Operator duties. Weaknesses and deficiencies must be determined and described.

4.3 Design

The Contractor must provide and present the proposed design of the system to DRDC for review prior to starting development.

4.4 Prototype

The Contractor must provide an updated report of the prototype testing and results throughout each phase of the project and must present this to the Centrifuge Operators, the Technical Authority and Project Manager.

4.5 Validation and Man-rating Test Plan

The Contractor must provide a plan to validate the performance and safety of the system.

4.6 Installation Plan

The Contractor must submit a plan detailing the effective decommissioning of the current Centrifuge Control System and the installation and commissioning of the proposed system.

4.7 Software Executables and Source Code

The software must be preloaded on the Control System. The Contractor must also provide the software and source code on DVD or other suitable non-volatile digital storage media. The software source code must be written to standards proposed by the contractor and agreed to by DRDC.

4.8 Training
Formal training for the Centrifuge Operators (up to 6 individuals) must be provided including a validation of the operator's training level. (Question: how many?)

4.9 Manuals
The Contractor must supply a User's Manual which includes, but not limited to, information regarding the system design, component lists and descriptions, operation, technical specifications, software troubleshooting guide and repair instructions. The User's Manual must be formatted in MS Office 2010 applications (Word, Excel, PowerPoint, etc.) compatible with the MS Windows 7 personal computing environment.

5. OTHER

5.1 Government Funded Equipment

- Equipment, facilities, and services:
    - Access to the centrifuge facility will be provided,
    - Appropriate access to all available centrifuge documentation will be provided.
- Access to Operating staff on pre-arranged appointment basis

5.2 Intellectual Property
The Government of Canada will have the full rights of use of the design, documentation, hardware, software and the source code.

5.3 Language Requirements
The Contractor must be fluent in the English language. Fluent means that the individuals must be able to communicate orally and in writing without any assistance and with minimal errors.

5.4 Reporting Requirements

Monthly reviews and reports are required. The Contractor must remain open to periodic project inspection and audit. DRDC retains the right to audit the Contractor's project processes, QA procedures and deliverables at any time during the work.

APPENDIX A – Control System Diagram

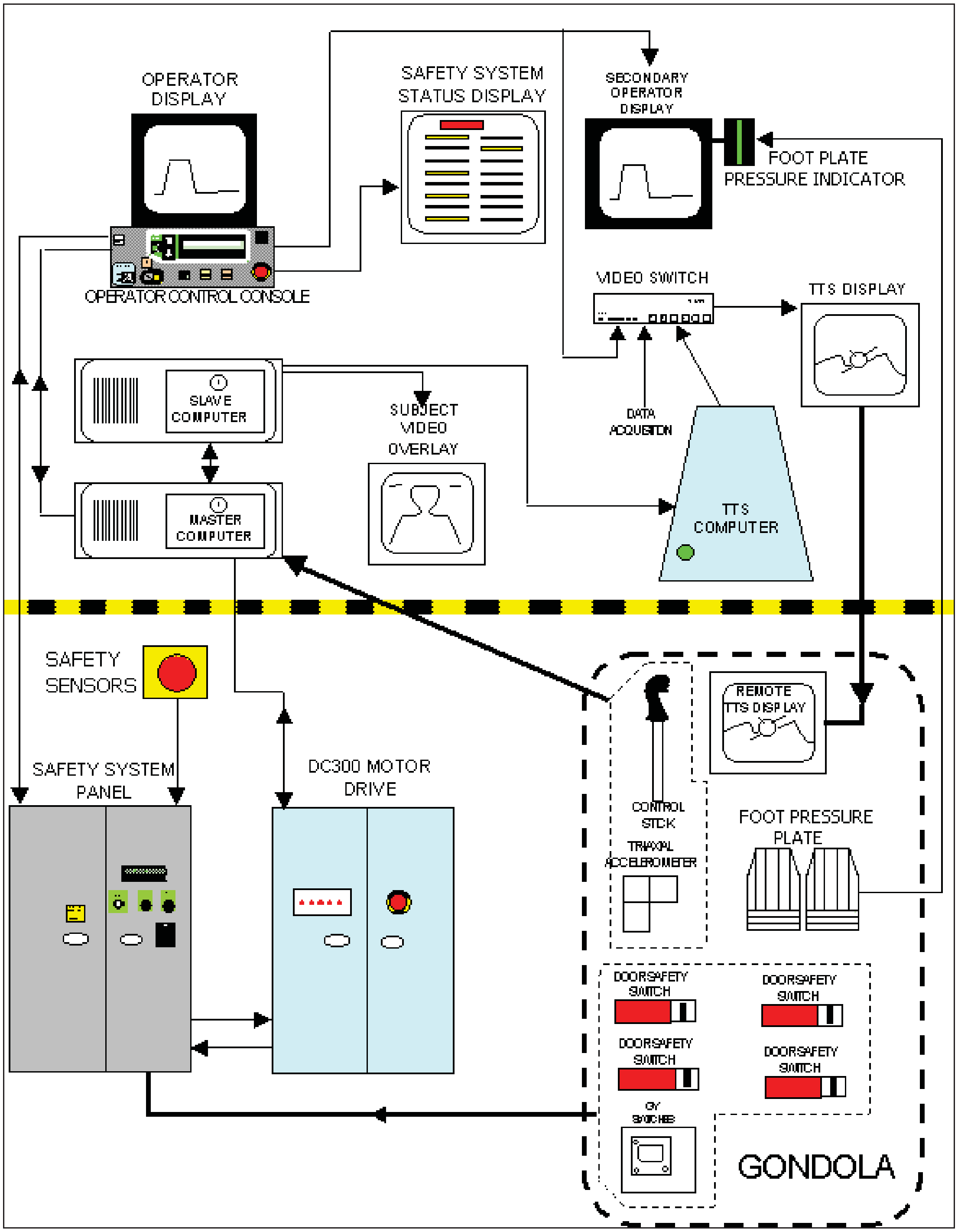

Figure A-1 – Control System diagram

APPENDIX B - Acronyms

CCS	Centrifuge Control System
DRDC	Defence Research and Development Canada
G-Force	Gravitational Force
G-LOC	Gravitational Force induced loss of consciousness
NATO	North Atlantic Treaty Organization
RFP	Request for Proposal
STANAG	Standardization Agreement
TTS	Target Tracking System

Annex B

EVALUATION CRITERIA

EXPERIENCE CRITERIA

1.1 The Bidder must have requisite knowledge and experience and must demonstrate success in delivering digital instrumentation and control systems of the kind suitable for the control of motion control systems for devices used for human occupancy. Specifically, documented evidence is required that demonstrates that the Contractor has:

1.1.1 a business focus on application development;

1.1.2 knowledge, experience and resources applicable and suitable to the work of upgrading a motion control system for safety critical, human-occupied devices.

1.1.3 at least 10 calendar years (within the 15 years prior to the closing date of the solicitation) of directly applicable experience in the project management, specification, design, development, testing, installation and commissioning of instrumentation and motion control systems used in fail-safe reliability regime.

1.1.4 Experience and resource depth in:

1.1.4.1 The design of real time instrumentation and control systems that include;

1.1.4.2 real time operating systems;

1.1.4.3 Human Machine Interface and Graphic User Interface design, human factors, information display, etc; and

1.1.4.4 National Instruments LabVIEW Programming Workbench or similar programming languages and tools;

1.1.5 The development and testing of such systems using:

1.1.5.1 National Instruments LabVIEW Programming Workbench or similar tools;

1.1.5.2 Automated test rigs and system simulators; and

1.1.5.3 Quality Assurance processes and procedures auditable by a qualified independent party.

2.1 The Bidder must be able to demonstrate their ability to maintain effective communications between the development team and the client.