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W8476-226486/B

**Advanced Improvised Explosive Device Detection and Defeat (AIEDDD) Project
Request for Information (RFI) Process**

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Solicitation Amendment 007 has been raised to:

- Extend the closing date on page 1 to June 28, 2024;
- Provide industry with a project update and to coordinate upcoming industry engagement;
- Provide additional questions to industry;
- Update portions of the Appendix A of Annex A for both the MUGV and SUGV.

This Amendment is divided into four sections:

- A. Section A – Project update and coordinating information for the Project Management Office (PMO) visits to the Original Equipment Manufacturer (OEM) and Vendor.
- B. Section B – Additional questions for industry under “Annex A Questions for Industry”
- C. Section C – Updated Appendix A1: Mini Uncrewed Ground Vehicle (MUGV) Technical Specification (Extracted from Annex A – Statement of Work (SOW) for the MUGV)
- D. Section D – Updated Appendix A1: Small Uncrewed Ground Vehicle (SUGV) Technical Specification (Extracted from Annex A – Statement of Work (SOW) for the SUGV)

Section A – Project update and coordinating information for the Project Management Office (PMO) visits to the Original Equipment Manufacturer (OEM) and Vendor.

1. Contracting Authority: In section 5 of the RFI, at Contracting Authority,

Delete:

Melanie Martyn
Supply Team Leader
Defence and Marine Procurement Branch
Public Services and Procurement Canada / Government of Canada
melanie.martyn@tpsgc-pwgsc.gc.ca

Replace with:

Mark Milloy
Supply Team Leader
Detection, Simulation and Optical Systems Division - QT
Public Services and Procurement Canada / Government of Canada
mark.milloy@tpsgc-pwgsc.gc.ca / 343-549-4768

2. Project structure. As announced in Amendment 006, the AIEDDD project will use a phased procurement approach. Project phase 1 will be the procurement of the Mini Uncrewed Ground Vehicle (MUGV) and the Small Uncrewed Ground Vehicle (SUGV), while phase 2 will be the procurement of the Mini Uncrewed Aircraft System (MUAS) and the High Energy Laser System (HELS). As such, the project team’s focus for the next 15 months will be on preparing and publishing the Request for Proposal (RFP) for phase 1. While not the priority during this time, work on phase 2 will continue in parallel.

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3. Project visits. Also announced in Amdt 006, the AIEDDD PMO will conduct visits to interested industry Original Equipment Manufacturer (OEM) and/or vendors during Fall 2023 and Winter 2024. Given the project phased approach, only the phase 1 (MUGV and SUGV) OEM/Vendors will be visited during this period. Visits on the phase 2 (MUAS and HELS) related products will be coordinated later in 2024. **Hosting a visit is not mandatory**, and it will have no implication on eligibility, and OEMs/Vendors will not be precluded from submitting a bid on future RFP's if they do not participate.
4. Visit Objectives:
 - a. For the project team to gain a clear understanding of the ability of the available products to meet each of the current requirements.
 - b. For the OEM/Vendor to ask questions about the project, and to provide any suggestions to the project team.
5. Dates. The PMO is currently planning two separate trips for the conduct of the visits, in the following timeframe:
 - a. Trip to Europe: **13th-24th of November 2023**.
 - b. Trip to USA and Canada (except Ottawa area): **4th-15th of December 2023**.
 - c. Ottawa area: flexible dates outside of the above windows.
6. Industry response. OEM/Vendor interested in participating must inform the Contracting Authority, Mark Milloy (mark.milloy@tpsgc-pwgsc.gc.ca), soonest, but no later than **September 7, 2023**, with the following information:
 - a. Name of the company.
 - b. Name of the visit POC.
 - c. Complete address of the location of the visit.
 - d. Preferred date(s) for the visit (if any).
 - e. Any firm unavailability during the trip window.
 - f. Anticipated duration needed for the visit.
7. Visit Scheduling. The AIEDDD Deputy Project Manager will compile the OEM preference and availability, develop the itinerary, and will coordinate with their POC as necessary to finalize the visit dates for the trip to occur in an effective and efficient manner.
8. Visit Planning Guidance to OEM. Hosting OEMs/Vendors should plan for the visiting project party to be composed of approximately seven participants, and for a duration of minimum one day to maximum two days per individual visit. The detailed agenda and sequence of event is up to the host, as long as it includes a minimum of the following (no particular order):
 - a. Opportunity for the PMO to see, touch and use the equipment (min 90 min per product).

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- b. Conference room to allow for discussion (min ½ day):
 - i. Review line by line the requirement specifications.
 - ii. Answer PMO questions (see Section B below), and any other topic for discussion.
9. Supplier should note that Canadian public servants are not allowed to accept any gifts, hospitality or other benefits that may have a real, apparent or potential influence on their objectivity in carrying out their official duties and responsibilities or that may place them under obligation to the donor. This includes activities such as free or discounted admission to sporting and cultural events, travel or conferences.
10. While the Government participants do not plan to provide any new information during the One-on-One meetings, any new information discussed will be posted for all potential bidders to view through an amendment to this RFI, unless it is deemed Commercial Confidential and then nothing will be published. Canada may request further consultations with any suppliers at any time during this RFI period in order to obtain clarification on feedback received. Suppliers are welcome to submit any presentation material and/or questions prior to their individual One-on-One session.
11. Point of contact. For all inquiries related to this RFI: Mark Milloy, SPAC/PSPC Mark.Milloy@tpsgc-pwgsc.gc.ca

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Section B – Additional questions for industry under “Annex A Questions for Industry”

In the RFI Annex A, under Technical Financial Costing requirements, **after** section “3. Additional comments”

Insert:

4.0 Advanced list of questions and discussion points (MUGV, SUGV)

AIEDDD is providing this sample list of questions and points to be discussed during the visits. It only aims at helping the OEM/Vendors by giving them ample time to prepare their answers and to formulate their questions to the project. There are no requirements to provide these answers to Canada by email ahead of time. This list is not all inclusive and additional questions and points for discussion will be brought up during the visits.

Note. For this section, the generic term “industry” refers specifically to each of the interested OEM/Vendor proposed UGV product.

Technical

1. CBRNE detectors.
 - a. The project team has made a change in concept:
 - i. Instead of requesting OEM/Vendors to include detectors and sensors as part of the MUGV, the project intends only on requesting OEM/Vendors to fabricate connectors and brackets to attach current sensors to the UGV and have its information relayed through the UGV comms system to the CCS.
 - ii. Canada will provide a list of devices (CBRNE detectors) to be integrated on the UGVs. For initial procurement, it would consist in a list of detectors currently in service in the Canadian Armed Forces (CAF) (list to be confirmed). Then, the in-service support contract will provision for the ability to design connectors for future CAF procured detectors.
 - iii. This concept is now applicable to both the MUGV and SUGV (as opposed to only the MUGV formally). List of sensors applicable to each may slightly differ.
 - b. The project is interested in industry feedback on this concept, and on their technical capabilities to support it. For example, the electronic infrastructure (number of available ports, bandwidth, software) for how many sensors, and the ability to supply power to the detectors.
2. Tether: We want to better understand the strength/resistance of industry’s fibre optics cable. What are the tensile strength, minimum bend radius, shear/crushing, abrasion resistance, or other characteristics?

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3. Zoom: Optical vs Digital. To better compare products and confirm our requirements, we need to confirm both your product's optical and digital capabilities.
4. Image: Does industry have any image stabilizing device/system?
5. Temperature: What are the minimum and maximum operating temperatures before there is any observable degradation in performance? Beyond that, what is the degradation that can be observed and what are its causes? Are there any limitations aside from battery degradation?
6. Radio System.
 - a. Current requirement to operate on MPU5 system stands. However, Canada wants to explore the flexibility that industry's products have in integrating a different radio system. This could be necessary as a future upgrade to the MPU5 system (longer term through the ISS contract), or through the desire to procure options equipped with a different system (short term through acquisition options). An example is the TrellisWare system.
 - b. What the level of work would be required to have industry's system capable of meeting those two requirements? What would be the cost impact?

Other

7. (Info) Basis of payment. For planning purposes, we will be asking for the Integrated Logistics Support (ILS) documents to be accepted before any equipment can be delivered and invoiced.
8. Options validity duration. Given that the Integrated Logistics Support (ILS) deliverables can take a fair amount time after contract award, Canada is considering two (2) "time marker" to request the option validity:
 - a. Options valid for 4 yrs after Contract Award; and
 - b. Options valid for 3 yrs after first delivery. Whichever date is the latest.
Any industry comment on this?
9. (Info) Currency. We will be asking all bids to be in CAD.
10. (Info) Bid evaluation preliminary concept. Intent is to proceed with a bid evaluation in two steps; a paper evaluation first, followed by a performance evaluation conducted in Canada by a third party. Details on which requirements will be tested and how they will be tested, will be developed later.
11. Production and Delivery. For macro planning purposes, Canada is interested in knowing what the UGV industry's timeline from contract award to first delivery is, and follow-on rate of production.

**Section C – Updated Appendix A1: Mini Uncrewed Ground Vehicle (MUGV) Technical Specification
(Extracted from Annex A – Statement of Work (SOW) for the MUGV)**

1. At section A1.0 Appendix: MUGVS Technical Specification,

**Delete and replace with attached copy of “A1.0 Appendix: MUGVS Technical Specification Version 2”
inserted herein.**

The paragraphs that were added, deleted, or modified have been identified with a yellow highlight to help the reader reviewing the changes.

This updated document aims at providing industry with the latest version of the technical specifications to set the basis for the OEM/vendor visits. It is purposely not a full RFI package update. It is not a final version.

**Section D – Updated Appendix A1: Small Uncrewed Ground Vehicle (SUGV) Technical Specification
(Extracted from Annex A – Statement of Work (SOW) for the SUGV)**

1. At section A1.0 Appendix: SUGVS Technical Specification,

**Delete and replace with attached copy of “A1.0 Appendix: SUGVS Technical Specification Version 2”
inserted herein.**

The paragraphs that were added, deleted, or modified have been identified with a yellow highlight to help the reader reviewing the changes.

This updated document aims at providing industry with the latest version of the technical specifications to set the basis for the OEM/vendor visits. It is purposely not a full RFI package update. It is not a final version.

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

A1.0 APPENDIX: MUGVS TECHNICAL SPECIFICATION VERSION 2

A1.1 System Requirements

A1.1.1 General

- A1.1.1.1 The Mini Unmanned Ground Vehicle System (MUGVS) must be based on proven, fielded equipment that is in-service with a North Atlantic Treaty Organization (NATO) or American, British, Canadian, Australian, New Zealand military partner or police agency of those countries.
- A1.1.1.2 The MUGVS must consist of the following components, and is further described in detail under the **System Component Requirements** section:
- A1.1.1.2.1 One (1) Mini Uncrewed Ground Vehicle (MUGV);
 - A1.1.1.2.2 One (1) Control and Communication System (CCS);
 - A1.1.1.2.3 Battery Set(s) for six (6) hours of operation;
 - A1.1.1.2.4 One (1) Battery Charging System;
 - A1.1.1.2.5 One (1) Drop Charge Release Mechanism;
 - A1.1.1.2.6 One (1) ABL-2000L Disruptor Adaptor;
 - A1.1.1.2.7 One (1) Needle Plus Disruptor Adaptor;
 - A1.1.1.2.8 Qty TBD (TBD) Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Detector Adaptors;
 - A1.1.1.2.9 One (1) Mapping Camera/Sensor;
 - A1.1.1.2.10 One (1) Pan Tilt Zoom (PTZ) Camera, and
 - A1.1.1.2.11 One (1) Hard Transport Container for the above components.
- A1.1.1.3 The MUGVS must include (stored within the Hard Transport Container) all tools required to setup and maintain the MUGVS in accordance with the **Operator Maintenance** Concept ANNEX A paragraph 4.1.1.1 (page 10).
- A1.1.1.4 The MUGVS must include (stored within the Hard Transport Container without needing to be folded or otherwise distorted from flat) the Technical Publication(s) listed within the CDRL(s) as being 'Issued with each MUGVS'.

A1.1.2 Transportability

- A1.1.2.1 The MUGVS must be transportable by fixed and rotary wing aircraft, cargo ships, rail, and commercial and military wheeled vehicles on highways and cross-country.

A1.2 System Component Requirements

A1.2.1 MUGV

A1.2.1.1 Mobility

- A1.2.1.1.1 The MUGV must maintain an average velocity of no less than five (5) km/h on level pavement or concrete surface.
- A1.2.1.1.2 The MUGV must traverse smooth polished surfaces, hard road surfaces, mud, fine sand, snow and ice.
- A1.2.1.1.3 The MUGV must climb and descend from obstacles (such as a road curb) of no less than a 10 cm height while carrying the minimum payload weight of 2kg.
- A1.2.1.1.4 The MUGV must traverse a dry grass-covered slope of no less than 15 degrees (27% grade) while carrying the minimum payload weight of 2kg.
- A1.2.1.1.5 The MUGV must climb and descend dry grass-covered slopes of no less than 30 degrees (58% grade) while carrying the minimum payload of 2kg.
- A1.2.1.1.6 The MUGV must hold position when not commanded to move, including when the MUGV is stopped on uneven ground or slopes and while carrying the minimum payload weight of 2kg.

A1.2.1.2 Firing Circuit

- A1.2.1.2.1 The MUGV must have no less than one (1) Firing Circuit that can initiate each of the following:
 - A1.2.1.2.1.1 M6 Electric Detonator;
 - A1.2.1.2.1.2 ABL-2000L Disruptor (Titanium), and
 - A1.2.1.2.1.3 Needle Plus disruptor.
- A1.2.1.2.2 The MUGV must have a built-in two (2) step action, to initiate the Firing Circuit. The first action is to arm the system, and the second action is the pressing of the fire button.
- A1.2.1.2.3 The power must not be applied to the Firing Circuit prior to the activation of the first action (arm) in the two-step action (arm+fire).
- A1.2.1.2.4 If the MUGV loses contact with the CCS, the MUGV must have a failsafe that removes power from the Firing Circuit (goes to a safe state) in no more than 60 seconds following the contact loss.
- A1.2.1.2.5 The MUGV must have a feature to conduct continuity checks of the entire Firing Circuit (following the safety limits of EN 13763-26 2004 para 7.4.1), initiated from the CCS, when one of the items listed at para. A1.2.1.2.1 are connected to the Firing Circuit.

A1.2.1.2.6 The MUGV Firing Circuit must be protected (isolated) from an inadvertent activation when power is cycled to the MUGV.

A1.2.1.2.7 Electro-Magnetic Compatibility and Interference

A1.2.1.2.7.1 The MUGV must meet the requirements of RE102 IAW MIL-STD-461G, or other equivalent international standard.

A1.2.1.2.7.2 The MUGV must meet the requirements of RS103 IAW MIL-STD-461G, or other equivalent international standard, for Army Ground levels from 2 MHz to 18 GHz.

A1.2.1.3 Cameras

A1.2.1.3.1 The MUGV Cameras must have the following features:

A1.2.1.3.1.1 Colour image;

A1.2.1.3.1.2 Low light and near infra-red illuminators;

A1.2.1.3.1.3 640x480 pixels or higher resolution;

A1.2.1.4 Field of View

A1.2.1.4.1 The MUGV must have an overall front field of view with the following:

A1.2.1.4.1.1 No less than a 60 degree horizontal field of view, and

A1.2.1.4.1.2 No less than a 120 degree vertical field of view;

A1.2.1.4.1.2.1 If required, the vertical field of view range can be met by either the camera tilting, the MUGV body tilting, or through a software based tilt.

A1.2.1.4.2 The MUGV must have an overall rear field of view with the following:

A1.2.1.4.2.1 No less than a 60 degree horizontal field of view;

A1.2.1.4.2.2 No less than a 60 degree vertical field of view;

A1.2.1.4.2.2.1 If required, the vertical field of view range can be met by either the camera tilting, the MUGV body tilting, or through a software based tilt.

A1.2.1.5 Radio

A1.2.1.5.1 The MUGV must continually act as a mobile RF communication relay, in a Mobile Ad-hoc Network (MANET), to assist with communication connection with any other device in the MANET using an MPU5 or Embedded Modules Wave Relay radio system (from Persistent Systems) with the same programming in a non-line-of-sight, subterranean, or reinforced concrete buildings, or to extend the range in line-of-sight applications.

- A1.2.1.5.2 The MUGV must use the MPU5 (NSN 5975-01-658-9155) or Embedded Module Wave Relay radio system with S-Band module NSN 5998-01-658-8999 (2200-2507 MHz) and L-Band module NSN 5895-01-662-2670 (1350-1390 MHz) to be interoperable with the current Canadian system.
- A1.2.1.5.3 The MUGV radio must be programmable to use an IP scheme imposed by DND to be interoperable with the current Canadian system.
- A1.2.1.5.4 The MUGV must have an Ethernet connection meeting IEEE Std. 802.3-2022 to set up the radio in a MANET.
- A1.2.1.6 Durability and Cleaning
 - A1.2.1.6.1 The MUGV must survive no less than five (5) consecutive throws with all possible landing angles from a height of no less than four (4) meters onto hard concrete, and remain fully functional.
 - A1.2.1.6.2 The MUGV must have no less than an IP65 rating, or equivalent, IAW NEMA IEC 60529.
 - A1.2.1.6.3 The MUGV must allow cleaning of the exterior surfaces with hot and cold low pressure water, steam and detergents, without wear, deterioration or damage.
- A1.2.2 **CCS**
 - A1.2.2.1 Display
 - A1.2.2.1.1 The CCS screen size must be no less than 254mm on the diagonal.
 - A1.2.2.1.2 The CCS must have an image display with a HD resolution of no less than 640x480 pixels.
 - A1.2.2.1.3 The CCS must have an image display whose brightness is user adjustable for daylight (no less than 1000 nits) and low light viewing.
 - A1.2.2.2 The CCS must add and remove a second simultaneous video feed from another camera to gain a better situational awareness of the operation.
 - A1.2.2.3 The CCS must record and store internally no less than 20 hours of videos and 1000 images concurrently.
 - A1.2.2.4 The CCS recorded data must be exportable to a portable computer using a USB port or SD card port.
 - A1.2.2.5 Durability
 - A1.2.2.5.1 The CCS must have no less than an IP64 rating, or equivalent, IAW NEMA IEC 60529.
 - A1.2.2.6 Radio
 - A1.2.2.6.1 The CCS must continually act as a mobile RF communication relay, in a MANET, to assist with communication connection with any other device in

the MANET using an MPU5 or Embedded Modules Wave Relay radio system (from Persistent Systems) with the same programming in a non-line-of-sight, subterranean, or reinforced concrete buildings, or to extend the range in line-of-sight applications.

A1.2.2.6.2 The CCS must use the MPU5 (NSN 5975-01-658-9155) or Embedded Module Wave Relay radio system with S-Band module NSN 5998-01-658-8999 (2200-2507 MHz) and L-Band module NSN 5895-01-662-2670 (1350-1390 MHz) to be interoperable with the current Canadian system.

A1.2.2.6.3 The CCS must have user access to the Web Management Interface to setup the MPU5 or Embedded Module or alternatively permit the changing of all radio parameters through the CCS interface including:

- A1.2.2.6.3.1 Frequency;
- A1.2.2.6.3.2 Bandwidth;
- A1.2.2.6.3.3 IP Scheme;
- A1.2.2.6.3.4 Network Node List; and
- A1.2.2.6.3.5 Encryption Key.

A1.2.2.6.4 The CCS must have a network visualization graphic showing the active nodes local to the MUGV with associated Signal to Noise Ratio (SNR) between the CCS and MUGV.

A1.2.2.6.5 The CCS must have a noise visualization graphic showing the signal strength between the nodes.

A1.2.2.6.6 The CCS Radio must be programmable to use an IP scheme imposed by DND to be interoperable with the current Canadian system.

A1.2.3 **Battery Sets**

A1.2.3.1 The MUGVS Battery System (MUGV, CCS, CBRNE Detectors, etc.) must provide no less than two (2) hours of continuous active operation at a temperature of 20°C (+/- 3 °C). Active operation is defined as:

A1.2.3.1.1 Power-on and initialization sequence of the MUGV and CCS;

A1.2.3.1.2 Movement of the MUGV 'down range' for 200m, with periodic movements throughout the majority of the two (2) hours, and then returning back for 200m before the two (2) hours has expired, and

A1.2.3.1.3 Continuous video transmission (small fluctuations allowed) between the MUGV and CCS throughout the two (2) hours.

A1.2.3.2 The MUGVS Battery System (MUGV, CCS, CBRNE Detectors, etc.) must provide no less than four (4) hours of continuous passive operation at a temperature of 20°C (+/- 3 °C). Passive operation is defined as:

A1.2.3.2.1 Power-on and initialization sequence of the MUGV and CCS; and

A1.2.3.2.2 Movement of the MUGV to a desired location 'down range' (within 200m) and holding its position while acting as an RF relay node for four (4) hours, and then returning back.

A1.2.3.3 The MUGVS must have Battery System for six (6) hours of operation.

A1.2.3.3.1 If using multiple Battery Sets, the MUGVS Battery Sets must be replaced in no more than five (5) minutes.

A1.2.3.4 The MUGVS Battery Set(s) must be rechargeable when installed in the MUGV and CCS.

A1.2.4 Battery Charging System

A1.2.4.1 The Battery Charging System must include a universal power input of 110VAC – 220VAC, 50Hz – 60Hz, with a North American plug type and a universal plug adapter kit.

A1.2.4.2 If using multiple Battery Sets, the Battery Charging System must be standalone from the MUGV and CCS, so they can be used while battery(ies) are charging.

A1.2.4.3 The Battery Charging System must provide visual indications of battery charging in order to indicate when charging is in progress and when it is complete.

A1.2.4.4 The Battery Charging System full recharge time for one (1) Battery Set (both MUGV and CCS) must not exceed eight (8) hours.

A1.2.4.5 The Battery Charging System must be certified CSA, CE, UL or equivalent.

A1.2.4.6 The Battery Charging System must recharge the full battery System at the same time (MUGV, CCS and CBRNE Detectors).

A1.2.5 Drop Charge Release Mechanism

A1.2.5.1 The Drop Charge Release Mechanism must support and hold a drop charge of no less than 1.60kg (approx. 3.53lbs), while climbing and descending from obstacles (such as road curb) of no less than 10 cm (approx. 4 inches)

A1.2.5.2 The Drop Charge Release Mechanism must carry and actuate the physical release of a drop charge (defined as two taped blocks of C4 explosive and Remote Firing Device Receiver), being at least 3.40kg (approx. 7.50lbs) in weight and a maximum of 6cm width x 6cm height x 30cm length (approx. 2.36 x 2.36 x 11.80 inches).

A1.2.5.3 The Drop Charge Release Mechanism must be controllable through the CCS.

A1.2.6 ABL-2000L Disruptor Adaptor

A1.2.6.1 The ABL-2000L Disruptor Adaptor must be adjustable thru the CCS to an angle of no less than 45 degrees upward and downward from the horizontal position.

A1.2.6.2 The MUGVS must fire the ABL-2000L Disruptor at all angles without damaging parts of the MUGV.

A1.2.7 Needle Plus Disruptor Adaptor

A1.2.7.1 The Needle Plus Disruptor Adaptor must be adjustable thru the CCS to an angle of no less than 45 degrees upward and downward from the horizontal position.

A1.2.7.2 The MUGVS must fire the Needle Plus Disruptor at all angles without damaging parts of the MUGV.

[Para A1.2.8. CETD was deleted]

A1.2.8 CBRNE Detectors

A1.2.8.1 The MUGV must be capable of integrating with the following CBRNE Detectors:

A1.2.8.1.1 List TBD.

A1.2.9 Mapping Camera / Sensor

A1.2.9.1 The MUGVS must have a mapping payload that can scan, and through software, reproduce a 2D image of building interior, displaying this on the CCS.

A1.2.9.2 The 2D image produced by the Mapping Camera/Sensor on the CCS must be exportable to a computer thru a USB port or SD card port.

A1.2.10 PTZ Camera

A1.2.10.1 The PTZ Camera must have no less than the following features:

A1.2.10.1.1 Colour image;

A1.2.10.1.2 Low light and near infra-red illuminators;

A1.2.10.1.3 40X zoom;

A1.2.10.1.4 640x480 pixels or higher resolution.

A1.2.10.1.5 No less than a 60 degree vertical field of view ;

A1.2.10.1.6 Pan no less than from -180 to +180 degrees (left and right);

A1.2.10.1.7 Tilt no less than +90 to -90 degrees (up and down).

A1.2.11 Hard Transport Container

A1.2.11.1 The Hard Transport Container must have no less than an IP66 rating, or equivalent, IAW NEMA IEC 60529.

A1.3 Physical Requirements

A1.3.1 Size

A1.3.1.1 The MUGV and CCS, with one (1) set of batteries each, must fit within the Soldier's Tactical Field Pack (NSN: 8465-20-000-2774).

A1.3.1.1.1 The Soldier's Tactical Field Pack (NSN: 8465-20-000-2774) has an available volume of: Height – 51 cm (20 in.), Width – 30.5cm (12 in.), and Depth – 20 cm (8 in.)

A1.3.2 Weight

A1.3.2.1 The MUGV and CCS (without the MPU5 radio), with one (1) set of batteries each, must not exceed 10kg in combined weight.

A1.3.3 Colour

A1.3.3.1 The MUGV must have the predominant exterior colour (so that it contributes to and does not compromise an operator's camouflage) of:

A1.3.3.1.1 Flat/matte finish green;

A1.3.3.1.2 Flat/matte finish earth tone;

A1.3.3.1.3 Flat/matte finish grey, or

A1.3.3.1.4 Flat/matte finish black.

A1.4 Environmental/Climatic Requirements

A1.4.1 Climatic Conditions

A1.4.1.1 The MUGVS must operate in temperatures from -20°C to $+39^{\circ}\text{C}$ with no reduction in performance and durability.

A1.4.1.2 The System must operate in temperatures from -21°C to -40°C without exceeding a reduction in battery performance of 50%.

A1.4.1.3 The MUGVS, without the batteries, must be stored in temperatures from -40°C to $+50^{\circ}\text{C}$ with no reduction in performance and durability.

A1.4.1.4 The MUGVS must operate in relative humidity of 5% to 95% IAW MIL-STD 810G Method 507.5 Humidity Cycle B1.

A1.4.2 Atmospheric Conditions

A1.4.2.1 The MUGV must operate in blowing sand and dust caused by wind gusts up to 40 km/h over a period of no less than one (1) hour.

A1.0 APPENDIX: SUGVS TECHNICAL SPECIFICATION VERSION 2

A1.1 System Requirements

A1.1.1 General

- A1.1.1.1 The Small Unmanned Ground Vehicle System (SUGVS) must be based on proven, fielded equipment that is in-service with a North Atlantic Treaty Organization (NATO) or American, British, Canadian, Australian, New Zealand military partner or police agency of those countries.
- A1.1.1.2 The SUGVS must consist of the following components, and is further described in detail under the **System Component Requirements** section:
- A1.1.1.2.1 One (1) Small Uncrewed Ground Vehicle (SUGV);
 - A1.1.1.2.2 One (1) Control and Communication System (CCS);
 - A1.1.1.2.3 Battery Sets for eight (8) hours of operation;
 - A1.1.1.2.4 One (1) Battery Charging System;
 - A1.1.1.2.5 One (1) Manipulator Arm and Gripper;
 - A1.1.1.2.6 Two (2) ABL-2000L Disruptor Adaptor;
 - A1.1.1.2.7 Two (2) ABL-3000L Disruptor Adaptor;
 - A1.1.1.2.8 Two (2) Needle Plus Disruptor Adaptor;
 - A1.1.1.2.9 Qty TBD (TBD) Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) Detector Adaptors;
 - A1.1.1.2.10 Hard Transport Container(s) for the above components, not including the SUGV.
- A1.1.1.3 The SUGVS must include (stored within the Hard Transport Container(s)) all tools required to setup and maintain the SUGVS in accordance with the **Operator Maintenance** Concept ANNEX A paragraph 4.1.1.1 (page 10).
- A1.1.1.4 The SUGVS must include (stored within the Hard Transport Container(s), without needing to be folded or otherwise distorted from flat) the Technical Publication(s) listed within the CDRL(s) as being 'Issued with each SUGVS'.

A1.1.2 Transportability

- A1.1.2.1 The SUGVS must be transportable by fixed and rotary wing aircraft, cargo ships, rail, and commercial and military wheeled vehicles on highways and cross-country.

A1.2 System Component Requirements

A1.2.1 SUGV

A1.2.1.1 Mobility

- A1.2.1.1.1 The SUGV must maintain an average velocity of no less than four (4) km/h on level pavement or concrete surface.
- A1.2.1.1.2 The SUGV must traverse smooth polished surfaces, hard road surfaces, mud, fine sand, snow and ice.
- A1.2.1.1.3 The SUGV must climb and descend stairs composed of steps of no less than 216 mm of height with a stair angle of no less than 45 degree while carrying the minimum payload weight of 20kg.
- A1.2.1.1.4 The SUGV must cross vertical obstacle walls of no less than 267mm in height, while carrying the minimum payload weight of 20kg.
- A1.2.1.1.5 The SUGV must traverse a dry grass-covered side slope of no less than 25 degrees (approx. 47% grade), while carrying the minimum payload weight of 20kg.
- A1.2.1.1.6 The SUGV must climb and descend dry grass-covered slopes of no less than 40 degrees (approx. 84% grade), while carrying the minimum payload weight of 20kg.
- A1.2.1.1.7 The SUGV must ford water at a depth of no less than 150mm.
- A1.2.1.1.8 The SUGV must hold position when not commanded to move, including when the SUGV is stopped on uneven ground or 40 degrees slopes (approx. 84% grade) and while carrying the minimum payload weight, of 20kg.

A1.2.1.2 Cameras

- A1.2.1.2.1 The SUGV Cameras must have the following features:
 - A1.2.1.2.1.1 Colour image;
 - A1.2.1.2.1.2 Low light and near infrared illuminators;
 - A1.2.1.2.1.3 640x480 pixel or higher resolution;

A1.2.1.3 Field of View

- A1.2.1.3.1 The SUGV must have an overall front field of view with the following:
 - A1.2.1.3.1.1 No less than a 60 degree horizontal field of view;
 - A1.2.1.3.1.2 No less than a 45 degree vertical field of view;
- A1.2.1.3.2 The SUGV must have an overall rear field of view with the following:
 - A1.2.1.3.2.1 No less than a 60 degree horizontal field of view;
 - A1.2.1.3.2.2 No less than a 40 degree vertical field of view;

A1.2.1.4 Pan Tilt Camera

A1.2.1.4.1 The SUGV must have a Pan Tilt Camera with no less than the following features:

- A1.2.1.4.1.1 Colour image;
- A1.2.1.4.1.2 Low light and near infra-red illuminators;
- A1.2.1.4.1.3 40X zoom;
- A1.2.1.4.1.4 640x480 pixel or higher resolution.
- A1.2.1.4.1.5 No less than a 60 degree vertical field of view;
- A1.2.1.4.1.6 Pan no less than from -180 to +180 degrees (left and right);
- A1.2.1.4.1.7 Tilt no less than from +90 to -90degrees (up and down);

A1.2.1.5 Voice Communication

A1.2.1.5.1 The SUGV must have integrated two-way audio communication allowing communication between personnel on the ground around the SUGV and the operator of the CCS.

A1.2.1.6 GPS

A1.2.1.6.1 The SUGV must have a Global Positioning system indicating the SUGV position when operating outside. No map is required, just the GPS coordinates in Military Grid Reference System.

A1.2.1.7 Firing Circuits

A1.2.1.7.1 The SUGV must have no less than two (2) Firing Circuits that can initiate each of the following:

- A1.2.1.7.1.1 M6 Electric Detonator;
- A1.2.1.7.1.2 ABL-2000L Disruptor (Titanium);
- A1.2.1.7.1.3 ABL-3000L Disruptor (Titanium); and
- A1.2.1.7.1.4 Needle Plus disruptor.

A1.2.1.7.2 The SUGV must have a built-in two (2) step action, to initiate each of the Firing Circuits. The first action is to arm the system, and the second action is the pressing of the fire button.

A1.2.1.7.3 The power must not be applied to the Firing Circuits prior to the activation of the first action (arm) in the two-step action (arm+fire).

A1.2.1.7.4 If the SUGV loses contact with the CCS, the SUGV must have a failsafe that removes power from the Firing Circuits (goes to a safe state) in no more than 60 seconds following the contact loss.

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- A1.2.1.7.5 The SUGV must have a feature to conduct continuity checks of each of the Firing Circuits (following the safety limits of EN 13763-26 2004 para 7.4.1), initiated from the CCS, when one of the items listed at para. A1.2.1.7.1 is connected to the Firing Circuits.
- A1.2.1.7.6 The SUGV Firing Circuit must be protected (isolated) from an inadvertent activation when power is cycled to the SUGV.
- A1.2.1.7.7 Electro-Magnetic Compatibility and Interference
- A1.2.1.7.7.1 The SUGV must meet the requirements of RE102 IAW MIL-STD-461G, or other equivalent international standard.
- A1.2.1.7.7.2 The SUGV must meet the requirements of RS103 IAW MIL-STD-461G, or other equivalent international standard, for Army Ground levels from 2 MHz to 18 GHz.
- A1.2.1.8 Radio
- A1.2.1.8.1 The SUGV must continually act as a mobile RF communication relay, in a Mobile Ad-hoc Network (MANET), to assist with communication connection with any other device in the MANET using an MPU5 or Embedded Modules Wave Relay radio system (from Persistent Systems) with the same programming in a non-line-of-sight, subterranean, or reinforced concrete buildings, or to extend the range in line-of-sight applications.
- A1.2.1.8.2 The SUGV must use the MPU5 (NSN 5975-01-658-9155) or Embedded Module Wave Relay radio system with S-Band module NSN 5998-01-658-8999 (2200-2507 MHz) and L-Band module NSN 5895-01-662-2670 (1350-1390 MHz) to be interoperable with the current Canadian system.
- A1.2.1.8.3 The SUGV radio must be programmable to use an IP scheme imposed by DND to be interoperable with the current Canadian system.
- A1.2.1.8.4 The SUGV must have an Ethernet connection meeting IEEE Std. 802.3-2022 to set up the radio in a MANET.
- A1.2.1.9 Fibre Optic Cable
- A1.2.1.9.1 The SUGV must carry, feed-out and rewind (can be automatic or manual rewind) a Fibre Optic Cable of no less than 300m +/- 2m.
- A1.2.1.10 Durability and Cleaning
- A1.2.1.10.1 The SUGV, when equipped with the Manipulator Arm and Gripper, must have no less than an IP65 rating, or equivalent, IAW NEMA IEC 60529.
- A1.2.1.10.2 The SUGV must allow cleaning of the exterior surfaces with hot and cold low-pressure water, steam and detergents, without wear, deterioration or damage.
- A1.2.2 **CCS**

- A1.2.2.1 Display
 - A1.2.2.1.1 The CCS screen size must be no less than 254mm on the diagonal.
 - A1.2.2.1.2 The CCS must have an image display with a HD resolution of no less than 640x480 pixels.
 - A1.2.2.1.3 The CCS must have an image display whose brightness is user-adjustable for daylight (no less than 1000 nits) and low light viewing.
- A1.2.2.2 The CCS must have a 3D-rendered image of the SUGV showing real-time relative positions of the Manipulator Arm and Gripper.
- A1.2.2.3 The CCS must add and remove a second simultaneous video feed from another camera to gain a better situational awareness of the operation.
- A1.2.2.4 The CCS must record and store internally no less than 20 hours of videos and 1000 images concurrently.
- A1.2.2.5 The CCS recorded data must be exportable to a portable computer using a USB port or SD card port.
- A1.2.2.6 Durability
 - A1.2.2.6.1 The CCS must have no less than an IP64 rating, or equivalent, IAW NEMA IEC 60529.
- A1.2.2.7 Radio
 - A1.2.2.7.1 The CCS must continually act as a mobile RF communication relay, in a MANET, to assist with communication connection with any other device in the MANET using an MPU5 or Embedded Modules Wave Relay radio system (from Persistent Systems) with the same programing in a non-line-of-sight, subterranean, or reinforced concrete buildings, or to extend the range in line-of-sight applications.
 - A1.2.2.7.2 The CCS must use the MPU5 (NSN 5975-01-658-9155) or Embedded Module Wave Relay radio system with S-Band module NSN 5998-01-658-8999 (2200-2507 MHz) and L-Band module NSN 5895-01-662-2670 (1350-1390 MHz) to be interoperable with the current Canadian system.
 - A1.2.2.7.3 The CCS must have user access to the Web Management Interface to setup the MPU5 or Embedded Module or alternatively permit the changing of all radio parameters through the CCS interface including:
 - A1.2.2.7.3.1 Frequency;
 - A1.2.2.7.3.2 Bandwidth;
 - A1.2.2.7.3.3 IP Scheme;
 - A1.2.2.7.3.4 Network Node List; and
 - A1.2.2.7.3.5 Encryption Key.

- A1.2.2.7.4 The CCS must have a network visualization graphic showing the active nodes local to the SUGV with associated Signal to Noise Ratio (SNR) between the CCS and SUGV.
- A1.2.2.7.5 The CCS must have a noise visualization graphic showing the signal strength between the nodes.
- A1.2.2.7.6 The CCS Radio must be programmable to use an IP scheme imposed by DND to be interoperable with the current Canadian system.
- A1.2.2.8 Fibre Optic Cable
 - A1.2.2.8.1 The CCS must have a Fibre Optic Cable connector and link to allow communication with and control of the SUGV.

A1.2.3 Battery Sets

- A1.2.3.1 The SUGV Battery System (SUGV, CCS, CBRNE Detectors, etc.) must provide no less than two (2) hours of continuous active operation at a temperature of 20°C (+/- 3 °C). Active Operation is defined as:
 - A1.2.3.1.1 Power-on and initialization sequence of the SUGV and CCS;
 - A1.2.3.1.2 Movement of the SUGV 'down range' for 200m, with periodic movements throughout the majority of the two (2) hours, and then returning back for 200m before the two (2) hours has expired; and
 - A1.2.3.1.3 Continuous video transmission (small fluctuations allowed) between the SUGV and CCS throughout the two (2) hours.
- A1.2.3.2 The SUGV Battery System (SUGV, CCS, CBRNE Detectors, etc.) must provide no less than four (4) hours of continuous passive operation at a temperature of 20°C (+/- 3 °C). Passive operation is defined as:
 - A1.2.3.2.1 Power-on and initialization sequence of the SUGV and CCS; and
 - A1.2.3.2.2 Movement of the SUGV to a desired location downrange (within 200 m) and holding its position while acting as an RF relay node for four (4) hours, and then returning back.
- A1.2.3.3 The Battery System (SUGV, CCS, CBRNE Detectors, Battery Chargers) must have enough Battery Sets for eight (8) hours of operation.
- A1.2.3.4 The batteries must be replaced in no more than five (5) minutes.
- A1.2.3.5 The System Battery Sets must be rechargeable when installed in the SUGV and CCS (in SITU charging).

A1.2.4 Battery Charging System

- A1.2.4.1 The Battery Charging System must include a universal power input of 110VAC – 220VAC, 50Hz – 60Hz, with a North American plug type and a universal plug adapter kit.

- A1.2.4.2 The Battery Charging System must be standalone from the SUGV and CCS, so they can be used while batteries are charging.
- A1.2.4.3 The Battery Charging System must provide visual indications of battery charging in order to indicate when charging is in progress and when it is complete.
- A1.2.4.4 The Battery Charging System full re-charge time for one (1) Battery Set (SUGV and CCS) must not exceed eight (8) hours, and must re-charge the Battery Set (SUGV and CCS) at the same time.
- A1.2.4.5 The Battery Charging System must be certified CSA, CE, UL or equivalent.
- A1.2.4.6 The Battery Charging System must recharge all batteries at the same time.

A1.2.5 **Manipulator Arm and Gripper**

- A1.2.5.1 The Manipulator Arm and Gripper horizontal reach beyond the front of the SUGV must be no less than 1600mm (the horizontal reach must be done without an Arm Extension addition to the Manipulator Arm and Gripper).
- A1.2.5.2 The Manipulator Arm and Gripper vertical reach must be no less than 2000mm, to reach aircraft overhead storage bins. The vertical reach can be done with an Arm Extension if the extension meets the following requirements:
 - A1.2.5.2.1 The Arm Extension must be a plug and play;
 - A1.2.5.2.2 The Arm Extension at maximum arm length must not reduce the manipulation precision of the SUGV gripper;
 - A1.2.5.2.3 The Arm Extension must keep the same lifting capacity without any degradation;
 - A1.2.5.2.4 The Arm Extension must also fire the ABL 2000L, ABL 3000L and the Needle Plus Disruptors, at the maximum vertical reach;
 - A1.2.5.2.5 The Arm Extension must use the same Gripper that is used on the Manipulator Arm and Gripper.
 - A1.2.5.2.6 The Arm Extension equipped with the Gripper must have the same gripper camera(s) providing the same video feedback without any degradation.
 - A1.2.5.2.7 The Arm Extension must be reinstalled and be functional within one (1) minute.
- A1.2.5.3 **Payload**
 - A1.2.5.3.1 The Manipulator Arm and Gripper must lift from the ground and carry a smooth pipe of 155mm in diameter, with a weight of no less than 20kg, when the manipulator arm is fully retracted.
 - A1.2.5.3.2 The Manipulator Arm and Gripper must lift from the ground and carry a smooth pipe of 155mm diameter, with a weight of no less than a 7kg, when the Manipulator arm is fully extended to the front of the SUGV.

A1.2.5.4 Gripper Camera

A1.2.5.4.1 The Manipulator Arm and Gripper camera field of view at the maximum vertical height must inspect everywhere inside the aircraft overhead storage bin without an add-on attachment to the Manipulator Arm and Gripper, other than the Arm Extension (if required).

A1.2.5.4.2 The Manipulator Arm and Gripper camera must have a field of view with the following features:

A1.2.5.4.2.1 Colour image;

[Para A1.2.5.4.2.2. Low light and near infra red illuminators was deleted]

A1.2.5.4.2.2 640x480 pixel or higher resolution;

A1.2.5.4.2.3 No less than a 60 degree horizontal field of view;

A1.2.5.4.2.4 No less than a 50 degree vertical field of view;

A1.2.5.4.2.5 Pan no less than -180 to +180degrees (left and right) (Panning can be met either through the camera itself panning or Manipulator Arm panning), and

A1.2.5.4.2.6 Tilt no less than +90 to -90 degrees (up and down) (Tilting can be met either through the camera itself tilting or Manipulator Arm tilting).

A1.2.5.5 Manipulator Arm

A1.2.5.5.1 The Manipulator Arm must have no less than the following features:

A1.2.5.5.1.1 Turret with no less than -180 to +180 degree horizontal rotation in either direction (left and right);

A1.2.5.5.1.2 Shoulder with no less than 180 degrees of freedom;

A1.2.5.5.1.3 Elbow with no less than 270 degrees of freedom;

A1.2.5.5.1.4 Wrist with no less than 300 degrees of freedom;

A1.2.5.5.1.5 Gripper rotation of no less than 360 degrees of freedom; and

A1.2.5.5.1.6 Gripper opening of no less than 155mm.

A1.2.5.6 The Manipulator arm and gripper must have no less than a total of six (6) programmable positions with a minimum of two (2) of the six (6) being customizable by the operator. Factory preset positions must include:

A1.2.5.6.1 Travelling pose;

A1.2.5.6.2 Weapon loading pose; and

A1.2.5.6.3 Storage pose.

A1.2.5.7 The Manipulator Arm and Gripper must carry and have two (2) disruptor mounts (carrying any possible mix between the three (3) disruptors), and sleeves if needed, for the following in-service barrel disruptors:

A1.2.5.7.1 Needle Plus (Recoil) (NSN: 1385-99-485-3385);

A1.2.5.7.2 ABL-2000L (Recoilless) (NSN: 1385-99-151-5469);

A1.2.5.7.3 ABL-3000L (Recoilless) (NSN: 1385-99-447-0479)

A1.2.5.8 Aiming Pointer and Range Finder

A1.2.5.8.1 The Manipulator Arm and Gripper must have a disruptor aiming pointer.

A1.2.5.8.1.1 This can be achieved by either the Manipulator Arm or Gripper camera, or by a laser pointer or equivalent system.

A1.2.5.8.2 The Manipulator Arm and Gripper aiming pointer must be viewable in daylight during a sunny day.

A1.2.5.8.3 The Manipulator Arm and Gripper must have a range finder to determine the distance between the disruptors and the target.

A1.2.6 **ABL-2000L Disruptor Adaptor**

A1.2.6.1 The SUGVS must fire the ABL-2000L Disruptor at all angles without damaging parts of the SUGV.

A1.2.7 **ABL-3000L Disruptor Adaptor**

A1.2.7.1 The SUGVS must fire the ABL-3000L Disruptor at all angles without damaging parts of the SUGV.

A1.2.8 **Needle Plus Disruptor Adaptor**

A1.2.8.1 The SUGVS must fire the Needle Plus Disruptor at all angles without damaging parts of the SUGV.

A1.2.9 **CBRNE Detectors**

A1.2.9.1 The SUGV must be capable of integrating with the following CBRNE Detectors:

A1.2.9.1.1 List TBD.

A1.2.10 **Hard Transport Container(s)**

A1.2.10.1 The Hard Transport Container(s) must have no less than an IP66 rating, or equivalent, IAW NEMA IEC 60529.

A1.3 Physical Requirements

A1.3.1 **Size**

A1.3.1.1 The SUGV width must be no more than 450mm, in order to fit in a commercial airplane aisle.

A1.3.2 Weight

A1.3.2.1 The SUGV, Manipulator Arm and Gripper, (not including the Fibre Optic Cable, Disruptor Mount and CCS), with one (1) set of batteries, must be no more than 90kg in combined weight. If the SUGV possesses a removable arm, it must be no more than 50kg and be able to be reinstalled and be functional in no more than one (1) minute. In the case of a removable arm, the main body of the UGV must be no more than 80Kg.

A1.3.3 Colour

A1.3.3.1 The SUGV must have a predominant exterior colour (so that it contributes to and does not compromise an operator's camouflage) of:

A1.3.3.1.1 Flat/matte finish green;

A1.3.3.1.2 Flat/matte finish earth tone;

A1.3.3.1.3 Flat/matte finish grey, or

A1.3.3.1.4 Flat/matte finish black.

A1.4 Environmental/Climatic Requirements

A1.4.1 Climatic Conditions

A1.4.1.1 The SUGVS must operate in temperatures from -20°C to +39°C with no reduction in performance and durability.

A1.4.1.2 The System must operate in temperatures from -21°C to -40°C without exceeding a reduction in battery performance of 50%.

A1.4.1.3 The SUGVS, without the batteries, must be stored in temperatures from -40°C to +50°C with no reduction in performance and durability.

A1.4.1.4 The SUGVS must operate in relative humidity of 5% to 95% IAW MIL-STD 810G Method 507.5 Humidity Cycle B1.

A1.4.2 Atmospheric Conditions

A1.4.2.1 The SUGV, CCS, and Manipulator Arm and Gripper must operate in blowing sand and dust caused by wind gusts up to 40 km/h over a period of no less than one (1) hour.