Request For Information (RFI)

for the

Innovation for Defence Excellence and Security Program

(IDEaS)

Sandbox Element

Sandbox RFI 2018-1

IDEaS IDEeS

INNOVATION FOR DEFENCE EXCELLENCE AND SECURITY

INNOVATION POUR LA DÉFENSE, L'EXCELLENCE ET LA SÉCURITÉ

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Annexes

1. INTRODUCTION

1.1. The Innovation for Defence Excellence and Security Program (IDEaS), on behalf of the Department of National Defence and Canadian Armed Forces (DND/CAF), is releasing this Request For Information (RFI) in order to engage the innovation community and gain their feedback on a collection of specific DND/CAF defence and security challenges for which DND/CAF intends to provide future opportunity in Sandbox test environments to selected Applicants. No submission or selection of such Applicants is being made at this time.

1.2. Within the IDEaS Program, Sandboxes are an opportunity for Participants to test and demonstrate their solutions to published Sandbox Challenges in a DND/CAF provided test environment and test scenario, receiving observational feedback from DND/CAF experts and potential users. Participants are not paid to attend the Sandbox, nor are they charged a fee to participate.

1.3. This RFI describes and invites:

1.3.1. Comments on the concept of an IDEaS Sandbox in general; and

1.3.2. Comments on specific DND/CAF Challenges for which an IDEaS Sandbox is notionally proposed.

1.4. This RFI includes a description of five Challenges and associated Sandboxes DND/CAF is expecting to conduct in 2019 if there is sufficient interest. This RFI will help determine which ones are done, and in what order. The RFI does not commit Canada to conduct any specific number of Sandboxes, enter into any contracts, or procure any goods or services.

2. BACKGROUND

2.1. In response to the release of the June 2017 Defence Policy *Strong, Secure, Engaged,* DND/CAF has created the Innovation for Defence Excellence and Security Program (IDEaS). IDEaS will transform the way innovation solutions to complex defence and security challenges are generated. The IDEaS Elements that will be used for this work are:

2.1.1. Ideation: "Structured Brainstorming"; Multi-disciplinary creativity sessions to refine challenges, explore problem space as well as solutions. Can be used anywhere in the innovation cycle to actively engage innovators and operators;

2.1.2. Innovation Networks: Proactive engagement of any innovator networks to become aware of Defence and Security (D&S) challenges and work collaboratively;

2.1.3. Contests: Monetary prizes used to incentivize demonstrable solutions;

2.1.4. Competitive Projects: Contracts or contribution agreements funding to advance the development of a solution;

2.1.5. Sandboxes: As defined above, in Section 1.2;

2.1.6. Innovation Assessment and Implementation: Opportunity for innovators to make their solutions available to DND/CAF (via buy, rent, lease, loan, etc.) for evaluation by CAF operators in a realistic environment.

3. DEFINITIONS

3.1. Innovators: The innovation community at large.

3.2. Applicants: Those that actually complete and submit an Application to a specific Sandbox when it is offered.

3.3. Applications: The information submitted by the Applicant for a specific Sandbox.

3.4. Qualified Applicants: The subset of Applicants whose Applications have met all of the mandatory criteria for a specific Sandbox.

3.5. Participants: The subset of Qualified Applicants who have received and accepted a confirmed invitation to attend an actual Sandbox.

4. SANDBOXES

4.1. In general, the design of the Sandbox, and in particular the timing of when it will be conducted, will be an optimized approach based on the level of interest in each Sandbox, the availability of DND/CAF resources, the DND/CAF priority for the Sandbox, and assorted other planning factors. For reasons of resource efficiency, the guiding desire is to conduct a single Sandbox at a single time for multiple Participants, rather than repeating similar Sandboxes throughout the year for different Participants.

4.2. For each announced Sandbox a specific description will be provided as each one will be quite different. That detail is not included in this RFI; however, the following generalities can be expected for each Sandbox that is conducted:

4.2.1. Test Environment. DND/CAF will provide a specific challenge and a corresponding test environment and scenario with appropriate experts and/or users in which Participants can test and/or demonstrate their mid to high level prototypes or ideas in a controlled setting. As part of the test environment, DND/CAF may provide some test equipment, targets, test subjects, role players, or other applicable components, but only when applicable to all attendees. Test equipment or supplies unique to a specific solution would be provided by that Participant.

4.2.2. Test Plan and Conduct. Within the DND/CAF posed challenge, objective, and scenario of the Sandbox, which may include mandatory test elements, Participants will design their specific test plan which DND/CAF will need to approve to ensure alignment with the intent and scenario, as well as other factors such as but not limited to safety, security, and capability of the test environment. The Participant will then conduct the approved testing and DND/CAF will provide limited observational feedback to the Participant. DND/CAF will not do the testing for the Participant.

4.2.3. Support Concept.

4.2.3.1. The Participant is responsible for providing all resources and services required for the successful conduct of their test plan unless explicitly provided by DND/CAF.

4.2.3.2. The Participant is responsible for all transportation, shipping, food, and lodging of all of their equipment and personnel to, during, and from the Sandbox unless explicitly provided by DND/CAF.

4.2.3.3. The Participant is responsible for the operation, maintenance, and repair of their solution during the Sandbox.

4.2.3.4. When the location and existing facilities permit, DND/CAF will usually provide appropriate gathering and preparation areas including protection from inclement weather, temporary storage of the Participant's equipment, limited business facilities such as meeting spaces, briefing areas, communication and computer access, printing and photocopying, etc.

4.2.3.5. There is no responsibility by DND/CAF for the solution being tested, and specifically no DND/CAF responsibility for maintenance, loss, or damage during or as a result of the Sandbox. Participants are fully responsible for insuring their own personnel, equipment, and activities

at their discretion.

4.2.4. Post-Sandbox

4.2.4.1. Attendance at a Sandbox, or even successful testing within the Sandbox, does not imply any intent or commitment that DND/CAF will undertake any further activity with any solution or company. It is a one-time Sandbox event only. It is completely up to the Participant what they do with the information learned during the Sandbox.

4.2.4.2. DND/CAF will internally consider the observations of all Sandboxes in order to monitor any progression towards solving the specific challenges and how that may or may not influence further force development planning, considerations, and priorities internal to IDEaS and across DND/CAF. Any such follow-on decisions are independent of the IDEaS Sandbox, are internal to DND/CAF, and will not be published as part of the Sandbox process. If a Sandbox leads DND/CAF to further pursue the challenge, such decisions would be announced via the other DND/CAF processes.

4.2.5. Intellectual Property. The Participant retains full ownership and control of the solution being tested and its intellectual property.

5. SANDBOX APPLICATION, EVALUATION, SELECTION, AND INVITATION PROCESS.

5.1. After this RFI, DND/CAF will determine which Sandboxes have a sufficient level of interest from Innovators to actually be designed and offered for Applications, and what level of capacity DND/CAF should allocate to each Sandbox. A Letter Of Interest (LOI) will then be issued inviting interested Innovators to apply to participate, after which the Sandbox will be conducted with the selected Participants.

5.2. As the capacity for any one Sandbox may be limited, a fair, open, and transparent application, evaluation, and selection process will be used in the LOI process to determine which Applicants receive a confirmed invitation to attend. The full model for doing this will be included in the LOI when it is released, and its generalities are as follows:

5.2.1. Application. This will be accomplished via an on-line application form.

5.2.2. Evaluation. Applications will be evaluated against a set of mandatory and rated evaluation criteria:

5.2.2.1. The full criteria that will be used in the mandatory and rated evaluations will be included in the LOI when it is issued and may vary in detail among the Sandboxes.

5.2.2.2. As a mandatory minimum, all solutions for all Sandboxes shall have already completed the work and testing associated with Solution Readiness Level 4 (SRL 4) as defined in Annex C, at the time of application. This ensures that solutions are ready for the integrated testing that DND/CAF expects in a Sandbox.

5.2.2.3. Those that do not meet all mandatory criteria will not receive an invitation to attend the Sandbox.

5.2.2.4. Those that do meet the mandatory criteria will be placed on a list of Qualified Applicants.

5.2.3. Selection. Using the results of the mandatory and rated evaluations, invitations to Qualified Applicants will be issued until a limiting factor for each Sandbox is reached. This may mean that although qualified, some Applicants may not receive an invitation to attend the Sandbox.

5.2.4. Invitation and Acceptance. Upon receiving a formal letter of invitation to participate in a specific Sandbox, recipients will then have a limited period to accept the invitation and the participatory terms and conditions it will include. Such terms and conditions will focus on the timely completion of pre-sandbox preparations including participation in planning conferences, as well as safety and security during testing, descriptions of what services DND/CAF will or will not provide and what the Participant will be responsible for, and so forth.

6. CHALLENGES INCLUDED IN THIS RFI

6.1. Annex A identifies and describes the current challenges for which DND/CAF may initially conduct a Sandbox. Additional challenges and other sandboxes may be included in subsequent iterations.

7. RFI RESPONSE FORMAT, SUBMISSION, AND SPECIFIC QUESTIONS

7.1. Responses to this RFI will only be accepted via the on-line response tool until 19 September 2018. https://dnd-ideas.smapply.io/prog/sandbox_rfi_2018-1/?lang=en

8. TREATMENT OF RESPONSES

8.1. The information provided by Respondents may be used by DND/CAF to:

8.1.1. Further develop DND/CAF defence and security concepts, problems, solutions, decisions, and scheduling.

8.1.2. Refine the specific challenges posed by DND/CAF in the RFI and their corresponding Sandboxes.

9. ADDITIONAL NOTES TO INTERESTED RESPONDENTS

9.1. All Respondent consultations are documented and this information is subject to the Access to Information Act. Respondents should identify any submitted information that is to be considered as either company confidential or proprietary. Canada will not reveal any designated confidential or proprietary information to public and/or third parties, except for independent consultant(s) which may participate in RFI response review.

10. SECURITY REQUIREMENTS

10.1. There are no security requirements in terms of submitting a response to this RFI.

11. RESPONSE DATE

11.1. RFI responses should be submitted on or before 19 September 2018.

12. RESPONSE EVALUATION AND RESPONDENT FOLLOW-UP

12.1. Following receipt of responses to this RFI, Canada will review the information received for the purpose of refining its way forward on Sandboxes. In order to maintain awareness within the responding community, DND/CAF will publish a RFI findings document.

12.2. The RFI findings document may include, but is not limited to, the following information:

12.2.1. the number of firms that participated;

12.2.2. a collective assessment on the responses received. Proprietary information will not be disclosed;

12.2.3. an estimated schedule for any resulting Sandboxes as applicable; and,

12.2.4. next steps.

12.3. The RFI findings document will be posted on BuyandSell.

13. ENQUIRIES

13.1. All enquiries and other communications related to this RFI must be directed exclusively to the RFI Authority identified in Section 15.

14. LANGUAGE

14.1. Responses and consultations are to be provided in one of the two official languages of Canada (English or French).

15. RFI AUTHORITY

15.1. All enquiries and other communications related to this RFI must be directed to the RFI Authority:

Heather Riggs

Strategic Procurement Advisor
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Defence Research and Development Canada
Innovation for Defence Excellence and Security Program (IDEaS)

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Sandbox 2018-1 Challenges

Appendix #	Challenge #	Title
1	2018-1-1	Counter Micro and Mini Unmanned Aerial Systems
2	2018-1-2	Camouflage Against Surveillance Technology for Dismounted Soldiers
3	2018-1-3	Corrosion Detection in Ships
4	2018-1-4	Enhanced Small Arms Targeting Systems
5	2018-1-5	Stand-Off Detection of Explosives

Challenge #: Sandbox RFI 2018-1, Challenge #1
Challenge Title: Counter Micro and Mini Unmanned Aerial Systems

1. Challenge Statement:

1.1. How might we passively detect and/or defeat (kinetically or non-kinetically) Micro and Mini Unmanned Aerial Systems (UAS)?

2. Background and Context:

2.1. While UAS come in many sizes, those of concern in this particular Sandbox are of the Class 1 Micro and Mini UAS under the NATO classification system:

2.1.1. Micro UAS with typical characteristics of: <2kg, up to 200ft Above Ground Level(AGL), normal mission radius of 5km Line of Sight (LOS);and

2.1.2. Mini UAS with typical characteristics of: 2-20kg, up to 3000ft AGL, normal mission radius of 25km LOS.

2.2. The increase of the availability, complexity and capabilities of such mini and micro UAS is posing increasing threats to Canadian Armed Forces (CAF) elements including observation of where we are and what we are doing, delivery of weapons against us, as well as swarming attacks by multiple UAS concurrently.

2.3. These threats occur in a variety of operational scenarios, four of which are of specific interest to defend against:

2.3.1. Defending a Forward Operating Base (FOB) or airfield, in which a counter-UAS system can be in a static location once deployed, and where equipment size and power consumption is not a major issue;

2.3.2. Defending a mobile vehicle force element such as a reconnaissance patrol, in which the counter-UAS system must be vehicle mounted and powered for mobility;

2.3.3. Defending a small element of dismounted soldiers, in which case the counter UAS system and its power source must be “Soldier Portable”; and

2.3.4. Functional in urban scenarios such as complex and cluttered infrastructure, obstacles, and electromagnetic environment.

2.4. While each operational scenario can have different parameters and priorities at any one time, the common counter-UAS effects sought are to:

2.4.1. Detect and track the UAS before the UAS detects/observes us. This range based aspect varies with the type and capability of sensors that the UAS is using.

2.4.2. Prevent/limit the UAS’s ability to transmit any data it collects.

2.4.3. Prevent/limit the UAS’s ability to close within its sensor or weapon range of our forces. This range varies with the type and capability of sensors and weapons that the UAS is using, and can be as rudimentary as the UAS itself carrying an explosive charge to the terminal target.

2.4.4. Concurrently overlaid with the above, countering swarms of such UAS.

2.5. The general methodology for achieving such countering effects can be characterized as:

2.5.1. Active detection, in which the system is transmitting a signal in order to detect the UAS (such as radar), which has the disadvantage of concurrently revealing the location of the transmitter;

2.5.2. Passive detection, which conceals our own position and relies on detecting the UAS from effects it generates (such as visual detection, electronic signatures, audible noise, etc).

2.5.3. Non-kinetic neutralization, such as jamming the UAS communications and remote controllability; and

2.5.4. Kinetic neutralization, which destroys the UAS with a weapon.

2.6. Current common detection methods rely on radar systems and visual identification to locate UAS. As the size of UAS becomes smaller and the payloads more effective the UAS area of influence increases and the ability to counter that threat diminishes. Consequently, the focus of this Sandbox is for Innovators to demonstrate their solutions to deal with this increasing threat including appropriate detection and tracking ranges, as well as kinetic and non-kinetic solutions for mitigating the micro and mini UAS.

3. Outcomes and Considerations:

3.1. The desired end-state outcome of this challenge is to implement a functional solution for passively detecting and then kinetically or non-kinetically defeating UAS, ideally in all four of the operational scenarios (airfield/FOB, vehicle mobility, dismounted soldier element, urban environment).

3.2. An intent of the IDEaS Program is to push for innovative solutions that will provide increased capabilities for DND/CAF beyond what is already in production and available for acquisition today. While the following characteristics indicate what we believe could be mandatory and/or desirable for this Challenge, these will be revaluated after responses from this RFI are received. Final entry criteria for the Sandbox will be published when it is opened for applications.

3.3. As the solutions and performance parameters for these scenarios can vary, so can the Sandbox test environment characteristics required in order to observe the solutions offered. DND/CAF has not yet determined whether to conduct a single Sandbox that covers all four scenarios, or if different Sandboxes should be conducted for each, or a combination thereof.

3.4. Consequently, one of the purposes of the RFI for this specific challenge is to determine the level of interest and projected developing capabilities in each counter-UAS scenario so that appropriate Sandboxes are designed and offered in the near future.

3.5. The RFI response form has several specific questions to elicit this information. When answering the RFI, please use Table 1 to situate your ability to address the different scenarios of this Challenge and the associated capability characteristics we are seeking:

Challenge #: Sandbox RFI 2018-1, Challenge #1
Challenge Title: Counter Micro and Mini Unmanned Aerial Systems

Table 1: Counter UAS Scenarios and Mandatory Performance
The information provided in the RFI responses will be used to establish the minimum mandatory performance levels for entry into the eventual Sandboxes, and will be published as part of the upcoming Application process

Counter-UAS System Characteristic	Operational Scenario the Counter UAS system would be applied to:			
	Airfield/FOB	**Mobile**	**Section Local Defence**	**Urban Operations**
Size and mobility	Can be static once deployed	Vehicle mounted (See Note 1)	Soldier-Portable	Vehicle mounted and/or Soldier-Portable
Power source/consumption	Provided by a local power grid (typically large deployable generators)	Vehicle powered	Soldier-portable power source.	Vehicle powered and/or Soldier-portable source.
Passively detecting micro	Minimum distances and altitudes for each scenario and sandbox will be established based on information gathered during this RFI.			
Passively detecting mini				
Kinetically Defeating micro				
Kinetically Defeating mini				
Non-Kinetically Defeating micro				
Non-Kinetically Defeating mini				
Defeating a Swarm of size:	TBD	TBD	TBD	TBD
Note 1: Solutions in the "Mobile" scenario must be fully viable as a vehicle mounted system; however, for the purposes of the Sandbox demonstrations it need not be physically mounted on a vehicle.				

3.6. Aside from what may become mandatory elements in the above Table, it is desirable that proposed solutions:

3.6.1. achieve all Counter-UAS scenarios with a single system.

3.6.2. minimize physical, electromagnetic, or other collateral damage in mitigating the UAS.

3.6.3. operate with the greatest degree of autonomy possible from initial UAS detection to mitigation.

4. Potential Sandbox:

4.1. Overview: The CAF will provide the Participants with access to a range environment where various UAS systems will be operated by the CAF in an appropriate manner and distances for the scenario. The Participant will demonstrate the functionality and

capability of their technology in detecting and/or defeating the UAS, as applicable to their solution.

4.1.1. Subject to the results of this RFI, this Sandbox is notionally planned as follows:

4.1.1.1.	Potential Submission of Applications:	Winter 2019
4.1.1.2.	Potential Location:	Alberta
4.1.1.3.	Potential Date:	Spring 2019

4.2. Concept, Scenario, and Test Environment. The type of test environment required for a counter-UAS system can vary significantly for each solution. Some will require a military weapons range with safety protocols, while others could be conducted in less restrictive areas. Consequently, what follows is a general intent that will be refined based on responses to this RFI and the types of proposed solutions are known. Conceivably, a kinetic sandbox could be conducted at a separate time and place than a non-kinetic one, or there may only be a single sandbox of a specific type.

4.2.1. After being given time to setup any required equipment, Participants will be able to demonstrate their solutions against a range of UAS in various scenarios.

4.2.2. DND/CAF experts will provide feedback to each Participant on how successful their solution was at finding detecting and/or defeating the UAS. Participants will also receive feedback on the projected functionality of their solution if it were in an actual theatre of operations.

4.2.3. The amount of time each Participant will have within the test environment will be determined later in the Sandbox design process so that it is sufficient for the types of solutions being proposed. Multiple sessions may be permitted subject to the event capacity and number of participants.

4.3. Test Resources to be made available: DND/CAF will provide the following:

4.3.1. A test area of suitable boundaries and airspace control for the planned activities including the operation of drones, electronic signals, and weapons. Precise details and sizes will depend on the proposed solutions and be determined at a later date.

4.3.2. Various small UAS operated by CAF personnel to be representative of those encountered on operations.

4.3.3. Data collection equipment, to include but may not be limited to tacking systems, visual recordings, and damage assessments.

4.3.4. Participants will receive all test data and performance analysis related to their systems, as well as any pertinent operator feedback or recommendations.

4.4. Support Concept.

4.4.1. Participants are responsible for all transportation, shipping, food, and lodging of all of their equipment and personnel to, from, and during the Sandbox.

4.4.2. DND/CAF will provide appropriate gathering and preparation areas including protection from inclement weather, temporary storage of the Participant's equipment, limited business facilities such as meeting spaces, and briefing areas.

4.4.3. As access to DND/CAF facilities is part of this Sandbox, Participants will have to meet all requisite security screening requirements, which will be determined at a later date.

4.4.4. Further details on the support concept, such as when the Participant, their equipment, and their personnel need to arrive by, will be determined and

announced once planning is completed and the Letter Of Interest (LOI) for applications to this Sandbox is released.

Challenge #: Sandbox 2018-1, Challenge #2
Challenge Title: Camouflage Against Surveillance Technology for Dismounted Soldiers

1. Challenge Statement:

1.1. How might we improve camouflage for dismounted soldiers in order to reduce detectability and identification by adversaries using thermal and multi spectral sense capabilities?

2. Background and Context:

2.1. Detecting the movements of personnel and equipment on operations and training is critical to maintaining tactical advantage, stealth and security. Dismounted soldiers must continually develop ways of thwarting sensing technologies in order to reduce their detectability and identification by adversaries. Different types of sensing technologies with various capabilities such as basic human to human line of sight, more complex optical surveillance systems, and multimodal sensors exist and are continually improving while our primary camouflage for soldiers has remained fixed.

2.2. Currently, the CAF relies on simple camouflage patterned uniforms to reduce direct human to human visual detectability; however, it is less effective against technology based surveillance systems. As a mitigation method we supplement it with such techniques as using blankets to reduce thermal detection, but additional methods against thermal and other sensors is sought.

2.3. As CANSOFCOM operates in small teams of 2-10 soldiers, the threshold of detectability to be mitigated is at the individual level rather than trying to conceal larger formations of soldiers in open areas.

2.4. Modifying the current camouflage pattern itself solely to change its visual appearance and its human to human unaided detection characteristics is not the intent of this Challenge, although it may be a by-product of any particular solution.

3. Outcomes and Considerations:

3.1. The end-state outcome of this challenge is to implement functional camouflage systems to conceal dismounted soldiers from optical surveillance systems and multimodal sensors in all types of geographic areas.

3.2. An intent of the IDEaS Program is to push for innovative solutions that will provide increased capabilities for DND/CAF beyond what is already in production and available for acquisition today. While the following characteristics indicate what we believe could be mandatory and/or desirable for this Challenge, these will be revaluated after responses from this RFI are received. Final entry criteria for the Sandbox will be published when it is opened for applications.

3.3. It is mandatory that:

3.3.1. Proposed solutions demonstrate an innovative leap ahead of current technology to provide camouflage for an individual dismounted soldier against one or more of the following detection methods:

3.3.1.1. Optical Surveillance Systems

- Visible light and near infrared;
- Low light night vision optics;
- Infrared (IR) thermal imaging; cooled and uncooled;
- Ultraviolet light;

- Multispectral; and
- Hyperspectral.

3.3.1.2. Multimodal Sensors

- Sense physical characteristics such as acoustic, motion, vibration, sound, pressure, temperature and humidity.

3.3.2. Proposed solutions must not limit the soldier's functionality, impede access to personal equipment, and interfere with their speed and agility, or their personal protection equipment.

3.4. It is desirable that proposed solutions:

3.4.1. Be lightweight and wearable/breathable.

4. Potential Sandbox:

4.1. Overview: The CAF will provide soldiers as test subjects to wear the submitted camouflage solutions and move around a test area in varying degrees of observability while CAF provided sensors attempt to detect them.

4.1.1. Subject to the results of this RFI, this Sandbox is notionally planned as follows:

4.1.1.1. Potential Submission of Applications: Winter 2019

4.1.1.2. Potential Location: Ontario

4.1.1.3. Potential Date: Spring 2019

4.2. Concept, Scenario, and Test Environment

4.2.1. After being given time to set up any required equipment with the test subjects, Participants will be able to demonstrate their solutions against a range of CAF detection technologies and observers in various scenarios (open and closed terrain). Soldiers will conduct a range of typical movements across the test area, ranging from fully observable open walking to covert methods, as well as any performance differences between single soldiers, pairs, or small teams.

4.2.2. A baseline observability of the same maneuvers in a standard current CAF uniform may also be conducted for comparative purposes.

4.2.3. In addition, soldiers will provide feedback on the functionality of the solutions in regards to conducting their normal other tasks, such as physical activity, vehicle entry/exit, weapons handling, combat tactics, techniques, and procedures, etc.

4.2.4. The amount of time each Participant's solution will have under observation will be determined later in the Sandbox design process so that it is sufficient for the types of solutions being proposed. Multiple sessions may be permitted subject to the event capacity and number of participants.

4.2.5. Test Resources to be made available: DND/CAF will provide the following:

4.2.5.1. Access to a suitable area for observation, likely in a military training area.

4.2.5.2. Soldiers made available to trial the camouflage;

4.2.5.3. A range of sensor technologies to assess the effectiveness of the solutions.

4.3. Support Concept.

4.3.1. As the Sandbox is being conducted at a major city, the Participant is responsible for all transportation, shipping, food, and lodging of all of their equipment and personnel to, from, and during the Sandbox.

4.3.2. DND/CAF will provide appropriate gathering and preparation areas including protection from inclement weather, temporary storage of the Participant's equipment, limited business facilities such as meeting spaces, and briefing areas.

4.3.3. As access to DND/CAF facilities is part of this Sandbox, Participants will have to meet all requisite security screening requirements, which will be determined at a later date.

4.4.5. Further details on the support concept, such as when the Participant, their equipment, and their personnel need to arrive by, will be determined and announced once planning is completed and the Letter Of Interest (LOI) for applications to this Sandbox is released.

Challenge #: Sandbox RFI 2018-1, Challenge #3
Challenge Title: Corrosion Detection in Ships

1. Challenge Statement:

1.1. How might we detect and assess corrosion behind surface coatings (such as paint, insulation, tiles, seamless decking …) onboard Royal Canadian Navy (RCN) platforms in order to reduce corrosion's operational impact and improve the effectiveness of scheduled and unscheduled maintenance?

2. Background and Context:

2.1. Corrosion prevention, detection, and repair on RCN platforms is an essential component throughout their service life. This includes the aspects of:

2.1.1. unscheduled maintenance when a corrosion problem is discovered while the ship is operational and requires immediate repair;

2.1.2. scheduled maintenance to repair corrosion during major overhauls or other maintenance opportunities;

2.1.3. the provision of corrosion data into the broader question of a vessel's seaworthiness and risk assessments for current operational use as well as estimates of the fatigue and overall life expectancy of that vessel; and

2.1.4. with consideration of the above, the prioritization of what maintenance on which ship is performed when in order to create an effective and efficient maintenance program in total for the RCN with the requisite operational availability.

2.2. While corrosion prevention and repair remain crucial aspects of this overall topic, this particular Sandbox is focusing on the corrosion detection aspect of this problem space.

2.3. The current approach to the corrosion detection has often been removing insulation, deck covering and interference items in order to see the steel plating and be able to perform an assessment of the required repairs. The removal of interference items can be very difficult and intrusive in itself, and is frequently not viable while the ship is operational. Consequently, the corrosion detection and repair planning is mostly done once the ship has started her major overhaul after the insulation, deck covering and interference items have been removed. Only then the repair surveys can be completed to define work repair scope. This leads to new unplanned work that will need to be completed as work arising, which leads to significant schedule delays and cost increases.

2.4. Alternatively, to be effective and efficient the detection of corrosion and the consequential maintenance planning would ideally be done well in advance of such major overhauls while the ship is still operational and without the removal of surface coatings (such as paint, insulation, tiles, seamless decking, etc).

2.5. In summary, currently, the RCN relies mostly on:

2.5.1. Visual or limited technologies for detection of corrosion via inspection as noticed, or during scheduled inspection cycles and/or based on historical experience and trends, including corrosion by-products or thinning of steel;

2.5.2. Experienced hull surveyors to determine if tile or seamless decking has delaminated from the steel deck;

2.6. These current methods are inadequate in their ability to:

2.6.1. assess steel condition under the tile or seamless decking;

2.6.2. detect corrosion in difficult to assess area like under/behind large pieces of equipment;

2.6.3. ability to "see" through insulation to assess steel plating.

3. Outcomes and Considerations:

Challenge #: Sandbox RFI 2018-1, Challenge #3
Challenge Title: Corrosion Detection in Ships

3.1. The end-state outcome of this challenge is to implement a functional solution for rapidly and easily detecting and informing the operators and engineers of all corrosion in a vessel while it is in operational use in a non-destructive manner that does not rely on human visual inspection or the removal of equipment. That information can then be used for unscheduled but required repairs, and planning for major work.

3.2. An intent of the IDEaS Program is to push for innovative solutions that will provide increased capabilities for DND/CAF beyond what is already in production and available for acquisition today. While the following characteristics indicate what we believe could be mandatory and/or desirable for this Challenge, these will be revaluated after responses from this RFI are received. Final entry criteria for the Sandbox will be published when it is opened for applications.

3.3. It is mandatory that proposed solutions:

3.3.1. Demonstrate an innovative leap ahead of current corrosion detection technology, rather than minor improvements. This is interpreted as:

3.3.1.1. not using human visual or human audible means as the primary detection method.

3.3.1.2. include at least one of the following features:

3.3.1.2.1. rapid detection sweeps of large areas of the ship including the surface and sub-surface/interior of the area/material being analysed, including at least one of:

- The hull; and/or.
- The deck; and/or.
- Major installed equipment; and/or.
- The interfaces between the above.

3.3.1.2.2. Provide real-time analysis and comparison with baseline data;

3.3.1.2.3. Function in a fluid medium such as underwater or in fuel filled tanks;

3.3.1.2.4. Function without the removal of surface coatings (such as paint, insulation, tiles, seamless decking, etc).

3.3.2. The technology must use a non-destructive and non-intrusive testing methodology as the ship and equipment must remain usable after the testing.

3.3.3. If the solution needs to be moved throughout and around the ship to complete any scans, the system shall be portable and small enough to be carried throughout the ship, and be weather resistant.

3.3.4. The solution must function in variable humidity and temperature conditions.

3.4. It is desirable that proposed solutions:

3.4.1. Be able to be utilized while at sea.

3.4.2. Require minimal operator training and minimal operator input, ideally having autonomous characteristics and potentially being fully autonomous.

3.4.3. Display the results in a visual manner rather than simple numeric data.

4. Potential Sandbox:

Challenge #: Sandbox RFI 2018-1, Challenge #3
Challenge Title: Corrosion Detection in Ships

4.1. Overview: The CAF will provide the participants access to assorted corroded test panels and a RCN warship where they will be able to demonstrate the functionality and capability of their corrosion detection solutions.

4.1.1. Subject to the results of this RFI, this Sandbox is notionally planned as follows:

4.1.1.1.	Potential Submission of Applications:	Fall 2018
4.1.1.2.	Potential Location:	Halifax or Victoria
4.1.1.3.	Potential Date:	Winter 2019

4.2. Concept, Scenario, and Test Environment

4.2.1. After being given time to setup any required equipment, Participants will be able to demonstrate their solutions against a range of corroded materials in varying degrees of difficulty. This materials will include assorted degrees of corrosion (depth and/or breadth), visible, non-visible, type of material, access to the material (distance from any sensors to the material due to insulation for example), and so forth. Some of the test articles or areas may be on test stands, while others may include and/or be installed on an actual RCN ship.

4.2.2. DND/CAF experts will be aware of the extent of the corrosion for each test article in advance and will provide feedback to each Participant on how successful their solution was at finding the corrosion.

4.2.3. Aside from actual detection of the corrosion, Participants will also receive feedback on the functionality of their solution in a RCN ship environment, particularly in regards to how effectively their solution can assess the many confined and corrosion prone spaces of a RCN ship.

4.2.4. The amount of time each Participant will have with each test article will be determined later in the Sandbox design process so that it is sufficient for the types of solutions being proposed. Multiple sessions may be permitted subject to the event capacity and number of participants.

4.2.5. Test Resources to be made available: DND/CAF will provide access to the following:

4.2.5.1. The exterior hull and interior decks of a RCN Warship;

4.2.5.2. Additional test articles or areas may be on test stands;

4.2.5.3. DND/CAF Subject Matter Experts.

4.3. Support Concept.

4.3.1. As the Sandbox is being conducted at a major city, the Participant is responsible for all transportation, shipping, food, and lodging of all of their equipment and personnel to, from, and during the Sandbox.

4.3.2. DND/CAF will provide appropriate gathering and preparation areas including protection from inclement weather, temporary storage of the Participant's equipment, limited business facilities such as meeting spaces, and briefing areas.

4.3.3. As access to DND/CAF facilities and a RCN ship is part of this Sandbox, Participants will have to meet all requisite security screening requirements, which will be determined at a later date.

4.4.6. Further details on the support concept, such as when the Participant, their equipment, and their personnel need to arrive by, will be determined and

announced once planning is completed and the Letter Of Interest (LOI) for applications to this Sandbox is released.

Challenge #: Sandbox RFI 2018-1, Challenge #4
Challenge Title: Enhanced Small Arms Targeting Systems

1. Challenge Statement:

1.1. How might we improve small arms targeting systems to increase the probability of a successful engagement?

2. Background and Context:

2.1. In a combat environment the ability to accurately engage the enemy with assorted weapons is essential. In the Special Operations Forces (SOF), doing so on the "first shot" with a high probability of success provides a particular advantage.

2.2. Setting aside the operator's personal skill level, the problem space of precisely when and in what azimuth to fire a weapon needs to apply targeting corrections for:

2.2.1. Whether or not the operator/weapon launch point is stationary or moving;

2.2.2. What the path of the munition will take as it transits to the target (such as wind influence, its ballistic characteristics, distance covered, speed, etc); and

2.2.3. Whether or not the target is stationary or moving.

2.3. When those three basic variables can be accurately accounted for and the resultant target point communicated to the operator/weapon and its sighting/targeting system, the probability of hitting that target on the first shot will increase significantly.

2.4. There are assorted techniques and technologies available for each of the above components; however, the synthesising of that information into a single targeting and fire decision remains reliant on the operator. This is training intensive and varies for each of the many weapons that SOF uses, their differing ballistic characteristics, and the different targets and movements.

2.5. If an automated targeting system could sense, consider, and blend all three components automatically and present the synthesized firing solution to the operator for their final decision to fire, this would improve the probability of a successful engagement and reduce the training required.

3. Outcomes and Considerations:

3.1. The ideal overall outcome is to implement a targeting system that is adaptable to a range of assorted existing weapons in which the weapon and munition characteristics are uploaded into the system after which it synthesizes and presents the total firing solution to the operator with a high probability of first shot success.

3.2. An intent of the IDEaS Program is to push for innovative solutions that will provide increased capabilities for DND/CAF beyond what is already in production and available for acquisition today. While the following characteristics indicate what we believe could be mandatory and/or desirable for this Challenge, these will be revaluated after responses from this RFI are received. Final entry criteria for the Sandbox will be published when it is opened for applications.

3.3. It is mandatory that proposed solutions:

3.3.1. Account for at least two of the following variables in determining the firing solution:

3.3.1.1. A moving operator/weapon launch point;

3.3.1.2. The path of the munition will take as it transits to the target (such as wind influence, its ballistic characteristics, distance covered, speed, etc); and

3.3.1.3. A moving target.

3.3.2. Present the synthesized firing solution in real time to the operator in such a manner that it is functionally useable to rapidly aim the weapon for their final decision to fire.

3.4. It is desirable that proposed solutions:

3.4.1. Account for all three basic variables for the firing solution (ref 2.2).

3.4.2. Regardless of the weapon system demonstrated on at the Sandbox, the targeting system be adaptable to a range of other ballistic small arms type of weapons in the SOF inventory.

3.4.3. If the system is not hard-mounted to the weapon system, it is desirable it uses wireless connections between any separated components.

4. Potential Sandbox:

4.1. Overview: CAF will provide a small arms weapons test range with assorted targets and firing stations, both stationary and moving, in which Participants will be able to demonstrate their solutions.

4.1.1. Subject to the results of this RFI, this Sandbox is notionally planned as follows:

4.1.1.1.	Potential Submission of Applications:	Winter 2019
4.1.1.2.	Potential Location:	Ontario
4.1.1.3.	Potential Date:	Spring 2019

4.2. Concept, Scenario, and Test Environment:

4.2.1. As the ultimate aim is to apply the targeting system to a variety of weapons, the focus of this Sandbox's effort is on the system's ability to determine a firing solution, and not the weapon itself. Two categories of innovations will be entertained as follows to enable this:

4.2.1.1. Innovators whose solution comprises only the targeting system that is mountable on a generic weapon, can optionally attach their system to an existing SOF weapon as specified below in order to demonstrate it. In such cases SOF will operate the weapon.

4.2.1.2. Innovators whose solution includes a weapon and an integrated targeting system can demonstrate their full solution including their own weapon; however,

4.2.1.2.1. The purpose of the demonstration remains the targeting system, not the weapon or munition itself.

4.2.1.2.2. The type of weapon used shall be comparable to at least one of the weapons listed below (4.2.4.3).

4.2.2. After being given time to setup any required equipment, Participants will be able to demonstrate their solution's ability to account for the three basic parameters under consideration: moving weapon, munition trajectory, and moving target.

4.2.3. Test scenarios and combinations of these parameters will be presented in order to cover the range of possibilities and different degrees of difficulty. Types of

targets used may vary depending on the weapon/munition type of the proposed solution.

4.2.4. Test Environment: DND/CAF will provide:

4.2.4.1. A suitable weapons test range.

4.2.4.2. Expected targets would be representative of humans, vehicles, and potentially small drones, including stationary and mobile variations.

4.2.4.3. For those Innovators seeking to demonstrate their targeting solution with an existing SOF weapon, access to the following will be given during the Sandbox, but operated by SOF personnel:

4.2.4.3.1. 50 Cal - http://www.army-armee.forces.gc.ca/en/weapons/m2-browning-machine-gun.page

4.2.4.3.2. C16 Close Area Suppression Weapon (CASW) - https://en.wikipedia.org/wiki/Heckler_%26_Koch_GMG

4.2.4.3.3. Mk 19 grenade launcher - https://en.wikipedia.org/wiki/Mk_19_grenade_launcher

4.2.4.3.4. C15 long-range sniper weapon (LRSW) - https://en.wikipedia.org/wiki/McMillan_TAC-50

4.2.4.3.5. C14 Timberwolf - https://en.wikipedia.org/wiki/C14_Timberwolf

4.2.4.3.6. C6 7.62-mm Medium Machine Gun - http://www.army-armee.forces.gc.ca/en/weapons/c6-general-purpose-machine-gun.page

4.2.4.3.7. C9A2 Light Machine Gun - http://www.army-armee.forces.gc.ca/en/weapons/c9a2-light-machine-gun.page

4.2.4.4. Ballistic characteristics of the above weapons will be made available when the Sandbox Call for Applications is released to enable appropriate Innovator preparations.

4.3. Support Concept.

4.3.1. The Participant is responsible for all transportation, shipping, food, and lodging of all of their equipment and personnel to, from, and during the Sandbox.

4.3.2. DND/CAF will provide appropriate gathering and preparation areas including protection from inclement weather, temporary storage of the Participant's equipment, limited business facilities such as meeting spaces, and briefing areas.

4.3.3. As access to DND/CAF facilities is part of this Sandbox, Participants will have to meet all requisite security screening requirements, which will be determined at a later date.

4.3.4. Further details on the support concept, such as when the Participant, their equipment, and their personnel need to arrive by, will be determined and announced once planning is completed and the Letter Of Interest (LOI) for applications to this Sandbox is released.

Challenge #: Sandbox RFI 2018-1, Challenge #5
Challenge Title: Stand-Off Detection of Explosives

1. Challenge Statement:

1.1. How might we improve stand-off detection of explosives in real time in order to reduce risk to soldiers operating in high risk environments?

2. Background and Context:

2.1. The evolving nature of the threat posed by Improvised Explosive Devices (IEDs) presents an ongoing and significant challenge for soldiers. This is particularly evident during vehicle operations on roads as the path of the vehicle is predictable and IEDs can be concealed and detonated in a variety of ways. Aside from the immediate and devastating impact of such devices, an explosion, or even the threat of one, can bring a convoy to a halt and further expose it to additional combat risks, as well as interfering with the original mission itself.

2.2. To counter this threat, assorted tactics, techniques, and procedures have been implemented, as well as new vehicle designs to disperse the explosive impacts and technical solutions to locate the IEDs.

2.3. Currently, the Army uses an Expedient Route Opening Capability (EROC). This consists of vehicles equipped with Ground Penetrating Radar (GPR) and metal detectors that are capable of finding roadside and buried IEDs. Unfortunately, both have very short ranges; consequently, the EROC moves slowly and is already virtually on top of anything it finds and must immediately stop.

2.4. Alternatively, if detectors could provide a forward looking longer range capability then IEDS could be located well in advance which would increase the time available to react, and by further consequence increase the permissible speed of travel and the level of safety. Given that current detection methods are of such short range even a small increase in the horizontal detection distance of 5-20 metres would significantly reduce the explosive force impact and risk levels, and increase combat speed and maneuverability.

3. Outcomes and Considerations:

3.1. The desired end-state outcome of this challenge is to implement a functional solution for detecting concealed explosives with sufficient warning to stop and avoid concealed IEDs while driving at normal vehicle speeds, recognizing that achieving such speeds is a futuristic stretch goal.

3.2. An intent of the IDEaS Program is to push for innovative solutions that will provide increased capabilities for DND/CAF beyond what is already in production and available for acquisition today. While the following characteristics indicate what we believe could be mandatory and/or desirable for this Challenge, these will be revaluated after responses from this RFI are received. Final entry criteria for the Sandbox will be published when it is opened for applications.

3.3. For the purposes of this Sandbox it is mandatory that proposed solutions:

3.3.1. Detect and notify the crew in real time of the location of concealed explosives under a dirt road from a horizontal distance of at least five meters in front of a moving vehicle with a 95% confidence factor. “Concealed” is to be interpreted as an IED device being sufficiently below the surface level and covered such that it is not visible.

3.4. It is desirable that proposed solutions include any/all of the following:

3.4.1. Exceed the mandatory performance levels, such as:

3.4.1.1. Horizontal detection ranges further than 5 metres.

3.4.1.2. Detection confidence factors higher than 95%.

3.4.1.3. Concealed depths deeper than the immediate sub-surface.

3.4.1.4. Concealed locations beside the road.

3.4.1.5. Additional road types (varying types of dirt/soil, gravel, paved, concrete)

3.4.2. Be suitable to be applied to all operational Army vehicles as an add-on equipment module, as opposed to requiring a dedicated "Detector Vehicle".

3.4.3. Function at as fast a vehicle speed as possible. It is recognized that achieving such full detection while at high speeds of up to 120 Km/Hr with sufficient stopping distance represents a very high futuristic stretch goal; however, every increment towards that is desirable.

3.4.4. Aside from indicating the location of the explosive (a mandatory requirement above), provide additional information such as the type of explosive, whether it has an radio frequency initiator, etc.

3.4.5. Require a minimal power demand that would already be available in a typical existing operational Army vehicle.

3.4.6. Require minimal operator training and minimal operator input, ideally having autonomous characteristics and potentially being fully autonomous and transparent to the vehicle driver until an automated alarm and location information is given.

3.5. Recognizing that sensor based solutions are usually installed on a vehicle that is independent of the sensor system itself, for the purposes of this Sandbox submitted solutions need not be currently installed on an operational Army vehicle and can use any sufficiently representative vehicle (such as a car, truck, SUV, quad-bike, etc); however:

3.5.1. if the solution is dependent on a unique purpose designed and built vehicle in order for the detector itself to work, then that vehicle and the operation of it shall be included as part of the submitted solution and Sandbox; and/or;

3.5.2. if the solution has a drone or other such non-vehicle component, that component and the operation of it shall be included as part of the submitted solution and Sandbox.

4. Potential Sandbox:

4.1. Overview: The CAF will provide the Participants with access to safe range environment with various explosive materials or simulations thereof concealed in various road environments where they will be able to drive down the road and demonstrate the functionality and capability of their explosive detection solutions.

4.1.1. Subject to the results of this RFI, this Sandbox is notionally planned as follows:

4.1.1.1.	Potential Submission of Applications:	Winter 2019
4.1.1.2.	Potential Location:	Alberta or Quebec
4.1.1.3.	Potential Date:	Spring / Summer 2019

4.2. Concept, Scenario, and Test Environment

4.2.1. After being given time to setup any required equipment, Participants will be able to demonstrate their solutions against a range of explosive materials buried in various road environments in varying degrees of difficulty and explosive types.

4.2.2. DND/CAF experts will provide feedback to each Participant on how successful their solution was at finding the explosives. Participants will also receive feedback on the projected functionality of their solution if it were in an actual theatre of operations.

4.2.3. The amount of time each Participant will have within the test environment will be determined later in the Sandbox design process so that it is sufficient for the types of solutions being proposed. Multiple sessions may be permitted subject to event capacity and number of participants.

4.3. Test Resources to be made available: DND/CAF will provide the following:

4.3.1. Various explosives or simulations thereof concealed in roads similar to those encountered on operations.

4.3.2. The necessity and viability of using real explosives or simulations will depend on the nature and detection methods of the proposed solutions. Real explosives will only be used where necessary and with appropriate safety protocols. This will be determined after the responses to this RFI are analysed, and will be presented when the Sandbox is published for applications.

4.3.3. Subject to the solutions being proposed, DND/CAF may provide a vehicle on which solutions can be temporarily loaded for the purposes of the Sandbox, such as a pick-up truck on which Participants could load their solution in a palletized configuration. This will be determined at a later date.

4.4. Support Concept.

4.4.1. As the Sandbox is being held near a major city, the Participant is responsible for all transportation, shipping, food, and lodging of all of their equipment and personnel to, from, and during the Sandbox.

4.4.2. DND/CAF will provide appropriate gathering and preparation areas including protection from inclement weather, temporary storage of the Participant's equipment, limited business facilities such as meeting spaces, and briefing areas.

4.4.3. As access to DND/CAF facilities is part of this Sandbox, Participants will have to meet all requisite security screening requirements, which will be determined at a later date.

4.4.4. Further details on the support concept, such as when the Participant, their equipment, and their personnel need to arrive by, will be determined and announced once planning is completed and the Letter Of Interest (LOI) for applications to this Sandbox is released.

Annex B
Solution Readiness Levels

The Solution Readiness Level (SRL) definitions for the purposes of IDEaS are identified below:

SRL 1: Identification—basic principles and/or properties are observed.

SRL 2: Definition—practical applications and/or concepts are formulated.

SRL 3: Observation and Analysis—analytical and/or laboratory research and/or experiments are undertaken.

SRL 4: Proof of Concept—basic integration of applications and/or concepts to demonstrate viability.

SRL 5: Validation—refined integration of applications and/or concepts to confirm validity.

SRL 6: Simulated Demonstration—near-end state solution is demonstrated and tested in a simulated environment.

SRL 7: Real-World Demonstration—near-end state solution is demonstrated and tested in an appropriate real-world environment.

SRL 8: Qualified Solution—end state solution is completed and refined through testing.

SRL 9: Proven Solution—final solution is implemented and proven successful.