



# DEEP SPACE

*Healthcare Challenge*

Applicant guide



For full details on the CSA-managed competition,  
visit [impact.canada.ca](http://impact.canada.ca)



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# 1 About the Challenge

As international ambitions for space travel extend beyond low-Earth orbit and towards the Moon and Mars, the issue of crew health becomes increasingly complex. Current medical operations for astronauts on the International Space Station (ISS) are Earth-centric, and heavily reliant on real-time medical support from ground-based experts. Typical missions to the ISS last around six months, and are supported by resupply missions and the ever-present option of emergency evacuation. These supports will become impractical on deep space missions that last up to two and a half years. Communication delays of up to 20 minutes will render ground-based oversight impractical, medical evacuation will no longer be an option, and the onboard medical facility will need to provide equipment and supplies to cover all medical eventualities for the duration of the mission.

We need to re-think our approach to astronaut healthcare by developing systems that are less reliant on Earth, and that provide increased autonomy to mission teams. This will need to be done with limited space, in a harsh environment and with generalist healthcare practitioner skills.

This situation bears many similarities with the daily healthcare delivery needs in rural and remote Canada. Practitioners in these regions are typically generalists who are working with limited equipment and space. They are reliant on specialist support from urban centers, with patients often being forced to leave their communities for what many of us would consider routine tests and diagnostics. This has led to a distinct health gap in terms of access to quality care.

The Canadian Space Agency is looking to address the overlapping issues faced in space and remote healthcare. We are looking to develop autonomous medical systems that have the potential to keep astronauts healthy on missions in the future, while improving access to quality care in remote communities today.

## 1.1 Challenge Statement

The Canadian Space Agency is challenging innovators to develop novel diagnostic and detection solutions that can support frontline health workers in detecting or diagnosing medical conditions in remote communities now, and eventually crews on long-duration deep space missions.

This Challenge seeks to incentivize Applicants to develop new technologies, or adapt existing technologies, that can support practitioners in a meaningful way in detecting and diagnosing medical conditions. These technologies could be stand-alone tools or be part of a larger system. They can be a supporting technology that allows breakthrough work in detection or diagnosis, or a tool that supports practitioners in building skills in this area.

## 1.2 Possible Opportunity Areas for Detection and Diagnostic Tools

- *Early detection of diseases:* In both remote communities and on deep space missions, the ability to detect a disease or medical condition early can play a huge role in improving outcomes. It could mean community members can receive treatment locally, without having to leave their community. Solutions in this area will not necessarily increase the amount of testing, but could leverage existing data or activities to identify potential issues.
- *Remote Health Monitoring:* Passive and unobtrusive monitoring of at-risk patients, or of patients dealing with a chronic illness, can allow practitioners to provide timely treatment, while maximizing their efficiency.
- *Just-in-time Medical Skills Training:* Practitioners in remote communities and on space missions are extremely busy, and learning new skills or maintaining those for procedures that are rarely performed can be a challenge. Solutions that can provide training, guidance or direction for diagnostic procedures could increase the efficiency and effectiveness of generalist practitioners, and minimize the need for external specialists.
- *Clinical Decision Support System:* With limited diagnostic capabilities in most remote communities, solutions that support generalist practitioners in rendering diagnoses would be of significant value. These solutions could take various forms, and would leverage current and historic patient data.
- *Point-of-care Diagnostics:* Diagnostic systems that can be implemented at the point-of-care in remote communities could significantly help in early detection of medical conditions, as well as in decision making around the need for medical evacuations. These solutions could include body fluid testing or imaging, with the goal being to minimize the reliance on external labs, facilities and specialists.

## 1.3 Challenge Structure

The Deep Space Healthcare Challenge follows a stage-gated approach. At each Stage, different financial and non-financial incentives will be available to successful participants. At every Stage, solutions will be reviewed against the assessment criteria, and selected winners will be invited to move to the following Stage.

### Stage 1 – Concept Design

- Applicants will be required to submit an online application which provides a detailed explanation of a design for a novel detection or diagnostic technology concept. The application will need to demonstrate how the technology meets the Challenge goals and assessment criteria.

**Note:** This Applicant Guide will help Applicants complete an application for Stage 1. Once selected, successful participants from Stage 1 will receive further reporting requirements and instructions for Stage 2. The following information is provided to give Applicants an idea of what will be required for Stages 2 and 3 of the Challenge, if selected as a semi-finalist in Stage 1. Detailed information for later Stages will be provided to semi-finalists and finalists at the start of each Stage.

### Stage 2 – Proof-of-Concept

- In this Stage, semi-finalists will develop a proof-of-concept (with a minimum TRL of 4<sup>1</sup>) that they will independently test in a lab environment. Semi-finalists will be required to submit data from their lab tests for evaluation at the end of this Stage, and will be asked to provide an early vision for how they plan to get their technology to market in the terrestrial context.

### Stage 3 - Prototype Demonstration

- Participants will be required to build an operational prototype of their technology, which will be demonstrated and tested in a simulated environment established and run by the CSA. Participants will also be required to demonstrate how their technology meets the needs of their target market, and provide an overview of their business plan.

## 1.4 Prize Details

Up to \$2.85 million in total will be awarded in grant funding to semi-finalists, finalists and the grand prize winner of the Deep Space Healthcare Challenge, in addition to various non-financial supports.

Stage	Number of winners	Prize amount per winner
Stage 1 – Concept Design	Up to 20 semi-finalists	\$30,000
Stage 2 – Proof-of-Concept	Up to 5 finalists	\$350,000
Stage 3 – Prototype Demonstration	1 grand prize winner	\$500,000

**Note:** The number of winners and prize amounts may vary depending on the applications received. For each stage, prize amounts will not be less than the amount per winner indicated above.

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<sup>1</sup> Technology Readiness Level (TRL) 4: Component and/or breadboard validation in a laboratory environment. Source: [NASA](#)

## Supports for Semi-Finalists in Stage 2

- Semi-finalists will be paired with ISC Community Advisors through Indigenous Services Canada (ISC). These advisors will provide insight into the remote context, to ensure that the unique needs of this setting are incorporated into the design at an early stage.
- Semi-finalists will attend a virtual workshop which will cover common failure points for healthcare technology development, such as regulatory considerations, intellectual property management, and business strategy development. NRC-IRAP will also participate in this workshop, and will connect each semi-finalist with an Industry Technology Advisor (ITA). These ITA's can provide feedback as appropriate to semi-finalists based on IRAP's existing programs, and can make connections to other resources as needed.
- Participants will have access to a session with a regional health authority, to increase participants understanding of the nuanced needs of these groups, and to support participants in building solutions that are solving real problems.

## Supports for Finalists in Stage 3

- Support from Community Advisors will continue, with the potential for input from a broader set of individuals through ISC
- Challenge Finalists will have access to coaching services through IRAP.
- Connection to CAN Health Network's industry partners, mentors and advisors to discuss the technology's commercial adoption
- Participants will have the opportunity to participate in a meet-and-greet with a group of private funders, who can provide advice on product development and fundraising, and who may be interested in investing



## 1.5 Timeline

Stages	Date/Deadline	Event
<b>Stage 1</b>	November 30, 2021	Challenge Launch
	December 15, 2021	<a href="#">Webinar for interested challenge applicants</a>
	February 1, 2022	Application Deadline for Stage 1 Submissions
	February – April 2022	Judging & Selection of Winners for Stage 1
	April 2022	Stage 1 Winners Announced
<b>Stage 2</b>	April 2022	Stage 2 Begins
	December 2022	Proof-of-concept data submission deadline
	February – March 2023	Judging & Selection of Winners for Stage 2
	March 2023	Stage 2 Winners Announced
<b>Stage 3</b>	March 2023	Stage 3 Begins
	Fall 2023	Prototype testing at Demonstration Site
	December 2023	Judging & Selection of Grand Prize Winner
	March 2024	Grand Prize Winner announced

## 2 Assessment Criteria, Jury and Selection Process

### 2.1 Assessment Criteria

The assessment of technologies will be based on the following criteria. These assessment criteria will be consistent throughout the three Stages of the challenge and only their relative weighting factors will change between Stages, as indicated.

All Stage 1 Challenge participants will generate a robust design for an innovative technology that support detection or diagnosis, and which adheres to the following three constraints:

1. Must address challenge areas being faced by remote healthcare practitioners. These challenge areas are outlined in Table 1.
2. Must have **potential** to address conditions that are expected to occur in space. These conditions are shown in Table 2.
3. Must **demonstrate potential** for future adaptation to the unique constraints of space. *It does not need to meet these constraints currently*, but must have the potential to meet them in the next five years. These constraints are outlined in Table 3.

**Table 1. Priority Areas for Remote Communities**

This list was compiled with support from Indigenous Services Canada, and is not presented in any order of importance. It is not an exhaustive list of medical priorities in remote communities.
Cardiovascular Diseases
Mental Health Conditions (including addictions)
Infectious Diseases (including TB and HIV)
Chronic Diseases (including diabetes)
Oncology
Trauma

**Table 2. Conditions of Concern in Space**

<p>The following list contains the main medical conditions of concern to deep space exploration teams. Please note that the conditions are listed in alphabetical order. Therefore, the numbers do not reflect the importance of the medical issues. The conditions are taken from the Integrated Medical Model (IMM) condition list (IMCL) developed by NASA and the IMPACT Conditions List (ICL 1.0)</p>	
Abdominal Injury	Abdominal Wall Hernia
Abnormal Uterine Bleeding	Acute Angle Closure Glaucoma
Acute Arthritis	Acute Cholecystitis/Biliary Colic
Acute Compartment Syndrome	Acute Coronary Syndrome
Acute Diverticulitis	Acute Pancreatitis
Acute Prostatitis	Acute Radiation Syndrome
Acute Sinusitis	Allergic Reaction (Mild to Moderate)
Altitude Sickness	Anaphylaxis
Angina/Myocardial Infarction	Anxiety
Appendicitis	Atrial Fibrillation/Atrial Flutter
Back Pain (Space Adaptation)	Barotrauma (Ear/Sinus block)
Behavioral Emergency	Burns Secondary to Fire
Cardiogenic Shock secondary to Myocardial Infarction	Cerumen Impaction
Chemical Skin Burn	Chest Injury
Choking/Obstructed Airway	Cold injury (Chilblains/Frostbite)
Constipation (Space Adaptation)	Decompression Sickness Secondary to Extravehicular Activity
Dental : Exposed Pulp	Dental: Abscess
Dental: Avulsion (Tooth Loss)	Dental: Caries
Dental: Crown Loss	Dental: Filling Loss
Depression	Diarrhea

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Dislocation - Elbow	Dislocation - Finger
Dislocation - Shoulder	Ebullism
Epistaxis	EVA related Dehydration
EVA related Hand Injury	EVA related Heat Illness
EVA related Shoulder Injury	EVA Related Suit Contact Injury
Eye - Corneal Ulcer	Eye - Retinal Detachment
Eye - Retinal Injury	Eye Chemical Burn
Eye Infection	Eye Irritation/Abrasion
Eye Penetration (foreign body)	Fingernail Delamination Secondary to Extravehicular Activity
Fracture - Arm	Fracture - Cervical Spine
Fracture - Hand	Fracture - Hip/Proximal Femur
Fracture - Lower Extremity (LE) Stress Fracture	Fracture - Lumbar Spine
Gastritis/Reflux/Esophagitis	Gastroenteritis
Head Injury	Headache (CO2 Induced)
Headache (Late)	Headache (Space Adaptation)
Hearing Loss	Hemorrhoids
Herpes Zoster Reactivation (Shingles)	Hypertension
Hypothermia	Indigestion
Influenza	Insomnia (Space Adaptation)
Lunar Dust Exposure	Medication Overdose/Adverse Reaction
Mouth Ulcer	Nasal Congestion (Space Adaptation)
Nephrolithiasis	Neuro-ocular syndrome
Neurogenic Shock	Nose bleed (Space Adaptation)



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Orthostatic Intolerance	Otitis Externa
Otitis Media	Paresthesias Secondary to Extravehicular Activity
Pharyngitis	Pregnancy
Reactive airway	Respiratory failure
Respiratory Infection	Seizures
Sensorimotor/Neurovestibular Disturbance	Sepsis
Skin Abrasion	Skin Infection
Skin Laceration	Skin Rash
Sleep Disorder	Small Bowel Obstruction
Smoke Inhalation	Space Motion Sickness (Space Adaptation)
Sprain/Strain - Ankle	Sprain/Strain - Back
Sprain/Strain - Elbow	Sprain/Strain - Hip
Sprain/Strain - Knee	Sprain/Strain - Neck
Sprain/Strain - Shoulder	Sprain/Strain - Wrist
Stroke (Cerebrovascular Accident)	Sudden Cardiac Arrest
Toxic Dermal Exposure	Toxic Exposure: Ammonia
Traumatic Hypovolemic Shock	Urinary Incontinence (Space Adaptation)
Urinary Retention (Space Adaptation)	Urinary Tract Infection
Use injuries - Lower Extremities	Use injuries - Upper Extremities
Vaginal Yeast Infection	Venous Thromboembolism
Vertebral Disc Disorder	Visual Impairment and/or Increased Intracranial Pressure (VIIP) (Space Adaptation)



**Table 3. Constraints for Space Adaptation**

Space Adaptation Constraints	
<b>Mass and Volume</b>	<p>Although no specific measurement must be respected, the mass of the technology should be minimal.</p> <p>The volume of the technology should not exceed the size of a <u>double ISS EXPRESS rack Middeck Locker (MDL)</u> equivalent</p> <p>THREE POSSIBILITIES:</p> <p>Double length: 49.2" x 18.125" x 21.882" (inches)</p> <p>Double width: 24.6" x 36.25" x 21.882" (inches)</p> <p>Double height: 24.6" x 18.125" x 43.764" (inches)</p>
<b>Vibration Resistance</b>	<p>The technology must be able to withstand peaks at 80dBA.</p> <p>The technology must be able to withstand continuous vibrations at (or below) 49dBA.</p>
<b>Storage</b>	<p>The technology should require minimal conditioned storage (freezer, incubator, etc.)</p>
<b>Magnetic field</b>	<p>The technology must not emit a time-varying magnetic field that exceeds 85 to 140 dBpt (depending on the frequency.)</p> <p>The technology must not emit a static magnetic field that exceeds 3.16G.</p>

**Table 4. Assessment Criteria**

Assessment Criteria	Indicator	Weighting		
		Stage 1	Stage 2	Stage 3
<b>Potential for Space Adaptation</b>	Does the solution have the ability to meet the criteria listed in Table 3 within the next 5 years	Y/N	Y/N	Y/N
<b>Relevance for Remote Terrestrial</b>	Does the solution support the detection or diagnosis of a medical condition in one of the categories listed on Constraints Table 1?	Y/N	Y/N	Y/N
	To what extent does the solution have the potential to significantly impact one or more additional conditions within the categories outlined on Constraints Table 1?	5%	5%	0%

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<b>Relevance for Space</b>	Does the solution have the potential to support the detection or diagnosis of a medical condition listed on Constraints Table 2?	Y/N	Y/N	Y/N
	To what extent does the solution have the potential to significantly impact one or more additional conditions outlined on Constraints Table 2?	5%	5%	0%
<b>Innovation</b>	Does the solution introduce new ideas or methods and/or open new opportunities in the remote healthcare sector?	20%	10%	10%
<b>Autonomy</b>	To what degree will the solution increase a patient's ability to remain in their own communities to receive care?	15%	15%	15%
	To what extent does the solution increase the autonomy of the remote healthcare provider by producing actionable information, and not simply data?			
	To what extent is the solution capable of effective operation in situations of no/low connectivity?			
<b>Effectiveness</b>	To what extent does the solution accurately support the detection or diagnosis of a specified condition, with sensitivity and specificity that compare to or exceed that of the currently accepted gold standard for the given condition?	15%	15%	20%
	Does the solution provide information that will enhance the practitioners management of the patient?			
<b>Solution Adoption Potential</b>	Does the applicant understand the limitations, requirements, and conditions for commercial success of their solution, and do they have a plan to address any barriers?	10%	15%	15%
	Is the technology scalable to other markets (sectors, regions, demographics)?			
	Applicant has a feasible and credible plan to develop and test a proof-of-concept in the next 8 months (i.e. achieve or exceed Level 4 of the Technology Readiness Level -TRL- scale by end of Stage 2)			

<b>Context Sensitivity</b>	Does the innovator show an understanding of the unique challenges and physical constraints experienced in remote communities, and does the design reflect the unique needs of these communities?	10%	15%	15%
<b>Ease-of-use</b>	Can the solution be effectively implemented at the point-of-care?	10%	10%	15%
	Does the solution minimize the need for advanced or specialized training?			
<b>Reliability</b>	Does the solution show resistance to power/data interruptions?	10%	10%	10%

### Stage 1 Judging

Following the Stage 1 submission deadline on February 1, 2022 at 9:00 PM Eastern Time, the Judging Panel will review the submissions and discuss, evaluate, and rank the entries. The Judging Panel has discretion in the assessment and scoring of submissions and in recommending the winners. CSA will review the recommendations from the Judging Panel, and CSA will select final winners for awards.

The Judging Panel will evaluate Stage 1 submissions according to the criteria listed in Table 4.

## 3 Who can Apply? Eligibility Details

Eligible Applicants to the challenge include the following:

- Businesses or other for-profit organizations in Canada;
- Not-for-profit organizations in Canada;
- Indigenous organizations and groups located in Canada;
- Post-secondary/academic institutions located in Canada; and
- Individuals or groups of individuals based in Canada.

Individuals or groups of individuals are encouraged to submit an application to the challenge, but in order to be eligible to receive prizes, they will be required to establish a Canadian legal entity (such as a corporation or a not-for-profit organization) capable of entering into binding agreements in Canada.



## 4 How to Apply?

### 4.1 Applying to the Challenge

Only applications submitted through the Impact Canada website via the designated challenge Application Form will be accepted. **Applications must be submitted through the online form no later than February 1, 2022 at 9:00 PM Eastern Time.**

Apply to the Deep Space Healthcare Challenge by using the [online form](#).

In order for an application to be considered for the challenge, applicants must complete and submit the following documents online by the closing date and time indicated above and on the Impact Canada website. A complete application package consists of the Challenge Application Form, with the following sections:

- Section 1: Applicant details
- Section 2: Proposed solution details
  - Design Abstract, Design Report, and Intellectual Property
- Section 3: Declaration
- Section 4: Survey (*optional*)

Incomplete applications will not be considered or assessed.

You will have the option to print your application for your records. If applicable, we encourage that you share this copy with the Duly Authorized Representative of your legal entity.

#### Application Details

##### Challenge Application Form

Applicants must fill in the Application Form available online on the Impact Canada website. The form consists of the following four sections:

- **Section 1: Applicant details**  
This section of the form requests basic information on the Applicant and primary contact applying to compete in this Challenge.
- **Section 2: Proposed solution details**  
In this section, you must provide details on your proposed solution and answer questions that relate to the assessment criteria to allow for a thorough assessment of the proposed solution against these criteria. *Note that this is the main section that will be used by the Judging Panel in the assessment process.* Make sure

this section includes all relevant information for the Judging Panel's consideration. See below for detailed step-by-step instructions on how to answer each question in the Application Form.

- **Section 3: Declaration**

In this section, you must review and accept the terms and conditions for the Deep Space Healthcare Challenge, and review and accept the Consent for Use, Disclosure and Copyright requirements. At any point during the Challenge, CSA may request that consent be given in writing or in a form at its satisfaction.

- **Section 4: Survey (optional)**

This section collects information on your experience with this challenge, information about your organization, as well as demographic information.

- Note that any data collected in the survey will be used strictly for administrative purposes to help Impact Canada understand the effectiveness of challenges, and to improve upon their design in the future. The data collected in this survey will be aggregated and no individual answers will be published. Your answers to this survey will not be used in the assessment process and will not affect your chances of success in this challenge or any other federal funding application. This information may be shared with other government departments.

### Confirmation of legal entity and/or not-for-profit status (if applicable)

This can be a copy of the status certificate, incorporation documents, patent letters, or articles of incorporation (as applicable). Note that in order for Applicants to receive a prize, it must be an Eligible Recipient as per Section 3. This requirement can be completed after submission of the application but it must be prior to receiving any prizes. Note that the Duly Authorized Representative, if applicable, of the Canadian legal entity will be signing the grant agreement.

## 4.2 How to Complete Section 2: Proposed Solution Details

Section 2 of the Application Form is the main section that will be used by the Judging Panel in the assessment process. Below are detailed instructions for each question to help you submit a good quality application.

**Q2.1. Design Abstract:** Please provide a brief summary description of your technology within a 250-word limit. Focus on how the proposed solution will directly address the Challenge Statement, and highlight the key value proposition that it provides for remote practitioners and communities.

**Q2.2. Design Report:** The following information provided will be used by the Judging Panel to assess your technology against the Challenge criteria.

### **2.2.1. Description of the proposed solution**

Please provide a more fulsome description of your technology within a 500 word limit. Your description needs to include information about what the technology is, what it does, how it

functions, and how it supports in the provision of patient care. The reader should come away with a good understanding of who the technology is designed for and how they would use it, along with an overview of the specific technologies that are incorporated in the design.

### 2.2.2. Describe the basic operational needs of the technology

Please provide a 500 word description of the basic operations of the technology. In your response, describe assumptions required for operation. This could include, for example:

- Details about the environment required
- Inputs required for operation
- If samples are required, how do they need to be prepared?
- If external data is required, describe the type and preferred format
- If practitioners or patients will interact with the technology, what skills do they need?
- Are there other technologies required for operation?

Please take into consideration that these solutions will not be implemented in a traditional healthcare setting, but in the unique conditions of remote communities.

**Q2.3. Assessment Criteria Section:** Each question in this section corresponds to a specific criteria from Table 4 presented above.

### 2.3.1 RELEVANCE FOR REMOTE TERRESTRIAL CONTEXT

**Part A:** Table 1 lists a number of priority areas for healthcare provision in remote communities. Your solution must present a clear ability to address one of these areas, or another priority area that you have identified with a clear justification. If you are identifying a priority area that is not listed in Table 1, ensure that you provide a detailed explanation, including references, detailing a clear relevance for remote communities.

**Part B (optional):** If your solution has the potential to provide impact in more than one listed priority area, identify these additional areas here, along with a detailed description of the potential.

### 2.3.2 RELEVANCE FOR SPACE

**Part A:** Table 2 lists a number of medical conditions that can reasonably be expected to occur in space. While your solution does not necessarily need to help detect or diagnose one of these conditions currently, you must be able to clearly show how it could in the coming years. In this

section, describe the listed medical condition for which your solution will primarily provide support, and describe the impact your solution will have in this area.

**Part B (optional):** If your solution has the potential to support the detection or diagnosis of more than one listed medical condition, identify these additional conditions here, along with a detailed description of the potential.

### 2.3.3 ADAPTABILITY FOR SPACE

Table 3 outlines certain technical constraints that will eventually need to be met in order for a technology to fly in space. While this is by no means an exhaustive list, the listed parameters are viewed as critical to consider in the early design process, as they may be more challenging to correct for in the future. It is not a requirement that these constraints are currently met, but there must be a clear path to meeting them within the next five years.

If it is not obvious that your technology already meets these criteria, please provide an explanation. If your technology does not currently meet these constraints, you must provide a detailed plan of how this can happen within the given timeline.

### 2.3.4 INNOVATION

This question seeks to establish an understanding of how your technology is different from other technologies that currently exist. Your description needs to be clear and well defined using simple language when detailing how your solution is novel and innovative. Ensure to provide examples that show how existing technologies are being used in the healthcare system, and the impact that your technology could have in this process.

### 2.3.5 EFFECTIVENESS

This question seeks to understand how well your solution can achieve its desired outcomes.

If your technology will be directly identifying medical conditions, identify the “gold standard” test or system that would be used in an urban setting. Explain how your solution compares to this standard in regards to sensitivity and specificity\*. If your technology is not yet providing measureable data, identify targets for these values that will be obtained in later stages of the Challenge. These target values can be based on a combination of research literature reviews, modeling data, early testing data if available, or other data sources.

If your technology is supporting detection and diagnosis through training or an underlying system, for example, please identify how you will (or do) measure the solution’s effectiveness. Please identify relevant comparisons, as well as target values for later stages of the Challenge.

*\* Sensitivity is the true positive rate, or the proportion of positive results relative to those who actually have the condition. Specificity is the true negative rate, or the proportion of negative results relative to those who do not have the condition.*

### **2.3.6 AUTONOMY – Healthcare Provider**

This question is looking to answer how your solution will allow healthcare providers to operate with less reliance on external tools, systems or experts. For example, describe the quality of the outputs for the practitioner – how they are presented, and what degree of expertise is required to understand them. Are the outputs actionable and definitive, and how will they influence the practitioner’s patient management plan? In your description, please include quantifiable data wherever possible, as well as targets for stages 2 and 3 of the Challenge.

### **2.3.7 AUTONOMY – Connectivity**

While connectivity options continue to improve in remote Canadian communities, this continues to be a challenge for remote practitioners, which will certainly be an issue for deep space missions. Please outline your solution’s functionality in situations with full connectivity, with slow connectivity, with intermittent connectivity, and with no connectivity. For each scenario, outline how the solution’s operations will be impacted technically, and highlight how this will impact the practitioner.

### **2.3.8 ADOPTION POTENTIAL**

This question is looking to assess the long-term viability of your solution. In outlining your business model, include any details from user consultations performed to-date. Outline markets that you are currently targeting, along with future growth opportunities. Please also identify any barriers to commercialization of your technology that might arise, and how you will address them. Discuss how your design, prototyping and testing will be adapted to ensure successful commercialization in the future.

### **2.3.9 CONTEXT SENSITIVITY**

For this question, please highlight aspects of your design that support its implementation in the unique context of remote communities. Indicate how your design will respond to relevant challenges, and include targets for further context integration in the future. Only some of the challenges faced in these communities will be relevant for your technology, so you do not need to comment on every challenge listed. The provided list of challenges is not exhaustive, and if your solution addresses other challenges, please ensure that they are well described and evidence-based.

### 2.3.10 EASE-OF-USE

For this question, you are encouraged to walk us through a typical use-case for your solution from the perspective of the practitioner. Using simple language, explain every touch-point a user will have with the technology, including location, installation, start-up, setup, user interface, skills used, outputs, clean-up procedures, maintenance, transport, storage, etc. In your description, ensure any assumptions for operation have already been discussed in Question 2.2.2.

### 2.3.11 RELIABILITY

Please provide a description of the reliability of your technology within a 500-word limit, which may include an estimate of your technology's operational lifespan. Include comments on the solution's ability to manage variable temperatures and rough handling during transport to/from the community. Your answer should also provide an overview of the maintenance process and procedures, including the maintenance schedule, component maintenance or replacement as well as all critical spare parts that would be needed. In describing the maintenance procedure, please list any assumptions on skills and time required.

## Q2.4. Supporting Material

**2.4.1. Include any visual representations of the solution, which may include models, schematics, or drawings.** You are required to submit (a) visual representation(s) of your proposed technology. You should submit these visuals in a document in PDF format, of maximum five (5) Letter Size pages (8.5" x 11").

**2.4.2. Optional: Include any preliminary data or calculations that support the design and operation of the technology.** You may submit a document in PDF format, of maximum two (2) Letter Size pages (8.5" x 11"), including preliminary data or calculations.

**2.4.3. Intellectual Property:** Please provide all relevant details and explain the ownership of the intellectual property of the proposed solution. You may also demonstrate ownership of or permission to use any existing or off-the-shelf technology's intellectual property in the context of the Challenge.

## 5 Information for Semi-Finalists (If you are selected as a winner in Stage 1)

### 5.1 Prize Distribution

CSA will issue prize payments, by signing a grant agreement, to the winning Eligible Recipient within 60 calendar days after the announcement of the winner(s) as recommended by the Judging Panel and determined by CSA. All terms of payment for the prize will be set out in the grant agreement.

Because Impact Canada Challenge Prizes are funded using grants and contribution funds, the authority to release funds lies with the head of a federal department or agency or their delegate. Therefore, Judging Panels make recommendations for who should be awarded funding, and the Challenge planning team acts as a conduit to get those recommendations approved, in this case, CSA, and funding released.

Winning individuals and winning groups of individuals understand that CSA can only make Prize payments to an Eligible Recipient. If a winning Applicant is not an Eligible Recipient, it will be required to establish a Canadian legal entity (such as a corporation or a not-for-profit organization) capable of entering into binding agreements in Canada as indicated in Section 3 (Who can apply? Eligibility Details). CSA will require at a minimum from the Eligible Recipient the same information and consent submitted by the Applicant as part of the Stage 1 Application. Such information and consent must be provided upon request and to CSA's satisfaction. CSA may request additional information as the case may be.

### 5.2 Grant Agreement

In order to receive the prize amount at each Stage, each successful semi-finalist, finalist, and winner will be required to enter into a grant agreement with CSA.

Prior to entering into the grant agreement, all selected participants will undergo a due diligence process to confirm that they meet all requirements to receive Deep Space Healthcare Challenge grant funding. This may include the review of documentary proof of establishing that the Applicant is a Canadian legal entity capable of entering into legally binding agreements. The grant agreement will be signed by the Duly Authorized Representative of the organization.

### 5.3 Organizations in Quebec

An organization in Quebec whose operations are partially or fully funded by the province of Quebec may be subject to [the Act Respecting the Ministère du Conseil exécutif](#), R.S.Q., Chapter M-30.

Under Sections 3.11 and 3.12 of this Act, certain entities/organizations, as defined in the meaning of the Act, such as municipal bodies, school bodies, or public agencies, must obtain authorization from the [Secrétariat du Québec aux relations canadiennes](#) (SQRC), as indicated by the Act, before signing any funding agreement with the Government of Canada, its departments or agencies, or a federal public agency.

Consequently, any entity that is subject to the Act is responsible for obtaining such authorization before signing any funding agreement with the Government of Canada.

Quebec applicants will have to complete, sign and provide the M-30 Supporting Documentation form before signing the grant agreement (if applicable).

## **5.4 Subsequent Stages**

Detailed information for Stages 2 and 3 will be shared with Semi-Finalists and Finalists respectively, prior to the start of each new Stage.



## 6 General Terms & Conditions

Applicants to the Challenge agree to the following when submitting their application:

- Applicants agree to comply with all applicable laws.
- Applicants must be able to demonstrate ownership of or permission to use any intellectual property (IP) used in the challenge and provide necessary permission to CSA for the purpose of administering this challenge.
- Applicants warrant that all information given in and with the challenge Application Form for this solution is, to the best of their knowledge, complete, true and accurate.
- CSA has the discretion to cancel this challenge or any part thereof at any time.
- If applicable, CSA may seek translation services for applications, for the purpose of evaluation.

### 6.1 Privacy

#### Use and/or Disclosure

The personal and/or business information in, accompanying and/or submitted in support of this application is being collected under the authority of the Canadian Space Agency Act and, by applying to the Challenge, Applicants agree that such information, may be used by CSA, or disclosed to third parties including other government departments and members of the Jury panel to:

- Assess and review the eligibility of the Applicant and the Solution under the applicable CSA program.
- Verify the accuracy of the information provided in or with the Application Form and additional documents.
- Assess the efficiency of the challenge model in furthering departmental priorities.
- Assess how well the initiative contributed to CSA program objectives.

By applying, the Applicant consents that the information may also be used for the purposes of: contacting you should additional information be required; validating your credentials; facilitating payment of the grant in the event your application is successful; program administration; and evaluation, reporting, and statistical analysis.

The information collected under the application form of the Deep Space Healthcare Challenge will be stored and protected in the personal information bank of CSA (ASC PPU 045). Personal information will be treated and disclosed in accordance with the Privacy Act. You have the right to access your personal information held by CSA and to request changes to correct personal information by contacting the CSA Access to Information and Privacy Director at [asc.aiprp-atip.csa@canada.ca](mailto:asc.aiprp-atip.csa@canada.ca).

Business information will be disclosed only in accordance with the provisions of the Access to Information Act.



Information on the Privacy Act and the Access to Information Act is available at the following website: <http://laws.justice.gc.ca>. For further information about these Acts please contact the Access to Information and Privacy Director at [asc.aiprp-atip.csa@canada.ca](mailto:asc.aiprp-atip.csa@canada.ca).

### Copyright permission

CSA may disclose, reproduce and distribute any part of or the whole of the documentation provided in or with this Application Form, within CSA and to its authorized third parties, including other government departments, for purposes consistent with the receipt, assessment and subsequent treatment of the Application.

## 6.2 Intellectual property

Notwithstanding anything to the contrary in the Applicant Guide, CSA and the Privy Council Office claim no intellectual property (IP) rights from the application.

To the extent the Applicants and Recipients own IP resulting from their participation in the Challenge, the Applicants and Recipients agree to negotiate in good faith with CSA for a grant of a nonexclusive, non-transferable, irrevocable license to practice or have practiced for or on behalf of the Government of Canada, the intellectual property throughout the world, at reasonable compensation, if CSA chooses to pursue such a license.

By applying, in addition to the consents and authorizations contained in the Application Form, Applicants:

- Agree and certify that, the Applicant owns the intellectual property rights or is authorized to use them in connection with its project and the content presented in the application; and
- Agree that CSA may, at any time, require the Applicant, Recipient, its shareholders or members, as applicable, to provide it with any original document or additional information for the purpose of verifying the application or other information submitted or representation made in the course of the Challenge.

## 6.3 Delay, Cancellation or Termination

Applicants acknowledge that circumstances may arise that require the Challenge to be delayed, delayed indefinitely or cancelled. Such delay or cancellation, and/or the termination of the Challenge, shall be within the full discretion of CSA. Applicants accept any and all risk of damage or loss due to such delay, cancellation, and/or termination.

## 6.4 Costs and Expenses

Applicants are not required to make a purchase or pay a fee to participate in or win the Challenge. Applicants are fully responsible for all and any expenses incurred in connection with their participation in the Challenge, including, but not limited to, any expenses related to the submission of their application, for the elaboration or testing of solutions,

supplies and materials, such as for prototyping, intellectual property, transportation of people or material, and any insurance.

Similarly, participants will remain fully responsible for all expenses incurred and resources expended in connection with preparing their proposals, attending and participating in the testing for Stages 2 and 3, as the case may be.

## 6.5 Release, Liability and Compensation

Applicants agree to hold harmless and discharge CSA, the members of the Judging Panel, other federal departments or agencies from any and all liability for claims, losses, damages or expenses arising from its project and/or participation in the Challenge, as well as personal injury or death, loss or damage to property, or allegedly caused by the applicant, its shareholders, members, directors, officers, employees, contractors or volunteers, as applicable, when carrying out its project or during the course of its participation in the Challenge.

CSA, the members of the Judging Panel and other federal departments or agencies will not be liable to the applicant, its shareholders, members, directors, officers, employees, contractors or volunteers, as applicable, for any third party claims, lawsuits, demands or actions.

Applicants agree that CSA may, at any time and at its sole discretion, reject any application that fails to comply with the Applicant Guide, attempts to register for the Challenge in any manner or by any means other than those described in the Applicant Guide, attempts to disrupt the Challenge or circumvent the content of the Applicant Guide.

Applicants agree that CSA and the members of the Judging Panel cannot be held responsible for any rejected, lost, delayed, illegible, damaged or undeliverable applications or any delay or problem in the sending, processing, receiving or review of applications.

## 6.6 Records

It should be noted that original documents may be required by CSA at any time during the Challenge for the purpose of evaluating the application and verifying the submitted documents. Applicants are required to retain, for the duration of the Challenge, all original documents pertaining to their participation in the Challenge. Failing to provide those original documents or send them within the given time frame will result in the application being rejected.

## 6.7 Communication

By applying, the Applicants and Eligible Recipients consent to CSA and Impact Canada publishing photographs, videos or captions containing their name or image or of their representatives. They agree that this may include electronic publishing via the Internet, the social media or the Intranet, as well as publishing in printed documents and videos, or presenting at public events. They also agree that they cannot charge any fees or royalties in relation to the use of their name or image or of their representatives.

## 6.8 Legal Entities Constituted during the Challenge

If a new legal entity is constituted during the Challenge for purposes of recipient eligibility described in Section 3 above, and unless the context suggests otherwise, Applicant(s) include Eligible Recipient(s) for purposes of this section (6. General Terms & Conditions).

CSA is not responsible for any dispute between individuals of a group of individuals who applied for the Challenge regarding the distribution among that group of the prize or parts thereof. Any failure of the Eligible Recipient to share or otherwise make payments of any kind to individuals or a group of individuals who applied is the responsibility of the Eligible Recipient and not of CSA. CSA may, at any time and at its sole discretion, reject any application or ask reimbursement of any payments should such dispute arise.

## 6.9 Governing Law

The Challenge, including the Applicant Guide, shall be governed in accordance with the laws of the Province of Quebec and the applicable federal laws.

# 7 Official Languages

English and French are the official languages of Canada. The Government of Canada is committed to supporting the vitality and development of the English and French language minorities in Canada and encouraging full recognition of the use of English and French in Canadian society. Applicants can apply and require that they be contacted and served in the official language of their choice.

# 8 Contact

For any questions or clarifications regarding The Deep Space Healthcare Challenge, please contact the Canadian Space Agency team: [defisante-healthchallenge@asc-csa.gc.ca](mailto:defisante-healthchallenge@asc-csa.gc.ca). We will get back to you within five business days.

It is the responsibility of the applicants to obtain clarification of the requirements contained herein, if necessary, before submitting an application. At any point, applicants are welcome to share with CSA their comments or suggestions regarding the initiative or the process.

Updates will be provided on the Impact Canada website, including the latest Challenge news and frequently asked questions (FAQs).

Applicants are encouraged to follow us on social media for the latest developments.

## 9 Annex A: Definitions

### 9.1 Definition of Collaborators and Challenge Administrators

**Canadian Space Agency (CSA):** Is a federal agency responsible for managing all of Canada's civil space-related activities. CSA is responsible for advancing the knowledge of space through science and using its discoveries for the good of Canadians and all of humanity.

**Privy Council Office (PCO):** Supports the Canadian Prime Minister and Cabinet. Led by the Clerk of the Privy Council, the department helps the Canadian government in implementing its vision, goals and decisions in a timely manner.

**Impact Canada:** Housed within the Privy Council Office, is a Government of Canada-wide effort to help accelerate the adoption of innovative funding approaches to deliver meaningful results to Canadians. Challenge Prizes, Pay-for-Success projects and Behavioral Science are its key business lines.

### 9.2 Definition of Terms

**Applicant(s):** As defined in Section 3 of the Applicant Guide.

**Application Form:** Form described in Section 4.2 of the Applicant Guide.

**Applicant Guide:** Rules of the Challenge, including all terms and conditions contained in this present document and any new document published for Stage 2 and Stage 3 of the Challenge. Applicant Guide applies to all Applicants and Eligible Recipients.

**Concept of Operations:** A document describing the operations of a proposed system from a user's perspective, through a complete production cycle, including cleanup and any activities required to prepare for the following production cycle.

**Eligible recipient(s):** Is an Applicant eligible to receive prizes as described in Section 3 of the Applicant Guide. If at the time of Application, the Applicant is not an Eligible Recipient, the Eligible Recipient will be the legal entity described in Section 3 and as identified by the primary contact (as they appear in the Application Form) to the CSA.

**Judging Panel:** A panel of professionals and subject matter experts from government, academia, and industry who will evaluate and score all submissions.

**Stage:** A stage of the Challenge representing a key step in the development of technologies that will support the detection and diagnosis of medical conditions in remote communities. This challenge will have three Stages.

**Recipient:** Eligible Recipient who has been awarded a prize.

**Team:** An individual or group of individuals, identified as a Team or Team Members in the submitted Application Form in Section 1.

**Technology Readiness Level (TRL):** A method for estimating the maturity of technologies. The use of TRLs enables consistent, uniform discussions of technical maturity across different types of technology. Please refer to Annex B for more details.

## 10 Annex B: Reference Materials

### Health Inequalities Data Tool

<https://health-infobase.canada.ca/health-inequalities/data-tool/index>

### CSA Health Beyond Report

<https://asc-csa.gc.ca/eng/publications/health-beyond-report-advisory-council-deep-space-healthcare.asp>

### Technology Readiness Levels

<https://www.ic.gc.ca/eic/site/080.nsf/eng/00002.html>

### NASA - Development of an Accepted Medical Condition List for Exploration Medical Capability Scoping

<https://ntrs.nasa.gov/api/citations/20190027540/downloads/20190027540.pdf>

### NASA STD-3001: NASA Spaceflight Human-System Standard; Volume 2

Human Factors, Habitability, and Environmental Health (English only)

<https://www.nasa.gov/hhp/standards>

Users should be aware that information offered by non-GoC sites that are not subject to the *Official Languages Act* and to which the Canadian Space Agency links, may be available only in the language(s) used by the sites in question.