



National
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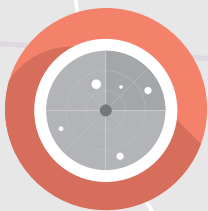


CANADIAN
ARMED FORCES

2020-2021 ANNUAL REPORT



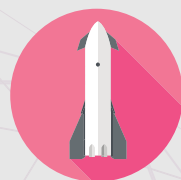
IDEaS
INNOVATION FOR DEFENCE
EXCELLENCE AND SECURITY





IDEaS

INNOVATION FOR DEFENCE EXCELLENCE AND SECURITY



ABOUT INNOVATION FOR DEFENCE EXCELLENCE AND SECURITY (IDEaS):

Since it launched in April 2018, IDEaS has been working with Canadian innovators to develop the S&T landscape, and we are now seeing innovative thinking develop into tangible solutions for the Department of National Defence and the Canadian Armed Forces (DND/CAF), as well as Canadians.

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MESSAGE FROM SOPHIE GALARNEAU

A/ASSISTANT DEPUTY MINISTER, DEFENCE RESEARCH AND DEVELOPMENT CANADA (2020/2021)



Every day we see firsthand the momentum and drive required to improve our defence and security capabilities, and protect our people. It truly does take a small village of talented people to power this change.

From the outreach that bring innovators through our doors, to the scientists that labour over challenge

statements and proposals, the procurement specialists that make the gears of the money machine move, and the leadership that propels the ship forward, it takes many.

Did I forget anyone? How about our innovators, without whose seemingly endless energy and drive we would be at a standstill. Integrators, challenge management experts, administrative staff, element leads... the list goes on. The IDEaS team is enviable in its expertise.

We rely on many internal and external partners to move projects through our innovation ecosystem. Innovators bring their ideas and concepts. Our internal partners help to manage the challenges, provide technical assessment and review proposals. And our DND/CAF stakeholders help to shape and guide the technology.

Our program regularly draws on the capacity and personnel of Defence Research and Development Canada (DRDC), DND's national network of science and technology research centres. We are grateful for the invaluable contribution and expertise of our Defence scientists.

Only four years ago, the program was printed words in a policy. It is now a lively, bustling hub of inspiration, people and concepts that will advance our safety and security for decades to come. That is why IDEaS exists; we support DND/CAF's mission by stimulating innovation and bringing solutions to enhance defence capabilities.

Our ecosystem has been building, and the robust program of work that is now being supported is expanding, taking shape and going places that not long ago were merely dreamed about. And thanks to the hard work of all of you, we are about to take full advantage of the future.

MESSAGE FROM ERIC FOURNIER

DIRECTOR GENERAL R&D INNOVATION



Innovation is a team sport. Nothing gets accomplished without great players, solid coaching, and the drive towards the finish line. It's also important to have a game plan as to where you are going.

IDEaS had a game plan going into 2020, and then life threw us a curveball: COVID-19. But our team

was able to improvise. We went virtual, adapted our processes and were able to quickly pivot to assist in the pandemic response — all within months of the pandemic's arrival.

Preserving personal protective equipment. Dealing with moral trauma. Sanitizing workspaces. These concepts are things we are now familiar with, and these are the challenges that IDEaS helped face as part of the larger Government of Canada response to COVID-19.

Throughout all this sea of change, the program was still able to advance technology along the defence innovation continuum. We hosted virtual events, funded 13 new challenges, invested over \$72 million, signed 171 projects, and initiated our first Test Drive.

After three years, hundreds of projects funded and countless assessments and adjustments by our evaluators, we are now starting to see projects that

entered the IDEaS innovation pipeline at a low Solution Readiness Level (SRL) develop into full prototypes ready for testing in real world situations. This is the final step before potentially transitioning solutions to DND/CAF. And while not all solutions will be a fit, we offer ample off-ramping partners and activities planned so that the innovator's journey can continue. The projects also offer new ways of thinking to our partners within and outside government.

This year's Test Drive was the first direct result of work we funded and helped advance through our Competitive Projects element to achieve a SRL of 8 or higher that the CAF was ready to take into a real world environment for testing. Innovation takes time, but this Test Drive shows the impact of our program on DND/CAF as they committed to test this solution with a goal of enhancing defence capabilities. As a team, we pushed, we tried, and learned. We found ways to move forward. There was a sustained effort from all levels to push this technology to a point of readiness. For that I am extremely proud.

And this is just the first of many. I continue to look forward to seeing the things we didn't even know were possible.

PROGRAM PERFORMANCE

During a year unique in its challenges, IDEaS continued to deliver on its program of work, advancing solutions for DND/CAF. While transitioning to a virtual environment, the program advanced research and technologies from Canadian innovators by investing in their projects and releasing new challenges, including helping with the pan-Canadian response to the COVID-19 pandemic.

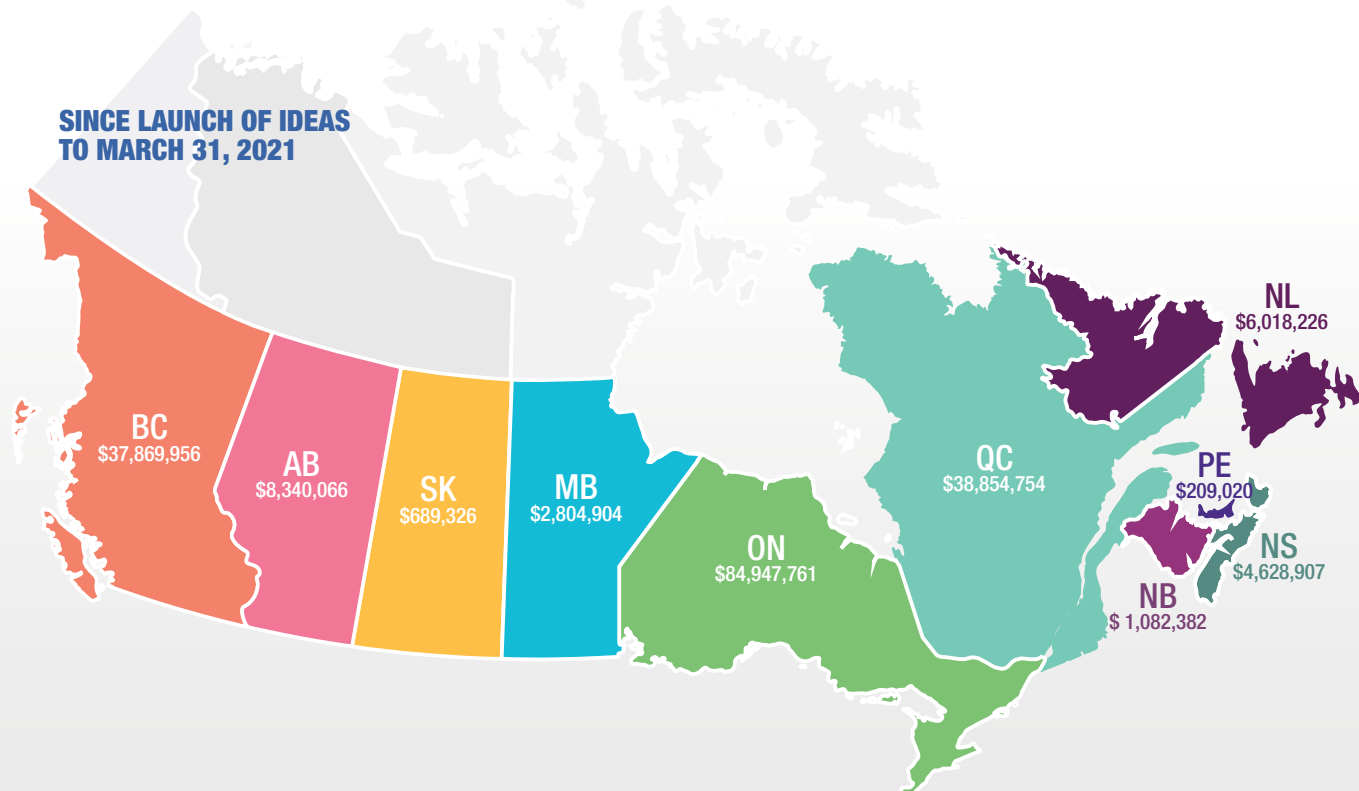
SINCE LAUNCH OF IDEAS TO MARCH 31, 2021



APRIL 1, 2020 TO MARCH 31, 2021

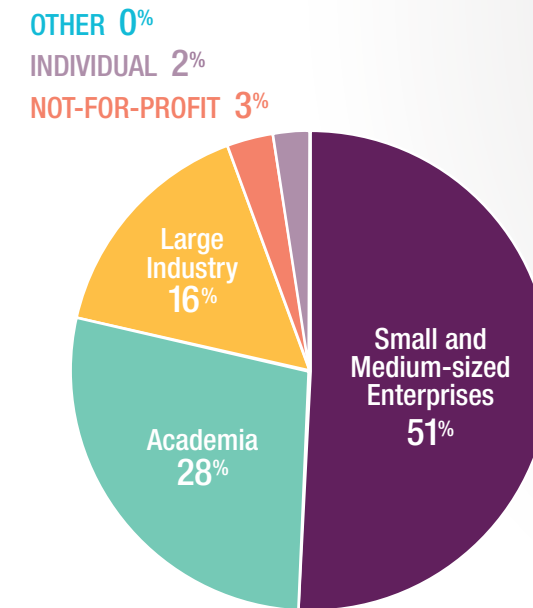


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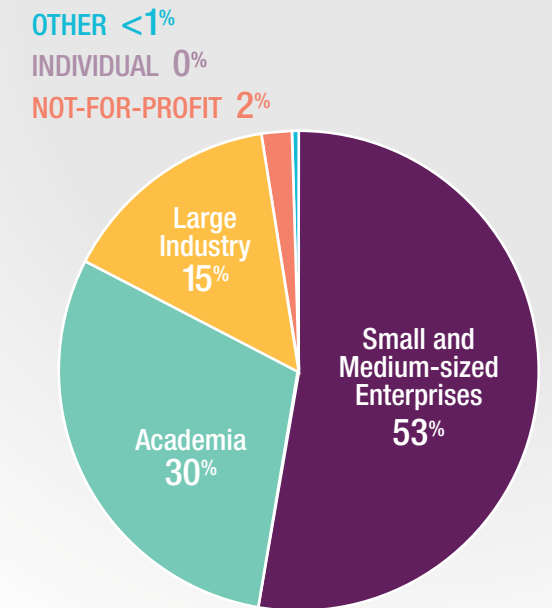


INNOVATOR TYPE BREAKDOWN:

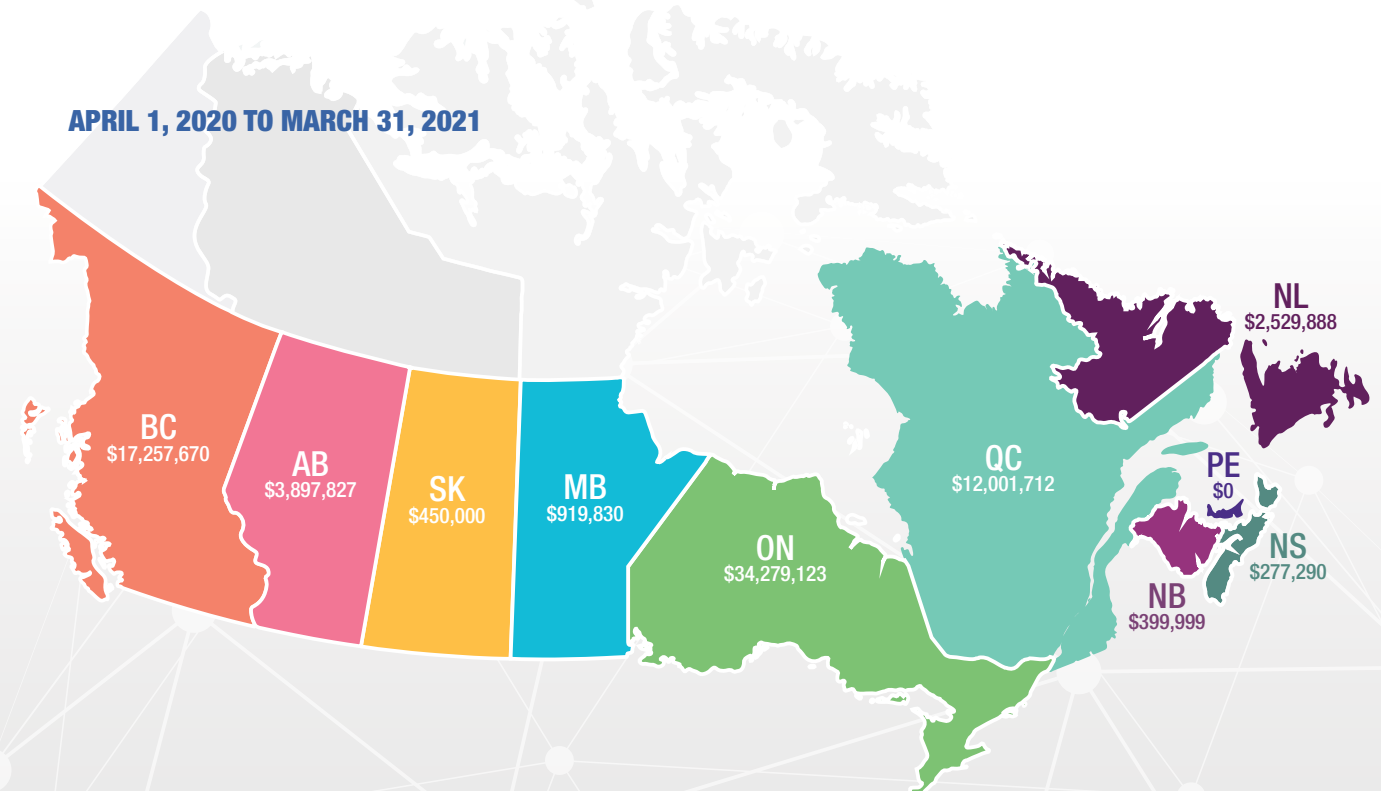
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IDEaS ECONOMIC IMPACT

Over and above solving Canada's toughest defence and security challenges, the IDEaS program supports the Canadian innovation community in parallel to bolstering defence capabilities. As such, exploring and tracking the economic and fiscal impact of the program on Canadian innovators was an intrinsic part of the work we've undertaken this past year.

Since its launch, the IDEaS program has invested over \$185.4M into 450 projects across our 5 funding elements: Competitive Projects, Innovation Networks, Contests, Sandboxes and Test Drives. In itself, the average investment per project is approximately \$312,000.

The impact of this investment has been nothing short of extraordinary. In fact, the funding from IDEaS helped maintain or create an estimated 526 jobs annually, and contributed more than \$219 million to the cumulative Gross Domestic Product (GDP) of the Canadian economy.

Over the past year the program shifted its gears, showcasing just how adaptable and resourceful its structure could be should crisis arise. Despite the hardships created by the pandemic, the IDEaS program

was able to quickly release challenges to innovators and fund DND/CAF-specific projects related to COVID-19 and adapt to the new reality. While our country was at a standstill, the IDEaS team worked tirelessly to ensure Canadian innovators were given a chance to work when many could not. In addition to the program's regular operations, nearly \$2.5 million was invested into three promising COVID-19 technologies produced by Canadians for Canadians.

Supporting state-of-the-art solutions in the fight against COVID-19 and future pandemic responses is an ongoing initiative. In IDEaS, we strive to support the innovation community and the Canadian economy, much like the CAF strives to protect and serve our country.



MEETING THE CHALLENGES OF A PANDEMIC

IDEaS ADAPTING TO MEET THE NEEDS OF A GLOBAL CRISIS

The COVID-19 pandemic shifted everything: priorities, work, families, and lives. Within DND/CAF, troops were deployed in new and unanticipated ways including assisting long-term care facilities, distributing personal protective equipment (PPE) and helping with contact tracing efforts.

IDEaS was no exception. The program adjusted its plans and work to accommodate a new reality. In-person events went virtual and new teams were assembled as new challenges presented themselves.

Soon after the pandemic started, the program was asked to pivot some of its resources to work with Health Canada and the Public Health Agency of Canada to assist in the Pan-Government Response. A tiger team was put together to develop COVID-19 specific challenges with a defence capability focus.

The challenge process started by asking two questions. How might we recognize, prevent and detect moral trauma among frontline staff? What are some novel ways to re-use COVID-19 protective gear or clean equipment and workspaces?

The innovation challenges that IDEaS presents to Canadian innovators are real world scenarios and problems facing by clients across the entire DND/CAF. The pandemic brought pressing and important

questions being faced by the DND/CAF that were tackled immediately, leading to the identification and issuance of four challenges related to COVID-19.

For example, the pandemic revealed shortcomings in the availability and type of PPE to protect against biological agents used by military personnel and First Responders as well as the ability of PPE and operational clothing and equipment to sustain repeated and rapid disinfection. The resulting "**Scrubbing your scrubs**" challenge invited solutions for rapid and effective decontamination of PPE, allowing to re-use COVID-19 protective gear. We were looking for innovative material and design solutions, as well as rapid and effective decontamination strategies and solutions for PPE, operational clothing and equipment for personnel responding to events involving biological hazards.

The Competitive Projects team worked hard to issue this particular Call for Proposals (CFP) and manage the process of reviewing the proposals and determining which projects would receive funding.



<p>RAPID RESPONSE: Real-time insights for pandemic decision-making</p>	<p>MORAL TRAUMA ON THE FRONTLINE: See, prevent and treat</p>	<p>SCRUBBING YOUR SCRUBS: Finding ways to re-use COVID-19 protective gear</p>	<p>SUPER SANITIZE: Cleaning sensitive equipment and workspaces</p>
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THE FOUR COVID-19 CHALLENGES

IDEaS received 469 proposals to strengthen the country's response to COVID-19, as well as future pandemics. 48 projects were selected and funded up to \$200,000, which will help in the development of strategies to reuse protective gear, clean equipment and workspaces, gain real-time insight for decision-making, and care for frontline workers.

In addition to the four challenges issued, the program worked with other government departments including the National Research Council (NRC) to address other pandemic issues of importance to Canadians. Three contribution agreements were signed for solicited projects related to pandemic response. These projects were managed and primarily funded by IDEaS.

Funding valued at just over \$1 million was awarded to innovators to develop COVID-19 fast testing kits. A third contribution agreement, valued at \$2.1 million, was



awarded to advance the clinical development of a broad-spectrum antiviral drug.

The benefits of these projects will aid in decision-making and future approaches to similar threats. But more broadly, they will have long-term benefits for defence capability and civilian response to future pandemics.

ADDITIONAL PROJECTS:

1. CUSTOM BIOLOGICS

Custom Biologics has developed diagnostic point-of-care kits that are more stable for shipping and storage and will not require trained personnel for administering. Saliva-based tests are used to detect SARS-CoV-2 instead of a nose swab, a much simpler and more agreeable procedure. And finally, point-of-care readers that can be deployed in diverse community-based settings such as long-term care facilities, mobile clinics, airports, and seagoing vessels.



2. DIAGNOSTIC BIOCHEM CANADA INC.

Diagnostic Biochem Canada Inc. successfully developed four Anti-SARS-Cov-2 serological tests. Two of them, the total antibody and IgG tests, were the first Canadian COVID-19 serological tests to be authorized for in vitro diagnostics in Canada. The tests aid in the detection of an adaptive immune response to the virus, and verify vaccination response.

WHAT HAS BEEN DONE TO DATE

- IDEaS invested \$1 million in Diagnostic Biochem Canada's project which developed a dry blood spot sampling method and testing kit to measure COVID-19 antibodies.
- Diagnostic Biochem Canada went on to receive Health Canada COVID-19 Medical Device Authorization for its ELISA Kit in Canada.

PANDEMIC CHALLENGES BY THE NUMBERS:

- 4 CHALLENGES ISSUED**
- 469 PROPOSALS RECEIVED**
- 48 PROJECTS FUNDED @ \$200,000**
- 2 \$1M DIRECT CONTRIBUTIONS AWARDED TO ADVANCE RAPID TESTING**
- 1 \$2.1M CONTRIBUTION AGREEMENT AWARDED TO ADVANCE THE RESEARCH AND DEVELOPMENT OF A BROAD-SPECTRUM ANTI-VIRAL DRUG CANDIDATE THROUGH CLINICAL TRIAL TESTING**
- > \$11,000,000 TOTAL FUNDING**

PROGRAM OF WORK UPDATES

COMPETITIVE PROJECTS' FOURTH CALL FOR PROPOSALS FOCUSED ON PEOPLE AND TECHNOLOGY



The Competitive Projects element launched its fourth CFP on October 28th, 2020. Seven challenges focused on new technologies that will help create better detection systems, improve command and control capabilities, enhance logistics and protective gear, and improve cybersecurity aboard navy vessels. In addition, a more people-focused challenge looked at potential solutions to integrating soldiers back to civilian life.

In 2020, 283 proposals were submitted as part of this call, with 54 proposals being accepted for funding up to \$200,000. The most innovative solutions will be provided an opportunity to advance their projects over a one-year period with an additional \$1 million.

CHALLENGES:

- **Making Data Make Sense:** Real-time Data Analysis for Rapid Decision Making (RCAF)
- **Essential Deliveries:** Getting Vital Supplies to Troops Using Autonomous Vehicles (ARMY)

- **Better Than Meets The Eye:** Reliable Object Detection Amongst the Waves (NAVY)
- **Armour Up!** Modular Lightweight Armour for Land Vehicles (ARMY)
- **Navigating Your Next Chapter:** The Transition Back to Civilian Life (MPC)
- **It's Not Just Noise:** Innovative Tools for Acoustic Sensor Operations (NAVY)
- **Knot Vulnerable:** Locking Down Cybersecurity on Naval Vessels (NAVY)



FOCUS ON PEOPLE: HELPING SOLDIERS BECOME CIVILIANS AGAIN

Technology matters, but people matter most. That's why we are also testing technologies that help assist soldiers, particularly those who are ill and injured, successfully transition out of military service and back to civilian life.

IDEaS spent over \$6 million in funding for projects focusing on people this year alone. Seven innovators were selected to receive the second phase \$1 million funding to advance their projects under the challenge Navigating Your Next Chapter: The Transition Back to Civilian.

Since IDEaS launched in 2018, it has invested \$27.7 million in 65 projects in the people domain, such as understanding and addressing Post-Traumatic Stress Disorder (PTSD); recruiting, retaining, and reaching 25% representation of women by 2026; predicting and optimizing personnel performance; increasing human performance in extreme climatic environments; respiratory protection for DND/CAF members; innovating beyond the classroom with language learning and retention; and preventing and treating moral trauma on the frontline.

COMPETITIVE PROJECTS AT A GLANCE FOR 2020-2021:

11
CHALLENGES
LAUNCHED
(7 CFP4 CHALLENGES
+ 4 COVID-19 CHALLENGES)

752
PROPOSALS
RECEIVED

102
PROJECTS
SIGNED

TOTAL FUNDING OVER \$20 MILLION

TEST DRIVES

IDEaS marked a significant milestone for technology advancement, with its first project completing the Competitive Projects stream and moving to a Test Drive. This marked the first of what will be many projects making the transition from lab to field testing.



SAPPER LABS: SUCCESS IN THE LAB RESULTS IN A TEST DRIVE

Sapper Labs' cyber attribution project is the first IDEaS-funded solution to advance to a Test Drive with a contract valued at \$7.5 million.

After its first two contracts under the Competitive Projects challenge "Cyber Attribution of Sophisticated Threat Actors in the Defence of Canada", Sapper Labs built and tested an effective next-generation cyber defence platform capable of detecting and engaging advanced persistent threats with speed and precision. The project

advanced from a Proof of Concept (SRL 4) to a Qualified Solution (SRL 8), and has now entered Test Drive where the Canadian Special Operations Forces Command (CANSOFCOM) is currently testing and evaluating the technology in a realistic setting in Ottawa.

The objective of the Test Drive is to validate the cyber attribution capability in a DND/CAF operational setting. Installation, configuration, and training is completed, and operational testing is expected to be completed in 2022.



Sapper Labs is the **first of many projects** that will emerge from the Competitive Projects stream. The results show that given the right support, **innovators can quickly progress solutions** through the IDEaS innovation pipeline and will provide solutions to complex problems such as cyber attribution, ultimately benefitting Canadians.

Eric Fournier, Director General R&D Innovation



GREEN HEAT TEST DRIVE: LOW CARBON ENERGY GENERATION FOR HEATING EXISTING BUILDINGS

GREEN HEAT STARTS ITS LOW-CARBON JOURNEY

The Test Drive initiated an innovation process with a CFP, starting the journey towards a lower carbon future for DND/CAF.

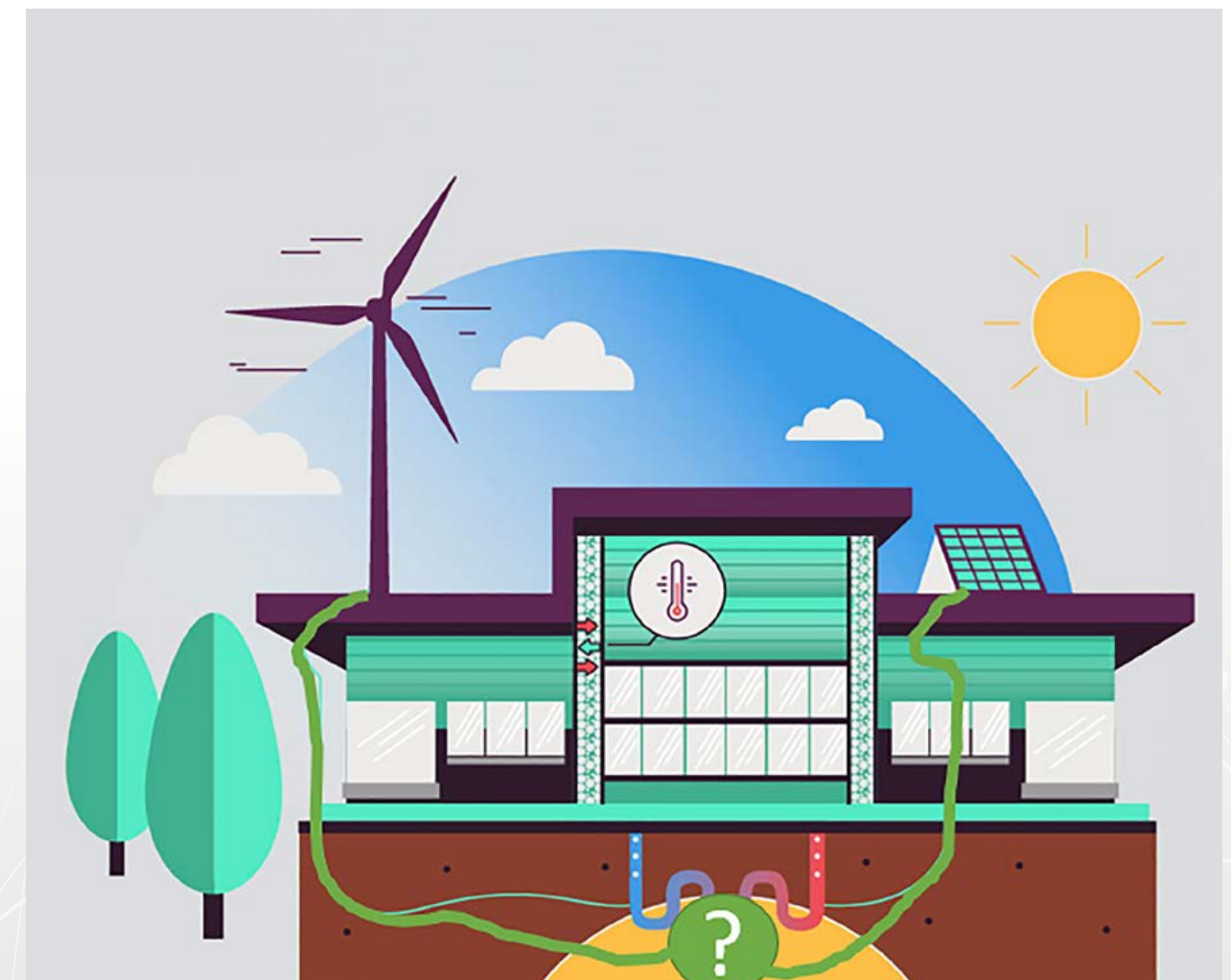
With the largest real estate portfolio across the Government of Canada, DND/CAF are looking for ways to reduce their carbon footprint. Currently, 60 per cent of the energy requirements in DND facilities is for space heating, 90 per cent of which is generated from the burning of fossil fuels. The challenge is in finding ways to convert these buildings to low-carbon heating without requiring a major building retrofit, which would be cost prohibitive.

In November 2020, IDEaS partnered with Defence Construction Canada to issue an advanced procurement notice for the Green Heat Test Drive

CFP, looking for creative energy generation solutions to pair up with existing heating systems to help lower our carbon footprint.

The challenge that IDEaS will pose to innovators is to offer a large-scale, low-carbon energy generation/transfer system for heating existing buildings that can be integrated with current hydronic heat distribution systems. The call for proposals is scheduled to open in July 2021.

The winning bidder will be announced in spring 2022, and the project will be installed and operated by the innovator at Canadian Forces Base Kingston. Running for three years, the goal is to reduce energy used for heating by burning of fossil fuels by 90 per cent below 2005 levels by 2050.



INNOVATION NETWORKS: ADVANCED MATERIALS AND AUTONOMOUS SYSTEMS

Innovation Networks is fostering the ability to do some blue sky research. Creating research clusters of likeminded researchers, called “Micro-nets”, has allowed them to tackle more complex challenges in current and future defence and security domains. The purpose of this effort is to bring key scientific communities together to collaborate, develop knowledge and advance R&D that is critical to DND/CAF. Through Innovation Networks, Micro-nets and the Defence Team are provided the opportunity to work together on innovative solutions which can improve our capabilities to protect, secure and defend Canada and its citizens.

Bringing together advanced concepts and thinking in Spring 2021, the Innovation Networks Annual Symposium brought Micro-nets together for the first time to present their research on the Advanced Materials and Autonomous Systems challenges.



- The annual symposium is a unique opportunity for Micro-nets to present the progress of their research to the DND/CAF stakeholders, DRDC staff, the innovation community, as well as to each other.
- The Micro-nets are not quite at the halfway point of their projects, but they already have given us a taste of where the research is going, and many interesting applications are on the horizon.
- The Micro-nets are showing us the importance of interdisciplinary research teams: researchers don't have time to learn about all the individual fields, but by working together, they can bring the knowledge from multiple different areas.

Working together, innovators are making meaningful advances in this body of knowledge, addressing the challenge in a more meaningful and impactful way.



CONTESTS: POP-UP CITY PITCH EVENT HEATS THINGS UP



Contests are a way to find innovative solutions to defence and security challenges using competition as a motivator. From pitch events to hack-a-thons, contests are designed to get the best results to the challenges identified by the DND/CAF. This format can vary, but the goal remains the same: to attract a greater number of participants and reward the best solutions.

When the Contest launched in 2018, it began charting a long-term path to sustainability for temporary camps. We called on innovators to propose and develop solutions that provide energy, water and waste management systems for the CAF's relocatable temporary camps deployed in national and international operations.

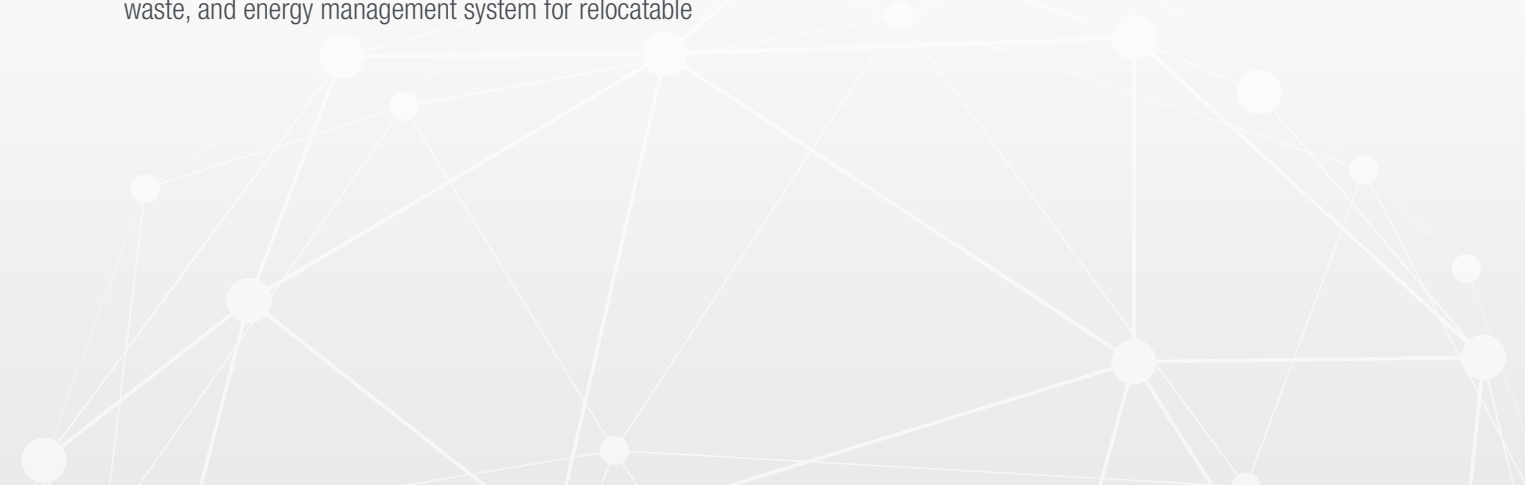
Round one identified technologies in the energy, water, and wastewater domains. Round two's partnering event brought teams together to produce an integrated solution for the whole concept.

Teams were set to pitch their concepts at the Pop-up city Pitch Event. However, as with most things in 2020, the pandemic had other plans. Pivoting to a virtual platform, the Pitch Event brought together judges and contestants from across all of government and Canada. Six proposals on how to best integrate water, wastewater and energy systems were shared at a competitive, pitch-style event, putting the best ideas forward and vying to be one of the three semi-finalists.

Three \$1.5 million prizes will be awarded to build a prototype of their integrated systems. The results of the pitch event will mean real world application of the proposed technologies and systems.

The multi-year process will allow for these three semi-finalists to build and test their prototypes. They will compete for a \$2 million grand prize in Round 4, with an end goal of finalizing a solution for a better water, waste, and energy management system for relocatable

temporary camps used by the CAF. In this last round, the teams will build a working prototype to be tested on site at a CAF facility with a goal of reducing water and energy consumption and waste by at least 33%.



SANDBOX: CORROSION DETECTION IN SHIPS RE-LAUNCH



Sandboxes are opportunities for innovators to get their products and services in front of national defence experts and demonstrate their capabilities. Innovators receive observational feedback from DND, CAF experts and potential users.

Due to its hands-on nature, the Sandbox element relies heavily on in-person participation. Demonstrations are experiences where innovators are given real world scenarios and equipment to test their technologies. They require DND/CAF personnel present, observing and working in close quarters in most cases.

When the Sandbox re-launched in 2020, hopes were high that the pandemic would be well on its way to being

over, and several applications were received and ready to go. Unfortunately, due to COVID-19 restrictions, all Sandbox activities were postponed until a safe environment could be created for participants and DND/CAF staff. The Sandbox element will re-launch the Corrosion Detection in Ships Sandbox which was forced to shutter operations. The Sandbox team is preparing to host the Sandbox in the spring of 2022.

CORROSION DETECTION IN SHIPS

THE CHALLENGE:

“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?”

THE GOAL:

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.



CONCLUSION

In its first two years of the program, IDEaS focused on growth, bringing innovators into the ecosystem, and casting a wide net to bring new thinking to the table. In its third year, the program assessed, recalibrated, made adjustments to its program structure, took advantage of lessons learned, and we are now in a position to offer solutions to DND/CAF. This was evident in the first Test Drive coming from our Competitive Projects stream. We also learned from the COVID-19 response that we could quickly pivot if needed, and get funding out the door quickly.

In addition, during the course of the last year, IDEaS transitioned from an in-person to a virtual workplace. We remained flexible, taking on new challenges, all while pushing technologies forward in a number of domains critical to defence and security.

With 58 challenges issued to date, over \$185 million issued in funding, and our first Test Drive underway, we are turning defence challenges into solutions through a thorough and evolving innovation ecosystem. We have progressed new challenges, adapted our processes and become agile in order to adjust to change. All this has left us better prepared to move forward on our journey.

Next steps for the program includes more Test Drives and investments in evolving projects designed to meet the needs of DND/CAF. We will continue developing partnerships to strengthen our innovation community.

In the next fiscal year, we will work on designing a Marketplace to connect IDEaS-funded solutions with opportunities beyond the program. This science fair platform will provide innovators with higher SRL technologies the opportunity to showcase the solutions they developed through IDEaS to potential end-users within DND/CAF, as well as potential users in other government departments and private industry.

The program will continue exploring the exploitation and commercialization of IDEaS solutions into meaningful and useful capabilities for DND/CAF. We look forward to our next program enhancements that will continue building on the innovation continuum and create positive outcomes for our Canadian innovators and the Defence Team.



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