



National
Defence

Défense
nationale



Canada

Key Emerging Industrial Capabilities Research at Defence Research & Development Canada (DRDC)



**STRONG
SECURE
ENGAGED**

**PROTECTION
SÉCURITÉ
ENGAGEMENT**



NEW MISSION

Enhance Canada's defence and security posture through excellence in science, technology and innovation.

NEW VISION

To be Canada's science, technology and innovation leader, trusted advisor, collaborative partner, and knowledge integrator for defence and security

Mandate:

ADM(S&T) provides national leadership on defence and security Science, Technology and Innovation (ST&I), to enhance Canada's defence and Security posture

- ✓ Act as Chief Science Advisor to the DND, CAF and public safety and security communities
- ✓ Exercise functional authority to ensure coherence of the DND/CAF ST&I investments
- ✓ Engage and collaborate with an extended network of stakeholders, domestic and international partners.

2





Key Industrial Capabilities - Competencies

- **Many Competencies have been core DND/CAF S&T Domains and part of the ADM(S&T) Research Program for many years**
- **They are established capabilities where Canada is globally competitive, and areas where domestic capacity is essential to national security**

- Aerospace Systems and Components
- Armour
- Defence Systems Integration
- Electro-Optical / Infrared (EO/IR) Systems
- Ground Vehicle Solutions
- In-Service Support

- Marine Ship-Borne Mission and Platform Systems
- Munitions
- Shipbuilding, Design and Engineering Services
- Sonar and Acoustic Systems
- Training and Simulation





Key Industrial Capabilities - Emerging

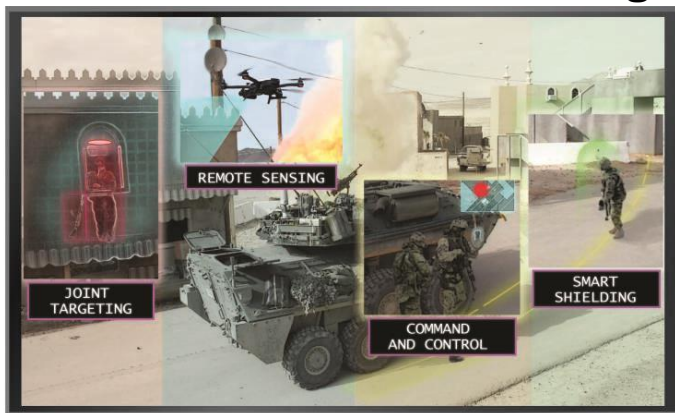
- Emerging technology with the potential for rapid growth and significant opportunities



Remotely-piloted Systems and Autonomous Technologies



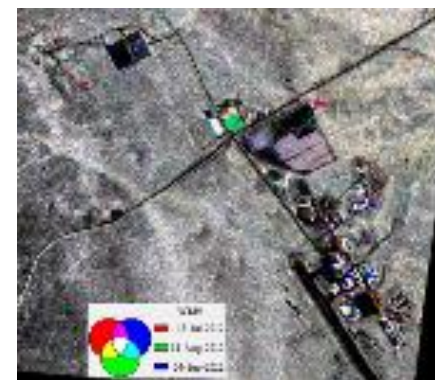
**Cyber Resilience
Non-traditional Cyber Security**



Artificial Intelligence



Advanced Materials



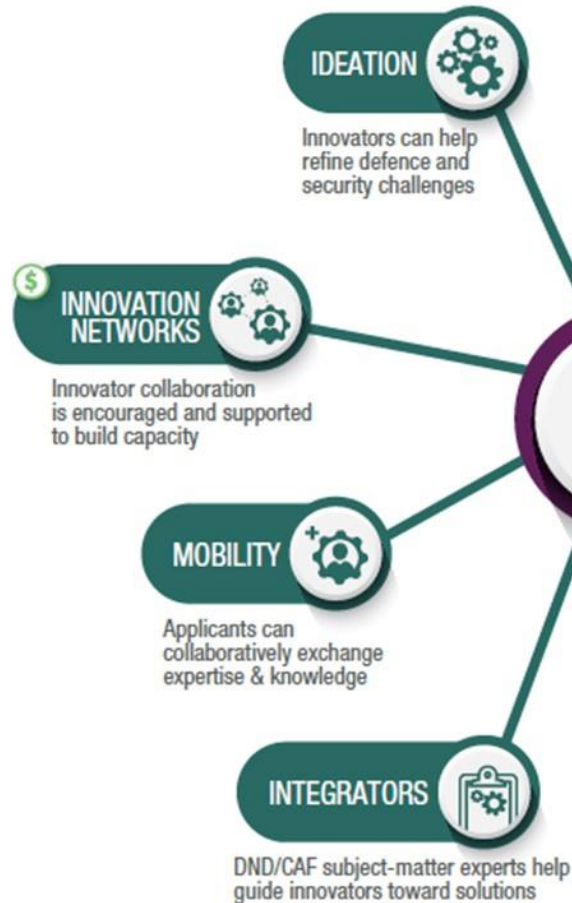
Space Systems





The IDEaS Program has options for *all innovators* to **CONNECT**, **DEVELOP** and **EVALUATE** their solutions.

CONNECT TO OTHER INNOVATORS



DEVELOP THEIR INNOVATIONS



EVALUATE THEIR CONCEPTS AND SOLUTIONS



Indicates elements that provide funding.





IDEaS Program Highlights

CURRENT STATUS

- ❖ 44 challenges issued
- ❖ \$63.5M committed and spent
- ❖ 6 micro-nets signed and 6 more approved
- ❖ More than 220 funded entities
- ❖ 1 upcoming challenge
- ❖ 1 successful Sandbox on C-UAS





Competitive Projects



Innovators are awarded Contracts or contribution funding for their defence and security solutions

October 24, 2019 closing date for the following challenges:

- [Spring into Action – Fast and adaptive logistics planning for military missions](#)
- [Spot The Hack: Intrusion detection systems for avionics networks and bus technologies](#)
- [Beyond The Classroom: Innovative language learning and retention](#)
- [All Systems Go! Predicting and optimizing maintenance for military platforms](#)
- [Quantum Leap: Shrinking sensing technologies for field operations](#)





Contests



Incentivize innovators to develop demonstrable solutions

The First IDEaS contest has launched! The [Pop-up City: Integrated Energy, Water and Waste Management Systems for Deployed Camps](#) contest will consist of a four rounds of individual and group competitions with over 3.5 million in prizes to develop a scalable prototype of a Relocatable Temporary Camp for troops of the Canadian Armed Forces.

Round 1 applications due November 1, 2019

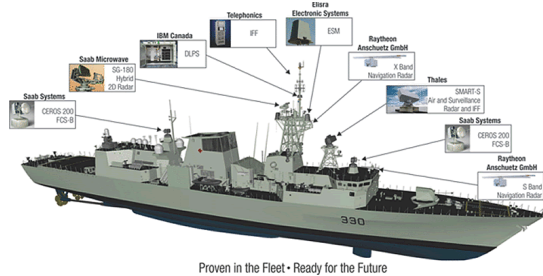




DRDC's Cyber Operations S&T Program

- **Platform and System Risk Analysis:** Methodology for cyber risk analysis of military platforms
- **Advanced Reverse Engineering and Forensic Tools and Techniques:** For hardening, robustness
- **Real-Time System Monitoring:** Resistance to cyber attack for software and embedded systems
- **Resilient Mission Critical Platforms:** Vulnerability assessment for cyber-physical systems
- **Tactical Edge Cyber Command and Control (TEC3):** Network/security SA and C2 at tactical edge
- **Advanced Mobile Network Operations (AMNO):** Cross-layer security in distributed networks
- **ACDC-Tactical Environments (ACDC-TE):** Automated cyber defence in wireless networks

Platform-to-Assembly Secured Systems (PASS)



Proven in the Fleet • Ready for the Future



Tactical Network Operations (TNO)

- Provides a framework and platform for end-to-end cyber defence
 - **Anticipates** threats by modelling potential attacks to critical assets
 - **Adapts** to dynamic networks and changing mission priorities
 - **Acts** to reduce risk by optimally hardening the network and responding to attacks

Cyber Decision Making and Response (CDMR)





IDEaS Investments and Opportunities: Cyber Program

Competitive Project - CFP1

Cyber attribution for the defence of Canada

Seeking ways to improve the methods for obtaining secure cyberspace attribution. Having the ability to identify the perpetrator of malicious cyber activity as a first step before taking action.

Competitive Project – CFP2

Understanding cyber intent

Seeking ways to optimize cyber response efforts. Tools and methods are sought for detecting malicious cyber-attacks, and increasing the efficiency and accuracy of human “triage” activities. Desired outcomes include understanding the changing strategies, tactics and patterns of behavior associated with adversaries and adversarial tactics in cyberspace.

Competitive Project – CFP3b

Identifying Cyber Dependencies, Vulnerabilities and Threats

Solutions to support mission-oriented cyber security and defence in order to develop robust continuity plans for cyber assets and capabilities

Competitive Project – CFP3c

Intrusion detection systems for avionics networks and bus technologies

Seeking innovative solutions for effective Intrusion Detection Systems (IDS) for avionics network and bus technologies used within the aerospace and space industry



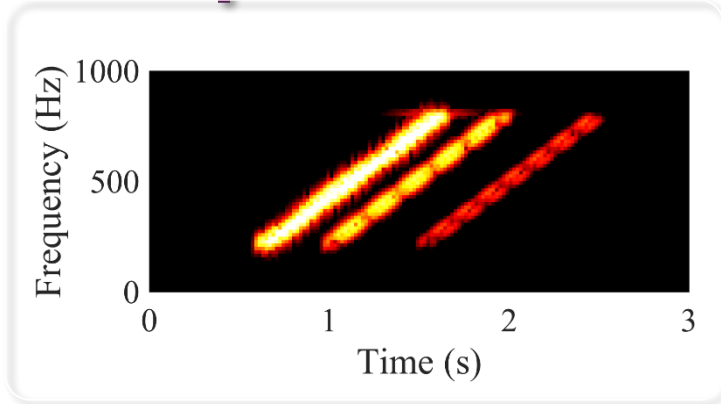


DRDC's AI S&T Program – Examples in the Maritime Domain

AI to Assist with Passive Acoustic Sonar Processing

- DRDC has been asked to help revolutionize the way the RCN does business with a new, integrated approach to mission planning, situational awareness, and command and control
- The targeted end state for CRACCEN will be a predictive situational awareness, battlespace management, operational planning, and mission execution system for UWW
- We have distilled its essence into two parts:
 - a 20-year vision (CRACCEN)
 - a 5-year project (CRACCEN I)

CRACCEN: Command Reconnaissance Area Control and Coordination Environmental Network



- **Currently:**
 - Automated detection to determine potential acoustic signals of interest; typically passed to operator for identification
 - **Future Plans:**
 - Ultimate goal is to fully automate all sonar processing (detection, classification, localization, and tracking), which will require AI
 - Develop solutions for both “big data” and embedded processing
- Challenges:**
- Developing appropriate datasets for training AI
 - Classified nature of acoustic intelligence





IDEaS Investments and Opportunities:

AI Program

- Common Theme – AI as a Decision-Assistant
- For Many Domains

Topic	Title	Company	Amount	Contract start date	Contract end date	Client
15. Making sense of the chatter	Making Sense of Social Media Chatter with SMART	Nexalogy	\$1M	Oct 2019	Oct 2020	CFINTCOM DGSTAR Army
15. Making sense of the chatter	Making Sense of Social Media Chatter through Behaviour Analytics	MDA	\$200K	Oct 2018	Mar 2019	CFINTCOM DGSTAR Army
15. Making sense of the chatter	Improved Intelligence Capability Through Fusion of Actionable Intelligence From Social Media and Other Open Sources	OODA	\$200K	Oct 2018	Mar 2019	CFINTCOM DGSTAR Army
15. Making sense of the chatter	Using deep learning for media fusion and analytics to improve situational awareness	Xtract AI	\$200K	Oct 2018	Mar 2019	CFINTCOM DGSTAR Army





DRDC's Autonomous Technologies S&T Program



Autonomous Systems S&T Capability

- Defeat and Protect Against Deadly Threats
- Removing the Soldier, Sailor, Aviator from harm's way

Develop new concepts of operations to integrate autonomy into CF operations
Develop operating techniques for autonomy to augment the operator
Develop prototypes and support CF acquisition of autonomous platforms

IMPACT

Enhanced CF awareness of the utility of autonomy to augment the operator including in CBR environments

Lower risk CF acquisition and employment of autonomous platforms

Reduced risk to CF personnel in complex environments.

Evidence-based Advice to Counter UxV & to inform Decision Making in Defence & Security –





IDEaS Investments and Opportunities: Autonomous Technologies

Innovation Network

Autonomous Systems for Defence and Security: Trust and Barriers to Adoption

Seeking to promote revolutionary advances in our understanding of autonomous systems for defence and security applications, with a focus on trust and barriers to adoption. Six micro-networks funded.

Sandbox, September 2019

Countering Micro and Mini Unmanned Aerial Systems

An opportunity for innovators to demonstrate the functionality and capability of their technology in detecting and/or defeating (kinetically/non-kinetically) micro and mini UAS at CFB Suffield.



Ideation Session, December 2019

Countering Unmanned Aerial Systems (C-UAS): Challenges for Innovation

Initiating a dialogue to explore current and likely future UAS developments, in order to identify potential threats to people, physical assets, and critical infrastructure, as the basis for identifying an integrated set of technical challenges and accelerating innovations associated with C-UAS.





DRDC's Advanced Materials S&T Program

Many Interests (streams)

Maritime

- Propellers made with composite materials
- Propellers that are coated (corrosion, signature)
- Submarine anechoic tiles
- Coatings (corrosion, self-healing, ...)

Protection

- Advanced armour (including transparent) and protective materials
- Material response under high-strain rate
- Additive manufacturing
- Coatings (Self-healing, signature reduction,...)
- Radar absorbing materials

New Materials

Graphene (defence applications)
Responsive and multi-functional materials

Properties

Power and Energy materials (energy harvesting)
Non-destructive evaluation of materials

And others...

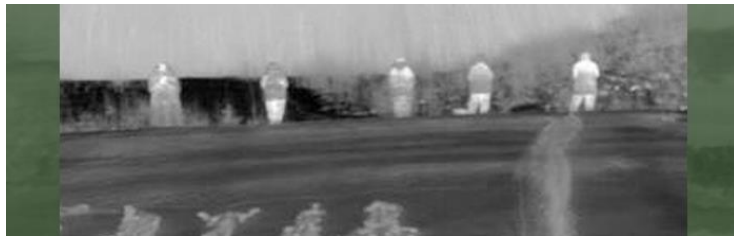




IDEaS Investments and Opportunities: Advanced Materials

Competitive Projects

Now you see me, now you don't –
reducing visual and infrared detection
of soldiers and their vehicles (CA);



Lightweight ballistic protection –
Enhancement of efficient ballistic
protection

Innovation Network

Advanced Materials: Physical Protection and Detection Avoidance

Seeking to stimulate the development of revolutionary advances in materials science for defence & security applications, with a focus on emerging and advanced materials, including advanced manufacturing methods. Six Micro-Nets were awarded funding.

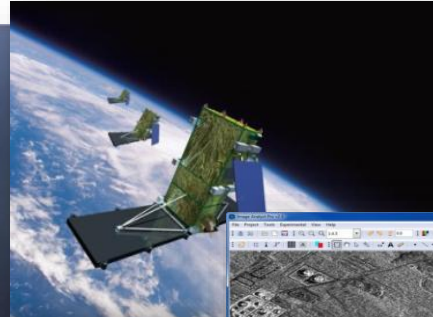




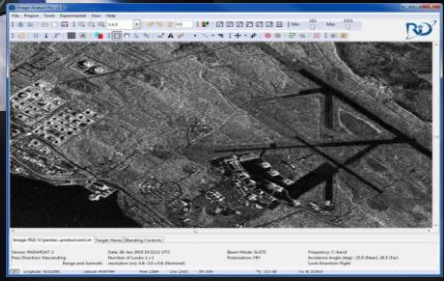
DRDC Space Systems S&T Program

Space-Based ISR

Exploitation of space-based capabilities for arctic and maritime surveillance and intelligence in support of military operations

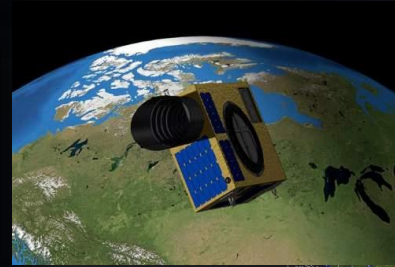


RADARSAT Constellation Mission image (c) CSA 2013



Space Operations

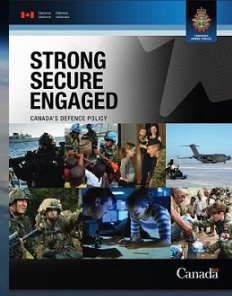
Capabilities to provide space situational awareness and to defend and protect national space assets



NEOSSAT



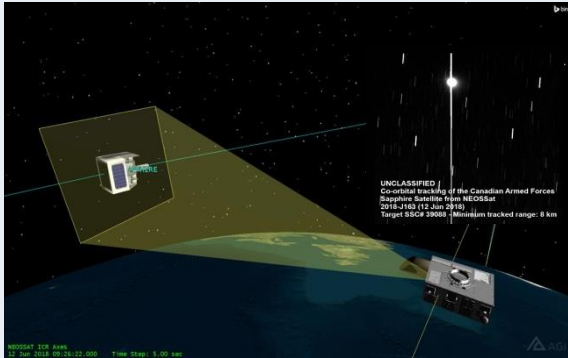
“Canada must develop advanced space and cyber capabilities, and expand cutting-edge research and development”
– Strong, Secure, Engaged: Canada’s Defence Policy, 2017





DRDC Space Operations S&T Program

Space Situational Awareness



Project Objectives

Characterize / understand Earth orbiting space objects using ground and space based sensors. Support CAF in Space Domain Awareness

S&T Themes:

- Optical/Radar satellite tracking
- Understanding space object pattern of life, intent and characteristics
- Non-traditional sensor integration and fusion
- Experimentation with R&D space and ground-based optical sensors

Space Mission Assurance



Project Objectives

Examine Space Mission Assurance, Space System Resiliency within the context of Canadian defensive space operations

S&T Themes:

- Analysis of risks, vulnerabilities and mitigations to space systems
- Enhance resilience of space systems (through IDEaS)
- Defend and protect space systems

Navigation Warfare



Project Objectives

To achieve Position Navigation Timing (PNT) superiority and ensure that the CAF can operate successfully in a GPS-denied environment

S&T Themes:

- Counter PNT
- PNT Resilience
- PNT Situational Awareness
- PNT Operational Assessments
- Support to CAF
- Leverage International Agreements with Allies

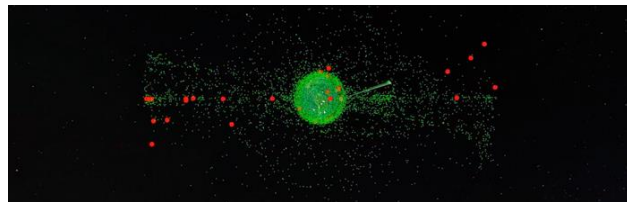




IDEaS Investments and Opportunities: Space Systems

Competitive Projects

Collision Course – tracking and de-orbiting space debris



Shields Up? Defend and protect satellites from natural and artificial threats



Identification and characterization of space objects – maintain a complete and continuous situational awareness for effective management of space assets

