Achieving Arctic Domain Awareness: Canada’s developing approach

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THIS PRESENTATION IS UNCLASSIFIED
Drivers for an Enhanced R&D Program in Continental Surveillance

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Broader range of threat weapons: long range, precision, stealth, hypersonic speed, drones.</td>
</tr>
<tr>
<td>Environment</td>
<td>Unique and changing geophysical ocean conditions, particularly in the North.</td>
</tr>
<tr>
<td>Theatre</td>
<td>Greater accessibility to and economic activity in the North</td>
</tr>
<tr>
<td>Geopolitics</td>
<td>Strategic messaging to contribute to deterrence of attack on North America</td>
</tr>
</tbody>
</table>
All Domain Situational Awareness (ADSA) S&T Program Overview

• A 5-year $133M effort, funded prior to Defence Policy *Strong, Secure, Engaged* (SSE)
• Provides science-based advice to senior leadership on enhanced surveillance capabilities for the approaches to and in the North
• Informs future acquisition and capability development projects

• In 2017, SSE reinforced the priority of Arctic surveillance and provided additional strategic guidance (3 primary initiatives)
Advancing Arctic Surveillance Technologies and Concepts

Understanding the changing Arctic environment

More affordable and effective space-based sensing

Arctic experimentation

Long range radar capabilities

New surveillance methods

Improved underwater sensing

Modelling, Simulation and Analysis

ADSA - Air and Maritime Domains
ADSA – Resourced Projects

ADSA S&T PROJECTS CURRENTLY IN EXECUTION TO PROVIDE ADVICE & SOLUTIONS:

- **Polar Over the Horizon Radar (OTHR)**
  - Longer range radar in the Arctic

- **Compress the Tasking, Collection, Processing, Exploitation and Dissemination (TCPED) cycle**
  - Facilitates decision making cycle

- **Canadian Arctic Underwater Sentinel Experimentation (CAUSE)**
  - Improves underwater surveillance

- **Threat, Requirement and Gap (TRG) Analysis**
  - Understanding security challenges in Canada, in particular the Arctic
Defence and Security IDEaS Innovation Program

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

CONNECT TO OTHER INNOVATORS
- IDEATION
  - Innovators can help refine defence and security challenges

DEVELOP THEIR INNOVATIONS
- CONTESTS
  - Innovators can compete for contest prizes

- COMPETITIVE PROJECTS
  - Innovators can compete for developmental funding

- SANDBOXES
  - Innovators can test and demonstrate their solutions

- ASSESSMENT & IMPLEMENTATION
  - Innovators can have their solutions assessed by DND/CAF

INDICATES ELEMENTS THAT PROVIDE FUNDING.
Arctic-related IDEaS Program initiatives

• Through access to external innovation, S&T will evaluate, oversee and advise to exploit innovation efforts and results in:
  – Call for Proposal (CfP) 2 Challenge #6 Persistent maritime surface sensor
  – CfP2 Challenge #9 Full spectrum Communications in the Arctic
  – CfP1: Challenge #5 Human Performance in extreme climate
  – CfP1: Challenge #7 Persistent maritime surveillance
  – CfP1: Challenge #12 Resilient non-GPS Position, Navigation and timing
  – CfP3: Breaking the Ice - Ground solutions for de-icing/anti-icing of aircraft
  – CfP3: Cold Winds Blow: Smaller ruggedized Wind turbines for the Arctic
  – Sandbox: Detect, defend against and defeat (small) UAVs (Sept 2019)
  – Innovation Network: Autonomous Systems
  – Innovation Network: Digital network infrastructure in the North
  – and new calls planned for the coming year in relevant topics
International Cooperation Engagement Program for Polar Research (ICE-PPR)

**Purpose:** to collaborate on defence related operations, exercises, and S&T projects, supporting polar objectives

**Membership:** Finland, Sweden, Norway, Denmark, Canada, US, New Zealand

“Observers”: Iceland, Chile

**Working Groups:**
- Environment (US lead),
- Situational Awareness (DK),
- Platforms (NZ) and
- Human Performance (CA)
Human Performance WG – CA lead (Vaughn Cosman)

Three meetings (Washington), 2017, 2018, 2019
VTC from Alert 2018
VIP visits to OP NANU
Invited participation in “THE AVIATOR” (2019+)
Invited participation in Finnish Arctic training ex (2020+)
Nutrition, Cognition, land/ice survival, operations, fabrics, sea survival, power and energy, shelter, non-freezing and freezing injuries, standardized protocols

Next meeting: May 2020 (Norway)
Exercises and Trials - S&T for Op Nunalivut

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Arctic Edge 2020

ARCTIC EDGE (AE) is a NORAD and USNORTHCOM sponsored, Alaskan Command (ALCOM) led, Field Training Exercise, conducted during even years in Alaska and focused on operational to tactical-level planning and execution of Homeland Defense (HD) and Defense Support of Civil Authorities (DSCA) missions, 24 Feb -06 Mar 2020.

**Exercise Objectives**

- Exercise Defence Plans
- Practice Arctic SOPs / TTPs
- **Advance CA/USA Arctic interoperability**
- Exploit Arctic research / trials opportunities
- Create opportunities for strategic messaging
- Expedite CJOCs feedback loop to environmental FG and joint enablers with tangible TTPs, SOPS or joint doctrine concerning Arctic Operations in the Defense of North America
Working together with Indigenous Communities

- Consultation with local governments and community leaders on:
  - Research facility locations
  - Minimizing environmental impact and footprint
  - Coordinating Arctic operations
  - Supporting local economies
Future
Defence of North America ST&I Program Lines of Effort

Focus Area Long-term Vision
- Strategic advice – provide timely science-based advice on NORAD modernization for multi-layered sensing, Command and Control, and effective defeat
- Address Operational Issues - respond to urgent issues and gaps
- Assist with Force Development – advise CBP & rapid insertion
- Pursue leap ahead technologies – push the boundary on emerging and classified technologies, enhance TRLs and exploit
- Harness the best innovators– engage innovators on key challenges

Shape and integrate enabling S&T activities from other Focus Areas
In summary

• S&T analyses for surveillance of Northern Approaches are on track.
• R&D carried out in close collaboration with the US.
• Solutions delivered are generating science-based evidence of the feasibility of surveillance technologies, logistics, and ops in the North.
• Combination of internal and externally accessed R&D
• Will inform future acquisition programs including eventual replacement of the North Warning System.
• New expanded program to support Continental Defence risk mitigation in new domains of Cyber/Info, Aerospace/space and Land
Questions

Source: Canadian Coast Guard, *Icebreaker Requirements 2017–2022*.
Departmental Strategic Guidance

• $133M was allocated by the Department of National Defence (DND) for an S&T program to inform decisions on surveillance capabilities for the approaches and in the North (2015-2020).
• While the program was funded prior to Defence Policy *Strong, Secure, Engaged* (SSE), it included guidance on S&T surveillance programs:

  - *Prioritizing Arctic joint intelligence, surveillance and reconnaissance as a defence research and development priority to produce innovative solutions to surveillance challenges in the North. (Initiative 69)*
  - *Collaborate with the United States on the development of new technologies to improve Arctic surveillance and control, including the renewal of the North Warning System. (Initiative 109)*
  - *Modernize NORAD to meet existing challenges and evolving threats to North America, taking into account the full range of threats. (Initiative 111)*
**OTHR Project**

- **Objectives:** To assess viability of OTHR as an option for the surveillance of the North in augmentation to current North Warning System (NWS) and NORAD capability. Develop technology and signal processing techniques to overcome Aurora Borealis phenomenology and clutter suppression.

- **Deliverables:** Capabilities, tools, knowledge, concepts and advice for improved mission effectiveness and greater situational awareness through integrated, interoperable and networked ISR capabilities, including networked sensors with a shared operational picture.
TCPED – Improving the Space-Based Intelligence Process

**Objective:** Compress TCPED cycle for RADARSAT Constellation Mission (RCM) and follow-on missions.

> 23 Projects delivered through the Defence Innovation Research Program (DIRP)
TCPED – Gray Jay Pathfinder

• Industry partner: University of Toronto Institute for Aerospace Studies, Space Flight Laboratory (UTIAS-SFL)

• Demonstration of microsatellite ISR constellation for the high north (1 x chief and 2 x followers)

• Phase 1 ($6M, 18 months, TRL5 / Tech Demo)
  o Develop and test in laboratory a low-cost, multi-sensor microsatellite prototype with multi-band RF, AIS, ADS-B, and IR sensors to geolocate and characterize moving air or sea emitting or dark targets.

• Phase 2 ($9M, 16 months, TRL8 / Pilot Demo)
  o 3 satellites built, launched, and flown in formation for 6 mos. to: demonstrate the technology; assess the performance on orbit; and determine how the system could meet operational requirements.
CAUSE Project

Explore and demonstrate various enabling technologies for wide-area underwater/under-ice surveillance and communications in the Arctic

- **CAATEX**: Coordinated Arctic Acoustic Thermometry Experiment
- **Drifting Arctic Monitoring System (DAMS)**
  - Drifting, ice capable, surveillance array
- **DRDC Acoustic Surveillance Array (DASA)**
  - Seabed Surveillance Array, cabled to shore
- **Distributed Underwater Sensor Network (DUSN)**
  - Bottom-moored surveillance sensors and network nodes
CAUSE Project - Accomplishment

- Long-endurance UUV – Cellula Robotics
- Towed Array for UUV – Geospectrum Technologies
- Low-frequency acoustic source for underwater communications and active sonar - Geospectrum Technologies
TRG Analysis Project Overview

• Objectives:
  o Assess threats in the three approved domains (Air, Maritime Surface and Maritime Sub-Surface) for the Canadian Arctic and relevant approaches;
  o Analyze surveillance requirements in support of Joint Operational Command & NORAD;
  o Compare selected technology options against these requirements; and
  o Analyze Arctic/ISR capability gaps in support of DND/CAF.