‘Strong, Secure and Engaged’

The Next Generation of Canadian Space Domain Awareness

Mr. Cam Stoltz (Col Ret’d)
Director Space Requirements
28 April 2021
OVERVIEW

• ‘Strong at Home, Secure in North America and Engaged in the World’

• Research & Development (R&D) in New Space Technologies

• SDA Engagements, Current and Future Partnerships

• DND's Roadmap & SDA Capabilities
‘STRONG, SECURE, ENGAGED’
A New Canadian Vision for Defence: STRONG, SECURE, ENGAGED.

Space effects are a joint enabler across all missions & integral to Pan-Domain Ops.

**STRONG at home**
- Steadfast defence of Canada
- Rapid disaster response
- Effective search and rescue
- Enhanced presence in the Arctic
- Innovative defence sector

**SECURE in North America**
- Continuous watch over Canadian air and sea approaches
- Modern and effective NORAD
- Strong defence relationship with the U.S.
- Cutting edge defence research

**ENGAGED in the world**
- Robust commitment to NATO, UN and Coalitions
- Support to Canadian interests and humanitarian assistance
- Improved early warning
- Integrated capacity building with partners

AGILE, COMBAT READY CANADIAN ARMED FORCES AND RESILIENT PEOPLE AND FAMILIES
SSE - SPACE OBJECTIVES

• In collaboration with allies, Deter ...increasingly relevant to the space and cyber domains

• Invest in and employ (Deliver) a range of space capabilities

• Defend and Protect space capabilities

• Work with partners to promote Canada’s national interests on space issues

• Provide leadership in shaping international norms for responsible behaviour in space

• Conduct cutting-edge R&D on new spacetechologies

UNCLASSIFIED
RESEARCH & DEVELOPMENT
S&T INNOVATION FOR DEFENCE EXCELLENCE AND SECURITY (IDEAS) PROGRAM

Challenges | Date launched | Status
--- | --- | ---
CFP 1 Challenge 13: Identification and Characterization of Space Objects | April 2018 | 4 solutions funded completion by May 2021
CFP 3 Challenge 2: Collision Course - tracking and de-orbiting space debris | August 2019 | 6 solutions funded completion Dec 2020
CFP 3 Challenge - Shields up! Defend & Protect satellites from natural and artificial threats | Sep 2019 | 7 solutions funded completion Feb 2021

SPACE DOMAIN AWARENESS (SDA)

ENGAGEMENTS, CURRENT AND FUTURE PARTNERSHIPS
COMBINED SPACE OPERATIONS (CSpO) ON SOCIAL MEDIA

Royal Canadian Air Force @RCAF_ARC - Apr 18, 2020
"Destabilizing test activities can affect space safety/stability, which is essential for our partners and allies. It is more important than ever to advance norms of responsible behavior in space!" BGen Kevin Whale, CAF Space Component Commander

U.S. Space Command @US_SpaceCom - Apr 15, 2020
It's a shared interest, responsibility of all spacefaring nations to create safe/stable/operationally sustainable conditions in space. In this time of crisis, space systems support global logistics/transpo/comms to defeat COVID19. go.usa.gov/xv8rH

Royal Canadian Air Force @RCAF_ARC
Combined Space Operations initiative Principals from met on 13-14 Jan to continue work on a shared vision and mission to ensure the space domain remains safe, secure, and accessible to all.

National Defence @NationalDefence - Aug 6, 2020
On 23 July 2020, representatives from attended the virtual combined Space Operations (CSpO) Principals Board.

Russia conducts space-based anti-satellite weapons test. U.S. Space Command has evidence that Russia conducted a non-destructive test of a space-based anti-satellite weapon. On July 15, ...

spacecom.mil

UNDER A COMMON VISION, WE AGREED UPON GUIDING PRINCIPLES AND LINES OF EFFORT TO IMPROVE COMBINED MILITARY SPACE OPERATIONS, FOSTER COOPERATION AND COORDINATION, AND TO COLLECTIVELY PROMOTE RESPONSIBLE BEHAVIOR IN SPACE UNDER THE CSpO INITIATIVE.

Canada.ca/Defence
# DND SPACE MOUs AND PARTNERSHIPS

<table>
<thead>
<tr>
<th>All Space MOUs</th>
<th>#</th>
<th>Partners</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PERSONNEL</strong> - Exchange of defence personnel</td>
<td>6</td>
<td>OGDs (CSA, ISED) &amp; US</td>
<td>Agreement to provide on-site working assignments to selected military members, scientists, engineers and logisticians. Including CAF members’ assignments as Astronauts.</td>
</tr>
<tr>
<td><strong>RDT&amp;E</strong> - Satellite bus and payloads, Command &amp; Control Information Systems (C2I)</td>
<td>5</td>
<td>Allies (FEYEes)</td>
<td>Collaboration in research, development, testing, evaluation, and prototyping potentially leading to new and improved defense capabilities.</td>
</tr>
<tr>
<td><strong>OPERATIONS</strong> - SATCOM, ISR, SSA, PNT, Search &amp; Rescue</td>
<td>11</td>
<td>OGDs (CSA, NRCan, SSC) &amp; Allies (FEYEes + DEN, LUX, NED, DEU, FR)</td>
<td>From sensor data sharing, development and operations of space effects, development &amp; coordination infrastructure and mission command and control systems; and policy.</td>
</tr>
</tbody>
</table>

**SDA specific partnerships:** 10 MOUs & 5 SAs/PAs
SPACE DOMAIN AWARENESS (SDA)

ROADMAP
Now, Space is... Congested

Canada has ~60 satellites on orbit (commercial, civil, military); ~55 active, 5 debris

>2200 active satellites
>23,000 tracked objects...

...plus >500,000 smaller objects we can’t track, travelling at up to 36,000 km/hr

Example: GEOINT Planned Expansion

Not to mention satellites for:
- Communication
- Position, Nav, Timing
- Missile Warning
- Weather
- Etc.
potential adversaries have developed a wide array of ground and space-based weapons to disrupt/deny commercial and military space systems:

- Jamming of GPS and comms satellites
- Blinding of ISR satellites using directed energy weapons
- Anti-satellite missiles
- Space-based on-orbit counter-space capabilities
- Physical attacks against ground sites and infrastructure
- Cyber attacks against space systems and infrastructure

Source: “Competing in Space”, National Air & Space Intelligence Center, December 2018
Space is...

- On orbit servicing, refuel, repair...
- Lunar Gateway
- Exploration...
- High Altitude Platforms - Pseudo-Sats

Competitive

Space mining...
CANADA’S CURRENT SSA CAPABILITY
CANADIAN SPACE SURVEILLANCE SYSTEM

- Launched 25 February 2013
- Mass: ~ 148 kg
- Dimensions: ~ 1 m³
- Orbit: 784 km sun-synchronous
- Tracking Capability:
  - 360 objects per day (requirement)
  - >450 objects per day (proven)
- Field of View: 1.4 degrees
- Brightness Sensitivity:
  - Visual Magnitude 6 to 15 (requirement)
  - Visual Magnitude 16 (proven)
- Design life: 5 years (goal of 7)
NEAR-EARTH ORBIT SURVEILLANCE SATELLITE (R&D)

- Joint project between CSA and DRDC
- Dual mission microsatellite:
  - Asteroid astronomy, and
  - Space Situational Awareness (SSA) research
- Prime Contractor: Microsatellite Systems Canada Inc. (Missisauga, ON)
- Launched 25 February 2013
- Mass: 74 kg
- Dimensions: 137 × 78 × 38 cm
- Orbit: 792 km sun-synchronous
CANADA’S FUTURE SDA CAPABILITY
SDA is critical for providing the operating picture of all activities in space for the protection and defence of key space assets.
SofS 2 intends to deliver both a Ground-based Optical (GBO) sensor system as well as an Space-Based Optical (SBO) sensor system.

SofS 2 will support both national and allied space surveillance missions.
SURVEILLANCE OF SPACE 2 (SOFS 2)

PROJECT SCOPE:
SofS 2 will enable the RCAF to continue performing deep space surveillance for the protection of Canadian deep space assets, mission assurance for space-based capabilities that support the CAF, and to ensure Canada is an active contributor to the operations of the US Space Surveillance Network (SSN). Preferred option consists of both Space-Based Optical (SBO) and Ground-Based Optical (GBO) systems.

NEXT STEPS:
Project Approval to enter the Definition (Def) phase in Fall 2021 in order to begin engineering studies and issue Requests for Proposals (RFP).

PROJECT STATUS:
- In Options Analysis
  - Def: Fall 2021
  - GBO: Imp: 2024, IOC: 2025, FOC: 2026
  - SBO: Imp: 2025, IOC: 2029, FOC: 2030
- Preliminary Estimate
  - Total Project Value: $100M-$250M

CONTACT INFORMATION:
Project Director: Maj Charles Wood
Email: Charles.wood2@forces.gc.ca
For industry questions regarding SofS 2:

• Refer to the information available on buyandsell.gc.ca

• RFI W8474-207923/A (GBO) & RFI W8474-187639/B (SBO)

• Point of Contact: Alan Chan, PSPC
‘Strong, Secure and Engaged’

The Next Generation of Canadian Space Domain Awareness

Mr. Cam Stoltz (Col Ret’d)
Director Space Requirements
28 April 2021