Defence Innovation Research Program (DIRP)

Stakeholder Engagement
January 13, 2016
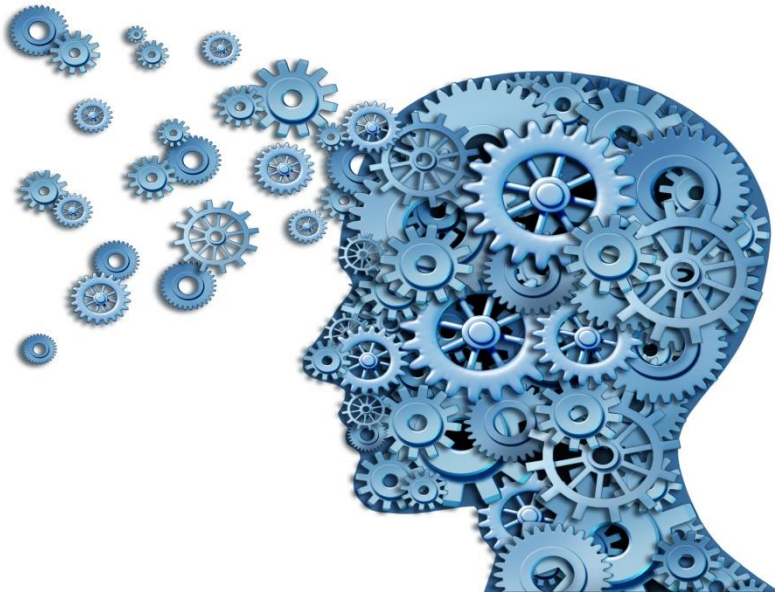
AGENDA

- **Introduction** – *Kate Caves (*PWGSC, Science Procurement Directorate)

- **DRDC Overview and Joint Force Development program** – *Dr. Julie Lefebvre* (DGSTJFD)

- **DIRP Strategic Objectives** – *Dr. Paris W. Vachon* (DRDC – Ottawa Research Centre)

- **PWGSC** – *Kate Caves* (PWGSC, Science Procurement Directorate)

- **Q&A**

- **One-on-one sessions**

Stakeholder Day

- Open Dialogue
- Ask Questions
- Give Feedback
- Fair, transparent and equal treatment to all parties

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DRDC

- Provides a knowledge and technology advantage to support defence and security operations at home and abroad

- National Leader in Defence and Security Science and Technology (S&T)

- Agency of Department of National Defence (DND)

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DRDC Key Facts

- **8 research centres located in 4 provinces**
- **1,400 employees**
- **$275 million operating budget**

NATIONAL CAPITAL REGION

CENTRE FOR OPERATIONAL RESEARCH AND ANALYSIS

CENTRE FOR SECURITY SCIENCE

DIRECTOR GENERAL MILITARY PERSONNEL RESEARCH AND ANALYSIS

OTTAWA RESEARCH CENTRE

SUFFIELD RESEARCH CENTRE

VALCARTIER RESEARCH CENTRE

ATLANTIC RESEARCH CENTRE

NATIONAL CAPITAL

TORONTO RESEARCH CENTRE

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ADM S&T and DRDC

Mission
Provide a science, technology and knowledge advantage for Canada's defence and security

Vision
DRDC is a national leader and an international partner in S&T critical to Canada's defence and security

Roles

- Delivers knowledge, analysis and advice based on science and technology

- Recruits new ideas, knowledge and solutions by engaging with national and international partners

- Performs research and development in classified, sensitive and strategic areas

- A well managed research organization that promotes a respectful and inclusive workplace

Impacts

- Build agile and adaptable forces to carry out missions across a wide spectrum of operations

- Assist and support CAF and civilian personnel before, during and after operations

- Enable the acquisition, sharing and use of critical information in support of situational awareness and decision-making

- Develop and implement solutions to maximize the affordability and sustainability of DND and the CAF

- Support public safety and security practitioners in their mission to protect Canadians

- Anticipate, prepare for and counter the emergence of future threats

S&T Strategy

- [Science and Technology in Action: Delivering Results for Canada's Defence and Security](#) (2013)

- A comprehensive, long-term blueprint to help ensure DND, the CAF, and its public safety and security partners have the tools and capabilities to defend Canada and carry out their core missions and activities

- Based on three key approaches:
  - Build
  - Collaborate
  - Access

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S&T Portfolios

STRATEGIC DECISION SUPPORT - 00

NAVY - 01

ARMY - 02

AIR FORCE - 03

PERSONNEL - 05

JOINT FORCE DEVELOPMENT - 05

PUBLIC SAFETY AND SECURITY - 05

FORCE EMPLOYMENT - 06

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Joint Force Development (JFD) Portfolio Overview

- **Command and Control / Communication Information Systems (C2/CIS)**

- **Cyber Operations**

- **Intelligence**

- **Intelligence, Surveillance and Reconnaissance (ISR)**

- **Space Operations**

Key Clients:

- Chief Force Development (CFD)

- Chief Defence Intelligence (CDI)

- Assistant Deputy Minister (Information Management) (ADM(IM))

✓ Reshaped JFD S&T programs to address client-based outcomes

✓ Projects are conducted in collaboration with OGDs, industry, academia and allies

✓ Sourcing strategy requires an understanding of industry interests, strategic goals, capabilities and capacities

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ISR S&T Client-Based Outcomes

The CAF have accurate, timely, and persistent situational awareness of Canada's territory and its air and maritime approaches as well as other international areas of interest

- Continue to operationally exploit space-based Synthetic Aperture Radar (SAR) and Electro-Optic/Infrared (EO/IR)

- Maintain and improve Maritime Domain Awareness (MDA) *

- Maintain and improve Arctic intelligence *

- Conduct Intelligence Preparation of the Battlefield (IPB) in support of deployed forces *

- Execute the Direction, Collection, Processing and Dissemination (DCPD) cycle *

* Using space-based sensors when appropriate

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All Domain Situational Awareness (ADSA) S&T Program

- This approved investment will position S&T to be ready to provide impartial advice on the broadest range of questions pertaining to enhanced domain awareness of air, surface and sub-surface approaches to Canada.

- ADSA S&T will:
  - analyse requirements with DND/CAF and NORAD stakeholders;
  - work with partners to identify and leverage innovations;
  - conduct, where necessary, R&D projects to de-risk and test unproven technologies;
  - integrate and deliver advice on a regular basis;
  - provide information on technical maturity, predicted operational performance, sustainability and risks.

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DIR Program Evolution

- Defence Industrial Research Program (DIRP) was started in the 1980's
  - Intended to support and complement DRDC programs
- Converted to PWGSC contract-based program in mid-1990's
  - Leverage industry-initiated research projects
  - Support DND objectives in Defence S&T
  - Introduce new technologies into DND and the CAF
  - 50-50 cost shared
  - IP owned by proponent with access by Crown
- Rebranded as Defence Innovation Research Program (DIRP) in 2015
  - More frequent, more focussed calls with Strategic Objectives (this is the first)
  - Open to industry and academia
  - Canadian lead
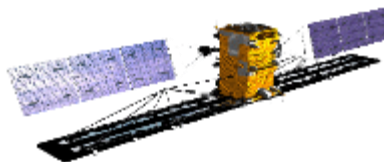 - > 50 % of the work must be done in Canada
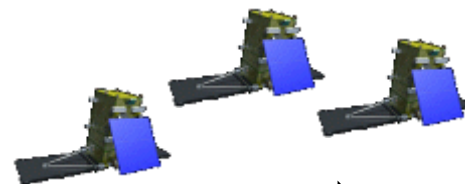
RADARSAT Evolution

RADARSAT-1:
1995 to 2013

- Design life: 5 years
- Operational: 18 years
- GC owned
- One operational user
- R&D component

RADARSAT-2:
2007 to ?

- Design life: 7 years
- Operational: Yes
- MDA owned and operated
- GC data pre-purchase
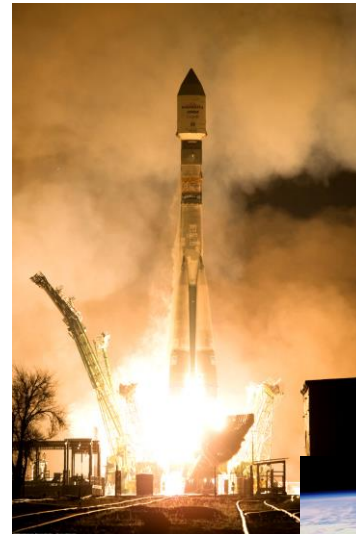- Many operational users
- New imaging modes

RCM:
2018 (planned)

- Design life: 7 years
- GC owned
- CSA and user dept. funding
- Operational focus
- SAR and AIS payloads
- Faster tasking / delivery

THREE-SATELLITE CONSTELLATION DAILY COVERAGE OF CANADA

GREENLAND
CANADA
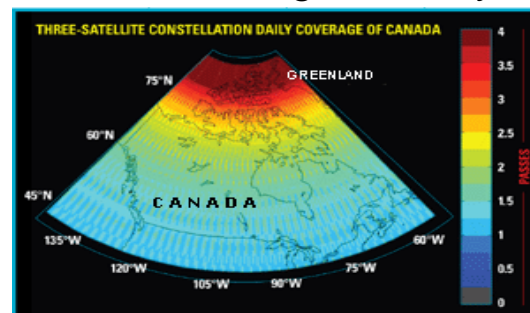
RADARSAT-2

- C-band synthetic aperture radar (SAR)
- Built, owned, operated by MDA
- GoC $446M investment returned as imagery
- Launched Dec. 2007
- 780 km altitude, 24-day exact repeat
- Wide coverage (up to 530 km)
- High resolution (down to < 3 m)
- Single / Dual / Quad polarization
- ≈ 165 images/day
- Fast product delivery
- Unclassified products
- Government + commercial users:
  - Sea ice monitoring
  - Flood monitoring
  - Ship and oil detection
  - DEM generation
  - Subsidence monitoring

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Polar Epsilon: Joint Space-Based Wide Area Surveillance and Support Capability

Overview

Aim: (1) Support to CF operations;
    (2) Arctic, maritime domain awareness.
Description: Exploit RADARSAT-2 for
        DND/CF operational stakeholders.
Funding: $53.3 M, DND.
Project Phase: Operational.

Capabilities

Arctic Surveillance (Land) (R-2):
  • Surveillance of Canada's Arctic Region;
Environmental Sensing (MODIS):
  • Support to CF operations;
Near-Real Time Ship Detection (R-2):
  • Surveillance of Maritime approaches;
  • Global surveillance (CDI);
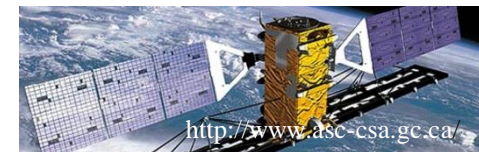Maritime Satellite Surveillance Radar (R-2):
  • New beam modes for ship detection and maritime surveillance.

Schedule	IOC	FOC
Arctic Surveillance (Land)	Oct-09	Jun-10
Environmental Sensing	May-11	Apr-12
Near-Real Time Ship Detection	Aug-11	Mar-12
Maritime Satellite Surveillance Radar	Mar-12	Dec-12

NRTSD:
• Reception at Masstown and
  Aldergrove
• Processing at Aldergrove
• OTHGold in 5 to 7 minutes
• Automated ingest into RMP

http://www.asc-csa.gc.ca/

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Ship detection density

OS contacts, count = 238,680

Arctic site monitoring

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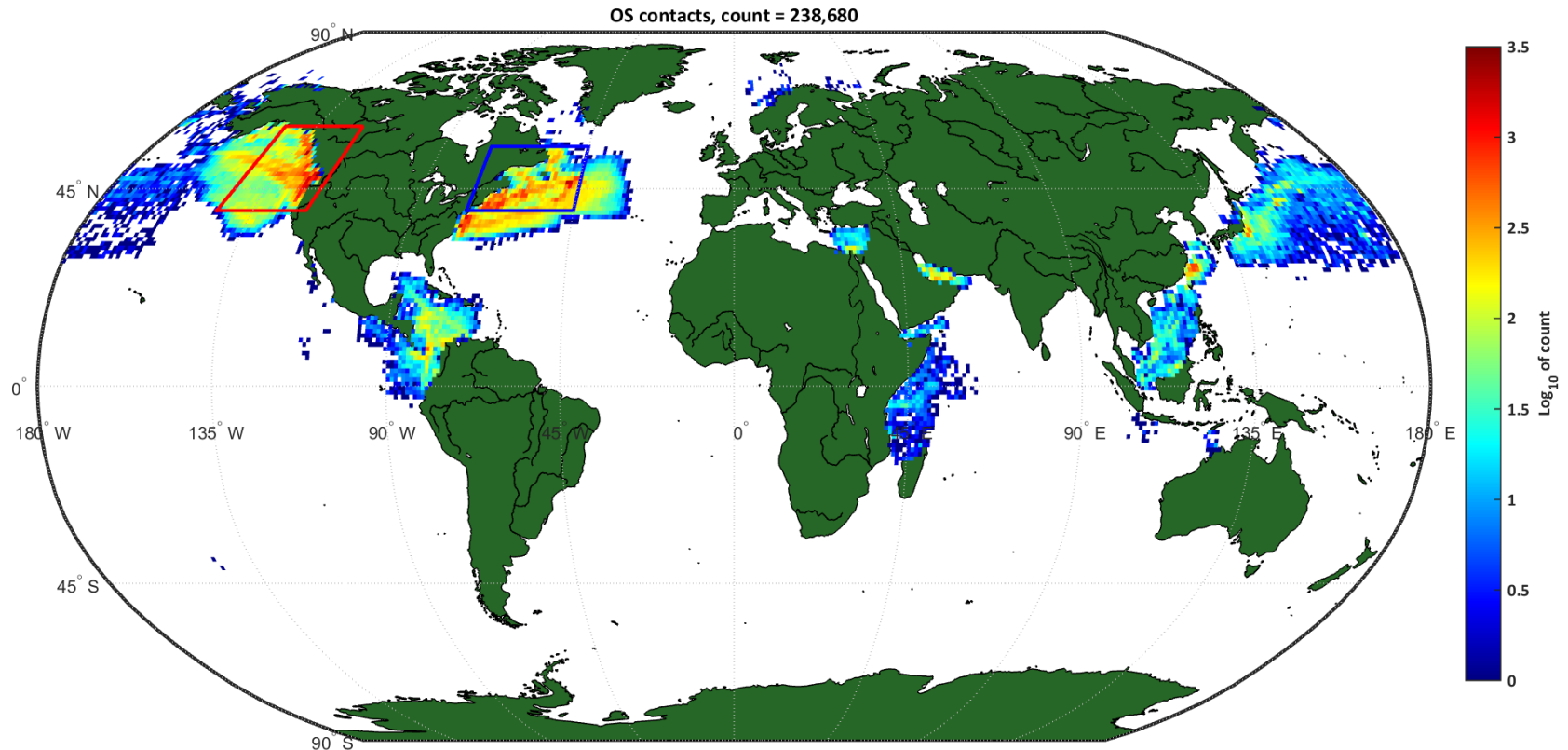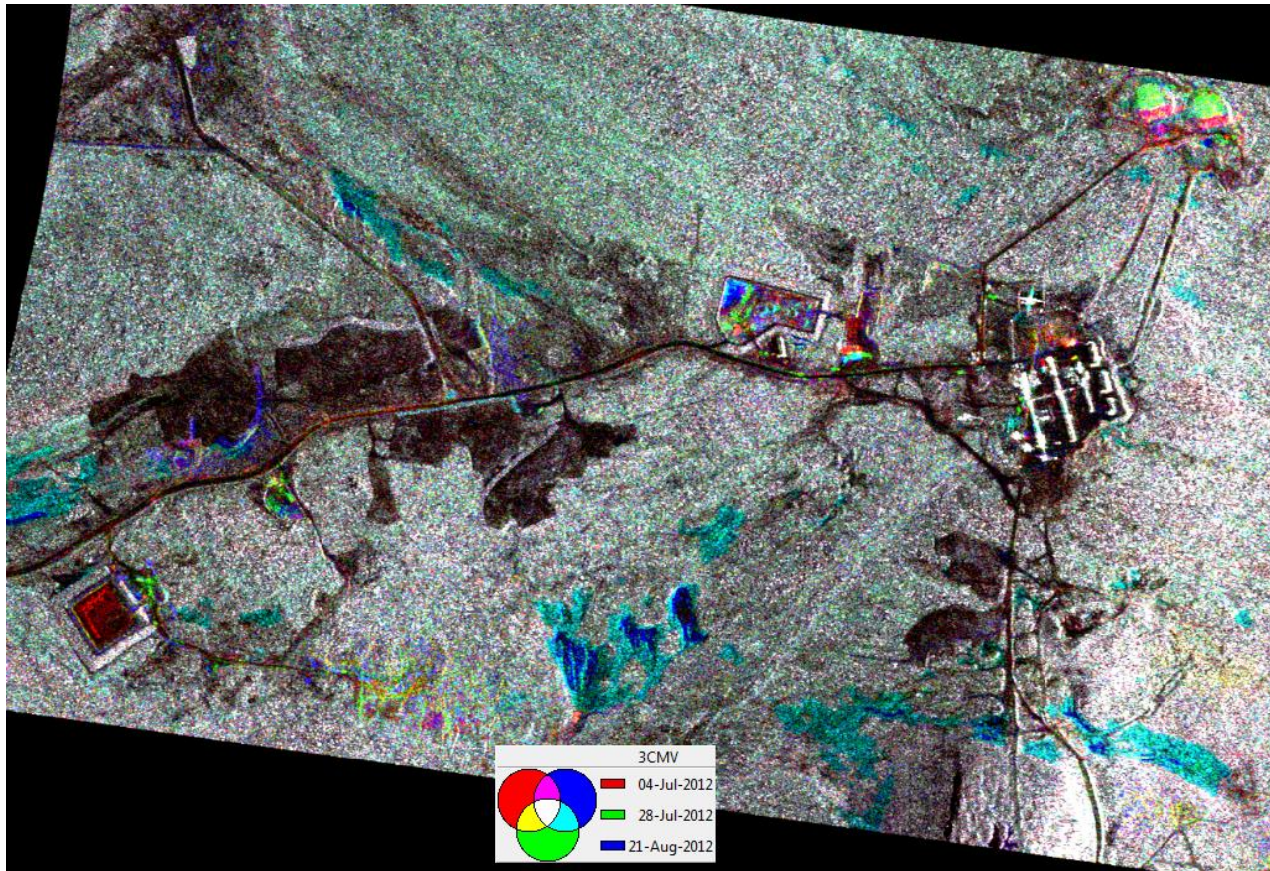
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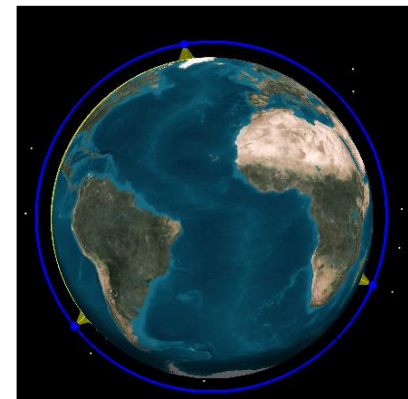
RADARSAT Constellation Mission (RCM)

Mission	3-satellite constellation (scalable) Co-located C-band SAR and AIS sensors
Bus	Canadian Smallsat Bus
Mass	1400 kg
Design life	7 years (per satellite)
Launch	Falcon 9 (single launch), July 2018
Orbit	600 km, 12-day exact repeat 100 m radius orbital tube, 4-day CCD
SAR antenna	6.75 m by 1.38 m
SAR power	≈ 1600 W peak, ≈ 220 W average
SAR polarisation	Single Pol / Dual Pol / Compact Pol One polarimetric mode
SAR duty cycle	15 min/orbit (peak 20 min), 10 min continuous Daily coverage of maritime approaches
AIS receiver	23 min/orbit (5 min for required performance) OBP, GBP, 2-polarizations, 4-channels

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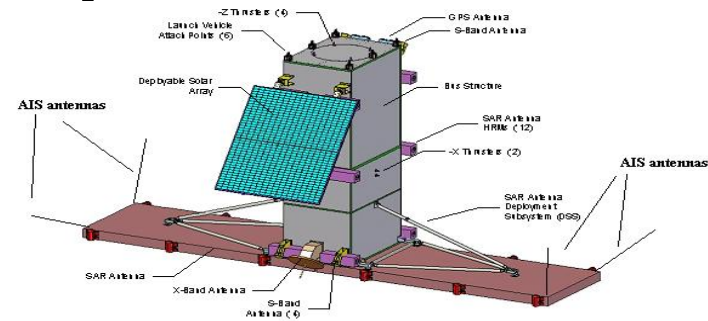
RCM Applications

- Sovereignty and Security
- Maritime Monitoring
- Northern Development
- Disaster Management
- Environmental Monitoring
- Management of Natural Resources

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Polar Epsilon 2: Space-based Surveillance and Reconnaissance Capability

Overview: Whole of Government approach to delivering more persistent and responsive Arctic, maritime, and deployed ops surveillance & reconnaissance using RCM
Status: Implementation Phase
Cost: $142.7M including 2 years P,O&M
P,O&M: Steady state FY19/20, $13.3M yearly
IOC: Nov '18; **FOC:** Mar '19

http://www.asc-csa.gc.ca/

Capabilities:
- SAR and AIS payloads
- SAR coverage:
  - ~ Daily for maritime approaches
  - Multi-daily for Arctic
  - 4-day coherent change detection
- AIS coverage:
  - With SAR plus daily global coverage
  - Near-real time ship detection, identification, and tracking
  - "dark" target detection

Notes:
- Follow-on/improve Polar Epsilon capability
- AIS receivers:
  - OBP and GBP, AIS 3/4 ready
- Aligning PE2 schedule with RCM schedule

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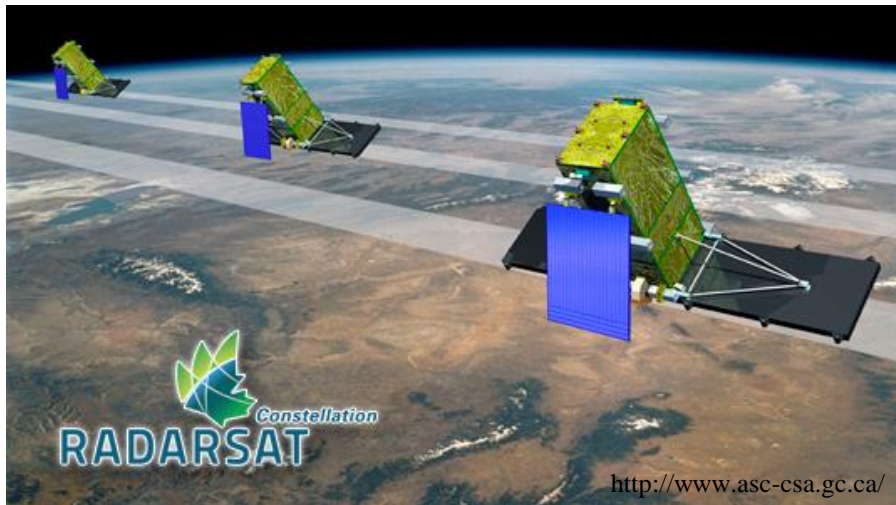
RCM End-to-End Timelines

- Routine Imaging
  - For orders that are not time critical, the entire end-to-end duration will be less than 48 hours from order cut-off to product delivery
  - N.B.: "Enhanced Management of Orders and Conflicts" (EMOC) process for RADARSAT-2 requires a 2-month ordering lead time
- Fast Tasking
  - Activities inserted into the imaging and downlink timelines with uplink within 5 hours of order being received by the Ground Segment
- Real-Time Downlink / Near Real-Time (NRT) Processing
  - Real-time downlink to X-band station visible to the spacecraft
  - Delivery of image products within 10 minutes, ship products with 15 minutes
  - Combine Fast Tasking with NRT processing: order submission to product in hand in as little as 6 hours when utilizing Canadian Reception Stations for real-time downlink

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Intelligence Cycle

Feedback from continuous and iterative review and evaluation of all aspects throughout the intelligence cycle to improve future direction.

Direction

Determination of intelligence requirements, planning the collection effort, issuance of orders and requests to collection agencies, and maintenance of a continuous check on the productivity of such agencies.

Dissemination

Review and Evaluation

Collection

The timely conveyance of intelligence, in an appropriate form and by any suitable means, to those who need it.

The exploitation of sources by collection agencies and the delivery of the information obtained to the appropriate processing unit for use in the production of intelligence.

Processing

Dissemination | Tasking

Review and Evaluation

Exploitation | Collection

Processing

TCPED

The production of intelligence through collation, evaluation, analysis, integration, and interpretation of information and/or other intelligence.

So what happens after RCM?

- Canada has developed a niche role as a provider of intelligence derived from wide-area maritime surveillance data
- DRDC seeks to support DND interests by proactively strengthening this role
    - Anticipate an ongoing operational interest in SAR and AIS
    - Anticipate an operational interest in complementary sensors
    - Consequences of emerging/disruptive technologies and industry trends
    - Significantly reduce the timeline from tasking to information to improve system-of-systems operations for tipping and cueing other assets
    - De-risking and maturing of technologies that could be considered for RCM follow-on missions

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DIRP Strategic Objectives

- Strategic Objective 1 - Developing cueing role and automated tasking

- Strategic Objective 2 - Radar concepts

- Strategic Objective 3 - On-board processing

- Strategic Objective 4 - AIS antenna and receiver concepts

- Strategic Objective 5 - Maritime surveillance tools

- Strategic Objective 6 - Land surveillance tools

Strategic Objective 1 - Developing cueing role and automated tasking

- Development of new algorithms, tools, fusion capabilities, target tracking, and CONOPS for RCM follow-on missions' cueing role within a system of systems. This includes automated or near-real-time autonomous and automatic submission of RCM follow-on missions' surveillance taskings with minimal lead time, to permit flexible operations in a system-of-systems environment.

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Strategic Objective 2 - Radar concepts

- Maturing of new radar concepts for RCM follow-on missions, including technology identification (e.g., multi-aperture, multi-frequency), and spacecraft and orbital concepts, with a goal of increasing swath coverage and maintaining or improving detection performance.

Strategic Objective 3 - On-board processing

- Maturing of on-board processing capabilities for RCM follow-on missions and development of reliable information products i.e., the analyst is no longer in the loop. This could include both extension of on-board processing for ship detection and identification and development of new on-board processing applications such as in support of Intelligence Preparation of the Battlefield (IPB) and Arctic facility monitoring.

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Strategic Objective 4 - AIS antenna and receiver concepts

- Maturing of AIS antenna and receiver concepts for RCM follow-on missions, including antenna concepts, such as beam forming across the SAR swath, receiver algorithms, and advanced algorithms amenable to on-board processing, with a goal of improving "first-pass" AIS detection performance and time-lines for association with SAR detection.

Strategic Objective 5 - Maritime surveillance tools

- Development, implementation, and pre-operational demonstration of new tools for exploitation of RADARSAT-2 and RCM SAR data for ship detection including ship classification, false alarm rate reduction, and ship velocity estimation.

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Strategic Objective 6 - Land surveillance tools

- Development, implementation, and pre-operational demonstration of new tools for exploitation of RADARSAT-2 and RCM SAR data for land surveillance including Arctic surveillance, IPB, change detection, topography, terrain classification, shoreline delineation, and littoral zone bathymetry.

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Estimated Timelines

- Stakeholder Day and One-on-one meetings   Jan. 13, 2016
- Publish Feedback & Outcomes   Jan. 22, 2016 (est.)
- Post Request for Proposals (RFP)   Feb. 12, 2016 (est.)
- Issuance of Contracts   Jun. 1, 2016 (est.)

Evaluation

Kate Caves (PWGSC)
819-956-3871

kate.caves@tpsgc-pwgsc.gc.ca

PWGSC Involvement:

- Chairing evaluations
- Conducting debriefs
- Addressing all inquiries from suppliers

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Mandatory Criteria

- DND relevance
  - Military relevance to the CAF and/or Allied forces
  - Relevance to Defence S&T capabilities and Defence S&T investment priorities
- Compliance with the DIRP Framework
- Canadian company lead and at least 50% Canadian content
- Certifications
- Proposals must demonstrate how they respond to and address at least one (1) of the six (6) Strategic Objectives

- Failure to satisfy all of the above disqualifies the proposal

Point Rated Criteria

- Entity Track Record (20 points)

- Research Content and Work Plan (60 points)

- Project Manager and Key Personnel (20 points)

- Technology Exploitation Plan (40 points)

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Proposal Selection

- Proposals that meet all mandatory and point-rated elements will be presented to the DIRAC for review and validation.

- Committee members possess a wide range of technical and corporate expertise and have a good understanding of DND and CAF needs and requirements.

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Certifications

- Federal Innovators Program for Employment Equity – Certification

- Former Public Servant Certification

- Price Certification

- Controlled Goods

- Integrity Provisions – List of Names

- **Intellectual Property**

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QUESTIONS