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Meteorological Service of Canada – Update

**NOAA Satellite Proving Ground/User-Readiness
June 2, 2014**

David Bradley (Meteorological Service of Canada)

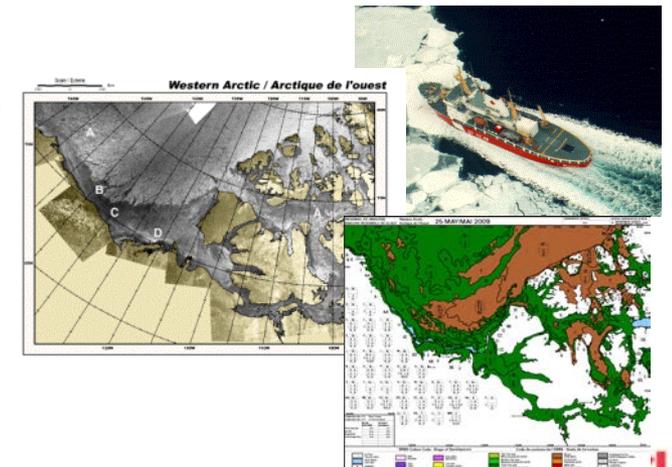
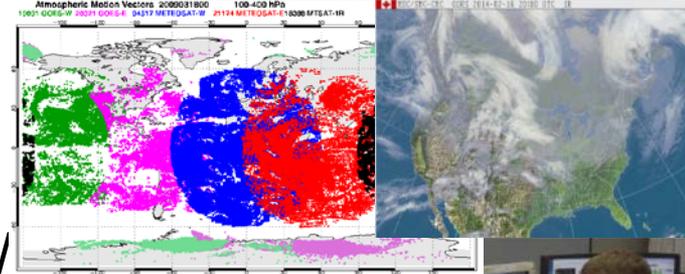
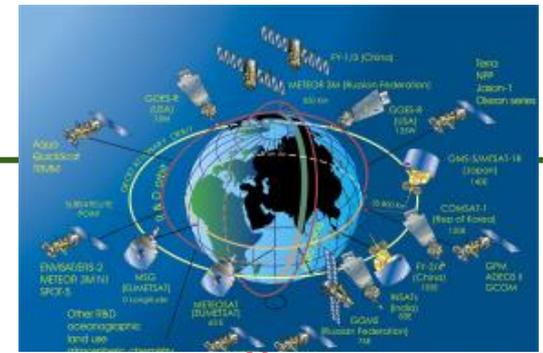
Meteorological Service of Canada

The Meteorological Service of Canada (MSC) is a division of Environment Canada, which primarily provides public meteorological information and weather forecasts and warnings of severe weather and other environmental hazards. MSC also monitors and conducts research on climate, atmospheric science, air quality, water quantities, ice and other environmental issues.

The screenshot shows the homepage of the Meteorological Service of Canada. At the top, there is a black navigation bar with the Government of Canada logo and text in English and French, along with links for Canada.gc.ca, Services, Departments, and Français. Below this is a blue header with the word "Weather" on the left, a large red maple leaf in the center, and the "Canada" logo on the right. A search bar is located on the right side of the header. Below the header is a dark blue navigation menu with tabs for Weather, Alerts, Marine, Air Quality, Analyses and Modelling, and Past Weather. The main content area features three large weather maps of Canada: a precipitation map on the left, a current conditions map in the center, and a cloud cover map on the right. Each map includes a small inset of the surrounding region.

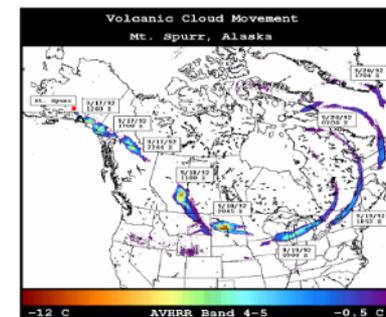
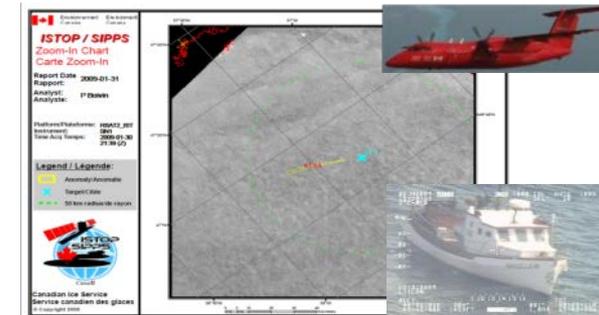
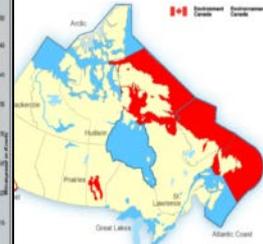
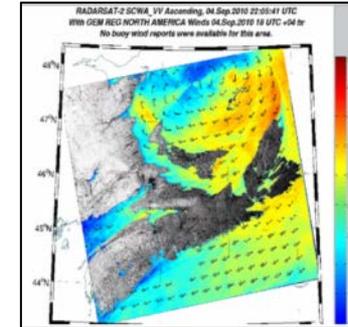
MSC Space Activities

- Weather Forecasts and Warnings
 - 1.5M forecasts, 10k weather warnings
 - aviation, marine, and ice
- Numerical Weather Prediction (NWP)
 - near-real time global data
 - 15-20 satellites, 4M+ obs/day assimilated
 - 90% of obs are space-based
- Sea Ice Monitoring and Forecasts
 - 2000+ ice charts, 400-500 warnings/yr
 - RADARSAT and other SAR satellites, meteorological missions
 - in partnership with Canadian Coast Guard



MSC Space Activities

- SAR Winds
 - surface wind speed retrieval over water
 - 2013 - operational for marine forecasts and warnings
 - RADARSAT and other SAR
- Pollution Detection and Deterrence
 - ISTOP - Integrated Satellite Tracking of Ocean Pollution
 - aircraft, RADARSAT and other SAR
- Environmental Emergency
 - Volcanic Ash Advisory Centre – Dorval
 - plume analysis and reverse modeling (CBRN)
 - oil spill detection and response
 - met, optical, RADARSAT and other SAR



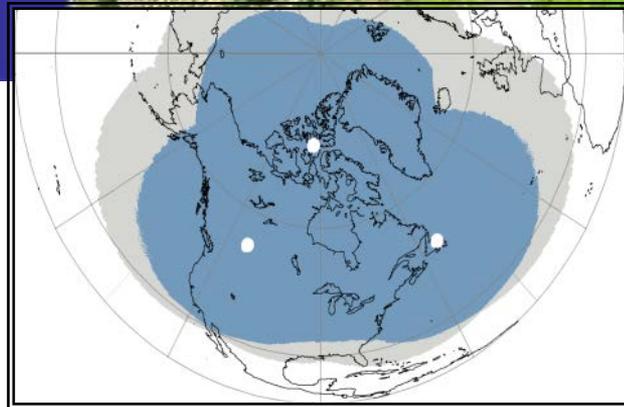
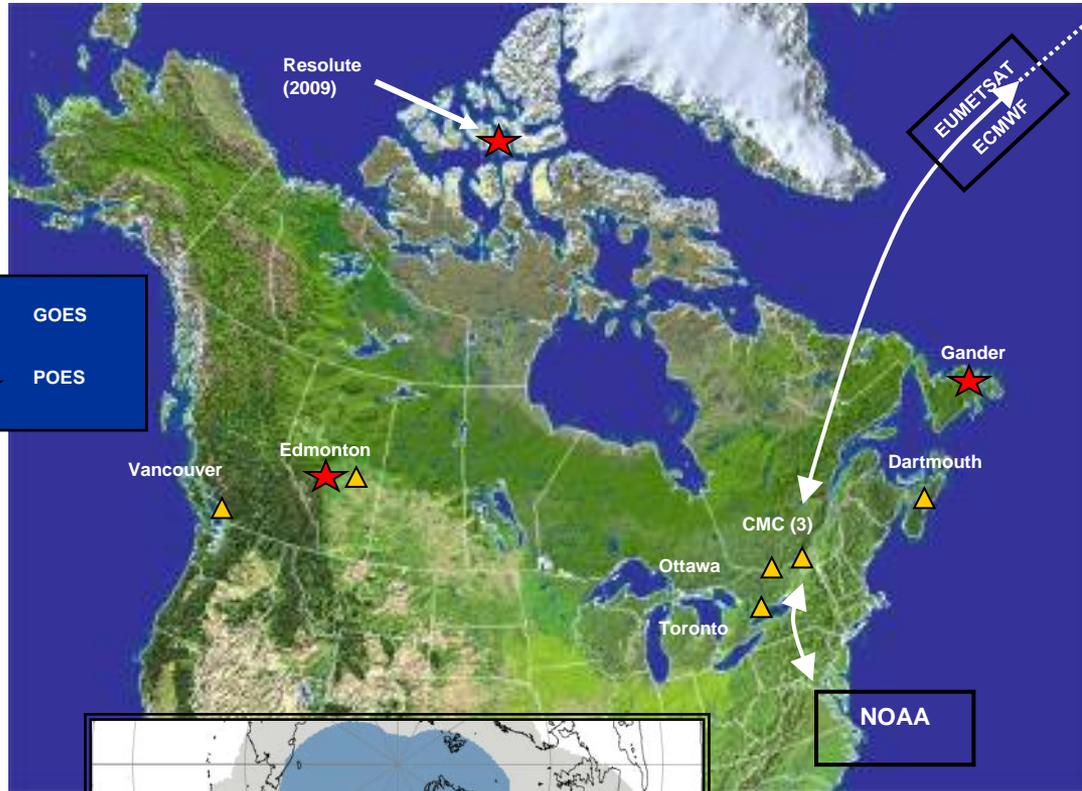
MSC Satellite Reception

- EC Satellite Reception Network

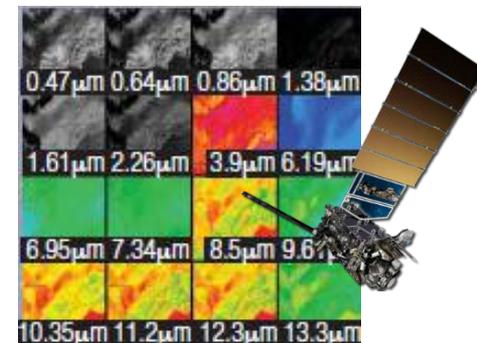
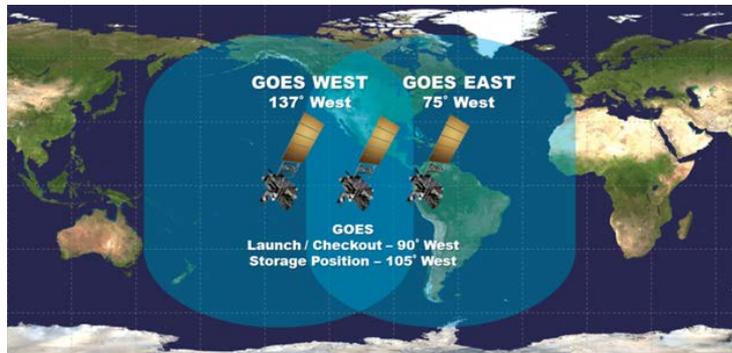
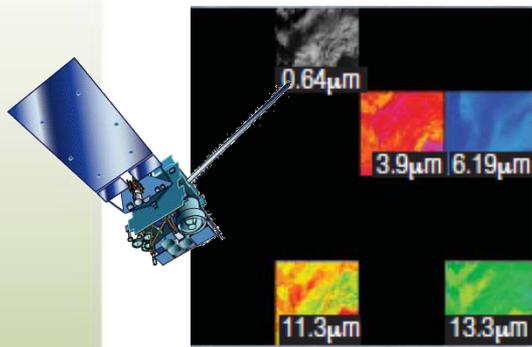
- 10 Geostationary (GOES)
- 4 Polar Orbiting (POES)
- operational data exchange within WMO global network

- Preparation for Next-Generation Met Missions – 2017-2020

- JPSS, GOES-R, Post-EPS



Next Gen Geostationary Satellite: GOES-R



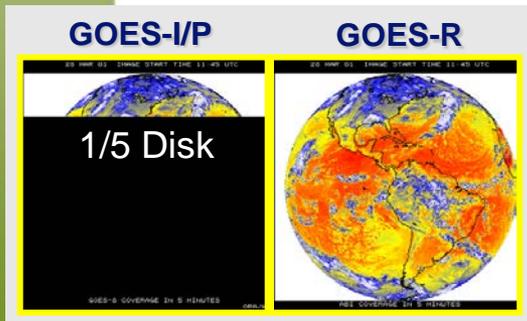
GOES-now

3 satellites in orbit
5 Imager bands
30 min full disk



GOES-R

Launch 2016
16 Imager bands
5 min full disk



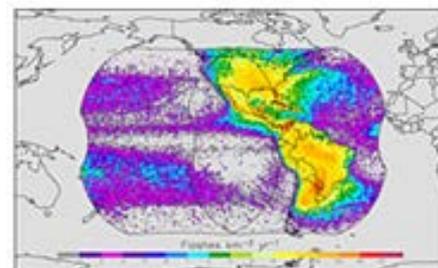
Baseline Products

- Advanced Baseline Imager (ABI)**
 - Aerosol Detection (Including Smoke and Dust)
 - Aerosol Optical Depth (AOD)
 - Clear Sky Masks
 - Cloud and Moisture Imagery
 - Cloud Optical Depth
 - Cloud Particle Size Distribution
 - Cloud Top Height
 - Cloud Top Phase
 - Cloud Top Pressure
 - Cloud Top Temperature
 - Derived Motion Winds
 - Derived Stability Indices
 - Downward Shortwave Radiation: Surface
 - Fire/Hot Spot Characterization
 - Hurricane Intensity Estimation
 - Land Surface Temperature (Skin)
 - Legacy Vertical Moisture Profile
 - Legacy Vertical Temperature Profile
 - Radiances
 - Rainfall Rate/QPE
 - Reflected Shortwave Radiation: TOA
 - Sea Surface Temperature (Skin)
 - Snow Cover
 - Total Precipitable Water
 - Volcanic Ash: Detection and Height

- Geostationary Lightning Mapper (GLM)**
 - Lightning Detection: Events, Groups & Flashes
- Space Environment In-Situ Suite (SEISS)**
 - Energetic Heavy Ions
 - Magnetospheric Electrons & Protons: Low Energy
 - Magnetospheric Electrons: Med & High Energy
 - Magnetospheric Protons: Med & High Energy
 - Solar and Galactic Protons
- Magnetometer (MAG)**
 - Geomagnetic Field
- Extreme Ultraviolet and X-ray Irradiance Suite (EXIS)**
 - Solar Flux: EUV
 - Solar Flux: X-ray Irradiance
- Solar Ultraviolet Imager (SUVI)**
 - Solar EUV Imagery

Future Capabilities

- Advanced Baseline Imager (ABI)**
 - Absorbed Shortwave Radiation: Surface
 - Aerosol Particle Size
 - Aircraft Icing Threat
 - Cloud Ice Water Path
 - Cloud Layers/Heights
 - Cloud Liquid Water
 - Cloud Type
 - Convective Initiation
 - Currents
 - Currents: Offshore
 - Downward Longwave Radiation: Surface
 - Enhanced "V"/Overshooting Top Detection
 - Flood/Standing Water
 - Ice Cover
 - Low Cloud and Fog
 - Ozone Total
 - Probability of Rainfall
 - Rainfall Potential
 - Sea and Lake Ice: Age
 - Sea and Lake Ice: Concentration
 - Sea and Lake Ice: Motion
 - Snow Depth (Over Plains)
 - SO₂ Detection
 - Surface Albedo
 - Surface Emissivity
 - Tropopause Folding Turbulence Prediction
 - Upward Longwave Radiation: Surface
 - Upward Longwave Radiation: TOA
 - Vegetation Fraction: Green
 - Vegetation Index
 - Visibility



Geostationary Lightning Mapper (GLM)

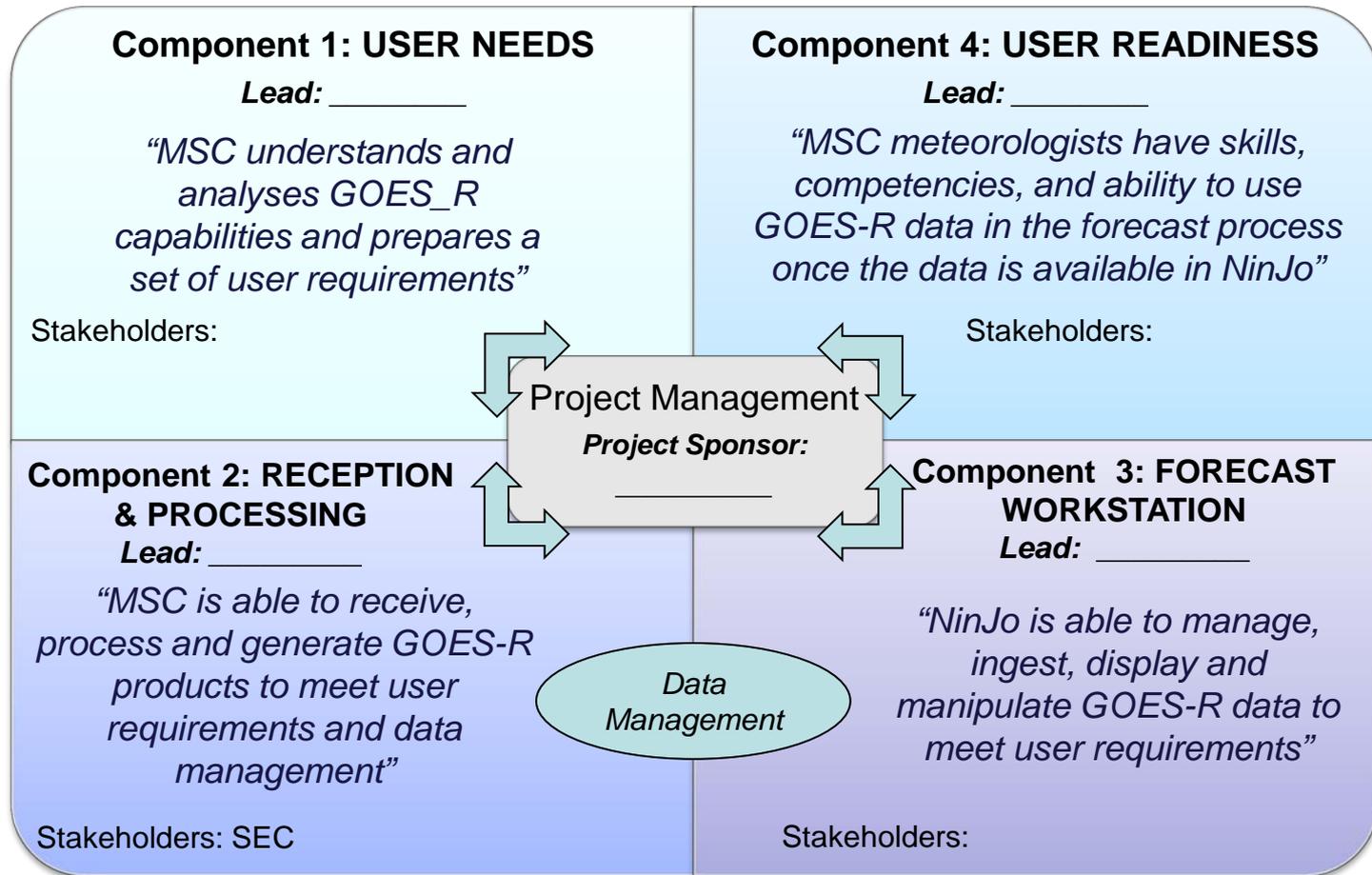


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Preparing for GOES-R



Recommendation: Establish GOES-R Project Board (Prince2) Directors with Component Leads (*SENIOR USERS & SUPPLIERS*)

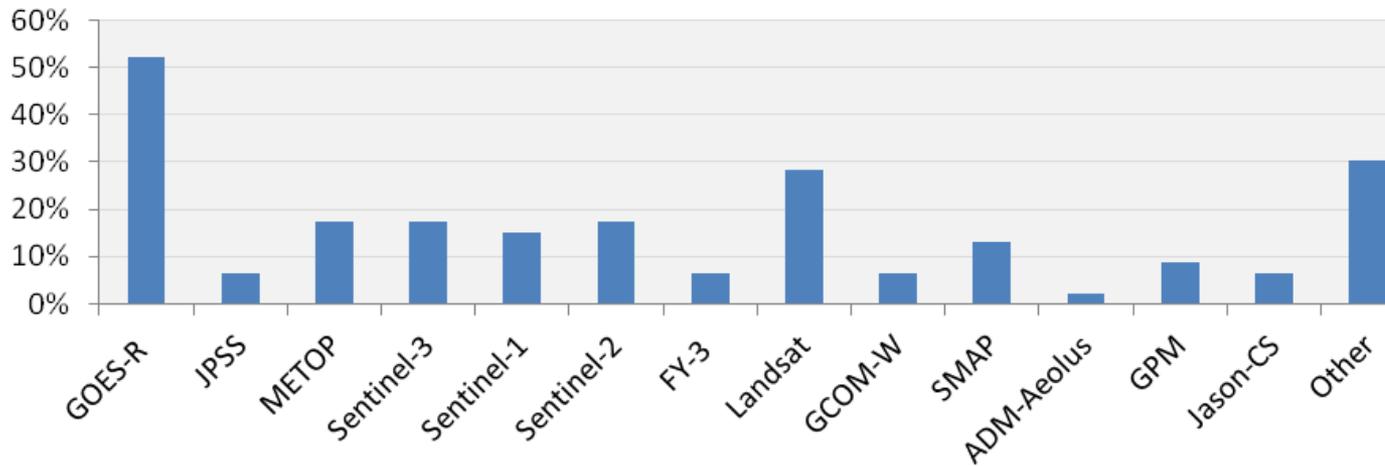


Satellite Data Requirements in RA III / RA IV

- WMO endorsed working group;
- consists of a representative number of members from the satellite data user community in the Region, joined, as associate members, by satellite data providers and WMO.
- maintains an updated list of satellite data and products available to the Region through existing dissemination services.
- regularly reviews sources of regional needs and undertakes, as needed, further information gathering, such as surveys, to ensure that views of WMO Members in the Region are adequately represented.
- maintains a dialogue with satellite data providers of relevance to the Region, and other partners as needed, to ensure that its recommendations are implemented.

RA III / RA IV Survey Results

Q3B - You are planning to use data from which satellites



Q7 - Do you intend to buy direct readout stations for the next satellite generation?

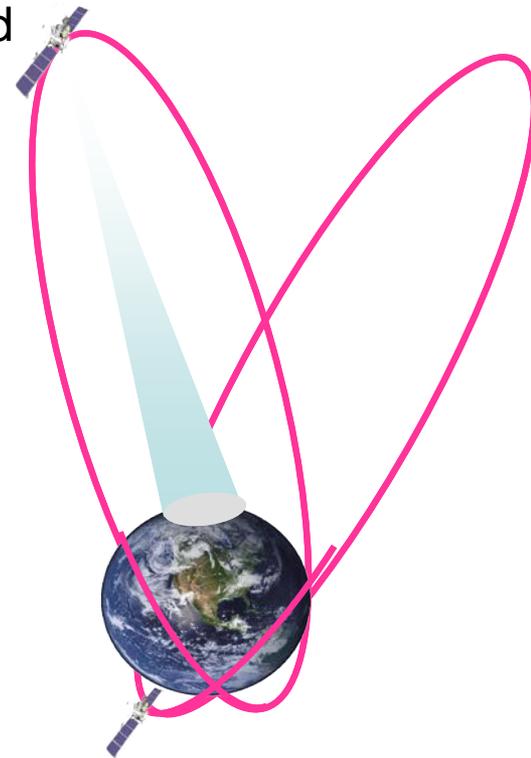


Key messages:

- there is a coordinated group of non-U.S. users from the Americas of GOES (and other) satellite data
- that there is high dependency of these users on U.S. satellites,
- that the group's feedback should be considered in the operations and planning of U.S. satellites

Canadian Polar Communications and Weather Mission (PCW)

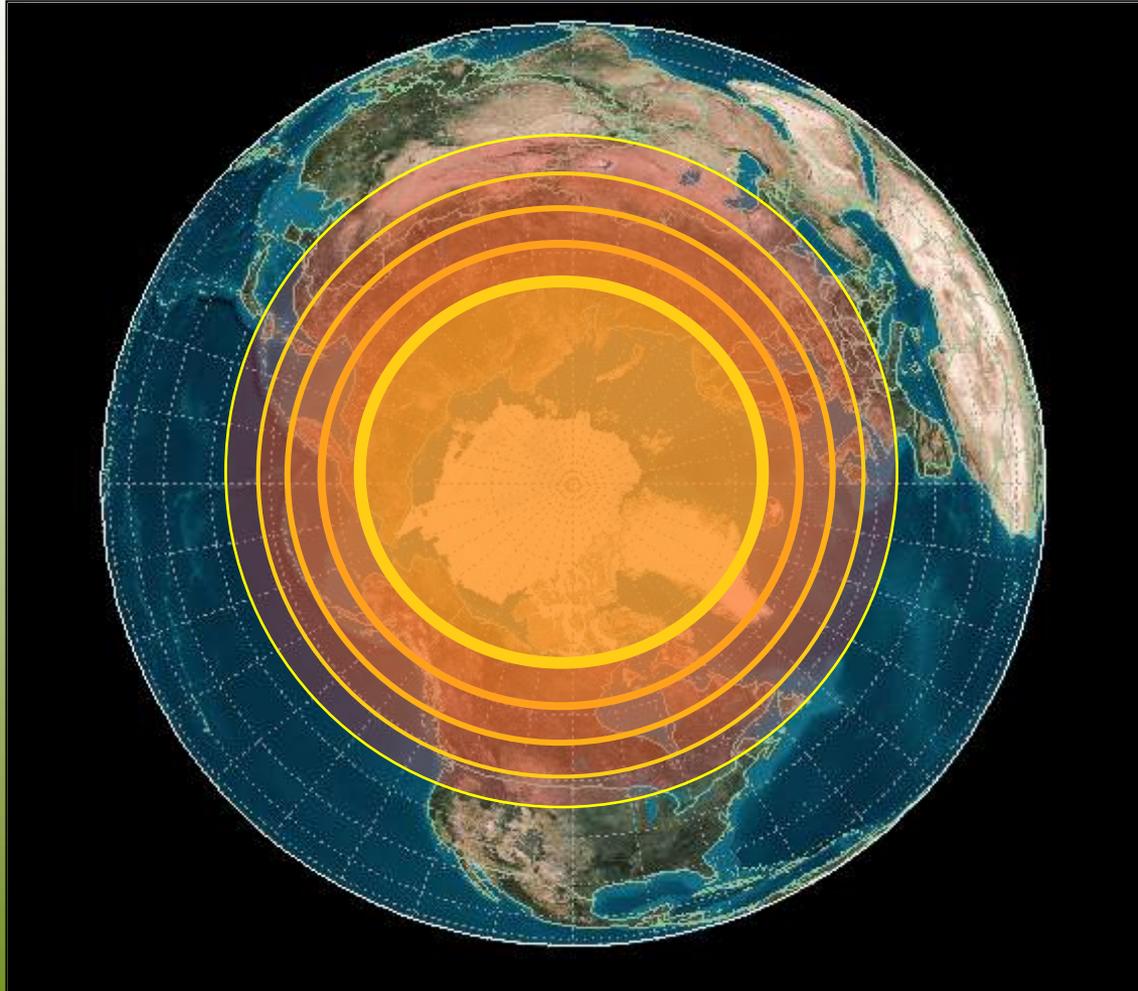
- Mission concept to support Canadian interests in the Arctic developed by Canadian Space Agency (CSA)
 - in partnership with Environment Canada (EC) and Department of National Defence (DND)
- Requirements
 - civil and military broadband communications
 - weather imaging
 - space weather
- CSA Phase A studies completed - 2012
 - 2-satellite, HEO orbit (Molniya) concept
- Military narrowband communications (UHF) requirements added – DND + Allies
- Approval by Government required to proceed



PCW Weather – High Level Requirements

- ‘GEO-like’ continuous imaging of Arctic circumpolar region
- ‘GEO-like’ spatial and temporal resolution
- ‘next-generation’ meteorological imager
- near-real time processing to L1c for delivery to Environment Canada
- compatibility with GEO imagers as part of WMO Global Observing System
 - end-to-end implications to achieve this class of performance
 - e.g., radiometric/geometric/spectral instrument performance, calibration, etc

PCW Weather – Spatial Coverage



Continuous Imaging

- 24 hours
- ≤ 20 min refresh
(goal: ≤ 15 min)

Spatial Coverage

- 100% - 65°N - 90°N
- $\geq 95\%$ - 60°N - 65°N
- $\geq 90\%$ - 55°N - 60°N
- $\geq 80\%$ - 50°N - 55°N
- $\geq 70\%$ - 45°N - 50°N
- Best effort* - $<45^{\circ}\text{N}$

On-demand Imaging *(optional)*

- *user-selected sub-regions*
- ≤ 10 min refresh

Thank you!



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