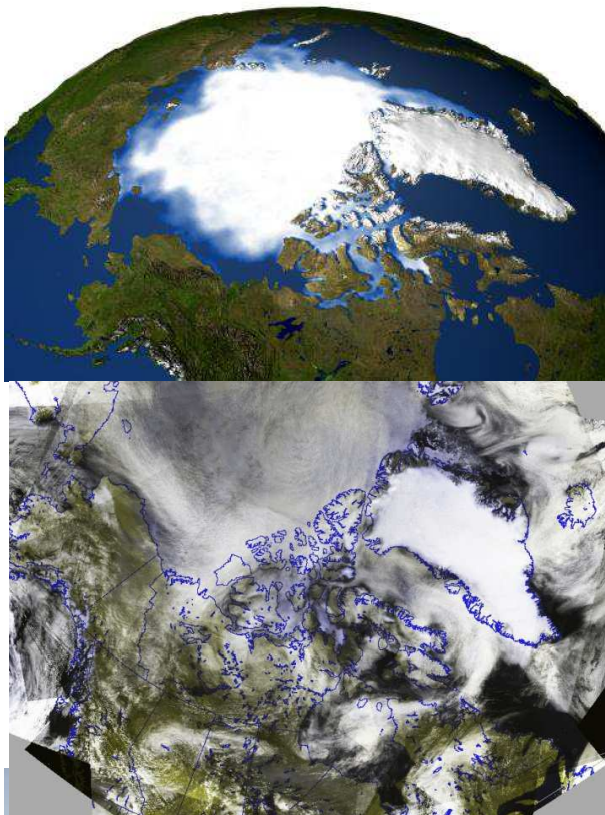


# Status of Canadian Polar Communications and Weather Mission (PCW)

Canadian Space Agency  
Environment Canada  
CGMS-42  
19-23 May, 2014





# Background

- 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





# Request for Information (RFI)

- RFI released to industry - November 2013
  - response date – January 2014
- Purpose
  - Inform industry of the proposed PCW initiative
  - Seek industry comments on the requirements, feasibility, cost, risk and business models
  - Inform the development of a business case for consideration by Government
- High-Level Requirements (capabilities) vs. specifications
  - seeking innovation and diversity of technical and business solutions
  - target: 2020-2022 launch

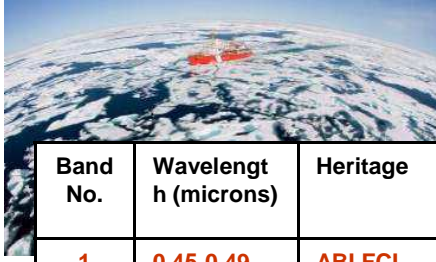


# Weather

## 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

# Imager Requirements



Band No.	Wavelength (microns)	Heritage	Priority	GSD (km)		Main applications
				Goal	Max	
1	0.45-0.49	ABI,FCI	1	0.5	1.5	Surface, clouds, aerosols
2	0.59-0.69	ABI, FCI	1	0.5	1.5	Wind, clouds, ice mapping
3	0.704-0.714	MERIS-09	2	0.5	1.5	Water quality, chlorophyll
4	0.85-0.89	ABI, FCI	1	0.5	1.5	Wind, aerosols, vegetation
5	1.04 – 1.06	SGLI SW1	2	1.0	3.0	Snow grain and clouds
6	1.37-1.39	ABI, FCI	2	1.0	3.0	Cirrus detection
7	1.58-1.64	ABI, FCI	1	0.5	1.5	Snow-cloud distinction, ice cover
8	2.22-2.28	ABI, FCI	1	1.0	3.0	Aerosol, smoke, cloud phase
9	3.80-4.00	ABI, FCI	1	2.0	3.0	Fog, fire detection, ice/cloud separation, wind, phase.
10	5.77-6.60	ABI, FCI	1	2.0	3.0	Wind, high level humidity
11	6.75-7.15	ABI, MTSAT	2	2.0	3.0	Wind, mid level humidity
12	7.24-7.44	ABI, FCI	1	2.0	3.0	Wind, low level humidity,SO <sub>2</sub>
13	8.30-8.70	ABI, FCI	1	2.0	3.0	Total water, cloud phase
14	9.42-9.80	ABI, FCI	2	2.0	3.0	Total ozone
15	10.1-10.6	ABI, FCI	2	2.0	3.0	Cloud, surface, cirrus
16	10.8-11.6	ABI, HIRS	1	2.0	3.0	Cloud, SST, ash
17	11.8-12.8	ABI, FCI	1	2.0	3.0	Ash, SST
18	13.0-13.6	ABI, FCI	1	2.0	3.0	Cloud height
19	13.5-13.8	MODIS,HIRS	2	2.0	6.0	Cloud height, low level temperature
20	13.8-14.1	MODIS,HIRS	2	2.0	6.0	Cloud height, mid level temperature
21	14.1-14.4	MODIS,HIRS	2	2.0	6.0	Cloud height, high level temperature

**Advanced 'Next-Gen' Imager**  
(MTG, GOES-R class)

## Channels

Priority 1 (req'd) -12

Priority 2 (desirable) – 9

## Ground Sampling Distance

(+/- P/8 hrs from apogee)

Max. 1.5km-6.0km

Goal 0.5km-2.0km

*Desirable (for INR)*

1 x 0.5km channel

1 x high-res. IR (Arctic night)

## Calibration

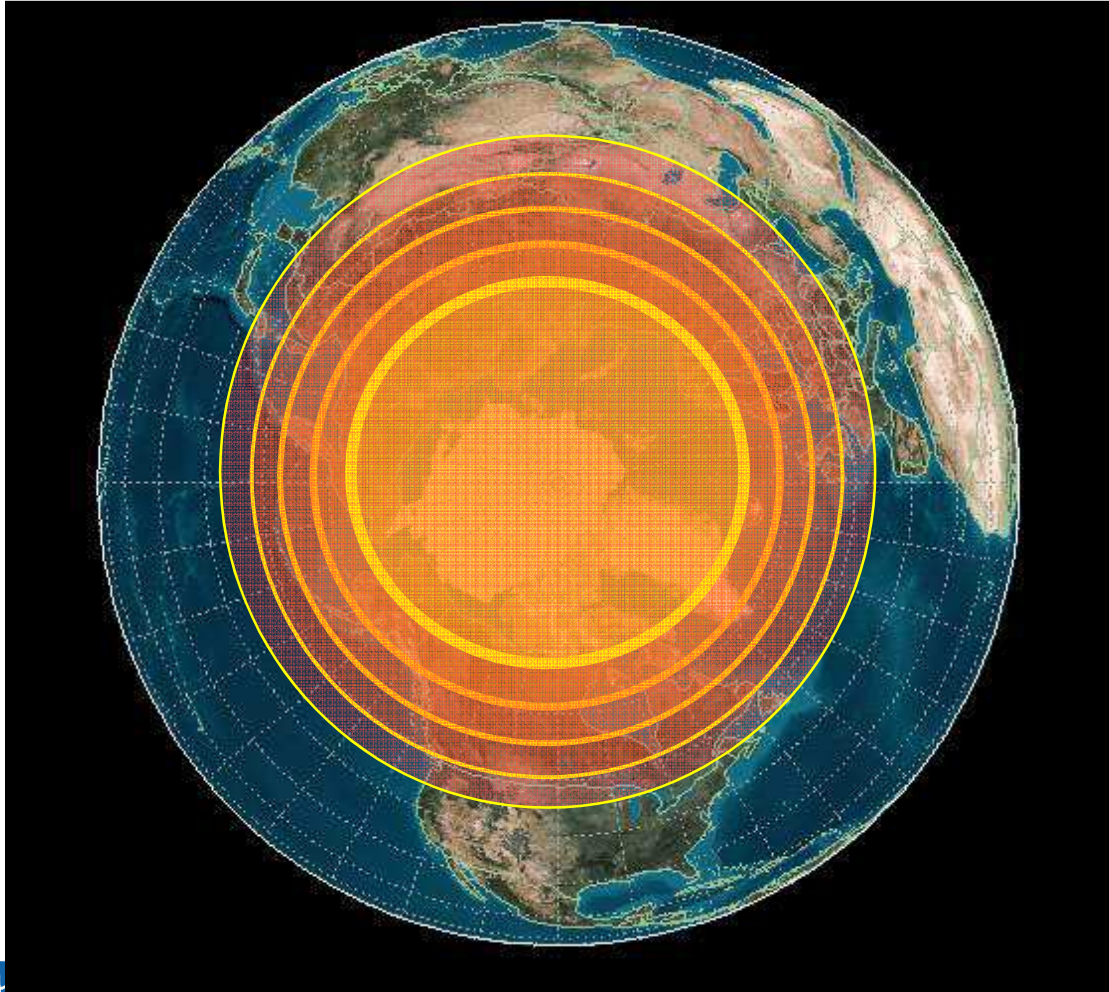
- pre-launch and on-orbit characterization appropriate to support GSICS\* practices

\*Global Space-based Inter-calibration System





# Weather Spatial Coverage



Viewing Angle  $\leq 70^\circ$

## Continuous Imaging

- 24 hours
- $\leq 20$  min refresh  
(goal:  $\leq 15$  min)

## Spatial Coverage

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

## On-demand Imaging (optional)

- user-selected sub-  
regions
- $\leq 10$  min refresh



# Weather Ground Segment

- Continuous real-time downlink
  - simultaneous reception from all visible satellites
  - required: Arctic Area of Interest (AOI)
  - *goal: areas of processable imagery outside Arctic AOI*
- Products
  - Level 0, Level 1
    - routine processing to L1c to standardized grid for Arctic region
    - routine processing to L1b or L1c outside Arctic region (tbd)
    - latency - 20 min
      - *goal:  $\leq 15$  min or  $\leq$  image refresh frequency*
- Image quality, monitoring, and calibration tools
- L2+, user services, long-term preservation outside scope of RFI



# Status

- RFI Outcomes
  - 20+ respondents, incl. several complete system solutions
  - technical feasibility confirmed
  - variety of space and ground segment architectures proposed
  - variety of procurement and service models proposed
  - little cost information
- Weather
  - all weather requirements can be met or exceeded
- Next Steps
  - Autumn 2014 - options and business case development
    - new Space Policy Framework and governance processes
    - consideration by Government