



CSPP GEO and LEO at the Meteorological Service of Canada

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Madison, Wisconsin
June 21st 2022

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Transformation, Innovation and Engineering Division
Monitoring and Data Services Directorate
Meteorological Service of Canada

Outline

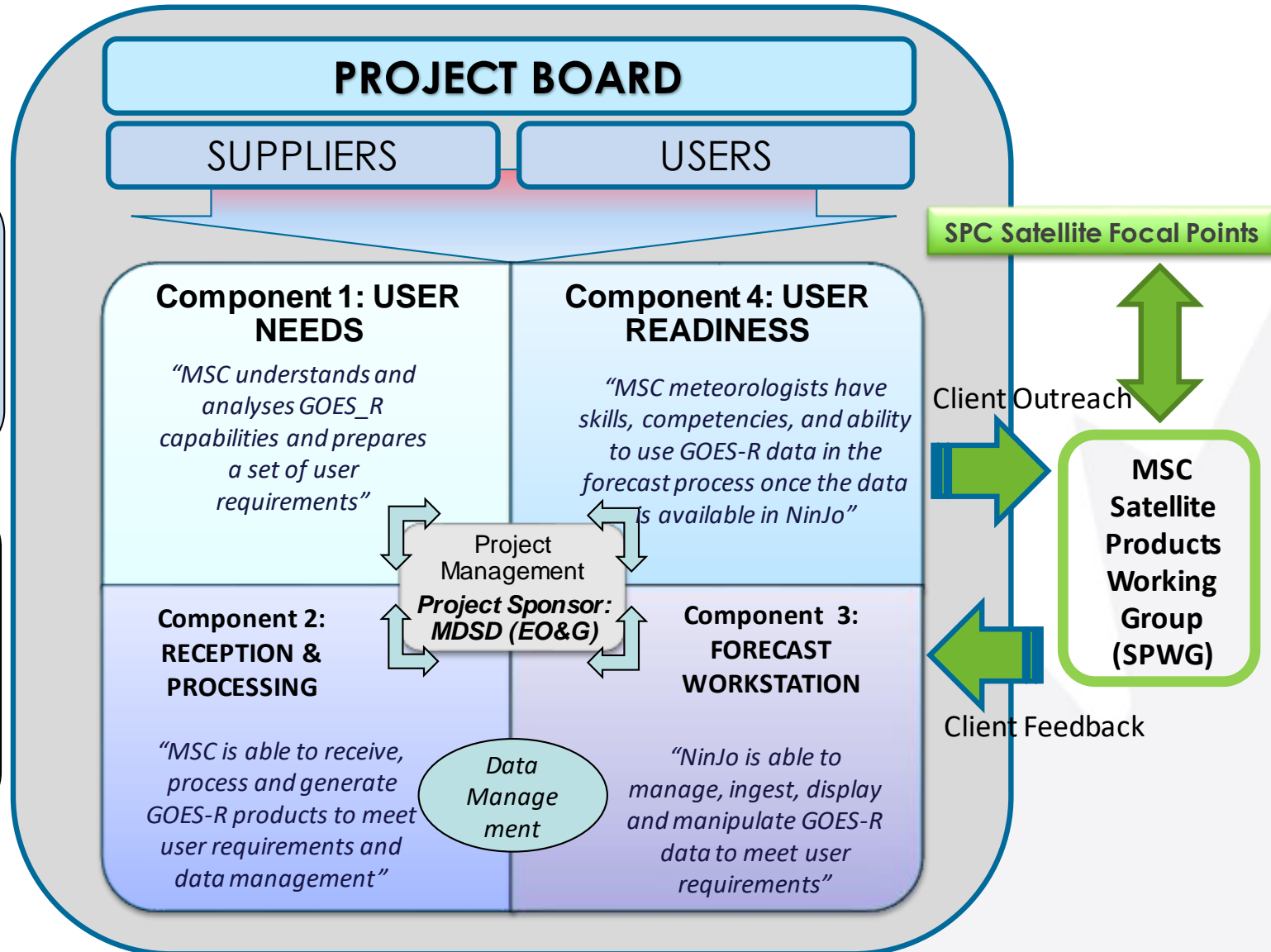
- GEO at the MSC
- LEO at the MSC
- Satellite EO developments in Canada

GEO Network Transition - Before

- 5 GOES-East, 4 GOES-West stations,
- 1 Backup (CMC)
 - Centralized (CMC) & Regional products
- Ground Station Infrastructure
 - 5.0 m fixed-direction antennas
- Direct broadcast since 1995



GOES-R Readiness Project



Geostationary Lightning Mapper Project

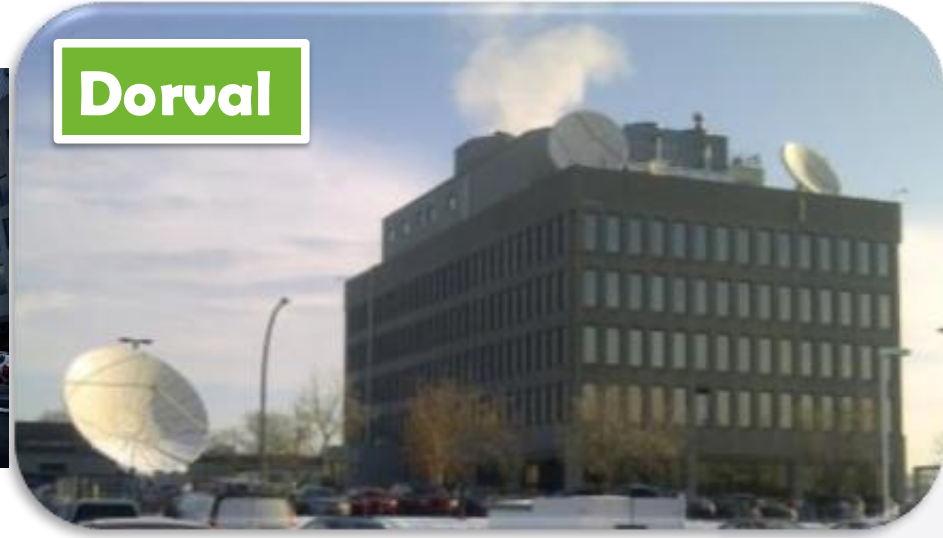
"Joint project with NOAA on product validation and application in Canada"

Component 5: CCMEP Activities

"GOES-R requirements at "CMC" are met and activities are communicated and coordinated"



GOES-R Infrastructure Renewal



Dorval



Vancouver

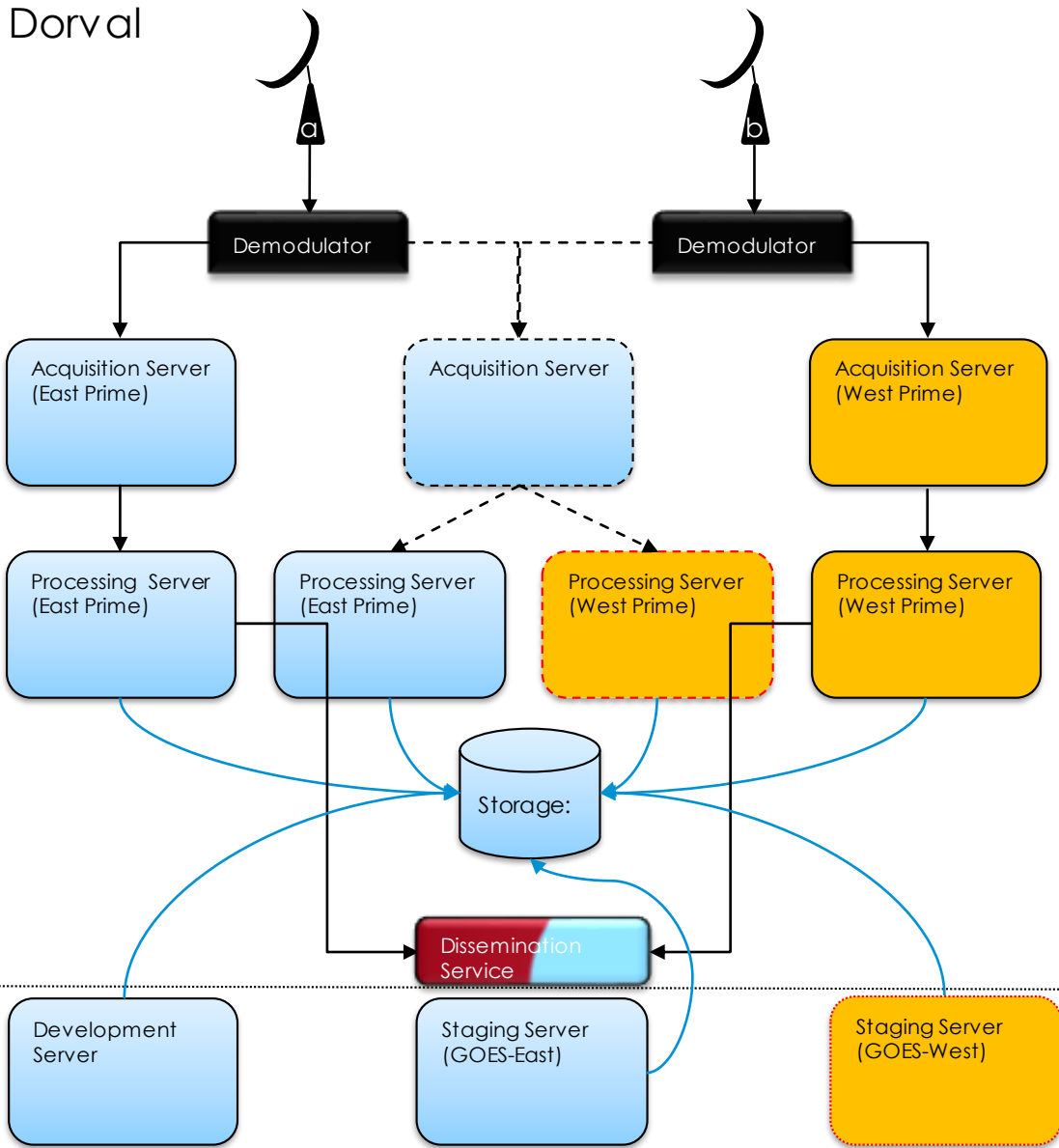


Downsview

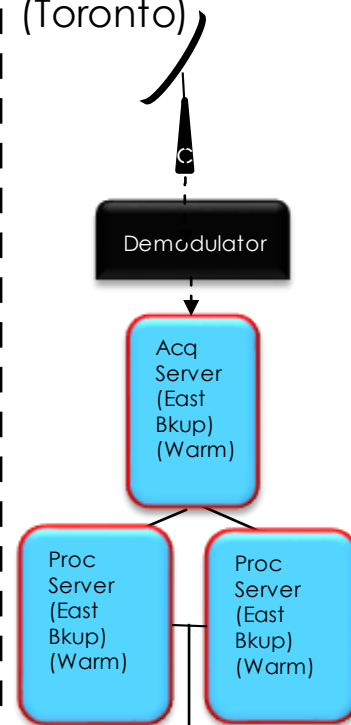


GOES-R Data Processing Architecture

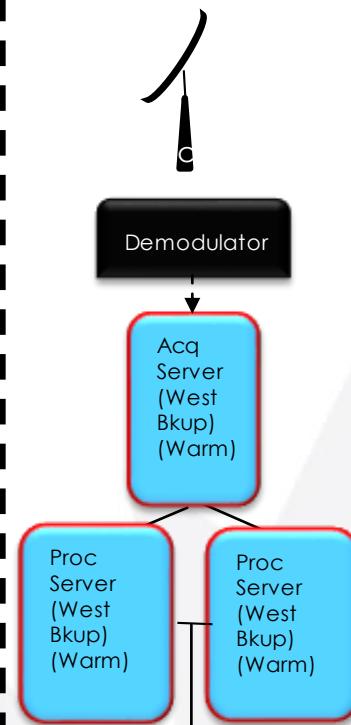
Dorval



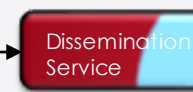
Downsview
(Toronto)



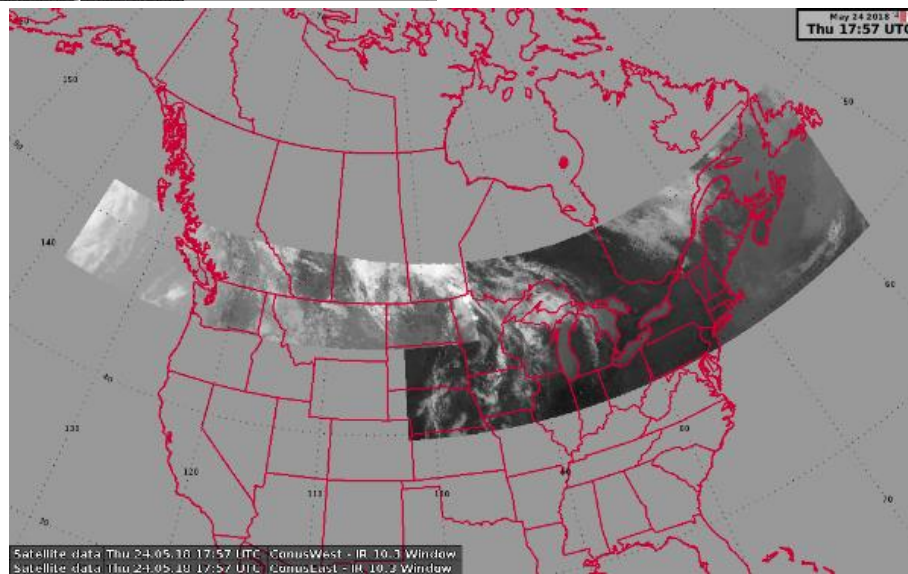
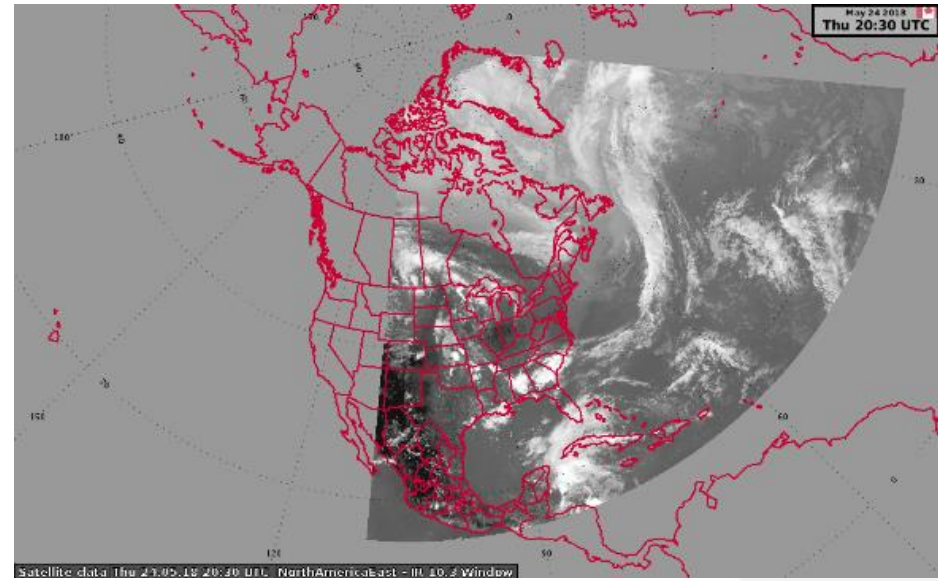
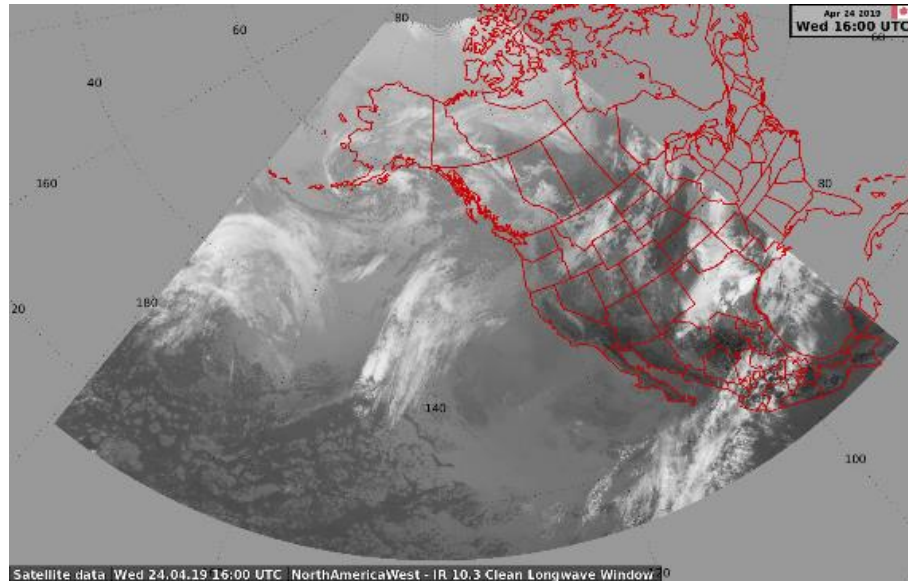
Vancouver



Eastgate (or CMC-Dorval)



NINJO Products – FD AND CONUS



All Channels

RGBs on the fly

NINJO Workstation

The screenshot displays the NINJO Workstation interface. At the top, the main window title bar reads "Basic_Scene1 - Mainwindow (DWT chungonormal)". Below it is a menu bar with options: File, Edit, View, Editing, Map area, Active scene, Scenes, Tools, Product, Procedures, Help. A toolbar with various icons is located below the menu bar. A red arrow points to this toolbar with the label "Main window tool bars".

Below the main toolbar is a row of icons representing loaded data layers. A red arrow points to these icons with the label "Loaded layers of data fields". To the right of this row, another red arrow points to a small icon labeled "AL" with the label "Access layers".

The main display area is divided into several sections. On the left, a vertical toolbar contains icons for data loading and image enhancement, with a red arrow pointing to it and the label "Layer tool bars [data loading and image enhancement]".

The central part of the screen shows a large map titled "500 mb May 03 2012 Thu 12:00 UTC". The map displays a color-coded weather system over a geographical area. A red arrow points to the map area with the label "3 secondary scenes loaded with different types of data fields".

On the right side, there are three smaller secondary scenes stacked vertically, each showing different data fields. Red arrows point from the main map to these secondary scenes.

At the bottom of the main map area, there is a time navigation bar with a slider and a play button. A red arrow points to it with the label "Time navigation 14 days of data are archived".

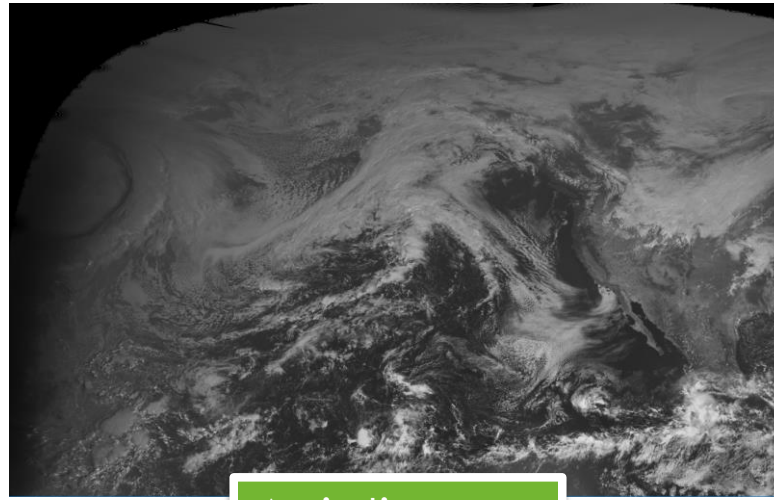
At the bottom of the screen, there is a status bar with a table of data fields:

NWP-Model	Thu 03.05.12 12:00 UTC	ABSV, 10E-5.1s, 500 [isobaric level]	GEMREGIONAL+012h	03.05.12 00:00 UTC
NWP-Model	Thu 03.05.12 12:00 UTC	WND, kt, 500 [isobaric level]	GEMREGIONAL+012h	03.05.12 00:00 UTC
NWP-Model	Thu 03.05.12 12:00 UTC	HGT 500 [isobaric level]	GEMREGIONAL+006h	03.05.12 06:00 UTC
Satellite data	Thu 03.05.12 12:00 UTC	GOES-E - IR 6.7 WaterVapour		

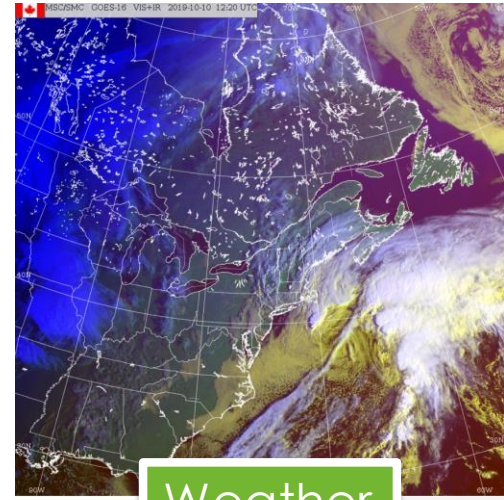
Other Client Products



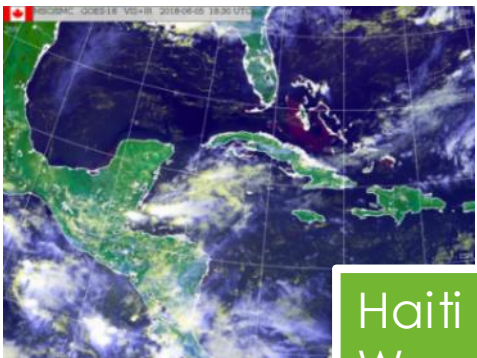
National IM products



Aviation & Defence



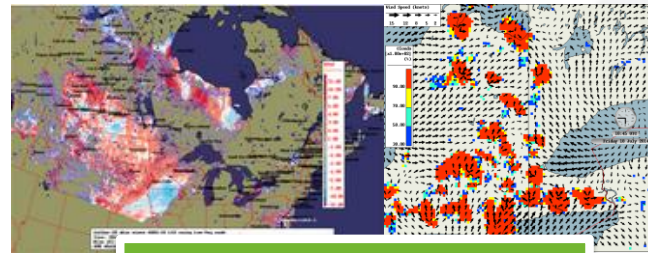
Weather Office



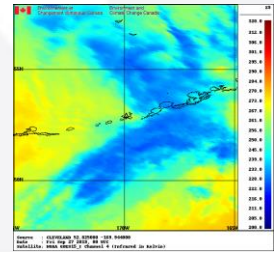
Haiti Wxo



Canadian Ice Service



Research and Development



Env. Emergencies

Canadian Meteorological & Oceanographic Society (CMOS) Training



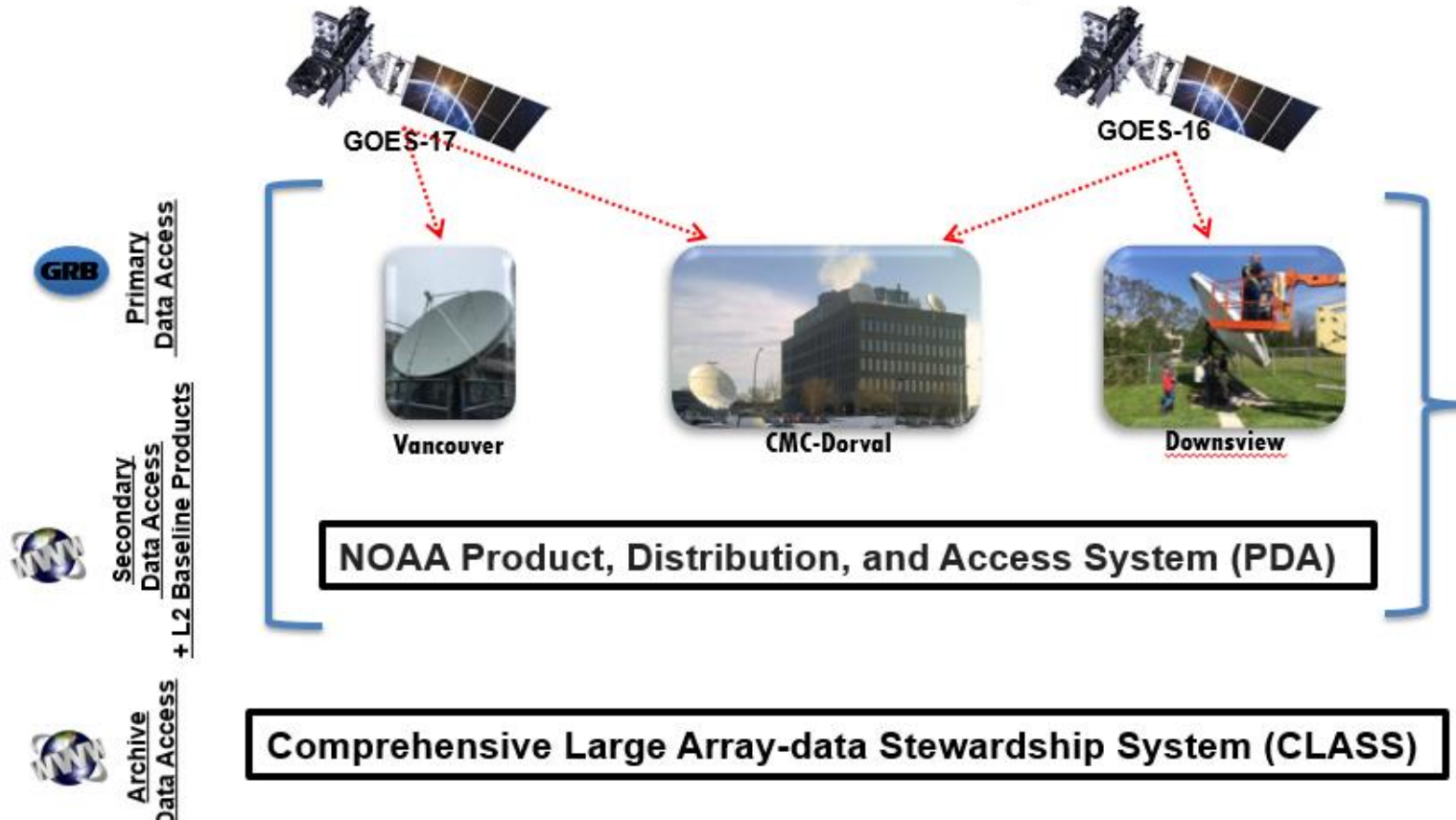
WOW! This satellite stuff is so cool!!!



MSC's GOES-R End-to-End System

MSC operations in Sept 2019

MSC operations in Jan 2018

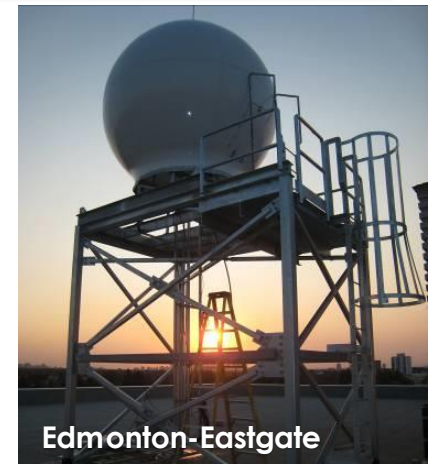


End Users

Science (RnD)	Ninjo (SPCs)	CCMEP	ADS/DWS	NavCAN	Haiti Wxo	ECCC Wxo	CIS
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MSC's polar-orbiting satellite reception network provides near real-time satellite data...

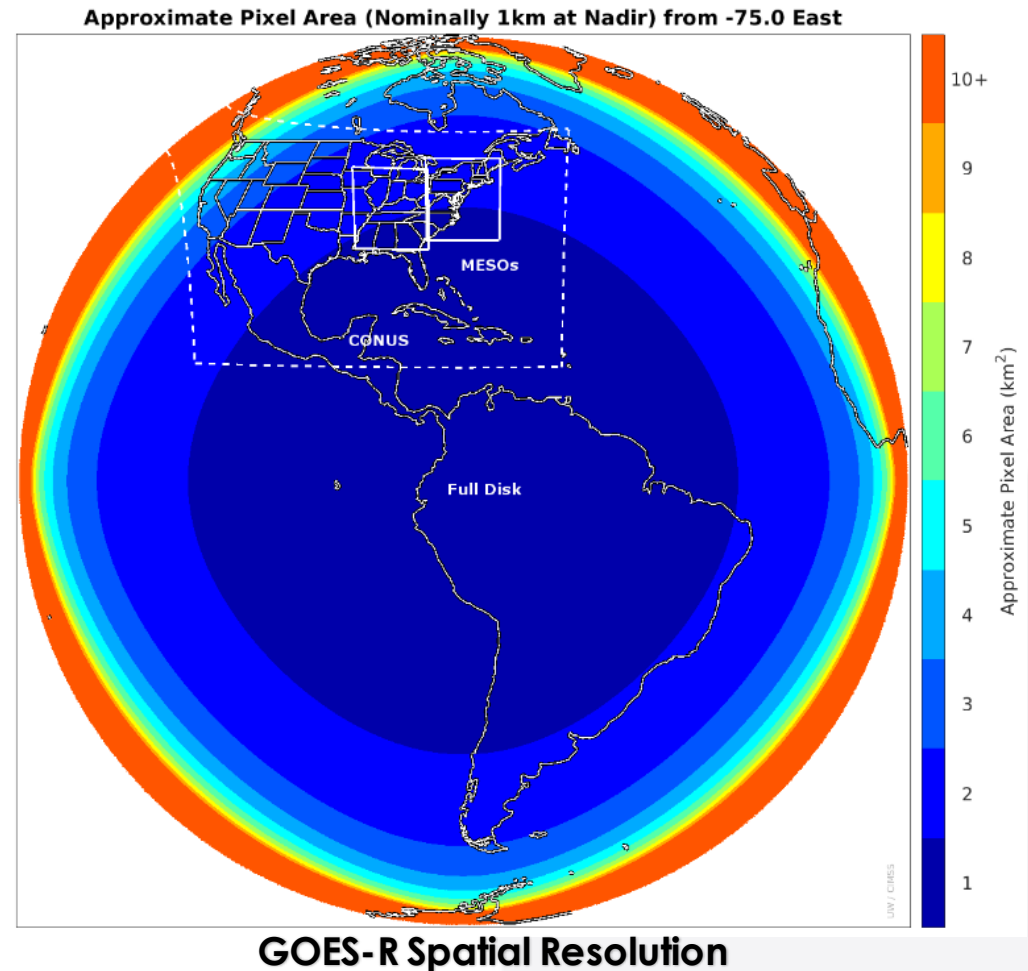
- HRPT stations in Gander (2007), Edmonton-Eastgate (2009), Stony Plain (2009), and Resolute (2010)
- Tracking NOAA and EUMETSAT platforms (NOAA and Metop series satellites)
- Ground Station Infrastructure
 - 2.4 m L-/X-Band tracking antenna inside a radome
 - Reception electronics and product generation from Seaspace Corp.



...to support the MSC's weather and environmental monitoring programs

Low spatial resolution of GOES satellites over the North...

- **User Groups:** Public forecasts, Marine, Aviation (Civil), Aviation (Defence), Emergency Response (eg. Volcanic Ash), Ice, Numerical Weather Prediction, Met Research, Forestry, Search & Rescue
- Satellites received:
 - L-Band: NOAA-15, NOAA-18, NOAA-19, METOP-B, METOP-C
 - X-Band: Aqua, Terra, Suomi-NPP
- **WMO DBNet Contributions:**
 - Currently contributing to EARS and NOAA from Gander and Edmonton stations



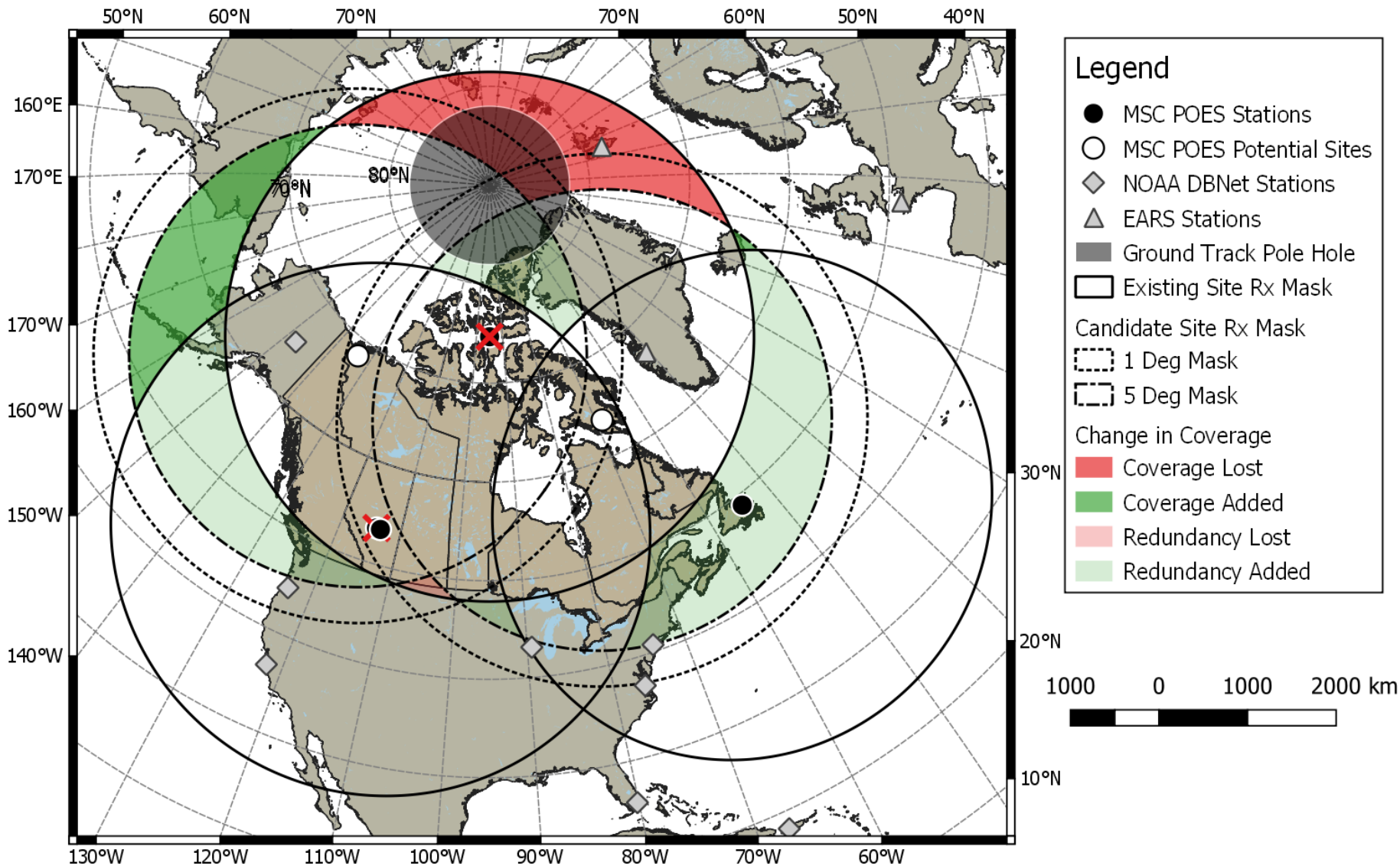
...makes NRT POES data critical for Arctic forecast operations

MSC's polar-orbiting satellite reception network has surpassed its life cycle management date...

- The benefits of a renewed polar-orbiting satellite reception network (aka. POES network) for ECCC are:
 - Address rust-out of existing infrastructure to ensure continuity of critical meteorological satellite data for ECCC's weather and environmental monitoring programs
 - Expanded network coverage and enhanced redundancy in the Arctic, where these data are most valuable
 - Reducing the latency of satellite products to end users through an improved data processing environment
 - Access to next generation satellite data that will enhance the meteorological information available to ECCC's operational weather forecasting and environmental monitoring programs

...and has received new funding to replace the network

Coverage comparison between existing and renewed LEO networks



ECCCC will implement the “POES Renewal project” over 5 years...



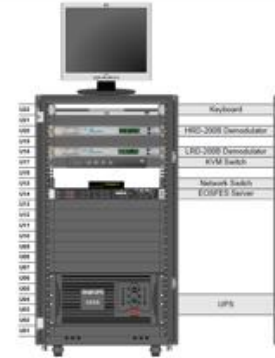
Edmonton-Eastgate (AB)



Gander (NL)



Inuvik (NWT) + Iqaluit (NU) ** NEW



Indoor Equipment on-site



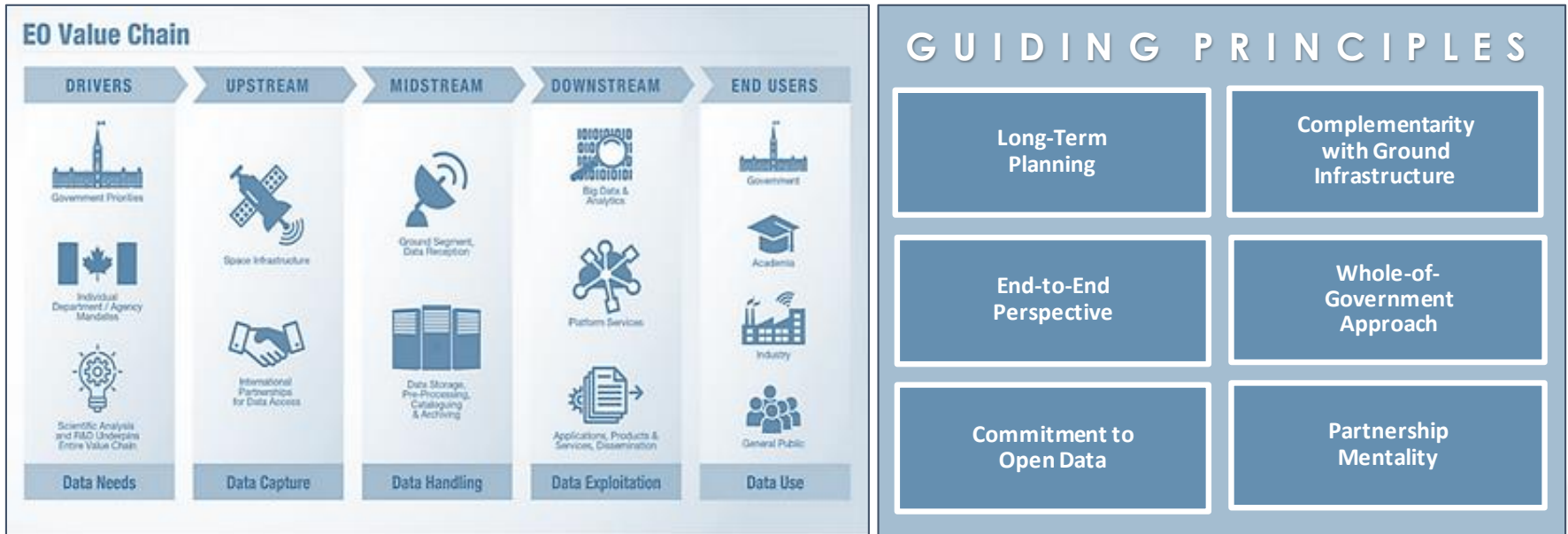
SSC Enterprise Data Centres



NOAA (JPSS) and EUMETSAT (Metop-SG) are planning to launch 9 new meteorological satellite missions, providing data continuity until the 2040s

...expanding network coverage and enhancing redundancy in the Arctic, where the data are most valuable

Advancing SEO capabilities requires an 'end-to-end' perspective following guiding principles...



...to ensure the full socio-economic value of SBEO is realized for federal departments and for Canadians

Resourceful, Resilient, Ready: Canada's Strategy for Satellite Earth Observation

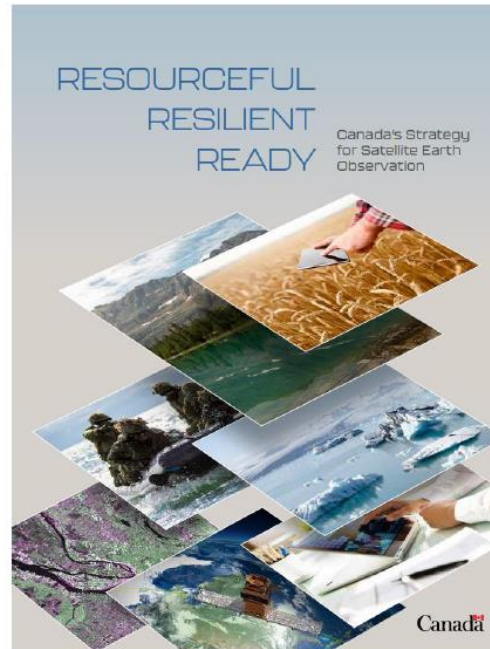
Economy Press Release

Canada Announces Strategy for Satellite Earth Observation

Twenty-one Canadian organizations receive funding to make innovative use of Earth observation data LONGUEUIL, QC, Jan. 20, 2022 /CNW/



- 1) Ensure the benefits of satellite EO are maximized
- 2) Harness satellite EO to tackle climate change and issues that matter to Canadians
- 3) Strengthen delivery of critical services to keep Canadians healthy, safe and informed
- 4) Inspire satellite EO skills and capacity development for the next generation



MESSAGE FROM THE MINISTERS

In 2019, the Government of Canada proudly announced Exploration, Innovation, Immigration: A New Space Strategy for Canada¹. In this document, our Government committed to ensuring Canada's leadership in leveraging satellite data to support scientific excellence, innovation and economic development. With the impacts of climate change becoming more evident every day, innovations in space technologies provide Canadians with reliable and timely information to support science-based decision-making, while supporting countless services across the country and driving our economy.

Canada has a long history as a global leader in satellite Earth observation technology, beginning in 1966 when Canada became only the third country to operate a satellite in orbit. We are now laying the groundwork for the continuation of that excellence. As the Minister of Innovation, Science and Industry, in collaboration with the Honourable Steven Guilbeault, Minister of Environment and Climate Change and the Honourable Jonathan Wilkinson, Minister of Natural Resources, we are following up on the commitments made in the Space Strategy by presenting our vision for the future. Resourceful, Resilient, Ready: Canada's Strategy for Satellite Earth Observation, developed in consultation with industry and academia, our new strategy outlines the path to equipping Canada with as many tools as possible to confront climate change and to support Canadians in the 21st century.

Satellites are an integral part of our lives. Many of our everyday decisions, from bringing an umbrella on a walk to deciding if roads are safe to drive, are informed by data provided by satellites passing over our country. National safety and security are also dependent on the critical vantage point of space as increasingly detailed satellite data supports decision making in our communities related to wildfires, floods, and other natural hazards. Satellites help keep Canadians healthy by monitoring air quality in our cities, modelling the movement of disease-spreading species, and forecasting harmful algal blooms in our water. For Canadian industry, the growing demand for environmental and industrial intelligence is bolstering high-tech development. Start-ups and Earth observation firms are using artificial intelligence and advanced data analytics to provide science-based services, from daily crop maps that help agricultural producers feed Canadians to advanced forest growth models that help resource companies provide the products we need for a growing and vibrant population.

¹ <https://www150.comptes/Canada/Canada/SpaceAgency/Immigration.pdf>



In this new strategy, we outline the path forward to capitalize on satellite technology for day-to-day evidence-based decision making and planning. Recent and future investments in new satellite data streams and ground infrastructure will not only help ensure our services continue to deliver for Canadians, but will also see them expand their application in areas such as public health and infrastructure. The strategy highlights our plans to bring together Canada's best scientists to work in data-rich, high-powered analytics environments where better solutions for challenges like climate change and disaster management can be developed and implemented faster. It also recognizes the potential, and the value, of bringing our observations from space down to local communities, especially in Canada's North where the use of satellite information is becoming more important as we work to build resilience to climate change. Finally, the efforts outlined in the strategy provide the foundation to directly support Canada's world-class aerospace and high-tech sectors, building innovation, strengthening the economy and making our industries more competitive.

Our Government remains focused on unlocking the full potential of space technology. Recognizing social, economic, and environmental priorities here on Earth, we remain committed to equipping Canadians to excel in the jobs of the future, to support scientific excellence, to monitor and adapt to climate change, and to advance technology development for the benefit of all humankind.

The Honourable François-Philippe Champagne,
Minister of Innovation, Science and Industry

The Honourable Steven Guilbeault,
Minister of Environment and Climate Change

The Honourable Jonathan Wilkinson,
Minister of Natural Resources Canada

Budget 2021 – Funding given for satellite data reception (RADARSAT and LEO)
Budget 2022 – WildfireSAT mission

There is a recognized need to fill weather and climate data gaps in the North...



AOM – Arctic Observing Mission

Weather, greenhouse gases, air quality in the North



On May 29th, 2019 the daily high temperature reached 6 degrees C in Eureka, Nunavut

- AOM would provide authoritative information on weather, greenhouse gases, and air quality and space weather in the North
- Key international partners have expressed support for a partnership cost-shared approach to this mission



Government of Canada



- AOM will help Canada respond to key GC and ECCC priorities:
 - Predicting weather and environmental conditions
 - Building a strong economy post-COVID
 - Protecting safety and security of Canadians
 - Taking action on clean growth and climate change



...while also providing authoritative data on GHG emissions to inform decision making around climate change mitigation and adaptation

Summary

- The MSC's geostationary satellite reception network is resilient with GRB being a critical data feed for users
- The MSC's polar-orbiting satellite reception network is being renewed to improve LEO data availability
- Canada has developed a federal Satellite Earth Observation Strategy to guide EO investments for the next 15 years
- Many thanks to the support provided by NOAA, CIMSS, and the CSPP team for their excellent collaboration and continued support

Thank you

