



Ocean Science & Water Colour activities at the Canadian Space Agency

Genevieve Gariepy, Mission Manager, CSA

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Canadian Space
Agency

Agence spatiale
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THE SWOT MISSION

Surveying Earth surface water to help adapt to climate change and improve water management



Support to science (\$)

- Shared investment with ECCC and DFO
- Subsequent support planned – CSA Research Opportunities in Space Science (ROSS)



See ROSS
announcement
of opportunity



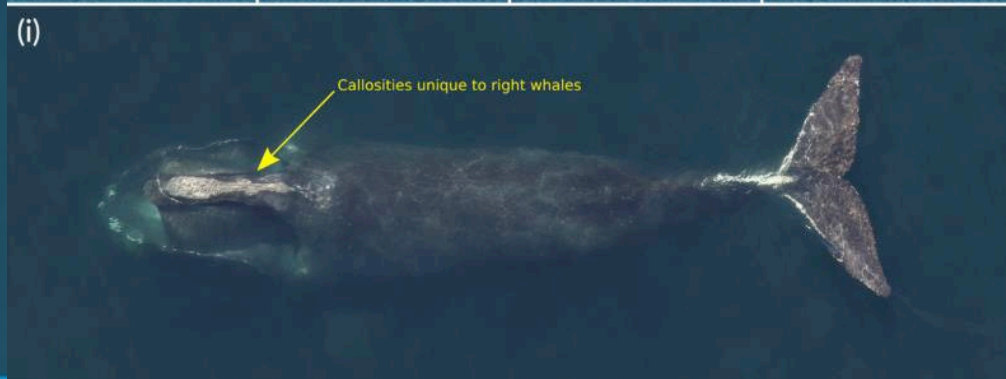
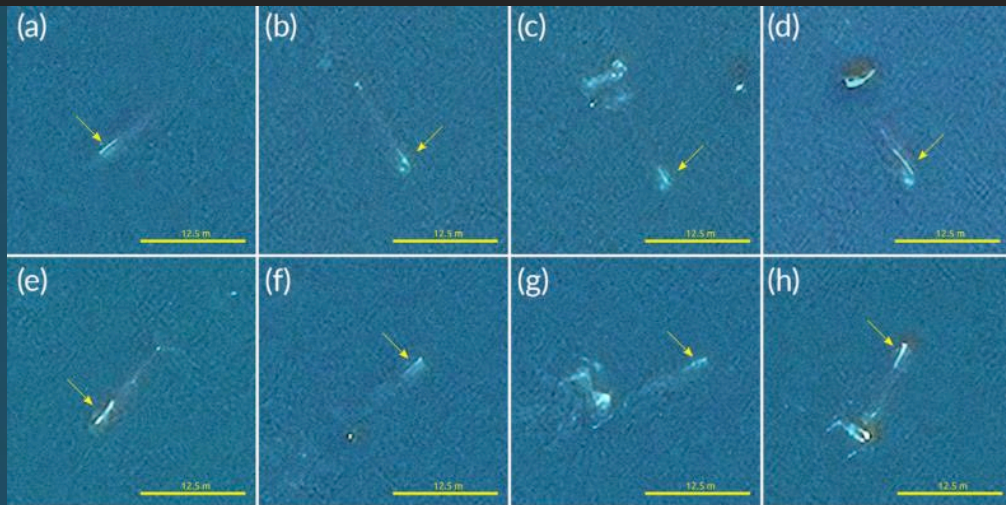
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smartWhales initiative



Strategy for Earth Observation

- Legend**
- Funding Announcement
 - Milestone
 - Publication



Water Colour: Hyperspectral mission concept

WHY

Inland Water quality

- Aquatic biogeochemistry and harmful algal blooms
- Reduce impacts across recreational usage, public health, operational costs

Health of coastal ocean environment

- Plankton bloom, bathymetry
- Sustainable aquaculture and fisheries
- Marine conservation

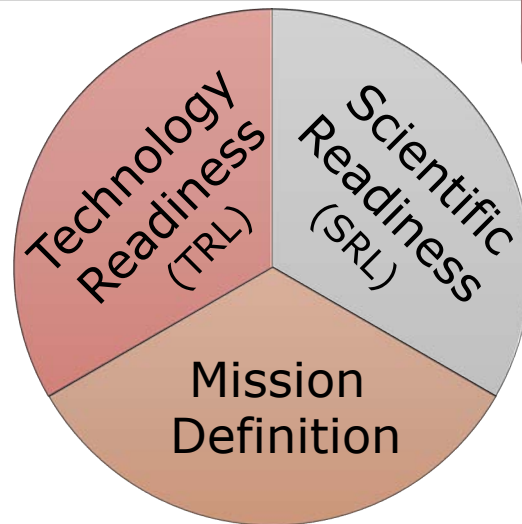
Hyperspectral imager

WHAT

- Spectral range: 350 – 1000 nm
- Spectral sampling: 2.5-5 nm
- Spatial resolution: 100 m

Sub-weekly revisit

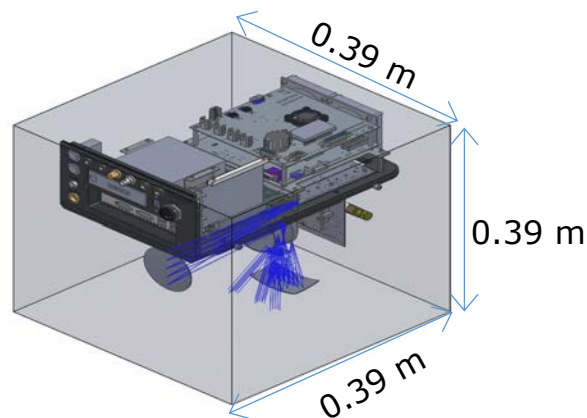
HOW



The WISE instrument

Swath width	150 km
GSD at nadir	100 m
Spectral range	380 – 970 nm
Spectral sampling	≤5 nm
# spectral bands	118
Peak SNR	350:1
Mass	10 kg
Volume	39x39x39 cm ³
Power	<70 W

Phase 0 concept
Completed in 2015

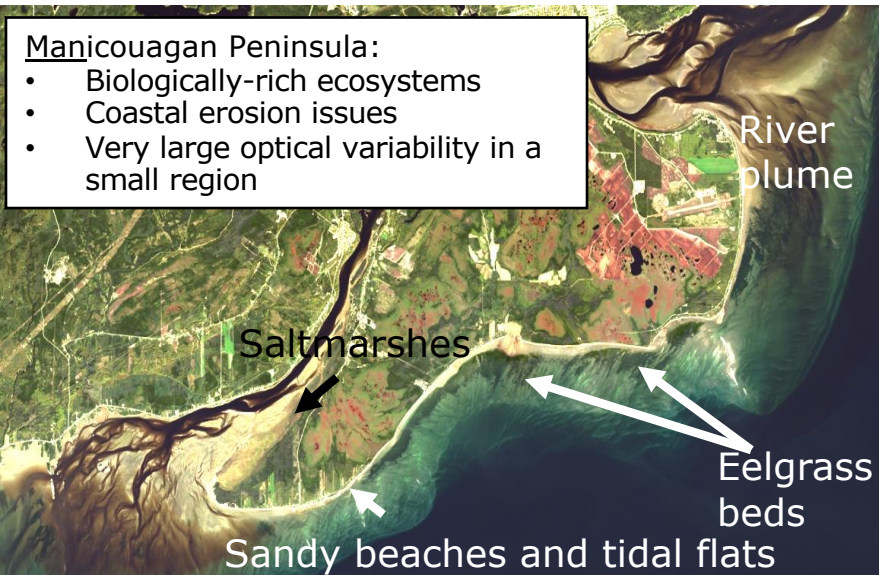


WISE prototype
Built 2017



WISE – airborne flights

2019: WISE-Man



Manicouagan Peninsula:

- Biologically-rich ecosystems
- Coastal erosion issues
- Very large optical variability in a small region

FAST grants



2022:Algae-WISE



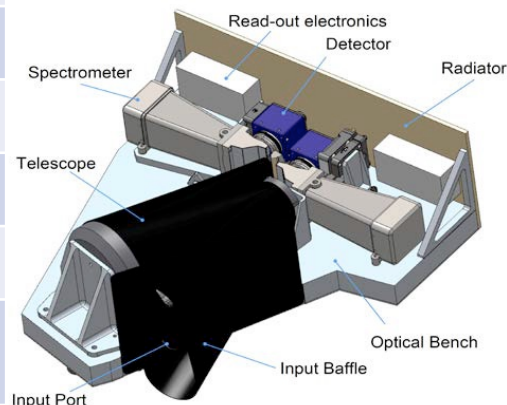
Micro- and macroalgae, phytoplankton functional type

Bathymetry, water constituents, bottom type mapping
Data available online (catalogue.ogsl.ca)

The DICE instrument

Swath width	240 km
GSD at nadir	100 m
Spectral range	360 – 910 nm (SWIR TBC)
Spectral sampling	≤1.25 nm
# spectral bands	440
Peak SNR	950:1 (binned to 10 nm)
Mass	38 kg (opto-box) 12 kg (e-box)
Volume	74x65x47 cm³ (opto-box) 23x33x17 cm³ (e-box)
Power	65 W

Phase 0 concept
Completed in 2017



DICE prototype
Completion 2023
Airborne flights
2024-2025

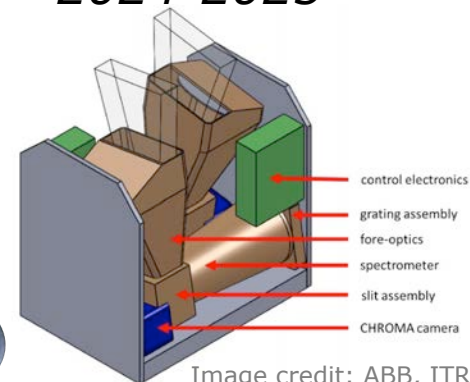
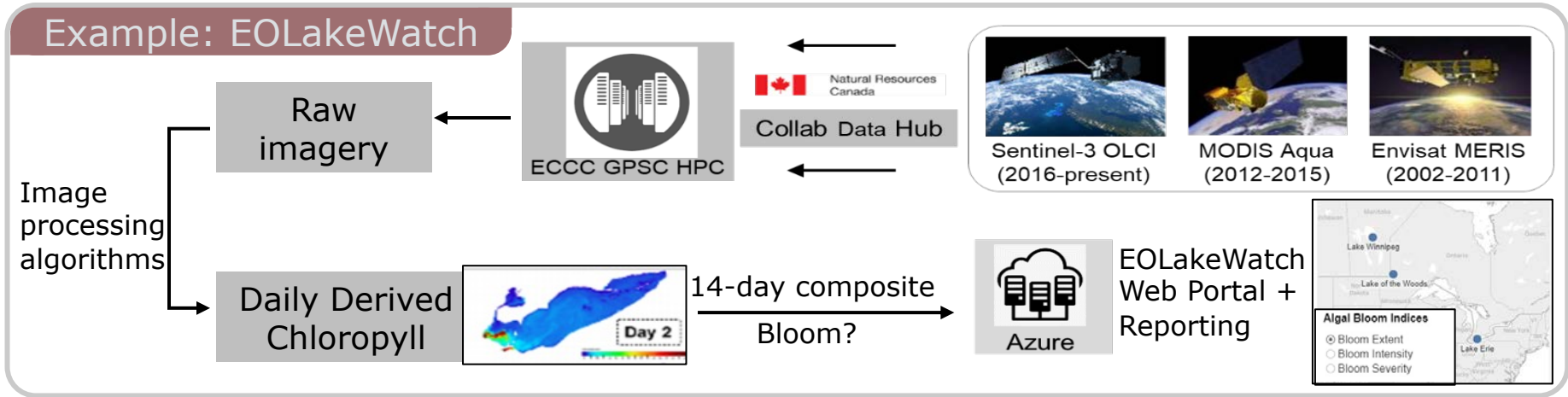


Image credit: ABB, ITRES

Increasing SRL

- Exploring ways to invest in integrated processing chain
 - Developing algorithms
 - Demonstrate applications, products and services
 - Build core expertise and develop highly qualified personnel



PRISMA/ENMAP data analysis

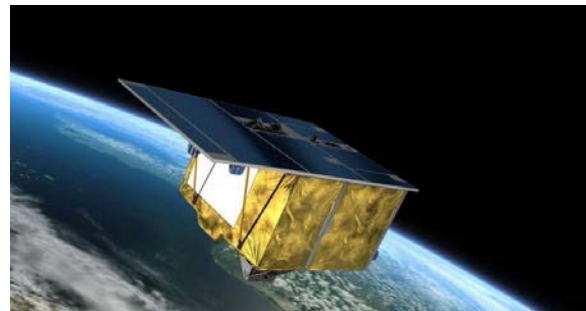
Ongoing activity: Assessing new land-focused hyperspectral imagers for water color applications



PRISMA – launched 2019

Hyperspectral imagers

- Spectral range: ~400 –2500 nm
- Spectral sampling: ~6.5-10 nm
- Spatial resolution: 30 m



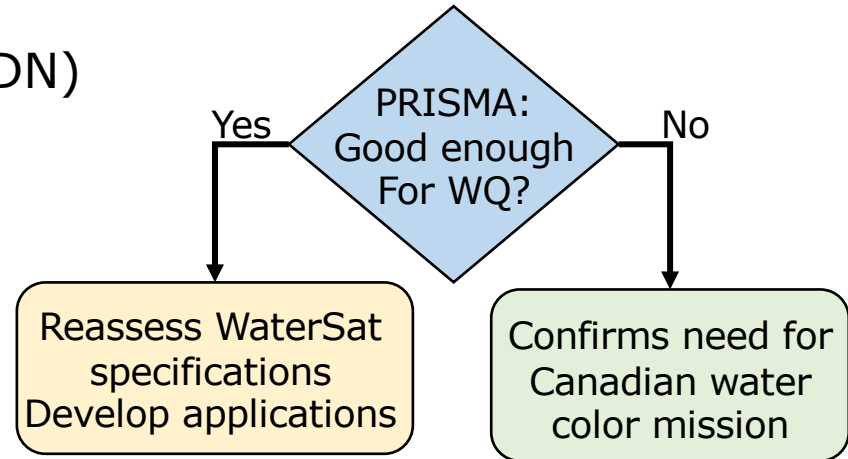
ENMAP – launched 2022

- Data analysis ongoing
- Assess potential/quality for inland water quality retrievals

- Call for data closed June 30 2023
- Netcolor coordinated proposal for Canadian waters

PRISMA data analysis

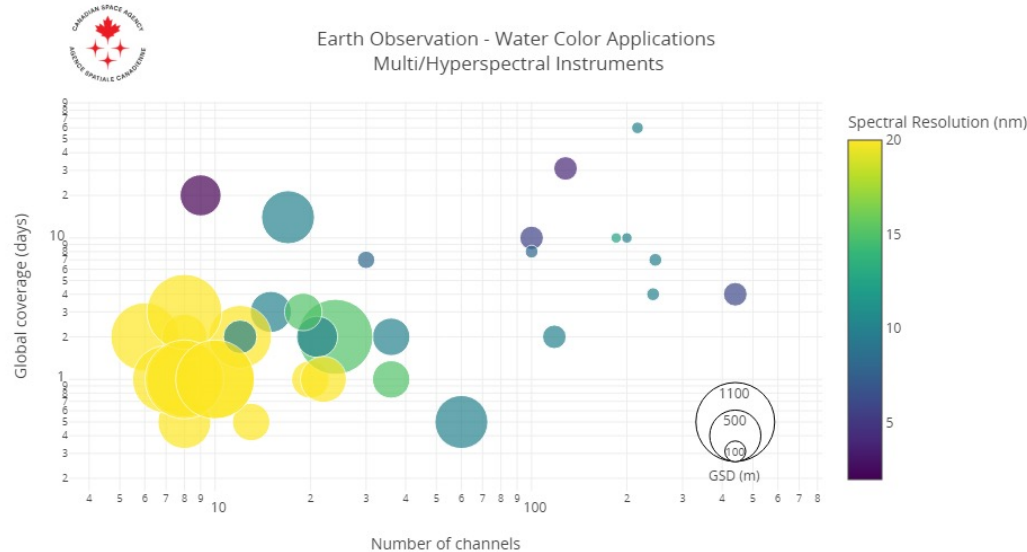
- Intern at CSA/ECCC working on Canadian perspective on PRISMA efficacy for water colour applications
 - **SNR retrieval & pixel binning** for PRISMA images of Lake Erie, Lake Winnipeg, and Lake of the Woods
 - Use **Mixture Density Network (MDN)** to extract CDOM, Chl-a, TSM, etc.
 - Find **coincident Sentinel-3/OLCI images** to compare



Revisiting the mission concept



- Revisit Canadian mission concept in light of new and planned mission
 - Planned contract to science community
 - Stakeholder engagement
- Explore international partnerships opportunities



Potential collaboration with Aquawatch

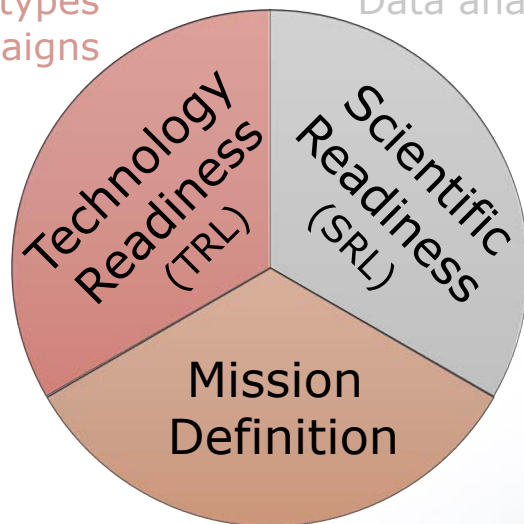
- Exploring opportunities for collaboration
 - Feasibility study for a joint mission
 - Joint pilot site in Canada (HydraSpectra sensor from Aquawatch)
 - Synergies in developing an Indigenous Engagement Strategy
 - Testing/development of an end-to-end simulator



Conclusion

Payload concepts
WISE & DICE prototypes
Airborne campaigns

Integrated processing chain
Data analysis from PRISMA/ENMAP



Revisit Canadian mission concept
Explore international partnerships

- Still need & interest for water color mission concept
 - High revisit
 - 100 m spatial resolution
- Hope to connect with interested stakeholders



