

Status report on the current and future satellite systems by the Canadian Space Agency

Presented to CGMS-40 plenary session, agenda item [III.2] by Guennadi Kroupnik





Coordination Group for Meteorological Satellites

2 Add CGMS agency logo here (in the slide master)

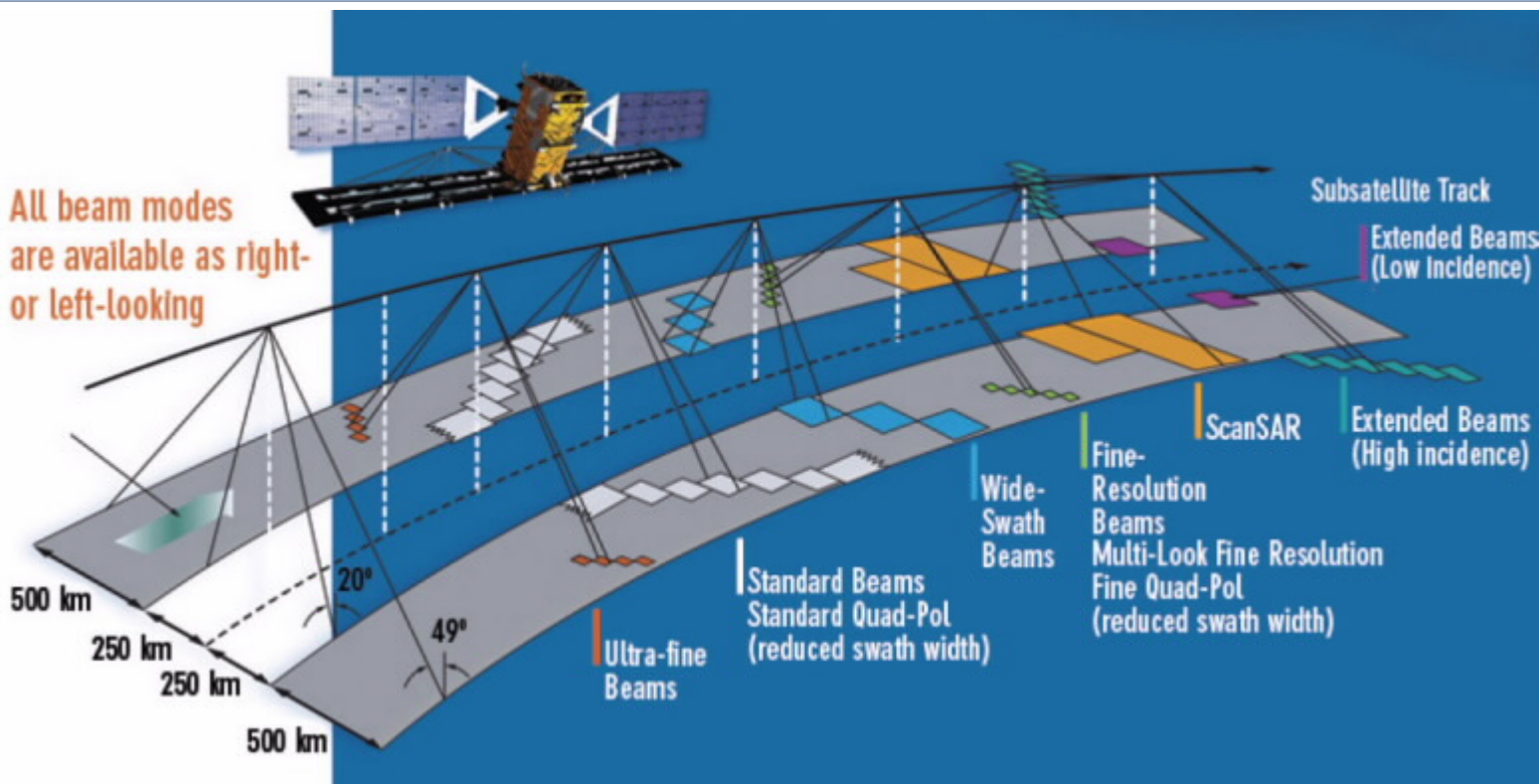
CGMS

Overview - CSA current and future Atmospheric Composition satellite systems

	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	
MOPITT on Terra Nadir column: CO	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
OSIRIS on Odin Limb Scatter vertical profiles: O3, NO2, BrO, aerosols	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
SCISAT/ACE Solar Occultation vertical profiles: over 37 gas species, aerosols	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
CASS Solar Occultation & Limb Scatter vertical profiles: over 37 gas species, aerosols	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
TICFIRE Nadir and Limb Far IR emission: polluted thin ice clouds	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active

CURRENT LEO SATELLITES

- Radarsat - 1 : launched in 1995 and still going strong !
- Radarsat – 2: launched in 2007. PPP with MDA.



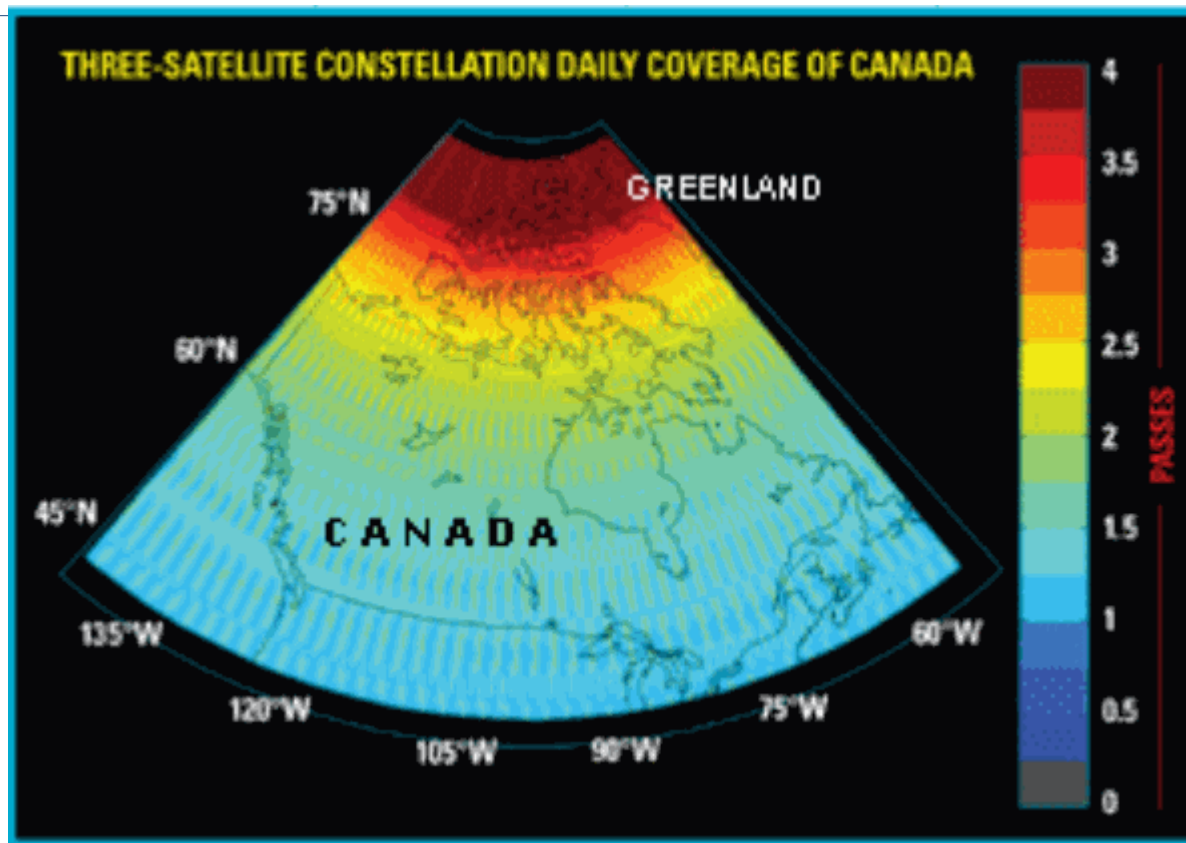
CURRENT R&D SATELLITES

- MOPITT – launched in 1999 (on Terra). Nadir , column CO
- OSIRIS – launched in 2001 (on Odin). Limb Scatter, vertical profiles: O3, NO2, BrO, aerosols
- SCISAT/ACE - launched in 2003. Solar Occultation , vertical profiles: 37 gas species, aerosols
- Extensively used by atmospheric science and climate communities:
 - ESA and NASA-led activities to generate Essential Climate Variable products for Ozone and Aerosols
 - WCRP/SPARC activities related to ozone trends and chemistry-climate model evaluations
- MOPITT, OSIRIS and SCISAT are operating well beyond their design lives:
 - CSA intention is to operate them as long as they produce quality observations



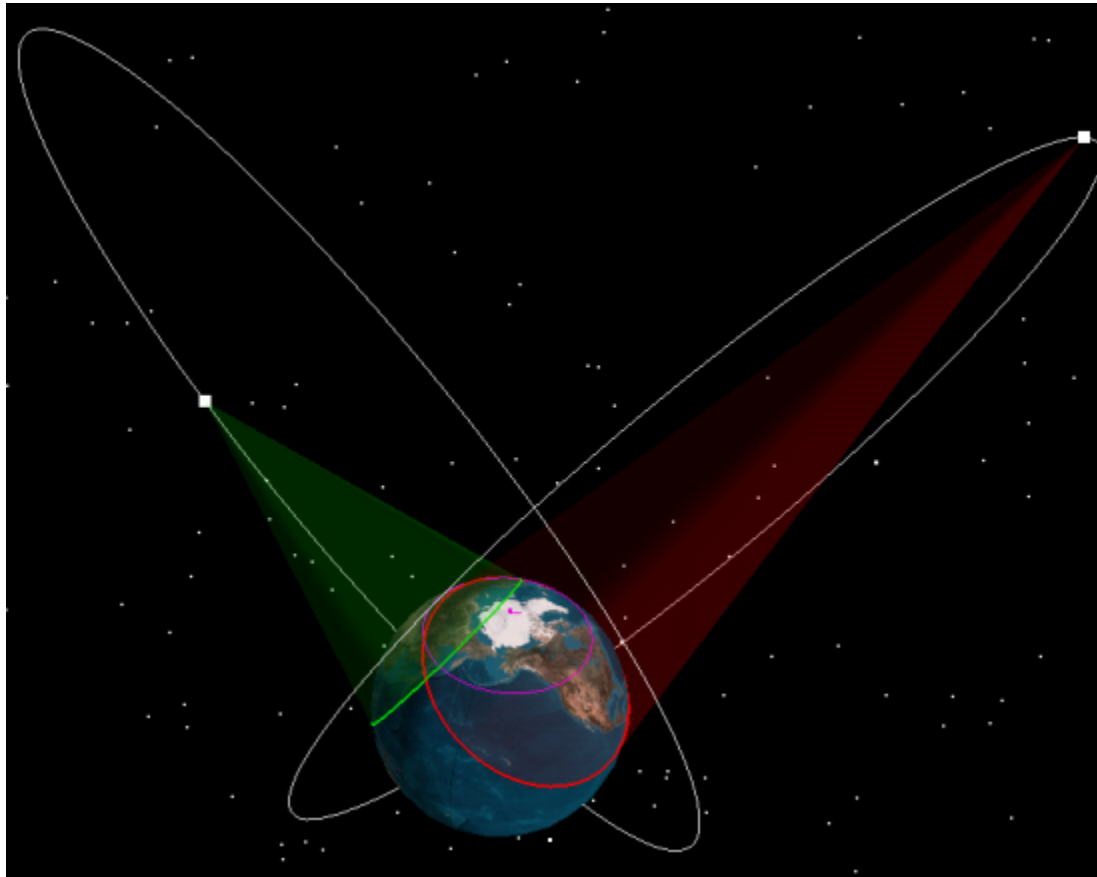
FUTURE LEO SATELLITES

- Radarsat Constellation Mission: ensuring continuity in SAR-C data.
- Launch - 2016



FUTURE HEO SATELLITES

Polar Communications & Weather (PCW) Mission.



2 satellites in HEO to provide:

Continuous GEO-like imagery above 50° N (refresh rate 15 minutes)

24/7 High data rate communication services in Ka-band and X-Band, (addition of UHF services is being considered)

Continuously collected space weather data

FUTURE HEO SATELLITES –Status update

➤ **PCW Accomplishments:**

- ✓ Users Requirements Document (URD v. 6.1) - released
- ✓ Mission Requirements Document (MRD Rev. C) – available via CSA web
- ✓ Reference system conceptual design (Phase A) - complete
- ✓ PHEOS instruments (3) conceptual design (Phase A) - complete
- ✓ Preliminary Procurement Business Case (PPP vs. MCP) - complete
- ✓ Socio-Economic Benefits Study Report - October 2012
- ✓ Preliminary Investment Business Case – October 2012
- ✓ Service Requirements Document (Initial Release) – October 2012

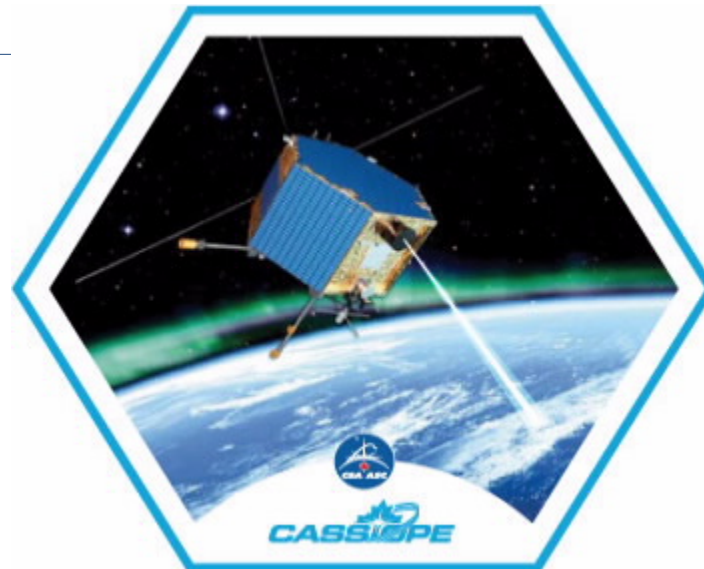
➤ **PCW Work in Progress:**

- UHF Requirements and Feasibility study (CSA/DND/CRC) – March 2013
- Critical Technologies development – July 2014
- PHEOS technologies development – March 2014
- Bi-lateral and multi-lateral international collaboration scenarios
- Targeted entry in operations 2018.



FUTURE R&D SATELLITES

- CASSIOPE – launch 2013. ePOP space weather payload comprises a suite of eight scientific instruments, including plasma imagers, radio wave receivers, magnetometers and cameras.
- M3MSat – launch 2013. AIS and LDR communication payloads, capable to pick-up low power signals from in-situ sensors
- CASS (Chemical and Aerosol Sounding Satellite) -will respond to needs for vertical profile observations of ozone, ODSs, GHGs, aerosols and precursors as identified by GCOS/CEOS. Planned launch -2016
- TICFIRE – Nadir and Limb Far IR emissions: polluted thin ice clouds. Launch-2017



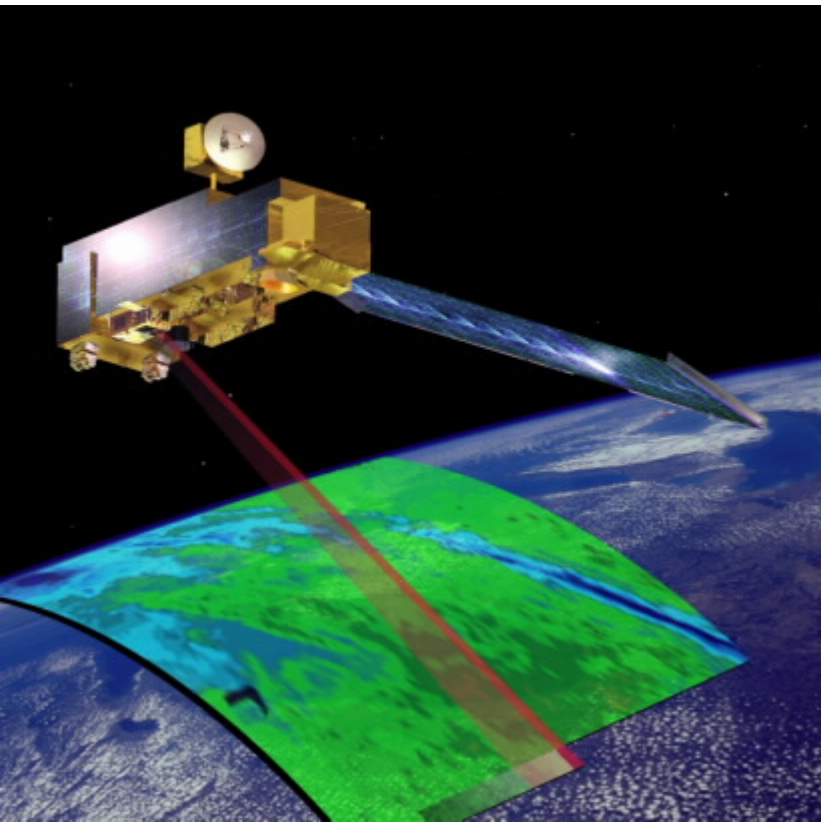
To be considered by CGMS:

- PCW is open for international Collaboration
 - Definition and validation of User's needs and Requirements,
 - Launch capabilities,
 - Meteorological Payload or its subsystems/core components
 - Spacecraft subsystems and/or critical components,
 - Enhanced communications capabilities,
 - Secondary payload and its data processing or service delivery:
 - Ground segment (Back-up TT&C, Data processing and applications).
- CSA is looking for an opportunity to partner on CASS mission.
- Potential use of M3MSat AIS and LDR capabilities for in-situ measurements



Back-up

MOPITT: Measurements Of Pollution In The Troposphere



**Launched in 1999 on NASA's
Terra satellite**

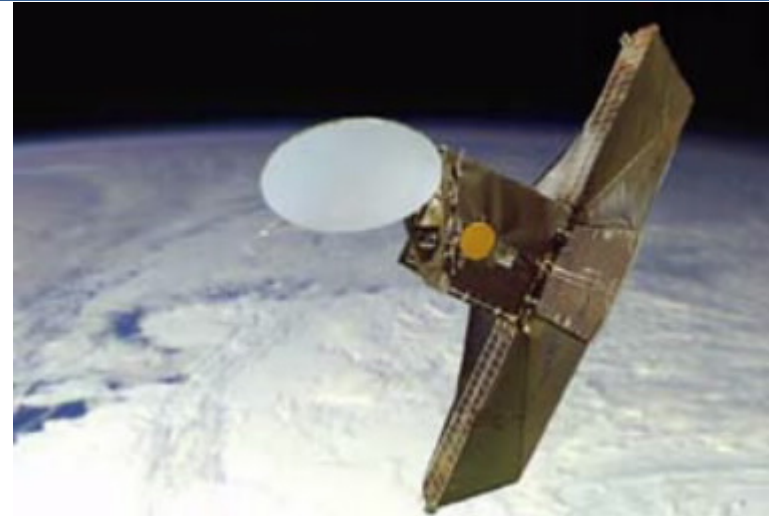
**Instrument operations are
performed at the University of
Toronto**

- **Measures concentration of carbon monoxide in the troposphere**
- **Observes sources, transport and diffusion of this product of incomplete combustion**
- **Links with CO₂ and ozone**

OSIRIS

Optical Spectrograph and InfraRed Imaging System

on the Odin spacecraft
routine operations since 2001



Limb radiance profiles of scattered sunlight from 270 nm to 810 nm.

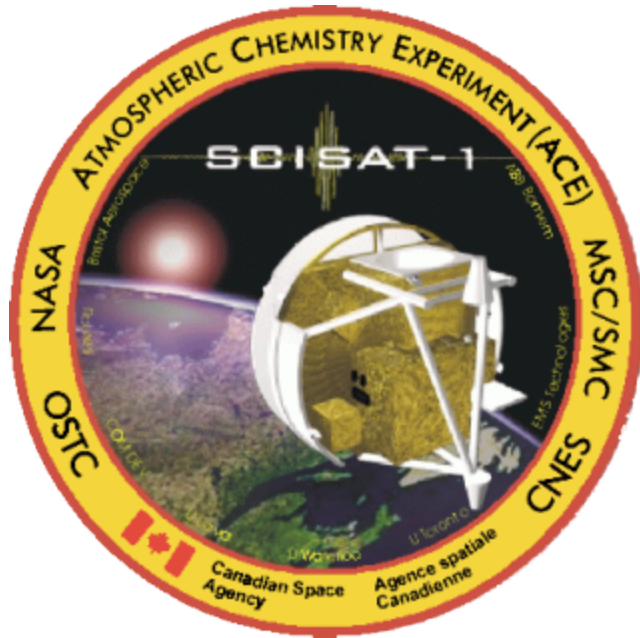
The profiles, which are constrained to the sunlit section of the orbit, have a height resolution varying between 1 and 2 km.

Primary data products: O₃, NO₂ and aerosols

Science products: BrO, NO₃, mesospheric OH and H₂O

Validation shows OSIRIS ozone agreement with ACE-FTS and SAGE II better than 3% over the altitude range 18 km to 53 km. The OSIRIS observations are being used to extend the SAGE instruments data sets.

SCISAT – ACE: Instruments



- Infrared Fourier Transform Spectrometer (FTS) operating between 2 and 13 microns with a resolution of 0.02 cm^{-1}
- 2-channel visible/near infrared Imagers, operating at 0.525 and 1.02 microns (cf., SAGE II)
- UV / Visible spectrometer (MAESTRO) 0.285 to 1.03 microns, resolution $\sim 1\text{-}2 \text{ nm}$
- Suntracker keeps the instruments pointed at the sun's radiometric center.

Launched August 2003

Routine operations since
February 2004