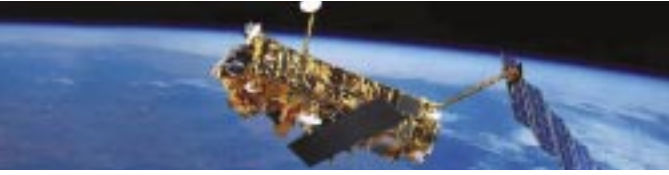


ENVISAT

Canada and the ENVISAT Program



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Maintaining Canada's Niche in Remote Sensing from Space

Much like Canada, the **European Space Agency (ESA)** has been using satellites to "keep an eye" on the Earth's environment for almost a decade.

Through the Cooperation Agreement between the Government of Canada and **ESA**, Canada chose to participate in the **ENVISAT** environmental satellite program. Canada's co-operation with **ESA** provides an ideal platform for the sharing of knowledge and expertise and the promotion of the use of advanced specialized technologies developed by Canadian space companies. It also offers unique opportunities to participate directly in select **ESA** programs, activities and in decision making, like the **ENVISAT** program.

ENVISAT will complement **RADARSAT-1** and assure data continuity between **RADARSAT-1** and **RADARSAT-2**, to be launched at the end of 2003. The satellite has an important role in the preparation for **RADARSAT-2** but also for future Canadian missions, such as a hyperspectral sensor mission. **ENVISAT** data will help develop Canadian knowledge and expertise, keeping Canada at the forefront of remote sensing from space.



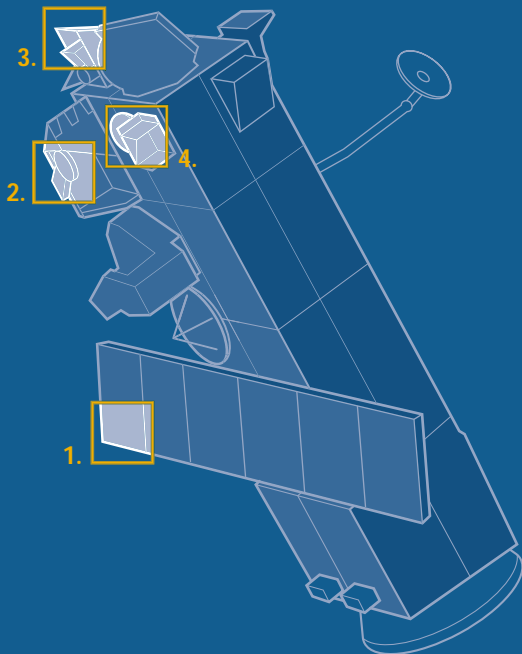


Some of Canada's top space companies have contributed key components to the design and construction of **ENVISAT**, partnered with Astrium and Alcatel, the most recognized companies in the world in the development of Earth Observation satellites.

1. EMS Technologies of Sainte-Anne de Bellevue, Quebec designed, manufactured, and tested onboard electronic sub-systems for the **Advanced Synthetic Aperture Radar (ASAR)** antenna that will enable **ENVISAT** to capture data from every corner of our planet in all weather conditions, day or night. The **ASAR** antenna will contribute to preparing the scientific community for future **SAR (Synthetic Aperture Radar)** satellites such as **RADARSAT-2**.

Specifically, **EMS'** role in the **ASAR** Project encompasses three areas:

- Structural and thermal analysis support to the prime contractor (Astrium) for the overall Antenna subsystem;
- Design of the composite RF Panel Feed distribution network including RF design and associated mechanical analysis of large distributed feed networks;
- Design and manufacture of the Antenna Deployment Test System (DTS).



2-3. ABB Bomem of Quebec City, Quebec, provided engineering support in instrument design and data analysis, and developed optical test equipment for one of the ten special instruments to be placed onboard **ENVISAT**, the **Michelson Interferometer for Passive Atmospheric Sounding (MIPAS)**. The **MIPAS** is a high-resolution Fourier transform infrared spectrometer - a sophisticated instrument designed to measure the concentration of various atmospheric constituents. It has a high spectral resolution and range, allowing global measurement of more than 20 trace gases during all seasons, atmospheric pressure, and temperature. **ABB Bomem** also developed software to allow selection and generation of **Medium Resolution Imaging Spectrometer (MERIS instrument)** products.

3-4. COM DEV of Cambridge, Ontario, supplied the **MIPAS** Signal Processing Subsystem Electronics and onboard flight software, and delivered two space qualified oscillator units operating at 23.8 GHz and 36.5 GHz for the **Microwave Radiometer (MWR)**. This instrument will be used to measure atmospheric water vapour, the liquid water content of clouds, soil moisture over land, surface energy, and detect and classify different forms of ice.



5. MacDonald, Dettwiler and Associates of Richmond, British Columbia, was the main supplier of high-speed data acquisition and processing systems due to their expertise in Earth Observation satellites and their solid experience as leader of the development of the ground segment for **ESA's ERS-1 and ERS-2** satellites. It developed and provided eight innovative Front End Processors, a direct-to-disk data capture system that enables direct archiving of newly acquired **ENVISAT** Advanced SAR data and created systems capable of processing **ERS** SAR data into **ENVISAT** format.

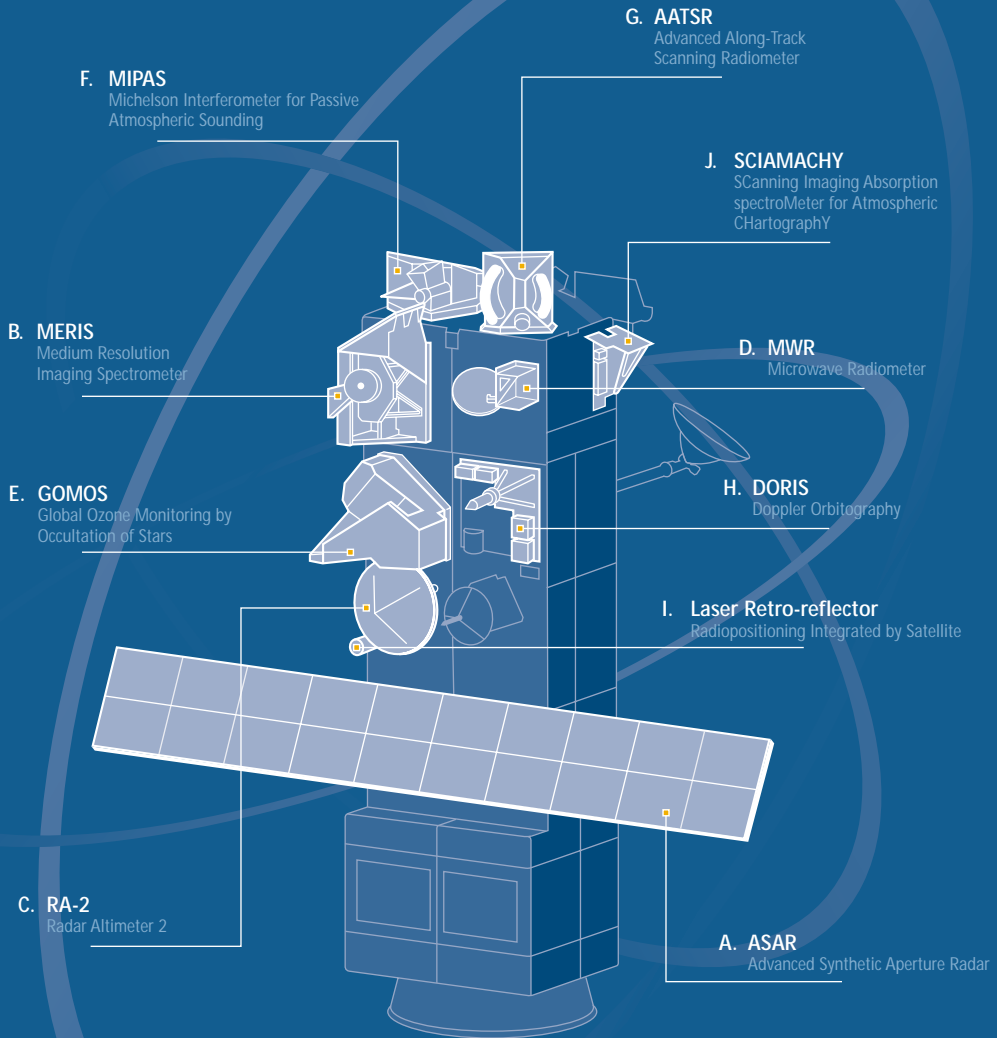
5. MPB Technologies of Pointe Claire, Quebec, built three transponders, part of a system that characterizes the signal from the **ASAR** instrument. The transponders, located in Flevoland, The Netherlands, will be used as a precision point target to monitor gain variations. The transponder calibration gives excellent gain calibration and also provides data for the estimation of antenna beam-pointing biases.

The **Canada Centre for Remote Sensing** will play a key role in the reception and distribution of **ENVISAT ASAR** data through ground stations located in Gatineau, Quebec, and Prince Albert, Saskatchewan.

ENVISAT Sensors



ENVISAT views the Earth with unprecedented detail and richness; it provides scientists with more accurate information and data on the Earth's atmosphere, oceans, land and ice. Onboard the spacecraft are ten highly sophisticated instruments that work day and night collecting crucial environmental data.





A. ASAR - Advanced Synthetic Aperture Radar

Maps the surface of the planet below, with several different modes that allow broad views or detailed snapshots. Able to map the shape of the land, profile waves and ice, monitor land use and types of vegetation, and measure some of the properties of the surface.

B. MERIS - Medium Resolution Imaging Spectrometer

Images the surface and clouds in sunlight that capture visible light and some of the infrared part of the spectrum. Able to determine the exact "colour" of oceans and coastal zones, which reflects biological activity and other processes; monitor clouds and detect invisible water vapour in the atmosphere; and identify plants at various stages of their growth.

C-D. RA-2 and MWR - Radar Altimeter 2 and Microwave Radiometer

Measures the satellite's height above the surface to an accuracy of 4.5 cm (in 800 km). When combined with exact orbital tracking data from DORIS, RA-2 measurements yield a profile of the sea or ice surface below. Further signal processing on the ground gives data on wave conditions and wind speeds in mid-oceans. MWR measures amount of water vapour in atmosphere to correct RA-2 radar signals for best accuracy.

E. GOMOS - Global Ozone Monitoring by Occultation of Stars

Tracks stars and monitors their light spectra as they set through the Earth's atmosphere. Able to build vertical profiles of water vapour and ozone through the atmosphere from altitudes of 20-100 km.

F. MIPAS - Michelson Interferometer for Passive Atmospheric Sounding

Observes the atmosphere in middle infrared range, mapping the profiles of a series of different trace gases. Able to map industrial pollutants, and greenhouse gases to shed new light on atmospheric chemistry.

G. AATSR - Advanced Along-Track Scanning Radiometer

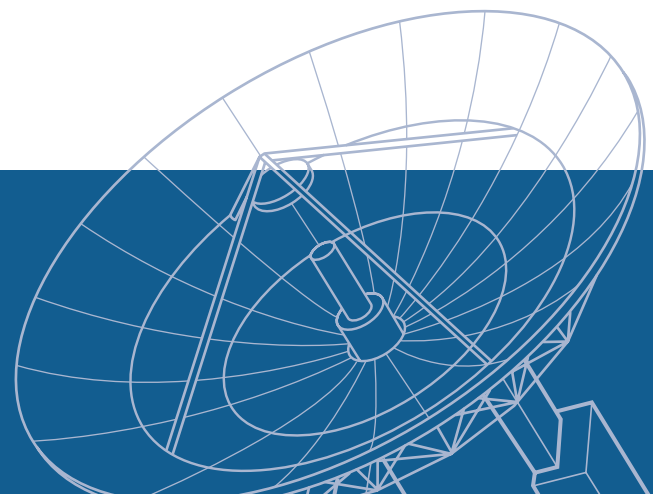
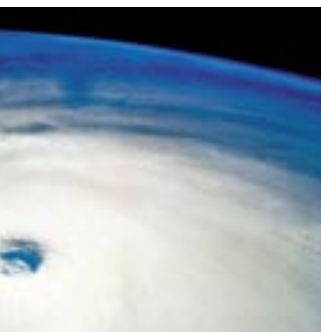
Scans land and ocean surface at several infrared and visible frequencies to accurately measure temperature. Able to measure sea surface temperature to an accuracy of 0.3°C. Detects hot spots from forest fires. Maps the extent of vegetation in different regions.

H-I. DORIS and Laser Retro-reflector - Doppler Orbitography and Radiopositioning Integrated by Satellite

Measures exact orbital position of satellite to an accuracy of 4.5 cm, and orbital speed to an accuracy of 0.4 mm/s. Works with radar altimeter to produce maps of ocean surface and derive gravitational field maps of seabed and elevation maps of land. Laser reflector allows ground-based laser ranging of satellite to calibrate DORIS and RA-2.

J. SCIAMACHY - SCanning Imaging Absorption spectroMeter for Atmospheric CHartography

Maps atmosphere over a very wide wavelength range, which allows detection of trace gases, ozone and related gases, clouds and dust particles throughout the atmosphere. Gives total amounts of gases and profiles in the atmosphere. Versatile instrument which will enable investigation of many different facets of atmospheric chemistry, including the effects of forest fires, industrial pollution, arctic haze, dust storms and volcanic eruptions.



State-of-the-Art Research



As part of **ESA's** data policy to maximize the beneficial use of data from **ENVISAT** and to stimulate a balanced development of scientific, public and commercial use of data, **ESA** launched an **Announcement of Opportunity (AO)** for the use of **ENVISAT** data. Canada is well represented in the group of chosen projects within the **ESA AO**. Canadian universities, government departments and industries submitted a wide range of project subjects that were accepted. These diverse projects range from coastal zones and oceans, ice monitoring, geology and disaster management to calibration and validation.

Comparison between RADARSAT and ENVISAT



RADARSAT-1
(1995-)
SAR

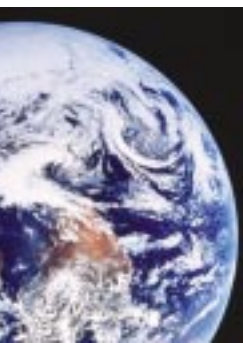
ENVISAT
(2002-)
ASAR

RADARSAT-2
(2003-)
SAR

Spatial resolution	10 to 100 metres	30 to 1000 metres	3 to 1000 metres
Polarization	HH	HH, VV, HV or VH	Fully polarimetric
Look direction	Right-looking (Left-looking for Antarctic missions)	Right-looking	Routine left- and right-looking operation
On board recording device	Analogue recorders	Solid-state recorders	Solid-state recorders
Location Accuracy Device	None	Three instruments for corrections and precise orbit provision (MWR, DORIS, and LRR).	GPS receivers onboard
Yaw-steering	None	Yes	Yes

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Through Canada's participation in the design, construction and deployment of **ESA's ENVISAT**, the **Canadian Space Agency** is building Canadian knowledge and expertise, rewarding Canadian innovation with opportunity and strengthening Canada's economy by leading the world in Earth Observation.



Learn more about the Canadian Space Agency and ENVISAT at:
www.space.gc.ca