List of Projects
Space, Airborne and Ground Instruments

Founded in 1973 as Bomem Inc, ABB Analytical Measurement enables scientists around the world to perform through excellence in infrared spectroscopy. ABB is a market leader in Fourier Transform Infrared technology in terms of innovation, reliability and performance. Our company is proud of its Space heritage that contributed to several major environmental and scientific missions.

Space Instruments

ENVISAT / MIPAS

ABB has been involved since 1989 in the MIPAS (Michelson Interferometer for Passive Atmospheric Sounding) project, a FTS launched on the ENVISAT platform in early 2002. ABB was responsible for the performance analysis and modeling, for the design and construction of optical ground support equipment and for ground segment tasks. ABB is still involved in the surveillance of in-flight performance and in Level-1 data processing.

AIRS

The Atmospheric Infrared Sounder (AIRS) launched by NASA in spring 2002 is designed to provide improved data about the atmosphere, land and oceans for application in climate studies and weather forecasts. AIRS consists in a high spectral resolution grating spectrometer featuring a multi-aperture echelle grating. ABB developed three ground support systems for AIRS: a collimator and two blackbodies.

The Spatial Collimator System (SCS) provides a collimated beam at varying angles for verification of the spatial performance and allows spectral testing in gas cell mode.

The Large Aperture Blackbody (LABB) & Space View Blackbody (SVBB) are infrared calibration sources to verify the instrument's performance. The SVBB simulates the deep space view. The LABB is adjustable in temperature and simulates Earth view and flight calibration sources.

Terra / MOPITT

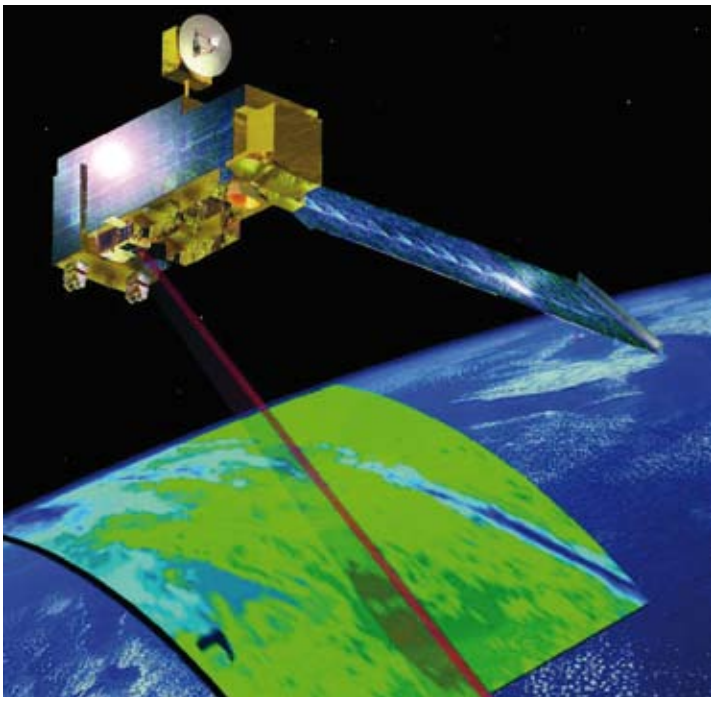
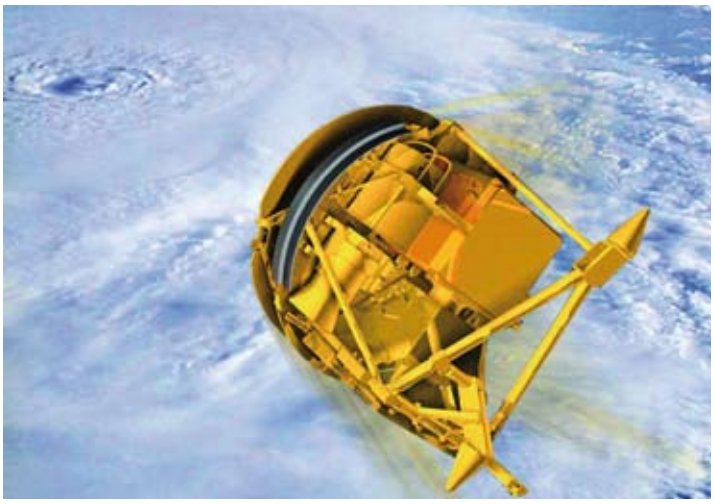


ABB has been involved in the development of the MOPITT instrument (Measurement of the Pollution in the Troposphere) for the Canadian Space Agency. MOPITT was launched in December 1999 and has been operational ever since. ABB has designed and built the in-flight calibration sources for the MOPITT instrument. ABB also developed the ground calibration source

HITA

ABB has been involved in several phases of the Hyperspectral Imager Technology Assessment, a study sponsored by the Canadian Space Agency. In one of these phases, ABB has been given the task of designing and coding two pieces of software. The first one, named the Lumped Parameter Model (LPM), is used to estimate the performances (signal to noise ratio, optical quality, spectral and spatial resolution, etc.) of hyperspectral instruments. The second one, called the Data Flow Model (DFM), is used to simulate the complete chain of data processing within an hyperspectral mission. The DFM and the LPM combined together form a powerful tool to determine user requirements in terms of instrument performances and to evaluate instrument/ mission design options to meet these requirements.

Scisat / ACE



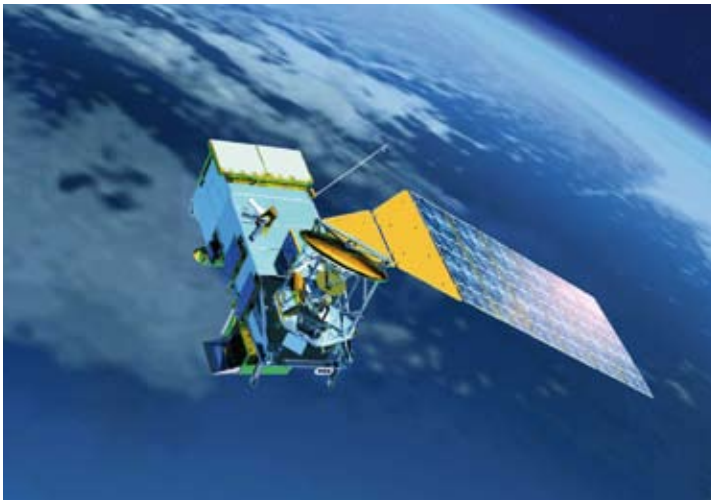
The Atmospheric Chemistry Experiment (ACE) is the main payload of the Canadian science satellite, SciSat. ACE consists of a suite of instruments in which the primary element is an infrared Fourier Transform Spectrometer (FTS) coupled with an auxiliary 2-channel visible (525 nm) and a near infrared imager (1020 nm). The FTS is a high-resolution (0.02 cm^{-1}) instrument operating in the 750 to 4100 cm^{-1} spectral range. The ACE mission measures and analyzes the chemical and dynamical processes that control the distribution of ozone in the upper troposphere and stratosphere. A high inclination (74 degrees) and low earth orbit (650 km) allows coverage of tropical, mid-latitude and polar regions.

ABB developed ACE-FTS the main instrument on-board SciSat. The Science Team includes Canadian scientists as well as scientists from the United States, Belgium, Japan, France and Sweden. The space craft bus was built by Bristol Aerospace. SciSat-1 was launched in August 2003 by NASA and was declared fully operational in March 2004.

SCISAT Team, received the 2009 Alouette Award

The Canadian Aeronautics and Space Institute (CASI) presented the 2009 Alouette Award to the SCISAT team for outstanding contributions to advancement in Canadian space technology, applications, science and engineering that goes to leaders of the development of the outstandingly successful Canadian SCISAT satellite.

NPOESS / CrIS



ABB, along with its partner, ITT, is currently developing the Cross-track Infrared Sounder (CrIS), one of the instruments of the next generation of US polar-orbiting meteorological satellites (NPOESS) that will progressively replace the current POES series.

Through surface radiance measurements,CrIS will provide improved measurements of the temperature and moisture profiles of the atmosphere. Meteorology forecasters use temperature and moisture sounding data in advanced numerical models to improve both global and regional predictions of weather patterns, storm tracks and precipitation.

The current High-resolution Infrared Radiation Sounder (HIRS) instrument on Polar Operational Environmental Satellites (POES) provides about 20 infrared channels of information and is able to characterize atmospheric temperature profiles to an accuracy of 2 to 3 degrees Kelvin. Modern and future forecast models demand higher accuracy. In comparison, the CrIS instrument will provide over 1300 spectral channels of information in the infrared at an improved horizontal spatial resolution and will be able to measure temperature profiles with enhanced vertical resolution to an accuracy approaching one Kelvin. This will result in improved five-day weather forecasts and a better understanding of the formation of storms and changing weather patterns. ABB provides the interferometer module, the internal calibration target and the sensor data record (SDR) algorithms.

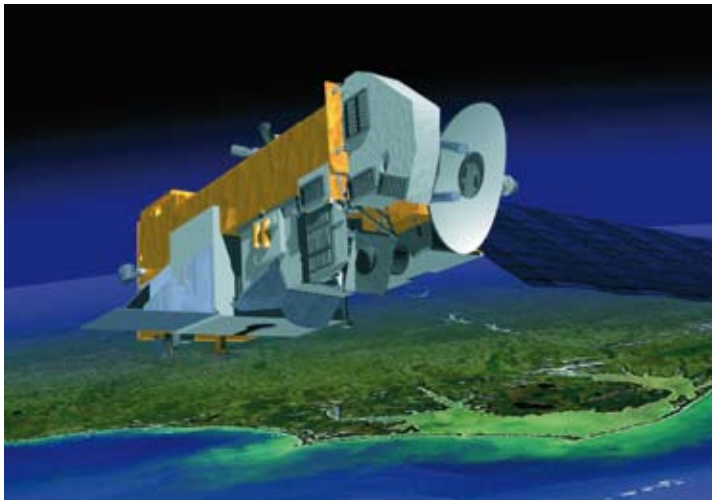
ABB received Excellence Award for the CrIS Project

During the manufacturing and test activities of the first Flight Unit, ABB demonstrated exceptional NPOESS teamwork in supporting the successful integration of the interferometer into the CrIS sensor. In June 2006, ABB has been presented with a NPOESS Outstanding Supplier Award from Northrop Grumman Corporation, the prime contractor of the NPOESS program.

NGST IFTS

In early 2000, ABB conducted a concept study of a Canadian science instrument for the NGST (Next Generation Space Telescope), now called JWST. An imaging spectrometer based on the FTS technology was proposed to meet the science requirement of the mission. ABB was also a member of the American team proposing a similar instrument and also contributed to the European IFTS study as well. A breadborad interferometer implementing new servo and scanning approach was built and merged with cameras and optics from the LLNL (Lawrence Livermore National Laboratory) to conduct a demonstration campaign called LIFTS on a 3.5 meter telescope in New Mexico.

Aura / TES



The Tropospheric Emission Spectrometer (TES) is a high resolution Fourier Transform Spectrometer that is used to measure and profile most gases important for the tropospheric physics and chemistry. It flies on the Earth Observing System (EOS) Aura polar orbiting platform. ABB has delivered the On-Board Calibration Subsystem (OBCS) that allows the radiometric and spatial calibration of the TES instrument during flight. The first component of the OBCS is a blackbody source that provides a known infrared signal for the radiometric calibration of the spectrometer. The second component is a spatial calibration source used for the monitoring of the relative positions of the four TES focal planes. The last element is the control electronics that monitor and control the operation of the two calibration sources.

JWST / FGS & TFI

One of the most ambitious space project of the decade, the JWST (James Webb Space Telescope), a 6.5 meter giant mirror in orbit around the sun, will be launched in 2013 to study various astronomical objects far in the universe. Canada is contributing to this international effort by providing the eyes of the satellite: the FGS (Fine Guidance Sensor) which will be used to point the telescope at a tiny piece of sky. A science instrument called the TFI (Tuneable Filter imager) is attached to the FGS. ABB is responsible for the delivery of the Optical Ground Support Equipment (OGSE) which will enable COM DEV, the prime contractor of the FGS and TFI to test the performance of the FGS/TFI. The OGSE uses custom optical fibers and small telescopes to generate a star field of variable size, position, intensity and wavelength which simulates the infrared light coming from the telescope. The OGSE must meet strict alignment and position requirements at the operating temperature of 30 K.

GOSAT / TANSO

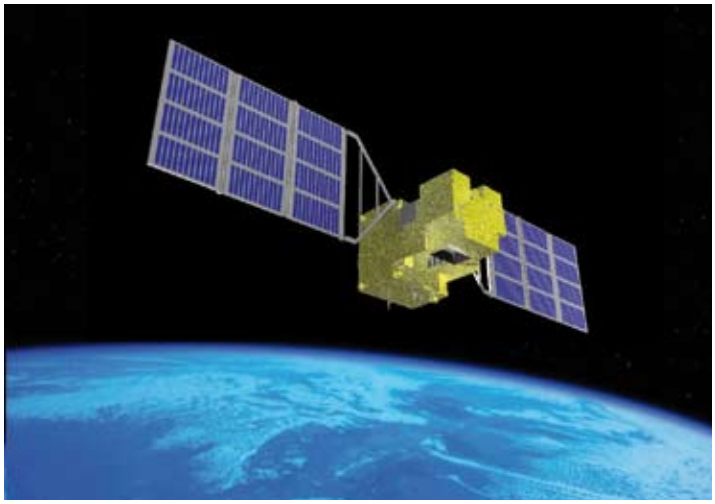


ABB has manufactured the interferometer and its control electronics for the Japanese instrument TANSO that will fly on the GOSAT satellite. GOSAT is the first satellite dedicated to the observation of multiple greenhouse gases. TANSO is a FTS that will be used to monitor the sinks and sources of CO2 from space. GOSAT has a resolution of 0.2 cm^{-1} and cover a broad spectral range from about 740 nm to about 14 µm. The interferometer was delivered to NEC Toshiba Space, the prime contractor of the TANSO instrument in 2007.

Meteorological sounders for MTG and GOES-R+

ABB was involved in the definition phases of the sounders for the European program MTG (Meteosat Third Generation) and for the American GOES-R (Geostationary Operational Environmental Satellite) programs. An ABB concept called the GFI (Generic Flight Interferometer) forms the heart of proposed instrument for these future sounder instruments. Prototype version of the interferometer were assembled and tested to validate lifetime, survival to launch and to space environment.

Airborne instruments

HIS

The HIS (High-resolution Interferometer Sounder) instrument is based on the ABB balloon-borne instrument. It has been used to demonstrate the possibility of replacing filter radiometers by FTS for temperature and humidity profiling of the atmosphere. Flown on a Proteus aircraft and a NASA ER-2, the HIS system is owned and operated by the University of Wisconsin.

Balloon-Borne Instruments

The first instruments built by ABB were balloon-borne Fourier transform spectrometers used for atmospheric measurements by solar occultation. A series of these instruments were built for several organizations such as Atmospheric Environment Services of Canada, University of Denver and the French CNRS. Also, a special cryogenically cooled FT system was built for NASA Goddard for atmospheric absorption measurements. These instruments featured high throughput with 2" aperture and high resolution to 0.01 cm^{-1}. They also offered numerical filtering for data reduction and used dynamic alignment of one of the interferometer mirrors to maintain the required accuracy on the recombining beams. Most of these systems are still in use even 20 years after their delivery.

ARIES

The ARIES instrument is a fast scan interferometer mounted in the pod of a scientific dedicated airplane of the United Kingdom Meteorological Office. Based on the ABB MB series, the system is used for remote sensing of the Earth and the atmosphere in the spectral band 500-2950 cm^{-1} with a maximum resolution of 1 cm^{-1} apodized. It is designed to operate over an altitude range from 0 to 10 km. This instrument has successfully flown in various missions. ARIES was recently upgraded in 2007 to update the acquisition electronics, modernize control software, and replace optics for enhanced performance.

NASTI

The NAST-I (NPOESS Airborne Sounding Testbed Interferometer) is a high resolution Michelson interferometer developed in collaboration with MIT Lincoln Laboratory. The unapodized spectral resolution of NAST-I is 0.25 cm^{-1} within a 590 - 2810 cm^{-1} (3.6 - 17 µm) spectral range. The infrared radiance measurements obtained from the NAST-I instrument provide detailed spectral characteristics of the atmosphere and land surface along with detailed atmospheric temperature and water vapor profiles. ABB provided the heart of this Fourier Transform Spectrometer, i.e. the interferometer including the metrology source and the control electronics for the moving mirror and the dynamic alignment.

ASPECT

Aspect is an airborne version of the state-of-the-art fast scanning interferometer MR254. The US Environmental Protection Agency uses this sensor to monitor the quality of the air after natural and unnatural catastrophes (fires, industrial accidents, etc.) It is a compact and light-weight instrument that uses two-band detector as well as a down-looking telescope to collect spectral data of the scene when the airplane is flying over the sites to investigate.

Tsukuba

Tsukuba is a Fourier transform spectrometer built by ABB for the Japanese space agency (JAXA). This instrument is a ground/airbone version of the space instrument TANSO that flies on the GOSAT satellite. Tsukuba was used from various airplanes to develop and validate GOSAT ground processing algorithms and now helps validating data gathered by GOSAT.

Ground-based Instruments

SpIOMM

SpIOMM (Spectromètre Imageur de l'Observatoire du Mont Mégantic) is a pioneer instrument, which became, in 2005, the world's only imaging FTS used in astronomy. It currently operates from Québec's Mont Mégantic' 1.6 meter telescope. Developed in collaboration with Université Laval, the instruments can collect wide band spectra in the visible range (350 - 900 nm) for each of the 1.7 million pixels of its detector (1340 × 1300 pixels), resulting in an unprecedented sky coverage. It allows astronomers to combine imagery and spectroscopy into a powerful single observation technique and thus maximize the collection of photons gathered by their telescope.

Beijing

The Beijing instrument is a ground-based solar occultation spectrometer. Using the Sun as back illumination, it measures spectra of the atmosphere in order to determine the concentration of various atmospheric chemicals. With such a strong source of radiance, the spectrometer can achieve spectral resolution of 0.02 cm^{-1} and still maintain a good signal to noise ratio. It covers the spectral range from about 2.5 µm to 13.3 µm.

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About ABB

ABB Analytical Measurements designs, manufactures and markets optical instruments and analytical solutions for industrial and remote sensing applications.Building on more than 35 years of experience in Fourier spectrometers and optical instrumentation, ABB's engineering department has the expertise and capabilities to efficiently serve customers interested in remote sensing environmental, meteorological and defense applications. Its dedicated team of engineers offers the best solutions with reliable spaceborne and airborne instruments, infrared calibration systems, hyperspectral imagers, and software for ground segments and simulation.

Contact us

ABB Analytical Measurement
585 Charest Blvd East, suite 300
Quebec, (Quebec) G1K 9H4
Canada
Phone: +1 418-877-2944
Email: ftir@ca.abb.com

www.abb.com/analytical

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