

# Space Missions

The University of Calgary is home to national and international leaders in space science, geomatics, communications and satellite systems. Our researchers have been involved in more than 20 space missions:



UNIVERSITY OF CALGARY

Year	Mission	Country	Description	UCalgary role
1970	1971 ISIS-II	Canada	ISIS II (International Satellites for Ionospheric Studies) was the fourth Canadian satellite launched in a series to study the ionosphere. It carried the scanning auroral photometer, an innovative instrument that captured the first truly global images of the aurora.	The auroral photometer was led by UCalgary space physicist Cliff Anger.
	1972 RAO	Canada	Rothney Astrophysical Observatory dedicated. It consisted of a joined pair of ATCO trailers, a Minnaert observing terrace for astronomical laboratories, and a 41-cm telescope and dome for astronomical research.	UCalgary research and teaching facility, located in Priddis, Alberta. The 1.8m A.R. Cross telescope is one of the three largest telescopes in Canada.
1980	1986 CANOPUS	Canada	CANOPUS stands for Canadian Auroral Network for the OPEN Program Unified Study, a ground-based instrument array for remote sensing the high-latitude ionosphere. This was the Canadian contribution to a global initiative to study the physics of near-Earth-space. A key CANOPUS instrument was the All-Sky Imager (ASI), which was among the first devices to employ digital (CCD) technology for scientific imaging.	The CANOPUS ASI was designed, built, and operated (for more than a decade) by a UCalgary-based team. For two years at the end of CANOPUS, UCalgary was responsible for the operation of all the CANOPUS instruments.
	1986 Viking	Sweden	Viking, Sweden's first satellite, explored plasma processes in Earth's magnetosphere and the ionosphere. The mission carried an UltraViolet (UV) imager that captured the first sequences (movies) of images of the global aurora, revealing a fundamentally new view of geospace dynamics.	Built by Canadian industry, UCalgary space physicists provided the scientific leadership of the Viking UV imager.
	1989 Akebono	Japan	Akebono was a satellite to study aurora and Earth's magnetosphere environment. It was developed by the Institute of Space and Astronautical Science and launched on an M-3SII rocket on February 22, 1989. After 26 years of successful observation, operation was terminated on April 23, 2015, due to the degradation of solar cells and the decay of orbit.	Canada's NRC provided a suprathermal ion mass spectrometer for this mission. Starting in 1995, UCalgary assumed leadership of this instrument.
1990	1992 Freja	Sweden	This Swedish satellite was launched October 6, 1992, carrying two Canadian instruments. These were the Cold Plasma Analyzer (CPA), and an UltraViolet Imager (UVI), both of which supported Freja's science objectives of studying plasma processes in the upper atmosphere.	The UVI was led by UCalgary, and CPA was led by National Research Council of Canada (NRC) and later (starting in 1995) UCalgary.
	1995 OEDIPUS - C	Canada	Observations of Electric-field Distributions in the Ionospheric Plasma — a Unique Strategy (OEDIPUS) C was launched on November 7, 1995. It consisted of sounding rocket experiments that used spinning, conductive tethers as a double probe for measurements of weak electric fields in the aurora.	UCalgary space physicists provided the Thermal Ion Detector for OEDIPUS-C.
	1995 Interball	Russia	The Interball mission consisted of four spacecraft equipped by an international consortium and launched by the Russian Space Agency to study the correlations between plasma processes in the tail of the magnetosphere and in the Van Allen radiation belt (auroral particles acceleration region) with a high time-space resolution. One of the spacecraft carried the UltraViolet Auroral Imager (UVAI).	UVAI was led by UCalgary space physicists.
	1995 CGPS	Canada	The Canadian Galactic Plane Survey (CGPS) uses the Dominion Radio Astrophysical Observatory (DRAO) synthesis telescope to study hydrogen emissions from the plane of our galaxy, the Milky Way. This project revives national interest in radio astronomy, and secures an exciting future for DRAO.	CGPS is funded through a major Natural Sciences and Engineering Research Council of Canada (NSERC) award led by UCalgary astronomers.
	1997 VSOP	Japan	The Very long baseline interferometry Space Observatory Program (VSOP) satellite carries an 8m radio antenna that serves as the space-borne counterpart for ground-based radio telescopes for very-long-baseline interferometry (VLBI). The mission delivers 100X better spatial (angular) resolution than the Hubble Space Telescope.	UCalgary is the Canadian data analysis centre for VSOP.
	1998 ACTIVE	Canada	The ACTIVE sounding rocket was launched on April 28, 1998, carrying three instruments.	ACTIVE was led by UCalgary space physicists.
	1998 Nozomi	Japan	Nozomi was designed to study the upper Martian atmosphere and its interaction with the solar wind and to develop technologies for use in future planetary missions. Due to problems encountered during complex manoeuvres, Nozomi missed Mars and is now in eternal orbit around the Sun.	UCalgary space physicists led the development of the thermal plasma analyzer on Nozomi.
2000	2000 GEODISIC	Canada	The Geoelectrodynamics and Electro-Optical Detection of Electron and Suprathermal Ion Currents (GEODISIC) sounding rocket mission studied study plasma in the Earth's ionosphere.	UCalgary researchers developed a thermal electron imager (TEI) and suprathermal ion imager (SII) for GEODESIC. Sensors measured low energy-charged particles in the earth's atmosphere — electrons and ions — that are energized by the northern lights and escape into outer space.
	2000 S520-2	Japan	Sounding rocket that studied ion-heating mechanism near the polar cusp.	UCalgary space physicists provided an imaging ion mass spectrometer for the mission.
	2002 Cusp2002	USA	Probed the dayside cusp ionosphere and detected the first stages of upward ionospheric acceleration.	UCalgary provided two CCD-based particle imagers.
	2003 CGSM	Canada	Canadian GeoSpace Monitoring (CGSM) was developed as the CSA-funded 'next phase' of the CANOPUS project. CGSM is a ground-based network of optical, radio, and magnetic field detectors designed to provide a continent-wide view of the dynamics of Earth's ionosphere over Canada.	UCalgary space physicists led the Canadian community in developing the proposal for CGSM, and led three networks of CGSM instruments (All-Sky Imagers, Meridian Scanning Photometers, and riometers).
	2003 ALMA	USA	The Atacama Large Millimeter Array, a massive radio telescope, was developed in Chile's high desert. This is one of the National Science Foundation's (NSF) largest science infrastructure projects and is used for radio astronomy by researchers around the world.	UCalgary led a consortium of Canadian universities in the successful application to the Canada Foundation for Innovation (CFI) for funding to support Canada's involvement in ALMA.
	2007 JOULE/ JOULE-II	USA	Two instrumented rockets measured small-scale electric field and electron density fluctuations in the thin atmosphere from about 60 to 120 miles above Earth's surface. They tracked the transition from magnetospheric to atmospheric control of ion flows and defined a new "edge of space".	UCalgary provided CCD-based suprathermal ion imagers (SII).
	2007 S520-23	Japan	Measured flows of neutral and ionized gases in the ionosphere.	UCalgary provided an SII.
	2007 THEMIS	USA	Time History of Events and Macroscale Interactions during Substorms (THEMIS) is a mission to investigate what causes auroras in the Earth's atmosphere to dramatically change from slowly shimmering waves of light to wildly shifting streaks of colour. Discovering what causes auroras to change will provide scientists with important details on how the planet's magnetosphere works and the important Sun-Earth connection.	UCalgary and UC Berkeley co-lead the development and deployment of a continent-wide network of All-Sky Imagers that play a central role in the mission science.
2010	2011 RAO	Canada	Rothney Astrophysical Observatory solar-observing telescope came online.	RAO and all of its instruments is a UCalgary program.
	2012 S520-26	Japan	A follow-on to S520-23, and a two-section rocket payload to measure neutral and ion winds in the upper atmosphere using chemical release and in-situ plasma measurements.	UCalgary space physicists provided an imaging ion mass spectrometer for ion velocity measurements.
	2012 RISR	Canada/USA	Resolute Bay Incoherent Scatter Radar (RISR) is a powerful ground-based radar that was developed to study how physical processes in near-Earth-space affect Earth's upper atmosphere. It provides detailed measurements of ionospheric parameters (electron number density, plasma velocities, etc.), information that is key to studying the coupling between our space environment and the upper atmosphere.	RISR is a joint Canada-US initiative. The radar and supporting instruments were funded through the US-NSF and a major UCalgary-led CFI award. UCalgary and US partner SRI-International operate the facility.
	2012 Swarm	European Union	Swarm is a European Space Agency (ESA) mission to study the Earth's magnetic field. High-precision and high-resolution measurements of the strength, direction and variations of the Earth's magnetic field, complemented by precise navigation, accelerometer and electric field measurements, are providing data essential for modeling the geomagnetic field and its interaction with other physical aspects of the Earth system. The results will offer a unique view of the inside of the Earth from space, enabling the composition and processes of the interior to be studied in detail and increase our knowledge of atmospheric processes and ocean circulation patterns that affect climate and weather.	Following earlier successes with GEODESIC and Joule, UCalgary space physicists were invited by ESA to lead the Electric Field Instruments on the Swarm satellites.
	2013 NEOSat	DRDC/CSA	The Near Earth Object Surveillance Satellite (NEOSat) is a dual-use microsatellite of Defence Research and Development Canada (DRDC) and the Canadian Space Agency (CSA). The main objectives are to search the sky near the Sun to discover and track asteroids of the inner solar system, and to track artificial satellites in high Earth orbits. The former activity will further explore the population of small bodies near the Sun; the latter will improve tracking and characterization of spacecraft.	UCalgary scientists were responsible for mission design, planning and operation, as well as on-orbit testing, calibration, and operation of space telescope. UCalgary was also responsible for coordination of satellite use with DRDC.
	2012 CASSIOPE (ePOP)	Canada	Enhanced polar outflow probe (ePOP). CASSIOPE is the first Canadian hybrid satellite to carry a dual mission in the fields of telecommunications and scientific research. The main objectives are to gather information to better understand the science of space weather, while verifying high-speed communications concepts through the use of advanced space technologies.	UCalgary space physicists led the development of the ePOP mission, including the mission design and planning, and the design, build, integration and operation of the 8-instrument ePOP payload. This included the fabrication and testing of four of the instruments.
	2013 GO Canada	Canada	Geospace Observatory Canada is CSA's follow-on to CGSM and CANOPUS. This ground-based network of imagers, radars, riometers, magnetometers, and GPS systems provides a world-unique view of ionospheric and auroral processes over much of Canada.	UCalgary leads four of the arrays that comprise GO Canada (the auroral imagers, riometers, photometers, and very low frequency (VLF) receivers).
	2014 ABOVE-2	Canada	Airborne Balloon Observations of VLF waves and Electrons over ABOVE involves the development of x-ray detectors for flights on three high-altitude balloons, studying the radiation belts and their impact on the upper atmosphere.	UCalgary leads ABOVE-2, and developed the flight VLF receiver and payload integration.
	2015 Astrosat	India	The Astrosat satellite carries five separate telescopes to image simultaneously in x-rays to visible light, something that until now has only been done with combinations of space- and ground-based telescopes.	UCalgary astrophysicists provide key support, including calibration, for Canada's contribution of a UV imager.
	2016 OSIRIS-REx	USA	OSIRIS-REx is NASA's mission to Earth-crossing asteroid Benu, which will potentially impact Earth in the late 22nd century. The spacecraft will map Benu's surface, and return a sample of its rocky surface. The science objectives include studying early solar system processes, asteroid compositions, and asteroid geology.	The CSA is a partner in OSIRIS-REx, and is providing the funding for the scanning LIDAR, a key instrument for the mission. Scientific leadership for the Canadian role in the mission is shared by UCalgary and YorkU, and UCalgary planetary scientists will study and curate the Canadian portion of the Benu sample returned by OSIRIS-REx.
	2016 TREx	Canada	The Transition Region Explorer (TREx) is a new network of ground-based auroral imagers viewing the sky over Manitoba, Saskatchewan, and Alberta. TREx deployment begins in 2016, and within three years the array will include cameras operating at more than four wavelengths and with frame rates as high as 30 images every second. The array includes 'stream computing' software to support 'on-the-fly' decision-making by the network itself, and state-of-the-art GPS units for ionospheric investigations and as a test bed to explore how space weather affects satellite navigation systems.	UCalgary led the successful TREx CFI proposal, is developing and deploying the optical imagers, and is working with researchers in the US to develop the GPS and imaging riometer components of the project.
	2017 EPEx	Canada	The Energetic Particle Explorer (EPEx) is a stratospheric balloon mission designed to study short bursts of energetic electrons striking the upper atmosphere.	UCalgary leads the project, and provides the x-ray imager and payload integration.
	2020	2022 SMILE	European Union & China	The Solar wind Magnetosphere Ionosphere Link Explorer (SMILE) will be a revolutionary satellite mission designed to simultaneously image the solar wind-magnetosphere interaction with an x-ray imager (developed by astrophysicists) and the global aurora with an UltraViolet Imager (UVI). SMILE will be the first scientific satellite to observe the complete causal chain of space weather.
2025 PCW		Canada	The Polar Communications and Weather (PCW) system would consist of two satellites in polar orbits to provide Canada with critical weather information and communications capabilities in the high arctic. The operational objective for PCW is to provide continuous imaging of weather, including clouds and ice, everywhere north of 45° geographic latitude. PCW would be Canada's contribution to the global fleet of weather satellites operated by the US, Europe, and China. This proposed mission would have a unique orbit, and would be the first satellite project supporting 24/7 viewing of the polar region.	UCalgary leads one of the three possible secondary payloads, namely auroral imagers that would provide 24/7 viewing of the northern hemisphere aurora, providing a globally unprecedented view of space weather and the physics of near-Earth-space.