The Belgian Institute for Space Aeronomy celebrates its fiftieth anniversary

During the fifty years since its foundation in 1964, the Belgian Institute for Space Aeronomy (BIRA-IASB) has been developing its scientific and technological expertise for studying the physics and chemistry of the atmospheres of the Earth, planets and comets, and the sun's impact on them. This know-how is reflected in the basic and applied research and supporting IT and engineering activities which serve the scientific community, policy makers and the general public.

The Belgian Institute for Space Aeronomy has been growing continuously throughout its existence. As of 1 October 2014, there were 156 personnel members among which 120 doing research including 90 scientists. The average age of the personnel was 40 and women accounted for 28% of the total. In 2013, BIRA-IASB's total annual budget amounted to about 12 million € (60% of which coming from external funding linked to ongoing research projects). Besides, 67% of BIRA-IASB's staff were under contract.

The research activities at BIRA-IASB are spread over 4 scientific divisions: space physics, atmospheric sources and sinks, reactive gases in the atmosphere, and solar radiation in atmospheres. The first division deals with the study of solar winds and their effects on technologies and society, with interplanetary space, the interactions between the Earth's magnetosphere and ionosphere, celestial bodies, etc. The second and third divisions study gases and particles distributions in the atmosphere (sources of emission, formation and loss through chemical reactions, deposition or diffusion in space, transport of gases and particles in the atmosphere). The fourth division focuses on the interactions between solar radiation and the atmosphere, extra-terrestrial and terrestrial ultraviolet (UV) solar radiation, and the planetary aeronomy of Mars and Venus. All divisions include applications for society and the general public: examples are space weather and chemical weather, support to aviation control, dissemination of UV index information, etc.

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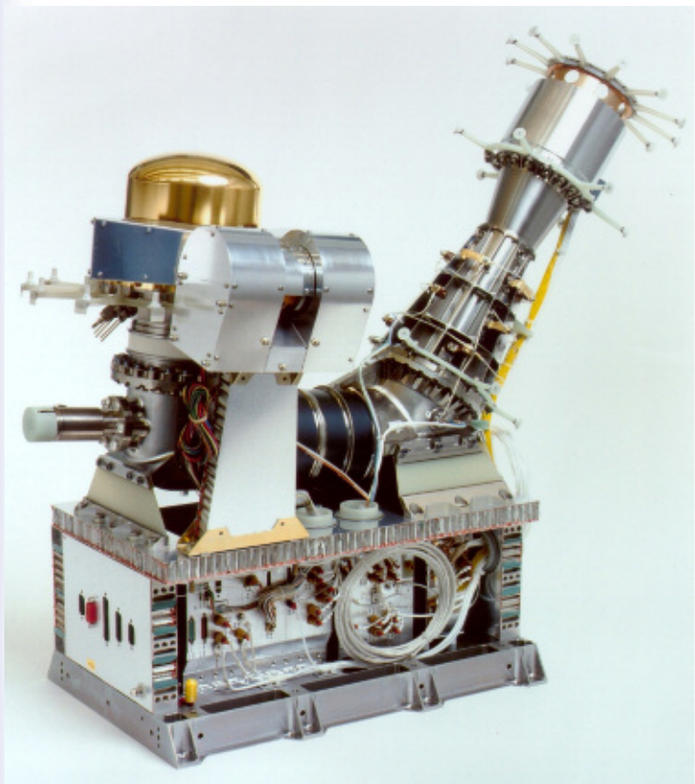
Dr Martine De Maziere, acting director of BIRA-IASB



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Photograph of the DFMS (Double Focusing Mass Spectrometer) before delivery for integration on the satellite

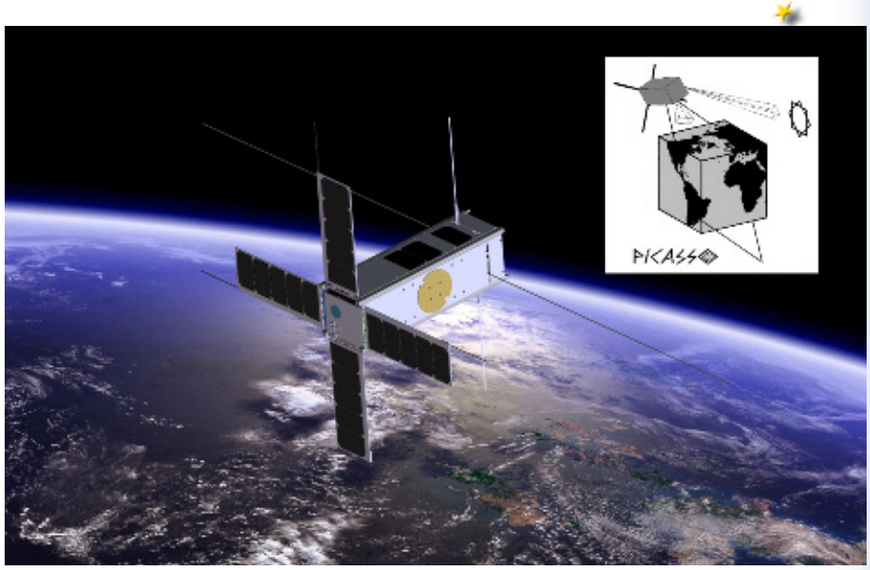
BIRA-IASB researchers make use of 3 essential techniques for their studies: observations from space with satellites, from the ground, or from balloons or airplanes, theory and numerical modelling, and laboratory experiments to characterize the chemical reactions in the atmosphere or to gather spectroscopic data in support of remote sensing based on spectrometric methods.

Currently, BIRA-IASB has a total of 110 ongoing projects. In the selection discussed hereafter, we focus on projects with a strong technological component. Among these, there is ROSETTA, the ESA's mission to comet 67P/Churyumov-Gerasimenko launched 10 years ago. *"The Rosetta orbiter has eventually arrived, the instruments have been activated and they work well"* Dr. Martine De Mazière explains. *"We have received the first data on the comet and started to analyse them"*. BIRA-IASB participated in the design of DFMS (Double Focusing Mass Spectrometer), one of the three components of ROSINA, on board of Rosetta. A spectrometer for ion and neutral analysis, DFMS was designed as part of a collaboration with the University of Berne, IMEC, for the detector chip and its electronic part, and the industrial player OIP for the production and tests of printed electronic circuit boards.

BIRA-IASB is also fully committed to the NOMAD (Nadir and Occultation for Mars Discovery) project, a state-of-the-art spectrometer suite whose launching is scheduled as early as 2016. NOMAD will measure the chemical composition of the atmosphere of Mars on-board the ESA-NASA Exomars mission. Here again, BIRA-IASB is cooperating with OIP (for

the design, production, assembly and testing of spectrometer components) but also with CSL (Liège Space Center), Lambda-X, AMOS, ETCA and other companies in Belgium and Europe.

Together with the Uccle-based Royal Observatory of Belgium, BIRA-IASB is deeply involved in the space weather component of ESA's programme "Space Situation Awareness". Hereto, it collaborates with several companies such as Space Applications Services (SAS), Spacebel, DH Consultancy, without forgetting 2 companies in Germany and Spain.



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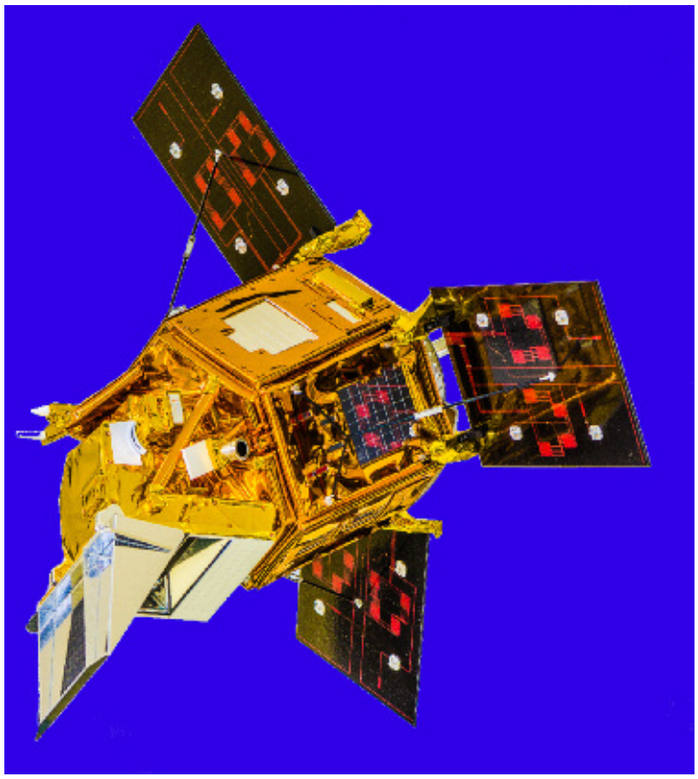
Artist's view of PICASSO orbiting the earth. The inset shows the PICASSO logo.

Another far-reaching experience enables BIRA-IASB to promote its wide range of expertise: PICASSO. *"This project aims at demonstrating the monitoring of the ozone layer and in situ magnetospheric measurements using a Cubesat type nanosatellite whose dimensions are 30x10x 10 cm³"* Dr. Martine De Mazière underlines. This mission was approved by ESA as "In orbit demonstration" mission. In this framework, BIRA-IASB is collaborating with the Royal Observatory of Belgium, the Royal Meteorological Institute of Belgium (which has developed its own ESA-approved Cubesat for climate observations), and CSL, Finland and a UK-based company.

The ALTIUS project is another example of a strong collaboration with Belgian industries (Qinetiq and OIP). ALTIUS is a micro-satellite designed to observe vertical profiles of ozone and other related constituents in the stratosphere to upper troposphere.



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A picture of a model of the TROPOMI spacecraft, showing clearly the solar panels at the front, and the spectrometer and radiative cooler at the rear

Furthermore, BIRA-IASB is carrying on designing instruments for the monitoring of atmospheres and space environment. The Institute has recently come up with miniaturized instruments for pollution monitoring. *"These instruments work on several platforms among which a small car. The latter project is supported by the Belgian National Lottery and aims at measuring nitrogen dioxide in Belgium. We will draw a map of nitrogen dioxide pollution in Belgium in order to contribute to the assessment of air quality"*, Dr. Martine De Mazière adds. Another similar instrument, SWING, has been designed to fly onboard a drone. Campaigns have already successfully been performed in Romania with a local company providing the drone. Such a mapping of pollution perfectly complements as well as validates satellite measurements that enjoy a lower spatial resolution. They will, for example, support validation of the TROPOMI satellite data.

BIRA-IASB is fully dedicated to the TROPOMI satellite project which is due to be launched in 2016 to monitor air quality. The Institute took part extensively in algorithm development and will strongly support the validation of the measurements.

It is clear that one of the strengths of BIRA-IASB is to open up to a wide variety of partners, including industrial companies. Thanks to these partnerships, the development of instruments is shared by both parties, BIRA-IASB resorting to its mechanical and electronic workshops. No doubt such partnerships with the industry have a bright future given the increased competition for space observations. They are also essential for supporting and advancing our scientific research objectives. There is an important cross-fertilization between progress in scientific research and technological innovation.

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