German Aerospace Center

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REXUS and BEXUS: Students fly their own research experiments on stratospheric balloons

9 October 2008

First campaign of the German-Swedish BEXUS programme completed successfully

It only takes ten minutes to fill BEXUS with 10 000 cubic metres of gas

With the completion of two research balloon flights, the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) and the Swedish National Space Board (SNSB) brought the first campaign of the joint REXUS/BEXUS student programme to a successful close on Thursday 9 October. On Wednesday 8 October 2008, the BEXUS 6 and BEXUS 7 balloons were launched from the European rocket and balloon launch site Esrange near the town of Kiruna in Sweden, 200 kilometres north of the Arctic Circle.

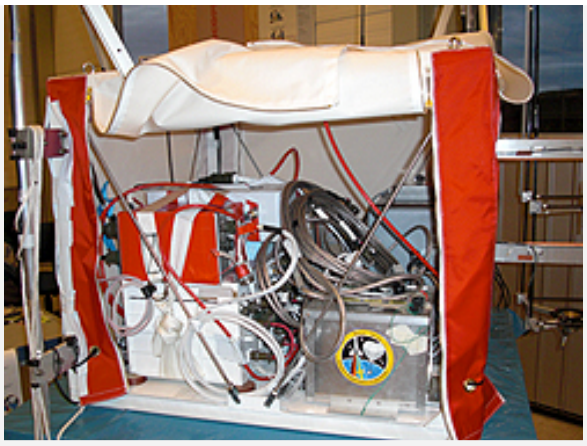
In a total of eight experiments, students from ten different countries investigated the composition of the stratosphere as well as wind and weather phenomena. They also used the helium balloons to find answers to questions of technology. In the context of their REXUS/BEXUS programme, DLR and SNSB make two research balloons and two research rockets available every year for European students wishing to conduct their own experiments. In this way, students can gain hands-on experience in preparing and carrying out space exploration projects.

Launch of the BEXUS 6 balloon

The launch of the balloons was the culmination of the BEXUS research project (**B**allon-**EX**perimente für **U**niversitäts-**S**tudenten; **B**alloon-**EX**periments for **U**niversity **S**tudents) for which 30 students had been preparing for a whole year. Three experiments from German colleges of higher education managed to qualify for this year's research campaign. The other five were designed by students from Sweden, Poland, Romania, Italy, the Netherlands, Austria, the Czech Republic and Australia.

Experiments from German colleges of higher education: Turatemp, Turawind and DOLS

The Turatemp (Turbulence in the stratospheric temperature field) and Turawind (Turbulence in the stratospheric wind field) experiments were developed by three female students of the Leibniz Institute of Atmospheric Physics (Leibniz-Institut für Atmosphärenphysik; IAP) associated with the University of Rostock. The goal of the experiments is to gain a better understanding of the physical processes taking place in the stratosphere and thus to contribute to climate research. To achieve this goal, the students measured so-called small-scale fluctuations in the temperature and wind field in the stratosphere. These are the result of turbulence in breaking gravity waves. Gravity waves are generated in the lower atmosphere, for instance when air flows over a mountain range. They can transfer momentum from their source up to the mesosphere at altitudes of 50 to 85 kilometres. As the air becomes increasingly rarefied higher up in the atmosphere, the laws of physics dictate that the amplitude of the waves increases accordingly, until they break just like water waves on the shore. The energy of the breaking wave dissipates and the waves are transformed. The findings of this experiment will be analysed in the context of both a doctoral thesis and a graduation thesis, and they will be used in numerical climate models.

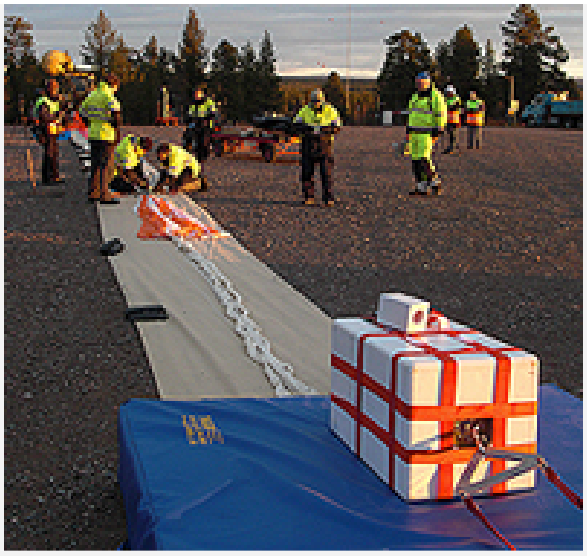


BEXUS 6 payload with the Turatemp and Turawind experiments

In the DOLS (**D**iversity and **O**rigin of **L**ife in the **S**tratosphere) experiment, microorganisms such as bacteria or spores were collected by sucking many cubic metres of air through sterile filters. Earlier research already established that microorganisms exist and are able to survive in the hostile environment of the stratosphere. The specimens collected in the present experiment will be analysed in the laboratory using modern molecular biological methods and they will be classified in the so-called "Tree of Life". With their experiment, the students wish to help resolve the exciting question whether the microorganisms in the stratosphere originated from the Earth or from space.

The eight students of the DOLS team are from Tübingen, Heidelberg, Hildesheim, Munich, Mainz and Barcelona. For this BEXUS experiment, they have formed an interdisciplinary team. The ICARUS experiment designed by students from the Warsaw University of Technology and the Politehnica University of Bucharest was attached to a balloon. It tested the open- and closed-loop controllability of a remote-controlled lifting body vehicle.

Further experiments: Stratospheric Census, TimePix and AURORA



The balloon for the BEXUS 6 mission laid out on the ground

The Stratospheric Census experiment addresses questions similar to those explored by DOLS. It was designed by an international group of students, all currently based at the Luleå University of Technology in Kiruna. The TimePix experiment set up by students of Charles University and the Czech Technical University in Prague uses a hybrid pixel detector to conduct real-time measurements of cosmic radiation. The AURORA experiment of the Sapienza University of Rome tests suitable sensors for determining physical atmospheric data. In addition to this, it contains a telescope capable of recording images of the Earth's upper atmosphere. LowCoins, another experiment of the Sapienza University of Rome, tests new sensors for determining the balloon's attitude and position.

REXUS and BEXUS - a programme for young scientific talent

In June 2007, DLR and SNSB created the REXUS/BEXUS programme. Through this programme, they enable students to gain hands-on experience in preparing and carrying out space exploration projects. Every autumn, students can submit proposals for experiments to be flown in the gondola of a balloon, or on board sounding rockets (REXUS - **R**aketen-**EX**perimente für **U**niversitäts-**S**tudenten ; **R**ocket **EX**periments for **U**niversity **S**tudents). Half of the payload capacity of the rockets and balloons is always reserved for students of German universities and colleges of higher education. SNSB has made the Swedish share available to students from other ESA member states as well.

BEXUS 6 student team

The BEXUS balloons are especially suited for atmospheric research and technological experiments. The helium balloons have a volume of 10 000 to 12 000 cubic metres, and they can reach an altitude of 20 to 35 kilometres during a three- to six-hour flight. The balloon system can have a maximum length of up to 100 metres; the maximum payload capacity is 100 kilogrammes. Similar scientific questions are addressed by REXUS research rocket missions. The rockets reach an altitude of about 100 kilometres and they offer several minutes of experiment time.

The DLR Space Agency (DLR Raumfahrt-Agentur) in Bonn manages the programme and allocates the DLR experiments. The REXUS/BEXUS project office was set up at the DLR Institute of Space Systems (DLR-Institut für Raumfahrtsysteme) in Bremen for the organisation, supervision and integration of the German experiments. It is responsible for internal project management at DLR. The flight campaigns are carried out by EuroLaunch, a joint venture of DLR's Mobile Rocket Base (Mobile Raketenbasis; MoRaBa) and the Esrange Space Center of the Swedish Space Corporation (SSC).

This year's call for ideas for the five-year REXUS/BEXUS student programme was announced by the DLR Space Agency and (on behalf of the Swedish space agency SNSB) by the European Space Agency ESA in early September 2008. The next student campaign using REXUS research rockets will take place in Kiruna in March 2009. Experiment proposals for the balloon campaign of September 2009 and the rocket campaign of March 2010 can be submitted until 17 November 2008.

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