TEXUS 50 – Anniversary for Germany's sounding rocket programme

12 April 2013

It is the world's longest running rocket programme for conducting research in microgravity, and today it is celebrating an anniversary. Around 35 years after the launch of the first TEXUS mission in December 1977, the 50th TEXUS rocket was successfully launched into space from the Esrange Space Center near Kiruna in northern Sweden on 12 April 2013 at 06:25 CEST. The flight lasted 20 minutes, with six minutes of microgravity. A parachute then returned the scientific payload to the ground.

The German Aerospace Center's (Deutsches Zentrum für Luft- und Raumfahrt; DLR) sounding rocket carried four German biology and materials research experiments to an altitude of 261 kilometres. The VSB-30 rocket was powered during its initial climb, which lasted a little over 30 seconds, and then continued its journey in free flight.

"The main payload on board the TEXUS 50 mission is the **EML** electromagnetic levitation facility developed in Germany," reports Otfried Joop, TEXUS project manager at the DLR Space Administration, adding: "It is being used by researchers at the DLR Institute of Material Physics in Space to conduct two experiments in which they can investigate the thermophysical properties and solidification behaviour of metal alloys, which are of great interest to industry. The scientists are investigating a nickel-zirconium alloy, as well as an aluminium-nickel compound that is used in aviation and other transport systems." Thanks to the TEXUS flight, the Cologne-based DLR researchers are acquiring highly accurate data for computer simulations that form part of modern industrial manufacturing processes.

At the University of Marburg, scientists want to use **fungal sporophores** to investigate the initial reactions of an organism to changes in gravity. How are these sensed and how quickly does the fungus react to the change in gravity and to microgravity? "The relatively long period the rocket spends in microgravity, and a built-in precision centrifuge, should enable the scientists to measure the kinetics and threshold value – that is, the minimum amount of gravity that the fungus needs to respond – for the first time," explains Joop.

In the second biological experiment on TEXUS 50, scientists from the University of Freiburg want to identify the **genes and gene products** (messenger RNA) that play a role in the perception and processing of gravity in plants. To do this, the flight is carrying seedlings of Arabidopsis Thaliana, a plant that has been used by researchers as a model organism since the 1940s due to its relatively simple genetic structure. "After the flight, the TEXUS seedlings will be compared to plants that remained on the ground," says Otfried Joop in summary. Among other things, the researchers will be looking for answers to the question of which classes of gene are activated or deactivated by changes in gravity.

Double campaign – two rockets in one week

"TEXUS 50/51 is also the first German double campaign since 1981," says Joop. One week after the anniversary mission, TEXUS 51 will be ready for launch on 19 April 2013 with four more experiments by German scientists:

Researchers from the Fraunhofer Institute for Integrated Systems and Device Technology (Fraunhofer IISB) in Erlangen, the University of Freiburg and the University of Bayreuth have been studying the incorporation of particles during directional solidification of silicon crystals for photovoltaic cells, as part of the **ParSiWal** experiment. This is intended to clarify the mechanisms by which harmful silicon carbide particles are integrated into silicon crystals during the crystallisation process. The presence of silicon carbide (SiC) particles during the industrial

production of silicon for photovoltaic cells hinders the mechanical processing of the product and reduces the efficiency of the finished solar cells. It is therefore important to prevent the integration of SiC particles into the silicon crystal. The particles are formed during crystallisation in a silicon melt that is contaminated with carbon. Gravity significantly influences the flow of the melt and causes the SiC particles to sink, as they are denser than silicon. In space, these gravity-induced effects are eliminated. This significantly reduces the complexity of the processes and simplifies their physical description. The results should ultimately contribute to an improvement in the quality and efficiency of solar cells.

The **FOKUS** experiment run by the Max Planck Institute of Quantum Optics in Munich should prove that the technology of a frequency comb is mature enough for applications in spaceflight. At the core of a frequency comb is a pulsed laser that is used to measure optical frequencies. This technology will be used in precision spectroscopy, for example when investigating trace gases in the atmosphere, in astrophysics, or in new, extremely precise atomic clocks for research missions or navigation. The frequency comb is a laser that was developed by the Max Planck Institute of Quantum Optics in 1999. Theodor W. Hänsch shared the 2005 Nobel Prize for Physics in recognition of this work.

The **SITI-2** medical and biological experiment, conducted by a group of scientists at the University of Magdeburg, should explain the mechanisms that lead to problems with the human immune system in microgravity – some astronauts suffer greatly from infections during long stays in space. For this reason, the TEXUS 51 flight will carry cell cultures in which the activity of genes in immune systems are set to be investigated using modern DNA chip technology. If the scientists confirm their suspicion that certain molecules in the cell membrane are responsible for the problems caused by microgravity, these results might lead to new approaches in the fight against long-term illnesses.

Finally, in the **TRACE-3** material science experiment, run by the ACCESS research centre in Aachen, processes and structures that are important for the solidification of metal alloys will be analysed. The scientists will monitor this in, for example, a mixture of organic substances that solidifies like a liquid metal. The solidification process can then be observed directly, as the alloy is transparent. The data acquired should improve industrial casting processes.

Since 1977, throughout the TEXUS programme, some 300 scientific experiments have been carried out, 70 percent of these under contract to DLR, and around 30 percent under collaboration with the European Space Agency (ESA). "This means that, in collaboration with other DLR flight facilities, TEXUS is an essential component for fundamental research in microgravity, and hence also for the preparation of long-term space experiments, possibly on the International Space Station," said Otfried Joop, summing up the programme.

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Launch of TEXUS 50

TEXUS 50 was succesfully launched on 12 April 2013 at 06:25 CEST from the Esrange Space Center near Kiruna, in northern Sweden, carrying four German experiments on board. The rocket reached an altitude of 261 kilometers. There were 6 minutes and 20 seconds of microgravity during the flight.

Credit: DLR (CC-BY 3.0).

TEXUS 50 in the launch tower

The TEXUS-50-rocket mounted in the launch tower at the Swedish Esrange Space Center near Kiruna.

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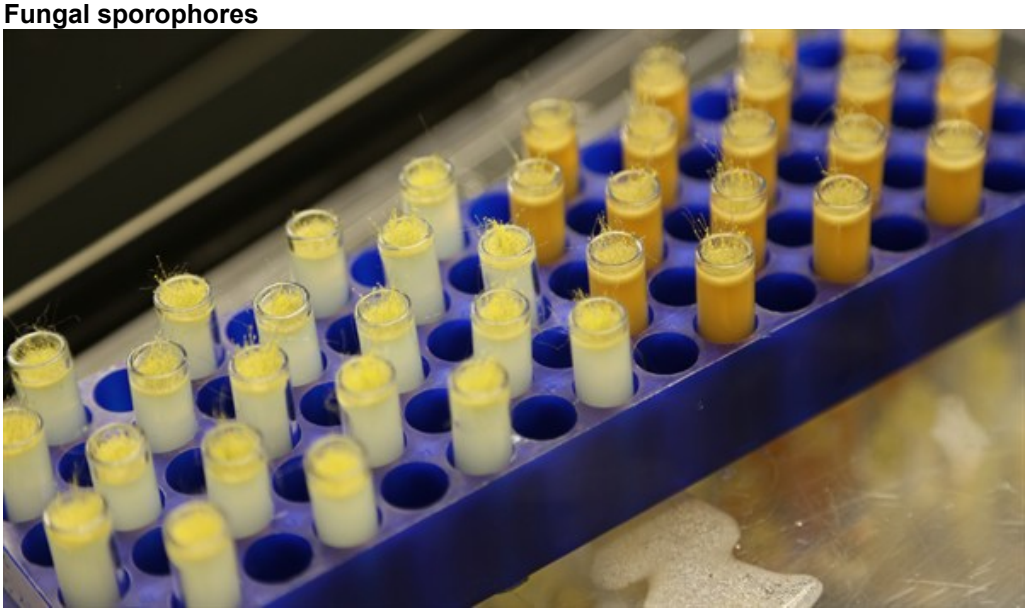
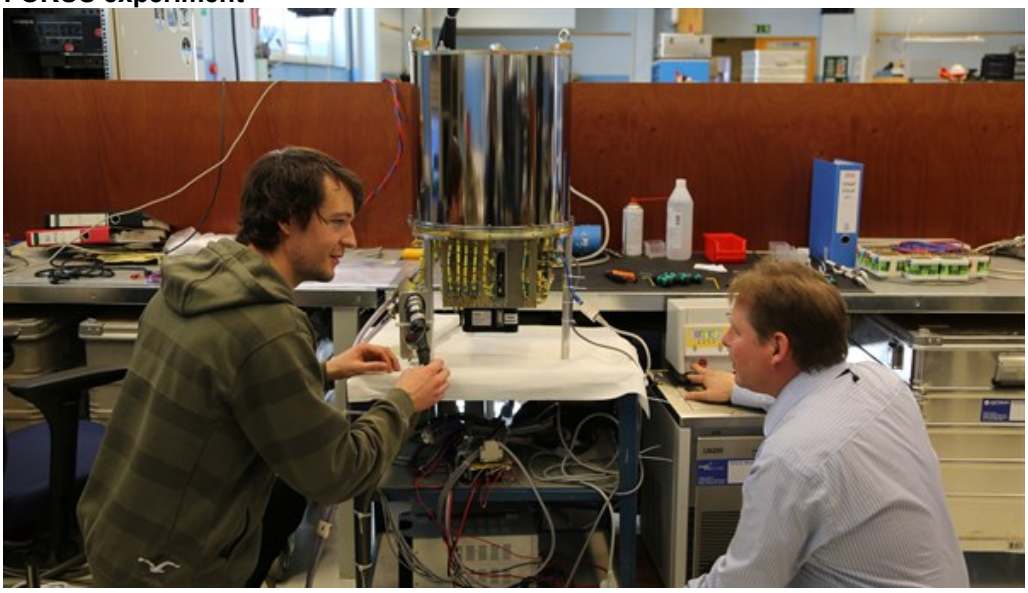
Fungal sporophores



Researchers from the University of Marburg are investigating the initial reactions of an organism to microgravity during the TEXUS 50 flight. A total of four German experiments flew on the rocket.

Credit: DLR (CC-BY 3.0).

FOKUS experiment



The FOKUS experiment, run by the Max Planck Institute of Quantum Optics in Munich, is testing a frequency comb at the core of which is a pulsed laser that is used to measure optical frequencies. This technology will be used in precision spectroscopy.

Credit: DLR (CC-BY 3.0).

TEXUS rocket motor

For the TEXUS programme, Brazilian two-stage VSB 30 rockets are used. The solid rocket motors are prepared for flight by engineers from DLR’s Mobile Rocket Base (Mobilen Raketenbasis; MORABA).

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