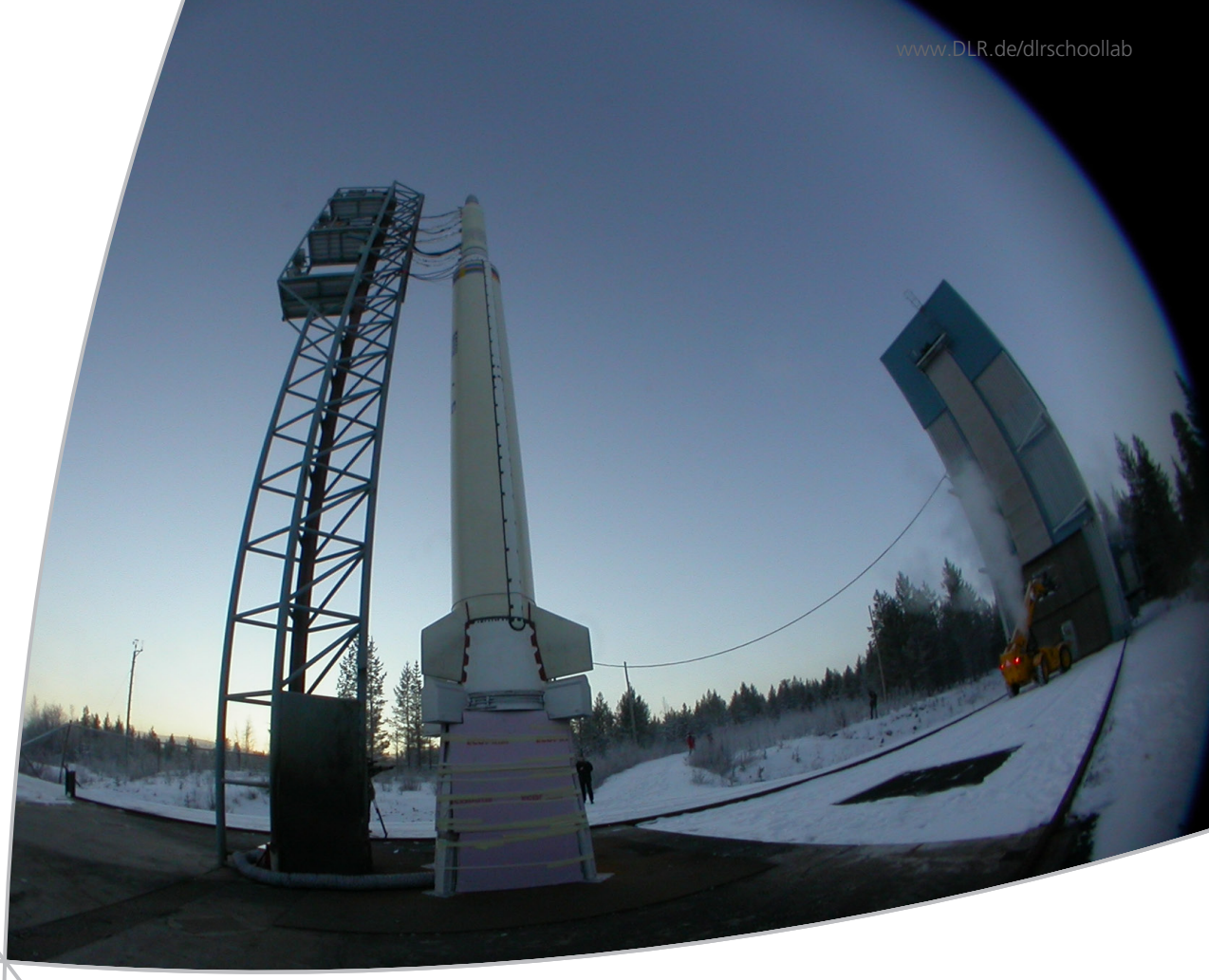
DLR



DLR_School_Lab

Oberpfaffenhofen

MORABA

Mobile Rocket Base

The first known use of rockets dates to the year 1232, when Chinese warriors managed to so terrify Mongolian attackers with the help of firework rockets that they took flight.

Today, rockets are an important research tool. They put satellites in orbit, bring astronauts to the International Space Station ISS, and help to monitor earth's atmosphere.

Rockets provide access to realms that would otherwise be inaccessible. But whether we are talking about a rocket for a New Year's celebration or for a trip to the moon, the underlying principle is the same.

MORABA

Fig. 1: Students launch a water rocket

Applications for rockets and the mobile rocket base

New concepts for the atmospheric reentry of space transport systems
For manned space missions like space shuttle flights, reentry into the earth's atmosphere is a particularly critical phase, hot in the literal sense of the word. Temperatures over one thousand degrees centigrade envelop the outer hull of the space vehicle during this process! In the SHEFEX (Sharp Edge Flight Experiment) project, DLR attempted for the first time to use a reentry body with a sharp-edged profile. This technology could make future space vehicles much less expensive and considerably safer.

The missile was brought to an altitude of over 200 km with the help of a two-stage rocket, after which it reentered the atmosphere at a velocity seven times that of sound. When designing the rocket as well as conducting the flight, scientists were able to rely on the team in charge of the mobile rocket launching base MORABA and thus on over 30 years of experience in launching rockets.

Technology experiments in microgravity – TEXUS
Investigating biological, physical and physiological processes taking place in a microgravity environment is an important subject of current research. The insights gained help us to better understand our world, and particularly how life might have arisen on Earth. A relatively inexpensive method for generating microgravity for a fairly prolonged period is to use unmanned rockets on parabolic flights. The largest and strongest ones achieve altitudes above 800 km, with microgravity conditions existing for about 14 minutes. The DLR_School_Lab's MORABA experiment demonstrates the course of a rocket mission in some detail, from initial mission planning to analyzing the measurement results.

What causes a rocket to fly?
Rockets are the only aircraft which can fly (or more precisely, can change their velocity) in the vacuum of space. The reason lies in the special propulsion method used by rockets. Why this is the case is something you can find out in the DLR_School_Lab's MORABA experiment, where you can also get an answer to the question of why astronauts are not really weightless, but only feel that way.

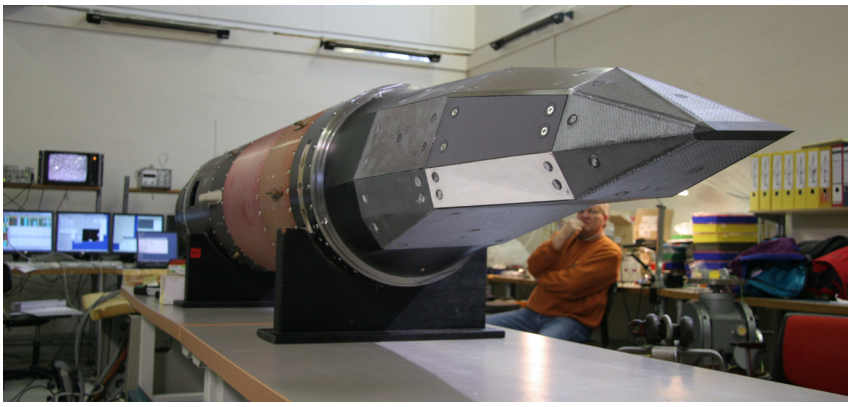


Fig. 2: SHEFEX, a reentry body with a sharp-edged profile

Fig. 3: Launch of the TEXUS mission

The Experiment

A so-called water rocket is used in the DLR_School_Lab's MORABA experiment. It employs water and compressed air as fuel. When started from its mobile base this rocket achieves a launch velocity over 150 km/h and an altitude above 40 meters. The fundamentals of weightlessness research are investigated with the help of a small drop tower and experiments on board the rocket.

Simulating the rocket flight
The experiment is planned in detail before the first rocket launch, and with the help of simulation programs the flight is optimized already in advance. The mission goal is to achieve a maximal flight altitude.

Analyzing the results
The rocket's flight is recorded by an on-board micro-camera and relayed to the ground via radio signals. At the same time the experiments taking place on board the rocket are recorded by a second micro-camera. Analyzing these two films leads to conclusions about the course of the flight and the conditions on board the rocket, and rounds out the experiment.

Glossary

MORABA
The "Mobile Rocket Base" is involved in the design, preparation and implementation of high altitude research projects. It is used to conduct experiments with high altitude research rockets.

TEXUS
Technology experiments under microgravity conditions have been a permanent part of the DLR space program since the 1970s. Most of the experiment relate to biological issues. They could be roughly described as "long parabolic flights using rockets."

SHEFEX
The "Sharp Edge Flight Experiment" was designed to investigate for the first time the utility of sharp edged profiles on bodies reentering the earth's atmosphere - and it was a success!

Shootinger
This is the name given to the first complete construction kit for water rockets; it includes PET bottles and a special launching ramp.

Fig. 4: Preparing to launch the SL 1 rocket

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DLR at a Glance

DLR is Germany's national aeronautics and space research center. Its extensive research and development activities in the fields of aeronautics, space, transportation and energy are integrated in national and international cooperative ventures. In addition to this research, as Germany's space agency the federal government has given DLR the responsibility to plan and implement the German space program and to represent German interests internationally. DLR is also the umbrella organization for Germany's largest project management agencies.

Approximately 6,500 people are employed at DLR's 13 locations, which include Köln (headquarters), Berlin, Bonn, Braunschweig, Bremen, Göttingen, Hamburg, Lampoldshausen, Neustrelitz, Oberpfaffenhofen, Stuttgart, Trauen and Weilheim. DLR also operates offices in Brussels, Paris and Washington D.C.

DLR Oberpfaffenhofen

Aerospace, environment and transportation are DLR's primary fields of interest in Oberpfaffenhofen. Some 1,500 people work there in nine different institutes and facilities, making DLR Oberpfaffenhofen the largest DLR location.

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