

EuroLaunch – A DLR and SSC Cooperation for Sounding Rocket and Balloon Missions

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EuroLaunch¹ is a cooperation between the German Aerospace Center (DLR) and SSC in the field of sounding rocket and balloon activities. DLR and SSC are well equipped for supporting most types of sounding rocket and balloon missions using Esrange Space Center, the SSC launch facility, as the prime range or any other worldwide location depending on the scientific mission requirements. Esrange Space center is located north the Arctic Circle near the city of Kiruna. Esrange as well as the Mobile Rocket Base (DLR-MORABA⁵) provides all expertise and infrastructure for the launch of sounding rockets and stratospheric balloons. The collaborative coordination of services and infrastructures creates an efficient, cost effective and flexible partner for sounding rocket- and balloon missions. Both partners have long experience in the sounding rocket and balloon business and EuroLaunch will continue to create synergies to the benefits of the customers. The paper gives an overview over completed, ongoing and future activities of EuroLaunch as well as over all the resources provided, for example facilities at Esrange, mobile infrastructure of MORABA, vehicle systems, payload systems and logistics.

I. Introduction

EuroLaunch¹ is a cooperation between between the German Aerospace Center (DLR) and the SSC in the field of sounding rocket and balloon activities. The EuroLaunch agreement between both partners was signed on December 8th 2003 at Esrange Space Center. Both organisations have provided launch operation services to scientists and space organisations in Europe and worldwide since the late sixties. The EuroLaunch agreement strengthens the ongoing cooperation between DLR and SSC.

DLR and SSC are well equipped for supporting most types of sounding rocket and balloon missions using Esrange Space Center, the SSC launch facility, as the prime range or any other worldwide location depending on the scientific mission requirements. Esrange is located north of the Arctic Circle near Kiruna in northern Sweden. It provides systems and capabilities for the launch of sounding rockets and stratospheric balloons. A unique land impact area of 5200 square kilometers offers an economical advantage for recovery and re-flight of experiments.

DLR-MORABA, located at the DLR Space Center in Oberpfaffenhofen near Munich, provides mobile infrastructure and capabilities for the launch of sounding rockets and support for balloon missions. We describe the infrastructure in section II of this paper.

DLR and SSC exhibit more than 35 years of successful cooperation, now concentrated in the EuroLaunch cooperation. It gained manifold experiences from supporting research projects in a wide variety of scientific fields. The coordination of services and infrastructure of both organisations provides an efficient, flexible and cost effective partner for sounding rockets and balloon missions. A large number of launch operations is a guarantee for the capability of the EuroLaunch cooperation.

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II. The EuroLaunch Facilities

A. The Esrange Facilities

Esrange, the SSC launch facility, is located north of the Arctic Circle near Kiruna in northern Sweden. Esrange provides systems and capabilities for the launch of sounding rockets and stratospheric balloons. A unique land impact area of 5200 square kilometers, offers an economical advantage for recovery and re-flight of experiments. The Kiruna area offers unique opportunities for space and environmental research. Therefore it is not surprising that sophisticated facilities for space researchers and users of space technology have grown up here. Esrange is the centre for these operations and has long experience in rocket launching, high-altitude balloons, and the control and operation of different types of satellite. Through the years, Esrange has evolved into a European centre for space and a world centre for ozone research in the northern hemisphere.

Work at Esrange is carried out under contract to research and space organisations, and to companies in Sweden, Europe, the USA and Japan and other countries. The location, 200 km north of the Arctic Circle, offers several unique advantages:

- Payloads from sounding rockets have a land touchdown area 120 km x 75 km in size.
- The touchdown area for balloon payloads is a vast land area in the north of Sweden, Norway, Finland and Russia.
- The location is outstanding for observations of boreal phenomena such as northern lights, noctilucent clouds and mother-of-pearl clouds.
- Polar satellites make 12 to 14 passes daily through Esrange's coverage area.
- Sounding rockets



Figure 1. Esrange Main Building

B. MORABA Facilities

DLR-MORABA, located at the DLR site in Oberpfaffenhofen near Munich, provides mobile infrastructure and capabilities for the launch of sounding rockets and support for balloon missions. The main tasks of MORABA are support of national and international space projects as well as preparation and operation of sounding rockets and balloons for scientific applications in the areas of

- Aeronomy
- Astronomy
- Magnetospheric physics
- Geophysics
- Atmospheric physics and chemistry

MORABA is also responsible for

- technological experiments under micro-gravity conditions (duration from 3 to 15 minutes)
- testing of newly developed experiments and technologies for satellites or the International Space Station (ISS)

- development and production of mechanical and electronic sub-systems for sounding rockets, which are not commercially available
- application of mobile TM/TC- and radar stations for satellite missions

MORABA offers a lot of complete mobile infrastructure for launching sounding rockets:

Data communication systems

- TM/TC systems for L & S-band
- C-band radar system
- Flight control & termination
- E-Link high-speed TM/TC link for balloons
- EBASS balloon service system

Launchers

- Single rail launchers
- Launchers for meteorological rockets
- Launch equipment for dynamic & auxiliary balloon release

Support systems

- Timing
- Countdown
- Power and communication

C. Other used Facilities

EuroLaunch in the past also has used the launch facility in Alcântara, Brazil (CLA, Centro de Lançamento de Alcântara). This range has been used from the IAE (Instituto de Aeronáutica e Espaço) to launch six RTV's (Range Test Vehicles) with the support of MORABA and Esrange-personnel. More information about all the offered facilities can be found in an information brochure about EuroLaunch. This can be downloaded from the EuroLaunch webpage

III. Projects within EuroLaunch

In the following we describe some recent activities in which EuroLaunch is involved.

A. The REXUS/BEXUS Project

Rexus/Bexus is the main ongoing activity within EuroLaunch. REXUS/BEXUS is bilateral German-Swedish cooperation to offer students experiment opportunities using sounding rocket and balloon flights from Esrange Space Center in Northern Sweden and is executed by EuroLaunch.

Organisations backing the Rexus Bexus programme are:

DLR - Deutsches Zentrum für Luft- und Raumfahrt/ German Aerospace Center.
DLR is Germany's national research centre for aeronautics and space².

SNSB - Swedish National Space Board.
SNSB is a central governmental agency under the Ministry of Industry, Employment and Communication³

ESA Education

ESA Education Office coordinates education activities to help young Europeans, aged from 6 to 28, to gain and maintain an interest in science and technology range⁴

REXUS stands for "Rocket Experiments for University Students", and the programme is considered as an annual sounding rocket program launched from the Esrange Space Center.

REXUS experiments are usually launched from Esrange on a rocket powered by an Improved Orion Motor with 290 kg of propellant. It is capable of taking 40 kg of student experiment modules to an altitude of approximately 100 km. REXUS is an unguided, spin-stabilised, solid-propellant, single stage rocket. The vehicle has a length of 5.6 m and a diameter of 356 mm and the total available mass for student experiments is about 30 kg. The REXUS program is a joint project between SSC and the Mobile Rocket Base (MORABA) of the German Aerospace Center DLR. The campaign is conducted by EuroLaunch in close cooperation with the students. Up to now there have been 11 Rexus rockets launched on Esrange.

BEXUS stands for Balloon-borne Experiments for University Students and is a yearly recurring experimental flight with a stratospheric balloon.

BEXUS experiments are lifted by balloon from Esrange to an altitude of 20-35 km, depending on total experiment mass (40-100 kg). The experiments are hanging 65-100 m below the balloon. The BEXUS balloon has a volume of 12,000 m³ and a diameter of 14m when filled. The total mass available for the experiments is between 40 and 100 kg. The maximum altitude is 35 km and the flight duration is 2.5 hrs. The campaign is conducted by EuroLaunch in close cooperation with the students.

Up to now there have been launched 13 Bexus balloons from the Esrange ballon pad.

B. Further projects with support of EuroLaunch support

There are other projects where EuroLaunch is involved with personell and infrastructure

- MASER 12 – launch support
- Taurus/Orion requalification flight with possible ROTEX payload
- STERN – Student Rockets with main focus on new rocket drive, launching from Esrange
- SHEFEX2 – Telecommand support
- Patriot/ Improved Malemute qualification flight

C. Other EuroLaunch Perspectives for the near future

For the future there exists the possibility to enlarge the launch facilities at Esrange. A new launching tower could be built on the opposite side of the river near the recent launching facilities. This new launching facility can be used for the launching of small satellites with polar orbits. A first test for this could be a launch of a VLM-type rocket.

References

Websites with more informations

¹EuroLaunch

<http://www.eurolaunch.org/>

On this website more information material can be found including the EuroLaunch brochure and brochures about the EBASS (Esrange Ballon Service System) and E-Link (Esrange Airborne Data Link System)balloon telemetry systems.

²DLR

www.dlr.de

³SNSB

www.snsb.se

⁴ESA

<http://www.esa.int/education>

⁵L. Altenbuchner, J. Ettl, M. Hörschgen, W. Jung, A. Stamminger and P. Turner, "MORABA – Overview on DLR's Mobile Rocket Base and Projects", paper within this proceedings issue.