

# Europlanet Expert Exchange Report

Visiting the Swedish Institute of Space Physics and the ESRANGE Space Center

## Introduction

As a Mechatronics Engineering student at Budapest University of Technology and Economics, and also a Research Assistant at Wigner RCP, I was involved in atmospheric magnetic research and will also be involved in the commissioning of a SERF magnetometer for future experiments.

**Objective of my visit was to further expand my knowledge** on ESA-certified development processes and experiments at the Swedish Institute of Space Physics (IRF).

**Location of the visit:** Swedish Institute of Space Physics (Kiruna), ESRANGE Space Center

**Duration of the visit:** 27 June 2022 - 01 July 2022 (arrival back to Budapest on 02 July 2022)

**The purpose of the visit:**

- gather a better knowledge about the test facilities used at IRF, especially the thermo-vacuum chamber and other mechanical test instruments,
- learn more about the quality insurance system of IRF,
- collect information about CAD/CAM systems and PCB design softwares used at IRF,
- collect information soldering and its quality assurance in workshop,
- have a better understanding of the usage of SERF magnetometers.

Visited departments / facilities of IRF:

### *Auroral Large Imaging System (ALIS)*

- ALIS consists of light-sensitive cameras for auroral studies.
- I had the opportunity to visit the control room and view beautiful and scientifically useful images made by the system.
- Unfortunately I couldn't see the system during operation, because there was a holiday period during the visit.

### *EISCAT Radiotelescope*

- EISCAT Scientific Association operates a radar system of four radars for meteor and ionospheric (or upper atmospheric) studies (including auroral studies).
- In Norway, EISCAT operates a UHF and a VHF transmitter and receiver and also an ionospheric heater facility (a powerful radio wave transmitter with an array of antennas which is used for research of plasma turbulence).
- One of their receiver stations are located in Kiruna, which I have visited with colleagues.

### *ESRAD Radar System*

- ESRAD is an MST (Mesosphere-Stratosphere-Troposphere) radar for atmospheric studies.

- The 16 x 18 array of 5-element yagi antennas (set of multiple connected antennas) work together as a single antenna.
- Technical specifications of the receivers allow heights from 100 m – 128 km to be sampled, with pulse repetition between 100 Hz to 16 kHz and pulse lengths corresponding to height resolutions between 75 m and 3 km.

#### *NLC Camera System*

- The NLC camera system is a network of automated cameras, which are responsible for studying noctilucent clouds.
- Although optics is a bit outside of my field, but we have seen some stunning image.

#### *IRF SpaceLab*

- IRF SpaceLab has facilities for space instrument design, qualification and testing.
- Visiting SpaceLab was the far most interesting part of my study visit in Kiruna, because I have seen a fully integrated system (both vertically and horizontally) in operation.
- SpaceLab with its infrastructure and the knowledge base of its colleagues is able to plan experiments and also design, manufacture and test the necessary equipment for it – be it mechanical, electrical or software components. This facility makes a very much needed bridge between space sciences and the space industry.
- The facilities I visited: Solar Simulator, Thermal Vacuum (TVC025, but also  $\mu$ TVAC), Vacuum Oven, Detector Testing, Vibration Testing (we even visited the new vibration testing laboratory currently in the works) and the Integration Laboratory.
- The facilities I didn't visit: Calibration Facility, Climate Chamber.

#### *Summary of the visit: the study visit achieved its objectives to the maximum*

I gained insight into the IRF's quality management system, mainly through SpaceLab's laboratories and workshops. According to my impressions, their quality system does not only exist on paper, but is the operational basis of the actual daily management.

Designing and making high-quality PCBs is important in the space sector. I worked on developing PCBs for satellites, high-altitude balloons and sounding rockets at my university, so I truly experienced the need for these skills. SpaceLab has ECSS-certified soldering operators, according to ECSS-Q-ST-70-08C and ECSS-Q-ST-70-38C.

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