



CZECH TECHNICAL UNIVERSITY

MOBILITA-AKCE 200

Study internship at Aalto University, Finland

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Acknowledgment

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University administrative matters

Before leaving the Czech Republic and CTU, I had to take care of administrative matters related to the stay abroad. I first needed to deal with enrolling for my Master's thesis on KOS but also physically by making the coordinator of my department accept and sign my proposal. This was done quite fast, taking into account I did it ahead of time and organized a meeting with the right people. After that, I had to apply for the Mobilita-Akce 200 scholarship. This task was a bit troublesome as most of the documents were in the Czech language. Thankfully I could ask the help of my coordinator at CTU, who read and corrected the application for me. The process was rather quick, and only a few days after applying, I already received a positive answer from the Vice-Dean.

After arriving in Finland, I had to take care of my enrollment as a visiting student at Aalto University. I have to admit that Finland is a very well organized country, making things easier for upcoming visitors from abroad. I only had to give them a copy of my passport with a few other details for them to organize everything digitally. The following day I could already go to the HR department of Aalto University to pick my credentials, my key card, and see my desk in an open space.

Regarding immigration matters, I was lucky to have done an Erasmus exchange in Finland (in the city of Oulu) already so I did not need to register myself at the immigration office. Indeed, I was still in their database with a Finnish personal number, and the only thing I had to do was to go to the closest post office to update my new address.

Practical experience and everyday life

In this section I would like to speak about my global experience in Finland. I was working in the department Electronics and Nanoengineering in the Space Science and Technology field. I was a member of an entire department working on the launch of several CubeSats. My main task was to study and determine which attitude sensors, actuators and propulsion systems can fulfil the mission requirements. To do so, I conducted an overall mission overview with the science team to fulfill the asked requirements of the payloads and I ran analysis focused on the spacecraft environment using AGI STK and SPENVIS to decide the usefulness of magnetorquers.

Moreover, I was to design the attitude control and orbit maintenance systems for feasibility analysis. A side task was to provide thermal and mechanical departments with expertise about AOCS to assist in crucial technical decisions. Last but not least, I took part in the making of a first of its kind CubeSat mission to GTO. To elaborate on the latter, the number of missions designed to GTO is very low. That is high likely due to the harsh space environment surrounding the CubeSat. Indeed, the high energy radiations can cause critical damages to the on-board subsystems leading to a precipitated mission's end of life if not designed properly. Moreover, this orbit is often used as only a step when missions to GEO are launched. As a result, the orbit is filled with space objects coming from launch stage pieces or rocket fragmentation debris. The lack of scientific experiments at GTO is a motivation for the FORESAIL program alongside with demonstrating the feasibility of sending and using a CubeSat as a platform for experiments at this altitude. I felt accepted in the group very fast, and my workmates made sure I was feeling comfortable during the meetings. Another task I was assigned to was to create animation and renders of FORESAIL-1, FORESAIL-2, and AALTO-3 CubeSats in collaboration with Aalto Satellites Media for outreach purposes using Blender and other graphical design software.

Towards the end of my stay, I could finally conclude on the actuators and sensors to be used, and was able to design major requirements for the mission (regarding both attitude and orbit control), a mode architecture of the system, and a Function Enabling Scheme per Mode. I could provide the team I was part of with useful information, needed from other experts working on the remaining subsystems. Designing a satellite is not easy, and requires a lot of focus. Nonetheless, I had so much fun doing it, and it helped me to find out what I really want to aim for once I graduate. It allowed me to gain a more in-depth and practical knowledge of developing and designing a space mission from scratch. I could understand the connection within the spacecraft's subsystems and increase my efficiency in working in the space industry. As I was every day working on STK and following pieces of training weekly, I liked the so-called Digital Mission Engineering side when planning a mission, and would like to continue following this path hopefully.

Of course, I can't continue writing this report without talking about the global pandemic that shocked the world. Because of COVID-19, I had to work remotely from my apartment, having regular online meeting with the team every two days. Nonetheless, I feel lucky to have lived the COVID-19 outbreak in Finland. The country took good care of the situation, taking the right measures at the right time. We were not imposed a quarantine like in most of Europe, but were asked to reduce our movements as much as possible. Restaurants, bars, cinemas and others had to close to only reopen during the month of June. Moreover, because most of the inhabitants of Finland live in the region around the capital Helsinki, the government decided that the inner borders of the latter would be shut down, limiting the movement of the virus. It was a bit sad because I wanted to travel within Finland during my free time, yet I am glad they took such a decision as we can now see it paid off.

I was living in Espoo, the second largest city and municipality in Finland and located a few kilometers west from Helsinki. My apartment was located at the terminus of the metro, making my movements to and from the university relatively easy. I lived in a shared apartment with two Indian people. I really enjoyed having them as my roommates as I could open myself to a completely new culture. Regularly we were organizing dinners were they would cook specialities from India (adapting the spiciness for me) and I would

take care of the dessert. I have to say that it was a wonderful experience and definitely will keep in touch with them.

The range of possible activities was quite reduced because of COVID-19 during my free time, adding to the fact that this winter was very warm and almost no snow fell in southern Finland. Nonetheless, I had the chance to have another friend from Germany doing a study stay at Aalto university as well. We usually went to play football and badminton together in order to relax and exercise from the busy week at the university. Furthermore, we both had a passion for aerial photography and hikes. A typical weekend would be to find an interesting place on Google Maps and hike to this location. There we would fly our drones following the local rules while having some snacks in the nature. Finnish forests and lakes are beautiful, and it was always amazing to see how close from Helsinki we could find those lost places, filled with small islands where it was possible to even camp.

As said previously, the winter was very warm with temperatures ranging between 0° and 5° instead of the usual -25°. As a result, it was raining when it was supposed to snow. However, one aspect that did not change is the length of the days, being quite short when I arrived and very long when I left. Thankfully I already had experience living in a Scandinavian country, so I knew how to cope with the side effects of late sunsets and early sunrises (the other way around works as well).

Money

Before coming to Finland, I was already aware of the life cost here, but still had to stick with a strict budget for those months. I was lucky to have applied to HOAS, which is the student organization in Helsinki renting apartments for Finnish students but also foreign students. My rent was 239€, which was nothing compared to private apartments where it could rise to 800€ for a room in a shared apartment. The only downside was that the room was not furnished when I arrived. I had to go to a second hand store to buy a bed, chairs, a desk etc... Thankfully this place had a wide range of products in good conditions and I could furnish my room for less than 100€. Concerning the public transports in Helsinki, the price of a single ticket was 2.80€. With that ticket, it was possible to use all kind of transports inside Helsinki (bus, tram, metro). A seasonal ticket for one month as a student was 32.80€, which is a big difference compared to the prices in Prague, where the public transports were not only cheaper but also more efficient.

Concerning the food, I was mostly buying frozen food as fresh meat for example was very expensive. I allowed myself a budget of 50€ per week for groceries during my stay but even with this amount, I could only afford the basics. Same rules were applying to restaurants, where it was usual to spend a minimum of 25€ for a meal.

Conclusion

To conclude, I am happy to say I really enjoyed my stay in Finland despite the situation caused by COVID-19. It is a mind blowing country, full of nature, forests, lakes, but also very modern cities and buildings. I had no problems integrating in the society as everyone there speaks English fluently. It did not stop me from learning the basis of Finnish, which

is a very difficult language to learn. Professionally, I discovered the space industry for real, and could see how a space project is being conducted, from the mission proposal to the mission analysis, to the verifying tests etc... It is thanks to this stay abroad that I also had the opportunity to follow a training offered by the European Space Agency about space debris and how important they are for the future of space exploration. I met a lot of new interesting people, colleagues, workmates, friends and could expand my network as much as possible. I am looking forward to coming back to Finland, and will definitely keep this location in mind for a potential future workplace as the space industry is growing exponentially there.