Personal Report about my research stay at Carnegie Mellon University

I must admit that applying for the Marshall Plan Scholarship and getting everything worked out with the research institution was a really tedious and long process. Preparing all kinds of documents for the university and especially getting the US VISA was a bit annoying but totally worth it in the end. Ever since I have watched "The Last Lecture" by Randy Pausch (go watch it, it's on YouTube), it has been my dream to go to Carnegie Mellon University (CMU). This was a few months before I even started my bachelor's studies. It's an honor to get such the unique opportunity to visit CMU and do research there and get a scholarship by the Marshall Plan Foundation on top of it.

I did research for my master's thesis in the Biorobotics Lab at CMU. The head of the lab is Professor Howie Choset. Over the last decade the lab mostly focused on modular robotics, mostly snake robots, but also hexapods or medical robots. In the last few years the spinoff company hebirobotics [1]was founded by three grad students and with the help of Howie Choset. The company focuses on robotic modules which are specifically aimed at agile manufacturing and quick reconfiguration with a target audience of researchers, engineers and industrial integrators. My research was focused on trying to estimate kinematic and dynamic parameters of arbitrary robot configurations given various sensor data from the modules.

The lab consisted of many undergrads, a few Grad students, postdocs and full-time researchers. Their field of studies ranged from Computer Science, Electrical Engineering to Mechanical Engineering which are of course all required to solve problems in the field of robotics. The postdocs had their own offices, so except if you asked them to come, or for meetups, they weren't present in the lab. This doesn't mean that they weren't available though. Anytime you wrote them an email they responded swiftly and often came to the lab to discuss things. During summer half of the people left for home or doing internships, but those places got filled with summer interns from places like China, India, Brazil and others. Overall the lab probably consisted of 20-30 people and most of the time 10-20 of those were present in the lab itself. This is fairly big for CMU standards from what I gathered. Additionally, the lab environment really showed the difference between Austrian universities and universities in the US. Undergrads would come to the lab nearly daily to work on their projects and also Grad students came daily working for hours. Even on Saturdays, and also Sundays people were in the lab. It was a very competitive environment and everyone was eager to learn new things and produce results.

In my opinion the quality of research done in the lab was outstanding. Grads and Undergrads did very interesting research, including my project. While the undergrads often solved simpler problems, they also sometimes teamed up with the grad students to help them. This resulted in several papers which were published in journals in the time I have been there. Furthermore, the robots and research result was shown at conferences all around the world. If somebody was stuck, things could always be resolved at the latest in the weekly meetings when everybody was around.

[1] http://www.hebirobotics.com/

Having postdocs and full-time researchers around meant, that at least one person probably had an answer or a hint on how to proceed.

CMU itself is one of the best CS and Robotics universities in the US, and that showed. Many professors are considered to be leading researchers in their field. Furthermore, a lot of important books in CS and Robotics have been written by them. This means, that as long as you are willing to ask, all the knowledge you could ask for is in reach for you. Every week there have been several talks on topics like AI, Machine-Learning, Robotics and more. These were sometimes held by grad students, but also often by faculty members or people from the industry. On every Friday, a Robotic talk was given by external Professors like from MIT. These talks can be watched on YouTube and are very interesting and insightful to learn more about the current state of Robotics.

Integration in the lab environment went really smooth once I arrived. While they had PCs for everyone to use, it was advised to use your own laptop since they were probably faster. The topic of my thesis was in robotics, but it was different to the research everyone else did. This sadly meant I did not have a real partner to bounce of ideas, as mentioned everyone was friendly and open to any questions though. My real advisor wasn't Howie Choset but one of the guys who formed the spinoff company. They weren't located on campus but had an office 10 minutes from CMU. In the beginning, it was a bit unclear what exactly I should achieve and that sadly cost me some time. Additionally, the modules I should use for my thesis weren't available right from the beginning and so I had to use different modules at first, which produced slightly different results.

My biggest mistake was probably that I didn't ask enough especially in the beginning. You yourself are solely responsible to finish your research and produce a proper thesis. If people see you are willing to work hard and you ask the right questions, they are more than happy to help you. You are writing a master's thesis after all and are expected to not needing a guiding hand all the time. So, the biggest advice I can give is to ask, ask, ask, especially in the beginning to clear up any questions. Furthermore, to address the elephant in the room, start early enough with writing on the actual thesis. It's obvious, but yet again most people don't do it and then have too little time in the end which results in sub-optimal writing.

Additionally, your research is not everything. Being in a different country on a different continent means that you should grasp the opportunity and set away enough time to also see different parts of the country to get a better sense of American people and the culture. While Pittsburgh is without a doubt a small but nice city, it's not the most exciting one. I am glad that I visited friends in New York and Washington, and after I finished my stay at CMU I traveled the West Coast and Hawaii for three weeks. Yet I am sad that I ran out of time in the end and not visit the Kennedy Space Center in Florida. Set aside time for traveling in the beginning already. Don't wait a few months till you have results, you will never be fully satisfied and there is always more to do. Trying to cram in everything in the last two month probably means that you won't be able to do everything you wanted to.

In the end, I must say that it has been one of my best experiences in my life, and I am thankful to the Marshall Plan Foundation, Howie Choset and everyone at CMU, Professor Robert Merz at the Fachhochschule Salzburg, and everyone else who supported me for giving me this opportunity.