DAAD RISE 2009 Internship Report

Host Institution:

Technische Universität Darmstadt

Department of System Reliability and Machine Acoustics (SzM)

Darmstadt, Germany

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"I agree that my report and accompanying pictures can be used by the DAAD in printed materials, presentations and on the website in order to inform funding organizations, sponsors, and students about the RISE program."

My name is David Hiemstra and I study Mechanical Engineering at the University of Michigan in Ann Arbor, Michigan. I had the great opportunity to participate in the DAAD RISE internship program during the summer of 2009 in Darmstadt, Germany at the Technische Universität Darmstadt (TUD). I applied for the RISE program because it seemed an excellent way to gain engineering experience, improve my German, and strengthen my pre-existing connections with Germany, and it absolutely was.

My ties with Germany began when my family moved there from the U.S. for two years during middle school. It was a very good experience, and ever since, I have done my best to return to Germany to further improve my German and to re-immerse myself in the German culture. I would like to eventually live there long-term for further studies or for work. I was excited to have an opportunity with the RISE program to accomplish both goals of getting hands-on engineering experience as well as giving me a chance to return to Germany.

My internship was in Darmstadt, a small city with 140,000 inhabitants, roughly the size of my hometown, Ann Arbor, Michigan. Darmstadt is located in mid-western Germany, 20 miles south of Frankfurt. I had never been in Darmstadt before and it was exciting exploring a new city. Although Darmstadt was largely destroyed by bombs in World War II, it was rebuilt and there are still many interesting things to see. I bought a guide to the city's attractions and spent many afternoons exploring and learning about the history of many famous landmarks such as the "Ludwig's Column" statue in the main square, the historic castle, the Hundertwasser-styled Waldspirale and the famous Mathildenhöhe artists-colony. I also saw much of the surrounding landscape and castles on bike tours by myself and with Germans I had met.

My internship was in the Machine Acoustics department of the TUD (Systemzuverlässigkeit und Maschinenakustik). Acoustics is a field I am interested in. I have done music recording and production as a hobby, but it was exciting working in the field of acoustics from an engineering point of view. My advisor's PhD thesis project I worked on was the validation and improvement of a computer model of a Harmonic-Drive gear-train to reduce the gear-train's noise and vibrations. A test rig had been built to make measurements of the actual gear trains for comparisons with the computer model, and my first project was to simplify and expand code for

obtaining measurements. My second and largest project was designing and conducting a sensitivity experiment on the test-rig.

In all my projects I learned a lot. One thing I learned was the importance of using engineering theory. The use and understanding of the underlying theory was highly stressed by my advisor. I found it very insightful talking through the theory and predicting results with my advisor and then running tests to see if our predictions were correct.

My SzM research group

I also had many opportunities to use and improve my programming skills. Before the internship I had not really enjoyed programming; however it was such an important tool during my internship that I came to enjoy and value it.

In my second project, I learned to apply statistical and experimental methods to solve engineering problems, a skill that will absolutely help me in my engineering career. I learned how to design experiments to test the significance of relationships between different factors which may affect a process; in my case, identifying which factors (amount of grease, tightness of bolts, etc.) significantly affected the measurements made on the gear-train test-rig.

Another important part of my internship was witnessing many of the "Diplomarbeit" student project presentations. It was required as a student at the TUD in my department to complete a semester-long engineering project. This was very different from my undergraduate engineering curriculum, because all of my required long-term projects at the University of Michigan are team projects. I think team projects are very important, but I was very impressed by what the students at the TUD could do on their own. Each student would be assigned a project, for example, "design a display-stand to explain acoustic theory in a creative manner to be built and put in the main lobby." By watching their presentations, it was apparent that they would attack the problem

with engineering theory, come up with solutions to the problem based on the theory, design an experiment to validate their idea, and make recommendations based on the outcome. The research projects were very thorough and impressive. It was very good motivation for me to know what I should be capable of as an engineering student, and is one of the reasons I would now like to attend graduate school, in order to do a master's thesis project.

The internship part of the RISE program was invaluable. However, the time I spent in Darmstadt outside of work and my travels were also extremely important. One of the most enjoyable things I did was joining a local triathlon team. The people were very fun. I swam with them in the evenings, and then went to the beer gardens with them after practice. Towards the end of my stay in Darmstadt, I participated in a local triathlon with the team. I had never done one before, and it was wonderful.

Another great experience I had was "couchsurfing" in Norway. I bought a 10-Euro plane ticket to Sandefjord, Norway, and found a person on couchsurfing.org who hosted me for a weekend. My host showed me around and I got a good feel for the local culture. The best part of the weekend was going to the coast of the North Sea. The landscape with it was rugged but beautiful. While exploring Sandefjord I also visited a very interesting whaling museum and spent hours in a local guitar shop playing the Norwegian guitars.

The North Sea coast off Norway

Further travel destinations of mine included Heidelberg for the DAAD RISE meeting, and Nürnberg, München and Köln to visit friends. The German Rail Pass that was given to us by the RISE program was amazing, as it eliminated travel costs for me. With the RISE scholarship and Rail Pass, I was able to live and travel comfortably without using my own money.

I am extremely happy with my experience through the DAAD RISE program this summer. I gained important, applicable engineering experience, improved my German, travelled often and enjoyed life in Darmstadt.