

Over the past nine weeks, I've worked with seven other Olin students on engineering projects given to us by scientists at the Goddard Space Flight Center. I worked on two teams of four students. In one project, we worked on building a Multichannel Analyzer. In the other, we worked on controlling an Continuous Adiabatic Demagnetization Refrigerator.

A Multichannel Analyzer, or MCA, is an instrument that takes in a voltage signal, detects pulses, and sends information about those pulses to the computer over a USB connection. Similar instruments currently cost hundreds or thousands of dollars. We were able to develop an MCA with materials that cost under \$50 (excluding the power supply). In this project, I learned much about several aspects of electrical engineering. In particular, I learned much about how to build circuits that can deal with extremely fast signals (i.e., pulses as fast as tens of nanoseconds). Also, I got my first taste of PICs, how to program them, and how to use them to control circuits. For more information about the MCA project, visit our website at <http://nasa.ece.olin.edu/projects/2008/mca/>.

An Adiabatic Demagnetization Refrigerator, or ADR, is a cooling device that uses magnets and some properties of thermodynamics to achieve temperatures as low as a twentieth of a degree above absolute zero. Temperatures this low are required for x-ray detectors that rely on measuring minute changes in temperature to detect individual x-ray photons. A single stage ADR requires a liquid helium bath at 2 Kelvin. The ADR then lowers the temperature to 50 milliKelvin. The problem with this is that once the liquid helium is expended, the ADR can no longer achieve the required temperature. A continuous ADR, or CADR, aims to eliminate the need for a liquid helium bath by using multiple stages for progressively cool from 4 Kelvin to 50 milliKelvin. The challenge that remains is to control the temperature of the coolest stage to within one part in 50,000. Our job was to develop a control algorithm that would be able to achieve this. Although we did not succeed in doing so, we thought of several techniques and even implemented some of these ideas. In this project, I gained much experience in using LabVIEW, an engineering software tool, and learned about control theory. For more information about the ADR project, visit our website at <http://nasa.ece.olin.edu/projects/2008/adr>.

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