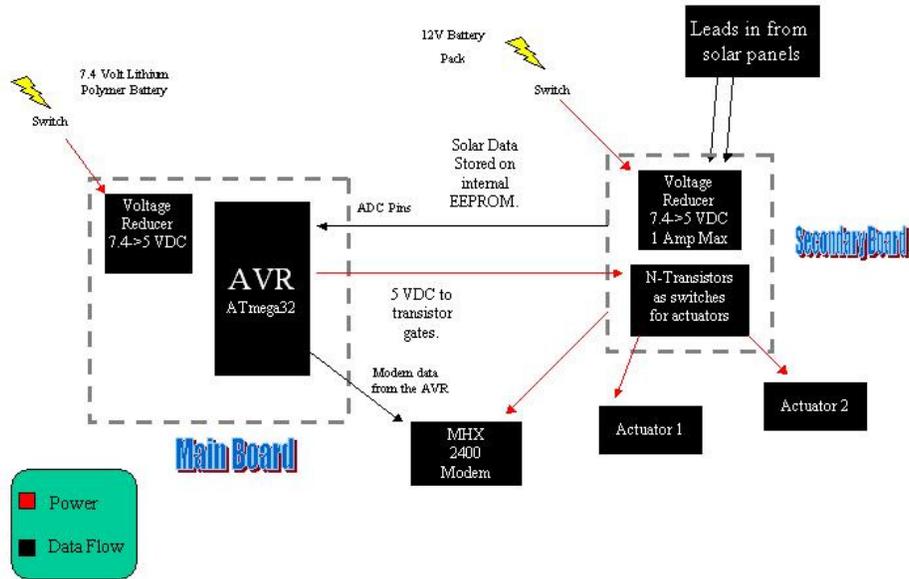


Colorado Space Grant Consortium  
Independent Study Credit  
Final Report

**Shawn Michael Carroll**

Final Functional Diagram



DemoSat  
PhoenixSat

Aaron Russert  
Alicia Harris  
Curtis Miller  
Erin Tucker  
Kaylee Bush  
Miranda Rohlffing  
Nic Zinnern  
Shawn Carroll

Brian Sanders

August 31, 2007

## 1.0 Student Background

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Before taking the Gateway to Space class, I wasn't qualified to work on the DemoSat project. Before Gateway to Space, I had done a limited amount of soldering, and I had a vague idea on how to read a schematic. Over the course of Gateway to Space, I worked with Andrew Berg to design and construct a custom circuit board. By the end of the project, we built and configured a series of boards to output a sound of 1Khz (oscillator), receive it (mic/pre-amp), rectify it, and reduce it to a peak of 2V (limiter), depending on the intensity of the sound received. In addition to gaining circuits experience, I also learned a lot about how a balloon satellite is constructed. Everything that I learned in Gateway was directly applicable to my position on the DemoSat team.

The ambition to work on DemoSat was also inspired by my Gateway mission. Berg and I were insistent on flying our satellite again, but after I received the position with Space Grant, we were unable to do so. I was happy to work on a more complex project though. Berg's hard work as our project manager also sparked my interest in leading the DemoSat team. The project manager has a lot of responsibility, and I have always liked taking a leadership role, so I decided to express my interest to be project manager. I was thrilled when I was voted to be the project manager. I not only got to build another satellite, I also gained the managerial experience that I was seeking.

## 2.0 Overview of Semester Work and Assignments

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One of the biggest challenges in creating our main board was to make sure that the board was handling the limitations and requirements of each subsystem. After doing much research and talking to Brian, I found out that there was a board that RocketSat was using that had a handful of components that were going to be necessary to our system. Erik Phalke of RocketSat designed a general board that will most likely act as a starting point for future DemoSat/Gateway mission. This board held the AVR and had a place for the voltage reducer. The real work came in making the appropriate connections from the modem to AVR, configuring a load system for incoming voltages, and designing an activation system for the actuators.

The managerial portion of my job was quite different and a new experience for me. The larger tasks that I completed as a manager were: sending out emails on meetings and or updates on progress, keeping individual subsystems on schedule as much a possible, heading meetings, and organizing all of our larger presentations.

### 3.0 Individual Conclusions and Results

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At the beginning of the semester, I had a vague idea on how to read schematics. As the board progressed, I had to learn more about reading schematics to understand how to build a more complex board that was not so intuitive. It was also nice that material that I was covering in physics about components was directly related to what I was doing!

In building the board, I also gained experience with soldering. I had soldered before working at Space Grant, but I learned better technique, and I soldered my first surface mount components. I also learned about solder vacuums, which can come in handy when you make a mistake or need to move a component. I also learned to check the continuity of my ground connections with a multi meter. Simple checks along the way can help alleviate issues that are almost impossible to trace down later.

Physics exposed me to resistors, capacitors, and inductors, but I was able to learn about transistors during my construction of the board. I had heard that transistors were one of this centuries' greatest advancements in technology, and I was finally able to put one to practical use. I ended up using an N-Type transistor as a switch to give power to the actuators. By applying a 5V spike to the gate pin, the transistor then acted like an open switch and allowed the voltage from our secondary battery pack to activate the actuators. When the gate was neutral, the transistor then acted like a closed switch again.

The final component that I learned about was a micro controller. The team decided on an Atmega 32. Micro controllers were new to me, but I was amazed at how versatile and useful they were in controlling events in the satellite. With an understanding of embedded C programming, one can use the Atmega 32 to control a plethora of other components on a board. Our AVR stored volatages, deployed solar arrays, and streamed a text string to the microwave modem.

My work on the board was beneficial because the board was the "heart" of the satellite that tied all of the subsystems together. Without the board, all we would have is a box of unusable subsystems. Each subsystem was important to the satellite, but most of them required running through the main board to connect to other subsystems.

My most beneficial contributions as project manger were organizing the presentations and organizing/heading meetings. For the PDR, CDR, and the final presentation, it was my job as the project manager to take the required deliverables and organize them into a coherent presentation. I found this to be an excellent learning experience. I received good feedback from the group that my outlines were helpful.

Organizing the meetings was important in keeping everyone up to speed on the project and to make sure that progress was being made. With eight team members, it was hard to have regular meetings. In order to compensate for our lack of meetings, I tried to send out emails on our progress, but I found them to be ineffective. Initially, the emails were too lengthy and no one read them. Over the course of the semester, I became better at writing terse emails. I felt that these email were useful in keeping everyone updated on the satellite's project, and communicating meeting times and locations.

#### 4.0 Individual Lessons Learned and Advisor Feedback

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I had a good experience with Space Grant this semester. I wish I had more time to put into the project. I had a really busy academic schedule this semester, and I was not able to be the project manager that I wanted to be. I wish I could have been a little more organized. If I had been better organized, I might have been able to keep the project on schedule. My goal this summer is to make sure that realistic deadlines are set and that they are met. It would be nice to speak with individuals on a regular basis to discuss progress/complications. I did not have the time to do this last semester.

Overall, I have really enjoyed my time with Space Grant, and I am looking forward to a great summer!

## 5.0 Hours and Outreach

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Start	End	Hours
1/8/2007	1/14/2007	N/A
1/15/2007	1/21/2007	N/A
1/22/2007	1/28/2007	N/A
1/29/2007	2/4/2007	4
2/5/2007	2/11/2007	10.25
2/12/2007	2/18/2007	4
2/19/2007	2/25/2007	6.5
2/26/2007	3/4/2007	13
3/5/2007	3/11/2007	14.75
3/12/2007	3/18/2007	5
3/19/2007	3/25/2007	15
3/26/2007	4/1/2007	8
4/2/2007	4/8/2007	35
4/9/2007	4/15/2007	24
4/16/2007	4/22/2007	4
4/23/2007	4/29/2007	8.5
4/30/2007	5/6/2007	3.5

### Outreach:

4/20/2007 Lego Drop Activity (1:00~3:30pm)

## 6.0 Grade

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When it comes to the Quality, Quantity, Documentation and On-time work, I feel that I deserve somewhere between 35 to 40 percent of the total 40 percent. Overall, I feel that I completed quality progress reports and presentation slides, and I completed them on time. I have improved my report writing and presentation skills over the semester, but they could still use some work.

I did complete over 100 hours. I exceeded the requirement by over 55 hours, so I feel that I should receive all of this credit. I also followed the code of conduct and I feel that I should receive full credit here as well. Also, I feel that I did a complete job on my progress reports, and I feel that I should receive full credit here as well. I also completed my outreach and should receive all of these points too.

Finally, I have completed this final report and I will complete my exit interview on the 8<sup>th</sup> of May. I feel that I did a complete job on this report, and I feel that I should receive full credit for it.

Overall, I feel like I have deserved between a 95 and 100 percent when all of the percentages above are summed.