Internship Final Report

Discuss each of your objectives using the given outline

My first objective is "Draw schematics that implement the given requirements, and are able to be created by a lab (not unrealistic schematics)". I chose this objective because I am working on a specialized radio that needs interface hardware to effectively communicate with it. This often takes to form of test boards that communicate between a desktop and the radio. This provided the opportunity for me to learn about schematic drawing tools and some practice designing hardware in a way that wasn't specifically taught in classes. This is how I originally planned to complete the objective, and it was successful, I did design schematics for a radio-desktop interface.

The criteria for this objective were to follow the requirements and to make it implementable. I did meet these objectives, by following the requirements of SDL hardware design and getting the design into the next phases of manufacturing. These objectives were useful in keeping me focused on the end goal of the schematic drawing and were useful to my employer because they now have a board to facilitate communication to the radio.

My second objective is "Write documentation on using the designed system, and meets customer requirements". I originally planned on meeting this by writing documentation on the software for the radio, and this mostly worked. The target audience is not the general public in this case but is other engineers that mostly know what's going on with radios. This resulted in not writing quite the same documentation as previously expected, but I did still write good documentation. There's not currently a good way to show exactly how effective I was with this

objective because the project is ongoing and my documentation has not been published to the customers yet but has been through the technical writing process.

My third objective is "Implementing software that is compatible with a softcore processor". This was met by redesigning the software used in the radio for easier compatibility with other computers. The plan worked mostly as expected, and I was able to learn more about this process than I originally thought I would learn. I recently got a lot of experience with Git, specifically using branches, pull requests, doing bug fixes, and a more 'agile' approach to software. I was effective in meeting this criterion, which I know by having pull requests accepted, being given more tasks, and innovating better ways to code/organize the radio.

This objective was useful for my skill development by directly leaning on what I enjoy doing in this field and being directly applicable to my next job which will be in firmware. This objective was helpful to my current employer by providing them with a more robust software framework and associated tests that will more easily facilitate future software development.

My fourth objective is "Implementing algorithms to transfer commands and data from host to client". This objective stayed mostly the same as expected and I was able to implement a fairly robust way to communicate back and forth between the desktop and the user. This objective was met well, as shown by the unit and system tests that I also implemented to prove the correctness and effectiveness of the communication scheme. This is very useful to my professional development because I practiced testing parts of codes that I previously hadn't attempted to test. This is also useful to my employer because they have a tested system for communication.

My fifth objective is "Unit Testing on the system to ensure each function performs as designed, and system testing to ensure the system functions according to customer

requirements". I originally planned to meet this objective by writing, running, and debugging the unit tests. This was the objective that worked almost exactly as expected. I spent a lot of time this semester testing. The criteria were to ensure the programs worked as designed and that those designs held up to the customer's requirements. The criteria to evaluate this objective is how well these tests show the performance of the software. I met this objective by writing over one hundred tests to evaluate the performance of the software and hardware on the radio.

This objective is really useful to my future career because, in all my design tasks in the future, I will be either writing the tests or interfacing with the tests that others are writing. Knowing all the ins and outs of how testing works will be beneficial so I can write good and robust software. This is helpful to my employer because they have a way to double-check system performance.

A description of the job or position held

My job title is "Engineering Assistant - RF". The RF stands for Radio Frequency. I mostly worked on the software to interface with the RF designs. This included things like interfacing with the radio, controlling the functionality of the radio, and keeping track of internal information such as telemetry. I worked with my coworkers to coordinate the requirements that we were focusing on. I was also able to learn skills like Git to further coordinate with co-workers.

Your relationship with your supervisor and co-workers

I had a good relationship with my co-workers and supervisor. We mostly talked about work things but occasionally got into friendly conversations and even a few post-work

get-togethers for parties and things. We made a well-functioning team and everyone had respect

for each other's own skills and values along with their personality and individualism.

Some students find that the work environment provides as many educational benefits as the tasks they perform, if not more. Develop a statement(s) regarding the way(s) in which your work experience has been of benefit to you (be specific). These may be positive or negative.

My work has had a very positive influence on my education. The first and foremost was

connecting what I was learning at school to the real-world work environment. More specifically,

since I was working on a radio at the same time as learning about things like signal constellations

and modulation techniques in Dr. Moon's Communication Systems class, I was able to link what

was happening in class to what was happening on the radio. I also learned good software

development skills which further grew my software experience from my CS minor (where I

initially learned things like Git) to writing good tests (which were mentioned in lots of classes

but never were a focus).

Describe the relationship(s) you see between your academic major and the job you performed.

My major was Electrical Engineering for my undergrad a Computer Engineering for my

Master's program. This job was a good mix of both of those skill sets as I was working on a

software-define-radio, the skills from Electrical Engineering were useful like communications,

signal processing, and circuit design, and the skills from my Computer Engineering class were useful like programming, FPGA/digital design, and computer architecture.

What strengths and weaknesses have you discovered in yourself as a result of this work experience?

I learned that I work best when I have a lot to do and that I need to be organized to work best. This can be a strength because I will often have plenty of work to do in the work environment and as long as I can stay organized through all the tasks, I will be able to be successful in whatever job I have. I also learned that I enjoy conversations with people that have a similar experience to my own, like those working at the same job and having the same major. This can be a weakness if I were to spend too long getting to know my coworkers, it could turn into a distraction.

Identify ways in which Utah State University can be more responsive to your individual needs (additional activities, additional courses, counseling services, etc.) Be specific

The process to apply for this class was vague. I now know that there were some forms that would have been helpful at the beginning of the semester to know, for example, the document "Student Manual" would have been very helpful to have. The "Student Manual" outlines the expectations of the learning objectives and gives some good examples. Since I wasn't given this document, I had to guess what would be good objectives and then had to go back and forth with Dr. Chakraborty to finalize them to a good working state. The same

document also outlines what I should be doing throughout the semester to prepare for this paper and the interview with my supervisor. I was not aware of any of these requirements until now when I am writing the paper.

Discuss a specific university course you completed and how the knowledge and skills learned in that course were applied to your job.

I took the course Advanced Reprogrammable Computing from Dr. Phillips, which was an amazing course. From that course, I learned how to effectively write code for an FPGA, which is used to control the radio through GPIO as well as run a softcore processor. If I hadn't taken the Reconfigurable Computing courses I would not have had nearly enough experience to know how to program FPGAs.

Explain ways in which classroom learning could be improved and expanded.

Many of the classes I have taken discuss topics that are good to know and helpful in some situations, but it would be more helpful if the whole semester was focused on working on one single project. Some courses do this, but even those courses tend to break apart the final projects into smaller projects that later need to be rewritten into the final project. Advanced Reconfigurable Computing was a good example of this, where within the first couple of labs we were writing code that lived through the end of the final project as written. This is helpful because most real-world jobs don't have you doing different things every week. Most

engineering jobs stay working on one project for many months at a time if not years. It would be good to get experience in working on more long-term projects.

Tell about your future with the company

I am not staying with Space Dynamics Lab after this semester. This is no fault of SDL or ECE 6250, I am graduating this semester and moving on to work for a different company; however, I did have the opportunity to apply for a full-time position on my same team.

Describe your employer's function or service. How does your particular job contribute to the total operation?

My team worked on a software-defined radio that was designed to easily fit into small satellites. This radio was originally designed by JPL, after they sent it to Mars they handed the project over to SDL to maintain and iterate on it. SDL has had the radio for 5-10 years and has sold somewhere around 20 radios to various small satellites, the most recent notable being NASA's DART mission.

My particular job is to do whatever is needed for the project. There are enough team members that I have been focusing on the software and firmware side of the radio, while other team members worked more on the hardware. We have recently been cleaning up the code that JPL originally wrote to make it more programmer-friendly when the small satellites are trying to communicate with the radio.

In what ways has this experience confirmed or modified your ideas and plans for a career

This has confirmed that I want to be doing firmware/low-level software because I was able to experience firsthand what that is really like in the real world. I was able to work on a team that was still trying to find its feet for good software development, and I was able to help implement an Agile framework for development. I enjoyed doing that, and so I now know that I will enjoy doing that kind of work.

How does this experience affect your attitudes toward yourself? Towards others? Toward further education or experience? How does it affect your sense of values?

I had the attitude that I would enjoy working on my own in my own office and not interact with coworkers except in limited circumstances. From this, I changed my attitude, and now I know that I enjoy having close relationships with my coworkers. This also comes because my attitude toward my coworkers has changed, I now view them more as individuals. My attitude towards education has been positively changed, being around people who have a high college education, and seeing what a good impact it has been for them. I grew up in a family that went to college, but mostly a minimum to get away with a job. Now that I have seen what people can do with Master's and Ph.D.'s I have a greater desire to eventually further my education.

What suggestions would you make to another co-op student considering your present type of work?

I would recommend participating in this program, but I would suggest that the students keep a journal throughout the semester. This would allow for a better report at the end of the semester, and give the student a more accurate overview of what was happening throughout the semester. This would help in removing recency bias, and primacy bias.

In case your employer would welcome suggestions, what improvements in his or her organization and operation might you suggest?

My employer does a very good job in general. My suggestion to them would be to somehow allow a student to work at hours that aren't 9 to 5. A lot of students have classes throughout the day and can struggle to be at work during 'work hours'. If it was easier to work at student hours, they might be able to get more students onto the job.

What do you observe in the "work society" that relates to public concern for protecting the environment? Conserving energy? Improving economy? The welfare of individuals, groups, and society as a whole?

In my work, we focused on research and development, specifically for space research. This is an important field of research because it can progress human understanding. This can help us understand a better way to treat our own earth, conserve energy, and protect the nature that we currently have. Space research can benefit the human race specifically by helping us

push the boundary for human knowledge on the human body. This can advance our

understanding of medicine, what humans are and aren't capable of, and what is the best way to

progress and preserve life on our planet.

On the basis of your observations in your present job environment, how do you characterize the general attitude of employees toward work? Do you believe this represents the typical view of the work ethic in the current society?

The members of my team were all very self-motivated, there were very few times when

anyone didn't know what they should be doing next. When there were multiple options of what

to work on, the most important task was chosen, and this helped the team progress towards the

final goal of improving and finalizing the radio design.

I don't think this is a typical work ethic, based on my previous work experience. I worked

over a summer at a warehouse for a large online store, where the barrier to entry was much lower

than in my current position. In other words, you didn't need a college degree to work in the

warehouse. I don't think that is a rule but is probably more of a trend. If a person is willing to go

through a few years of college education for a position, they are more likely to want to work in

that environment.