Co-p Work Term 2 Summary

After finishing my spring classes, I returned to the Repeater Subsystem Operations (RSO) department for my second co-op work term. I had been told by past students that for the second term you hit the ground running and that’s exactly what I did. After getting my security badge back and checking in with my boss, I went straight to work and picked up where I left off in learning Pro/Engineer.

This work term I started by designing the hole configurations for vibration and shock test plates as well as designing a flight grade harness that powers a flight unit while it checks the RF power output through a pulse transient test. This test measures the output signal and taking the known input signal, it checks that there are not unexpected losses or other changes to the signal.

Working on and producing test models for a flight waveguide was another great opportunity. A waveguide does just what it sounds like it should; it directs and manipulates a signal or wave. I was able to further the design and help with the testing of a waveguide that will be used over 130 times in a satellite that will be launching soon.

I also designed a low pass filter housing that mimicked flight conditions and tested different combinations of capacitors and substrates. Since this was for a large wavelength passive circuit, which does not produce energy, some material substitutes were able to be made to save on production time and cost.

With the many different electrical components needed to build all of the flight units being produced, it is important to have the necessary parts in stock so that there are
not unnecessary schedule delays. I helped my boss with a parts list database he created that tracks what parts will be needed and how long they take to come in after being ordered. This not only reduces delays, but it also creates a smarter way to plan for and order parts.

In addition to these projects, I took two classes through Loral to be able to create Engineering Change Orders (ECOs) and Drawing Change Engineering Change Orders (DCECOs). After finishing my projects I am able to submit them for review and make changes, on my own, to the models and drawings, as needed.

Again, I have enjoyed working at Space Systems/Loral. Even though I only worked twelve weeks this summer instead of 16, as in the first part of my co-op program, I was able to pick up where I left off, starting work immediately on my first day back and accomplishing a significant amount during my short time there this summer.

Outside of work, I returned to the same housing complex which was very convenient. I was already familiar with the area and I was able to reconnect with the friends that I had made last fall. This term I also toured San Francisco, drove down Lombard Street, went to Muir Woods, biked across the Golden Gate Bridge and visited Napa through one of the Cornell alumni events. There is a lot to do in the Bay area.

The co-op program is designed to give students a comprehensive learning experience with a real world company. I would encourage everyone to go to the Co-op Office and check out all the possibilities that are available to you in this program. Though I am a bit biased, I strongly recommend applying for a position with Loral. It is an excellent company to work for!
Space Systems/Loral in Palo Alto, California, is a world class communication satellite company. For over 50 years it has been a leader in communication satellites starting with the launch of Courier 1B in 1960. This was the world’s first active repeater satellite that was used to transmit a message from President Eisenhower to the United Nations. Since then, Loral has accumulated over 1400 years on-orbit flight experience. In April 2008, the company launched the world’s largest communication satellite with a 12 meter reflector called ICO. Loral is an exciting company to work for!

I started my co-op position in Advanced Programs and Systems. This group of experienced engineers works on over 60 requests for information and proposals each year from customers all over the world. A full design and technical layout for a proposal must be turned around anywhere from a few days to 4 weeks.

When launching a geosynchronous satellite, it can be released by the launch vehicle into a geosynchronous transfer orbit (GTO) with the apogee at a variety of altitudes. After which the satellite will circularize the orbit by raising perigee in a series of Main Satellite Thruster burns. If it is dropped off in super synchronous GTO (an orbit with apogee greater than geosynchronous orbit which is approximately 42,000 km) it can then circularize by additionally lowering apogee to minimize propellant requirements. When determining where the satellite will be released, the distance that the signal can travel must first be determined, otherwise the satellite could be too far away and we would not have any contact with it. The farthest that the satellite can safely go is called its maximum radius of apogee. I created an Excel workbook that, with minimal inputs, can generate a list of all possible ground station that Space Systems/Loral can use with a limiting radius of apogee for each. This provides a fast and easy way to find the maximum radius of
apogee that the satellite can go and still communicate with Earth. Working on this project taught me about signals, frequency bands, losses, and orbital dynamics.

An eclipse can be serious to a satellite depending on how long the sunlight is blocked from the solar arrays. While in the midst of an eclipse, the satellite obtains its power from its rechargeable batteries to operate its payload, keep the equipment warm, and maintain itself in orbit. If an eclipse should be of excessive duration, the satellite’s equipment can reach undesirably low temperature and its functioning would be impaired. I helped work on a spreadsheet to identify such events so that they can be taken into consideration in the designing of the satellite.

Writing proposals is a fast pace environment so it is important to have consolidated information readily available. Another project that I worked on was to update and add payload information on past and current satellites making this information quick and easy to access for future use.

After working in Advanced Programs and Systems, I decided to transfer to the Repeater Subsystem Operations (RSO) Department for my last few weeks to gain hands on experience designing in Pro E.

This software program is important because it is used to engineer housings and test fixtures for components within the satellite. I have used Pro E to create 3D models and drawings for each part or fixture that I have worked on. While working in RSO, I have sent a new adjustable wave guide transition, a test cover for flight hardware, and two test fixtures for a converter to the Loral machine shop.

In addition to learning within your specific department, Loral offers classes so that you can be trained on different programs and has New Hire Seminars so that you can gain a better understanding of what the other departments in the company do.
I have had a wonderful co-op experience at Loral. It is a great place to work and learn. In both departments, I felt comfortable asking questions to my co-workers, my mentors, and my bosses. I attended staff meetings and presented before the group. Everyone was friendly and happy to share their experiences. This allowed me to learn a great deal in a short period of time.

Aside from the workplace, Loral provides very nice apartments that are conveniently located near the train station, where I take a free shuttle to work. Living in the downtown area of Mountain View, I am within walking distance of the post office, shops, restaurants, bakeries, and markets. This makes getting groceries and supplies very convenient. Also, the San Jose International Airport is only a 20 minute trip from my apartment.

For free time, there are a lot of activities in this area. San Francisco is a little over an hour train ride away. By car, the beach can be reached in about an hour and it takes about 5 hours to drive to the Sequoia National Park for a weekend trip. There are also sports clubs and churches that you can become involved with. California’s beautiful weather will spoil you. I was here about two months before we had our first rainy day. The few since then don’t even come close to an Ithaca rainstorm.

I highly recommend applying for a position with Loral!
Alex Kadesch  
Ack46  
Mechanical Engineering  
Sikorsky Aircraft  
Summer 2009

Co-op Job Summary

I worked for Sikorsky Aircraft in the Aerodynamics and External Noise group. The group as whole is divided into aerodynamics and acoustics. The aerodynamics side focuses on analyzing airfoil data for the fleet of aircrafts. The acoustics side troubleshoots and tests acoustics on completed aircraft. Despite the clear division of the group, I worked on something unique that could not be categorized as aerodynamics or acoustics. I assisted in certifying a new commercial aircraft for flight into icing conditions. One way to certify aircrafts for flight into known icing conditions is to manufacture a simulated worst case ice shape and fly the aircraft with this attached. I was responsible for determining this ice shape. Using a NASA icing code, I ran a plethora of conditions for the aircraft in an attempt to determine which shape would most affect flight. In addition to identifying an ice shape, I used the same code to model an electrothermal heating system in place on the main rotor blade.

Upon arriving at Sikorsky, I knew little about icing and its effects on the aerodynamic properties of an aircraft. In order to assume a working knowledge, I spent the first three weeks learning as much as I could. I read and re-read publications on the subject. I looked over previous studies of ice accretions on aircrafts and previous certifications. Much of my learning was facilitated through my mentor, Eric Jacobs. He gave me classroom sessions on aerodynamics, provided me with reports to read, and was able to point me in the right direction when I desired to learn more about a specific topic.
Understanding icing requires knowledge from both fluids and heat transfer. Ice accretion becomes a problem when it changes the flow around an airfoil severely enough to change flight characteristics. Knowledge of fluid dynamics helped me to understand why the ice affects an airfoil the way it does. A solution to the problem that icing presents is to heat the airfoil to remove the ice. A background in heat transfer allowed me to more efficiently work on the thermal model and troubleshoot. Both of these topics interest me, but I would not want to dedicate my career to either of them. The co-op experience taught me that I want a job incorporating a lot of different topics. I want to use my vast knowledge of engineering topics to solve a problem instead of just using one or two topics.

Cornell does a great job preparing students to enter the professional world, but much of the personal development needed to make the jump can only be learned on the job. Work ethic is something that jumped out at me upon entering the work place. Almost every employee is motivated to accomplish the job efficiently and effectively at Sikorsky. Work ethic at Cornell, while better than other schools, does not compare to Sikorsky. At Cornell, every student cares about their personal development and personal performance, which is the way it should be. At Sikorsky, the employees are focused on the greater good: the company. It was refreshing to be in a different environment for a change. Even though I was just working at Sikorsky temporarily, the contagious work ethic took hold of me as well.

In the workplace, I had to pay great attention to detail while at Cornell details can often be overlooked. If I mess up a decimal point or do some simple math wrong in the workplace, the results could cost thousands of dollars. I often struggled with attention to
detail early on because of the different attitude Cornell takes. Professors write tests that a student can only hope to finish if he writes as fast as he can. This provides no time for a student to check his or her work. The attitude at Sikorsky is the complete opposite. Neither my supervisor nor co-workers cared about speed as much as they did correctness. Professors may want to take a look at their strategies for tests and ask how they prepare a student for the real world.

I did a fall and summer co-op so decided to get a full year lease and try to sublet during the spring term. I choose a place near Yale to make it easier to find a subletter. This ended up working out for me. The company does not provide housing. They do have a service that looks for housing, but I didn’t find this very helpful. In terms of transportation, it is almost necessary to have a car. The only other option is try to get a ride with another employee. Sikorsky does not offer much in terms of employee entertainment outside of work. There is no employee softball league or flag football league that they sponsor. This is one of the downsides that come with a large diverse company I guess. I lived in New Haven but did not take advantage of all the city had to offer. New Haven has a great night life but I chose to go to bed early and be fully rested for work.

After my first work term, I was debating whether I wanted to work at Sikorsky again. During my first work term I had little work to do. During the 40 hour workweek I would rarely have more than 10 hours of work to do. Part of this was because work would come as parts arrived from outside sources for the aircrafts. If a part was late, I would have to wait until it came in until I had work. I felt under utilized and not at all challenged. I expressed these concerns to my co-op coordinator at Sikorsky. He found
me a new group for the second term. My co-op coordinator ended up being my mentor for the second term. He understood that I was looking for a more challenging experience and did his best to provide me with interesting and challenging work. In the second term, the work I was doing was beneficial to the company. During the first term, I would often be given tasks just to keep me busy that in no way benefitted the company. It is a much better experience to be working to accomplish something instead of working to stay busy. Overall I enjoyed the coop experience and would recommend it to any sophomore.
About the Company
Space Systems/Loral is a company that designs and manufactures satellites. Its headquarters is in Palo Alto, CA. SS/L satellite applications include GPS, digital communications, broadcasting, and environmental monitoring.

My Co-op Work Assignment
My co-op work assignment was in the Structural Analysis & Test department. We worked closely with the Structural Products and Satellite Analysis department. Our primary duty was an important one: make sure the satellite doesn’t break.
To do this, we used a variety of approaches. One of the major tools used was finite element analysis. We don’t have a set of mechanics for every component of the satellite. It just isn’t practical (and perhaps isn’t feasible) to have a set for comm. panels, another set for solar arrays, another set for propellant tanks, and another set for everything else. Instead, we have sets for simple geometric shapes like bars, quadrilaterals, and tetrahedrons. If we put enough of these shapes together, we can approximate the geometry of whatever component we want to analyze. My first few weeks at SS/L were devoted to becoming familiar with finite element software through tutorials and simple models. Training was taught mainly by reading manuals and asking coworkers. Putting together finite element models was one of my major duties as a co-op in the Structural Analysis & Test department.
Once I received the component geometry from the Design group, I constructed the model in the finite element software and tested them. The guidelines would specify the conditions the component had to meet. If the component met requirements, I would provide supporting documentation, and approve it for manufacturing. If the component did not meet requirements, I would assist in the redesign process.
Another method of validating the satellite or its components was testing. We would apply thousands of pounds on certain components to make sure that it could withstand conditions that are harsher than expected. One of the other tests involved putting a finished satellite onto a shaker table, and watching a few tons move back and forth until it looks like a blur. While I didn’t perform any of these tests, I did observe, and write the documentation for it.
While finite element analysis and component testing should definitely be expected for structural analysis, I was also assigned to a computer programming project. It involved coming up with some basic MATLAB code to turn thousands of lines of test data output into a digestible form.
My mentor, Mahantesh Hiremath, was an invaluable resource to me during the co-op. He only gave a few tasks to me, but he had plenty of advice regarding my education and career.
Most of my assignments had me paired/teamed up with one or two other engineers, and it changed depending on the assignment. I got a chance to work with different people and
learn about their specialty. All of them were receptive to any questions I had, so I could complete the assignments properly.

Assessment of Learning and Development
One of the biggest takeaways I had during my co-op experience is the importance of model setup. There wasn't much work involving hand calculations. Just like how a calculator can solve arithmetic problems for you, computers can solve matrices or differential equations for you as well. However, you need to give the computer the right equations to solve (in the model setup). I rarely had to perform the calculations I learned at university, but knowing how to do them gave me insight into how to set up the model to let the computer do it properly.
I also learned that "engineering" is not the same as "science." In "engineering," it's OK to be wrong, as long as you are on the safe side of your "wrong" analysis. "Engineering" doesn't necessarily seek exact results like "science" does.

Life Outside of Co-op
SS/L has made the logistics of the co-op very convenient. They provided travel arrangements to relocate to and from California. They provided housing in the area. And, they provided a shuttle bus service to commute to work.
Housing is close to the train station, which goes all around the Bay Area.

Evaluation
One of the best features of this job was working on a correlation project. A finite element model was not producing results that closely matched test data. I was assigned to work with other engineers to adjust the model to improve its accuracy. When I realized that the other engineers were also challenged by this problem, I knew for sure that I wasn't just getting work that the full-timers didn't want.
One of the negative aspects of this job is that the analysis department doesn't have a product. Unlike the design or manufacturing departments, we can't claim we were directly involved in making a satellite.
About the Company
Space Systems/Loral is a company that designs and manufactures satellites. Its headquarters is in Palo Alto, CA. SS/L satellite applications include GPS, digital communications, broadcasting, and environmental monitoring.

Co-op Work Assignment
My work term was in the Thermal Engineering Department. The group provided thermal requirements, designs, analyses and testing. Temperature requirements provided guidelines for thermal product designs. The group provided designs for heaters and thermal blankets to insure that other subsystems could operate properly. If temperatures went unregulated, bonds could come undone or the propulsion system could cease functioning. Analysis would predict spacecraft temperatures during orbit and testing would verify the analyses.

During my work term, I was involved in analyzing flight data from active satellites in order to determine the power consumption from the on-board heaters.

I also worked with Thermal Desktop (a thermal modeling program) to reduce the complexity of existing models to improve processing time.

I was also involved a thermal distortion test. A satellite sees a temperature difference between its environment on the Earth's surface and its environment in orbit. As a result, the satellite shape warps and slightly distorts signals to and from Earth. In order to understand the distortion better, we varied the temperature on a satellite mock-up. I provided support by preparing equipment like temperature sensors and heaters, and developed code for interpreting data from the sensors.

Training involved going through tutorials for Thermal Desktop. The rest of the learning happened on the job as necessary. My coworkers were an invaluable resource and taught me so that I could handle whatever tasks I was assigned to.

Assessment of Learning and Development
My department was composed primarily of Mechanical Engineers. Performing analysis involved concepts from thermodynamics and heat transfer. Having knowledge of electrical circuits and orbital dynamics is helpful with analysis as well. Working on designs drew from CAD skills with Pro/E or AutoCAD. A background in computer programming allowed me to take on a larger variety of responsibilities.

Life Outside of Co-op
Housing, relocation, and commuting are all arranged by SS/L. Housing in a nice neighborhood is provided by SS/L. Flights going to and from California are provided by SS/L. A free shuttle bus runs from a train station, approximately 10 min. from the housing accommodations, directly to SS/L main campus.
Owning a car would generally make transportation easier, but there are a variety of transportation systems that serve the Bay Area (CalTrain, BART, VTA, Muni).

During the summer, SS/L runs a softball league. Teams are more casual than competitive and typically play once per week. SS/L also offers a casual cycling club that promotes fitness.

Evaluation

One of the best features of this job was the level of involvement that the department offered. Although engineers were typically divided into design, analysis, or testing, there was the opportunity to try all three fields.

Testing made the co-op experience especially interesting because it gave me a chance to get up close with hardware that will go into space, something that not all employers can offer.
Elliot Kulakow – eak56
Independent Major – Concentration in Applied Physics and Spacecraft Engineering
Space Systems/Loral – Fall 2008

Work Assignment:

I was assigned to the Bus Electronics department within Loral. That’s bus as in school bus, not electrical bus. The bus is the backbone of the spacecraft, containing all of the subsystems required to carry the payload (RF components, antennae, etc) into its desired orbit, and keep it there for the full (usually 15 year) mission duration. I arrived at a very fortunate time, both for myself and for the department. For the past couple of years they had been designing an upgrade to the existing control electronics for the bus, called Omega 3. This internal research and development program was nearing the end of the design stage, and moving into testing.

I was assigned to assist the Telemetry Encoder team. While I had no assigned mentor, I quickly gravitated towards a de-facto mentor with over 20 years of experience with Loral. He helped me find projects to work on, and improve my problem solving skills. Fortunately, I had an opportunity to work with him to design the final component of the chip- a Reed-Solomon encoder, used for error correction. I got to use some of the math from AEP 321, as well as learn new mathematical concepts, like Galois fields and modulo-2 arithmetic, that are critical to modern information protection (if you’ve heard of a CRC, I worked with those too). This was very cool and allowed me to make an immediate contribution in a needy area. Needless to say, this process helped my transition into the group immensely.

After finishing the design, I moved on to learning how to use test equipment, while waiting for actual hardware to arrive. While pursuing this I learned a ton about serial input and output, data processing, and how to design a robust test. Once hardware arrived I dived into the LabWindows/CVI programming environment (highly recommended), learning C in the process, and wound up building software that will be used for automated testing of these units before integration onto the spacecraft.

Learning and Professional Development:

While electrical engineering is not my major, nor is it a primary interest of mine, spaceships are. I had little to no classroom experience with most of the techniques and concepts I worked with. Outside of general programming classes, and ECE314 for Verilog, the only class I applied meaningful knowledge from was Mathematical Physics. The most important thing classes teach is not what they actually cover, but rather the engineering approach to problems. Problem sets and assignments are poor substitutes for real-world problems, but the way you absorb information to get through them is similar to how you prepare yourself to attack real problems. These techniques are by far the most valuable thing Cornell has to offer, and they work.

Being at a large aerospace prime company has been very interesting to me. Loral is no where near the size of Lockheed, but with over 5,000 employees it is no small potato. Such size carries with it some advantages, and some disadvantages. The nice thing is, with so many people around there’s always someone you can ask for help. The
downside is lots of paperwork. I managed to avoid doing very much of this, but a full
time engineer would not be so lucky. Either way, I am looking forward to experiencing
different degrees of size during my career, and recommend you do the same. Starting off
at a large company gives you a great perspective on how things should be done better, yet
how difficult it actually is to coordinate a massively parallel development project.

My experiences during this work term with Loral have greatly enhanced my
problem solving ability, my independent learning ability, my software development
ability, and my knowledge of electronics. The co-op process is absolutely right for you,
the reader, if you remember this important tip: when out of work, hassle people until they
give you something interesting. When you're becoming part of an already developed
team, unless you take the initiative you will find yourself bored and under-utilized. I
took the initiative and it has been incredibly rewarding.

Life Outside of Work:

Loral was the perfect co-op for me because not only did they provide interesting
work and nice wages, they found housing for us too! Not only did they find housing,
they got us housing in downtown Mountain View, one of the nicest neighborhoods in
Silicon Valley. We were a 10 minute walk from the Caltrain station, where the company
shuttle would pick up employees in the morning, and deposit them in the evening.
Thusly, we paid nothing for transportation to work, and had a great selection of
restaurants within a 10 minute walk. While transportation to most of the rest of the bay
area leaves something to be desired, it is still pretty easy to get wherever you need to go—
especially if that wherever is San Francisco.

San Francisco is probably the nicest city in the world. By and large it is young,
cheerful, and friendly. Not to mention the concert scene is great. There’s always
something going on in the city, whether it’s a concert, a protest, or a giant party. And
when there’s not something going on, it’s still fun to walk around. Our co-op group even
went crabbing by the Golden Gate Bridge (delicious and highly recommended) several
times. Also, if you’re 21, like me, there are lots of good bars all over the place, and a
fairly good club scene in San Jose. I didn’t go out to those very often though, the whole
9-5 job makes a night of drinking much less appealing than endless problem sets do.

If athletics are your thing, there are plenty of clubs for you to join that compete in
just about any sport you could want. Some of them are company sponsored, but most are
just at the local gym. Community service groups are also plentiful. I provided tech
support to a local group that helps immigrants find work (my girlfriend was volunteering
there) on a couple of Saturdays, and arranged for them to pick up food donations from a
local farmer’s market. There are volunteer groups for everything though—especially the
environment and gay rights, if those are your hot button issues.

Evaluation:

The best thing about this job is everything. Silicon Valley, good wages, free nice
housing, challenging problems, and a fairly relaxed environment combine for the perfect
coop experience. Aside from an international experience, I cannot envision something
better. The only downside is taxes are going to be a nightmare this year.
Work Assignment:

This work term, I worked in the same department, Bus Electronics, as I had worked in over the fall. The project was the same, upgrading Spacecraft Control Electronics for the main bus, and the same subsystem within this project – the Telemetry Encoder. My role over the summer has been more or less identical to my role towards the end of the fall. In fact, I even worked on the same piece of software, unmodified since I left the first time.

I've worked with pretty much the same group of people as previously. It's shrunken slightly since I first arrived in the fall, and hence I have had more responsibility for my software and assisting other team members. Pretty much the entire goal for this term has been bringing the software and hardware environment I was working in up to production readiness. This has involved becoming more fluent in the programming environment, CVI/Lab Windows, and more competent in dealing with Windows hardware issues (a nightmare) as well as the boards themselves. Overall, this has been much less challenging than my fall assignment, in large part because I'd already learned most of what I needed.

Learning and Professional Development:

My learning and professional development for this work term has been very different than the first term. First and foremost, I haven't had to pick up all of the technical elements from scratch. I was already pretty expert in what I've been doing from the last work term, and consequently my development has been limited to the areas I didn't have time to explore last time. While I certainly have learned a lot more about threading, the Windows environment (unfortunately), Systems Verilog and associated simulation environments, and I/O, it has been a much smaller technical gain than previously. Rather, I have learned a lot more about organization and communication in the professional environment. I have had to communicate with a contractor on the other side of the country, in preparation to releasing software for them to implement, as well as with co-workers who may not be as tuned into the needs and nuances of the project as I have become. These experiences have taught me to never take information for granted, and to always assume that the other guy will mess up and not do it right the first, second, and sometimes even third times!

Life Outside of Work:

Loral is really a great company to co-op for. Though their college programs budget has been cut slightly, they still provide top-notch housing in an excellent location, close to the shuttle stop to get to work, and also close to some decent bars and excellent restaurants. This time around I'm driving back to Ithaca across the country, and let me tell you that's an excellent plan. At a $0.50/mile reimbursement rate, as well as covering
the cost of hotel, you are almost guaranteed to break even or even make money. Even if you do elect to fly, you can pick your flight and they will pay for transportation to and from the airport as well.

My extra-workicular (to invent a word) activities were pretty much the same as last time. Silicon Valley is nerd heaven and you won’t be disappointed with the nifty events and stores you can find around. That being said, there’s still a decent party scene in some areas, especially San Jose and San Francisco. Even in Mountain View, you will find some neat bars, a microbrewery (delicious), and of course plenty of good wine. Of course, you would be remiss if you come to California and don’t go to the redwoods. In as short as a 45 minute drive, you can be in beautiful, fairly remote, areas with nice trails and a little bit of old growth. There’s also the beach, wine country, and— a little farther away— the Sierra. All in all, top notch.

Evaluation:

While this term has been marginally less exciting than the fall term, largely due to familiarity and routine, it has still been an excellent experience. You will be very hard pressed to find a co-op with a better combination of wages, housing, location, and challenge.
Dan Milavitch
Applied & Engineering Physics
Space Systems/Loral, Electrical Systems Engineer
Fall 2008

Job Details

Space Systems/Loral is the world leader in manufacturing high powered commercial satellites. Companies such as DirecTV and Sirius/XM radio and many communications companies enter into contracts with SS/L to design, build, and launch the satellites they need to accomplish their business plans. I worked as part of the Systems Engineering group, and more specifically in Electrical Systems. Electrical Systems consists of the Data Handling Subsystem (DHS) and Electrical Power Subsystem (EPS). Most of my time was spent working with two experienced DHS engineers and one Power engineer who is the head of Electrical Systems. They would give me jobs to do and work with me when I had questions in order to get me up to speed on how the satellites work.

The DHS receives, decodes, and distributes commands from the ground to the spacecraft, as well as relays back telemetry (health checks) to the ground. As my supervisor told me on my first day, it is “the glue” that is needed for all the pieces of the satellite to function together. The Power Subsystem is responsible for converting sun energy from solar cells, or discharging batteries during eclipses, into usable power for the spacecraft loads. Although the learning curve to learn about these systems is quite steep, it is also extremely rewarding. Each spacecraft has a Satellite Orbital Operations Handbook (SOOH) which describes in detail every part of every subsystem, and these documents were invaluable to me learning about the satellites. In addition, every customer of SS/L is offered training on their satellites and the presentations are available to all employees to read themselves. Every engineer in the office was also very willing to help me and answer any questions I had which was often the best way to learn.

During my term, I often shadowed one of my mentors on the test floor of her satellite while she looked at and verified the DHS test scripts that the Systems Test Engineers ran. This involves hands on work with the satellites and a lot of troubleshooting when problems arise. As a new engineer, I would often watch and listen as well as ask countless questions to understand the procedures and reasons for these tests. During downtime, I was given many tasks that involved really learning how the satellites are put together and how the systems work. I updated one of the Telemetry and Command (T&C) databases called Limits that is used on every satellite but was never populated generically. Every satellite would have these limits such as temperature thresholds and voltage or current limits input manually instead of having them already incorporated through a standard limits database. Future satellites will (hopefully) use this new limits database for their limits information and a standard will be recognized.

Another task I was given was to update a few wiring templates that database engineers use in order to maximize the robustness of wiring and minimize mistakes made in wiring together boxes. These will be used by the Systems Engineers most likely for years. After familiarizing myself with the spacecraft wiring, I was able to audit the wiring of satellites that are in the process of being built now. It is a great feeling to know my work will be
used in the future and that I have made an impact on satellites that will be launching in the near future.

As an AEP student, I felt as if I did not need to use much of my classroom knowledge to do the job except for a very broad knowledge of basic physics. Most of the knowledge I needed came from the few ECE courses I had taken such as digital logic and basic circuits. I think I would have been very lost if I had no experience in either of these areas.

Living Arrangements and Free Time

Loral makes the transition to co-op extremely easy. They provided housing in very nice corporate apartments and even let us pick the dates we wanted to move in and leave. We lived in Mountain View, five miles from Palo Alto, and a ten minute walk from the nearest train station where a Loral shuttle would pick us up for work and drop us off at the end of the day. There are many local restaurants, parks, and stores for anything we could want.

I drove from Philadelphia to Palo Alto in order to have my car, and Loral covered all transportation, food and lodging costs for me to get there. I found, however, that I did not use it as much as I thought I would. The regular use I got out of it was from going grocery shopping and to the gym, but other than that driving most places is more of a hassle than taking a train. The trains and public transportation systems in the bay area are very efficient and can get you almost anywhere you want to go. The longest train to San Francisco on the weekend may take up to an hour and a half, but is really the best option for getting around. It is even simple to get to the airports, 49ers or San Jose Sharks games using the trains, and traffic and parking are not an issue.

Many activities you could want are also available in the area. My roommate found a floorball club that plays a few times a week five minutes from our apartment that we joined and played for the entire time we were there, and we plan to play again next summer. We even took a 3 hour drive to Fresno to compete in a tournament with the team where we came in second place in a last minute shootout. There is a gym less than 2 miles from the apartment, several parks in walking distance, and never a lack of activity in the area if you try to find it.

Overall

Space Systems/Loral is the ideal company to work for if you have any interest in aerospace and truly taking on an interesting, yet challenging job. I enjoyed my time due to learning something new every day and always having the resources available to help me along the way. All work that is done is appreciated at some level and SS/L puts you to work as another engineer, not as a busywork intern. To get a real grasp of how a world-class business runs and operates, SS/L will not disappoint.
Dan Milavitch
Applied & Engineering Physics
Space Systems/Loral, Electrical Systems Engineer
Summer 2009

Job Details

This summer I continued my co-op in the Electrical Systems department working on DHS. I got to see several different satellites launch in just a few months including Terrestar, Sirius FM-5, and AsiaSat 5. Since I had learned enough about the job during my first term, I was given more responsibility in getting work done for the department. Among the numerous jobs I was given, my main tasks were split into two parallel focuses. The first was creating some electronic tools to make the job of DHS engineer easier, and the second was doing the DHS production work for a newly signed satellite called Hughes Jupiter under the supervision of the responsible engineer.

In making tools, I learned the Python programming language because it lent itself well to the applications I was working on. I had used programming languages before, so it was just a matter of learning some new syntax and rules to use it. Once I knew it well enough, I was able to write code to analyze what is called the normal telemetry frame of a chosen satellite and output where the spare words were in memory. This telemetry frame is basically a chunk of information that is sent from the satellite to the ground to monitor the health of the satellite’s hardware. It took a lot of thought to implement all the required rules and understand the telemetry frame, so it was definitely an interesting mini-project. Another tool I helped in making was to create a script for Launch Configuration. Every satellite that launches needs to be in a very specific configuration when it is on the launch pad, and it takes a lot of engineering to get it that way. The tool helps by looking at satellite-specific hardware and outputting what the nominal configuration should be for launch.

The most involved task I had was working on the new satellite Hughes Jupiter as the DHS engineer. The engineer who was assigned to do the production work also had another satellite to work on, so I took the bulk of the new work and got to experience working as one of the Electrical Systems engineers. This involved going to meetings, compiling subsystem specifications, determining how much DHS equipment was needed to support the payload as well as creating a block diagram for the DHS, writing monthly progress reports for the customer, and being involved on a daily basis in getting the satellite on the right track towards its launch in early 2012.

Living Arrangements and Free Time

Housing was provided the same way as my first term. This time, however, I decided to fly instead of drive. I then bought a bike which was my main means of transportation for the summer. This made it easy to get to and from work, to the gym, and
to the grocery store. This added up to over 50 miles a week of riding which was healthy and saved money that I would have had to spend on my car.

In my free time, I took several trips to San Francisco, as well as a weekend trip to San Diego. Other co-ops who were 21 often went out on the weekend to bars and clubs for something to do. There is always something to do in the bay area if you look for it.

Overall

My second term at Space Systems/Loral was even more interesting than the first, and I learned a lot more about satellites and Systems Engineering. I felt like a team member in the office rather than an intern or sidekick. I looked forward to going to work because I knew I would be busy doing real work, and I knew I was the go-to engineer when other Jupiter team members had issues that involved the DHS. I could not have made a better choice than to take a co-op position with Loral, and I know it will be extremely valuable experience for my future.
I worked in the Mechanical Systems Engineering department at Space Systems/Loral for my Co-op work term. Space Systems/Loral is an industry leader in communication satellites, such as DirecTV’s satellites. Mechanical Systems flows down requirements for the parts of the satellite so that they will survive the space environment and also makes sure that each part has met those requirements.

I worked mainly on mechanical shock during my term. I hadn’t learned anything about shock from classes at Cornell so I had quite a bit to learn when I got to Loral. Most of it was done from talking with my mentor and other co-workers about shock and research on my own. I was able to learn a lot about shock, but it was also rewarding to put that to use since I was able to design and conduct several tests for shock attenuation.

One of my longer projects was developing a shock analysis tool to be used by the Mechanical Systems department. This was done in excel and much of the visual basic and construction of the tool was easy to learn, however it took quite a while to develop a tool that covered several different aspects of shock and determining damage to a unit.

Another project that I worked on was attenuating shock to one of the thrusters for the satellite. The thruster was breaking at the high shock levels seen when it was directly mounted on the panel and my job was to investigate and test different ways to attenuate the shock.

The projects that I worked on were very rewarding. I was able to have several independent projects along with a few team projects. I worked with many people in the
Mechanical Systems department as well as people from many different fields that I needed to interact with to accomplish my goals. I gained a lot of experience communicating and presenting ideas and results to co-workers who had varying backgrounds in the material. It’s very important to be able to tailor your communication techniques depending on who you are talking with.

Loral was very helpful with housing and transportation. Apartments were provided and paid for. The location was great and there are plenty of restaurants near by and it’s only a 10-15 minute walk to the Caltrain Station. The Caltrain runs all the way to San Francisco and it’s about $8 for a ticket. Loral runs a shuttle from the Caltrain station to work that runs 3 times, so there is always a cheap and convenient way to get to work.

It’s also important to note that Loral will pay for relocation expenses, whether it be flying or driving. This was important to me, because it helped me make the decision to drive to California. The weather was great. It rained maybe 5 times and the temperature was in the mid 70’s until late November.

I would highly recommend asking for or searching out involving and rewarding work to do right from the beginning. Working for Loral was a great experience and they did everything right in terms of interesting work, travel, housing and pay.
For my second work term, I worked in the Mechanical Systems Engineering department at Space Systems/Loral. Space Systems/Loral is an industry leader in communication satellites, such as DirecTV’s satellites. Mechanical Systems flows down requirements for the parts of the satellite so that they will survive the space environment and also makes sure that each part has met those requirements.

During my shorter summer term, I provided day to day support to the technicians who installed units on the spacecraft. My main job function was to manage Non-Conformance Reports (NCR’s). An NCR is generated every time there something does work quite how it was supposed to. This included material failures of joints, out of tolerance parts, design oversights, etc.

One of the main failures that I saw on the spacecraft was incorrect material used for a part. The aluminum was in the fully annealed state which led to hardness issues and threads that were stripped when the fastening screws were tightened. Handling all of the NCR’s required general knowledge of the entire spacecraft and good communication skills to track down the information that you need to keep the spacecraft on schedule.

The projects I worked on this term were very interesting because I was able to gain hands on experience with the spacecraft since I was around the hardware every day. This was much better than sitting at a desk all day and allowed me to learn much better from the visual association of the parts to the data that I had been working with.
Again, house and transportation was provided by Loral. SS/L did a great job taking care of any issues that I had with the apartment or travel. The small co-op events that were put on by the company are nice to meet up with the other co-ops and a sign of Loral’s appreciation for the hard work that the co-ops put in.
Coop Job Summary

I worked for Space Systems Loral, a leading provider of communications satellites and systems, in one continuous term from spring through summer. My position was in the tower structural and integration design section. The department I worked for is responsible for designing, manufacturing, and assembling the satellite structure.

On the site training was provided in numerous ways. I attended new hire seminars which gave an overview of different departments within the company. I was also given a training manual and time to learn pro-engineer which is a 3D computer aid design program. My other training consisted of reading company training manuals and standards. During the beginning of the term I was given a mentor who showed me around the company and taught me specifics about how the company functioned. Towards the middle of the term I directed any questions to my surrounding coworkers who were always willing to help me out.

During my term I work on numerous projects. In the beginning I was involved with testing certain parts of the satellite structure. I help make drawings of test specimens and designed testing fixtures. I also made changes to engineering drawings and was introduced to the numerous parts of the satellite structure. During the middle part of the term I was given more long term projects such as writing standards used to design the satellite. I also became involved with creating engineering drawings of flight hardware at this time, mainly metal and composite parts. Later in the term I began to
become more involved in changing and adding to 3D models and then making drawings so that they could be manufactured. Towards the end of the term my supervisor gave me the opportunity to work on the manufacturing floor where the structures are built. I spent half my time on the manufacturing floor and the other half designing. I was able to physically build the satellite structure and watch it undergo tests. I also able to see and work on some of the designs I had previously made during the term. During my time on the manufacturing floor I created manufacturing process instructions which describe step by step how certain parts are built.

This co-op was a great learning experience. I was able to learn what designing engineering products entails and how an original concept transforms into a finished product. It helped show me how my educational background as a mechanical engineer can be applied in a professional setting, specifically how many different disciplines of engineering combine together. This was my first position in a professional environment and at first it was a little intimidating. However, everyone at Loral was very helpful at introducing me to responsibilities of the job. I learned many of the specifics of how an engineering department is organized and functions. I also discovered the importance of communication in a professional setting.

Loral arranged for very nice living accommodations. They paid for my flight to and from the San Francisco Bay Area. The also provided housing in downtown Mountain View, about a fifteen minute drive from work. Transportation to and from work was facilitate by a Loral bus which picked me up every day from a nearby train station. I would recommend acquiring a car for anyone spending a long time here. I did not have a car but I was able to get around using public transportation.
Overall I had a great experience during my co-op term. I really enjoyed learning the different parts of the satellite and how they all come together. I also like being able to help design parts that would actually be flown on some satellites.