This past spring marked five years since I first learned I was the recipient of the Loyal Order of Propellerheads Scholarship. Looking back over the past five years, a lot has happened, but I still remember the day I opened the letter stating that I had been selected as the recipient of the LOOP scholarship. I was of course, thrilled to have been selected. The very first thing I did, however, was look up what a ‘Propellerhead’ was because I honestly had no idea what that was. When a Google Image search popped up images of multi-colored hats with a propeller affixed to the top, I knew that this was a group I could get along with!

In the subsequent years, I was honored to be mentored by such wise, successful, and caring people. The mentorship and guidance allowed me to grow into the person I am today, not only as an engineer, but as a person too. Each year, beyond what I learned in the classroom, I gained valuable life lessons too. My freshman year, I learned it was okay to pave a new path. I switched majors after one quarter because after being introduced to Mechanical Engineering, I knew that was exactly what I wanted to do! My second year, as an intern at Raytheon, I learned to ask questions. In meetings when managers and engineers spoke entirely in acronyms, I learned it was better to ask what each one meant rather than constantly be confused by corporate jargon. My junior year, I learned that calculated risks can pay off. I decided to spend the summer studying abroad in Munich, Germany. Despite not knowing a word of German, I walked away from the experience with a greater appreciation for global engineering challenges and countless new lifelong friendships. My senior year, I learned to be bold. I ran for a leadership position in Engineering Ambassadors, the club that runs the tours for the College of Engineering. I was nervous about the amount of responsibility and the number of people that would be counting on me to do a good job, but in the end, I am so glad I was bold enough to run for and take the job. Managing the tours was very rewarding. My grad year, I learned to show my passion. I was surrounded by graduate students who were passionate about the same things I was. We had a dedicated work room, the ‘Grad Lab’, which was the perfect environment for fostering the academic spirit. It was here that I really felt like an engineer for the first time, as we debated the best way to approach engineering challenges and collaborated to get the job done.

From starting out not knowing what I wanted to do to graduating from Cal Poly with a strong passion for engineering, I know I have come a long way and I am sure the other LOOP students have a similar journey. This newsletter serves to show a little bit about where each of us is on the path through college and our respective careers with articles about our technical projects and personal interests. I hope you enjoy the very first annual LOOP newsletter.

Q&A with our newest scholar Elizabeth Heyde
I had a chance to chat with our newest LOOP scholarship recipient biomedical engineering freshman from Arroyo Grande, CA, Elizabeth Heyde. She talks about school, Cal Poly, and her favorite places in San Luis Obispo.

Cal Poly Graduation 2015
A look at Cal Poly’s June commencement ceremonies.
This past summer, I interned at Workday, a human resources software provider. I worked on the application security team that focuses on authenticating and authorizing users. When an employee at a company like Morgan Stanley logs into Workday’s application, they post their credentials (usually a user-name and password). For security reasons, Workday does not store the user-name and password information of its clients, so Workday instead asks Morgan Stanley’s server if the user is valid. Workday will grant the user access or deny access depending on the response of the customer’s server. In this way, it is the responsibility of each Workday customer to determine whether a given user should be able to use the system or not.

One of my contributions to the team was improving the performance of this interaction. A single server at Workday may handle requests from multiple customers. Sometimes one of these customers may have a server that is broken and not responding. In these cases, when employees attempt to login, Workday will wait for their server to respond and when it does not return quickly, Workday must deny the request. When Workday’s server is waiting for many responses, the system may be slow to process new login attempts. To solve this issue, I implemented the circuit breaker pattern where our server stops issuing requests to servers that have been malfunctioning. After a specified “timeout” period, new credentials are passed to the server to determine whether the server is now working. By using this technique, Workday’s servers are free to process requests more quickly without worrying about the servers that are broken. The pattern is used to prevent Workday’s server from wasting its resources sending requests to servers that are known to be malfunctioning. More information about this concept can be found here: http://doc.akka.io/docs/akka/snapshot/common/circuitbreaker.html.

Starting spring quarter of last school year I worked in the PolyGAIT lab for Dr. Freed. While learning the APIs for the several different RFID readers I worked on a project to catalog each of the RFID tags owned by the lab so they could be quickly referenced by anyone working on a project. I used the manufacturer’s spec sheets to create a database that could sort the tags by traits. So if you wanted a UHF tag with a range of 10m the database would give you all tags that met those requirements and their location in storage. At the same time I was learning the APIs for each of the readers so that I could program them to take in data from RFID tags and process and store it in a database. Once the lab reopens in winter quarter after Dr. Freed gets back from sabbatical I will be working on a project using the conveyor belt to test quality assurance capabilities of different RFID tags and readers in manufacturing.
Early Crack Detection in Gears
by Kelsey Engel

Early detection of defects in gear boxes is an ongoing area of research in the field of Mechanical Engineering. Chips or cracks in gears that propagate can lead to catastrophic system failures, meaning thousands of dollars of repairs necessary and long system downtimes. The Mechanical Engineering Rotor Dynamics graduate class was tasked with developing and validating a planetary gear box model and analyzing the system vibrational response after inducing a defect to the system, such as a chipped tooth. Planetary gear sets are used in transmissions and gas turbine engines because of their high power density and increased torque capacity compared to traditional parallel axis gear trains.

To perform this study, the planetary gear system was first modeled using CAD software, Solidworks. The profile of each tooth was calculated using a program created in MATLAB, which provided the dimension of the pitch, base, addendum, and dedendum circles, and the involute profile of the gear tooth. To make the gear teeth more realistic, backlash was added to simulate the actual clearance between mating gear teeth. Backlash allows the gears to mesh without binding up and prevents tooth damage. However, too much backlash can be detrimental to the system, as the planetary gear set would no longer work as designed.

In practice, gear boxes often get damaged due to wear or foreign objects. Part of this study is to see the effects on a planetary gear model with a damaged tooth in the sun gear. In Solidworks, one tooth was selected to be modeled as damaged.

After the model was finalized in Solidworks as detailed above, the model was imported into ADAMS. ADAMS is a multibody dynamics simulation software that was used for the majority of the analysis in this study. It is able to show the dynamics of the moving parts, specifically how the parts interact with each other and their surroundings, and how the loads and forces are distributed throughout the mechanical system. Before running any simulation, the model was set up by creating joints, applying contacts, assigning material properties, determining motions, and applying resistive torques.

Several cases were run with different input speeds to perform a model validation. Results from the simulation software were compared to predicted results using hand calculations. After the model setup had been confirmed, the damaged gear tooth cases were run. Fast Fourier Transform (FFT) plots were used to assess the vibrational response of the system. FFT plots use Fourier transforms to find the frequency of components of a signal that have been buried in noise. FFT plots were generated for two cases: one with a perfect gear box and one with a gear box with a chipped tooth. By studying the FFT plots, it is theoretically possible to see changes between the frequency response of the perfect gear and the damaged gear. This information is helpful when diagnosing gear boxes and detecting potential damage to the gears. A damaged gear would have an FFT plot where the gear mesh frequencies dominated and suppressed the magnitude of the sidebands that were present on the perfect gear model. The gear mesh frequency is the frequency at which the teeth mesh in a gear box and sidebands are frequencies are signals on either side of the gear mesh frequency that consist of all the Fourier components of the signal except the main frequency. A damaged gear would have an FFT plot where the gear mesh frequencies dominated and the magnitude of the sidebands were suppressed. On the “perfect gear” model, there would be prominent sidebands.

For this study, the FFT plots were generated using the contact force between the sun gear and one of the planetary gears. This contact was selected because it is the interface where the chipped tooth would have the most effect. The peaks in the “perfect gear” plot correspond with the gear mesh frequency of the sun and planetary gears. As demonstrated in the FFT plots to the right, the effects of the chipped tooth aren’t prominent. This indicates that the model isn’t refined enough to handle defects as small as the chipped tooth in this model. Further research in this area is being conducted at Cal Poly currently.
Protecting the Internet
by David Scrobonia

Web applications such as Facebook and Amazon are constantly under attack from hackers attempting to steal credit card information, passwords, and personal information. To prevent this these companies have to implement security measures such as firewalls and intrusion detection systems (IDS) to monitor all traffic they receive for malicious activity. While these systems do well to reject many attacks, they are unable to fully understand the attacks in the context of the application. Attacks on Facebook will be different than attacks on Amazon, and being able to detect these attacks at an application level, that is in the actual Facebook code, as opposed to at a network level provides a huge advantage for the defenders.

For my thesis I will be studying application level IDS by contributing to the only notable and open source application level IDS, AppSensor. AppSensor is a project by OWASP, the leading organization in web application security. Currently the AppSensor project is in need of help on an Analysis Engine, which learns about the system and makes decisions. When sensors in the application detect abnormal activity they share that information with the Analysis Engine. The Analysis Engine then makes a series of decisions regarding whether the activity is an attack, if it warrants an alert somebody, or if features need to be turned off to protect the application. It is also learning about the application to understand what “normal” activity is.

I'm currently talking with the head of the AppSensor project about how exactly I can contribute and the scope of what I'll be working on. I'm really looking forward to this project and am excited to see what I'll be able to build this upcoming year.

GRID Alternatives Solar Panels Project
by Sarah Waltz

Through the Honors Program this year, I got the opportunity to complete a unique project with GRID Alternatives. GRID Alternatives is an organization working to transition to renewable energy and make this energy available in underserved communities. I, along with a group of five other honors students, spent a day in Atascadero working with GRID Alternatives to install solar panels on the roof of a house. After learning about the purpose and technology of solar panels during an orientation, it was fascinating to get the hands on installation experience. As part of our project my group was asked to present on how to improve the GRID Alternatives program. We felt that GRID could benefit from expanding their pool of volunteers and getting more college and high school students involved and invested in their mission.

In addition, the creation of an internship program for college students would create more committed volunteers and the opportunity for volunteers to use GRID Alternatives as a means to get involved in a renewable energy career path. Overall, this experience with the honors program was a fun volunteer project that enhanced my understanding of solar energy but also gave me a chance to collaborate with students on a process improvement project.
An Interview with New LOOP Student Elizabeth Heyde

Interview Conducted by: Kelsey Engel

I had a chance to chat with our newest LOOP scholarship recipient, biomedical engineering freshman from Arroyo Grande, CA, Elizabeth Heyde. She talks about school, Cal Poly, and her favorite places in San Luis Obispo.

Q: Why did you decide to become an engineer?

A: I decided on Biomedical Engineering because I have always been around engineering (my dad works at the power plant) and I have been personally impacted by developments in medical technology.

Q: What is your favorite part about Cal Poly so far?

A: I have really enjoyed meeting new people and also not being constantly monitored by my parents.

Q: What is one interesting, non-academic thing you have learned in college so far?

A: I’m learning that I can get tired of eating pizza and frozen yogurt. I never thought I’d see the day when I’d get tired of eating those…. I guess there is such a thing as too much of a good thing.

Q: When you’re not studying, what do you do for fun?

A: I joined a few clubs and an intramural soccer team.

Q: Where is your favorite place to eat on campus or in downtown SLO?

A: Firestone!

Q: What is the biggest challenge you’ve had in college so far and how did you overcome it?

A: Waking up for my 7am class. It would probably be easier if I could remember to go to bed at a more reasonable hour, but I’m getting better.

Q: Where is your favorite study spot?

A: My favorite study spot is currently the library. For the first two or three weeks it was my dorm room, but then I discovered how tempting naps were.

Q: Do you have any specific engineering interests or any idea of what your ideal job would be?

A: I’m not quite sure yet, but I think I’m more excited by the aspects of neural engineering than anything else so far. I don’t exactly know why, but I find brain stuff particularly fascinating.

Q: One thing I would like the LOOP group to know about me is...

A: I found out earlier today that the movie Finding Dory is coming out next summer and I am dying inside because there are still seven months before the release date. Pixar movies are my absolute favorite.
Enjoying Exploring
by David Scrobonia

Every summer for the last 5 years my high school friends and I have returned to the same campsite at the same state park to camp for a few days. The state park is Standish Hickey State Park in Mendocino County and has been the one constant in all of our lives as we grew out of our hometown and found new homes at college. I look forward to it every year and this year was no different. There is a jumping rock, a swimming hole, and hiking trails among a thick forest of trees. It’s especially nice in summer as a reprieve from the hours I spend indoors on computers at work.

I really enjoy hiking, backpacking, and camping of all nature as I also backpacked King’s Canyon and Yosemite with my roommate this last summer. To top it all off, I will be traveling to Costa Rica this November with my brother to hike the Arenal Volcano, zipline in Monteverde National Park and whitewater raft down the Pacuare River. I love to be in nature and outdoors and I am excited to travel out of the country to continue to explore.

Engineers Without Borders (EWB): Malawi Team
by Sarah Waltz

Engineers Without Borders (EWB) was one of the clubs that excited me the most during Open House and was one of the many reasons I chose Cal Poly. Beginning fall quarter, I have been working on the Malawi team for the Engineers Without Borders club. This team, which started about a year ago, has visited the village of Kumponda twice to complete surveying and begin implementing projects. The village there is heavily reliant on agriculture but have a lack of water for crops so our team has started an irrigation project. The plan for this project is to implement a man-made canal that will stretch about a mile through the village and provide the people with closer access to water for farming. For me, this project has involved a great deal of research, which has expanded my knowledge of other engineering disciplines such as Civil Engineering.

I plan to stay involved in EWB in future years as I have a passion for Africa and for undeveloped countries. This past year, my family and I returned from our 10th annual house-building project in Mexico (7 years in Tijuana and 3 years in Tecate) where we build a house for a needy family. I am always thankful for, but also for how many things could be improved with better processes and infrastructure. It’s beautiful to see something that I love learning about in school line up with something I love doing in the world. Engineers Without Borders does an incredible job of allowing college students to apply their academics to their love for service.
Cal Poly Triathlon Team
by Jeremy Kerfs

During the Spring Quarter, I joined the Cal Poly Triathlon team on a bike-ride to Santa Barbara. We started the journey in front of the Cal Poly Rec Center at 7:00am on a Saturday. The first leg was relatively easy; after a few hours we stopped in Guadalupe to replenish our water and eat some snacks. Then we began a trek inland that ended in Lompoc after passing by the Vandenberg Air Force Base. The SAG (Support and Gear) vehicle met up with us, so we had access to our food and plenty of extra sunscreen. After Lompoc we began a steady climb for almost eight miles before a rapid descent through a canyon into Gaviota. Once again, we restocked on water and snacks; then we enjoyed a scenic ride along the stunning coastline for 20 miles before reaching Isla Vista. We ate some burritos and continued our ride down State Street into Santa Barbara. Finally, we arrived at the train station after nearly 120 miles of biking. We then loaded our gear and took the train back to Cal Poly. Overall it was a fun way to see much of California’s central coast.

Influencing the Next Generation of Engineers
by Kelsey Engel

This year marked the second year of the Freshman Service Project, a new program from the mechanical engineering department. This program aims to give mechanical engineering freshmen the experience of giving back to the community, while refining their engineering skills. Students are put in teams and are tasked with developing an engineering experience for elementary and middle school students in the community. This year, there were several forums for the outreach experiences: an engineering night on the Cal Poly campus, classroom visits to the neighboring Bishop’s Peak Elementary school, a school field trip to the Cal Poly campus from a Lompoc middle school, and visits to after school programs in Grover Beach, Nipomo, Arroyo Grande, and other surrounding communities. The program targeted underserved populations, trying to get many potential first-generation college students interested in science and engineering.

The projects that the students created had to encompass the Cal Poly learn by doing philosophy. Each student walked away from the experience with a new piece of technical knowledge as well. Meanwhile, the freshmen students, who were doing the teaching, gained an entirely different experience. It forced them to learn how to communicate ideas and information to an audience with limited previous knowledge on the subject. They also had to work in a team environment for multiple months, learning how to work through problems and achieve successes together.

I had the privilege of working with this program throughout the past year. I served as the student assistant to Dr. Jim Widmann, the program lead professor. I also served as a student mentor to the freshmen students, helping guide them through the development of their projects. I found this experience very rewarding in a number of ways. It was very inspirational to see the elementary and middle school students get excited about engineering. I attended one of the project deployments at an after school program and watched as my freshmen students helped the younger students make bottle rockets. There were two fifth-grade students that were really inspired by the activity. They begged the engineering students to let them test out their bottle rockets numerous times, all while trying different fin shapes. On the other end, I also really enjoyed helping the freshmen students share their passion for engineering. It was a good feeling watching them explain an engineering concept to the younger kids because sometimes I was the one that explained the finer technical details with them! Being able to share my engineering knowledge with them to accomplish their goals was very rewarding. I enjoyed being on the teaching/mentorship side of this experience and would consider working with students in an academic environment in the future.
Founders Corner

Dick Hartung

Dick Hartung was born and raised in Detroit Michigan. Upon graduating from high school in Algonac, Michigan he attended Michigan State University where he received a BS in Mechanical Engineering and an MS in Applied Mechanics. He then went to work at Lockheed Missiles and Space Company (LMSC) Research Lab in Palo Alto, California as an Advanced Study Scientist while working on his PhD Engineering Mechanics at Stanford University and later an MBA at Santa Clara University. While at Lockheed Research Labs, Dick held positions of Manager of the Applied Mechanics Lab, and Director of Engineering Sciences Directorate. He was later elected Vice President of LMSC’s Information Services Organization. When Lockheed acquired a small imaging company, FORMTEK Dick was named COO. His last position at Lockheed was Exec VP of Lockheed Information Management Systems Company until retiring in 2001.

Dick has a son and two daughters and five grandchildren. He lives with his partner, Carol, in Santa Rosa, California where he enjoys woodworking in his shop, gardening, and attending theater and music events. He has boated extensively on the east and west coasts and the Great Lakes. Currently he sails his 32 foot sloop on San Francisco Bay.

Dick has been associated with Cal Poly for 30 years as a member of the Engineering Dean’s Advisory Council and The President’s Council of Advisors. He is the founder of the LOOP Scholarship Endowment.

Chuck Terhune

Chuck Terhune was born in Washington D.C at Walter Reed Hospital and grew up in a traveling military family. During his childhood he attended several schools throughout the United States and finally graduated from Surrattsville High School just outside of Washington D.C. He attended Purdue University and received a BS in Mechanical Engineering. Then went to work for the Ralph M. Parsons engineering and construction company (Later the Parsons Corporation) where he worked as a Mechanical engineer in heat transfer and industrial mechanical process within the petrochemical, mining and aerospace markets. While at Parsons Corporation he attended UCLA’s Executive Engineering Master’s program and received a Masters of Engineering degree. At Parsons he served in many capacities including Director of domestic and international engineering and construction programs in the Petroleum and DOE markets, Vice President of Engineering, Vice President of the Federal Division, Vice President of Procurement and Senior Vice President of Operations and Support.

Chuck has a son and he and his wife Kat live in La Crescenta, California where he enjoys tutoring young readers through the Kiwanis Literary program, is active as the La Cañada-Flintridge Tournament of Roses Site Chair, enjoys float design, animation and construction, is an avid student of guitar and wood carving.

Chuck has been associated with Cal Poly for 20 years as a member of the Dean’s Advisory Council and one of the first members of the LOOP Scholarship Endowment.

Chuck is on the right.
Chuck Harrington

**Professional Overview** Chuck Harrington is the Chairman, Chief Executive Officer, and President of Parsons Corporation, a global engineering, construction, and defense services firm headquartered in Pasadena, California, with more than 15,000 employees and revenues exceeding $3 billion. Chuck joined Parsons in 1982, working on diverse programs in locations ranging from Saudi Arabia to the North Slope of Alaska and in a broad range of markets from oil and gas to nuclear fuel reprocessing, biotechnology and wireless communications. In 2006 Chuck was named Chief Financial Officer. In 2008, Chuck became CEO and then Chairman. He was named President of the corporation in 2009.

**Education** Chuck graduated magna cum laude from Cal Poly SLO, with a bachelor’s degree in agricultural engineering. He then graduated with honors from the Anderson School of Management at the UCLA, with a MBA concentrated in finance and marketing. Chuck also attended the Advanced Management Program at the Fuqua School of Business at Duke University. He is a registered professional mechanical engineer.

**Additional Information** The son of a rice farmer and Reagan appointee, Chuck grew up in Northern California. He enjoys water sports (e.g., wake boarding, surfing, water skiing), snow skiing, tennis, and golf, and his hobbies include industrial arts and hunting. Chuck and his wife have three children, two son-in-laws, and two granddaughters. In addition to serving on Cal Poly’s SLO Foundation Board of Directors, Chuck is Chairman of the Cal Poly President’s Council of Advisors. He is also a member of the boards of AES Corporation, the J.G. Boswell Company, the Business-Higher Education Forum, and the California Science Center Foundation Board of Trustees. In 2014, he was honored by the New York Building Congress with a 2015 Industry Recognition Award.

Bill Swanson

William H Swanson “Bill” is the former chairman and chief executive officer of Raytheon Company. Bill served as chairman and CEO of Raytheon from January 2004 to March 2014, at which time he stepped down from the role of CEO. He retired from the company in September 2014, finishing a 42-plus year career with the company.

Bill joined Raytheon in 1972 and held a wide range of leadership positions, including manufacturing manager of the company’s largest operation, senior vice president and general manager of the Missile Systems Division, general manager of Raytheon Electronic Systems, president of Electronic Systems, chairman and chief executive officer of Raytheon Systems Company and president of Raytheon.

He is a native of California; he graduated magna cum laude from California Polytechnic State University with a bachelor’s degree in industrial engineering. His graduate work was performed in business administration at Golden Gate University. He has been awarded an honorary Doctor of Laws degree from Pepperdine University and an honorary Doctor of Science degree from California Polytechnic State University.

In addition to his professional accomplishments, Bill is emeritus director of the Congressional Medal of Honor Foundation board; member of the NextEra Energy, Inc. board of directors and chair of its Audit Committee; member of the TJX Companies, Inc. board of directors; chairman of the Massachusetts Competitive Partnership and vice chairperson to the John F. Kennedy Library Foundation board of directors. He also serves on the President of the United States National Security Telecommunications Advisory Committee. He is active in the field of education as chairman of the California Polytechnic State University Foundation board of directors and serves on the Cal Poly President’s Advisory Committee.

He and his wife Cheryl have been married for more than forty-five years and own property in San Luis Obispo and Monterey Counties. They love food, wine, and classic cars. They enjoy showing their cars at events around the country. Currently they spend time in Boston, the Edna Valley and Pebble Beach.
June 2015 Graduation in Pictures

by Kelsey Engel

On June 13, 2015, Cal Poly held commencement ceremonies for the College of Engineering. In attendance were my parents, Tami and John, my younger sister, Lindsey, Chuck and Kat Terhune, and Dick Hartung and Carol Orme. Graduation day was so special because of the wonderful people who I got to share it with! Here’s a look at some of the festivities:

Sharing a big smile with President Armstrong.

Here I am with some of my greatest supporters. From left, Lindsey, John, Tami, Dick, me, and Chuck.

A sea of happy graduates at the main graduation ceremony. Can you find me?

Here I am receiving my degree at the Mechanical Engineering department ceremony.

Here we are in my backyard for a celebratory lunch. My mom got a cake made with my kindergarten picture on it!

Post-graduation ceremony picture in front of the main Cal Poly sign.
LOOP Scholars

Kelsey Engel
LOOP Alumni
MS Mechanical Engineering ’15

David Scrobonia
MS Computer Science ’16

Jeremy Kerfs
Electrical Engineering ’16

Gabriel Seelig
Industrial Engineering ’17

Sarah Waltz
Industrial Engineering ’18

Elizabeth Heyde
Biomedical Engineering ’19

California Polytechnic State University
1 Grand Ave
San Luis Obispo, CA 93401