

Becoming Aware: Sustainability
Grand Challenge Scholars Program Portfolio
Grand Challenge: Sustainability

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This portfolio is submitted in partial fulfillment of the Olin Grand Challenge Scholars
Program requirements

Reflection

The Grand Challenge Scholars Program, in conjunction with the Olin Curriculum, has helped me cultivate my interests and awareness of global problems and to design, research and implement real world solutions. The focus of my Grand Challenge Experiences have been in sustainable design and research, designing and improving the lives of the disabled, and becoming an entrepreneurial global citizen.

Working to restore our planet through research and sustainable design has given me confidence in applying my engineering skills to help preserve our environment. One key insight that I gained, while conducting my sustainable design projects, is that to maintain the incredible planet we live on everyone must give back as to not create more waste and to help undo the damage that has already been done.

My interdisciplinary experiences have improved my team working skills and my understanding of different skill sets. Working on teams with people from different backgrounds helped give me insights into how people work and think, as well as how they are motivated. Learning how to work effectively on a team is a very important skill to have as an engineer working in industry.

Through the process of starting my own advertising company with a group of fellow peers I learned what it takes to start a business. The skills I learned that I plan on taking with me into my future career include organization, perseverance, and opportunities for finding financial success. I also learned that the meaning of the word product does not necessary need to refer to a physical object, but rather it can refer to a location or service that there is a demand for.

My study away semester in Singapore gave me the experience of living in a different part of the world and learning how to adapt to differences in culture. Traveling around South East Asia let me see and experience so many different cultures, religions, languages, foods, and cultural enrichment. I was able to learn about what other types of people value and need to live their lives. Becoming a global citizen has helped me work with people who are culturally different from me and has instilled in me a passion to travel. I think these experiences will help me work with people from different backgrounds and will make international travel more meaningful.

Service learning has given me confidence that I can apply my engineering skills to improve the lives of others and has instilled in me a sense of responsibility to do so. I feel as though the people that have the opportunities to become highly educated should give back to their communities and apply the skills and knowledge they have gained to improve the lives of others.

The Grand Challenge Program has instilled five important areas of personal development within me, including awareness of global needs, interdisciplinary skills, entrepreneurial skills, service responsibility, and the idea that I am a global citizen. In what follows, I will describe in greater detail my journey through Olin that included these five areas and the ways in which I have grown personally and professionally.

Grand Challenge Sustainability Focused Projects Reflection

My strong interest in sustainability that I developed from living in a community where everyone recycles their own trash, lead me to participate in an Environmental Sustainability Carbon Footprint Reduction through Energy Management extracurricular club, participate in two sustainable design research projects as part of classwork and work with a sustainable manufacturing company to gain better insight into their manufacturing process. Through these projects I have gained a better understanding of sustainability related issues and methods in which I can be more sustainable. I plan on using these skills to join sustainability focused groups in my future and to bring more awareness to my community.

Carbon Footprint Reduction through Energy Management

In the Carbon Footprint extracurricular we evaluated the inefficiencies in my school and looked at improving energy conservation. We spent time analyzing different lighting configurations and building-sized central heating units at Olin. This extracurricular provided a hands-on learning environment where I learned about small changes I could make on a daily basis to help save the environment in the long run.

Preserve: The effects of calcium carbonate filler on polypropylene

I took a Failure Analysis class as a Mechanical Engineering depth course because I was interested in material science and designing products that do not break easily. While taking a this class I was on a team working with a company called Preserve that was investigating the effects of calcium carbonate fillers to be used in recycled polypropylene plates. Preserve makes products out of recycled plastics. During this research project I helped to investigate the effects of different percentages of calcium carbonate filler on Preserve's products.

Specifically, I helped conduct wear tests, microhardness tests, tensile tests, and degradation tests. It turns out that the most useful tests for preserve were the wear tests which were done to determine the resistance of the plates to surface scratching and abrasion. Aesthetics are very important to a plate, especially in terms of how long a consumer will keep it, and thus aesthetic failure is almost as important as mechanical failure. Preserve gave us plates that had different percentages of



calcium carbonate filler and for the wear tests we clamped the plates down and cut them with a standard dinner knife. Each cut was examined under the optical light microscope and the cuts were classified into four main categories ranging from no scratch to deep scratch. We found that Preserve could add a small amount of calcium carbonate filler to their products to help offset some of the cost of production. It is cheaper to produce plastic products with calcium carbonate filler, so this information could be useful to Preserve and potentially other manufacturing companies in the future.

Working with a sustainable company such as Preserve really helped me broaden my understanding of resource management and the importance of recycling. It was transforming to see my own engineering skills being put to work to help improve a recycling and manufacturing process such as the one Preserve uses. The most memorable experiences about being on this team were designing my own test procedure, and coming up with a creative and effective way of presenting the data.

Sustainable Design: Reduce Home Heating by integrating Space Heaters

At Olin I was able to take a Sustainable Design course that had a group project in which we designed a sustainable alternative to central heating. Our design centered on using occupancy sensors and small space heaters to decrease the amount of central heating that was necessary for the entire building. During this project we interviewed space heater users, discerned their needs and values, analyzed their energy impact over a year, and designed a system that would fit their needs in a more sustainable way. Below is one of our final posters. It shows two of our users with the implemented system.

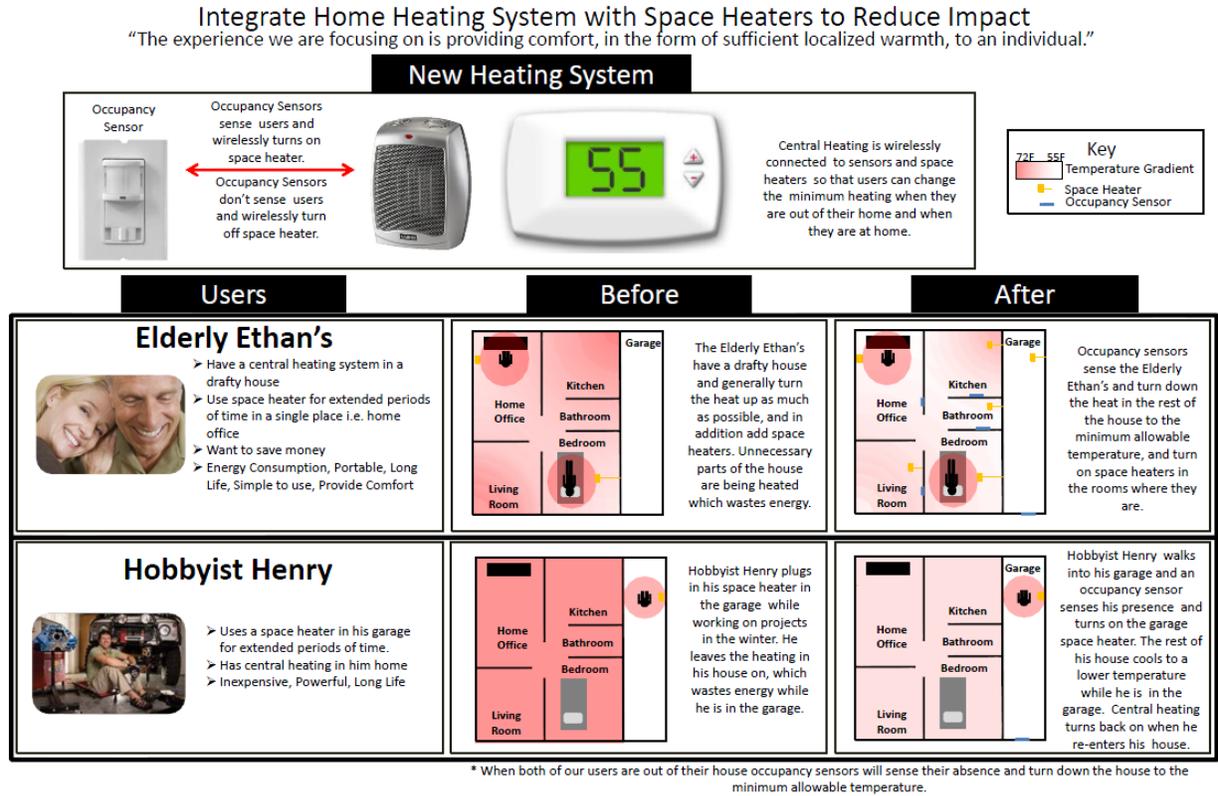


Figure 1: Designing an integrated home heating system with space heaters to reduce impact for Sustainable Design

Defining Urban Form and how it can affect suburbia

Under the Grand Challenge topic of restoring and improving urban infrastructure I did an individual research project for my sustainable design class. This project was on urban form and how suburbia can be retrofitted to meet the demands of current society and still be sustainable. During my research I found that suburbs in the U.S today are very inefficient and unsustainable because they have low density, minimal mixed land and building use, and the urban layout is not conducive to a sustainable form of transportation. Below is one of the diagrams from my research paper describing a possible process of turning the current unsustainable suburbia into a more sustainable living space.

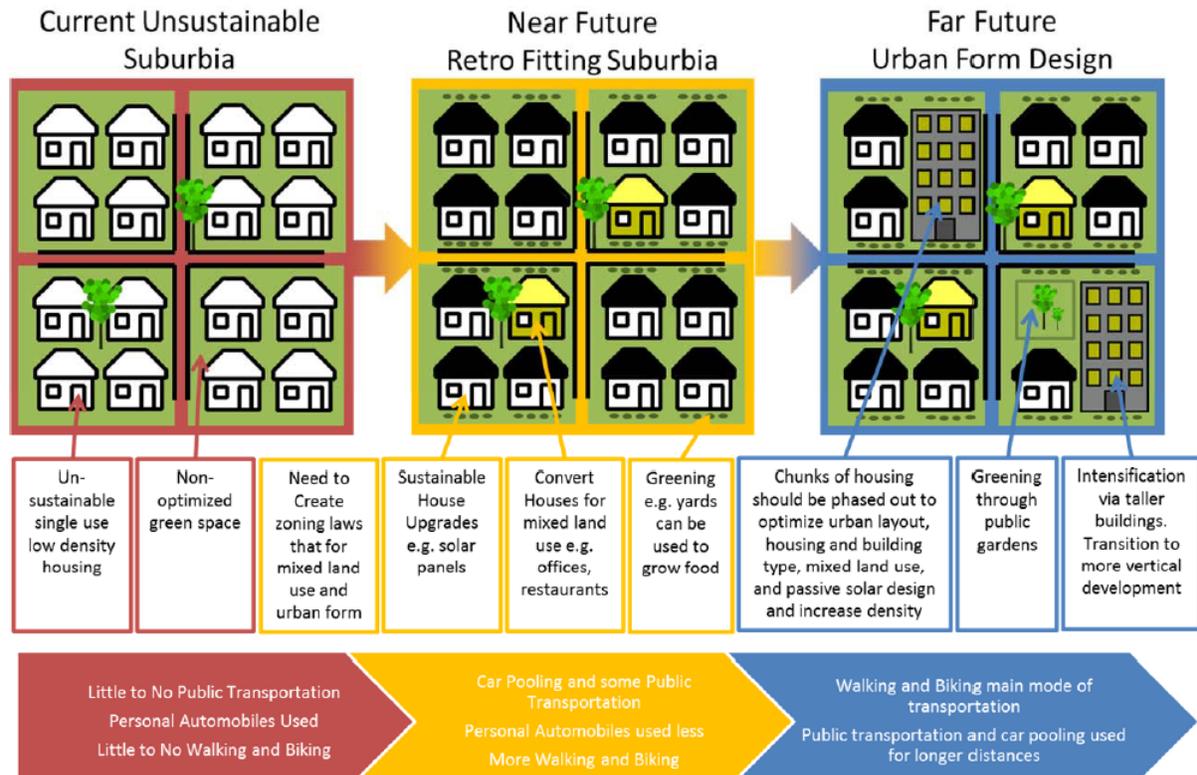


Figure 2: Transitioning from unsustainable suburbia to a sustainable living environment (Final personal research project for Sustainable Design)

I learned that the important characteristics of urban form (urban design, transportation and land use patterns) that should be optimized include density, mixed land use, urban layout, housing and building type, and transportation. The low density single use unsustainable suburbia needs to both stop being built, possibly through a change in zoning laws, and be retrofitted for a more sustainable society. In the far future, when the upkeep and maintenance of older residential housing costs more than building newer higher density, mixed use buildings, some of the houses should be phased out in return for more sustainable options.

This research project helped me understand why different building methods are unsustainable and to learn about different methods for improving unsustainable areas that have already been built.

Global Awareness Reflection

Study Away in Singapore

During the spring of my junior year I had the opportunity to study away at the National University of Singapore. One of the classes I was able to take was Chinese where I had the chance to learn a great deal about the language and the culture.

While living in Singapore I was able to travel all over South East Asia, including Malaysia, China, Indonesia, Thailand, Cambodia, Vietnam, Hong Kong, and Taiwan. This experience truly changed my life because I was able to experience so many different cultures, foods, religious ceremonies, and cultural traditions. I was able to see how other people lived and worked. I now know I have a much more globalized view of the world than before.

I personally think it is very important for a well-rounded educated individual to live in a different part of the world and to experience a different culture. This is because the experience allows people to empathize with other groups of people and makes for a better global understanding of different cultures. This experience made me appreciate my own culture as well as the cultures that make up the rest of the world. Below is a picture of the group of us who studied away in Singapore in front of a Hindu temple in Singapore. In the future I will be able to work with people from different cultures more effectively and I will continue to travel to find more of international enrichment.

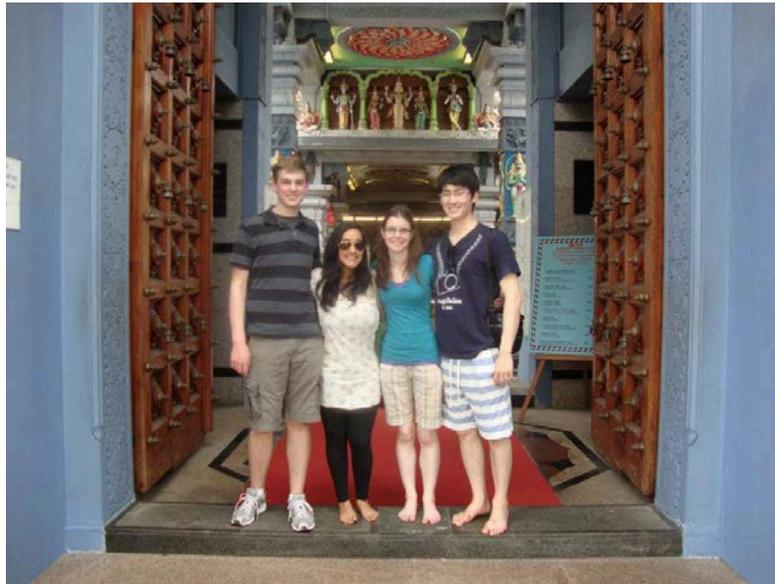


Figure 3: The Olin group of students who studied away in Singapore standing in the doorway of a Hindu Temple.

One of the most memorable experiences from studying away was being able to go see Angkor Wat in Cambodia. This enormous Hindu/Buddhist temple is one of the largest religious landmarks in the world. During our tour we learned about the importance of religion in their culture, and the importance of Angkor Wat to Cambodia (which is on their flag). This eye opening experience allowed me to see a society in which religion is an enormous part of their culture, which is important to understand from a world view perspective.

Studying abroad allowed me to learn and work with people who think differently than me. There were times when we had to find a compromise because we valued different

things. This study away experience helped me improve my cooperative team working skills and helped me understand people's values from a different culture.

Entrepreneurial Experience Reflection

During my college years I have had the opportunity to take Foundations in Business and Entrepreneurship and Engineering Economy. Both of these classes had large projects in which I learned hands on entrepreneurial and economics skills.

Foundations in Business and Entrepreneurship

For the main project in Foundations in Business and Entrepreneurship I was on a team that launched our own start-up. My team started an advertising business where we worked with local businesses to advertise for them. One of the stories that provided inspiration for this idea was about a team of college student who were given a challenge to earn the most amount of money in a very short amount of time. The team that won sold their ten minute end-of-semester presentation slot to a large company that wanted the students in the class as employees. Our team used this inspirational story and came up with our own idea in which we wanted to create a business with very little overhead. We wanted to provide a service rather than a product because we wanted to spend the least amount of time manufacturing a product. Our slogan was "Connecting companies to campuses." The companies we worked with paid us to advertise for them on our campus. They paid us the money upfront, and thus there was very little risk involved. We also set up a table in our campus center where we sold some of their products to students. By creating almost no overhead our team generated the most money out of the class.

This project taught me to think creatively about the term "product." I learned that a product doesn't necessarily need to be a physical item; it can be a service or a strategic location. The businesses we were working with paid us to advertise for them because of our network of contacts and because of the location we had to advertise. This project also helped me learn team working skills and how to get things done in a large group and under a tight schedule.

Engineering Economy

During my semester-long group project in Engineering Economy, which I took during my cultural exchange in Singapore, my team researched and analyzed the most economical engineering collegiate degree for Singaporean citizens. We based our analysis off of the estimated tuition costs of the National University of Singapore's undergraduate and graduate school costs, and the average time spent in school for these degrees. Our team analyzed all of the money transfers in terms of the annual present worth. All of our analysis was done using excel macros, and we verified our initial results with literature values.

My team found that the type of engineering degree doesn't make much of a difference because the incomes of different engineering degrees are very close. However, the time spent getting the degree is the most important factor in the comparison.

This project taught me a lot about team work and getting things done with a very large group and with team members who are very culturally diverse. I also learned a lot about economic analysis of different situations and how to apply economics concepts to real world entrepreneurial problems. I think these skills will help me and the volunteer organizations I am involved with to find financial success.

Service Learning Reflection

Designing for Caretakers of Blind Children

During my college experience I took two classes in which I designed products to better serve the blind, and caretakers of the blind. These experiences have shaped the way I view the engineering skills I have gained during college and how they can be applied to help people.

I worked with a team of students in a class called User Oriented Collaborative Design (UOCD) to design for caretakers of blind children. We first interviewed people from this user group both in person and online. We spent a lot of time speaking with parents and teachers and trying to figure out how we could better empower them to succeed in the challenges they face every day. We generated possible areas of opportunity and a list of requirements that would meet their core needs and values. Then we generated ideas and designs based on this information and we worked with our user group to better design for them.

We decided to focus on parents of blind children and we learned that one of their biggest difficulties was connecting with their child on a personal level. We found a study that discussed the importance between the bond of a parent and a child in the very early years of life, and how much that bond is grown via visual cues such as smiling, eye contact and waving. This study discussed the high levels of depression in parents with blind children because of how difficult it was to grow and develop their bond. ([The Blind Child and His Parents: Congenital Visual Defect and the Repercussion of Family Attitudes on the Early Development of the Child](#) by Lairy and Harrison-Covello). We also found some statistics that showed an abnormally large percentage of divorces occurring after a disabled child was born into a family ([Divorce Rates Among Families of Children with Disabilities](#) by Morstad)

With these things in mind, and with the information gained from the personal interviews we had with our users, we designed something called an Everpresent. An Everpresent is a keepsake similar to a locket, but focuses on the other senses. The Everpresent aims to create an important memory and bond between a parent and a blind child.

This class allowed me to see the importance of designing for a user group and keeping their core needs and values throughout the design process. This class also let me see the importance of using the skills we learn as an engineer and giving back to the community.

user:
Nothing can stop this young, passionate caretaker of a blind child. She is energetic, proactive, highly networked and ready to move and shake the world—or at the very least give her child the best opportunities in life possible.



EverPresent

A present from the past.

EverPresent is designed for a blind child and their caretaker. Their matching EverPresent necklaces or key chains are like photographs but with sound and smell—and a little magic too!



Encourage Emotional Health

Strengthen relationship with Child

values:
Hopeful
Inner
Harmony
Loving
Happiness



Remember their scent.
Capture a scent that reminds you of them.



Hear their voice.
Records their voice saying something just for you.



Unlock a Secret Message.
Stores a secret message for the future only revealed when you touch them together.





By Lucas Hill, Mariah Dunn, Mandy Korpusik, Amy Malinowski

#1 Only one can remember with a photo.



#2 Make it at a workshop.



A blind child and their caretaker attend a workshop sponsored by their local National Association of Parents of Visually Impaired (NAPVI) chapter. This event allows for a support network and community building.

#3 Remember each other.



#5 Both can remember together forever with EverPresent!



#4 Unlock a secret message.



Stores a secret message only revealed when you touch them together. Being able to carry hopes to the future makes this something you can cherish forever!



#3 Remember each other.



Capture a scent that reminds you of them. Slide the necklace or keychain open to smell it over and over again.



Records their voice saying something just for you. Twist the top and hold the necklace or keychain against your jaw to hear them talk just to you!



By Lucas Hill, Mariah Dunn, Mandy Korpusik, Amy Malinowski

Figures 5 and 6: The Everpresent is a keepsake designed for enhancing the relationship between a parent and a blind child.

Designing for Blind Children

After taking UOCD, I had learned so much about caretakers of blind children and blind children themselves, that I wanted to go at least one step further. There was a mechanism I wanted to design and build for this group of people. I took a class called Principles of Engineering where I worked with a group of students to design and develop a self-organizing bookshelf. This shelf used both voice recognition and optical recognition for storing and retrieving items. The reason for designing this mechanism was because during UOCD we learned how difficult it was for blind children to keep track of their things and to determine whether something was theirs or not. This shelf was a way for both the blind child to store their belongings and for a parent of the blind child to store items they wanted their child to have access to.

For this project I worked on a team with a software developer, and two electrical engineers. I designed and machined the mechanical system for the autoshelf, while my other teammates worked in their areas of expertise. The final prototype of the mechanism that could be placed in front of a bookshelf can be seen in the picture below. My team created a website detailing the implementation of the mechanical, electrical, and software systems so that others could build and implement a system like ours. The process of designing and implementing a physical item for a disabled group of people was a very empowering experience, and it made me appreciate how much I have learned at Olin and how much I can give back to my community.

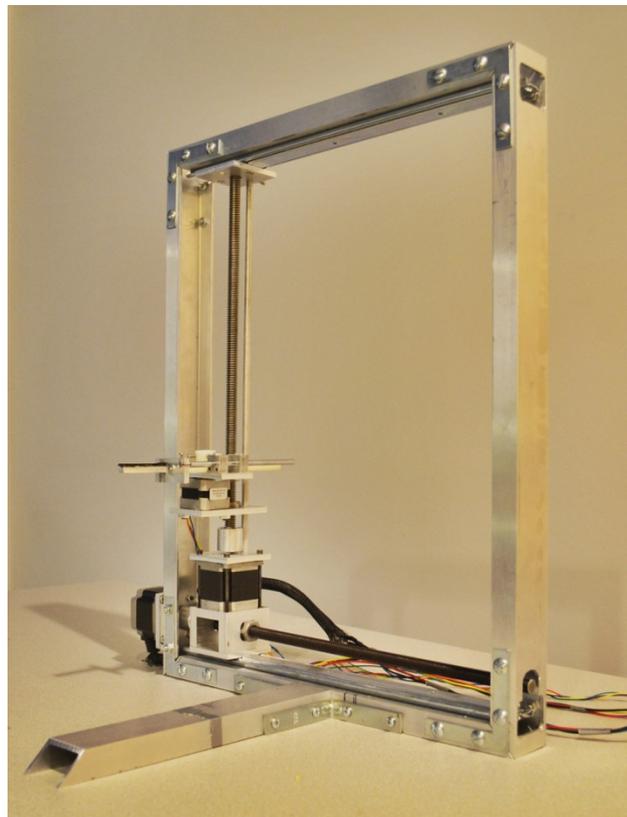


Figure 7: The final prototype of a self-organizing shelf designed to meet the needs of blind users.

Interdisciplinary Experience Reflection

An interdisciplinary experience is one where a group of people from different backgrounds come together under circumstances in which they are working towards the same goal. Olin's curriculum is tailored around giving their student interdisciplinary experiences through group projects in almost every class. I will focus this reflection on my final Senior Capstone Project at Olin.

For my final Senior Capstone Project at Olin I am participating in a yearlong group project working with Boeing. During this project I am on a team of peers with different engineering backgrounds and we are working with specialists from both Boeing and Olin to improve Boeing's optimization process. An important insight that I have gained while working on a team with engineers from different backgrounds is that everyone has their own strengths, whether it is programming, mechanical design, visualizing data, or presenting, no skill should go undervalued. Also, an even distribution of work and responsibility is essential to the success of a project.

During this class we learned about the importance of team roles and we each took on a specific title including project manager, communications liaison, budget officer, and the safety and ethics advisor. The project manager makes sure everyone is on task and that we are giving ourselves enough time for success. The communications liaison speaks directly with the company liaison and conveys information from our Olin SCOPE team to the Boeing liaison. The communications liaison is also in direct contact via email with the Boeing liaison. The budget officer keeps track of how much money the team is spending, and calculates a project budget for the rest of the semester. The safety and ethics advisor oversees that the project is safe and that it is being held to high standards of integrity. I took the role of the safety and ethics advisor and I work with the team and the SCOPE advisors to make sure our project is meeting high standards. My team has weekly meetings where we work together as well as call our liaison at Boeing to get feedback. Below is a picture of my team at a factory tour at Boeing in Seattle.



Figure 8: Senior Capstone Project team during a factory tour of Boeing

This experience, along with so many other interdisciplinary experiences, has taught me how to work on a team, how to incorporate different talents from people to improve a project, and to schedule meetings and plan a successful timeline to meet goals. These projects have also taught me how to learn about the strengths and weaknesses of team members and how to bring out the best of each member to complete a project.