

# GCSP Portfolio: Engineering for Others

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During the summer leading up to my first year at Franklin W. Olin College of Engineering, Alison Black, the Assistant Dean of Student Life, contacted all the incoming first-year students and requested that we each write a Statement of Interest that outlined what we wanted to accomplish when we got to Olin.

My Statement of Interest outlined one dozen goals, eight of which are listed below:

1. Get Involved with leadership activities or student government
2. Help plan and organize school events
3. Volunteer with individuals with developmental disabilities
4. Work or volunteer with children
5. Take classes in business or management
6. Work on assistive technology
7. Have an internship every summer (not always with the same company)
8. Get accepted into graduate school

As I sat down to reflect on my Olin experience, I realized that much of it was summarized in the list above. I can honestly say that, with a few caveats, I reached and often exceeded all of the goals I outlined before I set foot on Olin's Campus. In addition to reaching all of these goals, they all focused on a central theme: Engineering for Others. Below I break down the eight goals listed above and reflect on my experiences and how they all contributed to this central theme.

### **Goals 1-3**

I achieved my first three goals, (1) get involved with leadership activities or student government, (2) help plan and organize school events, and (3) volunteer with individuals with developmental disabilities, all through my involvement in Olin's SERV Board. SERV (Support Encourage and Recognize Volunteers) is Olin's umbrella community service organization. As an elected member of the SERV board for the last three years, and Manager of Finance and Records for the last two years, I have been in charge of identifying service opportunities for Olin students, planning/running service events, and documenting and balancing the finances for all events.

One experience on the SERV board that stayed with me for the last several years goes back to my first semester at Olin in the fall of 2010. Soon after being elected to the board, I was selected as the leader for the annual SERV Auction an event where students, faculty, staff, and the nearby community join together and support a charity by donating and bidding on everything from gift certificates, to babysitting, to handmade arts and crafts. Besides the fact that I was leading it, the 2010 auction was especially important to me because my classmates, faculty, and staff voted for the charity that I nominated, BeLikeBrit, to receive the proceeds from the auction. Several members of the community knew how important the BeLikeBrit organization was to me and rallied around my passion and supported me. Ultimately, with the help of the entire Olin community and the surrounding business, we were able to raise over \$9,500 to support BeLikeBrit in building an orphanage in the recently earthquake ravished Haiti. Together we made a real difference in the lives of others.



**Figure 1. Photo from the SERV Auction, a annual charity auction that I helped organized while on the Olin College SERV Board.**

Reflecting on my experience, my decision to run for an elected position on the board was spurred by my extensive volunteer experience in high school and my drive to help others around me. Throughout most of my life I've made a conscious effort to help those who are less fortunate than I. During my early adolescence, my drive to help others took the form of volunteer work with individuals with developmental disabilities, experiences that gave me the opportunity to see the world through a variety of lenses. I got a glimpse into what it was like to be an 18 month old infant with learning disabilities struggling with making everyday decisions such as what toys to play with or what snack to eat. Additionally, I saw the world through the eyes of a high school senior with Down's syndrome who got so angry and frustrated when he couldn't communicate with his teachers, peers, or potential employers because his disability prevented him from being able to clearly articulate his thoughts.

As I grew older, I began develop an affinity for science, technology, engineering, and mathematics (STEM) while my empathy for those who are disadvantaged continued to mature. I never made the connection between these two skills sets, until one project during my junior year of high school allowed me to connect my interest in STEM with my unique ability to understand, feel, and empathize with others. Ultimately this connection evolved and I decided to pursue a career in STEM and apply my knowledge/skills to improve the lives of others.

Enrolling in Olin meant I was pursuing a career in STEM and my decision to run for the SERV board allowed me to continue to do the volunteer work that I loved and ensured that I would never forget what brought me into this field in the first place.

#### **Goal 4**

In addition to my volunteer work with SERV, I accomplished my fourth goal, work or volunteer with children, through two years on involvement on another volunteer group on campus, Engineering Discovery. Engineering Discovery is a student run outreach program at Olin dedicated to fostering passion and excitement for engineering and science in K-12 students of all backgrounds. My specific role in the organization involved writing curricula and running bi-weekly workshops focused on open-ended,

hands-on team projects at an afterschool program at The Needham Housing Authority, a subsidized housing facility in Needham, MA. Here I designed open-ended science and engineering projects around topics that both supplemented the public school curriculum and were personally exciting to students in the program. For one such project, I worked with two members of the Class of 2013, Elizabeth Threlkeld and Mandy Korpusik, to design and implement Electricity & Magnetism curriculum that built off the Department of Education Curricula Standards for Massachusetts [1], as well as the curriculum framework for Needham public schools [2]. We guided students through three hands-on lessons focused on (a) electricity, (b) magnetism, and (c) electromagnetism and focused the learning objectives around thinking creatively, communicating clearly, and collaborating with others.

My time with Engineering Discovery, much like my work on SERV, allowed me to continue to do the volunteer work I loved and make a difference in others' lives. Additionally, Engineering Discovery allowed me to both share my excitement and enthusiasm for STEM with the next generation of students as well as share the unique hand-on, project based education that truly resonated with me when I got to Olin.



**Figure 2. A photo of me working with several elementary school students to help build and test bottle rockets as part of my involvement with Engineering Discovery.**

### **Goal 5**

My fifth goal was to take classes in business or management, which I accomplished through Olin's Foundations in Business and Entrepreneurship course. Throughout that course we studied a variety of examples of entrepreneurship through both case studies and visiting lecturers.

Prior to entering the course I had a very narrow definition of entrepreneurship, believing it was all about starting your own company and either (a) failing miserably or (b) making lots of money. According to The Merriam-Webster Dictionary, an entrepreneur is "one who organizes, manages, and assumes the risks of a business or enterprise" [3]. During the course, and more specifically my final project, my definition evolved to align with the broader parts of the Merriam-Webster definition which don't simply focus on a business, but instead an 'enterprise.'

For the final project in the course, our instructor, Professor Steve Gold, deviated from the traditional structure of the course where students normally formed small businesses in teams and competed to maximize profit. Instead, Professor Gold encouraged us to view entrepreneurship in a different light and develop an enterprise that focused on 'social change.' At first, I did not buy into the idea of entrepreneurship for social change but after selecting my team and project, which (not surprisingly) focused on increasing student involvement in community service opportunities on campus, I began to warm up to the idea.

My team and I had developed an 'enterprise' in that we had a difficult project that involved many people/resources. Through a series of campus wide awareness events, surveying students on their volunteer interest, outreach to leaders on campus, and a promotional video, we were able to significantly increase student involvement in community service opportunities, at least for that semester. Outside of the impact we made on campus, I believe this project significantly changed my views on business, entrepreneurship, and what I deem as a successful venture. After all, non-profits are still enterprises and entrepreneurs don't need to make lots of money. Who knows, maybe one day I'll start my own non-profit and look back at this class as the starting point for an interest in non-profits and making a difference through means outside of money.

#### **Goal 6**

Next, my sixth goal was to work on assistive technology and I achieved this through both a course project and two summer experiences. First, I enrolled in the first ever offering of a course titled Engineering for Humanity. The course was co-taught by an engineer and an anthropologist and focused on the anthropology, design, and engineering. We studied the aging population, both through a literature review and user visits with older adults in the nearby community. After spending two-third of the semester identifying user needs and values, we formed project teams focusing on a improving the lives of a single individuals

I had the opportunity to work with three of my classmates to improve the daily life of a 98 year old woman, Christine. My team and I visited Christine in her home and tagged along on several of her errands to help identify difficulties that have arisen in her life due to aging and muscle deterioration. Ultimately, we worked with Christine to modify her couch where she spent much of her day reading, but had a difficulty rising from and lowering to safely.



**Figure 3. My teammate Rachel Sirkin and I working with one of our Engineering for Humanity volunteers on an empathy activity.**

This type of project, applying STEM to improve others' lives, was exactly what drew me to Olin in the first place. Arguably the best part of my Olin experience was how Olin fostered this interest in understanding/empathizing with others and utilizing that understanding to developing technologies which improve their lives. Through courses like Engineering for Humanity and User Oriented Collaborative Design (UOCD) as well as an overall curriculum focus on 'people centric engineering', Olin taught me that to be a great engineer I needed both the technical skills and a deep concern for the needs of others.

### **Goal 7**

My seventh goal was to have an internship every summer (not always with the same company). I met this goal for my first two summers, interning at Kiva Systems during the summer of 2011 and then Harvard University/Wyss Institute for Biologically Inspired Engineering during the summer of 2012. However, I loved my work so much at Harvard I had to return there for the summer of 2013, and thus not fully meet my goal of having an internship every summer with different companies.

At Harvard, I utilized the knowledge and skills I developed at Olin to pursue the development of challenging and advanced assistive technology under the supervision of Professor Conor Walsh. I worked on the development of a soft-exosuit for gait augmentation of healthy individuals, as a proof-of-concept [4-6]. However, ultimately this soft, flexible exosuit technology could have a much broader impact by assisting individuals with disabilities to walk. This technology could assist those with abnormal gait patterns including those with Parkinson's Disease, Cerebral Palsy, recovering from a stroke, or older adults with muscle weakness.

Applying this technology to individuals with Parkinson's Disease (PD) in particular could have a significant impact, both in the US and globally. An estimated 5 million people have PD worldwide, a number that is expected to double by 2030 [7-8]. Patients with PD face significant risks for the development of co-morbidities and rapid decline in health related quality of life (HRQoL) [8-11]. Recently, deterioration of

walking was identified as the single most important factor contributing to the decline in HRQoL in patients with PD [12]. Thus, effective interventions that improve walking could significantly reduce an individual's disability.

During these two summer experiences I was able to use my engineering skill set and user-oriented and project-based learning (PjBL) education to design, build, and conduct human subject testing on multiple exosuit prototypes. As one of the two individuals to first work on this research, I was responsible for many landmark tasks including fabricating the preliminary suit architecture and controller, and conducting human subjects testing to quantify the biological effects of the suit.

Along the way, I encountered many challenges including major setbacks related to low efficiency force distribution through soft materials and high pressure concentrations on the skin/landmark joints. These challenges were exactly the type I had spent my entire Olin education learning how to tackle, real-world, open ended, and ill-defined challenges that you cannot solve by looking in the back of a textbook. However, looking at the low efficiency force distribution through soft materials as an example, I learned how sew, I learned what materials and fabric weaves had the least give, and I used this knowledge along with content from my *Mechanics of Solids & Structures* coursework to produce multiple suite prototypes and significantly increase the efficiency of the suit. The drive, dedication, foresight, and the engineering skills I gained at Olin allowed me to overcome this challenge and many others challenges as I continued to move towards my goal of improving the lives of those with gait impairments through the development of this first proof-of-principle exosuit prototype.

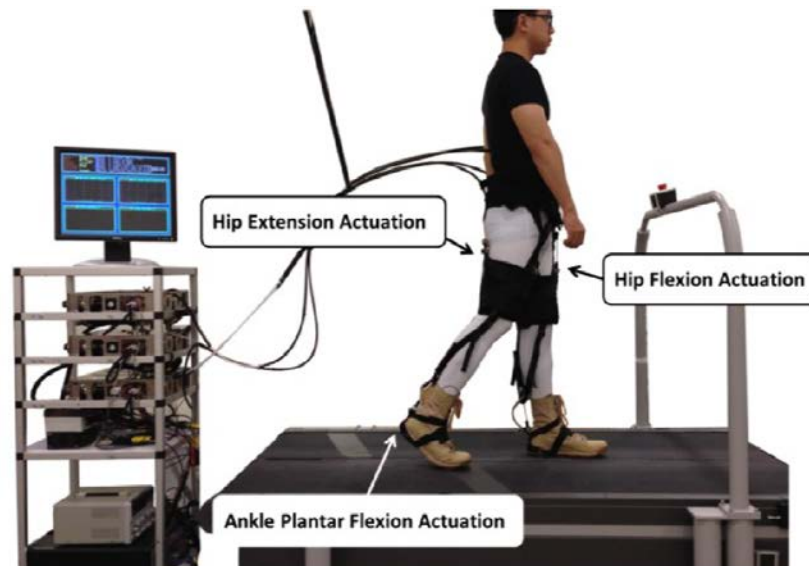


Figure 4. A prototype of the soft exosuit displaying the multi-joint actuation platform (left) and soft exosuit with ankle and hip actuation (right) [3].

### Goal 8

My eighth and final goal was to get accepted into graduate school. I was able to accomplish this, and ultimately decide to continue my work on the soft exosuit and pursue a PhD at Harvard, a project and university that were both a distant dream four years ago. This opportunity will allow me to take the knowledge and skills I developed at Olin through its hands-on, project based curriculum and apply it directly to what I entered engineering to do, improve the lives of others.



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