The Development of a College Engineering Organization and the Inevitable Transition of Power

A Handbook for an Engineering Student Leader

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# Acknowledgements

Although the public often directs their praise and admiration to the founder or the leader of an organization, they are often just a small single puzzle piece to a far-greater picture. There are scores of people that will affect the initial birth of any organization; some internal to the group and some external. If I were to thank each individual person that has positively affected the creation of the University of New Hampshire (UNH) Students for the Exploration and Development of Space (SEDS), my college engineering organization, it would fill a couple pages. I could also say the same to the people who created barriers and problems to plow through; all of which are crucially needed to learn, grow and teach.

To Kevin, Scott and Sheldon of the UNH College of Engineering and Physical Sciences (CEPS) Technical Service Center for putting up with my constant questions and allowing the organization to expand and feel like home for so many students.

To the staff within the mechanical engineering department and CEPS including Kelly, Pam, Sheri, Dean McCrone and Dean Zerker. To Todd Gross for being our advisor and a constant confidant for me.

To Reilly, the first senior project and connected alumni.

To Ross, Grace, Silas, Lucas, and Zach who have been members and contributors since nearly the beginning of UNH SEDS whose opinions I respect greatly.

To Alice, Jeff, Alex, Dylan, Max, Cornelis, and Porter for giving me hope that the club has a stronger future with me out of it.

And to Thomas, the best #2 I could ask for and my dearest friend. May we continue to grow and make a difference in the space industry and the world.

# Preface

When I was a freshman at the University of New Hampshire (UNH) in 2016, I was upset and discouraged by the state of the engineering organizations available for underclassmen. Yes, freshman could join the teams, but what did that really entail? They were made up of entirely or primarily senior mechanical engineering students using it for credit on their senior design project. Each year, a different group of non-passionate seniors filled the groups just to satisfy a requirement. What is the fun in that? What actual learning, engineering and otherwise, can be done in less then one year? What kind of growth can be fostered on the organizational level each year with that system? I could not settle for this, so I decided to go the much harder route of creating one. I founded UNH Students for the Exploration and Development of Space (SEDS), one of now 80 chapters nationwide that support the development and learning of students to one day join the space industry. Although my team is a space/rocket organization, the learning in this handbook is universal to any type of engineering organization (fire and flight does attract an intelligent and passionate crowd, though).

UNH SEDS started with a few people passionate about space and the affect it can have on the world. During its first academic year (17-18), we were 7 strong with around $1,500 of total funds to work on basic rocket building and simulating techniques Our work won second place at a large university research conference which gave us recognition on the university level. During its second academic year (18-19), we grew to 13 strong ranging in 5 different majors and every class with around $4,000 of total funds. We started work on New Hampshire’s first hybrid engine entirely built by students. In its third year and my final year, the organization grew to the largest and most powerful engineering organization on campus with 40 active members ranging in 8 different majors and every class with around $20,000 of total funds to work on a full hybrid powered rocket to compete in Spaceport America Cup in June 2020.

This handbook contains all the lessons and advice I can give after starting my own college engineering organization over 3 years. I have run into countless failures and mishaps, and just a handful of critical successes. Although each were important, this handbook serves to help you navigate the web of creating your own organization to help mitigate the pain points and save you countless hours of struggle.

I owe everything to UNH SEDS. I owe my career path that lead me to work at the top rocket launch companies in the U.S. including interning at Rocket Lab, being awarded the prestigious Matthew Isakowitz Fellowship Program, and working full-time at SpaceX after graduation. I owe most of my learning during university as classes need to be applied to something to fundamentally understand it. I owe all the connections I made in the industry that lead me to my opportunities. I owe my general identity and personality. Most importantly, I owe some of my dearest and closest friends to UNH SEDS. They are my second family in life.

This handbook will read like I am speaking to you, constantly drawing up specific examples of my own experience with UNH SEDS to help illustrate the major takeaways I want you to come away with from each sequence and section of the handbook. Although I recommend a full read-through first and then reference sections when needed, you can also just read certain sections that you are looking for help in. Although this might help alleviate mistakes and failures you might have made without this handbook, you will still see failure and regret. Do not let that discourage you. Plow through problems and take 100% ownership of your organization and the work it produces. Now let’s get started.

# Ignition

The purpose of this section is to review the thoughts, actions, and realities of what it takes to start an organization. This sequence in a college engineering organization’s lifespan typically lasts from initial conception to less than 6 months. We begin this sequence with Signifiers to Start, which walks you through the fundamental questions you need to ask yourself before embarking on this journey. We will then move to Building Around a Project, a crucial step to build a base of work and culture needed so you can then go about Identifying a Growable Team. By the end, you will have gone through many struggles, but will have created the start of a blossoming college engineering organization.

## The Signifiers to Start

Starting an organization is hard. It is not the type of hard that you get from difficult homework assignments or labs, but one that sticks to you, constantly on your mind till you move-on with your life. You don’t get instant appreciation or gratification. You don’t even get a grade! Sounds terrible, right? But it can be the most rewarding thing you have done up to this point in your life. You will make sacrifices to your personal life. You will have many late nights. You will need to sober up a bit and have some free weekends. You will need to reduce waste in other areas of your life to free up time. The organization will become your top priority, not necessarily because you need it to, but because you will want it to be. It could turn to your driving force in life, guiding you to a path of success and happiness. If you haven’t been scared off yet, you might be up for this. Let’s get to the critical questions to ask yourself to provide a framework for yourself on your motives and abilities.

The fundamental question to ask yourself is why are you interested in starting an engineering organization at your school, personally? It could be to gain the experience needed to land an internship or job that you desire. It could also be because you want a chance to feed your passion for the engineering group you want to start. Are you just bored and want to make something for yourself to do? All are acceptable reasons and are very important to know internally for yourself. The fundamental purpose you have for the organization will pave the outcome you will create. Personally, the former reasons are the strongest driving forces, and are usually intertwined with each other. Having a dream outcome for yourself after university and the work you do in the organization naturally feeds your passion for a subject can motivate and drive you to work tirelessly. Write down your reasons personally and keep them close. Not only will it create a base for yourself to revisit when times get tough and forget why you are doing what you do, it will also create an amazing relic to leave for the organization once you leave.

The next question to really consider is the timing of your organization. Don’t try to start ‘another’ racecar team. Don’t try to start a general engineering club that changes subjects and industries every semester. You want to create an engineering organization that can build each year and retain folks passionate about the areas you work in. What also impacts the amount of success you can have right away is overall interest in the industry. I was very lucky. I fell in love with rockets after I witnessed a booster landing of a SpaceX booster, and it happened to be that there was no rocket/space engineering organization on campus, and I read that the commercial space industry is expanding at an exponential rate. I struck a win on both categories without even thinking about it when it was going on. What is unique about my university, UNH, is that there is not an aerospace engineering major option, so the students at the school are naturally less space oriented as many of those students go to the schools with these programs. But what I did not suspect was to find students that really wanted to get into space after already choosing to go to UNH, just like myself. These students were not just interested, but the members that gravitated to the club had a real love and passion for the power of space. As you really explore all the routes you can take with your organization, please consider all these factors as, when they are in your favor, will help you greatly.

A very common concern for students looking to start an organization or take ownership of one during yearly elections is they are not capable of leading. It is true that some students struggle to speak publicly or lack fundamental qualities that enable people to follow them. That is a huge minority, though, Leadership is learned and grown, which is why there is an entire section within the Throttle Up sequence that explores this area. This concern should not alter or demotivate you at all. To become good at something, you must both start doing it and do it all the time. Let this be your start and let the rest of your college career be doing it all the time. You must have the energy to learn it, though. Are you discouraged by failure, or are you driven by it? A new leader will see failure a great deal more then any success, so prepare yourself mentally to handle that and move forward from it. It took a great deal of failed Falcon 9 landing attempts to finally have a success, and the same will go for growing your leadership skills.

The final topic to touch upon before you decide if the signifiers to start are pushing you to start an organization is the common roadblocks you will hit initially. The largest headache at the beginning, and honestly forever and always, is how to navigate the Maze of Power. The Maze of Power is the web I use to define the different people to contact given the question or ask you have. I remember specifically one time I had a question that required 7 forwards in an email to get to the right person to help me. Professors and staff at your university will create natural roadblocks for you as you become a student organization and schedule your first meetings, but stay determined and do not be afraid to bother and bother until they know you aren’t a one-time ask type of person. Remember, people working at a university are not there for the money but are there because they wanted to make an impact in the next generation of workers, and they are on your side. They are busy and want to ensure that you are worth their time. They are some of your biggest assets, and they are responsible for fundamental growths of your organization that is often overlooked greatly. Get to know them and understand their imperatives.

So, you have asked yourself some fundamental questions and might be itching to get started. When I got this idea, I could hardly sleep. The excitement is great, and it should drive you. The next most important understanding and topic to work out is building your organization around a project.

## Building around a Project

It is a very common mistake to build a group first, then you build a project around the group. That does not work. In reality, you must identify the goals of the organization by the time you leave that are realistic, with a detailed view for the first year based purely on what you want to do. Once that is done and worked out clearly for yourself, recruit individually with friends or classmates that seem interested by word of mouth. Alter your plan a little to fit those handful of people to get on board, and then stick to it. Once you have that overarching schedule, including short and long-term goals, now you can build a group around it. Some students won’t be attracted to what you and your handful of first recruits want, but that is okay. You aren’t here to satisfy everyone, because then you will satisfy no one. Allow your group to start small with a focused goal and allow the natural expansion of the group expand your scope appropriately. Only a handful of students will make an impact to the organization the first year, so you might as well keep the work done something you and your most committed members are extremely passionate about. Once some work is produced that is exciting, more and more students will want to get involved.

Now that you have that framework of the organization and a small handful of interested students, now it is time to make an exciting presentation and schedule a meeting to present it to a larger audience. Select one or two of the already interested members to help you with this, including helping make the presentation so it is grabbing, and delivering it to the group of students that come to hear from you. There are three things that need to be done before the introduction meeting to get people to come: attention grabbing flyers, emails to the students you want in the group, and obtaining an appropriate amount of pizza.

Food is extremely important, as you probably know as it is needed to stay alive. Having it for the first meeting is a great incentive for somewhat students to come and listen to you. As this cost’s money, it is useful to reach out to the school to ask if they can fund this initial meeting, and it is likely that they will. Schools want to support students taking leadership outside of the classroom. Make informative, to the point flyers to post everywhere around the academic building that draw the right crowd for your group with at least a few days in advance before the meeting. Make it as simple as you can including the when and where it is, why students would be interested in the content, and that there is free pizza. The next thing is to get emails to students directly about the meeting that is also very to the point so an interested student will want to know more. All schools do this differently, but usually the individual departments have ways of mass communicating with their students, which is the route you should take. Approach in-person each department that you want to get an email out for you and connect personally with them. Follow-up with the email you want sent and confirm they send it out over the next couple days. Pick a room to meet that you can reserve through the school and make it a room most people know. It shouldn’t be in a non-engineering building, but somewhere engineering students already hang out in. Have it at night to avoid class schedules. 8:00 pm is usually a great start time for organization meetings. If your university has specific bar nights during the week, like mine does on Tuesday and Thursday, avoid those days as that will limit the amount of 21+ members that will come.

Practice presenting before the meeting and come with confidence. Like me, this will be the first time you are presenting this idea to a large crowd, and it might be the first time you speak openly to a bunch of strangers. Do not become discouraged if only 7 people show up. Remember, you just need 5-10 members to hit the ground running, so quantity is not the goal. It is quality. Go in detail more about what the group is, what you want to do, and the next steps after the meeting. Next steps should not be another presentation meeting, but conversations that start your project. They are there to work on cool stuff, not talk about non-value-added things. The quicker you can get to progress on something, the faster and stronger you will expand. But remember, for your organization to be effective, it must at heart be a learning organization. Stress that, as the interested members need to know the project you do are to learn, including failing and succeeding.

## Identifying a Growable Team

The first meeting is not just to present your goals to people but is also used for you to meet and gauge the interest of each person attending. Make it a goal to talk to each person, have them sign in with their contact information, and write notes down on each person. Get to know them and why they took time out of their night to come to your meeting. T.J. Sullivan, author of Motivating the Middle, defined the terms top-third, middle-third, and bottom-third members. What he means by these terms is that each college organization shows a common trend of having groups of students with different levels of commitment. “Top-third members do most of the work. They are the visible, busy leaders. If their hands are not actively doing something for the group, their minds are likely thinking about the next event, meeting, project. They run for office. They step up when there is a need (Sullivan).” His work was done mostly for fraternity and sorority groups, and I have found some of his definitions a little out of date and wrong for what you experience in a college engineering organization. Instead of breaking them up into thirds you see more of a top quartile, middle half and bottom quartile. It is more of a trend to see a fewer amount of students take the top role of a college engineering organization, with a larger concentration being in the middle, meaning “a middle-third member is happy to contribute to the success of the organization, but is much more likely to be a supporting player than the MVP (Sullivan).” I will use my variation of Sullivan’s definition of types of members in an organization for the remainder of the handbook, but the general meaning of the types of students are nearly the same. So the entire goal of the initial meeting is to gain interest from as many students as possible, and it will be clear who are the top-quartile and middle half members are, while the bottom-quartile members will maybe show up to general meetings, but will rarely contribute to the actual engineering or general discussion.

Once you have some interest from the first meeting and have the next steps planned and scheduled, it is time to start thinking if anything needs to change from your initial thoughts of the organization. As it grows, it will become increasingly more difficult to institute large change, so now is the time. Once you are feeling good about the next planned meeting and the stuff you and the top team members want from it, it is time to grow the organization with the members you have. What people or groups can help you at this point? It is imperative to become a student organization with the university and your college of engineering if possible. It is also a requirement to have an advisor at this stage, so be sure to meet with some professors that align with the organizations interest or a professor that seems very willing to help out. Energy is the most wanted train of an advisor, not expertise in the subject. Great resources can come from this including help from staff, money, and most importantly, possible organization space to do your work and have meeting. I personally fought to get room space, and once I got a small section of a room, I made it my duty to make it feel like a home base for the group. Take it slow, and don’t ask for a lot off the bat. You might think you need it but let your organization grow until it becomes apparent it just needs more space. It is also sometimes beneficial to reach out to other organization at the school or community level that somewhat lie with your interests to gain initial connections with already prospering groups. I did not do this but looking back, it could have helped a lot.

The most important advice I can give you at this stage and at this section of the handbook is from a book called Why Doers Do by David E. Wile. The author says “people don’t change much,” which is a very important thing to understand on a deep level here. It took me quite a while to get this in my head and use it on the day-to-day. What this means is that it is not your job to motivate or inspire the students to join your club. Have them join because the work you want to do inspires and motivates them. People don’t change so try not to waste time pondering how to get more people interested. Work with what you have and students will naturally want to work on it if it is meaningful and exciting. Do not forget that as you begin to start your projects.

At this stage, you should have determined the why in starting your organization, and have created an initial base of interested members and future leaders to get started on your goal and first project. It is now time to nurture that and not let the energy down. If an organization stays static, it slowly dies. It is now time to Throttle Up and tackle the bulk of the content in this handbook as this stage is deep in potential roadblocks, failures, and insights.

# Throttle Up

The purpose of this section is to understand the growth, knowledge and action needed to Throttle Up the strength of your new engineering organization. This sequence in a college engineering organization’s lifespan typically lasts from 6 months old to less than 2 years. The learning objectives of this sequence though, in its root, is always applicable to all the future sequences of launching a college engineering organization. We begin this sequence with Growing your Leadership Skills which will impart the fundamentals learning how to lead people and motivate students specifically to rally around a common mission. We will then move to Learning to Manage a Team, a fundamental skillset for starting and ending projects successfully all while correctly managing engineering students. That flows seamlessly onto a deep discussion on The Art of Meetings, a discussion on Increasing your Budget Sustainably for the organization and comes to a beautiful finale that wraps all these sections together in Growing the Culture of your organization.

## Growing your Leadership Skills

### The Fundamentals of Leadership

### Motivating Students

## Learning to Manage a Team

### The Fundamentals of Management

### The Life of a Project

### Managing Engineering Students

## The Art of Meetings

## Increasing your Budget Sustainably

## Growing the Culture

## Expanding your Membership

# Orbits and Transfers

The purpose of this section is to understand how to sustain what has been making your new organization great, and how to navigate the art of organizational change. This sequence in a college engineering organization’s lifespan typically comes into play after Ignition and during Throttle Up. It is important to note, though, that the lessons and practices learned here are applicable to many areas of developing a student engineering organization. We begin this sequence with Sustaining the Organization and Culture which will teach you how to identify and sustain beneficial organizational project, practices and culture, but will then quickly move to the opposite. Facilitating Change will dive into the fundamental truths of humans and their relationship with change, and how, when done right, can be used to transfer out of a an imminent future collision within your current orbit.

## Sustaining the Organization and Culture

## Facilitating Change

# De-Orbit and Land

The purpose of this section is to prepare for the inevitable transition of power of your engineering organization. This sequence should officially begin the year before you graduate with the last 4 months needing a significant amount of energy. This sequence is the most important sequence of them all, as if this is not done correctly, all your work building the organization will fizzle. We begin this sequence with diving very deep into how to tackle Transitions your Leadership of the organization to the passionate underclassmen members. It then rolls into a Closing your Project section as by the end of this sequence, you have built an organization with the ability to sustain itself for decades after you are gone, carrying you and your founding members legacies.

## Transitioning of Leadership

## Closing your Project