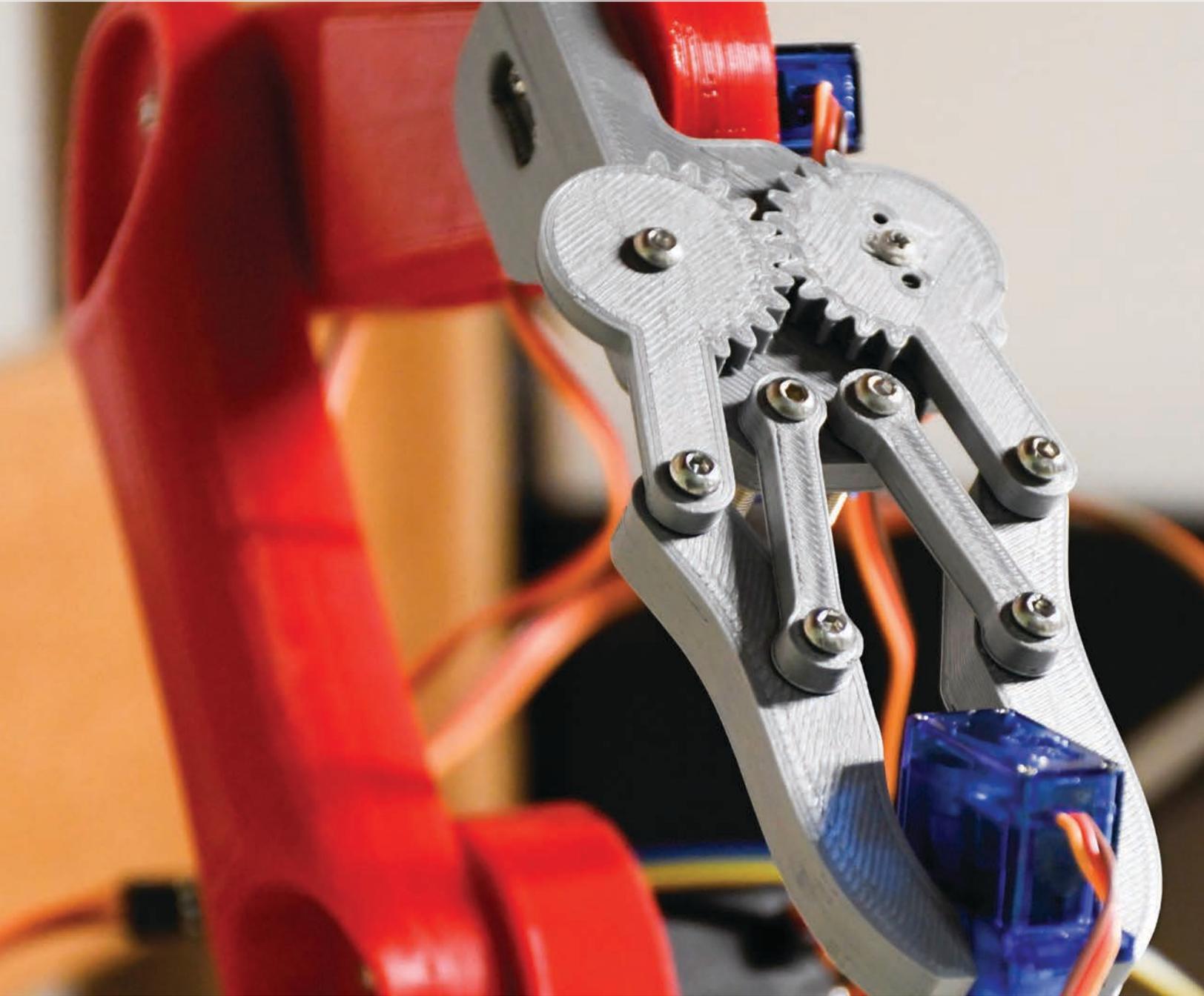


Engineers' Forum

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Photo / Thanh Tran
On the Cover
Robot arm controlled by arduino module. The 3D printed parts were assembled by Thanh Tran from an online open source project.

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(Top) **VT MOTORSPORTS
FORMULA SAE**
Photo / Thanh Tran

(Middle) **MIND MUSIC MACHINE
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(Left) **ROBOT DISPLAYED IN
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Photo / Kendal Price

(Background) **VT MOTORSPORTS FORMULA SAE** Photo / Thanh Tran

LETTER FROM THE EDITOR

Welcome to 2020! We hope you're having a strong start to the year and spring semester. In our February issue, we'll introduce you to a new set of engineering opportunities and stories that'll inspire you to pursue experiential growth and professional development here at Virginia Tech.

Kashyap Bhatt starts off this issue by showcasing the significance of undergraduate research. If you're interested in learning about why research is important or how to get started, Kashyap's article is a must-read.

Melanie Do and **Isabella Bartolome** continue to shine a spotlight on VT engineering teams through the Ware Lab series. Learn more about Astrobotics and Concrete Canoe through interviews with leads from each team.

Promoting minority representation and inclusion in her article, **Soumya Khanna** passionately writes about a team dedicated to supporting international students in Galipatia, the engineering living-learning community.

Curious about entrepreneurship? **Mehak Kamal** captures the unique platform called HitchHike that was designed by two engineering entrepreneurs to help Hokies find and secure transportation.

If you're keeping an eye out for engineering internships, co-ops, or full-time jobs, make sure to read **Jin Tian Acton's** informative piece on Torc Robotics, a company dedicated to autonomous transportation.

To conclude our February issue, **Alexander Petsopoulos** gives you valuable insight on his experience at the U.S. Naval Research Laboratory (NRL) in hopes of helping you choose the NRL as your next internship or job.

Thank you for picking up a copy of the February issue of *Engineers' Forum*. Through your incredible support, we are able to fully capture the student engineering experience at Virginia Tech.

Sincerely,



Julia A. Pimentel
Editor-in-Chief

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Undergraduate Research at Virginia Tech

Article / **Kashyap Bhatt**

Virginia Tech has many opportunities for the all-round development of an engineer: clubs, seminars, guest lectures, design teams, and more. One of these opportunities—which isn't quite as famous, but is equally beneficial and rewarding—is undergraduate research. There are many undergraduate students who want to pursue research as their career. Virginia Tech has excellent resources to make their goal a reality. Unfortunately, the lack of awareness and knowledge pertaining to undergraduate research prevents these students from starting early. **This article will explain what undergraduate research entails, why research is important, and most importantly describe how one can be a part of undergraduate research at Virginia Tech.**



Pimentel cutting off excess metal from lattice structure at VT Fire Foundry. Photo / Julia Pimentel

Why should one even be interested in doing undergraduate research?

Firstly, it is never too late or too early to be a part of undergraduate research. You can be a freshman or a senior, and the benefits that you will reap from your research will be valuable and worthwhile. You should pursue undergraduate research because exploring new things is always interesting, right? Well, if this wasn't a good reason, then here are a few points that could change or excite your mind:

It broadens your knowledge base.

Have you ever found a concept really cool and wanted to learn more about it? Well, research is a very unique way of integrating new and old techniques and using them to solve real world problems. Exploring a topic in real life rather than just learning it from a textbook combined with doing mandatory lab experiments is much more fun and helps you to comprehend the complex topic.

It gives you exposure to real-world research environment.

Why wait to do research in graduate school when you can potentially start four years early? For those students who are interested in pursuing research as a career, immersing oneself in a research setting at such an early stage is invaluable. Undergraduate research not only gives you an opportunity to explore different areas of interests, but also gives you a real world experience of what actually happens in a research lab. Additionally, for those students who are unsure about their future, pursuing an undergraduate research project helps them in knowing if they are fit for continuing it after their graduation, thereby helping students make an informed choice about their career.

It is unique and very different from traditional classes.

As compared to traditional classes where attendance is typically mandatory, the instructor teaches a fixed syllabus, and you have to do assignments regularly, research offers much more freedom and fluidity depending on the faculty in charge. Moreover, undergraduate research helps in developing a collaborative spirit.

It helps build meaningful contacts.

While working at a research lab, you will meet amazing peers and professors who are motivated and hard-working. These people will not only help you grow and succeed, but will likely continue to serve as a mentor in the future. Maintaining a professional relationship with them will increase your academic network at Virginia Tech and will open new opportunities. While working on a project, you will have to be around people from different majors and



Pimentel, an Ambassador for the VT Office of Undergraduate Research, gives a presentation to demonstrate the steps to obtaining a research position. Photo / Julia Pimentel

diverse fields to work efficiently as a team. The interdisciplinary interactions offered by undergraduate research is incredibly applicable in today's workplace..

So, by this time, if you are thinking about pursuing undergraduate research, let me tell you how you can be a part of this awesome opportunity.

How to be part of undergraduate research?

Just ask. Yeah, it's that easy. Don't hesitate even if your resume isn't packed with prior lab or industry experiences, just go for it. If you know a professor who is currently doing research in a topic that you are interested in, go and talk to

them during office hours and express your interest. Or, if you don't know any professor and are an introvert like me, use the "Cold Email" technique and start sending emails to professors you have never met and politely ask them about any open opportunities in their lab after introducing yourself and your passions. An important part of this step is to not fear rejection. I took part in undergraduate research and before getting a position at that lab, seven professors didn't respond to my emails and three professors outright rejected me. If you think you have enough experience, request for a paid position; you can also ask for a volunteering role. Professors are understanding and will give you an opportunity if they see that you are motivated. Lastly, even if you think that these techniques are weird or

new, try them because undergraduate research is worth it.

Resources at Virginia Tech

Virginia Tech has a designated Office for Undergraduate Research which provides several resources to students who are interested in undergraduate research. One can search for scholarship opportunities, contact an ambassador for queries, and even learn how to get



Promotional material at Dennis Dean Undergraduate Research and Creative Scholarship Conference. Photo / Julia Pimentel

started in research. In addition to these features, the Office of Undergraduate Research has recently created a database of undergraduate research opportunities which helps faculty connect with students who are interested and would like to be a part of their research.

So, what are you waiting for? Start finding research that you are interested in and start shooting off those emails to professors. -Kashyap Bhatt

Office of undergraduate research website: <https://www.research.undergraduate.vt.edu/>





Photo / Jessica Viehman

Ware Lab Series: ASCE Concrete Canoe

Article / **Melanie Do**



What is Concrete Canoe?

Concrete Canoe is an interdisciplinary design team that really needs all engineering majors to fully function. Even though it's called Concrete Canoe, it's not just for **civil engineers**. We really need a lot of **aerospace** and **ocean engineers** because civil engineers really don't know much about boats. Other than the fact we have to take fluid mechanics—so we know about pressure and points—but other than that, we don't

really know that much, so we need those types of people. **Materials science** and **chemical engineers** are really helpful for making the actual concrete. People don't realize it, but concrete is a super complex chemical product. Concrete actually gets its strengths from a gel. We also need **mechanical engineers** and **computer science** majors because we do a lot of CNC routing and work. The more diversified we are with our engineers, the more effective we usually are.

What is your name and what is your role?

My name is Jessica Viehman and I am a captain of the Concrete Canoe team and in charge of the mix design.

What is Mix Design?

I am in charge of everything that goes into the actual concrete mix, so all the different aggregates, cements, dyes, add mixtures, math, [and] chemistry that goes into making the canoe actually work. So, I am in charge of making the concrete designs, doing all the calculations, then physically making them, and testing the cylinders to see if they meet our specifications.

Why should students get involved with the Concrete Canoe team?

We love what we do and are really passionate about it. We get to have fun together and we get dirty. The other day I made a mix test design and the team wanted to do either a blue or green canoe, so we tested green. I looked like the **Incredible Hulk** when we finished. There are a lot of challenges where we get to use what we're learning in class and

work together as a team. We're not super strict; we're not super rigorous. The fall semester is a lot of work not in the Lab, so we're coming up with our design, doing a lot of calculations, figuring out what we want the canoe to look like. The spring semester is when it's really fun because we're pretty much in the lab 3-5 times a week and we're assembling the canoe, sanding it, preparing to put the concrete in—it's just a lot of hands-on work and a lot of man hours that go into that. It's just a great program to learn more about the department you're in by meeting all these people. You get a lot of hands-on practical experience, you can go on field trips with us, and we always try to have a teaching moment at the beginning of the year called Concrete 101 and Boat 101.

How do students get involved?

We have a page on GobblerConnect and our email is virginiatechconcretecanoe@gmail.com. There is also a page through the civil engineering department and ASCE page. We also have a Facebook page and our own website. If you want to email us or contact us, we can add you to our listserv and groupme, which is where we post a lot of our updates. Or if you just happen to be near the Structures Lab and you just want to pop in, then we'd be happy to have you. Clarification, even though we're housed in the Ware Lab, we don't actually work in the Ware Lab. We're actually in the Structures Lab which is over by the farms on the other side of 460. We do provide transportation and rides for the underclassmen who still live on campus.

Do you have to be a specific major or grade?

No, actually we have a graphic design department, so any major, we're happy

to have you. It's not all just engineers, but we'd love to have a graphic design student on the team. 25% of our score is aesthetics, 25% is rowing, 25% is the paper, and the other 25% is the actual canoe and how it looks. It's a holistic approach.

How is Concrete Canoe doing competition wise?

Last year, we were in 3rd place, the year before that, we were in 2nd, this year hopefully 1st place, that's the goal. How the competition works is, there's regional sections. There's probably 15-20 teams across the US, and then whoever gets 1st in that competition gets to go to Nationals. It's called Nationals, but there are also International teams, which is pretty neat. Nationals is going to be in Wisconsin this year.

What is the best thing/favorite moment you've gotten out of being on the team?

I picked where I wanted to go to school based off the criteria that they had a concrete canoe team. I started doing concrete research in 9th grade. I'm from Pittsburg, so they had a big research circuit thing for students. When I came here and saw the team at CEED O-Show and at Gobblerfest, I told the team my interest in concrete. It was really nice because they were so welcoming to me as a freshman. They accepted me into the group and I was able to help consult on the mix design as a freshman. Now, I'm the concrete girl to everyone. Yesterday, I was driving a freshman back from the Lab and he said, "I've never met anyone as passionate about concrete as you." Overall being in charge of a design team can be stressful because everyone is depending on you and there's so many

things you have to watch out for, but the comradery and working towards a common goal is really awesome...AND especially making concrete.

mean, it's Virginia Tech, everyone here is pretty nice. Everyone's really welcoming and don't be afraid to put yourself out there because it can really open you up to new experiences.

Any last thoughts?

People who have a slight interest in not just our design team, but any design team, look into it, research it because you could make a lot of valuable friendships and experiences that could help change your trajectory and what you want to do. Don't be shy to reach out to people, I

Interested in Concrete Canoe?

Email: virginiatechconcretecanoe@gmail.com.

Here's some more info: www.ef.org.vt.edu/concrete-canoe



Photo / Jessica Viehman



Photo / Jessica Viehman



Photo / Jessica Viehman



Photo / Astrobotics

Ware Lab Series: Astrobotics

Article / **Isabella Bartolome**

What is Astrobotics?



Astrobotics is a Virginia Tech team that designs and builds an autonomous robot to mine the surface of the moon because, if you can get underneath the moon's surface to a depth of about 45 centimeters, you can actually get to an icy regolith. NASA's most recent project, Artemis, among others are trying to build more permanent bases and having easy access to water while in outer space is important. Not only can you use it for drinking

and irrigation, but, if you break apart the components of water, you can actually get hydrogen and oxygen, which could give you rocket fuel.

What is your name, major, and role?

My name is Grant Anderson and I'm the team lead of Astrobotics. We split ourselves into three teams (electrical, coding, and mechanical). I primarily handle the mechanical side of things, but I also oversee the whole project. I am a sophomore in Mechanical Engineering.

Why should students get involved with Astrobotics and what are some of the benefits of being on the team?

Being on Astrobotics is a great learning experience. There's a lot that you can really get out of physically building and seeing how things are assembled. It also gives you a lot of experience working with various tools and the design process. Astrobotics in particular is a small team and we're a very young team; there are about 16 of us and this year we're mostly freshmen and sophomores.

How can students get involved with Astrobotics?

There's a quick application process on our website: vtastrobotics.strikingly.com We also call in applicants for an interview and, from there, you can join the team.

The main thing we look for in applicants is a willingness to learn, because we can teach you anything you need to know—you just have to engage. If you have experience with robotics or working

with tools, it would be helpful, but it's not required. We usually ask that members contribute about 10 hours of their time to the team and project per week; one of the advantages of the Ware Lab is that any team member has 24/7 access to it. Therefore, if you can't meet at a certain time, we can work around that. Right now, our team meetings are Thursdays at 9 PM because that's when everybody's available. As long as you're putting your effort in, it's not a big deal when you come in to work. We're happy to have people join!

Do you have to be a specific major or grade to join?

No. We usually divide the team into mechanical, electrical, and autonomous, which typically attracts mechanical, electrical, and computer engineers and computer scientists. However, those lines are a lot more blurred; I'm a mechanical engineering major, but last year I was doing pretty much all the wiring for the project alongside another teammate. We try to organize, but there's no strict definitions of what you have to be. In the past we've also had civil and aerospace engineers on Astrobotics.

How long have you been the team lead of Astrobotics and what drew you to the position?

I've been the team lead since the beginning of this past fall semester. I was one of the few volunteers on Astrobotics because last year we were primarily a senior design team. We had a couple volunteers who would work and help alongside the design team, but it wasn't much. Then, with a lot of the technical issues that happened at the end of last year, I was one of the few members left on the team and I didn't want to see Astrobotics go. I decided I would help

pick the team back up, meet with our faculty advisor, and work hard to rebuild the program. I'm definitely happy with everyone on the team; we all try to keep Astrobotics going despite last year's situation.

“work hard to rebuild the program” -Grant Anderson

How is Astrobotics doing competition wise?

There is a competition in May, the National Robotic Mining Competition: Lunarbotics. It's down at the Kennedy

Space Center in Florida and a bunch of other universities compete. Teams get graded on the weight of the robot, power usage, how much material it can mine, among other criteria. In the past we have gone to Lunarbotics, but we probably will not this year.

Typically, teams apply and then follow a process for the duration of the year since they're essentially going through a NASA project. In the fall, you have your systems plan and prototyping and you send updates to NASA throughout the year. Then, towards the end of March, you send proof of life—showing that you have a completed robot and that your team will be able to compete. In May, you can test and adjust your robot and, at the end of the month about a week after finals, every team goes to compete.

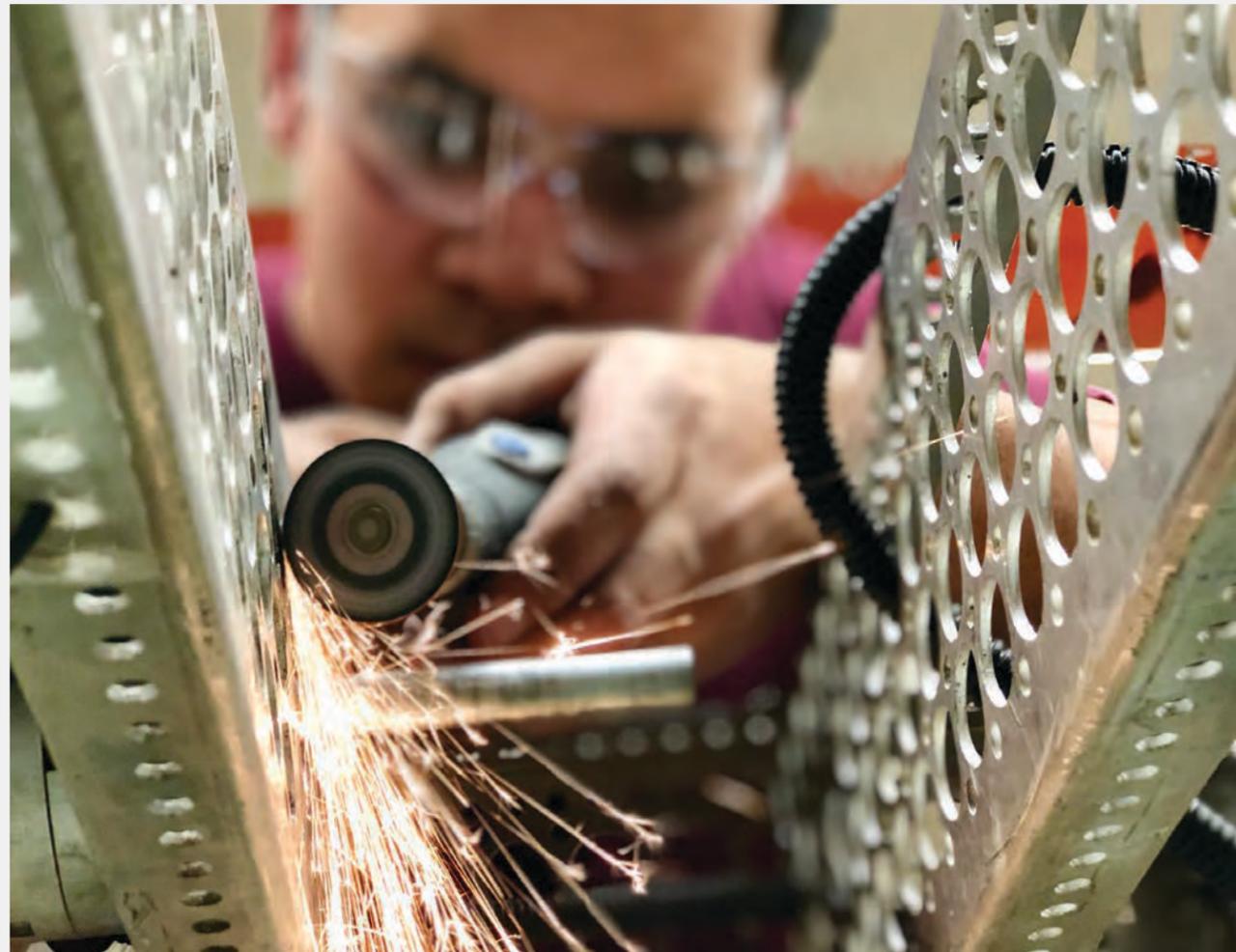


Photo / Twitter @VTAstrobotics

What is the best thing/favorite moment you've gotten out of Astrobotics?

My favorite memory on Astrobotics would be seeing the machine last year work for the first time. I wasn't directly involved in the design, but, to make up for that, I was in the lab every weekend for hours on end during the spring just helping to assemble it and put it together. As I said earlier, I did a lot of the electrical wiring for the robot, so it was a lot of fun to finally see it all power on, work, and be tested.

Any last thoughts for potential team members?

Astrobotics is always recruiting and we're always in the Ware Lab, so if you're ever curious or want to ask anything, just swing by and we'd be happy to talk with you. If you're interested in applying, please do; we'd love to have you!



Photo / Twitter @VTAstrobotics

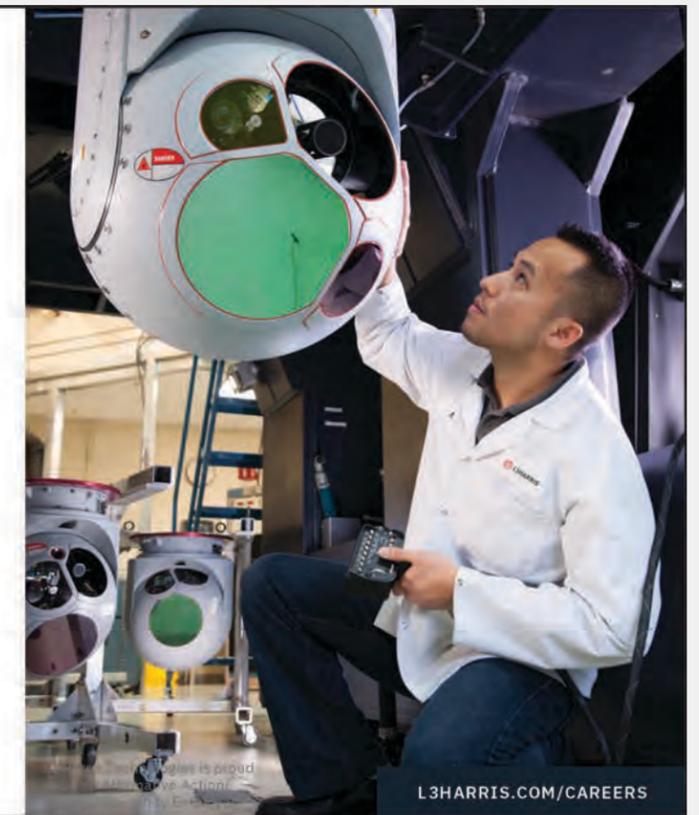


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Photo / Pictured from left to right: Tawni Paradise, Soumya Khanna, Haritha Gnanasegar, Xiaohan Ma

Photos by: Thanh Tran

Supporting International Students in Galipatia LLC

Article / **Soumya Khanna**

This team aims to address the most critical needs and challenges that international students in the Galipatia engineering living-learning community (LLC) struggled with during their transition to Virginia Tech and the United States. The first-year team is comprised of Haritha and Tawni along with CEED (Center for the Enhancement of Engineering Diversity) as financial support. The following article highlights each team member's unique story.

Tawni Paradise is pursuing a Ph.D. in Engineering Education at Virginia Tech and has previously held a graduate assistantship in CEED in which she taught two sections of Hypatia. Tawni recalls, "We didn't have specific aims or goals, beyond just helping the international students in Galipatia to the best of our abilities. A lot of what we were doing was to address issues that were brought to us or issue[s] that Haritha faced...but we didn't have a definitive path."



Tawni recalls, "As a Hypatia instructor, I was responsible for providing academic support for the students in my sections, all of whom were first-year female engineering students. Among the 75 students within my sections, I was lucky enough to have 8 international students from various countries." Tawni recognized the unique perspectives that international students brought to the classroom and also noticed the different barriers they faced. Some of these barriers included adjusting to the basic culture in America, such as the proper way to interact with others (i.e. faculty or industry folks), or the adjustment to educational norms, such as the meaning of credits for courses, the purpose of office hours, or suggested formats for resumes. While I felt competent in supporting these adjustments and sharing the academic norms of Virginia Tech, I didn't always integrate this information into the basic curriculum of the Hypatia course. Recognizing this, I aimed to provide additional support to my international students while relying on them to identify topics that they were struggling with. This worked pretty well over the course of the first couple of months of class; however, it became clear that these students experienced barriers that I didn't have the expertise to support them with, such as visa concerns or questions about getting internships as an international student. Given my lack of experience with the cultural transition of moving to America as an international student, I partnered with Haritha, who is an active member of the CEED community and an international student herself. Together, we aimed to support international students in Galipatia and identify support systems on campus that are particularly useful in considering the international student transition, such as Cranwell International Center and Smith Career Center.

"helping the international students in Galipatia to the best of our abilities"

-Tawni Paradise



Photo / Tawni Paradise

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Haritha Gnanasegar, a junior studying **computer engineering**, is an international student residing in **Kuwait**. Haritha served as a mentor in the Hypatia LLC in her sophomore year. “During my sophomore year, Tawni reached out to me and told me about her experience working with international students. A lot of the barriers we spoke about were the ones I faced in the past. I learned a lot of things the hard way. I was able to get past some of the hurdles international students face while still struggling with a few. We believed that having targeted sessions for international students would help them be aware of some of the issues that were likely to occur in advance so that they could be prepared for occurrences such as navigating through career fairs; talking to companies that hire international students; looking out for housing options during the break; keeping an updated visa. Working with international students has been a unique experience because it is a place where learning comes from both sides. I’d love to learn about new cultures and meet people from diverse backgrounds. As an international student myself it gave me a way to connect with them as a person who was in their shoes a year ago.”



Photo / Haritha Gnanasegar

Carol Ma, a sophomore studying **industrial and systems engineering**, is from **China**. “My freshman year at Virginia Tech was my first year in the United States. Living and learning in a brand new country for me required lots of courage and lots of help from other people. Because of language and cultural barriers, the new-coming international students feel extremely lonely and uncomfortable. They tend to find friends from their own country and get into a mindset of never being able to join the American culture. I tell them [that] every single feeling you are feeling right now has been felt by us already. Don’t be afraid. We are here to help you.”

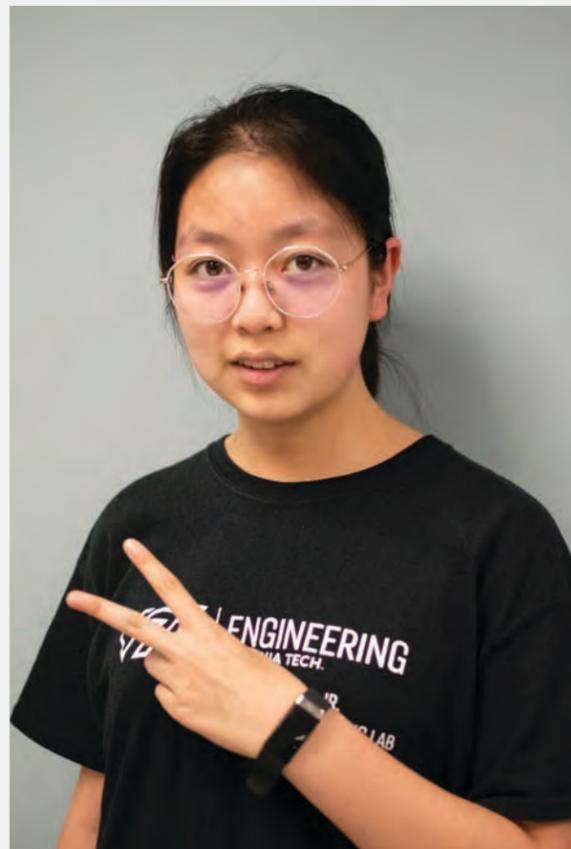


Photo / Xiaohan Ma

I also noticed that some people can get used to the environment to change more quickly than others. My goal in this group is to find the differences among people and try to bring

down every big issue to small and executable tasks to help others in specific ways.

Lastly, I’m **Soumya Khanna** and I’m a sophomore in **computer science**. I’m an international student residing in **Kuwait**. I joined this team to provide a support system to international students in the Galipatia/CEED community. As international students, we face troubles that most people don’t relate to and it gets really frustrating to have to figure out everything on your own. The first-year in college is overwhelming being so far away from home even for local students. International high schools are so different compared to high schools here, so when I first got here I didn’t know how credits or GPA were calculated. Adapting to a whole new culture was only possible through the support of friends and campus resources. Cranwell is a great help when it comes to official work however I felt very helpless when it came to other things like academics, job opportunities, etc. Tawni and Haritha organized a few events for the international student community which I found very helpful. We knew we could rely on someone to ask if we have any doubts/questions.

In the fall of 2019, we branched out and organized an event for international students in the peer mentoring program led by CEED. In the near future, our team also aims to do research about international students’ transition to the US.



Photo / Soumya Khanna



Photo / Proudly holding check from Kickstart - VT to support HitchHike endeavors

Engineering Entrepreneurship: HitchHike

Article / **Mehak Kamal**

Sai Gurrapu and Qasim Wani are two Virginia Tech engineering entrepreneurs who followed their passion for technology to create HitchHike.



The lack of a proper transportation platform for the VT community was a problem that Gurrapu and Wani faced constantly. They set out to solve this by developing HitchHike. Throughout the development process, they realized that this problem exists in many colleges across the nation. At Virginia Tech alone, there are 19,000+ members in the general Facebook carpool group. Similar amounts were found for other universities during their research; there's a lot of unaddressed demand in this area. In the next year, they plan on

expanding HitchHike to other universities in Virginia. Eventually, they envision HitchHike to be a national platform that students across the nation can use to find long-distance rides to and from their university.

What is HitchHike?

HitchHike is a long distance carpooling platform exclusive for Virginia Tech students. With HitchHike, you can request a ride from a fellow Hokie or sell seats in your car. Since August 19th 2019, over 300 Hokies have shared over 7000 miles of commute!

Who can request a ride?

Any registered user with a valid @vt.edu account. Only Virginia Tech affiliated members can register to be members on our platform. To be approved to join the HitchHike community, just register with your official @vt.edu email. Our team will confirm your email and approve or deny your request to join the community. The entire process takes 2-3 minutes to complete. We added extra layers of security guaranteeing the safety of our platform.

How is this app different from something like Lyft and Uber?

HitchHike is a platform that enables Virginia Tech students to share seats in their car for any trip they may be taking.

- Only Virginia tech students can use the platform.
- Drivers, not the app, set prices for a trip.
- HitchHike is specifically geared for longer trips. Whether you're traveling back home or to DC, northern Virginia, Chesapeake, Richmond, Nashville, Blacksburg, or anywhere else, we can help you take a full car there.
- You cannot request a HitchHike driver within minutes, most trips are planned in advance.

What's your tech stack?

HitchHike incorporates PWA (Progressive Web Apps technologies) which is basically a web-app that operates as a native application. The advantages of using PWA is that development time and division is significantly lowered while updates are automatically deployed via techniques such as continuous integration.

- Node.JS for backend. Utilizes multi-threaded processes using compression engine and asynchronous JavaScript.
- MongoDB and Mongoose framework for Database as a Service.
- Python and C++ for Machine Learning and Web Scraping.
- Socket.IO for sending web socket based asynchronous chat messages.
- Semantic UI for CSS framework.
- Vue.JS for our frontend framework.

What do you use Machine Learning for in your app?

Recommender Systems.
FraperCHOTSAM.
Fraper.
Computer Vision.

How have you addressed safety with your app?

The Team at HitchHike is dedicated to the safety of its community. To achieve this, only Virginia Tech students are allowed to use the platform. To keep your personal information private, HitchHike provides in-app messaging services so no personal contact information ever has to be shared. We confirm drivers through a series of verification methods and all drivers and riders can be reviewed for increased transparency when deciding whom you want to travel with.

How does the app actually work?



A driver is traveling from one city to another and has empty seats in their car for the trip. If you also need to go to the same city, you can request to carpool with that driver through HitchHiqe.



A rider wants to travel from one city to another. You can request a ride for a certain date and time. When a driver sees your request and wants to drive, they can accept it and you will automatically be added to their trip.

Is there any cost of using HitchHiqe?

Nope. 100% free.

Can I be both a rider and driver?

Sure.

How do I pay for the rides?

All payments are handled off of the HitchHiqe platform between the driver and rider. Cash and Venmo are the most common forms of payment and are handled at the time of the trip. Drivers specify what payment types they accept and this can be seen in the different trip summaries when you search for trips. Payment method can be determined through communication with the driver with our in-app messaging feature.

How do you verify the drivers?

Drivers are confirmed through a series of steps by our platforms' artificial intelligence algorithms utilizing the users drivers license, vehicle license plate number, and vehicle manufacturer.

Is there a feedback system to rate riders and drivers?

Yes. HitchHiqe has an in-built recommendation system, HitchHiqe Alerts, that can recommend users with rides. HitchHiqe uses a series of Machine Learning algorithms to select the best rides that you might be interested in based on their past history.

Receiving recommendations is as easy as:

- Step 1:** Enter the place you want to receive recommendations from.
- Step 2:** Enter the timeline you want to receive recommendations for.
- Step 3:** Select frequency of recommendations (daily, weekly, monthly).

Once you create your recommendation alert HitchHiqe will automatically send you a new list of rides based on your frequency.

Who can be involved in the future?

They're actively looking for oddballs and out-of-the-box thinkers for their team who are interested in building the future of college transportation infrastructure. If you have experience with building highly-scalable web applications or creating large-scale marketing campaigns, then drop a line at hitchhiqe@gmail.com if you think you're a good fit for their team.

“oddballs
and out-
of-the-box
thinkers”

-Mehak Kamal

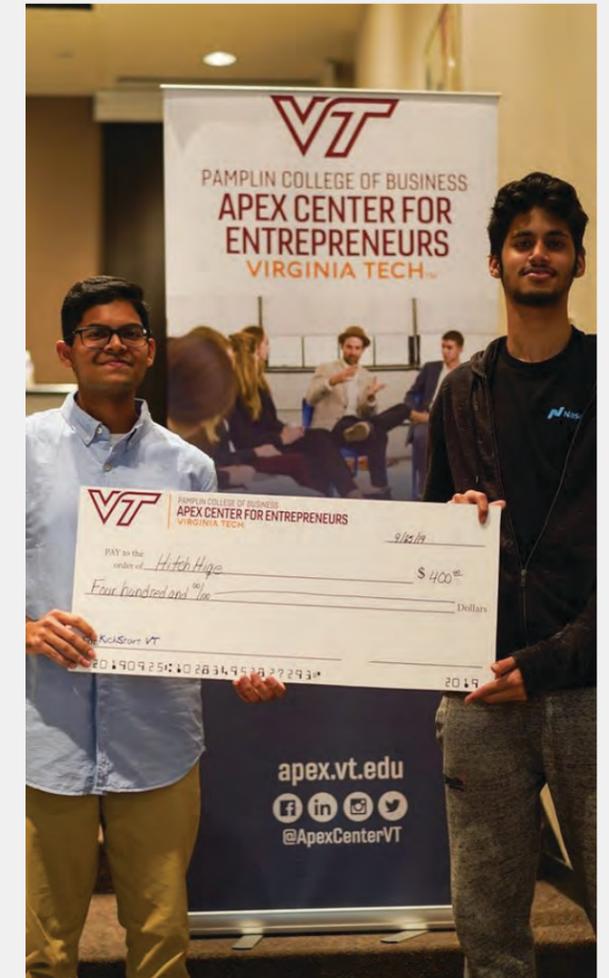


Photo / Recognition from Apex Center for Entrepreneurs



Photo / Founders Gurrupu and Wani pitch HitchHiqe

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Photo / Meghan Juanarena, Torc's Director of Talent Acquisition

T O R C R o b o t i c s

Article / **Jin Tian Acton**

Interview with Meghan Juanarena, Torc's Director of Talent Acquisition, and Eileen Baumann, Director of Uncork-it, Inc. which is the PR Representative for TORC



What does TORC do?

Torc Robotics is a company headquartered in Blacksburg that develops self-driving vehicle technology. This involves the software that controls the vehicle, plus the systems integration to implement the technology on different platforms. Torc develops

the complete software stack, enabling the vehicle to see (perception), think (planning), and do (control). By controlling every decision made throughout the autonomous system, and by basing those decisions off raw sensor data, the company can ensure the intelligence, reliability, and trustworthiness of its technology. Testing and validation are key elements of Torc's ability to rapidly deploy self-driving vehicles. Torc tests its systems in simulation, on closed tracks, and on public roads.

What projects are you currently working on?

Torc is working on a number of different projects. One involves a transit vehicle in France that is currently being tested on public roads. (Press release here: www.ef.org.vt.edu/torc1) One of the newest projects, however, is in partnership with Daimler Trucks — the largest truck manufacturer in the world. Daimler recently acquired a majority interest in Torc and the two partners are currently testing Torc's technology on trucks on highway 81. (Press releases here: www.ef.org.vt.edu/torc2 and www.ef.org.vt.edu/torc3) You can find other projects in the press releases here: www.ef.org.vt.edu/torc4.

The following answers are from Meghan Juanarena, Torc's Director of Talent Acquisition.

What does a day in the life of a TORC employee look like?

Engineers at Torc get to work on some of the most interesting, challenging, and rewarding projects in autonomous technology. Imagine creating a system that can perform all the complex decisions and behaviors of a human driver while eliminating the errors and distraction factors that cause 94% of the accidents on the road today. Torc's

[Torc employees] work in a collaborative team environment, with each team contributing to a specific component, such as classification or mapping. Our vehicles are on the road testing almost daily, and software engineers are encouraged to work with test engineers and safety drivers to evaluate their code performance in real-life scenarios. Our software engineers then take a combination of this real-world data and simulation scenarios to continue to evolve our autonomous software to better handle the complexities of the road. We do not shy away from edge cases, we embrace them.

The human factor of creating autonomous vehicles cannot be downplayed. Behind the robotics, there is a team of people who have a passion for technology and making the world a better place. Here at Torc you will be a contributing member to our technology at every level and a valued member of the team, with the opportunity to see the technology you are creating in motion.

“We do not shy away from edge cases, we embrace them”

-Meghan Juanarena

What sorts of applicants are you looking for?

At Torc, we've developed our own end-to-end software stack and we are hiring software engineers across our teams. Candidates who showcase a willingness to learn, strong work ethic, and passion for changing the world with self-driving technology are going to fit in well with our team. Additionally, a strong background in the best practices of core languages such as C++ and ROS are key for many of our positions. Torc uses C++ to power autonomy because well written C++ code is extremely fast and extendable. The specialties we are looking for are in behaviors and planning, machine learning, mapping, and sensor integration and fusion.

When looking at applicants, what are some key differences or skills that make candidates stand out?

Candidates stand out by having served as a contributing member for robotics projects and competitions in areas of

interest to build experience. Working in group projects and learning from others helps a lot when it comes to understanding new technology and preparing to work in a collaborative team environment. Gaining additional experience while in school through internships is also preferred. Many of our Torc'rs also chose to pursue a secondary degree, consider a master's project that pushes you to learn something specialized related to the field of autonomy. While we expect focused knowledge in your specific area of development, we also look for the ability to understand how the entire system works together.

What advice would you give a college student when applying to companies?

I highly recommend applicants do their research on the company prior to applying and in preparation for the interview itself. It's important to not only find the specific position you'd like to have post graduation, but also ensure the position is within a company with a mission and culture that will keep you engaged and passionate about your work.

What is something you wish applicants knew before applying and a common mistake people make?

Ensure your resume is a true reflection of your experience as it relates to the role you are applying to. Anticipate being asked and expected to know technologies listed on your resume. I recommend avoiding listing keywords unless you truly have the experience. You can also showcase these on your resume in a way that also gives an idea of your proficiency level within each technology. Focus on your true strengths and knowledge related to the role.

What are some tips you have for interviewing?

1. Bring along examples of work that you're proud of – we encourage our candidates to bring their portfolios or presentations

- of their accomplishments to their interview.
2. Take some time to research the company's history and innovative projects. Interviewers will be interested to know what excites you most about joining the team.
3. Ask questions - The interview not only lets us know about you, but it can also give you more information about the role you will be playing in creating technology that revolutionizes transportation. Prepare questions that you'd like to know about the role, the company, or your team.
4. The Torc team is not just interested in your resume; we also want to know what makes you who you are. The business skills and personality traits you have are just as important to your success as your technical experience is.

What skills are most valuable in a tech company?

The ability to adapt to the ever-changing environment and a passion for continuous learning.



“ability to adapt ... and a passion for continuous learning”
-Meghan Juanarena

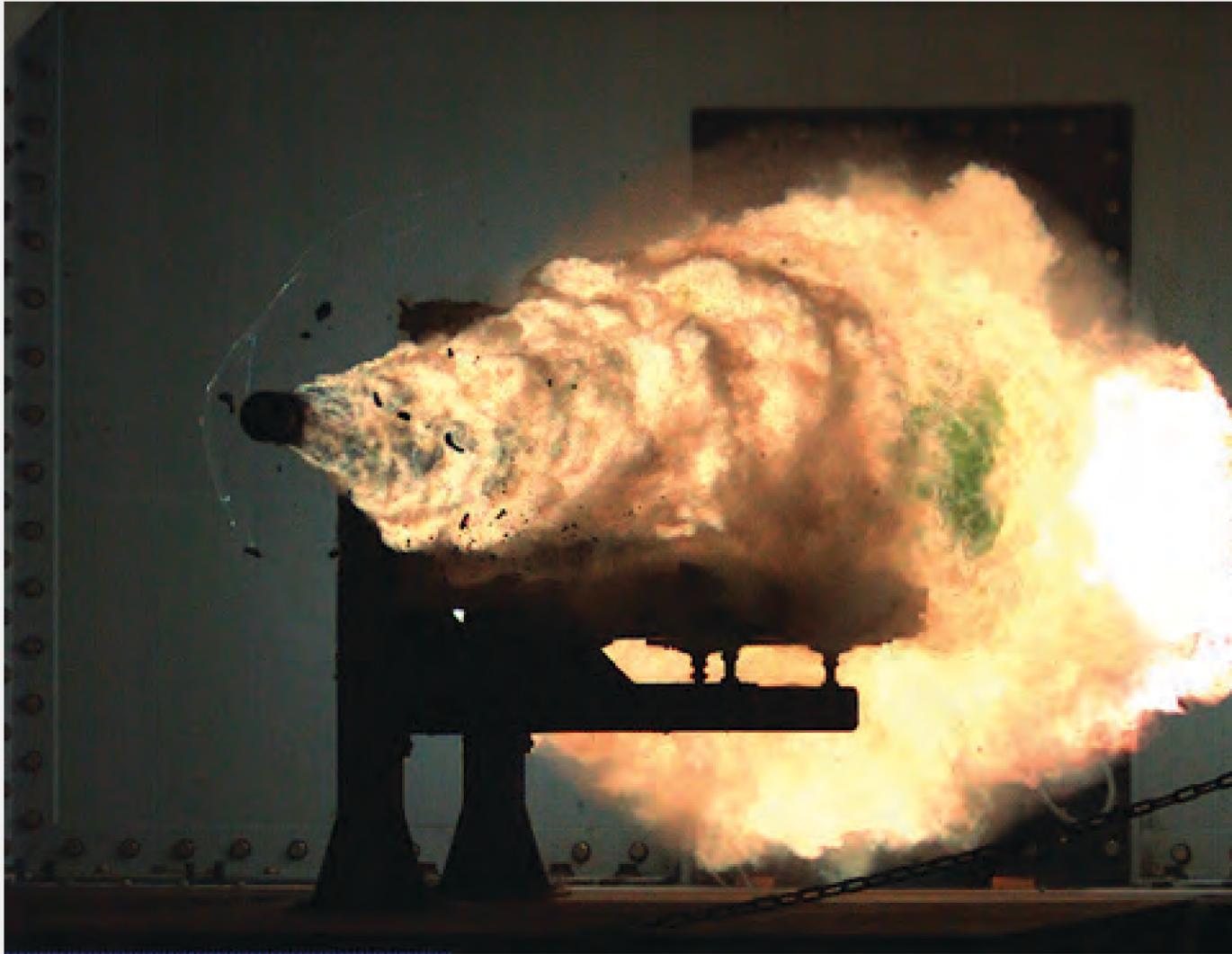


Photo / An electromagnetic railgun fired at Naval Surface Warfare Center, on January 31, 2008, firing a 3.2 kg projectile at 10.64MJ (megajoules) with a muzzle velocity of 2520 m/s. The NRL railgun fires a projectile 3 times more energetic than the one seen in this U.S. Navy Photograph.

Hokies Helping Hokies: The U.S. Naval Research Laboratory

Article / **Alexander Petsopoulos**

Last summer, I had the opportunity to intern at The **U.S. Naval Research Laboratory (NRL)** in Washington, D.C. It opened in 1923 at the request of Thomas Edison, and it is the United States Navy's premier research institution. The NRL is responsible for the invention of Radio Detection and Ranging (RADAR), the first American satellite program (Project Vanguard), and Onion Routing, the anonymous, Deep Web communication technique behind Tor. Additionally, the NRL's Plasma Physics Group holds the world record for "most energetic rail gun projectile" at 33 megajoules, or enough energy to launch a 23lb bullet at Mach 8. I saw this rail gun last summer; it's a **beast**.



**“33 megajoules,
or enough
energy to launch
a 23lb bullet at
Mach 8.”**

-Alex Petsopoulos

All accomplishments aside, the NRL is well-positioned to continue its nearly century-long legacy of providing advanced scientific capabilities necessary to fortify our country's Naval superiority. This is due in part to our world-class research facilities and state-of-the-art equipment. For example, our Laboratory for Autonomous Systems Research (LASR) houses 4 unique high bay environments, including the 150' x 75' x 30' high Prototyping High Bay, with its motion capture system capable of tracking up to 50 objects. LASR's Littoral High Bay features a 45' x 25' x 5.5' deep pool with its own 16-channel wave generator, capable of creating directional waves. Alan Schultz, Director of Autonomous Systems Research at NRL, explains for Donna McKinney's



Photo / "The Tropical High Bay, part of the Laboratory for Autonomous Systems Research, is a 60' by 40' greenhouse that contains a re-creation of a southeast Asian rain forest. In the Tropical High Bay, temperatures average 80 degrees with 80 percent humidity year round. (Photo: U.S. Naval Research Laboratory)" More info about this one-of-a-kind NRL facility can be found at: www.ef.org.vt.edu/NRL-LAB

2012 News Release, “The Desert High Bay contains a 40’ by 14’ area of sand 2-foot deep, and contains 18-foot high rock walls that allow testing of robots and sensors in a desert-like environment.” This laboratory, and dozens of other cutting-edge facilities, are open to all the NRL engineers and scientists performing relevant research.

This article attempts to make a persuasive case for Virginia Tech students to make the NRL their next summer internship, or post-graduation career. The NRL sits at a convenient working location for many of Virginia Tech’s students that hail from Northern Virginia and Maryland. For the 7000+ Hokies who call NOVA home, the NRL is just a 30-minute drive from Tyson’s Corner Center in Fairfax County. As a Washington Nationals fan, I appreciate the NRL’s sub-5-mile vicinity to Nationals Park and many of DC’s other accompanying attractions like the White House, the Smithsonian National Air and Space Museum, and the National Gallery of Art. Also, we sit on the banks of the historic Potomac River. When stuck on

a challenging technical problem, walking down the riverside is a peaceful way to clear one’s head.

Beyond location and challenging research, the NRL provides interns incredible opportunities through its unparalleled student benefits. Our pay is competitive with the already high average for DC area engineering interns, yet where the NRL really shines is its Undergraduate Tuition Assistance Program. While not a guaranteed benefit for all interns, section managers who intend to convert their interns to full-time employees after graduation have the ability to pay for their student employees’ college tuition in full through higher-level division funds. I am on this program, and will not have to pay any tuition for the rest of my undergraduate career. Since the NRL is a federal government facility, employees have access to Student Loan Repayment benefits upon conversion to a full-time hire, which enables an employee’s student loans to be paid off by the NRL (up to \$60,000 in loans can be paid off over 6 years).

When pursuing one’s graduate degree as a full-time employee, the NRL encourages employees to competitively apply to its Edison Memorial Graduate Training Program. This unparalleled training program not only pays for an employee’s tuition and educational fees as they pursue their graduate degree part-time, but it also gives them two paid days off of work each week during the semester to focus on their studies. A 2017 Virginia Tech Aerospace Engineering graduate, my coworker Robert Scheible, explained in a recent interview, “You won’t find this level of emphasis on education in any private company, or any other government labs for that matter. At the NRL, co-workers listen to and respect you regardless of age; good ideas are listened to and acted upon.”

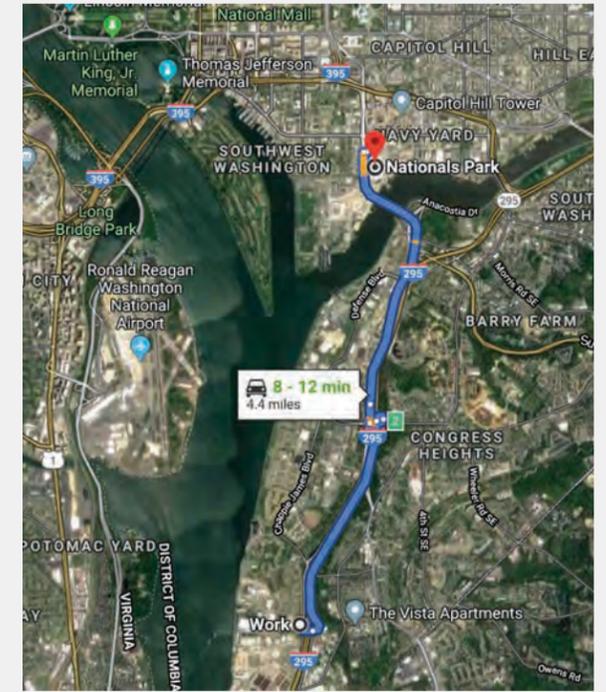


Photo (Top) / For any Astros fans who want to watch a real team play baseball with me after work

Photo (Bottom) / Looking east from the Potomac River, a satellite receiver sits atop a NRL’s building 43. This 50-foot radio telescope was used by the NRL’s Radio Astronomy group in the early 1950s to make the first accurate radar measurements of the distance to the moon.



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How to Get a Job at NRL

As a preface, I cannot guarantee this method will work for you. However, below are the exact steps I followed in September of my freshman year that landed me my current position. Additionally, I have sent this procedure to two of my peers here at Virginia Tech. After following it, they both received internship offers within the week. The steps are as follows:

1 Craft a Competitive Resumé

I'm not going to teach you how to write a resumé here, but this is much easier than many students think. A great starting place is Virginia Tech's Career & Professional Development's (CPD) website, <https://career.vt.edu/>. At their Smith Career Center next to McComas hall, CPD offers drop-in resumé reviews Monday through Friday, from 11 AM to 3 PM. Just walk in with a printed-out draft of your resumé, and have it reviewed by a professional for free.

2 Read This Packet

https://www.nrl.navy.mil/content_images/HR_Recruitment_Folder.pdf
Yes, it's a long URL. If it's that painful for you to type out, here's a short-link from our website: www.ef.org.vt.edu/NRL

3 Create a Shortlist of Divisions

Pick all of them if you'd like. For me, this was as simple as finding "Aerospace Engineering" on the chart below and contacting all of the accompanying divisions.

	Radar	Information Technology	Optical Sciences	Tactical Electronic Warfare	Chemistry	Materials Science and Technology	Plasma Physics	Computational Physics & Fluid Dynamics	Electronics Science and Technology	Biomolecular Science and Engineering	Acoustics	Remote Sensing	Oceanography	Marine Geosciences	Space Meteorology	Space Science	Spacecraft Development
Aerospace Engineer																	
Astrophysicist																	
Chemical Engineer																	
Computational Research Linguist																	
Computer Engineer																	
Computer Scientist																	
Electrical Engineer																	
Electronics Engineer																	
Engineering Res. Psychologist																	
Geologist																	
Geophysicist																	
Materials Research Engineer																	
Mathematician																	
Mechanical Engineer																	
Metallurgist																	
Meteorologist																	
Oceanographer																	
Physical Scientist																	
Physicist																	
Research Biologist																	
Research Chemist																	
Social Scientist																	

Photo / Chart is taken from NRL's "HR Recruitment Folder" outlining the variety and breadth of engineers and scientists needed at the 18 unique Research Divisions.

4 Go to a Career Fair (Optional)

In my case, this was meeting my current supervisor, Donald Kahl (Virginia Tech Class of 1986), at Engineering Expo. When I spoke to him this December about what he's looking for in students at career fairs, such as our upcoming CAMEO CareerFest (February 24 - 25), Don said, "Grades matter, but the whole person matters more. I'm looking for creative students with design team experience that have done their homework on NRL. Know what we do before you come to talk to us at a career fair or reach out digitally."

Both of my Virginia Tech coworkers did all of their networking via email and had phone interviews scheduled within the week of sending their first emails. If the NRL won't be at an upcoming career fair, you can still take action below!

5 Email the Divisions on Your List

If you went the career fair route, mention who you talked to at the career fair in your email. Regardless, give some background into who you are (attach your resumé), why you're interested in working at the NRL, and what you could bring to that specific division. Make sure to send tailored emails to each division, showing that you know what their division does. An easy way to do this is to reference something from their entry in HR Recruitment Folder I've linked to in bullet 2, where you can also find each division's email address.

TACTICAL ELECTRONIC WARFARE DIVISION - Code 5700 - ewinfo@nrl.navy.mil

The Tactical Electronic Warfare Division is responsible for research and development in support of the Navy's tactical electronic warfare requirements and missions. These include electronic warfare support measures, electronic countermeasures, and supporting counter-countermeasures, as well as studies, analyses, and simulations for determining and improving the effectiveness of these systems.



An NRL research physicist aligns the 30 TW Ti:Sapphire laser system.

Photo / Here's an example of where to look for email addresses for each division. My division's entry, Tactical Electronic Warfare, is shown. Taken from NRL's "HR Recruitment Folder"

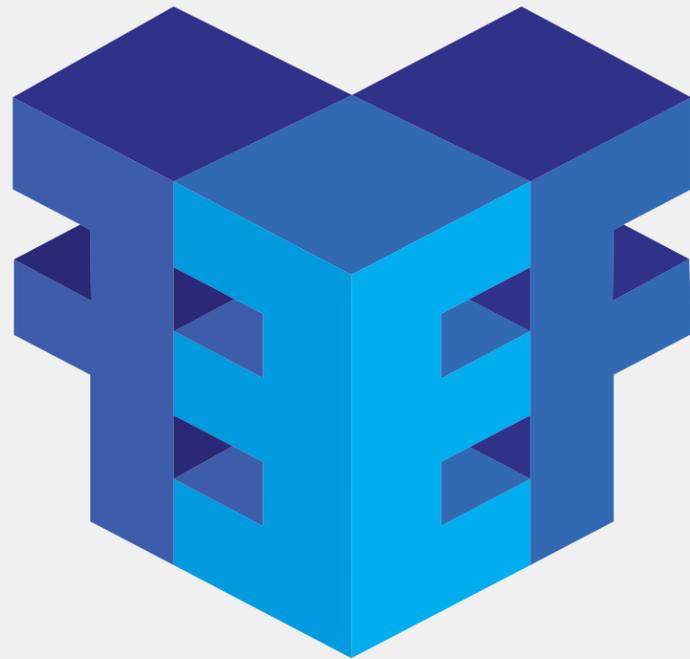
That's it! Good luck to all Hokies pursuing internships and full-time jobs at this spring's career fairs, and I hope to see many of you this summer at the U.S. Naval Research Laboratory!



Writer / Alexander Petsopoulos joined Engineers' Forum as a Staff Writer in 2018 and currently serves as the magazine's Managing Editor. He is a member of the International Association of Professional Writers & Editors and enjoys reading, writing, and solving problems.

ENGINEERS' FORUM

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Volume 41 No. 1

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