

I'm Santa Ono, the President and Vice-Chancellor of UBC. On this season of the Blue and Goldcast, I'm speaking with the people who are helping to shape UBC's next century. From our faculty to our students.

Our university is a leader in sustainability which is something I take a lot of pride in, but we can always do more, especially when it comes to sustainable ways of getting to and from campus. Bhargav Thoom and Daniel Zhao are both mechanical engineering students at our Vancouver campus. They're also the leads of the UBC Thunderbikes, a student design team working on electric bikes, including one for me. Bhargav, Daniel, welcome. How are you guys doing?

Bhargav Thoom: I'm going really well. Thanks for having us here.

Daniel Zhao: I'm doing great too. Thank you so much. It's a pleasure.

Santa: It's great to see you in person even though it's virtual. I've really enjoyed speaking with you about your project and your enthusiasm and heard all of your teammates on your design team. Design teams are something that we're very excited about here at UBC. They're a very important part of the engineering program. Daniel, can you briefly tell me about what a design team is?

Daniel: Absolutely. For all your listeners who might not know, engineering has over 30 student-led design teams. They range from a variety of different topics. We have automotive, we have aerospace, we have biomedical. Thunderbikes, we're a automotive design team. We specialize in the design and build of electric performance motorcycles and also bikes. Each design team is led by a captain. I'm the captain of the UBC Thunderbikes as well as an executive team with a technical officer, safety officer, finance, and admin officers.

We focus on a project of our choice. Every year, design teams will typically go to a competition to showcase their project and compete against other universities. In our first year, UBC Thunderbikes went to the Lost Sierra E-Bike Festival. This is a festival in California and we actually drove down with our bicycle that year and competed. Had we finished our electric motorcycle this year, we would have been racing at the AHRMA Formula Lightning Varsity Challenge. That would have been in the summer in New Jersey.

Santa: Well, we're very proud of you. Thanks for that explanation. Bhargav, you founded the Thunderbikes. What interests you about electric bikes?

Bhargav: I originally started UBC Thunderbikes. It was brought upon by a need that I saw at UBC. First of all, in third year, it was my first year where I was going to be commuting to UBC. At first, I started by using a bicycle and trying to bike my way to UBC. I noticed by the time it was around second week that I was coming a little late to my ADM classes. I wanted to explore some other solutions and that's when I played around with building my own electric bike. It caught the attention of both my peers and professors alike.

That's when we thought that maybe this could be more than just an individual personal project and it morphed into a design team. I'm really excited about what's

going on here. It is helping other students like myself who are commuting to convert their own bikes to electric bikes by giving them knowledge and some background in how the system works, as well as providing resources such as tooling if they needed to build their own set.

Santa: Now, let's talk about the Thunderbikes project specifically. Bhargav, you've been working on electric bikes that aren't your average commuter bicycle. Tell me what's so cool about the thunder bikes project.

Bhargav: The focus of what we want to do at Thunderbikes is we want to inspire sustainability, but we also want to show the appeal of these new vehicles. There's a lot of performance that could be drawn from these new propulsion methods. I'm really excited to explore what the limits are. The race that we went to the last year, E-Bike Festival, was a race where we're trying to build the highest performance electric bikes. We explored in different kilowatts of power. We explored in different drive train configurations. It was really fun competing with teams that have put thousands of dollars into their builds.

Unfortunately, we did not finish that race due to an unfortunate accident in the rock gardens where we punctured our rear tire. We were able to get some great knowledge. If it wasn't for that puncture, I believe we would have at least podiumed and we would have finished quite high. I'm excited to see where this team is headed. Right now, we're working on the SuperSport motorcycle, we're taking the knowledge that we've learned from our previous builds and we're building on a higher voltage system with higher motor power ratings. We're not just doing this to brag about the fastest bike that we can build, but we're doing this so that we could improve sustainability at UBC. We wanted to do that through doing the campus commuter project with San Antonio.

Santa: Well, I saw a photograph I think of the electric motorcycle you were making, and it looked pretty fast. How fast are these motorcycles? Electric motorcycles actually traveled?

Bhargav: Our target design specifications as of right now is to reach 200 kilometers per hour. We, unfortunately, aren't at a state where we can do this direct testing, but hopefully, once some of the restrictions are easiest and we're allowed to work in person, we can put this assembly together and take it to the track to see how we do.

Santa: Well, it's very awesome. I'm really inspired by what you all are doing. Now, Daniel, I've commissioned an e-bike from the Thunderbikes. Tell me about that bike and how's the project going?

Daniel: Absolutely. To give a timeline, you contacted us in around August of last year with interest in our project and discussions that eventually led to the commissioning of this bike. Since then, we've recruited many talented first and second-year engineering students because our team is focused on the electric SuperSport motorcycle that Bhargav mentioned. We had to recruit actually an additional team. Out of this, we had an idea to use this project as a junior project for lower year engineering students to develop the hands-on skills and expertise they would need before coming onto our motorcycle project.

We've gotten such a great group of enthusiastic individuals. We've divided them exactly how we divided our motorcycle project into different sub-teams for the battery, for the motor, for the controls unit. We can't promise a set date right now with the restrictions currently, but we're promising to deliver the bike to you in the near future.

Santa: That brings me to the next question. Either of you can answer this. Certainly, working on projects like this are not straightforward, even when things are normal, but during COVID I'm sure there are even more barriers and challenges that you have to deal with because there are public health guidelines. Can you talk a little bit about what's it been like to navigate COVID-19 in this very complex project involving lots of people and sub-teams and all that? Has it been hard?

Daniel: Yes, absolutely. Design teams in their nature are very in-person and hands-on projects. Having these restrictions placed upon us and not being able to meet in person has been a barrier to our development, but we've come up with a lot of ways to get past this and still be a very effective team. From my standpoint, as the captain, I aim to develop a team that promotes trust, and promotes personal relationships, I guess, between the team members.

Some of the activities that I've been trying to do with this team are so that we can promote that bonding. I'll give you one example, every month, we have a team-wide meeting with all the different team members. Now some of the team members that have joined us from this year actually haven't met any other team members in person so what I've done is, each meeting will break out into rooms about four or five individuals, and we'll do an activity that gets them to know each other better. One activity that I did was, I asked them to take a picture of something that was really meaningful to them that was in their room.

Some people took a picture of their first hockey skates, there are these like size to event skates. Other people showed off their humor, maybe by taking a picture of a sandwich they were going to eat for lunch after the meeting was over. It's just really through these team activities that we've built a really trusting team, people are comfortable with each other. What I find is that the most effective teams have this sort of attribute. I'll let Bhargav talk a little bit more about the technical sides of navigating COVID-19.

Bhargav: Thanks, Daniel. I agree with Daniel, it has definitely been a challenge. As part of my role as a technical officer, what I aim to do is to educate some of the newer team members so that they are able to develop the best bike possible. A lot of incoming students join design teams because they want that hands-on experience and they want to put to practice what they learn in class, unfortunately, it's difficult to do so when we can all work and meet at this project.

I think what's really come in handy was what I learned about agile project management and learning to be able to shift and meet the challenges that are presented as a project manager. One thing that was really an inspiration to me was researching into the E-motor competition, and one of the winning bikes was designed entirely virtually on CAD prior to actually being built.

I wanted to employ the same design approach for our bike and it's been good, I think the team has drastically improved in their abilities to visualize a design and be able to design it in SolidWorks, the CAD software that we use. I'm really happy with how far we've come since the start of the pandemic so I'm happy with that.

Santa: I'm really happy this is happening because one of the things that I worry about the most during COVID is that there aren't these opportunities for interpersonal and teamwork, collaboration and so that's one of the wonderful things about design teams, is that you come together. There's also this intergenerational support mentoring that happens between upper-year students and first or second-year students. Kudos to you for your entrepreneurship and your leadership and bringing people together. I believe that the leadership that you're showing in this design team itself but also in leading specific projects, the motorcycle project or the e-bike project, both of you, are really developing in ways that you may not even be aware of now and will become really very useful for you as you develop and move on in life.

This makes me very happy and I think the listeners will be really happy to see how you've been able to continue to do this even during COVID. Bhargav, how would you like to see student-led projects like Thunderbikes contribute to UBC's sustainability goals? You know that I made a pretty big pledge last year that there's a climate emergency. Our sustainability goals are both ambitious but are also being watched by people around the world. What example would you like your student-led project to give to the rest of the week?

Bhargav: The main idea is I would like to focus on doing projects that not only showcase the performance capabilities and our ability to engineer but doing projects that are substantial investment into sustainability. Building a really fast electric motorcycle is really cool. It pushes the limits of what we can do with electric vehicles. The fastest electric motorcycle is not going to be used by an average consumer.

We're doing that but we're also working on developing more accessible ways of getting access to electric bikes and that's through this project the campus community would challenge. This is something that's unique. I hope that more design teams adopt a similar approach where they still continue and push the envelope of performance through their big projects. Then they also actively contribute to having sustainability initiative here at UBC.

Santa: I have a question for both of you. You guys probably have all kinds of different ideas about what sustainable transportation is going to be like in the future. You probably have different ideas. If I'm thinking about what cars used to be like when I was your age and what cars are like now, if you think about the Tesla Model X, it's scary. We wouldn't have even been able to dream about what she can do with a Tesla now. I'd like to ask both of you for your own independent ideas about what sustainable transportation in the future. It can be motorcycles, it can be bikes, it can be cars. What do you think is going to be like 20 years from now? Let's start with Daniel.

Daniel: Sure. I'll give you one very concrete idea. It piggybacks on the idea of the SkyTrain extension to UBC. This wouldn't be in the scope of Thunderbikes, design team, but personally, I think it would be really cool to have a fleet of electric bikes there, where students could get off the SkyTrain station, take one of the electric

bikes from that hub and ride it to UBC campus. This would alleviate some of the issues surrounding the 99 line being overpopulated, and also, it will reduce the number of cars. Perhaps instead of renting an Evo or getting a buddy to drive you, you could just simply ride an electric bicycle to campus.

Santa: I got to chime in there before I forget. I spent a lot of time trying to convince different levels of government that they shouldn't stop funding. It just keeps going while the boring machine is in the ground and go all the way to UBC. I'm going to keep that idea of yours quiet, even though it's a great idea because I don't want them to think that that's the solution, as opposed to going all the way to UBC.

Daniel: Obviously, it would be fantastic for the SkyTrain extension to go all the way to UBC.

Santa: I interrupted you. I was rude, I'm sorry, but I had to say that. What's your other idea?

Daniel: It's not really an idea, but recently, UBC held a 2030 competition, where it asked participants to imagine what 2030 would look like. We put out a submission of our own. Through that, we found that 36% of UBC Vancouver's campus emissions are actually commuting-related. That's a third of all emissions. Simply by cutting this down in half through the use of electric bikes, or through the use of some other alternative, we will be saving on a very large chunk of our emissions.

Santa: What about you, Bhargav?

Bhargav: Santa, you mentioned public infrastructure and this new project for introducing more public transportation in Vancouver and assisting in commuting to UBC itself. I think that's very important and that's going to drastically change the way that we are able to move around. However, I would like to see a part of personal transportation still be worked on and improved so that individuals have the freedom to be able to travel the way that they see fit. I think bikes is a great example of how we can improve transportation.

It also provides exercise and keeps people active and able to travel longer distances than they would physically be able to do on a regular bike or by foot. I'm very happy about the fact that electric bikes are being more widely adopted. I'd like to see that continue. If we are incorporating more funds for public infrastructure, it would be nice to see a way for them to also incorporate that with electric bikes. For example, having charge stations at a transit station or ways to store the bikes in the train so that they can travel with you would be ideal things that I'd like to see in the future.

Santa: Thank you so much. I got a question for you. You have all this class work as part of your degree program, and then you have design teams. If I asked you this maybe awkward question, between your classes and your design team, what do you get more pumped to go to every day? What's more exciting for you? Be honest, no worries. We're not mentioning any professors or anything like that. If you think about those two aspects of your degree, how do they fit together or are they equal? You can just say the perfectly correct answers. They're equally important. Or just tell me what you think.

Bhargav: For me, at least, I think there's been a lot of times that at least the past few years where I've prioritized by design teamwork over my classwork, my grades did not like that. One thing that's really good about UBC is it seems like all the props believe in what design teams are able to do. They're often eager to accommodate you to be able to modify some of your coursework so that it also assists with what you're doing on your design team.

Santa: That's wonderful. How about you, Daniel? Which do you prefer?

Daniel: We have such a great collection of design teams here at UBC and it's really one of our crown jewels in the faculty. To answer your question, I think I've definitely flipped flopped as well. There were times where design team took up, perhaps, the vast majority of my time. Thinking back to recruitment back in September, every single day, we were putting out new content, trying to attract the new engineering students.

Once they were recruited, catching them up to speed on the basics. There's also been times where before midterms, for example, and in the final season where design teams have definitely taken a back seat. I also want to add that, if you think about it in the professor's point of view, they are actually very interested in the work we do as well. Our faculty advisors, Dr. Jon Nakane and Dr. Jonathan Barrett have shown a lot of interest in our work.

Particularly, this last summer, when we bought our motorcycle frame that we're using currently, Dr. Nakano actually wrote the check for us to go buy that motorcycle out of his own pocket. Of course, he was reimbursed later, but it just goes to show that they are really willing to support us in every way that they can. It's really endearing and it's really motivating for them to have the same interest in our projects that we do.

Santa: That's fantastic. That was totally unscripted just for the listener. They're speaking from their heart. I think that you guys have got it just right. I just was in an interview and they were asking me about my grades and university and before university and they weren't always the best. I can tell you that it's very hard to value the education that you're getting through the design team.

Don't, for one moment, regret the time that you're putting into design teams because, as I said, the education that you're receiving in doing so in terms of understanding the applications of what you're learning but also the leadership training you're getting is invaluable. I would argue that is going to be incredibly important and beneficial for the rest of your life. Hopefully, when they listen to this podcast, people are going to say I want to be part of Thunderbikes too. How can they find out more about your design team and other design teams that are actually working at UBC just now?

Bhargav: There's a really good site called teams.engineering.ubc.ca that has a page for all the different design teams that exist at UBC. Each one has a website link to their specific team to just provide a little bit more about what the team does and what their recruitment season looks like. Design teams were very important when I was making my decision on which UBC I go to.

Having two electric car teams at UBC seal the deal. Design teams are becoming more interdisciplinary now and that's really good to see. Oftentimes, it's difficult for

design teams to run because everyone just wants to do the engineering work and no one wants to do the actual team management. We're really lucky to have Daniel to do both, but we hope to garner more talent that sorts in the future.

Daniel: I think Bhargav touched on a lot of the key points. I like to just further add that if you're interested, no matter what discipline you're in engineering, we have business students on the team, we have students in computer science on the team, just apply. Looking back when I was in first year and second year, I didn't think I can make a really big impact on an engineering design team but from a captain's point of view now, I stress a lot more on that eagerness to learn and someone who is really teachable. If you're in first and second year, just apply. Even if you're in upper years and haven't had design team experience throughout your earlier years, there's definitely positions for everyone.

Santa: Just before we close up this podcast, what's in the future for you guys?

Bhargav: That's a very interesting question. I mentioned earlier that one of the reasons why I came to UBC was because of the design team opportunities. That's true. Another reason was because there were companies that focused on sustainable transportation and automotive industry, the high street from UBC campus.

Recently, for my classroom project, I wanted to try something different so I pursued a project with a Fujitsu that's focused on a firefighter drone and machine learning using machine learning to identify forest fires. Just as firefighters so that they don't get stranded stuck in a fire. I'm really intrigued with what's going on with machine learning and image classification and object detection.

This is also something that I would like to do. There's a lot of different opportunities that I'm really excited about. Whatever happens though, I am sure that even if I work in an industry outside of the automotive industry, I am going to continue doing these projects as a hobby of my own. I'm just eager to start the next chapter of my life whatever that may be, I know that what I've done here at UBC and UBC Thunderbikes is going to stay with me for a long time.

Daniel: For me, I'm casting my net, fairly wide. Throughout my engineering degree, I've actually done two Co-Op terms, working in the industry. My first was in food and beverages. Then my second was at Metro Vancouver, who prides themselves on sustainability. I've really enjoyed my time at Thunderbikes. Being in a position of leadership is a great position of responsibility. I've learned so much just leading the team. For the future, I would like to try something similar in the stream, but not necessarily, development of electric vehicles. Similar to Bhargav, is definitely something I will be interested in no matter if I work in that field or not.

This electrification of our world is amazing to see right now. GM earlier this year announced that they were going to go all-electric by 2035. As well, recently, Volvo also said they were going to go all-electric by 2030. It's really cool to see these large auto manufacturers make these very, very bold promises. Without a doubt, there's an electric revolution happening in this world right now. I'm still trying to find my place in it but hopefully, sometime soon I'll be able to find that place.

Santa: Bhargav and Daniel, you're inspirational. It's not just the revolution, it's necessary for us to confront the climate emergency. Thank you for your leadership. If there's anything that I can do to help either of you as you find your place, don't hesitate to reach out to me. I certainly feel that I know you because of your leadership. We are very proud of you as an institution. Bhargav and Daniel, thanks so much for being on Blue and Goldcast today.

Daniel: Thank you so much, Dr. Ono.

Bhargav: Thank you again for having us. It was very nice talking to you.

Santa: Bhargav Thoom is a Team Technical Officer with the UBC Thunderbikes. Daniel Zhao is the Design Team's Captain. They're both in their final year of mechanical engineering. You can find out more about UBC Thunderbikes at ubchunderbikes.ca.

That does it for this month's episode. You can find links to our guest's work as well as previous editions of the show at blueandboldcast.com. You can also find us on your favorite podcast app, like Apple Podcasts or Stitcher. You can tweet at me @ubcpres. That's press with a Z. I'm Santa Ono. Thanks for listening.