

# ENGINEERS' FORUM



**VOLUME 39 - No. 1**

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# ENGINEERS' FORUM

## LETTER FROM THE EDITOR

Happy spring semester, readers! The staff at Engineers' Forum Magazine is thrilled to update you with some exciting stories from these past few months. Our production team has once again delivered top quality work for all of you and we will continue to do so in further issues. This issue of our magazine focuses on some of the most exciting projects and important programs going on here at Virginia Tech.

Reporting on the lively VT community is always stimulating for us with countless stories emerging constantly across all departments. This issue of Engineers' Forum uncovers three stories on the innovative work and developmental efforts going on at the university as well as some of our own efforts for outreach and community development. Jessica Deters, an Engineers' Forum writer and graduate student in the Department of Engineering Education, is back with another article in this issue covering the Virginia Tech Science Festival this past November. With over 6000 attendees, this event is a crucial part of the community's efforts to educate the youth and show them the exciting possibilities in STEM. I joined the writers for this issue of our magazine with a highlight piece on some of the teams we awarded this past fall semester for the second round of our student awards program. Our copyeditor Abby Slater is back with another article, highlighting the work of FutureHAUS VT. This team is working on modelling the homes of the future and is a part of an international effort to revolutionize the mobility and capabilities of the modern home.

This past semester we received applications from around 30 teams for our student awards and were glad to provide 10 different teams with individual awards to support their agendas. Many of the teams are senior design teams out of the Mechanical Engineering department, so we will be featuring their stories in the next issue of our magazine in time for the Mechanical Engineering Senior Design Expo at the end of the semester. Look out for that news and other inspiring stories coming out of Virginia Tech in the April issue of Engineers' Forum.

Editor-in-Chief,



Zeyad Zeitoun

On The Cover



Photo: Kyle Vandervelden  
The LumenHAUS model's high-tech features are apparent from all angles.  
Read More on Pg. 13

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# VOLUME 39

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# NUMBER 1

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## FEATURES

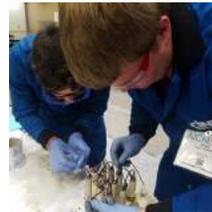
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### Science Festival Models Inclusive Outreach

Jessica Deters

PAGE 09



### Engineers' Forum Issues Another Round of Student Awards to Engineering Teams

Zeyad Zeitoun

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### Virginia Tech Students Bring Houses into the Future

Abby Slater

A budding scientist practices his newscasting skills at the WDBJ Television exhibit. The exhibit gave attendees the opportunity to learn about weather and see a green screen in action.



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# SCIENCE FESTIVAL

# MODELS INCLUSIVE

# OUTREACH

ARTICLE: JESSICA DETERS

PHOTOS: DR. PHYLLIS NEWBILL

A group of students, parents, and teachers gathers for a photo at last October's Science Festival.



Last November, over 6,000 community members visited Virginia Tech's campus for the fourth annual Virginia Tech Science Festival. Dr. Phyllis Newbill, the Outreach and Engagement Coordinator at the Institute for Creativity, Arts, and Technology (ICAT), spearheaded the efforts. Newbill ensured that this year's attendees included kids from all parts of Virginia. She partnered with the Virginia Tech College Access Collaborative to identify areas in Virginia from which, in previous years, no students had applied to Virginia Tech. This year, two charter buses full of kids from several of these areas arrived at the Science Festival. With the help of 4H, a network of youth organizations committed to youth development, the visitors were given proper accommodations including adequate food and housing.

"For kids who have never set foot on a college campus, it's hard to imagine themselves in college. For kids who have visited a college campus, it's hard for them not to imagine themselves in college," Newbill noted. 4H's involvement in the Science Festival helped bring in students from as far as Norfolk to the Virginia Tech campus and give them the opportunity to imagine themselves in college. The Science Festival is also giving more and more students the opportunity to be exposed to STEM each year.

This year, organizers took extra measures to make sure the festival was a safe place for all in attendance. Virginia Tech partnered with the Center for Autism Research and brought in volunteers trained in Supporting Autism Friendly Environments (SAFE). In addition, each festival building had sensory-friendly spaces, as well as specially identified exhibitors who were given extra training to accommodate students on the autism spectrum.

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**AMERICAN WOODMARK**

Young Science Festival attendees learn about electricity from an exhibitor. There were over 80 exhibits at the Science Festival, several put on by Virginia Tech students and organizations.



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Providing all kids with a safe environment in which to engage with the exhibits goes hand in hand with Newbill and ICAT's philosophy.

"My goal is to give kids the time, space, and permission to think and do. The Science Festival is one of the ways that gives kids permission to completely geek out," says Newbill. "People ask me if I'm a teacher, and I say yes, but. I'm not a teacher in the school system, but I do arrange environments where people can learn."

Critics of events like the Science Festival say it is impossible

to teach students a concept in the 30 seconds they spend interacting with any given exhibit. Newbill, however, disagrees. "It's not the point to teach them a concept. The point is for them to walk away saying, Yeah! Science is awesome!" It is Newbill's hope that the excitement kids experience at the festival will last long after the buses leave. "I want kids to grow up with the idea that science is accessible, fun, and worth their time," claims Newbill. Another benefit of the festival is that this excitement for science might bring kids back to Virginia Tech as future Hokies.

While the kids serve as the primary audience, they are not the



# 120 YEARS

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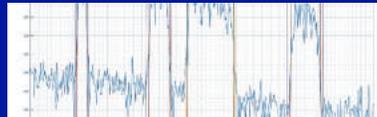
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Students reflect on their Science Festival experience, writing one word to describe the event.

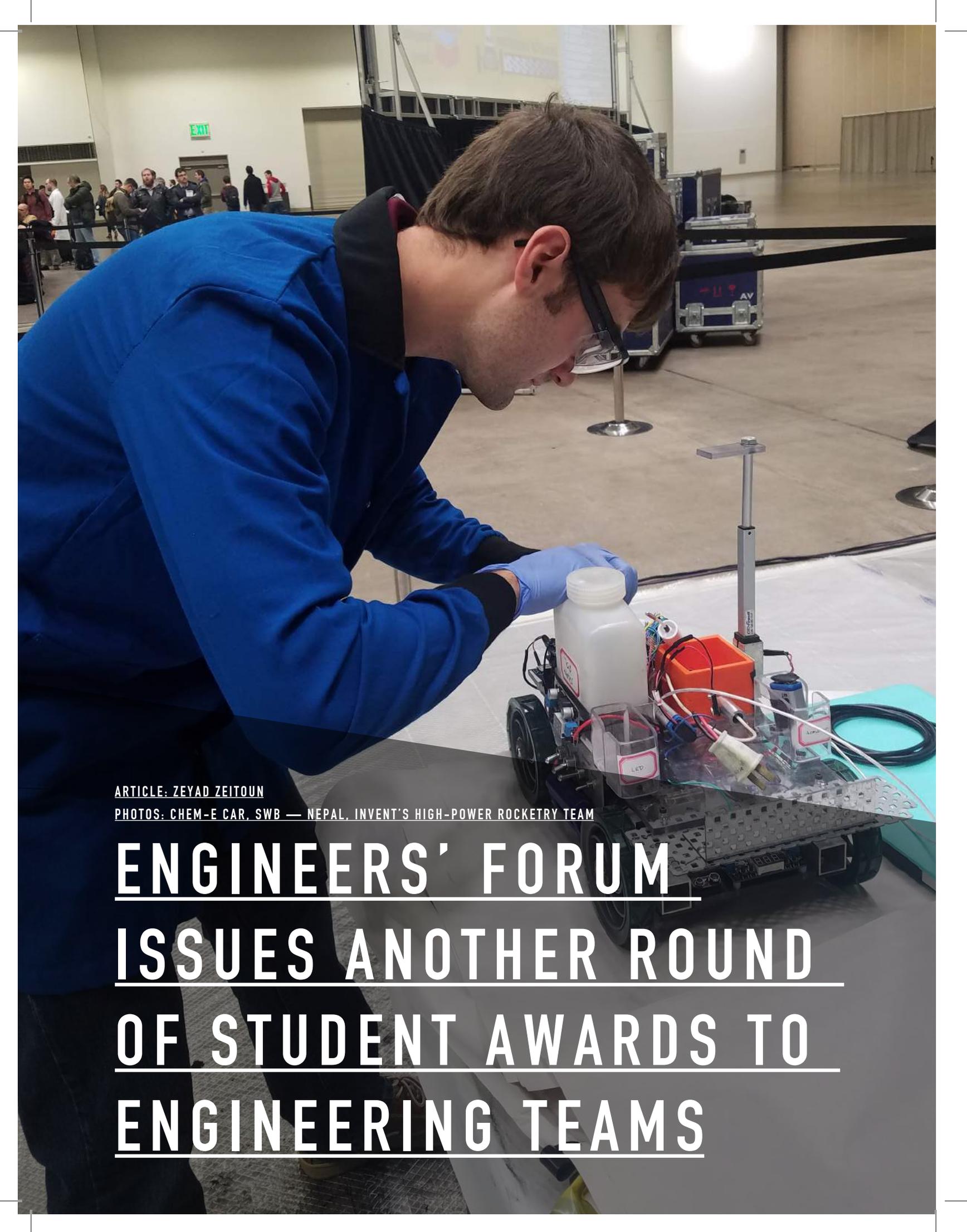


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only people who benefit from the Science Festival. Exhibitors had a unique opportunity to practice communicating their work to one of the most unforgiving audiences: kids. In contrast to a conference setting where presenters have one chance to present and are then met with questions from their peers, the Science Festival offered presenters the opportunity to tell their story hundreds of times throughout the day, perfecting their spiels with each iteration.

For further practice and experience in presenting, 30 graduate students participated in "the Nutshell Game," a challenge in which they are required to explain their research in only 90 seconds. Not only were the students restricted on time, but their explanations had to be simple enough to be understood by the 5th grade judge. The Nutshell Game and the evening lecture were new additions this year. The lecture was given by Dr. Christopher Emdin, who spoke on STEM education and its potential to empower the youth.



A young man with dark hair and safety glasses, wearing a blue jacket and blue gloves, is leaning over a table in a large indoor arena. He is focused on adjusting a white plastic bottle on a custom-built robot. The robot is mounted on a metal chassis with two large black wheels and is equipped with various electronic components, including a red battery pack, a blue motor, and a clear plastic container labeled 'LED'. A vertical metal rod with a horizontal crossbar is attached to the robot. In the background, other people and equipment are visible, suggesting a competition or exhibition setting.

ARTICLE: ZEYAD ZEITOUN

PHOTOS: CHEM-E CAR, SWB — NEPAL, INVENT'S HIGH-POWER ROCKETRY TEAM

# ENGINEERS' FORUM ISSUES ANOTHER ROUND OF STUDENT AWARDS TO ENGINEERING TEAMS

The Chem-E car team poses with their final product. The chemical engineering design team received a second award from Engineers' Forum this semester.



Engineers' Forum Magazine has always based itself on strengthening the learning environment at Virginia Tech by giving students the chance to peer into departments and areas of study that they normally wouldn't have exposure to. For the last 37 years we have consistently provided the latest updates on major engineering projects and endeavors at the university. Our staff are also given the opportunity to meet with their peers and professors in an extra-curricular setting in pursuit of their writing and photography material. This gives our writers and photographers the chance to sharpen their own skills while also boosting their inter-personal skills and networks.

In the past few years we have decided to transform our magazine into something greater than purely reading content. With a recent simultaneous change of both editor-in-chief and faculty advisor, our staff got to work brainstorming new ideas to expand our impact on the community we serve. As a result of the expert management and publishing skills of our previous management, we found ourselves with the means to financially support the students we write about.

As of fall semester 2017, Engineers' Forum has provided support to 15 teams from several different departments in the form of student awards. The April 2017 issue of our magazine highlights several of the teams awarded last year including some groups that we had previously covered in our magazines and kept up contact with. We pride ourselves on a strong stream of communication with the teams we work with in order to generate new content and supply our readers with interesting stories every few months.

(below) InVent's High-Power Rocketry team is pictured with their rocket at the Kentland Farm research facility. The group of dozens of undergraduates operates out of the living-learning communities in Lee Hall.



This past semester Engineers' Forum awarded 10 teams with individual awards no less than \$500 each. More than half of the teams selected for awards are from the mechanical engineering department, mainly out of the senior design program. These teams will be featured in the upcoming April issue of our magazine in time for their senior design expo. Several of these teams have a humanitarian focus with real impact potential, which was one of our key points for assessing the applications.

Many of the other applicants outside of the senior design program also had a humanitarian focus. One of these teams is the Service Without Borders – Nepal team. Their goal is “to promote the development of student design, project management... as well as increasing cultural understanding and providing international

Virginia Tech's SWB Nepal team pose roadside with a beautiful view of the Himalayas. The group of engineers is dedicated to helping a small village called Dhumba recover from the devastating 2015 earthquake.



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experiential learning.” While this diverse group of students has the chance to travel abroad, their goal is to help rehabilitate an area of Nepal hit badly by the devastating earthquake in April 2015.

A team from SWB previously traveled to a small village called Dhumba in Nepal, with a population of about 250 people, to help them recover from this natural disaster. The team returned this past winter break to build upon the project that was started years ago. The SWB group helps improve the irrigation system of this village, which was harmed by the 2015 earthquake.

Julian Park, the team lead for SWB – Nepal recalled the greatest benefit of the project is “the fact that you get to see how much impact you’ve made on these people’s lives.” Park joined the group in order to make that impact, and proudly claims that working on projects like these is the reason he pursued engineering in the first place. Of course, projects like SWB come with roadblocks, particularly when dealing with a small, remote

country like Nepal. Park informed us that “communication was a big obstacle,” but with persistence and a constant line of updates coming from the contacts in Nepal, the team was able to keep up with the progress of the project.

Engineers’ Forum also awarded inVenT’s High-Power Rocketry in the fall semester, which is a team of approximately 40 undergraduates with a whopping 30 freshmen. They are based out of Lee Hall, a living-learning community on campus that we have featured previously in our magazine. As freshmen are usually still in the discovery phase of their academic careers, inVenT aims to “familiarize the freshmen with engineering concepts while allowing them to figure out where their passions may lie.” Team lead Nicole Gouhin informed me that “we don’t expect members to have any real engineering experience... the team teaches the members the importance of communication, flexibility, and safety.” This team is unique as it blends fun and professionalism in a way that is extremely beneficial to its young team members as they start their journeys at Virginia Tech. The High-Power



Rocketry team has plans to build the rocket by this March and send 15 of the dozens of team members to competition this semester. This obviously requires hefty financial supports, with thousands of dollars going into the travel costs alone, let alone thousands going into the costs of the rocket itself. Engineers' Forum's financial support will go to the motor casings and J class motors of inVenT's rocket.

A team from the chemical engineering department succeeded in receiving a second award from Engineers' Forum this year, particularly because they have a fresh group of students every year as well as a renewed set of requirements. Chem-E car was awarded with a student award once again as a result of their hard efforts and competition success. We hope to continue to run this awards program as long as we are capable to do so. Supporting these engineering team not only gives us the opportunity to give back, but it also provides us with a fresh source of new stories that we can provide to you, the readers of our magazine. Look

out for a story on the mechanical engineering senior design teams we awarded this year in the April 2018 issue of Engineers' Forum.

The LumenHAUS from the 2010 competition now sits on Virginia Tech's campus for all to see.



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# VIRGINIA TECH STUDENTS BRING HOUSES INTO THE FUTURE

ARTICLE: ABBY SLATER

PHOTOS: KYLE VANDERVELDEN

Alexa can tell you the weather before you step outside. Your car effortlessly links to your smartphone and can drive itself. Your coffee cup keeps your beverage at the temperature you set via Bluetooth. Thanks to innovative technology, everyday items have the ability to become extraordinary, personalized machines. Why should your house be any different?

In November 2018, Virginia Tech's FutureHAUS Dubai team will demonstrate their innovative approach to futuristic housing in the Solar Decathlon Middle East. The international competition, launched in 2002 and organized by the US Department of Energy, draws 21 student-led teams from around the globe to design and build sustainable, solar-powered houses. Virginia Tech stands alone as the only team from the USA in the competition.

The team's design will focus on practical and technological innovations in insulation, energy usage, cost effectiveness, and spatial flexibility. "When you think about it, housing hasn't changed much in the last 50 years," says Laurie Booth, an

architecture student here at Virginia Tech. "What we're doing is looking for ways to make your house smart, almost smarter than you."

Booth showed us around the LumenHAUS model on Virginia Tech's campus, which won the 2010 Solar Decathlon Europe. Meticulous planning and high-tech design are apparent in every detail. This "flexible living space" acts as the team's headquarters while they plan and design for the upcoming competition. The LumenHAUS incorporates spectacles such as NASA's aerogel insulation, pull-out kitchen counter space, and a 5-foot turning radius in the bathroom to accommodate wheelchairs. The kitchen, built in 2008, is especially impressive. "You can Skype your grandmother on the backsplash; there even are sensors in the fridge that will tell you when you're running out of milk" says Booth proudly.

The construction in preparation for FutureHAUS Dubai began in January 2018, but the planning and design for the model

Architecture student Laurie Booth explains the project.



**“We’re really hoping that what we’re researching can be applied to the real world because we really do believe that it increases the quality of life, that it’s more efficient, that your house can take care of you”**

date back almost a year. The Virginia Tech student team has worked tirelessly, studying past competitions while learning the newest technologies in order to build the most efficient and technologically advanced house possible. The team used Revit, a 3D modeling program, to build a digital model of the house. Engineers and architects can design mechanical and electrical systems and Revit will calculate energy output. The program helps them stay organized, and provides the documentation required for the Solar Decathlon Dubai.

There are also specific energy requirements set by the heads of the competition. Each house must perform a series of tasks during the competition period including heating water, charging an electric car, and cooking meals, to demonstrate the functionality and efficiency of the house. For one sub-contest, they must wash and dry six towels, all of which will then be weighed to prove efficiency. The team faces the challenge of balancing a high-tech house, full of sensors and appliances, with low energy output. But, Booth reassures, “We’re currently producing more energy than we’re using.”



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This year's competition will take place at Mohammed bin Rashid Al Maktoum Solar Park, the world's largest solar park, which offers the ideal climate for solar energy. The FutureHAUS team is working with SunPower, a solar energy company that will supply all 40 solar panels for the house. They will work together to design the most efficient and innovative panels for the specific environment; for example, the duo is working on rotating solar panels that will shed sand when in Dubai.

The FutureHAUS is an example of prefabricated modular housing, meaning its individual cartridges are built off-site at a factory, then shipped and assembled on-site. This is more efficient and cost effective, and will hopefully, according to the Booth, change housing concepts and design forever. "Soon, you should be able to buy a house on Amazon," she says.

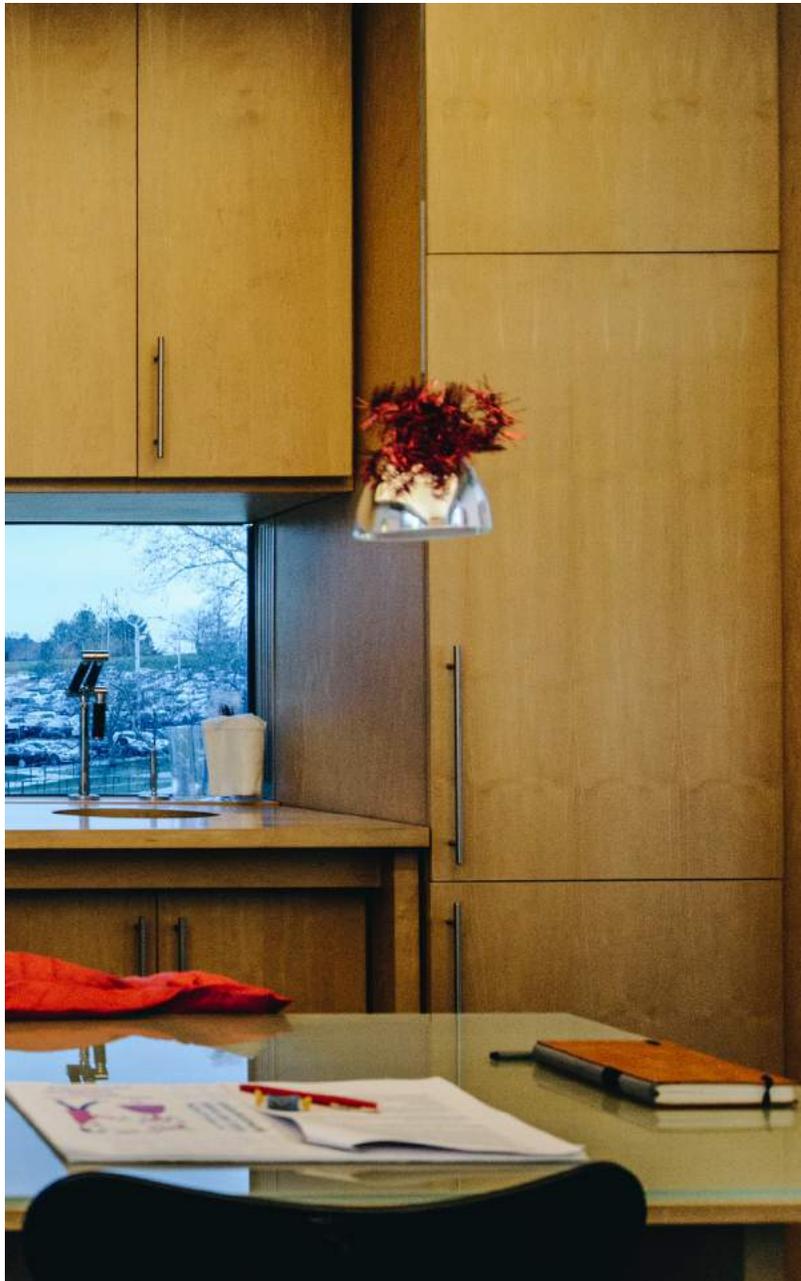
This introduces a new challenge to the team: how to transport the

house to Dubai in November. The Industrial Systems Engineering students are tasked with researching methods and strategies to ship the house. "We're looking into flying the house as opposed to shipping it, just so we don't lose our entire project into the ocean," jokes Booth.

Insulation is a huge concern for the efficiency of the house. The team uses SIPs, structural insulated panels, which have an R-value of up to 41 in the FutureHAUS, to increase thermal resistance. They also employed the use of polystyrene foam, an extremely efficient material that Booth foresees as the future of housing technology. "Why are we still making houses out of 2x4's?" Booth wonders aloud. "Why can't we use a super exact material that's also super insulated?"

The FutureHAUS team is also concerned with affording consumers the ability to age in place. The concept is that, as

The bedroom and living room portion of the 2010 LumenHAUS model.



people age and have varying abilities, the house will adapt to them. It will essentially learn how to take care of its inhabitants as their needs change so that people don't have to constantly move and adapt to their living space.

Aside from publicity and prestige, the Solar Decathlon Middle East competition has brought many benefits to the students and faculty of Virginia Tech. The FutureHAUS team is incredibly interdisciplinary, relying on the knowledge of students and faculty from departments such as interior design, architecture, engineering, business, graphic design, industrial design, and landscape. Students are learning how to work on a team that integrates numerous skill sets. This unique, international opportunity offers students all across campus the chance to learn real world skills while still in school. "This experience has added a realness to our education," says Booth. Working directly with industry leaders as students offers a taste of what awaits them

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The LumenHAUS model's high-tech features are apparent from all angles.



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after graduation, and prepares the team members for success in the real world. Some students are even working with Kohler on a system to create potable water from waste water. Sponsors include Dupont, Philips, and Mitsubishi.

Faculty involvement has been an incredibly useful tool for the students. The project would not have been possible without the efforts of faculty advisor Joseph Wheeler, project manager Bobby Vance, construction manager Bob Schubert, lead mechanical engineer Mike Ellis, lead electrical engineer Igor Cvetcovic, and computer science faculty lead Denis Gracanin.

The model is currently being assembled by students in the Research Demonstration Facility at Virginia Tech. Summer 2018 will be spent testing final electrical components such as energy output and balance. Then, come November, the team has 7 days to complete the complex assembly at the competition site prior to the 10-day event.

The team has proven itself in years past, and we believe they can make Virginia Tech proud again this year at the Solar Decathlon Dubai. As for the future of housing technology, thanks to the innovative minds of the FutureHAUS team, the possibilities are limitless.



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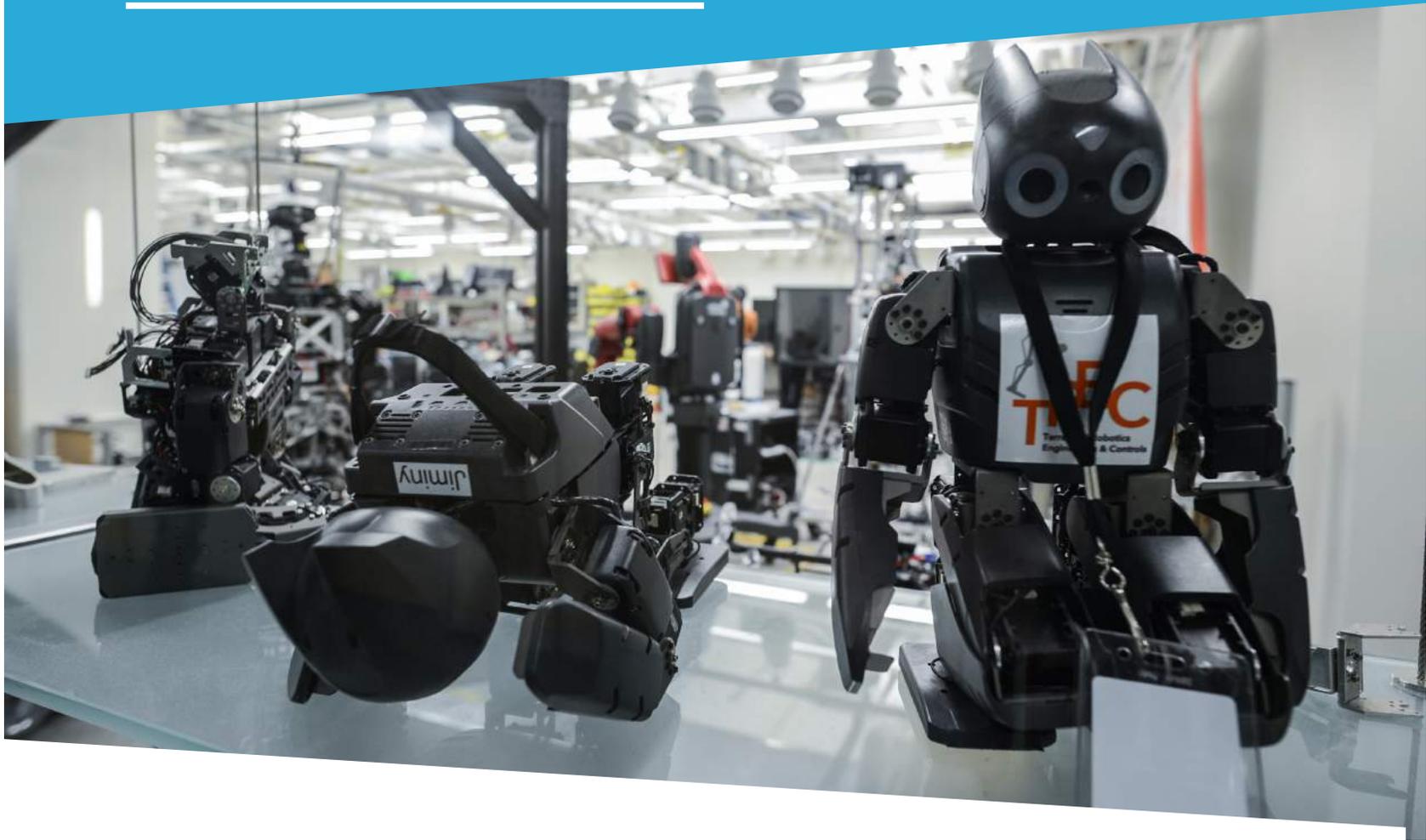
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