Engineers' Forum

Volume 36 - Number 2 - April 2015

VT RALLY

The team will be racing their Utility Terrain Vehicle against professional teams like Mid-America Motorworks and Kujo

CONCRETE CANOE

The Civil Engineering Department of Virginia Tech's College of Engineering constructs a canoe out of concrete from scratch every year and races it in an annual competition.

Letter From the Editor

Hello fellow Hokies!

Welcome back to another exciting episode of the Engineers' Forum magazine! The issue you hold in your hands showcases some of the latest and most interesting upcoming news about science and technology happening right here on our campus! Inside you will find plenty of news on some of our most bright and innovative design teams on campus. Check out a great spread on the vehicle that VT rally is building, and get ready to take to the seas with the new SailBOT senior design project! If you're interested in the great expanse of outer space and our future in it, look into our piece on the Astrobotics team and their ambitious plans to build a self-navigating mining robot.

At Virginia Tech, what does it mean to "invent the future"? Here at the Engineers' Forum, we take a look at some teams that imagine complex designs and overcome challenges to innovation in order to keep the future bright and interesting. Check out our story about using supercomputing to predict the weather, as well as the upcoming competition to design the best version of a canoe entirely made of concrete! If you want to know more about our engineering family on campus, check in with our very own Student Engineers Council and learn a little more about their goals and their valuable contribution to engineers here on campus and beyond.

We have even more stories on our website, be sure to check it out if you get a chance! We are always on the lookout for great stories, so chime in with your feedback or ideas about what you want to see in our next issue! And last of all, thank you for picking up a copy of the publication!

Coleman Merenda
Editor-In-Chief

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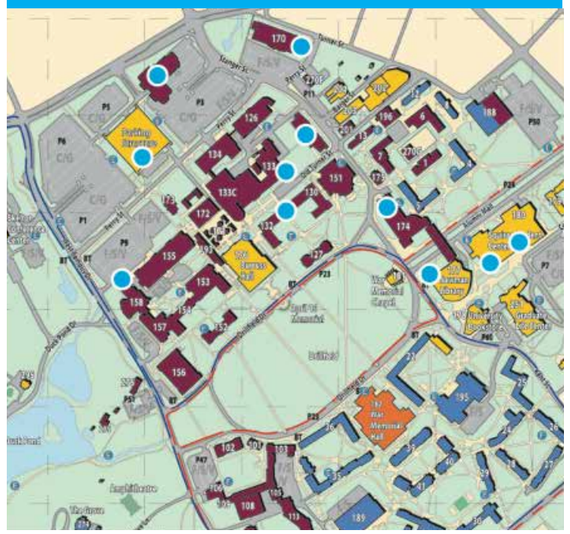


Rally the Engineers!

By Alex Levine
Freshman, General Engineering

If you take a look into the back right corner of Virginia Tech's Ware Lab, you will find VT Rally, one of the lab's senior design teams. VT Rally was founded by ten seniors and two juniors in September 2013 as a way to do what they love: build and race vehicles.

Chris Golightly and Marty O'Connell, two mechanical engineering majors, were part of the initial team as juniors and have now risen to lead the team. Golightly is responsible for the various team activities including coordinating sponsorships and making sure that the team is up to speed in their design classes. His co-leader O'Connell heads the chassis sub-team.

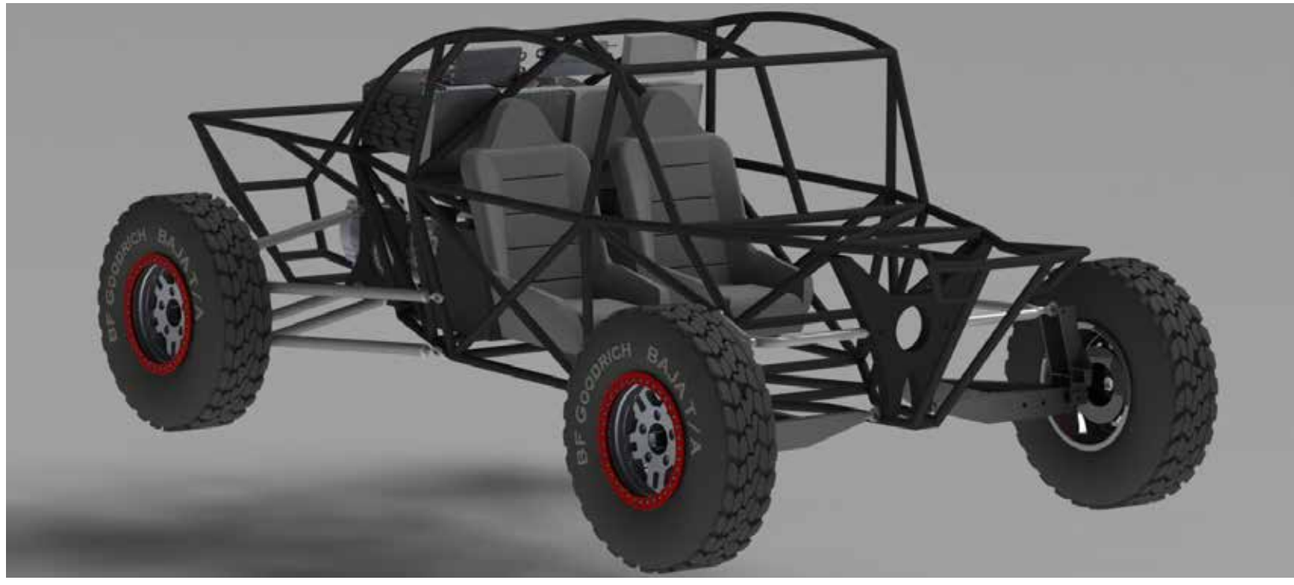
Each sub-teams, other than the chassis team, is composed of three members, including a team leader. The team is composed of 14 members divided among five sub-teams: drive-train, engine, suspension, controls and chassis.

The drivetrain team is responsible for components that bring power to the wheels, essentially allowing the vehicle to move. The engine team optimizes and refines the engine, which was donated from a Ford Focus. The suspension team ensures that the vehicle has proper shock absorbing capabilities and drives smoothly, while the control sub-team is responsible for any ergonomic and interface concerns that the drivers of the vehicle may have. Finally, the chassis team designs the entire body of the vehicle using computer-aided design (CAD) programs. It is their responsibility to make sure all the parts of the vehicle fit together perfectly.

A massive whiteboard, known as the action-track board, ties all of the steps in the design and building process together. It features a detailed outline of all the projects the team is working on, including information such as due dates and team leaders. O'Connell was the one who originally introduced the idea of having such a visible and open schedule after seeing how well it worked during his time as an intern for Volvo. The board is a big hit among the team members, as well as the companies who tour the lab, due to its efficiency.

Currently, the two co-leaders have great ambitions for VT Rally. This year, they have embarked on a grueling single-year design cycle to compete in the Silverstate 300 race, which takes place in Las Vegas in May. The Silverstate 300 is part of the Best in the Desert racing series and involves a 300-mile drive through the Nevada desert. The team will be racing their utility terrain vehicle (UTV) against professional teams including Mid-America Motorworks and Kujo. Needless to say, VT Rally will be facing some stiff competition.

This year's design team is drastically different from the last year's team. Last year, the team aimed to design and build a vehicle that was much smaller and had a 90 horsepower maximum. Unfortunately, the team was unable to meet the April deadline last year, and as a result, could not compete in the UTV Rally Raid.



Photos: C.A.M. Gerlach/Engineers Forum
Clockwise from top left: 1. The stripped remains of VT Rally's original vehicle. Most salvageable parts have either been incorporated into the new design or sold for capital. 2. Russell Gilbert works on fine tuning the eventual location of the bell housing adapter, which will connect the engine to the transmission system. 3. Marty O'Connell [left] and Chris Golightly [right] – the team leaders of VT Rally. 4. A CAD rendering of the completed chassis of the vehicle. With a width of over 127 inches, not including tires, VT Rally has designed a truly impressive beast of a machine. 5. The team's Action Track Board, brought back from Volvo by team co-leader Marty O'Connell, helps keep the team focused and on top of deadlines.

Traffic Bowl: The Road to Success

By Alexander Papp
Junior, Civil Engineering

Photo: Aaron Clark

The Traffic Bowl participants stand with Dr. Katz

Virginia Tech students who participated in the Traffic Bowl brought pride to the Civil Engineering Department as they emerged victorious in the Virginia section of the competition. Inspired by the popular game show Jeopardy!, the Traffic Bowl pits teams from different schools against one another to answer a variety of questions related to transportation engineering. Categories include traffic safety, signs, road markings, planning and design. Similar to the television show, there are two categorical rounds followed by a final segment with a single question.

Nida Syed, Ashley Sumner and Noelle Wilcox represented Virginia Tech in the competition and were accompanied by Dr. Bryan Katz, a transportation engineering professor. They competed against the University of Virginia (UVA) and Virginia Military Institute (VMI), two schools with prominent civil engineering programs.

After many tense rounds, Virginia Tech managed to come out on top. UVA finished in second place with 0 points, while VMI finished third with negative 1700 points. Virginia Tech won with 5200 points and will continue on to the regional competition. The students will be travelling to Biloxi, Mississippi, where they will face other universities from southern states. The winners of the regionals will each receive $1000 scholarships and continue on to the national championship.

Dr. Katz, who has accompanied multiple teams in the past, has high hopes for the group. While Virginia Tech has not had much success at past regional events, there is still a great deal to be excited about. The competition gives students the chance to apply their knowledge of engineering in a fun, competitive environment.

Additionally, they get the chance to interact with students from other schools and to connect with people that they may work with in the future. The Traffic Bowl is hosted by the Institute of Traffic Engineers and is sponsored by numerous companies. The competition tests the skills and knowledge that engineering students will need once they enter the workplace.

The regional championships will be held near the end of April. Past winners include Georgia Tech and Clemson University, but 2015 may just be the year for Virginia Tech. While this season has already passed, Dr. Katz encourages interested students to participate in future events. In the meantime, good luck to the team as they prepare for regionals!

General Engineering Provides Foundation for Undecided Engineering Students

By Nahu Dimitri
Junior, Biochemistry

Coleman Merenda is a senior in Industrial and Systems Engineering who began his academic career as an undecided student.

Natasha L. Smith, Director of Enrollment Management, standing in front of the 14,000-pound Rolls Royce jet engine in Goodwin Hall

Virginia Tech's engineering program boasts a number of highly accredited specialized fields of study and is considered one of the most prestigious engineering programs in the nation. Industrial systems, civil and chemical engineering are just some of the courses of study that Virginia Tech's College of Engineering (COE) offers to its students. Despite all of the options available, there are still some students who don't know which specific engineering major they would like to pursue. The general engineering program allots more time for undecided students to decide the specific engineering track that they would like to pursue, while also giving them access to classes restricted to other students.

For most students, it does not take too long to figure out what they have a passion for. Coleman Merenda first enrolled at Virginia Tech as a university studies major due to the fact that he was unsure about what he wanted to study. "It took me about a year to figure out what I wanted to do," Merenda stated in an interview. "But when I did, I spoke to an advisor for counseling."

When students have difficulty choosing what path they would like to pursue, they have the opportunity to speak to a counselor who will advise them on what track is best suited for them. "The advisors were really helpful," Merenda added. "I did not realize there [is] so much paperwork and so many loops that you had to jump through. Without their help, it would've been much more difficult to transfer."

As a result of a colossal increase in enrollment in 2012, a management team was hired to ensure that the departments within the COE would not be overwhelmed. "Before the new requirements, most of the engineering majors didn't have many class restrictions and you could submit a transfer application any day of the year," said Natasha Smith, director of engineering enrollment. "Now, in order to switch into any of the engineering majors, one must have a minimum 3.0 GPA, a set of completed courses and apply during our weekly cycle that comes three times a year."

Demand for entry into the College of Engineering has been larger than ever. There are currently 2,300 students enrolled in general engineering, a number that continues to rise. As a result, more guidelines and a new enrollment program have been put in place to ensure that everyone has a fair chance.

When asked what advice he would give to students hoping to transfer into the COE, Merenda's response epitomized the typical mindset of an engineering major at Virginia Tech: "Decide as fast as you can, figure out exactly what you need and make sure to take classes over the summer."

New Weather Model Storms onto the Scene

By C.A.M. Gerlach
Sophomore, Meteorology and Geography

Photo: C.A.M. Gerlach/Engineers Forum

Racks of computing units comprising Virginia Tech's Blue Ridge supercomputer, operated by the university's Advanced Research Computing (ARC) unit. This system runs the WRF weather model in cooperation with the Department of Geography.

Photo: C.A.M. Gerlach/Engineers Forum

Dr. Andrew Ellis, Associate Professor of Meteorology and Climate Science in Virginia Tech's Geography department. Dr. Ellis is currently coordinates the research applications for Virginia Tech's WRF weather model.

Inside the vast electronic brain of Blue Ridge, Virginia Tech's top supercomputer, something stirred, like a gust of wind on a hot summer day. In the same way a sudden breeze might alert a careful observer to an oncoming storm, that stirring — the initialization of the university's new Weather Research and Forecasting (WRF) model — signaled a significant step forward for predicting and understanding dangerous and damaging weather.

According to meteorology instructor and WRF team member David Carroll, the model is fully up and running, and is in the final stages of being "polished" for public consumption. Considering that the model outputs over 300 distinct products, the team must pick and prioritize which graphics will be produced and displayed on Virginia Tech's forthcoming Virginia Weather and Climate website, and make sure the whole process works as expected. The university's Geography Department and meteorology program, along with those involved in biological systems engineering, forecast ecosystems research and climate modeling at Virginia Tech are some of the major players in this domain of research.

The reliability and quality of the output is particularly important given the array of planned and potential users, including not only Virginia citizens interested in the weather, but local television stations, school systems, governments and the Hokie Weather Watch media organization. Virginia Tech's Facilities Management Department may use it to help plan and manage events. For example, the model can be used to ensure that graduation remains safe and rain-free. Even more significantly, the Blacksburg National Weather Service office is planning to employ Virginia Tech's WRF to aid in their predictions, due to some key advantages that this new option has over the more commonly-used national models. Since these Weather Service forecasts are used in some form by most public weather outlets in the region, the resulting improvements might reach a large percentage of the million-plus people residing therein.

As meteorology professor Dr. Andrew Ellis describes it, the most important of these advantages is the WRF's much finer resolution, with grid points every three kilometers as opposed to an order of magnitude coarser with the national models. This allows it to simulate local-scale processes far better, particularly those involving complex terrain, like the Appalachians, or variables that can change widely over small scales, such as temperature or precipitation. Both of these factors are particularly important during winter weather events, where small, fine-scale differences in any of these quantities can make or break a forecast, turning 20 centimeters of snow into a mere 20 millimeters of rain, or even a deadly coating of ice. According to Dr. Ellis, a common such scenario for Blacksburg occurs "when cold air laden with Great Lakes moisture moves in from the Northwest, [and] the national models have a hard time resolving what will happen when it hits the mountains." He added, "It could be a half meter of snow or just a dusting, depending on local effects," which the model would help address.

Additionally, the relatively large domain includes all the key influences on Virginia weather, from Great Lakes moisture to Atlantic tropical cyclones, many of which current National Weather Service models at that scale do not cover. One final edge is the WRF model's flexibility. With direct control over the output, the WRF's core parameters can be tweaked and optimized for our region and the specific forecast situation, potentially improving the quality of the final result.

When it comes to research, "there are so many different uses of the model given its flexibility," according to Sean Ridge, a senior meteorology major. "It is employed at scales ranging from 2 meters above ground level to climate simulations of the next 100 years."

As Carroll describes, initially, research will likely focus on case studies of high-impact events, especially those affecting Virginia. "Looking at past events through this new high-resolution model will help determine if it can pick up atmospheric conditions missed by others," Carroll said. "That will also provide the initial view into how it handles different storm events."

For example, most models cannot resolve the infamous and often deadly fog events in the Fancy Gap area along

One of the main processing racks of the Blue Ridge supercomputer, housing some of its 6,528 processor cores. These are, in effect, "nerve cells" of the machine when running the WRF weather model.

The main communications equipment rack for the Blue Ridge supercomputer. These form the "synapses" connecting the processing core "nerve cells" on which the WRF weather model runs.

I-81. Virginia Tech's WRF might be able to help us understand the cause behind this fog. Furthermore, another university used a similar tool to discover a correlation between soil moisture and upslope snow in the mountains; Virginia Tech's installation may uncover many similar clues for our area.

Several further possibilities include forest ecosystem research, pollution and air quality modeling and downscaling much coarser climate models to determine the impacts of climate change on local-scale weather. In summary, according to Dr. Ellis, "It can be used for anything investigating fine scale features and processes that the bigger models simply can't pick up."

Beyond its practical applications, the chance to work with the WRF model is a serious draw for many of Virginia Tech's students. It offers hands-on experience that is highly sought after by graduate schools and employers. "When the meteorology program began, one of the major components was not only producing students that had weather expertise, but also experience in spatial analytics," said Dr. Ellis. "Although we have strong coursework in GIS (Geographic Information Systems) and meteorology, it is a little tougher to get both blended together in one exercise, and the WRF would do so beautifully for our students," he added.

The meteorology program's unique approach with the WRF model extends beyond just the model itself. As Carroll states, "we hope to provide unique model output that utilizes multiple GIS layers which can show any number of variables along the earth's surface. In that way, the weather model mimics what we are attempting to do program-wide."

As for the future, the WRF team is optimistic. Dr. Ellis summed up much of this sentiment. "I think the opportunities are fairly rich in terms of developing research projects that not only have practical use, but also good theoretical meaning," he commented. "So I'd like to see a nice little research enterprise evolve around our WRF."
When it comes to operational use, the most immediate rewards are even closer to being realized. As Carroll concluded, "Many of the graphics are stunning, so it will be an exciting time when the output becomes available to everyone."

If all goes well, that metaphorical storm might arrive by the time this forecast is printed.

2000

Total number of available output data products from Virginia Tech's WRF

1/10

250 billion

Total number of 4D points at which the model equations are evaluated

2007

Most recent year in which Blue Ridge would have been the world's most powerful supercomputer

10 million

Square kilometres covered by the model's domain

400 trillion

Peak number of floating point operations Blue Ridge can perform, per second

Blue Ridge is approximately this many times more powerful then the average VT student laptop

The SailBOT Team's Second Year Leap

By Brooke Misailidis

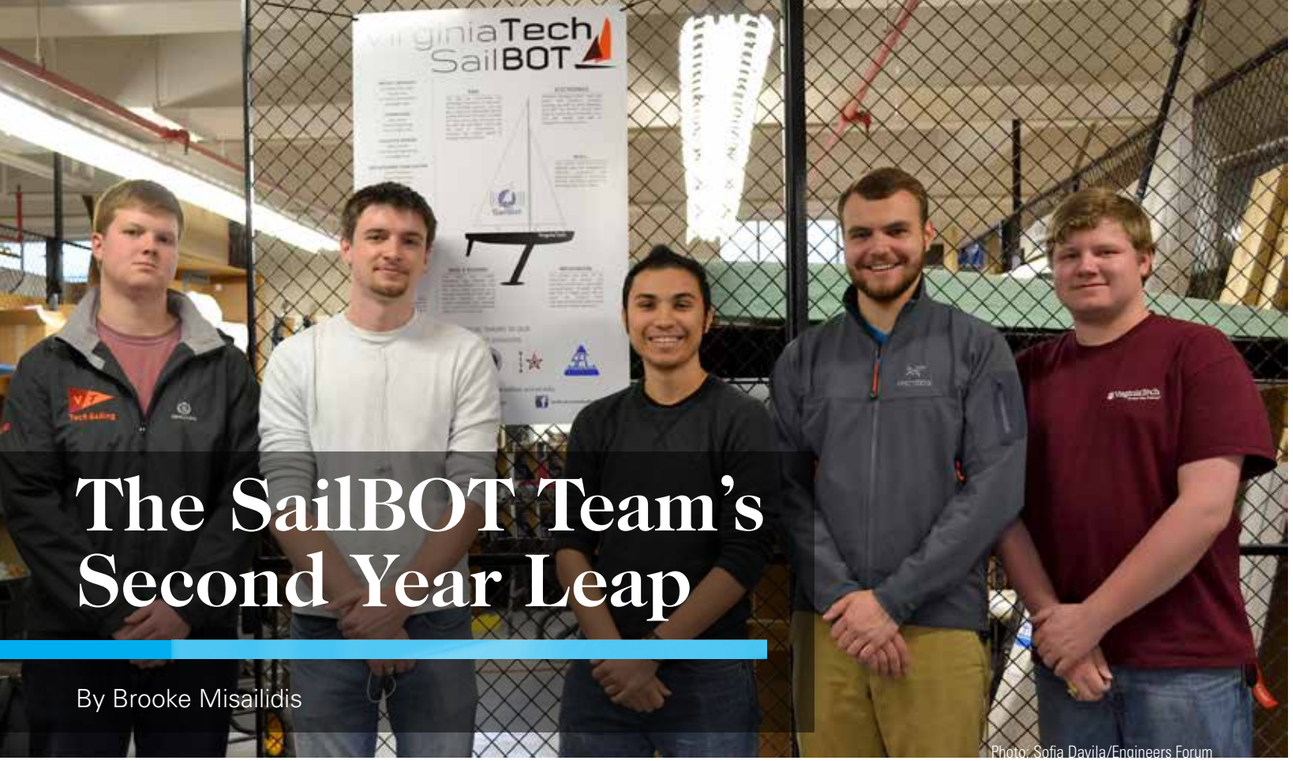


Photo: Sofia Davila/Engineers Forum

Sail team captain Ben Hayes, Hull team captain Chris Wemple, Commodore Marc Rauer, Mechanical team captain George Uehling, Keel & Rudder team captain Lucas Thompson.

The SailBOT team is one of the newest senior design projects in Virginia Tech's Ware Lab. The team's main objective is to design and build an autonomous robotic sailboat. Virginia Tech competed, and finished fourth, in the 2014 International Robotic Sailing Regata (ISRS) this past June. They were up against five other teams from American and Canadian universities, and were considered one of the competition's best first year competitors.

The team was founded after an interest meeting held by the Society of Naval Architects and Marine Engineers (SNAME) during the spring semester of 2013. The initial team was comprised of over 65 members, and was sponsored by various organizations including SNAME, the Student Engineers' Council, the Bradley Department of Electrical and Computer Engineering and the Department of Aerospace and Ocean Engineering. The current team leaders are Commodore Marc Rauer; sail team Captain Ben Hayes; hull team captain Chris Wemple; and keel & rudder team captain Lucas Thompson.

George Uehling, a senior mechanical engineering major, and one of the team's original members, shared some of the difficulties that came about during the team's first year. "Much of the first year was spent trying to learn things from scratch," Uehling said. "A lot of team members had technical design experience, but the actual construction was the tough part." The team has improved leaps and bounds since the initial growing pains of last year, as Uehling noted.

Uehling shared the mast model he created to plan the position of various parts that would be superimposed on the plug. The plug is a giant slab that is shaped in order to form the main body of the boat around it. Last year's plug was made of wood, but this year, the team decided to use a foam plug instead. This was a simple adjustment that allowed for more precise machine work.

Rauer, the commodore and team leader, explained the challenges of coordinating the team: "A project like this differs in scale and scope from a regular group project," he commented. "It requires work to be allocated to groups within the team and the timing of each group dictates the overall progress." The preparation process lasts close to nine months, including the summer.

New members join the team at various points throughout the year. Being a multidisciplinary team, numerous majors, some outside of engineering, are represented. This includes electrical engineering, mechanical engineering, ocean engineering, aerospace engineering, material science engineering, computer science and marketing. Wemple, a senior ocean engineering major, commented that, "Freshman don't usually have the technical experience, but tend to have practical experience with things like sailing or building models."

While the team is currently lead by upperclassmen, they welcome early involvement from freshmen in order to create a better foundation for the team in the future.

Photo: Sofia Davila/Engineers Forum

Ben Hayes stands alongside the sail for the team, which must operate autonomously.

Photo: Sofia Davila/Engineers Forum

Chris Wemple and the foam plug used for the body of the boat.

Photo: Sofia Davila/Engineers Forum

George Uehling models a mast used to plan where parts will be placed on the actual boat.

Mining for Mars

By Miles Harnad
Freshman, General Engineering

Automobiles have been around for over 100 years, and the Wright brothers first took to the sky back in 1903. But since when have we been building space mining robots? At Virginia Tech's highly regarded Ware Lab, the Astrobotics team is developing a robotic prospector to probe the distant and unfamiliar surface of Mars.

Every year, NASA sponsors and hosts The Robotic Mining Challenge at the Kennedy Space Center. To win the contest, teams must design and build a robot that will self-navigate a given space to collect regolith (Martian soil) as well as gravel, all within a certain amount of time. The gravel simulates possible chunks of water in the form of ice on the surface of Mars, vital to sustaining a human colony on the lifeless planet.

The concept of a "space mining robot" may sound far-fetched or overly futuristic, yet the VT Astrobotics team is building exactly that. Since the competition deals with such a novel, untested area of engineering, no single proven design dominates in this young field, leaving participants with plenty of room to innovate and explore. When developing the robot to tackle such an alien environment, no ideas are off the table. As such, each team's design is groundbreaking and revolutionary in its own right as a reflection of the group's vision and imagination.

This year Lewis and vice-lead Brandon Medina have placed a strong emphasis on organization, with a written schedule for each week to keep the operation on track. The Virginia Tech contingent's 25 members hail from a variety of fields, with particular concentrations in mining, mechanical and aerospace engineering. This unique mix and the resulting interdisciplinary collaboration should improve the final product through bringing together the unique strengths of each engineering specialty. The mining engineers apply the optimal methods of digging and collection; the aerospace engineers work to keep the robot light-weight and easily controllable; and the mechanical engineers focus on the design and assembly of the automaton as a whole.

VT Astrobotics is the only team that has their own 3D Printer.

Nathan Lewis (left) and Brandon Medina (right) look forward to seeing the design come to fruition.

While each of these components is exciting in and of themselves, it is the automation of the robot that has team leader Nathan Lewis the most thrilled. Most of the programming team members are freshmen this year, so the group will have plenty of talent going forward into future competitions. For the first year students, getting a drone to do the whole job on its own will be a very rewarding experience.

Furthermore, this year's robot will be loaded with sensors and computers to identify the target minerals, but the most innovative plan for the projects lies in its novel material collection system. The device itself resembles an arm tipped with miniature waterwheels. Slits in the "waterwheels" will pick up the regolith and gravel as they spin, dispensing the gathered materials into a storage bin. The key advantage of this design is that it stirs up less dust while operating, which should score the team extra points in the competition.

All of this planning takes up considerable time, and is further complicated by the fact that the project team was not assembled until October, in addition to the high turnover from the large number of graduating seniors each year. Therefore, the group dedicated the remainder of the fall semester to planning and design, so they could hit the ground running once back from winter break. After purchasing the needed parts and components for the robot, they have now begun assembling it together into a functional unit. This process will continue into April, when the team hopes to spend the rest of their time testing and adjusting their entry in preparation for the competition in May.

All the equipment and tools are in place for construction of the robot.

While the current roster features a heavy presence of seniors, Medina emphasizes that any student who is passionate about space exploration will be more than welcome on the team. Along with the fun and excitement that comes with working on cutting edge technology, employers appreciate the work experience gained from the project, and firms such as Honeybee Robotics and NASA are very active with their recruiting at the competition. While space mining may not be a booming industry at the moment, it is certainly going to be a player in the future. Asteroids boast mineral resources far in excess of what is available on our planet, and robots will be needed to extract these ores. Due to this profitability, the competition is a good look ahead towards the future of human involvement in space.

Being on the cutting edge of technology and research already has considerable appeal, but the real driver of the Ware Lab's Astrobotics group is the creativity and imagination expressed in every facet of their design. Under Lewis and Medina, the project appears poised to achieve great things, whether that be at the competition this May or the day that robots are actually mining the surface of Mars. While the team's objective may be to construct a robot to explore a distant frontier, their key to success has been a solid, grounded effort leveraging the human strengths of each and every member.

Through the curing process, the concrete can feel dry, but still be weak. A 28-day curing process allows the concrete to come very close to its maximum strength. Compared to last year's canoe, this year's canoe is lighter, thinner and less rounded, making the canoe easier to maneuver in the water.

Photo: Sofia Davila/Engineers Forum

Sink or Swim:

A Concrete Example

By Kristine Mapili
Junior, Civil Engineering

Photo: Sofia Davila/Engineers Forum

Team captain Nadeem Khan explains that in order to make concrete float, it must have a density that is less than the density of water.

The job of an engineer revolves around solving problems, from calculating the maximum load on a structure to planning out the timeline for a major project. Sometimes the key issues are obvious from the beginning and the solutions need to be planned out well in advance, while in other instances, obstacles pop up later down the road and must be surmounted on the fly.

Both of these types of problem solving are called for in conquering one Virginia Tech design team's objective: to build and race a canoe constructed entirely out of concrete. The average initial reaction might be one of abject disbelief, due to the apparent difficulties involved. "Wouldn't it just sink to the bottom?" many might ask. Concrete may not be the most practical material for a watercraft compared to other options, but for the students involved, the project is more about the journey than the finish line. The experience allows aspiring engineers to explore a fundamental skill common to the discipline: creating a final product within a set of unique constraints with the best possible performance.

Though the American Society of Civil Engineers adopted it as an annual competition in 1988, the concrete canoe challenge has existed in some form since the 1960s. Virginia Tech's team, run by the Department of Civil Engineering, builds its entry from scratch each year and races it in the contest. This current project is headed by captains Brian Hutter, Heather Hicks and Nadeem Khan.

The Virginia Tech squad tested three possible concrete mixtures this year, aiming to make the canoe lighter and faster compared to last year's model. On a basic level, the craft needs to be less dense than water in order to float, so the ideal material would maximize volume while minimizing mass. This is accomplished by including glass spheres, fibers, and other components in the mix, along with a shape designed for high buoyancy. After testing key parameters, the team decided on a composition that was lighter than

last year's mixture, yet still strong enough to use in construction.

After the best material was selected, the students made several batches and ran compression tests to measure the strength of the concrete throughout the curing phase. The first batch was tested after seven days, as the concrete reached about 60 to 70 percent of its maximum strength. The second batch was examined after two weeks, and the third after a month, as the concrete approached its final durability.

Foam is cut to the shape of the canoe design as a mold for the concrete, and reused for transportation to protect it. To keep the craft structurally sound while in the water, it is composed of three concrete layers with reinforcing material between each. Reinforcing agents are also used in the concrete mixture itself, preventing the canoe from cracking. This is particularly important since it must resist two forces: the weight of people in it from the top, putting the structure there under compression, and the opposing normal force of the water on the bottom, resulting in tension on the concrete. Because concrete is stronger under compression than tension, the reinforcement gives the bonds of the concrete something to latch on to, allowing it to better resist the latter force.

Photo: Sofia Davila/Engineers Forum

When deciding which mixture to use out of three, the second mixture was the only one that would float in water, but was still strong enough to make a well-constructed canoe.

Photo: Sofia Davila/Engineers Forum

Team captain Brian Hutter sprays down the burlap with water to keep the concrete moisturized. When the cement is moistened, the concrete has better developed bonds to prevent cracks.

After the reinforcement process, the canoe then must undergo a "wet cure" for four weeks to hydrate the cement, during which the boat is sprayed with water every day, and burlap is layered on top to retain moisture. Although concrete can dry in a short amount of time after being poured, keeping it moist helps the mixture develop stronger bonds to further decrease the likelihood of cracking. Once this is complete, the concrete is removed from the mold, which can be a tricky process since the material shrinks during curing. While this effect can be reduced using special chemicals in the mixture, it is impossible to eliminate completely. Once successfully extracted, the craft is sanded down and decorated, making it ready for competition.

This year's concrete canoe contest takes place the first weekend in April at the Virginia Military Institute. Every year, the rules dictating the shape, size, composition and other elements change, forcing students to create fresh designs each time. In the first three of the competition's four phases, entrants submit a design report prior to the contest, team captains present to the judges and the organizers evaluate the aesthetics of each boat. For the main event, each group competes in a series of races as the students responsible for each canoe try to be the first to paddle across the finish. The greater momentum of concrete compared to more conventional materials makes this task difficult, as steering becomes much more challenging. Teams cannot usually practice before the competition due to the risk of cracking if the concrete is exposed to water prematurely, so the crew can't get a sense of the canoe's handling until they jump in the craft for the first race. However, finding out how their vessel behaves in the water has to happen quickly for the Virginia Tech crew to have a chance, a process which team captain Hutter calls "problem solving on the spot."

This year's squad hopes to qualify for the national competition, and to do so will require every bit of their skill and talent, organized into task forces to solve specific problems. One such sub-group works on creating a stand to support past canoes, such as the "pencil boat," the most recent design to reach nationals and showcased at Patton Hall, as well as last year's entry currently on display at the Ware Lab. Another committee conducts structural analysis to ensure the craft withstands the stresses and loads it will face during throughout the competition.

Any willing and able student can contribute to the

Photo: Sofia Davila/Engineers Forum

The team tested three different mixtures in order to figure out which would be the best to use for the canoe. The first is very similar to the mixture used by last year's team. Compared to the first mixture, the second one is lighter, and the third one is stronger.

SECI

SPOTLIGHT ON THE

STUDENT ENGINEERS' COUNCIL

BY GWEN ELWOOD

2014-2015 SEC Executive Board: Front Row left to right: Matt Slutsker, Andrew Lee, Nate Kibler, Andrew Trad, Second row: Gwen Elwood, Ben Drew, Miles Mallinger, Third row; Walker Olsen, Greg Scott, Zachary Mayes, Back row: Casey Hux, Sean Goodrich, Matt Donaldson
Not Pictured: Ishita Ganotra and Eugenia Walk

SEC Logo: Created by Emily Bollman and Andrew Trad

Photo: Amanda Brown

Keynote Speaker, Dr. Jack Lesko at the Leadership in Engineering Conference

Every year, over 5,000 eager students attend the Engineering Exposition in hopes of finding employment. Organizing this career fair is no small feat, and it takes the combined efforts of the entire Student Engineers' Council (SEC) to make it happen.

The Engineering Exposition hosts over 250 companies and provides an incredible opportunity for students to engage with company representatives. The Expo is three days long; two days for the fair and then one day for interviews. While the Engineering Expo is by far the largest event for the council, it is only the beginning of what they do for the College of Engineering at Virginia Tech.

The SEC serves as the liaison between students, administration, companies and engineering organizations. The executive board for the SEC is comprised of 14 students who organize events and oversee the bi-monthly general assembly meetings. These students meet weekly to discuss and assess the status of the council and the progress being made on certain events.

The annual events hosted by the SEC are the Freshman Major Mixer, Leadership in Engineering Conference and E-Week.

The Freshman Major Mixer is an event that takes place in the first month of first semester. It is an event showcasing all 14 engineering majors, as well as the design teams and student organizations, to the general engineering students. This has been proven to a be a huge success due to the fact that it helps the incoming class take one step closer to determining a major and becoming more involved in college.

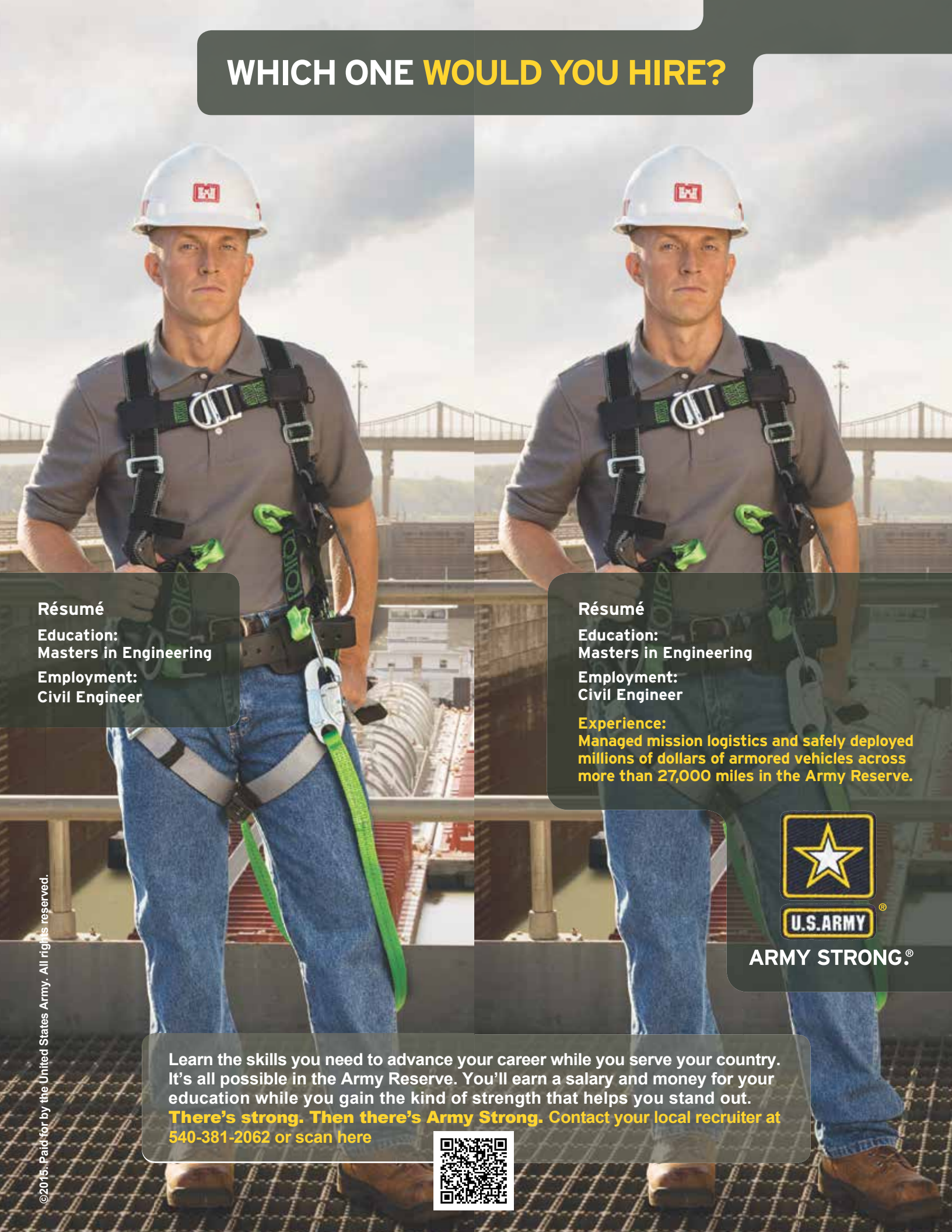
The Leadership in Engineering Conference is another event that is held in the fall. It is the perfect opportunity for students to step back from the technical material taught in the engineering courses and focus on applying leadership skills to the engineering field.

Last fall, the conference was held in Goodwin Hall, the new engineering building on campus. The two keynote speakers for the event were Michael Cardman, a Hokie alum, as well as Virginia Tech's very own Dr. Jack Lesko. The conference also included various breakout sessions hosted by companies and Virginia Tech faculty.

E-week is a weeklong celebration of the engineering students on campus and involves several speakers, design team showcases, and competitions. This year, the event was held the week after spring break. The week started off with three speakers: Ms. Gretchen Edelmon, Mr. Edward Colvin and Dr. Alfred Wicks.

The next day was the design team showcase on the Drillfield. The design teams, as well as other engineering organizations, set up tables on the Drillfield to share their projects with the Virginia Tech community. Finally, on the third day, teams competed to build the largest, most sturdy spaghetti tower in the engineering design challenge.

WHICH ONE WOULD YOU HIRE?



Résumé

Education:
Masters in Engineering

Employment:
Civil Engineer

Résumé

Education:
Masters in Engineering

Employment:
Civil Engineer

Experience:
Managed mission logistics and safely deployed millions of dollars of armored vehicles across more than 27,000 miles in the Army Reserve.

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